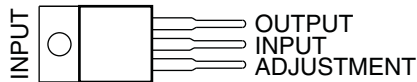


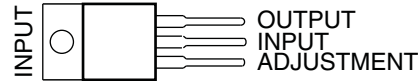
FEATURES

- 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

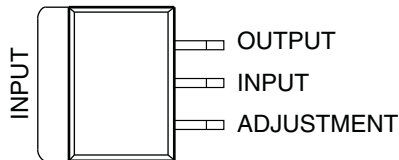
LM237, LM337...KC (TO-220) PACKAGE
(TOP VIEW)



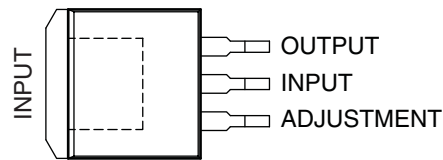
LM337...KCS (TO-220) PACKAGE
(TOP VIEW)



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_J | PACKAGE ⁽¹⁾ | | 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 | LM337KTTPR | L337 |
| | TO-220 – KC | Tube of 50 | LM337KC | LM337 |
| | TO-220 – KCS | Tube of 50 | LM337KCSSE3 | 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.



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.

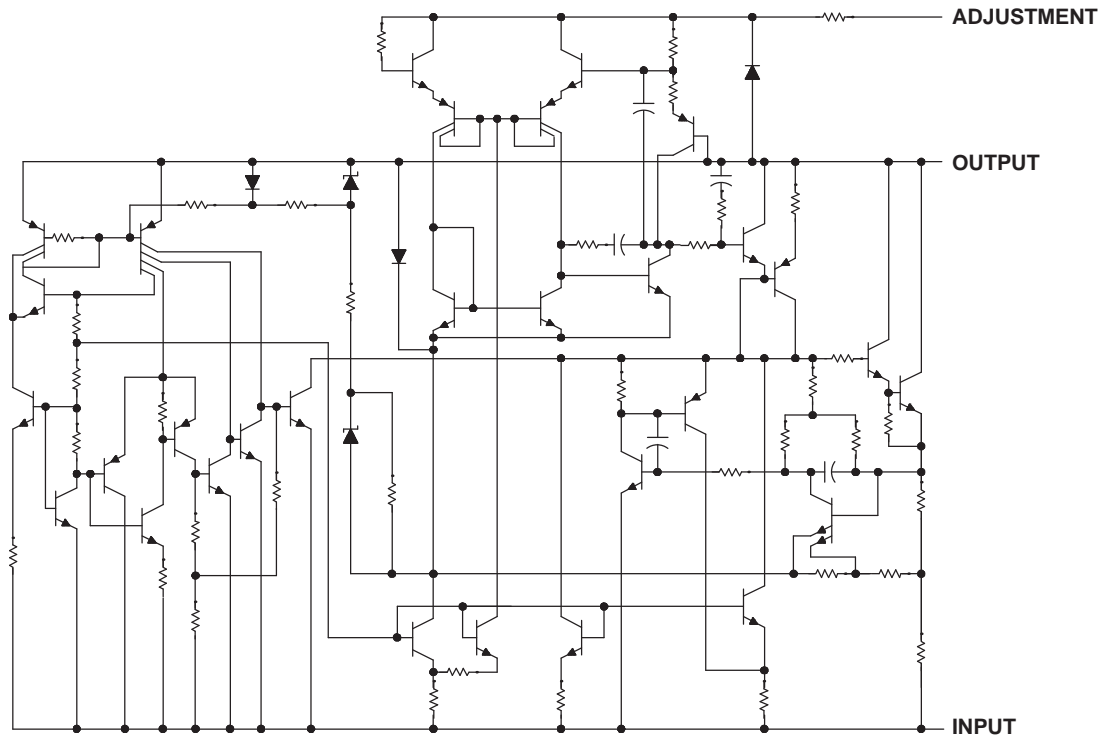
PowerFLEX is a trademark of Texas Instruments.

LM237, LM337

3-TERMINAL ADJUSTABLE REGULATORS

SLVS047K—NOVEMBER 1981—REVISED NOVEMBER 2007

SCHEMATIC DIAGRAM



Absolute Maximum Ratings⁽¹⁾

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 |
| | | 1,6 mm (1/16 in) from case for 10 s | |
| 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⁽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 (KCC) | 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 $T_J(\max)$, 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 | V _I – V _O ≤ 40 V, P ≤ 15 W | 10 | 1500 | mA |
| | | V _I – V _O ≤ 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 ⁽¹⁾ | | LM237 | | | LM337 | | | UNIT |
|---|---|-----------------------------|--------|-------|--------|--------|-------|--------|------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Input regulation ⁽²⁾ | 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 | V _O ≤ 5 V | 25 | | | 50 | | | mV |
| | | V _O ≥ 5 V | 0.3 | 0.5 | | 0.3 | 1 | | % |
| | I _O = 10 mA to 1.5 A | V _O ≤ 5 V | 50 | | | 70 | | | mV |
| | | V _O ≥ 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 | V _I – V _O ≤ 40 V | | 2.5 | 5 | | 2.5 | 10 | | mA |
| | V _I – V _O ≤ 10 V | | 1.2 | 3 | | 1.5 | 6 | | |
| Peak output current | V _I – V _O ≤ 15 V | | 1.5 | 2.2 | | 1.5 | 2.2 | | A |
| | V _I – V _O ≤ 40 V, T _J = 25°C | | 0.24 | 0.4 | | 0.15 | 0.4 | | |
| ADJUSTMENT current | | | 65 | 100 | | 65 | 100 | | μA |
| Change in ADJUSTMENT 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 ADJUSTMENT) | 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 |

- (1) Unless otherwise noted, the following test conditions apply: |V_I – V_O| = 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.
- (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

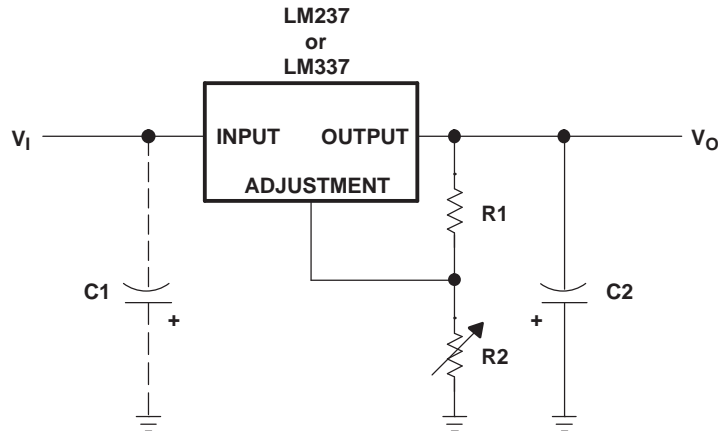
Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS ⁽¹⁾ | LM237, LM337 | | | UNIT |
|---|--|-------------------------|-------|--------|---------------|
| | | MIN | TYP | MAX | |
| Input regulation ⁽²⁾ | $V_I - V_O = -3\text{ V to } -40\text{ V}$ | | 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 | μA |
| 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 | μA |
| 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

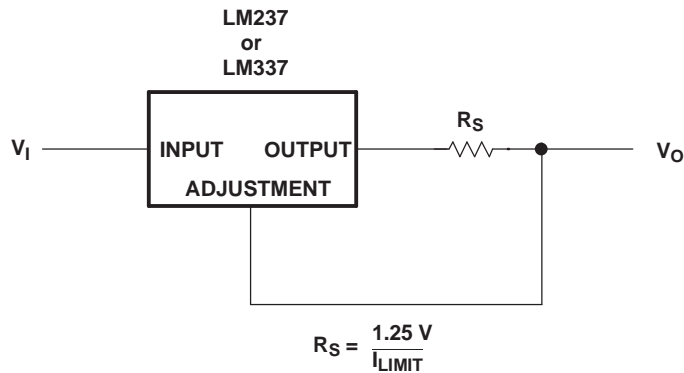


Figure 2. Current-Limiting Circuit

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|------------------|-----------------|------|-------------|-------------------------|------------------|----------------------|--------------|-------------------------|----------------|
| LM237KC | OBSOLETE | TO-220 | KC | 3 | | TBD | Call TI | Call TI | -25 to 150 | LM237 | |
| LM237KCE3 | OBSOLETE | TO-220 | KC | 3 | | TBD | Call TI | Call TI | -25 to 150 | LM237 | |
| LM237KCSE3 | ACTIVE | TO-220 | KCS | 3 | 50 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | -25 to 150 | LM237 | Samples |
| LM237KTER | OBSOLETE | PFM | KTE | 3 | | TBD | Call TI | Call TI | -25 to 150 | | |
| LM337KC | OBSOLETE | TO-220 | KC | 3 | | TBD | Call TI | Call TI | 0 to 125 | LM337 | |
| LM337KCE3 | OBSOLETE | TO-220 | KC | 3 | | TBD | Call TI | Call TI | 0 to 125 | LM337 | |
| LM337KCSE3 | ACTIVE | TO-220 | KCS | 3 | 50 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | 0 to 125 | LM337 | Samples |
| LM337KTER | OBSOLETE | PFM | KTE | 3 | | TBD | Call TI | Call TI | 0 to 125 | LM337 | |
| LM337KTPR | OBSOLETE | PFM | KTP | 2 | | TBD | Call TI | Call TI | 0 to 125 | L337 | |
| LM337KTPRG3 | OBSOLETE | PFM | KTP | 2 | | TBD | Call TI | Call TI | 0 to 125 | L337 | |
| LM337KTTR | ACTIVE | DDPAK/ TO-263 | KTT | 3 | 500 | Green (RoHS & no Sb/Br) | CU SN | Level-3-245C-168 HR | 0 to 125 | LM337 | Samples |
| LM337KTTRG3 | ACTIVE | DDPAK/ TO-263 | KTT | 3 | 500 | Green (RoHS & no Sb/Br) | CU SN | Level-3-245C-168 HR | 0 to 125 | LM337 | Samples |
| LM337KVURG3 | ACTIVE | TO-252 | KVU | 3 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-3-260C-168 HR | 0 to 125 | LM337 | Samples |
| LM337Y | OBSOLETE | DIESALE | Y | 0 | | TBD | Call TI | Call TI | 0 to 125 | | |

(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), 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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | 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 | TO-252 | KVU | 3 | 2500 | 330.0 | 16.4 | 6.9 | 10.5 | 2.7 | 8.0 | 16.0 | Q2 |

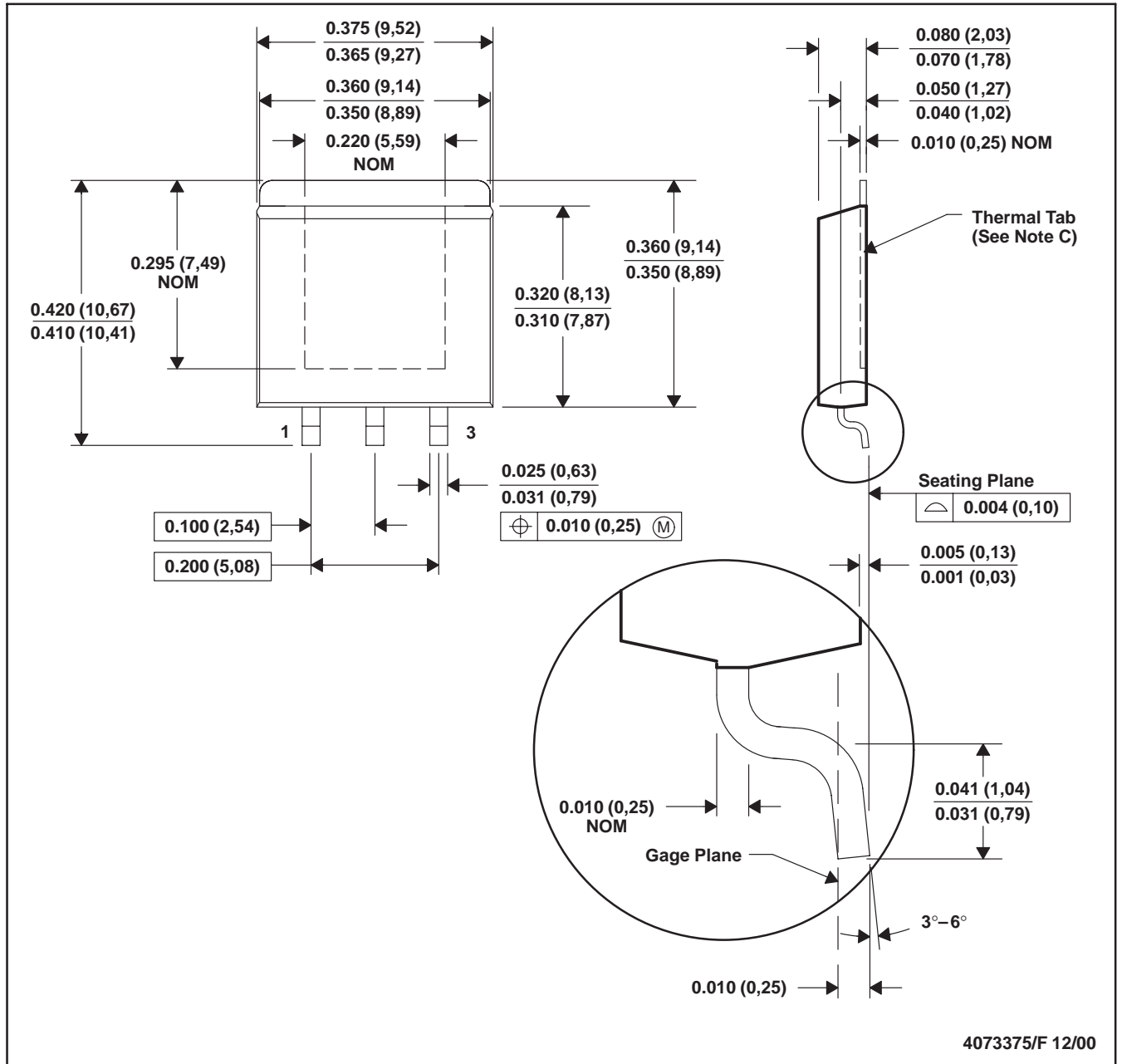
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM337KTTR | DDPAK/TO-263 | KTT | 3 | 500 | 340.0 | 340.0 | 38.0 |
| LM337KVURG3 | TO-252 | KVU | 3 | 2500 | 340.0 | 340.0 | 38.0 |

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

PowerFLEX is a trademark of Texas Instruments.

KTP (R-PSFM-G2)

PowerFLEX™ PLASTIC FLANGE-MOUNT PACKAGE



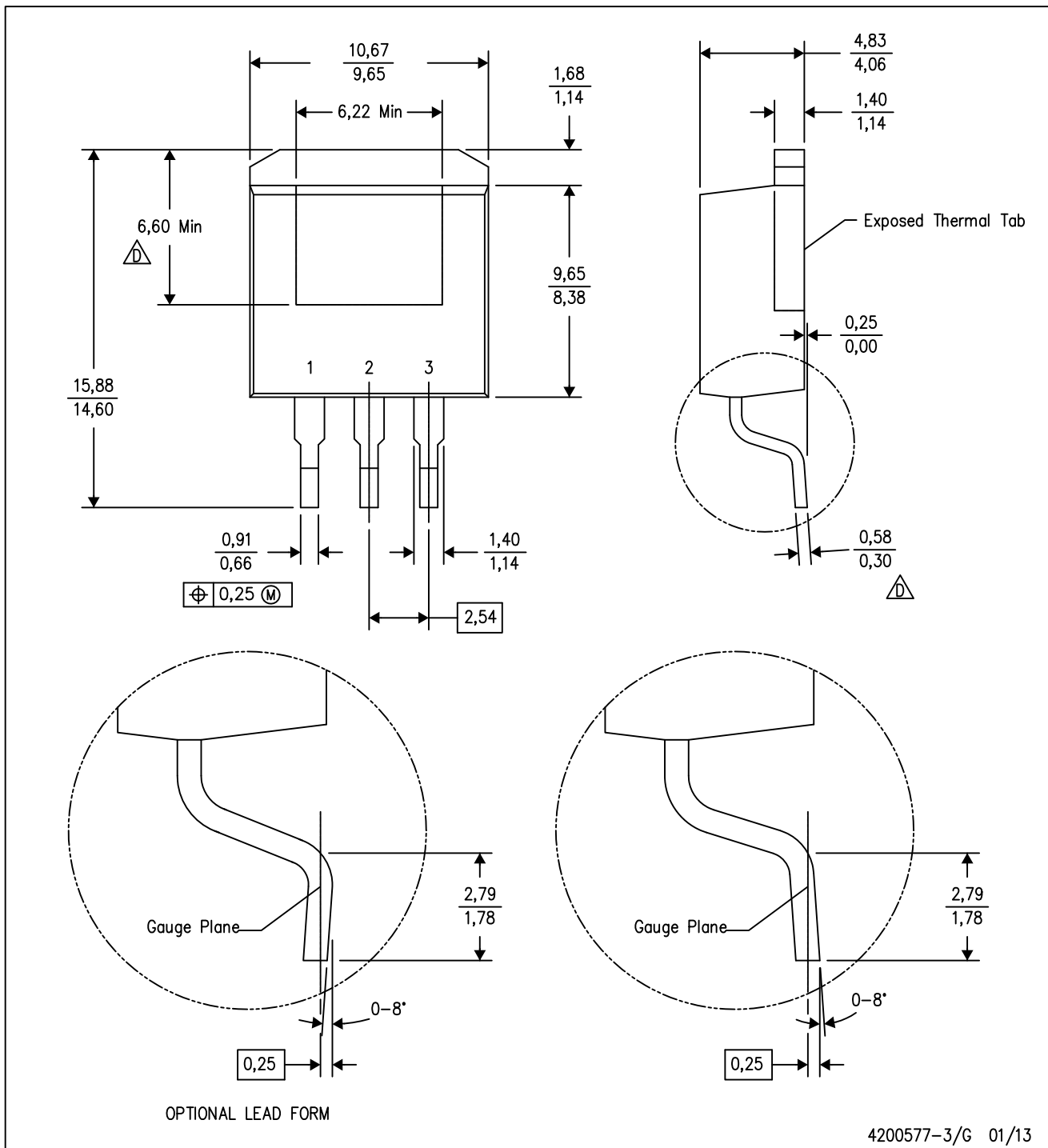
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. The center lead is in electrical contact with the thermal tab.
 D. Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).
 E. Falls within JEDEC TO-252 variation AC.

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KTT (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

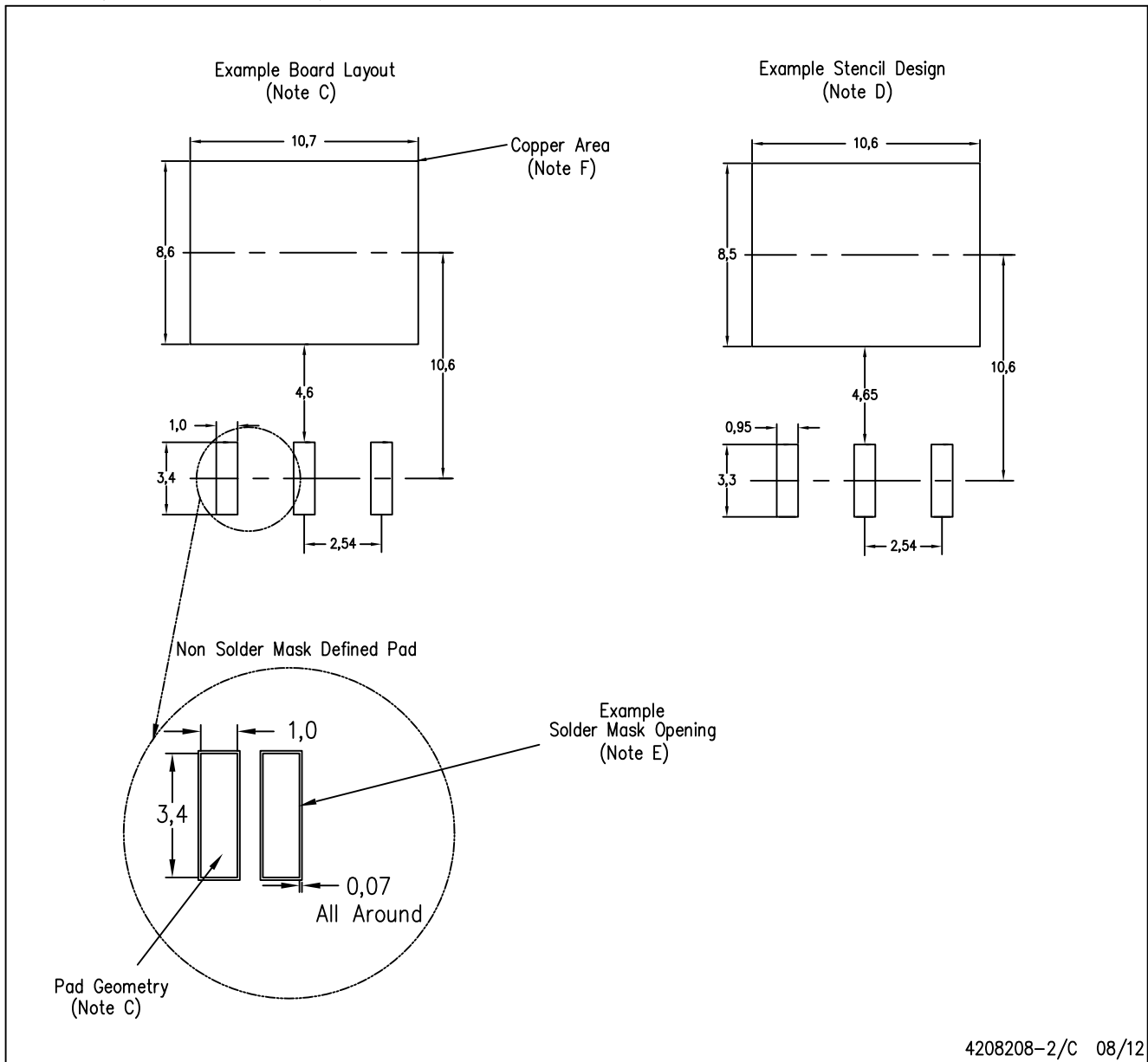


4200577-3/G 01/13

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

KTT (R-PSFM-G3)

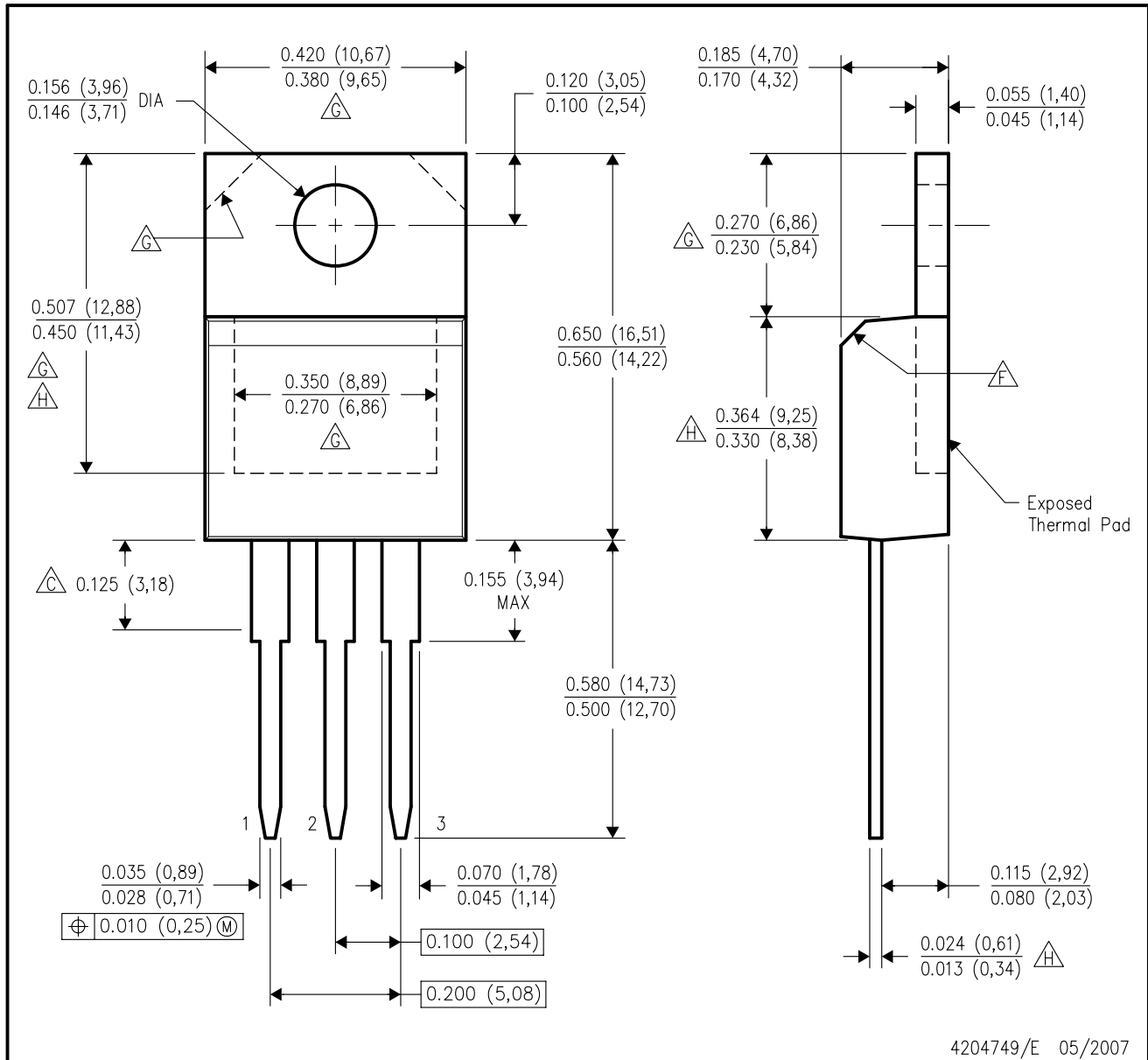
PLASTIC FLANGE-MOUNT PACKAGE



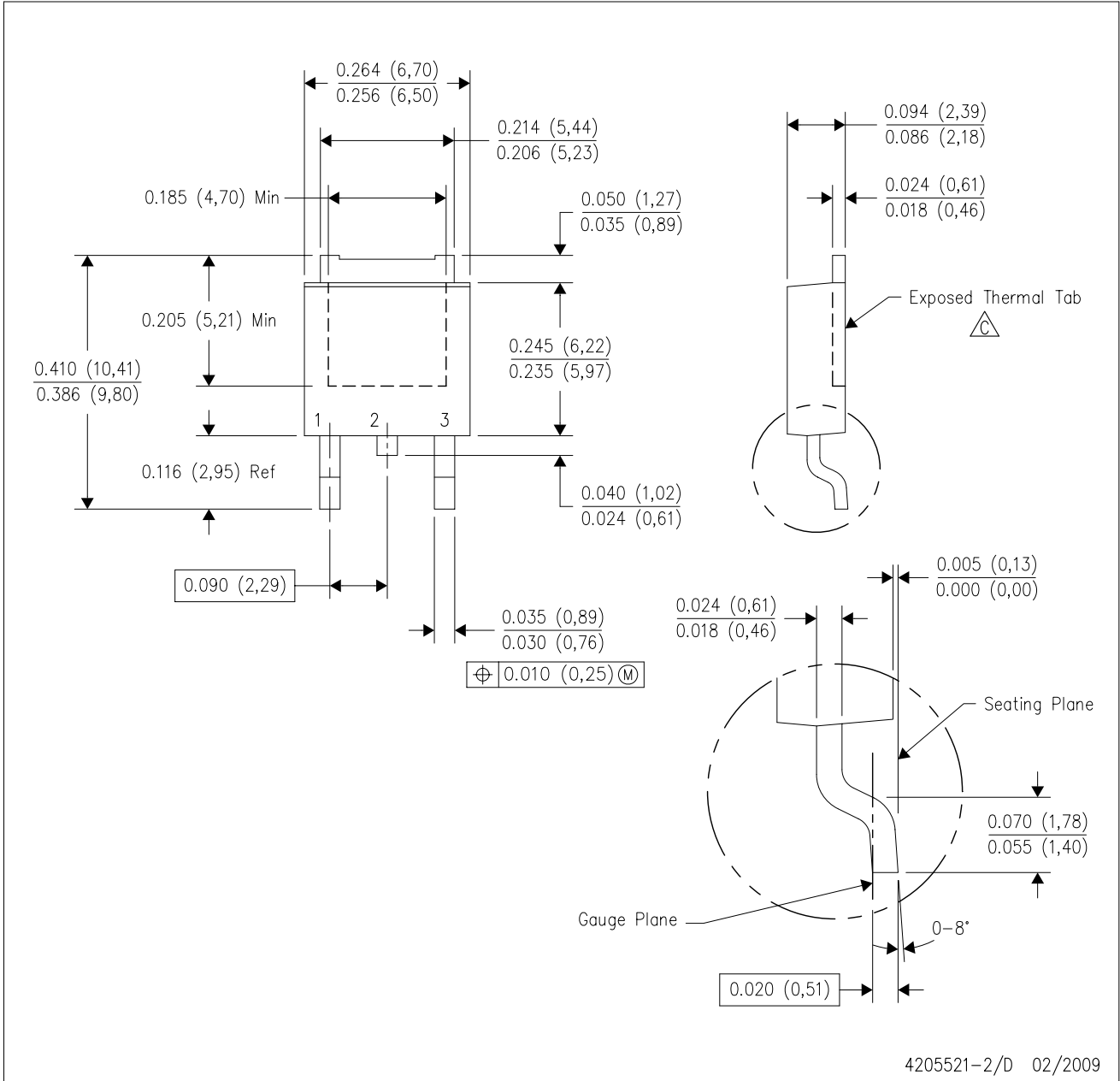
- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-SM-782 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.
 - 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.
 - $\triangle C$ 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, minimum exposed pad length, and maximum body length.

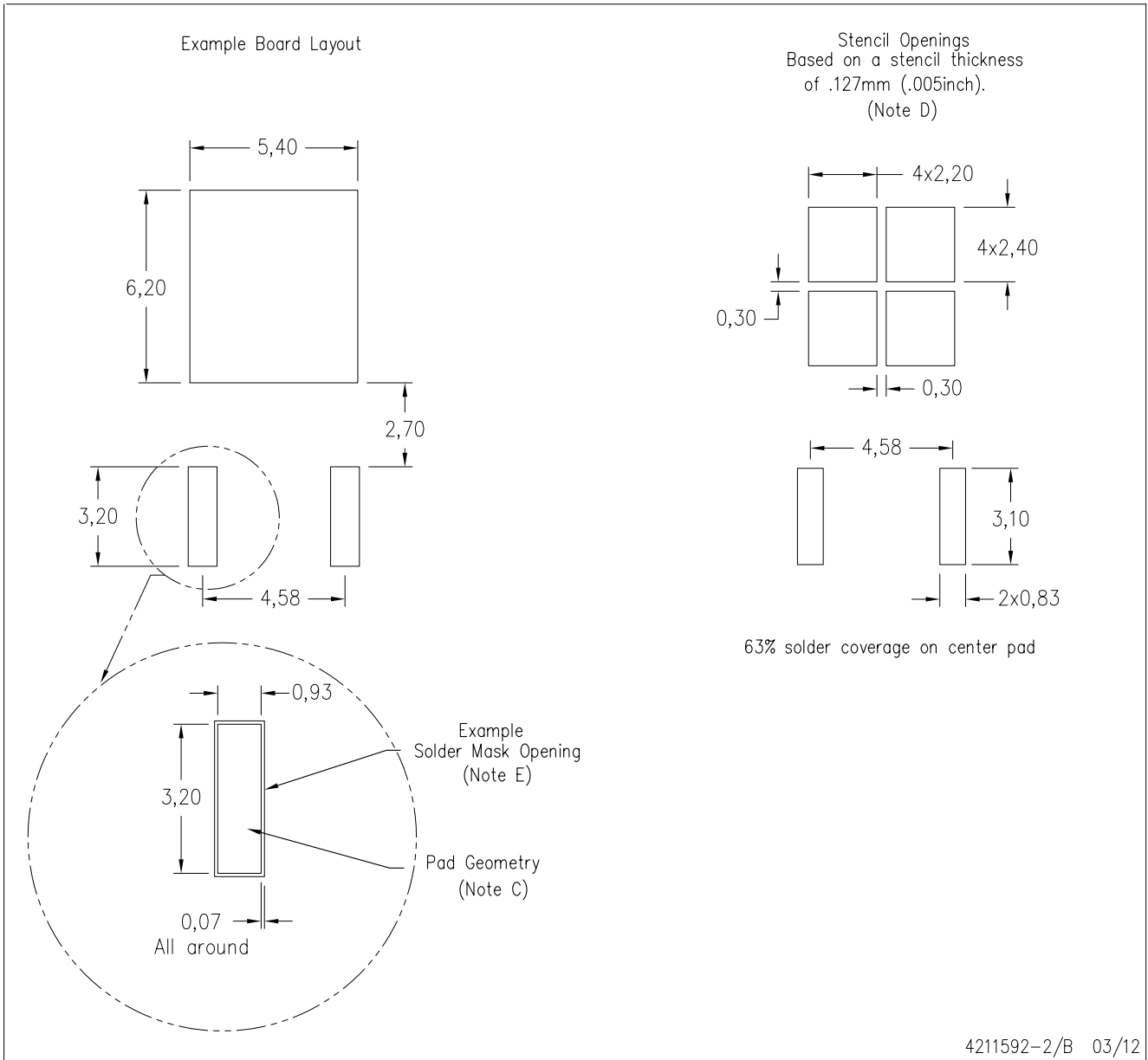


4205521-2/D 02/2009

- 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 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.

KVU (R-PSFM-G3)

PLASTIC FLANGE MOUNT PACKAGE

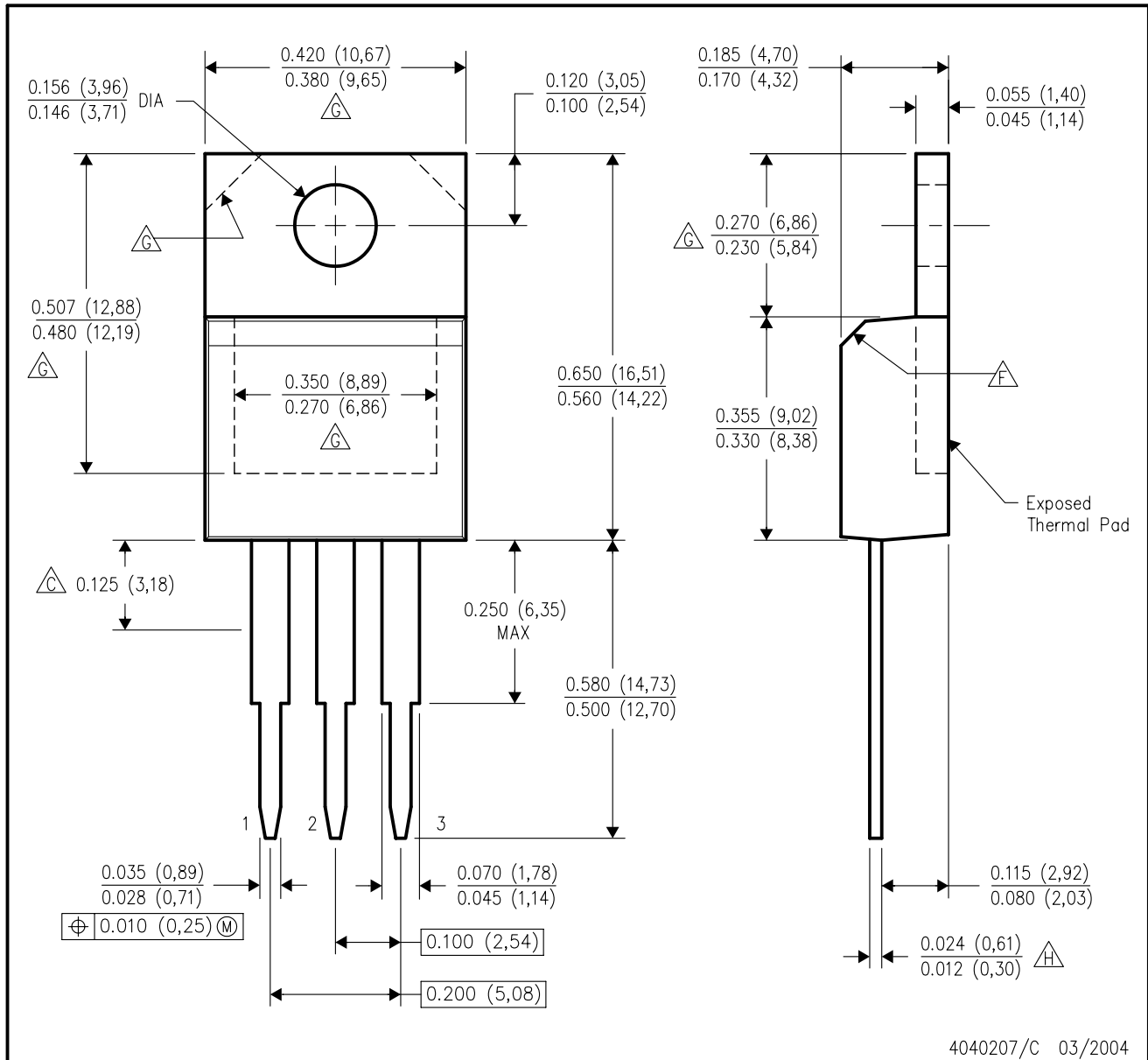


4211592-2/B 03/12

- 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.
 - $\triangle C$ 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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