

## Single D-Type Flip-Flop with 3-State Output

Check for Samples: [SN74LVC1G374-Q1](#)

### FEATURES

- **Qualified for Automotive Applications**
- **Supports 5-V  $V_{CC}$  Operation**
- **Inputs Accept Voltages to 5.5 V**
- **Max  $t_{pd}$  of 4 ns at 3.3 V**
- **Low Power Consumption, 10- $\mu$ A Max  $I_{CC}$**
- **$\pm 24$ -mA Output Drive at 3.3 V**
- **$I_{off}$  Supports Partial-Power-Down Mode Operation**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**

### DESCRIPTION

This single D-type flip-flop is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

The SN74LVC1G374 features a 3-state output designed specifically for driving highly capacitive or relatively low-impedance loads. This device is particularly suitable for implementing buffer registers, input/output (I/O) ports, bidirectional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q output is set to the logic level set up at the data (D) input.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the output in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the output neither loads nor drives the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

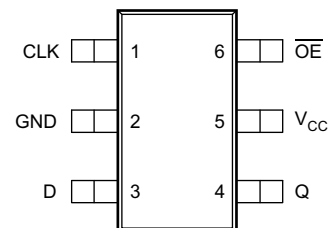
$\overline{OE}$  does not affect the internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

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This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

**DBV OR DCK PACKAGE  
(TOP VIEW)**



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

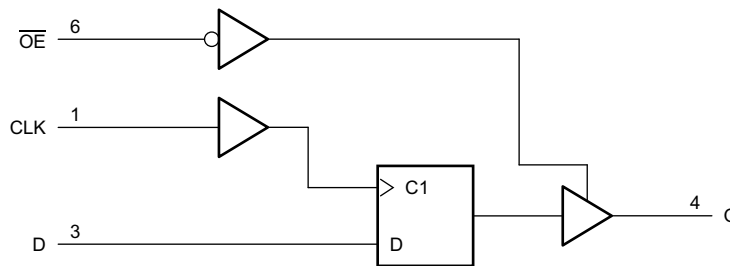


These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

**Table 1. FUNCTION TABLE**

INPUTS			OUTPUT Q
OE	CLK	D	
L	↑	L	L
L	↑	H	H
L	H or L	X	Q
H	X	X	Z

**LOGIC DIAGRAM (POSITIVE LOGIC)**



**ABSOLUTE MAXIMUM RATINGS**

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

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage range	-0.5	6.5	V	
V <sub>I</sub>	Input voltage range <sup>(2)</sup>	-0.5	6.5	V	
V <sub>O</sub>	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	-0.5	6.5	V	
	Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>	-0.5	V <sub>CC</sub> + 0.5	V	
I <sub>IK</sub>	Input clamp current, (V <sub>I</sub> < 0)		-50	mA	
I <sub>OK</sub>	Output clamp current, (V <sub>O</sub> < 0)		-50	mA	
I <sub>O</sub>	Continuous output current		±50	mA	
	Continuous current through V <sub>CC</sub> or GND		±100	mA	
θ <sub>JA</sub>	Package thermal impedance <sup>(4)</sup>	DBV package		165	°C
		DCK package		259	°C
T <sub>stg</sub>	Storage temperature range	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 and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V<sub>CC</sub> is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

**RECOMMENDED OPERATING CONDITIONS<sup>(1)</sup>**

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	Operating		V
		Data retention only		

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

**RECOMMENDED OPERATING CONDITIONS<sup>(1)</sup> (continued)**

		MIN	MAX	UNIT
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 – V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	
		V <sub>CC</sub> = 3 V to 3.6 V	2	
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 – V <sub>CC</sub>	
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.35 – V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.7	
		V <sub>CC</sub> = 3 V to 3.6 V	0.8	
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.3 – V <sub>CC</sub>	
V <sub>I</sub>	Input voltage	0	5.5	V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.65 V	–4	mA
		V <sub>CC</sub> = 2.3 V	–8	
		V <sub>CC</sub> = 3 V	–16	
			–24	
		V <sub>CC</sub> = 4.5 V	–32	
	V <sub>CC</sub> = 5 V, T <sub>A</sub> = –40°C to 85°C	–40		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65 V	4	mA
		V <sub>CC</sub> = 2.3 V	8	
		V <sub>CC</sub> = 3 V	16	
			24	
		V <sub>CC</sub> = 4.5 V	32	
	V <sub>CC</sub> = 5 V, T <sub>A</sub> = –40°C to 85°C	40		
Δt/Δv	Input transition rise or fall rate	V <sub>CC</sub> = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V	20	ns/V
		V <sub>CC</sub> = 3.3 V ± 0.3 V	10	
		V <sub>CC</sub> = 5 V ± 0.5 V	5	
T <sub>A</sub>	Operating free-air temperature	–40	125	°C

## ELECTRICAL CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = -40°C to 85°C			T <sub>A</sub> = -40°C to 125°C			UNIT
			MIN	TYP <sup>(1)</sup>	MAX	MIN	TYP <sup>(1)</sup>	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -100 μA	1.65 V to 5.5 V	V <sub>CC</sub> - 0.1			V <sub>CC</sub> - 0.1			V
	I <sub>OH</sub> = -4 mA	1.65 V	1.2			1.2			
	I <sub>OH</sub> = -8 mA	2.3 V	1.9			1.9			
	I <sub>OH</sub> = -16 mA		2.4			2.4			
	I <sub>OH</sub> = -24 mA	3 V	2.3			2.3			
	I <sub>OH</sub> = -32 mA	4.5 V	3.8			3.8			
	I <sub>OH</sub> = -40 mA	5 V	4.4						
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	1.65 V to 5.5 V				0.1			V
	I <sub>OL</sub> = 4 mA	1.65 V				0.45			
	I <sub>OL</sub> = 8 mA	2.3 V				0.3			
	I <sub>OL</sub> = 16 mA					0.4			
	I <sub>OL</sub> = 24 mA	3 V				0.55			
	I <sub>OL</sub> = 32 mA	4.5 V				0.55			
	I <sub>OL</sub> = 40 mA	5 V				0.513			
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 to 5.5 V				±1			μA
I <sub>OZ</sub>	V <sub>O</sub> = 0 to 5.5 V	1.65 V to 5.5 V				±5			μA
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0				±10			μA
I <sub>CC</sub>	V <sub>I</sub> = 5.5 V or GND, I <sub>O</sub> = 0	1.65 V to 5.5 V				10			μA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND	3 V to 5.5 V				500			μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V				3			pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	3.3 V				6			pF

(1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

## TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 1](#))

		V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 5 V ± 0.5 V		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	100		125		150		175		MHz
t <sub>w</sub>	Pulse duration, CLK high or low	3.3		3		2.8		2.5		ns
t <sub>su</sub>	Setup time, data before CLK↑	3.5		2.5		2		1.5		ns
t <sub>h</sub>	Hold time, data after CLK↑	3.4		1.6		1.5		1.5		ns

## SWITCHING CHARACTERISTICS

over free-air temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $C_L = 30\text{ pF}$  or  $50\text{ pF}$  (unless otherwise noted) (see [Figure 1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$		$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 5\text{ V}$ $\pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$f_{\text{max}}$			100		125		150		175		MHz
$t_{\text{pd}}$	CLK	Q	2.7	18.3	1.8	8.2	1.6	6	1	4	ns
$t_{\text{en}}$	$\overline{\text{OE}}$	Q	2	13	1.5	6.3	0.9	5	0.7	3.5	ns
$t_{\text{dis}}$	$\overline{\text{OE}}$	Q	2	14	1.1	5.3	1.4	4.5	0.8	3.1	ns

## SWITCHING CHARACTERISTICS

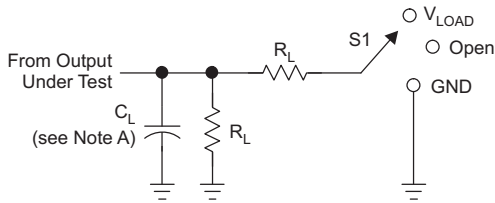
over free-air temperature range of  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ,  $C_L = 30\text{ pF}$  or  $50\text{ pF}$  (unless otherwise noted) (see [Figure 1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$		$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 5\text{ V}$ $\pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$f_{\text{max}}$			100		125		150		175		MHz
$t_{\text{pd}}$	CLK	Q	2.7	18.3	1.8	10.2	1.6	7	1	5	ns
$t_{\text{en}}$	$\overline{\text{OE}}$	Q	2	14	1.5	8.3	0.9	6.5	0.7	5.5	ns
$t_{\text{dis}}$	$\overline{\text{OE}}$	Q	2	16	1.1	7.3	1.4	6	0.8	5.1	ns

## OPERATING CHARACTERISTICS, $T_A = 25^{\circ}\text{C}$

PARAMETER		TEST CONDITIONS	$V_{CC} = 1.8\text{ V}$	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	$V_{CC} = 5\text{ V}$	UNIT
			TYP	TYP	TYP	TYP	
Power dissipation	Outputs enabled		24	24	25	27	pF
Cpd capacitance	Outputs disabled	$f = 10\text{ MHz}$	8	8	9	11	

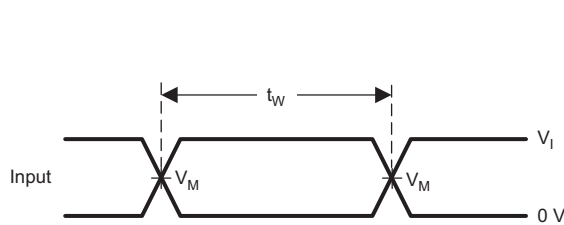
PARAMETER MEASUREMENT INFORMATION



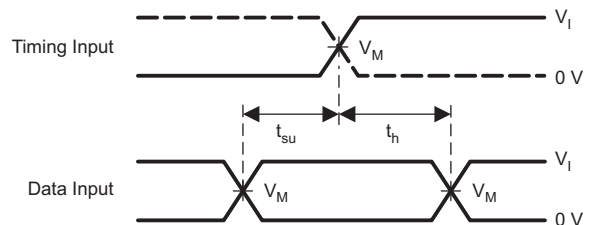
LOAD CIRCUIT

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

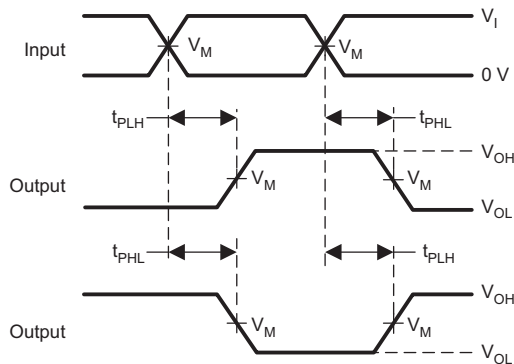
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8 V \pm 0.15 V$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5 V \pm 0.2 V$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
$3.3 V \pm 0.3 V$	3 V	$\leq 2.5 \text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$5 V \pm 0.5 V$	$V_{CC}$	$\leq 2.5 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 $\Omega$	0.3 V



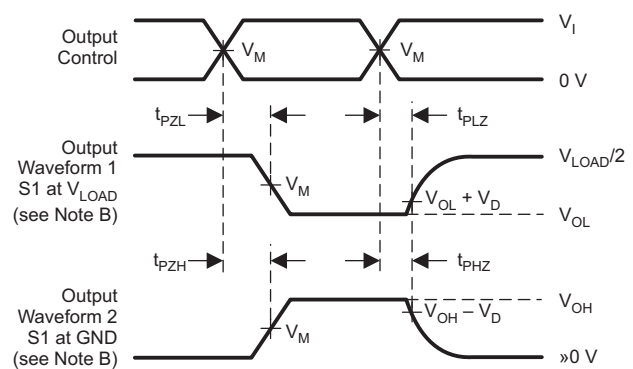
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. 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.  
 C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ .  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .  
 F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .  
 G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .  
 H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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**REVISION HISTORY**

<b>Changes from Revision A (April 2008) to Revision B</b>	<b>Page</b>
• Removed Ordering Information table. ....	<a href="#">1</a>

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**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="#">CLVC1G374QDBVRQ1</a>	Active	Production	SOT-23 (DBV)   6	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(35B5, CA4O)
CLVC1G374QDBVRQ1.B	Active	Production	SOT-23 (DBV)   6	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(35B5, CA4O)
<a href="#">CLVC1G374QDCKRQ1</a>	Active	Production	SC70 (DCK)   6	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 125	D4O
CLVC1G374QDCKRQ1.B	Active	Production	SC70 (DCK)   6	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	D4O

(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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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 SN74LVC1G374-Q1 :**

- Catalog : [SN74LVC1G374](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**

**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
CLVC1G374QDBVRQ1	SOT-23	DBV	6	3000	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3
CLVC1G374QDBVRQ1	SOT-23	DBV	6	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
CLVC1G374QDCKRQ1	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CLVC1G374QDBVRQ1	SOT-23	DBV	6	3000	180.0	180.0	18.0
CLVC1G374QDBVRQ1	SOT-23	DBV	6	3000	200.0	183.0	25.0
CLVC1G374QDCKRQ1	SC70	DCK	6	3000	210.0	185.0	35.0

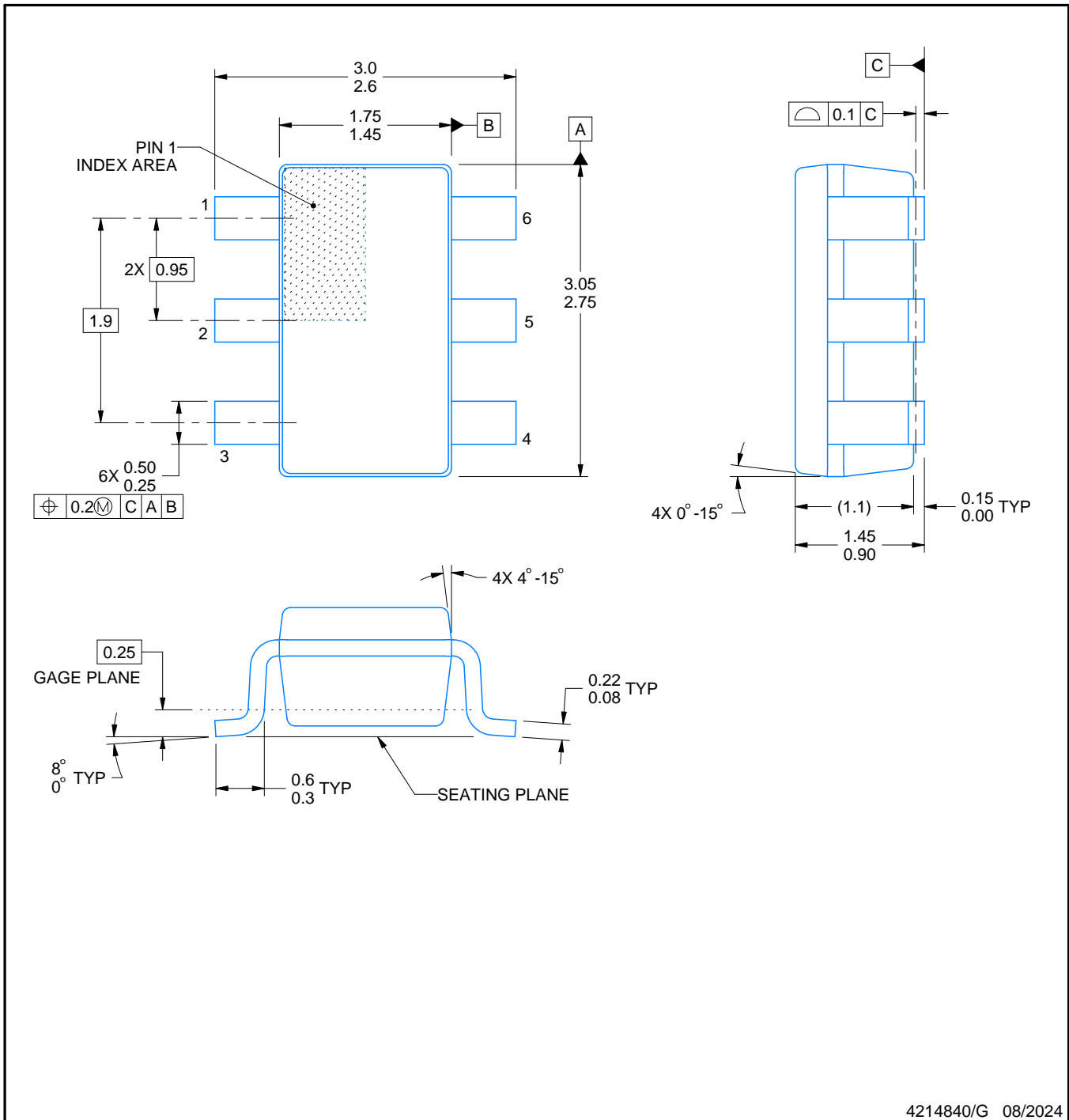
# DBV0006A



# PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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## NOTES:

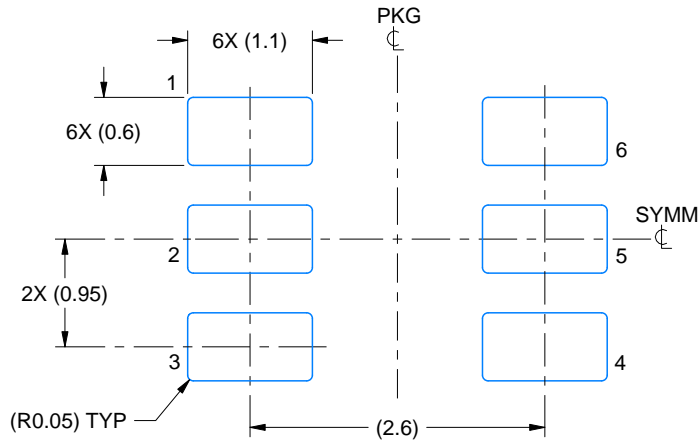
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

# EXAMPLE BOARD LAYOUT

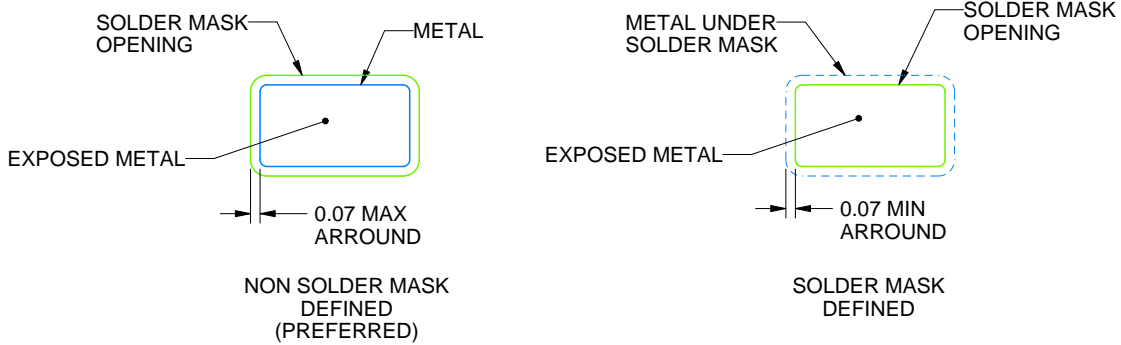
DBV0006A

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)

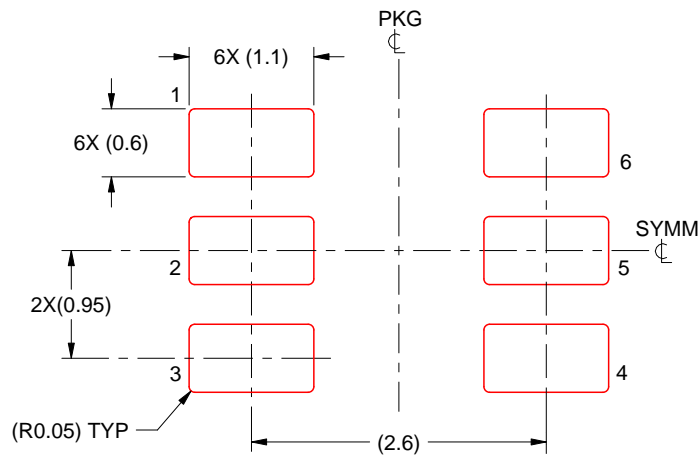
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



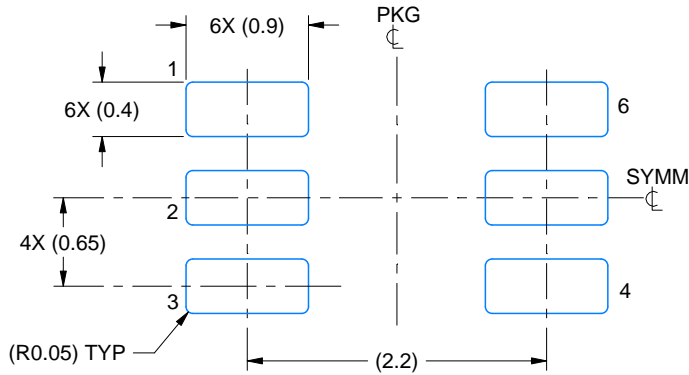
SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

4214840/G 08/2024

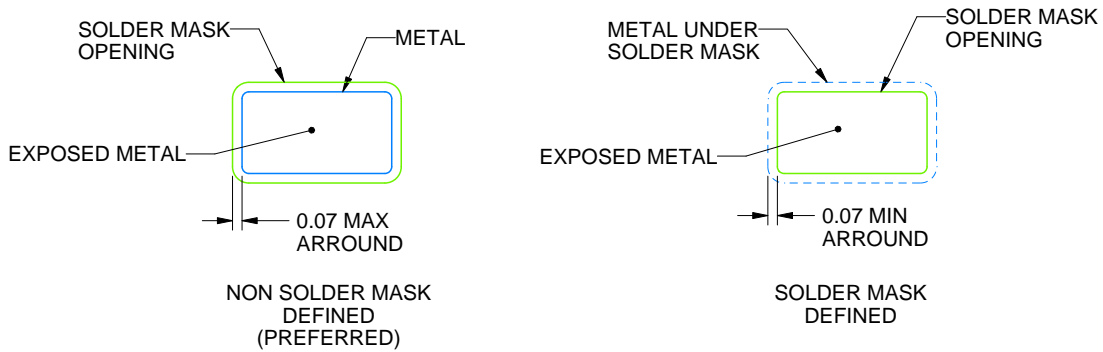
NOTES: (continued)

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.





LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X

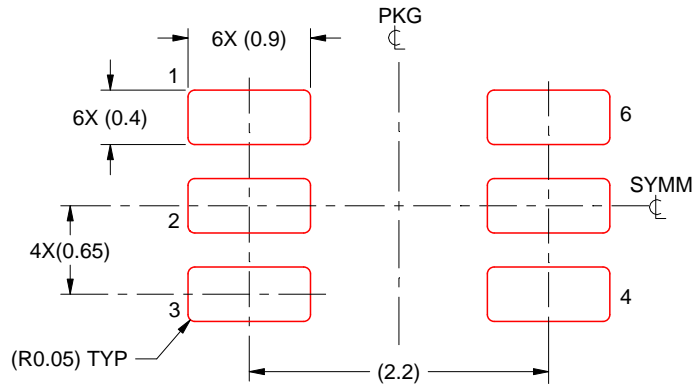


SOLDER MASK DETAILS

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NOTES: (continued)

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



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

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NOTES: (continued)

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

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