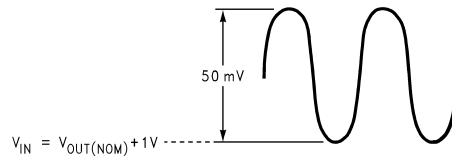


**Figure 1. Line Transient Input Test Signal**



**Figure 2. PSRR Input Test Signal**







Typical Performance Characteristics (continued)

Unless otherwise specified,  $C_{IN} = C_{OUT} = 1 \mu\text{F}$  ceramic,  $C_{BYPASS} = 0.01 \mu\text{F}$ ,  $V_{IN} = V_{OUT} + 0.2 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ , EN pin is tied to  $V_{IN}$ .

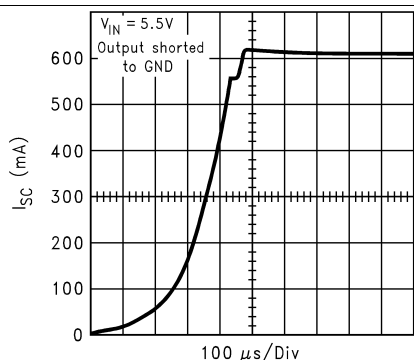


Figure 15. Short Circuit Current (DSBGA)

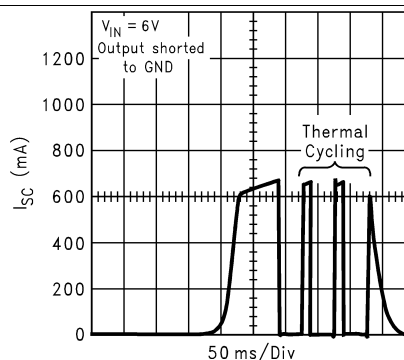


Figure 16. Short Circuit Current (DSBGA)

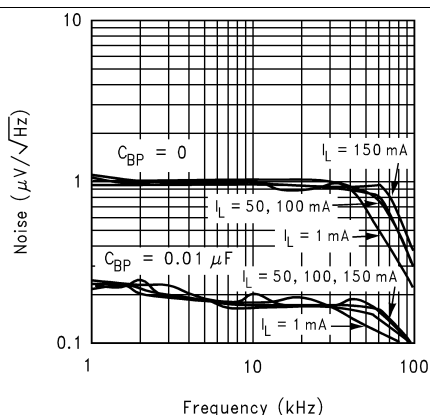


Figure 17. Output Noise Spectral Density

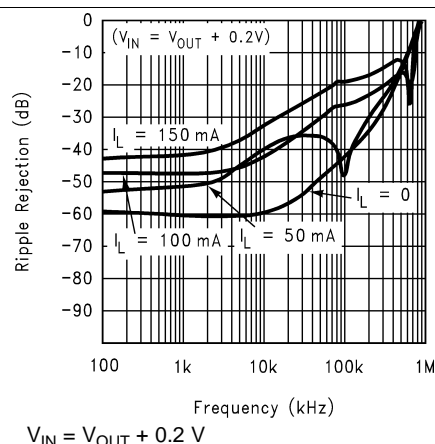


Figure 18. Ripple Rejection

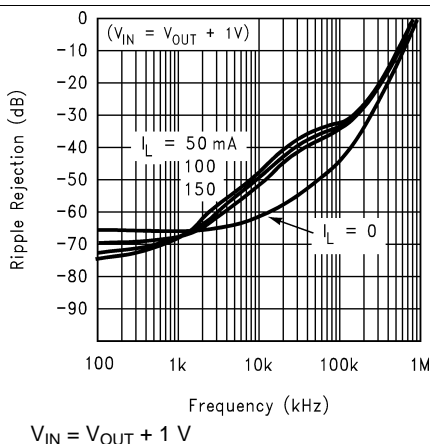


Figure 19. Ripple Rejection

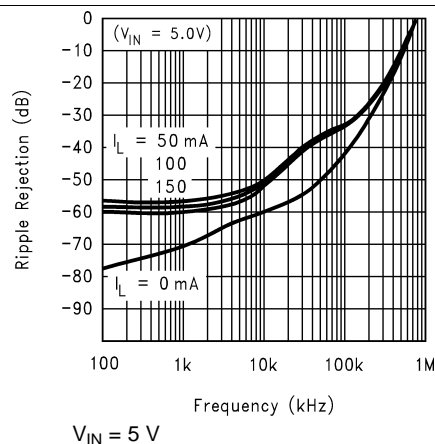


Figure 20. Ripple Rejection

### Typical Performance Characteristics (continued)

Unless otherwise specified,  $C_{IN} = C_{OUT} = 1 \mu\text{F}$  ceramic,  $C_{BYPASS} = 0.01 \mu\text{F}$ ,  $V_{IN} = V_{OUT} + 0.2 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ , EN pin is tied to  $V_{IN}$ .

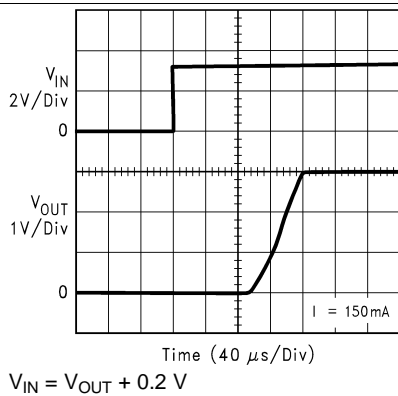


Figure 21. Start-up Time

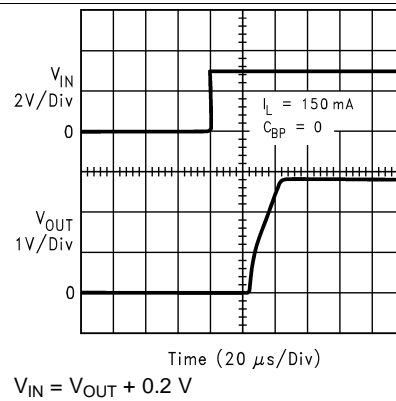


Figure 22. Start-up Time

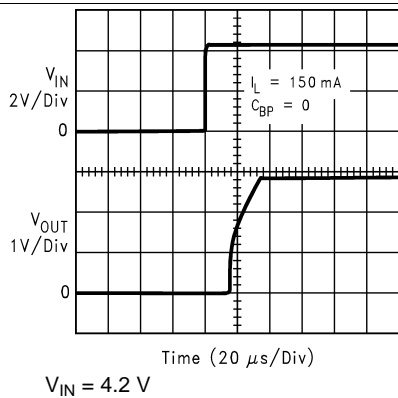


Figure 23. Start-up Time

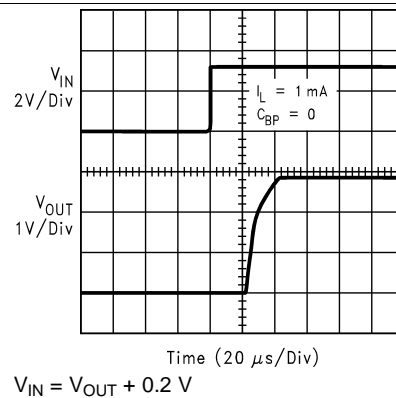


Figure 24. Start-up Time

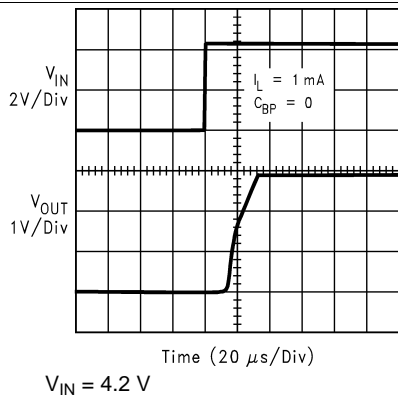


Figure 25. Start-up Time

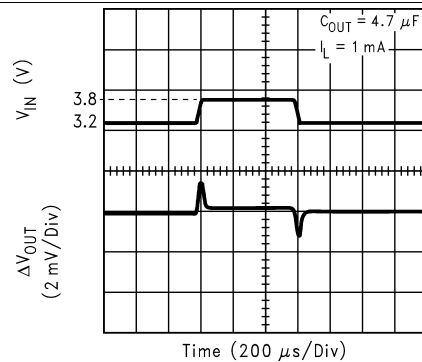


Figure 26. Line Transient Response

Typical Performance Characteristics (continued)

Unless otherwise specified,  $C_{IN} = C_{OUT} = 1 \mu F$  ceramic,  $C_{BYPASS} = 0.01 \mu F$ ,  $V_{IN} = V_{OUT} + 0.2 V$ ,  $T_A = 25^\circ C$ , EN pin is tied to  $V_{IN}$ .

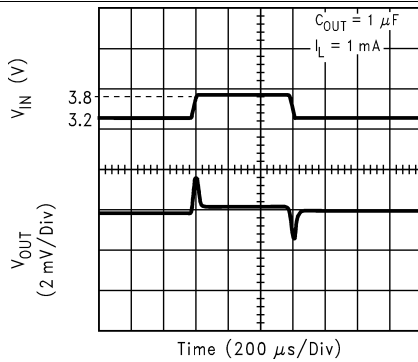


Figure 27. Line Transient Response

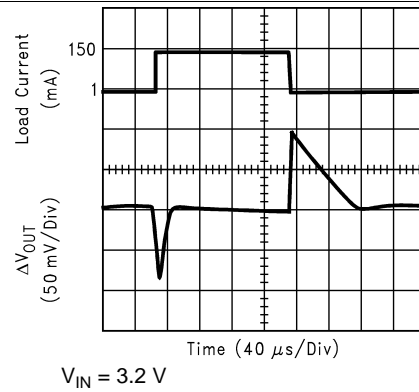


Figure 28. Load Transient Response

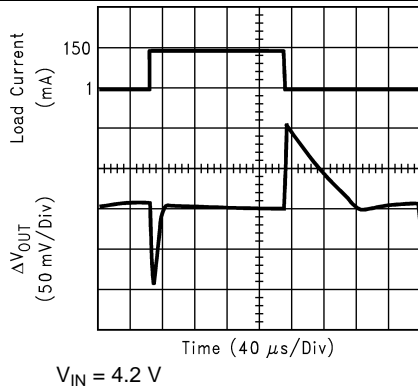


Figure 29. Load Transient Response

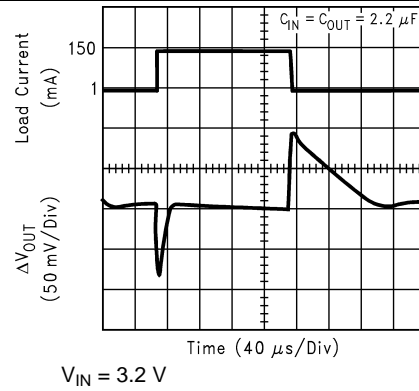


Figure 30. Load Transient Response

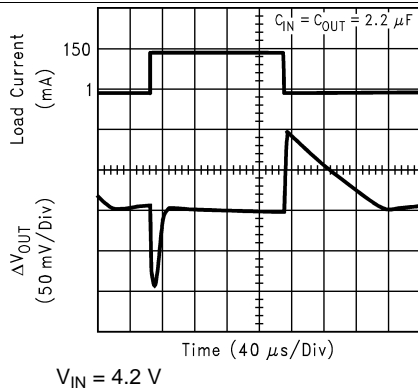


Figure 31. Load Transient Response

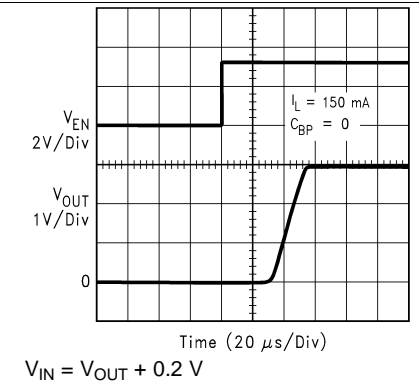


Figure 32. Enable Response

### Typical Performance Characteristics (continued)

Unless otherwise specified,  $C_{IN} = C_{OUT} = 1 \mu\text{F}$  ceramic,  $C_{BYPASS} = 0.01 \mu\text{F}$ ,  $V_{IN} = V_{OUT} + 0.2 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ , EN pin is tied to  $V_{IN}$ .

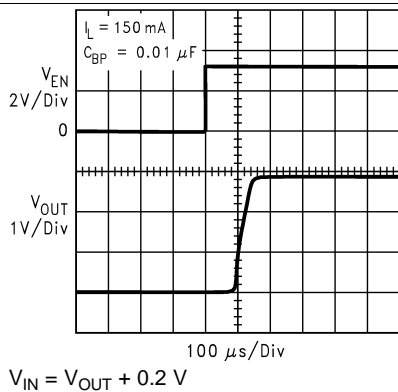


Figure 33. Enable Response

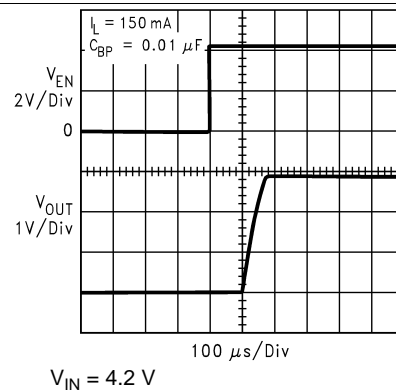


Figure 34. Enable Response

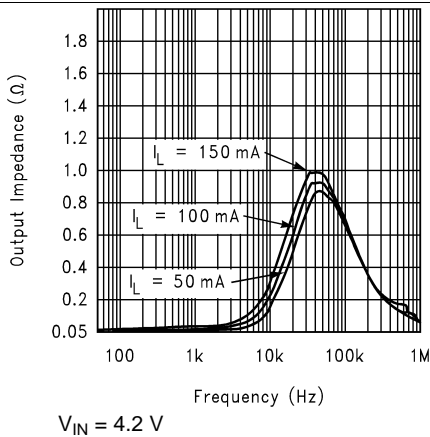


Figure 35. Output Impedance

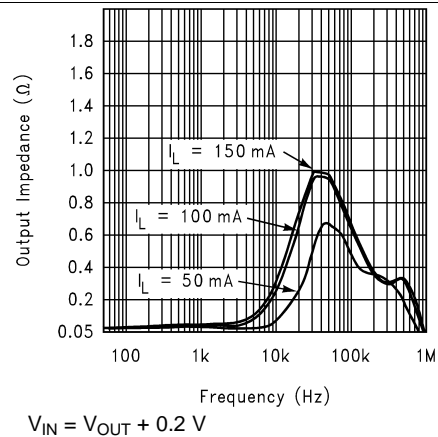


Figure 36. Output Impedance

## 7 Detailed Description

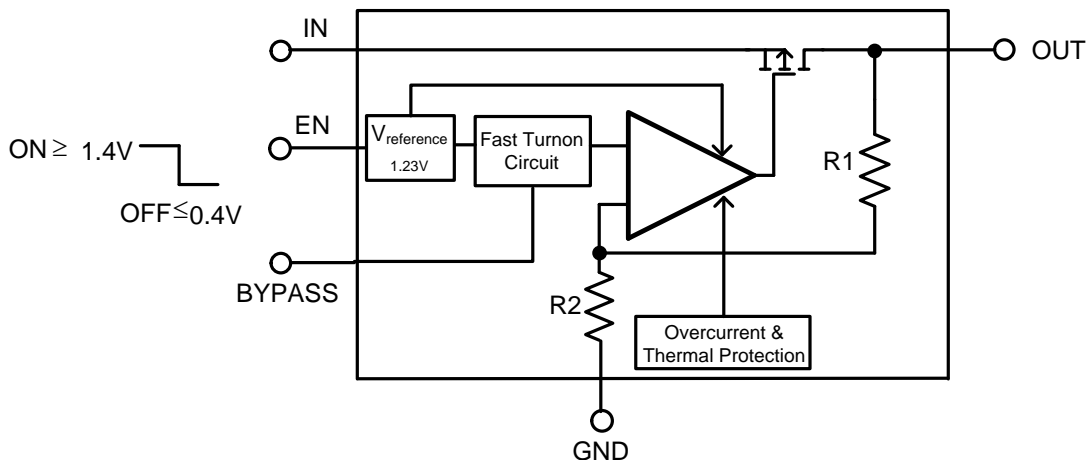
### 7.1 Overview

The LP3985 family of fixed-output, ultra-low-dropout and low noise regulators offers exceptional, cost-effective performance for battery powered applications. Available in output voltages from 2.5 V to 5 V, the family is capable of delivering 150-mA continuous load current. Standard regulator features, such as overcurrent and overtemperature protection, are also included.

The LP3985 contains several features to facilitate battery powered designs:

- Multiple voltage options
- Low dropout voltage, typical dropout of 60 mV at 150-mA load current
- Low quiescent current and low ground current, typically 140  $\mu$ A at 150-mA load, and 85- $\mu$ A at 0-mA load
- A shutdown feature is available, allowing the regulator to consume only 0.003  $\mu$ A typically when the EN pin is pulled low
- Overtemperature protection and overcurrent protection circuitry is designed to safeguard the device during unexpected conditions
- Enhanced stability: The LP3985 is stable with output capacitor, which allows the use of ceramic capacitors on the output
- Power supply rejection is better than 50 dB at low frequencies and starts to roll off at 1 kHz.
- Low noise: A BYPASS pin allows for low-noise operation, with a typical output noise of 30  $\mu$ V<sub>RMS</sub>, with the use of a 10-nF bypass capacitor.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 No-Load Stability

The LP3985 will remain stable and in regulation with no external load. This is specially important in CMOS RAM keep-alive applications.

#### 7.3.2 On/Off Input Operation

The LP3985 is turned off by pulling the EN pin low, and turned on by pulling it high. If this feature is not used, the EN pin should be tied to  $V_{IN}$  to keep the regulator output on at all time. To assure proper operation, the signal source used to drive the EN input must be able to swing above and below the specified turnon/turnoff voltage thresholds listed in [Electrical Characteristics](#) under  $V_{IL}$  and  $V_{IH}$ .

## Feature Description (continued)

### 7.3.3 Fast On-Time

The LP3985 output is turned on after  $V_{REF}$  voltage reaches its final value (1.23 V, nominal). To speed up this process, the noise reduction capacitor at the BYPASS pin is charged with an internal 70- $\mu$ A current source. The current source is turned off when the bandgap voltage reaches approximately 95% of its final value. The turnon time is determined by the time constant of the bypass capacitor. The smaller the capacitor value, the shorter the turn on time, but less noise gets reduced. As a result, turn on time and noise reduction need to be taken into design consideration when choosing the value of the bypass capacitor.

## 7.4 Device Functional Modes

### 7.4.1 Operation with $V_{OUT(TARGET)} + 0.3\text{ V} \leq V_{IN} \leq 6\text{ V}$

The device operates if the input voltage is equal to, or exceeds,  $V_{OUT(TARGET)} + 0.3\text{ V}$ . At input voltages below the minimum  $V_{IN}$  requirement, the device does not operate correctly, and output voltage may not reach target value.

### 7.4.2 Operation Using the EN Pin

If the voltage on the EN pin is less than 0.4 V, the device is disabled, and in this state shutdown current does not exceed 1.5  $\mu$ A. Raising  $V_{EN}$  above 1.4 V initiates the start-up sequence of the device.

## 8 Application and Implementation

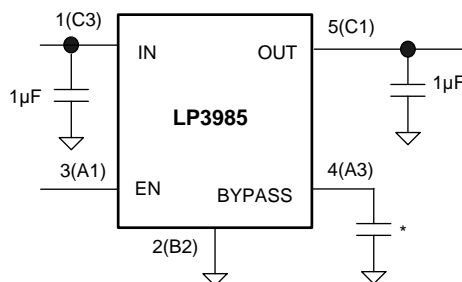
### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 8.1 Application Information

The LP3985 can provide 150-mA output current with 2.5-V to 6-V input. It is stable with a small 1- $\mu\text{F}$   $\pm 30\%$  ceramic or high-quality tantalum output capacitor. The DSBGA requires the smallest possible PC board area – the total application circuit area can be less than 2 mm x 2.5 mm, a fraction of a 1206 case size. An optional external bypass capacitor reduces the output noise without slowing down the load transient response. Fast startup time is achieved by utilizing an internal power-on circuit that actively pre-charges the bypass capacitor. Typical output noise is 30  $\mu\text{V}_{\text{RMS}}$  at frequencies from 10 Hz to 100 kHz. Typical power supply rejection is 50 dB at 1 kHz.

### 8.2 Typical Application



Pin Numbers in parenthesis indicate DSBGA package.  
\* Optional Noise Reduction Capacitor.

**Figure 37. LP3985 Typical Application**

#### 8.2.1 Design Requirements

DESIGN PARAMETERS	VALUE
Input voltage	4.2 V, $\pm 10\%$ provided by the DC-DC converter switching at 1 MHz
Output voltage	3 V, $\pm 5\%$
Output current	150 mA (maximum)
RMS noise, 10 Hz to 100 kHz	30 $\mu\text{V}_{\text{RMS}}$
PSRR at 1 kHz	50 dB

#### 8.2.2 Detailed Design Procedure

##### 8.2.2.1 External Capacitors

Like any low-dropout regulator, the LP3985 requires external capacitors for regulator stability. The LP3985 is specifically designed for portable applications requiring minimum board space and smallest components. These capacitors must be correctly selected for good performance.

##### 8.2.2.2 Input Capacitor

An input capacitance of approximately 1  $\mu\text{F}$  is required between the LP3985 input pin and ground (the amount of the capacitance may be increased without limit).

This capacitor must be located a distance of not more than 1 cm from the input pin and returned to a clean analog ground. A ceramic capacitor is recommended although a good quality tantalum or film capacitor may be used at the input.

---

**NOTE**

Tantalum capacitors can suffer catastrophic failures due to surge current when connected to a low-impedance source of power (like a battery or a very large capacitor). If a tantalum capacitor is used at the input, it must be verified by the manufacturer to have a surge current rating sufficient for the application.

---

There are no requirements for the ESR on the input capacitor, but tolerance and temperature coefficient must be considered when selecting the capacitor to ensure the capacitance will remain within the operational range over the full range of temperature and operating conditions.

### 8.2.2.3 Output Capacitor

Correct selection of the output capacitor is important to ensure stable operation in the intended application.

The output capacitor must meet all the requirements specified in the recommended capacitor table over all conditions in the application. These conditions include DC-bias, frequency and temperature. Unstable operation will result if the capacitance drops below the minimum specified value. (See the next section Capacitor Characteristics).

The LP3985 is designed specifically to work with very small ceramic output capacitors. A 1- $\mu$ F ceramic capacitor (dielectric type X7R) with ESR between 5 m $\Omega$  to 500 m $\Omega$  is suitable in the LP3985 application circuit. X5R capacitors may be used but have a narrower temperature range. With these and other capacitor types (Y5V, Z6U) that may be used, selection is dependant on the range of operating conditions and temperature range for that application. (see [Capacitor Characteristics](#) ).

It may also be possible to use tantalum or film capacitors at the output, but these are not as attractive for reasons of size and cost (see [Capacitor Characteristics](#)).

It is also recommended that the output capacitor be placed within 1 cm from the output pin and returned to a clean ground line.

### 8.2.2.4 Capacitor Characteristics

The LP3985 is designed to work with ceramic capacitors on the output to take advantage of the benefits they offer: for capacitance values in the range of 1  $\mu$ F to 4.7  $\mu$ F, ceramic capacitors are the smallest, least expensive, and have the lowest ESR values (which makes them best for eliminating high frequency noise). The ESR of a typical 1- $\mu$ F ceramic capacitor is in the range of 20 m $\Omega$  to 40 m $\Omega$ , which easily meets the ESR requirement for stability by the LP3985.

For both input and output capacitors careful interpretation of the capacitor specification is required to ensure correct device operation. The capacitor value can change greatly dependant on the conditions of operation and capacitor type.

In particular the output capacitor selection should take account of all the capacitor parameters to ensure that the specification is met within the application. Capacitance value can vary with DC bias conditions as well as temperature and frequency of operation. Capacitor values will also show some decrease over time due to aging. The capacitor parameters are also dependant on the particular case size with smaller sizes giving poorer performance figures in general. As an example [Figure 38](#) shows a typical graph showing a comparison of capacitor case sizes in a Capacitance vs. DC Bias plot. As shown in the graph, as a result of the DC Bias condition the capacitance value may drop below the minimum capacitance value given in the recommended capacitor table (0.7  $\mu$ F in this case). Note that the graph shows the capacitance out of spec for the 0402 case size capacitor at higher bias voltages. It is therefore recommended that the capacitor manufacturers' specifications for the nominal value capacitor are consulted for all conditions as some capacitor sizes (for example, 0402) may not be suitable in the actual application.



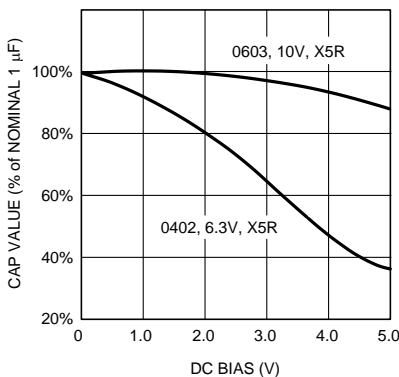


Figure 38. Graph Showing A Typical Variation In Capacitance vs DC Bias

The ceramic capacitor's capacitance can vary with temperature. The capacitor type X7R, which operates over a temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , will only vary the capacitance to within  $\pm 15\%$ . The capacitor type X5R has a similar tolerance over a reduced temperature range of  $-55^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . Most large value ceramic capacitors (around  $2.2\ \mu\text{F}$ ) are manufactured with Z5U or Y5V temperature characteristics. Their capacitance can drop by more than 50% as the temperature goes from  $25^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . Therefore X7R is recommended over Z5U and Y5V in applications where the ambient temperature will change significantly above or below  $25^{\circ}\text{C}$ .

Tantalum capacitors are less desirable than ceramic for use as output capacitors because they are more expensive when comparing equivalent capacitance and voltage ratings in the  $1\text{-}\mu\text{F}$  to  $4.7\text{-}\mu\text{F}$  range.

Another important consideration is that tantalum capacitors have higher ESR values than equivalent size ceramics. This means that while it may be possible to find a tantalum capacitor with an ESR value within the stable range, it would have to be larger in capacitance (which means bigger and more costly) than a ceramic capacitor with the same ESR value. It should also be noted that the ESR of a typical tantalum will increase about 2:1 as the temperature goes from  $25^{\circ}\text{C}$  down to  $-40^{\circ}\text{C}$ , so some guard band must be allowed.

### 8.2.2.5 Noise Bypass Capacitor

Connecting a  $0.01\text{-}\mu\text{F}$  capacitor between the CBYPASS pin and ground significantly reduces noise on the regulator output. This cap is connected directly to a high impedance node in the band gap reference circuit. Any significant loading on this node will cause a change on the regulated output voltage. For this reason, DC leakage current through this pin must be kept as low as possible for best output voltage accuracy.

The types of capacitors best suited for the noise bypass capacitor are ceramic and film. High-quality ceramic capacitors with either NPO or COG dielectric typically have very low leakage. Polypropylene and polycarbonate film capacitors are available in small surface-mount packages and typically have extremely low leakage current.

Unlike many other LDOs, addition of a noise reduction capacitor does not effect the load transient response of the device.

### 8.2.2.6 Thermal Considerations

#### CAUTION

Due to the limited power dissipation characteristics of the available SOT-23 (DBV) and DSBGA (YZR) packages, all possible combinations of output current ( $I_{\text{OUT}}$ ), input voltage ( $V_{\text{IN}}$ ), output voltage ( $V_{\text{OUT}}$ ), and ambient temperatures ( $T_{\text{A}}$ ) cannot be ensured.

Power dissipation,  $P_{\text{D}}$  is calculated from the following formula:  $P_{\text{D}} = ((V_{\text{IN}} - V_{\text{OUT}}) \times I_{\text{OUT}})$ .

The LP3985 regulator has internal thermal limiting designed to protect the device during overload conditions. For continuous normal conditions, the recommended maximum operating junction temperature is 125°C. It is important to give careful consideration to all sources of thermal resistance from junction to ambient. Additional heat sources mounted nearby must also be considered.

For surface-mount devices, heat sinking is accomplished by using the heat-spreading capabilities of the PC board and its copper traces. Copper board stiffeners and plated through-holes can also be used to spread the heat generated by power devices. Example: Given an output voltage of 3.3 V, an input voltage range of 4 V to 6 V, a maximum output current of 100 mA, and a maximum ambient temperature of 50°C, what is the maximum operating junction temperature? The power dissipated by the device is found using the formula:

$$P_{D(MAX)} = ((V_{IN(MAX)} - V_{OUT}) \times I_{OUT(MAX)})$$

where

- $I_{OUT(MAX)} = 100 \text{ mA}$
  - $V_{IN(MAX)} = 6 \text{ V}$
  - $V_{OUT} = 3.3 \text{ V}$
- (1)

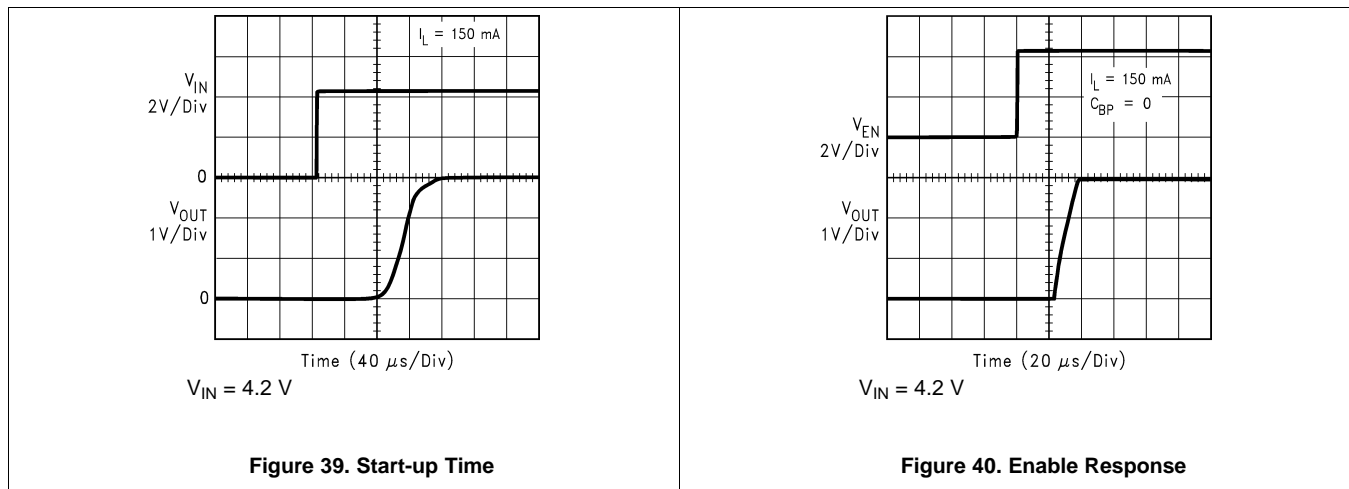
For example,  $P_{D(MAX)} = ((6 \text{ V} - 3.3 \text{ V}) \times 100 \text{ mA}) = 0.27 \text{ W}$ .

Using the 5-pin SOT-23 (DBV) package, the LP3985 junction-to-ambient thermal resistance ( $R_{\theta JA}$ ) has a rating of 220°C/W using the standard JEDEC JESD51-7 PCB (High-K) circuit board. The junction temperature rise above ambient is found using the formula:

$$T_{RISE} = P_{D(MAX)} \times R_{\theta JA};$$

for example,  $T_{J(MAX)} = 50^\circ\text{C} + 59.4^\circ\text{C} = 109.4^\circ\text{C}$ .

### 8.2.3 Application Curves



## 9 Power Supply Recommendations

The LP3985 is designed to operate from an input voltage supply range between 2.5 V and 6 V. The input-voltage range provides adequate headroom in order for the device to have a regulated output. This input supply must be well regulated. If the input supply is noisy, additional input capacitors with low ESR can help to improve the output noise performance.

## 10 Layout

### 10.1 Layout Guidelines

For best overall performance, place all circuit components on the same side of the circuit board and as near as practical to the respective LDO pin connections. Place ground return connections to the input and output capacitor, and to the LDO ground pin as close to each other as possible, connected by a wide, component-side, copper surface. The use of vias and long traces to create LDO circuit connections is strongly discouraged and negatively affects system performance. This grounding and layout scheme minimizes inductive parasitics, and thereby reduces load-current transients, minimizes noise, and increases circuit stability. A ground reference plane is also recommended and is either embedded in the PCB itself or located on the bottom side of the PCB opposite the components. This reference plane serves to assure accuracy of the output voltage, shield noise, and behaves similar to a thermal plane to spread (or sink) heat from the LDO device. In most applications, this ground plane is necessary to meet thermal requirements.

### 10.2 Layout Examples

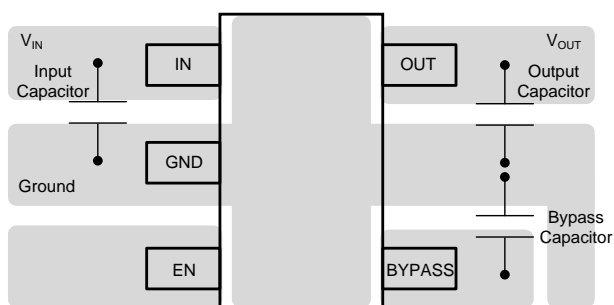


Figure 41. LP3985 SOT-23 Package Typical Layout

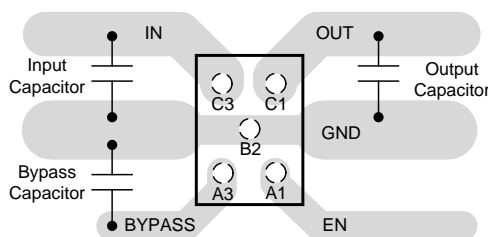


Figure 42. LP3985 DSBGA Package Typical Layout

### 10.3 DSBGA Mounting

The DSBGA package requires specific mounting techniques which are detailed in Texas Instruments Application Note 1112 *DSBGA Wafer Level Chip Scale Package (SNVA009)*. Referring to the section *Surface Mount Technology (SMT) Assembly Considerations*, it should be noted that the pad style which must be used with the 5-bump package is NSMD (non-solder mask defined) type.

For best results during assembly, alignment ordinals on the PC board may be used to facilitate placement of the DSBGA device.

### 10.4 DSBGA Light Sensitivity

Exposing the DSBGA device to direct sunlight will cause mis-operation of the device. Light sources such as halogen lamps can effect electrical performance if brought near to the device.

### DSBGA Light Sensitivity (continued)

The wavelengths which have most detrimental effect are reds and infra-reds, which means that the fluorescent lighting used inside most buildings has very little effect on performance. A DSBGA test board was brought to within 1 cm of a fluorescent desk lamp and the effect on the regulated output voltage was negligible, showing a deviation of less than 0.1% from nominal.

## 11 Device and Documentation Support

### 11.1 Documentation Support

#### 11.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments Application Note AN-1187 *Leadless Leadframe Package (LLP)* ([SNOA401](#)).
- Texas Instruments Application Note AN-1112 *DSBGA Wafer Level Chip Scale Package* ([SNVA009](#)).

### 11.2 Trademarks

All trademarks are the property of their respective owners.

### 11.3 Electrostatic Discharge Caution



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.

### 11.4 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**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
LP3985IM5-2.5	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	LCSB	
LP3985IM5-2.5/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCSB	<a href="#">Samples</a>
LP3985IM5-2.7/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCUB	<a href="#">Samples</a>
LP3985IM5-2.8/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCJB	<a href="#">Samples</a>
LP3985IM5-2.9/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCYB	<a href="#">Samples</a>
LP3985IM5-3.0	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	LCRB	
LP3985IM5-3.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCRB	<a href="#">Samples</a>
LP3985IM5-3.2/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDPB	<a href="#">Samples</a>
LP3985IM5-3.3	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	LDQB	
LP3985IM5-3.3/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDQB	<a href="#">Samples</a>
LP3985IM5-4.7	NRND	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 125	LDRB	
LP3985IM5-4.7/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDRB	<a href="#">Samples</a>
LP3985IM5-5.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDSB	<a href="#">Samples</a>
LP3985IM5X-2.5/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCSB	<a href="#">Samples</a>
LP3985IM5X-2.8/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCJB	<a href="#">Samples</a>
LP3985IM5X-285/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCXB	<a href="#">Samples</a>
LP3985IM5X-3.0	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	LCRB	
LP3985IM5X-3.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LCRB	<a href="#">Samples</a>
LP3985IM5X-3.3	NRND	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 125	LDQB	

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
LP3985IM5X-3.3/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDQB	<a href="#">Samples</a>
LP3985IM5X-4.7/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDRB	<a href="#">Samples</a>
LP3985IM5X-5.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LDSB	<a href="#">Samples</a>
LP3985ITL-2.5/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-2.6/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-2.7/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-2.8/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-2.9/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-285/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-3.0/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-3.1/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-3.2/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-3.3/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-4.75/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-4.8/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITL-5.0/NOPB	ACTIVE	DSBGA	YZR	5	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-2.5/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-2.6/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>

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
LP3985ITLX-2.7/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-2.8/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-2.9/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-285/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-3.0/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-3.1/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-3.2/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-3.3/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-4.75/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>
LP3985ITLX-4.8/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		5	<a href="#">Samples</a>
LP3985ITLX-5.0/NOPB	ACTIVE	DSBGA	YZR	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 125	5	<a href="#">Samples</a>

(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.



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**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.

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**TAPE AND REEL INFORMATION**

**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
LP3985IM5-2.5	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-2.5/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-2.7/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-2.8/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-2.9/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-3.0	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-3.0/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-3.2/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-3.3	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-3.3/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-4.7	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-4.7/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5-5.0/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-2.5/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-2.8/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-285/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-3.0	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-3.0/NOPB	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
LP3985IM5X-3.3	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-3.3/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-4.7/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985IM5X-5.0/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LP3985ITL-2.5/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-2.6/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-2.7/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-2.8/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-2.9/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-285/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-3.0/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-3.1/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-3.2/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-3.3/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-4.75/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-4.8/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITL-5.0/NOPB	DSBGA	YZR	5	250	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-2.5/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-2.6/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-2.7/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-2.8/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-2.9/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-285/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-3.0/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-3.1/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-3.2/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-3.3/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-4.75/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-4.8/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1
LP3985ITLX-5.0/NOPB	DSBGA	YZR	5	3000	178.0	8.4	1.09	1.55	0.76	4.0	8.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

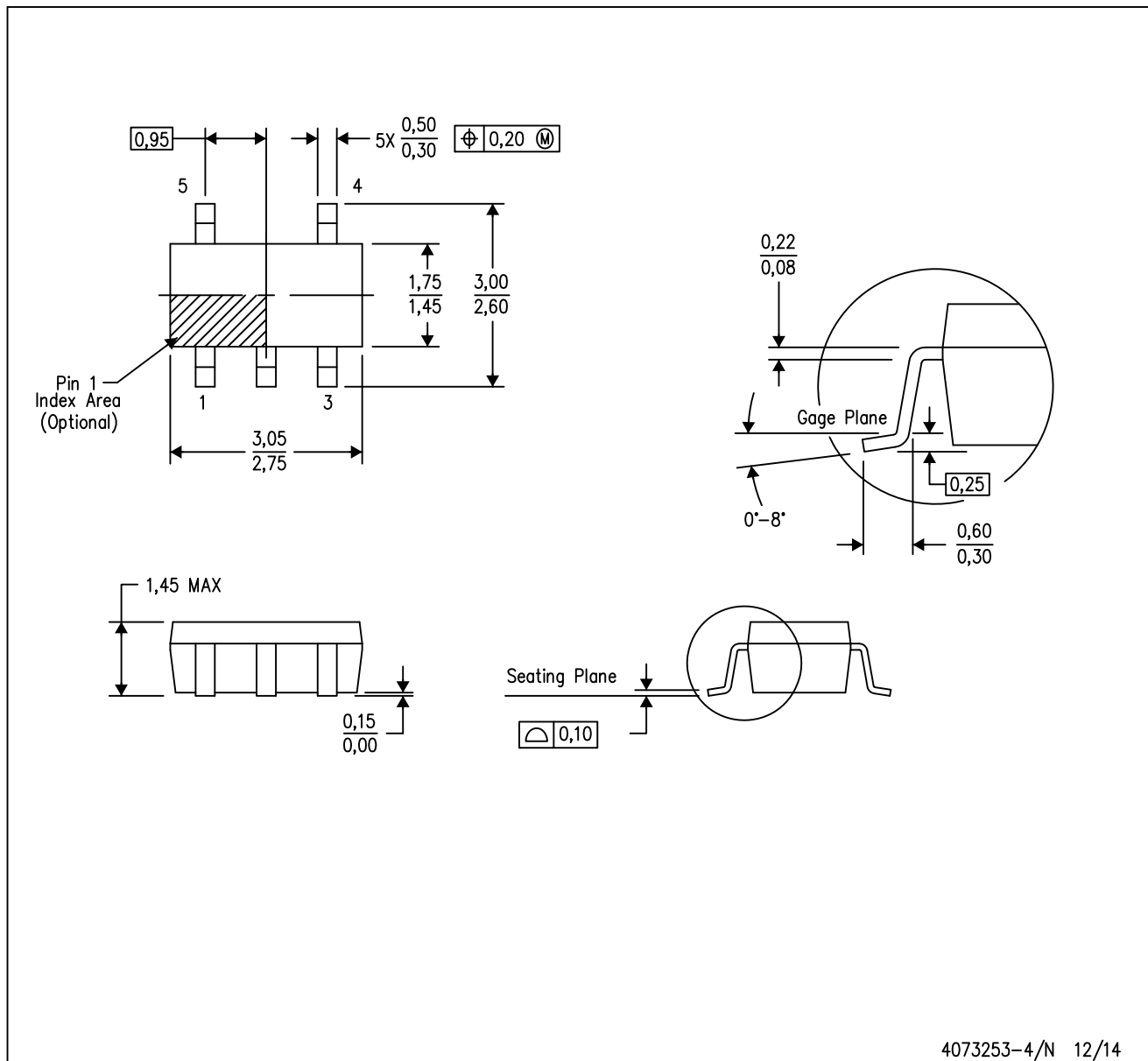

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LP3985IM5-2.5	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-2.5/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-2.7/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-2.8/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-2.9/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-3.0	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-3.0/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-3.2/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-3.3	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-3.3/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-4.7	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-4.7/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5-5.0/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LP3985IM5X-2.5/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-2.8/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-285/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-3.0	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-3.0/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-3.3	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-3.3/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LP3985IM5X-4.7/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985IM5X-5.0/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0
LP3985ITL-2.5/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-2.6/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-2.7/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-2.8/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-2.9/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-285/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-3.0/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-3.1/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-3.2/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-3.3/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-4.75/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-4.8/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITL-5.0/NOPB	DSBGA	YZR	5	250	210.0	185.0	35.0
LP3985ITLX-2.5/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-2.6/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-2.7/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-2.8/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-2.9/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-285/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-3.0/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-3.1/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-3.2/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-3.3/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-4.75/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-4.8/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0
LP3985ITLX-5.0/NOPB	DSBGA	YZR	5	3000	210.0	185.0	35.0

DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - Falls within JEDEC MO-178 Variation AA.

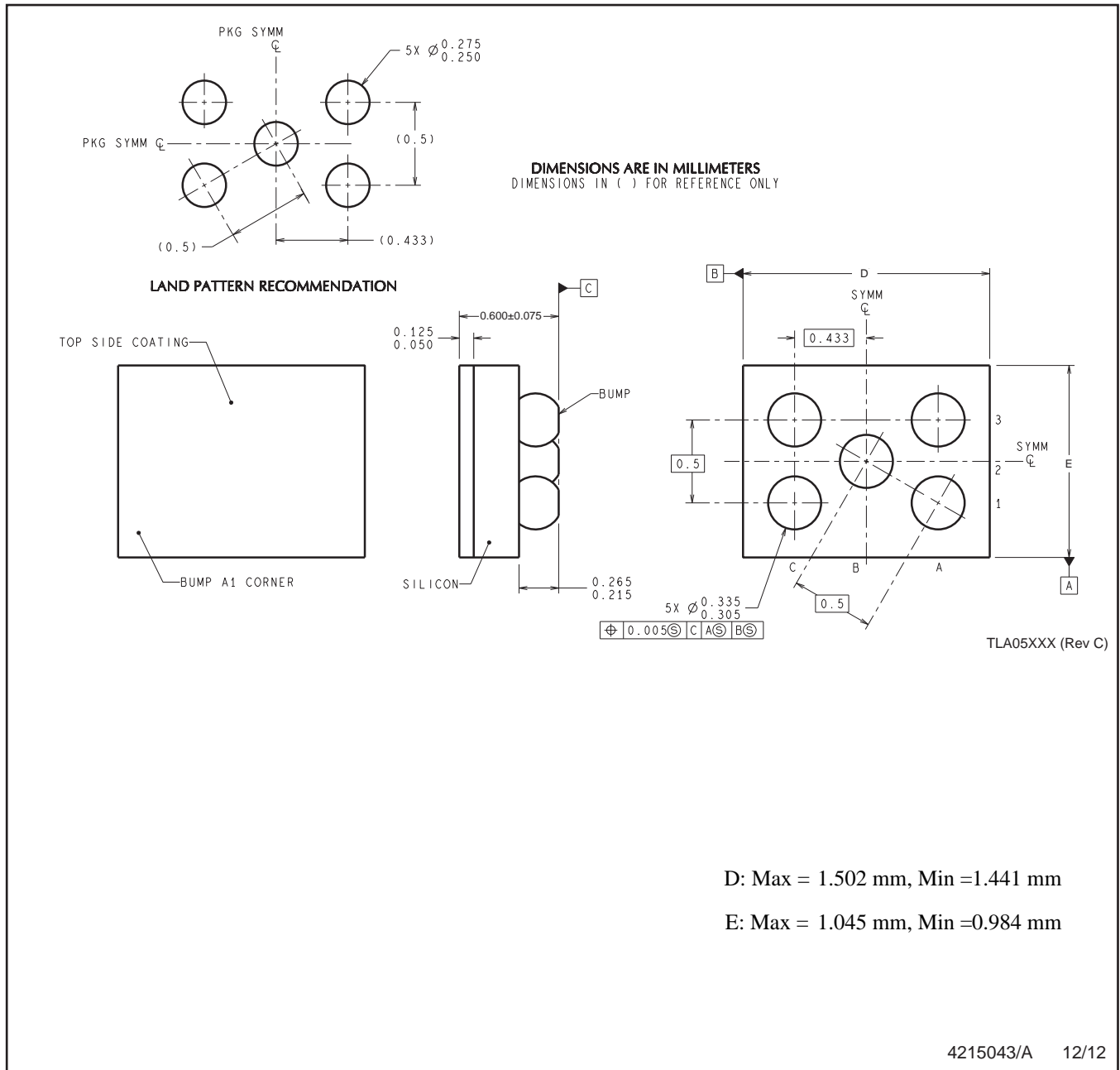
DBV (R-PDSO-G5)

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.

YZR0005



D: Max = 1.502 mm, Min = 1.441 mm

E: Max = 1.045 mm, Min = 0.984 mm

4215043/A 12/12

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.



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