HD74LS83A ●4-Bit Binary Full Adders (with Fast Carry)

This improved full addrer performs 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. This adder features full internal look ahead across all four bit generating the carry term in ten nanoseconds typically. This provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

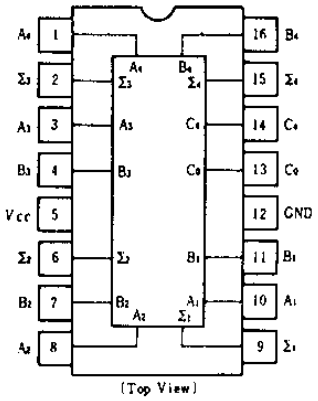
■FUNCTION TABLE

Inputs				Outputs					
				When C0 = L			When C0 = H		
				When C2 = L			When C2 = H		
A_1 / A_3	B_1 / B_3	A_2 / A_4	B_2 / B_4	Σ_1 / Σ_3	Σ_2 / Σ_4	C_2 / C_4	Σ_1 / Σ_3	Σ_2 / Σ_4	C_2 / C_4
L	L	L	L	L	L	L	H	L	L
H	L	L	L	H	L	L	L	H	L
L	H	L	L	H	L	L	L	H	L
H	H	L	L	L	H	L	H	H	L
L	L	H	L	L	H	L	H	H	L
H	L	H	L	H	H	L	L	L	H
L	H	H	L	H	H	L	L	L	H
H	H	H	L	L	L	H	H	L	H
L	L	L	H	L	H	L	H	H	L
H	L	L	H	H	H	L	L	L	H
L	H	L	H	H	H	L	L	L	H
H	H	L	H	L	L	H	H	L	H
L	L	H	H	L	L	H	H	L	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

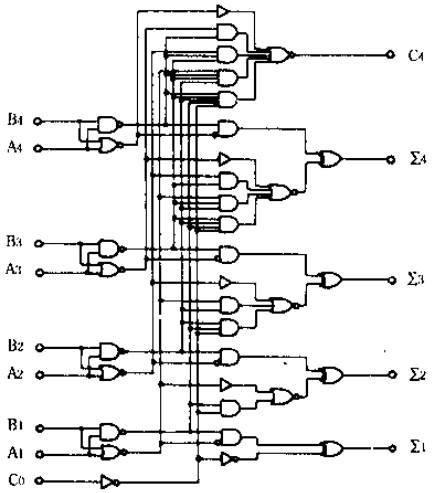
H; high level, L; low level, X; irrelevant

Note) Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs Σ1 and Σ2 and the value of the internal carry C2. The value at C2, A3, B3, A4, and B4 are than used to determine outputs Σ3, Σ4 and C4.

■PIN ARRANGEMENT



■BLOCK DIAGRAM



■ELECTRICAL CHARACTERISTICS (Ta = − 20 ~ + 75°C)

Item		Symbol	Test Conditions		min	typ*	max	Unit
Input voltage		V_{IH}			2.0		—	V
		V_{IL}			—		0.8	V
Output voltage		V_{OH}	V_{CC} = 4.75V, V_{IH} = 2V, V_{IL} = 0.8V, I_{OH} = −400μA		2.7		—	V
		V_{OL}	V_{CC} = 4.75V, V_{IH} = 2V, V_{IL} = 0.8V	I_{OL} = 4mA	—		0.4	V
				I_{OL} = 8mA	—		0.5	
Input current	except C0	I_{IH}	V_{CC} = 5.25V, V_I = 2.7V		—		40	μA
	C0				—		20	
	except C0	I_{IL}	V_{CC} = 5.25V, V_I = 0.4V		—		−0.8	mA
	C0						0.4	
	except C0	I_I	V_{CC} = 5.25V, V_I = 7V		—		0.2	mA
	C0				—		0.1	
Short circuit output current		I_{OS}	V_{CC} = 5.25V		−20		−100	mA
Supply current		I_{CC}	V_{CC} = 5.25V	All inputs = 0V	—	22	39	mA
				B input 0.8V, Other inputs 4.5V	—	19	34	
				All inputs 4.5V	—	19	34	
Input clamp voltage		V_{IK}	V_{CC} = 4.75V, I_{IN} = −18mA		—		−1.5	V

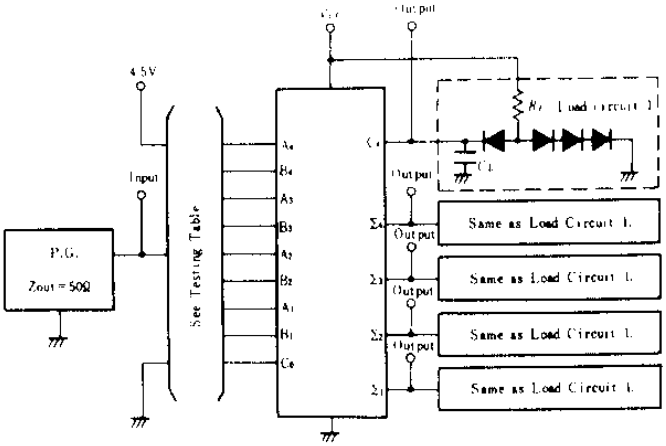
* V_{CC}=5V, Ta=25°C

■SWITCHING CHARACTERISTICS (V_{CC} = 5V, Ta = 25°C)

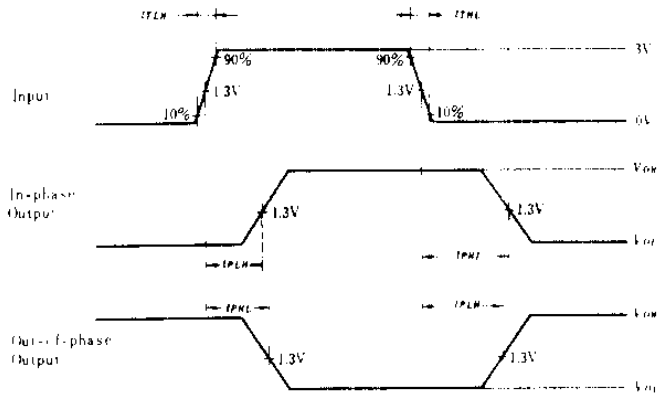
Item	Symbol	Inputs	Outputs	Test Conditions	min	typ	max	Unit
Propagation delay time	t_{PLH}	C_0	Σ_0	C_L = 15pF, R_L = 2kΩ		16	24	ns
	t_{PHL}					15	24	ns
	t_{PLH}	A_1, B_1	Σ_1		—	15	24	ns
	t_{PHL}				—	15	24	ns
	t_{PLH}	C_0	C_2		—	11	17	ns
	t_{PHL}					15	22	ns
	t_{PLH}	A_2, B_2	C_3			11	17	ns
	t_{PHL}				—	12	17	ns

■TESTING METHOD

1) Test Circuit



Waveform

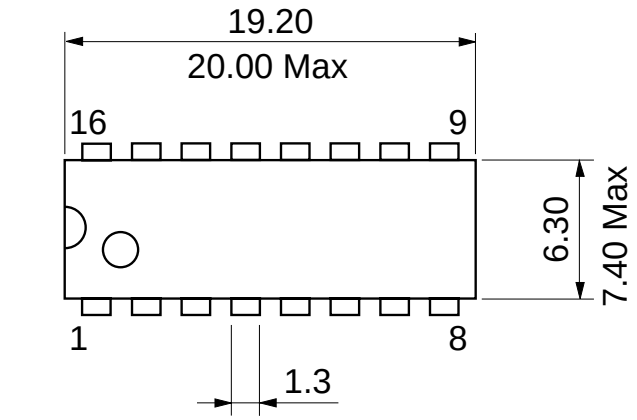


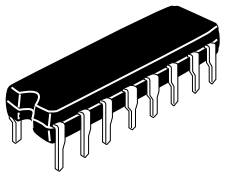
Notes) 1. Input pulse; $t_{TLH} \leqq 15$ns, $t_{THL} \leqq 6$ns, PRR=1MHz, duty cycle=50%
2. C_L includes probe and jig capacitance.
3. All diodes are 1S2074 Ⓗ.

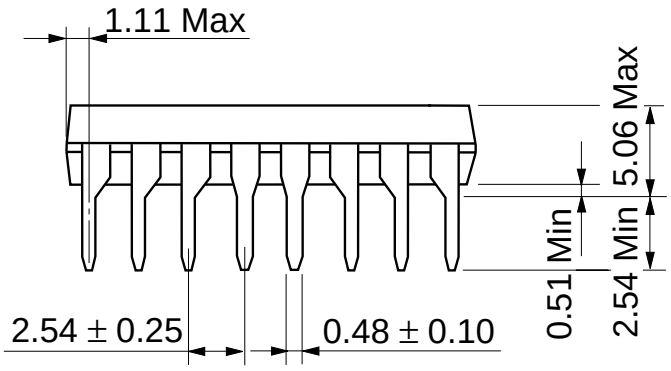
2) Testing Table

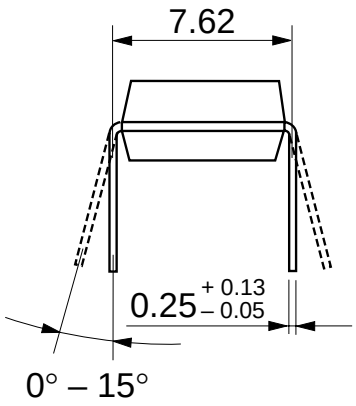
Item	From input to output	Inputs									Outputs				
		B_4	A_4	B_3	A_3	B_2	A_2	B_1	A_1	C_0	C_4	Σ_4	Σ_3	Σ_2	Σ_1
t_{PLH} t_{PHL}	C_0 →Σ_i or C_4	GND	GND	GND	GND	GND	GND	GND	GND	IN	——	——	——	——	OUT
		GND	4.5V	GND	4.5V	GND	4.5V	GND	4.5V	IN	OUT	OUT	OUT	OUT	OUT
	A_i or B_i →Σ_i or C_4	GND	GND	GND	GND	GND	GND	GND / IN	IN / GND	GND	——	——	——	——	OUT
		GND	GND	GND	GND	GND / IN	IN / GND	GND	GND	GND	——	——	——	OUT	——
		GND	GND	GND / IN	IN / GND	GND	GND	GND	GND	GND	——	——	OUT	——	——
		GND / IN	IN / GND	GND	GND	GND	GND	GND	GND	GND	——	OUT	——	——	——
		GND	GND	GND	GND	GND	GND	4.5V / IN	IN / 4.5V	GND	——	——	——	OUT	OUT
		GND	GND	GND	GND	4.5V / IN	IN / 4.5V	GND	GND	GND	——	——	OUT	OUT	——
		GND	GND	4.5V / IN	IN / 4.5V	GND	GND	GND	GND	GND	——	OUT	OUT	——	——
		4.5V / IN	IN / 4.5V	GND	GND	GND	GND	GND	GND	GND	OUT	OUT	——	——	——

Unit: mm



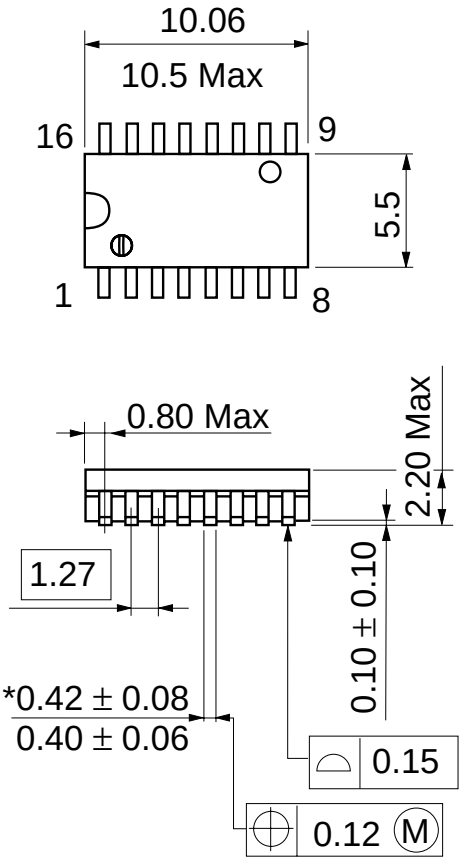


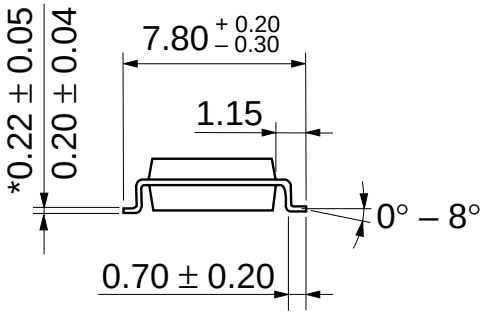


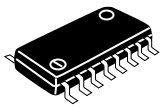


Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g

Unit: mm



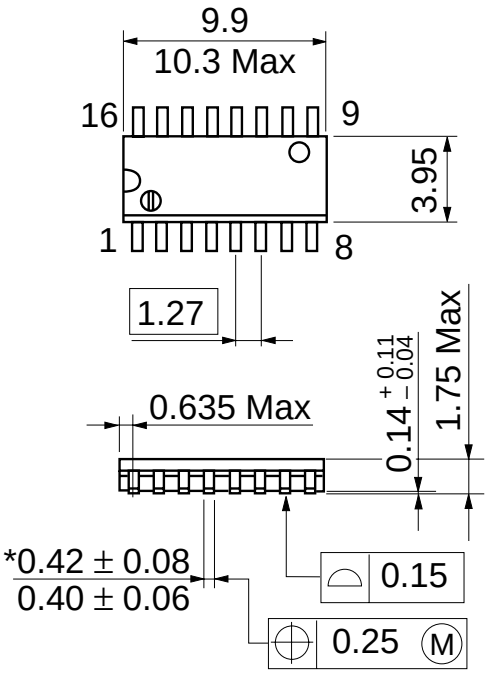


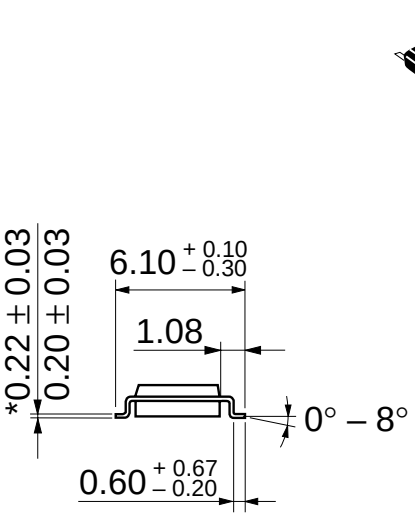


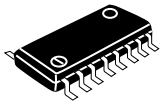
*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g

Unit: mm







*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

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