SN74LV4052A Dual 4-Channel Analog Multiplexers and Demultiplexers

1 Features

- 1.65V to 5.5V V_{CC} operation
- Fast switching
- High on-off output-voltage ratio
- Low crosstalk between switches
- Extremely low input current
- Latch-up performance exceeds 100mA per JESD 78, class II
- ESD protection exceeds JESD 22:
  - 2000V human-body model (A114-A)
  - 1000V charged-device model (C101)

2 Applications

- Telecommunications
- Infotainment
- Signal gating and isolation
- Home appliances
- Programmable logic circuits
- Modulation and demodulation

3 Description

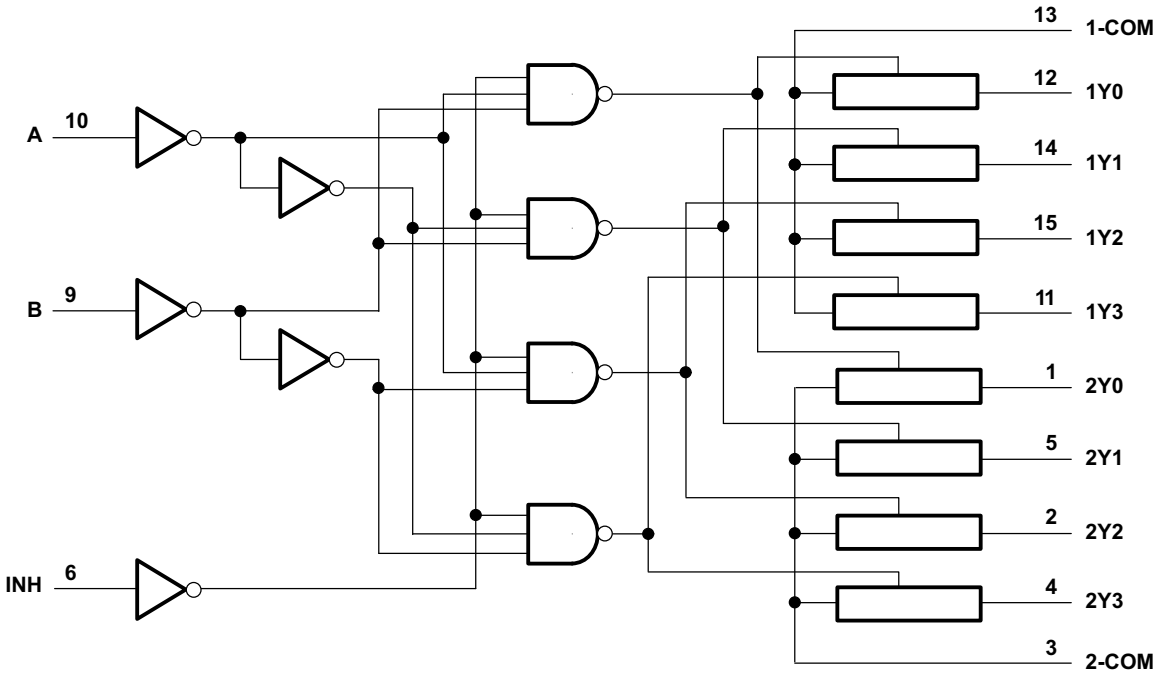
The SNx4LV4052A device is a dual, 4-channel CMOS analog multiplexer and demultiplexer that is designed for 1.65V to 5.5V V_{CC} operation.

The SNx4LV4052A device handles both analog and digital signals. Each channel permits signals with amplitudes up to 5.5V (peak) to be transmitted in either direction.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE (2)
SNx4LV4052A	D (SOIC, 16)	9.9mm × 6mm
	PW (TSSOP, 16)	5mm × 6.4mm
	RGY (VQFN, 16)	4mm × 3.5mm

(1) For more information, see Section 11.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Logic Diagram (Positive Logic)

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4 Pin Configuration and Functions

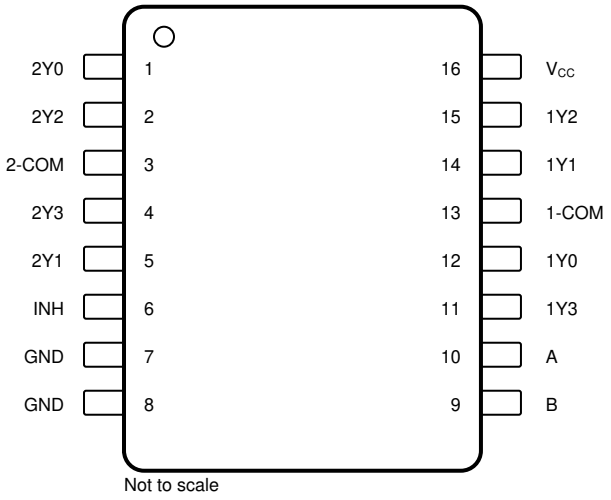


Figure 4-1. D or PW Packages, 16-Pin SOIC or TSSOP (Top View)

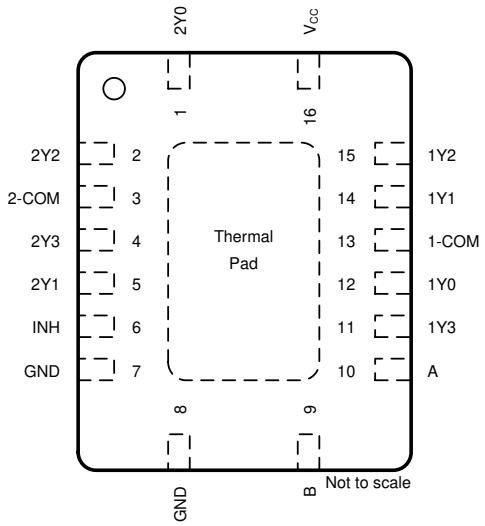


Figure 4-2. RGY Package, 16-Pin VQFN With Thermal Pad (Top View)

Table 4-1. Pin Functions

PIN		TYPE[1]	DESCRIPTION
NAME	NO.		
2Y0	1	I/O	Port 2 channel 0
2Y2	2	I/O	Port 2 channel 2
2-COM	3	I/O	Port 2 common channel
2Y3	4	I/O	Port 2 channel 3
2Y1	5	I/O	Port 2 channel 1
INH	6	I	Inhibit input
GND	7	—	Device ground
GND	8	—	Device ground
B	9	I	Logic input selector B
A	10	I	Logic input selector A
1Y3	11	I/O	Port 1 channel 3
1Y0	12	I/O	Port 1 channel 0
1-COM	13	I/O	Port 1 common channel
1Y1	14	I/O	Port 1 channel 1
1Y2	15	I/O	Port 1 channel 2
V_{CC}	16	—	Device power

(1) I = input, O = output

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1) (3)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		–0.5	7.0	V
V_I	Logic input voltage range		–0.5	7.0	V
V_{IO}	Switch I/O voltage range(2) (3)		–0.5	V_{CC} + 0.5	V
I_{IK}	Input clamp current	V_I < 0	–20		mA
I_{IOK}	Switch IO diode clamp current	V_{IO} < 0 or V_{IO} > V_{CC}	–50	50	mA
I_T	Switch continuous current	V_{IO} = 0 to V_{CC}		±25	mA
	Continuous current through V_{CC} or GND			±50	mA
T_J	Junction temperature			150	°C
T_{stg}	Storage temperature		–65	150	°C

(1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. Absolute maximum ratings do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If briefly operating outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.
(2) Pins are diode-clamped to the power-supply rails. Over voltage signals must be voltage and current limited to maximum ratings.
(3) This value is limited to 5.5V maximum

5.2 ESD Ratings

				VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002(1)	All pins	±4000	V
		Charged device model (CDM), per AEC Q100-011	All pins	±1500	

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

5.3 Thermal Information: SN74LV4052A

THERMAL METRIC (1)		SN74LV4052A D (SOIC) 16 PINS	SN74LV4052A PW (TSSOP) 16 PINS	SN74LV4052A RGY (VQFN) 16 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	115.2	140.2	89.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	75.0	72.6	89.7	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	76.6	98.7	65.4	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	31.3	13.4	25.0	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	75.7	97.3	65.2	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	48.9	°C/W

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

5.4 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		1(2)		5.5	V
V_{IH}	High-level input voltage, logic control inputs	V_{CC} = 1.65	1.2		5.5	V
		V_{CC} = 2V	1.5		5.5	
		V_{CC} = 2.3V to 2.7V	V_{CC} x 0.7		5.5	
		V_{CC} = 3V to 3.6V	V_{CC} x 0.7		5.5	
		V_{CC} = 4.5V to 5.5V	V_{CC} x 0.7		5.5	
V_{IL}	Low-level input voltage, logic control inputs	V_{CC} = 1.65	0		0.4	V
		V_{CC} = 2V	0		0.5	
		V_{CC} = 2.3V to 2.7V	0		V_{CC} x 0.3	
		V_{CC} = 3V to 3.6V	0		V_{CC} x 0.3	
		V_{CC} = 4.5V to 5.5V	0		V_{CC} x 0.3	
V_I	Logic control input voltage		0		5.5	V
V_{IO}	Switch input or output voltage		0		V_{CC}	V
Δt/ΔV	Logic input transition rise or fall rate	V_{CC} = 2.3V to 2.7V			200	ns/V
		V_{CC} = 3V to 3.6V			100	
		V_{CC} = 4.5V to 5.5V			20	
T_A	Ambient temperature		–40		125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND for proper device operation. Refer to TI application report *Implications of Slow or Floating CMOS Inputs*, SCBA004.
(2) When using a V_{CC} of ≤1.2V, it is recommended to use these devices only for transmitting digital signals. When supply voltage is near 1.2V the analog switch ON resistance becomes very non-linear

5.5 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		Condition	T_A	V_{CC}	MIN	TYP	MAX	UNIT
r_{ON}	ON-state switch resistance	I_T = 2mA, V_I = V_{CC} or GND, V_{INH} = V_{IL}	25°C	1.65V		60	150	Ω
r_{ON}	ON-state switch resistance	I_T = 2mA, V_I = V_{CC} or GND, V_{INH} = V_{IL}	–40°C to 85°C	1.65V			225	Ω
r_{ON}	ON-state switch resistance	I_T = 2mA, V_I = V_{CC} or GND, V_{INH} = V_{IL}	–40°C to 125°C	1.65V			225	Ω
r_{ON}	ON-state switch resistance	I_T = 2mA, V_I = V_{CC} or GND, V_{INH} = V_{IL}	25°C	2.3V		38	180	Ω
			–40°C to 85°C				225	
			–40°C to 125°C				225	
			25°C	3V		30	150	Ω
			–40°C to 85°C				190	
			–40°C to 125°C				190	
			25°C	4.5V		22	75	Ω
			–40°C to 85°C				100	
			–40°C to 125°C				100	
$r_{ON(p)}$	Peak ON-state resistance	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	25°C	1.65V		220	600	Ω

5.5 Electrical Characteristics (continued)

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		Condition	T_A	V_{CC}	MIN	TYP	MAX	UNIT
$r_{ON(p)}$	Peak ON-state resistance	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	–40°C to 85°C	1.65V			700	Ω
$r_{ON(p)}$	Peak ON-state resistance	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	–40°C to 125°C	1.65V			700	Ω
$r_{ON(p)}$	Peak ON-state resistance	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	25°C	2.3V		113	500	Ω
			–40°C to 85°C				600	
			–40°C to 125°C				600	
			25°C	3V		54	180	Ω
			–40°C to 85°C				225	
			–40°C to 125°C				225	
			25°C	4.5V		31	100	Ω
			–40°C to 85°C				125	
			–40°C to 125°C				125	
Δr_{ON}	Difference in ON-state resistance between switches	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	25°C	1.65V		3	40	Ω
Δr_{ON}	Difference in ON-state resistance between switches	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	–40°C to 85°C	1.65V			50	Ω
Δr_{ON}	Difference in ON-state resistance between switches	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	–40°C to 85°C	1.65V			50	Ω
Δr_{ON}	Difference in ON-state resistance between switches	I_T = 2mA, V_I = GND to V_{CC}, V_{INH} = V_{IL}	25°C	2.3V		2.1	30	Ω
			–40°C to 85°C				40	
			–40°C to 125°C				40	
			25°C	3V		1.4	20	Ω
			–40°C to 85°C				30	
			–40°C to 125°C				30	
			25°C	4.5V		1.3	15	Ω
			–40°C to 85°C				20	
			–40°C to 125°C				20	
I_{IH} I_{IL}	Control input current	V_I = 5.5V or GND	25°C	0 to 5.5V			0.1	μA
			–40°C to 85°C				1	
			–40°C to 125°C				2	
$I_{S(off)}$	OFF-state switch leakage current	V_I = V_{CC} and V_O = GND, or V_I = GND and V_O = V_{CC}, V_{INH} = V_{IH}	25°C	5.5V			0.1	μA
			–40°C to 85°C				1	
			–40°C to 125°C				2	
$I_{S(on)}$	ON-state switch leakage current	V_I = V_{CC} or GND, V_{INH} = V_{IL} (see Figure 6-3)	25°C	5.5V			0.1	μA
			–40°C to 85°C				1	
			–40°C to 125°C				2	
I_{CC}	Supply current	V_I = V_{CC} or GND V_{INH} = 0V	25°C	5.5V		0.01		μA
			–40°C to 85°C				20	
			–40°C to 125°C				40	
C_{IC}	Control input capacitance	f = 10MHz	25°C	3.3V		2		pF

5.5 Electrical Characteristics (continued)

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		Condition	T_A	V_{CC}	MIN	TYP	MAX	UNIT
C_{OS}	Switch terminal capacitance	f = 10MHz	25°C	3.3V		5		pF
C_{IS}	Common terminal capacitance	f = 10MHz	25°C	3.3V		23		pF
$C_{OS(on)}$	Common terminal ON-capacitance	f = 10MHz	25°C	3.3V		23		pF
C_F	Feedthrough capacitance	f = 10MHz	25°C	3.3V		0.5		pF
C_{PD}	Power dissipation capacitance	C_L = 50pF, f = 10MHz	25°C	3.3V		6		pF

5.6 Timing Characteristics V_{CC} = 2.5V ± 0.2V

PARAMETER		FROM (INPUT)	TO (OUTPUT)	CONDITIONS	T_A	MIN	TYP	MAX	UNIT
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	C_L = 15pF	25°C		1.9	10	ns
					–40°C to 85°C			16	
					–40°C to 125°C			18	
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	C_L = 15pF	25°C		6.6	18	ns
					–40°C to 85°C			23	
					–40°C to 125°C			25	
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	C_L = 15pF	25°C		7.4	18	ns
					–40°C to 85°C			23	
					–40°C to 125°C			25	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	C_L = 50pF	25°C		3.8	12	ns
					–40°C to 85°C			18	
					–40°C to 125°C			20	
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	C_L = 50pF	25°C		7.8	28	ns
					–40°C to 85°C			35	
					–40°C to 125°C			35	
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	C_L = 50pF	25°C		11.5	28	ns
					–40°C to 85°C			35	
					–40°C to 125°C			35	

5.7 Timing Characteristics V_{CC} = 3.3V ± 0.3V

PARAMETER		FROM (INPUT)	TO (OUTPUT)	CONDITIONS	T_A	MIN	TYP	MAX	UNIT
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	C_L = 15pF	25°C		1.2	6	ns
					–40°C to 85°C			10	
					–40°C to 125°C			12	
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	C_L = 15pF	25°C		4.7	12	ns
					–40°C to 85°C			15	
					–40°C to 125°C			18	
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	C_L = 15pF	25°C		5.7	12	ns
					–40°C to 85°C			15	
					–40°C to 125°C			18	

5.7 Timing Characteristics V_{CC} = 3.3V ± 0.3V (continued)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	CONDITIONS	T_A	MIN	TYP	MAX	UNIT
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	C_L = 50pF	25°C		2.5	9	ns
					–40°C to 85°C			12	
					–40°C to 125°C			14	
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	C_L = 50pF	25°C		5.5	20	ns
					–40°C to 85°C			25	
					–40°C to 125°C			25	
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	C_L = 50pF	25°C		8.8	20	ns
					–40°C to 85°C			25	
					–40°C to 125°C			25	

5.8 Timing Characteristics V_{CC} = 5V ± 0.5V

PARAMETER		FROM (INPUT)	TO (OUTPUT)	CONDITIONS	T_A	MIN	TYP	MAX	UNIT
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	C_L = 15pF	25°C		0.6	4	ns
					–40°C to 85°C			7	
					–40°C to 125°C			10	
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	C_L = 15pF	25°C		3.5	8	ns
					–40°C to 85°C			10	
					–40°C to 125°C			12	
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	C_L = 15pF	25°C		4.4	10	ns
					–40°C to 85°C			11	
					–40°C to 125°C			12	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	C_L = 50pF	25°C		1.5	6	ns
					–40°C to 85°C			8	
					–40°C to 125°C			10	
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	C_L = 50pF	25°C		4	14	ns
					–40°C to 85°C			18	
					–40°C to 125°C			18	
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	C_L = 50pF	25°C		6.2	14	ns
					–40°C to 85°C			18	
					–40°C to 125°C			18	

5.9 AC Characteristics

PARAMETER	FROM (INPUT)	TO (OUTPUT)	Device	CONDITIONS		MIN	TYP	MAX	UNIT
Frequency response (switch on)	COM or Yn	Yn or COM	SN74LV4052	C_L = 50pF, R_L = 600Ω, F_{in} = 1MHz (sine wave) see Figure 6-6) (1)	V_{CC} = 2.3V		30		MHz
					V_{CC} = 3V		35		
					V_{CC} = 4.5V		50		
Charge Injection (control input to signal output)	INH	COM or Yn		C_L = 50pF, R_L = 600Ω, F_{in} = 1MHz (sine wave) (see Figure 6-8)	V_{CC} = 2.3V		20		mV
					V_{CC} = 3V		35		
					V_{CC} = 4.5V		60		

5.9 AC Characteristics (continued)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	Device	CONDITIONS		MIN	TYP	MAX	UNIT
Feedthrough attenuation (switch off)	COM or Yn	Yn or COM		C_L = 50pF, R_L = 600Ω, F_{in} = 1MHz (sine wave) (see Figure 6-9) (2)	V_{CC} = 2.3V		–45		dB
					V_{CC} = 3V		–45		
					V_{CC} = 4.5V		–45		
Crosstalk (between any switches)	COM or Yn	Yn or COM		C_L = 50pF, R_L = 600Ω, F_{in} = 1MHz (sine wave) (see Figure 6-7) (2)	V_{CC} = 2.3V		–45		dB
					V_{CC} = 3V		–45		
					V_{CC} = 4.5V		–45		
Sine-wave distortion	COM or Yn	Yn or COM		C_L = 50pF, R_L = 10kΩ, F_{in} = 1kHz (sine wave) (see Figure 6-9)	V_I = $2V_{p-p}$ V_{CC} = 2.3V		0.1		%
					V_I = $2.5V_{p-p}$ V_{CC} = 3V		0.1		
					V_I = $4V_{p-p}$ V_{CC} = 4.5V		0.1		

5.10 Typical Characteristics

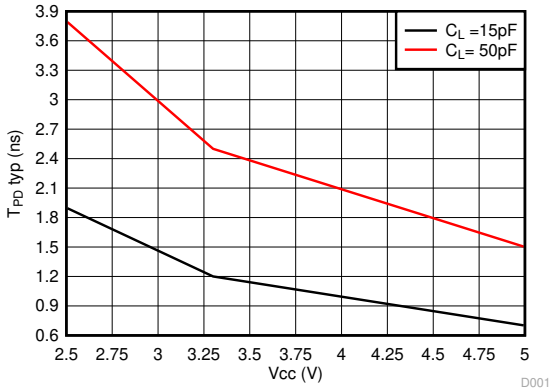


Figure 5-1. Typical Propagation Delay vs V_{cc}

6 Parameter Measurement Information

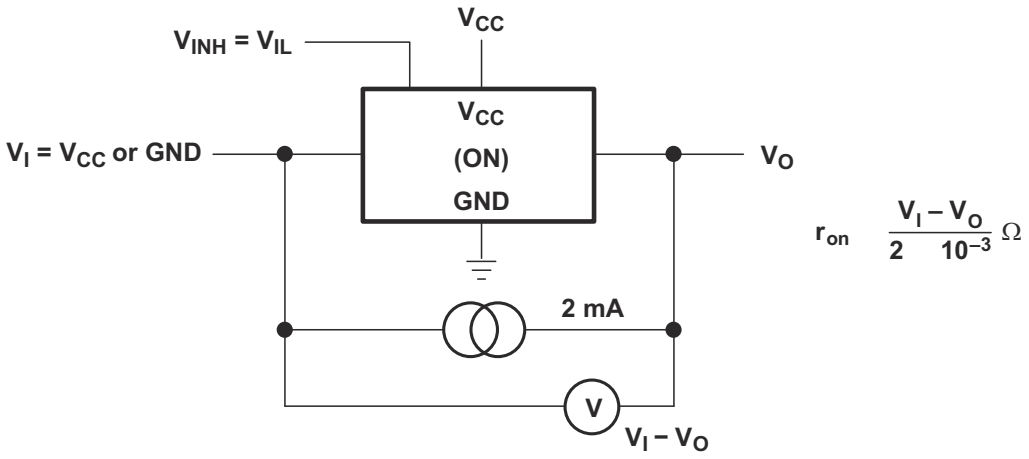
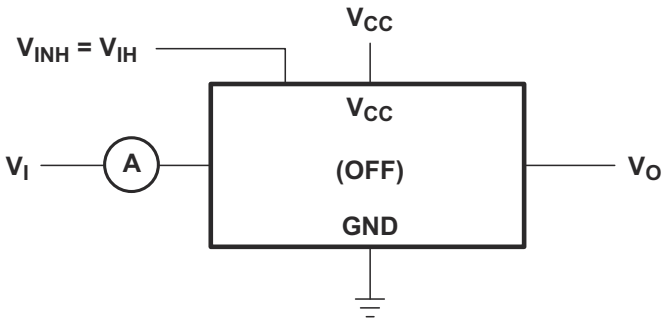


Figure 6-1. ON-State Resistance Test Circuit



Condition 1: $V_I = 0$, $V_O = V_{CC}$
Condition 2: $V_I = V_{CC}$, $V_O = 0$

Figure 6-2. OFF-State Switch Leakage-Current Test Circuit

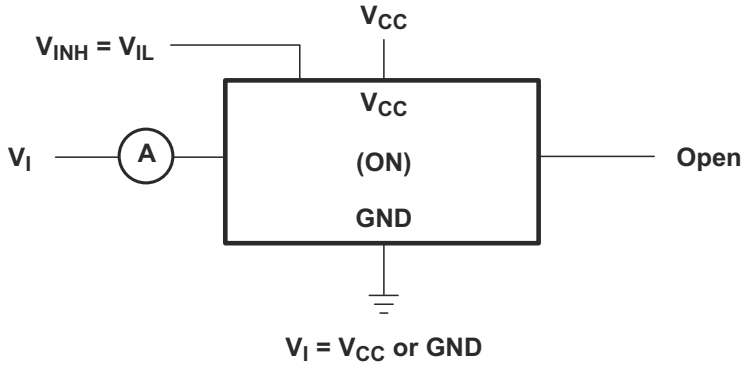


Figure 6-3. ON-State Switch Leakage-Current Test Circuit

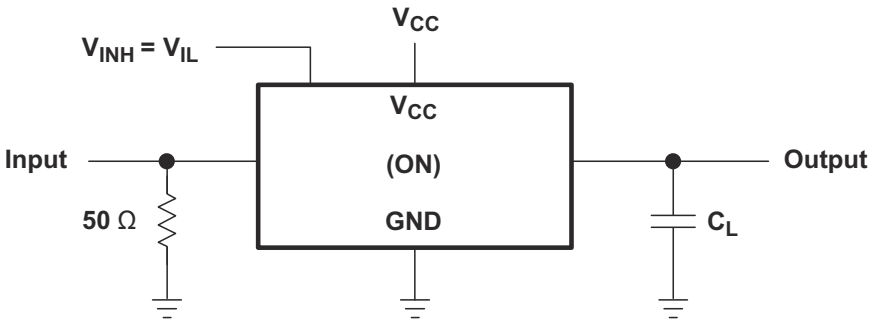
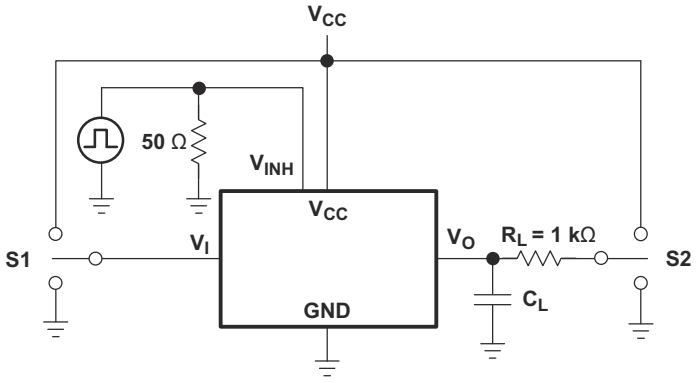
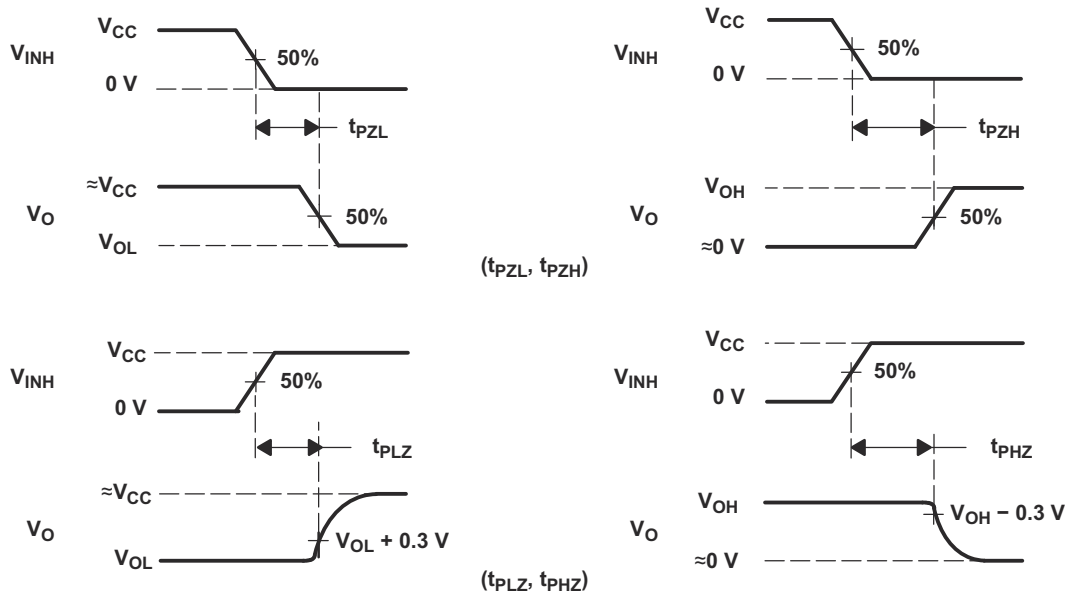


Figure 6-4. Propagation Delay Time, Signal Input to Signal Output



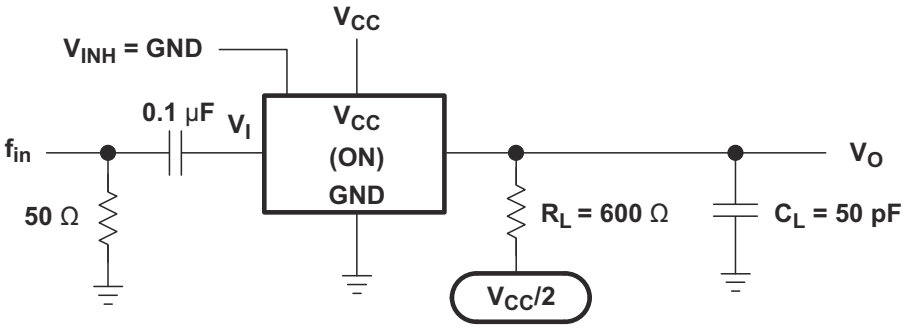
TEST	S1	S2
t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	GND V_{CC}	V_{CC} GND

TEST CIRCUIT



VOLTAGE WAVEFORMS

Figure 6-5. Switching Time (t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}), Control to Signal Output



NOTE A: f_{in} is a sine wave.

Figure 6-6. Frequency Response (Switch ON)

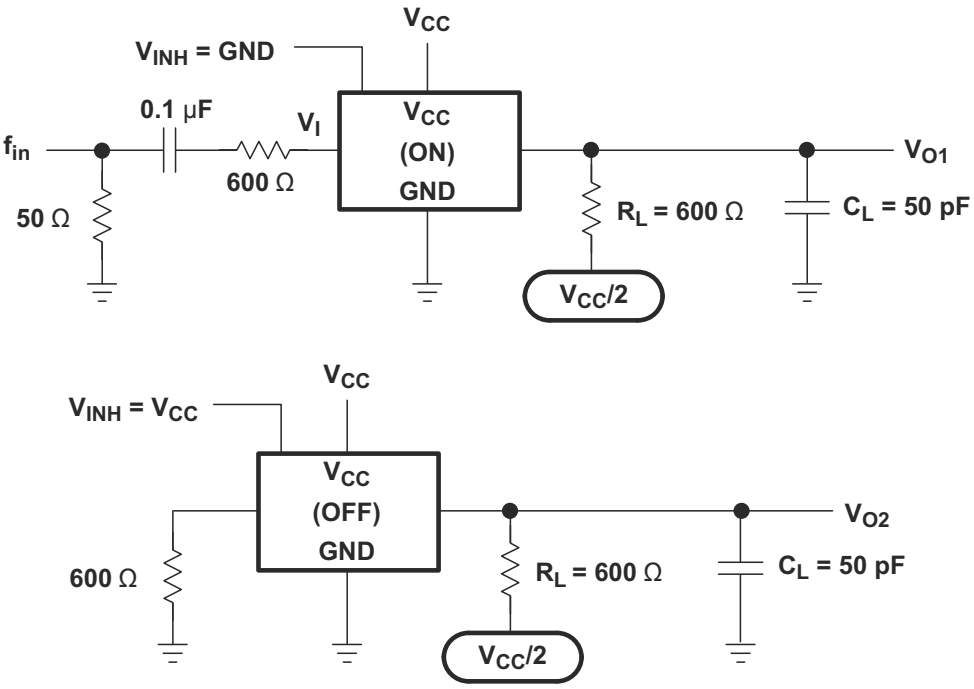


Figure 6-7. Crosstalk Between Any Two Switches

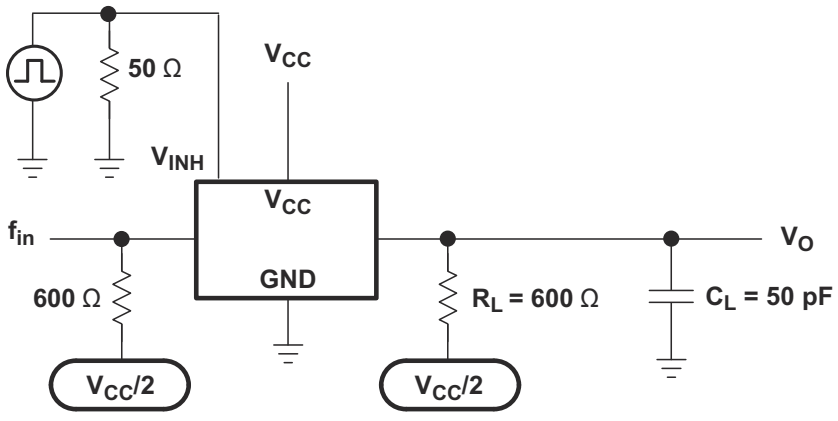


Figure 6-8. Crosstalk Between Control Input and Switch Output

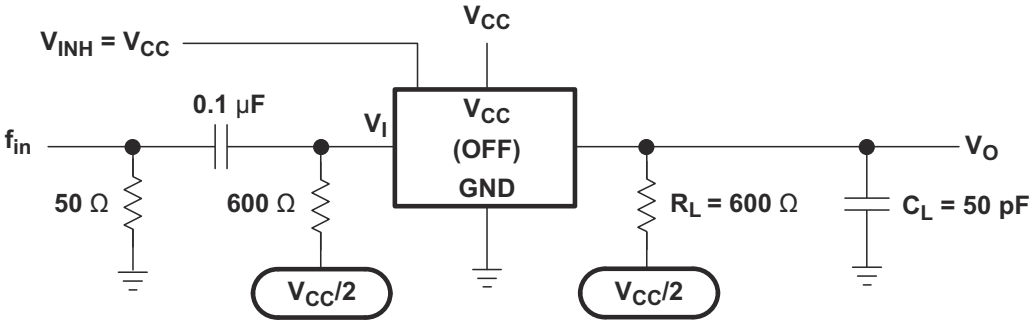


Figure 6-9. Feedthrough Attenuation (Switch OFF)

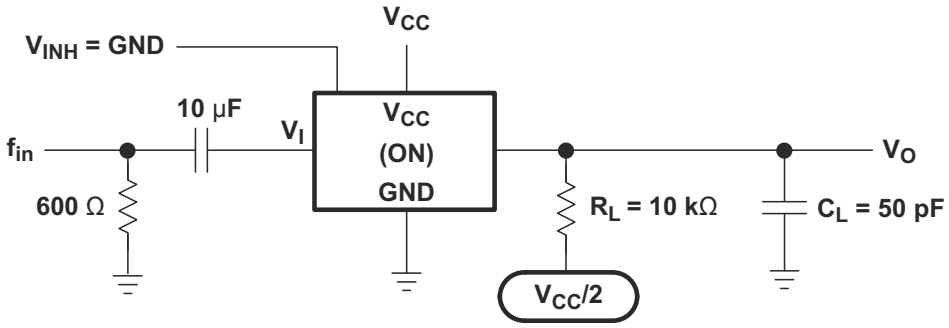


Figure 6-10. Sine-Wave Distortion

7 Detailed Description

7.1 Overview

The SNx4LV4052A device is a dual, 4-channel CMOS analog multiplexer and demultiplexer that is designed for 2V to 5.5V V_{CC} operation. It has low input current consumption at the digital input pins and low crosstalk between switches. The active low Inhibit (INH) tri-state all the channels when high and when low, depending on the A and B inputs, one of the four independent input/outputs (nY0 - nY3) connects to the COM channel. The SNx4LV4052A is available in multiple package options including TSSOP (PW) and QFN (RGY).

7.2 Functional Block Diagram

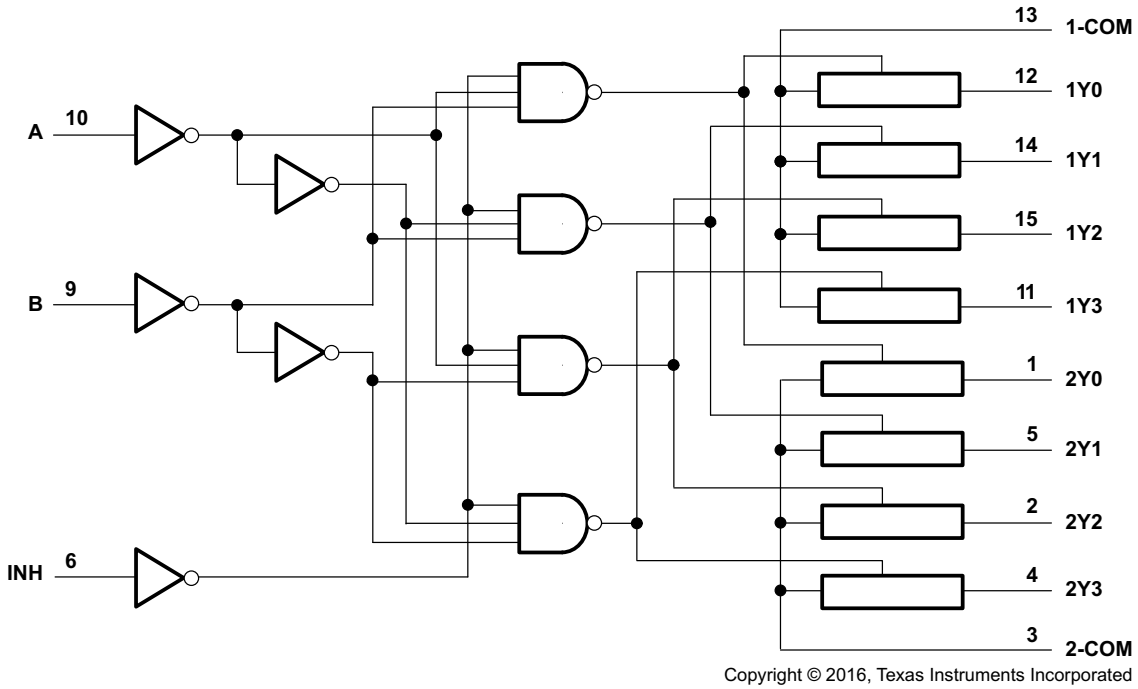


Figure 7-1. Logic Diagram (Positive Logic)

7.3 Feature Description

- The SNx4LV4052A operates from 2V to 5.5V V_{CC} with extremely low input current consumption at the CMOS input pins of A, B and INH.
- The SNx4LV4052A enables fast switching with low crosstalk between the switches. 5.5V peak level bidirectional transmission allowed with the either analog or digital signals.

7.4 Device Functional Modes

Table 7-1 lists the functional modes of SNx4LV4052A.

Table 7-1. Function Table

INPUTS			ON CHANNELS
INH	B	A	
L	L	L	1Y0, 2Y0
L	L	H	1Y1, 2Y1
L	H	L	1Y2, 2Y2
L	H	H	1Y3, 2Y3
H	X	X	None

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, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

Typical applications for the SNx4LV4052A include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

8.2 Typical Application

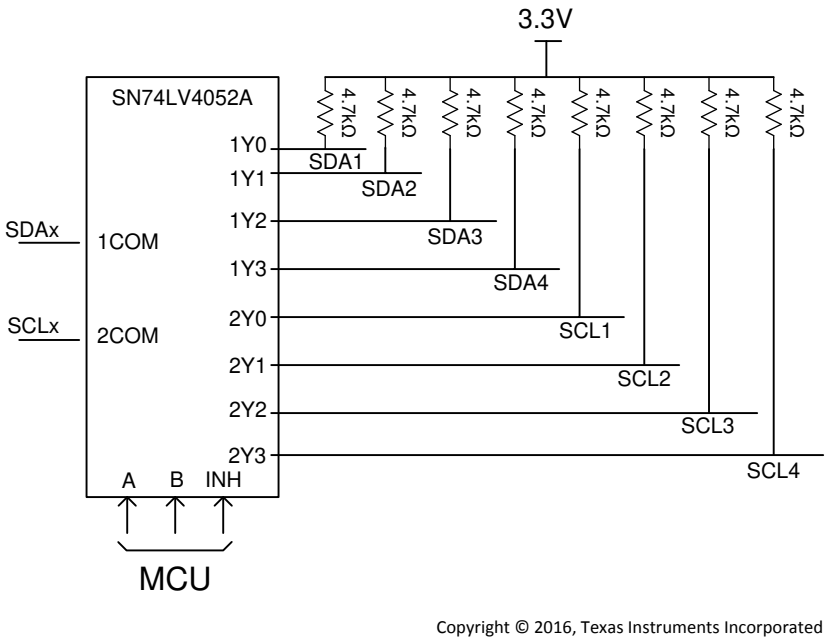


Figure 8-1. Typical I²C Multiplexing Application

8.2.1 Design Requirements

Designing with the SNx4LV4052A device requires a stable input voltage between 2V and 5.5V (see *Recommended Operating Conditions* for details). Another important design consideration are the characteristics of the signal being multiplexed—ensure no important information is lost due to timing or incompatibility with this device.

8.2.2 Detailed Design Procedure

The SNx4LV4052A dual 1- to 4-channel multiplexer is an excellent choice for I²C selection. The I²C data and clock lines are selected using A,B select lines from the MCU. The pullup resistors are selected based on the capability of the driver. Low pullup resistor results in faster rise time; however, it generates additional current during the low state into the driver. See the *Recommended Operating Conditions* for the input transition rates (V_{IH} and V_{IL}) of the CMOS inputs.

8.2.3 Application Curve

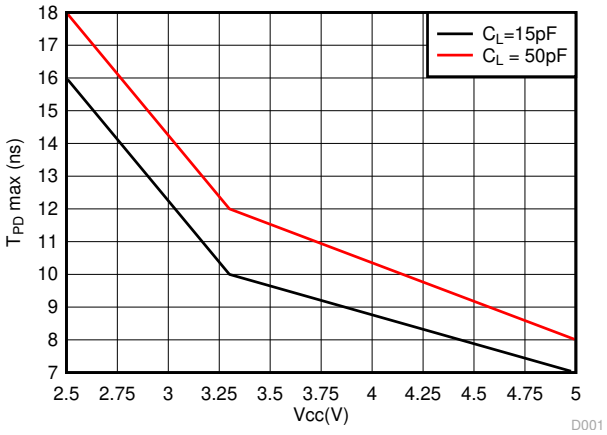


Figure 8-2. Maximum Propagation Delay vs V_{cc}

8.3 Power Supply Recommendations

Most systems have a common 3.3V or 5V rail that can supply the V_{CC} pin of this device. If this rail is not available, a switched-mode power supply (SMPS) or a low dropout regulator (LDO) can supply this device from a higher-voltage rail.

See the *Recommended Operating Conditions* for operating voltage range for this device. Having bypass capacitors of 0.1µF is highly recommended.

8.4 Layout

8.4.1 Layout Guidelines

TI recommends keeping the signal lines as short and as straight as possible (see Figure 8-3). Incorporation of microstrip or stripline techniques are also recommended when signal lines are more than 1 in. long. These traces must be designed with a characteristic impedance of either 50Ω or 75Ω as required by the application.

Do not place this device too close to high-voltage switching components because they may cause interference. Not all PCB traces can be straight and therefore some traces must turn corners. Figure 8-4 shows progressively better techniques of rounding corners. Only the last example (BEST) maintains constant trace width and minimizes reflections.

8.4.2 Layout Example

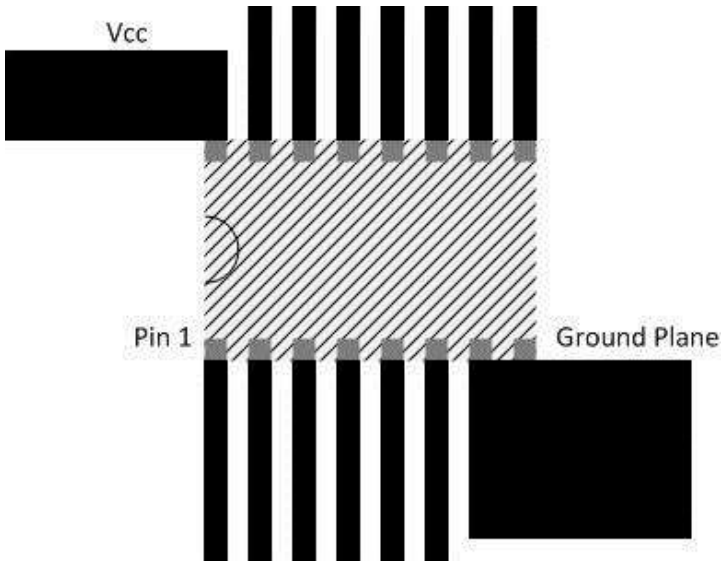


Figure 8-3. Layout Schematic

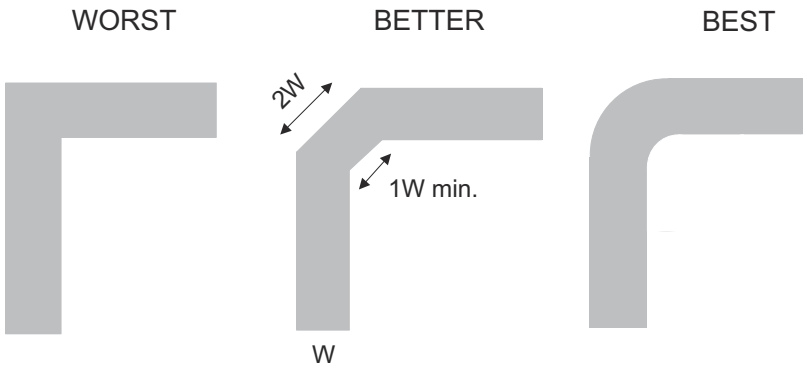


Figure 8-4. Trace Example

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *Implications of Slow or Floating CMOS Inputs*

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

9.5 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.

9.6 Glossary

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

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision K (November 2016) to Revision L (June 2024)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document	1
• Added new VIH and VIL Specifications at 1.65V Vcc	5
• Increased max ambient temperature max to 125C	5
• Added Ron, Ron Peak, and Delta Ron Specifications at 1.65V Vcc	5
• Added Ron, Ron Peak, and Delta Ron Specifications at 125C	5
• Added Timing Specifications at 125C	7

Changes from Revision J (October 2012) to Revision K (November 2016)	Page
• Added *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section	1
• Deleted *Ordering Information* table; see *Package Option Addendum* at the end of the data sheet	1
• Deleted SN54LV4052A from data sheet	1

11 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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV4052AD	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	-40 to 85	LV4052A	
SN74LV4052ADBR	NRND	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LW052A	
SN74LV4052ADBRE4	NRND	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LW052A	
SN74LV4052ADGVR	NRND	TVSOP	DGV	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LW052A	
SN74LV4052ADR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	LV4052A	Samples
SN74LV4052AN	NRND	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-40 to 85	SN74LV4052AN	
SN74LV4052ANSR	NRND	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	74LV4052A	
SN74LV4052APW	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-40 to 85	LW052A	
SN74LV4052APWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	LW052A	Samples
SN74LV4052APWT	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-40 to 85	LW052A	
SN74LV4052ARGYR	ACTIVE	VQFN	RGY	16	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	LW052A	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) **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 finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

OTHER QUALIFIED VERSIONS OF SN74LV4052A :

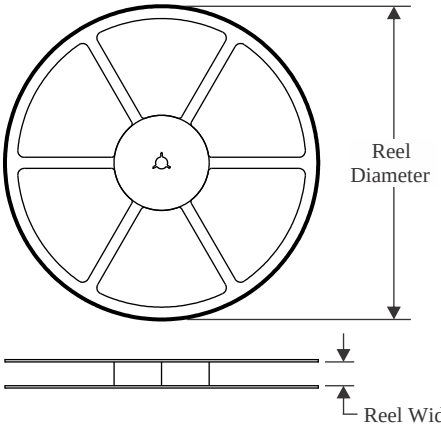
- Automotive : SN74LV4052A-Q1
- Enhanced Product : SN74LV4052A-EP

NOTE: Qualified Version Definitions:

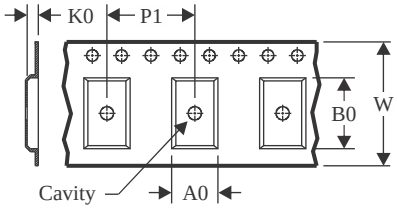
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

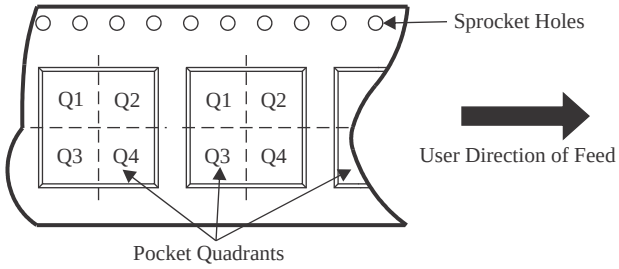


TAPE DIMENSIONS



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

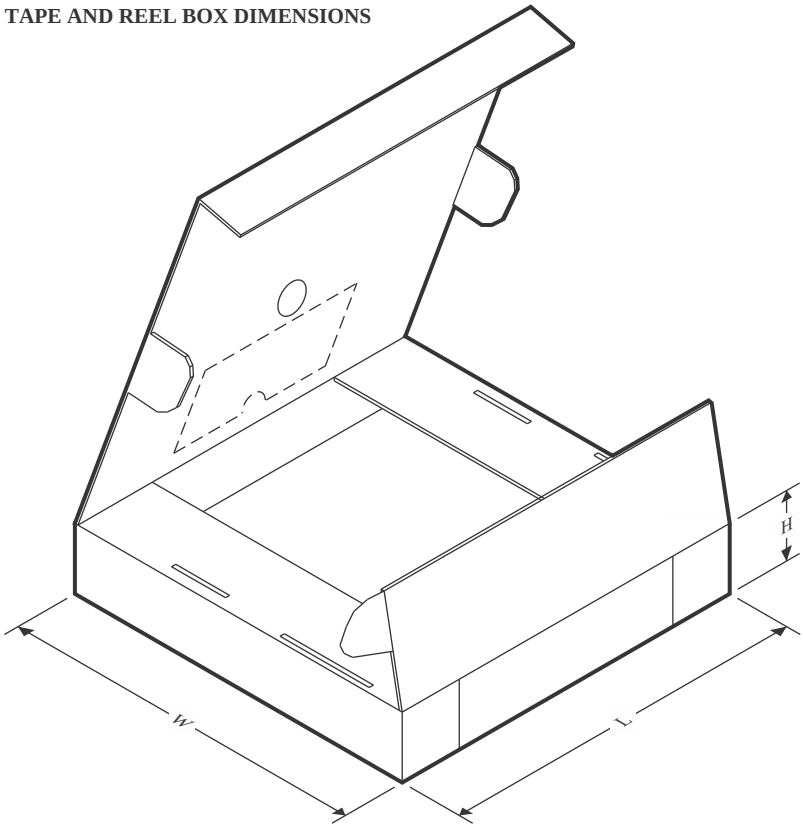
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74LV4052ADBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74LV4052ADGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74LV4052ADR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LV4052ANSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LV4052APWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV4052APWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV4052APWT	TSSOP	PW	16	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV4052ARGYR	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	8.0	12.0	Q1

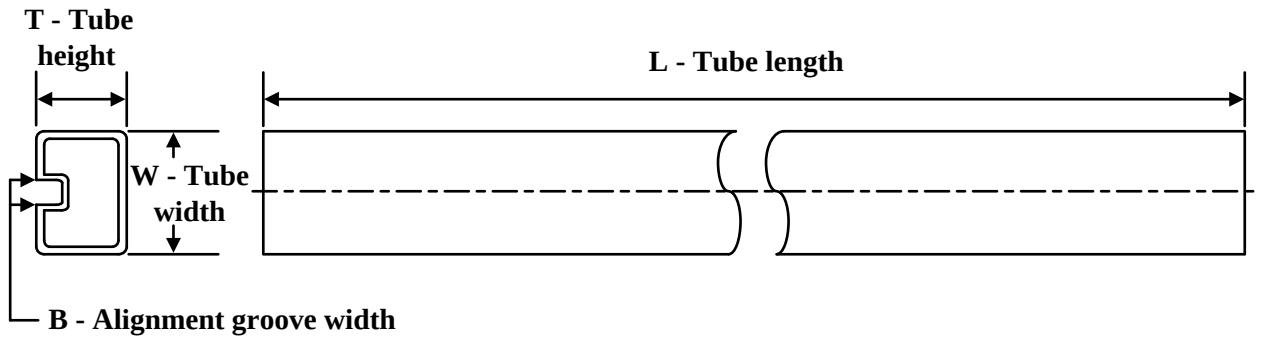
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV4052ADBR	SSOP	DB	16	2000	356.0	356.0	35.0
SN74LV4052ADGVR	TVSOP	DGV	16	2000	356.0	356.0	35.0
SN74LV4052ADR	SOIC	D	16	2500	340.5	336.1	32.0
SN74LV4052ANSR	SO	NS	16	2000	356.0	356.0	35.0
SN74LV4052APWR	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74LV4052APWRG4	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74LV4052APWT	TSSOP	PW	16	250	356.0	356.0	35.0
SN74LV4052ARGYR	VQFN	RGY	16	3000	367.0	367.0	35.0

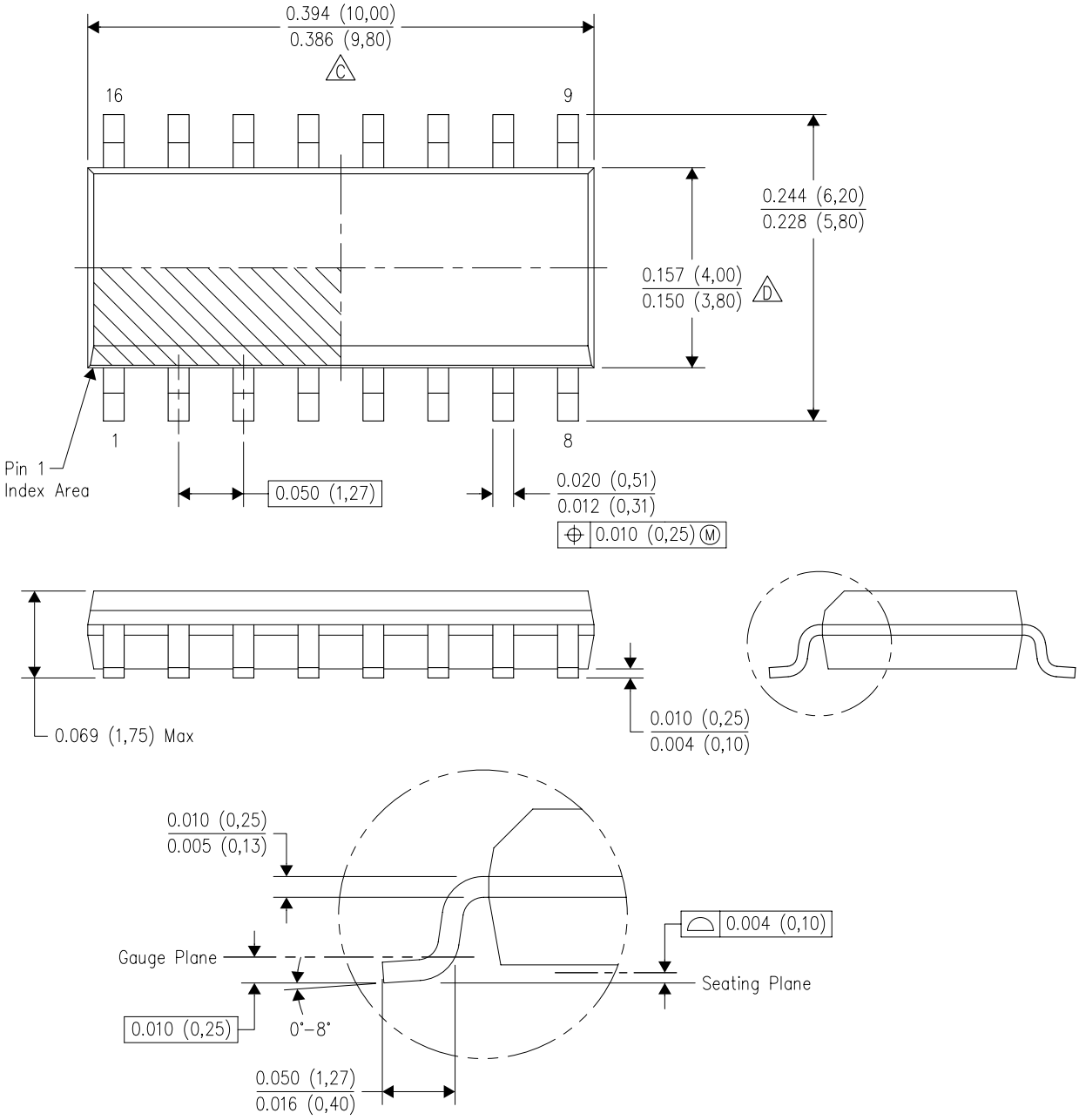
TUBE



*All dimensions are nominal

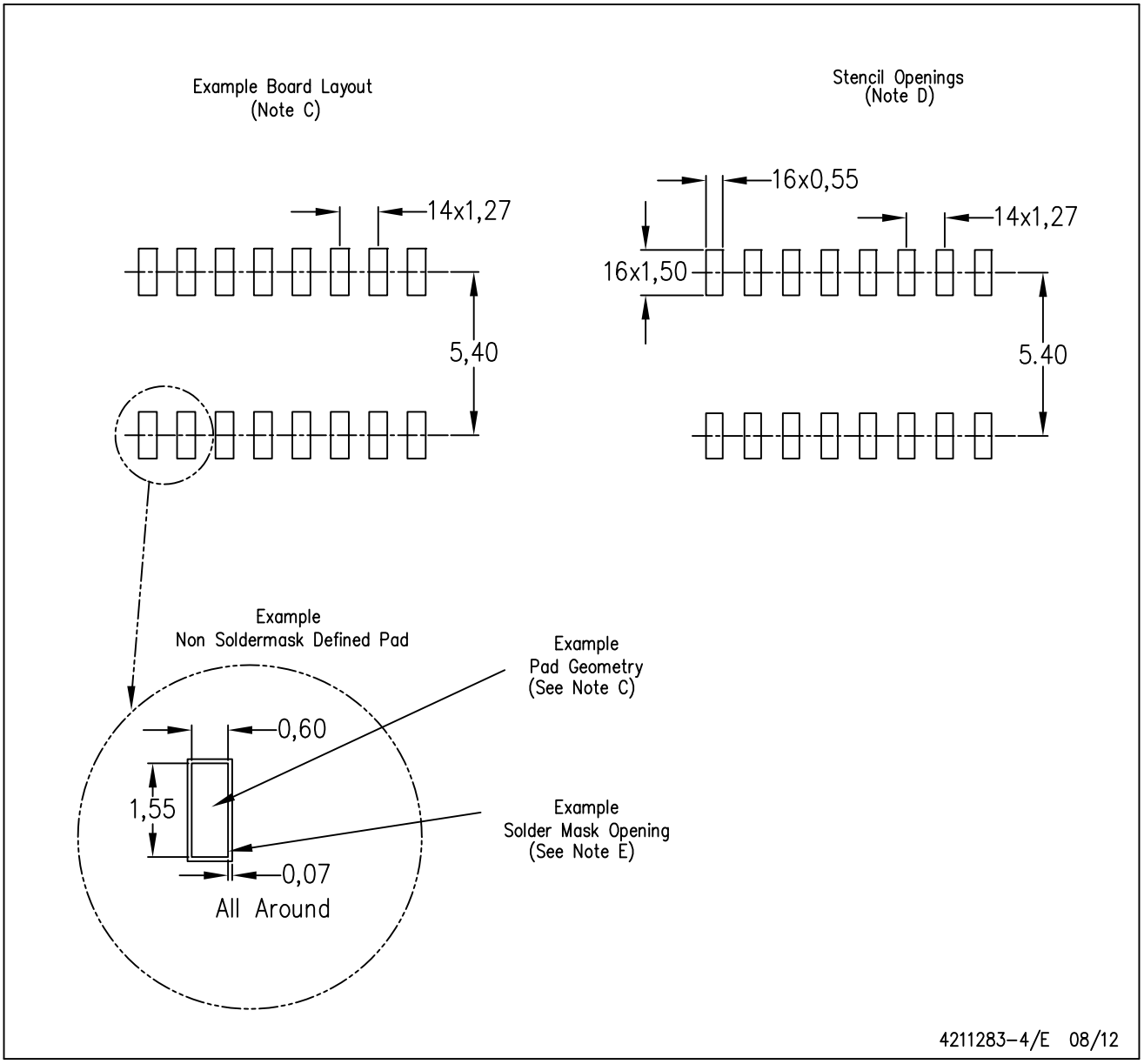
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
SN74LV4052AD	D	SOIC	16	40	507	8	3940	4.32
SN74LV4052AN	N	PDIP	16	25	506	13.97	11230	4.32
SN74LV4052AN	N	PDIP	16	25	506	13.97	11230	4.32
SN74LV4052APW	PW	TSSOP	16	90	530	10.2	3600	3.5
SN74LV4052APWE4	PW	TSSOP	16	90	530	10.2	3600	3.5
SN74LV4052APWG4	PW	TSSOP	16	90	530	10.2	3600	3.5

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AC.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



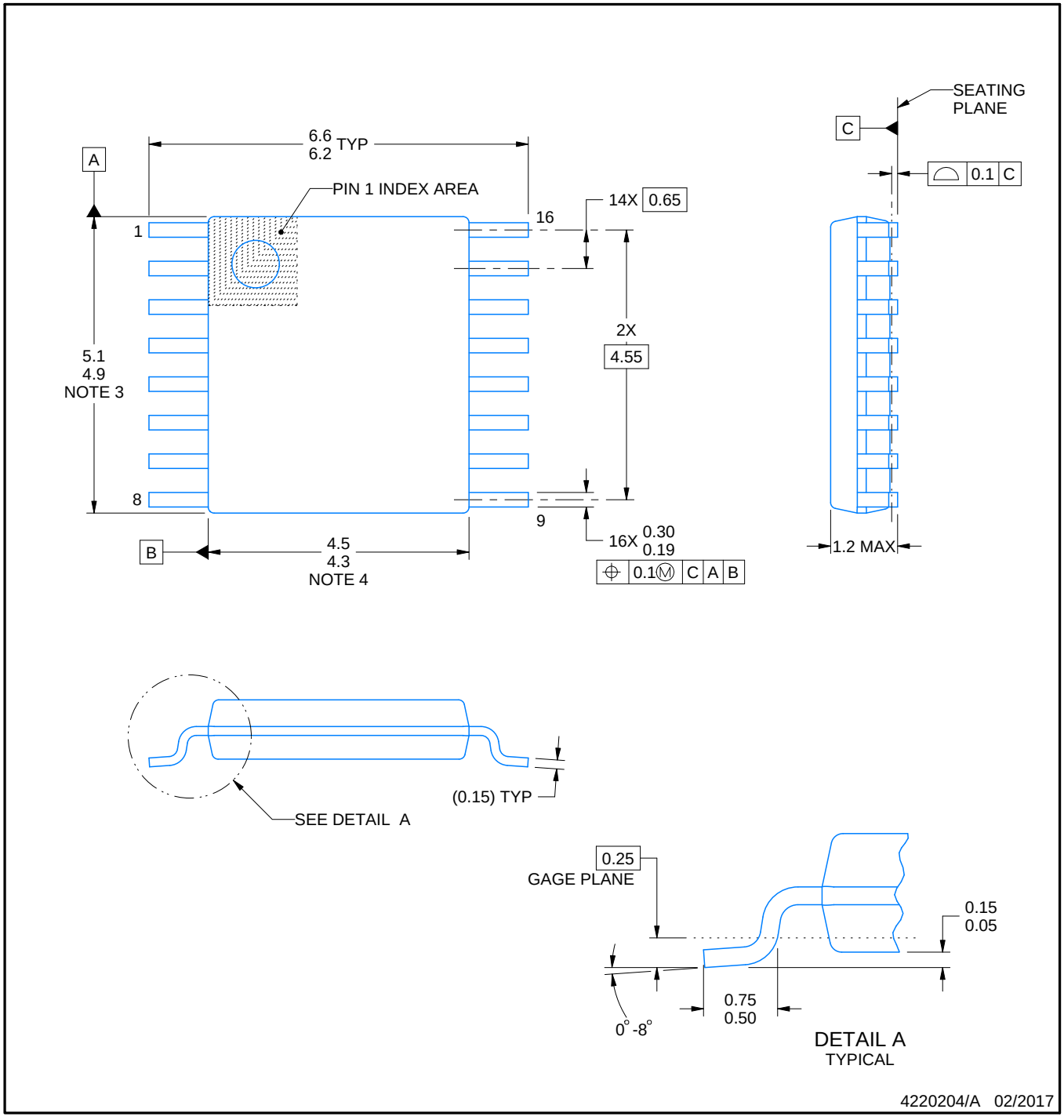
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PACKAGE OUTLINE

PW0016A

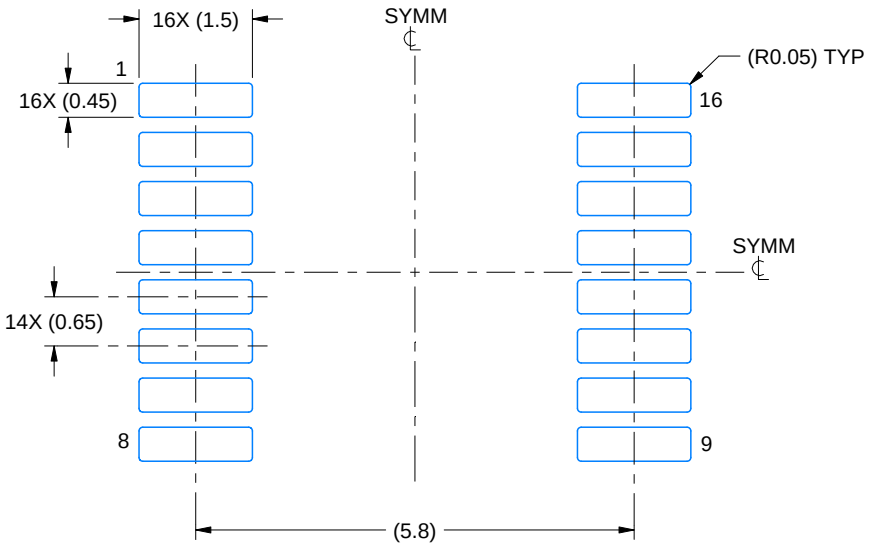
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

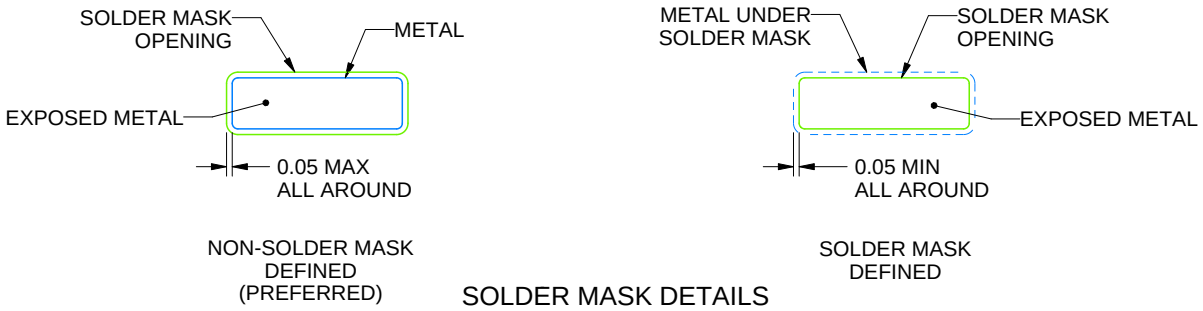


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. 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 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

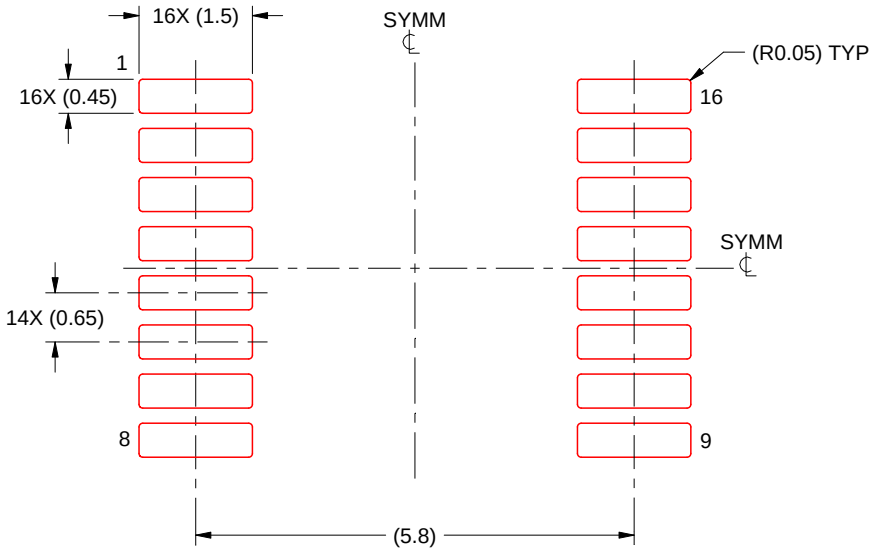


SOLDER MASK DETAILS

4220204/A 02/2017

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.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/A 02/2017

NOTES: (continued)

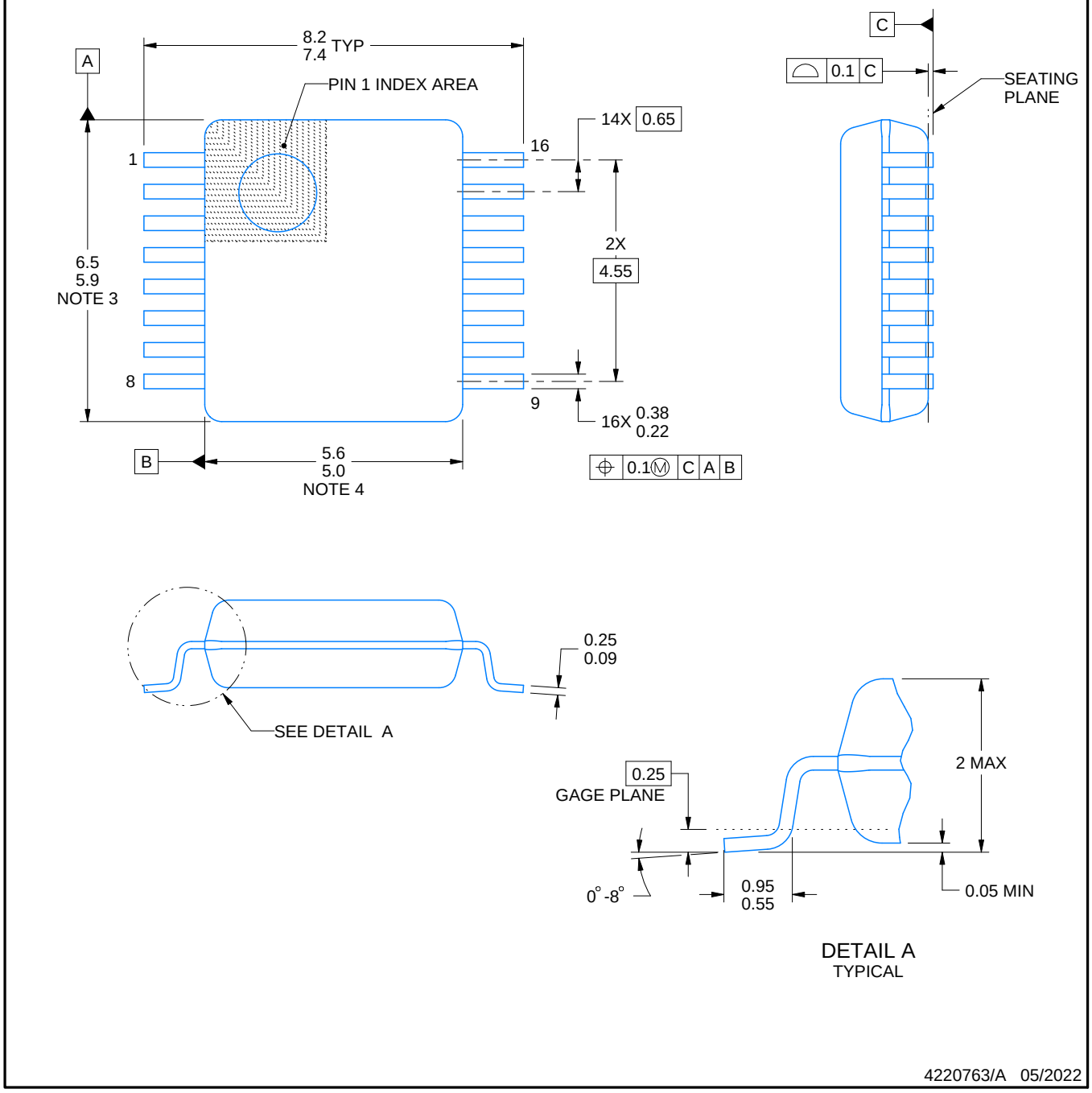
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

DB0016A

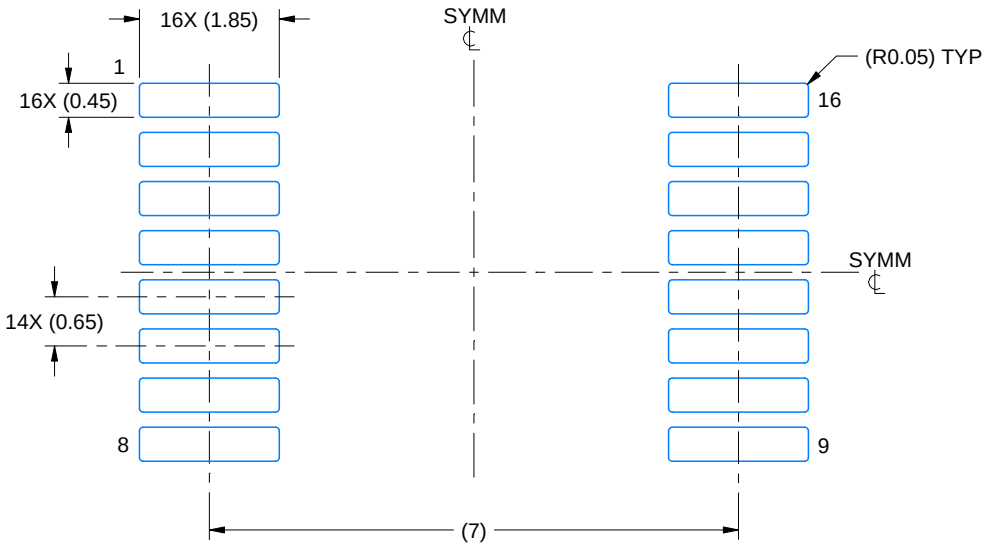
SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

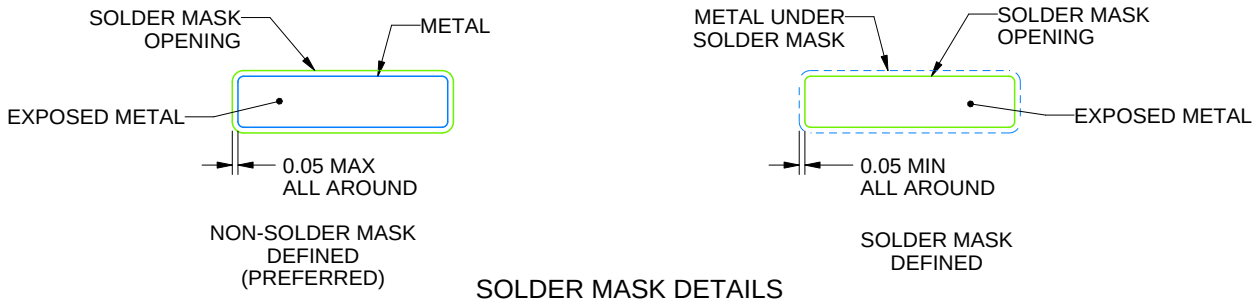


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. 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 0.15 mm per side.
4. Reference JEDEC registration MO-150.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

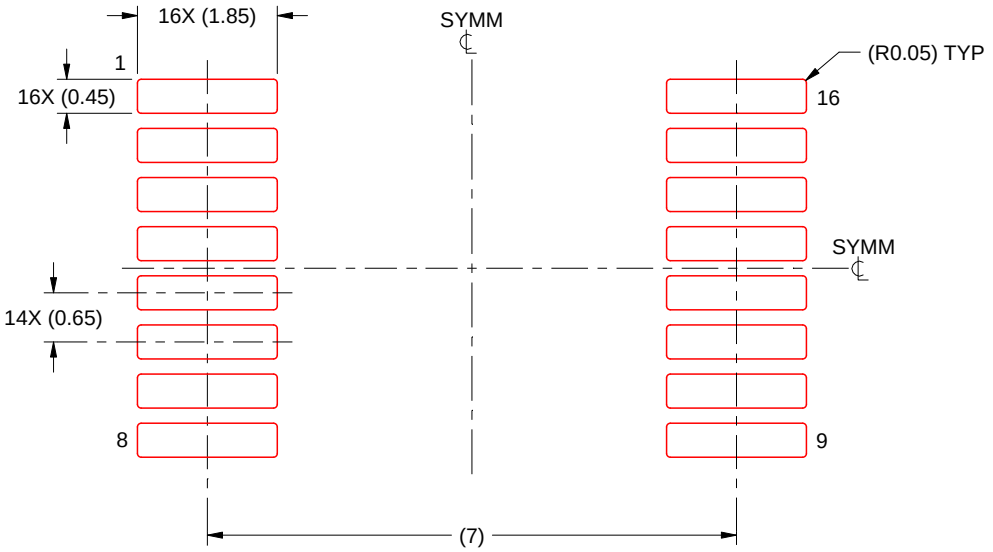


SOLDER MASK DETAILS

4220763/A 05/2022

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220763/A 05/2022

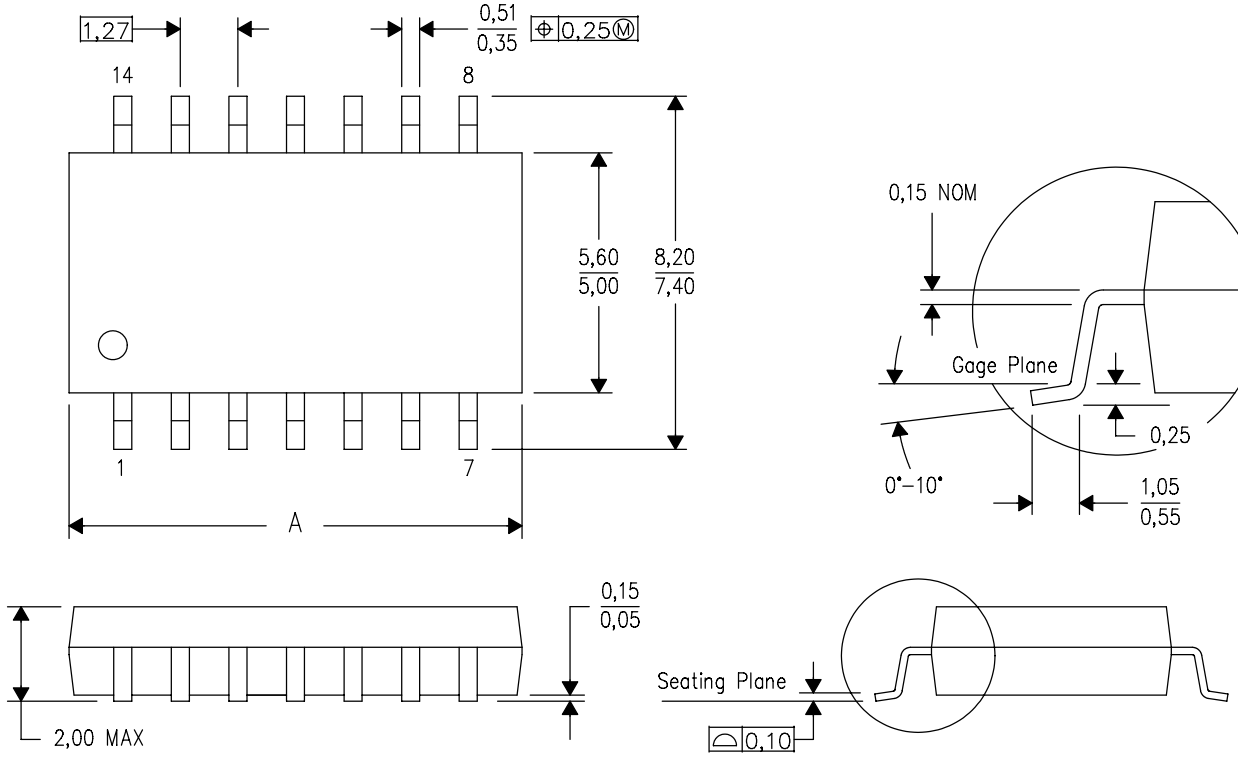
NOTES: (continued)

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

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



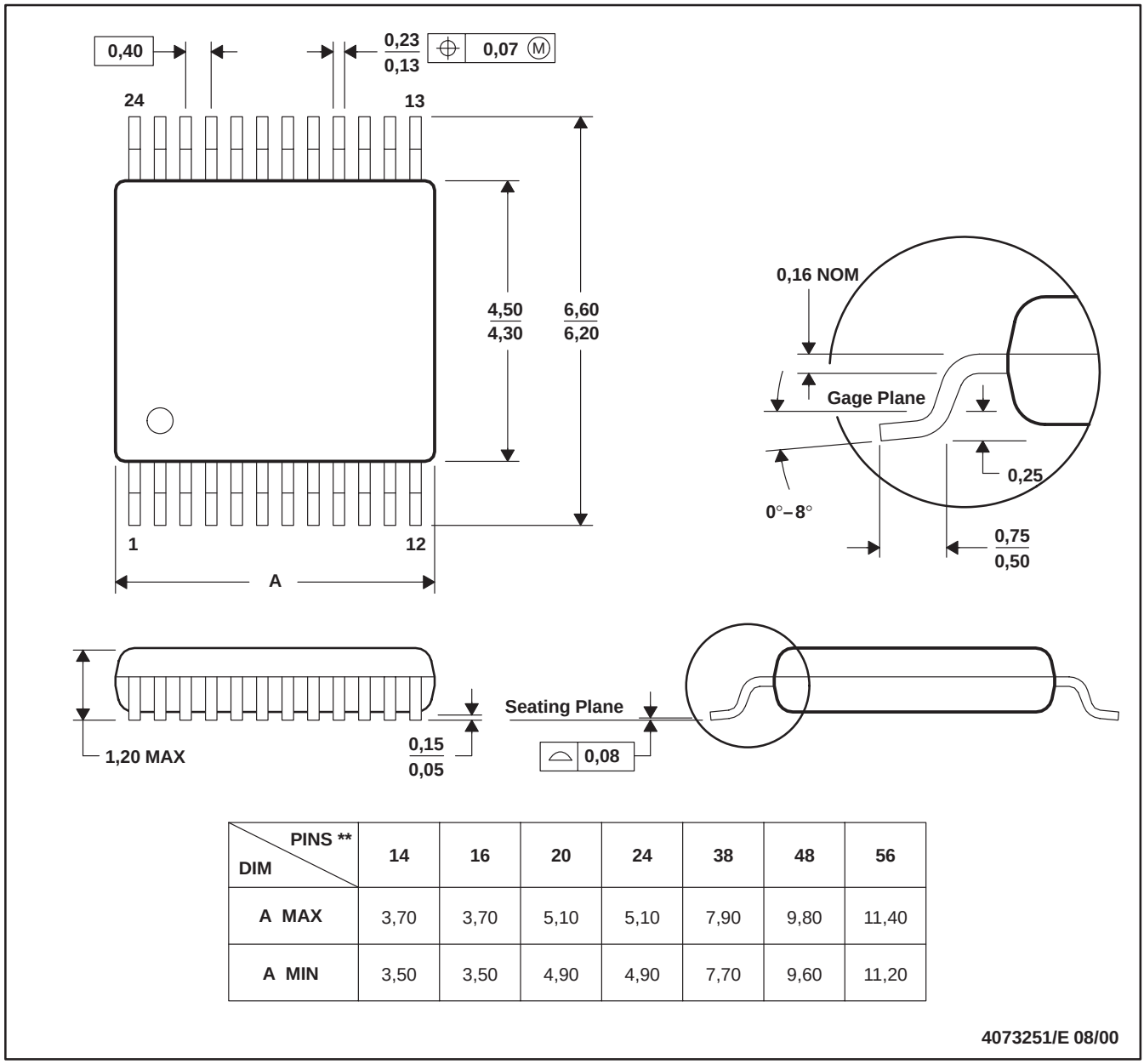
DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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, not to exceed 0,15.

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

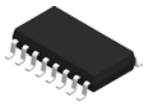
24 PINS SHOWN



DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

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, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

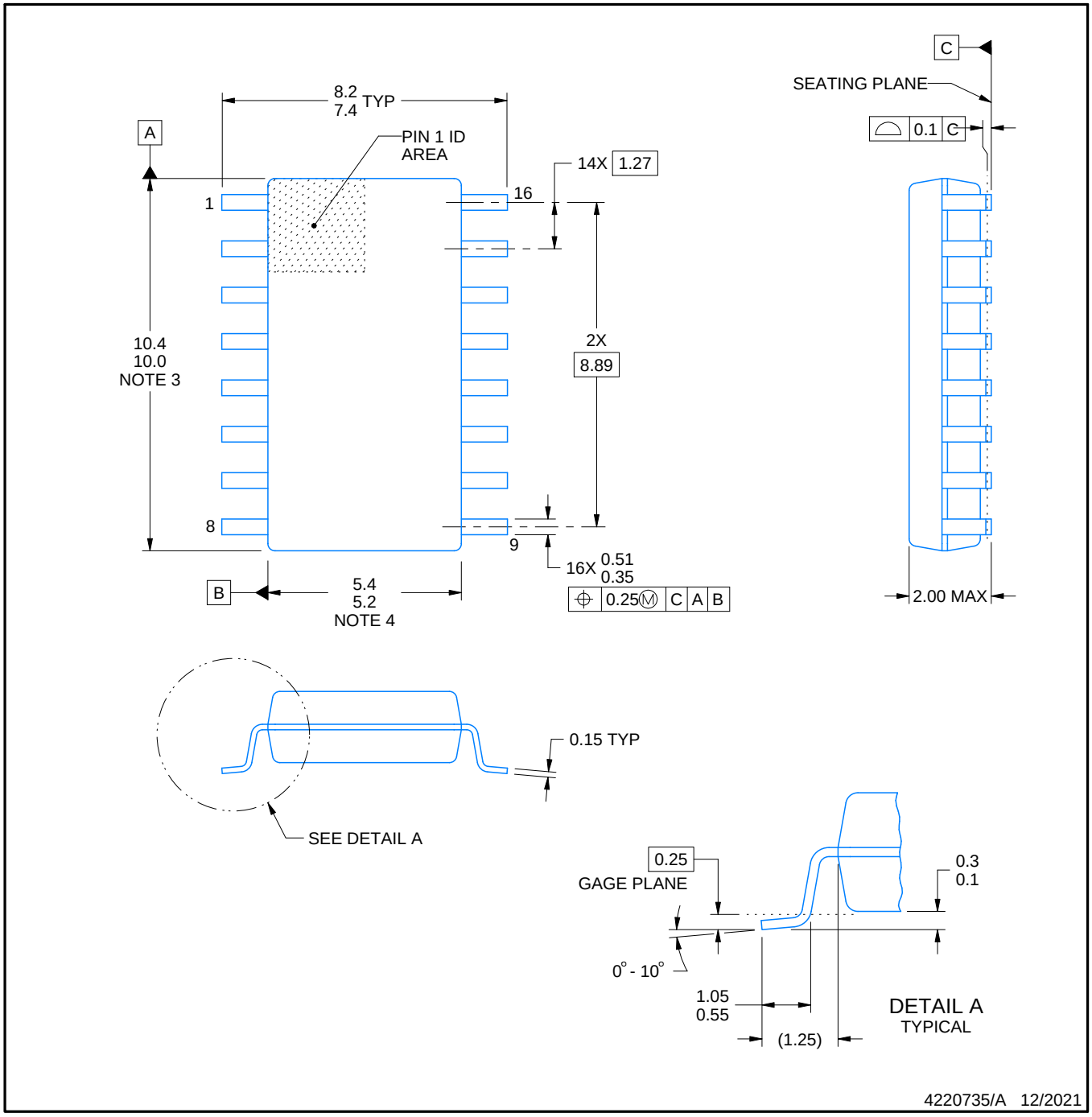


PACKAGE OUTLINE

NS0016A

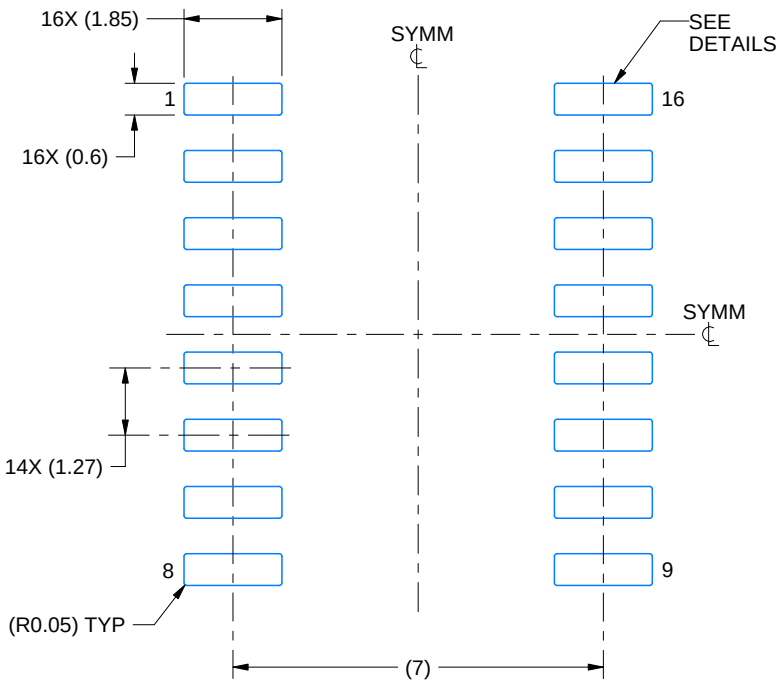
SOP - 2.00 mm max height

SOP

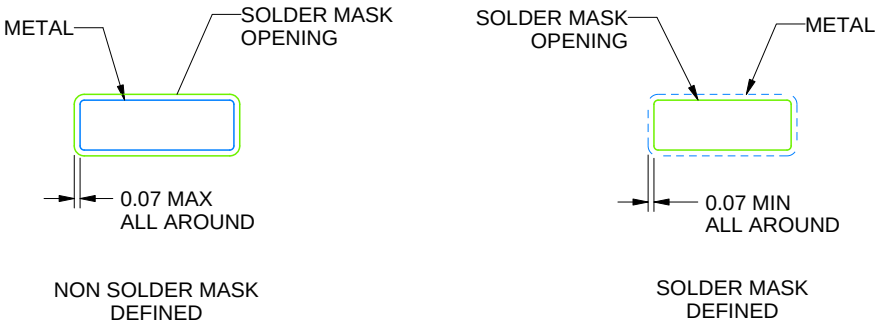


NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. 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 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.



LAND PATTERN EXAMPLE
SCALE:7X



NON SOLDER MASK
DEFINED

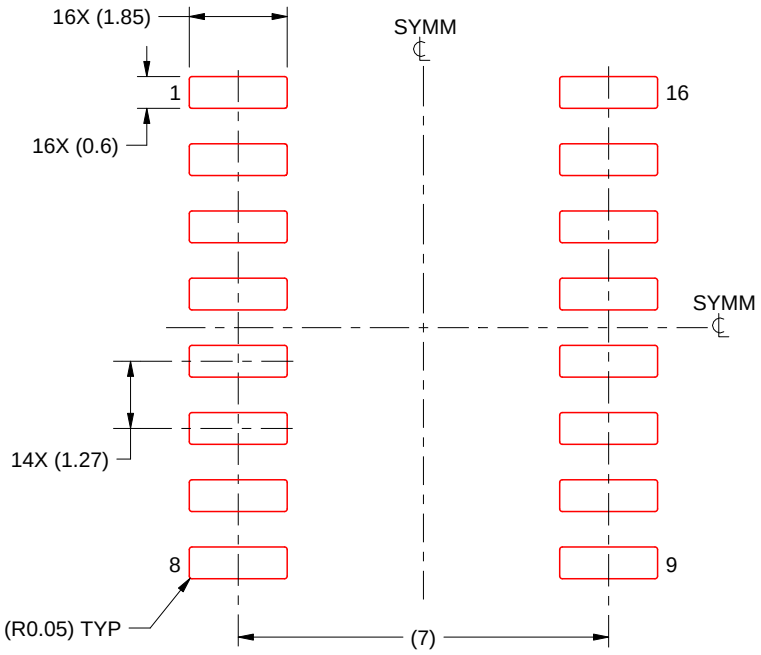
SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220735/A 12/2021

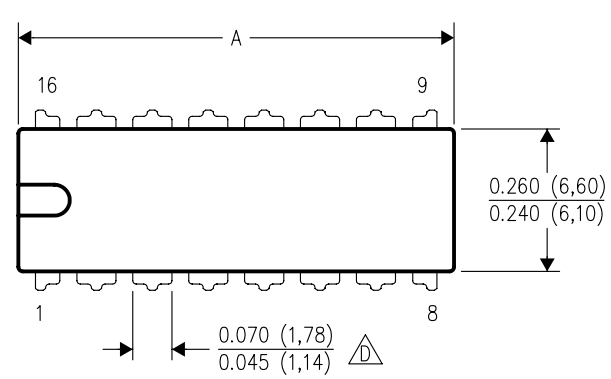
NOTES: (continued)

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

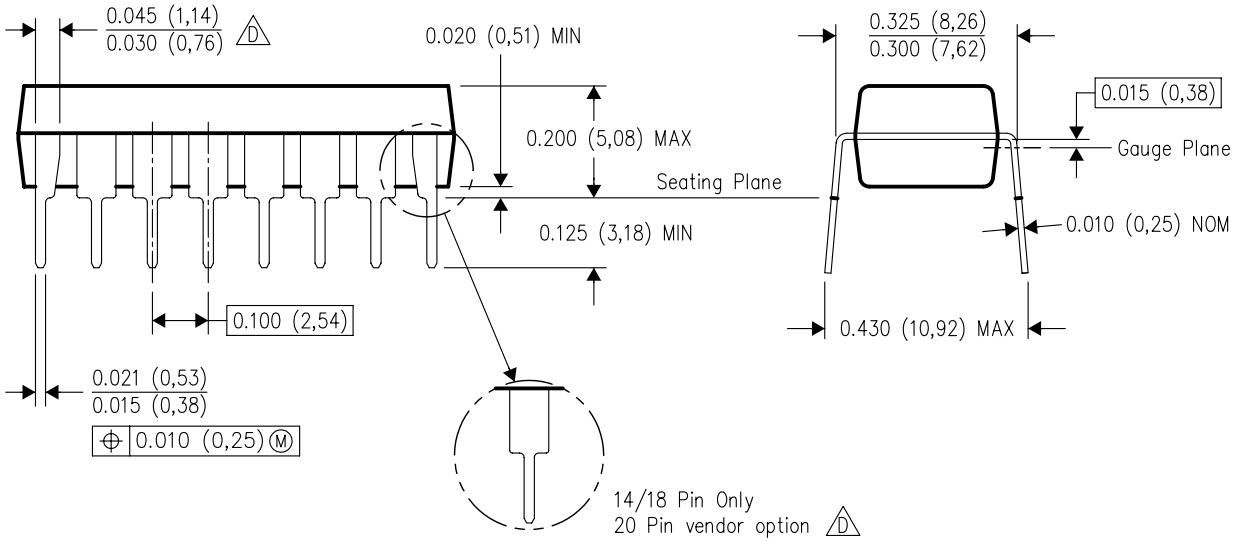
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



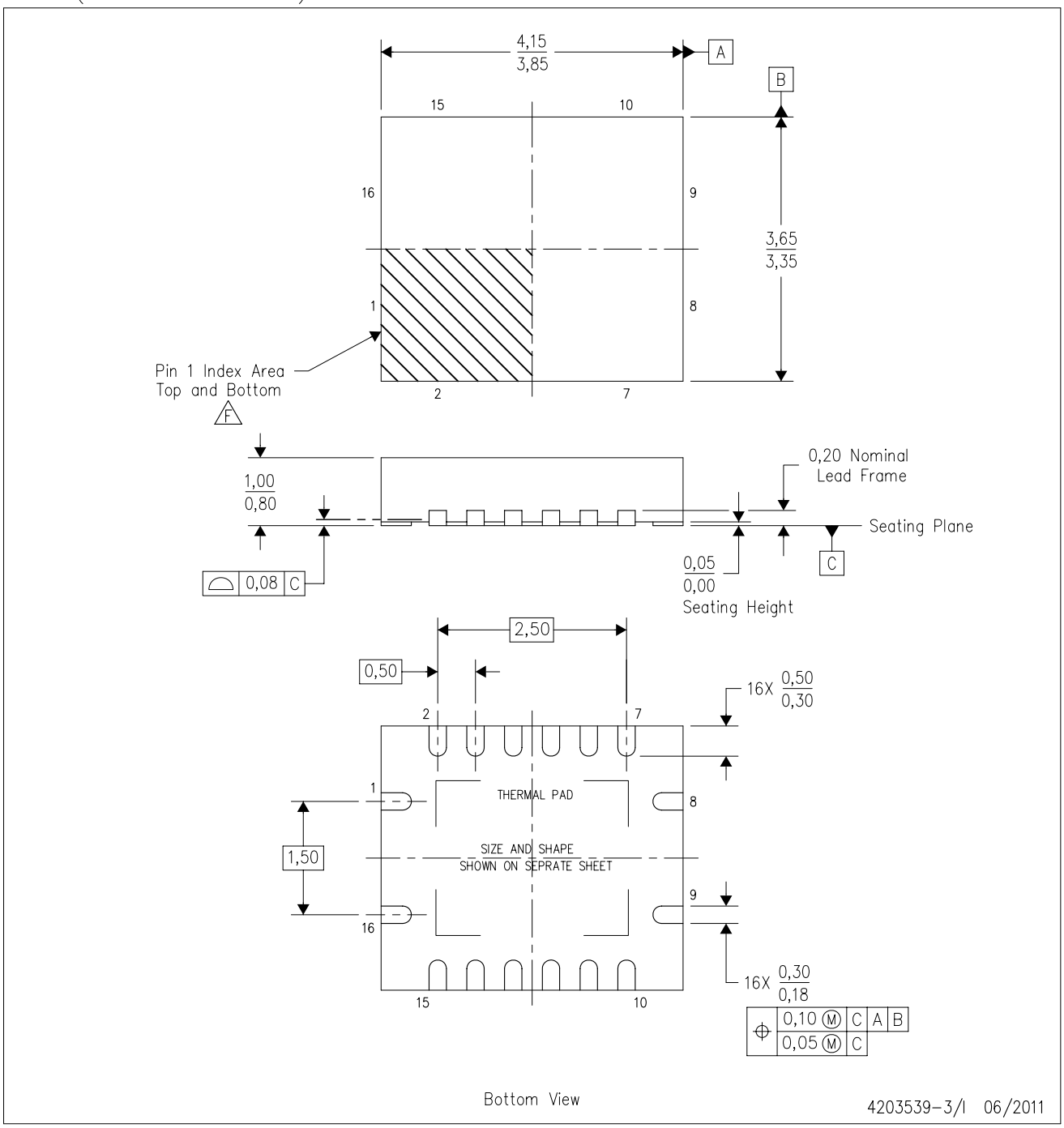
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

RGY (R–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No–Lead) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
G. Package complies to JEDEC MO–241 variation BA.

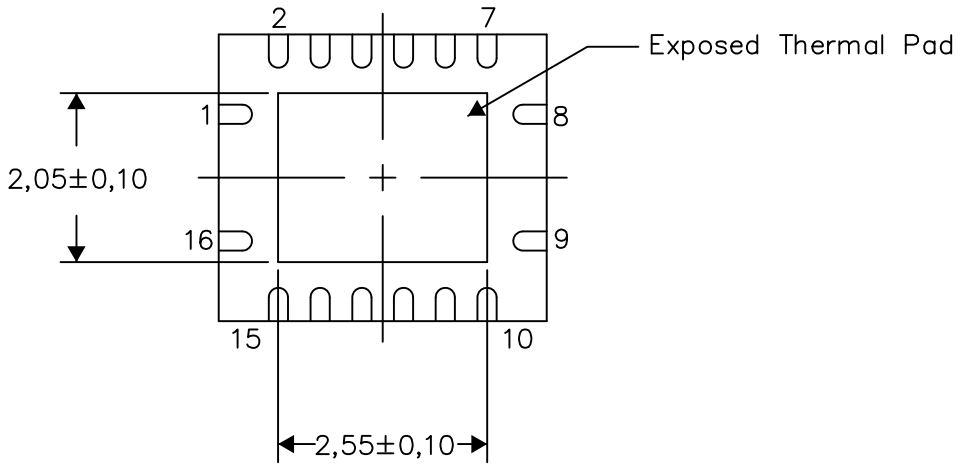
RGY (R–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No–Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



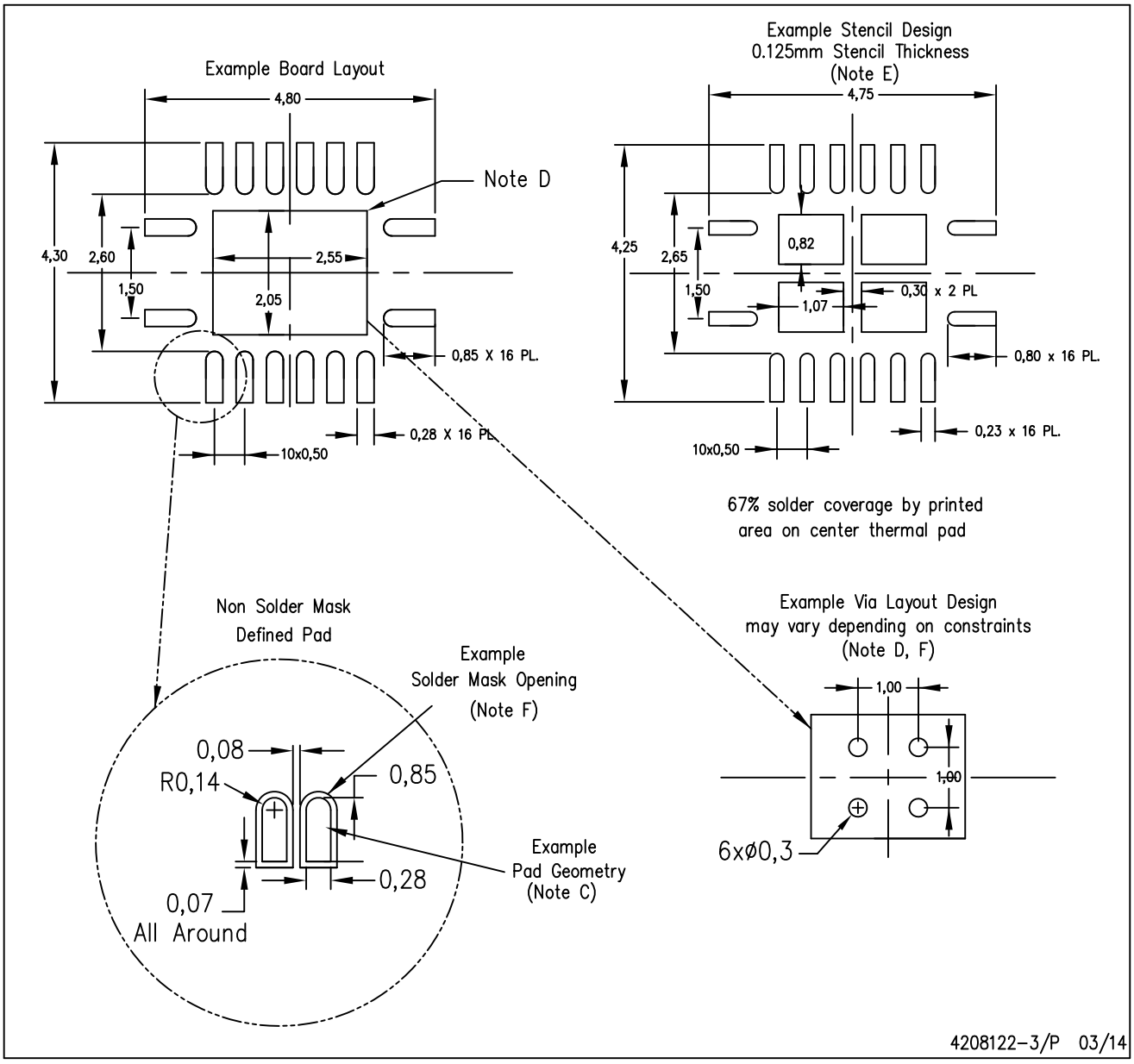
Bottom View

Exposed Thermal Pad Dimensions

4206353–3/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (R–PVQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat–Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http: //www.ti.com>.
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. Refer to IPC 7525 for stencil design considerations.
F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

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