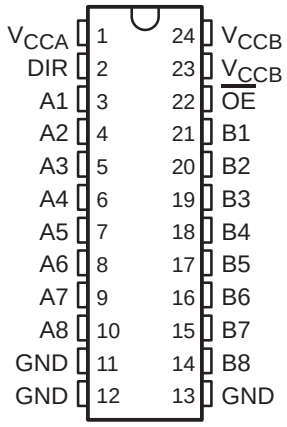
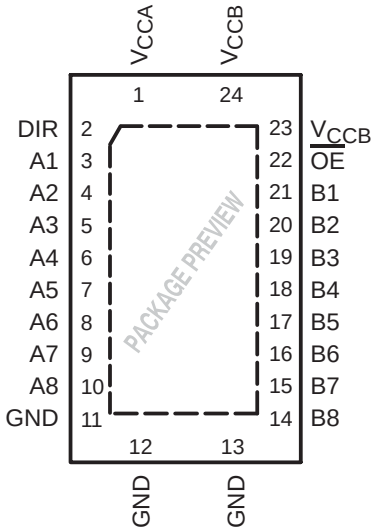
- **Control Inputs V_{IH}/V_{IL} Levels Are Referenced to V_{CCA} Voltage**
- **V_{CC} Isolation Feature − If Either V_{CC} Input Is at GND, Both Ports Are in the High-Impedance State**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.4-V to 3.6-V Power-Supply Range**
- **I/Os Are 4.6-V Tolerant**

DGV OR PW PACKAGE
(TOP VIEW)



NC − No internal connection

RGY PACKAGE
(TOP VIEW)



description/ordering information

This 8-bit noninverting bus transceiver uses two separate configurable power-supply rails. The A-port is designed to track V_{CCA}. V_{CCA} accepts any supply voltage from 1.4 V to 3.6 V. The B-port is designed to track V_{CCB}. V_{CCB} accepts any supply voltage from 1.4 V to 3.6 V. This allows universal low-voltage bidirectional translation between any of the 1.5-V, 1.8-V, 2.5-V, and 3.3-V voltage nodes.

The SN74AVC8T245 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 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.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	QFN − RGY	Tape and reel	SN74AVC8T245RGYR	TBD
	TSSOP − PW	Tube	SN74AVC8T245PW	TBD
		Tape and reel	SN74AVC8T245PWR	
	TVSOP − DGV	Tape and reel	SN74AVC8T245DGVR	TBD

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

PACKAGE PREVIEW

PRODUCT PREVIEW

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

description/ordering information (continued)

The SN74AVC8T245 is designed so that the control pins (DIR and $\overline{OE}$) are supplied by V_{CCA}.

The SN74AVC8T245 solution is compatible with a single-supply system and can be replaced later with a ’245 function with minimal PCB redesign.

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

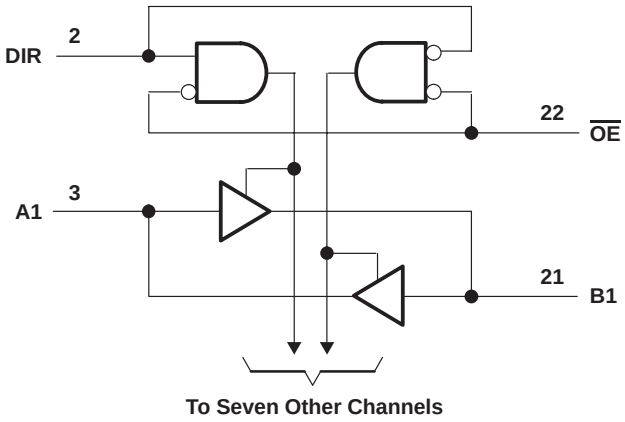
The V_{CC} isolation feature ensures that if either V_{CC} input is at GND, both ports are in the high-impedance state.

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

FUNCTION TABLE
(each 8-bit section)

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CCA} and V_{CCB}	−0.5 V to 4.6 V
Input voltage range, V_I (see Note 1): I/O ports (A port)	−0.5 V to 4.6 V
I/O ports (B port)	−0.5 V to 4.6 V
Control inputs	−0.5 V to 4.6 V
Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1): A port	−0.5 V to 4.6 V
B port	−0.5 V to 4.6 V
Voltage range applied to any output in the high or low state, V_O (see Notes 1 and 2): A port	−0.5 V to V_{CCA} + 0.5 V
B port	−0.5 V to V_{CCB} + 0.5 V
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 mA
Continuous current through V_{CCA}, V_{CCB}, or GND	±100 mA
Package thermal impedance, θ_{JA} (see Note 3): DGV package	86°C/W
PW package	88°C/W
RGY package	TBD°C/W
Storage temperature range, T_{stg}	−65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
2. The output positive-voltage rating may be exceeded up to 4.6 V maximum if the output current rating is observed.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

PRODUCT PREVIEW

recommended operating conditions (see Notes 4 through 6)

			V_{CCI}	V_{CCO}	MIN	MAX	UNIT
V_{CCA}	Supply voltage				1.4	3.6	V
V_{CCB}	Supply voltage				1.4	3.6	V
V_{IH}	High-level input voltage	Data inputs	1.4 V to 1.95 V		$V_{CCI} \times 0.65$		V
			1.95 V to 2.7 V		1.6		
			2.7 V to 3.6 V		2		
V_{IL}	Low-level input voltage	Data inputs	1.4 V to 1.95 V			$V_{CCI} \times 0.35$	V
			1.95 V to 2.7 V			0.7	
			2.7 V to 3.6 V			0.8	
V_{IH}	High-level input voltage	DIR and $\overline{OE}$ (Referenced to V_{CCA})	1.4 V to 1.95 V		$V_{CCA} \times 0.65$		V
			1.95 V to 2.7 V		1.6		
			2.7 V to 3.6 V		2		
V_{IL}	Low-level input voltage	DIR and $\overline{OE}$ (Referenced to V_{CCA})	1.4 V to 1.95 V			$V_{CCA} \times 0.35$	V
			1.95 V to 2.7 V			0.7	
			2.7 V to 3.6 V			0.8	
V_O	Output voltage	Active state			0	V_{CCO}	V
		3-state			0	3.6	
V_I	Input voltage				0	3.6	V
I_{OH}	High-level output current			1.4 V to 1.6 V		−6	mA
				1.65 V to 1.95 V		−8	
				2.3 V to 2.7 V		−9	
				3 V to 3.6 V		−12	
I_{OL}	Low-level output current			1.4 V to 1.6 V		6	mA
				1.65 V to 1.95 V		8	
				2.3 V to 2.7 V		9	
				3 V to 3.6 V		12	
$\Delta t/\Delta v$	Input transition rise or fall rate					5	ns/V
T_A	Operating free-air temperature				−40	85	°C

NOTES: 4. V_{CCI} is the V_{CC} associated with the data input port.
5. V_{CCO} is the V_{CC} associated with the output port.
6. All unused data inputs of the device must be held at V_{CCI} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Notes 7 and 8)

PARAMETER		TEST CONDITIONS		V_{CCA}	V_{CCB}	MIN	TYP†	MAX	UNIT
V_{OH}		I_{OH} = −100 μA	$V_I = V_{IH}$	1.4 V to 3.6 V	1.4 V to 3.6 V	V_{CCO}−0.2			V
		I_{OH} = −6 mA	$V_I = V_{IH}$	1.4 V	1.4 V	TBD			
		I_{OH} = −8 mA	$V_I = V_{IH}$	1.65 V	1.65 V	1.2			
		I_{OH} = −9 mA	$V_I = V_{IH}$	2.3 V	2.3 V	1.75			
		I_{OH} = −12 mA	$V_I = V_{IH}$	3 V	3 V	2.3			
V_{OL}		I_{OL} = 100 μA	$V_I = V_{IL}$	1.4 V to 3.6 V	1.4 V to 3.6 V			0.2	V
		I_{OL} = 6 mA	$V_I = V_{IL}$	1.4 V	1.4 V			0.35	
		I_{OL} = 8 mA	$V_I = V_{IL}$	1.65 V	1.65 V			0.45	
		I_{OL} = 9 mA	$V_I = V_{IL}$	2.3 V	2.3 V			0.55	
		I_{OL} = 12 mA	$V_I = V_{IL}$	3 V	3 V			0.7	
I_I	Control inputs	$V_I = V_{CCA}$ or GND		1.4 V to 3.6 V	3.6 V			±2.5	μA
I_{off}	A port	V_I or V_O= 0 to 3.6 V		0 V	0 to 3.6 V			±5	μA
	B port			0 to 3.6 V	0 V			±5	
I_{OZ}‡	A or B ports	$V_O = V_{CCO}$ or GND, $V_I = V_{CCI}$ or GND	$\overline{OE} = V_{IH}$	3.6 V	3.6 V		±2.5	±5	μA
	B port		$\overline{OE}$ = don't care	0 V	3.6 V		±2.5	±5	
	A port			3.6 V	0 V		±2.5	±5	
I_{CCA}		$V_I = V_{CCI}$ or GND,	I_O = 0	1.6 V	1.6 V			3	μA
				1.95 V	1.95 V			4	
				2.7 V	2.7 V			5	
				0 V	3.6 V			−1	
				3.6 V	0 V			4	
				3.6 V	3.6 V			8	
I_{CCB}		$V_I = V_{CCI}$ or GND,	I_O = 0	1.6 V	1.6 V			3	μA
				1.95 V	1.95 V			4	
				2.7 V	2.7 V			5	
				0 V	3.6 V			4	
				3.6 V	0 V			−1	
				3.6 V	3.6 V			8	
I_{CCA} + I_{CCB} (see Table 1)		$V_I = V_{CCI}$ or GND,	I_O = 0	1.4 V to 3.6 V	1.4 V to 3.6 V			TBD	μA
C_i	Control inputs	V_I = 3.3 V or GND		3.3 V	3.3 V				pF
C_{io}	A or B ports	V_O = 3.3 V or GND		3.3 V	3.3 V				pF

† All typical values are at T_A = 25°C.
‡ For I/O ports, the parameter I_{OZ} includes the input leakage current.
NOTES: 7. V_{CCO} is the V_{CC} associated with the output port.
8. V_{CCI} is the V_{CC} associated with the input port.

PRODUCT PREVIEW

switching characteristics over recommended operating free-air temperature range, V_{CCA} = 1.5 V ± 0.1 V (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.5 V ± 0.1 V		V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B									ns
t_{PHL}											
t_{PLH}	B	A									ns
t_{PHL}											
t_{PZH}	$\overline{OE}$	A									ns
t_{PZL}											
t_{PZH}	$\overline{OE}$	B									ns
t_{PZL}											
t_{PHZ}	$\overline{OE}$	A									ns
t_{PLZ}											
t_{PHZ}	$\overline{OE}$	B									ns
t_{PLZ}											

switching characteristics over recommended operating free-air temperature range, V_{CCA} = 1.8 V ± 0.15 V (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.5 V ± 0.1 V		V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B									ns
t_{PHL}											
t_{PLH}	B	A									ns
t_{PHL}											
t_{PZH}	$\overline{OE}$	A									ns
t_{PZL}											
t_{PZH}	$\overline{OE}$	B									ns
t_{PZL}											
t_{PHZ}	$\overline{OE}$	A									ns
t_{PLZ}											
t_{PHZ}	$\overline{OE}$	B									ns
t_{PLZ}											

switching characteristics over recommended operating free-air temperature range, V_{CCA} = 2.5 V ± 0.2 V (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.5 V ± 0.1 V		V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B									ns
t_{PHL}											
t_{PLH}	B	A									ns
t_{PHL}											
t_{PZH}	$\overline{OE}$	A									ns
t_{PZL}											
t_{PZH}	$\overline{OE}$	B									ns
t_{PZL}											
t_{PHZ}	$\overline{OE}$	A									ns
t_{PLZ}											
t_{PHZ}	$\overline{OE}$	B									ns
t_{PLZ}											

switching characteristics over recommended operating free-air temperature range, V_{CCA} = 3.3 V ± 0.3 V (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.5 V ± 0.1 V		V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B									ns
t_{PHL}											
t_{PLH}	B	A									ns
t_{PHL}											
t_{PZH}	$\overline{OE}$	A									ns
t_{PZL}											
t_{PZH}	$\overline{OE}$	B									ns
t_{PZL}											
t_{PHZ}	$\overline{OE}$	A									ns
t_{PLZ}											
t_{PHZ}	$\overline{OE}$	B									ns
t_{PLZ}											

operating characteristics, V_{CCA} and V_{CCB} = 3.3 V, T_A = 25°C

PARAMETER			TEST CONDITIONS	TYP	UNIT
C_{pdA}	Power dissipation capacitance per transceiver, A port input, B port output	Outputs enabled	C_L = 0, f = 10 MHz		pF
		Outputs disabled			
	Power dissipation capacitance per transceiver, B port input, A port output	Outputs enabled			
		Outputs disabled			
C_{pdB}	Power dissipation capacitance per transceiver, A port input, B port output	Outputs enabled	C_L = 0, f = 10 MHz		pF
		Outputs disabled			
	Power dissipation capacitance per transceiver, B port input, A port output	Outputs enabled			
		Outputs disabled			

PRODUCT PREVIEW

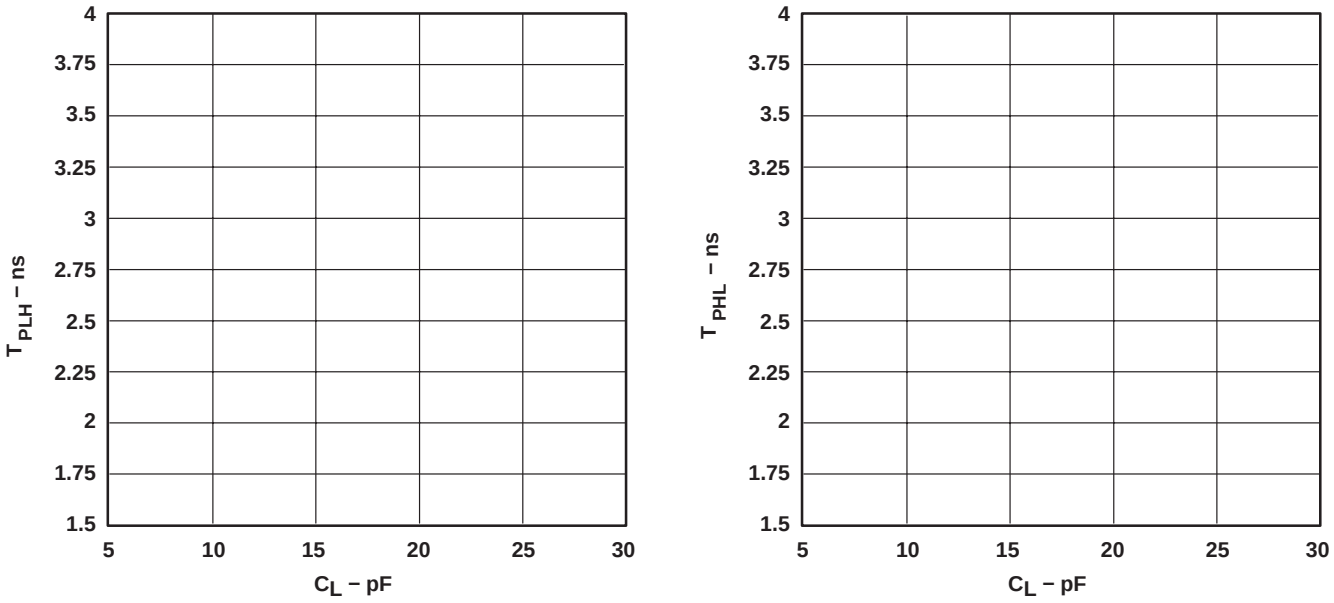
typical total static power consumption (I_{CCA} and I_{CCB})

V_{CCB}	V_{CCA}				UNIT
	1.5 V	1.8 V	2.5 V	3.3 V	
1.5 V	TBD	TBD	TBD	TBD	nA
1.8 V	TBD	TBD	TBD	TBD	
2.5 V	TBD	TBD	TBD	TBD	
3.3 V	TBD	TBD	TBD	TBD	

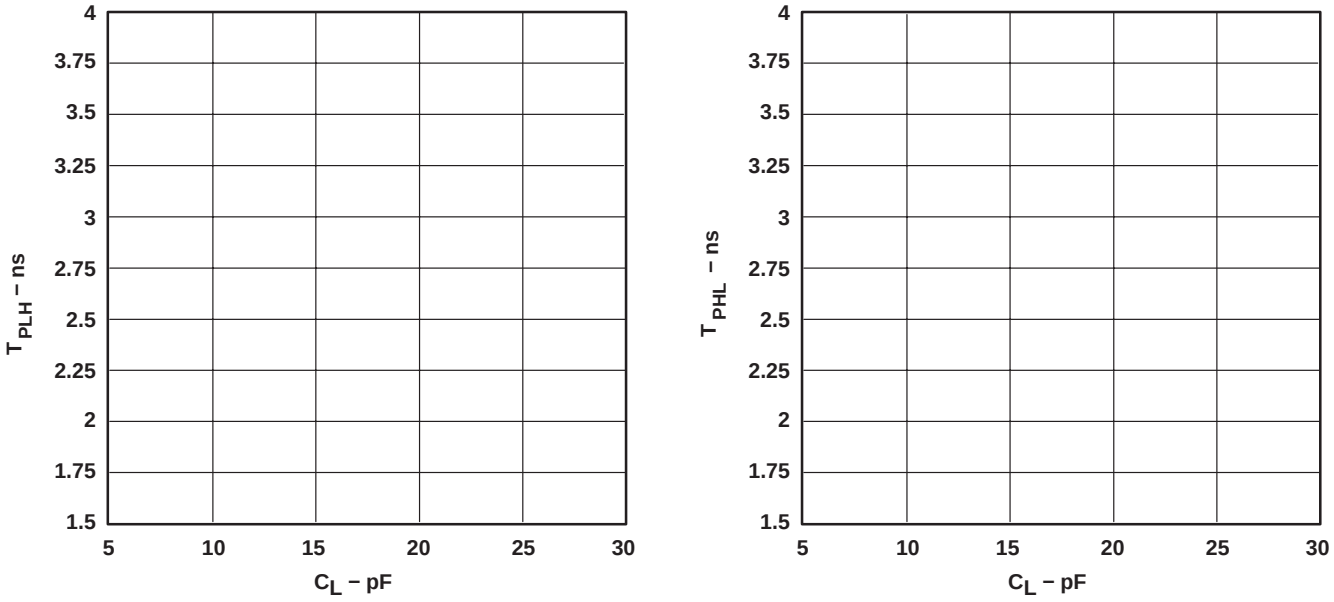
TABLE 1

TYPICAL CHARACTERISTICS

TYPICAL PROPAGATION DELAY vs LOAD CAPACITANCE, $T_A = 25°C, V_{CCA} = 1.5\ V \pm 0.1\ V$

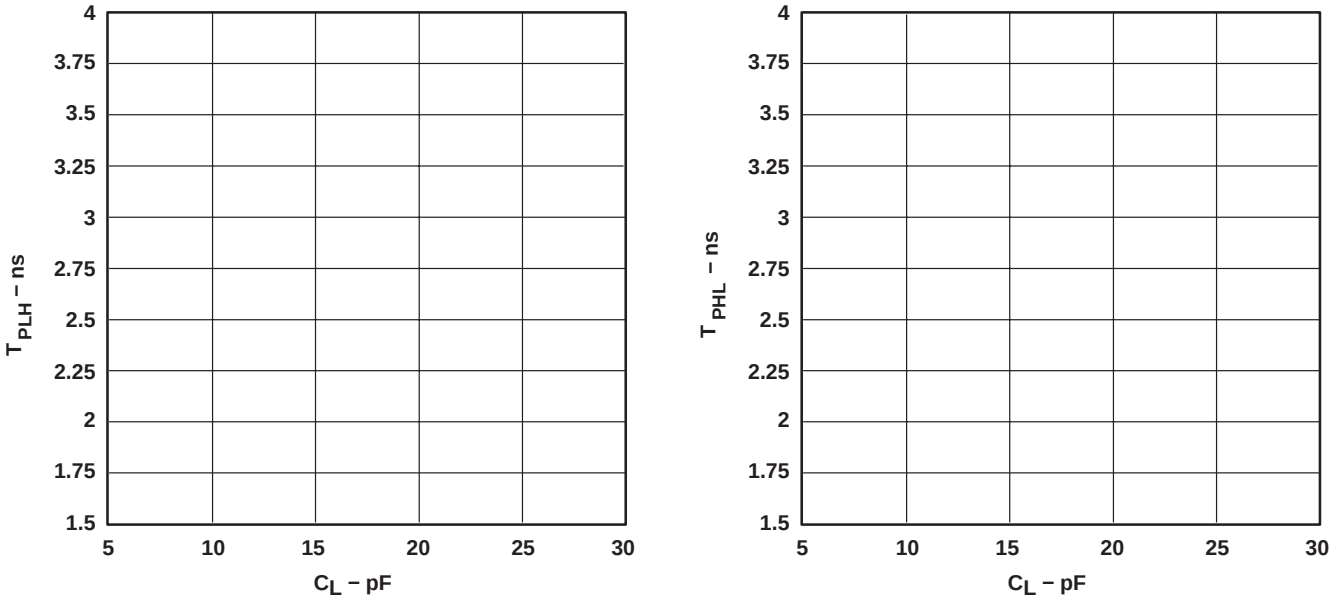


TYPICAL PROPAGATION DELAY vs LOAD CAPACITANCE, $T_A = 25°C, V_{CCA} = 1.8\ V \pm 0.15\ V$

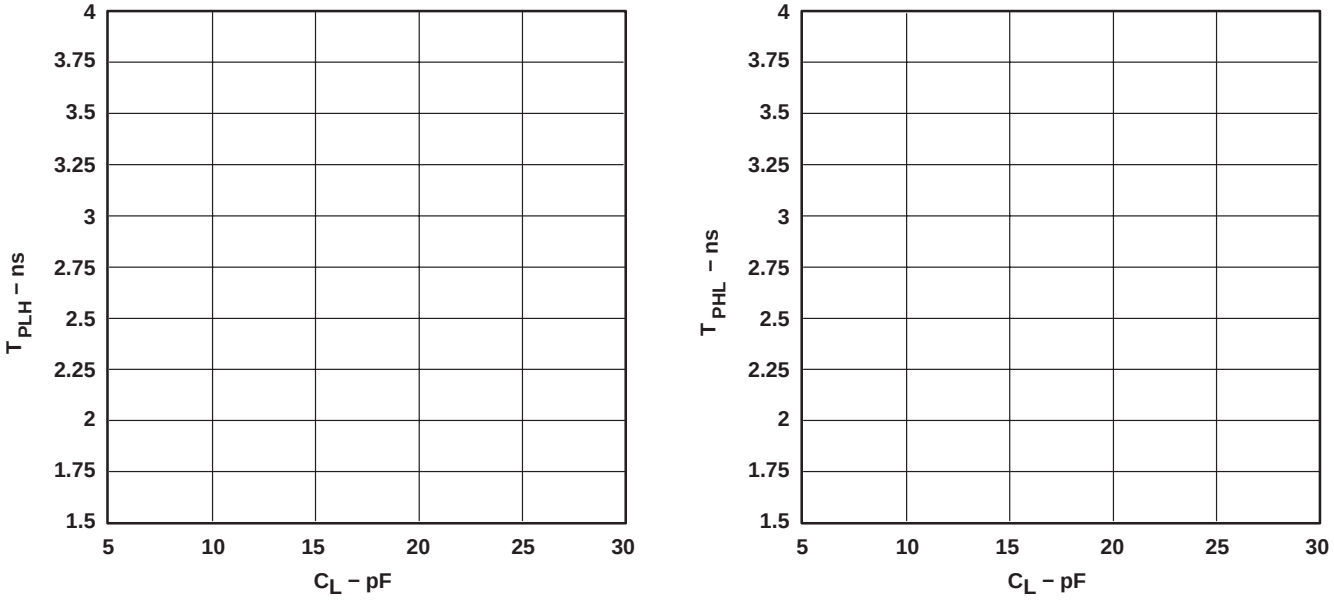


PRODUCT PREVIEW

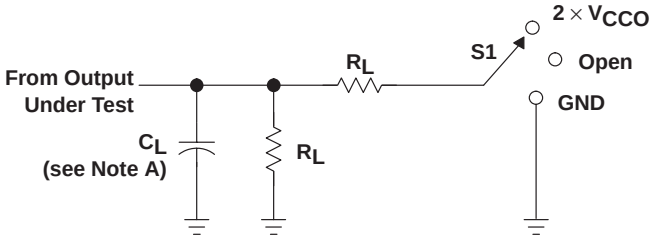
TYPICAL PROPAGATION DELAY vs LOAD CAPACITANCE,
T_A = 25°C, V_{CCA} = 2.5 V ±0.2 V



TYPICAL PROPAGATION DELAY vs LOAD CAPACITANCE,
T_A = 25°C, V_{CCA} = 3.3 V ±0.3 V



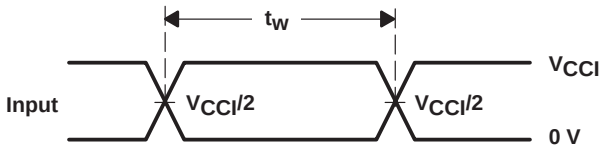
PARAMETER MEASUREMENT INFORMATION



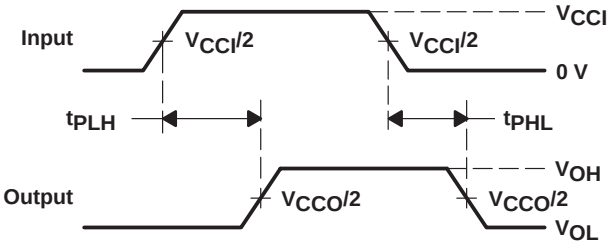
TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CCO}$
t_{PHZ}/t_{PZH}	GND

LOAD CIRCUIT

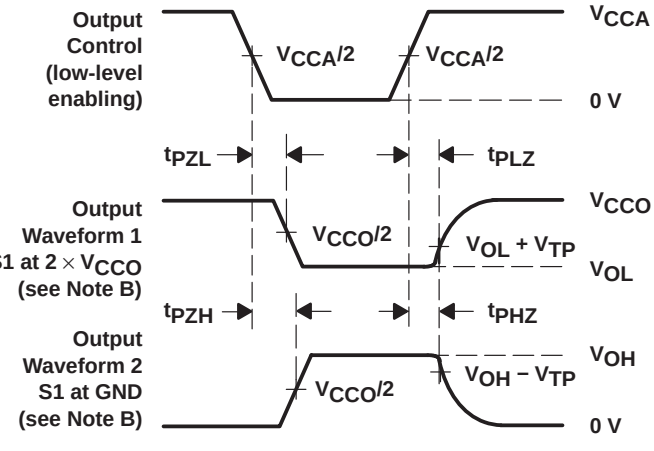
V_{CCO}	C_L	R_L	V_{TP}
1.5 V ± 0.1 V	15 pF	2 kΩ	0.1 V
1.8 V ± 0.15 V	15 pF	2 kΩ	0.15 V
2.5 V ± 0.2 V	15 pF	2 kΩ	0.15 V
3.3 V ± 0.3 V	15 pF	2 kΩ	0.3 V



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

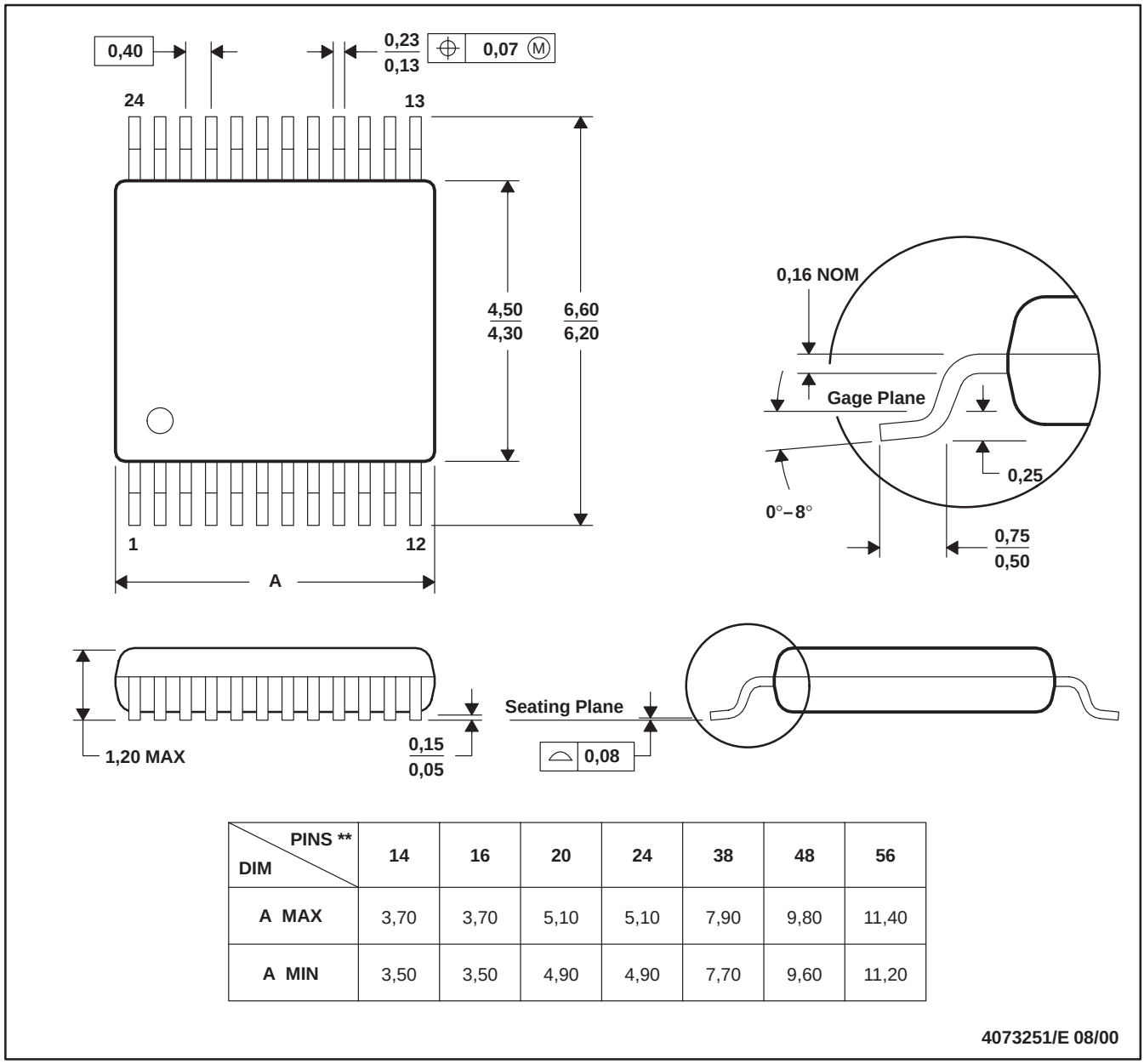
NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, dv/dt ≥ 1 V/ns, dv/dt ≥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 1. Load Circuit and Voltage Waveforms

PRODUCT PREVIEW

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

24 PINS SHOWN



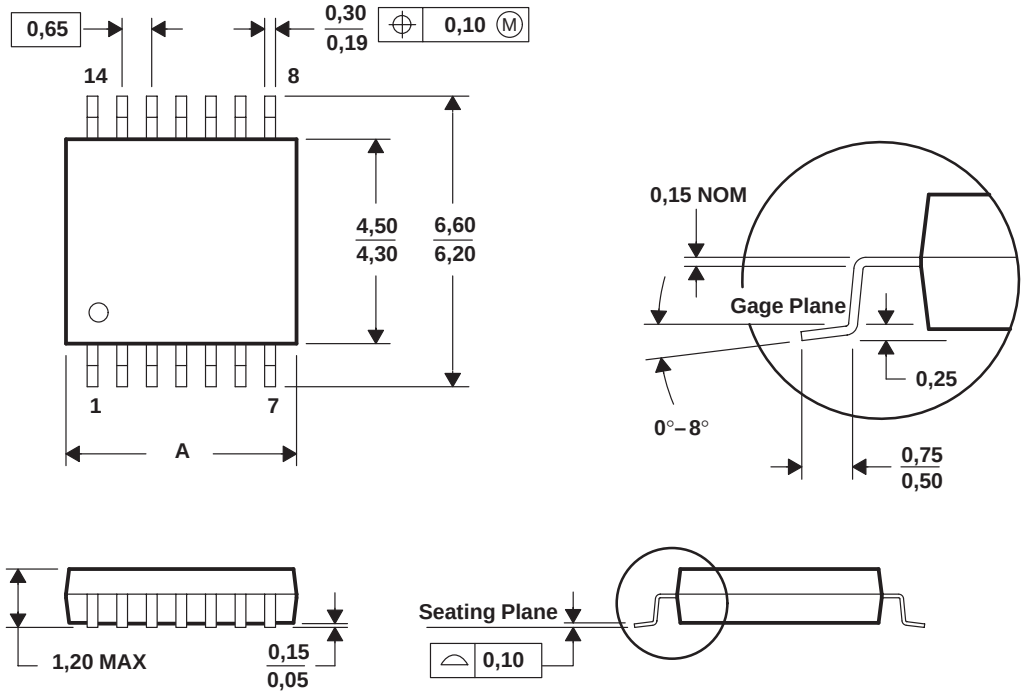
DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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