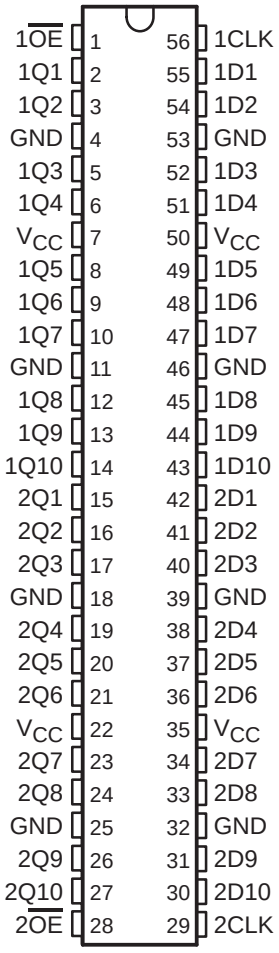
- **State-of-the-Art Advanced BiCMOS Technology (ABT) *Widebus*™ Design for 2.5-V and 3.3-V Operation and Low Static Power Dissipation**
- **Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 2.3-V to 3.6-V V_{CC})**
- **Typical V_{OLP} (Output Ground Bounce) < 0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **High-Drive (–24/24 mA at 2.5-V and –32/64 mA at 3.3-V V_{CC})**
- **Power Off Disables Outputs, Permitting Live Insertion**
- **High-Impedance State During Power Up and Power Down Prevents Driver Conflict**
- **Uses Bus Hold on Data Inputs in Place of External Pullup/Pulldown Resistors to Prevent the Bus From Floating**
- **Auto3-State Eliminates Bus Current Loading When Output Exceeds V_{CC} + 0.5 V**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model; and Exceeds 1000 V Using Charged-Device Model, Robotic Method**
- **Flow-Through Architecture Facilitates Printed Circuit Board Layout**
- **Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **Package Options Include Plastic Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), Thin Very Small-Outline (DGV) Packages, and 380-mil Fine-Pitch Ceramic Flat (WD) Package**

SN54ALVTH16821 . . . WD PACKAGE
SN74ALVTH16821 . . . DGG, DGV, OR DL PACKAGE
(TOP VIEW)



description

The ’ALVTH16821 devices are 20-bit bus-interface flip-flops with 3-state outputs designed for 2.5-V or 3.3-V V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

The devices can be used as two 10-bit flip-flops or one 20-bit flip-flop. The 20-bit flip-flops are edge-triggered D-type flip-flops. On the positive transition of the clock (CLK), the flip-flops store the logic levels set up at the D inputs.

description (continued)

A buffered output-enable ($\overline{OE}$) input can be used to place the ten outputs in either a normal logic state (high or low level) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without need for interface or pullup components.

$\overline{OE}$ does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

When V_{CC} is between 0 and 1.2 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.2 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.

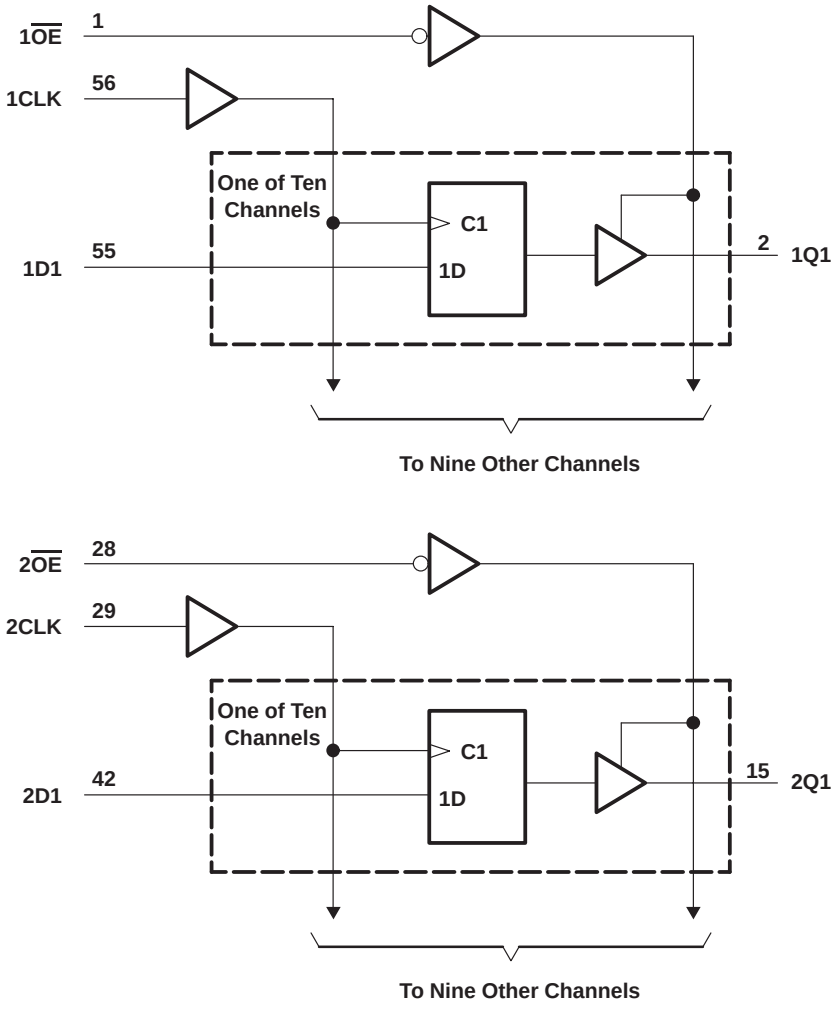
Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN54ALVTH16821 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74ALVTH16821 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE
(each 10-bit section)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	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 4.6 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 7 V
Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1) . . . . . –0.5 V to 7 V
Voltage range applied to any output in the high state, V_O (see Note 1) . . . . . –0.5 V to 7 V
Output current in the low state, I_O: SN54ALVTH16821 . . . . . 96 mA
SN74ALVTH16821 . . . . . 128 mA
Output current in the high state, I_O: SN54ALVTH16821 . . . . . –48 mA
SN74ALVTH16821 . . . . . –64 mA
Input clamp current, I_{IK} ($V_I < 0$) . . . . . –50 mA
Output clamp current, I_{OK} ($V_O < 0$) . . . . . –50 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package . . . . . 81°C/W
DGV package . . . . . 86°C/W
DL package . . . . . 74°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.

recommended operating conditions, V_{CC} = 2.5 V ± 0.2 V (see Note 3)

			SN54ALVTH16821			SN74ALVTH16821			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{CC}	Supply voltage		2.3		2.7	2.3		2.7	V
V_{IH}	High-level input voltage		1.7			1.7			V
V_{IL}	Low-level input voltage				0.7			0.7	V
V_I	Input voltage		0	V_{CC}	5.5	0	V_{CC}	5.5	V
I_{OH}	High-level output current				–6			–8	mA
I_{OL}	Low-level output current				6			8	mA
	Low-level output current; current duty cycle ≤ 50%; f ≥ 1 kHz				18			24	
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled			10			10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200			200			µs/V
T_A	Operating free-air temperature		–55		125	–40		85	°C

NOTE 3: All unused control 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.

recommended operating conditions, V_{CC} = 3.3 V ± 0.3 V (see Note 3)

			SN54ALVTH16821			SN74ALVTH16821			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{CC}	Supply voltage		3		3.6	3		3.6	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		5.5	0	V_{CC}	5.5	V
I_{OH}	High-level output current				–24			–32	mA
I_{OL}	Low-level output current				24			32	mA
	Low-level output current; current duty cycle ≤ 50%; f ≥ 1 kHz				48			64	
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled			10			10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200			200			µs/V
T_A	Operating free-air temperature		–55		125	–40		85	°C

NOTE 3: All unused control 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, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted) (see Figure 1)

PARAMETER		TEST CONDITIONS		SN54ALVTH16821			SN74ALVTH16821			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 2.3 V,	I_I = –18 mA			–1.2			–1.2	V
V_{OH}		V_{CC} = 2.3 V to 2.7 V,	I_{OH} = –100 µA	V_{CC}–0.2			V_{CC}–0.2			V
		V_{CC} = 2.3 V	I_{OH} = –6 mA	1.8						
			I_{OH} = –8 mA				1.8			
V_{OL}		V_{CC} = 2.3 V to 2.7 V,	I_{OL} = 100 µA			0.2			0.2	V
		V_{CC} = 2.3 V	I_{OL} = 6 mA			0.4				
			I_{OL} = 8 mA						0.4	
			I_{OL} = 18 mA			0.5				
			I_{OL} = 24 mA						0.5	
I_I	Control inputs	V_{CC} = 2.7 V,	V_I = V_{CC} or GND			±1			±1	µA
		V_{CC} = 0 or 2.7 V,	V_I = 5.5 V			10			10	
	Data inputs	V_{CC} = 2.7 V	V_I = 5.5 V			10			10	
			V_I = V_{CC}			1			1	
			V_I = 0			–5			–5	
I_{off}		V_{CC} = 0,	V_I or V_O = 0 to 4.5 V						±100	µA
I_{BHL}‡		V_{CC} = 2.3 V,	V_I = 0.7 V		115			115		µA
I_{BHH}§		V_{CC} = 2.3 V,	V_I = 1.7 V		–10			–10		µA
I_{BHLO}¶		V_{CC} = 2.7 V,	V_I = 0 to V_{CC}	300			300			µA
I_{BHHO}#		V_{CC} = 2.7 V,	V_I = 0 to V_{CC}	–300			–300			µA
I_{EX}‖		V_{CC} = 2.3 V,	V_O = 5.5 V			125			125	µA
$I_{OZ(PU/PD)}$☆		V_{CC} ≤ 1.2 V, V_O = 0.5 V to V_{CC}, V_I = GND or V_{CC}, $\overline{OE}$ = don't care				±100			±100	µA
I_{OZH}		V_{CC} = 2.7 V	V_O = 2.3 V, V_I = 0.7 V or 1.7 V			5			5	µA
I_{OZL}		V_{CC} = 2.7 V	V_O = 0.5 V, V_I = 0.7 V or 1.7 V			–5			–5	µA
I_{CC}		V_{CC} = 2.7 V, I_O = 0, V_I = V_{CC} or GND	Outputs high		0.04	0.1		0.04	0.1	mA
			Outputs low		2.3	4.5		2.3	4.5	
			Outputs disabled		0.04	0.1		0.04	0.1	
C_i		V_{CC} = 2.5 V,	V_I = 2.5 V or 0		3.5			3.5		pF
C_o		V_{CC} = 2.5 V,	V_O = 2.5 V or 0		6.5			6.5		pF

† All typical values are at V_{CC} = 2.5 V, T_A = 25°C.
‡ The bus-hold circuit can sink at least the minimum low sustaining current at V_{IL} max. I_{BHL} should be measured after lowering V_{IN} to GND and then raising it to V_{IL} max.
§ The bus-hold circuit can source at least the minimum high sustaining current at V_{IH} min. I_{BHH} should be measured after raising V_{IN} to V_{CC} and then lowering it to V_{IH} min.
¶ An external driver must source at least I_{BHLO} to switch this node from low to high.
# An external driver must sink at least I_{BHHO} to switch this node from high to low.
‖ Current into an output in the high state when V_O > V_{CC}
☆ High-impedance state during power up or power down

electrical characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54ALVTH16821			SN74ALVTH16821			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 3 V,	I_I = –18 mA			–1.2			–1.2	V
V_{OH}		V_{CC} = 3 V to 3.6 V,	I_{OH} = –100 µA	V_{CC}–0.2			V_{CC}–0.2			V
		V_{CC} = 3 V	I_{OH} = –24 mA	2						
			I_{OH} = –32 mA				2			
V_{OL}		V_{CC} = 3 V to 3.6 V,	I_{OL} = 100 µA			0.2			0.2	V
		V_{CC} = 3 V	I_{OL} = 16 mA						0.4	
			I_{OL} = 24 mA			0.5				
			I_{OL} = 32 mA						0.5	
			I_{OL} = 48 mA			0.55				
			I_{OL} = 64 mA						0.55	
I_I	Control inputs	V_{CC} = 3.6 V,	V_I = V_{CC} or GND			±1			±1	µA
		V_{CC} = 0 or 3.6 V,	V_I = 5.5 V			10			10	
	Data inputs	V_{CC} = 3.6 V	V_I = 5.5 V			10			10	
			V_I = V_{CC}			1			1	
			V_I = 0			–5			–5	
I_{off}		V_{CC} = 0,	V_I or V_O = 0 to 4.5 V						±100	µA
I_{BHL}‡		V_{CC} = 3 V,	V_I = 0.8 V	75			75			µA
I_{BHH}§		V_{CC} = 3 V,	V_I = 2 V	–75			–75			µA
I_{BHLO}¶		V_{CC} = 3.6 V,	V_I = 0 to V_{CC}	500			500			µA
I_{BHHO}#		V_{CC} = 3.6 V,	V_I = 0 to V_{CC}	–500			–500			µA
I_{EX}‖		V_{CC} = 3 V,	V_O = 5.5 V			125			125	µA
$I_{OZ(PU/PD)}$☆		V_{CC} ≤ 1.2 V, V_O = 0.5 V to V_{CC}, V_I = GND or V_{CC}, $\overline{OE}$ = don't care				±100			±100	µA
I_{OZH}		V_{CC} = 3.6 V	V_O = 3 V, V_I = 0.8 V or 2 V			5			5	µA
I_{OZL}		V_{CC} = 3.6 V	V_O = 0.5 V, V_I = 0.8 V or 2 V			–5			–5	µA
I_{CC}		V_{CC} = 3.6 V, I_O = 0, V_I = V_{CC} or GND	Outputs high		0.07	0.1		0.07	0.1	mA
			Outputs low		3.2	5.5		3.2	5	
			Outputs disabled		0.07	0.1		0.07	0.1	
ΔI_{CC}□		V_{CC} = 3 V to 3.6 V, One input at V_{CC} – 0.6 V, Other inputs at V_{CC} or GND				0.4			0.4	mA
C_i		V_{CC} = 3.3 V,	V_I = 3.3 V or 0		3.5			3.5		pF
C_o		V_{CC} = 3.3 V,	V_O = 3.3 V or 0		6			6		pF

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
‡ The bus-hold circuit can sink at least the minimum low sustaining current at V_{IL} max. I_{BHL} should be measured after lowering V_{IN} to GND and then raising it to V_{IL} max.
§ The bus-hold circuit can source at least the minimum high sustaining current at V_{IH} min. I_{BHH} should be measured after raising V_{IN} to V_{CC} and then lowering it to V_{IH} min.
¶ An external driver must source at least I_{BHLO} to switch this node from low to high.
# An external driver must sink at least I_{BHHO} to switch this node from high to low.
‖ Current into an output in the high state when V_O > V_{CC}
☆ High-impedance state during power up or power down
□ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

timing requirements over recommended operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted) (see Figure 1)

			SN54ALVTH16821		SN74ALVTH16821		UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency			150		150	MHz
t_w	Pulse duration, CLK high or low		1.6		1.5		ns
t_{su}	Setup time, data before CLK↑	Data high	1.6		1.5		ns
		Data low	2.1		2		
t_h	Hold time, data after CLK↑	Data high	0.4		0.3		ns
		Data low	1.1		1		

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 2)

			SN54ALVTH16821		SN74ALVTH16821		UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency			150		150	MHz
t_w	Pulse duration, CLK high or low		1.6		1.5		ns
t_{su}	Setup time, data before CLK↑	Data high	1.6		1.5		ns
		Data low	1.6		1.5		
t_h	Hold time, data after CLK↑	Data high	1.1		1		ns
		Data low	1.1		1		

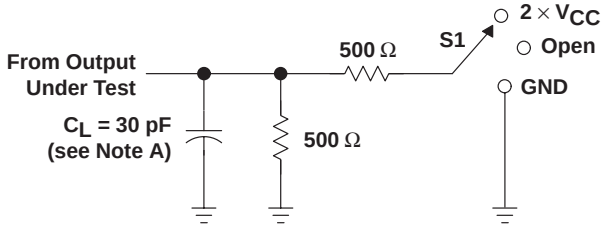
switching characteristics over recommended operating free-air temperature range, C_L = 30 pF, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ALVTH16821		SN74ALVTH16821		UNIT
			MIN	MAX	MIN	MAX	
f_{max}			150		150		MHz
t_{PLH}	CLK	Q	1	4.2	1	4.1	ns
t_{PHL}			1	4.5	1	4.4	
t_{PZH}	$\overline{OE}$	Q	1.5	4.7	1.5	4.6	ns
t_{PZL}			1	4.2	1	4.1	
t_{PHZ}	$\overline{OE}$	Q	1.5	4.6	1.5	4.5	ns
t_{PLZ}			1	5	1	4.9	

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 2)

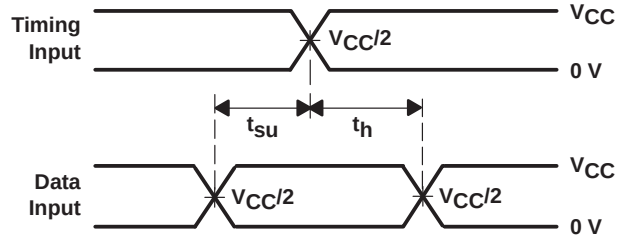
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ALVTH16821		SN74ALVTH16821		UNIT
			MIN	MAX	MIN	MAX	
f_{max}			150		150		MHz
t_{PLH}	CLK	Q	1	3.6	1	3.5	ns
t_{PHL}			1	3.6	1	3.5	
t_{PZH}	$\overline{OE}$	Q	1	4.2	1	4.1	ns
t_{PZL}			1	3.7	1	3.6	
t_{PHZ}	$\overline{OE}$	Q	1	4.9	1	4.8	ns
t_{PLZ}			1	4.8	1	4.6	

PARAMETER MEASUREMENT INFORMATION
V_{CC} = 2.5 V ± 0.2 V

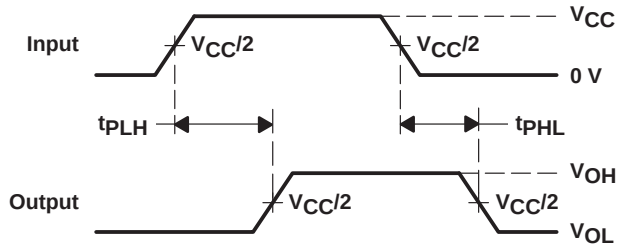


LOAD CIRCUIT

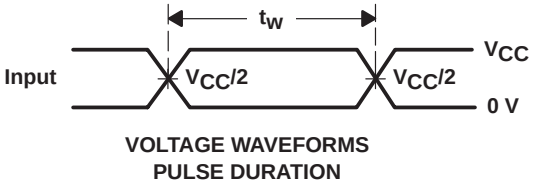
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	2 × V_{CC}
t_{PHZ}/t_{PZH}	GND



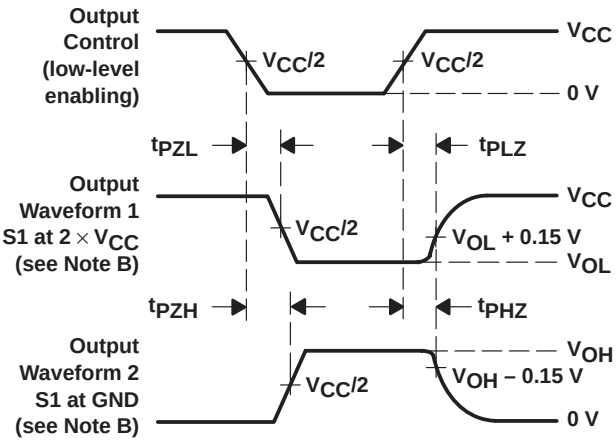
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION

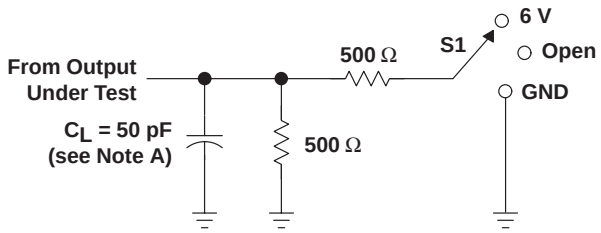


VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

NOTES: 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, t_r ≤ 2 ns, t_f ≤ 2 ns.
D. The outputs are measured one at a time with one transition per measurement.

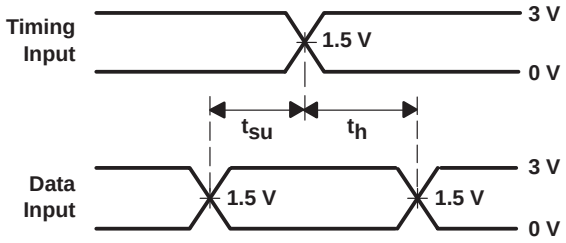
Figure 1. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION
V_{CC} = 3.3 V ± 0.3 V

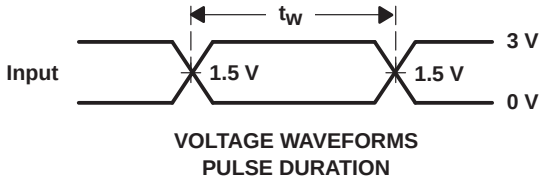


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

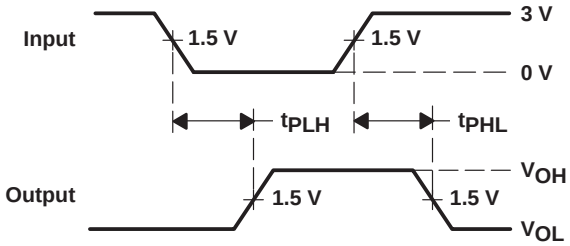
LOAD CIRCUIT



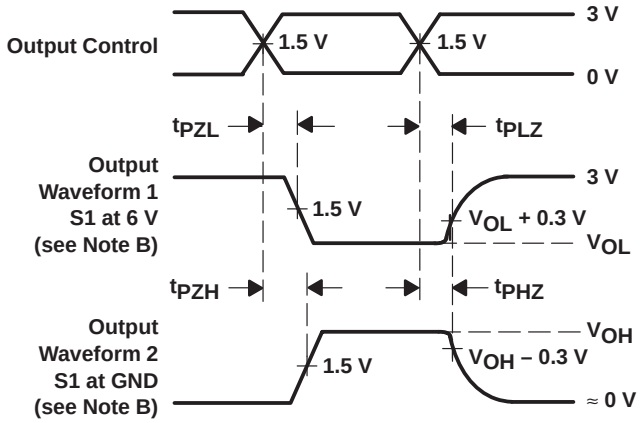
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



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. Waveform22 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, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
D. The outputs are measured one at a time with one transition per measurement.

Figure 2. 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)
74ALVTH16821DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTH16821DLRG4	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTH16821GRE4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTH16821GRG4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTH16821VRE4	ACTIVE	TVSOP	DGV	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ALVTH16821VRG4	ACTIVE	TVSOP	DGV	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTH16821DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTH16821DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTH16821GR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALVTH16821VR	ACTIVE	TVSOP	DGV	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

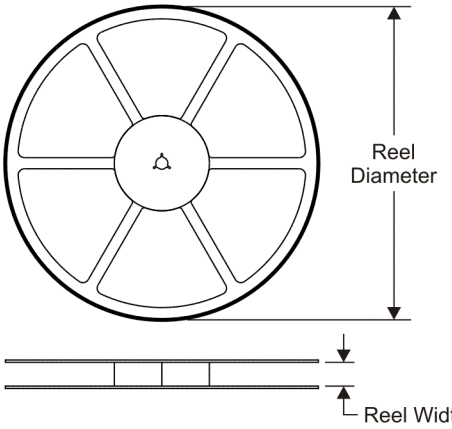
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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)

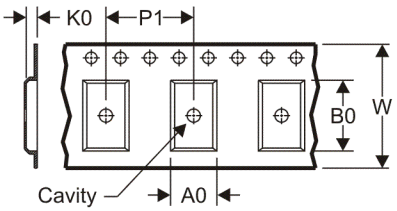
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

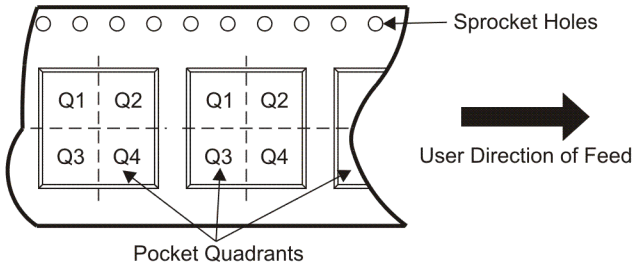


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

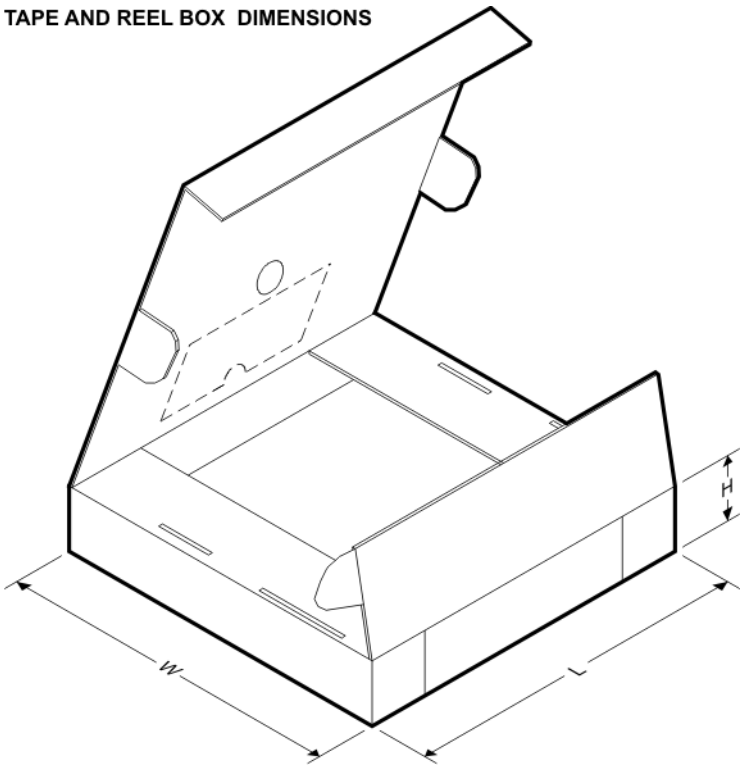
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74ALVTH16821DLR	SSOP	DL	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1
SN74ALVTH16821GR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1
SN74ALVTH16821VR	TVSOP	DGV	56	2000	330.0	24.4	6.8	11.7	1.6	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

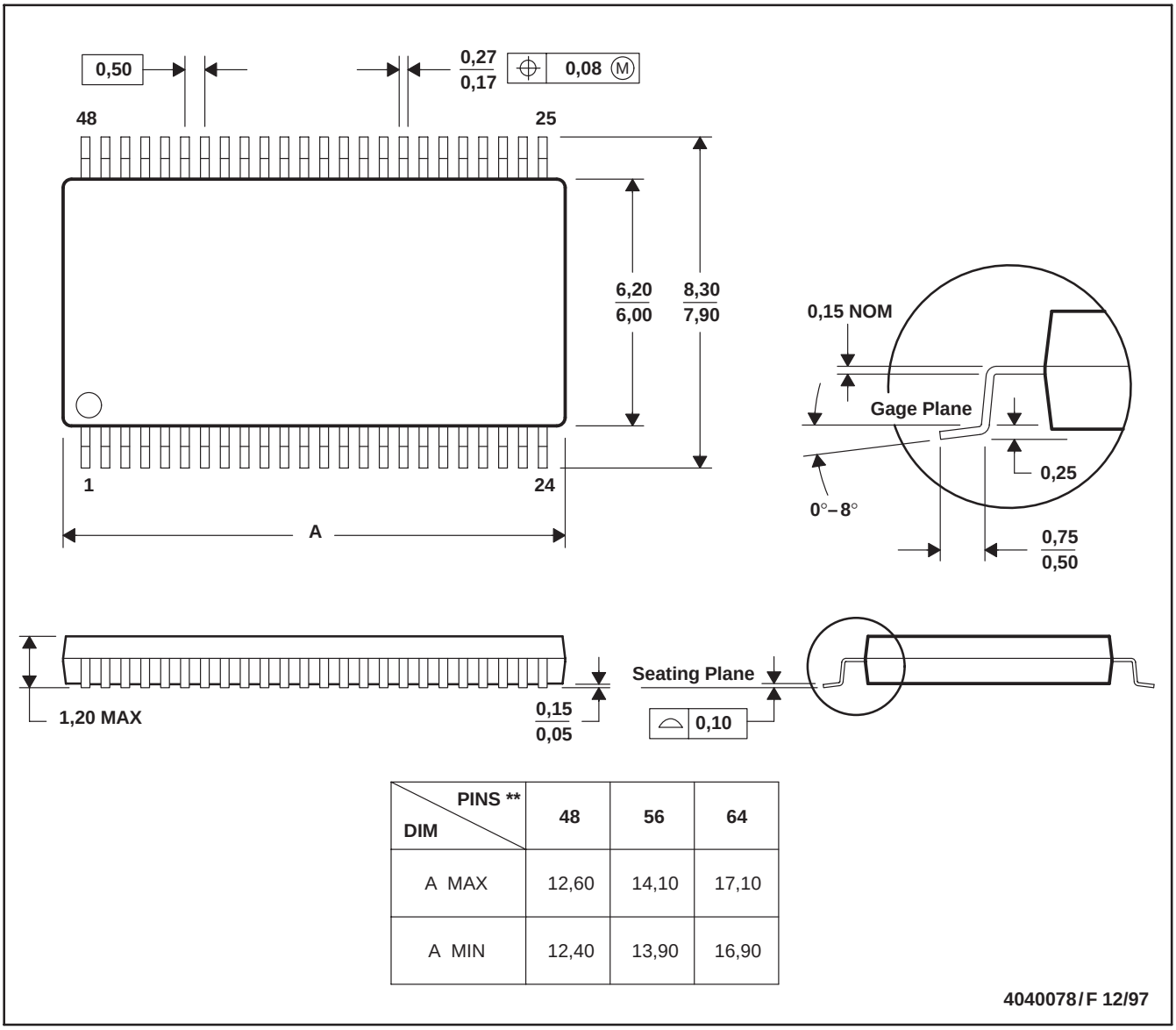


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALVTH16821DLR	SSOP	DL	56	1000	346.0	346.0	49.0
SN74ALVTH16821GR	TSSOP	DGG	56	2000	346.0	346.0	41.0
SN74ALVTH16821VR	TVSOP	DGV	56	2000	346.0	346.0	41.0

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

48 PINS SHOWN

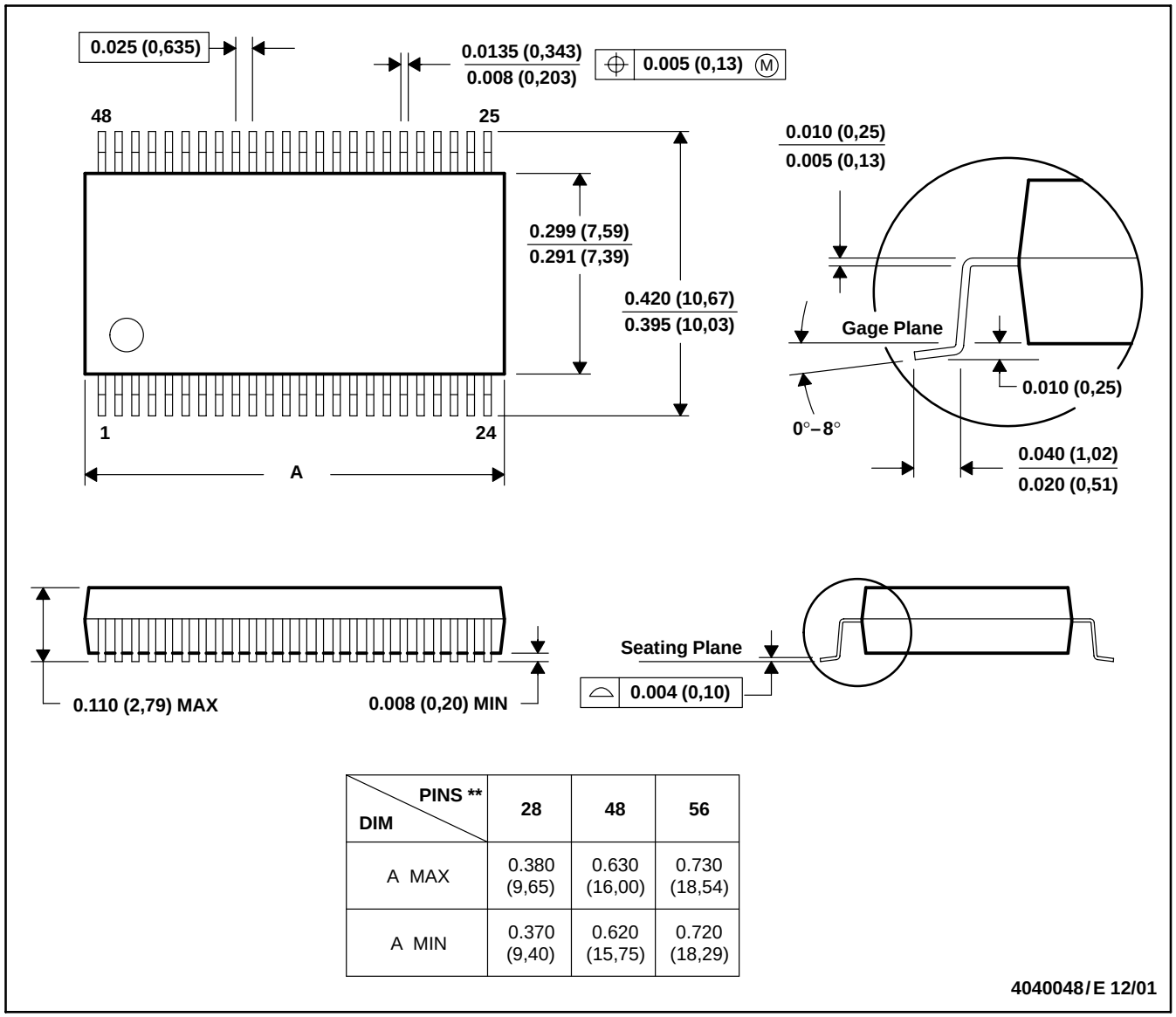


DIM \ PINS **	48	56	64
A MAX	12,60	14,10	17,10
A MIN	12,40	13,90	16,90

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



DIM \ PINS **	28	48	56
A MAX	0.380 (9,65)	0.630 (16,00)	0.730 (18,54)
A MIN	0.370 (9,40)	0.620 (15,75)	0.720 (18,29)

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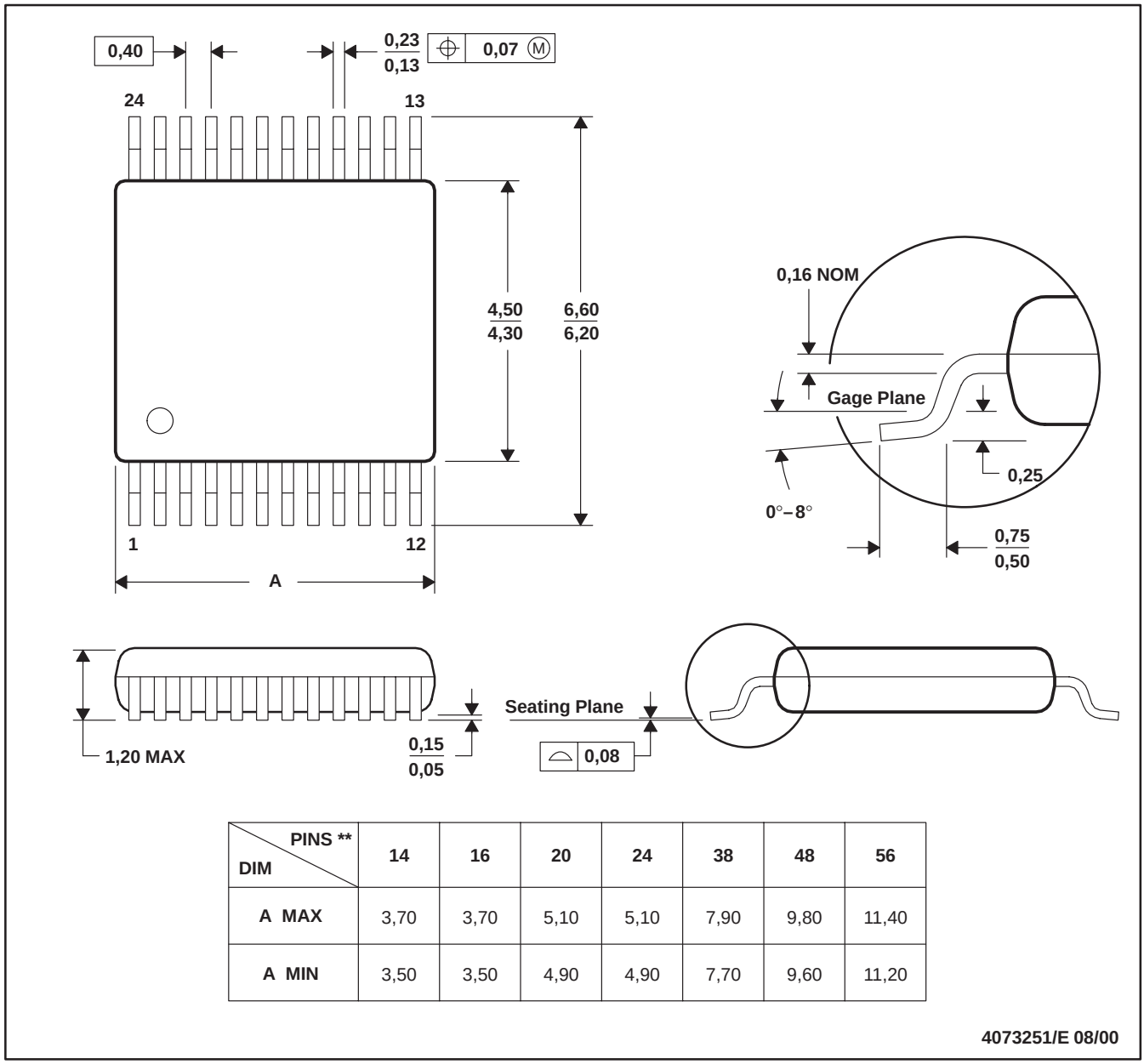
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MO-118

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

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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 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

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