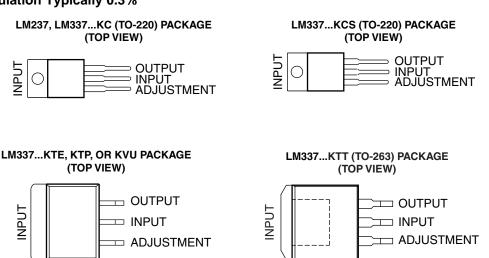


## FEATURES

- **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%**



- **Ripple Rejection Typically 77 dB**
- **Direct Replacement for Industry-Standard** LM237 and LM337



## **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.

Т <sub>Ј</sub>	PAC	KAGE <sup>(1)</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–25°C to 150°C	TO-220 – KC	Tube of 50	LM237KC	LM237
	PowerFLEX <sup>™</sup> – KTE	Reel of 2000	LM337KTER	LM337
	PowerFLEX – KTP	Reel of 3000	LM337KTPR	L337
000 to 40500	TO-220 – KC	Tube of 50	LM337KC	LM337
0°C to 125°C	TO-220 – KCS	Tube of 50	LM337KCSE3	LM337
	TO-252 – KVU	Reel of 2500	LM337KVURG3	LM337
	TO-263 – KTT	Reel of 500	LM337KTTR	LM337

#### **ORDERING INFORMATION**

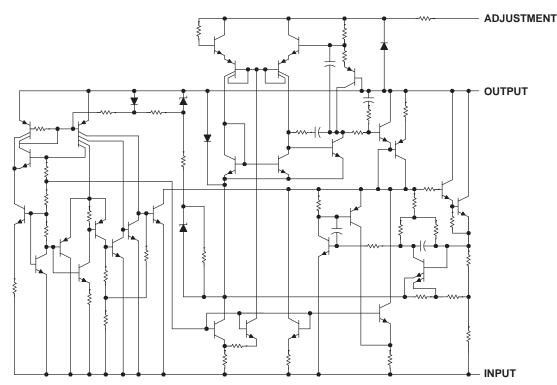
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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.



### 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
TJ	Operating virtual junction temperature			150	°C
	Lead temperature	1,6 mm (1/16 in) from case for 10 s		260	°C
T <sub>stg</sub>	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	θ <b>JC</b>	ALθ
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	24.8°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.

2



SLVS047K-NOVEMBER 1981-REVISED NOVEMBER 2007

## **Recommended Operating Conditions**

			MIN	MAX	UNIT		
	Output ourroot	$ V_{I} - V_{O}  \le 40 \text{ V}, \text{ P} \le 15 \text{ W}$	10	1500	mA		
10	Output current	Dutput current $ V_{I} - V_{O}  \le 10 \text{ V}, \text{ P} \le 15 \text{ W}$					
т	Operating virtual junction temperature	LM237	-25	150	°C		
IJ	Operating virtual junction temperature	LM337	0	125	C		

## **Electrical Characteristics**

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

DADAMETED	TEST CONDITION		LM237			LM337		UNIT	
PARAMETER	TEST CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	UNIT	
Input regulation <sup>(2)</sup>	$V_1 - V_0 = -3 V \text{ to } -40 V$	$T_J = 25^{\circ}C$		0.01	0.02		0.01	0.04	%/V
Input regulation (	$v_1 - v_0 = -3 v t_0 - 40 v$	$T_J = MIN$ to MAX		0.02	0.05		0.02	0.07	70/ V
Ripple rejection	$V_0 = -10 V$ , f = 120 Hz			60			60		dB
	$V_{O} = -10 \text{ V}, \text{ f} = 120 \text{ Hz}, \text{ C}_{AD}$	μF = 10 μF	66	77		66	77		uБ
	I <sub>O</sub> = 10 mA to 1.5 A,	$ V_0  \le 5 V$			25			50	mV
Output regulation	$T_J = 25^{\circ}C$	V <sub>0</sub>   ≥ 5 V		0.3	0.5		0.3	1	%
	I <sub>O</sub> = 10 mA to 1.5 A	V <sub>0</sub>   ≤ 5 V			50			70	mV
	$I_0 = 10 \text{ IIA to } 1.5 \text{ A}$	V <sub>0</sub>   ≥ 5 V			1			1.5	%
Output-voltage change with temperature	$T_J = MIN$ to MAX		0.6			0.6		%	
Output-voltage long-term drift	After 1000 h at $T_J = MAX$ and		0.3	1		0.3	1	%	
Output noise voltage	f = 10 Hz to 10 kHz, $T_J = 25^{\circ}$	С		0.003			0.003		%
Minimum output current to	$ V_{I}-V_{O} \leq 40~V$		2.5	5		2.5	10	mA	
maintain regulation	$ V_I - V_O  \le 10 \text{ V}$		1.2	3		1.5	6	ШA	
Peak output current	$ V_I - V_O  \le 15 V$		1.5	2.2		1.5	2.2		А
reak output current	$ V_I - V_O  \le 40 \text{ V}, \text{ T}_J = 25^{\circ}\text{C}$	0.24	0.4		0.15	0.4		A	
ADJUSTMENT current				65	100		65	100	μA
Change in ADJUSTMENT current	$V_{I} - V_{O} = -2.5 \text{ V to } -40 \text{ V}, I_{O} = T_{J} = 25^{\circ}\text{C}$		2	5		2	5	μA	
Reference voltage	$V_{I} - V_{O} = -3 V \text{ to } -40 V,$	$T_J = 25^{\circ}C$	-1.225	-1.25	-1.275	-1.213	-1.25	-1.287	
(OUTPUT to ADJUSTMENT)	$I_O = 10 \text{ mA to } 1.5 \text{ A},$ P ≤ rated dissipation	$T_J = MIN$ to MAX	-1.2	-1.25	-1.3	-1.2	-1.25	-1.3	V
Thermal regulation	Initial $T_J = 25^{\circ}C$ , 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

SLVS047K-NOVEMBER 1981-REVISED NOVEMBER 2007

## TEXAS INSTRUMENTS www.ti.com

### **Electrical Characteristics**

T<sub>J</sub> = 25°C

PARAMETER	TEST CONDI		LM2	UNIT			
FARAIVIETER	TEST CONDI	TEST CONDITIONS <sup>(1)</sup>					UNIT
Input regulation <sup>(2)</sup>	$V_{1} - V_{0} = -3 V \text{ to } -40 V$				0.01	0.04	%/V
Pipple rejection	V <sub>O</sub> = -10 V, f = 120 Hz				60		dB
Ripple rejection	$V_{O} = -10 V$ , f = 120 Hz, C <sub>AD</sub>	<sub>J</sub> = 10 μF		66	77		uВ
Output regulation	$I_0 = 10 \text{ mA to } 1.5 \text{ A}$	V <sub>0</sub>   ≤	5 V			50	mV
Output regulation	$ V_0  \ge 5$		5 V		0.3	1	%
Output noise voltage	f = 10 Hz to 10 kHz	f = 10 Hz to 10 kHz					%
Minimum output current to maintain	$ V_I - V_O  \le 40 \text{ V}$		2.5	10	mA		
regulation	$ V_I - V_O  \le 10 \text{ V}$		1.5	6	ША		
Dook output ourropt	$ V_1 - V_0  \le 15 V$			1.5	2.2		А
Peak output current	$ V_I - V_O  \le 40 \text{ V}$	0.15	0.4		A		
ADJUSTMENT current				65	100	μA	
Change in ADJUSTMENT current	$V_{\rm I} - V_{\rm O} = -2.5$ V to $-40$ V, $I_{\rm O}$			2	5	μA	
Reference voltage (OUTPUT to ADJUSTMENT)	$V_I - V_O = -3 V \text{ to } -40 V, I_O = P \le \text{ rated dissipation}$		-1.213	-1.25	-1.287	V	

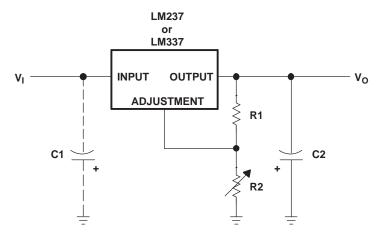
(1) Unless otherwise noted, the following test conditions apply: |V<sub>1</sub> - V<sub>0</sub>| = 5 V and I<sub>0</sub> = 0.5 A. All characteristics are measured with a 0.1-μF capacitor across the input and a 1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction 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.

4

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## **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  $1-\mu F$  solid tantalum capacitor required only if the regulator is more than 10 cm (4 in) from the power-supply filter capacitor. C2 is a  $1-\mu F$  solid tantalum or  $10-\mu F$  aluminum electrolytic capacitor required for stability.

### Figure 1. Adjustable Negative-Voltage Regulator

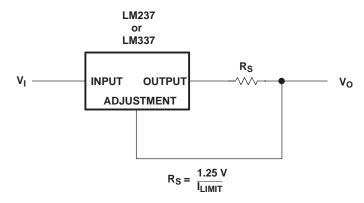


Figure 2. Current-Limiting Circuit



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7-Jun-2010

## **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>	Samples (Requires Login)
LM237KC	OBSOLETE	TO-220	KC	3		TBD	Call TI	Call TI	Samples Not Available
LM237KCE3	OBSOLETE	TO-220	KC	3		TBD	Call TI	Call TI	Samples Not Available
LM237KCSE3	ACTIVE	TO-220	KCS	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Request Free Samples
LM237KTER	OBSOLETE	PFM	KTE	3		TBD	Call TI	Call TI	Samples Not Available
LM337KC	OBSOLETE	TO-220	KC	3		TBD	Call TI	Call TI	Samples Not Available
LM337KCE3	OBSOLETE	TO-220	KC	3		TBD	Call TI	Call TI	Samples Not Available
LM337KCSE3	ACTIVE	TO-220	KCS	3	50	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Request Free Samples
LM337KTER	OBSOLETE	PFM	KTE	3		TBD	Call TI	Call TI	Samples Not Available
LM337KTPR	OBSOLETE	PFM	KTP	2		TBD	Call TI	Call TI	Samples Not Available
LM337KTPRG3	OBSOLETE	PFM	KTP	2		TBD	Call TI	Call TI	Samples Not Available
LM337KTTR	ACTIVE	DDPAK/ TO-263	КТТ	3	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-245C-168 HR	Request Free Samples
LM337KTTRG3	ACTIVE	DDPAK/ TO-263	КТТ	3	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-245C-168 HR	Request Free Samples
LM337KVURG3	ACTIVE	PFM	KVU	3	2500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	Request Free Samples
LM337Y	OBSOLETE	DIESALE	Y	0		TBD	Call TI	Call TI	Samples Not Available

<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.

(2) 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)



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7-Jun-2010

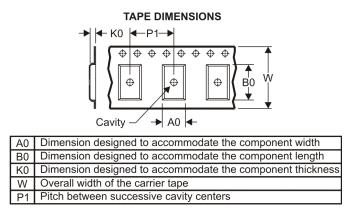
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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## TAPE AND REEL INFORMATION





# QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nomir	nal											
Device	•	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM337KTTR	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.6	15.8	4.9	16.0	24.0	Q2
LM337KVURG3	PFM	KVU	3	2500	330.0	16.4	6.9	10.5	2.7	8.0	16.0	Q2



# PACKAGE MATERIALS INFORMATION

11-Mar-2008

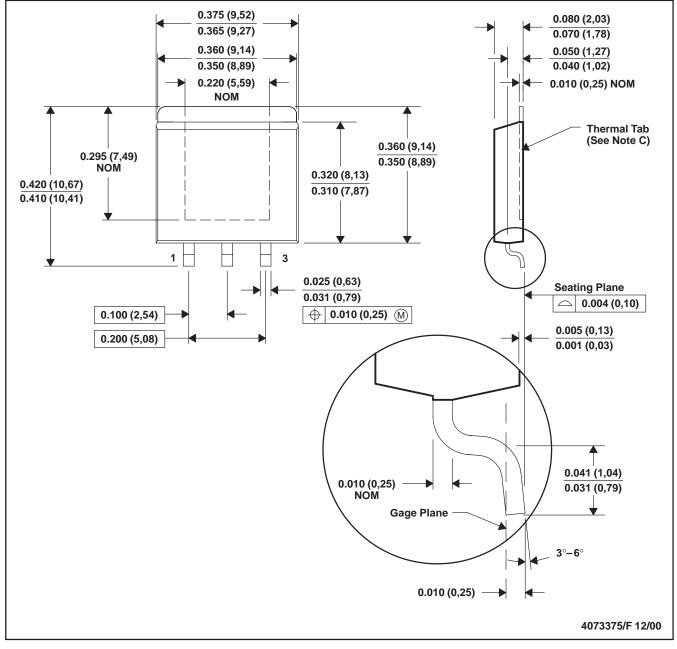


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM337KTTR	DDPAK/TO-263	КТТ	3	500	340.0	340.0	38.0
LM337KVURG3	PFM	KVU	3	2500	340.0	340.0	38.0

MPFM001E - OCTOBER 1994 - REVISED JANUARY 2001

#### PowerFLEX<sup>™</sup> PLASTIC FLANGE-MOUNT



- 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 MO-169

**KTE (R-PSFM-G3)** 

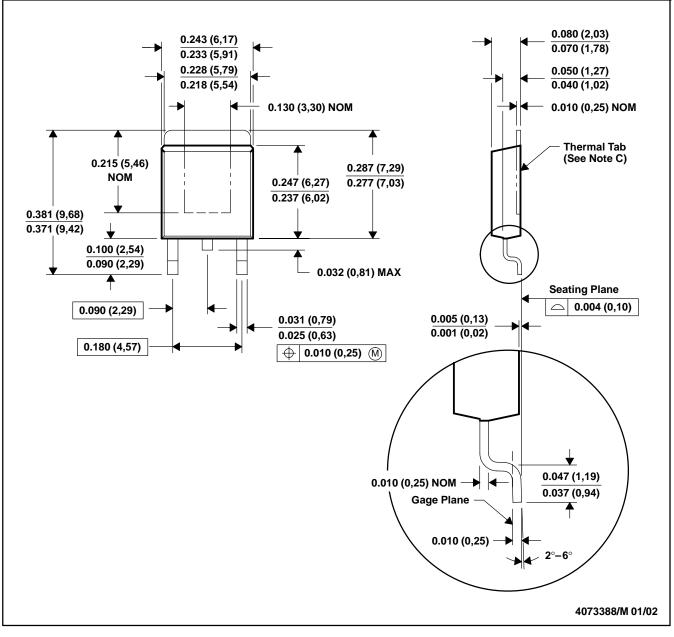
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# **MECHANICAL DATA**

MPSF001F - JANUARY 1996 - REVISED JANUARY 2002

#### KTP (R-PSFM-G2)

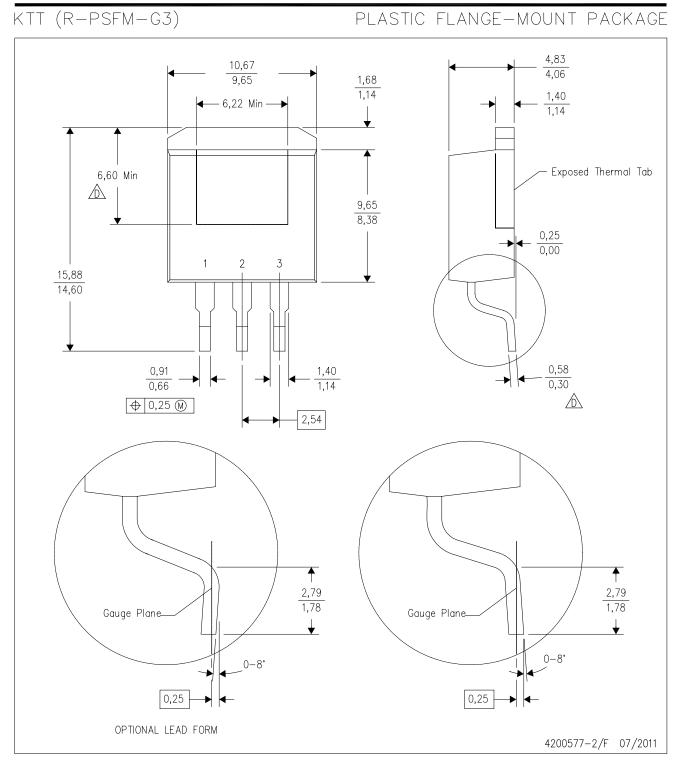
#### PowerFLEX<sup>™</sup> PLASTIC FLANGE-MOUNT PACKAGE



- 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**



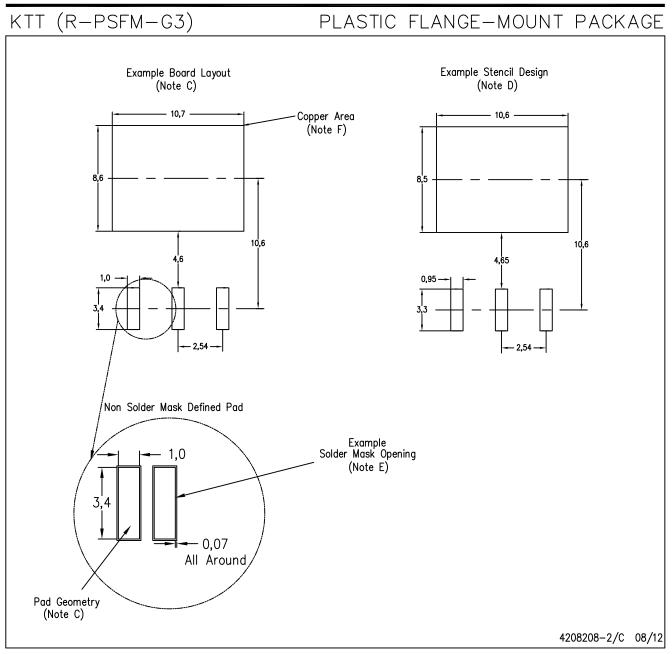
NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

C. Body dimensions do not include mold flash or protrusion. Mold flash or protrusion not to exceed 0.005 (0,13) per side.

A Falls within JEDEC TO-263 variation AA, except minimum lead thickness and minimum exposed pad length.





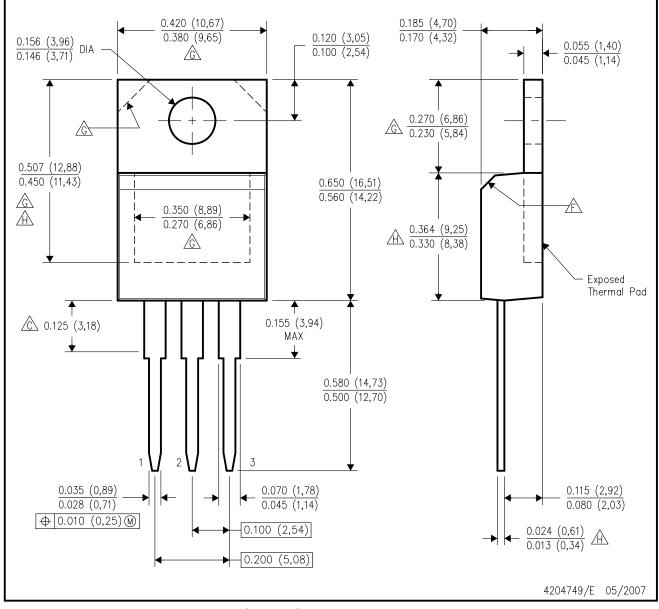
NOTES: A. All linear dimensions are in millimeters.

- 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.



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.
- Lead dimensions are not controlled within this area.

D. All lead dimensions apply before solder dip.

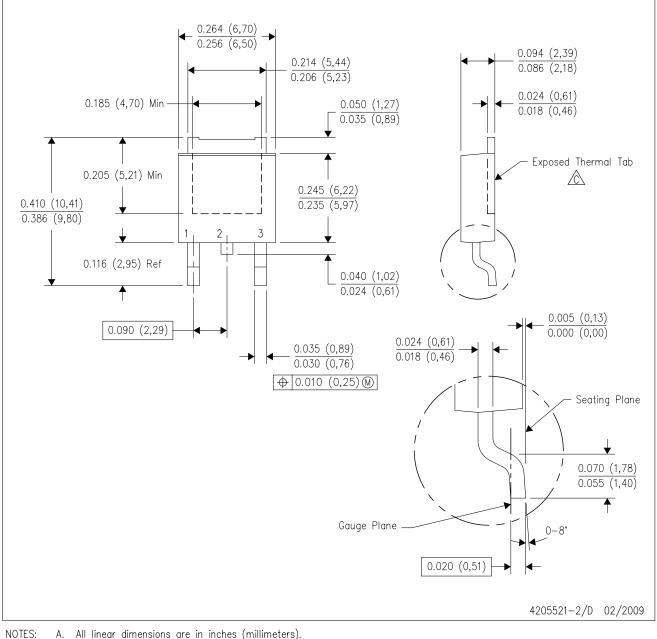
- E. The center lead is in electrical contact with the mounting tab.
- F The chamfer is optional.
- A Thermal pad contour optional within these dimensions.

Falls within JEDEC TO-220 variation AB, except minimum lead thickness, minimum exposed pad length, and maximum body length.



KVU (R-PSFM-G3)

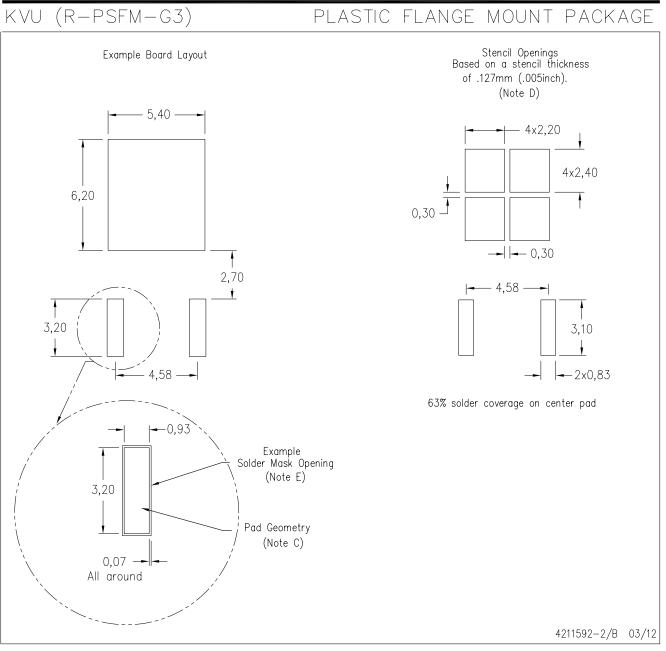
# PLASTIC FLANGE-MOUNT PACKAGE



- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\bigtriangleup$  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.



# LAND PATTERN DATA



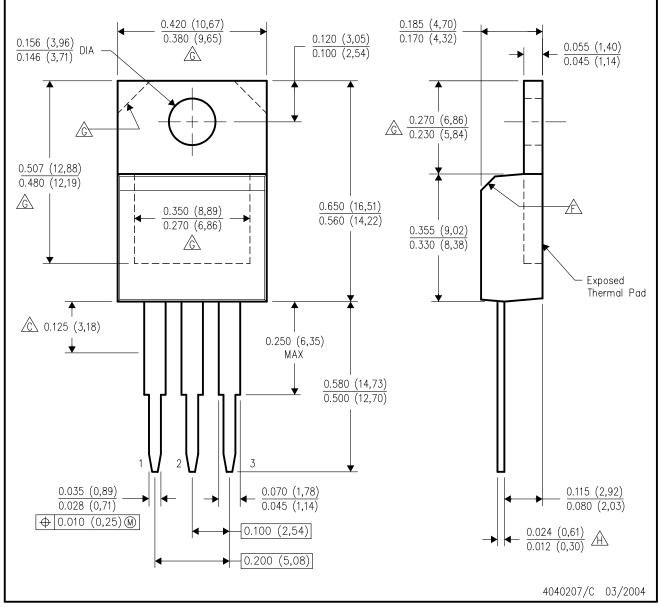
NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-SM-782 is an alternate information source for PCB land pattern 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 for other stencil recommendations.
- E. Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in thermal pad.



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.
- 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.
- $\frown$  The chamfer is optional.
- A Thermal pad contour optional within these dimensions.
- $\triangle$  Falls within JEDEC TO-220 variation AB, except minimum lead thickness.



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Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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