

# SN74AXC8T245-Q1 Automotive 8-Bit Dual-Supply Bus Transceiver With Configurable Voltage Translation and Tri-State Outputs

## 1 Features

- AEC-Q100 Qualified for Automotive Applications
- Qualified Fully Configurable Dual-Rail Design Allows Each Port to Operate With a Power Supply Range From 0.65 V to 3.6 V
- Operating Temperature From  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- Multiple Direction Control Pins to Allow Simultaneous Up and Down Translation
- Up to 380 Mbps Support When Translating from 1.8 V to 3.3 V
- $V_{CC}$  Isolation Feature to Effectively Isolate Both Buses in a Power-Down Scenario
- Partial Power-Down Mode to Limit Backflow Current in a Power-Down Scenario
- Compatible With SN74AVC8T245-Q1 Level Shifter
- Latch-Up Performance Exceeds 100 mA Per JEDEC 78, Class II

## 2 Applications

- Infotainment Head Unit
- ADAS Fusion
- ADAS Front Camera
- HEV Battery Management System

## 3 Description

The SN74AXC8T245-Q1 AEC-Q100 qualified device is an 8-bit non-inverting bus transceiver that resolves voltage level mismatch between devices operating at the latest voltage nodes (0.7 V, 0.8 V, and 0.9 V) and devices operating at industry standard voltage nodes (1.8 V, 2.5 V, 3.3 V) and vice versa.

The device operates by using two independent power-supply rails ( $V_{CCA}$  and  $V_{CCB}$ ) that operate as low as 0.65 V. Data pins A1 through A8 are designed to track  $V_{CCA}$ , which accepts any supply voltage from 0.65 V to 3.6 V. Data pins B1 through B8 are designed to track  $V_{CCB}$ , which accepts any supply voltage from 0.65 V to 3.6 V.

The SN74AXC8T245-Q1 device is designed for 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 of the direction-control inputs (DIR1 and DIR2). The output-enable ( $\overline{\text{OE}}$ ) input is used to disable the outputs so the buses are effectively isolated.

The SN74AXC8T245-Q1 device is designed so the control pins (DIR and  $\overline{\text{OE}}$ ) are referenced to  $V_{CCA}$ .

This device is fully specified for partial-power-down applications using  $I_{\text{off}}$ . The  $I_{\text{off}}$  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 ensures that if either  $V_{CC}$  input supply is below 100 mV, all level shifter outputs are disabled and placed into a high-impedance state.

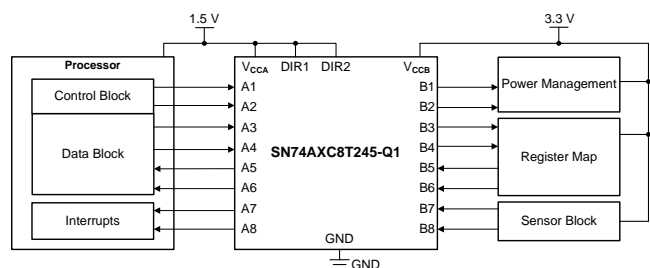
To ensure the high-impedance state of the level shifter I/Os during power up or power down,  $\overline{\text{OE}}$  should be tied to  $V_{CCA}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN74AXC8T245QPWRQ1	TSSOP (24)	4.40 mm x 7.80 mm
SN74AXC8T245QRHLQ1	VQFN (24)	3.50 mm x 5.50 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

### Typical Application Schematic



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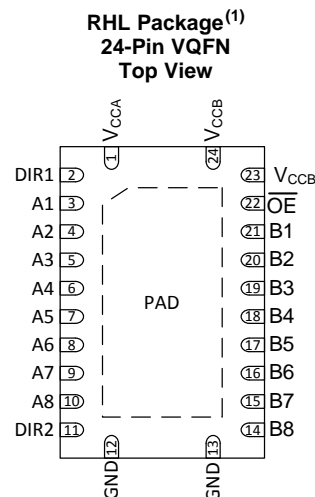
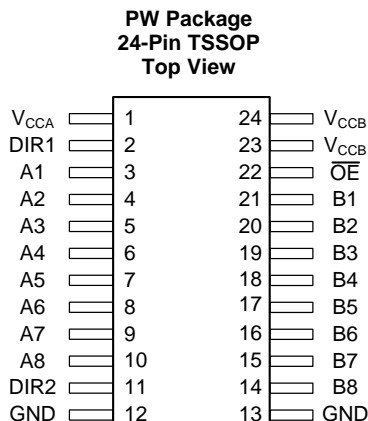
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## 4 Revision History

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

DATE	REVISION	NOTES
November 2018	*	Advance Information Release.

## 5 Pin Configuration and Functions



(1) PAD - may be grounded (recommended) or left floating.

### Pin Functions

PIN		I/O	DESCRIPTION
NAME	PW, RHL		
A1	3	I/O	Input/output A1. Referenced to V <sub>CCA</sub> .
A2	4	I/O	Input/output A2. Referenced to V <sub>CCA</sub> .
A3	5	I/O	Input/output A3. Referenced to V <sub>CCA</sub> .
A4	6	I/O	Input/output A4. Referenced to V <sub>CCA</sub> .
A5	7	I/O	Input/output A5. Referenced to V <sub>CCA</sub> .
A6	8	I/O	Input/output A6. Referenced to V <sub>CCA</sub> .
A7	9	I/O	Input/output A7. Referenced to V <sub>CCA</sub> .
A8	10	I/O	Input/output A8. Referenced to V <sub>CCA</sub> .
B1	21	I/O	Input/output B1. Referenced to V <sub>CCB</sub> .
B2	20	I/O	Input/output B2. Referenced to V <sub>CCB</sub> .
B3	19	I/O	Input/output B3. Referenced to V <sub>CCB</sub> .
B4	18	I/O	Input/output B4. Referenced to V <sub>CCB</sub> .
B5	17	I/O	Input/output B5. Referenced to V <sub>CCB</sub> .
B6	16	I/O	Input/output B6. Referenced to V <sub>CCB</sub> .
B7	15	I/O	Input/output B7. Referenced to V <sub>CCB</sub> .
B8	14	I/O	Input/output B8. Referenced to V <sub>CCB</sub> .
DIR1	2	I	Direction-control signal 1. Referenced to V <sub>CCA</sub> . Refer to <a href="#">Table 1</a> .
DIR2	11	I	Direction-control signal 2. Refer to <a href="#">Table 1</a> . Referenced to V <sub>CCA</sub> . Tie to GND to maintain backward compatibility with SN74AVC8T245-Q1 device.
GND	12	—	Ground
	13	—	Ground
OE	22	I	Output Enable. Pull to GND to enable all outputs. Pull to V <sub>CCA</sub> to place all outputs in high-impedance mode. Referenced to V <sub>CCA</sub> . Refer to <a href="#">Table 1</a> .
V <sub>CCA</sub>	1	—	A-port supply voltage. 0.65 V ≤ V <sub>CCA</sub> ≤ 3.6 V
V <sub>CCB</sub>	23	—	B-port supply voltage. 0.65 V ≤ V <sub>CCB</sub> ≤ 3.6 V
	24	—	B-port supply voltage. 0.65 V ≤ V <sub>CCB</sub> ≤ 3.6 V

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
Supply voltage, $V_{CCA}$		-0.5	4.2	V
Supply voltage, $V_{CCB}$		-0.5	4.2	V
Input voltage, $V_I$ <sup>(2)</sup>	I/O ports (A port)	-0.5	4.2	V
	I/O ports (B port)	-0.5	4.2	
	Control inputs	-0.5	4.2	
Voltage applied to any output in the high-impedance or power-off state, $V_O$ <sup>(2)</sup>	A port	-0.5	4.2	V
	B port	-0.5	4.2	
Voltage applied to any output in the high or low state, $V_O$ <sup>(2) (3)</sup>	A port	-0.5	$V_{CCA} + 0.2$	V
	B port	-0.5	$V_{CCB} + 0.2$	
Input clamp current, $I_{IK}$	$V_I < 0$	-50		mA
Output clamp current, $I_{OK}$	$V_O < 0$	-50		mA
Continuous output current, $I_O$		-50	50	mA
Continuous current through $V_{CCA}$ , $V_{CCB}$ , or GND		-100	100	mA
Junction Temperature, $T_J$			150	°C
Storage temperature, $T_{stg}$		-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 4.2 V maximum if the output current rating is observed.

### 6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per AEC Q100-002 <sup>(1)</sup>	±8000	V
	Charged-device model (CDM), per AEC Q100-011	±1000	

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

### 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted) <sup>(1)(2)(3)</sup>

		MIN	MAX	UNIT	
V <sub>CCA</sub>	Supply voltage	0.65	3.6	V	
V <sub>CCB</sub>	Supply voltage	0.65	3.6	V	
V <sub>IH</sub>	High-level input voltage	Data inputs	V <sub>CCI</sub> = 0.65 V - 0.75 V	V <sub>CCI</sub> × 0.70	V
			V <sub>CCI</sub> = 0.76 V - 1 V	V <sub>CCI</sub> × 0.70	
			V <sub>CCI</sub> = 1.1 V - 1.95 V	V <sub>CCI</sub> × 0.65	
			V <sub>CCI</sub> = 2.3 V - 2.7 V	1.6	
			V <sub>CCI</sub> = 3 V - 3.6 V	2	
	Control inputs (DIR, $\overline{OE}$ ) Referenced to V <sub>CCA</sub>	V <sub>CCA</sub> = 0.65 V - 0.75 V	V <sub>CCA</sub> × 0.70		
		V <sub>CCA</sub> = 0.76 V - 1 V	V <sub>CCA</sub> × 0.70		
		V <sub>CCA</sub> = 1.1 V - 1.95 V	V <sub>CCA</sub> × 0.65		
		V <sub>CCA</sub> = 2.3 V - 2.7 V	1.6		
		V <sub>CCA</sub> = 3 V - 3.6 V	2		
V <sub>IL</sub>	Low-level input voltage	Data inputs	V <sub>CCI</sub> = 0.65 V - 0.75 V	V <sub>CCI</sub> × 0.30	V
			V <sub>CCI</sub> = 0.76 V - 1 V	V <sub>CCI</sub> × 0.30	
			V <sub>CCI</sub> = 1.1 V - 1.95 V	V <sub>CCI</sub> × 0.35	
			V <sub>CCI</sub> = 2.3 V - 2.7 V	0.7	
			V <sub>CCI</sub> = 3 V - 3.6 V	0.8	
	Control inputs (DIR, $\overline{OE}$ ) Referenced to V <sub>CCA</sub>	V <sub>CCA</sub> = 0.65 V - 0.75 V	V <sub>CCA</sub> × 0.30		
		V <sub>CCA</sub> = 0.76 V - 1 V	V <sub>CCA</sub> × 0.30		
		V <sub>CCA</sub> = 1.1 V - 1.95 V	V <sub>CCA</sub> × 0.35		
		V <sub>CCA</sub> = 2.3 V - 2.7 V	0.7		
		V <sub>CCA</sub> = 3 V - 3.6 V	0.8		
V <sub>I</sub>	Input voltage <sup>(3)</sup>	0	3.6	V	
V <sub>O</sub>	Output voltage	Active state	0	V <sub>CCO</sub> <sup>(2)</sup>	V
		Tri-state	0	3.6	
$\Delta t/\Delta v$	Input transition rise or fall rate		10	ns/V	
T <sub>A</sub>	Operating free-air temperature	-40	125	°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.

(3) All unused data inputs of the device must be held at V<sub>CCI</sub> or GND to ensure proper device operation. See the [Implications of Slow or Floating CMOS Inputs](#) application report.

### 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74AXC8T245-Q1		UNIT
		PW (TSSOP)	RHL (VQFN)	
		24 PINS	24 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	92.0	35	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	29.3	39.9	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	46.7	13.8	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	1.5	0.3	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	46.2	13.8	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	N/A	1.4	°C/W

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

## 6.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	-40°C to 85°C			-40°C to 125°C			UNIT
				MIN	TYP <sup>(3)</sup>	MAX	MIN	TYP <sup>(3)</sup>	MAX	
V <sub>OH</sub> High-level output voltage	V <sub>I</sub> = V <sub>IH</sub>	I <sub>OH</sub> = -100 μA	0.7 V - 3.6 V	0.7 V - 3.6 V	V <sub>CCO</sub> - 0.1		V <sub>CCO</sub> - 0.1		V	
		I <sub>OH</sub> = -50 μA	0.65 V	0.65 V	0.55		0.55			
		I <sub>OH</sub> = -200 μA	0.76 V	0.76 V	0.58		0.58			
		I <sub>OH</sub> = -500 μA	0.85 V	0.85 V	0.65		0.65			
		I <sub>OH</sub> = -3 mA	1.1 V	1.1 V	0.85		0.85			
		I <sub>OH</sub> = -6 mA	1.4 V	1.4 V	1.05		1.05			
		I <sub>OH</sub> = -8 mA	1.65 V	1.65 V	1.2		1.2			
		I <sub>OH</sub> = -9 mA	2.3 V	2.3 V	1.75		1.75			
		I <sub>OH</sub> = -12 mA	3 V	3 V	2.3		2.3			
V <sub>OL</sub> Low-level output voltage	V <sub>I</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	0.7 V - 3.6 V	0.7 V - 3.6 V			0.1		V	
		I <sub>OL</sub> = 50 μA	0.65 V	0.65 V			0.1			
		I <sub>OL</sub> = 200 μA	0.76 V	0.76 V			0.18			
		I <sub>OL</sub> = 500 μA	0.85 V	0.85 V			0.2			
		I <sub>OL</sub> = 3 mA	1.1 V	1.1 V			0.25			
		I <sub>OL</sub> = 6 mA	1.4 V	1.4 V			0.35			
		I <sub>OL</sub> = 8 mA	1.65 V	1.65 V			0.45			
		I <sub>OL</sub> = 9 mA	2.3 V	2.3 V			0.55			
I <sub>OL</sub> = 12 mA	3 V	3 V			0.7					
I <sub>I</sub> Input leakage current	Control Inputs (DIR, $\overline{OE}$ ): V <sub>I</sub> = V <sub>CCA</sub> or GND	0.65 V - 3.6 V	0.65 V - 3.6 V	-0.5		0.5		-1	1	μA
I <sub>off</sub> Partial power down current	A Port: V <sub>I</sub> or V <sub>O</sub> = 0 V - 3.6 V	0 V	0 V - 3.6 V	-8		8		-12	12	μA
	B Port: V <sub>I</sub> or V <sub>O</sub> = 0 V - 3.6 V	0 V - 3.6 V	0 V	-8		8		-12	12	
I <sub>OZ</sub> (3) High-impedance state output current	A Port: V <sub>O</sub> = V <sub>CCO</sub> or GND, V <sub>I</sub> = V <sub>CCI</sub> or GND, $\overline{OE}$ = V <sub>IH</sub>	3.6 V	3.6 V	-8		8		-12	12	μA
	B Port: V <sub>O</sub> = V <sub>CCO</sub> or GND, V <sub>I</sub> = V <sub>CCI</sub> or GND, $\overline{OE}$ = V <sub>IH</sub>	3.6 V	3.6 V	-8		8		-12	12	
I <sub>CCA</sub> V <sub>CCA</sub> supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0 mA	0.65 V - 3.6 V	0.65 V - 3.6 V			20		40		μA
		0 V	3.6 V	-2		-12				
		3.6 V	0 V			12		25		
I <sub>CCB</sub> V <sub>CCB</sub> supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0 mA	0.65 V - 3.6 V	0.65 V - 3.6 V			20		40		μA
		0 V	3.6 V			12		25		
		3.6 V	0 V	-2		-12				
I <sub>CCA</sub> + I <sub>CCB</sub> Combined supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0 mA	0.65 V - 3.6 V	0.65 V - 3.6 V			30		60		μA
C <sub>i</sub> Input capacitance	Control Inputs (DIR, $\overline{OE}$ ): V <sub>I</sub> = 3.3 V or GND	3.3 V	3.3 V			4.5		4.5		pF
C <sub>io</sub> Data I/O capacitance	Ports A and B: $\overline{OE}$ = V <sub>CCA</sub> , V <sub>O</sub> = 1.65V DC + 1 MHz -16 dBm sine wave	3.3 V	3.3 V			5.7		5.7		pF

- (1) V<sub>CCO</sub> is the V<sub>CC</sub> associated with the output port.
- (2) V<sub>CCI</sub> is the V<sub>CC</sub> associated with the input port.
- (3) All typical values are for T<sub>A</sub> = 25°C
- (4) For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

## 6.6 Switching Characteristics, $V_{CCA} = 0.7\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V $\pm$ 0.05 V		0.8 V $\pm$ 0.04 V		0.9 V $\pm$ 0.045 V		1.2 V $\pm$ 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	172	0.5	114	0.5	82	0.5	49	ns
		-40°C to 125°C	0.5	172	0.5	114	0.5	82	0.5	49	
	From input B to output A	-40°C to 85°C	0.5	172	0.5	153	0.5	126	0.5	88	
		-40°C to 125°C	0.5	172	0.5	153	0.5	126	0.5	88	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	192	0.5	192	0.5	192	0.5	192	ns
		-40°C to 125°C	0.5	195	0.5	195	0.5	195	0.5	195	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	156	0.5	129	0.5	118	0.5	120	
		-40°C to 125°C	0.5	157	0.5	129	0.5	120	0.5	122	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	237	0.5	237	0.5	237	0.5	237	ns
		-40°C to 125°C	0.5	237	0.5	237	0.5	237	0.5	237	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	223	0.5	145	0.5	106	0.5	74	
		-40°C to 125°C	0.5	223	0.5	145	0.5	106	0.5	74	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V $\pm$ 0.1 V		1.8 V $\pm$ 0.15 V		2.5 V $\pm$ 0.2 V		3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	46	0.5	49	0.5	61	0.5	142	ns
		-40°C to 125°C	0.5	46	0.5	49	0.5	61	0.5	142	
	From input B to output A	-40°C to 85°C	0.5	83	0.5	82	0.5	81	0.5	81	
		-40°C to 125°C	0.5	83	0.5	82	0.5	81	0.5	81	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	192	0.5	192	0.5	192	0.5	192	ns
		-40°C to 125°C	0.5	195	0.5	195	0.5	195	0.5	195	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	69	0.5	66	0.5	67	0.5	150	
		-40°C to 125°C	0.5	70	0.5	67	0.5	67	0.5	150	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	237	0.5	237	0.5	237	0.5	237	ns
		-40°C to 125°C	0.5	237	0.5	237	0.5	237	0.5	237	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	68	0.5	69	0.5	84	0.5	552	
		-40°C to 125°C	0.5	68	0.5	69	0.5	84	0.5	552	

## 6.7 Switching Characteristics, $V_{CCA} = 0.8\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V $\pm$ 0.05 V		0.8 V $\pm$ 0.04 V		0.9 V $\pm$ 0.045 V		1.2 V $\pm$ 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	153	0.5	95	0.5	62	0.5	32	ns
		-40°C to 125°C	0.5	153	0.5	95	0.5	62	0.5	32	
	From input B to output A	-40°C to 85°C	0.5	114	0.5	95	0.5	78	0.5	52	
		-40°C to 125°C	0.5	114	0.5	95	0.5	78	0.5	52	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	101	0.5	101	0.5	101	0.5	101	ns
		-40°C to 125°C	0.5	103	0.5	103	0.5	103	0.5	103	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	141	0.5	114	0.5	104	0.5	106	
		-40°C to 125°C	0.5	142	0.5	115	0.5	106	0.5	109	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	102	0.5	102	0.5	102	0.5	102	ns
		-40°C to 125°C	0.5	102	0.5	102	0.5	102	0.5	102	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	202	0.5	124	0.5	86	0.5	52	
		-40°C to 125°C	0.5	202	0.5	124	0.5	86	0.5	52	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V $\pm$ 0.1 V		1.8 V $\pm$ 0.15 V		2.5 V $\pm$ 0.2 V		3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	26	0.5	25	0.5	25	0.5	35	ns
		-40°C to 125°C	0.5	26	0.5	25	0.5	25	0.5	35	
	From input B to output A	-40°C to 85°C	0.5	42	0.5	41	0.5	40	0.5	40	
		-40°C to 125°C	0.5	42	0.5	41	0.5	40	0.5	40	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	101	0.5	101	0.5	101	0.5	101	ns
		-40°C to 125°C	0.5	103	0.5	103	0.5	103	0.5	103	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	55	0.5	51	0.5	49	0.5	51	
		-40°C to 125°C	0.5	57	0.5	53	0.5	50	0.5	52	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	102	0.5	102	0.5	102	0.5	102	ns
		-40°C to 125°C	0.5	102	0.5	102	0.5	102	0.5	102	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	44	0.5	43	0.5	45	0.5	58	
		-40°C to 125°C	0.5	44	0.5	43	0.5	45	0.5	58	



## 6.8 Switching Characteristics, $V_{CCA} = 0.9\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V ± 0.05 V		0.8 V ± 0.04 V		0.9 V ± 0.045 V		1.2 V ± 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	–40°C to 85°C	0.5	127	0.5	78	0.5	52	0.5	23	ns
		–40°C to 125°C	0.5	127	0.5	78	0.5	52	0.5	23	
	From input B to output A	–40°C to 85°C	0.5	82	0.5	63	0.5	52	0.5	39	
		–40°C to 125°C	0.5	82	0.5	63	0.5	52	0.5	39	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	125	0.5	125	0.5	125	0.5	125	ns
		–40°C to 125°C	0.5	128	0.5	128	0.5	128	0.5	128	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	131	0.5	105	0.5	96	0.5	99	
		–40°C to 125°C	0.5	133	0.5	107	0.5	98	0.5	101	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	124	0.5	124	0.5	124	0.5	124	ns
		–40°C to 125°C	0.5	128	0.5	128	0.5	128	0.5	128	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	191	0.5	113	0.5	75	0.5	41	
		–40°C to 125°C	0.5	191	0.5	113	0.5	75	0.5	41	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	–40°C to 85°C	0.5	17	0.5	15	0.5	14	0.5	17	ns
		–40°C to 125°C	0.5	17	0.5	15	0.5	14	0.5	17	
	From input B to output A	–40°C to 85°C	0.5	28	0.5	24	0.5	22	0.5	22	
		–40°C to 125°C	0.5	28	0.5	24	0.5	22	0.5	22	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	125	0.5	125	0.5	125	0.5	125	ns
		–40°C to 125°C	0.5	128	0.5	128	0.5	128	0.5	128	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	47	0.5	44	0.5	40	0.5	73	
		–40°C to 125°C	0.5	50	0.5	46	0.5	42	0.5	73	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	124	0.5	124	0.5	124	0.5	124	ns
		–40°C to 125°C	0.5	128	0.5	128	0.5	128	0.5	128	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	34	0.5	32	0.5	31	0.5	35	
		–40°C to 125°C	0.5	34	0.5	32	0.5	31	0.5	35	

## 6.9 Switching Characteristics, $V_{CCA} = 1.2\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V ± 0.05 V		0.8 V ± 0.04 V		0.9 V ± 0.045 V		1.2 V ± 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	–40°C to 85°C	0.5	88	0.5	52	0.5	39	0.5	15	ns
		–40°C to 125°C	0.5	88	0.5	52	0.5	39	0.5	15	
	From input B to output A	–40°C to 85°C	0.5	49	0.5	32	0.5	23	0.5	15	
		–40°C to 125°C	0.5	49	0.5	32	0.5	23	0.5	15	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	87	0.5	87	0.5	87	0.5	87	ns
		–40°C to 125°C	0.5	91	0.5	91	0.5	91	0.5	91	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	119	0.5	94	0.5	85	0.5	89	
		–40°C to 125°C	0.5	121	0.5	96	0.5	88	0.5	93	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	34	0.5	34	0.5	34	0.5	34	ns
		–40°C to 125°C	0.5	36	0.5	36	0.5	36	0.5	36	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	168	0.5	98	0.5	61	0.5	29	
		–40°C to 125°C	0.5	168	0.5	98	0.5	61	0.5	30	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	–40°C to 85°C	0.5	10	0.5	9	0.5	7	0.5	7	ns
		–40°C to 125°C	0.5	10	0.5	9	0.5	7	0.5	8	
	From input B to output A	–40°C to 85°C	0.5	13	0.5	11	0.5	8	0.5	7	
		–40°C to 125°C	0.5	13	0.5	11	0.5	8	0.5	7	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	87	0.5	87	0.5	87	0.5	87	ns
		–40°C to 125°C	0.5	91	0.5	91	0.5	91	0.5	91	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	38	0.5	35	0.5	31	0.5	29	
		–40°C to 125°C	0.5	41	0.5	38	0.5	33	0.5	31	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	34	0.5	34	0.5	34	0.5	34	ns
		–40°C to 125°C	0.5	36	0.5	36	0.5	36	0.5	36	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	22	0.5	19	0.5	17	0.5	17	
		–40°C to 125°C	0.5	23	0.5	20	0.5	18	0.5	18	

## 6.10 Switching Characteristics, $V_{CCA} = 1.5\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V ± 0.05 V		0.8 V ± 0.04 V		0.9 V ± 0.045 V		1.2 V ± 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	–40°C to 85°C	0.5	84	0.5	42	0.5	28	0.5	13	ns
		–40°C to 125°C	0.5	84	0.5	42	0.5	28	0.5	13	
	From input B to output A	–40°C to 85°C	0.5	46	0.5	26	0.5	17	0.5	10	
		–40°C to 125°C	0.5	46	0.5	26	0.5	17	0.5	10	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	34	0.5	34	0.5	34	0.5	34	ns
		–40°C to 125°C	0.5	37	0.5	37	0.5	37	0.5	37	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	115	0.5	89	0.5	80	0.5	85	
		–40°C to 125°C	0.5	117	0.5	91	0.5	83	0.5	89	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	21	0.5	21	0.5	21	0.5	21	ns
		–40°C to 125°C	0.5	23	0.5	23	0.5	23	0.5	23	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	159	0.5	90	0.5	55	0.5	24	
		–40°C to 125°C	0.5	159	0.5	90	0.5	55	0.5	25	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	–40°C to 85°C	0.5	9	0.5	7	0.5	6	0.5	5	ns
		–40°C to 125°C	0.5	9	0.5	7	0.5	6	0.5	6	
	From input B to output A	–40°C to 85°C	0.5	9	0.5	7	0.5	6	0.5	5	
		–40°C to 125°C	0.5	9	0.5	8	0.5	6	0.5	5	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	34	0.5	34	0.5	34	0.5	34	ns
		–40°C to 125°C	0.5	37	0.5	37	0.5	37	0.5	37	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	35	0.5	31	0.5	28	0.5	25	
		–40°C to 125°C	0.5	38	0.5	34	0.5	31	0.5	27	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	–40°C to 85°C	0.5	21	0.5	21	0.5	21	0.5	21	ns
		–40°C to 125°C	0.5	23	0.5	23	0.5	23	0.5	23	
	From input $\overline{OE}$ to output B	–40°C to 85°C	0.5	17	0.5	15	0.5	12	0.5	11	
		–40°C to 125°C	0.5	18	0.5	15	0.5	13	0.5	12	

## 6.11 Switching Characteristics, $V_{CCA} = 1.8\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V $\pm$ 0.05 V		0.8 V $\pm$ 0.04 V		0.9 V $\pm$ 0.045 V		1.2 V $\pm$ 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	82	0.5	41	0.5	24	0.5	11	ns
		-40°C to 125°C	0.5	82	0.5	41	0.5	24	0.5	11	
	From input B to output A	-40°C to 85°C	0.5	49	0.5	25	0.5	15	0.5	9	
		-40°C to 125°C	0.5	49	0.5	25	0.5	15	0.5	9	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	37	0.5	37	0.5	37	0.5	37	ns
		-40°C to 125°C	0.5	40	0.5	40	0.5	40	0.5	40	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	113	0.5	87	0.5	78	0.5	83	
		-40°C to 125°C	0.5	115	0.5	89	0.5	81	0.5	87	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	17	0.5	17	0.5	17	0.5	17	ns
		-40°C to 125°C	0.5	19	0.5	19	0.5	19	0.5	19	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	157	0.5	88	0.5	54	0.5	23	
		-40°C to 125°C	0.5	157	0.5	88	0.5	54	0.5	23	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V $\pm$ 0.1 V		1.8 V $\pm$ 0.15 V		2.5 V $\pm$ 0.2 V		3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	8	0.5	6	0.5	5	0.5	5	ns
		-40°C to 125°C	0.5	8	0.5	7	0.5	6	0.5	5	
	From input B to output A	-40°C to 85°C	0.5	7	0.5	6	0.5	5	0.5	4	
		-40°C to 125°C	0.5	7	0.5	7	0.5	5	0.5	4	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	37	0.5	37	0.5	37	0.5	37	ns
		-40°C to 125°C	0.5	40	0.5	40	0.5	40	0.5	40	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	33	0.5	30	0.5	27	0.5	57	
		-40°C to 125°C	0.5	36	0.5	33	0.5	29	0.5	60	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	17	0.5	17	0.5	17	0.5	17	ns
		-40°C to 125°C	0.5	19	0.5	19	0.5	19	0.5	19	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	15	0.5	13	0.5	10	0.5	9	
		-40°C to 125°C	0.5	16	0.5	14	0.5	11	0.5	10	

## 6.12 Switching Characteristics, $V_{CCA} = 2.5\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V $\pm$ 0.05 V		0.8 V $\pm$ 0.04 V		0.9 V $\pm$ 0.045 V		1.2 V $\pm$ 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	81	0.5	40	0.5	22	0.5	8	ns
		-40°C to 125°C	0.5	81	0.5	40	0.5	22	0.5	8	
	From input B to output A	-40°C to 85°C	0.5	61	0.5	25	0.5	14	0.5	7	
		-40°C to 125°C	0.5	61	0.5	25	0.5	14	0.5	7	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	25	0.5	25	0.5	25	0.5	25	ns
		-40°C to 125°C	0.5	28	0.5	28	0.5	28	0.5	28	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	111	0.5	85	0.5	76	0.5	81	
		-40°C to 125°C	0.5	113	0.5	87	0.5	78	0.5	84	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	11	0.5	11	0.5	11	0.5	11	ns
		-40°C to 125°C	0.5	12	0.5	12	0.5	12	0.5	12	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	155	0.5	86	0.5	52	0.5	21	
		-40°C to 125°C	0.5	155	0.5	86	0.5	52	0.5	21	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V $\pm$ 0.1 V		1.8 V $\pm$ 0.15 V		2.5 V $\pm$ 0.2 V		3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	6	0.5	5	0.5	4	0.5	4	ns
		-40°C to 125°C	0.5	6	0.5	5	0.5	5	0.5	4	
	From input B to output A	-40°C to 85°C	0.5	6	0.5	5	0.5	4	0.5	4	
		-40°C to 125°C	0.5	6	0.5	5	0.5	5	0.5	4	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	25	0.5	25	0.5	25	0.5	25	ns
		-40°C to 125°C	0.5	28	0.5	28	0.5	28	0.5	28	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	31	0.5	28	0.5	25	0.5	23	
		-40°C to 125°C	0.5	34	0.5	31	0.5	28	0.5	25	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	11	0.5	11	0.5	11	0.5	11	ns
		-40°C to 125°C	0.5	12	0.5	12	0.5	12	0.5	12	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	14	0.5	11	0.5	9	0.5	7	
		-40°C to 125°C	0.5	14	0.5	12	0.5	9	0.5	8	

### 6.13 Switching Characteristics, $V_{CCA} = 3.3\text{ V}$

See [Figure 1](#) and [Figure 2](#) for test circuit and loading conditions. See [Figure 3](#) and [Figure 4](#) for measurement waveforms.

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			0.7 V $\pm$ 0.05 V		0.8 V $\pm$ 0.04 V		0.9 V $\pm$ 0.045 V		1.2 V $\pm$ 0.1 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	81	0.5	40	0.5	22	0.5	7	ns
		-40°C to 125°C	0.5	81	0.5	40	0.5	22	0.5	7	
	From input B to output A	-40°C to 85°C	0.5	142	0.5	35	0.5	17	0.5	7	
		-40°C to 125°C	0.5	142	0.5	35	0.5	17	0.5	8	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	22	0.5	22	0.5	22	0.5	22	ns
		-40°C to 125°C	0.5	24	0.5	24	0.5	24	0.5	24	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	111	0.5	84	0.5	75	0.5	80	
		-40°C to 125°C	0.5	113	0.5	86	0.5	78	0.5	83	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	9	0.5	9	0.5	9	0.5	9	ns
		-40°C to 125°C	0.5	10	0.5	10	0.5	10	0.5	10	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	154	0.5	86	0.5	51	0.5	20	
		-40°C to 125°C	0.5	154	0.5	86	0.5	51	0.5	20	

PARAMETER	TEST CONDITIONS		B-PORT SUPPLY VOLTAGE ( $V_{CCB}$ )								UNIT
			1.5 V $\pm$ 0.1 V		1.8 V $\pm$ 0.15 V		2.5 V $\pm$ 0.2 V		3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$ Propagation delay	From input A to output B	-40°C to 85°C	0.5	5	0.5	4	0.5	4	0.5	4	ns
		-40°C to 125°C	0.5	5	0.5	4	0.5	4	0.5	4	
	From input B to output A	-40°C to 85°C	0.5	5	0.5	5	0.5	4	0.5	4	
		-40°C to 125°C	0.5	6	0.5	5	0.5	4	0.5	4	
$t_{dis}$ Disable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	22	0.5	22	0.5	22	0.5	22	ns
		-40°C to 125°C	0.5	24	0.5	24	0.5	24	0.5	24	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	30	0.5	27	0.5	25	0.5	23	
		-40°C to 125°C	0.5	33	0.5	30	0.5	27	0.5	25	
$t_{en}$ Enable time	From input $\overline{OE}$ to output A	-40°C to 85°C	0.5	9	0.5	9	0.5	9	0.5	9	ns
		-40°C to 125°C	0.5	10	0.5	10	0.5	10	0.5	10	
	From input $\overline{OE}$ to output B	-40°C to 85°C	0.5	13	0.5	10	0.5	8	0.5	7	
		-40°C to 125°C	0.5	14	0.5	11	0.5	8	0.5	7	

**6.14 Operating Characteristics:  $T_A = 25^\circ\text{C}$** 

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$C_{pdA}$ Power dissipation capacitance per transceiver (A to B: outputs enabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		1.2	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		2	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		2.5	
$C_{pdA}$ Power dissipation capacitance per transceiver (A to B: outputs disabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		1.1	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		2	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		2.1	
$C_{pdA}$ Power dissipation capacitance per transceiver (B to A: outputs enabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		9.3	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		11.8	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		11.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		12	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		12.2	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		13	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		16.4	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		18.1	
$C_{pdA}$ Power dissipation capacitance per transceiver (B to A: outputs disabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		2.6	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		1.2	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		1.1	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		1.2	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		1.2	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		1.3	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		1.6	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		3.9	

**ADVANCE INFORMATION**

**Operating Characteristics:  $T_A = 25^\circ\text{C}$  (continued)**

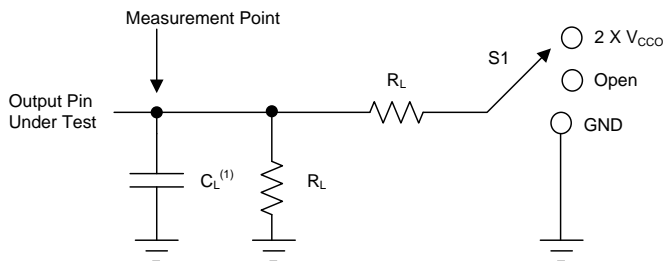
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$C_{pdB}$ Power dissipation capacitance per transceiver (A to B: outputs enabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		9.3	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		11.7	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		11.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		11.9	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		12.2	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		12.9	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		16.3	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		18	
$C_{pdB}$ Power dissipation capacitance per transceiver (A to B: outputs disabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		2.6	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		11.7	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		11.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		11.9	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		12.2	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		12.9	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		16.3	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		3.9	
$C_{pdB}$ Power dissipation capacitance per transceiver (B to A: outputs enabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		1.2	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		2	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		2.5	
$C_{pdB}$ Power dissipation capacitance per transceiver (B to A: outputs disabled)	$C_L = 0$ , $R_L = \text{Open}$ $f = 1 \text{ MHz}$ , $t_r = t_f = 1 \text{ ns}$	$V_{CCA} = V_{CCB} = 0.7 \text{ V}$		1.1	pF
		$V_{CCA} = V_{CCB} = 0.8 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 0.9 \text{ V}$		1.8	
		$V_{CCA} = V_{CCB} = 1.2 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.5 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 1.8 \text{ V}$		1.7	
		$V_{CCA} = V_{CCB} = 2.5 \text{ V}$		2	
		$V_{CCA} = V_{CCB} = 3.3 \text{ V}$		2.1	



## 7 Parameter Measurement Information

Unless otherwise noted, all input pulses are supplied by generators having the following characteristics:

- $f = 1$  MHz
- $Z_0 = 50 \Omega$
- $dv / dt \leq 1$  ns/V



(1)  $C_L$  includes probe and jig capacitance.

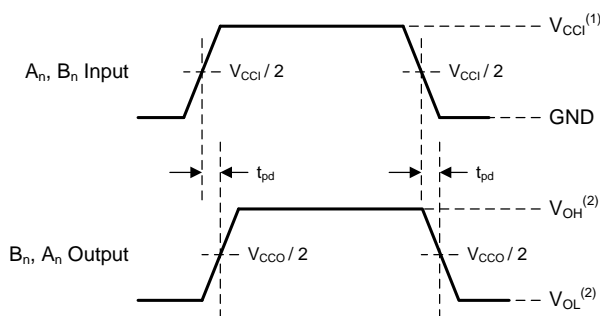
Figure 1. Load Circuit

Parameter	$V_{CC0}$	$R_L$	$C_L$	S1	$V_{TP}$
$t_{pd}$	1.1 V - 3.6 V	2 k $\Omega$	15 pF	Open	N/A
	0.65 V - 0.95 V	20 k $\Omega$	15 pF	Open	N/A
$t_{en}^{(1)}, t_{dis}^{(1)}$	3 V - 3.6 V	2 k $\Omega$	15 pF	2 X $V_{CC0}$	0.3 V
	1.65 V - 2.7 V	2 k $\Omega$	15 pF	2 X $V_{CC0}$	0.15 V
	1.1 V - 1.6 V	2 k $\Omega$	15 pF	2 X $V_{CC0}$	0.1 V
	0.65 V - 0.95 V	20 k $\Omega$	15 pF	2 X $V_{CC0}$	0.1 V
$t_{en}^{(2)}, t_{dis}^{(2)}$	3 V - 3.6 V	2 k $\Omega$	15 pF	GND	0.3 V
	1.65 V - 2.7 V	2 k $\Omega$	15 pF	GND	0.15 V
	1.1 V - 1.6 V	2 k $\Omega$	15 pF	GND	0.1 V
	0.65 V - 0.95 V	20 k $\Omega$	15 pF	GND	0.1 V

(1) Output waveform on the conditions that input is driven to a valid Logic Low.

(2) Output waveform on the condition that input is driven to a valid Logic High.

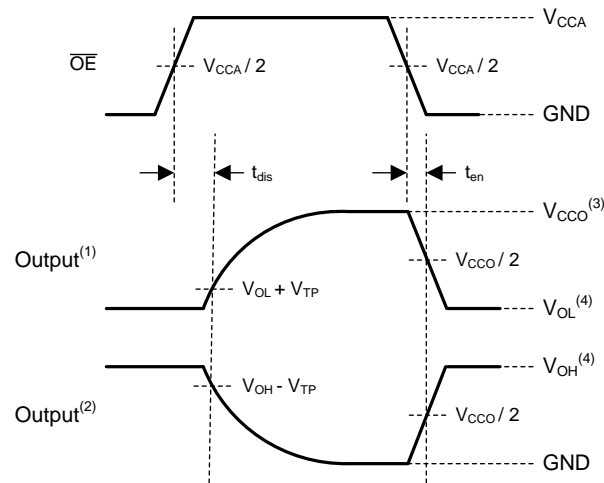
Figure 2. Load Circuit Conditions



(1)  $V_{CCI}$  is the supply pin associated with the input port.

(2)  $V_{OH}$  and  $V_{OL}$  are typical output voltage levels with specified  $R_L$ ,  $C_L$ , and  $S_1$ .

Figure 3. Propagation Delay

**Parameter Measurement Information (continued)**


- (1) Output waveform on the condition that input is driven to a valid Logic Low.
- (2) Output waveform on the condition that input is driven to a valid Logic High.
- (3)  $V_{CCO}$  is the supply pin associated with the output port.
- (4)  $V_{OH}$  and  $V_{OL}$  are typical output voltage levels with specified  $R_L$ ,  $C_L$ , and  $S_1$ .

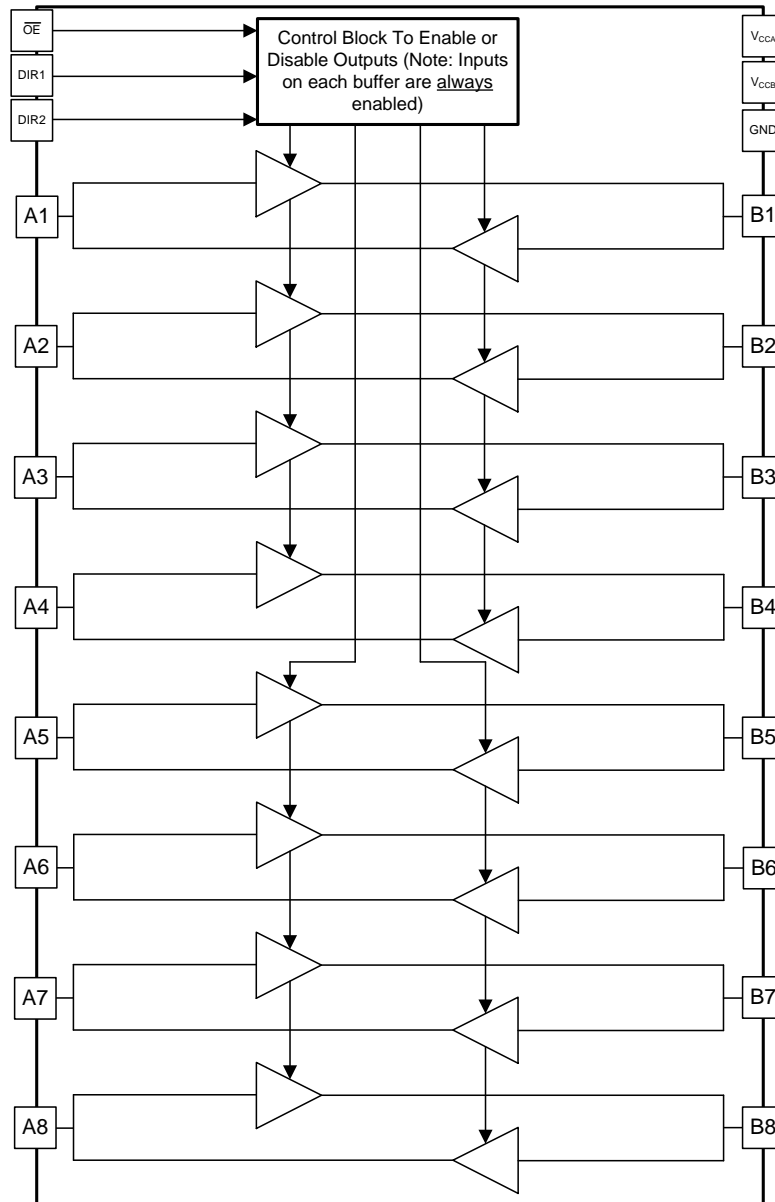
**Figure 4. Enable Time And Disable Time**

## 8 Detailed Description

### 8.1 Overview

The SN74AXC8T245-Q1 device is an 8-bit, dual-supply non-inverting transceiver with bidirectional voltage level translation. The I/O pins labeled with A and the control pins (DIR1, DIR2, and  $\overline{OE}$ ) are supported by  $V_{CCA}$ , and the I/O pins labeled with B are supported by  $V_{CCB}$ . Both the A port and the B port are able to accept I/O voltages ranging from 0.65 V to 3.6 V.

### 8.2 Functional Block Diagram



## 8.3 Feature Description

### 8.3.1 Up-Translation and Down-Translation From 0.65 V to 3.6 V

Both supply pins are configured from 0.65 V to 3.6 V, which makes the device suitable for translating between any of the low voltage nodes (0.7 V, 0.8 V, 0.9 V, 1.2 V, 1.8 V, 2.5 V, and 3.3 V).

### 8.3.2 Multiple Direction Control Pins

Two control pins are used to configure the 8 data I/Os. I/O channels 1 through 4 are grouped together and I/O channels 5 through 8 are banked together. The benefit of this is to permit simultaneous up-translation and down-translation within one device. This eliminates the need for multiple devices, where each device can only provide up-translation or down-translation sequentially. Simultaneous up and down translation is supported when both  $V_{CCA}$  and  $V_{CCB}$  are at least 1.40 V.

### 8.3.3 $I_{off}$ Supports Partial-Power-Down Mode Operation

This feature is to limit the leakage current of an I/O pin being driven to a voltage as large as 3.6 V while having its corresponding power supply rail powered down. This is represented by the  $I_{off}$  parameter in the [Electrical Characteristics](#) table.

## 8.4 Device Functional Modes

All control inputs are referenced to  $V_{CCA}$  and must be driven to a valid Logic High or Logic Low (that is, not floating) to assure proper device operation and to prevent excessive power consumption. [Table 1](#) summarizes the possible modes of device operation based on the configuration of the control inputs.

**Table 1. Function Table<sup>(1)</sup>**

CONTROL INPUTS			Signal Direction	
$\overline{OE}$	DIR1	DIR2	Bits 1:4	Bits 5:8
H	X	X	Disabled (Hi-Z)	
L	L	L	B to A	
L	L	H	B to A	A to B
L	H	L	A to B	
L	H	H	A to B	B to A

(1) Input circuits of the data I/Os are always active and must be driven to a valid logic level.

## 9 Application and Implementation

### NOTE

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

### 9.1 Application Information

The AEC-Q100 qualified SN74AXC8T245-Q1 device can be used in level-translation applications for interfacing devices or systems operating at different voltage nodes. Figure 5 depicts an application in which the SN74AXC8T245-Q1 device is up-translating a 0.7 V input to a 3.3 V output to interface between a system controller and a peripheral device.

### 9.2 Typical Application

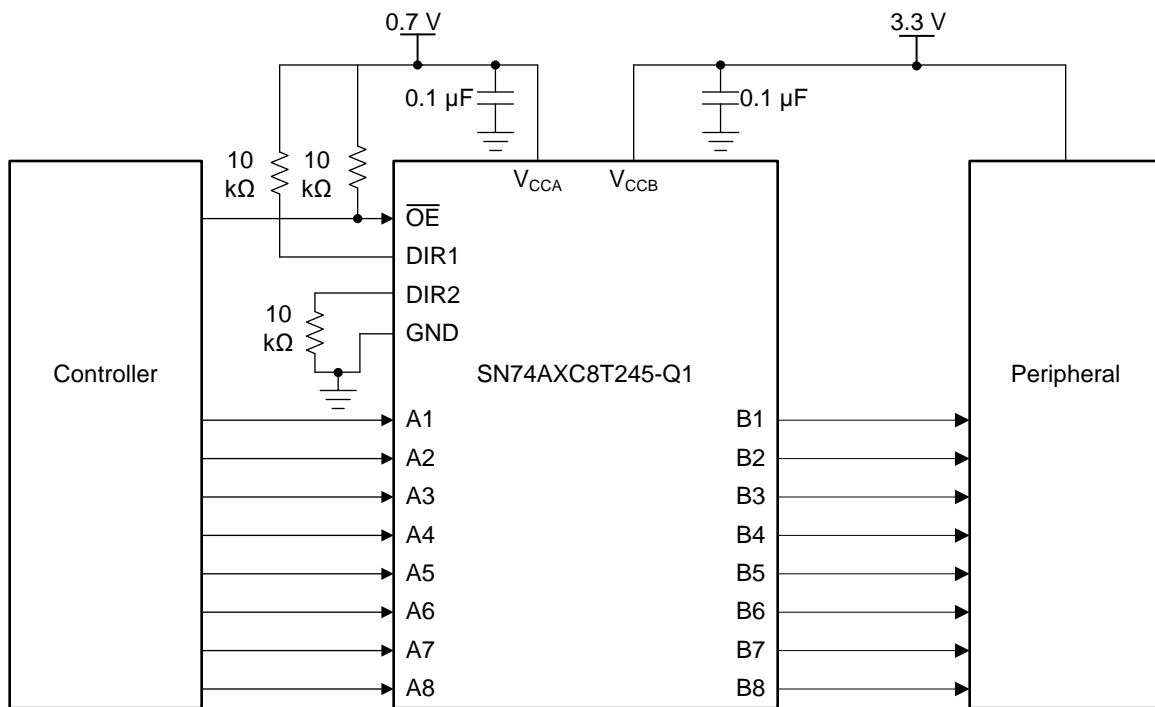


Figure 5. Typical Application Schematic

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## Typical Application (continued)

### 9.2.1 Design Requirements

For this design example, use the parameters listed in [Table 2](#).

**Table 2. Design Parameters**

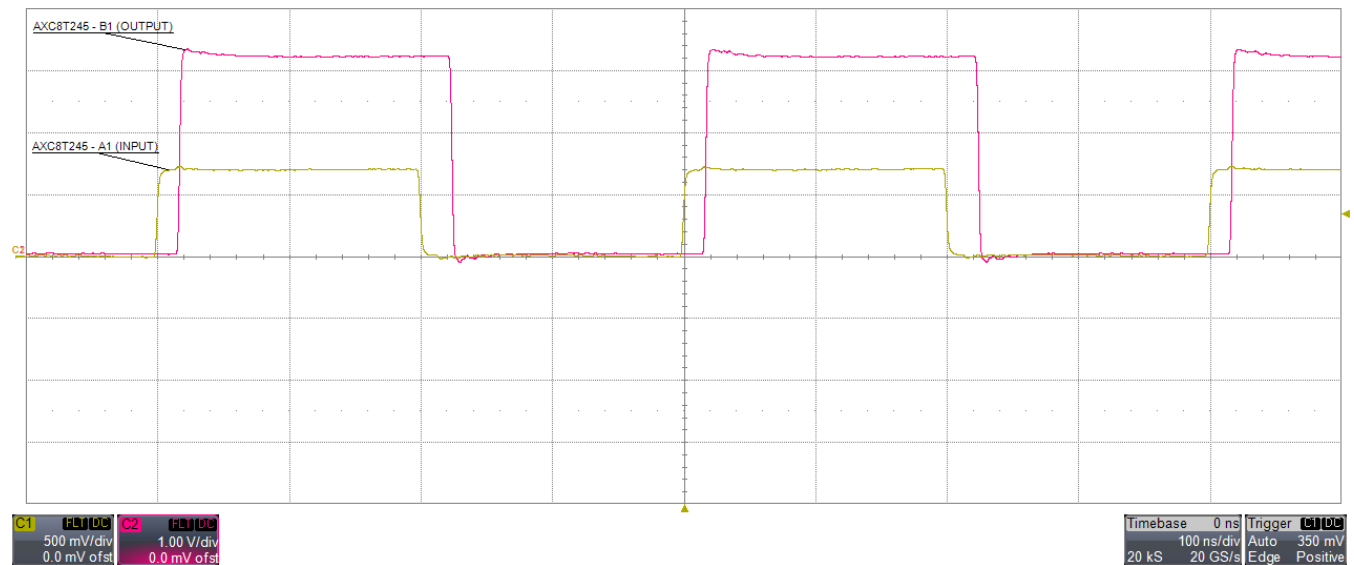
DESIGN PARAMETERS	EXAMPLE VALUE
Input voltage range	0.65 V to 3.6 V
Output voltage range	0.65 V to 3.6 V

### 9.2.2 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 SN74AXC8T245-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.
- Output voltage range
  - Use the supply voltage of the device that the SN74AXC8T245-Q1 device is driving to determine the output voltage range.

### 9.2.3 Application Curve



**Figure 6. Translation Up (0.7 V to 3.3 V) at 2.5 MHz**

## 10 Power Supply Recommendations

Always apply a ground reference to the GND pins first. There are no additional requirements for power supply sequencing.

This device was designed with various power supply sequencing methods in mind to help prevent unintended triggering of downstream devices. For more information regarding the power up glitch performance of the AXC family of level translators, see the [Power Sequencing for AXC Family of Devices](#) application report.

## 11 Layout

### 11.1 Layout Guidelines

To assure reliability of the device, 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 help adjust rise and fall times of signals depending on the system requirements.

### 11.2 Layout Example

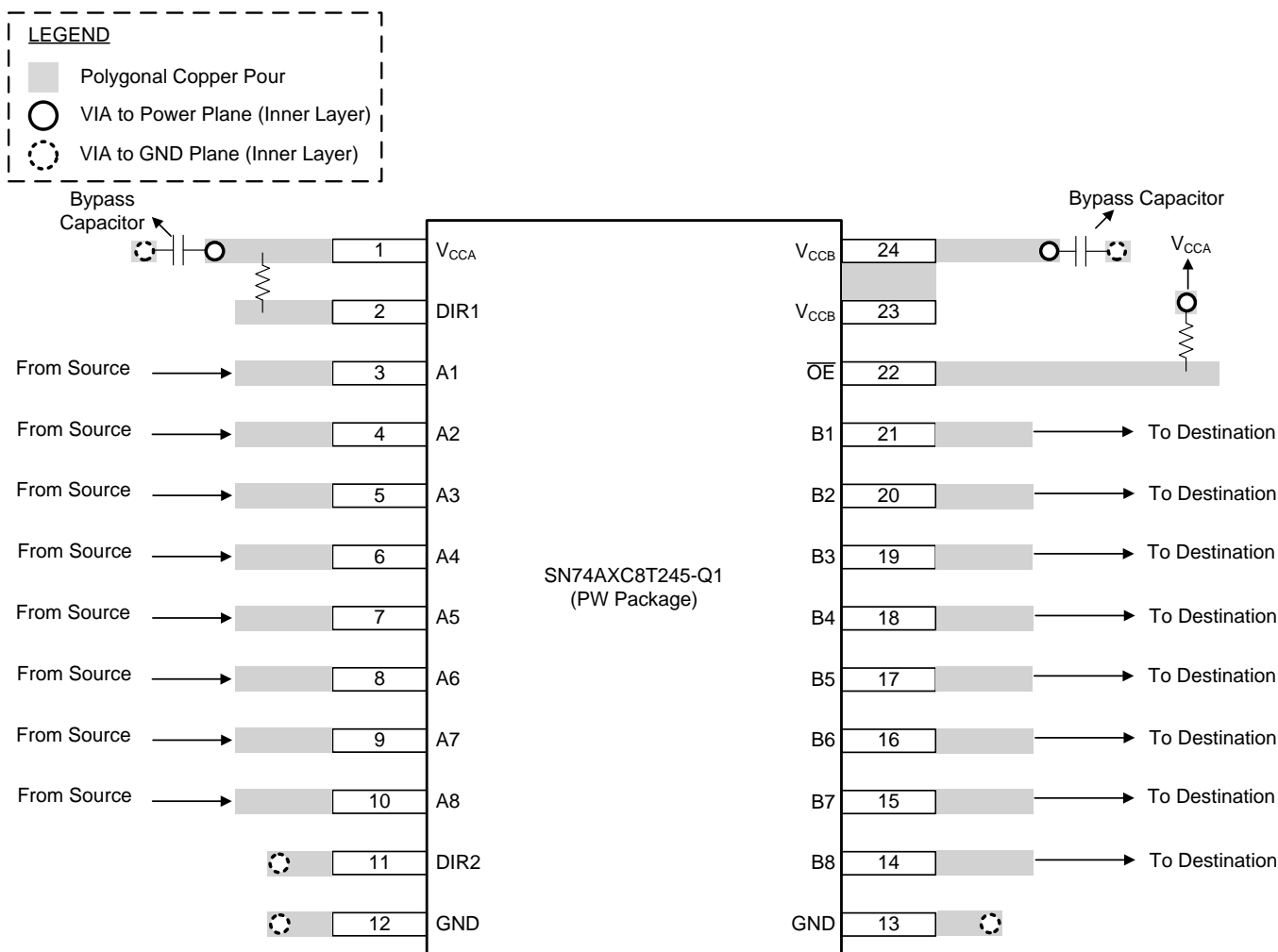


Figure 7. SN74AXC8T245-Q1 Device Layout Example

ADVANCE INFORMATION

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [Implications of Slow or Floating CMOS Inputs](#) application report
- Texas Instruments, [Power Sequencing for AXC Family of Devices](#) application report
- Texas Instruments, [Evaluate the SN74AXC8245-Q1](#) using the EVM

### 12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* 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.

### 12.3 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](http://e2e.ti.com), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 12.4 Trademarks

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 12.5 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.

### 12.6 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 13 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
PCAXC8T245QPWRQ1	ACTIVE	TSSOP	PW	24	2000	TBD	Call TI	Call TI	-40 to 125		<a href="#">Samples</a>
PCAXC8T245QRHLRQ1	ACTIVE	VQFN	RHL	24	1000	TBD	Call TI	Call TI	-40 to 125		<a href="#">Samples</a>
SN74AXC8T245QPWRQ1	PREVIEW	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	AX8T245Q	

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN74AXC8T245-Q1 :**

- Catalog: [SN74AXC8T245](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

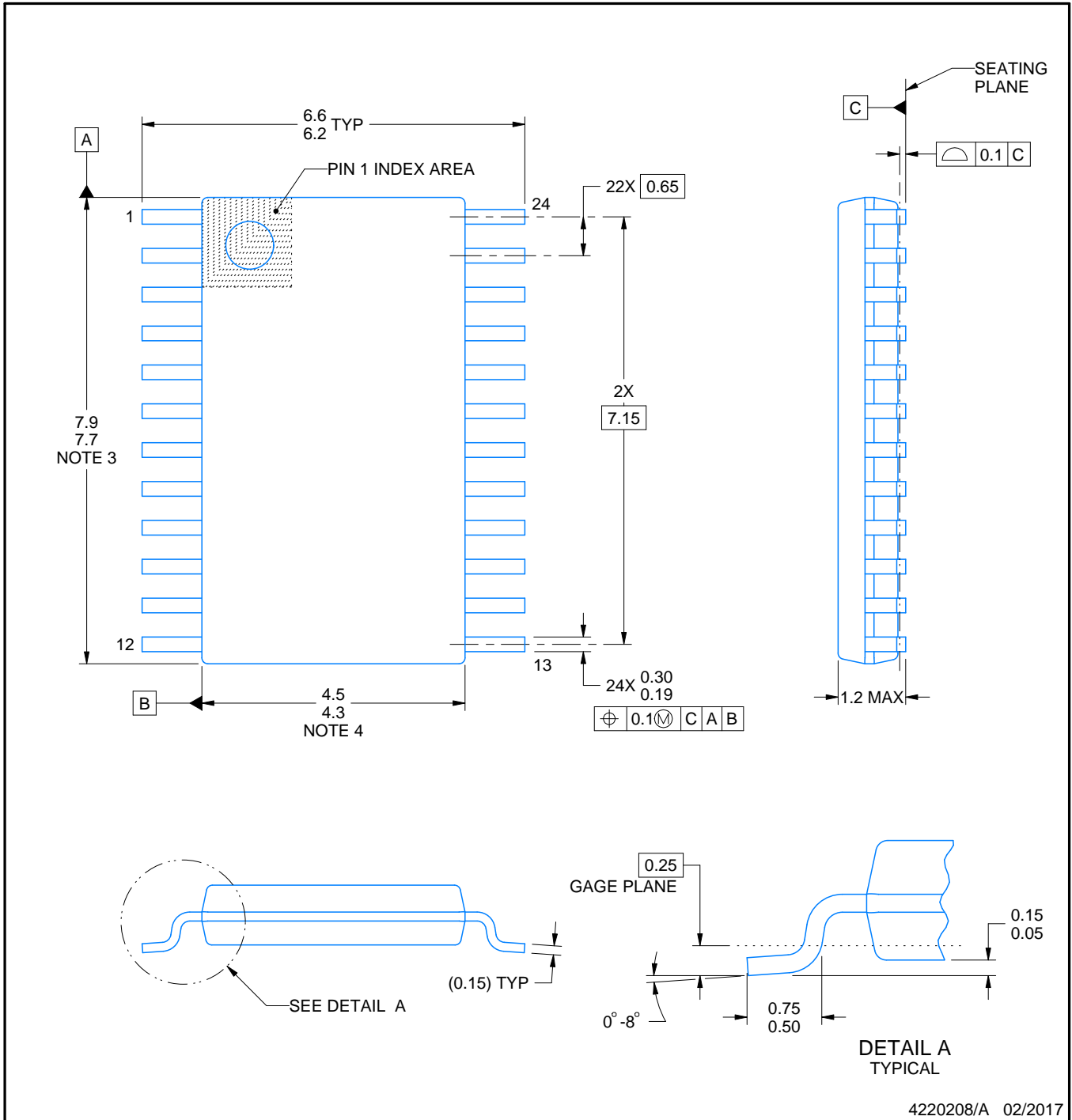
# PW0024A



# 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

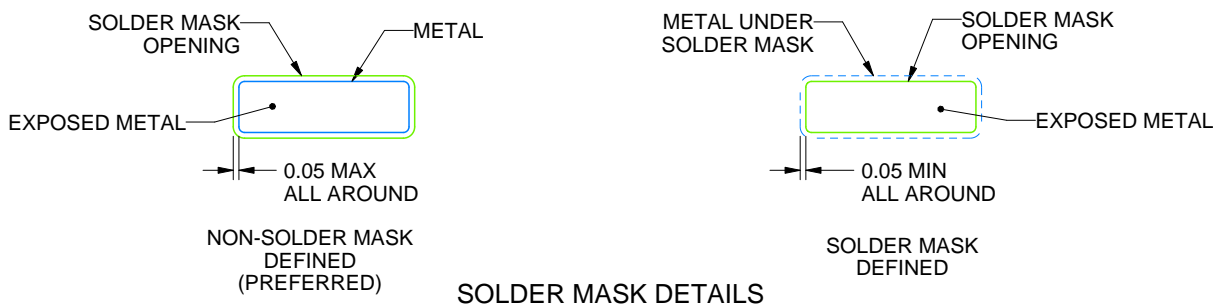
PW0024A

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



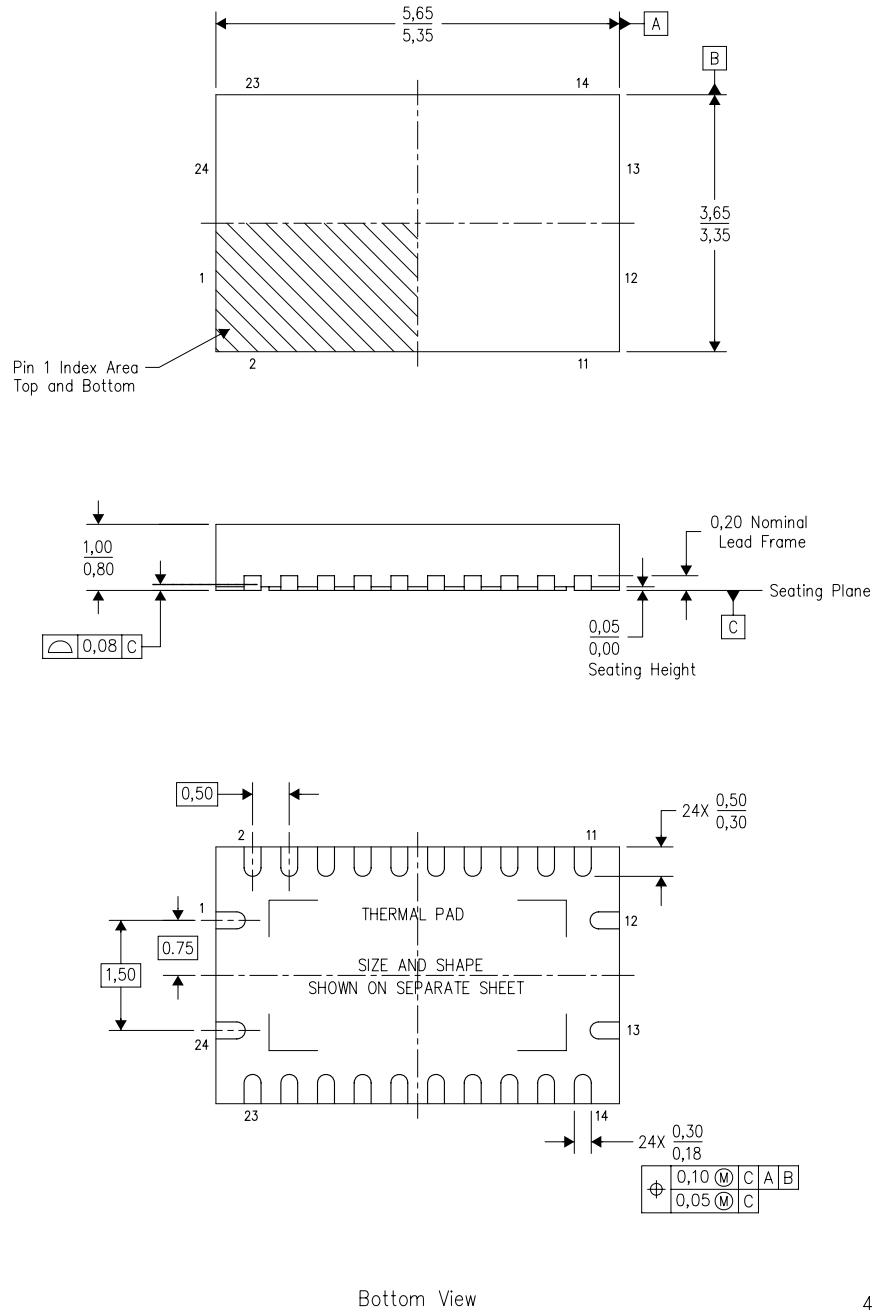
NOTES: (continued)

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.

# MECHANICAL DATA

RHL (R-PVQFN-N24)

PLASTIC QUAD FLATPACK NO-LEAD



4205346-4/J 12/11

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - JEDEC MO-241 package registration pending.

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