- **Members of the Texas Instruments *Widebus*™ Family**

- **Inputs Are TTL-Voltage Compatible**

- **Provide Extra Data Width Necessary for Wider Address/Data Paths or Buses With Parity**

- **Flow-Through Architecture Optimizes PCB Layout**

- **Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise**

- ***EPIC*™ (Enhanced-Performance Implanted CMOS) 1-μm Process**

- **Package Options Include Plastic 300-mil Shrink Small-Outline (DL) Packages Using 25-mil Center-to-Center Pin Spacings and 380-mil Fine-Pitch Ceramic Flat (WD) Packages Using 25-mil Center-to-Center Pin Spacings**

54ACT16823 . . . WD PACKAGE
74ACT16823 . . . DL PACKAGE
(TOP VIEW)

1$\overline{CLR}$	1		56	1CLK	
1$\overline{OE}$	2		55	1$\overline{CLKEN}$	
1Q1	3		54	1D1	
GND	4		53	GND	
1Q2	5		52	1D2	
1Q3	6		51	1D3	
V_{CC}	7		50	V_{CC}	
1Q4	8		49	1D4	
1Q5	9		48	1D5	
1Q6	10		47	1D6	
GND	11		46	GND	
1Q7	12		45	1D7	
1Q8	13		44	1D8	
1Q9	14		43	1D9	
2Q1	15		42	2D1	
2Q2	16		41	2D2	
2Q3	17		40	2D3	
GND	18		39	GND	
2Q4	19		38	2D4	
2Q5	20		37	2D5	
2Q6	21		36	2D6	
V_{CC}	22		35	V_{CC}	
2Q7	23		34	2D7	
2Q8	24		33	2D8	
GND	25		32	GND	
2Q9	26		31	2D9	
2$\overline{OE}$	27		30	2$\overline{CLKEN}$	
2$\overline{CLR}$	28		29	2CLK	

description

These 18-bit flip-flops feature 3-state outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, parity bus interfacing, and working registers.

The 'ACT16823 can be used as two 9-bit flip-flops or one 18-bit flip-flop. With the clock-enable ($\overline{CLKEN}$) input low, the D-type flip-flops enter data on the low-to-high transitions of the clock. Taking $\overline{CLKEN}$ high disables the clock buffer, thus latching the outputs. Taking the clear ($\overline{CLR}$) input low causes the Q outputs to go low independently of the clock.

A buffered output-enable ($\overline{OE}$) input can be used to place the outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly.

$\overline{OE}$ 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 74ACT16823 is packaged in the TI shrink small-outline package, which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54ACT16823 is characterized for operation over the full military temperature range of 55°C to 125°C. The 74ACT16823 is characterized for operation from −40°C to 85°C
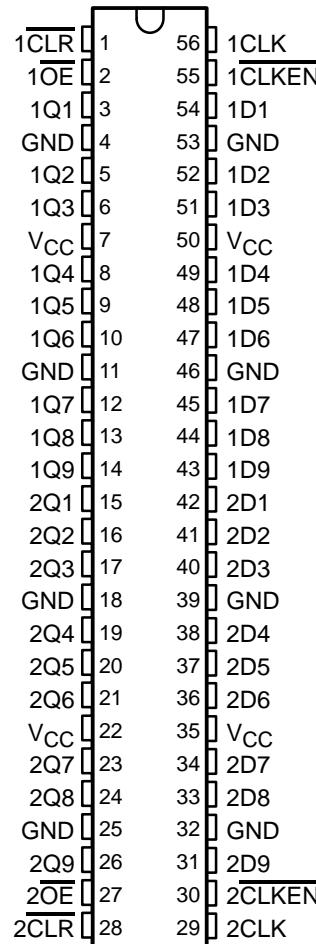
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FUNCTION TABLE
(each 9-bit stage)

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

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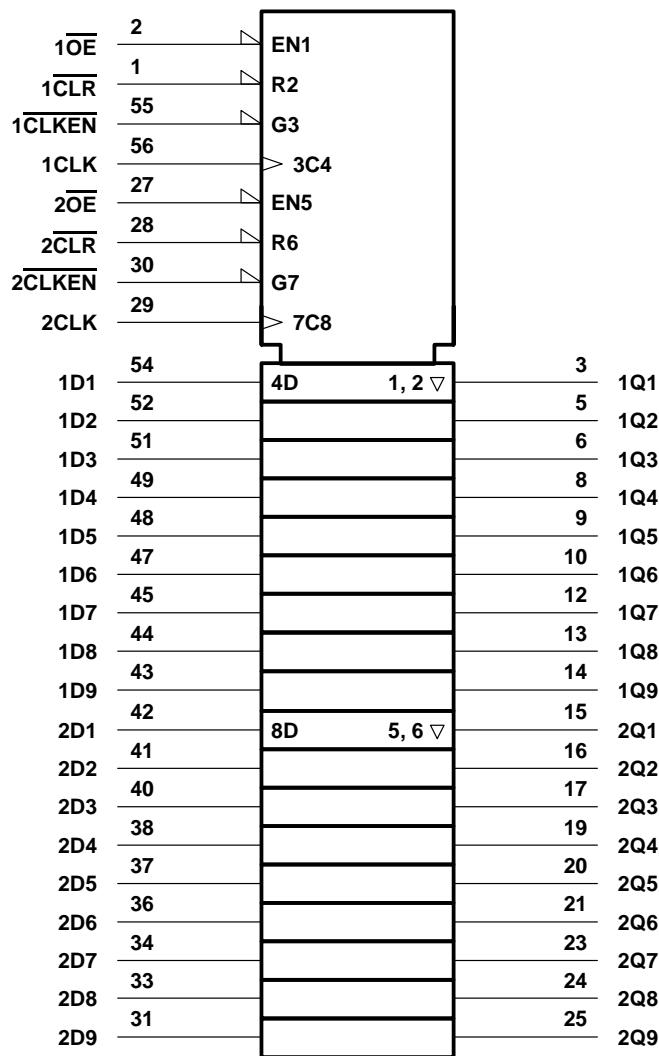
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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logic diagram (positive logic)
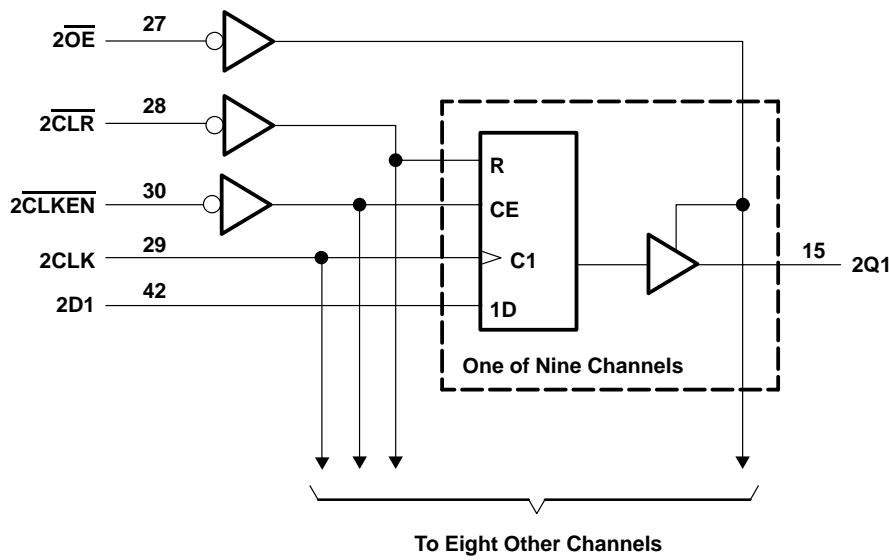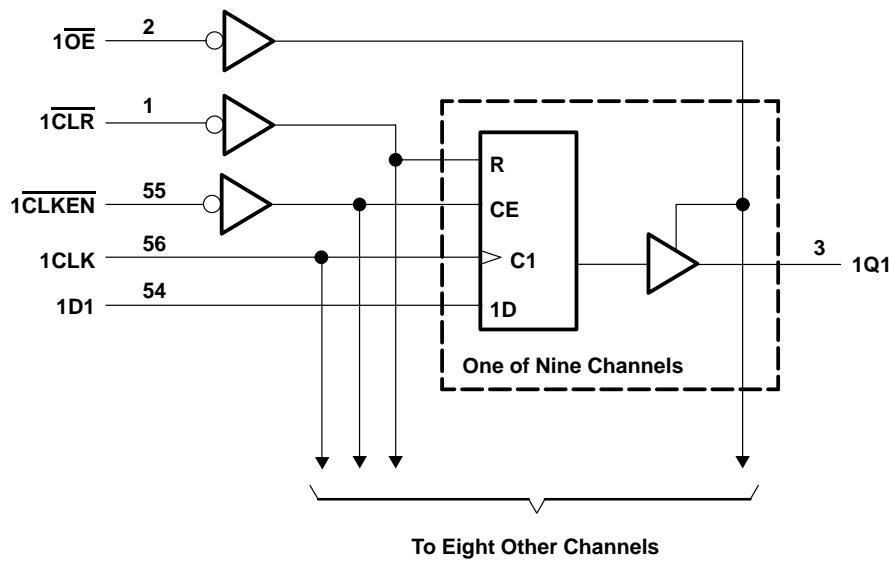
To Eight Other Channels

To Eight Other Channels

3

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 V_{CC} + 0.5 V
Output voltage range, V_O (see Note 1) . . . . –0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) . . . . ±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) . . . . ±50 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . ±50 mA
Continuous current through V_{CC} or GND . . . . ±450 mA
Maximum package power dissipation at T_A = 55°C (in still air) (see Note 2): DL package . . . . 1.4 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 voltage ratings may be exceeded if the input and output current ratings are observed.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

recommended operating conditions (see Note 2)

		54ACT16823			74ACT16823			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	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
V_O	Output voltage	0		V_{CC}	0		V_{CC}	V
I_{OH}	High-level output current			–24			–24	mA
I_{OL}	Low-level output current			24			24	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0		10	0		10	ns/V
T_A	Operating free-air temperature	–55		125	–40		85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

![Texas Instruments logo]

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

PARAMETER	TEST CONDITIONS		V_{CC}	$T_A = 25°C$			54ACT16823		74ACT16823		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	$I_{OH} = -50\ \mu A$		4.5 V	4.4			4.4		4.4		V
			5.5 V	5.4			5.4		5.4		
	$I_{OH} = -24\ mA$		4.5 V	3.94			3.8		3.8		
			5.5 V	4.94			4.8		4.8		
	$I_{OH} = -75\ mA†$		5.5 V				3.85		3.85		
V_{OL}	$I_{OL} = 50\ \mu A$		4.5 V			0.1		0.1		0.1	V
			5.5 V			0.1		0.1		0.1	
	$I_{OL} = 24\ mA$		4.5 V			0.36		0.44		0.44	
			5.5 V			0.36		0.44		0.44	
	$I_{OL} = 75\ mA†$		5.5 V					1.65		1.65	
I_I	$V_I = V_{CC}$ or GND		5.5 V		±0.1			±1		±1	μA
I_{OZ}	$V_O = V_{CC}$ or GND		5.5 V		±0.5			±5		±5	μA
I_{CC}	$V_I = V_{CC}$ or GND,	$I_O = 0$	5.5 V		8			80		80	μA
$\Delta I_{CC}‡$	One input at 3.4 V, Other inputs at V_{CC} or GND		5.5 V		0.9			1		1	mA
C_i	$V_I = V_{CC}$ or GND		5 V		3						pF
C_O	$V_O = V_{CC}$ or GND		5 V		12						pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.
‡ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or V_{CC}.

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

			$T_A = 25°C$		54ACT16823		74ACT16823		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	90	0	90	0	90	MHz
t_w	Pulse duration	$\overline{CLR}$ low	3.3		3.3		3.3		ns
		CLK high or low	5.5		5.5		5.5		
t_{su}	Setup time before CLK↑	$\overline{CLR}$ inactive	0.5		0.5		0.5		ns
		Data	7		7		7		
		$\overline{CLKEN}$ low	3.5		3.5		3.5		
t_h	Hold time after CLK↑	Data	0.5		0.5		0.5		ns
		$\overline{CLKEN}$ high or low	2.5		2.5		2.5		

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switching characteristics over recommended operating free-air temperature range,
V$_{CC}$ = 5 V $\pm$ 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T$_A$ = 25°C			54ACT16823		74ACT16823		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f$_{max}$			90			90		90		MHz
t$_{PLH}$	CLK	Q	4.2	7.5	10.6	4.2	12.1	4.2	12.1	ns
t$_{PHL}$			4.8	8.3	11.5	4.8	12.9	4.8	12.9	
t$_{PHL}$	$\overline{CLR}$	Q	3.4	7.3	11.2	3.4	12.5	3.4	12.5	ns
t$_{PZH}$	$\overline{OE}$	Q	2.4	5.9	9.5	2.4	10.7	2.4	10.7	ns
t$_{PZL}$			3.3	7.1	11.3	3.3	12.8	3.3	12.8	
t$_{PHZ}$	$\overline{OE}$	Q	5.5	7.6	9.7	5.5	10.3	5.5	10.3	ns
t$_{PLZ}$			4.6	6.7	8.8	4.6	9.4	4.6	9.4	

operating characteristics, V$_{CC}$ = 5 V, T$_A$ = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
C$_{pd}$ Power dissipation capacitance per flip-flop	Outputs enabled	C$_L$ = 50 pF,	f = 1 MHz	42	pF
	Outputs disabled			24	

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PARAMETER MEASUREMENT INFORMATION
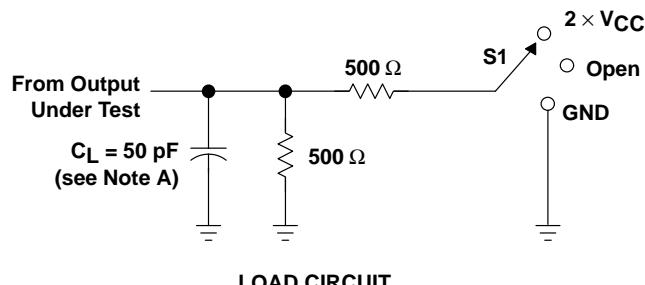
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

LOAD CIRCUIT

VOLTAGE WAVEFORMS

VOLTAGE WAVEFORMS

VOLTAGE WAVEFORMS

VOLTAGE WAVEFORMS
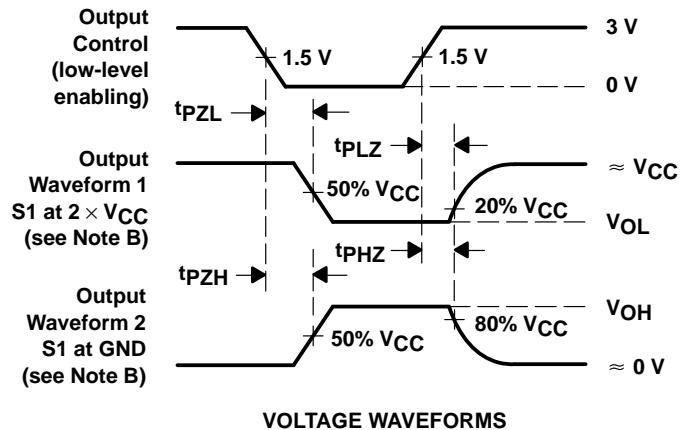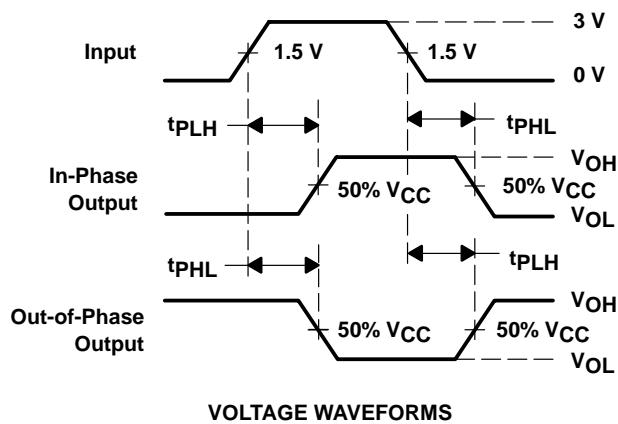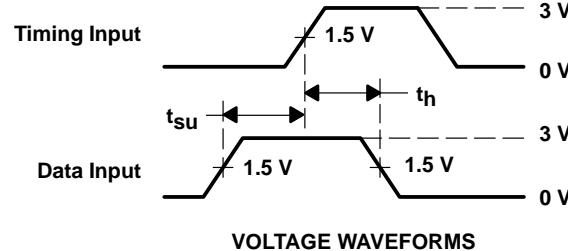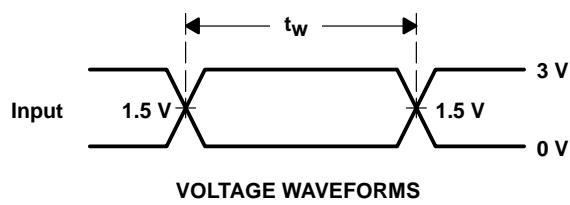
NOTES: A. C_L includes probe and jig capacitance.
   B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
      Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
   C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 ns.
   D. The outputs are measured one at a time with one input transition per measurement.

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]
74ACT16823DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16823DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16823DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16823DLRG4	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.
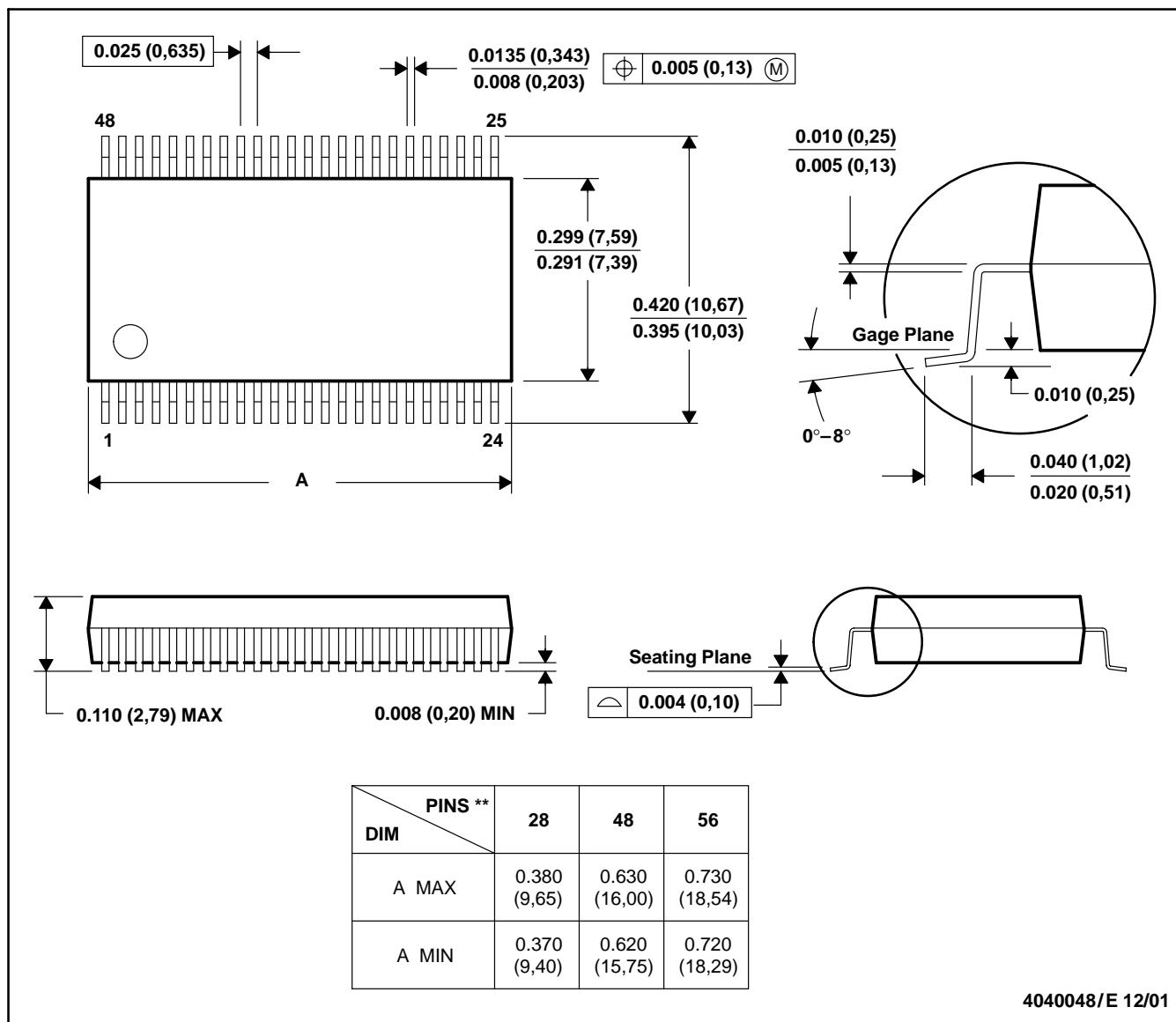
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DL (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN

PINS ** DIM	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)

4040048 / E 12/01

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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