INCH-POUND
MIL-M-38510/110C
19 August 2003
SUPERSEDING
MIL-M-38510/110B
11 September 1989

MILITARY SPECIFICATION

MICROCIRCUITS, LINEAR, QUAD OPERATIONAL AMPLIFIERS, MONOLITHIC SILICON

Reactivated after 20 August 2003 and may be used for either new or existing design acquisitions.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product herein shall consist of this specification sheet and MIL-PRF-38535.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for monolithic silicon, quad operational amplifiers. Two product assurance classes and a choice of case outlines and lead finish are provided for each type and are reflected in the complete part number. For this product, the requirements of MIL-M-38510 have been superseded by MIL-PRF-38535, (see 6.3).

1.2 Part number. The complete part number should be in accordance with MIL-PRF-38535.

1.2.1 Device types. The device types are internally compensated and should be as shown as follows:

Device type	Circuit
01 1/	Quad operational amplifier, medium power
02 2/	Quad operational amplifier, medium power, under compensated version of device type 01
03	Quad operational amplifier, medium speed, low noise
04	Quad operational amplifier medium speed, low noise (alternate pin out)
05 3/	Quad operational amplifier, single supply, low power
06 3/	Quad operational amplifier, single supply, low power

1.2.2 Device class. The device class should be the product assurance level as defined in MIL-PRF-38535.

1/ Devices may be monolithic or they consist of two separate independent die.
2/ Device type 02 wideband amplifier is under compensated and can only be used with a closed loop gain of five or greater.
3/ Device types 05 and 06, single supply amplifiers, can be used with dual supplies, however, because of its class B output stage, the crossover distortion in the output signal may be unacceptable for the application.

Comments, suggestions, or questions on this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAS, 3990 East Broad St., Columbus, OH 43216-5000, or emailed to linear@dscc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

AMSC N/A FSC 5962

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.2.3 Case outlines. The case outlines should be designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
A 4/	GDFP5-F14 or CDFP6-F14	14	Flat pack
C	GDIP1-T14 or CDIP2-T14	14	Dual-in-line
D	GDFP1-F14 or CDFP2-F14	14	Flat pack
Z	GDFP1-G14	14	Flat pack with gullwing leads

1.3 Absolute maximum ratings.

Supply voltage range :
  Device types 01, 02, 03, and 04 .... ±22 V dc 5/
  Device types 05 and 06 .... 36 V or ±18 V 5/
Input voltage range:
  Device types 01, 02, 03, and 04 .... ±20 V dc 6/
  Device types 05 and 06 .... -V_{CC} – 0.3 V to +V_{CC}
Differential input voltage range .... ±30 V dc 7/
Input current range:
  Device types 01 and 02 .... -0.1 mA to +10 mA
  Device types 03, 04, 05, and 06 .... 10 mA to +0.1 mA
Storage temperature range .... -65°C to +150°C
Output short-circuit duration .... Unlimited 8/
Lead temperature (soldering, 60 seconds) .... +300°C
Junction temperature (T_J) .... +175°C 9/
Thermal resistance, junction-to-case (θ_{JC}) :
  Cases A, C, D, and Z .... See MIL-STD-1835

1.4 Recommended operating conditions.

Supply voltage range:
  Device types 01, 02, 03, and 04 .... ±5 V dc to ±20 V dc
  Device types 05 and 06 .... ±5 V dc to +30 V dc
Ambient temperature range (T_A) .... -55°C to +125°C

4/ Inactive package case outline.
5/ Voltages in excess of these may be applied for short-term tests if voltage difference does not exceed 44 volts (36 volts for device types 05 and 06).
6/ For device types 01 through 04, for supply voltages less than ±20 V dc, the absolute maximum input voltage is equal to the supply voltage. For device types 05 and 06, for supply voltages differences of less than 36 V, the absolute maximum input voltage is equal to the supply voltage.
7/ The differential input voltage range should not exceed the supply voltage range.
8/ Short circuit may be to ground or either supply. Rating applies to +125°C case temperature or +75°C ambient temperature.
9/ For short term test (in the specific burn-in and life test configuration when required and up to 168 hours maximum) T_J = +275°C.

1.5 Power and thermal characteristics.

Case outlines	Maximum allowable power dissipation	Maximum θ_{JC}	Maximum θ_{JA}
A, D	350 mW at T_A = +125°C	60°C/W	140°C/W
C	400 mW at T_A = +125°C	35°C/W	120°C/W
Z	350 mW at T_A = +125°C	25°C/W	176°C/W still air
			116°C/W 500 LFPM

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-38535 - Integrated Circuits (Microcircuits) Manufacturing, General Specification for.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-883 - Test Method Standard for Microelectronics.
MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein the text of this document shall takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Microcircuits furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturers list before contract award (see 4.3 and 6.4).

3.2 Item requirements. The individual item requirements shall be in accordance with MIL-PRF-38535 and as specified herein or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein.

3.3.1 Terminal connections. The terminal connections shall be as specified on figure 1.

3.3.2 Schematic circuits. The schematic circuits shall be maintained by the manufacturer and made available to the qualifying activity and the preparing activity upon request upon request.

3.3.3 Case outlines. The case outlines shall be as specified in 1.2.3.

3.3.4 Packaging and sealing material. Package and sealing material shall be in accordance with MIL-PRF-38535.

3.4 Lead material and finish. Lead material and finish shall be in accordance with MIL-PRF-38535.

3.5 Electrical performance characteristics. The following electrical performance characteristics are as specified in table I, and apply over the full ambient operating temperature range of -55°C to +125°C and for supply voltages as follows.

Unless otherwise specified, source resistance (R_S) shall be 50 Ω for all tests.

Device types 01, 02, 03, and 04 will have a dual power supply with $\pm V_{CC}$ (min) at ±5 V and $\pm V_{CC}$ (max) at ±20 V.

Device types 05 and 06 will have a single power supply with $\pm V_{CC}$ (min) at ±5 V and $\pm V_{CC}$ (max) at ±30 V.

3.5.1 Instability oscillations. The devices shall be free of oscillations when operated in the test circuits of this specifications.

3.6 Electrical test requirements. Electrical test requirements for each device class shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table III.

3.7 Marking. Marking shall be in accordance with MIL-PRF-38535.

3.8 Microcircuit group assignment. The devices covered by this specification shall be in microcircuit group number 49 (see MIL-PRF-38535, appendix A).

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_A \le +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input offset voltage	V_{IO}	1/	1	01,02, 04,05		±5	mV
				03		±3	
				06		±2	
			2,3	01,02, 04		±6	
				03		±5	
				05		±7	
				06		±4	
Input offset voltage temperature sensitivity	$\Delta V_{IO} / \Delta T$		2	01,02, 04		±25	µV/°C
				03		±20	
				05,06		±30	
			3	01,02, 04		±25	
				03		±20	
				05,06		±30	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions $-55°C \leq T_A \leq +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input offset current	I_{IO}	$R_S = 50\ \Omega$ 1/	1,2	01,02		±25	nA
				03,05		±30	
				04		±75	
				06		±10	
			3	01,02, 03,05		±75	
				04		±150	
				06		±30	
Input offset current temperature sensitivity	$\Delta I_{IO} / \Delta T$		2	01,02, 03		±200	pA/°C
				04		±500	
				05,06		±400	
			3	01,02		±400	
				03		±500	
				04		±1000	
				05,06		±700	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions $-55°C \le T_A \le +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input bias current	$+I_{IB}$	$R_S = 20\ k\Omega$ 1/	1,2	01,02	-0.1	100	nA
				03	-200	+0.1	
				04	-250	+0.1	
				05	-150	+0.1	
				06	-50	+0.1	
			3	01,02	-0.1	325	
				03	-325	+0.1	
				04	-400	+0.1	
				05	-300	+0.1	
				06	-100	+0.1	
	$-I_{IB}$		1,2	01,02	-0.1	100	
				03	-200	+0.1	
				04	-250	+0.1	
				05	-150	+0.1	
				06	-50	+0.1	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions $-55°C \leq T_A \leq +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input bias current	$-I_{IB}$	R_S = 20 kΩ 1/	3	01,02	-0.1	325	nA
				03	-325	+0.1	
				04	-400	+0.1	
				05	-300	+0.1	
				06	-100	+0.1	
Power supply rejection ratio	+PSRR	$+V_{CC}$ = 10 V, $-V_{CC}$ = -20 V	1,2,3	01,02, 03,04		±100	µV/V
		$+V_{CC}$ = 30 V to 5 V		05,06		±100	
	-PSRR	$+V_{CC}$ = 20 V, $-V_{CC}$ = -10 V		01,02, 03,04		±100	
Input voltage common mode rejection	CMR	V_{CM} = 30 V 2/	1,2,3	01,02, 03,04	76		dB
		V_{CM} = 28 V 2/		05,06	76		
Output short-circuit current (for positive output)	$I_{OS}(+)$	$\pm V_{CC}$ = ±15 V, 3/ t ≤ 25 ms, only one amplifier shorted to GND at one time	1,2	01,02	-55		mA
				03,04	-80		
		$\pm V_{CC}$ = 30 V, 3/ t ≤ 25 ms, only one amplifier shorted to GND at one time		05,06	-70		
		$\pm V_{CC}$ = ±15 V, 3/ t ≤ 25 ms, only one amplifier shorted to GND at one time	3 4/	01,02	-75		
				03,04	-80		
		$\pm V_{CC}$ = 30 V, 3/ t ≤ 25 ms, only one amplifier shorted to GND at one time		05,06	-70		

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions -55°C ≤ T_A ≤ +125°C see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output short-circuit current (for negative output	$I_{OS}(-)$	±V_{CC} = ±15 V, 3/ t ≤ 25 ms, only one amplifier shorted to GND at one time	1,2	01,02		55	mA
			3 4/	01,02		75	
				03,04		80	
Supply current	I_{CC}	±V_{CC} = ±15 V 5/	1,2	01,02		+3.6	mA
				03		+7	
				04		+11	
		+V_{CC} = 30 V 5/		05,06		+3	
		±V_{CC} = ±15 V 5/	3	01,02		+4.5	
				03		9	
				04		+13	
		V_{CC} = 30 V 5/		05,06		+4	
Output voltage swing (maximum)	+V_{OP}	±V_{CC} = ±20 V, R_L = 10 kΩ	4,5,6	01,02, 03,04	+16		V
		V_{CC} = 30 V, R_L = 10 kΩ		05,06	+27		
		±V_{CC} = ±20 V, R_L = 2 kΩ		01,02, 03,04	+15		
		V_{CC} = 30 V, R_L = 2 kΩ		05,06	+26		
	-V_{OP}	±V_{CC} = ±20 V, R_L = 10 kΩ		01,02, 03,04		-16	
		±V_{CC} = ±20 V, R_L = 2 kΩ		01,02, 03,04		-15	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions $-55°C \leq T_A \leq +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Single ended open loop voltage gain 6/	$A_{VS}(+)$	$\pm V_O = \pm 15$ V, $R_L = 10$ kΩ	4	01,02, 03,04	50		V/mV
		$V_O = 1$ V to 26 V, $R_L = 10$ kΩ		05,06	50		
		$\pm V_O = \pm 15$ V, $R_L = 10$ kΩ	5,6	01,02, 03,04	25		
		$V_O = 1$ V to 26 V, $R_L = 10$ kΩ		05,06	25		
	$A_{VS(-)}$	$\pm V_O = \pm 15$ V, $R_L = 2$ kΩ	4	01,02, 03,04	50		
		$V_O = 5$ V to 20 V, $R_L = 2$ kΩ		05,06	50		
		$\pm V_O = \pm 15$ V, $R_L = 2$ kΩ	5,6	01,02, 03,04	25		
		$V_O = 5$ V to 20 V, $R_L = 2$ kΩ		05,06	25		
	A_{VS}	$\pm V_{CC} = \pm 5$ V, $V_O = \pm 2$ V, $R_L = 10$ kΩ and 2 kΩ	4	01,02, 03,04	10		
		$V_{CC} = 5$ V, $V_O = 1$ V to 2.5 V, $R_L = 10$ kΩ and 2 kΩ		05,06	10		
		$\pm V_{CC} = \pm 5$ V, $V_O = \pm 2$ V, $R_L = 10$ kΩ and 2 kΩ	5,6	01,02, 03,04	10		
		$V_{CC} = 5$ V, $V_O = 1$ V to 2.5 V, $R_L = 10$ kΩ and 2 kΩ		05,06	10		

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions -55°C ≤ T_A ≤ +125°C see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Low level output voltage	V_{OL}	$+V_{CC}$ = 30 V, R_L = 10 kΩ	4,5,6	05,06		35	mV
		$+V_{CC}$ = 30 V, I_{OL} = 5 mA				1.5	V
		$+V_{CC}$ = 4.5 V, I_{OL} = 2 µA				0.4	
High level output voltage	V_{OH}	$+V_{CC}$ = 30 V, I_{OH} = 10 mA	4,5,6	05,06	27		V
		$+V_{CC}$ = 4.5 V, I_{OH} = 10 mA	4,5		2.4		
			6		2.3		
Transient response rise time	$TR_{(tr)}$	$\pm V_{CC}$ = ±20 V, A_V = 1 7/ see figure 4	7,8A,8B	01,02		1.0	µs
				03		0.2	
				04		0.3	
		$\pm V_{CC}$ = ±20 V, A_V = 5 7/ see figure 4		01,02		1.0	
		$+V_{CC}$ = 30 V, A_V = 1 7/ see figure 4		05,06		1.0	
Transient response overshoot	$TR_{(OS)}$	$\pm V_{CC}$ = ±20 V, 7/ see figure 4	7,8A,8B	01,02		25	%
				03		35	
				04		50	
		$+V_{CC}$ = 30 V, 7/ see figure 4		05,06		60	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions $-55°C \le T_A \le +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Slew rate 9/	SR(+) and SR(-)	$\pm V_{CC} = \pm 20$ V, $A_V = 1$, see figure 5	7,8A,8B	01	+0.2		V/µs
				03	0.8		
				04	0.6		
		$\pm V_{CC} = \pm 20$ V, $A_V = 5$, see figure 5		02	0.8		
		$V_{CC} = 30$ V, $A_V = 1$, see figure 5		05,06	0.1		
Noise (broadband)	NI(BB)	$\pm V_{CC} = \pm 20$ V, $R_S = 50$ Ω, $T_A = +25°C$	9	01,02		15	µV rms
				03,04		5	
		$\pm V_{CC} = \pm 15$ V, $R_S = 50$ Ω, $T_A = +25°C$		05,06		15	
Noise (popcorn)	NI(PC)	$\pm V_{CC} = \pm 20$ V, $R_S = 20$ kΩ, $T_A = +25°C$	9	01,02		40	µV peak
				03,04		50	
		$\pm V_{CC} = \pm 15$ V, $R_S = 20$ kΩ, $T_A = +25°C$		05,06		50	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions $-55°C \leq T_A \leq +125°C$ see figure 2 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Channel separation	CS	$T_A = +25°C$, see figure 7	7	01,02, 03,04, 05,06, 07,08	80		dB

1/ Device types 01 to 04 shall be tested at $V_{CM} = 0$ V, +15 V, and –15 V with $\pm V_{CC} = \pm 20$ V; and at $V_{CM} = 0$ V with $\pm V_{CC} = \pm 5$ V. Device types 05 and 06 should be tested at $V_{CM} = -13$ V with $V_{CC} = 2$ V and $-V_{CC} = -28$ V; $V_{CM} = +15$ V with $+V_{CC} = 30$ V and $-V_{CC} = 0$ V; $V_{CM} = +1.4$ V with $V_{CC} = 5$ V and $-V_{CC} = 0$ V; $V_{CM} = -1.1$ V at $\pm V_{CC} = 2.5$ V.

2/ CMR is determined by measuring input offset voltage as follows:

Offset voltage condition	Device types						Units
	01 - 04			05 and 06			
	$+V_{CC}$	$-V_{CC}$	V_O	$+V_{CC}$	$-V_{CC}$	V_O	
1	35	-5	15	30	0	15	V
2	5	-35	-15	2	-28	-13	V

3/ Continuous limits will be considerably lower and apply for $-55°C \leq T_A \leq 25°C$.

4/ $I_{SO(+)}$ and $I_{SO(-)}$ limits for device type 01 only at $T_A = -55°C$ are –75 mA and 75 mA respectively.

5/ I_{CC} limits are the total for all four amplifiers at no load, connected as grounded followers.

6/ AVS(+) for device types 05 and 06 only.

7/ Device types 05 and 06 transient response is specified with the input pulse referenced to 5 V. For application purposes the device may be operated with the input referenced to ground, however, saturation effects will cause the response time to increase by approximately 50 percent.

TABLE II. Electrical test requirements.

MIL-PRF-38535 test requirements	Subgroups (see table III)	
	Class S devices	Class B devices
Interim electrical parameters	1	1
Final electrical test parameters 1/	1,2,3,4	1,2,3,4
Group A test requirements	1,2,3,4,5,6, 7,8	1,2,3,4,5,6, 7,8
Group B electrical test parameters when using the method 5005 QCI option	1,2,3,4,5,6, 7,8	N/A
Group C end point electrical parameters	1,2,3, and table IV delta limits	1 and table IV delta limits
Group D end point electrical parameters	1,2,3	1

1/ PDA applies to subgroup 1.

4. VERIFICATION.

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-PRF-38535 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not effect the form, fit, or function as function as described herein.

4.2 Screening. Screening shall be in accordance with MIL-PRF-38535, and shall be conducted on all devices prior to qualification and quality conformance inspection. The following additional criteria shall apply:

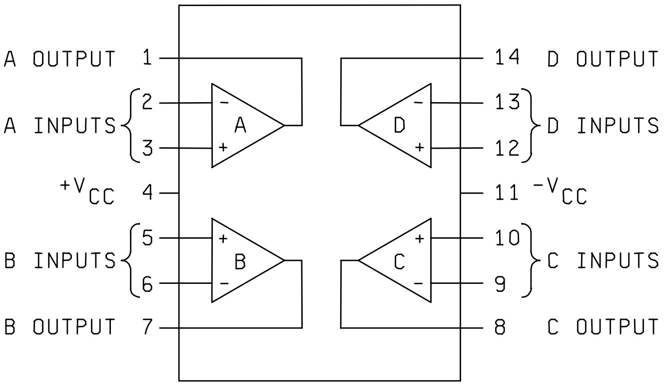
a. The burn-in test duration, test condition, and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The burn-in test circuit shall be maintained under document control by the device manufacturer's Technology Review Board (TRB) in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II, except interim electrical parameters test prior to burn-in is optional at the discretion of the manufacturer.

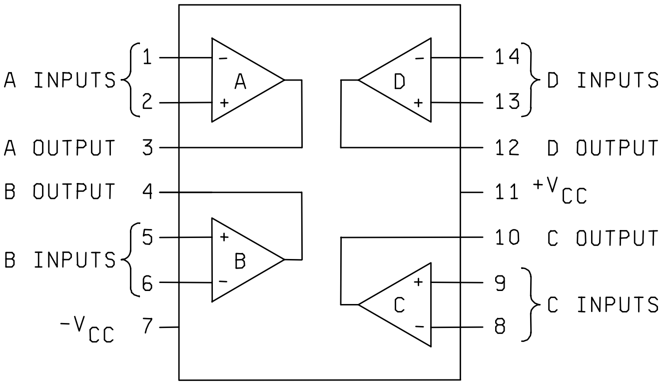
c. Additional screening for space level product shall be as specified in MIL-PRF-38535.

4.3 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-38535.

DEVICE TYPES 01,02,03,05 AND 06
CASES A,C,D AND Z
SEE NOTE 1



DEVICE TYPE 04
CASES A AND C
SEE NOTE 2



NOTES:

1. 14 lead flat pack, dual in line package, and gullwing flat pack.
2. 14 lead flat pack and dual in line package.

FIGURE 1. Case outlines and terminal connections.

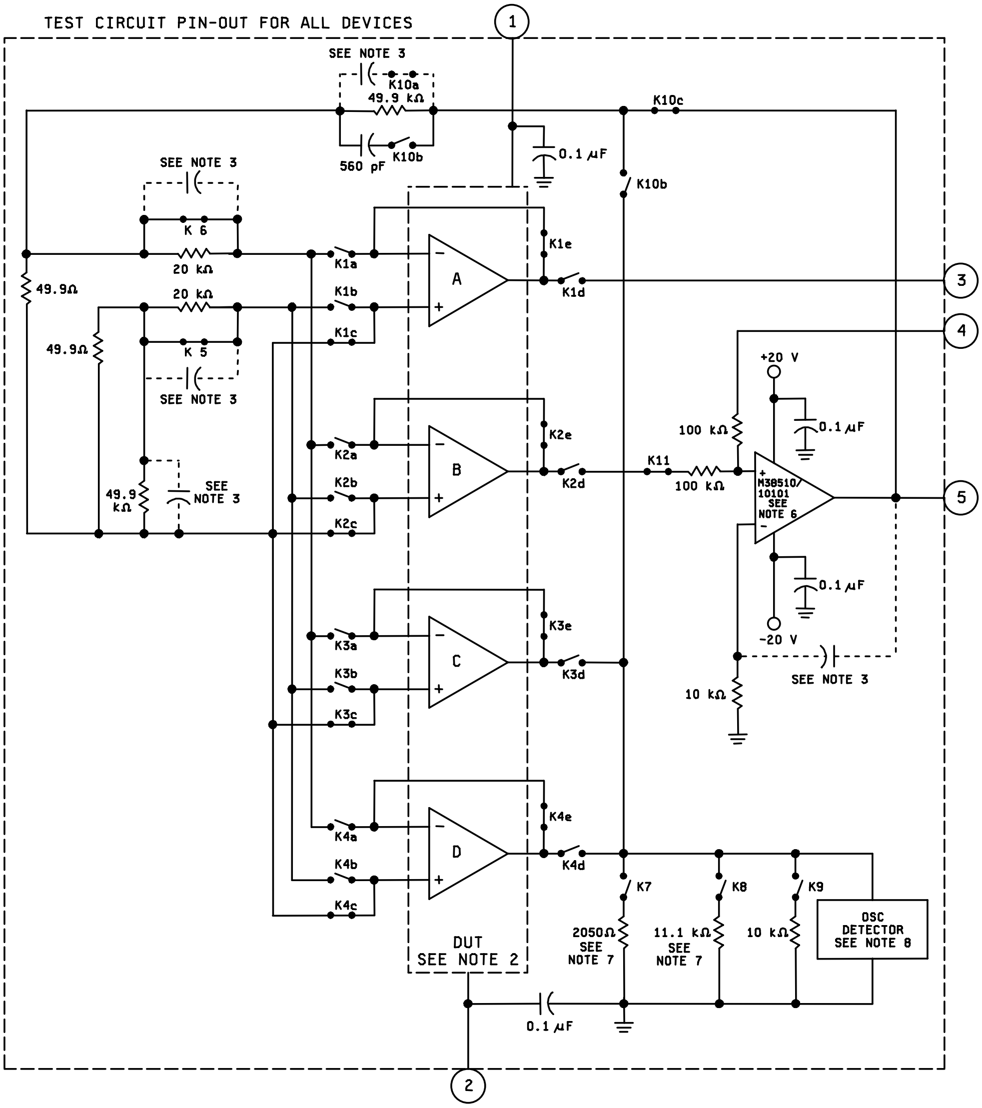


FIGURE 2. Test circuit for static tests.

NOTES:

1/ All resistors ±0.1 percent tolerance and all capacitors are ±10 % tolerance.

2/ Precautions shall be taken to prevent damage to the device under test during insertion into socket and change of state of relays (i.e. disable voltage supplies, current limit $\pm V_{CC}$, etc.).

3/ Stabilizing capacitors may be added as required, if needed to prevent oscillations. Also, proper wiring procedures shall be followed to prevent oscillations. Loop response and settling time shall be consistent with the test rate such that any value has settled for at least five loop time constants before the value is measured, however, adequate settling time shall be allowed such that each parameter has settled to within five percent of its final value. There are two general methods to stabilize the test circuit: One method is with a capacitor in the nulling amplifier feedback loop and the other method is with a capacitor in parallel with the 49.9 kΩ closed loop feedback resistor. Both methods shall not be used simultaneously.

4/ All relays are shown in the normal de-energized state. Relays K1, K2, K3, and K4 select amplifiers A, B, C, and D respectively. The rest of the relays are used to select the conditions for each test.

5/ Each amplifier shall be tested separately, except for the ICC measurements where all the amplifiers shall be connected as grounded followers (relays K1 through K4 de-energized).

6/ The nulling amplifier should be an M38510/11001XXXor similar. Saturation of the nulling amplifier is not allowed on test where the E (pin 5) value is measured.

7/ The load resistors 2,050 Ω and 11.1 kΩ yield effective load resistances of 2 kΩ and 10 kΩ, respectively.

8/ Any oscillation greater that 300 mV in amplitude (peak - peak) shall be a cause for device failure.

FIGURE 2. Test circuit for static tests- Continued.

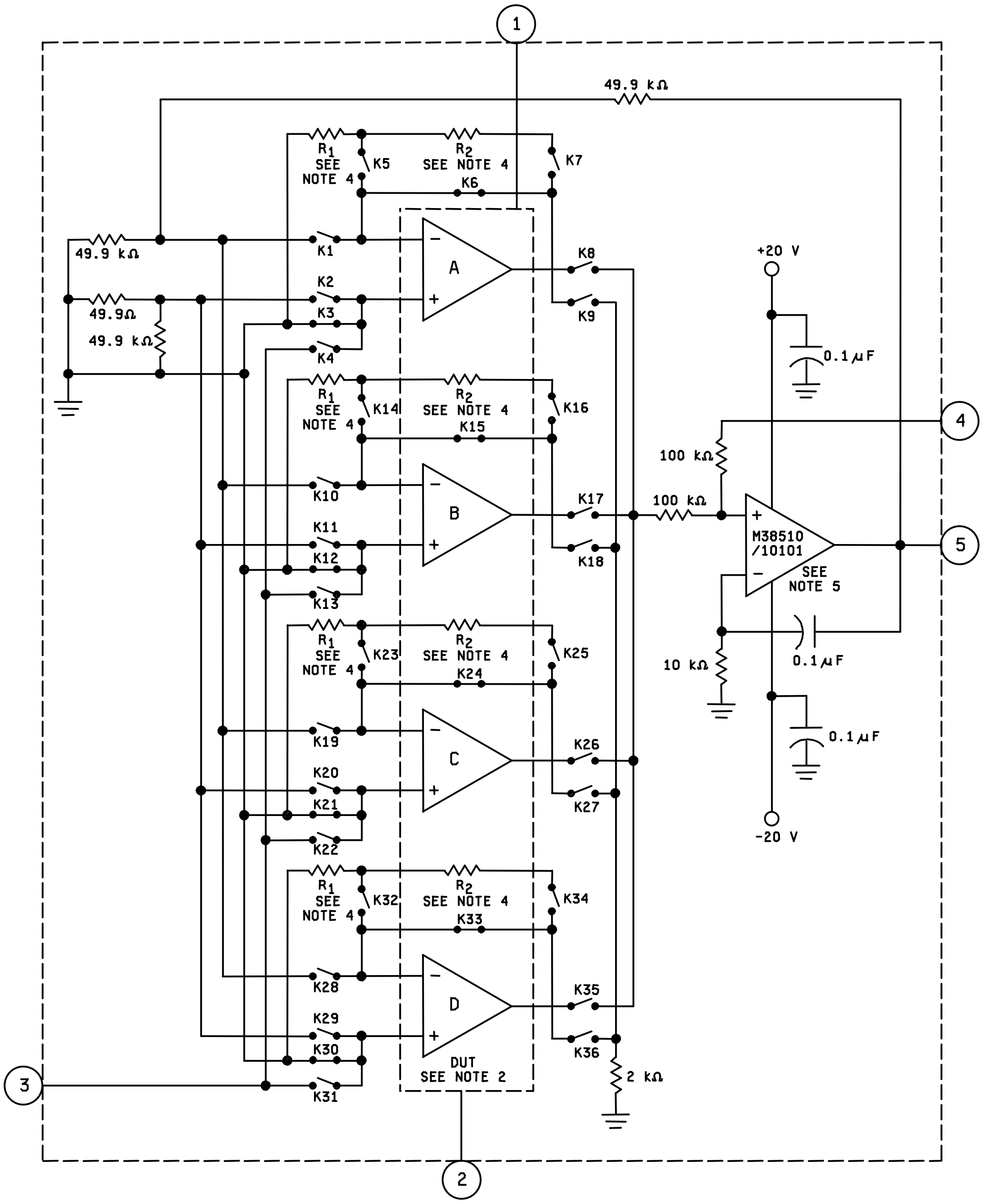


FIGURE 3. Test circuit for channel separation.

Test requirements.

CS test number*	Channels tested	Relays energized		
		All device types		Additional for device type 02
		Driven	Monitored	Driven
103 (100)	A to B	3,4,9	10,11,12,15,17	5,6,7
104 (101)	A to C	“	19,20,21,24,26	“
105 (102)	A to D	“	28,29,30,33.35	“
106 (103)	B to A	12,13,18	1,2,3,6,8	14,15,16
107 (104)	B to C	“	19,20,21,24,26	“
108 (105)	B to D	“	28,29,30,33,35	“
109 (106)	C to A	21,22,27	1,2,3,6,8	23,24,25
110 (107)	C to B	“	10,11,12,15,17	“
111 (108)	C to D	“	28,29,30,33,35	“
112 (109)	D to A	30,31,36	1,2,3,6,8	32,33,34
113 (110)	D to B	“	10,11,12,15,17	“
114 (111)	D to C	“	19,20,21,24,26	“

* Numbers in parenthesis apply to device types 05 and 06.

1/ All resistors are ±0.1 % tolerance and all capacitors are ±10%.

2/ Precautions shall be taken to prevent damage to the device under test during insertion into socket and change of state relays (i.e. disable voltage supplies, current limit $\pm V_{CC}$, etc.).

3/ All relays are shown in the normal de-energized state. The above table shall be used to determine which relays to energize for each test.

4/ R_1 and R_2 shall be used with device type 02 only and shall be such that $A_V = 5$ V/V.

5/ The nulling amplifier shall be a M38510/11001XXX or similar. Saturation of the nulling amplifier is not allowed.

FIGURE 3. Test circuit for channel separation - Continued.

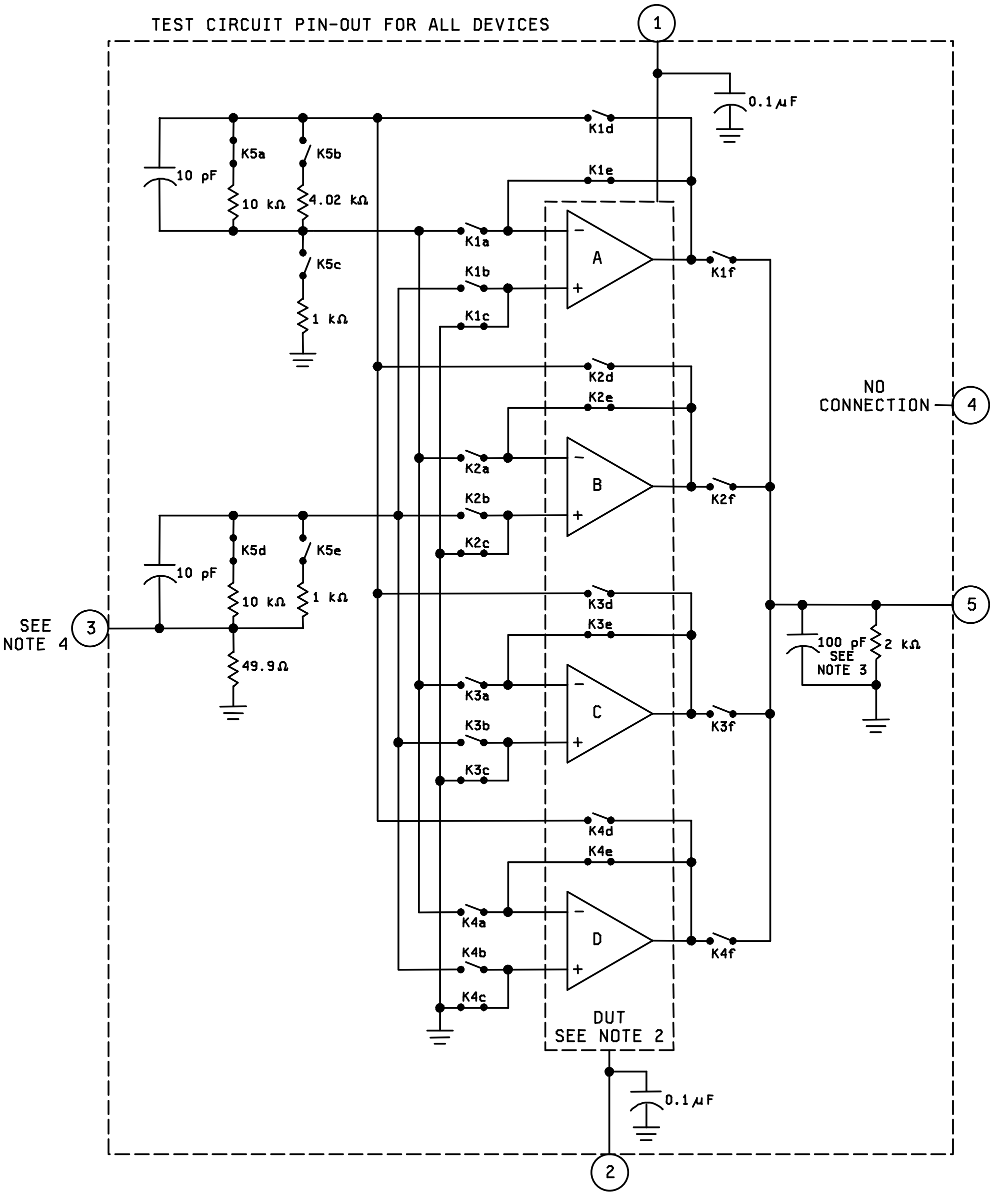
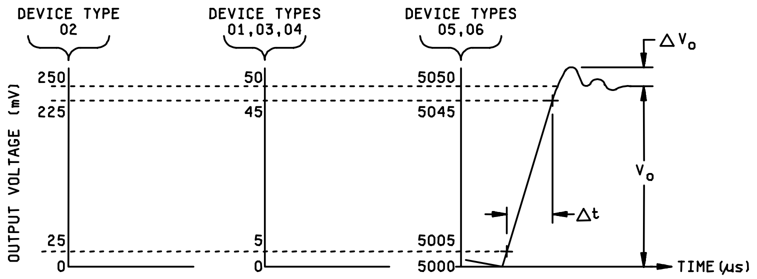
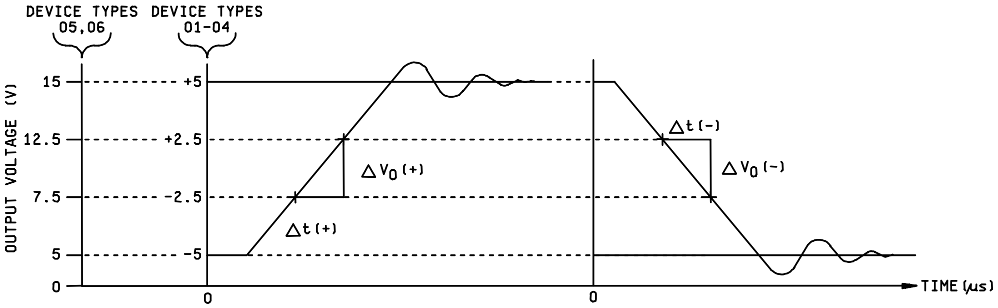


FIGURE 4. Test circuit and waveform for transient response .



WAVEFORM 1

$TR(t_r) = \Delta t; \; TR(os) = 100(\Delta V_o/V_o)$



WAVEFORM 2

$SR(+) = \Delta V_o(+)/\Delta t(+)$

WAVEFORM 3

$SR(-) = \Delta V_o(-)/\Delta t(-)$

1/ All resistors are ±0.1 % tolerance and all capacitors are ±10% tolerance.

2/ Precautions shall be taken to prevent damage to the device under test during insertion into socket and change of state of relays (i.e. disable voltage supplies, current limit $\pm V_{CC}$, etc.).

3/ This capacitance includes the actual measured value with stray and wire capacitance.

4/ Relays K1, K2, K3, and K4 select amplifiers A, B, C, and D respectively. Relay K5 shall be energized for device type 02 only. The input pulse shall have the following characteristics:

FIGURE 4. Test circuit and waveform for transient response – Continued.

Input pulse table

Parameter symbol	Device type	Rise time	Amplitude
TR(t_r)	01,03,04	50 ns or less	+50 mV referenced to GND
	02		+250 mV referenced to GND
	05,06		+50 mV referenced to 5 V
TR(os)	01,03,04		+50 mV referenced to GND
	02		+250 mV referenced to GND
	05,06		+50 mV referenced to 5 V
SR(+)	01,03,04		-5 V to +5 V step
	02		-1 V to +1 V step
	05,06		+5 V to +15 V step
SR(-)	01,03,04		+5 V to -5 V step
	02		+1 V to -1 V step
	05,06		+15 V to +5 V step

FIGURE 4. Test circuit and waveform for transient response – Continued.

TABLE III. Group A inspection for device types 01, 02, 03, and 04. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types						Unit
														01, 02		03		04		
														Limits		Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	Min	Max	
1 T_A = +25°C	V_{IO}	4001	1 4/	35 V	-5 V		-15 V		None	5	E_1	V	$V_{IO} = E_1$		±5		±3		±5	mV
		“	2 4/	5 V	-35 V		15 V		“		E_2	“	$V_{IO} = E_2$		±5		±3		±5	“
		“	3 4/ 5/	20 V	-20 V		GND		“		E_3	“	$V_{IO} = E_3$		±5		±3		±5	“
		“	4 4/	5 V	-5 V		GND		“		E_4	“	$V_{IO} = E_4$		±5		±3		±5	“
	I_{IO}	“	5	35 V	-5 V		-15 V		K5, K6		E_5	“	$I_{IO} = 50\ (E_1 - E_5)$		±25		±30		±75	nA
		“	6	5 V	-35 V		15 V		“		E_6	“	$I_{IO} = 50\ (E_2 - E_6)$		±25		±30		±75	“
		“	7	20 V	-20 V		GND		“		E_7	“	$I_{IO} = 50\ (E_3 - E_7)$		±25		±30		±75	“
		“	8	5 V	-5 V		GND		“		E_8	“	$I_{IO} = 50\ (E_4 - E_8)$		±25		±30		±75	“
	$+I_{IB}$	“	9	35 V	-5 V		-15 V		K5		E_9	“	$+I_{IB} = 50\ (E_1 - E_9)$	-0.1	100	-200	+0.1	-250	+0.1	nA
		“	10	5 V	-35 V		15 V		“		E_{10}	“	$+I_{IB} = 50\ (E_2 - E_{10})$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	11	20 V	-20 V		GND		“		E_{11}	“	$+I_{IB} = 50\ (E_3 - E_{11})$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	12	5 V	-5 V		GND		“		E_{12}	“	$+I_{IB} = 50\ (E_4 - E_{12})$	-0.1	100	-200	+0.1	-250	+0.1	“
	$-I_{IB}$	“	13	35 V	-5 V		-15 V		K5		E_{13}	“	$-I_{IB} = 50\ (E_{13} - E_1)$	-0.1	100	-200	+0.1	-250	+0.1	nA
		“	14	5 V	-35 V		15 V		“		E_{14}	“	$-I_{IB} = 50\ (E_{14} - E_2)$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	15	20 V	-20 V		GND		“		E_{15}	“	$-I_{IB} = 50\ (E_{15} - E_3)$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	16	5 V	-5 V		GND		“		E_{16}	“	$-I_{IB} = 50\ (E_{16} - E_4)$	-0.1	100	-200	+0.1	-250	+0.1	“
	+PSRR	4003	17	10 V	-20 V		GND		None		E_{17}	“	$+PSRR = (E3 - E17) \times 100$		±100		±100		±100	µV/V
	-PSRR	4003	18	20 V	-10 V		GND		None		E_{18}	“	$-PSRR = (E3 - E18) \times 100$		±100		±100		±100	µV/V
	CMR	4003	19 4/	Calculate value using data from tests 1 and 2									$CMR = 20 \log \left\lvert 3 \times 10^4 / E1 - E2 \right\rvert$	76		76		76		dB
	$I_{OS(+)}$	3011	20 6/	15 V	-15 V	GND	-10 V		None	3	I_1	mA	$I_{OS(+)} = I_1$	-55		-80		-80		mA
	$I_{OS(-)}$	3011	21 6/	15 V	-15 V	GND	10 V		“	3	I_2	“	$I_{OS(-)} = I_2$		55		80		80	“
	I_{CC}	3005	22 7/	15 V	-15 V				“	2	I_3	“	$I_{CC} = I3$		3.6		7		11	“
2 T_A = +125°C	V_{IO}	4001	23 4/	35 V	-5 V		-15 V		“	5	E_{19}	V	$V_{IO} = E_{19}$		±6		±5		±6	mV
		“	24 4/	5 V	-35 V		15		“	5	E_{20}	“	$V_{IO} = E_{20}$		±6		±5		±6	“
		“	25 4/ 5/	20 V	-20 V		GND		“	5	E_{21}	“	$V_{IO} = E_{21}$		±6		±5		±6	“
		“	26 4/	5 V	-5 V		GND		“	5	E_{22}	“	$V_{IO} = E_{22}$		±6		±5		±6	“

See footnotes at end of table.

TABLE III. Group A inspection for device types 01, 02, 03, and 04. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types						Unit
														01, 02		03		04		
														Limits		Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	Min	Max	
2 T_A =+125°C	ΔV_{IO} / ΔT	4001 “	27	$\Delta V_{IO} / \Delta T = (V_{IO}$ (Test 25 – V_{IO} (Test 3)) / 100°C											±25		±20		±25	µV/°C
	I_{IO}	“	28	35 V	-5 V		-15 V		K5, K6	5	E_{23}	V	$I_{IO} = 50 (E_{19} – E_{23})$		±25		±30		±75	nA
		“	29	5 V	-35 V		15 V		“	“	E_{24}	“	$I_{IO} = 50 (E_{20} – E_{24})$		±25		±30		±75	“
		“	30	20 V	-20 V		GND		“	“	E_{25}	“	$I_{IO} = 50 (E_{21} – E_{25})$		±25		±30		±75	“
		“	31	5 V	-5 V		GND		“	“	E_{26}	“	$I_{IO} = 50 (E_{22} – E_{26})$		±25		±30		±75	“
	$\Delta I_{IO}/\Delta T$	“	32 8/	$\Delta V_{IO} / \Delta T = (I_{IO}$ (Test 30) – I_{IO} (Test 7)) / 100°C											±200		±200		±500	pA/°C
	$+I_{IB}$	“	33	35 V	-5 V		-15 V		K5	5	E_{27}	V	$+I_{IB} = 50 (E_{19} – E_{27})$	-0.1	100	-200	+0.1	-250	+0.1	nA
		“	34	5 V	-35 V		15 V		“	“	E_{28}	“	$+I_{IB} = 50 (E_{20} – E_{28})$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	35	20 V	-20 V		GND		“	“	E_{29}	“	$+I_{IB} = 50 (E_{21} – E_{29})$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	36	5 V	-5 V		GND		“	“	E_{30}	“	$+I_{IB} = 50 (E_{22} – E_{30})$	-0.1	100	-200	+0.1	-250	+0.1	“
	$-I_{IB}$	“	37	35 V	-5 V		-15 V		K6	“	E_{31}	“	$-I_{IB} = 50 (E_{31} – E_{19})$	-0.1	100	-200	+0.1	-250	+0.1	nA
		“	38	5 V	-35 V		15 V		“	“	E_{32}	“	$-I_{IB} = 50 (E_{32} – E_{20})$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	39	20 V	-20 V		GND		“	“	E_{33}	“	$-I_{IB} = 50 (E_{33} – E_{21})$	-0.1	100	-200	+0.1	-250	+0.1	“
		“	40	5 V	-5 V		GND		“	“	E_{34}	“	$-I_{IB} = 50 (E_{34} – E_{22})$	-0.1	100	-200	+0.1	-250	+0.1	“
	+PSRR	4003	41	10 V	-20 V		GND		None	“	E_{35}	“	+PSRR = (E21 – E35) x 100		±100		±100		±100	µV/V
	-PSRR	4003	42	20 V	-10 V		GND		None	“	E_{36}	“	-PSRR = (E21 – E36) x 100		±100		±100		±100	µV/V
	CMR	4003	43 4/	Calculate value using data from tests 23 and 24.									CMR = 20 log $\lvert 3 \times 10^4$ / E19 – E20$\rvert$	76		76		76		dB
	$I_{OS(+)}$	3011	44 6/	15 V	-15 V	GND	-10 V		None	3	I_4	mA	$I_{OS(+)} = I_4$	-55		-80		-80		mA
	$I_{OS(-)}$	3011	45 6/	15 V	-15 V	GND	10 V			3	I_5	“	$I_{OS(-)} = I_5$		55		80		80	“
	I_{CC}	3005	46 7/	15 V	-15 V					2	I_6	“	I_{CC} = I6		3.6		7		11	“
2 T_A = -55°C	V_{IO}	4001	47 4/	35 V	-5		-15 V		None	5	E_{37}	V	$V_{IO} = E_{37}$		±6		±5		±6	mV
			48 4/	5 V	-35 V		15			5	E_{38}	“	$V_{IO} = E_{38}$		±6		±5		±6	“
			49 4/	20 V	-20 V		GND			5	E_{39}	“	$V_{IO} = E_{39}$		±6		±5		±6	“
			50 4/	5 V	-5 V		GND			5	E_{40}	“	$V_{IO} = E_{40}$		±6		±5		±6	“

See footnotes at end of table.

TABLE III. Group A inspection for device types 01, 02, 03, and 04. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types						Unit
														01, 02		03		04		
														Limits		Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	Min	Max	
3 T_A =-55°C	ΔV_{IO} / ΔT	4001	51 8/	$\Delta V_{IO} / \Delta T = (V_{IO}$ (Test 3 – V_{IO} (Test 49)) / 80°C											±25		±20		±25	µV/°C “
	I_{IO}	“	52	35 V	-5 V		-15 V		K5, K6	5	E_{41}	V	$I_{IO} = 50 (E_{37} – E_{41})$		±75		±75		±150	nA
		“	53	5 V	-35 V		15 V		“	“	E_{42}	“	$I_{IO} = 50 (E_{38} – E_{42})$		±75		±75		±150	“
		“	54	20 V	-20 V		GND		“	“	E_{43}	“	$I_{IO} = 50 (E_{39} – E_{43})$		±75		±75		±150	“
		“	55	5 V	-5 V		GND		“	“	E_{44}	“	$I_{IO} = 50 (E_{40} – E_{44})$		±75		±75		±150	“
	$\Delta I_{IO}/\Delta T$	“	56 8/	$\Delta V_{IO} / \Delta T = (I_{IO}$ (Test 7 – I_{IO} (Test 54)) / 80°C											±400		±500		±1000	pA/°C
	$+I_{IB}$	“	57	35 V	-5 V		-15 V		K5	5	E_{45}	V	$+I_{IB} = 50 (E_{37} –E_{45})$	-0.1	325	-325	+0.1	-400	+0.1	nA
		“	58	5 V	-35 V		15 V		“	“	E_{46}	“	$+I_{IB} = 50 (E_{38} –E_{46})$	-0.1	325	-325	+0.1	-400	+0.1	“
		“	59	20 V	-20 V		GND		“	“	E_{47}	“	$+I_{IB} = 50 (E_{39} –E_{47})$	-0.1	325	-325	+0.1	-400	+0.1	“
		“	60	5 V	-5 V		GND		“	“	E_{48}	“	$+I_{IB} = 50 (E_{40} –E_{48})$	-0.1	325	-325	+0.1	-400	+0.1	“
	$-I_{IB}$	“	61	35 V	-5 V		-15 V		K6	“	E_{49}	“	$-I_{IB} = 50 (E_{49} –E_{37})$	-0.1	325	-325	+0.1	-400	+0.1	nA
		“	62	5 V	-35 V		15 V		“	“	E_{50}	“	$-I_{IB} = 50 (E_{50} –E_{38})$	-0.1	325	-325	+0.1	-400	+0.1	“
		“	63	20 V	-20 V		GND		“	“	E_{51}	“	$-I_{IB} = 50 (E_{51} –E_{39})$	-0.1	325	-325	+0.1	-400	+0.1	“
		“	64	5 V	-5 V		GND		“	“	E_{52}	“	$-I_{IB} = 50 (E_{52} –E_{40})$	-0.1	325	-325	+0.1	-400	+0.1	“
	+PSRR	4003	65	10 V	-20 V		GND		None	“	E_{53}	“	+PSRR = (E39 – E53) x 100		±100		±100		±100	µV/V
	-PSRR	4003	66	20 V	-10 V		GND		None	“	E_{54}	“	-PSRR = (E39 – E54) x 100		±100		±100		±100	µV/V
	CMR	4003	67 4/	Calculate value using data from tests 47 and 48									CMR = 20 log $\|3 \times 10^4 / E37 – E38\|$	76		76		76		dB
	$I_{OS(+)}$	3011	68 6/	15 V	-15 V	GND	-10 V		None	3	I_7	mA	$I_{OS(+)} = I_7$	-75		-80		-80		mA
	$I_{OS(-)}$	3011	69 6/	15 V	-15 V	GND	10 V		“	3	I_8	“	$I_{OS(-)} = I_8$		75		80		80	“
	I_{CC}	3005	70 7/	15 V	-15 V				“	2	I_9	“	$I_{CC} = I_9$		4.5		9		13	“
4 T_A = +25°C	$+V_{OP}$	4004	71	20 V	-20 V		-20 V		K8	3	$(E_0)_1$	V	$+V_{OP} = (E_0)_1$	+16		+16		+16		V
	$-V_{OP}$	“	72	20 V	-20 V		20 V		K8	3	$(E_0)_2$	“	$-V_{OP} = (E_0)_2$		-16		-16		-16	“
	$+V_{OP}$	“	73	20 V	-20 V		-20 V		K7	3	$(E_0)_3$	“	$+V_{OP} = (E_0)_3$	+15		+15		+15		“
	V_{OP}	“	74	20 V	-20 V		20 V		K7	3	$(E_0)_4$	“	$-V_{OP} = (E_0)_4$		-15		-15		-15	“

See footnotes at end of table.

TABLE III. Group A inspection for device types 01, 02, 03, and 04. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types						Unit
														01, 02		03		04		
														Limits		Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	Min	Max	
4 T_A =+25°C	$A_{VS(+)}$	4004	75 5/	20 V	-20 V		-15 V		K8	5	E_{55}	V	$A_{VS(+)} = 15/(E_3 - E_{55})$	50		50		50		V/mV
	$A_{VS(+)}$	“	76 5/	20 V	-20 V		-15 V		K7	“	E_{56}	“	$A_{VS(+)} = 15/(E_3 - E_{56})$	50		50		50		“
	$A_{VS(-)}$	“	77 5/	20 V	-20 V		15 V		K8	“	E_{57}	“	$A_{VS(-)} = 15/(E_{57} - E_3)$	50		50		50		“
	$A_{VS(-)}$	“	78 5/	20 V	-20 V		15 V		K7	“	E_{58}	“	$A_{VS(-)} = 15/(E_{58} - E_3)$	50		50		50		“
	A_{VS}	“	79	5 V	-5 V		-2 V		K8	“	E_{59}	“	$A_{VS} = 4/(E_{60} - E_{59})$	10		10		10		“
		“		5 V	-5 V		2 V		K8	“	E_{60}	“								“
		“	80	5 V	-5 V		-2 V		K7	“	E_{61}	“	$A_{VS} = 4/(E_{62} - E_{61})$	10		10		10		“
		“		5 V	-5 V		2 V		K7	“	E_{62}	“								“
5 T_A =+125°C	$+V_{OP}$	“	81	20 V	-20 V		-20 V		K8	3	$(E_0)_5$	“	$+V_{OP} = (E_0)_5$	+16		+16		+16		V
	$-V_{OP}$	“	82	20 V	-20 V		20 V		K8	3	$(E_0)_6$	“	$-V_{OP} = (E_0)_6$		-16		-16		-16	“
	$+V_{OP}$	“	83	20 V	-20 V		-20 V		K7	3	$(E_0)_7$	“	$+V_{OP} = (E_0)_7$	+15		+15		+15		“
	$-V_{OP}$	“	84	20 V	-20 V		20 V		K7	3	$(E_0)_8$	“	$-V_{OP} = (E_0)_8$		-15		-15		-15	“
	$A_{VS(+)}$	“	85 5/	20 V	-20 V		-15 V		K8	5	E_{63}	“	$A_{VS(+)} = 15/(E_{21} - E_{63})$	25		25		25		V/mV
	$A_{VS(+)}$	“	86 5/	20 V	-20 V		-15 V		K7	“	E_{64}	“	$A_{VS(+)} = 15/(E_{21} - E_{64})$	25		25		25		“
	$A_{VS(-)}$	“	87 5/	20 V	-20 V		15 V		K8	“	E_{65}	“	$A_{VS(-)} = 15/(E_{65} - E_{21})$	25		25		25		“
	$A_{VS(-)}$	“	88 5/	20 V	-20 V		15 V		K7	“	E_{66}	“	$A_{VS(-)} = 15/(E_{66} - E_{21})$	25		25		25		“
	A_{VS}	“	89	5 V	-5 V		-2 V		K8	“	E_{67}	“	$A_{VS} = 4/(E_{68} - E_{67})$	10		10		10		“
		“		5 V	-5 V		2 V		K8	“	E_{68}	“								“
		“	90	5 V	-5 V		-2 V		K7	“	E_{69}	“	$A_{VS} = 4/(E_{70} - E_{69})$	10		10		10		“
		“		5 V	-5 V		2 V		K7	“	E_{70}	“								“
6 T_A = -55°C	$+V_{OP}$	“	91	20 V	-20 V		-20 V		K8	3	$(E_0)_9$	“	$+V_{OP} = (E_0)_9$	+16		+16		+16		V
	$-V_{OP}$	“	92	20 V	-20 V		20 V		K8	3	$(E_0)_{10}$	“	$-V_{OP} = (E_0)_{10}$		-16		-16		-16	“
	$+V_{OP}$	“	93	20 V	-20 V		-20 V		K7	3	$(E_0)_{11}$	“	$+V_{OP} = (E_0)_{11}$	+15		+15		+15		“
	$-V_{OP}$	“	94	20 V	-20 V		-20 V		K7	3	$(E_0)_{12}$	“	$-V_{OP} = (E_0)_{12}$		-15		-15		-15	“

See footnotes at end of table.

TABLE III. Group A inspection for device types 01, 02, 03, and 04. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types						Unit
														01, 02		03		04		
														Limits		Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	Min	Max	
6 T_A =-55°C	$A_{VS(+)}$	4004	95	20 V	-20 V		-15 V		K8	5	E_{71}	V	$A_{VS(+)} = 15/(E_{39} - E_{71})$	25		25		25		V/mV
	$A_{VS(+)}$	“	96	20 V	-20 V		-15 V		K7	“	E_{72}	“	$A_{VS(+)} = 15/(E_{39} - E_{72})$	25		25		25		“
	$A_{VS(-)}$	“	97	20 V	-20 V		15 V		K8	“	E_{73}	“	$A_{VS(-)} = 15/(E_{73} - E_{39})$	25		25		25		“
	$A_{VS(-)}$	“	98	20 V	-20 V		15 V		K7	“	E_{74}	“	$A_{VS(-)} = 15/(E_{74} - E_{39})$	25		25		25		“
	A_{VS}	“	99	5 V	-5 V		-2 V		K8	“	E_{75}	“	$A_{VS} = 4/(E_{76} - E_{75})$	10		10		10		“
		“		5 V	-5 V		2 V		K8	“	E_{76}	“								“
		“	100 9/	5 V	-5 V		-2 V		K7	“	E_{77}	“	$A_{VS} = 4/(E_{78} - E_{77})$	10		10		10		“
		“		5 V	-5 V		2 V		K7	“	E_{78}	“								“
7 T_A =+25°C	NI(BB)		101 10/	20 V	-20 V		GND		K10, K11	3	$(E_0)_{13}$	mVrms	$NI(BB) = (E_0)_{13}$		15		5		5	µVrms
	NI(PC)		102	20 V	-20 V		“		K5, K6, K10, K11	3	$(E_0)_{14}$	mVpk	$NI(PC) = (E_0)_{14}$		40		50		50	µVpk
	CS		103	20 V	-20 V	11/	“		See fig. 3	5	E_{79}	V	$CS = 20 \log \lvert 2 \times 10^4 / E_{79} - E_{80} \rvert$	80		80		80		dB
				20 V	-20 V	12/	“		“	“	E_{80}	“		80		80		80		“
			104	20 V	-20 V	11/	“		“	“	E_{81}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{81} - E_{82} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{82}	“		80		80		80		“
			105	20 V	-20 V	11/	“		“	“	E_{83}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{83} - E_{84} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{84}	“		80		80		80		“
			106	20 V	-20 V	11/	“		“	“	E_{85}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{85} - E_{86} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{86}	“		80		80		80		“
			107	20 V	-20 V	11/	“		“	“	E_{87}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{87} - E_{88} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{88}	“		80		80		80		“
			108	20 V	-20 V	11/	“		“	“	E_{89}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{89} - E_{90} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{90}	“		80		80		80		“
			109	20 V	-20 V	11/	“		“	“	E_{91}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{91} - E_{92} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{92}	“		80		80		80		“
			110	20 V	-20 V	11/	“		“	“	E_{93}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{93} - E_{94} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{94}	“		80		80		80		“
			111	20 V	-20 V	11/	“		“	“	E_{95}	“	$CS = 20 \log \lvert 2 \times 10^4 / E_{95} - E_{96} \rvert$	80		80		80		“
				20 V	-20 V	12/	“		“	“	E_{96}	“		80		80		80		“

See footnotes at end of table.

TABLE III. Group A inspection for device types 01, 02, 03, and 04. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types						Unit
														01, 02		03		04		
														Limits		Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	Min	Max	
7 T_A =+25°C	CS		112	20 V	-20 V	11/	GND		See fig. 3	5	E_{97}	V	CS = 20 log $\|2 \times 10^4 / E_{97} - E_{98}\|$	80		80		80		dB
				20 V	-20 V	12/	"		"	"	E_{98}	"		80		80		80		"
			113	20 V	-20 V	11/	"		"	"	E_{99}	"	CS = 20 log $\|2 \times 10^4 / E_{99} - E_{100}\|$	80		80		80		"
				20 V	-20 V	12/	"		"	"	E_{100}	"		80		80		80		"
			114	20 V	-20 V	11/	"		"	"	E_{101}	"	CS = 20 log $\|2 \times 10^4 / E_{101} - E_{102}\|$	80		80		80		"
				20 V	-20 V	12/	"		"	"	E_{102}	"		80		80		80		"
	$TR(t_r)$		115	20 V	-20 V	IN	"	OUT	See fig. 4	"	Δt	µs	(Waveform 1) $TR(t_r) = \Delta t$		1.0		0.2		0.3	µs
	$TR(_{os})$		116	20 V	-20 V		"		"	"	V_O;ΔV_O	V	(Waveform 1) TR(OS) – 100 $(\Delta V_O/V_O)$		25		35		50	%
	SR(+)		117	20 V	-20 V		"		"	"	ΔV_O; Δt	V; µs	(Waveform 2) SR(+) = $V_O/\Delta t$	9/		0.8		0.6		V/µs
	SR(-)		118	20 V	-20 V		"		"	"	ΔV_O; Δt	V; µs	(Waveform 3) SR(-) = $\Delta V_O/\Delta t$	9/		0.8		0.6		V/µs
8			119 to 126	Same tests, terminal conditions and limits as subgroup7, tests 115 through 118 except T_A = 125°C and T_A = -55°C.																

See footnotes at end of table.

TABLE III. Group A inspection for device types 05 and 06. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types 05 Limits		Device types 06 Limits		Unit
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	
1 T_A = +25°C	V_{IO}	4001	1 4/	30 V	GND		-15 V		None	5	E_1	V	$V_{IO} = E_1$		±5		±2	mV
			2 4/	2 V	-28 V		13 V		"	"	E_2	"	$V_{IO} = E_2$		±5		±2	"
			3 4/	5 V	GND		-1.4 V		"	"	E_3	"	$V_{IO} = E_3$		±5		±2	"
			4 4/	2.5 V	-2.5 V		1.1 V		"	"	E_4	"	$V_{IO} = E_4$		±5		±2	"
	I_{IO}		5	30 V	GND		-15 V		K5, K6	"	E_5	"	$I_{IO} = 10^6 (E_1 – E_5)/R_S$		±30		±10	nA
			6	2 V	-28 V		13 V		"	"	E_6	"	$I_{IO} = 10^6 (E_2 – E_6)/R_S$		±30		±10	"
			7	5 V	GND		-1.4 V		"	"	E_7	"	$I_{IO} = 10^6 (E_3 – E_7)/R_S$		±30		±10	"
			8	2.5 V	-2.5 V		1.1 V		"	"	E_8	"	$I_{IO} = 10^6 (E_4 – E_8)/R_S$		±30		±10	"
	$+I_{IB}$		9	30 V	GND		-15 V		K5	"	E_9	"	$+I_{IB} = 10^6 (E_1 – E_9)/R_S$	-150	+0.1	-50	+0.1	nA
			10	2 V	-28 V		13 V		"	"	E_{10}	"	$+I_{IB} = 10^6 (E_2 – E_{10})/R_S$	-150	+0.1	-50	+0.1	"
			11	5 V	GND		-1.4 V		"	"	E_{11}	"	$+I_{IB} = 10^6 (E_3 – E_{11})/R_S$	-150	+0.1	-50	+0.1	"
			12	2.5 V	-2.5 V		1.1 V		"	"	E_{12}	"	$+I_{IB} = 10^6 (E_4 – E_{12})/R_S$	-150	+0.1	-50	+0.1	"
	$-I_{IB}$		13	30 V	GND		-15 V		K6	"	E_{13}	"	$-I_{IB} = 10^6 (E_{13} – E_1)/R_S$	-150	+0.1	-50	+0.1	nA
			14	2 V	-28 V		13 V		"	"	E_{14}	"	$-I_{IB} = 10^6 (E_{14} – E_2)/R_S$	-150	+0.1	-50	+0.1	"
			15	5 V	GND		-1.4 V		"	"	E_{15}	"	$-I_{IB} = 10^6 (E_{15} – E_3)/R_S$	-150	+0.1	-50	+0.1	"
			16	2.5V	-2.5 V		1.1 V		"	"	E_{16}	"	$-I_{IB} = 10^6 (E_{16} – E_4)/R_S$	-150	+0.1	-50	+0.1	"
	+PSRR	4003	17	30 V	GND		-1.4 V		None	"	E_{17}	"	$+PSRR = (E_{17} – E_{18})$		±100		±100	µV/V
				5 V	GND		-1.4 V		None	"	E_{18}	"	x 40					"
	CMR	4003	18 4/	Calculate value using data from tests 1 and 2									$CMR = 20 \log \lvert 2.8 \times 10^4 / E_1 – E_2 \rvert$	76		76		dB
	$I_{OS(+)}$	3011	19 6/	30 V	GND	GND	-25 V		None	3	I_1	mA	$I_{OS(+)} = I_1$	-70		-70		mA
	I_{CC}	3005	20 7/	30 V	GND				None	2	I_2	mA	$I_{CC} = I_2$		3		3	mA
	V_{IO}	4001	21 4/	30 V	GND		-15 V		None	5	E_{19}	V	$V_{IO} = E_{19}$		±7		±4	mV
		"	22 4/	2 V	-28 V		13 V		"	"	E_{20}	"	$V_{IO} = E_{20}$		±7		±4	"
2 T_A =+125°C		"	23 4/	5 V	GND		-1.4 V		"	"	E_{21}	"	$V_{IO} = E_{21}$		±7		±4	"
		"	24 4/	2.5 V	-2.5 V		1.1 V		"	"	E_{22}	"	$V_{IO} = E_{22}$		±7		±4	"

See footnotes at end of table.

TABLE III. Group A inspection for device types 05 and 06 - Continued. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types				Unit
														05		06		
														Limits		Limits		
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	
2 T_A =+125°C	$\Delta V_{IO} / \Delta T$	4001	25	$\Delta V_{IO} / \Delta T = (V_{IO}$ (Test 23 – V_{IO} (Test 3)) / 100°C											±30		±30	µV/°C
	I_{IO}	"	26	30 V	GND		-15 V		K5, K6	5	E_{23}	V	$I_{IO} = 10^6 (E_{19} - E_{23})/R_S$		±30		±10	nA
		"	27	2 V	-28 V		13 V		"	"	E_{24}	"	$I_{IO} = 10^6 (E_{20} - E_{24})/ R_S$		±30		±10	"
		"	28	5 V	GND		-1.4 V		"	"	E_{25}	"	$I_{IO} = 10^6 (E_{21} - E_{25})/ R_S$		±30		±10	"
		"	29	2.5 V	-2.5 V		1.1 V		"	"	E_{26}	"	$I_{IO} = 10^6 (E_{22} - E_{26})/ R_S$		±30		±10	"
	$\Delta I_{IO}/\Delta T$	"	30 8/	$\Delta I_{IO} / \Delta T = (I_{IO}$ (Test 28 – I_{IO} (Test 7)) / 100°C											±400		±400	pA/°C
	$+I_{IB}$	"	31	30 V	GND		-15 V		K5	5	E_{27}	V	$+I_{IB} = 10^6 (E_{19} - E_{27})/ R_S$	-150	+0.1	-50	+0.1	nA
		"	32	2 V	-28 V		13 V		"	"	E_{28}	"	$+I_{IB} = 10^6 (E_{20} - E_{28})/ R_S$	-150	+0.1	-50	+0.1	"
		"	33	5 V	-GND		-1.4 V		"	"	E_{29}	"	$+I_{IB} = 10^6 (E_{21} - E_{29})/ R_S$	-150	+0.1	-50	+0.1	"
		"	34	2.5 V	-2.5 V		1.1 V		"	"	E_{30}	"	$+I_{IB} = 10^6 (E_{22} - E_{30})/ R_S$	-150	+0.1	-50	+0.1	"
	$-I_{IB}$	"	35	30 V	GND		-15 V		K6	"	E_{31}	"	$-I_{IB} = 10^6 (E_{31} - E_{19})/ R_S$	-150	+0.1	-50	+0.1	nA
		"	36	2 V	-28 V		13 V		"	"	E_{32}	"	$-I_{IB} = 10^6 (E_{32} - E_{20})/ R_S$	-150	+0.1	-50	+0.1	"
		"	37	5 V	GND		-1.4 V		"	"	E_{33}	"	$-I_{IB} = 10^6 (E_{33} - E_{21})/ R_S$	-150	+0.1	-50	+0.1	"
		"	38	2.5 V	-2.5 V		1.1 V		"	"	E_{34}	"	$-I_{IB} = 10^6 (E_{34} - E_{22})/ R_S$	-150	+0.1	-50	+0.1	"
	+PSRR	4003	39	30 V	GND		-1.4 V		None	"	E_{35}	"	$+PSRR = (E_{35} - E_{36})$		±100		±100	µV/V
		"		5 V	GND		-1.4 V		None	"	E_{36}	"	x 40					"
	CMR	4003	40 4/	Calculate value using data from tests 21 and 22.									$CMR = 20 \log \lvert 2.8 \times 10^4 / E_{19} - E_{20} \rvert$	76		76		dB
	$I_{OS(+)}$	3011	41 6/	30 V	GND	GND	-25 V		None	3	I_3	mA	$I_{OS(+)} = I_3$	-70		-70		mA
	I_{CC}	3005	42 7/	30 V	GND				None	2	I_4	mA	$I_{CC} = I_4$		3		3	mA
2 T_A = +125°C	V_{IO}	4001	43 4/	30 V	GND		-15 V		None	5	E_{37}	V	$V_{IO} = E_{37}$		±7		±4	mV
			44 4/	2 V	-28 V		13		"	"	E_{38}	"	$V_{IO} = E_{38}$		±7		±4	"
			45 4/	5 V	GND		-1.4 V		"	"	E_{39}	"	$V_{IO} = E_{39}$		±7		±4	"
			46 4/	2.5 V	-2.5		1.1 V		"	"	E_{40}	"	$V_{IO} = E_{40}$		±7		±4	"
	$\Delta V_{IO} / \Delta T$		47 8/	$\Delta V_{IO} / \Delta T = (V_{IO}$ (Test 3 – V_{IO} (Test 45)) / 80°C											±30		±30	µV/°C

See footnotes at end of table.

TABLE III. Group A inspection for device types 05 and 06 - Continued. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types 05 Limits		Device types 06 Limits		Unit
				1	2	3	4	5		No.	Value	Unit		Min	Max	Min	Max	
3 T_A =-55°C	I_{IO}	4001	48	30 V	GND		-15 V		K5, K6	5	E_{41}	V	$I_{IO} = 10^6 (E_{37} - E_{41})/R_S$		±75		±30	nA
		"	49	2 V	-28 V		13 V		"	"	E_{42}	"	$I_{IO} = 10^6 (E_{38} - E_{42})/R_S$		±75		±30	"
		"	50	5 V	GND		-1.4 V		"	"	E_{43}	"	$I_{IO} = 10^6 (E_{39} - E_{43})/R_S$		±75		±30	"
		"	51	2.5 V	-2.5 V		1.1 V		"	"	E_{44}	"	$I_{IO} = 10^6 (E_{40} - E_{44})/R_S$		±75		±30	"
	$\Delta I_{IO}/\Delta T$	"	52 8/	$\Delta I_{IO} / \Delta T = (I_{IO}$ (Test 50 – I_{IO} (Test 7)) / 80°C											±700		±700	pA/°C
	$+I_{IB}$	"	53	30 V	GND		-15 V		K5	5	E_{45}	V	$+I_{IB} = 10^6 (E_{37} - E_{45})/R_S$	-300	+0.1	-100	+0.1	nA
		"	54	2 V	-28 V		13 V		"	"	E_{46}	"	$+I_{IB} = 10^6 (E_{38} - E_{46})/R_S$	-300	+0.1	-100	+0.1	"
		"	55	5 V	GND		-1.4 V		"	"	E_{47}	"	$+I_{IB} = 10^6 (E_{39} - E_{47})/R_S$	-300	+0.1	-100	+0.1	"
		"	56	2.5 V	-2.5 V		1.1 V		"	"	E_{48}	"	$+I_{IB} = 10^6 (E_{40} - E_{48})/R_S$	-300	+0.1	-100	+0.1	"
	$-I_{IB}$	"	57	30 V	GND		-15 V		K6	"	E_{49}	"	$-I_{IB} = 10^6 (E_{49} - E_{37})/R_S$	-300	+0.1	-100	+0.1	nA
		"	58	2 V	-28 V		13 V		"	"	E_{50}	"	$-I_{IB} = 10^6 (E_{50} - E_{38})/R_S$	-300	+0.1	-100	+0.1	"
		"	59	5 V	GND		-1.4 V		"	"	E_{51}	"	$-I_{IB} = 10^6 (E_{51} - E_{39})/R_S$	-300	+0.1	-100	+0.1	"
		"	60	2.5 V	-2.5 V		1.1 V		"	"	E_{52}	"	$-I_{IB} = 10^6 (E_{52} - E_{40})/R_S$	-300	+0.1	-100	+0.1	"
	+PSRR	4003	61	30 V	GND		-1.4 V		None	"	E_{53}	"	+PSRR = (E53 – E54) x 40		±100		±100	µV/V
		"		5 V	GND		-1.4 V		None	'	E_{54}	"			±100		±100	"
	CMR	4003	62 4/	Calculate value using data from tests 43 and 44.									$CMR = 20 \log \lvert 2.8 \times 10^4 / E_{37} - E_{38} \rvert$	76		76		dB
	$I_{OS(+)}$	3011	63 6/	30 V	GND	GND	-25 V		None	3	I_5	mA	$I_{OS(+)} = I_5$	-70		-70		mA
	I_{CC}	3005	64 7/	30 V	GND				None	2	I_6	mA	$I_{CC} = I_6$		4		4	"
4 T_A = +25°C	$+V_{OP}$	4004	65	30 V	GND		-30 V		K8	3	$(E_0)_1$	V	$+V_{OP} = (E_0)_1$	27		27		V
	$-V_{OP}$	"	66	30 V	GND		-30 V		K7	3	$(E_0)_2$	"	$+V_{OP} = (E_0)_2$	26		26		"
	$A_{VS(+)}$	"	67	30 V	GND		-26 V		K8	5	E_{55}	"	$A_{VS(+)} = 25/(E_{56} - E_{55})$	50		50		V/mV
		"		30 V	GND		-1 V		K8	"	E_{56}	"		50		50		"
		"	68	30 V	GND		-20 V		K7	"	E_{57}	"	$A_{VS(+)} = 15/(E_{58} - E_{57})$	50		50		"
		"		30 V	GND		-5 V		K7	"	E_{58}	"		50		50		"

See footnotes at end of table.

TABLE III. Group A inspection for device types 05 and 06 - Continued. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types 05, 06 Limits		Unit
				1	2	3	4	5		No.	Value	Unit		Min	Max	
4 T_A =+25°C	A_{VS}	4004	69	5 V	GND		-2.5 V		K8	5	E_{59}	V	$A_{VS(+)} = 1.5/(E_{60} – E_{59})$	10		V/mV
		“		5 V	GND		-1 V		K8	“	E_{60}	“				“
		“	70	5 V	GND		-2.5 V		K7	“	E_{61}	“	$A_{VS(-)} = 1.5/(E_{62} – E_{61})$	10		“
		“		5 V	GND		-1 V		K7	“	E_{62}	“				“
	V_{OL}	3007	71	30 V	GND		5 V		K11, K9	3	$(E_0)_3$	mV	$V_{OL} = (E_0)_3$		35	V/m
		“	72	30 V	GND	5 mA	5 V		K11	“	$(E_0)_4$	V	$V_{OL} = (E_0)_4$		1.5	V
		“	73	4.5 V	GND	2 µA	5 V		K11	“	$(E_0)_5$	“	$V_{OL} = (E_0)_5$		0.4	“
	V_{OH}	3006	74	30 V	GND	-10 mA	-5 V		K11	“	$(E_0)_6$	“	$V_{OH} = (E_0)_6$	27		“
	V_{OH}	3006	75	4.5 V	GND	-10 mA	-5 V		K11	“	$(E_0)_7$	“	$V_{OH} = (E_0)_7$	2.4		“
5 T_A =+125°C	$+V_{OP}$	4004	76	30 V	GND		-30 V		K8	“	$(E_0)_8$	“	$+V_{OP} = (E_0)_8$	27		“
	$-V_{OP}$	“	77	30 V	GND		-30 V		K7	“	$(E_0)_9$	“	$-V_{OP} = (E_0)_9$	26		“
	$A_{VS(+)}$	“	78	30 V	GND		-26 V		K8	5	E_{63}	“	$A_{VS(+)} = 25/(E_{64} – E_{63})$	25		V/mV
		“		30 V	GND		-1 V		K8	“	E_{64}	“				“
		“	79	30 V	GND		-20 V		K7	“	E_{65}	“	$A_{VS(+)} = 15/(E_{66} – E_{65})$	25		“
		“		30 V	GND		-5V		K7	“	E_{66}	“				“
	A_{VS}	“	80	5 V	GND		-2.5 V		K8	“	E_{67}	“	$A_{VS} = 1.5/(E_{68} – E_{67})$	10		V/mV
		“		5 V	GND		-1 V		K8	“	E_{68}	“				“
		“	81	5 V	GND		-2.5 V		K7	“	E_{69}	“	$A_{VS} = 1.5/(E_{70} – E_{69})$	10		“
		“		5 V	GND		-1 V		K7	“	E_{70}	“				“
	V_{OL}	3007	82	30 V	GND		5 V		K11, K9	3	$(E_0)_{10}$	mV	$V_{OL} = (E_0)_{10}$		35	mV
		“	83	30 V	GND	5 mA	5 V		K11	“	$(E_0)_{11}$	V	$V_{OL} = (E_0)_{11}$		1.5	V
		“	84	4.5 V	GND	2 µA	5 V		K11	“	$(E_0)_{12}$	“	$V_{OL} = (E_0)_{12}$		0.4	“
	V_{OH}	3006	85	30 V	GND	-10 mA	-5 V		K11	“	$(E_0)_{13}$	“	$V_{OH} = (E_0)_{13}$	27		“
	V_{OH}	3006	86	4.5 V	GND	-10 mA	-5 V		K11	“	$(E_0)_{14}$	“	$V_{OH} = (E_0)_{14}$	2.4		“

See footnotes at end of table.

TABLE III. Group A inspection for device types 05 and 06 - Continued. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types 05, 06 Limits		Unit
				1	2	3	4	5		No.	Value	Unit		Min	Max	
6 T_A =-55°C	$+V_{OP}$	4004	87	30 V	GND		-30 V		K8	3	$(E_0)_{15}$	V	$+V_{OP} = (E_0)_{15}$	27		V
	$+V_{OP}$	“	88	30 V	GND		-30 V		K7	“	$(E_0)_{16}$	“	$+V_{OP} = (E_0)_{16}$	26		V
	$A_{VS(+)}$	“	89	30 V	GND		-26 V		K8	5	E_{71}	“	$A_{VS(+)} = 25/(E_{72} – E_{71})$	25		V/mV
		“		30 V	GND		-1 V		K8	“	E_{72}	“		25		“
		“	90	30 V	GND		-20 V		K7	“	E_{73}	“	$A_{VS(+)} = 15/(E_{74} – E_{73})$	25		“
		“		30 V	GND		-5 V		K7	“	E_{74}	“		25		“
	A_{VS}	“	91	5 V	GND		-2.5 V		K8	“	E_{75}	“	$A_{VS} = 1.5/(E_{76} – E_{75})$	10		“
		“		5 V	GND		-1 V		K8	“	E_{76}	“				“
		“	92	5 V	GND		-2.5 V		K7	“	E_{77}	“	$A_{VS} = 1.5/(E_{78} – E_{77})$	10		“
		“		5 V	GND		-1 V		K7	“	E_{78}	“				“
	VOL	3007	93	30 V	GND		5 V		K11, K9	3	$(E_0)_{17}$	mV	$V_{OL} = (E_0)_{17}$		35	mV
		“	94	30 V	GND	5 mA	5 V		K11	“	$(E_0)_{18}$	V	$V_{OL} = (E_0)_{18}$		1.5	V
		“	95	4.5 V	GND	2 µA	5 V		K11	“	$(E_0)_{19}$	“	$V_{OL} = (E_0)_{19}$		0.4	“
	VOH	3006	96	30 V	GND	-10 mA	-5 V		K11	“	$(E_0)_{20}$	“	$V_{OH} = (E_0)_{20}$	27		“
	VOH	3006	97	4.5 V	GND	-10 mA	-5 V		K11	“	$(E_0)_{21}$	“	$V_{OH} = (E_0)_{21}$	2.3		“
7 T_A =+25°C	NI(BB)		98 10/	15 V	-15 V		GND		K10, K11	“	$(E_0)_{22}$	mVrms	$NI(BB) = (E_0)_{22}$		15	µVrms
	NI(PC)		99 10/	15 V	-15 V		GND		K5,K6,K10, K11	“	$(E_0)_{23}$	mVpk	$NI(PC) = (E_0)_{23}$		50	µVpk
	CS		100	30 V	GND	16 V	-1.4 V		See fig. 3	5	E_{79}	V	$CS = 20 \log 1.5 \times 10^4 / E_{79} – E_{80}\|$	80		dB
				30 V	GND	1 V	-1.4 V		“	“	E_{80}	“		80		“
			101	30 V	GND	16 V	-1.4 V		“	“	E_{81}	“	$CS = 20 \log 1.5 \times 10^4 / E_{81} – E_{82}\|$	80		“
				30 V	GND	1 V	-1.4 V		“	“	E_{82}	“		80		“
			102	30 V	GND	16 V	-1.4 V		“	“	E_{83}	“	$CS = 20 \log 1.5 \times 10^4 / E_{83} – E_{84}\|$	80		“
				30 V	GND	1 V	-1.4 V		“	“	E_{84}	“		80		“
			103	30 V	GND	16 V	-1.4 V		“	“	E_{85}	“	$CS = 20 \log 1.5 \times 10^4 / E_{85} – E_{86}\|$	80		“
				30 V	GND	1 V	-1.4 V		“	“	E_{86}	“		80		“

See footnotes at end of table.

TABLE III. Group A inspection for device types 05 and 06 - Continued. 1/

Subgroup	Symbol	MIL-STD -883 method	Test no.	Adapter pin numbers					Energized relays 2/	Measured pins			Equations 3/	Device types 05, 05 Limits		Unit
				1	2	3	4	5		No.	Value	Unit		Min	Max	
7 T_A =+25°C	CS		104	30 V	GND	16 V	-1.4 V		See fig. 3	5	E_{87}	V	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{87} - E_{88} \rvert$	80		dB
				30 V	GND	1 V	-1.4 V		“		E_{88}	“		80		“
			105	30 V	GND	16 V	-1.4 V		“		E_{89}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{89} - E_{90} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{90}	“		80		“
			106	30 V	GND	16 V	-1.4 V		“		E_{91}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{91} - E_{92} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{92}	“		80		“
			107	30 V	GND	16 V	-1.4 V		“		E_{93}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{93} - E_{94} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{94}	“		80		“
			108	30 V	GND	16 V	-1.4 V		“		E_{95}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{95} - E_{96} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{96}	“		80		“
			109	30 V	GND	16 V	-1.4 V		“		E_{97}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{97} - E_{98} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{98}	“		80		“
			110	30 V	GND	16 V	-1.4 V		“		E_{99}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{99} - E_{100} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{100}	“		80		“
			111	30 V	GND	16 V	-1.4 V		“		E_{101}	“	$CS = 20 \log \lvert 1.5 \times 10^4 / E_{101} - E_{102} \rvert$	80		“
				30 V	GND	1 V	-1.4 V		“		E_{102}	“		80		“
	$TR(t_r)$		112	30 V	GND	IN		OUT	See fig. 4		Δt	µs	(Waveform 1) $TR(t_r) = \Delta t$		1.0	µs
	$TR(_{os})$		113	30 V	GND	IN		OUT	“		$V_O;\Delta V_O$	V	(Waveform 1) $TR(OS) = 100\ (\Delta V_O/V_O)$		60	%
	SR(+)	4002	114	30 V	GND	IN		OUT	“		ΔV_O; Δt	V; µs	(Waveform 2) $SR(+) = V_O/\Delta t$	0.1		V/µs
	SR(-)	“	115	30 V	GND	IN		OUT	“		ΔV_O; Δt	V; µs	(Waveform 3) $SR(-) = \Delta V_O/\Delta t$	0.1		V/µs
8			116 to 123	Same tests, terminal conditions and limits as subgroup 7, tests 112 through 115 except T_A = 125°C and T_A = -55°C.												

See footnotes at end of table.

TABLE III. Group A inspection - Continued.

1/ Use table III in conjunction with the following:

Tests	Device type	Figure
1 – 102	01 – 04	2
1 – 99	05 – 06	
103 – 114	01 – 04	3
100 – 111	05 – 06	
115 – 126	01 – 04	4
112 - 123	05 - 06	

2/ K1, K2, K3, or K4 relay will also be energized as follows:

a. Device types 01 through 04 – test numbers 22 and 103 through 126.

b. Device types 05 and 06 – test numbers 20 and 100 through 123.

3/ The equations take into account both the closed loop gain of 1,000 and the scale factor multiplier so that the calculator value is in table I units; therefore, use the measured value units in the equation. (For example: If E_1 = 2 V and V_{IO} = E_1, then V_{IO} = E_1, then V_{IO} = 2 mV).

4/ Each device shall be tested over the common mode range as specified in table III with the output forced to the worse case condition. V_{CM} is achieved by grounding the inputs and algebraically subtracting V_{CM} from each supply. Common mode rejection is calculated using the offset voltage values measured at the common mode range end points.

5/ In device types 01 through 04, to minimize thermal drift, the reference voltage for gain measurement (E_3, E_{21}, and E_{39}) shall be taken immediately prior to or after the reading corresponding to device gain (E_{55}, E_{56}, E_{57}, E_{58}, E_{63}, E_{64}, E_{65}, E_{66}, E_{71}, E_{72}, E_{73}, and E_{74}).

6/ Only one amplifier shall be tested at one time and its output shall be shorted to ground for 25 ms or less.

7/ Each amplifier shall be tested separately, except for the I_{CC} measurements where all the amplifiers shall be connected as grounded followers (relays K1 through K4 de-energized).

8/ Tests 27, 32, 51, and 56 for devices types 01 through 04 and tests 25, 30, 47, and 52 for device types 05 and 06, which require a read and record measurement plus a calculation, may be omitted except when subgroups 2 and 3 are being accomplished for group A sampling inspection and groups C and D end point measurement.

9/ SR(+) and SR(-) are 0.2 V/µs for device type 01 and 0.8 V/µs for device type 02.

10/ Broadband noise (NI(BB) shall be measured using an rms voltmeter with a bandwidth of 10 Hz to 5 kHz. “Popcorn” noise (NI(PC)) shall be measured for 15 seconds.

11/ For device types 01, 03, and 04, V_{IN} = 10 V; for device type 02, V_{IN} = 2 V.

12/ For device types 01, 03, and 04, V_{IN} = -10 V; for device type 02, V_{IN} = -2 V.

TABLE IV. Group C and Group B life test end point electrical parameters.

(T_A = +25°C, ±V_{CC} = ±20 V for device types 01 – 04 and
+V_{CC} = 30 V for device types 05 and 06).

Table III test no.	Test	01, 02				03				Unit
		Limit		Delta		Limit		Delta		
		Min	Max	Min	Max	Min	Max	Min	Max	
3	V_{IO}	-5	+5	-1	+1	-3.0	+3.0	-0.5	+0.5	mV
11	$+I_{IB}$	+0.1	+100	-15	+15	-200	-1	-20	20	nA
15	$-I_{IB}$	+0.1	+100	-15	+15	-200	-1	-20	20	nA

Table III test no.	Test	04				05				Unit
		Limit		Delta		Limit		Delta		
		Min	Max	Min	Max	Min	Max	Min	Max	
3	V_{IO}	-5	+5	-1	+1	-5	+5	-1	+1	mV
11	$+I_{IB}$	-250	-1	-25	+25	-150	-1	-15	+15	nA
15	$-I_{IB}$	-250	-1	-25	+25	-150	-1	-15	+15	nA

Table III test no.	Test	06				Unit
		Limit		Delta		
		Min	Max	Min	Max	
3	V_{IO}	-2	+2	-0.5	+0.5	mV
11	$+I_{IB}$	-50	-1	-10	+10	nA
15	$-I_{IB}$	-50	-1	-10	+10	nA

1/ For device types 05 and 06, the table III test numbers are as follows: V_{IO} use test number 1, $+I_{IB}$ use the test number 9, $-I_{IB}$ use test number 13.

4.4 Technology Conformance inspection (TCI). Technology conformance inspection shall be in accordance with MIL-PRF-38535 and herein for groups A, B, C, and D inspections (see 4.4.1 through 4.4.4).

4.4.1 Group A inspection. Group A inspection shall be in accordance with table III of MIL-PRF-38535 and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 9, 10, and 11 shall be omitted.

4.4.2 Group B inspection. Group B inspection shall be in accordance with table II of MIL-PRF-38535.

4.4.3 Group C inspection. Group C inspection shall be in accordance with table IV of MIL-PRF-38535 and as follows:

a. End point electrical parameters shall be as specified in table II herein.

b. The steady-state life test duration, test condition, and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The burn-in test circuit shall be maintained under document control by the device manufacturer's Technology Review Board (TRB) in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

4.4.4 Group D inspection. Group D inspection shall be in accordance with table V of MIL-PRF-38535. End point electrical parameters shall be as specified in table II herein.

4.5 Methods of inspection. Methods of inspection shall be specified and as follows.

4.5.1 Voltage and current. All voltage values given are referenced to the external zero reference level of the supply voltage. Currents given are for conventional current and are positive when flowing into the referenced terminal.

4.5.2 Life test cooldown procedure. When devices are measured at +25°C following application of the steady state life or burn-in test condition, they shall be cooled to within 10°C of their power stable condition at room temperature prior to removal of the bias.

5. PACKAGING

5.1 Packaging requirements. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department of Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

6.1 Intended use. Microcircuits conforming to this specification are intended for Government microcircuit applications (original equipment) and logistic purposes.

6.2 Ordering data. The contract or purchase order should specify the following:

a. Title, number, and date of the specification.

b. Complete part number (see 1.2).

c. Requirements for delivery of one copy of the quality conformance inspection data pertinent to the device inspection lot to be supplied with each shipment by the device manufacturer, if applicable.

d. Requirements for certificate of compliance, if applicable.

e. Requirements for notification of change of product or process to acquiring activity in addition to notification of the qualifying activity, if applicable.

f. Requirements for failure analysis (including required test condition of MIL-STD-883, method 5003), corrective action and reporting of results, if applicable.

g. Requirements for product assurance options.

h. Requirements for special carriers, lead lengths, or lead forming, if applicable. These requirements should not affect the part number. Unless otherwise specified, these requirements will not apply to direct purchase by or direct shipment to the Government.

i. Requirements for "JAN" marking.

j. Packaging requirements (see 5.1).

6.3 Superseding information. The requirements of MIL-M-38510 have been superseded to take advantage of the available Qualified Manufacturer Listing (QML) system provided by MIL-PRF-38535. Previous references to MIL-M-38510 in this document have been replaced by appropriate references to MIL-PRF-38535. All technical requirements now consist of this specification and MIL-PRF-38535. The MIL-M-38510 specification sheet number and PIN have been retained to avoid adversely impacting existing government logistics systems and contractor's parts lists.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List QML-38535 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DSCC-VQ, 3990 E. Broad Street, Columbus, Ohio 43213-1199.

6.5 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535 and MIL-STD-1331.

6.6 Logistic support. Lead materials and finishes (see 3.4) are interchangeable. Unless otherwise specified, microcircuits acquired to Government logistic support will be acquired to device class B (see 1.2.2), and lead material and finish A (see 3.4). Longer length leads and lead forming should not affect the part number.

6.7 Substitutability. The cross-reference information below is presented for the convenience of users. Microcircuits covered by this specification will functionally replace the listed generic-industry type. Generic-industry microcircuit types may not have equivalent operational performance characteristics across military temperature ranges or reliability factors equivalent to MIL-M-38510 device types and may have slight physical variations in relation to case size. The presence of this information should not be deemed as permitting substitution of generic-industry types for MIL-M-38510 types or as a waiver of any of the provisions of MIL-M-38535.

Military device type	Generic-industry type
01	LM148
02	LM149
03	4741, 4156
04	4136
05	LM124
06	LM124A

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 11
NASA - NA
DLA - CC

Preparing activity:
DLA - CC

Project 5962-1976

Review activities:
Army - MI, SM
Navy - AS, CG, MC, SH, TD
Air Force – 03, 19, 99

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1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-M-38510/110C	2. DOCUMENT DATE *(YYYYMMDD)* 2003/08/19

3. DOCUMENT TITLE
MICROCIRCUITS, LINEAR, QUAD OPERATIONAL AMPLIFIERS, MONOLITHIC SILICON, PART NUMBERS M38510/10101 THROUGH M38510/10106

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) DSN *(If applicable)*	7. DATE SUBMITTED *(YYYYMMDD)*

8. PREPARING ACTIVITY

a. NAME Rick Officer	b. TELEPHONE *(Include Area Code* (1) Commercial 614-692-0518 (2) DSN 850-0518
c. ADDRESS *(Include Zip Code)* DSCC-VAS 3990 East Broad Street Columbus, Ohio 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703)767-6888 DSN 427-6888

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