REVISIONS			
LTR	**DESCRIPTION**	**DATE**	**APPROVED**
A	Add output voltage to the device types 1.2.1. - phn	03-07-10	Thomas M. Hess
B	Make clarification to output current limit test. Add inch dimensions to figure 1 and update the boilerplate paragraphs. - ro	09-02-19	R. Heber
C	Add footnote 6/ to paragraph 1.4. Add terminal descriptions to figure 2. Make change to the Output voltage min limit under paragraph 1.4. Add min limit to Output current limit test under Table I. Add sentence to note 3 as specified under figure 1. Update document paragraphs to reflect current requirements. - ro	14-12-04	C. Saffle

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

REV																					
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REV STATUS OF PAGES	**REV**		C	C	C	C	C	C	C	C	C	C	C	C	C	C					
	PAGE		1	2	3	4	5	6	7	8	9	10	11	12	13	14					

PMIC N/A	**PREPARED BY** Phu H. Nguyen	**DEFENSE SUPPLY CENTER COLUMBUS** **COLUMBUS, OHIO 43218-3990**
Original date of drawing YY-MM-DD 03-05-27	**CHECKED BY** Phu H. Nguyen	**TITLE** MICROCIRCUIT, LINEAR, FAST-TRANSIENT-RESPONSE 1-A LOW DROPOUT VOLTAGE REGULATORS, MONOLITHIC SILICON
	APPROVED BY Thomas M. Hess	
	SIZE A / **CODE IDENT. NO.** 16236	**DWG NO.** **V62/03630**
	REV C	**PAGE** 1 **OF** 14

1. SCOPE

1.1 Scope. This drawing documents the general requirements of a high performance fast-transient-response1-A low dropout voltage regulator microcircuit, with an operating temperature range of -40°C to +125°C.

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

V62/03630	-	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).

Device type	Generic	Output voltage	Circuit function
01	TPS76701-EP	+1.5 V to +5.5 V	Fast-transient-response 1-A low-dropout voltage regulator.
02	TPS76715-EP	+1.5 V	Fast-transient-response 1-A low-dropout voltage regulator.
03	TPS76718-EP	+1.8 V	Fast-transient-response 1-A low-dropout voltage regulator.
04	TPS76725-EP	+2.5 V	Fast-transient-response 1-A low-dropout voltage regulator.
05	TPS76727-EP	+2.7 V	Fast-transient-response 1-A low-dropout voltage regulator.
06	TPS76728-EP	+2.8 V	Fast-transient-response 1-A low-dropout voltage regulator.
07	TPS76730-EP	+3.0 V	Fast-transient-response 1-A low-dropout voltage regulator.
08	TPS76733-EP	+3.3 V	Fast-transient-response 1-A low-dropout voltage regulator.
09	TPS76750-EP	+5.0 V	Fast-transient-response 1-A low-dropout voltage regulator.

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

Outline letter	Number of pins	JEDEC PUB 95	Package style
X	20	MO-153	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/ 2/

Input voltage range (V_I) ..... -0.3 V to +13.5 V 3/
Voltage range at $\overline{EN}$ ..... -0.3 V to V_I + 0.3 V
Maximum $\overline{RESET}$ voltage ..... +16.5 V
Peak output current ..... Internally limited
Output voltage (V_O) (OUT, FB) ..... +7.0 V
Continuous total power dissipation ..... See dissipation rating tables
Operating virtual junction temperature range (T_J) ..... -40°C to +125°C
Storage temperature range (T_{STG}) ..... -65°C to +150°C
ESD rating, (HBM) ..... 2 kV

Dissipation rating table – ambient temperatures

Package	Air flow (CFM)	$T_A < 25°C$ Power rating	Derating factor above $T_A = 25°C$	$T_A = 70°C$ Power rating	$T_A = 85°C$ Power rating
X 4/	0	2.9 W	23.5 mW/°C	1.9 W	1.5 W
	300	4.3 W	34.6 mW/°C	2.8 W	2.2 W
X 5/	0	3.0 W	23.8 mW/°C	1.9 W	1.5 W
	300	7.2 W	57.9 mW/°C	4.6 W	3.8 W

1.4 Recommended operating conditions. 6/

Input voltage range (V_I) ..... +2.7 V to +10.0 V 7/
Output voltage (V_O) ..... +1.2 V to +5.5 V
Output current (I_O) ..... 0 A to 1.0 A 8/
Operating virtual junction temperature range (T_J) ..... -40°C to +125°C 8/

1/ Users are cautioned to review the manufacturers data manual for additional user information relating to these devices.
2/ 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.
3/ All voltage values are with respect to network terminal ground.
4/ This parameter is measured with the recommended copper heat sink pattern on a 1-layer PCB, 5 in x 5 in printed circuit board (PCB), 1 ounce copper, 2 in x 2 in coverage (4 in^2).
5/ This parameter is measured with the recommended copper heat sink pattern on a 8-layer PCB, 1.5 in x 2 in PCB, 1 ounce copper with layer 1, 2, 4, 5, 7, and 8 at 5% coverage (0.9 in^2) and layers 3 and 6 at 100% coverage (6 in^2). For more information, refer to the manufacturer technical brief SLMA002.
6/ Use of this product beyond the manufacturers design rules or stated parameters is done at the user’s risk. The manufacturer and/or distributor maintain no responsibility or liability for product used beyond the stated limits.
7/ To calculate the minimum input voltage for your maximum output current, use the following equation: $V_{I(min)} = V_{O(max)} + V_{DO(max\ load)}$.
8/ 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.

2. APPLICABLE DOCUMENTS

JEDEC Solid State Technology Association

JEDEC PUB 95 – 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).

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. The case outline shall be as shown in 1.2.2 and figure 1.

3.5.2 Terminal connections. The terminal connections shall be as shown in figure 2.

3.5.3 Logic diagram. The logic diagram shall be as shown in figure 3.

3.5.4 Timing diagram. The timing diagram shall be as shown in figure 4.

TABLE I. Electrical performance characteristics. 1/

Test	Symbol	Conditions $V_I = V_{O(Typ)} + 1$ V, I_O = 1 mA, $\overline{EN}$ = 0 V, C_O = 10 μF unless otherwise specified	Temperature, T_J	Device type	Limits		Unit
					Min	Max	
Output voltage 2/	V_O	1.5 V ≤ V_O ≤ 5.5 V,	+25°C	01	V_O typical		V
		10 μA to 1 A load	-40°C to 125°C		0.98 V_O	1.02 V_O	
		2.7 V < V_{IN} < 10 V,	+25°C	02	1.5 typical		
		10 μA to 1 A load	-40°C to 125°C		1.470	1.530	
		2.8 V < V_{IN} < 10 V,	+25°C	03	1.8 typical		
		10 μA to 1 A load	-40°C to 125°C		1.764	1.836	
		3.5 V < V_{IN} < 10 V,	+25°C	04	2.5 typical		
		10 μA to 1 A load	-40°C to 125°C		2.450	2.550	
		3.7 V < V_{IN} < 10 V,	+25°C	05	2.7 typical		
		10 μA to 1 A load	-40°C to 125°C		2.646	2.754	
		3.8 V < V_{IN} < 10 V,	+25°C	06	2.8 typical		
		10 μA to 1 A load	-40°C to 125°C		2.744	2.856	
		4.0 V < V_{IN} < 10 V,	+25°C	07	3.0 typical		
		10 μA to 1 A load	-40°C to 125°C		2.940	3.060	
		4.3 V < V_{IN} < 10 V,	+25°C	08	3.3 typical		
		10 μA to 1 A load	-40°C to 125°C		3.234	3.366	
		6.0 V < V_{IN} < 10 V,	+25°C	09	5.0 typical		
		10 μA to 1 A load	-40°C to 125°C		4.900	5.100	
Quiescent current 2/	I_Q	10 μA < I_O < 1 A, $\overline{EN}$ = 0 V	+25°C	All	85 typical		μA
(GND current)		I_O = 1 A, $\overline{EN}$ = 0 V	-40°C to 125°C			125	
Output voltage 2/ 3/ line regulation (ΔV_O / V_O)		V_O + 1 V < V_I ≤ 10 V	+25°C	All	0.01 typical		%/V

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions $V_I = V_{O(Typ)} + 1$ V, $I_O = 1$ mA, $\overline{EN} = 0$ V, $C_O = 10$ µF unless otherwise specified	Temperature, T_J	Device type	Limits		Unit
					Min	Max	
Load regulation			+25°C	All	3 typical		mV
Output noise voltage		BW = 200 Hz to 100 kHz, $I_C = 1$ A, $C_O = 10$ µF	+25°C	03	55 typical		µVrms
Output current limit		$V_O = 0$ V	-40°C to 125°C	All	1.2	2	A
Thermal shutdown junction temperature			+25°C	All	150 typical		°C
Standby current		$\overline{EN} = V_I$, 2.7 V < V_I < 10 V	+25°C	All	1 typical		µA
			-40°C to 125°C			10	
Feedback (FB) input current		FB = 1.5 V	+25°C	01	2 typical		nA
High level enable input voltage			-40°C to 125°C	All	1.7		V
Low level enable input voltage			-40°C to 125°C	All		0.9	V
Power supply ripple 2/ rejection	PSRR	f = 1 kHz, $C_O = 10$ µF	+25°C	03	60 typical		dB
Reset, minimum input voltage for valid $\overline{RESET}$		$I_{O(RESET)} = 300$ µA	+25°C	All	1.1 typical		V
Reset trip threshold voltage		V_O decreasing	-40°C to 125°C	All	92	98	%/V_O
Reset hysteresis voltage		Measured at V_O	+25°C	All	0.5 typical		%/V_O
Reset output low voltage		$V_I = 2.7$ V, $I_{O(RESET)} = 1$ mA	-40°C to 125°C	All		0.4	V
Reset leakage current		$V_{(RESET)} = 5$ V	-40°C to 125°C	All		1	µA
RESET time out delay			+25°C		200 typical		ms
Input current $\overline{EN}$		$\overline{EN} = 0$ V	-40°C to 125°C	All	-1	1	µA
		$\overline{EN} = V_I$			-1	1	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued. 1/

Test	Symbol	Conditions $V_I = V_{O(Typ)} + 1$ V, I_O = 1 mA, $\overline{EN}$ = 0 V, C_O = 10 µF unless otherwise specified	Temperature, T_J	Device type	Limits		Unit
					Min	Max	
Dropout voltage 4/		I_O = 1 A	+25°C	06	500 typical		mV
			-40°C to 125°C			825	
			+25°C	07	450 typical		
			-40°C to 125°C			675	
			+25°C	08	350 typical		
			-40°C to 125°C			575	
			+25°C	09	230 typical		
			-40°C to 125°C			380	

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. Operating at free air temperature range.

2/ Minimum IN operating voltage is 2.7 V or $V_{O(Typ)}$ + 1V, whichever is greater. Maximum IN voltage 10 V.

3/ If $V_O \leq 1.8$ V then V_{Imax} = 10 V, V_{Imin} = 2.7 V:

Line Regulation (mV) = (% / V) x $\frac{V_O(V_{Imax} - 2.7V)}{100}$ x 1000

If $V_O \geq 2.5$ V then V_{Imax} = 10 V, $V_{Imin} = V_O + 1$ V:

Line Regulation (mV) = (% / V) x $\frac{V_O(V_{Imax} - (V_O + 1V))}{100}$ x 1000

4/ IN voltage equals $V_{O(Typ)}$ – 100 mV; device type 01 output voltage set to 3.3 V nominal with external resistor divider. Device type 02, 03, 04 and 07 dropout voltage limited by input voltage range limitations (for example., device type 07 input voltage needs to drop to 2.9 V for purpose of this test).

Case X

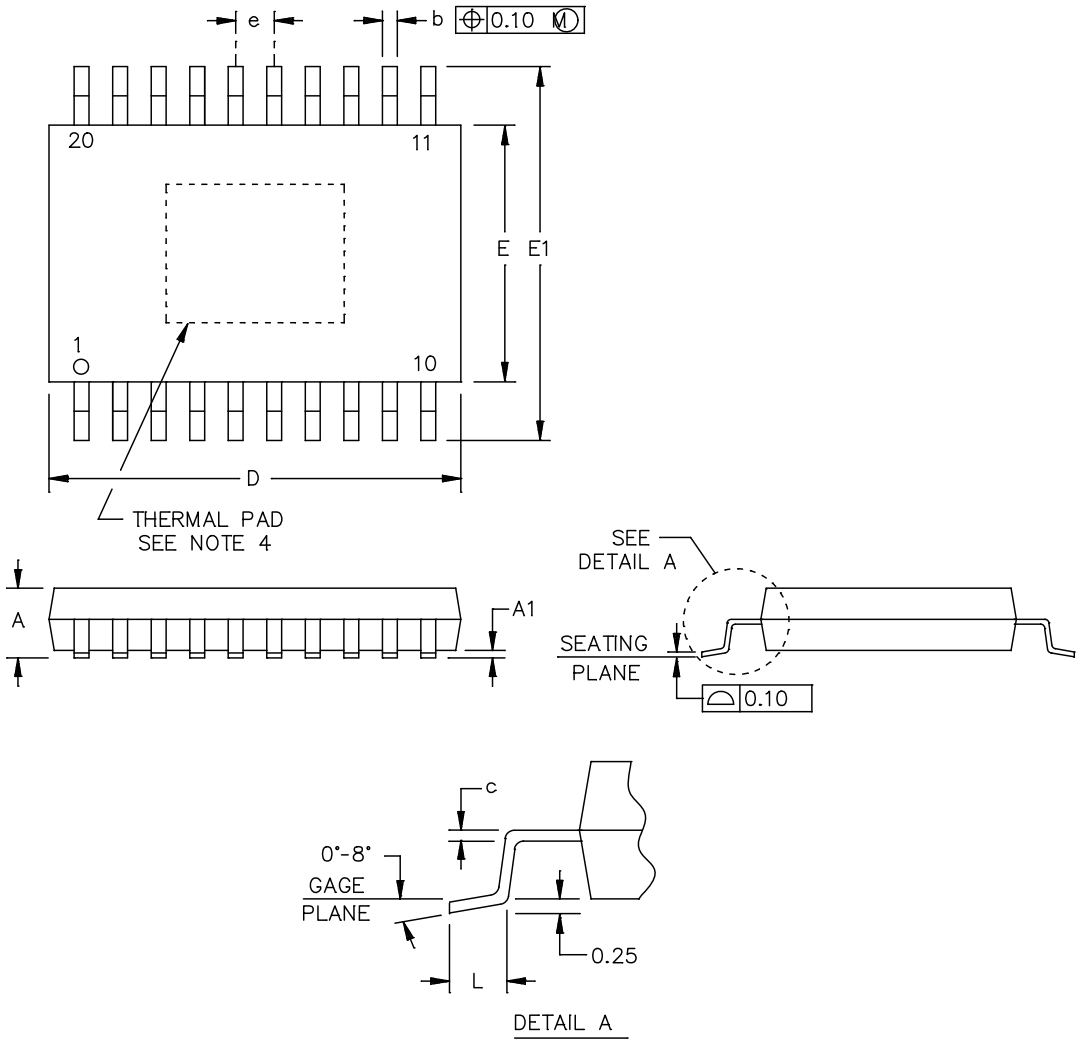


FIGURE 1. Case outline.

DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO	SIZE A	CODE IDENT NO. 16236	DWG NO. V62/03630
		REV C	PAGE 8

Case X – continued.

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	---	.047	---	1.20
A1	.001	.005	0.05	0.15
b	.007	.011	0.19	0.30
c	.005 nominal		0.15 nominal	
D	.251	.259	6.40	6.60
E	.169	.177	4.30	4.50
E1	.244	.259	6.20	6.60
e	.025 BSC		0.65 BSC	
L	.019	.029	0.50	0.75

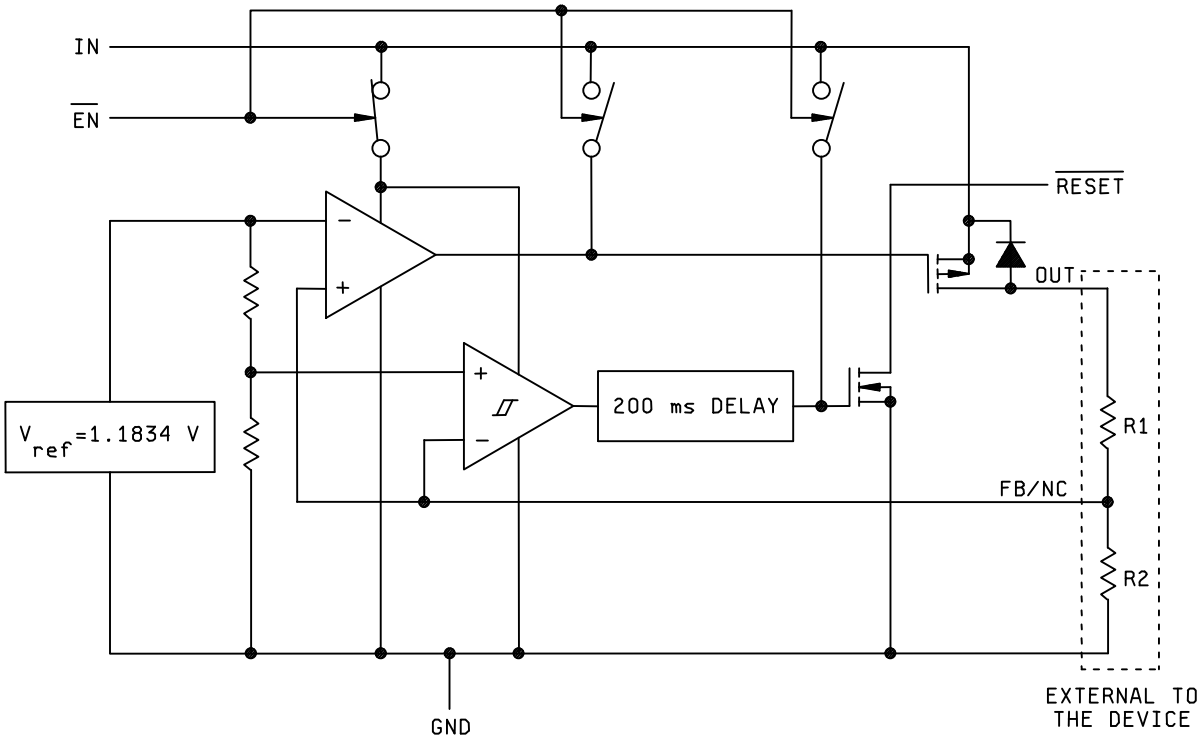
NOTES:
1. Controlling dimensions are millimeter, inch dimensions are given for reference only.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusions. Mold flash and protrusion shall not exceed 0.15 mm (0.006 inch) per side.
4. The package thermal performance may be enhanced by bonding the thermal pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected leads.
5. Falls within JEDEC MO-153.

FIGURE 1. Case outline - Continued.

Device type	01	
Case outline	X	
Terminal number	Terminal symbol	Description
1	GND/HSINK	Ground/heatsink.
2	GND/HSINK	Ground/heatsink.
3	GND	Regulator ground.
4	NC	No connect.
5	$\overline{EN}$	Enable input.
6	IN	Input voltage.
7	IN	Input voltage.
8	NC	No connect.
9	GND/HSINK	Ground/heatsink.
10	GND/HSINK	Ground/heatsink.
11	GND/HSINK	Ground/heatsink.
12	GND/HSINK	Ground/heatsink.
13	OUT	Regulated output voltage.
14	OUT	Regulated output voltage.
15	FB/NC	Feedback input voltage for adjustable device (no connect for fixed options).
16	$\overline{RESET}$	$\overline{RESET}$ output.
17	NC	No connect.
18	NC	No connect.
19	GND/HSINK	Ground/heatsink.
20	GND/HSINK	Ground/heatsink.

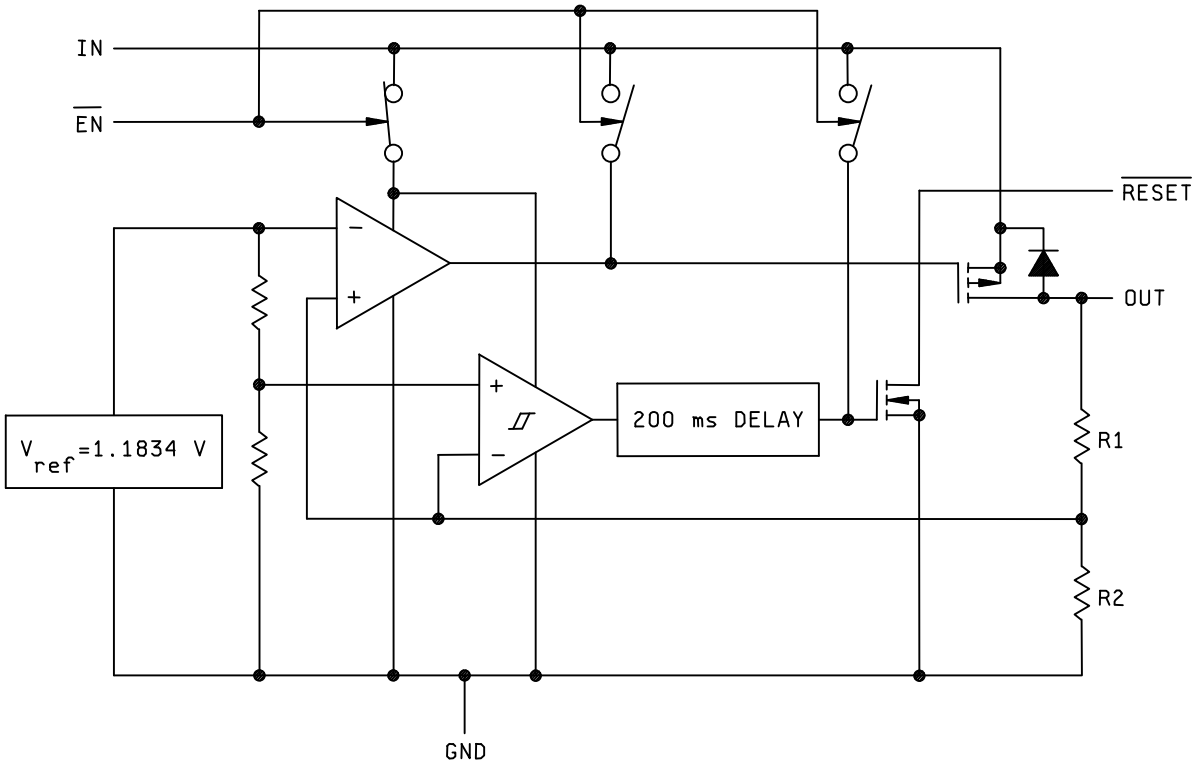
NC = No internal connection.

FIGURE 2. Terminal connections.



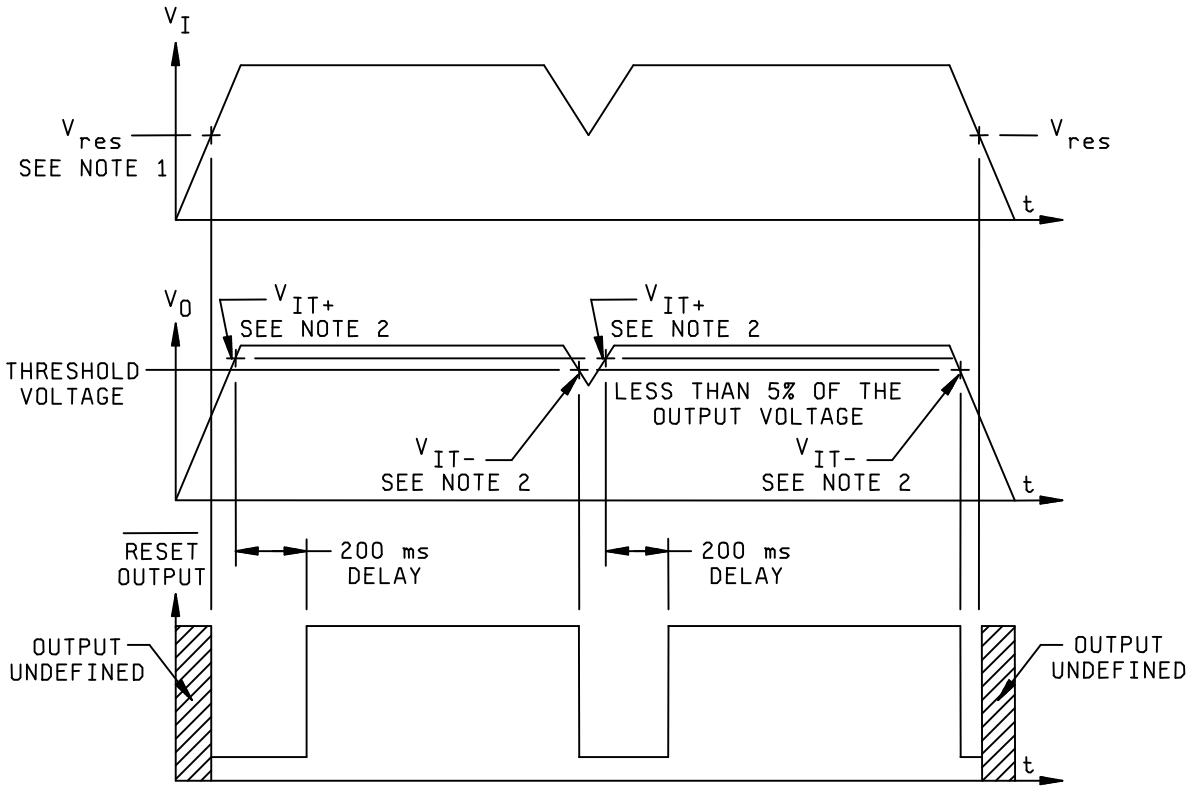
Adjustable version

FIGURE 3. Block diagram.



Fixed voltage version

FIGURE 3. Block diagram - Continued.



NOTES:

1. V_{res} is the minimum input voltage for a valid $\overline{\text{RESET}}$. The symbol V_{res} is not currently listed within EIA or JEDEC standards for semiconductor symbology.
2. Trip voltage (V_{IT} -) is typically 5% lower than the output voltage (95% 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 2/
V62/03630-01XE	01295	TPS76701QPWPREP
V62/03630-02XE	01295	TPS76715QPWPREP
V62/03630-03XE	01295	TPS76718QPWPREP
V62/03630-04XE	01295	TPS76725QPWPREP
V62/03630-05XE	3/	TPS76727QPWPREP
V62/03630-06XE	3/	TPS76728QPWPREP
V62/03630-07XE	3/	TPS76730QPWPREP
V62/03630-08XE	01295	TPS76733QPWPREP
V62/03630-09XE	01295	TPS76750QPWPREP

1/ The vendor item drawing establishes an administrative control number for identifying the item on the engineering documentation.
2/ Available taped and reeled in quantities of 2000 per reel.
3/ This device is not available from the approved source of supply.

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