

OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS065B – DECEMBER 1982 – REVISED JANUARY 1995

- 3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Buffered Control Inputs
- SN74ALS577A Has Synchronous Clear
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), Standard Plastic (N, NT) and Ceramic (J) 300-mil DIPs, and Ceramic Flat (W) Packages

description

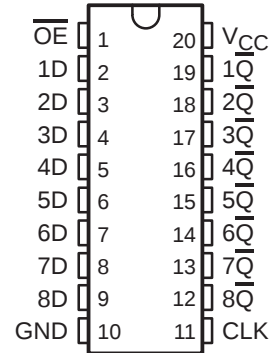
These octal D-type edge-triggered flip-flops feature 3-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

These flip-flops enter data on the low-to-high transition of the clock (CLK) input.

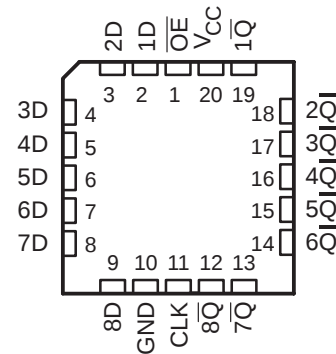
The output-enable ($\overline{OE}$) input does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are disabled.

The SN54ALS576B and SN54AS576 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS576B, SN74ALS577A, and SN74AS576 are characterized for operation from 0°C to 70°C .

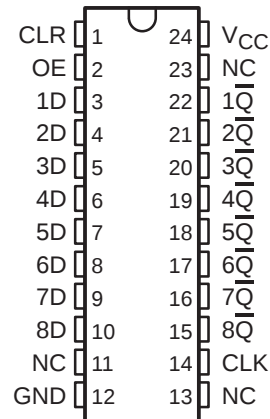
SN54ALS576B, SN54AS576 . . . J OR W PACKAGE
SN74ALS576B, SN74AS576 . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS576B, SN54AS576 . . . FK PACKAGE
(TOP VIEW)



SN74ALS577A . . . DW OR NT PACKAGE
(TOP VIEW)



NC – No internal connection

SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576
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Function Tables

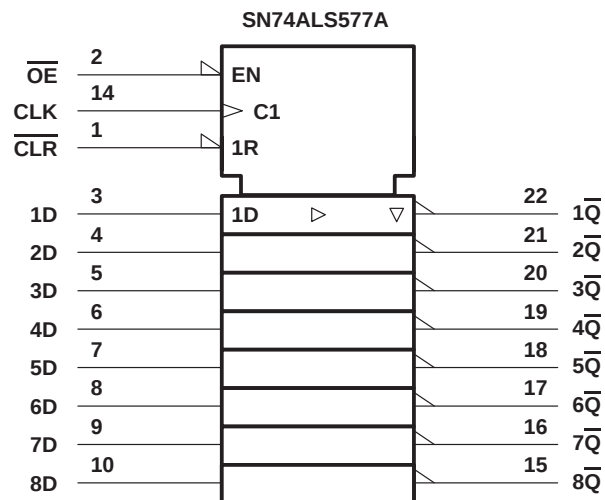
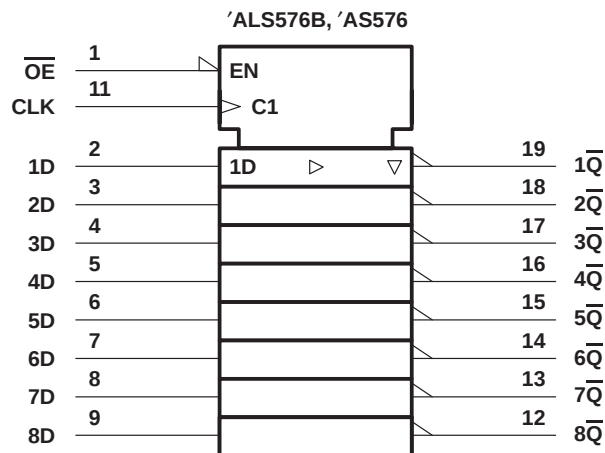
'ALS576B, 'AS576
(each flip-flop)

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

SN74ALS577A
(each flip-flop)

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

logic symbols[†]



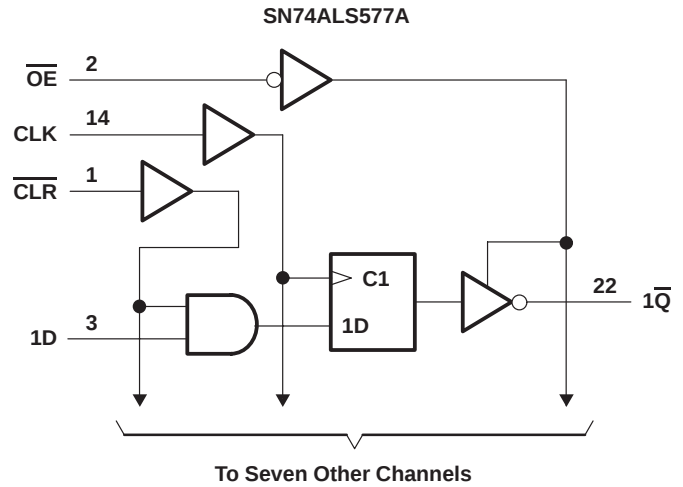
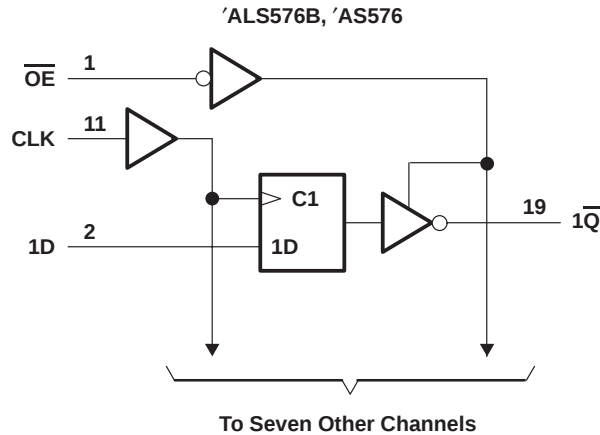
[†] These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown for the 'ALS576B and 'AS576 are for the DW, J, N, and W packages.

Pin numbers shown for the SN74ALS577A are for the DW and NT packages.

SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576
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logic diagrams (positive logic)



Pin numbers shown are for the DW, J, N, and W packages.

Pin numbers shown are for the DW and NT packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V_{CC}	7 V
Input voltage, V_I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T_A : SN54ALS576B	–55°C to 125°C
SN74ALS576B, SN74ALS577A	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

			SN54ALS576B			SN74ALS576B SN74ALS577A			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				0.7			0.8	V
I_{OH}	High-level output current				–1			–2.6	mA
I_{OL}	Low-level output current				12			24	mA
f_{clock}	Clock frequency	'ALS576B	0		22	0		30	MHz
		SN74ALS577A				0		30	
t_w	Pulse duration	'ALS576B, CLK high or low	25			16.5			ns
		SN74ALS577A, CLK high or low				16.5			
t_{su}	Setup time before CLK $\uparrow$	Data	15			15			ns
		SN74ALS577A CLR				15			
t_h	Hold time after CLK $\uparrow$	Data	4			0			ns
		SN74ALS577A CLR				0			
T_A	Operating free-air temperature		–55		125	0		70	°C

SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	SN54ALS576B			SN74ALS576B SN74ALS577A			UNIT
		MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
V_{IK}	$V_{CC} = 4.5\text{ V}$, $I_I = -18\text{ mA}$			-1.2			-1.2	V
V_{OH}	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$, $I_{OH} = -0.4\text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
	$V_{CC} = 4.5\text{ V}$, $I_{OH} = -1\text{ mA}$	2.4	3.3					
	$V_{CC} = 4.5\text{ V}$, $I_{OH} = -2.6\text{ mA}$				2.4	3.2		
V_{OL}	$V_{CC} = 4.5\text{ V}$, $I_{OL} = 12\text{ mA}$		0.25	0.4		0.25	0.4	V
	$V_{CC} = 4.5\text{ V}$, $I_{OL} = 24\text{ mA}$					0.35	0.5	
I_{OZH}	$V_{CC} = 5.5\text{ V}$, $V_O = 2.7\text{ V}$			20			20	μA
I_{OZL}	$V_{CC} = 5.5\text{ V}$, $V_O = 0.4\text{ V}$			-20			-20	μA
I_I	$V_{CC} = 5.5\text{ V}$, $V_I = 7\text{ V}$			0.1			0.1	mA
I_{IH}	$V_{CC} = 5.5\text{ V}$, $V_I = 2.7\text{ V}$			20			20	μA
I_{IL}	$V_{CC} = 5.5\text{ V}$, $V_I = 0.4\text{ V}$			-0.2			-0.2	mA
$I_O^{\ddagger}$	$V_{CC} = 5.5\text{ V}$, $V_O = 2.25\text{ V}$	-20		-112	-30		-112	mA
I_{CC}	$V_{CC} = 5.5\text{ V}$, Outputs high		10	18		10	18	mA
	$V_{CC} = 5.5\text{ V}$, Outputs low		15	24		15	24	
	$V_{CC} = 5.5\text{ V}$, Outputs disabled		16	30		16	30	

[†] All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

[‡] The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = MIN to MAX§						UNIT
			SN54ALS576B		SN74ALS576B		SN74ALS577A		
			MIN	MAX	MIN	MAX	MIN	MAX	
f _{max}			22		30		30		MHz
t _{PLH}	CLK	Any $\overline{Q}$	4	24	3	14	4	14	ns
t _{PHL}			4	20	4	14	4	14	
t _{PZH}	$\overline{OE}$	Any $\overline{Q}$	4	24	3	18	4	18	ns
t _{PZL}			3	23	4	18	4	18	
t _{PHZ}	$\overline{OE}$	Any $\overline{Q}$	2	14	1	10	2	10	ns
t _{PLZ}			3	29	2	15	3	15	

^{\S} For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V_{CC}	7 V
Input voltage, V_I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T_A : SN54AS576	–55°C to 125°C
SN74AS576	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

		SN54AS576			SN74AS576			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		
I _{OH}	High-level output current		−12			−15			mA		
I _{OL}	Low-level output current		32			48			mA		
f _{clock} *	Clock frequency		0	100		0	125		MHz		
t _w *	Pulse duration	CLK high	5			4			ns		
		CLK low	4			2					
t _{su} *	Setup time, data before CLK↑		3			2			ns		
t _h *	Hold time, data after CLK↑		3			2			ns		
T _A	Operating free-air temperature		−55			125			0	70	°C

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.



SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SN54AS576			SN74AS576			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	$V_{CC} = 4.5\text{ V}$, $I_I = -18\text{ mA}$				-1.2			-1.2	V
V_{OH}	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$, $I_{OH} = -2\text{ mA}$		$V_{CC} - 2$			$V_{CC} - 2$			V
	$V_{CC} = 4.5\text{ V}$	$I_{OH} = -12\text{ mA}$	2.4	3.2					
		$I_{OH} = -15\text{ mA}$				2.4	3.3		
V_{OL}	$V_{CC} = 4.5\text{ V}$	$I_{OL} = 32\text{ mA}$		0.29	0.5				V
		$I_{OL} = 48\text{ mA}$					0.33	0.5	
I_{OZH}	$V_{CC} = 5.5\text{ V}$, $V_O = 2.7\text{ V}$				50			50	μA
I_{OZL}	$V_{CC} = 5.5\text{ V}$, $V_O = 0.4\text{ V}$				-50			-50	μA
I_I	$V_{CC} = 5.5\text{ V}$, $V_I = 7\text{ V}$				0.1			0.1	mA
I_{IH}	$V_{CC} = 5.5\text{ V}$, $V_I = 2.7\text{ V}$				20			20	μA
I_{IL}	D	$V_{CC} = 5.5\text{ V}$, $V_I = 0.4\text{ V}$			-3			-2	mA
	All others				-0.5			-0.5	
$I_O^\ddagger$	$V_{CC} = 5.5\text{ V}$, $V_O = 2.25\text{ V}$		-30		-112	-30		-112	mA
I_{CC}	$V_{CC} = 5.5\text{ V}$	Outputs high		77	125		77	125	mA
		Outputs low		84	135		84	135	
		Outputs disabled		84	135		84	135	

† All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = MIN to MAX§				UNIT
			SN54AS576		SN74AS576		
			MIN	MAX	MIN	MAX	
f _{max} *			100		125		MHz
t _{PLH}	CLK	Any $\overline{Q}$	3	11	3	8	ns
t _{PHL}			4	11	4	9	
t _{PZH}	$\overline{OE}$	Any $\overline{Q}$	2	7	2	6	ns
t _{PZL}			3	11	3	10	
t _{PHZ}	$\overline{OE}$	Any $\overline{Q}$	2	7	2	6	ns
t _{PLZ}			2	7	2	6	

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

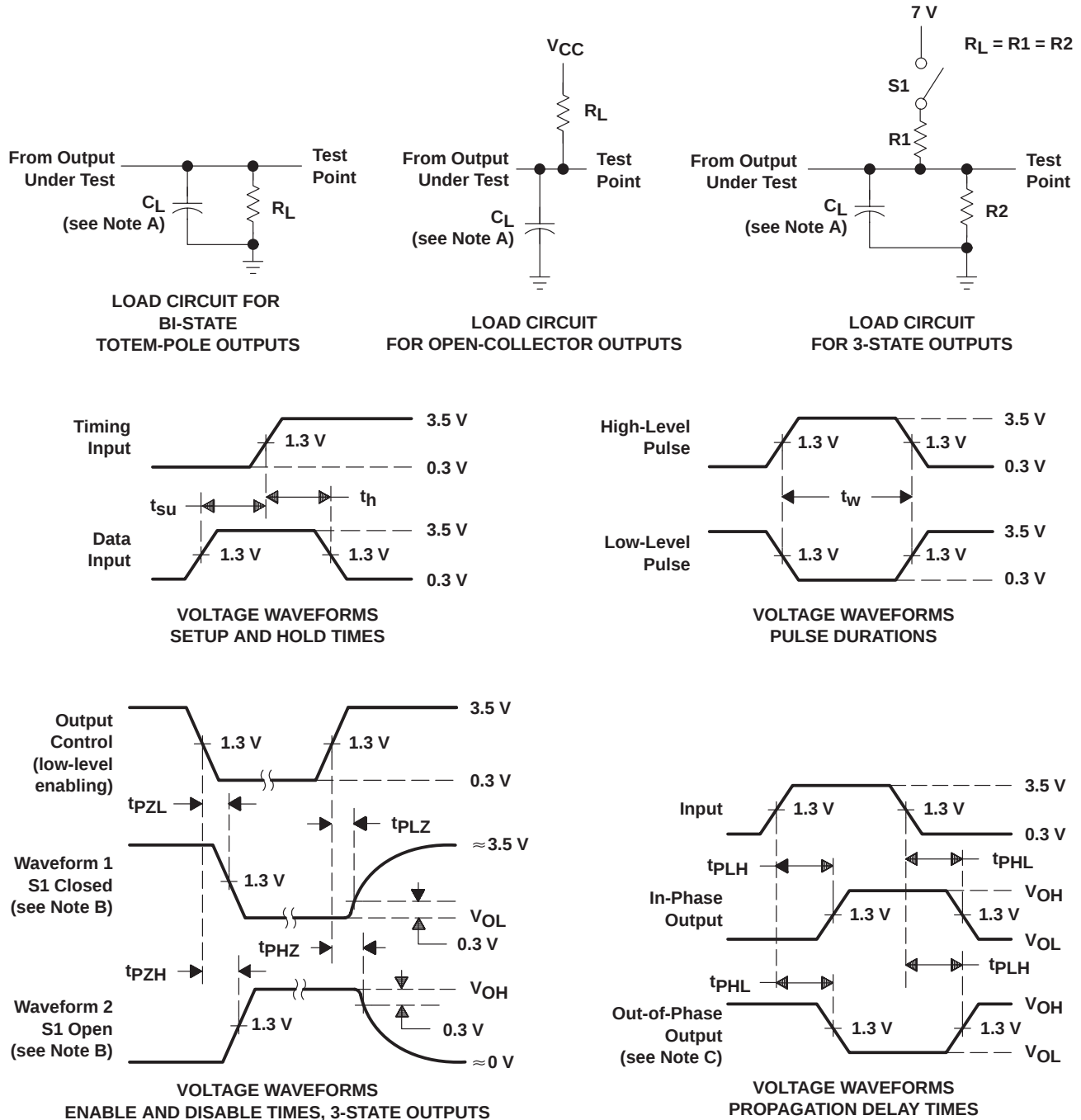
§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

SN54ALS576B, SN54AS576
SN74ALS576B, SN74ALS577A, SN74AS576

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PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.
 D. All input pulses have the following characteristics: $PRR \leq 1 \text{ MHz}$, $t_r = t_f = 2 \text{ ns}$, duty cycle = 50%.
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits 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⁾
84001022A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
8400102RA	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
8400102SA	ACTIVE	CFP	W	20	1	TBD	Call TI	Level-NC-NC-NC
SN54ALS576BJ	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
SN54AS576J	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
SN74ALS576BDW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS576BDWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS576BDWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS576BDWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS576BN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74ALS576BN3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74ALS576BNE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74ALS576BNSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS576BNSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ADW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ADWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ADWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ADWRE4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ANSR	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ANSRE4	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS577ANT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74ALS577ANT3	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI
SN74ALS577ANTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74AS576DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS576DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS576DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS576DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS576N	ACTIVE	PDIP	N	20	20	Pb-Free	CU NIPDAU	Level-NC-NC-NC

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
(RoHS)								
SN74AS576NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SNJ54ALS576BFB	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54ALS576BJ	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54ALS576BW	ACTIVE	CFP	W	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AS576FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AS576J	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC

⁽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) 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.

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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J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within Mil-Std 1835 GDFP2-F20

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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



14/18 Pin Only
20 Pin vendor option

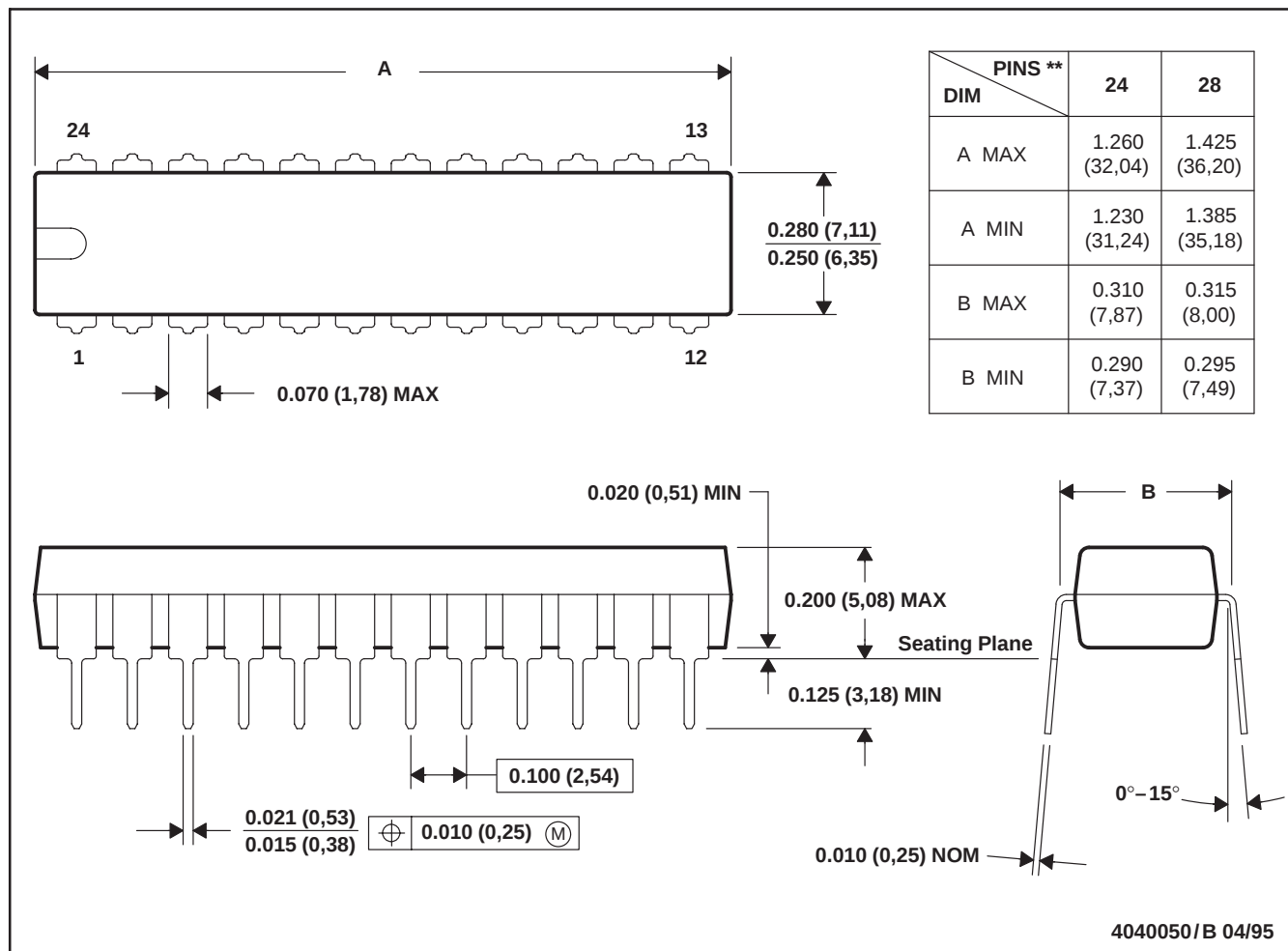
4040049/E 12/2002

- 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.

NT (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

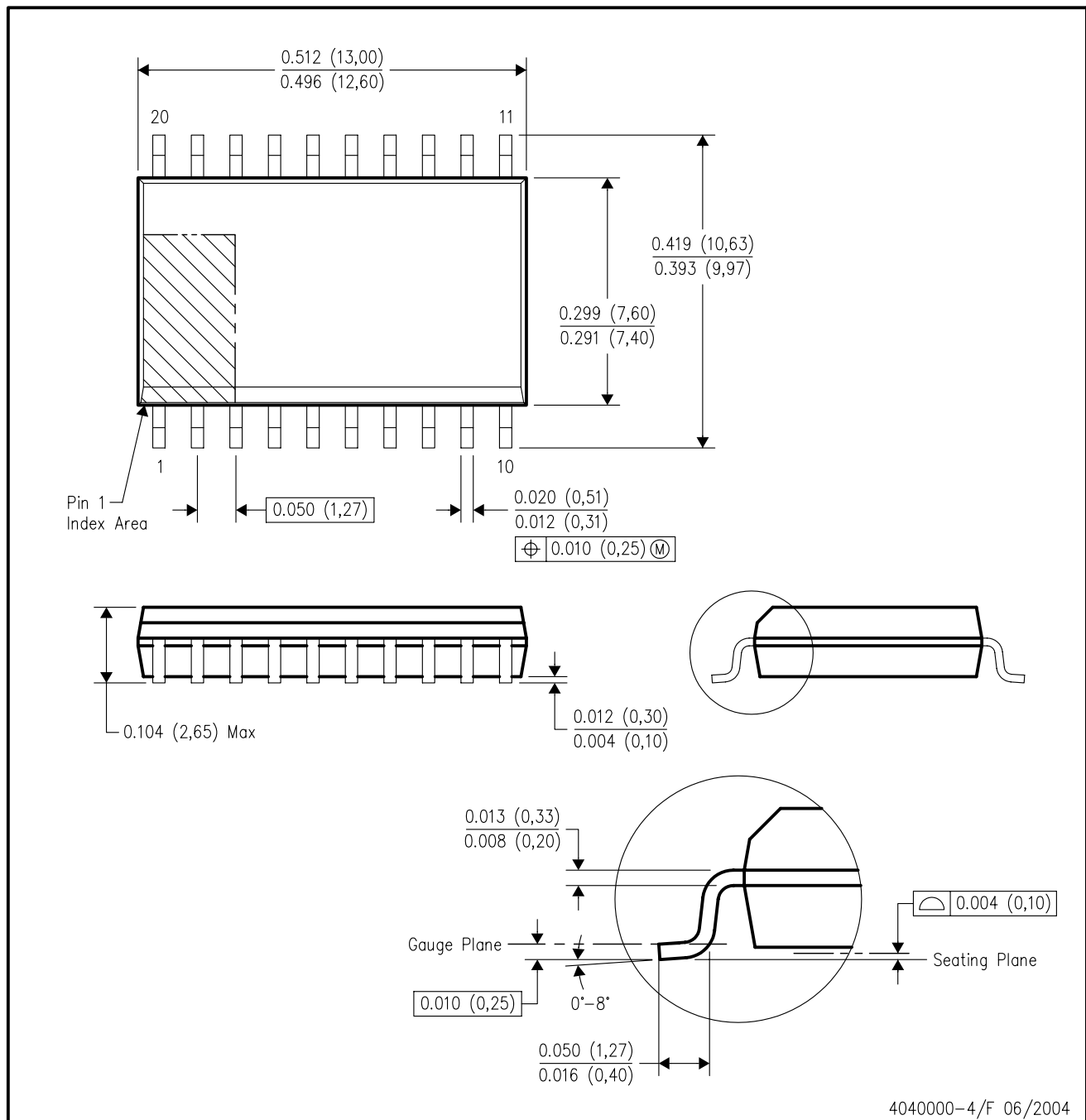
24 PINS SHOWN



NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.

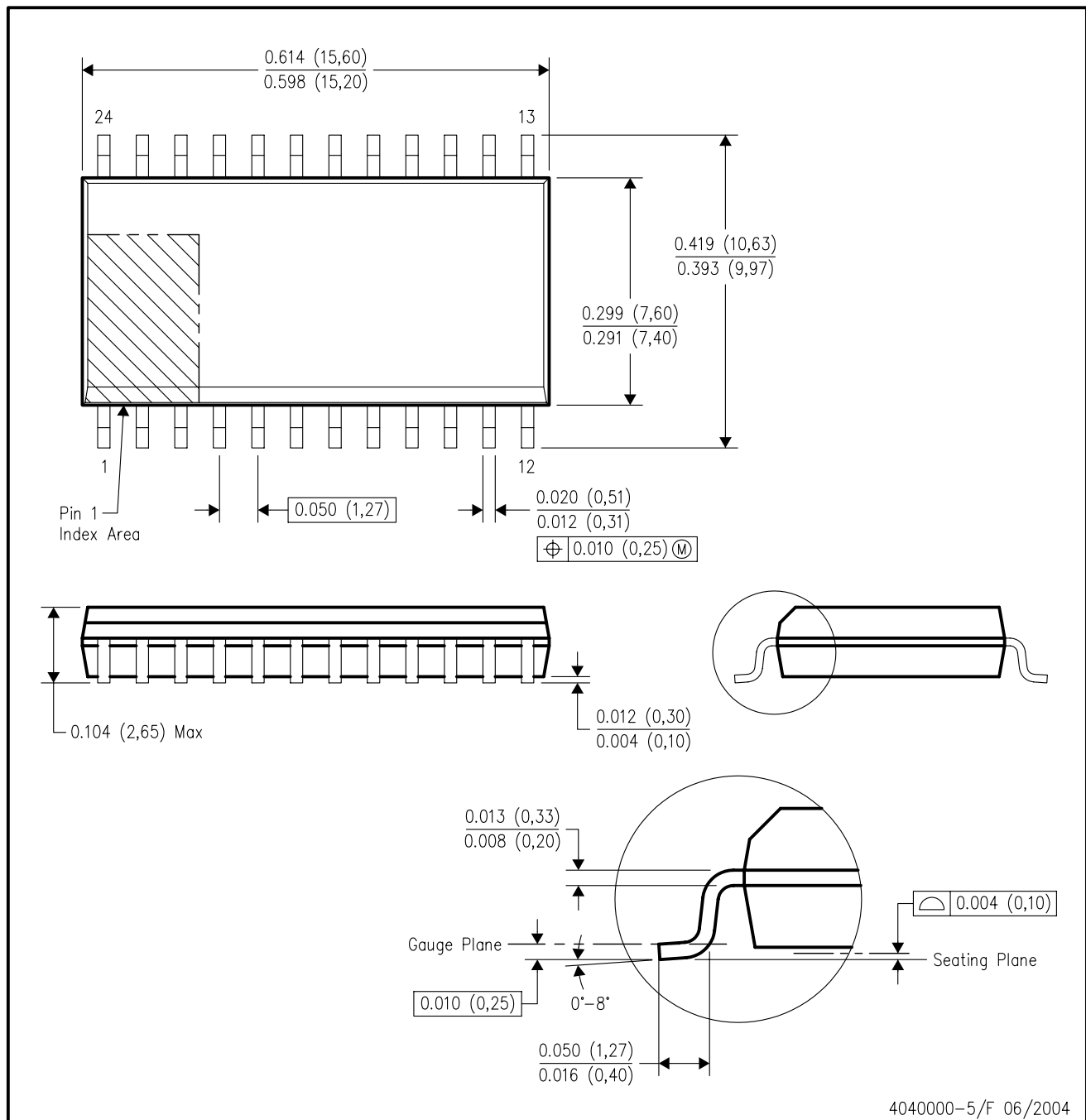
DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



DW (R-PDSO-G24)

PLASTIC SMALL-OUTLINE PACKAGE



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

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-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.

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