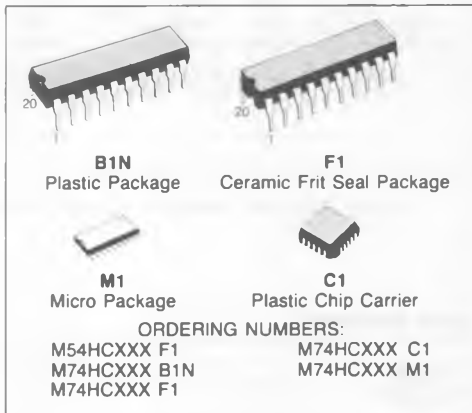


OCTAL D-TYPE LATCH WITH 3-STATE OUTPUT

HC373/573 NON INVERTING, HC533/563 INVERTING

- **HIGH SPEED**
 $t_{PD} = 15 \text{ ns (TYP.) at } V_{CC} = 5\text{V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
 15 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.)}$
- **BALANCED PROPAGATION DELAYS**
 $t_{PLH} = t_{PHL}$
- **WIDE OPERATING VOLTAGE RANGE**
 $V_{CC} \text{ (OPR.)} = 2\text{V to } 6\text{V}$
- **PIN AND FUNCTION COMPATIBLE**
 WITH 74LS373/533/563/573



DESCRIPTION

The M54/74HC373, M54/74HC533, M54/74HC563 and M54/74HC573 are high speed CMOS OCTAL LATCH with 3-STATE OUTPUT fabricated with silicon gate C²MOS technology.

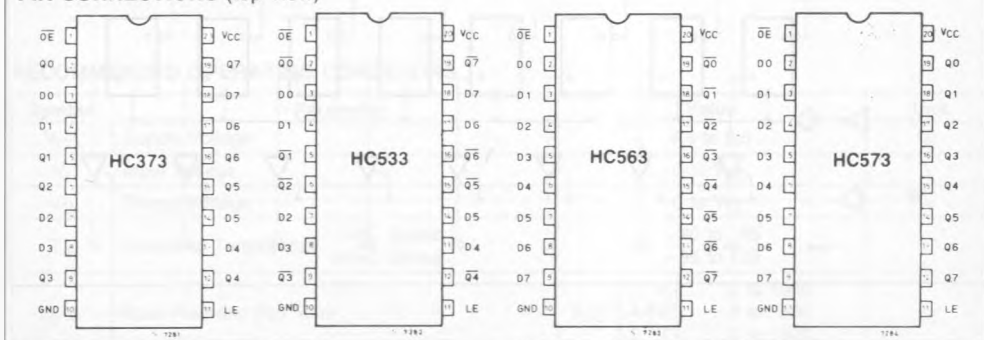
These ICs achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

These 8-bit D-type latches are controlled by a latch enable input (LE) and a output enable input (OE). While the LE input is held at a high level, the Q outputs will follow the data input precisely or inversely. When the LE is taken low, the Q outputs will be latched precisely or inversely at the logic level of D input data. While the OE input is at low level,

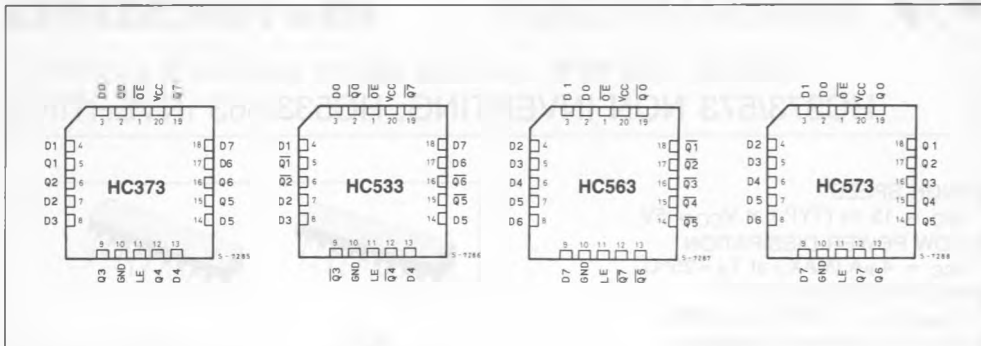
the eight outputs will be in a normal logic state (high or low logic level) and while high level the outputs will be in a high impedance state.

The application designer has a choice of combination of inverting and non-inverting outputs, symmetrical and neighbouring input/output pin layout. The HC373 and the HC573, the HC533 and the HC563 have the same function and the same characteristics respectively, but have different pin layouts. The three-state output configuration and the wide choice of outline make bus-organized systems simple. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

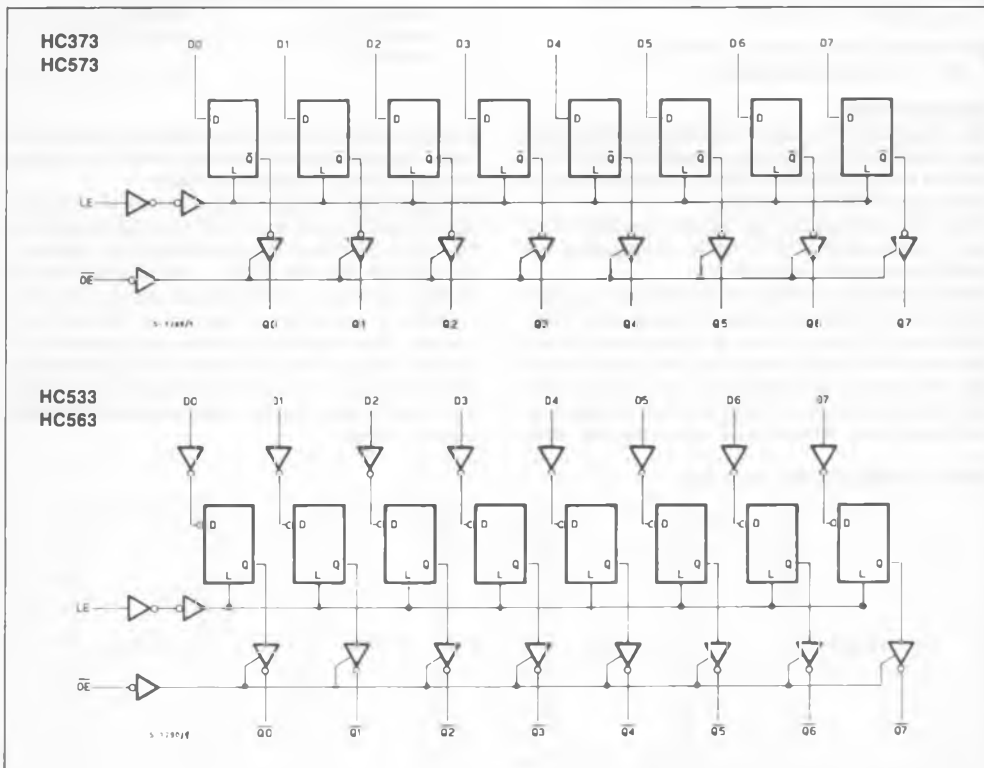
PIN CONNECTIONS (top view)



CHIP CARRIER



LOGIC DIAGRAM



TRUTH TABLE

| INPUTS | | | OUTPUTS | |
|--------|----|---|----------------------|------------------------------|
| OE | LE | D | Q (HC373) (HC573) | \bar{Q} (HC533) (HC563) |
| H | X | X | Z | Z |
| L | L | X | NO CHANGE* | NO CHANGE* |
| L | H | L | L | H |
| L | H | H | H | L |

X: DON'T CARE Z: HIGH IMPEDANCE

*: Q/ \bar{Q} OUTPUTS ARE LATCHED AT THE TIME WHEN THE LE INPUT IS TAKEN LOW LOGIC LEVEL.

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-------------------------------------|--|--------------------------------|------|
| V _{CC} | Supply Voltage | - 0.5 to 7 | V |
| V _I | DC Input Voltage | - 0.5 to V _{CC} + 0.5 | V |
| V _O | DC Output Voltage | - 0.5 to V _{CC} + 0.5 | V |
| I _{IK} | DC Input Diode Current | ± 20 | mA |
| I _{OK} | DC Output Diode Current | ± 20 | mA |
| I _O | DC Output Source Sink Current Per Output Pin | ± 35 | mA |
| I _{CC} or I _{GND} | DC V _{CC} or Ground Current | ± 70 | mA |
| P _D | Power Dissipation | 500 (*) | mW |
| T _{stg} | Storage Temperature | - 65 to 150 | °C |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: ≅ 65°C derate to 300 mW by 10 mW/°C: 65°C to 85°C

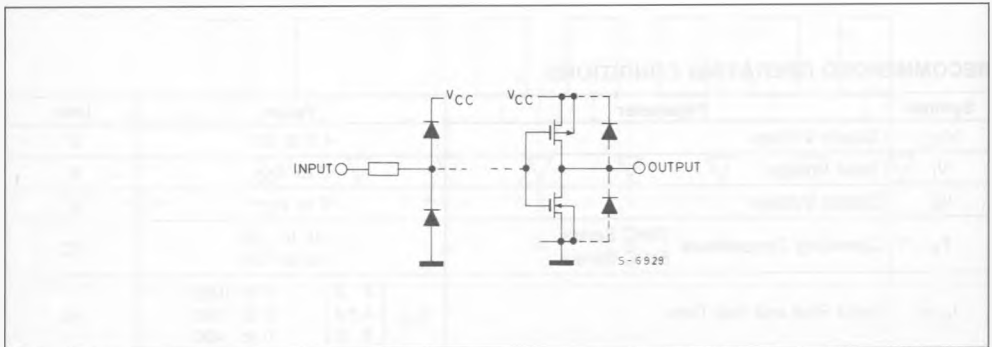
RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|---------------------------------|---|--|------|
| V _{CC} | Supply Voltage | 4.5 to 5.5 | V |
| V _I | Input Voltage | 0 to V _{CC} | V |
| V _O | Output Voltage | 0 to V _{CC} | V |
| T _A | Operating Temperature 74HC Series 54HC Series | - 40 to 85 - 55 to 125 | °C |
| t _r , t _f | Input Rise and Fall Time | V _{CC} { 2 V 0 to 1000 4.5V 0 to 500 6 V 0 to 400 | ns |

DC SPECIFICATIONS

| Symbol | Parameter | V _{CC} | Test Condition | T _A = 25°C 54HC and 74HC | | | - 40 to 85°C 74HC | | - 55 to 125°C 54HC | | Unit | | | | | | | |
|-----------------|----------------------------------|-----------------|--|--|------|------|----------------------|------|-----------------------|------|-------|-----|------|------|-----|------|-----|------|
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | | | | | | | | |
| V _{IH} | High Level Input Voltage | 2.0 | | 1.5 | — | — | 1.5 | — | 1.5 | — | V | | | | | | | |
| | | 4.5 | | 3.15 | — | — | 3.15 | — | 3.15 | — | | | | | | | | |
| | | 6.0 | | 4.2 | — | — | 4.2 | — | 4.2 | — | | | | | | | | |
| V _{IL} | Low Level Input Voltage | 2.0 | | — | — | 0.5 | — | 0.5 | — | 0.5 | V | | | | | | | |
| | | 4.5 | | — | — | 1.35 | — | 1.35 | — | 1.35 | | | | | | | | |
| | | 6.0 | | — | — | 1.8 | — | 1.8 | — | 1.8 | | | | | | | | |
| V _{OH} | High Level Output Voltage | 2.0 | V _I | I _O | | | | | | | | | | | | | | |
| | | 4.5 | V _{IH} or V _{IL} | - 20 μA | | | | | | | | 1.9 | 2.0 | — | 1.9 | — | 1.9 | — |
| | | 6.0 | | - 6.0 mA | | | | | | | | 4.4 | 4.5 | — | 4.4 | — | 4.4 | — |
| | | 4.5 | V _{IL} | - 6.0 mA | | | | | | | | 5.9 | 6.0 | — | 5.9 | — | 5.9 | — |
| 6.0 | - 7.8 mA | 4.18 | | 4.31 | — | 4.13 | — | 4.10 | — | | | | | | | | | |
| V _{OL} | Low Level Output Voltage | 2.0 | V _{IH} or V _{IL} | 20 μA | | | | | | | | | | | | | | |
| | | 4.5 | | — | | | | | | | | 0.0 | 0.1 | — | 0.1 | — | 0.1 | |
| | | 6.0 | | — | | | | | | | | 0.0 | 0.1 | — | 0.1 | — | 0.1 | |
| | | 4.5 | | 6.0 mA | | | | | | | | — | 0.17 | 0.26 | — | 0.33 | — | 0.40 |
| 6.0 | 7.8 mA | — | 0.18 | 0.26 | — | 0.33 | — | 0.40 | | | | | | | | | | |
| I _I | Input Leakage Current | 6.0 | V _I = V _{CC} or GND | | — | — | ± 0.1 | — | ± 1.0 | — | ± 1.0 | μA | | | | | | |
| I _{OZ} | 3-State Output Off-State Current | 6.0 | V _I = V _{IH} or V _{IL} V _O = V _{CC} or GND | | — | — | ± 0.5 | — | ± 5.0 | — | ± 1.0 | μA | | | | | | |
| I _{CC} | Quiescent Supply Current | 6.0 | V _I = V _{CC} or GND I _O = 0 | | — | — | 4 | — | 40 | — | 80 | μA | | | | | | |

INPUT AND OUTPUT EQUIVALENT CIRCUIT



AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

| Symbol | Parameter | V_{CC} | Test Condition | $T_A = 25^\circ\text{C}$ 54HC and 74HC | | | -40 to 85°C 74HC | | -55 to 125°C 54HC | | Unit |
|------------------------|--|----------|-------------------------|---|------|------|-------------------------------------|------|--------------------------------------|------|------|
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| t_{LH} t_{THL} | Output Transition Time | 2.0 | | — | 24 | 60 | — | 75 | — | 90 | ns |
| | | 4.5 | | — | 8 | 12 | — | 15 | — | 18 | |
| | | 6.0 | | — | 6 | 10 | — | 13 | — | 15 | |
| t_{PLH} t_{PHL} | Propagation Delay Time (LE - Q, \bar{Q}) * | 2.0 | | — | 82 | 175 | — | 220 | — | 265 | ns |
| | | 4.5 | | — | 22 | 35 | — | 44 | — | 53 | |
| | | 6.0 | | — | 19 | 30 | — | 37 | — | 45 | |
| t_{PLH} t_{PHL} | Propagation Delay Time (LE-Q, \bar{Q}) ** | 2.0 | | — | 75 | 150 | — | 190 | — | 225 | ns |
| | | 4.5 | | — | 19 | 30 | — | 38 | — | 45 | |
| | | 6.0 | | — | 16 | 26 | — | 33 | — | 38 | |
| t_{PLH} t_{PHL} | Propagation Delay Time (D-Q, \bar{Q}) * | 2.0 | | — | 66 | 145 | — | 180 | — | 220 | ns |
| | | 4.5 | | — | 18 | 29 | — | 36 | — | 44 | |
| | | 6.0 | | — | 16 | 25 | — | 31 | — | 38 | |
| t_{PLH} t_{PHL} | Propagation Delay Time (D-Q, \bar{Q}) ** | 2.0 | | — | 63 | 130 | — | 165 | — | 195 | ns |
| | | 4.5 | | — | 16 | 26 | — | 33 | — | 39 | |
| | | 6.0 | | — | 14 | 22 | — | 28 | — | 33 | |
| $t_{W(H)}$ | Minimum Pulse Width (LE) | 2.0 | | — | 30 | 75 | — | 95 | — | 110 | ns |
| | | 4.5 | | — | 8 | 15 | — | 19 | — | 22 | |
| | | 6.0 | | — | 7 | 13 | — | 16 | — | 19 | |
| t_s | Minimum Set-up Time | 2.0 | | — | 10 | 50 | — | 65 | — | 75 | ns |
| | | 4.5 | | — | 2 | 10 | — | 13 | — | 15 | |
| | | 6.0 | | — | 2 | 9 | — | 11 | — | 13 | |
| t_h | Minimum Hold Time | 2.0 | | — | — | 50 | — | 65 | — | 75 | ns |
| | | 4.5 | | — | — | 10 | — | 13 | — | 15 | |
| | | 6.0 | | — | — | 9 | — | 11 | — | 13 | |
| t_{PZL} t_{PZH} | Output Enable Time * | 2.0 | $R_L = 1\text{K}\Omega$ | — | 72 | 150 | — | 190 | — | 225 | ns |
| | | 4.5 | | — | 18 | 30 | — | 38 | — | 45 | |
| | | 6.0 | | — | 15 | 26 | — | 33 | — | 38 | |
| t_{PZL} t_{PZH} | Output Enable Time ** | 2.0 | $R_L = 1\text{K}\Omega$ | — | 62 | 140 | — | 175 | — | 210 | ns |
| | | 4.5 | | — | 18 | 28 | — | 35 | — | 42 | |
| | | 6.0 | | — | 16 | 24 | — | 30 | — | 36 | |
| t_{PZH} t_{PHZ} | Output Disable Time * | 2.0 | $R_L = 1\text{k}\Omega$ | — | 45 | 150 | — | 190 | — | 225 | ns |
| | | 4.5 | | — | 22 | 30 | — | 38 | — | 45 | |
| | | 6.0 | | — | 20 | 26 | — | 33 | — | 37 | |
| t_{PLZ} t_{PHZ} | Output Disable Time ** | 2.0 | $R_L = 1\text{K}\Omega$ | — | 45 | 150 | — | 190 | — | 225 | ns |
| | | 4.5 | | — | 22 | 30 | — | 38 | — | 45 | |
| | | 6.0 | | — | 20 | 26 | — | 33 | — | 38 | |
| C_{IN} | Input Capacitance | | | — | 5 | 10 | — | 10 | — | — | pF |
| C_{OUT} | Output Capacitance | | | — | 10 | — | — | — | — | — | pF |
| $C_{PD} \blacklozenge$ | Power Dissipation Capacitance | | | — | 41 | — | — | — | — | — | pF |

Note \blacklozenge C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit)

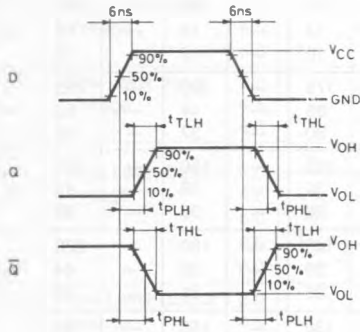
Average operating current can be obtained by the following equation.

$$I_{CC(oper)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per Latch)} \quad * \text{ M54/74HC373/533}$$

$$** \text{ M54/74HC563/573}$$

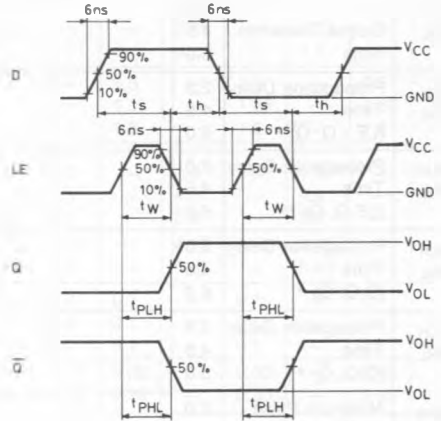
SWITCHING CHARACTERISTICS TEST WAVEFORM

t_{PLH} , t_{PHL} (D - Q, \bar{Q})



S-10427/A

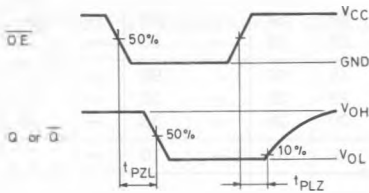
t_{PLH} , t_{PHL} (LE - Q, \bar{Q}), t_s , t_h , t_w



S-10428

t_{PLZ} , t_{PZL}

The 1K Ω load resistors should be connected between outputs and V_{CC} line and the 50 pF load capacitors should be connected between outputs and GND line. All inputs except \overline{OE} input should be connected to V_{CC} line or GND line such that outputs will be in low logic level while \overline{OE} is put in held low.

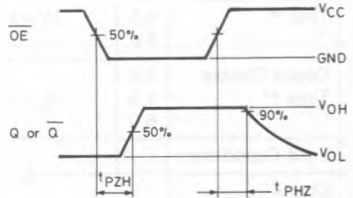


S-10429

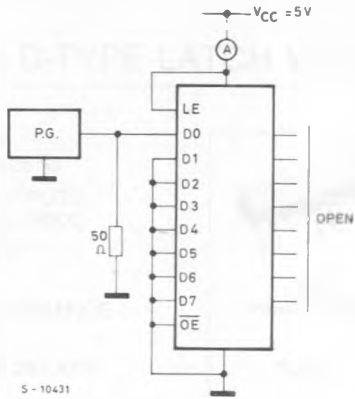
t_{PHZ} , t_{PZH}

The 1K Ω load resistors and the 50pF load capacitors should be connected between each output and GND line.

All inputs except \overline{OE} input should be connected to V_{CC} or GND line such that output will be in high logic level while OE input is held low.



S-10430

TEST CIRCUIT I_{CC} (Opr.)

INPUT WAVEFORM IN THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.