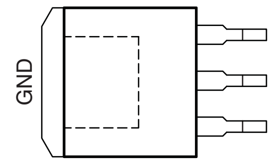
LOW-DROPOUT FIXED-VOLTAGE REGULATORS

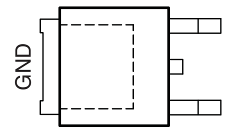
FEATURES

- **Qualified for Automotive Applications**
- **±3% Output Voltage Variation Across Load and Temperature**
- **Load-Dump Protection**
- **500-mV Maximum Dropout Voltage at 500 mA (3.3-V Option)**
- **Fixed 1.8-V, 2.5-V, and 3.3-V Outputs**
- **Internal Thermal-Overload Protection**
- **Internal Overvoltage Protection**
- **Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval**
- **TLE4274 Alternative**

KTT (TO-263) PACKAGE (TOP VIEW)



KVU (TO-252) PACKAGE (TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The TL760M family of low-dropout regulators offers a variety of fixed-voltage options that offer a maximum continuous input voltage of 26 V. Utilizing a pnp pass element, these regulators are capable of sourcing 500 mA of current, with a specified maximum dropout of 500 mV (3.3-V and 2.5-V options), making these regulators ideal for low-voltage applications. Additionally, the TL760M regulators offer very tight output accuracy of ±3% across operating load and temperature ranges. Other convenient features the regulators provide are internal overcurrent limiting, thermal-overload protection, and overvoltage protection. The TL760M is load-dump protected to its maximum operating condition of 45 V. Stability has been optimized for typical automotive applications and low-cost capacitors. The TL760M family of regulators is available in fixed voltages of 1.8 V, 2.5 V, and 3.3 V.

ORDERING INFORMATION(1)

T_A	V_O (TYP)	PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	1.8 V	TO-263 – KTT	Reel of 500	TL760M18QKTTRQ1	PREVIEW
	2.5V	TO-263 – KTT	Reel of 500	TL760M25QKTTRQ1	PREVIEW
	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.
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

ABSOLUTE MAXIMUM RATINGS(1)

over operating virtual junction temperature range (unless otherwise noted)

V_I	Maximum input voltage	45 V
T_J	Operating virtual junction temperature	150°C
T_{stg}	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(1)

PACKAGE	BOARD	θ_{JA}
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_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 impact reliability.

TL760M33 THERMAL RESISTANCE

1-oz copper, one-layer PCB

THERMAL RESISTANCE	VALUE
R_{JA}	55°C/W (area = 240 mm^2)
R_{JC}	5.5°C/W from FET to tab
R_{JC}	0.1°C/W from die center to tab

RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V_I	Input voltage(1)	3	26	V
I_O	Output current	0	500	mA
T_J	Operating virtual-junction temperature	–40	150	°C

(1) Minimum V_I is equal to 3 V or V_O(max) + 0.6 V, whichever is greater.

TL760M33 ELECTRICAL CHARACTERISTICS

V_I = 6 V, I_O = 500 mA, T_J = –40°C to 150°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS[(1)]		MIN	TYP	MAX	UNIT
V_O	Output voltage	I_O = 5 mA to 500 mA, V_I = 3.8 V to 26 V, T_J = 125°C		3.2	3.3	3.4	V
		T_J = 150°C, I_O = 5 mA to 300 mA, V_I = 3.8 V to 26 V		3.2	3.3	3.4	
I_Q	Current consumption, $I_Q = I_I - I_O$	V_I = 6 V	I_O = 250 mA		8	15	mA
			I_O = 500 mA		20	30	
	Line regulation	V_I = 3 V to 28 V			10	25	mV
PSRR	Power-supply ripple rejection	f = 100 Hz, V_{ripple} = 0.5 V_{PP}, V_I = 6 V			62		dB
	Load regulation	I_O = 5 mA to 500 mA			5	30	mV
V_{DO}	Dropout voltage[(2)]	I_O = 250 mA				400	mV
		I_O = 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_O, has dropped 100 mV from the nominal value obtained when V_I = 6 V

TL760M25 ELECTRICAL CHARACTERISTICS

V_I = 6 V, I_O = 500 mA, T_J = –40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS[(1)]		MIN	TYP	MAX	UNIT
V_O	Output voltage	I_O = 5 mA to 500 mA, V_I = 3 V to 26 V		2.425	2.5	2.575	V
I_Q	Current consumption, $I_Q = I_I - I_O$	V_I = 6 V	I_O = 250 mA		8	15	mA
			I_O = 500 mA		20	30	
	Line regulation	V_I = 3 V to 28 V			10	25	mV
PSRR	Power-supply ripple rejection	f = 100 Hz, V_{ripple} = 0.5 V_{PP}, V_I = 6 V			62		dB
	Load regulation	I_O = 5 mA to 500 mA			4	23	mV
V_{DO}	Dropout voltage[(2)]	I_O = 250 mA				400	mV
		I_O = 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_O, has dropped 100 mV from the nominal value obtained when V_I = 6 V

TL760M18 ELECTRICAL CHARACTERISTICS

V_I = 6 V, I_O = 500 mA, T_J = –40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS[(1)]		MIN	TYP	MAX	UNIT
V_O	Output voltage	I_O = 5 mA to 500 mA, V_I = 3 V to 26 V		1.746	1.8	1.854	V
I_Q	Current consumption, $I_Q = I_I - I_O$	V_I = 6 V	I_O = 250 mA		8	15	mA
			I_O = 500 mA		20	30	
	Line regulation	V_I = 3 V to 28 V			10	25	mV
PSRR	Power-supply ripple rejection	f = 100 Hz, V_{ripple} = 0.5 V_{PP}, V_I = 6 V			62		dB
	Load regulation	I_O = 5 mA to 500 mA			3	17	mV
V_{DO}	Dropout voltage	I_O = 250 mA				[(2)]	mV
		I_O = 500 mA				[(2)]	

(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) Dropout voltage is limited by the input voltage range, with minimum V_I = 3 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.

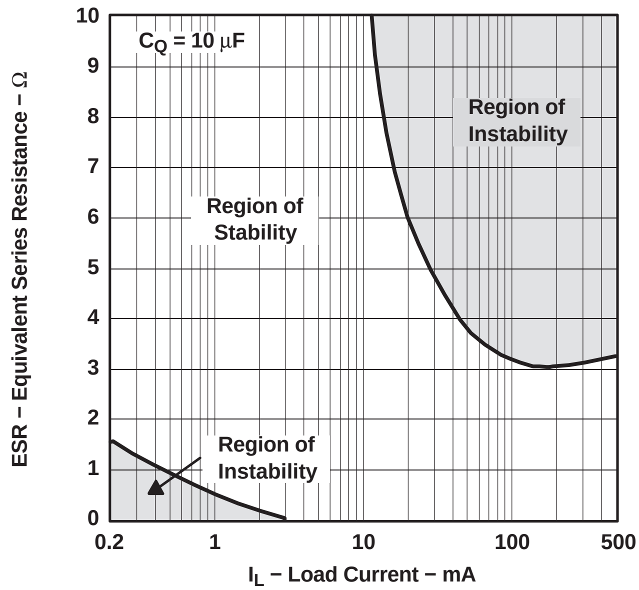


Figure 1.

TYPICAL APPLICATION SCHEMATIC

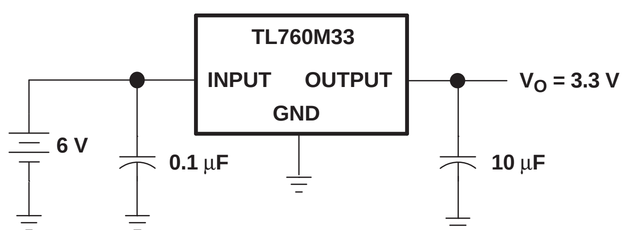


Figure 2.

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE vs JUNCTION TEMPERATURE (M33 VERSION)

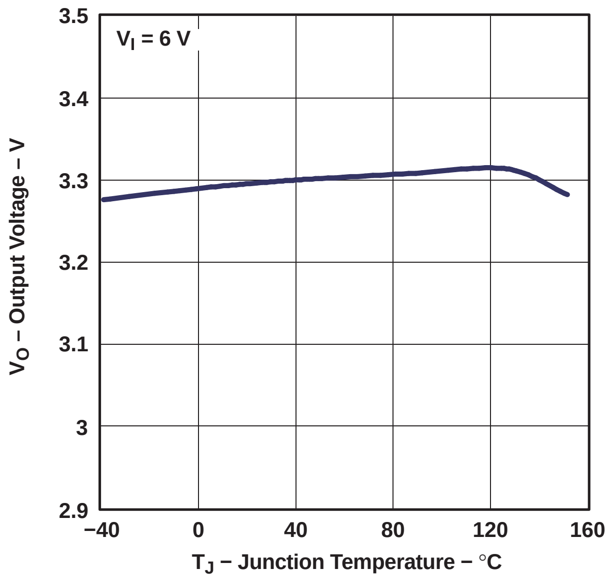


Figure 3.

OUTPUT VOLTAGE vs JUNCTION TEMPERATURE (M25 VERSION)

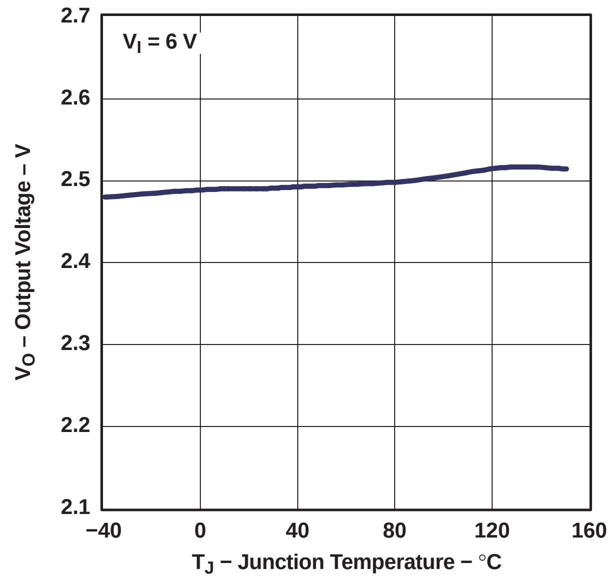


Figure 4.

OUTPUT VOLTAGE vs JUNCTION TEMPERATURE (M18 VERSION)

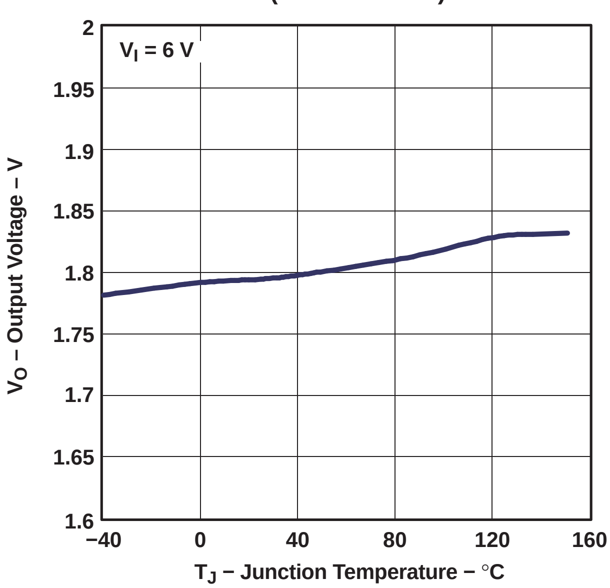


Figure 5.

INPUT CURRENT vs INPUT VOLTAGE (M33 VERSION)

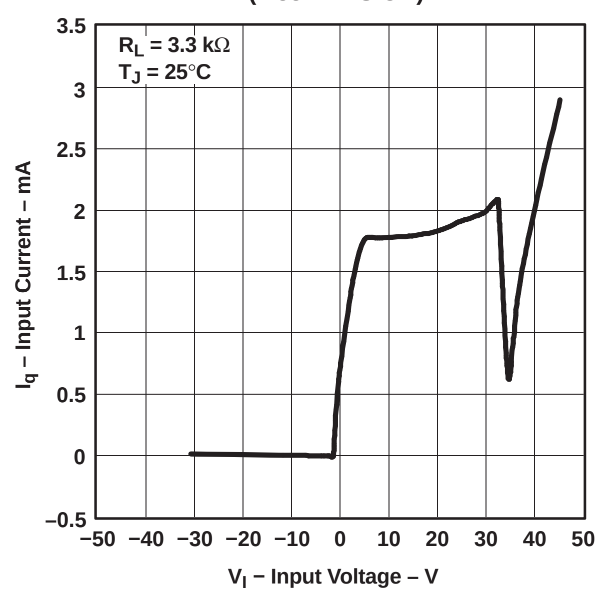


Figure 6.

TYPICAL CHARACTERISTICS (continued)

INPUT CURRENT vs INPUT VOLTAGE (M25 VERSION)

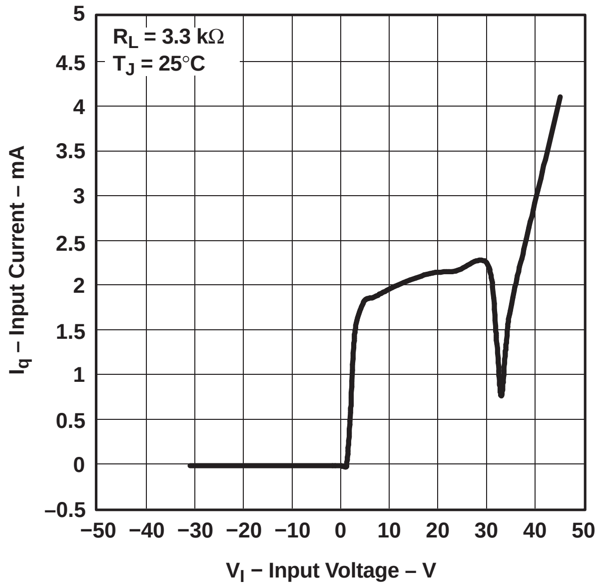


Figure 7.

INPUT CURRENT vs INPUT VOLTAGE (M18 VERSION)

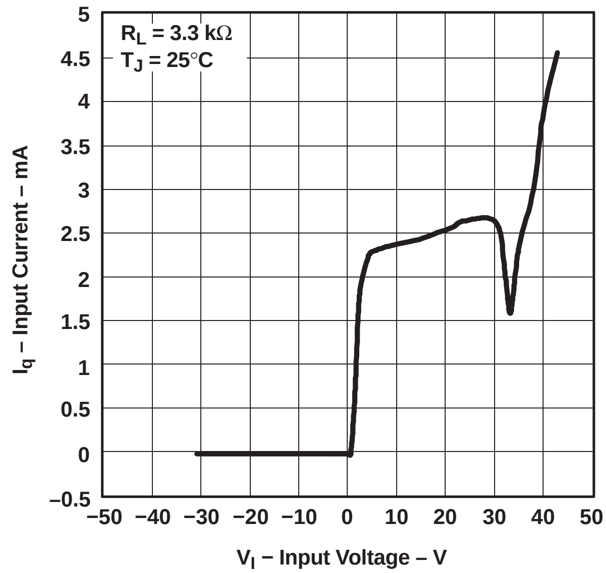


Figure 8.

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
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

[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.

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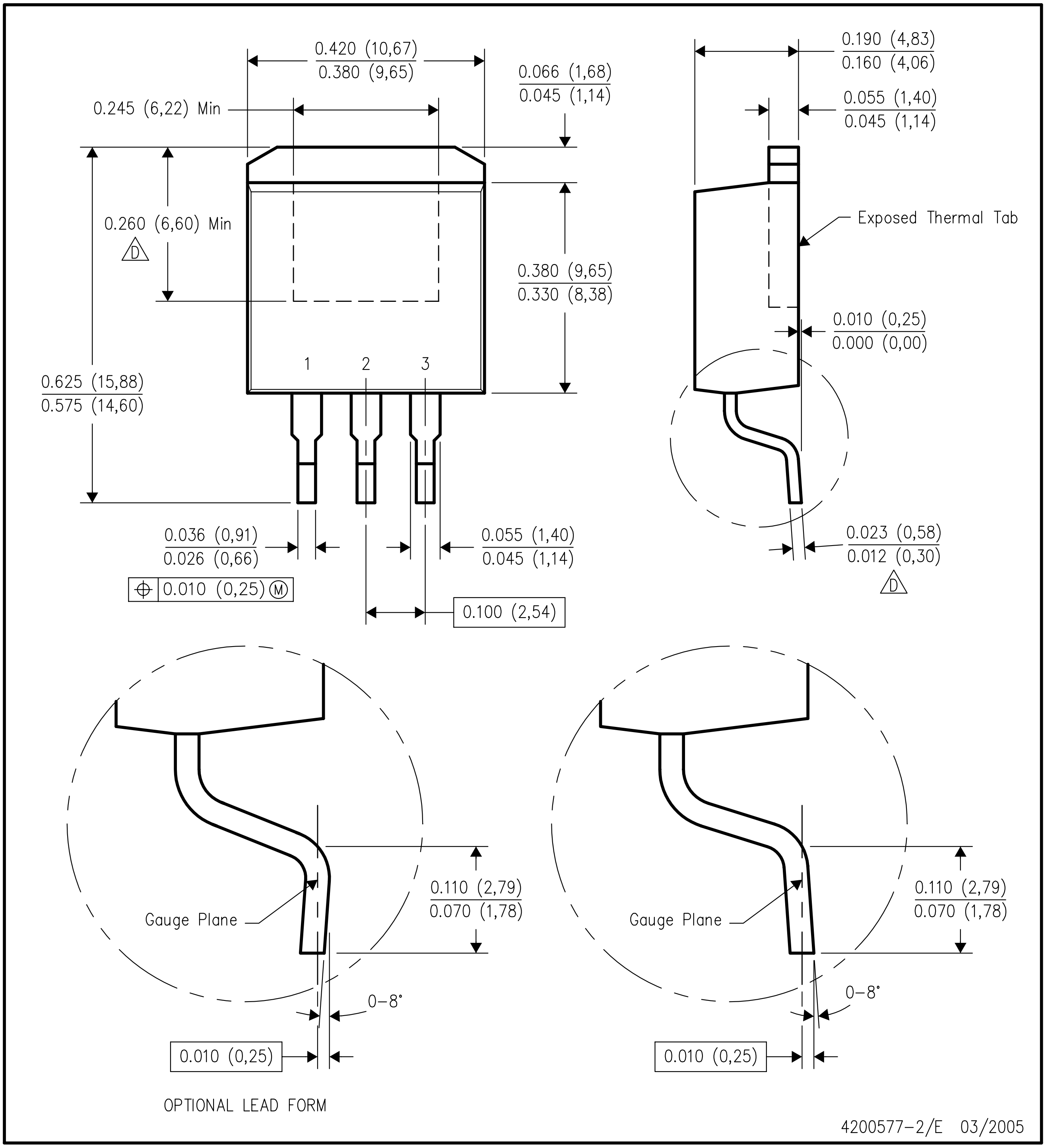
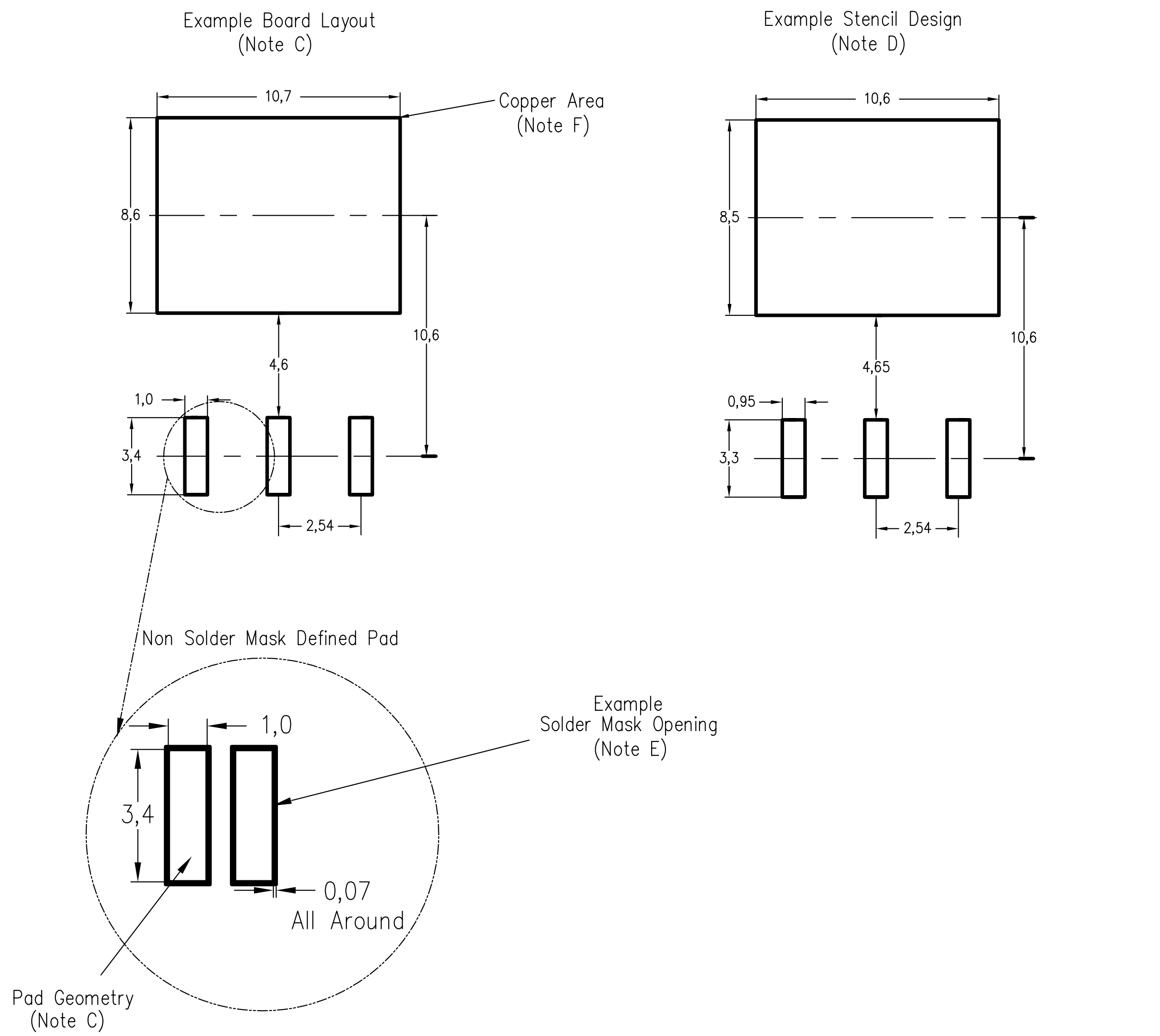
KTT (R–PSFM–G3) PLASTIC FLANGE–MOUNT PACKAGE



NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- 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)



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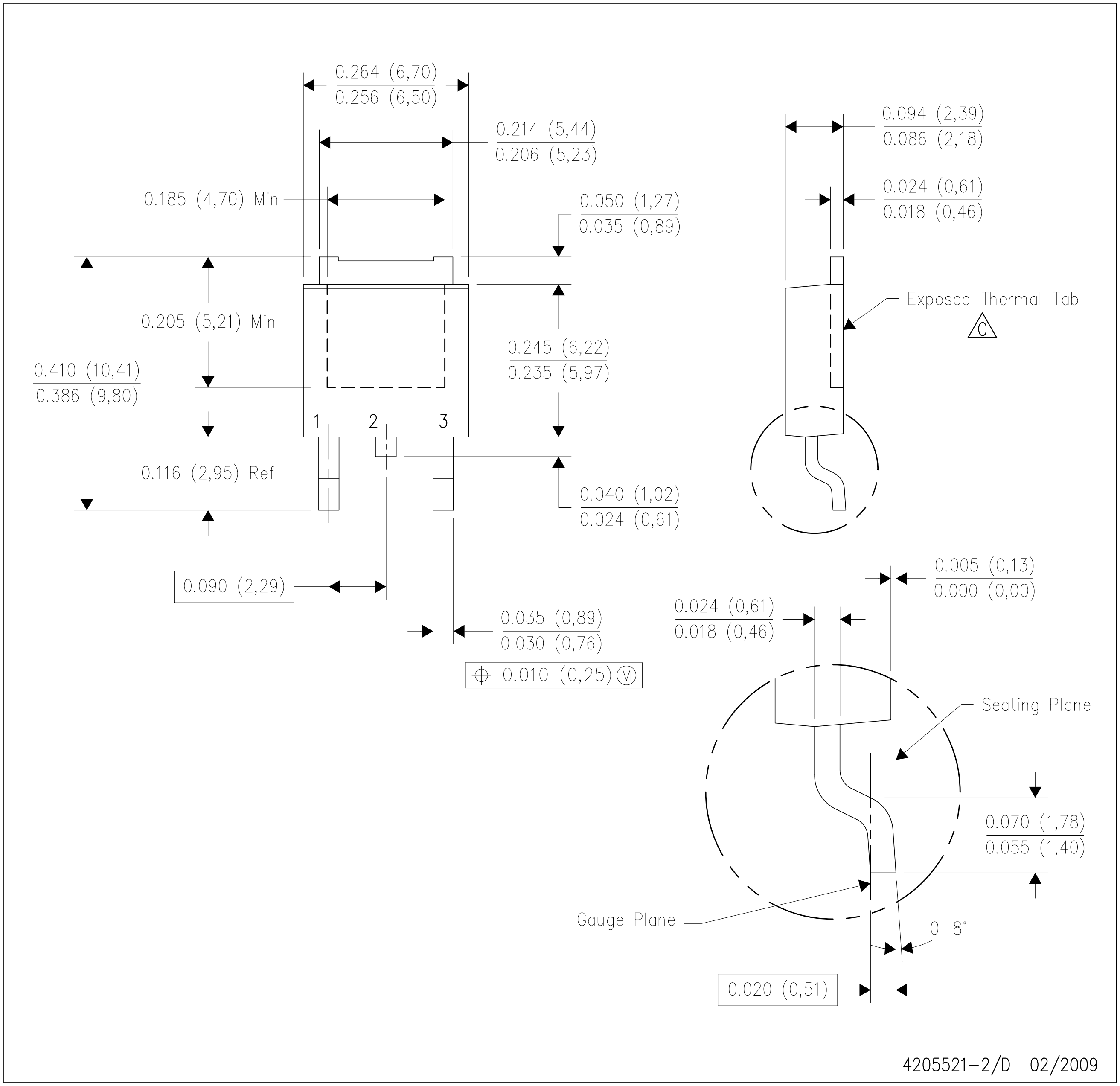
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC–SM–782 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should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

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.
- 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.

IMPORTANT NOTICE