



SN74LVC1G80 シングル正エッジ・トリガ、D タイプ・フリップ・フロップ

1 特長

- テキサス・インスツルメンツの NanoFree™ パッケージで供給
- JESD 78, Class II 準拠で 100mA 超のラッチアップ性能
- JESD 22 を超える ESD 保護
 - 2000V、人体モデル (A114-A)
 - 200V、マシン・モデル (A115-A)
 - 1000V、荷電デバイス・モデル (C101)
- 5V V_{CC} 動作をサポート
- 5.5V までの入力電圧に対応
- V_{CC} への降圧変換をサポート
- 4.2ns の最大 t_{pd} (3.3 V)
- 低消費電力、最大 I_{CC} 10 μ A
- 3.3V において ± 24 mA の出力駆動能力
- I_{off} により部分的パワーダウン・モードおよびバック・ドライブ保護をサポート
- JESD 78, Class II 準拠で 100mA 超のラッチアップ性能

2 アプリケーション

- 試験および測定機器
- エンタープライズ・スイッチング
- 通信インフラ
- 個人用電子機器
- 白物家電

3 概要

SN74LVC1G80 デバイスはシングル正エッジ・トリガ、D タイプ・フリップ・フロップで、1.65V ~ 5.5V の V_{CC} で動作するように設計されています。

データ (D) 入力のデータがセットアップ時間の要件と合致すると、クロック・パルスが正に変化するエッジで、データが $\bar{Q}$ 出力へ転送されます。クロックのトリガは電圧レベルで発生し、クロック・パルスの立ち上がり時間とは直接関係しません。ホールド時間のインターバルの後で、出力のレベルに影響を及ぼすことなく、D 入力のデータを変化させることができます。

NanoFree™ パッケージ技術は IC パッケージの概念における主要なブレイクスルーであり、ダイをパッケージとして使用します。

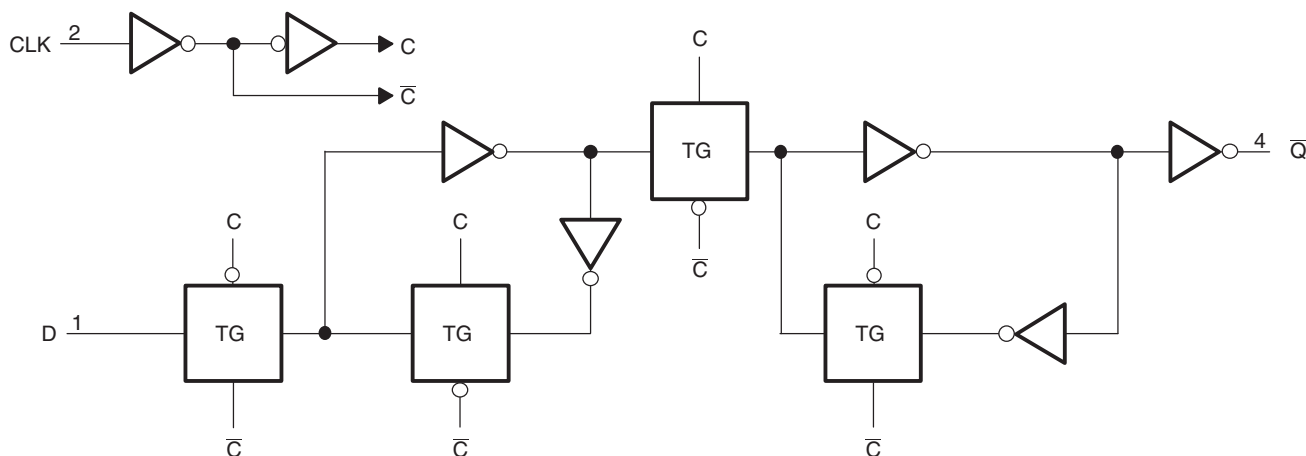
このデバイスは、 I_{off} を使用する部分的パワーダウン・アプリケーション用に完全に動作が規定されています。 I_{off} 回路は、デバイスの電源がオフになったとき、出力をディセーブルします。これによってデバイスへの電流の逆流が抑止され、デバイスが損傷から保護されます。

製品情報⁽¹⁾

型番	パッケージ	本体サイズ(公称)
SN74LVC1G80DBV	SOT-23 (5)	2.90mm×1.60mm
SN74LVC1G80DCK	SC70 (5)	2.00mm×1.25mm
SN74LVC1G80YZP	DSBGA (5)	1.41mm×0.91mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある注文情報を参照してください。

ロジック図 (正論理)



(1) TG - 伝送ゲート

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4 改訂履歴

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Revision R (December 2013) から Revision S に変更

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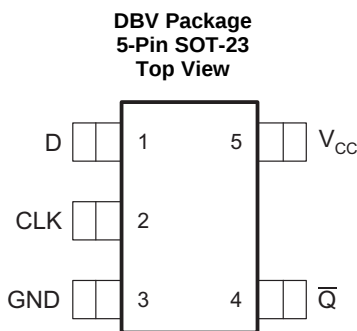
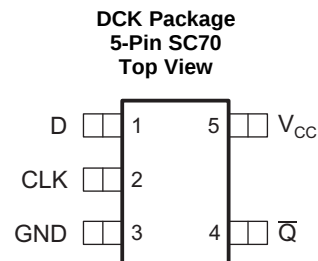
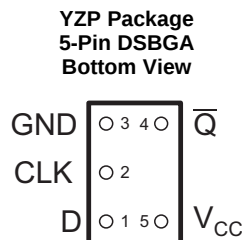
• 「アプリケーション」セクション、「製品情報」表、「ESD定格」表、「熱に関する情報」表、「代表的特性」セクション、「機能説明」セクション、「デバイスの機能モード」セクション、「アプリケーションと実装」セクション、「電源に関する推奨事項」セクション、「レイアウト」セクション、「デバイスおよびドキュメントのサポート」セクション、「メカニカル、パッケージ、および注文情報」セクションを追加.....	1
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• Changed $R_{\theta JA}$ value for DBV package from: 206°C/W to: 243.4°C/W	5
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Revision Q (January 2007) から Revision R に変更

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5 Pin Configuration and Functions



Pin Functions⁽¹⁾

PIN		I/O	DESCRIPTION
NO.	NAME		
1	D	I	Data input
2	CLK	I	Positive-Edge-Triggered Clock input
3	GND	—	Ground pin
4	$\overline{Q}$	O	Inverted output
5	V _{CC}	—	Positive Supply

(1) See [メカニカル、パッケージ、および注文情報](#) for dimensions

6 Specifications

6.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage		−0.5	6.5	V
V _I	Input voltage ⁽²⁾		−0.5	6.5	V
V _O	Voltage applied to any output in the high-impedance or power-off state ⁽²⁾		−0.5	6.5	V
V _O	Voltage applied to any output in the high or low state ⁽²⁾⁽³⁾		−0.5	V _{CC} + 0.5	V
I _{IK}	Input clamp current	V _I < 0		−50	mA
I _{OK}	Output clamp current	V _O < 0		−50	mA
I _O	Continuous output current			±50	mA
	Continuous current through V _{CC} or GND			±100	mA
T _J	Junction temperature			150	°C
T _{stg}	Storage temperature		−65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) The value of V_{CC} is provided in *Recommended Operating Conditions*.

6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1000
		Machine model (MM)	±200

- (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.

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT	
V _{CC}	Supply voltage	Operating	1.65	5.5	V
		Data retention only	1.5		
V _{IH}	High-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V	1.7		
		V _{CC} = 3 V to 3.6 V	2		
		V _{CC} = 4.5 V to 5.5 V	0.7 × V _{CC}		
V _{IL}	Low-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.35 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V	0.7		
		V _{CC} = 3 V to 3.6 V	0.8		
		V _{CC} = 4.5 V to 5.5 V	0.3 × V _{CC}		
V _I	Input voltage	0	5.5	V	
V _O	Output voltage	0	V _{CC}	V	
I _{OH}	High-level output current	V _{CC} = 1.65 V	−4		mA
		V _{CC} = 2.3 V	−8		
		V _{CC} = 3 V	−16		
			−24		
		V _{CC} = 4.5 V	−32		
I _{OL}	Low-level output current	V _{CC} = 1.65 V	4		mA
		V _{CC} = 2.3 V	8		
		V _{CC} = 3 V	16		
			24		
		V _{CC} = 4.5 V	32		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V	20		ns/V
		V _{CC} = 3.3 V ± 0.3 V	10		
		V _{CC} = 5 V ± 0.5 V	5		
T _J	Junction temperature		150	°C	
T _A	Operating free-air temperature	DBV and DCK packages	−40	125	°C
		YZP package	−40	85	

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See the TI application report, [Implications of Slow or Floating CMOS Inputs](#) (SCBA004).

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74LVC1G80			UNIT
		DBV (SOT-23)	DCK (SC70)	YZP (DSBGA)	
		5 PINS	5 PINS	5 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	243.4	278.9	136.9	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	179	121.3	1.3	°C/W
R _{θJB}	Junction-to-board thermal resistance	77.6	65.6	32.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	58.4	7.5	6.3	°C/W
ψ _{JB}	Junction-to-board characterization parameter	77	64.9	32.6	°C/W

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

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6.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}	I _{OH} = −100 μA	1.65 V to 5.5 V	V _{CC} − 0.1			V
	I _{OH} = −4 mA	1.65 V	1.2			
	I _{OH} = −8 mA	2.3 V	1.9			
	I _{OH} = −16 mA	3 V	2.4			
	I _{OH} = −24 mA		2.3			
	I _{OH} = −32 mA	4.5 V	3.8			
V _{OL}	I _{OL} = 100 μA	1.65 V to 5.5 V			0.1	V
	I _{OL} = 4 mA	1.65 V			0.45	
	I _{OL} = 8 mA	2.3 V			0.3	
	I _{OL} = 16 mA	3 V			0.4	
	I _{OL} = 24 mA				0.55	
	I _{OL} = 32 mA	4.5 V			0.55	
I _I CLK or D inputs	V _I = 5.5 V or GND	0 to 5.5 V			±10	μA
I _{off}	V _I or V _O = 5.5 V	0			±10	μA
I _{CC}	V _I = 5.5 V or GND, I _O = 0	1.65 V to 5.5 V			10	μA
ΔI _{CC}	One input at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND	3 V to 5.5 V			500	μA
C _i	V _I = V _{CC} or GND T _A = −40°C to 85°C	3.3 V			3.5	pF

 (1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

6.6 Timing Requirements: T_A = –40°C to +85°C

 over recommended operating free-air temperature range, T_A = –40°C to +85°C (unless otherwise noted) (see [Figure 3](#))

		V _{CC}	MIN	MAX	UNIT
f _{clock} Clock frequency		V _{CC} = 1.8 V ± 0.15 V	160		MHz
		V _{CC} = 2.5 V ± 0.2 V			
		V _{CC} = 3.3 V ± 0.3 V			
		V _{CC} = 5.5 V ± 0.5 V			
t _w Pulse duration, CLK high or low		V _{CC} = 1.8 V ± 0.15 V	2.5		ns
		V _{CC} = 2.5 V ± 0.2 V			
		V _{CC} = 3.3 V ± 0.3 V			
		V _{CC} = 5.5 V ± 0.5 V			
t _{su} Setup time before CLK↑	Data high	V _{CC} = 1.8 V ± 0.15 V	2.3		ns
		V _{CC} = 2.5 V ± 0.2 V	1.5		
		V _{CC} = 3.3 V ± 0.3 V	1.3		
		V _{CC} = 5.5 V ± 0.5 V	1.1		
	Data low	V _{CC} = 1.8 V ± 0.15 V	2.5		
		V _{CC} = 2.5 V ± 0.2 V	1.5		
		V _{CC} = 3.3 V ± 0.3 V	1.3		
		V _{CC} = 5.5 V ± 0.5 V	1.1		
t _h Hold time, data after CLK↑		V _{CC} = 1.8 V ± 0.15 V	0		ns
		V _{CC} = 2.5 V ± 0.2 V	0.2		
		V _{CC} = 3.3 V ± 0.3 V	0.9		
		V _{CC} = 5.5 V ± 0.5 V	0.4		

6.7 Timing Requirements: $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$

over recommended operating free-air temperature range, $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ (unless otherwise noted) (see [Figure 3](#))

		V_{CC}	MIN	MAX	UNIT
f_{clock}	Clock frequency	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	160		MHz
		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$			
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			
		$V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$			
t_w	Pulse duration, CLK high or low	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	2.5		ns
		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$			
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			
		$V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$			
t_{su}	Data high	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	2.3		ns
		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	1.5		
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.3		
		$V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$	1.1		
	Data low	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	2.5		
		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	1.5		
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.3		
		$V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$	1.1		
t_h	Hold time, data after CLK $\uparrow$	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	0		ns
		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	0.2		
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	0.9		
		$V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$	0.4		

6.8 Switching Characteristics: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $C_L = 15\text{ pF}$

over recommended operating free-air temperature range, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $C_L = 15\text{ pF}$ (unless otherwise noted) (see [Figure 3](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	MIN	MAX	UNIT
f_{max}			$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	160		MHz
			$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$			
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			
			$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$			
t_{pd}	CLK	$\overline{Q}$	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	3	9.1	ns
			$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	1.5	6	
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.3	4.2	
			$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	1.1	3.8	

6.9 Switching Characteristics: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $C_L = 30\text{ pF}$ or 50 pF

over recommended operating free-air temperature range, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $C_L = 30\text{ pF}$ or 50 pF (unless otherwise noted) (see [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	MIN	MAX	UNIT
f_{max}			$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	160		MHz
			$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$			
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			
			$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$			
t_{pd}	CLK	$\overline{Q}$	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	4.4	9.9	ns
			$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	2.3	7	
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2	5.2	
			$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	1.3	4.5	

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6.10 Switching Characteristics: $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, $C_L = 30\text{ pF}$ or 50 pF

 over recommended operating free-air temperature range, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, $C_L = 30\text{ pF}$ or 50 pF (unless otherwise noted) (see [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	MIN	MAX	UNIT
f_{max}			$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	160		MHz
			$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$			
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			
			$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$			
t_{pd}	CLK	$\bar{Q}$	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$	4.4	12.5	ns
			$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	2.3	8.5	
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2	6	
			$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	1.3	5.5	

6.11 Operating Characteristics
 $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd} Power dissipation capacitance	$f = 10\text{ MHz}$	$V_{CC} = 1.8\text{ V}$	24	pF
		$V_{CC} = 2.5\text{ V}$	24	
		$V_{CC} = 3.3\text{ V}$	25	
		$V_{CC} = 5\text{ V}$	27	

6.12 Typical Characteristics

This plot shows the different I_{CC} values for various voltages on the data input (D). Voltage sweep on the input is from 0 V to 6.5 V.

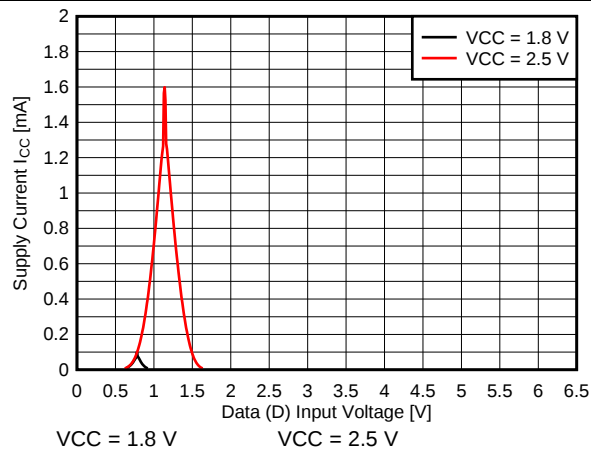


Figure 1. Supply Current (I_{CC}) vs Data (D) Input Voltage

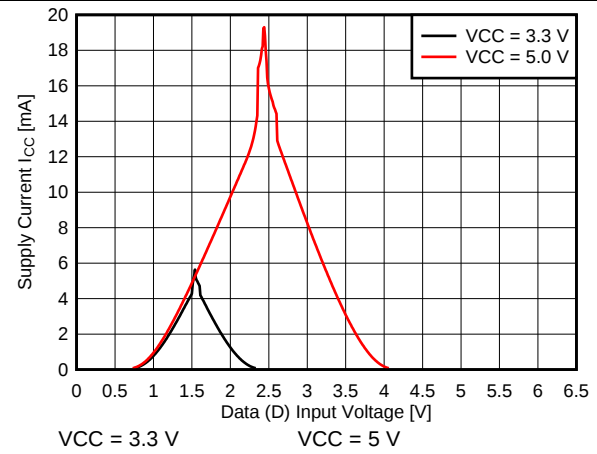
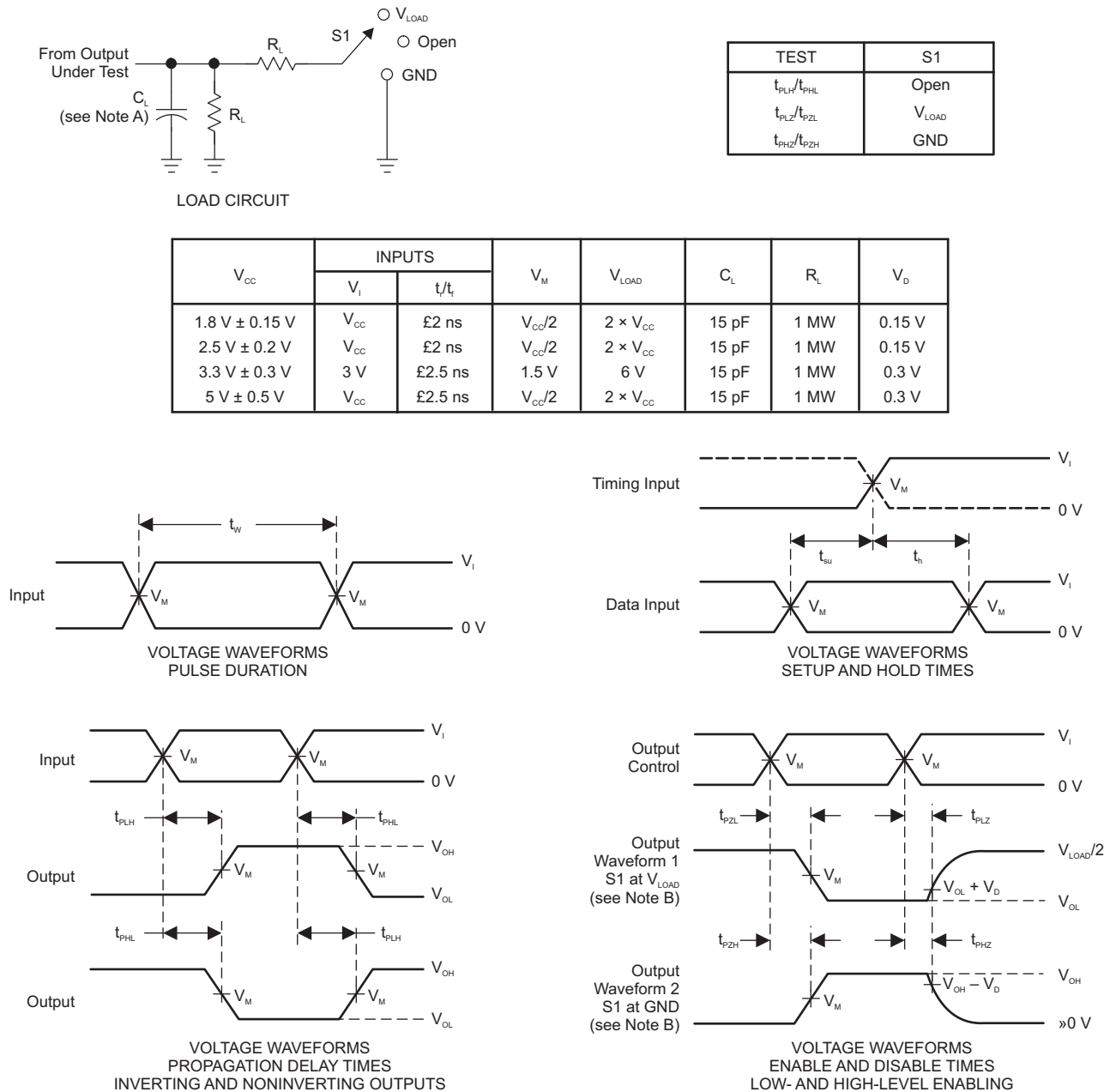


Figure 2. Supply Current (I_{CC}) vs Data (D) Input Voltage

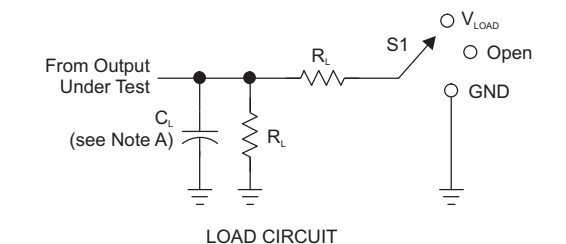
7 Parameter Measurement Information



- NOTES:
- C_L includes probe and jig capacitance.
 - Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 - All input pulses are supplied by generators having the following characteristics: PRR $\leq 10\text{ MHz}$, $Z_o = 50\text{ }\Omega$.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - All parameters and waveforms are not applicable to all devices.

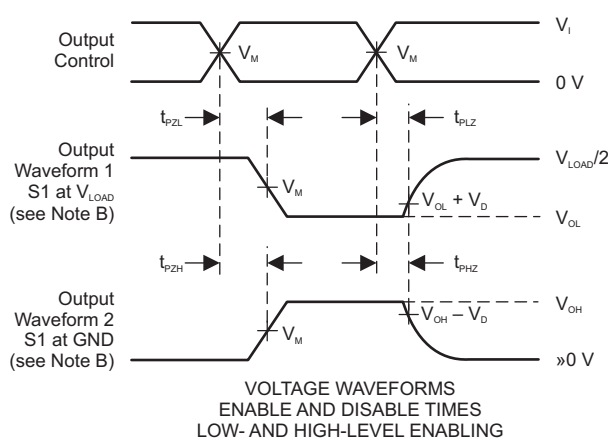
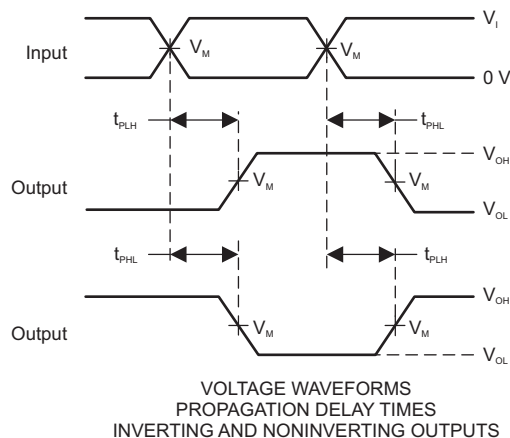
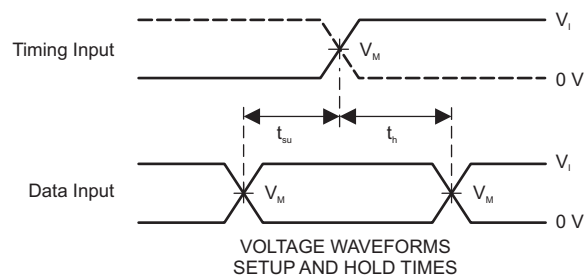
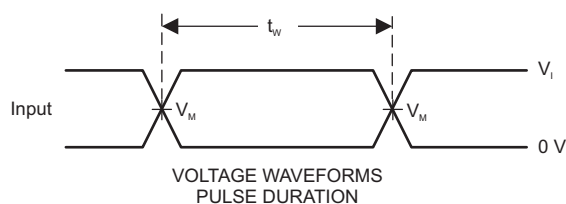
Figure 3. Load Circuit and Voltage Waveforms

Parameter Measurement Information (continued)



TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_D
	V_I	t/t_i					
$1.8\text{ V} \pm 0.15\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 kW	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 W	0.15 V
$3.3\text{ V} \pm 0.3\text{ V}$	3 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 W	0.3 V
$5\text{ V} \pm 0.5\text{ V}$	V_{CC}	$\leq 2.5\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 W	0.3 V



- NOTES:
- C_L includes probe and jig capacitance.
 - Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 - All input pulses are supplied by generators having the following characteristics: PRR $\leq 10\text{ MHz}$, $Z_O = 50\text{ }\Omega$.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - All parameters and waveforms are not applicable to all devices.

Figure 4. Load Circuit and Voltage Waveforms

8 Detailed Description

8.1 Overview

The SN74LVC1G80 is a single positive-edge-trigger D-type flip-flop. Data at the input (D) is transferred to the output ($\bar{Q}$) on the positive-going edge of the clock pulse when the setup time requirement is met. Because the clock triggering occurs at a voltage level, it is not directly related to the rise time of the clock pulse. This allows for data at the input to be changed without affecting the level at the output, following the hold-time interval.

8.2 Functional Block Diagram

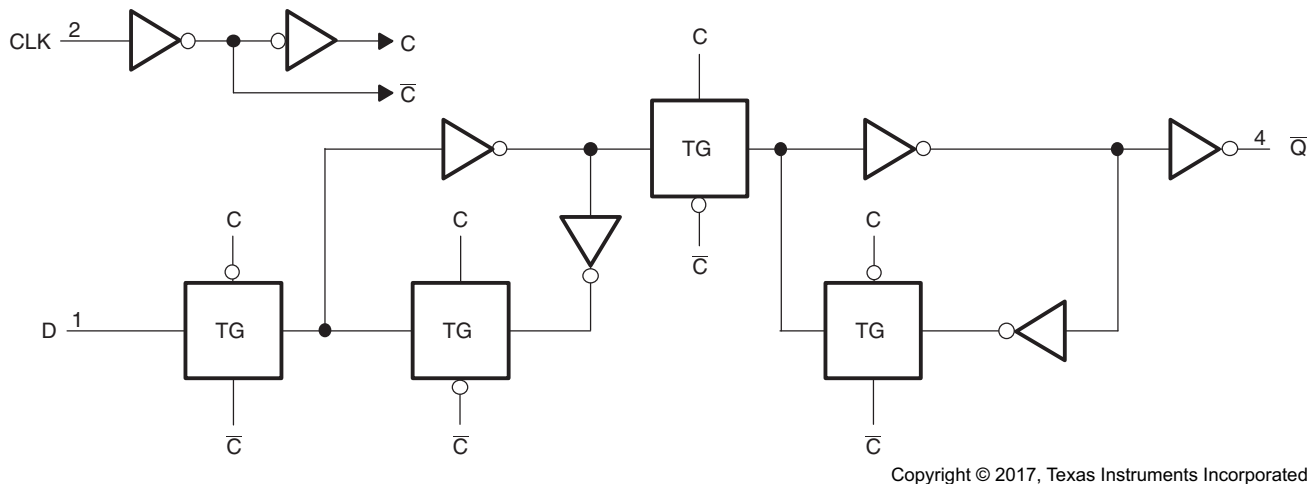


Figure 5. Logic Diagram (Positive Logic)

8.3 Feature Description

8.3.1 Balanced High-Drive CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The high drive capability of this device creates 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 power output of the device to be limited to avoid thermal runaway and damage due to over-current. The electrical and thermal limits defined in the [Absolute Maximum Ratings](#) must be followed at all times.

8.3.2 Standard CMOS Inputs

Standard CMOS inputs are high impedance and are typically modeled as a resistor 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 [Recommended Operating Conditions](#), and the maximum input leakage current, given in the [Electrical Characteristics](#), using ohm's law ($R = V \div I$).

Signals applied to the inputs need to have fast edge rates, as defined by $\Delta t/\Delta v$ in [Recommended Operating Conditions](#) to avoid excessive currents and oscillations. If tolerance to a slow or noisy input signal is required, a device with a Schmitt-trigger input should be utilized to condition the input signal prior to the standard CMOS input.

Feature Description (continued)

8.3.3 Clamp Diodes

The inputs and outputs to this device have negative clamping diodes.

CAUTION

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

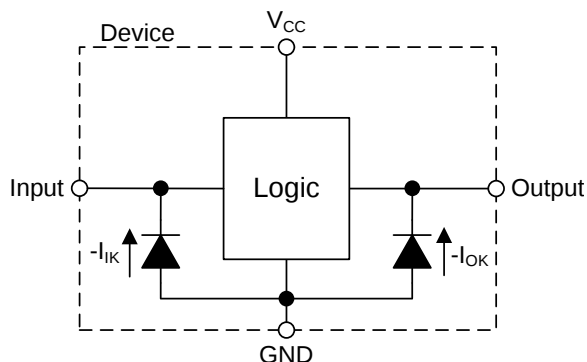


Figure 6. Electrical Placement of Clamping Diodes for Each Input and Output

8.3.4 Partial Power Down (I_{off})

The inputs and outputs for this device enter a high impedance state when the supply voltage is 0 V. The maximum leakage into or out of any input or output pin on the device is specified by I_{off} in the [Electrical Characteristics](#).

8.3.5 Over-Voltage Tolerant Inputs

Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value specified in the [Absolute Maximum Ratings](#).

8.4 Device Functional Modes

[Table 1](#) lists the functional modes of the SN74LVC1G80.

Table 1. Function Table

INPUTS		OUTPUT $\bar{Q}$
CLK	D	
↑	H	L
↑	L	H
L	X	Q_0

9 Application and Implementation

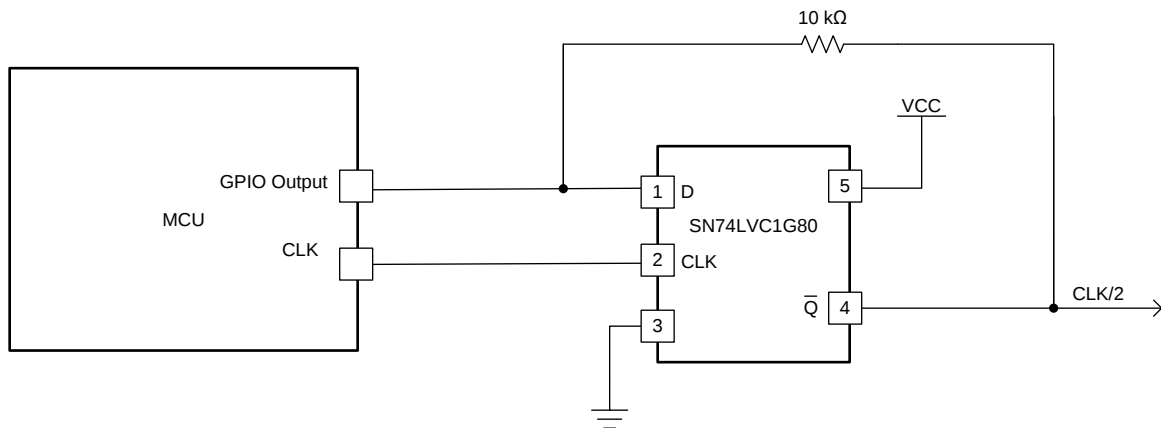
NOTE

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

9.1 Application Information

A useful application for the SN74LVC1G80 is using it as a frequency divider. By feeding back the output ($\bar{Q}$) to the input (D), the output will toggle on every rising edge of the clock waveform. The output goes HIGH once every two clock cycles so essentially the frequency of the clock signal is divided by a factor of two. The SN74LVC1G80 does not have preset or clear functions so the initial state of the output is unknown. This application implements the use of a microcontroller GPIO pin to initially set the input HIGH, so the output LOW. Initialization is not needed, but should be kept in mind. Post initialization, the GPIO pin is set to a high impedance mode. Depending on the microcontroller, the GPIO pin could be set to an input and used to monitor the clock division.

9.2 Typical Application



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Figure 7. Clock Frequency Division

9.2.1 Design Requirements

For this application, a resistor needs to be placed on the feedback line in order for the initialization voltage from the microcontroller to overpower the signal coming from the output ($\bar{Q}$). Without it the state at the input would be challenged by the GPIO from the microcontroller and from the output of the SN74LVC1G80.

The SN74LVC1G80 device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits.

Typical Application (continued)

9.2.2 Detailed Design Procedure

1. Recommended input conditions:
 - For rise time and fall time specifications, see $\Delta t/\Delta v$ in [Recommended Operating Conditions](#).
 - For specified high and low levels, see V_{IH} and V_{IL} in [Recommended Operating Conditions](#).
 - Input voltages are recommended to not go below 0 V and not exceed 5.5 V for any V_{CC} . See [Recommended Operating Conditions](#).
2. Recommended output conditions:
 - Load currents should not exceed ± 50 mA. See [Absolute Maximum Ratings](#).
 - Output voltages are recommended to not go below 0 V and not exceed the V_{CC} voltage. See [Recommended Operating Conditions](#).
3. Feedback resistor:
 - A 10-k Ω resistor is chosen here to bias the input so the microcontroller GPIO output can initialize the input and output. The resistor value is important because a resistance too high, say at 1 M Ω , would cause too much of a voltage drop, causing the output to no longer be able to drive the input. On the other hand, a resistor too low, such as a 1 Ω , would not bias enough and might cause current to flow into the microcontroller, possibly damaging the device.

9.2.3 Application Curve

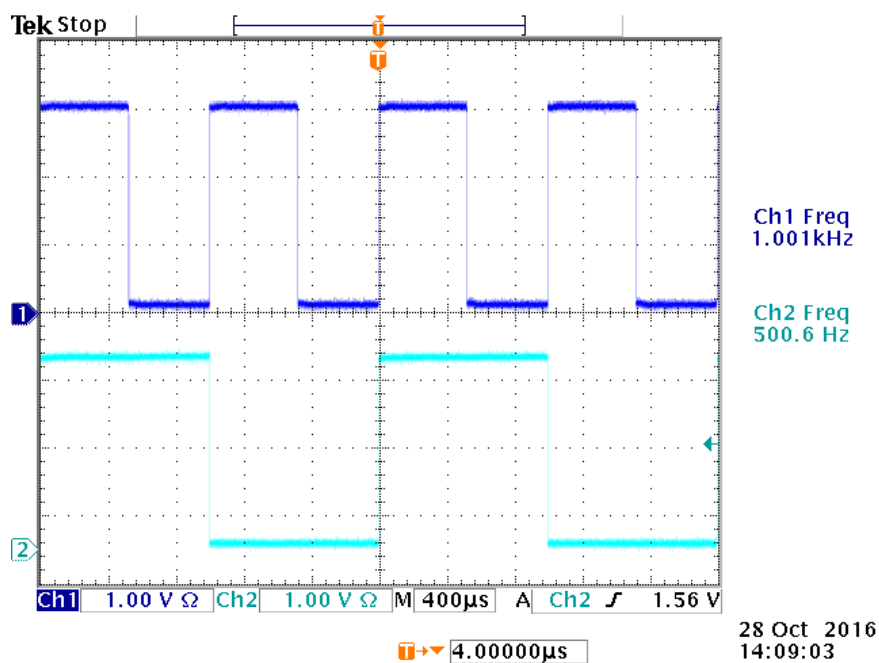


Figure 8. Frequency Division

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating listed in [Recommended Operating Conditions](#). A 0.1- μF bypass capacitor is recommended to be connected from the VCC terminal to GND to prevent power disturbance. To reject different frequencies of noise, use multiple bypass capacitors in parallel. Capacitors with values of 0.1 μF and 1 μF are commonly used in parallel. The bypass capacitor must be installed as close to the power terminal as possible for best results.

11 Layout

11.1 Layout Guidelines

When a PCB trace turns a corner at a 90° angle, a reflection can occur. A reflection occurs primarily because of the change of width of the trace. At the apex of the turn, the trace width increases to 1.414 times the width. This increase upsets the transmission-line characteristics, especially the distributed capacitance and self-inductance of the trace which results in the reflection. Not all PCB traces can be straight and therefore some traces must turn corners. [Figure 9](#) shows progressively better techniques of rounding corners. Only the last example (BEST) maintains constant trace width and minimizes reflections.

11.2 Layout Example

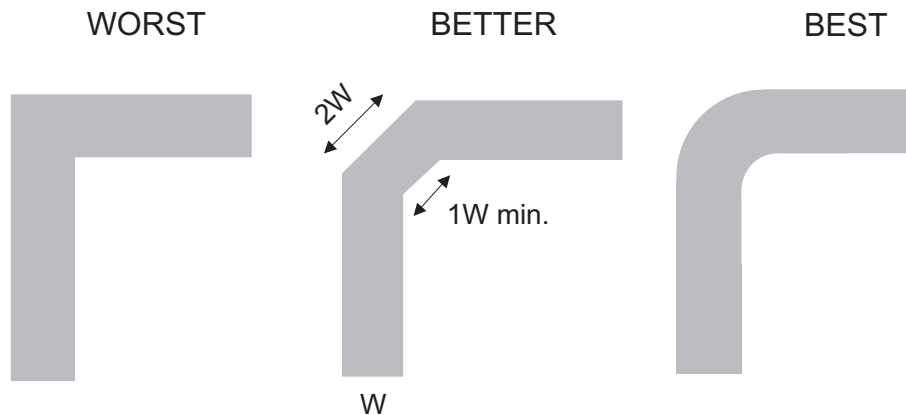


Figure 9. Trace Example

12 デバイスおよびドキュメントのサポート

12.1 ドキュメントのサポート

12.1.1 関連資料

関連資料については、以下を参照してください。

『[低速またはフローティングCMOS入力の影響](#)』, SCBA004

12.2 ドキュメントの更新通知を受け取る方法

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12.3 コミュニティ・リソース

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12.6 Glossary

[SLYZ022](#) — TI Glossary.

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

13 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

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)
SN74LVC1G80DBVR	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(C805, C80F, C80J, C80R)
SN74LVC1G80DBVR.A	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(C805, C80F, C80J, C80R)
SN74LVC1G80DBVR.B	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(C805, C80F, C80J, C80R)
SN74LVC1G80DBVRE4	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C80F
SN74LVC1G80DBVRG4	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C80F
SN74LVC1G80DBVRG4.B	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C80F
SN74LVC1G80DBVT	Active	Production	SOT-23 (DBV) 5	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(C805, C80F, C80J, C80R)
SN74LVC1G80DBVT.B	Active	Production	SOT-23 (DBV) 5	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(C805, C80F, C80J, C80R)
SN74LVC1G80DBVTG4	Active	Production	SOT-23 (DBV) 5	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C80F
SN74LVC1G80DBVTG4.B	Active	Production	SOT-23 (DBV) 5	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C80F
SN74LVC1G80DCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(CX5, CXF, CXJ, CX K, CXR)
SN74LVC1G80DCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(CX5, CXF, CXJ, CX K, CXR)
SN74LVC1G80DCKR.B	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(CX5, CXF, CXJ, CX K, CXR)
SN74LVC1G80DCKRG4	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CX5
SN74LVC1G80DCKRG4.B	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CX5
SN74LVC1G80DCKT	Active	Production	SC70 (DCK) 5	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(CX5, CXF, CXJ, CX K, CXR)
SN74LVC1G80DCKT.B	Active	Production	SC70 (DCK) 5	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(CX5, CXF, CXJ, CX K, CXR)
SN74LVC1G80YZPR	Active	Production	DSBGA (YZP) 5	3000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(CX7, CXN)
SN74LVC1G80YZPR.B	Active	Production	DSBGA (YZP) 5	3000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(CX7, CXN)

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

(2) 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.

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

(4) 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.

(5) 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.

(6) 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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OTHER QUALIFIED VERSIONS OF SN74LVC1G80 :

- Automotive : [SN74LVC1G80-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
SN74LVC1G80DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74LVC1G80DBVRG4	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
SN74LVC1G80DBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74LVC1G80DBVTG4	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
SN74LVC1G80DCKR	SC70	DCK	5	3000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
SN74LVC1G80DCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
SN74LVC1G80DCKRG4	SC70	DCK	5	3000	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74LVC1G80DCKT	SC70	DCK	5	250	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74LVC1G80DCKT	SC70	DCK	5	250	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
SN74LVC1G80DCKT	SC70	DCK	5	250	180.0	8.4	2.47	2.3	1.25	4.0	8.0	Q3
SN74LVC1G80YZPR	DSBGA	YZP	5	3000	178.0	9.2	1.02	1.52	0.63	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC1G80DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
SN74LVC1G80DBVRG4	SOT-23	DBV	5	3000	180.0	180.0	18.0
SN74LVC1G80DBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
SN74LVC1G80DBVTG4	SOT-23	DBV	5	250	180.0	180.0	18.0
SN74LVC1G80DCKR	SC70	DCK	5	3000	208.0	191.0	35.0
SN74LVC1G80DCKR	SC70	DCK	5	3000	210.0	185.0	35.0
SN74LVC1G80DCKRG4	SC70	DCK	5	3000	180.0	180.0	18.0
SN74LVC1G80DCKT	SC70	DCK	5	250	180.0	180.0	18.0
SN74LVC1G80DCKT	SC70	DCK	5	250	180.0	180.0	18.0
SN74LVC1G80DCKT	SC70	DCK	5	250	202.0	201.0	28.0
SN74LVC1G80YZPR	DSBGA	YZP	5	3000	220.0	220.0	35.0

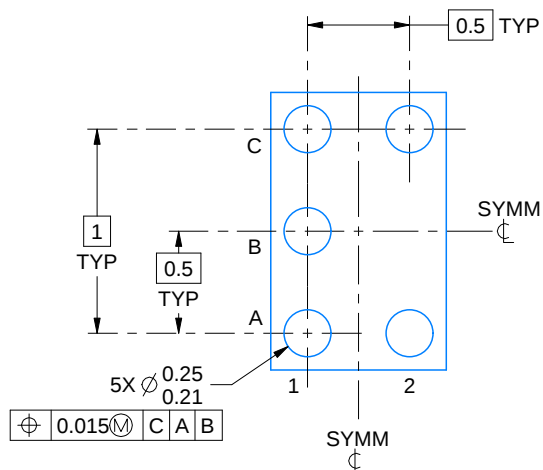
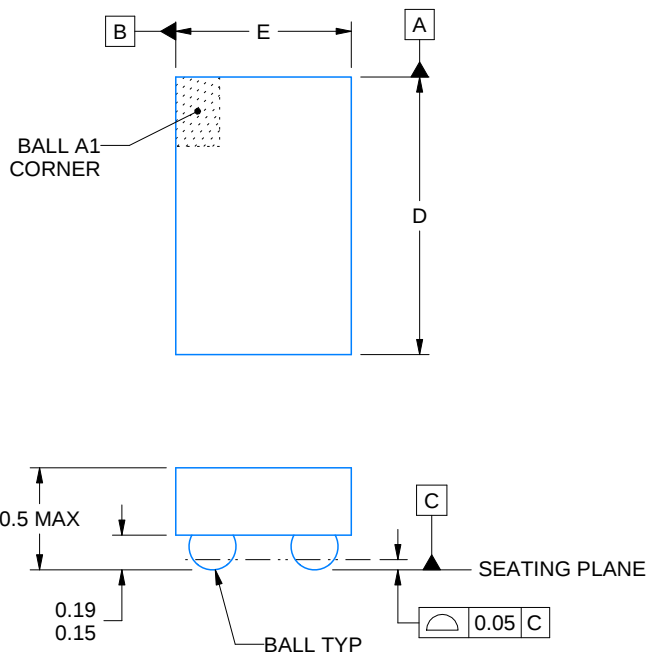
YZP0005



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



D: Max = 1.418 mm, Min = 1.358 mm
E: Max = 0.918 mm, Min = 0.858 mm

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NOTES:

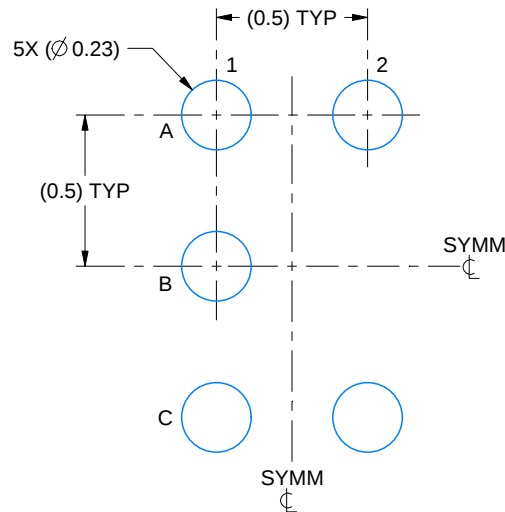
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

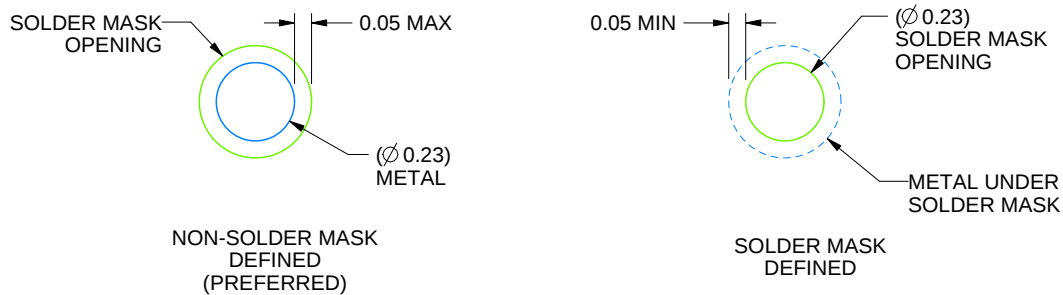
YZP0005

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:40X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

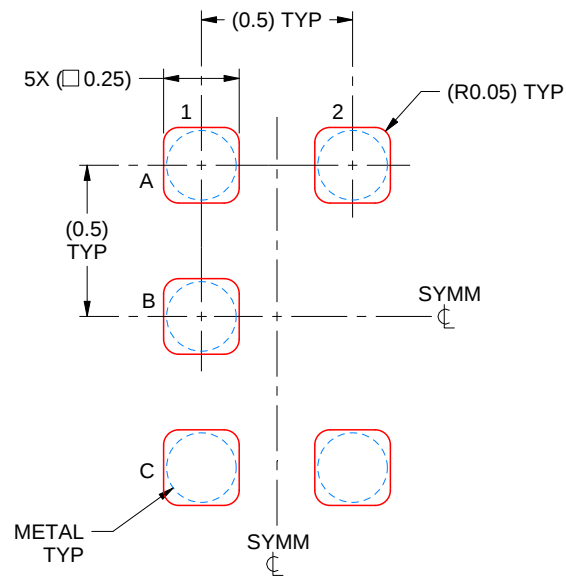
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YZP0005

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY

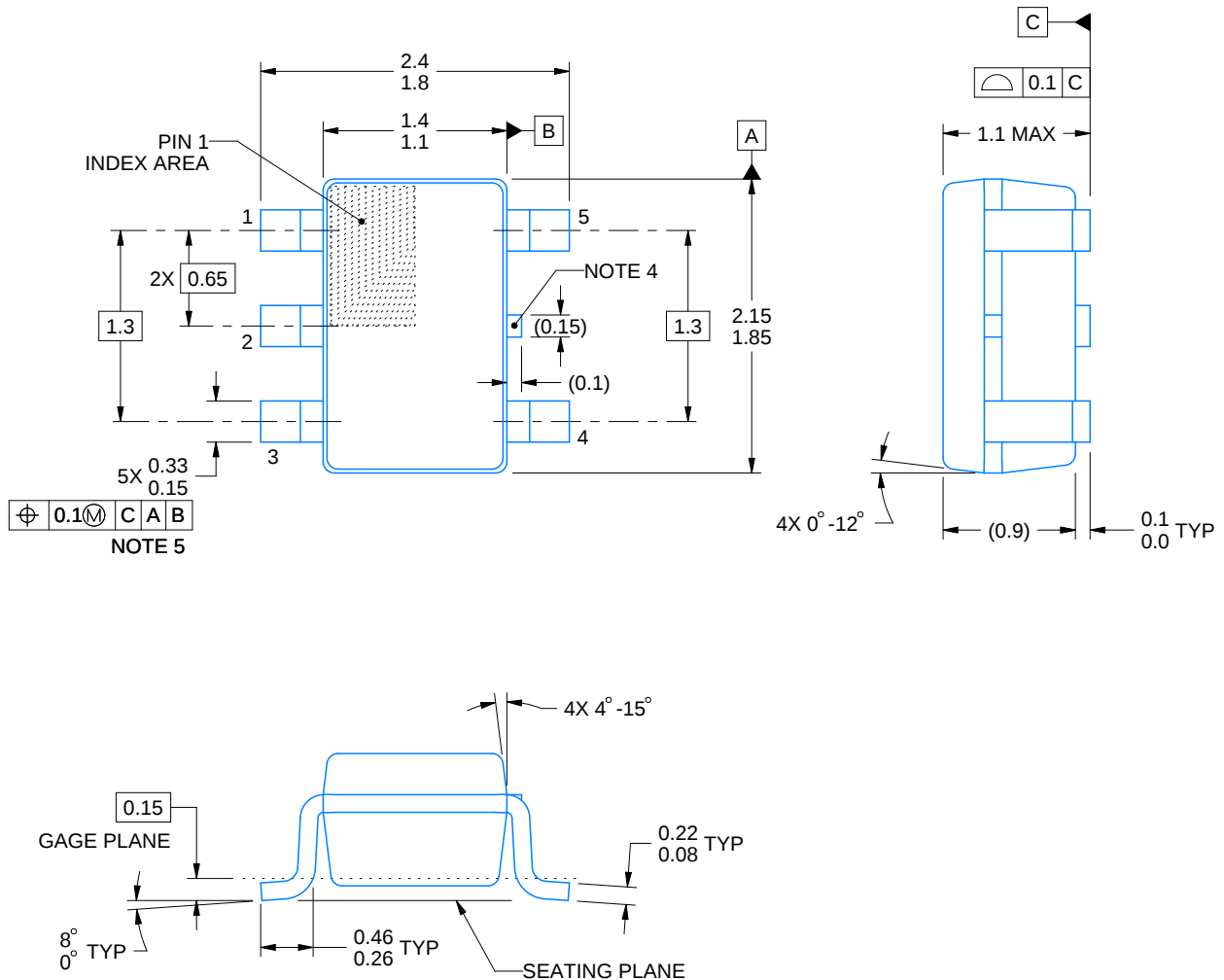


SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:40X

4219492/A 05/2017

NOTES: (continued)

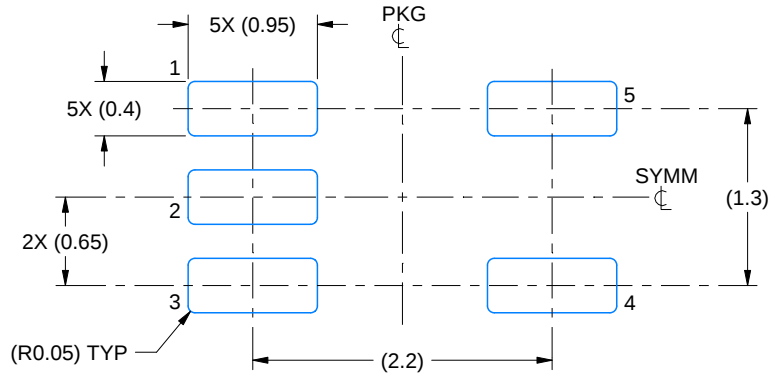
4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.



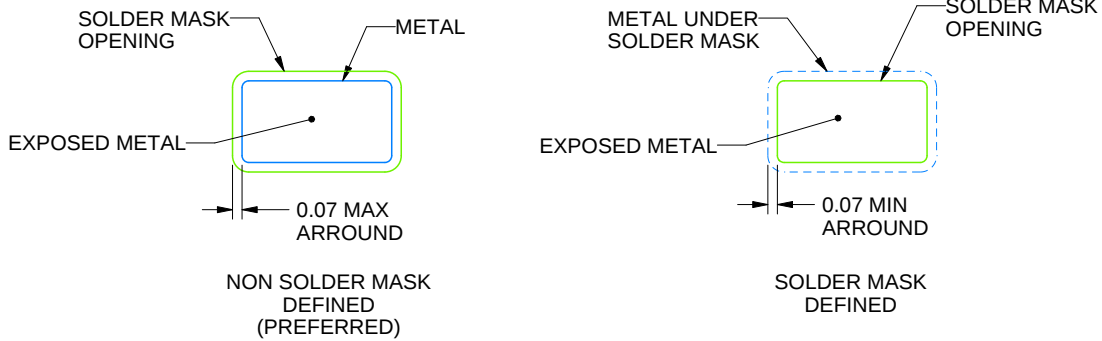
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NOTES:

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. Reference JEDEC MO-203.
4. Support pin may differ or may not be present.
5. Lead width does not comply with JEDEC.
6. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X

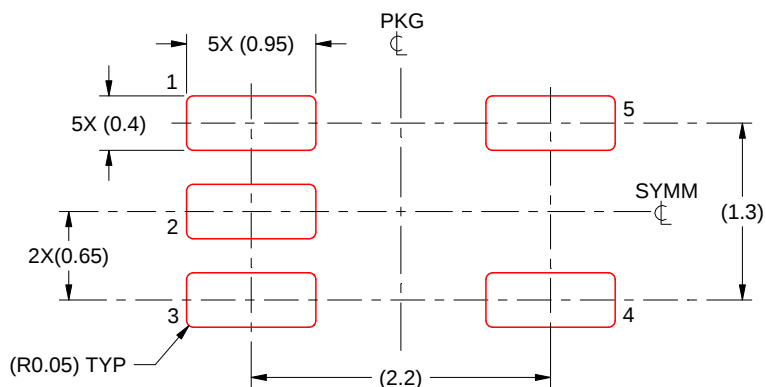


SOLDER MASK DETAILS

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NOTES: (continued)

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



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:18X

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NOTES: (continued)

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

EXAMPLE BOARD LAYOUT

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

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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

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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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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