

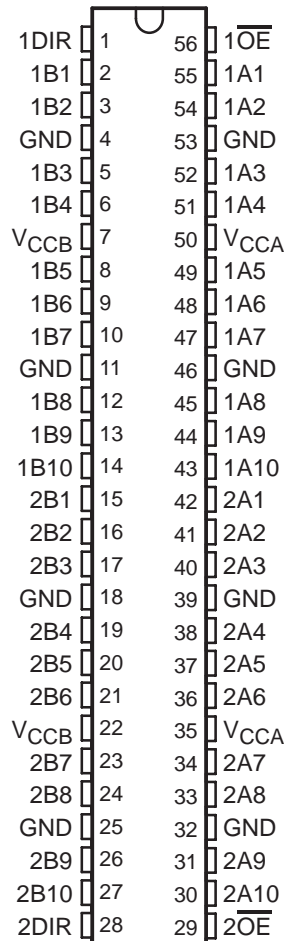
SN74AVC20T245

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

SCE5566F – MAY 2004 – REVISED APRIL 2005

- 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
- Overvoltage-Tolerant Inputs/Outputs Allow Mixed-Voltage-Mode Data Communications
- Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the 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
- Max Data Rates
 - 380 Mbps (1.8-V to 3.3-V Translation)
 - 260 Mbps (< 1.8-V to 3.3-V Translation)
 - 260 Mbps (Translate to 2.5 V)
 - 210 Mbps (Translate to 1.8 V)
 - 120 Mbps (Translate to 1.5 V)
 - 100 Mbps (Translate to 1.2 V)
- 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)

DGG OR DGV PACKAGE
(TOP VIEW)



description/ordering information

This 20-bit noninverting bus transceiver uses two separate configurable power-supply rails.

The SN74AVC20T245 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.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	TSSOP – DGG	Tape and reel	SN74AVC20T245DGGR	AVC20T245
	TVSOP – DGV	Tape and reel	SN74AVC20T245DGVR	WG245
	VFBGA – GQL	Tape and reel	SN74AVC20T245GQLR	WG245
	VFBGA – ZQL (Pb-free)		SN74AVC20T245ZQLR	

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



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WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

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description/ordering information (continued)

The SN74AVC20T245 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 is used to disable the outputs so that the buses are isolated.

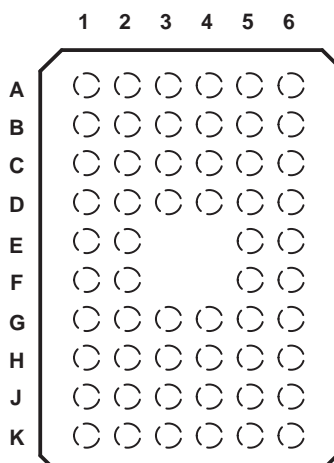
The SN74AVC20T245 is designed so that the control (1DIR, 2DIR, $1\overline{OE}$, and $2\overline{OE}$) inputs are supplied by V_{CCA} .

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, 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.

GQL OR ZQL PACKAGE (TOP VIEW)



terminal assignments

	1	2	3	4	5	6
A	1B1	1B2	1DIR	$1\overline{OE}$	1A2	1A1
B	1B3	1B4	GND	GND	1A4	1A3
C	1B5	1B6	V_{CCB}	V_{CCA}	1A6	1A5
D	1B7	1B8	GND	GND	1A8	1A7
E	1B9	1B10			1A10	1A9
F	2B1	2B2			2A2	2A1
G	2B3	2B4	GND	GND	2A4	2A3
H	2B5	2B6	V_{CCB}	V_{CCA}	2A6	2A5
J	2B7	2B8	GND	GND	2A8	2A7
K	2B9	2B10	2DIR	$2\overline{OE}$	2A10	2A9

FUNCTION TABLE (each 10-bit section)

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

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recommended operating conditions (see Notes 4 through 8)

		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 (see Note 7)	1.2 V to 1.95 V	V _{CCI} × 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 (see Note 7)	1.2 V to 1.95 V	V _{CCI} × 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}) (see Note 8)	1.2 V to 1.95 V	V _{CCA} × 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}) (see Note 8)	1.2 V to 1.95 V	V _{CCA} × 0.35		V
			1.95 V to 2.7 V	0.7		
			2.7 V to 3.6 V	0.8		
V _I	Input voltage			0	3.6	V
V _O	Output voltage	Active state		0	V _{CCO}	V
		3-state		0	3.6	V
I _{OH}	High-level output current		1.2 V	-3		mA
			1.4 V to 1.6 V	-6		
			1.65 V to 1.95 V	-8		
			2.3 V to 2.7 V	-9		
			3 V to 3.6 V	-12		
I _O L	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		
Δt/Δv	Input transition rise or fall rate				5	ns/V
T _A	Operating free-air temperature			-40	85	°C

- NOTES:
- V_{CCI} is the V_{CC} associated with the data input port.
 - V_{CCO} is the V_{CC} associated with the output port.
 - 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.
 - For V_{CCI} values not specified in the data sheet, V_{IH(min)} = V_{CCI} × 0.7 V, V_{IL(max)} = V_{CCI} × 0.3 V.
 - For V_{CCI} values not specified in the data sheet, V_{IH(min)} = V_{CCA} × 0.7 V, V_{IL(max)} = V_{CCA} × 0.3 V.



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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Notes 9 and 10)

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		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	±1		±5	μA	
	A or B port		0 to 3.6 V	0 V	±0.1	±1		±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	±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				35	μA	
			0 V	3.6 V				-5		
			3.6 V	0 V				35		
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				35	μA	
			0 V	3.6 V				35		
			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				65	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 ports	V _O = 3.3 V or GND	3.3 V	3.3 V	7				pF	

† For I/O ports, the parameter I_{OZ} includes the input leakage current.

NOTES: 9. V_{CCO} is the V_{CC} associated with the output port.

10. V_{CCI} is the V_{CC} associated with the input port.



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switching characteristics over recommended operating free-air temperature range,
V_{CCA} = 1.2 V (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CCB} = 1.2 V	V _{CCB} = 1.5 V	V _{CCB} = 1.8 V	V _{CCB} = 2.5 V	V _{CCB} = 3.3 V	UNIT
			TYP	TYP	TYP	TYP	TYP	
t _{PLH}	A	B	3.8	3.1	2.8	2.7	3.3	ns
t _{PHL}			3.8	3.1	2.8	2.7	3.3	
t _{PLH}	B	A	4.1	3.8	3.6	3.5	3.4	ns
t _{PHL}			4.1	3.8	3.6	3.5	3.4	
t _{PZH}	\overline{OE}	A	6.5	6.5	6.5	6.5	6.5	ns
t _{PZL}			6.5	6.5	6.5	6.5	6.5	
t _{PZH}	\overline{OE}	B	5.6	4.4	3.8	3.3	3.2	ns
t _{PZL}			5.6	4.4	3.8	3.3	3.2	
t _{PHZ}	\overline{OE}	A	6.4	6.4	6.4	6.4	6.4	ns
t _{PLZ}			6.4	6.4	6.4	6.4	6.4	
t _{PHZ}	\overline{OE}	B	5.7	4.6	4.7	4.1	5.4	ns
t _{PLZ}			5.7	4.6	4.7	4.1	5.4	

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} = 1.2 V	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
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A	B	3.8	0.5	6.4	0.5	5.4	0.5	4.3	0.5	3.9	ns
t _{PHL}			3.8	0.5	6.4	0.5	5.4	0.5	4.3	0.5	3.9	
t _{PLH}	B	A	3.1	0.5	6.4	0.5	6.1	0.5	5.8	0.5	5.7	ns
t _{PHL}			3.1	0.5	6.4	0.5	6.1	0.5	5.8	0.5	5.7	
t _{PZH}	\overline{OE}	A	4.3	1.5	10.3	1.5	10.3	1.5	10.2	1.5	10.2	ns
t _{PZL}			4.3	1.5	10.3	1.5	10.3	1.5	10.2	1.5	10.2	
t _{PZH}	\overline{OE}	B	5.2	1	10.3	1	8.4	0.5	6.1	0.5	5.3	ns
t _{PZL}			5.2	1	10.3	1	8.4	0.5	6.1	0.5	5.3	
t _{PHZ}	\overline{OE}	A	4.5	2	9	2	9	2	9	2	9	ns
t _{PLZ}			4.5	2	9	2	9	2	9	2	9	
t _{PHZ}	\overline{OE}	B	5.1	1.5	9	1.5	7.8	1	6.4	1	5.9	ns
t _{PLZ}			5.1	1.5	9	1.5	7.8	1	6.4	1	5.9	



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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	3.6	0.5	6.1	0.5	5	0.5	3.9	0.5	3.5	ns
t_{PHL}			3.6	0.5	6.1	0.5	5	0.5	3.9	0.5	3.5	
t_{PLH}	B	A	2.8	0.5	5.4	0.5	5	0.5	4.7	0.5	4.6	ns
t_{PHL}			2.8	0.5	5.4	0.5	5	0.5	4.7	0.5	4.6	
t_{PZH}	\overline{OE}	A	3.4	1	8.1	1	7.9	1	7.9	1	7.9	ns
t_{PZL}			3.4	1	8.1	1	7.9	1	7.9	1	7.9	
t_{PZH}	\overline{OE}	B	5	0.5	10	0.5	7.9	0.5	5.7	0.5	4.8	ns
t_{PZL}			5	0.5	10	0.5	7.9	0.5	5.7	0.5	4.8	
t_{PHZ}	\overline{OE}	A	4.1	2	7.4	2	7.4	2	7.4	2	7.4	ns
t_{PLZ}			4.1	2	7.4	2	7.4	2	7.4	2	7.4	
t_{PHZ}	\overline{OE}	B	4.9	1.5	8.7	1.5	7.4	1	5.8	1	5.1	ns
t_{PLZ}			4.9	1.5	8.7	1.5	7.4	1	5.8	1	5.1	

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	3.5	0.5	5.8	0.5	4.7	0.5	3.5	0.5	3	ns
t_{PHL}			3.5	0.5	5.8	0.5	4.7	0.5	3.5	0.5	3	
t_{PLH}	B	A	2.7	0.5	4.3	0.5	3.9	0.5	3.5	0.5	3.4	ns
t_{PHL}			2.7	0.5	4.3	0.5	3.9	0.5	3.5	0.5	3.4	
t_{PZH}	\overline{OE}	A	2.5	0.5	5.4	0.5	5.3	0.5	5.2	0.5	5.2	ns
t_{PZL}			2.5	0.5	5.4	0.5	5.3	0.5	5.2	0.5	5.2	
t_{PZH}	\overline{OE}	B	4.8	0.5	9.6	0.5	7.6	0.5	5.3	0.5	4.3	ns
t_{PZL}			4.8	0.5	9.6	0.5	7.6	0.5	5.3	0.5	4.3	
t_{PHZ}	\overline{OE}	A	3	1.1	5.2	1.1	5.2	1.1	5.2	1.1	5.2	ns
t_{PLZ}			3	1.1	5.2	1.1	5.2	1.1	5.2	1.1	5.2	
t_{PHZ}	\overline{OE}	B	4.7	1.2	8.2	1.2	6.9	1	5.3	1	5	ns
t_{PLZ}			4.7	1.2	8.2	1.2	6.9	1	5.3	1	5	

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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	3.4	0.5	5.7	0.5	4.6	0.5	3.4	0.5	2.9	ns
t_{PHL}			3.4	0.5	5.7	0.5	4.6	0.5	3.4	0.5	2.9	
t_{PLH}	B	A	3.3	0.5	3.9	0.5	3.5	0.5	3	0.5	2.9	ns
t_{PHL}			3.3	0.5	3.9	0.5	3.5	0.5	3	0.5	2.9	
t_{PZH}	\overline{OE}	A	2.2	0.5	4.4	0.5	4.3	0.5	4.2	0.5	4.1	ns
t_{PZL}			2.2	0.5	4.4	0.5	4.3	0.5	4.2	0.5	4.1	
t_{PZH}	\overline{OE}	B	4.7	1	9.6	0.5	7.5	0.5	5.1	0.5	4.1	ns
t_{PZL}			4.7	1	9.6	0.5	7.5	0.5	5.1	0.5	4.1	
t_{PHZ}	\overline{OE}	A	3.4	0.8	5	0.8	5	0.8	5	0.8	5	ns
t_{PLZ}			3.4	0.8	5	0.8	5	0.8	5	0.8	5	
t_{PHZ}	\overline{OE}	B	4.6	1.2	8.1	1.2	6.7	1	5.1	0.8	5	ns
t_{PLZ}			4.6	1.2	8.1	1.2	6.7	1	5.1	0.8	5	

operating characteristics, $T_A = 25^\circ\text{C}$

PARAMETER			TEST CONDITIONS	$V_{CCA} = V_{CCB} = 1.2 \text{ V}$	$V_{CCA} = V_{CCB} = 1.5 \text{ V}$	$V_{CCA} = V_{CCB} = 1.8 \text{ V}$	$V_{CCA} = V_{CCB} = 2.5 \text{ V}$	$V_{CCA} = V_{CCB} = 3.3 \text{ V}$	UNIT
				TYP	TYP	TYP	TYP	TYP	
C_{pdA}^\dagger	A to B	Outputs Enabled	$C_L = 0,$ $f = 10 \text{ MHz},$ $t_r = t_f = 1 \text{ ns}$	1	1	1	1	2	pF
		Outputs Disabled		1	1	1	1		
	B to A	Outputs Enabled		12	13	14	15	16	
		Outputs Disabled		1	1	1	1	1	
C_{pdB}^\dagger	A to B	Outputs Enabled	$C_L = 0,$ $f = 10 \text{ MHz},$ $t_r = t_f = 1 \text{ ns}$	13	13	14	15	16	pF
		Outputs Disabled		1	1	1	1	1	
	B to A	Outputs Enabled		1	1	1	2	2	
		Outputs Disabled		1	1	1	1	1	

† Power-dissipation capacitance per transceiver



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

TABLE 1

V _{CCB}	V _{CCA}						UNIT
	0 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
0 V	0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	μA
1.2 V	< 0.5	< 1	< 1	< 1	< 1	1	
1.5 V	< 0.5	< 1	< 1	< 1	< 1	1	
1.8 V	< 0.5	< 1	< 1	< 1	< 1	< 1	
2.5 V	< 0.5	1	< 1	< 1	< 1	< 1	
3.3 V	< 0.5	1	< 1	< 1	< 1	< 1	

TYPICAL CHARACTERISTICS

TYPICAL PROPAGATION DELAY (A to B) vs LOAD CAPACITANCE
 $T_A = 25^\circ\text{C}, V_{CCA} = 1.2\text{ V}$

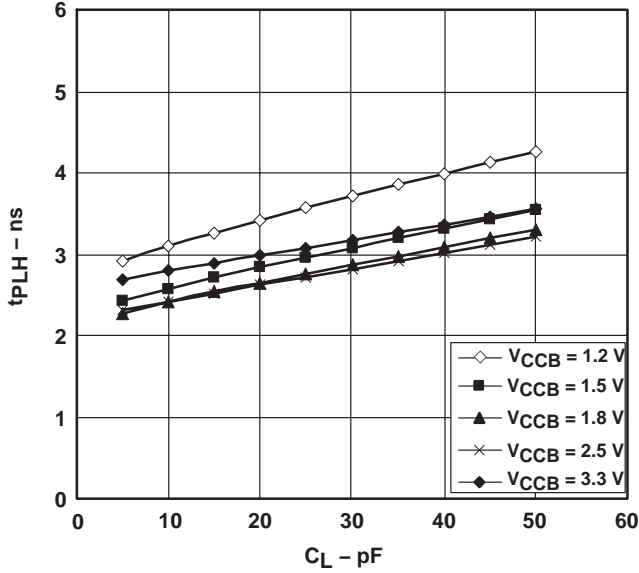


Figure 1

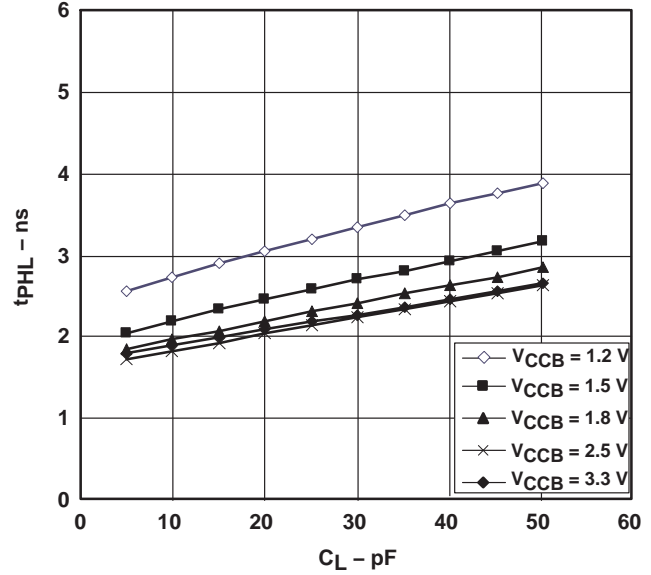


Figure 2

TYPICAL PROPAGATION DELAY (A to B) vs LOAD CAPACITANCE
 $T_A = 25^\circ\text{C}, V_{CCA} = 1.5\text{ V}$

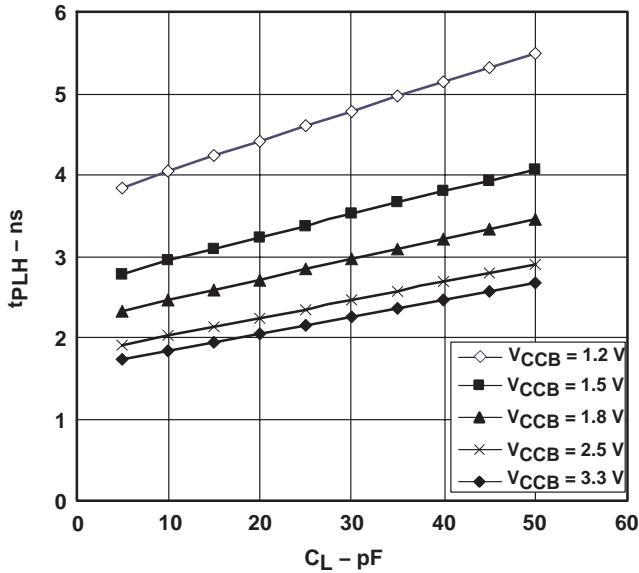


Figure 3

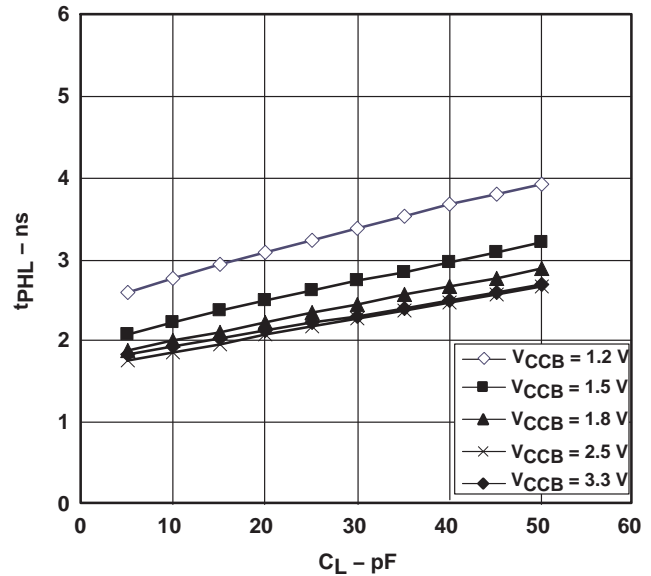


Figure 4

SN74AVC20T245
20-BIT DUAL-SUPPLY BUS TRANSCEIVER
WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

SCE5566F – MAY 2004 – REVISED APRIL 2005

TYPICAL PROPAGATION DELAY (A to B) vs LOAD CAPACITANCE
 $T_A = 25^\circ\text{C}$, $V_{CCA} = 1.8\text{ V}$

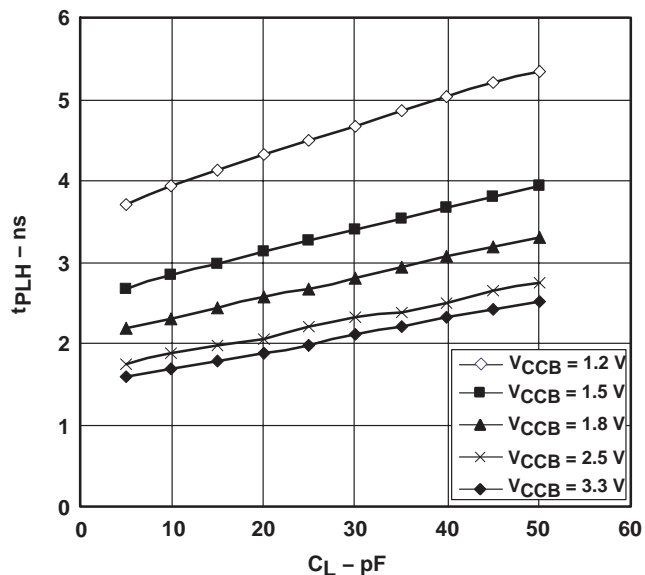


Figure 5

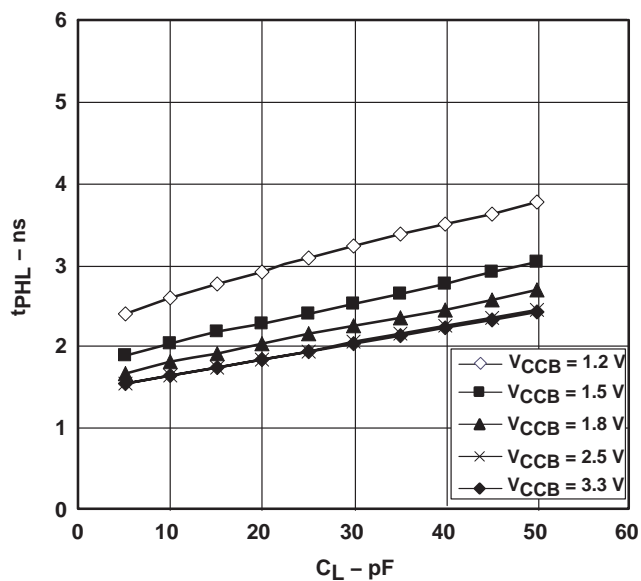


Figure 6

TYPICAL PROPAGATION DELAY (A to B) vs LOAD CAPACITANCE
 $T_A = 25^\circ\text{C}$, $V_{CCA} = 2.5\text{ V}$

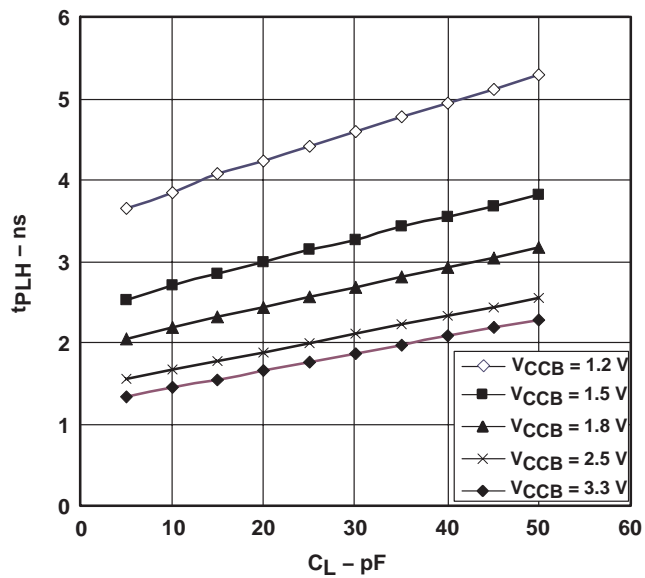


Figure 7

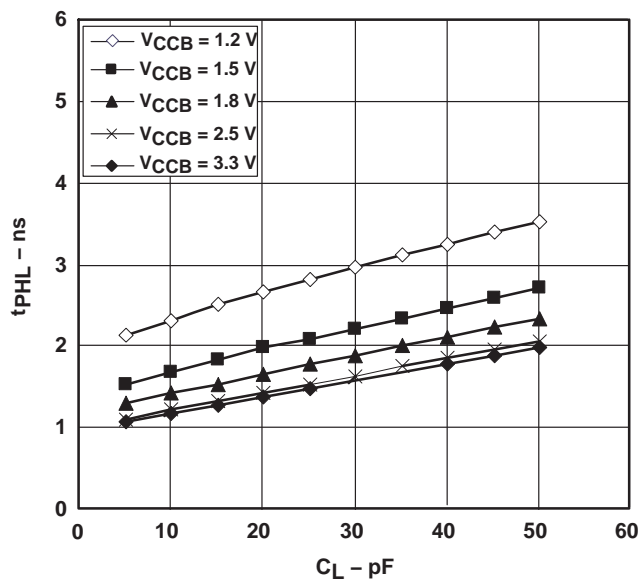


Figure 8

SN74AVC20T245
20-BIT DUAL-SUPPLY BUS TRANSCEIVER
WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

SCES566F – MAY 2004 – REVISED APRIL 2005

TYPICAL PROPAGATION DELAY (A to B) vs LOAD CAPACITANCE
 $T_A = 25^\circ\text{C}, V_{CCA} = 3.3\text{ V}$

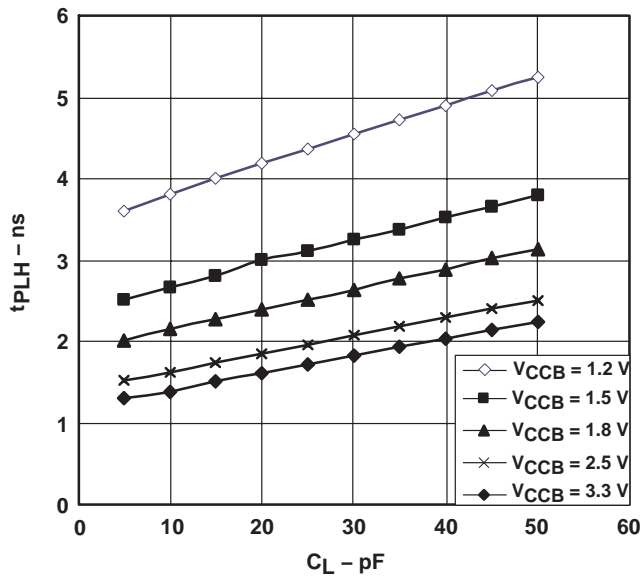


Figure 9

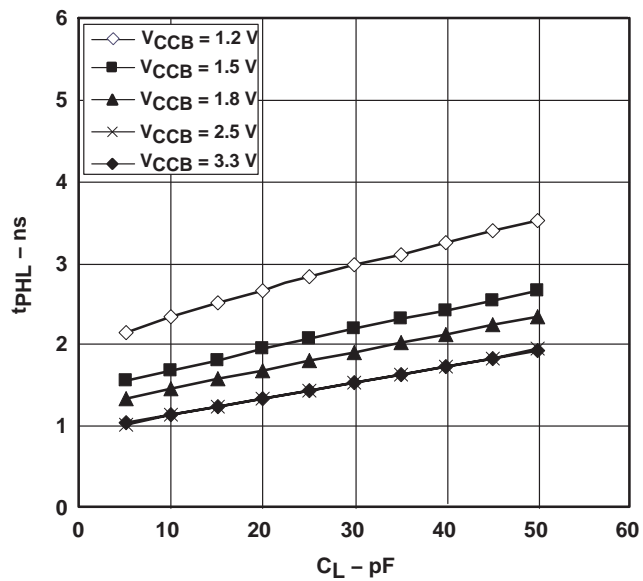
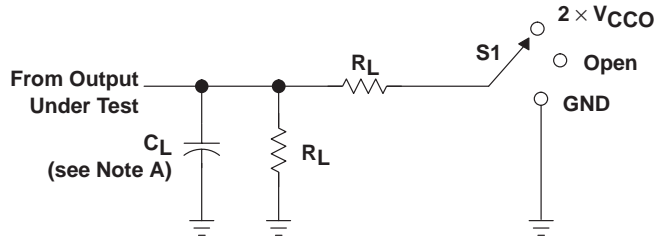


Figure 10

SN74AVC20T245
20-BIT DUAL-SUPPLY BUS TRANSCEIVER
WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

SCES566F – MAY 2004 – REVISED APRIL 2005

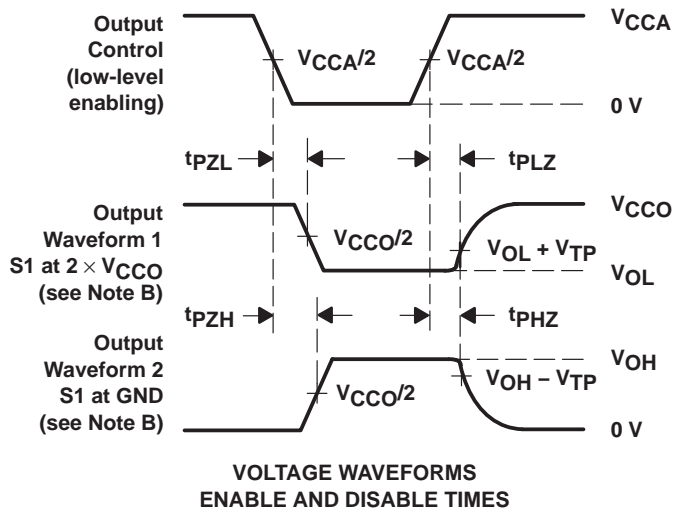
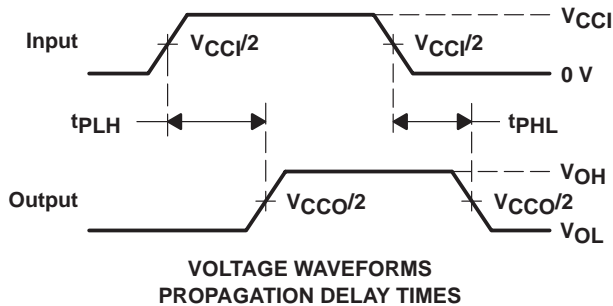
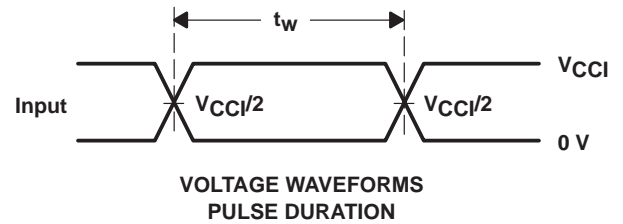
PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

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

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



- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_O = 50 \Omega$, $dv/dt \geq 1$ V/ns.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - V_{CCI} is the V_{CC} associated with the input port.
 - V_{CCO} is the V_{CC} associated with the output port.

Figure 11. 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⁾
74AVC20T245DGGRE4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74AVC20T245DGVRE4	ACTIVE	TVSOP	DGV	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AVC20T245DGG	PREVIEW	TSSOP	DGG	56	35	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AVC20T245DGGR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AVC20T245DGVR	ACTIVE	TVSOP	DGV	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AVC20T245GQLR	ACTIVE	VFBGA	GQL	56	1000	TBD	SNPB	Level-1-240C-UNLIM
SN74AVC20T245ZQLR	ACTIVE	VFBGA	ZQL	56	1000	Pb-Free (RoHS)	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) 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.

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)

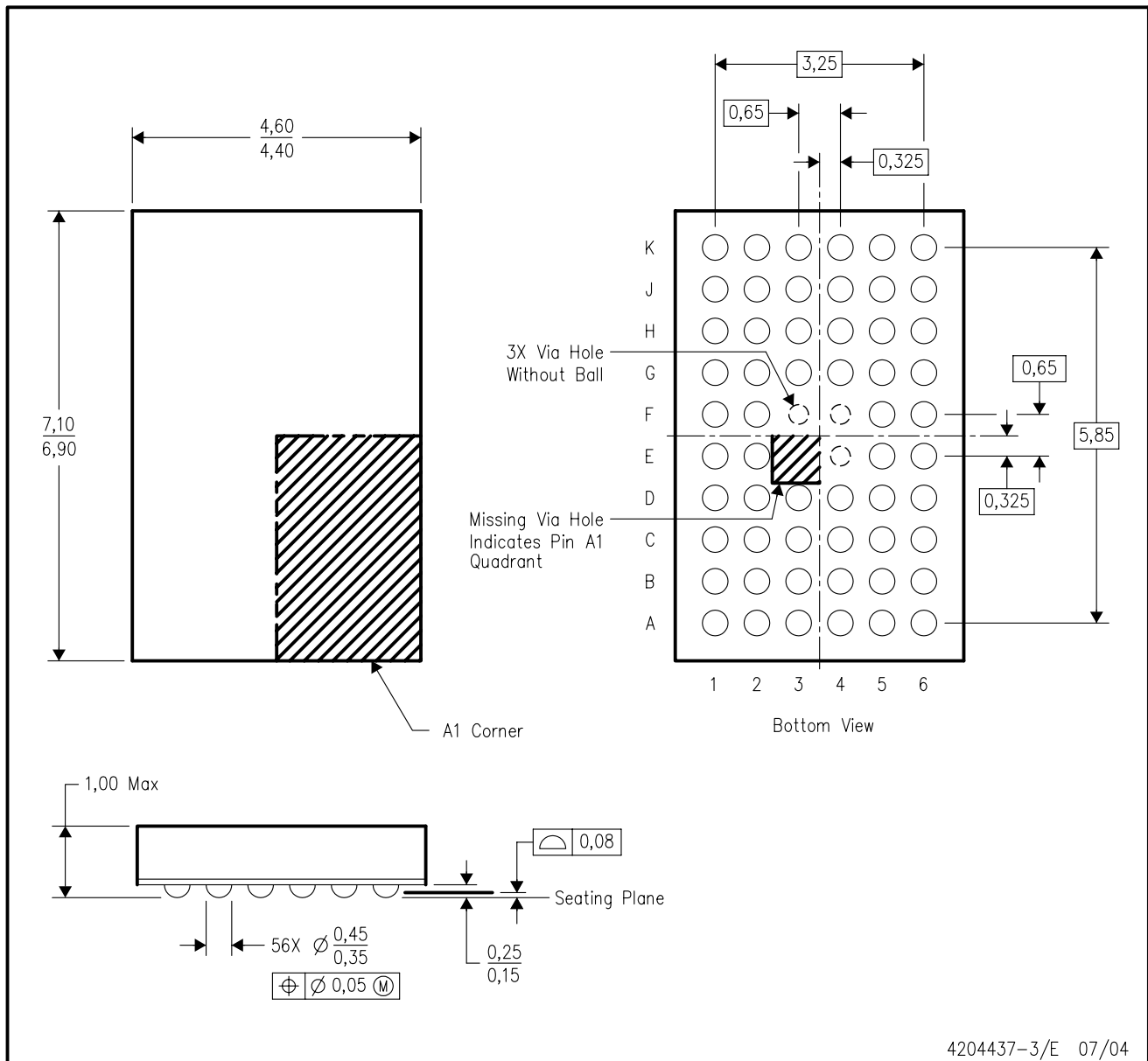
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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ZQL (R-PBGA-N56)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MO-225 variation BA.
 - D. This package is lead-free. Refer to the 56 GQL package (drawing 4200583) for tin-lead (SnPb).

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

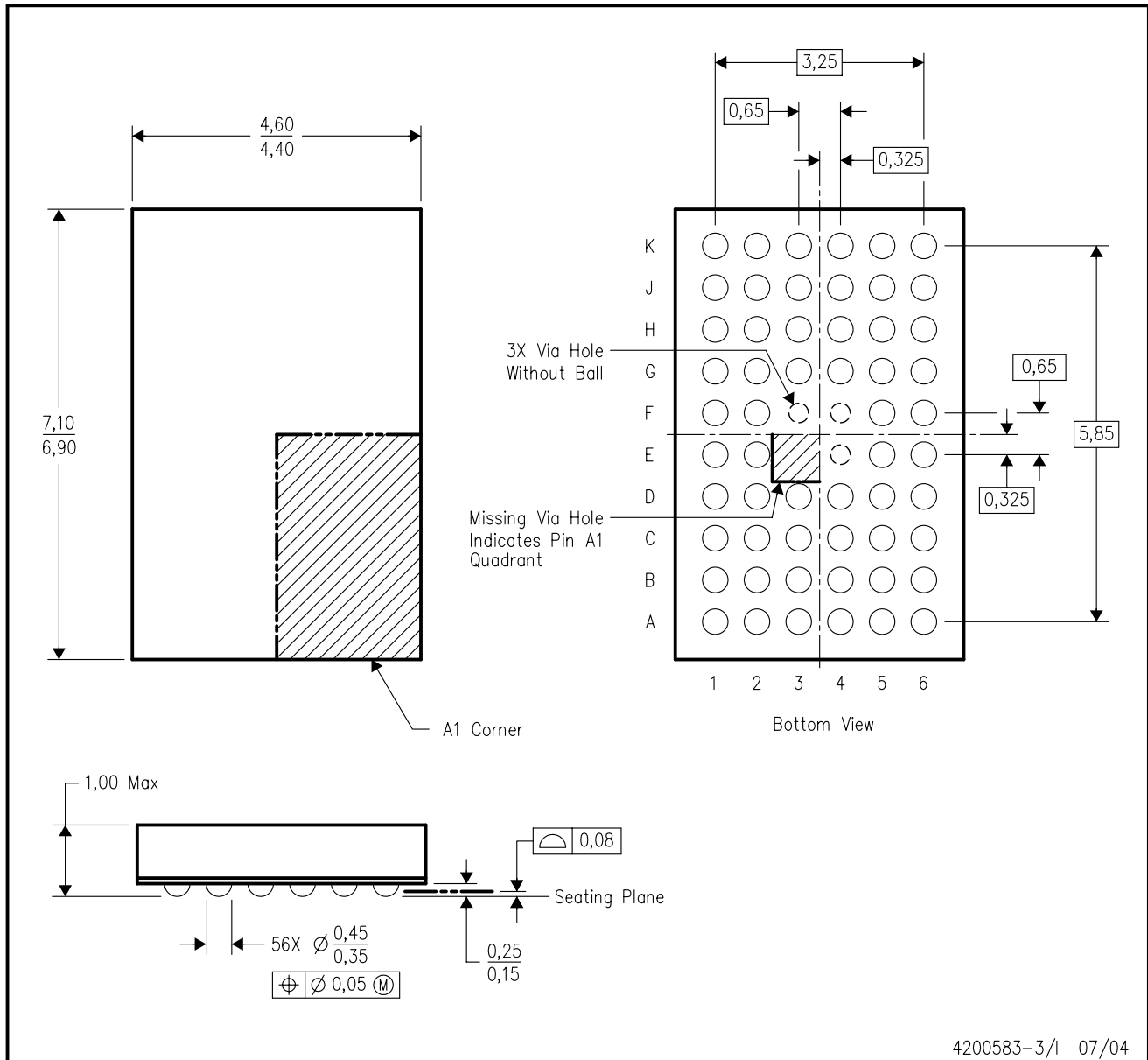
24 PINS SHOWN



- 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

GQL (R-PBGA-N56)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MO-225 variation BA.
 - D. This package is tin-lead (SnPb). Refer to the 56 ZQL package (drawing 4204437) for lead-free.

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265