

## DM74LS283

### 4-Bit Binary Adders with Fast Carry

#### General Description

These full adders perform the addition of two 4-bit binary numbers. The sum ( $\Sigma$ ) outputs are provided for each bit and the resultant carry ( $C_4$ ) 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.

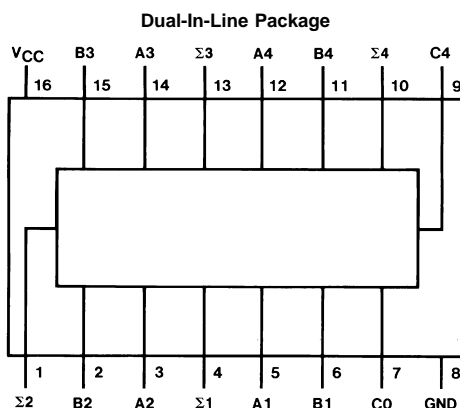
The adder logic, including the carry, is implemented in its true form meaning that the end-around carry can be accomplished without the need for logic or level inversion.

- 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 Fairchild Semiconductor Sales Office/Distributor for specifications.

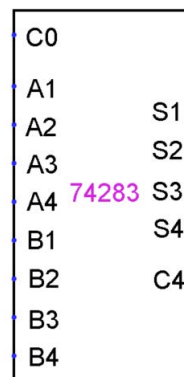
#### Features

- Full-carry look-ahead across the four bits

#### Connection Diagram



#### Symbol



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

#### Equation

$$(C_4 S_4 S_3 S_2 S_1)_2 = (A_4 A_3 A_2 A_1)_2 + (B_4 B_3 B_2 B_1)_2 + (000C_0)_2$$

$$C_0 = \text{Carry In } (C_{IN})$$

$$C_0 = 0 \Rightarrow A+B$$

$$C_0 = 1 \Rightarrow A+B+1$$

$$C_4 = \text{Carry Out } (C_{OUT})$$

**Absolute Maximum Ratings** (Note 1)

Supply Voltage

Input Voltage

Operating Free Air Temperature Range

7V

7V

DM54LS and 54LS

DM74LS

Storage Temperature Range

–55°C to +125°C

0°C to +70°C

–65°C to +150°C

**Recommended Operating Conditions**

Symbol	Parameter	DM54LS283			DM74LS283			Units
		Min	Nom	Max	Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High Level Input Voltage	2			2			V
V <sub>IL</sub>	Low Level Input Voltage			0.7			0.8	V
I <sub>OH</sub>	High Level Output Current			–0.4			–0.4	mA
I <sub>OL</sub>	Low Level Output Current			4			8	mA
T <sub>A</sub>	Free Air Operating Temperature	–55		125	0		70	°C

**Note 1:** 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.

**Electrical Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = –18 mA			–1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max	DM54	2.5	3.4	V
		V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	DM74	2.7	3.4	
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max	DM54		0.25	V
		V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	DM74		0.35	
		I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min	DM74		0.25	
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max	A, B		0.2	mA
		V <sub>I</sub> = 7V	C0		0.1	
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max	A, B		40	μA
		V <sub>I</sub> = 2.7V	C0		20	
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max	A, B		–0.8	mA
		V <sub>I</sub> = 0.4V	C0		–0.4	
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max	DM54	–20	–100	mA
			DM74	–20	–100	
I <sub>CC1</sub>	Supply Current	V <sub>CC</sub> = Max (Note 4)		19	34	mA
I <sub>CC2</sub>	Supply Current	V <sub>CC</sub> = Max (Note 5)		22	39	mA

**Note 2:** All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

**Note 3:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

**Note 4:** I<sub>CC1</sub> is measured with all outputs open, all B inputs low and all other inputs at 4.5V, or all inputs at 4.5V.

**Note 5:** I<sub>CC2</sub> is measured with all outputs open and all inputs grounded.

## Switching Characteristics

at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$

Symbol	Parameter	From (Input) To (Output)	R <sub>L</sub> = 2 kΩ				Units
			C <sub>L</sub> = 15 pF		C <sub>L</sub> = 50 pF		
			Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to Σ1, Σ2		24		28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to Σ1, Σ2		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to Σ3		24		28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to Σ3		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to Σ4		24		28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to Σ4		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	A <sub>i</sub> or B <sub>i</sub> to Σ <sub>i</sub>		24		28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	A <sub>i</sub> or B <sub>i</sub> to Σ <sub>i</sub>		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to C4		17		24	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to C4		17		25	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	A <sub>i</sub> or B <sub>i</sub> to C4		17		24	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	A <sub>i</sub> or B <sub>i</sub> to C4		17		26	ns

## Truth Table

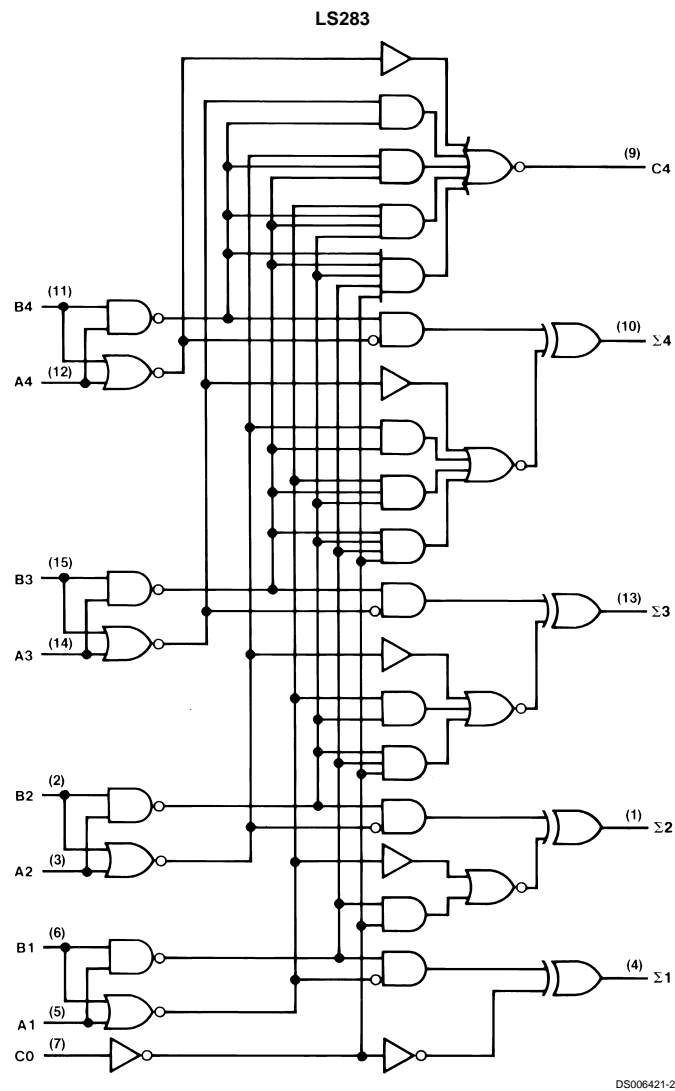
Input				Outputs					
				When C0 = L			When C0 = H		
A1	B1	A2	B2	When C2 = L			When C2 = H		
				$\Sigma 1$	$\Sigma 2$	C2	$\Sigma 1$	$\Sigma 2$	C2
A3	B3	A4	B4	$\Sigma 3$	$\Sigma 4$	C4	$\Sigma 3$	$\Sigma 4$	C4
L	L	L	L	L	L	L	H	L	L
H	L	L	L	H	L	L	L	H	L
L	H	L	L	L	L	L	H	H	L
H	H	L	L	L	H	L	H	H	L
L	L	H	L	H	H	L	L	L	H
H	L	H	L	H	H	L	L	L	H
L	H	H	L	L	L	H	H	L	H
H	H	H	L	L	H	L	H	H	L
L	L	L	H	H	H	L	L	L	H
H	L	L	H	H	H	L	L	L	H
L	H	L	H	L	L	H	H	L	H
H	H	L	H	L	L	H	H	L	H
L	L	H	H	H	L	H	L	H	H
H	L	H	H	H	L	H	L	H	H
L	H	H	H	H	L	H	L	H	H
H	H	H	H	L	H	H	H	H	H

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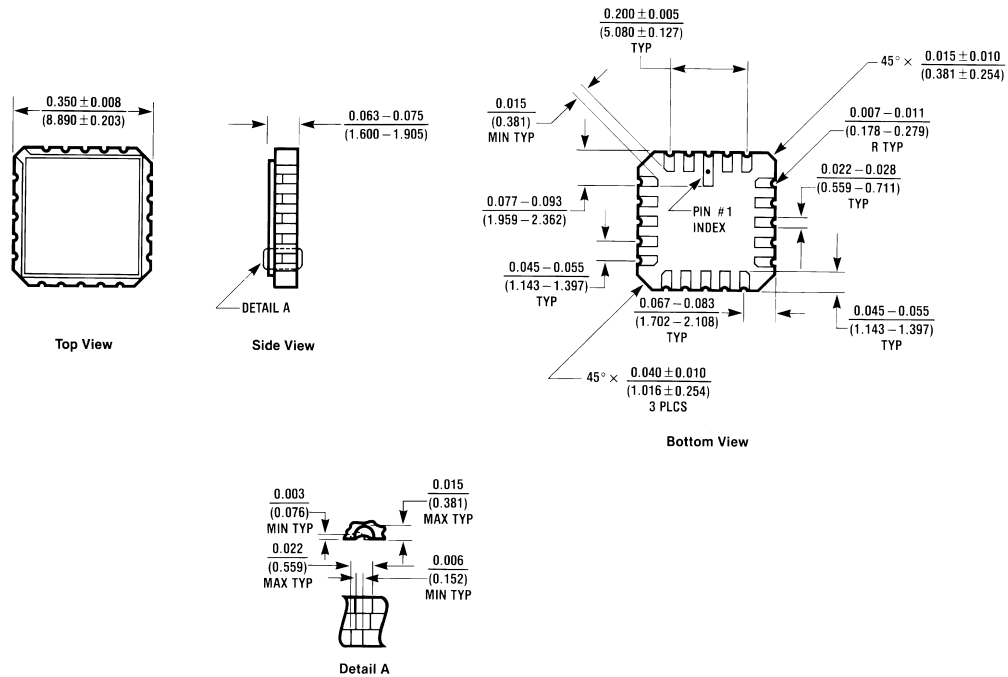
H = High Level, L = Low Level

**Note 6:** Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs  $\Sigma 1$  and  $\Sigma 2$  and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs  $\Sigma 3$ ,  $\Sigma 4$ , and C4.

## Logic Diagram

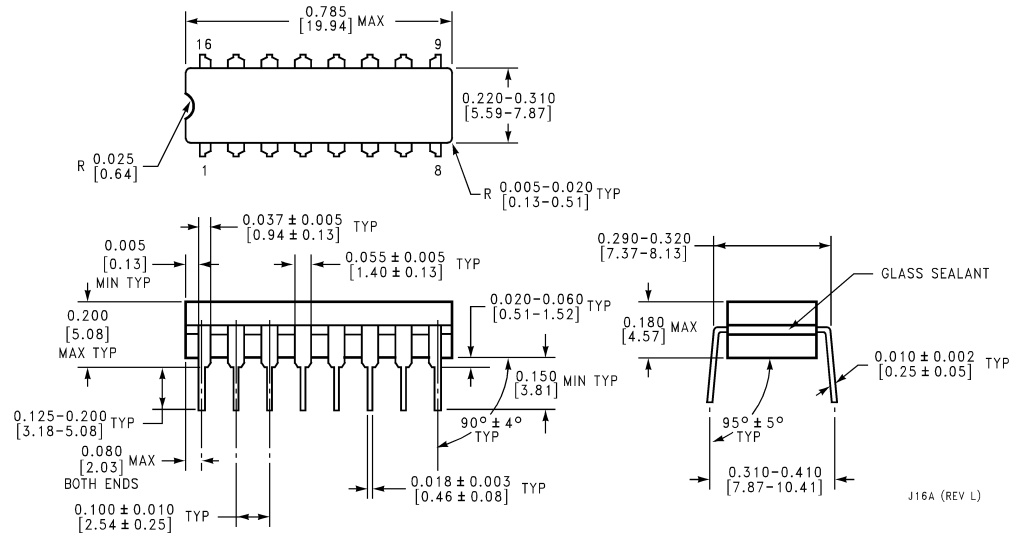


## Physical Dimensions inches (millimeters) unless otherwise noted



E20A (REV D)

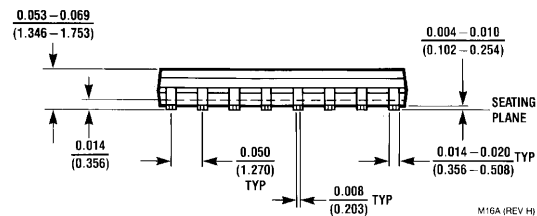
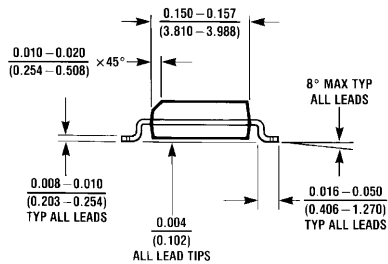
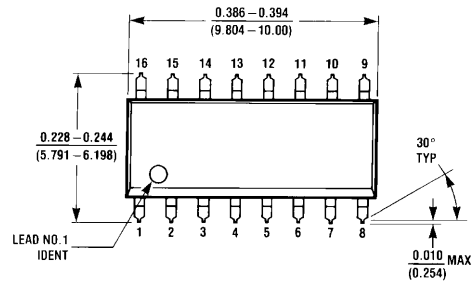
**Ceramic Leadless Chip Carrier Package (E)**  
**Order Number 54LS283LMQB**  
**Package Number E20A**



J16A (REV L)

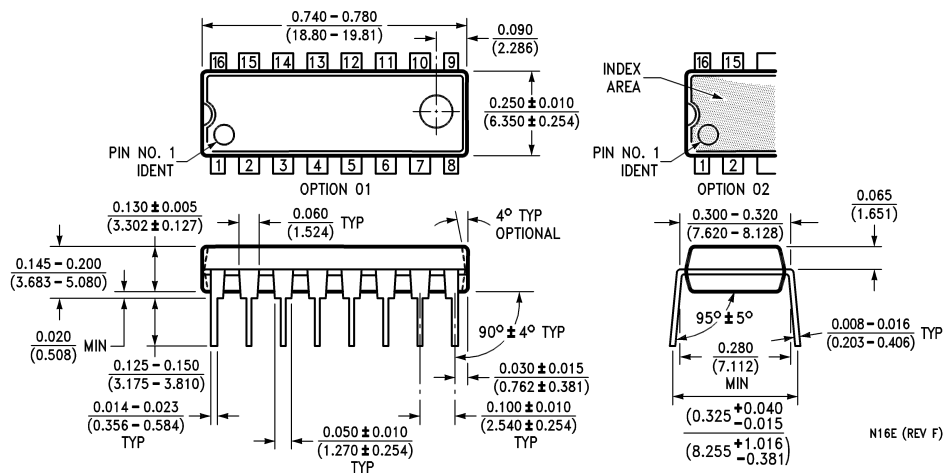
**16-Lead Ceramic Dual-In-Line Package (J)**  
**Order Number 54LS283DMQB or DM54LS283J**  
**Package Number J16A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



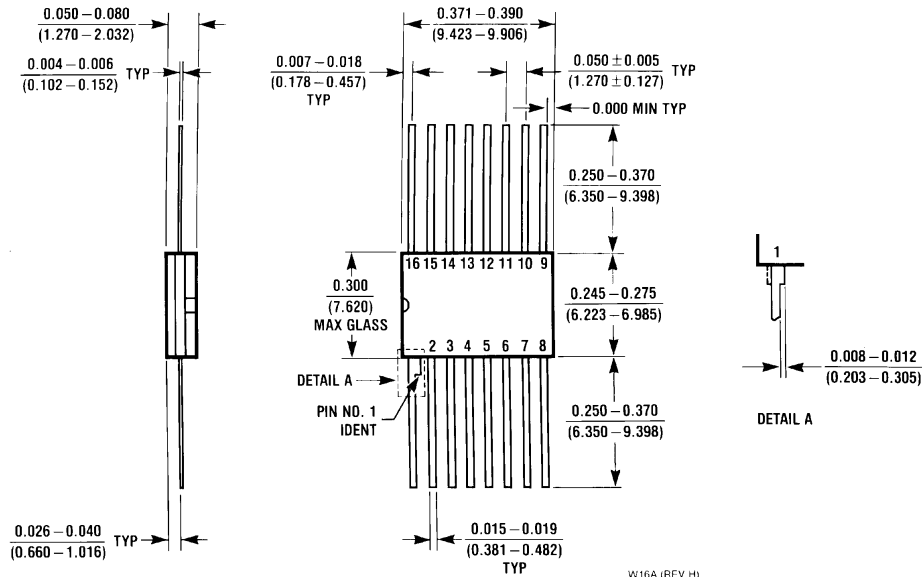
M16A (REV H)

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



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

# Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



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

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