

SN54ABT162827A, SN74ABT162827A 20-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS248F – JULY 1993 – REVISED JUNE 2004

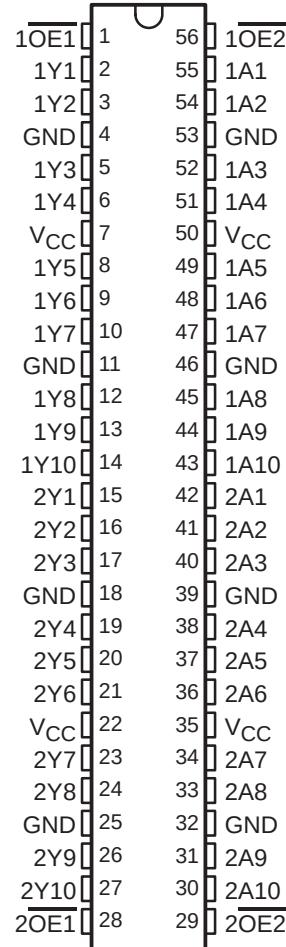
- Members of the Texas Instruments Widebus™ Family
- Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required
- High-Impedance State During Power Up and Power Down
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Distributed V_{CC} and GND Pins Minimize High-Speed Switching Noise
- I_{off} and Power-Up 3-State Support Hot Insertion
- Flow-Through Architecture Optimizes PCB Layout
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)

description/ordering information

The 'ABT162827A devices are noninverting 20-bit buffers composed of two 10-bit buffers with separate output-enable signals. For either 10-bit buffer, the two output-enable ($1OE1$ and $1OE2$, or $2OE1$ and $2OE2$) inputs must both be low for the corresponding Y outputs to be active. If either output-enable input is high, the outputs of that 10-bit buffer are in the high-impedance state.

The outputs, which are designed to source or sink up to 12 mA, include equivalent 25-Ω series resistors to reduce overshoot and undershoot.

SN54ABT162827A . . . WD PACKAGE
SN74ABT162827A . . . DGG OR DL PACKAGE
(TOP VIEW)



ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SSOP – DL	Tube	SN74ABT162827ADL	ABT162827A
		Tape and reel	SN74ABT162827ADLR	
	TSSOP – DGG	Tape and reel	SN74ABT162827ADGGR	ABT162827A
-55°C to 125°C	CFP – WD	Tube	SNJ54ABT162827AWD	SNJ54ABT162827AWD

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



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20-BIT BUFFERS/DRIVERS
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description/ordering information (continued)

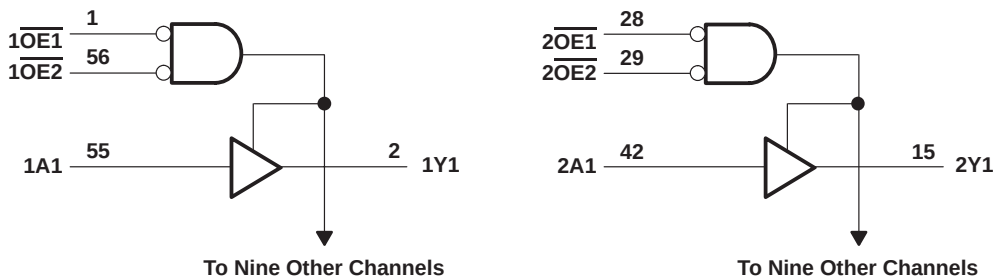
These devices are fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance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

To ensure the high-impedance state during power up or power down, $\overline{OE}$ shall 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 10-bit buffer)

INPUTS			OUTPUT
$\overline{OE1}$	$\overline{OE2}$	A	Y
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	X	Z

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 7 V
Input voltage range, V_I (see Note 1)	-0.5 V to 7 V
Voltage range applied to any output in the high or power-off state, V_O	-0.5 V to 5.5 V
Current into any output in the low state, I_O	30 mA
Input clamp current, I_{IK} ($V_I < 0$)	-18 mA
Output clamp current, I_{OK} ($V_O < 0$)	-50 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package	64°C/W
DL package	56°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 and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

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recommended operating conditions (see Note 3)

		SN54ABT162827A		SN74ABT162827A		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	4.5	5.5	4.5	5.5	V
V _{IH}	High-level input voltage	2		2		V
V _{IL}	Low-level input voltage		0.8		0.8	V
V _I	Input voltage	0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current		–3		–12	mA
I _{OL}	Low-level output current		8		12	mA
Δt/ΔV	Input transition rise or fall rate		10		10	ns/V
Δt/ΔV _{CC}	Power-up ramp rate	200		200		μs/V
T _A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: 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.

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20-BIT BUFFERS/DRIVERS

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

PARAMETER		TEST CONDITIONS	T _A = 25°C			SN54ABT162827A		SN74ABT162827A		UNIT		
			MIN	TYP†	MAX	MIN	MAX	MIN	MAX			
V _{IK}		V _{CC} = 4.5 V, I _I = -18 mA	-1.2			-1.2		-1.2		V		
V _{OH}		V _{CC} = 4.5 V, I _{OH} = -1 mA	3.35			3.35		3.35		V		
		V _{CC} = 5 V, I _{OH} = -1 mA	3.85			3.85		3.85				
		V _{CC} = 4.5 V	I _{OH} = -3 mA	3.1			3.1		3.1			
			I _{OH} = -12 mA	2.6*					2.6			
V _{OL}		V _{CC} = 4.5 V	I _{OL} = 8 mA	0.4			0.8		0.65		V	
			I _{OL} = 12 mA	0.8*					0.8			
V _{hys}					100					mV		
I _I		V _{CC} = 0 to 5.5 V, V _I = V _{CC} or GND			±1			±1		μA		
I _{OZPU}		V _{CC} = 0 to 2.1 V, V _O = 0.5 V to 2.7 V, $\overline{OE}$ = X			±50			±50		μA		
I _{OZPD}		V _{CC} = 2.1 V to 0, V _O = 0.5 V to 2.7 V, $\overline{OE}$ = X			±50			±50		μA		
I _{OZH} ‡		V _{CC} = 2.1 V to 5.5 V, V _O = 2.7 V, $\overline{OE} \geq 2$ V			10			10		μA		
I _{OZL} ‡		V _{CC} = 2.1 V to 5.5 V, V _O = 0.5 V, $\overline{OE} \geq 2$ V			-10			-10		μA		
I _{off}		V _{CC} = 0, V _I or V _O ≤ 4.5 V			±100			±100		μA		
I _{CEX}		V _{CC} = 5.5 V, V _O = 5.5 V	Outputs high			50			50		μA	
I _O §		V _{CC} = 5.5 V, V _O = 2.5 V			-25	-75	-100	-25	-100	-25	-100	mA
I _{CC}		V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND	Outputs high			2			2		mA	
			Outputs low			32			32			
			Outputs disabled			2			2			
ΔI _{CC} ¶	Data inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND	Outputs enabled			1			1.5		mA	
			Outputs disabled			0.05			1			
	Control inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND			1.5			1.5		1.5		
C _i		V _I = 2.5 V or 0.5 V			4					pF		
C _O		V _O = 2.5 V or 0.5 V			7					pF		

* On products compliant to MIL-PRF-38535, this parameter does not apply.

[†] All typical values are at V_{CC} = 5 V.

[‡] The parameters I_{OZH} and I_{OZL} include the input leakage current.

[§] Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

[¶] This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$			SN54ABT162827A		SN74ABT162827A		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	1	2.1	3.6	1	4.1	1	3.9	ns
t_{PHL}			1.1	2.8	4.2	1.1	5	1.1	4.7	
t_{PZH}	$\overline{OE}$	Y	1.5	3.4	6.3	1.5	7.2	1.5	6.9	ns
t_{PZL}			1.6	3.5	5.3	1.6	6.6	1.6	6.3	
t_{PHZ}	$\overline{OE}$	Y	2.1	4.1	6.5	2.1	6.8	2.1	6.6	ns
t_{PLZ}			1.5	3.5	5.9	1.5	7.3	1.5	6.3	

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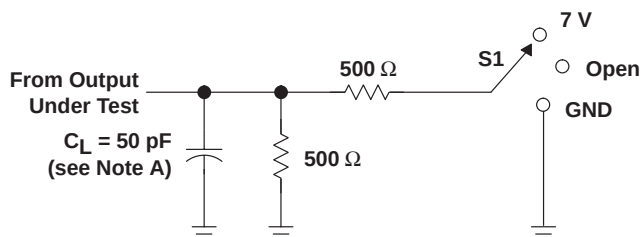
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20-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

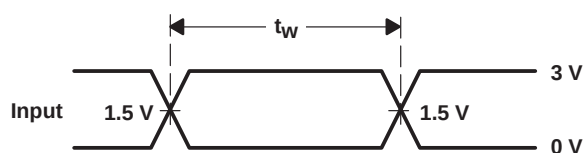
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PARAMETER MEASUREMENT INFORMATION

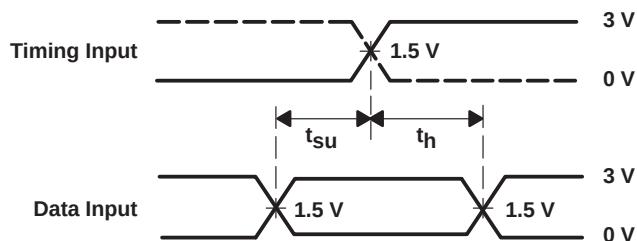


LOAD CIRCUIT

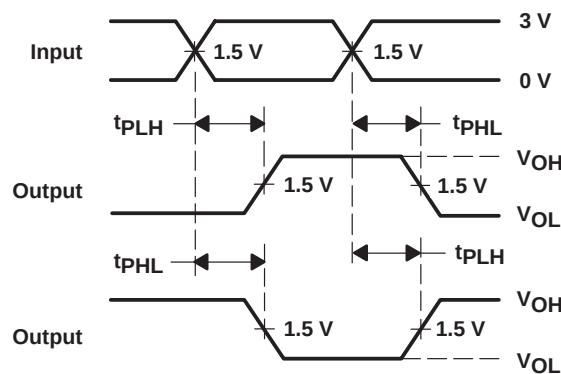
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



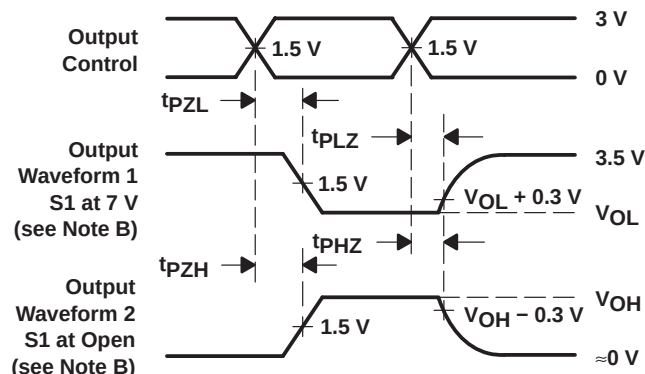
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
- D. The outputs are measured one at a time, with one transition per measurement.
- E. 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⁾
74ABT162827ADGGRE4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ABT162827ADGGRG4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ABT162827ADLRG4	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT162827ADGGR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT162827ADL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT162827ADLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT162827ADLR	ACTIVE	SSOP	DL	56	1000	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.

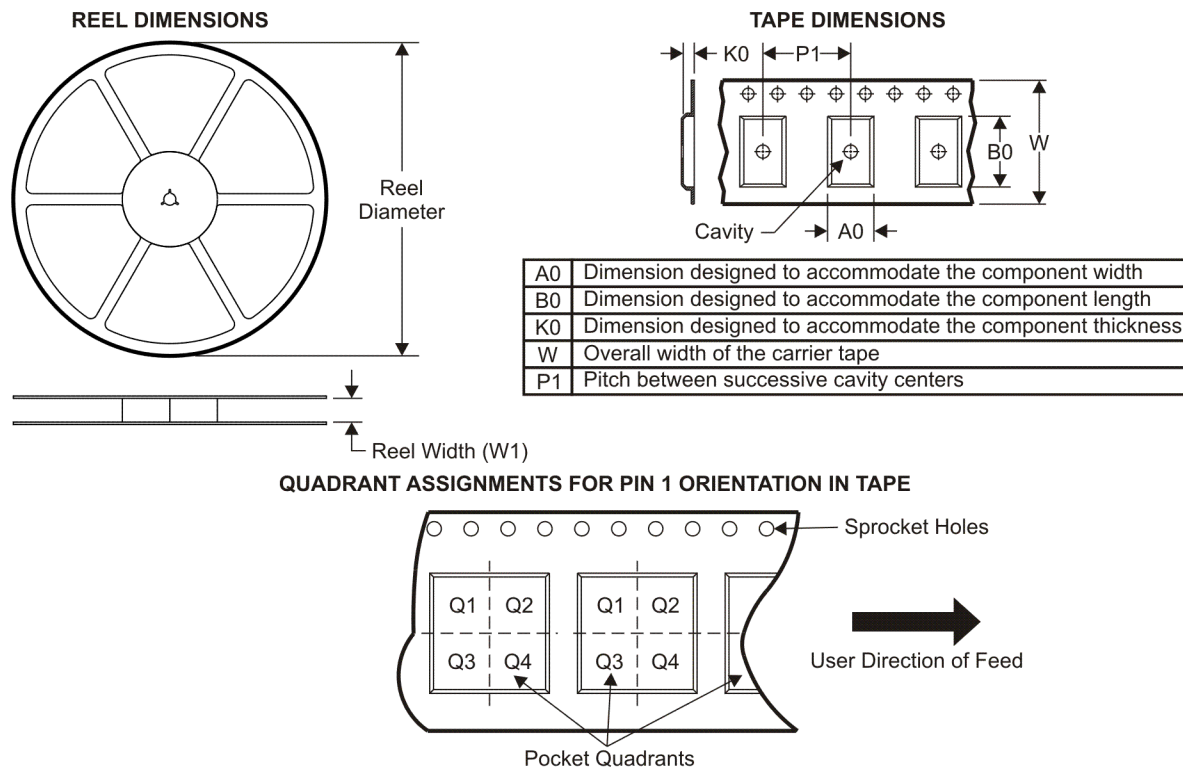
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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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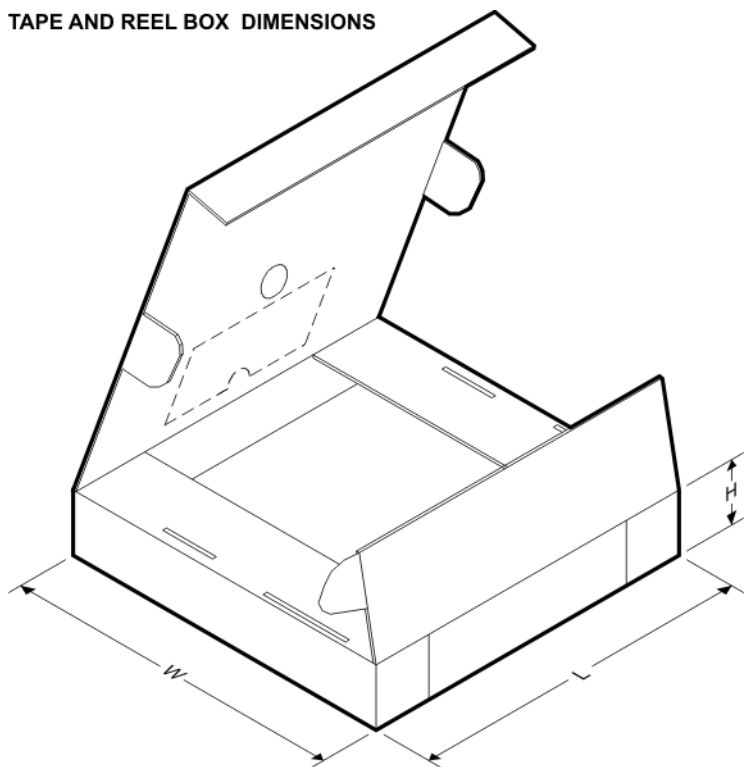
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TAPE AND REEL INFORMATION


*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
SN74ABT162827ADGGR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1
SN74ABT162827ADLR	SSOP	DL	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS



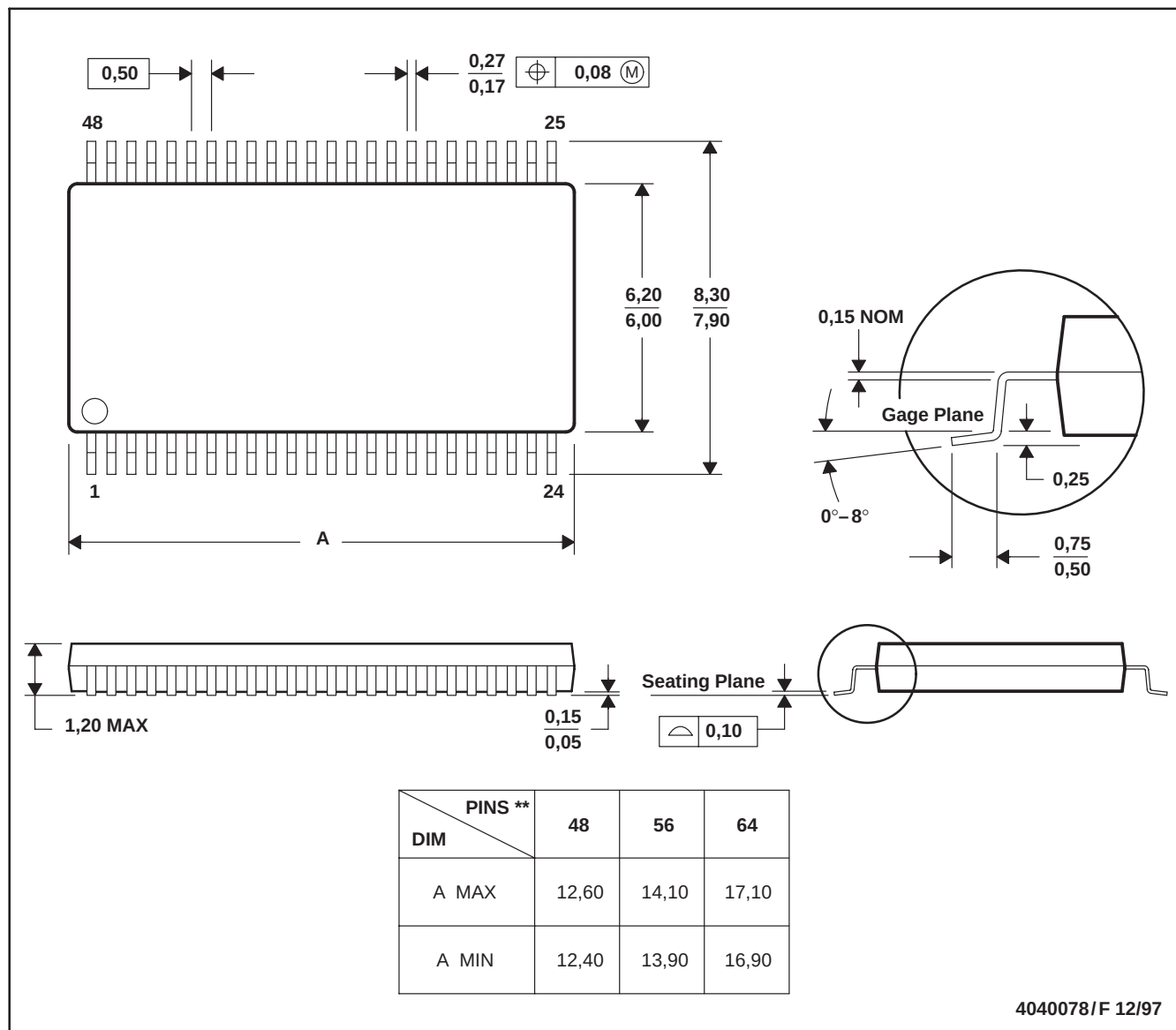
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ABT162827ADGGR	TSSOP	DGG	56	2000	346.0	346.0	41.0
SN74ABT162827ADLR	SSOP	DL	56	1000	346.0	346.0	49.0

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN

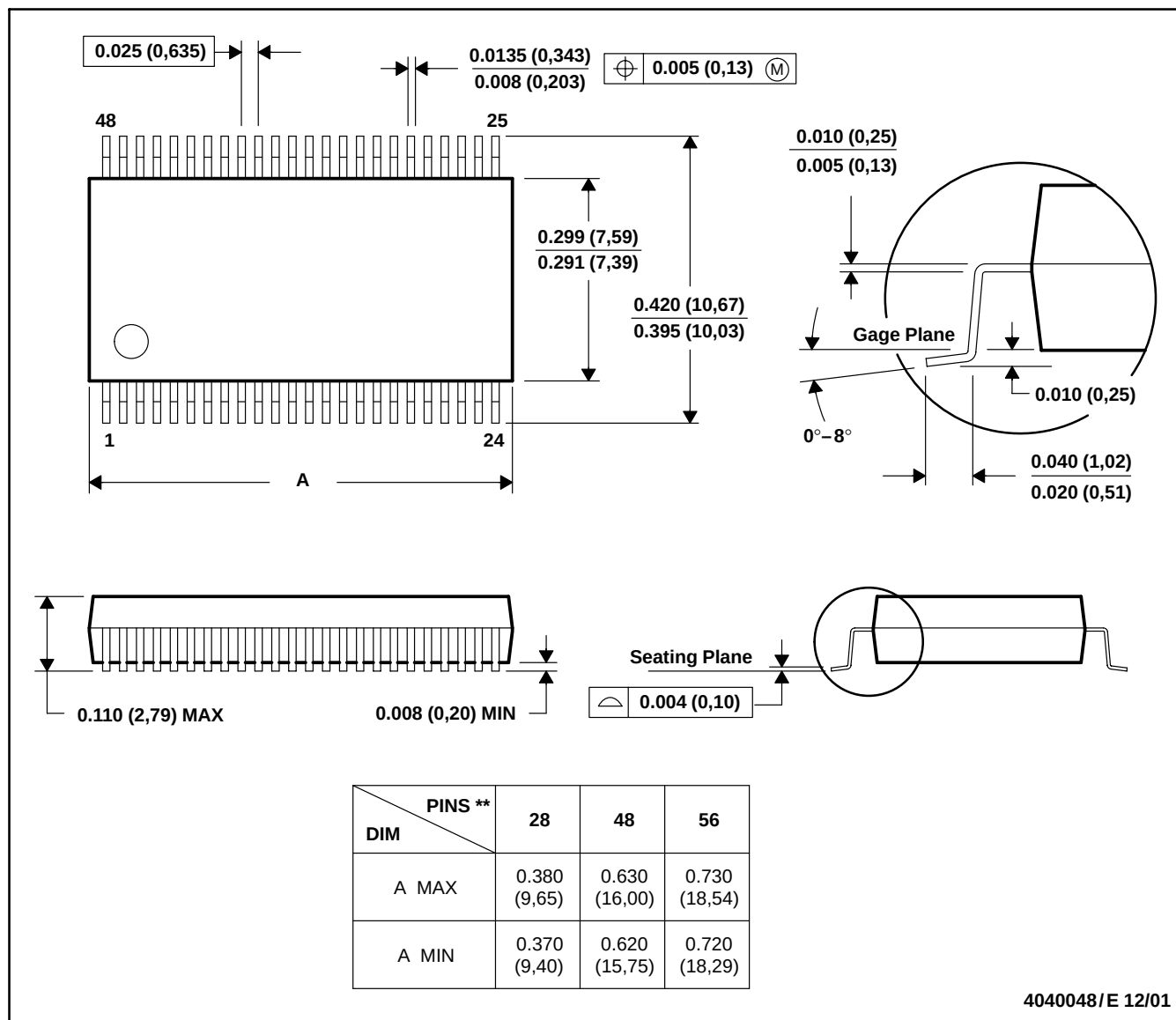


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

DL (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- 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 MO-118

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