

# SN74LVC7001A Quad 2-Input AND Gates with Schmitt-Trigger Inputs

## 1 Features

- Operating range from 1.1V to 3.6V
- 5.5V tolerant input pins
- Supports standard pinouts
- Latch-up performance exceeds 250mA per JESD 17
- ESD protection exceeds JESD 22
  - 2000V Human-Body Model (A114-A)
  - 1000V Charged-Device Model (C101)

## 2 Applications

- [Combining power good signals](#)
- [Enable digital signals](#)

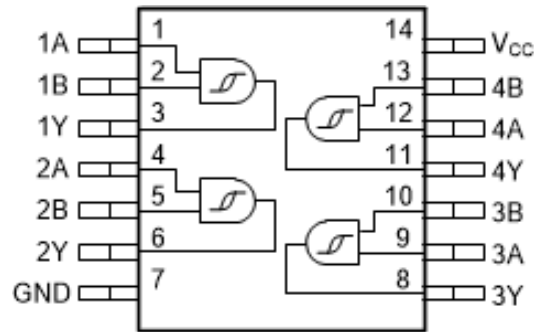
## 3 Description

The SN74LVC7001A contains four independent 2-input AND gates with Schmitt-trigger inputs. Each gate performs the Boolean function  $Y = A \bullet B$  in positive logic.

### Package Information

PART NUMBER	PACKAGE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>	BODY SIZE (NOM) <sup>(3)</sup>
SN74LVC7001A	BQA (WQFN, 14)	3mm × 2.5mm	3mm × 2.5mm
	PW (TSSOP, 14)	5mm × 6.4mm	5mm × 4.4mm

- (1) For more information, see [Section 11](#).
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



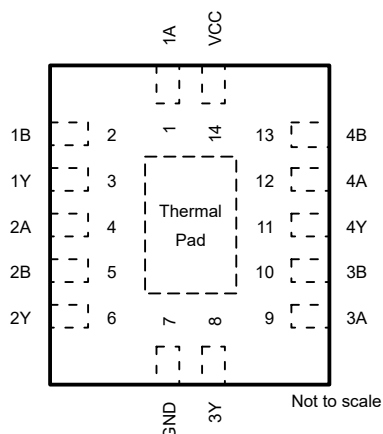
Logic Diagram



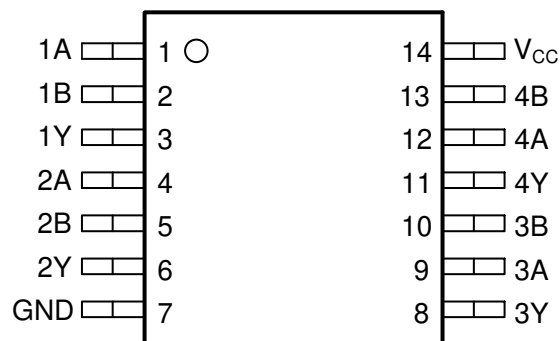
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## 4 Pin Configuration and Functions



**Figure 4-1. BQA Package, 14 Pin WQFN (Top View)**



**Figure 4-2. PW Package, 14 Pin TSSOP (Top View)**

**Table 4-1. Pin Functions**

PIN		TYPE <sup>(1)</sup>	DESCRIPTION
NAME	NO.		
1A	1	I	Channel 1, Input A
1B	2	I	Channel 1, Input B
1Y	3	O	Channel 1, Output Y
2A	4	I	Channel 2, Input A
2B	5	I	Channel 2, Input B
2Y	6	O	Channel 2, Output Y
GND	7	—	Ground
3Y	8	O	Channel 3, Output Y
3A	9	I	Channel 3, Input A
3B	10	I	Channel 3, Input B
4Y	11	O	Channel 4, Output Y
4A	12	I	Channel 4, Input A
4B	13	I	Channel 4, Input B
V <sub>CC</sub>	14	—	Positive Supply
Thermal Information <sup>(2)</sup>		—	The thermal pad can be connected to GND or left floating. Do not connect to any other signal or supply.

- (1) I = input, O = output  
(2) For BQA package only.

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage range		-0.5	6.5	V
$V_I$	Input voltage range <sup>(2)</sup>		-0.5	6.5	V
$V_O$	Output voltage range <sup>(2)</sup>		-0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current	$V_I < 0V$		-50	mA
$I_{OK}$	Output clamp current	$V_O < 0V$		-50	mA
$I_O$	Continuous output current			$\pm 50$	mA
$I_O$	Continuous output current through $V_{CC}$ or GND			$\pm 100$	mA
$T_J$	Junction temperature		-65	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) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	$\pm 2000$	V
		Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup>	$\pm 1000$	

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 5.3 Recommended Operating Conditions

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

Specifications	Description	Condition	MIN	MAX	UNIT
$V_{CC}$	Supply voltage		1.1	3.6	V
$V_I$	Input voltage			5.5	V
$V_O$	Output voltage	(High or low state)		$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 1.8V$		-4	mA
		$V_{CC} = 2.3V$		-8	
		$V_{CC} = 2.7V$		-12	
		$V_{CC} = 3V$		-24	
$I_{OL}$	Low-level output current	$V_{CC} = 1.8V$		4	mA
		$V_{CC} = 2.3V$		8	
		$V_{CC} = 2.7V$		12	
		$V_{CC} = 3V$		24	
$\Delta t/\Delta v$	Input transition rise or fall rate			10	ns/V
$T_A$	Operating free-air temperature		-40	125	°C

## 5.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		Package Options		UNIT
		PW (TSSOP)	BQA (WQFN)	
		14 PINS	14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	150.8	102.3	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	78.3	96.8	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	93.8	70.9	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	24.7	16.6	°C/W
$Y_{JB}$	Junction-to-board characterization parameter	93.2	70.9	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	-	50.1	°C/W

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

## 5.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	$V_{CC}$	-40°C to 125°C			UNIT
			MIN	TYP	MAX	
$V_{T+}$	Positive-going input threshold voltage	1.1V	0.5		0.8	V
$V_{T+}$	Positive-going input threshold voltage	1.5V	0.7		1.11	V
$V_{T+}$	Positive-going input threshold voltage	1.65V	0.4		1.3	V
$V_{T+}$	Positive-going input threshold voltage	1.95V	0.6		1.5	V
$V_{T+}$	Positive-going input threshold voltage	2.3V	0.8		1.7	V
$V_{T+}$	Positive-going input threshold voltage	2.5V	0.8		1.7	V
$V_{T+}$	Positive-going input threshold voltage	2.7V	0.8		2	V
$V_{T+}$	Positive-going input threshold voltage	3V	0.9		2	V
$V_{T+}$	Positive-going input threshold voltage	3.6V	1.1		2	V
$V_{T-}$	Negative-going input threshold voltage	1.1V	0.2		0.6	V
$V_{T-}$	Negative-going input threshold voltage	1.5V	0.34		0.75	V
$V_{T-}$	Negative-going input threshold voltage	1.65V	0.2		0.9	V
$V_{T-}$	Negative-going input threshold voltage	1.95V	0.3		1	V
$V_{T-}$	Negative-going input threshold voltage	2.3V	0.4		1.2	V
$V_{T-}$	Negative-going input threshold voltage	2.5V	0.4		1.2	V
$V_{T-}$	Negative-going input threshold voltage	2.7V	0.4		1.4	V
$V_{T-}$	Negative-going input threshold voltage	3V	0.6		1.5	V
$V_{T-}$	Negative-going input threshold voltage	3.6V	0.8		1.7	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	1.1V	0.07		0.53	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	1.5V	0.18		0.60	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	1.65V	0.1		1.2	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	1.95V	0.2		1.3	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	2.3V	0.3		1.3	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	2.5V	0.3		1.3	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	2.7V	0.3		1.1	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	3V	0.3		1.2	V
$\Delta V_T$	Hysteresis ( $V_{T+} - V_{T-}$ )	3.6V	0.3		1.2	V
$V_{OH}$	$I_{OH} = -100\mu A$	1.1V to 3.6V	$V_{CC} - 0.2$			V
$V_{OH}$	$I_{OH} = -4mA$	1.65V	1.2			V
$V_{OH}$	$I_{OH} = -8mA$	2.3V	1.75			V

## 5.5 Electrical Characteristics (continued)

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	-40°C to 125°C			UNIT
			MIN	TYP	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -12mA	2.7V	2.2			V
V <sub>OH</sub>		3V	2.4			V
V <sub>OH</sub>	I <sub>OH</sub> = -24mA	3V	2.2			V
V <sub>OL</sub>	I <sub>OH</sub> = 100μA	1.1V to 3.6V			0.15	V
V <sub>OL</sub>	I <sub>OH</sub> = 4mA	1.65V			0.45	V
V <sub>OL</sub>	I <sub>OH</sub> = 8mA	2.3V			0.7	V
V <sub>OL</sub>	I <sub>OH</sub> = 12mA	2.7V			0.4	V
V <sub>OL</sub>	I <sub>OH</sub> = 24mA	3V			0.55	V
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.6V			±5	μA
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = V <sub>CC</sub>	0V			±10	μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6V			40	μA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> - 0.6V, other inputs at V <sub>CC</sub> or GND	2.7V to 3.6V			500	μA
C <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3V				pF
C <sub>O</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	3.3V				pF
C <sub>PD</sub>	f = 10MHz	1.8V		31		pF
C <sub>PD</sub>	f = 10MHz	2.5V		31		pF
C <sub>PD</sub>	f = 10MHz	3.3V		32		pF

## 5.6 Switching Characteristics

over operating free-air temperature range; typical values measured at T<sub>A</sub> = 25°C (unless otherwise noted). See *Parameter Measurement Information*

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	V <sub>CC</sub>	-40°C to 125°C			UNIT
					MIN	TYP	MAX	
t <sub>pd</sub>	A or B	Y	C <sub>L</sub> = 15pF	1.2V ± 0.1V		12	44	ns
t <sub>pd</sub>	A or B	Y	C <sub>L</sub> = 15pF	1.5V ± 0.12V		9	15	ns
t <sub>pd</sub>	A or B	Y	C <sub>L</sub> = 30pF	1.8V ± 0.15V			10.2	ns
t <sub>pd</sub>	A or B	Y	C <sub>L</sub> = 30pF	2.5V ± 0.2V			6.9	ns
t <sub>pd</sub>	A or B	Y	C <sub>L</sub> = 50pF	2.7V			6.4	ns
t <sub>pd</sub>	A or B	Y	C <sub>L</sub> = 50pF	3.3V ± 0.3V			5.6	ns
t <sub>sk(o)</sub>				3.3V ± 0.3V			1.5	ns

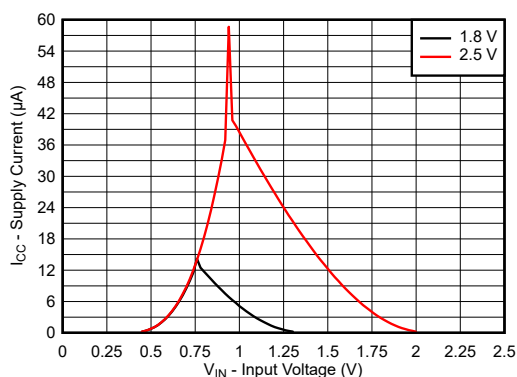
## 5.7 Noise Characteristics

V<sub>CC</sub> = 3.3V, C<sub>L</sub> = 50pF, T<sub>A</sub> = 25°C

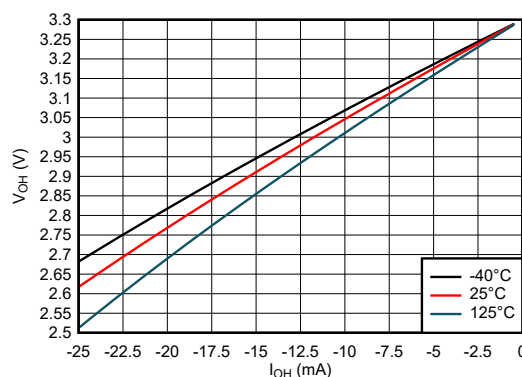
PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
V <sub>OL(P)</sub>	Quiet output, maximum dynamic V <sub>OL</sub>		0.9	0.8	V
V <sub>OL(V)</sub>	Quiet output, minimum dynamic V <sub>OL</sub>	-0.8	-0.3		V
V <sub>OH(V)</sub>	Quiet output, minimum dynamic V <sub>OH</sub>	2.2	3.3		V
V <sub>IH(D)</sub>	High-level dynamic input voltage	2.0			V
V <sub>IL(D)</sub>	Low-level dynamic input voltage			0.8	V

## 5.8 Typical Characteristics

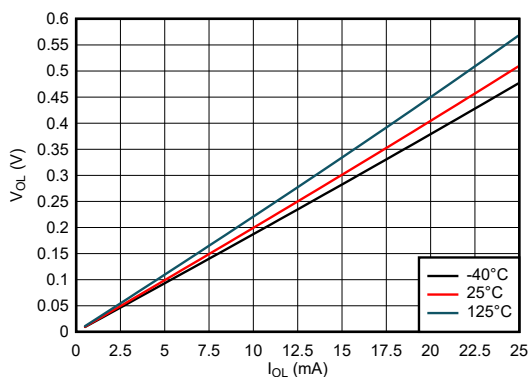
$T_A = 25^\circ\text{C}$  (unless otherwise noted)



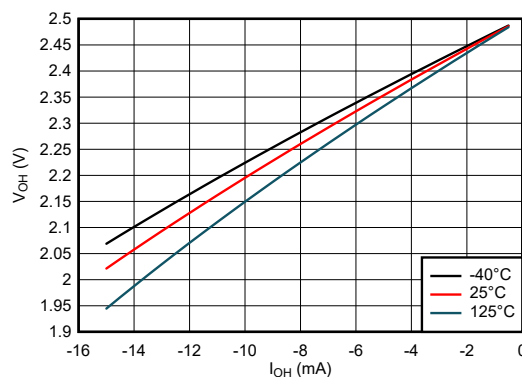
**Figure 5-1. Supply Current Across Input Voltage 1.8V and 2.5V Supply**



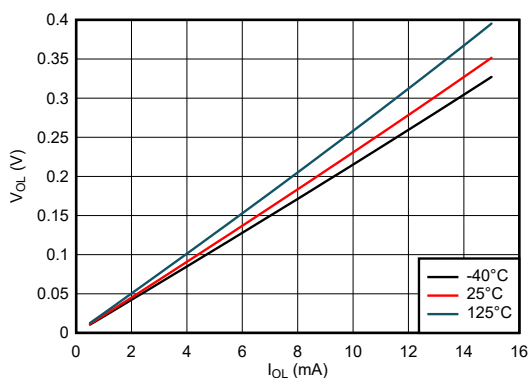
**Figure 5-2. Output Voltage vs Current in HIGH State; 3.3V Supply**



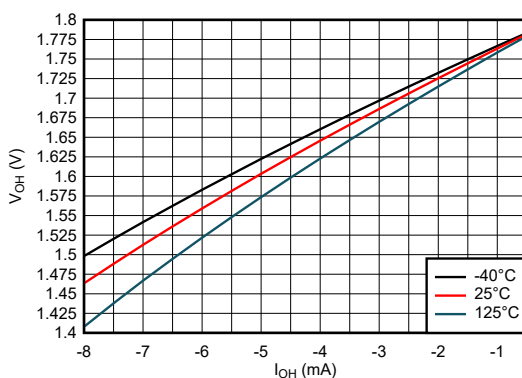
**Figure 5-3. Output Voltage vs Current in LOW State; 3.3V Supply**



**Figure 5-4. Output Voltage vs Current in HIGH State; 2.5V Supply**



**Figure 5-5. Output Voltage vs Current in LOW State; 2.5V Supply**



**Figure 5-6. Output Voltage vs Current in HIGH State; 1.8V Supply**

## 5.8 Typical Characteristics (continued)

$T_A = 25^\circ\text{C}$  (unless otherwise noted)

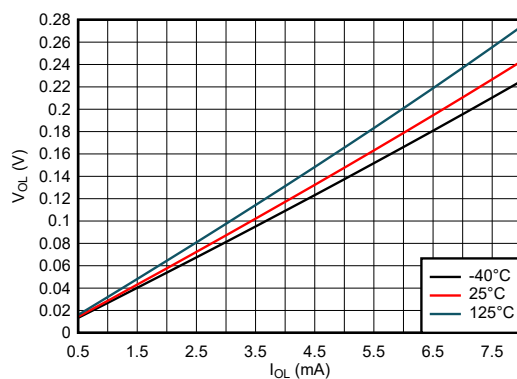


Figure 5-7. Output Voltage vs Current in LOW State; 1.8V Supply

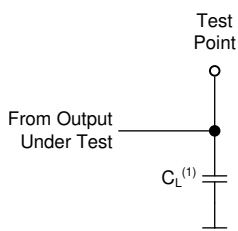


## 6 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{MHz}$ ,  $Z_O = 50\Omega$ .

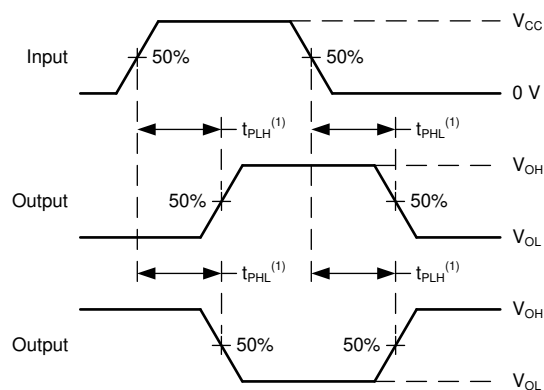
For clock inputs,  $f_{\text{max}}$  is measured when the input duty cycle is 50%.

The outputs are measured one at a time with one input transition per measurement.



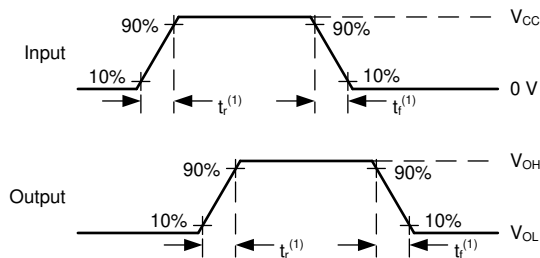
(1)  $C_L$  includes probe and test-fixture capacitance.

**Figure 6-1. Load Circuit for Push-Pull Outputs**



(1) The greater between  $t_{PLH}^{(1)}$  and  $t_{PHL}^{(1)}$  is the same as  $t_{pd}$ .

**Figure 6-2. Voltage Waveforms Propagation Delays**



(1) The greater between  $t_r$  and  $t_f$  is the same as  $t_t$ .

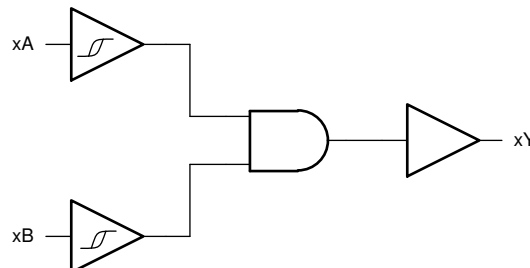
**Figure 6-3. Voltage Waveforms, Input and Output Transition Times**

## 7 Detailed Description

### 7.1 Overview

This device contains four independent 2-input AND gates with Schmitt-trigger inputs. Each gate performs the Boolean function  $Y = A \bullet B$  in positive logic.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Balanced CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The drive capability of this device may create fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the output power of the device to be limited to avoid damage due to over-current. The electrical and thermal limits defined in the [Absolute Maximum Ratings](#) must be followed at all times.

The SN74LVC7001A can drive a load with a total capacitance less than or equal to the maximum load listed in the [Switching Characteristics](#) connected to a high-impedance CMOS input while still meeting all of the datasheet specifications. Larger capacitive loads can be applied, however it is not recommended to exceed the provided load value. If larger capacitive loads are required, it is recommended to add a series resistor between the output and the capacitor to limit output current to the values given in the [Absolute Maximum Ratings](#).

#### 7.3.2 CMOS Schmitt-Trigger Inputs

Standard CMOS inputs are high impedance and are typically modeled as a resistor from the input to ground in parallel with the input capacitance given in the [Electrical Characteristics](#). The worst case resistance is calculated with the maximum input voltage, given in the [Absolute Maximum Ratings](#), and the maximum input leakage current, given in the [Electrical Characteristics](#), using ohm's law ( $R = V \div I$ ).

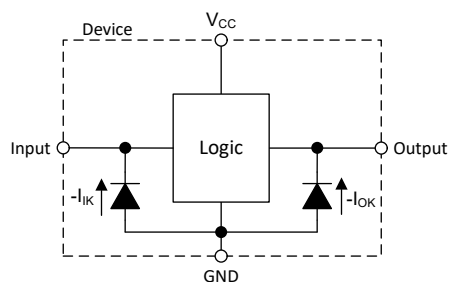
The Schmitt-trigger input architecture provides hysteresis as defined by  $\Delta V_T$  in the [Electrical Characteristics](#), which makes this device extremely tolerant to slow or noisy inputs. While the inputs can be driven much slower than standard CMOS inputs, it is still recommended to properly terminate unused inputs. Driving the inputs slowly will also increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, please see [Understanding Schmitt Triggers](#).

#### 7.3.3 Clamp Diode Structure

Figure 7-1 shows the inputs and outputs to this device have negative clamping diodes only.

#### CAUTION

Voltages beyond the values specified in the [Absolute Maximum Ratings](#) table can cause damage to the device. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.



**Figure 7-1. Electrical Placement of Clamping Diodes for Each Input and Output**

## 7.4 Device Functional Modes

**Table 7-1. Function Table**

INPUTS		OUTPUT
A	B	Y
H	H	H
L	X	L
X	L	L

## 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

In this application, three 2-input AND gates are combined to produce a 4-input AND gate function as shown in [Figure 8-1](#). The fourth gate can be used for another application in the system, or the inputs can be grounded and the channel left unused.

This device is used to directly control the RESET pin of a motor controller. The controller requires four input signals to all be HIGH before being enabled, and should be disabled in the event that any one signal goes LOW. The 4-input AND gate function combines the four individual reset signals into a single active-low reset signal.

### 8.2 Typical Application

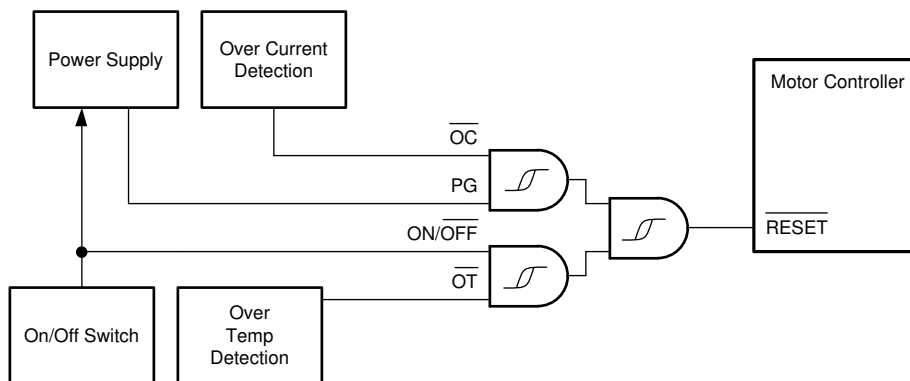


Figure 8-1. Typical Application Schematic

#### 8.2.1 Design Requirements

##### 8.2.1.1 Power Considerations

Ensure the desired supply voltage is within the range specified in the [Recommended Operating Conditions](#). The supply voltage sets the device's electrical characteristics as described in the [Electrical Characteristics](#).

The supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the SN74LVC7001A plus the maximum supply current,  $I_{CC}$ , listed in the [Electrical Characteristics](#). The logic device can only source or sink as much current as it is provided at the supply and ground pins, respectively. Be sure not to exceed the maximum total current through GND or  $V_{CC}$  listed in the [Absolute Maximum Ratings](#).

Total power consumption can be calculated using the information provided in [CMOS Power Consumption and  \$C\_{pd}\$  Calculation](#).

Thermal increase can be calculated using the information provided in [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices](#).

### CAUTION

The maximum junction temperature,  $T_J(\text{max})$  listed in the [Absolute Maximum Ratings](#), is an *additional limitation* to prevent damage to the device. Do not violate any values listed in the [Absolute Maximum Ratings](#). These limits are provided to prevent damage to the device.

### 8.2.1.2 Input Considerations

Input signals must cross  $V_{L(min)}$  to be considered a logic LOW, and  $V_{H(max)}$  to be considered a logic HIGH. Do not exceed the maximum input voltage range found in the [Absolute Maximum Ratings](#).

Unused inputs must be terminated to either  $V_{CC}$  or ground. These can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input is to be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The resistor size is limited by drive current of the controller, leakage current into the SN74LVC7001A, as specified in the [Electrical Characteristics](#), and the desired input transition rate. A 10k $\Omega$  resistor value is often used due to these factors.

The SN74LVC7001A has no input signal transition rate requirements because it has Schmitt-trigger inputs.

Another benefit to having Schmitt-trigger inputs is the ability to reject noise. Noise with a large enough amplitude can still cause issues. To know how much noise is too much, please refer to the  $\Delta V_T(min)$  in the [Electrical Characteristics](#). This hysteresis value will provide the peak-to-peak limit.

Unlike what happens with standard CMOS inputs, Schmitt-trigger inputs can be held at any valid value without causing huge increases in power consumption. The typical additional current caused by holding an input at a value other than  $V_{CC}$  or ground is plotted in the [Typical Characteristics](#).

Refer to [Section 7.3](#) for additional information regarding the inputs for this device.

### 8.2.1.3 Output Considerations

The positive supply voltage is used to produce the output HIGH voltage. Drawing current from the output will decrease the output voltage as specified by the  $V_{OH}$  specification in the [Electrical Characteristics](#). Similarly, the ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the  $V_{OL}$  specification in the [Electrical Characteristics](#).

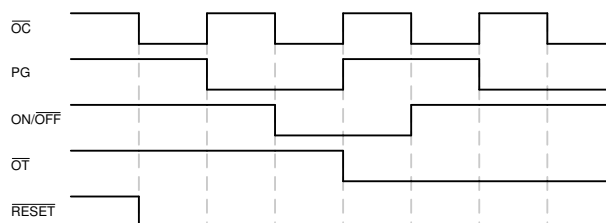
Unused outputs can be left floating. Do not connect outputs directly to  $V_{CC}$  or ground.

Refer to [Section 7.3](#) for additional information regarding the outputs for this device.

## 8.2.2 Detailed Design Procedure

1. Add a decoupling capacitor from  $V_{CC}$  to GND. The capacitor needs to be placed physically close to the device and electrically close to both the  $V_{CC}$  and GND pins. An example layout is shown in the [Section 8.4](#).
2. Ensure the capacitive load at the output is  $\leq 70pF$ . This is not a hard limit; however, it will optimize performance. This can be accomplished by providing short, appropriately sized traces from the SN74LVC7001A to the receiving device.
3. Ensure the resistive load at the output is larger than  $(V_{CC} / I_O(max)) \Omega$ . This will not violate the maximum output current from the [Absolute Maximum Ratings](#). Most CMOS inputs have a resistive load measured in megaohms; much larger than the minimum calculated above.
4. Thermal issues are rarely a concern for logic gates, however the power consumption and thermal increase can be calculated using the steps provided in the application report, [CMOS Power Consumption and Cpd Calculation](#)

### 8.2.3 Application Curves



**Figure 8-2. Typical Application Timing Diagram**

### 8.3 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the [Recommended Operating Conditions](#). Each  $V_{CC}$  terminal should have a bypass capacitor to prevent power disturbance. A  $0.1\mu\text{F}$  capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The  $0.1\mu\text{F}$  and  $1\mu\text{F}$  capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in [Figure 8-3](#).

### 8.4 Layout

#### 8.4.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must never be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or  $V_{CC}$ , whichever makes more sense for the logic function or is more convenient.

#### 8.4.2 Layout Example

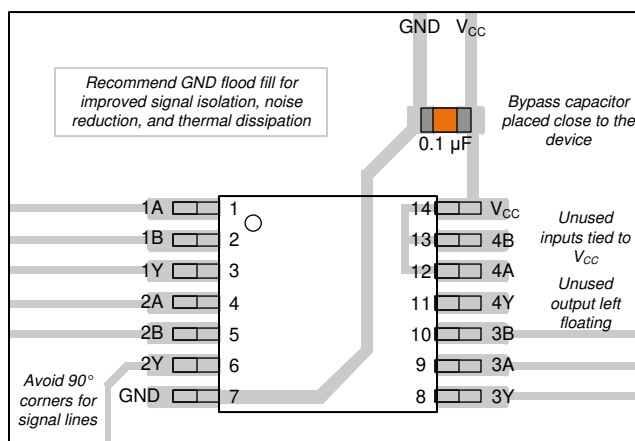


Figure 8-3. Example Layout for the SN74LVC7001A

## 9 Device and Documentation Support

### 9.1 Documentation Support

#### 9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [Introduction to Logic application report](#)
- Texas Instruments, [Implications of Slow or Floating CMOS Inputs application note](#)

### 9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Notifications* 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.

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### 9.4 Trademarks

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### 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 * (February 2024) to Revision A (March 2024)	Page
• Changed the status of the <i>PW</i> package from: <i>preview</i> to: <i>active</i> .....	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 part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN74LVC7001ABQAR</a>	Active	Production	WQFN (BQA)   14	3000   LARGE T&R	Yes	SELECTIVE AG (TOP SIDE)	Level-1-260C-UNLIM	-40 to 125	LC701A
SN74LVC7001ABQAR.A	Active	Production	WQFN (BQA)   14	3000   LARGE T&R	Yes	SELECTIVE AG (TOP SIDE)	Level-1-260C-UNLIM	-40 to 125	LC701A
<a href="#">SN74LVC7001APWR</a>	Active	Production	TSSOP (PW)   14	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 125	LVC7001
SN74LVC7001APWR.A	Active	Production	TSSOP (PW)   14	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC7001

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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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.



**OTHER QUALIFIED VERSIONS OF SN74LVC7001A :**

- Automotive : [SN74LVC7001A-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION



\*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
SN74LVC7001ABQAR	WQFN	BQA	14	3000	180.0	12.4	2.8	3.3	1.1	4.0	12.0	Q1
SN74LVC7001APWR	TSSOP	PW	14	3000	330.0	12.4	6.9	5.6	1.6	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)
SN74LVC7001ABQAR	WQFN	BQA	14	3000	210.0	185.0	35.0
SN74LVC7001APWR	TSSOP	PW	14	3000	353.0	353.0	32.0

## GENERIC PACKAGE VIEW

**BQA 14**

**WQFN - 0.8 mm max height**

2.5 x 3, 0.5 mm pitch

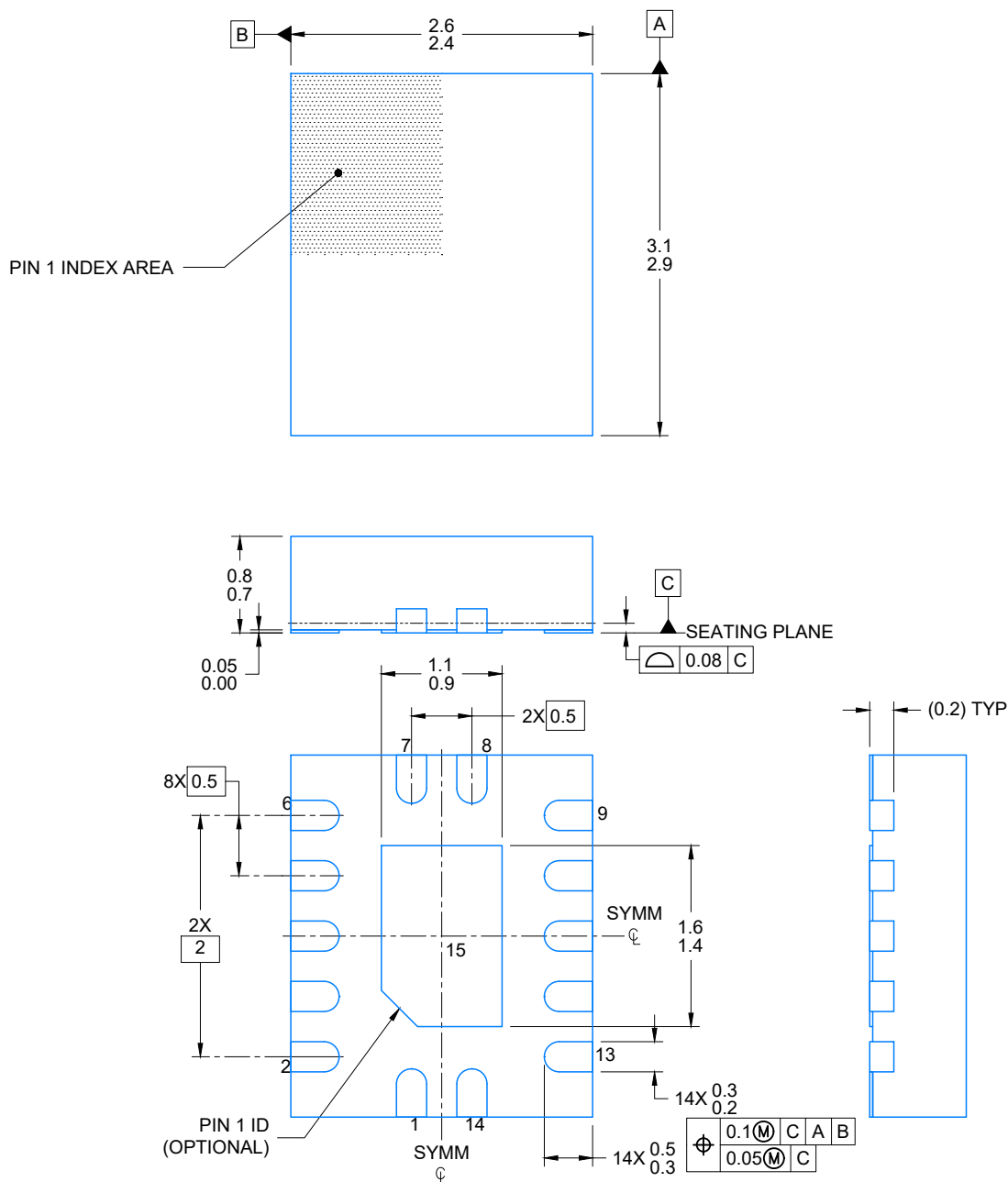
PLASTIC QUAD FLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



**WQFN - 0.8 mm max height**

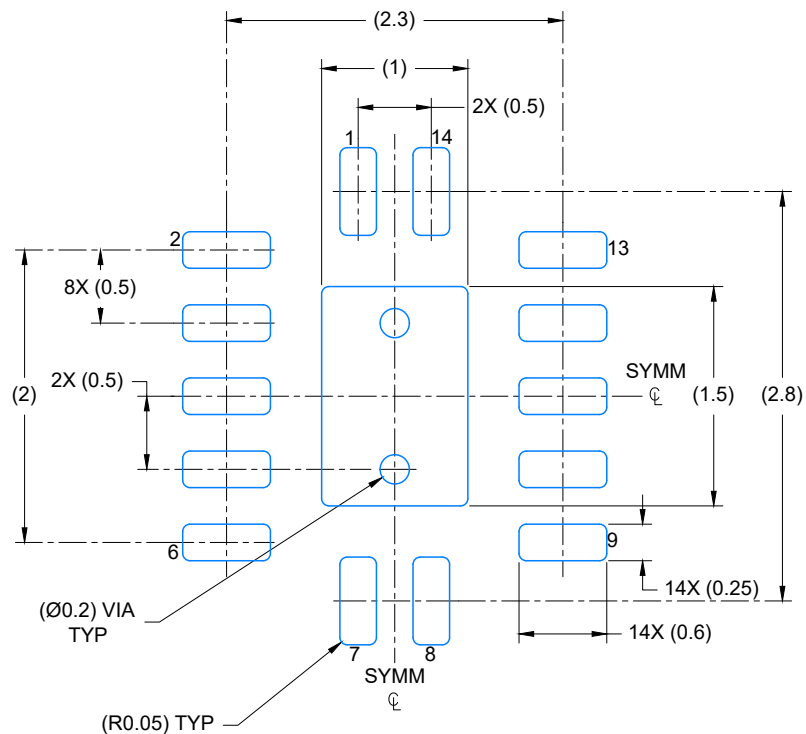
PLASTIC QUAD FLAT PACK-NO LEAD

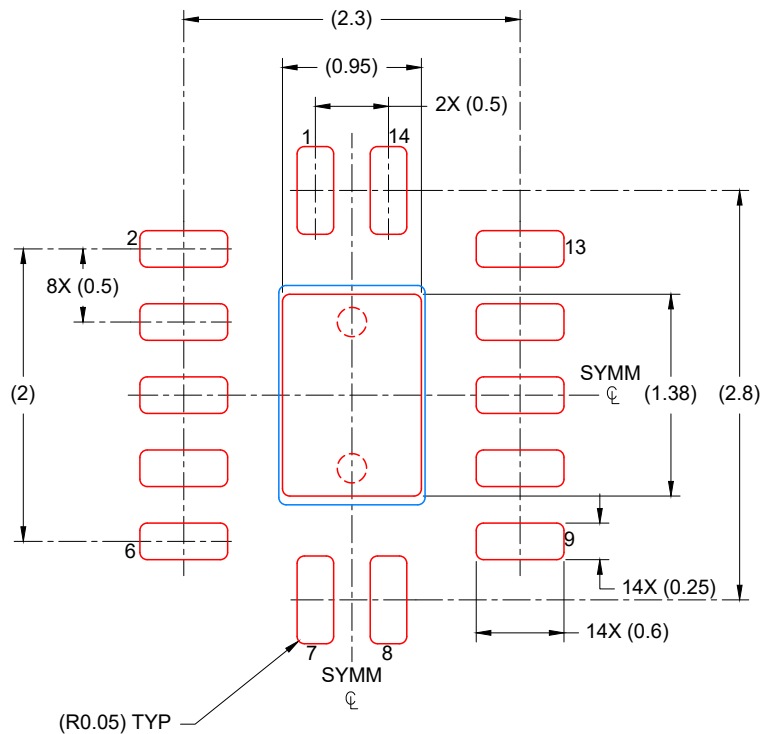


4224636/A 11/2018

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. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.





SOLDER PASTE EXAMPLE  
 BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD  
 88% PRINTED COVERAGE BY AREA  
 SCALE: 20X

4224636/A 11/2018

NOTES: (continued)

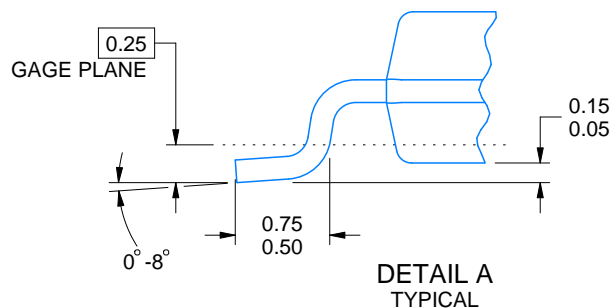
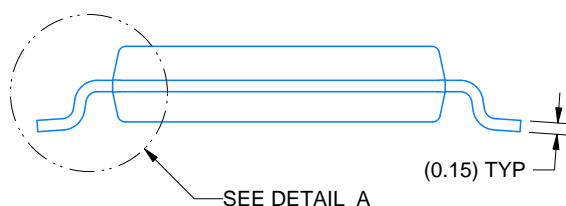
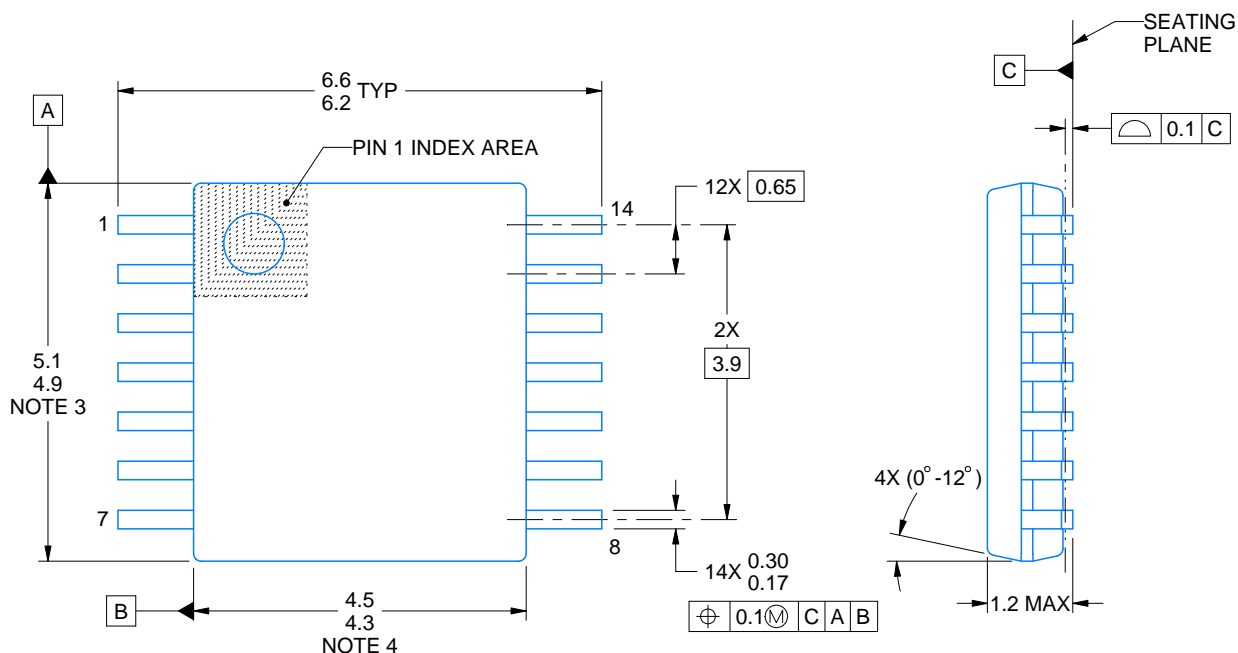
6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.



## PACKAGE OUTLINE

## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220202/B 12/2023

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.



# EXAMPLE BOARD LAYOUT

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220202/B 12/2023

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

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220202/B 12/2023

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.

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Last updated 10/2025