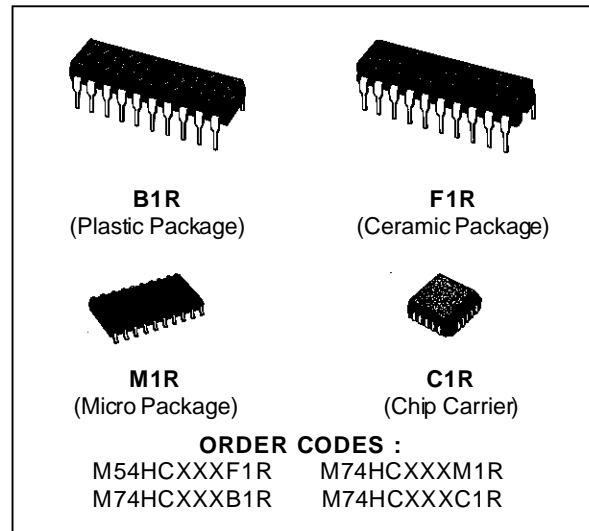


OCTAL D-TYPE FLIP FLOP WITH 3 STATE OUTPUT
HC374 NON INVERTING - HC534 INVERTING

- HIGH SPEED
f_{MAX} = 77 MHz (TYP.) AT V_{CC} = 5 V
- LOW POWER DISSIPATION
I_{CC} = 4 μA (MAX.) AT T_A = 25 °C
- HIGH NOISE IMMUNITY
V_{NIH} = V_{NIL} = 28 % V_{CC} (MIN)
- OUTPUT DRIVE CAPABILITY
15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
I_{OL} = |I_{OH}| = 6 mA (MIN.)
- BALANCED PROPAGATION DELAYS
t_{PLH} = t_{PHL}
- WIDE OPERATING VOLTAGE RANGE
V_{CC} (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE
WITH 54/74LS374/534



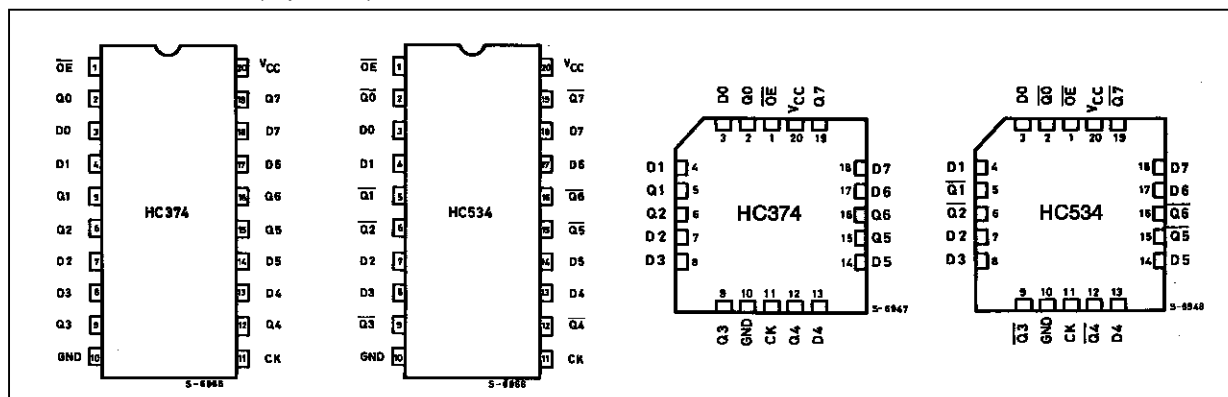
DESCRIPTION

The M54/74HC374, M54/74HC534, are high speed CMOS OCTAL D-TYPE FLIP FLOP WITH 3-STATE OUTPUTS fabricated with in silicon gate C²MOS technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption. These 8-bit D-type flip-flops are controlled by a clock input (CK) and an output enable input (\overline{OE}). On the positive transition of the clock, the Q outputs will be set to the logic state that were setup at the D inputs (HC374) or their complements (HC534).

While the \overline{OE} input is low, 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 output control does not affect the internal operation of flip-flops. That is, the old data can be retained or the new data can be entered even while the outputs are off. The application engineer has a choice of combination of inverting and non-inverting outputs. The HC374 and HC574 are identical, apart from pin layout. The 3-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 CONNECTION (top view)



INPUT AND OUTPUT EQUIVALENT CIRCUIT



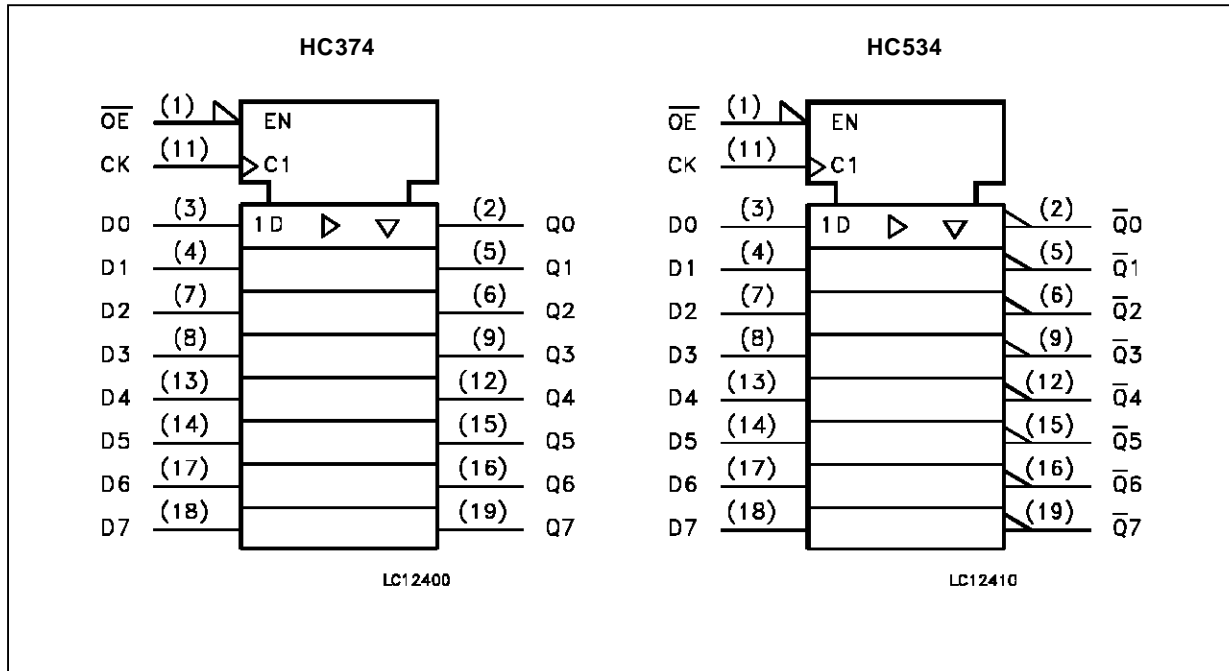
PIN DESCRIPTION (HC374)

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

PIN DESCRIPTION (HC534)

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

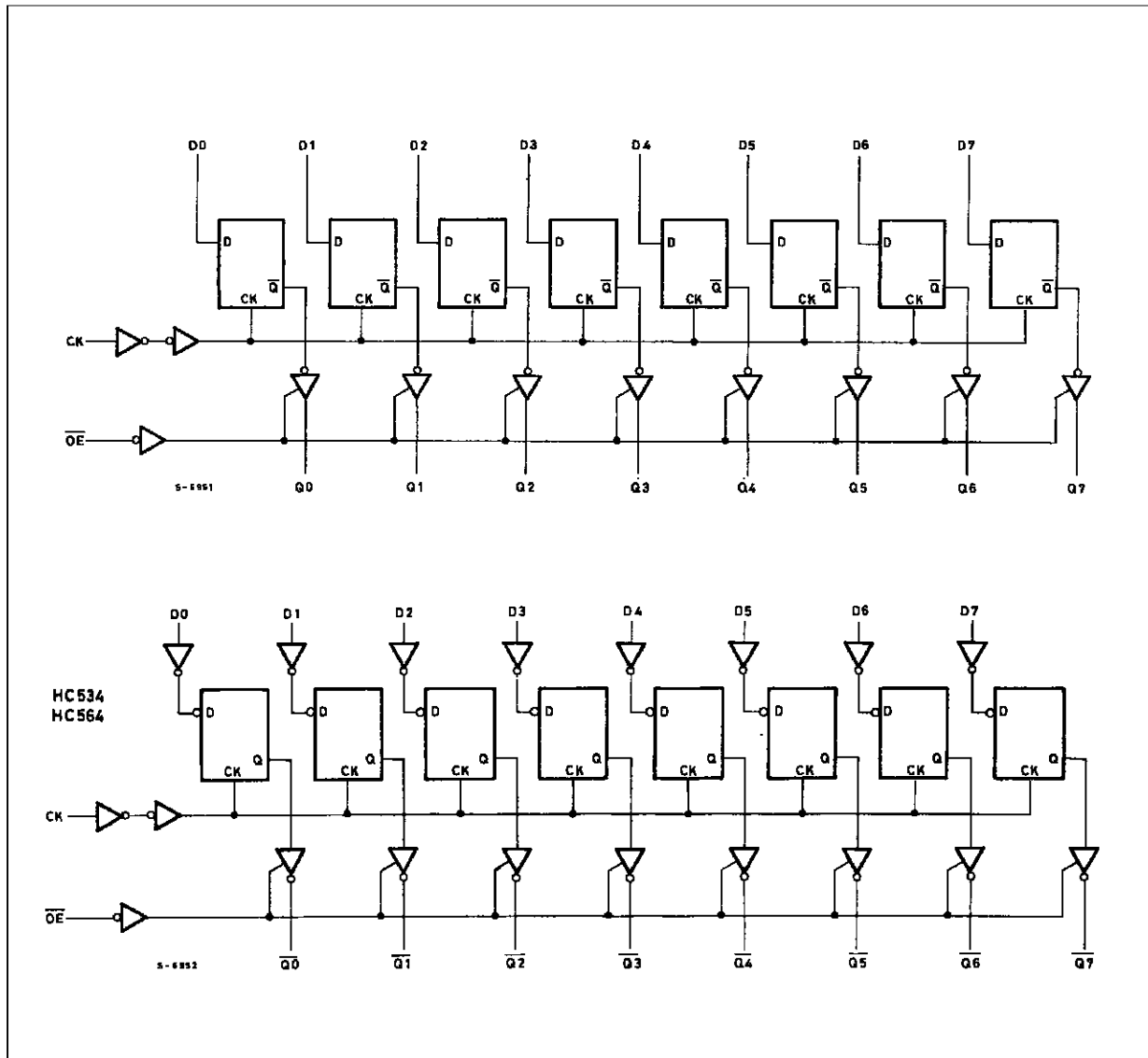
IEC LOGIC SYMBOLS



TRUTH TABLE

| INPUTS | | | OUTPUTS | |
|--------|--------------|---|-----------|-------------------|
| OE | CK | D | Q (HC374) | \bar{Q} (HC534) |
| H | X | X | Z | Z |
| L | \downarrow | X | NO CHANGE | NO CHANGE |
| L | \uparrow | L | L | H |
| L | \uparrow | H | H | L |

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 condition 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 | |

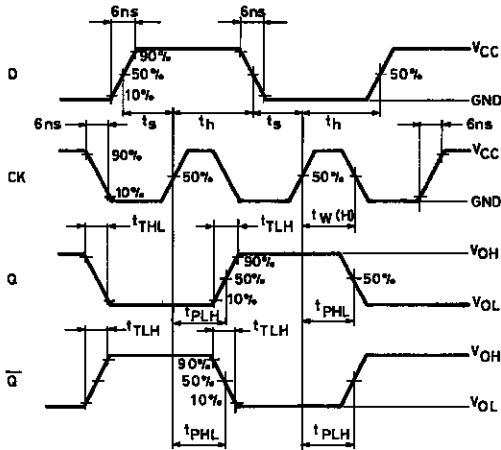
AC ELECTRICAL CHARACTERISTICS ($C_L = 50 \text{ pF}$, Input $t_r = t_f = 6 \text{ ns}$)

| 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 (CLOCK - Q, \bar{Q}) | 2.0 | 50 | | | 45 | 140 | | 175 | | 210 | ns |
| | | 4.5 | | | | 15 | 28 | | 35 | | 42 | |
| | | 6.0 | | | | 13 | 24 | | 30 | | 36 | |
| | | 2.0 | 150 | | | 60 | 190 | | 240 | | 285 | ns |
| | | 4.5 | | | | 20 | 38 | | 48 | | 57 | |
| | | 6.0 | | | | 17 | 32 | | 41 | | 48 | |
| t _{PLZ} t _{PHZ} | 3 State Output Enable Time | 2.0 | 50 | R _L = 1 KΩ | | 39 | 135 | | 170 | | 205 | ns |
| | | 4.5 | | | | 13 | 27 | | 34 | | 41 | |
| | | 6.0 | | | | 11 | 23 | | 29 | | 35 | |
| | | 2.0 | 150 | R _L = 1 KΩ | | 54 | 185 | | 230 | | 280 | ns |
| | | 4.5 | | | | 18 | 37 | | 46 | | 56 | |
| | | 6.0 | | | | 15 | 31 | | 39 | | 48 | |
| f _{MAX} | Maximum CLock Frequency | 2.0 | 50 | | 6.2 | 18 | | 5 | | 4.2 | | ns |
| | | 4.5 | | | 31 | 75 | | 25 | | 21 | | |
| | | 6.0 | | | 37 | 90 | | 30 | | 25 | | |
| t _{w(L)} t _{w(H)} | Minimum Pulse Width (CLOCK) | 2.0 | 50 | | | 15 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | | 6 | 15 | | 19 | | 22 | |
| | | 6.0 | | | | 6 | 13 | | 16 | | 19 | |
| t _s | Minimum Set-up Time | 2.0 | 50 | | | 25 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | | 6 | 15 | | 19 | | 22 | |
| | | 6.0 | | | | 4 | 13 | | 16 | | 19 | |
| t _h | Minimum Hold Time | 2.0 | 50 | | | | 0 | | 0 | | 0 | ns |
| | | 4.5 | | | | | 0 | | 0 | | 0 | |
| | | 6.0 | | | | | 0 | | 0 | | 0 | |
| C _{IN} | Input Capacitance | | | | | 5 | 10 | | 10 | | 10 | pF |
| C _{OUT} | Out put Capacitance | | | | | 10 | | | | | | pF |
| C _{PD} (*) | Power Dissipation Capacitance | | | | | 47 | | | | | | 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 FLIP-FLOP) and C_{PD} when N pcs of FLIP-FLOP operate, can be gained by following equation: C_{PD} (TOTAL) = 30 + 17 x N (pF)

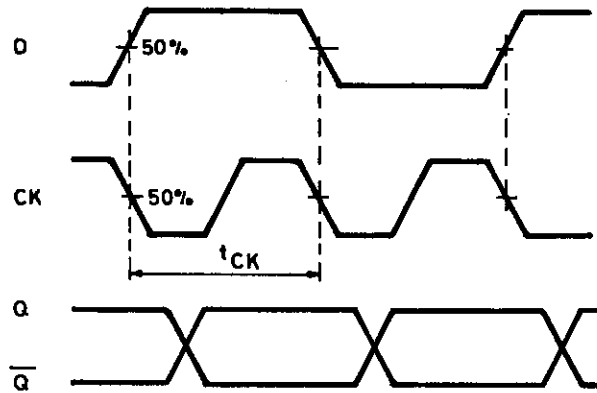
SWITCHING CHARACTERISTICS TEST WAVEFORM

t_{PLH} , t_{PHL} , t_s , t_h , t_w



S-10450

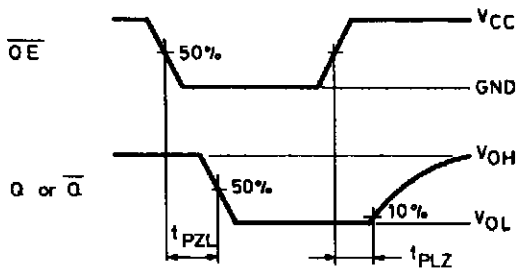
f_{MAX}



S-10451

t_{PLZ} , t_{PZL}

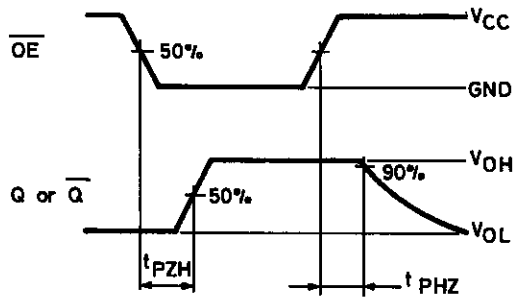
The 1KΩ load resistors should be connected between outputs and VCC line and the 50pF load capacitors should be connected between outputs and GND line. All inputs except OE input should be connected to VCC line or GND line such that outputs will be in low logic level while OE input is held low.



S-10429

t_{PHZ} , t_{PZH}

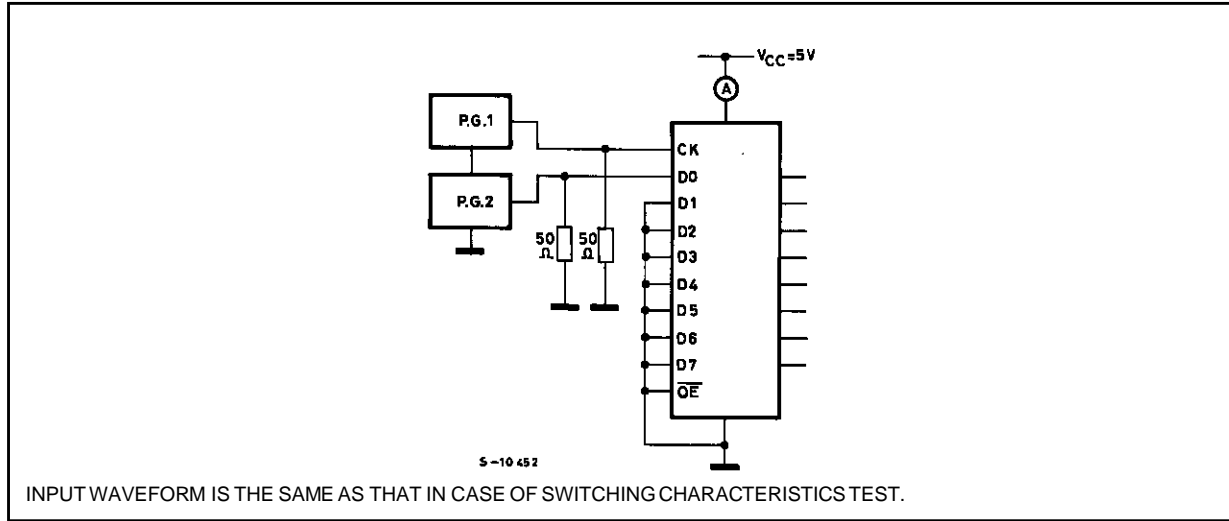
The 1KΩ load resistors and the 50pF load capacitors should be connected between each output and GND line. All inputs except OE input should be connected to VCC or GND line such that output will be in high logic level while OE input is held low.



S-10430

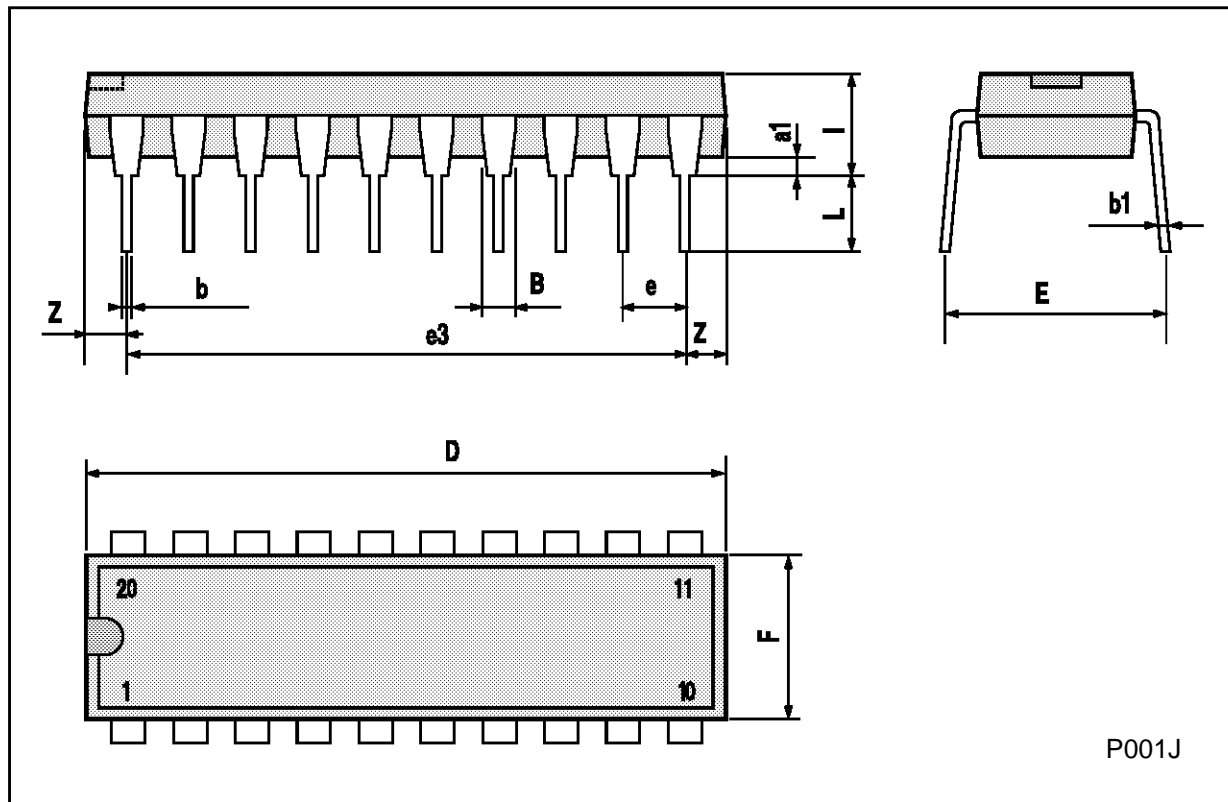
M54/M74HC374/534

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 |



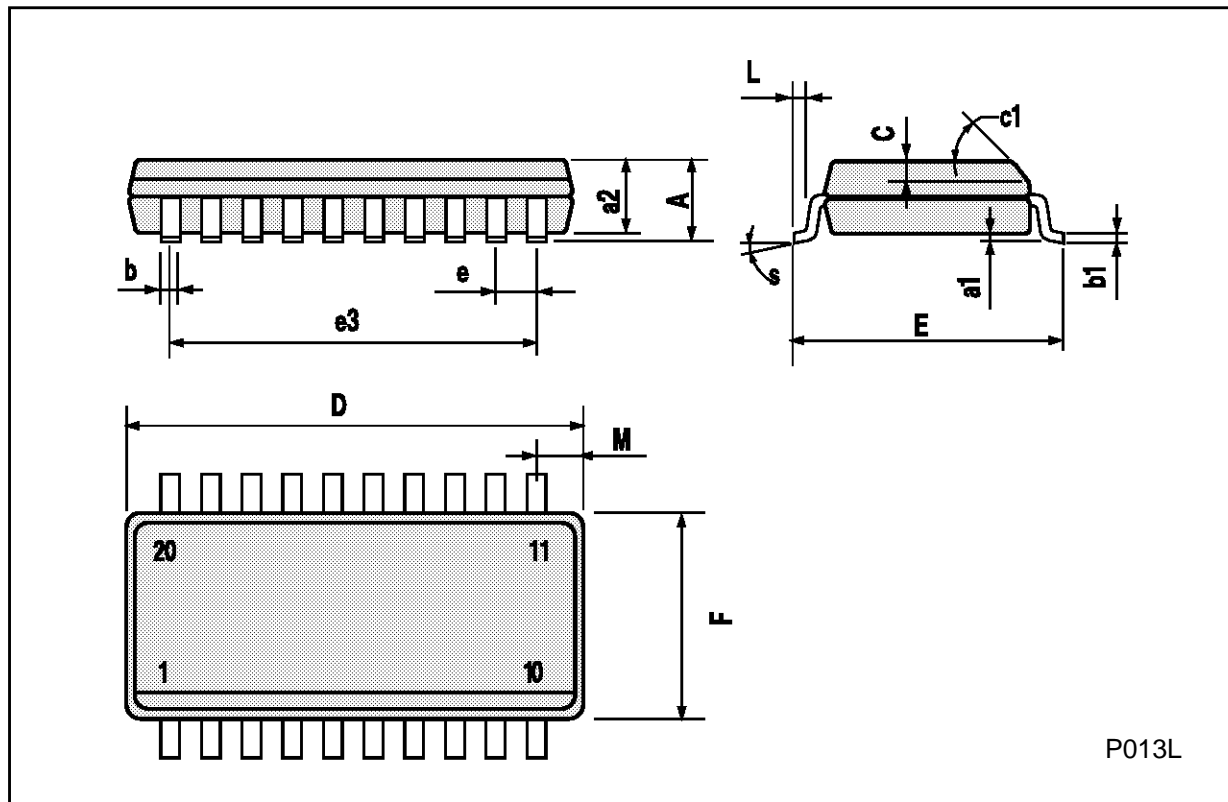
Ceramic DIP20 MECHANICAL DATA

| 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 |



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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