

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add device type 03, 04, 05, and 06. Add outline letter D. Make changes to 1.2.1, 1.2.2, 1.3, 1.4, table I, figure 1, and throughout.	92-12-09	M. A. Frye

THE ORIGINAL FIRST PAGE OF THIS DRAWING HAS BEEN REPLACED.

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

PMIC N/A	PREPARED BY Rick C. Officer	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444		
STANDARDIZED MILITARY DRAWING THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE AMSC N/A	CHECKED BY Charles E. Besore	MICROCIRCUIT, LINEAR, QUAD, PRECISION OPERATIONAL AMPLIFIER, MONOLITHIC SILICON		
	APPROVED BY Michael A. Frye			
	DRAWING APPROVAL DATE 90-05-05	SIZE A	CAGE CODE 67268	5962-90604
	REVISION LEVEL A	SHEET 1	OF 11	1

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:

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	TLC274	Precision quad operational amplifier
02	TLC279	Precision quad operational amplifier (see V _{IO} test, table I)
03	TLC27M4	Precision quad operational amplifier, medium power
04	TLC27M9	Precision quad operational amplifier, medium power (see V _{IO} test, table I)
05	TLC27L4	Precision quad operational amplifier, low power
06	TLC27L9	Precision quad operational amplifier, low power (see V _{IO} test, table I)

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

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
C	GDIP1-T14 or CDIP2-T14	14	Dual-in-Line
D	GDFP1-F14 or CDFP2-F14	14	Flat pack
2	CQCC1-N20	20	Square leadless chip carrier

1.2.3 Lead finish. The lead finish shall be as specified in MIL-M-38510. 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.

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1.3 Absolute maximum ratings.

Supply voltage (V_{DD})	18 V dc
Differential input voltage (V_{ID})	$\pm V_{DD}$
Input voltage range (V_I)	-0.3 V dc to V_{DD}
Input current (any input) (I_I)	± 5 mA
Output current (each output) (I_O)	± 30 mA
Total current into V_{DD} terminal	45 mA
Total current out of ground terminal	45 mA
Output short-circuit duration ^{1/}	Unlimited
Power dissipation (P_D):	
Cases C and 2	1375 mW at $T_A = +25^\circ\text{C}$ ^{2/}
Case D	996 mW at $T_A = +25^\circ\text{C}$ ^{2/}
Storage temperature range	-65°C to $+150^\circ\text{C}$
Lead temperature (soldering, 60 second):	$+260^\circ\text{C}$
Thermal resistance, junction-to-case (Θ_{JC})	See MIL-STD-1835
Junction Temperature (T_J)	$+150^\circ\text{C}$

1.4 Recommended operating conditions.

Supply voltage range (V_{DD})	4 V dc to 16 V dc
Common-mode input voltage:	
$V_{DD} = 5$ V	+3.5 V dc maximum
$V_{DD} = 10$ V	+8.5 V dc maximum
Ambient operating temperature range (T_A)	-55°C to $+125^\circ\text{C}$
Unity gain bandwidth: ($T_A = +25^\circ\text{C}$)	
$V_{DD} = 5$ V (device types 01 and 02)	1.5 MHz
$V_{DD} = 10$ V (device types 01 and 02)	2.0 MHz
$V_{DD} = 5$ V (device types 03 and 04)	525 kHz
$V_{DD} = 10$ V (device types 03 and 04)	635 kHz
$V_{DD} = 5$ V (device types 05 and 06)	85 kHz
$V_{DD} = 10$ V (device types 05 and 06)	110 kHz

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-M-38510 - Microcircuits, General Specification for.

STANDARDS

MILITARY

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

^{1/} Short circuit may be to ground or either power supply. Rating applied to $T_A = +25^\circ\text{C}$.
^{2/} For case outlines C and 2, derate at 12 mW/ $^\circ\text{C}$ above $T_A = +25^\circ\text{C}$. For case outline D, derate at 8 mW/ $^\circ\text{C}$ above $T_A = +25^\circ\text{C}$.

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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.

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.

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.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device type	V _{DD}	Group A subgroups	Limits ^{1/}		Unit				
						Min	Max					
Input offset voltage _{2/ 3/}	V _{IO}	V _O = 1.4 V, V _{IC} = 0 V, R _S = 50Ω	01, 03, 05	5 V	1	10	mV					
					2,3	12						
				10 V	1	10						
					2,3	12						
				02	5 V	1,2,3	3.75					
					10 V		4.3					
			04, 06	5 V	4	900	μV					
					2,3	3750						
				10 V	1	1200						
					2,3	4300						
				Input offset current	I _{IO}	V _O = 2.5 V, V _{IC} = 2.5 V		ALL	5 V	1	.100	nA
										2	15	
V _O = 5 V, V _{IC} = 5 V	ALL	10 V	1			.100						
			2			15						
Input bias current	I _{IB}	V _O = 2.5 V, V _{IC} = 2.5 V	ALL			5 V	1	.150				
							2	35				
		V _O = 5 V, V _{IC} = 5 V	ALL	10 V	1	.150						
					2	35						
		Common-mode input voltage range _{4/}	V _{ICR}		ALL	5 V	1	0 to 4	V			
							2,3	0 to 3.5				
10 V	1					0 to 9						
	2,3					0 to 8.5						
High level output voltage _{3/}	V _{OH}					V _{ID} = 100 mV	ALL	5 V	1	3.2	V	
									2,3	3		
		10 V	1	8								
			2,3	7.8								

See footnote at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device type	V _{DD}	Group A subgroups	Limits ^{1/}		Unit		
						Min	Max			
Low level output voltage	V _{OL}	V _{ID} = -100 mV, I _{OL} = 0 mA	ALL	5 V	1,2,3		50	mV		
				10 V	1,2,3		50			
Large-signal differential voltage gain ^{4/}	A _{VD}	V _O = 0.25 V to 2 V	01,02	5 V	4	5		V/mV		
					5,6	3.5				
		V _O = 1 V to 6 V	01,02	10 V	4	10				
					5,6	7				
		V _O = 0.25 V to 2 V	03,04	5 V	4	25				
					5,6	15				
		V _O = 1 V to 6 V	03,04	10 V	4	25				
					5,6	15				
		V _O = 0.25 V to 2 V	05,06	5 V	4	50				
					5,6	25				
		V _O = 1 V to 6 V	05,06	10 V	4	50				
					5,6	25				
Common-mode rejection ratio	CMRR	V _{IC} = V _{ICR} minimum	ALL	5 V	1	65		dB		
					2,3	60				
					10 V	1	65			
						2,3	60			
Power supply rejection ratio	PSRR	V _{DD} = 5 V to 10 V, V _O = 1.4 V	01,02	5 V and 10 V	1	65		dB		
					2,3	60				
					03,04, 05,06	5 V and 10 V	1		70	
							2,3		60	

See footnote at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device type	V _{DD}	Group A subgroups	Limits 1/		Unit
						Min	Max	
Supply current (four amplifiers)	I _{DD}	V _O = 2.5 V, V _{IC} = 2.5 V, No load	01,02	5 V	1		6.4	mA
					2		4.4	
					3		10	
		V _O = 5 V, V _{IC} = 5 V, No load	01,02	10 V	1		8	mA
					2		5.6	
					3		12	
		V _O = 2.5 V, V _{IC} = 2.5 V, No load	03,04	5 V	1		1120	μA
					2		720	
					3		1760	
	V _O = 5 V, V _{IC} = 5 V, No load	03,04	10 V	1		1200		
				2		960		
				3		2000		
	V _O = 2.5 V, V _{IC} = 2.5 V, No load	05,06	5 V	1		68		
				2		48		
				3		120		
	V _O = 5 V, V _{IC} = 5 V, No load	05,06	10 V	1		92		
				2		60		
				3		192		

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device type	V _{DD}	Group A subgroups	Limits		Unit
						Min	Max	
Slew rate at unity gain	SR	R _L = 10 kΩ, C _L = 100 pF, V _{Ipp} = 5.5 V, Measured at 1.6 V and 4.3 V	01,02	10 V	1	2.8		V/μs
					2	1.68		
					3	3.8		
		R _L = 100 kΩ, C _L = 20 pF, V _{Ipp} = 5.5 V, Measured at 1.6 V and 4.3 V	03,04	10 V	1	.25		
					2	.15		
					3	.35		
		R _L = 1 MΩ, C _L = 20 pF, V _{Ipp} = 5.5 V, Measured at 1.6 V and 4.3 V	05,06	10 V	1	.02		
					2	.01		
					3	.03		

- 1/ The limiting terms "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.
- 2/ The difference between device types 01, 03, 05 and 02, 04, 06 is a lower input offset voltage for device types 02, 04, and 06.
- 3/ R_L = 10 kΩ for device types 01 and 02, R_L = 100 kΩ for device types 03 and 04, and R_L = 1 MΩ for device types 05 and 06.
- 4/ This range also applies to each input individually.

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Device types	01, 02, 03, 04, 05, and 06	
Case outlines	C and D	2
Terminal number	Terminal symbol	
1	OUTPUT 1	NC
2	INPUT- 1	OUTPUT 1
3	INPUT+ 1	INPUT- 1
4	V _{DD}	INPUT+ 1
5	INPUT+ 2	NC
6	INPUT- 2	V _{DD}
7	OUTPUT 2	NC
8	OUTPUT 3	INPUT+ 2
9	INPUT- 3	INPUT- 2
10	INPUT+ 3	OUTPUT 2
11	GND	NC
12	INPUT+ 4	OUTPUT 3
13	INPUT- 4	INPUT- 3
14	OUTPUT 4	INPUT+ 3
15	---	NC
16	---	GND
17	---	NC
18	---	INPUT+ 4
19	---	INPUT- 4
20	---	OUTPUT 4

NC = No connection

FIGURE 1. Terminal connections.

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

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

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TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (in accordance with method 5005, table I)
Interim electrical parameters (method 5004)	1
Final electrical test parameters (method 5004)	1*, 2, 3, 4
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.

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 original equipment manufacturer 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-EC, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444, 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.

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