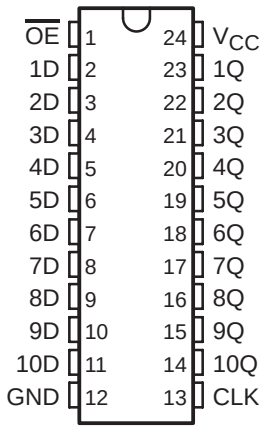
- **Functionally Equivalent to AMD's AM29821**
- **Provide Extra Data Width Necessary for Wider Address/Data Paths or Buses With Parity**
- **Outputs Have Undershoot-Protection Circuitry**
- **Power-Up High-Impedance State**
- **Buffered Control Inputs Reduce dc Loading Effects**
- **Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic (NT) and Ceramic (JT) 300-mil DIPs**

SN54ALS29821 . . . JT PACKAGE
SN74ALS29821 . . . DW OR NT PACKAGE
(TOP VIEW)



description

These 10-bit edge-triggered D-type flip-flops feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are true to the data (D) input.

A buffered output-enable ($\overline{OE}$) input can place the ten outputs in either a normal logic state (high or low logic levels) or a high-impedance state. The outputs also are in the high-impedance state during power-up and power-down conditions. The outputs remain in the high-impedance state while the device is powered down. 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 interface or pullup components.

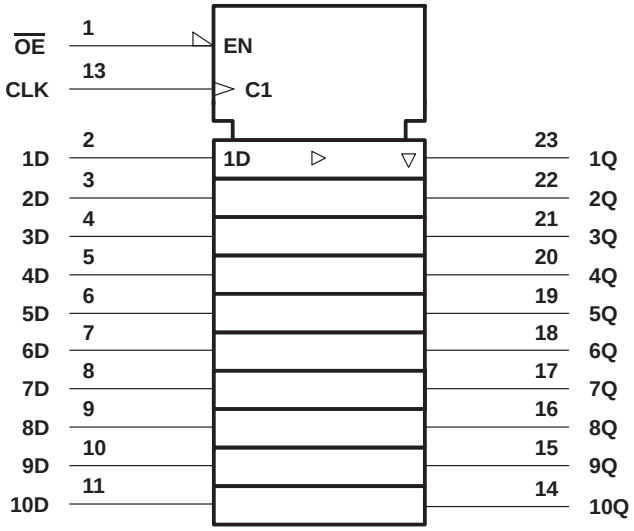
$\overline{OE}$ does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54ALS29821 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74ALS29821 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE
(each flip-flop)

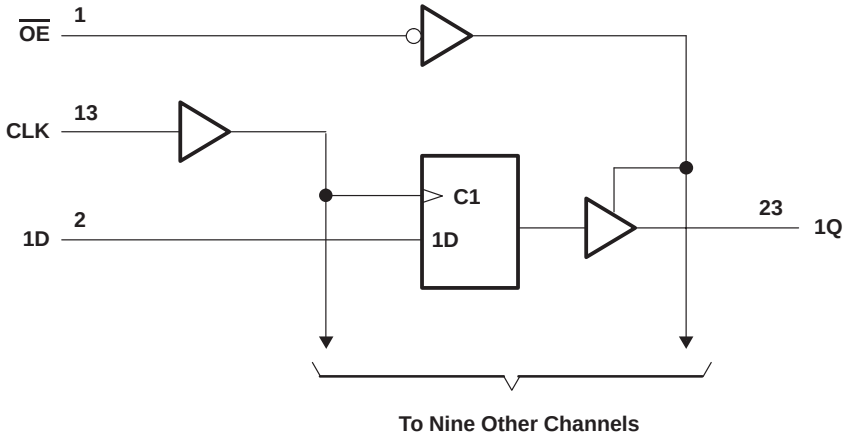
INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage, V_{CC} . . . . . 7 V
Input voltage, V_I . . . . . 5.5 V
Voltage applied to a disabled 3-state output . . . . . 5.5 V
Operating free-air temperature range, T_A: SN54ALS29821 . . . . . −55°C to 125°C
SN74ALS29821 . . . . . 0°C to 70°C
Storage temperature range . . . . . −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.

recommended operating conditions

		SN54ALS29821			SN74ALS29821			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			−24			−24	mA
I_{OL}	Low-level output current			48			48	mA
t_w	Pulse duration, CLK high or low	7			7			ns
t_{su}	Setup time, data before CLK↑	4			4			ns
t_h	Hold time, data after CLK↑	2			2			ns
T_A	Operating free-air temperature	−55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS		SN54ALS29821			SN74ALS29821			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	V_{CC} = 4.75 V,	I_I = −18 mA			−1.2			−1.2	V
V_{OH}	V_{CC} = 4.75 V	I_{OH} = −15 mA	2.4	3.3		2.4	3.3		V
		I_{OH} = −24 mA	2	3.1		2	3.1		
V_{OL}	V_{CC} = 4.75 V,	I_{OL} = 48 mA		0.35	0.5		0.35	0.5	V
I_{OZH}	V_{CC} = 5.25 V,	V_O = 2.4 V			50			20	µA
I_{OZL}	V_{CC} = 5.25 V,	V_O = 0.4 V			−50			−20	µA
I_I	V_{CC} = 5.25 V,	V_I = 5.5 V			0.1			0.1	mA
I_{IH}	V_{CC} = 5.25 V,	V_I = 2.7 V			20			20	µA
I_{IL}	V_{CC} = 5.25 V,	V_I = 0.4 V			−0.5			−0.2	mA
I_{OS}‡	V_{CC} = 5.25 V,	V_O = 0	−75		−250	−75		−250	mA
I_{CC}	V_{CC} = 5.25 V,	Outputs open		80	115		80	115	mA

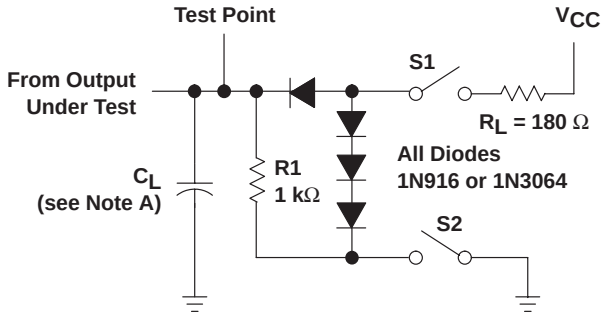
† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CC} = MIN to MAX†, T_A = MIN to MAX†				UNIT
				SN54ALS29821		SN74ALS29821		
				MIN	MAX	MIN	MAX	
t_{PLH}	CLK	Any Q	C_L = 50 pF	2	11.5	2	10	ns
t_{PHL}				2	11.5	2	10	
t_{PLH}	CLK	Any Q	C_L = 300 pF	2	21		16	ns
t_{PHL}				2	21		16	
t_{PZH}	$\overline{OE}$	Any Q	C_L = 50 pF	1	17		14	ns
t_{PZL}				1	17		14	
t_{PZH}	$\overline{OE}$	Any Q	C_L = 300 pF	1	25		20	ns
t_{PZL}				1	29.5		23	
t_{PHZ}	$\overline{OE}$	Any Q	C_L = 50 pF	1	16		14	ns
t_{PLZ}				1	14		12	
t_{PHZ}	$\overline{OE}$	Any Q	C_L = 5 pF	1	12		9	ns
t_{PLZ}				1	11		9	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

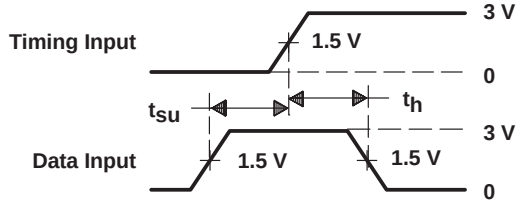
PARAMETER MEASUREMENT INFORMATION



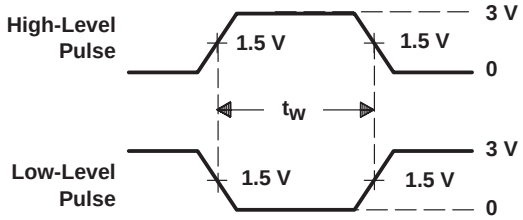
LOAD CIRCUIT

SWITCH POSITION TABLE

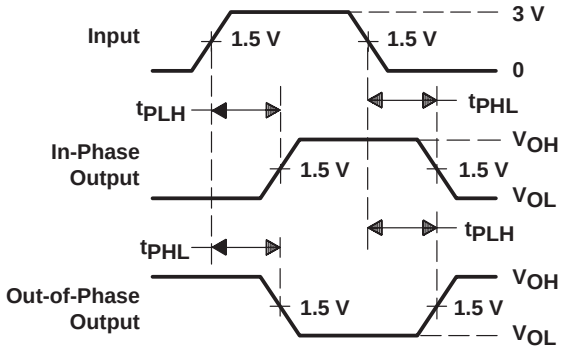
TEST	S1	S2
t_{PLH}	Closed	Closed
t_{PHL}	Closed	Closed
t_{PZH}	Open	Closed
t_{PZL}	Closed	Open
t_{PHZ}	Closed	Closed
t_{PLZ}	Closed	Closed



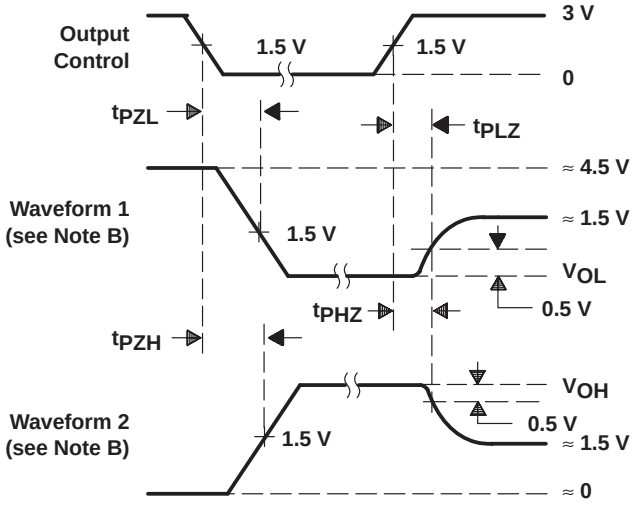
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATIONS



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

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 ≤ 2.5 ns, t_f ≤ 2.5 ns.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9061601LA	ACTIVE	CDIP	JT	24	1	TBD	SNPB	N / A for Pkg Type	-55 to 125	5962-9061601LA SNJ54ALS29821J T	Samples
SN74ALS29821DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS29821	Samples
SNJ54ALS29821JT	ACTIVE	CDIP	JT	24	1	TBD	SNPB	N / A for Pkg Type	-55 to 125	5962-9061601LA SNJ54ALS29821J T	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54ALS29821, SN74ALS29821 :

- Catalog: SN74ALS29821
- Military: SN54ALS29821

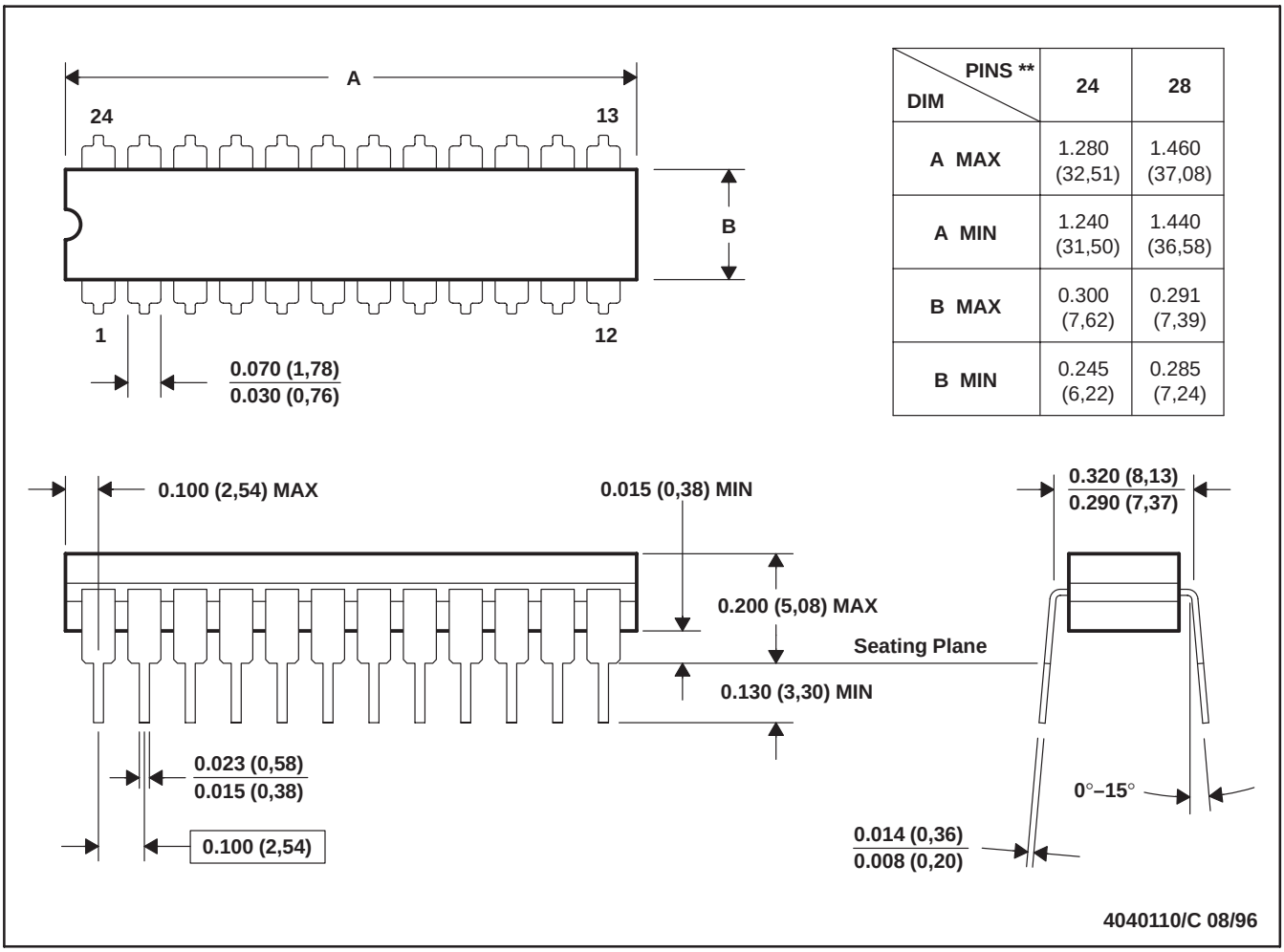
NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

MCER004A – JANUARY 1995 – REVISED JANUARY 1997

JT (R-GDIP-T)** **CERAMIC DUAL-IN-LINE**

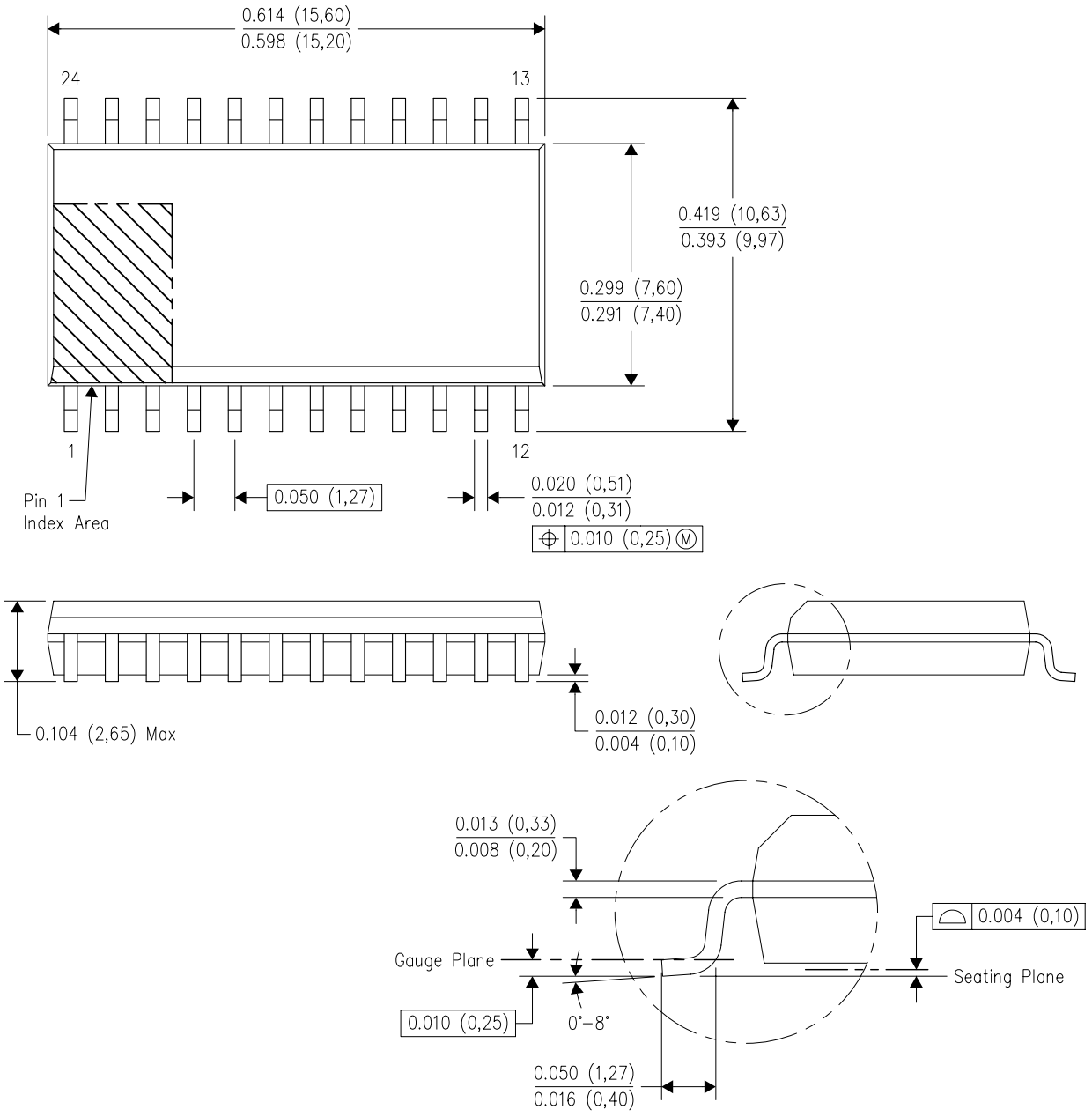
24 LEADS SHOWN



DIM \ PINS **	24	28
A MAX	1.280 (32,51)	1.460 (37,08)
A MIN	1.240 (31,50)	1.440 (36,58)
B MAX	0.300 (7,62)	0.291 (7,39)
B MIN	0.245 (6,22)	0.285 (7,24)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification.
E. Falls within MIL STD 1835 GDIP3-T24, GDIP4-T28, and JEDEC MO-058 AA, MO-058 AB

DW (R–PDSO–G24) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
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 AD.

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