

# SN54LS385, SN74LS385 QUADRUPLE SERIAL ADDERS/SUBTRACTORS

SDLS170

D2412. NOVEMBER 1977 — REVISED MARCH 1988

- Four Synchronous Elements in a Single 20-Pin Package
- Buffered Clock and Direct Clear Inputs
- Independent Two's-Complement Addition/Subtraction

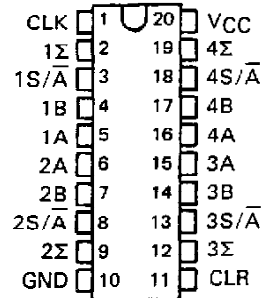
**description**

The 'LS385 is a general purpose adder/subtractor and is particularly useful as a companion part to the SN54LS384/SN74LS384 serial/parallel two's-complement multiplier. The 'LS385 contains four independent adder/subtractor elements with common clock and clear.

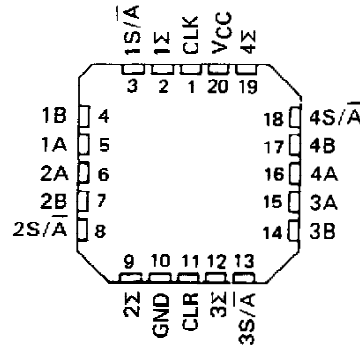
Each of the four independent sum ( $\Sigma$ ) outputs reflects its respective A and B input as controlled by the S/ $\bar{A}$  control. When S/ $\bar{A}$  is high the  $\Sigma$  function is A minus B. When S/ $\bar{A}$  is low the  $\Sigma$  function is A plus B.

When low, the clear input asynchronously resets the sum flip-flop low and the carry flip-flop either high in the subtract mode or low in the add mode. The clock is positive-edge triggered and controls the sum and carry flip-flops according to the function table.

SN54LS385 . . . J PACKAGE  
SN74LS385 . . . DW OR N PACKAGE  
(TOP VIEW)



SN54LS385 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE

SELECTED FUNCTION	INPUTS					DATA IN CARRY FLIP-FLOP		$\Sigma$ OUTPUT AFTER $\uparrow$
	CLR	S/ $\bar{A}$	A	B	CLK	BEFORE $\uparrow$	AFTER $\uparrow$	
Clear	L	L	X	X	X	L	L	L
	L	H	X	X	X	H	H	L
Add	H	L	L	L	$\uparrow$	L	L	L
	H	L	L	L	$\uparrow$	H	L	H
	H	L	L	H	$\uparrow$	L	L	H
	H	L	L	H	$\uparrow$	H	L	H
	H	L	H	L	$\uparrow$	L	L	L
	H	L	H	L	$\uparrow$	H	L	L
	H	L	H	H	$\uparrow$	L	L	L
Subtract	H	H	L	L	$\uparrow$	L	L	H
	H	H	L	L	$\uparrow$	H	L	L
	H	H	L	H	$\uparrow$	L	L	H
	H	H	L	H	$\uparrow$	H	L	H
	H	H	H	L	$\uparrow$	L	H	L
	H	H	H	L	$\uparrow$	H	H	L
	H	H	H	H	$\uparrow$	L	H	L

H = high level, L = low level, X = irrelevant,  
 $\uparrow$  = transition from low to high level at the clock input

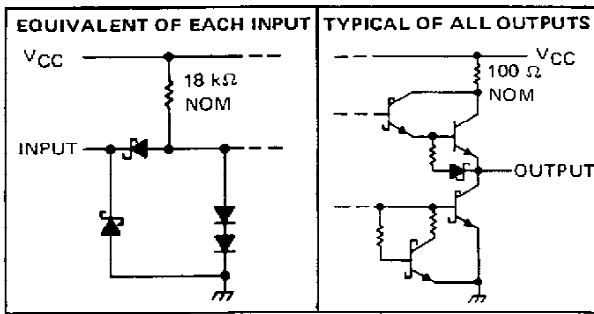
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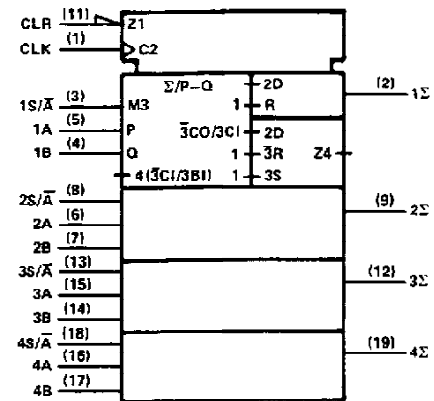
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## schematics of inputs and outputs

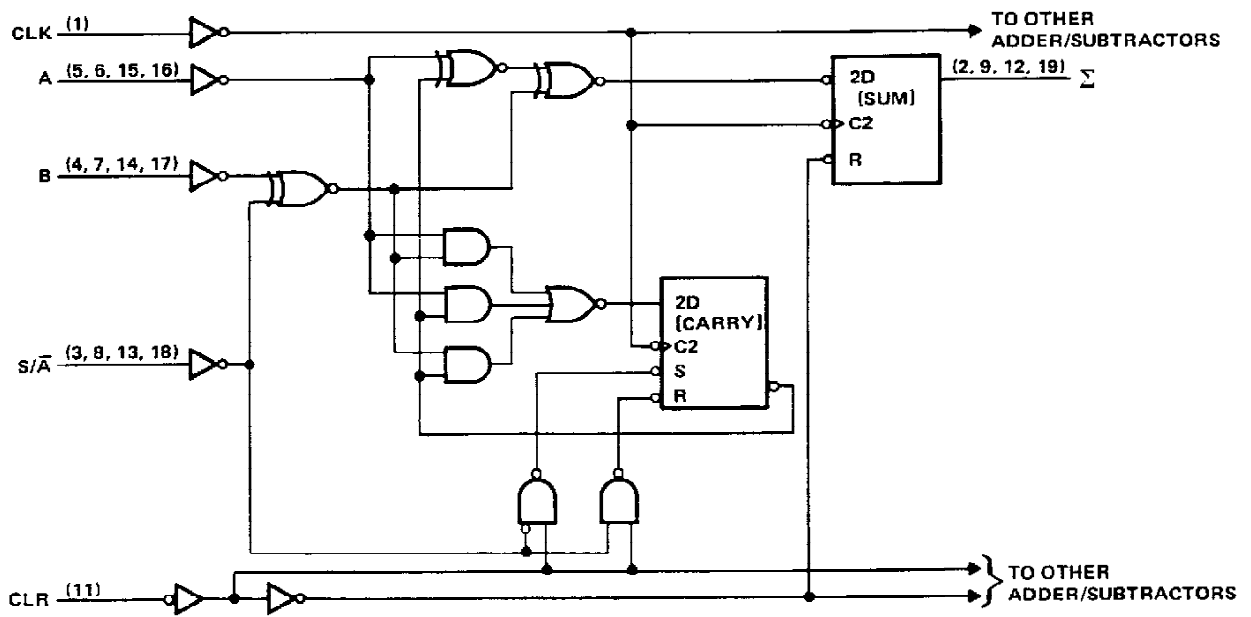


## logic symbol†



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

## logic diagram (each adder/subtractor, positive logic)



Pin numbers shown are for DW, J, or N packages.

TEXAS  
INSTRUMENTS

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## recommended operating conditions

	SN54LS385			SN74LS385			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$ (see Note 1)	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
Clock frequency, $f_{clock}$	0		30	0		30	MHz
Width of clock pulse, $t_w$	16			16			ns
Setup time, $t_{su}$	10			10			ns
Hold time, $t_h$	3			3			ns
Operating free-air temperature, $T_A$	-55		125	0		70	$^{\circ}$ C

NOTE 1: Voltage values are with respect to network ground terminal.

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

PARAMETER	TEST CONDITIONS†	SN54LS385			SN74LS385			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	3.5		2.7	3.5		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	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$			0.1			0.1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$			20			20	$\mu$ A
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-0.4			-0.4	mA
$I_{OS}$ Short-circuit output current§	$V_{CC} = \text{MAX}$	-20		-100	-20		-100	mA
$I_{CC}$ Supply current	$V_{CC} = \text{MAX}$ , See Note 2		48	75		48	75	mA

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

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

§ Not more than one output should be shorted at a time.

NOTE 2:  $I_{CC}$  is measured with all inputs grounded and all outputs open.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{max}$			$C_L = 15 \text{ pF}$ , $R_L = 2 \text{ k}\Omega$ , See Note 3	30	40		MHz
$t_{PLH}$	Clock	$\Sigma$			14	22	ns
$t_{PHL}$					18	27	
$t_{PHL}$	Clear	$\Sigma$			18	30	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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