Ultra-Low Power, Supply Voltage Supervisor

Check for Samples: **TPS3839**

FEATURES

- **1-mm × 1-mm µSON or 3-Pin SOT23 Package**
- **Ultra-Low Supply Current: 150 nA (typ)**
- **Operating Supply Voltage: 0.6 V to 6.5 V**
- **Ensured Valid RESET for V_{DD} > 0.6 V**
- **Push-Pull RESET Output**
- **Temperature Range: –40°C to +85°C**
- **Factory-Trimmed RESET Threshold Voltages**

APPLICATIONS

- **Portable and Battery-Powered Equipment**
- **Industrial Equipment**
- **Cell Phones**
- **Glucose Monitors**
- **Metering**
- **Televisions**

DESCRIPTION

The TPS3839 is an ultra-low current, 150-nA (typ) voltage supervisory circuit that monitors a single voltage. The device asserts an active-low reset signal whenever the V_{DD} supply voltage drops below the factory-trimmed reset threshold voltage. The reset output remains asserted for 200 ms (typ) after the V_{DD} voltage rises above the threshold voltage. The TPS3839 is designed to ignore fast transients on the V_{DD} pin.

The ultra-low current consumption of 150 nA makes the TPS3839 ideal for use in low-power and portable applications. The TPS3839 is ensured to have the correct output logic state for supply voltages down to 0.6 V.

The device features precision factory-trimmed threshold voltages and extremely low power operation. The TPS3839 is available is a 3-pin SOT23 (DBZ) package or a 4-pin 1-mm × 1-mm (DQN) µSON package.
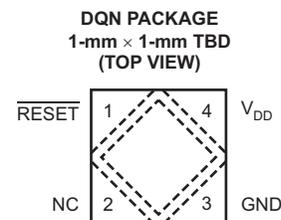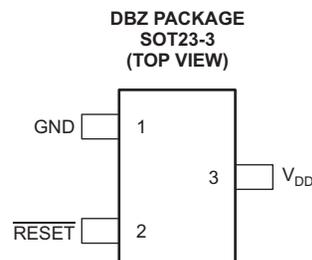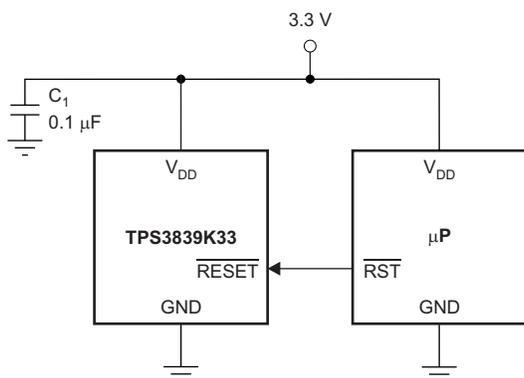
PRODUCT PREVIEW

TPS3839

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ORDERING INFORMATION[1]

PRODUCT	THRESHOLD VOLTAGE (V)	PACKAGE TYPE	TOP MARKINGS
TPS3839A09DQN	0.900	X2SON	TBD
TPS3839G12DQN	1.120	X2SON	TBD
TPS3839G12DBZ	1.120	SOT23	TBD
TPS3839E16DQN	1.520	X2SON	TBD
TPS3839G18DQN	1.670	X2SON	TBD
TPS3839G18DBZ	1.670	SOT23	TBD
TPS3839L30DBZ	2.630	SOT23	TBD
TPS3839K33DQN	2.930	X2SON	TBD
TPS3839K33DBZ	2.930	SOT23	TBD
TPS3839G33DQN	3.080	X2SON	TBD
TPS3839K50DQN	4.380	X2SON	TBD
TPS3839K50DBZ	4.380	SOT23	TBD

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

ABSOLUTE MAXIMUM RATINGS[1]

Over operating free-air temperature range, unless otherwise noted.

		VALUE		UNIT
		MIN	MAX	
Voltage	VDD	−0.3	7	V
	On $\overline{\text{RESET}}$	−0.3	7	V
Current	RESET pin		5	mA
Continuous total power dissipation		See Thermal Information Table		
Temperature[2]	Operating ambient, T_A	−40	+85	°C
	Storage, T_{stg}	−65	+150	°C
Electrostatic discharge (ESD) rating:	Human body model (HBM)		2	kV
	Charge device model (CDM)		500	V

(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 my affect device reliability.

(2) As a result of the low dissipated power in this device, it is assumed that T_J is equal to T_A.

THERMAL INFORMATION

THERMAL METRIC[1]		TPS3839	UNITS
		DRY (µSON)	
		6 PINS	
θ_{JA}	Junction-to-ambient thermal resistance	293.8	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance	165.1	
θ_{JB}	Junction-to-board thermal resistance	160.8	
ψ_{JT}	Junction-to-top characterization parameter	27.3	
ψ_{JB}	Junction-to-board characterization parameter	65.8	
θ_{JCbot}	Junction-to-case (bottom) thermal resistance	65.8	

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

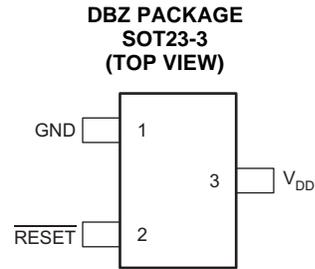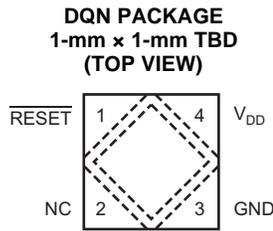**PRODUCT PREVIEW**

ELECTRICAL CHARACTERISTICS

At T_A = –40°C to +85°C, 0.9 V < V_{DD} < 6.5 V, and C_1 = 0.1 µF, unless otherwise noted.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{DD}	Input supply range		0.9		6.5	V
$V_{(VO)}$	Minimum V_{DD} voltage for valid output	I_{OL} = 1 µA			0.6	V
I_{DD}	Supply current (into VDD pin)	Output not connected		150	600	mA
V_{OL}	Low-level output voltage $\overline{RESET}$	V_{DD} = 0.9 V to 1.2 V, I_{OL} = 120 µA			0.4	V
		V_{DD} = 1.2 V to 2.8 V, I_{OL} = 0.5 mA			0.4	V
		V_{DD} = 2.8 V to 6.5 V, I_{OL} = 2 mA			0.4	V
V_{OH}	High-level output voltage $\overline{RESET}$	V_{DD} = 0.9 V to 1.8 V, I_{OH} = –50 µA	V_{DD} – 0.4			V
		V_{DD} = 1.8 V to 3.3 V, I_{OH} = –0.5 mA	V_{DD} – 0.4			V
		V_{DD} = 3.3 V to 6.5 V, I_{OH} = –2 mA	V_{DD} – 0.4			V
$V_{(THA)}$	Negative-going input threshold accuracy		–2.0	±1.0	+2.0	%
$V_{IT–}$	Negative-going threshold voltage	TPS3839A09	0.882	0.900	0.918	V
		TPS3839G12	1.098	1.120	1.142	V
		TPS3839E16	1.490	1.520	1.550	V
		TPS3839G18	1.637	1.670	1.703	V
		TPS3839L30	2.577	2.630	2.683	V
		TPS3839K33	2.871	2.930	2.989	V
		TPS3839G33	3.018	3.080	3.142	V
		TPS3839K50	4.292	4.380	4.468	V
V_{hys}	Hysteresis voltage	$V_{(SENSE)}$ falling		10		mV

TIMING REQUIREMENTS

PARAMETER		MIN	TYP	MAX	UNIT
t_W	Minimum V_{DD} pulse width to RESET		1		µs
t_D	RESET delay time (power-up delay)	120	200	320	ms
t_{PHL}	Propagation delay, V_{DD} falling (power-down delay)		20		µs

PRODUCT PREVIEW

PIN CONFIGURATIONS

DQN PACKAGE
1-mm × 1-mm TBD
(TOP VIEW)

$\overline{\text{RESET}}$	1	4	V_{DD}
NC	2	3	GND

DBZ PACKAGE
SOT23-3
(TOP VIEW)

GND — 1

3 — V_{DD}

$\overline{\text{RESET}}$ — 2

PIN ASSIGNMENTS

PIN NAME	PIN NO		DESCRIPTION
	DQN	DBZ	
GND	3	1	Ground
NC	2	—	Do not connect
$\overline{\text{RESET}}$	1	2	Active low RESET output. RESET has a push-pull output drive and is capable of directly driving input pins. This in remains low as long as V_{DD} is below the factory threshold voltage and remains low until a certain time (t_D) after V_{DD} rises above the threshold voltage.
VDD	4	3	Supply voltage

FUNCTIONAL BLOCK DIAGRAM
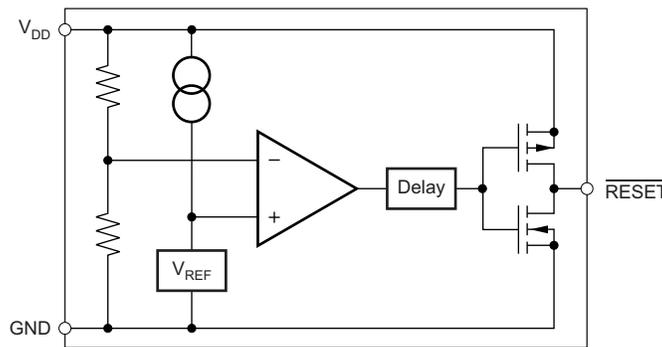
Figure 1. TPS3895A Block Diagram

Product Folder Link(s): *TPS3839*

APPLICATION INFORMATION

APPLICATION CIRCUIT

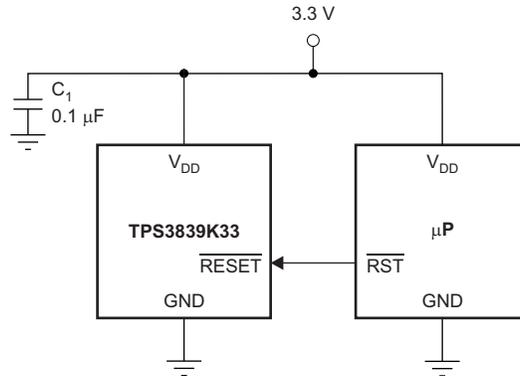Figure 2 shows an example typical application circuit.

Figure 2. Typical Application Circuit

VDD TRANSIENT REJECTION

The TPS3839 has built-in rejection of fast transients on the V_{DD} pin. Transient rejection is dependent on both transient duration and transient amplitude. Transient amplitude is measured from the bottom of the transient to the negative threshold voltage of the TPS3839, as shown in Figure 3.
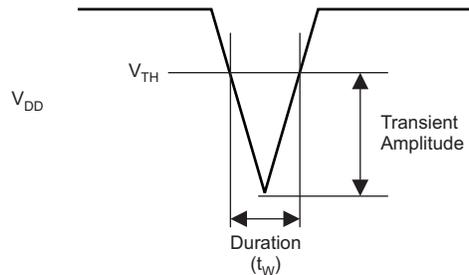

Figure 3. Voltage Transient Measurement

The TPS3839 does not respond to fast-duration, low-amplitude or long-duration, small-amplitude transients. Figure 4 shows the relationship between the transient amplitude and duration required to trigger a reset. Any combination of duration and amplitude above the curve generates a reset signal.

Figure 4. TPS3839 Transient Rejection

PRODUCT PREVIEW

INPUT CAPACITOR

The TPS3839 uses a unique sampling scheme to maintain an extremely low average quiescent current of 150 nA. The TPS3839 typically only consumes approximately 100 nA of dc current. However, this current rises to approximately 15 µA for about 200 µs while the TPS3839 samples the input voltage. If the source impedance is high then the additional current during sampling may trigger a false reset because of the apparent voltage drop at V_{DD}. For high V_{DD} source or trace impedance applications, it is recommended to add a small 0.1-µF bypass capacitor near the TPS3839 V_{DD} pin. The bypass capacitor effectively keeps the average current at 150 nA and reduces the effects of a high-impedance voltage source.

BIDIRECTIONAL RESET PINS

Some microcontrollers have bidirectional RESET pins that act both as an input and an output. A series resistor should be placed between the TPS3839 output and the microcontroller RESET pin to protect against excessive current flow when both the TPS3839 and the microcontroller attempt to drive the RESET line. Figure 5 shows the connection of the TPS3839 with a microcontroller using a series resistor to drive a bidirectional RESET line.
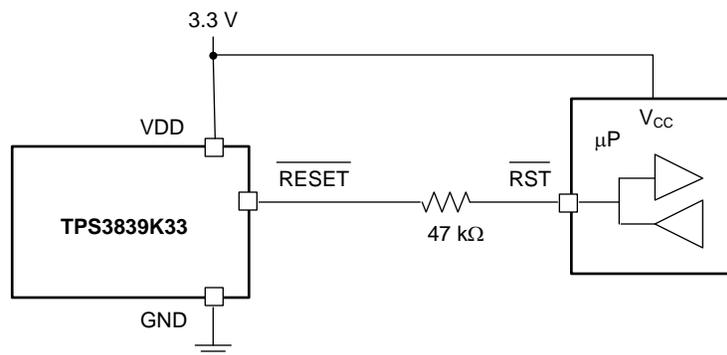

Figure 5. Connection to Bidirectional RESET Pin

SINGLE ALKALINE CELL MONITORING

The low operating voltage and threshold options make the TPS3839 well-suited for monitoring single-cell alkaline battery applications. Figure 6 shows the TPS3839A09 used to disable a boost converter when the cell voltage reaches 0.9 V, which is the end of the discharge voltage for a single alkaline battery cell. When the cell voltage reaches 0.9 V, the TPS61261 enable pin is driven low. This setting disables the TPS61261 and places it in a low-current shutdown state. The combination of the TPS3839 and TPS61261 only consumes 250 nA (typical) from the discharged battery.
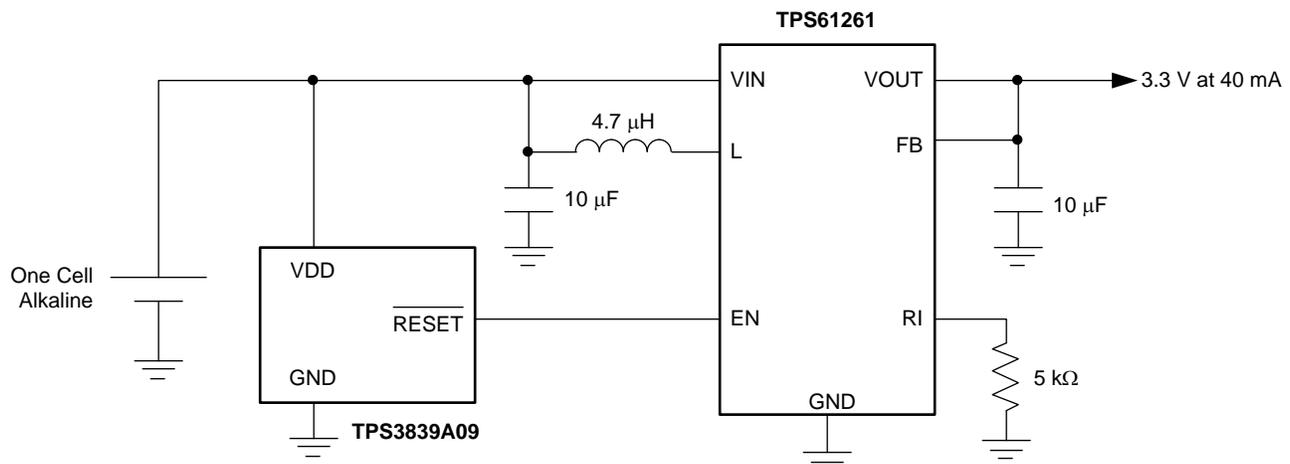

Figure 6. Disabled Boost Converter

Product Folder Link(s): *TPS3839*

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
TPS3839A09DBZR	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI	
TPS3839A09DBZT	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI	
TPS3839A09DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839A09DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839E16DBZR	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI	
TPS3839E16DBZT	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI	
TPS3839E16DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839E16DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839G12DBZR	PREVIEW	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	
TPS3839G12DBZT	PREVIEW	SOT-23	DBZ	3	250	TBD	Call TI	Call TI	
TPS3839G12DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839G12DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839G18DBZR	PREVIEW	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	
TPS3839G18DBZT	PREVIEW	SOT-23	DBZ	3	250	TBD	Call TI	Call TI	
TPS3839G18DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839G18DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839G33DBZR	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI	
TPS3839G33DBZT	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI	
TPS3839G33DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839G33DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839K33DBZR	PREVIEW	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	
TPS3839K33DBZT	PREVIEW	SOT-23	DBZ	3	250	TBD	Call TI	Call TI	
TPS3839K33DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839K33DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839K50DBZR	PREVIEW	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	
TPS3839K50DBZT	PREVIEW	SOT-23	DBZ	3	250	TBD	Call TI	Call TI	
TPS3839K50DQNR	PREVIEW	X2SON	DQN	4	3000	TBD	Call TI	Call TI	
TPS3839K50DQNT	PREVIEW	X2SON	DQN	4	250	TBD	Call TI	Call TI	
TPS3839L30DBZR	PREVIEW	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	
TPS3839L30DBZT	PREVIEW	SOT-23	DBZ	3	250	TBD	Call TI	Call TI	

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
TPS3839L30DQNR	PREVIEW	X2SON	DQN	4		TBD	Call TI	Call TI	
TPS3839L30DQNT	PREVIEW	X2SON	DQN	4		TBD	Call TI	Call TI	

[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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DBZ (R−PDSO−G3)   PLASTIC SMALL−OUTLINE

3,04 / 2,80   A

B

3

2,64 / 2,10

1,40 / 1,20

1   2

0,95   3X 0,50 / 0,30

1,90

⊕ | 0,20 Ⓜ | C | A | B

1,02 / 0,88

1,12 / 0,89

⌒ | 0,10 | C

Seating Plane

0,10 / 0,01

C

0,20 / 0,08

Gauge Plane

Seating Plane

0,25   0°−8°

0,60 / 0,20   ⟋E⟍

4203227/B 04/2005

NOTES: A.   All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M−1994.
         B.   This drawing is subject to change without notice.
         C.   Lead dimensions are inclusive of plating.
         D.   Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
     ⟋E⟍ Falls within JEDEC TO−236 variation AB, except minimum foot length.

DQN (S−PX2SON−N4)   PLASTIC SMALL OUTLINE NO−LEAD

$\frac{1,05}{0,95}$ A

B

$\frac{1,05}{0,95}$

4   3

Pin 1 Index Area

1   2

$\frac{0,40}{0,34}$

0,05 C

Seating Plane

$\frac{0,05}{0,00}$

C

0,65

0,325

$\frac{0,30}{0,20}$

1   2

Pin 1 Identifier

THERMAL PAD
SIZE AND SHAPE
SHOWN ON
SEPARATE SHEET

3X $\frac{0,30}{0,15}$

4   3

4X $\frac{0,25}{0,15}$

⊕ | 0,10 Ⓜ | C | A | B
0,05 Ⓜ | C

Bottom View
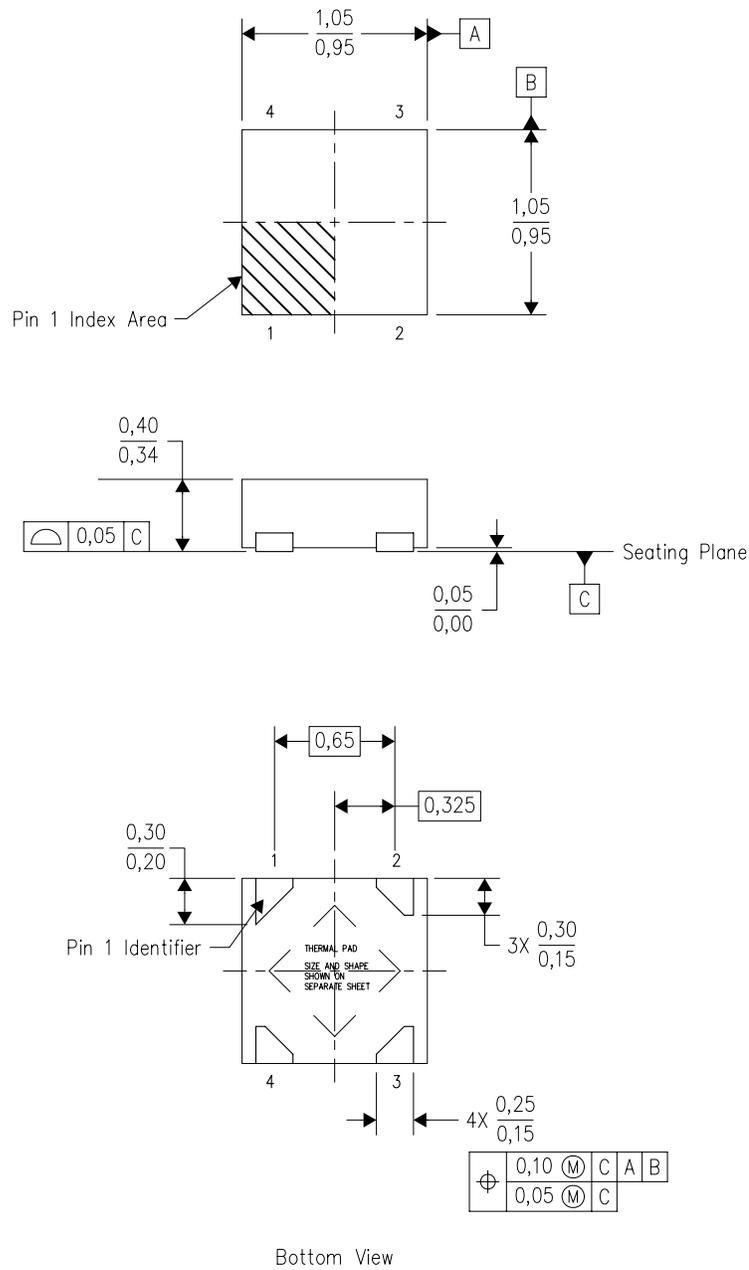
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NOTES: A.   All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M−1994.
         B.   This drawing is subject to change without notice.
         C.   SON (Small Outline No−Lead) package configuration.
         D.   The package thermal pad must be soldered to the board for thermal and mechanical performance.
         E.   See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.

IMPORTANT NOTICE

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
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DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
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