INCH-POUND

MIL-M-38510/110B
11 September 1989
SUPERSEDING
MIL-M-38510/110A
7 January 1983

MILITARY SPECIFICATION

MICROCIRCUITS, LINEAR, QUAD OPERATIONAL AMPLIFIERS, MONOLITHIC SILICON

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

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 outline and lead finish are provided for each type and are reflected in the complete Part or Identifying Number (PIN) (see 6.6).

1.2 Classification.

1.2.1 Device type. The quad operational amplifiers shall be internally compensated and shall be distinguished by the following circuit characteristics.

Device type	Circuit
01	Medium power.
02 1/	Medium power, undercompensated version of device type 01.
03	Medium speed, low noise.
04	Medium speed, low noise (alternate pinout).
05 2/	Single supply, low power.
06 2/	Single supply, low power.

1.2.2 Device class. The device class shall be the product assurance level as defined in MIL-M-38510.

1/ Device type 02 wideband amplifier is under compensated and can only be used with a closed loop gain of five or greater.

2/ 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Rome Air Development Center (RBE-2), Griffiss AFB, NY 13441-5700, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A
FSC 5962

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

1.2.3 Case outline. The case outline shall be designated as follows:

Outline letter	Case outline (see MIL-M-38510, appendix C)
A	F-1 (14-lead, .280" x .260" x .085") flat package
C	D-1 (14-lead, .785" x .310" x .200") dual-in-line package
D	F-2 (14-lead, .390" x .260" x .085") flat package

1.3 Absolute maximum ratings.

Supply voltage range:	
Device types 01, 02, 03 and 04 - - - - - - - - - -	±22 V 3/
Device types 05 and 06 - - - - - - - - - - - - - - -	36 V or ±18 V 3/
Input voltage range:	
Device types 01, 02, 03 and 04 - - - - - - - - - -	±20 V 4/
Device types 05 and 06 - - - - - - - - - - - - - - -	$-V_{CC}$ -0.3 V to $+V_{CC}$
Differential input voltage range - - - - - - - - - -	±30 V 5/
Input current range:	
Device types 01 and 02 - - - - - - - - - - - - - -	-0.1 to 10 mA
Device types 03, 04, 05, and 06- - - - - - - - - - -	10 to 0.1 mA
Storage temperature range- - - - - - - - - - - - -	-65°C to +150°C
Output short-circuit duration- - - - - - - - - - - -	Unlimited 6/
Lead temperature (soldering, 60 seconds) - - - - -	300°C
Junction temperature (T_J)- - - - - - - - - - - - -	175°C 7/

1.4 Recommended operating conditions.

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

1.5 Power and thermal characteristics.

Case outline	Package	Maximum allowable power dissipation	Maximum θ_{JC}	Maximum θ_{JA}
A, D,	14 lead flat package	350 mW @ T_A = 125°C	60°C/W	140°C/W
C	Dual-in-line	400 mW @ T_A = 125°C	35°C/W	120°C/W

3/ Voltages in excess of these may be applied for short-term tests if voltage difference does not exceed 44 volts (36 volts for device type 05).

4/ For device types 01 through 04, for supply voltages less than ±20 V, the absolute maximum input voltage is equal to the supply voltage. For device types 05 and 06 for supply voltage differences of less than 36 V, the absolute maximum input voltage is equal to the supply voltage.

5/ The differential input voltage range shall not exceed the supply voltage range.

6/ Short circuit may be to ground or either supply. Rating applies to +125°C case temperature or +75°C ambient temperature.

7/ For short term test (in the specific burn-in and life test configuration where required and up to 168 hours maximum) T_J = 275°C.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document 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 (see 6.2).

SPECIFICATION

MILITARY

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

STANDARD

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Detail specifications. The individual item requirements shall be in accordance with MIL-M-38510, and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

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

3.2.2 Typical schematic circuits. The typical schematic circuits shall be as specified on figure 2.

3.2.3 Schematic circuits. Schematic circuits shall be submitted to the preparing activity prior to inclusion of a manufacturer's device in this specification and shall be submitted to the qualifying activity and agent activity (DESC-ECS) as a prerequisite for qualification. All qualified manufacturers' schematics shall be maintained by the agent activity and will be available upon request.

3.2.4 Case outlines. The case outlines shall be as specified in 1.2.3 herein.

3.2.5 Package and sealing material. Package and sealing material shall be in accordance with MIL-M-38510.

3.3 Lead material and finish. The lead material and finish shall be in accordance with MIL-M-38510 (see 6.4).

TABLE I. Electrical performance characteristics.

Characteristics	Symbol	Conditions (unless otherwise specified, requirements of 3.4 and figure 6 shall apply).		Device types 01, 02 Limits Min	01, 02 Max	03 Limits Min	03 Max	04 Limits Min	04 Max	05 Limits Min	05 Max	06 Limits Min	06 Max	Units
Input offset voltage	V_{IO}	1/	$T_A = 25^\circ C$		±5		±3		±5		±5		±2	mV
			$-55^\circ C \leq T_A \leq 125^\circ C$		±6		±5		±6		±7		±4	
Input offset voltage temperature sensitivity	$\Delta V_{IO}/\Delta T$		ΔT_A from $-55^\circ C$ to $25^\circ C$		±25		±20		±25		±30		±30	$\mu V/^\circ C$
			ΔT_A from $25^\circ C$ to $125^\circ C$		±25		±20		±25		±30		±30	
Input offset current	I_{IO}	1/	$25^\circ C \leq T_A \leq 125^\circ C$		±25		±30		±75		±30		±10	nA
		$R_S = 20\ k\Omega$	$T_A = -55^\circ C$		±75		±75		±150		±75		±30	
Input offset current temperature sensitivity	$\Delta I_{IO}/\Delta T$		ΔT_A from $-55^\circ C$ to $25^\circ C$		±400		±500		±1000		±700		±700	$pA/^\circ C$
			ΔT_A from $25^\circ C$ to $125^\circ C$		±200		±200		±500		±400		±400	
Input bias current	$+I_{IB}$	1/	$25^\circ C \leq T_A \leq 125^\circ C$	0.1	100	-200	-1	-250	-1	-150	-1	-50	-1	nA
		$R_S = 20\ k\Omega$	$T_A = -55^\circ C$	0.1	325	-325	-1	-400	-1	-300	-1	-100	-1	
	$-I_{IB}$	1/	$25^\circ C \leq T_A \leq 125^\circ C$	0.1	100	-200	-1	-250	-1	-150	-1	-50	-1	nA
		$R_S = 20\ k\Omega$	$T_A = -55^\circ C$	0.1	325	-325	-1	-400	-1	-300	-1	-100	-1	
Power supply rejection ratio	+PSRR	Device types 01 through 04, $+V_{CC}$ = 10 V and $-V_{CC}$ = -20 V. For device types 05 and 06, $+V_{CC}$ = 30 V to 5 V			±100		±100		±100		±100		±100	$\mu V/V$
	-PSRR	$+V_{CC}$ = 20 V and $-V_{CC}$ = -10 V (Device types 01 through 04 only)			±100		±100		±100	---	---	---	---	$\mu V/V$
Input voltage common mode rejection	CMR	2/ Common mode range	30 V for types 01-04 28 V for types 05 and 06	76	---	76	---	76	---	76	---	76	---	dB
Output short circuit current (for positive) output)	$I_{OS(+)}$	3/ (Only one amplifier shorted to GND at one time) $t \leq 25$ ms	4/ $T_A = -55^\circ C$	-75	---	-80	---	-80	---	-70	---	-70	---	mA
			$25^\circ C \leq T_A \leq 125^\circ C$	-55	---	-80	---	-80	---	-70	---	-70	---	
Output short circuit current (for negative output)	$I_{OS(-)}$	For types 01-04, $+V_{CC}$ = ±15 V	4/ $T_A = -55^\circ C$	---	75	---	80	---	80	---	---	---	---	mA
		For types 05 and 06, $+V_{CC}$ = 30 V	$25^\circ C \leq T_A \leq 125^\circ C$	---	55	---	---	---	---	---	---	---	---	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Characteristics	Symbol	Conditions (unless otherwise specified, requirements of 3.4 and figure 6 shall apply).		Device types 01, 02 Limits Min	01, 02 Max	03 Limits Min	03 Max	04 Limits Min	04 Max	05, 06 Limits Min	05, 06 Max	Units
Supply current	5/ I_{CC}	For types 01-04, $\pm V_{CC}$ = ±15 V	T_A = -55°C	---	4.5	---	9	---	13	---	4	mA
			T_A = 25°C	---	3.6	---	7	---	11	---	3	
		For types 05 and 06, $+V_{CC}$ = 30 V	T_A = 125°C	---	3.6	---	7	---	11	---	3	
Maximum output voltage swing	$+V_{OP}$	For types 01-04, $\pm V_{CC}$ = ±20 V	R_L = 10 kΩ	+16	---	+16	---	+16	---	+27	---	V
		For types 05 and 06, $+V_{CC}$ = 30 V	R_L = 2 kΩ	+15	---	+15	---	+15	---	+26	---	V
	$-V_{OP}$	$\pm V_{CC}$ = ±20 V	R_L = 10 kΩ	---	-16	---	-16	---	-16	---	---	V
			R_L = 2 kΩ	---	-15	---	-15	---	-15	---	---	V
Single ended open loop voltage gain	$A_{VS(+)}$ and	R_L = 10 kΩ For types 01-04, $\pm V_O$ = ±15 V	T_A = 25°C	50	---	50	---	50	---	50	---	V/mV
		For types 05 and 06, V_O = 1 to 26 V	-55°C ≤ T_A ≤ 125°C	25	---	25	---	25	---	25	---	
	$A_{VS(-)}$ 6/	R_L = 2 kΩ	T_A = 25°C	50	---	50	---	50	---	50	---	
		For types 01-04; $\pm V_O$ = ±15 V For types 05 and 06, V_O = 5 to 20 V	-55°C ≤ T_A ≤ 125°C	25	---	25	---	25	---	25	---	
	A_{VS}	R_L = 10 kΩ and 2 kΩ	T_A = 25°C	10	---	10	---	10	---	10	---	
		For types 01-04, $\pm V_{CC}$ = ±5 V, V_O = ±2 V For types 05 and 06, $+V_{CC}$ = +5 V, V_O = 1 to 2.5 V	-55°C ≤ T_A ≤ 125°C	10	---	10	---	10	---	10	---	
Low level output voltage	V_{OL}	$+V_{CC}$ = 30 V, R_L = 10 kΩ		---	---	---	---	---	---	---	35	mV
		$+V_{CC}$ = 30 V, I_{OL} = 5 mA		---	---	---	---	---	---	---	1.5	V
		$+V_{CC}$ = 4.5 V, I_{OL} = 2 μA		---	---	---	---	---	---	---	0.4	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Characteristics	Symbol	Conditions (unless otherwise specified, requirements of 3.4 and figure 6 shall apply).		Device types 01, 02 Limits Min	01, 02 Max	03 Limits Min	03 Max	04 Limits Min	04 Max	05, 06 Limits Min	05, 06 Max	Units
High level output voltage	V_{OH}	$\pm V_{CC}$ = 30 V, I_{OH} = 10 mA		---	---	---	---	---	---	27	---	V
		$\pm V_{CC}$ = 4.5 V, I_{OH} = 10 mA	T_A = 25°C, 125°C	---	---	---	---	---	---	2.4	---	
			T_A = -55°C							2.3		
Transient response	TR(tr)	7/ Figure 8 $\pm V_{CC}$ = ±20 V for types 01 - 04, $\pm V_{CC}$ = 30 V for types 05 and 06	A_V = 1	---	1.0	---	0.2	---	0.3	---	1.0	µs
			A_V = 5	---	1.0	---	---	---	---	---	---	
	TR(OS)		Overshoot	---	25	---	35	---	50	---	50	%
Slew rate	SR(+) and	Figure 8 $\pm V_{CC}$ = ±20 V for types 01 - 04;	Devices 01, 03, 04, 05, 06 A_V = 1	0.2	---	0.8	---	0.6	---	0.1	---	V/µs
	SR(-)	$\pm V_{CC}$ = 30 V for types 05 and 06	Device 02 only A_V = 5	0.8	---	---	---	---	---	---	---	
Noise (broadband)	NI(BB)	T_A = 25°C, R_S = 50Ω $\pm V_{CC}$ = ±15 V for devices 05 and 06 $\pm V_{CC}$ = ±20 V for device 01-04		---	15	---	5	---	5	---	15	µV rms
Noise (popcorn)	NI(PC)	T_A = 25°C, R_S = 20 kΩ $\pm V_{CC}$ = ±15 V for devices 05 and 06 $\pm V_{CC}$ = ±20 V for device 01-04		---	40	---	50	---	50	---	50	µVpeak
Channel separation	CS	T_A = 25°C (figure 7)		80	---	80	---	80	---	80	---	dB

See footnotes on page 7.

1/ Device types 01-04 shall be tested at V_{CM} = 0, +15 V and -15 V with $\pm V_{CC}$ = ±20 V; and at V_{CM} = 0 V with $\pm V_{CC}$ = ±5 V. Device type 05 shall be tested at V_{CM} = -13 V with $+V_{CC}$ = 2 V and $-V_{CC}$ = -28; 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_U	$+V_{CC}$	$-V_{CC}$	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 ≤ T_A ≤ 25°C.

4/ $I_{SO(+)}$ and $I_{SO(-)}$ limits for device type 01 only @ 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 type 05 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.

3.4 Electrical performance characteristics. The electrical performance characteristics are as specified in table I, and apply over the full operating ambient temperature range for supply voltages as follows. Unless otherwise specified, source resistance (R_S) shall be 50Ω for all tests.

Device type	$\pm V_{CC}$(min)	$\pm V_{CC}$(max)	Power supply
01, 02, 03, and 04	±5 V	±20 V	Dual
05, and 06	+5 V	+30 V	Single

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

3.5 Electrical test requirements. The 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.

3.6 Marking. Marking shall be in accordance with MIL-M-38510.

3.6.1 Serialization. All class S devices shall be serialized in accordance with MIL-M-38510.

3.6.2 Correctness of indexing and marking. All devices shall be subjected to the final electrical tests specified in table II after part marking to verify that they are correctly indexed and identified by PIN. Optionally, an approved electrical test may be devised especially for this requirement.

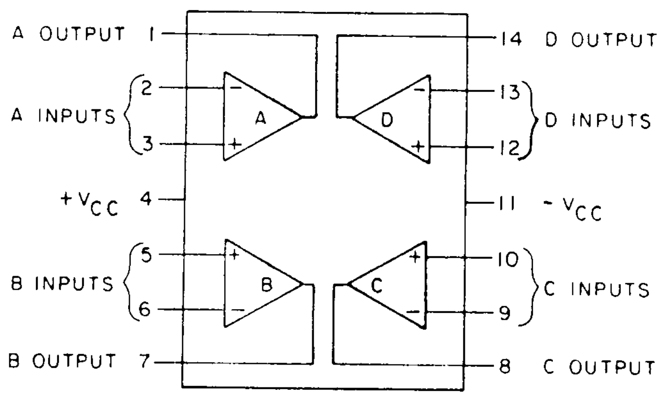
3.7 Microcircuit group assignment. The devices covered by this specification shall be in microcircuit group number 49 (see MIL-M-38510, appendix E).

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (see table III) Class S devices	Class B devices
Interim electrical parameters (method 5004)	1	1
Final electrical test parameters (method 5004)	1*,2,3,4	1*,2,3,4
Group A test electrical tests (method 5005)	1,2,3,4 5,6,7,8	1,2,3,4 5,6,7
Group C end-point and group B, class S, electrical parameters (method 5005)	1,2,3, and table IV delta limits	1 and table IV delta limits
Additional electrical test for group C inspection	N/A	8
Group D end-point electrical parameters (method 5005)	1,2,3	1

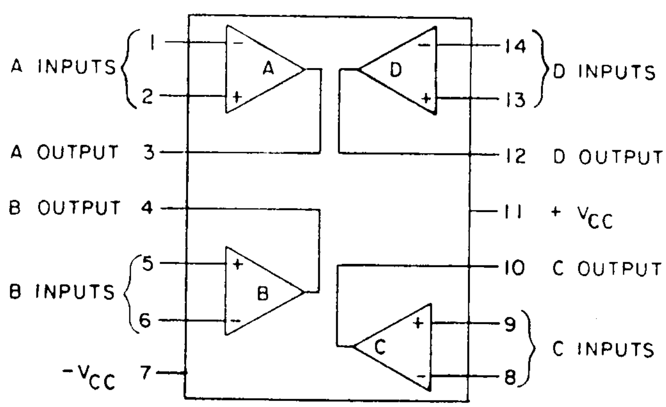
* PDA applies to subgroup 1 (see 4.2d).

Device types 01, 02, 03, 05 and 06 (cases A, C and D)*



*14-lead flat-pack and dual-in-line (top view)

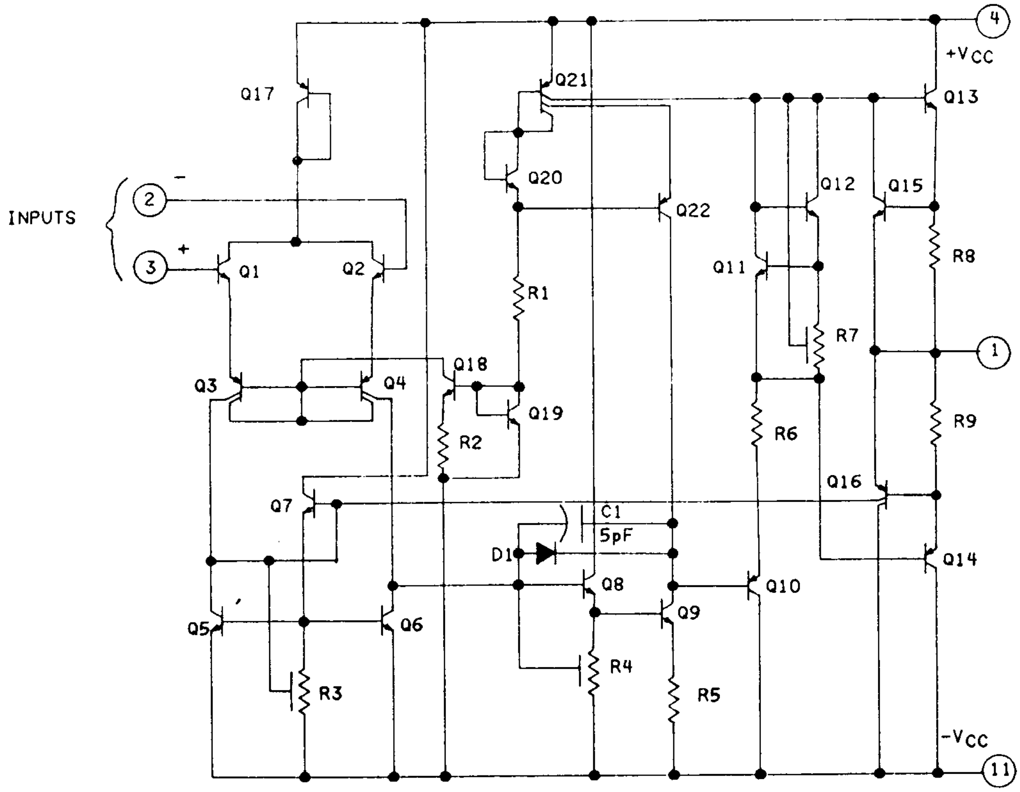
Device type 04
(Cases A and C)**



** 14-lead flat package dual-in-line (top view).

FIGURE 1. Terminal connections.

Device types 01 and 02



Resistor values

R_1 = 310 kΩ

R_2 = 10 kΩ

R_3 = 75 kΩ

R_4 = 100 kΩ

R_5 = 300Ω

R_6 = 1 kΩ

R_7 = 40 kΩ

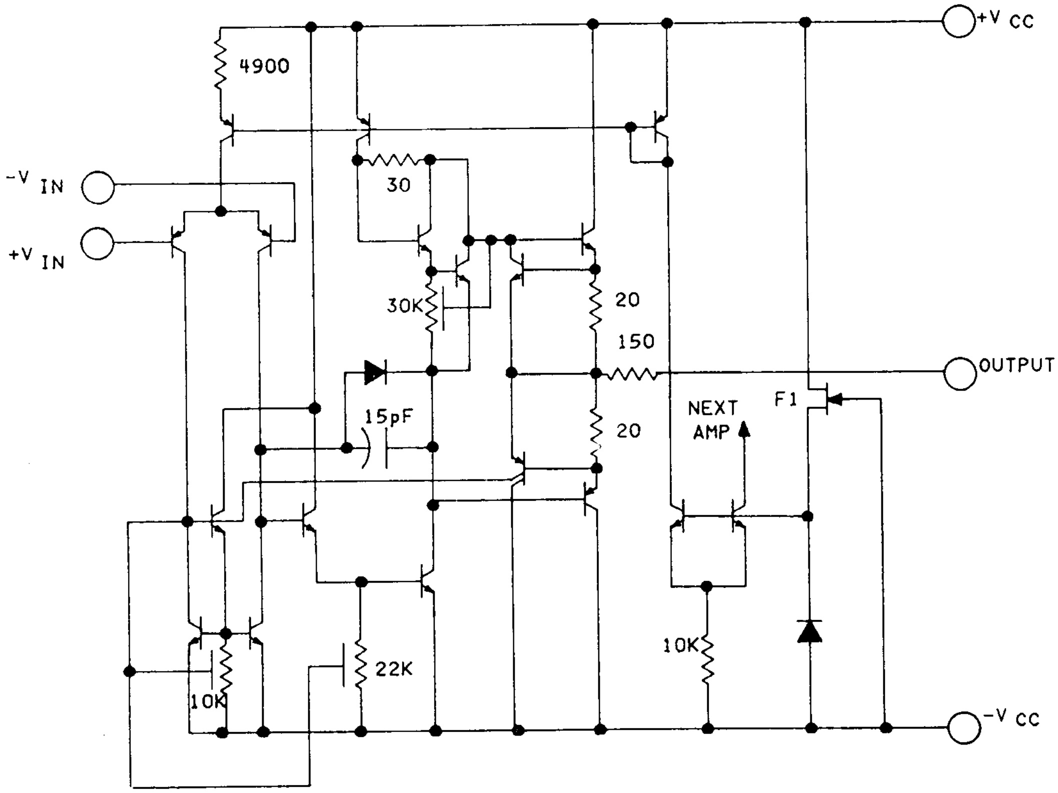
R_8 = 25Ω

R_9 = 22Ω

NOTES:
1. Component values are nominal.
2. Circuit shown is 1/4 of device.

FIGURE 2. Typical schematic circuits.

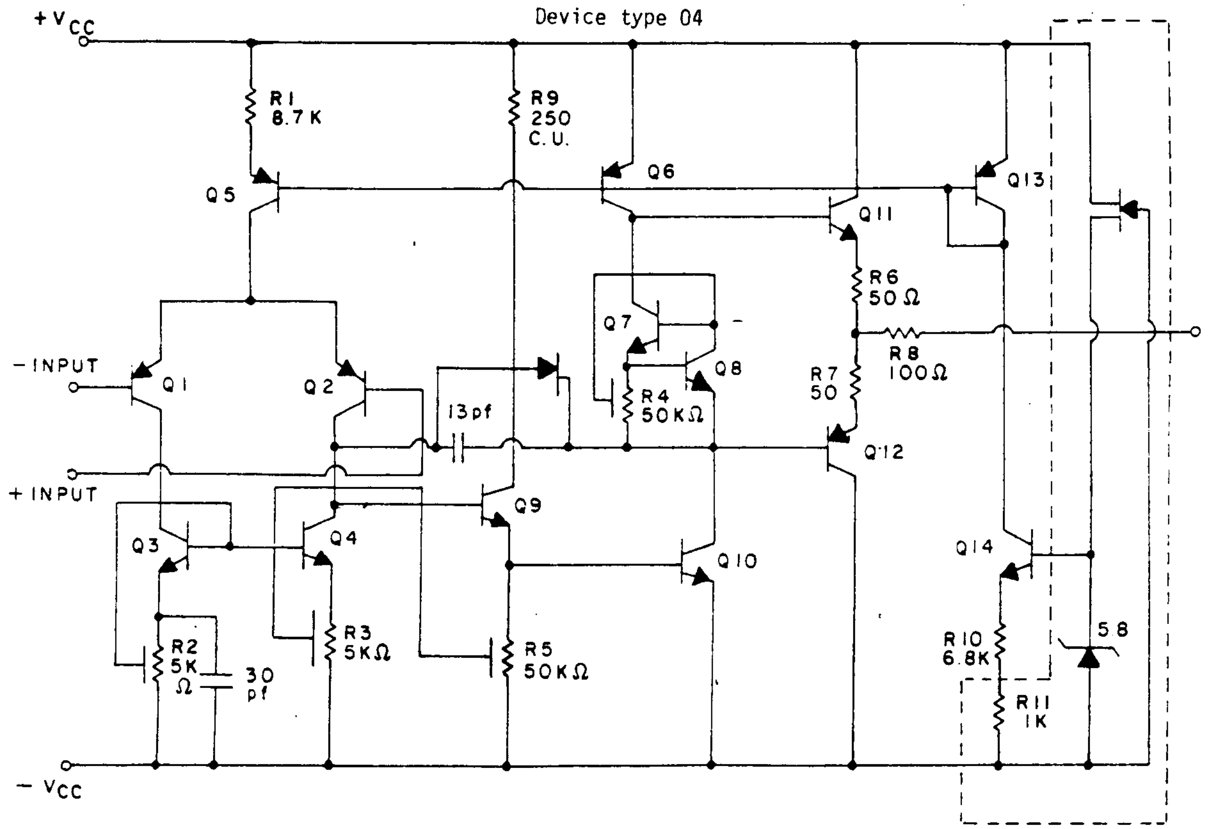
Device type 03



NOTES:
1. Component values are nominal.
2. Circuit shown is 1/4 of device.

FIGURE 2. Typical schematic circuits - Continued.

Device type 04

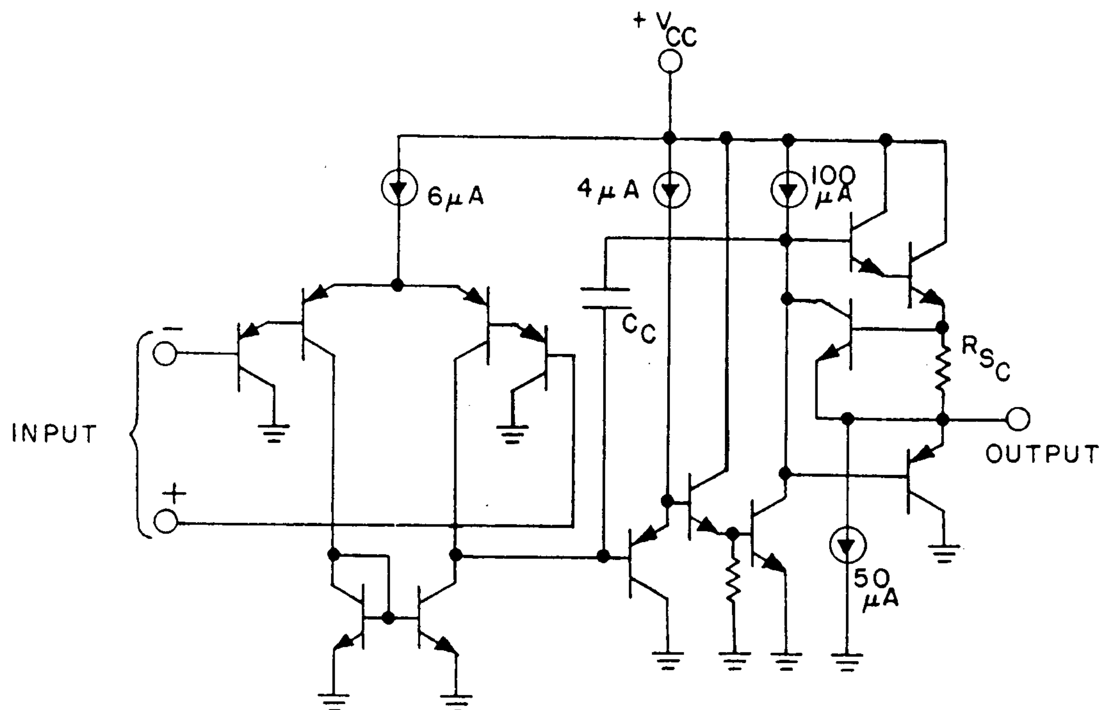


Channel (A, B) share one common bias, Channel (C, D) share another common bias.

NOTES:
1. Component values are nominal.
2. The schematic shows 1/4 of the device except for the common bias circuit in the dashed box.

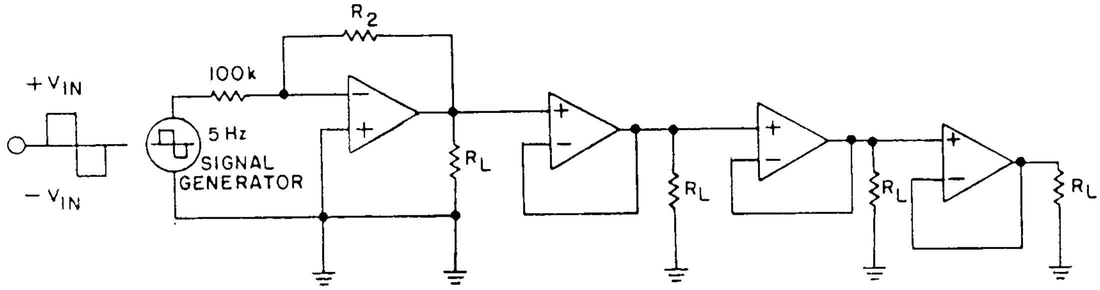
FIGURE 2. Typical schematic circuits - Continued.

Device types 05 and 06



NOTES:
1. Component values are nominal.
2. Circuit shown is 1/4 of device.

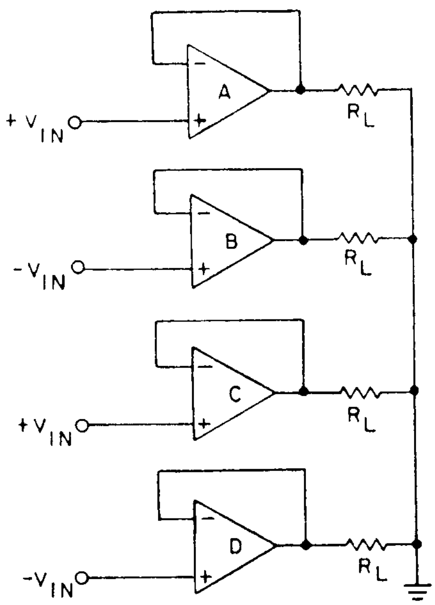
FIGURE 2. Typical schematic circuits - Continued.



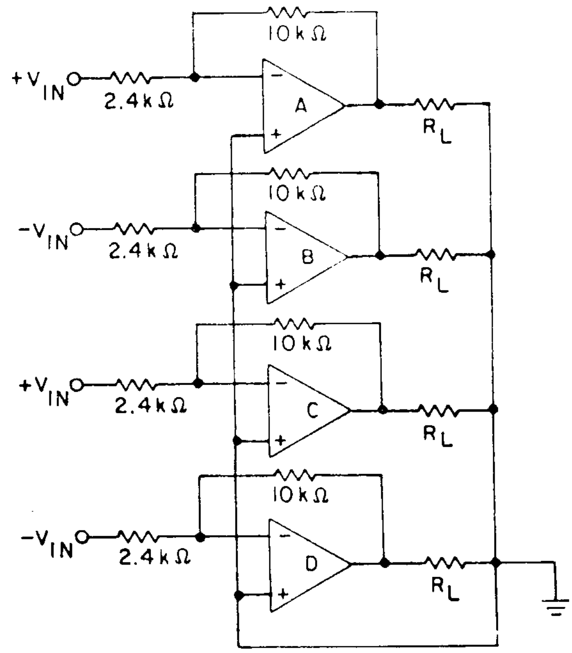
Device type	Test conditions @ T_A = 125°C				1/ 2/ R_L (Ω)	1/ 3/ R_L (Ω)
	$+V_{CC}$ (V)	$-V_{CC}$ (V)	$+V_{IN}$ (V)	R_2 1/ (kΩ)		
01	20	-20	±1	100	470	360
02	20	-20	±0.25	390	470	360
03	20	-20	±1	100	1600	750
04	15	-15	±1	100	2200	680
05, 06	30	0	0 to -2	100	910	750

1/ All resistor tolerances are ±5%.
2/ These values of R_L apply to case outlines A and D only.
3/ These values of R_L apply to case outline C only.

FIGURE 3. Test circuit for burn-in and operating life tests.



Circuit for device types 01, 03, 04, 05 and 06

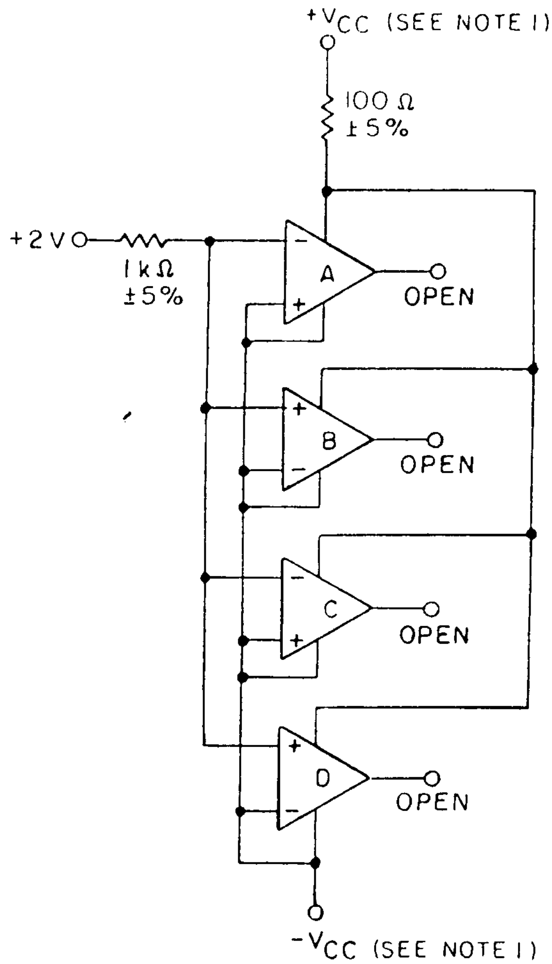


Circuit for device type 02

Device type	Test conditions @ T_A = 125°C			1/ 2/ R_L (Ω)	1/ 3/ R_L (Ω)
	$+V_{CC}$ (V)	$-V_{CC}$ (V)	$+V_{IN}$ (V)		
01	20	-20	±1	470	360
02	20	-20	±0.25	470	360
03	20	-20	±1	1600	750
04	15	-15	±1	2200	680
05, 06	30	0	$+V_{IN}$ = 2 V, $-V_{IN}$ = 0 V 4/	910	750

1/ All resistor tolerances are ±5%.
2/ These values of R_L apply to case outlines A and D only.
3/ These values of R_L apply to case outline C only.
4/ With $-V_{CC}$ = 0, V_{IN} for device types 05 and 06 cannot go below ground.

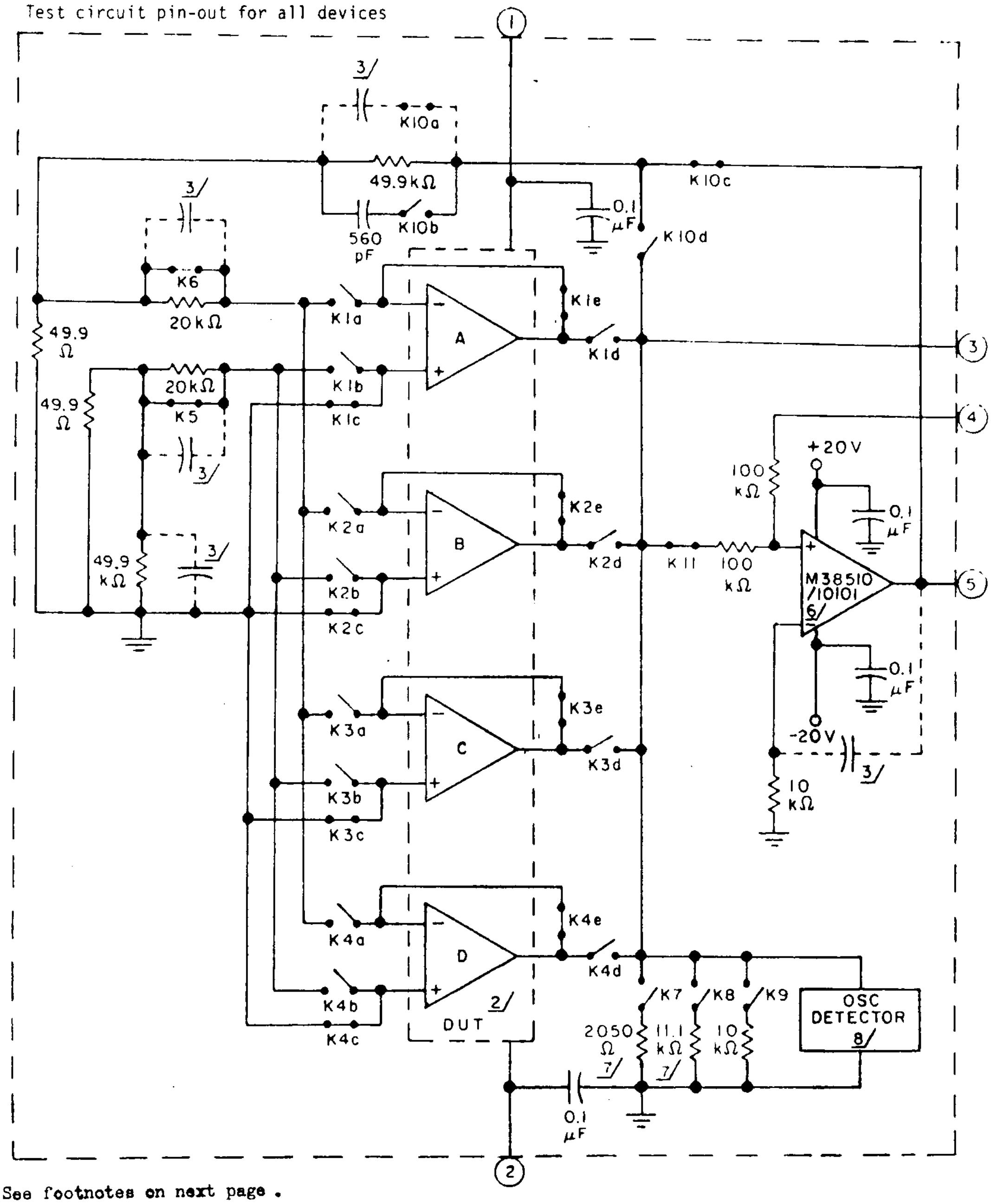
FIGURE 4. Test circuit for burn-in and life tests (steady state, power and reverse bias).



NOTES:

1. $-V_{CC}$ = 0; $+V_{CC}$ = 40 V for device types 01, 02 and 03; $+V_{CC}$ = 30 V for device types 04, 05 and 06.
2. If accelerated, high temperature test conditions are used, the device manufacturer shall ensure that at least 85% of the applied voltage is dropped across the device during test at temperature. The device is not considered functional under accelerated test conditions.

FIGURE 5. Accelerated burn-in and life test circuits.



See footnotes on next page.

FIGURE 6. Test circuit for static tests.

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

2/ Precautions shall be taken to prevent damage to the D.U.T. 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.

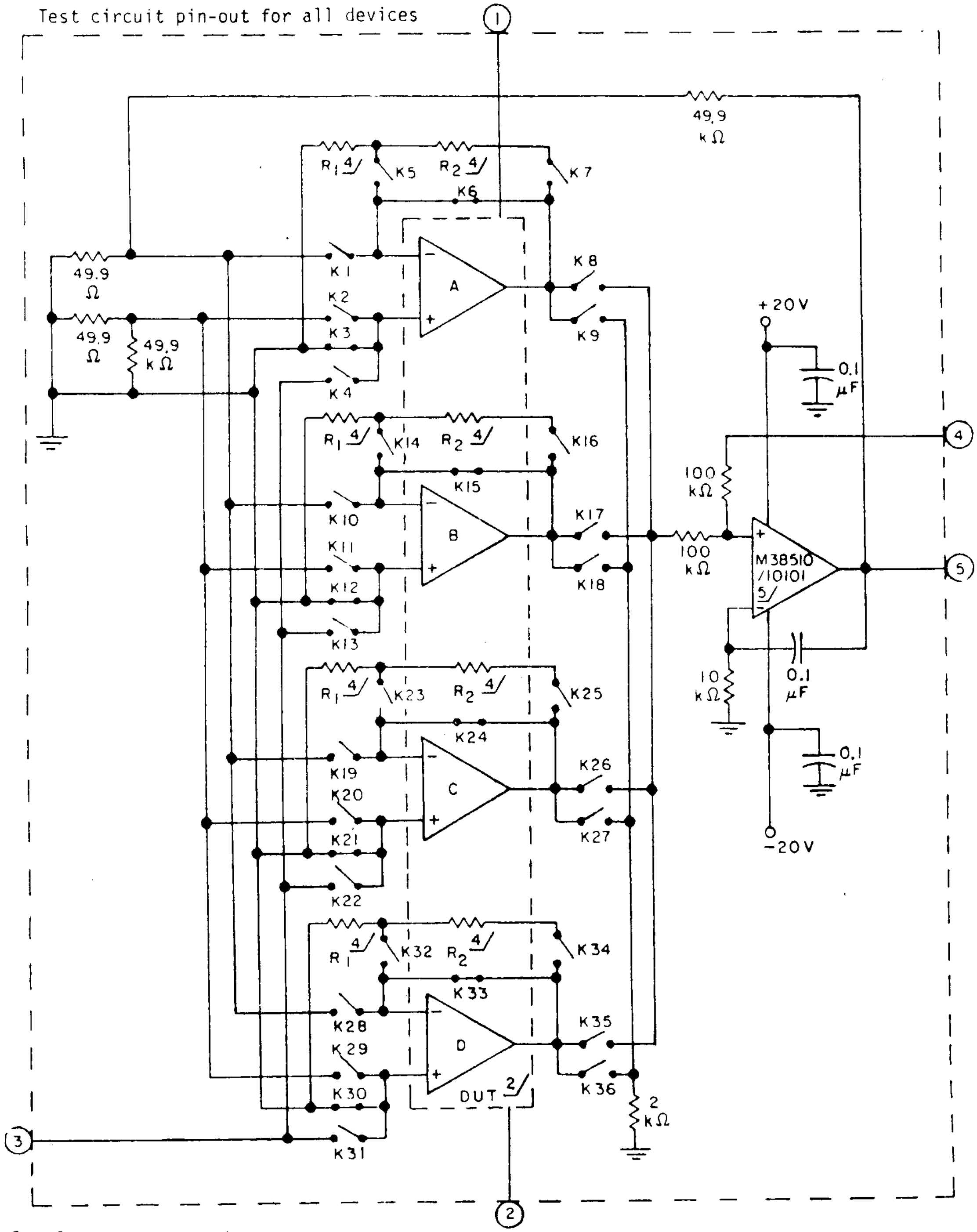
5/ Each amplifier shall be tested separately, except for the I_{CC} measurements where all the amplifiers shall be connected as grounded followers (relays K1 through K4 de-energized).

6/ The nulling amplifier shall be an M38510/10101XXX or similar. Saturation of the nulling amplifier is not allowed on tests where the E (pin 5) value is measured.

7/ The load resistors 2050Ω and 11.1 kΩ yield effective load resistances of 2 kΩ and 10 kΩ respectively.

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

FIGURE 6. Test circuit for static tests - Continued.



See footnotes on next page.

FIGURE 7. 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 parentheses apply to device types 05 and 06.

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

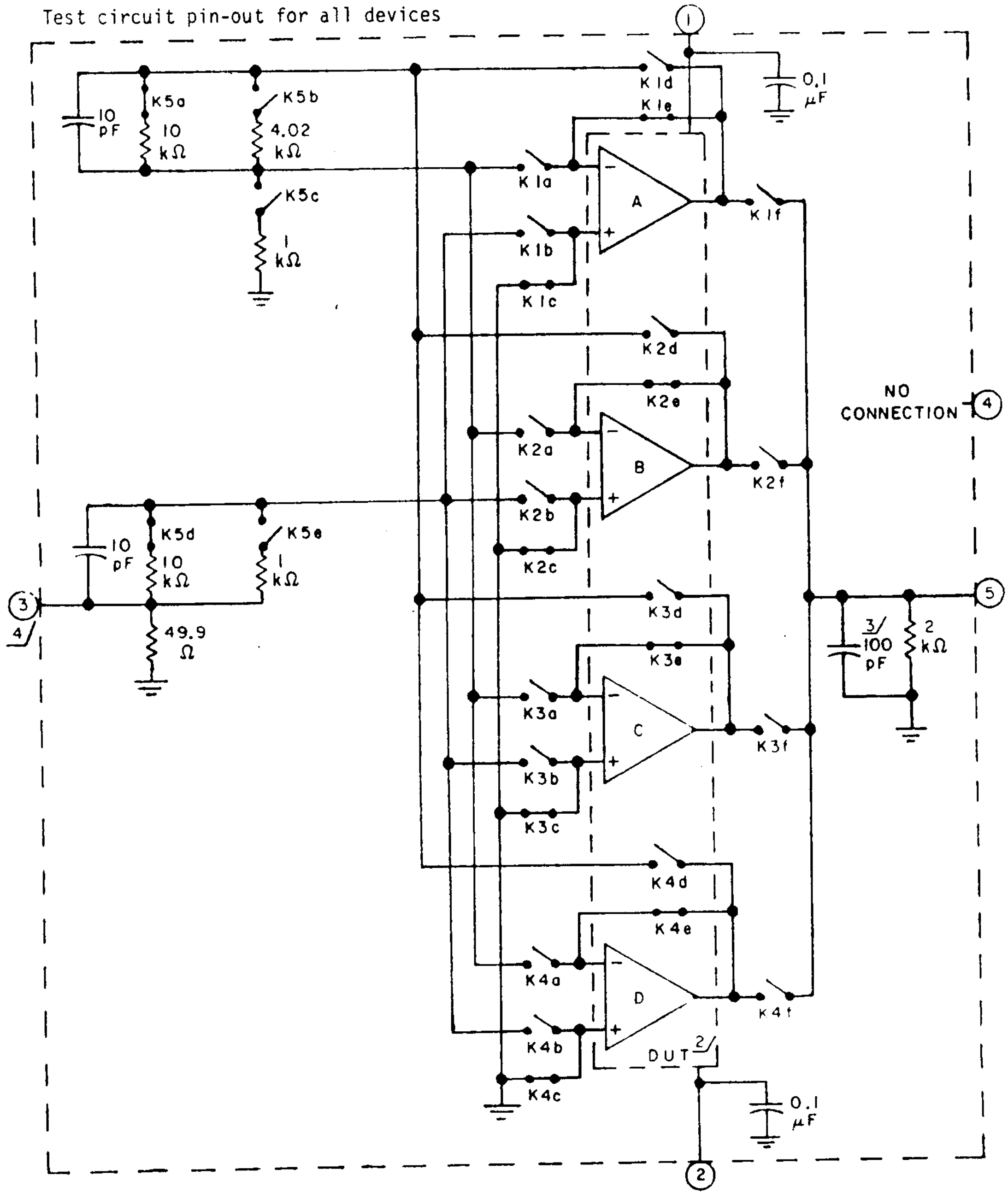
2/ Precautions shall be taken to prevent damage to the D.U.T. during insertion into socket and change of state of relays (i.e. disable voltage supplies, current limit $\pm V_{CC}$, etc.).

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.

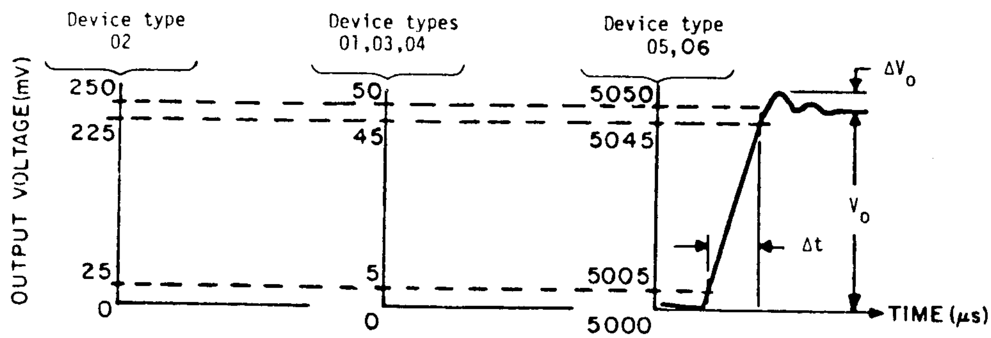
5/ The nulling amplifier shall be a M38510/10101XXX or similar. Saturation of the nulling amplifier is not allowed.

FIGURE 7. Test circuit for channel separation - Continued.



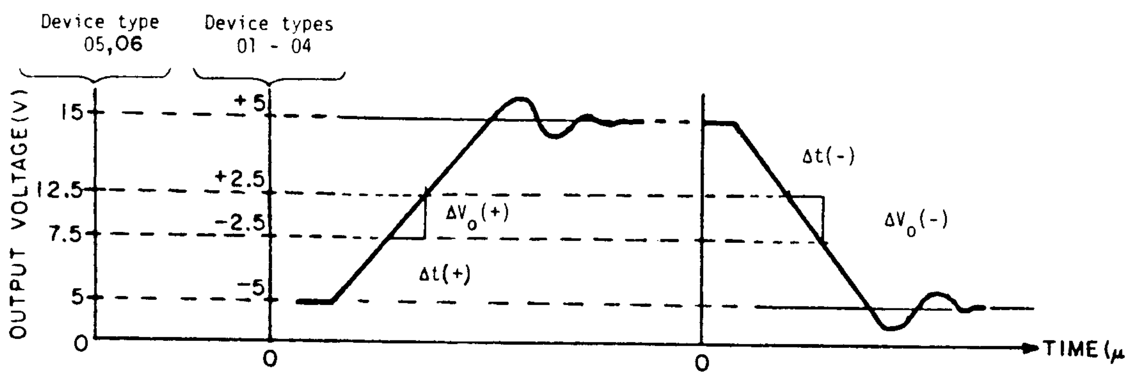
See footnotes on next page.

FIGURE 8. Test circuit and waveform for transient response.



WAVEFORM 1

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



WAVEFORM 2

SR(+) = ΔV_o(+)/Δt(+)

WAVEFORM 3

SR(-) = ΔV_o(-)/Δt(-)

1/ All resistors are ±0.1% tolerance and all capacitors are ±10% tolerance.
2/ Precautions shall be taken to prevent damage to the D.U.T. 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 8. Test circuit and waveforms for transient response - Continued.

Input pulse table.

Parameter symbol	Device type	Risetime	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 8. Test circuit and waveforms 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 1	2	3	4	5	Energized 2/ relays	Measured pins No.	Value	Unit	Equations 3/	01, 02 Limits Min	01, 02 Limits Max	03 Limits Min	03 Limits Max	04 Limits Min	04 Limits Max	Unit
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	"	$V_{IO} = E_2$		"		"		"	"
	"	"	3 4/ 5/	20 V	-20 V		GND		"	"	E_3	"	$V_{IO} = E_3$		"		"		"	"
	"	"	4 4/	5 V	-5 V		GND		"	"	E_4	"	$V_{IO} = E_4$		"		"		"	"
	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	"	$I_{IO} = 50\ (E_2 - E_6)$		"		"		"	"
	"	"	7	20 V	-20 V		GND		"	"	E_7	"	$I_{IO} = 50\ (E_3 - E_7)$		"		"		"	"
	"	"	8	5 V	-5 V		GND		"	"	E_8	"	$I_{IO} = 50\ (E_4 - E_8)$		"		"		"	"
	$+I_{IB}$	"	9	35 V	-5 V		-15 V		K5	"	E_9	"	$+I_{IB} = 50\ (E_1 - E_9)$	0.1	100	-200	-1	-250	-1	"
	"	"	10	5 V	-35 V		15 V		"	"	E_{10}	"	$+I_{IB} = 50\ (E_2 - E_{10})$	"	"	"	"	"	"	"
	"	"	11	20 V	-20 V		GND		"	"	E_{11}	"	$+I_{IB} = 50\ (E_3 - E_{11})$	"	"	"	"	"	"	"
	"	"	12	5 V	-5 V		GND		"	"	E_{12}	"	$+I_{IB} = 50\ (E_4 - E_{12})$	"	"	"	"	"	"	"
	$-I_{IB}$	"	13	35 V	-5 V		-15 V		K5	"	E_{13}	"	$-I_{IB} = 50\ (E_{13} - E_1)$	"	"	"	"	"	"	"
	"	"	14	5 V	-35 V		15 V		"	"	E_{14}	"	$-I_{IB} = 50\ (E_{14} - E_2)$	"	"	"	"	"	"	"
	"	"	15	20 V	-20 V		GND		"	"	E_{15}	"	$-I_{IB} = 50\ (E_{15} - E_3)$	"	"	"	"	"	"	"
	"	"	16	5 V	-5 V		GND		"	"	E_{16}	"	$-I_{IB} = 50\ (E_{16} - E_4)$	"	"	"	"	"	"	"
	+PSRR	4003	17	10 V	-20 V		GND		None	"	E_{17}	"	$+PSRR = (E_3 - E_{17})100$		±100		±100		±100	µV/V
	-PSRR	4003	18	20 V	-10 V		GND		None	"	E_{18}	"	$-PSRR = (E_3 - E_{18})100$		±100		±100		±100	µV/V
	CMR	4003	19 4/	Calculate value using data from tests 1 and 2									$CMR = 20 \log \left\| \frac{3 \times 10^4}{E_1 - E_2} \right\|$	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	"	$I_{CC} = I_3$	---	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 V		"	"	E_{20}	"	$V_{IO} = E_{20}$		"		"		"	"
	"	"	25 4/ 5/	20 V	-20 V		GND		"	"	E_{21}	"	$V_{IO} = E_{21}$		"		"		"	"
	"	"	26 4/	5 V	-5 V		GND		"	"	E_{22}	"	$V_{IO} = E_{22}$		"		"		"	"

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test no.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relays	Measured pins No.	Value	Unit	Equations 3/	Device types 01, 02 Limits Min	Max	03 Limits Min	Max	04 Limits Min	Max	Unit
2 (T_A = 125°C)	$\Delta V_{IO}/\Delta T$	4001	27 8/	$\Delta V_{IO}/\Delta T = [V_{IO}$ (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}	"	$I_{IO} = 50 (E_{20} - E_{24})$		"		"		"	"
	"	"	30	20 V	-20 V		GND		"	"	E_{25}	"	$I_{IO} = 50 (E_{21} - E_{25})$		"		"		"	"
	"	"	31	5 V	-5 V		GND		"	"	E_{26}	"	$I_{IO} = 50 (E_{22} - E_{26})$		"		"		"	"
	$\Delta I_{IO}/\Delta T$	"	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	-1	-250	-1	nA
	"	"	34	5 V	-35 V		15 V		"	"	E_{28}	"	$+I_{IB} = 50 (E_{20} - E_{28})$	"	"	"	"	"	"	"
	"	"	35	20 V	-20 V		GND		"	"	E_{29}	"	$+I_{IB} = 50 (E_{21} - E_{29})$	"	"	"	"	"	"	"
	"	"	36	5 V	-5 V		GND		"	"	E_{30}	"	$+I_{IB} = 50 (E_{22} - E_{30})$	"	"	"	"	"	"	"
	$-I_{IB}$	"	37	35 V	-5 V		-15 V		K6	"	E_{31}	"	$-I_{IB} = 50 (E_{31} - E_{19})$	"	"	"	"	"	"	"
	"	"	38	5 V	-35 V		15 V		"	"	E_{32}	"	$-I_{IB} = 50 (E_{32} - E_{20})$	"	"	"	"	"	"	"
	"	"	39	20 V	-20 V		GND		"	"	E_{33}	"	$-I_{IB} = 50 (E_{33} - E_{21})$	"	"	"	"	"	"	"
	"	"	40	5 V	-5 V		GND		"	"	E_{34}	"	$-I_{IB} = 50 (E_{34} - E_{22})$	"	"	"	"	"	"	"
	+PSRR	4003	41	10 V	-20 V		GND		None	"	E_{35}	"	$+PSRR = (E_{21} - E_{35})\ 100$		±100		±100		±100	µV/V
	-PSRR	4003	42	20 V	-10 V		GND		None	"	E_{36}	"	$-PSRR = (E_{21} - E_{36})\ 100$		±100		±100		±100	µV/V
	CMR	4003	43 4/	Calculate value using data from tests 23 and 24									$CMR = 20 \log \left\| \frac{3 \times 10^4}{E_{19} - E_{20}} \right\|$	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	"	$I_{CC} = I_6$	---	3.6	---	7	---	11	"
3 (T_A = -55°C)	V_{IO}	4001	47 4/	35 V	-5 V		-15 V		"	5	E_{37}	V	$V_{IO} = E_{37}$		±6		±5		±6	mV
	"	"	48 4/	5 V	-35 V		15 V		"	"	E_{38}	"	$V_{IO} = E_{38}$		"		"		"	"
	"	"	49 4/	20 V	-20 V		GND		"	"	E_{39}	"	$V_{IO} = E_{39}$		"		"		"	"
	"	"	50 4/	5 V	-5 V		GND		"	"	E_{40}	"	$V_{IO} = E_{40}$		"		"		"	"

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test no.	Adapter pin numbers					Energized 2/ relays	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)	$\Delta V_{IO}/\Delta T$	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}	"	$I_{IO} = 50 (E_{38} - E_{42})$		"		"		"	"
	"	"	54	20 V	-20 V		GND		"	"	E_{43}	"	$I_{IO} = 50 (E_{39} - E_{43})$		"		"		"	"
	"	"	55	5 V	-5 V		GND		"	"	E_{44}	"	$I_{IO} = 50 (E_{40} - E_{44})$		"		"		"	"
	$\Delta I_{IO}/\Delta T$	"	56 8/	$\Delta I_{IO}/\Delta T = [I_{IO}$ (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	-1	-400	-1	nA
	"	"	58	5 V	-35 V		15 V		"	"	E_{46}	"	$+I_{IB} = 50 (E_{38} - E_{46})$	"	"	"	"	"	"	"
	"	"	59	20 V	-20 V		GND		"	"	E_{47}	"	$+I_{IB} = 50 (E_{39} - E_{47})$	"	"	"	"	"	"	"
	"	"	60	5 V	-5 V		GND		"	"	E_{48}	"	$+I_{IB} = 50 (E_{40} - E_{48})$	"	"	"	"	"	"	"
	$-I_{IB}$	"	61	35 V	-5 V		-15 V		K6	"	E_{49}	"	$-I_{IB} = 50 (E_{49} - E_{37})$	0.1	325	-325	-1	-400	-1	"
	"	"	62	5 V	-35 V		15 V		"	"	E_{50}	"	$-I_{IB} = 50 (E_{50} - E_{38})$	"	"	"	"	"	"	"
	"	"	63	20 V	-20 V		GND		"	"	E_{51}	"	$-I_{IB} = 50 (E_{51} - E_{39})$	"	"	"	"	"	"	"
	"	"	64	5 V	-5 V		GND		"	"	E_{52}	"	$-I_{IB} = 50 (E_{52} - E_{40})$	"	"	"	"	"	"	"
	+PSRR	4003	65	10 V	-20 V		GND		None	"	E_{53}	"	+PSRR = $(E_{39} - E_{53})$ 100		±100		±100		±100	µV/V
	-PSRR	4003	66	20 V	-10 V		GND		None	"	E_{54}	"	-PSRR = $(E_{39} - E_{54})$ 100		±100		±100		±100	µV/V
	CMR	4003	67 4/	Calculate value using data from tests 47 and 48									$CMR = 20 \log \left\| \frac{3 \times 10^4}{E_{37} - E_{38}} \right\|$	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		None	3	I_8	"	$I_{OS(-)} = I_8$	---	75	---	80	---	80	"
	I_{CC}	3005	70 7/	15 V	-15 V				None	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		K_8	3	$(E_O)_1$	V	$+V_{OP} = (E_O)_1$	+16	---	+16	---	+16	---	V
	$-V_{OP}$	"	72	20 V	-20 V		20 V		K_8	3	$(E_O)_2$	"	$-V_{OP} = (E_O)_2$	---	-16	---	-16	---	-16	"
	$+V_{OP}$	"	73	"	"		-20 V		K_7	3	$(E_O)_3$	"	$+V_{OP} = (E_O)_3$	+15	---	+15	---	+15	---	"
	$-V_{OP}$	"	74	"	"		20 V		K_7	3	$(E_O)_4$	"	$-V_{OP} = (E_O)_4$	---	-15	---	-15	---	-15	"

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test no.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relays	Measured pins No.	Value	Unit	Equations 3/	Device types 01, 02 Limits Min	Max	03 Limits Min	Max	04 Limits Min	Max	Unit
4 (T_A = 25°C)	$A_{VS(+)}$	4004	75 5/	20 V	-20 V		-15 V		K_8	5	E_{55}	V	$A_{VS(+)} = 15/(E_3 - E_{55})$	50	---	50	---	50	---	V/mV
	$A_{VS(+)}$	"	76 5/	"	"		-15 V		K_7	"	E_{56}	"	$A_{VS(+)} = 15/(E_3 - E_{56})$	"	---	"	---	"	---	"
	$A_{VS(-)}$	"	77 5/	"	"		15 V		K_8	"	E_{57}	"	$A_{VS(-)} = 15/(E_{57} - E_3)$	"	---	"	---	"	---	"
	$A_{VS(-)}$	"	78 5/	"	"		15 V		K_7	"	E_{58}	"	$A_{VS(-)} = 15/(E_{58} - E_3)$	"	---	"	---	"	---	"
	A_{VS}	" "	79	5 V 5 V	-5 V -5 V		-2 V 2 V		K_8 K_8	" "	E_{59} E_{60}	" "	$A_{VS} = 4/(E_{60} - E_{59})$	10	---	10	---	10	---	"
	" "	" "	80	5 V 5 V	-5 V -5 V		-2 V 2 V		K_7 K_7	" "	E_{61} E_{62}	" "	$A_{VS} = 4/(E_{62} - E_{61})$	10	---	10	---	10	---	"
5 (T_A = 125°C)	$+V_{OP}$	"	81	20 V	-20 V		-20 V		K_8	3	$(E_O)_5$	"	$+V_{OP} = (E_O)_5$	+16	---	+16	---	+16	---	V
	$-V_{OP}$	"	82	20 V	-20 V		20 V		K_8	3	$(E_O)_6$	"	$-V_{OP} = (E_O)_6$	---	-16	---	-16	---	-16	"
	$+V_{OP}$	"	83	20 V	-20 V		-20 V		K_7	3	$(E_O)_7$	"	$+V_{OP} = (E_O)_7$	+15	---	+15	---	+15	---	"
	$-V_{OP}$	"	84	"	"		20 V		K_7	3	$(E_O)_8$	"	$-V_{OP} = (E_O)_8$	---	-15	---	-15	---	-15	"
	$A_{VS(+)}$	"	85 5/	"	"		-15 V		K_8	5	E_{63}	"	$A_{VS(+)} = 15/(E_{21} - E_{63})$	25	---	25	---	25	---	V/mV
	$A_{VS(+)}$	"	86 5/	"	"		-15 V		K_7	"	E_{64}	"	$A_{VS(+)} = 15/(E_{21} - E_{64})$	"	---	"	---	"	---	"
	$A_{VS(-)}$	"	87 5/	"	"		15 V		K_8	"	E_{65}	"	$A_{VS(-)} = 15/(E_{65} - E_{21})$	"	---	"	---	"	---	"
	$A_{VS(-)}$	"	88 5/	"	"		15 V		K_7	"	E_{66}	"	$A_{VS(-)} = 15/(E_{66} - E_{21})$	"	---	"	---	"	---	"
	A_{VS}	" "	89	5 V 5 V	-5 V -5 V		-2 V 2 V		K_8 K_8	" "	E_{67} E_{68}	" "	$A_{VS} = 4/(E_{68} - E_{67})$	10	---	10	---	10	---	"
	" "	" "	90	5 V 5 V	-5 V -5 V		-2 V 2 V		K_7 K_7	" "	E_{69} E_{70}	" "	$A_{VS} = 4/(E_{70} - E_{69})$	10	---	10	---	10	---	"
6 (T_A = -55°C)	$+V_{OP}$	"	91	20 V	-20 V		-20 V		K_8	3	$(E_O)_9$	"	$+V_{OP} = (E_O)_9$	+16	---	+16	---	+16	---	V
	$-V_{OP}$	"	92	20 V	-20 V		20 V		K_8	3	$(E_O)_{10}$	"	$-V_{OP} = (E_O)_{10}$	---	-16	---	-16	---	-16	"
	$+V_{OP}$	"	93	20 V	-20 V		-20 V		K_7	3	$(E_O)_{11}$	"	$+V_{OP} = (E_O)_{11}$	+15	---	+15	---	+15	---	"
	$-V_{OP}$	"	94	20 V	-20 V		20 V		K_7	3	$(E_O)_{12}$	"	$-V_{OP} = (E_O)_{12}$	---	-15	---	-15	---	-15	"

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test no.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relays	Measured pins No.	Value	Unit	Equations 3/	Device types 01, 02 Limits Min	Max	03 Limits Min	Max	04 Limits Min	Max	Unit
6 (T_A = -55°C)	$A_{VS(+)}$	4004	95	20 V	-20 V		-15 V		K_8	5	E_{71}	V	$A_{VS(+)} = 15/(E_{39} - E_{71})$	25	---	25	---	25	---	V/mV
	$A_{VS(+)}$	"	96	"	"		-15 V		K_7	"	E_{72}	"	$A_{VS(+)} = 15/(E_{39} - E_{72})$	"	---	"	---	"	---	"
	$A_{VS(-)}$	"	97	"	"		15 V		K_8	"	E_{73}	"	$A_{VS(-)} = 15/(E_{73} - E_{39})$	"	---	"	---	"	---	"
	$A_{VS(-)}$	"	98	"	"		15 V		K_7	"	E_{74}	"	$A_{VS(-)} = 15/(E_{74} - E_{39})$	"	---	"	---	"	---	"
	A_{VS}	" "	99	5 V 5 V	-5 V -5 V		-2 V 2 V		K_8 K_8	" "	E_{75} E_{76}	" "	$A_{VS} = 4/(E_{76} - E_{75})$	10	---	10	---	10	---	"
	" "	" "	100 9/	5 V 5 V	-5 V -5 V		-2 V 2 V		K_7 K_7	" "	E_{77} E_{78}	" "	$A_{VS} = 4/(E_{78} - E_{77})$	10	---	10	---	10	---	"
7 (T_A = 25°C)	NI(BB)		101 10/	20 V	-20 V		GND		K_{10}, K_{11}	3	$(E_O)13$	mVrms	$NI(BB) = (E_O)13$	---	15	---	5	---	5	µV rms
	NI(PC)		102	"	"		"		K_5, K_6, K_{10}, K_{11}	3	$(E_O)14$	mVpk	$NI(PC) = (E_O)14$	---	40	---	50	---	50	µVpk
	CS "		103	" "	" "	11/ 12/	" "		See Fig. 7 "	5 "	E_{79} E_{80}	V "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{79} - E_{80}} \right\|$	80 "	---	80 "	---	80 "	---	dB "
	" "		104	" "	" "	11/ 12/	" "		" "	" "	E_{81} E_{82}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{81} - E_{82}} \right\|$	" "	--- ---	" "	--- ---	" "	--- ---	" "
	" "		105	" "	" "	11/ 12/	" "		" "	" "	E_{83} E_{84}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{83} - E_{84}} \right\|$	" "		" "		" "		" "
	" "		106	" "	" "	11/ 12/	" "		" "	" "	E_{85} E_{86}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{85} - E_{86}} \right\|$	" "		" "		" "		" "
	" "		107	" "	" "	11/ 12/	" "		" "	" "	E_{87} E_{88}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{87} - E_{88}} \right\|$	" "		" "		" "		" "
	" "		108	" "	" "	11/ 12/	" "		" "	" "	E_{89} E_{90}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{89} - E_{90}} \right\|$	" "		" "		" "		" "
	" "		109	" "	" "	11/ 12/	" "		" "	" "	E_{91} E_{92}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{91} - E_{92}} \right\|$	" "		" "		" "		" "
	" "		110	" "	" "	11/ 12/	" "		" "	" "	E_{93} E_{94}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{93} - E_{94}} \right\|$	" "		" "		" "		" "
	" "		111	" "	" "	11/ 12/	" "		" "	" "	E_{95} E_{96}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{95} - E_{96}} \right\|$	" "		" "		" "		" "

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test no.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relays	Measured pins No.	Value	Unit	Equations 3/	Device types 01, 02 Limits Min	01, 02 Max	03 Limits Min	03 Max	04 Limits Min	04 Max	Unit
7 (T_A = 25°C)	CS "		112	20 V "	-20 V "	11/ 12/	GND "		See Fig. 7 "	5 "	E_{97} E_{98}	V "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{97} - E_{98}} \right\|$	80 "	---	80 "	---	80 "	---	dB "
	" "		113	" "	" "	11/ 12/	" "		" "	" "	E_{99} E_{100}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{99} - E_{100}} \right\|$	" "		" "		" "		" "
	" "		114	" "	" "	11/ 12/	" "		" "	" "	E_{101} E_{102}	" "	$CS = 20 \log \left\| \frac{2 \times 10^4}{E_{101} - E_{102}} \right\|$	" "		" "		" "		" "
	$TR(t_r)$		115	20 V	-20 V	IN	"	OUT	See Fig. 8	"	Δt	µs	(Waveform 1) $TR(t_r) = \Delta t$	---	1.0	---	0.2	---	0.3	µs
	$TR_{(os)}$		116	"	"		"		"	"	$V_O; \Delta V_O$	V	(Waveform 1) $TR(OS) - 100 (\Delta V_O / V_O)$	---	25	---	35	---	50	%
	SR(+)		117	"	"		"		"	"	ΔV_O; Δt	V; µs	(Waveform 2) $SR(+) = V_O/\Delta t$	9/	---	0.8	---	0.6	---	V/µs
	SR(-)		118	"	"		"		"	"	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 subgroup 7, 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 2/ relay	Measured pins			Equation 3/	Device type 05 Limits		Device type 06 Limits		Units
				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	"	$V_{IO} = E_2$		"		"	"
	"	"	3 4/	5 V	GND		-1.4 V		"	"	E_3	"	$V_{IO} = E_3$		"		"	"
	"	"	4 4/	2.5 V	-2.5 V		1.1 V		"	"	E_4	"	$V_{IO} = E_4$		"		"	"
	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	"	$I_{IO} = 10^6 (E_2 - E_6)/R_S$		"		"	"
	"	"	7	5 V	GND		-1.4 V		"	"	E_7	"	$I_{IO} = 10^6 (E_3 - E_7)/R_S$		"		"	"
	"	"	8	2.5 V	-2.5 V		1.1 V		"	"	E_8	"	$I_{IO} = 10^6 (E_4 - E_8)/R_S$		"		"	"
	$+I_{IB}$	"	9	30 V	GND		-15 V		K5	"	E_9	"	$+I_{IB} = 10^6 (E_1 - E_9)/R_S$	-150	-1	-50	-1	"
	"	"	10	2 V	-28 V		13 V		"	"	E_{10}	"	$+I_{IB} = 10^6 (E_2 - E_{10})/R_S$	"	"	"	"	"
	"	"	11	5 V	GND		-1.4 V		"	"	E_{11}	"	$+I_{IB} = 10^6 (E_3 - E_{11})/R_S$	"	"	"	"	"
	"	"	12	2.5 V	-2.5 V		1.1 V		"	"	E_{12}	"	$+I_{IB} = 10^6 (E_4 - E_{12})/R_S$	"	"	"	"	"
	$-I_{IB}$	"	13	30 V	GND		-15 V		K6	"	E_{13}	"	$-I_{IB} = 10^6 (E_{13} - E_1)/R_S$	"	"	-50	-1	"
	"	"	14	2 V	-28 V		13 V		"	"	E_{14}	"	$-I_{IB} = 10^6 (E_{14} - E_2)/R_S$	"	"	"	"	"
	"	"	15	5 V	GND		-1.4 V		"	"	E_{15}	"	$-I_{IB} = 10^6 (E_{15} - E_3)/R_S$	"	"	"	"	"
	"	"	16	2.5 V	-2.5 V		1.1 V		"	"	E_{16}	"	$-I_{IB} = 10^6 (E_{16} - E_4)/R_S$	"	"	"	"	"
	+PSRR	4003	17	30 V 5 V	GND GND		-1.4 V -1.4 V		None None	" "	E_{17} E_{18}	" "	$+PSRR = (E_{17} - E_{18})40$		±100		±100	µV/V
	CMR	4003	18 4/	Calculate value using data from tests 1 and 2									$CMR = 20 \log \left\| \frac{2.8 \times 10^4}{E_1 - E_2} \right\|$	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
2 (T_A = 125°C)	V_{IO}	4001	21 4/	30 V	GND		-15 V		"	5	E_{19}	V	$V_{IO} = E_{19}$		±7		±4	mV
	"	"	22 4/	2 V	-28 V		13 V		"	"	E_{20}	"	$V_{IO} = E_{20}$		"		"	"
	"	"	23 4/	5 V	GND		-1.4 V		"	"	E_{21}	"	$V_{IO} = E_{21}$		"		"	"
	"	"	24 4/	2.5 V	-2.5 V		1.1 V		"	"	E_{22}	"	$V_{IO} = E_{22}$		"		"	"

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test No.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relay	Measured pins No.	Value	Unit	Equation 3/	Device type 05 Limits Min	Max	Device type 06 Limits Min	Max	Units
2 (T_A = 125°C)	$\Delta V_{IO}/\Delta T$	4001	25 8/	$\Delta V_{IO}/\Delta T = [V_{IO}$ (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}	"	$I_{IO} = 10^6 (E_{20} - E_{24})/R_S$		"		"	"
	"	"	28	5 V	GND		-1.4 V		"	"	E_{25}	"	$I_{IO} = 10^6 (E_{21} - E_{25})/R_S$		"		"	"
	"	"	29	2.5 V	-2.5 V		1.1 V		"	"	E_{26}	"	$I_{IO} = 10^6 (E_{22} - E_{26})/R_S$		"		"	"
	$\Delta I_{IO}/\Delta T$	"	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	-1	-50	-1	nA
	"	"	32	2 V	-28 V		13 V		"	"	E_{28}	"	$+I_{IB} = 10^6 (E_{20} - E_{28})/R_S$	"	"	"	"	"
	"	"	33	5 V	GND		-1.4 V		"	"	E_{29}	"	$+I_{IB} = 10^6 (E_{21} - E_{29})/R_S$	"	"	"	"	"
	"	"	34	2.5 V	-2.5 V		1.1 V		"	"	E_{30}	"	$+I_{IB} = 10^6 (E_{22} - E_{30})/R_S$	"	"	"	"	"
	$-I_{IB}$	"	35	30 V	GND		-15 V		K6	"	E_{31}	"	$-I_{IB} = 10^6 (E_{31} - E_{19})/R_S$	-150	-1	-50	-1	nA
	"	"	36	2 V	-28 V		13 V		"	"	E_{32}	"	$-I_{IB} = 10^6 (E_{32} - E_{20})/R_S$	"	"	"	"	"
	"	"	37	5 V	GND		-1.4 V		"	"	E_{33}	"	$-I_{IB} = 10^6 (E_{33} - E_{21})/R_S$	"	"	"	"	"
	"	"	38	2.5 V	-2.5 V		1.1 V		"	"	E_{34}	"	$-I_{IB} = 10^6 (E_{34} - E_{22})/R_S$	"	"	"	"	"
	+PSRR	4003	39	30 V 5 V	GND GND		-1.4 V -1.4 V		None None	" "	E_{35} E_{36}	" "	$+PSRR = (E_{35} - E_{36})40$		±100		±100	µV/V
	CMR	4003	40 4/	Calculate value using data from tests 21 and 22									$CMR = 20 \log \left\| \frac{2.8 \times 10^4}{E_{19} - E_{20}} \right\|$	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
3 (T_A = -55°C)	V_{IO}	4001	43 4/	30 V	GND		-15 V		"	5	E_{37}	V	$V_{IO} = E_{37}$		±7		±4	mV
	"	"	44 4/	2 V	-28 V		13 V		"	"	E_{38}	"	$V_{IO} = E_{38}$		"		"	"
	"	"	45 4/	5 V	GND		-1.4 V		"	"	E_{39}	"	$V_{IO} = E_{39}$		"		"	"
	"	"	46 4/	2.5 V	-2.5 V		1.1 V		"	"	E_{40}	"	$V_{IO} = E_{40}$		"		"	"
	$\Delta V_{IO}/\Delta T$	"	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 1/ - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test No.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relay	Measured pins No.	Value	Unit	Equation 3/	Device type 05 Limits Min	Max	Device type 06 Limits Min	Max	Units
3 (T_A = -55°C)	I_{IO}	4001	48	30 V	GND		-15 V		K5, K5	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}	"	$I_{IO} = 10^6 (E_{38} - E_{42})/R_S$		"		"	"
	"	"	50	5 V	GND		-1.4 V		"	"	E_{43}	"	$I_{IO} = 10^6 (E_{39} - E_{43})/R_S$		"		"	"
	"	"	51	2.5 V	-2.5 V		1.1 V		"	"	E_{44}	"	$I_{IO} = 10^6 (E_{40} - E_{44})/R_S$		"		"	"
	$\Delta I_{IO}/\Delta T$	"	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	-1	-100	-1	nA
	"	"	54	2 V	-28 V		13 V		"	"	E_{46}	"	$+I_{IB} = 10^6 (E_{38} - E_{46})/R_S$	"	"	"	"	"
	"	"	55	5 V	GND		-1.4 V		"	"	E_{47}	"	$+I_{IB} = 10^6 (E_{39} - E_{47})/R_S$	"	"	"	"	"
	"	"	56	2.5 V	-2.5 V		1.1 V		"	"	E_{48}	"	$+I_{IB} = 10^6 (E_{40} - E_{48})/R_S$	"	"	"	"	"
	$-I_{IB}$	"	57	30 V	GND		-15 V		K6	"	E_{49}	"	$-I_{IB} = 10^6 (E_{49} - E_{37})/R_S$	-300	-1	-100	-1	"
	"	"	58	2 V	-28 V		13 V		"	"	E_{50}	"	$-I_{IB} = 10^6 (E_{50} - E_{38})/R_S$	"	"	"	"	"
	"	"	59	5 V	GND		-1.4 V		"	"	E_{51}	"	$-I_{IB} = 10^6 (E_{51} - E_{39})/R_S$	"	"	"	"	"
	"	"	60	2.5 V	-2.5 V		1.1 V		"	"	E_{52}	"	$-I_{IB} = 10^6 (E_{52} - E_{40})/R_S$	"	"	"	"	"
	+PSRR	4003	61	30 V 5 V	GND GND		-1.4 V -1.4 V		None None	" "	E_{53} E_{54}	" "	$+PSRR = (E_{53} - E_{54})40$		±100		±100	µV/V
	CMR	4003	62 4/	Calculate value using data from tests 43 and 44									$CMR = 20 \log \left\| \frac{2.8 \times 10^4}{E_{37} - E_{38}} \right\|$	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/	"	"				None	2	I_6	mA	$I_{CC} = I_6$	---	4	---	4	mA
4 (T_A = 25°C)	$+V_{OP}$	4004	65	"	"		-30 V		K8	3	$(E_o)_1$	V	$+V_{OP} = (E_o)_1$	27	---	27	---	V
	$+V_{OP}$	"	66	"	"		-30 V		K7	3	$(E_o)_2$	"	$+V_{OP} = (E_o)_2$	26	---	26	---	V
	$A_{VS(+)}$	" "	67	" "	" "		-26 V -1 V		K8 K8	5 "	E_{55} E_{56}	" "	$A_{VS(+)} = 25/(E_{56} - E_{55})$	50	---	50	---	V/mV
	"	" "	68	" "	" "		-20 V -5 V		K7 K7	" "	E_{57} E_{58}	" "	$A_{VS(+)} = 15/(E_{58} - E_{57})$	50	---	50	---	V/mV

See footnotes at end of table.

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

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

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test No.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relay	Measured pins No.	Value	Unit	Equation 3/	Limits Min	Max	Units
6 (T_A = -55°C)	$+V_{OP}$	4004	87	30 V	GND		-30 V		K8	3	$(E_o)_{15}$	V	$+V_{OP} = (E_o)_{15}$	27	---	V
	$+V_{OP}$	"	88	"	"		-30 V		K7	"	$(E_o)_{16}$	"	$+V_{OP} = (E_o)_{16}$	26	---	V
	$A_{VS(+)}$	" "	89	" "	" "		-26 V -1 V		K8 K8	5 "	E_{71} E_{72}	" "	$A_{VS(+)} = 25/(E_{72} - E_{71})$	25	---	V/mV
	" "	" "	90	" "	" "		-20 V -5 V		K7 K7	" "	E_{73} E_{74}	" "	$A_{VS(+)} = 15/(E_{74} - E_{73})$	25	---	V/mV
	A_{VS}	" "	91	5 V 5 V	" "		-2.5 V -1 V		K8 K8	" "	E_{75} E_{76}	" "	$A_{VS} = 1.5/(E_{76} - E_{75})$	10	---	V/mV
	" "	" "	92	5 V 5 V	" "		-2.5 V -1 V		K7 K7	" "	E_{77} E_{78}	" "	$A_{VS} = 1.5/(E_{78} - E_{77})$	10	---	V/mV
	V_{OL}	3007	93	30 V	"		5 V		K11, K9	3	$(E_o)_{17}$	mV	$V_{OL} = (E_o)_{17}$	---	35	mV
	"	"	94	30 V	"	5 mA	5 V		K11	"	$(E_o)_{18}$	V	$V_{OL} = (E_o)_{18}$	---	1.5	V
	"	"	95	4.5 V	"	2 µA	5 V		K11	"	$(E_o)_{19}$	V	$V_{OL} = (E_o)_{19}$	---	0.4	V
	V_{OH}	3006	96	30 V	"	-10 mA	-5 V		K11	"	$(E_o)_{20}$	V	$V_{OH} = (E_o)_{20}$	27	---	V
	V_{OH}	3006	97	4.5 V	"	-10 mA	-5 V		K11	"	$(E_o)_{21}$	V	$V_{OH} = (E_o)_{21}$	2.3	---	V
7 (T_A = 25°C)	NI(BB)		98 10/	15 V	-15 V		GND		K10, K11	"	$(E_o)_{22}$	mVrms	$NI(BB) = (E_o)_{22}$	---	15	µV rms
	NI(PC)		99 10/	15 V	-15 V		GND		K5,K6,K10, K11	"	$(E_o)_{23}$	mV pk	$NI(PC) = (E_o)_{23}$	---	50	µVpk
	CS "		100	30 V "	GND "	16 V 1 V	-1.4 V "		See Fig. 7 "	5 "	E_{79} E_{80}	V "	$CS = 20 \log \left\| \frac{1.5 \times 10^4}{E_{79} - E_{80}} \right\|$	80 "	---	dB "
	" "		101	" "	" "	16 V 1 V	" "		" "	" "	E_{81} E_{82}	" "	$CS = 20 \log \left\| \frac{1.5 \times 10^4}{E_{81} - E_{82}} \right\|$	" "	---	" "
	" "		102	" "	" "	16 V 1 V	" "		" "	" "	E_{83} E_{84}	" "	$CS = 20 \log \left\| \frac{1.5 \times 10^4}{E_{83} - E_{84}} \right\|$	" "	---	" "
	" "		103	" "	" "	16 V 1 V	" "		" "	" "	E_{85} E_{86}	" "	$CS = 20 \log \left\| \frac{1.5 \times 10^4}{E_{85} - E_{86}} \right\|$	" "	---	" "
	" "		104	" "	" "	16 V 1 V	" "		" "	" "	E_{87} E_{88}	" "	$CS = 20 \log \left\| \frac{1.5 \times 10^4}{E_{87} - E_{88}} \right\|$	" "	---	" "

See footnotes at end of table.

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

Subgroup	Symbol	MIL-STD-883 method	Test No.	Adapter pin numbers 1	2	3	4	5	Energized 2/ relay	Measured pins No.	Value	Unit	Equation 3/	Limits Min	Max	Units
7 (T_A = 25°C)	CS "		105	30 V "	GND "	16 V 1 V	-1.4 V "		See Fig. 7 "	5 "	E_{89} E_{90}	V "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{89} - E_{90}} \right\rvert$	80 "	---	dB "
	" "		106	" "	" "	16 V 1 V	" "		" "	" "	E_{91} E_{92}	" "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{91} - E_{92}} \right\rvert$	" "	---	" "
	" "		107	" "	" "	16 V 1 V	" "		" "	" "	E_{93} E_{94}	" "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{93} - E_{94}} \right\rvert$	" "	---	" "
	" "		108	" "	" "	16 V 1 V	" "		" "	" "	E_{95} E_{96}	" "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{95} - E_{96}} \right\rvert$	" "	---	" "
	" "		109	" "	" "	16 V 1 V	" "		" "	" "	E_{97} E_{98}	" "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{97} - E_{98}} \right\rvert$	" "	---	" "
	" "		110	" "	" "	16 V 1 V	" "		" "	" "	E_{99} E_{100}	" "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{99} - E_{100}} \right\rvert$	" "	---	" "
	" "		111	" "	" "	16 V 1 V	" "		" "	" "	E_{101} E_{102}	" "	$CS = 20 \log \left\lvert \frac{1.5 \times 10^4}{E_{101} - E_{102}} \right\rvert$	" "	---	" "
	TR(tr)		112	"	"	IN		OUT	See Fig. 8	"	Δt	μs	(Waveform 1) $TR(tr) = \Delta t$	---	1.0	μs
	TR(os)		113	"	"	"		"	"	"	V_O; ΔV_O	V	(Waveform 1) $TR(os) = 100\ (\Delta V_O / V_O)$	---	50	%
	SR(+)	4002	114	"	"	"		"	"	"	ΔV_O; Δt	V; μs	(Waveform 2) $SR(+) = \Delta V_O / \Delta t$	0.1	---	V/μs
	SR(-)	4002	115	"	"	"		"	"	"	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 at T_A = 125°C and at T_A = -55°C.												

1/ Use table III in conjunction with the following:

Tests	Device type	Figure
1-102	01-04	6
1-99	05-06	
103-114	01-04	7
100-111	05-06	
115-126	01-04	8
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 calculated 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} = 2 mV.

FOOTNOTES - Continued.

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.

4. PRODUCT ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-M-38510 and methods 5005 and 5007, as applicable, of MIL-STD-883, except as modified herein.

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to qualification and quality conformance inspections. The following additional criteria shall apply:

a. Interim and final electrical test parameters shall be as specified in table II, interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

b. Burn-in (method 1015 of MIL-STD-883).

   1. For class S devices. Test condition D using the circuit shown in figure 3.

   2. For class B devices. Test condition D using the circuit shown on figure 3, or test condition C using the circuit shown on figure 4, or test condition F using the circuit shown on figure 5.

c. Reverse bias burn-in (method 1015 of MIL-STD-883). This screen test shall apply to class S devices only using the circuit shown on figure 4.

d. The percent defective allowable (PDA) for class S and class B devices shall be as specified in MIL-M-38510, based on failures from group A, subgroup 1 test after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883, and with no intervening electrical measurements. If interim electrical parameter tests are performed prior to burn-in, failures resulting from pre burn-in screening may be excluded from the PDA. If interim electrical parameter tests prior to burn-in are omitted, then all screening failures shall be included in the PDA. The verified failures of group A, subgroup 1 after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent defective for that lot, and the lot shall be accepted or rejected based on the PDA for the applicable device class.

4.3 Qualification inspection. Qualification inspection shall be in accordance with MIL-M-38510. Inspections to be performed shall be those specified in method 5005 of MIL-STD-883 and herein for groups A, B, C, and D inspections (see 4.4.1 through 4.4.4).

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510. Inspection to be performed shall be those specified in method 5005 of MIL-STD-883 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 I of method 5005 of MIL-STD-883 and as follows:

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

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

4.4.2 Group B inspection. Group B inspection shall be in accordance with table II of method 5005 of MIL-STD-883 and as follows:

a. Steady state life test for class S devices shall be in accordance with table IIa (subgroup 5) of method 5005 of MIL-STD-883, using the circuit on figure 5. If the alternate burn-in conditions are used, the circuit on figure 4 shall be used.

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

4.4.3 Group C inspection. Group C inspection shall be in accordance with table III of method 5005 and as follows:

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

b. Steady state life test for class B devices (method 1005 of MIL-STD-883). Test condition D using the circuit shown on figure 3 or test condition F using the circuit shown on figure 5 or test condition C using the circuit shown on figure 4.

4.4.4 Group D inspection. Group D inspection shall be in accordance with table IV of method 5005 of MIL-STD-883. End-point electrical parameters shall be as specified in table II herein.

4.5 Methods of inspections. Methods of inspections shall be as specified in the appropriate tables and as follows. Electrical test circuits as prescribed herein or in the referenced test methods of MIL-STD-883 shall be acceptable. Other test circuits shall require the approval of the qualifying activity.

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.

TABLE IV. Group C end-point electrical parameters.

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

Table III test no. 1/	Test		01, 02 min	01, 02 max	03 min	03 max	04 min	04 max	05 min	05 max	06 min	06 max	Units
3	V_{IO}	Limit	-5	5	-3	3	-5	5	-5	5	-2	2	mV
		Delta	-1	1	-0.5	0.5	-1	1	-1	1	-.5	.5	
11	$+I_{IB}$	Limit	0.1	100	-200	-1	-250	-1	-150	-1	-50	-1	nA
		Delta	-15	15	-20	20	-25	-25	-15	15	-10	10	
15	$-I_{IB}$	Limit	0.1	100	-200	-1	-250	-1	-150	-1	-50	-1	nA
		Delta	-15	15	-20	20	-25	25	-15	15	-10	10	

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.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-38510.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Microcircuits conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Part or Identifying Number (PIN) (see 6.6).

d. 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.

e. Requirement for certificate of compliance, if applicable.

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

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

h. Requirements for product assurance options.

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

j. Requirements for "JAN" marking.

6.3 Abbreviations, symbols, and definitions. The abbreviations, symbols and definitions used herein are defined in MIL-M-38510 and MIL-STD-1331.

6.4 Logistic support. Lead materials and finishes (see 3.3) are interchangeable. Unless otherwise specified, microcircuits acquired for Government logistic support will be acquired to device class B (see 1.2.2), lead material and finish C (see 3.3). Longer length leads and lead forming shall not affect the PIN.

6.5 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 shall 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-38510.

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

6.6 Part or Identifying Number (PIN). The PIN is created as specified in MIL-M-38510.

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 change.

CONCLUDING MATERIAL

Custodians:
Army - ER
Navy - EC
Air Force - 17
NASA - NA

Review activities:
Army - AR, MI
Navy - OS, SH
Air Force - 11, 19, 85, 99
DLA - ES

User activities:
Army - SM
Navy - AS, CG, MC

Preparing activity:
Air Force - 17

Agent:
DLA - ES

(Project 5962-1187)