

OCTAL D-TYPE LATCH WITH 3 STATE OUTPUT
HC563 INVERTING - HC573 NON INVERTING

- HIGH SPEED
 $t_{PD} = 13 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25 \text{ }^\circ\text{C}$
- HIGH NOISE IMMUNITY
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY
15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
 $I_{OL} = |I_{OH}| = 6 \text{ mA (MIN.)}$
- 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 54/74LS563/573

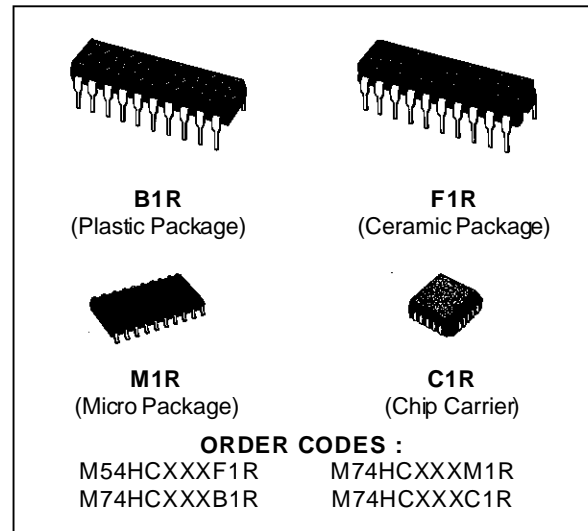
DESCRIPTION

The M54/74HC563 and M54HC573 are high speed CMOS OCTAL LATCH WITH 3-STATE OUTPUTS fabricated with in silicon gate C²MOS technology.

These ICs archive 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 (\overline{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



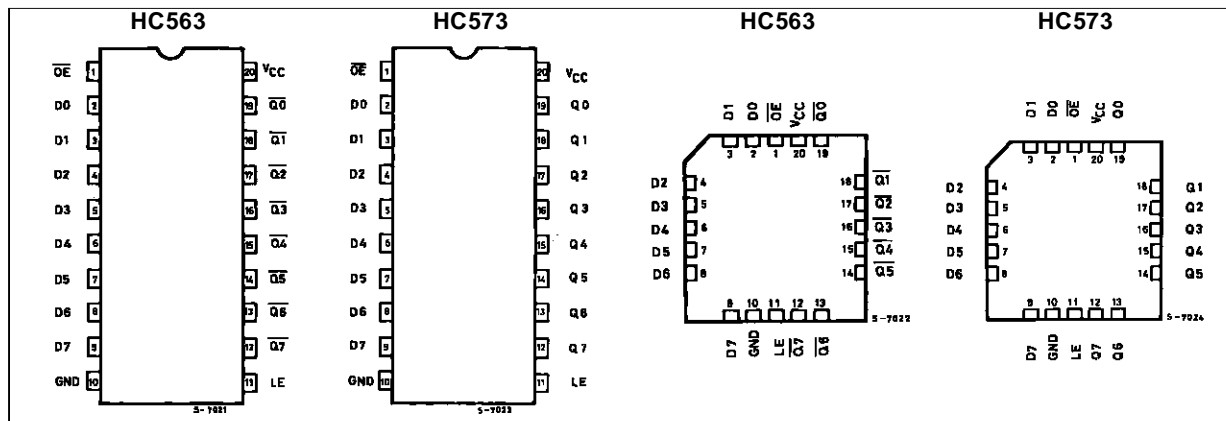
of D input data. While the \overline{OE} input is at low level, the eight outputs will be in a normal logic state (high or low logic level) and while high level the outputs will be in a high impedance state.

The application designer has a choice of combination of inverting and non inverting outputs.

The three state output configuration and the wide choice of outline make bus organized system simple.

All inputs are equipped with protection circuits against discharge and transient excess voltage.

PIN CONNECTION (top view)



INPUT AND OUTPUT EQUIVALENT CIRCUIT



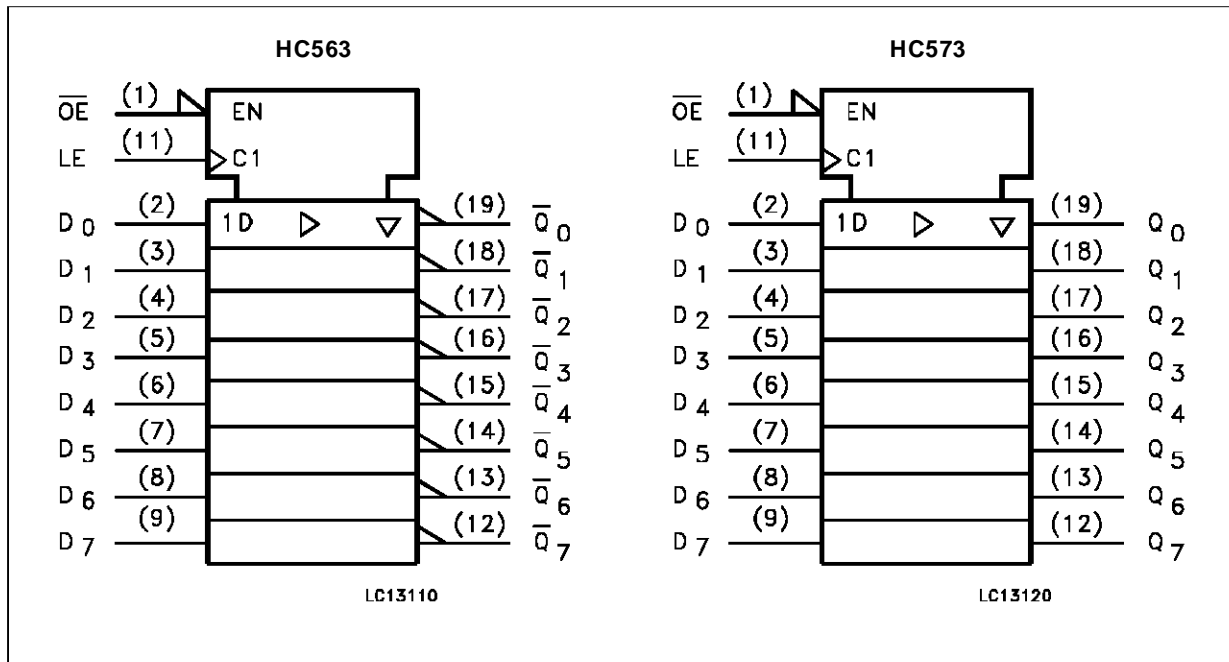
PIN DESCRIPTION (HC563)

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------------------------------|------------------------------------|--|
| 1 | \overline{OE} | 3 State output Enable Input (Active LOW) |
| 2, 3, 4, 5, 6, 7, 8, 9 | D0 to D7 | Data Inputs |
| 12, 13, 14, 15, 16, 17, 18, 19 | $\overline{Q0}$ to $\overline{Q7}$ | 3 State Latch Outputs |
| 11 | LE | Latch Enable Input |
| 10 | GND | Ground (0V) |
| 20 | Vcc | Positive Supply Voltage |

PIN DESCRIPTION (HC573)

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------------------------------|-----------------|--|
| 1 | \overline{OE} | 3 State output Enable Input (Active LOW) |
| 2, 3, 4, 5, 6, 7, 8, 9 | D0 to D7 | Data Inputs |
| 12, 13, 14, 15, 16, 17, 18, 19 | Q0 to Q7 | 3 State Latch Outputs |
| 11 | LE | Latch Enable Input |
| 10 | GND | Ground (0V) |
| 20 | Vcc | Positive Supply Voltage |

IEC LOGIC SYMBOLS

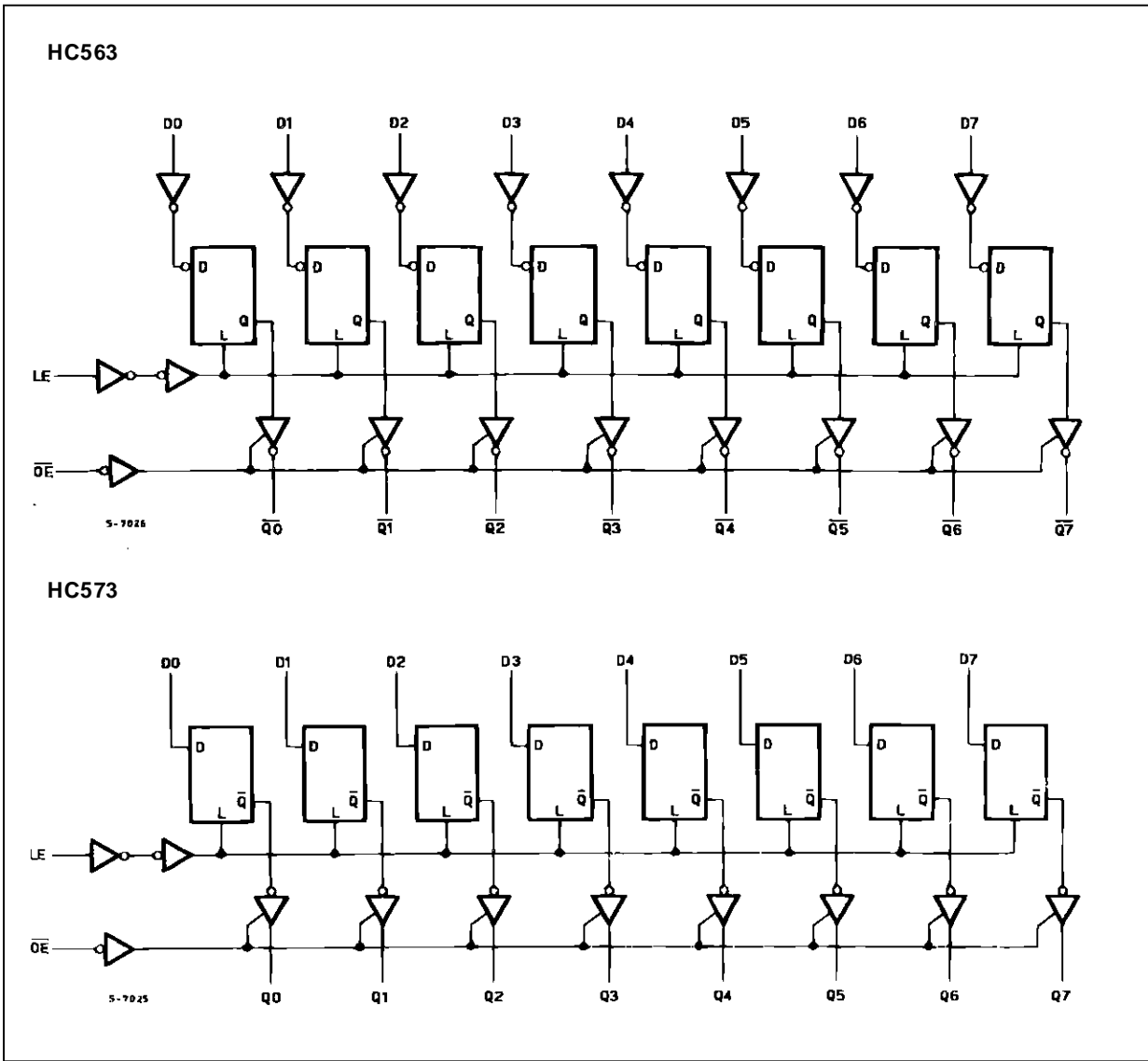


TRUTH TABLE

| INPUTS | | | OUTPUTS | |
|--------|----|---|-------------|-------------|
| OE | LE | D | Q (HC573) | Q̄ (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/Q̄ OUTPUTS ARE LATCHED AT THE TIME WHEN THE LE INPUT IS TAKEN LOW LOGIC LEVEL.

LOGIC DIAGRAMS



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 |
| T _L | Lead Temperature (10 sec) | 300 | °C |

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

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

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|---------------------------------|--|-------------------------------------|------|
| V _{CC} | Supply Voltage | 2 to 6 | V |
| V _I | Input Voltage | 0 to V _{CC} | V |
| V _O | Output Voltage | 0 to V _{CC} | V |
| T _{op} | Operating Temperature: M54HC Series | -55 to +125 | °C |
| | M74HC Series | -40 to +85 | °C |
| t _r , t _f | Input Rise and Fall Time | V _{CC} = 2 V 0 to 1000 | ns |
| | | V _{CC} = 4.5 V 0 to 500 | |
| | | V _{CC} = 6 V 0 to 400 | |

DC SPECIFICATIONS

| Symbol | Parameter | Test Conditions | | Value | | | | | | Unit | | |
|-----------------|----------------------------------|------------------------|--|---|-------------------------|------|----------------------|------|-----------------------|------|------|---|
| | | V _{CC} (V) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | | |
| | | | | 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 = V _{IH} or V _{IL} | I _O = -20 μA | 1.9 | 2.0 | | 1.9 | | 1.9 | V | |
| | | 4.5 | | | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | | | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | I _O = -6.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | | |
| | | 6.0 | | I _O = -7.8 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| V _{OL} | Low Level Output Voltage | 2.0 | V _I = V _{IH} or V _{IL} | I _O = 20 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | | I _O = 6.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| | | 6.0 | | | I _O = 7.8 mA | | 0.18 | 0.26 | | 0.33 | | |
| I _I | Input Leakage Current | 6.0 | V _I = V _{CC} or GND | | | ±0.1 | | ±1 | | ±1 | 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 | | ±10 | μA | |
| I _{CC} | Quiescent Supply Current | 6.0 | V _I = V _{CC} or GND | | | 4 | | 40 | | 80 | μA | |

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

| Symbol | Parameter | Test Conditions | | | Value | | | | | | Unit | |
|--|-------------------------------------|------------------------|------------------------|------------------------|---|----------|------|----------------------|------|-----------------------|------|------|
| | | V _{CC} (V) | C _L (pF) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t _{TLH} t _{THL} | Output Transition Time | 2.0 | 50 | | | 25 | 60 | | 75 | | 90 | ns |
| | | 4.5 | | | | 7 | 12 | | 15 | | 18 | |
| | | 6.0 | | | | 6 | 10 | | 13 | | 15 | |
| t _{PLH} t _{PHL} | Propagation Delay Time (LE - Q, Q̄) | 2.0 | 50 | | | 50 | 115 | | 145 | | 175 | ns |
| | | 4.5 | | | | 15 | 23 | | 29 | | 35 | |
| | | 6.0 | | | | 13 | 20 | | 25 | | 30 | |
| | | 2.0 | 150 | | | 60 | 155 | | 195 | | 235 | ns |
| | | 4.5 | | | | 20 | 31 | | 39 | | 47 | |
| | | 6.0 | | | | 17 | 26 | | 33 | | 40 | |
| t _{PLH} t _{PHL} | Propagation Delay Time (D - Q, Q̄) | 2.0 | 50 | | | 42 | 110 | | 140 | | 165 | ns |
| | | 4.5 | | | | 14 | 22 | | 28 | | 33 | |
| | | 6.0 | | | | 12 | 19 | | 24 | | 28 | |
| | | 2.0 | 150 | | | 57 | 150 | | 190 | | 225 | ns |
| | | 4.5 | | | | 19 | 30 | | 38 | | 45 | |
| | | 6.0 | | | | 16 | 26 | | 32 | | 38 | |
| t _{PZL} t _{PZH} | 3 State Output Enable Time | 2.0 | 50 | R _L = 1 KΩ | | 55 | 140 | | 175 | | 210 | ns |
| | | 4.5 | | | | 17 | 28 | | 35 | | 42 | |
| | | 6.0 | | | | 14 | 24 | | 30 | | 36 | |
| | | 2.0 | 150 | R _L = 1 KΩ | | 66 | 180 | | 225 | | 270 | ns |
| | | 4.5 | | | | 22 | 36 | | 45 | | 54 | |
| | | 6.0 | | | | 19 | 31 | | 38 | | 46 | |
| t _{PLZ} t _{PHZ} | 3 State Output Disable Time | 2.0 | 50 | R _L = 1 KΩ | | 40 | 125 | | 155 | | 190 | ns |
| | | 4.5 | | | | 17 | 25 | | 31 | | 38 | |
| | | 6.0 | | | | 15 | 21 | | 26 | | 32 | |
| t _{W(L)} t _{W(H)} | Minimum Pulse Width | 2.0 | 50 | | | 40 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | | 8 | 15 | | 19 | | 22 | |
| | | 6.0 | | | | 7 | 13 | | 16 | | 19 | |
| t _s | Minimum Set-up Time | 2.0 | 50 | | | 16 | 50 | | 65 | | 75 | ns |
| | | 4.5 | | | | 5 | 10 | | 13 | | 15 | |
| | | 6.0 | | | | 3 | 9 | | 11 | | 13 | |
| t _h | Minimum Hold Time | 2.0 | 50 | | | | 5 | | 5 | | 5 | ns |
| | | 4.5 | | | | | 5 | | 5 | | 5 | |
| | | 6.0 | | | | | 5 | | 5 | | 5 | |
| C _{IN} | Input Capacitance | | | | | 5 | 10 | | 10 | | 10 | pF |
| C _{OUT} | Output Capacitance | | | | | 10 | | | | | | pF |
| C _{PD} (*) | Power Dissipation Capacitance | | | for HC563 for HC573 | | 49 51 | | | | | | pF |

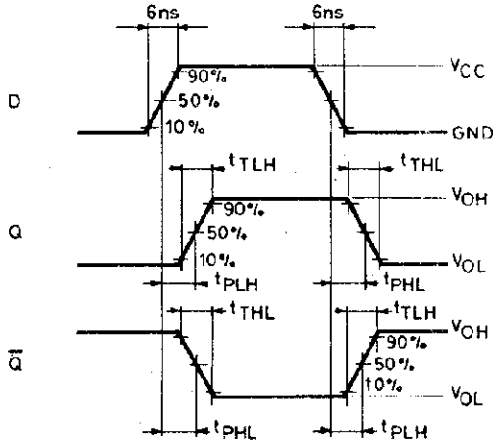
(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$ (per Gate)

The CPD when n pcs of FLIP-FLOP operate, can be gained by following equations:

for HC563 CPD (TOTAL) = 33 + 16 x n [pF]; for HC573 CPD (TOTAL) = 33 + 18 x n [pF]

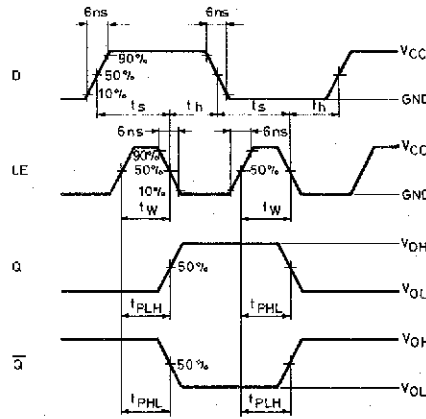
SWITCHING CHARACTERISTICS TEST WAVEFORM

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



S-10427/A

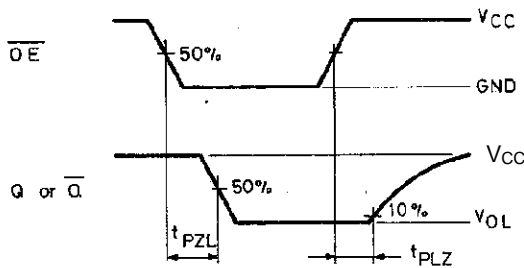
t_{PLH} , t_{PHL} , (LE - Q, \bar{Q}) t_s , t_h , t_w



S-10428

t_{PLZ} , t_{PZL}

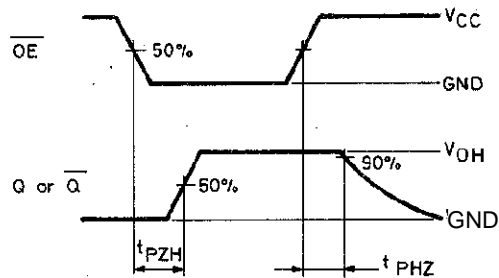
The 1KΩ load resistors should be connected between outputs and VCC line and the 50pF load capacitors should be connected between outputs and GND line. All inputs except \overline{OE} input should be connected to VCC line or GND line such that outputs will be in low logic level while \overline{OE} input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



S-10429

t_{PHZ} , t_{PZH}

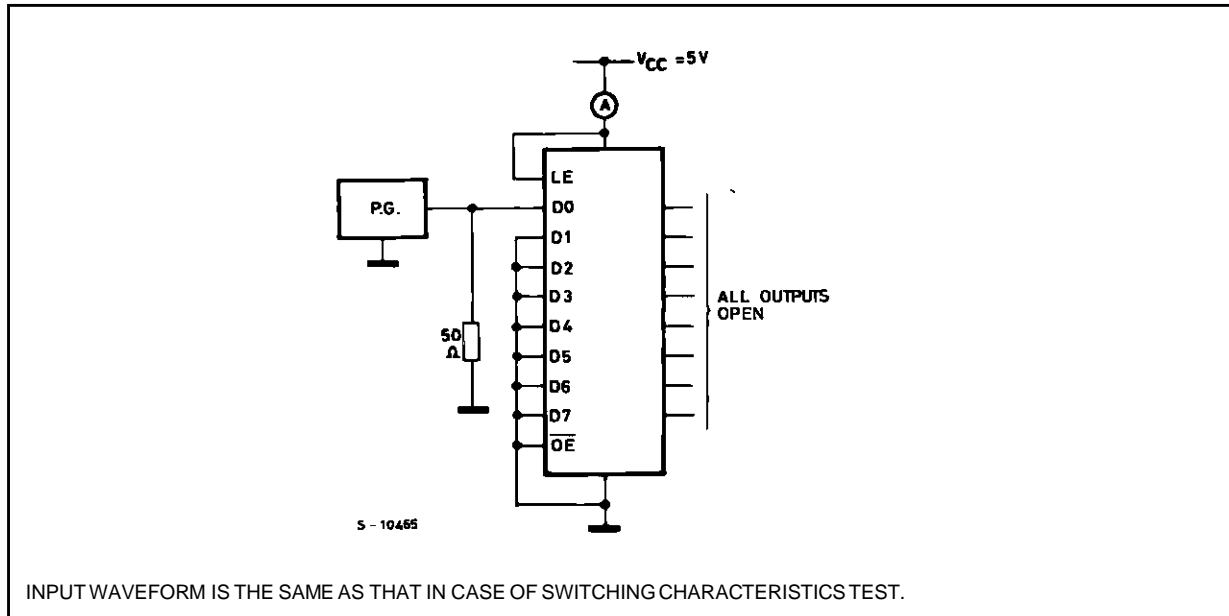
The 1KΩ load resistors and the 50pF load capacitors should be connected between each output and GND line. All inputs except \overline{OE} input should be connected to VCC or GND line such that output will be in high logic level while \overline{OE} input is held low.



S-10430

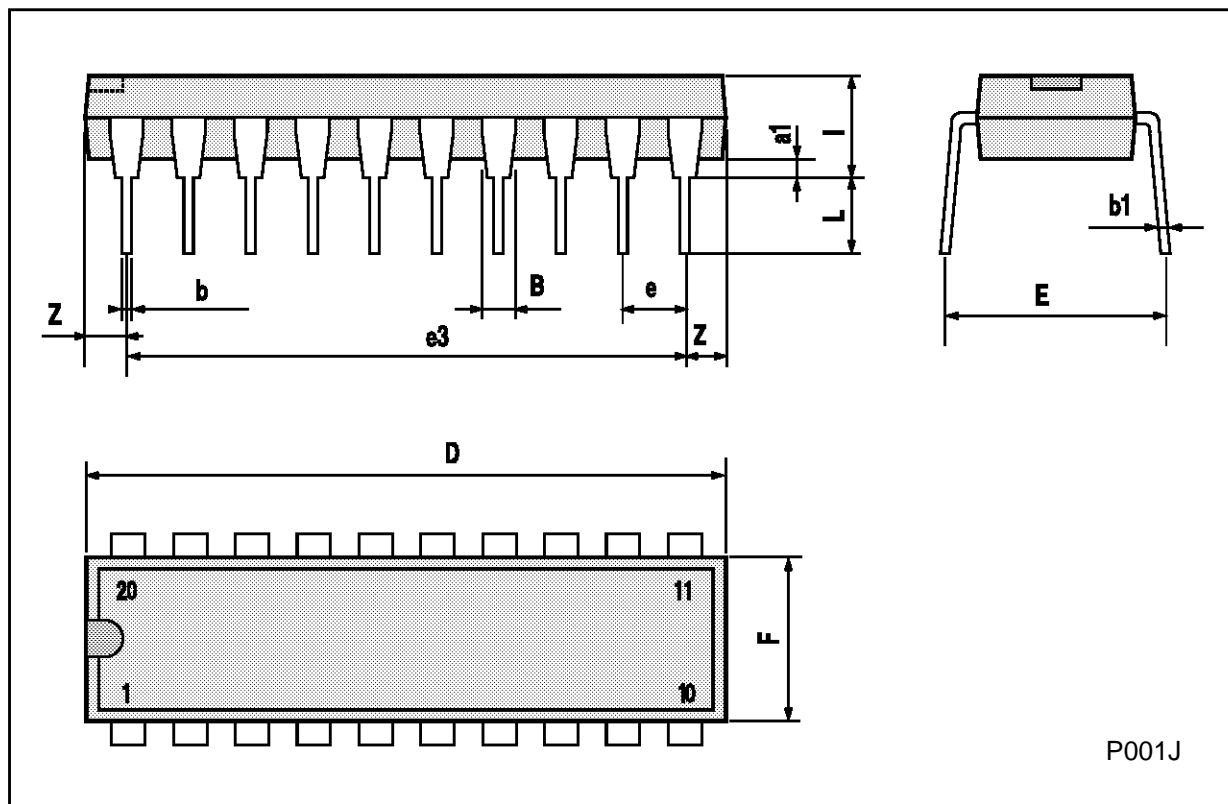
M54/M74HC563/573

TEST CIRCUIT I_{CC} (Opr.)



Plastic DIP20 (0.25) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.254 | | | 0.010 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.45 | | | 0.018 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 25.4 | | | 1.000 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 22.86 | | | 0.900 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 3.93 | | | 0.155 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.34 | | | 0.053 |



Ceramic DIP20 MECHANICAL DATA

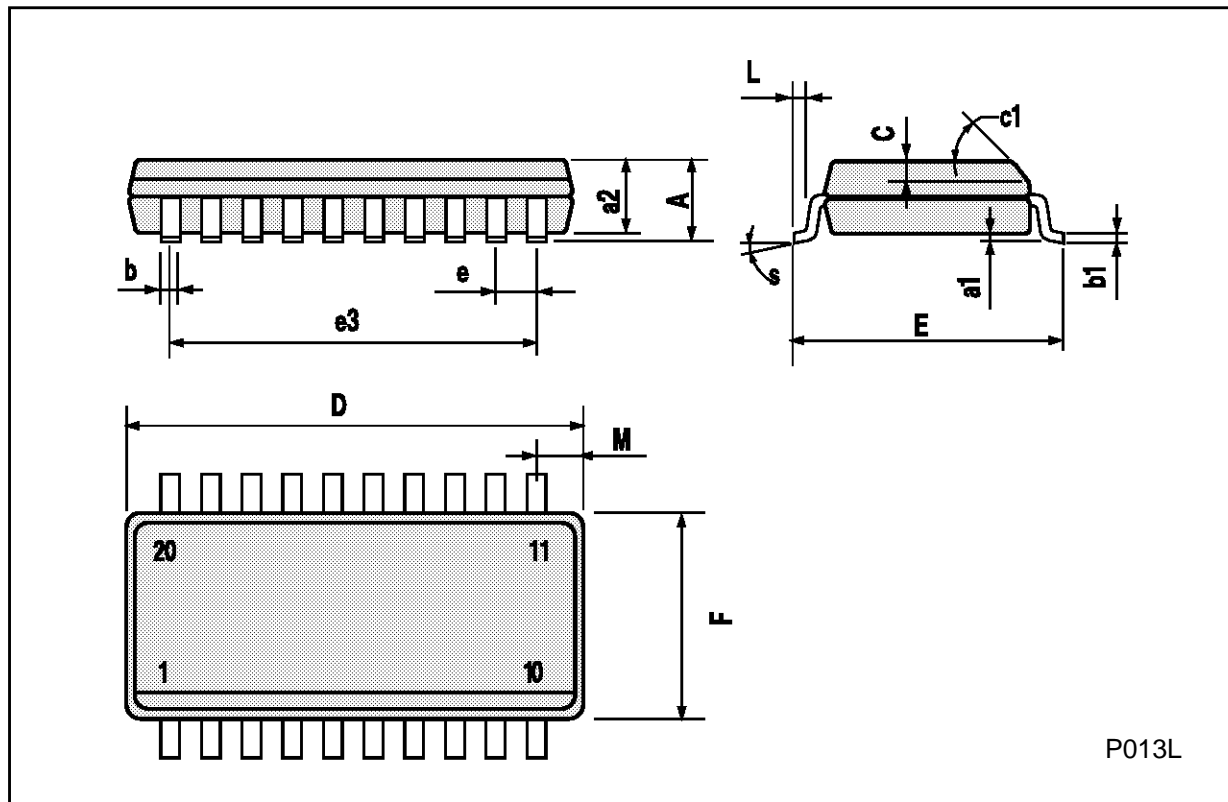
| DIM. | mm | | | inch | | |
|------|-----------------------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 25 | | | 0.984 |
| B | | | 7.8 | | | 0.307 |
| D | | 3.3 | | | 0.130 | |
| E | 0.5 | | 1.78 | 0.020 | | 0.070 |
| e3 | | 22.86 | | | 0.900 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 0.016 | | 0.022 |
| I | 1.27 | | 1.52 | 0.050 | | 0.060 |
| L | 0.22 | | 0.31 | 0.009 | | 0.012 |
| M | 0.51 | | 1.27 | 0.020 | | 0.050 |
| N1 | 4° (min.), 15° (max.) | | | | | |
| P | 7.9 | | 8.13 | 0.311 | | 0.320 |
| Q | | | 5.71 | | | 0.225 |



P057H

SO20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.10 | | 0.20 | 0.004 | | 0.007 |
| a2 | | | 2.45 | | | 0.096 |
| b | 0.35 | | 0.49 | 0.013 | | 0.019 |
| b1 | 0.23 | | 0.32 | 0.009 | | 0.012 |
| C | | 0.50 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 12.60 | | 13.00 | 0.496 | | 0.512 |
| E | 10.00 | | 10.65 | 0.393 | | 0.419 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 11.43 | | | 0.450 | |
| F | 7.40 | | 7.60 | 0.291 | | 0.299 |
| L | 0.50 | | 1.27 | 0.19 | | 0.050 |
| M | | | 0.75 | | | 0.029 |
| S | 8° (max.) | | | | | |



PLCC20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 9.78 | | 10.03 | 0.385 | | 0.395 |
| B | 8.89 | | 9.04 | 0.350 | | 0.356 |
| D | 4.2 | | 4.57 | 0.165 | | 0.180 |
| d1 | | 2.54 | | | 0.100 | |
| d2 | | 0.56 | | | 0.022 | |
| E | 7.37 | | 8.38 | 0.290 | | 0.330 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 5.08 | | | 0.200 | |
| F | | 0.38 | | | 0.015 | |
| G | | | 0.101 | | | 0.004 |
| M | | 1.27 | | | 0.050 | |
| M1 | | 1.14 | | | 0.045 | |



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