

**TYPES SN74LS283, SN74S283
SN54LS283, SN54S283
4-BIT BINARY FULL ADDERS WITH FAST CARRY**
OCTOBER 1976—REVISED DECEMBER 1983

- Full-Carry Look-Ahead Across the Four Bits
- Systems Achieve Partial Look-Ahead Performance with the Economy of Ripple Carry
- Supply Voltage and Ground on Corner Pins to Simplify P-C Board Layout

TYPICAL ADD TIMES

TYPE	TWO		TYPICAL POWER DISSIPATION PER ADDER
	8-BIT WORDS	16-BIT WORDS	
'LS283	25ns	45ns	95 mW
'S283	15ns	30ns	510 mW

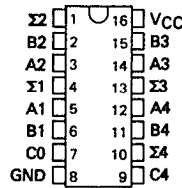
description

These improved full adders perform the addition of two 4-bit binary words. The sum (Σ) 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 generating the carry term in ten nanoseconds, typically, for the LS283, and 7.5 nanoseconds for the S283. This capability provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

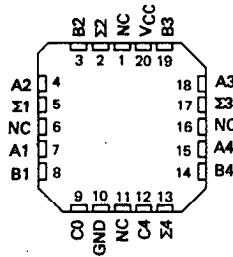
The adder logic, including the carry, is implemented in its true form. End around carry can be accomplished without the need for logic or level inversion.

Series 54LS, and Series 54S circuits are characterized for operation over the full temperature range of -55°C to 125°C . Series 74LS and Series 74S circuits are characterized for 0°C to 70°C operation.

**SN54LS283, SN54S283 ... J PACKAGE
SN74LS283, SN74S283 ... D OR N PACKAGE
(TOP VIEW)**



**SN54LS283, SN54S283 ... FK PACKAGE
(TOP VIEW)**



NC - No internal connection

FUNCTION TABLE

INPUT				OUTPUT							
				WHEN $C_0 = L$				WHEN $C_0 = H$			
				WHEN $C_2 = L$				WHEN $C_2 = H$			
A1	B1	A2	B2	Σ_1	Σ_2	C_2	Σ_3	Σ_4	C_4	Σ_3	Σ_4
L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	H	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	H	L	L	L	L	L	L	L	L
L	L	H	L	L	L	L	L	L	L	L	L
L	L	H	H	L	L	L	L	L	L	L	L
L	H	L	L	L	L	L	L	L	L	L	L
L	H	L	H	L	L	L	L	L	L	L	L
L	H	H	L	L	L	L	L	L	L	L	L
L	H	H	H	L	L	L	L	L	L	L	L
H	L	L	L	L	L	L	L	L	L	L	L
H	L	L	H	L	L	L	L	L	L	L	L
H	L	H	L	L	L	L	L	L	L	L	L
H	L	H	H	L	L	L	L	L	L	L	L
H	H	L	L	L	L	L	L	L	L	L	L
H	H	L	H	L	L	L	L	L	L	L	L
H	H	H	L	L	L	L	L	L	L	L	L
H	H	H	H	L	L	L	L	L	L	L	L

H = high level, L = low level

NOTE: Input conditions at A1, B1, A2, B2, and C_0 are used to determine outputs Σ_1 and Σ_2 and the value of the internal carry C_2 . The values at C_2 , A3, B3, A4, and B4 are then used to determine outputs Σ_3 , Σ_4 , and C_4 .

PRODUCTION DATA

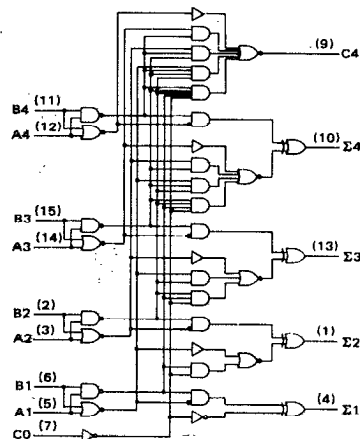
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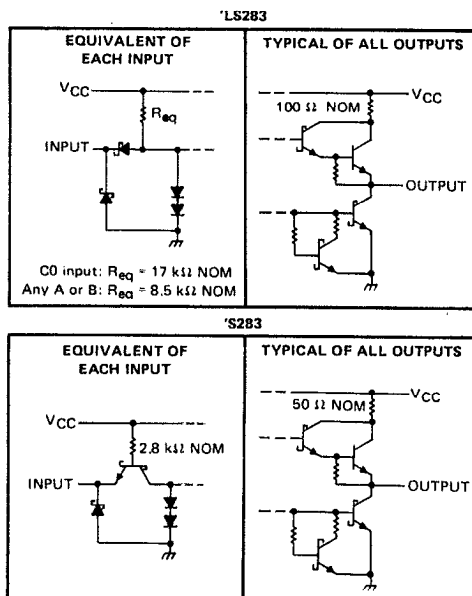
**TYPES SN74LS283, SN74S283
SN54LS283, SN54S283
4-BIT BINARY FULL ADDERS WITH FAST CARRY**

logic diagram

schematics of inputs and outputs



Pin numbers shown on logic notation are for D, J or N packages.



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage 'S283	5.5 V
'LS283	7 V
Interemitter voltage (see Note 2)	5.5 V
Operating free-air temperature range: SN54LS283, SN54S283	-55°C to 125°C
SN74LS283, SN74S283	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTES: 1. Voltage values, except interemitter voltage, are with respect to network ground terminal.

2. This is the voltage between two emitters of a multiple emitter transistor. This rating applies for the '283 and 'S283 only between the following pairs: A1 and B1, A2 and B2, A3 and B3, A4 and B4.

TYPES SN74LS283, SN54LS283
4-BIT BINARY FULL ADDERS WITH FAST CARRY

recommended operating conditions

	SN54LS283			SN74LS283			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-400			-400	μ A
Low-level output current, I_{OL}			4			8	mA
Operating free-air temperature, T_A	-55		125	0		70	$^{\circ}$ C

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

PARAMETER		TEST CONDITIONS†	SN54LS283			SN74LS283			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage			0.7			0.8		V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$		-1.5			-1.5		V
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$	2.5	3.4		2.7	3.4		V
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 4 \text{ mA}$	0.25	0.4		0.25	0.4		V
		$V_{IL} = V_{IL \text{ max}}, I_{OL} = 8 \text{ mA}$				0.35	0.5		
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$		0.2			0.2		mA
	Any A or B								
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$		40			40		μ A
	C0			20			20		
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-0.8			-0.8		mA
	C0			-0.4			-0.4		
I_{OS}	Short-circuit output current§	$V_{CC} = \text{MAX}$	-20	-100		-20	-100		mA
I_{CC}	Supply current	$V_{CC} = \text{MAX},$ Outputs open							mA
		All inputs grounded	22	39		22	39		
		All B low, other inputs at 4.5 V	19	34		19	34		
		All inputs at 4.5 V	19	34		19	34		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$.

§ Only one output should be shorted at a time and duration of the short-circuit should not exceed one second.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$

PARAMETER ¹	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	C0	Any Σ	C _L = 15 pF. R _L = 2 kΩ, See Note 3	16	24		ns
t _{PHL}				15	24		
t _{PLH}	A _i or B _i	Σ _j		15	24		ns
t _{PHL}				15	24		
t _{PLH}	C0	C4		11	17		ns
t _{PHL}				11	22		
t _{PLH}	A _i or B _i	C4		11	17		ns
t _{PHL}				12	17		

† t_{PLH} = Propagation delay time, low-to-high-level output

‡ t_{PHL} = Propagation delay time, high-to-low-level output

NOTE 3: See General Information Section for load circuits and voltage waveforms.

TYPES SN74S283, SN54S283
4-BIT BINARY FULL ADDERS WITH FAST CARRY

recommended operating conditions

		SN54S283			SN74S283			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}	Any output except C4	-1			-1			mA
	Output C4	-500			-500			μ A
Low-level output current, I_{OL}	Any output except C4	20			20			mA
	Output C4	10			10			mA
Operating free-air temperature, T_A		-55			0			$^{\circ}$ C

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

PARAMETER		TEST CONDITIONS [†]		MIN	TYP [‡]	MAX	UNIT
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage				0.8		V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN.}$, $I_I = -18 \text{ mA}$				-1.2	V
V_{OH}	High-level output voltage	SN54S283	$V_{CC} = \text{MIN.}$, $V_{IH} = 2 \text{ V.}$	2.5	3.4		V
		SN74S283	$V_{IL} = 0.8 \text{ V.}$, $I_{OH} = \text{MAX.}$	2.7	3.4		
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN.}$, $V_{IH} = 2 \text{ V.}$				0.5	V
		$V_{IL} = 0.8 \text{ V.}$, $I_{OL} = \text{MAX.}$					
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX.}$, $V_I = 5.5 \text{ V}$				1	mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX.}$, $V_I = 2.7 \text{ V}$				50	μ A
I_{IL}	Low-level input current	$V_{CC} = \text{MAX.}$, $V_I = 0.5 \text{ V}$				-2	mA
I_{OS}	Short-circuit output current [§]	Any output except C4	$V_{CC} = \text{MAX.}$	-40		-100	mA
		Output C4		-20		-100	
I_{CC}	Supply current	$V_{CC} = \text{MAX.}$, Outputs open	All B low, other inputs at 4.5 V		80		mA
			All inputs at 4.5 V		95	160	

[†]For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.

[‡]All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$.

[§]Only one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tPLH	C0	Any Σ	CL = 15 pF, RL = 280 Ω, See Note 3		11	18	ns
tPHL					12	18	
tPLH	Ai or Bi	Σi			12	18	ns
tPHL					11.5	18	
tPLH	C0	C4	CL = 15 pF, RL = 560 Ω, See Note 3		6	11	ns
tPHL					7.5	11	
tPLH	Ai or Bi	C4			7.5	12	ns
tPHL					8.5	12	

[†] t_{PLH} = Propagation delay time, low-to-high-level output

t_{PHL} = Propagation delay time, high-to-low-level output

NOTE 3: See General Information Section for load circuits and voltage waveforms