

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	Revise drawing, update sources.	29 September 2000	Monica Poelking
B	Supplier/address/CAGE change and reformat document	23 May 2002	Thomas M. Hess

PREVIOUS CAGE CODE 14933 SUPERSEDED BY 037Z3
 THE ORIGINAL FIRST PAGE OF THIS DRAWING HAS BEEN REPLACED.

Prepared in accordance with MIL-STD-100

Selected item drawing

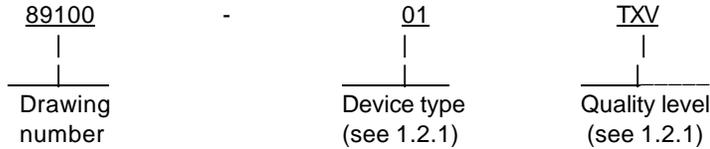
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REV STATUS OF PAGES	REV	B	B	A	B	B	B	A	A	A	A	A	A	A	A	A	A	A	B	
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PMIC N/A	PREPARED BY Roger Kissel		DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OH http://www.dsccl.dla.mil/programs/milspec/docsearch.asp																	
Original date of drawing 19 December 1989	CHECKED BY Alan Barone		TITLE SEMICONDUCTOR DEVICE, POWER SWITCHING REGULATOR ASSEMBLY																	
	APPROVED BY David E. Moore																			
	SIZE A	CODE IDENT. NO. 037Z3		DWG NO.		89100														
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1. SCOPE

1.1 Scope. This drawing describes the requirements for power switching regulator semiconductor assembly.

1.2 Part or Identifying Number (PIN). The complete PIN shall be as follows:



1.2.1 Device types. The device types shall identify the polarity and voltage of the devices as follows: The TX and TXV suffix relates to the JANTX and JANTXV level requirements of MIL-PRF-19500.

<u>Device type</u>	<u>Quality level</u>	<u>Description</u>	<u>Figure number</u>
01	TX, TXV	5 A, 60 V, positive	1 (similar to TO-66)
02	TX, TXV	5 A, 80 V, positive	1 (similar to TO-66)
03	TX, TXV	5 A, 100 V, positive	1 (similar to TO-66)
04	TX, TXV	5 A, 60 V, negative	1 (similar to TO-66)
05	TX, TXV	5 A, 80 V, negative	1 (similar to TO-66)
06	TX, TXV	5 A, 100 V, negative	1 (similar to TO-66)

1.3 Maximum ratings. $T_C = +25^\circ\text{C}$ (unless otherwise noted).

Type	V 4-1 (input voltage)	V 1-2 (output voltage)	V 3-4 (Drive input reverse voltage)	I 1 (1) (continuous output current)	I 3 (drive current)	$R_{\theta JC}$	$R_{\theta CA}$	T_J	T_{STG}
	<u>V</u>	<u>V</u>	<u>V</u>	<u>A</u>	<u>A</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C</u>	<u>°C</u>
01	60	60	5	5	-0.2	4	60	-55 to +125	-65 to +150
02	80	80	5	5	-0.2	4	60	-55 to +125	-65 to +150
03	100	100	5	5	-0.2	4	60	-55 to +125	-65 to +150
04	-60	-60	-5	-5	0.2	4	60	-55 to +125	-65 to +150
05	-80	-80	-5	-5	0.2	4	60	-55 to +125	-65 to +150
06	-100	-100	-5	-5	0.2	4	60	-55 to +125	-65 to +150

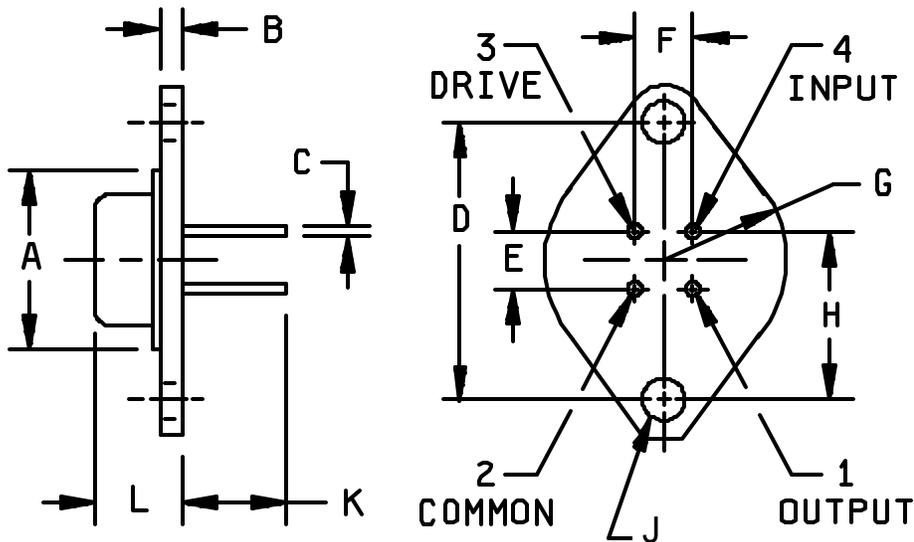
(1) Applies to $T_C = +25^\circ\text{C}$, derate 1% per $^\circ\text{C}$ above T_C of $+25^\circ\text{C}$.

1.4 Primary electrical characteristics. See table II, group A inspection, for the primary electrical characteristics.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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Dimensions (see notes)									
LTR	Inches		Millimeters		LTR	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	---	.620	---	15.75	G	---	.350	---	8.89
B	.050	.075	1.27	1.90	H	.570	.590	14.48	14.99
C	.028	.034	0.71	0.86	J	.142	.152	3.61	3.86
D	.958	.962	24.33	24.43	K	.360	---	9.14	---
E	.190	.210	4.83	5.33	L	.250	.340	6.35	8.64
F	.190	.210	4.83	5.33					

Notes:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Case is electrically isolated.
4. Leads may be soldered to within .062 (1.57) of base provided temperature-time exposure is < +260°C for 10 seconds.
5. Case outline is similar to TO-66.

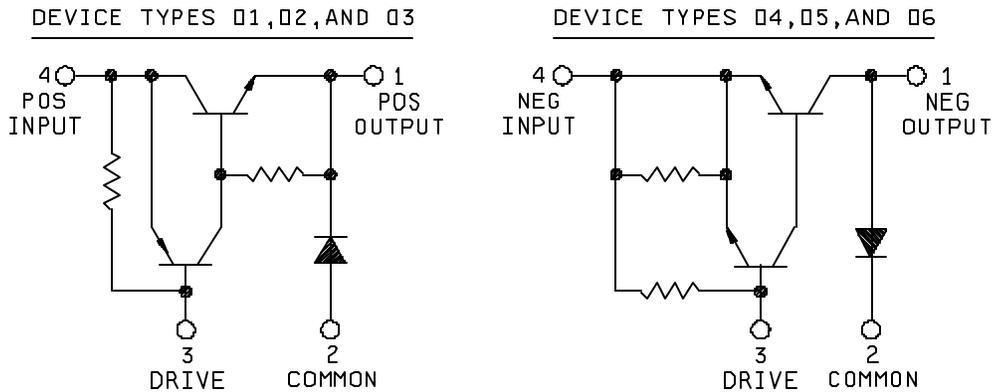


FIGURE 1. Dimensions, configurations, and schematics.

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2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARDS

FEDERAL

DEPARTMENT OF DEFENSE

MIL-STD-750 - Test Methods for Semiconductor Devices

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 herein.

3.1.1 Lead material and finish. Unless otherwise specified, lead finish shall be solderable as defined in MIL-PRF-19500.

3.1.2 Internal construction. Multiple chip construction shall be permitted.

3.2 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows:

- V 4-1 - The voltage measured between terminal 4 and terminal 1 of the device.
- V 1-2 - The voltage measured between terminal 1 and terminal 2 of the device.
- V 3-4 - The voltage measured between terminal 3 and terminal 4 of the device.
- I 1 - The amount of current flow out of terminal 1.
- I 3 - The amount of current flow into terminal 3.
- V 4-1(on) - The voltage measured from terminal 4 to terminal 1 while the power switch is in the on-state.
- V 2-1(on) - The voltage measured from terminal 2 to terminal 1 while the diode is in the on-state.
- I 4-1 - The leakage current measured flowing from terminal 4 to terminal 1 while the power switch is in the off-state.
- I 1-2 - The leakage current measured flowing from terminal 1 to terminal 2 while the diode is in the off-state.

3.3 Marking. Marking shall be in accordance with MIL-PRF-19500. The full part number shall consist of this drawing number and the dash number.

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3.4 Manufacturer eligibility. To be eligible to supply devices to this drawing, the manufacturer shall have an approved facility in accordance with MIL-PRF-19500 for at least one line. In addition, all devices specified herein shall meet all requirements of MIL-PRF-19500 except qualification requirements.

3.5 Submission of certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as a source of supply in 6.4. The certificate of compliance submitted to DSCC-VAC, prior to listing as a suggested source of supply in 6.4, shall state that the manufacturer's product meets the requirements of MIL-PRF-19500 and the requirements herein.

3.6 Recycled, recovered or environmentally preferable materials. Recycled, recovered or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.7 Workmanship. The semiconductor shall be uniform in quality and free from any defects that will affect life, serviceability or appearance.

4. VERIFICATION

4.1 Sampling and inspection. Unless otherwise specified, sampling and inspection procedures shall be performed in accordance with MIL-PRF-19500, and as specified herein.

4.2 Screening. All devices shall be screened in accordance with MIL-PRF-19500 (table IV requirements) and as specified herein. Devices that exceed the limits of table I, herein, shall not be acceptable.

Screen (see table IV, of MIL-PRF-19500)	Measurement
	TX and TXV levels
1	Method 2072 of MIL-STD-750, (TXV types only)
2	Method 1032 of MIL-STD-750
3	Method 1051 of MIL-STD-750, condition F, $t_{low} = -55^{\circ}C$, $t_{extreme} \geq 15$ minutes, no dwell at $+25^{\circ}C$, 10 cycles
4	Method 2006 of MIL-STD-750, 10,000 G, Y1 orientation, 1 minute hold time does not apply
5	Method 2052 of MIL-STD-750, condition A, not required for junction coated devices.
7	Method 1071 of MIL-STD-750, conditions C and H
10	Method 1039 of MIL-STD-750, condition A, $t = 48$ hours, $T_A = +125^{\circ}C$ (see figure 2 for circuit and conditions)
11	See table I for the appropriate dash number (omit deltas)
12	Method 1039 of MIL-STD-750, condition B, $T_A = +25^{\circ}C$, (see figure 3 for the circuit and conditions for the applicable dash number)
13	See table I for the appropriate dash number and group A, subgroup 2 of table II herein

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4.3 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.3.1 Group A inspection. Group A inspection shall consist of the inspections and tests specified in table II. (End-point electrical measurements shall be in accordance with table I herein.)

4.3.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIb of MIL-PRF-19500, and table III herein. Electrical measurements shall be in accordance with table I herein.

4.3.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions for subgroup testing in table VII of MIL-PRF-19500, and table IV herein. Electrical measurements (end-points) shall be in accordance with the applicable steps of table I herein.

4.3.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions for subgroup testing in table V herein. Electrical measurements shall be in accordance with table I herein.

4.4 Methods of inspection. Methods of inspection shall be as specified in MIL-PRF-19500 and as specified herein.

TABLE I. Screening and groups B and C electrical measurements.

Inspection and dash number	Conditions <u>1/</u>	Limits		Delta limits <u>2/</u>	Units
		Minimum	Maximum		
V 4-1 (on) -01, -02, -03 -04, -05, -06	I4 = 2 A, I3 = -.02 A I4 = -2 A, I3 = .02 A		1.5 -1.5	±0.3 ±0.3	V V
ΔV 2-1 (on) -01, -02, -03 -04, -05, -06	I2 = 2 A I2 = -2 A		1.0 -1.0	±0.3 ±0.3	V V
I 4-1 All types	V 4-1 = rated input voltage (see 1.3)		10	±1 or 100% whichever is greater	μA
I 1-2 All types	V 1-2 = rated output voltage (see 1.3)		10	±2 or 100% whichever is greater	μA

1/ All tests at T_C = +25°C unless noted. See table II for MIL-STD-750 method reference.

2/ Not required for groups B and C.

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TABLE II. Group A inspection.

Inspection and dash number 1/	MIL-STD-750		Limits		Units
	Method	Conditions	Min	Max	
<u>Subgroup 1</u>					
Visual and mechanical All types	2071				
<u>Subgroup 2</u>					
$T_C = +25^\circ\text{C}$					
V 4-1 (on) -01, -02, -03 -04, -05, -06	3071	Pulsed I4 = 2 A, I3 = -.02 A I4 = -2 A, I3 = .02 A		1.5 -1.5	V V
-01, -02, -03 -04, -05, -06		I4 = 5 A, I3 = -.02 A I4 = -5 A, I3 = .02 A		3.5 -3.5	V V
V 2-1 (on) -01, -02, -03 -04, -05, -06	4011	Pulsed I2 = 2 A I2 = -2 A		1.0 -1.0	V V
-01, -02, -03 -04, -05, -06		I2 = 5 A I2 = -5 A		1.5 -1.5	V V
I 4-1 All types	3041	Pulsed V 4-1 = rated input voltage (see 1.3)		10	μA
I 1-2 All types	4016	Pulsed V 1-2 = rated output voltage (see 1.3)		10	μA
<u>Subgroup 3</u>					
$T_C = +100^\circ\text{C}$					
High temperature operation					
I 4-1 All types	3041	Pulsed V 4-1 = rated input voltage (see 1.3)		1.0	mA
I 1-2 All types	4016	Pulsed V 1-2 = rated output voltage (see 1.3)		1.0	mA
Low temperature operation					
$T_C = -55^\circ\text{C}$					
V 4-1 (on) -01, -02, -03 -04, -05, -06	4011	Pulsed I4 = 2 A, I3 = -.02 A I4 = -2 A, I3 = .02 A		2.0 -2.0	V V

See footnote at end of table.

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TABLE II. Group A inspection - continued

Inspection and dash number <u>1/</u>	MIL-STD-750		Limits		Units
	Method	Conditions	Min	Max	
<u>Subgroup 4</u>		$T_c = +25^\circ\text{C}$			
Switching tests					
Current delay time (tdi) -01, -02, -03 -04, -05, -06	3251	See figure 4		40 40	ns ns
Current rise time (tri) -01, -02, -03 -04, -05, -06	3251	See figure 4		75 75	ns ns
Voltage rise time (trv) -01, -02, -03 -04, -05, -06	3251	See figure 4		50 50	ns ns
Voltage storage time (tsv) -01, -02, -03 -04, -05, -06	3251	See figure 4		1000 1000	ns ns
Voltage fall time (tfv) -01, -02, -03 -04, -05, -06	3251	See figure 4		75 75	ns ns
Current fall time (tfi) -01, -02, -03 -04, -05, -06	3251	See figure 4		150 150	ns ns
<u>Subgroup 5</u>		$T_c = +25^\circ\text{C}$			
Reverse bias clamped inductive test	3053	$t = 1$ second			
All types		See figure 5			
End-point electrical measurements		See table I (omit deltas)			

1/ For sampling plan, see MIL-PRF-19500.

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TABLE III. Group B inspection.

Inspection <u>1/</u>	MIL-STD-750	
	Method	Conditions
<u>Subgroup 1</u>		
Solderability	2026	
Resistance to solvents	1022	
<u>Subgroup 2</u>		
Thermal Shock (temperature cycling)	1051	No dwell time is required at +25°C, test condition C, except T = -55°C to +150°C, (45 cycles including screening), $t_{\text{extreme}} > 10$ minutes
Hermetic seal Fine leak	1071	Test condition H
Gross leak		Test condition C
Electrical end-points		See table I (omit deltas)
<u>Subgroup 3</u>		
Steady-state operational life	1027	340 hours minimum, circuit and conditions as specified on figure 3, $T_A = +25^\circ\text{C}$
Electrical tests		See table I (omit deltas)
<u>Subgroup 4</u>		
De-cap internal visual (design verification)	2075	Visual criteria in accordance with qualified design
Bond strength	2037	The sample shall be a minimum of 3 devices and shall include all wire sizes.
<u>Subgroup 5</u>		
Thermal resistance	4081	$R_{\theta JC}$ of the diode (4°C/W max)
<u>Subgroup 6</u>		
High-temperature life (non-operating)	1032	340 hours minimum, $T_A = +150^\circ\text{C}$
Electrical tests		See table I (omit deltas)

1/ For sampling plan, see MIL-PRF-19500.

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TABLE IV. Group C inspection.

Inspection <u>1/</u>	MIL-STD-750	
	Method	Conditions
<u>Subgroup 1</u> Physical dimensions	2066	Dimensions as specified on figure 1
<u>Subgroup 2</u> Thermal Shock	1056	Test condition B
Terminal strength	2036	Test condition A, weight = 3 pounds, time = 15 s
Hermetic seal Fine leak	1071	Test condition H
Gross leak		Test condition C
Moisture resistance	1021	Omit initial conditioning
Electrical end-points		See table I (omit deltas)
<u>Subgroup 3</u> Shock	2016	Non-operating, 1500 G's, 0.5 ms, 5 blows in each orientation (X1, Y1, Z1)
Vibration variable frequency	2056	
Constant acceleration	2006	1 minute in each orientation, X1, Y1 at 10,000 G minimum
Electrical tests		See table I (omit deltas)
<u>Subgroup 4</u> Salt atmosphere (corrosion)	1041	
<u>Subgroup 5</u> Not applicable		
<u>Subgroup 6</u> Steady-state operational life	1026	1000 hours, circuit and conditions as specified on figure 3, T _A = +25°C
Electrical tests		See table I (omit deltas)

1/ For sampling plan, see MIL-PRF-19500.

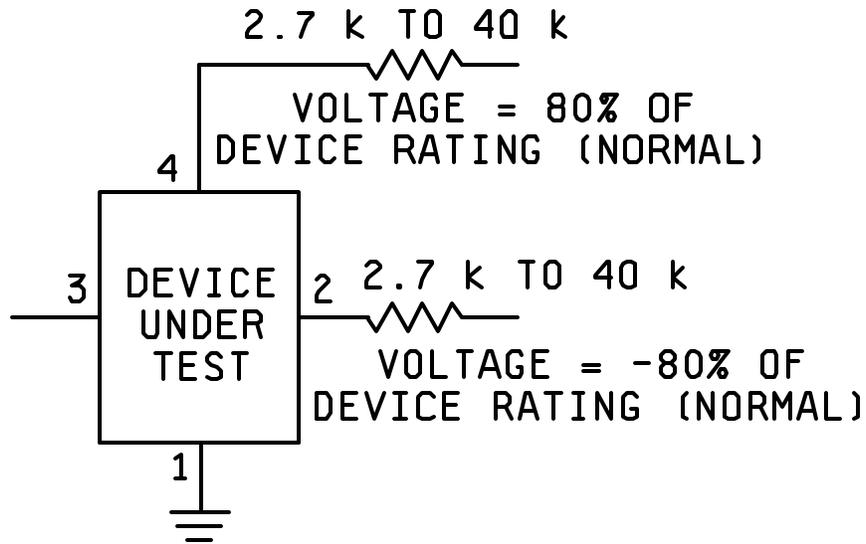
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TABLE V. Group E inspection for initial design verification.

Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
<u>Subgroup 1</u> Thermal shock (temperature cycling) Hermetic seal Electrical tests	1051 1071	No dwell time is required at +25°C, test condition C, except T = -55°C to +150°C, (1000 cycles including screening), $t_{\text{extreme}} > 10$ minutes See table I (omit deltas)	22 devices c = 0
<u>Subgroup 2</u> Steady-state dc blocking life Electrical end-points	1027	1,000 hours, circuit and conditions as specified on figure 2, $T_A = +125^\circ\text{C}$ See table I (omit deltas)	22 devices c = 0
<u>Subgroup 3</u> Destructive physical analysis		Visual criteria in accordance with design	3 devices c = 0
<u>Subgroups 4, 5, and 6</u> Not applicable			

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DEVICE TYPES 01,02, AND 03

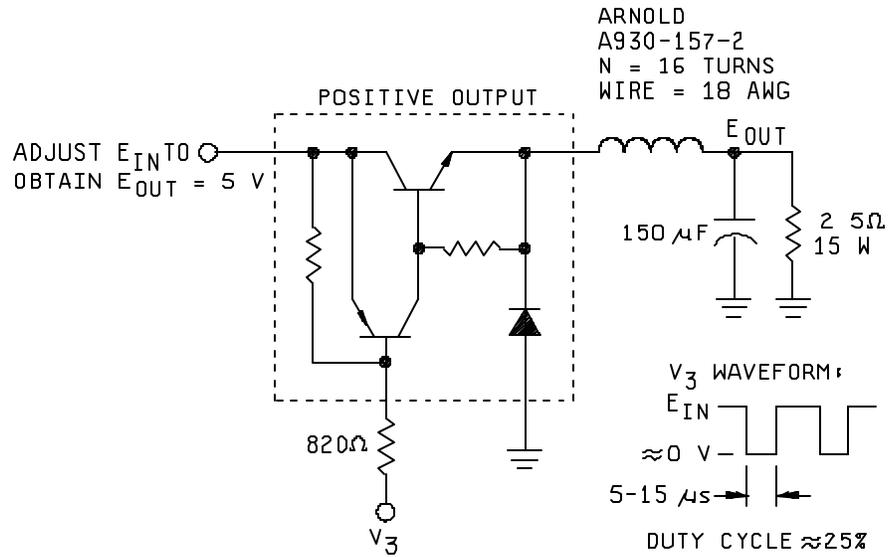


Note: Test circuits and conditions for -04, -05, and -06 are identical but of opposite polarity.

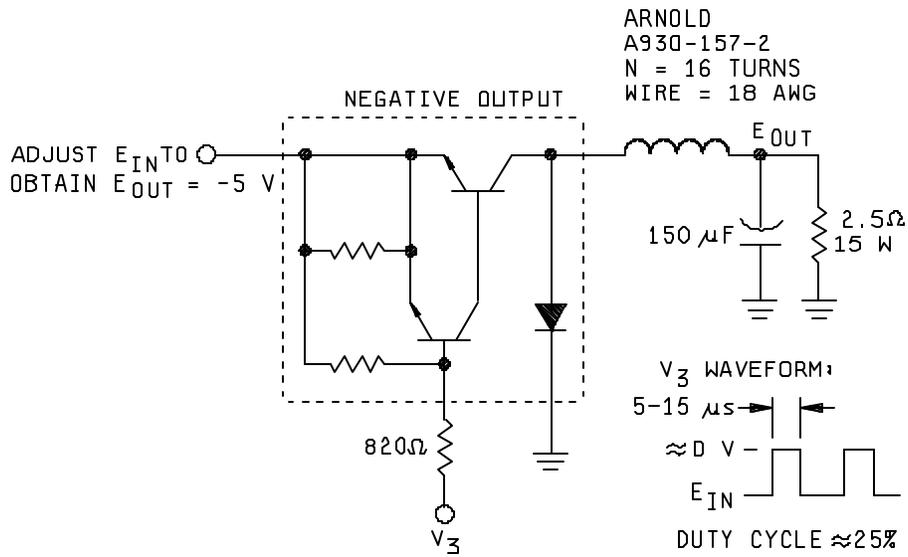
FIGURE 2. High temperature reverse bias circuit.

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DEVICE TYPES 01,02,AND 03



DEVICE TYPES 04,05,AND 06

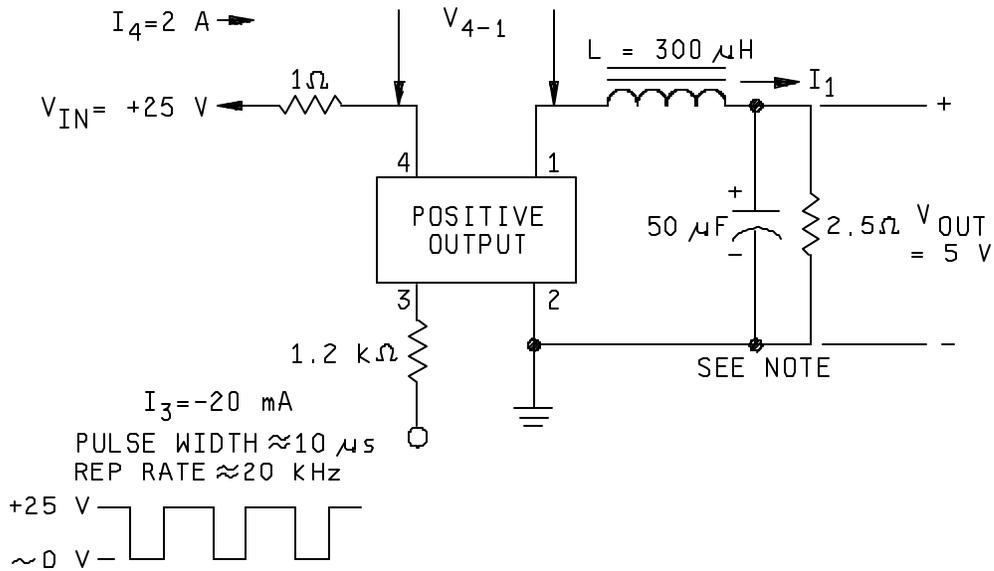


Note: No heat sink allowed. T_A must be controlled to prevent thermal runaway.

FIGURE 3. Burn-in circuit.

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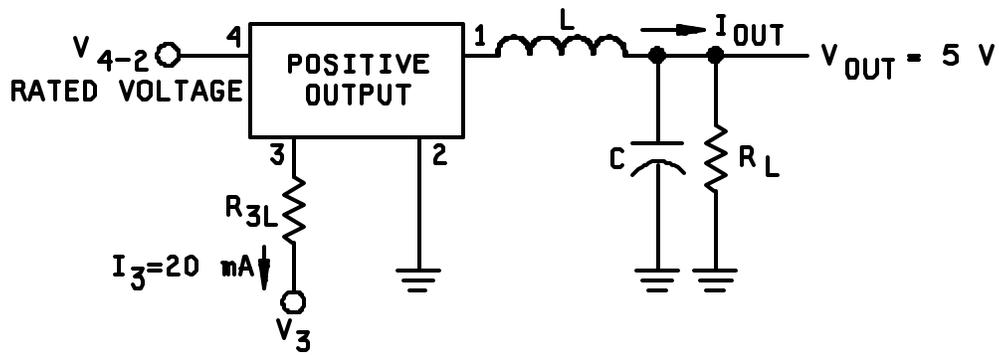
DEVICE TYPES 01, 02, AND 03



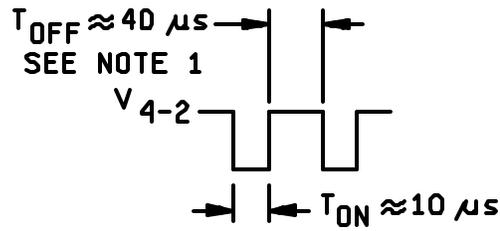
NOTE: Test circuit and conditions for -04, -05, and -06 are identical but of opposite polarity $V_{IN} = -25 \text{ V}$, $V_{OUT} = -5 \text{ V}$.

FIGURE 4. Switching speed circuit.

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INPUT WAVEFORM (V_3)



NOTES:

1. Adjust T_{ON} to obtain specified I_{OUT} .
2. Negative output test circuits and waveforms are identical but have opposite polarity.

Component values					
Dash numbers	R_{3L} Ω	L μH	C μF	R_L Ω	I_{OUT} A
-01, -04	3000	300	100	2.5	2
-02, -05	4000	300	100	2.5	2
-03, -06	5000	300	100	2.5	2

FIGURE 5. Reverse bias clamped inductive test circuit and conditions.

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5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. Power switching regulator assemblies 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 the OEM application. This drawing is intended exclusively to prevent the proliferation of unnecessary duplicate specifications, drawings, and stock catalog listings. When a military specification exists and the product covered by this drawing has been qualified for listing on QML-19500, this drawing will be inactivated and will not be used for new design. The QML-19500 product shall be the preferred item for all applications.

6.2 Ordering data. The contract or purchase order should specify the following:

- a. Complete PIN (see 1.2.1).
- b. Requirements for delivery of one copy of the conformance inspection data or certificate of compliance that parts have passed conformance inspection with each shipment of parts by the manufacturer.
- c. Requirements for packaging and packing.

6.3 Users of record. Coordination of this document for future revisions are coordinated only with the suggested sources of supply and the users of record of this document. Requests to be added as a recorded user of this drawing should be in writing to: Defense Supply Center, Columbus, ATTN: DSCC/VAC, Post Office Box 3990, Columbus, OH 43216-5000 or by telephone (614) 692-0510 or DSN 850-0510.

6.4 Suggested source of supply. A suggested source of supply is listed herein. Additional sources will be added as they become available. The vendor listed herein has agreed to this drawing and has submitted a certificate of compliance (see 3.6 herein) to DSCC-VAC.

DSCC drawing PIN (1)	Vendor similar PIN	Vendor CAGE	Vendor name and address
89100-01TX, TXV	PIC600	43611	Microsemi NES 6 Lake Street Lawrence, MA 01841-3011
89100-02TX, TXV	PIC601	43611	
89100-03TX, TXV	PIC602	43611	
89100-04TX, TXV	PIC610	43611	
89100-05TX, TXV	PIC611	43611	
89100-06TX, TXV	PIC612	43611	

(1) Parts must be purchased to this DSCC PIN to assure that all performance requirements are met.

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