

# SN54273, SN54LS273, SN74273, SN74LS273 OCTAL D-TYPE FLIP-FLOP WITH CLEAR

SDLS090 – OCTOBER 1976 – REVISED MARCH 1988

- Contains Eight Flip-Flops With Single-Rail Outputs
- Buffered Clock and Direct Clear Inputs
- Individual Data Input to Each Flip-Flop
- Applications Include:
  - Buffer/Storage Registers
  - Shift Registers
  - Pattern Generators

## description

These monolithic, positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic with a direct clear input.

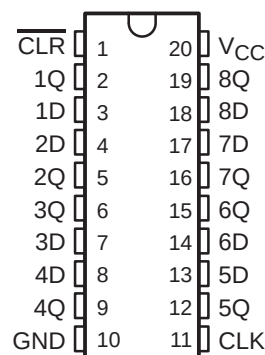
Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output.

These flip-flops are guaranteed to respond to clock frequencies ranging from 0 to 30 megahertz while maximum clock frequency is typically 40 megahertz. Typical power dissipation is 39 milliwatts per flip-flop for the '273 and 10 milliwatts for the 'LS273.

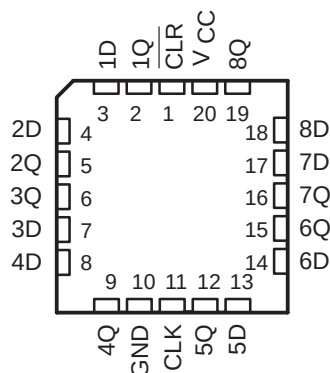
FUNCTION TABLE  
(each flip-flop)

| INPUTS |       |   | OUTPUT<br>Q    |
|--------|-------|---|----------------|
| CLEAR  | CLOCK | D |                |
| L      | X     | X | L              |
| H      | ↑     | H | H              |
| H      | ↑     | L | L              |
| H      | L     | X | Q <sub>0</sub> |

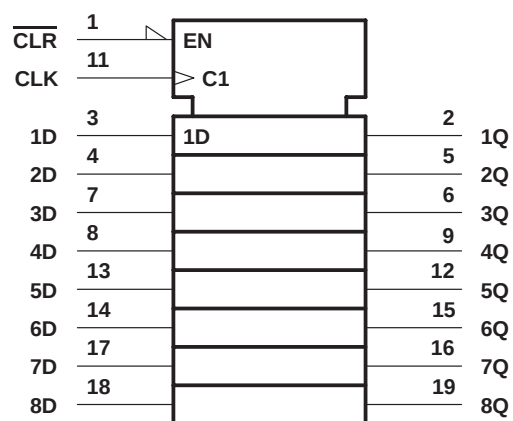
SN54273, SN74LS273 . . . J OR W PACKAGE  
SN74273 . . . N PACKAGE  
SN74LS273 . . . DW OR N PACKAGE  
(TOP VIEW)



SN54LS273 . . . FK PACKAGE  
(TOP VIEW)



## logic symbol†



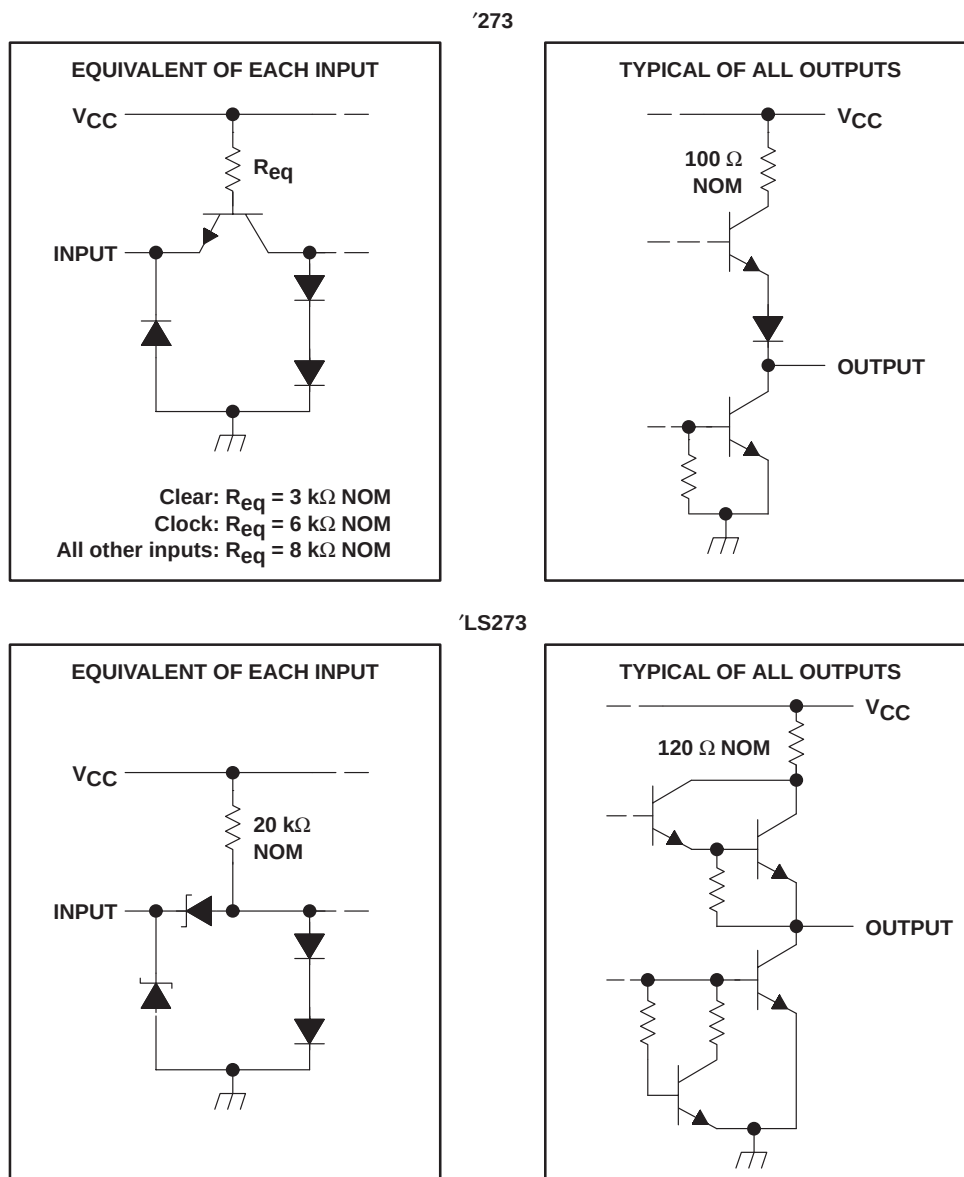
† This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12. Pin numbers shown are for the DW, J, N, and W packages.

# SN54273, SN54LS273, SN74273, SN74LS273

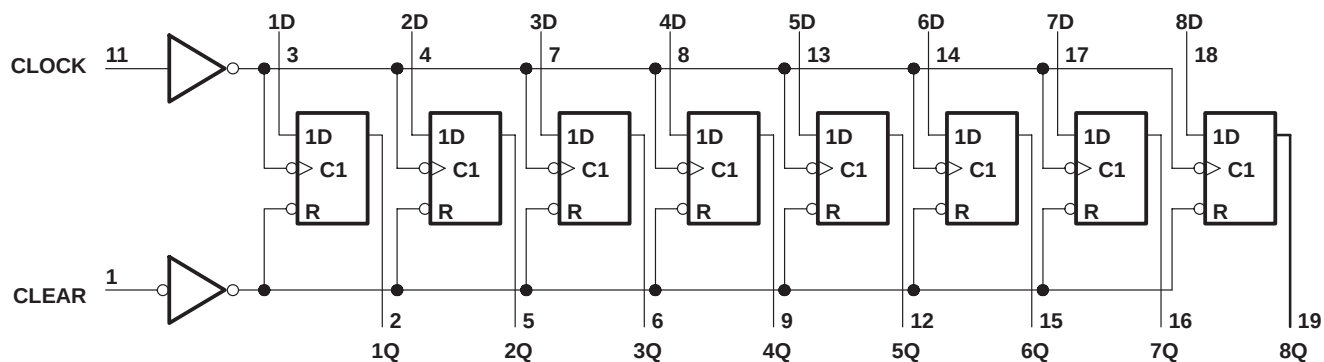
## OCTAL D-TYPE FLIP-FLOP WITH CLEAR

SDLS090 – OCTOBER 1976 – REVISED MARCH 1988

### schematics of inputs and outputs



### logic diagram (positive logic)



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

# SN54273, SN54LS273, SN74273, SN74LS273 OCTAL D-TYPE FLIP-FLOP WITH CLEAR

SDLS090 – OCTOBER 1976 – REVISED MARCH 1988

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                                       |                |
|-------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                 | 7 V            |
| Input voltage                                         | 5.5 V          |
| Operating free-air temperature range, $T_A$ : SN54273 | –55°C to 125°C |
| SN74273                                               | 0°C to 70°C    |
| Storage temperature range                             | –65°C to 150°C |

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

## recommended operating conditions

|                                                |                      | SN54273 |     |     | SN74273 |     |      | UNIT |
|------------------------------------------------|----------------------|---------|-----|-----|---------|-----|------|------|
|                                                |                      | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| Supply voltage, V <sub>CC</sub>                |                      | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| High-level output current, I <sub>OH</sub>     |                      | −800    |     |     | −800    |     |      | μA   |
| Low-level output current, I <sub>OL</sub>      |                      | 16      |     |     | 16      |     |      | mA   |
| Clock frequency, f <sub>clock</sub>            |                      | 0       |     | 30  | 0       |     | 30   | MHz  |
| Width of clock or clear pulse, t <sub>w</sub>  |                      | 16.5    |     |     | 16.5    |     |      | ns   |
| Setup time, t <sub>su</sub>                    | Data input           | 20↑     |     |     | 20↑     |     |      | ns   |
|                                                | Clear inactive state | 25↑     |     |     | 25↑     |     |      |      |
| Data hold time, t <sub>h</sub>                 |                      | 5↑      |     |     | 5↑      |     |      | ns   |
| Operating free-air temperature, T <sub>A</sub> |                      | −55     |     | 125 | 0       |     | 70   | °C   |

$\uparrow$  The arrow indicates that the rising edge of the clock pulse is used for reference.

## 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                       | $V_{CC} = \text{MIN}$ ,<br>$I_I = -12 \text{ mA}$                                    |                                                  |     |                  | –1.5 | V       |
| $V_{OH}$  | High-level output voltage                 | $V_{CC} = \text{MIN}$ ,<br>$V_{IL} = 0.8 \text{ V}$ ,<br>$I_{OH} = -800 \mu\text{A}$ |                                                  | 2.4 | 3.4              |      | V       |
| $V_{OL}$  | Low-level output voltage                  | $V_{CC} = \text{MIN}$ ,<br>$V_{IL} = 0.8 \text{ V}$ ,<br>$I_{OH} = 16 \text{ mA}$    |                                                  |     |                  | 0.4  | V       |
| $I_I$     | Input current at maximum input voltage    | $V_{CC} = \text{MAX}$ ,<br>$V_I = 5.5 \text{ V}$                                     |                                                  |     |                  | 1    | mA      |
| $I_{IH}$  | High-level input current                  | Clear                                                                                | $V_{CC} = \text{MAX}$ ,<br>$V_I = 2.4 \text{ V}$ |     |                  | 80   | $\mu$ A |
|           |                                           | Clock or D                                                                           |                                                  |     |                  | 40   |         |
| $I_{IL}$  | Low-level input current                   | Clear                                                                                | $V_{CC} = \text{MAX}$ ,<br>$V_I = 0.4 \text{ V}$ |     |                  | –3.2 | mA      |
|           |                                           | Clock or D                                                                           |                                                  |     |                  | –1.6 |         |
| $I_{OS}$  | Short-circuit output current <sup>§</sup> | $V_{CC} = \text{MAX}$                                                                |                                                  | –18 |                  | –57  | mA      |
| $I_{CC}$  | Supply current                            | $V_{CC} = \text{MAX}$ ,<br>See Note 2                                                |                                                  |     | 62               | 94   | mA      |

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

NOTE 2: With all outputs open and 4.5 V applied to all data and clear inputs,  $I_{CC}$  is measured after a momentary ground, then 4.5 V, is applied to clock.

# SN54273, SN54LS273, SN74273, SN74LS273

## OCTAL D-TYPE FLIP-FLOP WITH CLEAR

SDLS090 – OCTOBER 1976 – REVISED MARCH 1988

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

| PARAMETER                                                             | TEST CONDITIONS                                               | MIN | TYP | MAX | UNIT |
|-----------------------------------------------------------------------|---------------------------------------------------------------|-----|-----|-----|------|
| $f_{\max}$ Maximum clock frequency                                    | $C_L = 15\text{ pF}$ ,<br>$R_L = 400\ \Omega$ ,<br>See Note 3 | 30  | 40  |     | MHz  |
| $t_{PHL}$ Propagation delay time, high-to-low-level output from clear |                                                               |     | 18  | 27  | ns   |
| $t_{PLH}$ Propagation delay time, low-to-high-level output from clock |                                                               |     | 17  | 27  | ns   |
| $t_{PHL}$ Propagation delay time, high-to-low-level output from clock |                                                               |     | 18  | 27  | ns   |

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

### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

|                                                         |                                            |
|---------------------------------------------------------|--------------------------------------------|
| Supply voltage, $V_{CC}$ (see Note 1)                   | 7 V                                        |
| Input voltage                                           | 7 V                                        |
| Operating free-air temperature range, $T_A$ : SN54LS273 | $-55^\circ\text{C}$ to $125^\circ\text{C}$ |
| SN74LS273                                               | $0^\circ\text{C}$ to $70^\circ\text{C}$    |
| Storage temperature range                               | $-65^\circ\text{C}$ to $150^\circ\text{C}$ |

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

### recommended operating conditions

|                                       |                      | SN54LS273     |     |      | SN74LS273     |     |      | 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 | $\mu\text{A}$    |
| Low-level output current, $I_{OL}$    |                      |               |     | 4    |               |     | 8    | mA               |
| Clock frequency, $f_{\text{clock}}$   |                      | 0             |     | 30   | 0             |     | 30   | MHz              |
| Width of clock or clear pulse, $t_w$  |                      | 20            |     |      | 20            |     |      | ns               |
| Setup time, $t_{su}$                  | Data input           | 20 $\uparrow$ |     |      | 20 $\uparrow$ |     |      | ns               |
|                                       | Clear inactive state | 25 $\uparrow$ |     |      | 25 $\uparrow$ |     |      |                  |
| Data hold time, $t_h$                 |                      | 5 $\uparrow$  |     |      | 5 $\uparrow$  |     |      | ns               |
| Operating free-air temperature, $T_A$ |                      | -55           |     | 125  | 0             |     | 70   | $^\circ\text{C}$ |

$\uparrow$  The arrow indicates that the rising edge of the clock pulse is used for reference.



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# SN54273, SN54LS273, SN74273, SN74LS273 OCTAL D-TYPE FLIP-FLOP WITH CLEAR

SDLS090 – OCTOBER 1976 – REVISED MARCH 1988

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

| PARAMETER                                                 | TEST CONDITIONS <sup>†</sup>                                                                                   | SN54LS273 |                  |      | SN74LS273 |                  |      | UNIT |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------|------------------|------|-----------|------------------|------|------|
|                                                           |                                                                                                                | MIN       | TYP <sup>‡</sup> | MAX  | MIN       | TYP <sup>‡</sup> | MAX  |      |
| V <sub>IH</sub> High-level input voltage                  |                                                                                                                | 2         |                  |      | 2         |                  |      | V    |
| V <sub>IL</sub> Low-level input voltage                   |                                                                                                                |           |                  | 0.7  |           |                  | 0.8  | V    |
| V <sub>IK</sub> Input clamp voltage                       | V <sub>CC</sub> = MIN, I <sub>I</sub> = –18 mA                                                                 |           |                  | –1.5 |           |                  | –1.5 | V    |
| V <sub>OH</sub> High-level output voltage                 | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>ILmax</sub> , I <sub>OH</sub> = –400 µA | 2.5       | 3.4              |      | 2.7       | 3.4              |      | V    |
| V <sub>OL</sub> Low-level output voltage                  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>ILmax</sub> , I <sub>OL</sub> = 4 mA    | 0.25      | 0.4              |      | 0.25      | 0.4              |      | V    |
|                                                           |                                                                                                                |           |                  |      | 0.35      | 0.5              |      |      |
| I <sub>I</sub> Input current at maximum input voltage     | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V                                                                    |           |                  | 0.1  |           |                  | 0.1  | mA   |
| I <sub>IH</sub> High-level input current                  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                                                                  |           |                  | 20   |           |                  | 20   | µA   |
| I <sub>IL</sub> Low-level input current                   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                                  |           |                  | –0.4 |           |                  | –0.4 | mA   |
| I <sub>OS</sub> Short-circuit output current <sup>§</sup> | V <sub>CC</sub> = MAX                                                                                          | –20       |                  | –100 | –20       |                  | –100 | mA   |
| I <sub>CC</sub> Supply current                            | V <sub>CC</sub> = MAX, See Note 2                                                                              |           | 17               | 27   |           | 17               | 27   | mA   |

<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<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

<sup>§</sup> Not more than one output should be shorted at a time and duration of short circuit should not exceed one second.

NOTE 2: With all outputs open and 4.5 V applied to all data and clear inputs, I<sub>CC</sub> is measured after a momentary ground, then 4.5 V, is applied to clock.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C**

| PARAMETER                                                                    | TEST CONDITIONS                                                 | MIN | TYP | MAX | UNIT |
|------------------------------------------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|------|
| f <sub>max</sub> Maximum clock frequency                                     | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 2 kΩ,<br>See Note 3 | 30  | 40  |     | MHz  |
| t <sub>PHL</sub> Propagation delay time, high-to-low-level output from clear |                                                                 |     | 18  | 27  | ns   |
| t <sub>PLH</sub> Propagation delay time, low-to-high-level output from clock |                                                                 |     | 17  | 27  | ns   |
| t <sub>PHL</sub> Propagation delay time, high-to-low-level output from clock |                                                                 |     | 18  | 27  | ns   |

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



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