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

REV																			
SHEET																			
REV																			
SHEET																			

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
92-03-13

REVISION LEVEL

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, OPERATIONAL AMPLIFIER, WIDEBAND, FAST SETTLING, MONOLITHIC SILICON

SIZE	CAGE CODE	5962-87784
A	67268	

SHEET 1 OF 10

DESC FORM 193
JUL 91

5962-E332

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:

5962-87784	01	C	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish per MIL-M-38510

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-5190	Fast settling wideband operational amplifier
02	EL-2190	Fast settling wideband 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
C	D-1 (14-lead, .785" x .310" x .200"), dual-in-line package
X	See figure 1 (12-lead, .615" x .150"), can 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	6.0 V dc
Voltage at either input terminal	+V to -V
Peak output current (< 10% duty cycle)	50 mA
Storage temperature range	-65°C to +150°C
Maximum power dissipation (P_D) 1/:	
Case C	1.02 W
Case X	1.45 W
Case 2	1.06 W
Lead temperature (soldering, 10 seconds)	+275°C
Thermal resistance, junction-to-case (Θ_{JC}):	
Cases C, 2	See MIL-M-38510, appendix C
Case X	82°C/W
Thermal resistance, junction-to-ambient (Θ_{JA}):	
Case C	98°C/W
Case X	69°C/W
Case 2	95°C/W
Junction temperature (T_J)	+175°C

1/ Derate linearly above T_A = +75°C as follows:
Case C: 10.2°C/W
Case X: 14.5°C/W
Case 2: 10.6°C/W

1.4 Recommended operating conditions.

Positive supply voltage range (+V)	+12 V dc to +15 V dc
Negative supply voltage range (-V)	-12 V dc to -15 V dc
Common mode input voltage (V_{CM})	$\leq \lvert(+V - (-V))/2\rvert$
Load resistance (R_L)	$\geq 200\Omega$
Ambient operating temperature range (T_A)	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specification, standard, 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, 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 2.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and 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	Limits 2/ Min	Limits 2/ Max	Unit
Input offset voltage	V_{IO}	V_{CM} = 0 V, $+R_S$ = 100Ω, $-R_S$ = 100Ω	Device type 01	1		±5	mV
				2, 3		±10	
			Device type 02	1		±2	mV
				2, 3		±6	
Input bias current	$+I_{IB}$	V_{CM} = 0 V, $+R_S$ = 1.1 kΩ, $-R_S$ = 100Ω		1		±15	µA
				2, 3		±20	
	$-I_{IB}$	V_{CM} = 0 V, $+R_S$ = 100Ω, $-R_S$ = 1.1 kΩ		1		±15	µA
				2, 3		±20	
Input offset current	I_{IO}	V_{CM} = 0 V, $+R_S$ = 1.1 kΩ, $-R_S$ = 1.1 kΩ		1		±4.0	µA
				2, 3		±6.0	
Common mode input voltage range	$+V_{CM}$	+V = 10 V, -V = -20 V		1, 2, 3	5.0		V
	$-V_{CM}$	+V = 20 V, -V = -10 V		1, 2, 3	-5.0		V
Large signal voltage gain	$+A_{VOL}$	V_{OUT} = 0 V and 5.0 V, R_L = 200Ω		1	15		kV/V
				2, 3	5.0		
	$-A_{VOL}$	V_{OUT} = 0 V and -5.0 V, R_L = 200Ω		1	15		kV/V
				2, 3	5.0		

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

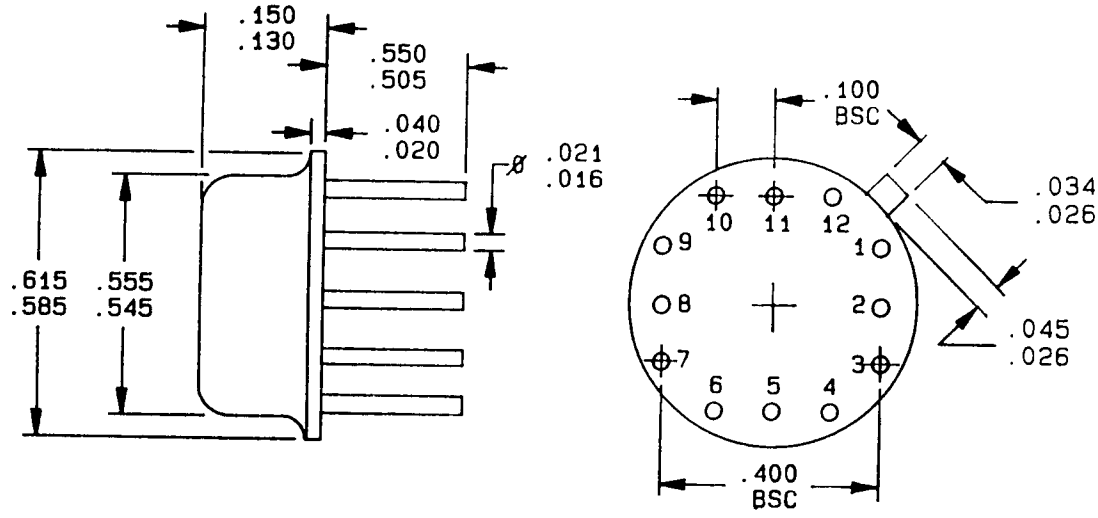
Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Group A subgroups	Limits 2/ Min	Limits 2/ Max	Unit
Common mode rejection ratio	+CMRR	ΔV_{CM} = 5.0 V, +V = 10 V, -V = -20 V, V_{OUT} = -5.0 V		1, 2, 3	74		dB
	-CMRR	ΔV_{CM} = -5.0 V, +V = 20 V, -V = -10 V, V_{OUT} = 5.0 V		1, 2, 3	74		dB
Output current	$+I_{OUT}$	$V_{OUT} \ge$ -5.0 V, T_A = +25°C		1	25		mA
	$-I_{OUT}$	$V_{OUT} \ge$ 5.0 V, T_A = +25°C		1	-25		mA
Output voltage swing	$+V_{OUT}$	R_L = 200Ω		1, 2, 3	5.0		V
	$-V_{OUT}$	R_L = 200Ω		1, 2, 3	-5.0		V
Quiescent power supply current	$+I_{CC}$	V_{OUT} = 0 V, I_{OUT} = 0 mA	Device type 01	1, 2, 3		25	mA
			Device type 02	1, 2, 3		17	mA
	$-I_{CC}$	V_{OUT} = 0 V, I_{OUT} = 0 mA	Device type 01	1, 2, 3		-25	mA
			Device type 02	1, 2, 3		-17	mA
Power supply rejection ratio	+PSRR	+V = 10 V and 20 V, -V = -15 V		1, 2, 3	70		dB
	-PSRR	-V = -10 V and -20 V, +V = +15 V		1, 2, 3	70		dB
Slew rate	+SR	V_{OUT} = -5.0 V to +5.0 V, R_L = 200Ω, A_V = +5 V/V		7	160		V/μs
				8 3/	100		
	-SR	V_{OUT} = +5.0 V to -5.0 V, R_L = 200Ω, A_V = +5 V/V		7	160		V/μs
				8 3/	100		

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	Limits 2/ Min	Limits 2/ Max	Unit
Gain bandwidth product 3/ 4/	GBWP	$V_{OUT} \le 200$ mV, $f_o = 100$ kHz, $R_L = 1$ kΩ, $T_A = +25°C$	4	150		MHz
		$V_{OUT} \le 200$ mV, $f_o = 1.0$ MHz $R_L = 1$ kΩ, $T_A = +25°C$	4	150		MHz
Full power bandwidth 3/ 5/	FPBW	$V_{PK} = 5.0$ V, $R_L = 200Ω$	4	5.0		MHz
			5, 6	4.0		
Closed loop stable gain 3/	CLSG	$R_L = 200Ω$, $C_L \le 10$ pF	4, 5, 6	5.0		V/V
Rise time 3/ 6/	t_r	$V_{OUT} = 0$ V to +200 mV, $R_L = 200Ω$ $A_V = +5$ V/V	9		18	ns
			10, 11		20	
Fall time 3/ 6/	t_f	$V_{OUT} = 0$ V to -200 mV, $R_L = 200Ω$ $A_V = +5$ V/V	9		18	ns
			10, 11		20	
Overshoot 3/	+OS	$V_{OUT} = 0$ V to +200 mV, $R_L = 200Ω$ $A_V = +5$ V/V	9,10,11		40	%
	-OS	$V_{OUT} = 0$ V to -200 mV, $R_L = 200Ω$ $A_V = +5$ V/V	9,10,11		40	%
Output resistance 3/	R_{OUT}	Open loop, $T_A = +25°C$ $A_V = +5$ V/V	4		60	Ω
Quiescent power consumption 7/	P_C	$V_{OUT} = 0$ V, $I_{OUT} = 0$ mA, Device type 01	1, 2, 3		750	mW
		Device type 02	1, 2, 3		510	
Settling time 3/	t_s	$R_L = 200Ω$, 5 V step to 0.01%	9		200	ns

1/ +V = +15 V, -V = -15 V, $R_S = 100Ω$, $R_L = 100$ kΩ, $C_L \le 10$ pF, $V_{OUT} = 0$ V, and $A_V = +5$ V/V unless otherwise specified.
2/ The limiting term "min" (minimum) and "max" (maximum) shall be considered to apply to magnitudes only. Negative current shall be defined as conventional current flow out of a device terminal.
3/ If not tested, shall be guaranteed to the limits specified in table I.
4/ Gain bandwidth product measured using open loop frequency response.
5/ Full power bandwidth = $\frac{SR}{2\pi V_{pk}}$.
6/ Rise and fall times measured between 10% and 90% point.
7/ Quiescent power consumption based on quiescent supply current test maximum (no load on outputs).



Inches	mm
.016	.41
.020	.51
.021	.53
.026	.67
.034	.86
.040	1.02
.045	1.14
.100	2.54
.130	3.30
.150	3.81
.400	10.16
.505	12.83
.545	13.84
.550	13.97
.555	14.10
.585	14.86
.615	15.62

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Pin numbers are for reference only and do not appear on package.
4. All leads - increase maximum limit by .003 (0.08 mm) when lead finish A or B is applied.

FIGURE 1. Case outline X.

Device types	01, 02		
Case outlines	C	X	2
Terminal number	Terminal symbol		
1	NC	NC	NC
2	NC	NC	NC
3	NC	NC	NC
4	-INPUT	NC	NC
5	+INPUT	-INPUT	NC
6	-V	+INPUT	-INPUT
7	NC	NC	NC
8	NC	NC	+INPUT
9	NC	NC	-V
10	OUTPUT	-V	NC
11	+V	OUTPUT	NC
12	NC	+V	NC
13	NC	---	NC
14	NC	---	OUTPUT
15	---	---	NC
16	---	---	+V
17	---	---	NC
18	---	---	NC
19	---	---	NC
20	---	---	NC

NC = No connections.

FIGURE 2. Terminal connections.

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

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.

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, 7
Group A test requirements (method 5005)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10**, 11**
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.
** Subgroups 10 and 11 are guaranteed if not tested.

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.

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.