

# 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

### 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.

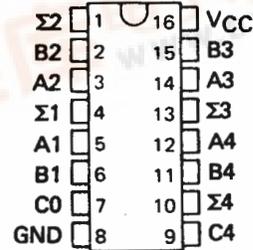
These improved full adders perform the addition of two 4-bit binary words. The sum ( $\Sigma$ ) outputs are provided for each bit and the resultant carry (C4) is obtained from the fourth bit. These adders feature full internal look-ahead across all four bits generating the carry term in ten nanoseconds, 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  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . Series 74, Series 74LS, and Series 74S circuits are characterized for  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  operation.

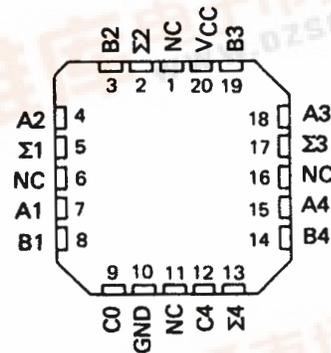
SN54283, SN54LS283 . . . J OR W PACKAGE  
SN54S283 . . . J PACKAGE  
SN74283 . . . N PACKAGE  
SN74LS283, SN74S283 . . . D OR N PACKAGE

(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	B1	A2	B2	$\Sigma 1$	$\Sigma 2$	C2	$\Sigma 1$	$\Sigma 2$	C2		
A3	B3	A4	B4	$\Sigma 3$	$\Sigma 4$	C4	$\Sigma 3$	$\Sigma 4$	C4		
L	L	L	L	L	L	L	H	L	L		
H	L	L	L	L	H	L	L	H	L		
L	H	L	L	L	H	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

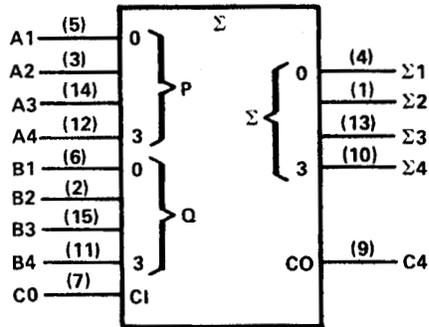
NOTE: Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs  $\Sigma 1$  and  $\Sigma 2$  and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs  $\Sigma 3$ ,  $\Sigma 4$ , and C4.



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

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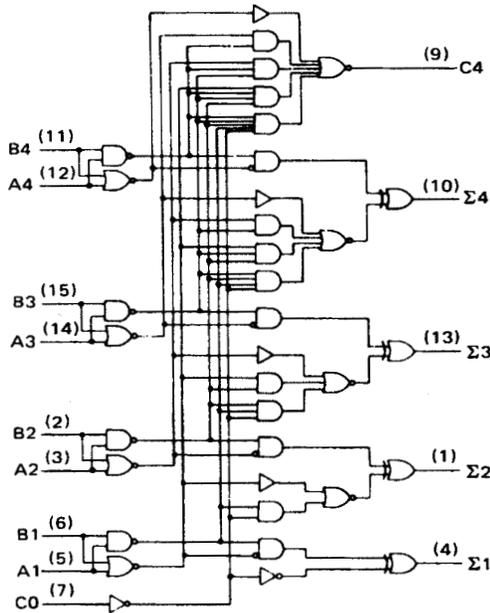
## logic symbol†



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

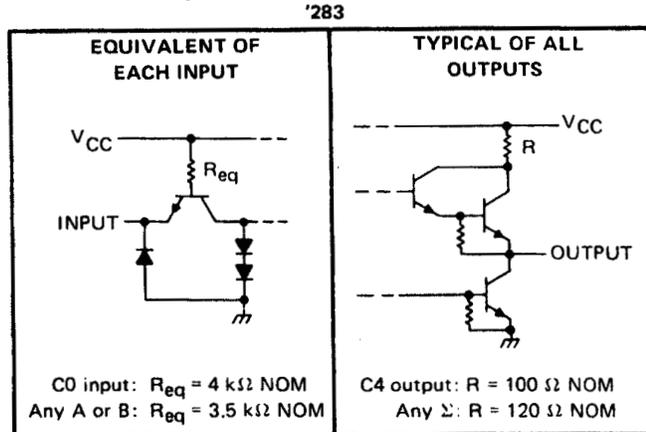
Pin numbers shown are for D, J, N, and W packages.

## logic diagram (positive logic)

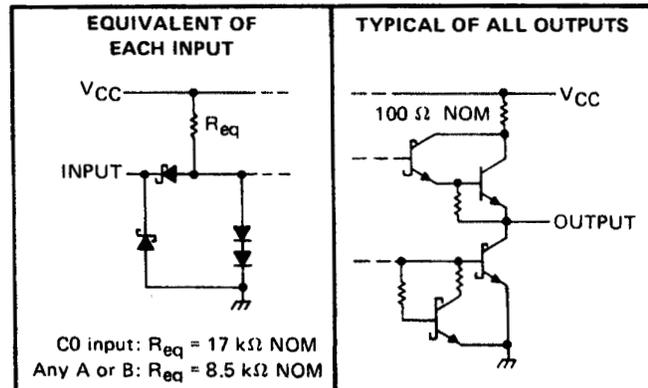


Pin numbers shown are for D, J, N, and W packages.

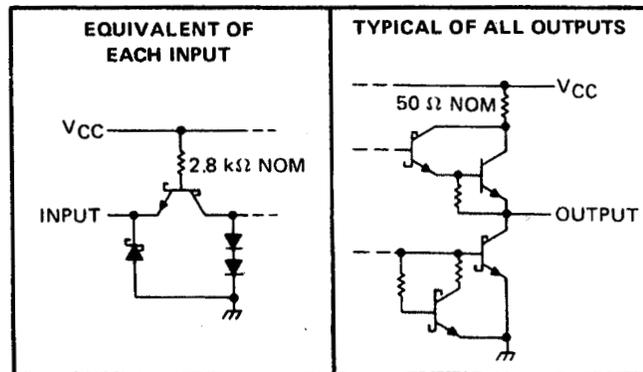
## schematics of inputs and outputs



'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.

# SN54283, SN74283

## 4-BIT BINARY FULL ADDERS WITH FAST CARRY

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### 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			$\mu$ A
	Output C4			-400			
Low-level output current, $I_{OL}$	Any output except C4			16			mA
	Output C4			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 <sup>†</sup>	SN54283			SN74283			UNIT	
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	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	$\mu$ 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 <sup>§</sup>	Any output except C4	$V_{CC} = \text{MAX}$			-20	-55	-18	-55	mA
	Output C4	$V_{CC} = \text{MAX}$			-20	-70	-18	-70	
$I_{CC}$ 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		

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

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

<sup>§</sup> Only one output should be shorted at a time.

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

PARAMETER <sup>¶</sup>	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	C0	Any $\Sigma$	$C_L = 15 \text{ pF}, R_L = 400 \Omega,$ See Note 3	14	21		ns
$t_{PHL}$				12	21		
$t_{PLH}$	$A_i$ or $B_i$	$\Sigma_j$		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		

<sup>¶</sup>  $t_{PLH}$  = 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

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### 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	$\mu$ 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 <sup>†</sup>	SN54LS283			SN74LS283			UNIT	
			MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	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	0.25	0.4	V	
			$I_{OL} = 8 \text{ mA}$				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		mA
		C0								
$I_{IH}$	High-level input current	Any A or B	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$			40		40		$\mu$ A
		C0								
$I_{IL}$	Low-level input current	Any A or B	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-0.8 <sup>§</sup>		-0.8		mA
		C0								
$I_{OS}$	Short-circuit output current <sup>§</sup>	$V_{CC} = \text{MAX}$	-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			

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

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

<sup>§</sup>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 <sup>¶</sup>	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS			MIN	TYP	MAX	UNIT
$t_{PLH}$	C0	Any $\Sigma$	$C_L = 15 \text{ pF},$ See Note 3	$R_L = 2 \text{ k}\Omega,$		16	24	ns	
$t_{PHL}$						15	24		
$t_{PLH}$	$A_i$ or $B_i$	$\Sigma_i$				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		

<sup>¶</sup> $t_{PLH}$  = 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.

# SN54S283, SN74S283

## 4-BIT BINARY FULL ADDERS WITH FAST CARRY

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### 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			$\mu$ 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 <sup>†</sup>		MIN	TYP <sup>‡</sup>	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	$\mu$ 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 <sup>§</sup>	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	

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.

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

<sup>§</sup>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 <sup>†</sup>	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	C0	Any $\Sigma$	$C_L = 15 \text{ pF}, R_L = 280 \Omega,$ See Note 3	11		18	ns
$t_{PHL}$				12		18	
$t_{PLH}$	$A_i$ or $B_i$	$\Sigma_i$		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	

<sup>†</sup> $t_{PLH}$  = 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 <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
76043012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
7604301EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
7604301FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/31202B2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
JM38510/31202BEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
JM38510/31202BFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SN54LS283J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN54S283J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN74283N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS283D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS283DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS283DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS283DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS283N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS283N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS283NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS283NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS283NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S283D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74S283N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74S283N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74S283NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SNJ54LS283FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS283J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS283W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S283FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S283J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54S283W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC

<sup>(1)</sup> 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.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check

<http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265