

# SN74AVC8T245-Q1 Automotive 8-Bit Dual-Supply Bus Transceiver

## With Configurable Voltage Translation and 3-State Outputs

### 1 Features

- Qualified for automotive applications
- AEC Q100 test guidance with the following results:
  - Device temperature grade 1:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  ambient operating temperature range
  - Device HBM ESD Classification Level H2
  - Device CDM ESD Classification Level C3B
- Control inputs  $V_{IH}$  and  $V_{IL}$  levels are referenced to  $V_{CCA}$  voltage
- $V_{CC}$  isolation feature – if either  $V_{CC}$  input is at GND, all I/O ports are in the high-impedance state
- $I_{off}$  supports partial power-down-mode operation
- Fully configurable dual-rail design allows each port to operate over the full 1.4-V to 3.6-V power-supply range
- I/Os are 4.6-V tolerant
- Maximum data rates:
  - 170Mbps ( $V_{CCA} < 1.8\text{ V}$  or  $V_{CCB} < 1.8\text{ V}$ )
  - 320Mbps ( $V_{CCA} \geq 1.8\text{ V}$  and  $V_{CCB} \geq 1.8\text{ V}$ )
- Latch-up performance exceeds 100 mA per JESD 78, Class II

### 2 Applications

- [Telematics](#)
- [Cluster](#)
- [Head unit](#)
- [Navigation systems](#)

### 3 Description

The SN74AVC8T245-Q1 is an 8-bit noninverting bus transceiver that uses two separate configurable power-supply rails. The SN74AVC8T245-Q1 operation is optimal with  $V_{CCA}$  and  $V_{CCB}$  set at 1.4 V to 3.6 V. It is operational with  $V_{CCA}$  and  $V_{CCB}$  as low as 1.2 V. The A port is designed to track  $V_{CCA}$ .  $V_{CCA}$  accepts any supply voltage from 1.2 V to 3.6 V. The B port is designed to track  $V_{CCB}$ .  $V_{CCB}$  accepts any supply voltage from 1.2 V to 3.6 V. This allows for universal low-voltage bidirectional translation between any of the 1.2-V, 1.5-V, 1.8-V, 2.5-V, and 3.3-V voltage nodes.

The SN74AVC8T245-Q1 design enables asynchronous communication between data buses. The device transmits data from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. One can use the output-enable ( $\overline{OE}$ ) input to disable the outputs so the buses are effectively isolated.

In the SN74AVC8T245-Q1 design,  $V_{CCA}$  supplies the control pins (DIR and  $\overline{OE}$ ).

This device specification covers partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs when the device is powered down. This inhibits current backflow into the device which prevents damage to the device.

The  $V_{CC}$  isolation feature allows both ports to be in the high-impedance state if either  $V_{CC}$  input is at GND.

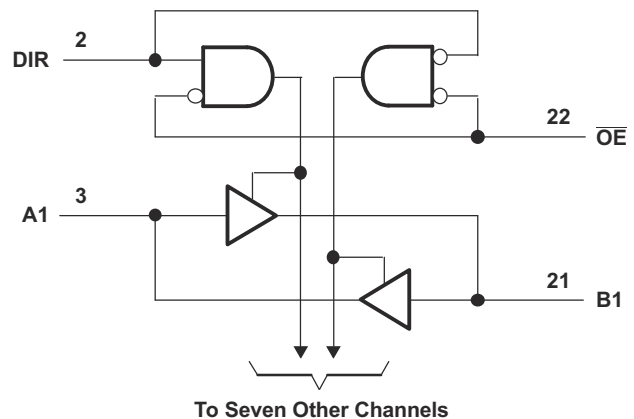
To put the device in the high-impedance state during power up or power down, tie  $\overline{OE}$  to  $V_{CC}$  through a pullup resistor; the current-sinking capability of the driver determines the minimum value of the resistor.

#### Package Information

PART NUMBER	PACKAGE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>
SN74AVC8T245-Q1	RHL (VQFN, 24)	5.5 mm × 3.5 mm
	PW (TSSOP, 24)	7.8 mm × 6.4 mm

(1) For more information, see [Section 11](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



**Logic Diagram (Positive Logic)**



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## 4 Pin Configuration and Functions

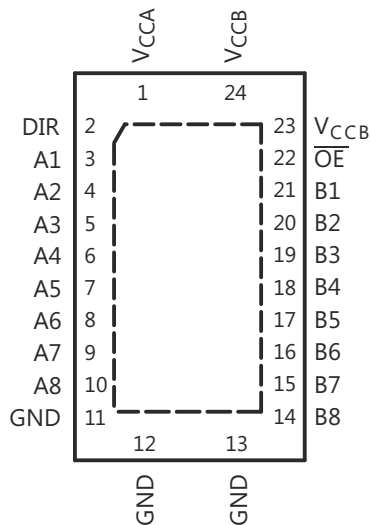


Figure 4-1. RHL Package, 24-Pin VQFN (Top View)

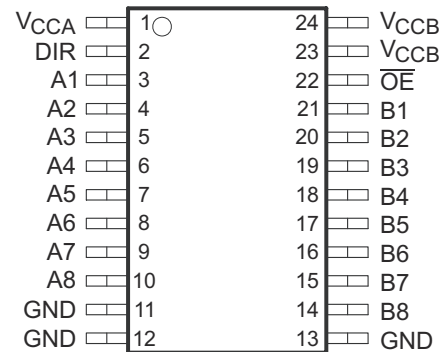


Figure 4-2. PW Package, 24-Pin TSSOP (Top View)

Table 4-1. Pin Functions

NAME	PIN		TYPE <sup>(1)</sup>	DESCRIPTION
	VQFN	TSSOP		
A1	3	3	I/O	Input/output A1. Referenced to $V_{CCA}$ .
A2	4	4	I/O	Input/output A2. Referenced to $V_{CCA}$ .
A3	5	5	I/O	Input/output A3. Referenced to $V_{CCA}$ .
A4	6	6	I/O	Input/output A4. Referenced to $V_{CCA}$ .
A5	7	7	I/O	Input/output A5. Referenced to $V_{CCA}$ .
A6	8	8	I/O	Input/output A6. Referenced to $V_{CCA}$ .
A7	9	9	I/O	Input/output A7. Referenced to $V_{CCA}$ .
A8	10	10	I/O	Input/output A8. Referenced to $V_{CCA}$ .
B1	21	21	I/O	Input/output B1. Referenced to $V_{CCB}$ .
B2	20	20	I/O	Input/output B2. Referenced to $V_{CCB}$ .
B3	19	19	I/O	Input/output B3. Referenced to $V_{CCB}$ .
B4	18	18	I/O	Input/output B4. Referenced to $V_{CCB}$ .
B5	17	17	I/O	Input/output B5. Referenced to $V_{CCB}$ .
B6	16	16	I/O	Input/output B6. Referenced to $V_{CCB}$ .
B7	15	15	I/O	Input/output B7. Referenced to $V_{CCB}$ .
B8	14	14	I/O	Input/output B8. Referenced to $V_{CCB}$ .
DIR	2	—	I	Direction-control input for 1 ports
GND	12, 13	11, 12, 13	—	Ground
$\overline{OE}$	22	22	I	3-state output-mode enable. Pull $\overline{OE}$ high to place '2' outputs in 3-state mode. Referenced to $V_{CCA}$ .
$V_{CCA}$	1	1	—	A-port power supply voltage. $1.2\text{ V} \leq V_{CCA} \leq 3.6\text{ V}$
$V_{CCB}$	23, 24	23, 24	—	B-port power supply voltage. $1.2\text{ V} \leq V_{CCB} \leq 3.6\text{ V}$
Thermal pad			—	The exposed thermal pad must be connected as a secondary GND or be left electrically open.

(1) I = input, O = output

## 5 Specifications

### 5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
$V_{CCA}$	Supply voltage		-0.5	4.6	V
$V_{CCB}$					
$V_I$	Input voltage <sup>(2)</sup>	I/O ports (A port)	-0.5	4.6	V
		I/O ports (B port)	-0.5	4.6	V
		Control inputs	-0.5	4.6	V
$V_O$	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	A port	-0.5	4.6	V
		B port	-0.5	4.6	V
$V_O$	Voltage range applied to any output in the high or low state <sup>(2) (3)</sup>	A port	-0.5	$(V_{CCA} + 0.5)$	V
		B port	-0.5	$(V_{CCB} + 0.5)$	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 $V_{CCA}$ , $V_{CCB}$ , 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 device withstands voltages in excess of input voltage and output negative-voltage ratings while operating within the input and output current ratings.
- (3) The device withstands voltages in excess of the output positive-voltage rating up to 4.6 V maximum while operating within the output current rating.

### 5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per AEC Q100-002 Classification Level H2 <sup>(1)</sup>	±2000	V
		Charged-device model (CDM), per AEC Q100-011 Classification Level C3B	±750	

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

### 5.3 Recommended Operating Conditions

See (1) (2) (3)

		$V_{CCI}$	$V_{CCO}$	MIN	MAX	UNIT
$V_{CCA}$	Supply voltage			1.2	3.6	V
$V_{CCB}$	Supply voltage			1.2	3.6	V
$V_{IH}$	High-level input voltage	Data inputs	1.2 V to 1.95 V	$V_{CCI} \times 0.65$		V
			1.95 V to 2.7 V	1.6		
			2.7 V to 3.6 V	2		
$V_{IL}$	Low-level input voltage	Data inputs	1.2 V to 1.95 V	$V_{CCI} \times 0.35$		V
			1.95 V to 2.7 V	0.7		
			2.7 V to 3.6 V	0.8		
$V_{IH}$	High-level input voltage	DIR (referenced to $V_{CCA}$ )	1.2 V to 1.95 V	$V_{CCA} \times 0.65$		V
			1.95 V to 2.7 V	1.6		
			2.7 V to 3.6 V	2		
$V_{IL}$	Low-level input voltage	DIR (referenced to $V_{CCA}$ )	1.2 V to 1.95 V	$V_{CCA} \times 0.35$		V
			1.95 V to 2.7 V	0.7		
			2.7 V to 3.6 V	0.8		
$V_I$	Input voltage			0	3.6	V
$V_O$	Output voltage	Active state		0	$V_{CCO}$	V
		3-state		0	3.6	V
$I_{OH}$	High-level output current		1.2 V	-3		mA
			1.4 V to 1.6 V	-6		
			1.65 V to 1.95 V	-8		
			2.3 V to 2.7 V	-9		
			3 V to 3.6 V	-12		
$I_{OL}$	Low-level output current		1.2 V	3		mA
			1.4 V to 1.6 V	6		
			1.65 V to 1.95 V	8		
			2.3 V to 2.7 V	9		
			3 V to 3.6 V	12		
$\Delta t / \Delta v$	Input transition rise or fall rate				5	ns / V
$T_A$	Operating free-air temperature			-40	125	°C

- (1)  $V_{CCI}$  is the  $V_{CC}$  associated with the input port.
- (2)  $V_{CCO}$  is the  $V_{CC}$  associated with the output port.
- (3) Hold all unused data inputs of the device at  $V_{CCI}$  or GND for proper device operation. See the TI application report, [Implications of Slow or Floating CMOS Inputs](#), SCBA004.

## 5.4 Thermal Information

THERMAL METRIC		SN74AVC8T245-Q1		UNIT
		RHL (VQFN)	PW (TSSOP)	
		24 PINS	24 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	36.8	93.1	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	32.5	36.7	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	15.7	48.4	°C/W
$\psi_{JT}$	Junction-to-top characterization parameter	0.7	93.1	°C/W
$\psi_{JB}$	Junction-to-board characterization parameter	15.6	48.0	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	5.6	N/A	°C/W

## 5.5 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)<sup>(2) (1)</sup>

PARAMETER		TEST CONDITIONS	$V_{CCA}$	$V_{CCB}$	$T_A$	MIN	TYP	MAX	UNIT
$V_{OH}$		$V_I = V_{IH}$	1.2 V to 3.6 V	1.2 V to 3.6 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	$V_{CCO}$ -0.2			V
			1.2 V	1.2 V	$T_A = 25^\circ\text{C}$	0.95			
			1.4 V	1.4 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	1			
			1.65 V	1.65 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	1.2			
			2.3 V	2.3 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	1.75			
			3 V	3 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	2.3			
$V_{OL}$		$V_I = V_{IL}$	1.2 V to 3.6 V	1.2 V to 3.6 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$			0.2	V
			1.2 V	1.2 V	$T_A = 25^\circ\text{C}$	0.15			
			1.4 V	1.4 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	0.35			
			1.65 V	1.65 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	0.45			
			2.3 V	2.3 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	0.55			
			3 V	3 V	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	0.7			
$I_I$	Control inputs	$V_I = V_{CCA}$ or GND	1.2 V to 3.6 V	1.2 V to 3.6 V	$T_A = 25^\circ\text{C}$	$\pm 0.02$	$\pm 0.25$	$\mu\text{A}$	
					$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		$\pm 1$		
$I_{off}$	A or B port	$V_I$ or $V_O = 0$ to 3.6 V	0 V	0 V to 3.6 V	$T_A = 25^\circ\text{C}$	$\pm 0.1$	$\pm 1$	$\mu\text{A}$	
					$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		$\pm 5$		
			0 V to 3.6 V	0 V	$T_A = 25^\circ\text{C}$	$\pm 0.1$	$\pm 1$		
					$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		$\pm 5$		
$I_{OZ}^{(3)}$	A or B port	$V_O = V_{CCO}$ or GND, $V_I = V_{CCI}$ or GND, $OE = V_{IH}$	3.6 V	3.6 V	$T_A = 25^\circ\text{C}$	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$	
					$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		$\pm 5$		

## 5.5 Electrical Characteristics (continued)

over recommended operating free-air temperature range (unless otherwise noted)<sup>(2)</sup> (1)

PARAMETER		TEST CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	T <sub>A</sub>	MIN	TYP	MAX	UNIT
I <sub>CCA</sub>		V <sub>I</sub> = V <sub>CCi</sub> or GND <sup>(3)</sup> , I <sub>O</sub> = 0	1.2 V to 3.6 V	1.2 V to 3.6 V	T <sub>A</sub> = -40°C to +125°C			15	μA
			0 V	3.6 V	T <sub>A</sub> = -40°C to +125°C		-2		
			3.6 V	0 V	T <sub>A</sub> = -40°C to +125°C		15		
I <sub>CCB</sub>		V <sub>I</sub> = V <sub>CCi</sub> or GND <sup>(3)</sup> , I <sub>O</sub> = 0	1.2 V to 3.6 V	1.2 V to 3.6 V	T <sub>A</sub> = -40°C to +125°C			15	μA
			0 V	3.6 V	T <sub>A</sub> = -40°C to +125°C		15		
			3.6 V	0 V	T <sub>A</sub> = -40°C to +125°C		-2		
I <sub>CCA</sub> + I <sub>CCB</sub>		V <sub>I</sub> = V <sub>CCi</sub> or GND, I <sub>O</sub> = 0	1.2 V to 3.6 V	1.2 V to 3.6 V	T <sub>A</sub> = -40°C to +125°C			25	μA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = 3.3 V or GND	3.3 V	3.3 V	T <sub>A</sub> = 25°C		3.5		pF
C <sub>io</sub>	A or B port	V <sub>O</sub> = 3.3 V or GND	3.3 V	3.3 V	T <sub>A</sub> = 25°C		6		pF

- (1) V<sub>CCi</sub> is the V<sub>CC</sub> associated with the input port.  
(2) V<sub>CCO</sub> is the V<sub>CC</sub> associated with the output port.  
(3) For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

## 5.6 Switching Characteristics: V<sub>CCA</sub> = 1.2 V

over recommended operating free-air temperature range, V<sub>CCA</sub> = 1.2 V (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CCB</sub>	TYP	UNIT
t <sub>PLH</sub> , t <sub>PHL</sub>	A	B	V <sub>CCB</sub> = 1.2 V	3.1	ns
			V <sub>CCB</sub> = 1.5 V	2.6	
			V <sub>CCB</sub> = 1.8 V	2.5	
			V <sub>CCB</sub> = 2.5 V	3	
			V <sub>CCB</sub> = 3.3 V	3.5	
t <sub>PLH</sub> , t <sub>PHL</sub>	B	A	V <sub>CCB</sub> = 1.2 V	3.1	ns
			V <sub>CCB</sub> = 1.5 V	2.7	
			V <sub>CCB</sub> = 1.8 V	2.5	
			V <sub>CCB</sub> = 2.5 V	2.4	
			V <sub>CCB</sub> = 3.3 V	2.3	
t <sub>PZH</sub> , t <sub>PZL</sub>	$\overline{\text{OE}}$	A	V <sub>CCB</sub> = 1.2 V	5.3	ns
			V <sub>CCB</sub> = 1.5 V		
			V <sub>CCB</sub> = 1.8 V		
			V <sub>CCB</sub> = 2.5 V		
			V <sub>CCB</sub> = 3.3 V		
t <sub>PZH</sub> , t <sub>PZL</sub>	$\overline{\text{OE}}$	B	V <sub>CCB</sub> = 1.2 V	5.1	ns
			V <sub>CCB</sub> = 1.5 V	4	
			V <sub>CCB</sub> = 1.8 V	3.5	
			V <sub>CCB</sub> = 2.5 V	3.2	
			V <sub>CCB</sub> = 3.3 V	3.1	

### 5.6 Switching Characteristics: $V_{CCA} = 1.2\text{ V}$ (continued)

 over recommended operating free-air temperature range,  $V_{CCA} = 1.2\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	TYP	UNIT
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$	4.8	ns
			$V_{CCB} = 1.5\text{ V}$		
			$V_{CCB} = 1.8\text{ V}$		
			$V_{CCB} = 2.5\text{ V}$		
			$V_{CCB} = 3.3\text{ V}$		
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$	4.7	ns
			$V_{CCB} = 1.5\text{ V}$	4	
			$V_{CCB} = 1.8\text{ V}$	4.1	
			$V_{CCB} = 2.5\text{ V}$	4.3	
			$V_{CCB} = 3.3\text{ V}$	5.1	

### 5.7 Switching Characteristics: $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$

 over recommended operating free-air temperature range,  $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	A	B	$V_{CCB} = 1.2\text{ V}$		3.1		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		14.7	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		13.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		13.9	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		17.2	
$t_{PLH}$ , $t_{PHL}$	B	A	$V_{CCB} = 1.2\text{ V}$		3.1		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		14.7	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		14.2	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		13.5	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		13.2	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		5.3		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		20.5	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		20.5	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		20.5	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		20.5	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		5.1		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		18.6	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		17.7	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		15.1	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		14.4	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		4.8		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		20.3	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		20.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		20.3	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		20.3	

### 5.7 Switching Characteristics: $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$ (continued)

 over recommended operating free-air temperature range,  $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	MIN	TYP	MAX	UNIT
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		4.7		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		20.0	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		18.6	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		17.9	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		18.9	

### 5.8 Switching Characteristics: $V_{CCA} = 1.8\text{ V} \pm 0.15\text{ V}$

 over recommended operating free-air temperature range,  $V_{CCA} = 1.8\text{ V} \pm 0.15\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	A	B	$V_{CCB} = 1.2\text{ V}$		2.5		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		14.2	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		13.0	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		12.3	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.1	
$t_{PLH}$ , $t_{PHL}$	B	A	$V_{CCB} = 1.2\text{ V}$		2.5		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		13.3	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		13.0	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		12.1	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		11.8	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		3		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		17.2	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		17.2	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		17.2	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		17.2	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		4.6		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		19.6	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		17.0	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		14.2	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		13.2	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		2.8		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		17.7	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		17.7	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		17.7	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		17.7	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		3.9		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		18.9	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		17.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		15.8	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		15.4	

### 5.9 Switching Characteristics: $V_{CCA} = 2.5\text{ V} \pm 0.2\text{ V}$

over recommended operating free-air temperature range,  $V_{CCA} = 2.5\text{ V} \pm 0.2\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	A	B	$V_{CCB} = 1.2\text{ V}$		2.4		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		13.5	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		12.1	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		10.7	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		10.2	
$t_{PLH}$ , $t_{PHL}$	B	A	$V_{CCB} = 1.2\text{ V}$		3		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		13.9	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		12.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		10.7	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		10.4	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		2.2		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		13.7	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		13.7	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		13.7	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		13.7	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		4.5		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		19.1	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		16.5	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		13.3	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.3	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		1.8		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		14.2	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		14.2	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		14.2	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		14.2	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		3.6		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		17.7	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		16.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		14.2	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.1	

### 5.10 Switching Characteristics: $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range,  $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	A	B	$V_{CCB} = 1.2\text{ V}$		2.3		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		13.2	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		11.1	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		10.4	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		9.7	

### 5.10 Switching Characteristics: $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$ (continued)

over recommended operating free-air temperature range,  $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}$	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$	B	A	$V_{CCB} = 1.2\text{ V}$		3.5		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		17.2	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		12.1	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		10.2	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		9.7	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		2		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		12.3	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		12.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		12.3	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.3	
$t_{PZH}$ , $t_{PZL}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		4.5		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		18.9	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		16.1	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		13.2	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.3	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	A	$V_{CCB} = 1.2\text{ V}$		1.7		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		12.3	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		12.3	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		12.3	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.3	
$t_{PHZ}$ , $t_{PLZ}$	$\overline{OE}$	B	$V_{CCB} = 1.2\text{ V}$		3.4		ns
			$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	0.5		17.4	
			$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	0.5		15.8	
			$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	0.5		13.7	
			$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	0.5		12.6	

### 5.11 Operating Characteristics

T<sub>A</sub> = 25°C

PARAMETER		TEST CONDITIONS	V <sub>CCA</sub>	TYP	UNIT	
C <sub>pdA</sub> <sup>(1)</sup>	A to B	Outputs enabled	C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	1	pF
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V			
	Outputs disabled	C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	1		
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V			
	B to A	Outputs enabled	C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	12	
				V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V	12	
V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V				12		
V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V				13		
V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V				14		
Outputs disabled		C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	1		
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V			
C <sub>pdB</sub> <sup>(1)</sup>	A to B	Outputs enabled	C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	12	
				V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V	12	
				V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V	12	
				V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V	13	
				V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V	14	
	Outputs disabled	C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	1		
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V			
	B to A	Outputs enabled	C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	1	
				V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V		
V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V						
V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V						
V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V						
Outputs disabled		C <sub>L</sub> = 0, f = 10 MHz, t <sub>r</sub> = t <sub>f</sub> = 1 ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2 V	1		
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5 V			
			V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V			

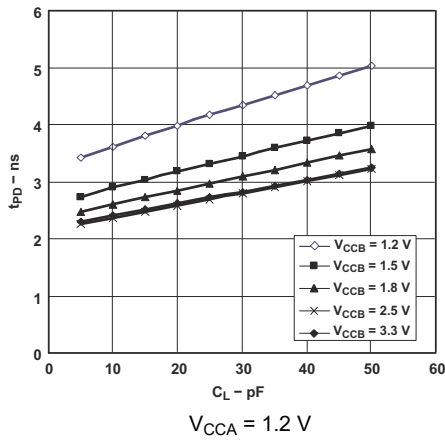
(1) Power dissipation capacitance per transceiver

### 5.12 Typical Total Static Current Consumption ( $I_{CCA} + I_{CCB}$ )

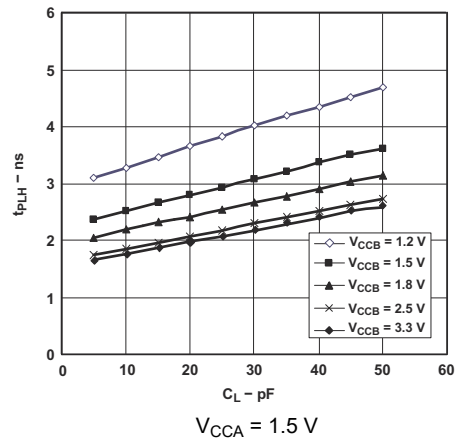
$V_{CCB}$	$V_{CCA}$						UNIT
	0 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
0 V	0	<0.5	<0.5	<0.5	<0.5	<0.5	$\mu$ A
1.2 V	<0.5	<1	<1	<1	<1	1	$\mu$ A
1.5 V	<0.5	<1	<1	<1	<1	1	$\mu$ A
1.8 V	<0.5	<1	<1	<1	<1	<1	$\mu$ A
2.5 V	<0.5	1	<1	<1	<1	<1	$\mu$ A
3.3 V	<0.5	1	<1	<1	<1	<1	$\mu$ A

### 5.13 Typical Characteristics

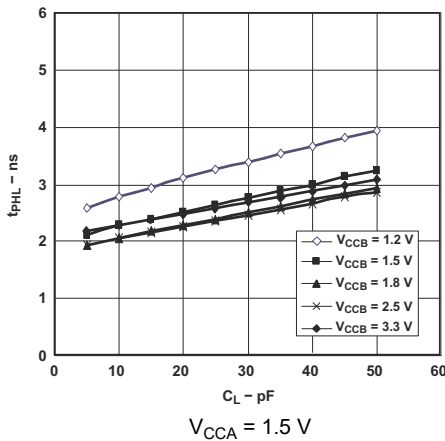
T<sub>A</sub> = 25°C



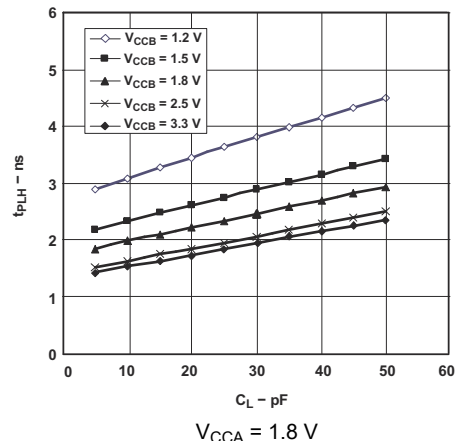
**Figure 5-1. Typical Propagation Delay (A to B) vs Load Capacitance**



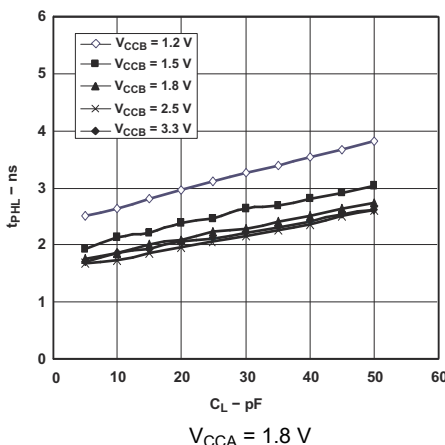
**Figure 5-2. Typical Propagation Delay (A to B) vs Load Capacitance**



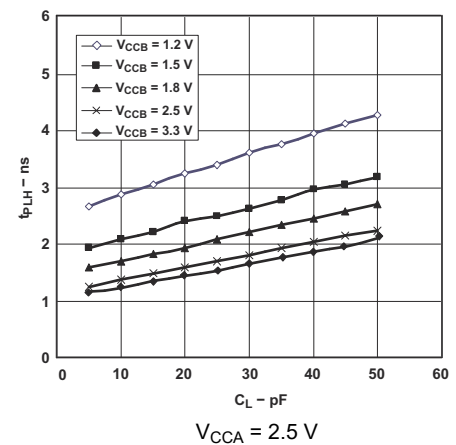
**Figure 5-3. Typical Propagation Delay (A to B) vs Load Capacitance**



**Figure 5-4. Typical Propagation Delay (A to B) vs Load Capacitance**



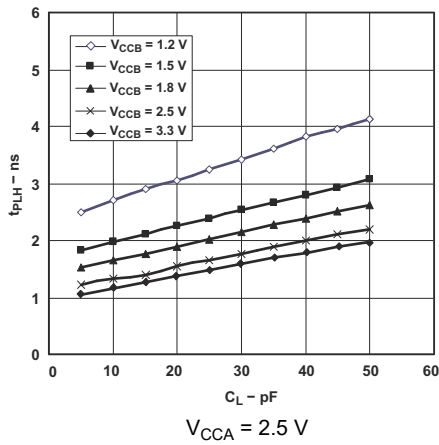
**Figure 5-5. Typical Propagation Delay (A to B) vs Load Capacitance**



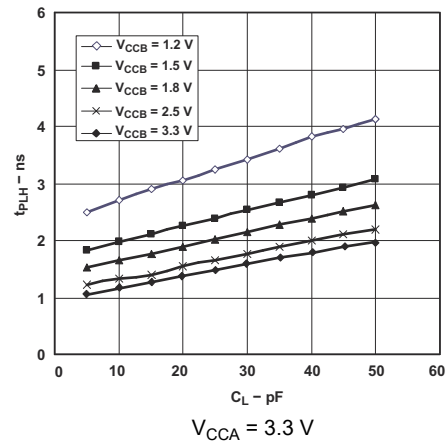
**Figure 5-6. Typical Propagation Delay (A to B) vs Load Capacitance**

### 5.13 Typical Characteristics (continued)

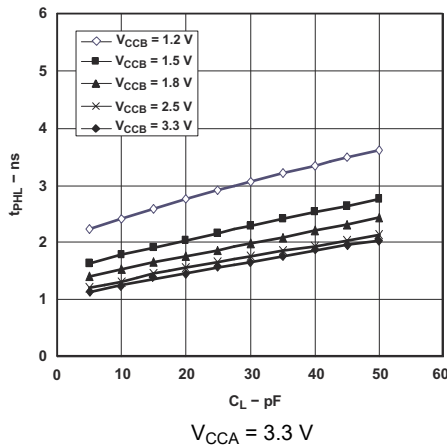
$T_A = 25^\circ\text{C}$



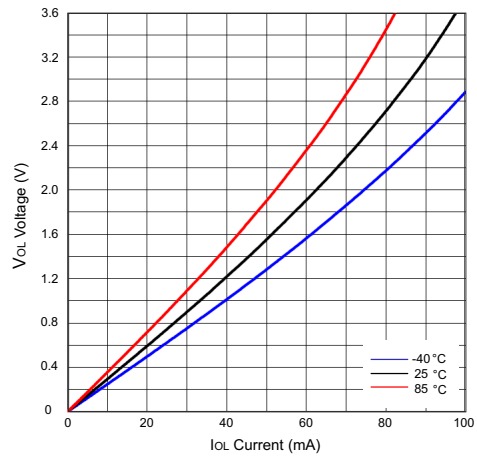
**Figure 5-7. Typical Propagation Delay (A to B) vs Load Capacitance**



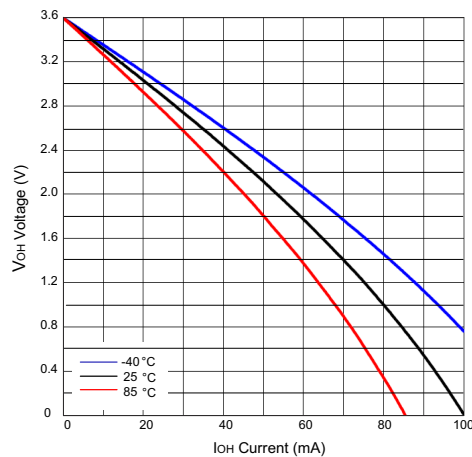
**Figure 5-8. Typical Propagation Delay (A to B) vs Load Capacitance**



**Figure 5-9. Typical Propagation Delay (A to B) vs Load Capacitance**

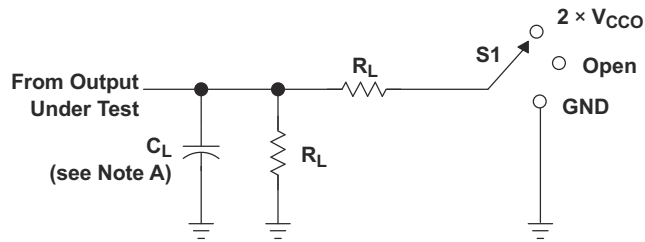


**Figure 5-10. Low-Level Output Voltage ( $V_{OL}$ ) vs Low-Level Current ( $I_{OL}$ )**



**Figure 5-11. High-Level Output Voltage ( $V_{OH}$ ) vs High-Level Current ( $I_{OH}$ )**

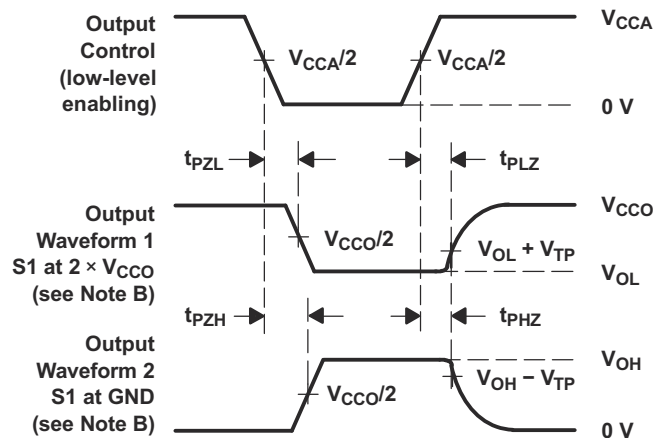
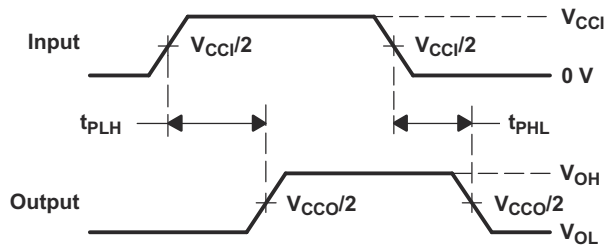
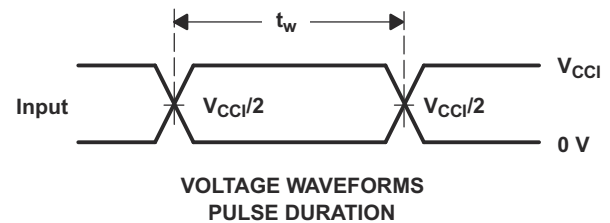
## 6 Parameter Measurement Information



LOAD CIRCUIT

TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CCO}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CCO}$	$C_L$	$R_L$	$V_{TP}$
1.2 V	15 pF	2 k $\Omega$	0.1 V
1.5 V $\pm$ 0.1 V	15 pF	2 k $\Omega$	0.1 V
1.8 V $\pm$ 0.15 V	15 pF	2 k $\Omega$	0.15 V
2.5 V $\pm$ 0.2 V	15 pF	2 k $\Omega$	0.15 V
3.3 V $\pm$ 0.3 V	15 pF	2 k $\Omega$	0.3 V



- 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,  $Z_O = 50 \Omega$ ,  $dv/dt \geq 1$  V/ns.
  - 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.  $V_{CC1}$  is the  $V_{CC}$  associated with the input port.
  - I.  $V_{CCO}$  is the  $V_{CC}$  associated with the output port.

Figure 6-1. Load Circuit and Voltage Waveforms

## 7 Detailed Description

### 7.1 Overview

The SN74AVC8T245-Q1 is an 8-bit, dual-supply noninverting bidirectional voltage level translation device.  $V_{CCA}$  supports the Ax pins and control pins (DIR and  $\overline{OE}$ ), and  $V_{CCB}$  supports the Bx pins. The A port can accept I/O voltages ranging from 1.2 V to 3.6 V, while the B port can accept I/O voltages from 1.2 V to 3.6 V. A high on DIR allows data transmission from Ax to Bx and a low on DIR allows data transmission from Bx to Ax when  $\overline{OE}$  is set to low. When  $\overline{OE}$  is set to high, both Ax and Bx pins are in the high-impedance state.

### 7.2 Functional Block Diagram

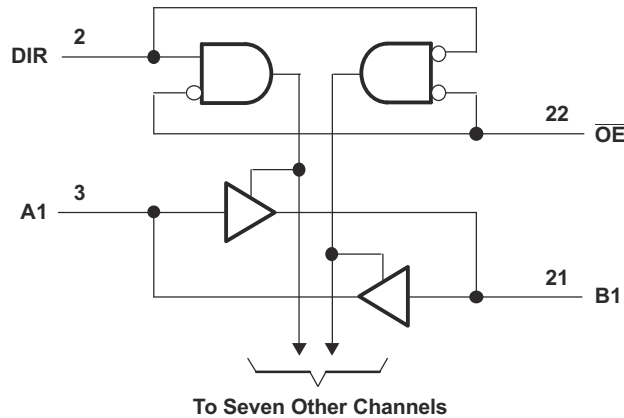


Figure 7-1. Logic Diagram (Positive Logic)

### 7.3 Feature Description

#### 7.3.1 Fully Configurable Dual-Rail Design

Both  $V_{CCA}$  and  $V_{CCB}$  can be supplied at any voltage between 1.2 V and 3.6 V; thus, making the device an excellent choice for translating between any of the low voltage nodes (1.2 V, 1.8 V, 2.5 V, and 3.3 V).

#### 7.3.2 Supports High Speed Translation

The SN74AVC8T245-Q1 device can support high data rate applications. The translated signal data rate can be up to 380Mbps when the signal is translated from 1.8 V to 3.3 V.

#### 7.3.3 $I_{off}$ Supports Partial-Power-Down Mode Operation

$I_{off}$  prevents backflow current by disabling I/O output circuits when the device is in partial-power-down mode.

### 7.4 Device Functional Modes

Table 7-1 lists the functional modes of the device.

Table 7-1. Function Table  
(Each 8-Bit Section)

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	All outputs Hi-Z

## 8 Application and Implementation

### Note

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

### 8.1 Application Information

The SN74AVC8T245-Q1 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The SN74AVC8T245-Q1 device is an excellent choice for applications where a push-pull driver is connected to the data I/Os. The maximum data rate can be up to 320Mbps when the device translates a signal from 1.8 V to 3.3 V.

### 8.2 Typical Application

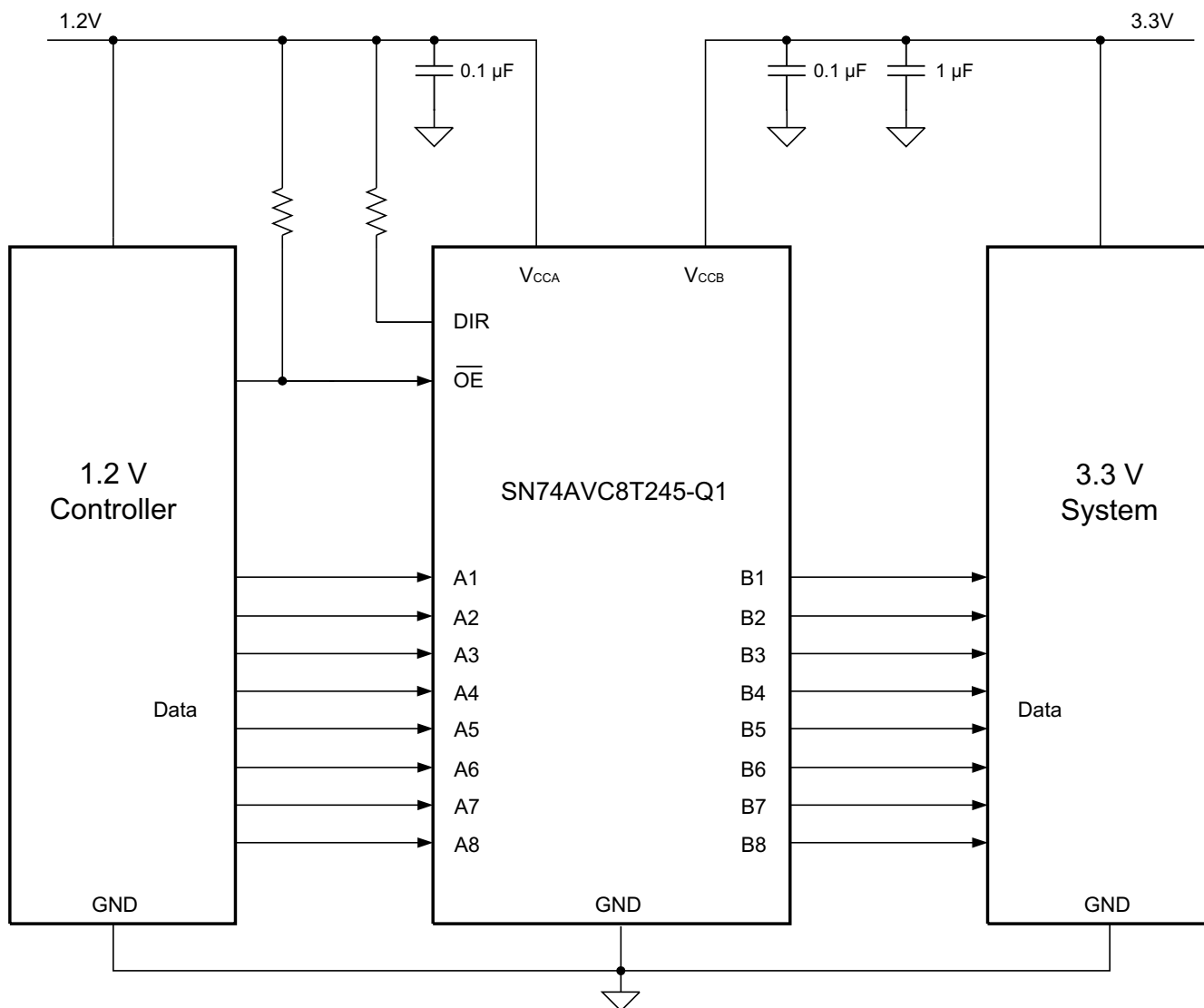


Figure 8-1. Typical Application Diagram

## 8.2.1 Design Requirements

Table 8-1 lists the parameters for this design example.

**Table 8-1. Design Parameters**

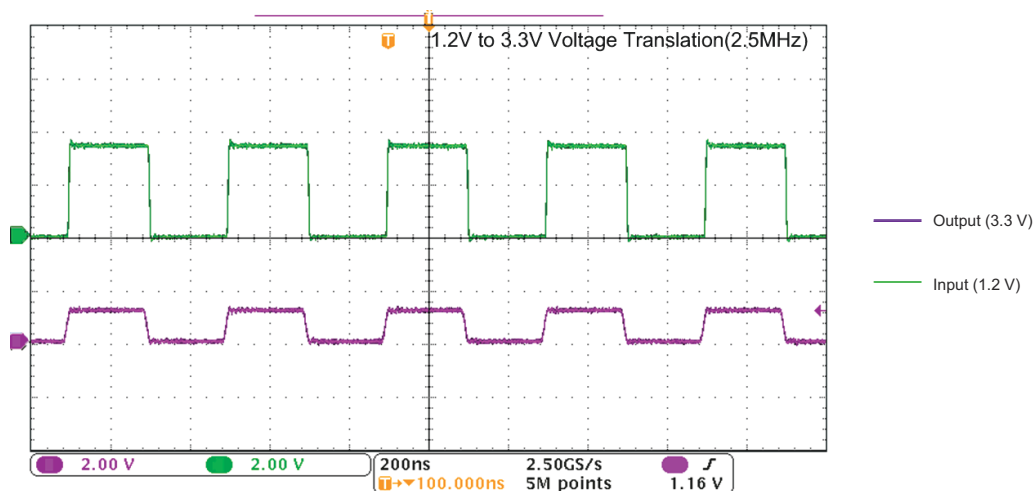
DESIGN PARAMETER	EXAMPLE VALUE
Input voltage range	1.2 V
Output voltage range	3.3 V

## 8.2.2 Detailed Design Procedure

To begin the design process, determine the following:

- Input voltage range
  - Use the supply voltage of the device that is driving the SN74AVC8T245-Q1 device to determine the input voltage range. For a valid logic high, the value must exceed the  $V_{IH}$  of the input port. For a valid logic low, the value must be less than the  $V_{IL}$  of the input port. For this example, the input voltage is 1.2 V.
- Output voltage range
  - Use the supply voltage of the device that the SN74AVC8T245-Q1 device is driving to determine the output voltage range. For this example, the output voltage is 3.3 V.

## 8.2.3 Application Curve



**Figure 8-2. Translation Up (1.2 V to 3.3 V) at 2.5 MHz**

## 8.3 Power Supply Recommendations

The SN74AVC8T245-Q1 device uses two separate configurable power-supply rails:  $V_{CCA}$  and  $V_{CCB}$ .  $V_{CCA}$  accepts any supply voltage from 1.2 V to 3.6 V, and  $V_{CCB}$  accepts any supply voltage from 1.2 V to 3.6 V. The A port and B port are designed to track  $V_{CCA}$  and  $V_{CCB}$  respectively, allowing for low-voltage bidirectional translation between any of the 1.2-V, 1.5-V, 1.8-V, 2.5-V, and 3.3-V voltage nodes.

$V_{CCA}$  supplies the output-enable ( $\overline{OE}$ ) input circuit in this design; when the  $\overline{OE}$  input is high, all outputs are placed in the high-impedance state. To put the outputs in the high-impedance state during power up or power down, the  $\overline{OE}$  input pin must be tied to  $V_{CCA}$  through a pullup resistor and must not be enabled until  $V_{CCA}$  and  $V_{CCB}$  are fully ramped and stable. The current-sinking capability of the driver determines the minimum value of the pullup resistor to  $V_{CCA}$ .

## 8.4 Layout

### 8.4.1 Layout Guidelines

For device reliability, it is recommended to follow common printed-circuit board layout guidelines:

- Use bypass capacitors on power supplies.
- Use short trace lengths to avoid excessive loading.
- Place pads on the signal paths for loading capacitors or pullup resistors to adjust signal rise and fall times, depending on the system requirements.

### 8.4.2 Layout Example

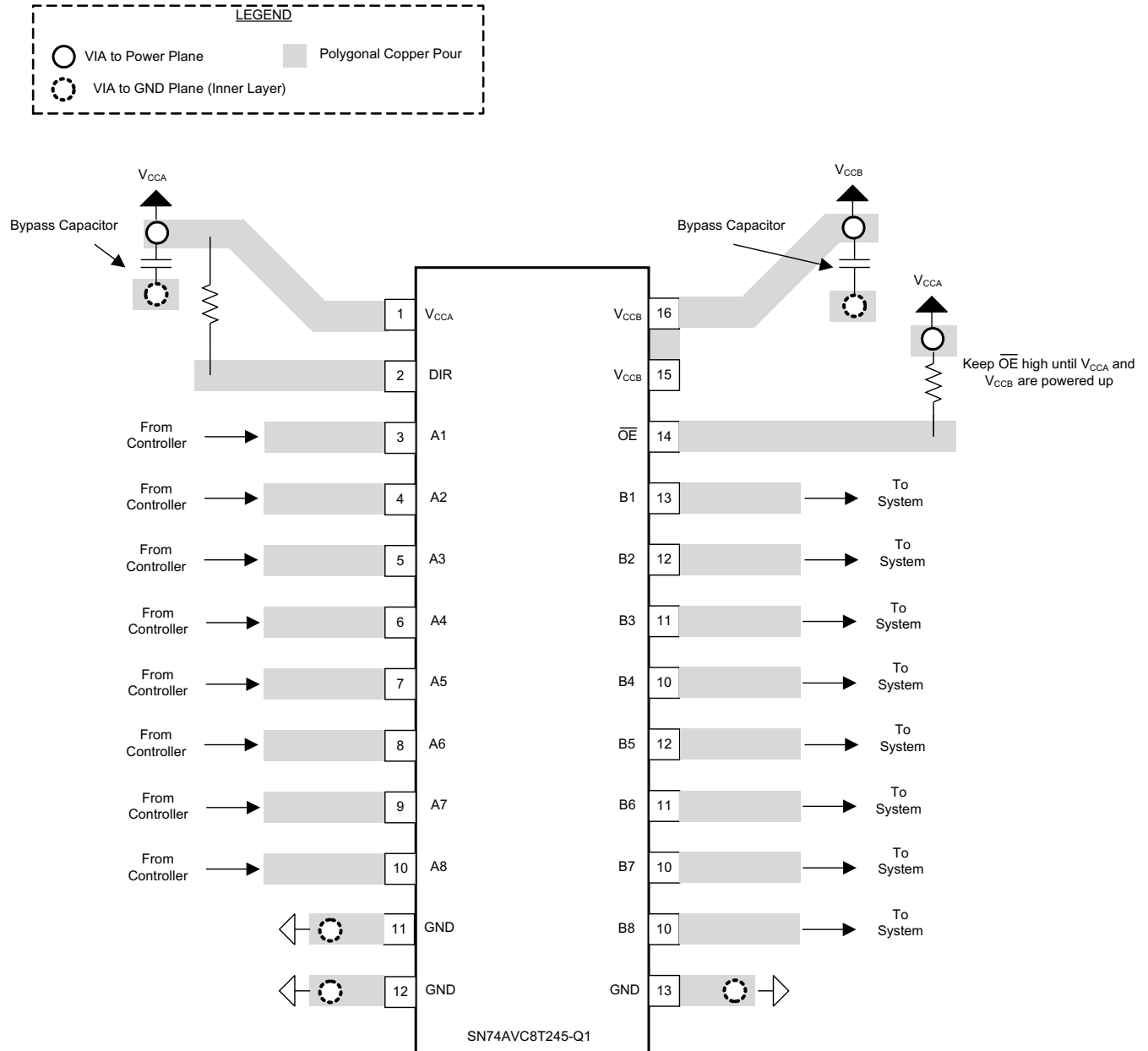


Figure 8-3. SN74AVC8T245-Q1 Layout Diagram

## 9 Device and Documentation Support

### 9.1 Documentation Support

#### 9.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [Implications of Slow or Floating CMOS Inputs Application Note](#)
- Texas Instruments, [Understanding and Interpreting Standard-Logic Data Sheets Application Note](#)
- Texas Instruments, [Introduction to Logic Application Note](#)
- Texas Instruments, [Voltage Translation Between 3.3-V, 2.5-V, 1.8-V, and 1.5-V Logic Standards Application Note](#)
- Texas Instruments, [AVC Advanced Very-Low-Voltage CMOS Logic Data Book User's Guide](#)

#### 9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

#### 9.3 Support Resources

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

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#### 9.4 Trademarks

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#### 9.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

#### 9.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 10 Revision History

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

<b>Changes from Revision D (October 2017) to Revision E (November 2023)</b>	<b>Page</b>
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Updated the thermal information for the <i>RHL</i> package and updated the information for the <i>PW</i> package.....	6
<b>Changes from Revision C (March 2016) to Revision D (October 2017)</b>	<b>Page</b>
• Added Junction temperature, $T_j$ in <i>Absolute Maximum Ratings</i> table.....	4
• Deleted 2DIR and 2 OE from <i>Overview</i> .....	17
<b>Changes from Revision B (December 2012) to Revision C (January 2016)</b>	<b>Page</b>
• Added <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes, Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section.....	1
• Deleted <i>Ordering Information</i> table.....	1

<b>Changes from Revision A (June 2011) to Revision B (December 2012)</b>	<b>Page</b>
• Added bullets to the Features list.....	1
• Added <i>Pin Functions</i> table to the data sheet.....	3
• Deleted $\theta_{JA}$ row from <i>Absolute Maximum Ratings</i> table.....	4
• Changed ESD ratings.....	4
• Added Thermal Information table.....	6
• Added Figure 7-10 and Figure 7-11 to the <i>Typical Characteristics</i> section .....	14

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">CAVC8T245QRHLRQ1</a>	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	WE245Q
CAVC8T245QRHLRQ1.A	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	WE245Q
CAVC8T245QRHLRQ1.B	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	WE245Q
<a href="#">SN74AVC8T245QPWRQ1</a>	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	WE245Q
SN74AVC8T245QPWRQ1.A	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	WE245Q
SN74AVC8T245QPWRQ1.B	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	WE245Q

(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 SN74AVC8T245-Q1 :**

- Catalog : [SN74AVC8T245](#)

## 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
CAVC8T245QRHLRQ1	VQFN	RHL	24	1000	330.0	12.4	3.8	5.8	1.2	8.0	12.0	Q1
SN74AVC8T245QPWRQ1	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

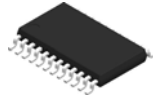
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CAVC8T245QRHLRQ1	VQFN	RHL	24	1000	367.0	367.0	35.0
SN74AVC8T245QPWRQ1	TSSOP	PW	24	2000	353.0	353.0	32.0

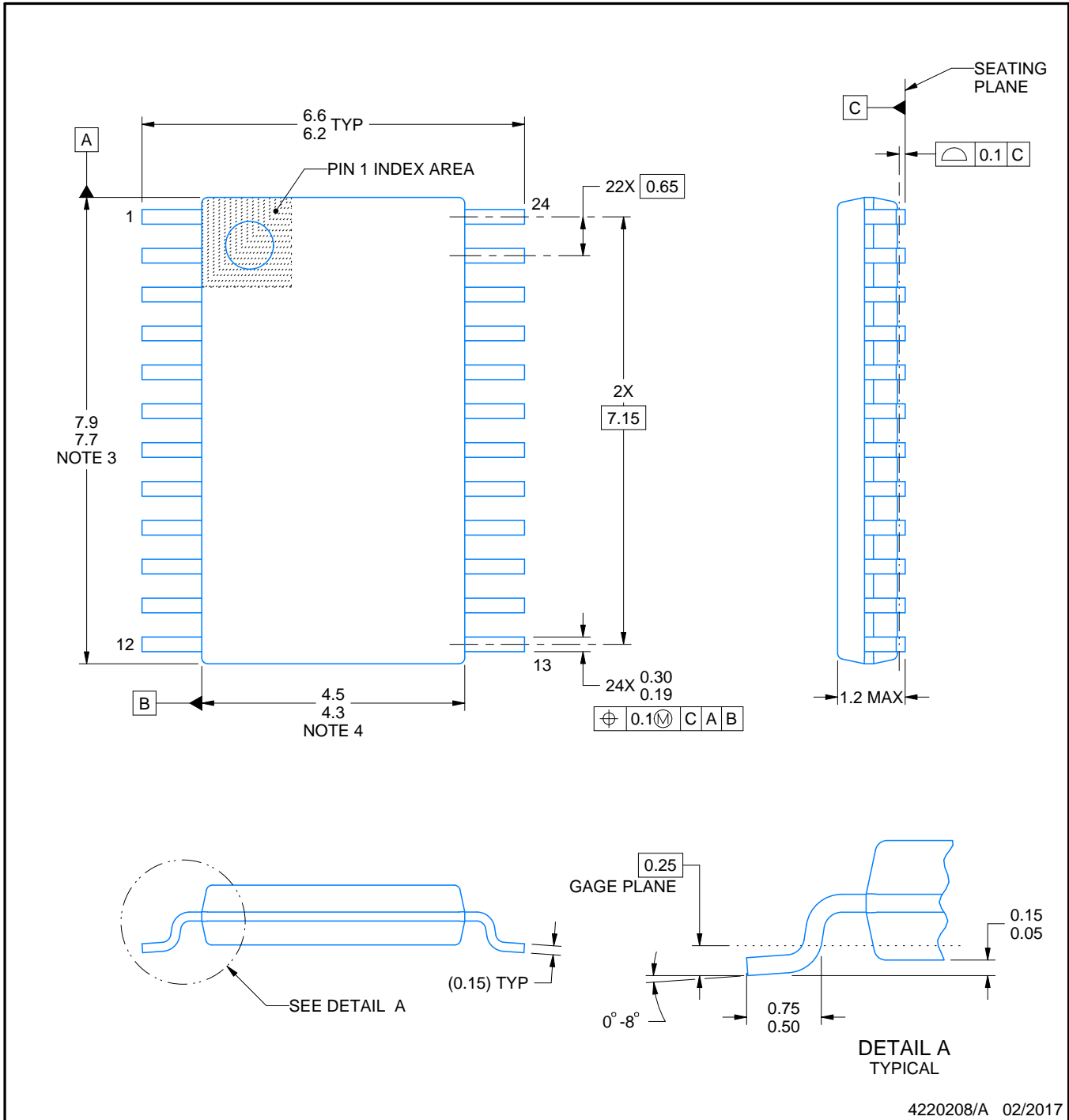
PW0024A



# PACKAGE OUTLINE

## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220208/A 02/2017

NOTES:

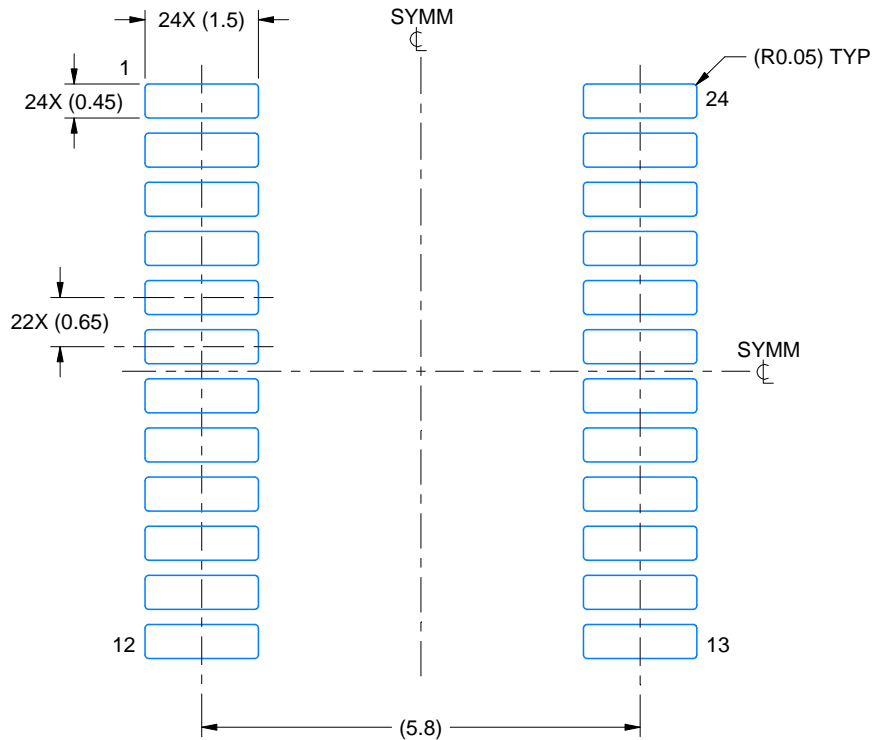
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

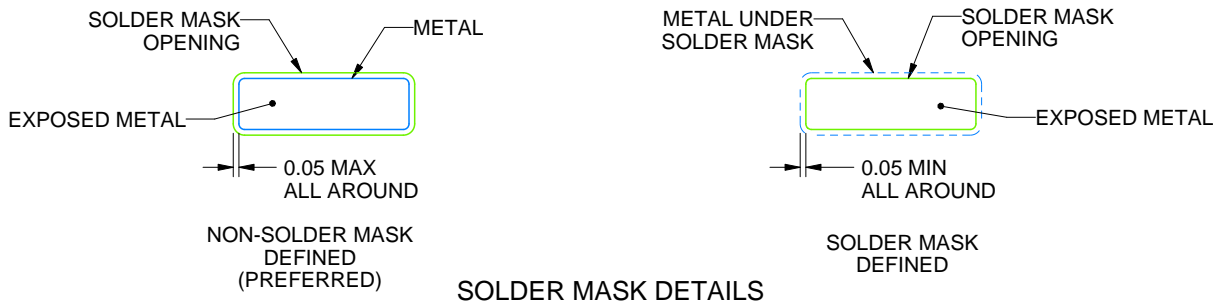
PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220208/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.

# EXAMPLE STENCIL DESIGN

PW0024A

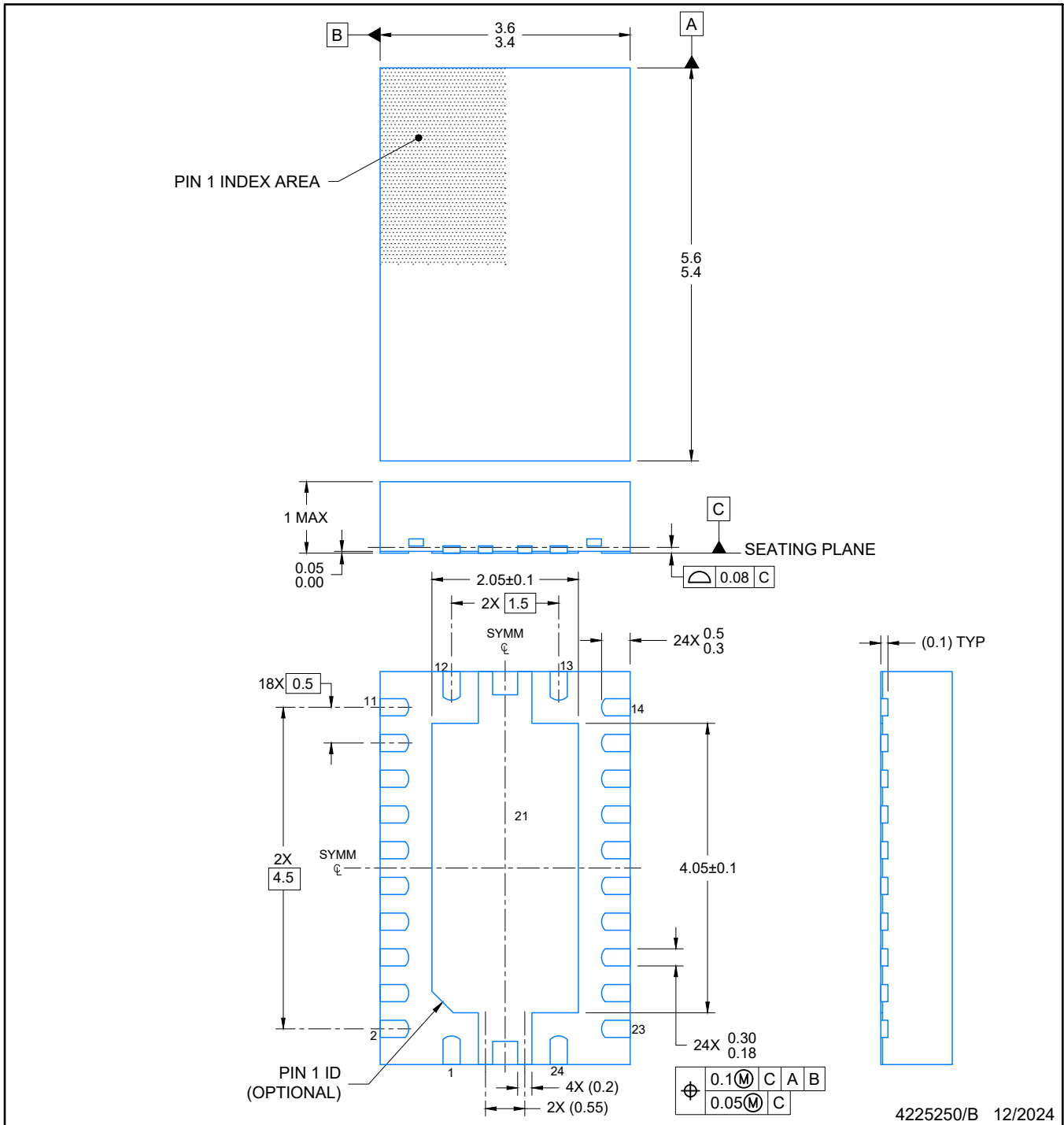
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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.



4225250/B 12/2024

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.

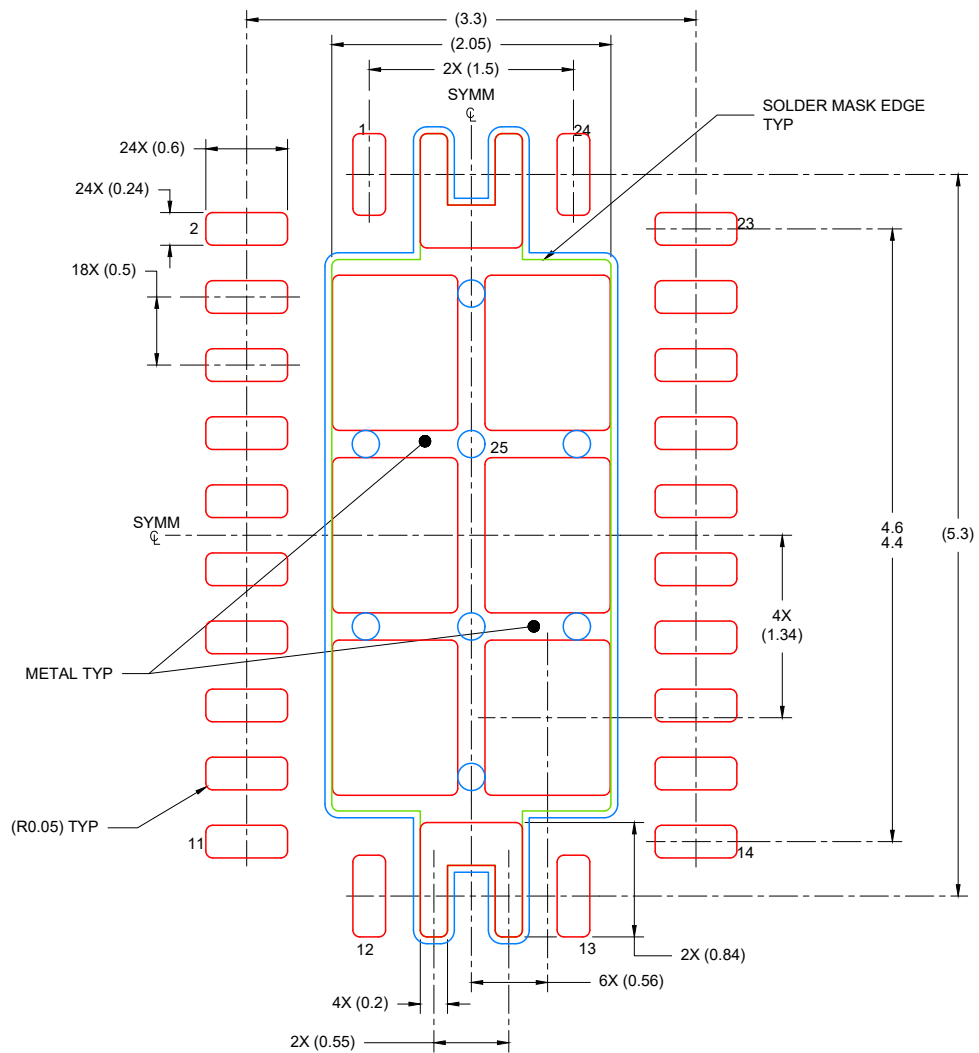


# EXAMPLE STENCIL DESIGN

VQFN - 1 mm max height

RHL0024A

PLASTIC QUAD FLATPACK- NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD  
80% PRINTED COVERAGE BY AREA  
SCALE: 18X

4225250/B 12/2024

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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