INCH-POUND
MIL-M-38510/112B
18 February 2004
SUPERSEDING
MIL-M-38510/112A
27 January 1986

MILITARY SPECIFICATION

MICROCIRCUITS, LINEAR, VOLTAGE COMPARATORS, MONOLITHIC SILICON

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

Reactivated after 18 February 2004 and may be used for either new or existing design acquisition

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, voltage comparators. Two product assurance classes and a choice of case outlines and lead finishes are provided 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 For this product, the requirements of MIL-M-38510 have been superseded by MIL-PRF-38535, (see 6.3)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 or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-38535, and as specified herein.

1.2.1 Device types. The device types are as follows:

Device type	Circuit
01	Quad voltage comparator, single supply, low power
02	Dual voltage comparator, single supply, low power

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

1.2.3 Case outline. The case outline are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
A 1/	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
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
G	MACY1-T8	8	Can
2	CQCC1-N20	20	Square leadless chip carrier

1/ Inactive package case outline.

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 email ed to bipolar@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.

1.3 Absolute maximum ratings.

Positive supply voltage	36 V
Total supply voltage	36 V or ±18 V
Output voltage	36 V
Input voltage range	-0.3 V to +36 V 2/
Differential input voltage	36 V
Sink current	20 mA (approximately)
Output short circuit to ground	Continuous 3/
Storage temperature range	-65°C to +150°C
Junction temperature (T_J)	+175°C 4/
Lead temperature (soldering, 60 s)	+300°C.

1.4 Recommended operating conditions.

Supply voltage (V_{CC})	5 V dc to 30 V dc
Operating temperature range	-55°C to +125°C

1.5 Power and thermal characteristics.

Case outline	Package	Maximum allowable power dissipation	maximum θ_{J-C}	maximum θ_{J-A}
A, D	14-lead FP	350 mW @ T_A = 125°C	60°C/W	140°C/W
C, P	Dual-in-line	400 mW @ T_A = 125°C	35°C/W	120°C/W
G	8-lead can	330 mW @ T_A = 125°C	40°C/W	150°C/W
2	20-terminal	90 mW @ T_A = 125°C	55°C/W	121°C/W

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

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 cited in the solicitation or contract.

2/ The input voltage should be within the common mode range to insure a proper output state.

3/ No protection exists for short circuits to the positive supply.

4/ 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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents are available online at http://assist.daps.dla.mil;quicksearch/ or www.dodssp.daps.mil or 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 specification 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.

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

3.4 Lead material and finish. The lead material and finish shall be in accordance with MIL-PRF-38535 (see 6.6).

3.5 Electrical performance characteristics. The electrical performance characteristics are as specified in table I, and apply over the full recommended case operating temperature range, unless otherwise specified.

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 50 (see MIL-PRF-38535, appendix A).

TABLE I. Electrical performance characteristics.

Characteristics	Symbol	Conditions 1/ 5 V < + V_{CC} < 30 V (see 3.5 and figure 2 unless otherwise indicated)	Device type	Limits		Units
				Min	Max	
Input offset voltage	V_{IO}	T_A = +25°C 2/	All	-5	5	mV
		-55°C ≤ T_A ≤ 125°C 2/		-7	7	
Input offset voltage temperature sensitivity	$\frac{\Delta V}{\Delta T}IO$	-55°C ≤ ΔT_A ≤ 25°C	All	-25	25	µV/°C
		25°C ≤ ΔT_A ≤ 125°C		-25	25	
Input offset current	I_{IO}	R_S = 20 k, 25°C ≤ T_A ≤ 125°C 2/	All	-25	25	nA
		R_S = 20 k, T_A = -55°C 2/		-75	75	
Input offset current temperature sensitivity	$\frac{\Delta V}{\Delta T}IO$	-55°C ≤ T_A ≤ 25°C	All	-400	400	pA/°C
		25°C ≤ T_A ≤ 125°C		-300	300	
Input bias current	$+I_{IB}$	R_S = 20 k, 25°C ≤ T_A ≤ 125°C 2/	All	-100	+0.1	nA
		R_S = 20 k, T_A = -55°C 2/		-200	+0.1	
	$-I_{IB}$	R_S = 20 k, 25°C ≤ T_A ≤ 125°C 2/		-100	+0.1	
		R_S = 20 k, T_A = -55°C 2/		-200	+0.1	
Input voltage common mode rejection	CMR	+V_{CC} = 30 V 3/	All	75		dB
		+V_{CC} = 5 V 3/		70		
Output leakage	I_{CEX}	+V_{CC} = V_O = +30 V, 25°C ≤ T_A ≤ 125°C	All		1.0	µA
Input leakage current	$+I_{IL}$	+V_{CC} = 36 V, V+$_I$ = 34 V, V-$_I$ = 0 V	All	-500	500	nA
	$-I_{IL}$	+V_{CC} = 36 V, V+$_I$ = 0 V, V-$_I$ = 34 V		-500	500	
Low level output voltage	V_{OL}	+V_{CC} = 4.5 V, I_O = 4 mA, T_A = +25°C	All		0.4	V
		+V_{CC} = 4.5 V, I_O = 8 mA, T_A = +25°C			1.5	
		+V_{CC} = 4.5 V, I_O = 4 mA, -55°C ≤ T_A ≤ 125°C			0.7	
		+V_{CC} = 4.5 V, I_O = 8 mA, -55°C ≤ T_A ≤ 125°C			2.0	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Characteristics	Symbol	Conditions 1/ 5 V < + V_{CC} < 30 V (see 3.5 and figure 2 unless otherwise indicated)	Device Type	Limits		Units
				Min	Max	
Power supply current	I_{CC}	V_{IO} = 15 mV, +V_{CC} = 5 V, T_A = -55°C	All		3	mA
		V_{IO} = 15 mV, +V_{CC} = 5 V, T_A = 25°C			2	
		V_{IO} = 15 mV, +V_{CC} = 5 V, T_A = 125°C			2	
		V_{IO} = 15 mV, +V_{CC} = 30 V, T_A = -55°C			4	
		V_{IO} = 15 mV, +V_{CC} = 30 V, T_A = 25°C			3	
		V_{IO} = 15 mV, +V_{CC} = 30 V, T_A = 125°C			3	
Open loop voltage gain	A_{VS}	+V_{CC} = 15 V, R_L = 15 kΩ, 1 V ≤ V_O ≤ 11 V, T_A = 25°C	All	50		V/mV
		+V_{CC} = 15 V, R_L = 15 kΩ, 1 V ≤ V_O ≤ 11 V, -55°C ≤ T_A ≤ 125°C	All	25		
Channel separation	CS	+V_{CC} = 30 V, T_A = 25°C figure 4	All	80		dB
Response time low-to-high level	t_{RLH}	+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 5 mV, -55°C ≤ T_A ≤ 25°C	All		5	µs
		+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 5 mV, T_A = 125°C			7	
		+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 50 mV, -55°C ≤ T_A ≤ 25°C			0.8	
		+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 50 mV, T_A = 125°C			1.2	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Characteristics	Symbol	Conditions 1/ 5 V < + V_{CC} < 30 V (see 3.5 and figure 2 unless otherwise indicated)	Device Type	Limits		Units
				Min	Max	
Response time high-to-low level	t_{RHL}	+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 5 mV, -55°C ≤ T_A ≤ 25°C	All		2.5	µs
		+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 5 mV, T_A = 125°C			3	
		+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 50 mV, -55°C ≤ T_A ≤ 25°C			0.8	
		+V_{CC} = 5 V, V_{IN} = 100 mV, R_L = 5.1 kΩ, see figure 3, V_{OD} = 50 mV, T_A = 125°C			1.0	
Voltage latch (high level input)	V_{LAT}	+V_{CC} = 5 V, T_A = 25°C, V_{IN} = 10 V, figure 9, I_O = 4 mA	All		0.4	V

FOOTNOTES :

1/ For devices marked with the “Q” certification mark, the parameters listed herein may be guaranteed if not tested to the limits specified in accordance with the manufacturer’s QM plan.

2/ V_{IO}, I_{IO} and ±I_{IB} shall be measured at the common mode extremes at 30 V and 5 V, as shown below:

Condition	Common Mode	+V_{CC}	-V_{CC}	+V_{IN}	+V_O
1	(-CM)	30 V	0 V	0 V	15 V
2	(+CM)	2 V	- 28 V	0 V	-13 V
3	(-CM)	5 V	0 V	0 V	1.4 V
4	(+CM)	2 V	-3 V	0 V	-1.6 V

3/ CMR shall be calculated from V_{io} measurements defined in footnote 2/.

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*, 2, 3, 4	1*, 2, 3, 4
Group A test requirements	1, 2, 3, 4, 5, 6, 7, 8, 9	1, 2, 3, 4, 5, 6, 7, 8, 9
Group B electrical test parameters when using the method 5005 QCI option	1, 2, 3 and table IV delta limits	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

*PDA applies to subgroup 1 (see 4.3c).

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. Reverse bias burn-in (method 1015 of MIL-STD-1835) required on class S devices only.

d. 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 TYPE 01
CASE 2

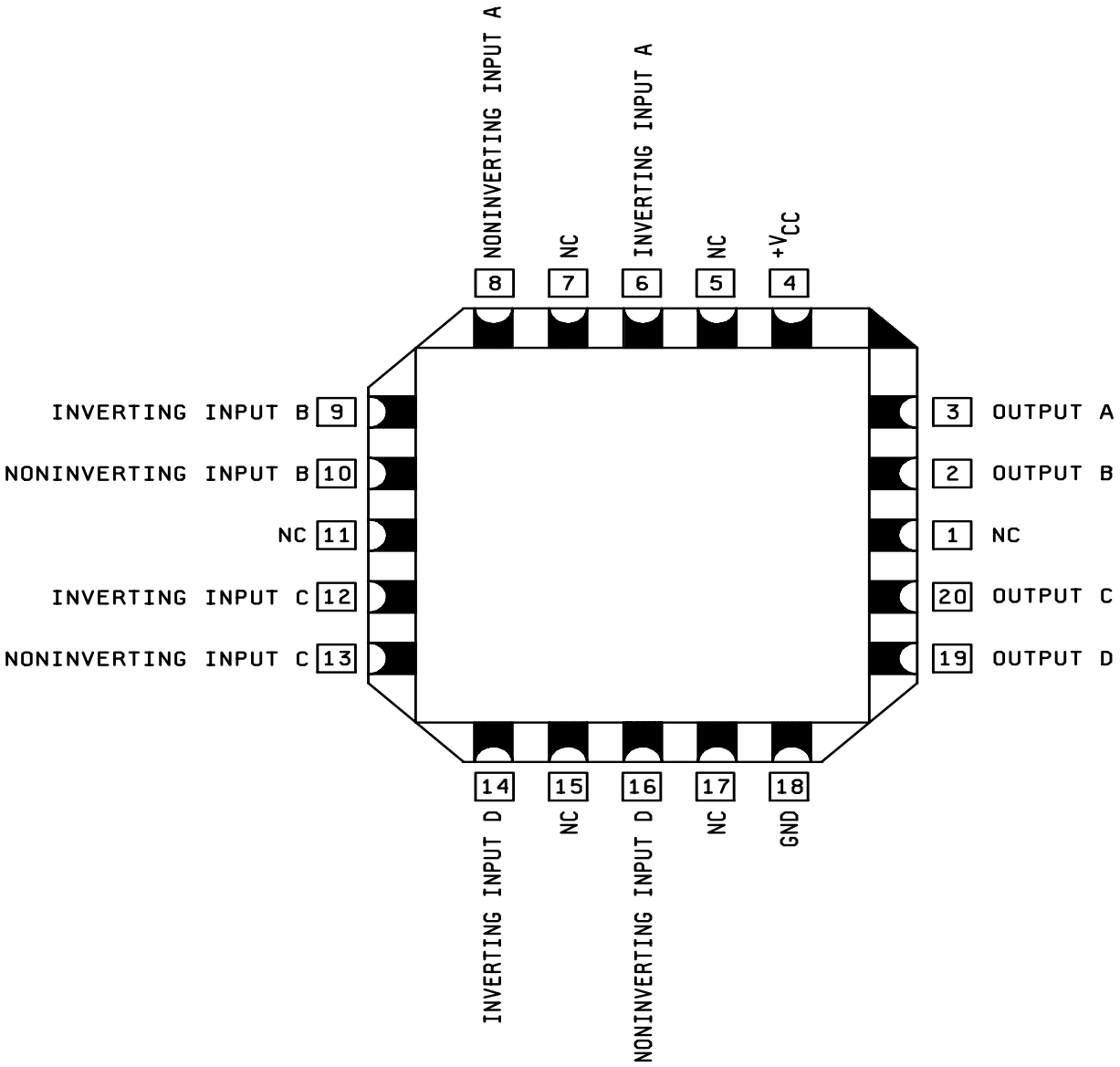
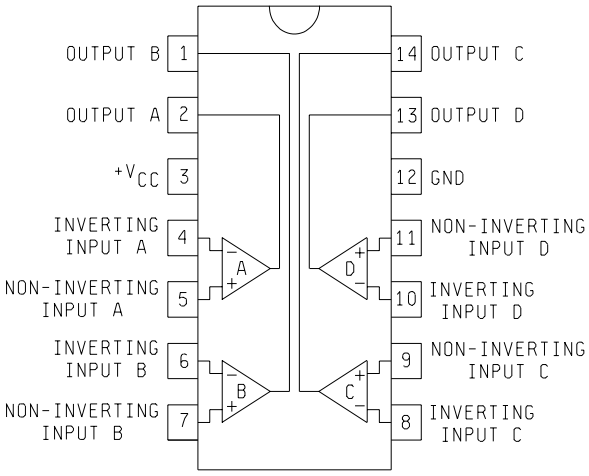


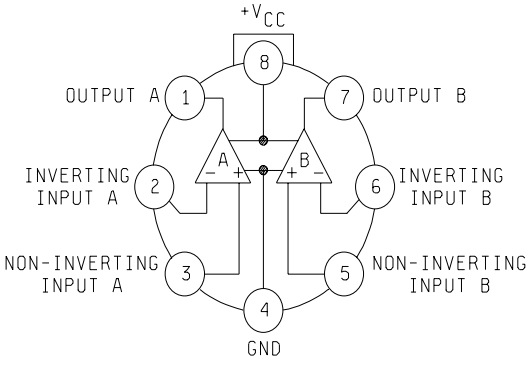
Figure 1. Terminal connections.

DEVICE TYPE 01
CASES A,C, AND D



DEVICE TYPE 02

CASE G



CASE P

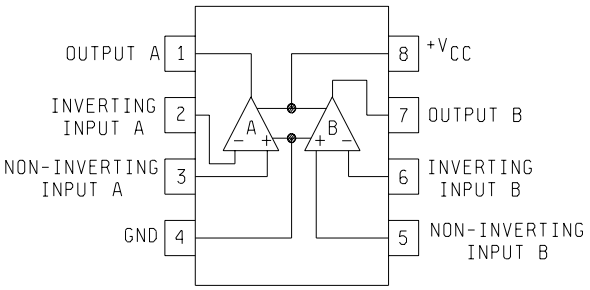
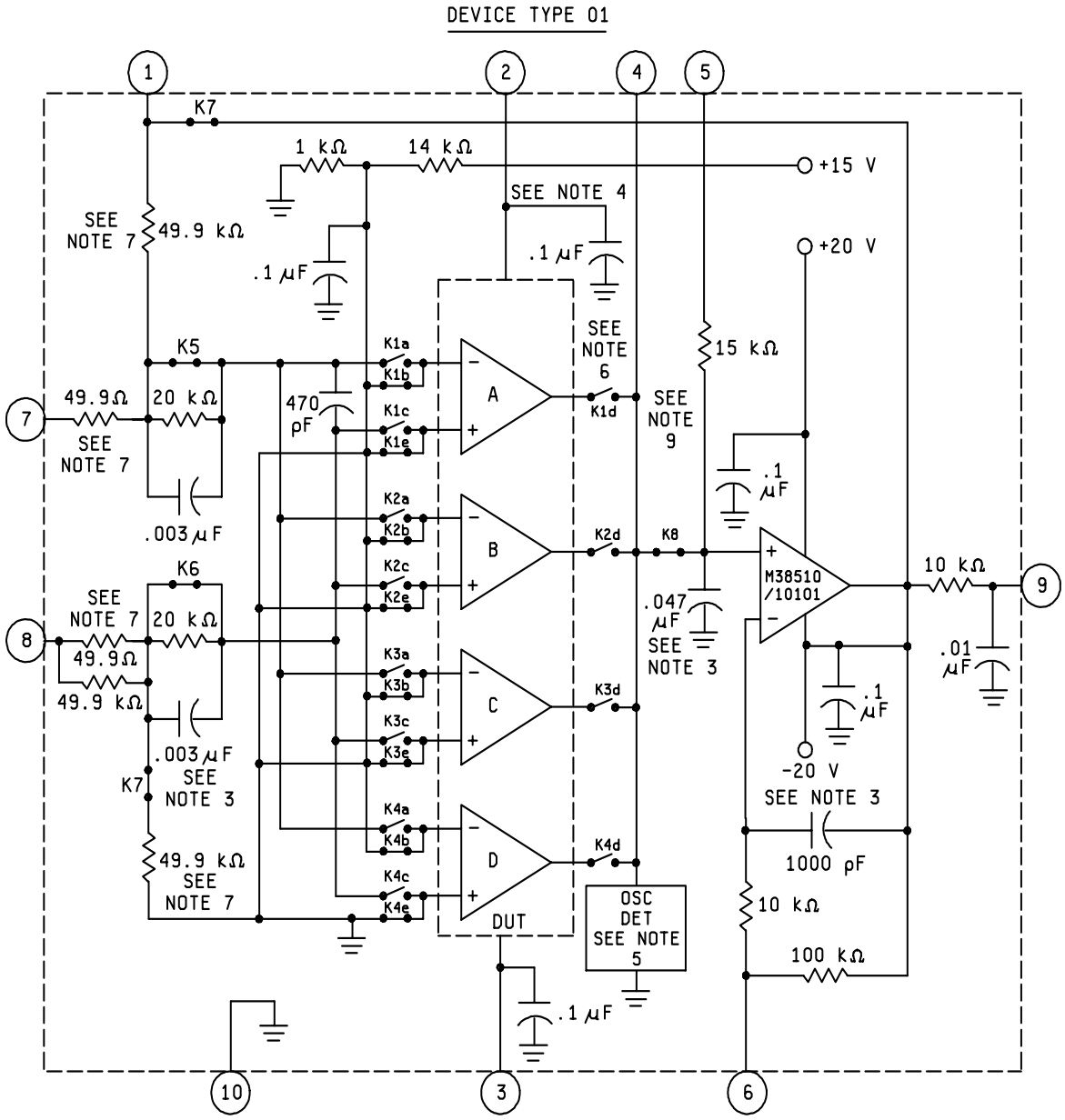
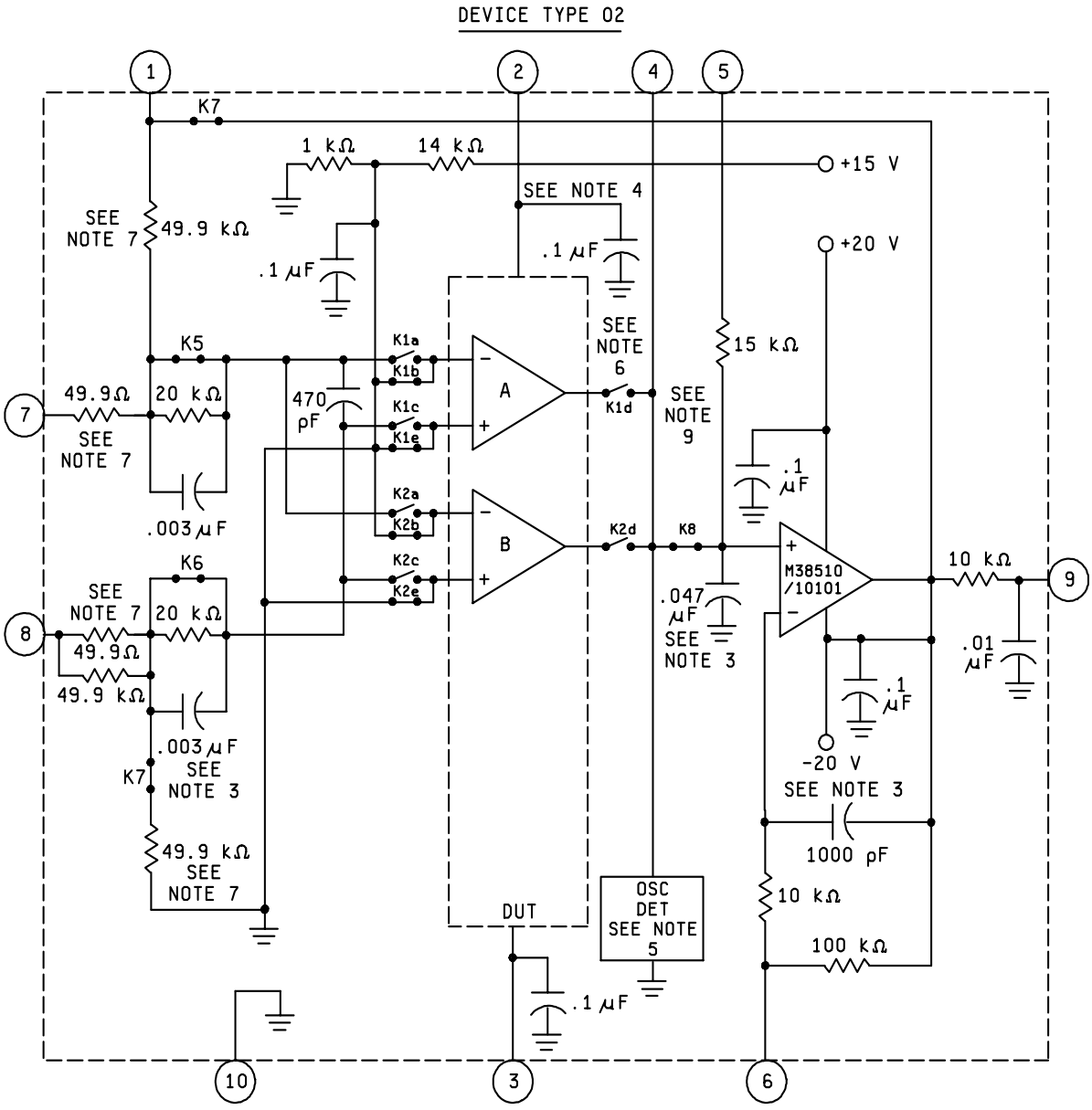


Figure 1. Terminal connections - Continued.



See following notes.

FIGURE 2. Test circuit for static and dynamic tests.



See following footnotes.

FIGURE 2. Test circuit for static and dynamic tests – Continued.

NOTES:

1. Test circuit pin conditions shall be as specified in the schedule of this figure.
2. Subgroups, test temperatures and limits shall be as specified in table III.
3. As required to prevent oscillations. Also, proper wiring procedures shall be followed to prevent oscillations. Loop response and settling time shall be consistent with test rate such that any value has settled to within 5% of its final value before measuring. Suggested values shown may not ensure loop stability for all layouts. Actual compensation also shall be approved by preparing activity prior to use.
4. Precautions shall be taken to prevent damage to the D.U.T. during insertion into the socket and change of relay contacts.
5. Any oscillation greater than 300 mV (pk-pk) shall be cause for device failure.
6. Relays K1 thru K4 select the comparator under test. The idle comparators have 1 V applied to the (-) input to force their outputs to the low state.
7. These resistors are ±0.1% tolerance matched to ±0.01%. All other resistors are ±1% tolerance and capacitors are 10% tolerance.
8. Common mode rejection is calculated using the offset voltage values measured at the common mode range end points.
9. The relays shown indicate test connections only. All relays are shown in their de-energized states. Relay coils are not shown.
10. Saturation of the nulling amplifier is not allowed on tests where E value is measured.

FIGURE 2. Test circuit for static and dynamic tests – Continued.

DEVICE TYPE 01

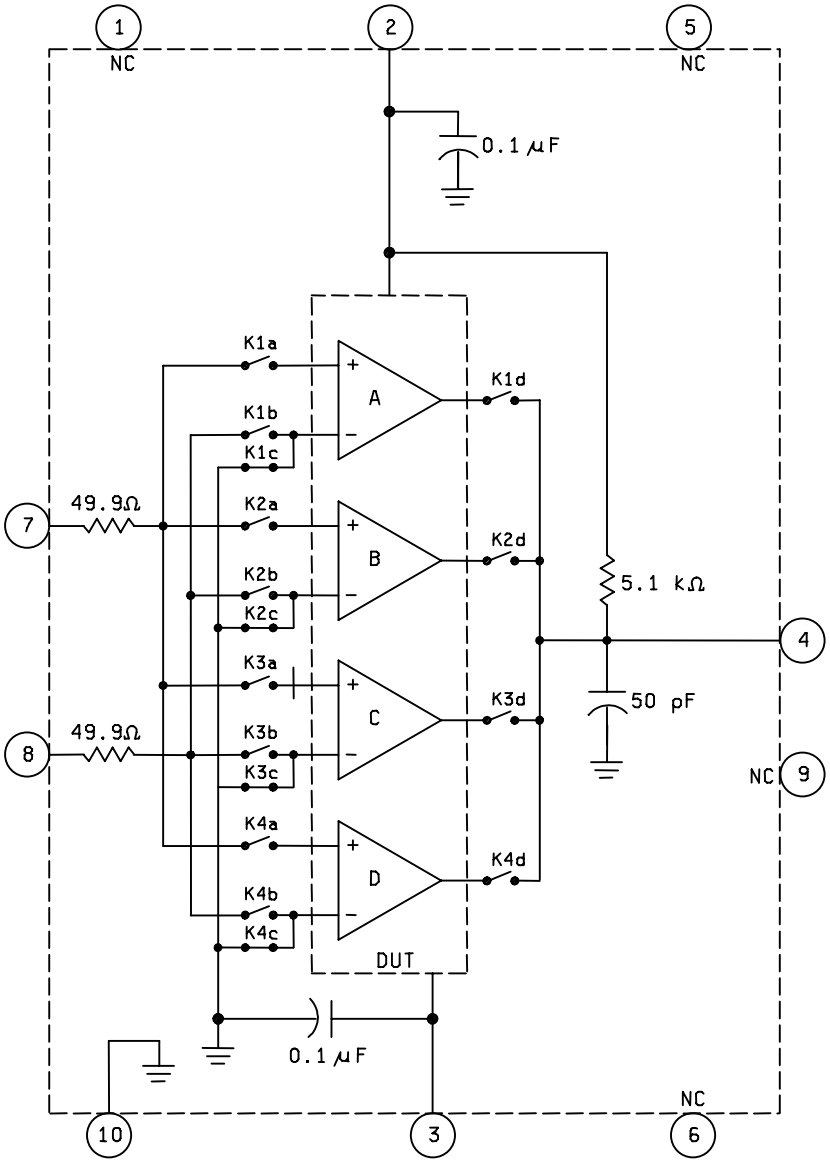


FIGURE 3. Response time test circuit and waveform.

DEVICE TYPE 02

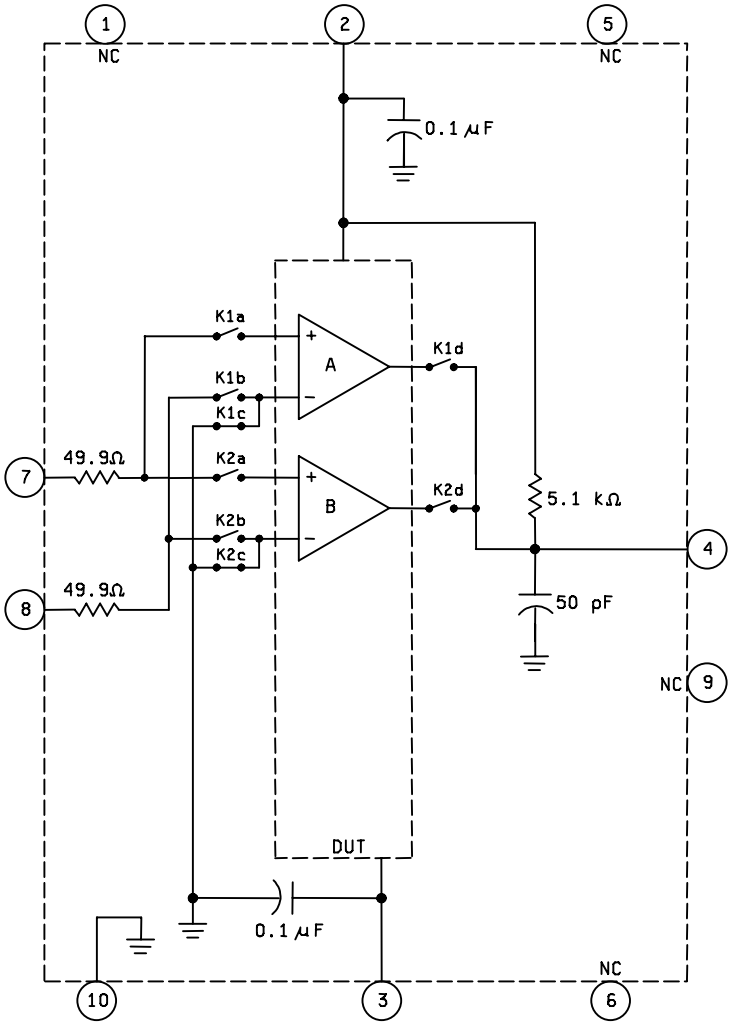
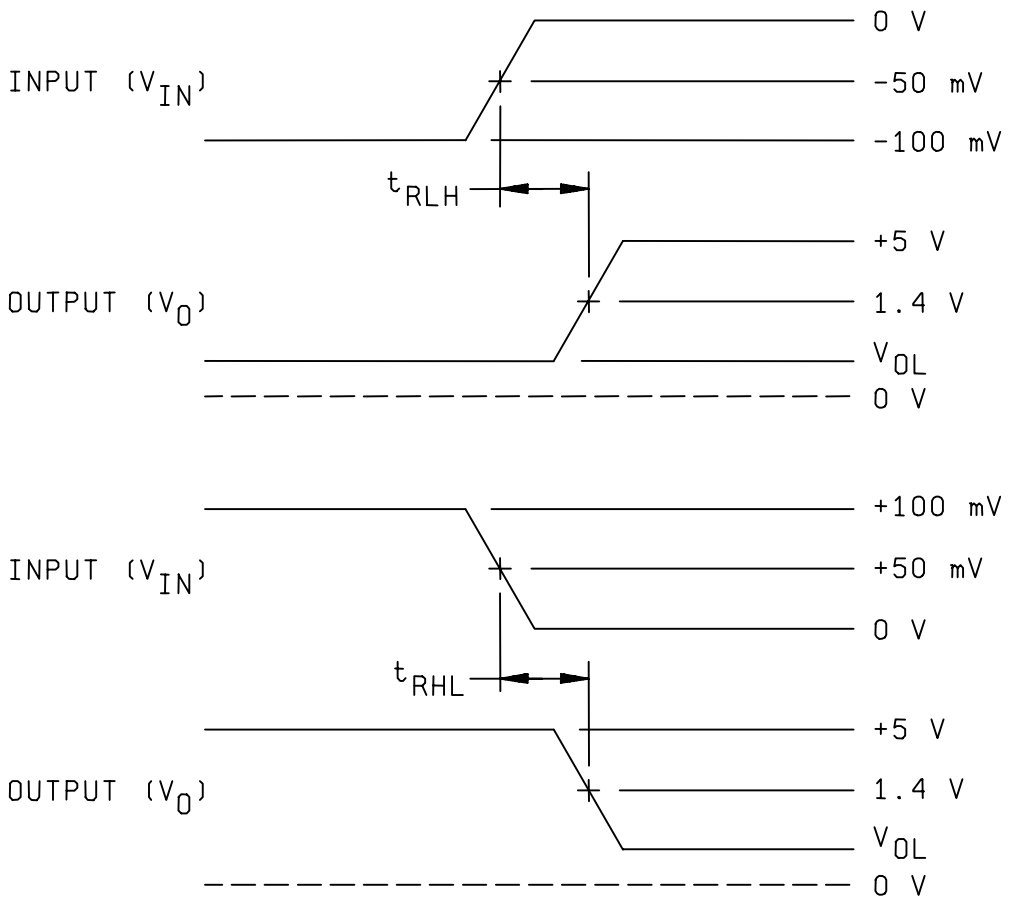


FIGURE 3. Response time test circuit and waveform. - Continued.



NOTES:

1 Adjust the signal generator so that V_{IN} is a 100 mV pulse train with a 10 µs pulse width at 50 kHz, t_{TLH} and $t_{THL} \leq 10$ ns and $Z_0 \approx 50\Omega$.

2 Setup procedure:
   a. With $V_{IN} = 0$, adjust V_{REF} from -5.0 mV to +5.0 mV for subgroup 1, adjust V_{REF} from -7.0 mV to +5.0 mV for subgroups 2 and 3, in 0.1 mV steps and stop when output switches from high to low.
   b. Change V_{REF} from the value obtained in (a) above by the required V_{OD} (overdrive).
   c. Apply V_{IN} and measure the response time.

3 All resistor tolerances are ±1% and all capacitor tolerances are ±10%.

4 The output capacitance includes scope, probe and jig capacitance.

FIGURE 3. Response time test circuit and waveform. - Continued.

DEVICE TYPE 01

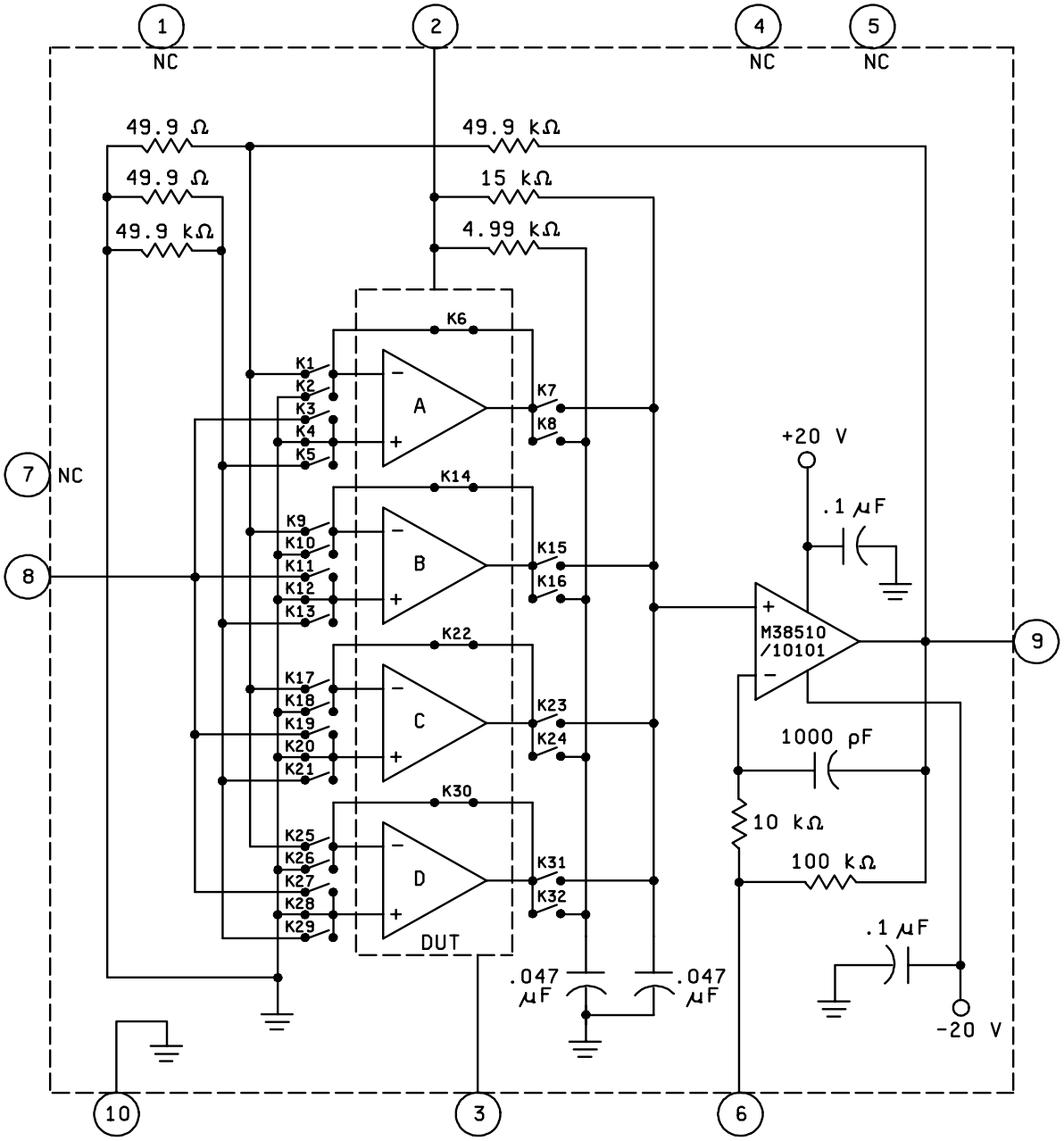


FIGURE 4. Channel separation test circuit.

DEVICE TYPE 02

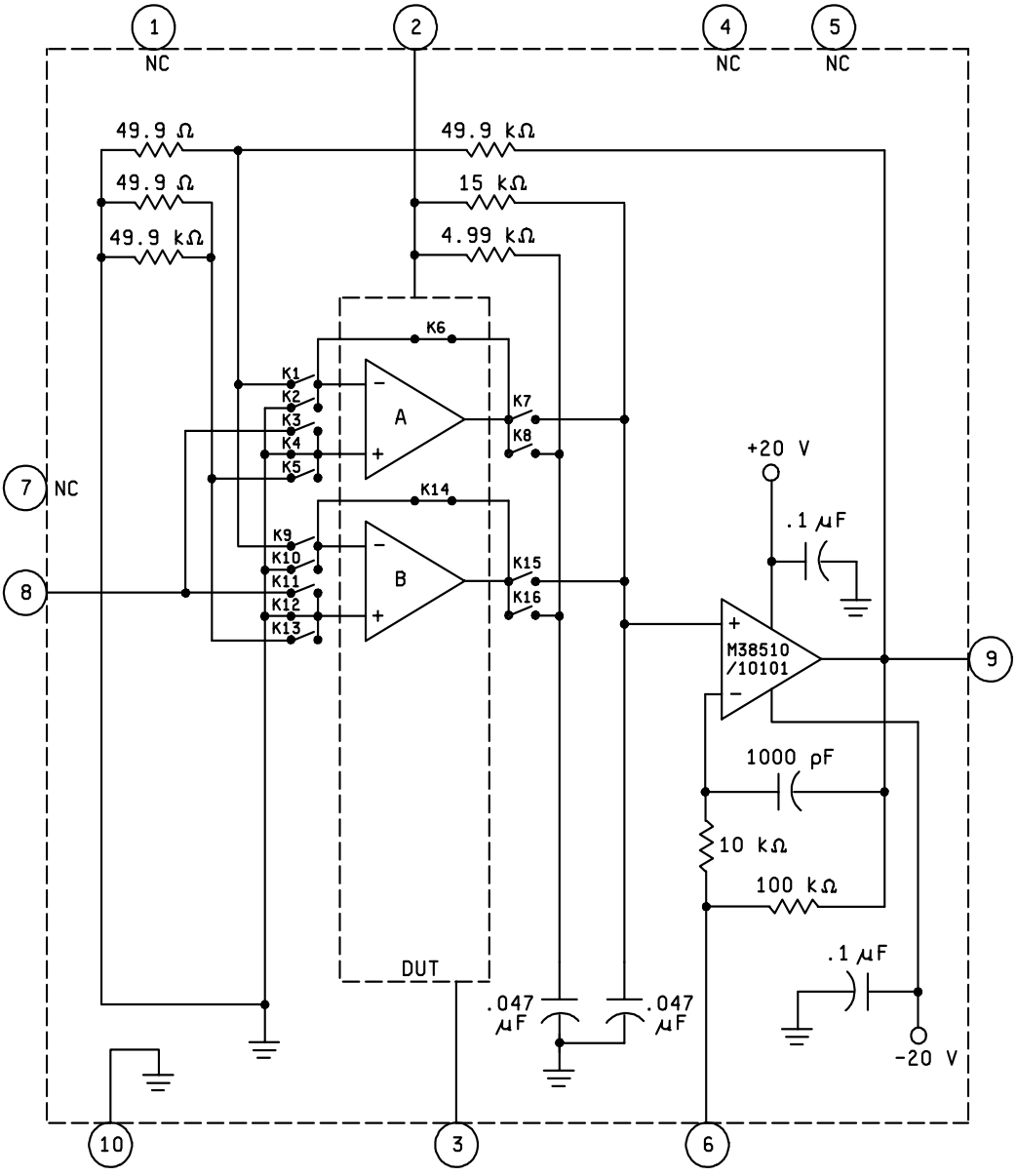


FIGURE 4. Channel separation test circuit. - Continued.

NOTES:

1 All resistor are ±0.1% tolerance and all capacitor are ±10% tolerance.

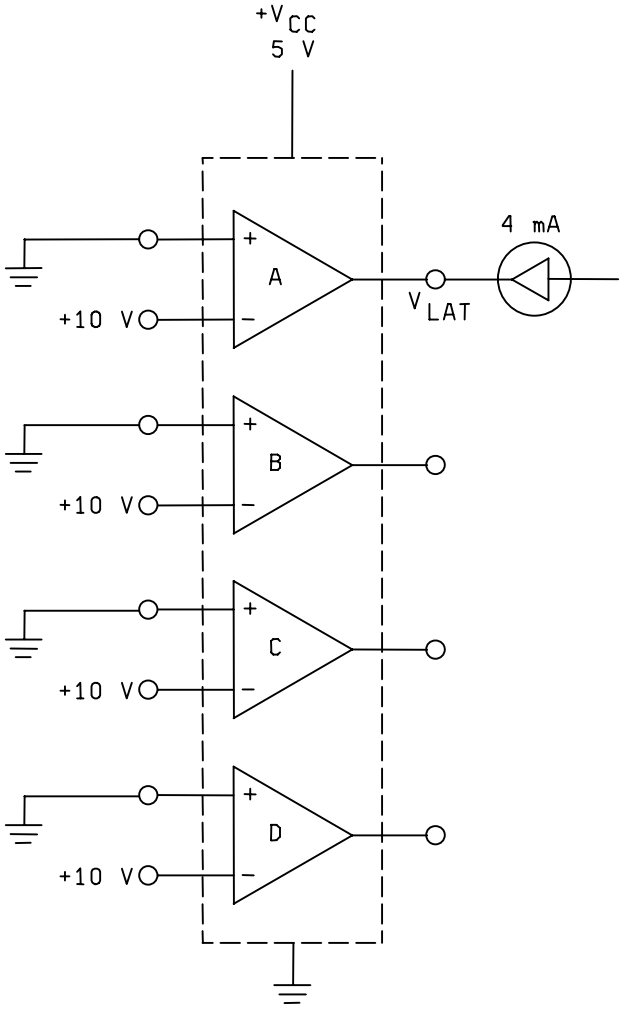
2 Precautions shall be taken to prevent damage to the D.U.T. during insertion into socket and change of state of relays (i.e. disable voltage supplies, current limit $\pm V_{CC}$, etc.).

3 All relays are shown in the normal de-energized state. The following table shall be used to determine which relays to energize for each test. (For device type 02, use tests 87 and 90 only.)

Channel sep. test no.	Channels tested	Relays energized	
		Driven channel	Monitored channel
87	A to B	2,3,4,6,8	9,12,13,14,15
88	A to C		17,20,21,22,23
89	A to D		25,28,29,30,31
90	B to A	10,11,12,14,16	1,4,5,6,7
91	B to C		17,20,21,22,23
92	B to D		25,28,29,30,31
93	C to A	18,19,20,22,24	1,4,5,6,7
94	C to B		9,12,13,14,15
95	C to D		25,28,29,30,31
96	D to A	26,27,28,30,32	1,4,5,6,7
97	D to B		9,12,13,14,15
98	D to C		17,20,21,22,23

4 The nulling amplifier shall be a JM38510/10101XXX or equivalent. Saturation of the nulling amplifier is not allowed.

FIGURE 4. Channel separation test circuit. - Continued.



NOTES:
1. Test shall be performed on each comparator separately (device type 01 - four comparators, device type 02 - two comparators).
2. Constant current source shall supply 4 mA into output.

FIGURE 5. Voltage latch test circuit.

TABLE III. Group A inspection.

Subgroup	Symbol	MIL-STD-883 method	Test No.	1/ Notes	Adapter pin numbers										Energized relays	Measured pin			Equation
					1	2	3	4	5	6	7	8	9	10		No.	Value	Unit	
1 T_A = 25°C	V_{IO}	4001	1	2/ 12/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	11/	9	E_1	V	$V_{IO} = E_1$
			2		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	11/	9	E_2	V	$V_{IO} = E_2$
			3		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	11/	9	E_3	V	$V_{IO} = E_3$
			4		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	11/	9	E_4	V	$V_{IO} = E_4$
	I_{IO}	4001	5	2/ 12/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K5, K6 11/	9	E_5	V	$I_{IO} = 50 (E_1 - E_5)$
			6		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K5, K6 11/	9	E_6	V	$I_{IO} = 50 (E_2 - E_6)$
			7		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K5, K6 11/	9	E_7	V	$I_{IO} = 50 (E_3 - E_7)$
			8		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K5, K6 11/	9	E_8	V	$I_{IO} = 50 (E_4 - E_8)$
	$+I_{IB}$	4001	9	2/ 12/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K6 11/	9	E_9	V	$+I_{IB} = 50 (E_1 - E_9)$
			10		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K6 11/	9	E_{10}	V	$+I_{IB} = 50 (E_2 - E_{10})$
			11		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K6 11/	9	E_{11}	V	$+I_{IB} = 50 (E_3 - E_{11})$
			12		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K6 11/	9	E_{12}	V	$+I_{IB} = 50 (E_4 - E_{12})$
	$-I_{IB}$	4001	13	2/ 12/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K5 11/	9	E_{13}	V	$-I_{IB} = 50 (E_{13} - E_1)$
			14		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K5 11/	9	E_{14}	V	$-I_{IB} = 50 (E_{14} - E_2)$
			15		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K5 11/	9	E_{15}	V	$-I_{IB} = 50 (E_{15} - E_3)$
			16		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K5 11/	9	E_{16}	V	$-I_{IB} = 50 (E_{16} - E_4)$
	CMR	4003	17	3/	Calculate value using data from tests 1 and 2. 9/														$CMR = 20 \log \left\lvert \frac{28000}{E_1 - E_2} \right\rvert$
			18		Calculate value using data from tests 3 and 4. 9/														$CMR = 20 \log \left\lvert \frac{3000}{E_3 - E_4} \right\rvert$
	I_{CEX}	3009	19	4/	-15 V	30 V	0 V	30 V	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	I_1	mA	$I_{CEX} = I_1$
	$+I_{IL}$	4001	20	8/	---	36 V	0 V	---	0 V	0 V	0 V	34 V	---	GND	K7, K8 11/	8	I_2	nA	$+I_{IL} = I_2$
	$-I_{IL}$	4001	21	8/	---	36 V	0 V	---	0 V	0 V	34 V	0	---	GND	K7, K8 11/	7	I_3	nA	$+I_{IL} = I_3$
	V_{OL}	3007	22	I_O = 4 mA	15 V	4.5 V	0 V	4 mA	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	E_{17}	V	$V_{OL} = E_{17}$
			23	I_O = 8 mA	15 V	4.5 V	0 V	8 mA	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	E_{18}	V	$V_{OL} = E_{18}$
	I_{CC}	3005	24	$V_0 = V_{OL}$ 5/	15 V	5 V	0 V	---	0 V	0 V	0 V	0 V	---	GND	K1,K2,K3, K4,K7,K8	2	I_4	mA	$I_{CC} = I_4$
			25		15 V	30 V	0 V	---	0 V	0 V	0 V	0 V	---	GND	K1,K2,K3, K4,K7,K8	2	I_5	mA	$I_{CC} = I_5$
2 T_A = 125°C	V_{IO}	4001	26	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	11/	9	E_{19}	V	$V_{IO} = E_{19}$
			27		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	11/	9	E_{20}	V	$V_{IO} = E_{20}$
			28		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	11/	9	E_{21}	V	$V_{IO} = E_{21}$
			29		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	11/	9	E_{22}	V	$V_{IO} = E_{22}$
	$\frac{\Delta V_{IO}}{\Delta T}$	4001	30	7/	$\frac{\Delta V_{IO}}{\Delta T}$ = [V_{IO} (test 26) - V_{IO} (test 1)] /100°C														
	I_{IO}	4001	31	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{23}	V	$I_{IO} = 50 (E_{19} - E_{23})$
			32		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{24}	V	$I_{IO} = 50 (E_{20} - E_{24})$
			33		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{25}	V	$I_{IO} = 50 (E_{21} - E_{25})$
			34		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{26}	V	$I_{IO} = 50 (E_{23} - E_{26})$
	$\frac{\Delta I_{IO}}{\Delta T}$	4001	35	7/	$\frac{\Delta I_{IO}}{\Delta T}$ = [I_{IO} (test 31) - I_{IO} (test 5)] /100°C														
	$+I_{IB}$	4001	36	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K6 11/	9	E_{27}	V	$+I_{IB} = 50 (E_{19} - E_{27})$
			37		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K6 11/	9	E_{28}	V	$+I_{IB} = 50 (E_{20} - E_{28})$
			38		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K6 11/	9	E_{29}	V	$+I_{IB} = 50 (E_{23} - E_{29})$
			39		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K6 11/	9	E_{30}	V	$+I_{IB} = 50 (E_{24} - E_{30})$
	$-I_{IB}$	4001	40	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K5 11/	9	E_{31}	V	$-I_{IB} = 50 (E_{31} - E_{19})$
			41		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K5 11/	9	E_{32}	V	$-I_{IB} = 50 (E_{32} - E_{20})$
			42		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K5 11/	9	E_{33}	V	$-I_{IB} = 50 (E_{33} - E_{21})$
			43		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K5 11/	9	E_{34}	V	$-I_{IB} = 50 (E_{34} - E_{22})$

See footnotes at end of table.

TABLE III. Group A inspection - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test No.	1/ Notes	Adapter pin numbers										Energized relays	Measured pin			Equation
					1	2	3	4	5	6	7	8	9	10		No.	Value	Unit	
2 T_A = 125°C	CMR	4003	44	3/	Calculate value using data from tests 26 and 27. 9/														CMR = 20 log $\frac{28000}{\lvert E_{19} - E_{20} \rvert}$
			45		Calculate value using data from tests 28 and 29. 9/														CMR = 20 log $\frac{3000}{\lvert E_{21} - E_{22} \rvert}$
	I_{CEX}	3009	46	4/	-15 V	30 V	0 V	30 V	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	I_6	µA	$I_{CEX} = I_6$
	$+I_{IL}$	4001	47	8/	---	36 V	0 V	---	0 V	0 V	0 V	34 V	---	GND	K7, K8 11/	8	I_7	nA	$+I_{IL} = I_7$
	$-I_{IL}$	4001	48	8/	---	36 V	0 V	---	0 V	0 V	34 V	0	---	GND	K7, K8 11/	7	I_8	nA	$-I_{IL} = I_8$
	V_{OL}	3007	49	I_O = 4 mA	15 V	4.5 V	0 V	4 mA	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	E_{35}	V	$V_{OL} = E_{35}$
			50	I_O = 8 mA	15 V	4.5 V	0 V	8 mA	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	E_{36}	V	$V_{OL} = E_{36}$
	I_{CC}	3005	51	$V_0 = V_{OL}$ 5/	15 V	5 V	0 V	---	0 V	0 V	0 V	0 V	---	GND	K1,K2,K3, K4,K7,K8	2	I_9	mA	$I_{CC} = I_9$
			52		15 V	30 V	0 V	---	0 V	0 V	0 V	0 V	---	GND	K1,K2,K3, K4,K7,K8	2	I_{10}	mA	$I_{CC} = I_{10}$
3 T_A = -55°C	V_{IO}	4001	53	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	11/	9	E_{37}	V	$V_{IO} = E_{37}$
			54		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	11/	9	E_{38}	V	$V_{IO} = E_{38}$
			55		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	11/	9	E_{39}	V	$V_{IO} = E_{39}$
			56		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	11/	9	E_{40}	V	$V_{IO} = E_{40}$
	$\frac{\Delta V_{IO}}{\Delta T}$	4001	57	7/	$\frac{\Delta V_{IO}}{\Delta T}$ = [V_{IO} (test 53) - V_{IO} (test 1)] /80°C														
	I_{IO}	4001	58	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{41}	V	$I_{IO} = 50 (E_{37} - E_{41})$
			59		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{42}	V	$I_{IO} = 50 (E_{38} - E_{42})$
			60		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{43}	V	$I_{IO} = 50 (E_{39} - E_{43})$
			61		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K5, K6 11/	9	E_{44}	V	$I_{IO} = 50 (E_{40} - E_{44})$
	$\frac{\Delta I_{IO}}{\Delta T}$	4001	62	7/	$\frac{\Delta V_{IO}}{\Delta T}$ = [V_{IO} (test 58) - V_{IO} (test 5)] /80°C														
	$+I_{IB}$	4001	63	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K6 11/	9	E_{45}	V	$+I_{IB} = 50 (E_{37} - E_{45})$
			64		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K6 11/	9	E_{46}	V	$+I_{IB} = 50 (E_{38} - E_{46})$
			65		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K6 11/	9	E_{47}	V	$+I_{IB} = 50 (E_{39} - E_{47})$
			66		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K6 11/	9	E_{48}	V	$+I_{IB} = 50 (E_{40} - E_{48})$
	$-I_{IB}$	4001	67	2/	---	30 V	0 V	---	30 V	15 V	0 V	0 V	---	GND	K5 11/	9	E_{49}	V	$-I_{IB} = 50 (E_{49} - E_{37})$
			68		---	2 V	-28 V	---	2 V	-13 V	0 V	0 V	---	GND	K5 11/	9	E_{50}	V	$-I_{IB} = 50 (E_{50} - E_{38})$
			69		---	5 V	0 V	---	5 V	1.4 V	0 V	0 V	---	GND	K5 11/	9	E_{51}	V	$-I_{IB} = 50 (E_{51} - E_{39})$
			70		---	2 V	-3 V	---	2 V	-1.6 V	0 V	0 V	---	GND	K5 11/	9	E_{52}	V	$-I_{IB} = 50 (E_{52} - E_{40})$
	CMR	4003	71	3/	Calculate value using data from tests 53 and 54. 9/														CMR = 20 log $\frac{28000}{\lvert E_{37} - E_{38} \rvert}$
			72		Calculate value using data from tests 55 and 56. 9/														CMR = 20 log $\frac{3000}{\lvert E_{39} - E_{40} \rvert}$
	I_{CEX}	3009	73	4/	-15 V	30 V	0 V	30 V	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	I_{11}	µA	$I_{CEX} = I_{11}$
	$+I_{IL}$	4001	74	8/	---	36 V	0 V	---	0 V	0 V	0 V	34 V	---	GND	K7, K8 11/	8	I_{12}	nA	$+I_{IL} = I_{12}$
	$-I_{IL}$	4001	75	8/	---	36 V	0 V	---	0 V	0 V	34 V	0	---	GND	K7, K8 11/	7	I_{13}	nA	$-I_{IL} = I_{13}$
	V_{OL}	3007	76	I_O = 4 mA	15 V	4.5 V	0 V	4 mA	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	E_{53}	V	$V_{OL} = E_{53}$
			77	I_O = 8 mA	15 V	4.5 V	0 V	8 mA	0 V	0 V	0 V	0 V	---	GND	K7, K8 11/	4	E_{54}	V	$V_{OL} = E_{54}$
	I_{CC}	3005	78	$V_0 = V_{OL}$ 5/	15 V	5 V	0 V	---	0 V	0 V	0 V	0 V	---	GND	K1,K2,K3, K4,K7,K8	2	I_{14}	mA	$I_{CC} = I_{14}$
			79		15 V	30 V	0 V	---	0 V	0 V	0 V	0 V	---	GND	K1,K2,K3, K4,K7,K8	2	I_{15}	mA	$I_{CC} = I_{15}$

See footnotes at end of table.

TABLE III. Group A inspection - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test No.	1/ Notes	Adapter pin numbers										Energized relays	Measured pin			Equation
					1	2	3	4	5	6	7	8	9	10		No.	Value	Unit	
4 T_A = 25°C	A_{VS}	4004	80	6/	---	15 V	0 V		15 V	11 V 1 V	0 V	0 V	---	GND	11/	9	E_{55} E_{56}	V	$A_V = \frac{10}{E_{56} - E_{55}}$
5 T_A = 125°C	A_{VS}	4004	81	6/	---	15 V	0 V		15 V	11 V 1 V	0 V	0 V	---	GND	11/	9	E_{57} E_{58}	V	$A_V = \frac{10}{E_{58} - E_{57}}$
6 T_A = -55°C	A_{VS}	4004	82	6/	---	15 V	0 V		15 V	11 V 1 V	0 V	0 V	---	GND	11/	9	E_{59} E_{60}	V	$A_V = \frac{10}{E_{60} - E_{59}}$
7 T_A = 25°C	t_{RLH}		83		$+V_{CC}$ = 5 V; V_{IN} = 100 mV R_L = 5.1 KΩ Figure 3												V_{OD} = 5 mV		See response time Waveforms
	t_{RLH}		84														V_{OD} = 50 mV		
	t_{RHL}		85														V_{OD} = 5 mV		
	t_{RHL}		86														V_{OD} = 50 mV		
	CS		87	$+V_{CC}$ = 30 V fig. 4	---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{61} E_{62}	V	$CS = 20 \log \frac{30000}{\lvert E_{61} - E_{62} \rvert}$
			88		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{63} E_{64}	V	$CS = 20 \log \frac{30000}{\lvert E_{63} - E_{64} \rvert}$
			89		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{65} E_{66}	V	$CS = 20 \log \frac{30000}{\lvert E_{65} - E_{66} \rvert}$
			90		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{67} E_{68}	V	$CS = 20 \log \frac{30000}{\lvert E_{67} - E_{68} \rvert}$
			91		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{69} E_{70}	V	$CS = 20 \log \frac{30000}{\lvert E_{69} - E_{70} \rvert}$
			92		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{71} E_{72}	V	$CS = 20 \log \frac{30000}{\lvert E_{71} - E_{72} \rvert}$
			93		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{73} E_{74}	V	$CS = 20 \log \frac{30000}{\lvert E_{73} - E_{74} \rvert}$
			94		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{75} E_{76}	V	$CS = 20 \log \frac{30000}{\lvert E_{75} - E_{76} \rvert}$
			95		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{77} E_{78}	V	$CS = 20 \log \frac{30000}{\lvert E_{77} - E_{78} \rvert}$
			96		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{79} E_{80}	V	$CS = 20 \log \frac{30000}{\lvert E_{79} - E_{80} \rvert}$
			97		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{81} E_{82}	V	$CS = 20 \log \frac{30000}{\lvert E_{81} - E_{82} \rvert}$
			98		---	20 V	-10 V	---	---	15 V	---	+1 V -1 V	---	GND	See figure 4	9	E_{83} E_{84}	V	$CS = 20 \log \frac{30000}{\lvert E_{83} - E_{84} \rvert}$

See footnotes at end of table.

TABLE III. Group A inspection - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test No.	1/ Notes	Adapter pin numbers										Energized relays	Measured pin			Equation
					1	2	3	4	5	6	7	8	9	10		No.	Value	Unit	
8 T_A = 125°C	t_{RLH}		99		$+V_{CC}$ = 5 V; V_{IN} = 100 mV												V_{OD} = 5 mV		See response time Waveforms
	t_{RLH}		100		R_L = 5.1 KΩ												V_{OD} = 50 mV		
	t_{RHL}		101		Figure 3												V_{OD} = 5 mV		
	t_{RHL}		102														V_{OD} = 50 mV		
8 T_A = -55°C	t_{RLH}		103		$+V_{CC}$ = 5 V; V_{IN} = 100 mV												V_{OD} = 5 mV		See response time Waveforms
	t_{RLH}		104		R_L = 5.1 KΩ												V_{OD} = 50 mV		
	t_{RHL}		105		Figure 3												V_{OD} = 5 mV		
	t_{RHL}		106														V_{OD} = 50 mV		
9 T_A = 25°C	V_{LAT}		107		$+V_{CC}$ = 5 V; Figure 5														
			108		I_O = 4 mA														
			109																
			110																

1/ For devices marked with the "Q" certification mark, the parameters used herein may be guaranteed if not tested to the limits specified in accordance with the manufacturer's QM plan.

2/ V_{IO}, I_{IO}, $+I_{IB}$ AND $-I_{IB}$ measured over the common mode range for 30 V and 5 V power supply conditions.

3/ CMR is calculated for 30 V and 5 V power supply conditions.

4/ I_{CEX} is measured with the output in the high state (V_{OH}) and connected to +30 V.

5/ I_{CC} is measured at no load, but with the output of each op amp in its low state.

6/ A_{VS} is measured with a 15 kΩ pullup resistor between the output levels of 1 V and 11 V.

7/ Tests 30, 35, 57 and 62 which require a read and record measurement plus a calculation may be omitted except when subgroup 2 and 3 are being accomplished for group A sampling inspection and groups C and D end point measurements.

8/ $+I_{IL}$ is measured with +34 V on the + input and 0 V on the - input. $-I_{IL}$ is measured with +34 V on the - input and 0 V on the + input.

9/ Common mode refection is calculated using the offset voltage values measured at the common mode range end points.

10/ Each device shall be tested over the common mode range as specified in table III with the output forced to voltage midway between $+V_{CC}$ and $-V_{CC}$ supplies. V_{CM} is achieved by grounding the inputs and algebraically subtracting V_{CM} from each supply. Common mode refection is calculated using offset voltage values measured at the common mode rejection end points.

11/ Relays K1 thru K4 select comparator under test.

12/ Each comparator shall be tested separately, except for the I_{CC} measurements where all comparators shall be connected as grounded followers.

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 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, except the input offset voltage (or differential voltage) are referenced to the external zero reference level of the supply voltage. Currents are conventional current and positive when flowing into the referenced terminal.

TABLE IV. Group C end-point electrical parameters (T_A = 25°C).

Test no.	Test	$+V_{CC}$ 30 V Limits		Delta	Units
		Min	Max		
1	V_{IO}	-5	5	±1	mV
9	$+I_{IB}$	-100	0.1	±15	nA
13	$-I_{IB}$	-100	0.1	±15	nA

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 or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service'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 original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents 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 lead lengths, or lead forming, if applicable. These requirements should not affect the part number.

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 43123-1199.

6.5 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535, MIL-HDBK-1331, and as follows:.

6.5.1 Logic threshold voltage. The approximate voltage at the output of the comparator at which the loading logic circuitry changes its digital state.

6.5.2 Voltage gain. The ratio of the change in output voltage to the change in voltage between the input terminals producing it with the dc output level in the vicinity of the logic threshold voltage.

6.5.3 Response time. The interval between the application of an input step function and the time when the output crosses the logic threshold voltage. The input step drives the comparator from some initial, saturated input voltage to an input level just barely in excess of that required to bring the output from saturation to the logic threshold voltage. This excess is referred to as the voltage overdrive.

6.5.4 Positive output level. The dc output voltage in the positive direction with the input voltage equal to or greater than a minimum specified amount.

6.5.5 Negative output level. The dc output voltage in the negative direction with the input voltage equal to or greater than a minimum specified amount.

6.5.6 Low level output voltage. The maximum low state output voltage at a specified level of sink current into the device.

6.5.7 Differential input voltage. The difference between the two voltages applied to the input terminals of an amplifier. The difference is considered positive when the non-inverting input is positive with respect to the inverting input and negative when the inverting input is positive with respect to the non-inverting input (V_{ID}).

6.5.8 Output leakage current. The current into the output of an amplifier with the output in the high level (off) state.

6.6 Logistic support. Lead materials and finishes (see 3.4) 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 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-PRF-38535.

Military device type	Generic-industry type
01	LM 139
02	LM 193

6.8 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

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

Preparing activity:
DLA-CC

(Project 5962-1981)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at www.dodssp.daps.mil.

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