

54LS283/DM54LS283/DM74LS283 4-Bit Binary Adders with Fast Carry

General Description

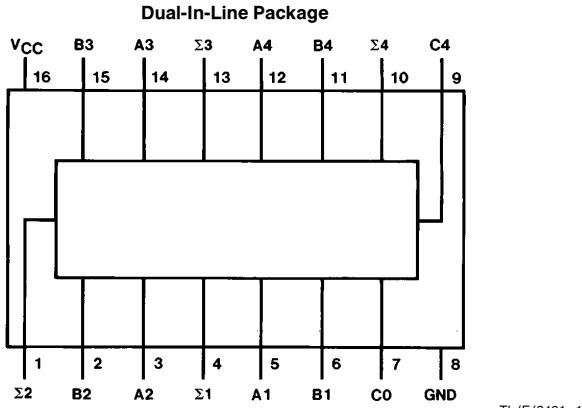
These full adders perform the addition of two 4-bit binary numbers. The sum (Σ) outputs are provided for each bit and the resultant carry (C4) is obtained from the fourth bit. These adders feature full internal look ahead across all four bits. This provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

The adder logic, including the carry, is implemented in its true form meaning that the end-around carry can be accomplished without the need for logic or level inversion.

Features

- Full-carry look-ahead across the four bits
- Systems achieve partial look-ahead performance with the economy of ripple carry
- Typical add times
 - Two 8-bit words 25 ns
 - Two 16-bit words 45 ns
- Typical power dissipation per 4-bit adder 95 mW
- Alternate Military/Aerospace device (54LS283) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

Connection Diagram



TL/F/6421-1

Order Number 54LS283DMQB, 54LS283FMQB, 54LS283LMQB,
DM54LS283J, DM54LS283W, DM74LS283M or DM74LS283N
See NS Package Number E20A, J16A, M16A, N16E or W16A

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	
DM54LS and 54LS	−55°C to +125°C
DM74LS	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	DM54LS283			DM74LS283			Units
		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			0.7			0.8	V
I_{OH}	High Level Output Current			−0.4			−0.4	mA
I_{OL}	Low Level Output Current			4			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	$V_{CC} = \text{Min}$, $I_I = -18 \text{ mA}$			−1.5	V
V_{OH}	High Level Output Voltage	$V_{CC} = \text{Min}$, $I_{OH} = \text{Max}$	DM54	2.5	3.4	V
		$V_{IL} = \text{Max}$, $V_{IH} = \text{Min}$	DM74	2.7	3.4	
V_{OL}	Low Level Output Voltage	$V_{CC} = \text{Min}$, $I_{OL} = \text{Max}$	DM54		0.25	V
		$V_{IL} = \text{Max}$, $V_{IH} = \text{Min}$	DM74		0.35	
	$I_{OL} = 4 \text{ mA}$, $V_{CC} = \text{Min}$	DM74		0.25	0.4	
I_I	Input Current @ Max Input Voltage	$V_{CC} = \text{Max}$	A, B		0.2	mA
		$V_I = 7V$	C0		0.1	
I_{IH}	High Level Input Current	$V_{CC} = \text{Max}$	A, B		40	μA
		$V_I = 2.7V$	C0		20	
I_{IL}	Low Level Input Current	$V_{CC} = \text{Max}$	A, B		−0.8	mA
		$V_I = 0.4V$	C0		−0.4	
I_{OS}	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 2)	DM54	−20	−100	mA
			DM74	−20	−100	
I_{CC1}	Supply Current	$V_{CC} = \text{Max}$ (Note 3)		19	34	mA
I_{CC2}	Supply Current	$V_{CC} = \text{Max}$ (Note 4)		22	39	mA

Note 1: All typicals are at $V_{CC} = 5V$, $T_A = 25^\circ\text{C}$.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 3: I_{CC1} is measured with all outputs open, all B inputs low and all other inputs at 4.5V, or all inputs at 4.5V.

Note 4: I_{CC2} is measured with all outputs open and all inputs grounded.

Switching Characteristics at $V_{CC} = 5V$ and $T_A = 25^\circ C$ (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	$R_L = 2\text{ k}\Omega$				Units	
			$C_L = 15\text{ pF}$		$C_L = 50\text{ pF}$			
			Min	Max	Min	Max		
t_{PLH}	Propagation Delay Time Low to High Level Output	C_0 to Σ_1, Σ_2		24		28	ns	
t_{PHL}	Propagation Delay Time High to Low Level Output	C_0 to Σ_1, Σ_2		24		30	ns	
t_{PLH}	Propagation Delay Time Low to High Level Output	C_0 to Σ_3		24		28	ns	
t_{PHL}	Propagation Delay Time High to Low Level Output	C_0 to Σ_3		24		30	ns	
t_{PLH}	Propagation Delay Time Low to High Level Output	C_0 to Σ_4		24		28	ns	
t_{PHL}	Propagation Delay Time High to Low Level Output	C_0 to Σ_4		24		30	ns	
t_{PLH}	Propagation Delay Time Low to High Level Output	A_i or B_i to Σ_i		24		28	ns	
t_{PHL}	Propagation Delay Time High to Low Level Output	A_i or B_i to Σ_i		24		30	ns	
t_{PLH}	Propagation Delay Time Low to High Level Output	C_0 to C_4		17		24	ns	
t_{PHL}	Propagation Delay Time High to Low Level Output	C_0 to C_4		17		25	ns	
t_{PLH}	Propagation Delay Time Low to High Level Output	A_i or B_i to C_4		17		24	ns	
t_{PHL}	Propagation Delay Time High to Low Level Output	A_i or B_i to C_4		17		26	ns	

Function Table

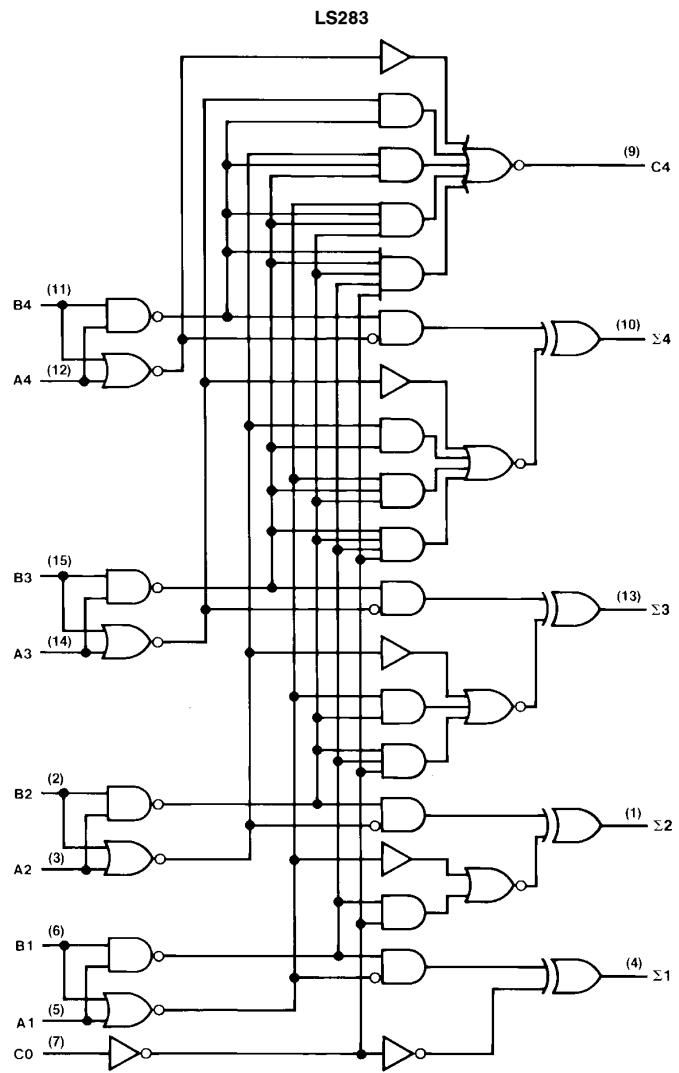
Input					Outputs								
					When $C_0 = L$				When $C_0 = H$				
When $C_2 = L$		When $C_2 = H$		When $C_2 = L$		When $C_2 = H$							
A1 A3	B1 B3	A2 A4	B2 B4	Σ_1 Σ_3	Σ_2 Σ_4	C2 C4	Σ_1 Σ_3	Σ_2 Σ_4	C2 C4	Σ_1 Σ_3	Σ_2 Σ_4	C2 C4	
L	L	L	L	L	L	L	H	L	L	L	L	L	
H	L	L	L	H	L	L	L	L	L	H	H	L	
L	H	L	L	H	L	L	L	L	L	H	H	L	
H	H	L	L	L	H	L	H	L	L	H	H	L	
L	L	H	L	L	H	L	H	L	L	H	H	L	
H	L	H	L	H	H	L	L	H	L	L	H	H	
L	H	H	L	H	L	H	L	H	L	L	H	H	
H	H	H	L	L	H	L	H	L	L	L	H	H	
L	L	L	H	H	L	H	L	H	L	H	L	L	
H	L	H	H	H	H	L	L	H	L	L	H	H	
L	H	H	H	H	L	H	L	H	L	H	H	H	
H	H	H	H	L	H	L	H	L	H	H	H	H	

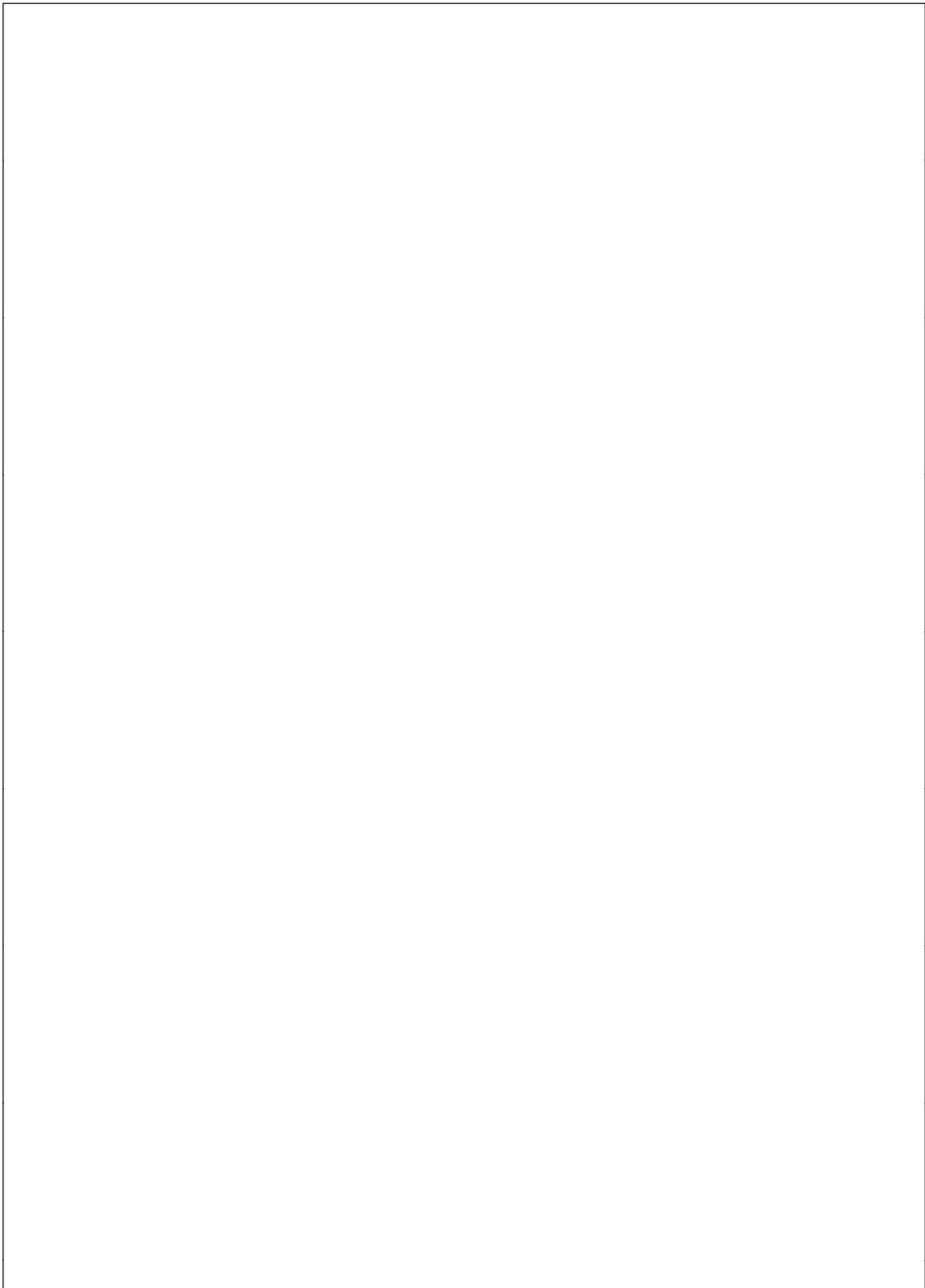
H = High Level, L = Low Level

Note: Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs Σ_1 and Σ_2 and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs Σ_3 , Σ_4 , and C4.

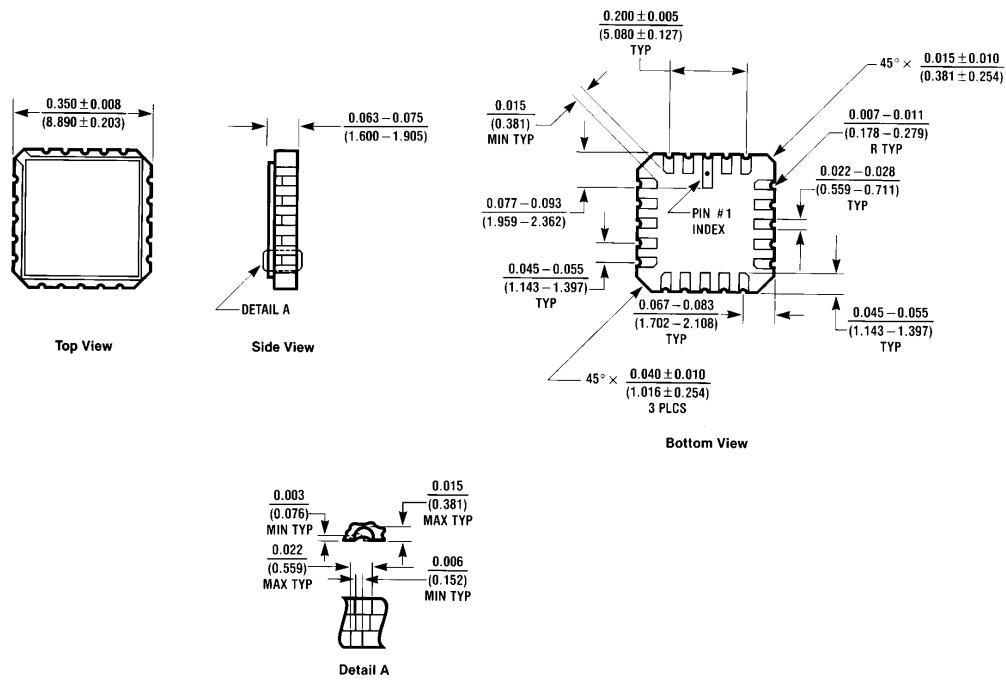
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Logic Diagram



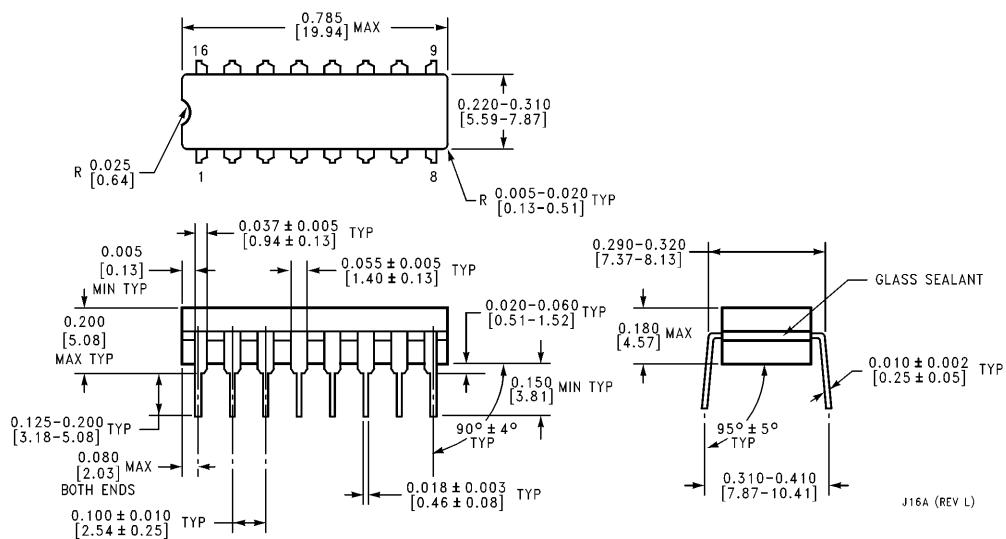


Physical Dimensions



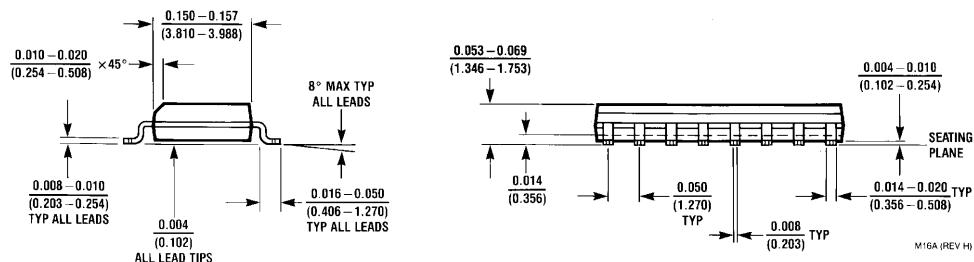
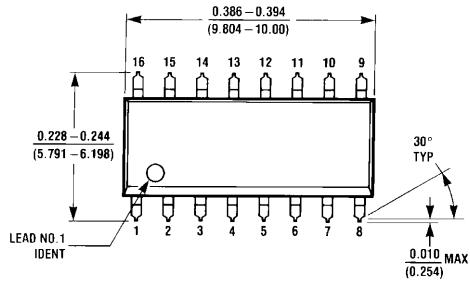
**Ceramic Leadless Chip Carrier Package (E)
Order Number 54LS283LMQB
NS Package Number E20A**

E20A (REV D)

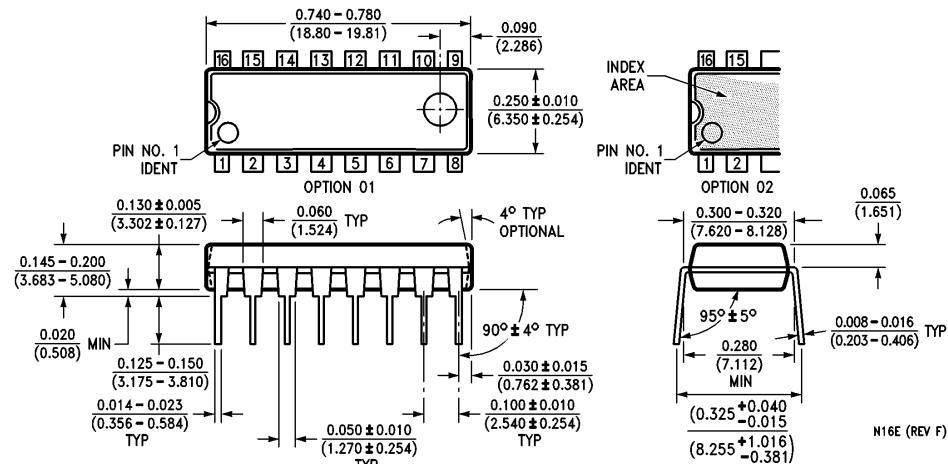


**16-Lead Ceramic Dual-In-Line Package (J)
Order Number 54LS283DMQB or DM54LS283J
NS Package Number J16A**

Physical Dimensions inches (millimeters) (Continued)

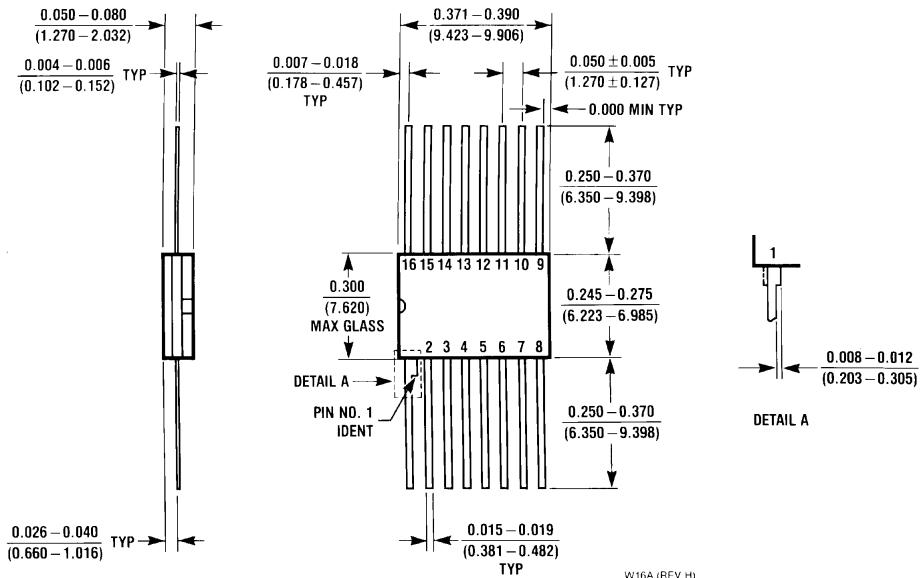


**16-Lead Small Outline Molded Package (M)
Order Number DM74LS283M
NS Package Number M16A**



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS283N
NS Package Number N16E

Physical Dimensions inches (millimeters) (Continued)



16-Lead Ceramic Flat Package (W)
Order Number 54LS283FMQB or DM54LS283W
NS Package Number W16A

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National Semiconductor
Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: (800) 272-9959
Fax: (800) 737-7018

National Semiconductor
Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor
Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor
Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2406