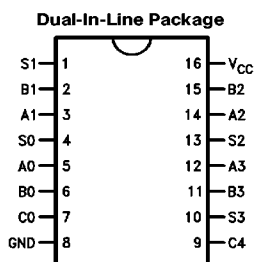


54283/DM74283 4-Bit Binary Full Adder (with Fast Carry)

General Description

The '283 high speed 4-bit binary full adders with internal carry lookahead accept two 4-bit binary words (A0–A3, B0–B3) and a Carry input (C0). They generate the binary Sum outputs (S0–S3) and the Carry output (C4) from the most significant bit. They operate with either active HIGH or active LOW operands (positive or negative logic).

Connection Diagram



TL/F/9786–1

Order Number 54283DMQB, 54283FMQB or DM74283N
See NS Package Number J16A, N16E or W16A

Pin Names	Description
A0–A3	A Operand Inputs
B0–B3	B Operand Inputs
C0	Carry Input
S0–S3	Sum Outputs
C4	Carry Output

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	5.5V
Operating Free Air Temperature Range	
54	−55°C to +125°C
DM74	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	54283			DM74283			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			0.8			0.8	V
I _{OH}	High Level Output Current			−0.4			−0.4	mA
I _{OL}	Low Level Output Current			16			16	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} = Min, I _I = −12 mA			−1.5	V
V _{OH}	High Level Output Voltage	V _{CC} = Min, I _{OH} = Max V _{IL} = Max	2.4	3.4		V
V _{OL}	Low Level Output Voltage	V _{CC} = Min, I _{OL} = Max V _{IH} = Min		0.2	0.4	V
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 5.5V			1	mA
I _{IH}	High Level Input Current	V _{CC} = Max, V _I = 2.4V			40	μA
I _{IL}	Low Level Input Current	V _{CC} = Max, V _I = 0.4V			−1.6	mA
I _{OS}	Short Circuit Output Current at S _n	V _{CC} = Max (Note 2)	54	−20	−55	mA
			DM74	−20	−55	
I _{OS}	Short Circuit Output Current at C4	V _{CC} = Max (Note 2)	54	−20	−70	mA
			DM74	−18	−70	
I _{CCH}	Supply Current with Outputs High	V _{CC} = Max	54		99	mA
			DM74		110	

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 2: Not more than one output should be shorted at a time.

Switching Characteristics

$V_{CC} = +5.0V$, $T_A = +25^\circ C$ (See Section 1 for waveforms and load configurations)

Symbol	Parameter	$C_L = 15 \text{ pF}$, $R_L = 400\Omega$		Units
		Min	Max	
t_{PLH} t_{PHL}	Propagation Delay C_0 or S_n		21	ns
t_{PLH} t_{PHL}	Propagation Delay A_n or B_n to S_n		24	ns
t_{PLH} t_{PHL}	Propagation Delay C_0 to C_4		14	ns
t_{PLH} t_{PHL}	Propagation Delay A_n or B_n to C_4		16	ns

Functional Description

The '283 adds two 4-bit binary words (A plus B) plus the incoming carry C_0 . The binary sum appears on the Sum (S_0 – S_3) and outgoing carry (C_4) outputs. The binary weight of the various inputs and outputs is indicated by the subscript numbers, representing powers of two.

$$2^0 (A_0 + B_0 + C_0) + 2^1 (A_1 + B_1) + 2^2 (A_2 + B_2) + 2^3 (A_3 + B_3) = S_0 + 2S_1 + 4S_2 + 8S_3 + 16C_4$$

Where (+) = plus

Interchanging inputs of equal weight does not affect the operation. Thus C_0 , A_0 , B_0 can be arbitrarily assigned to pins 5, 6 and 7. Due to the symmetry of the binary add function, the '283 can be used either with all inputs and outputs active HIGH (positive logic) or with all inputs and outputs active LOW (negative logic). Note that if C_0 is not used it must be tied LOW for active HIGH logic or tied HIGH for active LOW logic.

Example:

	C_0	A_0	A_1	A_2	A_3	B_0	B_1	B_2	B_3	S_0	S_1	S_2	S_3	C_4
Logic Levels	L	L	H	L	H	H	L	L	H	H	H	L	L	H
Active HIGH	0	0	1	0	1	1	0	0	1	1	1	0	0	1
Active LOW	1	1	0	1	0	0	1	1	0	0	0	1	1	0

Active HIGH: $0 + 10 + 9 = 3 + 16$ Active LOW: $1 + 5 + 6 = 12 + 0$

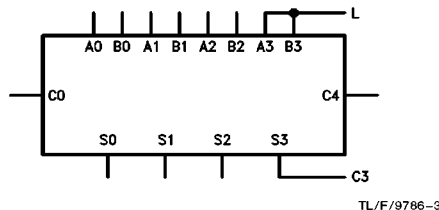


FIGURE a. 3-Bit Adder

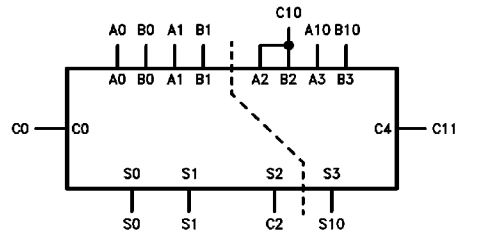


FIGURE b. 2-Bit and 1-Bit Adders

Functional Description (Continued)

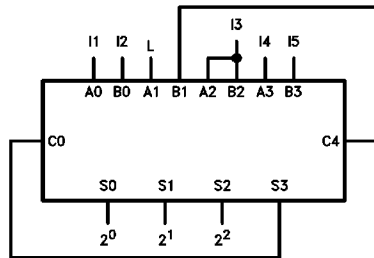


FIGURE c. 5-Input Encoder

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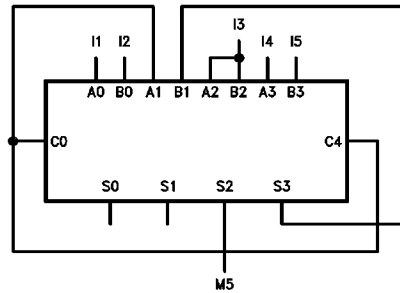
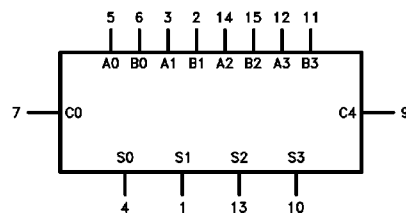


FIGURE d. 5-Input Majority Gate

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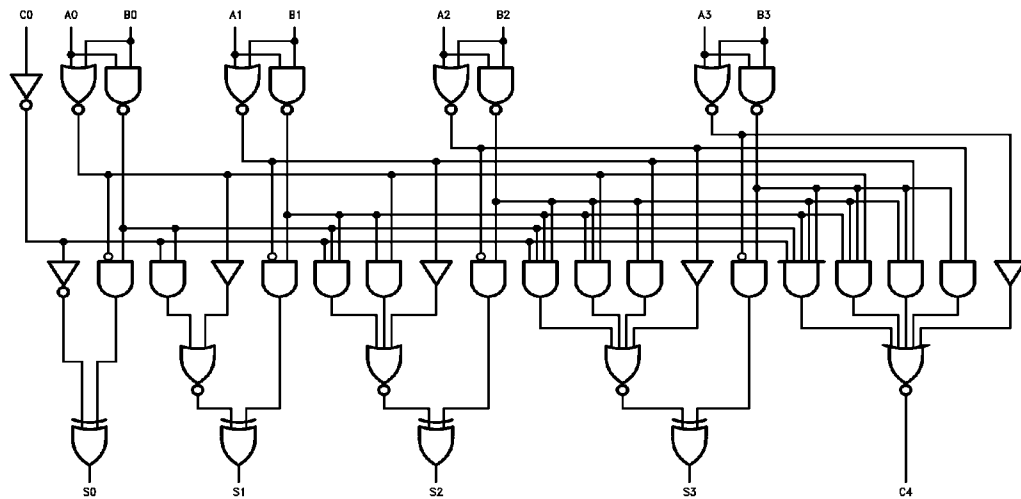
Logic Symbol



V_{CC} = Pin 16
GND = Pin 8

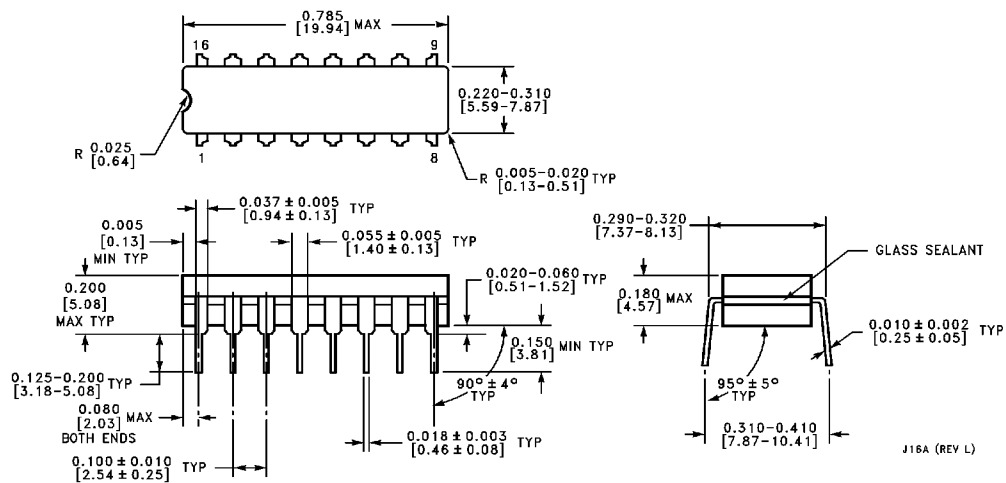
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Logic Diagram

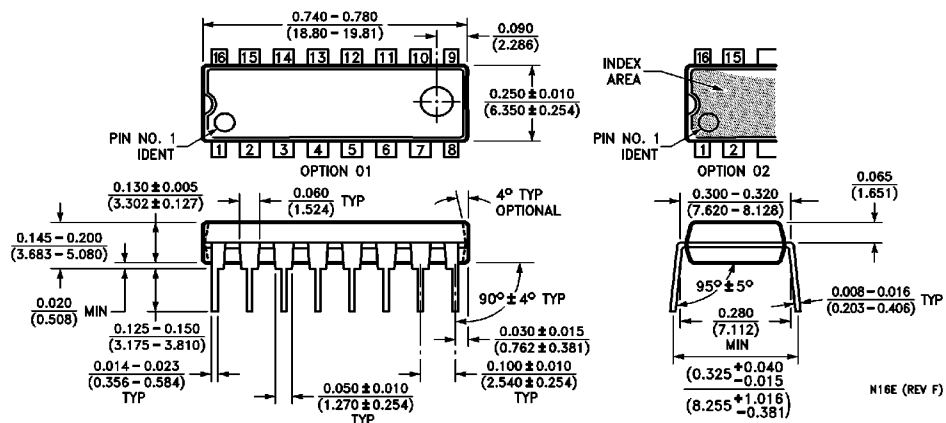


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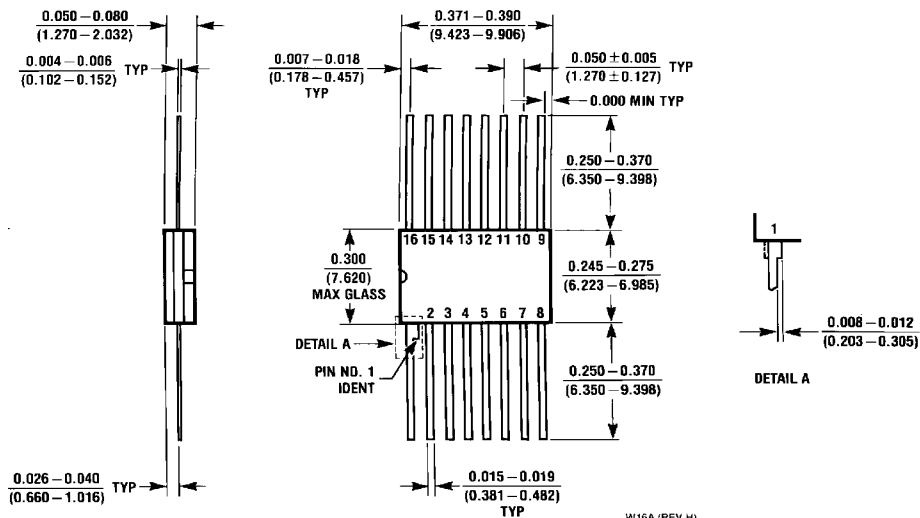
Physical Dimensions inches (millimeters)



16-Lead Ceramic Dual-In-Line Package (J)
Order Number 54283DMQB
NS Package Number J16A



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74283N
NS Package Number N16E

Physical Dimensions inches (millimeters) (Continued)

16-Lead Ceramic Flat Package (W)
Order Number 54283FMQB
NS Package Number W16A

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