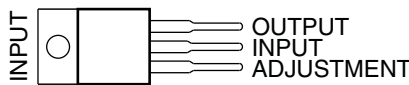


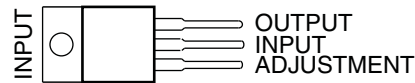
**FEATURES**

- Output Voltage Range Adjustable From –1.2 V to –37 V
- Output Current Capability of 1.5 A Max
- Input Regulation Typically 0.01% Per Input-Voltage Change
- Output Regulation Typically 0.3%
- Peak Output Current Constant Over Temperature Range of Regulator
- Ripple Rejection Typically 77 dB
- Direct Replacement for Industry-Standard LM237 and LM337

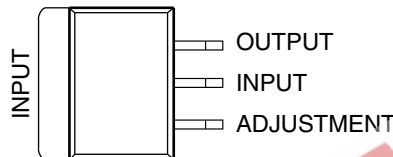
LM237, LM337...KC (TO-220) PACKAGE (TOP VIEW)



LM337...KCS (TO-220) PACKAGE (TOP VIEW)



LM337...KTE, KTP, OR KVU PACKAGE (TOP VIEW)



LM337...KTT (TO-263) PACKAGE (TOP VIEW)



**DESCRIPTION/ORDERING INFORMATION**

The LM237 and LM337 are adjustable 3-terminal negative-voltage regulators capable of supplying in excess of –1.5 A over an output voltage range of –1.2 V to –37 V. They are exceptionally easy to use, requiring only two external resistors to set the output voltage and one output capacitor for frequency compensation. The current design has been optimized for excellent regulation and low thermal transients. In addition, the LM237 and LM337 feature internal current limiting, thermal shutdown, and safe-area compensation, making them virtually immune to failure by overloads.

The LM237 and LM337 serve a wide variety of applications, including local on-card regulation, programmable output-voltage regulation, and precision current regulation.

**ORDERING INFORMATION**

T <sub>J</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–25°C to 150°C	TO-220 – KC	Tube of 50	LM237KC	LM237
0°C to 125°C	PowerFLEX™ – KTE	Reel of 2000	LM337KTER	LM337
	PowerFLEX – KTP	Reel of 3000	LM337KTPR	L337
	TO-220 – KC	Tube of 50	LM337KC	LM337
	TO-220 – KCS	Tube of 50	LM337KCSE3	LM337
	TO-252 – KVU	Reel of 2500	LM337KVURG3	LM337
	TO-263 – KTT	Reel of 500	LM337KTTR	LM337

(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).



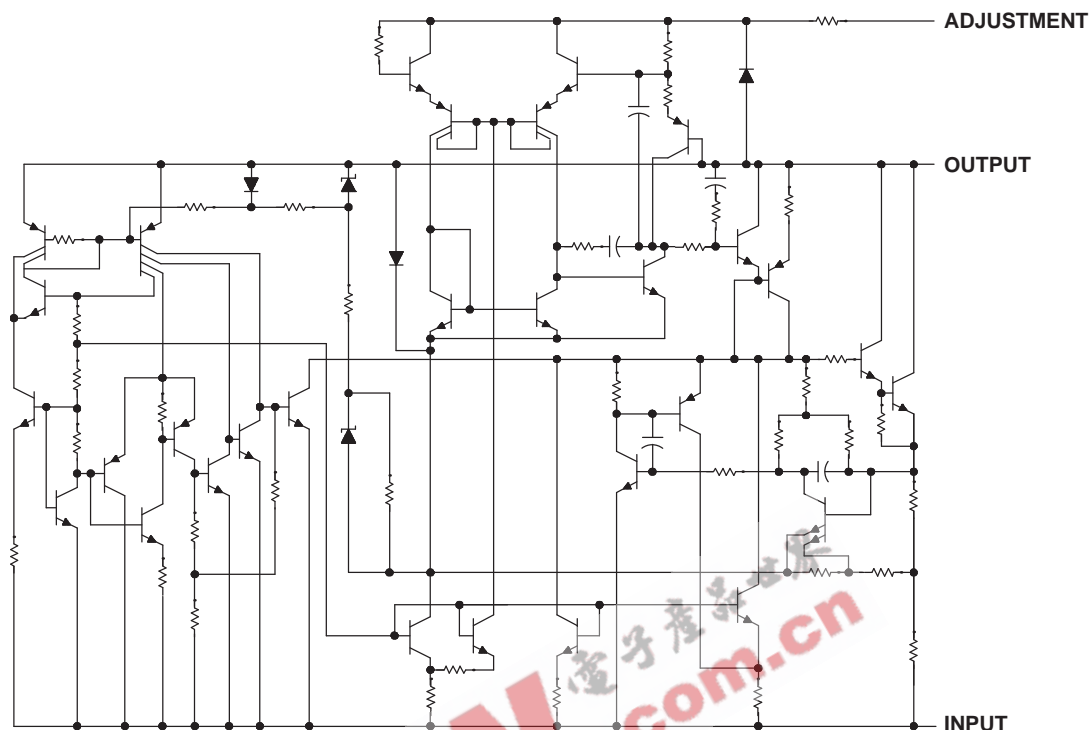
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PowerFLEX is a trademark of Texas Instruments.

# LM237, LM337 3-TERMINAL ADJUSTABLE REGULATORS

SLVS047J—NOVEMBER 1981—REVISED MAY 2007

## SCHEMATIC DIAGRAM



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

over operating temperature ranges (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		260	°C
$T_{stg}$ 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	$\theta_{JC}$	$\theta_{JA}$
PowerFLEX (KTE)	High K, JESD 51-5	3°C/W	23°C/W
PowerFLEX (KTP)	High K, JESD 51-5	19°C/W	28°C/W
TO-220 (KC)	High K, JESD 51-5	3°C/W	19°C/W
TO-220 (KCS)	High K, JESD 51-5	3°C/W	24.8°C/W
TO-252 (KVU)	High K, JESD 51-5		30.3°C/W
TO-263 (KTT)	High K, JESD 51-5	18°C/W	25.3°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
I <sub>O</sub>	Output current	V <sub>I</sub> – V <sub>O</sub>   ≤ 40 V, P ≤ 15 W	10	1500	mA
		V <sub>I</sub> – V <sub>O</sub>   ≤ 10 V, P ≤ 15 W	6	1500	
T <sub>J</sub>	Operating virtual junction temperature	LM237	–25	150	°C
		LM337	0	125	

### Electrical Characteristics

over recommended ranges of operating virtual junction temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>		LM237			LM337			UNIT		
			MIN	TYP	MAX	MIN	TYP	MAX			
Input regulation <sup>(2)</sup>	V <sub>I</sub> – V <sub>O</sub> = –3 V to –40 V	T <sub>J</sub> = 25°C	0.01	0.02		0.01	0.04		%V		
		T <sub>J</sub> = MIN to MAX	0.02	0.05		0.02	0.07				
Ripple rejection	V <sub>O</sub> = –10 V, f = 120 Hz		60			60			dB		
	V <sub>O</sub> = –10 V, f = 120 Hz, C <sub>ADJ</sub> = 10 μF		66	77		66	77				
Output regulation	I <sub>O</sub> = 10 mA to 1.5 A, T <sub>J</sub> = 25°C	V <sub>O</sub>   ≤ 5 V	25			50			mV		
		V <sub>O</sub>   ≥ 5 V	0.3	0.5		0.3	1		%		
	I <sub>O</sub> = 10 mA to 1.5 A	V <sub>O</sub>   ≤ 5 V	50			70			mV		
		V <sub>O</sub>   ≥ 5 V	1			1			1.5	%	
Output-voltage change with temperature	T <sub>J</sub> = MIN to MAX		0.6			0.6			%		
Output-voltage long-term drift	After 1000 h at T <sub>J</sub> = MAX and V <sub>I</sub> – V <sub>O</sub> = –40 V		0.3			0.3			1	%	
Output noise voltage	f = 10 Hz to 10 kHz, T <sub>J</sub> = 25°C		0.003			0.003			%		
Minimum output current to maintain regulation	V <sub>I</sub> – V <sub>O</sub>   ≤ 40 V		2.5			5			mA		
	V <sub>I</sub> – V <sub>O</sub>   ≤ 10 V		1.2			3					
Peak output current	V <sub>I</sub> – V <sub>O</sub>   ≤ 15 V		1.5			2.2			A		
	V <sub>I</sub> – V <sub>O</sub>   ≤ 40 V, T <sub>J</sub> = 25°C		0.24			0.4					
ADJUSTMENT current			65			100			μA		
Change in ADJUSTMENT current	V <sub>I</sub> – V <sub>O</sub> = –2.5 V to –40 V, I <sub>O</sub> = 10 mA to MAX, T <sub>J</sub> = 25°C		2			5			μA		
Reference voltage (OUTPUT to ADJUSTMENT)	V <sub>I</sub> – V <sub>O</sub> = –3 V to –40 V, I <sub>O</sub> = 10 mA to 1.5 A, P ≤ rated dissipation	T <sub>J</sub> = 25°C	–1.225	–1.25	–1.275	–1.213	–1.25	–1.287	V		
		T <sub>J</sub> = MIN to MAX	–1.2	–1.25	–1.3	–1.2	–1.25	–1.3			
Thermal regulation	Initial T <sub>J</sub> = 25°C, 10-ms pulse		0.002			0.02			0.003	0.04	%/W

- (1) Unless otherwise noted, the following test conditions apply: |V<sub>I</sub> – V<sub>O</sub>| = 5 V and I<sub>O</sub> = 0.5 A. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions. All characteristics are measured with a 0.1-μF capacitor across the input and a 1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
- (2) Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

# LM237, LM337

## 3-TERMINAL ADJUSTABLE REGULATORS

SLVS047J–NOVEMBER 1981–REVISED MAY 2007

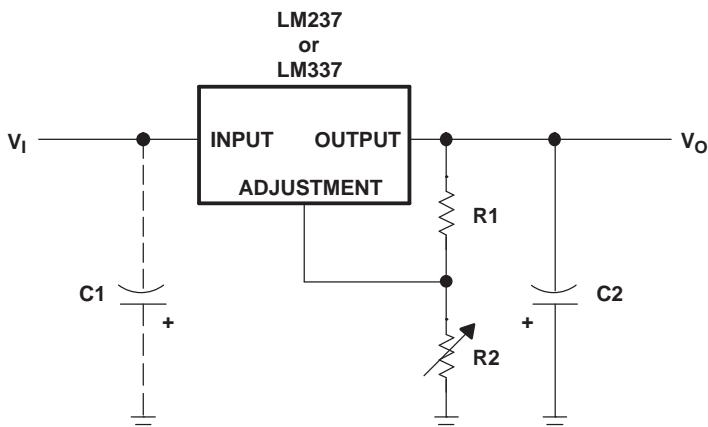
### Electrical Characteristics

$T_J = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	LM237, LM337			UNIT
		MIN	TYP	MAX	
Input regulation <sup>(2)</sup>	$V_I - V_O = -3\text{ V to } -40\text{ V}$		0.01	0.04	%/V
Ripple rejection	$V_O = -10\text{ V}, f = 120\text{ Hz}$		60		dB
	$V_O = -10\text{ V}, f = 120\text{ Hz}, C_{\text{ADJ}} = 10\text{ }\mu\text{F}$	66	77		
Output regulation	$I_O = 10\text{ mA to } 1.5\text{ A}$	$ V_O  \leq 5\text{ V}$		50	mV
		$ V_O  \geq 5\text{ V}$	0.3	1	%
Output noise voltage	$f = 10\text{ Hz to } 10\text{ kHz}$		0.003		%
Minimum output current to maintain regulation	$ V_I - V_O  \leq 40\text{ V}$		2.5	10	mA
	$ V_I - V_O  \leq 10\text{ V}$		1.5	6	
Peak output current	$ V_I - V_O  \leq 15\text{ V}$	1.5	2.2		A
	$ V_I - V_O  \leq 40\text{ V}$	0.15	0.4		
ADJUSTMENT current			65	100	$\mu\text{A}$
Change in ADJUSTMENT current	$V_I - V_O = -2.5\text{ V to } -40\text{ V}, I_O = 10\text{ mA to MAX}$		2	5	$\mu\text{A}$
Reference voltage (OUTPUT to ADJUSTMENT)	$V_I - V_O = -3\text{ V to } -40\text{ V}, I_O = 10\text{ mA to } 1.5\text{ A}, P \leq \text{rated dissipation}$	-1.213	-1.25	-1.287	V

- (1) Unless otherwise noted, the following test conditions apply:  $|V_I - V_O| = 5\text{ V}$  and  $I_O = 0.5\text{ A}$ . All characteristics are measured with a  $0.1\text{-}\mu\text{F}$  capacitor across the input and a  $1\text{-}\mu\text{F}$  capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
- (2) Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

**APPLICATION INFORMATION**

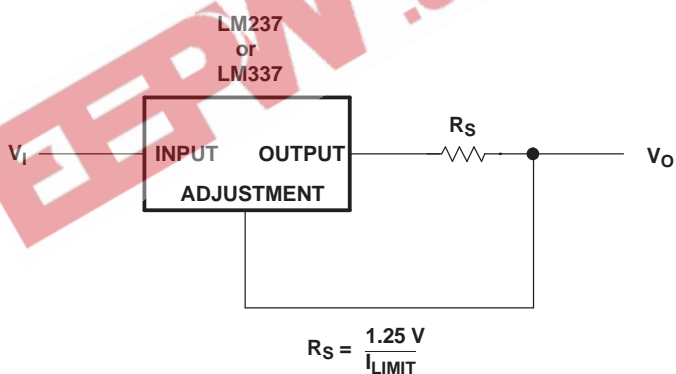


R1 typically is 120 Ω.

$$R2 = R1 \left( \frac{-V_O}{-1.25} - 1 \right), \text{ where } V_O \text{ is the output in volts.}$$

C1 is a 1-μF solid tantalum capacitor required only if the regulator is more than 10 cm (4 in) from the power-supply filter capacitor. C2 is a 1-μF solid tantalum or 10-μF aluminum electrolytic capacitor required for stability.

**Figure 1. Adjustable Negative-Voltage Regulator**



**Figure 2. Current-Limiting Circuit**

**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>
LM237KC	NRND	TO-220	KC	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
LM237KCE3	NRND	TO-220	KC	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
LM237KCSE3	ACTIVE	TO-220	KCS	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
LM237KTER	OBSOLETE	PFM	KTE	3		TBD	Call TI	Call TI
LM337KC	NRND	TO-220	KC	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
LM337KCE3	NRND	TO-220	KC	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
LM337KCSE3	ACTIVE	TO-220	KCS	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
LM337KTER	NRND	PFM	KTE	3	2000	TBD	CU SN	Level-3-240C-168 HR
LM337KTPR	NRND	PFM	KTP	2	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM
LM337KTPRG3	NRND	PFM	KTP	2	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM
LM337KTTR	ACTIVE	DDPAK/ TO-263	KTT	3	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-245C-168 HR
LM337KTTRG3	ACTIVE	DDPAK/ TO-263	KTT	3	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-245C-168 HR
LM337KVURG3	ACTIVE	PFM	KVU	3	2500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR
LM337Y	OBSOLETE	DIESALE	Y	0		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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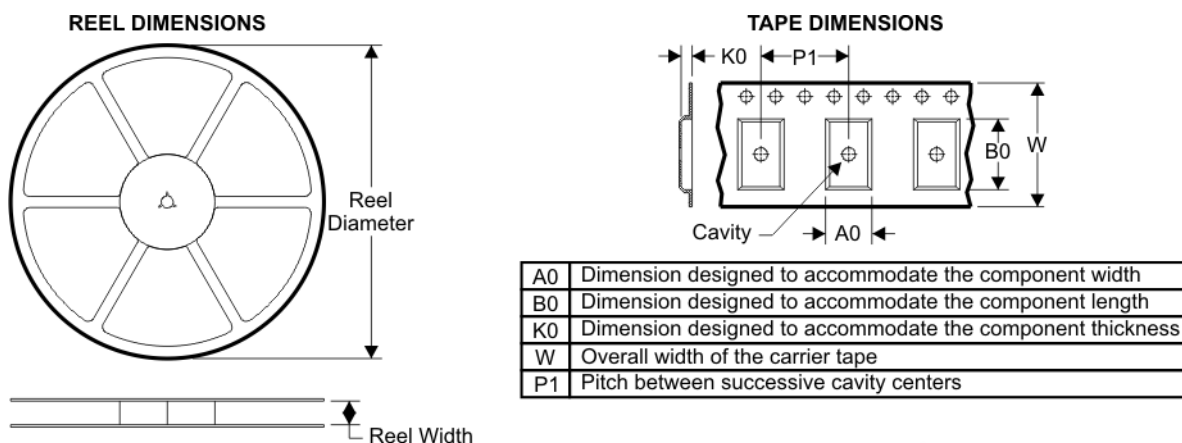
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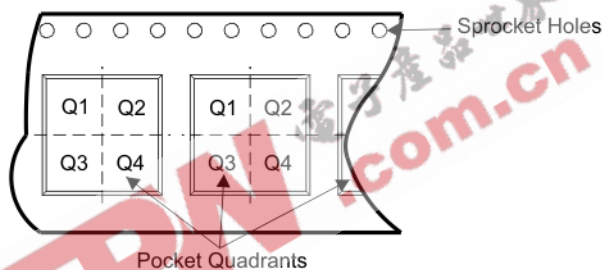
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**TAPE AND REEL BOX INFORMATION**



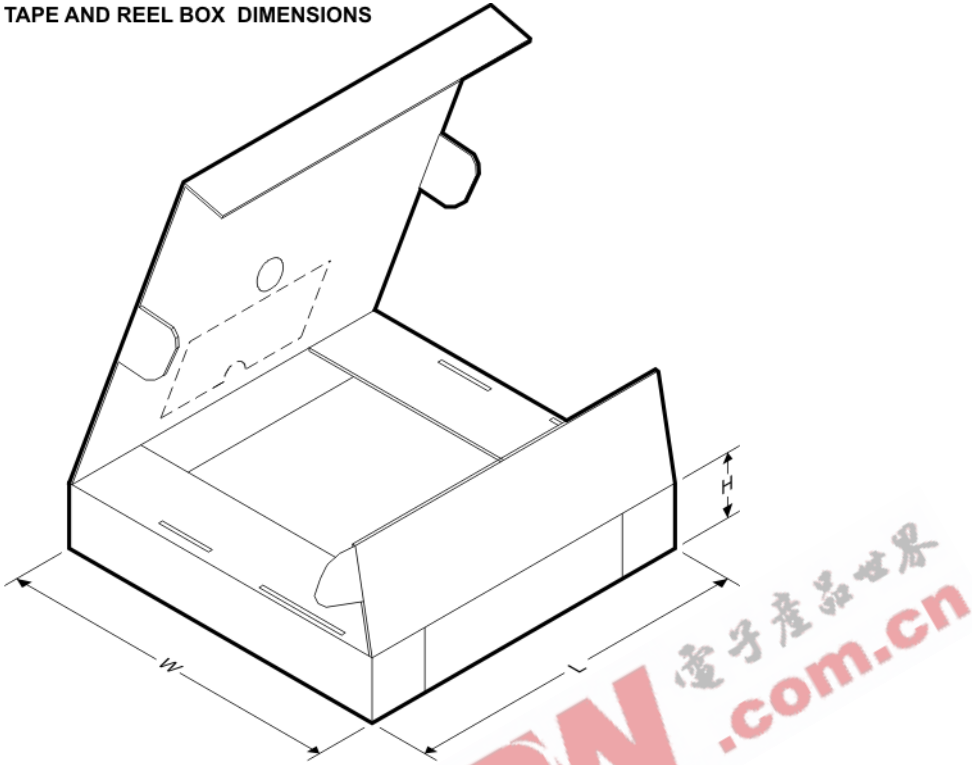
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM337KTTR	KTT	3	SITE 45	330	24	10.6	15.8	4.9	16	24	Q2
LM337KVURG3	KVU	3	SITE 45	330	16	6.9	10.5	2.7	8	16	Q2



**TAPE AND REEL BOX DIMENSIONS**



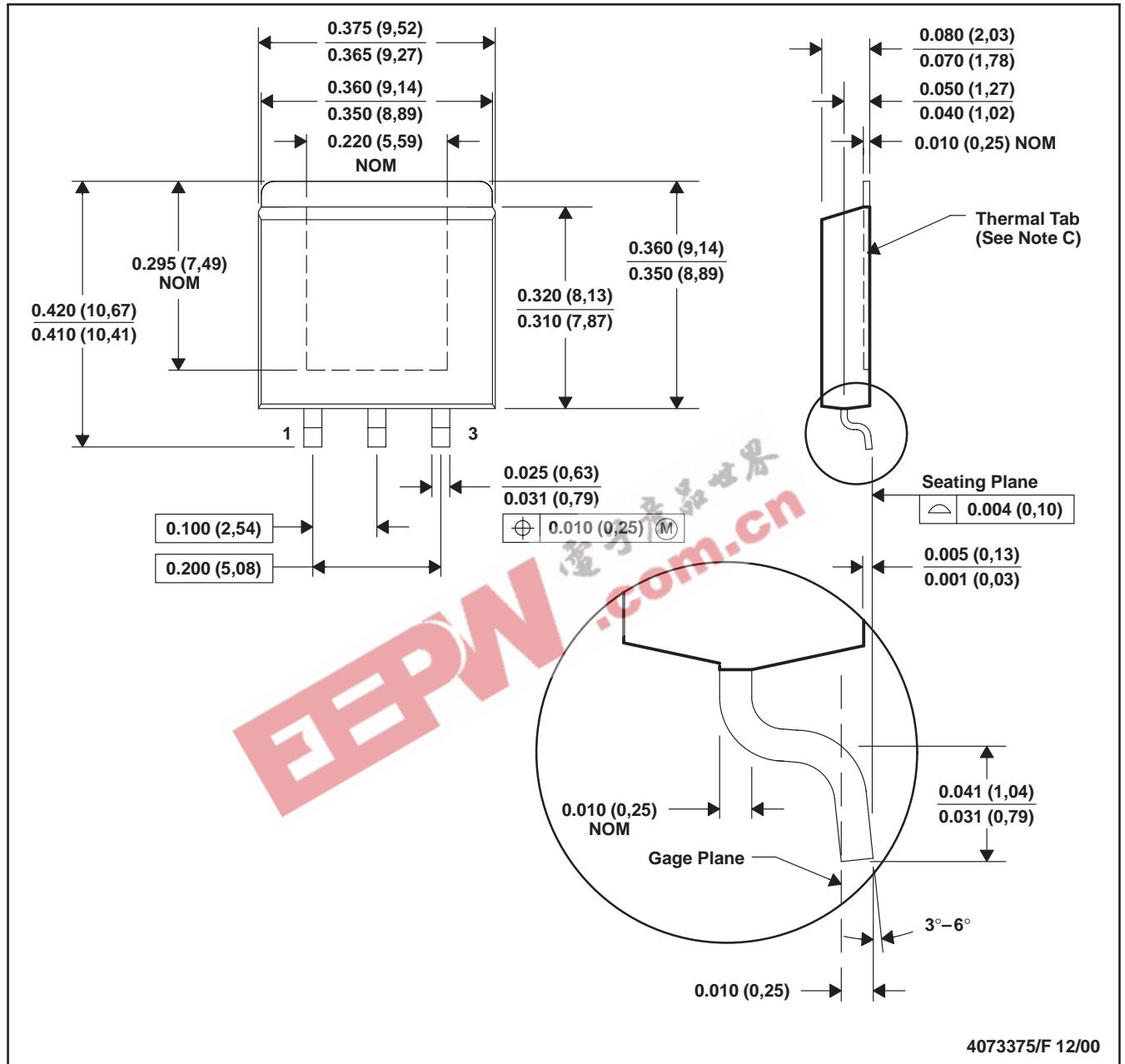
Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
LM337KTTR	KTT	3	SITE 45	340.0	340.0	38.0
LM337KVURG3	KVU	3	SITE 45	340.0	340.0	38.0

# MECHANICAL DATA

MPFM001E – OCTOBER 1994 – REVISED JANUARY 2001

KTE (R-PSFM-G3)

PowerFLEX™ PLASTIC FLANGE-MOUNT



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - The center lead is in electrical contact with the thermal tab.
  - Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).
  - Falls within JEDEC MO-169

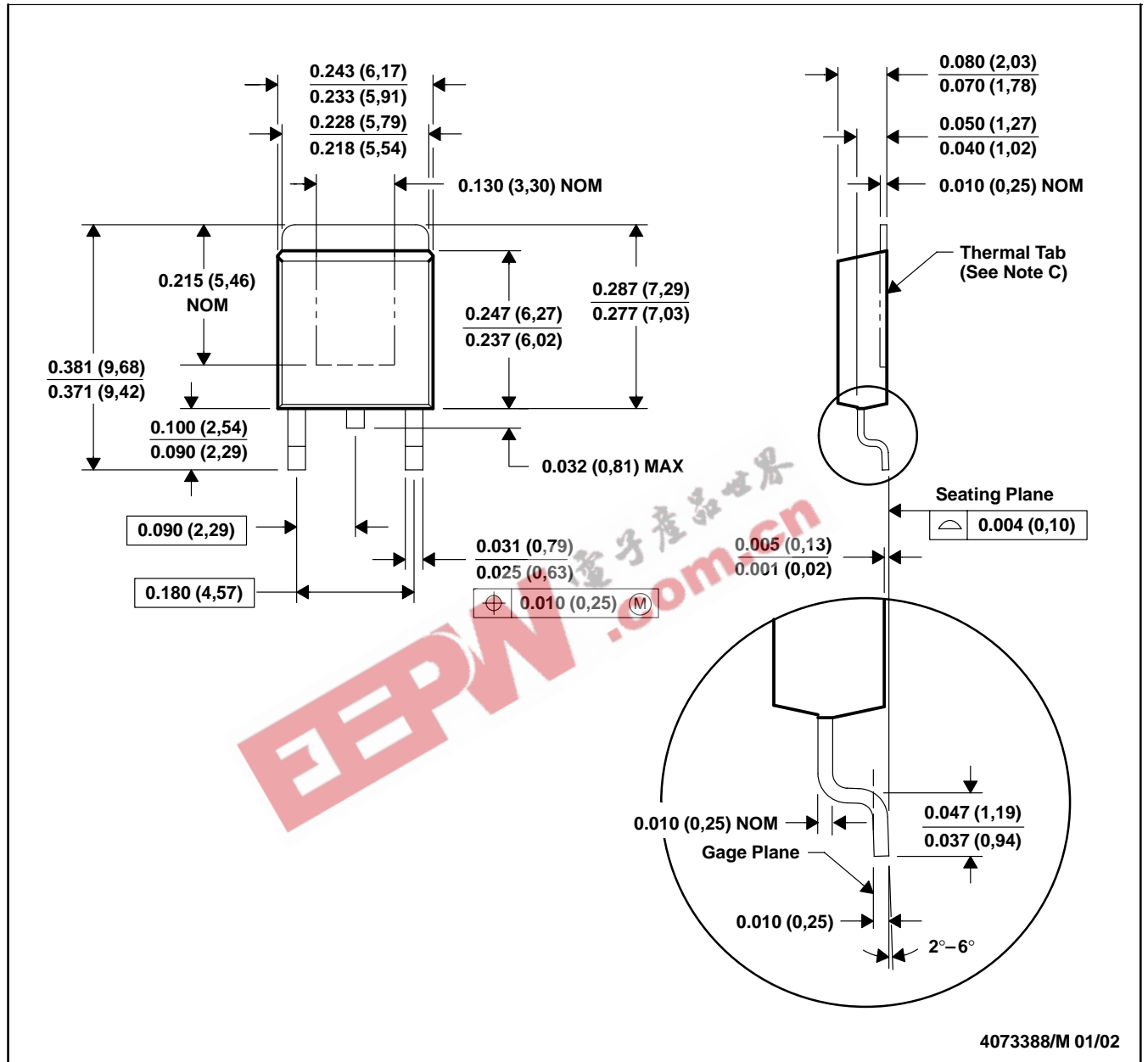
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KTP (R-PSFM-G2)

PowerFLEX™ PLASTIC FLANGE-MOUNT PACKAGE



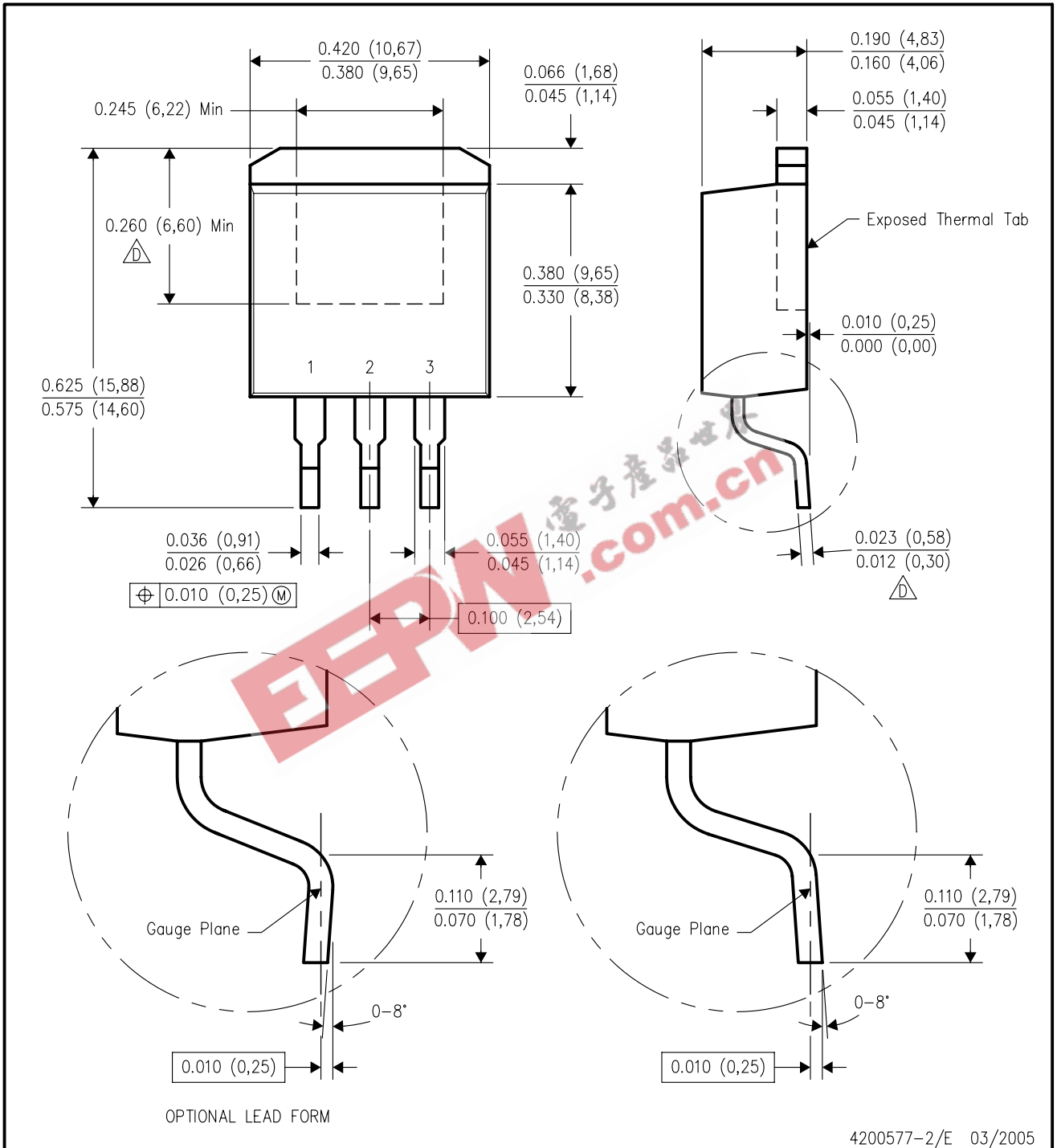
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. The center lead is in electrical contact with the thermal tab.  
 D. Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).  
 E. Falls within JEDEC TO-252 variation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

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# MECHANICAL DATA

KTT (R-PSFM-G3)

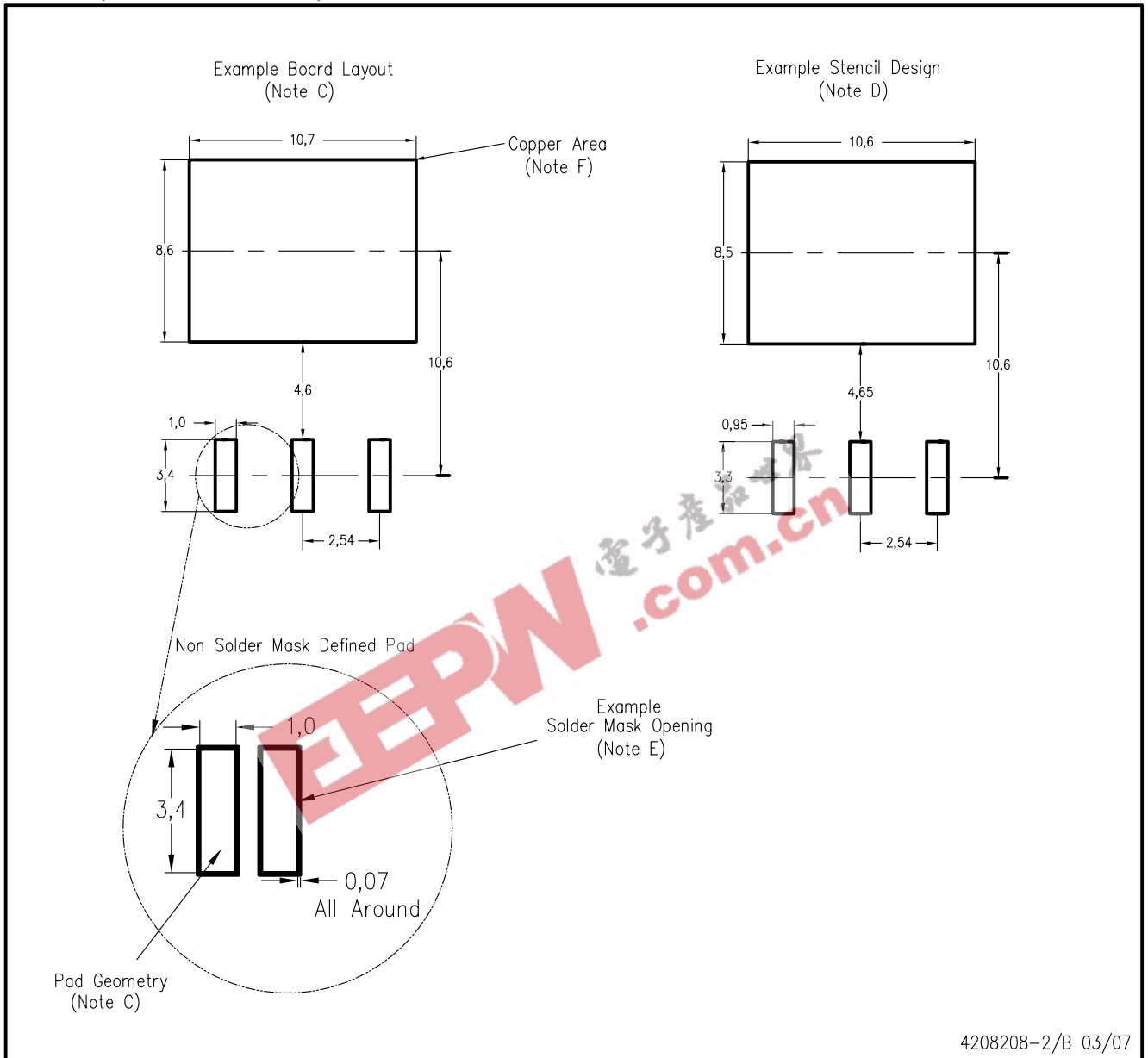
PLASTIC FLANGE-MOUNT PACKAGE



4200577-2/E 03/2005

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion. Mold flash or protrusion not to exceed 0.005 (0,13) per side.
- △ Falls within JEDEC TO-263 variation AA, except minimum lead thickness and minimum exposed pad length.

KTT (R-PSFM-G3)

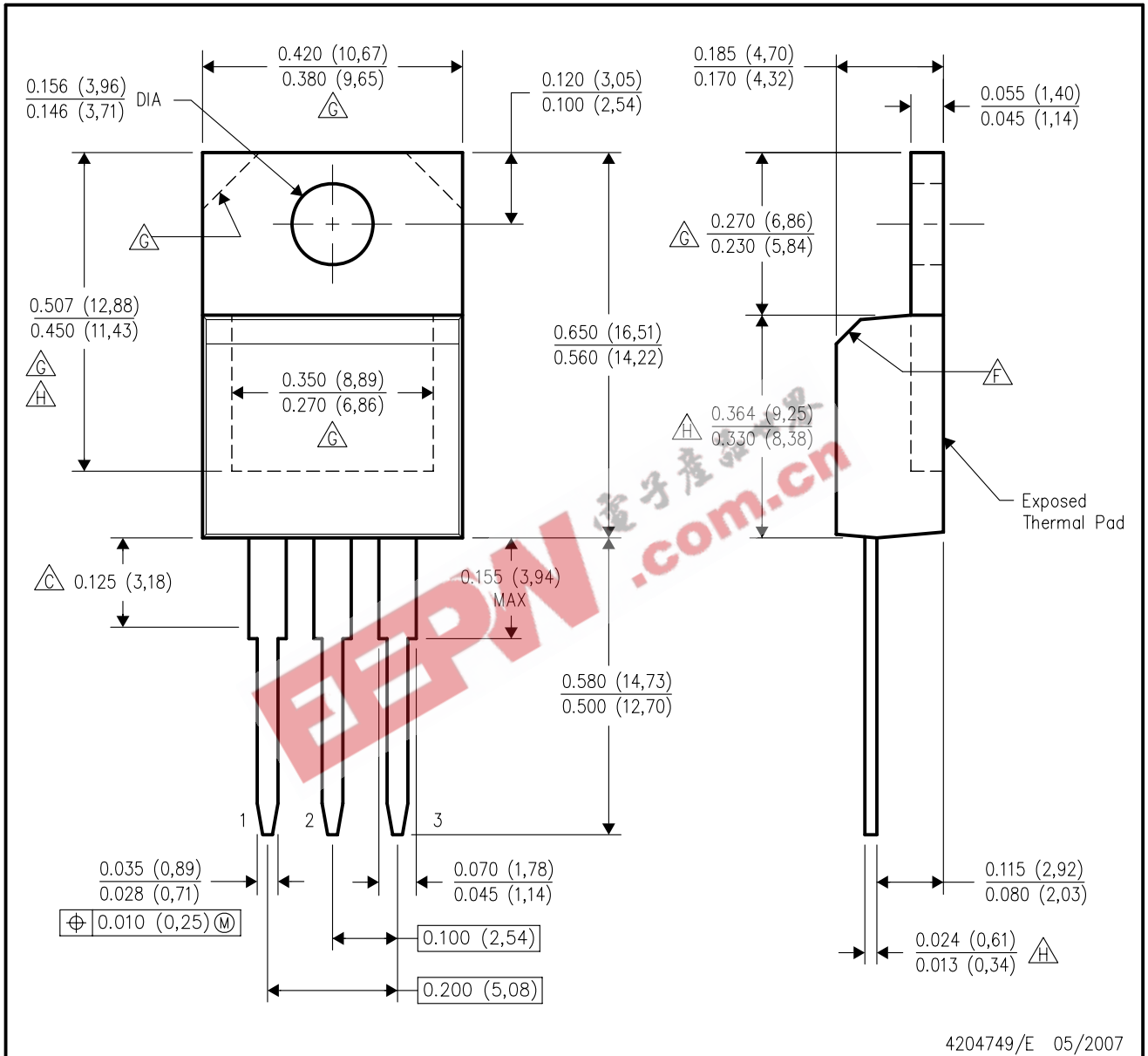


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-SM-782 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.
  - F. This package is designed to be soldered to a thermal pad on the board. Refer to the Product Datasheet for specific thermal information, via requirements, and recommended thermal pad size. For thermal pad sizes larger than shown a solder mask defined pad is recommended in order to maintain the solderable pad geometry while increasing copper area.

# MECHANICAL DATA

## KCS (R-PSFM-T3)

## PLASTIC FLANGE-MOUNT PACKAGE

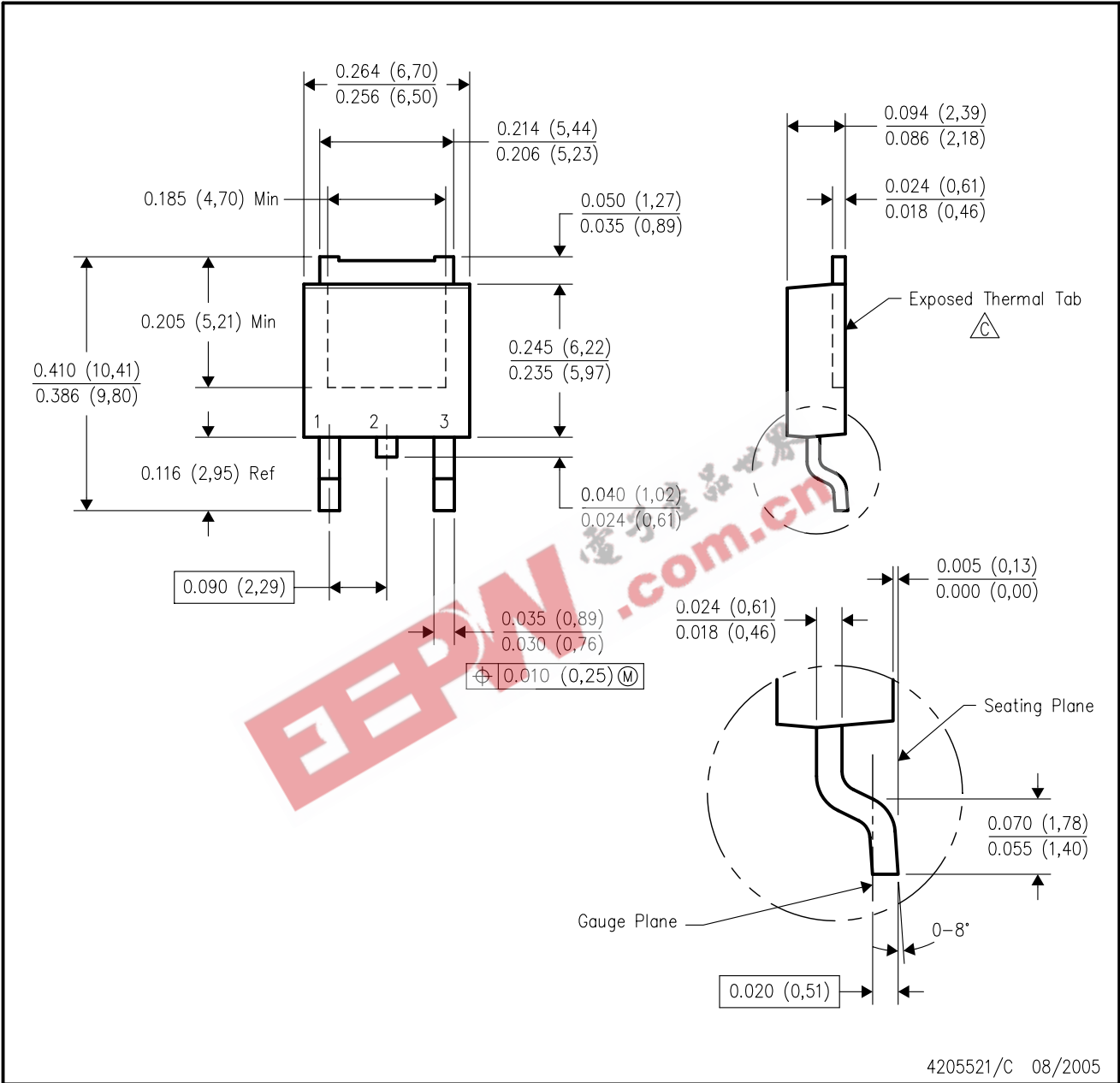


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Lead dimensions are not controlled within this area.
  - D. All lead dimensions apply before solder dip.
  - E. The center lead is in electrical contact with the mounting tab.
  - F. The chamfer is optional.
  - G. Thermal pad contour optional within these dimensions.
  - H. Falls within JEDEC TO-220 variation AB, except minimum lead thickness, minimum exposed pad length, and maximum body length.

MECHANICAL DATA

KVU (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

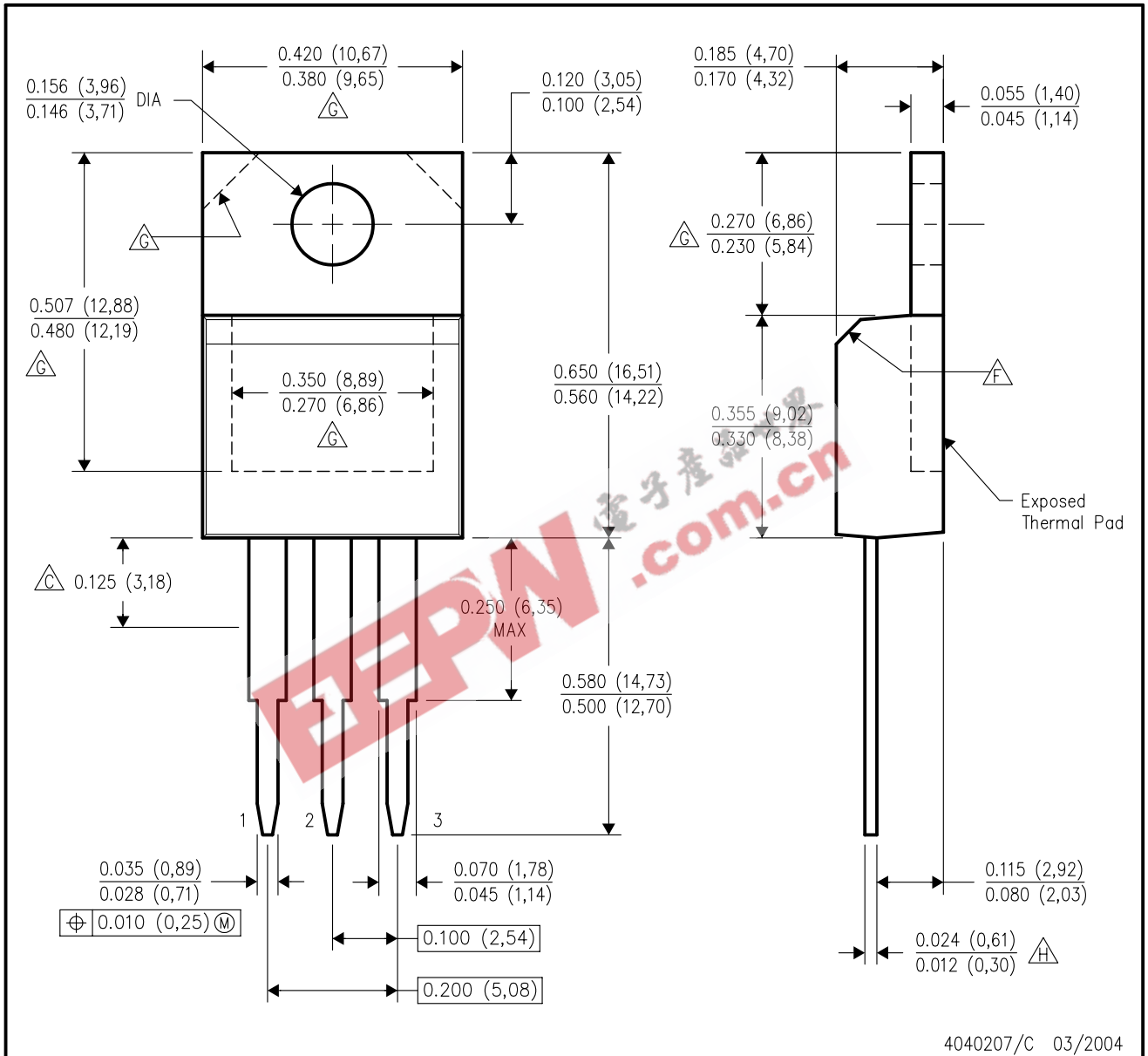


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  The center lead is in electrical contact with the exposed thermal tab.
  - D. Body Dimensions do not include mold flash or protrusions. Mold flash and protrusion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

# MECHANICAL DATA

## KC (R-PSFM-T3)

## PLASTIC FLANGE-MOUNT PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Lead dimensions are not controlled within this area.
  - D. All lead dimensions apply before solder dip.
  - E. The center lead is in electrical contact with the mounting tab.
  - $\triangle F$  The chamfer is optional.
  - $\triangle G$  Thermal pad contour optional within these dimensions.
  - $\triangle H$  Falls within JEDEC TO-220 variation AB, except minimum lead thickness.



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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
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