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

REV																								
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REV STATUS OF SHEETS	REV																							
	SHEET	1	2	3	4	5	6	7	8	9	10													

PMIC N/A

STANDARDIZED MILITARY DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

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DRAWING APPROVAL DATE
91-10-02

REVISION LEVEL

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, OPERATIONAL AMPLIFIER, LOW NOISE, UNCOMPENSATED, MONOLITHIC SILICON

SIZE	CAGE CODE	
A	67268	5962-89631

SHEET 1 OF 10

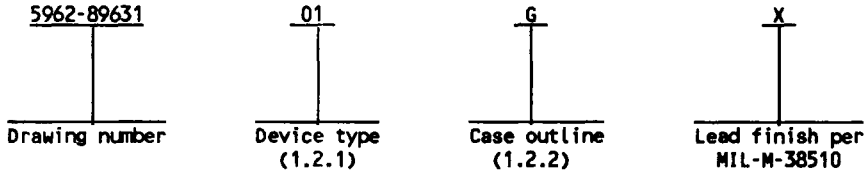
DESC FORM 193
SEP 87

* U.S. GOVERNMENT PRINTING OFFICE: 1987 — 748-129/60911

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 type(s). The device type(s) shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	HA-5111	Low-noise, uncompensated, operational amplifier

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

Outline letter	Case outline
G	A-1 (8-lead, .370" x .185"), can
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	40 V dc
Differential input voltage (V_{ID})	7.0 V dc
Voltage at either input terminal	V+ to V-
Input current (I_{IN})	25 mA
Output short circuit duration	Indefinite
Storage temperature range	-65°C to +150°C
Maximum power dissipation (P_D):	
Case G	830 mW 1/
Case P	1.22 W 1/
Case 2	1.35 W 1/
Lead temperature (soldering, 10 seconds)	+275°C
Thermal resistance, junction-to-case (Θ_{JC})	See MIL-M-38510, appendix C
Thermal resistance, junction-to-ambient (Θ_{JA}):	
Case G	121°C/W
Case P	82°C/W
Case 2	74°C/W
Junction temperature (T_J)	+175°C

1/ Derate linearly above T_A = +75°C for case G = 8.3 mW/°C, case P = 12.2 mW/°C and case 2 = 13.5 mW/°C.

1.4 Recommended operating conditions.

Positive supply voltage range (V+)	+5.0 V dc to +15 V dc
Negative supply voltage range (V-)	-5.0 V dc to -15 V dc
Common mode input voltage (V_{CM})	≤ (V+ - (V-))/2
Load resistance (R_L)	500Ω
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.)

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 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 herein.

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

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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits Min	Limits Max	Unit
Input offset voltage	V_{IO}	V_{CM} = 0.0 V	1	All	-3.0	+3.0	mV
			2, 3		-4.0	+4.0	
Input bias current	$+I_B$	V_{CM} = 0.0 V, $+R_S$ = 100 kΩ, $-R_S$ = 100Ω	1	All	-200	+200	nA
			2, 3		-325	+325	
	$-I_B$	V_{CM} = 0.0 V, $+R_S$ = 100Ω, $-R_S$ = 100 kΩ	1		-200	+200	
			2, 3		-325	+325	
Input offset current	I_{IO}	V_{CM} = 0.0 V, $+R_S$ = 100 kΩ, $-R_S$ = 100 kΩ	1	All	-75	+75	nA
			2, 3		-125	+125	
Common mode voltage range	$+V_{CM}$	V+ = 3.0 V, V- = -27 V	1, 2, 3	All	12		V
	$-V_{CM}$	V+ = 27 V, V- = -3.0 V				-12	
Common mode rejection ratio	+CMRR	V_{CM} = 10 V, V+ = 5.0 V, V- = -25 V, V_{OUT} = -10 V	1, 2, 3	All	80		dB
	-CMRR	V_{CM} = -10 V, V+ = 25 V, V- = -5.0 V, V_{OUT} = 10 V			80		
Output current	$+I_{OUT}$	V_{OUT} = -15 V, V+ = 18 V, V- = -18 V	1, 2, 3	All	25		mA
	$-I_{OUT}$	V_{OUT} = 5.0 V, V+ = 18 V, V- = -18 V				-25	
Quiescent power supply	$+I_{CC}$	V_{OUT} = 0 V, I_{OUT} = 0 mA	1, 2, 3	All		6.0	mA
	$-I_{CC}$				-6.0		

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output voltage	$+V_{OUT1}$	R_L = 2.0 kΩ	1, 2, 3	All	12		V
	$+V_{OUT2}$	R_L = 600Ω, V+ = 18 V, V- = -18 V			15		
	$-V_{OUT1}$	R_L = 2.0 kΩ				-12	
	$-V_{OUT2}$	R_L = 600Ω, V+ = 18 V, V- = -18 V				-15	
Power supply rejection ratio	+PSRR	V+ = 10 V and 20 V, V- = -15 V	1, 2, 3	All	80		dB
	-PSRR	V- = -10 V and -20 V, V+ = 15 V			80		
Offset voltage adjustment	$+V_{IO}$ (adj)	2/	1, 2, 3	All	V_{IO} -1.0		mV
	$-V_{IO}$ (adj)				V_{IO} +1.0		
Quiescent power consumption 3/ 4/	P_C	V_{OUT} = 0 V, I_{OUT} = 0 mA	1, 2, 3			180	mW
Differential input resistance 3/	R_{IN}	V_{CM} = 0.0 V, T_A = +25°C	4	All	250		kΩ
Low frequency peak noise 3/	E_{NP-P}	0.1 Hz to 10 Hz, T_A = +25°C	4	All		0.2	μV_{P-P}
Input noise voltage density 3/	E_N	R_S = 20Ω, f_O = 1.0 kHz, R_L = 2.0 kΩ, T_A = +25°C	4	All		8.0	$\frac{nV}{\sqrt{Hz}}$

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits Min	Limits Max	Unit
Input noise 3/ current density	I_N	R_S = 2.0 MΩ, f_O = 1.0 kHz, R_L = 2.0 kΩ, T_A = +25°C	4	All		3.0	$\frac{pA}{\sqrt{Hz}}$
Slew rate	+SR	V_{OUT} = -5.0 V to +5.0 V, measured at -2.5 V to +2.5 V, R_L = 2.0 kΩ, R_S = 50Ω, T_A = +25°C	4	All	40		V/μs
	-SR	V_{OUT} = +5.0 V to -5.0 V, measured at -2.5 V to +2.5 V, R_L = 2.0 kΩ, R_S = 50Ω, T_A = +25°C			40		
Gain bandwidth product 3/	GBWP	V_{OUT} = 200 mV, R_L = 2.0 kΩ, T_A = +25°C; f = 10 kHz	4	All	70		MHz
		f = 1.0 MHz			70		
Output resistance 3/	R_{OUT}	Open loop, T_A = +25°C	4	All		150	Ω
Full power 3/ 5/ bandwidth	FPBW	V_{PEAK} = 10 V, R_L = 2.0 kΩ, T_A = +25°C	4	All	630		kHz
Large signal voltage gain	$+A_{VOL}$	V_{OUT} = 0.0 V and 10 V, R_L = 2.0 kΩ	4, 5, 6	All	100		kV/V
	$-A_{VOL}$	V_{OUT} = 0.0 V and -10 V, R_L = 2.0 kΩ			100		
Closed loop stable gain 3/	CLSG	R_L = 2.0 kΩ, C_L = 50 pF	4, 5, 6	All	10		V/V
Rise time 3/ 6/	t_r	V_{OUT} = 0.0 V to +200 mV, T_A = +25°C	9	All		60	ns
Fall time 3/ 6/	t_f	V_{OUT} = 0.0 V to -200 mV, T_A = +25°C	9	All		60	ns

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Overshoot 3/	+OS	V_{OUT} = 0.0 V to +200 mV, T_A = +25°C	9	All		40	%
	-OS	V_{OUT} = 0.0 V to -200 mV, T_A = +25°C				40	

1/ Unless otherwise specified, V+ = +15 V, V- = -15 V, R_S = 100Ω, R_L = 500 kΩ, C_L = 50 pF, V_{OUT} = 0.0 V, and A_V = 10 V/V.

2/ Offset adjustment range is V_{IO} (measured) 1.0 mV minimum referred to output. This test is for functionality only to assure adjustment through 0.0 V.

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

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

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

6/ Rise and fall times measured between 10-percent and 90-percent point.

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.

Device type	01	
Case outlines	G and P	2
Terminal number	Terminal symbol	
1	BALANCE	NC
2	INPUT-	BALANCE
3	INPUT+	NC
4	V-	NC
5	BALANCE	INPUT-
6	OUTPUT	NC
7	V+	INPUT+
8	COMP	NC
9	---	NC
10	---	V-
11	---	NC
12	---	BALANCE
13	---	NC
14	---	NC
15	---	OUTPUT
16	---	NC
17	---	V+
18	---	NC
19	---	NC
20	---	COMP

NC = No connection.

FIGURE 1. Terminal connections.

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°C, minimum.

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, 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°C, minimum.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

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 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.

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, 6, 9**
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.
** Subgroup 9, if not tested, shall be guaranteed to the limits specified in table I herein.

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.

STANDARDIZED MILITARY DRAWING SOURCE APPROVAL BULLETIN

DATE: 91-10-02

Approved sources of supply for SMD 5962-89631 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 1/
5962-8963101GX	34371	HA2-5111/883
5962-8963101PX	34371	HA7-5111/883
5962-89631012X	34371	HA4-5111/883

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

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