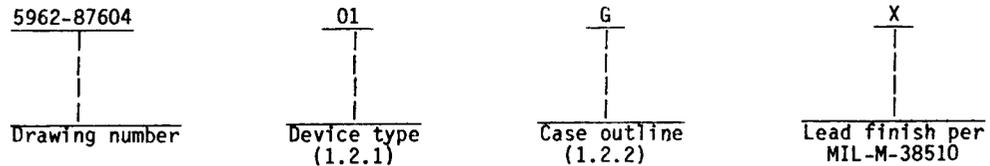




1. SCOPE

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 number. The complete part number shall be as shown in the following example:



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

Device type	Generic number	Circuit function
01	LM10	Operational amplifier and voltage reference

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
G	A-1 (8-lead, .370" x .185"), can package
P	D-4 (8-lead, .405" x .310" x .200") dual-in-line package

1.3 Absolute maximum ratings.

Supply voltage ( $V_S$ )	45 V dc
Differential input voltage	$\pm 40$ V dc <sup>1/</sup>
Power dissipation ( $P_D$ )	160 mW <sup>2/</sup>
Output short circuit duration	Indefinite
Storage temperature range	$-55^\circ\text{C}$ to $+150^\circ\text{C}$ <sup>3/</sup>
Lead temperature (soldering, 10 seconds)	$300^\circ\text{C}$
Junction temperature ( $T_J$ )	$150^\circ\text{C}$
Thermal resistance, junction-to-case ( $\theta_{JC}$ ):	
Cases G and P	See MIL-M-38510, appendix C
Thermal resistance, junction-to-ambient ( $\theta_{JA}$ ):	
Case G	$150^\circ\text{C/W}$
Case P	$100^\circ\text{C/W}$

1.4 Recommended operating conditions.

Ambient operating temperature range ( $T_A$ ) - - - - -  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$

- 1/ The input voltage can exceed the supply voltages provided that the voltage from the input to any other terminal does not exceed the maximum differential input voltage and excess dissipation is accounted for when  $V_{IN} < V_-$ .
- 2/ The maximum operating junction temperature is  $150^\circ\text{C}$  for device 01. At elevated temperatures, devices must be derated based on package thermal resistance.
- 3/ Internal thermal limiting prevents excessive heating that could result in sudden failure, but the IC can be subjected to accelerated stress with a shorted output and worst-case conditions.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>	5962-87604
	REVISION LEVEL B	SHEET 2

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 Drawing (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 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 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 part number listed in 1.2 herein. In addition, the manufacturer's part number may also be marked as listed in MIL-BUL-103 (see 6.6 herein).

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	<b>SIZE</b> <b>A</b>		5962-87604
		<b>REVISION LEVEL</b> <b>B</b>	<b>SHEET</b> <b>3</b>

DESC FORM 193A  
SEP 87

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

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C < T <sub>A</sub> < +125°C unless otherwise specified <sup>1/</sup>	Group A subgroups	Limits		Unit
				Min	Max	
Input offset voltage	V <sub>IO</sub>	I <sub>L</sub> = 0 mA	1		±2	mV
			2, 3		±3	
		V <sub>S</sub> = 1.2 V, I <sub>L</sub> = ±2 mA	1		±3	
		V <sub>S</sub> = 1.3 V, I <sub>L</sub> = ±2 mA	2, 3		±4	
		V <sub>S</sub> = 4 V, I <sub>L</sub> = ±20 mA	1		±3	
		V <sub>S</sub> = 4 V, I <sub>L</sub> = ±15 mA	2, 3		±4	
Input offset current	I <sub>IO</sub>	1.2 V < V <sub>S</sub> < 45 V, V <sub>-</sub> ≤ V <sub>CM</sub> ≤ V <sub>+</sub> - .85 V <sup>2/</sup>	1		±.7	nA
			2, 3		±1.5	
Input bias current	I <sub>IB</sub>	1.2 V < V <sub>S</sub> < 45 V, V <sub>-</sub> ≤ V <sub>CM</sub> ≤ V <sub>+</sub> - .85 V	1		20	
			2, 3		30	
Common mode rejection	CMRR	V <sub>S</sub> = 45 V, -20 V ≤ V <sub>CM</sub> ≤ 24.2 V	4	93		dB
			5, 6	87		
Supply voltage rejection	PSRR	V <sub>+</sub> = .85 V, -.35 V ≥ V <sub>-</sub> ≥ -44.2 V	4	90		
			5, 6	84		
			4	96		
			5, 6	90		

See footnotes at end of table.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL <b>B</b>	SHEET <b>4</b>

DESC FORM 193A  
SEP 87

U. S. GOVERNMENT PRINTING OFFICE: 1988-548-904

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>A</sub> < +125°C unless otherwise specified 1/		Group A subgroups	Limits		Unit
					Min	Max	
Line regulation	V <sub>RLINE</sub>	I <sub>REF</sub> = 1 mA	1.2 V ≤ V <sub>S</sub> ≤ 45 V	4	91		dB
			1.3 V ≤ V <sub>S</sub> ≤ 45 V	5, 6	85		
Load regulation	V <sub>RLOAD</sub>	0 ≤ I <sub>REF</sub> ≤ 1 mA	V <sub>S</sub> = 1.2 V	4	60		
			V <sub>S</sub> = 1.3 V	5, 6	57		
Supply current	I <sub>S</sub>			1		400	μA
				2, 3		500	
Large signal voltage gain	A <sub>v</sub>	V <sub>S</sub> = ±20 V, I <sub>OUT</sub> = 0 mA, V <sub>OUT</sub> = ±19.95 V		4	120		V/mV
				5, 6	80		
		V <sub>S</sub> = ±2 V	I <sub>OUT</sub> = ±20 mA	4	5		
		V <sub>OUT</sub> = ±1.4 V	I <sub>OUT</sub> = ±15 mA	5, 6	1.5		
		V <sub>S</sub> = ±2 V, I <sub>OUT</sub> = ±20 mA, V <sub>OUT</sub> = ±1.4 V		4	1.5		
V <sub>S</sub> = ±20 V, I <sub>OUT</sub> = 0 mA, V <sub>OUT</sub> = ±19.95 V		4	1.5				
V <sub>S</sub> = ±2 V, I <sub>OUT</sub> = ±20 mA, V <sub>OUT</sub> = ±1.4 V		5, 6	.5				
V <sub>S</sub> = ±20 V, I <sub>OUT</sub> = 0 mA, V <sub>OUT</sub> = ±19.95 V		4	1.5				
V <sub>S</sub> = ±2 V, I <sub>OUT</sub> = ±20 mA, V <sub>OUT</sub> = ±1.4 V		5, 6	.5				

See footnotes at end of table.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL A	SHEET 5

DESC FORM 193A  
SEP 87

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

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>A</sub> < +125°C unless otherwise specified <sup>1/</sup>	Group A subgroups	Limits		Unit	
				Min	Max		
Shunt gain <sup>3/</sup>	A <sub>VSH</sub>	1.2 V < V <sub>OUT</sub> < 6.1 V, 0.1 mA < I <sub>OUT</sub> < 2 mA, R <sub>L</sub> = 1.1 KΩ	4	14		V/mV	
		1.2 V < V <sub>OUT</sub> < 6.2 V, 0.1 mA < I <sub>OUT</sub> < 2 mA, R <sub>L</sub> = 1.1 KΩ	5, 6	6			
		1.4 V < V <sub>OUT</sub> < 6.4 V, 0.1 mA < I <sub>OUT</sub> < 15 mA, R <sub>L</sub> = 250Ω	4	8			
		1.4 V < V <sub>OUT</sub> < 6.4 V, 0.1 mA < I <sub>OUT</sub> < 10 mA, R <sub>L</sub> = 250Ω	5, 6	4			
Amplifier gain	A <sub>V</sub>	.2 V < V <sub>REF</sub> < 35 V, I <sub>REF</sub> = 1 mA	4	50		V/mV	
			5, 6	23			
Feedback sense voltage	V <sub>SENSE</sub>	.2 V < V <sub>REF</sub> < 35 V, 0 < I <sub>REF</sub> < 1 mA	1	195	205	mV	
			2, 3	194	206		
Feedback current	I <sub>SENSE</sub>		1		50	nA	
			2, 3		65		
Supply current change	ΔI <sub>S</sub>	.5 V < V <sub>OUT</sub> < 25 V	1.2 V < V <sub>S</sub> < 45 V	1		±100	μA
			1.3 V < V <sub>S</sub> < 45 V	2, 3		±150	
		V <sub>S</sub> = 5 V, 4.5 V < V <sub>OUT</sub> < 5 V T <sub>A</sub> = +25°C	1		±60		

1/ At T<sub>A</sub> = +25°C: (1.2 V < V<sub>S</sub> < 45 V, V<sub>-</sub> < V<sub>CM</sub> < V<sub>+</sub> - .85 V), and at T<sub>A</sub> = +125°C and -55°C: (1.3 V < V<sub>S</sub> < 45 V, V<sub>-</sub> < V<sub>CM</sub> < V<sub>+</sub> - 1 V), unless otherwise specified.

2/ For T<sub>J</sub> > 90°C, I<sub>OS</sub> may exceed 1.5 nA for V<sub>CM</sub> = V<sub>-</sub>. With T<sub>J</sub> = +125°C and V<sub>-</sub> < V<sub>CM</sub> < V<sub>+</sub> + 0.1 V, I<sub>OS</sub> < 5 nA.

3/ This defines operation in floating applications such as the bootstrapped regulator or two-wire transmitter. Output is connected to the V<sub>+</sub> terminal of the IC and input common mode is referred to V<sub>-</sub> (see typical applications). Effect of larger output voltage swings with higher load resistance can be accounted for by adding the positive-supply rejection error.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL B	SHEET 6

DESC FORM 193A  
SEP 87

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

Device type	01
Case outlines	G and P
Terminal number	Terminal symbol
1	Reference output
2	OP AMP input (-)
3	OP AMP input (+)
4	V-
5	Balance
6	OP AMP output
7	V+
8	Reference feedback

FIGURE 1. Terminal connections.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL B	SHEET 7

DESC FORM 193A  
SEP 87

☆ U. S. GOVERNMENT PRINTING OFFICE: 1988-550-547

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.

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.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL B	SHEET 8

DESC FORM 193A  
SEP 87

☆ U. S. GOVERNMENT PRINTING OFFICE: 1988-550-547

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

\* 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 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.

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL <b>B</b>	SHEET 9

6.6 Approved sources of supply. Approved sources of supply are listed in MIL-BUL-103. Additional sources will be added to MIL-BUL-103 as they become available. 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. The approved sources listed below are for information purposes only and are current only to the date of the last action of this document.

Military drawing part number	Vendor CAGE number	Vendor similar part number <u>1/</u>
5962-8760401GX	27014 64155	LM10H/883B LM10H/883
5962-8760401PX	64155	LM10J8/883

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>
27014	National Semiconductor Corporation 2900 Semiconductor Drive Santa Clara, CA 95051
64155	Linear Technology Corporation 1630 McCarthy Boulevard Milpitas, CA 95035-7487

<b>STANDARDIZED MILITARY DRAWING</b> DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE <b>A</b>		5962-87604
		REVISION LEVEL <b>B</b>	SHEET 10

DESC FORM 193A  
SEP 87

☆ U. S. GOVERNMENT PRINTING OFFICE: 1988-550-547

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