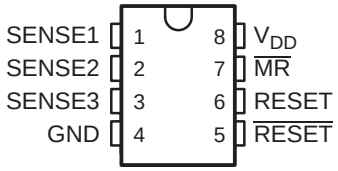
TRIPLE PROCESSOR SUPERVISORS

FEATURES

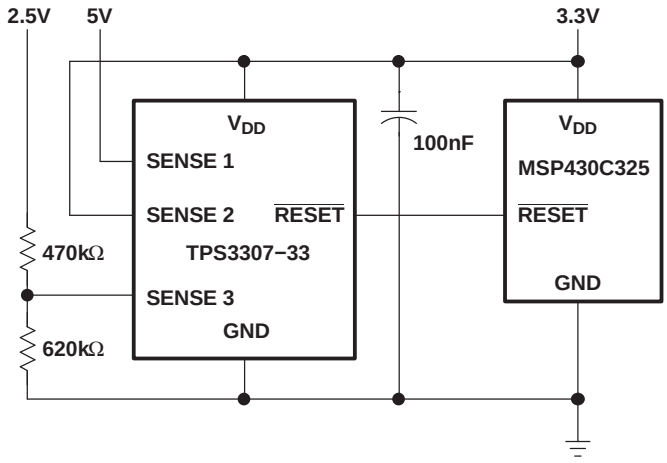
- **Triple Supervisory Circuits for DSP and Processor-Based Systems**
- **Power-On Reset Generator With Fixed Delay Time of 200ms, No External Capacitor Needed**
- **Temperature-Compensated Voltage Reference**
- **Maximum Supply Current of 40μA**
- **Supply Voltage Range: 2V to 6V**
- **Defined $\overline{\text{RESET}}$ Output From $V_{DD} \geq 1.1V$**
- **MSOP-8 and SO-8 Packages**
- **Temperature Range : – 40°C to +85°C**

D OR DGN PACKAGE
(TOP VIEW)



TYPICAL APPLICATIONS

Figure 1 lists some of the typical applications for the TPS3307 family, and a schematic diagram for a processor-based system application. This application uses TI part numbers TPS3307-33 and MSP430C325.



- **Applications using DSPs, Microcontrollers or Microprocessors**
- **Industrial Equipment**
- **Programmable Controls**
- **Automotive Systems**
- **Portable/Battery Powered Equipment**
- **Intelligent Instruments**
- **Wireless Communication Systems**
- **Notebook/Desktop Computers**

Figure 1. Applications Using the TPS3307 Family

DESCRIPTION

The TPS3307 family is a series of micropower supply voltage supervisors designed for circuit initialization primarily in DSP and processor-based systems, which require more than one supply voltage.

The product spectrum of the TPS3307-xx is designed for monitoring three independent supply voltages: 3.3V/1.8V/adj, 3.3V/2.5V/adj or 3.3V/5V/adj. The adjustable SENSE input allows the monitoring of any supply voltage >1.25V.

The various supply voltage supervisors are designed to monitor the nominal supply voltage as shown in the following supply voltage monitoring table.

During power-on, $\overline{\text{RESET}}$ is asserted when the supply voltage V_{DD} becomes higher than 1.1V. Thereafter, the supply voltage supervisor monitors the SENSE*n* inputs and keeps $\overline{\text{RESET}}$ active as long as SENSE*n* remain below the threshold voltage V_{IT+}.

An internal timer delays the return of the $\overline{\text{RESET}}$ output to the inactive state (high) to ensure proper system reset. The delay time, $t_{d\ (typ)}$ = 200ms, starts after all SENSE*n* inputs have risen above the threshold voltage V_{IT+}. When the voltage at any SENSE input drops below the threshold voltage V_{IT-}, the $\overline{\text{RESET}}$ output becomes active (low) again.

The TPS3307-xx family of devices incorporates a manual reset input, $\overline{\text{MR}}$. A low level at $\overline{\text{MR}}$ causes $\overline{\text{RESET}}$ to become active. In addition to the active-low $\overline{\text{RESET}}$ output, the TPS3307-xx family includes an active-high RESET output.

The devices are available in either 8-pin MSOP or standard 8-pin SO packages.

The TPS3307-xx devices are characterized for operation over a temperature range of –40°C to +85°C.

SUPPLY VOLTAGE MONITORING

DEVICE	NOMINAL SUPERVISED VOLTAGE			THRESHOLD VOLTAGE (TYP)		
	SENSE1	SENSE2	SENSE3	SENSE1	SENSE2	SENSE3
TPS3307-18	3.3V	1.8V	User defined	2.93V	1.68V	1.25V(1)
TPS3307-25	3.3V	2.5V	User defined	2.93V	2.25V	1.25V(1)
TPS3307-33	5V	3.3V	User defined	4.55V	2.93V	1.25V(1)

(1) The actual sense voltage has to be adjusted by an external resistor divider according to the application requirements.

AVAILABLE OPTIONS(1)

T_A	PACKAGED DEVICES		MARKING DGN PACKAGE	CHIP FORM (Y)
	SMALL OUTLINE (D)	PowerPAD™ µ-SMALL OUTLINE (DGN)		
–40°C to +85°C	TPS3307-18D	TPS3307-18DGN	TIAAP	TPS3307-18Y
	TPS3307-25D	TPS3307-25DGN	TIAAQ	TPS3307-25Y
	TPS3307-33D	TPS3307-33DGN	TIAAR	TPS3307-33Y

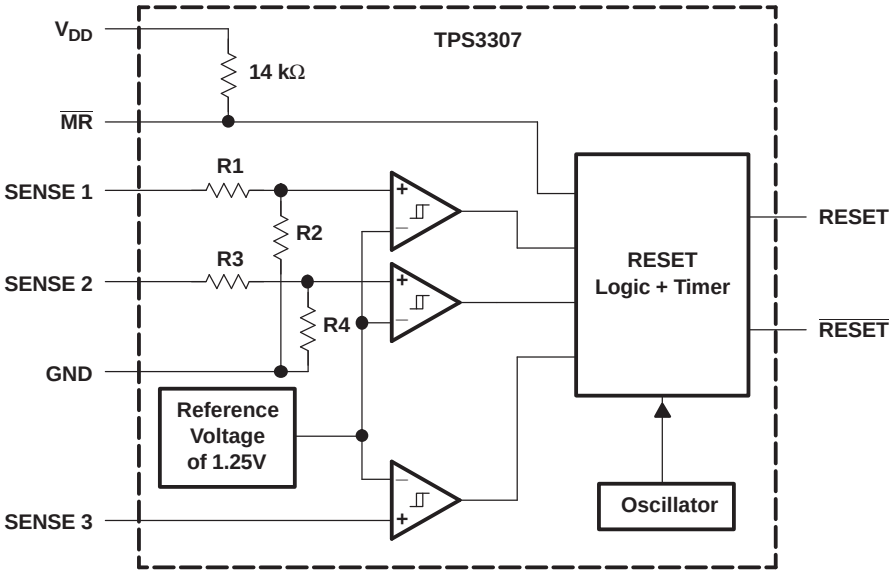
(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

Function/Truth Tables

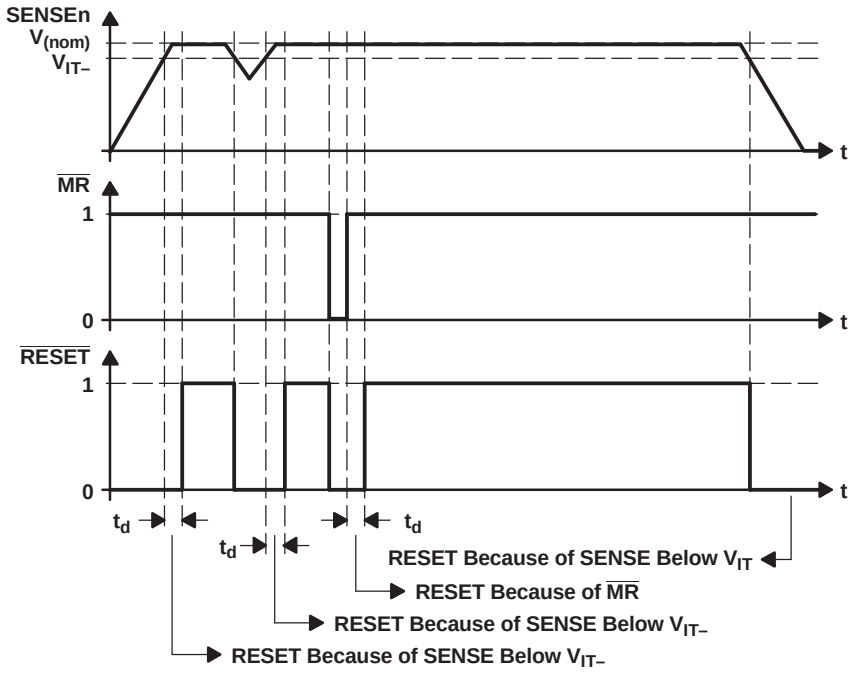
$\overline{\text{MR}}$	SENSE1 > V_{IT1}	SENSE2 > V_{IT2}	SENSE3 > V_{IT3}	$\overline{\text{RESET}}$	RESET
L	X(1)	X(1)	X	L	H
H	0	0	0	L	H
H	0	0	1	L	H
H	0	1	0	L	H
H	0	1	1	L	H
H	1	0	0	L	H
H	1	0	1	L	H
H	1	1	0	L	H
H	1	1	1	H	L

(1) X = Don't care

Functional Block Diagram



Timing Diagram



TPS3307Y Chip Information

These chips, when properly assembled, display characteristics similar to those of the TPS3307. Thermal compression or ultrasonic bonding may take place on the doped aluminium bonding pads. The chips may be mounted with conductive epoxy or a gold-silicon preform.

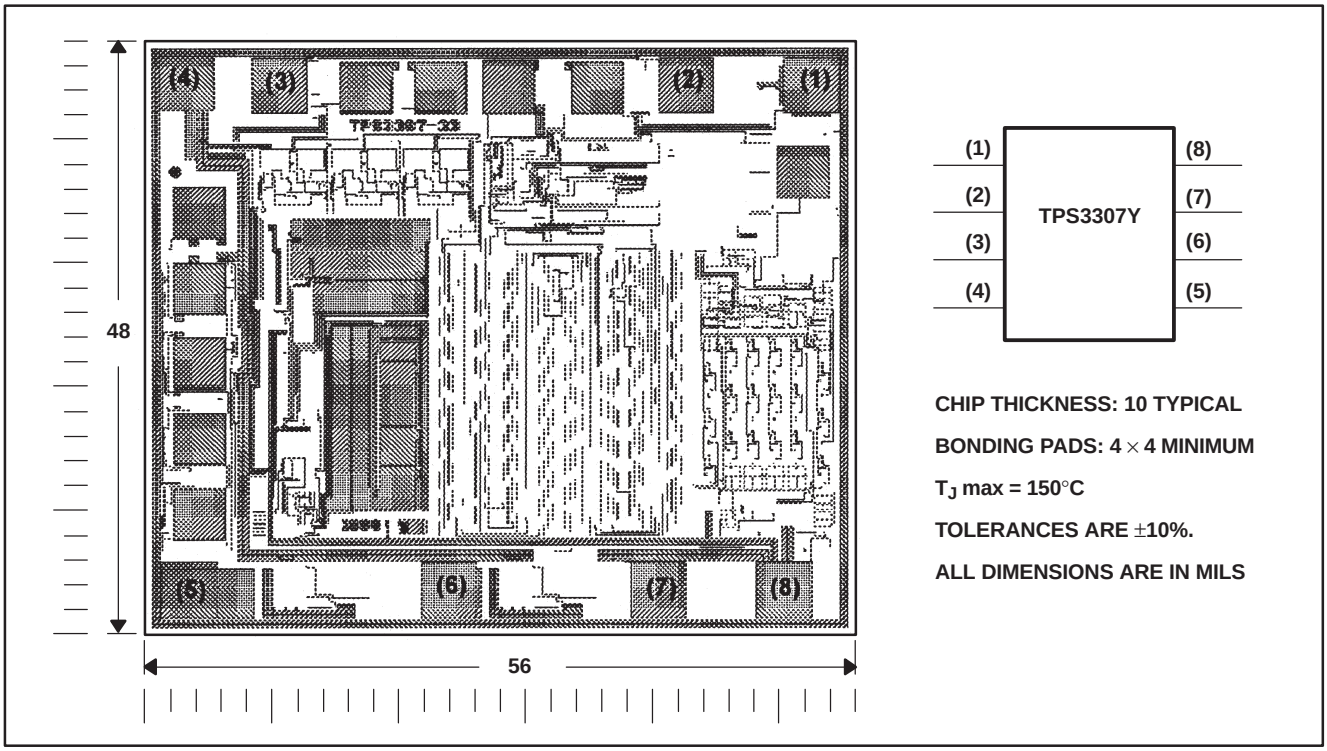


Table 2. Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
GND	4		Ground
$\overline{MR}$	7	I	Manual reset
$\overline{RESET}$	5	O	Active-low reset output
RESET	6	O	Active-high reset output
SENSE1	1	I	Sense voltage input 1
SENSE2	2	I	Sense voltage input 2
SENSE3	3	I	Sense voltage input 3
V_{DD}	8		Supply voltage

Absolute Maximum Ratings(1)

Over operating free-air temperature range (unless otherwise noted).

	UNIT
Supply voltage, V_{DD}(2)	7V
$\overline{MR}$ pin	–0.3V to V_{DD} +0.3V
All other pins(2)	–0.3V to 7V
Maximum low output current, I_{OL}	5mA
Maximum high output current, I_{OH}	–5mA
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{DD}$)	±20mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{DD}$)	±20mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	–40°C to +85°C
Storage temperature range, T_{stg}	–65°C to +150°C
Soldering temperature	+260°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 GND. For reliable operation the device must not be operated at 7V for more than t = 1000h continuously.

Dissipation Rating Table

PACKAGE	$T_A \le +25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = +25°C$	$T_A = +70°C$ POWER RATING	$T_A = +85°C$ POWER RATING
DGN	2.14W	17.1mW/°C	1.37W	1.11W
D	725mW	5.8mW/°C	464mW	377mW

Recommended Operating Conditions

At specified temperature range.

	MIN	MAX	UNIT
Supply voltage, V_{DD}	2	6	V
Input voltage at $\overline{MR}$ and SENSE3, V_I	0	V_{DD} + 0.3	V
Input voltage at SENSE1 and SENSE2, V_I	0	$(V_{DD}+0.3)V_{IT}/1.25V$	V
High-level input voltage at $\overline{MR}$, V_{IH}	0.7 x V_{DD}		V
Low-level input voltage at $\overline{MR}$, V_{IL}		0.3 × V_{DD}	V
Input transition rise and fall rate at $\overline{MR}$, $\Delta t/\Delta V$		50	ns/V
Operating free-air temperature range, T_A	–40	+85	°C

Electrical Characteristics

Over recommended operating free-air temperature range (unless otherwise noted).

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage		V_{DD} = 2V to 6V, I_{OH} = –20 µA	V_{DD} – 0.2V			V
			V_{DD} = 3.3V, I_{OH} = –2mA	V_{DD} – 0.4V			
			V_{DD} = 6V, I_{OH} = –3mA	V_{DD} – 0.4V			
V_{OL}	Low-level output voltage		V_{DD} = 2V to 6V, I_{OL} = 20µA			0.2	V
			V_{DD} = 3.3V, I_{OL} = 2mA			0.4	
			V_{DD} = 6V, I_{OL} = 3mA			0.4	
	Power-up reset voltage(1)		$V_{DD} \geq$ 1.1V, I_{OL} = 20µA			0.4	V
$V_{IT–}$	Negative-going input threshold voltage(2)	VSENSE3	V_{DD} = 2V to 6V, T_A = 0°C to +85°C	1.22	1.25	1.28	V
		VSENSE1, VSENSE2		1.64	1.68	1.72	
				2.20	2.25	2.30	
				2.86	2.93	3	
				4.46	4.55	4.64	
		VSENSE3	V_{DD} = 2V to 6V, T_A = –40°C to +85°C	1.22	1.25	1.29	V
		VSENSE1, VSENSE2		1.64	1.68	1.73	V
				2.20	2.25	2.32	
				2.86	2.93	3.02	
				4.46	4.55	4.67	
V_{hys}	Hysteresis at VSENSEn input		$V_{IT–}$= 1.25V		10		mV
			$V_{IT–}$= 1.68V		15		
			$V_{IT–}$= 2.25V		20		
			$V_{IT–}$= 2.93V		30		
			$V_{IT–}$= 4.55V		40		
I_H	High-level input current	$\overline{MR}$	$\overline{MR}$ = 0.7 × V_{DD}, V_{DD} = 6V		–130	–180	µA
		SENSE1	VSENSE1 = V_{DD} = 6V		5	8	
		SENSE2	VSENSE2 = V_{DD} = 6V		6	9	
		SENSE3	VSENSE3 = V_{DD}	–25		25	nA
I_L	Low-level input current	$\overline{MR}$	$\overline{MR}$ = 0V, V_{DD} = 6V		–430	–600	µA
		SENSEn	VSENSE1,2,3 = 0V	–25		25	nA
I_{DD}	Supply current					40	µA
C_i	Input capacitance		V_I = 0V to V_{DD}		10		pF

(1) The lowest supply voltage at which $\overline{RESET}$ becomes active. t_r, $V_{DD} \geq$ 15µs/V

(2) To ensure best stability of the threshold voltage, a bypass capacitor (ceramic 0.1µF) should be placed close to the supply terminals.

Timing Requirements

At V_{DD} = 2V to 6V, R_L = 1MΩ, C_L = 50pF, T_A = +25°C.

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_w	Pulse width	SENSEn	$V_{SENSEnL} = V_{IT-} - 0.2V$, $V_{SENSEnH} = V_{IT+} + 0.2V$	6			µs
		$\overline{MR}$	$V_{IH} = 0.7 \times V_{DD}$, $V_{IL} = 0.3 \times V_{DD}$	100			ns

Switching Characteristics

At V_{DD} = 2V to 6V, R_L = 1MΩ, C_L = 50pF, T_A = +25°C.

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_d	Delay time		$V_{I(SENSEn)} \geq V_{IT+} + 0.2V$, $\overline{MR} \geq 0.7 \times V_{DD}$. See Timing Diagram.	140	200	280	ms
t_{PHL}	Propagation (delay) time, high-to-low level output	$\overline{MR}$ to $\overline{RESETMR}$ to RESET	$V_{I(SENSEn)} \geq V_{IT+} + 0.2V$, $V_{IH} = 0.7 \times V_{DD}$, $V_{IL} = 0.3 \times V_{DD}$		200	500	ns
t_{PLH}	Propagation (delay) time, low-to-high level output	$\overline{MR}$ to $\overline{RESETMR}$ to RESET					
t_{PHL}	Propagation (delay) time, high-to-low level output	SENSEn to $\overline{RESET}$ SENSEn to RESET	$V_{IH} = V_{IT+} + 0.2V$, $V_{IL} = V_{IT-} - 0.2V$, $\overline{MR} \geq 0.7 \times V_{DD}$		1	5	µs
t_{PLH}	Propagation (delay) time, low-to-high level output	SENSEn to $\overline{RESET}$ SENSEn to RESET					

Typical Characteristics

NORMALIZED SENSE THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE AT V_{DD}

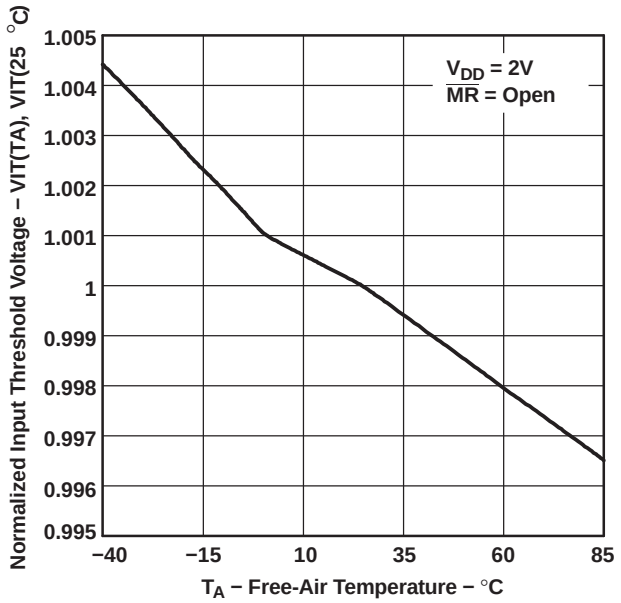


Figure 2.

SUPPLY CURRENT vs SUPPLY VOLTAGE

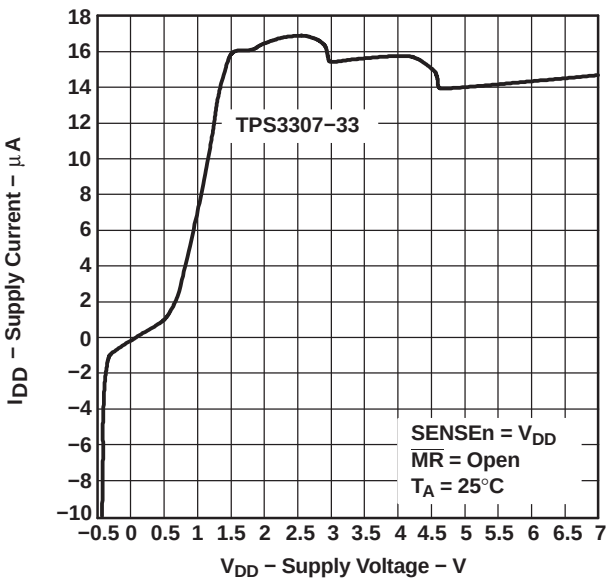


Figure 3.

INPUT CURRENT vs INPUT VOLTAGE AT $\overline{MR}$

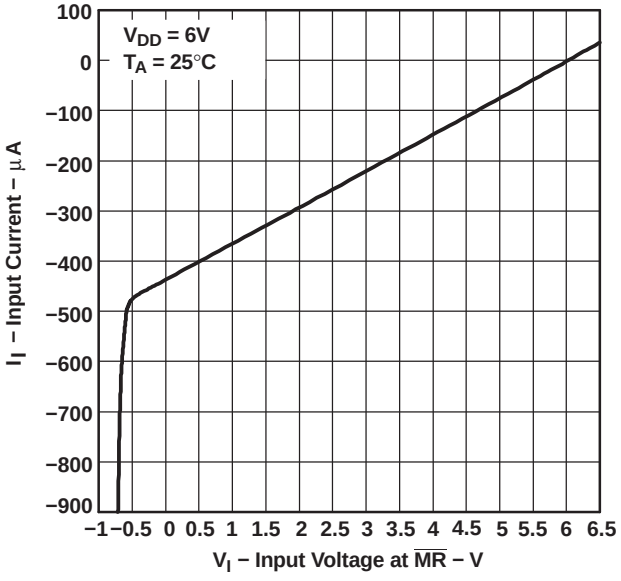


Figure 4.

MINIMUM PULSE DURATION AT SENSE vs THRESHOLD OVERDRIVE

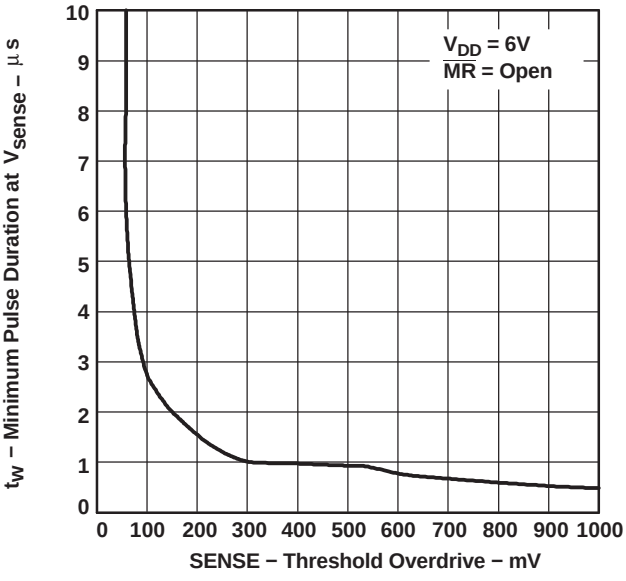


Figure 5.

Typical Characteristics (continued)

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

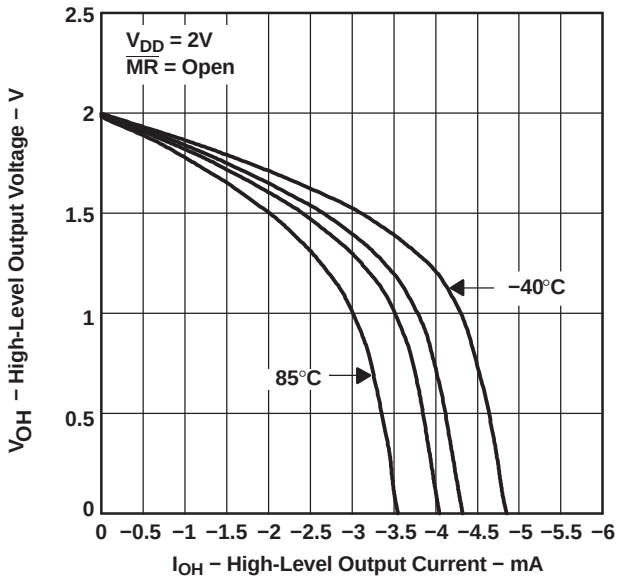


Figure 6.

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

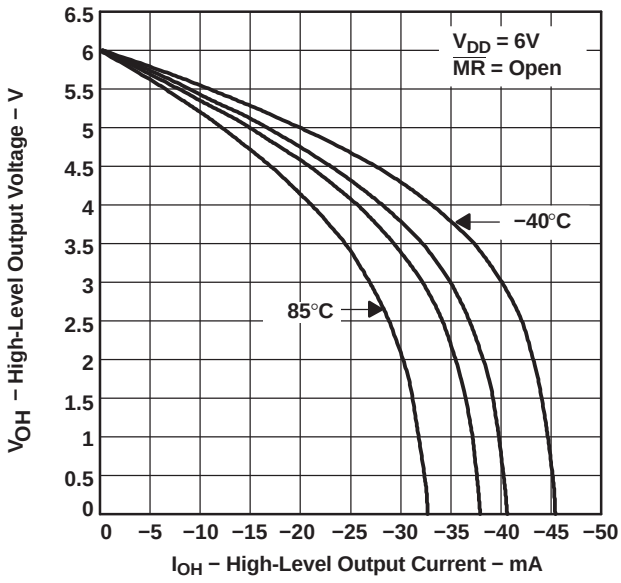


Figure 7.

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

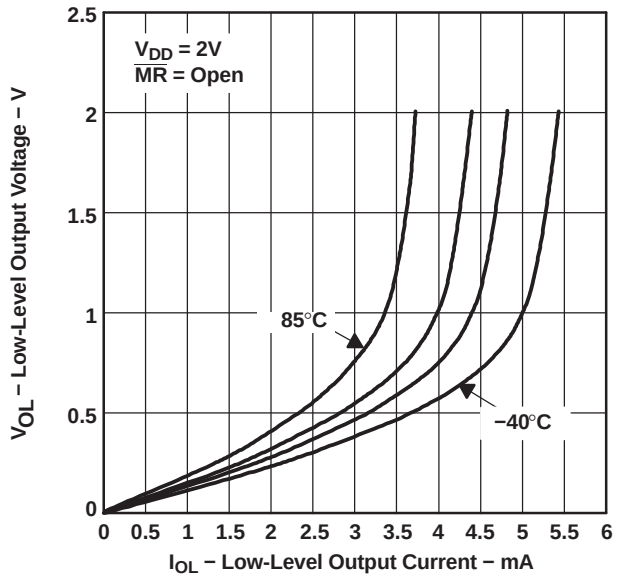


Figure 8.

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

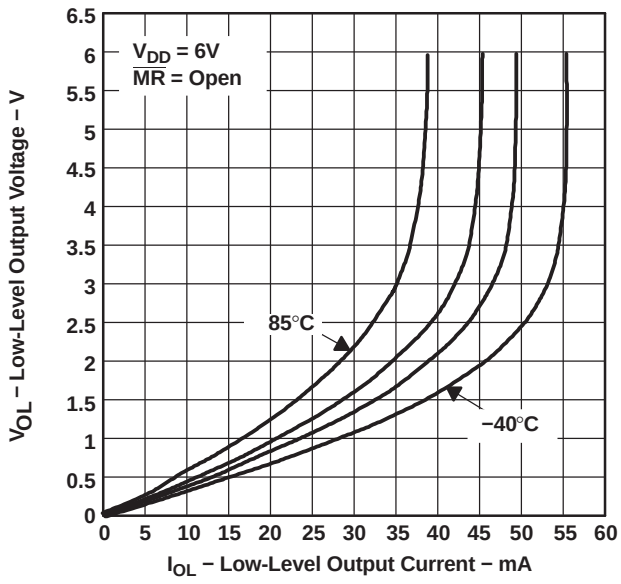


Figure 9.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TPS3307-18D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DGN	ACTIVE	MSOP-Power PAD	DGN	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DGNG4	ACTIVE	MSOP-Power PAD	DGN	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DGNR	ACTIVE	MSOP-Power PAD	DGN	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DGNRG4	ACTIVE	MSOP-Power PAD	DGN	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-18DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DGN	ACTIVE	MSOP-Power PAD	DGN	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DGNG4	ACTIVE	MSOP-Power PAD	DGN	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DGNR	ACTIVE	MSOP-Power PAD	DGN	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DGNRG4	ACTIVE	MSOP-Power PAD	DGN	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-25DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33DGN	ACTIVE	MSOP-Power PAD	DGN	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33DGNG4	ACTIVE	MSOP-Power PAD	DGN	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33DGNR	ACTIVE	MSOP-	DGN	8	2500	Green (RoHS &	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
		Power PAD				no Sb/Br)		
TPS3307-33DGNRG4	ACTIVE	MSOP-Power PAD	DGN	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3307-33DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

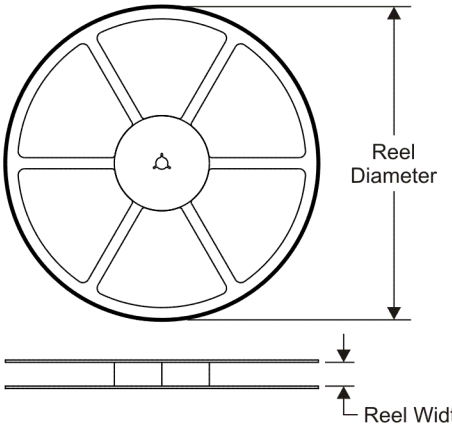
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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)

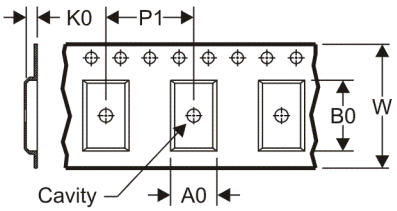
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

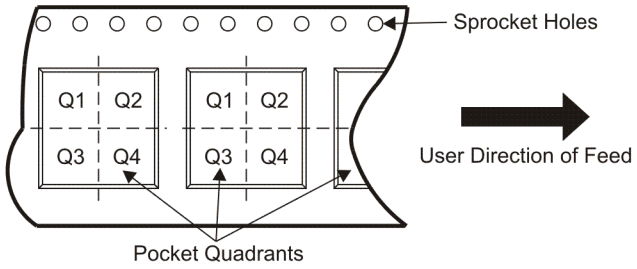


TAPE DIMENSIONS



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

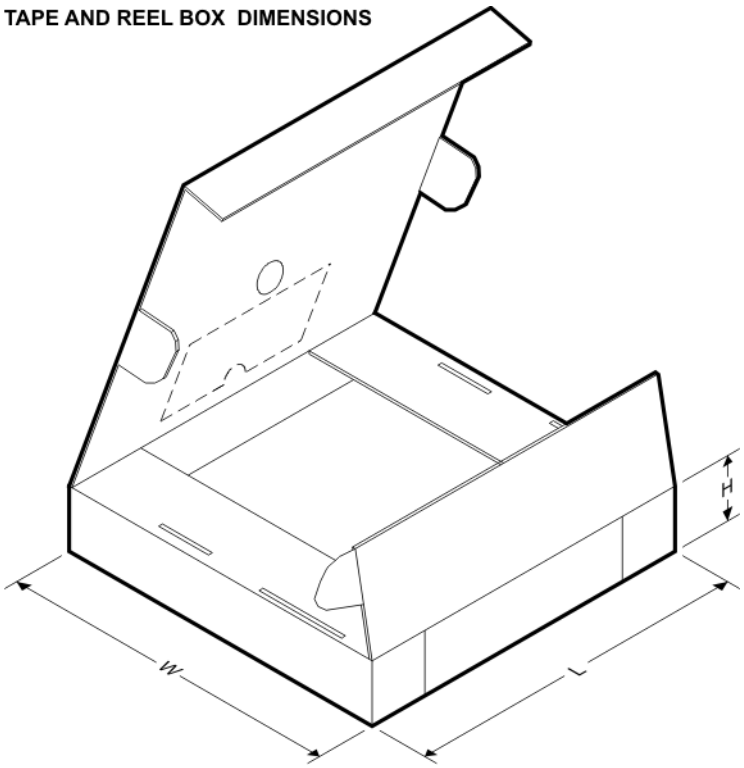
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS3307-18DGNR	MSOP-Power PAD	DGN	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3307-18DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TPS3307-25DGNR	MSOP-Power PAD	DGN	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3307-25DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TPS3307-33DGNR	MSOP-Power PAD	DGN	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3307-33DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

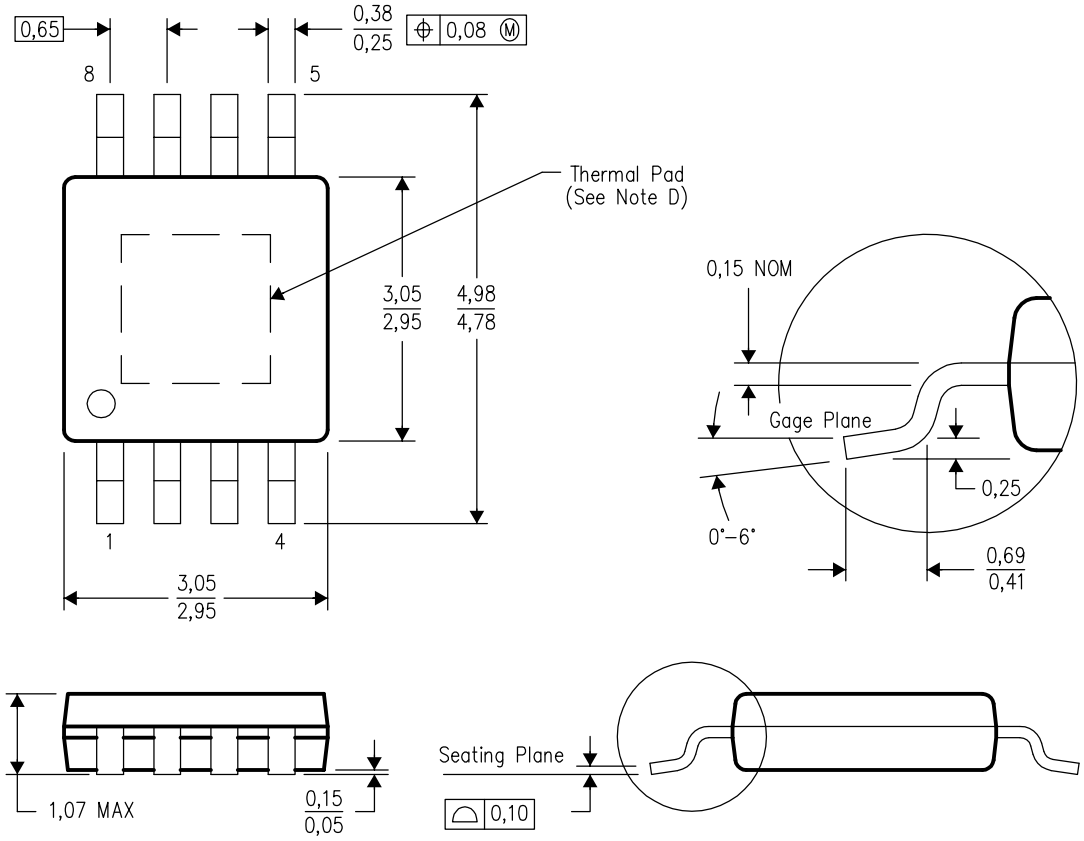
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS3307-18DGNR	MSOP-PowerPAD	DGN	8	2500	358.0	335.0	35.0
TPS3307-18DR	SOIC	D	8	2500	346.0	346.0	29.0
TPS3307-25DGNR	MSOP-PowerPAD	DGN	8	2500	358.0	335.0	35.0
TPS3307-25DR	SOIC	D	8	2500	346.0	346.0	29.0
TPS3307-33DGNR	MSOP-PowerPAD	DGN	8	2500	358.0	335.0	35.0
TPS3307-33DR	SOIC	D	8	2500	346.0	346.0	29.0

DGN (S–PDSO–G8) PowerPAD™ PLASTIC SMALL–OUTLINE PACKAGE



4073271/C 08/03

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.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 for information regarding recommended board layout. This document is available at www.ti.com <http://www.ti.com>.
E. Falls within JEDEC MO–187

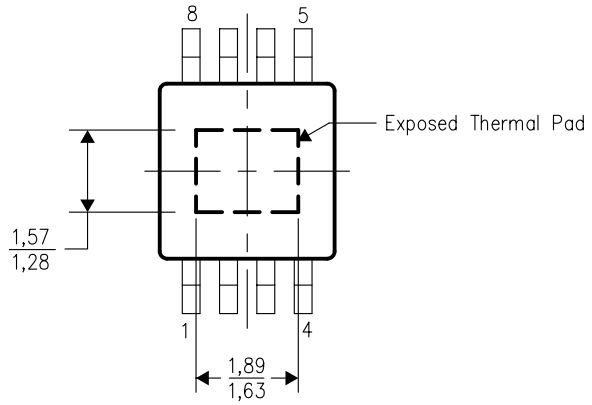
PowerPAD is a trademark of Texas Instruments.

THERMAL INFORMATION

This PowerPAD™ package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For additional information on the PowerPAD package and how to take advantage of its heat dissipating abilities, refer to Technical Brief, PowerPAD Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 and Application Brief, PowerPAD Made Easy, Texas Instruments Literature No. SLMA004. Both documents are available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.

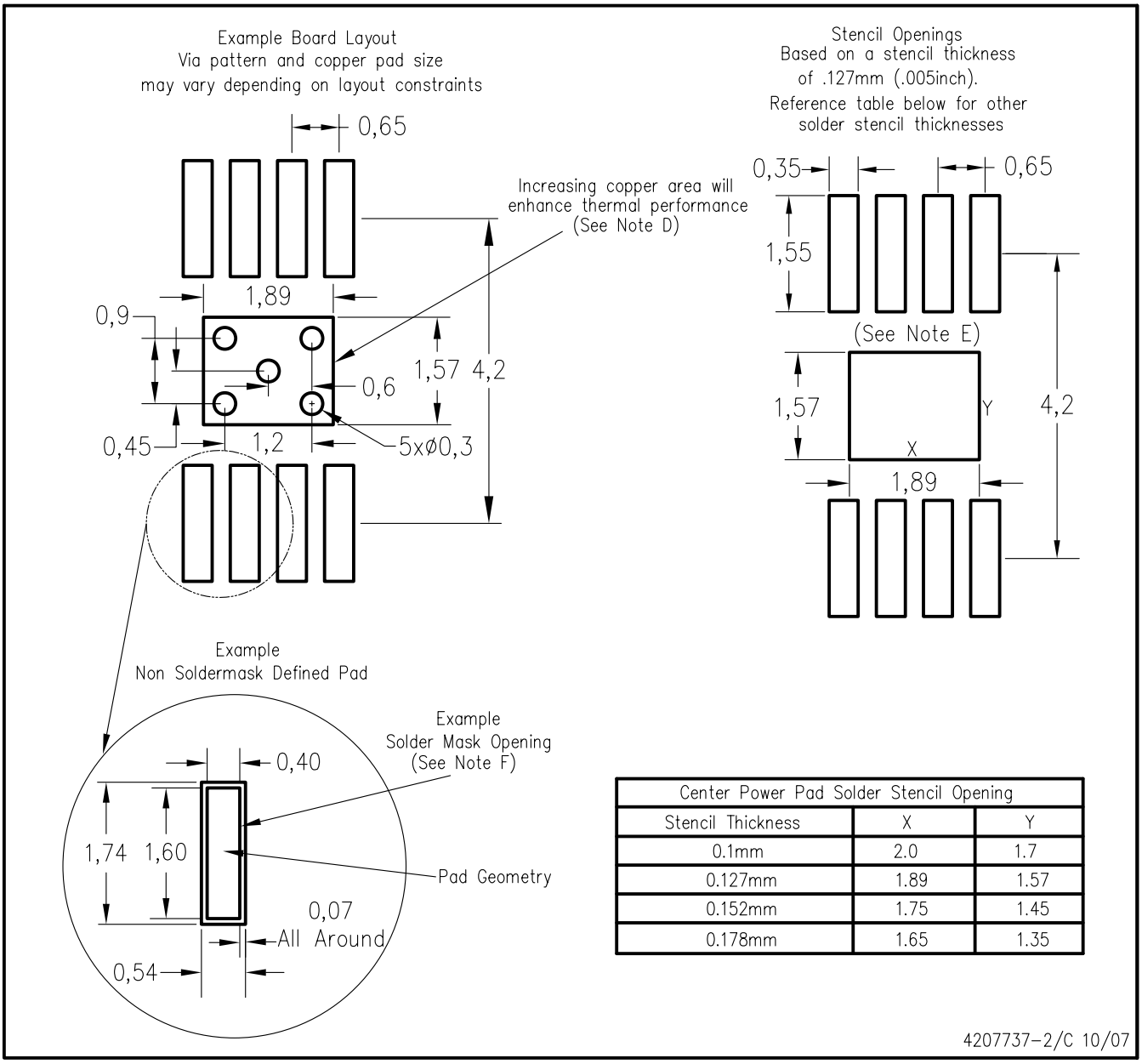


Top View

NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions

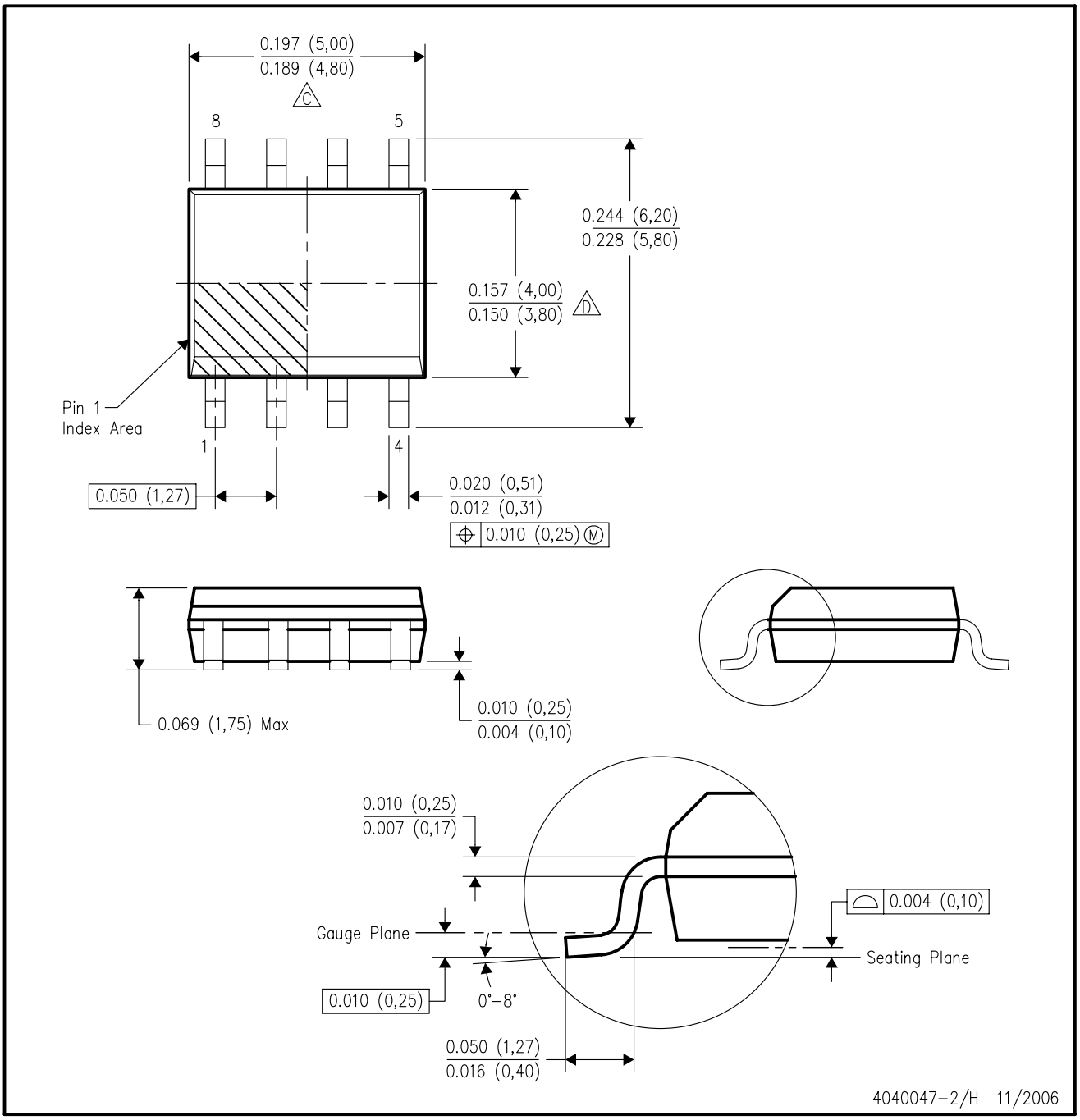
DGN (R–PDSO–G8) PowerPAD™



Center Power Pad Solder Stencil Opening		
Stencil Thickness	X	Y
0.1mm	2.0	1.7
0.127mm	1.89	1.57
0.152mm	1.75	1.45
0.178mm	1.65	1.35

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002, SLMA004, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http://www.ti.com>. Publication IPC–7351 is recommended for alternate designs.
E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.
F. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
E. Reference JEDEC MS–012 variation AA.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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