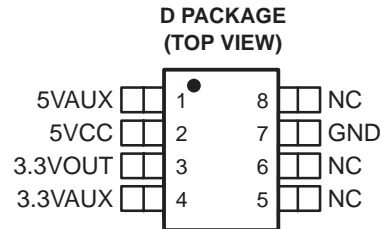


- Automatic Input Voltage Source Selection
- Glitch-Free Regulated Output
- 5-V Input Voltage Source Detector With Hysteresis
- 250-mA Load Current Capability With 5-V or 3.3-V Input Source
- Low  $r_{DS(on)}$  Auxiliary Switch



## description

The TPPM0303 is a low-dropout regulator with auxiliary power management that provides a constant 3.3-V supply at the output capable of driving a 250-mA load.

The TPPM0303 provides a regulated power output for systems that have multiple input sources and require a constant voltage source with a low-dropout voltage. This is a single output, multiple input, intelligent power source selection device with a low-dropout regulator for either 5VCC or 5VAUX inputs, and a low-resistance bypass switch for the 3.3VAUX input.

Transitions may occur from one input supply to another without generating a glitch outside of the specification range on the 3.3-V output. The device has an incorporated reverse-blocking scheme to prevent excess leakage from the input terminals in the event that the output voltage is greater than the input voltage.

The input voltage is prioritized in the following order: 5VCC, 5VAUX, and 3.3VAUX.



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2001, Texas Instruments Incorporated

## SLVS364 – FEBRUARY 2001

The diagram illustrates the power management system for the TMS320C6748, showing the flow of power from input rails to the output rail (3.3VOUT) and the associated control and protection blocks.

**Input Rails and Initial Regulation:**

- 5VCC:** Connected to a **5-V Detection** block and the input of a **Linear Regulator With LDO**.
- 5VAUX:** Connected to a **5VAUX Detection** block and the input of another **Linear Regulator With LDO**.
- 3.3VAUX:** Connected to a **3VAUX Detection** block and the input of a **Low ON Resistance Switch**.

**Control and Protection Blocks:**

- 5-V Detection and Control:** Receives inputs from the **5-V Detection** and **5VAUX Detection** blocks. It provides control signals to the **Gate Drive** and **Gate Drive and Control** blocks.
- Gate Drive and Control:** Receives inputs from the **Linear Regulator With LDO** blocks and the **Over Temperature** block. It provides control signals to the **Gate Drive** block.
- Gate Drive:** Receives inputs from the **Low ON Resistance Switch** and the **5-V Detection and Control** block. It provides control signals to the **Linear Regulator With LDO** blocks.

**Output and Protection:**

- 3.3VOUT:** The output of the system, connected to **GND**. It is the output of the **Linear Regulator With LDO** blocks and the **Low ON Resistance Switch**.
- Current Sensor:** Monitors the current flowing through the **Linear Regulator With LDO** blocks and the **Low ON Resistance Switch**. It provides feedback to the **Gate Drive and Control** block.
- Over Temperature:** Monitors the temperature of the system. It provides a shutdown signal to the **Gate Drive and Control** block.

TERMINAL NAME	NO.	I/O	DESCRIPTION
3.3VAUX	4	I	3.3-V auxiliary input
3.3VOUT	3	O	3.3-V output with a typical capacitance load of 4.7 $\mu$ F
5VAUX	1	I	5-V auxiliary input
5VCC	2	I	5-V main input
GND	7	I	Ground
NC	5,6,8		No internal connection

**Table 1. Input Selection**

INPUT VOLTAGE STATUS (V)			INPUT SELECTED	OUTPUT (V)	OUTPUT (I)
5VCC	5VAUX	3.3VAUX	5VCC/5VAUX/3.3VAUX	3.3VOUT	I <sub>L</sub> (mA)
0	0	0	None	0	0
0	0	3.3	3.3VAUX	3.3	250
0	5	0	5VAUX	3.3	250
0	5	3.3	5VAUX	3.3	250
5	0	0	5VCC	3.3	250
5	0	3.3	5VCC	3.3	250
5	5	0	5VCC	3.3	250
5	5	3.3	5VCC	3.3	250

**absolute maximum ratings over operating free-air temperature (unless otherwise noted)†**

Supply voltage, 5-V main input, V <sub>(5VCC)</sub> (see Notes 1 and 2)	7 V
Auxiliary voltage, 5-V input, V <sub>(5VAUX)</sub> (see Notes 1 and 2)	7 V
Auxiliary voltage, 3.3-V input, V <sub>(3.3VAUX)</sub> (see Notes 1 and 2)	5 V
3.3-V output current limit, I <sub>(LIMIT)</sub>	1.5 A
Continuous power dissipation (low-K), P <sub>D</sub> (see Note 3)	0.625 W
Electrostatic discharge susceptibility, human body model, V <sub>(HBMESD)</sub>	2 kV
Operating ambient temperature range, T <sub>A</sub>	0°C to 70°C
Storage temperature range, T <sub>stg</sub>	–55°C to 150°C
Operating junction temperature range, T <sub>J</sub>	–5°C to 120°C
Lead temperature (soldering, 10 second), T <sub>(LEAD)</sub>	260°C

† 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.

- NOTES: 1. All voltage values are with respect to GND.  
 2. Absolute negative voltage on these terminal should not be below –0.5 V.  
 3. The device derates with increase in ambient temperature, T<sub>A</sub>. See Thermal Information section.

**recommended operating conditions**

	MIN	TYP	MAX	UNIT
5-V main input, V <sub>(5VCC)</sub>	4.5		5.5	V
5-V auxiliary input, V <sub>(5VAUX)</sub>	4.5		5.5	V
3.3-V auxiliary input, V <sub>(3.3VAUX)</sub>	3		3.6	V
Load capacitance, C <sub>L</sub>	4.23	4.7	5.17	μF
Load current, I <sub>L</sub>	0		250	mA
Ambient temperature, T <sub>A</sub>	0		70	°C

# TPPM0303

## 250-mA LOW-DROPOUT REGULATOR

### WITH AUXILIARY POWER MANAGEMENT

SLVS364 – FEBRUARY 2001

electrical characteristics over recommended operating free-air temperature range,  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $C_L = 4.7\ \mu\text{F}$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V(5VCC)/ V(5VAUX)	5-V inputs		4.5	5	5.5	V
I(Q)	Quiescent supply current	From 5VCC or 5VAUX terminals, I <sub>L</sub> = 0 to 250 mA		2.5	5	mA
		From 3.3VAUX terminal, I <sub>L</sub> = 0 A		250	500	μA
I <sub>L</sub>	Output load current		0.25			A
I(LIMIT)	Output current limit	3.3VOUT = 0 V			2	
T(TSD) <sup>†</sup>	Thermal shutdown	3.3VOUT output shorted to 0 V	150		180	°C
T <sub>hys</sub> <sup>†</sup>	Thermal hysteresis			15		
V(3.3VOUT)	3.3-V output	I <sub>L</sub> = 250 mA	3.135	3.3	3.465	V
C <sub>L</sub>	Load capacitance	Minimal ESR to insure stability of regulated output		4.7		μF
I <sub>lkg</sub> (REV)	Reverse leakage output current	Tested for input that is grounded. 3.3VAUX, 5VAUX or 5VCC = GND, 3.3VOUT = 3.3 V			50	μA

$^\dagger$  Design targets only. Not tested in production.

#### 5-V detect

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V(TO_LO)	Threshold voltage, low	5VAUX or 5VCC ↓	3.85	4.05	4.25	V
V(TO_HI)	Threshold voltage, high	5VAUX or 5VCC ↑	4.1	4.3	4.5	V

#### auxiliary switch

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
R(SWITCH)	Auxiliary switch resistance	5VAUX = 5VCC = 0 V, 3.3VAUX = 3.3 V, I <sub>L</sub> = 150 mA			0.4	Ω
ΔV <sub>O</sub> (ΔV <sub>I</sub> )	Line regulation voltage	5VAUX or 5VCC = 4.5 V to 5.5 V		2		mV
ΔV <sub>O</sub> (ΔI <sub>O</sub> )	Load regulation voltage	20 mA < I <sub>L</sub> < 250 mA		40		mV
V <sub>I</sub> – V <sub>O</sub>	Dropout voltage	I <sub>L</sub> < 250 mA			1	V

#### thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta\text{JC}}$ Thermal impedance, junction-to-case			39	$^\circ\text{C/W}$
$R_{\theta\text{JA}}$ Thermal impedance, junction-to-ambient	Low-K (see Note 4)		176	$^\circ\text{C/W}$
	High-K (see Note 4)		98	

NOTE 4: See JEDEC PCB specifications for low-K and high-K.

## TYPICAL CHARACTERISTICS

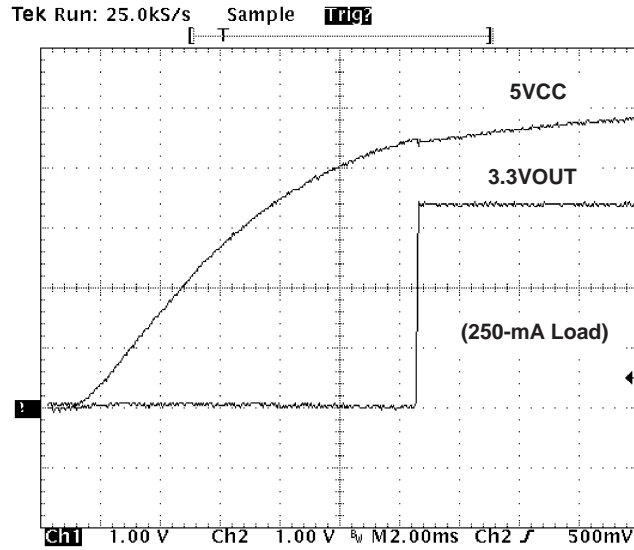


Figure 1. 5VCC Cold Start

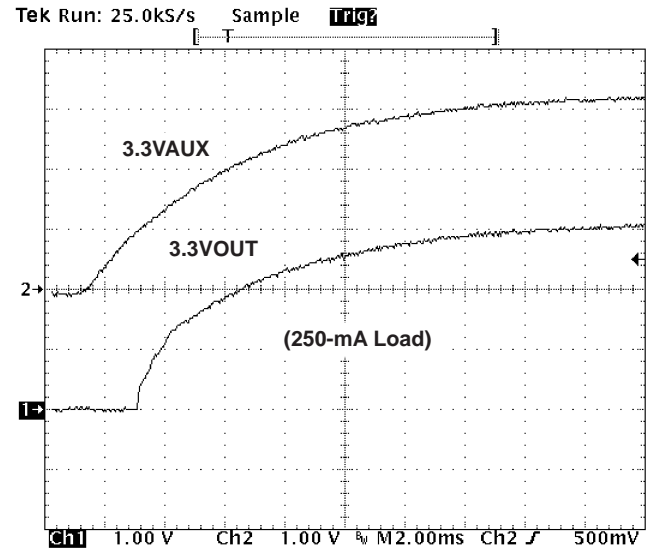


Figure 2. 3.3VAUX Cold Start

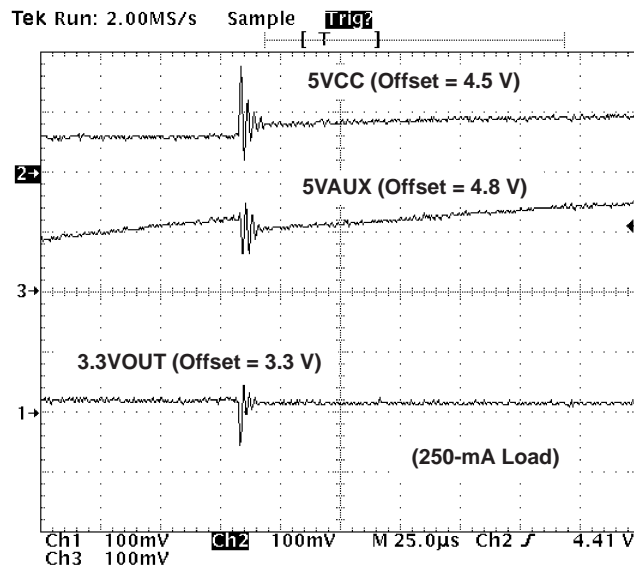


Figure 3. 5VCC Power Up (5VAUX = 5 V)

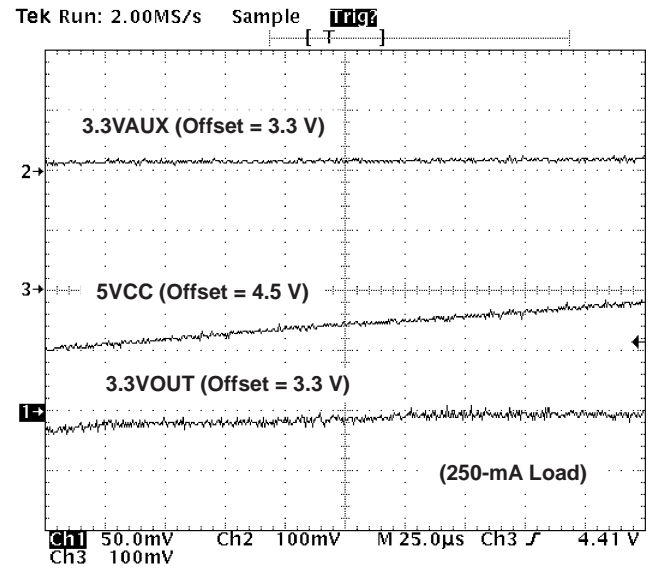


Figure 4. 5VCC Power Up (3.3VAUX = 3.3 V)

## TYPICAL CHARACTERISTICS

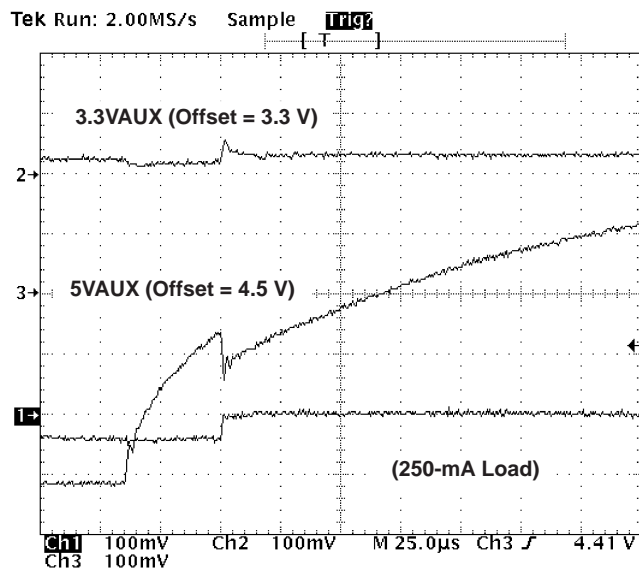


Figure 5. 5VAUX Power Up (3.3VAUX = 3.3 V)

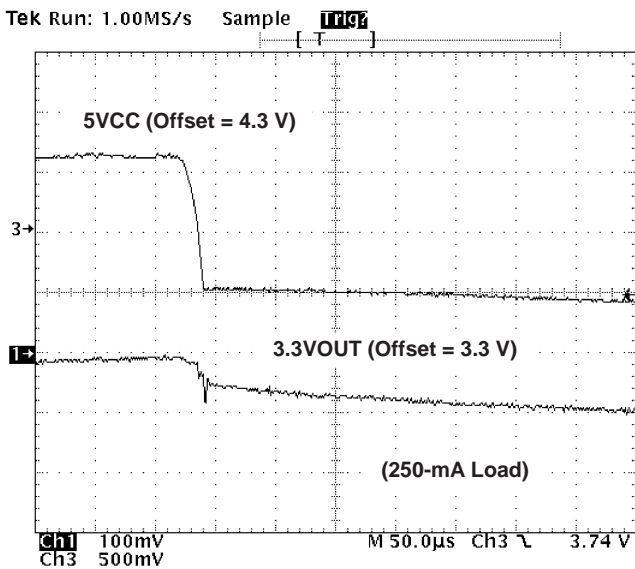


Figure 6. 5VCC Power Down (3.3VAUX = 3.3 V)

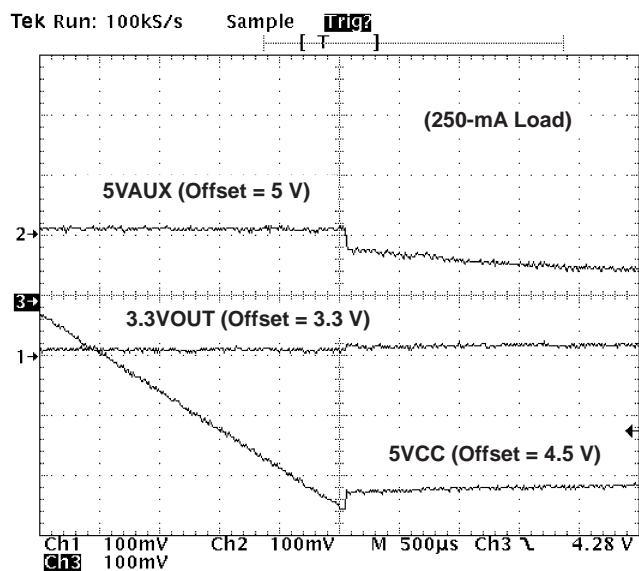


Figure 7. 5VCC Power Down (5VAUX = 5 V)

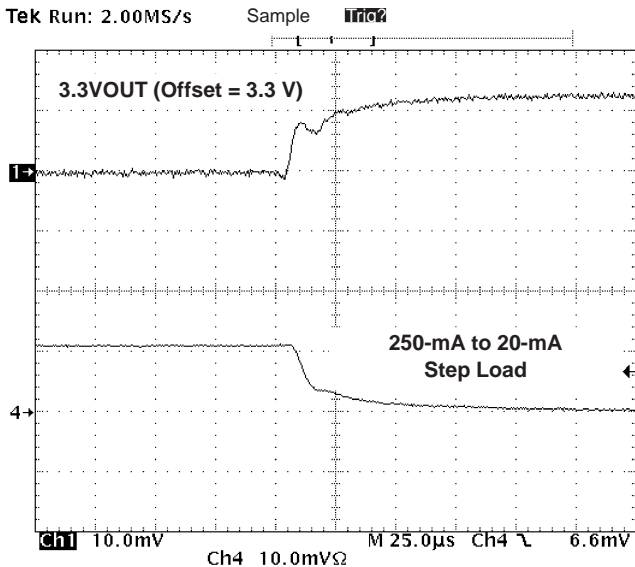
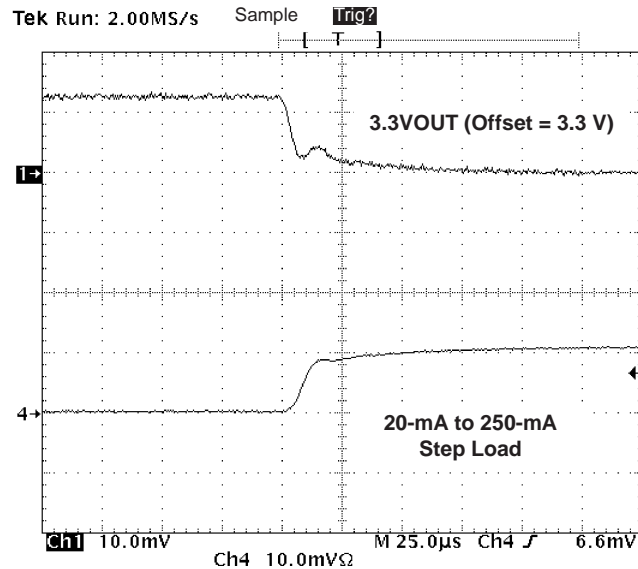


Figure 8. 5VCC Load Transient Response Falling

## TYPICAL CHARACTERISTICS



**Figure 9. 5VCC Load Transient Response Rising**

## THERMAL INFORMATION

To ensure reliable operation of the device, the junction temperature of the output device must be within the safe operating area (SOA). This is achieved by having a means to dissipate the heat generated from the junction of the output structure. There are two components that contribute to thermal resistance. They consist of two paths in series. The first is the junction to case thermal resistance,  $R_{\theta JC}$ ; the second is the case to ambient thermal resistance,  $R_{\theta CA}$ . The overall junction to ambient thermal resistance,  $R_{\theta JA}$ , is determined by:

$$R_{\theta JA} = R_{\theta JC} + R_{\theta CA}$$

The ability to efficiently dissipate the heat from the junction is a function of the package style and board layout incorporated in the application. The operating junction temperature is determined by the operating ambient temperature,  $T_A$ , and the junction power dissipation,  $P_J$ .

The junction temperature,  $T_J$ , is equal to the following thermal equation:

$$T_J = T_A + P_J (R_{\theta JC}) + P_J (R_{\theta CA})$$

$$T_J = T_A + P_J (R_{\theta JA})$$

This particular application uses the 8-pin SO package with standard lead frame with a dedicated ground terminal. Hence, the maximum power dissipation allowable for an operating ambient temperature of 70°C, and a maximum junction temperature of 150°C is determined as:

$$P_J = (T_J - T_A) / R_{\theta JA}$$

$$P_J = (150 - 70) / 176 = 0.45 \text{ W when using a low-K PCB.}$$

$$P_J = (150 - 70) / 98 = 0.81 \text{ W when using a high-K PCB.}$$

Worst case maximum power dissipation is determined by:

$$P_D = (5.5 - 3) \times 0.25 = 0.625 \text{ W}$$

Normal operating maximum power dissipation is (see Figure 10):

$$P_D = (5 - 3.3) \times 0.25 = 0.425 \text{ W}$$

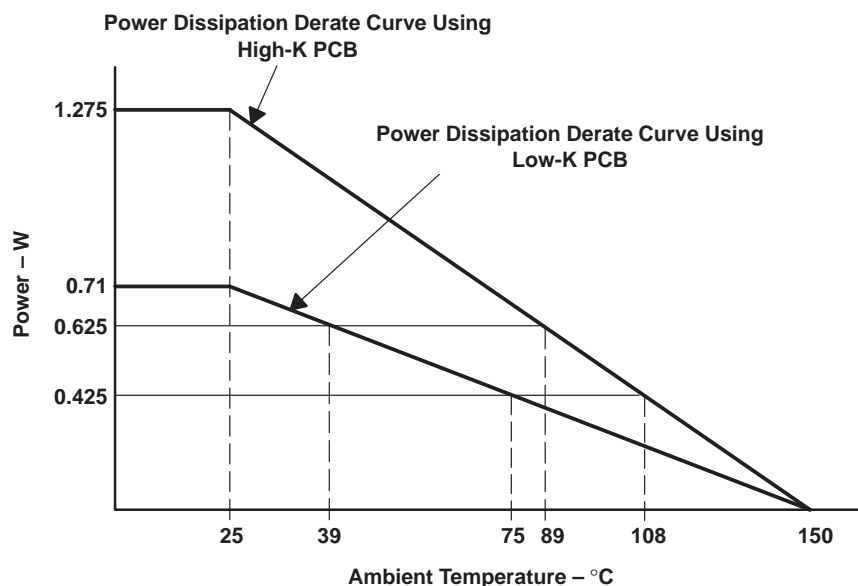
# TPPM0303

## 250-mA LOW-DROPOUT REGULATOR

### WITH AUXILIARY POWER MANAGEMENT

SLVS364 – FEBRUARY 2001

#### THERMAL INFORMATION



NOTE: These curves are to be used for guideline purposes only. For a particular application, a more specific thermal characterization is required.

Figure 10. Power Dissipation Derating Curves

#### APPLICATION INFORMATION

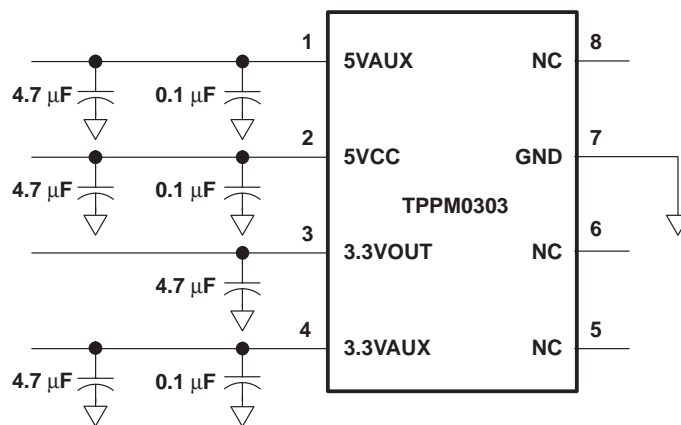


Figure 11. Typical Application Schematic

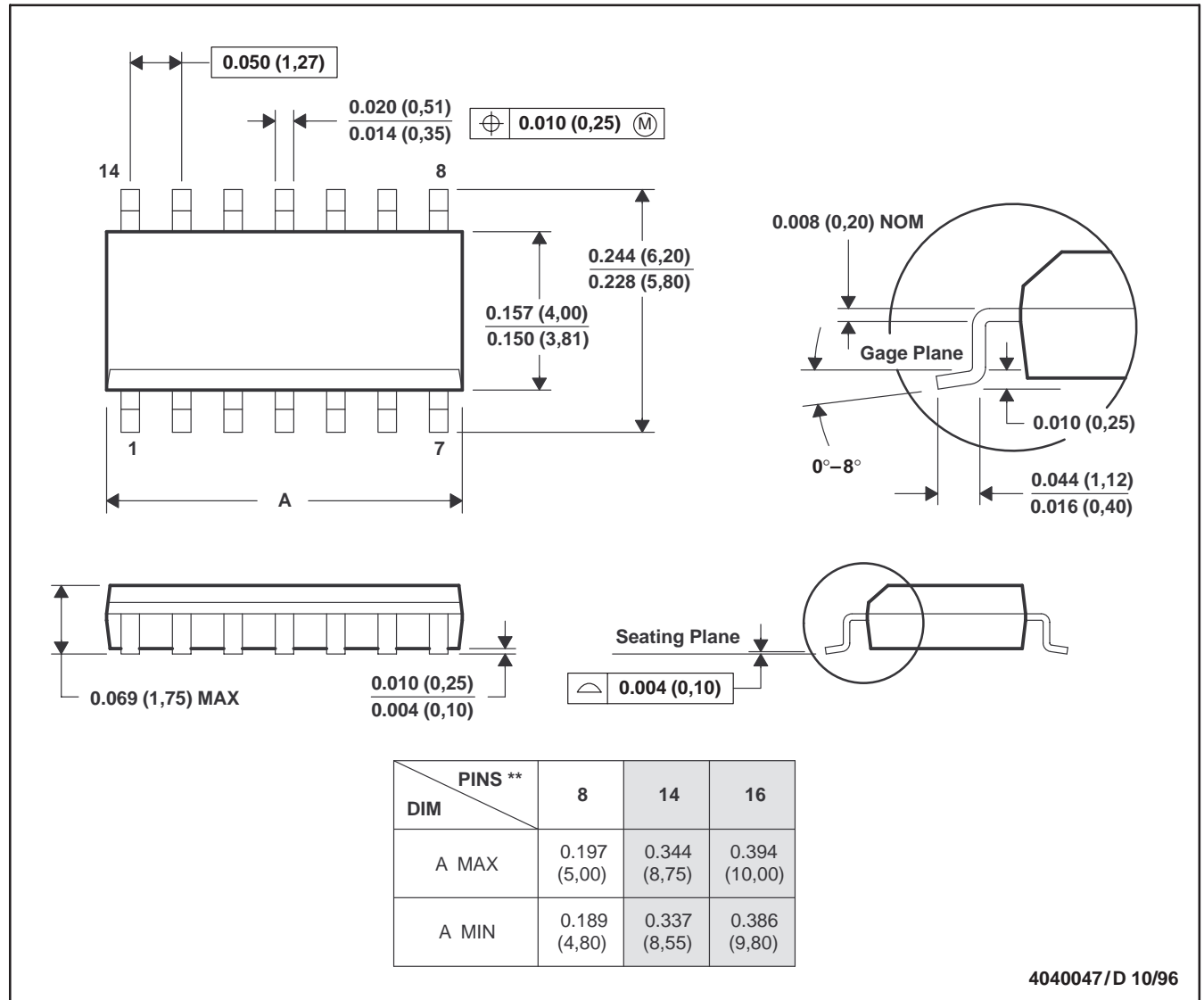


## MECHANICAL DATA

**D (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

**14 PINS SHOWN**



- 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, not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-012

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

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

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. 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 of TI covering or relating to any combination, machine, or process in which such products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, license, warranty or endorsement thereof.

Reproduction of 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. Representation or reproduction of this information with alteration voids all warranties provided for an associated TI product or service, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Resale of TI's 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, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Also see: Standard Terms and Conditions of Sale for Semiconductor Products. [www.ti.com/sc/docs/stdterms.htm](http://www.ti.com/sc/docs/stdterms.htm)

Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265

Copyright © 2001, Texas Instruments Incorporated