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MIL-M-38510/135B
18 December 1987
SUPERSEDING
MIL-M-38510/135A
18 August 1986

MILITARY SPECIFICATION

MICROCIRCUITS, LINEAR, LOW OFFSET 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, low offset operational amplifiers. Two product assurance classes and a choice of case outline and lead finish are reflected in the complete part number.

1.2 Part number. The part number shall be in accordance with MIL-M-38510.

1.2.1 Device type. The device type shall be as follows:

Device type	Circuit
01	Single operational amplifier, ultra low offset, internally compensated
02	Single operational amplifier, low offset, internally compensated
03	Single operational amplifier, ultra low offset, internally compensated, ultra low noise
04	Dual operational amplifier, low offset, ultra low noise internally compensated
05	Single operational amplifier, ultra low offset, internally compensated ultra low noise, broadband

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

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

Outline letter	Case outline (see MIL-M-38510, appendix C)
C	D-1 (14-lead 1/4" x 3/4"), dual-in-line package
G	A-1 (8-lead can)
P	D-4 (8-lead 1/4" x 3/8"), dual-in-line package
2	C-2 (20-terminal (.350" x .350"), square chip carrier package

1.3 Absolute maximum ratings.

Supply voltage (V_{CC}) - - - - - - - - - - - -	± 22 V
Input voltage range (V_{IN}) - - - - - - - - - -	$\pm V_{CC}$
Differential input voltage range	
Devices 01 and 02 - - - - - - - - - - - -	± 30 V
Devices 03, 04 and 05 - - - - - - - - - -	± 0.7 V
Output short circuit duration - - - - - - -	1/
Lead temperature (soldering, 60 seconds)- -	+300°C
Storage temperature range - - - - - - - - -	-65°C to +150°C
Junction temperature (T_J) - - - - - - - - -	+175°C
Maximum power dissipation (P_D) 2/ - - - - -	500 mW

1/ Output may be shorted to ground indefinitely at $V_S = \pm 15$ volts, $T_A = 25°C$. Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

2/ Maximum power dissipation versus ambient temperature.

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, 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

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1.4 Recommended operating conditions.

Supply voltage (V_{CC}):	
Device types 01 and 02- - - - - - - - - - -	±4.5 V to ±20.0 V
Device types 03, 04 and 05- - - - - - - - -	±4.5 V to ±18.0 V
Ambient operating temperature range (T_A)- -	-55°C to +125°C

1.5 Power and thermal characteristics.

Package	Case outline	Maximum allowable power dissipation	Maximum θ_{JC}	Maximum θ_{JA}
14 lead dual-in-line	C	400 mW at T_A = 125°C	50°C/W	120°C/W
8 lead can	G	330 mW at T_A = 125°C	60°C/W	150°C/W
8 lead dual-in-line	P	400 mW at T_A = 125°C	50°C/W	120°C/W
20 terminal SQ. CCP	2	400 mW at T_A = 125°C	55°C/W	120°C/W

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification and standard. The following specification and standard form a part of this specification to the extent specified herein. Unless otherwise specified, the issue of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards and supplement thereto, cited in the solicitation.

SPECIFICATION

MILITARY

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

STANDARD

MILITARY

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

(Copies of the specification and standard required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

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

3. REQUIREMENTS

3.1 Detail specification. 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 Circuit diagram and terminal connections. The circuit diagram and terminal connections shall be as shown on figure 1.

3.2.2 Schematic circuits. The 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. The typical schematic circuits shall be as shown on figure 2.

TABLE I. Electrical performance characteristics.

Characteristics	Symbol	Conditions: $\pm V_{CC} = \pm 15$ V, Unnulled, paragraph 3.4, figure / unless otherwise specified	Limits Device 01 Min	Device 01 Max	Device 02 Min	Device 02 Max	Device 03 Min	Device 03 Max	Device 04 Min	Device 04 Max	Device 05 Min	Device 05 Max	Unit
Input offset voltage	V_{IO}	Figure 8 1/2/3/ $T_A = +25°C$	-25	25	-75	75	-25	25	-80	80	-25	25	µV
		$-55°C \leq T_A \leq +125°C$ 1/2/	-60	60	-200	200	-60	60	-180	180	-60	60	µV
		End-point limit 3/	-100	100	-175	175	-100	100	-180	180	-100	100	µV
Input offset voltage temperature sensitivity	dV_{IO}/dT		-.6	.6	-1.3	1.3	-.6	.6	-1.0	1.0	-.6	.6	$\frac{\mu V}{°C}$
Input bias current	$+I_{IB}$	$T_A = +25°C$ 1/	-2	2	-3	3	-40	40	-40	40	-40	40	nA
		$-55°C \leq T_A \leq +125°C$ 1/	-4	4	-6	6	-60	60	-60	60	-60	60	nA
		End-point limit 3/	-3	3	-4.5	4.5	-50	50	-50	50	-50	50	nA
	$-I_{IB}$	$T_A = +25°C$ 1/	-2	2	-3	3	-40	40	-40	40	-40	40	nA
		$-55°C \leq T_A \leq +125°C$ 1/	-4	4	-6	6	-60	60	-60	60	-60	60	nA
		End-point limit 3/	-3	3	-4.5	4.5	-50	50	-50	50	-50	50	nA
Input offset current	I_{IO}	$T_A = +25°C$ 1/	-2	2	-2.8	2.8	-35	35	-35	35	-35	35	nA
		$-55°C \leq T_A \leq +125°C$ 1/	-4	4	-5.6	5.6	-50	50	-50	50	-50	50	nA
Power supply rejection ratio	+PSRR	Device types 01, 02 $+V_{CC} = 20$ V to 5 V, $-V_{CC} = -15$ V Device types 03, 04, 05 $+V_{CC} = 18$ V to 5 V, $-V_{CC} = -15$ V $T_A = +25°C$	-10	10	-10	10	-10	10	-10	10	-10	10	$\frac{\mu V}{V}$
	-PSRR	Device types 01, 02 $+V_{CC} = 15$ V, $-V_{CC} = -20$ V to -5 V Device types 03, 04, 05 $+V_{CC} = 15$ V, $-V_{CC} = -18$ V to -5 V $T_A = +25°C$	-10	10	-10	10	-10	10	-10	10	-10	10	$\frac{\mu V}{V}$
	+PSRR	Device types 01, 02 $+V_{CC} = 20$ V to 5 V, $-V_{CC} = -15$ V Device types 03, 04, 05 $+V_{CC} = 18$ V to 5 V, $-V_{CC} = -15$ V $-55°C \leq T_A \leq +125°C$	-20	20	-20	20	-16	16	-16	16	-16	16	$\frac{\mu V}{V}$
	-PSRR	Device types 01, 02 $+V_{CC} = 15$ V, $-V_{CC} = -20$ V to -5 V Device types 03, 04, 05 $+V_{CC} = 15$ V, $-V_{CC} = -18$ V to -5 V $-55°C \leq T_A \leq +125°C$	-20	20	-20	20	-16	16	-16	16	-16	16	$\frac{\mu V}{V}$

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Characteristics	Symbol	Conditions: $\pm V_{CC} = \pm 15$ V, Unnulled, paragraph 3.4, figure 7 unless otherwise specified	Limits Device 01 Min	Device 01 Max	Device 02 Min	Device 02 Max	Device 03 Min	Device 03 Max	Device 04 Min	Device 04 Max	Device 05 Min	Device 05 Max	Unit
Power supply rejection ratio	PSRR	Device types 01, 02 $V_{CC} = \pm 4.5$ V to ± 20 V Device types 03, 04, 05 $V_{CC} = \pm 4.5$ V to ± 18 V $T_A = +25°C$	-10	10	-10	10	-10	10	-10	10	-10	10	$\frac{\mu V}{V}$
		Device types 01, 02 $V_{CC} = \pm 4.5$ V to ± 20 V Device types 03, 04, 05 $V_{CC} = \pm 4.5$ V to ± 18 V $-55°C \le T_A \le +125°C$	-20	20	-20	20	-16	16	-16	16	-16	16	$\frac{\mu V}{V}$
Common mode rejection ratio	CMRR	$V_{CM} = \pm 13$ V for 01, 02 $V_{CM} = \pm 11$ V for 03, 04, 05 $T_A = +25°C$	110		110		114		114		114		dB
		$V_{CM} = \pm 13$ V for 01, 02 $V_{CM} = \pm 10$ V for 03, 04, 05 $-55°C \le T_A \le +125°C$	106		106		108		108		108		dB
Adjustment for input offset	V_{IO} Adj(+)	$T_A = +25°C$ 1/	.5		.5		.5		.5		.5		mV
	V_{IO} Adj(-)	$T_A = +25°C$ 1/		-.5		-.5		-.5		-.5		-.5	mV
Output short circuit current	$I_{OS}(+)$	$t \le 25$ ms 4/ $-55°C \le T_A < +125°C$					-70		-60		-70		mA
		$T_A = +25°C, +125°C$	-65		-65								"
		$T_A = -55°C$	-70		-70								"
	$I_{OS}(-)$	$t \le 25$ ms 4/ $-55°C \le T_A \le +125°C$						70		70		70	mA
		$T_A = +25°C, +125°C$		65		65							"
		$T_A = -55°C$		70		70							"
Supply current	I_{CC}	$T_A = +25°C$ 1/ 5/		4		4		5		5		5	mA
		$-55°C \le T_A \le +125°C$ 1/ 5/		5		5		6		6		6	mA
Output voltage swing (minimum)	V_{OP}	$R_L = 1$ kΩ for 01, 02 $R_L = 600Ω$ for 03, 04, 05 $-55°C \le T_A \le +125°C$	-10	10	-10	10	-10	10	-10	10	-10	10	V
		$R_L = 2,000Ω$ $-55°C \le T_A \le +125°C$	-12	12	-12	12	-11.5	11.5	-11.5	11.5	-11.5	11.5	V
Open loop voltage gain (single ended)	A_{VS}	$T_A = +25°C$ 6/	300		200		1,000		1,000		1,000		$\frac{V}{mV}$
		$-55°C \le T_A \le +125°C$ 6/	200		150		600		600		600		$\frac{V}{mV}$

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Characteristics	Symbol	Conditions: ±V_{CC} = ±15 V, Unnulled, paragraph 3.4, figure 7 unless otherwise specified	Limits										Unit
			Device 01		Device 02		Device 03		Device 04		Device 05		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Slew rate	SR(+) and SR(-)	Device types 01, 02, 03, 04 V_{IN} = ±5 V, A_V = 1 Device type 05 V_{IN} = ±1 V, A_V = 5 T_A = +25°C, see Figure 11	.08		.08		1.7		1.7		11		$\frac{V}{\mu s}$
Input noise voltage density	En	f_o = 10 Hz, T_A = +25°C Figure 9		18		18		5.5		6.0		5.5	$\frac{nV}{\sqrt{Hz}}$
		f_o = 100 Hz		14		14		4.0		5.0		4.0	$\frac{nV}{\sqrt{Hz}}$
		f_o = 1 kHz		12		12		3.8		3.9		3.8	$\frac{nV}{\sqrt{Hz}}$
Low frequency input noise voltage	Enpp	f_o = 0.1 Hz to 10 Hz, T_A = +25°C Figure 10		.6		.6		.18		.20		.18	μVpp
Input noise current density	I_n	f_o = 10 Hz, T_A = +25°C Figure 9						5.66		5.66		5.66	$\frac{pA}{\sqrt{Hz}}$
		f_o = 100 Hz, T_A = +25°C Figure 9						1.88		2.1		1.88	$\frac{pA}{\sqrt{Hz}}$
		f_o = 1 kHz, T_A = +25°C Figure 9						0.84		0.89		0.84	$\frac{pA}{\sqrt{Hz}}$

1/ Tested at Vcm = 0, V_{CC} = ±15 V.

2/ Due to the inherent warm-up drift of device types 01, 03, 04, and 05, testing shall occur no sooner than 5 minutes after application of power.

3/ Refer to table IV for end-point parameters.

4/ Continuous short circuit limits are considerably less than the indicated test limits since maximum power dissipation cannot be exceeded.

5/ For device type 04, I_{CC} is per amplifier.

6/ V_{OUT} = 0 to +10 for $A_{VS}(+)$ and V_{OUT} = 0 to -10 for $A_{VS}(-)$. R_L = 2,000 ohms.

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

3.2.4 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 and 6.5 herein.

3.4 Electrical performance characteristics. The electrical performance characteristics are as specified in table I, and apply over the full recommended ambient operating temperature range for supply voltages from ±4.5 V to ±20 V dc for device types 01 and 02 and for supply voltages from ±4.5 V to ±18 V dc for device types 03, 04 and 05. Unless otherwise specified, source resistance (Rs) shall be 50 ohms for all tests.

3.4.1 Offset null circuits. The nulling inputs shall be capable of being nulled 0.5 mV beyond the specified offset voltage limits for $-55^\circ C \leq T_A \leq +125^\circ C$ using the circuit shown on figure 3.

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

3.5 Rebonding. Rebonding shall be in accordance with MIL-M-38510.

3.6 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.

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

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

3.7.2 Correctness of indexing and markings. 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 part number. Optionally, an approved electrical test may be devised especially for this required.

3.8 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 1/ (method 5004)	1,2,3,4, 7	1,2,3,4
Group A test requirements 2/ (method 5005)	1,2,3,4, 5,6,7,9	1,2,3,4, 5,6,7,9
Group C end-point and group B, class S electrical parameters (method 5005) 3/	1,2,3, and table IV delta limits	1 and table IV delta limits
Group D end-point electrical parameters (method 5005) 3/	1,2,3 and table IV end-point limits	1 and table IV end-point limits

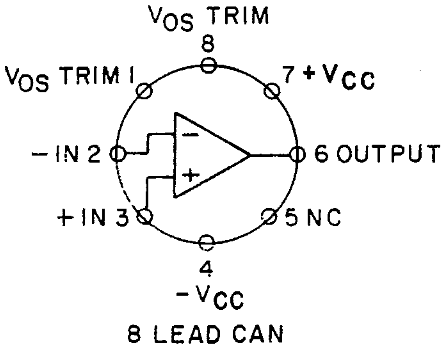
1/ PDA applies to subgroup 1 (see 4.2c).

2/ Subgroup 9 shall have a LTPD of 5 for class S and class B devices.

3/ Table IV end-point parameters shall be used for V_{IO} and I_{IB} for class S and class B devices.

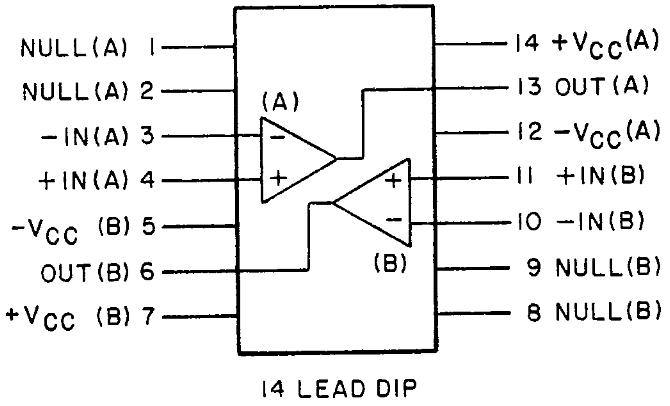
Device types 01, 02, 03, and 05

Case G



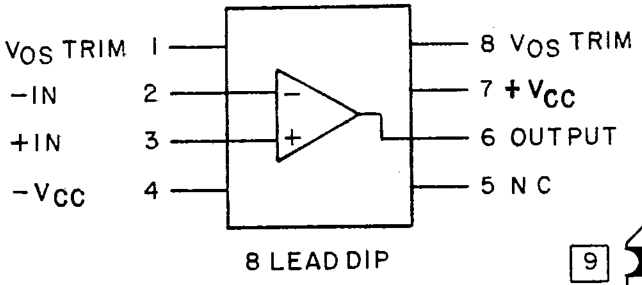
Device type 04

Case C



Device types 01, 02, 03, and 05

Case P



Device types 01, 02, 03, and 05

Case 2

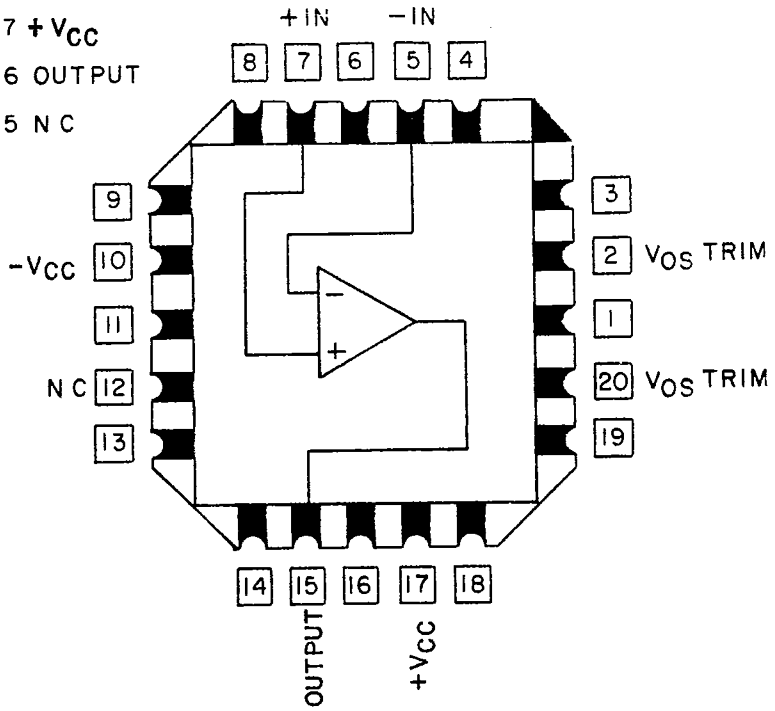
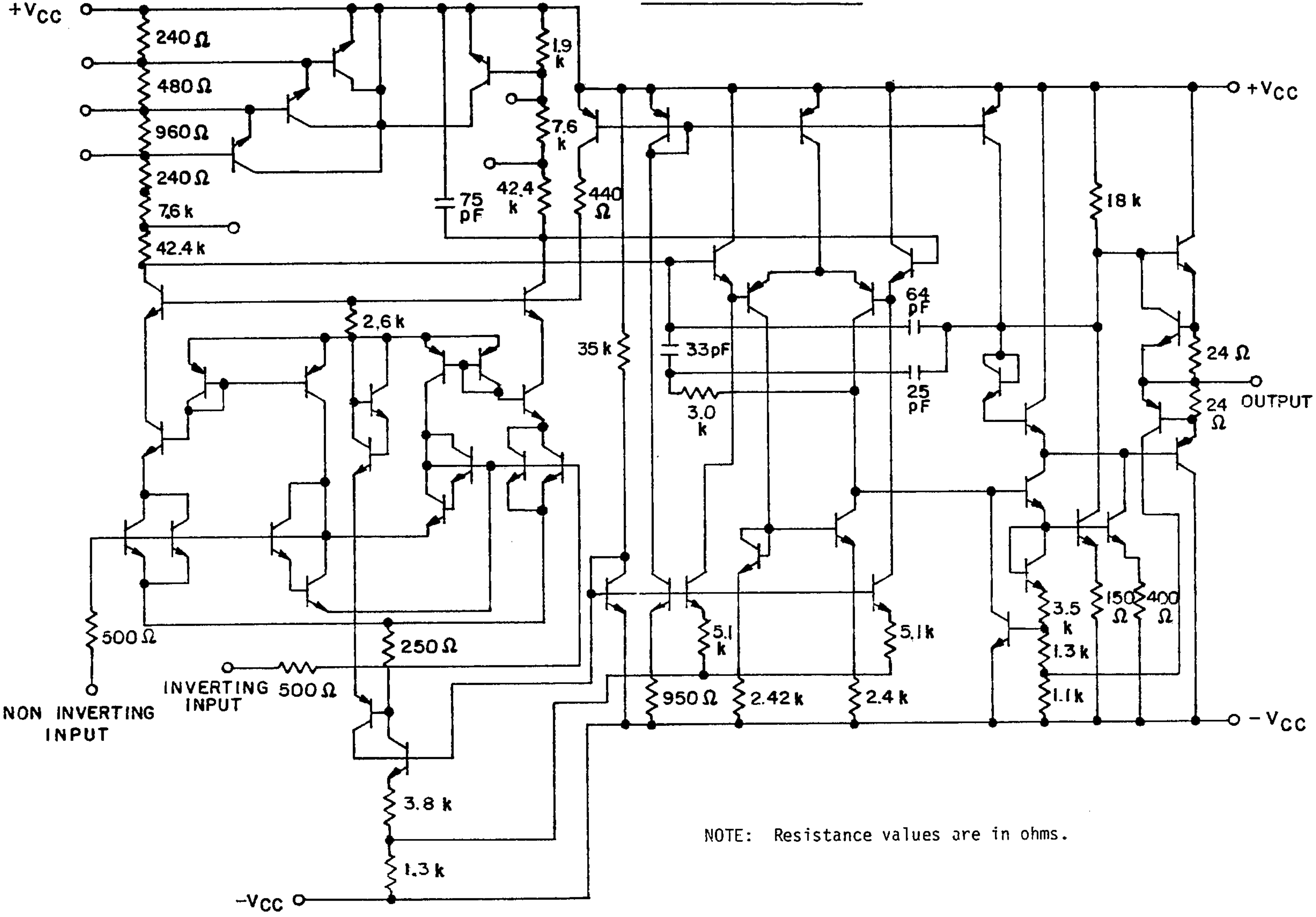


FIGURE 1. Terminal connections.

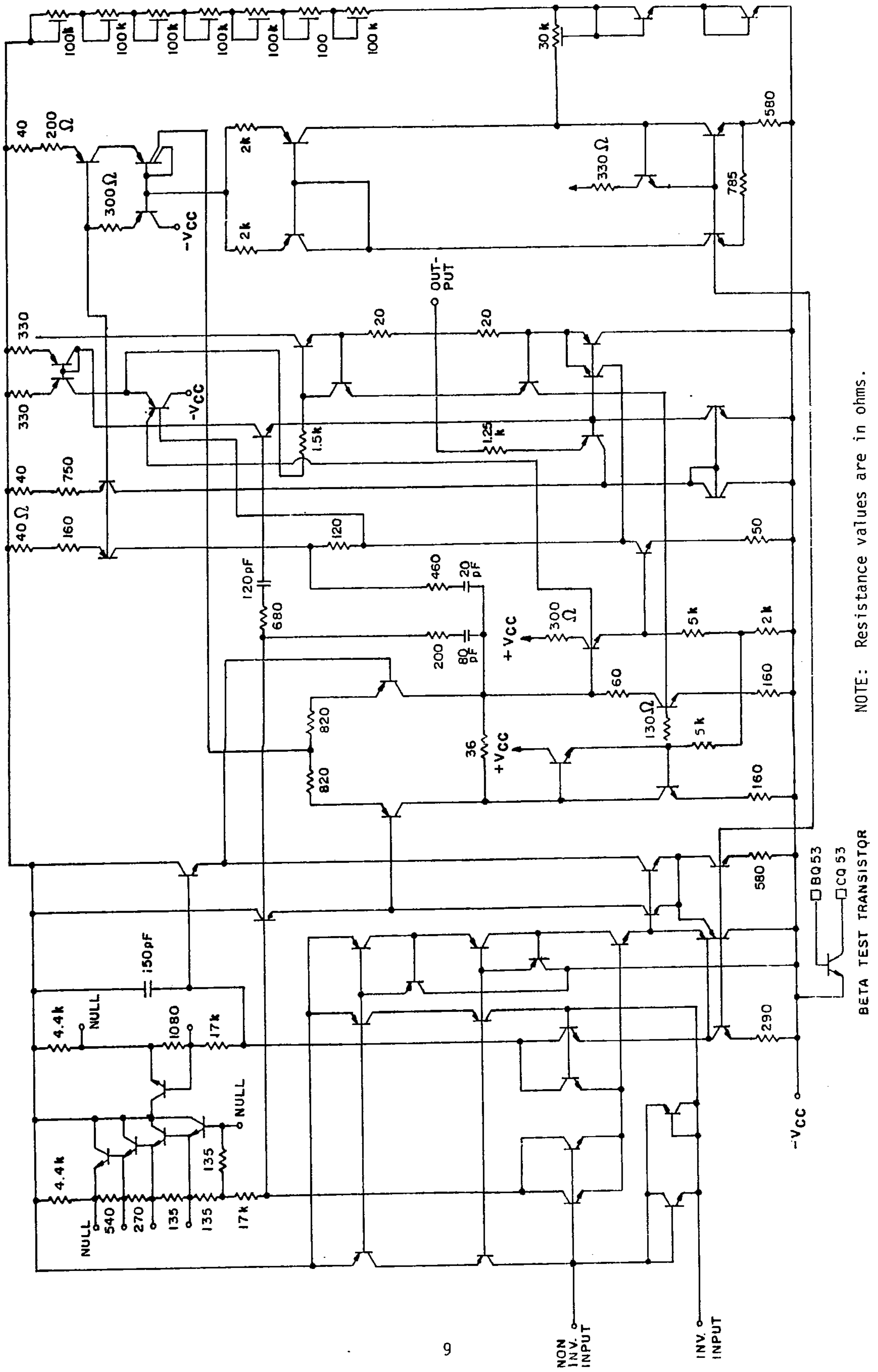
Device types 01 and 02



NOTE: Resistance values are in ohms.

FIGURE 2. Typical functional schematic circuits.

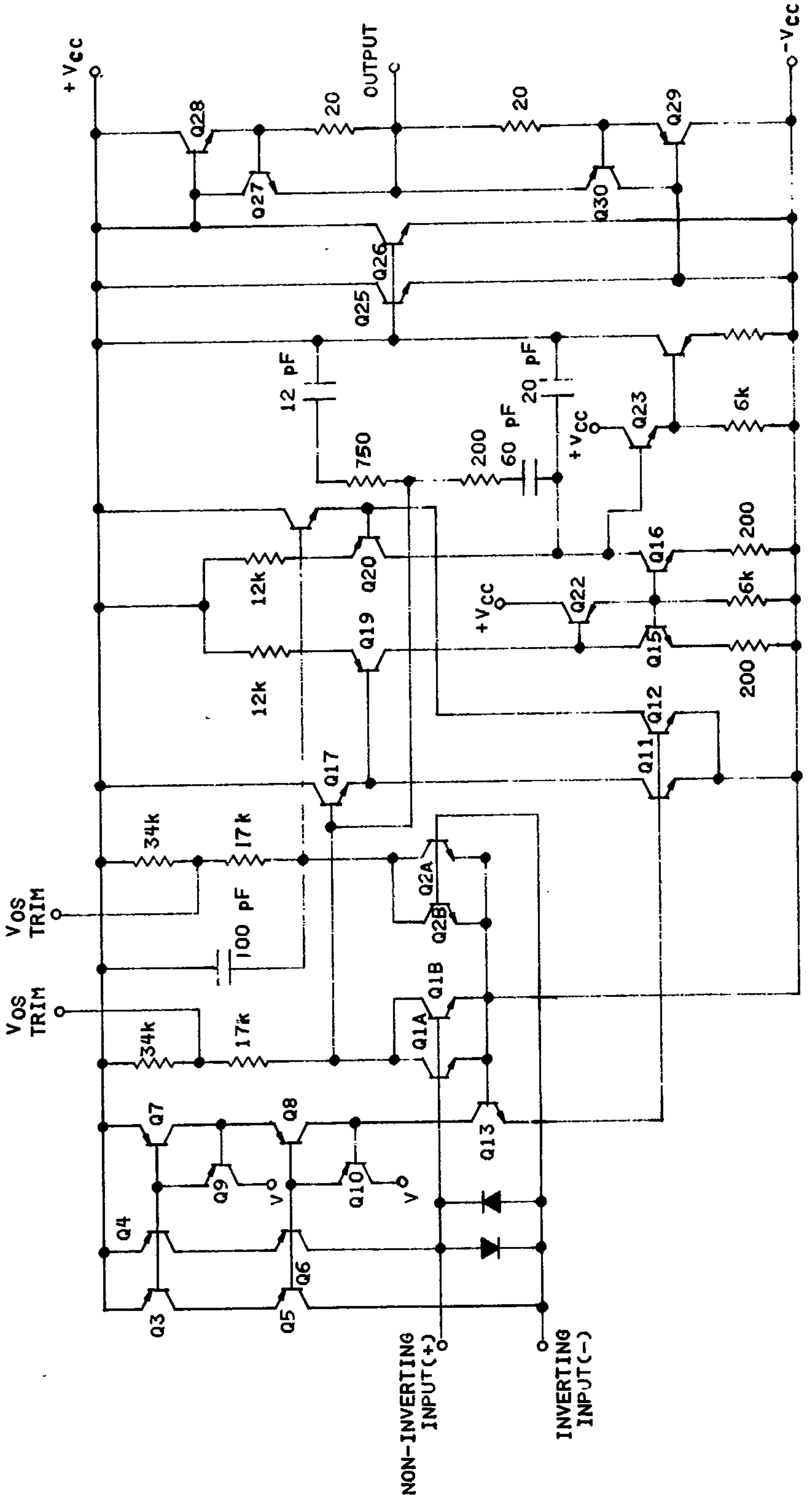
Device types 03 and 04



NOTE: Resistance values are in ohms.

FIGURE 2. Typical functional schematic circuits - Continued.

Device type 05

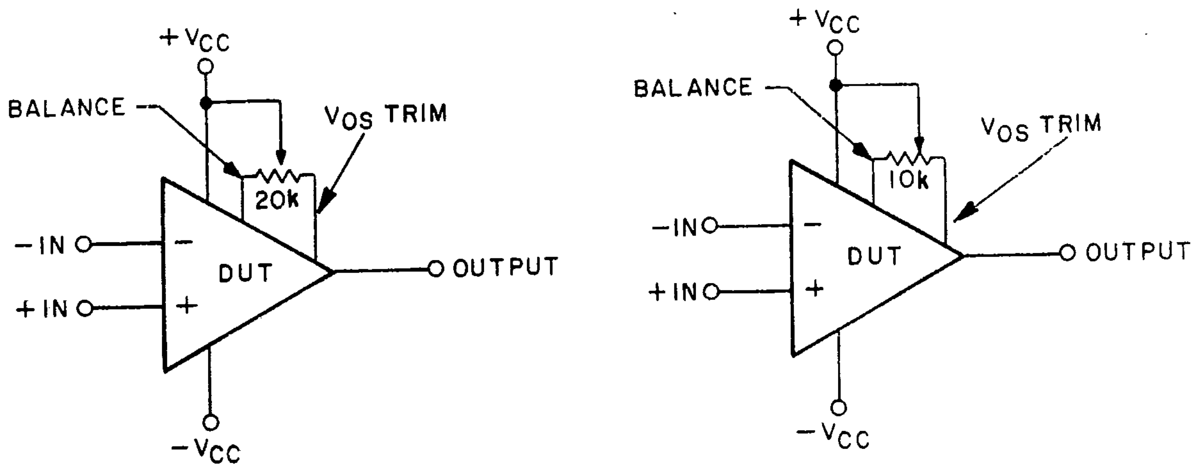


NOTE: Resistance values are in ohms.

FIGURE 2. Typical functional schematic circuits - Continued.

Device types 01 and 02

Device types 03, and 05



Device type 04

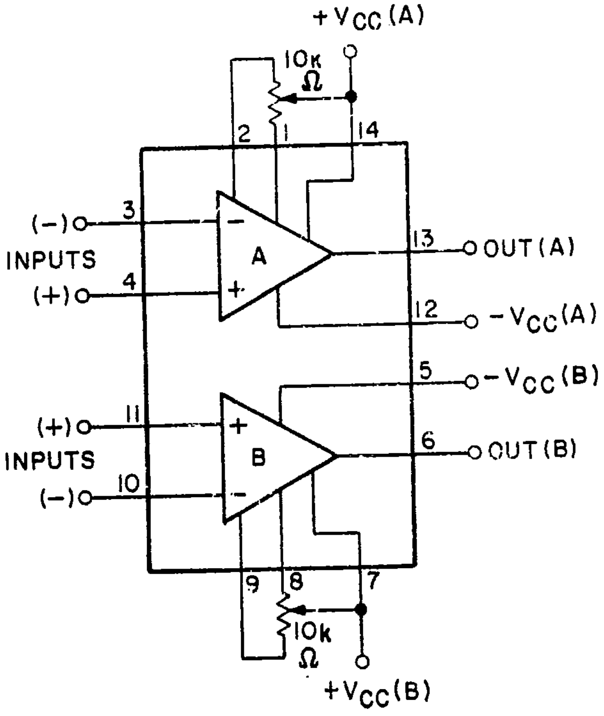
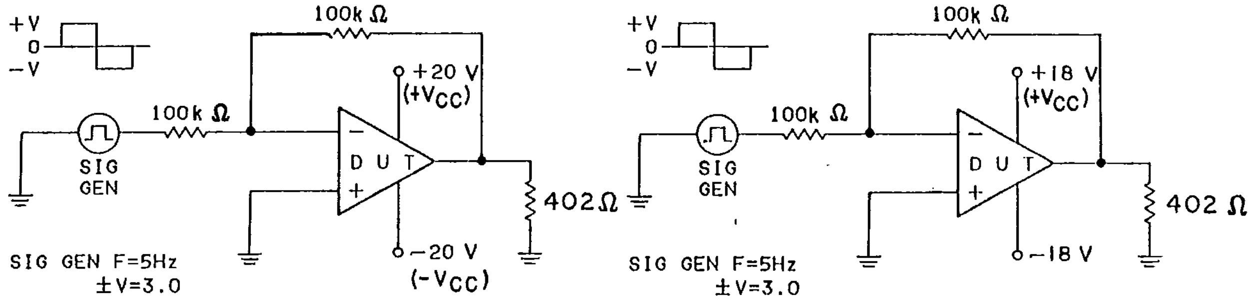


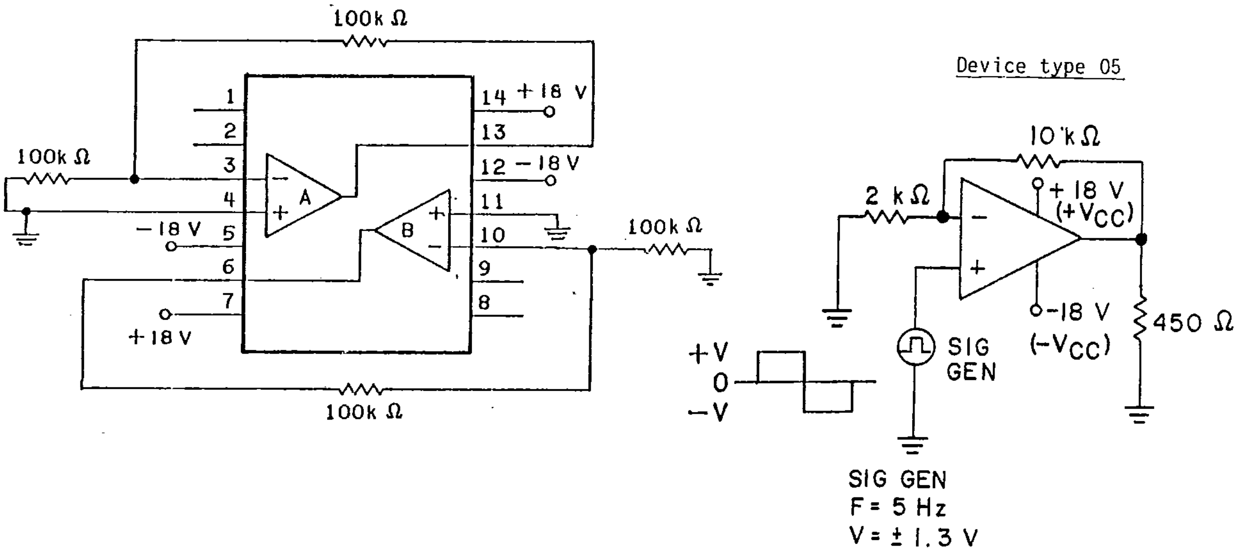
FIGURE 3. Offset null circuit.



Device types 01 and 02

Device type 03

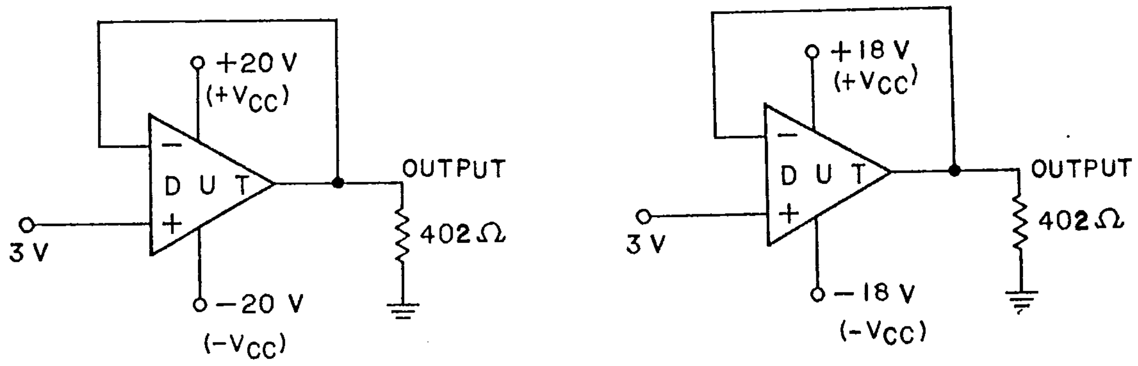
Device type 04



Device type 05

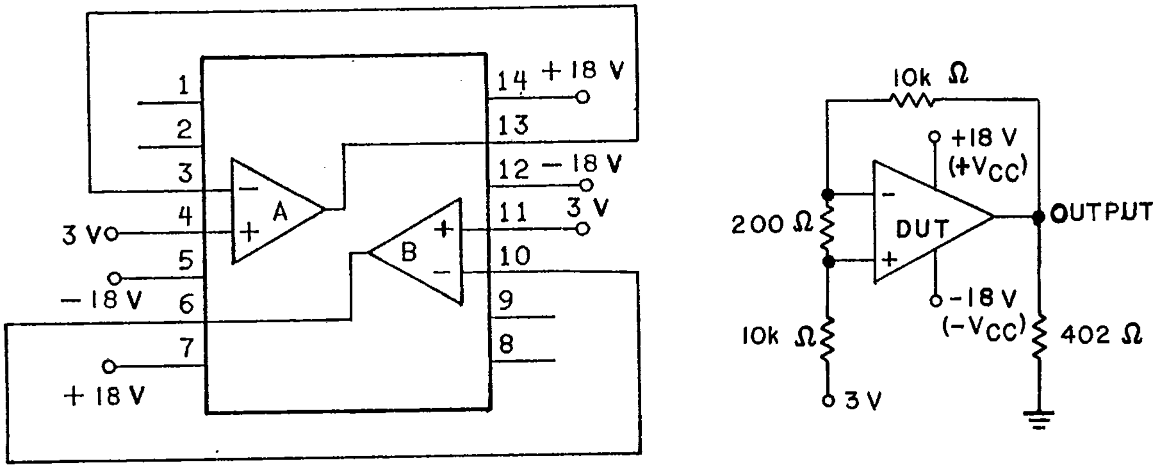
NOTE:
1. The actual measured value of the resistors shall not exceed ±5 percent of its required value due to use, heat, or age.

FIGURE 4. Test circuit burn-in and steady state life test.



Device types 01 and 02

Device type 03



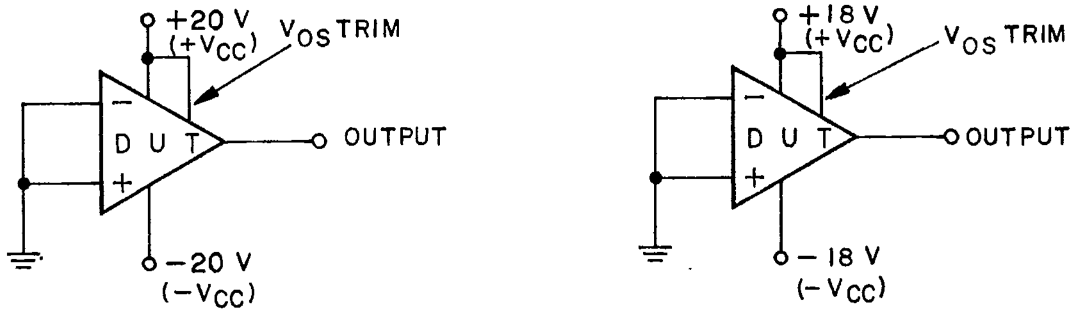
Device type 04

Device type 05

NOTE:
1. The actual measured value of the resistors shall not exceed ±5 percent of its required value due to use, heat, or age.

FIGURE 5. Test circuit, burn-in (steady state power and reverse bias) and steady state life test.

Device types 01 and 02 Device types 03, and 05



Device type 04

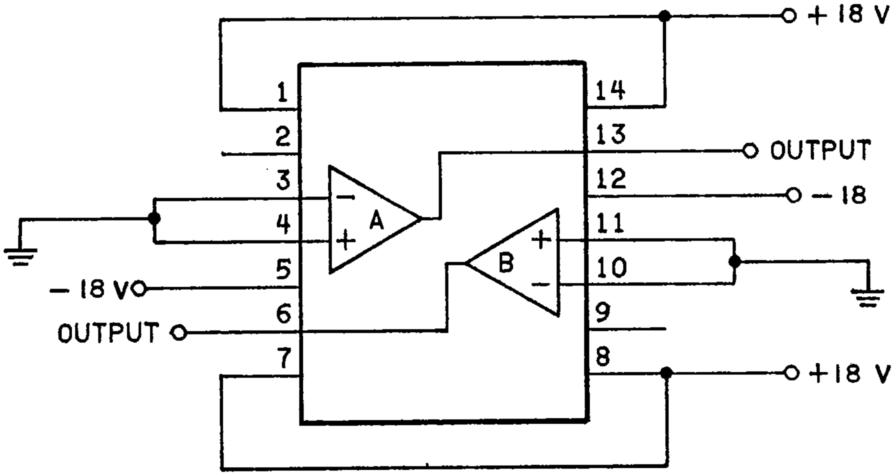


FIGURE 6. Accelerated burn-in and life test circuit.

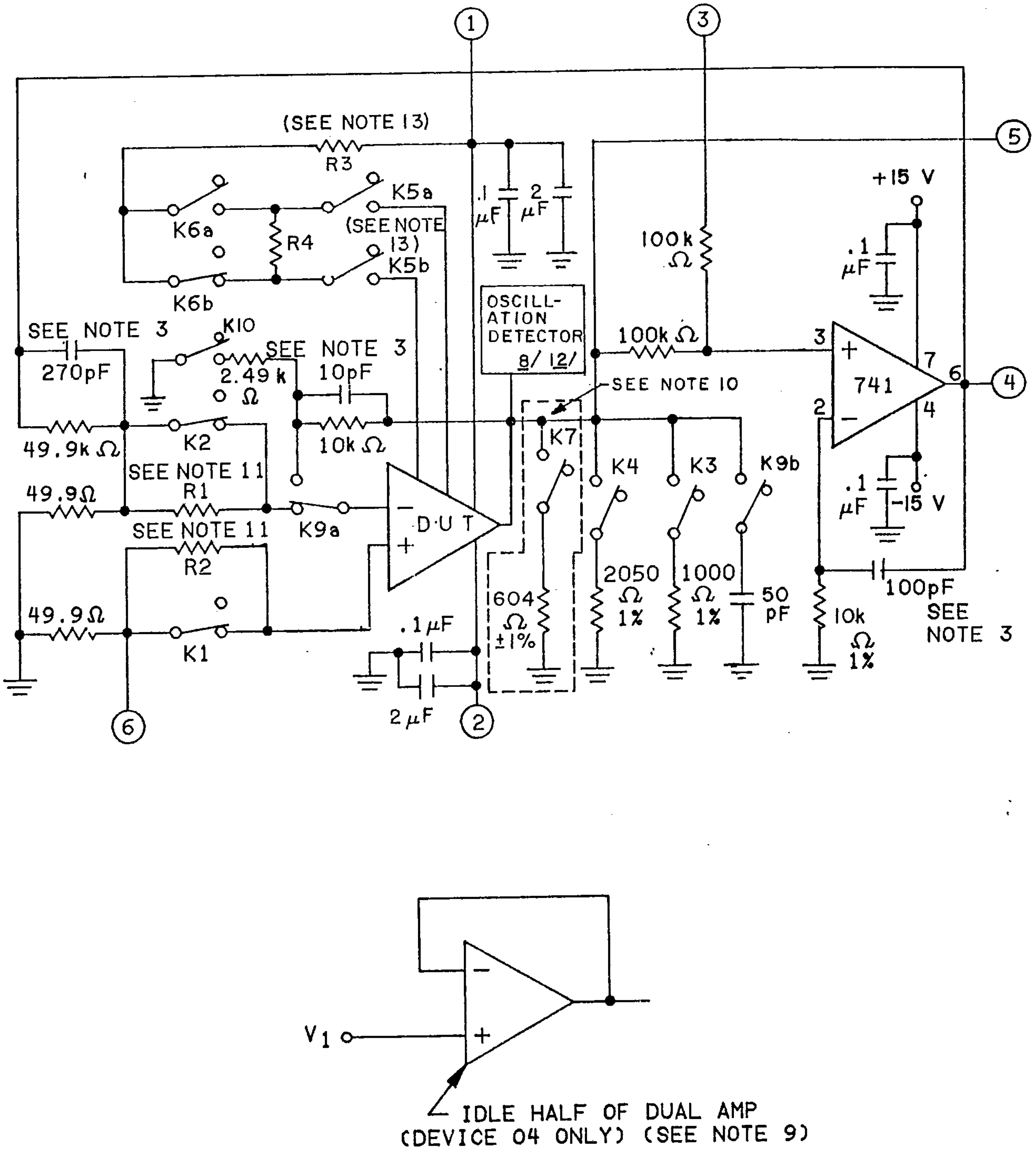
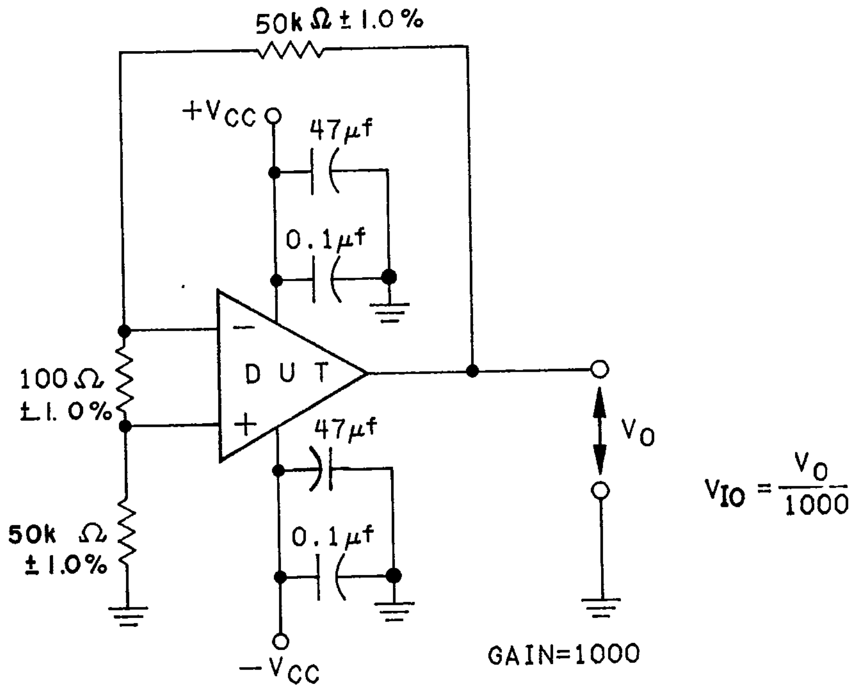


FIGURE 7. Test circuit for static test and slew rate.

NOTES:

1. All resistors are ±0.1 percent tolerance and all capacitors are ±10 percent unless otherwise specified.
2. Precautions shall be taken to prevent damage to the DUT during insertion into socket and change of relay state (i.e. disable voltage supplies, current limit $\pm V_{CC}$, etc.).
3. Compensation capacitors should be added as required for test circuit stability. Proper wiring procedures shall be followed to prevent unwanted coupling and oscillations, etc. Loop response and settling time shall be consistent with the test rate such that any value has settled for at least 5 loop time constants before the value is measured.
4. Adequate settling time should be allowed such that each parameter has settled to within 5 percent of its final value.
5. All relays are shown in the normal de-energized state.
6. Saturation of the nulling amp is not allowed on tests where the pin 4 value is measured.
7. The load resistors 1000Ω and 2050Ω yield effective load resistance of 100Ω and 2000Ω respectively.
8. Any oscillation greater than 300 mV pk-pk in amplitude shall be cause for device failure.
9. Device type 04 only, test both halves for all tests. The idle half of the dual amplifiers shall be maintained in this configuration where V_1 is midway between $+V_{CC}$ and $-V_{CC}$, or the manufacturer has the option to connect the idle half in a V_{ID} configuration such that the inputs are maintained at the same common mode voltage as the D.U.T.
10. Circuit within dashed area used for devices 03, 04, and 05 only.
11. For devices 01 and 02: R1 = 500 kΩ ±.01%; R2 = 500 kΩ ±.01%.
    For devices 03, 04, and 05: R1 = 50 kΩ ±.01%; R2 = 50 kΩ ±.01%.
12. When using this test circuit for measuring slew rate, the oscillation detector shall be disabled.
13. For devices 01 and 02: R3 = 27 kΩ, ±5%, R4 = 100 kΩ, ±5%.
    For devices 03, 04, and 05: R3 = 0Ω, R4 = 10 kΩ, ±5%.

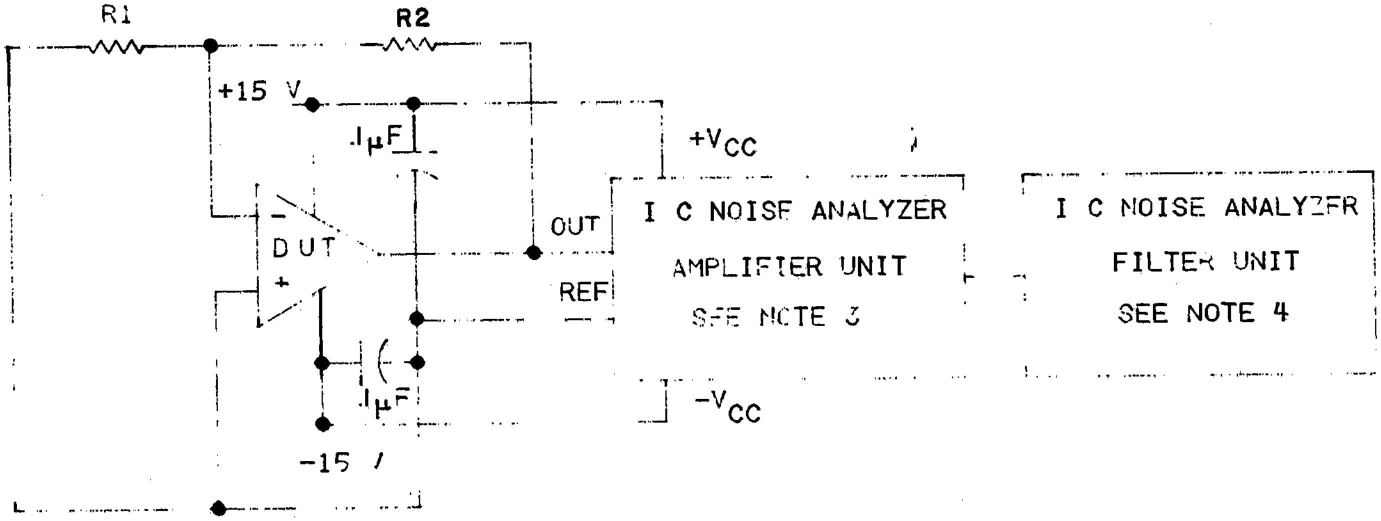
FIGURE 7. Test circuit for static test and slew rate - Continued.



NOTES:

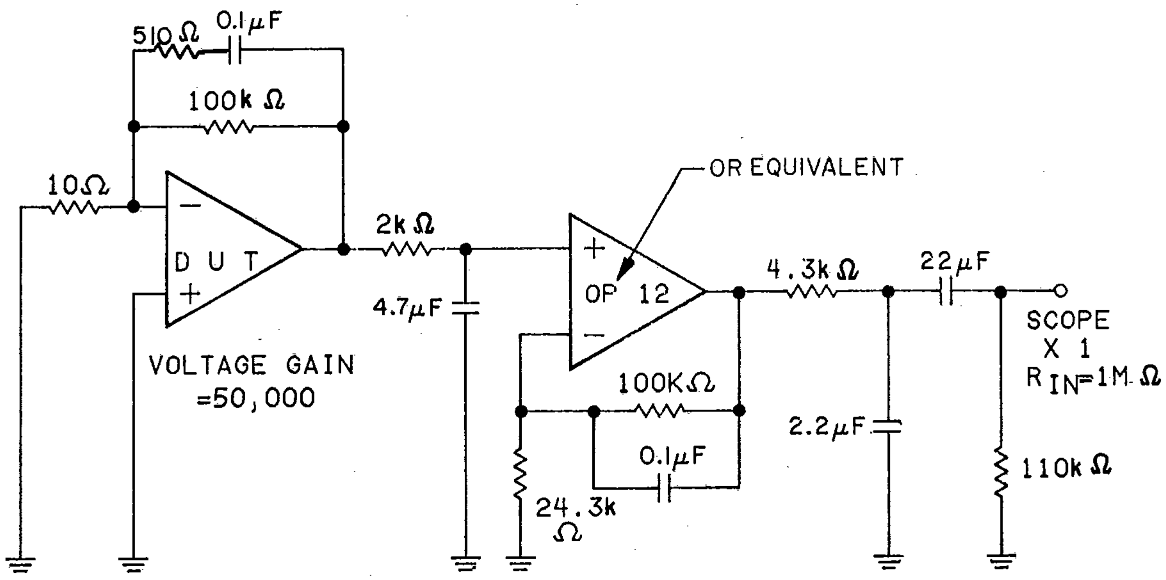
1. Same configuration used for both amplifiers of device 04.
2. Low thermal EMF sockets are recommended. The number of solder joints and dissimilar-metal junctions are to be minimized. The test cicuit should contain a minimum number of components. All components should have the lowest possible temperature coefficients.
3. The temperature of the test circuit should be equal to that of the device under test (DUT).

FIGURE 8. Voltage offset test circuit.



NOTES:
1. Input noise voltage density (En) test: R1 = 50Ω, R2 = 10 kΩ.
   Input noise current density (In) test: R1 = 105 kΩ, R2 = 2.0 MΩ.
2. All resistors are metal film and ±1% tolerance. Capacitors are in microfarads and are ±10% tolerance.
3. Quan-Tech model 2283 or equivalent.
4. Quan-Tech model 2181 or equivalent.

FIGURE 9. Noise density test circuit.



NOTES:
1. All capacitor values are for non polarized capacitors only.
2. Resistors values are ±1.0%.

FIGURE 10. Low frequency noise test circuit.

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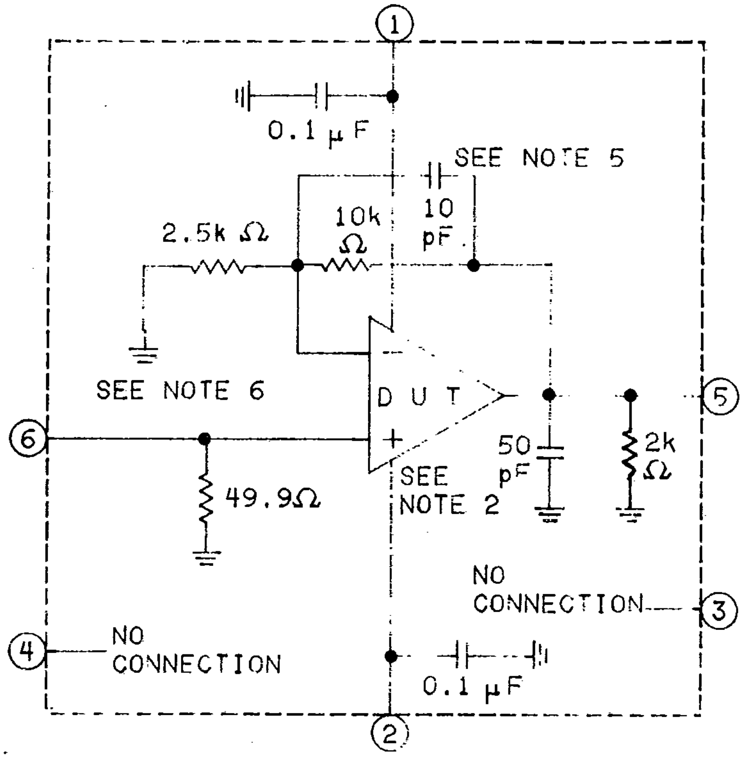
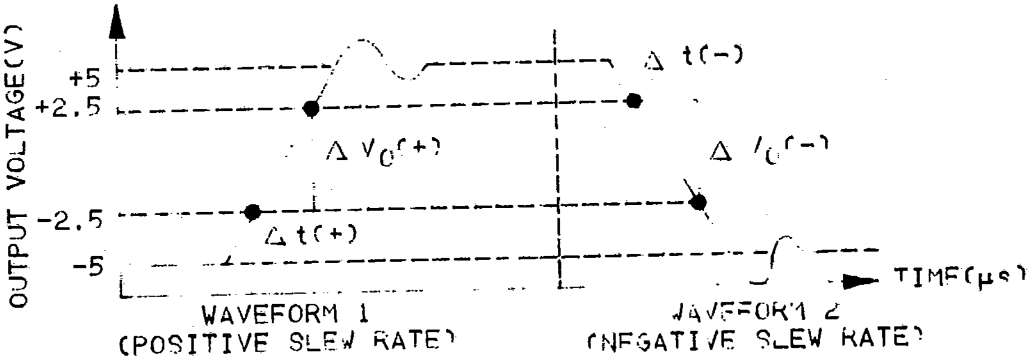


NOTES:
1. Resistors are ±1.0 percent tolerance and capacitors are ±10 percent tolerance.
2. This capacitance includes the actual measured value with stray and wire capacitance.
3. Precautions shall be taken to prevent damage to the DUT during insertion into socket and in applying power.
4. Pulse input and output characteristics are shown on the next space.
5. Compensation capacitors should be added as required for test circuit stability. Proper wiring procedures shall be followed to prevent unwanted coupling and oscillations, etc. Loop response and settling time shall be consistent with the test rate such that any value has settled for at least 5 loop time constants before the value is measured.
6. For device type 05 only.

FIGURE 11. Test circuit for slew rate.



Parameter symbol	Device type	Input pulse signal @ $t_r \leq$ 50 ns	Output pulse signal	Equation
SR (+)	01, 02, 03, 04	-5 V to +5 V step (AV = 1)	Waveform 1	$SR(+) = \Delta V_O(+)/\Delta t(+)$
SR (-)	01, 02, 03, 04	+5 V to -5 V step (AV = 1)	Waveform 2	$SR(-) = \Delta V_O(-)/\Delta t(-)$
SR (+)	05	-1 V to +1 V step (AV = 5)	Waveform 1	$SR(+) = \Delta V_O(+)/\Delta t(+)$
SR (-)	05	+1 V to -1 V step (AV = 5)	Waveform 2	$SR(-) = \Delta V_O(-)/\Delta t(+)$

FIGURE 11. Test circuit for slew rate - Continued.

TABLE III. Group A inspection for device types 01 and 02.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
1 T_A = +25°C	$+I_{IB}$	4001	1 2		15 15	-15 -15	0 0	None K1	4 4	E1 E2	V V	$V_{IO} = E1$ $+I_{IB} = 2(E1-E2)$	01 02	-2 -3	2 3	nA "
	$-I_{IB}$	4001	3		15	-15	0	K2	4	E3	V	$-I_{IB} = 2(E3-E1)$	01 02	-2 -3	2 3	" "
	I_{IO}	4001	4	2/								$I_{IO} = 2(2E1-E2-E3)$	01 02	-2 -2.8	2 2.8	" "
	+PSRR	4003	5		20 5	-15 -15	0 0	None	4	E4 E5	V V	+PSRR = 66(E4-E5)	01,02	-10	10	$\frac{\mu V}{V}$
	-PSRR	4003	6		15 15	-20 -5	0 0	None	4	E6 E7	V V	-PSRR = 66(E6-E7)	01,02	-10	10	$\frac{\mu V}{V}$
	PSRR	4003	7		4.5 20	-4.5 -20	0 0	None	4	E8 E9	V V	PSRR = 32.25 x (E8-E9)	01,02	-10	10	$\frac{\mu V}{V}$
	CMRR	4003	8		28 2	-2 -28	-13 13	None	4	E10 E11	V V	$CMRR = 20 \log \left\lvert \frac{26000}{E11-E10} \right\rvert$	01,02	110		dB
	$V_{IO}Adj(+)$		9		15	-15	0	K5	4	E12	V	$V_{IO}Adj(+) = E1-E12$	01,02	.5		mV
	$V_{IO}Adj(-)$		10		15	-15	0	K5,K6	4	E13	V	$V_{IO}Adj(-) = E1-E13$	01,02		-.5	mV
	$I_{OS}(+)$	3011	11	3/	15	-15	-10	None	5	I1	mA	$I_{OS}(+) = I1$	01,02	-65		mA
	$I_{OS}(-)$	3011	12	3/	15	-15	10	None	5	I2	mA	$I_{OS}(-) = I2$	01,02		65	"
	I_{CC}	4005	13		15	-15	0	None	1	I3	mA	$I_{CC} = I3$	01,02		4	"
2 T_A = +125°C	V_{IO}	4001	14	Fig. 8	15	-15	0			E14	V	$V_{IO} = \frac{E14}{1000}$	01 02	-60 -200	60 200	µV µV
	$\frac{dV_{IO}}{dT}$	4001	15	Fig. 8 4/								$\frac{dV_{IO}}{dT} = \frac{(E14-E44)}{100(1000)}$	01 02	-.6 -1.3	.6 1.3	$\frac{\mu V}{°C}$
	$+I_{IB}$	4001	16 17		15 15	-15 -15	0 0	None K1	4 4	E15 E16	V V	$V_{IO} = E15$ $+I_{IB} = 2(E15-E16)$	01 02	-4 -6	4 6	nA "
	$-I_{IB}$	4001	18		15	-15	0	K2	4	E17	V	$-I_{IB} = 2(E17-E15)$	01 02	-4 -6	4 6	" "
	I_{IO}	4001	19	2/								$I_{IO} = 2(2E15-E16-E17)$	01 02	-4 -5.6	4 5.6	" "
	+PSRR	4003	20		20 5	-15 -15	0 0	None	4	E18 E19	V V	+PSRR = 66(E18-E19)	01,02	-20	20	$\frac{\mu V}{V}$
	-PSRR	4003	21		15 15	-20 -5	0 0	None	4	E20 E21	V V	-PSRR = 66(E20-E21)	01,02	-20	20	$\frac{\mu V}{V}$

TABLE III. Group A inspection for device types 01 and 02 - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
2 $T_A = +125°C$	PSRR	4003	22		4.5 20	-4.5 -20	0 0	None	4	E22 E23	V V	PSRR = 32.25 x (E22-E23)	01,02	-20	20	$\frac{\mu V}{V}$
	CMRR	4003	23		28 2	-2 -28	-13 13	None	4	E24 E25	V V	$CMRR = 20 \log \left\| \frac{26000}{E24-E25} \right\|$	01,02	106		dB
	$I_{OS}(+)$	3011	24	3/	15	-15	-10	None	5	I4	mA	$I_{OS}(+) = I4$	01,02	-65		mA
	$I_{OS}(-)$	3011	25	3/	15	-15	10	None	5	I5	mA	$I_{OS}(-) - I5$	01,02		65	"
	I_{CC}	4005	26		15	-15	0	None	1	I6	mA	$I_{CC} = I6$	01,02		5	"
3 $T_A = -55°C$	V_{IO}	4001	27	Fig. 8	15	-15	0			E26	V	$V_{IO} = \frac{E26}{1000}$	01 02	-60 -200	60 200	µV µV
	$\frac{dV_{IO}}{dT}$	4001	28	Fig. 8 4/								$\frac{dV_{IO}}{dT} = \frac{(E26-E44)}{80(1000)}$	01 02	-.6 -1.3	.6 1.3	$\frac{\mu V}{°C}$
	$+I_{IB}$	4001	29 30		15 15	-15 -15	0 0	None K1	4 4	E27 E28	V V	$V_{IO} = E27$ $+I_{IB} = 2(E27-E28)$	01 02	-4 -6	4 6	nA "
	$-I_{IB}$	4001	31		15	-15	0	K2	4	E29	V	$-I_{IB} = 2(E29-E27)$	01 02	-4 -6	4 6	" "
	I_{IO}	4001	32	2/								$I_{IO} = 2(2E27-E28-E29)$	01 02	-4 -5.6	4 5.6	" "
	+PSRR	4003	33		20 5	-15 -15	0 0	None	4	E30 E31	V V	+PSRR = 66(E30-E31)	01,02	-20	20	$\frac{\mu V}{V}$
	-PSRR	4003	34		15 15	-20 -5	0 0	None	4	E32 E33	V V	-PSRR = 66(E32-E33)	01,02	-20	20	$\frac{\mu V}{V}$
	PSRR	4003	35		4.5 20	-4.5 -20	0 0	None	4	E34 E35	V V	PSRR = 32.25 x (E34-E35)	01,02	-20	20	$\frac{\mu V}{V}$
	CMRR	4003	36		28 2	-2 -28	-13 13	None	4	E36 E37	V V	$CMRR = 20 \log \left\| \frac{(26000)}{E36-E37} \right\|$	01,02	106		dB
	$I_{OS}(+)$	3011	37	3/	15	-15	-10	None	5	I7	mA	$I_{OS}(+) = I7$	01,02	-70		mA
	$I_{OS}(-)$	3011	38	3/	15	-15	10	None	5	I8	mA	$I_{OS}(-) = I8$	01,02		70	"
	I_{CC}	3005	39		15	-15	0	None	1	I9	mA	$I_{CC} = I9$	01,02		5	"

See footnotes at end of table.

TABLE III. Group A inspection for device types 01 and 02 - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
4 T_A = +25°C	$+V_{OP}$	4004	40 41		15	-15	-15	K3 K4	5	E38 E39	V V	$+V_{OP} = E38$ $+V_{OP} = E39$	01,02 01,02	10 12		V "
	$-V_{OP}$	4004	42 43		15	-15	15	K3 K4	5	E40 E41	V V	$-V_{OP} = E40$ $-V_{OP} = E41$	01,02 01,02		-10 -12	" "
	$A_{VS}(+)$	4004	44		15	-15	-10	K4	4	E42	V	$A_{VS}(+) = \frac{10}{(E1-E42)}$	01 02	300 200		$\frac{V}{mV}$
	$A_{VS}(-)$	4004	45		15	-15	10	K4	4	E43	V	$A_{VS}(-) = \frac{10}{(E43-E1)}$	01 02	300 200		$\frac{V}{mV}$
	V_{IO}	4001	46	Fig. 8	15	-15	0			E44	V	$V_{IO} = \frac{E44}{1000}$	01 02	-25 -75	25 75	µV µV
5 T_A = +125°C	$+V_{OP}$	4004	47 48		15	-15	-15	K3 K4	5	E45 E46	V V	$+V_{OP} = E45$ $+V_{OP} = E46$	01,02 01,02	10 12		V "
	$-V_{OP}$	4004	49 50		15	-15	15	K3 K4	5	E47 E48	V V	$-V_{OP} = E47$ $-V_{OP} = E48$	01,02 01,02		-10 -12	" "
	$A_{VS}(+)$	4004	51		15	-15	-10	K4	4	E49	V	$A_{VS}(+) = \frac{10}{(E15-E49)}$	01 02	200 150		$\frac{V}{mV}$
	$A_{VS}(-)$	4004	52		15	-15	10	K4	4	E50	V	$A_{VS}(-) = \frac{10}{(E50-E15)}$	01 02	200 150		$\frac{V}{mV}$
6 T_A = -55°C	$+V_{OP}$	4004	53 54		15	-15	-15	K3 K4	5	E51 E52	V V	$+V_{OP} = E51$ $+V_{OP} = E52$	01,02 01,02	10 12		V "
	$-V_{OP}$	4004	55 56		15	-15	15	K3 K4	5	E53 E54	V V	$-V_{OP} = E53$ $-V_{OP} = E54$	01,02 01,02		-10 -12	" "
	$A_{VS}(+)$	4004	57		15	-15	-10	K4	4	E55	V	$A_{VS}(+) = \frac{10}{(E27-E55)}$	01 02	200 150		$\frac{V}{mV}$
	$A_{VS}(-)$	4004	58		15	-15	10	K4	4	E56	V	$A_{VS}(-) = \frac{10}{(E56-E27)}$	01 02	200 150		$\frac{V}{mV}$
7 T_A = +25°C	SR(+)	4002	59	5/ 6/	15	-15	0	K4, K9	5	$\Delta V_O(+)$, $\Delta t(+)$	$\frac{V}{\mu s}$	$SR(+) = \frac{\Delta V_O(+)}{\Delta t(+)}$	01,02	.08		$\frac{V}{\mu s}$
	SR(-)	4002	60	5/ 6/	15	-15	0	K4, K9	5	$\Delta V_O(-)$, $\Delta t(-)$	$\frac{V}{\mu s}$	$SR(-) = \frac{\Delta V_O(-)}{\Delta t(-)}$	01,02	.08		$\frac{V}{\mu s}$

See footnotes at end of table.

TABLE III. Group A inspection for device types 01 and 02 - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
7 T_A = +25°C	E_n		61	f_o = 10 Hz						E57	$\frac{nV}{\sqrt{Hz}}$	$E_n = E57$	01,02		18	$\frac{nV}{\sqrt{Hz}}$
			62	f_o = 100 Hz						E58		$E_n = E58$			14	
			63	f_o = 1 kHz Fig. 9						E59		$E_n = E59$			12	
	E_{npp}		64	Fig. 10						E60	V_{pp}	$E_{npp} = \frac{E60}{50000}$	01,02		0.6	μV_{pp}

See footnotes at end of table.

TABLE III. Group A inspection for device types 03, 04, and 05.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number 1	2	3	Energized relays	Measured pin No.	Value	Units	Equation	Device type	Limits Min	Max	Units
1 T_A = +25°C	$+I_{IB}$	4001	1 2		15 15	-15 -15	0 0	None K1	4 4	E1 E2	V V	$V_{IO} = E1$ $+I_{IB} = 20(E1-E2)$ $+I_{IB} = 2(E1-E2)$ - device type 05	03, 04, 05	-40	40	nA
	$-I_{IB}$	4001	3		15	-15	0	K2	4	E3	V	$-I_{IB} = 20(E3-E1)$ $-I_{IB} = 2(E3-E1)$ - device type 05	03, 04, 05	-40	40	"
	I_{IO}	4001	4	2/								$I_{IO} = 20(2E1-E2-E3)$ $I_{IO} = 2(2E1-E2-E3)$ device type 05	03, 04, 05	-35	35	"
	+PSRR	4003	5		18 5	-15 -15	0 0	None	4	E4 E5	V V	+PSRR = 66(E4-E5)	03, 04, 05	-10	10	$\frac{\mu V}{V}$
	-PSRR	4003	6		15 15	-18 -5	0 0	None	4	E6 E7	V V	-PSRR = 66(E6-E7)	03, 04, 05	-10	10	$\frac{\mu V}{V}$
	PSRR	4003	7		4.5 18	-4.5 -18	0 0	None	4	E8 E9	V V	PSRR = 32.25 x (E8-E9)	03, 04, 05	-10	10	$\frac{\mu V}{V}$
	CMRR	4003	8		26 4	-4 -26	-11 11	None	4	E10 E11	V V	$\mathrm{CMRR} = 20 \log \left\lvert \frac{22000}{E11-E10} \right\rvert$	03, 04, 05	114		dB
	$V_{IO}Adj(+)$		9		15	-15	0	K5	4	E12	V	$V_{IO}Adj(+) = E1-E12$	03, 04, 05	.5		mV
	$V_{IO}Adj(-)$		10		15	-15	0	K5,K6	4	E13	V	$V_{IO}Adj(-) = E1-E13$	03, 04, 05		-.5	mV
	$I_{OS}(+)$	3011	11	3/	15	-15	-10	None	5	I1	mA	$I_{OS}(+) = I1$	03, 05 04	-70 -60		mA
	$I_{OS}(-)$	3011	12	3/	15	-15	10	None	5	I2	mA	$I_{OS}(-) = I2$	03, 04, 05		70	"
	I_{CC}	4005	13		15	-15	0	None	1	I3	mA	$I_{CC} = I3$	03, 04, 05		5	"
2 T_A = +125°C	V_{IO}	4001	14	Fig. 8	15	-15	0			E14	V	$V_{IO} = \frac{E14}{1000}$	03, 05 04	-60 -180	60 180	μV μV
	dV_{IO} /dT	4001	15	Fig. 8 4/								$\frac{dV_{IO}}{dT} = \frac{E14-E44}{100(1000)}$	03, 05 04	-.6 -1.0	.6 1.0	$\frac{\mu V}{°C}$
	$+I_{IB}$	4001	16 17		15 15	-15 -15	0 0	None K1	4 4	E15 E16	V V	$V_{IO} = E15$ $+I_{IB} = 20(E15-E16)$ $+I_{IB} = 2(E15-E16)$ - device type 05	03, 04, 05	-60	60	nA
	$-I_{IB}$	4001	18		15	-15	0	K2	4	E17	V	$-I_{IB} = 20(E17-E15)$ $-I_{IB} = 2(E17-E15)$ - device type 05	03, 04, 05	-60	60	"
	I_{IO}	4001	19	2/								$I_{IO} = 20(2E15-E16-E17)$ $I_{IO} = 2(2E15-E16-E17)$ - device type 05	03, 04, 05	-50	50	"
	+PSRR	4003	20		18 5	-15 -15	0 0	None	4	E18 E19	V V	+PSRR = 66(E18-E19)	03, 04, 05	-16	16	$\frac{\mu V}{V}$
	-PSRR	4003	21		15 15	-18 -5	0 0	None	4	E20 E21	V V	-PSRR = 66(E20-E21)	03, 04, 05	-16	16	$\frac{\mu V}{V}$

TABLE III. Group A inspection for device types 03, 04 and 05 - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
2 $T_A = +125°C$	PSRR	4003	22		4.5 18	-4.5 -18	0 0	None	4	E22 E23	V V	$\mathrm{PSRR} = 32.25 \times (E22-E23)$	03,04, 05	-16	16	$\frac{\mu V}{V}$
	CMRR	4003	23		25 5	-5 -25	-10 10	None	4	E24 E25	V V	$\mathrm{CMRR} = 20 \log \left\lvert\frac{20000}{E24-E25}\right\rvert$	03,04, 05	108		dB
	$I_{OS}(+)$	3011	24	3/	15	-15	-10	None	5	I4	mA	$I_{OS}(+) = I4$	03,05 04	-70 -60		mA
	$I_{OS}(-)$	3011	25	3/	15	-15	10	None	5	I5	mA	$I_{OS}(-) = I5$	03,04, 05		70	"
	I_{CC}	4005	26		15	-15	0	None	1	I6	mA	$I_{CC} = I6$	03,04, 05		6	"
3 $T_A = -55°C$	V_{IO}	4001	27	Fig. 8	15	-15	0			E26	V	$V_{IO} = \frac{E26}{1000}$	03,05 04	-60 -180	60 180	μV
	dV_{IO}/dT	4001	28	Fig. 8 4/								$\frac{dV_{IO}}{dT} = \frac{(E26-E44)}{100(1000)}$	03,05 04	-.6 -1.0	.6 1.0	$\frac{\mu V}{°C}$
	$+I_{IB}$	4001	29 30		15 15	-15 -15	0 0	None K1	4 4	E27 E28	V V	$V_{IO} = E27$ $+I_{IB} = 20(E27-E28)$ $+I_{IB} = 2(E27-E28)$ - device type 05	03,04, 05	-60	60	nA
	$-I_{IB}$	4001	31		15	-15	0	K2	4	E29	V	$-I_{IB} = 20(E29-E27)$ $-I_{IB} = 2(E29-E27)$ - device type 05	03,04, 05	-60	60	"
	I_{IO}	4001	32	2/								$I_{IO} = 20(2E27-E28-E29)$ $I_{IO} = 2(2E27-E28-E29)$ - device type 05	03,04, 05	-50	50	"
	+PSRR	4003	33		18 5	-15 -15	0 0	None	4	E30 E31	V V	$+\mathrm{PSRR} = 66(E30-E31)$	03,04, 05	-16	16	$\frac{\mu V}{V}$
	-PSRR	4003	34		15 15	-18 -5	0 0	None	4	E32 E33	V V	$-\mathrm{PSRR} = 66(E32-E33)$	03,04, 05	-16	16	$\frac{\mu V}{V}$
	PSRR	4003	35		4.5 18	-4.5 -18	0 0	None	4	E34 E35	V V	$\mathrm{PSRR} = 32.25 \times (E34-E35)$	03,04, 05	-16	16	$\frac{\mu V}{V}$
	CMRR	4003	36		25 5	-5 -25	-10 10	None	4	E36 E37	V V	$\mathrm{CMRR} = 20 \log \left\lvert\frac{(20000)}{E36-E37}\right\rvert$	03,04, 05	108		dB
	$I_{OS}(+)$	3011	37	3/	15	-15	-10	None	5	I7	mA	$I_{OS}(+) = I7$	03,05 04	-70 -60		mA
	$I_{OS}(-)$	3011	38	3/	15	-15	10	None	5	I8	mA	$I_{OS}(-) = I8$	03,04, 05		70	"
	I_{CC}	3005	39		15	-15	0	None	1	I9	mA	$I_{CC} = I9$	03,04, 05		6	"

See footnotes at end of table.

TABLE III. Group A inspection for device types 03, 04 and 05 - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
4 T_A = +25°C	$+V_{OP}$	4004	40 41		15	-15	-15	K7 K4	5	E38 E39	V V	$+V_{OP} = E38$ $+V_{OP} = E39$	03,04, 05	10 11.5		V "
	$-V_{OP}$	4004	42 43		15	-15	15	K7 K4	5	E40 E41	V V	$-V_{OP} = E40$ $-V_{OP} = E41$	03,04, 05		-10 -11.5	" "
	$A_{VS}(+)$	4004	44		15	-15	-10	K4	4	E42	V	$A_{VS}(+) = \frac{10}{(E1-E42)}$	03,04, 05	1000		$\frac{V}{mV}$
	$A_{VS}(-)$	4004	45		15	-15	10	K4	4	E43	V	$A_{VS}(-) = \frac{10}{(E43-E2)}$	03,04, 05	1000		$\frac{V}{mV}$
	V_{IO}	4001	46	Fig. 8	15	-15	0			E44	V	$V_{IO} = \frac{E44}{1000}$	03,05 04	-25 -80	25 80	µV
5 T_A = +125°C	$+V_{OP}$	4004	47 48		15	-15	-15	K7 K4	5	E45 E46	V V	$+V_{OP} = E45$ $+V_{OP} = E46$	03,04, 05	10 11.5		V "
	$-V_{OP}$	4004	49 50		15	-15	15	K7 K4	5	E47 E48	V V	$-V_{OP} = E47$ $-V_{OP} = E48$	03,04, 05		-10 -11.5	" "
	$A_{VS}(+)$	4004	51		15	-15	-10	K4	4	E49	V	$A_{VS}(+) = \frac{10}{(E15-E49)}$	03,04, 05	600		$\frac{V}{mV}$
	$A_{VS}(-)$	4004	52		15	-15	10	K4	4	E50	V	$A_{VS}(-) = \frac{10}{(E50-E15)}$	03,04, 05	600		$\frac{V}{mV}$
6 T_A = -55°C	$+V_{OP}$	4004	53 54		15	-15	-15	K7 K4	5	E51 E52	V V	$+V_{OP} = E51$ $+V_{OP} = E52$	03,04, 05	10 11.5		V "
	$-V_{OP}$	4004	55 56		15	-15	15	K7 K4	5	E53 E54	V V	$-V_{OP} = E53$ $-V_{OP} = E54$	03,04, 05		-10 -11.5	" "
	$A_{VS}(+)$	4004	57		15	-15	-10	K4	4	E55	V	$A_{VS}(+) = \frac{10}{(E27-E55)}$	03,04, 05	600		$\frac{V}{mV}$
	$A_{VS}(-)$	4004	58		15	-15	10	K4	4	E56	V	$A_{VS}(-) = \frac{10}{(E56-E27)}$	03,04, 05	600		$\frac{V}{mV}$

See footnotes at end of table.

TABLE III. Group A inspection for device types 03, 04 and 05 - Continued.

Subgroup	Symbol	MIL-STD-883 method	Test no.	Notes 1/	Adapter pin number			Energized relays	Measured pin			Equation	Device type	Limits		Units
					1	2	3		No.	Value	Units			Min	Max	
7 T_A = +25°C	SR(+)	4002	59	5/,6/, 7/	15	-15	0	K4, K9, K10	5	$\Delta V_O(+)$, $\Delta t(+)$	$\frac{V}{\mu s}$	$SR(+) = \frac{\Delta V_O(+)}{\Delta t(+)}$	03,04 05	1.7 11		$\frac{V}{\mu s}$
	SR(-)	4002	60	5/,6/, 7/	15	-15	0	K4, K9, K10	5	$\Delta V_O(-)$, $\Delta t(-)$	$\frac{V}{\mu s}$	$SR(-) = \frac{\Delta V_O(-)}{\Delta t(-)}$	03,04 05	1.7 11		$\frac{V}{\mu s}$
	E_n		61	f_o = 10 Hz						E57	$\frac{nV}{\sqrt{Hz}}$	$E_n = E57$	03,05 04		5.5 6.0	$\frac{nV}{\sqrt{Hz}}$
			62	f_o = 100 Hz						E58		$E_n = E58$	03,05 04		4.0 5.0	
			63	f_o = 1 kHz Fig. 9						E59		$E_n = E59$	03,05 04		3.8 3.9	
	E_{npp}		64	Fig. 10						E60	V_{pp}	$E_{npp} = \frac{E60}{50000}$	03,05 04		.18 .20	μV_{pp}
9 T_A = +25°C	I_n		65	f_o = 10 Hz						E61	$\frac{pA}{\sqrt{Hz}}$	$I_n = \left\{ \left[(E61)^2 - (E57)^2 - (1.64 \times 10^{-15}) \right] 10^{-10} \right\}^{0.5}$	03,05 04		5.66 5.66	$\frac{pA}{\sqrt{Hz}}$
			66	f_o = 100 Hz						E62		$I_n = \left\{ \left[(E62)^2 - (E58)^2 - (1.64 \times 10^{-15}) \right] 10^{-10} \right\}^{0.5}$	03,05 04		1.88 2.1	
			67	f_o = 1 kHz Fig. 9						E63		$I_n = \left\{ \left[(E63)^2 - (E59)^2 - (1.64 \times 10^{-15}) \right] 10^{-10} \right\}^{0.5}$	03,05 04		0.84 0.89	

1/ All tests apply to figure 7, unless otherwise specified.

2/ I_{IO} is calculated using data from previous tests.

3/ $I_{OS}(+)$ and $I_{OS}(-)$ are measured with the output shorted to ground for less than 25 milliseconds

4/ dV_{IO}/dt is calculated using data from previous tests.

5/ Slew rate can be measured using figure 11. All test signals for figure 7 are shown on figure 11.

6/ The oscillation detector will be disconnected during slew rate tests.

7/ Slew rate: For device types 03 and 04 energize relays K4 and K9.
For device type 05 energize relays K4, K9 and K10.

4. QUALITY 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 inspection. The following additional criteria shall apply:

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

(1) Class S devices: Test condition D, using the circuit shown on figure 4.

(2) Class B devices: Test condition D, using the circuit shown on figure 4, or test condition C using the circuit shown on figure 5, or test condition F using the circuit shown on figure 6.

b. 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 6.

c. 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.

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 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).

4.3.1 Qualification extension. For qualification inspection, if a manufacturer qualifies to device type 01 which is designed and manufactured identically (same die, same process, same screening) in all respects (except electrical testing) to device type 02, then qualification may be extended to device type 02 when authorized by the qualifying activity. Additionally, part I qualification may be extended to device type 02 only after acceptance by the qualifying activity of subgroup C1 testing performed on this device type and submission of data in accordance with MIL-M-38510, appendix D.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510 and as specified herein.

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. Electrical test requirements shall be as specified in table II herein.

b. Subgroups 8, 10, and 11 of table I of method 5005 of MIL-STD-883 shall be omitted.

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

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

b. Steady state life test for class S devices shall be in accordance with table IIa of method 5005 of MIL-STD-883, using the circuit shown on figure 6. If the alternate burn-in conditions are used, the circuit shown on figure 5 shall be used.

4.4.3 Group C inspection. Group C inspection shall be in accordance with table III of method 5005 of MIL-STD-883 and as follows:

a. End-point electrical parameters shall be as specified in table II herein. Delta limits shall apply only to subgroup 1 of group C inspection, and shall consist of tests specified in table IV 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 4, or test condition F using the circuit shown on figure 6, or test condition C using the circuit shown on figure 5.

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. Delta limits do not apply.

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

4.5.1 Voltage and current. All voltage values given are referenced to the ground terminal of the device under test (DUT). Current values given are for conventional current and are positive when flowing into the referenced terminal.

4.5.2 Life test cooldown procedures. 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, V_{CM} = 0, $\pm V_{CC}$ = ±15 V for all device types)

Test	Device 01				Device 02				Unit
	Limit		Delta		Limit		Delta		
	Min	Max	Min	Max	Min	Max	Min	Max	
V_{IO}	-100	100	-75	75	-175	175	-100	100	µV
$+I_{IB}$	-3	3	-1	1	-4.5	4.5	-1.5	1.5	nA
$-I_{IB}$	-3	3	-1	1	-4.5	4.5	-1.5	1.5	nA

Test	Device 03 and 05				Device 04				Unit
	Limit		Delta		Limit		Delta		
	Min	Max	Min	Max	Min	Max	Min	Max	
V_{IO}	-100	100	-75	75	-180	+180	-100	100	µV
$+I_{IB}$	-50	50	-10	+10	-50	50	-10	10	nA
$-I_{IB}$	-50	50	-10	+10	-50	50	-10	10	nA

5. PACKAGING

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

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 Ordering data. The acquisition document should specify the following:

a. Complete part number (see 1.2).

b. 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.

c. Requirements for certificate of compliance, if applicable.

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

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

f. Requirements for product assurance options.

g. Requirements for special lead lengths, or lead forming, if applicable. These requirements shall not affect the part number.

h. 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 part number.

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	Operational amplifier description
01	OP-07A	Single, ultra low offset internally compensated
02	OP-07, 714	Single, low offset internally compensated
03	OP-27A	Single, ultra low offset, internally compensated, ultra low noise
04	OP-227A	Dual, low offset, internally compensated, ultra low noise.
05	OP-37A	Single, ultra low offset, internally compensated, ultra low noise, broadband.

6.6 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 - 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

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