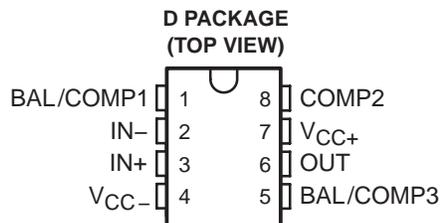


# LM218-Q1

## FAST GENERAL-PURPOSE OPERATIONAL AMPLIFIER

SLOS450A – NOVEMBER 2004 – REVISED APRIL 2008

- Qualified for Automotive Applications
- Small-Signal Bandwidth . . . 15 MHz Typ
- Slew Rate . . . 20 V/ $\mu$ s Min
- Bias Current . . . 250 nA Max
- Supply-Voltage Range . . .  $\pm 5$  V to  $\pm 20$  V
- Internal Frequency Compensation
- Input and Output Overload Protection
- Same Pin Assignments as General-Purpose Operational Amplifiers



### description/ordering information

The LM218 is a precision, fast operational amplifier designed for applications requiring wide bandwidth and high slew rate. It features a factor-of-ten increase in speed over general-purpose devices without sacrificing dc performance.

This operational amplifier has internal unity-gain frequency compensation. This considerably simplifies its application because no external components are necessary for operation. However, unlike most internally compensated amplifiers, external frequency compensation may be added for optimum performance. For inverting applications, feed-forward compensation boosts the slew rate to over 150 V/ $\mu$ s and almost double the bandwidth. Overcompensation can be used with the amplifier for greater stability when maximum bandwidth is not needed. Further, a single capacitor can be added to reduce the settling time for 0.1% error band to under 1  $\mu$ s.

The high speed and fast settling time of this operational amplifier makes it useful in A/D converters, oscillators, active filters, sample-and-hold circuits, and general-purpose amplifiers.

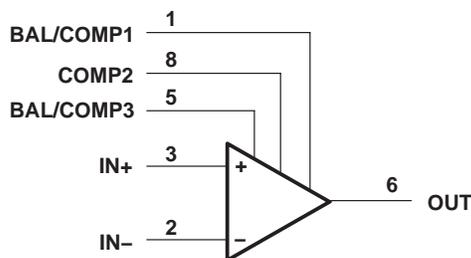
### ORDERING INFORMATION<sup>†</sup>

T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE <sup>‡</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	10 mV	SOIC (D) Reel of 2500	LM218IDRQ1	LM218I

<sup>†</sup> For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at <http://www.ti.com>.

<sup>‡</sup> Package drawings, thermal data, and symbolization are available at <http://www.ti.com/packaging>.

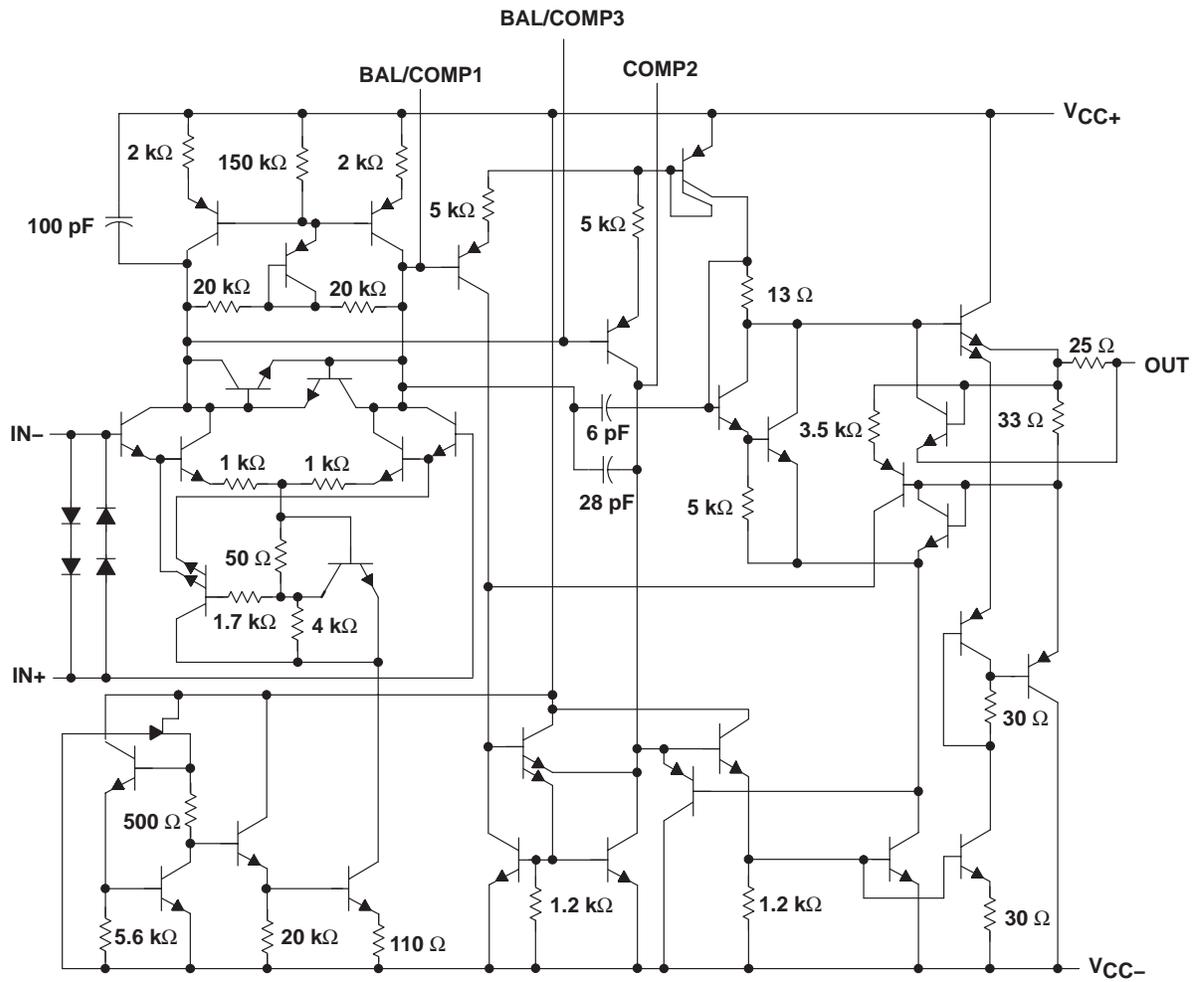
### symbol



# LM218-Q1 FAST GENERAL-PURPOSE OPERATIONAL AMPLIFIER

SLOS450A – NOVEMBER 2004 – REVISED APRIL 2008

## schematic



Component values shown are nominal.

# LM218-Q1

## FAST GENERAL-PURPOSE OPERATIONAL AMPLIFIER

SLOS450A – NOVEMBER 2004 – REVISED APRIL 2008

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

Supply voltage: $V_{CC+}$ (see Note 1) .....	20 V
$V_{CC-}$ (see Note 1) .....	–20 V
Input voltage, $V_I$ (either input, see Notes 1 and 2) .....	±15 V
Differential input current, $V_{ID}$ (see Note 3) .....	±10 V
Duration of output short circuit (see Note 4) .....	Unlimited
Operating virtual junction temperature, $T_J$ .....	150°C
Package thermal impedance, $\theta_{JA}$ (see Notes 5 and 6) .....	126°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds .....	260°C
Storage temperature range, $T_{stg}$ .....	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, unless otherwise noted, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
  2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
  3. The inputs are shunted with two opposite-facing base-emitter diodes for overvoltage protection. Therefore, excessive current flows if a different input voltage in excess of approximately 1 V is applied between the inputs, unless some limiting resistance is used.
  4. The output can be shorted to ground for either power supply. For the LM218, the unlimited duration of the short circuit applies at (or below) 85°C case temperature or 75°C free-air temperature.
  5. Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  6. The package thermal impedance is calculated in accordance with JESD 51-7.

### electrical characteristics at specified free-air temperature (see Note 7)

PARAMETER		TEST CONDITIONS‡	$T_A$ §	MIN TYP MAX			UNIT
				MIN	TYP	MAX	
$V_{IO}$	Input offset voltage	$V_O = 0$	25°C	2	10		mV
			Full range			15	
$I_{IO}$	Input offset current	$V_O = 0$	25°C	6	50		nA
			Full range			100	
$I_{IB}$	Input bias current	$V_O = 0$	25°C	120	250		nA
			Full range			500	
$V_{ICR}$	Common-mode input voltage range	$V_{CC\pm} = \pm 15$ V	Full range	± 11.5			V
$V_{OM}$	Maximum peak output voltage swing	$V_{CC\pm} = \pm 15$ V, $R_L = 2$ k $\Omega$	Full range	± 12	± 13		V
$A_{VD}$	Large-signal differential voltage amplification	$V_{CC\pm} = \pm 15$ V, $V_O = \pm 10$ V, $R_L \geq 2$ k $\Omega$	25°C	50	200		V/mV
			Full range	25			
$B_1$	Unity-gain bandwidth	$V_{CC\pm} = \pm 15$ V	25°C	15			MHz
$r_i$	Input resistance		25°C	3			M $\Omega$
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$	Full range	80	100		dB
$k_{SVR}$	Supply-voltage rejection ratio ( $\Delta V_{CC}/\Delta V_{IO}$ )		Full range	70	80		dB
$I_{CC}$	Supply current	$V_O = 0$ , No load	25°C	5	8		mA

‡ All characteristics are measured under open-loop conditions with common-mode input voltage, unless otherwise specified.

§ Full range for LM218I is –40°C to 85°C.

NOTE 7: Unless otherwise noted,  $V_{CC} = \pm 5$  V to  $\pm 20$  V. All typical values are at  $V_{CC\pm} = \pm 15$  V and  $T_A = 25^\circ\text{C}$ .

### operating characteristics, $V_{CC\pm} = \pm 15$ V, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$\Delta V_I = 10$ V, $C_L = 100$ pF, See Figure 1	20	70		V/ $\mu\text{s}$



# LM218-Q1 FAST GENERAL-PURPOSE OPERATIONAL AMPLIFIER

SLOS450A – NOVEMBER 2004 – REVISED APRIL 2008

## PARAMETER MEASUREMENT INFORMATION

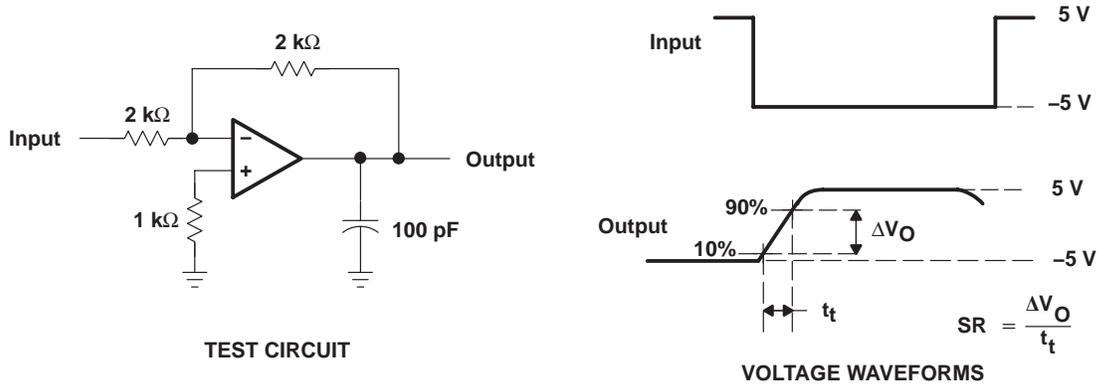


Figure 1. Slew Rate

**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
LM218IDRG4Q1	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LM218I	<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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

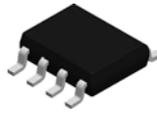
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

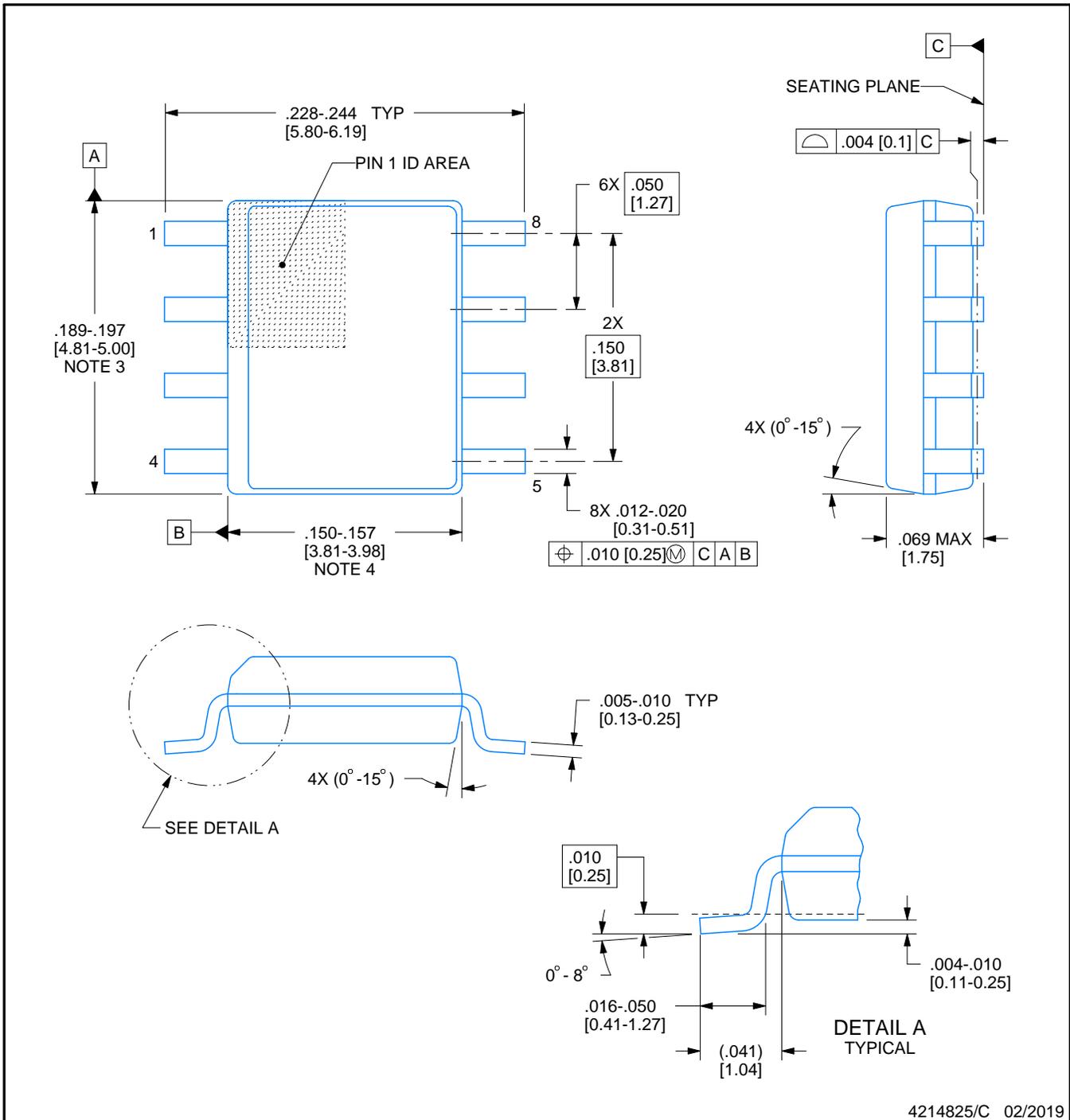


D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

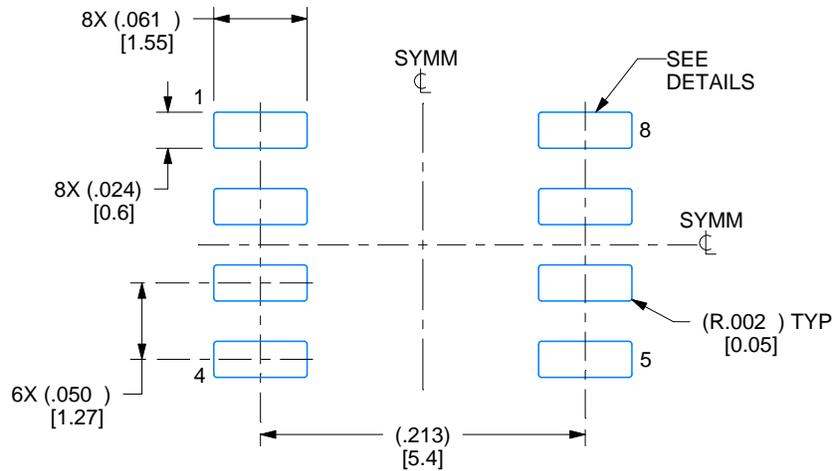
1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

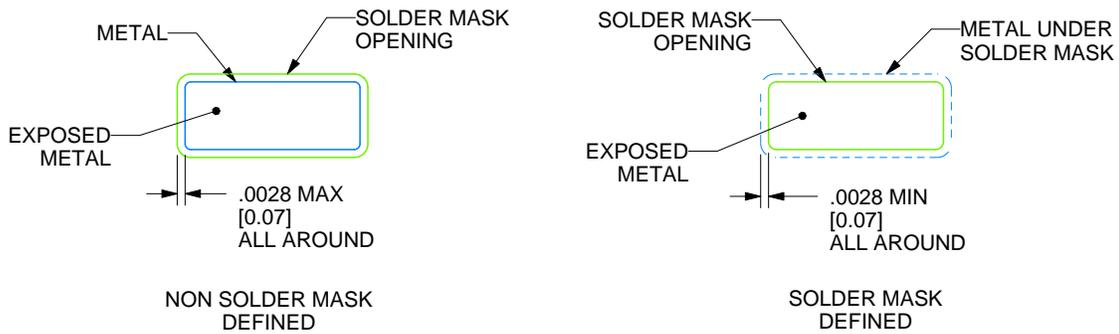
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

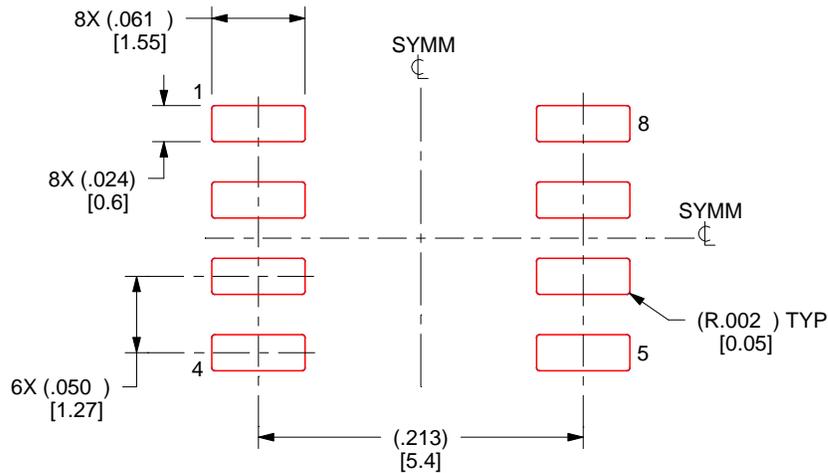
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale ([www.ti.com/legal/termsofsale.html](http://www.ti.com/legal/termsofsale.html)) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2020, Texas Instruments Incorporated