REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add vendor CAGE U4637 and 69210. Add case outlines T and U. Change test limits for line regulation, load regulation, standby current drain, and standby current drain with line tests. Change test conditions for line regulation and output voltage tests. Add temperature characterization for ripple rejection test. Change footnotes 1/, 2/, and 5/ in table I.	89-07-24	M. A. Frye
B	Add case outline 2. Change to test conditions in table I. Editorial changes throughout.	92-09-15	M. A. Frye
C	Add device type 02. Add case outline P. Technical and editorial changes throughout.	93-11-09	M. A. Frye
D	Add device type 03. Technical and editorial changes throughout.	94-04-04	M. A. Frye

THE ORIGINAL FIRST PAGE OF THIS DRAWING HAS BEEN REPLACED.

REV																			
SHEET																			
REV	D																		
SHEET	15																		

REV STATUS OF SHEETS	REV	D	D	D	D	D	D	D	D	D	D	D	D	D	D
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14

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
88-07-28

REVISION LEVEL
D

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, POSITIVE 5-VOLT REGULATOR, MONOLITHIC SILICON

SIZE	CAGE CODE	5962-87782
A	67268	

SHEET 1 OF 15

DESC FORM 193
JUL 91

5962-E153-94

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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:

5962-87782	01	P	X
Drawing number	Device type (see 1.2.1)	Case outline (see 1.2.2)	Lead finish (see 1.2.3)

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

Device type	Generic number	Circuit function
01	7805A (see terminal connections, case 2)	Positive regulator, 5-volt fixed
02	78M05M	Positive regulator, 5-volt fixed
03 1/	7805A (see terminal connections, case 2)	Positive regulator, 5-volt fixed

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
N	See figure 1	3	Surface mount
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
T	See figure 1	3	TO-257 flange mounted
U	See figure 1	3	TO-257 flange mounted with isolated tab
X	See figure 1	3	TO-39 can
Y	See figure 1	2	TO-3 can
Z	MBFM4-P2	2	TO-66 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.

Input voltage:
  Operating or output shorted to ground (device types 01, 02 and 03) 35 V dc
  Transient (device type 01 and 03) . . . . . 43 V dc 2/
Output current (I_O)
  Cases P, X and 2 (device type 01 and 03) . . . . . 0.5 A
  Cases Y, Z, T, N, and U (device type 01 and 03) . . . . . 1.0 A
Storage temperature range . . . . . -65°C to +150°C
Lead temperature (soldering, 10 seconds) . . . . . +300°C
Case temperature, case outline 2 (soldering, 10 seconds):
  Device type 02 . . . . . +260°C
Power dissipation (P_D):
  T_C = +25°C:
    Device type 01 and 03, cases X and 2 . . . . . 2 W
    Device type 01, case Y . . . . . 20 W
    Device type 01, cases Z, T, and U . . . . . 15 W

1/ Device type 03 has been added only to incorporate a different pinout for case outline 2.
2/ The 43-volt input rating refers to the ability of the regulator to withstand high line or transient conditions without damage. Since the regulator's maximum current capability is reduced, the output may fall out of regulation at high input voltages under nominal loading.

1.3 Absolute maximum ratings - Continued.

Power dissipation (P_D) - continued:	
T_A = +25°C:	
Device type 01 and 03, cases X and 2	1.0 W
Device type 01, case Y	4.3 W
Device type 01, cases Z, T, and U	3.0 W
Device type 01, case N	15.0 W
Device type 02, case P	1050 mW 3/
Device type 02, case 2	1375 mW 4/
Thermal resistance, junction-to-case (Θ_{JC}):	
Case P	See MIL-STD-1835
Case T and N	3.5°C/W
Case U	4.2°C/W
Case X	15°C/W
Case Y	3°C/W
Case Z	6°C/W
Case 2	See MIL-STD-1835
Thermal resistance, junction-to-ambient (Θ_{JA}):	
Cases N, X, and 2 (device type 01 and 03)	120°C/W
Case Y (device type 01)	29°C/W
Cases Z, U, and T (device type 01)	42°C/W
Case P (device type 02)	110°C/W
Case 2 (device type 02)	65°C/W
Junction temperature (T_J)	+150°C 5/

1.4 Recommended operating conditions.

Ambient operating temperature range (T_A)	-55°C to +125°C
Input voltage range (V_{IN})	+8 V dc to +25 V dc

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.)

3/ Derate at 8.4 mW/°C above T_A = +25°C.
4/ Derate at 11.0 mW/°C above T_A = +25°C.
5/ The device is protected by a thermal shutdown circuit which is designed to turn off the output transistor whenever the device junction temperature is in excess of +150°C.

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 outlines shall be in accordance with 1.2.2 herein and on figure 1.

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 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.

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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Device types	Group A subgroups	Limits Min	Limits Max	Unit
Output voltage	V_{OUT}	T_A = +25°C		01, 03	1	4.92	5.08	V
		T_A = +25°C		02	1	4.8	5.2	
		V_{IN} = 7.5 V to 20 V 2/		01, 03	1, 2, 3	4.85	5.15	
		V_{IN} = 8.0 V to 20 V 2/		02	1, 2, 3	4.7	5.3	
Ripple rejection 3/	$\frac{\Delta V_{IN}}{\Delta V_{OUT}}$	f = 120 Hz, V_{IN} = 8 V to 18 V		01, 03	4	68		dB
					5, 6 4/	60		
		f = 120 Hz, I_{OUT} = 100 mA, V_{IN} = 8 V to 18 V		02	4,5,6 4/	62		
		f = 120 Hz, I_{OUT} = 300 mA, V_{IN} = 8 V to 18 V			4 4/	62		
Line regulation	V_{RLINE}	$-55°C \le T_J \le +125°C$ 3/ 5/	V_{IN} = 7.5 V to 20 V	01, 03	1		5	mV
					2, 3		12	
			V_{IN} = 8.0 V to 12 V		1		4	
					2, 3		10	
		T_A = +25 °C	V_{IN} = 7.0 V to 25 V	02	1		50	
			V_{IN} = 8.0 V to 20 V				25	
Dropout voltage	V_{DO}	T_A = +25°C ΔV_{OUT} = 100 mV	I_O = 1.0 A 6/	01, 03	1		2.5	V
			I_O = 500 mA 7/					
		T_A = +25°C	I_O = 350 mA	02	1		2.5	V

See footnotes at end of table.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Device types	Group A subgroups	Limits Min	Limits Max	Unit
Load regulation	V_{RLOAD}	$-55°C \le T_J \le +125°C$ 3/	I_O = 5.0 mA 6/ to 1.5 A	01, 03	1		12	mV
			I_O = 5.0 mA 6/ to 1.0 A	01, 03	2, 3		25	
			I_O = 250 mA 6/ to 750 mA	01, 03	1		6	
					2, 3		15	
			I_O = 5 mA 7/ to 500 mA	01, 03	1		25	
					2, 3		50	
		T_A = +25 °C	I_O = 5 mA to 500 mA	02	1		50	
			I_O = 5 mA to 200 mA				25	
Standby current drain	I_{SCD}			01, 03	1		6.0	mA
					2, 3		6.5	
				02	1		7.0	
Standby current drain change with line	ΔI_{SCD} (line)	V_{IN} = 7.5 V to 20 V		01, 03	1, 2, 3		0.8	mA
		V_{IN} = 8.0 V to 25 V, I_O = 200 mA		02	1, 2, 3		0.8	
Standby current drain change with load	ΔI_{SCD} (load)	I_O = 5.0 mA to 1 A 6/		01, 03	1, 2, 3		0.5	mA
		I_O = 5.0 mA to 500 mA 7/						
		I_O = 5.0 mA to 350 mA		02	1, 2, 3		0.5	
Peak output current	$I_{O(pk)}$	T_A = +25°C	6/	01, 03	1	1.5	3.3	A
			7/			0.5	1.7	
			4/	02	1	0.5	1.4	

See footnotes at end of table.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Device types	Group A subgroups	Limits Min	Limits Max	Unit
Short circuit current 8/	I_{OS}	V_{IN} = 35 V	6/	01, 03	1		1.2	A
					2, 3		2.8	
			7/		1		0.7	
					2, 3		2.0	
				02	1		0.6	
Output noise voltage 4/	N_O	T_A = +25°C, f = 10 Hz to 100 kHz		01, 03	7		40	μV/V rms
				02	7		200	μV
Long term stability 4/	$\Delta V_{OUT}/\Delta t$	T_A = +25°C, t = 1,000 hrs		01, 03	7		75	mV
Temperature coefficient 4/	$\Delta T/\Delta t$	T_A = -55°C to +25°C, I_O = 5.0 mA		02	1, 3		-2	mV/°C
		T_A = +25°C to +125°C, I_O = 5.0 mA			1, 2		-1.5	

1/ Unless otherwise specified, for device type 01 and 03, V_{IN} = 10 V and I_O = 500 mA for cases Y, Z, T, N, and U, V_{IN} = 10 V and I_O = 100 mA for cases X and 2. Maximum test current for cases X and 2 is 500 mA. For device type 02, V_{IN} = 10 V and I_O = 350 mA for cases P and 2.

2/ For device type 01 and 03, cases P, X and 2: I_O = 5 mA to 500 mA, P ≤ 2 W. For device type 01, case Y: I_O = 5 mA to 1.0 A, P ≤ 20 W. For device type 01, cases Z, T, N, and U: I_O = 5 mA to 1.0 A, P ≤ 15 W. For device type 02, cases P and 2: I_O = 5 mA to 350 mA, P ≤ 1.3 W.

3/ All measurements except output noise voltage and ripple rejection are made at constant junction temperature and with low duty cycle.

4/ Guaranteed, if not tested, to the limits specified.

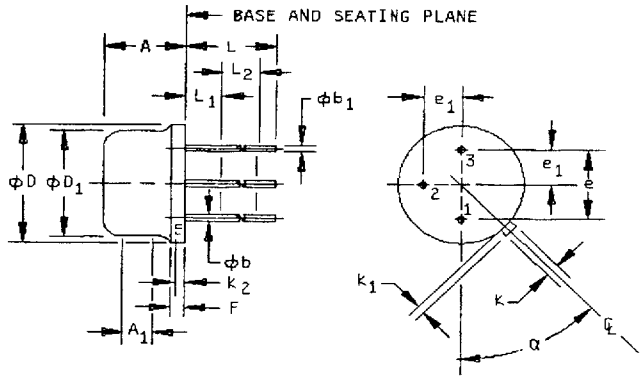
5/ Minimum load current for full line regulation is 5.0 mA.

6/ For cases Y, Z, T, N, and U only.

7/ For cases X and 2 only.

8/ Short circuit protection is only assured up to V_{IN} = 35 V.

Case outline X

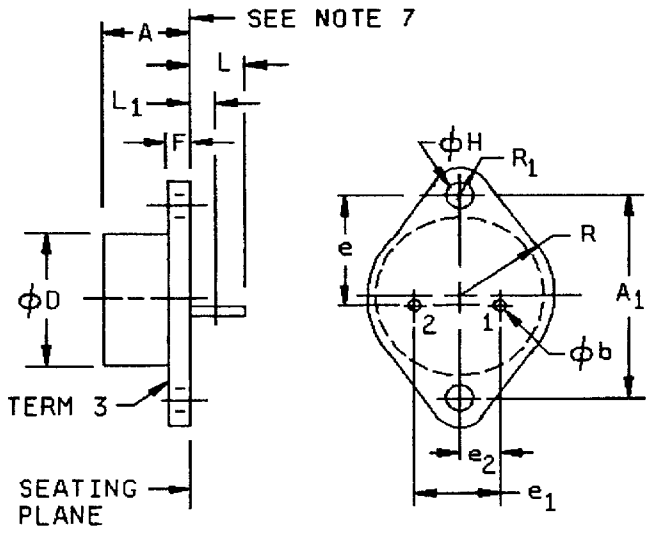


Ltr	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A	.165	.185	4.19	4.70	
ϕb	.016	.019	0.41	0.48	2
$\phi b1$	.016	.021	0.41	0.53	2
ϕD	.335	.370	8.51	9.40	
ϕD_1	.305	.335	7.75	8.51	
e	.200 T.P.		5.08 T.P.		4
e_1	.100 T.P.		2.54 T.P.		4
F		.050		1.27	
k	.028	.034	0.71	0.86	
k_1	.029	.045	0.74	1.14	3
k_2	.009	.041	0.23	1.04	
L	.500		12.70		
L_1		.050		1.27	
L_2	.250		6.35		
α	45° T.P.		45° T.P.		

NOTES:
1. The US government preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.
2. (All leads) ϕb applies between L_1 and L_2. ϕb_1 applies between the L_2 and .500 (12.70 mm) from the reference plane. Diameter is uncontrolled in L_1 and beyond .500 (12.70 mm) from the reference plane.
3. Measured from the maximum diameter of the product.
4. Leads having a maximum diameter of .019 (0.48 mm) measured in gauging plane .054 (1.37 mm) + .001 (0.03 mm) -.000 (0.00 mm) below the base plane of the product shall be within .007 (0.18 mm) of their true-position relative to a maximum width tab.
5. The product may be measured by direct methods or by gauge.

FIGURE 1. Case outlines.

Case outline Y

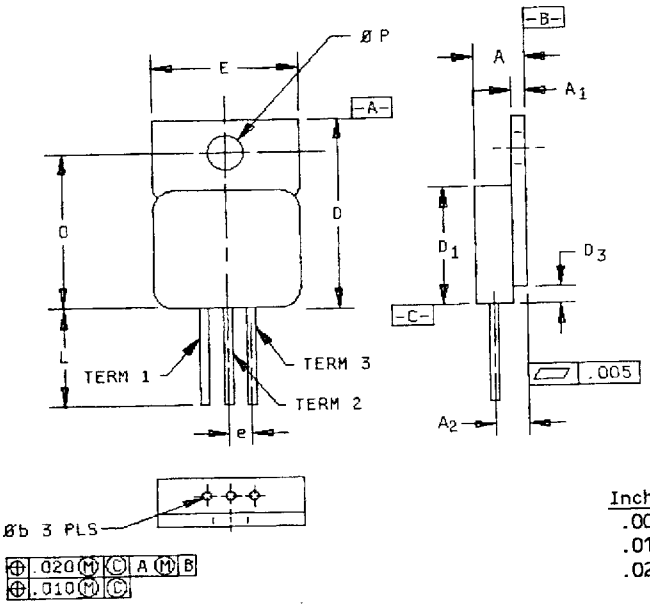


Ltr	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A	.250	.450	6.35	11.43	
A_1	1.177	1.197	29.90	30.40	
ϕb	.038	.043	.97	1.09	2, 6
ϕD		.875		22.22	
e	.655	.675	16.64	17.14	
e_1	.420	.440	10.67	11.16	
e_2	.205	.225	5.21	5.72	
F	.060	.135	1.52	3.43	
ϕH	.151	.161	3.84	4.09	4, 5
L	.312	.500	7.92	12.70	3
L_1		.050		1.27	2, 3
R	.495	.525	12.57	13.34	
R_1	.131	.188	3.33	4.78	

NOTES:
1. The US government preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.
2. (Two leads) ϕb applies between L_1 and .500 (12.70 mm) from the seating plane. Diameter is uncontrolled in L_1 and beyond .500 (12.70 mm) from the seating plane.
3. Two leads.
4. Two holes.
5. Two holes located at true position within diameter .010 (0.25 mm).
6. Leads having a maximum diameter of .043 (1.09 mm) measured in gauging plane .054 (1.37 mm) +.001 (0.03 mm) -.000 (0.00 mm) below the seating plane shall be located at true position within diameter .014 (0.36 mm).
7. The mounting surface of the header shall be flat to convex within .003 (0.08 mm) inside a .930 (23.62 mm) diameter circle on the center of the header and flat to convex within .006 (0.15 mm) overall.

FIGURE 1. Case outlines - Continued.

Case outlines T and U



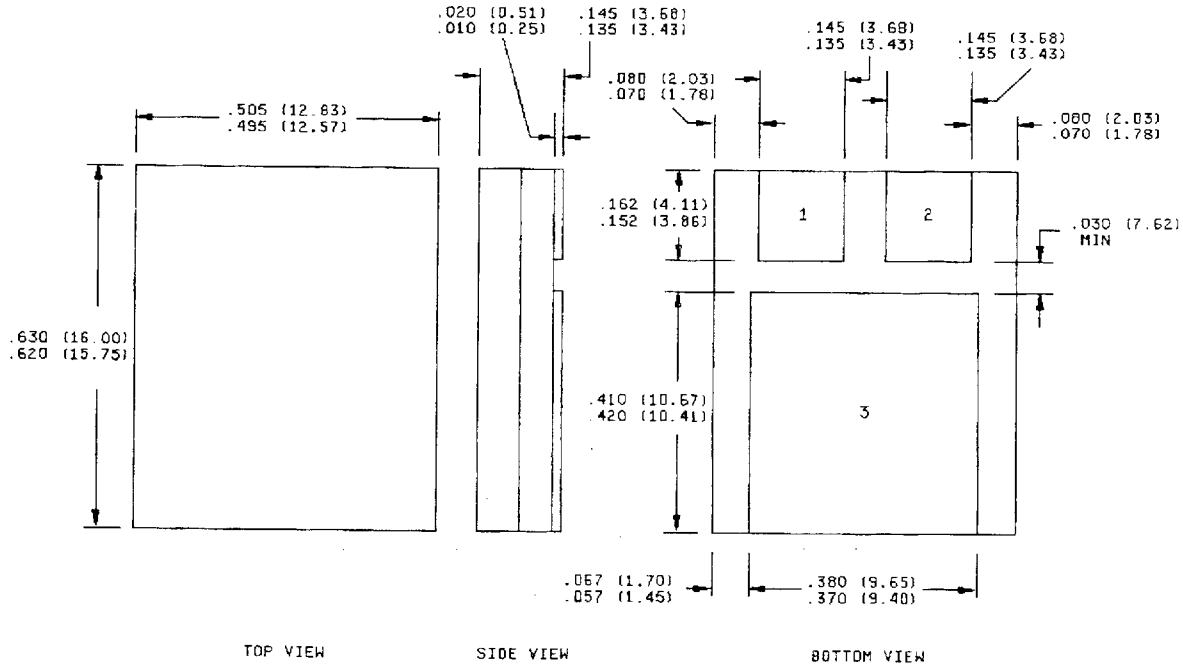
Inches	mm
.005	0.13
.010	0.25
.020	0.51

Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.200	4.83	5.08
A_1	.035	.045	0.89	1.14
A_2	.120	BSC	3.05	BSC
øb	.025	.035	0.64	.89
D	.645	.665	16.38	16.89
D_1	.410	.430	10.41	10.92
D_3	.000	.065	0.00	1.65
e	.100	BSC	2.54	BSC
E	.410	.422	10.41	10.71
L	.500	.750	12.70	19.05
Q	.527	.537	13.39	16.64
øP	.140	.150	3.56	3.81

NOTE:
The US government preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

FIGURE 1. Case outlines - Continued.

Case outline N

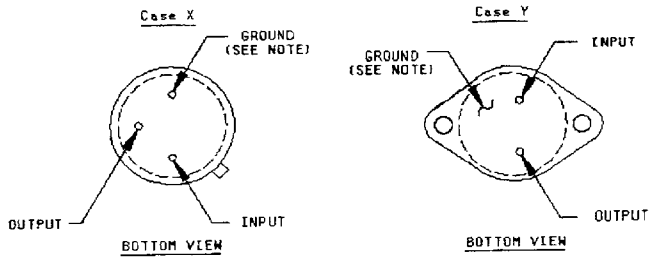


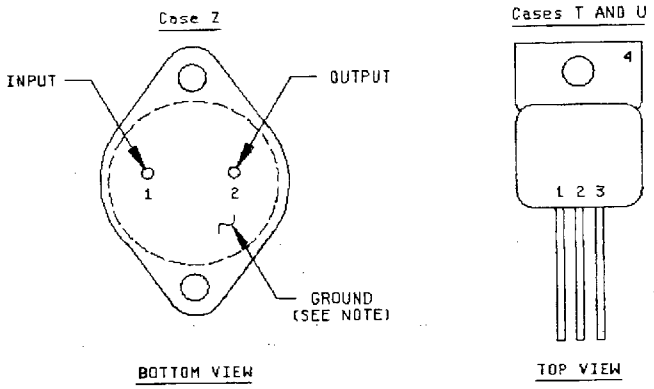
PINOUT

1	IN
2	OUT
3	GROUND

NOTE:
The US government preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

FIGURE 1. Case outlines - Continued.





NOTE: Case is connected to ground.

Case T	Case U
1 - Input	1 - Input
2 - Ground	2 - Ground
3 - Output	3 - Output
4 - Ground	4 - No connection

FIGURE 2. Terminal connections.

Device types	01	02		03
Case outlines	2	2	P	2
Terminal number	Terminal symbol			
1	NC	NC	GND	NC
2	V_{IN}	GND	NC	GND
3	NC	NC	NC	NC
4	NC	NC	V_{IN}	NC
5	NC	NC	NC	NC
6	NC	NC	V_{OUT}	NC
7	GND	NC	NC	NC
8	NC	NC	NC	V_{IN}
9	NC	NC	---	NC
10	V_{OUT}	V_{IN}	---	NC
11	NC	NC	---	NC
12	V_{OUT}	NC	---	NC
13	NC	NC	---	NC
14	NC	NC	---	NC
15	V_{OUT} SENSE	V_{OUT}	---	V_{OUT}
16	NC	NC	---	NC
17	V_{IN}	NC	---	NC
18	NC	NC	---	NC
19	NC	NC	---	NC
20	NC	NC	---	NC

NOTE: For normal operation, V_{OUT} SENSE must be connected externally to the load.

FIGURE 2. Terminal connections - Continued.

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**, 7**
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.
** Subgroups 4, 5, 6, and 7 if not tested shall be guaranteed to the limits specified in table I.

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 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°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).

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.