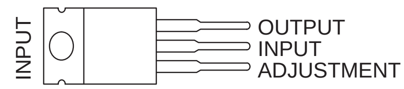
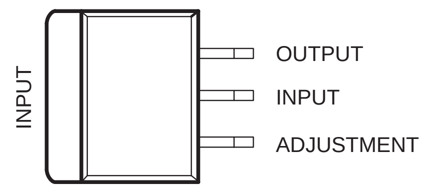
- **Output Voltage Range Adjustable From –1.2 V to –37 V**
- **Output Current Capability of 1.5 A Max**
- **Input Regulation Typically 0.01% Per Input-Voltage Change**
- **Output Regulation Typically 0.3%**
- **Peak Output Current Constant Over Temperature Range of Regulator**
- **Ripple Rejection Typically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

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



LM337 . . . KTE OR KTP 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.

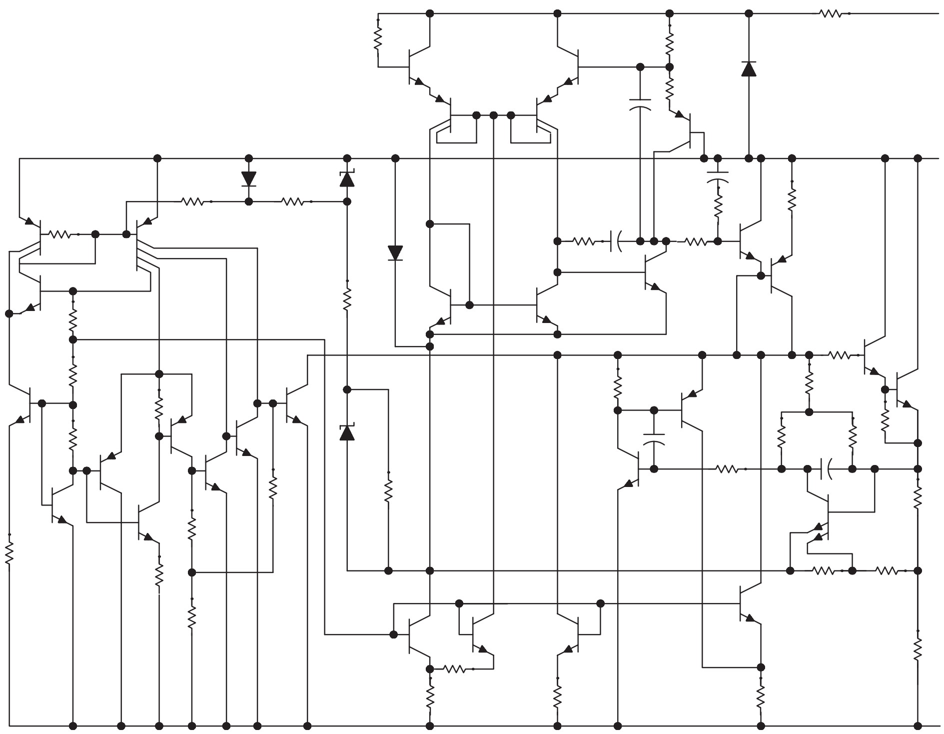
The LM237 and LM337 serve a wide variety of applications, including local on-card regulation, programmable output-voltage regulation, and precision current regulation.

ORDERING INFORMATION

T_J	PACKAGE†		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

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

schematic diagram



absolute maximum ratings over operating temperature ranges (unless otherwise noted)†

Input-to-output differential voltage, $V_I – V_O$ . . . . –40 V
Operating virtual junction temperature, T_J . . . . 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°C
Storage temperature range, T_{stg} . . . . –65°C to 150°C

† 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 (see Note 1)

PACKAGE	BOARD	θ_{JC}	θ_{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

NOTE 1: Maximum power dissipation is a function of T_J(max), θ_{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_O	Output current	$\lvert V_I – V_O \rvert \le 40$ V, P ≤ 15 W		10	1500	mA
		$\lvert V_I – V_O \rvert \le 10$ V, P ≤ 15 W		6	1500	
T_J	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†		LM237			LM337			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Input regulation‡	$V_I - V_O$ = –3 V to –40 V	T_J = 25°C		0.01	0.02		0.01	0.04	%/V
		T_J = MIN to MAX		0.02	0.05		0.02	0.07	
Ripple rejection	V_O = –10 V,	f = 120 Hz		60			60		dB
	V_O = –10 V, f = 120 Hz,	C_{ADJ} = 10 μF	66	77		66	77		
Output regulation	I_O = 10 mA to 1.5 A, T_J = 25°C	$\lvert V_O \rvert \le 5$ V			25			50	mV
		$\lvert V_O \rvert \ge 5$ V		0.3%	0.5%		0.3%	1%	
	I_O = 10 mA to 1.5 A	$\lvert V_O \rvert \le 5$ V			50			70	mV
		$\lvert V_O \rvert \ge 5$ 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 $V_I - V_O$ = –40 V			0.3%	1%		0.3%	1%	
Output noise voltage	f = 10 Hz to 10 kHz,	T_J = 25°C		0.003%			0.003%		
Minimum output current to maintain regulation	$\lvert V_I - V_O \rvert \le 40$ V			2.5	5		2.5	10	mA
	$\lvert V_I - V_O \rvert \le 10$ V			1.2	3		1.5	6	
Peak output current	$\lvert V_I - V_O \rvert \le 15$ V		1.5	2.2		1.5	2.2		A
	$\lvert V_I - V_O \rvert \le 40$ V,	T_J = 25°C	0.24	0.4		0.15	0.4		
Adjustment-terminal current				65	100		65	100	μA
Change in adjustment-terminal current	$V_I - V_O$ = – 2.5 V to –40 V, I_O = 10 mA to MAX	T_J = 25°C,		2	5		2	5	μA
Reference voltage (output to ADJ)	$V_I - V_O$ = – 3 V to –40 V, I_O = 10 mA to 1.5 A, P ≤ rated dissipation	T_J = 25°C	–1.225	–1.25	–1.275	–1.213	–1.25	–1.287	V
		T_J = MIN to MAX	–1.2	–1.25	–1.3	–1.2	–1.25	–1.3	
Thermal regulation	Initial T_J = 25°C,	10-ms pulse		0.002	0.02		0.003	0.04	%/W

† Unless otherwise noted, these specifications apply for the following test conditions $\lvert V_I - V_O \rvert$ = 5 V and I_O = 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.

‡ Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

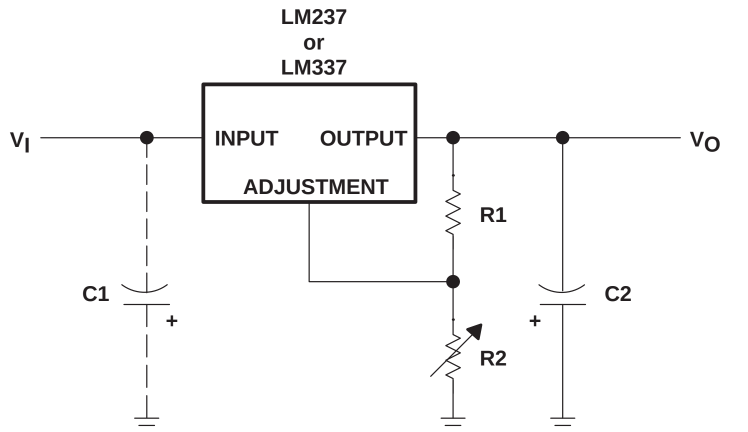
electrical characteristics, T_J = 25°C

PARAMETER	TEST CONDITIONS†	LM237, LM337			UNIT
		MIN	TYP	MAX	
Input regulation‡	$V_I - V_O$ = –3 V to –40 V		0.01	0.04	%/V
Ripple rejection	V_O = –10 V, f = 120 Hz		60		dB
	V_O = –10 V, C_{ADJ} = 10 µF, f = 120 Hz	66	77		
Output regulation	I_O = 10 mA to 1.5 A, $\lvert V_O \rvert \le 5$ V			50	mV
	I_O = 10 mA to 1.5 A, $\lvert V_O \rvert \ge 5$ V		0.3%	1%	
Output noise voltage	f = 10 Hz to 10 kHz		0.003%		
Minimum output current to maintain regulation	$\lvert V_I - V_O \rvert \le 40$ V		2.5	10	mA
	$\lvert V_I - V_O \rvert \le 10$ V		1.5	6	
Peak output current	$\lvert V_I - V_O \rvert \le 15$ V	1.5	2.2		A
	$\lvert V_I - V_O \rvert \le 40$ V	0.15	0.4		
Adjustment-terminal current			65	100	µA
Change in adjustment-terminal current	$V_I - V_O$ = – 2.5 V to –40 V, I_O = 10 mA to MAX		2	5	µA
Reference voltage (output to ADJ)	$V_I - V_O$ = – 3 V to –40 V, I_O = 10 mA to 1.5 A, P ≤ rated dissipation	–1.213	–1.25	–1.287	V

† Unless otherwise noted, these specifications apply for the following test conditions $\lvert V_I - V_O \rvert$ = 5 V and I_O = 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.

‡ Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

APPLICATION INFORMATION

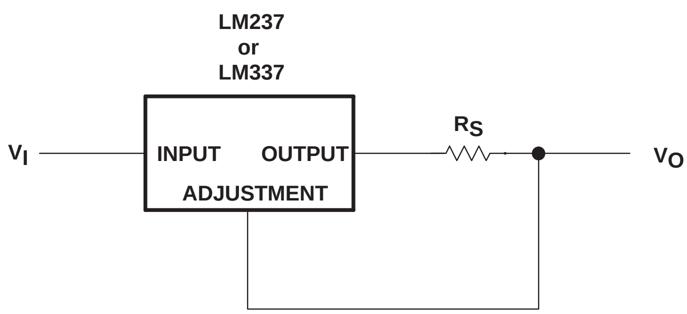


R1 typically is 120 Ω.

$$R2 = R1\left(\frac{-V_O}{-1.25} - 1\right)$$, where V_O 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



$$R_S = \frac{1.25\ V}{I_{LIMIT}}$$

Figure 2. Current-Limiting Circuit

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
LM237KC	ACTIVE	TO-220	KC	3	50	TBD	CU SNPB	Level-NC-NC-NC
LM237KTER	OBSOLETE	PFM	KTE	3		TBD	Call TI	Call TI
LM337KC	ACTIVE	TO-220	KC	3	50	TBD	CU SNPB	Level-NC-NC-NC
LM337KTER	ACTIVE	PFM	KTE	3	2000	TBD	CU SNPB	Level-1-220C-UNLIM
LM337KTPR	ACTIVE	PFM	KTP	2	3000	TBD	CU SNPB	Level-1-220C-UNLIM
LM337KTPRG3	ACTIVE	PFM	KTP	2	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM
LM337Y	OBSOLETE	XCEPT	Y	0		TBD	Call TI	Call TI

(1) 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) 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.
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)

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

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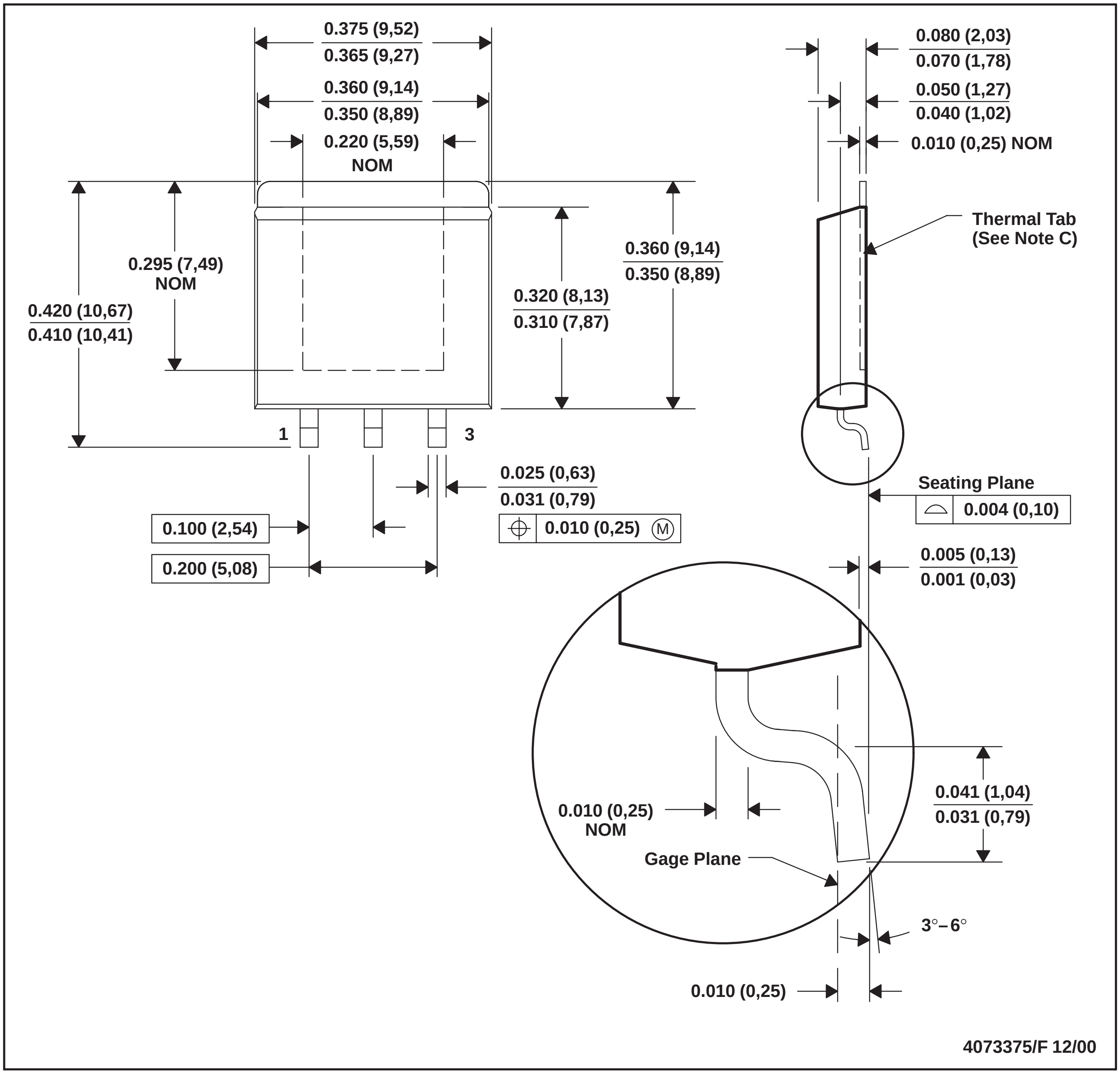
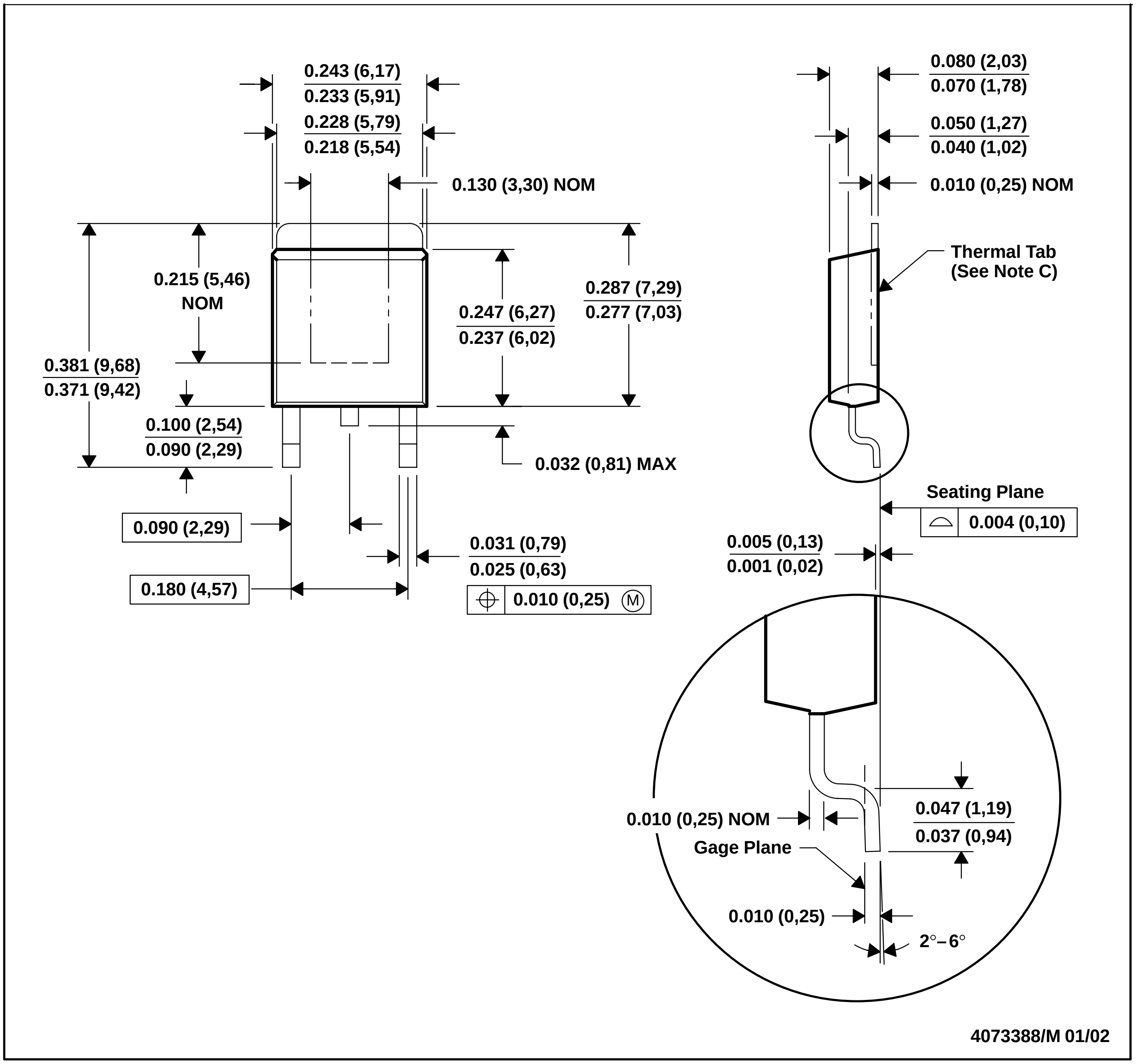
KTE (R-PSFM-G3) **PowerFLEX™ PLASTIC FLANGE-MOUNT**



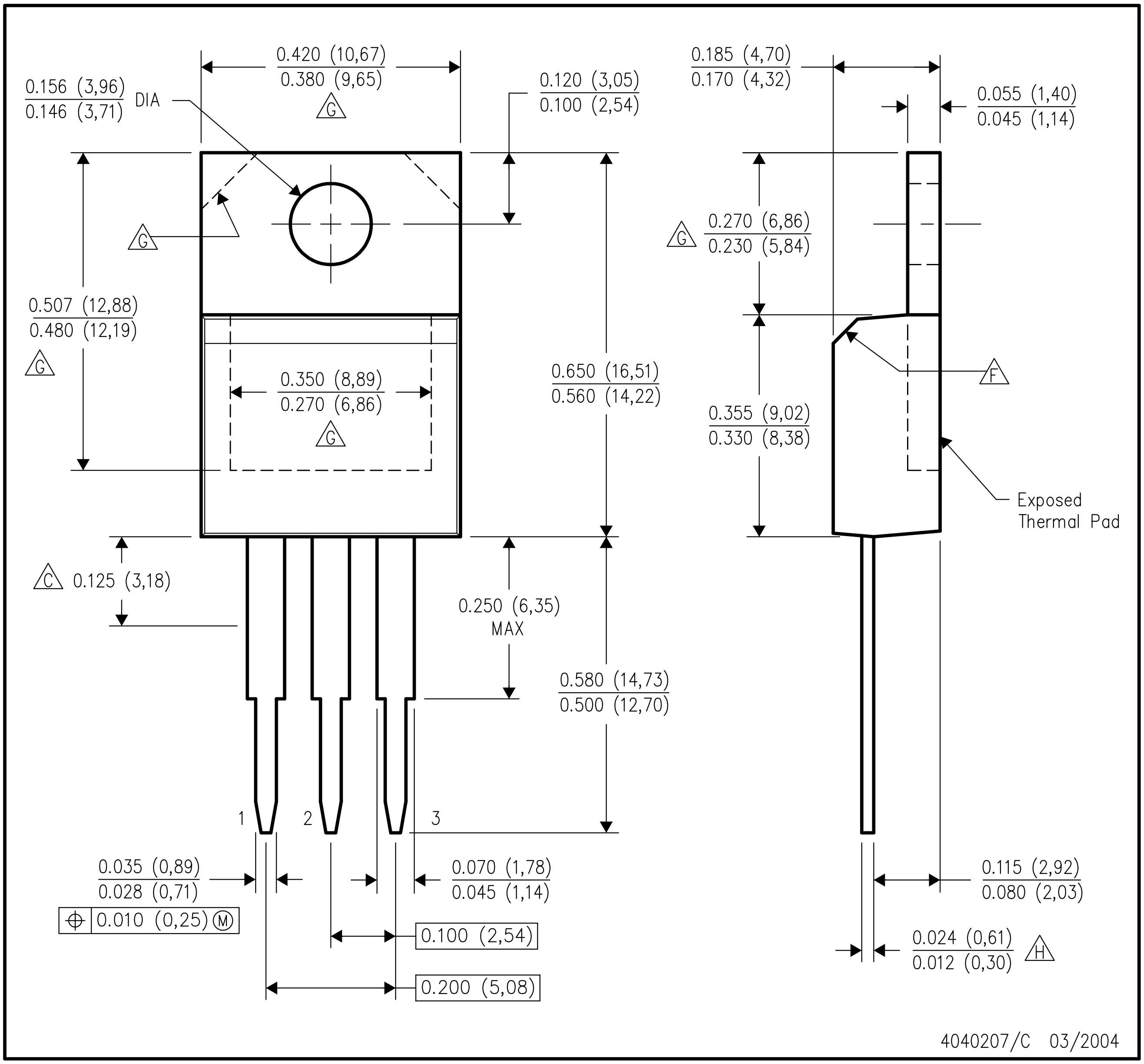
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the thermal tab.
D. Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).
E. Falls within JEDEC MO-169

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.

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.
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.

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