

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

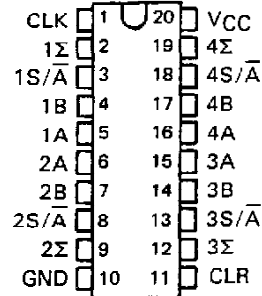
description

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.

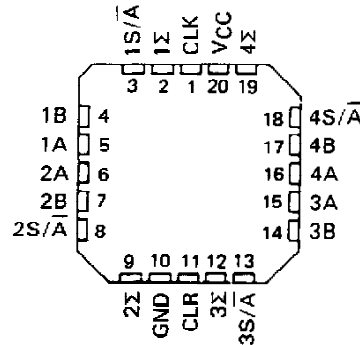
Each of the four independent sum (Σ) outputs reflects its respective A and B input as controlled by the S/\bar{A} control. When S/\bar{A} is high the Σ function is A minus B. When S/\bar{A} is low the Σ function is A plus B.

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		Σ 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	H	L
	H	L	H	H	\uparrow	H	H	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	H
	H	H	H	H	\uparrow	H	H	L

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

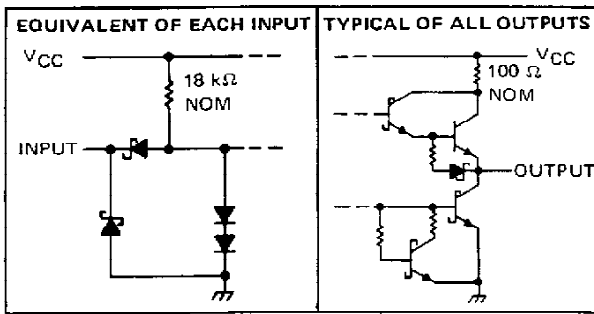
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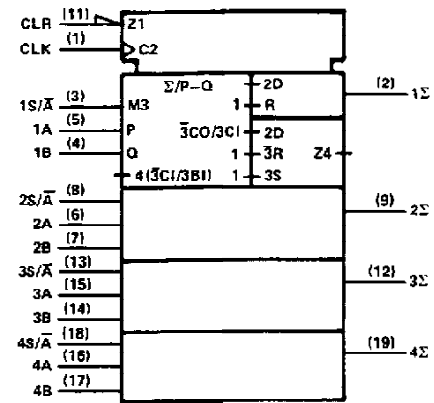
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schematics of inputs and outputs

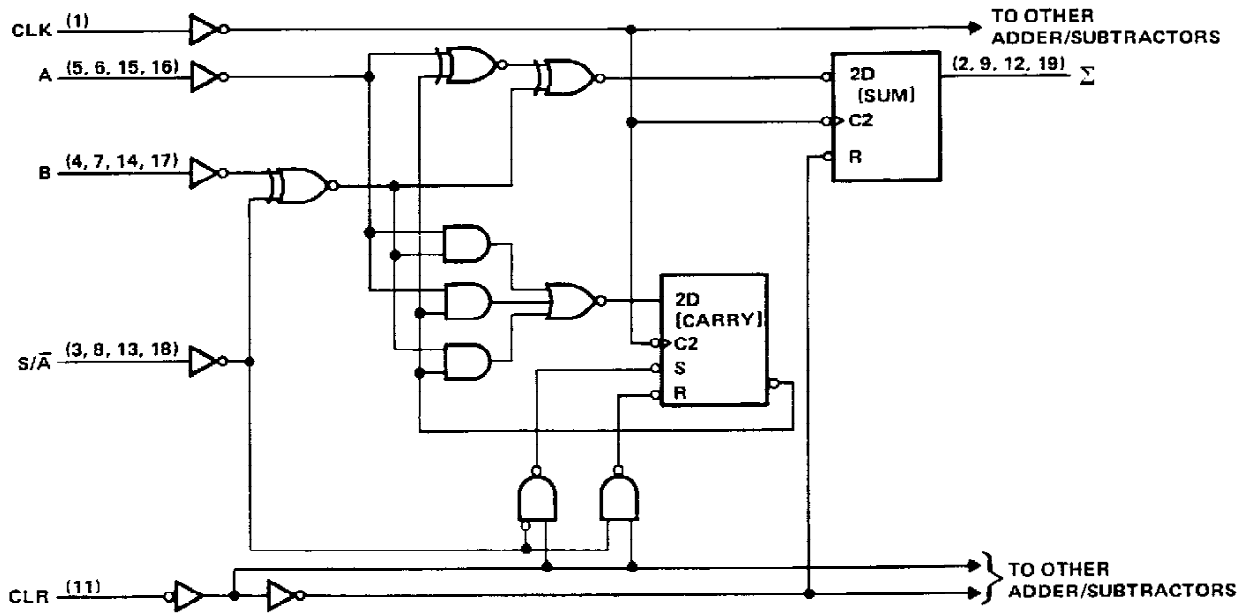


logic symbol†



†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	μ 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	μ 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	Σ			14	22	ns
t_{PHL}					18	27	
t_{PHL}	Clear	Σ			18	30	ns

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