


REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

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	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13				

STANDARDIZED MILITARY DRAWING <small>THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</small> AMSC N/A	PREPARED BY <i>Charles E. Besore</i>	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444		
	CHECKED BY <i>Charles E. Besore</i>			
	APPROVED BY 	MICROCIRCUIT, LINEAR, OPERATIONAL AMPLIFIER, LOW POWER, MONOLITHIC SILICON		
	DRAWING APPROVAL DATE 15 NOVEMBER 1990	SIZE A	CAGE CODE 67268	5962-89656
	REVISION LEVEL	SHEET 1		

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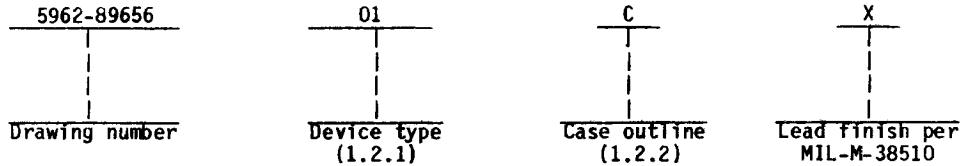
• U.S. GOVERNMENT PRINTING OFFICE: 1987 — 748-129/60911
5962-E1385

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

1. SCOPE

1.1 Scope. This drawing describes device requirements for class B microcircuits in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices".

1.2 Part or Identifying Number (PIN). The complete PIN shall be as shown in the following example:



1.2.1 Device types. The device types shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	HA-5141	Single, low power operational amplifier
02	HA-5142	Dual, low power operational amplifier
03	HA-5144	Quad, low power operational amplifier

1.2.2 Case outlines. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
C	D-1 (14-lead, .785" x .310" x .200"), dual-in-line package
G	A-1 (8-lead, .370" x .185"), can package
P	D-4 (8-lead, .405" x .310" x .200"), dual-in-line package
2	C-2 (20-terminal, .358" x .358" x .100"), square chip carrier package

1.3 Absolute maximum ratings.

Voltage between +V and -V terminals - - - - -	35 V dc
Differential input voltage - - - - -	±7.0 V dc
Voltage at either input terminal - - - - -	+V to -V
Storage temperature range - - - - -	-65°C to +150°C
Maximum power dissipation (P _D) at T _A = +75°C:	
Device type 01:	
Case G - - - - -	.67 W
Case P - - - - -	1.21 W
Case 2 - - - - -	1.34 W
Device type 02:	
Case G - - - - -	.67 W
Case P - - - - -	1.22 W
Case 2 - - - - -	1.35 W
Device type 03:	
Case C - - - - -	1.33 W
Case 2 - - - - -	1.32 W
Derating above T _A = +75°C:	
Device type 01:	
Case G - - - - -	6.7 mW/°C
Case P - - - - -	12.1 mW/°C
Case 2 - - - - -	13.4 mW/°C

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Device type 02:	
Case G - - - - -	6.7 mW/°C
Case P - - - - -	12.2 mW/°C
Case 2 - - - - -	13.5 mW/°C
Device type 03:	
Case C - - - - -	13.3 mW/°C
Case 2 - - - - -	13.2 mW/°C
Thermal resistance, junction-to-case (θ_{JC}) - - - - -	See MIL-M-38510, appendix C
Thermal resistance, junction-to-ambient (θ_{JA}):	
Device type 01:	
Case G - - - - -	149°C/W
Case P - - - - -	83°C/W
Case 2 - - - - -	74°C/W
Device type 02:	
Case G - - - - -	111°C/W
Case P - - - - -	82°C/W
Case 2 - - - - -	74°C/W
Device type 03:	
Case C - - - - -	75°C/W
Case 2 - - - - -	76°C/W
Lead temperature (soldering, 10 seconds) - - - - -	+275°C
Junction temperature (T_J)- - - - -	+175°C

1.4 Recommended operating conditions.

Supply voltage range ($\pm V$):	
Dual supply operation - - - - -	± 1.5 V dc to ± 15 V dc
Single supply operation - - - - -	+3.0 V dc to +30 V dc
Common mode input voltage (V_{CM})- - - - -	$< (+V - -V)/2$
Load resistance (R_L) - - - - -	> 50 k Ω
Ambient operating temperature range (T_A) - - - - -	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specification, standard, and bulletin. Unless otherwise specified, the following specification, standard, and bulletin of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATION

MILITARY

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

STANDARD

MILITARY

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

BULLETIN

MILITARY

MIL-BUL-103 - List of Standardized Military Drawings (SMD's).

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

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2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing shall take precedence.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices" 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 Case outlines. The case outlines shall be in accordance with 1.2.2 herein.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full ambient operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-STD-883 (see 3.1 herein). The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in MIL-BUL-103 (see 6.6 herein).

3.6 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-BUL-103 (see 6.6 herein). The certificate of compliance submitted to DESC-ECS prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-STD-883 (see 3.1 herein) and the requirements herein.

3.7 Certificate of conformance. A certificate of conformance as required in MIL-STD-883 (see 3.1 herein) shall be provided with each lot of microcircuits delivered to this drawing.

3.8 Notification of change. Notification of change to DESC-ECS shall be required in accordance with MIL-STD-883 (see 3.1 herein).

3.9 Verification and review. DESC, DESC's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with section 4 of MIL-M-38510 to the extent specified in MIL-STD-883 (see 3.1 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 quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.6 herein).

(2) $T_A = +125^\circ\text{C}$, minimum.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ -55°C < T _A < +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input offset voltage	V _{I01}	V _{CM} = 0 V 2/	1	A11		±6.0	mV
			2,3	A11		±8.0	mV
	V _{I02}	V _{CM} = 0 V, V _{OUT} = 1.4 V 3/	1	A11		±6.0	mV
			2,3	A11		±8.0	mV
Input bias current	+I _{B1}	V _{CM} = 0 V, +R _S = 10 kΩ, -R _S = 100Ω 2/	1	A11		±100	nA
			2,3	A11		±125	nA
	-I _{B1}	V _{CM} = 0 V, +R _S = 100Ω, -R _S = 10 kΩ 2/	1	A11		±100	nA
			2,3	A11		±125	nA
	+I _{B2}	V _{CM} = 0 V, V _{OUT} = 1.4 V, +R _S = 10 kΩ, -R _S = 100Ω 3/	1	A11		±100	nA
			2,3	A11		±125	nA
	-I _{B2}	V _{CM} = 0 V, V _{OUT} = 1.4 V, +R _S = 100Ω, -R _S = 10 kΩ 3/	1	A11		±100	nA
			2,3	A11		±125	nA
Input offset current	I _{I01}	V _{CM} = 0 V, +R _S = 10 kΩ, -R _S = 10 kΩ 2/	1	A11		±10	nA
			2,3	A11		±20	nA
	I _{I02}	V _{CM} = 0 V, V _{OUT} = 1.4 V, +R _S = 10 kΩ, -R _S = 10 kΩ 2/	1	A11		±10	nA
			2,3	A11		±20	nA

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C < T _A < +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Common mode range	+CMR ₁	V ₊ = 5.0 V, V ₋ = -25 V	1	A11	10		V
			2,3	A11	10		V
	-CMR ₁	V ₊ = 25 V, V ₋ = -5.0 V	1	A11	-10		V
			2,3	A11	-10		V
	+CMR ₂	V ₊ = 5.0 V to 2.0 V, V ₋ = 0 V to -3.0 V, V _{OUT} = 1.4 V to -1.6 V	1	A11	0 to 3		V
			2,3	A11	0 to 3		V
Large signal voltage gain	+AVOL1	V _{OUT} = 0 V and 10 V, R _L = 50 kΩ 2/	4	A11	20		kV/V
			5,6	A11	15		kV/V
	-AVOL1	V _{OUT} = 0 V and -10 V R _L = 50 kΩ 2/	4	A11	20		kV/V
			5,6	A11	15		kV/V
	+AVOL2	V _{OUT} = 1.4 V and 2.5 V, R _L = 50 kΩ 3/	4	A11	20		kV/V
			5,6	A11	15		kV/V
Common mode rejection ratio	+CMRR ₁	ΔV _{CM} = 10 V, +V = 5.0 V, -V = -25 V, V _{OUT} = -10 V	1	A11	77		dB
			2,3	A11	77		dB
	-CMRR ₁	ΔV _{CM} = 10 V, +V = 25 V, -V = -5.0 V, V _{OUT} = 10 V	1	A11	77		dB
			2,3	A11	77		dB

See footnotes at end of table.

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U. S. GOVERNMENT PRINTING OFFICE: 1985-549-904

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C < T _A < +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Common mode rejection ratio	+CMRR ₂	$\Delta V_{CM} = 0 \text{ V to } 3.0 \text{ V, } +V = 2.0 \text{ V,}$ $-V = -3.0 \text{ V, } V_{OUT} = -3.0 \text{ V}$	1	A11	77		dB
			2,3	A11	77		dB
Output voltage swing	+V _{OUT1}	R _L = 50 k Ω 2/	1	A11	10		V
			2,3	A11	10		V
	-V _{OUT1}	R _L = 50 k Ω 2/	1	A11	-10		V
			2,3	A11	-10		V
	+V _{OUT2}	R _L = 50 k Ω , terminated at 2.5 V 3/	1	A11	3.8		V
			2,3	A11	3.5		V
	-V _{OUT2}	R _L = 50 k Ω , terminated at 2.5 V 3/	1	A11		1.0	V
			2,3	A11		1.2	V
Power supply rejection ratio	+PSRR ₁	+V = 10 V and 20 V, -V = +15 V	1	A11	77		dB
			2,3	A11	77		dB
	-PSRR ₁	-V = -10 V and -20 V, +V = +15 V	1	A11	77		dB
			2,3	A11	77		dB
	+PSRR ₂	+V = 5.0 V and 15 V, -V = 0 V	1	A11	77		dB
			2,3	A11	77		dB

See footnotes at end of table.

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* U. S. GOVERNMENT PRINTING OFFICE: 1988-549-904

TABLE 1. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C < T _A < +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Channel separation	±CS	R _L = 50 kΩ	1,2,3	02,03	80		dB
Quiescent power supply current	+I _{CC1}	V _{OUT} = 0 V, I _{OUT} = 0 mA <u>2/</u>	1	01		150	μA
				02		300	
				03		600	
			2,3	01		200	μA
				02		400	
				03		800	
	-I _{CC1}	V _{OUT} = 0 V, I _{OUT} = 0 mA <u>2/</u>	1	01		-150	μA
				02		-300	
				03		-600	
2,3			01		-200	μA	
			02		-400		
			03		-800		
+I _{CC2}	V _{OUT} = 1.4 V, I _{OUT} = 0 mA <u>3/</u>	1	01		80	μA	
			02		160		
			03		320		

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C < T _A < +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Quiescent power supply current	+I _{CC2}	V _{OUT} = 1.4 V, I _{OUT} = 0 mA <u>3/</u>	2,3	01		100	μA
				02		200	
				03		400	
Slew rate	+SR ₁	V _{OUT} = -3.0 V to +3.0 V, V _{IN} SR < 25 V/μs, A _V = 1.0 V/V, T _A = +25°C <u>2/</u>	4	A11	0.8		V/μs
	-SR ₁	V _{OUT} = +3.0 V to -3.0 V, V _{IN} SR < 25 V/μs, A _V = 1.0 V/V, T _A = +25°C <u>2/</u>	4	A11	0.8		V/μs
	+SR ₂	V _{OUT} = 0 V to 3.0 V, V _{IN} SR < 25 V/μs, A _V = 1.0, V/V T _A = +25°C <u>3/</u>	4	A11	0.8		V/μs
	-SR ₂	V _{OUT} = 3.0 V to 0 V, V _{IN} SR < 25 V/μs, A _V = 1.0 V/V, T _A = +25°C <u>3/</u>	4	A11	0.8		V/μs
Full power bandwidth <u>4/ 5/</u>	FPBW ₁	V _{PEAK} = 10 V, A _V = 1.0 V/V, T _A = +25°C <u>2/</u>	4	A11	12.7		kHz
	FPBW ₂	V _{PEAK} = 1.1 V, V _{REF} = 2.5 V, A _V = 1.0 V/V, T _A = +25°C <u>3/</u>	4	A11	115.8		kHz
Minimum closed-loop stable gain <u>4/</u>	CLSG	R _L = 50 kΩ, C _L = 50 pF, A _V = 1.0 V/V	4,5,6	A11	1.0		V/V

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C < T _A < +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Quiescent power consumption 6/	PC ₁	V _{OUT} = 0 V, I _{OUT} = 0 mA, A _V = 1.0 V/V 2/	1,2,3	01		6.0	mW
				02		12	
				03		24	
	PC ₂	V _{OUT} = 1.4 V, I _{OUT} = 0 mA, A _V = 1.0 V/V 3/	1,2,3	01		0.5	mW
				02		1.0	
				03		2.0	

1/ R_S = 50Ω, R_L = 10 kΩ, C_L = 100 pF, and V_{OUT} = 0 V unless otherwise specified. For device types 02 and 03, tests apply to each amplifier.

2/ +V = +15 V and -V = -15 V.

3/ +V = +5.0 V and -V = 0.0 V

4/ If not tested, shall be guaranteed to the limits specified in table I.

5/ Full power bandwidth = $\frac{SR}{2\pi V_{PEAK}}$.

6/ Quiescent power consumption based on quiescent supply current test maximum (no load outputs).

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Device types	01		02		03	
Case outlines	G and P	2	G and P	2	C	2
Terminal number	Terminal symbol					
1	NC	NC	OUT 1	NC	OUT 1	NC
2	-IN	NC	-IN 1	OUT 1	-IN 1	OUT 1
3	+IN	NC	+IN 1	NC	+IN 1	-IN 1
4	-V	NC	-V	NC	+V	+IN 1
5	NC	-IN	+IN 2	-IN 1	+IN 2	NC
6	OUT	NC	-IN 2	NC	-IN 2	+V
7	+V	+IN	OUT 2	+IN 1	OUT 2	NC
8	NC	NC	+V	NC	OUT 3	+IN 2
9	---	NC	---	NC	-IN 3	-IN 2
10	---	-V	---	-V	+IN 3	OUT 2
11	---	NC	---	NC	-V	NC
12	---	NC	---	+IN 2	+IN 4	OUT 3
13	---	NC	---	NC	-IN 4	-IN 3
14	---	NC	---	NC	OUT 4	+IN 3
15	---	OUT	---	-IN 2	---	NC
16	---	NC	---	NC	---	-V
17	---	+V	---	OUT 2	---	NC
18	---	NC	---	NC	---	+IN 4
19	---	NC	---	NC	---	-IN 4
20	---	NC	---	+V	---	OUT 4

FIGURE 1. Terminal connections.

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

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with method 5005 of MIL-STD-883 including groups A, B, C, and D inspections. The following additional criteria shall apply.

4.3.1 Group A inspection.

- a. Tests shall be as specified in table II herein.
- b. Subgroups 7, 8, 9, 10, and 11 in table I, method 5005 of MIL-STD-883 shall be omitted.

4.3.2 Groups C and D inspections.

- a. End-point electrical parameters shall be as specified in table II herein.
- b. Steady-state life test conditions, method 1005 of MIL-STD-883:
 - (1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.6 herein).
 - (2) $T_A = +125^\circ\text{C}$, minimum.
 - (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Interim electrical parameters (method 5004)	---
Final electrical test parameters (method 5004)	1*,2,3,4,5,6
Group A test requirements (method 5005)	1,2,3,4,5,6
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.

5. PACKAGING

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

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6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-38510, the device specified herein will be inactivated and will not be used for new design. The QPL-38510 product shall be the preferred item for all applications.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-481 using DD Form 1693, Engineering Change Proposal (Short Form).

6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DESC-ECS, telephone (513) 296-6022.

6.5 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, Ohio 45444, or telephone (513) 296-5375.

6.6 Approved sources of supply. Approved sources of supply are listed in MIL-BUL-103. The vendors listed in MIL-BUL-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DESC-ECS.

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STANDARDIZED MILITARY DRAWING SOURCE APPROVAL BULLETIN

DATE: 1990 NOV 15

Approved sources of supply for SMD 5962-89656 are listed below for immediate acquisition only and shall be added to MIL-BUL-103 during the next revision. MIL-BUL-103 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DESC-ECS. This bulletin is superseded by the next dated revision of MIL-BUL-103.

Standardized military drawing PIN	Vendor CAGE number	Vendor similar PIN <u>1/</u>
5962-8965601GX	34371	HA2-5141/883
5962-8965601PX	34371	HA7-5141/883
5962-89656012X	34371	HA4-5141/883
5962-8965602GX	34371	HA2-5142/883
5962-8965602PX	34371	HA7-5142/883
5962-89656022X	34371	HA4-5142/883
5962-8965603CX	34371	HA1-5144/883
5962-89656032X	34371	HA4-5144/883

1/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

<u>Vendor CAGE number</u>	<u>Vendor name and address</u>
34371	Harris Semiconductor P.O. Box 883 Melbourne, FL 32901

<p>The information contained herein is disseminated for convenience only and the Government assumes no liability whatsoever for any inaccuracies in this information bulletin.</p>
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