SN54283, SN54LS283, SN54S283, SN74283, SN74LS283, SN74S283
4-BIT BINARY FULL ADDERS WITH FAST CARRY

SDLS095 OCTOBER 1976 – REVISED MARCH 1988

- 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 8-BIT WORDS	TWO 16-BIT WORDS	TYPICAL POWER DISSIPATION PER ADDER
'283	23ns	43ns	310 mW
'LS283	25ns	45ns	95 mW
'S283	15ns	30ns	510 mW

description

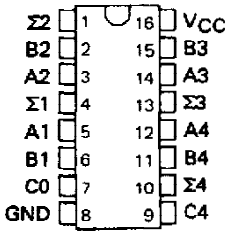
The '283 and 'LS283 adders are electrically and functionally identical to the '83A and 'LS83A, respectively; only the arrangement of the terminals has been changed. The 'S283 high performance versions are also functionally identical.

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 (C4) 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 '283 and '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.

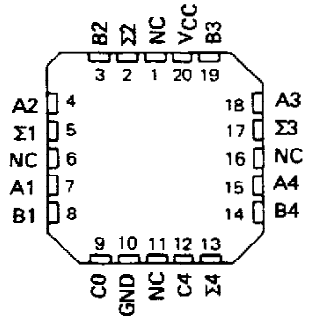
The adder logic, including the carry, is implemented in its true form. End around carry can be accomplished without the need for logic or level inversion.

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

SN54283, SN54LS283 . . . J OR W PACKAGE
SN54S283 . . . J PACKAGE
SN74283 . . . N PACKAGE
SN74LS283, SN74S283 . . . D OR N PACKAGE
(TOP VIEW)



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



NC - No internal connection

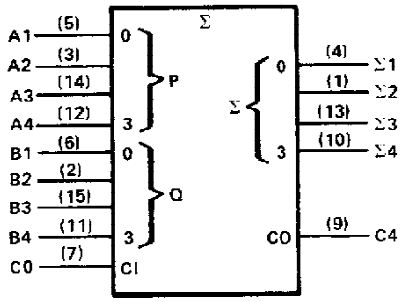
FUNCTION TABLE

INPUT				OUTPUT					
				WHEN C0 = L			WHEN C0 = H		
				WHEN C2 = L			WHEN C2 = H		
A1 / A3	B1 / B3	A2 / A4	B2 / B4	Σ1 / Σ3	Σ2 / Σ4	C2 / C4	Σ1 / Σ3	Σ2 / Σ4	C2 / 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	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

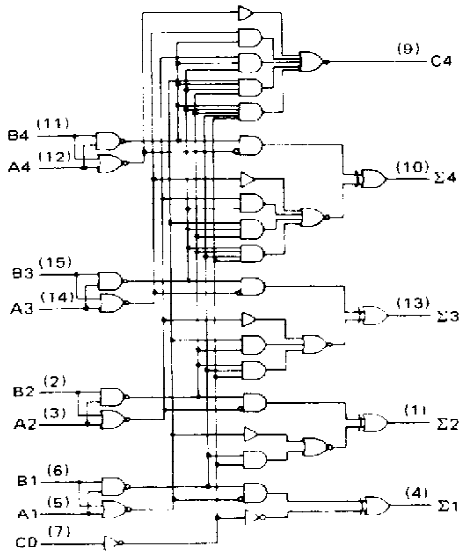
NOTE: Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs Σ1 and Σ2 and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs Σ3, Σ4, and C4.

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, N, and W packages.

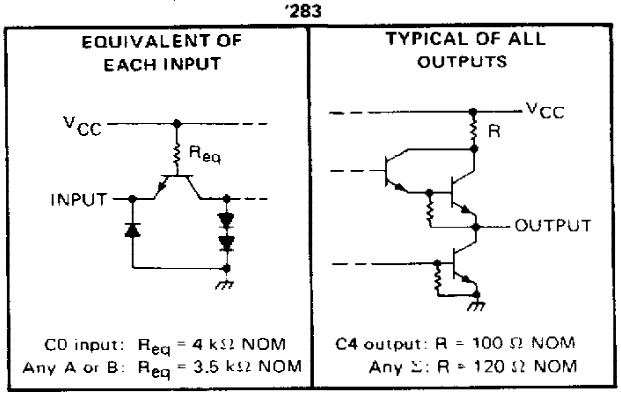
logic diagram (positive logic)



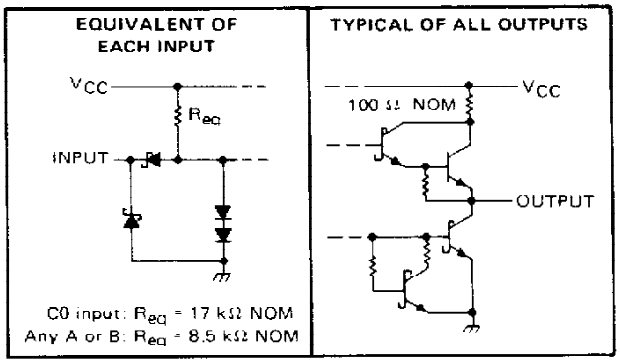
Pin numbers shown are for D, J, N, and W packages.

schematics of inputs and outputs

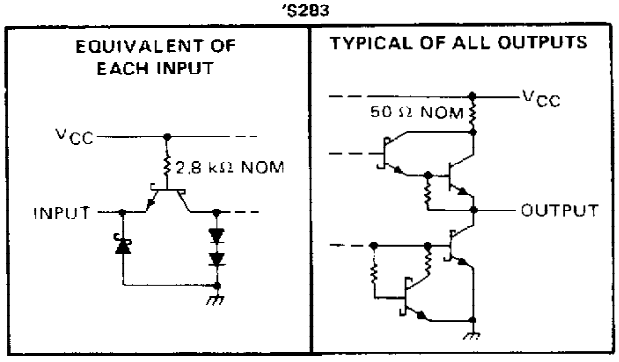
'283



'LS283



'S283



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

Supply voltage, V_{CC} (see Note 1)		7V
Input voltage: '283, 'S283		5.5V
'LS283		7V
Interemitter voltage (see Note 2)		5.5V
Operating free-air temperature range:	SN54283, SN54LS283, SN54S283	−55°C to 125°C
	SN74283, 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.

recommended operating conditions

		SN54283			SN74283			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			−800			−800	μA
	Output C4			−400			−400	
Low-level output current, I_{OL}	Any output except C4			16			16	mA
	Output C4			8			8	
Operating free-air temperature, T_A		−55		125	0		70	°C

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

PARAMETER			TEST CONDITIONS†		SN54283			SN74283			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage				2			2			V
V_{IL}	Low-level input voltage						0.8			0.8	V
V_{IK}	Input clamp voltage		V_{CC} = MIN, I_I = −12 mA				−1.5			−1.5	V
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = MAX		2.4	3.6		2.4	3.6		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = MAX			0.2	0.4		0.2	0.4	V
I_I	Input current at maximum input voltage		V_{CC} = MAX, V_I = 5.5 V				1			1	mA
I_{IH}	High-level input current		V_{CC} = MAX, V_I = 2.4 V				40			40	μA
I_{IL}	Low-level input current		V_{CC} = MAX, V_I = 0.4 V				−1.6			−1.6	mA
I_{OS}	Short-circuit output current§	Any output except C4	V_{CC} = MAX		−20		−55	−18		−55	mA
		Output C4			−20		−70	−18		−70	
I_{CC}	Supply current		V_{CC} = MAX, Outputs open	All B low, other inputs at 4.5 V		56			56		mA
				All inputs at 4.5 V		66	99		66	110	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Only one output should be shorted at a time.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER¶	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	C0	Any Σ	C_L = 15 pF, R_L = 400 Ω, See Note 3		14	21	ns
t_{PHL}					12	21	
t_{PLH}	A_i or B_i	Σ_i			16	24	ns
t_{PHL}					16	24	
t_{PLH}	C0	C4	C_L = 15 pF, R_L = 780 Ω, See Note 3		9	14	ns
t_{PHL}					11	16	
t_{PLH}	A_i or B_i	C4			9	14	ns
t_{PHL}					11	16	

¶ t_{PLH} = propagation delay time, low-to-high-level output
t_{PHL} = propagation delay time, high-to-low-level output
NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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	μA
Low-level output current, I_{OL}			4			8	mA
Operating free-air temperature, T_A	−55		125	0		70	°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} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} max, I_{OH} = −400 μA		2.5	3.4		2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} max	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
				I_{OL} = 8 mA					0.35	0.5	
I_I	Input current at maximum input voltage	Any A or B	V_{CC} = MAX, V_I = 7 V				0.2			0.2	mA
		C0					0.1			0.1	
I_{IH}	High-level input current	Any A or B	V_{CC} = MAX, V_I = 2.7 V				40			40	μA
		C0					20			20	
I_{IL}	Low-level input current	Any A or B	V_{CC} = MAX, V_I = 0.4 V				−0.8			−0.8	mA
		C0					−0.4			−0.4	
I_{OS}	Short-circuit output current§		V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CC}	Supply current		V_{CC} = MAX, Outputs open	All inputs grounded		22	39		22	39	mA
				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 V, T_A = 25°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 V, T_A = 25°C

PARAMETER¶	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_i			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: Load circuits and voltage waveforms are shown in Section 1.

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	μA
Low-level output current, I_{OL}	Any output except C4			20			20	mA
	Output C4			10			10	
Operating free-air temperature, T_A		−55		125	0		70	°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} = MIN,	I_I = −18 mA			−1.2	V
V_{OH}	High-level output voltage	SN54S283	V_{CC} = MIN,	V_{IH} = 2 V,	2.5	3.4		V
		SN74S283	V_{IL} = 0.8 V,	I_{OH} = MAX	2.7	3.4		
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IL} = 0.8 V,	V_{IH} = 2 V, I_{OL} = MAX			0.5	V
I_I	Input current at maximum input voltage		V_{CC} = MAX,	V_I = 5.5 V			1	mA
I_{IH}	High-level input current		V_{CC} = MAX,	V_I = 2.7 V			50	μA
I_{IL}	Low-level input current		V_{CC} = MAX,	V_I = 0.5 V			−2	mA
I_{OS}	Short-circuit output current§	Any output except C4	V_{CC} = MAX		−40		−100	mA
		Output C4			−20		−100	
I_{CC}	Supply current		V_{CC} = 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 V, T_A = 25°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 V, T_A = 25°C

PARAMETER¶	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	C0	Any Σ	C_L = 15 pF, R_L = 280 Ω, See Note 3		11	18	ns
t_{PHL}					12	18	
t_{PLH}	A_i or B_i	Σ_i			12	18	ns
t_{PHL}					11.5	18	
t_{PLH}	C0	C4	C_L = 15 pF, R_L = 560 Ω, See Note 3		6	11	ns
t_{PHL}					7.5	11	
t_{PLH}	A_i or B_i	C4			7.5	12	ns
t_{PHL}					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: Load circuits and voltage waveforms are shown in Section 1.

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