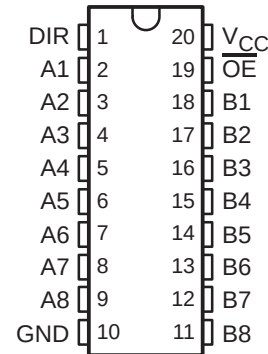


SN74LVCZ245A OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

SCES275G – JUNE 1999 – REVISED AUGUST 2003

- Operates From 2.7 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 6.3 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce)
<0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot)
>2 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- I_{off} and Power-Up 3-State Support Hot Insertion
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V V_{CC})
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

DB, DW, N, NS, OR PW PACKAGE
(TOP VIEW)



description/ordering information

This octal bus transceiver is designed for 2.7-V to 3.6-V V_{CC} operation.

The SN74LVCZ245A 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 device so the buses are effectively isolated.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of this device as a translator in a mixed 3.3-V/5-V system environment.

When V_{CC} is between 0 and 1.5 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, $\overline{OE}$ 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.

This device is fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 20	SN74LVCZ245AN	SN74LVCZ245AN
	SOIC – DW	Tube of 25	SN74LVCZ245ADW	LVCZ245A
		Reel of 2000	SN74LVCZ245ADWR	
	SOP – NS	Reel of 2000	SN74LVCZ245ANSR	LVCZ245A
	SSOP – DB	Reel of 2000	SN74LVCZ245ADBR	CV245A
	TSSOP – PW	Tube of 70	SN74LVCZ245APW	CV245A
		Reel of 2000	SN74LVCZ245APWR	CV245A
		Reel of 250	SN74LVCZ245APWT	CV245A

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



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

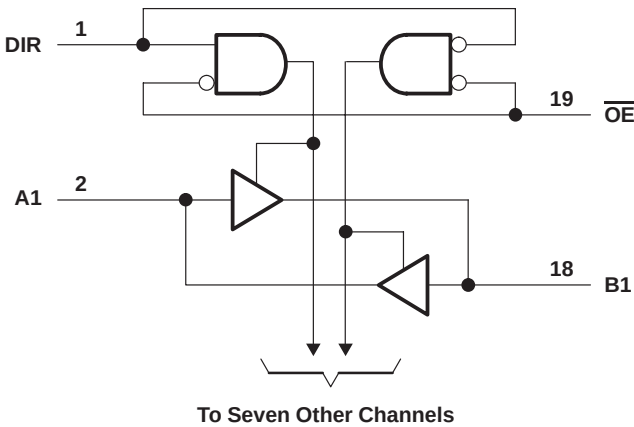
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FUNCTION TABLE

INPUTS		OPERATION
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_{CC}	–0.5 V to 6.5 V
Input voltage range, V_I (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high or low state, V_O (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ 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_{CC} or GND	±100 mA
Package thermal impedance, θ_{JA} (see Note 3):	
DB package	70°C/W
DW package	58°C/W
N package	89°C/W
NS package	60°C/W
PW package	83°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:
- The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
 - The value of V_{CC} is provided in the recommended operating conditions table.
 - The package thermal impedance is calculated in accordance with JESD 51-7.

SN74LVCZ245A
OCTAL BUS TRANSCEIVER
WITH 3-STATE OUTPUTS

SCES275G – JUNE 1999 – REVISED AUGUST 2003

recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V _{CC}	Supply voltage		2.7	3.6	V
V _{IH}	High-level input voltage	V _{CC} = 2.7 V to 3.6 V	2		V
V _{IL}	Low-level input voltage	V _{CC} = 2.7 V to 3.6 V		0.8	V
V _I	Input voltage		0	5.5	V
V _O	Output voltage	High or low state	0	V _{CC}	V
		3-state	0	5.5	
I _{OH}	High-level output current	V _{CC} = 2.7 V		–12	mA
		V _{CC} = 3 V		–24	
I _{OL}	Low-level output current	V _{CC} = 2.7 V		12	mA
		V _{CC} = 3 V		24	
Δt/Δv	Input transition rise or fall rate			6	ns/V
Δt/ΔV _{CC}	Power-up ramp rate		150		μs/V
T _A	Operating free-air temperature		–40	85	°C

NOTE 4: All unused inputs of the device must be held at V_{CC} 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)

PARAMETER	TEST CONDITIONS	V _{CC}	MIN	TYP [†]	MAX	UNIT
V _{OH}	I _{OH} = –100 μA	2.7 V to 3.6 V	V _{CC} –0.2			V
	I _{OH} = –12 mA	2.7 V	2.2			
		3 V	2.4			
	I _{OH} = –24 mA	3 V	2.2			
V _{OL}	I _{OL} = 100 μA	2.7 V to 3.6 V			0.2	V
	I _{OL} = 12 mA	2.7 V			0.4	
	I _{OL} = 24 mA	3 V			0.55	
I _I	Control inputs	V _I = 0 to 5.5 V			±5	μA
I _{off}		V _I or V _O = 5.5 V	0		±5	μA
I _{OZ} [‡]		V _O = 0 to 5.5 V			±5	μA
I _{OZPU}	V _O = 0.5 V to 2.5 V, $\overline{\text{OE}}$ = don't care	0 to 1.5 V			±5	μA
I _{OZPD}	V _O = 0.5 V to 2.5 V, $\overline{\text{OE}}$ = don't care	1.5 V to 0			±5	μA
I _{CC}	V _I = V _{CC} or GND	3.6 V			100	μA
	3.6 V ≤ V _I ≤ 5.5 V [§]				100	
ΔI _{CC}	One input at V _{CC} – 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V			100	μA
C _i	Control inputs	V _I = V _{CC} or GND	3.3 V	4		pF
C _{io}	A or B ports	V _O = V _{CC} or GND	3.3 V	6		pF

[†] All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

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

[§] This applies in the disabled state only.



SN74LVCZ245A
OCTAL BUS TRANSCEIVER
WITH 3-STATE OUTPUTS

SCES275G – JUNE 1999 – REVISED AUGUST 2003

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

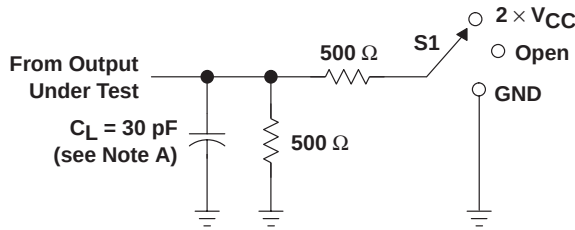
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}	A or B	B or A		7.3	1.5	6.3	ns
t_{en}	$\overline{OE}$	A or B		9.5	1.5	8.5	ns
t_{dis}	$\overline{OE}$	A or B		8.5	1.7	7.5	ns

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

PARAMETER			TEST CONDITIONS	$V_{CC} = 3.3\text{ V}$	UNIT
				TYP	
C_{pd} Power dissipation capacitance per transceiver	Outputs enabled	$f = 10\text{ MHz}$		42	pF
	Outputs disabled			3	

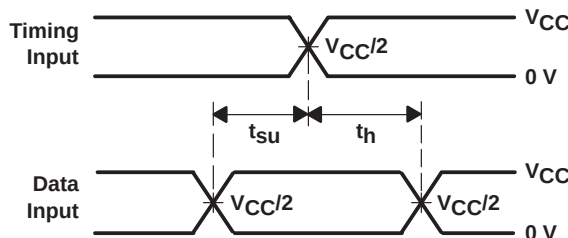
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V AND } 3.3\text{ V} \pm 0.3\text{ V}$

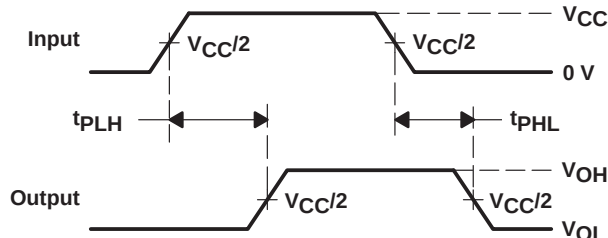


LOAD CIRCUIT

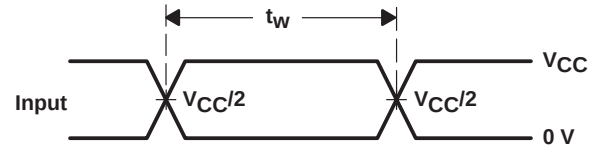
TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	2 $\times V_{CC}$
t_{PHZ}/t_{PZH}	GND



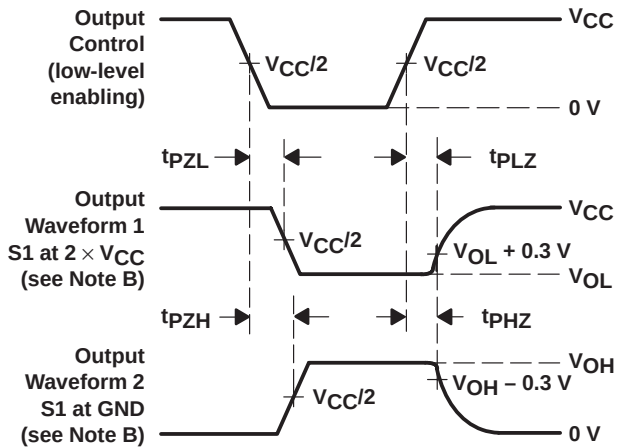
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

- 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: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2\text{ ns}$, $t_f \leq 2\text{ ns}$.
 - 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} .
 - All parameters and waveforms are not applicable to all devices.

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⁾
SN74LVCZ245ADBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LVCZ245ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LVCZ245ANSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ANSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245ANSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWTE4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ245APWTG4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	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.

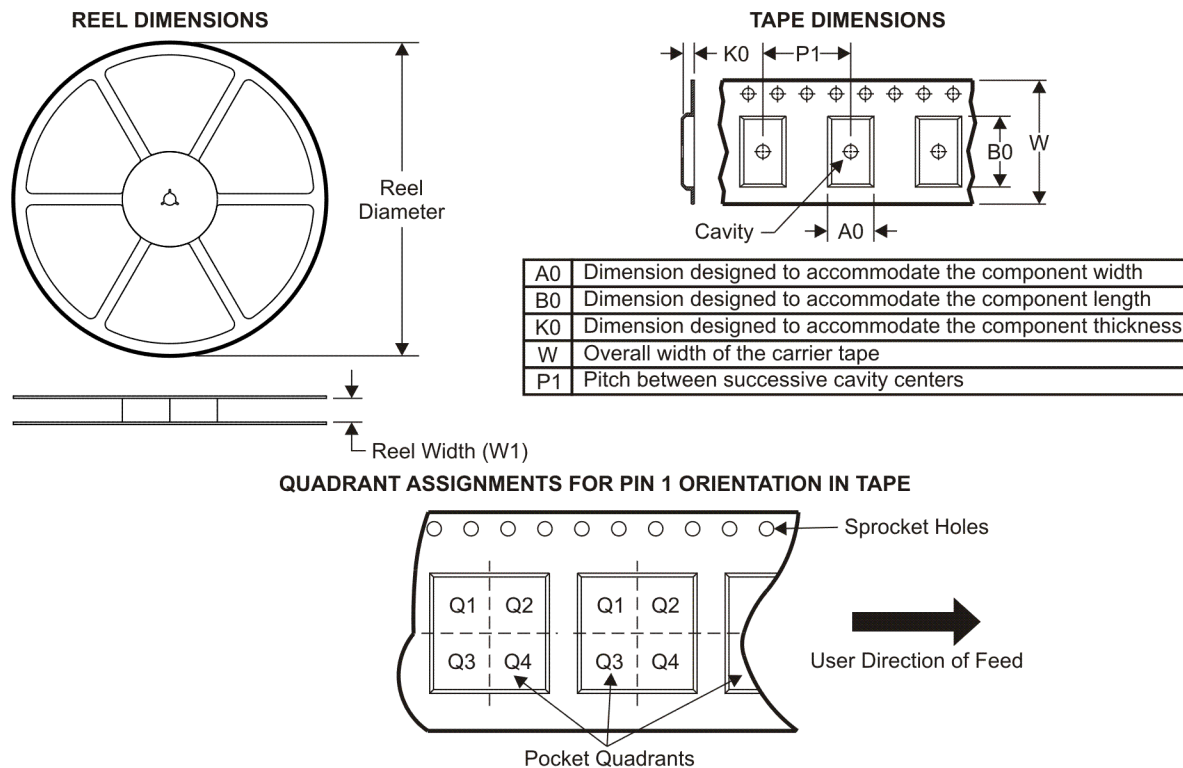
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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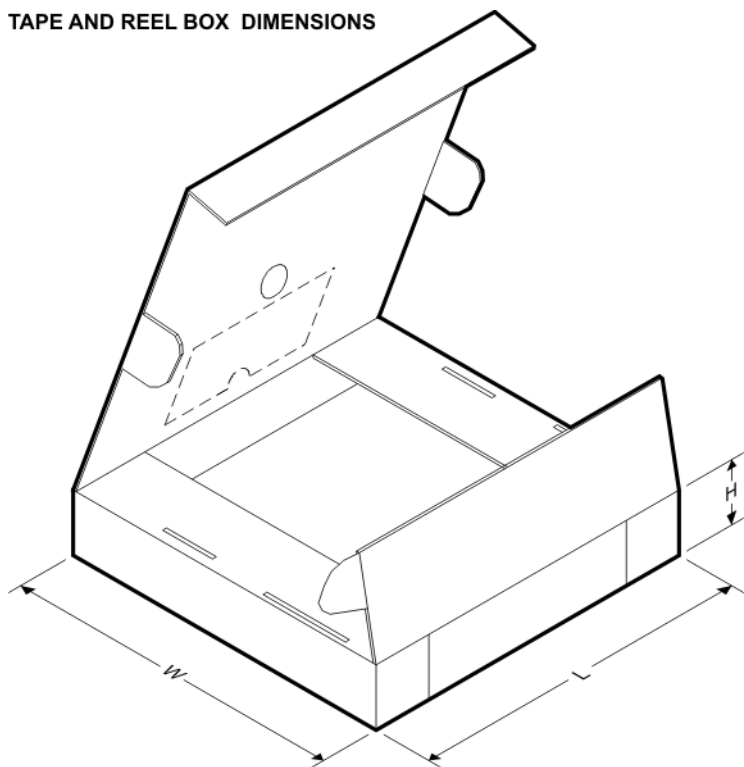
TAPE AND REEL INFORMATION



*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
SN74LVCZ245ADBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LVCZ245ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74LVCZ245APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



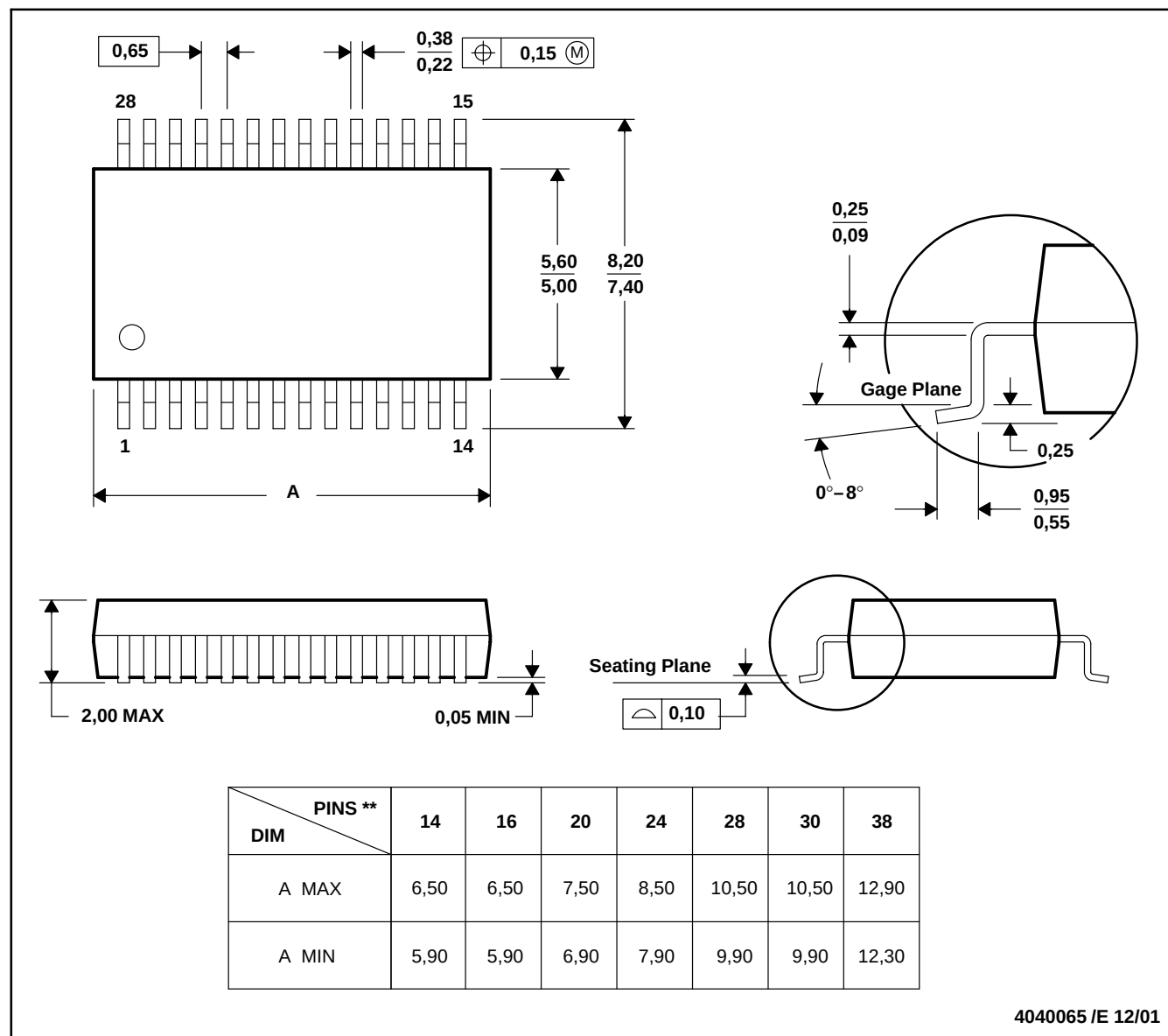
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVCZ245ADBR	SSOP	DB	20	2000	346.0	346.0	33.0
SN74LVCZ245ADWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74LVCZ245APWR	TSSOP	PW	20	2000	346.0	346.0	33.0

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

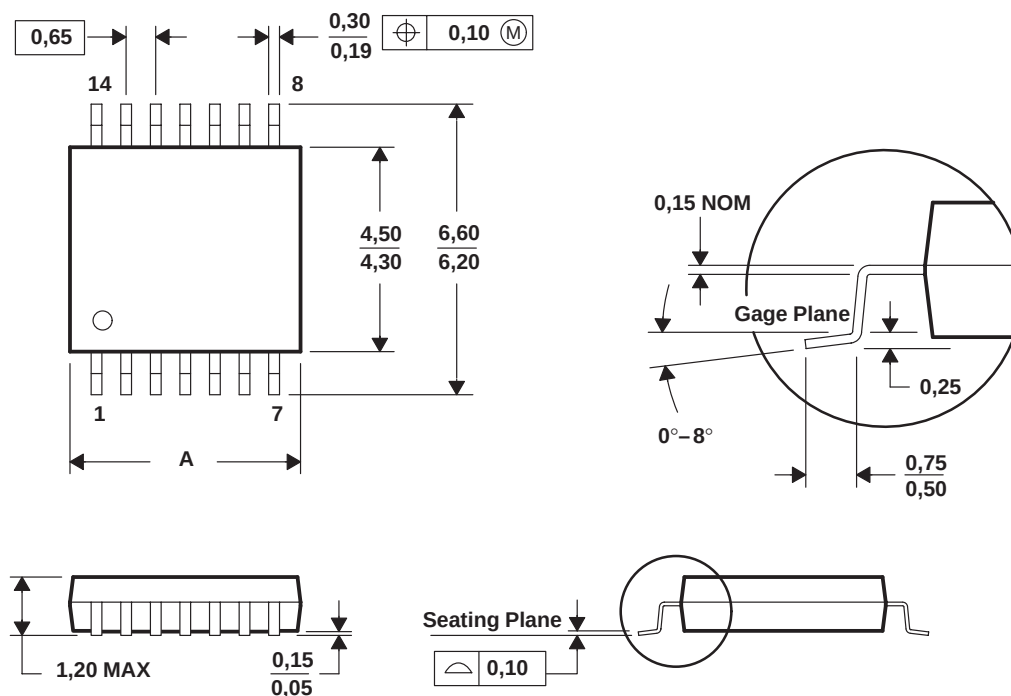


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



PINS ** DIM	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

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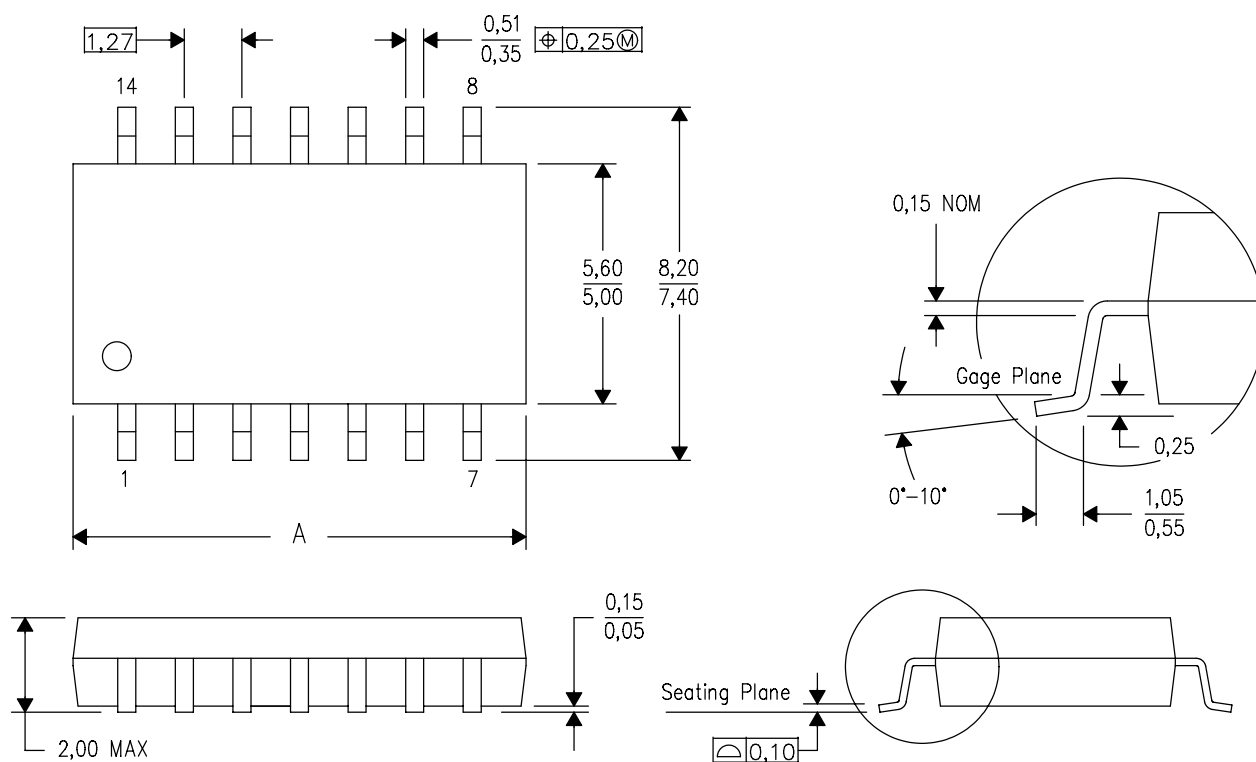
- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



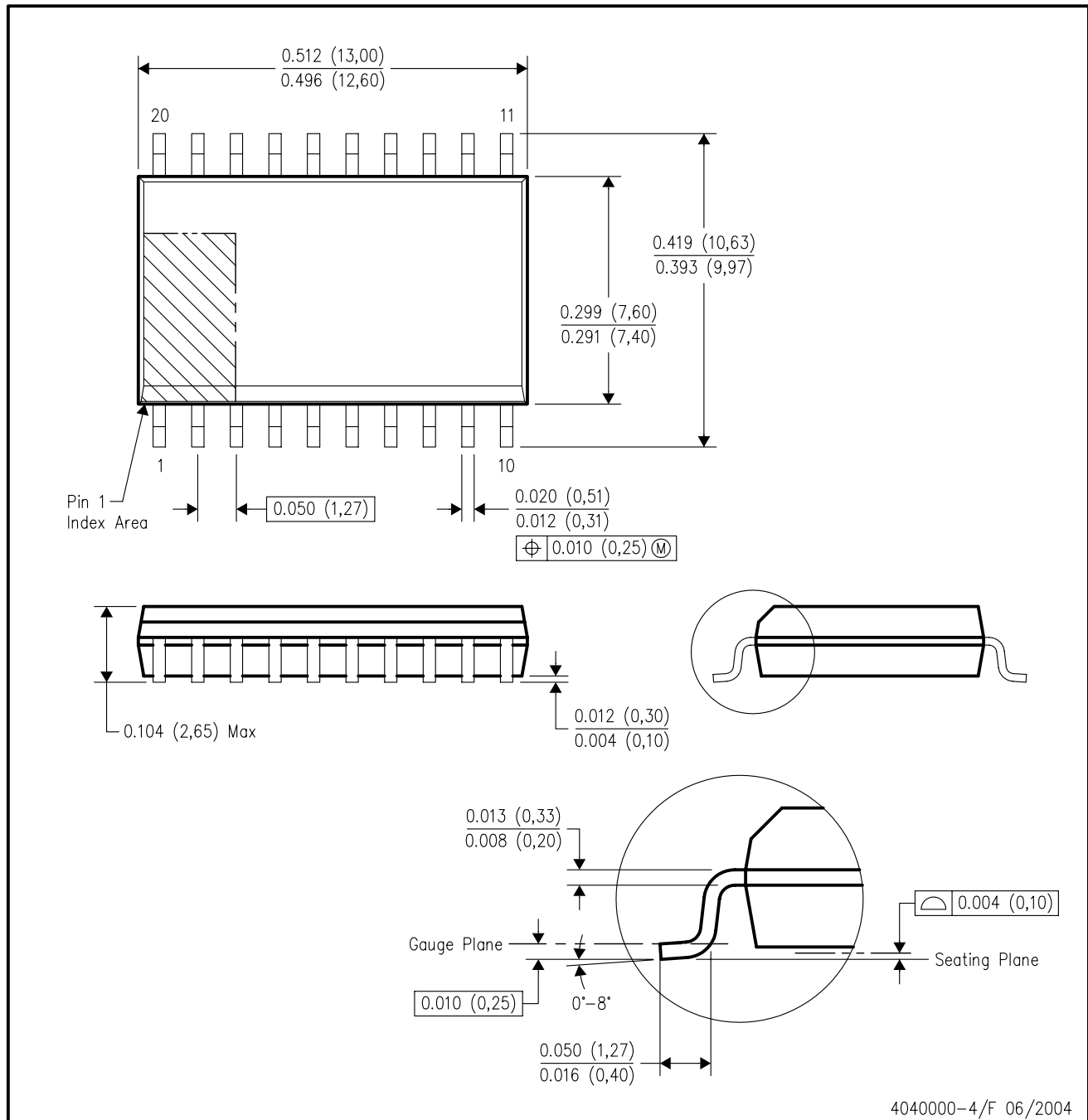
DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE

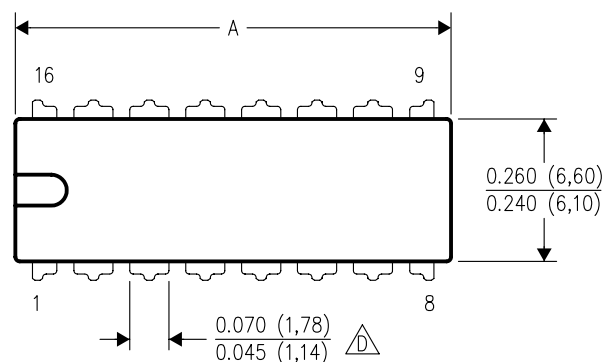


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

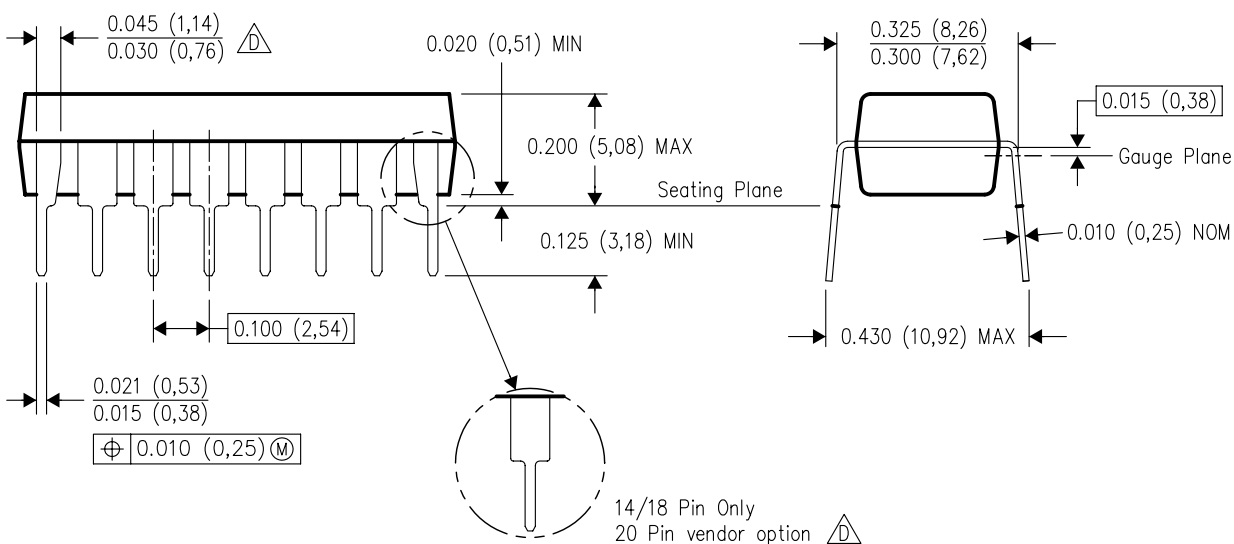
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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