

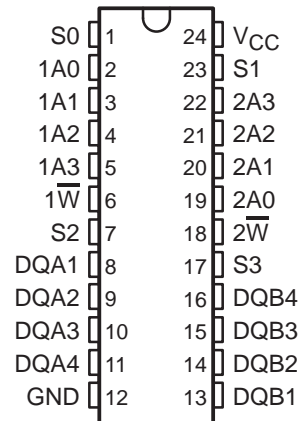
- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Each Register File Has Individual Write-Enable Controls and Address Lines
- Designed Specifically for Multibus Architecture and Overlapping File Operations
- Prioritized B-Input Port Prevents Write Conflicts During Dual-Input Mode
- Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic (NT) 300-mil DIPs

## description

This device features two 16-word by 4-bit register files. Each register file has individual write-enable ( $1\overline{W}$ ,  $2\overline{W}$ ) controls and address lines. This device has two 4-bit data I/O ports (DQA1–DQA4 and DQB1–DQB4). The data I/O ports can output to bus A and bus B, receive input from bus A and bus B, receive input from bus A and output to bus B, or output to bus A and receive input from bus B. To prevent writing conflicts in the dual-input mode, the B-input port takes priority. Two select (S0 and S1) lines control which port has access to which register. S2 determines whether the A ports are in the input or the output modes and S3 does likewise for the B ports. The address lines (1A0–1A3 or 2A0–2A3) are decoded by an internal 1-of-16 decoder to select which register word is to be accessed. All outputs are 3-state buffer-type outputs designed specifically to drive bus lines directly.

The SN74ALS870 is characterized for operation from 0°C to 70°C.

DW OR NT PACKAGE  
(TOP VIEW)



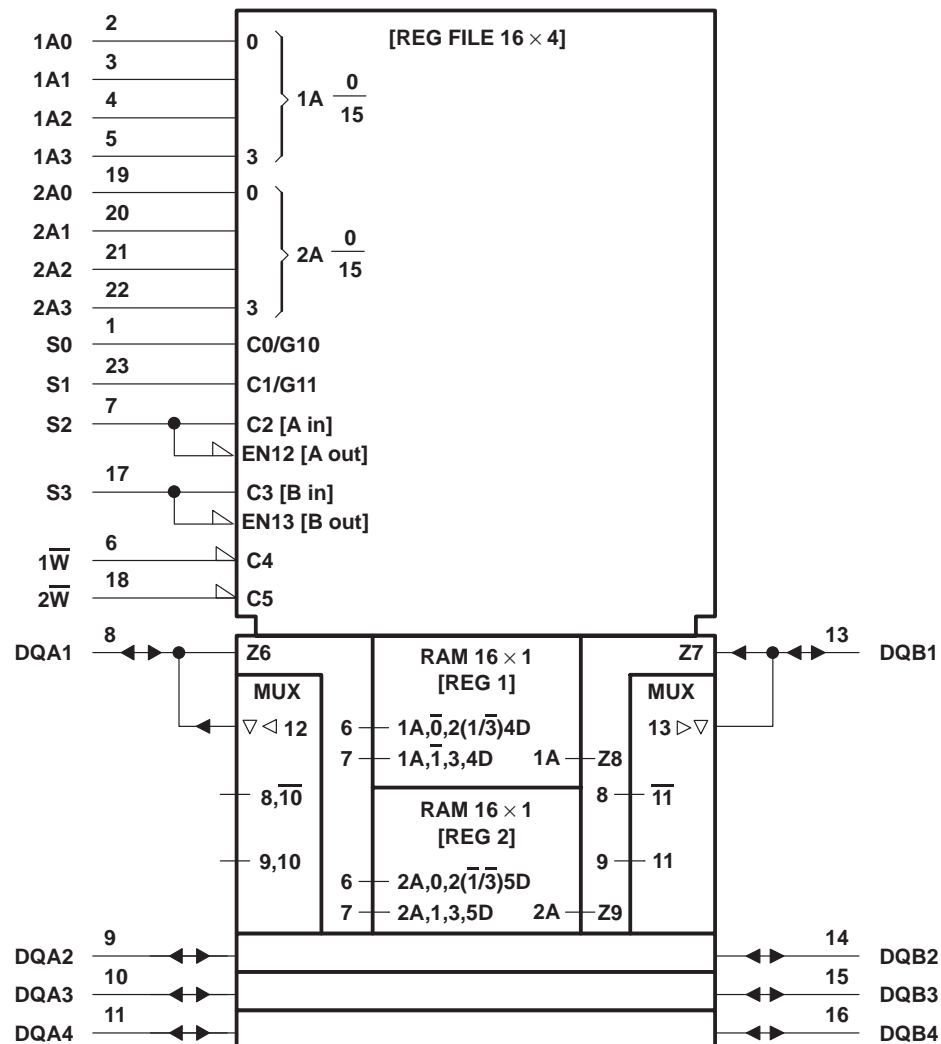
FUNCTION TABLE

FILE SELECT			INPUT/OUTPUT		
S0	S1	FILE SEL	S2	S3	I/O SEL
L	L	1R to A, 1R to B	L	L	A out, B out
H	L	2R to A, 1R to B			
L	H	1R to A, 2R to B			
H	H	2R to A, 2R to B			
L	L	A to 1R, 1R to B	H	L	A in, B out
H	L	A to 2R, 1R to B			
L	H	A to 1R, 2R to B			
H	H	A to 2R, 2R to B			
L	L	1R to A, B to 1R	L	H	A out, B in
H	L	2R to A, B to 1R			
L	H	1R to A, B to 2R			
H	H	2R to A, B to 2R			
L	L	B to 1R	H	H	A in, B in
H	L	A to 2R, B to 1R			
L	H	A to 1R, B to 2R			
H	H	B to 2R			

# SN74ALS870 DUAL 16-BY-4 REGISTER FILES

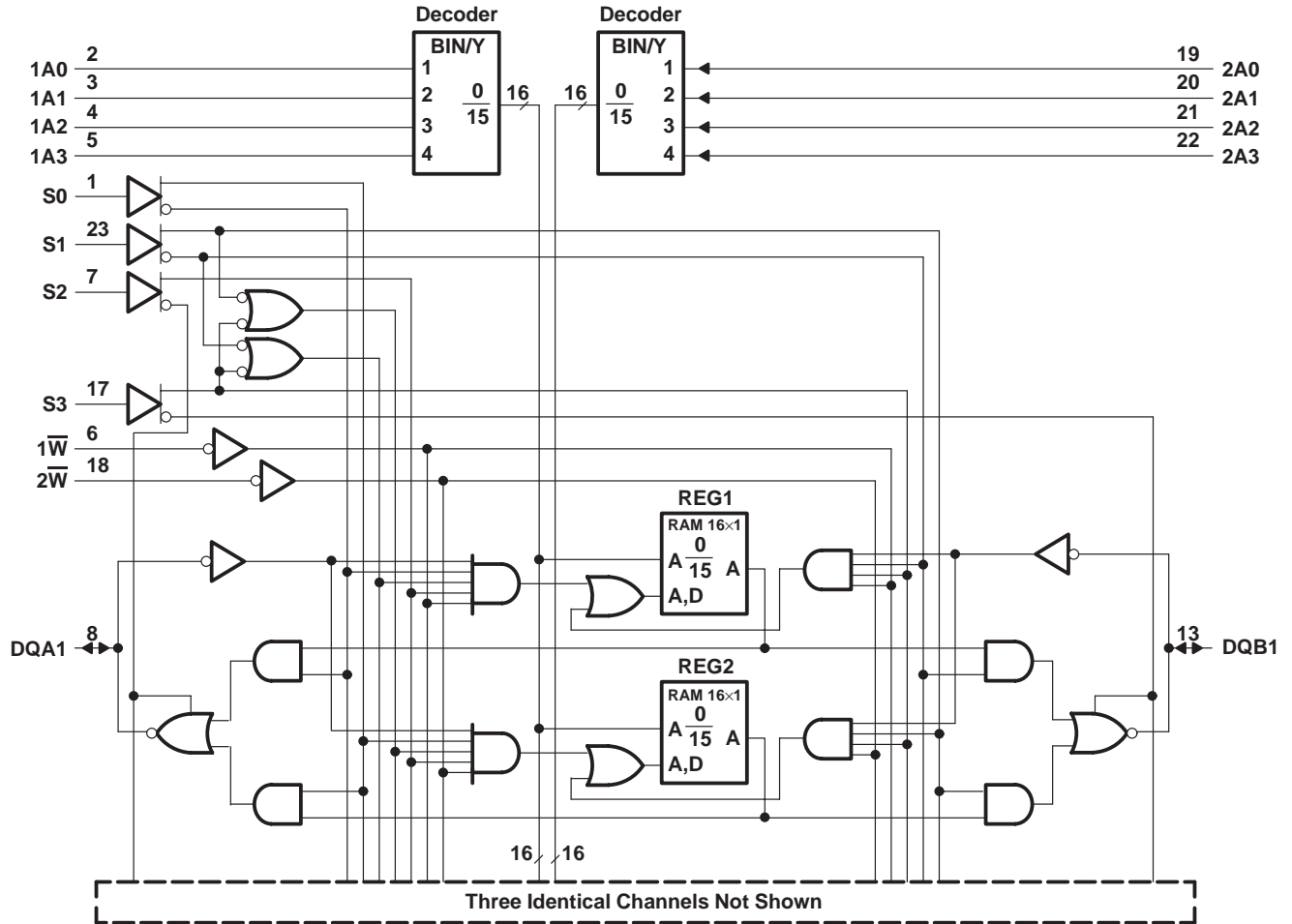
SDAS139A – DECEMBER 1982 – REVISED JANUARY 1995

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)<sup>†</sup>

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$ : All inputs	7 V
I/O ports	5.5 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, $T_A$	0°C to 70°C
Storage temperature range	–65°C to 150°C

<sup>†</sup> 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.

# SN74ALS870

## DUAL 16-BY-4 REGISTER FILES

SDAS139A – DECEMBER 1982 – REVISED JANUARY 1995

### recommended operating conditions

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{OH}$	High-level output current			-2.6	mA
$I_{OL}$	Low-level output current			24	mA
$t_w$	Pulse duration, write	12			ns
$t_{su}$	Setup time	Address before write↓	5		ns
		Data before write↑	15		
		Select before write↓	12		
$t_h$	Hold time	Address before write↓	0		ns
		Data before write↑	0		
		Select before write↓	12		
$T_A$	Operating free-air temperature	0		70	°C

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

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ ,	$I_I = -18\text{ mA}$			-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
		$V_{CC} = 4.5\text{ V}$ ,	$I_{OH} = -2.6\text{ mA}$	2.4	3.2		
$V_{OL}$		$V_{CC} = 4.5\text{ V}$ ,	$I_{OL} = 24\text{ mA}$	0.35	0.5		V
$I_I$	Control inputs	$V_{CC} = 5.5\text{ V}$	$V_I = 7\text{ V}$		0.1		mA
	DQA and DQB ports		$V_I = 5.5\text{ V}$		0.2		
$I_{IH}$	1W and 2W	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 2.7\text{ V}$		20		μA
	Other control inputs				40		
	DQA and DQB ports‡				50		
$I_{IL}$	Control inputs	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 0.4\text{ V}$		-0.2		mA
	DQA and DQB ports‡				-0.2		
$I_{O\$}$		$V_{CC} = 5.5\text{ V}$ ,	$V_O = 2.25\text{ V}$	-30		-112	mA
$I_{CC}$		$V_{CC} = 5.5\text{ V}$			80	110	mA

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

‡ For I/O ports, the parameters  $I_{IH}$  and  $I_{IL}$  include the off-state output current.

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



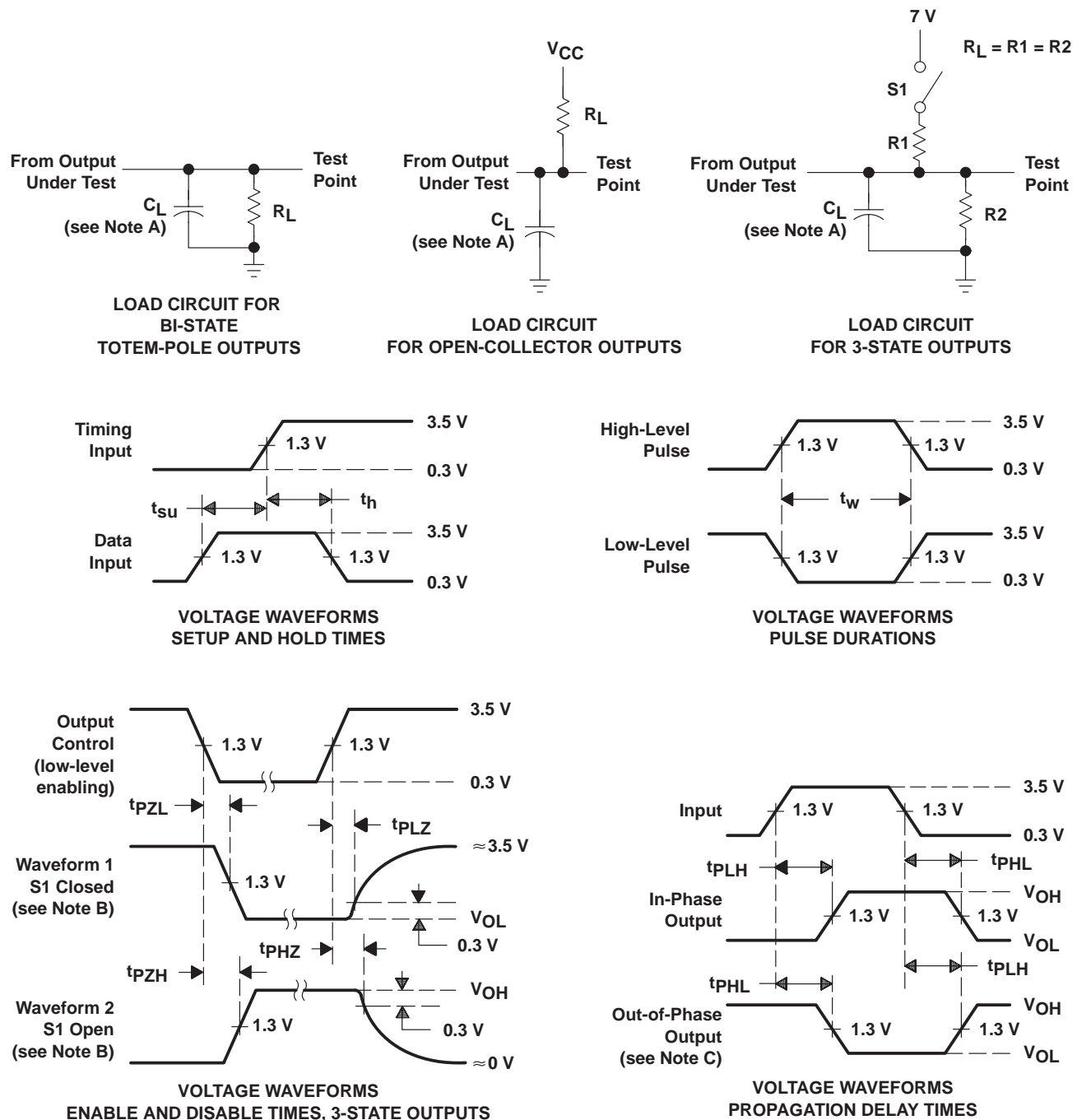
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**switching characteristics (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T <sub>A</sub> = MIN to MAX†		UNIT
			MIN	MAX	
t <sub>a</sub> (A)	Any A	Any DQ	3	19	ns
t <sub>a</sub> (S)	S0	Any DQA	3	15	ns
	S1	Any DQB	3	15	
t <sub>dis</sub>	S2	Any DQA	3	14	ns
	S3	Any DQB	3	14	
t <sub>en</sub>	S2	Any DQA	3	17	ns
	S3	Any DQB	3	17	
t <sub>pd</sub>	$\overline{W}$	Any DQ	5	23	ns
	DQA	DQB	5	26	
	DQB	DQA	5	26	

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

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:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  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 <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74ALS870DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870DWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870DWRE4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870DWRG4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870NSR	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870NSRE4	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870NSRG4	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS870NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS870NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

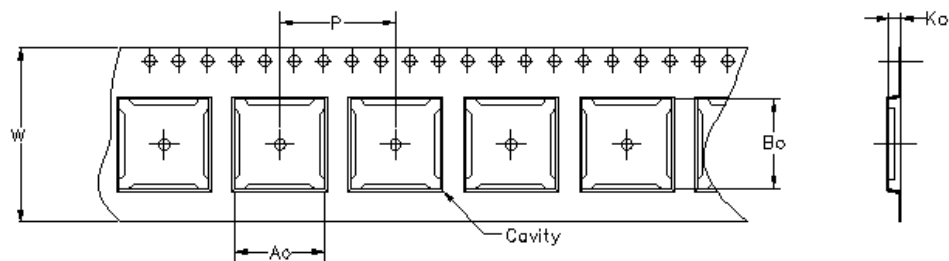
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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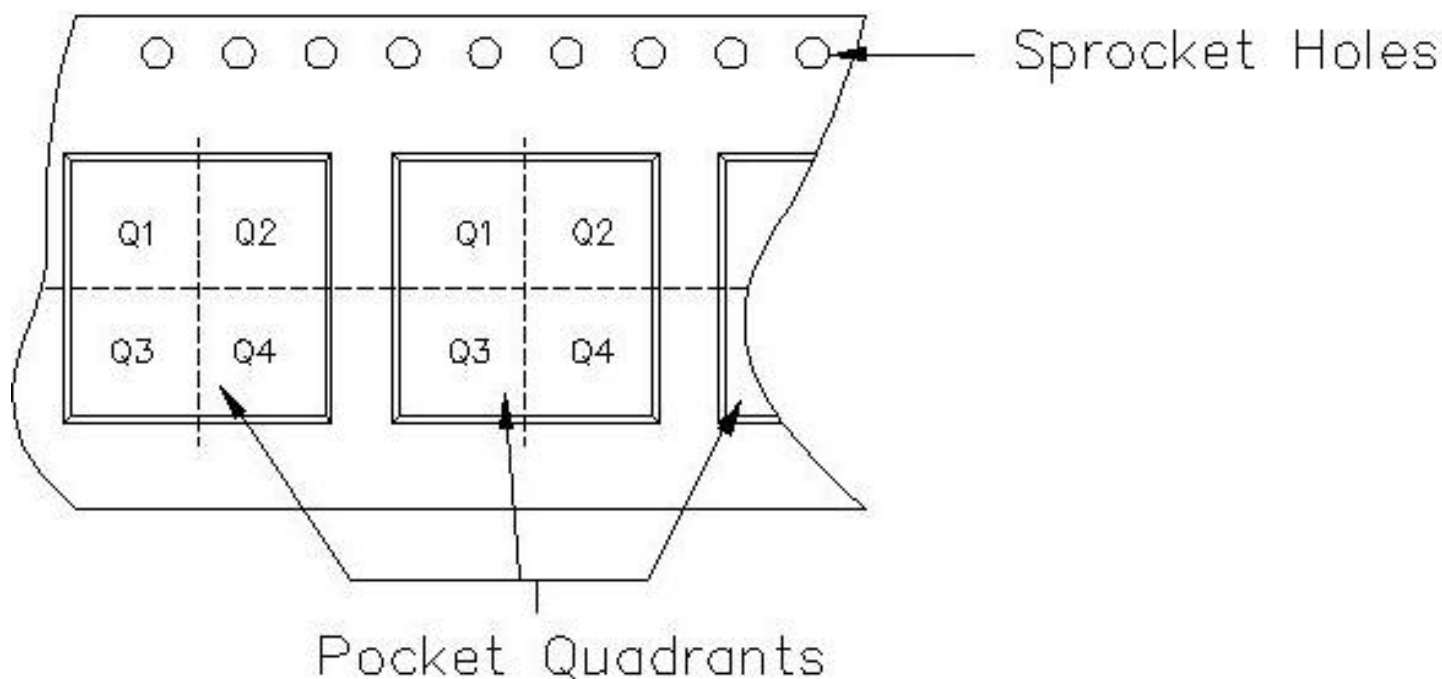
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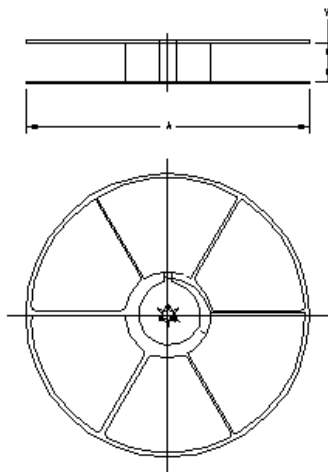
Carrier tape design is defined largely by the component length, width, and thickness.

$A_0$ = Dimension designed to accommodate the component width.
$B_0$ = Dimension designed to accommodate the component length.
$K_0$ = Dimension designed to accommodate the component thickness.
$W$ = Overall width of the carrier tape.
$P$ = Pitch between successive cavity centers.



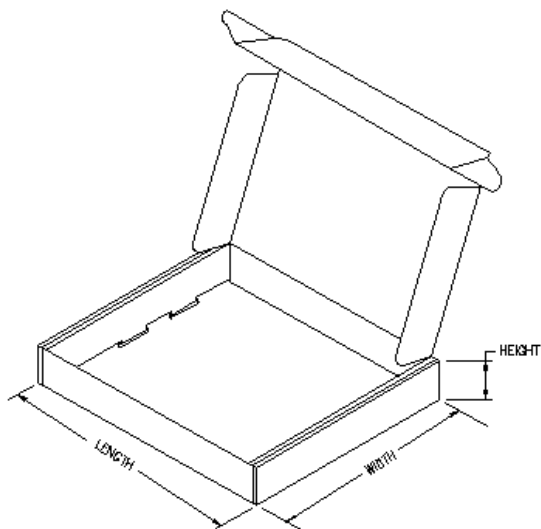
## TAPE AND REEL INFORMATION

Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS870DWR	DW	24	TAI	330	24	10.75	15.7	2.7	12	24	Q1
SN74ALS870NSR	NS	24	MLA	330	24	8.2	15.4	2.5	12	24	Q1



## TAPE AND REEL BOX INFORMATION

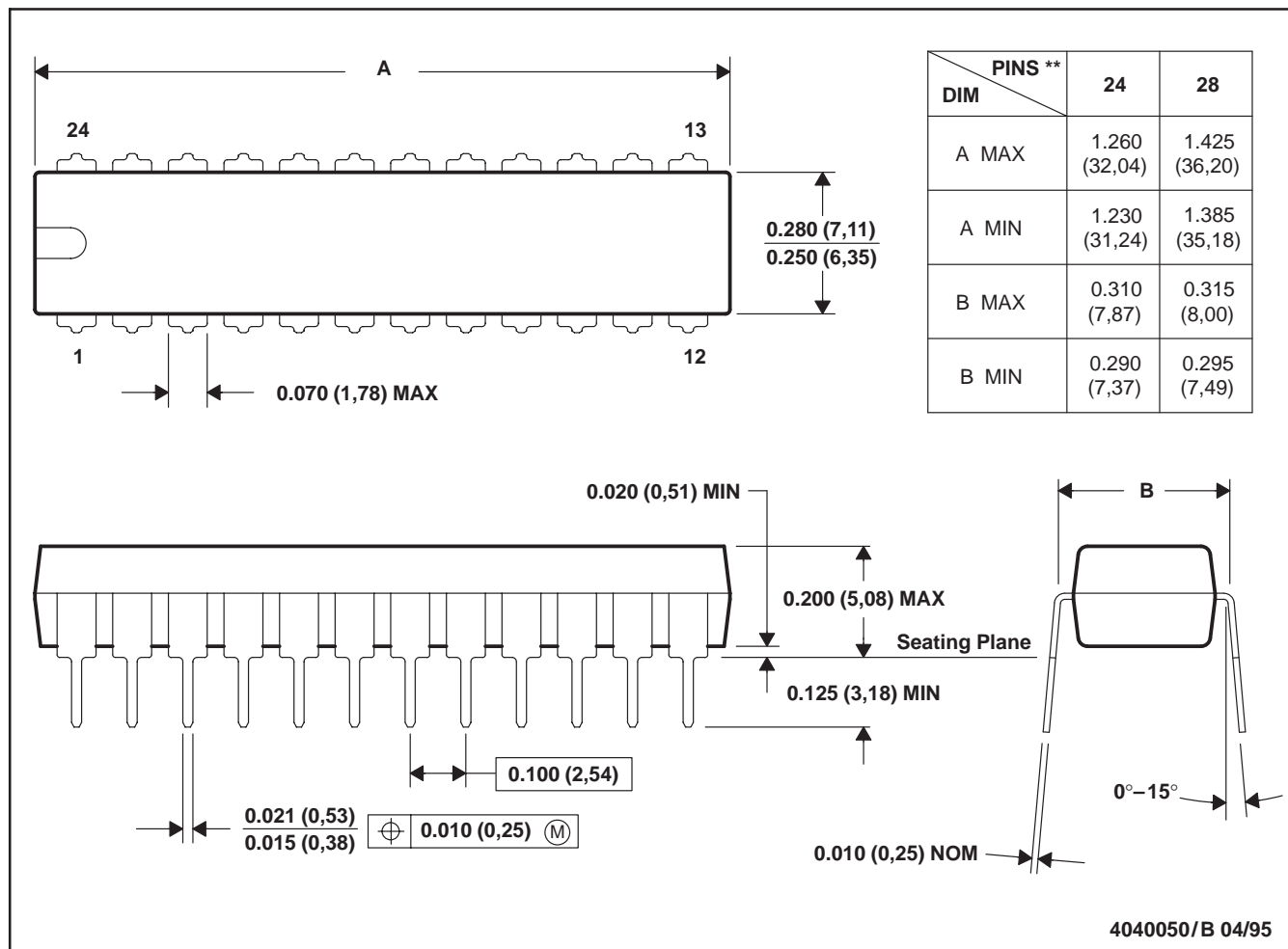
Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
SN74ALS870DWR	DW	24	TAI	346.0	346.0	41.0
SN74ALS870NSR	NS	24	MLA	346.0	346.0	41.0



## NT (R-PDIP-T\*\*)

## PLASTIC DUAL-IN-LINE PACKAGE

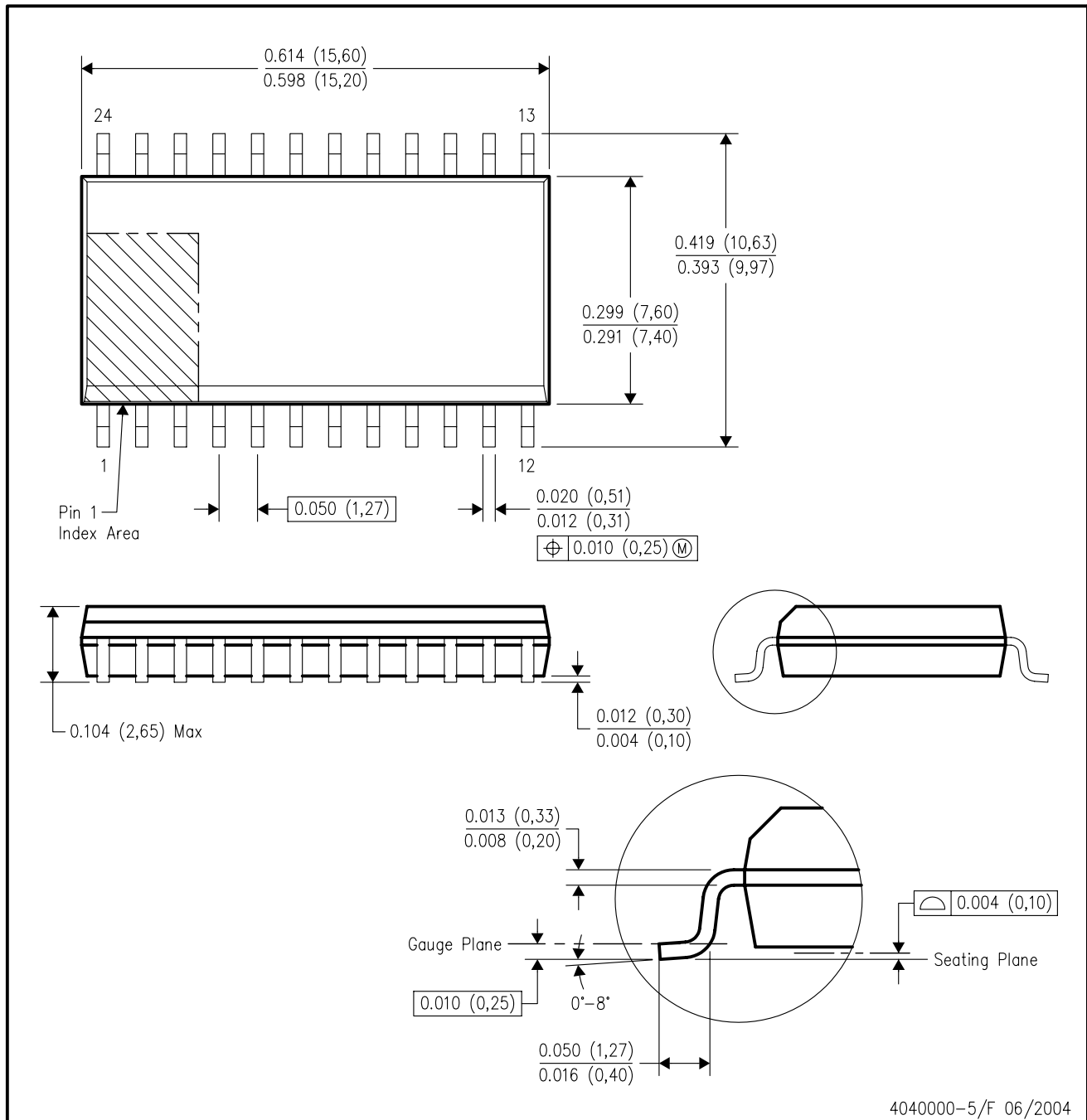
24 PINS SHOWN



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

## DW (R-PDSO-G24)

## PLASTIC SMALL-OUTLINE PACKAGE



# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

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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.

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