

SN54LS385, SN74LS385 QUADRUPLE SERIAL ADDERS/SUBTRACTORS

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

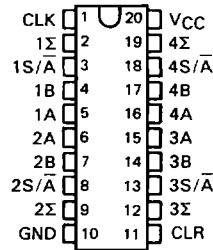
description

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.

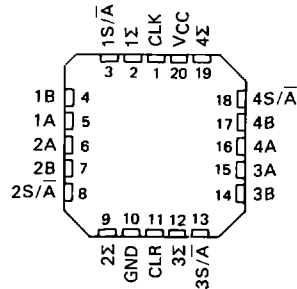
Each of the four independent sum (Σ) outputs reflects its respective A and B input as controlled by the S/ \bar{A} control. When S/ \bar{A} is high the Σ function is A minus B. When S/ \bar{A} is low the Σ function is A plus B.

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 |
|-------------------|--------|--------------|---|---|-----|-------------------------|---------|----------|
| | CLR | S/ \bar{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 | 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 | L | 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 | H | H |

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

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PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

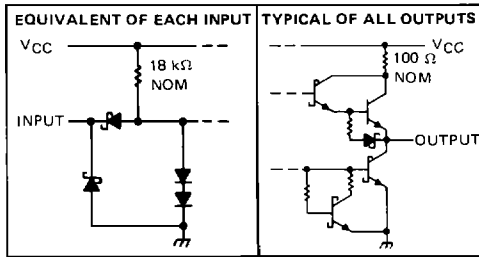
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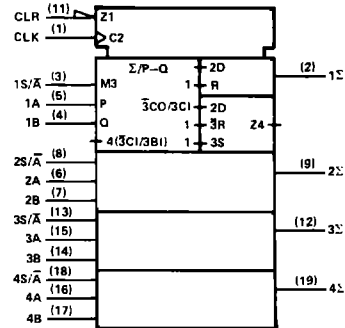
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SN54LS385, SN74LS385 QUADRUPLE SERIAL ADDERS/SUBTRACTORS

schematics of inputs and outputs



logic symbol†

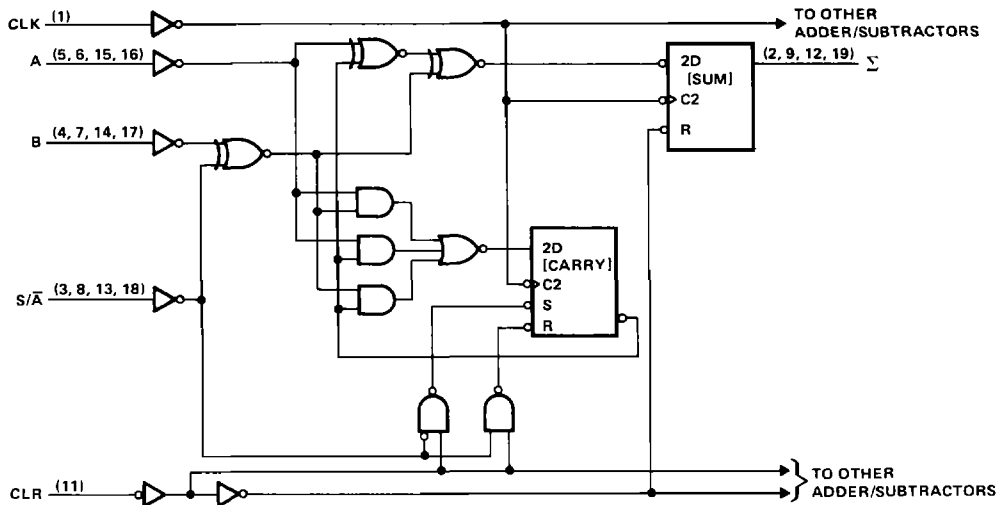


†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12

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logic diagram (each adder/subtractor, positive logic)



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

SN54LS385, SN74LS385 QUADRUPLE SERIAL ADDERS/SUBTRACTORS

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 | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{ILmax}, I_{OH} = -400 \mu\text{A}$ | 2.5 | 3.5 | | 2.7 | 3.5 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{ILmax}$ | $I_{OL} = 4 \text{ mA}$ | | 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 | -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

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