# TL783 High-voltage Adjustable Regulator

## 1 Features

- Output Adjustable From 1.25 V to 125 V when Used with an External Resistor Divider
- 700-mA Output Current
- Full Short-Circuit, Safe-Operating-Area, and Thermal-Shutdown Protection
- 0.001%/V Typical Input Voltage Regulation
- 0.15% Typical Output Voltage Regulation
- 76-dB Typical Ripple Rejection

## 2 Applications

- Electronic Point of Sale
- Medical, Health, and Fitness Applications
- Printers
- Applications and White Goods

## 3 Description

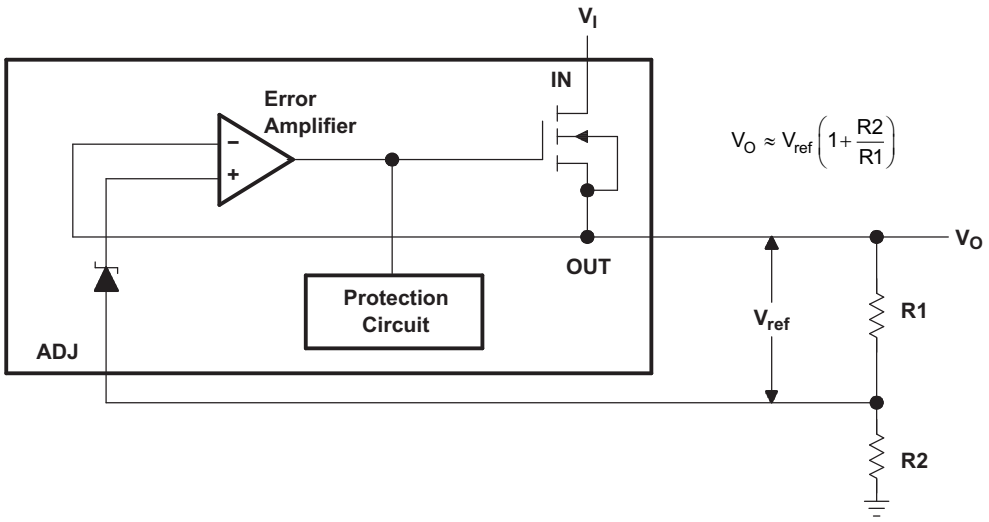
The TL783 device is an adjustable three-terminal high-voltage regulator with an output range of 1.25 V to 125 V and a DMOS output transistor capable of sourcing more than 700 mA. It is designed for use in high-voltage applications where standard bipolar regulators cannot be used. Excellent performance specifications, superior to those of most bipolar regulators, are achieved through circuit design and advanced layout techniques.

**Device Information(1)**

| PART NUMBER | PACKAGE (PIN) | BODY SIZE (NOM) |
|---|---|---|
| TL783 | TO-220 (3) | 10.17 mm × 9.02 mm |
| | | 10.16 mm × 8.70 mm |
| | PFM (3) | 9.40 mm × 8.00 mm |
| | TO-263 (3) | 10.18 mm × 8.41 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

## 4 Simplified Schematic




An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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## 5 Revision History

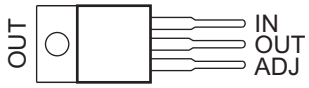
**Changes from Revision M (April 2008) to Revision N** **Page**

- Added *Applications*, *Device Information* table, *Pin Functions* table, *ESD Ratings* table, *Thermal Information* table, *Typical Characteristics*, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section. ... 1
- Deleted *Ordering Information* table. ... 1

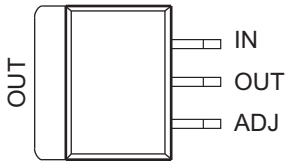

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# 6 Pin Configuration and Functions

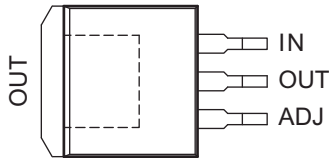
**KC (TO-220) PACKAGE**
**(TOP VIEW)**




**KTE (PowerFLEX™) PACKAGE**
**(TOP VIEW)**




**KTT (TO-263) PACKAGE**
**(TOP VIEW)**




**Pin Functions**

| PIN | | | | TYPE | DESCRIPTION |
|---|---|---|---|---|---|
| NAME | KC TO-220 | KTE PowerFLEX™ | KTT TO-263 | | |
| ADJ | 1 | 1 | 1 | I/O | Voltage adjustment pin. Connect a resistor divider to determine the output voltage. |
| IN | 3 | 3 | 3 | I | Supply Input |
| OUT | 2 | 2 | 2 | O | Voltage Output |

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# 7 Specifications

## 7.1 Absolute Maximum Ratings

over operating temperature range (unless otherwise noted)(1)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| $V_I - V_O$ | Input-to-output differential voltage | | 125 | V |
| $T_J$ | Operating virtual junction temperature | | 150 | °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.

## 7.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1) | 2500 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2) | 1000 | |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

## 7.3 Recommended Operating Conditions

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| $V_I - V_O$ | Input-to-output differential voltage | | 125 | V |
| $I_O$ | Output current | 15 | 700 | mA |
| $T_J$ | Operating virtual junction temperature | 0 | 125 | °C |

## 7.4 Thermal Information

| THERMAL METRIC(1) | | TL783 | | | UNIT |
|---|---|---|---|---|---|
| | | KTE | KTT | KC | |
| | | 3 PINS | | | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 23 | 25.3 | 19 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | N/A | 18 | 17 | |
| $R_{\theta JP}$ | Junction-to-exposed-pad thermal resistance | 2.7 | 1.94 | 3 | |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.


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## 7.5 Electrical Characteristics

$V_I - V_O$ = 25 V, $I_O$ = 0.5 A, $T_J$ = 0°C to 125°C (unless otherwise noted)

| PARAMETER | TEST CONDITIONS[1] | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Input voltage regulation[2] | $V_I - V_O$ = 20 V to 125 V, P ≤ rated dissipation | $T_J$ = 25°C | | 0.001 | 0.01 | %/V |
| | | $T_J$ = 0°C to 125°C | | 0.004 | 0.02 | |
| Ripple rejection | $\Delta V_{I(PP)}$ = 10 V, $V_O$ = 10 V, f = 120 Hz | | 66 | 76 | | dB |
| Output voltage regulation | $I_O$ = 15 mA to 700 mA, $T_J$ = 25°C | $V_O$ ≤ 5 V | | 7.5 | 25 | mV |
| | | $V_O$ ≥ 5 V | | 0.15% | 0.5% | — |
| | $I_O$ = 15 mA to 700 mA, P ≤ rated dissipation | $V_O$ ≤ 5 V | | 20 | 70 | mV |
| | | $V_O$ ≥ 5 V | | 0.3% | 1.5% | — |
| Output voltage change with temperature | | | | 0.4% | | |
| Output voltage long-term drift | 1000 hours at $T_J$ = 125°C, $V_I - V_O$ = 125 V | | | 0.2% | | |
| Output noise voltage | f = 10 Hz to 10 kHz, $T_J$ = 25°C | | | 0.003% | | |
| Minimum output current to maintain regulation | $V_I - V_O$ = 125 V | | | | 15 | mA |
| Peak output current | $V_I - V_O$ = 25 V, t = 1 ms | | | 1100 | | mA |
| | $V_I - V_O$ = 15 V, t = 30 ms | | | 715 | | |
| | $V_I - V_O$ = 25 V, t = 30 ms | | 700 | 900 | | |
| | $V_I - V_O$ = 125 V, t = 30 ms | | 100 | 250 | | |
| ADJ input current | | | | 83 | 110 | µA |
| Change in ADJ input current | $V_I - V_O$ = 15 V to 125 V, $I_O$ = 15 mA to 700 mA, P ≤ rated dissipation | | | 0.5 | 5 | µA |
| Reference voltage (OUT to ADJ)[3] | $V_I - V_O$ = 10 V to 125 V, $I_O$ = 15 mA to 700 mA, P ≤ rated dissipation | | 1.2 | 1.27 | 1.3 | V |

(1) Pulse-testing techniques maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
(2) Input voltage regulation is expressed here as the percentage change in output voltage per 1-V change at the input
(3) Due to the dropout voltage and output current-limiting characteristics of this device, output current is limited to less than 700 mA at input-to-output voltage differentials of less than 25 V.

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## 7.6 Typical Characteristics

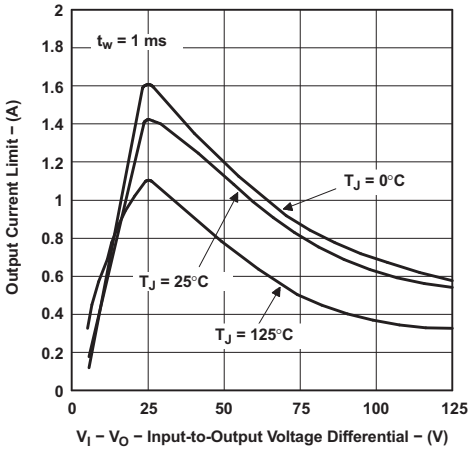



**Figure 1. Output Current Limit vs Input-to-Output Voltage Differential**

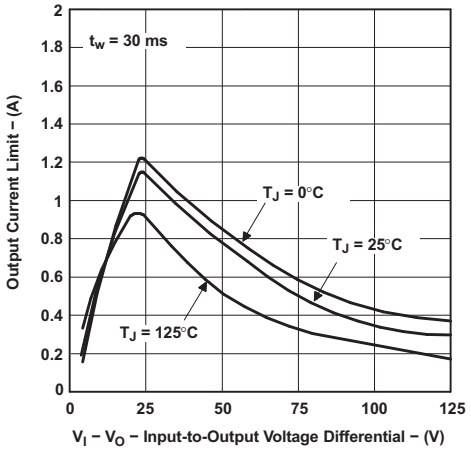



**Figure 2. Output Current Limit vs Input-to-Output Voltage Differential**

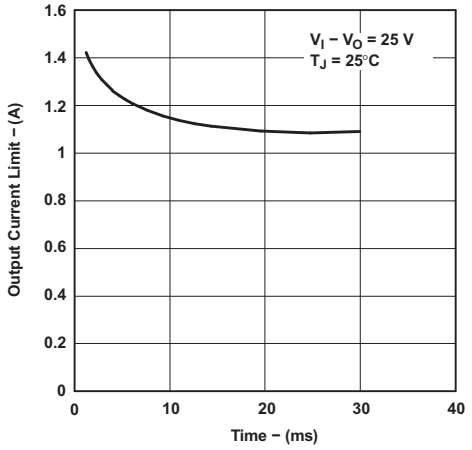



**Figure 3. Output Current Limit vs Time**

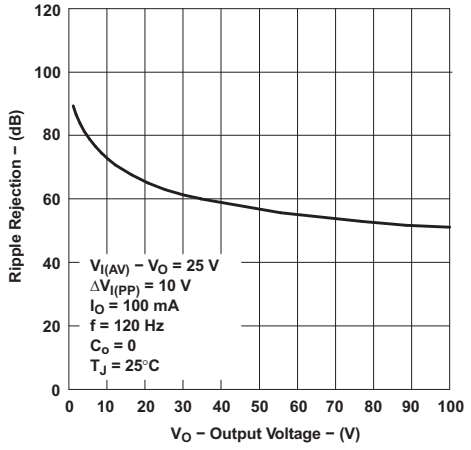



**Figure 4. Ripple Rejection vs Output Voltage**

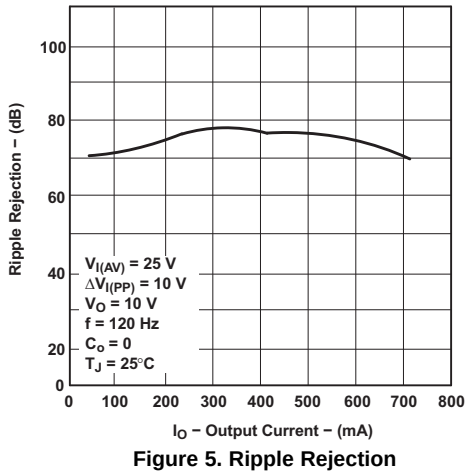



**Figure 5. Ripple Rejection vs Output Current**

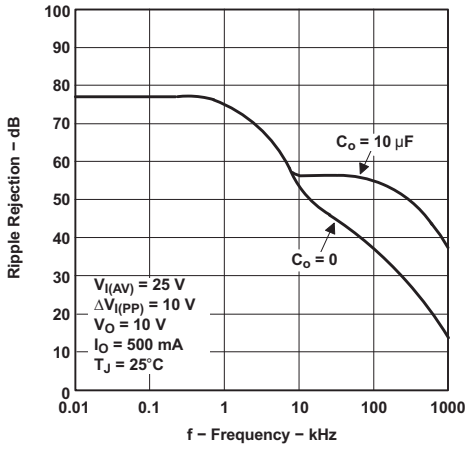



**Figure 6. Ripple Rejection vs Frequency**


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## Typical Characteristics (continued)

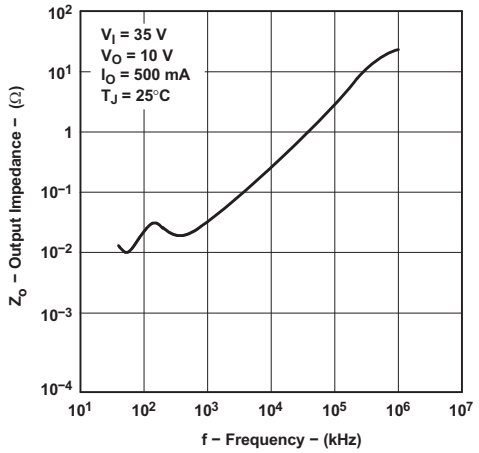



**Figure 7. Output Impedance vs Frequency**

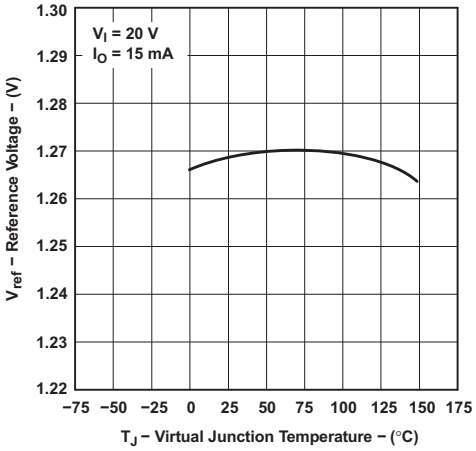



**Figure 8. Reference Voltage vs Virtual Junction Temperature**

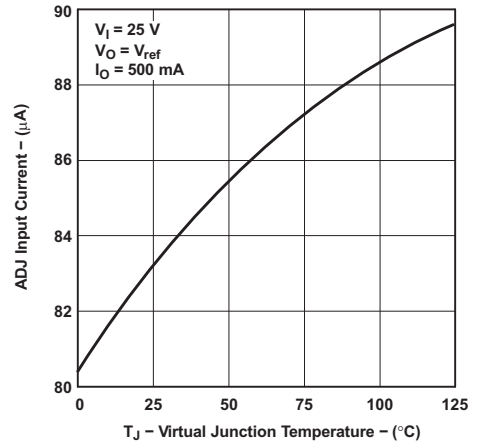



**Figure 9. Input Current at ADJ vs Virtual Junction Temperature**

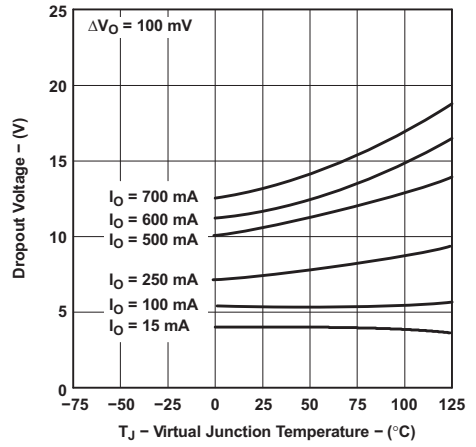



**Figure 10. Dropout Voltage vs Virtual Junction Temperature**

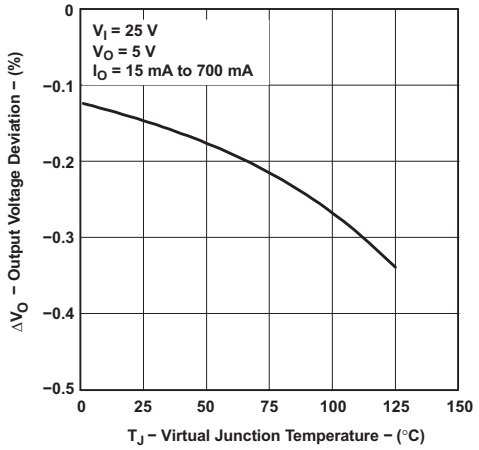
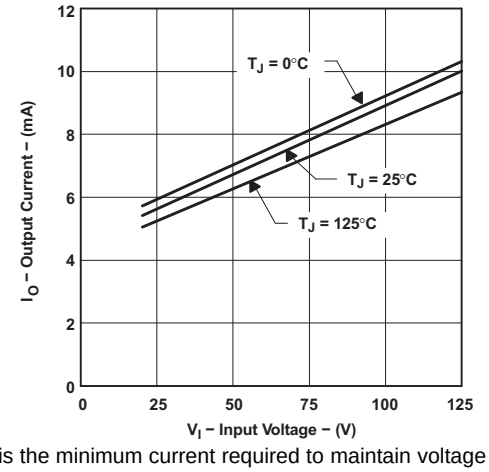



**Figure 11. Output Voltage Deviation vs Virtual Junction Temperature**




(1) This is the minimum current required to maintain voltage regulation.

**Figure 12. Output Current vs Input Voltage**

# 8 Detailed Description

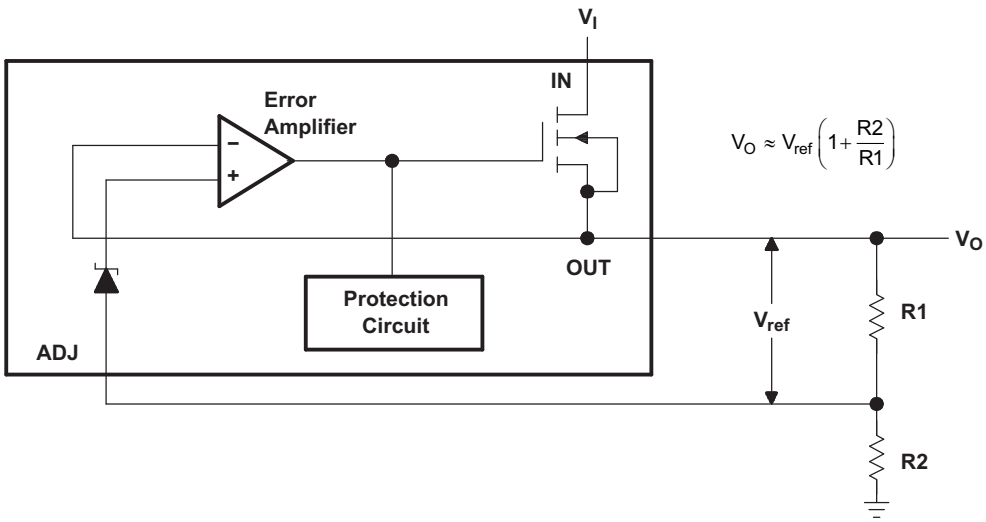
## 8.1 Overview

The TL783 device is an adjustable three-terminal high-voltage regulator with an output range of 1.25 V to 125 V and a DMOS output transistor capable of sourcing more than 700 mA. It is designed for use in high-voltage applications where standard bipolar regulators cannot be used. Excellent performance specifications, superior to those of most bipolar regulators, are achieved through circuit design and advanced layout techniques.

As a state-of-the-art regulator, the TL783 device combines standard bipolar circuitry with high-voltage double-diffused MOS transistors on one chip, to yield a device capable of withstanding voltages far higher than standard bipolar integrated circuits. Because of its lack of secondary-breakdown and thermal-runaway characteristics usually associated with bipolar outputs, the TL783 maintains full overload protection while operating at up to 125 V from input to output. Other features of the device include current limiting, safe-operating-area (SOA) protection, and thermal shutdown. Even if ADJ is disconnected inadvertently, the protection circuitry remains functional.

Only two external resistors are required to program the output voltage. An input bypass capacitor is necessary only when the regulator is situated far from the input filter. An output capacitor, although not required, improves transient response and protection from instantaneous output short circuits. Excellent ripple rejection can be achieved without a bypass capacitor at the adjustment terminal.

## 8.2 Functional Block Diagram




## 8.3 Feature Description

- Output Adjustable From 1.25 V to 125 V when Used with an External Resistor Divider
- 700-mA Output Current
- Full Short-Circuit, Safe-Operating-Area, and Thermal-Shutdown Protection
- 0.001%/V Typical Input Voltage Regulation
- 0.15% Typical Output Voltage Regulation
- 76-dB Typical Ripple Rejection

## 8.4 Device Functional Modes

### 8.4.1 Active Mode

The TL783 acts as a high-voltage adjustable regulator. The device works to keep the voltage at the OUT pin 1.25 V higher than the voltage at the ADJ pin. Therefore, a resistor divider can be used to set the output voltage.


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# 9 Application and Implementation

**NOTE**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

## 9.1 Application Information

### 9.1.1 General Configurations

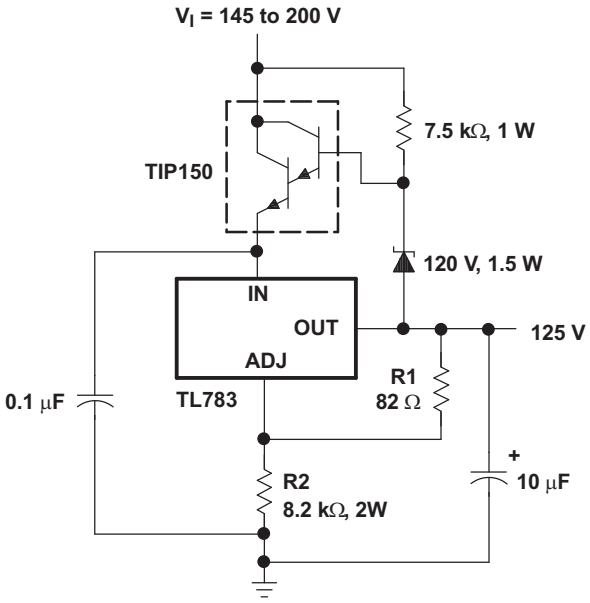



**Figure 13. 125-V Short-Circuit-Protected Off-Line Regulator**

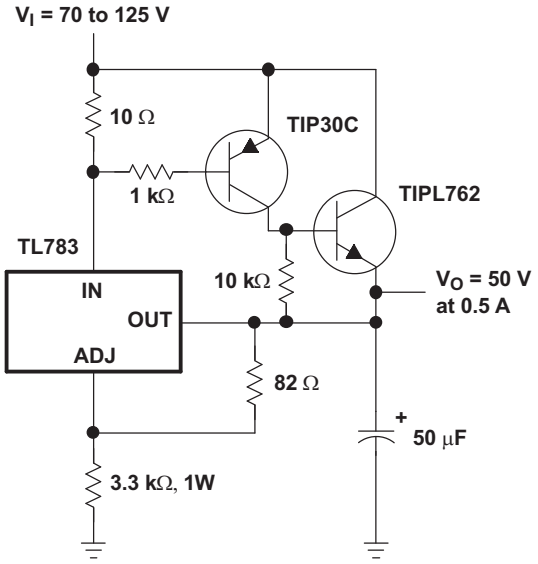



**Figure 14. 50-V Regulator With Current Boost**

## Application Information (continued)

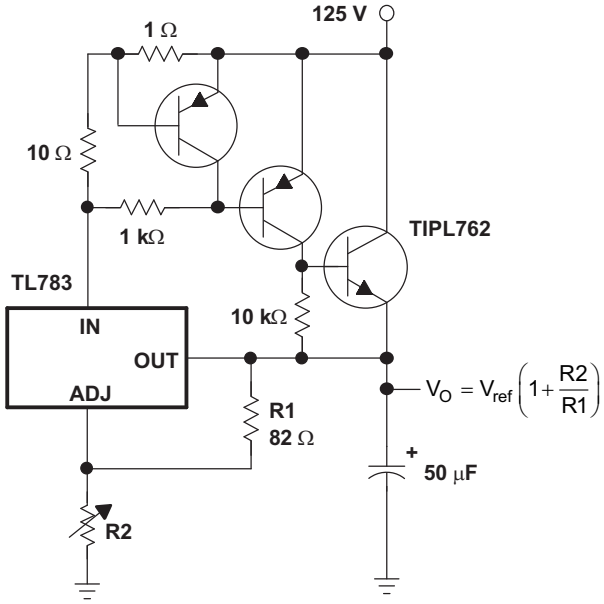



**Figure 15. Adjustable Regulator With Current Boost and Current Limit**

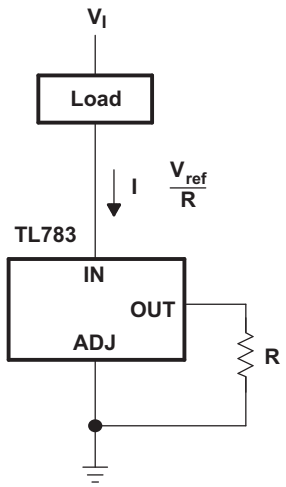



**Figure 16. Current-Sinking Regulator**


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## Application Information (continued)

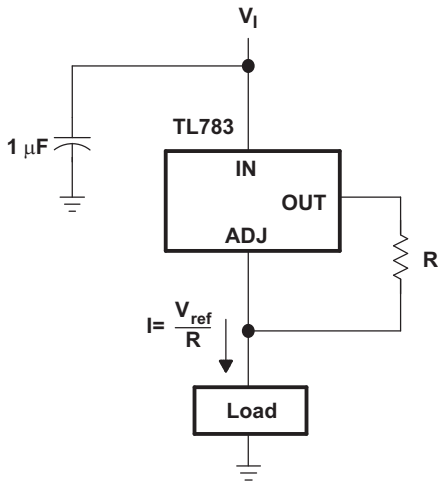



**Figure 17. Current-Sourcing Regulator**

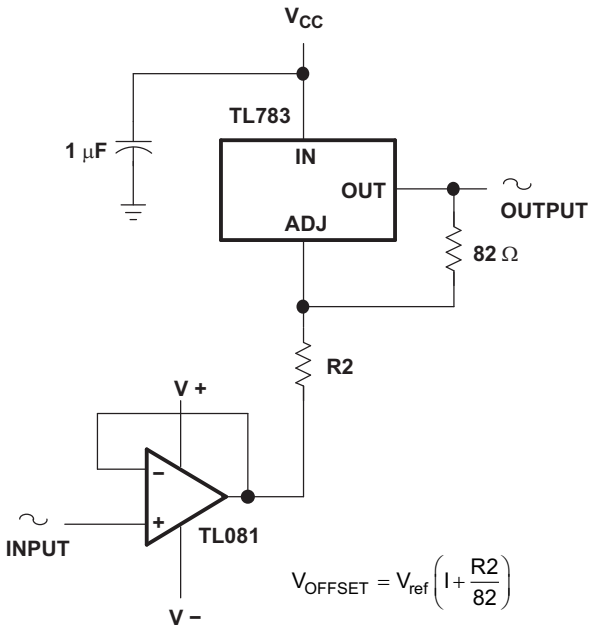



**Figure 18. High-Voltage Unity-Gain Offset Amplifier**

## Application Information (continued)

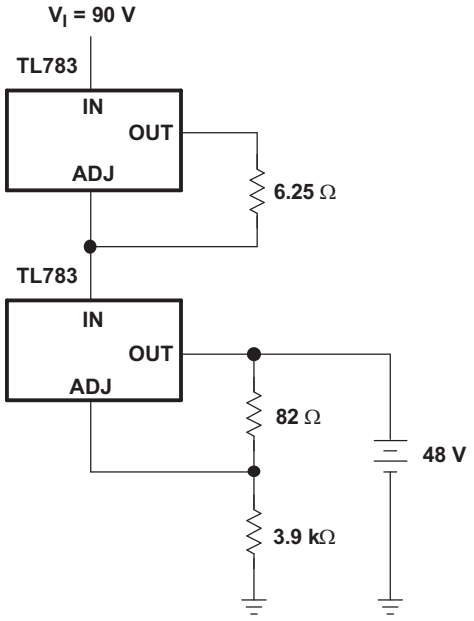
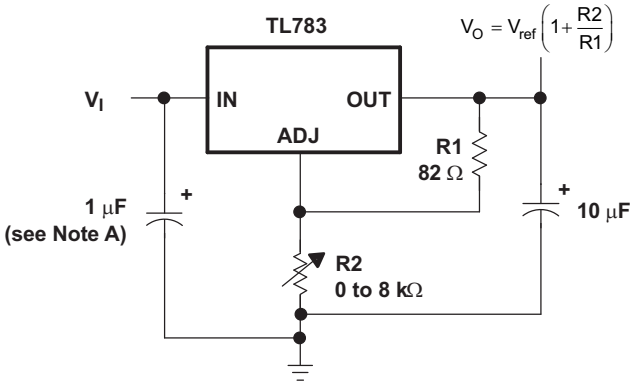



**Figure 19. 48-V 200-mA Float Charger**

## 9.2 Typical Application

The TL783 is typically used as an adjustable regulator.




A. Needed if device is more than 4 inches from filter capacitor

**Figure 20. 1.25-V to 115-V Adjustable Regulator**

### 9.2.1 Design Requirements

- Input and output decoupling capacitors for noise filtering.
- Resistor divider consisting of R1 and R2 to set the output voltage.


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## Typical Application (continued)

### 9.2.2 Detailed Design Procedure

The internal reference (see *Simplified Schematic*) generates 1.25 V nominal ($V_{ref}$) between OUT and ADJ. This voltage is developed across R1 and causes a constant current to flow through R1 and the programming resistor R2, giving an output voltage of:

$$V_O = V_{ref} (1 + R2 / R1) + I_{I(ADJ)} (R2)$$

or

$$V_O \approx V_{ref} (1 + R2 / R1)$$

The TL783 was designed to minimize the input current at ADJ and maintain consistency over line and load variations, thereby minimizing the associated (R2) error term.

To maintain $I_{I(ADJ)}$ at a low level, all quiescent operating current is returned to the output terminal. This quiescent current must be sunk by the external load and is the minimum load current necessary to prevent the output from rising. The recommended R1 value of 82 Ω provides a minimum load current of 15 mA. Larger values can be used when the input-to-output differential voltage is less than 125 V (see the output-current curve in Figure 12) or when the load sinks some portion of the minimum current.

#### *9.2.2.1 Bypass Capacitors*

The TL783 regulator is stable without bypass capacitors; however, any regulator becomes unstable with certain values of output capacitance if an input capacitor is not used. Therefore, the use of input bypassing is recommended whenever the regulator is located more than four inches from the power-supply filter capacitor. A 1-µF tantalum or aluminum electrolytic capacitor usually is sufficient.

Adjustment-terminal capacitors are not recommended for use on the TL783 because they can seriously degrade load transient response, as well as create a need for extra protection circuitry. Excellent ripple rejection presently is achieved without this added capacitor.

Due to the relatively low gain of the MOS output stage, output voltage dropout may occur under large-load transient conditions. The addition of an output bypass capacitor greatly enhances load transient response and prevents dropout. For most applications, it is recommended that an output bypass capacitor be used, with a minimum value of:

$$C_o (\mu F) = 15 / V_O$$

Larger values provide proportionally better transient-response characteristics.

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## Typical Application (continued)

### 9.2.2.2 Protection Circuitry

The TL783 regulator includes built-in protection circuits capable of guarding the device against most overload conditions encountered in normal operation. These protective features are current limiting, safe-operating-area protection, and thermal shutdown. These circuits protect the device under occasional fault conditions only. Continuous operation in the current limit or thermal shutdown mode is not recommended.

The internal protection circuits of the TL783 protect the device up to maximum-rated $V_I$ as long as certain precautions are taken. If $V_I$ is switched on instantaneously, transients exceeding maximum input ratings may occur, which can destroy the regulator. Usually, these are caused by lead inductance and bypass capacitors causing a ringing voltage on the input. In addition, when rise times in excess of 10 V/ns are applied to the input, a parasitic npn transistor in parallel with the DMOS output can be turned on, causing the device to fail. If the device is operated over 50 V and the input is switched on, rather than ramped on, a low-Q capacitor, such as tantalum or aluminum electrolytic, should be used, rather than ceramic, paper, or plastic bypass capacitors. A Q factor of 0.015, or greater, usually provides adequate damping to suppress ringing. Normally, no problems occur if the input voltage is allowed to ramp upward through the action of an ac line rectifier and filter network.

Similarly, when an instantaneous short circuit is applied to the output, both ringing and excessive fall times can result. A tantalum or aluminum electrolytic bypass capacitor is recommended to eliminate this problem. However, if a large output capacitor is used, and the input is shorted, addition of a protection diode may be necessary to prevent capacitor discharge through the regulator. The amount of discharge current delivered is dependent on output voltage, size of capacitor, and fall time of $V_I$. A protective diode (see Figure 21) is required only for capacitance values greater than:

$$C_o\ (\mu F) = 3 \times 10^4 / (V_O)^2$$

Care always should be taken to prevent insertion of regulators into a socket with power on. Power should be turned off before removing or inserting regulators.

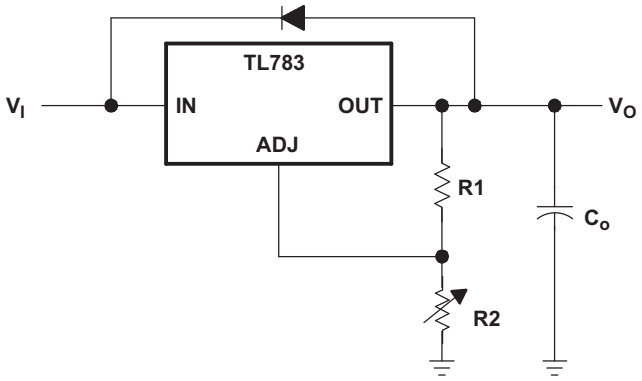



**Figure 21. Regulator With Protective Diode**


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## Typical Application (continued)

### 9.2.2.3 Load Regulation

The current-set resistor (R1) should be located close to the regulator output terminal, rather than near the load. This eliminates long line drops from being amplified, through the action of R1 and R2, to degrade load regulation. To provide remote ground sensing, R2 should be near the load ground.

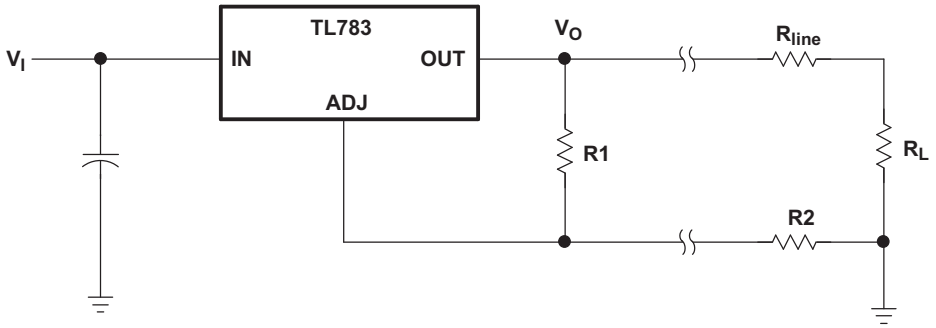



**Figure 22. Regulator With Current-Set Resistor**

### 9.2.3 Application Curves

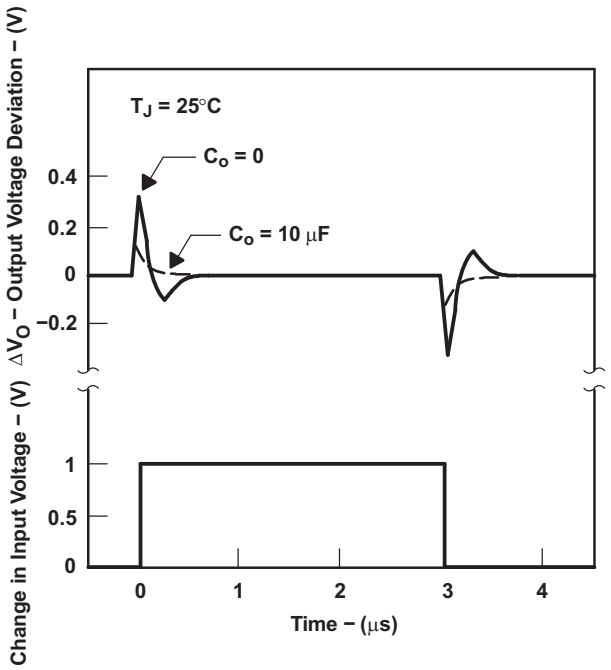



**Figure 23. Line Transient Response**

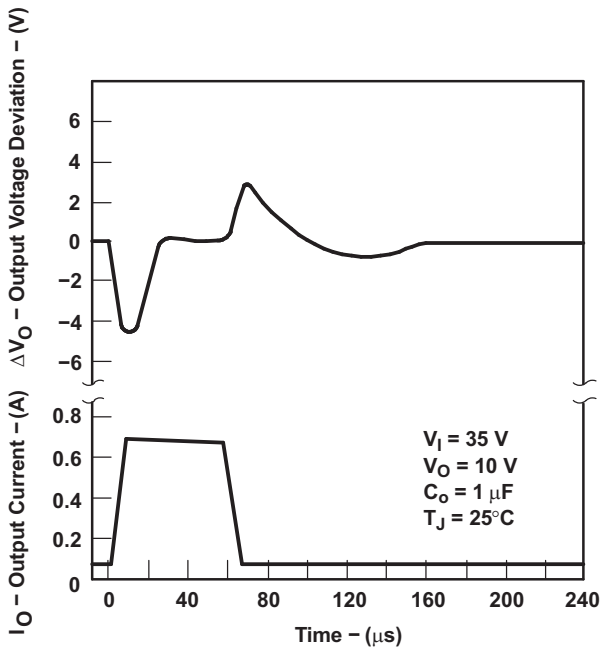



**Figure 24. Load Transient Response**

# 10 Power Supply Recommendations

A decoupling capacitor is needed on the IN pin of the TL783 if the TL783 is more than 4 inches from its power supply's filter capacitor. The differential input and output voltage levels are detailed in *Recommended Operating Conditions*.

# 11 Layout

## 11.1 Layout Guidelines

Input and output traces should be thick enough to handle desired currents, which can reach up to 700 mA on the output. ADJ pin traces can be smaller because the adjustment current is negligible.

## 11.2 Layout Example

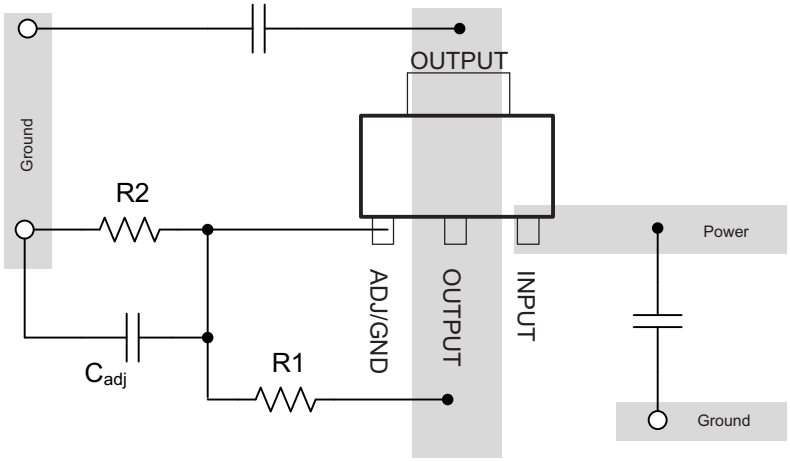



**Figure 25. Layout Example**

# 12 Device and Documentation Support

## 12.1 Trademarks

All trademarks are the property of their respective owners.

## 12.2 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## 12.3 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

# 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.


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## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TL783CKC | OBSOLETE | TO-220 | KC | 3 | | TBD | Call TI | Call TI | 0 to 125 | TL783C | |
| TL783CKCE3 | OBSOLETE | TO-220 | KC | 3 | | TBD | Call TI | Call TI | 0 to 125 | TL783C | |
| TL783CKCSE3 | ACTIVE | TO-220 | KCS | 3 | 50 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | 0 to 125 | TL783C | Samples |
| TL783CKTER | OBSOLETE | PFM | KTE | 3 | | TBD | Call TI | Call TI | 0 to 125 | TL783 | |
| TL783CKTTR | ACTIVE | DDPAK/ TO-263 | KTT | 3 | 500 | Green (RoHS & no Sb/Br) | CU SN | Level-3-245C-168 HR | 0 to 125 | TL783C | Samples |
| TL783CKTTRG3 | ACTIVE | DDPAK/ TO-263 | KTT | 3 | 500 | Green (RoHS & no Sb/Br) | CU SN | Level-3-245C-168 HR | 0 to 125 | TL783C | Samples |

(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.

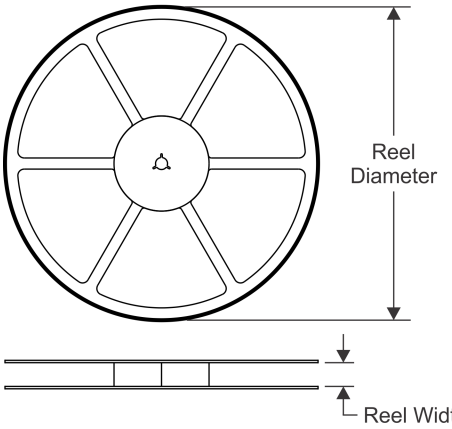
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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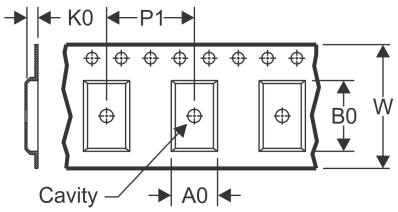
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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

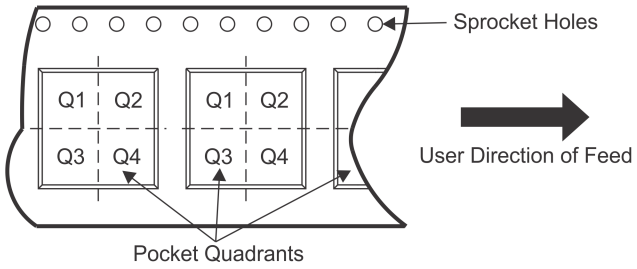



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

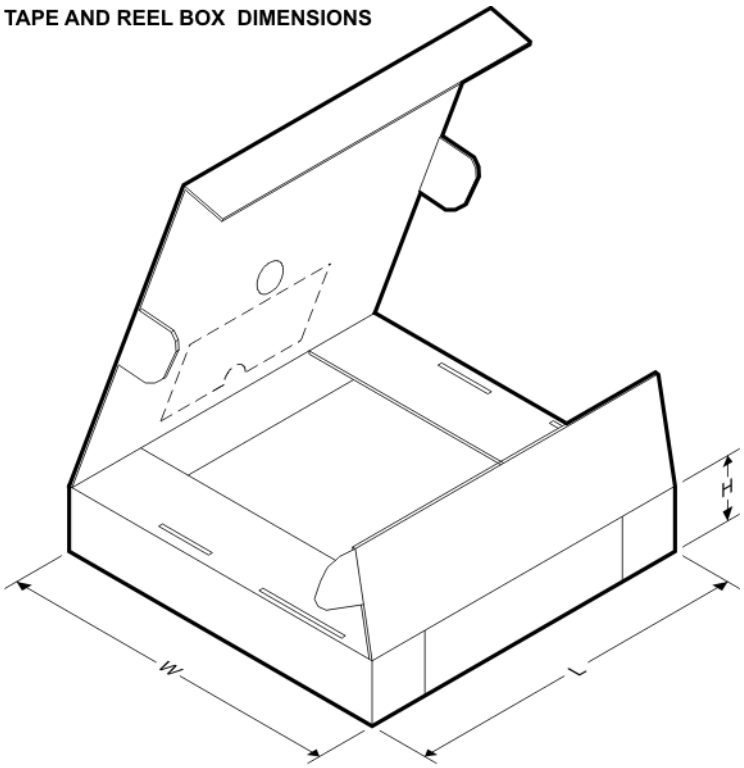
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL783CKTTR | DDPAK/ TO-263 | KTT | 3 | 500 | 330.0 | 24.4 | 10.8 | 16.3 | 5.11 | 16.0 | 24.0 | Q2 |

**TAPE AND REEL BOX DIMENSIONS**

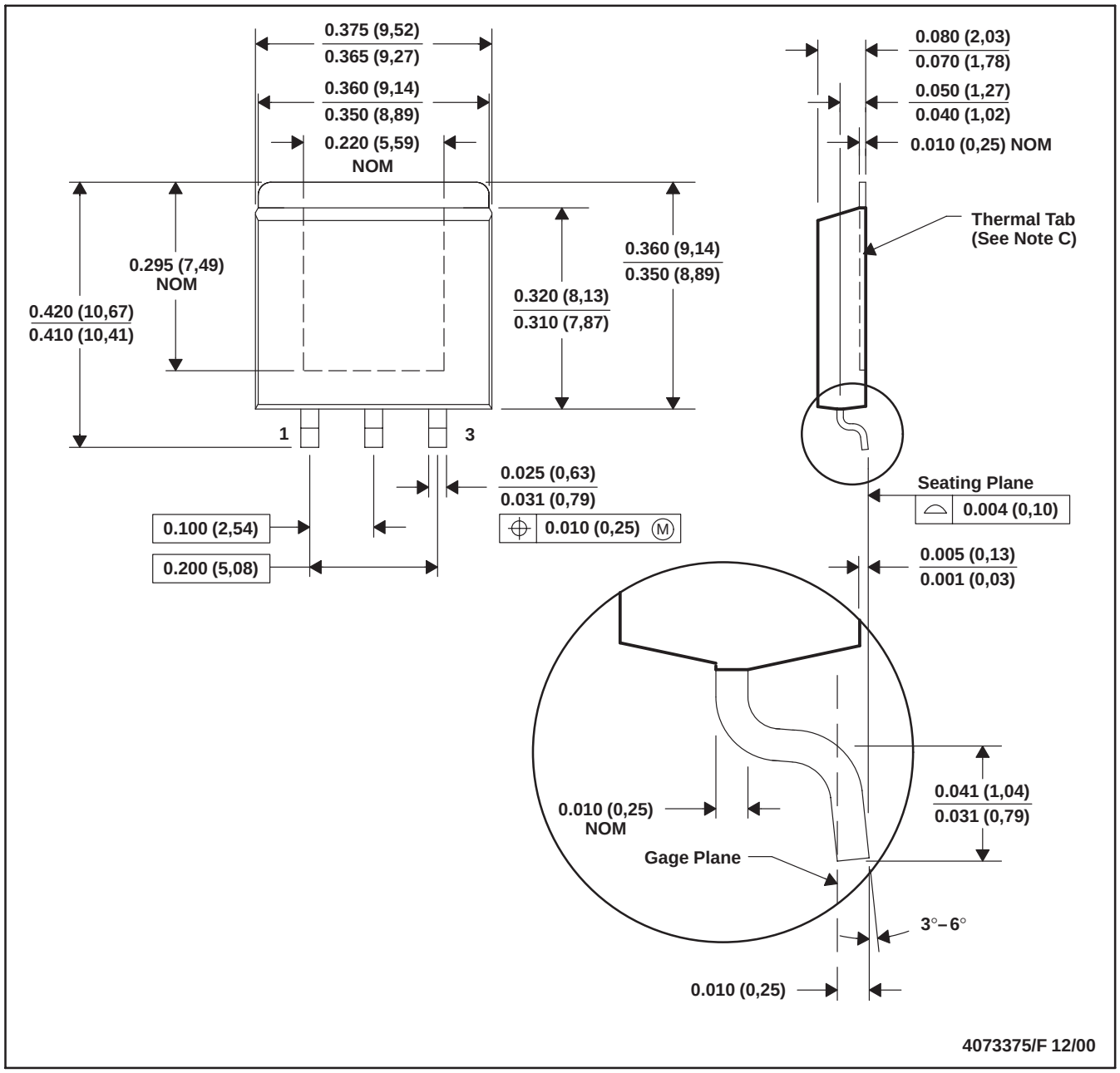



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TL783CKTTR | DDPAK/TO-263 | KTT | 3 | 500 | 340.0 | 340.0 | 38.0 |

MPFM001E – OCTOBER 1994 – REVISED JANUARY 2001

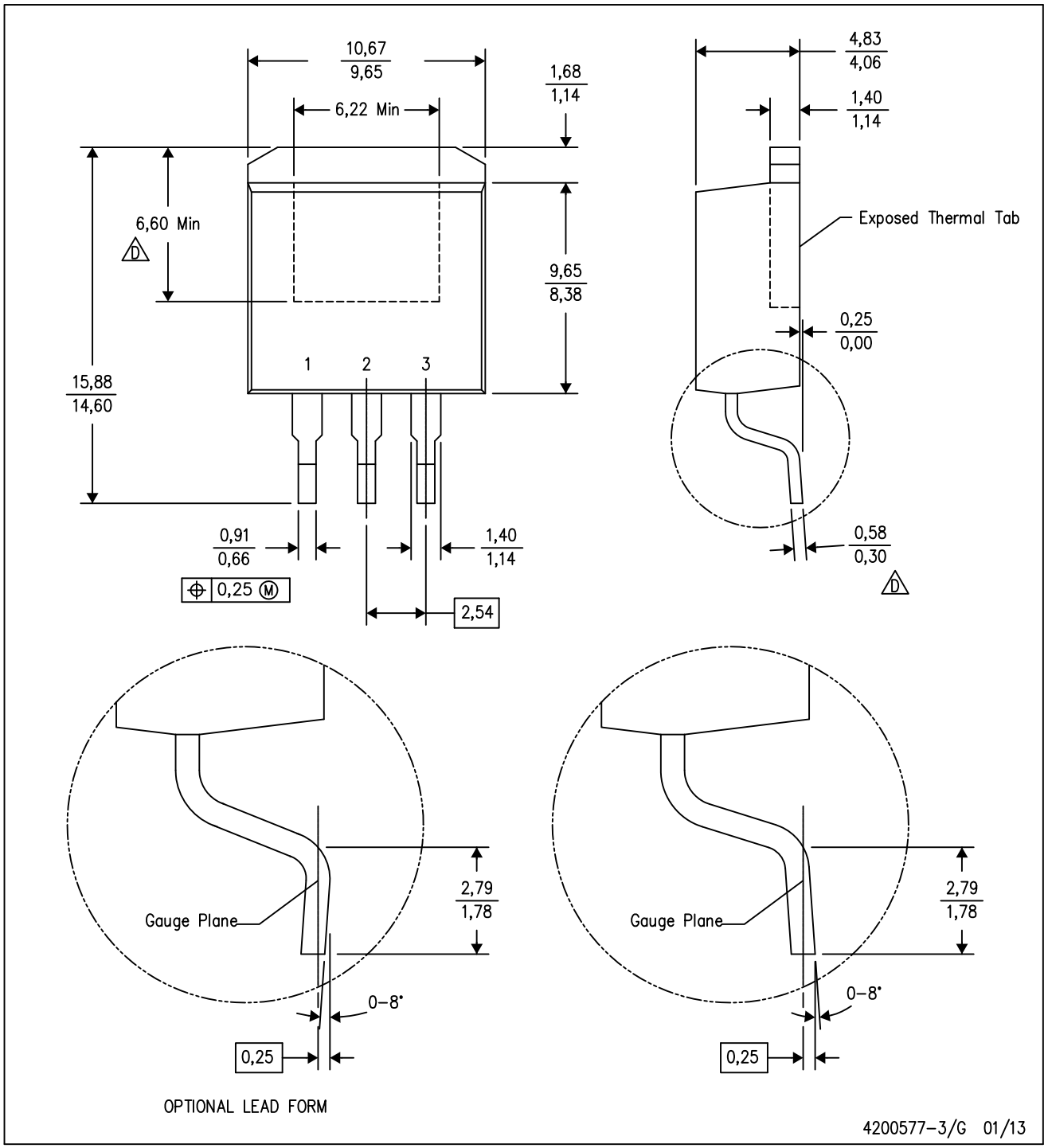
**KTE (R-PSFM-G3)** **PowerFLEX™ PLASTIC FLANGE-MOUNT**




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

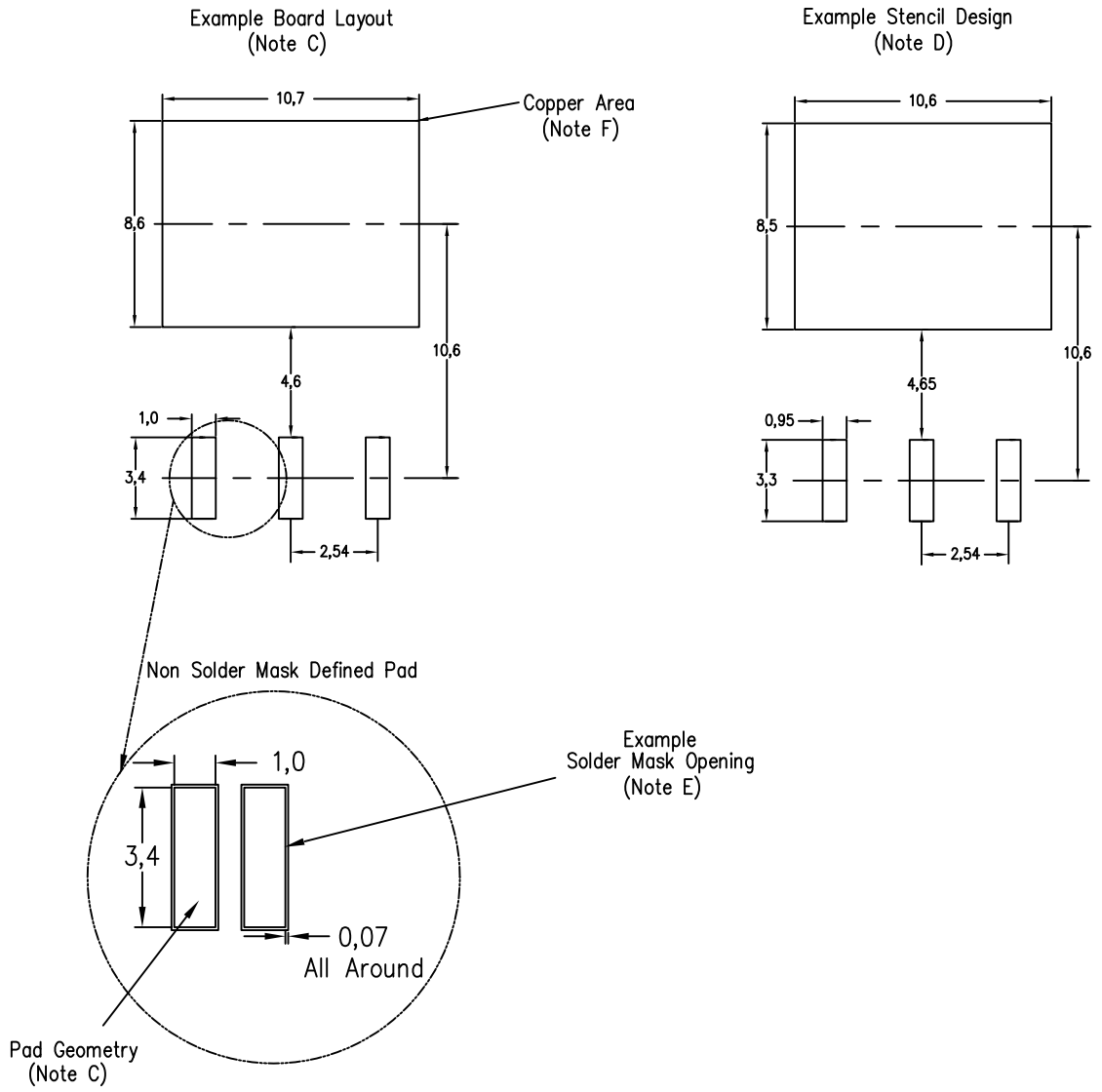
PowerFLEX is a trademark of Texas Instruments.

KTT (R–PSFM–G3) PLASTIC FLANGE–MOUNT PACKAGE

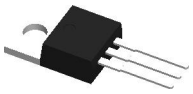



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash or protrusion not to exceed 0.005 (0,13) per side.
D. Falls within JEDEC TO–263 variation AA, except minimum lead thickness and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

KTT (R–PSFM–G3) PLASTIC FLANGE–MOUNT PACKAGE




NOTES:
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.

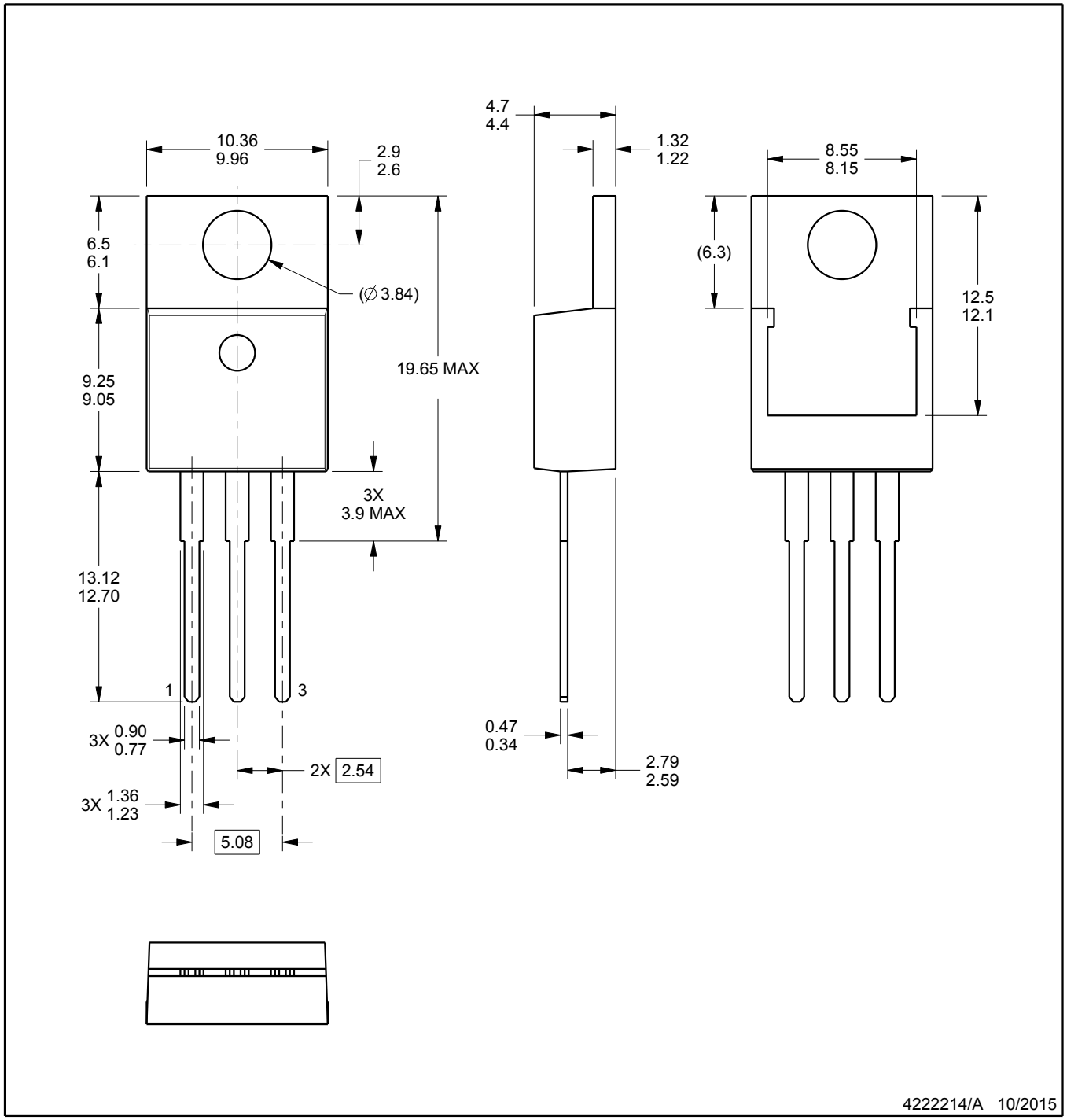


# PACKAGE OUTLINE

## KCS0003B

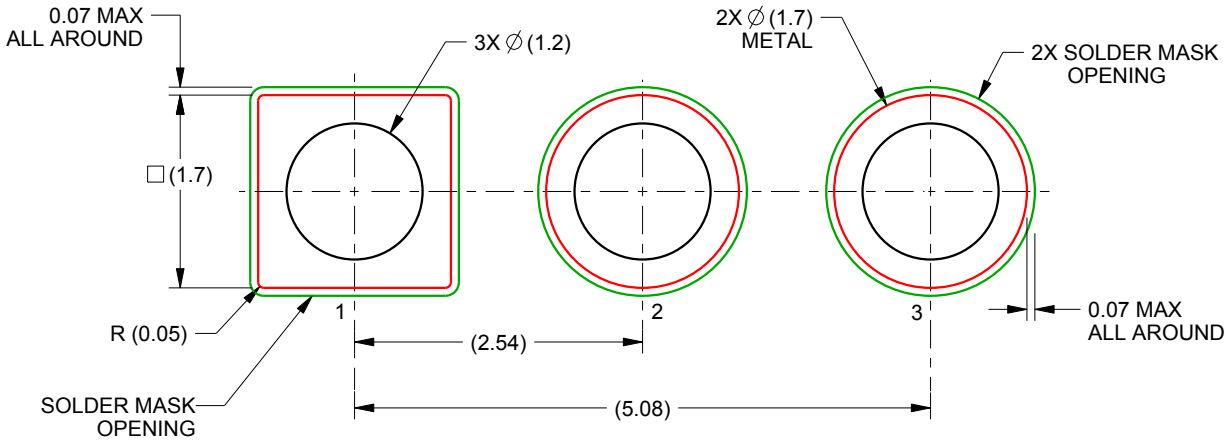
## TO-220 - 19.65 mm max height

TO-220




NOTES:

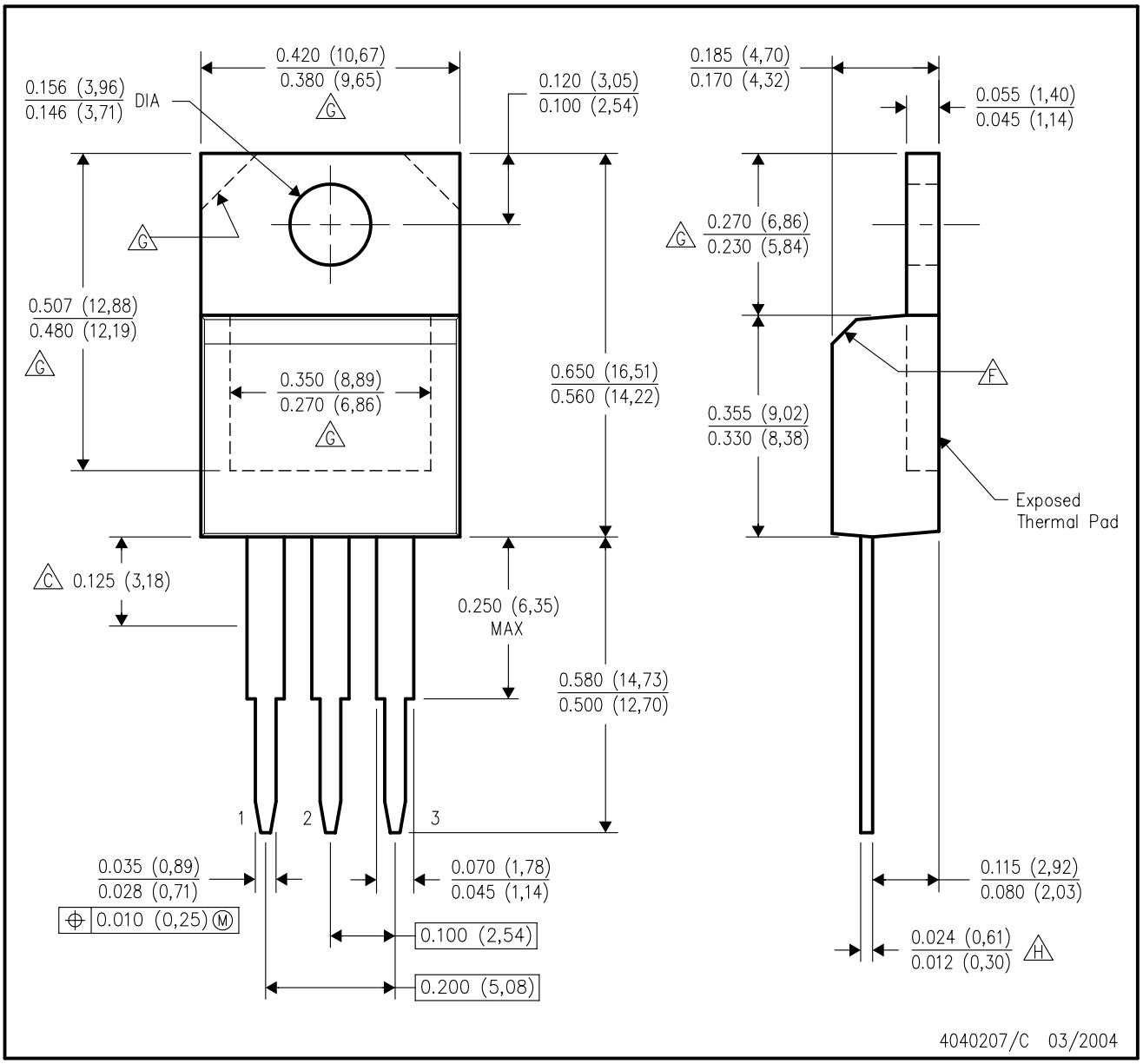
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-220.




LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE:15X

4222214/A 10/2015

## 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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