REVISIONS			
LTR	**DESCRIPTION**	**DATE**	**APPROVED**
A	Update boilerplate to current MIL-PRF-38535 requirements. - PHN	14-04-23	Thomas M. Hess

CURRENT DESIGN ACTIVITY CAGE CODE 16236
HAS CHANGED NAMES TO:
DLA LAND AND MARITIME
COLUMBUS, OHIO 43218-3990

Prepared in accordance with ASME Y14.24

Vendor item drawing

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REV STATUS OF PAGES	**REV**	A	A	A	A	A	A	A	A	A	A	A							
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PMIC N/A	**PREPARED BY** Phu H. Nguyen	**DEFENSE SUPPLY CENTER, COLUMBUS** **COLUMBUS, OHIO**
Original date of drawing YY-MM-DD 07-01-18	**CHECKED BY** Phu H. Nguyen	**TITLE** MICROCIRCUIT, LINEAR, 250-mA LDO VOLTAGE REGULATOR WITH POWER-GOOD OUTPUT, MONOLITHIC SILICON
	APPROVED BY Thomas M. Hess	
	SIZE **A** / **CODE IDENT. NO.** **16236**	**DWG NO.** **V62/06663**
	REV	**PAGE** 1 **OF** 11

AMSC N/A

5962-V067-14

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1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance 250-mA voltage regulator with power-good output, with an extended operating temperature range of -55°C to +125°C.

1.2 Vendor Item Drawing Administrative Control Number. The manufacturers PIN is the item of identification. The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation:

V62/06663	01	X	E
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). 1/

Device	Generic	Output voltage	Circuit function
01	TPS77401-EP	Adjustable 1.5 V to 5.5 V	250-mA LDO voltage regulator with power-good output

1.2.2 Case outline(s). The case outline are as specified herein.

Outline letter	Number of pins	JEDEC PUB 95	Package style
X	8	JEDEC MO-187	Plastic small outline

1.2.3 Lead finishes. The lead finishes are as specified below or other lead finishes as provided by the device manufacture:

Finish designator	Material
A	Hot solder dip
B	Tin-lead plate
C	Gold plate
D	Palladium
E	Gold flash palladium
Z	Other

1.3 Absolute maximum ratings. 1/

Input voltage range (V_I) ..... -0.3 V to +13.5 V 2/
Voltage range at $\overline{EN}$ ..... -0.3 V to +16.5 V
Maximum PG voltage ..... +16.5 V
Peak output current ..... Internally limited
Continuous total power dissipation..... See dissipation rating tables
Maximum output voltage (V_O) (OUT, FB) ..... +5.5 V
Operating virtual junction temperature range (T_J) ..... -55°C to +125°C
Storage temperature range (T_{STG})..... -65°C to +150°C 3/
ESD rating, (HBM) ..... 2 kV

Dissipation Rating Table – Ambient Temperatures

Case outline	Air Flow (CFM)	θ_{JA} (°C/W)	θ_{JC} (°C/W)	T_A < 25°C Power rating	Derating Factor Above T_A = 25°C	T_A = 70°C Power Rating	T_A = 85°C Power Rating
X	0	266.2	3.84	376 mW	3.76 mW/°C	207 6 mW	150 mW
	150	255.2	3.92	392 mW	3.92 mW/°C	216 mW	157 mW
	250	242.8	4.21	412 mW	4.12 mW/°C	227 mW	165 mW

1.4 Recommended operating conditions.

Input voltage (V_I) ..... +2.7 V to +10.0 V 4/
Output voltage range (V_O) ..... +1.5 V to +5.5 V
Output current (I_O) ..... 0 to 250 mA 5/
Operating virtual junction temperature range (T_J) ..... -55°C to +125°C

2. APPLICABLE DOCUMENTS

JEDEC – SOLID STATE TECHNOLOGY ASSOCIATION (JEDEC)

JEP95 – Registered and Standard Outlines for Semiconductor Devices

(Copies of these documents are available online at http:/www.jedec.org or from JEDEC – Solid State Technology Association, 3103 North 10th Street, Suite 240–S, Arlington, VA 22201-2107).

1/ Stresses beyond those listed under “absolute maximum rating” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2/ All voltage values are with respect to network terminal ground.
3/ Long term high temperature storage and/or extended use at maximum recommended operating conditions may result in a reduction of overall device life. See manufacturer data for additional information on enhanced plastic packaging.
4/ To calculate the minimum input voltage for your maximum output current, use the following equation:
$V_{I(min)} = V_{O(max)} + V_{DO(max\ load)}$.
5/ Continuous current and operating junction temperature are limited by internal protection circuitry, but it is not recommended that the device operate under conditions beyond those specified in this table for extended periods of time.

3. REQUIREMENTS

3.1 Marking. Parts shall be permanently and legibly marked with the manufacturer's part number as shown in 6.3 herein and as follows:

A. Manufacturer's name, CAGE code, or logo
B. Pin 1 identifier
C. ESDS identification (optional)

3.2 Unit container. The unit container shall be marked with the manufacturer's part number and with items A and C (if applicable) above.

3.3 Electrical characteristics. The maximum and recommended operating conditions and electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.4 Design, construction, and physical dimension. The design, construction, and physical dimensions are as specified herein.

3.5 Diagrams.

3.5.1 Case outline(s). The case outline(s) shall be as shown in 1.2.2 and figure 1.

3.5.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.5.3 Block diagrams. The block diagrams shall be as specified on figure 3.

3.5.4 Timing diagram. The timing diagram shall be as specified on figure 4.

TABLE I. Electrical performance characteristics. 1/

Test		Test conditions 2/ unless otherwise specified	Limits		Unit
			Min	Max	
Output voltage 3/ 4/	Adjustable voltage	$1.5\ V \le V_O \le 5.5\ V, T_J = 25°C$	$0.98\ V_O$	$1.02\ V_O$	V
		$1.5\ V \le V_O \le 5.5\ V$, T_J = Full range	$0.977\ V_O$	$1.023\ V_O$	
	1.5 V output	$2.7\ V < V_{IN} < 10.0\ V$	1.5 Typ		
		$2.7\ V \le V_{IN} \le 10.0\ V$, $T_J = 25°C$	1.470	1.530	
	1.8 V output	$2.8\ V < V_{IN} < 10.0\ V$	1.8 Typ		
		$2.8\ V \le V_{IN} \le 10.0\ V$, $T_J = 25°C$	1.764	1.836	
	2.7 V output	$3.7\ V < V_{IN} < 10.0\ V$	2.7 Typ		
		$3.7\ V \le V_{IN} \le 10.0\ V$, $T_J = 25°C$	2.648	2.754	
	2.8 V output	$3.8\ V < V_{IN} < 10.0\ V$	2.8 Typ		
		$3.8\ V \le V_{IN} \le 10.0\ V$, $T_J = 25°C$	2.744	2.856	
	3.3 V output	$4.3\ V < V_{IN} < 10.0\ V$	3.3 Typ		
		$4.3\ V \le V_{IN} \le 10.0\ V$, $T_J = 25°C$	3.234	3.366	
	5.0 V output	$6.0\ V < V_{IN} < 10.0\ V$	5.0 Typ		
		$6.0\ V \le V_{IN} \le 10.0\ V$, $T_J = 25°C$	4.9	5.1	
Quiescent current (GND current) 3/ 4/		$T_J = 25°C$	92 Typ		µA
		T_J = Full range		135	
Output voltage line regulation ($\Delta V_O/V_O$) 5/		$V_O + 1\ V < V_I \le 10.0\ V$, $T_J = 25°C$	0.005 Typ		%/V
		$V_O + 1\ V < V_I \le 10.0\ V$		0.05	
Load regulation		$T_J = 25°C$	1 Typ		mV
Output noise voltage		BW = 300 Hz to 100 kHz, $T_J = 25°C$	55 Typ		µVrms
Output current limit		$V_O = 0\ V$		1.3	A
Peak output current		2 ms pulse width, 50 % duty cycle	400 Typ		mA
Thermal shutdown junction temperature			144 Typ		°C
Standby current		$\overline{EN} = V_I$, $T_J = 25°C$,		1	µA
		$\overline{EN} = V_I$, T_J = Full range		3	
FB input current	Adjustable volatge	FB = 1.5 V		1.0	µA
High level enable input voltage			2.0		V
Low level enable input voltage				0.7	V
Enable input current			-1	1	µA
PSRR Power supply ripple rejection		f = 1 kHz, $T_J = 25°C$	55 Typ		dB
PG	Minimum input voltage for valid PG	$I_{(PG)} = 300\ µA$, $V_{(PG)} \le 0.8V$	1.1 Typ		V
	Trip threshold voltage	V_O decreasing	79	85	$\%V_O$
	Hysteresis voltage	Measured at V_O	0.5 Typ		$\%V_O$
	Output low voltage	$V_I = 2.7\ V$, $I_{(PG)} = 1\ mA$		0.4	V
	Leakage current	$V_{(PG)} = 5.0\ V$		1.0	µA

See notes at end of table.

TABLE I. Electrical performance characteristics - Continued. 1/

Test		Symbol	Test conditions 2/ unless otherwise specified	Limits		Unit
				Min	Max	
Dropout voltage 6/	2.8 V output	V_{DO}	I_O = 250 mA, T_J = 25°C	270 Typ		mV
			I_O = 250 mA		475	
	3.3 V output		I_O = 250 mA, T_J = 25°C	200 Typ		
			I_O = 250 mA, T_J = Full range		350	
	5.0 V output		I_O = 250 mA, T_J = 25°C	125 Typ		
			I_O = 250 mA		190	

1/ Testing and other quality control techniques are used to the extent deemed necessary to assure product performance over the specified temperature range. Product may not necessarily be tested across the full temperature range and all parameters may not necessarily be tested. In the absence of specific parametric testing, product performance is assured by characterization and/or design.

2/ Over recommended operating junction temperature range (T_J = -55°C to 125°C), $V_I = V_{O(Typ)} + 1$ V, I_O = 1 mA, $\overline{EN}$ = 0 V, C_O = 10 μF, unless otherwise specified.

3/ Minimum input operating voltage is 2.7 V or $V_{O(Typ)}$ + 1V, whichever is greater. Maximum input voltage 10.0 V, minimum output current 1 mA.

4/ I_O = 1 mA to 250 mA.

5/ If V_O < 1.8 V then $V_{i(max)}$ = 10.0 V, $V_{I(min)}$ = 2.7 V:

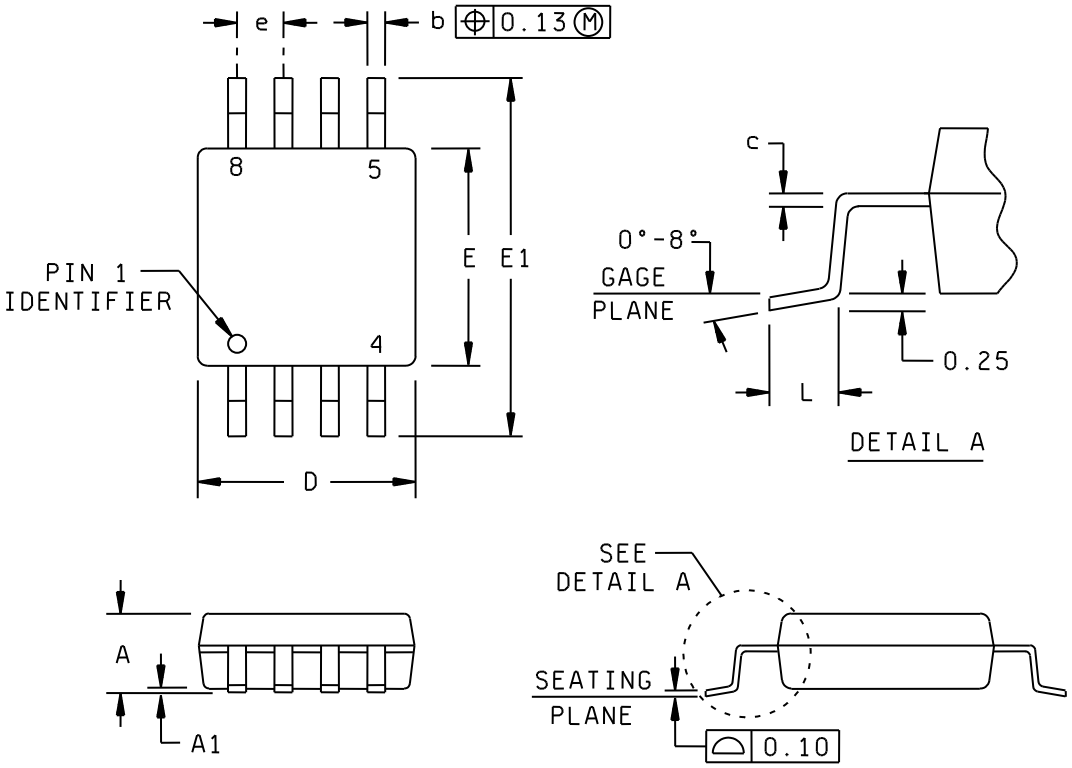
$$\text{Line regulation (mV)} = (\%/V) \times \frac{V_O(V_{I(max)} - 2.7V)}{100} \times 1000$$

If V_O > 2.5 V then $V_{I(max)}$ = 10.V, $V_{i(min)}$ V_O + 1 V:

$$\text{Line regulation (mV)} = (\%/V) \times \frac{V_O(V_{I(max)} - (V_O + 1V))}{100} \times 1000$$

6/ IN voltage equals $V_{O(Typ)}$ – 100 mV; 1.5 V, 1.8 V. and 2.7 V dropout voltage limited by input voltage range limitations (i.e., 3.3 V input voltage needs to drop to 3.2 V for purpose of this test).

Case X



Symbol	Min	Max	Symbol	Min	Max
A		1.10	D/E	2.90	3.10
A1	0.05	0.15	E1	4.75	5.05
b	0.25	0.38	e	0.65 BSC	
c	0.13	0.23	L	0.40	0.70

Notes:
1. All linear dimensions are in millimeters.
2. This drawing is subject to change without notice.
3. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per end.
4. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 mm per side.
5. Falls within JEDEC MO-187 variation AA, except interlead flash.

FIGURE 1. Case outline.

Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	FB/SENSE	5	IN
2	PG	6	IN
3	$\overline{EN}$	7	OUT
4	GND	8	OUT

FIGURE 2. Terminal connections.

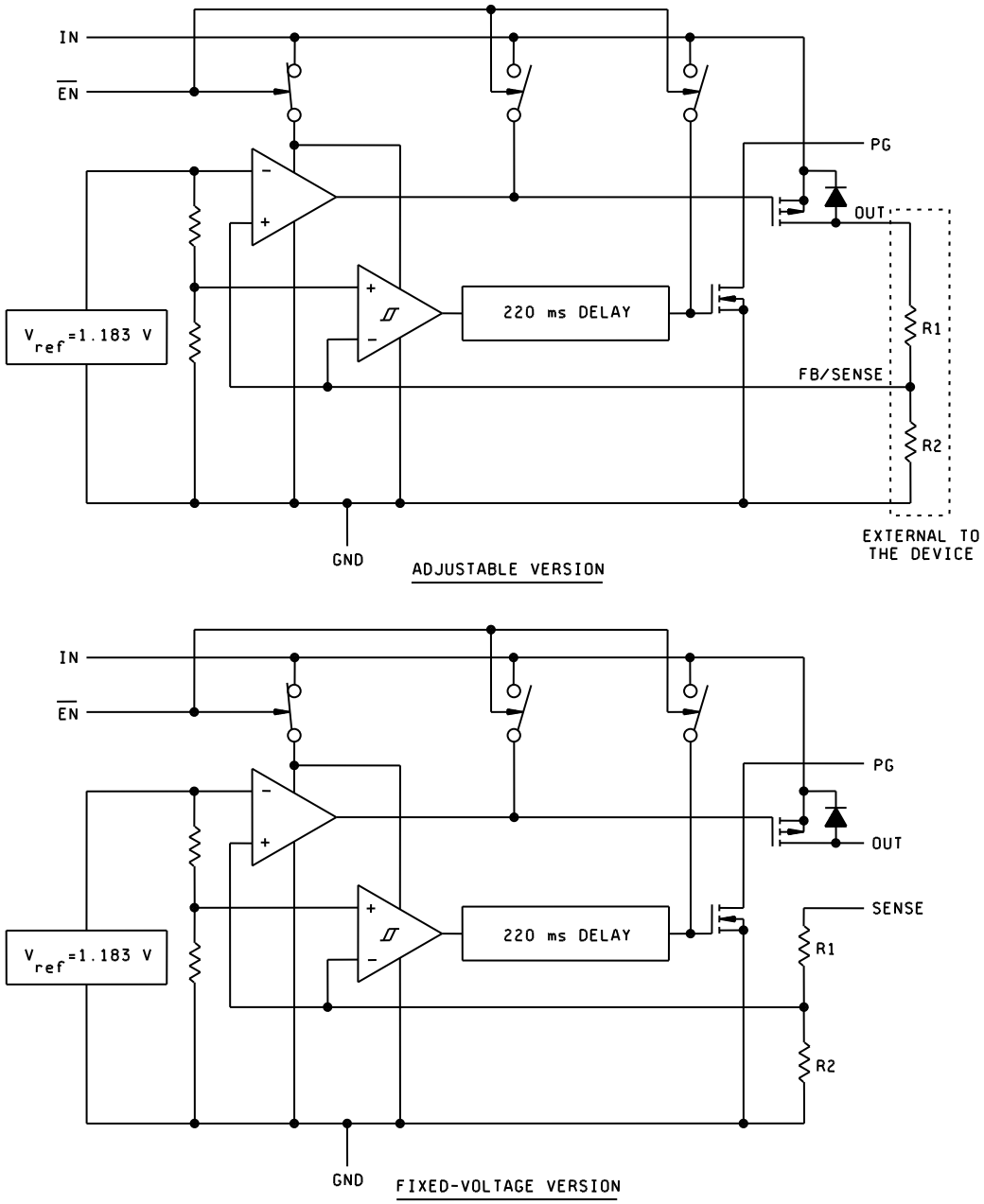
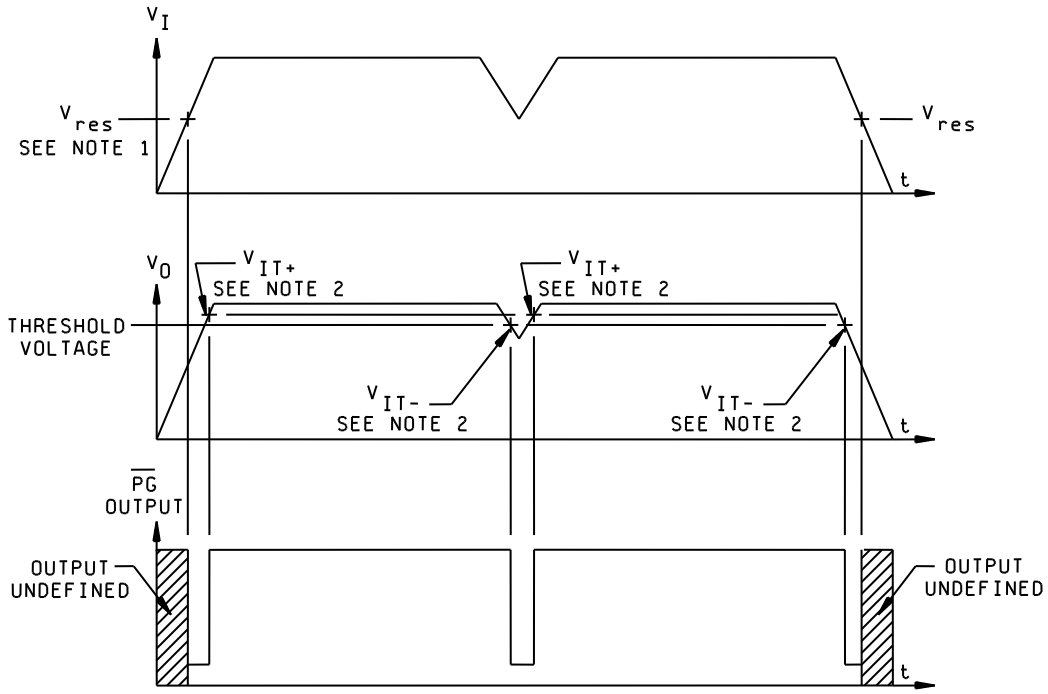


FIGURE 3. Block diagrams.

PG timing diagram



Notes:

1. V_{res} is the minimum input voltage for a valid PG. The symbol V_{res} is not currently listed within EIA or JEDEC standards for semiconductor symbology.
2. V_{IT-} Trip voltage is typically 17 % lower than the output voltage (83% V_O) V_{IT-} to V_{IT+} is the hysteresis voltage.

FIGURE 4. Timing diagram.

4. VERIFICATION

4.1 Product assurance requirements. The manufacturer is responsible for performing all inspection and test requirements as indicated in their internal documentation. Such procedures should include proper handling of electrostatic sensitive devices, classification, packaging, and labeling of moisture sensitive devices, as applicable.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Preservation, packaging, labeling, and marking shall be in accordance with the manufacturer's standard commercial practices for electrostatic discharge sensitive devices.

6. NOTES

6.1 ESDS. Devices are electrostatic discharge sensitive and are classified as ESDS class 1 minimum.

6.2 Configuration control. The data contained herein is based on the salient characteristics of the device manufacturer's data book. The device manufacturer reserves the right to make changes without notice. This drawing will be modified as changes are provided.

6.3 Suggested source(s) of supply. Identification of the suggested source(s) of supply herein is not to be construed as a guarantee of present or continued availability as a source of supply for the item. DLA Land and Maritime maintains an online database of all current sources of supply at http://www.landandmaritime.dla.mil/Programs/Smcr/.

Vendor item drawing administrative control number 1/	Device manufacturer CAGE code	Vendor part number	Symbol
V62/06663-01XE	01295	TPS77401MDGKREP	BYQ

1/ The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.

CAGE code	Source of supply
01295	Texas Instruments, Inc. Semiconductor Group 8505 Forest Lane P.O. Box 660199 Dallas, TX 75243 Point of contact: U.S. Highway 75 South P.O. Box 84, M/S 853 Sherman, TX 75090-9493