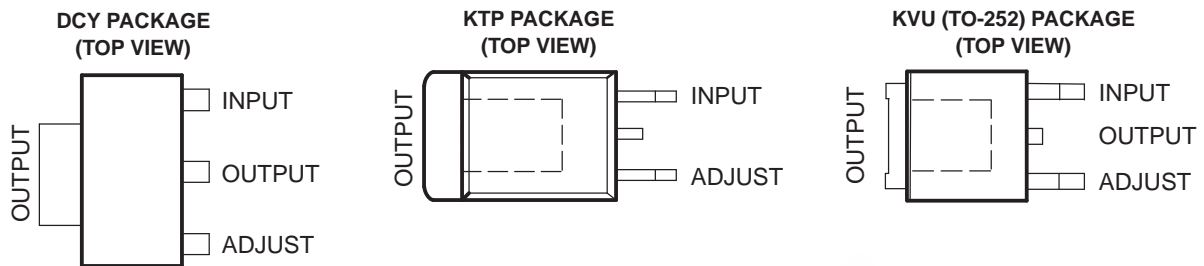


## FEATURES

- Output Voltage Range Adjustable From 1.25 V to 37 V
- Output Current Greater Than 500 mA
- Internal Short-Circuit Current Limiting
- Thermal-Overload Protection
- Output Safe-Area Compensation
- Q Devices Meet Automotive Performance Requirements
- Customer-Specific Configuration Control Can Be Supported for Q Devices Along With Major-Change Approval



## DESCRIPTION/ORDERING INFORMATION

The LM317M is an adjustable 3-terminal positive-voltage regulator capable of supplying more than 500 mA over an output-voltage range of 1.25 V to 37 V. The LM317M is exceptionally easy to use and requires only two external resistors to set the output voltage. Furthermore, both line and load regulation are better than standard fixed regulators.

In addition to having higher performance than fixed regulators, the device includes on-chip current limiting, thermal-overload protection, and safe-operating-area protection. All overload protection remains fully functional if the ADJUST terminal is disconnected.

Normally, no capacitors are needed unless the device is more than six inches from the input filter capacitors, in which case an input bypass capacitor is needed. An optional output capacitor can be added to improve transient response. The ADJUST terminal can be bypassed to achieve high ripple-rejection ratios, which are difficult to achieve with standard three-terminal regulators.

## ORDERING INFORMATION

$T_J$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 125°C	PowerFLEX™ – KTP	Reel of 2000	LM317MKTPR	LM317M
	SOT – DCY	Tube of 80	LM317MDCY	L4
		Reel of 2500	LM317MDCYR	
	TO-252 – KVU	Reel of 2500	LM317MKVURG3	LM317M
–40°C to 125°C	PowerFLEX – KTP	Reel of 2000	LM317MQKTPR	317MQ
	SOT – DCY	Reel of 2500	LM317MQDCYR	L5
			LM317MQDCYRG3	L8

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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# LM317M

## 3-TERMINAL ADJUSTABLE REGULATOR

SLVS2970 – APRIL 2000 – REVISED JULY 2006

### Absolute Maximum Ratings<sup>(1)</sup>

over operating temperature range (unless otherwise noted)

		MIN	MAX	UNIT
$V_I - V_O$	Input-to-output differential voltage		40	V
$T_J$	Operating virtual junction temperature		150	°C
	Lead temperature (within 5 mils of the plastic body for 10 s)		260	°C
				KTP, DCY packages
$T_{stg}$	Storage temperature range	-65	150	°C

(1) Stresses beyond those listed under "absolute maximum ratings" 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.

### Package Thermal Data<sup>(1)</sup>

PACKAGE	BOARD	$\theta_{JC}$	$\theta_{JCB}$	$\theta_{JA}$
PowerFLEX (KTP)	High K, JESD 51-5		3°C/W	28°C/W
SOT-223 (DCY)	High K, JESD 51-7	30.6°C/W		53°C/W
TO-252 (KVU)	High K, JESD 51-5			30.3°C/W

(1) Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.

### Recommended Operating Conditions

		MIN	MAX	UNIT
$V_I - V_O$	Input-to-output voltage differential		37	V
$I_O$	Output current		0.5	A
$T_J$	Operating virtual junction temperature	No suffix	0	125
		Q suffix	-40	125
				°C

### Electrical Characteristics

over recommended operating virtual-junction temperature range,  $V_I - V_O = 5$  V,  $I_O = 0.1$  A (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>		MIN	TYP	MAX	UNIT
Line regulation <sup>(2)</sup>	$V_I - V_O = 3$ V to 40 V	$T_J = 25^\circ\text{C}$		0.01	0.04	%V
		Full temperature range		0.02	0.07	
Load regulation	$I_O = 10$ mA to 500 mA	$T_J = 25^\circ\text{C}$		0.1	0.5	%V <sub>O</sub>
		Full temperature range		0.3	1.5	
ADJUST terminal current				50	100	μA
Change in ADJUST terminal current	$V_I - V_O = 3$ V to 40 V,	$I_O = 10$ mA to 500 mA		0.2	5	μA
Reference voltage	$V_I - V_O = 3$ V to 40 V,	$I_O = 10$ mA to 500 mA	1.2	1.25	1.3	V
Output-voltage temperature stability				0.7		%
Minimum load current to maintain regulation				3.5	10	mA
Maximum output current	$V_I - V_O \leq 15$ V		500	900		mA
	$V_I - V_O = 40$ V, $P_D \leq P_{D(\max)}$ ,	$T_J = 25^\circ\text{C}$	150	250		
RMS output noise voltage (% of V <sub>O</sub> )	$f = 10$ Hz to 10 kHz,	$T_J = 25^\circ\text{C}$		0.003		%V <sub>O</sub>
Ripple rejection	$V_O = 10$ V, $f = 120$ Hz, $T_J = 25^\circ\text{C}$	$C_{ADJ} = 0^{(3)}$		65		dB
		$C_{ADJ} = 10$ μF <sup>(3)</sup>	66	80		
Long-term stability	$T_J = 25^\circ\text{C}$			0.3	1	%/1k hrs

- (1) Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.  
 (2) Line voltage regulation is expressed here as the percentage change in output voltage per 1-V change at the input.  
 (3) CADJ is connected between the ADJUST terminal and ground.

**TYPICAL CHARACTERISTICS**

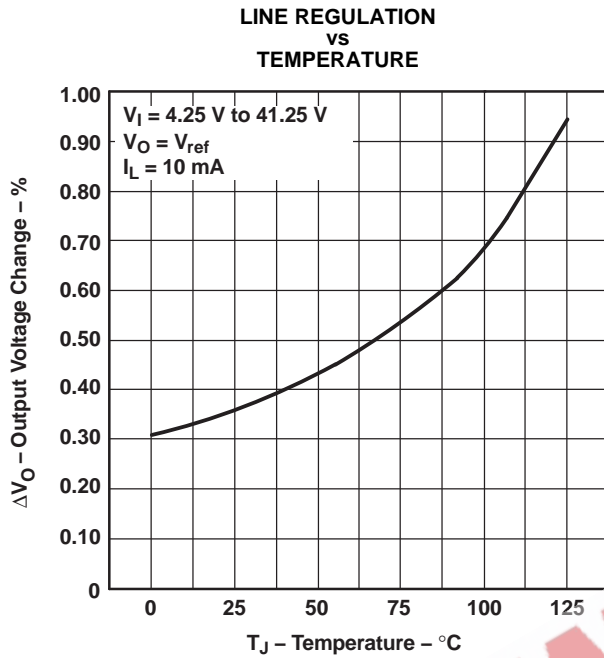


Figure 1.

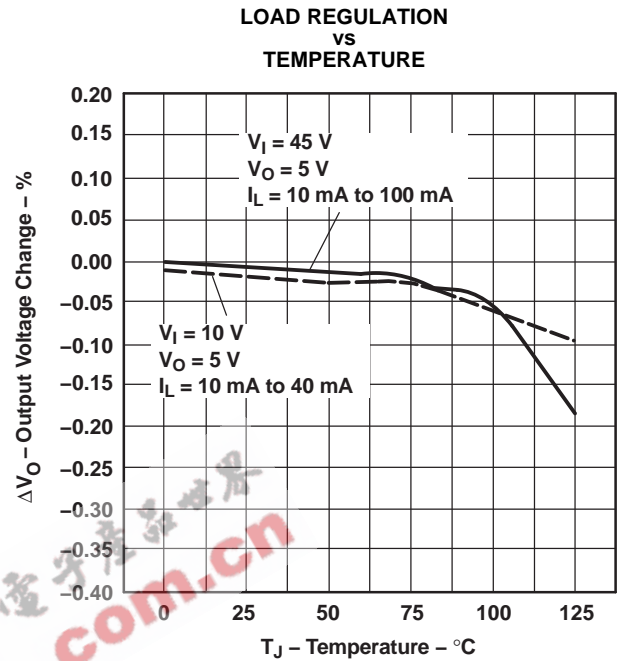


Figure 2.

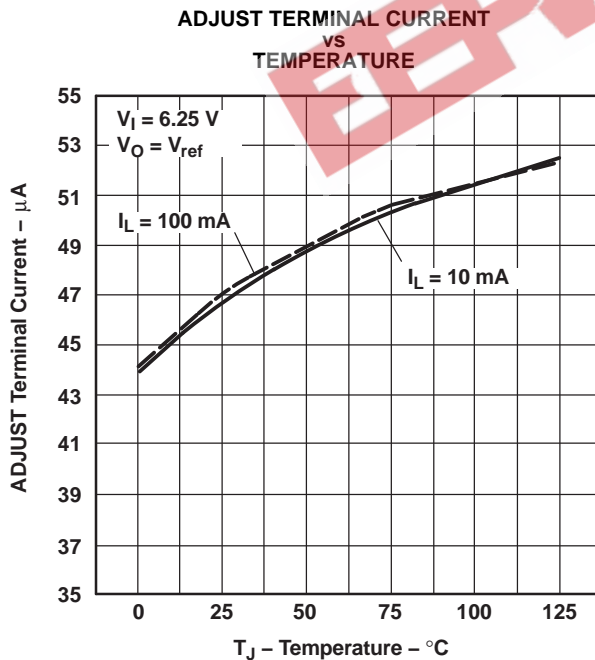


Figure 3.

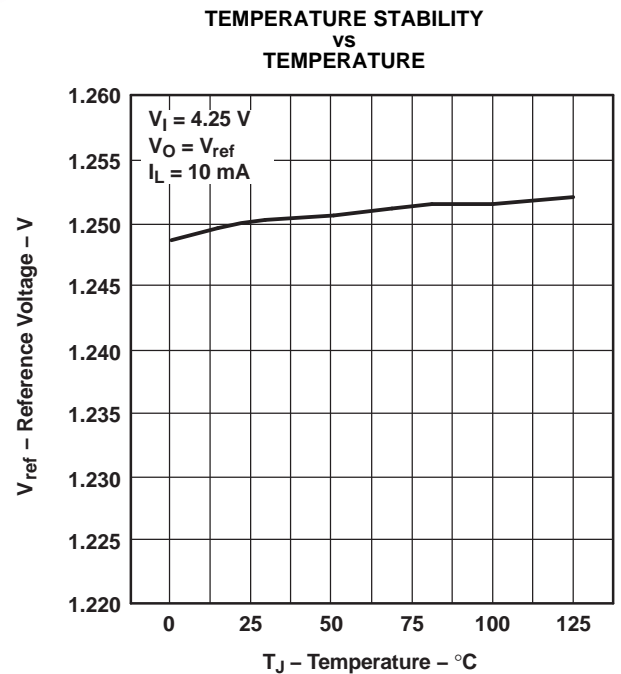


Figure 4.

TYPICAL CHARACTERISTICS (continued)

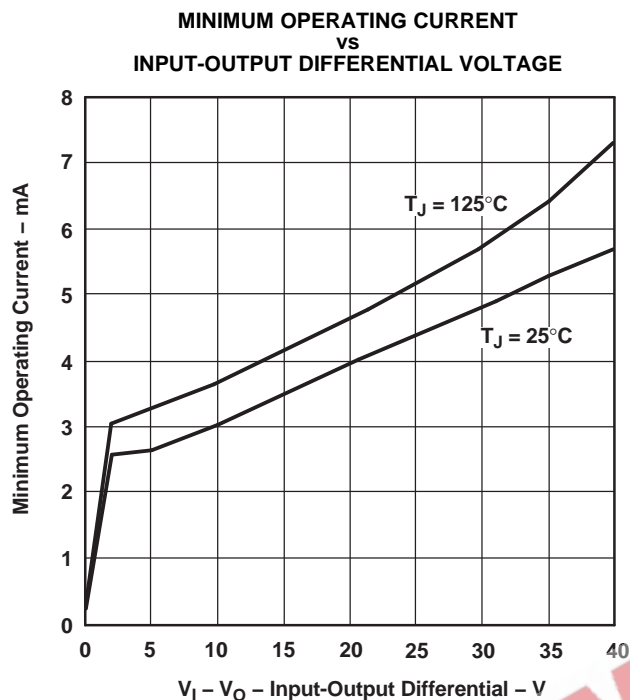


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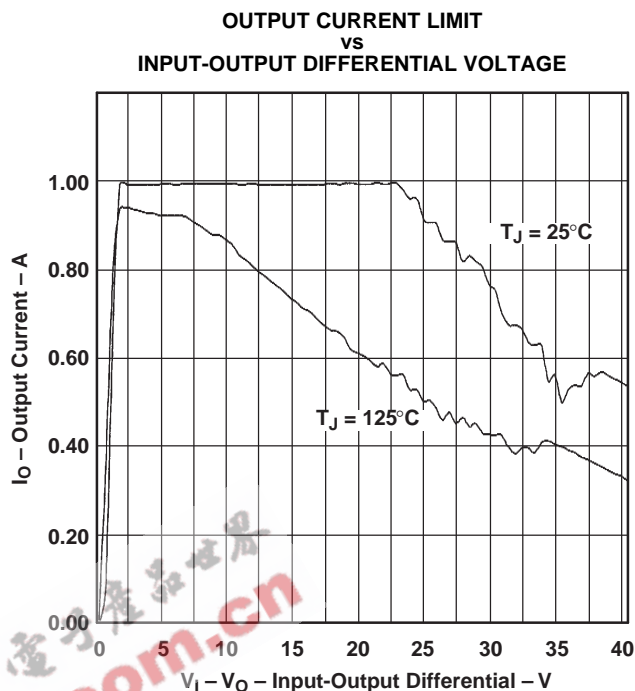


Figure 6.

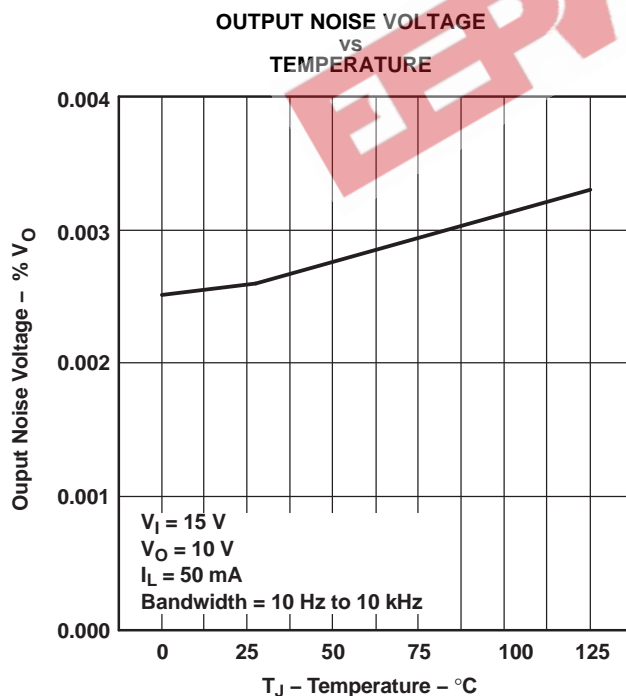


Figure 7.

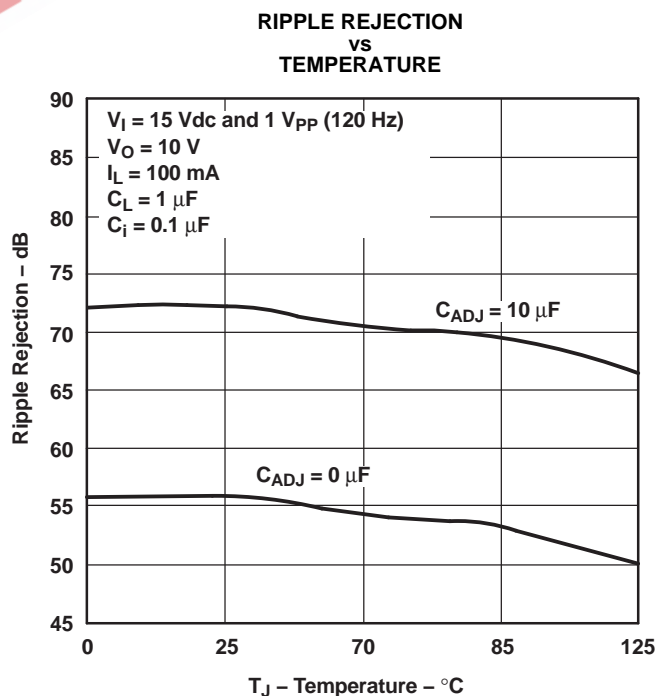
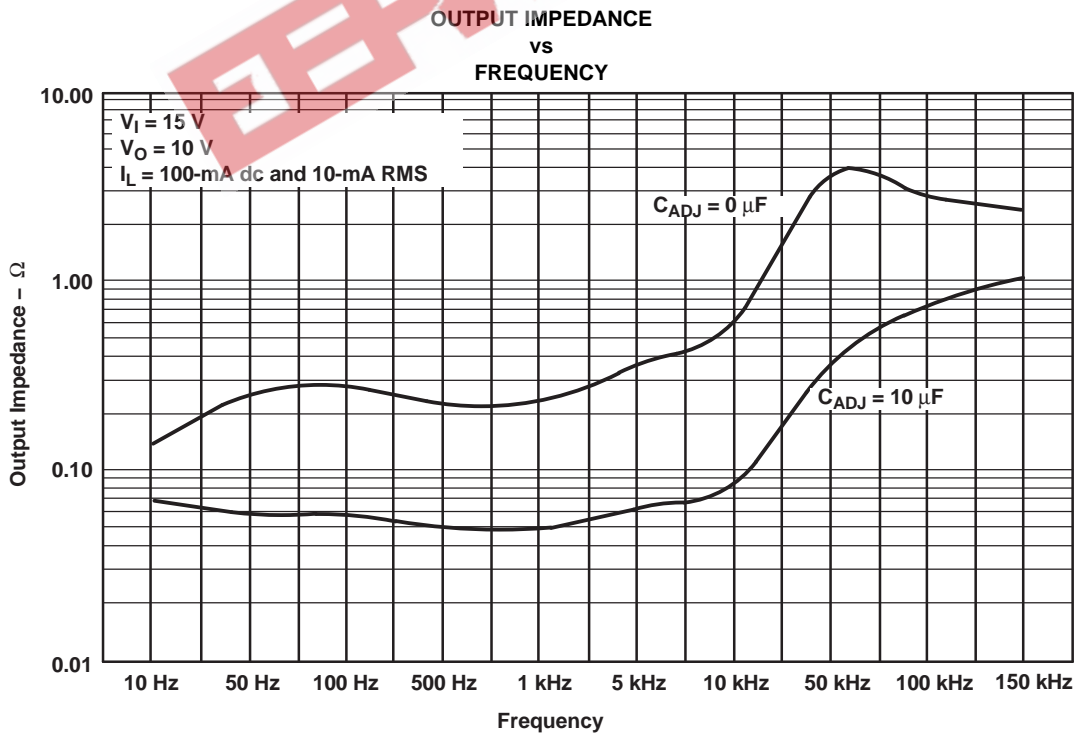
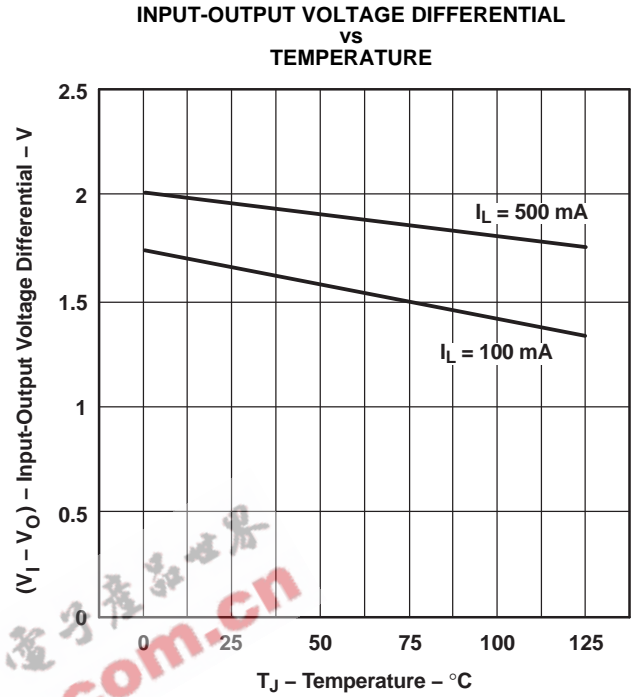
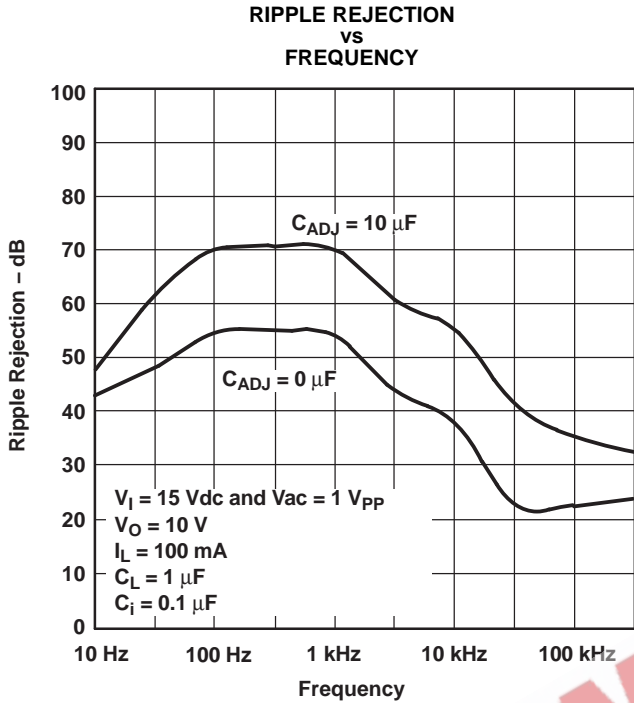


Figure 8.

TYPICAL CHARACTERISTICS (continued)



# LM317M 3-TERMINAL ADJUSTABLE REGULATOR

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## TYPICAL CHARACTERISTICS (continued)

### LINE TRANSIENT RESPONSE vs TIME

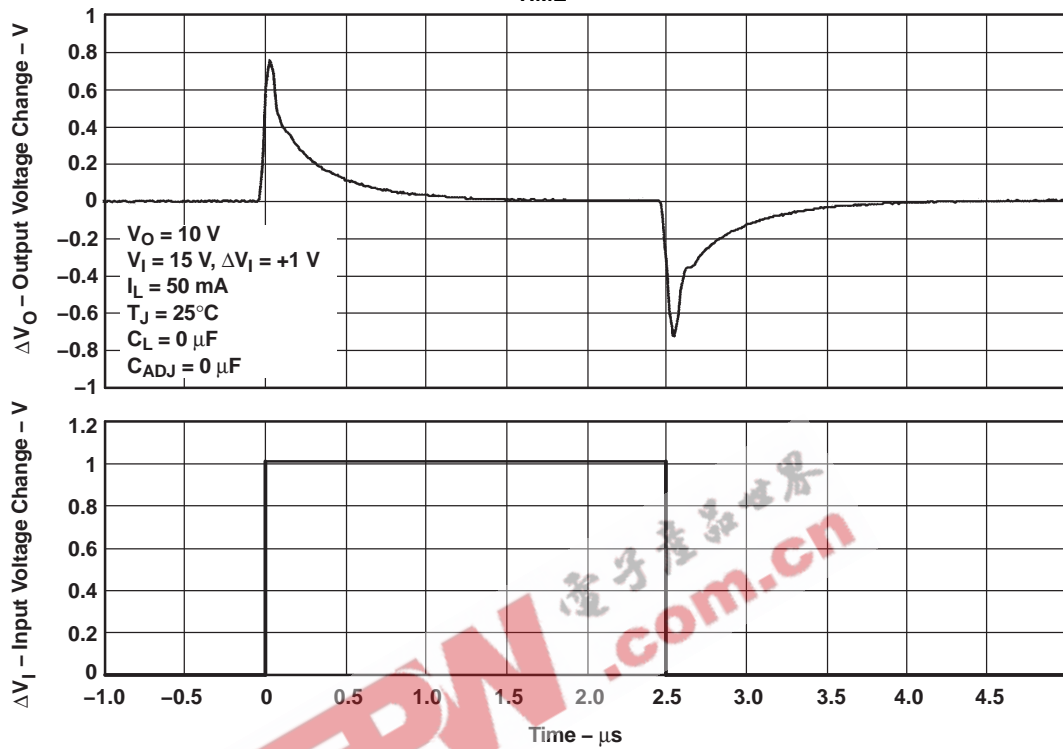


Figure 12.

### LOAD TRANSIENT RESPONSE vs TIME

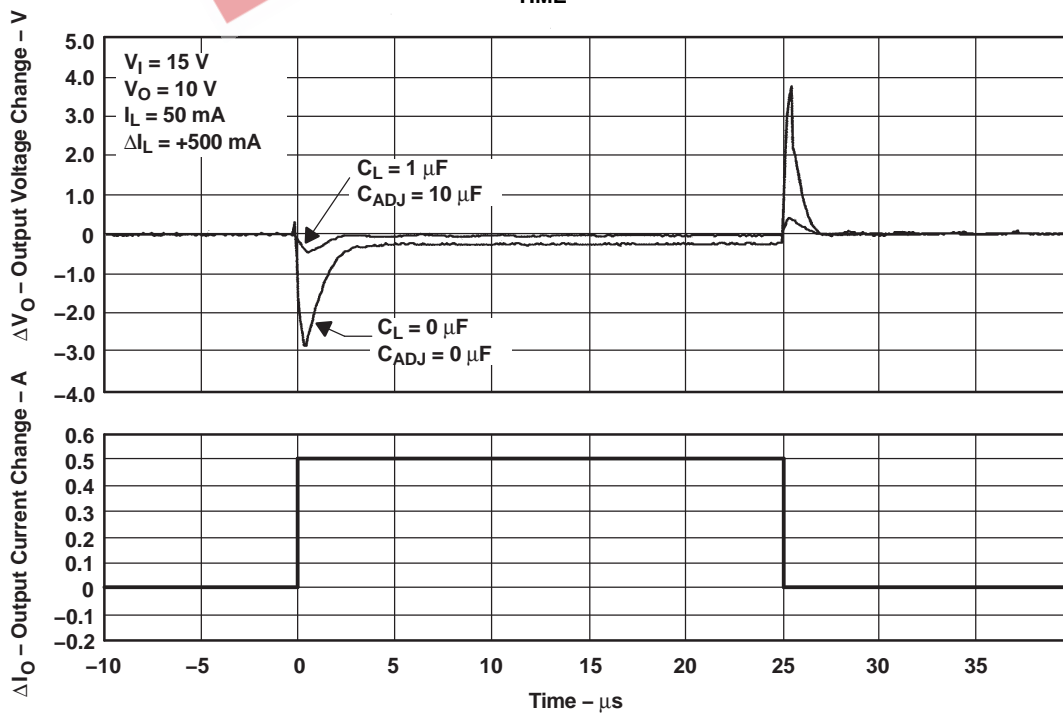
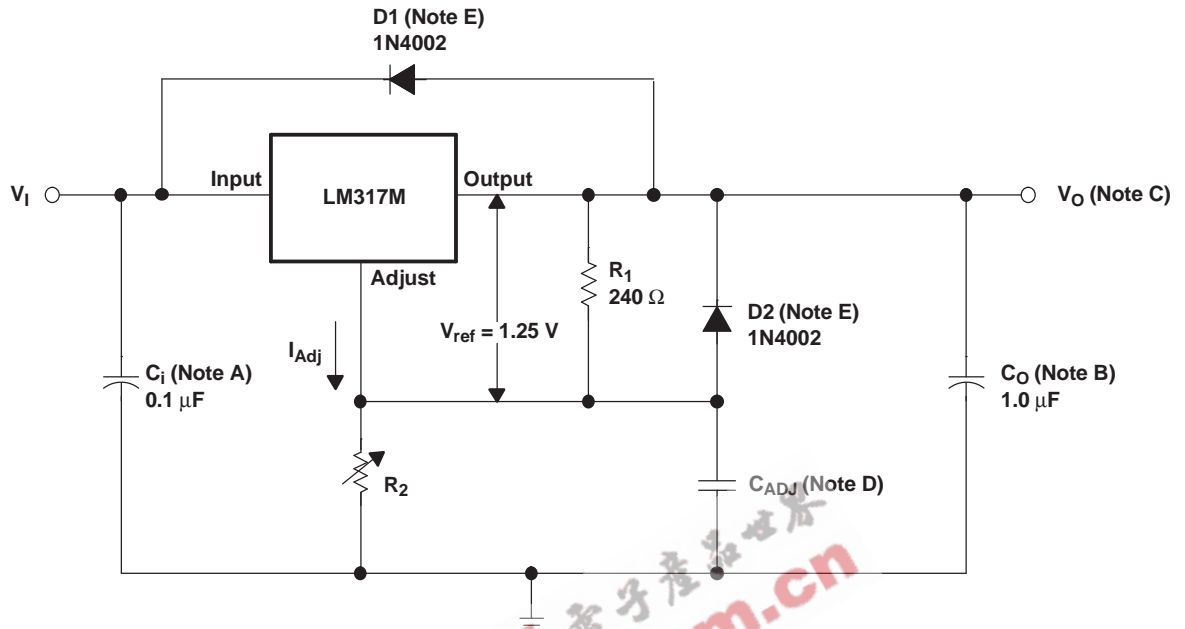


Figure 13.

**APPLICATION INFORMATION**



- NOTES:
- A.  $C_i$  is not required, but is recommended, particularly if the regulator is not in close proximity to the power-supply filter capacitors. A 0.1- $\mu\text{F}$  disc or 1- $\mu\text{F}$  tantalum provides sufficient bypassing for most applications, especially when adjustment and output capacitors are used.
  - B.  $C_O$  improves transient response, but is not needed for stability.
  - C.  $V_O$  is calculated as shown:

$$V_O = V_{\text{ref}} \left( 1 + \frac{R_2}{R_1} \right) + (I_{\text{Adj}} \times R_2)$$

Because  $I_{\text{Adj}}$  typically is 50  $\mu\text{A}$ , it is negligible in most applications.

- D.  $C_{\text{ADJ}}$  is used to improve ripple rejection; it prevents amplification of the ripple as the output voltage is adjusted higher. If  $C_{\text{ADJ}}$  is used, it is best to include protection diodes.
- E. If the input is shorted to ground during a fault condition, protection diodes provide measures to prevent the possibility of external capacitors discharging through low-impedance paths in the IC. By providing low-impedance discharge paths for  $C_O$  and  $C_{\text{ADJ}}$ , respectively, D1 and D2 prevent the capacitors from discharging into the output of the regulator.

**Figure 14. Adjustable Voltage Regulator**

PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
LM317MDCY	ACTIVE	SOT-223	DCY	4	80	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1YEAR
LM317MDCYG3	ACTIVE	SOT-223	DCY	4	80	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1YEAR
LM317MDCYR	ACTIVE	SOT-223	DCY	4	2500	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1YEAR
LM317MDCYRG3	ACTIVE	SOT-223	DCY	4	2500	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1YEAR
LM317MKTPR	NRND	PFM	KTP	2	3000	TBD	CU SN	Level-1-220C-UNLIM
LM317MKTPRG3	NRND	PFM	KTP	2	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM
LM317MKVURG3	ACTIVE	PFM	KVU	3	2500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR
LM317MQDCYR	ACTIVE	SOT-223	DCY	4	2500	TBD	SNPB	Level-2-235C-1 YEAR
LM317MQDCYRG3	ACTIVE	SOT-223	DCY	4	2500	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR
LM317MQKTPR	OBSOLETE	PFM	KTP	2		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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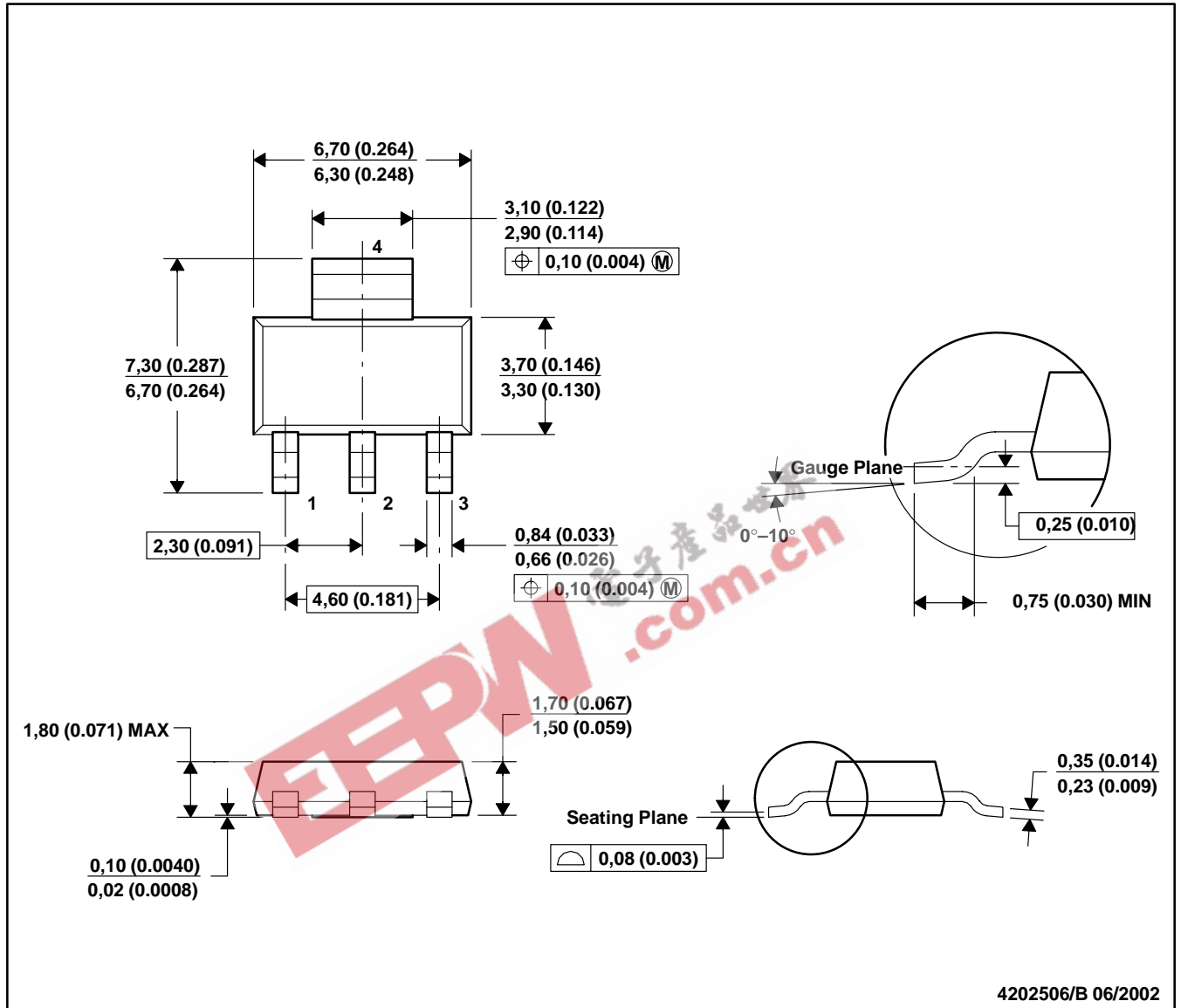


# MECHANICAL DATA

MPDS094A – APRIL 2001 – REVISED JUNE 2002

DCY (R-PDSO-G4)

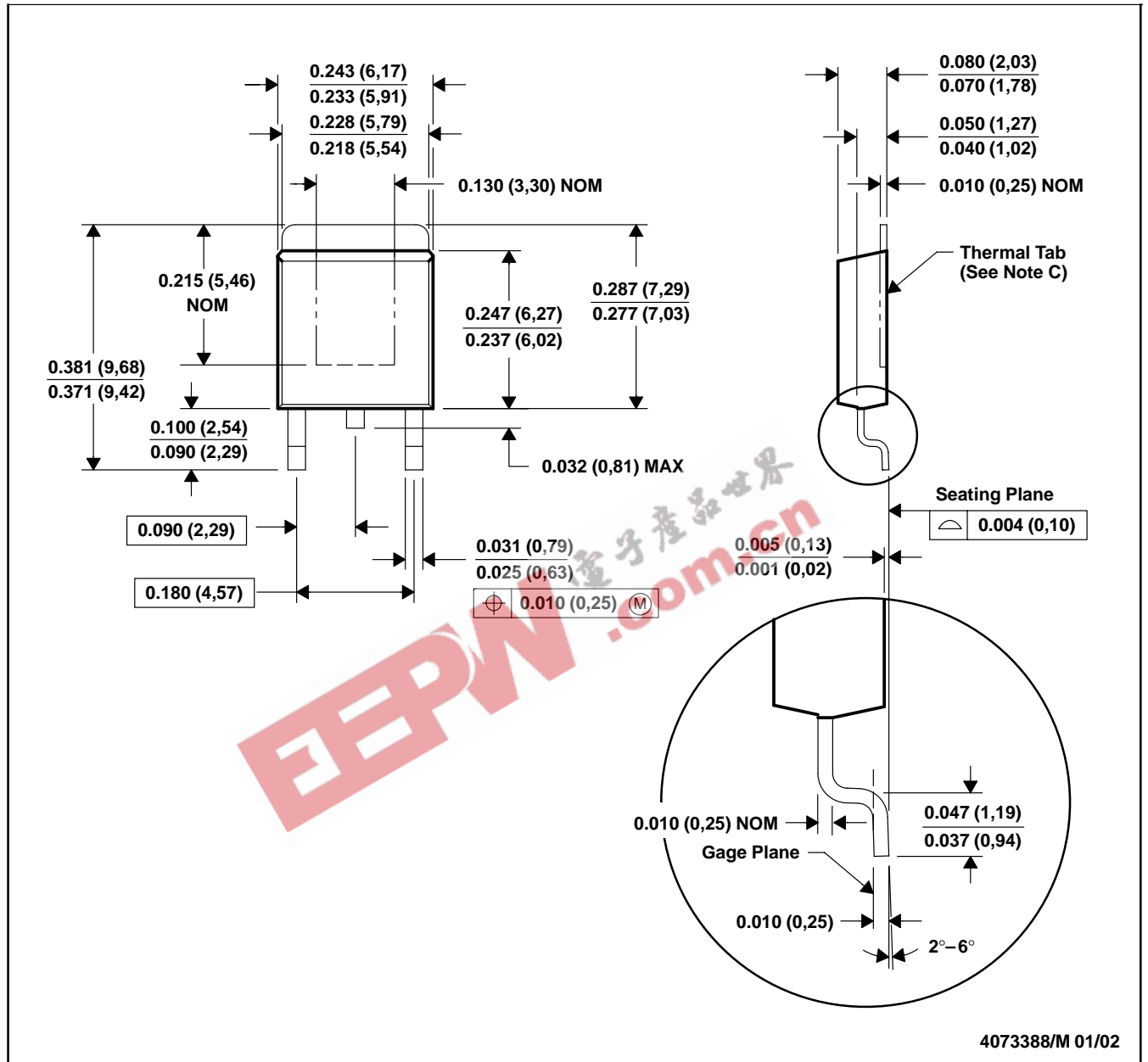
PLASTIC SMALL-OUTLINE



- NOTES: A. All linear dimensions are in millimeters (inches).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion.  
 D. Falls within JEDEC TO-261 Variation AA.

KTP (R-PSFM-G2)

PowerFLEX™ PLASTIC FLANGE-MOUNT PACKAGE



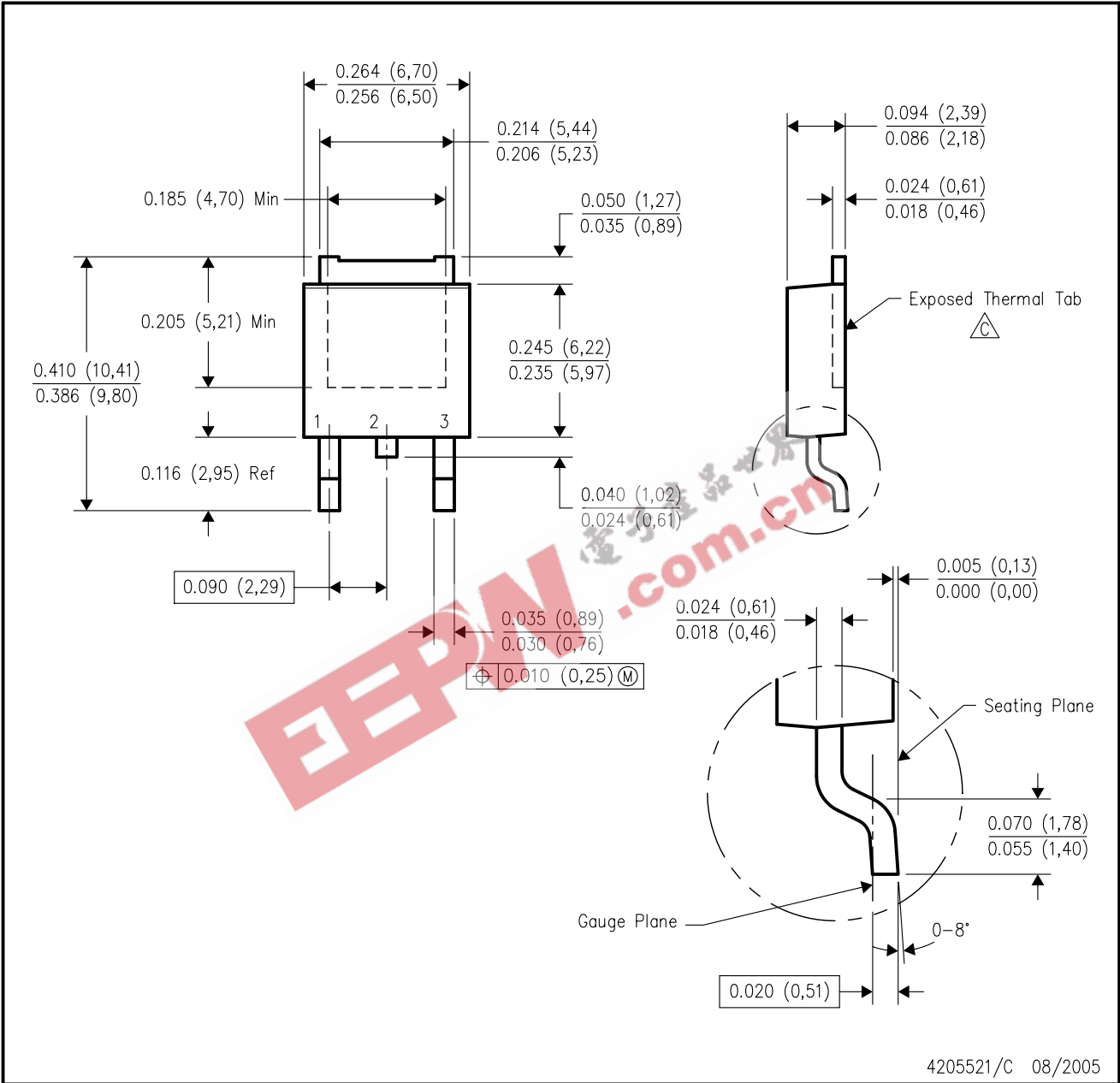
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. The center lead is in electrical contact with the thermal tab.  
 D. Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).  
 E. Falls within JEDEC TO-252 variation AC.

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MECHANICAL DATA

KVU (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  The center lead is in electrical contact with the exposed thermal tab.
  - D. Body Dimensions do not include mold flash or protrusions. Mold flash and protrusion shall not exceed 0.006 (0,15) per side.
  - E. Falls within JEDEC TO-252 variation AA.

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Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
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