

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



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

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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			Unite
Cymbol	r arameter	Min	Nom	Max	Min	Nom	Max	onito
V _{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V _{IH}	High Level Input Voltage	2			2			V
VIL	Low Level Input Voltage			0.8			0.8	V
Іон	High Level Output Current			-0.4			-0.4	mA
IOL	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	
VI	Input Clamp Voltage	$V_{CC} = Min, I_I$	$V_{CC} = Min, I_I = -12 \text{ mA}$			-1.5	V	
V_{OH}	High Level Output Voltage	$V_{CC} = Min, I_O$ $V_{IL} = Max$	_H = 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	Input Current @ Max Input Voltage	$V_{CC} = Max, V_1 = 5.5V$				1	mA	
IIH	High Level Input Current	$V_{CC} = Max, V_I = 2.4V$				40	μΑ	
IIL	Low Level Input Current	$V_{CC} = Max, V_I = 0.4V$				-1.6	mA	
los	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 V _{CC} = Ma	V _{CC} = Max	54	-20		-70	٣A	
Output Current at C4	(Note 2)	DM74	-18		-70			
ICCH	I _{CCH} Supply Current with	V _{CC} = Max	54			99	mΑ	
Outputs High	Outputs High	Putputs High				110		

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

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

itching Cha = +5.0V, T _A = -	+ 25°C (See Section 1 for waveforms	and load configuration	ons)	
Symbol	Parameter –	C _L = 15 pl	F, $R_L = 400\Omega$	– Units
		Min	Мах	
t _{PLH} t _{PHL}	Propagation Delay C0 or S _n		21 21	ns
t _{PLH} t _{PHL}	Propagation Delay A _n or B _n to S _n		24 24	ns
t _{PLH} t _{PHL}	Propagation Delay C0 to C4		14 16	ns
t _{PLH} t _{PHL}	Propagation Delay A _n or B _n to C4		14 16	ns

Functional Description

The '283 adds two 4-bit binary words (A plus B) plus the incoming carry C0. The binary sum appears on the Sum (S0–S3) and outgoing carry (C4 outputs. The binary weight of the various inputs and outputs is indicated by the subscript numbers, representing powers of two.

 $2^0 (A0 + B0 + C0) + 2^1 (A1 + B1) + 2^2 (A2 + B2) + 2^3 (A3 + B3) = S0 + 2S1 + 4S2 + 8S3 + 16C4$ Where (+) = plus

Interchanging inputs of equal weight does not affect the operation. Thus CO, AO, BO 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 CO is not used it must be tied LOW for active HIGH logic or tied HIGH for active LOW logic.

C0 A0 A1 A2 A3 B0 B1 B2 B3 S0 S1 S2 S3 C4

L H L H H L L H H H L L H

Example:

Logic Levels L



Due to pin limitations, the intermediate carries of the '283



C10 A10 B10 A0 B0 A1 B1 A0 B0 A1 B1 A2 B2 A3 B3 · C11 C0 · C4 CO S0 S1 S2 S3 S10 S0 S1 C2 TL/F/9786-4 FIGURE b. 2-Bit and 1-Bit Adders

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