REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add generic part number HA-2841 as device type 03. Add case outline C to device type 01. Make changes to 1.2.1, 1.3, TABLE I, and FIGURE 2.	94-05-16	M. A. FRYE

REV																			
SHEET																			
REV																			
SHEET																			

REV STATUS OF SHEETS	REV	A	A	A	A	A	A	A	A	A	A	A	A	A	
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	

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

PREPARED BY
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DRAWING APPROVAL DATE
90-06-28

REVISION LEVEL
A

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

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

SIZE	CAGE CODE	5962-87785
A	67268	

SHEET 1 OF 13

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-2541	Fast settling, unity gain stable, wideband operational amplifier
02	EL-2041	Fast settling, unity gain stable, wideband operational amplifier
03	HA-2841	Fast settling, unity gain stable, video operational amplifier

1.2.2 Case outline(s). The case outline(s) shall be as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
C	GDIP1-T14 or CDIP2-T14	14	Dual-in-line
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
X	See figure 1	12	Can
2	CQCC1-N20	20	Square leadless chip carrier

1.2.3 Lead finish. The lead finish shall be as specified in MIL-STD-883 (see 3.1 herein). Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

1.3 Absolute maximum ratings.

Voltage between +V and -V terminals	35 V dc
Differential input voltage (V_{IN})	±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)	2.0 W 1/
Lead temperature (soldering, 10 seconds):	
Device types 01 and 02	+275°C
Device type 03	+300°C
Thermal resistance, junction-to-case (θ_{JC}):	
Cases C, P, and 2	See MIL-STD-1835
Case X	82°C/W
Thermal resistance, junction-to-ambient (θ_{JA})	50°C/W
Junction temperature (T_J)	+175°C

1/ Derate linearly above T_A = +75°C at 20 mW/°C.

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})	< (+V - -V)/2
Load resistance (R_L)	1.0 kΩ
Ambient operating temperature range (T_A)	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and bulletin. Unless otherwise specified, the following specification, standards, 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-I-38535 - Integrated Circuits (Microcircuits) Manufacturing, General Specification for.

STANDARDS

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.
MIL-STD-1835 - Microcircuit Case Outlines.

BULLETIN

MILITARY

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

(Copies of the specification, standards, 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. Product built to this drawing that is produced by a Qualified Manufacturer Listing (QML) certified and qualified manufacturer or a manufacturer who has been granted transitional certification to MIL-I-38535 may be processed as QML product in accordance with the manufacturers approved program plan and qualifying activity approval in accordance with MIL-I-38535. This QML flow as documented in the Quality Management (QM) plan may make modifications to the requirements herein. These modifications shall not affect form, fit, or function of the device. These modifications shall not affect the PIN as described herein. A "Q" or "QML" certification mark in accordance with MIL-I-38535 is required to identify when the QML flow option is used.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-STD-883 (see 3.1 herein) and herein.

3.2.1 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 herein and figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

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		Unit
					Min	Max	
Input offset voltage	V_{IO}	V_{CM} = 0 V	1	01,02	-2.0	+2.0	mV
				03	-4.0	+4.0	
			2,3	01	-6.0	+6.0	
				02	-10.0	+10.0	
				03	-8.0	+8.0	
Input bias current	$+I_{IB}$	V_{CM} = 0 V, $+R_S$ = 1.1 kΩ, $-R_S$ = 100Ω	1	01	-35	+35	μA
			2,3		-50	+50	
			1	02	-15	+15	
			2,3		-20	+20	
			1	03	-10	+10	
			2,3		-20	+20	
	$-I_{IB}$	V_{CM} = 0 V, $+R_S$ = 100Ω, $-R_S$ = 1.1 kΩ	1	01	-35	+35	
			2,3		-50	+50	
			1	02	-15	+15	
			2,3		-20	+20	
			1	03	-10	+10	
			2,3		-20	+20	
Input offset current	I_{IO}	V_{CM} = 0 V, $+R_S$ = 1.1 kΩ, $-R_S$ = 1.1 kΩ	1	01	-7.0	+7.0	μA
			2,3		-9.0	+9.0	
			1	02	-4.0	+4.0	
			2,3		-6.0	+6.0	
			1	03	-1.0	+1.0	
			2,3		-2.0	+2.0	

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	
Common mode input voltage range	$+V_{CM}$	+V = 5.0 V, -V = -25 V	1,2,3	01,03	10		V
				02	8		
	$-V_{CM}$	+V = 25 V, -V = -5.0 V	1,2,3	01,03	-10		
				02	-8		
Large signal voltage gain	$+A_{VOL}$	V_{OUT} = 0 V and 10 V, R_L = 1.0 kΩ	4	01,03	10		kV/V
				02	7		
			5,6	All	5.0		
	$-A_{VOL}$	V_{OUT} = 0 V and -10 V, R_L = 1.0 kΩ	4	01,03	10		
				02	7		
			5,6	All	5.0		
Common mode rejection ratio	+CMRR	ΔV_{CM} = 10 V, +V = 5.0 V, -V = -25 V, V_{OUT} = -10 V	1,2,3	01,02	70		dB
			1	03	86		
			2,3		80		
	-CMRR	ΔV_{CM} = -10 V, +V = 25 V, -V = -5.0 V, V_{OUT} = 10 V	1,2,3	01,02	70		
			1	03	86		
			2,3		80		
Output current	$+I_{OUT}$	V_{OUT} = -10 V	1	01	10		mA
				02	25		
		V_{OUT} = -5 V 2/	1	03	25		
			2,3		15		
	$-I_{OUT}$	V_{OUT} = 10 V	1	01	-10		
				02	-25		
		V_{OUT} = +5 V 2/	1	03	-25		
			2,3		-15		

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 swing	$+V_{OUT}$	R_L = 1.0 kΩ	1,2,3	01,03	10		V
				02	11		
	$-V_{OUT}$	R_L = 1.0 kΩ	1,2,3	01,03	-10		
				02	-11		
Quiescent power supply current	$+I_{CC}$	V_{OUT} = 0 V, I_{OUT} = 0 mA	1,2,3	01		39	mA
				02		17	
				03		11	
	$+I_{CC}$	V_{OUT} = 0 V, I_{OUT} = 0 mA	1,2,3	01		-39	
				02		-17	
				03		-11	
Power supply rejection ratio	+PSRR	+V = 5.0 V and 15 V, -V = -15 V	1,2,3	01	70		dB
				02	60		
		+V = 10 V and 20 V, -V = -15 V		03	70		
	-PSRR	-V = -5.0 V and -15 V, +V = +15 V	1,2,3	01	70		
				02	60		
		-V = -10 V and -20 V, +V = +15 V		03	70		
Offset voltage adjustment	$+V_{IO}$ (adj)	T_A = +25°C 3/	1	All	V_{IO} -1.0		mV
	$-V_{IO}$ (adj)	T_A = +25°C 3/	1	All	V_{IO} +1.0		

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	
Differential input 4/ resistance	R_{IN}	V_{CM} = 0 V, T_A = +25°C	4	01,02	40		kΩ
Slew rate 4/	+SR	V_{OUT} = -3.0 V to 3.0 V, R_L = 1 kΩ, A_V = 1 V/V	7	01	200		V/μs
			8		150		
	-SR	V_{OUT} = 3.0 V to -3.0 V, R_L = 1 kΩ, A_V = 1 V/V	7		200		
			8		150		
	+SR	V_{OUT} = -3.0 V to 3.0 V, R_L = 1 kΩ, A_V = 1 V/V	7	02	180		
			8		130		
	-SR	V_{OUT} = 3.0 V to -3.0 V, R_L = 1 kΩ, A_V = 1 V/V	7		180		
			8		130		
	+SR	V_{OUT} = -3.0 V to 3.0 V, R_L = 1 kΩ, A_V = 1 V/V	7	03	200		
			8		187		
	-SR	V_{OUT} = 3.0 V to -3.0 V, R_L = 1 kΩ, A_V = 1 V/V	7		200		
			8		187		
Gain bandwidth product 4/	GBWP	V_{OUT} = ±100 mV, T_A = +25°C, R_L = 1 kΩ, f_1 = 100 kHz, f_2 = 10 MHz	4	All	38		MHz
		V_{OUT} = ±200 mV, T_A = +25°C, R_L = 1 kΩ, f_O = 100 kHz	4	03	42		
		V_{OUT} = ±200 mV, T_A = +25°C, R_L = 1 kΩ, f_O = 10 MHz			44		
Full power bandwidth 4/ 5/	FPBW	V_{PK} = 10 V, R_L = 1 kΩ	4	01	3.0		MHz
			5,6		2.4		
			4	02	2.8		
			5,6		2.0		

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	
Full power bandwidth 4/ 5/	FPBW	V_{PK} = 10 V, R_L = 1 kΩ	4	03	3.1		MHz
			5,6		3.0		
Closed loop stable gain 4/	CLSG	R_L = 1.0 kΩ, $C_L \le$ 10 pF	4,5,6	All	1.0		V/V
Rise time 4/ 6/	t_r	V_{OUT} = 0 V to +200 mV	9,10,11	01,02		10	ns
				03		6	
Fall time 4/ 6/	t_f	V_{OUT} = 0 V to -200 mV	9,10,11	01,02		10	ns
			9	03		5	
			10,11			6	
Settling time 4/	t_s	A_V = -1 V/V, 10 V step to 0.1%, T_A = +25°C	9	01		150	ns
		A_V = -1 V/V, 10 V step to 0.01%, T_A = +25°C				300	
		A_V = -1 V/V, 10 V step to 0.05%, T_A = +25°C	9	02		350	
Overshoot 4/	+OS	V_{OUT} = 0 V to +200 mV	9,10,11	01,02		40	%
			9	03		60	
			10,11			65	
	-OS	V_{OUT} = 0 V to -200 mV	9,10,11	01,02		40	
			9	03		60	
			10,11			70	
Output resistance 4/	R_{OUT}	Open loop	4	01,02		25	Ω

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	
Quiescent power 7/ consumption	P_C	V_{OUT} = 0 V, I_{OUT} = 0 mA	1,2,3	01		1.17	W
				02		.51	

1/ Unless otherwise specified, for dc tests, R_S = 100Ω, R_L = 100 kΩ, and V_{OUT} = 0 V. Unless otherwise specified, for ac tests, A_V = ±1 V/V and R_L = 1 kΩ.

2/ Device type 03 is designed to handle I_{OUT} = 10 mA at a 50 % duty cycle for T_J = +175°C. For I_{OUT} = 15 mA and T_J = +175°C, a duty cycle of less than or equal to 33% is required.

3/ 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 V.

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

5/ Full power bandwidth = $SR/(2 \times \pi \times V_{PK})$.

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

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

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.

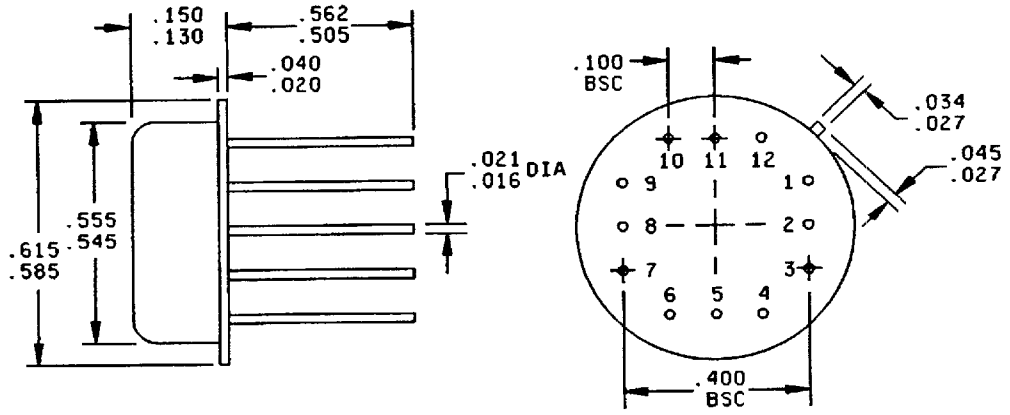
3.5 Marking. Marking shall be in accordance with MIL-STD-883 (see 3.1 herein). The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in MIL-BUL-103 (see 6.6 herein).

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-EC 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-EC 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.



Inches	mm	Inches	mm
.016	0.41	.130	3.30
.020	0.51	.150	3.81
.021	0.53	.400	10.16
.027	0.69	.505	12.83
.034	0.86	.545	13.84
.040	1.02	.555	14.10
.045	1.14	.562	14.27
.100	2.54	.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.

FIGURE 1. Case outline X.

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

NC = No connection.

FIGURE 2. Terminal connections.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with 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. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

(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.

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. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

(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-STD-883 (see 3.1 herein).

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (in accordance with 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)	1,2,3,4,5,6,7**, 8**,9**,10**,11**
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.
** Subgroups 7, 8, 9, 10, and 11, if not tested, are guaranteed to the limits specified in table I.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

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-973 using DD Form 1692, Engineering Change Proposal .

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-EC, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444-5270, or telephone (513) 296-5377.

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-EC.