

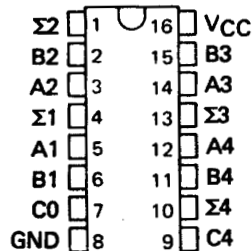
SN54283, SN54LS283, SN54S283, SN74283, SN74LS283, SN74S283 4-BIT BINARY FULL ADDERS WITH FAST CARRY

SDLS095A - 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

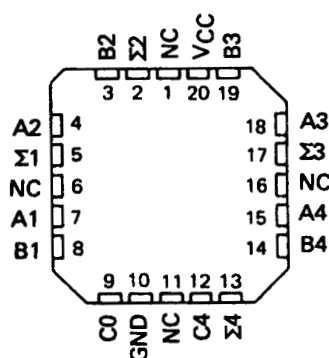
SN54283, SN54LS283 . . . J OR W PACKAGE
SN54S283 . . . J PACKAGE
SN74283 . . . N PACKAGE
SN74LS283, SN74S283 . . . D OR N PACKAGE

(TOP VIEW)



SN54LS283, SN54S283 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

TYPICAL ADD TIMES

TYPE	TWO		TYPICAL POWER DISSIPATION PER ADDER
	8-BIT WORDS	16-BIT WORDS	
'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 (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 '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.

FUNCTION TABLE

INPUT				OUTPUT							
				WHEN $C_0 = L$				WHEN $C_0 = H$			
A1	B1	A2	B2	Σ_1	Σ_2	C_2	Σ_1	Σ_2	Σ_3	Σ_4	C_4
A3	B3	A4	B4	Σ_3	Σ_4	C_4	Σ_3	Σ_4	Σ_4	C_4	
L	L	L	L	L	L	L	L	L	L	L	L
H	L	L	L	H	L	L	L	H	L	L	L
L	H	L	L	H	L	L	L	H	H	L	L
H	H	L	L	L	H	L	L	H	H	L	L
L	L	H	L	L	L	H	L	L	H	L	L
H	L	H	L	H	H	L	L	L	L	H	L
L	H	H	L	H	H	L	L	L	L	H	L
H	H	H	L	L	L	H	H	L	H	L	H
L	L	L	H	L	L	H	L	H	L	L	H
H	L	L	H	H	H	L	H	L	H	L	H
L	H	L	H	H	L	H	L	L	H	H	H
H	H	L	H	L	L	H	H	L	H	H	H
L	L	H	H	L	L	H	H	L	L	H	H
H	L	H	H	H	L	H	L	L	H	H	H
L	H	H	H	H	L	H	L	L	H	H	H
H	H	H	H	L	H	H	H	H	H	H	H

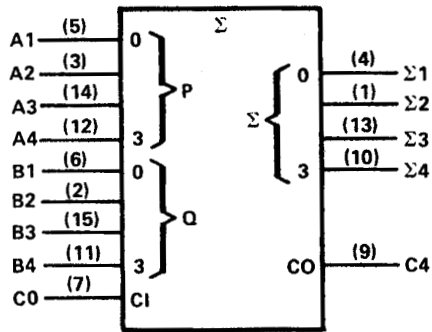
H = high level, L = low level

NOTE: Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs 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 .

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

SDLS095A - OCTOBER 1976 - REVISED MARCH 1988

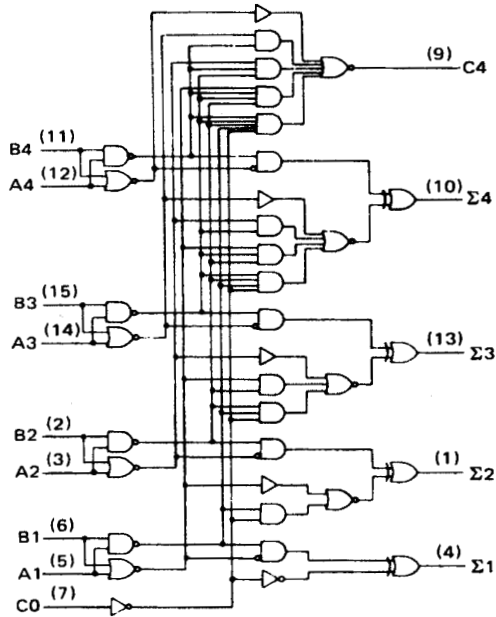
logic symbol†



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

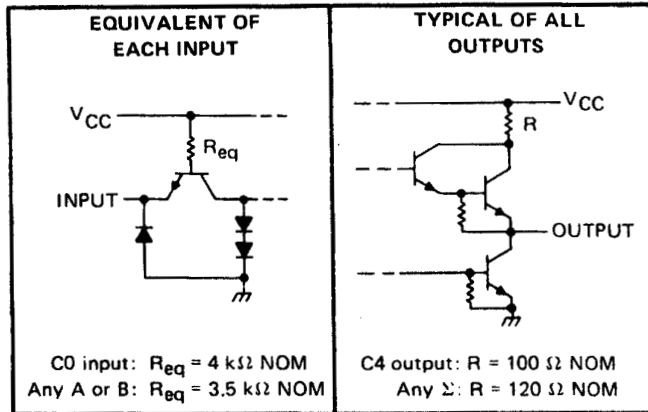
Pin numbers shown are for D, J, N, and W packages.

logic diagram (positive logic)

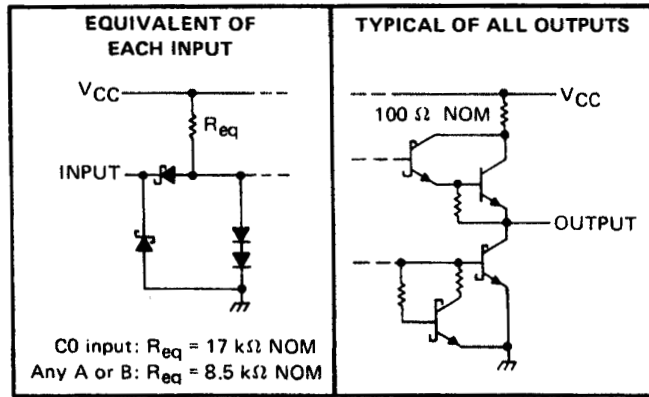


Pin numbers shown are for D, J, N, and W packages.

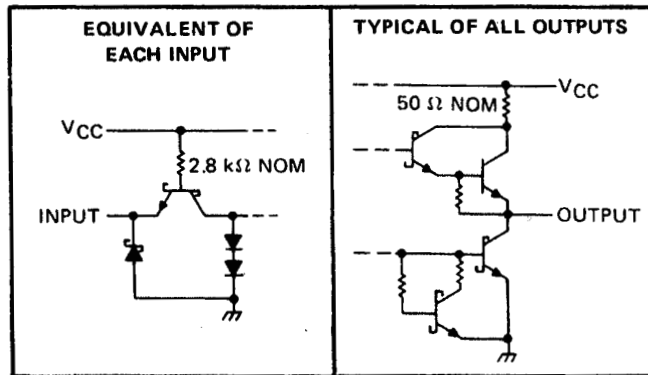
schematics of inputs and outputs '283



'LS283



'S283



absolute maximum ratings over operating free-air temperature (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.

SN54283, SN74283

4-BIT BINARY FULL ADDERS WITH FAST CARRY

SDLS095A - OCTOBER 1976 - REVISED MARCH 1988

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			μ A
	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		$^{\circ}$ 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	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$	-1.5			-1.5			V
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = \text{MAX}$	2.4	3.6		2.4	3.6		V
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = \text{MAX}$		0.2	0.4		0.2	0.4	V
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$	1			1			mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$	40			40			μ A
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$	-1.6			-1.6			mA
I_{OS}	Short-circuit output current [§]	Any output except C4	-20			-18			mA
		Output C4	-20			-18			
I_{CC}	Supply current	$V_{CC} = \text{MAX},$ 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 $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$.

[§] Only one output should be shorted at a time.

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

PARAMETER [¶]	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	C0	Any Σ	$C_L = 15 \text{ pF}, R_L = 400 \Omega,$ 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	$C_L = 15 \text{ pF}, R_L = 780 \Omega,$ 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.



SN54LS283, SN74LS283

4-BIT BINARY FULL ADDERS WITH FAST CARRY

SDLS095A – OCTOBER 1976 – REVISED MARCH 1988

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	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$	$I_{OL} = 4 \text{ mA}$		0.25	0.4	$I_{OL} = 4 \text{ mA}$		0.25	0.4	V
			$I_{OL} = 8 \text{ mA}$				$I_{OL} = 8 \text{ mA}$		0.35	0.5	
I_I	Input current at maximum input voltage	Any A or B	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$		0.2		0.2		0.2		mA
		C0									
I_{IH}	High-level input current	Any A or B	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$		40		40		40		μ A
		C0									
I_{IL}	Low-level input current	Any A or B	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-0.8		-0.8		-0.8		mA
		C0									
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	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 $V_{CC} = 5 \text{ V}, T_A = 25^{\circ} \text{C}$.

[§]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
t_{PLH}	C0	Any Σ	$C_L = 15 \text{ pF},$ See Note 3	$R_L = 2 \text{ k}\Omega,$	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: Load circuits and voltage waveforms are shown in Section 1.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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

SDLS095A - OCTOBER 1976 - REVISED MARCH 1988

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				
Operating free-air temperature, T_A		-55			0			70	$^{\circ}$ 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	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = \text{MAX}$			0.5	V	
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 Output C4	$V_{CC} = \text{MAX}$		-40	-100	mA
					-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
t_{PLH}	C0	Any Σ	$C_L = 15 \text{ pF}$, $R_L = 280 \Omega$, 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	$C_L = 15 \text{ pF}$, $R_L = 560 \Omega$, 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.



PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-7604301VEA	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7604301VE A SNV54LS283J	Samples
76043012A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	76043012A SNJ54LS 283FK	Samples
7604301EA	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	7604301EA SNJ54LS283J	Samples
7604301FA	ACTIVE	CFP	W	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	7604301FA SNJ54LS283W	Samples
JM38510/31202BEA	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31202BEA	Samples
JM38510/31202BFA	ACTIVE	CFP	W	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31202BFA	Samples
M38510/31202BEA	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31202BEA	Samples
M38510/31202BFA	ACTIVE	CFP	W	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31202BFA	Samples
SN54LS283J	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54LS283J	Samples
SN54S283J	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54S283J	Samples
SN74LS283D	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS283	Samples
SN74LS283N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74LS283N	Samples
SN74LS283NE4	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74LS283N	Samples
SN74LS283NSR	ACTIVE	SOP	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS283	Samples
SN74S283N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74S283N	Samples
SNJ54LS283FK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	76043012A SNJ54LS 283FK	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SNJ54LS283J	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	7604301EA SNJ54LS283J	Samples
SNJ54LS283W	ACTIVE	CFP	W	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	7604301FA SNJ54LS283W	Samples
SNJ54S283J	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54S283J	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54LS283, SN54LS283-SP, SN54S283, SN74LS283, SN74S283 :

- Catalog : [SN74LS283](#), [SN54LS283](#), [SN74S283](#)
- Military : [SN54LS283](#), [SN54S283](#)
- Space : [SN54LS283-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

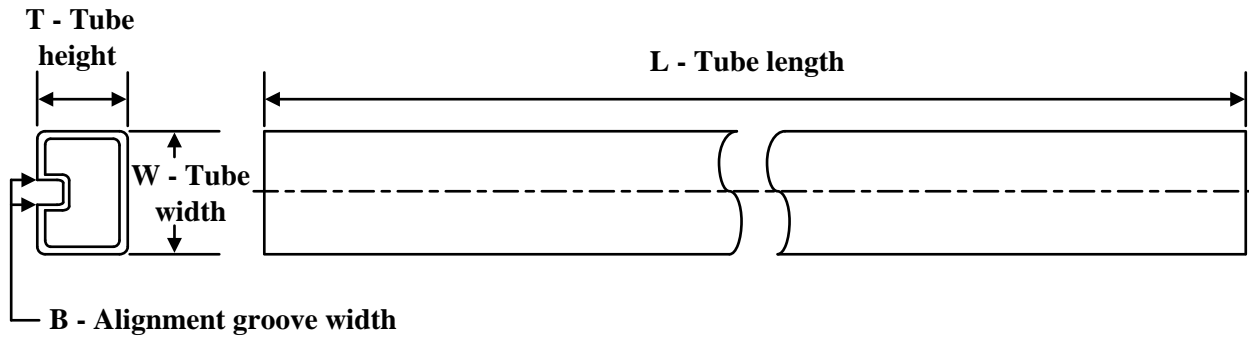
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS283NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS283NSR	SO	NS	16	2000	356.0	356.0	35.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
76043012A	FK	LCCC	20	55	506.98	12.06	2030	NA
7604301FA	W	CFP	16	25	506.98	26.16	6220	NA
JM38510/31202BFA	W	CFP	16	25	506.98	26.16	6220	NA
M38510/31202BFA	W	CFP	16	25	506.98	26.16	6220	NA
SN74LS283D	D	SOIC	16	40	507	8	3940	4.32
SN74LS283N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS283N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS283NE4	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS283NE4	N	PDIP	16	25	506	13.97	11230	4.32
SN74S283N	N	PDIP	16	25	506	13.97	11230	4.32
SN74S283N	N	PDIP	16	25	506	13.97	11230	4.32
SNJ54LS283FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LS283W	W	CFP	16	25	506.98	26.16	6220	NA

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