LP2980-N Micropower 50 mA Ultra Low-Dropout Regulator In SOT-23 Package

Check for Samples: LP2980-N

FEATURES

- **Ultra Low Dropout Voltage**
- **Output Voltage Accuracy 0.5% (A Grade)**
- **Ensured 50 mA Output Current**
- **Requires Only 1 μF External Capacitance**
- **< 1 μA Quiescent Current When Shutdown**
- **Low Ground Pin Current at all Load Currents**
- **High Peak Current Capability (150 mA Typical)**
- **Wide Supply Voltage Range (16V Max)**
- **Fast Dynamic Response to Line and Load**
- **Low Z_{OUT} Over Wide Frequency Range**
- **Over-Temperature and Over-Current Protection**
- **−40°C to +125°C Junction Temperature Range**

APPLICATIONS

- **Cellular Phone**
- **Palmtop/Laptop Computer**
- **Personal Digital Assistant (PDA)**
- **Camcorder, Personal Stereo, Camera**

DESCRIPTION

The LP2980-N is a 50 mA, fixed-output voltage regulator designed specifically to meet the requirements of battery-powered applications.

Using an optimized VIP (Vertically Integrated PNP) process, the LP2980-N delivers unequaled performance in all specifications critical to battery-powered designs:

Dropout Voltage. Typically 120 mV @ 50 mA load, and 7 mV @ 1 mA load.

Ground Pin Current. Typically 375 μA @ 50 mA load, and 80 μA @ 1 mA load.

Sleep Mode. Less than 1 μA quiescent current when ON/OFF pin is pulled low.

Minimum Part Count. Requires only 1 μF of external capacitance on the regulator output.

Precision Output. 0.5% tolerance output voltages available (A grade).

5.0V, 4.7V, 3.3V, 3.0V and 2.5V versions available as standard products.

Block Diagram

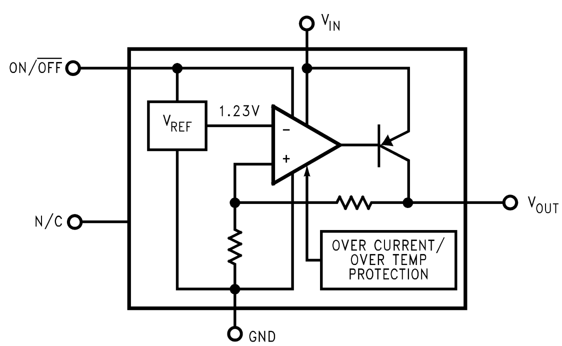


Figure 1.

Connection Diagram

Top View

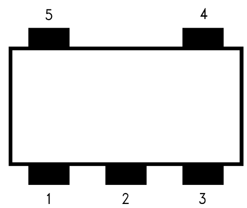


Figure 2. 5-Lead SOT-23 Package
See Package Number DBV0005A

PIN DESCRIPTIONS

Name	Pin Number	Function
V_{IN}	1	Input Voltage
GND	2	Common Ground (device substrate)
ON/OFF	3	Logic high enable input
N/C	4	Post package trim - **do not** connect to this pin
V_{OUT}	5	Regulated output voltage

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ABSOLUTE MAXIMUM RATINGS[1][2]

Storage Temperature Range	−65°C to +150°C
Operating Junction Temperature Range	−40°C to +125°C
Lead Temperature (Soldering, 5 sec.)	260°C
ESD Rating[3]	2 kV
Power Dissipation[4]	Internally Limited
Input Supply Voltage (Survival)	−0.3V to +16V
Input Supply Voltage (Operating)	2.1V to +16V
Shutdown Input Voltage (Survival)	−0.3V to +16V
Output Voltage (Survival)[5]	−0.3V to +9V
I_{OUT} (Survival)	Short Circuit Protected
Input-Output Voltage (Survival)[6]	−0.3V to +16V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its rated operating conditions.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
(3) The ESD rating of pins 3 and 4 for the SOT-23 package is 1 kV.
(4) The maximum allowable power dissipation is a function of the maximum junction temperature, $T_{J(MAX)}$, the junction-to-ambient thermal resistance, θ_{JA}, and the ambient temperature, T_A. The maximum allowable power dissipation at any ambient temperature is calculated using:

$$P(MAX) = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

The value of θ_{JA} for the SOT-23 package is 220°C/W. Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown.
(5) If used in a dual-supply system where the regulator load is returned to a negative supply, the LP2980-N output must be diode-clamped to ground.
(6) The output PNP structure contains a diode between the V_{IN} and V_{OUT} terminals that is normally reverse-biased. Reversing the polarity from V_{IN} to V_{OUT} will turn on this diode (See REVERSE CURRENT PATH).

ELECTRICAL CHARACTERISTICS

Limits in standard typeface are for T_J = 25°C, and limits in **boldface type** apply over the full operating temperature range. Unless otherwise specified: $V_{IN} = V_{O(NOM)}$ + 1V, I_L = 1 mA, C_{OUT} = 1 µF, $V_{ON/OFF}$ = 2V.

Symbol	Parameter	Conditions	Typ	LP2980AI-XX[1]		LP2980I-XX[1]		Units
				Min	Max	Min	Max	
ΔV_O	Output Voltage Tolerance	I_L = 1 mA		−0.50	0.50	−1.0	1.0	$\%V_{NOM}$
		1 mA < I_L < 50 mA		−0.75 **−2.5**	0.75 **2.5**	−1.5 **−3.5**	1.5 **3.5**	
$\frac{\Delta V_O}{\Delta V_{IN}}$	Output Voltage Line Regulation	$V_{O(NOM)}$ + 1V ≤ V_{IN} ≤ 16V	0.007		0.014 **0.032**		0.014 **0.032**	%/V
$V_{IN}–V_O$	Dropout Voltage[2]	I_L = 0	1		3 **5**		3 **5**	mV
		I_L = 1 mA	7		10 **15**		10 **15**	
		I_L = 10 mA	40		60 **90**		60 **90**	
		I_L = 50 mA	120		150 **225**		150 **225**	

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate Average Outgoing Quality Level (AOQL).
(2) Dropout voltage is defined as the input to output differential at which the output voltage drops 100 mV below the value measured with a 1V differential.

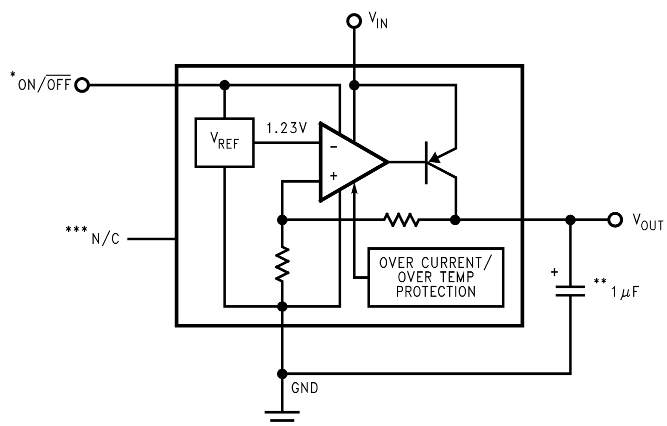
ELECTRICAL CHARACTERISTICS (continued)

Limits in standard typeface are for T_J = 25°C, and limits in **boldface type** apply over the full operating temperature range. Unless otherwise specified: $V_{IN} = V_{O(NOM)}$ + 1V, I_L = 1 mA, C_{OUT} = 1 µF, $V_{ON/OFF}$ = 2V.

Symbol	Parameter	Conditions	Typ	LP2980AI-XX (1)		LP2980I-XX (1)		Units
				Min	Max	Min	Max	
I_{GND}	Ground Pin Current	I_L = 0	65		95 **125**		95 **125**	µA
		I_L = 1 mA	80		110 **170**		110 **170**	
		I_L = 10 mA	140		220 **460**		220 **460**	
		I_L = 50 mA	375		600 **1200**		600 **1200**	
		$V_{ON/OFF}$ < 0.18V	0		**1**		**1**	
$V_{ON/OFF}$	ON/OFF Input Voltage (3)	High = O/P ON	1.4	**1.6**		**1.6**		V
		Low = O/P OFF	0.55		**0.18**		**0.18**	
$I_{ON/OFF}$	ON/OFF Input Current	$V_{ON/OFF}$ = 0	0		**−1**		**−1**	µA
		$V_{ON/OFF}$ = 5V	5		**15**		**15**	
$I_{O(PK)}$	Peak Output Current	$V_{OUT} \geq V_{O(NOM)}$ − 5%	150	100		100		mA
e_n	Output Noise Voltage (RMS)	BW = 300 Hz–50 kHz, C_{OUT} = 10 µF	160					µV
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Ripple Rejection	f = 1 kHz C_{OUT} = 10 µF	63					dB
$I_{O(MAX)}$	Short Circuit Current	R_L = 0 (Steady State) (4)	150					mA

(3) The ON/OFF inputs must be properly driven to prevent misoperation. For details, refer to ON/OFF INPUT OPERATION.
(4) See related curve(s) in TYPICAL PERFORMANCE CHARACTERISTICS section.

Typical Application Circuit



*ON/OFF input must be actively terminated. Tie to V_{IN} if this function is not to be used.
**Minimum Output Capacitance is 1 µF to insure stability over full load current range. More capacitance provides superior dynamic performance and additional stability margin (see APPLICATION HINTS).
***Do not make connections to this pin.

Figure 3.

TYPICAL PERFORMANCE CHARACTERISTICS

Unless otherwise specified: T_A = 25°C, $V_{IN} = V_{O(NOM)}$ + 1V, C_{OUT} = 2.2 µF, all voltage options, ON/$\overline{OFF}$ pin tied to V_{IN}.

Output Voltage vs Temperature

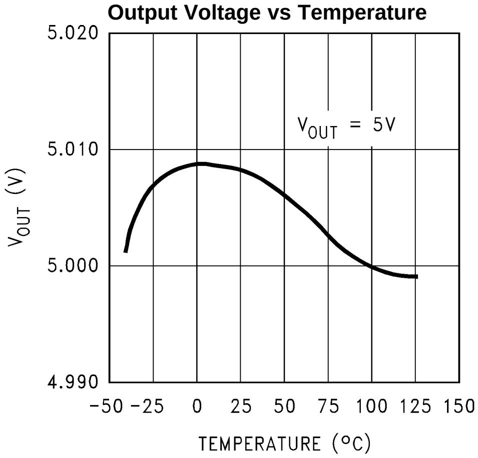


Figure 4.

Output Voltage vs Temperature

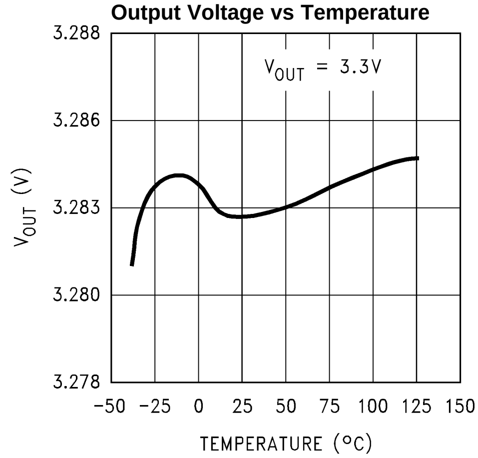


Figure 5.

Output Voltage vs Temperature

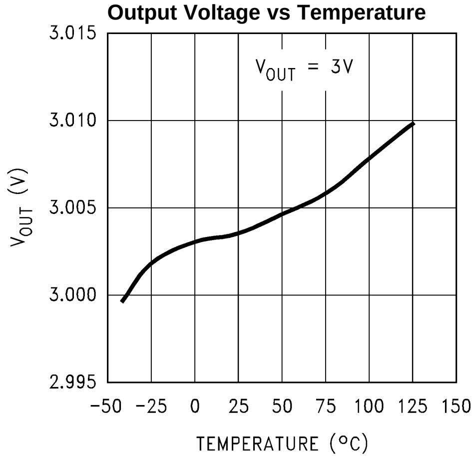


Figure 6.

Dropout Characteristics

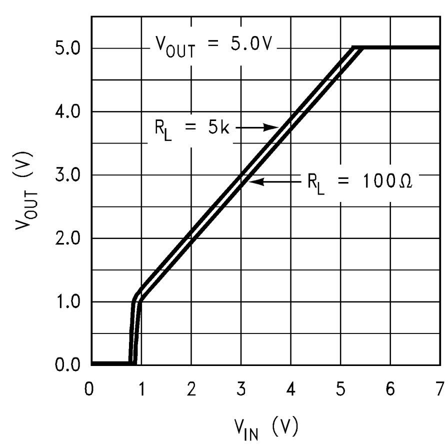


Figure 7.

Dropout Characteristics

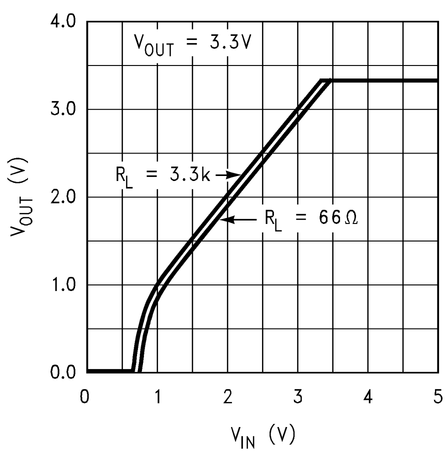


Figure 8.

Dropout Characteristics

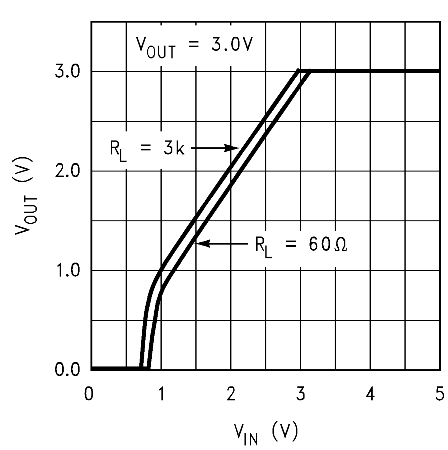


Figure 9.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Unless otherwise specified: T_A = 25°C, $V_{IN} = V_{O(NOM)}$ + 1V, C_{OUT} = 2.2 µF, all voltage options, ON/$\overline{OFF}$ pin tied to V_{IN}.

Dropout Voltage vs Temperature

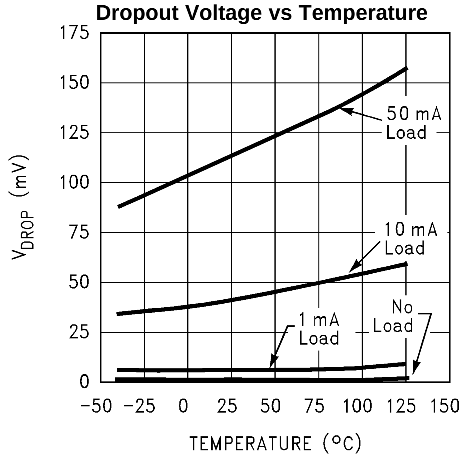


Figure 10.

Dropout Voltage vs Load Current

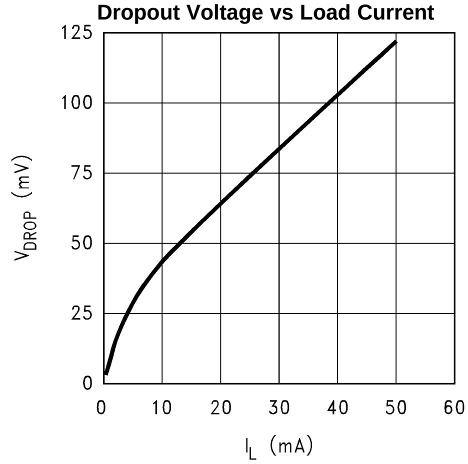


Figure 11.

Ground Pin Current vs Temperature

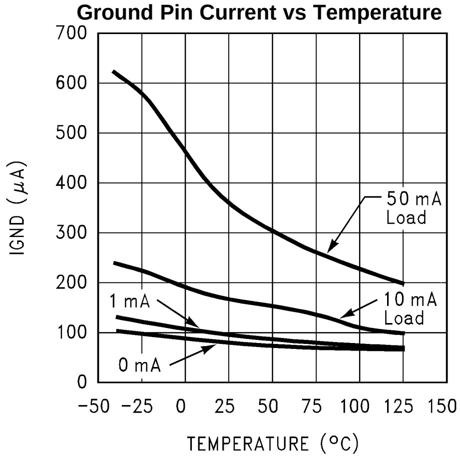


Figure 12.

Ground Pin Current vs Load Current

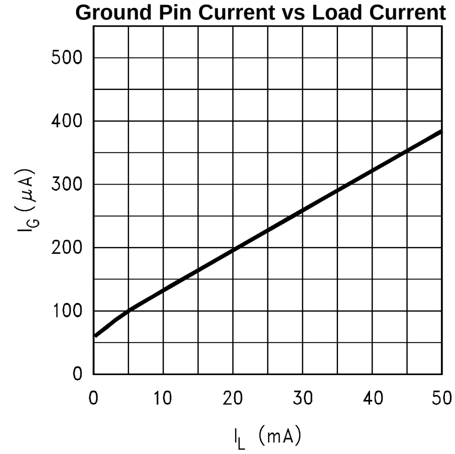


Figure 13.

Input Current vs V_{IN}

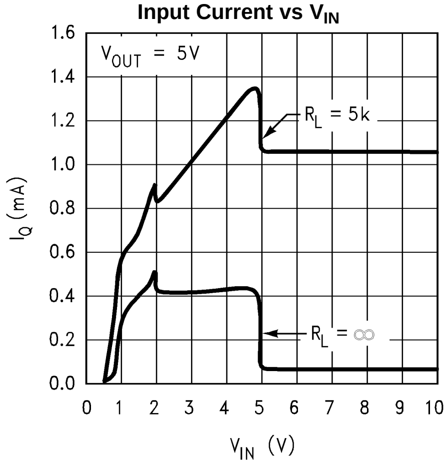


Figure 14.

Input Current vs V_{IN}

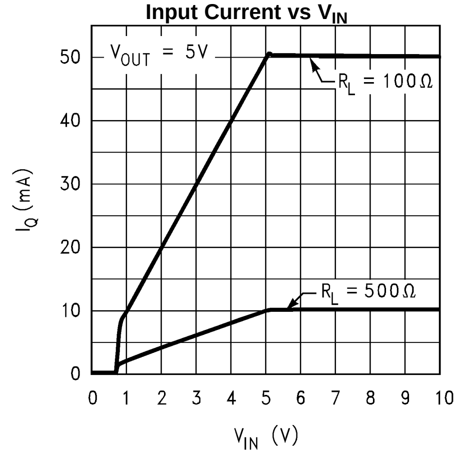


Figure 15.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Unless otherwise specified: T_A = 25°C, $V_{IN} = V_{O(NOM)}$ + 1V, C_{OUT} = 2.2 µF, all voltage options, ON/$\overline{OFF}$ pin tied to V_{IN}.

Line Transient Response

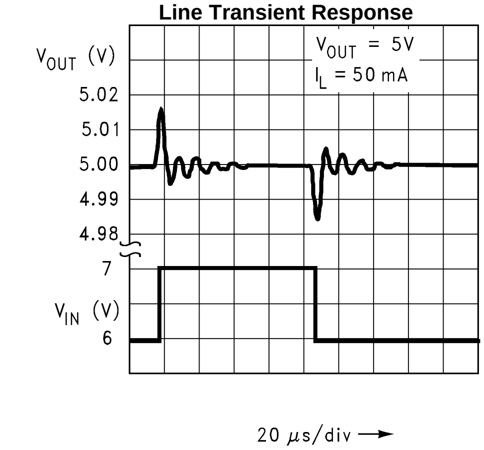


Figure 16.

Line Transient Response

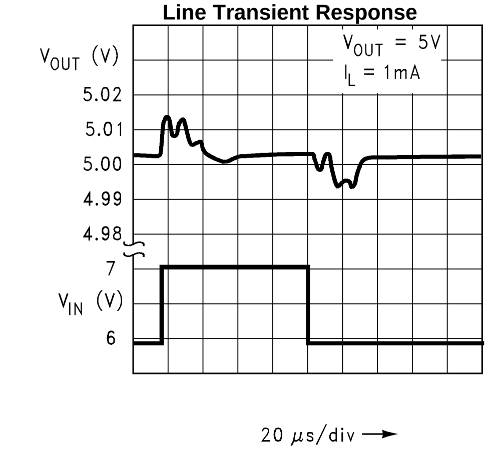


Figure 17.

Load Transient Response

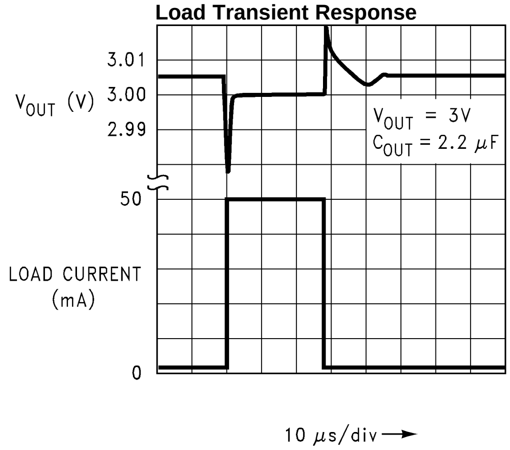


Figure 18.

Load Transient Response

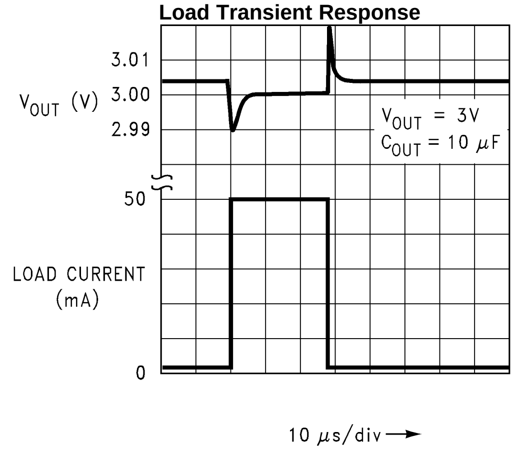


Figure 19.

Load Transient Response

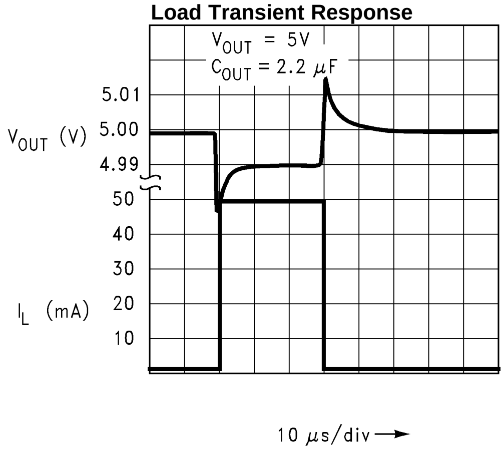


Figure 20.

Load Transient Response

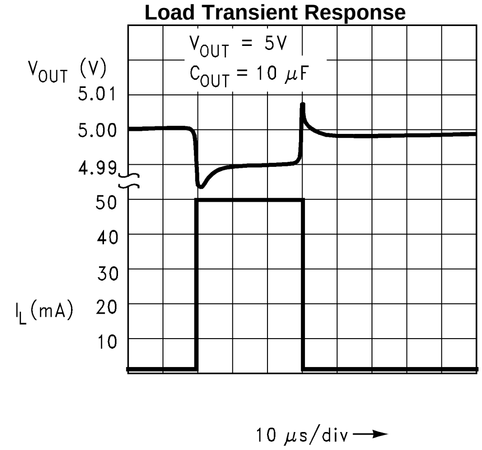


Figure 21.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Unless otherwise specified: T_A = 25°C, V_{IN} = $V_{O(NOM)}$ + 1V, C_{OUT} = 2.2 µF, all voltage options, ON/$\overline{OFF}$ pin tied to V_{IN}.

Short Circuit Current

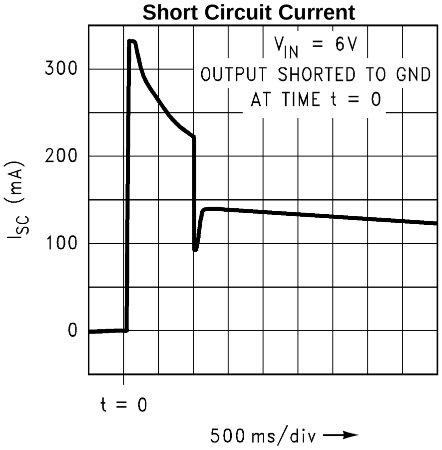


Figure 22.

Instantaneous Short Circuit Current vs Temperature

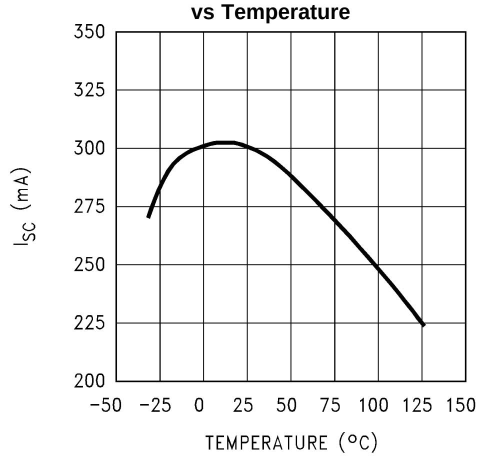


Figure 23.

Short Circuit Current

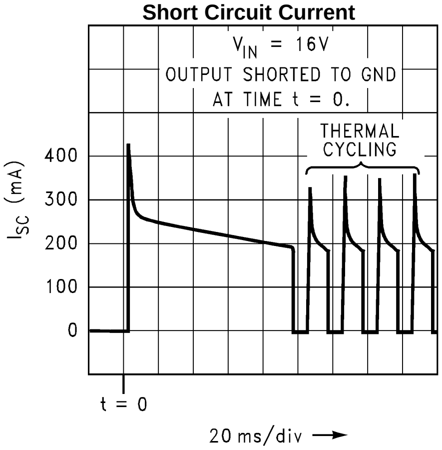


Figure 24.

Output Impedance vs Frequency

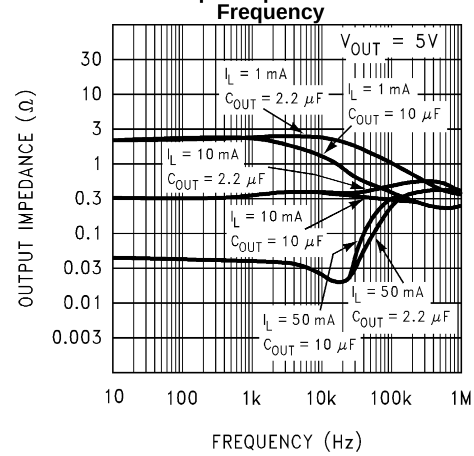


Figure 25.

Output Impedance vs Frequency

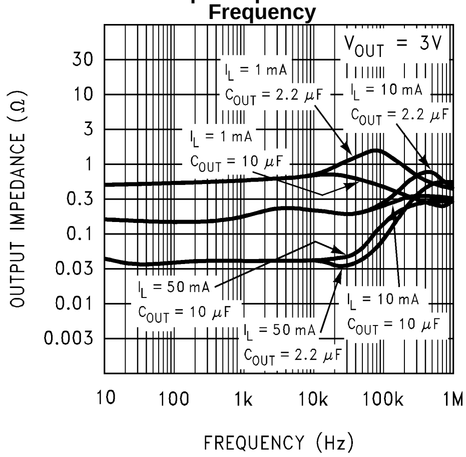


Figure 26.

Output Noise Density

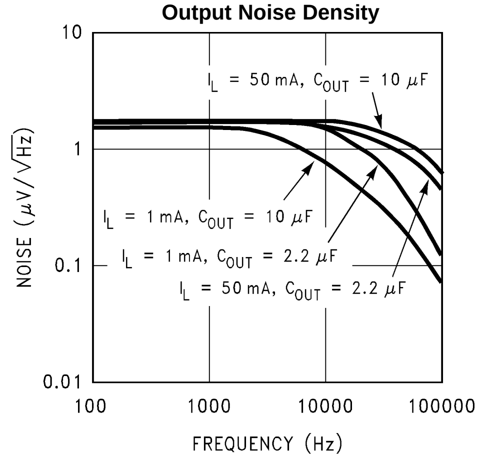


Figure 27.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Unless otherwise specified: T_A = 25°C, V_{IN} = $V_{O(NOM)}$ + 1V, C_{OUT} = 2.2 µF, all voltage options, ON/$\overline{OFF}$ pin tied to V_{IN}.

Ripple Rejection

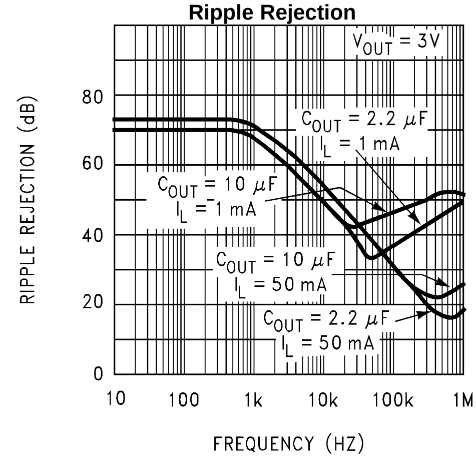


Figure 28.

Input to Output Leakage vs Temperature

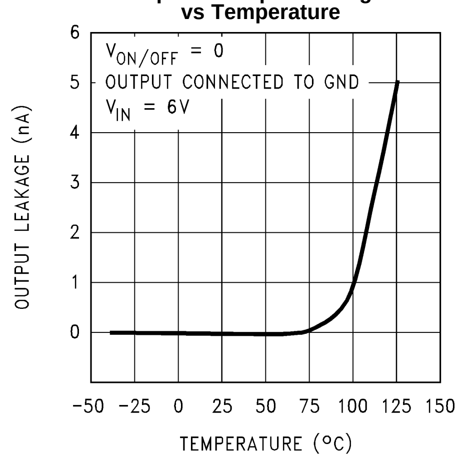


Figure 29.

Output Reverse Leakage vs Temperature

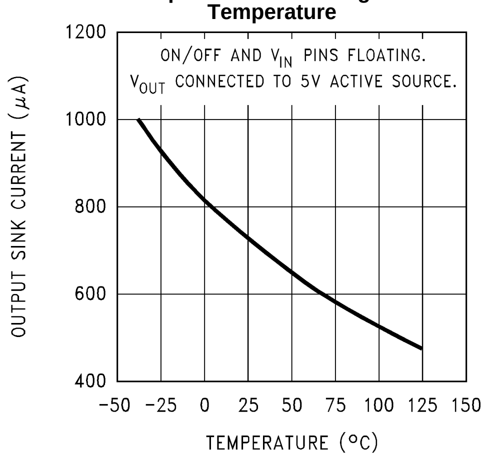


Figure 30.

Turn-On Waveform

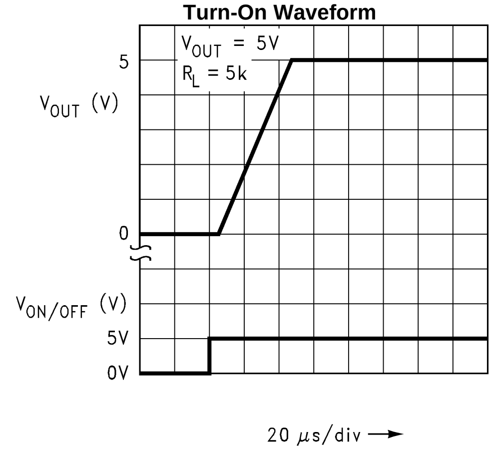


Figure 31.

Turn-Off Waveform

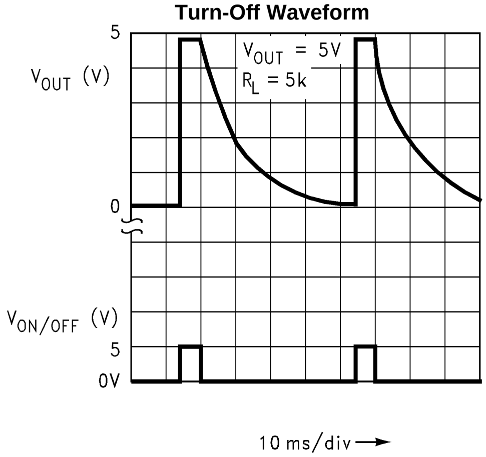


Figure 32.

ON/OFF Pin Current vs $V_{ON/OFF}$

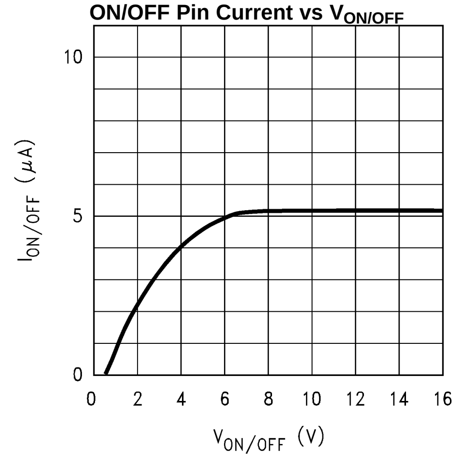


Figure 33.

APPLICATION HINTS

OUTPUT CAPACITOR

Like any low-dropout regulator, the LP2980-N requires an output capacitor to maintain regulator loop stability. This capacitor must be selected to meet the requirements of minimum capacitance and equivalent series resistance (ESR) range. It is not difficult to find capacitors which meet the criteria of the LP2980-N, as the acceptable capacitance and ESR ranges are wider than for most other LDOs.

In general, the capacitor value must be at least 1 μF (over the actual ambient operating temperature), and the ESR must be within the range indicated in Figure 34, Figure 35 and Figure 36. It should be noted that, although a maximum ESR is shown in these Figures, it is very unlikely to find a capacitor with ESR that high.

Tantalum Capacitors

Surface-mountable solid tantalum capacitors offer a good combination of small physical size for the capacitance value, and ESR in the range needed by the LP2980-N.

The results of testing the LP2980-N stability with surface-mount solid tantalum capacitors show good stability with values of at least 1 μF. The value can be increased to 2.2 μF (or more) for even better performance, including transient response and noise.

Small value tantalum capacitors that have been verified as suitable for use with the LP2980-N are shown in Table 1. Capacitance values can be increased without limit.

Aluminum Electrolytic Capacitors

Although probably not a good choice for a production design, because of relatively large physical size, an aluminum electrolytic capacitor can be used in the design prototype for an LP2980-N regulator. A value of at least 1 μF should be used, and the ESR must meet the conditions of Figure 34, Figure 35 and Figure 36. If the operating temperature drops below 0°C, the regulator may not remain stable, as the ESR of the aluminum electrolytic capacitor will increase, and may exceed the limits indicated in the Figures.

Table 1. Surface-Mount Tantalum Capacitor Selection Guide

1 μF Surface-Mount Tantalums	
Manufacturer	**Part Number**
Kemet	T491A105M010AS
NEC	NRU105M10
Siemens	B45196-E3105-K
Nichicon	F931C105MA
Sprague	293D105X0016A2T
2.2 μF Surface-Mount Tantalums	
Manufacturer	**Part Number**
Kemet	T491A225M010AS
NEC	NRU225M06
Siemens	B45196/2.2/10/10
Nichicon	F930J225MA
Sprague	293D225X0010A2T

Multilayer Ceramic Capacitors

Surface-mountable multilayer ceramic capacitors may be an attractive choice because of their relatively small physical size and excellent RF characteristics. However, they sometimes have ESR values lower than the minimum required by the LP2980-N, and relatively large capacitance change with temperature. The manufacturer's datasheet for the capacitor should be consulted before selecting a value.

Test results of LP2980-N stability using multilayer ceramic capacitors show that a minimum value of 2.2 μF is usually needed for the 5V regulator. For the lower output voltages, or for better performance, a higher value should be used, such as 4.7 μF.

Multilayer ceramic capacitors that have been verified as suitable for use with the LP2980-N are shown in Table 2.

Table 2. Surface-Mount Multilayer Ceramic Capacitor Selection Guide

2.2 µF Surface-Mount Ceramic	
Manufacturer	**Part Number**
Tokin	1E225ZY5U-C203
Murata	GRM42-6Y5V225Z16
4.7 µF Surface-Mount Ceramic	
Manufacturer	**Part Number**
Tokin	1E475ZY5U-C304

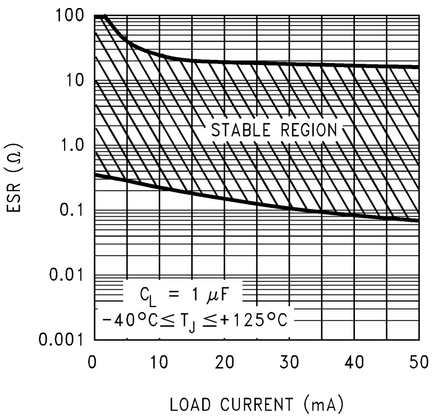


Figure 34. 1 µF ESR Range

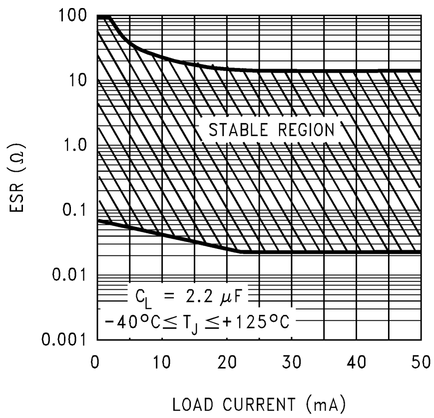


Figure 35. 2.2 µF ESR Range

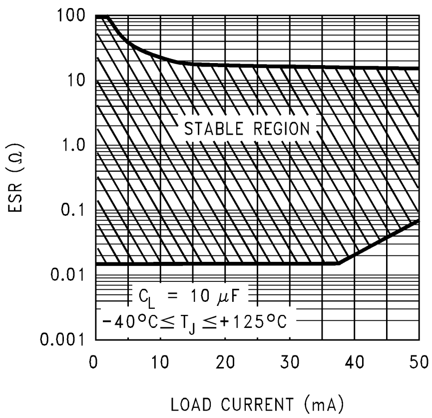


Figure 36. 10 µF ESR Range

REVERSE CURRENT PATH

The internal PNP power transistor used as the pass element in the LP2980-N has an inherent diode connected between the regulator output and input. During normal operation (where the input voltage is higher than the output) this diode is reverse biased (See Figure 37).

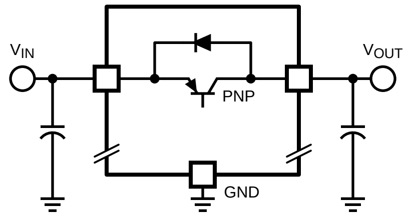


Figure 37. LP2980 Reverse Current Path

However, if the input voltage is more than a V_{BE} below the output voltage, this diode will turn ON and current will flow into the regulator output. In such cases, a parasitic SCR can latch which will allow a high current to flow into the V_{IN} pin and out the ground pin, which can damage the part.

The internal diode can also be turned on if the input voltage is abruptly stepped down to a voltage which is a V_{BE} below the output voltage.

In any application where the output voltage may be higher than the input voltage, an external Schottky diode must be connected from V_{IN} to V_{OUT} (cathode on V_{IN}, anode on V_{OUT}. See Figure 38), to limit the reverse voltage across the LP2980-N to 0.3V (See ABSOLUTE MAXIMUM RATINGS).

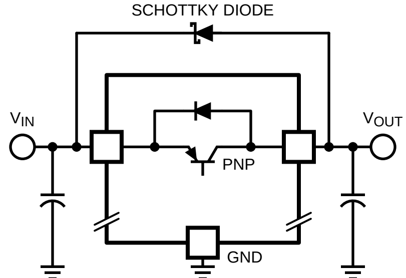


Figure 38. Adding External Schottky Diode Protection

ON/OFF INPUT OPERATION

The LP2980-N is shut off by pulling the ON/OFF input low, and turned on by driving the input high. If this feature is not to be used, the ON/OFF input should be tied to V_{IN} to keep the regulator on at all times (the ON/OFF input must **not** be left floating).

To ensure proper operation, the signal source used to drive the ON/OFF input must be able to swing above and below the specified turn-on/turn-off voltage thresholds which ensure an ON or OFF state (see ELECTRICAL CHARACTERISTICS).

The ON/OFF signal may come from either a totem-pole output, or an open-collector output with pull-up resistor to the LP2980-N input voltage or another logic supply. The high-level voltage may exceed the LP2980-N input voltage, but must remain within the Absolute Maximum Ratings for the ON/OFF pin.

It is also important that the turn-on/turn-off voltage signals applied to the ON/OFF input have a slew rate which is greater than 40 mV/μs.

IMPORTANT: The regulator shutdown function will not operate correctly if a slow-moving signal is used to drive the ON/OFF input.

Increasing Output Current

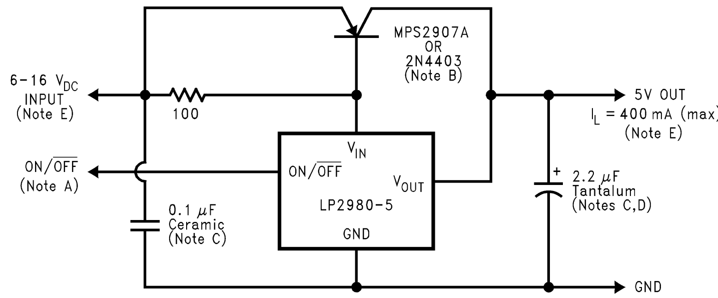


Figure 39. 5V/400mA Regulator

The LP2980-N can be used to control higher-current regulators, by adding an external PNP pass device. With the PNP transistors shown in Figure 39, the output current can be as high as 400 mA, as long as the input voltage is held within the Safe Operation Boundary Curves shown below in Figure 40.

To ensure regulation, the minimum input voltage of this regulator is 6V. This “headroom” is the sum of the V_{BE} of the external transistor and the dropout voltage of the LP2980-N.

Notes:

1. Drive this input with a logic signal (see APPLICATION HINTS). If the shutdown function is not to be used, tie the ON/OFF pin directly to the V_{IN} pin.
2. Recommended devices (other PNP transistors can be used if the current gain and voltage ratings are similar).
3. Capacitor is required for regulator stability. Minimum size is shown, and may be increased without limit.
4. Increasing the output capacitance improves transient response and increases phase margin.
5. Maximum safe input voltage and load current are limited by power dissipation in the PNP pass transistor and the maximum ambient temperature for the specific application. If a TO-92 transistor such as the MPS2907A is used, the thermal resistance from junction-to-ambient is 180°C/W in still air.

Assuming a maximum allowable junction temperature of 150°C for the MPS2907A device, the following curves show the maximum V_{IN} and I_L values that may be safely used for several ambient temperatures.

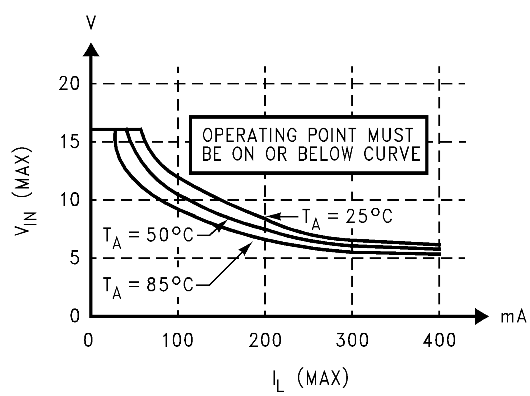


Figure 40. Safe Operation Boundary Curves for Figure 39

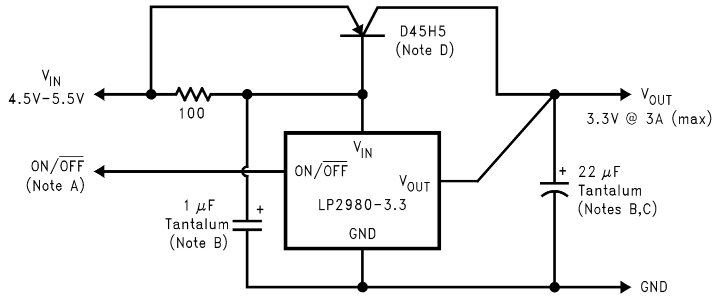


Figure 41. 5V to 3.3V @ 3A Converter

With limited input voltage range, the LP2980-N can control a 3.3V, 3A regulator with the use of a high current-gain external PNP pass transistor as shown in Figure 41. If the regulator is to be loaded with the full 3A, heat sinking will be required on the pass transistor to keep it within its rated temperature range. Refer to Figure 42 . For best load regulation at the high load current, the LP2980-N output voltage connection should be made as close to the load as possible.

Although this regulator can handle a much higher load current than can the LP2980-N alone, it can be shut down in the same manner as the LP2980-N. When the ON/OFF control is brought low, the converter will be in shutdown, and will draw less than 1 µA from the source.

Notes:

1. Drive this input with a logic signal (see APPLICATION HINTS). If the shutdown function is not to be used, tie the ON/OFF pin directly to the V_{IN} pin.
2. Capacitor is required for regulator stability. Minimum size is shown, and may be increased without limit.
3. Increasing the output capacitance improves transient response and increases phase margin.
4. A heatsink may be required for this transistor. The maximum allowable value for thermal resistance of the heatsink is dependent on ambient temperature and load current (see curves in Figure 42). Once the value is obtained from the graph, a heatsink must be selected which has a thermal resistance equal to or lower than this value. If the value is above 60°C/W, no heatsink is required (the TO-220 package alone will safely dissipate this).

For these curves, a maximum junction temperature of 150°C is assumed for the pass transistor. The case-to-heatsink attachment thermal resistance is assumed to be 1.5°C/W. All calculations are for 5.5V input voltage (which is worst-case for power dissipation).

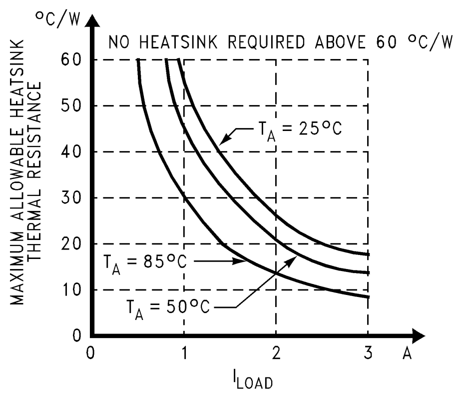


Figure 42. Heatsink Thermal Resistance Requirements for Figure 41

REVISION HISTORY

Changes from Revision L (April 2013) to Revision M	Page
• Changed layout of National Data Sheet to TI format	14

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LP2980AIM5-2.5	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L0NA	
LP2980AIM5-2.5/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L0NA	Samples
LP2980AIM5-3.0	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L02A	
LP2980AIM5-3.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L02A	Samples
LP2980AIM5-3.3	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L00A	
LP2980AIM5-3.3/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L00A	Samples
LP2980AIM5-4.7/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L37A	Samples
LP2980AIM5-5.0	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L01A	
LP2980AIM5-5.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L01A	Samples
LP2980AIM5X-2.5	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L0NA	
LP2980AIM5X-2.5/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L0NA	Samples
LP2980AIM5X-3.0	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L02A	
LP2980AIM5X-3.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L02A	Samples
LP2980AIM5X-3.3	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L00A	
LP2980AIM5X-3.3/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L00A	Samples
LP2980AIM5X-4.7	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L37A	
LP2980AIM5X-4.7/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L37A	Samples
LP2980AIM5X-5.0	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L01A	
LP2980AIM5X-5.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L01A	Samples
LP2980IM5-2.5/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L0NB	Samples
LP2980IM5-3.0	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L02B	

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LP2980IM5-3.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L02B	Samples
LP2980IM5-3.3	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L00B	
LP2980IM5-3.3/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L00B	Samples
LP2980IM5-3.8/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L21B	Samples
LP2980IM5-4.7/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L37B	Samples
LP2980IM5-5.0	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	L01B	
LP2980IM5-5.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L01B	Samples
LP2980IM5X-2.5	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L0NB	
LP2980IM5X-2.5/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L0NB	Samples
LP2980IM5X-3.0	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L02B	
LP2980IM5X-3.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L02B	Samples
LP2980IM5X-3.3	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L00B	
LP2980IM5X-3.3/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L00B	Samples
LP2980IM5X-4.7/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L37B	Samples
LP2980IM5X-5.0	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	L01B	
LP2980IM5X-5.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	L01B	Samples

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

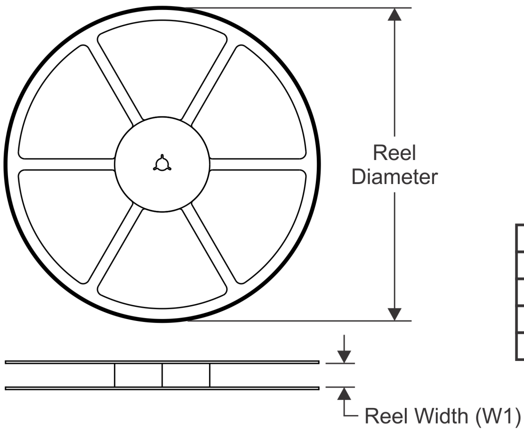
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

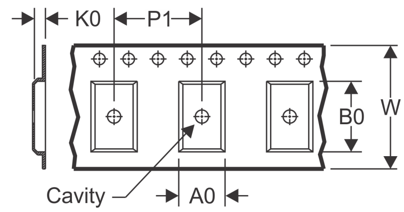
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

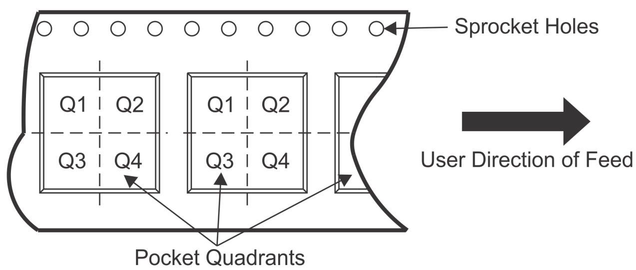


TAPE DIMENSIONS



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

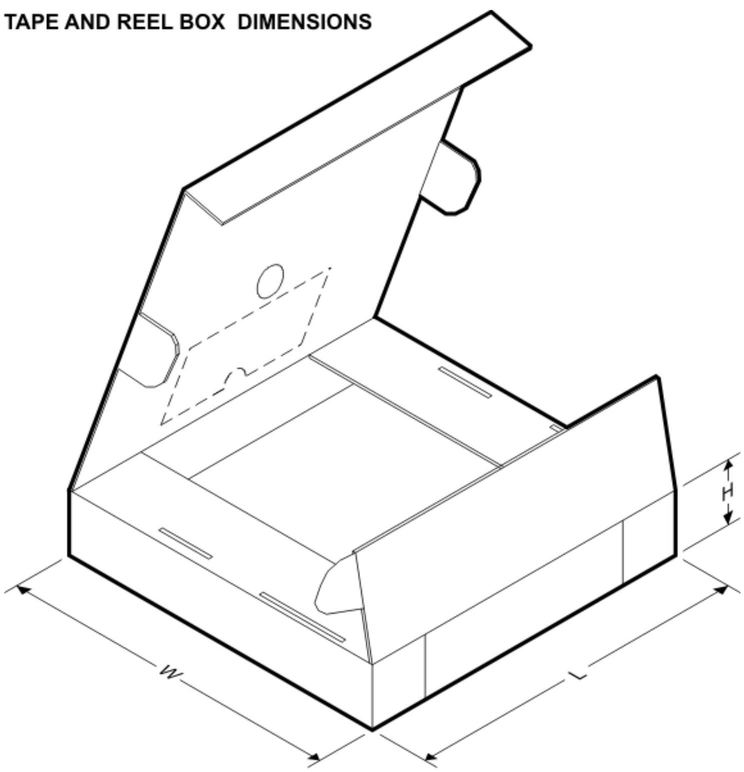


*All dimensions are nominal

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
LP2980AIM5-2.5	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-2.5/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-3.0	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-3.0/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-3.3	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-3.3/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-4.7/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-5.0	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5-5.0/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-2.5	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-2.5/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-3.0	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-3.0/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-3.3	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-3.3/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-4.7	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-4.7/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980AIM5X-5.0	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

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
LP2980AIM5X-5.0/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-2.5/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-3.0	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-3.0/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-3.3	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-3.8/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-4.7/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-5.0	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5-5.0/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-2.5	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-2.5/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-3.0	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-3.0/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-3.3	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-4.7/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-5.0	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP2980IM5X-5.0/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

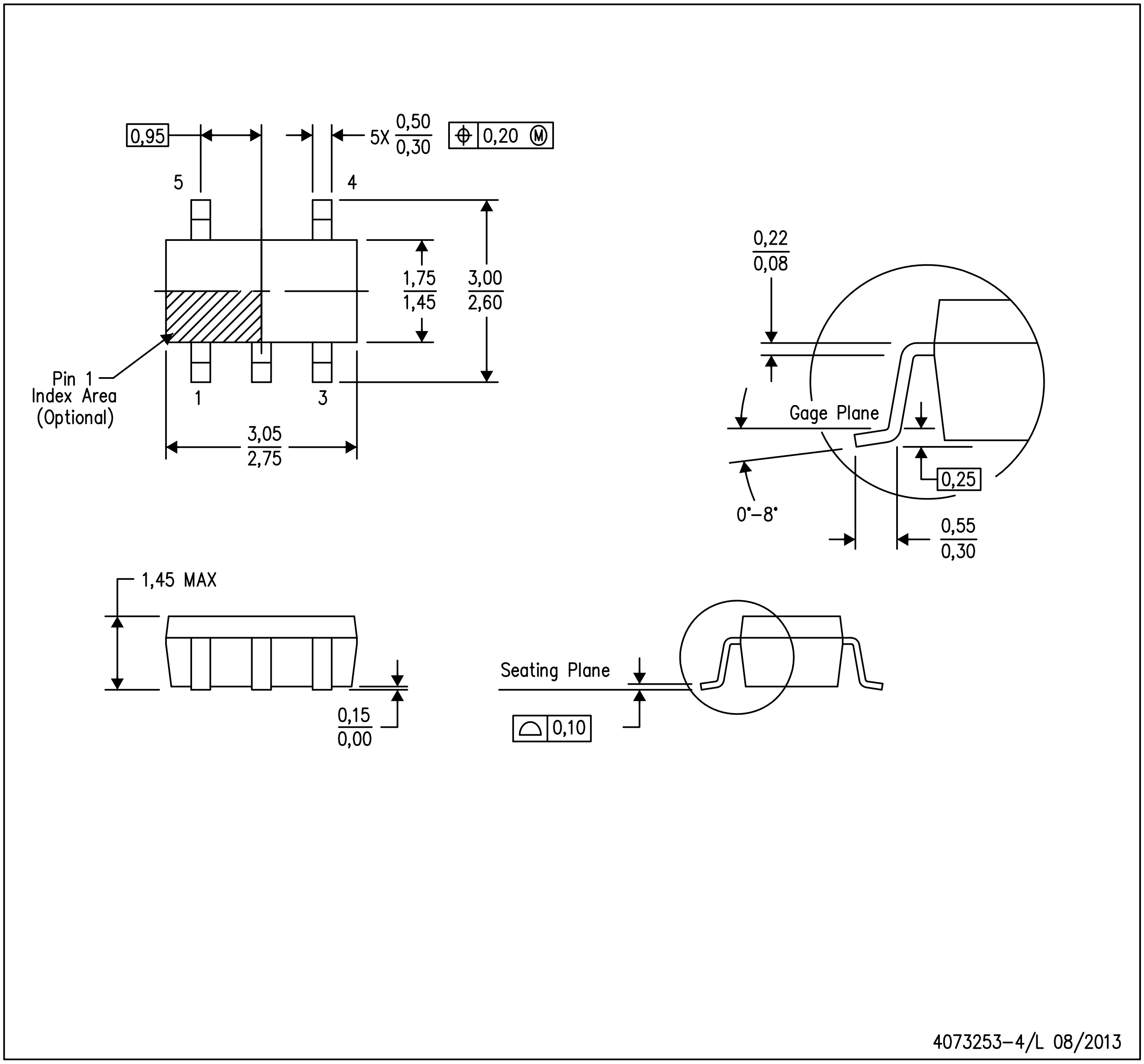
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

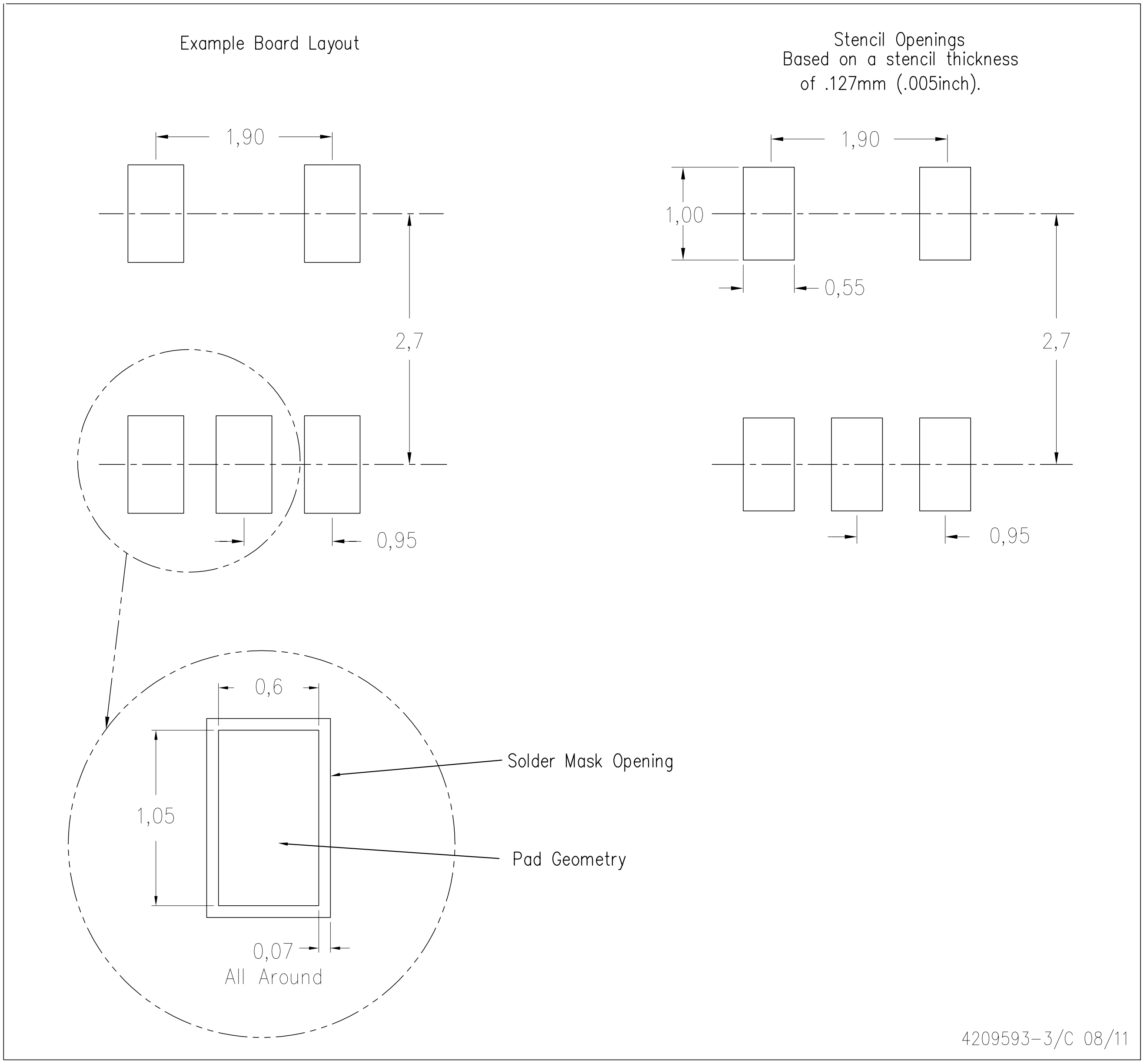
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LP2980AIM5-2.5	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-2.5/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-3.0	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-3.0/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-3.3	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-3.3/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-4.7/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-5.0	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5-5.0/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980AIM5X-2.5	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-2.5/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-3.0	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-3.0/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-3.3	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-3.3/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-4.7	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-4.7/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-5.0	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980AIM5X-5.0/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5-2.5/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-3.0	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-3.0/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-3.3	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-3.8/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-4.7/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-5.0	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5-5.0/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP2980IM5X-2.5	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-2.5/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-3.0	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-3.0/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-3.3	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-4.7/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-5.0	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP2980IM5X-5.0/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0

DBV (R-PDSO-G5) PLASTIC SMALL-OUTLINE 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 and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO-178 Variation AA.

DBV (R-PDSO-G5) PLASTIC SMALL OUTLINE



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. 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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

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 relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
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
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

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