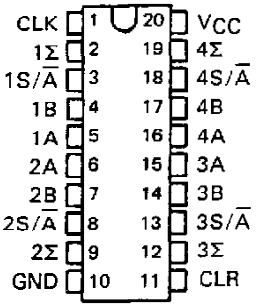
SN54LS385, SN74LS385
QUADRUPLE SERIAL ADDERS/SUBTRACTORS

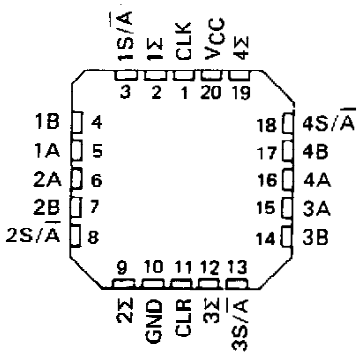
SDLS170 D2412, NOVEMBER 1977 – REVISED MARCH 1988

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

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



SN54LS385 . . . FK PACKAGE
(TOP VIEW)



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/$\overline{A}$ control. When S/$\overline{A}$ is high the Σ function is A minus B. When S/$\overline{A}$ is low the Σ function is A plus B.

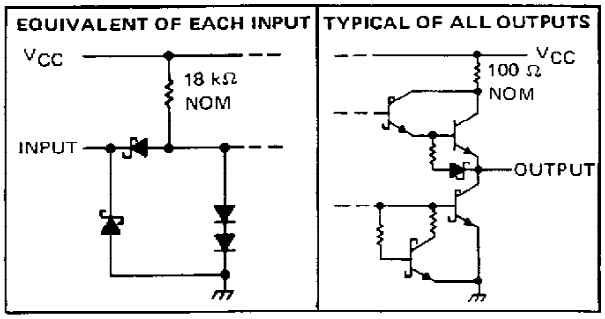
When low, the clear input asynchronously resets the sum flip-flop low and the carry flip-flop either high in the subtract mode or low in the add mode. The clock is positive-edge triggered and controls the sum and carry flip-flops according to the function table.

FUNCTION TABLE

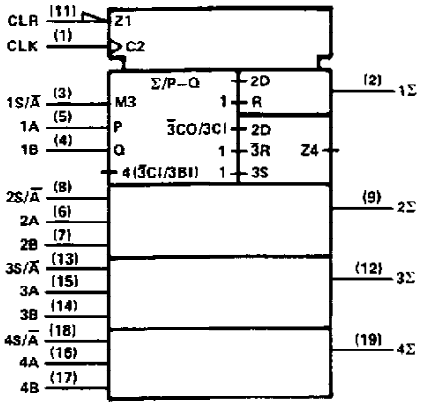
SELECTED FUNCTION	INPUTS					DATA IN CARRY FLIP-FLOP		Σ OUTPUT
	CLR	S/$\overline{A}$	A	B	CLK	BEFORE ↑	AFTER ↑	AFTER ↑
Clear	L	L	X	X	X	L	L	L
	L	H	X	X	X	H	H	L
Add	H	L	L	L	↑	L	L	L
	H	L	L	L	↑	H	L	H
	H	L	L	H	↑	L	L	H
	H	L	L	H	↑	H	H	L
	H	L	H	L	↑	L	L	H
	H	L	H	L	↑	H	H	L
	H	L	H	H	↑	L	H	L
	H	L	H	H	↑	H	H	H
Subtract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

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

schematics of inputs and outputs

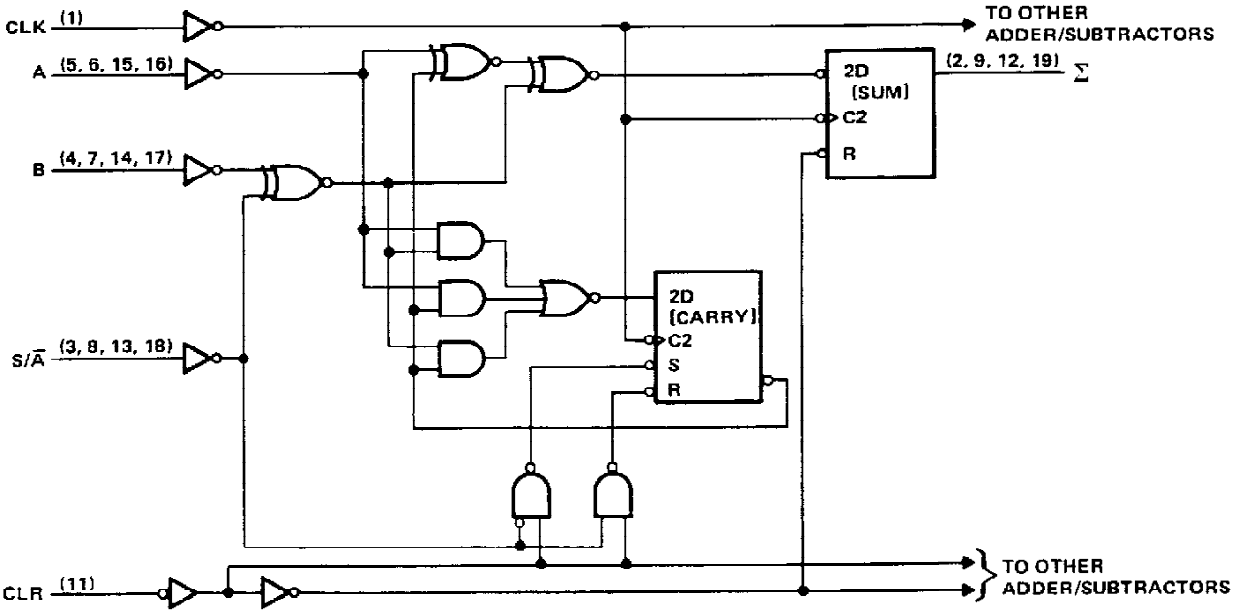


logic symbol†



†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.

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	μA
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	°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} = 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	3.5		2.7	3.5		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	V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V				−0.4			−0.4	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CC}	Supply current	V_{CC} = 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 V, T_A = 25°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 V, T_A = 25°C

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{max}			C_L = 15 pF, R_L = 2 kΩ, 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.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.