# SN54HC564, SN74HC564
# OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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- **High-Current 3-State Output Drive Bus-Lines Directly or Up to 15 LSTTL Loads**
- **Bus-Structured Pinout**
- **Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs**
- **Dependable Texas Instruments Quality and Reliability**

## description

These 8-bit latches feature three-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight-bit edge-triggered D-type flip-flops enter data on the low-to-high transition of the clock.

An output-control ($\overline{OC}$) input can be used to place the eight outputs in either a normal logic state (high or low levels) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased high-logic level provide the capability to drive the bus lines in a bus-organized system without need for interface or pull-up components.

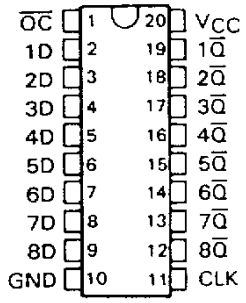
An output control does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54HC564 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74HC564 is characterized for operation from −40°C to 85°C.

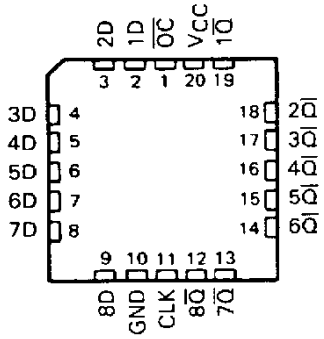
FUNCTION TABLE
(EACH FLIP-FLOP)

| INPUTS | | | OUTPUT |
|---|---|---|---|
| $\overline{OC}$ | CLK | D | $\overline{Q}$ |
| L | ↑ | H | L |
| L | ↑ | L | H |
| L | L | X | $\overline{Q}_0$ |
| H | X | X | Z |

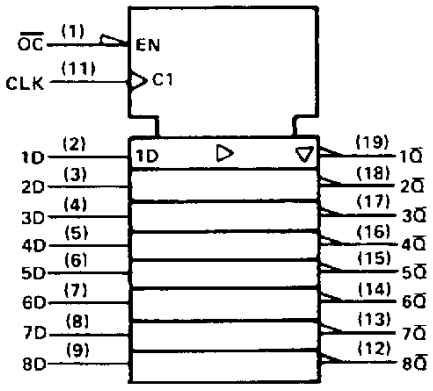
SN54HC564 . . . J PACKAGE
SN74HC564 . . . DW OR N PACKAGE
(TOP VIEW)




SN54HC564 . . . FK PACKAGE
(TOP VIEW)

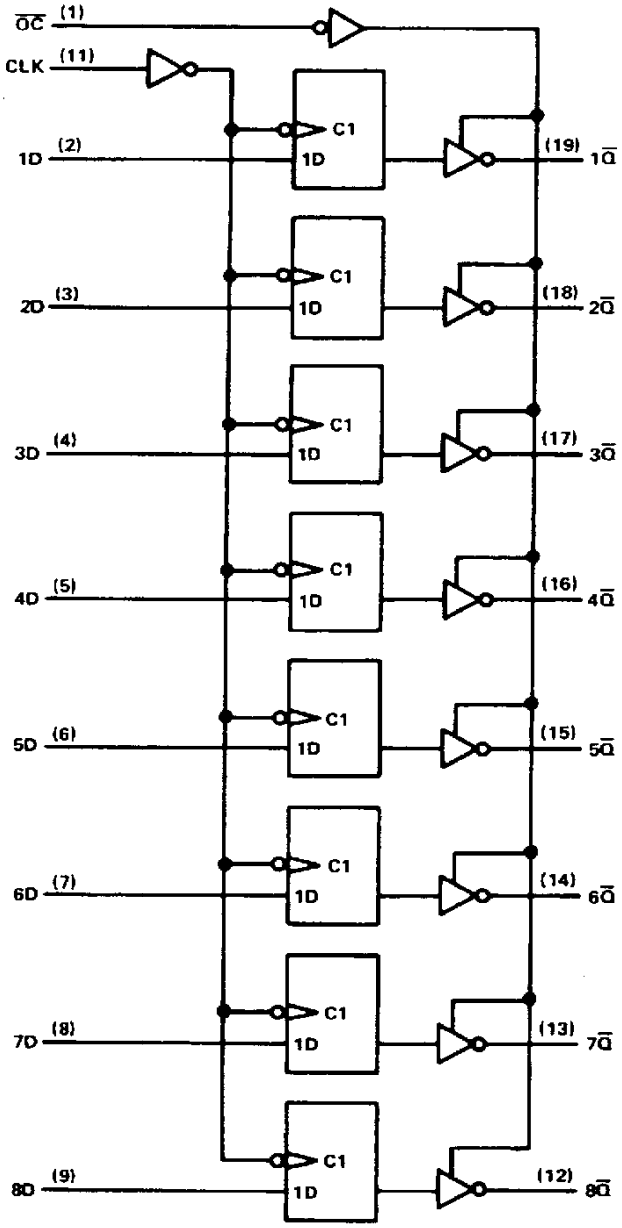



## logic symbol†




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

logic diagram (positive logic)



### absolute maximum ratings over operating free-air temperature range†

Supply voltage range, $V_{CC}$ . . . . . −0.5 V to 7 V
Input clamp current, $I_{IK}$ ($V_I < 0$ or $V_I > V_{CC}$) . . . . . ±20 mA
Output clamp current, $I_{OK}$ ($V_O < 0$ or $V_O > V_{CC}$) . . . . . ±20 mA
Continuous output current, $I_O$ ($V_O = 0$ to $V_{CC}$) . . . . . ±35 mA
Continuous current through $V_{CC}$ or GND pins . . . . . ±70 mA
Lead temperature 1,6 mm (1/16 in) from case for 60 s: FK or J package . . . . . 300°C
Lead temperature 1,6 mm (1/16 in) from case for 10 s: DW or N package . . . . . 260°C
Storage temperature range . . . . . −65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### recommended operating conditions

| | | | SN54HC564 | | | SN74HC564 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | | 2 | 5 | 6 | 2 | 5 | 6 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 2 V | 1.5 | | | 1.5 | | | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | | | 3.15 | | | |
| | | $V_{CC}$ = 6 V | 4.2 | | | 4.2 | | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 2 V | 0 | | 0.3 | 0 | | 0.3 | V |
| | | $V_{CC}$ = 4.5 V | 0 | | 0.9 | 0 | | 0.9 | |
| | | $V_{CC}$ = 6 V | 0 | | 1.2 | 0 | | 1.2 | |
| $V_I$ | Input voltage | | 0 | | $V_{CC}$ | 0 | | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | | $V_{CC}$ | 0 | | $V_{CC}$ | V |
| $t_t$ | Input transition (rise and fall) times | $V_{CC}$ = 2 V | 0 | | 1000 | 0 | | 1000 | ns |
| | | $V_{CC}$ = 4.5 V | 0 | | 500 | 0 | | 500 | |
| | | $V_{CC}$ = 6 V | 0 | | 400 | 0 | | 400 | |
| $T_A$ | Operating free-air temperature | | −55 | | 125 | −40 | | 85 | °C |

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

| PARAMETER | TEST CONDITIONS | $V_{CC}$ | $T_A$ = 25°C | | | SN54HC564 | | SN74HC564 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $V_{OH}$ | $V_I = V_{IH}$ or $V_{IL}$, $I_{OH}$ = −20 μA | 2 V | 1.9 | 1.998 | | 1.9 | | 1.9 | | V |
| | | 4.5 V | 4.4 | 4.499 | | 4.4 | | 4.4 | | |
| | | 6 V | 5.9 | 5.999 | | 5.9 | | 5.9 | | |
| | $V_I = V_{IH}$ or $V_{IL}$, $I_{OH}$ = −6 mA | 4.5 V | 3.98 | 4.30 | | 3.7 | | 3.84 | | |
| | $V_I = V_{IH}$ or $V_{IL}$, $I_{OH}$ = −7.8 mA | 6 V | 5.48 | 5.80 | | 5.2 | | 5.34 | | |
| $V_{OL}$ | $V_I = V_{IH}$ or $V_{IL}$, $I_{OL}$ = 20 μA | 2 V | | 0.002 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 V | | 0.001 | 0.1 | | 0.1 | | 0.1 | |
| | | 6 V | | 0.001 | 0.1 | | 0.1 | | 0.1 | |
| | $V_I = V_{IH}$ or $V_{IL}$, $I_{OL}$ = 6 mA | 4.5 V | | 0.17 | 0.26 | | 0.4 | | 0.33 | |
| | $V_I = V_{IH}$ or $V_{IL}$, $I_{OL}$ = 7.8 mA | 6 V | | 0.15 | 0.26 | | 0.4 | | 0.33 | |
| $I_I$ | $V_I = V_{CC}$ or 0 | 6 V | | ±0.1 | ±100 | | ±1000 | | ±1000 | nA |
| $I_{OZ}$ | $V_O = V_{CC}$ or 0 | 6 V | | ±0.01 | ±0.5 | | ±10 | | ±5 | μA |
| $I_{CC}$ | $V_I = V_{CC}$ or 0, $I_O$ = 0 | 6 V | | | 8 | | 160 | | 80 | μA |
| $C_I$ | | 2 to 6 V | | 3 | 10 | | 10 | | 10 | pF |

**timing requirements over recommended operating free-air temperature range (unless otherwise noted)**

| | | $V_{CC}$ | $T_A$ = 25°C | | SN54HC564 | | SN74HC564 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{clock}$ | Clock frequency | 2 V | 0 | 6 | 0 | 4.2 | 0 | 5 | MHz |
| | | 4.5 V | 0 | 31 | 0 | 21 | 0 | 25 | |
| | | 6 V | 0 | 36 | 0 | 25 | 0 | 29 | |
| $t_w$ | Pulse duration, CLK high or low | 2 V | 80 | | 120 | | 100 | | ns |
| | | 4.5 V | 16 | | 24 | | 20 | | |
| | | 6 V | 14 | | 20 | | 17 | | |
| $t_{su}$ | Setup time, data before CLK↑ | 2 V | 100 | | 150 | | 125 | | ns |
| | | 4.5 V | 20 | | 30 | | 25 | | |
| | | 6 V | 17 | | 26 | | 21 | | |
| $t_h$ | Hold time, data after CLK↑ | 2 V | 5 | | 5 | | 5 | | ns |
| | | 4.5 V | 5 | | 5 | | 5 | | |
| | | 6 V | 5 | | 5 | | 5 | | |

**switching characteristics over recommended operating free-air temperature range (unless otherwise noted), $C_L$ = 50 pF (see Note 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ | $T_A$ = 25°C | | | SN54HC564 | | SN74HC564 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | 2 V | 6 | 11 | | 4.2 | | 5 | | MHz |
| | | | 4.5 V | 31 | 36 | | 21 | | 25 | | |
| | | | 6 V | 36 | 40 | | 25 | | 29 | | |
| $t_{pd}$ | CLK | Any $\overline{Q}$ | 2 V | | 54 | 180 | | 270 | | 225 | ns |
| | | | 4.5 V | | 18 | 36 | | 54 | | 45 | |
| | | | 6 V | | 15 | 31 | | 46 | | 38 | |
| $t_{en}$ | $\overline{OC}$ | Any $\overline{Q}$ | 2 V | | 45 | 150 | | 225 | | 190 | ns |
| | | | 4.5 V | | 15 | 30 | | 45 | | 38 | |
| | | | 6 V | | 13 | 26 | | 38 | | 32 | |
| $t_{dis}$ | $\overline{OC}$ | Any $\overline{Q}$ | 2 V | | 45 | 150 | | 225 | | 190 | ns |
| | | | 4.5 V | | 15 | 30 | | 45 | | 38 | |
| | | | 6 V | | 13 | 26 | | 38 | | 32 | |
| $t_t$ | | Any $\overline{Q}$ | 2 V | | 28 | 60 | | 90 | | 75 | ns |
| | | | 4.5 V | | 8 | 12 | | 18 | | 15 | |
| | | | 6 V | | 6 | 10 | | 15 | | 13 | |

| | | | |
|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance per flip-flop | No load, $T_A$ = 25°C | 100 pF typ |

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

**switching characteristics over recommended operating free-air temperature range (unless otherwise noted), $C_L$ = 150 pF (see Note 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ | $T_A$ = 25°C | | | SN54HC564 | | SN74HC564 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $t_{pd}$ | D | Any $\overline{Q}$ | 2 V | | 75 | 230 | | 345 | | 290 | ns |
| | | | 4.5 V | | 24 | 46 | | 69 | | 58 | |
| | | | 6 V | | 21 | 34 | | 58 | | 49 | |
| $t_{en}$ | $\overline{OC}$ | Any $\overline{Q}$ | 2 V | | 57 | 200 | | 300 | | 250 | ns |
| | | | 4.5 V | | 19 | 40 | | 60 | | 50 | |
| | | | 6 V | | 17 | 34 | | 51 | | 43 | |
| $t_t$ | | Any $\overline{Q}$ | 2 V | | 60 | 210 | | 315 | | 265 | ns |
| | | | 4.5 V | | 17 | 42 | | 63 | | 53 | |
| | | | 6 V | | 14 | 36 | | 53 | | 45 | |

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

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