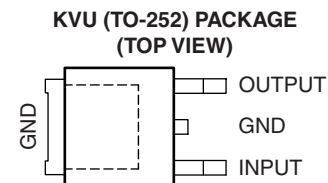
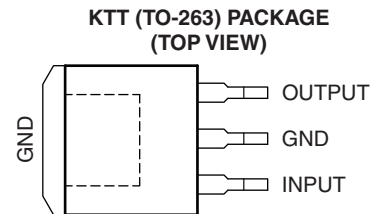


## LOW-DROPOUT FIXED-VOLTAGE REGULATORS

 Check for Samples: [TL760M33-Q1](#)

### FEATURES

- Qualified for Automotive Applications
- $\pm 3\%$  Output Voltage Variation Across Load and Temperature
- Load-Dump Protection
- 500-mV Maximum Dropout Voltage at 500 mA
- Fixed 3.3-V Output
- Internal Thermal-Overload Protection
- Internal Overvoltage Protection
- Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval



### DESCRIPTION/ORDERING INFORMATION

The TL760M33-Q1 low-dropout regulator offers a variety of fixed-voltage options that offer a maximum continuous input voltage of 26 V. Utilizing a pnp pass element, this regulator is capable of sourcing 500 mA of current, with a specified maximum dropout of 500 mV, making the TL760M33-Q1 ideal for low-voltage applications. Additionally, the TL760M33-Q1 regulator offers very tight output accuracy of  $\pm 3\%$  across operating load and temperature ranges. Other convenient features the regulators provide are internal overcurrent limiting, thermal-overload protection, and overvoltage protection. The TL760M33-Q1 is load-dump protected to its maximum operating condition of 45 V. Stability has been optimized for typical automotive applications and low-cost capacitors.

#### ORDERING INFORMATION<sup>(1)</sup>

$T_A$	$V_O$ (TYP)	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	3.3 V	TO-263 – KTT	Reel of 500	TL760M33QKTTRQ1	TL760M33Q1
		TO-252 – KVU	Reel of 2500	TL760M33QKVURQ1	760M33Q1

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

(2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).



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.

# TL760M33-Q1

SGLS284I – OCTOBER 2005 – REVISED DECEMBER 2010

www.ti.com

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

over operating virtual junction temperature range (unless otherwise noted)

V <sub>I</sub>	Maximum input voltage	45 V
T <sub>J</sub>	Operating virtual junction temperature	150°C
T <sub>stg</sub>	Storage temperature range	–65°C to 150°C

- (1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## PACKAGE THERMAL DATA<sup>(1)</sup>

PACKAGE	BOARD	θ <sub>JA</sub>
TO-252 (KVU)	High K, JESD 51-5	30.3°C/W
TO-263 (KTT)	High K, JESD 51-5	26.9°C/W

- (1) Maximum power dissipation is a function of T<sub>J(max)</sub>, θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> – T<sub>A</sub>)/θ<sub>JA</sub>. Operating at the absolute maximum T<sub>J</sub> of 150°C can impact reliability.

## THERMAL RESISTANCE

1-oz copper, one-layer PCB

THERMAL RESISTANCE	VALUE
R <sub>JA</sub>	55°C/W (area = 240 mm <sup>2</sup> )
R <sub>JC</sub>	5.5°C/W from FET to tab
R <sub>JC</sub>	0.1°C/W from die center to tab

## RECOMMENDED OPERATING CONDITIONS

	MIN	MAX	UNIT
V <sub>I</sub> Input voltage	3.8	26	V
I <sub>O</sub> Output current	0	500	mA
T <sub>J</sub> Operating virtual-junction temperature	–40	150	°C

## ELECTRICAL CHARACTERISTICS

V<sub>I</sub> = 6 V, I<sub>O</sub> = 500 mA, T<sub>J</sub> = –40°C to 150°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	MIN	TYP	MAX	UNIT
V <sub>O</sub> Output voltage	I <sub>O</sub> = 5 mA to 500 mA, V <sub>I</sub> = 3.8 V to 26 V, T <sub>J</sub> = 125°C	3.2	3.3	3.4	V
	T <sub>J</sub> = 150°C, I <sub>O</sub> = 5 mA to 300 mA, V <sub>I</sub> = 3.8 V to 26 V	3.2	3.3	3.4	
I <sub>Q</sub> Current consumption, I <sub>Q</sub> = I <sub>I</sub> – I <sub>O</sub>	V <sub>I</sub> = 6 V	I <sub>O</sub> = 250 mA		8	mA
		I <sub>O</sub> = 500 mA		20	
Line regulation	V <sub>I</sub> = 3.8 V to 28 V			10	mV
PSRR Power-supply ripple rejection	f = 100 Hz, V <sub>ripple</sub> = 0.5 V <sub>PP</sub> , V <sub>I</sub> = 6 V			62	dB
Load regulation	I <sub>O</sub> = 5 mA to 500 mA			5	mV
V <sub>DO</sub> Dropout voltage <sup>(2)</sup>	I <sub>O</sub> = 250 mA			400	mV
	I <sub>O</sub> = 500 mA			500	

- (1) Pulse-testing techniques are used to maintain the virtual junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.1-μF capacitor across the input and a 22-μF tantalum capacitor, with equivalent series resistance of 1.5 Ω on the output.
- (2) Measured when the output voltage, V<sub>O</sub>, has dropped 100 mV from the nominal value obtained when V<sub>I</sub> = 6 V

### COMPENSATION-CAPACITOR SELECTION INFORMATION

The TL760M is a low-dropout regulator. This means that the capacitance loading is important to the performance of the regulator because it is a vital part of the control loop. The capacitor value and the equivalent series resistance (ESR) both affect the control loop and must be defined for the load range. Figure 1 can be used to establish the capacitance value and ESR range for the best regulator performance.

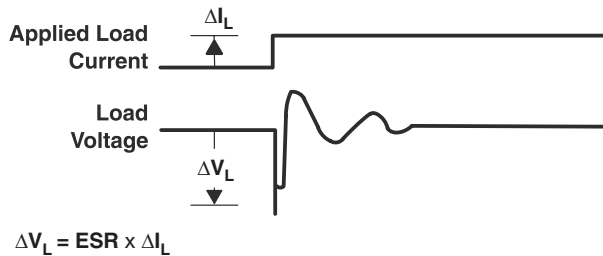
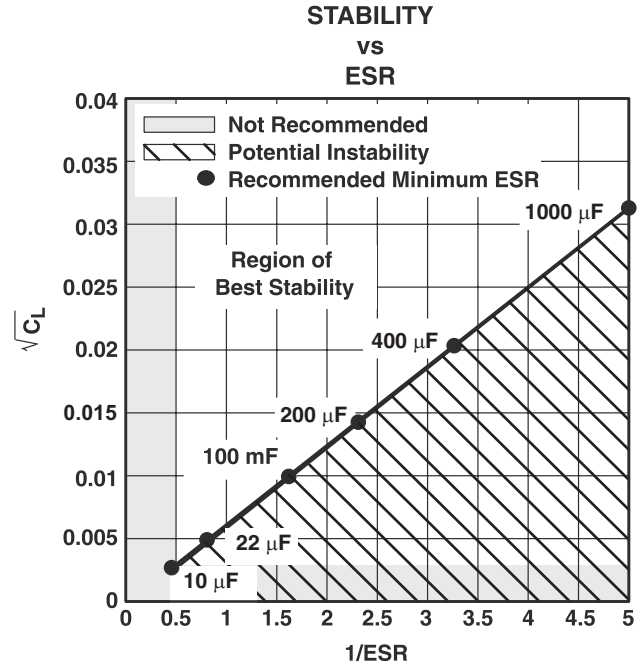
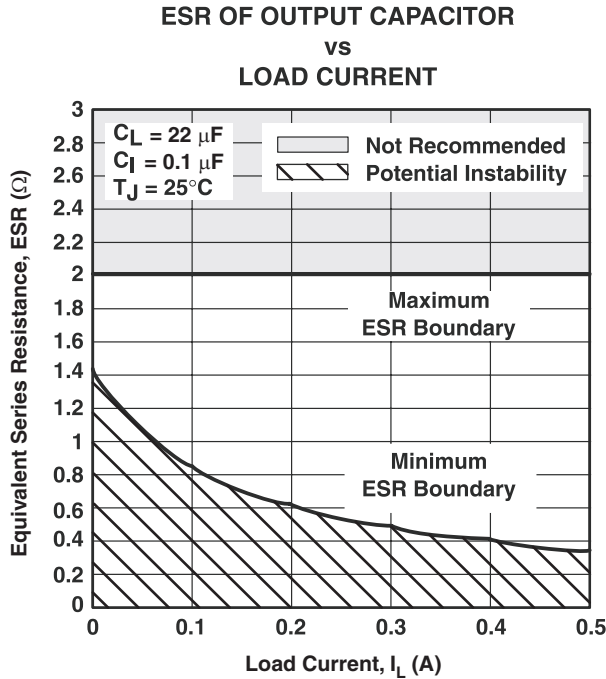


Figure 1.

Figure 2.

### TYPICAL APPLICATION SCHEMATIC

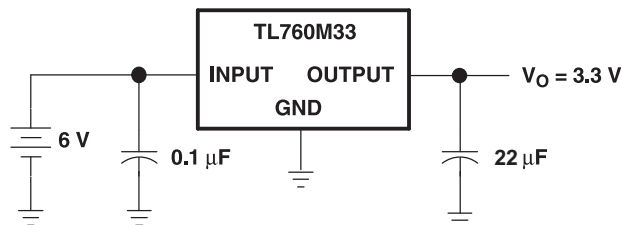


Figure 3.

**TYPICAL CHARACTERISTICS**

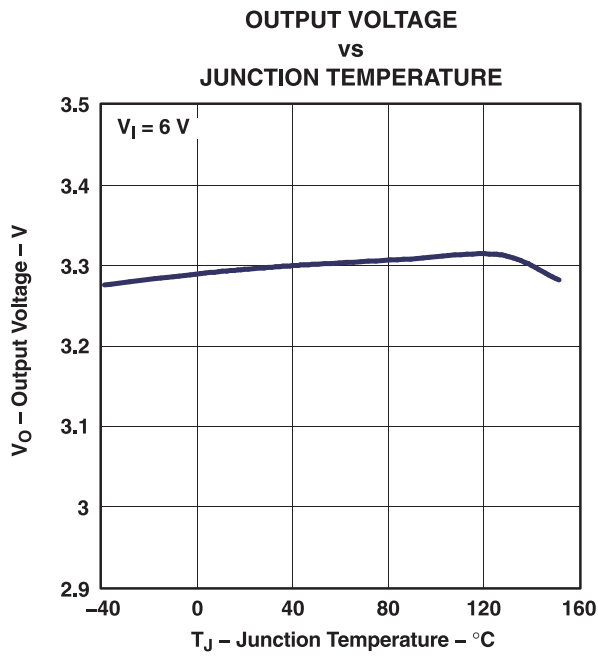


Figure 4.

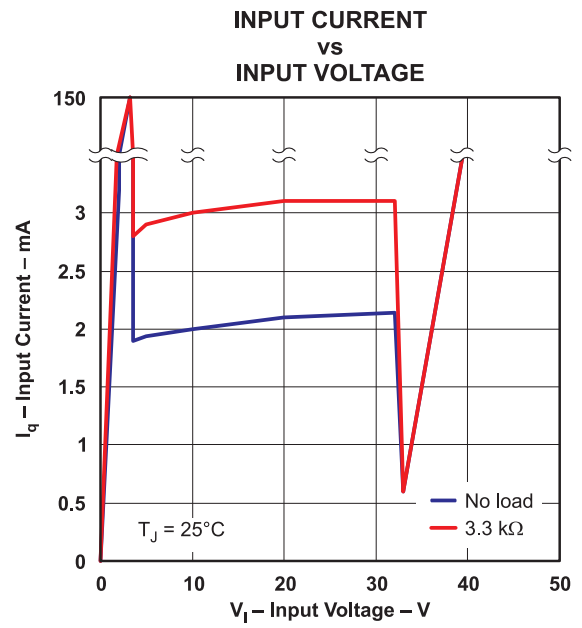


Figure 5.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL760M33QKTTRQ1	ACTIVE	DDPAK/ TO-263	KTT	3	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-245C-168 HR	
TL760M33QKVURQ1	ACTIVE	PFM	KVU	3	2500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBsolete:** TI has discontinued the production of the device.

<sup>(2)</sup> 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)

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

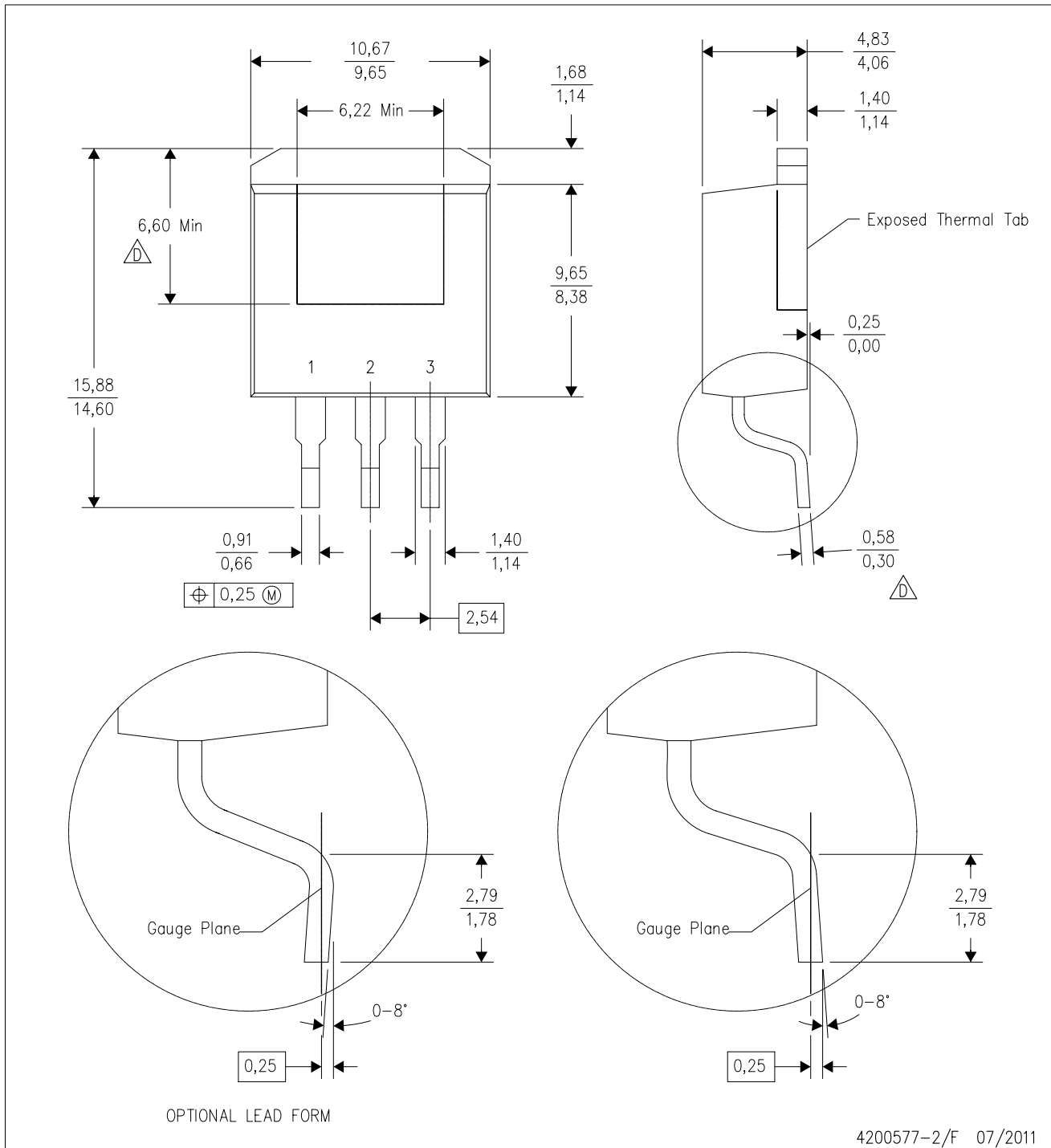
**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

# MECHANICAL DATA

KTT (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

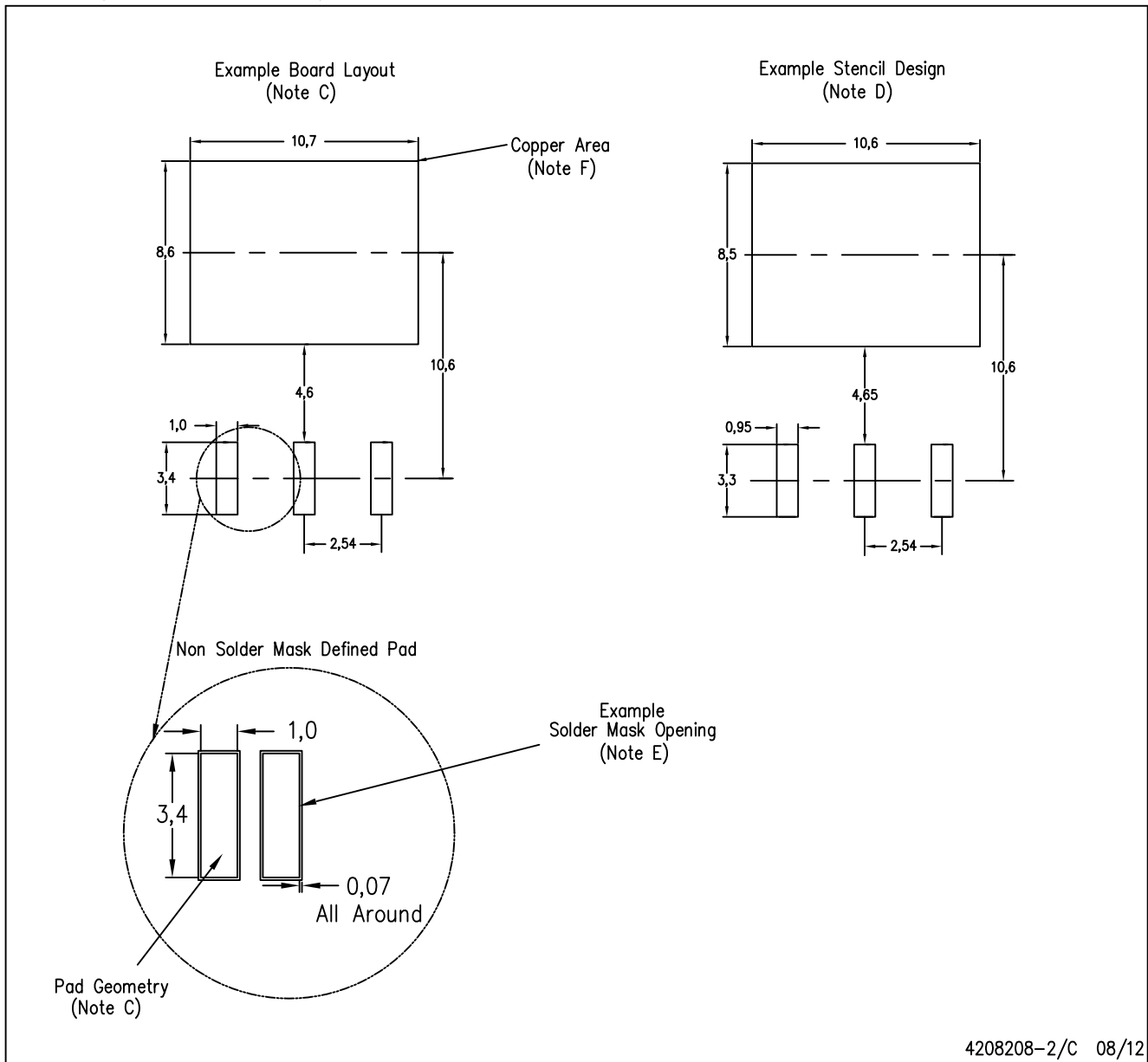


4200577-2/F 07/2011

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

KTT (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

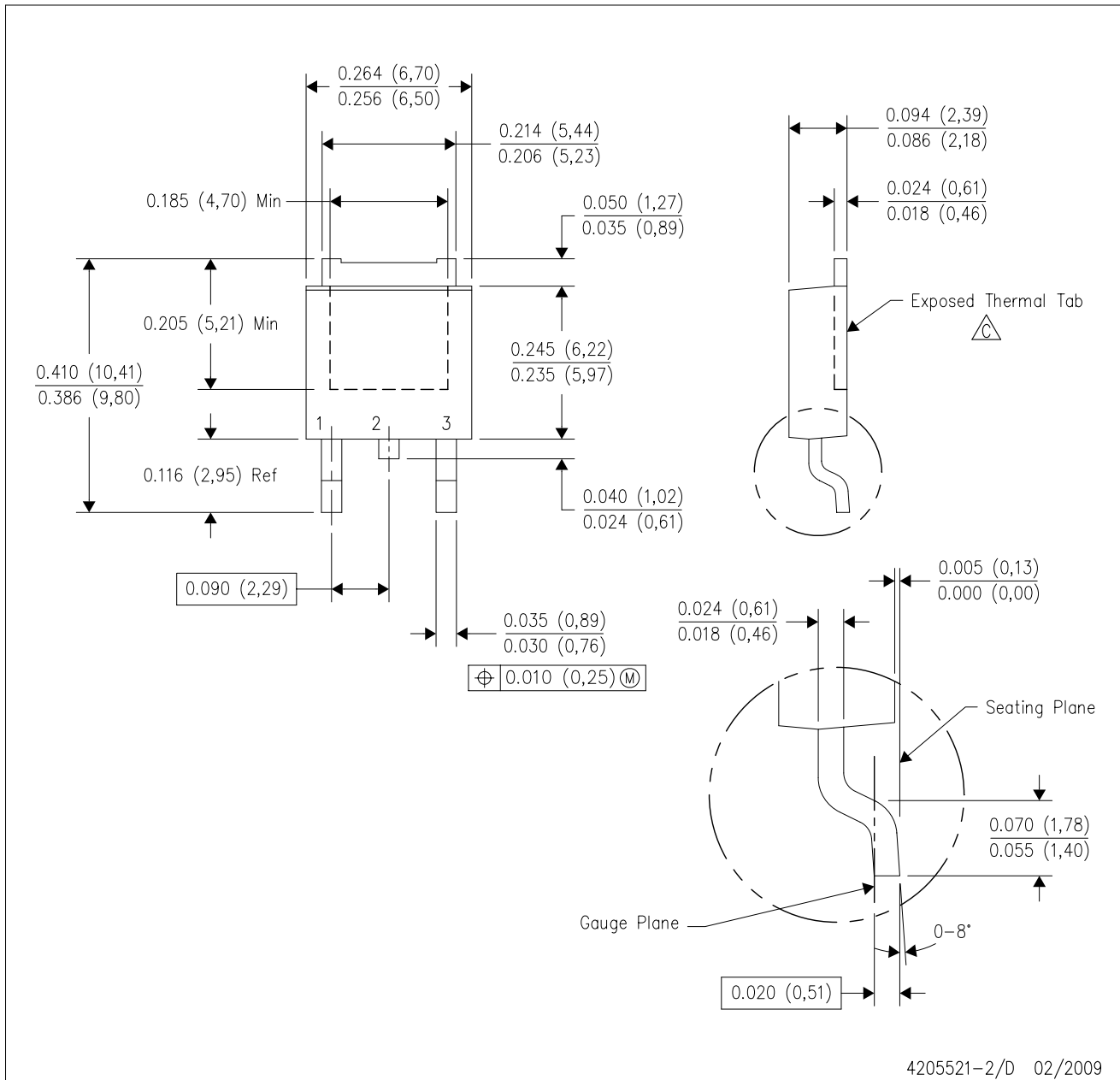


- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-SM-782 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact 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.

# MECHANICAL DATA

KVU (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

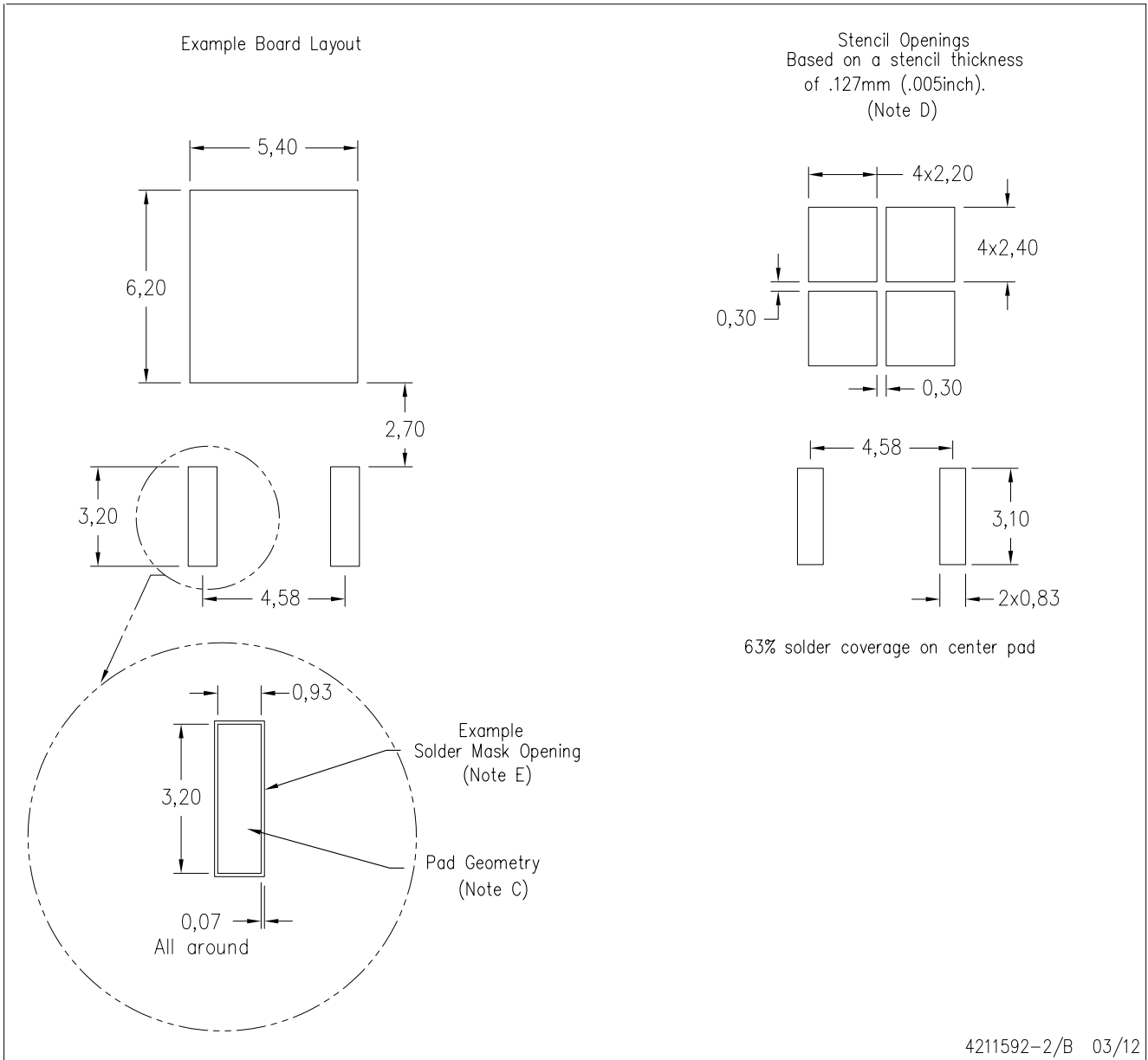


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  The center lead is in electrical contact with the exposed thermal tab.
  - D. Body Dimensions do not include mold flash or protrusions. Mold flash and protrusion 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



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

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)