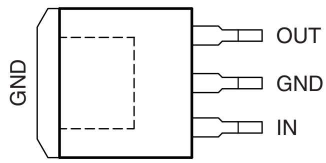
LOW DROPOUT VOLTAGE REGULATOR

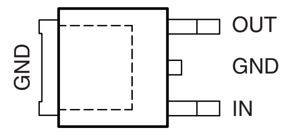
FEATURES

- **Qualified for Automotive Applications**
- **Output Voltage of 5 V ± 2%**
- **Very Low Current Consumption**
- **Power-On and Undervoltage Reset**
- **Very Low Dropout Voltage**
- **Short-Circuit Protection**
- **Reverse-Polarity Protection**
- **ESD Protection >6 kV**

KTT (TO-263) PACKAGE (TOP VIEW)



KVU (TO-252) PACKAGE (TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The TL720M devices are monolithic integrated low dropout voltage regulators offered in 3-pin TO packages. An input voltage up to 45 V is regulated to V_{OUT} of 5 V with 2% tolerance. The devices can drive loads up to 450 mA and are short-circuit proof. At overtemperature, the TL720M devices are turned off by the incorporated temperature protection.

The input capacitor (C_{IN}) compensates for line fluctuation. Using a resistor of approximately 1 Ω in series with C_{IN} dampens the oscillation of input inductivity and input capacitance. The output capacitor (C_{OUT}) stabilizes the regulation circuit. Stability is specified at $C_{OUT} \geq 22$ µF and ESR ≤ 5 Ω, within the operating temperature range.

The control amplifier compares a reference voltage to a voltage that is proportional to the output voltage and drives the base of the series transistor via a buffer. Saturation control as a function of the load current prevents any oversaturation of the power element. The device also incorporates a number of internal circuits for protection against:

- Overload
- Overtemperature
- Reverse polarity

ORDERING INFORMATION(1)

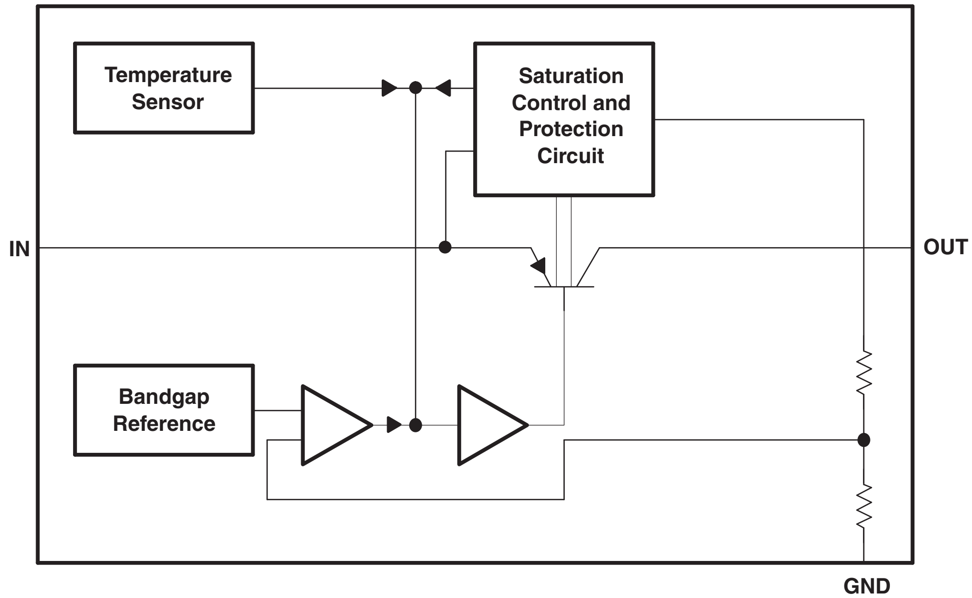
T_A	V_O NOM	PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	5 V	TO-252 (DPAK) – KVU	Reel of 2500	TL720M05QKVURQ1	720M05Q
		T0-263 – KTT	Reel of 500	TL720M05QKTTRQ1	T720M05Q

(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.

TERMINAL FUNCTIONS

NO.	NAME	DESCRIPTION
1	IN	Input voltage. Connect to ground as close to device as possible, through a ceramic capacitor.
2	GND	Ground. Internally connected to heatsink.
3	OUT	Output. Connect to ground with ≥22-µF capacitor, ESR < 5 Ω at 10 kHz.

FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS(1)

over operating free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_I	Input voltage range(2)		–42	45	V
V_O	Output voltage range		–1	40	V
θ_{JA}	Package thermal impedance, junction to free air(3)(4)	KTT package		26.9	°C/W
		KVU package		38.6	
T_J	Operating virtual-junction temperature range		–40	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.
(2) All voltage values are with respect to the network ground terminal.
(3) 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.
(4) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_I	Input voltage	5.5	42	V
T_A	Operating free-air temperature	–40	125	°C
T_J	Operating virtual-junction temperature	–40	150	°C

ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range, V_I = 13.5 V, T_J = −40°C to 150°C (unless otherwise noted) (see Figure 13)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_O	Output voltage	I_O = 5 mA to 400 mA, V_I = 6 V to 28 V		4.9	5.0	5.1	V
		I_O = 5 mA to 200 mA, V_I = 6 V to 40 V		4.9	5.0	5.1	
I_O	Output current limit			450	700		mA
I_Q	Current consumption $I_q = I_I - I_O$	I_O = 1 mA	T_J = 25°C		100	220	µA
			T_J ≤ 85°C		100	220	
		I_O = 250 mA			5	10	mA
		I_O = 400 mA			12	22	
V_{DO}	Dropout voltage(1)	I_O = 300 mA, $V_{do} = V_I - V_O$			250	500	mV
	Load regulation	I_O = 5 mA to 400 mA			15	30	mV
	Line regulation	ΔV_I = 8 to 32 V, I_O = 5 mA		–15	5	15	mV
PSRR	Power-supply ripple rejection	f_r = 100 Hz, V_r = 0.5 V_{pp}			60		dB
$\frac{\Delta V_O}{\Delta T}$	Temperature output-voltage drift				0.5		mV/K

(1) Measured when the output voltage V_O has dropped 100 mV from the nominal value obtained at V_I = 13.5 V

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE vs JUNCTION TEMPERATURE

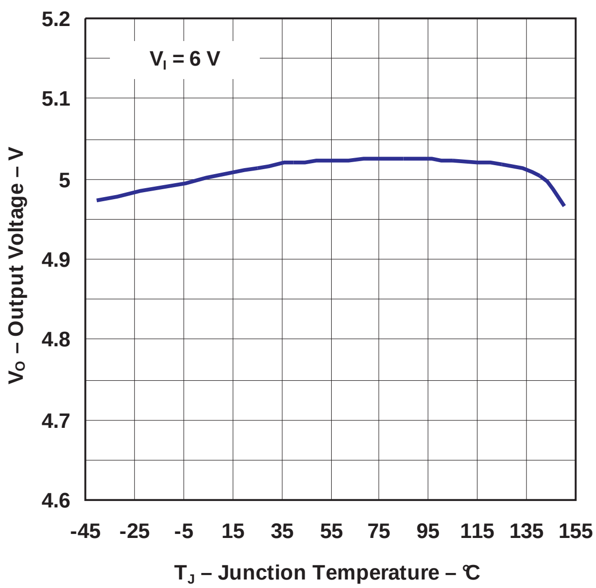


Figure 1.

OUTPUT VOLTAGE vs JUNCTION TEMPERATURE

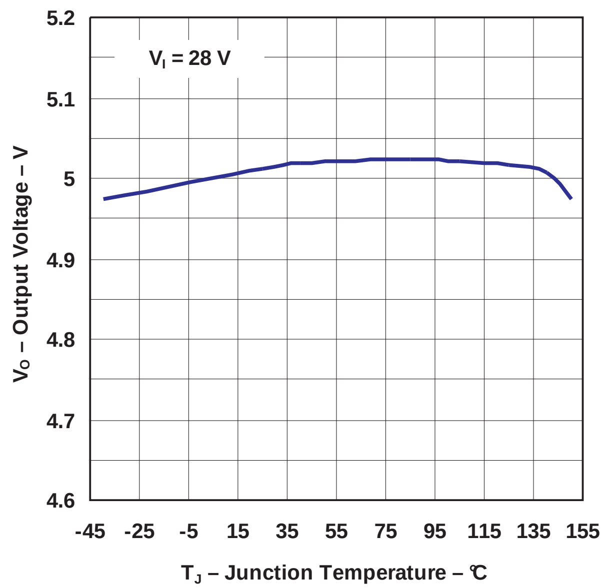


Figure 2.

OUTPUT VOLTAGE vs INPUT VOLTAGE

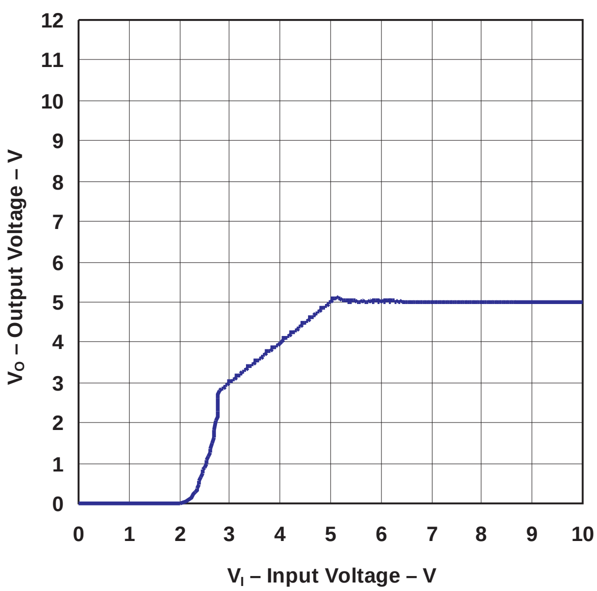


Figure 3.

OUTPUT CURRENT vs JUNCTION TEMPERATURE

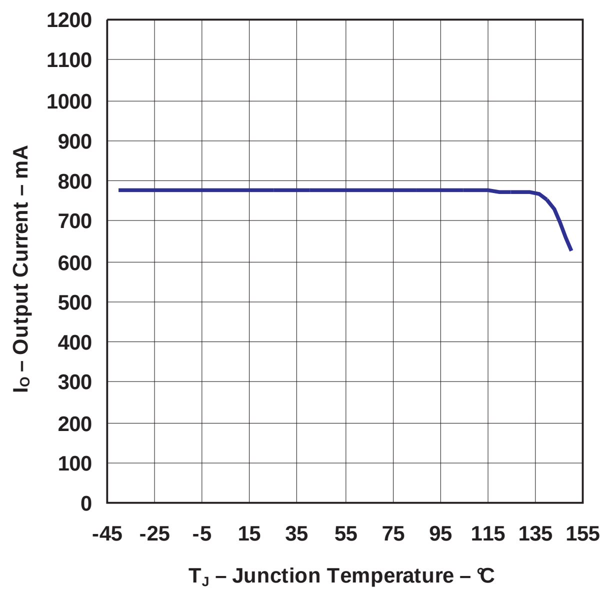


Figure 4.

TYPICAL CHARACTERISTICS (continued)

OUTPUT CURRENT vs INPUT VOLTAGE

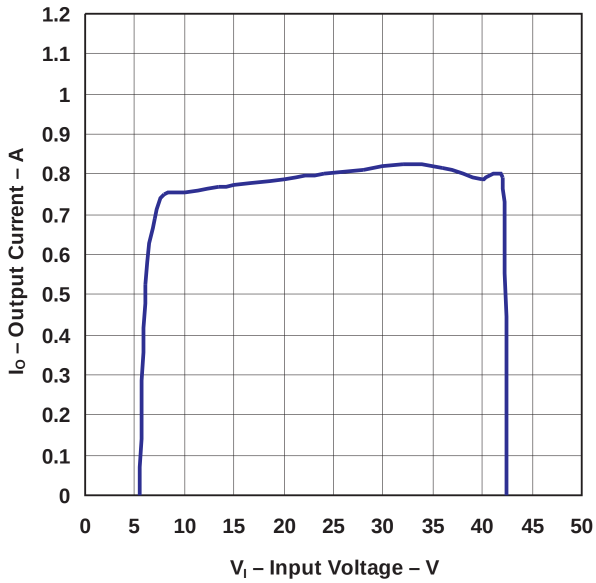


Figure 5.

CURRENT CONSUMPTION vs OUTPUT CURRENT

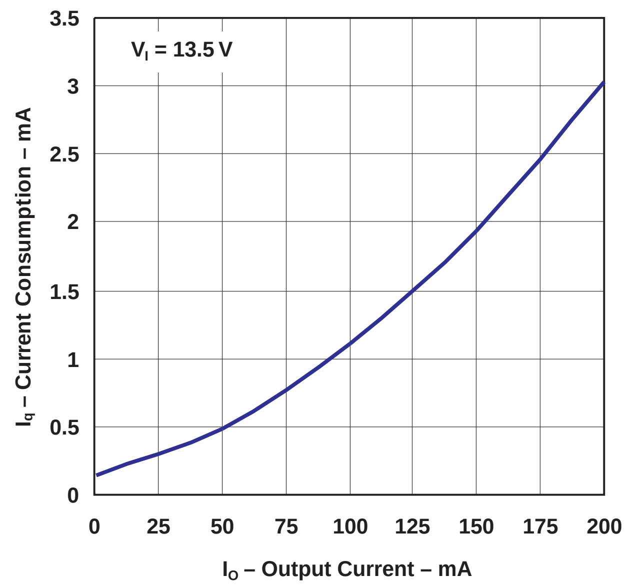


Figure 6.

CURRENT CONSUMPTION vs OUTPUT CURRENT

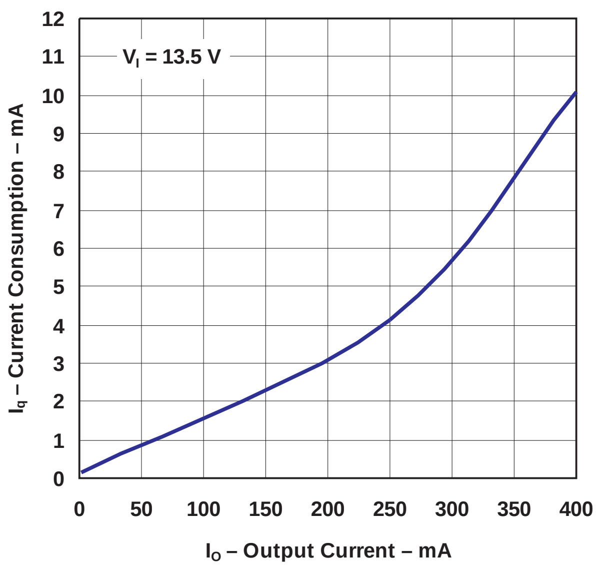


Figure 7.

DROPOUT VOLTAGE vs OUTPUT CURRENT

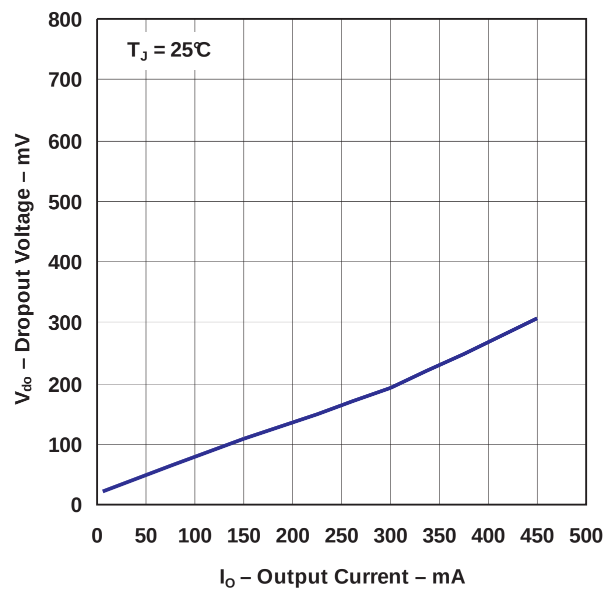


Figure 8.

TYPICAL CHARACTERISTICS (continued)

CHARGE CURRENT
vs
JUNCTION TEMPERATURE

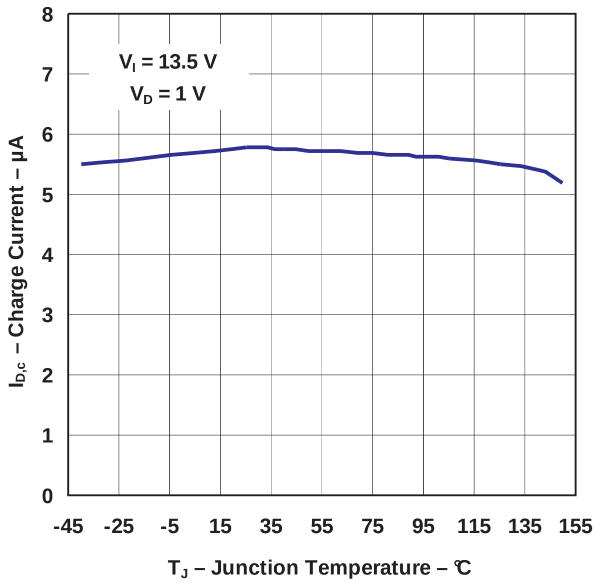


Figure 9.

POWER-SUPPLY RIPPLE REJECTION
vs
FREQUENCY

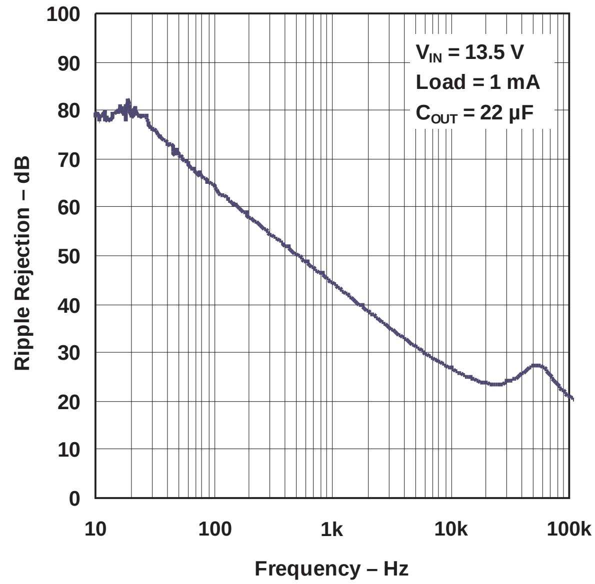


Figure 10.

POWER-SUPPLY RIPPLE REJECTION
vs
FREQUENCY

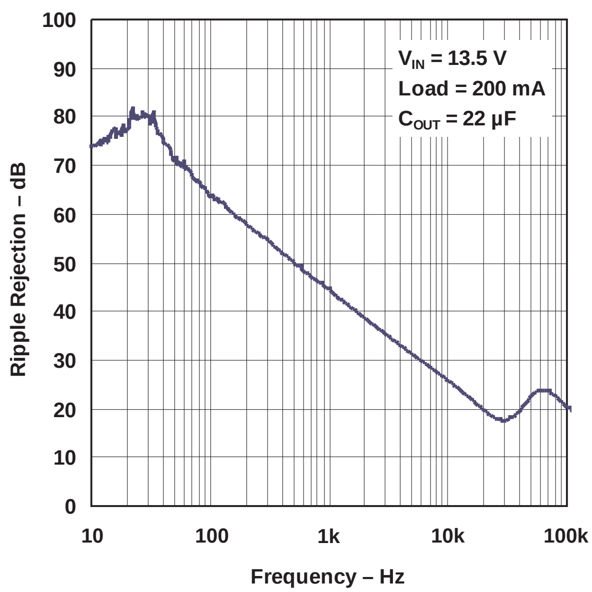


Figure 11.

POWER-SUPPLY RIPPLE REJECTION
vs
FREQUENCY

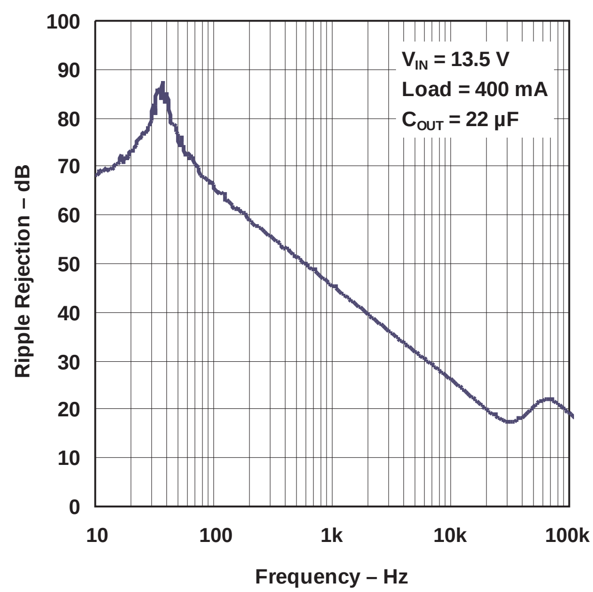


Figure 12.

PARAMETER MEASUREMENT INFORMATION

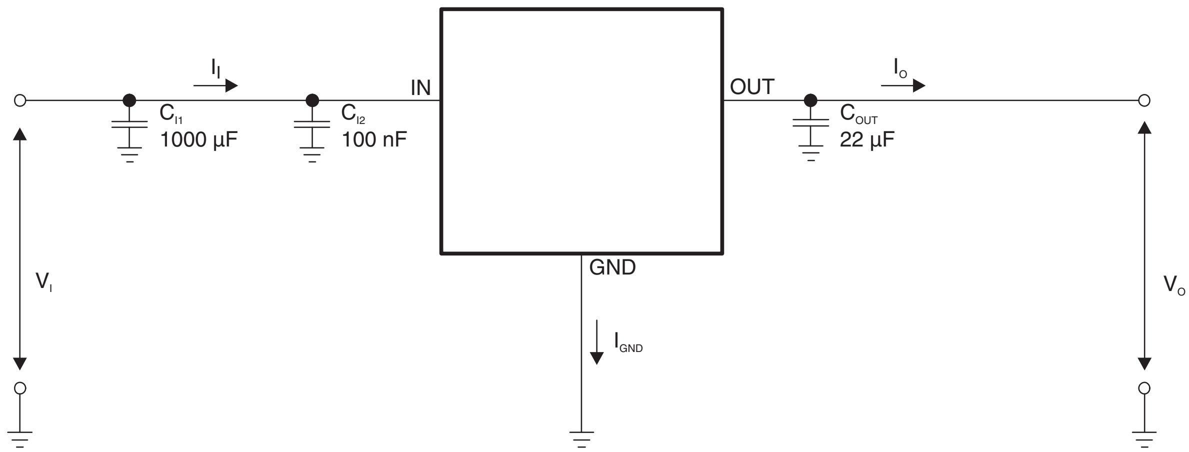


Figure 13. Test Circuit

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TL720M05QKTTRQ1	ACTIVE	DDPAK/ TO-263	KTT	3	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-245C-168 HR
TL720M05QKVURQ1	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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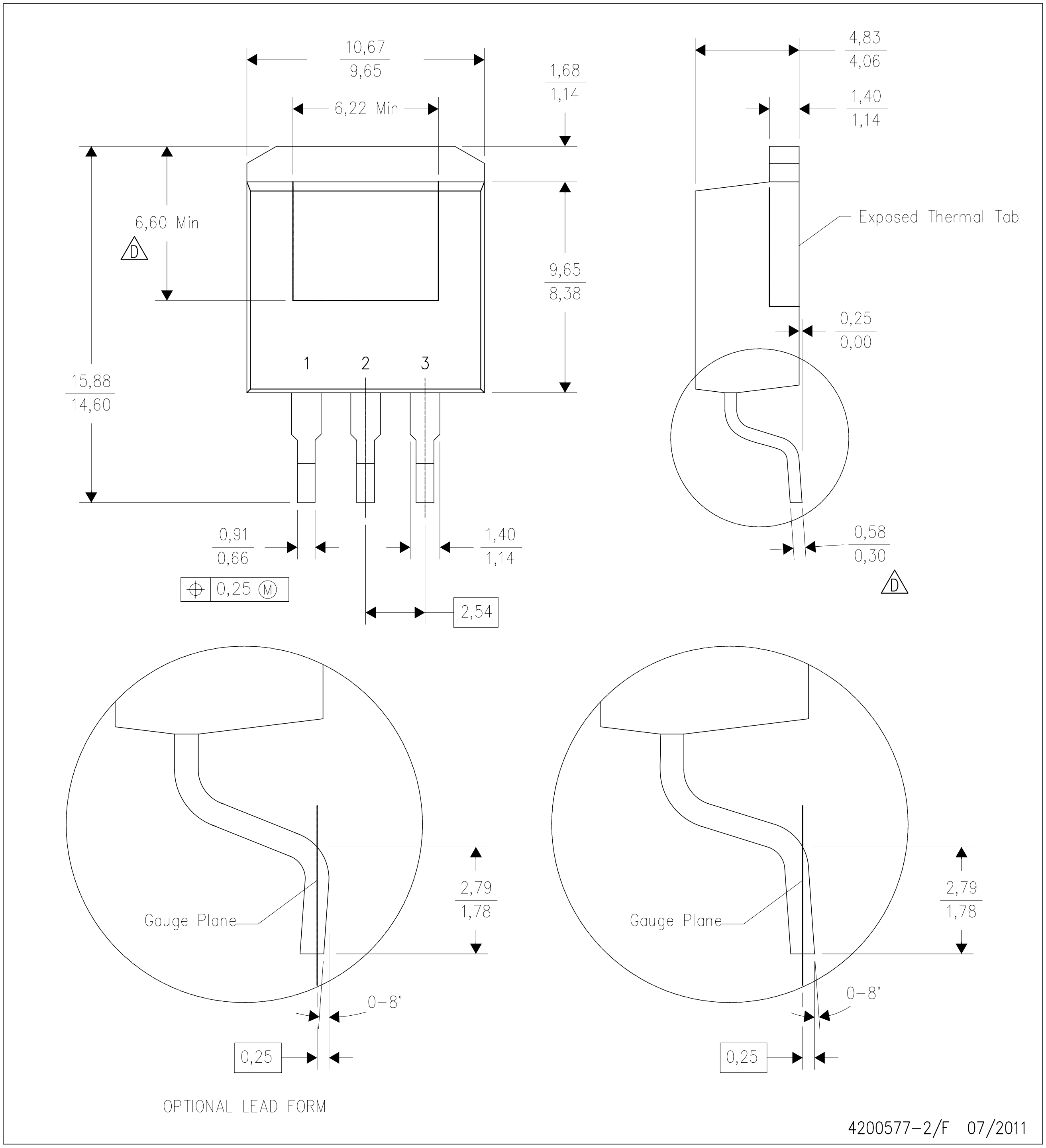
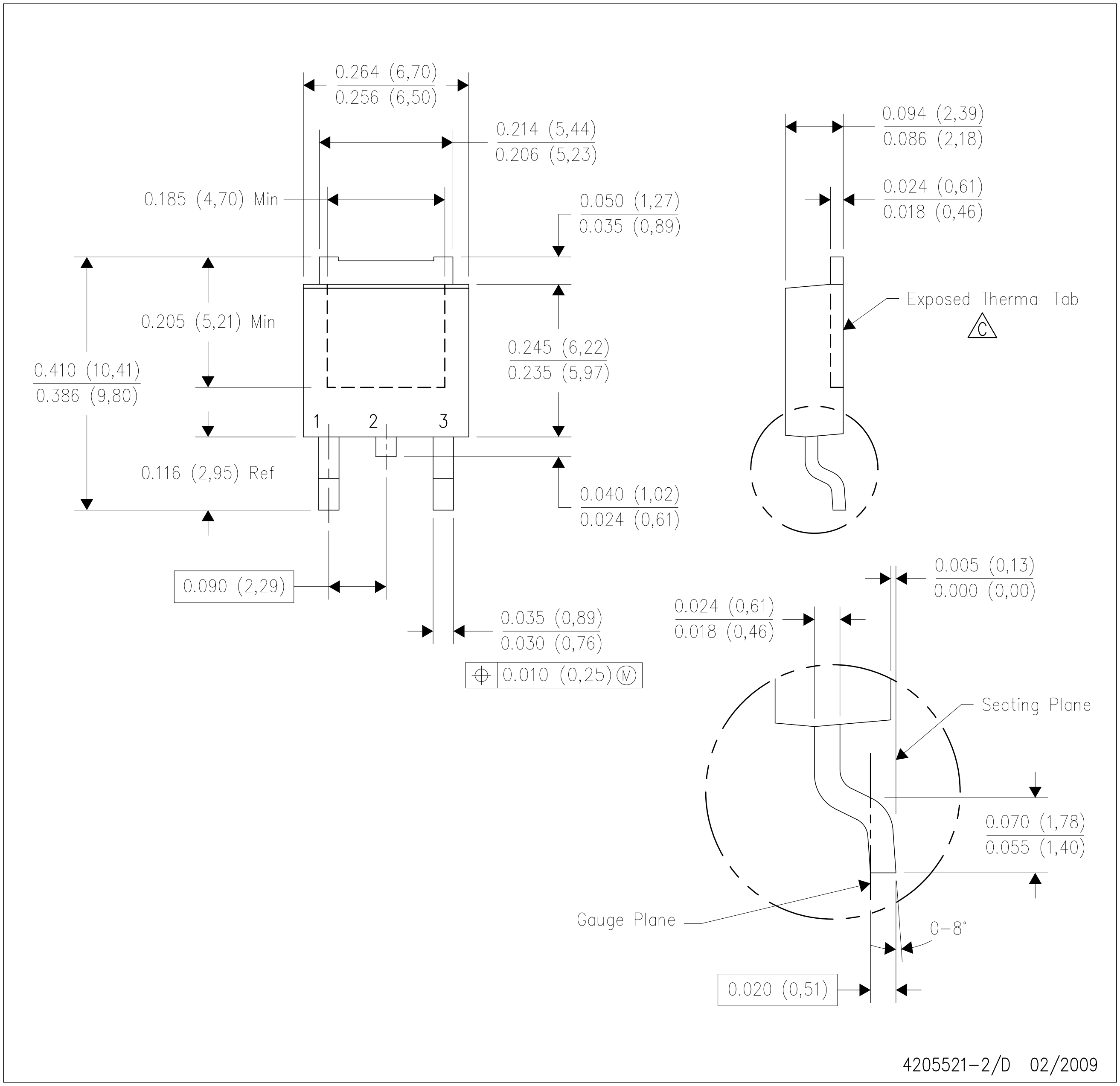
KTT (R-PSFM-G3) PLASTIC FLANGE-MOUNT PACKAGE



NOTES:
- A. All linear dimensions are in 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.

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.

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