

FEATURES

- 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, All Outputs Are in the High-Impedance State
- Overvoltage-Tolerant Inputs/Outputs Allow Mixed-Voltage-Mode Data Communications
- Fully Configurable Dual-Rail Design Allows Each Port to Operate Over Full 1.2-V to 3.6-V Power-Supply Range
- I_{off} Supports Partial-Power-Down Mode Operation
- I/Os Are 4.6-V Tolerant
- Latch-Up Performance Exceeds 100 mA 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)

DESCRIPTION/ORDERING INFORMATION

This 24-bit noninverting bus transceiver uses two separate configurable power-supply rails. The SN74AVC24T245 is optimized to operate with V_{CCA}/V_{CCB} set at 1.4 V to 3.6 V. It is operational with V_{CCA}/V_{CCB} as low as 1.2 V. The A port is designed to track V_{CCA} . V_{CCA} accepts any supply voltage from 1.2 V to 3.6 V. The B port is designed to track V_{CCB} . V_{CCB} accepts any supply voltage from 1.2 V to 3.6 V. This allows for universal low-voltage bidirectional translation between any of the 1.2-V, 1.5-V, 1.8-V, 2.5-V, and 3.3-V voltage nodes.

The SN74AVC24T245 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.

The SN74AVC24T245 is designed so that the control pins (1DIR, 2DIR, 3DIR, 4DIR, 5DIR, 6DIR, $1\overline{OE}$, $2\overline{OE}$, $3\overline{OE}$, $4\overline{OE}$, $5\overline{OE}$, and $6\overline{OE}$) are supplied by V_{CCA} .

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, then 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_{CCA} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	LFBGA – GRG	Tape and reel	SN74AVC24T245GRGR	WH245
	LFBGA – ZRG (Pb-free)	Tape and reel	SN74AVC24T245ZRGR	

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

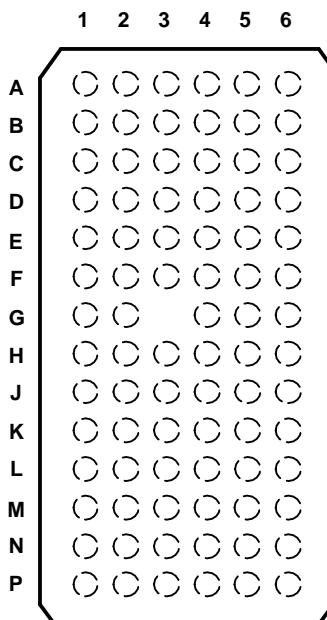


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SN74AVC24T245
24-BIT DUAL-SUPPLY BUS TRANSCEIVER
WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

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GRG OR ZRG PACKAGE
(TOP VIEW)



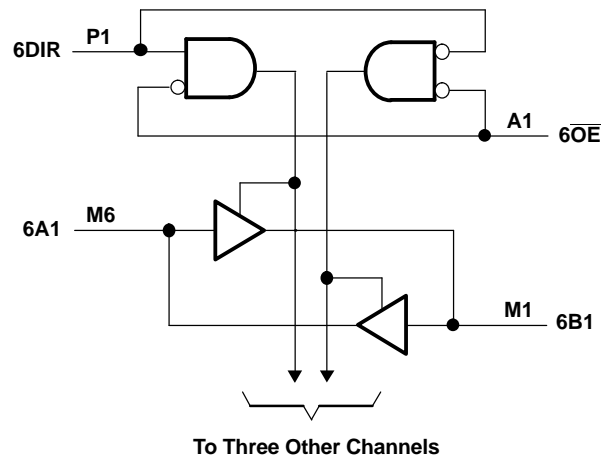
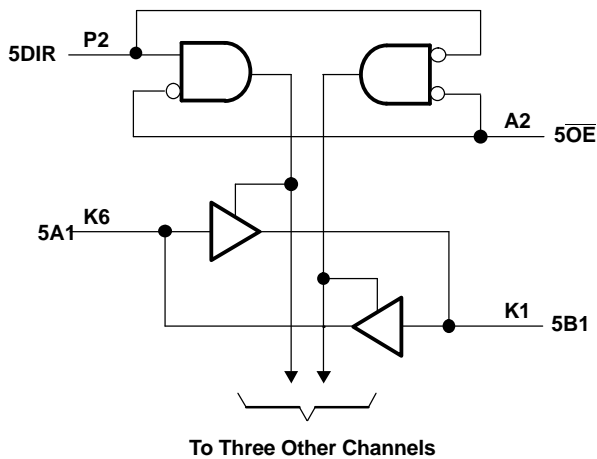
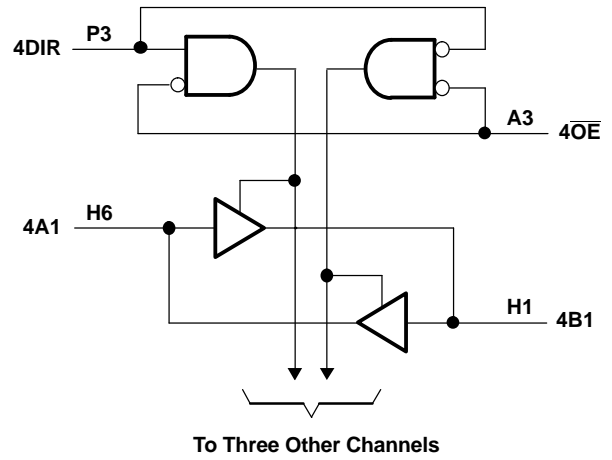
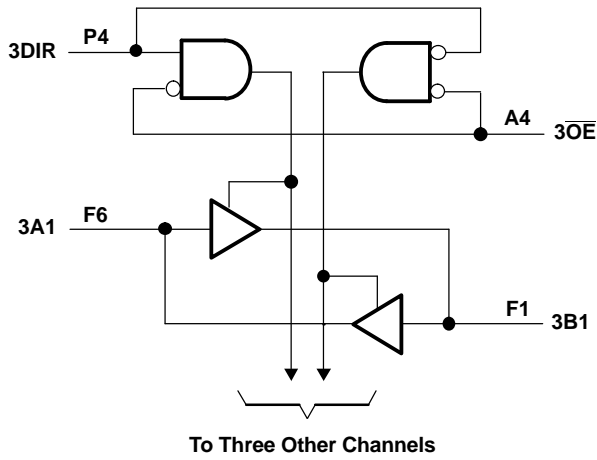
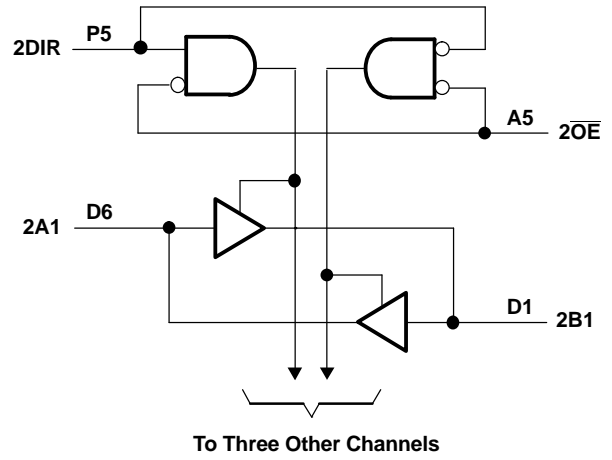
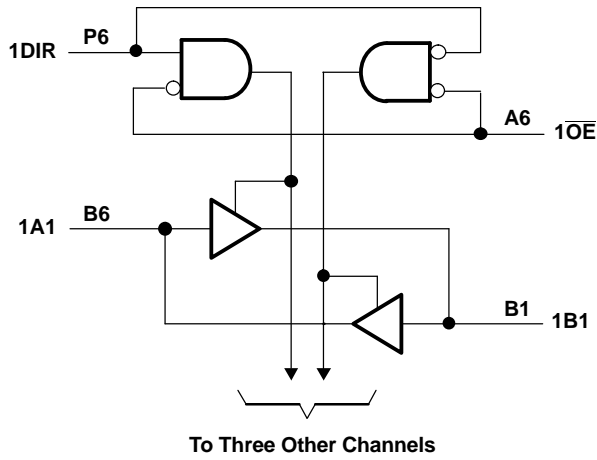
TERMINAL FUNCTIONS

	1	2	3	4	5	6
A	6 \overline{OE}	5 \overline{OE}	4 \overline{OE}	3 \overline{OE}	2 \overline{OE}	1 \overline{OE}
B	1B1	1B2	V _{CCB}	V _{CCA}	1A2	1A1
C	1B3	1B4	GND	GND	1A4	1A3
D	2B1	2B2	V _{CCB}	V _{CCA}	2A2	2A1
E	2B3	2B4	GND	GND	2A4	2A3
F	3B1	3B2	GND	GND	3A2	3A1
G	3B3	3B4		GND	3A4	3A3
H	4B1	4B2	V _{CCB}	V _{CCA}	4A2	4A1
J	4B3	4B4	GND	GND	4A4	4A3
K	5B1	5B2	GND	GND	5A2	5A1
L	5B3	5B4	V _{CCB}	V _{CCA}	5A4	5A3
M	6B1	6B2	GND	GND	6A2	6A1
N	6B3	6B4	V _{CCB}	V _{CCA}	6A4	6A3
P	6DIR	5DIR	4DIR	3DIR	2DIR	1DIR

FUNCTION TABLE
(EACH 4-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)



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WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

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Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT	
V_{CCA} V_{CCB}	Supply voltage range	-0.5	4.6	V	
V_I	Input voltage range ⁽²⁾	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 range applied to any output in the high-impedance or power-off state ⁽²⁾	A port	-0.5	4.6	V
		B port	-0.5	4.6	
V_O	Voltage range applied to any output in the high or low state ⁽²⁾⁽³⁾	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 each V_{CCA} , V_{CCB} , and GND		±100	mA	
θ_{JA}	Package thermal impedance ⁽⁴⁾	GRG/ZRG package	50	°C/W	
T_{stg}	Storage temperature range		-65	150	°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input 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 4.6 V maximum if the output current rating is observed.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾⁽²⁾⁽³⁾

		V_{CCI}	V_{CCO}	MIN	MAX	UNIT
V_{CCA}	Supply voltage			1.2	3.6	V
V_{CCB}	Supply voltage			1.2	3.6	V
V_{IH}	High-level input voltage	Data inputs ⁽⁴⁾	1.2 V to 1.95 V	$V_{CCI} \times 0.65$		V
			1.95 V to 2.7 V	1.6		
			2.7 V to 3.6 V	2		
V_{IL}	Low-level input voltage	Data inputs ⁽⁴⁾	1.2 V to 1.95 V	$V_{CCI} \times 0.35$		V
			1.95 V to 2.7 V	0.7		
			2.7 V to 3.6 V	0.8		
V_{IH}	High-level input voltage	DIR (referenced to V_{CCA}) ⁽⁵⁾	1.2 V to 1.95 V	$V_{CCA} \times 0.65$		V
			1.95 V to 2.7 V	1.6		
			2.7 V to 3.6 V	2		
V_{IL}	Low-level input voltage	DIR (referenced to V_{CCA}) ⁽⁵⁾	1.2 V to 1.95 V	$V_{CCA} \times 0.35$		V
			1.95 V to 2.7 V	0.7		
			2.7 V to 3.6 V	0.8		
V_I	Input voltage			0	3.6	V
V_O	Output voltage	Active state		0	V_{CCO}	V
		3-state		0	3.6	
I_{OH}	High-level output current		1.2 V	-3		mA
			1.4 V to 1.6 V	-6		
			1.65 V to 1.95 V	-8		
			2.3 V to 2.7 V	-9		
			3 V to 3.6 V	-12		
I_{OL}	Low-level output current		1.2 V	3		mA
			1.4 V to 1.6 V	6		
			1.65 V to 1.95 V	8		
			2.3 V to 2.7 V	9		
			3 V to 3.6 V	12		
$\Delta t/\Delta v$	Input transition rise or fall rate				5	ns/V
T_A	Operating free-air temperature			-40	85	°C

(1) V_{CCI} is the V_{CC} associated with the data input port.

(2) V_{CCO} is the V_{CC} associated with the output port.

(3) 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.

(4) For V_{CCI} values not specified in the data sheet, V_{IH} min = $V_{CCI} \times 0.7$ V, V_{IL} max = $V_{CCI} \times 0.3$ V.

(5) For V_{CCI} values not specified in the data sheet, V_{IH} min = $V_{CCA} \times 0.7$ V, V_{IL} max = $V_{CCA} \times 0.3$ V.

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WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



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Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)⁽¹⁾⁽²⁾

PARAMETER	TEST CONDITIONS		V _{CCA}	V _{CCB}	T _A = 25°C			-40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V _{OH}		V _I = V _{IH}	1.2 V to 3.6 V	1.2 V to 3.6 V				V _{CCO} - 0.2		V
			1.2 V	1.2 V	0.95					
			1.4 V	1.4 V				1.05		
			1.65 V	1.65 V				1.2		
			2.3 V	2.3 V				1.75		
			3 V	3 V				2.3		
V _{OL}		V _I = V _{IL}	1.2 V to 3.6 V	1.2 V to 3.6 V				0.2		V
			1.2 V	1.2 V	0.15					
			1.4 V	1.4 V				0.35		
			1.65 V	1.65 V				0.45		
			2.3 V	2.3 V				0.55		
			3 V	3 V				0.7		
I _I	Control inputs	V _I = V _{CCA} or GND	1.2 V to 3.6 V	1.2 V to 3.6 V		±0.025	±0.25		±1	μA
I _{off}	A or B port	V _I or V _O = 0 to 3.6 V	0 V	0 to 3.6 V		±0.1	±2.5		±5	μA
	A or B port		0 to 3.6 V	0 V		±0.1	±2.5		±5	
I _{OZ} ⁽³⁾	A or B port	V _O = V _{CCO} or GND, V _I = V _{CCI} or GND, OE = V _{IH}	3.6 V	3.6 V		±0.5	±2.5		±5	μA
I _{CCA}		V _I = V _{CCI} or GND, I _O = 0	1.2 V to 3.6 V	1.2 V to 3.6 V					40	μA
			0 V	3.6 V				-5		
			3.6 V	0 V				40		
I _{CCB}		V _I = V _{CCI} or GND, I _O = 0	1.2 V to 3.6 V	1.2 V to 3.6 V					40	μA
			0 V	3.6 V				40		
			3.6 V	0 V				-5		
I _{CCA} + I _{CCB}		V _I = V _{CCI} or GND, I _O = 0	1.2 V to 3.6 V	1.2 V to 3.6 V					75	μA
C _i	Control inputs	V _I = 3.3 V or GND	3.3 V	3.3 V		3.5				pF
C _{io}	A or B port	V _O = 3.3 V or GND	3.3 V	3.3 V		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) For I/O ports, the parameter I_{OZ} includes the input leakage current.

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2\text{ V}$	$V_{CCB} = 1.5\text{ V}$	$V_{CCB} = 1.8\text{ V}$	$V_{CCB} = 2.5\text{ V}$	$V_{CCB} = 3.3\text{ V}$	UNIT
			TYP	TYP	TYP	TYP	TYP	
t_{PLH}	A	B	4.1	3.3	3	2.8	3.2	ns
t_{PHL}			4.1	3.3	3	2.8	3.2	
t_{PLH}	B	A	4.4	4	3.8	3.6	3.5	ns
t_{PHL}			4.4	4	3.8	3.6	3.5	
t_{PZH}	\overline{OE}	A	6.4	6.4	6.4	6.4	6.4	ns
t_{PZL}			6.4	6.4	6.4	6.4	6.4	
t_{PZH}	\overline{OE}	B	6	4.6	4	3.4	3.2	ns
t_{PZL}			6	4.6	4	3.4	3.2	
t_{PHZ}	\overline{OE}	A	6.6	6.6	6.6	6.6	6.8	ns
t_{PLZ}			6.6	6.6	6.6	6.6	6.8	
t_{PHZ}	\overline{OE}	B	6	4.9	4.9	4.2	5.3	ns
t_{PLZ}			6	4.9	4.9	4.2	5.3	

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2\text{ V}$	$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$		$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$		$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$		$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	3.6	0.5	6.2	0.5	5.2	0.5	4.1	0.5	3.7	ns
t_{PHL}			3.6	0.5	6.2	0.5	5.2	0.5	4.1	0.5	3.7	
t_{PLH}	B	A	3.3	0.5	6.2	0.5	5.9	0.5	5.6	0.5	5.5	ns
t_{PHL}			3.3	0.5	6.2	0.5	5.9	0.5	5.6	0.5	5.5	
t_{PZH}	\overline{OE}	A	4.3	1	10.1	1	10.1	1	10.1	1	10.1	ns
t_{PZL}			4.3	1	10.1	1	10.1	1	10.1	1	10.1	
t_{PZH}	\overline{OE}	B	5.6	1	10.1	0.5	8.1	0.5	5.9	0.5	5.2	ns
t_{PZL}			5.6	1	10.1	0.5	8.1	0.5	5.9	0.5	5.2	
t_{PHZ}	\overline{OE}	A	4.5	1.5	9.1	1.5	9.1	1.5	9.1	1.5	9.1	ns
t_{PLZ}			4.5	1.5	9.1	1.5	9.1	1.5	9.1	1.5	9.1	
t_{PHZ}	\overline{OE}	B	5.5	1.5	8.7	1.5	7.5	1	6.5	1	6.3	ns
t_{PLZ}			5.5	1.5	8.7	1.5	7.5	1	6.5	1	6.3	

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Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2 \text{ V}$	$V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$		$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	3.4	0.5	5.9	0.5	4.8	0.5	3.7	0.5	3.3	ns
t_{PHL}			3.4	0.5	5.9	0.5	4.8	0.5	3.7	0.5	3.3	
t_{PLH}	B	A	3	0.5	5.2	0.5	4.8	0.5	4.5	0.5	4.4	ns
t_{PHL}			3	0.5	5.2	0.5	4.8	0.5	4.5	0.5	4.4	
t_{PZH}	\overline{OE}	A	3.4	1	7.8	1	7.8	1	7.8	1	7.8	ns
t_{PZL}			3.4	1	7.8	1	7.8	1	7.8	1	7.8	
t_{PZH}	\overline{OE}	B	5.4	1	9.2	0.5	7.4	0.5	5.3	0.5	4.5	ns
t_{PZL}			5.4	1	9.2	0.5	7.4	0.5	5.3	0.5	4.5	
t_{PHZ}	\overline{OE}	A	4.2	1.5	7.7	1.5	7.7	1.5	7.7	1.5	7.7	ns
t_{PLZ}			4.2	1.5	7.7	1.5	7.7	1.5	7.7	1.5	7.7	
t_{PHZ}	\overline{OE}	B	5.2	1.5	8.4	1.5	7.1	1	5.9	1	5.7	ns
t_{PLZ}			5.2	1.5	8.4	1.5	7.1	1	5.9	1	5.7	

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2 \text{ V}$	$V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$		$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	3.2	0.5	5.6	0.5	4.5	0.5	3.3	0.5	2.8	ns
t_{PHL}			3.2	0.5	5.6	0.5	4.5	0.5	3.3	0.5	2.8	
t_{PLH}	B	A	2.6	0.5	4.1	0.5	3.7	0.5	3.3	0.5	3.2	ns
t_{PHL}			2.6	0.5	4.1	0.5	3.7	0.5	3.3	0.5	3.2	
t_{PZH}	\overline{OE}	A	2.5	0.5	5.3	0.5	5.3	0.5	5.3	0.5	5.3	ns
t_{PZL}			2.5	0.5	5.3	0.5	5.3	0.5	5.3	0.5	5.3	
t_{PZH}	\overline{OE}	B	5.2	0.5	9.4	0.5	7.3	0.5	5.1	0.5	4.5	ns
t_{PZL}			5.2	0.5	9.4	0.5	7.3	0.5	5.1	0.5	4.5	
t_{PHZ}	\overline{OE}	A	3	1	6.1	1	6.1	1	6.1	1	6.1	ns
t_{PLZ}			3	1	6.1	1	6.1	1	6.1	1	6.1	
t_{PHZ}	\overline{OE}	B	5	1	7.9	1	6.6	1	6.1	1	5.2	ns
t_{PLZ}			5	1	7.9	1	6.6	1	6.1	1	5.2	

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2 \text{ V}$	$V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$		$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	3.2	0.5	5.5	0.5	4.4	0.5	3.2	0.5	2.7	ns
t_{PHL}			3.2	0.5	5.5	0.5	4.4	0.5	3.2	0.5	2.7	
t_{PLH}	B	A	2.8	0.5	3.7	0.5	3.3	0.5	2.8	0.5	2.7	ns
t_{PHL}			2.8	0.5	3.7	0.5	3.3	0.5	2.8	0.5	2.7	
t_{PZH}	\overline{OE}	A	2.2	0.5	4.3	0.5	4.2	0.5	4.1	0.5	4	ns
t_{PZL}			2.2	0.5	4.3	0.5	4.2	0.5	4.1	0.5	4	
t_{PZH}	\overline{OE}	B	5.1	0.5	9.3	0.5	7.2	0.5	4.9	0.5	4	ns
t_{PZL}			5.1	0.5	9.3	0.5	7.2	0.5	4.9	0.5	4	
t_{PHZ}	\overline{OE}	A	3.4	0.5	5	0.5	5	0.5	5	0.5	5	ns
t_{PLZ}			3.4	0.5	5	0.5	5	0.5	5	0.5	5	
t_{PHZ}	\overline{OE}	B	4.9	1	7.7	1	6.5	1	5.2	0.5	5	ns
t_{PLZ}			4.9	1	7.7	1	6.5	1	5.2	0.5	5	

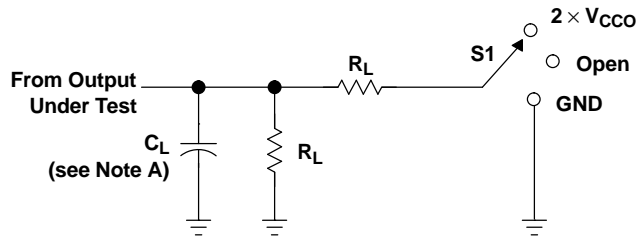
Operating Characteristics

V_{CCA} and $V_{CCB} = 3.3 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER			TEST CONDITIONS	$V_{CCA} = V_{CCB} = 1.5 \text{ V}$	$V_{CCA} = V_{CCB} = 1.2 \text{ V}$	$V_{CCA} = V_{CCB} = 1.8 \text{ V}$	$V_{CCA} = V_{CCB} = 2.5 \text{ V}$	$V_{CCA} = V_{CCB} = 3.3 \text{ V}$	UNIT
				TYP	TYP	TYP	TYP	TYP	
$C_{pdA}^{(1)}$	A to B	Outputs enabled	$C_L = 0$, $f = 10 \text{ MHz}$, $t_r = t_f = 1 \text{ ns}$	1	1	1	2	2	pF
		Outputs disabled		1	1	1	1	2	
	B to A	Outputs enabled		19	19	20	21	22	
		Outputs disabled		1	1	1	1	1	
$C_{pdB}^{(1)}$	A to B	Outputs enabled	$C_L = 0$, $f = 10 \text{ MHz}$, $t_r = t_f = 1 \text{ ns}$	19	19	20	21	22	pF
		Outputs disabled		1	1	1	1	1	
	B to A	Outputs enabled		1	1	1	2	2	
		Outputs disabled		1	1	1	1	2	

(1) Power dissipation capacitance per transceiver

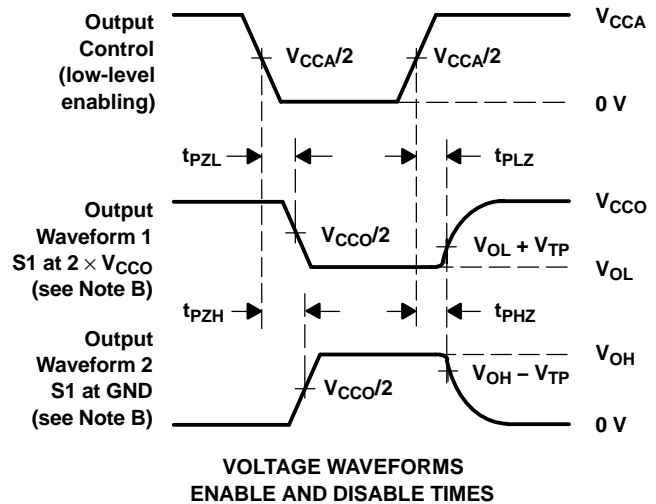
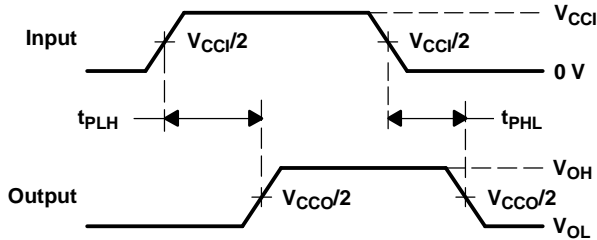
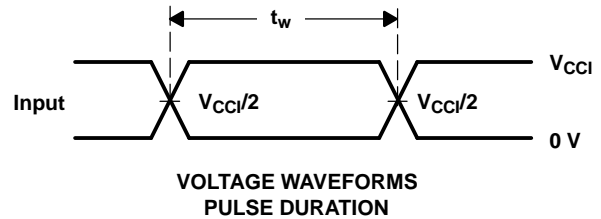
PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

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

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



- NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $dv/dt \geq 1\text{ V/ns}$.
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

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74AVC24T245GRGR	ACTIVE	BGA MI CROSTA R JUNI OR	GRG	83	1000	TBD	SNPB	Level-1-240C-UNLIM
SN74AVC24T245ZRGR	ACTIVE	BGA MI CROSTA R JUNI OR	ZRG	83	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM

⁽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⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AVC24T245GRGR	BGA MICROSTAR JUNIOR	GRG	83	1000	330.0	24.4	4.8	10.3	1.8	8.0	24.0	Q1
SN74AVC24T245ZRGR	BGA MICROSTAR JUNIOR	ZRG	83	1000	330.0	24.4	4.8	10.3	1.8	8.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

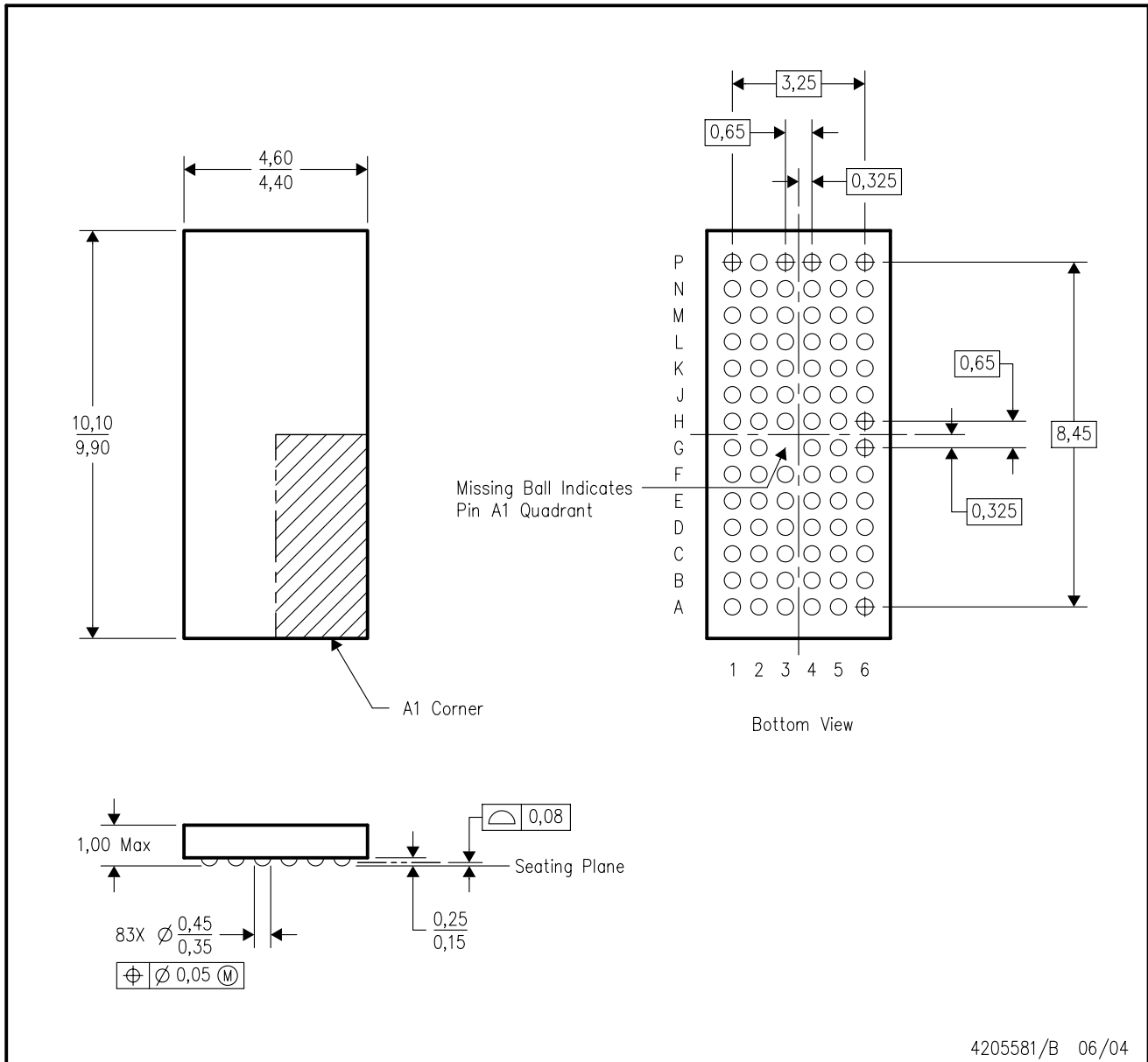


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AVC24T245GRGR	BGA MICROSTAR JUNIOR	GRG	83	1000	333.2	345.9	31.8
SN74AVC24T245ZRGR	BGA MICROSTAR JUNIOR	ZRG	83	1000	333.2	345.9	31.8

GRG (R-PBGA-N83)

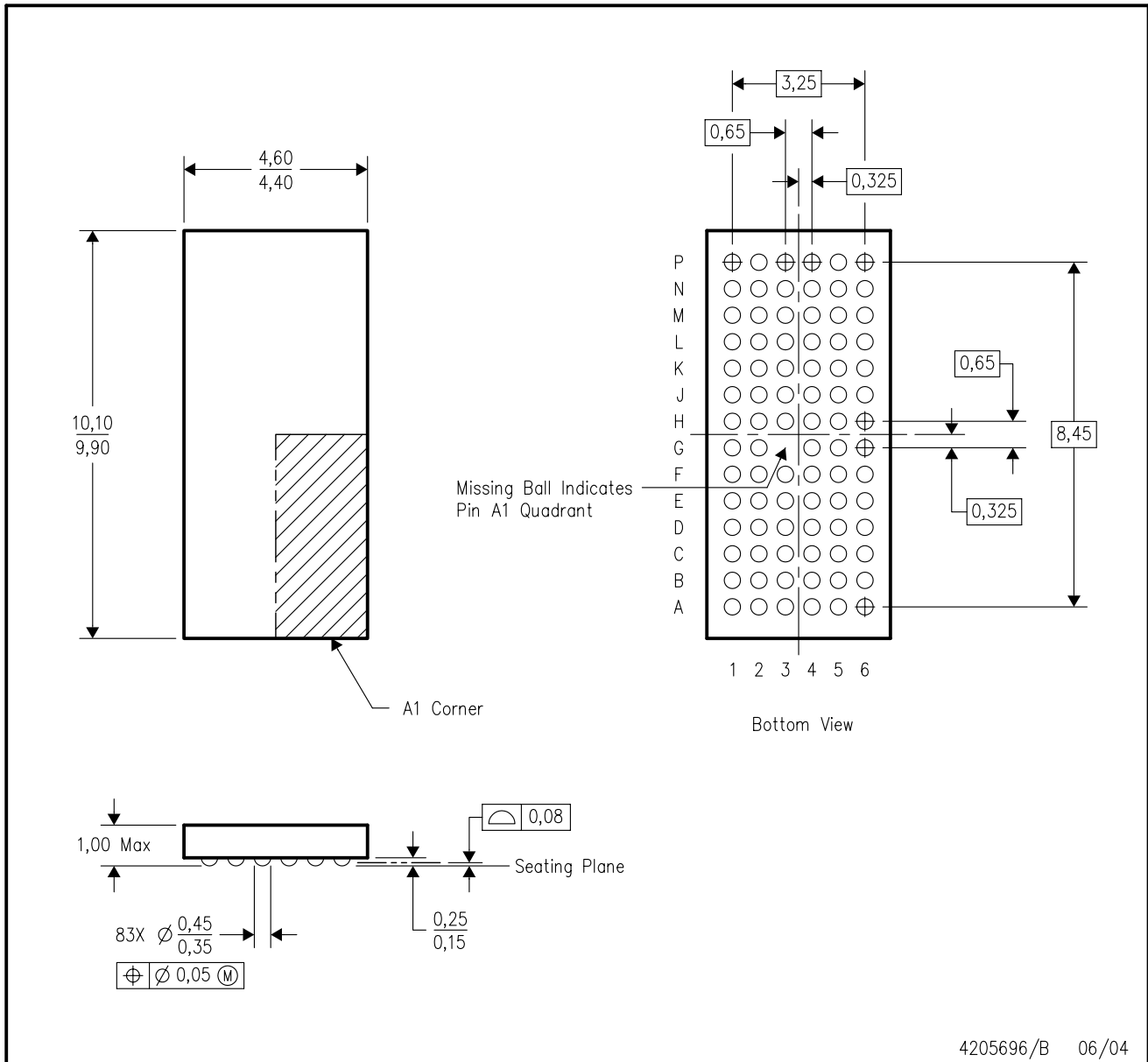
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. JEDEC MO-225 registration is pending.
 - D. This package is tin-lead (SnPb). Refer to the 83 ZRG package (drawing 4205696) for lead-free.

ZRG (R-PBGA-N83)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. JEDEC MO-225 registration is pending.
 - D. This package is lead-free. Refer to the 83 GRG package (drawing 4205581) for tin-lead (SnPb).

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