REVISIONS			
LTR	**DESCRIPTION**	**DATE**	**APPROVED**
A	Revise drawing, update sources.	7 August 2000	Monica Poelking
B	Supplier/address/CAGE change; reformat document	23 May 2002	Thomas M. Hess
C	Correct figure 1 - header thickness, supplier name, editorial changes throughout - RK	9 March 2006	Thomas M. Hess

CURRENT DESIGN ACTIVITY CAGE CODE 037Z3
DEFENSE LOGISTICS AGENCY
DEFENSE SUPPLY CENTER, COLUMBUS
COLUMBUS, OHIO 43218-3990

Prepared in accordance with ASME-14.100

Selected item drawing

REV																					
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REV STATUS OF PAGES	**REV**		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C		
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PMIC N/A	**PREPARED BY** Roger Kissel	**DEFENSE SUPPLY CENTER, COLUMBUS** **COLUMBUS, OH** http://www.dscc.dla.mil/programs/milspec/docsearch.asp
Original date of drawing 7 August 1990	**CHECKED BY** Alan Barone	**TITLE** SEMICONDUCTOR DEVICE, POWER SWITCHING REGULATOR ASSEMBLY
	APPROVED BY David E. Moore	
	SIZE A / **CODE IDENT. NO.** 037Z3	**DWG NO.** **90024**
	REV C	**PAGE** 1 **OF** 17

AMSC N/A

5961-E081

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:

90024	-	01	TXV
Drawing number		Device type (see 1.2.1)	Quality level (see 1.2.1)

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.

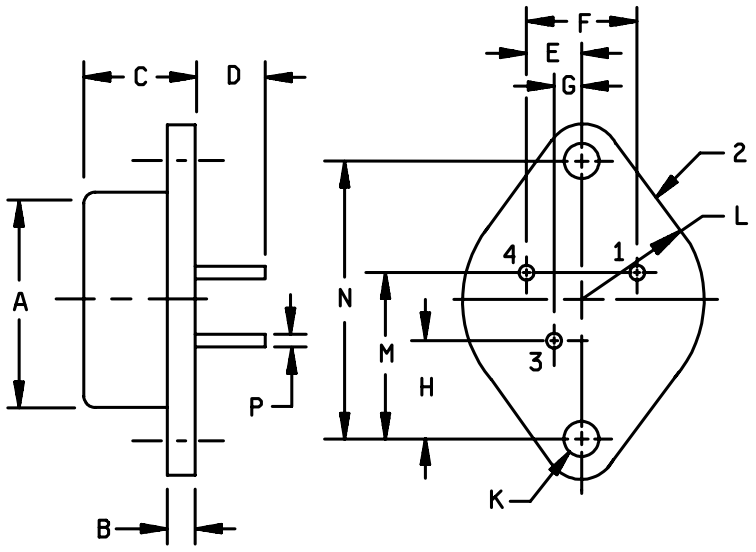
Device type	Quality level	Description	Figure number
01	TX, TXV	15 A, 60 V, positive	1 (similar to TO-3)
02	TX, TXV	15 A, 80 V, positive	1 (similar to TO-3)
03	TX, TXV	15 A, 100 V, positive	1 (similar to TO-3)
04	TX, TXV	15 A, 60 V, negative	1 (similar to TO-3)
05	TX, TXV	15 A, 80 V, negative	1 (similar to TO-3)
06	TX, TXV	15 A, 100 V, negative	1 (similar to TO-3)

1.3 Maximum ratings. T_C = +25°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}
	V	V	V	A	A	°C/W	°C/W	°C	°C
01	60	60	5	15	-0.4	2	30	-55 to +125	-65 to +150
02	80	80	5	15	-0.4	2	30	-55 to +125	-65 to +150
03	100	100	5	15	-0.4	2	30	-55 to +125	-65 to +150
04	-60	-60	-5	-15	0.4	2	30	-55 to +125	-65 to +150
05	-80	-80	-5	-15	0.4	2	30	-55 to +125	-65 to +150
06	-100	-100	-5	-15	0.4	2	30	-55 to +125	-65 to +150

(1) Applies to T_C = +25°C, derate 1 percent in accordance with degree Celsius above T_C = +25°C.

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



Dimensions (see notes)									
	Inches		Millimeters			Inches		Millimeters	
LTR	Min	Max	Min	Max	LTR	Min	Max	Min	Max
A		.875		22.23	H	.395	.405	10.03	10.29
B		.135		3.43	J	.151	.161	3.84	4.09
C	.250	.450	6.35	11.43	K		.188		4.78
D	.312		7.92		L		.525		13.34
E	.205	.225	5.21	5.72	M	.708	.728	17.98	18.49
F	.420	.440	10.67	11.18	N	1.177	1.197	29.90	30.40
G	.145	.165	3.68	4.19	P	.038	.043	0.97	1.09

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

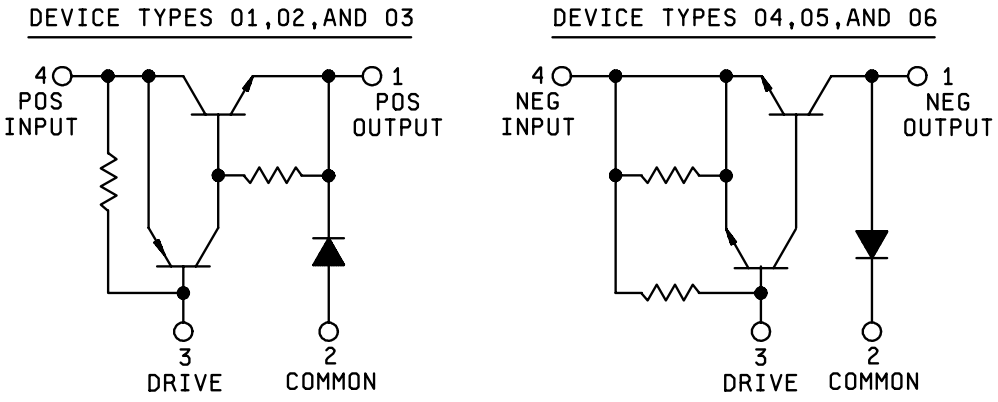


FIGURE 1. Dimensions, configurations, and schematics.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, 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.

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 and at least one qualified JAN device listed on QML-19500. In addition, all devices specified herein shall meet all requirements of MIL-PRF-19500, except qualification requirements.

3.5 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 Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990 prior to listing as an 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 Certificate of conformance. A certificate of conformance shall be provided with each lot of devices delivered in accordance with this drawing.

3.7 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.

3.8 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 II 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°C, $t_{extreme} \geq$ 15 minutes, no dwell at +25°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°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°C, (see figure 3 for the circuit and conditions for the applicable device type)
13	See table II for the appropriate dash number and group A, subgroup 2 of table I herein

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 I. (End-point electrical measurements shall be in accordance with table II 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 II 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 II 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 II herein.

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

TABLE I. Group A inspection.

Inspection and dash number 1/	MIL-STD-750		Limits		Units
	Method	Conditions	Min	Max	
Subgroup 1 Visual and mechanical All types	2071				
Subgroup 2		T_C = +25°C			
V 4-1 (on) -01, -02, -03 -04, -05, -06 -01, -02, -03 -04, -05, -06	3071	Pulsed I4 = 7 A, I3 = -.03 A I4 = -7 A, I3 = .03 A I4 = 15 A, I3 = -.03 A I4 = -15 A, I3 = .03 A		 1.5 -1.5 3.5 -3.5	 V V V V
V 2-1 (on) -01, -02, -03 -04, -05, -06 -01, -02, -03 -04, -05, -06	4011	Pulsed I2 = 7 A I2 = -7 A I2 = 15 A I2 = -15 A		 1.25 -1.25 1.75 -1.75	 V V 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
Subgroup 3 High temperature operation		T_C = +100°C			
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°C			
V 4-1 (on) -01, -02, -03 -04, -05, -06	4011	Pulsed I4 = 7 A, I3 = -.03 A I4 = -7 A, I3 = .03 A		 2.0 -2.0	 V V

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection and dash number 1/	MIL-STD-750		Limits		Units
	Method	Conditions	Min	Max	
Subgroup 4		T_C = +25°C			
Switching tests					
Current delay time (tdi)	3251	See figure 4			
-01, -02, -03				60	ns
-04, -05, -06				60	ns
Current rise time (tri)	3251	See figure 4			
-01, -02, -03				150	ns
-04, -05, -06				175	ns
Voltage rise time (trv)	3251	See figure 4			
-01, -02, -03				60	ns
-04, -05, -06				60	ns
Voltage storage time (tsv)	3251	See figure 4			
-01, -02, -03				1300	ns
-04, -05, -06				1300	ns
Voltage fall time (tfv)	3251	See figure 4			
-01, -02, -03				175	ns
-04, -05, -06				300	ns
Current fall time (tfi)	3251	See figure 4			
-01, -02, -03				300	ns
-04, -05, -06				300	ns
Subgroup 5		T_C = +25°C			
Reverse bias clamped inductive test	3053	t = 1 second			
All types		See figure 5			
End-point electrical measurements		See table II (omit deltas)			

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

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

Inspection and dash number	Conditions 1/	Limits		Delta limits 2/	Units
		Minimum	Maximum		
V 4-1 (on)					
-01, -02, -03	I4 = 7 A, I3 = -.03 A		1.5	±0.3	V
-04, -05, -06	I4 = -7 A, I3 = .03 A		-1.5	±0.3	V
ΔV 2-1 (on)					
-01, -02, -03	I2 = 7 A		1.25	±0.3	V
-04, -05, -06	I2 = -7 A		-1.25	±0.3	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 I for MIL-STD-750 method reference.
2/ Not required for groups B and C.

TABLE III. Group B inspection.

Inspection 1/	MIL-STD-750	
	Method	Conditions
Subgroup 1		
Solderability	2026	
Resistance to solvents	1022	
Subgroup 2		
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), $t_{extreme}$ > 10 minutes
Hermetic seal	1071	
Fine leak		Test condition H
Gross leak		Test condition C
Electrical tests		See table II (omit deltas)
Subgroup 3		
Steady-state operational life	1027	340 hours minimum, circuit and conditions as specified on figure 3, T_A = +25°C
Electrical tests		See table II (omit deltas)
Subgroup 4		
De-cap internal visual (design verification)	2075	Visual criteria in accordance with qualified design
Bond strength	2037	The sample shall be a minimum of three devices and shall include all wire sizes.
Subgroup 5		
Thermal resistance	4081	$R_{\Theta JC}$ of the diode (2°C/W max)
Subgroup 6		
High-temperature life (non-operating)	1032	340 hours minimum, T_A = +150°C
Electrical tests		See table II (omit deltas)

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

* TABLE IV. Group C inspection.

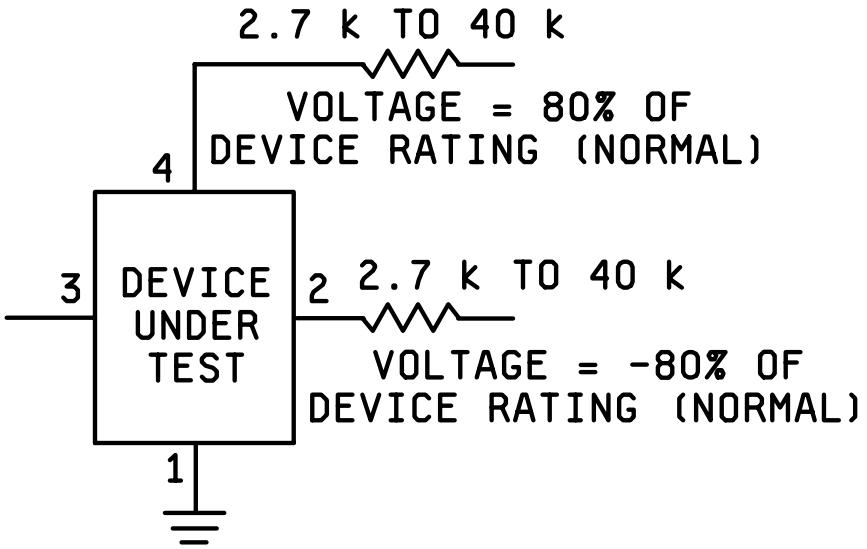
Inspection 1/	MIL-STD-750	
	Method	Conditions
Subgroup 1		
Physical dimensions	2066	Dimensions as specified on figure 1
Subgroup 2		
Thermal shock (glass strain)	1056	Test condition B
Terminal strength	2036	Test condition A, weight = 3 pounds, time = 15 s
Hermetic seal Fine leak	1071	Test condition H
Gross leak		Test condition C
Moisture resistance	1021	Omit initial conditioning
Electrical end-points		See table II (omit deltas)
Subgroup 3		
Shock	2016	Non-operating, 1,500 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 II (omit deltas)
Subgroup 4		
Salt atmosphere (corrosion)	1041	
Subgroup 5		
Not applicable		
Subgroup 6		
Steady-state operational life	1026	1,000 hours, circuit and conditions as specified on figure 3, T_A = +25°C
Electrical tests		See table II (omit deltas)

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

TABLE V. Group E inspection for initial design verification.

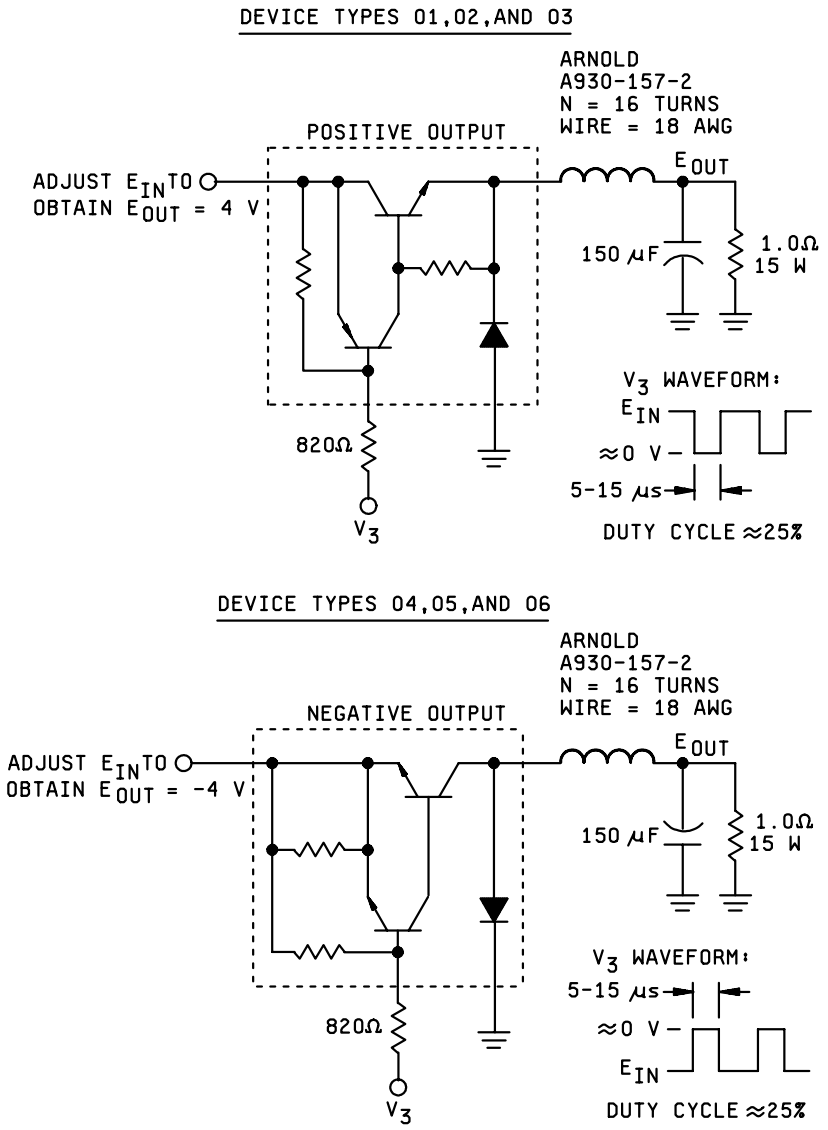
Inspection 1/	MIL-STD-750		Sample plan
	Method	Conditions	
Subgroup 1			22 devices c = 0
Thermal shock (temperature cycling)	1051	No dwell time is required at +25°C, test condition C, except T = -55°C to +150°C, (1,000 cycles including screening), $t_{extreme}$ > 10 minutes	
Hermetic seal	1071		
Electrical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

DEVICE TYPES 01,02, AND 03



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

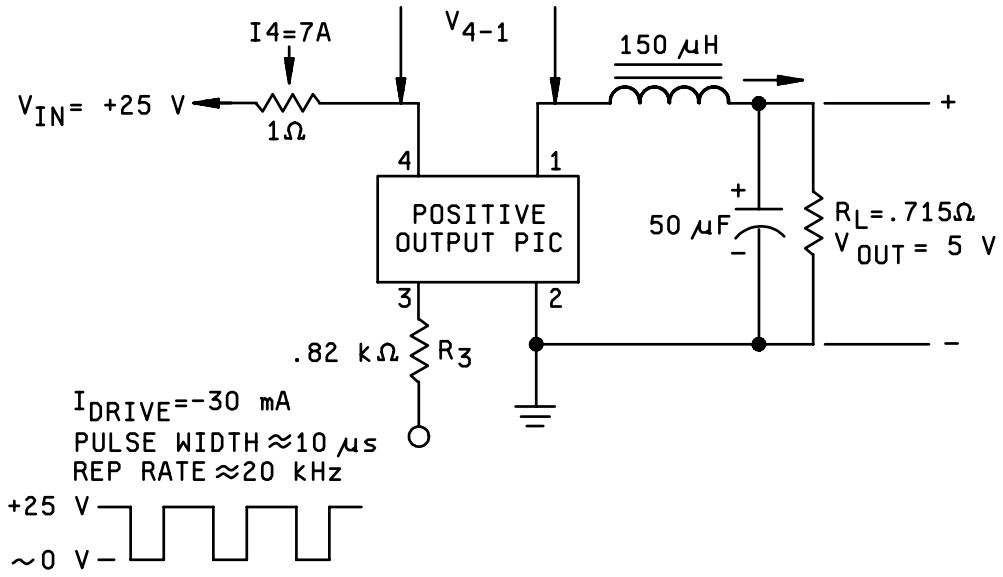
FIGURE 2. High temperature reverse bias circuit.



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

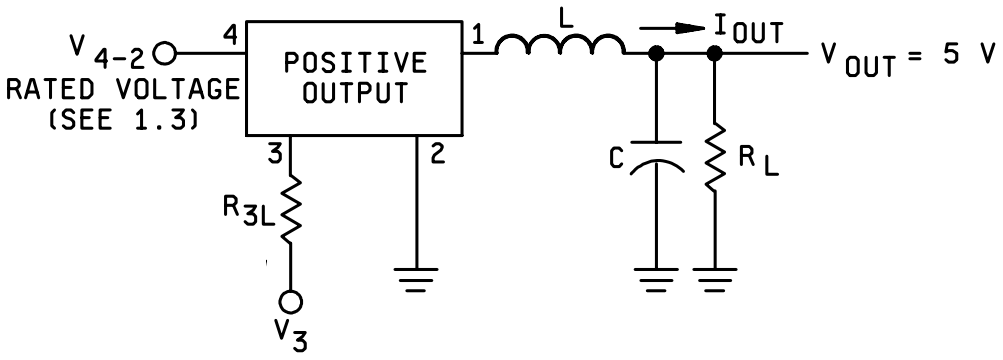
FIGURE 3. Burn-in circuit.

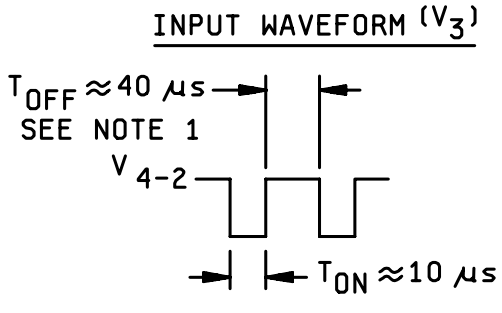
DEVICE TYPES 01,02,AND 03



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

FIGURE 4. Switching speed circuit.





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	2,000	150	100	1.0	5
-02, -05	2,700	150	100	1.0	5
-03, -06	3,300	150	100	1.0	5

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

5. PACKAGING

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

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 performance or 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 performance or 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 Acquisition requirements. The acquisition requirements should specify the following:

a. Complete PIN (see 1.2).

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 approved 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 43218-3990 or by telephone (614) 692-0510 or DSN 850-0510.

6.4 Approved sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. The vendors listed herein have agreed with this drawing and have submitted a certificate of compliance (see 3.5 herein) to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990 or emailed to Semiconductor@dscc.dla.mil.

DSCC drawing PIN (1)	Vendor similar designation or type number	Vendor CAGE	Vendor name and address
90024-01TX, TXV 90024-02TX, TXV 90024-03TX, TXV 90024-04TX, TXV 90024-05TX, TXV 90024-06TX, TXV	PIC645 PIC646 PIC647 PIC655 PIC656 PIC657	43611	Microsemi 6 Lake Street Lawrence, MA 01841-3011

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