

# SN74AVCH8T245 8-Bit Dual-Supply Bus Transceiver

## With Configurable Level-Shifting, Voltage Translation, and 3-State Outputs

### 1 Features

- Control inputs (DIR and  $\overline{OE}$ )  $V_{IH}$  and  $V_{IL}$  levels are referenced to  $V_{CCA}$  voltage
- Bus hold on data inputs eliminates the need for external pullup or pulldown resistors
- $V_{CC}$  isolation feature
- Fully configurable dual-rail design
- I/Os are 4.6-V tolerant
- $I_{off}$  supports partial-power-down mode operation
- Maximum data rates:
  - 320Mbps ( $V_{CCA} \geq 1.8V$  and  $V_{CCB} \geq 1.8V$ )
  - 170Mbps ( $V_{CCA} \leq 1.8V$  or  $V_{CCB} \leq 1.8V$ )
- Latch-up performance exceeds 100mA per JESD 78, class II
- ESD protection exceeds JESD 22:
  - 8000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

### 2 Applications

- Personal electronics
- Industrial
- Enterprise
- Telecommunications

### 3 Description

The SN74AVCH8T245 is an 8-bit noninverting bus transceiver that uses two separate configurable power-supply rails. The A port is designed to track  $V_{CCA}$ , which accepts any supply voltage from 1.2V to 3.6V. The B port is designed to track  $V_{CCB}$ , which also accepts any supply voltage from 1.2V to 3.6V. 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 SN74AVCH8T245 is designed for asynchronous communication between data buses. The device transmits data from either 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. The output-enable ( $\overline{OE}$ ) input can be used to disable the outputs so the buses are effectively isolated.

The design of SN74AVCH8T245 references the control pins (DIR and  $\overline{OE}$ ) to  $V_{CCA}$ .

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. It is not recommended to use pullup or pulldown resistors with the bus-hold circuitry.

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.

The  $V_{CC}$  isolation feature allows the outputs to be in the high-impedance state when either  $V_{CCA}$  or  $V_{CCB}$  is at GND. The bus-hold circuitry on the powered-up side always stays active.

The SN74AVCH8T245 solution is compatible with a single-supply system and can be replaced later with a '245 function, with minimal printed circuit board redesign.

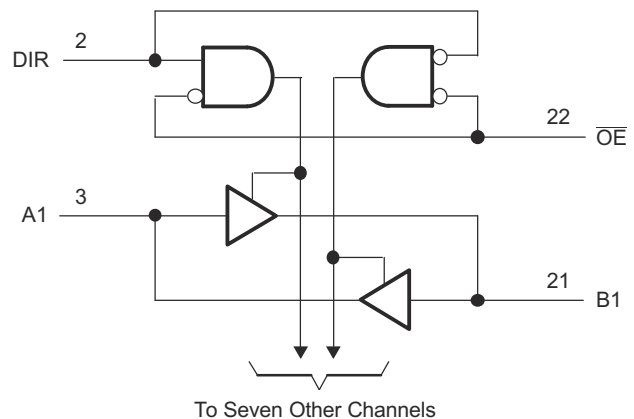
To put the device in the high-impedance state during power up or power down,  $\overline{OE}$  must be tied to  $V_{CCA}$  through a pullup resistor; the current-sinking capability of the driver determines the minimum value of the resistor.

### Package Information

PART NUMBER	PACKAGE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>
SN74AVCH8T245	DGV (TVSOP, 24)	5 mm × 6.4 mm
	PW (TSSOP, 24)	7.8 mm × 6.4 mm
	RHL (VQFN, 24)	5.5 mm × 3.5 mm

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

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



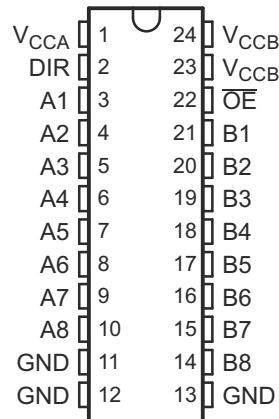
**Logic Diagram (Positive Logic)**



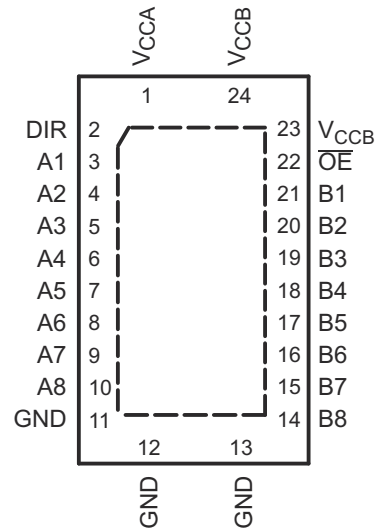
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## 4 Pin Configuration and Functions



**Figure 4-1. DGV or PW Package, 24-Pin TVSOP or TSSOP (Top View)**



**Figure 4-2. RHL Package, 24-Pin VQFN (Top View)**

**Table 4-1. Pin Functions**

PIN		I/O	DESCRIPTION
NAME	NO.		
A1	3	I/O	Input/output A1. Referenced to $V_{CCA}$ .
A2	4	I/O	Input/output A2. Referenced to $V_{CCA}$ .
A3	5	I/O	Input/output A3. Referenced to $V_{CCA}$ .
A4	6	I/O	Input/output A4. Referenced to $V_{CCA}$ .
A5	7	I/O	Input/output A5. Referenced to $V_{CCA}$ .
A6	8	I/O	Input/output A6. Referenced to $V_{CCA}$ .
A7	9	I/O	Input/output A7. Referenced to $V_{CCA}$ .
A8	10	I/O	Input/output A8. Referenced to $V_{CCA}$ .
B1	21	I/O	Input/output B1. Referenced to $V_{CCB}$ .
B2	20	I/O	Input/output B2. Referenced to $V_{CCB}$ .
B3	19	I/O	Input/output B3. Referenced to $V_{CCB}$ .
B4	18	I/O	Input/output B4. Referenced to $V_{CCB}$ .
B5	17	I/O	Input/output B5. Referenced to $V_{CCB}$ .
B6	16	I/O	Input/output B6. Referenced to $V_{CCB}$ .
B7	15	I/O	Input/output B7. Referenced to $V_{CCB}$ .
B8	14	I/O	Input/output B8. Referenced to $V_{CCB}$ .
DIR	2	I	Direction-control signal. Referenced to $V_{CCA}$ .
GND	11, 12, 13	—	Ground
$\overline{OE}$	22	I	3-state output-mode enables. Pull $\overline{OE}$ high to place all outputs in 3-state mode. Referenced to $V_{CCA}$ .
$V_{CCA}$	1	—	A-port supply voltage. $1.2V \leq V_{CCA} \leq 3.6V$
$V_{CCB}$	23, 24	—	B-port supply voltage. $1.2V \leq V_{CCB} \leq 3.6V$

## 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	
		Control inputs	-0.5	4.6	
$V_O$	Voltage 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	
$V_O$	Voltage 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	$V_{CCB} + 0.5$	
$I_{IK}$	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		-40	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, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The output positive-voltage rating may be exceeded up to 4.6V maximum if the output current rating is observed.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

### 5.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±8000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	±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.

### 5.3 Recommended Operating Conditions

See (1) (2)

				MIN	MAX	UNIT
V <sub>CCA</sub>	Supply voltage			1.2	3.6	V
V <sub>CCB</sub>	Supply voltage			1.2	3.6	V
V <sub>IH</sub>	High-level input voltage <sup>(1)</sup>	Data inputs	V <sub>CCI</sub> = 1.2V to 1.95V	V <sub>CCI</sub> × 0.65		V
			V <sub>CCI</sub> = 1.95V to 2.7V	1.6		
			V <sub>CCI</sub> = 2.7V to 3.6V	2		
V <sub>IL</sub>	Low-level input voltage <sup>(1)</sup>	Data inputs	V <sub>CCI</sub> = 1.2V to 1.95V	V <sub>CCI</sub> × 0.35		V
			V <sub>CCI</sub> = 1.95V to 2.7V	0.7		
			V <sub>CCI</sub> = 2.7V to 3.6V	0.8		
V <sub>IH</sub>	High-level input voltage	DIR and $\overline{OE}$ (referenced to V <sub>CCA</sub> )	V <sub>CCI</sub> = 1.2V to 1.95V	V <sub>CCA</sub> × 0.65		V
			V <sub>CCI</sub> = 1.95V to 2.7V	1.6		
			V <sub>CCI</sub> = 2.7V to 3.6V	2		
V <sub>IL</sub>	Low-level input voltage	DIR and $\overline{OE}$ (referenced to V <sub>CCA</sub> )	V <sub>CCI</sub> = 1.2V to 1.95V	V <sub>CCA</sub> × 0.35		V
			V <sub>CCI</sub> = 1.95V to 2.7V	0.7		
			V <sub>CCI</sub> = 2.7V to 3.6V	0.8		
V <sub>I</sub>	Input voltage	Control Inputs		0	3.6	V
V <sub>O</sub>	Output voltage <sup>(2)</sup>	Active state		0	V <sub>CCO</sub>	V
		3-state		0	3.6	
I <sub>OH</sub>	High-level output current		V <sub>CCO</sub> = 1.2V		–3	mA
			V <sub>CCO</sub> = 1.4V to 1.6V		–6	
			V <sub>CCO</sub> = 1.65V to 1.95V		–8	
			V <sub>CCO</sub> = 2.3V to 2.7V		–9	
			V <sub>CCO</sub> = 3V to 3.6V		–12	
I <sub>OL</sub>	Low-level output current		V <sub>CCO</sub> = 1.2V		3	mA
			V <sub>CCO</sub> = 1.4V to 1.6V		6	
			V <sub>CCO</sub> = 1.65V to 1.95V		8	
			V <sub>CCO</sub> = 2.3V to 2.7V		9	
			V <sub>CCO</sub> = 3V to 3.6V		12	
Δt/Δv	Input transition rise or fall rate				5	ns/V
T <sub>A</sub>	Operating free-air temperature			–40	85	°C

(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.

## 5.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74AVCH8T245			UNIT
		DGV (TVSOP)	PW (TSSOP)	RHL (VQFN)	
		24 PINS	24 PINS	24 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance <sup>(4)</sup>	116.7	93.1	36.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	48.5	36.7	32.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	62.1	48.4	15.7	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	7.0	93.1	0.7	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	61.6	48.0	15.6	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	5.6	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 5.5 Electrical Characteristics

All typical limits apply over  $T_A = 25^\circ\text{C}$ , and all maximum and minimum limits apply over  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
$V_{OH}$	High-level output voltage <sup>(1)</sup>	$I_{OH} = -100\mu\text{A}$ , $V_I = V_{IH}$	$V_{CCA} = V_{CCB} = 1.2\text{V to } 3.6\text{V}$	$V_{CCO} - 0.2$		V
		$I_{OH} = -3\text{mA}$ , $V_I = V_{IH}$	$V_{CCA} = V_{CCB} = 1.2\text{V}$	0.95		
		$I_{OH} = -6\text{mA}$ , $V_I = V_{IH}$	$V_{CCA} = V_{CCB} = 1.4\text{V}$	1.05		
		$I_{OH} = -8\text{mA}$ , $V_I = V_{IH}$	$V_{CCA} = V_{CCB} = 1.65\text{V}$	1.2		
		$I_{OH} = -9\text{mA}$ , $V_I = V_{IH}$	$V_{CCA} = V_{CCB} = 2.3\text{V}$	1.75		
		$I_{OH} = -12\text{mA}$ , $V_I = V_{IH}$	$V_{CCA} = V_{CCB} = 3\text{V}$	2.3		
$V_{OL}$	Low-level output voltage	$I_{OL} = 100\mu\text{A}$ , $V_I = V_{IL}$	$V_{CCA} = V_{CCB} = 1.2\text{V to } 3.6\text{V}$		0.2	V
		$I_{OL} = 3\text{mA}$ , $V_I = V_{IL}$	$V_{CCA} = V_{CCB} = 1.2\text{V}$		0.15	
		$I_{OL} = 6\text{mA}$ , $V_I = V_{IL}$	$V_{CCA} = V_{CCB} = 1.4\text{V}$		0.35	
		$I_{OL} = 8\text{mA}$ , $V_I = V_{IL}$	$V_{CCA} = V_{CCB} = 1.65\text{V}$		0.45	
		$I_{OL} = 9\text{mA}$ , $V_I = V_{IL}$	$V_{CCA} = V_{CCB} = 2.3\text{V}$		0.55	
		$I_{OL} = 12\text{mA}$ , $V_I = V_{IL}$	$V_{CCA} = V_{CCB} = 3\text{V}$		0.7	
$I_I$	Control inputs	$V_I = V_{CCA}$ or GND	$V_{CCA} = V_{CCB} = 1.2\text{V to } 3.6\text{V}$	$\pm 0.025$	$\pm 1$	$\mu\text{A}$
$I_{BHL}$	Bus-hold low sustaining current <sup>(5)</sup>	$V_I = 0.42\text{V}$	$V_{CCA} = V_{CCB} = 1.2\text{V}$		25	$\mu\text{A}$
		$V_I = 0.49\text{V}$	$V_{CCA} = V_{CCB} = 1.4\text{V}$	15		
		$V_I = 0.58\text{V}$	$V_{CCA} = V_{CCB} = 1.65\text{V}$	25		
		$V_I = 0.7\text{V}$	$V_{CCA} = V_{CCB} = 2.3\text{V}$	45		
		$V_I = 0.8\text{V}$	$V_{CCA} = V_{CCB} = 3.3\text{V}$	100		
$I_{BHH}$	Bus-hold high sustaining current <sup>(6)</sup>	$V_I = 0.78\text{V}$	$V_{CCA} = V_{CCB} = 1.2\text{V}$		-25	$\mu\text{A}$
		$V_I = 0.91\text{V}$	$V_{CCA} = V_{CCB} = 1.4\text{V}$	-15		
		$V_I = 1.07\text{V}$	$V_{CCA} = V_{CCB} = 1.65\text{V}$	-25		
		$V_I = 1.6\text{V}$	$V_{CCA} = V_{CCB} = 2.3\text{V}$	-45		
		$V_I = 2\text{V}$	$V_{CCA} = V_{CCB} = 3.3\text{V}$	-100		
$I_{BHLO}$	Bus-hold low overdrive current <sup>(3)</sup>	$V_I = 0 \text{ to } V_{CC}$	$V_{CCA} = V_{CCB} = 1.2\text{V}$		50	$\mu\text{A}$
			$V_{CCA} = V_{CCB} = 1.6\text{V}$	125		
			$V_{CCA} = V_{CCB} = 1.95\text{V}$	200		
			$V_{CCA} = V_{CCB} = 2.7\text{V}$	300		
			$V_{CCA} = V_{CCB} = 3.6\text{V}$	500		

## 5.5 Electrical Characteristics (continued)

All typical limits apply over  $T_A = 25^\circ\text{C}$ , and all maximum and minimum limits apply over  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
$I_{BH\text{HO}}$ Bus-hold high overdrive current <sup>(4)</sup>	$V_I = 0 \text{ to } V_{CC}$	$V_{CCA} = V_{CCB} = 1.2\text{V}$		–50		$\mu\text{A}$
		$V_{CCA} = V_{CCB} = 1.6\text{V}$		–125		
		$V_{CCA} = V_{CCB} = 1.95\text{V}$		–200		
		$V_{CCA} = V_{CCB} = 2.7\text{V}$		–300		
		$V_{CCA} = V_{CCB} = 3.6\text{V}$		–500		
$I_{\text{off}}$ Input/output power-off leakage current	$V_I = 0\text{V to } 3.6\text{V}, V_O = 0\text{V to } 3.6\text{V}$	$V_{CCA} = 0\text{V}, V_{CCB} = 0\text{V to } 3.6\text{V}$ A Port		$\pm 0.1$	$\pm 5$	$\mu\text{A}$
		$V_{CCA} = 0\text{V to } 3.6\text{V}, V_{CCB} = 0\text{V}$ B Port		$\pm 0.1$	$\pm 5$	
$I_{\text{OZ}}$ Off-state output current <sup>(1) (2) (7)</sup>	$V_O = V_{CCO} \text{ or GND}, V_I = V_{CCI} \text{ or GND}, \overline{\text{OE}} = V_{IH}$	$V_{CCA} = V_{CCB} = 3.6\text{V}$ A Port, B Port		$\pm 0.5$	$\pm 5$	$\mu\text{A}$
	$V_O = V_{CCO} \text{ or GND}, V_I = V_{CCI} \text{ or GND}, \overline{\text{OE}} = \text{Don't Care}$	$V_{CCA} = 0\text{V}, V_{CCB} = 3.6\text{V}$ B Port			$\pm 5$	
		$V_{CCA} = 3.6\text{V}, V_{CCB} = 0\text{V}$ A Port			$\pm 5$	
$I_{CCA}$ Supply current A port <sup>(2)</sup>	$V_I = V_{CCI} \text{ or GND}, I_O = 0$	$V_{CCA} = V_{CCB} = 1.2\text{V to } 3.6\text{V}$			8	$\mu\text{A}$
		$V_{CCA} = 0\text{V}, V_{CCB} = 3.6\text{V}$			–2	
		$V_{CCA} = 3.6\text{V}, V_{CCB} = 0\text{V}$			8	
$I_{CCB}$ Supply current B port <sup>(2)</sup>	$V_I = V_{CCI} \text{ or GND}, I_O = 0$	$V_{CCA} = V_{CCB} = 1.2\text{V to } 3.6\text{V}$			8	$\mu\text{A}$
		$V_{CCA} = 0\text{V}, V_{CCB} = 3.6\text{V}$			8	
		$V_{CCA} = 3.6\text{V}, V_{CCB} = 0\text{V}$			–2	
$I_{CCA} + I_{CCB}$ Combined supply current <sup>(2)</sup>	$V_I = V_{CCI} \text{ or GND}, I_O = 0$	$V_{CCA} = V_{CCB} = 1.2\text{V to } 3.6\text{V}$			16	$\mu\text{A}$
$C_i$ Input capacitance control pins	$V_I = 3.3\text{V or GND}$	$V_{CCA} = V_{CCB} = 3.3\text{V}$		3.5	4.5	pF
$C_{io}$ Input/output capacitance a or b port	$V_O = 3.3\text{V or GND}$	$V_{CCA} = V_{CCB} = 3.3\text{V}$		6	7	pF

- (1)  $V_{CCO}$  is the  $V_{CC}$  associated with the output port.
- (2)  $V_{CCI}$  is the  $V_{CC}$  associated with the input port.
- (3) An external driver must source at least  $I_{BH\text{LO}}$  to switch this node from low to high.
- (4) An external driver must sink at least  $I_{BH\text{HO}}$  to switch this node from high to low.
- (5) The bus-hold circuit can sink at least the minimum low sustaining current at  $V_{IL}$  max.  $I_{BH\text{L}}$  should be measured after lowering  $V_{IN}$  to GND and then raising it to  $V_{IL}$  max.
- (6) The bus-hold circuit can source at least the minimum high sustaining current at  $V_{IH}$  min.  $I_{BH\text{H}}$  should be measured after raising  $V_{IN}$  to  $V_{CC}$  and then lowering it to  $V_{IH}$  min.
- (7) For I/O ports, the parameter  $I_{\text{OZ}}$  includes the input leakage current.

## 5.6 Switching Characteristics, $V_{CCA} = 1.2V$

$T_A = 25^\circ C$  (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$  Propagation delay time: low-to-high-level output and high-to-low level output	A	B	$V_{CCB} = 1.2V$		3.1		ns
			$V_{CCB} = 1.5V$		2.6		
			$V_{CCB} = 1.8V$		2.5		
			$V_{CCB} = 2.5V$		3		
			$V_{CCB} = 3.3V$		3.5		
$t_{PLH}$ , $t_{PHL}$  Propagation delay time: low-to-high-level output and high-to-low level output	B	A	$V_{CCB} = 1.2V$		3.1		ns
			$V_{CCB} = 1.5V$		2.7		
			$V_{CCB} = 1.8V$		2.5		
			$V_{CCB} = 2.5V$		2.4		
			$V_{CCB} = 3.3V$		2.3		
$t_{PZH}$ , $t_{PZL}$  Enable time: to high level and to low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		5.3		ns
			$V_{CCB} = 1.5V$		5.3		
			$V_{CCB} = 1.8V$		5.3		
			$V_{CCB} = 2.5V$		5.3		
			$V_{CCB} = 3.3V$		5.3		
$t_{PZH}$ , $t_{PZL}$  Enable time: to high level and to low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		5.1		ns
			$V_{CCB} = 1.5V$		4		
			$V_{CCB} = 1.8V$		3.5		
			$V_{CCB} = 2.5V$		3.2		
			$V_{CCB} = 3.3V$		3.1		
$t_{PHZ}$ , $t_{PLZ}$  Disable time: from high level and from low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		4.8		ns
			$V_{CCB} = 1.5V$		4.8		
			$V_{CCB} = 1.8V$		4.8		
			$V_{CCB} = 2.5V$		4.8		
			$V_{CCB} = 3.3V$		4.8		
$t_{PHZ}$ , $t_{PLZ}$  Disable time: from high level and from low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		4.7		ns
			$V_{CCB} = 1.5V$		4		
			$V_{CCB} = 1.8V$		4.1		
			$V_{CCB} = 2.5V$		4.3		
			$V_{CCB} = 3.3V$		5.1		



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

All typical limits apply over  $T_A = 25^\circ C$ , and all maximum and minimum limits apply over  $T_A = -40^\circ C$  to  $85^\circ C$  (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$  Propagation delay time: low-to-high-level output and high-to-low level output	A	B	$V_{CCB} = 1.2V$		2.7		ns
			$V_{CCB} = 1.5V$	0.5		5.4	
			$V_{CCB} = 1.8V$	0.5		4.6	
			$V_{CCB} = 2.5V$	0.5		4.9	
			$V_{CCB} = 3.3V$	0.5		6.8	
$t_{PLH}$ , $t_{PHL}$  Propagation delay time: low-to-high-level output and high-to-low level output	B	A	$V_{CCB} = 1.2V$		2.6		ns
			$V_{CCB} = 1.5V$	0.5		5.4	
			$V_{CCB} = 1.8V$	0.5		5.1	
			$V_{CCB} = 2.5V$	0.5		4.7	
			$V_{CCB} = 3.3V$	0.5		4.5	
$t_{PZH}$ , $t_{PZL}$  Enable time: to high level and to low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		3.7		ns
			$V_{CCB} = 1.5V$	1.1		8.7	
			$V_{CCB} = 1.8V$	1.1		8.7	
			$V_{CCB} = 2.5V$	1.1		8.7	
			$V_{CCB} = 3.3V$	1.1		8.7	
$t_{PZH}$ , $t_{PZL}$  Enable time: to high level and to low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		4.8		ns
			$V_{CCB} = 1.5V$	1.1		7.6	
			$V_{CCB} = 1.8V$	1.1		7.1	
			$V_{CCB} = 2.5V$	1.1		5.6	
			$V_{CCB} = 3.3V$	1.1		5.2	
$t_{PHZ}$ , $t_{PLZ}$  Disable time: from high level and from low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		3.1		ns
			$V_{CCB} = 1.5V$	0.5		8.6	
			$V_{CCB} = 1.8V$	0.5		8.6	
			$V_{CCB} = 2.5V$	0.5		8.6	
			$V_{CCB} = 3.3V$	0.5		8.6	
$t_{PHZ}$ , $t_{PLZ}$  Disable time: from high level and from low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		4.1		ns
			$V_{CCB} = 1.5V$	0.5		8.4	
			$V_{CCB} = 1.8V$	0.5		7.6	
			$V_{CCB} = 2.5V$	0.5		7.2	
			$V_{CCB} = 3.3V$	0.5		7.8	

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

All typical limits apply over  $T_A = 25^\circ C$ , and all maximum and minimum limits apply over  $T_A = -40^\circ C$  to  $85^\circ C$  (unless otherwise noted) (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$ Propagation delay time: low-to-high-level output and high-to-low level output	A	B	$V_{CCB} = 1.2V$		2.5		ns
			$V_{CCB} = 1.5V$	0.5		5.1	
			$V_{CCB} = 1.8V$	0.5		4.4	
			$V_{CCB} = 2.5V$	0.5		4	
			$V_{CCB} = 3.3V$	0.5		3.9	
$t_{PLH}$ , $t_{PHL}$ Propagation delay time: low-to-high-level output and high-to-low level output	B	A	$V_{CCB} = 1.2V$		2.5		ns
			$V_{CCB} = 1.5V$	0.5		4.6	
			$V_{CCB} = 1.8V$	0.5		4.4	
			$V_{CCB} = 2.5V$	0.5		3.9	
			$V_{CCB} = 3.3V$	0.5		3.7	
$t_{PZH}$ , $t_{PZL}$ Enable time: to high level and to low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		3		ns
			$V_{CCB} = 1.5V$	1		6.8	
			$V_{CCB} = 1.8V$	1		6.8	
			$V_{CCB} = 2.5V$	1		6.8	
			$V_{CCB} = 3.3V$	1		6.8	
$t_{PZH}$ , $t_{PZL}$ Enable time: to high level and to low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		4.6		ns
			$V_{CCB} = 1.5V$	1.1		8.2	
			$V_{CCB} = 1.8V$	1		6.7	
			$V_{CCB} = 2.5V$	0.5		5.1	
			$V_{CCB} = 3.3V$	0.5		4.5	
$t_{PHZ}$ , $t_{PLZ}$ Disable time: from high level and from low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		2.8		ns
			$V_{CCB} = 1.5V$	0.5		7.1	
			$V_{CCB} = 1.8V$	0.5		7.1	
			$V_{CCB} = 2.5V$	0.5		7.1	
			$V_{CCB} = 3.3V$	0.5		7.1	
$t_{PHZ}$ , $t_{PLZ}$ Disable time: from high level and from low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		3.9		ns
			$V_{CCB} = 1.5V$	0.5		7.8	
			$V_{CCB} = 1.8V$	0.5		6.9	
			$V_{CCB} = 2.5V$	0.5		6	
			$V_{CCB} = 3.3V$	0.5		5.8	

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

All typical limits apply over  $T_A = 25^\circ C$ , and all maximum and minimum limits apply over  $T_A = -40^\circ C$  to  $85^\circ C$  (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$ Propagation delay time: low-to-high-level output and high-to-low level output	A	B	$V_{CCB} = 1.2V$		2.4		ns
			$V_{CCB} = 1.5V$	0.5		4.7	
			$V_{CCB} = 1.8V$	0.5		3.9	
			$V_{CCB} = 2.5V$	0.5		3.1	
			$V_{CCB} = 3.3V$	0.5		2.8	
$t_{PLH}$ , $t_{PHL}$ Propagation delay time: low-to-high-level output and high-to-low level output	B	A	$V_{CCB} = 1.2V$		3		ns
			$V_{CCB} = 1.5V$	0.5		4.9	
			$V_{CCB} = 1.8V$	0.5		4	
			$V_{CCB} = 2.5V$	0.5		3.1	
			$V_{CCB} = 3.3V$	0.5		2.9	
$t_{PZH}$ , $t_{PZL}$ Enable time: to high level and to low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		2.2		ns
			$V_{CCB} = 1.5V$	0.5		4.8	
			$V_{CCB} = 1.8V$	0.5		4.8	
			$V_{CCB} = 2.5V$	0.5		4.8	
			$V_{CCB} = 3.3V$	0.5		4.8	
$t_{PZH}$ , $t_{PZL}$ Enable time: to high level and to low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		4.5		ns
			$V_{CCB} = 1.5V$	1.1		7.9	
			$V_{CCB} = 1.8V$	0.5		6.4	
			$V_{CCB} = 2.5V$	0.5		4.6	
			$V_{CCB} = 3.3V$	0.5		4	
$t_{PHZ}$ , $t_{PLZ}$ Disable time: from high level and from low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		1.8		ns
			$V_{CCB} = 1.5V$	0.5		5.1	
			$V_{CCB} = 1.8V$	0.5		5.1	
			$V_{CCB} = 2.5V$	0.5		5.1	
			$V_{CCB} = 3.3V$	0.5		5.1	
$t_{PHZ}$ , $t_{PLZ}$ Disable time: from high level and from low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		3.6		ns
			$V_{CCB} = 1.5V$	0.5		7.1	
			$V_{CCB} = 1.8V$	0.5		6.3	
			$V_{CCB} = 2.5V$	0.5		5.1	
			$V_{CCB} = 3.3V$	0.5		3.9	

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

All typical limits apply over  $T_A = 25^\circ C$ , and all maximum and minimum limits apply over  $T_A = -40^\circ C$  to  $85^\circ C$  (unless otherwise noted) (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ , $t_{PHL}$  Propagation delay time: low-to-high-level output and high-to-low level output	A	B	$V_{CCB} = 1.2V$		2.3		ns
			$V_{CCB} = 1.5V$	0.5		4.5	
			$V_{CCB} = 1.8V$	0.5		3.7	
			$V_{CCB} = 2.5V$	0.5		2.9	
			$V_{CCB} = 3.3V$	0.5		2.5	
$t_{PLH}$ , $t_{PHL}$  Propagation delay time: low-to-high-level output and high-to-low level output	B	A	$V_{CCB} = 1.2V$		3.5		ns
			$V_{CCB} = 1.5V$	0.5		6.8	
			$V_{CCB} = 1.8V$	0.5		3.9	
			$V_{CCB} = 2.5V$	0.5		2.8	
			$V_{CCB} = 3.3V$	0.5		2.5	
$t_{PZH}$ , $t_{PZL}$  Enable time: to high level and to low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		2		ns
			$V_{CCB} = 1.5V$	0.5		4	
			$V_{CCB} = 1.8V$	0.5		4	
			$V_{CCB} = 2.5V$	0.5		4	
			$V_{CCB} = 3.3V$	0.5		4	
$t_{PZH}$ , $t_{PZL}$  Enable time: to high level and to low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		4.5		ns
			$V_{CCB} = 1.5V$	1.1		7.8	
			$V_{CCB} = 1.8V$	0.5		6.2	
			$V_{CCB} = 2.5V$	0.5		4.5	
			$V_{CCB} = 3.3V$	0.5		3.9	
$t_{PHZ}$ , $t_{PLZ}$  Disable time: from high level and from low level	$\overline{OE}$	A	$V_{CCB} = 1.2V$		1.7		ns
			$V_{CCB} = 1.5V$	0.5		4	
			$V_{CCB} = 1.8V$	0.5		4	
			$V_{CCB} = 2.5V$	0.5		4	
			$V_{CCB} = 3.3V$	0.5		4	
$t_{PHZ}$ , $t_{PLZ}$  Disable time: from high level and from low level	$\overline{OE}$	B	$V_{CCB} = 1.2V$		3.4		ns
			$V_{CCB} = 1.5V$	0.5		6.9	
			$V_{CCB} = 1.8V$	0.5		6	
			$V_{CCB} = 2.5V$	0.5		4.8	
			$V_{CCB} = 3.3V$	0.5		4.2	

## 5.11 Operating Characteristics

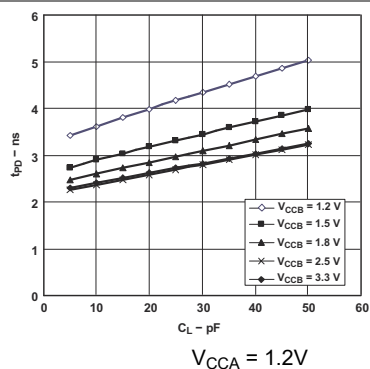
T<sub>A</sub> = 25°C

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		TYP	UNIT
C <sub>pdA</sub>	Power dissipation capacitance per transceiver <sup>(1)</sup> port A - outputs enabled	A	B	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	1	pF
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	1	
	Power dissipation capacitance per transceiver <sup>(1)</sup> port A - outputs disabled	A	B	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	1	
	Power dissipation capacitance per transceiver <sup>(1)</sup> port A - outputs enabled	B	A	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	12	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	12	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	12	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	13	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	14	
	Power dissipation capacitance per transceiver <sup>(1)</sup> port A - outputs disabled	B	A	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	1	
C <sub>pdB</sub>	Power dissipation capacitance per transceiver <sup>(1)</sup> port B - outputs enabled	A	B	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	12	pF
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	12	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	12	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	13	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	14	
	Power dissipation capacitance per transceiver <sup>(1)</sup> port B - outputs disabled	A	B	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	1	
	Power dissipation capacitance per transceiver <sup>(1)</sup> port B - outputs enabled	B	A	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	1	
	Power dissipation capacitance per transceiver <sup>(1)</sup> port B - outputs disabled	B	A	C <sub>L</sub> = 0pF, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.2V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 2.5V	1	
					V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3V	1	

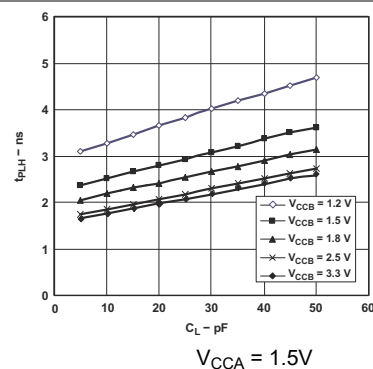
(1) See to TI application report, *CMOS Power Consumption and Cpd Calculation* (SCAA035).

## 5.12 Typical Characteristics

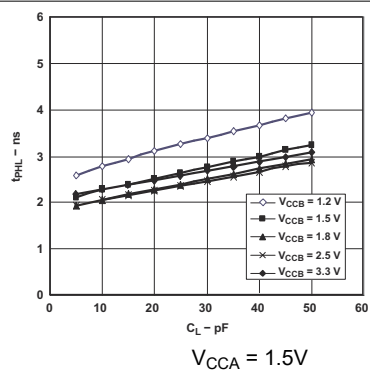
$T_A = 25^\circ\text{C}$



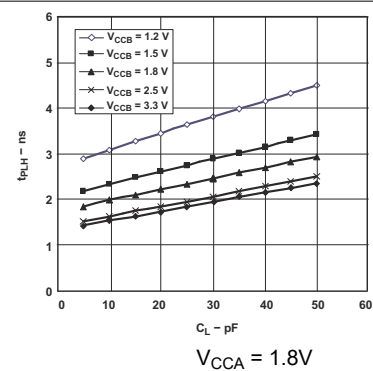
**Figure 5-1. Typical Propagation Delay (A to B) vs Load Capacitance**



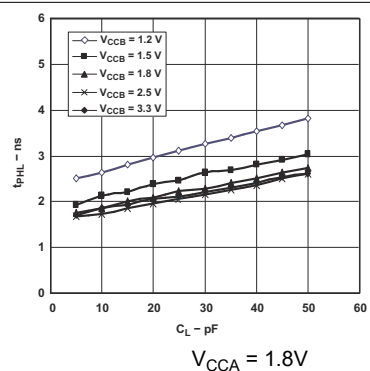
**Figure 5-2. Typical Propagation Delay (A to B) vs Load Capacitance**



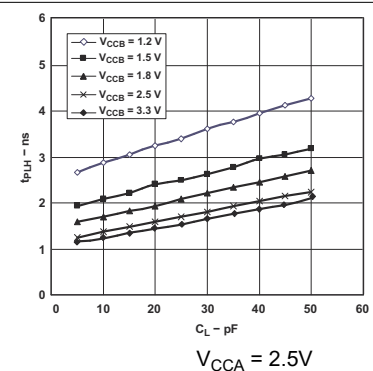
**Figure 5-3. Typical Propagation Delay (A to B) vs Load Capacitance**



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



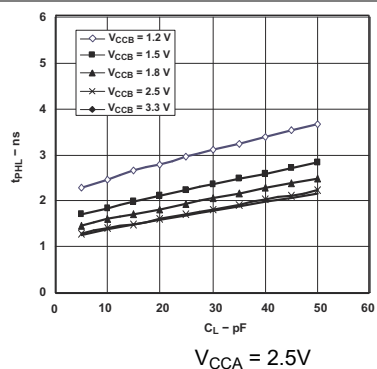
**Figure 5-5. Typical Propagation Delay (A to B) vs Load Capacitance**



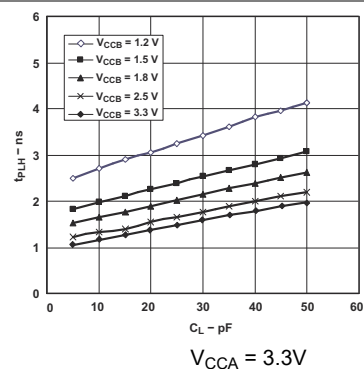
**Figure 5-6. Typical Propagation Delay (A to B) vs Load Capacitance**

## 5.12 Typical Characteristics (continued)

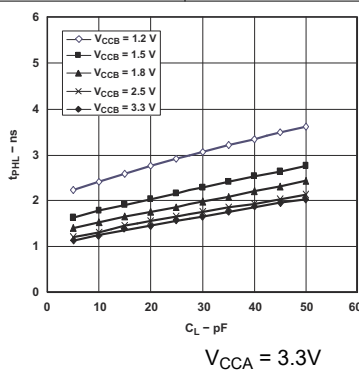
$T_A = 25^\circ\text{C}$



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

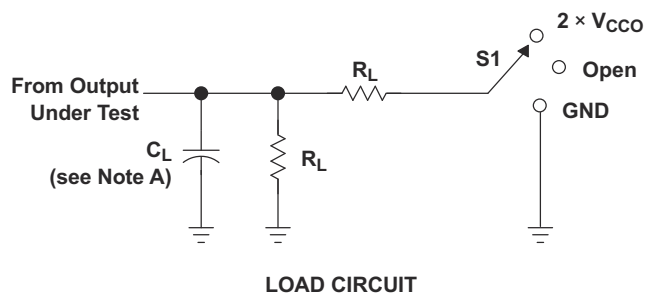


**Figure 5-8. Typical Propagation Delay (A to B) vs Load Capacitance**



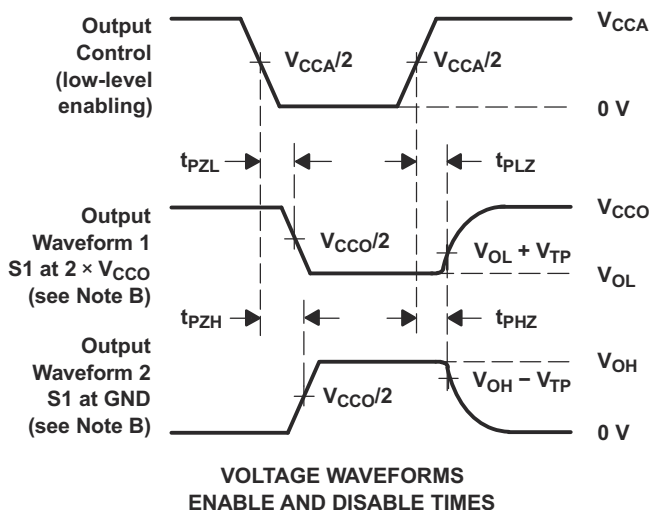
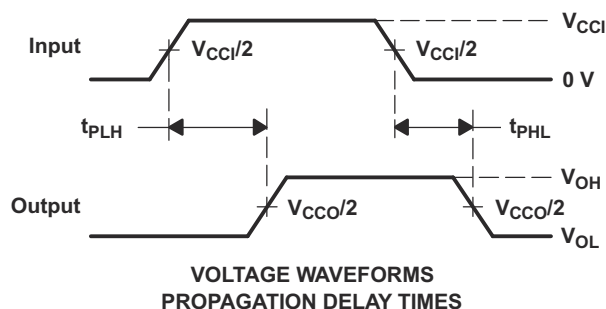
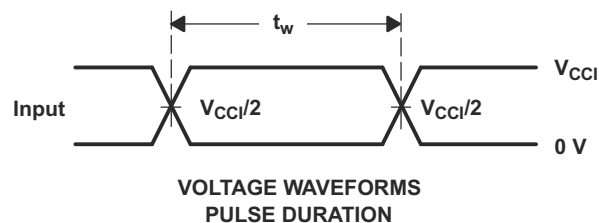
**Figure 5-9. Typical Propagation Delay (A to B) vs Load Capacitance**

## 6 Parameter Measurement Information



$V_{CCO}$	$C_L$	$R_L$	$V_{TP}$
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

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



- 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.  $V_{CCI}$  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 SN74AVCH8T245 is an 8-bit, dual supply noninverting bidirectional voltage level translator. Pins A1 through A4, and the control pins (DIR and  $\overline{OE}$ ) are referenced to  $V_{CCA}$ , while pins B1 through B4 are referenced to  $V_{CCB}$ . Both the A port and B port can accept I/O voltages ranging from 1.2V to 3.6V. With  $\overline{OE}$  set to low, a high on DIR allows data transmission from Port A to Port B, and a low on DIR allows data transmission from Port B to Port A. When  $\overline{OE}$  is set to high, both Port A and Port B outputs are in the high-impedance state. For more information, see [AVC Logic Family Technology and Application](#).

### 7.2 Functional Block Diagram

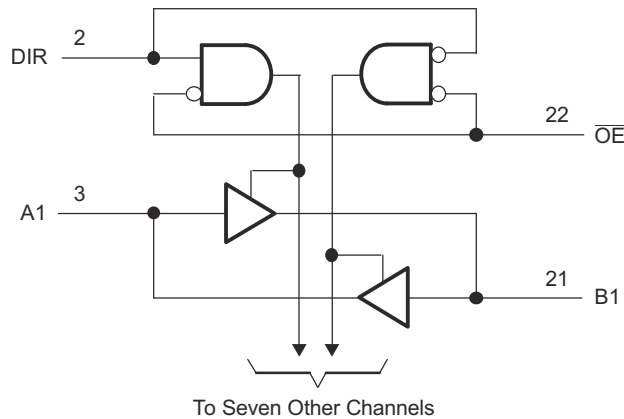


Figure 7-1. Logic Diagram (Positive Logic)

### 7.3 Feature Description

#### 7.3.1 Fully Configurable Dual-Rail Design

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

Table 7-1. Typical Total Static Power Consumption ( $I_{CCA} + I_{CCB}$ )

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

#### 7.3.2 Supports High-Speed Translation

SN74AVCH8T245 can support high data rate applications, which can be calculated from the maximum propagation delay. This is also dependent on output load. The translated signal data rate can be up to 320Mbps when both  $V_{CCA}$  and  $V_{CCB}$  are at least 1.8V.

#### 7.3.3 Partial-Power-Down Mode Operation

$I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the SN74AVCH8T245 when it is powered down. Damaging current backflow can occur in applications where subsections of a system are powered down (partial-power-down) to reduce power consumption.

### 7.3.4 Bus-Hold Circuitry

Active bus-hold circuitry holds unused or undriven data inputs at a valid logic state, which helps with board space savings and reduced component costs. Use of pull-up or pull-down resistors with the bus-hold circuitry is not recommended. For more information, see [Bus-Hold Circuit](#).

### 7.3.5 V<sub>CC</sub> Isolation Feature

The V<sub>CC</sub> isolation feature allows both ports to be in a high-impedance state if either V<sub>CCA</sub> or V<sub>CCB</sub> are at GND (or < 0.4V). For more information, see I<sub>OZ</sub> in the [Electrical Characteristics](#). This feature prevents false logic levels from being presented to either bus.

## 7.4 Device Functional Modes

[Table 7-2](#) lists the functional modes of the SN74AVCH8T245.

**Table 7-2. Function Table (Each 8-Bit Section)**

CONTROL INPUTS <sup>(1)</sup>		OUTPUT CIRCUITS		OPERATION
$\overline{OE}$	DIR	A PORT	B PORT	
L	L	Enabled	Hi-Z	B data to A bus
L	H	Hi-Z	Enabled	A data to B bus
H	X	Hi-Z	Hi-Z	Isolation

(1) Input circuits of the data I/Os are always active.

## 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 SN74AVCH8T245 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The SN74AVCH8T245 device is an excellent choice for data transmission when direction is different. The maximum data rate can be up to 320Mbps when device voltage power supply is more than 1.8V.

### 8.2 Typical Application

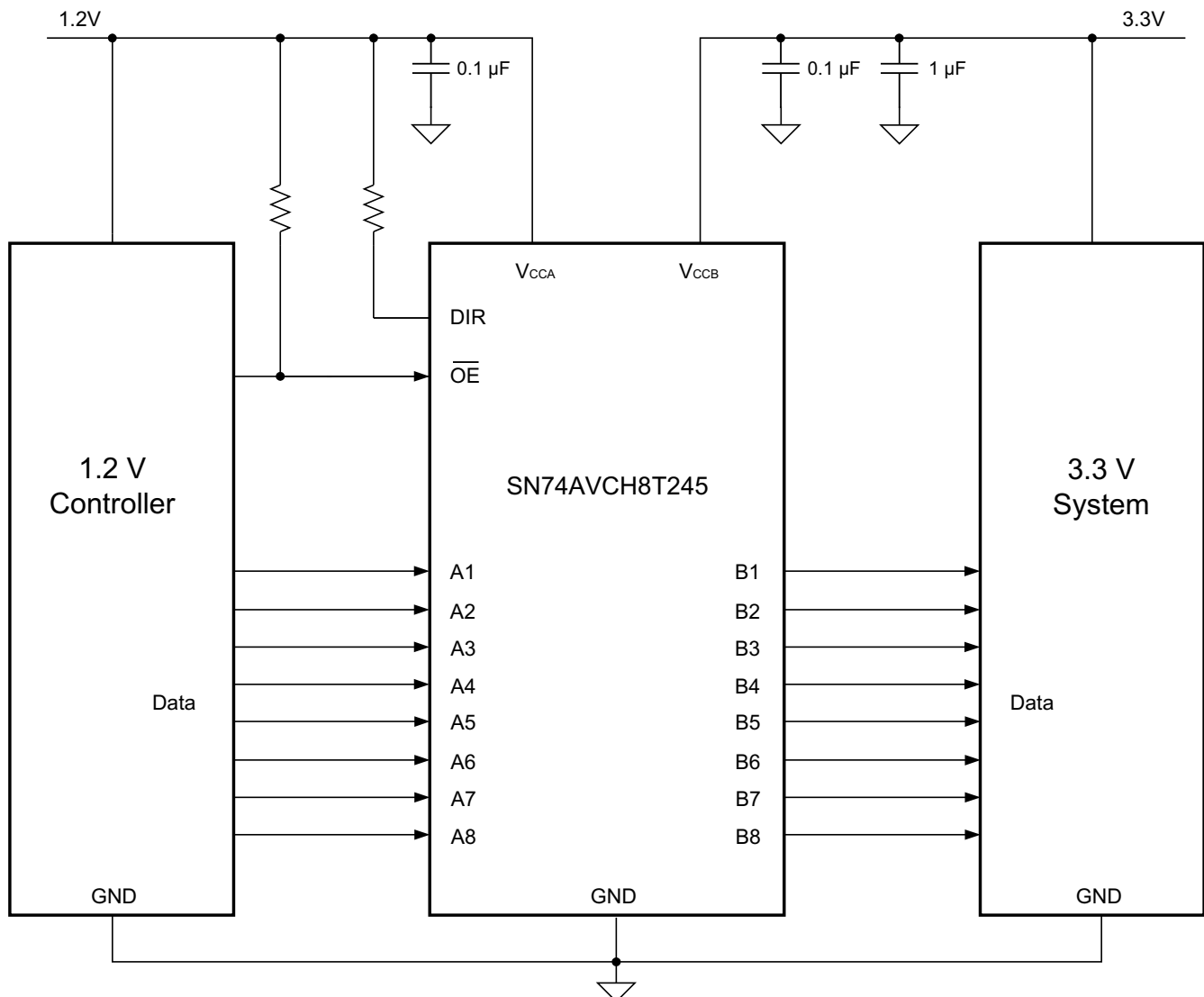


Figure 8-1. Typical Application Schematic

## 8.2.1 Design Requirements

For this design example, use the parameters listed in [Table 8-1](#).

**Table 8-1. Design Parameters**

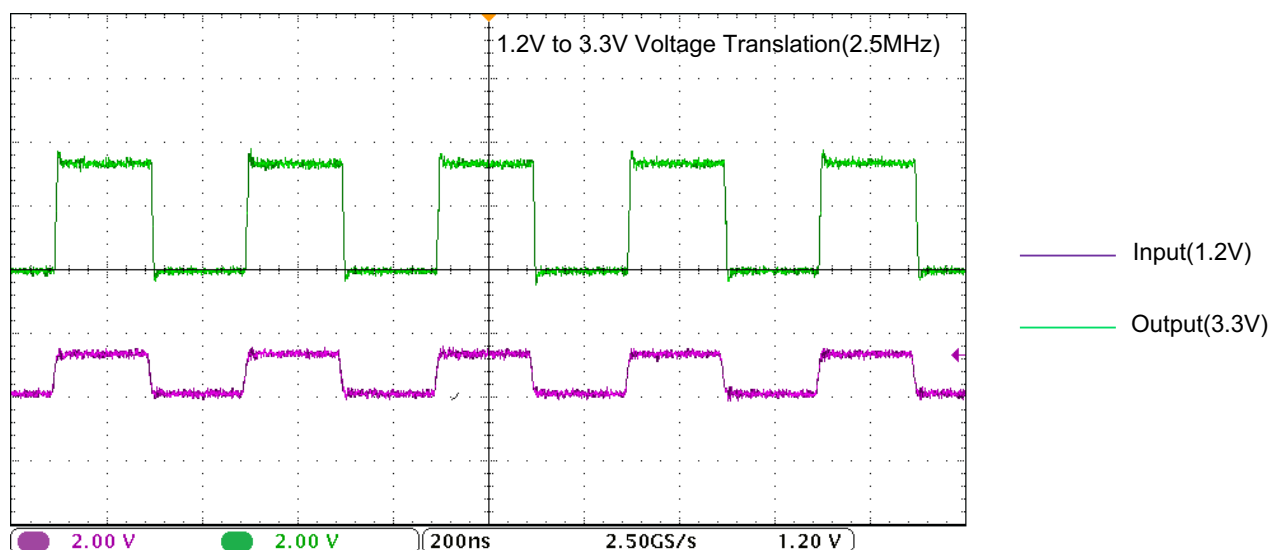
DESIGN PARAMETERS	EXAMPLE VALUE
Input voltage	1.2V to 3.6V
Output voltage	1.2V to 3.6V

## 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 SN74AVCH8T245 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.
- Output voltage range:
  - Use the supply voltage of the device that the SN74AVCH8T245 device is driving to determine the output voltage range.

## 8.2.3 Application Curves



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

## 8.3 Power Supply Recommendations

The design of the output-enable ( $\overline{OE}$ ) input circuit is referenced to  $V_{CCA}$  so that all outputs are placed in the high-impedance state when the  $\overline{OE}$  input is high. To put the outputs in a 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  $V_{CCA}$ .

$V_{CCA}$  or  $V_{CCB}$  can be powered up first. If the SN74AVCH8T245 is powered up in a permanently enabled state (for example  $\overline{OE}$  is always kept low), then pullup resistors are recommended at the input. Doing this allows for proper, glitch-free, power-up. For more information, see [Designing with SN4LVCXT245 and SN74LVCHXT245 Family of Direction Controlled Voltage Translators/Level-Shifters](#). In addition, the  $\overline{OE}$  pin may be shorted to GND if the application does not require use of the high-impedance state at any time.

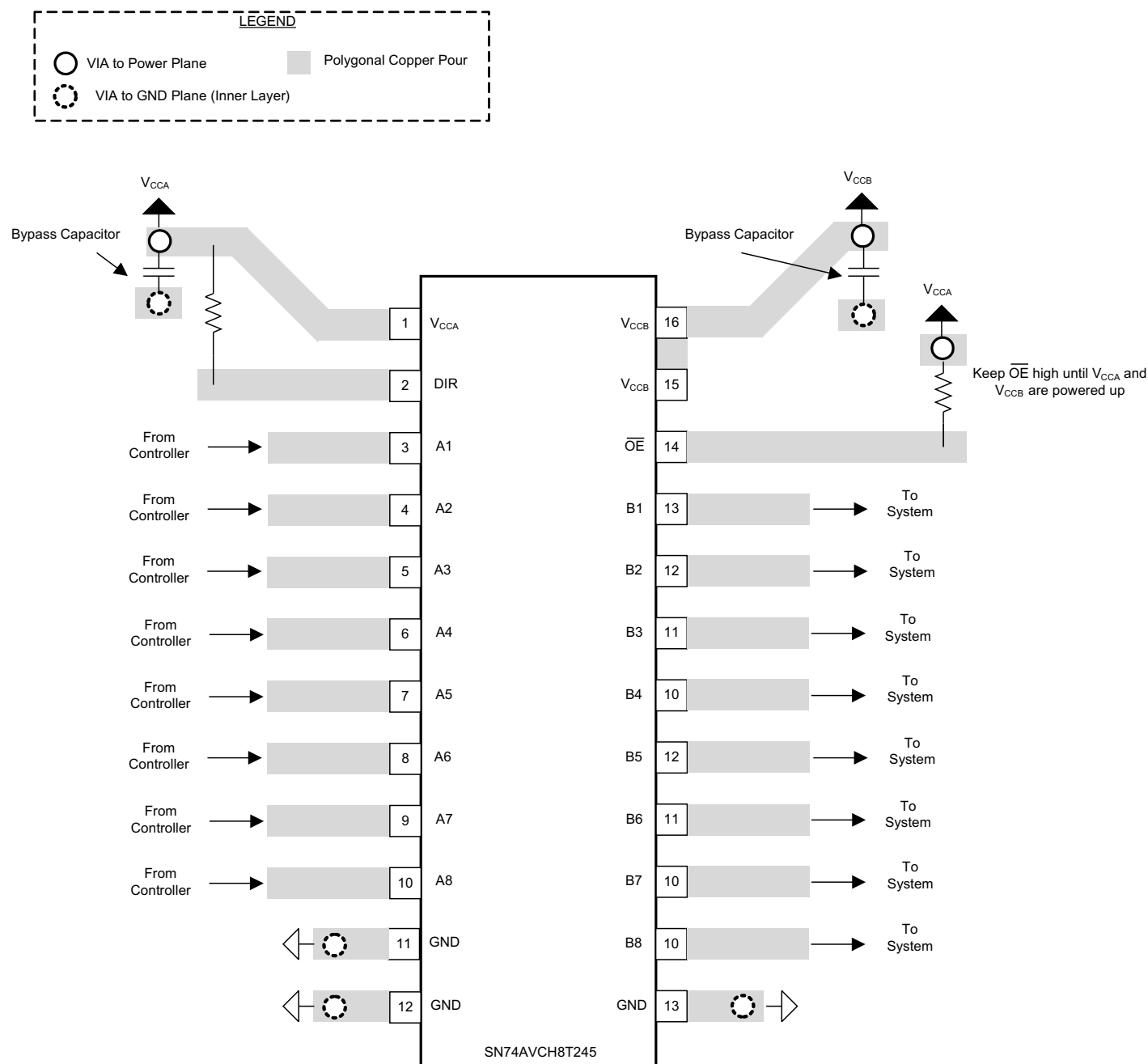
## 8.4 Layout

### 8.4.1 Layout Guidelines

For device reliability, TI recommends following the common printed-circuit board layout guidelines.

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

### 8.4.2 Layout Example



**Figure 8-3. SN74AVCH8T245 Layout Example**

## 9 Device and Documentation Support

### 9.1 Documentation Support

#### 9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [Designing with SN74LVCXT245 and SN74LVCHXT245 Family of Direction Controlled Voltage Translators/Level-Shifters](#)
- Texas Instruments, [Bus-Hold Circuit](#)
- Texas Instruments, [AVC Logic Family Technology and Applications](#)
- Texas Instruments, [CMOS Power Consumption and Cpd Calculation](#)

#### 9.2 Receiving Notification of Documentation Updates

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

#### 9.3 Support Resources

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

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#### 9.4 Trademarks

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#### 9.5 Electrostatic Discharge Caution



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

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

#### 9.6 Glossary

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

## 10 Revision History

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

Changes from Revision I (November 2023) to Revision J (April 2024)	Page
• Changed kW to kΩ in the <i>Load Circuit and Voltage Waveforms</i> figure.....	16

Changes from Revision H (January 2016) to Revision I (November 2023)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Updated the <i>Package Information</i> table to include package lead size.....	1
• Updated the <i>Thermal Information</i> table for the DGV, PW, and RHL packages.....	6

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**Changes from Revision G (March 2007) to Revision H (January 2016)**

**Page**

- Added *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section..... 1
  - Deleted the *Ordering Information* table..... 1
- 

## **11 Mechanical, Packaging, and Orderable Information**

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

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">74AVCH8T245DGVRG4</a>	Active	Production	TVSOP (DGV)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
74AVCH8T245DGVRG4.A	Active	Production	TVSOP (DGV)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
74AVCH8T245DGVRG4.B	Active	Production	TVSOP (DGV)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
74AVCH8T245PWRG4	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
74AVCH8T245RHRLRG4	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	WP245
<a href="#">SN74AVCH8T245DGVR</a>	Active	Production	TVSOP (DGV)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
SN74AVCH8T245DGVR.A	Active	Production	TVSOP (DGV)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
SN74AVCH8T245DGVR.B	Active	Production	TVSOP (DGV)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
<a href="#">SN74AVCH8T245PW</a>	Active	Production	TSSOP (PW)   24	60   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
SN74AVCH8T245PW.B	Active	Production	TSSOP (PW)   24	60   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
SN74AVCH8T245PWG4	Active	Production	TSSOP (PW)   24	60   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
<a href="#">SN74AVCH8T245PWR</a>	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
SN74AVCH8T245PWR.A	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
SN74AVCH8T245PWR.B	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	WP245
<a href="#">SN74AVCH8T245RHRL</a>	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	WP245
SN74AVCH8T245RHRL.A	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	WP245
SN74AVCH8T245RHRL.B	Active	Production	VQFN (RHL)   24	1000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	WP245

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

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

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

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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



**(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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## 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
74AVCH8T245DGVRG4	TVSOP	DGV	24	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AVCH8T245DGVR	TVSOP	DGV	24	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AVCH8T245RHRLR	VQFN	RHL	24	1000	180.0	12.4	3.8	5.8	1.2	8.0	12.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

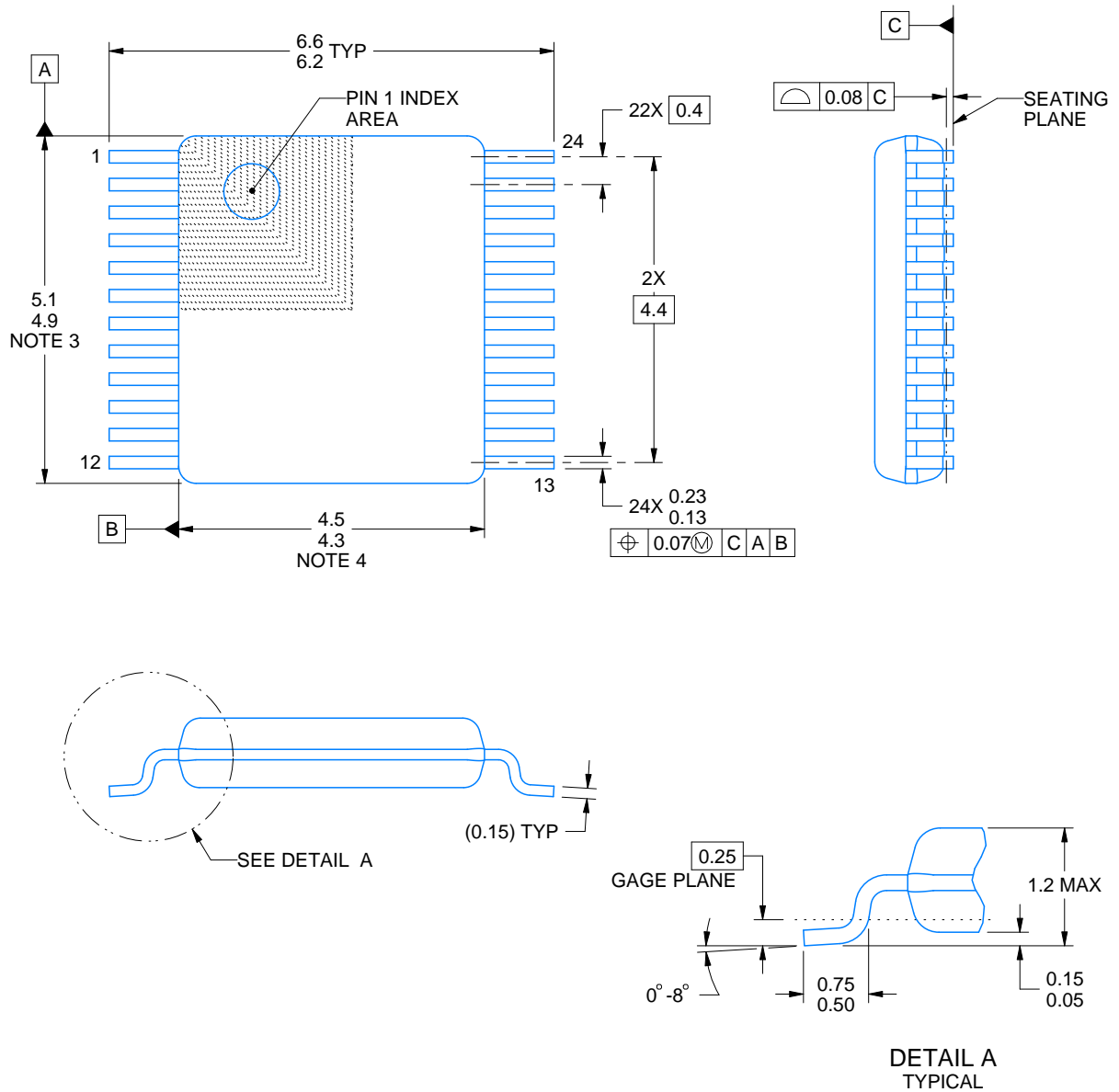
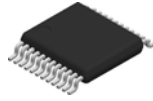
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74AVCH8T245DGVRG4	TVSOP	DGV	24	2000	353.0	353.0	32.0
SN74AVCH8T245DGVR	TVSOP	DGV	24	2000	353.0	353.0	32.0
SN74AVCH8T245RHLR	VQFN	RHL	24	1000	213.0	191.0	35.0

## TUBE



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74AVCH8T245PW	PW	TSSOP	24	60	530	10.2	3600	3.5
SN74AVCH8T245PW.B	PW	TSSOP	24	60	530	10.2	3600	3.5
SN74AVCH8T245PWG4	PW	TSSOP	24	60	530	10.2	3600	3.5



4229221/A 12/2022

NOTES:

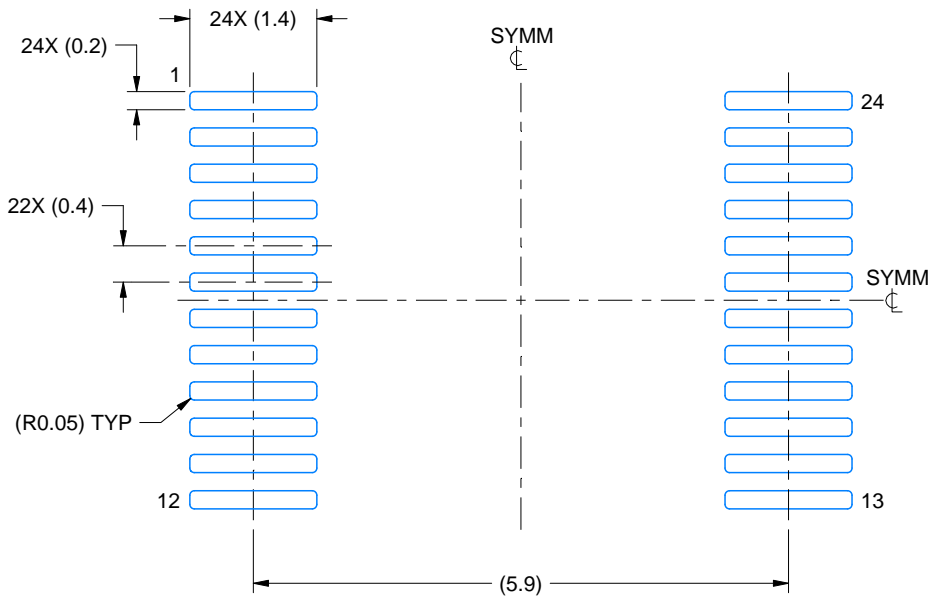
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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

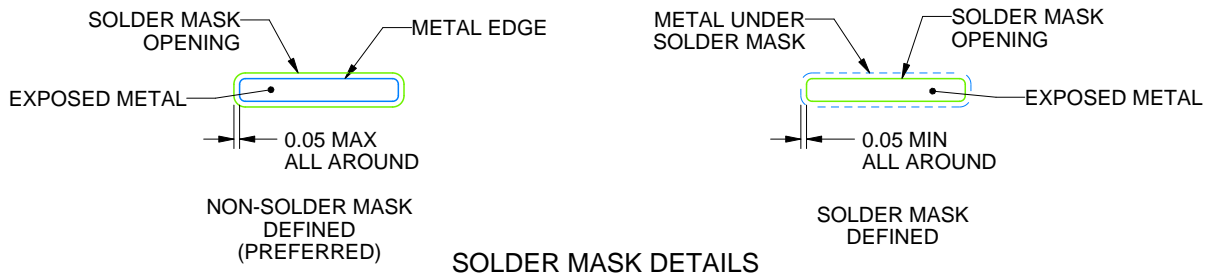
DGV0024A

TVSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 12X



SOLDER MASK DETAILS

4229221/A 12/2022

NOTES: (continued)

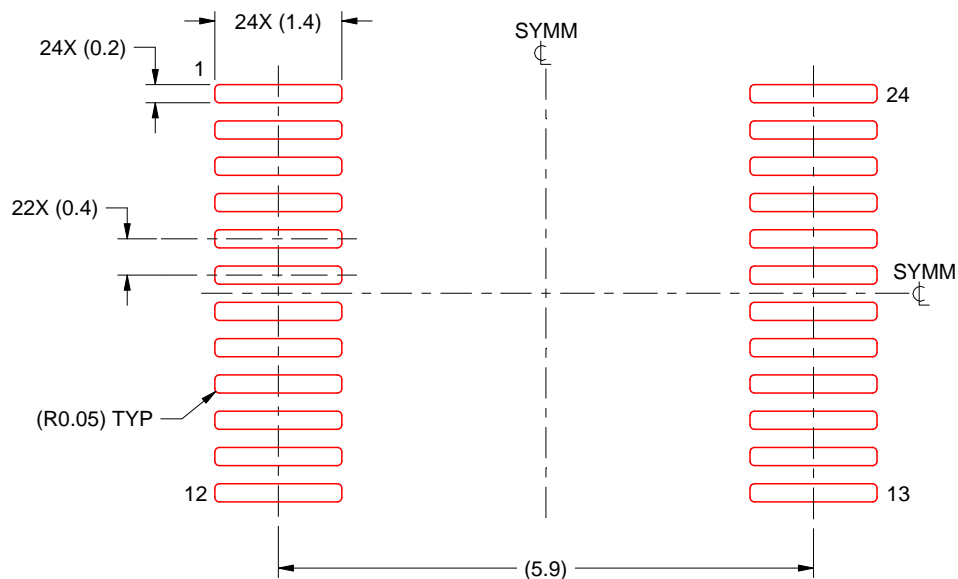
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DGV0024A

TVSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 12X

4229221/A 12/2022

NOTES: (continued)

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

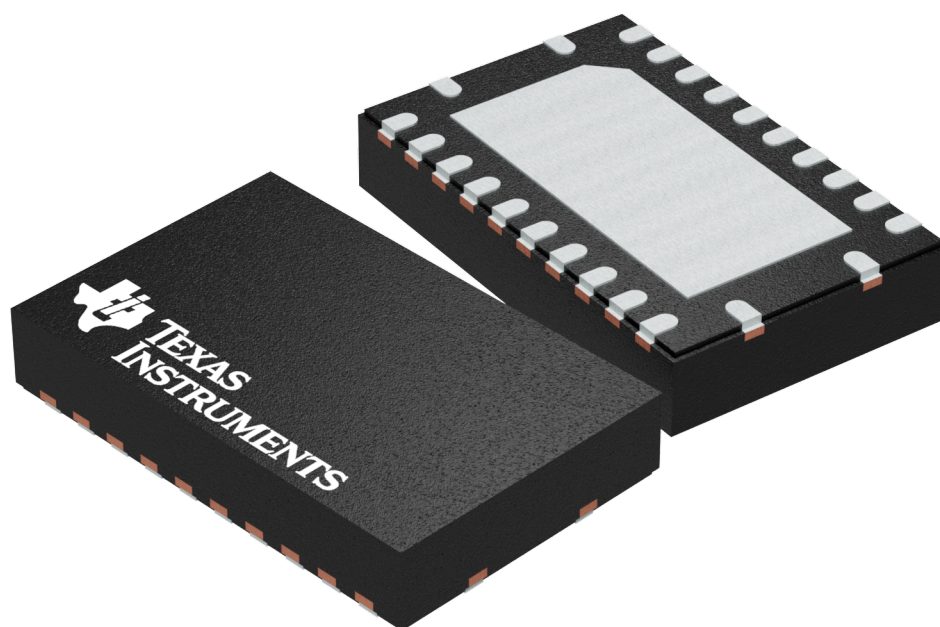
## GENERIC PACKAGE VIEW

**RGY 24**

**VQFN - 1 mm max height**

**5.5 x 3.5 mm, 0.5 mm pitch**

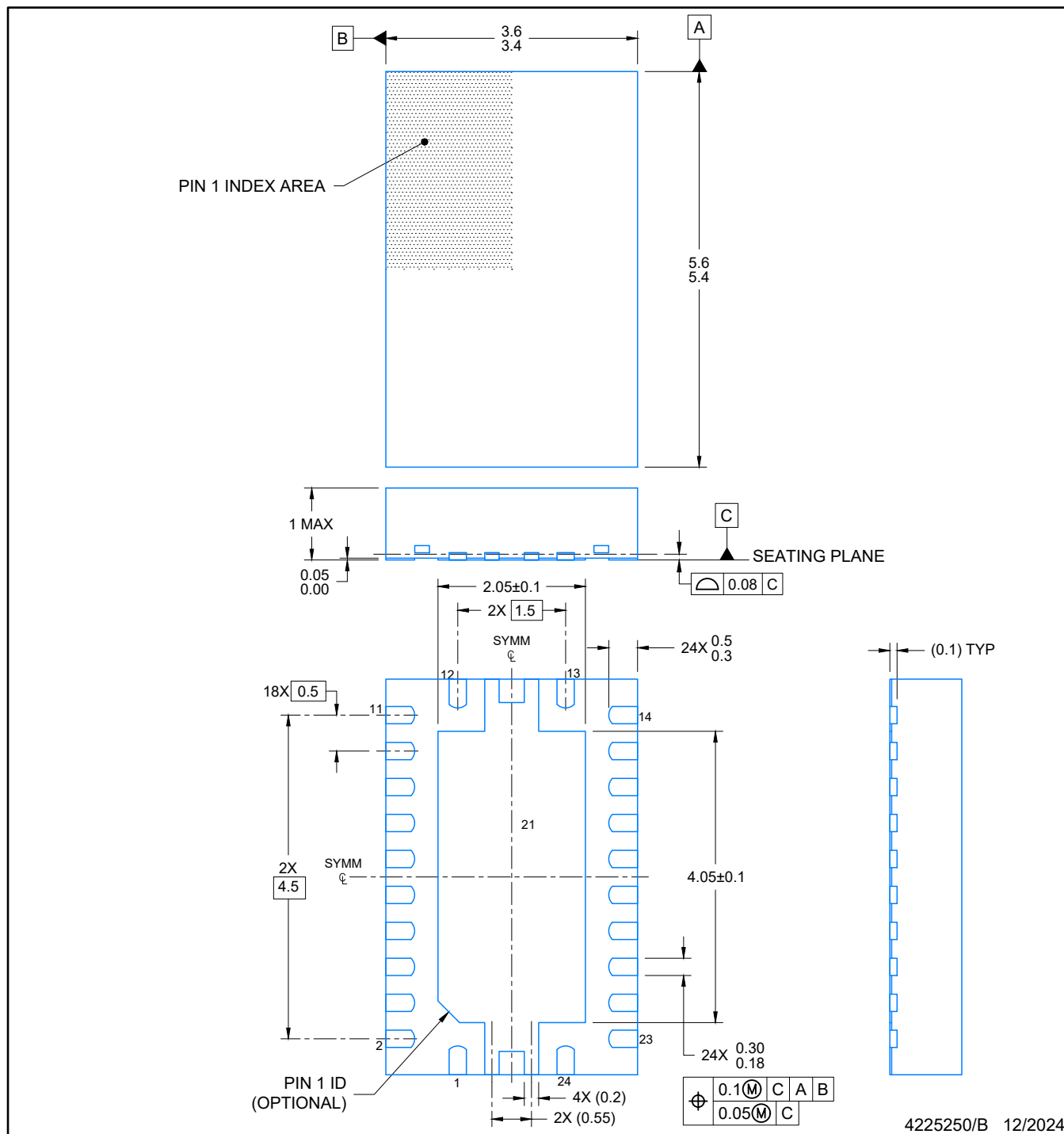
PLASTIC QUAD FLATPACK - NO LEAD



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

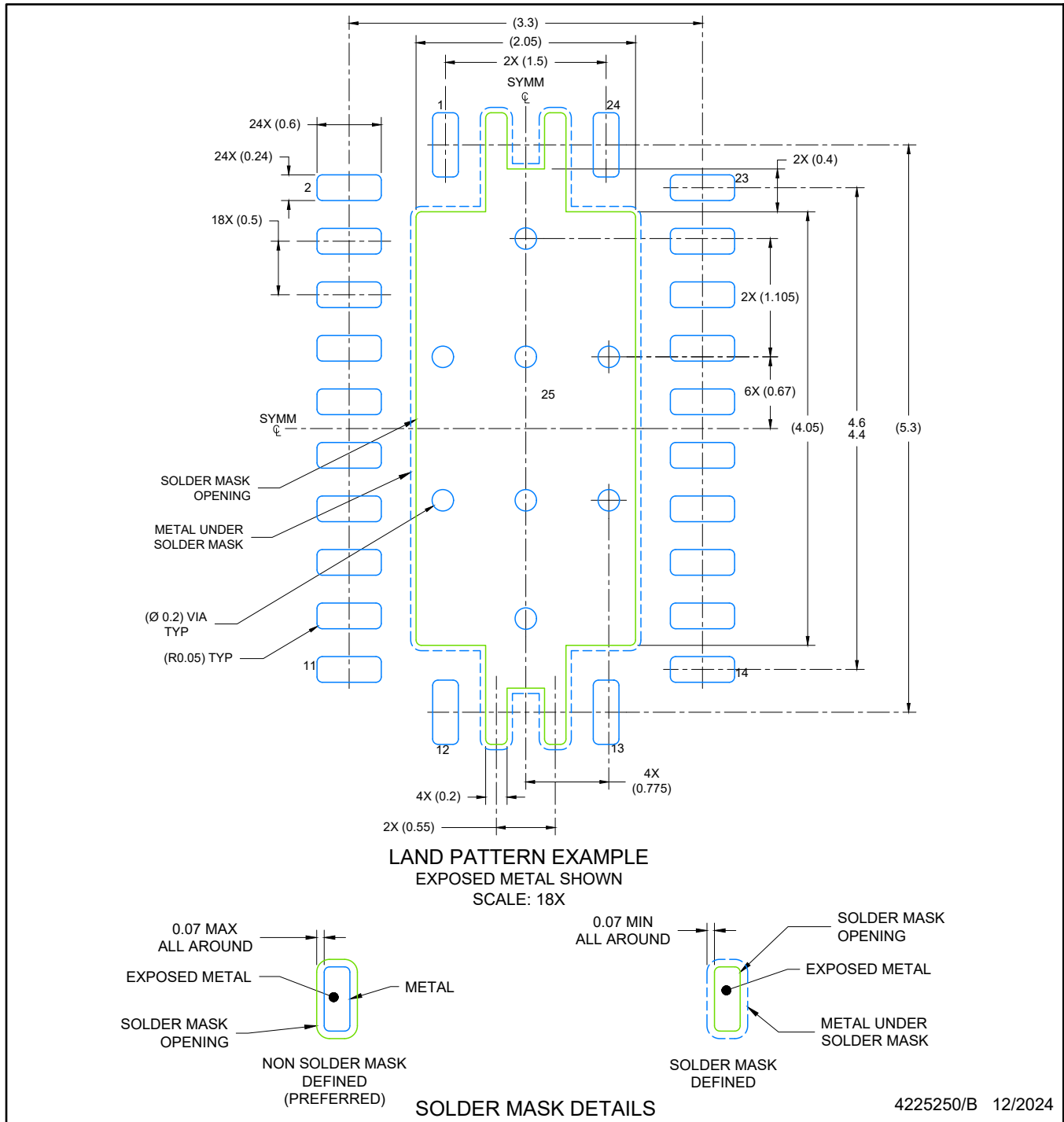
4203539-5/J





## NOTES:

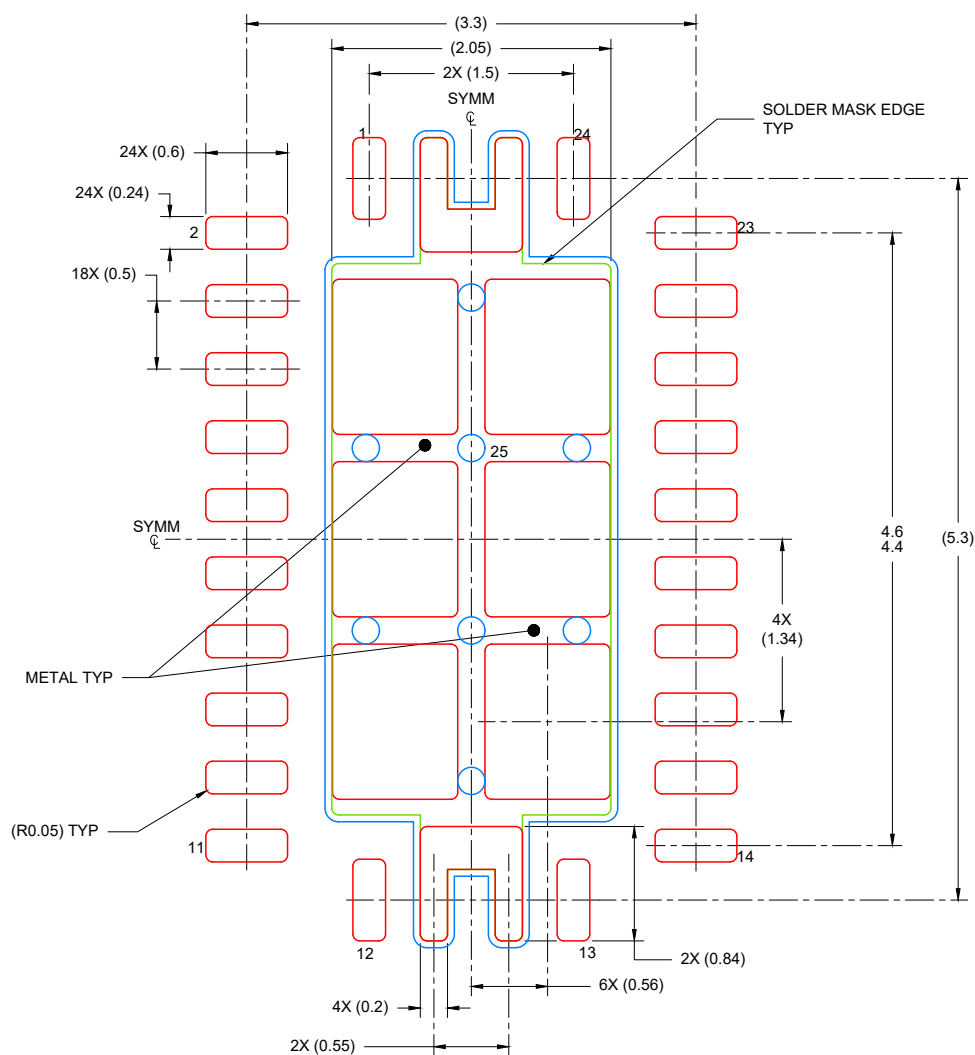
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.



NOTES: (continued)

- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
- Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

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.



## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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



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



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

4220208/A 02/2017

NOTES: (continued)

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

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