SN74LVC2G100 デュアル コンフィギュラブル マルチファンクション ゲート、フリップフロップ付き

1 特長

- 1.1V～3.6V の動作範囲
- 5.5V 耐圧入力ピン
- 標準ピン配置をサポート
- JESD 17 準拠で
  250mA 超のラッチアップ性能
- JESD 22 を上回る ESD 保護
  - 2000V、人体モデル (A114-A)
  - 1000V、デバイス帯電モデル (C101)

2 アプリケーション

- パワー・グッド信号の結合
- デジタル信号のイネーブル

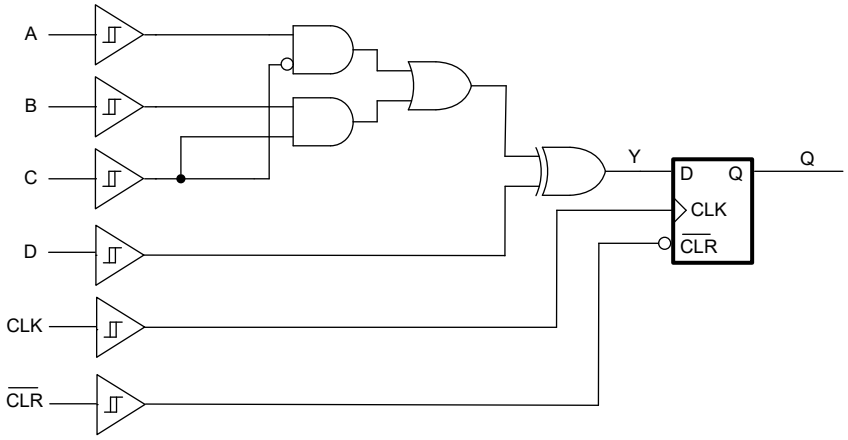
3 概要

SN74LVC2G100 は、デュアルかつシーケンシャルなコンフィギュラブル マルチファンクション デバイスであり、シュミット トリガ入力を採用しています。4 ビット入力の 16 個のパターンによって、出力の状態が決まります。出力の状態は、D フリップ フロップへの入力として機能します。その信号は CLK の立ち上がりエッジで Q 出力に転送されます。ユーザーはロジック機能として、MUX、AND、OR、NAND、NOR、インバータ、ノンインバータを選択できます。

パッケージ情報

部品番号	パッケージ (1)	パッケージ サイズ(2)	本体サイズ (公称)(3)
SN74LVC2G100	BQB (WQFN、16)	3.5mm × 2.5mm	3.5mm × 2.5mm
	PW (TSSOP、16)(4)	5mm × 6.4mm	5mm × 4.4mm

(1) 詳細については、セクション 11 を参照してください。
(2) パッケージ サイズ (長さ×幅) は公称値であり、該当する場合はピンも含まれます
(3) 本体サイズ (長さ×幅) は公称値であり、ピンは含まれません。
(4) プレビュー版パッケージのみ



機能図

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4 Pin Configuration and Functions

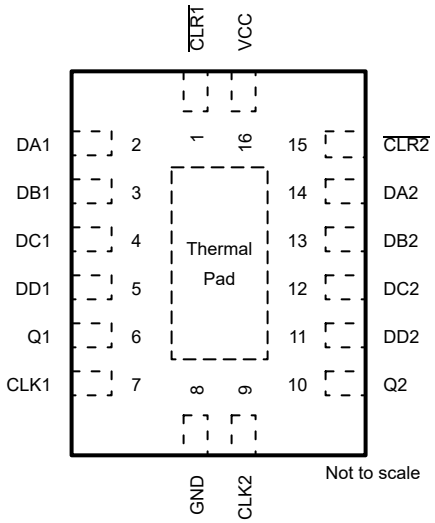


図 4-1. BQB Package, 16-Pin WQFN (Top View)

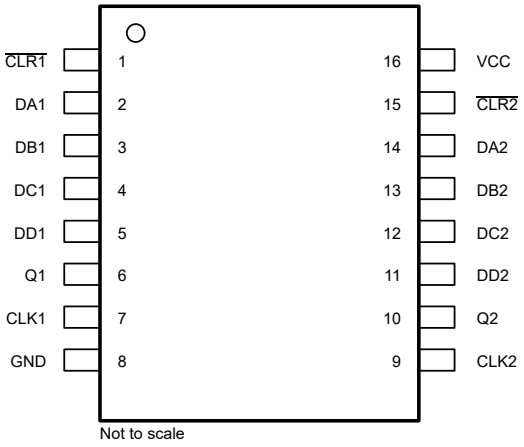


図 4-2. PW Package, 16-Pin TSSOP (Preview) (Top View)

表 4-1. Pin Functions

PIN		TYPE[1]	DESCRIPTION
NAME	NO.		
$\overline{CLR1}$	1	I	Clear for Channel 1, active low
DA1	2	I	Channel 1, Input A
DB1	3	I	Channel 1, Input B
DC1	4	I	Channel 1, Input C
DD1	5	I	Channel 1, Input D
Q1	6	O	Channel 1, Output Q
CLK1	7	I	Clock for Channel 1, rising edge triggered
GND	8	G	Ground
CLK2	9	I	Clock for Channel 2, rising edge triggered
Q2	10	O	Channel 2, Output Q
DD2	11	I	Channel 2, Input D
DC2	12	I	Channel 2, Input C
DB2	13	I	Channel 2, Input B
DA2	14	I	Channel 2, Input A
$\overline{CLR2}$	15	I	Clear for Channel 2, active low
V_{CC}	16	P	Positive Supply
Thermal Pad[2]		—	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, I/O = Input or Output, G = Ground, P = Power.
(2) BQB package only

5 Specifications

5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		-0.5	6.5	V
V_I	Input voltage range(2)		-0.5	6.5	V
V_O	Output voltage range(2)		-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			±50	mA
I_O	Continuous output current through V_{CC} or GND			±100	mA
T_J	Junction temperature		-65	150	°C
T_{stg}	Storage temperature		-65	150	°C
P_{tot}	Power dissipation(3) (4)			500	mW

(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.
(3) For the D package: above 70°C, the value of P_{tot} derates linearly with 8mW/°C.
(4) For the DB, NS, and PW packages: above 60°C, the value of P_{tot} derates linearly with 5.5mW/°C.

5.2 ESD Ratings

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

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

5.3 Recommended Operating Conditions

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

Specification	Description	Condition	MIN	MAX	UNIT
V_{CC}	Supply voltage	Operating	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	
Δt/Δv	Input transition rise or fall rate			10	ns/V
T_A	Operating free-air temperature		-40	125	°C

5.4 Thermal Information

THERMAL METRIC[1]		Package Options		UNIT
		PW (TSSOP)	BQB (WQFN)	
		16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	141.8	98.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	74.0	94.3	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	87.1	67.6	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	22.3	15.4	°C/W
Y_{JB}	Junction-to-board characterization parameter	86.6	67.6	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	-	46.2	°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	1.65 V	0.4		1.3	V
V_{T+}	Positive-going input threshold voltage	1.95 V	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	1.65 V	0.2		0.9	V
V_{T-}	Negative-going input threshold voltage	1.95 V	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
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	1.1V	0.07		0.53	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	1.5V	0.18		0.60	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	1.65 V	0.1		1.2	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	1.95 V	0.2		1.3	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	2.3V	0.3		1.3	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	2.5V	0.3		1.3	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	2.7V	0.3		1.1	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	3V	0.3		1.2	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	3.6V	0.3		1.2	V
V_{OH}	I_{OH}= –100µA	1.1V to 3.6V	V_{CC} - 0.2			V
V_{OH}	I_{OH}= –4mA	1.65 V	1.2			V

5.5 Electrical Characteristics (続き)

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

PARAMETER	TEST CONDITIONS	V_{CC}	-40°C to 125°C			UNIT
			MIN	TYP	MAX	
V_{OH}	I_{OH}= –8mA	2.3V	1.75			V
V_{OH}	I_{OH}= –12mA	2.7V	2.2			V
V_{OH}		3V	2.4			V
V_{OH}	I_{OH}= –24mA	3V	2.2			V
V_{OL}	I_{OH}= 100µA	1.1V to 3.6V		0.1	0.2	V
V_{OL}	I_{OH}= 4mA	1.65 V		0.24	0.45	V
V_{OL}	I_{OH}= 8mA	2.3V		0.3	0.7	V
V_{OL}	I_{OH}= 12mA	2.7V		0.2	0.4	V
V_{OL}	I_{OH}= 24mA	3V			0.55	V
I_I	V_I = V_{CC} or GND	3.6V		±1	±5	µA
I_{off}	V_I or V_O = V_{CC}	0V		±1	±10	µA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	3.6V		1	40	µA
ΔI_{CC}	One input at V_{CC} - 0.6V, other inputs at V_{CC} or GND	2.7V to 3.6V		500	5000	µA
C_I	V_I = V_{CC} or GND	3.3V		5.39		pF
C_O	V_O = V_{CC} or GND	3.3V		6.3		pF
C_{PD}	f = 10MHz	1.8V		12		pF
C_{PD}	f = 10MHz	2.5V		15		pF
C_{PD}	f = 10MHz	3.3V		17		pF

5.6 Switching Characteristics

over operating free-air temperature range; typical values measured at T_A = 25°C (unless otherwise noted). See #i#Parameter Measurement Information

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	V_{CC}	-40°C to 125°C			UNIT
					MIN	TYP	MAX	
t_{pd}	CLK	Q	C_L = 15pF	1.2V ± 0.1V		15	33	ns
				1.5V ± 0.12 V		13	18	ns
			C_L = 30pF	1.8V ± 0.15 V			13	ns
				2.5V ± 0.2V			8	ns
			C_L = 50pF	2.7V			8	ns
				3.3V ± 0.3V	1	3.5	7	ns
t_{pd}	$\overline{CLR}$	Q	C_L = 15pF	1.2V ± 0.1V		15	51	ns
				1.5V ± 0.12 V		13	19	ns
			C_L = 30pF	1.8V ± 0.15 V			14	ns
				2.5V ± 0.2V			10	ns
			C_L = 50pF	2.7V			9	ns
				3.3V ± 0.3V	1	3.4	9	ns
$t_{sk(o)}$				3.3V ± 0.3V			1	ns

5.7 Timing Characteristics

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

PARAMETER	DESCRIPTION	CONDITION	V_{CC}	-40°C to 125°C			UNIT
				MIN	TYP	MAX	
f_{clock}	Clock frequency		1.2V ± 0.1V			10	MHz
			1.5V ± 0.15 V			44	
			1.8V ± 0.15 V			73	MHz
			2.5V ± 0.2V			150	
			3.3V ± 0.3V			150	
t_W	Pulse duration	$\overline{CLR}$ low	1.2V ± 0.1V	4.3			ns
			1.5V ± 0.15 V	1.6			
			1.8V ± 0.15 V	4.1			
			2.5 ± 0.2V	3.3			
			3.3V ± 0.3V	3.3			
		CLK	1.2V ± 0.1V	6.95			
			1.5V ± 0.15 V	2.75			
			1.8V ± 0.15 V	4.1			
			2.5 ± 0.2V	3.3			
			3.3V ± 0.3V	3.3			
t_{SU}	Setup time before CLK ↑	DAx, DBx and DCx	1.2V ± 0.1V	26.4			ns
			1.5V ± 0.15 V	12.8			
			1.8V ± 0.15 V	8.34			
			2.5 ± 0.2V	6.03			
			3.3V ± 0.3V	6.03			
		DDx	1.2V ± 0.1V	20.3			ns
			1.5V ± 0.15 V	10.793			
			1.8V ± 0.15 V	6.66			
			2.5 ± 0.2V	4.824			
			3.3V ± 0.3V	4.824			
		$\overline{CLR}$ Inactive	1.2V ± 0.1V	11.6			ns
			1.5V ± 0.15 V	8.79			
			1.8V ± 0.15 V	4.34			
			2.5 ± 0.2V	2.51			
			3.3V ± 0.3V	2.324			
t_H	Hold time, data after CLK ↑	DAx, DBx and DCx	1.2V ± 0.1V	0			ns
			1.5V ± 0.15 V	0			
			1.8 ± 0.15 V	1			
			2.5 ± 0.2V	1			
			3.3 ± 0.3V	1			
		DDx	1.2V ± 0.1V	0			
			1.5V ± 0.15 V	0			
			1.8V ± 0.15 V	0.7			
			2.5V ± 0.2V	0.7			
			3.3V ± 0.3V	0.7			

5.8 Noise Characteristics

VCC = 3.3V, CL = 50pF, TA = 25°C

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}			0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}	-0.8	-0.3		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}	2.2	3.3		V
$V_{IH(D)}$	High-level dynamic input voltage	2.0			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.8	V

5.9 Typical Characteristics

T_A = 25°C (unless otherwise noted)

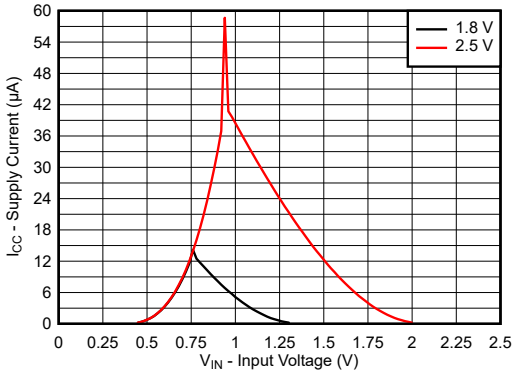


図 5-1. Supply Current Across Input Voltage 1.8V and 2.5V Supply

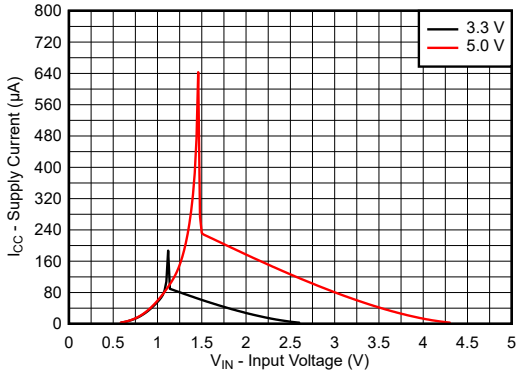


図 5-2. Supply Current Across Input Voltage 3.3V and 5.0V Supply

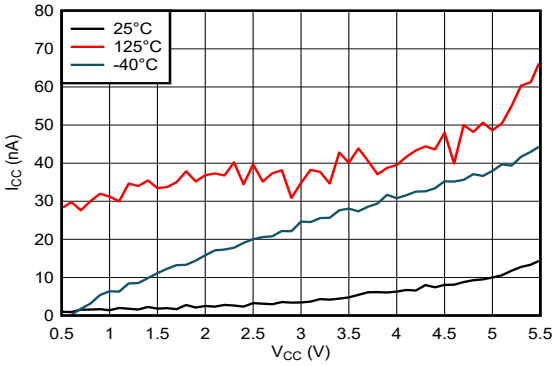


図 5-3. Supply Current Across Supply Voltage

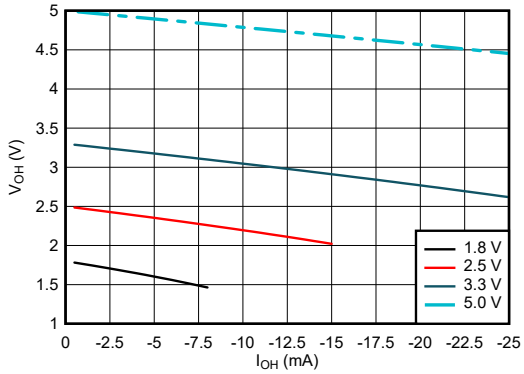


図 5-4. Output Voltage vs Current in HIGH State

5.9 Typical Characteristics (continued)

T_A = 25°C (unless otherwise noted)

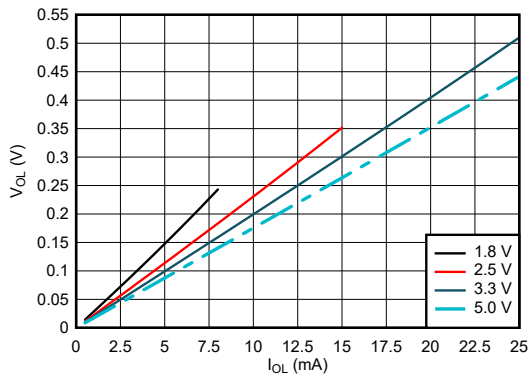


図 5-5. Output Voltage vs Current in LOW State

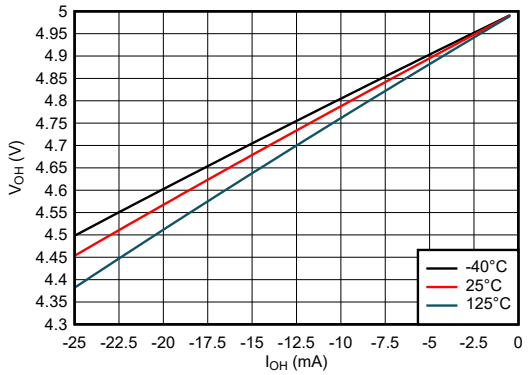


図 5-6. Output Voltage vs Current in HIGH State; 5V Supply

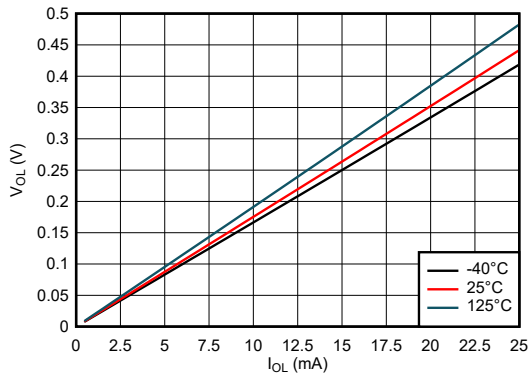


図 5-7. Output Voltage vs Current in LOW State; 5V Supply

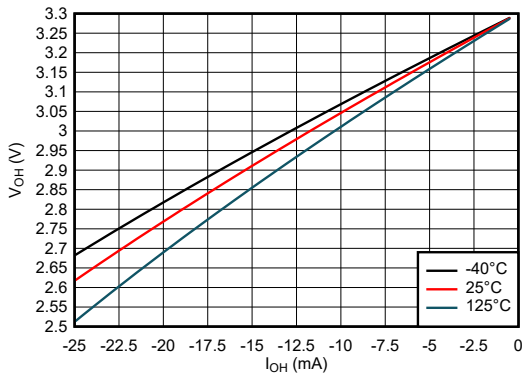


図 5-8. Output Voltage vs Current in HIGH State; 3.3V Supply

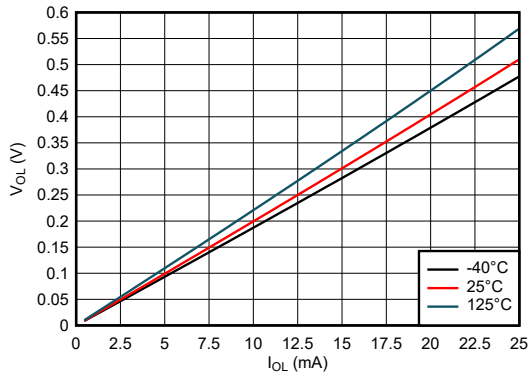


図 5-9. Output Voltage vs Current in LOW State; 3.3V Supply

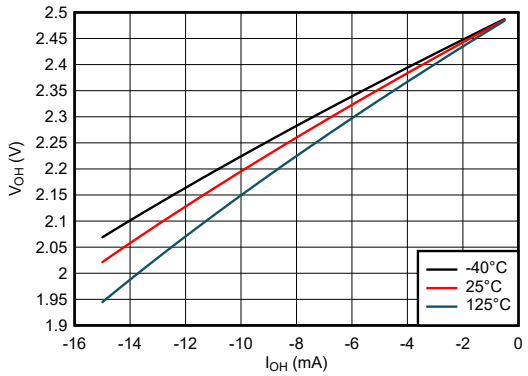


図 5-10. Output Voltage vs Current in HIGH State; 2.5V Supply

5.9 Typical Characteristics (continued)

T_A = 25°C (unless otherwise noted)

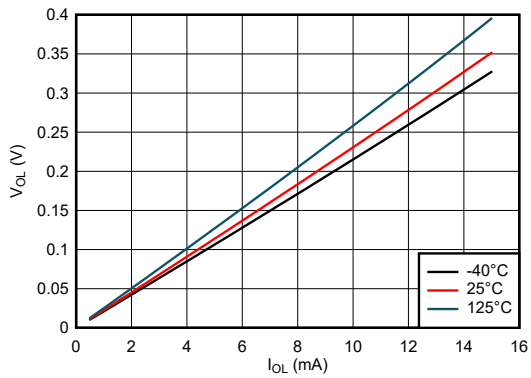


図 5-11. Output Voltage vs Current in LOW State; 2.5V Supply

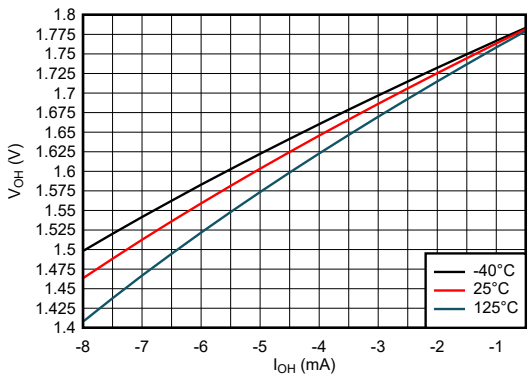


図 5-12. Output Voltage vs Current in HIGH State; 1.8V Supply

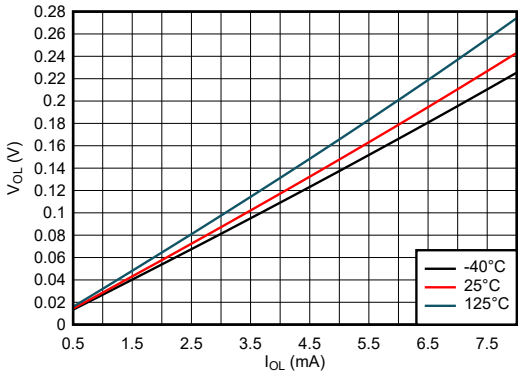


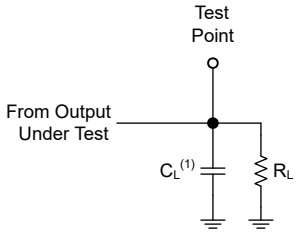
図 5-13. Output Voltage vs Current in LOW State; 1.8V Supply

6 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily for the examples listed in the following table. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1MHz, Z_O = 50Ω, t_t ≤ 2.5ns.

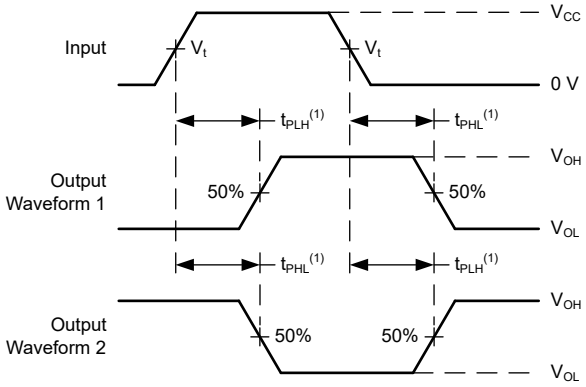
The outputs are measured individually with one input transition per measurement.

V_{CC}	V_t	R_L	C_L	ΔV
1.2V ± 0.1V	V_{CC}/2	2kΩ	15pF	0.1V
1.5V ± 0.12V	V_{CC}/2	2kΩ	15pF	0.1V
1.8V ± 0.15V	V_{CC}/2	1kΩ	30pF	0.15V
2.5V ± 0.2V	V_{CC}/2	500Ω	30pF	0.15V
2.7V	1.5V	500Ω	50pF	0.3V
3.3V ± 0.3V	1.5V	500Ω	50pF	0.3V



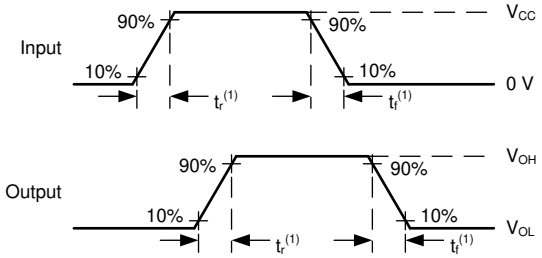
(1) C_L includes probe and test-fixture capacitance.

図 6-1. Load Circuit for Push-Pull Outputs



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

図 6-2. Voltage Waveforms Propagation Delays



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

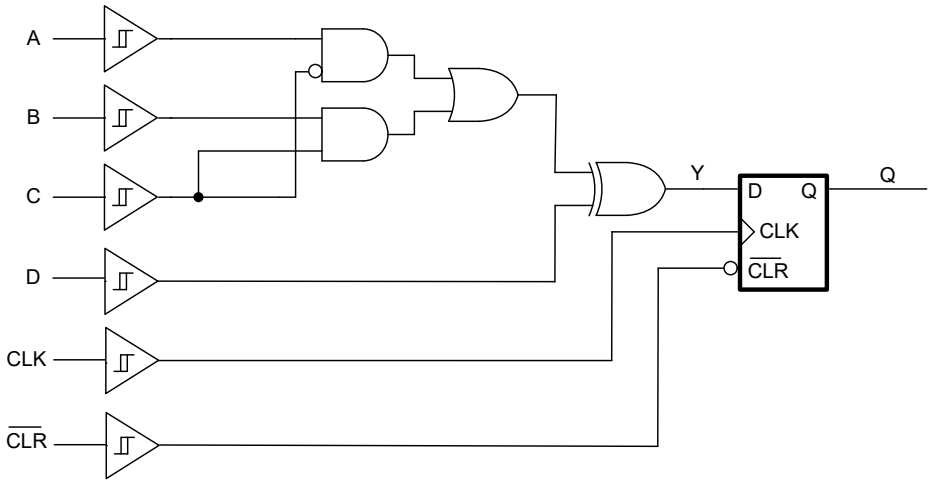
図 6-3. Voltage Waveforms, Input and Output Transition Times

7 Detailed Description

7.1 Overview

The SN74LVC2G100 is a dual, sequential, configurable multiple function device with Schmitt Trigger inputs. Sixteen patterns of a 4-bit input determines the output state. The output state serves as the input to a D-Flip Flop, which is transferred to the Q output on the positive going CLK edge. The user can choose the logic functions MUX, AND, OR, NAND, NOR, inverter, and non-inverter.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 CMOS Schmitt-Trigger Inputs

This device includes inputs with the Schmitt-trigger architecture. These inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics* table from the input to ground. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings* table, and the maximum input leakage current, given in the *Electrical Characteristics* table, using Ohm's law (R = V ÷ I).

The Schmitt-trigger input architecture provides hysteresis as defined by ΔV_T in the *Electrical Characteristics* table, 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 with slow transitioning signals will increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, please see *Understanding Schmitt Triggers*.

7.3.2 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 SN74LVC2G100 can drive a load with a total capacitance less than or equal to the maximum load listed in the *Switching Characteristics - 74* connected to a high-impedance CMOS input while still meeting all of the data sheet 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*.

7.3.3 Clamp Diode Structure

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

注意

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.

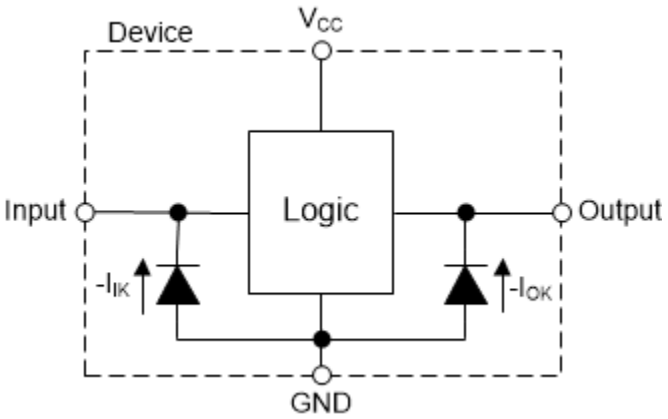


図 7-1. Electrical Placement of Clamping Diodes for Each Input and Output

7.4 Device Functional Modes

表 7-1. Function Table

INPUTS				OUTPUT
A	B	C	D	Y
L	L	L	L	L
L	L	L	H	H
L	L	H	L	L
L	L	H	H	H
L	H	L	L	L
L	H	L	H	H
L	H	H	L	H
L	H	H	H	L
H	L	L	L	H
H	L	L	H	L
H	L	H	L	L
H	L	H	H	H
H	H	L	L	H
H	H	L	H	L
H	H	H	L	H
H	H	H	H	L

表 7-2. Function Table

INPUTS(1) (2)			OUTPUT
$\overline{CLR}$	CLK	D	Q
L	X	X	L
H	↑	H	H
H	↑	L	L
H	L	X	Q_0

(1) H = high voltage level, L = low voltage level, X = don't care
(2) This configuration is nonstable; that is, it does not persist when CLR returns to its inactive (high) level.

7.5 Combinatorial Logic Configurations

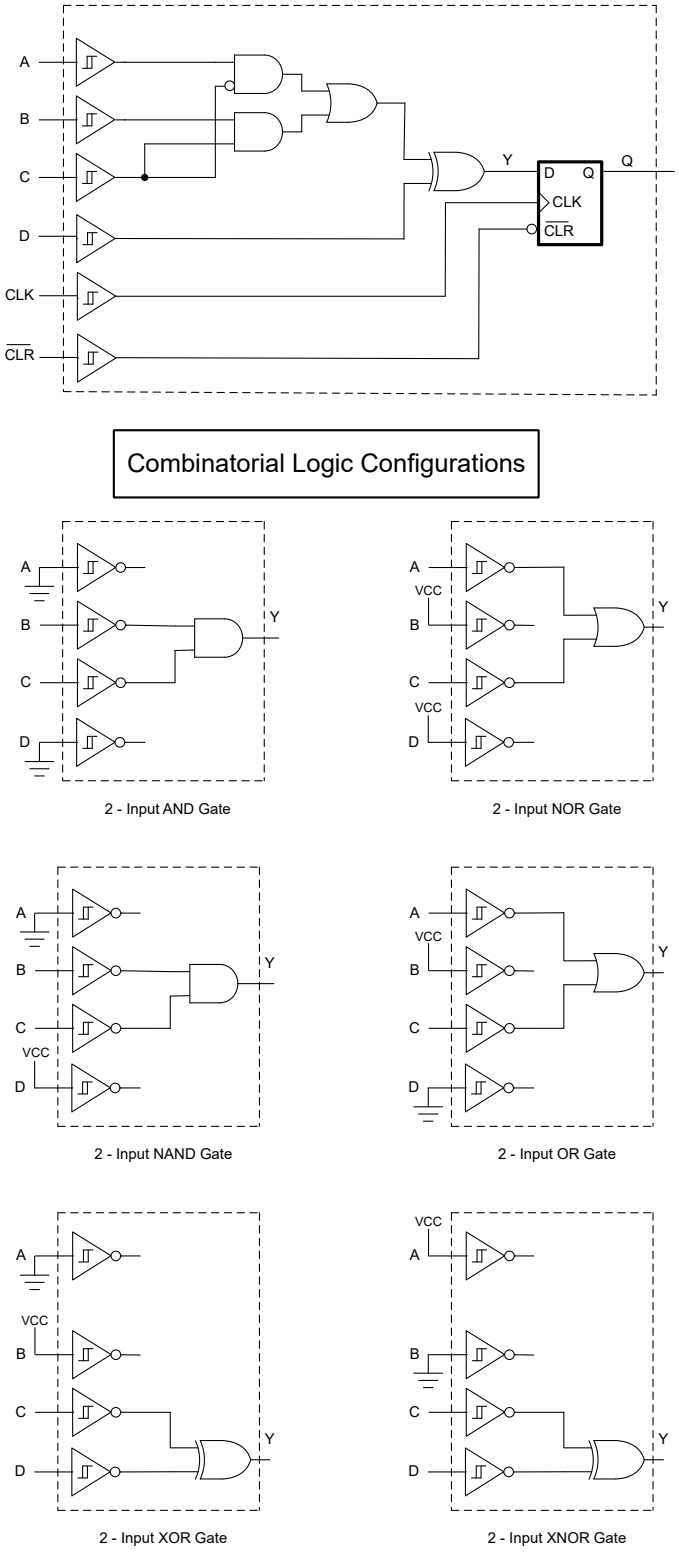


図 7-2. Logic Configurations

8 Application and Implementation

注

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

The SN74LVC2G100 device offers flexible configuration for many design applications. The following example describes basic power sequencing using the AND gate configuration. Power sequencing is often used in applications that require a processor or other delicate device with specific voltage timing requirements to protect the device from malfunctioning.

8.2 Typical Application

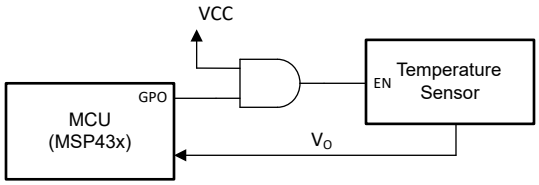


図 8-1. Typical Application Schematic

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 electrical characteristics of the device as described in the *Electrical Characteristics* section.

The positive voltage supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the SN74LVC2G100, plus the maximum static supply current (I_{CC}) listed in the *Electrical Characteristics*, and any transient current required for switching. The logic device can only source as much current that is provided by the positive supply source. Ensure the maximum total current through V_{CC} listed in the *Absolute Maximum Ratings* is not exceeded.

The ground must be capable of sinking current equal to the total current to be sunk by all outputs of the SN74LVC2G100 plus the maximum supply current, I_{CC}, listed in the *Electrical Characteristics*, and any transient current required for switching. The logic device can only sink as much current that can be sunk into its ground connection. Ensure the maximum total current through GND listed in the *Absolute Maximum Ratings* is not exceeded.

The SN74LVC2G100 can drive a load with a total capacitance less than or equal to 50pF while still meeting all of the data sheet specifications. Larger capacitive loads can be applied; however, it is not recommended to exceed 50pF.

The SN74LVC2G100 can drive a load with total resistance described by $R_L \geq V_O / I_O$, with the output voltage and current defined in the *Electrical Characteristics* table with V_{OH} and V_{OL}. When outputting in the HIGH state, the output voltage in the equation is defined as the difference between the measured output voltage and the supply voltage at the V_{CC} pin.

Total power consumption can be calculated using the information provided in the *CMOS Power Consumption and Cpd Calculation* application note.

Thermal increase can be calculated using the information provided in the *Thermal Characteristics of Standard Linear and Logic (SLL) Packages and Devices* application note.

> 注意
> The maximum junction temperature, $T_{J(max)}$ 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 $V_{t-(min)}$ to be considered a logic LOW, and $V_{t+(max)}$ 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. The unused inputs 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 will 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 drive current of the controller, leakage current into the SN74LVC2G100 (as specified in the *Electrical Characteristics*), and the desired input transition rate limits the resistor size. A 10kΩ resistor value is often used due to these factors.

The SN74LVC2G100 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 the *Feature Description* section 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*. 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*.

Push-pull outputs that could be in opposite states, even for a very short time period, should never be connected directly together. This can cause excessive current and damage to the device.

Two channels within the same device with the same input signals can be connected in parallel for additional output drive strength.

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

Refer to the *Feature Description* section 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 *Layout* section.
2. Ensure the capacitive load at the output is ≤ 70pF. This is not a hard limit; by design, however, it will optimize performance. This can be accomplished by providing short, appropriately sized traces from the SN74LVC2G100 to the receiving device.
3. Ensure the resistive load at the output is larger than (V_{CC} / I_O(max)) Ω, so that the maximum output current from the *Absolute Maximum Ratings* is not violated. Most CMOS inputs have a resistive load measured in mega ohms; much larger than the minimum calculated previously.

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

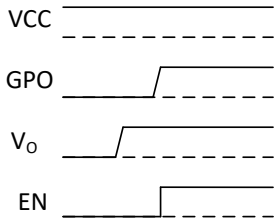


図 8-2. Typical Application Timing Diagram

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 0.1µF capacitor is recommended for this device. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. The 0.1µF and 1µF 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 *図 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

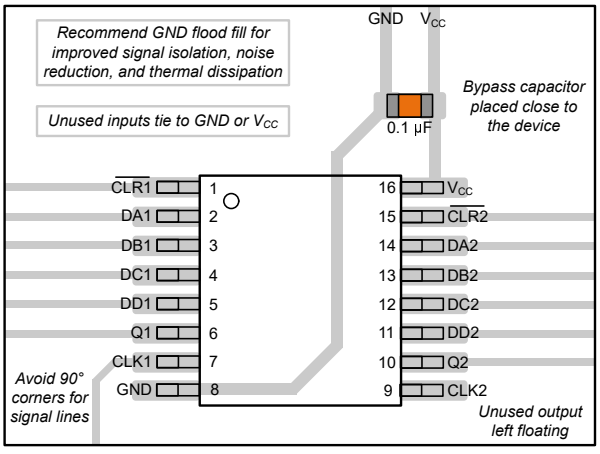


図 8-3. Example Layout for the SN74LVC2G100

9 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *CMOS Power Consumption and Cpd Calculation* application note
- Texas Instruments, *Designing With Logic* application note
- Texas Instruments, *Thermal Characteristics of Standard Linear and Logic (SLL) Packages and Devices* application note
- Texas Instruments, *Implications of Slow or Floating CMOS Inputs* application note

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9.6 用語集

テキサス・インスツルメンツ用語集　　この用語集には、用語や略語の一覧および定義が記載されています。

10 Revision History

DATE	REVISION	NOTES
April 2024	*	Initial Release

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.

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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
SN74LVC2G100BQBR	ACTIVE	WQFN	BQB	16	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC2G1	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 SN74LVC2G100 :

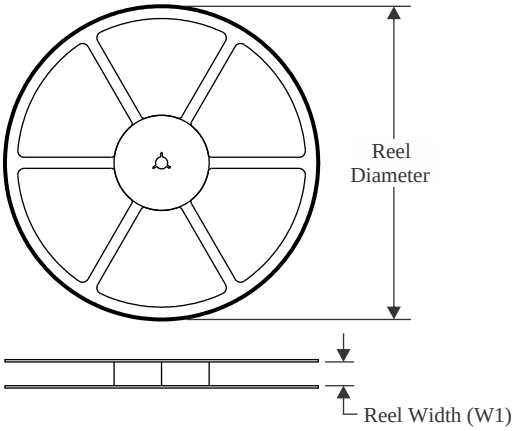
- Automotive : SN74LVC2G100-Q1

NOTE: Qualified Version Definitions:

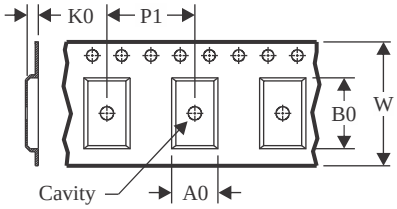
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

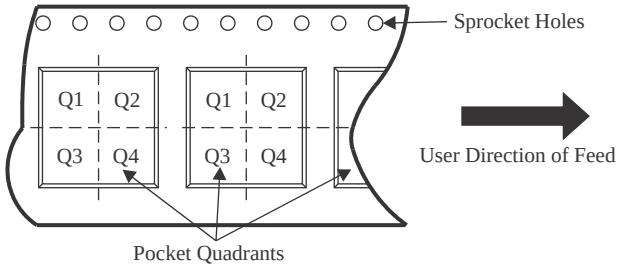


TAPE DIMENSIONS



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

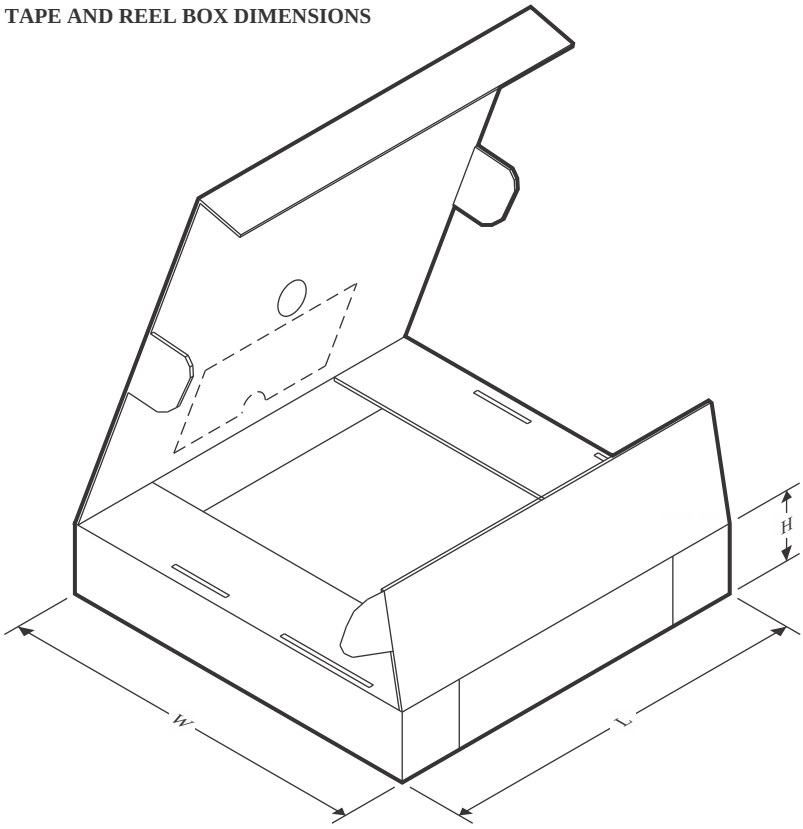
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74LVC2G100BQBR	WQFN	BQB	16	3000	180.0	12.4	2.8	3.8	1.2	4.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

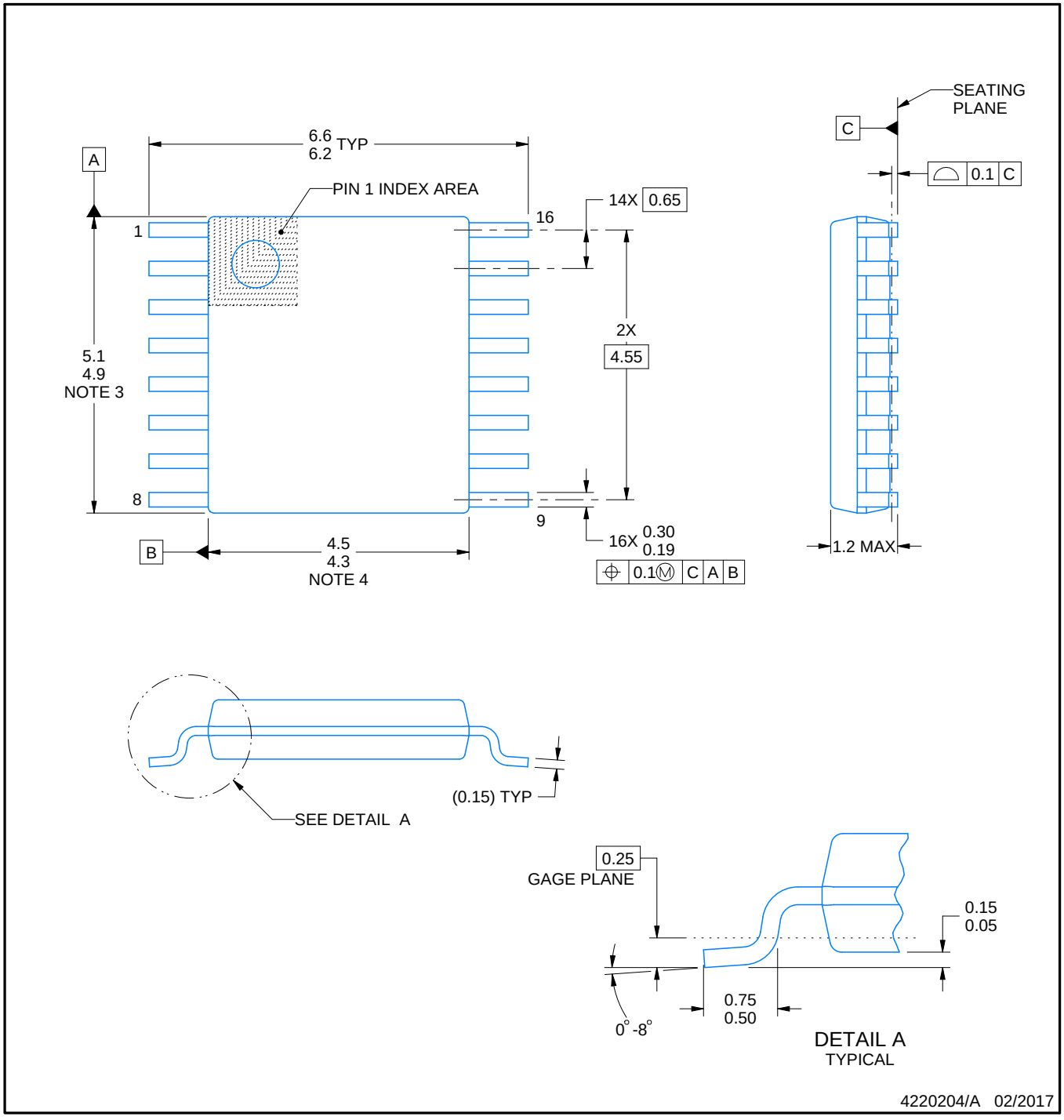
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC2G100BQBR	WQFN	BQB	16	3000	210.0	185.0	35.0

PACKAGE OUTLINE

PW0016A

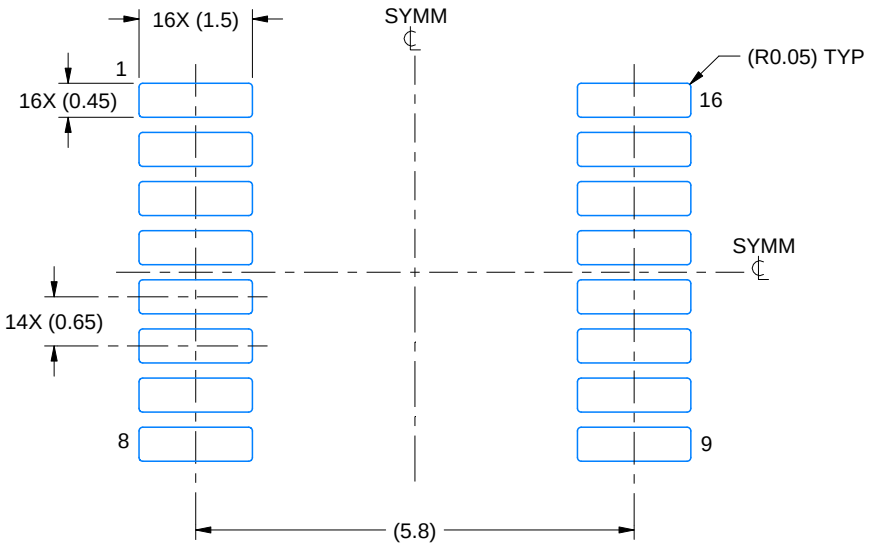
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

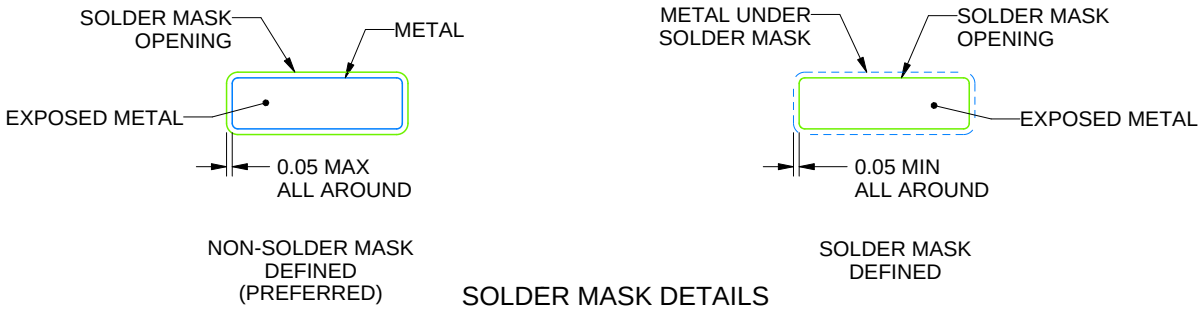


NOTES:

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

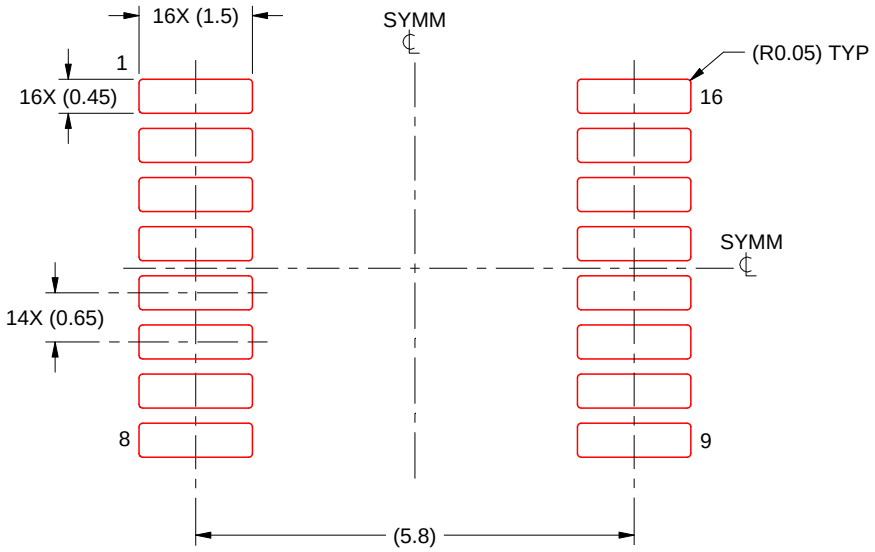


SOLDER MASK DETAILS

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.

GENERIC PACKAGE VIEW

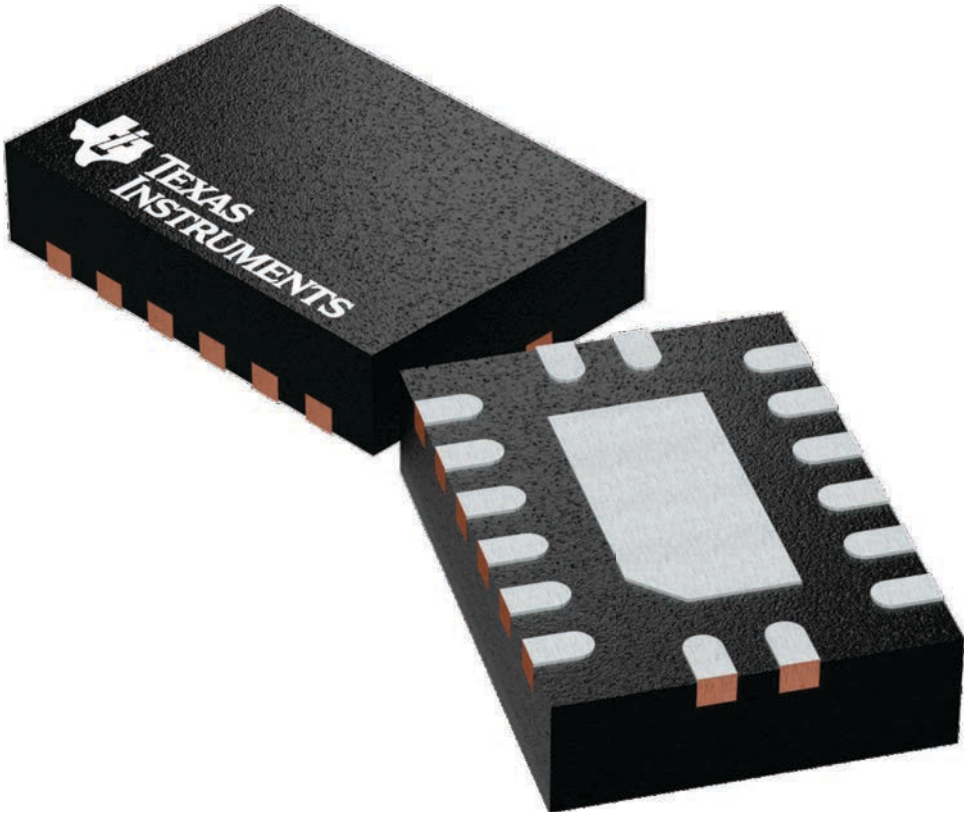
BQB 16

WQFN - 0.8 mm max height

2.5 x 3.5, 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.



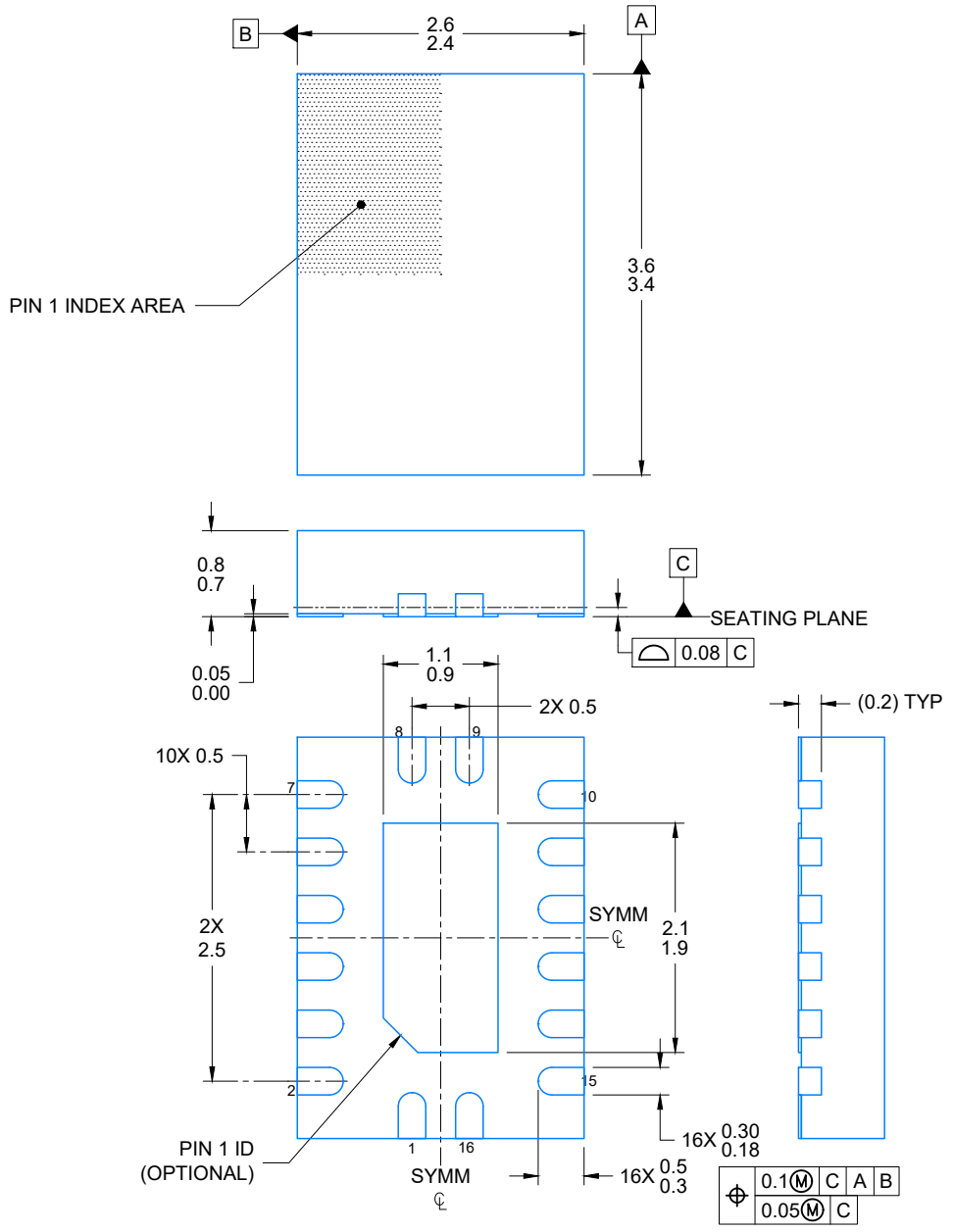
4226161/A

PACKAGE OUTLINE

BQB0016A

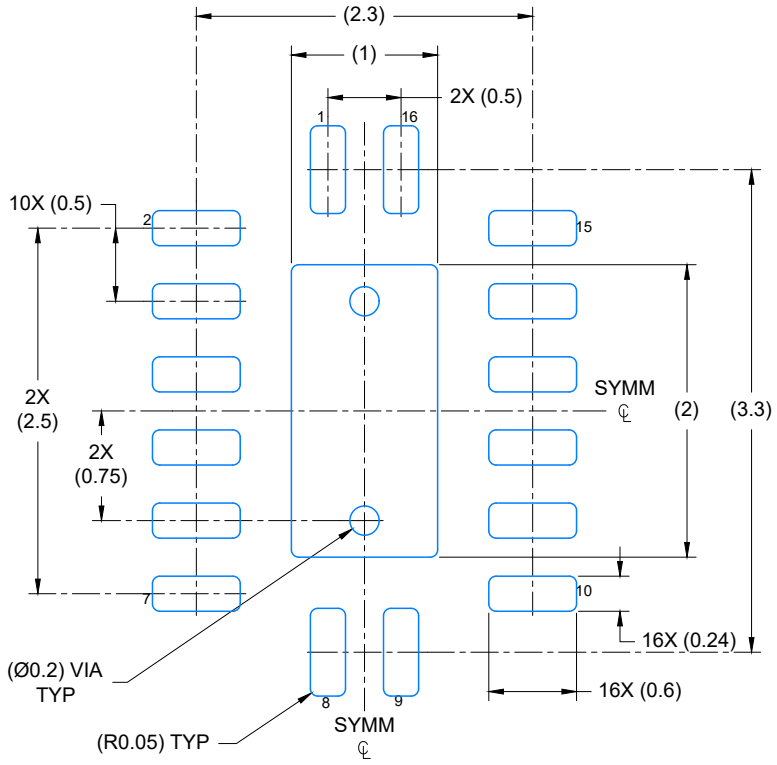
WQFN - 0.8 mm max height

PLASTIC QUAD FLAT PACK-NO LEAD

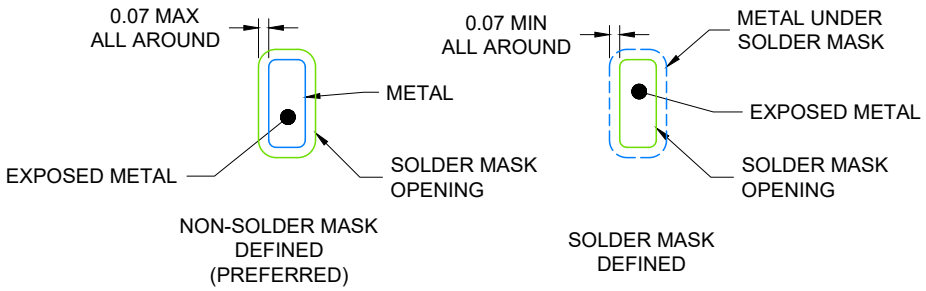


NOTES:

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.



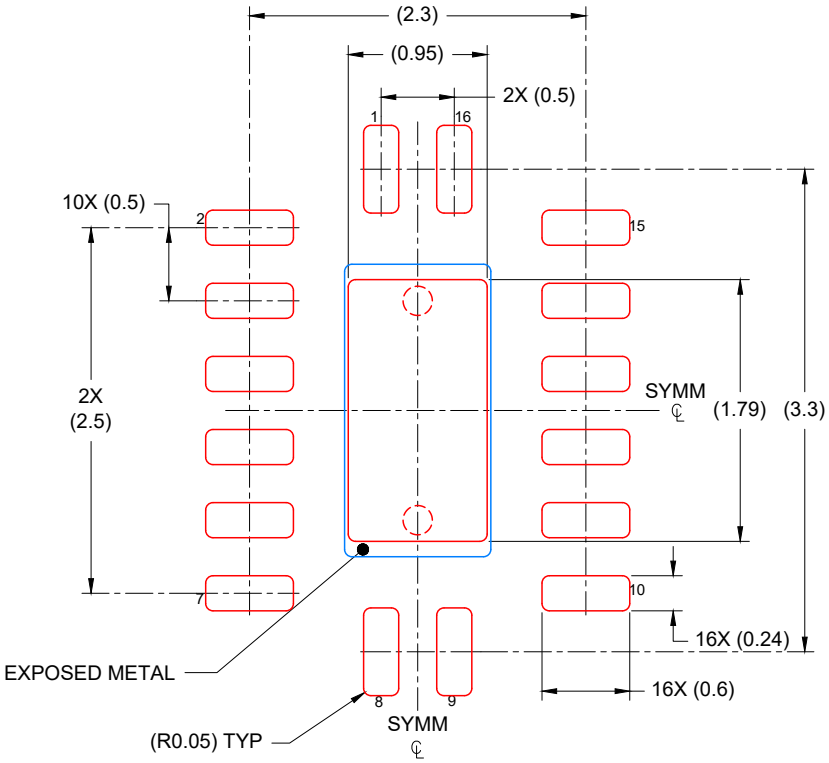
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



4224640/A 11/2018

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
85% PRINTED COVERAGE BY AREA
SCALE: 20X

4224640/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.

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