MIL-STD-975E (NASA)
30 June 1983

SUPERSEDING
MIL-STD-975D (NASA)
1 June 1982

MILITARY STANDARD

NASA STANDARD ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PARTS LIST

59GP

MIL-STD-975E
NOTICE 1
16 January 1984

MILITARY STANDARD

NASA STANDARD ELECTRICAL, ELECTRONIC,
AND ELECTROMECHANICAL (EEE) PARTS LIST

TO ALL HOLDERS OF MIL-STD-975E:

1) THE FOLLOWING PEN AND INK CHANGES ARE TO BE MADE:

Page 7.6

Under the Flip-Flop Description, add:

	54LS273	Octal D type flip-flop with clear	32501		B*X

Under the Shift-Register Description, add:

	54LS166	8-bit parallel input shift register with clear	30609		B*X

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After the Decoders/Encoders/Multiplexers description section and before the footnotes add the following new description section and related information:

Tranceivers	54LS245	Octal Noninverting bus transceivers with 3-state outputs	32803		B*X

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON, D.C. 20546

NASA Standard Electrical, Electronic and Electromechanical (EEE) Parts List

MIL-STD-975E (NASA)

1. This Military standard is approved for use by all elements of the National Aeronautics and Space Administration and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed as follows:

MANAGER
NASA STANDARD PARTS LEAD CENTER OFFICE (EG02)
MARSHALL SPACE FLIGHT CENTER, AL 35812.

FOREWORD

This standard is the technical baseline for standardizing parts selection in the design and construction of flight hardware and mission-essential ground support equipment. The intent of this standard is to focus part selection efforts on a reduced number of parts, thereby reducing system cost and improving part quality and availability.

Page 7.12

Under the Operational Amplifiers description Section, add:

	124	Quad (single supply, low power)	11005		B*X
	148	Quad (medium power, internal compensation)	11001		B*X
	156A	JFET (high performance, wide band, low offset)	11405		B*X
	157A	JFET (high performance, wide band, low offset, undercompensated)	11406		B*X

2) RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3) Holders of MIL-STD-975E will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or cancelled.

Custodian:

NASA-NA

Preparing Activity:

NASA-NA

CONTENTS

SECTIONS

1. SCOPE

1.1 General. This standard establishes a list of Electrical, Electronic and Electromechanical (EEE) Parts for use in the selection, procurement, and application for flight and mission-essential ground support equipment. The listings are limited to the following Federal Stock Classes:

- 5905 - resistors (including thermistors).
- 5910 - capacitors.
- 5915 - filters.
- 5920 - protective devices.
- 5935 - connectors.
- 5945 - relays.
- 5950 - inductors and transformers.
- 5955 - crystals.
- 5961 - diodes and transistors.
- 5962 - microcircuits.
- 6145 - wire and cable.

1.2 Purpose. The purpose of this standard is as follows:

a. To provide equipment designers and manufacturers with a list of electronic parts having two quality levels considered to be most acceptable for flight and mission-essential ground support equipment.

b. To control and minimize the variety of electronic parts used by government activities in order to maximize economic support of, to concentrate improvement on, and to facilitate effective logistic support of the electronic parts listed in this standard.

1.3 Classification. Two levels of quality are used in this standard. Grade 1 parts are higher-quality, government-specification-controlled parts intended for critical applications. Grade 2 parts are high-quality, government-specification-controlled parts for use in applications not requiring Grade 1 parts.

2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal form a part of this standard to the extent specified herein.

CAPACITORS (FSC 5910)

MIL-C-20	- Capacitors, Fixed, Ceramic Dielectric (Temperature Compensating), Established and Non-Established Reliability, General Specification for.
MIL-C-123	- Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable and General Purpose), High Reliability, General Specification for.
MIL-C-23269	- Capacitors, Fixed, Glass Dielectric, Established Reliability, General Specification for.
MIL-C-39003	- Capacitors, Fixed, Electrolytic (Solid Electrolyte), Tantalum, Established Reliability, General Specification for.
MIL-C-39006	- Capacitors, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, General Specification for.
MIL-C-39014	- Capacitors, Fixed, Ceramic Dielectric (General Purpose), Established Reliability, General Specification for.
MIL-C-55365	- Capacitors, Chip, Fixed, Tantalum, Established Reliability, General Specification for.
MIL-C-55681	- Capacitor, Chip, Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification for.
MIL-C-83421	- Capacitors, Fixed, Supermetallized Plastic Film Dielectric, (DC, AC, or DC and AC), Hermetically Sealed in Metal Cases, Established Reliability, General Specification for.

CONNECTORS (FSC 5935)

MSFC 40M38277	- Connectors, Electrical, Circular, Miniature, High Density, Environment Resisting, Specification for.
MSFC 40M39569	- Connectors, Electrical, Miniature Circular, Environment Resisting, 200 °C, Specification for.
GSFC S-311-P-4	- Connectors (and Contacts), Electrical, Rectangular, for Space Flight Use, General Specification for.
GSFC S-311-P-10	- Connectors, Subminiature, Electrical and Coaxial Contact, for Space Flight Use.
MIL-C-5015	- Connector, Electrical, Circular Threaded, AN Type, General Specification for.
MIL-C-22992	- Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type, General Specification for.
MIL-C-24308	- Connector, Electric, Rectangular, Miniature Polarized Shell, Rack and Panel, General Specification for.
MIL-C-26482	- Connector, Electrical, (Circular, Miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs, General Specification for.
MIL-C-38999	- Connector, Electrical, Circular, Miniature, High Density, Quick Disconnect, (Bayonet, Threaded and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for.
MIL-C-39012	- Connector, Coaxial, Radio Frequency, General Specification for.
MIL-C-39029	- Contacts, Electrical Connector, General Specification for.

DIODES (FSC 5961)

MIL-S-19500	- Semiconductor Devices, General Specification for.

FILTERS (FSC 5915)

MIL-F-18327	- Filters, High Pass, Low Pass, Band Pass, Band Suppression, and Dual Functioning, General Specification for.
MIL-F-28861	- Filters and Capacitors, Radio Frequency/Electromagnetic Interference Suppression, Specification for.

INDUCTORS (FSC 5950)

MIL-T-27	- Transformers and Inductors (Audio, Power, and High-Power Pulse), General Specification for.
MIL-C-15305	- Coil, Fixed and Variable, Radio Frequency, General Specification for.
MIL-C-39010	- Coils, Fixed, Radio Frequency, Molded, Established Reliability, General Specification for.

MICROCIRCUITS (FSC 5962)

MIL-M-38510	- Microcircuits, General Specification for.

PROTECTIVE DEVICES (FSC 5920)

MIL-F-23419	- Fuses, Instrument Type, General Specification for.
MIL-C-39019	- Circuit Breakers, Magnetic, Low-Power, Sealed, Trip-Free, General Specification for.

RELAYS (FSC 5945)

MIL-R-39016	- Relays, Electromagnetic, Established Reliability, General Specification for.

RESISTORS (FSC 5905)

MIL-R-39005	- Resistors, Fixed, Wire-Wound (Accurate), Established Reliability, General Specification for.

RESISTORS (FSC 5905)

MIL-R-39007	- Resistors, Fixed, Wire-Wound (Power Type), Established Reliability, General Specification for.
MIL-R-39008	- Resistors, Fixed Composition (Insulated), Established Reliability, General Specification for.
MIL-R-39009	- Resistors, Fixed, Wire-Wound (Power Type, Chassis Mounted), Established Reliability, General Specification for.
MIL-R-39015	- Resistors, Variable, Wire-Wound (Lead Screw Actuated), Established Reliability, General Specification for.
MIL-R-39017	- Resistors, Fixed, Film (Insulated), Established Reliability, General Specification for.
MIL-R-39032	- Resistors, Packaging of.
MIL-R-39035	- Resistors, Variable, Nonwire-Wound (Adjustment Type), Established Reliability, General Specification for.
MIL-R-55182	- Resistors, Fixed, Film, Established Reliability, General Specification for.
MIL-R-83401	- Resistor Networks, Fixed, Film, General Specification for.

THERMISTORS (FSC 5905)

MIL-T-23648	- Thermistor (Thermally Sensitive Resistor), Insulated, General Specification for.
GSFC S-311-P-18	- Thermistor (Thermally Sensitive Resistor), Insulated, Negative Temperature Coefficient, Style 311P18, Specification for.

TRANSFORMERS (FSC 5950)

MIL-T-27	- Transformers and Inductors (Audio, Power, and High-Power Pulse), General Specification for.
MIL-T-21038	- Transformers, Pulse, Low Power, General Specification for.

TRANSISTORS (FSC 5961)

MIL-S-19500	- Semiconductor Devices, General Specification for.

WIRE & CABLE (FSC 6145)

MIL-C-17	- Cable, Radio Frequency, Flexible and Semirigid, General Specification for.
MIL-W-5086	- Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy.
MIL-W-16878	- Wire, Electrical, Insulated, High Temperature.
MIL-W-22759	- Wire, Electric, Fluorocarbon Insulated, Copper or Copper Alloy.
MIL-C-27500	- Cable, Electrical, Shielded and Unshielded, Aerospace.
MIL-W-81381	- Wire, Electric, Polyimide-Insulated Copper and Copper Alloy.

NOTE: Additional information on specific performance, use, and application can be found in MIL-HDBK-978 and MIL-HDBK-979.

(Copies of specifications, standards, drawings, and publications requested by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

NOTE: Additional copies may be obtained from the following center:

COMMANDING OFFICER
NAVAL PUBLICATIONS & FORMS CENTER
5801 TABOR AVE
PHILADELPHIA, PA 19120

3. DEFINITIONS

3.1 Standard part. An EEE part approved for listing in this standard.

3.2 Nonstandard part. An EEE part that is not approved for listing in this standard. Grade 2 parts used in Grade 1 applications are nonstandard unless upgraded per Appendix B.

3.3 Grade 1. This is the classification used for higher quality standard parts intended for applications that the responsible NASA project office has determined to be critical.

3.3.1 Capacitors, Grade 1. This grade contains military established reliability (ER) parts purchased to S failure rate except where specifically noted.

3.3.2 Connectors, Grade 1. This grade contains connectors that are procurable to MSFC-SPEC "40M" and NASA/GSFC "S-311" specifications.

3.3.3 Crystals, Grade 1. Presently there are no Grade 1 crystals listed in this standard.

3.3.4 Diodes, Grade 1. This grade contains diodes that are MIL-S-19500 JANS qualified. When Grade 1 (JANS) parts are not on the Qualified Products List (QPL), Grade 2 or JANTXV or parts listed in this standard may be upgraded in accordance with Appendix B for use in Grade 1 applications.

3.3.5 Filters, Grade 1. There are no Grade 1 filters listed in this standard.

3.3.6 Inductors and Coils, Grade 1. This grade contains military established reliability (ER) parts purchased to R failure rate (0.01%/1000 hours). Inductors and coils covered by MIL-T-27 and MIL-C-15305 are not suitable for use in Grade 1 applications.

3.3.7 Microcircuits, Grade 1. This grade contains MIL-M-38510 qualified Class S devices. When Grade 1 (Class S) parts are not on the Qualified Products List (QPL), Grade 2 (Class B) parts may be upgraded in accordance with Appendix B for use in Grade 1 applications.

3.3.8 Protective Devices, Grade 1. There are no Grade 1 protective devices listed in this standard.

3.3.9 Relays, Grade 1. There are no Grade 1 relays listed in this standard.

3.3.10 Resistors, Grade 1. This grade contains military established reliability (ER) parts purchased to S failure rate except where specifically noted.

3.3.11 Thermistors, Grade 1. This grade contains thermistors that are procurable to NASA/GSFC specification S-311-P-18.

3.3.12 Transformers, Grade 1. Presently there are no Grade 1 transformers available. Grade 2 transformers may be upgraded in accordance with Appendix B for use in Grade 1 applications.

3.3.13 Transistors, Grade 1. This grade contains transistors that are MIL-S-19500 JANS qualified. When Grade 1 (JANS) parts are not on the Qualified Products List (QPL), Grade 2 or JANTXV parts listed in this standard may be upgraded in accordance with Appendix B for use in Grade 1 applications.

3.3.14 Wire and Cable, Grade 1. This grade contains wire qualified to MIL-W-22759 or MIL-W-81381, and cable qualified to MIL-C-17 and MIL-C-27500. The outgassing properties of these wires and cables are not controlled and must be evaluated for compliance to project outgassing requirements. Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore, the environment for such wire must be controlled.

3.4 Grade 2. This is the classification used for standard parts which meet the criteria for inclusion in this standard and are intended for applications not requiring Grade 1 parts.

3.4.1 Capacitors, Grade 2. This grade contains military established reliability (ER) parts purchased to a minimum P failure rate level (0.1%/1000 hours).

3.4.2 Connectors, Grade 2. This grade contains connectors that are procurable to NASA/MSFC "40M", NASA/GSFC "S-311," MIL-C-5015, MIL-C-24308, MIL-C-26482, MIL-C-38999, MIL-C-39012 and MIL-C-39029 specifications. The outgassing properties of the parts covered in the NASA specifications are controlled within the document; however, the outgassing properties of the parts covered in the military specifications are not controlled and must be evaluated for compliance to specific project outgassing requirements.

3.4.3 Crystals, Grade 2. There are no Grade 2 crystals listed in this standard.

3.4.4 Diodes, Grade 2. This grade contains JANTXV diodes that have been rescreened in accordance with the TX requirements of MIL-S-19500.

3.4.5 Filters, Grade 2. This grade contains filters that are qualified to MIL-F-18327 and MIL-F-28861.

3.4.6 Inductors and Coils, Grade 2. This grade contains inductors and coils that are procurable to military control specifications.

3.4.7 Microcircuits, Grade 2. This grade contains microcircuits which are qualified to MIL-M-38510 Class B, specifications.

3.4.8 Protective Devices, Grade 2. This grade contains devices that are qualified to MIL-F-23419/8 and MIL-C-39019/1 through MIL-C-39019/6.

3.4.9 Relays, Grade 2. This grade contains parts qualified to MIL-R-39016 failure rate level (FRL) P.

3.4.10 Resistors, Grade 2. This grade contains military established reliability (ER) parts purchased to R and/or P failure rate levels (see specific listings).

3.4.11 Thermistors, Grade 2. This grade contains thermistors that are procurable to military control specification MIL-T-27 and MIL-T-23648/19.

3.4.12 Transformers, Grade 2. This grade contains transformers that are procurable to military control specification MIL-T-27 and MIL-T-21038.

3.4.13 Transistors, Grade 2. This grade contains JANTXV transistors that have been rescreened in accordance with the TX requirements of MIL-S-19500.

3.4.14 Wire and Cable, Grade 2. This grade contains wire qualified to MIL-W-22759 or MIL-W-81381, and cable qualified to MIL-C-17 and MIL-C-27500. The outgassing properties of these wires and cables are not controlled and must be evaluated for compliance to project outgassing requirements. Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore, the environment for such wire must be controlled.

3.5 Upgraded Part. A part that is successfully tested to the respective criteria of Appendix B for use in Grade 1 applications.

3.6 Substitute Part. A part that is the best available part listed on current QPL's and is permitted for use in Grade 1 applications.

4. GENERAL REQUIREMENTS

4.1 Criteria for standard parts listing.

4.1.1 Criteria for candidate parts selection. A part will become a candidate for listing in this standard only if it meets all of the criteria in 4.1.1.1 through 4.1.1.4.

4.1.1.1 Application need. There must be multiple applications requiring the specific performance capability peculiar to the part proposed for listing. Consideration will be given to selecting parts capable of satisfying the widest range of design applications, and when applicable, parts should be compatible with existing listings (e.g., select a reference diode that is an extension of a listed series or a microcircuit that is generic to a family already listed). A definite need is assumed to exist for a part that has been used successfully in several recent space applications, provided that it is nonredundant (with respect to form, fit, or function) to existing listings or provides other compelling advantages (e.g., continuing availability) over such listings. In the latter case, deletion of the original listing may be in order.

4.1.1.2 Technological maturity. The design of the part must be finalized and must utilize proven materials and technologies. It must have been in production for a period sufficient to provide assurance that the critical design and process parameters have been identified and adequate controls have been developed. The technology also must have demonstrated suitability for flight hardware or mission-essential ground support equipment use.

4.1.1.3 Availability of manufacturers. The part should be in production by at least one and preferably two manufacturers whose previous peformance indicates that they are capable of qualifying their product to specifications adequate for listing in this standard.

4.1.1.4 Test or usage history. There must be sufficient test or usage experience with the part to:

a. Determine predominant failure modes and mechanisms.

b. Provide reasonable confidence that the part will perform reliably when supplied to an adequate specification.

c. Identify the derating and application restraints necessary for reliable use in flight hardware or mission-essential ground support equipment environments.

4.1.2 Criteria for standard parts approval. The criteria of 4.1.2.1 through 4.1.2.4 should be met before a candidate part can be approved and listed in this standard.

4.1.2.1 Characterization data. A comprehensive parameter characterization test program has been conducted to identify the part's performance capability through the operating temperature spectrum and over long life. This data must indicate that the part parameters are stable over operating temperature range and life, and must reveal peculiarities that should be considered or avoided in usage.

4.1.2.2 Evaluation tests. An environmental test program is usually conducted to determine actual stress levels at which the part fails or degrades significantly.

4.1.2.3 Specification. The part shall have an adequate government specification that defines performance, design, materials, quality controls and test requirements. Parameters in the specification shall realistically characterize the part over its range of specified environment and operating conditions.

4.1.2.4 Qualification. The part should be qualified to the applicable specification, and this qualification must be maintained in accordance with qualification retention requirements. Some parts may be listed when there is an indication that a QPL listing is imminent. QPL listing shall be reviewed by the user for latest qualification status.

4.1.3 Standard part removal criteria. A part listed in this standard may be removed for any of the following reasons:

a. The part becomes obsolete.

b. There are no longer any qualified sources for the part.

c. The part is replaced with a functionally similar device having improved characteristics or better reliability.

d. The part exhibits reliability problems for which no economically adequate controls or screens have been developed.

4.2 Part procurement. The user is responsible for the specifying and procurement of Standard Parts and assuring they comply with the applicable product assurance requirements.

4.2.1 Correlation of circuit requirements and detail specification test condition. When an application condition varies from the detail specification test condition(s), it shall be the responsibility of the contractor (or hardware designer/builder) to establish satisfactory correlation between the circuit requirements and the detail specification requirements.

4.2.2 Specification. All parts listed herein must be procured to the applicable detailed government specifications and be marked with the JAN brand (or approved abbreviation or NASA part number) which signifies satisfactory compliance with all the specification requirements. The "ordering data" paragraph of the detailed specifications should be consulted to assure that proper information is listed in the procurement document.

4.2.3 Qualified manufacturers. Qualified manufacturers are listed in the appropriate Qualified Products List (QPL). The procuring activity shall solicit bids from sources listed in the applicable QPL for the specific part. "Sole source" procurements are discouraged except when only one qualified source exists. The qualifying activity may be contacted to determine if qualification has been granted to additional manufacturers for the part under procurement subsequent to the publication of the current QPL, or if the previous qualification status of any listed manufacturers has changed. The qualifying activity for most QPL's is the Defense Electronics Supply Center (DESC-EQ), Dayton, Ohio 45444.

4.2.4 Receiving inspection. Receiving inspection should be performed on Standard Parts and should include:

a. Review of data shipped with parts for compliance.

b. Part count.

c. Inspection for part markings and external defects.

d. Electrical measurement (100%) of critical parameters, except sampling may be approved by NASA projects.

Adequate security, such as an environmentally controlled bonded storage area, should be provided for storing the received parts until use to maintain their integrity and traceability.

4.3 Parts application. The Standard Parts listed herein must be properly applied by the user for them to give satisfactory and reliable performance. The equipment shall be designed so that it will meet the specified performance and reliability requirements when using Standard Parts. Standard Parts must be used only for those characteristics or parameters which are controlled by the applicable detail specifications. The use of Standard Parts, as required by this standard, does not relieve the contractor (or hardware designer/builder) of the responsibility for complying with all equipment performance and other requirements set forth in the applicable system/equipment specification and contract.

4.3.1 Minimizing parts count. The variety of Standard Part types used in space equipment design should be the minimum necessary to provide satisfactory performance, and the user should exercise all reasonable design choices to achieve this objective.

4.3.2 Application guidelines. The application guidelines provided in MIL-HDBK-978, "NASA Parts Application Handbook," are recommended.

4.3.3 Parts derating. To achieve high reliability and good performance, derating from the qualified maximum ratings is required. All parts shall be derated in accordance with the derating criteria in Appendix A.

4.4 Nonstandard parts usage. Nonstandard parts shall be used only after they are approved by the responsible government activity.

4.5 Conflict of data. In the event of conflict between the technical description of Standard Parts described in this standard and the applicable specification, the specification shall govern.

4.6 Problem Reporting Procedure - Standardization Document Improvement Proposal, (DD Form 1426). Consistent with the parts standardization program, the use of the attached Standardization Document Improvement Proposal (DD form 1426) is encouraged as a communique for parts and commodity experience. Experience need not be restricted to problems, in which case a part may be requested to be removed, but may also include part or commodity additions to the standard. As a minimum, the "Remarks" paragraph should include the following (when appropriate): commodity ID, generic part number, user part number, and any pertinent data which may be of use for approving your request.

Reply to attention of:

MANAGER
NASA STANDARD PARTS LEAD CENTER OFFICE (EG02)
MARSHALL SPACE FLIGHT CENTER, AL 35812.

SECTION 1: SUMMARY OF STANDARD CAPACITORS

Page	Control Specification	Military Style	Description	Seal	Capacitance Range		DC Voltage Range (volts)		Operating Temperature Range (°C)		Grade 1 FRL 1/	Grade 2 FRL
					Min	Max	Min	Max	Min	Max		
1.2	MIL-C-20	CCR	Fixed, ceramic, temperature compensating	Nonhermetic	1.0 pf	0.082 µf	50	200	-55	+125	R	P
1.13	MIL-C-23269	CYR	Fixed, glass	Hermetic	0.5 pf	0.01 µf	100		-55	+125	S	S 4/
1.19	MIL-C-39003	CSR	Fixed, tantalum (solid) electrolytic	Hermetic	0.0047 µf	560 µf	10	75	-55	+125 2/	S	P
1.26	MIL-C-39006	CLR	Fixed, tantalum (nonsolid) electrolytic	Hermetic	0.39 µf	750 µf	15	375	-55	+125	R	P
1.41	MIL-C-39014	CKR	Fixed, ceramic	Nonhermetic	10 pf	1 µf	50	200	-55	+125	S	P
1.49	MIL-C-55365	CWR	Chip, fixed, tantalum	Unencapsulated	0.10 µf	100.0 µf	4	50	-55	+125	R	P
1.52	MIL-C-55681	CDR	Chip, fixed, ceramic dielectric	Unencapsulated	0.0012 µf	0.47 µf	50	200	-55	+125	R	P
1.56	MIL-C-83421	CRH	Fixed, supermetallized plastic film	Hermetic	0.001 µf	22 µf	30	400	-65	+100 3/	S	R

1/ Failure Rate Levels (FRLs), defined in %/1000 hours, are specified as follows: S = 0.001, R = 0.01, and P = 0.1.
2/ When properly derated, these capacitors may be operated over a temperature range of -55° to +125°C. The derated voltage at +125°C is approximately 66 percent of the full rated voltage. Refer to MIL-C-39003.
3/ Parts may be used at a maximum operating temperature of +100°C, but must be linearly derated above +85°C to 50 percent of the +85°C rated voltage.
4/ Available for 100 Vdc unit at S failure rate only.

MIL-C-20, CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Part Number Explanation:

CCRXX

Style - CCR identifies an established reliability, ceramic-dielectric, temperature-compensating, fixed capacitor; XX identifies the shape and the dimensions of the capacitor.

CX

Characteristics - C identifies the nominal temperature coefficient (0 ppm/°C), while "X" identifies the approximate tolerance envelope for the temperature coefficient. Characteristics available are:

X	±ppm/°C
G	30
H	60

XXX

Capacitance - Nominal value expressed in picofarads. 1/

X

Capacitance Tolerance specified in accordance with the following table:

X	Tolerance (±)	X	Tolerance (±)
C	0.25pf	G	2%
D	0.5 pf	J	5%
F	1%		

X

Failure Rate Level (%/1000 hours)
P = 0.1
R = 0.01

Part Number	Control Specification MIL-C-20	Style	Capacitance Range (pf)	Capacitance Tolerances Available	Rated Voltage (volts dc) 2/	Dissipation Factor (%)	Temperature Range (°C)	Temperature Characteristics Available	Minimum I.R. (megohms) @ Temperature +25°C	Minimum I.R. (megohms) @ Temperature +125°C	Configuration Case Type	Configuration Lead 4/ Type	FRL 5/ Grade 1	FRL 5/ Grade 2
CCR05CX XXX X X	/35	CCR05	1.0-3,300	C, D, F, G, J	50, 100, 200	0.15	-55 to +125	CG, CH	100 K megohm or 1000 megohm -µf, whichever is less 3/	10 K megohm or 100 megohm -µf, whichever is less 3/	Rect molded	Radial	R	P
CCR06CG XXX X X	/36	CCR06	390-10,000	F, G, J				CG						
CCR07CG XXX X X	/37	CCR07	2,200-22,000											
CCR08CG XXX X X	/38	CCR08	3,900-68,000	G, J										
CCR75CG XXX X X	/27	CCR75	1.0-680	C, D, F, G, J							Tubular molded	Axial	6/	
CCR76CG XXX X X	/28	CCR76	82-1,000	F, G, J										
CCR77CG XXX X X	/29	CCR77	150-5,600											
CCR78CG XXX X X	/30	CCR78	820-27,000											
CCR79CG XXX X X	/31	CCR79	3,900-82,000											

1/ For values >10 pf, the first two digits are significant, and the last signifies the number of zeros to follow. For values <10 pf, the letter R is used to indicate the decimal point, and succeeding digit(s) represent significant figure(s); e.g., 1R0 indicates 1.0 pf, and 392 indicates 3900 pf.

2/ For low voltage applications (<10 volts d.c.), it is recommended that capacitor rated voltage should be at least 100 volts d.c.

3/ When the megohm-µf form is used, the insulation resistance = X/C, where X = 1K megohm or 100 megohm (depending on the temperature) and C is the capacitance expressed in µf.

4/ MIL-C-20 specifies that leads be solderable, but the lead material itself is not specified. When leads are to be welded rather than soldered, copper leads and solder or tin-plate finish are not preferred and are not recommended. Consult the project engineer for recommendations for parts procurement.

5/ For space flight use, wax impregnates or other volatile materials must not be applied to the capacitor.

6/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-20/35, STYLE CCR05 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR05C	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	1.0	C	H1R0CR	H1R0CP
	1.2		H1R2CR	H1R2CP
	1.5		H1R5CR	H1R5CP
	1.8		H1R8CR	H1R8CP
	2.2		H2R2CR	H2R2CP
	2.7	C, D	H2R7*R	H2R7*P
	3.3		H3R3*R	H3R3*P
	3.9		H3R9*R	H3R9*P
	4.7		H4R7*R	H4R7*P
	5.6		H5R6*R	H5R6*P
	6.8		H6R8*R	H6R8*P
	8.2		H8R2*R	H8R2*P
	10	F, G, J	G100*R	G100*P
	12		G120*R	G120*P
	15		G150*R	G150*P
	18		G180*R	G180*P
	22		G220*R	G220*P
	27		G270*R	G270*P
	33		G330*R	G330*P
	39		G390*R	G390*P
	47		G470*R	G470*P
	56		G560*R	G560*P
	68		G680*R	G680*P
	82		G820*R	G820*P
	100		G101*R	G101*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/35, STYLE CCR05 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability (Continued)

Rated Voltage (volts, dc)	Capacitance		Part Number CCR05C	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	120	F, G, J	G121*R	G121*P
	150		G151*R	G151*P
	180		G181*R	G181*P
	220		G221*R	G221*P
	270		G271*R	G271*P
	330		G331*R	G331*P
100	360		G361*R	G361*P
	390		G391*R	G391*P
	470		G471*R	G471*P
	560		G561*R	G561*P
	680		G681*R	G681*P
	820		G821*R	G821*P
	1000		G102*R	G102*P
	1200		G122*R	G122*P
	1500		G152*R	G152*P
	1800		G182*R	G182*P
50	2200		G222*R	G222*P
	2700		G272*R	G272*P
	3300		G332*R	G332*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/36, STYLE CCR06 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR06CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	390	F, G, J	391*R	391*P
	470		471*R	471*P
	560		561*R	561*P
	680		681*R	681*P
	820		821*R	821*P
	1,000		102*R	102*P
	1,200		122*R	122*P
	1,500		152*R	152*P
	1,800		182*R	182*P
100	2,200		222*R	222*P
	2,700		272*R	272*P
	3,300		332*R	332*P
	3,900		392*R	392*P
	4,700		472*R	472*P
50	5,100		512*R	512*P
	5,600		562*R	562*P
	6,800		682*R	682*P
	8,200		822*R	822*P
	10,000		103*R	103*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/37, STYLE CCR07 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR07CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	2,200 2,700 3,300	F, G, J	222*R 272*R 332*R	222*P 272*P 332*P
100	5,600 6,800 8,200 10,000 12,000		562*R 682*R 822*R 103*R 123*R	562*P 682*P 822*P 103*P 123*P
50	15,000 18,000 22,000		153*R 183*R 223*R	153*P 183*P 223*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
* Choice of allowable tolerances.

MIL-C-20/38, STYLE CCR08 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR08CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200 200	3,900 4,700	G, J	392*R 472*R	392*P 472*P
100 100	15,000 18,000		153*R 183*R	153*P 183*P
50 50	56,000 68,000		563*R 683*R	563*P 683*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
* Choice of allowable tolerances.

MIL-C-20/27, STYLE CCR75 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR75CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	1.0	C	1R0CR	1R0CP
	1.1		1R1CR	1R1CP
	1.2		1R2CR	1R2CP
	1.3		1R3CR	1R3CP
	1.5		1R5CR	1R5CP
	1.6		1R6CR	1R6CP
	1.8		1R8CR	1R8CP
	2.0		2R0CR	2R0CP
	2.2		2R2CR	2R2CP
	2.4		2R4CR	2R4CP
	2.7	C, D	2R7*R	2R7*P
	3.0		3R0*R	3R0*P
	3.3		3R3*R	3R3*P
	3.6		3R6*R	3R6*P
	3.9		3R9*R	3R9*P
	4.3		4R3*R	4R3*P
	4.7		4R7*R	4R7*P
	5.1		5R1*R	5R1*P
	5.6		5R6*R	5R6*P
	6.8		6R8*R	6R8*P
	7.5		7R5*R	7R5*P
	8.2		8R2*R	8R2*P
	9.1		9R1*R	9R1*P
	10	F, G, J	100*R	100*P
	11		110*R	110*P
	12		120*R	120*P
	15		150*R	150*P
	18		180*R	180*P
	22		220*R	220*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/27, STYLE CCR75 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability (Continued)

Rated Voltage (volts, dc)	Capacitance		Part Number CCR75CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	27	F, G, J	270*R	270*P
	33		330*R	330*P
	39		390*R	390*P
	47		470*R	470*P
	56		560*R	560*P
	68		680*R	680*P
100	82		820*R	820*P
	100		101*R	101*P
	120		121*R	121*P
	150		151*R	151*P
	180		181*R	181*P
	220		221*R	221*P
50	270		271*R	271*P
	330		331*R	331*P
	390		391*R	391*P
	470		471*R	471*P
	560		561*R	561*P
	680		681*R	681*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/28, STYLE CCR76 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR76CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	82 100 120.	F, G, J	820*R 101*R 121*R	820*P 101*P 121*P
100	270 330 390		271*R 331*R 391*R	271*P 331*P 391*P
50	820 1,000		821*R 102*R	821*P 102*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/29, STYLE CCR77 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR77CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	150	F, G, J	151*R	151*P
	180		181*R	181*P
	220		221*R	221*P
	270		271*R	271*P
	330		331*R	331*P
	390		391*R	391*P
	510		511*P	511*P
	560		561*R	561*P
	680		681*R	681*P
100	820		821*R	821*P
	1,000		102*R	102*P
	1,200		122*R	122*P
	1,500		152*R	152*P
	1,800		182*R	182*P
	2,200		222*R	222*P
50	2,700		272*R	272*P
	3,300		332*P	332*P
	3,900		392*R	392*P
	4,700		472*R	472*P
	5,600		562*P	562*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/30, STYLE CCR78 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR78CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	820	F, G, J	821*R	821*P
	1,000		102*R	102*P
	1,200		122*R	122*P
	1,500		152*R	152*P
	1,800		182*R	182*P
	2,200		222*R	222*P
	2,700		272*R	272*P
	3,300		332*R	332*P
100	3,900		392*R	392*P
	4,700		472*R	472*P
	5,600		562*R	562*P
	6,800		682*R	682*P
	8,200		822*R	822*P
	10,000		103*R	103*P
	12,000		123*R	123*P
50	15,000		153*R	153*P
	18,000		183*R	183*P
	22,000		223*R	223*P
	27,000		273*R	273*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-20/31, STYLE CCR79 CAPACITORS
Fixed, Ceramic Dielectric, Temperature Compensating, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number CCR79CG	
	Nominal Value (pf)	Tolerances Available	Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	3,900	F, G, J	392*R	392*P
	4,700		472*R	472*P
	5,600		562*R	562*P
	6,800		682*R	682*P
	8,200		822*R	822*P
	10,000		103*R	103*P
100	15,000		153*R	153*P
	18,000		183*R	183*P
	22,000		223*R	223*P
	27,000		273*R	273*P
	33,000		333*R	333*P
	39,000		393*R	393*P
50	47,000		473*R	473*P
	56,000		563*R	563*P
	68,000		683*R	683*P
	82,000		823*R	823*P

1/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

* Choice of allowable tolerances.

MIL-C-23269, CAPACITORS
Fixed, Glass Dielectric, Established Reliability

Part number explanation:

M23269 — M23269 - Identifies CYR fixed, glass dielectric, established reliability capacitors conforming to MIL-C-23269.

/XX — /XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family.

-XXXX — -XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated dc voltage, and failure rate level (%/1000 hours).

Part Number	Control Specification	Style 1/, 2/	Capacitance		Working Voltage Vdc 3/	Maximum Dissipation Factor (%)	Temperature		Minimum Insulation Resistance (megohms) @ +25°C	FRL	
			Range (pf)	Tolerance (±)			Range (°C)	Coefficient (ppm/°C)		Grade 1	Grade 2
M23269/01-XXXX	MIL-C-0023269/1 (USAF)	CYR10	0.5-300	0.25pf, 1%, 2%, 5%	100	0.1	-55 to +125	140 ±25	100K	S	S
M23269/02-XXXX	MIL-C-0023269/2 (USAF)	CYR15	220-1200	1%, 2%, 5%						S	S
M23269/03-XXXX	MIL-C-0023269/3 (USAF)	CYR20	560-5100							S	S
M23269/04-XXXX	MIL-C-0023269/4 (USAF)	CYR30	3600-10,000							S	S

1/ See the tables following for the standard capacitors for the styles listed.
2/ All styles listed are in rectangular-glass, hermetic cases with axial leads. Lead material and coating are specified in the detailed specification sheet for each device type. However, not all lead materials listed are preferred and recommended for welding. Consult the project parts engineer for recommendations for part procurement.
3/ Capacitors operate at full rated voltage at temperatures up to +125°C.

MIL-C-23269/1, STYLE CYR10 CAPACITORS
Fixed, Glass Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/01-	
	Value (pf)	Tolerance (±)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	0.5	0.25pf	7001	
	1.0	0.25pf	7002	
	1.5	0.25pf	7003	
	2.2	0.25pf	7004	
		0.50pf	7005	
	2.7	0.25pf	7006	
	3.0	0.25pf	7007	
		0.50pf	7008	
	3.3	0.25pf	7009	
	3.6	0.25pf	7010	
		0.50pf	7011	
	3.9	0.25pf	7012	
	4.3	0.25pf	7013	
		0.50pf	7014	
	4.7	0.25pf	7015	
	5.1	0.25pf	7016	
	5.6	0.25pf	7017	
		5%	7018	
	6.2	0.25pf	7019	
		5%	7020	
	6.8	0.25pf	7021	
		5%	7022	
	7.5	0.25pf	7023	
		5%	7024	
	8.2	0.25pf	7025	
		5%	7026	
	9.1	0.25pf	7027	
		5%	7028	
	10	0.25pf	7029	
		5%	7030	
	11	0.25pf	7031	
		5%	7032	
	12	0.25pf	7033	
		5%	7034	
	13	2%	7035	
		5%	7036	
	15	2%	7037	
		5%	7038	
	16	2%	7039	
		5%	7040	
	18	2%	7041	
		5%	7042	
	20	2%	7043	
		5%	7044	
	22	2%	7045	
		5%	7046	
	24	2%	7047	
		5%	7048	
	27	1%	7049	
		2%	7050	
		5%	7051	
	30	1%	7052	
		2%	7053	
		5%	7054	
	33	1%	7055	
		2%	7056	
		5%	7057	
	36	1%	7058	
		2%	7059	
		5%	7060	
	39	1%	7061	
		2%	7062	
		5%	7063	
	43	1%	7064	

MIL-C-23269/1, STYLE CYR10 CAPACITORS
Fixed, Glass Dielectric, Established Reliability (Continued)

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/01-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	43	2	7065	
		5	7066	
	47	1	7067	
		2	7068	
		5	7069	
	51	1	7070	
		2	7071	
		5	7072	
	56	1	7073	
		2	7074	
		5	7075	
	62	1	7076	
		2	7077	
		5	7078	
	68	1	7079	
		2	7080	
		5	7081	
	75	1	7082	
		2	7083	
		5	7084	
	82	1	7085	
		2	7086	
		5	7087	
	91	1	7088	
		2	7089	
		5	7090	
	100	1	7091	
		2	7092	
		5	7093	
	110	1	7094	
		2	7095	
		5	7096	

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/01-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	120	1	7097	
		2	7098	
		5	7099	
	130	1	7100	
		2	7101	
		5	7102	
	150	1	7103	
		2	7104	
		5	7105	
	160	1	7106	
		2	7107	
		5	7108	
	180	1	7109	
		2	7110	
		5	7111	
	200	1	7112	
		2	7113	
		5	7114	
	220	1	7115	
		2	7116	
		5	7117	
	240	1	7118	
		2	7119	
		5	7120	
	270	1	7121	
		2	7122	
		5	7123	
	300	1	7124	
		2	7125	
		5	7126	

MIL-C-23269/2, STYLE CYR15 CAPACITORS
Fixed, Glass Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/02-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	220	1	7001	
		2	7002	
		5	7003	
	240	1	7004	
		2	7005	
		5	7006	
	270	1	7007	
		2	7008	
		5	7009	
	300	1	7010	
		2	7011	
		5	7012	
	330	1	7013	
		2	7014	
		5	7015	
	360	1	7016	
		2	7017	
		5	7018	
	390	1	7019	
		2	7020	
		5	7021	
	430	1	7022	
		2	7023	
		5	7024	
	470	1	7025	
		2	7026	
		5	7027	
	510	1	7028	
		2	7029	
		5	7030	

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/02-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	560	1	7031	
		2	7032	
		5	7033	
	620	1	7034	
		2	7035	
		5	7036	
	680	1	7037	
		2	7038	
		5	7039	
	750	1	7040	
		2	7041	
		5	7042	
	820	1	7043	
		2	7044	
		5	7045	
	910	1	7046	
		2	7047	
		5	7048	
	1000	1	7049	
		2	7050	
		5	7051	
	1100	1	7052	
		2	7053	
		5	7054	
	1200	1	7055	
		2	7056	
		5	7057	

MIL-C-23269/3, STYLE CYR20 CAPACITORS
Fixed, Glass Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/03-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	560	1	7001	
		2	7002	
		5	7003	
	620	1	7004	
		2	7005	
		5	7006	
	680	1	7007	
		2	7008	
		5	7009	
	750	1	7010	
		2	7011	
		5	7012	
	820	1	7013	
		2	7014	
		5	7015	
	910	1	7016	
		2	7017	
		5	7018	
	1000	1	7019	
		2	7020	
		5	7021	
	1100	1	7022	
		2	7023	
		5	7024	
	1200	1	7025	
		2	7026	
		5	7027	
	1300	1	7028	
		2	7029	
		5	7030	
	1500	1	7031	
		2	7032	
		5	7033	
	1600	1	7034	
		2	7035	
		5	7036	

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/03-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	1800	1	7037	
		2	7038	
		5	7039	
	2000	1	7040	
		2	7041	
		5	7042	
	2200	1	7043	
		2	7044	
		5	7045	
	2400	1	7046	
		2	7047	
		5	7048	
	2700	1	7049	
		2	7050	
		5	7051	
	3000	1	7052	
		2	7053	
		5	7054	
	3300	1	7055	
		2	7056	
		5	7057	
	3600	1	7058	
		2	7059	
		5	7060	
	3900	1	7061	
		2	7062	
		5	7063	
	4300	1	7064	
		2	7065	
		5	7066	
	4700	1	7067	
		2	7068	
		5	7069	
	5100	1	7070	
		2	7071	
		5	7072	

MIL-C-23269/4, STYLE CYR30 CAPACITORS
Fixed, Glass Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/04-	
	Value (nf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	3.6	1	7001	
		2	7002	
		5	7003	
	3.9	1	7004	
		2	7005	
		5	7006	
	4.3	1	7007	
		2	7008	
		5	7009	
	4.7	1	7010	
		2	7011	
		5	7012	
	5.1	1	7013	
		2	7014	
		5	7015	
	5.6	1	7016	
		2	7017	
		5	7018	

Rated Voltage (volts, dc)	Capacitance		Part Number M23269/04-	
	Value (nf)	Tolerance (±%)	Grade 1 FRL = S (0.001)	Grade 2 FRL = S (0.001)
100	6.2	1	7019	
		2	7020	
		5	7021	
	6.8	1	7022	
		2	7023	
		5	7024	
	7.5	1	7025	
		2	7026	
		5	7027	
	8.2	1	7028	
		2	7029	
		5	7030	
	9.1	1	7031	
		2	7032	
		5	7033	
	10.0	1	7034	
		2	7035	
		5	7036	

MIL-C-39003, CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Established Reliability

Part number explanation:

M39003 — M39003 - Identifies CSR fixed, tantalum, electrolytic (solid electrolyte), established reliability capacitors that are hermetically sealed in metal cases. The metal cases are insulated.

/XX — /XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family.

-XXXX — -XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated voltage, maximum dc leakage and dissipation factor, and failure rate level (%/1000 hours).

Part Number 1/	Control Specification	Style	Capacitance		Rated Voltage (Vdc) 3/	Operating Temperature Range (°C) 3/	Configuration			FRL	
			Range (µf)	Tolerance (±%)			Case Type	Lead Type	Lead Material	Grade 1 4/	Grade 2
M39003/01-XXXX	MIL-C-39003/1 Polarized 2/	CSR13	0.0047-220.0	10, 20	10, 20, 35, 50, 75	-55 to +125	Tubular	Axial	Tin-lead coated nickel. Solder coated nickel.	S	P
M39003/02-XXXX	MIL-C-39003/2 Polarized 2/	CSR09	0.047-15.0	10	10, 20, 35, 50, 75				Nickel-iron alloy	S	P
M39003/06-XXXX	MIL-C-39003/6 Polarized 2/	CSR33	1.2-560.0	10, 20	10, 20 35, 50				Tin-lead coated nickel. Solder coated nickel.	5/	P

1/ MIL-C-39003 capacitors are not recommended for use in power supply filters.
2/ Parts should see an effective current-limiting series resistance. See Appendix A for derating.
3/ When properly derated, these capacitors may be operated over a temperature range of -55° to +125°C. The derated voltage at +125°C is approximately 66 percent of the full rated voltage. Refer to MIL-C-39003.
4/ All parts must be subjected to the surge current test as specified by Appendix B, paragraph 4.0.
5/ CSR33 capacitors are not acceptable for Grade 1 applications.

MIL-C-39003/1, STYLE CSR13 CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability

Rated Voltage @ 85°C (volts, dc)	Capacitance		Maximum DC Leakage @			Maximum Dissipation Factor @		Case Size 1/	Part Number M39003/01-	
	Nominal Value (µf)	Tolerance (±%)	+25°C (µA)	+85°C (µA)	+125°C (µA)	-55°C & +25°C (%)	+85°C & +125°C (%)		Grade 1 FRL = S(0.001)	Grade 2 FRL = P (0.1)
10	3.9	10	0.3	6.0	7.5	4	4	A	2973	2493
	4.7	10 20	0.4	7.0	8.8				2974 2975	2494 2495
	27.0	10	2.0	40.0	50.0	6	6	B	2976	2496
	33.0	10 20	2.5	50.0	63.0				2977 2978	2497 2498
	39.0	10	2.5	50.0	63.0				2979	2499
	82.0	10	4.0	80.0	100.0			C	2980	2500
	100.0	10 20	5.0	100.0	125.0				2981 2982	2501 2502
	120.0	10	6.0	120.0	150.0	8	8		2983	2503
	180.0	10	9.0	180.0	226.0			D	2984	2504
	220.0	10 20	10.0	200.0	250.0				2985 2986	2505 2506
20	1.2	10	0.3	6.0	7.5	4	4	A	2999	2519
	1.5	10 20	0.3	6.0	7.5				3000 3001	2520 2521
	2.2	10 20	0.4	8.0	10.0				3003 3004	2523 2524
	8.2	10	1.0	20.0	25.0	6	6	B	3005	2525
	12.0	10	1.8	35.0	44.0				3008	2528
	15.0	10 20	2.0	40.0	50.0				3009 3010	2529 2530
	33.0	10 20	3.5	70.0	88.0			C	3012 3013	2532 2533
	47.0	10 20	4.5	90.0	113.0				3015 3016	2535 2536
	68.0	10 20	7.0	140.0	175.0			D	3018 3019	2538 2539
	100.0	10 20	10.0	200.0	250.0	8	8		3021 3022	2541 2542

1/ Case sizes are given in MIL-C-39003/1.

MIL-C-39003/1, STYLE CSR13 CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc)	Capacitance		Maximum DC Leakage @			Maximum Dissipation Factor @		Case Size 1/	Part Number M39003/01-	
	Nominal Value (µf)	Tolerance (±%)	+25°C (µA)	+85°C (µA)	+125°C (µA)	-55°C & +25°C (%)	+85°C & +125°C (%)		Grade 1 FRL = S(0.001)	Grade 2 FRL = P (0.1)
35	6.8	10	1.5	30.0	38.0	6	6	B	3024	2544
		20							3025	2545
	22.0	10	4.0	80.0	100.0			C	3026	2546
		20							3027	2547
	33.0	10	5.5	110.0	138.0			D	3029	2549
		20							3030	2550
	47.0	10	8.0	160.0	200.0				3032	2552
		20							3033	2553
50	0.0047	10	0.3	5.0	6.3	2	4	A	3034	2554
		20							3035	2555
	0.0068	10							3037	2557
		20							3038	2558
	0.01	10							3040	2560
		20							3041	2561
	0.015	10							3043	2563
		20							3044	2564
	0.022	10							3046	2566
		20							3047	2567
	0.033	10							3049	2569
		20							3050	2570
	0.047	10							3052	2572
		20							3053	2573
	0.068	10							3055	2575
		20							3056	2576
	0.1	10							3058	2578
		20							3059	2579
	0.15	10							3061	2581
		20							3062	2582
	0.47	10							3070	2590
		20							3071	2591
	1.5	10	0.6	12.0	15.0	4		B	3079	2599
		20							3080	2600
	2.7	10	1.0	20.0	25.0				3084	2604
	4.7	10	1.7	35.0	44.0				3088	2608
		20							3089	2609

1/ Case sizes are given in MIL-C-39003/1.

MIL-C-39003/1, STYLE CSR13 CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc)	Capacitance		Maximum DC Leakage @			Maximum Dissipation Factor @		Case Size 1/	Part Number M39003/01-	
	Nominal Value (µf)	Tolerance (±%)	+25°C (µA)	+85°C (µA)	+125°C (µA)	-55°C & +25°C (%)	+85°C & +125°C (%)		Grade 1 FRL = S(0.001)	Grade 2 FRL = P (0.1)
50	6.8	10	2.2	45.0	56.0	6	6	C	3091	2611
		20							3092	2612
	10.0	10	2.5	50.0	63.0				3094	2614
		20							3095	2615
	15.0	10	4.0	80.0	100.0				3097	2617
		20							3098	2618
	22.0	10	5.5	110.0	138.0			D	3100	2620
		20							3101	2621
75	0.12	10	0.3	5.0	6.3	2	4	A	3104	2624
	0.15	10							3105	2625
		20							3106	2626
	0.18	10							3107	2627
	0.27	10							3110	2630
	0.33	10							3111	2631
		20							3112	2632
	0.39	10							3113	2633
	0.47	10							3114	2634
		20							3115	2635
	0.68	10							3117	2637
		20							3118	2638
	1.5	10	0.6	10.0	13.0	4		B	3123	2643
		20							3124	2644
	2.2	10	0.8	15.0	19.0				3126	2646
		20							3127	2647
	3.3	10	1.2	20.0	25.0				3129	2649
		20							3130	2650
	4.7	10	3.0	60.0	75.0			C	3132	2652
		20							3133	2653
	6.8	10	5.0	100.0	125.0	6	6		3135	2655
		20							3136	2656
	10.0	10							3138	2658
		20							3139	2659
	15.0	10	7.0	140.0	175.0			D	3141	2661
		20							3142	2662

1/ Case sizes are given in MIL-C-39003/1.

MIL-C-39003/2, STYLE CSR09 CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability

Rated Voltage @ +85°C (volts, dc)	Nominal Capacitance Value (µf)	Maximum DC Leakage @			Maximum Dissipation Factor @			Case Size 1/	Part Number M39003/02-	
		+25°C (µA)	+85°C (µA)	+125°C (µA)	-55°C (%)	+25°C (%)	+85°C & +125°C (%)		Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
10	1.8	0.6	6.0	8.0	8	6	6	A1	0187	0067
	2.2	0.6	6.0	8.0				A1	0188	0068
	10.0	2.5	20.0	34.0				B1	0189	0069
	12.0	2.5	24.0	40.8				B1	0190	0070
	15.0	2.5	30.0	51.0				B1	0191	0071
20	0.56	0.6	6.0	8.0	4	3	4	A1	0196	0076
	0.68	0.6	6.0	8.0				A1	0197	0077
	0.82	0.6	6.0	8.0				A1	0198	0078
	1.0	0.6	6.0	8.0				A1	0199	0079
	3.3	1.0	13.2	22.4				B1	0200	0080
	3.9	2.0	15.6	26.5				B1	0201	0081
	4.7	2.0	18.8	32.0				B1	0202	0082
	5.6	2.0	22.4	38.1				B1	0203	0083
	6.8	2.0	27.2	46.2				B1	0204	0084
35	0.33	0.6	6.0	8.0				A1	0205	0085
	0.39	0.6	6.0	8.0				A1	0206	0086
	0.47	0.6	6.0	8.0				A1	0207	0087
	2.2	1.4	15.4	26.2				B1	0208	0088
	2.7	1.4	18.9	32.1				B1	0209	0089
50	0.22	0.6	6.0	8.0				A1	0210	0090
	0.27	0.6	6.0	8.0				A1	0211	0091
	1.5	1.4	15.0	25.5				B1	0212	0092
	1.8	1.4	18.0	30.6				B1	0213	0093
75	0.047	0.6	6.0	8.0				A1	0214	0094
	0.056							A1	0215	0095
	0.068							A1	0216	0096
	0.082							A1	0217	0097
	0.10							A1	0218	0098
	0.12							A1	0219	0099
	0.15							A1	0220	0100
	0.18							A1	0221	0101
	0.22							B1	0222	0102
	0.27							B1	0223	0103
	0.33			8.4				B1	0224	0104
	0.39			9.9				B1	0225	0105
	0.47		7.0	12.0				B1	0226	0106
	0.56		8.4	14.3				B1	0227	0107
	0.68		10.2	17.3				B1	0228	0108
	0.82	0.7	12.3	20.9				B1	0229	0109
	1.0	0.9	15.0	25.5				B1	0230	0110
	1.2	0.9	18.0	30.6				B1	0231	0111

1/ Case sizes are given in MIL-C-39003/2.

MIL-C-39003/6, STYLE CSR33 CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability

Rated Voltage (volts, dc)	Capacitance (µf)	Capacitance Tolerance (±%)	Maximum DC Leakage (µA) +25°C	Maximum DC Leakage (µA) +85°C	Maximum DC Leakage (µA) +125°C	Maximum Dissipation Factor (%)	Case Size 1/	Part Number M39003/06- Grade 1 FRL = S(0.001)	Part Number M39003/06- Grade 2 FRL = P(0.1)
10	6.8	10	0.5	2.0	2.0	6	A	2/	0116
	6.8	20	0.5				A		0117
	8.2	10	0.5				A		0118
	47.0	10	1.0				B		0119
	47.0	20	1.0	2.0	2.0	6	B		0120
	56.0	10		4.0	4.0		B		0121
	68.0	10		4.0	4.0		B		0122
	68.0	20		4.0	4.0		B		0123
	82.0	10	1.0	4.0	4.0	6	B		0124
	220.0	10	1.0	7.0	7.0	8	C		0125
	220.0	20	1.0	7.0	7.0	8	C		0126
	270.0	10	2.0	10.0	10.0	8	C		0127
	390.0	10	2.0	16.0	16.0	10	D		0128
	470.0	10	4.0				D		0129
	470.0	20	4.0				D		0130
	560.0	10	4.0				D		0131
20	2.7	10	0.5	2.0	2.0	4	A		0146
	3.3	10					A		0147
	3.3	20					A		0148
	3.9	10					A		0149
	18.0	10	1.0			6	B		0150
	22.0	10					B		0151
	22.0	20					B		0152
	27.0	10					B		0153
	56.0	10		10.0	10.0	6	C		0154
	68.0	10					C		0155
	68.0	20					C		0156
	82.0	10					C		0157
	100.0	10	1.0			6	C		0158
	100.0	20	1.0			6	C		0159
	120.0	10	1.0			6	C		0160
	150.0	10	2.0			8	D		0161
	150.0	20	2.0			8	D		0162
	180.0	10					D		0163

1/ Case sizes are given in MIL-C-39003/6.
2/ CSR33 is only considered as a Grade 2 part.

MIL-C-39003/6, STYLE CSR33 CAPACITORS
Fixed, Tantalum (Solid) Electrolytic, Polarized, Established Reliability (Continued)

Rated Voltage (volts, dc)	Capacitance (µf)	Capacitance Tolerance (±%)	Maximum DC Leakage (µA) +25°C	Maximum DC Leakage (µA) +85°C	Maximum DC Leakage (µA) +125°C	Maximum Dissipation Factor (%)	Case Size 1/	Part Number M39003/06- Grade 1 FRL = S(0.001)	Part Number M39003/06- Grade 2 FRL = P(0.1)
35	1.8	10	0.5	2.0	2.0	4	A	2/	0164
	8.2	10	1.0			6	B		0165
	10.0	10	1.0			6	B		0166
	10.0	20	1.0			6	B		0167
	33.0	10	1.0	5.0	5.0	6	C		0168
	33.0	20					C		0169
	39.0	10					C		0170
	47.0	10					C		0171
	47.0	20	1.0	5.0	5.0	6	C		0172
	56.0	10	2.0	10.0	10.0		D		0173
	68.0	10	2.0	10.0	10.0		D		0174
	68.0	20	2.0	10.0	10.0		D		0175
50	1.2	10	0.5	2.0	2.0	4	A		0176
	1.5	10	0.5				A		0177
	1.5	20	0.5				A		0178
	5.6	10	1.0				B		0179
	6.8	10	1.0	2.0	2.0	6	B		0180
	6.8	20		2.0	2.0		B		0181
	22.0	10		5.0	5.0		C		0182
	22.0	20		5.0	5.0		C		0183
	27.0	10	1.0	5.0	5.0	6	C		0184
	33.0	10		9.0	9.0		D		0185
	33.0	20		9.0	9.0		D		0186
	39.0	10		9.0	9.0		D		0187

1/ Case sizes are given in MIL-C-39003/6.
2/ CSR33 is only considered as a Grade 2 part.

MIL-C-39006, CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Hermetically Sealed, Established Reliability

Part number explanation:

M39006 - Identifies CLR tantalum, electrolytic (nonsolid electrolyte), fixed capacitors (polarized and nonpolarized), hermetically sealed in metal cases, with insulating sleeves, and conforming to MIL-C-39006.

/XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family.

-XXXX - Uniquely specifies the nominal cpacitance value, capacitance tolerance, rated dc voltage, dc leakage, and failure rate level (%/1000 hours).

Part Number	Control Specification	Style 1/	Capacitance Range (±µf)	Capacitance Tolerance (±%)	Working Voltage Vdc 3/	Operating Temperature Range °C	FRL Grade 1 4/	FRL Grade 2
M39006/01-XXXX	MIL-C-39006/1 Polarized/Etched Foil	CLR25 2/	32 to 580	+75, -15	15,25 or 30	-55 to +125	R	P
			12 to 150	+50, -15	50 or 75			
			4 to 70	+30, -15	100 or 150			
M39006/02-XXXX	MIL-C-39006/2 Nonpolarized/Etched Foil	CLR27 2/	18 to 350	+75, -15	15,25 or 30	-55 to +125	R	P
			6 to 80	+50, -15	50 or 75			
			2 to 35	+30, -15	100 or 150			
M39006/03-XXXX	MIL-C-39006/3 Polarized/Plain Foil	CLR35 2/	18 to 160	±20	15	-55 to +125	R	P
			12 to 100		25			
			10 to 85		30			
			68		35			
			6 to 55		50			
			4 to 40		75			
			3 to 30		100			
			2 to 20		150			
			1.5 to 15	±15	200			
			1 to 10	±15	300			

See end of table for footnotes.

MIL-C-39006, CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Hermetically Sealed, Established Reliability (Continued)

Part Number	Control Specification	Style 1/	Capacitance		Working Voltage Vdc 3/	Operating Temperature Range °C	FRL	
			Range (±µf)	Tolerance (±%)			Grade 1 4/	Grade 2
M39006/04-XXXX	MIL-C-39006/4 Nonpolarized/Plain Foil	CLR37 2/	10 to 100	±20	15	-55 to +125	R	P
			6 to 60		25			
			5.5 to 45		30			
			3 to 30		50			
			2 to 20		75			
			1.5 to 15		100			
			1 to 10		150			
			.75 to 7.5		200			
			.6 to 6	±15	250			
			.47 to 4.7		300			
			.39 to 3.9		375			
M39006/22-XXXX	MIL-C-39006/22 Polarized/Sintered Slug	CLR79	20 to 750	±5, ±10,±20	10	-55 to +125	R	P
			15 to 540		15			
			8 to 300		30			
			5 to 160		50			
			3.5 to 110		75			
			2.5 to 86		100			
			1.7 to 56		125			

1/ See the tables following for the standard capacitors for the styles listed.
2/ CLR25, CLR27, CLR35 and CLR37 are susceptible to vibration failures. Consult the project parts engineer for recommendations.
3/ For operation above 85°C, operating voltage shall be derated per MIL-C-39006/1, /2, /3, /4 or /22 as applicable.
4/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-39006/1, STYLE CLR25 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Etched Foil, Established Reliability

Rated 1/ Voltage @ 85°C (volts,dc)	Capacitance		Maximum DC Leakage (microamps)		Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Case Size 2/	Part Number M39006/01-	
	Nominal Value (µf)	Tolerance (%)	25°C	85°C & 125°C					Grade 1 FRL = 3/ R(0.01)	Grade 2 FRL = P(0.1)
15	60	+75, -15	2	10	10	17.2	55	G2	3088	3059
	200		3	40			17	G3	3089	3060
	400		6	80			9	G4	3090	3061
	580		9	100			6	G5	3091	3062
25	40		2	13	15	28.8	83	G2	3092	3063
	120		3	40			27	G3	3093	3064
	250		6	80			13	G4	3094	3065
	350		10	100			10	G5	3095	3066
30	32		2	14	20	34.5	106	G2	3096	3067
	110		4	50			31	G3	3097	3068
	220		8	90			16	G4	3098	3069
	300		11	120			11	G5	3099	3070
50	18	+50, -15	2	13	30	57.5	180	G2	3100	3071
	60		3	40			55	G3	3101	3072
	100		4	75			33	G4	3103	3074
	150		5	100			22	G5	3104	3075
75	12		2	13	50	86.2	270	G2	3105	3076
	30		3	34			110	G3	3106	3077
	70		6	80			47	G4	3107	3078
	100		10	100			33	G5	3108	3079
100	8	+30, -15	2	12	65	115	410	G2	3109	3080
	25		2.5	37			130	G3	3110	3081
	50		5	75			66	G4	3111	3082
	70		7	100			47	G5	3112	3083
150	4		2	13	100	172	750	G2	3113	3084
	13		3	30			250	G3	3114	3085
	25		5	80			130	G4	3115	3086
	36		8	100			94	G5	3116	3087

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/1.
2/ Case sizes are given in MIL-C-39006/1.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-39006/2, STYLE CLR27 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Nonpolarized, Etched Foil, Established Reliability

Rated 1/ Voltage @ 85°C (volts,dc)	Capacitance		Maximum DC Leakage (microamps)		Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Case Size 2/	Part Number M39006/02-	
	Nominal Value (µf)	Tolerance (%)	25°C	85°C & 125°C					Grade 1 3/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
15	40	+75, -15	2	10	10	17.2	85	G2	1284	1256
	120		3	40			27	G3	1285	1257
	250		6	80			14	G4	1286	1258
	350		9	100			10	G5	1287	1259
25	20		2	13	15	28.8	170	G2	1288	1260
	70		3	40			49	G3	1289	1261
	140		6	80			24	G4	1290	1262
	200		10	100			17	G5	1291	1263
30	18		2	14	20	34.5	188	G2	1292	1264
	60		4	50			57	G3	1293	1265
	120		8	90			28	G4	1294	1266
	170		11	120			20	G5	1295	1267
50	10	+50, -15	2	13	30	57.5	339	G2	1296	1268
	30		3	40			113	G3	1297	1269
	60		4	75			57	G4	1298	1270
	80		5	100			41	G5	1299	1271
75	6		2	13	50	86.2	560	G2	1300	1272
	15		3	34			226	G3	1301	1273
	35		5	80			97	G4	1302	1274
	50		10	100			68	G5	1303	1275
100	4	+30, -15	2	13	65	115	845	G2	1304	1276
	12		3	37			283	G3	1305	1277
	25		5	75			135	G4	1306	1278
	35		7	100			97	G5	1307	1279
150	2		2	13	100	172	1693	G2	1308	1280
	6		3	30			565	G3	1309	1281
	12		5	80			283	G4	1310	1282
	18		8	100			188	G5	1311	1283

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/2.
2/ Case sizes are given in MIL-C-39006/2.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-39006/3, STYLE CLR35 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Plain Foil, Established Reliability

Rated 1/ Voltage @ 85°C (volts,dc)	Capacitance		Maximum DC Leakage (microamps)		Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Case Size 2/	Part Number M39006/03-	
	Nominal Value (µf)	Tolerance (%)	25°C	85°C & 125°C					Grade 1 3/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
15	18	±20	2	4	10	17.2	125	G2	1447	1398
	55		2	10			41	G3	1448	1399
	110		4	20			20	G4	1449	1400
	160		5	30			14	G5	1450	1401
25	12		2	4	15	28.8	186	G2	1451	1402
	35		2	10			64	G3	1452	1403
	70		4	20			32	G4	1453	1404
	100		6	30			23	G5	1454	1405
30	10		2	6	20	34.5	265	G2	1455	1406
	30		2	13			75	G3	1456	1407
	60		4	26			37	G4	1457	1408
	85		6	38			27	G5	1458	1409
35	68		5	25	25	40.2	40	G5	1459	1410
50	6		2	6	30	57.5	372	G2	1460	1411
	20		2	13			112	G3	1461	1412
	40		4	26			56	G4	1462	1413
	55		6	38			41	G5	1463	1414
75	4		2	6	50	86.2	558	G2	1464	1415
	14		2	13			159	G3	1465	1416
	28		4	26			80	G4	1466	1417
	40		6	38			56	G5	1467	1418
100	3		2	6	65	115	743	G2	1468	1419
	10		2	13			223	G3	1469	1420
	20		3	25			112	G4	1470	1421
	30		6	38			74	G5	1471	1422
150	2		2	6	100	172	1115	G2	1472	1423
	7		3	13			319	G3	1473	1424
	14		4	26			159	G4	1474	1425
	20		6	38			112	G5	1475	1426

See end of table for footnote.

MIL-C-39006/3, STYLE CLR35 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Plain Foil, Established Reliability (Continued)

Rated 1/ Voltage @ 85°C (volts,dc)	Capacitance		Maximum DC Leakage (microamps)		Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Case Size 2/	Part Number M39006/03-	
	Nominal Value (µf)	Tolerance (%)	25°C	85°C & 125°C					Grade 1 FRL = R(0.01) 3/	Grade 2 FRL = P(0.1)
200	1.5	±15	8	32	150	230	1300	G2	1476	1427
	5		16	64			400	G3	1477	1428
	10		28	100			200	G4	1478	1429
	15		40	160			130	G5	1479	1430
300	1		10	50	200	345	2250	G2	1484	1435
	3		20	100			750	G3	1485	1436
	7		35	175			322	G4	1486	1437
	10		50	250			225	G5	1487	1438

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/3.
2/ Case sizes are given in MIL-C-39006/3.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-39006/4, STYLE CLR37 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Plain Foil, Established Reliability

Rated 1/ Voltage @ 85°C (volts,dc)	Capacitance		Maximum DC Leakage (microamps)		Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Case Size 2/	Part Number M39006/04-	
	Nominal Value (uf)	Tolerance (%)	25°C	85°C & 125°C					Grade 1 3/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
15	10	±20	2	4	10	17.2	223	G2	1335	1290
	35		2	10			64	G3	1336	1291
	70		4	20			32	G4	1337	1292
	100		5	30			23	G5	1338	1293
25	6		2	6	15	28.8	372	G2	1339	1294
	20		2	10			112	G3	1340	1295
	40		4	20			56	G4	1341	1296
	60		5	30			37	G5	1342	1297
30	5.5		2	6	20	34.5	406	G2	1343	1298
	18		2	12			124	G3	1344	1299
	36		4	26			62	G4	1345	1300
	45		6	36			50	G5	1346	1301
50	3		2	6	30	57.5	743	G2	1347	1302
	10		2	12			223	G3	1348	1303
	20		4	24			112	G4	1349	1304
	30		6	36			75	G5	1350	1305
75	2		2	6	50	86.2	1115	G2	1351	1306
	7		2	13			319	G3	1352	1307
	14		4	24			159	G4	1353	1308
	20		6	36			112	G5	1354	1309
100	1.5		2	6	65	115	1487	G2	1355	1310
	5		2	13			446	G3	1356	1311
	10		4	24			223	G4	1357	1312
	15		6	36			149	G5	1358	1313
150	1		2	6	100	172	2227	G2	1359	1314
	1.2		3	12			2000	G2	1360	1315
	3.5		3	13			638	G3	1361	1316
	7		4	24			319	G4	1362	1317
	10		6	36			223	G5	1363	1318

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/4.
2/ Case sizes are given in MIL-C-39006/4.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-39006/4, STYLE CLR37 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic, Polarized, Plain Foil, Established Reliability (Continued)

Rated 1/ Voltage @ 85°C (volts,dc)	Capacitance		Maximum DC Leakage (microamps)		Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Case Size 2/	Part Number M39006/04-	
	Nominal Value (µf)	Tolerance (%)	25°C	85°C & 125°C					Grade 1 3/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	0.75	±15	8	32	150	230	2700	G2	1364	1319
	2.5		16	64			800	G3	1365	1320
	5		28	112			400	G4	1366	1321
	7.5		40	160			260	G5	1367	1322
250	0.6		8	40	165	287	3300	G2	1368	1323
	2		16	80			1000	G3	1369	1324
	4		28	140			500	G4	1370	1325
	6		40	200			330	G5	1371	1326
300	0.47		10	50	200	345	4500	G2	1372	1327
	1.5		20	100			1500	G3	1373	1328
	3.3		35	175			643	G4	1374	1329
	4.7		50	250			450	G5	1375	1330
375	0.39		10	100	250	431	5620	G2	1376	1331
	1.2		20	225			1880	G3	1377	1332
	2.2		35	250			900	G4	1378	1333
	3.9		50	325			562	G5	1379	1334

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/4.
2/ Case sizes are given in MIL-C-39006/4.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
10	20	20 10 5	1	2	6	7	11.5	175	32	10.5	12	T1	0481 0482 0483	0261 0262 0263
	47	20 10 5			13			100	36	14	16	T1	0484 0485 0486	0264 0265 0266
	100	20 10 5		4	15			60				T2	0487 0488 0489	0267 0268 0269
	180	20 10 5		7	30			40				T2	0490 0491 0492	0270 0271 0272
	250	20 10 5	2	10	30			30	40			T3	0493 0494 0495	0273 0274 0275
	390	20 10 5		16	44			25	64	17.5	20	T3	0496 0497 0498	0276 0277 0278
	750	20 10	4		50			23	80	25	25	T4	0499 0500	0279 0280

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
15	15	20 10 5	1	2	5	10	17.2	155	24	10.5	12	T1	0501 0502 0503	0281 0282 0283
	33	20 10 5			10			90	28	14	16	T1	0504 0505 0506	0284 0285 0286
	70	20 10 5		4	13			75	28			T2	0507 0508 0509	0287 0288 0289
	120	20 10 5		7	18			50	28	17.5	20	T2	0510 0511 0512	0290 0291 0292
	170	20 10 5	2	10	25			35	32	14	16	T3	0513 0514 0515	0293 0294 0295
	270	20 10 5		16	32			30	56	17.5	20	T3	0516 0517 0518	0296 0297 0298
	540	20 10	6	24	40			23	80	25	25	T4	0519 0520	0299 0300

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
30	8	20 10 5	1	2	4	20	34.5	275	16	8	12	T1	0541 0542 0543	0321 0322 0323
	15	20 10 5			5			175	20	10.5		T1	0544 0545 0546	0324 0325 0326
	40	20 10 5		5	10			65	24	10.5		T2	0547 0548 0549	0327 0328 0329
	68	20 10 5		8	13			60	24	13	15	T2	0550 0551 0552	0330 0331 0332
	100	20 10 5	2	12	17			40	28	10.5	12	T3	0553 0554 0555	0333 0334 0335
	150	20 10 5		18	23			35	48	13	15	T3	0556 0557 0558	0336 0337 0338
	300	20 10	8	32	31			25	60	25	25	T4	0559 0560	0339 0340

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
50	5	20 10 5	1	2	3	30	57.5	400	16	5	6	T1	0561 0562 0563	0341 0342 0343
	10	20 10 5			4			250	24	8	9	T1	0564 0565 0566	0344 0345 0346
	25	20 10 5		5	8			95	20	10.5	12	T2	0567 0568 0569	0347 0348 0349
	47	20 10 5		9	11			70	28	13	15	T2	0570 0571 0572	0350 0351 0352
	60	20 10 5	2	12	12			45	16	10.5	12	T3	0573 0574 0575	0353 0354 0355
	82	20 10 5		16	15				32	13	15	T3	0576 0577 0578	0356 0357 0358
	160	20 10	8	32	17			27	50	25	25	T4	0579 0580	0359 0360

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
75	3.5	20 10 5	1	2	2.5	50	86.2	650	16	5	6	T1	0601 0602 0603	0381 0382 0383
	6.8	20 10 5			3.5			300	20	8	9	T1	0604 0605 0606	0384 0385 0386
	15	20 10 5		5	6			150	16	8	9	T2	0607 0608 0609	0387 0388 0389
	33	20 10 5		10	10			90	24	10.5	15	T2	0610 0611 0612	0390 0391 0392
	40	20 10 5	2	12	9			60	16	10.5	12	T3	0613 0614 0615	0393 0394 0395
	56	20 10 5		17	11				28		15	T3	0616 0617 0618	0396 0397 0398
	110	20 10	9	36	12			29	35	20	20	T4	0619 0620	0399 0400

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
100	2.5	20 10 5	1	2	2	65	115	950	16	7	8	T1	0621 0622 0623	0401 0402 0403
	4.7	20 10 5			3			500				T1	0624 0625 0626	0404 0405 0406
	11	20 10 5		4	5			200		8		T2	0627 0628 0629	0407 0408 0409
	22	20 10 5		9	7.5			100				T2	0630 0631 0632	0410 0411 0412
	30	20 10 5	2	12	7			80				T3	0633 0634 0635	0413 0414 0415
	43	20 10 5		17	8.5			70	20			T3	0636 0637 0638	0416 0417 0418
	86	20 10	9	36	10			30	25	15	15	T4	0639 0640	0419 0420

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39006/22, STYLE CLR79 CAPACITORS
Fixed, Tantalum (Nonsolid) Electrolytic (Polarized, Sintered Slug), Established Reliability (Continued)

Rated Voltage @ 85°C (volts, dc) 1/	Capacitance		Maximum DC Leakage (microamps)		Maximum Dissipation Factor (%)	Derated Voltage @ 125°C (volts,dc)	Surge Voltage @ 85°C (volts,dc)	Maximum Impedance (ohms)	Capacitance Change @			Case Size 2/	Part Number M39006/22-	
	Nominal Value (µf)	Tolerance (±%)	25°C	85°C & 125°C					-55°C (-%)	+85°C (+%)	+125°C (+%)		Grade 1 3/ FRL = R(0.01) 4/	Grade 2 FRL = P(0.1) 4/
125	1.7	20 10 5	1	2	2	85	144	1250	16	7	8	T1	0641 0642 0643	0421 0422 0423
	3.6	20 10 5			2.7			600				T1	0644 0645 0646	0424 0425 0426
	9	20 10 5		5	5			240				T2	0647 0648 0649	0427 0428 0429
	14	20 10 5		7	6			167				T2	0650 0651 0652	0430 0431 0432
	18	20 10 5	2	9	5			129				T3	0653 0654 0655	0433 0434 0435
	25	20 10 5		13	6			93				T3	0656 0657 0658	0436 0437 0438
	56	20 10	10	40	6.5			32	25	15	15	T4	0659 0660	0439 0440

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-39006/22.
2/ Case sizes are given in MIL-C-39006/22.
3/ Failure rate level (FRL) R parts shall be used in Grade 1 applications until FRL S parts become available.
4/ If optional vibration and shock (i.e., 51g random vibration, 80g sinusoidal vibration, and 500g shock) are required, the letter "H" shall be included at the end of the dash number.

MIL-C-39014, CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Part number explanation:

M39014 — M39014 - Identifies CKR fixed, ceramic, insulated, general purpose, established reliability capacitors conforming to MIL-C-39014.

/XX — /XX - Identifies the appropriate military specification sheet that uniquely specifies the capacitor family.

-XXXX — -XXXX - Uniquely specifies the nominal capacitance value, capacitance tolerance, rated dc voltage, and failure rate level (FRL) in %/1000 hours.

Part Number	Control Specification	Style	Capacitance		Rated Voltage Vdc 2/	Maximum Dissipation Factor (%)	Minimum Insulation Resistance @ 25°C	Operating Temperature Range (°C)	Configuration		FRL	
			Range 1/ (pf)	Tolerance (±%)					Case Type	Lead Type 3/	Grade 1 4/, 5/	Grade 2
M39014/01-XXXX	MIL-C-39014/1	CKR05	10-100,000	10,20	50,100 200	2.5	100,000 megohms or 1,000 megohm-microfarads, whichever is less 6/	-55 to +125	Molded	Radial	S	P
M39014/02-XXXX	MIL-C-39014/2	CKR06	1,500-1,000,000								S	P
M39104/05-XXXX	MIL-C-39014/5	CKR11	10-10,000		50,100				7/ Tubular	Axial	S	P
M39014/05-XXXX	MIL-C-39014/5	CKR12	5,600-47,000								S	P
M39014/05-XXXX	MIL-C-39014/5	CKR14	12,000-100,000								S	P
M39014/05-XXXX	MIL-C-39014/5	CKR15	68,000-1,000,000			2.5,3.0					S	P

1/ Capacitance values above 0.33µf are not recommended for use in critical applications because the parts are more susceptible to delaminations and cracks due to the thinness of the dielectric material.
2/ For low voltage applications (<10 volts d.c.), it is recommended that rated voltage be at least 100 volts d.c.
3/ MIL-C-39014 specifies that leads be solderable, but the lead material itself is not specified. When leads are to be welded rather than soldered, copper leads and solder or tin-plate finish are not preferred and are not recommended. Consult the project parts engineer for recommendations for part procurement.
4/ For space flight use, wax impregnants or other volatile materials must not be applied to the capacitor.
5/ Lots purchased for use in Grade 1 applications shall be subjected to the additional tests in Appendix B.
6/ Insulation resistance = X/C, where X = 1K megohm-µf and C is the capacitance expressed in µf.
7/ Glass encased capacitors should not be potted in hard materials. If potting in a hard material is required, then a resilient material shall be applied to the capacitor as a buffer.

MIL-C-39014/1, STYLE CKR05 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/01-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
200	10	10	1321	1241
	10	20	1322	1242
	15	10	1324	1244
	15	20	1325	1245
	22	10	1327	1247
	22	20	1328	1248
	33	10	1330	1250
	33	20	1331	1251
	47	10	1333	1253
	47	20	1334	1254
	68	10	1336	1256
	68	20	1337	1257
	100	10	1339	1259
	100	20	1340	1260
	150	10	1342	1262
	150	20	1343	1263
	220	10	1345	1265
	220	20	1346	1266
	330	10	1348	1268
	330	20	1349	1269
	470	10	1351	1271
	470	20	1352	1272
	680	10	1354	1274
	680	20	1355	1275
	1,000	10	1357	1277
	1,000	20	1358	1278

MIL-C-39014/1, STYLE CKR05 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability (Continued)

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/01-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
100	1,500	10	1360	1280
	1,500	20	1561	1481
	2,200	10	1563	1483
	2,200	20	1564	1484
	3,300	10	1566	1486
	3,300	20	1567	1487
	4,700	10	1569	1489
	4,700	20	1570	1490
	6,800	10	1572	1492
	6,800	20	1573	1493
	10,000	10	1575	1495
	10,000	20	1576	1496
50	15,000	10	1578	1498
	15,000	20	1579	1499
	22,000	10	1581	1501
	22,000	20	1582	1502
	33,000	10	1584	1504
	33,000	20	1585	1505
	47,000	10	1587	1507
	47,000	20	1588	1508
	68,000	10	1590	1510
	68,000	20	1591	1511
	100,000	10	1593	1513
	100,000	20	1594	1514

MIL-C-39014/2, STYLE CKR06 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/02-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
200	1,500	10	1322	1242
	1,500	20	1323	1243
	2,200	10	1326	1246
	2,200	20	1327	1247
	3,300	10	1329	1249
	3,300	20	1330	1250
	4,700	10	1332	1252
	4,700	20	1333	1253
	6,800	10	1335	1255
	6,800	20	1336	1256
	10,000	10	1338	1258
	10,000	20	1339	1259
100	15,000	10	1340	1260
	22,000		1342	1262
	33,000		1343	1263
	47,000		1345	1265
	68,000		1347	1267
	100,000		1350	1270
50	120,000		1353	1273
	150,000		1354	1274
	180,000		1355	1275
	220,000		1356	1276
	270,000		1357	1277
	330,000		1358	1278
	470,000		1360	1280
	680,000		1417	1409
	1,000,000		1419	1411

MIL-C-39014/5, STYLE CKR11 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/05-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
100	10	10	2201	2801
	10	20	2202	2802
	15	10	2204	2804
	15	20	2205	2805
	22	10	2207	2807
	22	20	2208	2808
	33	10	2210	2810
	33	20	2211	2811
	47	10	2213	2813
	47	20	2214	2814
	68	10	2216	2816
	68	20	2217	2817
	100	10	2219	2819
	100	20	2220	2820
	150	10	2222	2822
	150	20	2223	2823
	220	10	2225	2825
	220	20	2226	2826
	330	10	2228	2828
	330	20	2229	2829
	470	10	2231	2831
	470	20	2232	2832
	680	10	2234	2834
	680	20	2235	2835
	1,000	10	2237	2837
	1,000	20	2238	2838
	1,500	10	2240	2840
	1,500	20	2241	2841
	2,200	10	2243	2843
	2,200	20	2244	2844
	3,300	10	2246	2846
	3,300	20	2247	2847
	4,700	10	2249	2849
	4,700	20	2250	2850
50	6,800	10	2252	2852
	6,800	20	2253	2853
	10,000	10	2255	2855
	10,000	20	2256	2856

MIL-C-39014/5, STYLE CKR12 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/05-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
100	5,600	10	2257	2857
	6,800	10	2258	2858
	6,800	20	2259	2859
	8,200	10	2260	2860
	10,000	10	2261	2861
	10,000	20	2262	2862
50	12,000	10	2263	2863
	15,000	10	2264	2864
	15,000	20	2265	2865
	18,000	10	2266	2866
	22,000	10	2267	2867
	22,000	20	2268	2868
	27,000	10	2269	2869
	33,000	10	2270	2870
	33,000	20	2271	2871
	39,000	10	2272	2872
	47,000	10	2273	2873
	47,000	20	2274	2874

MIL-C-39014/5, STYLE CKR14 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/05-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
100	12,000	10	2275	2875
	15,000	10	2276	2876
	15,000	20	2277	2877
	18,000	10	2278	2878
	22,000	10	2279	2879
	22,000	20	2280	2880
	27,000	10	2281	2881
	33,000	10	2282	2882
	33,000	20	2283	2883
	39,000	10	2284	2884
	47,000	10	2285	2885
	47,000	20	2286	2886
50	56,000	10	2287	2887
	68,000	10	2288	2888
	68,000	20	2289	2889
	100,000	10	2291	2891
	100,000	20	2292	2892

MIL-C-39014/5, STYLE CKR15 CAPACITORS
Fixed, Ceramic Dielectric, Established Reliability

Rated Voltage (volts,dc)	Capacitance		Part Number M39014/05-	
	Value (pf)	Tolerance (±%)	Grade 1 FRL = S(0.001)	Grade 2 FRL = P(0.1)
100	68,000	10	2307	2907
	68,000	20	2308	2908
	100,000	10	2310	2910
	100,000	20	2311	2911
	120,000	10	2312	2912
	150,000	10	2313	2913
	150,000	20	2314	2914
	180,000	10	2315	2915
	220,000	10	2316	2916
	220,000	20	2317	2917
	270,000	10	2318	2918
	330,000	10	2319	2919
	330,000	20	2320	2920
50	470,000	10	2321	2921
	470,000	20	2322	2922
	680,000	10	2323	2923
	680,000	20	2324	2924
	1,000,000	10	2325	2925
	1,000,000	20	2326	2926

MIL-C-55365, CAPACITORS
Chip, Fixed, Tantalum, Established Reliability

Part number explanation:

CWRXX — Style - The three-letter symbol "CWR" identifies established reliability, tantalum fixed, chip capacitors and the XX identifies the design of the capacitor

X — Voltage - A single letter symbol identifies the voltage (rated, derated, and surge) as follows:

Symbol	Voltage (volts, dc) Rated (85°C)	Derated (125°C)	Surge (85°C)
C	4	2.7	5.0
D	6	4.0	8.0
F	10	7.0	13.0
H	15	10.0	20.0
J	20	13.0	26.0
K	25	17.0	32.0
M	35	23.0	46.0
N	50	33.0	65.0

X — Termination Finish - A single letter symbol identifies the termination finish as follows:

A: Solder-coated nickel
B: Gold
C: Solder-coated gold

XXX — Capacitance - The three-digit number identifies the nominal capacitance value, expressed in picofarads (pf). Where the nominal capacitance is 10 pf or greater, the first two digits represent significant figures and the last digit specifies the number or zeros to follow (for example: 10 pf = 100; 150 pf = 151; 1500 pf = 152). Where the nominal capacitance is less than 10 pf (a whole number or a mixed number), the letter "R" shall represent the decimal point, and the other digits are significant (for example: 1 pf = 1R0; 5.6 pf = 5R6; 8.2 pf = 8R2).

X — Capacitance Tolerance - A single-letter symbol identifies the capacitance tolerance as follows:

J: ±5%
K: ±10%
M: ±20%

X — Failure Rate Level - A single-letter symbol identifies the failure rate level as follows:

P: 0.1%/1000 hrs
R: 0.01%/1000 hrs
S: 0.001%/1000 hrs

Part Number	Control Specification	Capacitance Range (µf)	Capacitance Tolerance Available	Rated Voltage 1/ (Volts, dc)	Operating Temperature Range (°C)	FRL Grade 1	Grade 2
CWR06XXXXXX	MIL-C-55365/4	0.10 - 100.0	J, K, M	C, D, F, H, J, K, M, N	-55 to +125	R	P

1/ For operation above 85°C, operating voltage shall be derated as specified in MIL-C-55365.

MIL-C-55365/4, STYLE CWR06 CAPACITORS
Chip, Fixed, Tantalum, Established Reliability

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance (µf)	Tolerance (±%)	Maximum DC Leakage (Microamps) +25°C	+85°C	+125°C	Maximum Dissipation Factor (%) +25°C	+85°C & +125°C	Derated Voltage @ +125°C (volts, dc)	Surge Voltage @ +85°C (volts, dc)	Case Size 2/	Part Number CWR06 3/ Grade 1 FRL = R (0.01)	Grade 2 FRL = P (0.1)
4	2.2	5, 10, 20	1.0	10	12	6	8	2.7	5.0	A	CX225XR	CX225XP
	4.7		1.0	10	12	6	8			B	CX475XR	CX475XP
	6.8		1.0	10	12	6	8			C	CX685XR	CX685XP
	10.0		1.0	10	12	8	8			D	CX106XR	CX106XP
	15.0		1.0	10	12	8	10			E	CX156XR	CX156XP
	33.0		2.0	20	24	8	10			F	CX336XR	CX336XP
	68.0		3.0	30	36	10	12			G	CX686XR	CX686XP
	100.0		4.0	40	48	10	12			H	CX107XR	CX107XP
6	1.5		1.0	10	12	6	8	4.0	8.0	A	DX155XR	DX155XP
	3.3		1.0	10	12	6	8			B	DX335XR	DX335XP
	4.7		1.0	10	12	6	8			C	DX475XR	DX475XP
	6.8		1.0	10	12	6	8			D	DX685XR	DX685XP
	10.0		1.0	10	12	8	10			E	DX106XR	DX106XP
	22.0		2.0	20	24	8	10			F	DX226XR	DX226XP
	47.0		3.0	30	36	10	12			G	DX476XR	DX476XP
	68.0		4.0	40	48	10	12			H	DX686XR	DX686XP
10	1.0		1.0	10	12	6	8	7.0	13.0	A	FX105XR	FX105XP
	2.2		1.0	10	12	6	8			B	FX225XR	FX225XP
	3.3		1.0	10	12	6	8			C	FX335XR	FX335XP
	4.7		1.0	10	12	6	8			D	FX475XR	FX475XP
	6.8		1.0	10	12	6	8			E	FX685XR	FX685XP
	15.0		2.0	20	24	8	8			F	FX156XR	FX156XP
	33.0		3.0	30	36	10	12			G	FX336XR	FX336XP
	47.0		5.0	50	60	10	12			H	FX476XR	FX476XP
15	0.68		1.0	10	12	6	8	10.0	20.0	A	HX684XR	HX684XP
	1.5		1.0	10	12	6	8			B	HX155XR	HX155XP
	2.2		1.0	10	12	6	8			C	HX225XR	HX225XP
	3.3		1.0	10	12	6	8			D	HX335XR	HX335XP
	4.7		1.0	10	12	6	8			E	HX475XR	HX475XP
	10.0		2.0	20	24	6	8			F	HX106XR	HX106XP
	22.0		4.0	40	48	8	8			G	HX226XR	HX226XP
	33.0		5.0	50	60	8	8			H	HX336XR	HX336XP

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-55365.
2/ Case sizes are given in MIL-C-55365.
3/ Complete type designation will include termination finish and capacitance tolerance.

MIL-C-55365/4, STYLE CWR06 CAPACITORS
Chip, Fixed, Tantalum, Established Reliability (Continued)

Rated Voltage @ +85°C (volts dc) 1/	Nominal Capacitance (uf)	Tolerance (±%)	Maximum DC Leakage (Microamps) +25°C	+85°C	+125°C	Maximum Dissipation Factor (%) +25°C	+85°C & +125°C	Derated Voltage @ +125°C (volts, dc)	Surge Voltage @ +85°C (volts, dc)	Case Size 2/	3/ Part Number CWR06 Grade 1 FRL = R (0.01)	Grade 2 FRL = P (0.1)
20	0.47	5, 10, 20	1.0	10	12	6	8	13.0	26.0	A	JX474XR	JX474XP
	0.68		1.0	10	12	6	8			B	JX684XR	JX684XP
	1.0		1.0	10	12	6	8			B	JX105XR	JX105XP
	1.5		1.0	10	12	6	8			C	JX155XR	JX155XP
	2.2		1.0	10	12	6	8			D	JX225XR	JX225XP
	3.3		1.0	10	12	6	8			E	JX335XR	JX335XP
	6.8		2.0	20	24	6	8			F	JX685XR	JX685XP
	15.0		3.0	30	36	6	8			G	JX156XR	JX156XP
	22.0		4.0	40	48	6	8			H	JX226XR	JX226XP
25	0.33		1.0	10	12	6	8	17.0	32.0	A	KX334XR	KX334XP
	0.68		1.0	10	12	6	8			B	KX684XR	KX684XP
	1.0		1.0	10	12	6	8			C	KX105XR	KX105XP
	1.5		1.0	10	12	6	8			D	KX155XR	KX155XP
	2.2		1.0	10	12	6	8			E	KX225XR	KX225XP
	4.7		2.0	20	24	6	8			F	KX475XR	KX475XP
	6.8		2.0	20	24	6	8			G	KX685XR	KX685XP
	10.0		3.0	30	36	6	8			G	KX106XR	KX106XP
	15.0		4.0	40	48	6	8			H	KX156XR	KX156XP
35	0.22		1.0	10	12	6	8	23.0	46.0	A	MX224XR	MX224XP
	0.47		1.0	10	12	6	8			B	MX474XR	MX474XP
	0.68		1.0	10	12	6	8			C	MX684XR	MX684XP
	1.0		1.0	10	12	6	8			D	MX105XR	MX105XP
	1.5		1.0	10	12	6	8			E	MX155XR	MX155XP
	3.3		1.0	10	12	6	8			F	MX335XR	MX335XP
	4.7		2.0	20	24	6	8			G	MX475XR	MX475XP
	6.8		3.0	30	36	6	8			H	MX685XR	MX685XP
50	0.10		1.0	10	12	6	8	33.0	65.0	A	NX104XR	NX104XP
	0.15		1.0	10	12	6	8			A	NX154XR	NX154XP
	0.22		1.0	10	12	6	8			B	NX224XR	NX224XP
	0.33		1.0	10	12	6	8			B	NX334XR	NX334XP
	0.47		1.0	10	12	6	8			C	NX474XR	NX474XP
	0.68		1.0	10	12	6	8			D	NX684XR	NX684XP
	1.0		1.0	10	12	6	8			E	NX105XR	NX105XP
	1.5		1.0	10	12	6	8			F	NX155XR	NX155XP
	2.2		2.0	20	24	6	8			F	NX225XR	NX225XP
	3.3		2.0	20	24	6	8			G	NX335XR	NX335XP
	4.7		3.0	30	36	6	8			H	NX475XR	NX475XP

1/ For operation above +85°C, operating voltage shall be derated as specified in MIL-C-55365.
2/ Case sizes are given in MIL-C-55365.
3/ Complete type designation will include termination finish and capacitance tolerance.

MIL-C-55681, CAPACITORS, CHIP
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability

Part number explanation:

CDRYY	BY	YYY	Y	Y	Y	Y
Style- CDR identifies established reliability, ceramic dielectric, fixed, chip capacitor: YY identifies the dimensions of the capacitor	Rated Temperature and Voltage Temperature Limits:	Capacitance 1/	Rated Voltage (Vdc)- A = 50 B = 100 C = 200	Capacitance Tolerance- J = ±5% K = ±10% M = ±20%	Termination Finish - S = Solder-coated, final M = Palladium-silver N = Silver-nickel-gold	Failure Rate Level (%/1000 hours) P = 0.1 R = 0.01

Rated Temperature	Voltage Temperature Limits
B = -55°C to +125°C	P = 0 ± 30 ppm/°C X = ±15%

Part Number 2/	Control Specification	Style	Capacitance 3/		Rated 4/ Voltage @+125 °C (volts, dc)	Operating Temperature Range (°C)	Rated Temperature and Voltage Temperature Limits	Grade 1 5/	Grade 2
			Range (pf)	Tolerance Available					
CDR01BYYYYYYYY	MIL-C-55681/1	CDR01	10-4700	J, K, M	50, 100	-55 to +125	BP, BX	R	P
CDR03BYYYYYYYY	MIL-C-55681/1	CDR03	330-68,000						
CDR04BYYYYYYYY	MIL-C-55681/1	CDR04	1,200-180,000		50, 100, 200				
CDR05BYYYYYYYY	MIL-C-55681/2	CDR05	3,900-330,000		50, 100				
CDR06BYYYYYYYY	MIL-C-55681/3	CDR06	6,800-470,000						

1/ The nominal capacitance value expressed in picofarads (pf) is identified by a three-digit number; the first two digits represent significant figures and the last digit specifies the number of zeros to follow. For example, 1R0 indicates 1.0 pf, R75 indicates 0.75 pf, 0R5 indicates 0.5 pf, and 392 indicates 3900 pf.
2/ Complete part number must conform to that shown in part number explanation.
3/ When specified in the ordering data these capacitors may be legibly marked with a letter/color code identifying their individual capacitance value. For more details refer to MIL-C-55681.
4/ For low voltage applications (<10 volts d.c.), it is recommended that rated voltage be at least 100 volts d.c.
5/ Lots purchased for use in Grade 1 applications shall be subjected to the DPA requirements specified by Appendix B.

MIL-C-55681/1, STYLE CDR04 CHIP CAPACITORS
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		DF (%) Max	Rated Temperature and Voltage-Temperature Limits	Part Number CDR04B	
	Nominal Value (pf)	Tolerances Available			Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
200	1,200	J	0.15	BP	P122CJYR	P122CJYP
	1,500	J, K			P152C*YR	P152C*YP
	1,800	J			P182CJYR	P182CJYP
	2,200	J, K			P222C*YR	P222C*YP
	2,700	J			P272CJYR	P272CJYP
	3,300	J, K			P332C*YR	P332C*YP
100	39,000	K	2.50	BX	X393BKYR	X393BKYP
	47,000	K, M			X473B*YR	X473B*YP
	56,000	K			X563BKYR	X563BKYP
50	82,000	K			X823AKYR	X823AKYP
	100,000	K, M			X104A*YR	X104A*YP
	120,000	K			X124AKYR	X124AKYP
	150,000	K, M			X154A*YR	X154A*YP
	180,000	K			X184AKYR	X184AKYP

1/ Lots purchased for use in Grade 1 applications shall be subjected to the additional tests specified by Appendix B.

Y = Choice of termination finish.
* = Choice of tolerance.

MIL-C-55681/2, STYLE CDR05 CHIP CAPACITORS
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		DF % Max	Rated Temperature and Voltage-Temperature Limits	Part Number CDR05B	
	Nominal Value (pf)	Tolerances Available			Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
100	3,900	J, K	.15	BP	P392B*YR	P392B*YP
	4,700				P472B*YR	P472B*YP
	5,600				P562B*YR	P562B*YP
	68,000	K, M	2.50	BX	X683B*YR	X683B*YP
	82,000	K			X823BKYR	X823BKYP
	100,000	K, M			X104B*YR	X104B*YP
	120,000	K			X124BKYR	X124BKYP
	150,000	K, M			X154B*YR	X154B*YP
50	220,000	K, M			X224A*YR	X224A*YP
	270,000	K			X274AKYR	X274AKYP
	330,000	K, M			X334A*YR	X334A*YP

1/ Lots purchased for use in Grade 1 applications shall be subjected to the additional tests specified by Appendix B.

Y = Choice of termination finish.
* = Choice of tolerance.

MIL-C-55681/3, STYLE CDR06 CHIP CAPACITORS
Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability

Rated Voltage (volts, dc)	Capacitance		DF % Max	Rated Temperature and Voltage-Temperature Limits	Part Number CDR06B	
	Nominal Value (pf)	Tolerances Available			Grade 1 1/ FRL = R(0.01)	Grade 2 FRL = P(0.1)
100	6,800	J, K	0.15	BP	P682B*YR	P682B*YP
	8,200				P822B*YR	P822B*YP
	10,000				P103B*YR	P103B*YP
50	390,000	K	2.50	BX	X394AKYR	X394AKYP
	470,000	K, M			X474A*YR	X474A*YP

1/ Lots purchased for use in Grade 1 applications shall be subjected to the additional tests specified by Appendix B.

Y = Choice of termination finish.

* = Choice of tolerance.

MIL-C-83421, CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Hermetically Sealed, Established Reliability

Part number explanation:

M83421	/01	-X	XXX	X
M83421 - Identifies CRH established reliability, fixed, supermetallized plastic film dielectric capacitors that are hermetically sealed in metal cases and that conform to MIL-C-83421	/01 - Identifies the appropriate specification sheet that uniquely specifies the capacitor family	-X - Specifies the capacitor style 1 = CRH01 2 = CRH02 3 = CRH03 4 = CRH04 5 = CRH05	XXX - Uniquely specifies the capacitance value, capacitance tolerance, ac ratings, and physical dimensions of the capacitor	Failure Rate Level - R = 0.01%/1000 hours S = 0.001%/1000 hours

Part Number	Control Specification	Style 1/	Capacitance		Rated Voltage @ +85°C (Vdc)	Dissipation Factor (%, max)	Dielectric Absorption (%, max)	Operating Temperature Range (°C) 2/	FRL	
			Range (µf)	Tolerances (±%)					Grade 1	Grade 2
M83421/01-XXXXX	MIL-C-83421/1	CRH01	0.001-22.0	1,5,10	30	0.15	0.1	-65 to +100	S 3/	R
		CRH02	0.001-10.0		50					
		CRH03	0.001-10.0		100					
		CRH04	0.001- 3.9		200					
		CRH05	0.001- 2.0		400					

1/ All styles listed are in tubular cases with axial leads. Lead material and coating are specified in MIL-C-83421/1. However, not all lead materials listed are preferred and recommended for welding. Consult the NASA project parts engineer for recommendations for part procurement.

2/ Parts may be used at a maximum operating temperature of +100°C but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

3/ This capacitor is not approved for use in circuits where the energy is less than 500 microjoules.

MIL-C-83421/1, STYLE CRH01 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability

Rated Voltage @ +85°C (volts, dc 1/)	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Grade 1 FRL = S(0.001) Capacitance Tolerance (±%)			Grade 2 FRL = R(0.01) Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
30	.001	22.0	.001	22.0	.001	22.0	.006	1003S	1005S	1006S	1003R	1005R	1006R
	.0012						.007	1009S	1011S	1012S	1009R	1011R	1012R
	.0015						.008	1015S	1017S	1018S	1015R	1017R	1018R
	.0018						.010	1021S	1023S	1024S	1021R	1023R	1024R
	.002				.001		.011	1027S	1029S	1030S	1027R	1029R	1030R
	.0022				.001		.012	1033S	1035S	1036S	1033R	1035R	1036R
	.0027				.002		.015	1039S	1041S	1042S	1039R	1041R	1042R
	.0033				.002		.018	1045S	1047S	1048S	1045R	1047R	1048R
	.0039				.002		.021	1051S	1053S	1054S	1051R	1053R	1054R
	.0047				.003		.026	1057S	1059S	1060S	1057R	1059R	1060R
	.005				.003		.028	1063S	1065S	1066S	1063R	1065R	1066R
	.0056				.003		.031	1069S	1071S	1072S	1069R	1071R	1072R
	.0068				.004		.037	1075S	1077S	1078S	1075R	1077R	1078R
	.0082				.005		.045	1081S	1083S	1084S	1081R	1083R	1084R
	.01				.006		.055	1087S	1089S	1090S	1087R	1089R	1090R
	.012				.007		.066	1093S	1095S	1096S	1093R	1095R	1096R
	.015				.008		.082	1099S	1101S	1102S	1099R	1101R	1102R
	.018				.010		.10	1105S	1107S	1108S	1105R	1107R	1108R
	.02				.011		.11	1111S	1113S	1114S	1111R	1113R	1114R
	.022				.012		.12	1117S	1119S	1120S	1117R	1119R	1120R
	.027		.001		.015		.15	1123S	1125S	1126S	1123R	1125R	1126R
	.033		.002		.018		.18	1129S	1131S	1132S	1129R	1131R	1132R
	.039		.002		.021		.22	1135S	1137S	1138S	1135R	1137R	1138R
	.047		.003		.026		.26	1141S	1143S	1144S	1141R	1143R	1144R
	.05		.003		.028		.28	1147S	1149S	1150S	1147R	1149R	1150R
	.056		.003		.031		.31	1153S	1155S	1156S	1153R	1155R	1156R
	.068		.004		.037		.37	1159S	1161S	1162S	1159R	1161R	1162R
	.082		.005		.045		.45	1165S	1167S	1168S	1165R	1167R	1168R
	.1		.006		.055		.55	1171S	1173S	1174S	1171R	1173R	1174R
	.12		.007		.066		.66	1177S	1179S	1180S	1177R	1179R	1180R
	.15		.008		.082		.83	1183S	1185S	1186S	1183R	1185R	1186R
	.18		.010		.100		1.00	1375S	1377S	1378S	1375R	1377R	1378R
	.20		.011		.110	20.0	1.00	1189S	1191S	1192S	1189R	1191R	1192R

1/ Parts may be used at a maximum operating temperature of 100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH01 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability (Continued)

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Grade 1 FRL = S(0.001)			Grade 2 FRL = R(0.01)		
								Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
30	.22	22.0	.012	22.0	.12	18.5	1.02	1195S	1197S	1198S	1195R	1197R	1198R
	.27		.015		.15	17.0	1.15	1201S	1203S	1204S	1201R	1203R	1204R
	.33		.018		.18	16.0	1.32	1207S	1209S	1210S	1207R	1209R	1210R
	.39		.021		.21	15.0	1.46	1213S	1215S	1216S	1213R	1215R	1216R
	.47		.026		.26	14.0	1.65	1219S	1221S	1222S	1219R	1221R	1222R
	.50		.028		.28	13.5	1.69	1225S	1227S	1228S	1225R	1227R	1228R
	.56		.031		.31	12.9	1.81	1231S	1233S	1234S	1231R	1233R	1234R
	.68		.037		.37	12.0	2.04	1237S	1239S	1240S	1237R	1239R	1240R
	.82		.045		.45	10.0	2.05	1243S	1245S	1246S	1243R	1245R	1246R
	1.0		.055		.55	8.4	2.10	1249S	1251S	1252S	1249R	1251R	1252R
	1.2		.066		.66	7.2	2.15	1255S	1257S	1258S	1255R	1257R	1258R
	1.5		.082		.83	5.8	2.17	1261S	1263S	1264S	1261R	1263R	1264R
	1.8		.099		.99	4.8		1267S	1269S	1270S	1267R	1269R	1270R
	2.0		.110		1.10	4.4		1273S	1275S	1276S	1273R	1275R	1276R
	2.2		.12		1.21	4.0		1279S	1281S	1282S	1279R	1281R	1282R
	2.7		.15		1.49	3.3		1285S	1287S	1288S	1285R	1287R	1288R
	3.0		.17		1.65	2.9		1291S	1293S	1294S	1291R	1293R	1294R
	3.3		.18		1.82	2.7		1297S	1299S	1300S	1297R	1299R	1300R
	3.9		.21		2.14	2.3		1303S	1305S	1306S	1303R	1305R	1306R
	4.7		.26	18.7	2.20	1.9		1315S	1317S	1318S	1315R	1317R	1318R
	5.0		.28	17.6		1.8		1321S	1323S	1324S	1321R	1323R	1324R
	5.6		.31	15.7		1.6	2.20	1327S	1329S	1330S	1327R	1329R	1330R
	6.8		.37	13.0		1.3		1333S	1335S	1336S	1333R	1335R	1336R
	8.0		.44	11.0		1.1		1339S	1341S	1342S	1339R	1341R	1342R
	8.2		.45	10.7		1.1		1345S	1347S	1348S	1345R	1347R	1348R
	10.0		.55	8.8	2.20	.88		1351S	1353S	1354S	1351R	1353R	1354R
	12.0		.66	7.3		.73		1381S	1383S	1384S	1381R	1383R	1384R
	15.0		.83	5.9		.59		1357S	1359S	1360S	1357R	1359R	1360R
	20.0		1.10	4.4		.44		1363S	1365S	1366S	1363R	1365R	1366R
	22.0		1.21	4.0		.40		1369S	1371S	1372S	1369R	1371R	1372R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°Cto 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH02 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
								Grade 1 FRL = S(0.001)			Grade 2 FRL = R(0.01)		
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
50	.001	36.0	.001	36.0	.001	36.0	.009	2003S	2005S	2006S	2003R	2005R	2006R
	.0012				.001		.011	2009S	2011S	2012S	2009R	2011R	2012R
	.0015				.001		.013	2015S	2017S	2018S	2015R	2017R	2018R
	.0018				.002		.016	2021S	2023S	2024S	2021R	2023R	2024R
	.002				.002		.018	2027S	2029S	2030S	2027R	2029R	2030R
	.0022				.002		.020	2033S	2035S	2036S	2033R	2035R	2036R
	.0027				.002		.024	2039S	2041S	2042S	2039R	2041R	2042R
	.0033				.003		.030	2045S	2047S	2048S	2045R	2047R	2048R
	.0039				.004		.035	2051S	2053S	2054S	2051R	2053R	2054R
	.0047				.004		.042	2057S	2059S	2060S	2057R	2059R	2060R
	.005				.005		.045	2063S	2065S	2066S	2063R	2065R	2066R
	.0056				.005		.050	2069S	2071S	2072S	2069R	2071R	2072R
	.0068				.006		.061	2075S	2077S	2078S	2075R	2077R	2078R
	.0082				.007		.074	2081S	2083S	2084S	2081R	2083R	2084R
	.01				.009		.090	2087S	2089S	2090S	2087R	2089R	2090R
	.012				.011		.11	2093S	2095S	2096S	2093R	2095R	2096R
	.015		.001		.013		.14	2099S	2101S	2102S	2099R	2101R	2102R
	.018		.002		.016		.16	2105S	2107S	2108S	2105R	2107R	2108R
	.02		.002		.018		.18	2111S	2113S	2114S	2111R	2113R	2114R
	.022		.002		.020		.20	2117S	2119S	2120S	2117R	2119R	2120R
	.027		.002		.024		.24	2123S	2125S	2126S	2123R	2125R	2126R
	.033		.003		.030		.30	2129S	2131S	2132S	2129R	2131R	2132R
	.039		.004		.035		.35	2135S	2137S	2138S	2135R	2137R	2138R
	.047		.004		.042		.42	2141S	2143S	2144S	2141R	2143R	2144R
	.05		.005		.045	36.0	.45	2147S	2149S	2150S	2147R	2149R	2150R
	.056		.005		.050	36.0	.50	2153S	2155S	2156S	2153R	2155R	2156R
	.068		.006		.061	34.0	.58	2159S	2161S	2162S	2159R	2161R	2162R
	.082		.007		.074	32.0	.66	2165S	2167S	2168S	2165R	2167R	2168R
	.1		.009		.090	30.0	.75	2171S	2173S	2174S	2171R	2173R	2174R
	.12		.011		.11	30.0	.90	2177S	2179S	2180S	2177R	2179R	2180R
	.15		.013		.14	26.0	.98	2183S	2185S	2186S	2183R	2185R	2186R
	.18		.016		.16	25.0	1.13	2189S	2191S	2192S	2189R	2191R	2192R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH02 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability (Continued)

Rated Voltage @ +85 °C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
								Grade 1 FRL = S(0.001)			Grade 2 FRL = R(0.01)		
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
50	.20	36.0	.018	36.0	.18	24.0	1.20	2195S	2197S	2198S	2195R	2197R	2198R
	.22		.020		.20	23.0	1.27	2201S	2203S	2204S	2201R	2203R	2204R
	.27		.024		.24	19.0	1.28	2207S	2209S	2210S	2207R	2209R	2210R
	.33		.030		.30	18.0	1.48	2213S	2215S	2216S	2213R	2215R	2216R
	.39		.035		.35	17.0	1.66	2219S	2221S	2222S	2219R	2221R	2222R
	.47		.042		.42	15.7	1.85	2225S	2227S	2228S	2225R	2227R	2228R
	.50		.045		.45	15.2	1.90	2231S	2233S	2234S	2231R	2233R	2234R
	.56		.050		.50	14.4	2.01	2237S	2239S	2240S	2237R	2239R	2240R
	.68		.061		.61	14.0	2.38	2243S	2245S	2246S	2243R	2245R	2246R
	.82		.074		.74	12.0	2.46	2249S	2251S	2252S	2249R	2251R	2252R
	1.0		.090		.90	10.0	2.50	2255S	2257S	2258S	2255R	2257R	2258R
	1.2		.11		1.08	9.1	2.73	2261S	2263S	2264S	2261R	2263R	2264R
	1.5		.14		1.35	7.7	2.90	2267S	2269S	2270S	2267R	2269R	2270R
	1.8		.16		1.62	6.6	3.00	2273S	2275S	2276S	2273R	2275R	2276R
	2.0		.18		1.80	6.2	3.10	2279S	2281S	2282S	2279R	2281R	2282R
	2.2		.20		1.98	5.8	3.20	2285S	2287S	2288S	2285R	2287R	2288R
	2.7		.24		2.43	5.0	3.34	2291S	2293S	2294S	2291R	2293R	2294R
	3.0		.27		2.70	4.5	3.40	2297S	2299S	2300S	2297R	2299R	2300R
	3.3		.30		2.97	4.2	3.50	2303S	2305S	2306S	2303R	2305R	2306R
	3.9		.35		3.51	3.7	3.60	2309S	2311S	2312S	2309R	2311R	2312R
	4.7		.42	31.0		3.1		2321S	2323S	2324S	2321R	2323R	2324R
	5.0		.45	29.0		2.9		2327S	2329S	2330S	2327R	2329R	2330R
	5.6		.50	26.0		2.6		2333S	2335S	2336S	2333R	2335R	2336R
	6.8		.61	21.2	3.60	2.1	3.60	2339S	2341S	2342S	2339R	2341R	2342R
	8.0		.72	18.0		1.8		2345S	2347S	2348S	2345R	2347R	2348R
	8.2		.74	17.6		1.8		2351S	2353S	2354S	2351R	2353R	2354R
	10.0		.90	14.4		1.4		2357S	2359S	2360S	2357R	2359R	2360R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH03 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
								Grade 1 FRL = S(0.001)			Grade 2 FRL = R(0.01)		
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
100	.001	60.0	.001	60.0	.002	60.0	.015	3003S	3005S	3006S	3003R	3005R	3006R
	.0012				.002		.018	3009S	3011S	3012S	3009R	3011R	3012R
	.0015				.002		.022	3015S	3017S	3018S	3015R	3017R	3018R
	.0018				.003		.027	3021S	3023S	3024S	3021R	3023R	3024R
	.002				.003		.030	3027S	3029S	3030S	3027R	3029R	3030R
	.0022				.003		.033	3033S	3035S	3036S	3033R	3035R	3036R
	.0027				.004		.041	3039S	3041S	3042S	3039R	3041R	3042R
	.0033				.005		.050	3045S	3047S	3048S	3045R	3047R	3048R
	.0039				.006		.058	3051S	3053S	3054S	3051R	3053R	3054R
	.0047				.007		.071	3057S	3059S	3060S	3057R	3059R	3060R
	.005				.008		.075	3063S	3065S	3066S	3063R	3065R	3066R
	.0056				.008		.084	3069S	3071S	3072S	3069R	3071R	3072R
	.0068		.001		.010	60.0	.10	3075S	3077S	3078S	3075R	3077R	3078R
	.0082		.001		.012	60.0	.12	3081S	3083S	3084S	3081R	3083R	3084R
	.01		.002		.015	60.0	.15	3087S	3089S	3090S	3087R	3089R	3090R
	.012		.002	60.0	.018	59.0	.18	3093S	3095S	3096S	3093R	3095R	3096R
	.015		.002		.022	58.0	.22	3099S	3101S	3102S	3099R	3101R	3102R
	.018		.003		.027	57.0	.26	3105S	3107S	3108S	3105R	3107R	3108R
	.02		.003		.030	55.0	.28	3111S	3113S	3114S	3111R	3113R	3114R
	.022		.003		.033	53.0	.29	3117S	3119S	3120S	3117R	3119R	3120R
	.027		.004		.041	51.0	.34	3123S	3125S	3126S	3123R	3125R	3126R
	.033		.005		.050	50.0	.41	3129S	3131S	3132S	3129R	3131R	3132R
	.039		.006		.059	48.0	.47	3135S	3137S	3138S	3135R	3137R	3138R
	.047		.007		.070	47.0	.55	3141S	3143S	3144S	3141R	3143R	3144R
	.050		.008		.075	46.0	.58	3147S	3149S	3150S	3147R	3149R	3150R
	.056		.008		.084	46.0	.64	3153S	3155S	3156S	3153R	3155R	3156R
	.068		.010		.10	42.0	.71	3159S	3161S	3162S	3159R	3161R	3162R
	.082		.012		.12	38.0	.78	3165S	3167S	3168S	3165R	3167R	3168R
	.10		.015		.15	36.0	.90	3171S	3173S	3174S	3171R	3173R	3174R
	.12		.018		.18	35.0	1.05	3177S	3179S	3180S	3177R	3179R	3180R
	.15		.022		.23	33.0	1.24	3183S	3185S	3186S	3183R	3185R	3186R
	.18		.027		.27	31.0	1.40	3189S	3191S	3192S	3189R	3191R	3192R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH03 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability (Continued)

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
								Grade 1 FRL = S(0.001)			Grade 2 FRL = R(0.01)		
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
100	.20	60.0	.030	60.0	.30	30.0	1.50	3195S	3197S	3198S	3195R	3197R	3198R
	.22		.033		.33	27.0	1.50	3201S	3203S	3204S	3201R	3203R	3204R
	.27		.041		.41	24.0	1.62	3207S	3209S	3210S	3207R	3209R	3210R
	.33		.050		.50	23.0	1.90	3213S	3215S	3216S	3213R	3215R	3216R
	.39		.058		.59	22.0	2.15	3219S	3221S	3222S	3219R	3221R	3222R
	.47		.071		.71	21.0	2.47	3225S	3227S	3228S	3225R	3227R	3228R
	.5		.075		.75	20.0	2.50	3231S	3233S	3234S	3231R	3233R	3234R
	.56		.084		.84	19.0	2.64	3237S	3239S	3240S	3237R	3239R	3240R
	.68		.10		1.02	16.0	2.72	3243S	3245S	3246S	3243R	3245R	3246R
	.82		.12		1.23	14.0	2.87	3249S	3251S	3252S	3249R	3251R	3252R
	1.00		.15		1.50	12.0	3.00	3255S	3257S	3258S	3255R	3257R	3258R
	1.20		.18		1.80	11.0	3.25	3261S	3263S	3264S	3261R	3263R	3264R
	1.50		.23		2.26	10.0	3.75	3267S	3269S	3270S	3267R	3269R	3270R
	2.0		.30		3.00	8.1	4.10	3273S	3275S	3276S	3273R	3275R	3276R
	2.2		.33		3.31	7.5	4.12	3279S	3281S	3282S	3279R	3281R	3282R
	2.7		.41		4.05	6.5	4.40	3285S	3287S	3288S	3285R	3287R	3288R
	3.0		.45	60.0	4.51	6.0	4.51	3291S	3293S	3294S	3291R	3293R	3294R
	3.3		.50	55.0	4.73	5.5	4.55	3297S	3299S	3300S	3297R	3299R	3300R
	3.9		.59	49.0	4.90	5.0	4.90	3303S	3305S	3306S	3303R	3305R	3306R
	4.7		.71	43.0	5.00	4.3	5.00	3315S	3317S	3318S	3315R	3317R	3318R
	5.0		.75	40.0		4.0		3321S	3323S	3324S	3321R	3323R	3324R
	5.6		.84	36.0		3.6		3327S	3329S	3330S	3327R	3329R	3330R
	6.8		1.02	29.0	5.00	3.0	5.00	3333S	3335S	3336S	3333R	3335R	3336R
	8.0		1.20	25.0		2.5		3339S	3341S	3342S	3339R	3341R	3342R
	8.2		1.23	24.4		2.4		3345S	3347S	3348S	3345R	3347R	3348R
	10.0		1.50	20.0		2.0		3351S	3353S	3354S	3351R	3353R	3354R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH04 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Grade 1 FRL = S(0.001) Capacitance Tolerance (±%)			Grade 2 FRL = R(0.01) Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
200	.001	120.0	.001	120.0	.003	80.0	.020	4003S	4005S	4006S	4003R	4005R	4006R
	.0012				.004		.024	4009S	4011S	4012S	4009R	4011R	4012R
	.0015				.004		.030	4015S	4017S	4018S	4015R	4017R	4018R
	.0018				.005		.036	4021S	4023S	4024S	4021R	4023R	4024R
	.002				.006		.040	4027S	4029S	4030S	4027R	4029R	4030R
	.0022				.007		.044	4033S	4035S	4036S	4033R	4035R	4036R
	.0027				.008		.054	4039S	4041S	4042S	4039R	4041R	4042R
	.0033				.010		.066	4045S	4047S	4048S	4045R	4047R	4048R
	.0039		.001		.012		.078	4051S	4053S	4054S	4051R	4053R	4054R
	.0047		.001		.014		.094	4057S	4059S	4060S	4057R	4059R	4060R
	.005		.002		.015		.10	4063S	4065S	4066S	4063R	4065R	4066R
	.0056		.002		.017		.11	4069S	4071S	4072S	4069R	4071R	4072R
	.0068		.002		.020	80.0	.14	4075S	4077S	4078S	4075R	4077R	4078R
	.0082		.002		.025	80.0	.16	4081S	4083S	4084S	4081R	4083R	4084R
	.01		.003		.030	80.0	.20	4087S	4089S	4090S	4087R	4089R	4090R
	.012		.004		.036	78.0	.23	4093S	4095S	4096S	4093R	4095R	4096R
	.015		.004		.045	76.0	.29	4099S	4101S	4102S	4099R	4101R	4102R
	.018		.005		.054	74.0	.33	4105S	4107S	4108S	4105R	4107R	4108R
	.02		.006		.060	71.0	.36	4111S	4113S	4114S	4111R	4113R	4114R
	.022		.007		.066	68.0	.37	4117S	4119S	4120S	4117R	4119R	4120R
	.027		.008		.081	65.0	.44	4123S	4125S	4126S	4123R	4125R	4126R
	.033		.010		.099	62.0	.51	4129S	4131S	4132S	4129R	4131R	4132R
	.039		.012		.12	60.0	.59	4135S	4137S	4138S	4135R	4137R	4138R
	.047		.014		.14	57.0	.67	4141S	4143S	4144S	4141R	4143R	4144R
	.050		.015		.15	56.0	.70	4147S	4149S	4150S	4147R	4149R	4150R
	.056		.017		.17	56.0	.78	4153S	4155S	4156S	4153R	4155R	4156R
	.068		.020		.20	50.0	.85	4159S	4161S	4162S	4159R	4161R	4162R
	.082		.025		.25	44.0	.90	4165S	4167S	4168S	4165R	4167R	4168R
	.10		.030		.30	42.0	1.10	4171S	4173S	4174S	4171R	4173R	4174R
	.12		.036		.36	40.0	1.20	4177S	4179S	4180S	4177R	4179R	4180R
	.15		.045		.45	36.0	1.34	4183S	4185S	4186S	4183R	4185R	4186R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH04 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability (Continued)

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
								Grade 1 FRL = S(0.001)			Grade 2 FRL = R(0.01)		
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Capacitance Tolerance (±%)			Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
200	.18	120.0	.054	120.0	.54	34.0	1.54	4189S	4191S	4192S	4189R	4191R	4192R
	.20		.060		.60	33.0	1.65	4195S	4197S	4198S	4195R	4197R	4198R
	.22		.066		.66	32.0	1.76	4201S	4203S	4204S	4201R	4203R	4204R
	.27		.081		.81	29.0	1.96	4207S	4209S	4210S	4207R	4209R	4210R
	.33		.099		.99	28.0	2.31	4213S	4215S	4216S	4213R	4215R	4216R
	.39		.12	120.0	1.17	27.0	2.63	4219S	4221S	4222S	4219R	4221R	4222R
	.47		.14		1.41	26.0	3.06	4225S	4227S	4228S	4225R	4227R	4228R
	.5		.15		1.50	25.0	3.13	4231S	4233S	4234S	4231R	4233R	4234R
	.56		.17		1.61	23.0	3.17	4237S	4239S	4240S	4237R	4239R	4240R
	.68		.20		1.87	20.0	3.40	4243S	4245S	4246S	4243R	4245R	4246R
	.82		.25		2.05	18.0	3.70	4249S	4251S	4252S	4249R	4251R	4252R
	1.0		.30		2.25	15.0	3.75	4255S	4257S	4258S	4255R	4257R	4258R
	1.2		.36	120.0	2.61	13.5	4.05	4261S	4263S	4264S	4261R	4263R	4264R
	1.5		.45	120.0	3.20	12.0	4.50	4267S	4269S	4270S	4267R	4269R	4270R
	1.8		.54	110.0	3.74	11.0	5.00	4273S	4275S	4276S	4273R	4275R	4276R
	2.0		.60	100.0	4.05	10.0	5.00	4279S	4281S	4282S	4279R	4281R	4282R
	2.2		.66	90.5	4.20	9.1	5.00	4285S	4287S	4288S	4285R	4287R	4288R
	2.5		.75	80.0	4.31	8.0	5.00	4291S	4293S	4294S	4291R	4293R	4294R
	2.7		.81	77.0	4.60	7.7	5.20	4297S	4299S	4300S	4297R	4299R	4300R
	3.0		.90	70.0	5.04	7.0	5.27	4303S	4305S	4306S	4303R	4305R	4306R
	3.3		.99	65.0	5.21	6.5	5.36	4309S	4311S	4312S	4309R	4311R	4312R
	3.9		1.20	55.0	5.39	5.5	5.40	4315S	4317S	4318S	4315R	4317R	4318R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

MIL-C-83421/1, STYLE CRH05 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Grade 1 FRL = S(0.001) Capacitance Tolerance (±%)			Grade 2 FRL = R(0.01) Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
400	.001	240.0	.001	240.0	.006	100.0	.025	5003S	5005S	5006S	5003R	5005R	5006R
	.0012		.001		.007		.030	5009S	5011S	5012S	5009R	5011R	5012R
	.0015		.001		.009		.037	5015S	5017S	5018S	5015R	5017R	5018R
	.0018		.001		.011		.045	5021S	5023S	5024S	5021R	5023R	5024R
	.002		.001		.012		.050	5027S	5029S	5030S	5027R	5029R	5030R
	.0022		.001		.013		.055	5033S	5035S	5036S	5033R	5035R	5036R
	.0027		.002		.016		.068	5039S	5041S	5042S	5039R	5041R	5042R
	.0033		.002		.020		.083	5045S	5047S	5048S	5045R	5047R	5048R
	.0039		.002		.023		.097	5051S	5053S	5054S	5051R	5053R	5054R
	.0047		.003		.028		.12	5057S	5059S	5060S	5057R	5059R	5060R
	.005		.003		.030		.13	5063S	5065S	5066S	5063R	5065R	5066R
	.0056		.003		.034		.14	5069S	5071S	5072S	5069R	5071R	5072R
	.0068		.004		.041		.17	5075S	5077S	5078S	5075R	5077R	5078R
	.0082		.005		.049		.21	5081S	5083S	5084S	5081R	5083R	5084R
	.01		.006		.060		.25	5087S	5089S	5090S	5087R	5089R	5090R
	.012		.007		.072		.30	5093S	5095S	5096S	5093R	5095R	5096R
	.015		.009		.090	94.0	.35	5099S	5101S	5102S	5099R	5101R	5102R
	.018		.011		.11	90.0	.41	5105S	5107S	5108S	5105R	5107R	5108R
	.02		.012		.12	88.0	.44	5273S	5275S	5276S	5273R	5275R	5276R
	.022		.013		.13	85.0	.47	5111S	5113S	5114S	5111R	5113R	5114R
	.027		.016		.16	81.0	.55	5117S	5119S	5120S	5117R	5119R	5120R
	.033		.020		.20	78.0	.65	5123S	5125S	5126S	5123R	5125R	5126R
	.039		.023		.23	75.0	.73	5129S	5131S	5132S	5129R	5131R	5132R
	.047		.028		.28	71.0	.83	5135S	5137S	5138S	5135R	5137R	5138R
	.05		.030		.30	70.0	.88	5141S	5143S	5144S	5141R	5143R	5144R
	.056		.034		.34	67.5	.95	5147S	5149S	5150S	5147R	5149R	5150R
	.068		.041		.41	60.0	1.02	5153S	5155S	5156S	5153R	5155R	5156R
	.082		.049		.49	50.0	1.03	5159S	5161S	5162S	5159R	5161R	5162R
	.10		.060		.60	46.0	1.20	5165S	5167S	5168S	5165R	5167R	5168R
	.12		.072		.72	44.5	1.34	5171S	5173S	5174S	5171R	5173R	5174R
	.15		.090		.83	40.0	1.50	5177S	5179S	5180S	5177R	5179R	5180R
	.18		.11		.95	38.0	1.70	5279S	5281S	5282S	5279R	5281R	5282R

See end of table for footnote.

MIL-C-83421/1, STYLE CRH05 CAPACITORS
Fixed, Supermetallized Plastic Film Dielectric, Established Reliability (Continued)

Rated Voltage @ +85°C (volts, dc) 1/	Nominal Capacitance Value (µf)	AC Ratings for Sinusoidal Operation From -65°C to +100°C						Part Number M83421/01-					
		0 to .4 KHz		@ 4 KHz		@ 40 KHz		Grade 1 FRL = S(0.001) Capacitance Tolerance (±%)			Grade 2 FRL = R(0.01) Capacitance Tolerance (±%)		
		Volts	Amps	Volts	Amps	Volts	Amps	1.0	5.0	10.0	1.0	5.0	10.0
400	.20	240.0	.12	240.0	1.03	37.0	1.85	5183S	5185S	5186S	5183R	5185R	5186R
	.22		.13		1.10	35.0	1.93	5189S	5191S	5192S	5189R	5191R	5192R
	.27		.16		1.21	33.0	2.24	5195S	5197S	5198S	5195R	5197R	5198R
	.33		.20		1.32	32.0	2.65	5201S	5203S	5204S	5201R	5203R	5204R
	.39		.23		1.48	32.0	3.14	5207S	5209S	5210S	5207R	5209R	5210R
	.47		.28		1.68	31.0	3.64	5213S	5215S	5216S	5213R	5215R	5216R
	.5		.30		1.75	30.0	3.75	5219S	5221S	5222S	5219R	5221R	5222R
	.56		.34		1.92	29.0	4.05	5225S	5227S	5228S	5225R	5227R	5228R
	.68		.41		2.26	26.0	4.50	5231S	5233S	5234S	5231R	5233R	5234R
	.82		.49	234.0	2.63	23.4	4.80	5237S	5239S	5240S	5237R	5239R	5240R
	1.0		.60	208.0	3.00	20.8	5.20	5243S	5245S	5246S	5243R	5245R	5246R
	1.2		.72	183.0	3.48	18.3	5.50	5249S	5251S	5252S	5249R	5251R	5252R
	1.5		.90	160.0	4.14	16.0	6.00	5255S	5257S	5258S	5255R	5257R	5258R
	1.8		1.08	150.0	4.69	15.0	6.80	5261S	5263S	5264S	5261R	5263R	5264R
	2.0		1.20	140.0	5.00	14.0	7.00	5267S	5269S	5270S	5267R	5269R	5270R

1/ Parts may be used at a maximum operating temperature of +100°C, but must be derated linearly above +85°C to 50 percent of the +85°C rated voltage.

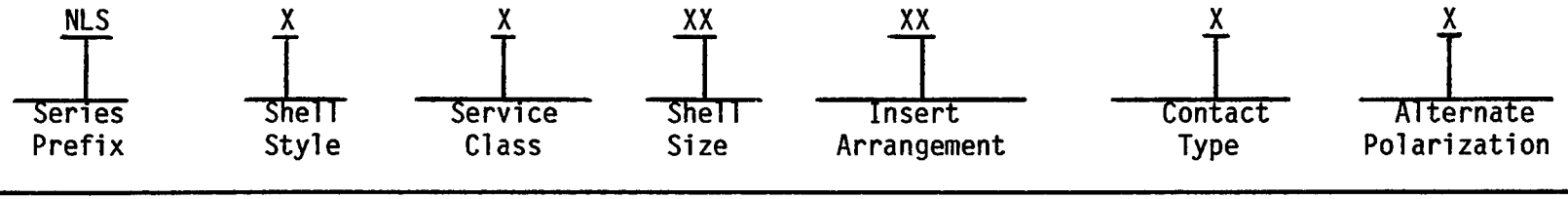
SECTION 2: SUMMARY OF STANDARD CONNECTORS

Page	Control Specification	Series	Description	Grade 1	Grade 2
2.2	40M38277 1/, 2/	--	High-density, miniature, environment resistant, circular (contacts, backshells, etc., available with connector)	5/	5/
2.3	40M39569 1/, 2/	--	Miniature, 200°C, environment resistant, circular (contacts, backshells, etc., available with connector)		
2.4	GSFC S-311-P-4 3/, 4/	--	Rack and panel, miniature, polarized shell, removable crimp contacts, rectangular		
2.5	GSFC S-311-P-10 3/, 4/	--	Rack and panel, miniature, polarized shell, soldered contacts, electrical and coaxial contacts, rectangular		
2.6	MIL-C-5015 1/, 3/, 6/, 7/, 8/	--	Threaded coupling, AN type, circular rear release crimp contacts, hermetic solder contacts, contact sizes 8 and larger only	9/	9/
2.7	MIL-C-24308 3/, 6/	--	Rack and panel, polarized shell, miniature rectangular		
2.10	MIL-C-26482 1/, 3/, 6/, 7/, 8/	2	Quick disconnect, environment resistant, miniature, circular (rear release crimp and solder contacts)		
2.11	MIL-C-38999 1/, 3/, 6/, 7/, 8/	I II	Scoop proof, miniature, circular Low silhouette, miniature, circular		
2.13	MIL-C-39012 3/, 6/	N,TNC, SC,SMA	Coaxial, radio frequency		
2.18	MIL-C-39029	--	Contacts, electrical connector		
2.20	MIL-C-55302 3/, 6/	--	Printed circuit subassembly and accessories, non-environment-resisting		
2.21	MIL-C-22992 1/, 3/, 7/	--	Plugs and receptacles, waterproof, quick disconnect, heavy duty type	GSE use only	

1/ Use of alternately keyed connections should be minimized in new designs.
2/ This is an MSFC specification.
3/ Stress corrosion properties of these connectors are not controlled.
4/ If contacts are procured separately, then GSFC detail specification shall be used.
5/ May be used in Grade 1 or in Grade 2 applications.
6/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
7/ Plating materials must be selected for environmental applications. Consult the project parts engineer for recommendation.
8/ If contacts are procured separately, MIL-C-39029 shall be used.
9/ May be used in Grade 2 applications; consult project parts engineer for recommendations on Grade 1 requirements.

40M38277 1/ CONNECTORS
Electrical, Circular, Miniature, High-Density, Environment Resisting

Part number explanation:

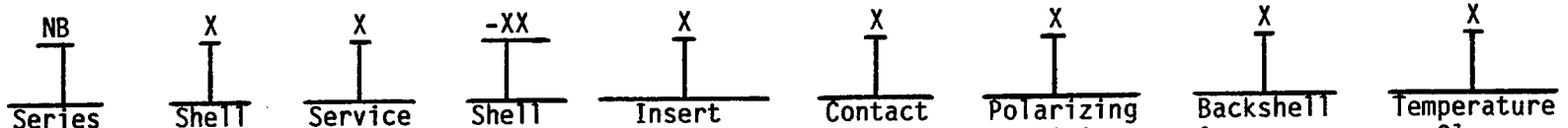


Part Number 2/, 3/, 4/		Control Specification	Specification Appendix	Configuration			
Grade 1	Grade 2			Style	Type	Mounting	Coupling
NLS5HXXXXXX		40M38277	D	Low Silhouette	Receptacle	Bulkhead	Bayonet
NLSOXXXXXXX			E		Receptacle	Flange	
NLS6XXXXXXX			F		Plug	Cabled	
NLS6GXXXXXX			G		Plug	Cabled 5/	
NLS7XXXXXXX			H		Receptacle	Jam-nut	
NLS3HXXXXXX			J		Receptacle	Solder	
NLS7HXXXXXX			K		Receptacle	Jam-nut	

1/ This is an MSFC specification.
2/ Use of alternately keyed connectors should be minimized in new designs.
3/ Contacts are given as part of the connector part number and are specified in the various appendixes of the connector specification.
4/ Contact size: 22D.
5/ RFI grounding.

40M39569 1/ CONNECTORS
Electrical, Miniature Circular, Environment Resisting, 200°C

Part number explanation:



Part Number 2/, 3/, 4/		Control Specification	Specification Appendix	Configuration			
Grade 1	Grade 2			Style	Type	Mounting	Coupling
NB0XXX-XXXXXX		40M39569	B	--	Receptacle	Narrow flange	Bayonet
NB4XXX-XXXXXX			C	--	Receptacle	Wide flange	
NB6XXX-XXXXXX			D	--	Plug	Cabled	
NB7XXX-XXXXXX			E	--	Receptacle	Jam-nut	
NB3HXX-XXXXXX			F	--		Solder	
NB7HXX-XXXXXX			G	--		Jam-nut	
NB8HXX-XXXXXX			H	Extended pin		Jam-nut	
NB5HXX-XXXXXX			J	Pin-socket		Thru-bulkhead	
NB6GXX-XXXXXX			0	RFI grounding	Plug	Cabled	

1/ This is an MSFC specification.
2/ Use of alternately keyed connectors should be minimized in new designs.
3/ Accessories such as backshells and contacts are given as part of the connector part number and are specified in the appendixes forming a part of this connector specification.
4/ Available contact sizes are 20, 16, or 12. Shielded contacts and sockets are available in size 12. Coax contacts and sockets are available in size B.

GSFC S-311-P-4 CONNECTORS
Electrical, Rectangular, for Space Flight Use, Crimp Removable Contacts

Part number explanation:

311P4	XX	-X	-X	-X	-XX
GSFC Control Specification	Detail Specification	Contact Arrangement	Contact Type P = pin S = socket	Residual Magnetism (Gamma) B = 200 C = 20 D = 2	Mounting Hole Diameter 12 = 0.120 15 = 0.154

Part Number 1/, 2/		Control Specification	GSFC Contact Arrangement 3/	Number of Contacts	MS Contact Locations
Grade 1	Grade 2				
311P407-X-X-X-XX 4/		GSFC S-311-P-4	-1	15	MS18273-2
			-2	26	MS18273-2
			-3	44	MS18275-2
			-4	62	MS18276-2
			-5	78	MS18277-2
			-6	104	MS14004-1
311P409-X-X-X-XX 5/			-1	9	MS18273-1
			-2	15	MS18274-1
			-3	25	MS18275-1
			-4	37	MS18276-1
			-5	50	MS18277-1

1/ Stress corrosion properties of these connectors are not controlled.
2/ These parts have been successfully tested and used in space applications, but not formally qualified.
3/ Refer to individual detail specifications for contact arrangements.
4/ Contact style: per GSFC S-311-P-4/8 (size 22D).
5/ Contact style: per GSFC S-311-P-4/10 (size 20).

GSFC S-311-P-10 CONNECTORS
Subminiature, Electrical and Coaxial Contact, for Space Flight Use, Solder Contacts

Part number explanation:

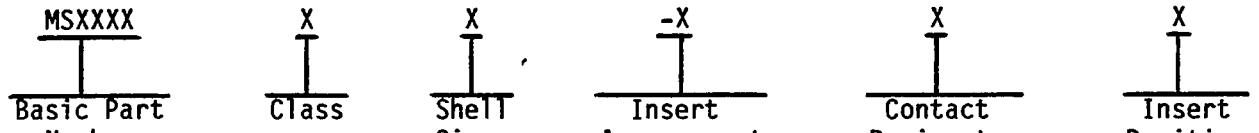
G311P10	-X	X	-X
GSFC Control Specification	Contact Arrangement	Contact Type P = pin S = socket	Residual Magnetism (Gamma) B = 200 C = 20 D = 2

Part Number 1/, 2/		Control Specification	Contact Arrangement Number 3/	Number of Contacts	Contact Size
Grade 1	Grade 2				
G311P10-XX-X		GSFC S-311-P-10	1	9	20
			2	15	20
			3	25	20
			4	37	20
			5	50	20

1/ Stress corrosion properties of these connectors are not controlled.
2/ These parts have been successfully tested and used in space applications, but not formally qualified.
3/ Refer to Figure 1 of the control specification for contact arrangements.

MIL-C-5015, CONNECTORS
Electrical, Circular, AN Type, Solder and Rear Release Crimp Contacts, Contact Sizes 8 and Larger

Part number explanation:

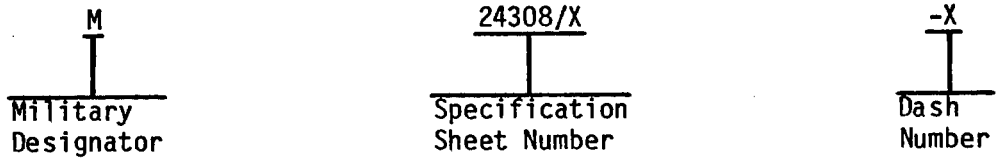


Part Number 1/, 2/, 3/, 4/, 5/, 6/	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Contacts	
Grade 2						
MS3450 XX-XXX	MIL-C-5015	Receptacle - Class L, W	Wall	Threaded	Crimp, rear release	Environmental
MS3452 XX-XXX			Box 7/			
MS3454 XX-XXX			Jam-nut			
MS3456 XX-XXX		Plug - Class L, W	Cabled			
MS3459 XX-XXX		Plug - Class L, W		Threaded, self-locking		
MS3100 XX-XXX		Receptacle - GSE	Wall	Threaded	Solder	
MS3102 XX-XXX		Receptacle - Class R	Box 7/			
MS3106 XX-XXX		Plug - GSE - Class R	Cabled			

1/ Complete part number must conform to that shown in the part number explanation.
2/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. Consult the project parts engineer for recommendations on Grade 1 requirements.
3/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Stress corrosion properties of these connectors are not controlled.
5/ Cadmium plating (Class W) must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
6/ Caution: It may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/ standards listed or referenced in this connector specification. Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.
7/ The rear of this connector is not protected against moisture or debris.

MIL-C-24308, CONNECTORS
Electrical, Rectangular, Miniature, Rack and Panel, Polarized Shell, Solder Contacts

Part number explanation:



Part Number 1/,2/,3/,4/,5/,6/ Grade 2	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Solder Contacts	
M24308/1-1	MIL-C-24308	Receptacle	Box	Auxiliary bolt	9	Non-environmental
/1-2					15	
/1-3					25	
/1-4					37	
/1-5					50	
M24308/3-1		Plug	Cabled	Auxiliary bolt	9	
/3-2					15	
/3-3					25	
/3-4					37	
/3-5					50	

1/ Complete part number must conform to that shown in the part number explanation.
2/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. For Grade 1 applications, consult GSFC specification S-311-P-10 in this section.
3/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Stress corrosion properties of these connectors are not controlled.
5/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation. At least one mating half of each of these connectors is cadmium plated.
6/ Caution: It may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification. Contacts, if ordered separately, shall be procured to MSFC-SPEC-1029.

MIL-C-24308, CONNECTORS
Electrical, Rectangular, Miniature, Rack and Panel, Polarized Shell, Crimp Removable Contacts

Part Number 1/, 2/, 3/, 4/, 5/, 6/ Grade 2	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Crimp Contacts	
M24308/2-1	MIL-C-24308	Receptacle	Box	Friction or auxiliary bolts	9	Non-environmental
/2-2					15	
/2-3					25	
/2-4					37	
/2-5					50	
M24308/4-1		Plug	Cabled	Friction or auxiliary bolts	9	
/4-2					15	
/4-3					25	
/4-4					37	
/4-5					50	

1/ Complete part number must conform to that shown in the part number explanation.
2/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. For Grade 1 applications, consult GSFC specification S-311-P-4 in this section.
3/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Stress corrosion properties of these connectors are not controlled.
5/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation. All of these connectors are cadmium plated.
6/ Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications /standards listed or referenced in this connector specification. Contacts, if ordered separately, shall be procured to MSFC-SPEC-1029.

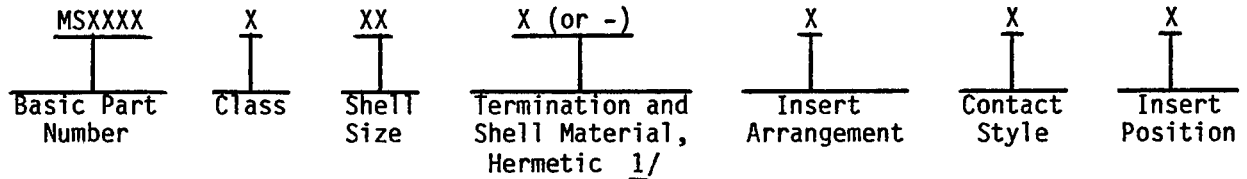
MIL-C-24308, CONNECTORS
Electrical, Rectangular, Miniature, Rack and Panel, Polarized Shell, High-Density Crimp Removable Contacts

Part Number 1/, 2/, 3/, 4/, 5/, 6/ Grade 2	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Crimp Contacts	
M24308/2-11	MIL-C-24308	Receptacle	Box	Auxiliary bolt	15	Non-environmental
/2-12					26	
/2-13					44	
/2-14					62	
/2-15					78	
/2-16					104	
M24308/4-11		Plug	Cabled	Auxiliary bolt	15	
/4-12					26	
/4-13					44	
/4-14					62	
/4-15					78	
/4-16					104	

1/ Complete part number must conform to that shown in the part number explanation.
2/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. For Grade 1 applications, consult GSFC specification S-311-P-4 in this section.
3/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Stress corrosion properties of these connectors are not controlled.
5/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation. All of these connectors are cadmium plated.
6/ Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/standards listed or referenced in this connector specification. Contacts, if ordered separately, shall be procured to MSFC-SPEC-1029.

MIL-C-26482, CONNECTORS, SERIES 2
Electrical, Circular, Miniature, Quick Disconnect, Environment Resistant

Part number explanation:

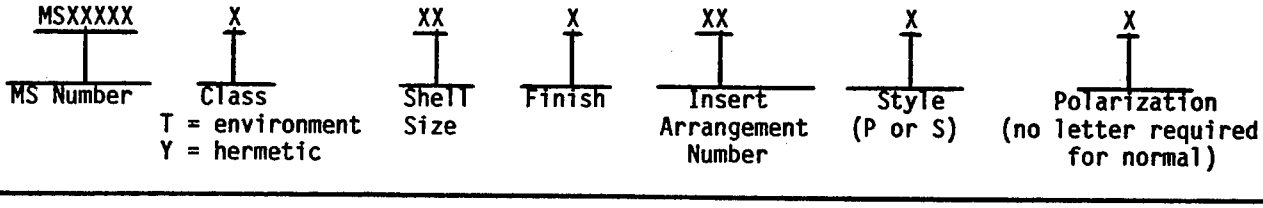


Part Number 2/, 3/, 4/, 5/, 6/, 7/, 8/ Grade 2	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Contacts	
MS3470 XXXXXXX	MIL-C-26482	Receptacle, Classes L & W	Narrow flange	Bayonet	Crimp, rear release	Environmental
MS3472 XXXXXXX			Wide flange			
MS3474 XXXXXXX			Jam-nut			
MS3475 XXXXXXX		Plug, Classes L & W, RFI shielded	Cabled			
MS3476 XXXXXXX		Plug, Classes L & W				
MS3449 XXXXXXX		Receptacles, Class H	Jam-nut		Solder	Hermetic

1/ Dash (-) denotes nonhermetic.
2/ Wherever they can be utilized, 40M39569 Connectors are preferred.
3/ Complete part number must conform to that shown in the part number explanation.
4/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. For Grade 1 applications, consult MSFC specification 40M39569 in this section.
5/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
6/ Stress corrosion properties of these connectors are not controlled.
7/ Cadmium plating (Class W) must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
8/ Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/ standards listed or referenced in this connector specification. Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.

MIL-C-38999, CONNECTORS (SERIES 1, SCOOP PROOF)
Electrical, Circular, Miniature, High-Density, Quick Disconnect, Environment Resistant, Removable Crimp and Hermetic Solder Contacts

Part number explanation:



Part Number 1/, 2/, 3/, 4/, 5/, 6/, Grade 2	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Contacts	
MS27466T XX X XX X X	MIL-C-38999	Receptacle	Wall-flange	Bayonet	Crimp	Environmental
MS27467T XX X XX X X		Plug, straight	Cabled	Bayonet	Crimp	
MS27468T XX X XX X X		Receptacle	Jam-nut	Bayonet	Crimp	
MS2747OY XX X XX X X		Receptacle	Jam-nut	Bayonet	Solder	Hermetic
MS27471Y XX X XX X X		Receptacle	Solder	Bayonet	Solder	Hermetic
MS27496T XX X XX X X		Receptacle	Box	Bayonet	Crimp	Environmental
MS27656T XX X XX X X		Receptacle	Back panel, wall-flange	Bayonet	Crimp	
MS27662T XX X XX X X		Receptacle	Thru-bulkhead	Bayonet	Feed through	

1/ Complete part number must conform to that shown in the part number explanation.
2/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. Consult the project parts engineer for recommendations on Grade 1 requirements.
3/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Stress corrosion properties of these connectors are not controlled.
5/ Cadmium plating (Finish B) must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
6/ Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/ standards listed or referenced in this connector specification. Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.

MIL-C-38999, CONNECTORS (SERIES II, LOW SILHOUETTE)
Electrical, Circular, Miniature, High-Density, Quick Disconnect (Bayonet Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts

Part Number 1/, 2/, 3/, 4/, 5/, 6/, 7/ Grade 2	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Contacts	
MS27472T XX X XX X X	MIL-C-38999	Receptacle	Wall-flange	Bayonet	Crimp	Environmental
MS27474T XX X XX X X		Receptacle	Jam-nut	Bayonet	Crimp	
MS27477Y XX X XX X X		Receptacle	Jam-nut	Bayonet	Solder	Hermetic
MS27478Y XX X XX X X		Receptacle	Solder	Bayonet	Solder	Hermetic
MS27484T XX X XX X X		Plug, straight	Cabled	Bayonet	Crimp	Environmental
MS27497T XX X XX X X		Receptacle	Back panel, wall-flange	Bayonet	Crimp	
MS27667T XX X XX X X		Receptacle	Thru-bulkhead	Bayonet	Feed through	

1/ Wherever they can be utilized, 40M38277 connectors are preferred.
2/ Complete part number must conform to that shown in the part number explanation.
3/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications. For Grade 1 applications, consult MSFC specification 40M38277 in this section.
4/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
5/ Stress corrosion properties of these connectors are not controlled.
6/ Cadmium plating (Finish B) must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
7/ Caution; it may be necessary to order accessories such as backshells, contacts, protective caps, and sealing plugs separately. Precautions must be taken to select accessories from military specifications/ standards listed or referenced in this connector specification. Crimp removable contacts, if ordered separately, shall be procured to MIL-C-39029.

MIL-C-39012, CONNECTORS
Coaxial, Radio Frequency

Part number explanation:

M39012 — Mil. Number Prefix

/XX — Specification Sheet Number

-XXXX — Dash Number

Part Number 1/,2/,3/,4/,5/ Grade 1	Part Number 1/,2/,3/,4/,5/ Grade 2	Control Specification	Series	Configuration Type	Configuration Mounting	Configuration Contacts	Impedance Nominal (ohms)	Class	Applicable Cable Number 5/
M39012/01-0501		MIL-C-39012	N	Plug	Cabled	Pin	50	2	RG-393 RG-142, RG-400
M39012/01-0503									
M39012/02-0501				Plug	Cabled	Socket			RG-393 RG-142, RG-400
M39012/02-0503									
M39012/02-0511				Receptacle	Cabled, flange, rear	Socket			RG-393 RG-142, RG-400
M39012/02-0513									
M39012/03-0501				Receptacle	Cabled, jam-nut, rear	Socket			RG-393 RG-142, RG-400
M39012/03-0503									
M39012/04-0001				Receptacle	Uncabled, jam-nut, front	Socket			--
M39012/04-0002				Receptacle	Flange, rear	Socket			--
M39012/04-0003				Receptacle	Uncabled, jam-nut, rear	Socket			--

1/ Complete part number must conform to that shown in the part number explanation.
2/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
3/ Stress corrosion properties of these connectors are not controlled.
4/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
5/ See Section 14, MIL-C-17, in this standard.

MIL-C-39012, CONNECTORS
Coaxial, Radio Frequency (Continued)

Part Number 1/,2/,3/,4/,5/		Control Specification	Series	Configuration			Impedance Nominal (ohms)	Class	Applicable Cable Number 5/
Grade 1	Grade 2			Type	Mounting	Contacts			
M39012/05-0501		MIL-C-39012	N	Plug, right angle	Cabled, rear	Pin	50	2	RG-393
M39012/05-0502			↓				↓	↓	RG-142, RG-400
M39012/26-0101			TNC	Plug	Cabled	Pin			RG-142, RG-400
M39012/26-0104									RG-303
M39012/26-0117									RG-302
M39012/26-0018									RG-316
M39012/27-0101				Plug	Cabled	Socket			RG-142, RG-400
M39012/27-0104									RG-303
M39012/27-0117									RG-302
M39012/27-0018									RG-316
M39012/28-0101				Receptacle	Cabled, jam-nut, rear	Socket			RG-142, RG-400
M39012/28-0104									RG-303
M39012/28-0117									RG-302
M39012/28-0018									RG-316
M39012/29-0101				Receptacle	Cabled, flange, rear	Socket			RG-142, RG-400
M39012/29-0104									RG-303
M39012/29-0117									RG-302
M39012/29-0018									RG-316
M39012/30-0101				Plug, right angle	Cabled	Pin			RG-142, RG-400
M39012/30-0104									RG-303
M39012/30-0117									RG-302
M39012/30-0018									RG-316
M39012/31-0001				Receptacle	Uncabled, jam-nut, front	Socket			--
M39012/31-0002			↓				↓	↓	--

1/ Complete part number must conform to that shown in the part number explanation.
2/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
3/ Stress corrosion properties of these connectors are not controlled.
4/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
5/ See Section 14, MIL-C-17, in this standard.

MIL-C-39012, CONNECTORS
Coaxial, Radio Frequency (Continued)

Part Number 1/,2/,3/,4/,5/		Control Specification	Series	Configuration			Impedance Nominal (ohms)	Class	Applicable Cable Number 5/
Grade 1	Grade 2			Type	Mounting	Contacts			
M39012/32-0001		MIL-C-39012	TNC	Receptacle	Uncabled, flange, rear	Socket	50	2	--
M39012/33-0001				Receptacle, right angle	Uncabled, jam-nut front	Socket			--
M39012/33-0002									
M39012/34-0001				Receptacle (hermetic)	Uncabled, jam-nut, front	Socket			--
M39012/34-0002				Receptacle (hermetic)	Uncabled, jam-nut, rear	Socket			--
M39012/35-0501			SC	Plug	Cabled	Pin			RG-393
M39012/35-0503									RG-142, RG-400
M39012/36-0501				Plug	Cabled	Socket			RG-393
M39012/36-0503									RG-142, RG-400
M39012/38-0501				Receptacle	Cabled, flange, rear	Socket			RG-393
M39012/38-0503									RG-142, RG-400
M39012/39-0501				Plug, right angle	Cabled	Pin			RG-393
M39012/39-0503									RG-142, RG-400
M39012/40-0503				Receptacle	Cabled, jam-nut, rear	Socket			RG-142, RG-400

1/ Complete part number must conform to that shown in the part number explanation.
2/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
3/ Stress corrosion properties of these connectors are not controlled.
4/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
5/ See Section 14, MIL-C-17, in this standard.

MIL-C-39012, CONNECTORS
Coaxial, Radio Frequency (Continued)

Part Number 1/,2/,3/,4/,5/ Grade 1	Part Number 1/,2/,3/,4/,5/ Grade 2	Control Specification	Series	Configuration Type	Configuration Mounting	Configuration Contacts	Impedance Nominal (ohms)	Class	Applicable Cable Number 5/
M39012/55-3006		MIL-C-39012	SMA	Plug	Cabled	Pin	50	2	RG-178
M39012/55-3007									RG-316
M39012/55-3009									RG-142
M39012/55-3010									RG-303
M39012/56-3006				Plug, right angle	Cabled	Pin			RG-178
M39012/56-3007									RG-316
M39012/56-3009									RG-142
M39012/56-3010									RG-303
M39012/57-3006				Plug	Cabled	Socket			RG-178
M39012/57-3007									RG-316
M39012/57-3009									RG-142
M39012/57-3010									RG-303
M39012/58-3006				Receptacle	Cabled, flange, rear	Socket			RG-178
M39012/58-3007									RG-316
M39012/58-3009									RG-142
M39012/58-3010									RG-303
M39012/59-3006				Receptacle	Cabled, jam-nut, rear	Socket			RG-178
M39012/59-3007									RG-316
M39012/59-3009									RG-142
M39012/59-3010									RG-303

1/ Complete part number must conform to that shown in the part number explanation.
2/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
3/ Stress corrosion properties of these connectors are not controlled.
4/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
5/ See Section 14, MIL-C-17, in this standard.

MIL-C-39012, CONNECTORS
Coaxial, Radio Frequency (Continued)

Part Number 1/,2/,3/,4/,5/		Control Specification	Series	Configuration			Impedance Nominal (ohms)	Class	Applicable Cable Number 5/
Grade 1	Grade 2			Type	Mounting	Contacts			
M39012/60-3001	M39012/60-3002	MIL-C-39012	SMA	Receptacle	Uncabled, flange, rear	Socket	50	2	--
M39012/61-3001	M39012/61-3002			Receptacle	Uncabled, jam-nut, rear	Socket			--
M39012/62-3001	M39012/62-3002			Receptacle (hermetic)	Uncabled, jam-nut, front	Socket			--

1/ Complete part number must conform to that shown in the part number explanation.
2/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
3/ Stress corrosion properties of these connectors are not controlled.
4/ Cadmium plating must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
5/ See Section 14, MIL-C-17, in this standard.

MIL-C-39029, CONTACTS
Crimp Removable, Electrical Connector

Part number explanation:

M39029/XX — Basic Part Number

-XXX — Bin Code

Part No.	Control Specification	Connector Specification	Contact Size		Wire Sizes	
			Pins	Sockets		
M39029/4-110	MIL-C-39029/4	MIL-C-26482 Series 2 (Pins)	20	--	20, 22, 24	
M39029/4-111			16		16, 18, 20	
M39029/4-113			12		12, 14	
M39029/5-115	MIL-C-39029/5	MIL-C-26482 Series 2 (Sockets)	--	20	20, 22, 24	
M39029/5-116				16	16, 18, 20	
M39029/5-118				12	12, 14	
M39029/29-214	MIL-C-39029/29	MIL-C-5015 (Pins)	8	--	8	10 1/
M39029/29-215			4		4	6 1/
M39029/29-216			0		0, 1	2 1/
M39029/30-220	MIL-C-39029/30	MIL-C-5015 (Sockets)	--	8	8	10 1/
M39029/30-221			--	4	4	6 1/
M39029/30-222			--	0	0, 1	2 1/

1/ Requires electrically conductive bushing per MS3348.

MIL-C-39029, CONTACTS
Crimp Removable, Electrical Connector (Continued)

Part No.	Control Specification	Connector Specification	Contact Size		Wire Sizes
			Pins	Sockets	
M39029/56-348	MIL-C-39029/56	MIL-C-38999 Series I (Sockets)	--	22D	22, 24, 26
M39029/56-351				20	20, 22, 24
M39029/56-352				16	16, 18, 20
M39029/56-353				12	12, 14
M39029/57-354	MIL-C-39029/57	MIL-C-38999 Series II (Sockets)	--	22D	22, 24, 26
M39029/57-357				20	20, 22, 24
M39029/57-358				16	16, 18, 20
M39029/57-359				12	12, 14
M39029/58-360	MIL-C-39029/58	MIL-C-38999 Series I & II (Pins)	22D	--	22, 24, 26
M39029/58-363			20		20,22, 24
M39029/58-364			16		16, 18, 20
M39029/58-365			12		12, 14
M39029/63-368	MIL-C-39029/63	MIL-C-24308 (Sockets)	--	20	20, 22, 24
M39029/64-369	MIL-C-39029/64	MIL-C-24308 (Pins)	20	--	20, 22, 24

MIL-C-55302, CONNECTORS, PRINTED CIRCUIT
Subassembly and Accessories Non-Environment-Resisting, Grade 2 Only

Part number explanation:

M55302	/XXX	-X	-XXX	X
Military Number Prefix	Spec Sheet Number	Type of Terminal	Number of Contacts 1/	Type of Mounting Hardware

Part Number 1/, 2/, 3/, 4/, 5/, 6/ Grade 2	Control Specification	Type	Type of Terminal 7/	Number of Contacts	Type of Mounting Hardware
M55302/55	MIL-C-55302	Plug	A, B, C, E, F	10,14,20,24,	L = 0.700 slotted
M55302/56		Receptacle	A, B, C, D, E, F	26,30,36,40,	turning jackscrew
M55302/57		Plug	B	44,50,54,56,	M = 0.500 slotted
M55302/58		Receptacle	A, B, C, D, E, F	60,66,70	turning jackscrew
M55302/59		Plug	B, C	90, 100,	S = 0.200 slotted
M55302/60		Receptacle	A, B, C, D	120	turning jackscrew
M55302/61		Plug	B	10, 14, 20	H = 0.200 turning
M55302/62		Receptacle	A, B, C, E, F	24, 26, 30,	jackscrew hex
M55302/63		Plug	A, B, C, E, F	36, 40, 44,	F = fixed jackscrew
M55302/64		Receptacle	A, B, C, D, E, F	50, 54, 56,	X = full round
M55302/65			G	60, 66, 70	Y = D-shaped
M55302/66			G		

1/ Number of contacts is a designer's option.
2/ Complete part number must conform to that shown in the part number explanation.
3/ There are no MIL-SPEC connectors available which are suitable for Grade 1 applications.
4/ Outgassing properties of these connectors are not controlled and must be evaluated for compliance to project outgassing requirements.
5/ Stress corrosion properties of these connectors are not controlled.
6/ Cadmium plating (Class W) must not be used in a vacuum environment or in close proximity to personnel during flight or flight simulation.
7/ A = solder cup; B = DIP terminal 0.140 inch long; C = DIP terminal 0.172 inch long; D = wirewrap; E = 0.058 inch flex circuit terminal; F = 0.100 inch flex circuit terminal; G = crimp termination.

MIL-C-22992, CONNECTORS
Electrical, Circular, Heavy Duty, Quick Disconnect Waterproof, Threaded Coupling
(Use for Ground Support Equipment only; may not be used for Space applications.)

Part number explanation:

MS1734	X	X	XX	X	XX	X	X
Military Spec No.	Type/ Mounting	Class 1/	Shell Size 2/	Finish 3/	Insert Arrangement 4/	Contact Type 5/	Alternate Insert Rotation (blank is normal) 6/

Part Number 7/, 8/, 9/	Control Specification	Configuration				Seal
		Type	Mounting	Coupling	Contacts	
MS17343 X XX X XX X X	MIL-C-22992	Receptacle	Wall flange	Threaded	Solder	Classes C and R 1/
MS17344 X XX X XX X X		Plug	Cabled			
MS17345 X XX X XX X X		Receptacle				
MS17346 X XX X XX X X			Box flange			
MS17347 X XX X XX X X			Wall--jam-nut			
MS17348 X XX X XX X X			Box--jam-nut			

1/ Class C = pressurized, Class R = environment resisting.
2/ Shell sizes: 12, 14, 16, 18, 20, 22, 24, 28, 32, 36, 40, and 44.
3/ Shell finish: N = Nonconductive, hard oxide coating; C = Conductive, cadmium plating over nickel plating.
4/ Insert arrangements per MS33681 and MS33691.
5/ Contact types: P = pin, S = socket.
6/ Normal insert rotation positions are preferred; alternates are W, X, Y, and Z.
7/ Complete part number must conform to that shown in the part number explanation.
8/ Stress corrosion properties of these connectors are not controlled.
9/ Alternately keyed connectors should not be used in new designs.

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SECTION 3: SUMMARY OF STANDARD CRYSTALS

Note: Presently there are no Grade 1 or Grade 2 crystals acceptable as NASA Standard Parts.

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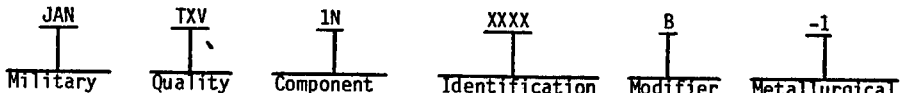
SECTION 4: SUMMARY OF STANDARD DIODES

Page	Control Specification	Description	Grade 1 1/ Type Designation	Grade 2 2/ Type Designation
4.2	MIL-S-19500	Small signal	JANS	JANTXV
4.2		Power		
4.3		Multiple array		
4.4		Zener - voltage regulator		
4.5		Zener - voltage suppressor		
4.5		Bipolar voltage suppressor		
4.6		FET - current regulator		
4.6		Schottky barrier		
4.7		Thyristor		
4.7		Light emitting diodes (LED)		

1/ When Grade 1 (JANS) parts are not listed on the QPL, JANTXV parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500 DIODES, SILICON

Part number explanation:



Designation	Grade 1 1/ Type Designation JANS	Grade 2 3/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics V_F (max) (V)	at I_F (Pk) (A)	I_R (max) (μA)	at V_R (V)	I_o (max avg) (A)	C_o (max) (pf)	t_{rr} (max) (ns)	Remarks
Small signal	--	1N645-1	/240	A1	1.0	400 mA 2/	50 nA	225	400 mA	20	--	Rectifier
		1N647-1		A1	1.0	400 mA 2/	50 nA	480	400 mA	20	--	
		1N649-1		A1	1.0	400 mA 2/	50 nA	600	400 mA	20	--	
	--	1N4148-1	/116	D035	1.0	10 mA	5	75	200 mA	4	5	Fast switching
		1N5712	/445	A1	1.0	35 mA	0.15	16	--	1.2	--	
		1N4150-1	/231	D035	0.86	50 mA	0.1	50	200 mA	2.5	4	
		1N4153-1	/337	D035	0.81	10 mA	0.05	50	150 mA	2.0	4	
Power	--	1N5415	/411	A248	1.5	9 2/	1.0	50	3	550	150	
		1N5416			1.5	9 2/	1.0	100	3	430	150	
		1N5417			1.5	9 2/	1.0	200	3	250	150	
		1N5418			1.5	9 2/	1.0	400	3	165	150	
		1N5419			1.5	9 2/	1.0	500	3	140	250	
		1N5420			1.5	9 2/	1.0	600	3	120	400	
	--	1N5615	/429	A248	1.6	3 2/	0.5	200	1	45	150	
		1N5617			1.6	3 2/	0.5	400	1	35	150	
		1N5619			1.6	3 2/	0.5	600	1	25	250	
		1N5621			1.6	3 2/	0.5	800	1	20	300	
		1N5623			1.6	3 2/	0.5	1000	1	15	500	
	--	1N3891	/304	D04	1.5	38	25	200	12 (T_C = 100°C)	---	200	
		1N3893		D04	1.5	38	25	400	12 (T_C = 100°C)	---	200	

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ Pulsed 2-percent duty cycle maximum, 8.3 ms maximum pulse width.
3/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500 DIODES, SILICON (Continued)

Designation	Grade 1 1/ Type Designation JANS	Grade 2 3/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics V_F (Max) (V)	at I_F (Pk) (A)	I_R (Max) (μA)	at V_R (V)	I_o (Max Avg) (A)	C_o (Max) (pf)	t_{rr} (Max) (ns)	Remarks
Power (Cont)		1N1202 A	/260	DO-4	1.35	38 2/	50	200	12(T_C = 150°C)	--	--	Rectifier
	--	1N5550	/420	A1	1.2	9 2/	1.0	200	3	--	--	
		1N5551			1.2	9 2/	1.0	400	3	--	--	
		1N5552			1.2	9 2/	1.0	600	3	--	--	
		1N5553			1.2	9 2/	1.0	800	3	--	--	
		1N5554			1.2	9 2/	1.0	1000	3	--	--	
	--	1N5614	/427	A248	1.3	3 2/	0.5	200	1	--	--	
		1N5616			1.3	3 2/	0.5	400	1	--	--	
		1N5618			1.3	3 2/	0.5	600	1	--	--	
		1N5620			1.3	3 2/	0.5	800	1	--	--	
		1N5622			1.3	3 2/	0.5	1000	1	--	--	
	--	1N5804	/477	A248	0.975	2.5 2/	1.0	100	1	--	25	Fast recovery
		1N5809		A1	0.925	6.0 2/	5.0	100	3	--	30	
		1N5806		A248	0.975	2.5 2/	1.0	150	1.0	--	25	
		1N5811		A1	0.925	6.0 2/	5.0	150	3.0	--	30	
	--	1N5814	/478	DO4	0.95	20 2/	10	100	5.0	--	35	
		1N5816		DO4	0.95	20 2/	10	150	5.0	--	35	
Multiple array	--	1N5768	/474	TO-86	1.0	100 mA	0.1	40	300 mA	4	20	Common cathode
		1N5770		TO-86								Common anode
		1N5772		TO-86						8		Common anode
		1N5774		TO-89								Common cathode
		1N6100		TO-89						4	5	--

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ Pulsed 2-percent duty cycle maximum, 8.3 ms maximum pulse width.
3/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics: P_D at T_A = 25°C (W)	V_Z (Nominal) at I_{ZT} (V)	I_{ZT} (mA)	V_Z (Reg) or Δ BV (mV)	Remarks
Zener-voltage reg	--	1N4370A-1 1N4371A-1 1N4372A-1	/127	D07	400 mW T_A = 50°C	2.4 2.7 3.0	20	1.0 V	Reference, temperature-compensated
	--	1N746A thru 759A 1N746A-1 thru 759A-1	/127	D07	400 mW T_A = 25°C	3.3 - 12	20	1.0 V - 0.4 V	
	--	1N962B thru 992B 1N962B-1 thru 978B-1	/117	D07	400 mW	11 - 200	11.5 - 0.65	0.5 V - 12 V	
	--	1N2970B thru 3015B	/124	D04	10 (T_C = 55°C)	6.8 - 200	370 - 12	0.4 V - 9.0 V	
	--	1N3016B thru 3051B 1N3821A thru 3828A	/115	A31	1.0	6.8 - 200 3.3 - 6.2	37 - 1.2 76 - 41	0.3 V - 12.0 V 1.0 V - 0.3 V	
	--	1N4460 thru 4496 1N4565A thru 4574A 1N4614 thru 4627	/406 /452 /435	A1 D07 D014	1.5 400 mW 400 mW	6.2 - 200 6.4 1.8 - 6.2	40 - 1.2 0.5 - 1.0 212 - 61.0	0.35 V - 12 V 5 - 100 --	
	--	1N4954 thru 4995	/356	A248	2.25	6.8 - 360	175 - 3	0.7 - 35 V	

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics: P_D at T_A = 25°C (W)	Electrical Characteristics: V_Z (Nominal) at I_{ZT} (V)	Electrical Characteristics: I_{ZT} (mA)	Electrical Characteristics: V_Z (Reg) or Δ BV (mV)	Remarks	
Zener-voltage reg (Cont)	--	1N821-1 1N823-1 1N825-1 1N827-1 1N829-1	/159	D07	250 mW	6.2	7.5	96 48 19 9 5	Reference, temperature-compensated	
	--	1N935B 1N937B thru 940B	/156	D07	500 mW	9.0	7.5	37 - 3.7 37 - 3.7		
	--	1N941B 1N943B	/157	D07	500 mW	11.7	7.5	239 - 47.0		
Zener-voltage suppr	--	1N5611	/434	D04	3	43.7	1.0	--	Transient voltage suppressor - 1500 watts of peak power dissipation at 25°C and tp = 1.0 ms	
		1N5629A thru 5665A 1N5907	/500	D013	1	7.0 - 210	10 - 1			
Bipolar voltage suppr	--	1N6102 thru 6137 1N6102A thru 6137A	/516	A298	2	6.12 - 210	175 - 5	--	500 W	Peak power dissipation at 25°C and tp = 1.0 ms
	--	1N6138 thru 6173 1N6138A thru 6173A			3				1500 W	

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics				
					P_O (V)	I_P (mA)	Z_T (MΩ)	Z_K (MΩ)	V_L (Vdc)
FET current reg	--	1N5285 thru 5314	/463	D07	100	0.297-5.17	14-0.235	1.95-0.012	1.00-2.90

Description	Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics										
					V_{RM} V(pk)	P_T (mW)	BV (10 μ Adc) (Vdc)	I_O (A)	V_F at I_F (V)	I_F (A)	I_R at V_R (μA)	V_R (V)	t_{rr} (ps)	C_O (pf)	Remarks
Schottky barrier	--	1N5711	/444	A1	50	250	70	33 mA	1.0	15 mA	0.2	50	100	2.0	Hot carrier diode (Schottky)

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500 DIODES, SILICON (Continued)

Description	Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics									Remarks
					V_{RM} V(pk)	V_{FM} (V)	I_{HOX} (mAdc)	I_o (A)	V_{RM} V(pk)	V_{KGM} V(pk)	V_{GT} (Vdc)	ton (µs)	t	
Thyristor	--	2N2323A	/276	TO5	50	2.2	2.0	0.22	50-300	6	0.1/0.9	--	--	Low-power SCR
		2N2324A			100									
		2N2326A			200									
		2N2328A			300									
		2N3029	/419	TO18	100	1.5	5.0	0.175	100	5	0.4/0.8	--	--	

Description	Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Electrical Characteristics										
					Color	I_{V_1} at θ = 0° (mcd)			I_{V_2} at θ = 30° (mcd)			V_F at I_F		I_R at V_R	
						Min	Max	I_F	Min	Max	I_F	Vdc	mAdc	µAdc	Vdc
LED	--	1N5765	/467	TO18	Red	0.5	3.0	20 mAdc	0.3	--	20 mAdc	2.0	20	1.0	3.0
		1N6092	/519		Red	1.0	--		0.5	--		3.0	20	1.0	3.0
		1N6093	/520		Yellow	1.0	--		0.5	--		3.0	20	1.0	3.0
		1N6094	/521		Green	0.8	--		0.4	--		3.0	20	1.0	3.0

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV diodes shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

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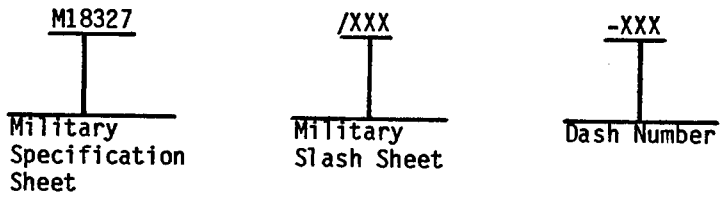
SECTION 5: SUMMARY OF STANDARD FILTERS

Page	Control Specification	Description	Frequency Range (Hz)		Grade 1	Grade 2
			Min	Max		
5.2	MIL-F-18327	Bandpass	228	18.6 M	1/	
5.3	MIL-F-28861	RF & EMI suppression	30K	1.0 G	1/	

1/ These parts are for use in Grade 2 applications only. Presently there are no Grade 1 filters available.

MIL-F-18327, FILTERS
Bandpass

Part number explanation:

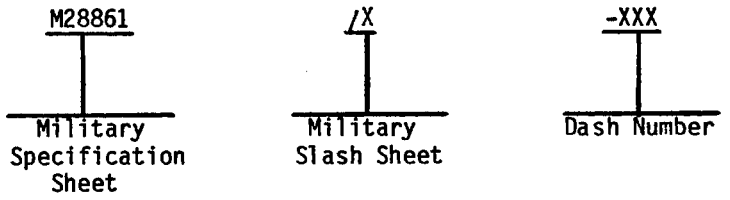


Part Number	Dash Number		Type Designation	Control Specification	Impedance (ohms)		Reference Frequency (Hz)	Insertion Loss (dB)	Frequency Range (Hz)	Discrimination (dB)		DC Operating Voltage (volts)
	Grade 1	Grade 2			Input	Output				Min	Max	
M18327/027-001	1/	001	FR6RX22YY2 (Band pass)	MIL-F-18327	2K	2K	18.6 M	3 max	18.545 M 18.578 M 18.622 M 18.655 M	60 -- -- 60	-- 6 6 --	Zero
M18327/046-00X	1/	001	FR7RX22ZZ1 (Band pass)		10K	10K	400	8 max	228 300 370 430 500 700	40 15 -- -- 15 40	-- -- 4 4 -- --	Zero
	1/	002			10K	10K	7,350	8 max	4,190 5,512 6,799 7,901 9,188 12,863	40 15 -- -- 15 40	-- -- 4 4 -- --	Zero

1/ These parts are for use in Grade 2 applications only. Presently there are no Grade 1 parts available.

MIL-F-28861, FILTERS
RF/EMI Suppression

Part number explanation:



Part Number	Style 1/	Voltage Rating Current			C	IR	Minimum Insertion Loss (MIL) at Low and High Frequency 3/				Grade 1	Grade 2 5/
							Low		High			
		Volts DC	Volts AC	Max Amps	Min µF	Min Megohms @ 25°C 2/	Freq (Hz)	MIL (dB)	Freq (Hz)	MIL (dB)		
M28861/1-003 M28861/1-013	FS-11	70	--	15	0.7	1000	30 K	8	1 G	70	4/	B
M28861/1-004 M28861/1-014					0.7	1000	30 K	8	1 G	70	4/	B
M28861/5-010 M28861/5-022	FS-50	200	125 (0 to 400 Hz)	5	0.15	1000	100 K	3	1 G	70	4/	B
M28861/5-011 M28861/5-023					0.15	1000	100 K	3	1 G	70	4/	B
M28861/5-012 M28861/5-024					0.30	1000	1M	49	1 G	80	4/	B

1/ FS denotes radio frequency/electromagnetic interference suppression filter.
2/ IR min at max rated temperature is 1/10th IR_{min} at 25°C.
3/ Temperature span is -55 to +125°C.
4/ Presently there are no Grade 1 filters available.
5/ Product level B per MIL-F-28861.

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SECTION 6: SUMMARY OF STANDARD INDUCTORS

Page	Control Specification	Description	Inductance Range (H)		Q Range		Failure Rate Level	
			Min	Max	Min	Max	Grade 1	Grade 2
6.2	MIL-T-27	High Q	1.0 m	100.0 m	26	32	1/	2/
6.4	MIL-C-15305	Fixed, molded, radio frequency	0.015 µ	1.0 m	25	65	1/	2/
6.11	MIL-C-39010	Fixed, molded, radio frequency	0.1 µ	100.0 m	18	75	R 3/	P

1/ No Grade 1 version of this part is available.
2/ These inductors shall be used in Grade 2 applications only. MIL-T-27 and MIL-C-15305 are not Established Reliability (ER) specifications and do not contain failure rate levels.
3/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications.

MIL-T-27, INDUCTORS
High Q

Part number explanation:

M27 — Military Specification Sheet

/XXX — Military Slash Sheet

-XX — Dash Number

Part Number		Control Specification	Inductance Range (H)		DC Current Range (mA)		DC Resistance Range (ohms)		Q Min Range	Case Material
Grade 1	1/ Grade 2		Min	Max	Min	Max	Min	Max		
2/	M27/146-XX	MIL-T-27	1 m	100 m	6	60	1.4	132	26 - 32	Epoxy molded

1/ MIL-T-27 shall be used in Grade 2 applications only. MIL-T-27 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-T-27/146, TYPE TF5R20ZZ INDUCTORS
High Q

Dash Number		Inductance (mH) ±2%	DC Current Max (mA) 2/	Peak Working Voltage (volts)	DC Resistance @ +25°C Max (ohms)	Quality Factor			Operating Temperature Range (°C)		Maximum Altitude (feet)	Case Material
Grade 1	1/ Grade 2					Q Min	Voltage (rms)	Frequency (kHz)	Min	Max		
3/	01	1	60	175	1.4	26	1.0	15	-55	+105	75,000	Epoxy molded
3/	02	5	28		7	30						
3/	03	10	20		11	32						
3/	04	25	13		38	32						
3/	05	50	9		75	32						
3/	06	100	6		132	32						

1/ MIL-T-27 shall be used in Grade 2 applications only. MIL-T-27 is not an Established Reliability (ER) specification and does not contain failure rate levels.
2/ The DC current is the amount of current that will reduce the inductance by 10 percent maximum.
3/ No Grade 1 version of this part is available.

MIL-C-15305 COILS
Molded, Fixed, Radio Frequency 1/

Part number explanation:

MSXXXXX — Military Specification Designator

-XX — Dash Number

Part Number		Inductance Range (µH)		Inductance Tolerance (±%)	Q Min Range	Self Resonant Freq Range (MHz)		Rated DC Current Range (mA)		Core Type	Construction	Leads
Grade 1	Grade 2 2/	Min	Max			Min	Max	Min	Max			
3/	MS14046-XX	5.60	33.00	10	45 - 75	19	60	165	495	Iron	Unshielded	Radial
	MS21367-XX	0.015	10	10, 20, 30	32 - 40	40	250	53	492	Iron	Shielded	Ribbon
	MS21368-XX	12.0	100	10	45 - 45	10	32	27	70	Iron	Shielded	Ribbon
	MS21369-XX	120	1000	10	35 - 45	1.8	6.0	23	53	Iron	Shielded	Ribbon
	MS75083-XX	0.10	1.00	10	25 - 40	230	680	385	1350	Phenolic	Unshielded	Axial
	MS75084-XX	1.2	27	10	25 - 50	20	150	130	590	Iron	Unshielded	Axial
	MS75085-XX	33.0	1000	10	30 - 50	3.4	24	28	130	Ferrite	Unshielded	Axial
	MS90538-XX	36	240	5	50 - 65	5.9	15.5	101	180	Iron	Unshielded	Axial
	MS90539-XX	270	1000	5	60 - 65	2.8	5.6	78	110	Iron	Unshielded	Axial

1/ Operating temperature range is -55°C to +105°C.
2/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.
3/ No Grade 1 version of this part is available.

MIL-C-15305 COILS, RADIO FREQUENCY
Encapsulated, Fixed, Microminiature, Shielded, Iron Core

Dash Number		Nominal Inductance (µH)	Tolerance (±%)	Test Frequency (MHz)	Q Min	Self Resonant Frequency Min (MHz)	DC Resistance at +25°C Max (ohms)	Rated DC Current (mA)
Grade 1	Grade 2 1/							
	MS14046-1	5.60	10	7.9	45	60	0.32	495
	MS14046-2	6.80			50	55	0.50	395
	MS14046-3	8.20				50	0.60	360
	MS14046-4	10.00			55	45	0.90	290
	MS14046-5	12.00		2.5	65	42	1.10	265
	MS14046-6	15.00				40	1.40	240
	MS14046-7	18.00			75	34	2.25	185
	MS14046-8	22.00				30	2.50	175
	MS14046-9	27.00			60	25	2.60	170
	MS14046-10	33.00			65	19	3.00	165
	MS21367-1	0.015	30	50	40	250	0.065	492
	MS21367-2	0.022					0.090	418
	MS21367-3	0.033					0.115	370
	MS21367-4	0.047					0.120	360
	MS21367-5	0.068					0.150	324
2/	MS21367-6	0.100					0.170	304
	MS21367-7	0.120	20	25	35		0.140	335
	MS21367-8	0.150			40		0.160	313
	MS21367-9	0.180					0.190	287
	MS21367-10	0.220					0.210	274
	MS21367-11	0.270					0.240	256
	MS21367-12	0.330					0.250	251
	MS21367-13	0.390				200	0.280	237
	MS21367-14	0.470				175	0.310	225
	MS21367-15	0.560				170	0.450	185
	MS21367-16	0.680				165	0.620	159
	MS21367-17	0.820				160	0.650	155
	MS21367-18	1.00			35	135	0.730	145
	MS21367-19	1.20	10	7.9		120	1.00	125
	MS21367-20	1.50				110	1.20	114
	MS21367-21	1.80			32	95	1.50	102
	MS21367-22	2.20				80	1.70	96
	MS21367-23	2.70			35	70	2.00	89
	MS21367-24	3.30				65	2.20	84
	MS21367-25	3.90			37	60	2.80	75

1/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-C-15305 COILS, RADIO FREQUENCY
Encapsulated, Fixed, Microminiature, Shielded, Iron Core (Continued)

Dash Number		Nominal Inductance (µH)	Tolerance (±%)	Test Frequency (MHz)	Q Min	Self Resonant Frequency Min (MHz)	DC Resistance at +25°C Max (ohms)	Rated DC Current (mA)
Grade 1	Grade 2 1/							
	MS21367-26	4.70				55	3.10	71
	MS21367-27	5.60				50	3.30	69
	MS21367-28	6.80		7.9	40	45	3.80	64
	MS21367-29	8.20				43	5.00	56
	MS21367-30	10.0				40	5.60	53
	MS21368-1	12.0			45	32	3.50	70
	MS21368-2	15.0			45	28	3.80	67
	MS21368-3	18.0			45	24	4.50	62
	MS21368-4	22.0			45	22	5.00	59
	MS21368-5	27.0			45	20	6.30	52
	MS21368-6	33.0			45	18	7.00	50
	MS21368-7	39.0		2.5	45	16	8.20	46
	MS21368-8	47.0			45	15	9.00	44
	MS21368-9	56.0			45	13	13.0	36
	MS21368-10	68.0			45	12	14.0	35
	MS21368-11	82.0			45	11	19.0	30
2/	MS21368-12	100.0	10		45	10	23.0	27
	MS21369-1	120			45	6.0	10	53
	MS21369-2	150			45	5.5	16	42
	MS21369-3	180			45	5.0	18	40
	MS21369-4	220			45	4.3	20	38
	MS21369-5	270			45	3.6	22	36
	MS21369-6	330		0.79	45	3.3	24	34
	MS21369-7	390			45	3.0	26	33
	MS21369-8	470			40	2.7	31	30
	MS21369-9	560			40	2.4	36	28
	MS21369-10	680			40	2.2	41	26
	MS21369-11	820			40	2.0	47	25
	MS21369-12	1000			35	1.5	54	23

1/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-C-15305 COILS, RADIO FREQUENCY
Molded, Fixed, Phenolic Core

Dash Number		Nominal Inductance (µH)	Tolerance (±%)	Test Frequency (MHz)	Q Min	Self Resonant Frequency Min (MHz)	DC Resistance at +25°C Max (ohms)	Rated DC Current (mA)
Grade 1	Grade 2 1/							
	MS75083-1	0.10				680	0.08	1350
	MS75083-2	0.12			40	640	0.09	1270
	MS75083-3	0.15			38	600	0.10	1200
	MS75083-4	0.18			35	550	0.12	1105
	MS75083-5	0.22				510	0.14	1025
	MS75083-6	0.27			33	430	0.16	960
2/	MS75083-7	0.33	10	25		410	0.22	815
	MS75083-8	0.39				365	0.30	700
	MS75083-9	0.47			30	330	0.35	650
	MS75083-10	0.56				300	0.50	545
	MS75083-11	0.68				275	0.60	495
	MS75083-12	0.82			28	250	0.85	415
	MS75083-13	1.00			25	230	1.00	385

1/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-C-15305 COILS, RADIO FREQUENCY
Molded, Fixed, Iron Core

Dash Number		Nominal Inductance (µH)	Tolerance (±%)	Test Frequency (MHz)	Q Min	Self Resonant Frequency Min (MHz)	DC Resistance at +25°C Max (ohms)	Rated DC Current (mA)
Grade 1	Grade 2 1/							
2/	MS75084-1	1.2	10	7.9	25	150	0.18	590
	MS75084-2	1.5			28	140	0.22	535
	MS75084-3	1.8				125	0.30	455
	MS75084-4	2.2			30	115	0.40	395
	MS75084-5	2.7			37	100	0.55	355
	MS75084-6	3.3				90	0.85	270
	MS75084-7	3.9				80	1.00	250
	MS75084-8	4.7			45	75	1.20	230
	MS75084-9	5.6				65	1.80	185
	MS75084-10	6.8			50	60	2.00	175
	MS75084-11	8.2				55	2.70	155
	MS75084-12	10			55	50	3.70	130
	MS75084-13	12		2.5	45	40	2.70	155
	MS75084-14	15			40	35	2.80	150
	MS75084-15	18				30	3.10	145
	MS75084-16	22			50	25	3.30	140
	MS75084-17	27				20	3.50	135

1/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-C-15305 COILS, RADIO FREQUENCY
Molded, Fixed, Ferrite Core

Dash Number		Nominal Inductance (µH)	Tolerance (±%)	Test Frequency (MHz)	Q Min	Self Resonant Frequency Min (MHz)	DC Resistance at +25°C Max (ohms)	Rated DC Current (mA)
Grade 1	Grade 2 1/							
	MS75085-1	33				24	3.4	130
	MS75085-2	39			45	22	3.6	125
	MS75085-3	47				20	4.5	110
	MS75085-4	56		2.5		18	5.7	100
	MS75085-5	68				15	6.7	92
	MS75085-6	82			50	14	7.3	88
	MS75085-7	100				13	8	84
	MS75085-8	120				12	13	66
	MS75085-9	150				11	15	61
2/	MS75085-10	180	10			10	17	57
	MS75085-11	220				9	21	52
	MS75085-12	270				8	25	47
	MS75085-13	330			30	7	28	45
	MS75085-14	390		0.79		6.5	35	40
	MS75085-15	470				6	42	36
	MS75085-16	560				5	46	35
	MS75085-17	680				4	60	30
	MS75085-18	820				3.8	65	29
	MS75085-19	1000				3.4	72	28

1/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-C-15305 COILS, RADIO FREQUENCY
Molded, Fixed, Microminiature, Iron Core

Part Number		Nominal Inductance (µH) (±5%)	Test Frequency (MHz)	Q Min	Self Resonant Frequency Min (MHz)	DC Resistance at +25°C Max (ohms)	Rated DC Current (mA)
Grade 1	Grade 2 1/						
	MS90538-01	36			15.5	2.50	180
	MS90538-02	39		60	14.5	2.60	176
	MS90538-03	43			13.7	2.70	172
	MS90538-04	47			13.0	2.75	170
	MS90538-05	51			12.7	2.85	167
	MS90538-06	56			12.0	3.00	164
	MS90538-07	62	2.50	55	11.5	3.15	160
	MS90538-08	68			11.0	3.30	156
	MS90538-09	75			10.5	3.70	147
	MS90538-10	82			10.3	3.90	143
2/	MS90538-11	91		50	10.0	4.30	136
	MS90538-12	100			9.5	4.50	133
	MS90538-13	110		60	8.9	4.90	128
	MS90538-14	120			8.7	5.20	124
	MS90538-15	130			8.5	5.45	121
	MS90538-16	150			8.0	6.05	114
	MS90538-17	160	0.79		7.5	6.40	111
	MS90538-18	180		65	7.0	6.75	108
	MS90538-19	200			6.5	7.10	106
	MS90538-20	220			6.2	7.45	103
	MS90538-21	240			5.9	7.80	101

1/ MIL-C-15305 shall be used in Grade 2 applications only. MIL-C-15305 is not an Established Reliability (ER) specification and does not contain failure rate levels.

2/ No Grade 1 version of this part is available.

MIL-C-39010 COILS
Fixed, Radio Frequency, Molded, Established Reliability

Part number explanation:

M39010	/XX	-X	XXX	X	X
Military Specification Designator	Slash Sheet	Class	Inductance Value	Inductance Tolerance	Failure Rate Level R = 0.01%/1000 hr. P = 0.1%/1000 hr.

Part Number	Failure Rate Level		Inductance Range (µH)		Inductance Tolerance (±%)	Q Min Range	Self Resonant Frequecy (MHz) Min	Rated DC Current (mA)	Core Type	Construction	Operating Temperature (°C)	
	Grade 1	Grade 2	Min	Max							Min	Max
M39010/01-AXXXXX			0.10	0.82	10	50-40	250-180	1790/370	Phenolic core & iron sleeve	Shielded	-55	+105
M39010/02-AXXXXX			1.00	12.0	10	55-44	140-44	1070/200	Iron	Shielded	-55	+105
M39010/03-AXXXXX	R 1/	P	15	100,000	10	60-18	49-0.11	250/3.0	Ferrite	Shielded	-55	+105
M39010/06-BXXXXX			0.15	4.7	20, 10	50-33	525-90	2450/260	Phenolic	Unshielded	-55	+125
M39010/07-AXXXXX			5.6	33	10	75-45	60-90	495/165	Iron	Unshielded	-55	+105

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications

MIL-C-39010/01 COILS, MICROMINIATURE
Magnetically Shielded (Phenolic Core, Iron Sleeve), Established Reliability

Dash Number		Inductance (±10%)(µH)	Q Min	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	DC Resistance (@ +25°C) Max (ohms)	Rated DC Current (mA)	Operating Temperature (°C)	
Grade 1 1/ FRL = R (0.01%)	Grade 2 FRL = P (0.1%)							Min	Max
AR10KR	AR10KP	0.10				0.025	1790		
AR12KR	AR12KP	0.12	50			0.034	1530		
AR15KR	AR15KP	0.15				0.037	1470		
AR18KR	AR18KP	0.18				0.047	1300		
AR22KR	AR22KP	0.22	49		250	0.067	1100		
AR27KR	AR27KP	0.27	47	25		0.11	853	-55	+105
AR33KR	AR33KP	0.33	46			0.13	780		
AR39KR	AR39KP	0.39	44			0.18	670		
AR47KR	AR47KP	0.47	44		235	0.25	565		
AR56KR	AR56KP	0.56	43		210	0.33	490		
AR68KR	AR68KP	0.68	42		190	0.45	420		
AR82KR	AR82KP	0.82	40		180	0.59	370		

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications

MIL-C-39010/02 COILS, MICROMINIATURE
Magnetically Shielded (Iron Core, Iron Sleeve), Established Reliability

Dash Number		Inductance (±10%)(µH)	Q Min	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	DC Resistance (@ +25°C) Max (ohms)	Rated DC Current (mA)	Operating Temperature (°C)	
Grade 1 1/ FRL = R (0.01%)	Grade 2 FRL = P (0.1%)							Min	Max
A1R0KR	A1R0KP	1.00		25	140	0.07	1070		
A1R2KR	A1R2KP	1.20			130	0.10	895		
A1R5KR	A1R5KP	1.50			115	0.12	815		
A1R8KR	A1R8KP	1.80			105	0.14	755		
A2R2KR	A2R2KP	2.20	44		100	0.19	650		
A2R7KR	A2R7KP	2.70			92	0.28	535		
A3R3KR	A3R3KP	3.30			85	0.35	480	-55	+105
A3R9KR	A3R9KP	3.90		7.9	75	0.40	450		
A4R7KR	A4R7KP	4.70			70	0.55	380		
A5R6KR	A5R6KP	5.60			65	0.72	335		
A6R8KR	A6R8KP	6.80			55	1.02	280		
A8R2KR	A8R2KP	8.20	50		50	1.32	245		
A100KR	A100KP	10.0			46	1.62	220		
A120KR	A120KP	12.0	55	2.5	44	2.00	200		

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications

MIL-C-39010/03 COILS, MICROMINIATURE
Magnetically Shielded (Ferrite Core, Ferrite Sleeve), Established Reliability

Dash Number		Inductance (±10%)(µH)	Q Min	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	DC Resistance (@ +25°C) Max (ohms)	Rated DC Current (mA)	Operating Temperature (°C)	
Grade 1 1/ FRL = R (0.01%)	Grade 2 FRL = P (0.1%)							Min	Max
A150KR	A150KP	15			49	0.80	315.0		
A180KR	A180KP	18			45	0.89	300.0		
A220KR	A220KP	22	45		41	0.96	290.0		
A270KR	A270KP	27			38	1.19	260.0		
A330KR	A330KP	33			34	1.37	240.0		
A390KR	A390KP	39		2.5	29	1.93	205.0		
A470KR	A470KP	47			27	2.11	195.0		
A560KR	A560KP	56	50		25	2.23	190.0		
A680KR	A680KP	68			21	2.70	180.0		
A820KR	A820KP	82			10.5	2.44	170.0		
A101KR	A101KP	100			10.0	3.12	160.0		
A121KR	A121KP	120			9.7	3.60	150.0		
A151KR	A151KP	150			8.5	4.10	140.0		
A181KR	A181KP	180	55		8.0	4.40	135.0		
A221KR	A221KP	220			7.5	5.00	125.0		
A271KR	A271KP	270			7.0	5.80	115.0		
A331KR	A331KP	330			6.5	6.40	110.0	-55	+105
A391KR	A391KP	390		7.9	6.2	7.40	105.0		
A471KR	A471KP	470			5.7	9.50	92.0		
A561KR	A561KP	560	60		4.7	10.5	90.0		
A681KR	A681KP	680			4.5	11.8	80.0		
A821KR	A821KP	820			4.2	13.0	80.0		
A102KR	A102KP	1,000			3.8	17.5	70.0		
A122KR	A122KP	1,200			1.5	22.1	60.0		
A152KR	A152KP	1,500			1.2	26.5	55.0		
A182KR	A182KP	1,800			1.0	29.9	50.0		
A222KR	A222KP	2,200	45		0.97	33.8	50.0		
A272KR	A272KP	2,700			0.92	47.3	40.0		
A332KR	A332KP	3,300		0.25	0.84	53.0	40.0		
A392KR	A392KP	3,900			0.80	73.8	35.0		
A472KR	A472KP	4,700			0.74	81.6	31.0		
A562KR	A562KP	5,600	44		0.73	98.9	28.0		
A682KR	A682KP	6,800			0.66	111.0	27.0		
A822KR	A822KP	8,200	40		0.54	119.0	26.0		
A103KR	A103KP	10,000			0.47	137.0	24.0		

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications.

MIL-C-39010/03 COILS, MICROMINIATURE
Magnetically Shielded (Ferrite Core, Ferrite Sleeve), Established Reliability (Continued)

Dash Number		Inductance (±10%)(µH)	Q Min	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	DC Resistance (@ +25°C) Max (ohms)	Rated DC Current (mA)	Operating Temperature (°C)	
Grade 1 1/ FRL = R (0.01%)	Grade 2 FRL = P (0.1%)							Min	Max
A123KR	A123KP	12,000	30	0.079	0.33	143.0	23.0	-55	+105
A153KR	A153KP	15,000			0.29	157.0	22.0		
A183KR	A183KP	18,000			0.28	175.0	21.0		
A223KR	A223KP	22,000	27		0.25	274.0	17.0		
A273KR	A273KP	27,000			0.21	308.0	16.0		
A333KR	A333KP	33,000			0.19	343.0	15.0		
A393KR	A393KP	39,000			0.17	376.0	15.0		
A473KR	A473KP	47,000	23		0.16	473.0	13.0		
A563KR	A563KP	56,000			0.14	512.0	13.0		
A683KR	A683KP	68,000			0.13	580.0	12.0		
A823KR	A823KP	82,000	21		0.12	618.0	11.0		
A104KR	A104KP	100,000	18		0.11	678.0	11.0		

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications.

MIL-C-39010/06 COILS, MICROMINIATURE
Phenolic Core, Established Reliability

Dash Number		Inductance (±10%)(µH)	Q Min	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	DC Resistance (@ +25°C) Max (ohms)	Rated DC Current (mA)	Operating Temperature (°C)	
Grade 1 1/ FRL = R (0.01%)	Grade 2 FRL = P (0.1%)							Min	Max
BR15LR	BR15LP	0.15(±20%)	50	25.0	525	0.030	2450	-55	+125
BR22LR	BR22LP	0.22(±20%)			450	0.055	1810		
BR33LR	BR33LP	0.33(±20%)	45		360	0.090	1400		
BR47LR	BR47LP	0.47(±20%)			310	0.120	1225		
BR56KR	BR56KP	0.56	50		280	0.135	1150		
BR68KR	BR68KP	0.68			250	0.150	1100		
BR82KR	BR82KP	0.82			220	0.220	900		
B1R0KR	B1R0KP	1.00			200	0.290	785		
B1R2KR	B1R2KP	1.20	33	7.9	180	0.420	650		
B1R5KR	B1R5KP	1.50			160	0.500	600		
B1R8KR	B1R8KP	1.80			150	0.650	525		
B2R2KR	B2R2KP	2.20			135	0.950	435		
B2R7KR	B2R7KP	2.70			120	1.20	385		
B3R3KR	B3R3KP	3.30			110	2.00	300		
B3R9KR	B3R9KP	3.90			100	2.30	280		
B4R7KR	B4R7KP	4.70			90	2.60	260		

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications.

MIL-C-39010/07 COILS, MICROMINIATURE
Powdered Iron Core, Established Reliability

Dash Number		Inductance (±10%)(μH)	Q Min	Test Frequency (MHz)	Self-Resonant Frequency Min (MHz)	DC Resistance (@ +25°C) Max (ohms)	Rated DC Current (mA)	Operating Temperature (°C)	
Grade 1 1/ FRL = R (0.01%)	Grade 2 FRL = P (0.1%)							Min	Max
A5R6KR	A5R6KP	5.6	45	7.9	60	0.32	495	-55	+105
A6R8KR	A6R8KP	6.8	50		55	0.50	395		
A8R2KR	A7R2KP	8.2			50	0.60	360		
A100KR	A100KP	10	55		45	0.90	290		
A120KR	A120KP	12	65	2.5	42	1.10	265		
A150KR	A150KP	15			40	1.40	240		
A180KR	A180KP	18	75		34	2.25	185		
A220KR	A220KP	22			30	2.50	175		
A270KR	A270KP	27	60		25	2.60	170		
A330KR	A330KP	33	65		19	3.00	165		

1/ Failure rate level (FRL) R parts as a minimum shall be used in Grade 1 applications.

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SECTION 7: SUMMARY OF STANDARD MICROCIRCUITS

Page	Control Specification	Description	Grade 1	Grade 2
7.2	MIL-M-38510	Microcircuit information	JAN Class S 1/	JAN Class B
7.3		Digital, TTL		
7.4 - 7.7		Digital, Schottky, low-power TTL		
7.8 - 7.9		Digital, CMOS		
7.10		Bipolar, memories		
7.11		Microprocessors		
7.12		Linear		

1/ When Grade 1 (Class S) parts are not listed in the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MICROCIRCUIT INFORMATION

MIL-M-38510 SPECIFICATION

MIL-M-38510 specification parts are the only microcircuits referenced in this standard. For Grade 1 parts, only Class S devices are listed. When Grade 1 (Class S) parts are not on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

Part Number explanation: 1/

JANM38510	/XXX	XX	X	X	X
Military designator	Detail Specification	Device Type	Device Class	Case outline 3/, 4/	Lead Finish 5/

Establishes the general requirements, quality and reliability requirements, detail requirements and specific characteristics of the microcircuits.

Determines the specific circuit or device type. (See detail specification for list.)

Three levels of microcircuit quality and reliability assurance are provided:

Class	Applications
S	Higher reliability
B	General
C	Commercial 2/

Pkg. Code	Case	Inches	Leads
A	FP	1/4 X 1/4	14
B	FP	1/4 X 3/16	14
C	DIP	1/4 X 3/4	14
D	FP	1/4 X 3/8	14
E	DIP	1/4 X 7/8	16
F	FP	1/4 X 3/8	16
G	TO-5	--	8
H	FP	1/4 X 1/4	10
I	TO-5	--	10
J	DIP	1/2-X 1 1/4	24
K	FP	3/8 X 1/2	24
Q	DIP	9/16 X 2 1/16	40
Z	FP	1/4 X 3/8	24
R	DIP	1/4 X 1/16	20
X	TO-5	----------	3
Y	TO-3	----------	2

A--Kovar or alloy 42 with hot solder dip

B--Kovar or alloy 42 with acid tin plate

C--Kovar or alloy 42 with gold plate

1/ The detail specification and QPL must be consulted to determine the availability of various packages (case outlines) and lead finishes. All variations are not available on all part types.
2/ Class C shall not be used in NASA applications.
3/ FP = Flat pack, DIP = dual-in-line package.
4/ Case outlines listed are not all-inclusive. Check QPL for case outlines available.
5/ When systems are to be fabricated by welding, the recommended lead finishes are gold plate or acid tin plate. A hot solder dip lead finish can be welded only by using special equipment and welding techniques.

MIL-M-38510, MICROCIRCUITS
Digital TTL 1/

Description	Commercial Type 2/	Function	JAN Part Number 3/		
			M38510/	Grade 1 4/	Grade 2
Gates	5409	AND, quad 2-input open collector	01602		B*X
	5423	NOR, dual expandable 4-input with strobe	00402		B*X
	5425	NOR, dual 4-input active pullup with strobe	00403		B*X
	5450	AND-OR-invert, dual 2-wide, 2-input expandable	00501		B*X
	5453	AND-OR-invert, 4-wide, 2-input expandable	00503		B*X
Inverters	5406	Hex open collector, 30V output	00801		R*X
	5416	Hex buffer (open collector)	00802		B*X
Buffer/drivers	5407	Driver, hex open collector	00803		B*X
Flip-flops	5470	J-K, edge triggered	00206		B*X
	5472	J-K, master-slave	00201		B*X
Registers	5477	4-bit latch	01502		B*X
Decoders-selectors	5443	Excess-3-to-decimal	01002		B*X
	5444	Excess-3-Gray-to-decimal	01003		B*X
	54150	Data selectors/multiplexers, 1 of 16	01401		B*X
	54154	Decoders/multiplexers, 4-line-to-16-line	15201		B*X
Decoders/drivers	5449	BCD-to-seven-segment	01009		B*X
	54145	BCD-to-decimal	01005		B*X
Multivibrators	54121	Single, monostable	01201		B*X
Parity checker	54180	Parity generator/checker	01901		B**
Miscellaneous MSI/LSI	5482	Full adder, 2-bit binary	00601		B*X

1/ These microcircuits are not available in "LS" to a MIL-M-38510 slash sheet.
2/ Use the JANM38510 part number for ordering.
3/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
4/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MIL-M-38510, MICROCIRCUITS
Digital, Schottky, Low-Power TTL

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Gates	54LS00	NAND, quad 2-input	30001	S*X	B*X
	54LS02	NOR, quad 2-input	30301	S*X	B*X
	54LS03	NAND, quad 2-input	30002		B*X
	54LS04	Hex inverter	30003	S*X	B*X
	54LS05	Hex inverter (open collector)	30004	S*X	B*X
	54LS08	AND, quad 2-input	31004	S*X	B*X
	54LS10	NAND, triple 3-input	30005	S*X	B*X
	54LS11	AND, triple 3-input	31001		B*X
	54LS12	NAND, triple 3-input (open collector)	30006		B*X
	54LS13	NAND, dual 4-input Schmitt trigger	31301		B*X
	54LS14	Hex inverter Schmitt trigger	31302	S*X	B*X
	54LS15	AND, triple 3-input (open collector)	31002		B*X
	54LS20	NAND, dual 4-input	30007	S*X	B*X
	54LS21	AND, dual 4-input	31003	S*X	B*X
	54LS22	NAND, dual 4-input (open collector)	30008	S*X	B*X
	54LS27	NOR, triple 3-input	30302	S*X	B*X
	54LS30	NAND, 8-input	30009		B*X
	54LS32	OR, quad 2-input	30501	S*X	B*X
	54LS51	AND-OR-invert, dual 2 wide 2 input	30401		B*X
	54LS54	AND-OR-invert, 4-wide, 2-3-3-2-input	30402		B*X
	54LS86	Exclusive-OR, quad 2-input	30502	S*X	B*X
	54LS132	NAND, quad 2-input Schmitt trigger	31303	S*X	B*X
	54LS266	Exclusive-NOR, quad 2-input (open collector)	30303	S*X	B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Buffers	54LS26	Buffer, NAND 2-input (open collector	32102		B*X
	54LS28	Buffer, NOR, quad 2-input	30204		B*X
	54LS37	Buffer, NAND quad 2-input	30202	S*X	B*X
	54LS38	Buffer, NAND quad 2-input (open collector)	30203	S*X	B*X
	54LS40	Buffer, NAND dual 4-input	30201		B*X
	54LS125	QUAD, bus buffer (inverting control input)	32301	S*X	B*X
	54LS126	Buffer, quad 3-state outputs	32302		B*X
	54LS240	OCTAL, inverting buffer (inverting control inputs)	32401		B*X
	54LS241	OCTAL, noninverting buffer (complementary control inputs)	32402		B*X
	54LS244	Noninverting OCTAL buffer gates (inverting control inputs)	32403		B*X
Drivers	54LS365	HEX, bus driver, gated enable inputs	32201	S*X	B*X
	54LS366	HEX, bus driver, gated enable input for x-y coincident bus control	32202	S*X	B*X
	54LS367	HEX, bus driver, 4-line and 2-line enable inputs	32203	S*X	B*X
	54LS368	HEX, inverter bus driver, 4-line and 2-line enable inputs	32204	S*X	B*X
Counters	54LS90	Decade counter	31501	S*X	B*X
	54LS92	Divide-by-twelve counter	31510	S*X	B*X
	54LS93	4-bit binary counter	31502	S*X	B*X
	54LS160	Synchronous 4-bit decade (asynchronous clear)	31503		B*X
	54LS161	Synchronous 4-bit binary (asynchronous clear	31504	S*X	B*X
	54LS162	Synchronous 4-bit decade (synchronous clear)	31511		B*X
	54LS163	Synchronous 4-bit binary counter (synchronous clear)	31512	S*X	B*X
	54LS190	Synchronous 4-bit up/down decade	31513	S*X	B*X
	54LS191	Synchronous 4-bit up/down binary (mode control)	31509	S*X	B*X
	54LS192	Synchronous 4-bit up/down decade counter (dual clock with clear)	31507	S*X	B*X
	54LS193	Synchronous 4-bit up/down binary (dual clock with clear)	31508	S*X	B*X
	54LS197	1 + 3-bit binary counter (:2 plus :8)	32002		B*X
	54LS290	Decade counter (BCD or bi-quinary)	32003	S*X	B*X
	54LS293	4-bit binary counter (:2 plus :8)	32004	S*X	B*X
	54LS390	Dual decade counter with A and B inputs	32701		B*X
	54LS393	Dual 4-bit binary counter	32702	S*X	B*X
	54LS490	Dual decade counter with clear and set-to-nine	32703	S*X	B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MIL-M-38510, MICROCIRCUITS
Digital, Schottky, Low-Power TTL (Continued)

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Flip-flops	54LS73	J-K with clear, dual	30101	S*X	B*X
	54LS74	D-type with preset/clear, dual	30102	S*X	B*X
	54LS76	J-K with preset/clear, dual	30110	S*X	B*X
	54LS107	J-K with clear, dual (positive)	30108	S*X	B*X
	54LS109	J-K with preset/clear, dual (positive)	30109	S*X	B*X
	54LS112	J-K with preset/clear, dual (negative)	30103	S*X	B*X
	54LS113	J-K with preset, dual (negative)	30104	S*X	B*X
	54LS114	J-K preset/clear/clock, dual (negative)	30105		B*X
	54LS122	Single monostable multivibrator, retriggerable, with clear)	31403		B*X
	54LS123	Dual monostable multivibrator (retriggerable, with clear)	31401		B*X
	54LS174	D-type, hex single outputs/clear	30106	S*X	B*X
	54LS175	D-type, quad complementary output/clear	30107	S*X	B*X
	54LS221	Dual monostable multivibrator, Schmitt trigger with clear)	31402		B*X
Latches	54LS75	4-bit bistable latch	31601	S*X	B*X
	54LS279	8-bit addressable latch	31602	S*X	B*X
	54LS259	Quad $\overline{S}$ - $\overline{R}$ latch	31603		B*X
	54LS375	Latch, 4-bit bistable	31604	S*X	B*X
Shift-registers	54LS95	4-bit parallel in/parallel out	30603	S*X	B*X
	54LS96	5-bit asynchronous preset	30604	S*X	B*X
	54LS164	8-bit parallel out/serial shift	30605	S*X	B*X
	54LS165	8-bit parallel-load shift register	30608		B*X
	54LS194	4-bit bidirectional	30601	S*X	B*X
	54LS195	4-bit parallel access	30602	S*X	B*X
	54LS295	4-bit bidirectional	30606	S*X	B*X
	54LS395	4-bit 3-state outputs	30607	S*X	B*X
	54LS670	4 x 4 register file	31901		B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Adders/ comparators	54LS83A	4-bit binary adder with carry	31201		B*X
	54LS283	4-bit binary full adder	31202		B*X
	54LS85	4-bit magnitude comparator	31101	S*X	B*X
Decoders/ encoders/ multiplexers	54LS42	BCD-to-decimal decoder	30703		B*X
	54LS47	BCD-to-seven segment decoder/driver (open collector)	30704		B*X
	54LS138	Single 3 to 8 line decoder	30701	S*X	B*X
	54LS139	Dual 2 to 4 line decoder	30702	S*X	B*X
	54LS148	8 to 3 line priority encoder	36001		B*X
	54LS151	8-input data selector/multiplexer	30901		
	54LS153	Dual, 4-input data selector/multiplexer	30902	S*X	B*X
	54LS156	Dual 2 line to 4 line decoder/demultiplexer	32602	S*X	B*X
	54LS157	Quad, 2-input data selector/multiplexer	30903	S*X	B*X
	54LS158	Quad, 2-input data selector/multiplexer	30904		B*X
	54LS251	8-input data selector/multiplexer	30905		B*X
	54LS253	Dual, 4-input data selector/multiplexer, tri-state	30908		B*X
	54LS257	Quad 2-input data selector/multiplexer,	30906	S*X	B*X
	54LS258	3-state outputs, with enable	30907	S*X	B*X
	54LS298	Quad, 2-input data selector/multiplexer with storage	30909	S*X	B*X
	54LS348	8 to 3 line priority encoder with 3-state outputs	36002		B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MIL-M-38510, MICROCIRCUITS
Digital, CMOS

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Gates	4011A	NAND, quad, 2-input	05001		B*X
	4012A	NAND, dual, 4-input	05002		B*X
	4023A	NAND, triple, 3-input	05003		B*X
	4000A	NOR, dual, 3-input, plus inverter	05201		B*X
	4001A	NOR, quad, 2-input	05202		B*X
	4002A	NOR, dual, 4-input	05203		B*X
	4025A	NOR, triple, 3-input	05204		B*X
	4007A	Dual complementary pair plus inverter	05301		B*X
	4019A	AND-OR select, quad	05302		B*X
	4030A	Quad 2-input exclusive or gate	05303		B*X
	4019B	Quad AND-OR select gate	05352		B*X
	4071B	OR, quad, 2-input	17101	S*X	B*X
	4072B	OR, dual, 4-input	17102	S*X	B*X
	4075B	OR, triple, 3-input	17103	S*X	B*X
	4081B	AND, quad, 2-input	17001	S*X	B*X
	4082B	AND, dual, 4-input	17002	S*X	B*X
	4073B	AND, triple, 3-input	17003	S*X	B*X
	4085B	AND-OR-invert, dual, 2-wide, 2-input	17201	S*X	B*X
	4086B	AND-OR-invert, expandable, 4-wide, 2-input	17202	S*X	B*X
	4070B	Exclusive-OR, quad	17203	S*X	B*X
	4077B	Exclusive-NOR, quad	17204	S*X	B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Buffers	4009A	Hex, inverter	05501		B*X
	4010A	Hex, noninverting	05502		B*X
	4049A	Hex, inverter	05503		B*X
	4050A	Hex, noninverting	05504		B*X
	4069UB	Hex, inverter	17401	S*X	B*X
	4502B	Hex, inverter/buffer, strobed	17403	S*X	B*X
Flip-flops	4013A	Dual, D-type with set/reset	05101		B*X
	4027A	Dual, J-K master slave	05102		B*X
	4043A	Quad 3-state R/S latch	05103		B*X
	4098B	Dual, monostable multivibrator	17504	S*X	B*X
	4099B	8-bit, addressable latch	17601	S*X	B*X
Counter/ dividers	4017A	Decade counter/divider	05601		B*X
	4018A	Presettable divide-by-N counter	05602		B*X
	4020A	14-stage ripple-carry binary counter/divider	05603		B*X
	4022A	Divide-by-8 counter/divider	05604		B*X
	4024A	7-stage binary counter	05605		B*X
Shift registers	4006A	Dual-4-stage, dual 5-stage, static	05701		B*X
	4014A	8-stage, synchronous, parallel or serial input, serial output, static	05702		B*X
	4015A	Dual-4-stage, serial input, parallel output, static	05703		B*X
	4021A	8-stage, asynchronous, parallel input, serial output or synchronous, serial input, serial output static	05704		B*X
	4031A	64-stage, static	05705		B*X
Switches	4016A	Quad bilateral switch	05801		B*X
	4066A	Quad bilateral switch	05802		B*X
Adder	4008A	4-bit full adder	05401		B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MIL-M-38510, MICROCIRCUITS
Bipolar, Memories

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
RAM's	93L415	Uncommitted collector	23103		B*X
	93L425	Static, 1K x 1, three-state output (70 ns)	23104		B*X
	93L422	Low power, 3-state output	23112		B*X
	93L422A	Low power, 3-state outputs	23115		B*X
PROM's	82S126	256 x 4 with open collector	20301		B*X
	82S129	256 x 4 with active pull-up and tri-state output	20302		B*X
	82S130	512 x 4 with open collector	20401		B*X
	82S131	512 x 4 with active pull-up and tri-state output	20402		B*X
	82S136	1K x 4 with open collector	20601		B*X
	82S137	1K x 4 with tri-state output	20602		B*X
	82S181	1K x 8 with active pull-up and tri-state output	20904		B*X
	82S191	2K x 8 with active pull-up and tri-state output	21002		B*X
	82S2708	1K x 8 with active pull-up and tri-state output	20905		B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MIL-M-38510, MICROCIRCUITS
Microprocessors

Commercial Part No. 1/	Word Size (Bits)	Fixed Instruction	Technology	Case Size	Clock Frequency (Max)	JAN Part Number 2/		
						M38510/	Grade 1 3/	Grade 2
8080A	8	Yes	NMOS	40-pin DIP	800 KHz	42001		B*X
8086	16	Yes	NMOS	40-pin-DIP	5 MHz	53001		B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

MIL-M-38510, MICROCIRCUITS
Linear

Description	Commercial Type 1/	Function	JAN Part Number 2/		
			M38510/	Grade 1 3/	Grade 2
Operational amplifiers	741	Single, internally compensated	10101		B*X
	747A	Dual, internally compensated	10102		B*X
	101A	Single, externally compensated	10103	S*X	B*X
	108A	Single, externally compensated	10104		B*X
	2101A	Dual, externally compensated	10105		B*X
	118	Precision, high-speed	10107	S*X	B*X
	1558	Dual, internally compensated	10108		B*X
	155	JFET input	11401		B*X
	2500	High slew rate, internally compensated	12204		B*X
	2510	High slew rate, internally compensated	12205		B*X
	2520	High slew rate, externally compensated	12206		B*X
	2600	High impedance, internally compensated	12202		B*X
Voltage regulators	723	Positive or negative voltage regulator	10201		B*X
	109	5-volt regulator	10701		B*X
	140H-12	12-volt Positive voltage regulator	10703		B*X
	140H-15	15-volt Positive voltage regulator	10704		B*X
	140K-05	5-volt Positive voltage regulator	10706		B*X
	140K-12	12-volt Positive voltage regulator	10707		B*X
	140K-15	15-volt Positive voltage regulator	10708		B*X
	120H-05	5-volt Negative voltage regulator	11501		B*X
	120H-12	12-volt Negative voltage regulator	11502		B*X
	120H-15	15-volt Negative voltage regulator	11503		B*X
	120K-05	5-volt Negative voltage regulator	11505		B*X
	120K-12	12-volt Negative voltage regulator	11506		B*X
	120K-15	15-volt Negative voltage regulator	11507		B*X
Voltage comparators	710	Single, differential	10301		B*X
	111	Precision buffer	10304	S*X	B*X
	139	Quad, single supply	11201		B*X
Line drivers/ receivers	9614	Dual differential driver (2-state outputs)	10403		B*X
	55113	Dual differential driver (tri-state outputs)	10405		B*X
	55107	Dual receiver	10401		B*X
	55108	Dual receiver (open collector)	10402		B*X
	9615	Dual differential receiver	10404		B*X
Timer	555	Single, precision	10901		B*X
	556	Dual, precision	10902		B*X

1/ Use the JANM38510 part number for ordering.
2/ The * is for choice of package style. The X is for choice of lead finish. Refer to QPL-38510 for specific choices available.
3/ When Grade 1 (Class S) parts are not listed on the QPL, Grade 2 (Class B) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

SECTION 8: SUMMARY OF STANDARD PROTECTIVE DEVICES

Page	Control Specification	Description	Grade 2
8.2	MIL-F-23419	Fuses, instrument type, subminiature, high-performance	1/
8.3	MIL-C-39019	Circuit breakers, magnetic, low-power	1/

1/ Suitable Grade 1 parts are not available. These parts are to be used in Grade 2 applications only.

MIL-F-23419/8, STYLE FM08 FUSES
Instrument Type (Subminiature, High-Performance)

Part number explanation:

FM08- (Style)

-A (Characteristic: A = normal interrupt time)

-XXXV (Voltage Rating Followed by letter V)

XXXXXA (Current Rating Followed by letter A)

Part Number 1/	Control Specification	Style	Current Rating (amps)	Overload Interrupt Time -55°C to +125°C Max (sec)		Maximum Voltage Rating (volts)	Cold Resistance Max 3/ (ohms)	Voltage Drop (volts) 4/	
				200% 2/	300% 2/			Min	Max
FM08-A-125V 1/8A	MIL-F-23419/8	FM08	1/8	5	0.1	125	2.31	0.85	1.15
FM08-A-125V 1/4A			1/4				0.781	0.59	0.80
FM08-A-125V 3/8A			3/8				0.462	0.572	0.713
FM08-A-125V 1/2A			1/2				0.308	0.488	0.660
FM08-A-125V 3/4A			3/4				0.187	0.145	0.197
FM08-A-125V 1A			1				0.138	0.157	0.213
FM08-A-125V 1-1/2A			1-1/2				0.088	0.153	0.207
FM08-A-125V 2A			2				0.0605	0.144	0.196
FM08-A-125V 2-1/2A			2-1/2				0.0462	0.125	0.169
FM08-A-125V 3A			3				0.0388	0.139	0.187
FM08-A-125V 4A			4				0.0253	0.110	0.150
FM08-A-125V 5A			5				0.0154	0.087	0.118
FM08-A-125V 7A			7				0.0110	0.087	0.118
FM08-A-125V 10A			10				0.0066	0.073	0.099
FM08-A-32V 15A			15	10.0	0.3	32	0.0044	0.065	0.087

1/ These parts are to be used in Grade 2 applications only.
2/ Percentage of nominal current rating.
3/ Cold resistance is measured at 10 percent or less of rated current.
4/ Voltage drop is measured after the fuse has been subjected to rated current for not less than 5 minutes and not more than 10 minutes.

MIL-C-39019, MAGNETIC CIRCUIT BREAKERS LOW-POWER, SEALED, TRIP-FREE

Part number explanation:

M39019 — Military Specification Designation

/XX — Specification Slash Sheet

-XXX — Dash Number

Part Number 1/, 2/, 3/	Control Specification	Current Range, Amps	Contact Configuration	Voltage Rating
M39019/01-XXX	MIL-C-39019	0.05 to 20.0	One pole	50 Vdc max or 240 Vac max at 60 or 400 Hz
M39019/02-XXX			One pole with SPDT aux 4/ contacts	
M39019/03-XXX			Two pole	
M39019/04-XXX			Two pole with SPDT aux 4/ contacts	
M39019/05-XXX			Three pole	
M39019/06-XXX			Three pole with SPDT 4/ aux contacts	

1/ See slash sheet for dimensions and configurations.
2/ Three trip characteristics available. Time delay A: Fast; Time delay B: Slow; Time delay C: No delay.
3/ High inrush capability available for time delay A and B configurations.
4/ Single-pole, double throw auxiliary contacts rated at 0.5 amp lamp load at 50 Vdc or 120 Vac.

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SECTION 9: SUMMARY OF STANDARD RELAYS

Page	Control Specification	Description	Grade 1 FRL	Grade 2 FRL
9.2	MIL-R-39016	Nonlatching	1/	P
9.2		Latching		

1/ Presently there are no Grade 1 parts available.

MIL-R-39016, RELAYS
Electromagnetic

Part number explanation:

M39016 — Military Specification Designation
/XX — Specification Slash Sheet
-XXX — Dash Number
X — Failure Rate Level

NONLATCHING

Part Number 1/	Control Specification	Contact Rating (amps) 2/	Contact Configuration	Package 3/	Failure Rate Level	
					Grade 1	Grade 2
M39016/9-XX	MIL-R-39016	1.0	DPDT	TO-5	4/	P 5/
M39016/11-XX		1.0	DPDT	TO-5		
M39016/13-XX		2.0	DPDT	1/2 size crystal can		
M39016/20-XX		1.0	DPDT	TO-5		
M39016/21-XX		1.0	DPDT	TO-5		
M39016/38-XX		2.0	DPDT	1/2 size crystal can		

LATCHING

Part Number 1/	Control Specification	Contact Rating (amps) 2/	Contact Configuration	Package 3/	Failure Rate Level	
					Grade 1	Grade 2
M39016/12-XX	MIL-R-39016	1.0	DPDT	TO-5	4/	P 5/
M39016/30-XX		1.0	DPDT	TO-5		

1/ No platings of cadmium or zinc shall be used. Molybdenum contact material shall not be used..
2/ Contact resistive rating at 28 Vdc.
3/ See appropriate slash sheet for dimensions and configurations.
4/ There are no grade 1 parts currently available.
5/ See QPL for vendors and configurations qualified to a P failure rate level.

SECTION 10: SUMMARY OF STANDARD RESISTORS

Page	Control Specification	Style	Description	Resistance 1/ Range (ohms)		Power Range (watts)		2/ Grade 1 FRL	Grade 2 FRL
				Min	Max	Min	Max		
10.2	MIL-R-39005	RBR	Fixed, wirewound (accurate), ER	4.99	1.37 M	0.125	0.75	R	P
10.4	MIL-R-39007	RWR	Fixed, wirewound (power type), ER	0.1	39.2 K	1	10	S	R
10.7	MIL-R-39008	RCR	Fixed, composition (insulated), ER	1.0	22 M	0.125	2	S	P
10.10	MIL-R-39009	RER	Fixed, wirewound (power type), chassis mounted, ER	0.1	39.2 K	5	30	R	P
10.13	MIL-R-39017	RLR	Fixed, film (insulated), ER	4.3	22.1 M	0.125	1.0	S, R	P
10.15	MIL-R-39015	RTR	Variable, wirewound (lead screw actuated), ER	10	10 K	0.75	0.75	3/	P,R 4/
10.17	MIL-R-39035	RJR	Variable, non-wirewound (adjustment type), ER	10	1.0 M	0.25	0.5	3/	P 4/
10.19	MIL-R-55182	RNR	Fixed, film (hermetic) ER	10	7.5 M	0.1	0.5	S	R
10.20	MIL-R-55182	RNC	Fixed, film, ER	1.0	15 M	0.05	0.5	S	R
10.24	MIL-R-83401	RZO	Fixed, film, networks	10	1 M	0.025	0.2	5/	4/

1/ The resistance values may be any value within the limits of the specification; however, it is preferred that the values be chosen from the decade table following the respective detail listing.
2/ When no source is listed on QPL to level S, alternate FRL R shall be used.
3/ Variable resistors are not considered suitable for Grade 1 applications.
4/ For Grade 2 applications, parts shall be upgraded in accordance with Appendix B.
5/ Presently there are no Grade 1 parts available.

MIL-R-39005, RESISTORS
Fixed, Wirewound (Accurate), Established Reliability

Part number explanation:

RBR XX X XXXX X X X

- RBR: MIL-R-39005
- XX: Size
- (RBR XX): Style
- The letters RBR identify established reliability, accurate, wire-wound, fixed resistors. "XX" represents a number which identifies the size and power rating of the resistors.
- X: Terminal Characteristic (L = Solderable, U = Weldable)
- XXXX: Significant Figures
- X: Number of Zeros
- (XXXX X): Resistance 1/
- X: Resistance Tolerance (±%) 2/ (Q = 0.02, A = 0.05, B = 0.10)
- X: Failure Rate (%/1000 hr) (P = 0.1, R = 0.01, S = 0.001)

Part Number	Control Specification	Style Size 3/	Characteristics				Failure Rate Level		
			Rated Power (watts 4/)	Resistance (ohms) Range Min	Resistance (ohms) Range Max 5/	Resistance (ohms) Tolerance 2/ (±%)	Max Volts (dc or peak) 6/	Grade 1	Grade 2
RBR52XXXXXXXX	MIL-R-39005/1	RBR52	1/2	10	806 K	.02, .05, .10	600	R	P
RBR54XXXXXXXX	MIL-R-39005/3	RBR54	1/4	4.99	255 K	.02, .05, .10	300	R	P
RBR56XXXXXXXX	MIL-R-39005/5	RBR56	1/8	10	100 K	.02, .05, .10	150	R	P
RBR57XXXXXXXX	MIL-R-39005/7	RBR57	3/4	10	1.37 M	.02, .05, .10	600	R	P

1/ For R ≥ 1000Ω, expressed by five digits, the first four are significant and the fifth is the number of zeros. For R < 1000Ω, the letter R replaces one of the digits and is used as a decimal point and all digits are significant.
2/ A resistance tolerance of ±0.02% (Q) is recommended.
3/ These resistors are encased in nonmetallic materials. The possibility of outgassing at low pressures must be considered in their application.
4/ Maximum operating temperature at full rated power shall not excced 125°C.
5/ Maximum values are for element wire diameter of 0.001 inch minimum, as specified by MIL-R-39005.
6/ The actual voltage which may be impressed across the resistors is determined by $E = \sqrt{PR}$
where: E = maximum applied voltage (dc or rms) in volts.
P = power in watts. R = nominal resistance
Under no conditions shall the applied voltage exceed the values specified.

MIL-R-39005, RESISTORS
Fixed, Wirewound (Accurate), Standard Values

Standard resistance values for the 10 to 100 decade at a resistance tolerance of ±.02%, ±.05%, and ±.10% (Q, A, B)

10.00	12.10	14.70	17.80	21.50	26.10	31.60	38.30	46.40	56.20	68.10	82.50
10.10	12.30	14.90	18.00	21.80	26.40	32.00	38.80	47.00	56.90	69.00	83.50
10.20	12.40	15.00	18.20	22.10	26.70	32.40	39.20	47.50	57.60	69.80	84.50
10.40	12.60	15.20	18.40	22.30	27.10	32.80	39.70	48.10	58.30	70.60	85.60
10.50	12.70	15.40	18.70	22.60	27.40	33.20	40.20	48.70	59.00	71.50	86.60
10.60	12.90	15.60	18.90	22.90	27.70	33.60	40.70	49.30	59.70	72.30	87.60
10.70	13.00	15.80	19.10	23.20	28.00	34.00	41.20	49.90	60.40	73.20	88.70
10.90	13.20	16.00	19.30	23.40	28.40	34.40	41.70	50.50	61.20	74.10	89.80
11.00	13.30	16.20	19.60	23.70	28.70	34.80	42.20	51.10	61.90	75.00	90.90
11.10	13.50	16.40	19.80	24.00	29.10	35.20	42.70	51.70	62.60	75.90	92.00
11.30	13.70	16.50	20.00	24.30	29.40	35.70	43.20	52.30	63.40	76.80	93.10
11.40	13.80	16.70	20.30	24.60	29.80	36.10	43.70	53.00	64.20	77.70	94.20
11.50	14.00	16.90	20.50	24.90	30.10	36.50	44.20	53.60	64.90	78.70	95.30
11.70	14.20	17.20	20.80	25.20	30.50	37.00	44.80	54.20	65.70	79.60	96.50
11.80	14.30	17.40	21.00	25.50	30.90	37.40	45.30	54.90	66.50	80.60	97.60
12.00	14.50	17.60	21.30	25.80	31.20	37.90	45.90	55.60	67.30	81.60	98.80

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

MIL-R-39007, RESISTORS
Fixed, Wirewound (Power Type), Established Reliability

Part number explanation:

RWR XX X XXX X X X

- RWR: MIL-R-39007
- XX: Size
- RWR XX: Style
- X: Terminal Characteristics
  - W = Weldable, inductively wound
  - S = Solderable, inductively wound
  - N = Solderable, non inductively wound
- XXX: Significant Figures
- X: Number of Zeros
- XXX X: Resistance 1/
- X: Resistance Tolerance
  - B = ±0.1%
  - D = ±0.5%
  - F = ±1.0% 2/
- X: Failure Rate
  - R = 0.01%/1000 hr.
  - S = 0.001%/1000 hr.

The letters, RWR identify established reliability, axial lead, power type, wire-wound fixed resistors. "XX" represents a number which identifies the size, wattage rating and construction of the resistors.

Part Number	Control Specification	Style Size 3/,4/	Characteristics: Rated Power (watts) 5/ @ +25°C	Resistance (ohms) Range 7/ Min 8/	Resistance (ohms) Range 7/ Max 6/	Tolerance (±%)	Maximum Voltage 9/ Rating	Failure Rate Level Grade 1	Failure Rate Level Grade 2
RWR78XXXXXXX	MIL-R-39007/7	RWR78	10	0.1	39.2 K		E = √PR	S	R
RWR80XXXXXXX	MIL-R-39007/8	RWR80	2	0.1	1.40 K		E = √PR	S	R
RWR81XXXXXXX	MIL-R-39007/9	RWR81	1	0.1	492	0.1, 0.5,	E = √PR	S	R
RWR84XXXXXXX	MIL-R-39007/10	RWR84	7	0.1	12.4 K	1.0	E = √PR	S	R
RWR89XXXXXXX	MIL-R-39007/11	RWR89	3	0.1	4.12 K		E = √PR	S	R

1/ For R > 100Ω, the first three digits are significant and the fourth is the number of zeros. For R < 100Ω, the letter R replaces one of the digits and is used as a decimal point. All digits are significant.

2/ A resistance tolerance of 1.0% (F) is recommended.

3/ These resistors are encased in nonmetallic materials. The possibility of outgassing at low pressures must be considered in their application.

4/ Certain coating materials used in fabricating resistors to this specification may be subject to outgassing of volatile material when operated at surface temperatures over 200°C. This phenomena should be taken into consideration for equipment design.

5/ Maximum operating temperature at full rated power shall not exceed 25°C. For operation above +25°C up to +275°C the applied power shall be derated as specified in MIL-R-39007.

6/ Maximum values are for element wire diameter of 0.001 inch minimum (0.0009 absolute minimum diameter) as specified by MIL-R-39007.
Application note: Resistors should not be used in circuits involved in high-frequency applications (above 20 kHz) where ac performance is of critical importance to the proper application of the circuit.

7/ For terminal N, minimum value = 10Ω; maximum value for RWR 80, RWR 81, RWR 84 and RWR 89 shall be 604, 234, 6.19K and 1.78 K ohms respectively.

8/ For tolerance "B" the minimum resistance value shall be 0.499 ohms.

9/ Where E = maximum applied voltage (dc or rms) in volts. P = power in watts. R = nominal resistance.

MIL-R-39007, RESISTORS
Fixed, Wirewound (Power Type), Established Reliability

Standard resistance values for the 10 to 100 decade at a resistance tolerance of ±.1%, ±.5% and ±1.0% (B, D, F)

Resistance Tolerance																	
B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)
10.0		10.0	14.7		14.7	21.5		21.5	31.6		31.6	46.4		46.4	68.1		68.1
10.1		---	14.9		---	21.8		---	32.0		---	47.0		---	69.0		---
10.2		10.2	15.0		15.0	22.1		22.1	32.4		32.4	47.5		47.5	69.8		69.8
10.4		---	15.2		---	22.3		---	32.8		---	48.1		---	70.6		---
10.5		10.5	15.4		15.4	22.6		22.6	33.2		33.2	48.7		48.7	71.5		71.5
10.6		---	15.6		---	22.9		---	33.6		---	49.3		---	72.3		---
10.7		10.7	15.8		15.8	23.2		23.2	34.0		34.0	49.9		49.9	73.2		73.2
10.9		---	16.0		---	23.4		---	34.4		---	50.5		---	74.1		---
11.0		11.0	16.2		16.2	23.7		23.7	34.8		34.8	51.1		51.1	75.0		75.0
11.1		---	16.4		---	24.0		---	35.2		---	51.7		---	75.9		---
11.3		11.3	16.5		16.5	24.3		24.3	35.7		35.7	52.3		52.3	76.8		76.8
11.4		---	16.7		---	24.6		---	36.1		---	53.0		---	77.7		---
11.5		11.5	16.9		16.9	24.9		24.9	36.5		36.5	53.6		53.6	78.7		78.7
11.7		---	17.2		---	25.2		---	37.0		---	54.2		---	79.6		---
11.8		11.8	17.4		17.4	25.5		25.5	37.4		37.4	54.9		54.9	80.6		80.6
12.0		---	17.6		---	25.8		---	37.9		---	55.6		---	81.6		---
12.1		12.1	17.8		17.8	26.1		26.1	38.3		38.3	56.2		56.2	82.5		82.5
12.3		---	18.0		---	26.4		---	38.8		---	56.9		---	83.5		---

See end of table for footnote.

MIL-R-39007, RESISTORS
Fixed, Wirewound (Power Type), Established Reliability (Continued)

Standard resistance values for the 10 to 100 decade at a resistance tolerance of ±.1%, ±.5% and ±1.0% (B, D, F)

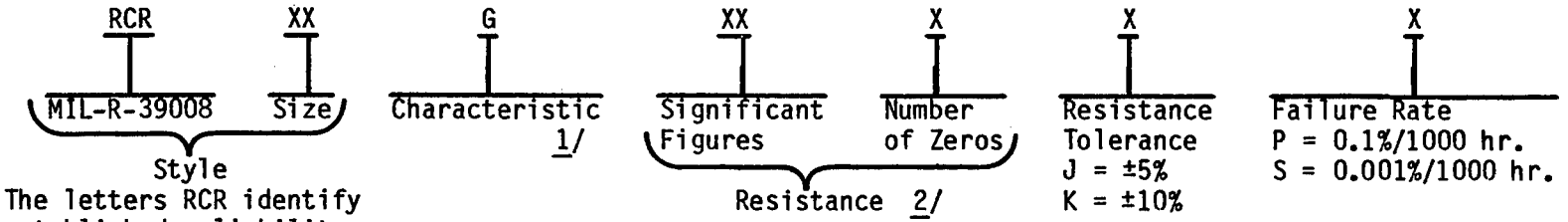
Resistance Tolerance																	
B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)	B 1/ (0.1)	D (0.5)	F (1.0)
12.4	12.4		18.2	18.2		26.7	26.7		39.2	39.2		57.6	57.6		84.5	84.5	
12.6	---		18.4	---		27.1	---		39.7	---		58.3	---		85.6	---	
12.7	12.7		18.7	18.7		27.4	27.4		40.2	40.2		59.0	59.0		86.6	86.6	
12.9	---		18.9	---		27.7	---		40.7	---		59.7	---		87.6	---	
13.0	13.0		19.1	19.1		28.0	28.0		41.2	41.2		60.4	60.4		88.7	88.7	
13.2	---		19.3	---		28.4	---		41.7	---		61.2	---		89.8	---	
13.3	13.3		19.6	19.6		28.7	28.7		42.2	42.2		61.9	61.9		90.9	90.9	
13.5	---		19.8	---		29.1	---		42.7	---		62.6	---		92.0	---	
13.7	13.7		20.0	20.0		29.4	29.4		43.2	43.2		63.4	63.4		93.1	93.1	
13.8	---		20.3	---		29.8	---		43.7	---		64.2	---		94.2	---	
14.0	14.0		20.5	20.5		30.1	30.1		44.2	44.2		64.9	64.9		95.3	95.3	
14.2	---		20.8	---		30.5	---		44.8	---		65.7	---		96.5	---	
14.3	14.3		21.0	21.0		30.9	30.9		45.3	45.3		66.5	66.5		97.6	97.6	
14.5	---		21.3	---		31.2	---		45.9	---		67.3	---		98.8	---	

1/ The resistance values for "B" tolerance may be of any value, but it is preferred that the values be chosen from tolerance "D" values in this table.

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

MIL-R-39008, RESISTORS
Fixed, Composition (Insulated), Established Reliability

Part number explanation:



The letters RCR identify established reliability, insulated, composition, fixed resistors. "XX" represents a number which identifies the size and power rating of the resistors.

Part Number	Control Specification	Style Size 3/	Characteristics					Failure Rate Level	
			Rated Power (watts) 4/	Resistance (ohms) Range Min	Resistance (ohms) Range Max	Tolerance (±%) 5/	Max Volts 6/	Grade 1	Grade 2
RCR05GXXXXX	MIL-R-39008/4	RCR05	1/8	2.7	22.0 M	5, 10	150	S	P
RCR07GXXXXX	MIL-R-39008/1	RCR07	1/4	2.7	22.0 M	5, 10	250	S	P
RCR20GXXXXX	MIL-R-39008/2	RCR20	1/2	1.0	22.0 M	5, 10	350	S	P
RCR32GXXXXX	MIL-R-39008/3	RCR32	1.0	1.0	22.0 M	5, 10	500	S	P
RCR42GXXXXX	MIL-R-39008/5	RCR42	2.0	10.0	22.0 M	5, 10	500	S	P

See next page for notes.

MIL-R-39008, RESISTORS
Fixed, Composition (Insulated), Established Reliability

1/ Characteristic G only available, 100% rated wattage at 70°C ambient. Derate linearly to zero watts at 130°C.
2/ The nominal resistance value expressed in ohms is identified by a 3 digit number. The first two digits represent significant figures and the last digit specifies the number of zeros to follow. When resistance values less than 10Ω are required, the letter "R" is substituted for one of the significant digits to represent the decimal point.
3/ These resistors are encased in a phenolic sleeve and are extremely sensitive to moisture. It is recommended that these resistors be baked for a period of 48 hours at 100°C (with no power applied) prior to usage and after a storage period of approximately 6 months or more.
4/ Maximum operating temperature at full rated power shall not exceed 70°C.
5/ A resistance tolerance of ±5% (J) is recommended.
6/ The actual voltage which may be impressed across the resistors is determined by $E = \sqrt{PR}$

where: E = maximum applied voltage (dc or rms) in volts.
P = derated power in watts.
R = nominal resistance

Under no conditions shall the applied voltage exceed the values specified.

MIL-R-39008, RESISTORS
Fixed, Composition (Insulated), Established Reliability

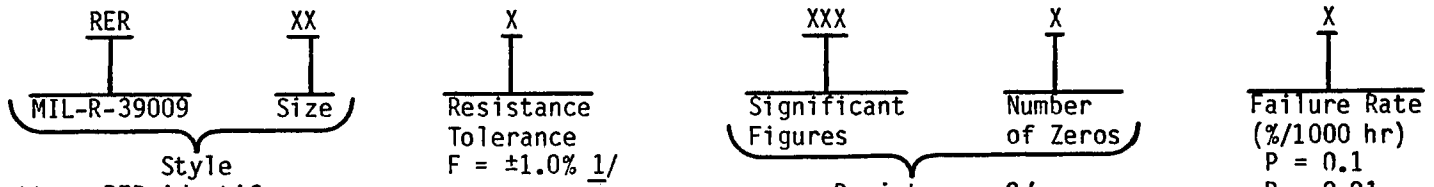
Standard resistance values for the 10 to 100 decade at a resistance tolerance of ±5% (J) and ±10% (K)

Resistance Values			
±5% (J)	±10% (K)	±5% (J)	±10% (K)
10	10	33	33
11	--	36	--
12	12	39	39
13	--	43	--
15	15	47	47
16	--	51	--
18	18	56	56
20	--	62	--
22	22	68	68
24	--	75	--
27	27	82	82
30	--	91	--

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

MIL-R-39009, RESISTORS
Fixed, Wirewound (Power Type, Chassis Mounted), Established Reliability

Part number explanation:



The letters RER identify established reliability, chassis mounted, power-type, wire-wound, fixed resistors. "XX" represents a number which identifies the size and power rating of the resistor.

Part Number	Control Specification	Style Size	Characteristics: Rated Power (watts) 5/, 6/	Resistance (ohms) Range Min	Resistance (ohms) Range Max 7/	Tolerance (±%) 1/	Max Volts 8/	Failure Rate Level: Grade 1	Failure Rate Level: Grade 2
3/ RER60FXXXXX	MIL-R-39009/1	RER60	5.0	0.10	3.32 K	F = 1.0	$E = \sqrt{PR}$	R	P
RER65FXXXXX		RER65	10.0	0.10	5.62 K	F = 1.0	$E = \sqrt{PR}$	R	P
RER70FXXXXX		RER70	20.0	0.10	12.1 K	F = 1.0	$E = \sqrt{PR}$	R	P
RER75FXXXXX		RER75	30.0	0.10	39.2 K	F = 1.0	$E = \sqrt{PR}$	R	P
4/ RER40FXXXXX	MIL-R-39009/2	RER40	5.0	1.0	1.65 K	F = 1.0	$E = \sqrt{PR}$	R	P
RER45FXXXXX		RER45	10.0	1.0	2.80 K				
RER50FXXXXX		RER50	20.0	1.0	6.04 K				
RER55FXXXXX		RER55	30.0	1.0	19.6 K				

See next page for footnotes.

MIL-R-39009, RESISTORS
Fixed, Wirewound (Power Type, Chassis Mounted), Established Reliability (Continued)

1/ Only resistance tolerance ±1.0% (F) is available.
2/ For R > 100Ω, the first three digits are significant and the fourth signifies the number of zeros. For R < 100 Ω all digits are significant; the letter R is substituted for one of the digits indicating a decimal point.
3/ Inductively wound.
4/ Non-inductively wound.
5/ These aluminum-housed, chassis-mounted styles are assigned power ratings when mounted on test chassis areas of a specific size at an ambient temperature of 25°C.
6/ Maximum operating temperature at full rated power shall not exceed 25°C. For operation above 25°C refer to MIL-R-39009.
7/ Maximum values are for element wire diameter of 0.001 inch minimum as specified by MIL-R-39009.
8/ Where: E = maximum applied voltage (dc or rms) in volts.
P = power in watts.
R = nominal resistance.

MIL-R-39009, RESISTORS
Fixed, Wirewound (Power Type, Chassis Mounted), Established Reliability

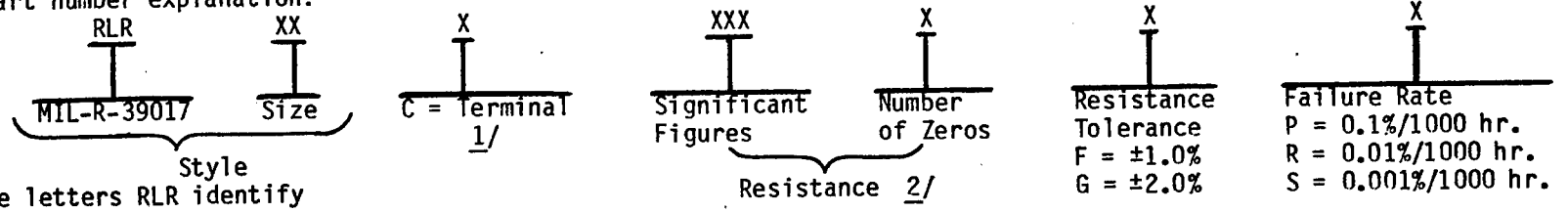
Standard resistance values for the 1 to 10 decade (F = ±1.0%)

1.00	1.21	1.47	1.78	2.15	2.61	3.16	3.83	4.64	5.62	6.81	8.25
1.02	1.24	1.50	1.82	2.21	2.67	3.24	3.92	4.75	5.76	6.98	8.45
1.05	1.27	1.54	1.87	2.26	2.74	3.32	4.02	4.87	5.90	7.15	8.66
1.07	1.30	1.58	1.91	2.32	2.80	3.40	4.12	4.99	6.04	7.32	8.87
1.10	1.33	1.62	1.96	2.37	2.87	3.48	4.22	5.11	6.19	7.50	9.09
1.13	1.37	1.65	2.00	2.43	2.94	3.57	4.32	5.23	6.34	7.68	9.31
1.15	1.40	1.69	2.05	2.49	3.01	3.65	4.42	5.36	6.49	7.87	9.53
1.18	1.43	1.74	2.10	2.55	3.09	3.74	4.53	5.49	6.65	8.06	9.76

NOTE: The standard resistance values up to and including the maximum value for every decade shall follow the sequence demonstrated for the "1 to 10" decade, above.

MIL-R-39017, RESISTORS
Fixed, Film (Insulated), Established Reliability

Part number explanation:



The letters RLR identify established reliability, insulated, fixed film resistors. "XX" represents a number which identifies the size and power rating of the resistors.

Part Number	Control Specification	Style Size 3/	Characteristics					Failure Rate Level		
			Rated Power (watts) 4/	Resistance (ohms) Range Min	Resistance (ohms) Range Max	Tolerance (±%) 5/	Max Volts 6/	Grade 1 7/	Grade 2	Substitute Grade 1
RLR05CXXXXXX	MIL-R-39017/5	RLR05	1/8	4.7	0.300 M	1.0, 2.0	200	S	P	R
RLR07CXXXXXX	MIL-R-39017/1	RLR07	1/4	10.0	22.1 M	1.0, 2.0	250	S	P	R
RLR20CXXXXXX	MIL-R-39017/2	RLR20	1/2	4.3	3.01 M	1.0, 2.0	350	S	P	R
RLR32CXXXXXX	MIL-R-39017/3	RLR32	1	10.0	2.7 M	1.0, 2.0	500	S	P	R

1/ Terminal C, solderable/weldable terminal, is the only one available.
2/ For R > 100Ω, the first three digits are significant and the fourth is the number of zeros. For R < 100Ω, the letter R replaces one of the digits and represents a decimal point. All digits are significant.
3/ These resistors are encased in nonmetallic materials; sensitivity to moisture and possible outgassing at low pressure must be considered in their application.
4/ Maximum operating temperature at full rated power shall not exceed 70°C.
5/ A resistance tolerance of ±1.0%(F) is recommended.
6/ The actual voltage which may be impressed across the resistors is determined by $E = \sqrt{PR}$
where: E = maximum applied voltage (dc or rms) in volts.
P = power in watts.
R = nominal resistance.
Under no conditions shall the applied voltage exceed the values specified.
7/ When no source is listed on QPL to level S, Failure Rate Level (FRL) R shall be used.

MIL-R-39017, RESISTORS
Fixed, Film (Insulated), Established Reliability

Standard resistance values for the 10 to 100 decade (A resistance tolerance of ±1.0% (F) is recommended.)

G (2.0)	F (1.0)	G (2.0)	F (1.0)	G (2.0)	F (1.0)	G (2.0)	F (1.0)
10.00	10.00	-----	18.70	-----	33.20	-----	56.20
-----	10.20	-----	19.10	-----	34.00	-----	57.60
-----	10.50	-----	19.60	-----	34.80	-----	59.00
-----	10.70	20.00	20.00	-----	35.70	-----	60.40
11.00	11.00	-----	20.50	36.00	-----	-----	61.90
-----	11.30	-----	21.00	-----	36.50	62.00	-----
-----	11.50	-----	21.50	-----	37.40	-----	63.40
-----	11.80	22.00	-----	-----	38.30	-----	64.90
12.00	-----	-----	22.10	39.00	-----	-----	66.50
-----	12.10	-----	22.60	-----	39.20	68.00	-----
-----	12.40	-----	23.20	-----	40.20	-----	68.10
-----	12.70	-----	23.70	-----	41.20	-----	69.80
13.00	13.00	24.00	-----	-----	42.20	-----	71.50
-----	13.30	-----	24.30	43.00	-----	-----	73.20
-----	13.70	-----	24.90	-----	43.20	75.00	75.00
-----	14.00	-----	25.50	-----	44.20	-----	76.80
-----	14.30	-----	26.10	-----	45.30	-----	78.70
-----	14.70	-----	26.70	-----	46.40	-----	80.60
15.00	15.00	27.00	-----	47.00	-----	82.00	-----
-----	15.40	-----	27.40	-----	47.50	-----	82.50
-----	15.80	-----	28.00	-----	48.70	-----	84.50
16.00	-----	-----	28.70	-----	49.90	-----	86.60
-----	16.20	-----	29.40	51.00	-----	-----	88.70
-----	16.50	30.00	-----	-----	51.10	-----	90.90
-----	16.90	-----	30.10	-----	52.30	91.00	-----
-----	17.40	-----	30.90	-----	53.60	-----	93.10
-----	17.80	-----	31.60	-----	54.90	-----	95.30
18.00	-----	-----	32.40	56.00	-----	-----	97.60
-----	18.20	33.00	-----				

MIL-R-39015, RESISTORS
Variable, Wirewound (Lead Screw Actuated), Established Reliability

Part number explanation:

M39015	/X	XXX	X	X
Document Number	Specification Sheet Number	Dash Number	Terminal Type 1/	Failure Rate P = 0.1%/1000 hrs. R = 0.01%/1000 hrs.

Part Number	Control Specification	Style Size	Characteristics								Failure Rate Level 4/
			Rated Power 2/ (watts)	Resistance (ohms)			Resolution Range (%)		Voltage Range 3/ (volts)		
				Tolerance (±%)	Range						
					Min	Max 5/	Min	Max	Min	Max	Grade 2
M39015/2-XXXXX	MIL-R-39015/2	RTR22	0.75	5.0	10	10 K	0.11	1.3	2.7	122.0	P
M39015/3-XXXXX	MIL-R-39015/3	RTR24			10	5 K	0.19	1.3	2.7	86.7	R, P

1/ Terminal types available: L - flexible insulated wire leads
P - printed circuit pin (base mount)
W - printed circuit pin (edge mount)
X - printed circuit pin (edge mount - alternate configuration).

2/ The power rating given is for the whole element and is directly proportional to the length of the element actually active in the circuit. If 50% of the element is in the circuit after adjustment, the power must be derated to 50% in order to limit the dissipation to a safe value. Maximum operating temperature at full rated power shall not exceed 85°C. For operation above 85°C the applied power shall be linearly directed to zero watts at +150°C.

3/ The actual voltage which may be impressed across these resistors is determined by

$$E = \sqrt{PR}$$

where E = maximum applied voltage (dc or rms) in volts
P = derated power in watts
R = the resistance of that portion of the element actually active in the circuit
Under no conditions shall the applied voltage exceed the values specified.

4/ Variable resistors are not suitable for Grade 1 applications.

5/ Value based on the use of wire having not less than .001 inch nominal (0.0009 absolute) diameter.

MIL-R-39015, RESISTORS
Variable, Wirewound (Lead Screw Actuated), Established Reliability
Standard Resistance Values

M39015/2 - style RTR22

Nominal Resistance Value (ohms)	Maximum Resolution (%) 1/	Maximum Working Voltage (volts)	Dash Number
10	1.3	2.7	009
20	1.0	3.8	010
50	0.80	6.1	011
100	0.51	8.7	001
200	0.42	12.3	002
500	0.42	19.4	003
1.0 K	0.36	27.4	004
2.0 K	0.29	38.7	005
5.0 K	0.26	61.3	006
10.0 K 2/	0.14	86.7	007

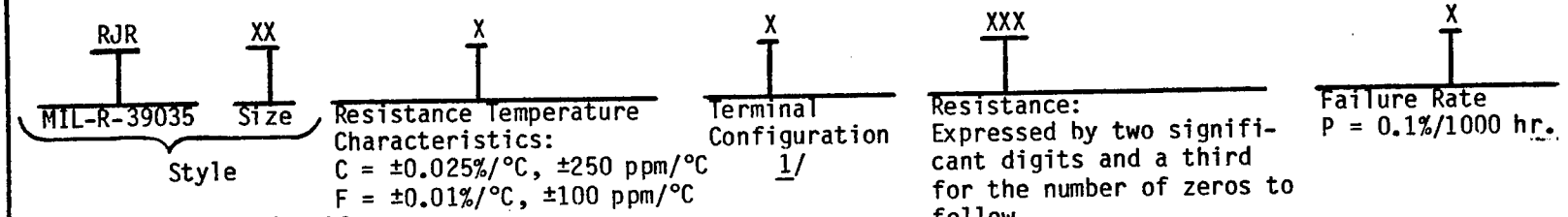
M39015/3 - style RTR24

Nominal Resistance Value (ohms)	Maximum Resolution (%) 1/	Maximum Working Voltage (volts)	Dash Number
10	1.3	2.7	001
20	1.1	3.8	002
50	0.77	6.1	003
100	0.62	8.7	004
200	0.55	12.3	005
500	0.51	19.4	006
1.0 K	0.37	27.4	007
2.0 K	0.30	38.7	008
5.0 K 3/	0.25	61.3	009

1/ Maximum resolution shown is theoretical.
2/ Value based on the use of wire having no less than 0.001 inch nominal (0.0009 absolute) diameter.
3/ Value based on the use of wire having no less than 0.001 inch ±10 percent diameter.

MIL-R-39035, RESISTORS
Variable, Non-Wirewound (Adjustment Type), Established Reliability

Part number explanation:



The letters RJR identify established reliability, adjustment type, nonwire wound, variable resistors. "XX" represents a number which identifies the physical size.

Part Number	Control Specification	Style Size	Characteristics							Failure Rate Level 4/
			Rated Power 2/ (watts)	Tolerance (±%)	Res Temp Char	Resistance Range (ohms)		Voltage Range 3/ (volts)		
						Min	Max	Min	Max	Grade 2
RJR24X X XXX X	MIL-R-39035/2	RJR24	0.50	10	C,F	10	1.0 M	2.23	300	P
RJR26X X XXX X	MIL-R-39035/3	RJR26	0.25		F	10	1.0 M	1.58	200	P

1/ P = printed circuit pins.
W = printed circuit pins (edge mounted).
X = printed circuit pins (edge mounted, alternate configuration).

2/ Power ratings are applicable only when the maximum resistance is engaged in the circuit. The power rating is reduced in the same proportion as the resistance. Maximum operating temperature at full-rated power shall not exceed 85°C. For operation above 85°C the power shall be linearly derated to zero watts at 150°C.

3/ The actual voltage which may be impressed across these resistors is determined by

$$E = \sqrt{PR}$$

where E = maximum applied voltage (dc or rms) in volts
P = derated power in watts
R = the resistance of that portion of the element actually active in the circuit.
Under no conditions shall the applied voltage exceed the values specified on page 10.15.

4/ Variable resistors are not suitable for Grade 1 applications.

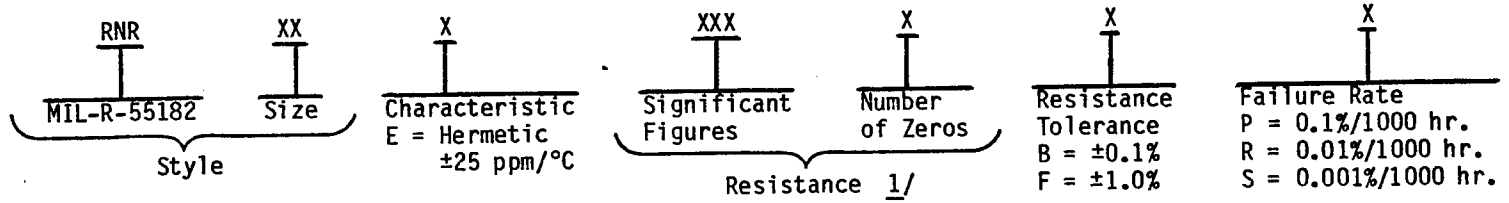
MIL-R-39035, RESISTORS
Variable, Non-Wirewound (Adjustment Type), Established Reliability

Nominal Resistance Value. (ohms) 1/	Maximum Rated Working Voltage (volts)	
	RJR24	RJR26
10	2.23	1.58
20	3.1	2.23
50	5.0	3.54
100	7.0	5.0
200	10.0	7.07
500	15.8	11.1
1.0 K	22.3	15.8
2.0 K	31.6	22.3
5.0 K	50.0	35.4
10 K	70.7	50.0
20 K	100	70.7
25 K	111	79.0
50 K	158	111
0.10 M	223	158
0.25 M	300	200
0.50 M	300	200
1.0 M	300	200

1/ K = kilohms; M = megohms

MIL-R-55182, RESISTORS
Fixed, Film, Solderable Established Reliability

Part number explanation:



The letters RNR identify established reliabiity, fixed, film, resistors, with a solderable type terminal. "XX" represents a number which identifies the size of the resistor.

Part Number	Control Specification	Style Size 2/	Characteristics					Failure Rate Level	
			Rated Power (watts) 3/	Resistance (ohms) Range Min	Resistance (ohms) Range Max	Tolerance (±%) 4/,5/	Max Volts 6/	Grade 1	Grade 2
RNR55EXXXXXX	MIL-R-55182/1	RNR55	1/10	10.0	1.21 M	0.1, 1.0	200	S	R
RNR60EXXXXXX	MIL-R-55182/3	RNR60	1/8	10.0	2.49 M	0.1, 1.0	250	S	R
RNR65EXXXXXX	MIL-R-55182/5	RNR65	1/4	10.0	4.99 M	0.1, 1.0	300	S	R
RNR70EXXXXXX	MIL-R-55182/6	RNR70	1/2	20.0	7.5 M	0.1, 1.0	350	S	R

1/ All styles are expressed by four digits; for R > 100Ω, the first three digits are significant and the fourth is the number of zeros. For R < 100Ω, the letter R replaces one of the digits and represents a decimal point.
2/ Hollow core devices shall not be used.
3/ Maximum operating temperature at full rated power shall not exceed +125°C. For operation above +125°C the applied power shall be linearly derated to zero watts at +175°C.
4/ A resistance tolerance of ±1.0% (F) is recommended.
5/ Resistors are electrostatic sensitive. For tolerance B (±0.1%) package in accordance with MIL-R-39032 as specified for field force protections.
6/ The actual voltage which may be impressed across the resistors is determined by $E = \sqrt{PR}$
where: E = maximum applied voltage (dc or rms) in volts.
P = power in watts.
R = nominal resistance.
Under no conditions shall the applied voltage exceed the values specified.

MIL-R-55182, RESISTORS
Fixed, Film, Solderable and Weldable, Established Reliability

Part number explanation:

RNC XX X XXX(XX) X X X

- RNC: MIL-R-55182
- XX: Size
- RNC XX: Style
  The letters RNC identify established reliability, fixed, film resistors, with a solderable/weldable terminal. "XX" represents a number which identifies the size of the resistors.
- X: Characteristic
  - E = Hermetic ±25 ppm/°C
  - H = Nonhermetic ±50 ppm/°C
  - Y = Nonhermetic ±5.0 ppm/°C up to +125°C, ±10 ppm/°C, +125°C to +175°C
- XXX(XX): Significant Figures
- X: Number of zeros
- XXX(XX) X: Resistance 1/
- X: Resistance Tolerance
  - T = ±0.01%
  - B = ±0.1%
  - F = ±1.0%
- X: Failure Rate
  - P = 0.1%/1000 hr
  - R = 0.01%/1000 hr
  - S = 0.001%/1000 hr

Part Number 2/	Control Specification	Style Size 3/	Characteristics					Failure Rate Level		
			Rated Power (watts) 5/	Resistance (ohms) Range Min 6/	Resistance (ohms) Range Max	Resistance (ohms) Tolerance (±%) 7/, 8/	Max Volts 9/	Grade 1	Grade 2	Substitute Grade 1
RNC50HXXXXXX	MIL-R-55182/7	RNC50	1/20	10.0	796 K	0.1, 1.0	200	S	P	—
RNC55XXXXXXX	MIL-R-55182/1	RNC55	1/10	10.0	1.21 M	0.1, 1.0	200	S	P	—
RNC60XXXXXXX	MIL-R-55182/3	RNC60	1/8	2.0	4.02 M	0.1, 1.0	250	S	P	—
RNC65XXXXXXX	MIL-R-55182/5	RNC65	1/4	1.0	8.06 M	0.1, 1.0	300	S	P	—
RNC70XXXXXXX	MIL-R-55182/6	RNC70	1/2	1.0	15.0M	0.1, 1.0	350	S	P	—
RNC90YXXXXXX	MIL-R-55182/9	RNC90 4/	3/10	4.99	.100 M	0.01, 0.1	300	S 10/	P	R

See next page for footnotes.

MIL-R-55182, RESISTORS
Fixed, Film, Solderable and Weldable, Established Reliability

1/ All styles except RNC90 are expressed by four digits; for R > 100Ω, the first three digits are significant and the fourth is the number of zeros. For R < 100Ω, the letter R replaces one of the digits and represents a decimal point. Styles RNC90 is expressed as five significant digits and a letter. For R < 1000Ω, the letter R is used as a decimal point. For values > 1000Ω but < 1.0 MΩ the letter K is used to represent a decimal point and multiplier. All digits preceding and following the letter (R or K) of the group represent significant figures.
2/ RNC55, RNC60, RNC65 and RNC 70 are not available in characteristic "Y".
3/ Hollow core devices shall not be used.
4/ Bulk metal film, RNC90Y style with ribbon-lead construction, is not acceptable for space flight applications.
5/ Maximum operating temperature at full rated power shall not exceed +125°C. For operation above +125°C the applied power shall be linearly derated to zero watts at +175°C.
6/ Minimum resistance values of 2.0Ω and 1.0Ω only apply to ±1% tolerance.
7/ A resistance tolerance of ±1.0%(F) is recommended. Tolerance T (±0.01%) is only available in RNC90 style.
8/ All styles except RNC90 are electrostatic sensitive. For tolerance B (±0.1%), package in accordance with MIL-R-39032 as specified for field force protection.
9/ The actual voltage which may be impressed across the resistors is determined by $E = \sqrt{PR}$

where: E = maximum applied voltage (dc or rms) in volts.
P = power in watts.
R = nominal resistance.

Under no conditions shall the applied voltage exceed the values specified.
10/ When no source is listed on QPL to level S, FRL R shall be used.

MIL-R-55182, RESISTORS
Fixed, Film, Established Reliability

Standard resistance values for the 10 to 100 decade for a resistance tolerance of ±1% (F).

10.0	12.1	14.7	17.8	21.5	26.1	31.6	38.3	46.4	56.2	68.1	82.5
10.2	12.4	15.0	18.2	22.1	26.7	32.4	39.2	47.5	57.6	69.8	84.5
10.5	12.7	15.4	18.7	22.6	27.4	33.2	40.2	48.7	59.0	71.5	86.6
10.7	13.0	15.8	19.1	23.2	28.0	34.0	41.2	49.9	60.4	73.2	88.7
11.0	13.3	16.2	19.6	23.7	28.7	34.8	42.2	51.1	61.9	75.0	90.9
11.3	13.7	16.5	20.0	24.3	29.4	35.7	43.2	52.3	63.4	76.8	93.1
11.5	14.0	16.9	20.5	24.9	30.1	36.5	44.2	53.6	64.9	78.7	95.3
11.8	14.3	17.4	21.0	25.5	30.9	37.4	45.3	54.9	66.5	80.6	97.6

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

MIL-R-55182, RESISTORS
Fixed, Film, Established Reliability

Standard resistance values for the 10 to 100 decade at a resistance tolerance of ±0.01% and ±0.1% (T and B).

10.00	12.10	14.70	17.80	21.50	26.10	31.60	38.30	46.40	56.20	68.10	82.50
10.10	12.30	14.90	18.00	21.80	26.40	32.00	38.80	47.00	56.90	69.00	83.50
10.20	12.40	15.00	18.20	22.10	26.70	32.40	39.20	47.50	57.60	69.80	84.50
10.40	12.60	15.20	18.40	22.30	27.10	32.80	39.70	48.10	58.30	70.60	85.60
10.50	12.70	15.40	18.70	22.60	27.40	33.20	40.20	48.70	59.00	71.50	86.60
10.60	12.90	15.60	18.90	22.90	27.70	33.60	40.70	49.30	59.70	72.30	87.60
10.70	13.00	15.80	19.10	23.20	28.00	34.00	41.20	49.90	60.40	73.20	88.70
10.90	13.20	16.00	19.30	23.40	28.40	34.40	41.70	50.50	61.20	74.10	89.80
11.00	13.30	16.20	19.60	23.70	28.70	34.80	42.20	51.10	61.90	75.00	90.90
11.10	13.50	16.40	19.80	24.00	29.10	35.20	42.70	51.70	62.60	75.90	92.00
11.30	13.70	16.50	20.00	24.30	29.40	35.70	43.20	52.30	63.40	76.80	93.10
11.40	13.80	16.70	20.30	24.60	29.80	36.10	43.70	53.00	64.20	77.70	94.20
11.50	14.00	16.90	20.50	24.90	30.10	36.50	44.20	53.60	64.90	78.70	95.30
11.70	14.20	17.20	20.80	25.20	30.50	37.00	44.80	54.20	65.70	79.60	96.50
11.80	14.30	17.40	21.00	25.50	30.90	37.40	45.30	54.90	66.50	80.60	97.60
12.00	14.50	17.60	21.30	25.80	31.20	37.90	45.90	55.60	67.30	81.60	98.80

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

MIL-R-83401, RESISTORS
Networks, Fixed, Film

Part number explanation:

M83401	XX	X	XXXX	X	X
Detail Spec Number	Specification Sheet Number	Characteristic 1/ K = ±100 ppm/°C M = ±300 ppm/°C (nonhermetic)	Resistance 2/	Tolerance F = ±1.0% G = ±2.0% J = ±5.0%	Schematic A B 3/ C G

Part Number 4/	Control Specification	Style		Pins/ Package	Schematic 3/, 7/	Power Rating 8/		Resistance Range (ohms)		Tolerance (±%)	Maximum Working Voltage/ Element 9/ (volts)
		Grade 1	Grade 2 6/			Element (watts)	Network (watts)	Min	Max		
M8340101 X XXXX X X	MIL-R-83401/1 5/	4/	RZ010	14/DIP	A B	0.2 0.1	1.4 1.3	10	1.0 M	1, 2, 5	100
M8340102 X XXXX X X	MIL-R-83401/2 5/	4/	RZ020	16/DIP	A B	0.2 0.1	1.6 1.5	10	1.0 M	1, 2, 5	100
M8340103 X XXXX X X	MIL-R-83401/3	4/	RZ030	14/FLAT	A B	0.05 0.025	0.35 0.325	10	1.0 M	1, 2, 5	50
M8340104 X XXXX X X	MIL-R-83401/4	4/	RZ040	6/SIP	C G	0.2 0.2	1.0 0.6	10	1.0 M	1, 2, 5	50
M8340105 X XXXX X X	MIL-R-83401/5	4/	RZ050	8/SIP	C G	0.2 0.2	1.4 0.8	10	1.0 M	1, 2, 5	50

1/ Use only hermetically-sealed units for space flight applications.
2/ For R ≥ 100Ω, the first three digits are significant and the fourth signifies the number of zeros. For R < 100Ω, all digits are significant; the letter R is substituted for one of the digits indicating a decimal point.
3/ See control specification for applicable schematic diagram.
4/ Presently there are no Grade 1 parts available.
5/ Ceramic sandwich construction shall not be used.
6/ For Grade 2 applications, parts shall be upgraded in accordance with Appendix B.
7/ Available in characteristics K and M. Characteristic K is preferred.
8/ These resistor networks and individual resistors shall have a power rating based on continuous full load operation at an ambient temperature of 70°C. For operation above 70°C the power shall be linearly derated to zero watts at 125°C.
9/ The actual voltage which may be impressed across each resistor element is determined by $E = \sqrt{PR}$
where E = maximum applied voltage (dc or rms)(in volts) P = derated power (watts)
R = the resistance of that portion of the element actually active in the circuit
Under no conditions shall the applied voltage exceed the values specified.

MIL-R83401, RESISTORS
Network, Fixed, Film, Standard Resistance Values for the 10 to 100 Decade

Resistance Tolerances

F (1.0)	G (2.0)	J (5.0)
10.00	10.00	
10.20	---	
10.50	---	
10.70	---	
11.00	11.00	
11.30	---	
11.50	---	
11.80	---	
12.00	12.00	
12.10	---	
12.40	---	
12.70	---	
13.00	13.00	
13.30	---	
13.70	---	
14.00	---	
14.30	---	
14.70	---	
15.00	15.00	
15.40	---	
15.80	---	
16.00	16.00	
16.20	---	

F (1.0)	G (2.0)	J (5.0)
16.50	---	
16.90	---	
17.40	---	
17.80	---	
---	18.00	
18.20	---	
18.70	---	
19.10	---	
19.60	---	
20.00	20.00	
20.50	---	
21.00	---	
21.50	---	
---	22.00	
22.10	---	
22.60	---	
23.20	---	
23.70	---	
-----	24.00	
24.30	---	
24.90	---	
25.50	---	
26.10	---	
26.70	---	

F (1.0)	G (2.0)	J (5.0)
---	27.00	
27.40	---	
28.00	---	
28.70	---	
29.40	---	
---	30.00	
30.10	---	
30.90	---	
31.60	---	
32.40	---	
---	33.00	
33.20	---	
34.00	---	
34.80	---	
35.70	---	
---	36.00	
36.50	---	
37.40	---	
38.30	---	
---	39.00	
39.20	---	
40.20	---	
41.20	---	

F (1.0)	G (2.0)	J (5.0)
42.20	---	
---	43.00	
43.20	---	
44.20	---	
45.30	---	
46.40	---	
---	47.00	
47.50	---	
48.70	---	
49.90	---	
---	51.00	
51.10	---	
52.30	---	
53.60	---	
54.90	---	
---	56.00	
56.20	---	
57.60	---	
59.00	---	
60.40	---	
61.90	---	
---	62.00	
63.40	---	

F (1.0)	G (2.0)	J (5.0)
64.90	---	
66.50	---	
---	68.00	
68.10	---	
69.80	---	
71.50	---	
73.20	---	
75.00	75.00	
76.80	---	
78.70	---	
80.60	---	
---	82.00	
82.50	---	
84.50	---	
86.60	---	
88.70	---	
90.90	---	
---	91.00	
93.10	---	
95.30	---	
97.60	---	

NOTE: For values up to and including the maximum value, use the values listed in this table multiplied by the appropriate power of 10.

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SECTION 11: SUMMARY OF STANDARD THERMISTORS

Page	Control Specification	Description	Resistance Range @ +25°C (ohms)		Grade 1	Grade 2
			Min	Max		
11.2	MIL-T-23648/19	Positive temperature coefficient	10	10K	1/	
11.5	GSFC S-311-P-18	Negative temperature coefficient	2252	30K	2/	

1/ Presently there are no Grade 1 parts available. Parts may be used in Grade 2 applications only.

2/ Parts may be used in Grade 1 and Grade 2 applications.

MIL-T-23648, THERMISTORS, INSULATED

Part number explanation:

RTHXX — Style
RTH identifies general purpose thermistors and "XX" represents a two digit number which identifies the physical configuration.

X — Resistance Ratio Characteristic:
E = 0.55 ±10%

X — Lead Type
S = Solderable (S only)

XXX — Zero Power Resistance @ +25°C 1/

X — Zero Power Resistance Tolerance @ +25°C
F = ±1%
G = ±2%
J = ±5%

Part Number		Control Specification	Style	Temp Coefficient	Seal	Resistance Ratio 3/	Resistance Values @ +25°C (ohms)		Thermal Time Constant (sec) Max	Dissipation Constant Min (mW/°C)	Power Rating 4/ @ +25°C (watts)
Grade 1	Grade 2						Min	Max			
2/	RTH42ES XXXX	MIL-T-23648/19	RTH42	Positive	Hermetic	E = 0.55 ±10%	10	10K	60	2.5	0.25

1/ Expressed in ohms and identified by a three-digit number. The first two digits represent significant figures and the last digit specifies the number of zeros to follow.

2/ Presently there are no Grade 1 parts available. Consult the system procuring activity for direction on Grade 1 applications.

3/ Resistance ratio is specified from +25°C to +125°C.

4/ For operation above +25°C, the applied power shall be linearly derated to zero watts at +125°C.

MIL-T-23648, THERMISTORS, INSULATED
Standard Resistance Values for the 10 to 100 Decade at a Resistance Tolerance of ±1%, ±2%, and ±5% (F, G, J)

10	22	47
11	24	51
12	27	56
13	30	62
15	33	68
16	36	75
18	39	82
20	43	91

NOTE: For values up to and including the maximum value, use the value listed in this table multiplied by the appropriate power of 10.

MIL-T-23648, THERMISTORS, INSULATED
Resistance Tolerance vs. Temperature for Tolerance Characteristics F, G, and J

Temperature (°C)	F (± percent)	G (± percent)	J (± percent)
-55	10	12	15
-15	5	6	9
0	3	4	7
25	1	2	5
50	3	4	7
75	5	6	9
100	7	9	12
125	10	12	15

MIL-T-23648, THERMISTORS, INSULATED
Factors for Determining Resistance at Various Temperatures

Temperature (°C)	Resistance Range (ohms)					
	10-68	82-150	180-470	560-1.2K	1.5K-5.6K	6.8K-10K
-55	0.615	0.582	0.560	0.550	0.515	0.510
-15	0.790	0.770	0.755	0.740	0.730	0.730
0	0.863	0.847	0.838	0.835	0.825	0.825
25	1.000	1.000	1.000	1.000	1.000	1.000
50	1.160	1.170	1.180	1.200	1.230	1.190
75	1.350	1.370	1.400	1.420	1.450	1.400
100	1.545	1.584	1.623	1.656	1.670	1.610
125	1.750	1.800	1.860	1.920	1.960	1.830

The appropriate factor is selected from the column headed by the resistance range which includes the zero-power 25°C resistance of the thermistor in question. The 25°C resistance of the thermistor is multiplied by the factor selected to obtain the resistance at any given factor.

Example: Given a thermistor with a 25°C resistance of 220 ohms, find the resistance at 75°C. Select the factor opposite 75°C column headed by the resistance range from the containing 220 ohms. The factor 1.400 is thus selected from the column headed 180-470. Multiply 220 ohms by the factor 1.400 to obtain the resistance at 75°C of 308 ohms.

GSFC S-311-P-18, THERMISTORS

Part number explanation:

311P18-XX-X-XXX

- 311P18-: GSFC Control Specification
- XX: Dash Number corresponds to the zero-power resistance of the thermistor @ +25°C.
- X: Lead Style:
  - S = 32 AWG, copper wire
  - T = 28 AWG, type ET per MIL-W-16876
  - N = 32 AWG, gold plated nickel wire
  - E = insulated lead (TFE), 32 AWG per MIL-I-22129; bare lead, style S; tubing (FEP), M23053/11-105c.
- XXX: Lead Length (cm):
  - 7.6 = 7R6, 76 = 76R, and 760 =761

Part Number 1/ Grade 1 Grade 2	Control Specification	Temp Coefficient	Seal	Zero Power Resistance (at 25°C) (ohms)	Tolerance Limits (0 to 70°C) (±%)	Operating and Storage Temperature Limits (°C)	Thermal Time Constant (sec) Max	Dissipation Constant (mW/°C) Min
311P18-01XXXX 311P18-02XXXX	GSFC S-311-P-18	Negative	Nonhermetic	2252 2252	1.02 0.51	-55 to +90 -55 to +70	10.0 2/	1.0 3/
311P18-03XXXX 311P18-04XXXX				3000 3000	1.02 0.56	-55 to +90 -55 to +70		
311P18-05XXXX 311P18-06XXXX				5000 5000	1.02 0.51	-55 to +90 -55 to +70		
311P18-07XXXX 311P18-08XXXX				10000 10000	0.93 0.56	-55 to +90 -55 to +70		
311P18-09XXXX 311P18-10XXXX				30000 30000	1.00 0.50	-55 to +90 -55 to +70		

1/ These parts have been successfully tested and used in space applications but are not formally qualified. No published QPL exists. See the control specification for recommended suppliers.

2/ For a thermistor suspended in still air, the thermal constant is 10.0 seconds maximum unless its lead style is "E"; the thermal time constant of "E" - lead parts is equal to 25 seconds maximum.

3/ For thermistors suspended in still air only (does not apply for lead style "E").

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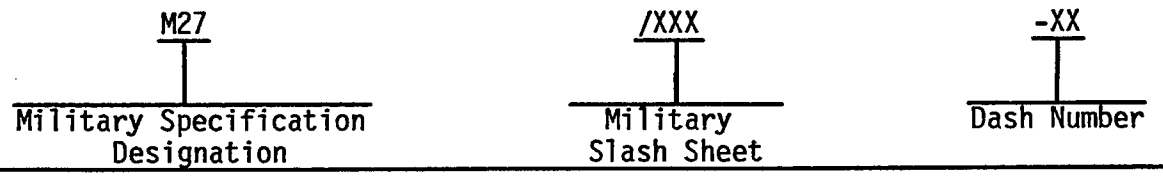
SECTION 12: SUMMARY OF STANDARD TRANSFORMERS

Grade 1	Grade 2	Page	Control Specification	Description
1/	1/	12.2	MIL-T-27	Audio frequency
		12.7	MIL-T-21038	Pulse, low-power

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1.

MIL-T-27 TRANSFORMERS
Audio Frequency

Part number explanation:



Part Number		Primary Impedance Range (ohms) 2/		Secondary Impedance Range (ohms) 2/		Power Level Range at 1 kHz (mW)	
Grade 1	Grade 2	Min	Max	Min	Max	Min	Max
1/	M27/103-XX	80 CT	30K CT	32 split	12K CT	50	500
	M27/165-XX	50 CT	100K	32 split	250K	10	250
	M27/166-XX	50	20K CT	8	1M	3	250
	M27/197-XX	20 CT	30K split	4	100K CT	4	10K

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1 applications.
2/ Where windings are listed as split, one-fourth of the listed impedance is available by paralleling the windings.

MIL-T-27/103 TYPE TF5R21ZZ TRANSFORMERS
Audio Frequency

Dash Number		Primary Impedance 2/ (ohms)	Secondary Impedance 2/ 3/ (ohms)	Primary DC Current (mA)	Power Level at 1 kHz (max) (mW)	Primary DC Resistance ±25% (ohms)	Secondary DC Resistance ±25% (ohms)	Frequency Response: ±3 dB at 400 Hz to 100 kHz and 1 mW	
Grade 1	Grade 2							Z_S (ohms)	Z_L (ohms)
1/	-01	10K CT 12K CT	10K CT 12K CT	1	100	970	1220	10K CT	10K CT
	-02	20K CT 30K CT	800 CT 1200 CT	0.5	50	815	140	20K CT	800 CT
	-03	10K CT 12.5K CT	2K split 2.5K split	1	100	620	220	10K CT	2K
	-04	10K CT 12K CT	2K CT 2.4K CT	1	100	870	180	10K CT	2K CT
	-05	10K CT 12.5K CT	1.2K CT 1.5K CT	1	100	870	130	10K CT	1.2K CT
	-06	10K CT 12K CT	500 CT 600 CT	1	100	870	50	10K CT	500 CT
	-07	2K CT 2.5K CT	8K split 10K split	3	100	180	440	2K CT	8K
	-08	1.5K CT	600 CT	3	500	87	90	1.5K CT	600 CT
	-09	1000 CT 1200 CT	50 CT 60 CT	3	500	110	9	1000 CT	50 CT
	-10	500 CT	600 CT	5.5	500	32	89	500 CT	600 CT
	-11	500 CT 600 CT	50 CT 60 CT	3	500	65	9	500 CT	50 CT
	-12	400 CT 500 CT	400 split 500 split	8 6	500	50	89	400 CT	400
	-13	400 CT 500 CT	40 split 50 split	8 6	500	50	6.5	400 CT	40
	-14	300 CT	600 CT	7	500	20	89	300 CT	600 CT
	-15	80 CT 100 CT	32 split 40 split	12 10	500	11.5	4	80 CT	32

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1 applications.
2/ Impedance values written one above the other indicate a range of matching impedances over which the parts will give satisfactory performance as long as the impedance ratio is maintained.
3/ Where windings are listed as split, one-fourth of the listed impedance is available by paralleling the winding.

MIL-T-27/165 TYPE TF5R21ZZ TRANSFORMERS
Audio Frequency

Dash Number		Primary Impedance 2/ (ohms)	Secondary Impedance 2/ (ohms)	Primary DCR ±25% (ohms)	Secondary DCR ±25% (ohms)	Power Level (mW)	Primary DC Current (mA)	Frequency Response at 200 Hz to 20 kHz ±3 dB		
Grade 1	Grade 2							Z_S (ohms)	Z_L (ohms)	E_L (volts)
	-01	80 CT 100 CT	32 split 40 split	4.9	3.2	250	16	80	32	2.8
	-02	200	250K	16	2500	10	0	200	250K	50
	-03	400 CT 500 CT	40 split 50 split	20	4.5	250	8	400	40	3.16
	-04	400 CT 500 CT	120 split 150 split	20	12.5	250	8	400	120	5.5
	-05	400 CT 500 CT	400 split 500 split	20	45	250	8	400	400	10
	-06	500 CT	3.2	15	0.35	250	0	500	3.2	0.9
	-07	600 CT	600 split	35	60	250	6	600	600	12.2
	-08	600 3/ split	10K CT	80	1050	200	9	600	10K	45
1/	-09	2K CT 4K CT	8 16	290	2	250	4 2	2K	8	1.4
	-10	2.5K CT	2.5K split	140	300	250	4	2.5K	2.5K	25
	-11	10K 25K	200 500	1225	30	200	3 1.5	10K	200	6.3
	-12	10K	2K CT	1000	40	200	1	10K	2K	20
	-13	10K CT 3/ 12K CT	10K split 12K split	855	1080	200	1	10K	10K	45
	-14	10K	90K	215	1850	100	0.25	10K	90K	95
	-15	20K 30K	800 1200	450	32	200	0.5	20K	800	12.6
	-16	30K	50	1850	3.8	200	1	30K	50	3.16
	-17	50K CT	600 split	2400	63	250	1	50K	600	12.2
	-18	100K	60	3400	3.7	200	0.5	100K	60	3.4

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1 applications.
2/ Impedance values written one above the other indicate a range of matching impedances over which the parts will give satisfactory performance as long as the impedance ratio is maintained.
3/ Electrostatic shield; shield ratio 5:1 minimum at 20 kHz.
4/ Where windings are listed as split, one-fourth of the listed impedance is available by paralleling the winding.

MIL-T-27/166 TYPE TF4R21YY TRANSFORMERS
Audio Frequency

Dash Number		Primary Impedance 2/ 3/ (ohms)	Secondary Impedance 2/ 3/ (ohms)	Primary DCR ±25% (ohms)	Secondary DCR ±25% (ohms)	Power Level (mW)	Primary DC Current (mA)	Frequency Response		
Grade 1	Grade 2							Frequency Range (Hz)	± (dB)	E_L (volts)
	-01	82	135K	14	6700	63	50	250- 8,000	2	92
	-02	50,200 CT 500 CT	50K	54	3827	3	0	50-10,000	2	12.2
	-03	50,200 CT 500 CT	50K CT	54	3827	3	0	50-10,000	2	12.2
	-04	500/125 split	150/37.5 split	35	16	250 4/	20	100-20,000	2	6.1
	-05	500/125 split	500/125 split	37	67	250 4/	20	100-20,000	2	11.2
	-06	600/150 split	600 CT	39	29	6.3	0	50-10,000	2	1.9
	-07	600/150 split	2K/500 split	70	280	31	0	50-20,000	2	7.9
	-08	600/150 split	1M	16.5	5100	10	0	200- 3,000	4	100
1/	-09	1500 CT	500/125 split	100	35	100	8	100-10,000	2	7.1
	-10	2000 CT 4000 CT	8 16	200	0.9	100	4	100-10,000	2	0.9
	-11	10K CT	500/125 split	750	52	100	4	100-10,000	2	7.1
	-12	10K/2.5K split	2K/500 split	780	195	100	4	100-10,000	2	14
	-13	10K/2.5K split	4K/1K split	800	350	100	4	100-10,000	2	20
	-14	10K	1M	330	4875	10	0	200- 3,000	4	100
	-15	15K	60K	690	3100	4	0	50-10,000	2	15.5
	-16	15K	60K	690	3100	25	4	200-10,000	2	39
	-17	15K	95K CT	673	3800	3	0	50-10,000	2	17
	-18	15K	95K CT split	1260	5800	12	4	200-10,000	2	34
	-19	20K CT	600/150 split	930	45	125	4	200-10,000	2	8.7

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1 applications.
2/ Impedance values written one above the other indicate a range of matching impedances over which the parts will give satisfactory performance as long as the impedance ratio is maintained.
3/ Where windings are listed as split, one-fourth of the listed impedance is available by paralleling the winding.
4/ 250 mW at 100 Hz, 1 watt at 200 Hz.

MIL-T-27/197 TYPE TF4R21YY TRANSFORMERS
Audio Frequency

Dash Number		Primary Impedance 2/ (ohms)	Secondary Impedance 2/ (ohms)	Unbalanced Primary DC Current (mA)	Power Level at 1 kHz max (mW)	Primary DC Resistance ±25% (ohms)	Secondary DC Resistance ±25% (ohms)	Frequency Range	Frequency Response: ±2 dB at 1 kHz		
Grade	Grade 2								E_S (volts)	Z_S (ohms)	Z_L (ohms)
1/	-01	15,000	80,000 split	8	200	3,050	11,250	100 Hz to 20 kHz	126	15K	80K split
	-02	15,000 split	80,000 split	0	15	1,075	2,960	30 Hz to 20 kHz	35	15K split	80K split
	-03	250 CT 500 CT 3/	50,000 CT 100,000 CT 3/	0	4	38	1,900	100 Hz to 20 kHz	20	250 CT	50K CT
	-04	15,000	500 CT 200 CT 125 CT 50 CT 4/	8	200	1,650	75	50 Hz to 20 kHz	10	15K	500 CT
	-05	30,000 split	500 CT 200 CT 125 CT 50 CT 4/	0	80	2,490	84	30 Hz to 20 kHz	6.3	30K split	500 CT
	-06	500 CT	500 split	0	1,000	33	35	40 Hz to 20 kHz	22	500 CT	500 CT
	-07	10,000 split	2,000 split	8	1,000	600	134	40 Hz to 20 kHz	45	10K split	2K split
	-08	500 CT	16 split	20	1,000	33	1.35	40 Hz to 20 kHz	4	500 CT	16 split
	-09	200 CT	400 split	20	1,000	14	22.2	40 Hz to 20 kHz	20	200 CT	400 split
	-10	48 CT	16 8 4/ 4	750 5/	5,000	5.0	1.82	40 Hz to 20 kHz	8.9	48 CT	16
	-11	20 CT	16 8 4/ 4	1,000 5/	10,000	1.25	1.0	75 Hz to 20 kHz	12.6	20 CT	16

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1 applications.
2/ Where windings are listed as split, one-fourth of the listed impedance is available by paralleling the winding.
3/ Impedance values written one above the other indicate a range of matching impedances over which the parts will give satisfactory performance as long as the impedance ratio is maintained.
4/ Secondary impedance is selectable by connecting various terminal connections.
5/ Balanced dc current.

MIL-T-21038 TRANSFORMERS
Pulse, Low-Power

Part number explanation:

M21038 — Military Specification Designation

/XX — Military Slash Sheet

-XXX — Dash Number

Part Number		Control Specification	Type Designation		DCR (ohms)			Blocking Oscillator Pulse					Coupling Circuit Characteristics						
Grade 1	Grade 2		Grade 1	Grade 2	1-2	3-4	5-6	Pulse Width	Rise Time	Over-shoot	Droop	Back-swing	Pulse Width	Volts Out	Rise Time	Over-shoot	Droop	Back-swing	Impedance Out, In
								µs	µs	(%)	(%)	(%)	µs		µs	(%)	(%)	(%)	(ohms)
1/	M21038/9-005	MIL-T-21038	1/	TP7SX 1110AZ	28	31	33	3	0.10	1	20	8	3	26	0.07	10	10	35	500

1/ These transformers are suitable for Grade 2 applications only. See Appendix B for guidelines to upgrade for Grade 1 applications.

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SECTION 13: SUMMARY OF STANDARD TRANSISTORS

Page	Control Specification	Description	Grade 1 1/	Grade 2 2/
			Type Designation	Type Designation
13.2	MIL-S-19500	Low-power, NPN, PNP	JANS	JANTXV
13.3		High-power, NPN, PNP		
13.4		RF devices, NPN, PNP		
13.5		J-FETs, N-channel, P-channel		
13.6		Choppers		
13.7		Unijunctions		
13.8		Optocoupler		

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

MIL-S-19500, TRANSISTORS
Silicon, Low Power (Less Than 2 W)

Part number explanation:

JAN	TXV	2N	XXXX	A	L
Minimum Qualified	Quality Level	Component Designation	Identification Number	Modifier	Lead Length

Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Maximum Rating				Electrical Characteristics							Remarks
				P_D at T_A = 25°C (mW)	BV_{CBO} (V)	BV_{CEO} (V)	I_C (A)	h_{FE} at I_C Min/Max	I_C (mA)	$V_{CE(SAT)}$ at I_C (V)	I_C (mA)	$I_{CBO(Max)}$ at $V_{CB(Max)}$ (nA)	Switching Time t_{on} (ns)	Switching Time t_{off} (ns)	
Low Power NPN															
2N2219AL	2N2219A	/251	T039	800	75	50	0.8	100/300	150	1	500	10	35	300	Comp to 2N2905A
2N2222A	2N2222A	/255	T018	500	75	50	0.8	100/300	150	1	500	10	35	300	Comp to 2N2907A
2N2369A	2N2369A	/317	T018	360	40	15	0.2	40/120	10	0.2	10	20	12	18	F_T = 500 MHz min
--	2N2484	/376	T018	360	60	60	0.05	200/500	10	0.3	1.0	50	--	--	--
--	2N3501	/366	T05	1.0W	150	150	0.3	100/300	150	0.4	150	50 @ 75 V	115	900	--
--	2N3700	/391	T018	500	140	80	1.0	100/300	150	0.2	150	10(I_{CES})	--	--	$t_{on} + t_{off}$ = 30 ns
--	2N4150	/394	T05	1.5W	100	70	10	40/120	5A	0.6	5A	100	500	500	--
--	2N5666	/455	T05	1.2W	250	200	5	40/120	1A	0.4	3A	1.0 mA	250	1,500	--
--	2N5667	/455	T05	1.2W	400	300	5	25/75	1A	0.4	3A	1.0 mA	250	2,000	--
Low Power PNP															
--	2N2605	/354	T046	400	70	60	0.03	100/300	0.010	0.5	10	20	--	--	Low-level, low-noise amp
2N2905AL	2N2905A	/290	T039	600	60	6	0.6	100/300	150	0.4	150	10	450	300	Comp to 2N2219A
2N2907A	2N2907A	/291	T018	400	60	60	0.6	100/300	150	0.4	150	10	45	300	Comp to 2N2222A
--	2N3251A	/323	T018	360	60	60	0.2	100/300	10	0.25	10	20 @ 40 V	70	250	--
--	2N3468	/348	T05	1.0	50	50	1.0	25/75	500	0.6	500	100 @ 30 V	40	90	--
--	2N3637	/357	T05	1W	175	175	1	100/300	50	0.6	50	100	400	600	--
--	2N3763	/396	T05	1W	60	60	1.5	40/140	500	0.5	500	100 @ 30 V	43	115	--
--	2N3765	/396	T046	500	60	60	1.5	40/140	500	0.5	500	100 @ 30 V	43	115	--
--	2N5416	/485	T05	750	350	300	1	30/120	50	2.0	50	0.05 mA	1,000	10,000	--
NPN Matched Pair															
--	2N2060	/270	T078	600(both)	100	60	500	40/120	1	0.3	50	2	--	--	h_{FE} matched ±10%,
--	2N2920	/355	T078	500(both)	70	60	30	175/600	10 µA	0.3	1.0	2	--	--	V_{BE} matched ±5 mV
PNP Matched Pair															
--	2N3810	/336	T078	600(both)	60	60	50	150/450	1	0.25	1.0	10	--	--	h_{FE} matched ±10%,
--	2N3811	/336	T078	600(both)	60	60	50	300/900	1	0.25	1.0	10	--	--	V_{BE} matched ±5 mV

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV transistors shall be rescreened for Grade 2 applications in accordance with the TX requirements of the applicable detail specification of MIL-S-19500.

MIL-S-19500, TRANSISTORS
Silicon, High-Power (Greater Than 2 W)

Grade 1 1/	Grade 2 2/			Maximum Rating				Electrical Characteristics							Remarks
													Switching Time		
Type Designation JANS	Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	P_D at T_C = 100°C (W)	BV_{CBO} (V)	BV_{CEO} (V)	I_C (A)	h_{FE} at I_C Min/Max	I_C (A)	$V_{CE(SAT)}$ at I_C (V)	I_C (A)	I_{CBO}(Max) at V_{CB}(Max) (µA)	t_{on} (µs)	t_{off} (µs)	
High-Power NPN															
--	2N3716	/408	TO3	87.5	100	80	10	50/150	1.0	1.0	5	1.0 mA (I_{CES}) @ 70 V	1.5	2.0	Comp to 2N3792
--	2N3749	/315	MT53	30	110	80	5	40/120	1	0.25	1	0.2	0.3	0.3	Similar to 2N2880. Isolated coll
--	2N3996	/374	TO111	30	100	80	5	40/120	1	2.0	5	0.2(I_{CES})	0.3	1.5	--
--	2N5038	/439	TO3	80	150	90	20	50/200	2	1.0	1.2	25 mA	0.5	2.0	--
--	2N5664	/455	TO66	30	250	20	5	40/120	1	0.4	3	1000	0.25	1.5	--
--	2N5665	/455	TO66	30	400	300	5	25/75	1	0.4	3	1000	0.25	2.0	--
--	2N5672	/498	TO3	80	150	120	30	20/100	15	0.75	15	25 mA	0.5	2.0	--
--	2N6308	/498	TO3	62.5	700	350	8	12/60	3	1.5	3	500(I_{CEX})	0.60	3.0	--
High-Power PNP															
--	2N3741	/441	TO66	25 W @ T_C = 25°C	80	80	4	30/100	0.25	0.6	1.0	0.1	0.4	1.0	--
--	2N3792	/379	TO3	85.7	80	80	10	50/150	1.0	1.0	5.0	1.0 mA (I_{CES}) @ 70 V	1.5	2.0	Comp to 2N3716
--	2N4399	/433	TO3	115	60	60	30	25/--	15	1.0	15	1000	0.4	2.1	--
--	2N5745	/433	TO3	115	80	80	20	25/--	10	1.5	15	1000	1.0	3.0	--

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

MIL-S-19500, TRANSISTORS
Silicon, RF Devices, NPN, PNP

Grade 1 1/ Type Designation	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg.	Maximum Ratings BV_{CBO} (Volts)	Maximum Ratings P_T T_C = 25°C (watts)	Electrical Characteristics h_{FE} (min/max)	Electrical Characteristics $\|h_{fe}\|$ @ f(MHz)		Electrical Characteristics P_{OUT} (min/max) (watts)	Electrical Characteristics @ P_{IN} (watts)	Electrical Characteristics @ f (MHz)	Electrical Characteristics @ η (%)	Remarks
NPN													
--	2N918	/301	T072	30	0.3	20/200	6/18	100	G_{pe} = 15db min		200		
--	2N2857	/343	T072	30	0.3	30/150	10/19	100	G_{pe} = 12.5/21 db		450		
--	2N3375	/341	T060	65	11.6	15/150	3.5 min	100	7.5/14 3/6	1 1	100 400	65 40	
--	2N3553	/341	T039	65	7.0	15/150	3.5 min	100	2.5/5	0.25	175	50	
--	2N3866	/398	T039	60	1.0 @ T_A = 25°C	15/200	2.5/8	200	1/2 0.5 min	0.15 0.075	400 400	45 40	
PNP													
--	2N4957	/426	T072	30	0.2 @ T_A = 25°C	30/150	12/36	100	G_{pe} = 17/25 db		450		

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

MIL-S-19500, TRANSISTORS
Silicon, Field Effect

Grade 1 1/	Grade 2 2/	Specification	EIA	Maximum Ratings				Electrical Characteristics						Remarks
Type Designation JANS	Type Designation JANTXV	MIL-S-19500	Pkg	P_T at T_A=25°C (mW)	V_{DG} (V)	V_{DS} (V)	I_G (mA)	$V_{GS(OFF)}$ (V)	I_{DSS} (V_G= 0) (mA)	$r_{ds(ON)}$ Max (Ω)	y_{fs} (µmho)	C_{iss} Max (pf)	C_{rss} Max (pf)	
N-Channel														
--	2N3821	/375	TO72	300	50	50	10	-4 max	0.5/25	--	1500/4500	6.0	3.0	--
--	2N3822	/375	TO72	300	50	50	10	-6 max	2/10	--	3000/6500	6.0	3.0	|yfs| @ 100 MHz = 3000 min
--	2N3823	/375	TO72	300	50	50	10	-8 max	4/20	--	3500/6500	6.0	2.0	|yfs| @ 200 MHz = 3200 min
--	2N4416A	/428	TO72	300	35	35	10	-2.5/ -6.0	5/15	--	4500/7500	4.0	0.8	gfs @ 400 MHz = 4000 min
--	2N4856	/385	TO18	360	40	40	50	-4/-10	50 min	25	--	18	8.0	Analog Sw / Chopper
--	2N4857	/385	TO18	360	40	40	50	-2/-6	20/100	40	--	18	8.0	Analog Sw / Chopper
--	2N4858	/385	TO18	360	40	40	50	-0.8/-4	8/80	60	--	18	8.0	Analog Sw / Chopper
P-Channel														
--	2N5114	/476	TO18	500	30	30	50	5/10	-30/-90	75	--	25	7.0	Analog Sw / Chopper
--	2N5115	/476	TO18	500	30	30	50	3/6	-15/-60	100	--	25	7.0	Analog Sw / Chopper
--	2N5116	/476	TO18	500	30	30	50	1/4	-5/-25	175	--	27	7.0	Analog Sw / Chopper

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

MIL-S-19500, TRANSISTORS
Silicon, Chopper

Grade 1 1/	Grade 2 2/			Maximum Ratings				Electrical Characteristics					Remarks
Type Designation JANS	Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	P_D at T_A = 25°C (mW)	BV_{CBO}	BV_{CEO}	I_C	h_{FE} at I_C		$V_{EC(ofs)}$ @ I_F = 0		$r_{ec(on)}$ (Ω)	
								Min/Max	(mA)	Min/Max	I_B	Min/Max	
--	2N2432A	/313	TO18	300	45	45	100	80/400	1	-/0.7mV	1 mA	-/15	--
--	2N2945A	/382	TO46	400	25	25	100	50/--	1	-/1 mV	1 mA	-/6	--

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

MIL-S-19500, TRANSISTORS
Silicon, Unijunction

Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	P_D at T_A=25°C (W)	Maximum Rating		Electrical Characteristics						Remarks
					I_e mA(rms)	V_{B2E} (V)	n at V_{B2B1} Min/Max	V_{B2B1} (V)	R_{BBO} at I_E = 0 Min/Max (KΩ)	V_{B2B1} (V)	V_{EB1} (SAT) (V)	V_{OB1} V(pk)	
--	2N4948	/388	TO72	0.36	50	30	0.55/ 0.82	10	4/12	3	3	6	General purpose, p-type emitter (n-type base)

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.

2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

MIL-S-19500, TRANSISTORS
Optocoupler

Grade 1 1/ Type Designation JANS	Grade 2 2/ Type Designation JANTXV	Specification MIL-S-19500	EIA Pkg	Maximum Ratings					Electrical Characteristics							Remarks
				P_D at T_A = 25°C (W)	V_{CEO} (Max) (V)	V_R (Max) (V)	I_C Max (mAdc)	I_F Max (mAdc)	$I_{C(ON)}$ V_{CE} = 5.0 V Min/Max (mAdc)	I_F (mA)	$V_{CE(SAT)}$ @ I_C & I_F Min/Max (V)	(mA)	(mA)	$I_{C(OFF)}$ @ V_{CE} I_C & I_B = 0 Min/Max (nA)	(V)	
--	4N23 4N23A	/486	PH13	0.3	35	2	50	40	6.0/--	10	--/0.3	5	20	--/100	20	The designation A denotes isolated phototransistor.
--	4N24 4N24A	/486		0.3	35	2	50	40	10.0/--	10	--/0.3	10	20	--/100	20	
--	4N47	/548	PH13	0.3	40	2.0	50	40	0.5/--	1.0	--/0.3	0.5	2.0	--/100	20	These devices are recommended for new design.
	4N48								1.0/5.0	1.0	--/0.3	1.0	2.0			
	4N49								2.0/10.0	1.0	--/0.3	2.0	2.0			

1/ When Grade 1 (JANS) parts are not listed on the QPL, Grade 2 (JANTXV) parts may be upgraded for use in Grade 1 applications in accordance with Appendix B.
2/ JANTXV transistors shall be rescreened in accordance with the TX requirements of the applicable detail specification of MIL-S-19500 for Grade 2 applications.

SECTION 14: SUMMARY OF STANDARD WIRE

Page	Control Specification	Description	Wire Size (AWG)		Voltage Rating Max (volts)	Grade 1	Grade 2
			Min	Max			
14.2	MIL-W-22759	Extruded TFE/ETFE	28	00	600	1/	
14.9	MIL-W-81381	Fluorocarbon-polyimide	30	00	600	1/	
14.15	MIL-W-5086	PVC/nylon jacket	16	0000	600	GSE only	
14.17	MIL-W-16878	PVC	32	18	600	GSE only	

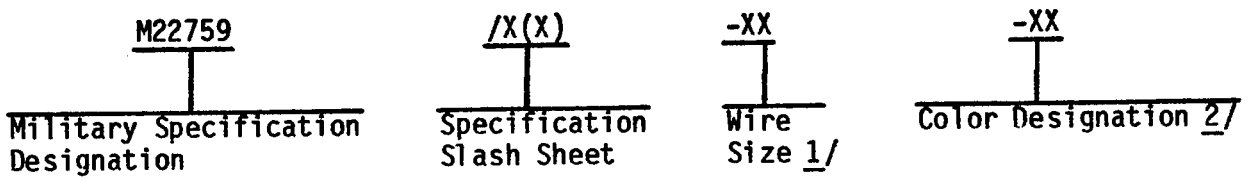
SECTION 14: SUMMARY OF STANDARD CABLE

Page	Control Specification	Description	Voltage Rating Range (V)		Grade 1	Grade 2
			Min	Max		
14.18	MIL-C-17	Radio frequency, flexible, coaxial (50, 75 and 93 ohms)	750	1875	1/	
14.19	MIL-C-27500	Electrical, shielded and unshielded (wire size: 000-30)	600	600	1/	

1/ See individual listings for grade callouts.

MIL-W-22759, WIRE
Electric, Fluoropolymer-Insulated, Copper or Copper Alloy

Part number explanation:



Part Number 3/		Control Specification	Wire Size Range 1/	Insulation	Coating	Voltage Rating Maximum (volts/rms)	Temperature (°C)
Grade 1	Grade 2						
M22759/3-XX-X		MIL-W-22759	22 - 00	TFE-glass-TFE	Nickel	600	260
M22759/11-XX-X			28 - 8	Extruded TFE	Silver 4/		200
M22759/12-XX-X			28 - 8	Extruded TFE	Nickel		260
M22759/16-XX-X			24 - 00	ETFE 5/	Tin		150
M22759/22-XX-X			28 - 20	Extruded TFE	Silver 4/		200
M22759/23-XX-X			28 - 20	Extruded TFE	Nickel		260

1/ Wire size is a number which is the nearest AWG size.
2/ Substitute the appropriate color code designator from MIL-STD-681.
3/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.
5/ ETFE = ethylene tetrafluoroethylene copolymer.

MIL-W-22759/3, WIRE
Electric, Fluoropolymer-Insulated, TFE-Glass-TFE, Medium Weight, Nickel-Coated Copper Conductor, 600-Volt, 260°C

Part Number 1/, 2/		Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire			
Grade 1	Grade 2			Min	Max	Resistance at 20°C (68°F) (ohms/1000 ft) Max	Thickness of TFE Jacket (inches)	Diameter (inches)	Weight (lbs/1000 ft) Max
M22759/3-22-XX		22	19 x 34	0.029	0.033	16.0	0.009 ±0.002	0.074 ±0.003	5.90
M22759/3-20-XX		20	19 x 32	0.037	0.041	9.77	0.009 ±0.002	0.082 ±0.003	7.90
M22759/3-18-XX		18	19 x 30	0.046	0.051	6.10	0.010 ±0.002	0.095 ±0.003	11.0
M22759/3-16-XX		16	19 x 29	0.052	0.058	4.76	0.010 ±0.002	0.103 ±0.004	13.6
M22759/3-14-XX		14	19 x 27	0.065	0.073	3.00	0.010 ±0.002	0.116 ±0.004	18.5
M22759/3-12-XX		12	37 x 28	0.084	0.090	1.98	0.010 ±0.002	0.133 ±0.004	26.6
M22759/3-10-XX		10	37 x 26	0.106	0.114	1.24	0.010 ±0.002	0.164 ±0.006	41.5
M22759/3-8-XX		8	133 x 29	0.158	0.173	0.694	0.010 ±0.002	0.235 ±0.007	77.4
M22759/3-6-XX		6	133 x 27	0.198	0.217	0.436	0.010 ±0.002	0.282 ±0.010	115.0
M22759/3-4-XX		4	133 x 25	0.250	0.274	0.275	0.012 ±0.003	0.351 ±0.015	184.0
M22759/3-2-XX		2	665 x 30	0.320	0.340	0.177	0.012 ±0.003	0.430 ±0.015	281.0
M22759/3-1-XX		1	817 x 30	0.360	0.380	0.144	0.014 ±0.004	0.480 ±0.015	358.0
M22759/3-01-XX		0	1045 x 30	0.395	0.425	0.113	0.014 ±0.004	0.525 ±0.025	436.0
M22759/3-02-XX		00	1330 x 30	0.440	0.475	0.089	0.014 ±0.004	0.585 ±0.025	554.0

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/3-20-9; white with orange stripe - M22759/3-20-93.

2/ Outgassing properties of this wire are not controlled and must be properly evaluated for compliance with project outgassing requirements.

MIL-W-22759/11, WIRE
Electric, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 600-Volt, 200°C

Part Number 1/, 2/, 3/		Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire		
Grade 1	Grade 2			Min	Max	Resistance at 20°C (68°F) (ohms/1000 ft) Max	Diameter (inches)	Weight (lbs/1000 ft) Max
M22759/11-28-XX		28	7 x 36	0.014	0.015	63.8	0.033 ±0.002	1.36
M22759/11-26-XX		26	19 x 38	0.018	0.020	38.4	0.038 ±0.002	1.90
M22759/11-24-XX		24	19 x 36	0.023	0.025	24.3	0.043 ±0.002	2.58
M22759/11-22-XX		22	19 x 34	0.029	0.032	15.1	0.049 ±0.002	3.72
M22759/11-20-XX		20	19 x 32	0.037	0.040	9.19	0.058 ±0.002	5.43
M22759/11-18-XX		18	19 x 30	0.046	0.050	5.79	0.068 ±0.002	8.14
M22759/11-16-XX		16	19 x 29	0.052	0.057	4.52	0.075 ±0.002	10.0
M22759/11-14-XX		14	19 x 27	0.065	0.072	2.88	0.090 ±0.002	15.1
M22759/11-12-XX		12	19 x 25	0.082	0.090	1.81	0.111 ±0.003	24.1
M22759/11-10-XX		10	37 x 26	0.106	0.112	1.19	0.139 ±0.004	37.8
M22759/11-8-XX		8	133 x 29	0.158	0.169	0.658	0.202 ±0.004	65.5

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/11-20-9; white with orange stripe - M22759/11-20-93.

2/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.

3/ Outgassing properties of this wire are not controlled and must be properly evaluated for compliance with project outgassing requirements.

MIL-W-22759/12, WIRE
Electric, Fluoropolymer-Insulated, Extruded TFE, Nickel-Coated Copper Conductor, 600-Volt, 260°C

Part Number 1/, 2/		Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire		
						Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)	Weight (lbs/1000 ft)
Grade 1	Grade 2			Min	Max	Max		Max
M22759/12-28-XX		28	7 x 36	0.014	0.016	67.9	0.033 ±0.002	1.36
M22759/12-26-XX		26	19 x 38	0.018	0.021	42.2	0.038 ±0.002	1.90
M22759/12-24-XX		24	19 x 36	0.023	0.026	25.9	0.043 ±0.002	2.58
M22759/12-22-XX		22	19 x 34	0.029	0.033	16.0	0.049 ±0.002	3.72
M22759/12-20-XX		20	19 x 32	0.037	0.041	9.77	0.058 ±0.002	5.43
M22759/12-18-XX		18	19 x 30	0.046	0.051	6.10	0.068 ±0.002	8.14
M22759/12-16-XX		16	19 x 29	0.052	0.058	4.76	0.075 ±0.002	10.0
M22759/12-14-XX		14	19 x 27	0.065	0.073	3.00	0.090 ±0.002	15.6
M22759/12-12-XX		12	19 x 25	0.082	0.092	1.89	0.111 ±0.003	24.4
M22759/12-10-XX		10	37 x 26	0.106	0.114	1.24	0.139 ±0.004	39.0
M22759/12-8-XX		8	133 x 29	0.158	0.173	0.694	0.204 ±0.004	67.0

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/12-20-9; white with orange stripe - M22759/12-20-93.

2/ Outgassing properties of this wire are not controlled and must be properly evaluated for compliance with project outgassing requirements.

MIL-W-22759/16, WIRE
Electric, Fluoropolymer-Insulated, Extruded ETFE 1/, Medium Weight, Tin-Coated Copper, 600 Volt, 150°

Part Number 2/,3/		Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Dia of Stranded Conductor (inches)		Finished Wire		
Grade 1	Grade 2			Min	Max	Max Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)	Weight (lbs/1000 ft) Max
M22759/16-24-XX		24	19 x 36	0.023	0.024	26.2	0.045 ±0.002	2.57
M22759/16-22-XX		22	19 x 34	0.029	0.031	16.2	0.052 ±0.002	3.68
M22759/16-20-XX		20	19 x 32	0.037	0.039	9.88	0.060 ±0.002	5.36
M22759/16-18-XX		18	19 x 30	0.046	0.049	6.23	0.071 ±0.002	7.89
M22759/16-16-XX		16	19 x 29	0.052	0.055	4.81	0.079 ±0.002	9.95
M22759/16-14-XX		14	19 x 27	0.065	0.069	3.06	0.093 ±0.002	14.9
M22759/16-12-XX		12	37 x 28	0.084	0.089	2.02	0.114 ±0.003	22.6
M22759/16-10-XX		10	37 x 26	0.106	0.112	1.26	0.139 ±0.003	35.1
M22759/16-8-XX		8	133 x 29	0.158	0.169	0.701	0.199 ±0.003	63.5
M22759/16-6-XX		6	133 x 27	0.198	0.212	0.445	0.250 ±0.003	99.9
M22759/16-4-XX		4	133 x 25	0.250	0.268	0.280	0.312 ±0.004	157.0
M22759/16-2-XX		2	665 x 30	0.320	0.340	0.183	0.388 ±0.004	245.0
M22759/16-1-XX		1	817 x 30	0.360	0.380	0.149	0.431 ±0.005	314.0
M22759/16-01-XX		0	1045 x 30	0.395	0.425	0.116	0.479 ±0.006	391.0
M22759/16-02-XX		00	1330 x 30	0.440	0.475	0.091	0.546 ±0.007	504.0

1/ ETFE = ethylene-tetrafluoroethylene copolymer.
2/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/16-20-9; white with orange stripe - M22759/16-20-93.
3/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.

MIL-W-22759/22, WIRE
Electric, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated, High-Strength Copper Alloy Conductor, 600-Volt, 200°C

Part Number 1/,2/,3/		Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire		
						Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)	Weight (lbs/1000 ft)
Grade 1	Grade 2			Min	Max	Max		Max
M22759/22-28-XX		28	7 x 36	0.014	0.015	74.4	0.033 ±0.002	1.32
M22759/22-26-XX		26	19 x 38	0.018	0.020	44.8	0.038 ±0.002	1.91
M22759/22-24-XX		24	19 x 36	0.023	0.024	28.4	0.043 ±0.002	2.61
M22759/22-22-XX		22	19 x 34	0.029	0.031	17.5	0.049 ±0.002	3.68
M22759/22-20-XX		20	19 x 32	0.037	0.039	10.7	0.058 ±0.002	5.38

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/22-20-9; white with orange stripe - M22759/22-20-93.
2/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.
3/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.

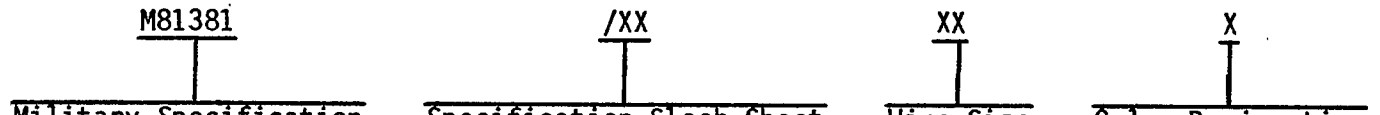
MIL-W-22759/23, WIRE
Electric, Fluoropolymer-Insulated, Extruded TFE, Nickel-Coated, High-Strength Copper Alloy Conductor, 600-Volt, 260°C

Part Number 1/,2/		Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire		
						Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)	Weight (lbs/1000 ft)
Grade 1	Grade 2			Min	Max	Max		Max
M22759/23-28-XX		28	7 x 36	0.014	.0.016	79.0	0.033 ±0.002	1.34
M22759/23-26-XX		26	19 x 38	0.018	0.020	49.4	0.038 ±0.002	1.92
M22759/23-24-XX		24	19 x 36	0.023	0.025	30.1	0.043 ±0.002	2.68
M22759/23-22-XX		22	19 x 34	0.029	0.031	18.6	0.049 ±0.002	3.73
M22759/23-20-XX		20	19 x 32	0.037	0.040	11.4	0.058 ±0.002	5.44

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 20, white - M22759/23-20-9; white with orange stripe - M22759/23-20-93.
2/ Outgassing properties of this wire are not controlled and must be evaluated for compliance with project outgassing requirements.

MIL-W-81381 WIRE
Electric, Fluorocarbon/Polyimide Insulated, Copper and Copper Alloy, 600 Volts

Part number explanation:



Part Number 1/,2/		Control Specification	Wire Size Range, AWG	Insulation	Coating	Temperature Rating Max (°C)
Grade 1	Grade 2					
M81381/7-XX-X		MIL-W-81381	26-10	Fluorocarbon/ polyimide	Silver 3/	200
M81381/8-XX-X			26-10		Nickel	200
M81381/9-XX-X			30-20		Silver 3/	200
M81381/10-XX-X			30-20		Nickel	200
M81381/21-XX-X			26-10		Tin	150

1/ Part number: The last X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681, except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter N and unpigmented polyimide resin insulation shall be designated by the letter C. The latter is preferred.

2/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.

3/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.

MIL-W-81381/7, WIRE
Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Silver-Coated Copper Conductor, 600 Volts, 200°C
Nominal 5.8 Mil Wall 1/

Part Number 2/, 3/, 4/	Wire Size, AWG	Conductor			Finished Wire				Insulation Tapes	
									Wrap 1 and Wrap 2	
Grade 1 | Grade 2		Stranding (Number of Strands x AWG Size of Strands)	Diameter (inches) Min	Diameter (inches) Max	Resistance at 20°C (68°F) (ohms/1000 ft) Max	Diameter (inches) Min	Diameter (inches) Max	Weight (lbs/1000 ft) Max	Tape Code 5/	Overlap (%) Min
M81381/7-26-XX	26	19 x 38	0.018	0.019	38.4	0.031	0.034	1.3		
M81381/7-24-XX	24	19 x 36	0.023	0.024	24.3	0.034	0.037	1.9		
M81381/7-22-XX	22	19 x 34	0.029	0.030	15.1	0.041	0.044	2.8		
M81381/7-20-XX	20	19 x 32	0.037	0.038	9.19	0.049	0.052	4.3		
M81381/7-18-XX	18	19 x 30	0.046	0.048	5.79	0.059	0.062	6.5	.1/1/.1	50
M81381/7-16-XX	16	19 x 29	0.052	0.054	4.52	0.065	0.068	8.3		
M81381/7-14-XX	14	19 x 27	0.065	0.068	2.88	0.078	0.082	12.7		
M81381/7-12-XX	12	37 x 28	0.084	0.087	1.90	0.097	0.101	19.4		
M81381/7-10-XX	10	37 x 26	0.106	0.110	1.19	0.120	0.124	30.3		

1/ Nominal values are for information only. Nominal values are not requirements.
2/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681, except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter N and unpigmented polyimide resin insulation shall be designated by the letter C. Examples: Size 20, opaque dark yellow - M81381/7-20-N; same with orange stripe - M81381/7-20-N3. Unpigmented (natural) insulation is preferred.
3/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.
4/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.
5/ Tape code: .1/1/.1 0.1 mil fluorinated ethylene propylene (FEP) fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin.

MIL-W-81381/8, WIRE
Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Nickel-Coated Copper Conductor, 600 Volts, 200°C, Nominal 5.8 Mil Wall 1/

Part Number 2/,3/		Wire Size, AWG	Conductor			Finished Wire				Insulation Tapes	
			Stranding (Number of Strands x AWG Size of Strands)	Diameter (inches)		Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)		Weight (lbs/1000 ft)	Wrap 1 and Wrap 2	
Grade 1	Grade 2			Min	Max	Max	Min	Max	Max	Tape 4/ Code	Overlap (%) Min
M81381/8-26-XX		26	19 x 38	0.018	0.020	42.2	0.031	0.034	1.4		
M81381/8-24-XX		24	19 x 36	0.023	0.024	25.9	0.034	0.037	2.0		
M81381/8-22-XX		22	19 x 34	0.029	0.031	16.0	0.041	0.044	3.0		
M81381/8-20-XX		20	19 x 32	0.037	0.039	9.77	0.049	0.052	4.5		
M81381/8-18-XX		18	19 x 30	0.046	0.049	6.10	0.059	0.062	6.8	.1/1/.1	50
M81381/8-16-XX		16	19 x 29	0.052	0.055	4.76	0.065	0.068	8.5		
M81381/8-14-XX		14	19 x 27	0.065	0.069	3.00	0.078	0.082	13.2		
M81381/8-12-XX		12	37 x 28	0.084	0.089	1.98	0.097	0.101	20.2		
M81381/8-10-XX		10	37 x 26	0.106	0.110	1.24	0.120	0.124	31.7		

1/ Nominal values are for information only. Nominal values are not requirements.
2/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681, except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter N and unpigmented polyimide resin insulation shall be designated by the letter C. Examples: Size 20, opaque dark yellow - M81381/8-20-N; same with orange stripe - M81381/8-20-N3. Unpigmented (natural) insulation is preferred.
3/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Tape code: .1/1/.1 0.1 mil fluorinated ethylene propylene (FEP) fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin.

MIL-W-81381/9, WIRE
Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Silver-Coated, High-Strength Copper Alloy Conductor, 600 Volts, 200°C, Nominal 5.8 Mil Wall 1/

Part Number 2/, 3/, 4/		Wire Size, AWG	Conductor			Finished Wire				Insulation Tapes	
			Stranding (Number of Strands x AWG Size of Strands)	Diameter (inches)		Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)		Weight (lbs/1000 ft)	Wrap 1 and Wrap 2	
Grade 1	Grade 2			Min	Max	Max	Min	Max	Max	Tape 5/ Code	Overlap (%) Min
M81381/9-30-XX		30	7 x 38	0.011	0.012	117.4	0.023	0.026	0.6		
M81381/9-28-XX		28	7 x 36	0.014	0.015	74.4	0.026	0.029	0.9		
M81381/9-26-XX		26	19 x 38	0.018	0.020	44.8	0.031	0.034	1.3		
M81381/9-24-XX		24	19 x 36	0.023	0.024	28.4	0.034	0.037	1.9	.1/1/.1	50
M81381/9-22-XX		22	19 x 34	0.029	0.031	17.5	0.041	0.044	2.9		
M81381/9-20-XX		20	19 x 32	0.037	0.039	10.7	0.049	0.052	4.4		

1/ Nominal values are for information only. Nominal values are not requirements.
2/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681, except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter N and unpigmented polyimide resin insulation shall be designated by the letter C. Examples: Size 20, opaque dark yellow - M81381/9-20-N; same with orange stripe - M81381/9-20-N3. Unpigmented insulation is preferred.
3/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.
4/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.
5/ Tape code: .1/1/.1 0.1 mil fluorinated ethylene propylene (FEP) fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin.

MIL-W-81381/10, WIRE
Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Nickel-Coated, High-Strength Copper Alloy Conductor, 600 Volts, 200°C, Nominal 5.8 Mil Wall 1/

Part Number 2/,3/		Wire Size, AWG	Conductor			Finished Wire				Insulation Tapes	
			Stranding (Number of Strands x AWG Size of Strands)	Diameter (inches)		Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)		Weight (lbs/1000 ft)	Wrap 1 and Wrap 2	
Grade 1	Grade 2			Min	Max	Max	Min	Max	Max	Tape 4/ Code	Overlap (%) Min
M81381/10-30-XX		30	7 x 38	0.011	0.013	129.6	0.023	0.027	0.7		
M81381/10-28-XX		28	7 x 36	0.014	0.016	79.0	0.026	0.030	1.0		
M81381/10-26-XX		26	19 x 38	0.018	0.020	49.4	0.031	0.034	1.4		
M81381/10-24-XX		24	19 x 36	0.023	0.025	30.1	0.034	0.037	2.0	.1/1/.1	50
M81381/10-22-XX		22	19 x 34	0.029	0.031	18.6	0.041	0.044	3.0		
M81381/10-20-XX		20	19 x 32	0.037	0.040	11.4	0.049	0.052	4.6		

1/ Nominal values are for information only. Nominal values are not requirements.
2/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681, except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter N and unpigmented polyimide resin insulation shall be designated by the letter C. Examples: Size 20, opaque dark yellow - M81381/10-20-N; same with orange stripe - M81381/10-20-N3. Unpigmented insulation is preferred.
3/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Tape code: .1/1/.1 0.1 mil fluorinated ethylene propylene (FEP) fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin.

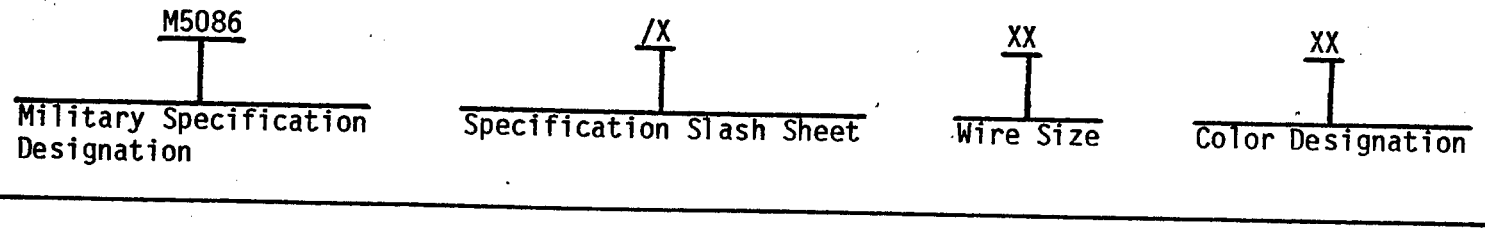
MIL-W-81381/21, WIRE
Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Tin-Coated Copper Conductor, 600 Volts, 150°C, Nominal 5.8 Mil Wall 1/

Part Number 2/,3/	Wire Size, AWG	Conductor			Finished Wire				Insulation Tapes	
		Stranding (Number of Strands x AWG Size of Strands)	Diameter (inches)		Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches)		Weight (lbs/1000 ft)	Wrap 1 and Wrap 2	
Grade 1 | Grade 2			Min	Max	Max	Min	Max	Max	Tape Code 4/	Overlap (%) Min
M81381/21-26-XX	26	19 x 38	0.018	0.021	41.3	0.030	0.034	1.3		
M81381/21-24-XX	24	19 x 36	0.023	0.026	26.2	0.034	0.038	2.0		
M81381/21-22-XX	22	19 x 34	0.029	0.033	16.2	0.041	0.045	3.0		
M81381/21-20-XX	20	19 x 32	0.037	0.041	9.88	0.048	0.053	4.4		
M81381/21-18-XX	18	19 x 30	0.046	0.051	6.23	0.058	0.063	6.6	.1/1/.1	50
M81381/21-16-XX	16	19 x 29	0.052	0.058	4.81	0.064	0.069	8.4		
M81381/21-14-XX	14	19 x 27	0.065	0.073	3.06	0.077	0.083	12.8		
M81381/21-12-XX	12	37 x 28	0.084	0.090	2.02	0.097	0.102	20.7		
M81381/21-10-XX	10	37 x 26	0.106	0.114	1.26	0.120	0.125	32.4		

1/ Nominal values are for information only. Nominal values are not requirements.
2/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681 except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter N and unpigmented polyimide resin insulation shall be designated by the letter C. Examples: Size 20, opaque dark yellow - M81381/21-20-N; same with orange stripe - M81381/21-20-N3. Unpigmented insulation is preferred.
3/ Outgassing properties of this wire are not controlled and must be evaluated for compliance to project outgassing requirements.
4/ Tape code: .1/1/.1 0.1 mil fluorinated ethylene propylene (FEP) fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin.

MIL-W-5086, WIRE
Electric, Polyvinyl-Chloride-Insulated, Copper or Copper Alloy

Part number explanation:



MIL-W-5086/1, WIRE
Electric, Polyvinyl-Chloride (PVC) Insulated, Nylon Jacket, Tin-Coated Copper Conductor, 600-Volt, 105°C
(Use for Ground Support Equipment only.)

Part Number 1/, 2/	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire		
			Min	Max	Resistance at 20°C (68°F) (ohms/1000 ft) Max	Diameter (inches)	Weight (lbs/1000 ft) Max
M5086/1-16-XX	16	19 x 29	0.052	0.058	4.81	0.098 ±0.004	10.70
M5086/1-14-XX	14	19 x 27	0.065	0.073	3.06	0.117 ±0.005	16.40
M5086/1-12-XX	12	37 x 28	0.084	0.090	2.02	0.137 ±0.005	24.70

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 14, white - M5086/1-14-9; white with orange stripe - M5086/1-14-93.
2/ White insulation is preferred.

MIL-W-5086/2, WIRE
Electric, Polyvinyl-Chloride-Insulated, PVC-Glass-Nylon, Tin-Coated Copper Conductor, 600-Volt, 105°C
(Use for Ground Support Equipment only.)

Part Number 1/, 2/	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor (inches)		Finished Wire		
			Min	Max	Resistance at 20°C (68°F) (ohms/1000 ft) Max	Diameter (inches)	Weight (lbs/1000 ft) Max
M5086/2-10-XX	10	37 x 26	0.106	0.114	1.26	0.189 ±0.007	44.0
M5086/2-8-XX	8	133 x 29	0.158	0.173	0.701	0.240 ±0.007	70.0
M5086/2-6-XX	6	133 x 27	0.198	0.217	0.445	0.293 ±0.007	110.0
M5086/2-4-XX	4	133 x 25	0.250	0.274	0.280	0.355 ±0.010	165.0
M5086/2-2-XX	2	665 x 30	0.320	0.340	0.183	0.425 ±0.010	250.0
M5086/2-1-XX	1	817 x 30	0.360	0.380	0.149	0.470 ±0.010	305.0
M5086/2-01-XX	0	1045 x 30	0.405	0.425	0.116	0.525 ±0.015	400.0
M5086/2-02-XX	00	1330 x 30	0.450	0.475	0.091	0.590 ±0.015	500.0
M5086/2-03-XX	000	1665 x 30	0.515	0.540	0.071	0.650 ±0.015	620.0
M5086/2-04-XX	0000	2109 x 30	0.580	0.605	0.056	0.720 ±0.015	785.0

1/ Part number: The X in the part number column shall be replaced by color code designators in accordance with MIL-STD-681. Examples: Size 8, white - M5086/2-8-9; white with orange stripe - M5086/2-8-93.
2/ White insulation is preferred.

MIL-W-16878/1, WIRE
Electrical, Polyvinyl-Chloride (PVC) Insulated, Tin-Coated Copper Conductor, 600-Volts, (Use for Ground Support Equipment only.)

Part number explanation:

M16878	/X(X)	B	X	X	X
Military Specification Designator	Specification Slash Sheet	Coated Copper	Conductor Size	Conductor Stranding	Color Designation

Color Designation Codes	
0 = Black	5 = Green
1 = Brown	6 = Blue
2 = Red	7 = Purple
3 = Orange	8 = Gray
4 = Yellow	9 = White

Part Number 1/, 2/	Wire Size, AWG	Stranding (Number of Strands x AWG Size of Strands)	Diameter of Stranded Conductor		Finished Wire		
			Min	Max	Resistance at 20°C (68°F) (ohms/1000 ft)	Diameter (inches) Max	Weight 3/ (lbs/1000 ft) (approx)
M16878/1-B-A-B-X	32	7 x 40	0.0088	0.011	189	0.032	0.74
M16878/1-B-B-B-X	30	7 x 38	0.011	0.013	114.1	0.034	0.92
M16878/1-B-C-B-X	28	7 x 36	0.014	0.016	68.6	0.037	1.2
M16878/1-B-D-E-X	26	19 x 38	0.018	0.022	41.3	0.041	1.7
M16878/1-B-E-E-X	24	19 x 36	0.023	0.027	26.2	0.047	2.4
M16878/1-B-F-E-X	22	19 x 34	0.029	0.033	16.2	0.053	3.5
M16878/1-B-G-E-X	20	19 x 32	0.037	0.041	9.88	0.061	5.2
M16878/1-B-H-E-X	18	19 x 30	0.046	0.052	6.23	0.072	7.7

1/ White insulation is preferred.
2/ This specification does not require QPL listings.
3/ Estimated weights are calculated from other specifications, and are tabulated here to facilitate design. This is not a specification requirement.

MIL-C-17, CABLE
Radio Frequency, Flexible, Coaxial

Part number explanation:

M17 — Military Specification Designation

/XXX — Specification Slash Sheet

RGXXX — Part Type

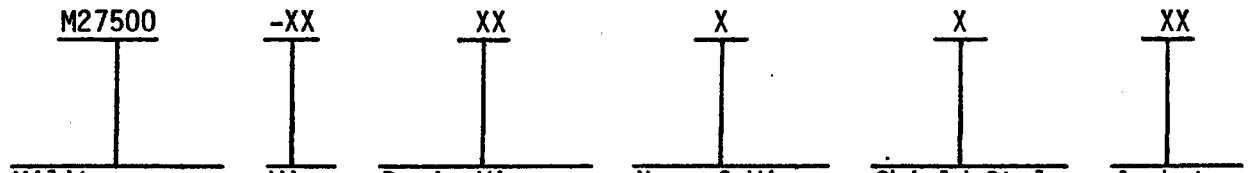
Part Number 1/ Grade 1	Part Number 1/ Grade 2	Control Specification	Characteristic Impedance (ohms)	Operating Frequency Max (GHz)	Voltage Working Max (Vrms)	Braid	Attenuation Max Range (dB/100 ft) (at 25°C - Sea Level)	Power Max Range (watts) (at 25°C - Sea Level)	Capacitance (pf/ft)	Diameter (inches) Min	Diameter (inches) Max
M17/60-RG142		MIL-C-17	50 ±2	12.4	1,400	Double	2.8 @ 50 MHz-76 @ 12.4 GHz	3500 @ 50 MHz 150 @ 12.4 GHz	29.3 nom	0.190	0.200
M17/93-RG178			50 ±2	3	750	Single	10 @ 50 MHz-94 @ 3 GHz	430 @ 50 MHz-47 @ 3 GHz	32 max	0.067	0.075
M17/94-RG179			75 ±3	3	900	Single	21 @ 400 MHz	1250 @ 50 MHz-145 @ 3 GHz	19.5 nom	0.095	0.105
M17/95-RG180			95 ±5	3	1,100	Single	17 @ 400 MHz	1050 @ 50 MHz-130 @ 3 GHz	15.4 nom	0.137	0.145
M17/110-RG302			75 ±3	3	1,700	Single	8 @ 400 MHz-26 @ 3 GHz	3500 @ 150 MHz-350 @ 3 GHz	19.5 max	0.197	0.207
M17/111-RG303			50 ±2	3	1,400	Single	2.6 @ 50 MHz-27 @ 3 GHz	3500 @ 50 MHz-350 @ 3 GHz	29.3 nom	0.165	0.175
M17/113-RG316			50 ±2	3	900	Single	7.5 @ 50 MHz-58 @ 3 GHz	600 @ 50 MHz-76 @ 3 GHz	32 max	0.094	0.102
M17/127-RG393 2/			50 ±2	11	1,875	Double	1.5 @ 50 MHz-40 @ 10 GHz	9000 @ 50 MHz-20 @ 10 GHz	32 max	0.380	0.400
M17/128-RG400 2/			50 ±2	12.4	1,400	Double	3.2 @ 50 MHz-90 @ 12.4 GHz	3500 @ 50 MHz-150 @ 10 GHz	32 max	0.190	0.200

1/ Outgassing properties of this cable are not controlled and must be evaluated for compliance to project outgassing requirements.

2/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.

MIL-C-27500 CABLE
Electrical, Shielded and Unshielded, Aerospace

Part number explanation:



1/ Wire size is a number which is the nearest AWG size. All wires used in the cable shall be of the same size.

2/ A letter symbol shall be used to designate the specification, type, and class in accordance with Table I.

3/ For shielded or jacketed cables, the number of wires shall be from 1 to 7. For unshielded and unjacketed or unshielded jacketed cables, the number of wires shall be from 2 to 7.

4/ Shield style and material of the overall shield(s) shall be designated by a single letter in accordance with Table II.

5/ The single jacket style shall consist of an outer jacket only. The double jacket style shall be used in conjunction with a double shield jacket only and shall consist of a jacket between the two shields and an outer jacket. The inner and outer jackets shall be of the same material. The jacket style and material shall be designated by two digits in accordance with Table III.

TABLE I
MIL-C-27500,CABLE 1/,2/
Single Conductor Wire

Spec, Type, Class Symbol	Basic Wire Specification	Insulation	Conductor Plating 2/	Material	Wire Size Range (AWG)	Voltage Rating (V)	Temp Rating (°C)
RA	MIL-W-22759/3	Fluoro-polymer	Nickle	Copper	22-00	600	260
RC	/11		Silver 3/		28-8		200
RF	/12		Nickel		28-8		260
TE	/16		Tin		24-00		150
TM	/22		Silver 3/	Copper alloy	28-20		200
TN	/23		Nickel		28-20		260
MR	MIL-W-81381/7	Polyimide	Silver 3/	Copper	26-10	600	200
MS	/8		Nickel	Copper	26-10		
MT	/9		Silver 3/	Copper alloy	30-20		
MV	/10		Nickel	Copper alloy	30-20		
NK	/21		Tin	Copper	26-10		150

1/ Outgassing properties of this cable are not controlled and must be evaluated for compliance to project outgassing requirements.

2/ This specification does not require QPL listings.

3/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.

TABLE II
MIL-C-27500, CABLE
Shield Style and Material

Shield Style/Material Symbol		Shield Material	Temperature Limit for Shield Material (Information Only)
Single Shield Style	Double Shield Style		
U	-	No shield	-----
T	V	Tin-coated copper, round	150°C
S	W	Silver-coated copper, round 1/	200°C
N	Y	Nickel-coated copper, round	260°C

1/ Silver-coated copper wire is susceptible to cuprous oxide corrosion ("red plague") when produced, stored, or used in a moist or high-humidity environment. Therefore the environment for such wire must be controlled.

TABLE III
MIL-C-27500, CABLE
Jacket Style and Material

Jacket Material Symbol 1/		Material	Temperature Limits for Jacket Material (Information Only)
Single Jacket	Double Jacket		
05	55	Extruded clear fluorinated ethylene propylene (FEP)	200°C
06	56	Extruded or taped and fused white polytetrafluoroethylene	260°C
09	59	Extruded white fluorinated ethylene propylene (FEP)	200°C
11	61	Tape of natural polyimide combined with clear fluorinated ethylene propylene (FEP) wrapped and heat sealed with FEP outer surface	200°C
12	62	Tape of natural polyimide combined with fluorinated ethylene propylene (FEP) wrapped and heat sealed with polyimide outer surface	200°C
21	71	Extruded clear perfluoroalkoxy (PFA)	260°C
22	72	Tape of natural polyimide combined with clear fluorinated ethylene propylene (FEP) wrapped and heat sealed with dip-coated modified aromatic polyimide outer surface	200°C

1/ The single jacket style shall consist of an outer jacket only. The double jacket style shall be used in conjunction with a double shield jacket only and shall consist of a jacket between the two shields and an outer jacket. The inner and outer jackets shall be of the same material. The jacket style and material shall be designated by two digits.

APPENDIX A

STANDARD PARTS DERATING

STANDARD PARTS DERATING

1.0 SCOPE.

Inclusion of parts in this standard is based on the premise that certain characteristics of the parts are derated for reliable operation.

1.1 Introduction. Derating is the reduction of electrical, thermal, and mechanical stresses applied to a part in order to decrease the degradation rate and prolong the expected life of the part. Derating increases the margin of safety between the operating stress level and the actual failure level for the part, providing added protection from system anomalies unforeseen by the designer. The following guidelines give basic information for the derating of Standard Parts. The specified derating percentages and notes will assist the designer in obtaining reliable operation of parts used in space equipment. It must be emphasized that the user should evaluate all parts to the project requirements and assure that adequate deratings are accomplished. These recommended derating factors are based on the best information currently available.

1.2 Derating Factors. The derating factors contained herein, when multiplied by the maximum rating, indicate the maximum recommended stress values and do not preclude further derating. When derating, the designer must first take into account the specification environmental and operating condition rating factors, consider the actual environmental and operating conditions of the application, then apply the recommended derating factor contained herein. Parts not appearing in these guidelines are lacking in empirical data and failure history. Since the operating characteristics for such parts cannot be guaranteed, it is a good policy to derate generously so as to provide an additional margin of safety. Where parts are listed, but are not given a specific derating value, a good practice should also be to derate generously. The derating instructions are listed for each commodity in the following paragraphs.

1.2.1 Capacitors. The derating factors for capacitors are tabulated below:

Type	Derating Factor 1/	Parameter	Applicable Notes
Ceramic (CCR, CKR, and CDR)	.60	Voltage	2/,3/, 4/
Glass (CYR)	.50	Voltage	2/,3/
Film (CRH)	.60	Voltage	2/,3/
Tantalum			
Foil (CLR)	.50	Voltage	2/,3/,5/
Wet slug (CLR)	.60	Voltage	2/,3/
Solid (CSR, CWR)			
>1 ohm/volt	.50	Voltage	2/,6/,3/
<1 ohm/volt	.40	Voltage	2/,3/,6/

1/ Multiplier of rated voltage to determine maximum operating voltage.

2/ The derating factors should be applied to the maximum rating of the applicable ER specification.

3/ The derated voltage applies to the sum of the peak ac voltage and the dc polarizing voltage

4/ For low voltage applications (<10 volts dc), it is recommended that capacitor rated voltage should be at least 100 volts dc.

5/ Ambient temperature should not exceed 70°C.

6/ Ambient temperature should not exceed 50°C.

1.2.2 Microcircuits. The derating factors for microcircuits are tabulated below:

LINEAR MICROCIRCUITS

Parameters	Diff Ampl (Oprnl)	Compara-tors	Sense Ampl	Current Ampl	Voltage Reg	Analog Switches
Supply voltages	.80	.90	.80	.80		.90
Power dissipation (percent of rated power at maximum operating temperature)	.75	.75	.75	.75	.80	.80
Ac input voltage (percent of rated ac voltage at actual supply voltage)	1.00	1.00	1.00	1.00		
Differential dc input input voltage	.30 1/	.30 1/	.70			
Single-ended dc input voltage				.80	.90	
Signal voltage referenced to negative supply voltage						.80
Input-output voltage differential					.80	
Output ac voltage	1.00			1.00		
Open collector (or drain) dc output voltage		.90	.90			
Operating ac or dc output current	.80	.80	.80	.80	.80 2/	.80
Maximum short-circuit output current sent by external means	.90	.90	.90	.90	.90	

NOTES:

1/ Should not exceed the BV_{EBO} of the transistors in the input circuit.
2/ 50 percent of rated current for two terminal regulators.

DIGITAL MICROCIRCUITS

Parameters	TTL	LP TTL	NMOS CMOS	Line Drivers and Receivers
Supply voltages	1/	1/	.70 2/	1.00 3/
Power dissipation (percent of rated power at maximum operating temperature)	.80 4/	.80 4/	.80	.80
Differential dc input voltage				1.00 3/
Single-ended dc input voltage	1.00	3/ 5/ 1.00	.50 2/	1.00 3/
Open collector (or drain) dc output voltage	.80	.80		.75
Operating ac or dc output current	.80 2/	.80 2/	.80 2/	.80

NOTES:

1/ Manufacturer's recommended operating voltages should be used.

2/ Further derating may be required for radiation environments (i.e., minimum Vcc to insure minimum dc reference for transients).

3/ Use 1.00 when used with digital logic families and 0.75 when used with analog logic families.

4/ Derating factor applicable to 85°C maximum or junction temperature less than 125°C.

5/ Transient input currents caused by the below-zero portion of ringing waveforms shall be limited to 2 mA. This condition may occur where LPTTL is driven by standard TTL.

1.2.3 Resistors. The derating factors for resistors are tabulated below:

Type	Derating Factor 1/	Parameter	Applicable Notes
Fixed			
Carbon composition	.60	Power	2/,3/
Film (high-stability and metal)	.60	Power	2/,3/
Wirewound, power, chassis mount	.60	Power	2/,3/
Wirewound, precision			
1.0%	.60	Power	2/,3/
0.1%	.25	Power	2/,3/
0.01%	.25	Power	2/,3/
Wirewound, power	.60	Power	2/,3/
Adjustable			
Wirewound	.70	Rated current	2/,3/,4/,5/
Non-wirewound	.70	Rated current	2/,3/,4/,5/
Networks	.60	Power	2/,3/
Thermistors	.50	Power	2/,3/,6/

NOTES:

1/ Under no conditions should the applied voltage exceed the values specified.

2/ The maximum voltage for all resistors should be no more than 80 percent of the MIL-ratings or 80 percent of $E = \sqrt{PR}$, whichever is less,
where:
E = Max applied voltage (dc or rms) (in volts)
P = Derated power (in watts)
R = The resistance of that portion of the element actually active in the circuit.

3/ High-density packaging may require further derating if ambient temperatures are increased.

4/ Rated current is defined as $I_R = \sqrt{\frac{P_{max}}{R_{max}}}$, and by limiting the current to 0.70 rated current, power is limited to 0.5 maximum power.

5/ Adjustable resistors. The actual voltage which may be impressed across these resistors is determined by $E = \sqrt{PR}$.

6/ Thermistors used in other than zero power applications should also have minimum wattage specified for the application.

1.2.4 Semiconductors. The derating factors for semiconductors (diodes and transistors) are tabulated below:

Device Type	Derating		Applicable Notes
	Factors	Parameters	
DIODES			
General purpose, rectifiers, switching, and SCR	.50 .50 .50	PIV Surge current Forward current	1/
Varactor	.75 .75	PIV Operating current	
Voltage regulator and voltage reference	2/	Zener current	1/,2/
TRANSISTORS			
General purpose, power, and switching	.50 .75 .75	Power Current Voltage	1/,3/ 4/

NOTES:

1/ Junction temperature should not exceed +125°C.

2/ Zener current should be limited to no more than $I_Z = I_Z$ nom $[+0.5(I_Z$ max $-I_Z$ nom$)]$.

3/ Worst-case combination at dc, ac, and transient voltages should be no greater than the derated limit.

4/ For power MOSFET devices, derate gate-to-source voltage to 60 percent of maximum rated voltage.

1.2.5 Transformers. The derating factors for transformers are tabulated below:

Class		Maximum Operating Parameters	
MIL-T-27	MIL-T-21038	Temperature 1/	Voltage
Q	Q	65°C	50% of maximum rated voltage
R	R	85°C	
S	S	105°C	

NOTES:

1/ a) Maximum operating temperature equals ambient temperature plus temperature rise of +10°C (allowance for hot spot). Compute temperature rise as follows:

$$\text{Temperature rise (°C)} = \frac{R-r}{r}(T + 234.5) - (T - t)$$

Where R = winding resistance under load
r = no-load winding resistance at ambient temperature T (°C)
t = specified initial ambient temperature (°C)
T = maximum ambient temperature (°C) at time of power shutoff. (T) shall not differ from (t) by more than 5°C.

b) The insulation classes of MIL style inductive parts have maximum operating temperature ratings which are generally based upon a life expectancy of at least 10,000 hours. The maximum operating temperatures in this table are selected to extend the life expectancy to 50,000 hours.

c) Custom-made inductive devices shall be evaluated on a materials basis and stressed at levels below the maximum rated operating temperature for the materials used. Devices having a maximum rated operating temperature in the range of 85°C to 130°C, shall be derated as follows: maximum operating temperature (°C) equals 0.75 times maximum rated operating temperature (°C). For devices with maximum rated temperatures outside this temperature interval, consult the project parts engineer for temperature derating recommendations.

1.2.6 Inductors/Coils. The derating factors for inductors/coils are tabulated below:

Class		Maximum Operating Parameters	
MIL-C-39010	MIL-C-15305	Temperature 1/	Voltage
-	0	65°C	50% of maximum rated voltage
A	A	85°C	
B	B	105°C	

NOTES:

1/ a) Maximum operating temperture equals ambient temperature plus temperature rise +10°C (allowance for hot spot). Compute temperature rise as follows:

$$\text{Temperature rise (°C)} = \frac{R-r}{r} (T + 234.5)$$

Where R = winding resistance under load
r = no-load winding resistance at ambient temperature T (°C)

b) The insulation classes of MIL style inductive parts have maximum operating temperature ratings which are generally based upon a life expectancy of at least 10,000 hours. The maximum operating temperatures in this table are selected to extend the life expectancy to 50,000 hours.

c) Custom-made inductive devices shall be evaluated on a materials basis and stressed at levels below the maximum rated operating temperature for the materials used. Devices having a maximum rated operating temperature in the range of 85°C to 130°C shall be derated as follows: maximum operating temperature (°C) equals 0.75 times maximum rated operating temperature (°C). For devices with maximum rated temperatures outside this temperature interval, consult the project parts engineer for temperature derating recommendations.

1.2.7 EMI Filters. The derating factors for EMI filters are tabulated below:

Class	Derating	Maximum Ambient Temperature
All	.50 of rated current .50 of rated voltage	85°C

1.2.8 Connectors. The derating factors for connectors are tabulated below:

Number of Contacts Used in Connector	Contact Size	Maximum Current Per Contact 1/ (amperes) Wire Size (AWG)							Maximum Operating Voltage
		16	18	20	22	24	26	28	
1 to 4	16	13.0	9.2	6.5					25 percent of rated dielectric with standby voltage
1 to 4	20			6.0	4.5	3.3			
1 to 4	22				4.5	3.3	2.5	1.8	
5 to 14	16	9.0	7.0	5.0					
5 to 14	20			5.0	3.5	2.7			
5 to 14	22				3.5	2.7	1.9	1.4	
15 or more	16	6.5	5.0	3.7					
15 or more	20			3.7	2.5	2.0			
15 or more	22				2.5	2.0	1.4	1.0	

NOTE:

1/ Maximum current may be carried by 10 percent of the contacts at one time. At such time, other contacts should be limited to 100 mA.

1.2.9 Fuses. The derating factors for fuses are tabulated below:

Fuse Current Rating (amperes)	Derating Factor	Parameter	Remarks
15 10 5 2 1 1/2 3/8 1/4 1/8	.50 .50 .50 .50 .45 .40 .35 .30 .25	Rated amperes 1/	Derating of fuses allows for possible loss of pressure, which lowers the blow current rating and allows for a decrease of current capability with time.

NOTE:

1/ Derating factors are based on data from fuses mounted on printed circuit boards and conformally coated. For other type mountings, consult the project parts engineer for recommendations.

1.2.10 Wire and Cable. The derating factors for wire and cable are tabulated below:

Wire Size (AWG)	Derate to___Amperes Maximum		Remarks
	Bundle or Cable	Single	
30	0.7	1.3	1. Current ratings for bundles or cables are based on bundles of 15 or more wires at 70°C in a hard vacuum. For smaller bundles, the allowable current may be proportionally increased as the bundle approaches a single wire. 2. Ratings are based on Teflon-insulated wire (Type TFE).
28	1.0	1.8	
26	1.4	2.5	
24	2.0	3.3	
22	2.5	4.5	
20	3.7	6.5	
18	5.0	9.2	
16	6.5	13.0	
14	8.5	19.0	
12	11.5	25.0	
10	16.5	33.0	
8	23.0	44.0	
6	30.0	60.0	
4	40.0	81.0	
2	50.0	108.0	
0	75.0	147.0	
00	87.5	169.0	

1.2.11 Relays. The factors provided pertain only to contact loads, and they are intended for derating specified loads established in the governing specifications (resistive, inductive, motor, and/or lamp loads). The users are cautioned to use the contact voltages and nominal coil voltages (currents) prescribed in the governing specifications. Utilization of reduced coil voltages and abnormal contact voltages can potentially reduce the life of the relay and compromise relay operation.

Derating parameters are based on the following factors:

A. Ambient operating temperature (Table T). This table considers the temperature extremes under which the relay may function.

B. Cycle rate per hour (Table R). This table defines a derating factor for nominal cycle rate.

C. Load application rate (Table L). This table establishes three categories of load application. They are:

1. Load A. Make, break and/or carry loads with an on time duration of 0 to 500 milliseconds. Off-time is equal to or greater than on-time.

2. Load B. Carry only loads. Relay does not make or break the load. Maximum on-time is 5 minutes. Off-time is equal to or greater than on-time

3. Load C. Make, break and/or carry. Those loads that do not fall into the category of loads A through B.

TABLE T

Temp Range	-65° to -21°C	-20° to +39°C	+40° to +84°C	+85° to +125°C
Factor	0.85	1.0	0.85	0.7

TABLE R

	Cycle Rate Per Hour		
Cycle rate	<1.0	1.0 to 10	>10
Factor	0.85	0.9	0.85

TABLE L

Load Application	A	B	C
Factor	1.0	1.5	0.8

The steps for load derating are:

1. Select the appropriate load (resistive, inductive, motor, or lamp) and rating from the military specification. Assume the relay being utilized is MS27400-5, and the type of load is motor. From the specification, the motor load is 4 amperes.
2. Determine the temperature range in the application. Select the appropriate factor from Table T.
3. Determine the cycle rate in the application. Select the appropriate factor from Table R.
4. Determine the load application. Select the appropriate factor from Table L.
5. Calculate the derated load by multiplying the various factors together. Using the number from item 1 above, derated load = 4 X T X R X L

Other examples are as follows:

Example 1: A 1.0 amp relay is operated in an environment with a temperature range of 25° to 70°C. The relay is cycled at a rate of 5 cycles per hour. The load application is make, break, and carry of a resistive load.

The worst case temperature is 70°C. From Table T select 0.85.

The cycle rate is 5 cycles/hour. From Table R select 0.9.

The load application is specified as make, break, and carry, from Table L select 0.8.

Relay derating factor is T x R x L = 0.85 x 0.9 x 0.8 = 0.612. The derated contact load is 0.612 x 1.0 = 0.612 amp resistive load.

Example 2: A 10 amp relay is operated in an environment with a temperature range of -40° to +35°C. The relay is turned on for 3 minutes every 2 hours. The load application is carry only (resistive load).

From Table T select 0.85
From Table R select 0.85
From Table L select 1.5

Load derating factor = 0.85 x 0.85 x 1.5 = 1.08.

The derated contact load is 1.08 x 10 = 10.8 amps resistive load.

NOTE: Although the relay is a 10 amp rated relay, the derated load capability is 10.8 amps when the unique application is considered.

Example 3: The relay utilized in example 1 will be used to switch a lamp load. From the governing specification, the lamp load capability is 0.1 amp. Utilizing the derating factor calculated in example 1, the derated contact load
= T x R x L x specified lamp load in amps
= 0.612 x 0.1 = 0.061 amp lamp load.

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APPENDIX B

GENERAL REQUIREMENTS FOR UPGRADING GRADE 2 DEVICES FOR USE IN GRADE 1 APPLICATIONS AND ADDITIONAL TESTING REQUIREMENTS FOR GRADE 1 PARTS

1.0 SCOPE

This appendix contains general requirements for upgrading Grade 2 parts to be used in Grade 1 applications and additional testing requirements for Grade 1 parts.

2.0 GENERAL

2.1 Introduction. To support the designs required by NASA Programs, this Standard Parts List includes parts that are only available as Grade 2. Before the parts can be used in a Grade 1 application, they must be upgraded to the requirements specified in this appendix for that commodity. Grade 2 parts shall not be upgraded if Grade 1 parts are available. If a commodity is not referenced in this appendix, no upgrading of quality levels in that commodity is allowed.

The requirements listed are the minimum required to reduce the risk of using parts in the system that initially do not meet Grade 1 requirements. Therefore, the specified screens must be fully complied with in order to upgrade a part to Grade 1.

On completion of the screening requirements, the parts shall be marked uniquely so that they may be easily identified once assembled into the equipment.

2.2 Marking. Upon successful completion of these upgrading requirements, each part shall be permanently and legibly marked with a NU (NASA Upgrade), except when the contractor utilizes a Specification Control Drawing (SCD) to implement these requirements and specifies a unique marking, so that the part may be identified and controlled. The marking shall be legible (with a contrasting color), nontoxic, and permanent such that it meets the resistance-to-solvents requirements of MIL-STD-883, Method 2015.

Part documentation shall reflect the successful completion of the upgrading requirements.

Alternate methods of part upgrading identification shall be approved by the NASA Project Engineer.

3.0 GENERAL REQUIREMENTS FOR UPGRADING GRADE 2 PARTS FOR GRADE 1 APPLICATIONS

3.1 Transistors and Diodes. The requirements for upgrading transistors and diodes are tabulated in Table 3.1.

3.2 Microcircuits. The requirements for upgrading microcircuits are tabulated in Table 3.2.

3.3 Transformers. The requirements for upgrading transformers are tabulated in Table 3.3.

3.4 Resistor Networks. The requirements for upgrading resistor networks (MIL-R-83401) are tabulated in Table 3.4.

4.0 ADDITIONAL TESTING REQUIREMENTS

4.1 Capacitors, Fixed, Tantalum (Solid) Electrolytic, (CSR). Each part shall be subjected to a surge current test of five charge-discharge surge current cycles of at least 1 second each per cycle at 25°C, -55°C, and +85°C and maximum rated voltage. 1/ The surge current test circuit shall comply with the following conditions:

A. The power supply used for charging the capacitors shall be capable of supplying a regulated direct voltage, variable from 0 to 150 volts, at a 15 amp minimum current capability.

B. The energy storage bank shall be placed across the dc-power supply. It shall consist of parallel aluminum electrolytic capacitors having an aggregate capacitance of 100,000 µf, -0, +30 percent, rated at 150 volts dc working or higher.

C. A 30-ampere mercury relay shall be used to switch the capacitor under test to the energy bank for charge and into a short circuit for discharge.

D. The total resistance of all wiring between the energy source and the capacitors under test, including the mercury relays but excluding fuses, shall not exceed 0.1 ohm.

E. The fuses in the test circuit shall have a rating of not less than 1 amp, nor more than 5 amp. A fuse shall be placed in series with each capacitor undergoing the surge current test. Each fuse shall have a maximum resistance of not more than 0.2 ohm.

F. A capacitor under test shall be considered a failure either when a fuse blows or the dc leakage current is exceeded or both.

4.2 Capacitors, Fixed, Ceramic, (CCR, CKR, and CDR). Parts shall meet the destructive physical analysis criteria given in Table IX, Group A Inspection, of MIL-C-123, and the humidity, steady state, low voltage criteria given in table X, Group B Inspection of MIL-C-123.

1/ Definition of surge current (inrush current) is the peak current, for a given duration, that the capacitor will receive from the turn-on of a bank of 100,000 µf aluminum electrolytic capacitors charged to the rated voltage of a given capacitor under test with a maximum series resistance of less than or equal to 0.3 ohm including the mercury relay, fuse, and wire.

TABLE 3.1. Requirements for Upgrading Transistors and Diodes for Use in Grade 1 Applications 1/

DPA

Destructive Physical Analysis (DPA) 2/, 3/	5 pieces for JANTXV - with zero rejects. 10 pieces for JANTX - with zero rejects.

SCREENING PER MIL-S-19500 — Test 100%

Screen	MIL-STD-750 Method	Requirement
1. Thermal shock (temperature cycling) 4/	1051	No dwell at 25°C; 20 cycles total with > 10 minutes at extremes.
2. Particle impact noise detection (for all devices with an internal cavity)	2052	Condition A or B.
3. Instability 5/ (a) Forward instability shock test (FIST) (b) Backward instability shock test (BIST)	2081	5 shocks of 1500 g min (1/2-ms rise time) in each of two mutually perpendicular planes, monitored continuously during shock. Vibration at 60 ±30 Hz, 0.1-inch min displacement for 30 seconds min monitored continuously during vibration.
4. Serialization	--	--
5. Interim electrical parameters	--	JANS interim electrical parameters per detail spec (read and record)
6. High-temperature reverse bias (HTRB) 6/	--	48 hrs min at T_A = 150°C min and min applied voltage as follows:
Burn-in (for transistors)	1039	Transistor - 80% min of rated V_{CB} (bipolar) or V_{GS} (FET), V_{GS} (MFET), as applicable.
Burn-in (for diodes and rectifiers)	1038	Diodes (except zeners) and rectifiers - rated < 10 amps at T_C > 100°C - 80% (min) of rated V_R. For all others, use test condition A (rated working peak reverse voltage).
7. Interim electrical and delta parameters (delta parameters shall be measured first)	--	JANS interim electrical parameters and deltas within 12 hours after removal of applied voltage per detail spec except a PDA of 5% on electricals and deltas (read and record).
8. Power burn-in 7/	--	Per JANS detail spec
Burn-in (for transistors)	1039	Transistors (168 hours min).
Burn-in (for diodes and rectifiers)	1038	Diodes (including zeners) and all rectifiers (168 hours min.)
Burn-in (for thyristor-controlled rectifiers)	1040	Thyristors (168 hours min).
9. Final electrical test (a) Interim electrical and delta parameters for PDA	--	Per JANS electrical and delta, with a PDA of 3%. All parameter measurements must be completed within 96 hrs after removal from burn-in conditions.
10. Radiography	2076.1	--
11. Hermetic seal 8/ (a) Fine 2/ (b) Gross	1071.1	-- (a) Test conditions G or H, max leak rate = 5×10^{-8} atm cc/s except 5×10^{-7} atm cc/s for devices with internal cavity > 0.3cc. (b) Test conditions A, C, D, E, or F.
12. Visual examination	2071	--

GROUP B PER MIL-S-19500

The following subgroups of Table IVa shall be performed per the LTPD specified:
Subgroup 4, Intermittent Operating Life, and the electrical parameters per JANS Detail Spec.

MARKING

A unique marking to signify compliance with these requirements. See para 2.2.

NOTES:
1/ JANTX and JANTXV diodes and JANTXV transistors require no rescreening to MIL-S-19500 Detail Specifications prior to upgrading to Grade 1. JANTX transistors shall not be upgraded for use in Grade 1 applications. For Grade 2 parts, the tests that have already been performed as part of the Grade 2 rescreen need not be repeated as part of the upgrade to Grade 1.
2/ Omit this test for metallurgically bonded, double plug diodes.
3/ Use MIL-STD-883, Method 5009, and the applicable test methods of MIL-STD-750.
4/ For axial-lead, glass-body diodes, 10 cycles of thermal shock (glass strain) in accordance with MIL-STD-750, Method 1056, Test Condition A, over the temperature range of 0° to 100°C shall be substituted for this test.
5/ Omit FIST and BIST tests for metallurgically bonded double-slug or stud-mounted diodes. Omit FIST test for temperature-compensated reference diodes.
6/ Zener diodes shall be subjected to HTRB at 80% of nominal V_Z for V_Z > 10 V. Omit test for devices with V_Z < 10 V.
7/ Reverse blocking test shall replace power burn-in for power rectifier at > 10 amp rating at T_C > 100°C and all thyristors.
8/ Omit this test for painted glass diodes.

TABLE 3.2. Requirement for Upgrading Grade 2 Microcircuits for use in Grade 1 Applications

DPA

Destructive Physical Analysis (DPA), MIL-STD-883, Method 5009

SCREENING PER MIL-STD-883, METHOD 5004.5 (All test to 100%)

Screen	Method	Requirements 1/
1. Particle impact noise detection (PIND)	2020	Test condition A or B.
2. Radiographic	2012	Two views.
3. Serialization	--	100%.
4. Interim (pre burn-in) electrical parameters	--	2/
5. Burn-in test	1015 3/	160 hrs at +125°C min
6. Interim (post burn-in) electrical parameters		2/ PDA of 5% on electricals and deltas.
7. Reverse bias burn-in	1015 3/	Test condition A or C, 75 hrs at 150°C min.
8. Final electrical and deltas		2/
9. Seal test (a) Fine (b) Gross	1014	Reject criteria per test method.

GROUP B PER MIL-STD-883, METHOD 5005.7

Subgroup	Method	Requirements
1(b) Internal water-vapor content	1018	On glass-frit-sealed packages only.
6(a) Electrical parameters	--	Per detail spec class S requirements.
6(b) Temp cycling	1010	Condition C, 100 cycles, minimum.
6(c) Constant acceleration	2001	Test Condition E, Y_1 orientation only.
6(d) Seal - fine and gross	1014	--
6(e) Electrical parameters	--	Per detail spec class S requirements.

MARKING

A unique marking to signify compliance with these requirements. See para 2.2.

NOTES:

1/ Except as stated below, the requirements shall be per Class S of applicable MIL-M-38510 detail specifications.

2/ Electrical parameters shall be read and recorded.

3/ Test condition f of Method 1015 shall not apply.

TABLE 3.3. Requirements for Upgrading Grade 2 Transformers for use in Grade 1 Applications

TRANSFORMER SCREENING PER MIL-STD-202

Screen	Method	Requirements
1. Initial measurements	--	1. Visual examination. 2. Dielectric withstanding voltage (DWV). 3. Induced voltage. 4. Insulation resistance (IR). 5. DC resistance (DCR) of each winding. 6. Primary inductance (L). 7. Turns ratio.
2. Thermal shock	Method 107. Test Condition A-1.	Use maximum temperature specified for transformer as maximum temperature. Transformer should be monitored for continuity on the last two cycles.
3. Burn-in	Not required.	--
4. Seal leak test 1/	Method 112. Test Condition C for fine leak. Test Condition D for gross leak.	Use maximum temperature specified for transformer as bath temperature.
5. Final measurements and tests	--	Repeat initial examination and measurements. Reject criteria: L> ±3% for powered toroids cores, gapped E, H, U/I, and pot cores. L> ±10% for ungapped E, H, U/I, and pot cores. DCR > ±3%. DWV < min specified. IR < min specified. Turns ratio must equal specified value.

LOW POWER PULSE TRANSFORMER SCREENING PER MIL-T-21038

1. Initial measurements	--	1. Visual examination. 2. Dielectric withstanding voltage (DWV). 3. Induced voltage. 4. Insulation resistance (IR). 5. DC resistance (DCR). 6. Open circuit inductance (OCL), 7. Leakage inductance. 8. Turns ratio.
2. Thermal shock	--	Not required.
3. Burn-in	MIL-T-21038 para 4.7.2 (Gross leak test)	--
4. Seal leak test	MIL-T-21038 para 4.7.5	--
5. Final measurements and tests	--	Repeat initial measurements and examinations. Measure turns ratio and waveform (rise time, overshoot, droop, backswing, decay time). Reject criteria: DCR > ±3%. DWV < min specified. IR < min specified. Turns ratio must equal specified value. Waveform parameters must not exceed the specified maximums.

MARKING

A unique marking to signify compliance with these requirements. See para 2.2.

NOTES:
1/ Do not perform these tests on encapsulated units.

TABLE 3.4. Requirements for Upgrading Grade 2 Resistor Networks (MIL-R-83401) for Use in Grade 1 Applications

SCREENING PER MIL-STD-202 (100%)

Screen	Method	Requirements
Thermal shock	107 T.C. B	Paragraph 4.6.3 of MIL-R-83401.
Burn-in	108	MIL-R-83401 (150 hours).
Electrical	MIL-R-83401 Group A	Shall be within spec limits before and after screen.

MARKING

A unique marking to signify compliance with these requirements. See para 2.2.

Custodian:

NASA-NA

Preparing Activity:

NASA-NA

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