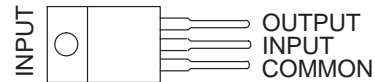


μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

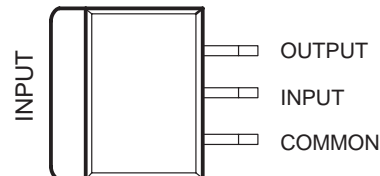
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- 3-Terminal Regulators
- Output Current Up To 1.5 A
- No External Components
- Internal Thermal Overload Protection
- High-Power Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation

KCS (TO-220) PACKAGE
(TOP VIEW)



KTE PACKAGE
(TOP VIEW)



description/ordering information

This series of fixed-negative-voltage integrated-circuit voltage regulators is designed to complement Series μA7800 in a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 A of output current. The internal current limiting and thermal shutdown features of these regulators essentially make them immune to overload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents and also as the power-pass element in precision regulators.

ORDERING INFORMATION

| T _J | V _{O(NOM)} (V) | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------------|------------------------------|--------------|--------------------------|---------------------|
| 0°C to 125°C | -15 | PowerFLEX™ (KTE) | Reel of 2000 | μA7915CKTER | μA7915C |
| | | TO-220, short shoulder (KCS) | Tube of 50 | μA7915CKCS | μA7915C |
| | -12 | PowerFLEX (KTE) | Reel of 2000 | μA7912CKTER | μA7912C |
| | | TO-220, short shoulder (KCS) | Tube of 50 | μA7912CKCS | μA7912C |
| | -8 | PowerFLEX (KTE) | Reel of 2000 | μA7908CKTER | μA7908C |
| | | TO-220, short shoulder (KCS) | Tube of 50 | μA7908CKCS | μA7908C |
| | -5 | PowerFLEX (KTE) | Reel of 2000 | μA7905CKTER | μA7905C |
| | | TO-220, short shoulder (KCS) | Tube of 50 | μA7905CKCS | μA7905C |

† 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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



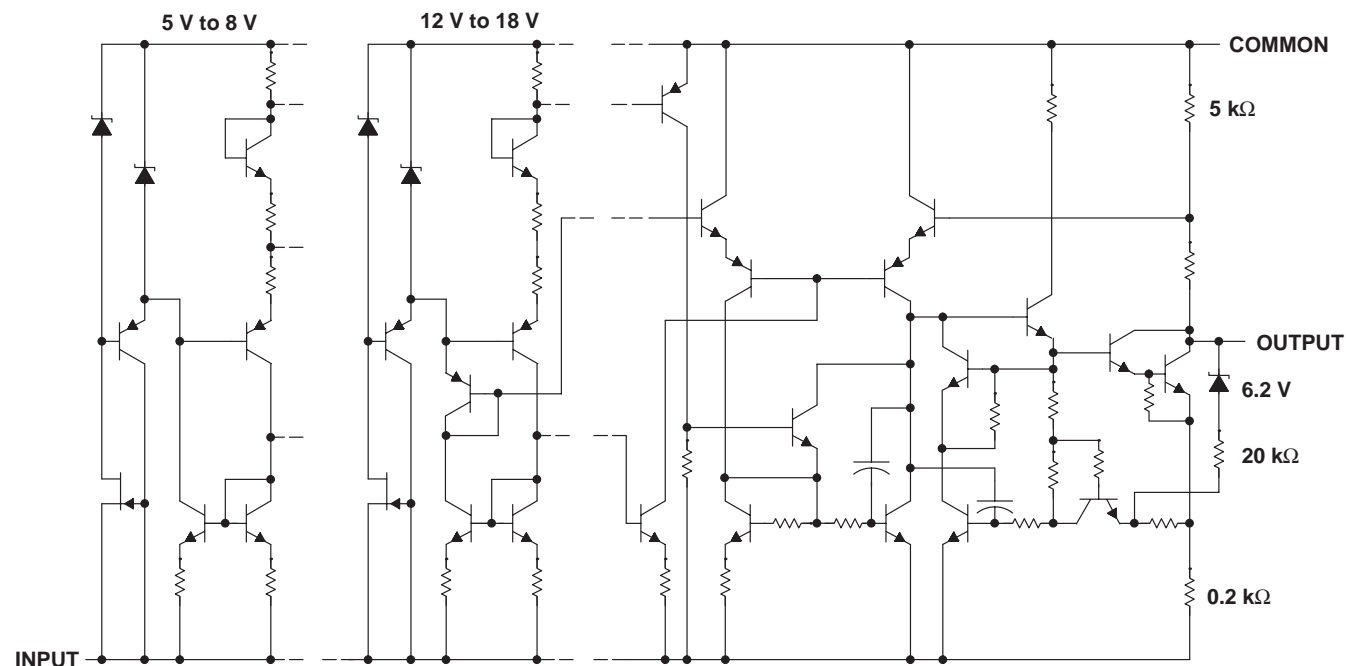
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μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

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schematic



All component values are nominal.

absolute maximum ratings over virtual junction temperature range (unless otherwise noted)†

| | |
|---|--------------|
| Input voltage, V_I | -35 V |
| Operating virtual junction temperature, T_J | 150°C |
| Storage temperature range, T_{stg} | -65 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 |
| TO-220 (KCS) | 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 | |
|-------|--|---------|-------|------|---|
| V_I | Input voltage | μA7905C | -7 | -25 | V |
| | | μA7908C | -10.5 | -25 | |
| | | μA7912C | -14.5 | -25 | |
| | | μA7915C | -17.5 | -25 | |
| I_O | Output current | | 1.5 | A | |
| T_J | Operating virtual junction temperature | 0 | 125 | °C | |



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μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

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electrical characteristics at specified virtual junction temperature, $V_I = -10$ V, $I_O = 500$ mA (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7905C | | | UNITS |
|---|--|--------------|---------|------|-------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | -4.8 | -5 | -5.2 | V |
| | $I_O = 5$ mA to 1 A, $P \leq 15$ W $V_I = -7$ V to -20 V, | 0°C to 125°C | -4.75 | | -5.25 | |
| Input regulation | $V_I = -7$ V to -25 V | | | 12.5 | 50 | mV |
| | $V_I = -8$ V to -12 V | | | 4 | 15 | |
| Ripple rejection | $V_I = -8$ V to -18 V, $f = 120$ Hz | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5$ mA to 1.5 A | | | 15 | 100 | mV |
| | $I_O = 250$ mA to 750 mA | | | 5 | 50 | |
| Temperature coefficient of output voltage | $I_O = 5$ mA | 0°C to 125°C | | -0.4 | | mV/°C |
| Output noise voltage | $f = 10$ Hz to 100 kHz | 25°C | | 125 | | μV |
| Dropout voltage | $I_O = 1$ A | 25°C | | 1.1 | | V |
| Bias current | | 25°C | | 1.5 | 2 | mA |
| Bias current change | $V_I = -7$ V to -25 V | | | 0.15 | 0.5 | mA |
| | $I_O = 5$ mA to 1 A | | | 0.08 | 0.5 | |
| Peak output current | | 25°C | | 2.1 | | A |

† 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

electrical characteristics at specified virtual junction temperature, $V_I = -11$ V, $I_O = 500$ mA (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7906C | | | UNITS |
|---|--|--------------|---------|------|-------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | -5.75 | -6 | -6.25 | V |
| | $I_O = 5$ mA to 1 A, $P \leq 15$ W $V_I = -8$ V to -21 V, | 0°C to 125°C | -5.7 | | -6.3 | |
| Input regulation | $V_I = -8$ V to -25 V | | | 12.5 | 120 | mV |
| | $V_I = -9$ V to -13 V | | | 4 | 60 | |
| Ripple rejection | $V_I = -9$ V to -19 V, $f = 120$ Hz | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5$ mA to 1.5 A | | | 15 | 120 | mV |
| | $I_O = 250$ mA to 750 mA | | | 5 | 60 | |
| Temperature coefficient of output voltage | $I_O = 5$ mA | 0°C to 125°C | | -0.4 | | mV/°C |
| Output noise voltage | $f = 10$ Hz to 100 kHz | 25°C | | 150 | | μV |
| Dropout voltage | $I_O = 1$ A | 25°C | | 1.1 | | V |
| Bias current | | 25°C | | 1.5 | 2 | mA |
| Bias current change | $V_I = -8$ V to -25 V | | | 0.15 | 1.3 | mA |
| | $I_O = 5$ mA to 1 A | | | 0.08 | 0.5 | |
| Peak output current | | 25°C | | 2.1 | | A |

† 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.



μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

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electrical characteristics at specified virtual junction temperature, $V_I = -14$ V, $I_O = 500$ mA (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7908C | | | UNITS |
|---|--|--------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | $I_O = 5$ mA to 1 A, $V_I = -10.5$ V to -23 V, $P \leq 15$ W | 25°C | -7.7 | -8 | -8.3 | V |
| | | 0°C to 125°C | -7.6 | | -8.4 | |
| Input regulation | $V_I = -10.5$ V to -25 V | | 12.5 | | 160 | mV |
| | $V_I = -11$ V to -17 V | | 4 | | 80 | |
| Ripple rejection | $V_I = -11.5$ V to -21.5 V, $f = 120$ Hz | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5$ mA to 1.5 A | | 15 | | 160 | mV |
| | $I_O = 250$ mA to 750 mA | | 5 | | 80 | |
| Temperature coefficient of output voltage | $I_O = 5$ mA | 0°C to 125°C | -0.6 | | | mV/°C |
| Output noise voltage | $f = 10$ Hz to 100 kHz | 25°C | 200 | | | μV |
| Dropout voltage | $I_O = 1$ A | 25°C | 1.1 | | | V |
| Bias current | | 25°C | 1.5 | | 2 | mA |
| Bias current change | $V_I = -10.5$ V to -25 V | | 0.15 | | 1 | mA |
| | $I_O = 5$ mA to 1 A | | 0.08 | | 0.5 | |
| Peak output current | | 25°C | 2.1 | | | A |

† 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

electrical characteristics at specified virtual junction temperature, $V_I = -19$ V, $I_O = 500$ mA (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7912C | | | UNITS |
|---|--|--------------|---------|-----|-------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | $I_O = 5$ mA to 1 A, $V_I = -14.5$ V to -27 V, $P \leq 15$ W | 25°C | -11.5 | -12 | -12.5 | V |
| | | 0°C to 125°C | -11.4 | | -12.6 | |
| Input regulation | $V_I = -14.5$ V to -25 V | | 5 | | 80 | mV |
| | $V_I = -16$ V to -22 V | | 3 | | 30 | |
| Ripple rejection | $V_I = -15$ V to -25 V, $f = 120$ Hz | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5$ mA to 1.5 A | | 15 | | 200 | mV |
| | $I_O = 250$ mA to 750 mA | | 5 | | 75 | |
| Temperature coefficient of output voltage | $I_O = 5$ mA | 0°C to 125°C | -0.8 | | | mV/°C |
| Output noise voltage | $f = 10$ Hz to 100 kHz | 25°C | 300 | | | μV |
| Dropout voltage | $I_O = 1$ A | 25°C | 1.1 | | | V |
| Bias current | | 25°C | 2 | | 3 | mA |
| Bias current change | $V_I = -14.5$ V to -25 V | | 0.04 | | 0.5 | mA |
| | $I_O = 5$ mA to 1 A | | 0.06 | | 0.5 | |
| Peak output current | | 25°C | 2.1 | | | A |

† 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.



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electrical characteristics at specified virtual junction temperature, $V_I = -23\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7915C | | | UNITS |
|---|--|--------------|---------|------|--------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | -14.4 | -15 | -15.6 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = -17.5\text{ V to }-25\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | -14.25 | | -15.75 | |
| Input regulation | $V_I = -17.5\text{ V to }-25\text{ V}$ | | | 5 | 100 | mV |
| | $V_I = -20\text{ V to }-25\text{ V}$ | | | 3 | 50 | |
| Ripple rejection | $V_I = -18.5\text{ V to }-25\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | | 20 | 300 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 8 | 150 | |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | 0°C to 125°C | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | 25°C | | 375 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | | 1.1 | | V |
| Bias current | | 25°C | | 2 | 3 | mA |
| Bias current change | $V_I = -17.5\text{ V to }-25\text{ V}$ | | | 0.04 | 0.5 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | 0.06 | 0.5 | |
| Peak output current | | 25°C | | 2.1 | | A |

† 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

electrical characteristics at specified virtual junction temperature, $V_I = -27\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7918C | | | UNITS |
|---|--|--------------|---------|------|-------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | -17.3 | -18 | -18.7 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = -21\text{ V to }-33\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | -17.1 | | -18.9 | |
| Input regulation | $V_I = -21\text{ V to }-33\text{ V}$ | | | 5 | 360 | mV |
| | $V_I = -24\text{ V to }-30\text{ V}$ | | | 3 | 180 | |
| Ripple rejection | $V_I = -22\text{ V to }-32\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | | 30 | 360 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 10 | 180 | |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | 0°C to 125°C | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | 25°C | | 450 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | | 1.1 | | V |
| Bias current | | 25°C | | 2 | 3 | mA |
| Bias current change | $V_I = -21\text{ V to }-33\text{ V}$ | | | 0.04 | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | 0.06 | 0.5 | |
| Peak output current | | 25°C | | 2.1 | | A |

† 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.



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electrical characteristics at specified virtual junction temperature, $V_I = -33\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | $T_{J\ddagger}$ | μA7924C | | | UNITS |
|---|--|-----------------|---------|------|-------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage [†] | | 25°C | -23 | -24 | -25 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = -27\text{ V to }-38\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | -22.8 | | -25.2 | |
| Input regulation | $V_I = -27\text{ V to }-38\text{ V}$ | | | 5 | 480 | mV |
| | $V_I = -30\text{ V to }-36\text{ V}$ | | | 3 | 240 | |
| Ripple rejection | $V_I = -28\text{ V to }-38\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 54 | 60 | | dB |
| Output regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | | 85 | 480 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 25 | 240 | |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | 0°C to 125°C | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | 25°C | | 600 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | | 1.1 | | V |
| Bias current | | 25°C | | 2 | 3 | mA |
| Bias current change | $V_I = -27\text{ V to }-38\text{ V}$ | | | 0.04 | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | 0.06 | 0.5 | |
| Peak output current | | 25°C | | 2.1 | | A |

[†] 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. All characteristics are measured with a 2-μF capacitor across the input and a 1-μF capacitor across the output.

[‡] This specification applies only for dc power dissipation permitted by absolute maximum ratings.

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| UA7905CKC | OBSOLETE | TO-220 | KC | 3 | | None | Call TI | Call TI |
| UA7905CKCS | ACTIVE | TO-220 | KCS | 3 | 50 | None | Call TI | Level-NC-NC-NC |
| UA7905CKTER | ACTIVE | PFM | KTE | 3 | 2000 | None | Call TI | Level-1-220C-UNLIM |
| UA7908CKC | OBSOLETE | TO-220 | KC | 3 | | None | Call TI | Call TI |
| UA7908CKCS | ACTIVE | TO-220 | KCS | 3 | 50 | None | Call TI | Level-NC-NC-NC |
| UA7908CKTER | ACTIVE | PFM | KTE | 3 | 2000 | None | Call TI | Level-1-220C-UNLIM |
| UA7912CKC | OBSOLETE | TO-220 | KC | 3 | | None | Call TI | Call TI |
| UA7912CKCS | ACTIVE | TO-220 | KCS | 3 | 50 | None | Call TI | Level-NC-NC-NC |
| UA7912CKTER | ACTIVE | PFM | KTE | 3 | 2000 | None | Call TI | Level-1-220C-UNLIM |
| UA7915CKC | OBSOLETE | TO-220 | KC | 3 | | None | Call TI | Call TI |
| UA7918CKC | OBSOLETE | TO-220 | KC | 3 | | None | Call TI | Call TI |
| UA7924CKC | OBSOLETE | TO-220 | KC | 3 | | None | 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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

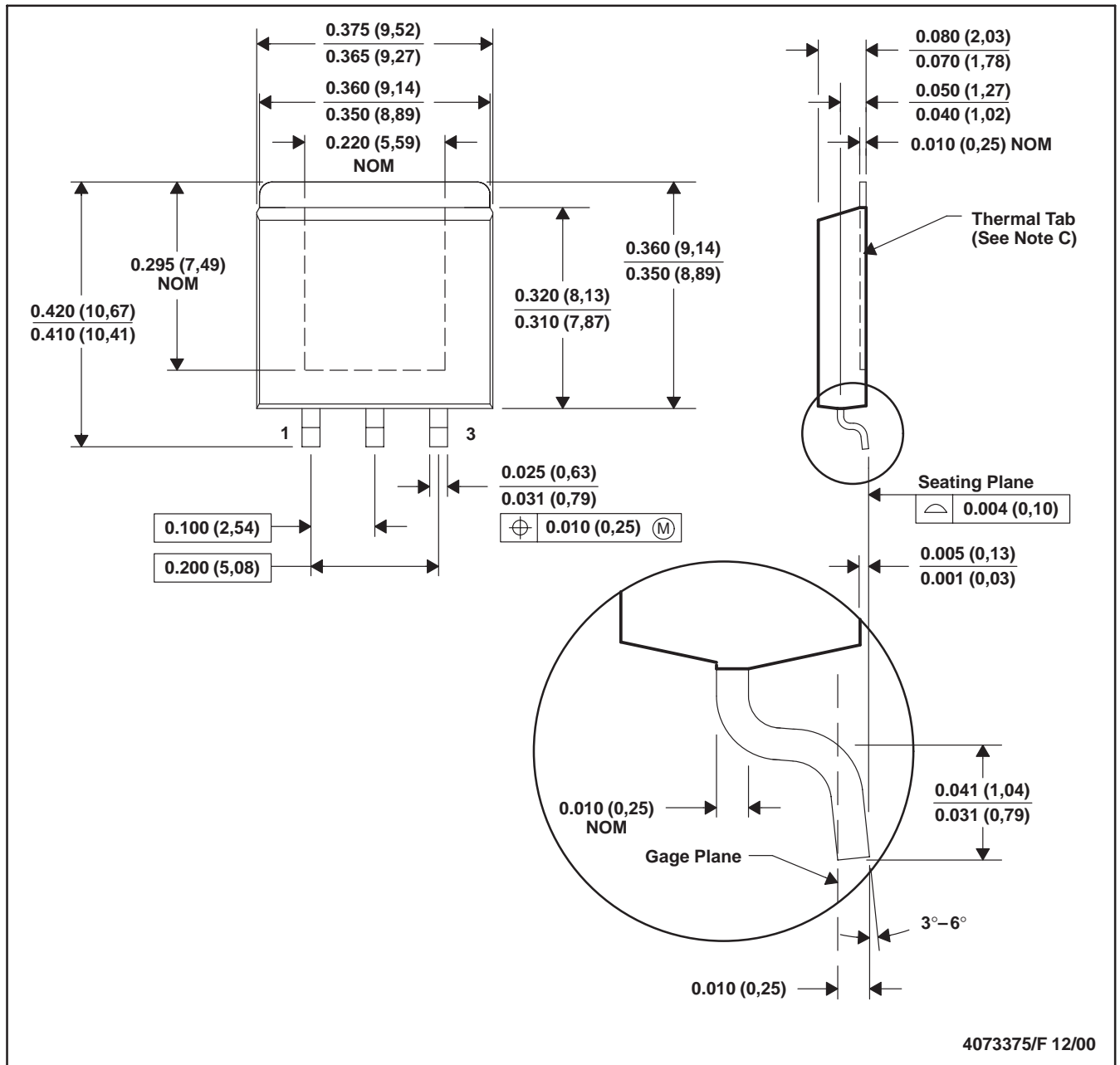
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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KTE (R-PSFM-G3)

PowerFLEX™ PLASTIC FLANGE-MOUNT



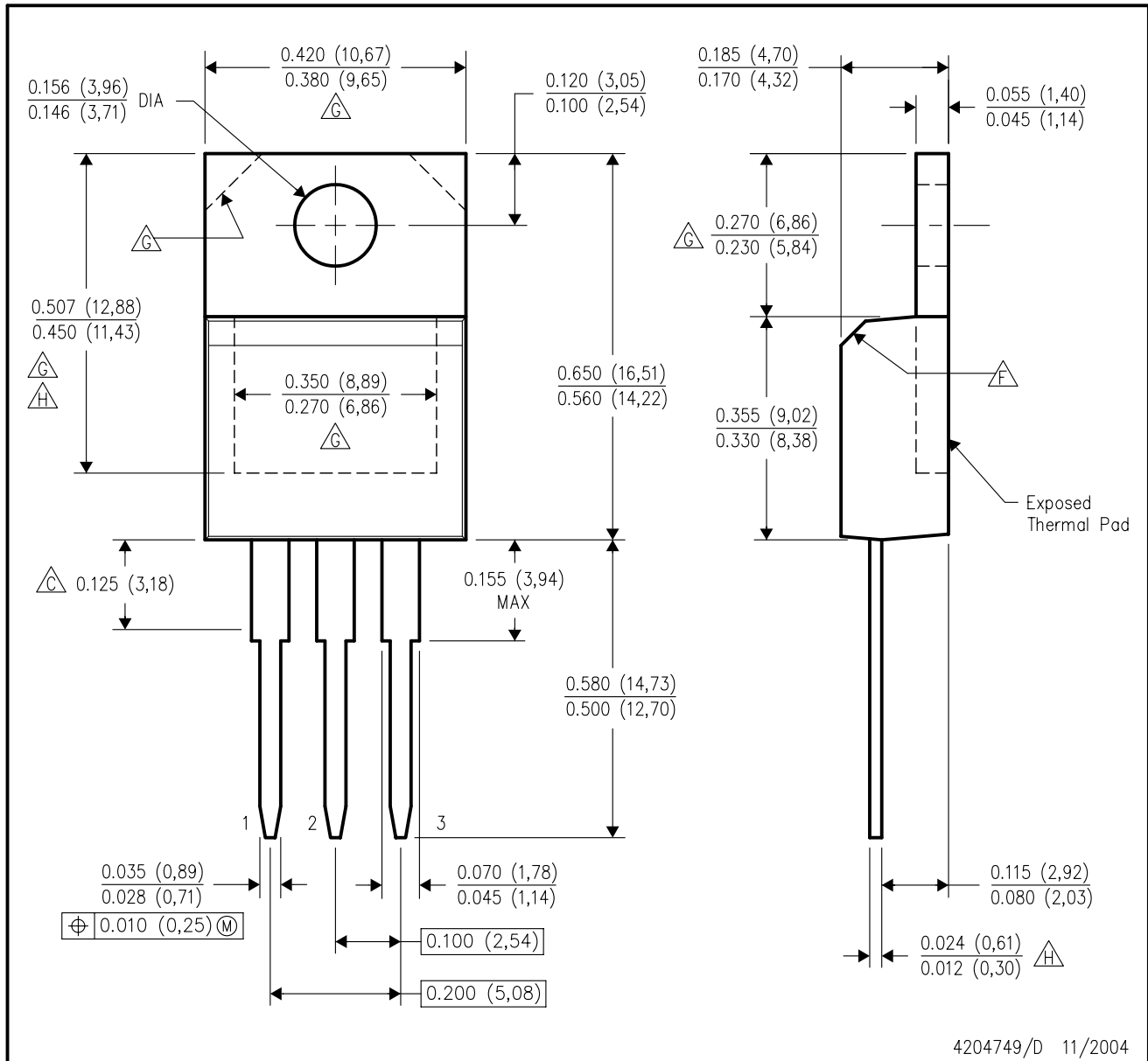
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. The center lead is in electrical contact with the thermal tab.
 D. Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).
 E. Falls within JEDEC MO-169

PowerFLEX is a trademark of Texas Instruments.



KCS (R-PSFM-T3)

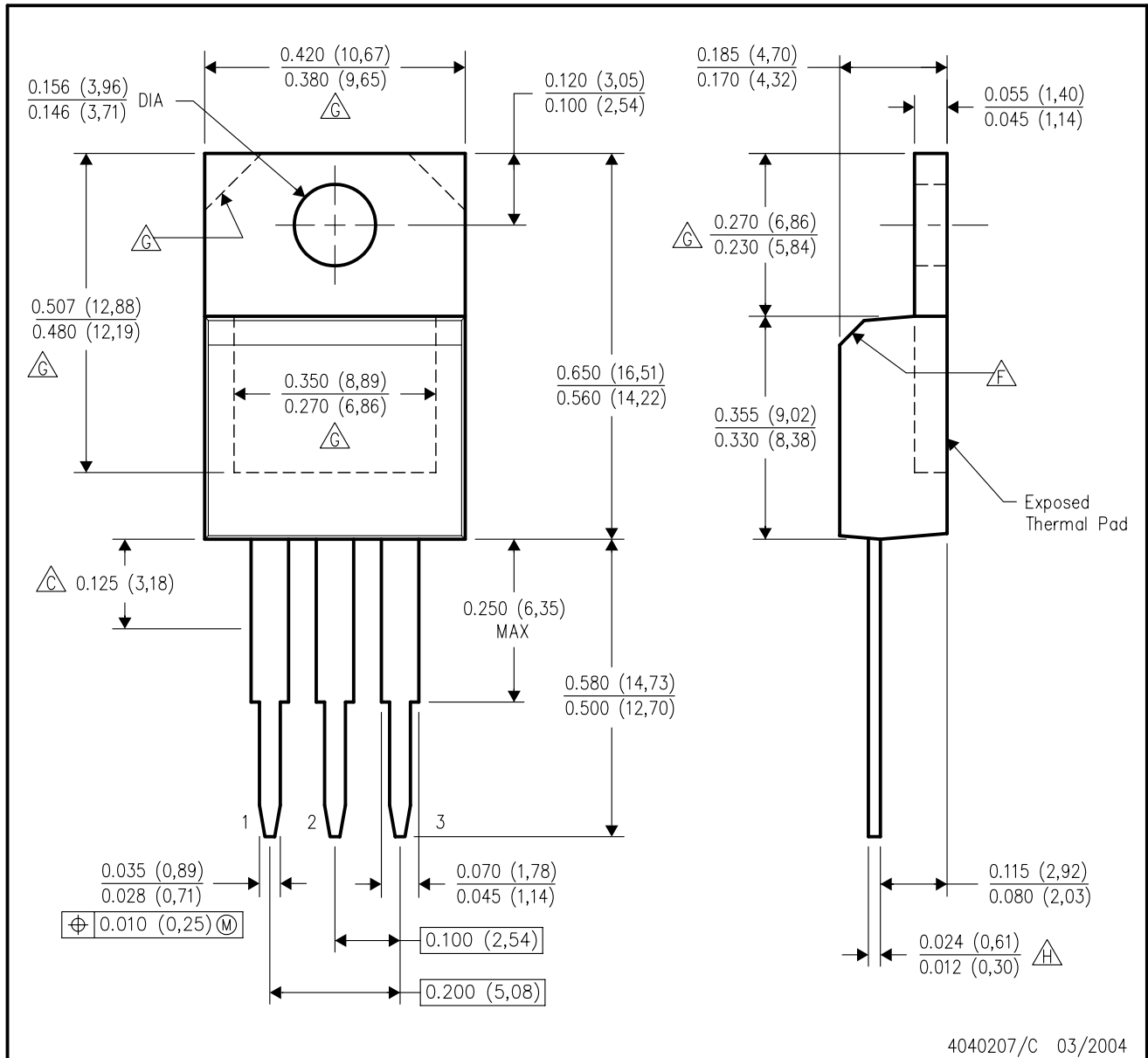
PLASTIC FLANGE-MOUNT PACKAGE



- 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 and minimum exposed pad length.

KC (R-PSFM-T3)

PLASTIC FLANGE-MOUNT PACKAGE



4040207/C 03/2004

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