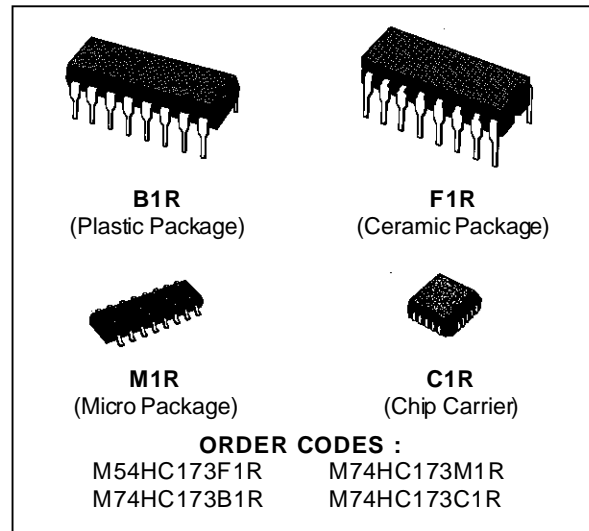


QUAD D-TYPE REGISTER (3-STATE)

- HIGH SPEED
 $f_{MAX} = 73 \text{ MHz (TYP.) at } V_{CC} = 5 \text{ V}$
- 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
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.)}$
- 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
 54/74LS 173



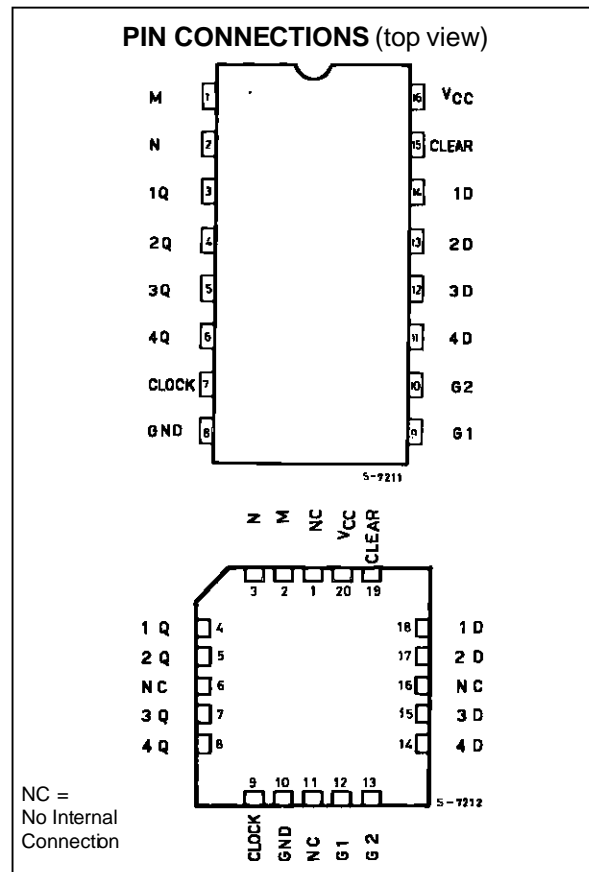
DESCRIPTION

The M54/74HC173 is a high speed CMOS QUAD D-TYPE REGISTER (3-STATE) fabricated in silicon gate C²MOS technology.

It has the same high speed performance of LSTTL combined with true CMOS low power consumption. This device is composed of a four-bit register including D-type flip-flops and 3-state buffers. The four flip-flops are controlled by a common clock input (CLOCK) and a common reset input (CLEAR). Signals applied to the data inputs (D₁-D₄) are stored at the respective flip-flops on the positive going transition of the clock input, only when both clock control inputs (G₁ and G₂) are held low.

The reset feature is asynchronous and active high. The stored data are provided on each output only when both output control inputs (M and N) are held low, otherwise the outputs go to the high-impedance state.

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



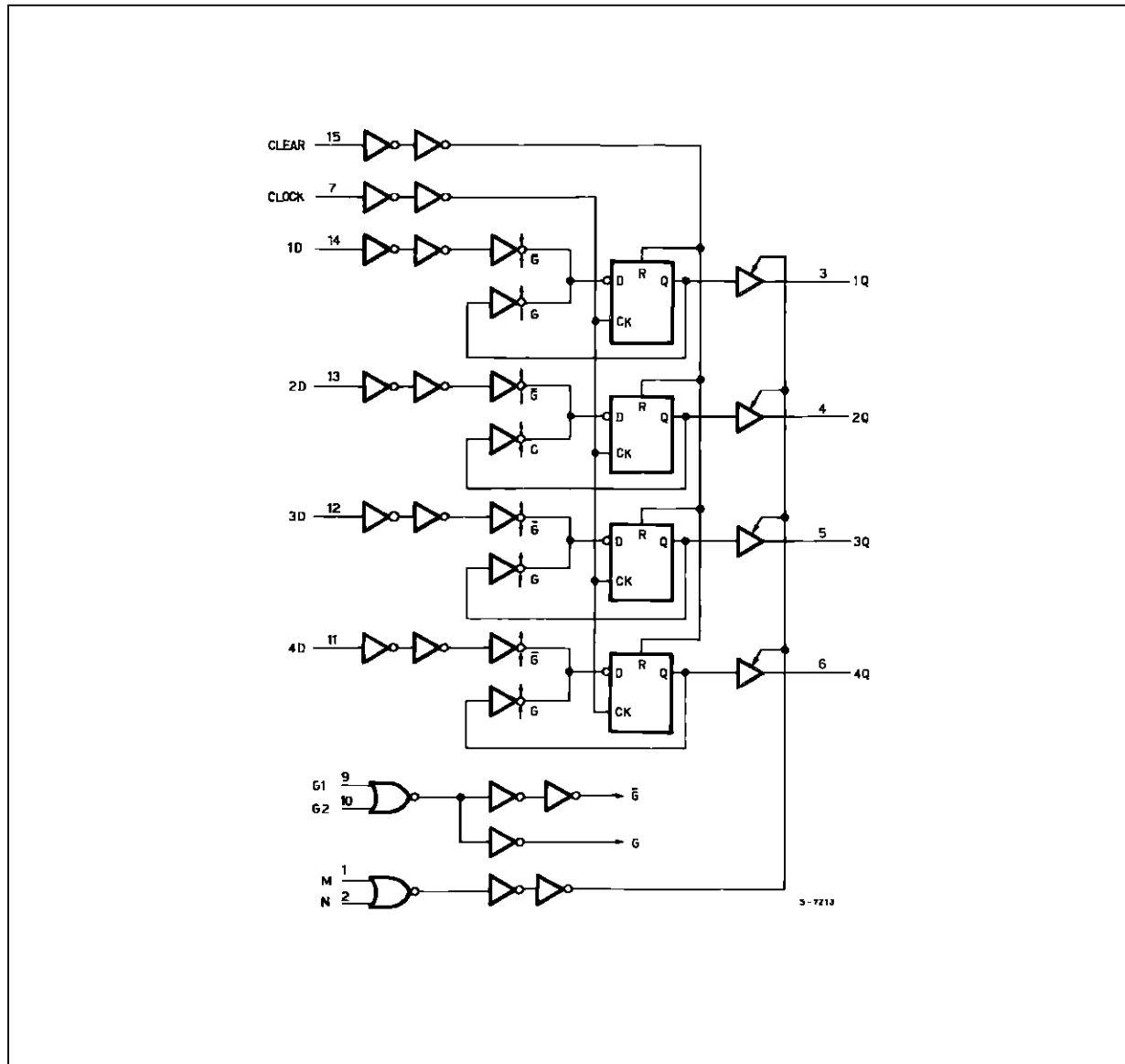
M54/M74HC173

TRUTH TABLE

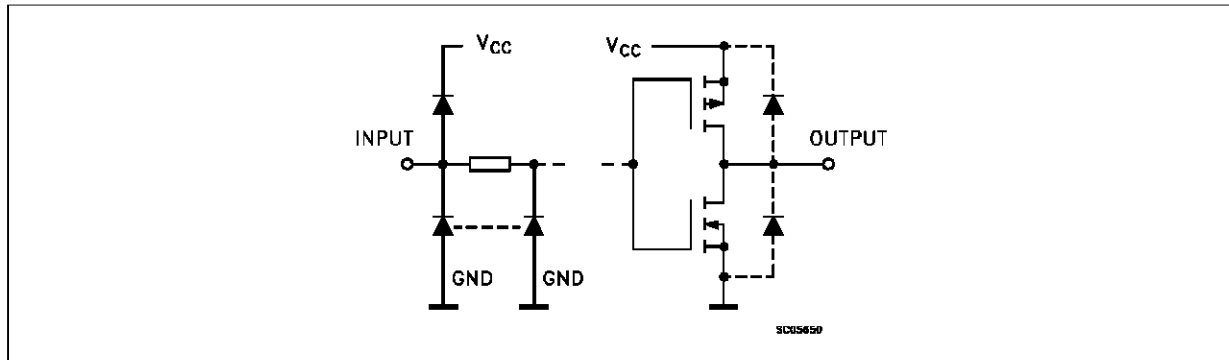
| CLEAR | CLOCK | DATA ENABLE | | Dn | OUTPUT CONTROL | | Qn |
|-------|-------|-------------|----|----|----------------|---|----|
| | | G1 | G2 | | M | N | |
| X | X | X | X | X | H | X | Z |
| X | X | X | X | X | X | H | Z |
| H | X | X | X | X | L | L | L |
| L | | X | X | X | L | L | Q0 |
| L | | H | X | X | L | L | Q0 |
| L | | X | H | X | L | L | Q0 |
| L | | L | L | H | L | L | H |
| L | | L | L | L | L | L | L |

X: Don't Care Z: High Impedance

LOGIC DIAGRAM



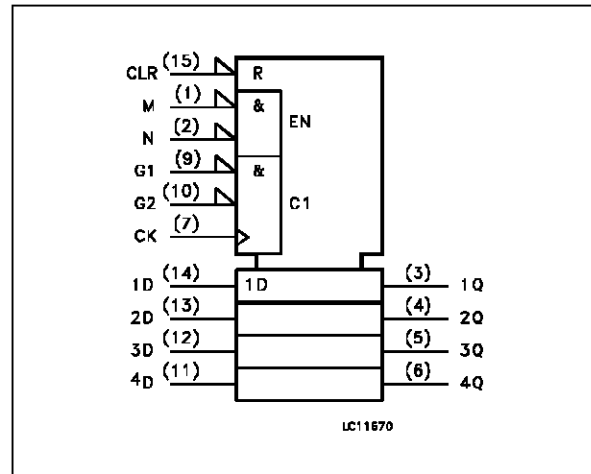
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|----------------|----------|---|
| 1, 2 | M, N | Output Enable Input (Active LOW) |
| 3, 4, 5, 6 | 1Q to 4Q | 3-State Flip-flop Outputs |
| 7 | CLOCK | Clock Input (LOW to HIGH, Edge-triggered) |
| 9, 10 | G1, G2 | Data Enable Inputs (Active LOW) |
| 14, 13, 12, 11 | 1D to 4D | Data Inputs |
| 15 | CLEAR | Asynchronous Master Reset (Active HIGH) |
| 8 | GND | Ground (0V) |
| 16 | Vcc | Positive Supply Voltage |

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATING

| 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

M54/M74HC173

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 M74HC Series | -55 to +125 -40 to +85 | °C °C | |
| t_r, t_f | Input Rise and Fall Time | $V_{CC} = 2\text{ V}$ | 0 to 1000 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 0 to 500 | |
| | | $V_{CC} = 6\text{ V}$ | 0 to 400 | |

DC SPECIFICATIONS

| Symbol | Parameter | Test Conditions | | Value | | | | | | Unit | | |
|----------|----------------------------------|---------------------------------|---|---------------------------------------|------|---------------|--------------------------------------|-----------|---------------------------------------|----------|---------------|------|
| | | | | $T_A = 25\text{ °C}$ 54HC and 74HC | | | $-40\text{ to }85\text{ °C}$ 74HC | | $-55\text{ to }125\text{ °C}$ 54HC | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. | |
| V_{IH} | High Level Input Voltage | 2.0 4.5 6.0 | | 1.5 | | | 1.5 | | 1.5 | | V | |
| | | | | 3.15 | | | 3.15 | | 3.15 | | | |
| | | | | 4.2 | | | 4.2 | | 4.2 | | | |
| V_{IL} | Low Level Input Voltage | 2.0 4.5 6.0 | | | | 0.5 | | 0.5 | | 0.5 | V | |
| | | | | | | 1.35 | | 1.35 | | 1.35 | | |
| | | | | | | 1.8 | | 1.8 | | 1.8 | | |
| V_{OH} | High Level Output Voltage | 2.0 4.5 6.0 4.5 6.0 | $V_I = V_{IH}$ or V_{IL} | $I_O = -20\text{ }\mu\text{A}$ | 1.9 | 2.0 | | 1.9 | | 1.9 | V | |
| | | | | | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | | | | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | | | 4.18 | 4.31 | | 4.13 | | 4.10 | | | |
| | | | | | | 5.68 | 5.8 | | 5.63 | | | 5.60 |
| V_{OL} | Low Level Output Voltage | 2.0 4.5 6.0 4.5 6.0 | $V_I = V_{IH}$ or V_{IL} | $I_O = 20\text{ }\mu\text{A}$ | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | | | 0.17 | 0.26 | | 0.37 | | 0.40 | | | |
| | | | | | | 0.18 | 0.26 | | 0.37 | | 0.40 | |
| 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 ($C_L = 50$ pF, Input $t_r = t_f = 6$ 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) | 2.0 | 50 | | 50 | 115 | | 145 | | 175 | ns | |
| | | 4.5 | | | 14 | 23 | | 29 | | 35 | | |
| | | 6.0 | | | 12 | 20 | | 25 | | 30 | | |
| | | 2.0 | 150 | | 65 | 145 | | 180 | | 220 | ns | |
| | | 4.5 | | | 18 | 29 | | 36 | | 44 | | |
| | | 6.0 | | | 15 | 25 | | 31 | | 37 | | |
| t _{PLH} t _{PHL} | Propagation Delay Time (CLEAR - Q) | 2.0 | 50 | | 50 | 115 | | 145 | | 175 | ns | |
| | | 4.5 | | | 14 | 23 | | 29 | | 35 | | |
| | | 6.0 | | | 12 | 20 | | 25 | | 30 | | |
| | | 2.0 | 150 | | 65 | 145 | | 180 | | 220 | ns | |
| | | 4.5 | | | 18 | 29 | | 36 | | 44 | | |
| | | 6.0 | | | 15 | 25 | | 31 | | 37 | | |
| f _{MAX} | Maximum Clock Frequency | 2.0 | 50 | | 8.6 | 20 | | 6.8 | | 5.8 | MHz | |
| | | 4.5 | | | 43 | 67 | | 34 | | 29 | | |
| | | 6.0 | | | 51 | 84 | | 40 | | 34 | | |
| t _{PZL} t _{PZH} | Output Enable Time | 2.0 | 50 | R _L = 1KΩ | | 50 | 115 | | 145 | | 175 | ns |
| | | 4.5 | | | 14 | 23 | | 29 | | 35 | | |
| | | 6.0 | | | 12 | 20 | | 25 | | 30 | | |
| | | 2.0 | 150 | R _L = 1KΩ | | 65 | 145 | | 180 | | 220 | ns |
| | | 4.5 | | | 18 | 29 | | 36 | | 44 | | |
| | | 6.0 | | | 15 | 25 | | 31 | | 37 | | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 2.0 | 50 | R _L = 1KΩ | | 36 | 105 | | 130 | | 160 | ns |
| | | 4.5 | | | 15 | 21 | | 26 | | 32 | | |
| | | 6.0 | | | 13 | 18 | | 22 | | 27 | | |
| t _{W(H)} t _{W(L)} | Minimum Pulse Width (CLOCK) | 2.0 | 50 | | | 16 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 4 | 15 | | 19 | | 22 | | |
| | | 6.0 | | | 3 | 13 | | 16 | | 19 | | |
| t _{W(L)} | Minimum Pulse Width (CLEAR) | 2.0 | 50 | | | 16 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 4 | 15 | | 19 | | 22 | | |
| | | 6.0 | | | 3 | 13 | | 16 | | 19 | | |
| t _s | Minimum Set-up Time (G1, G2) | 2.0 | 50 | | | 40 | 100 | | 125 | | 150 | ns |
| | | 4.5 | | | 10 | 20 | | 25 | | 30 | | |
| | | 6.0 | | | 9 | 17 | | 21 | | 26 | | |
| t _s | Minimum Set-up Time (D) | 2.0 | 50 | | | 24 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 6 | 15 | | 19 | | 22 | | |
| | | 6.0 | | | 5 | 13 | | 16 | | 19 | | |
| t _h | Minimum Hold Time (G1, G2, D) | 2.0 | 50 | | | 0 | | | 0 | | 0 | ns |
| | | 4.5 | | | 0 | | | 0 | | 0 | | |
| | | 6.0 | | | 0 | | | 0 | | 0 | | |

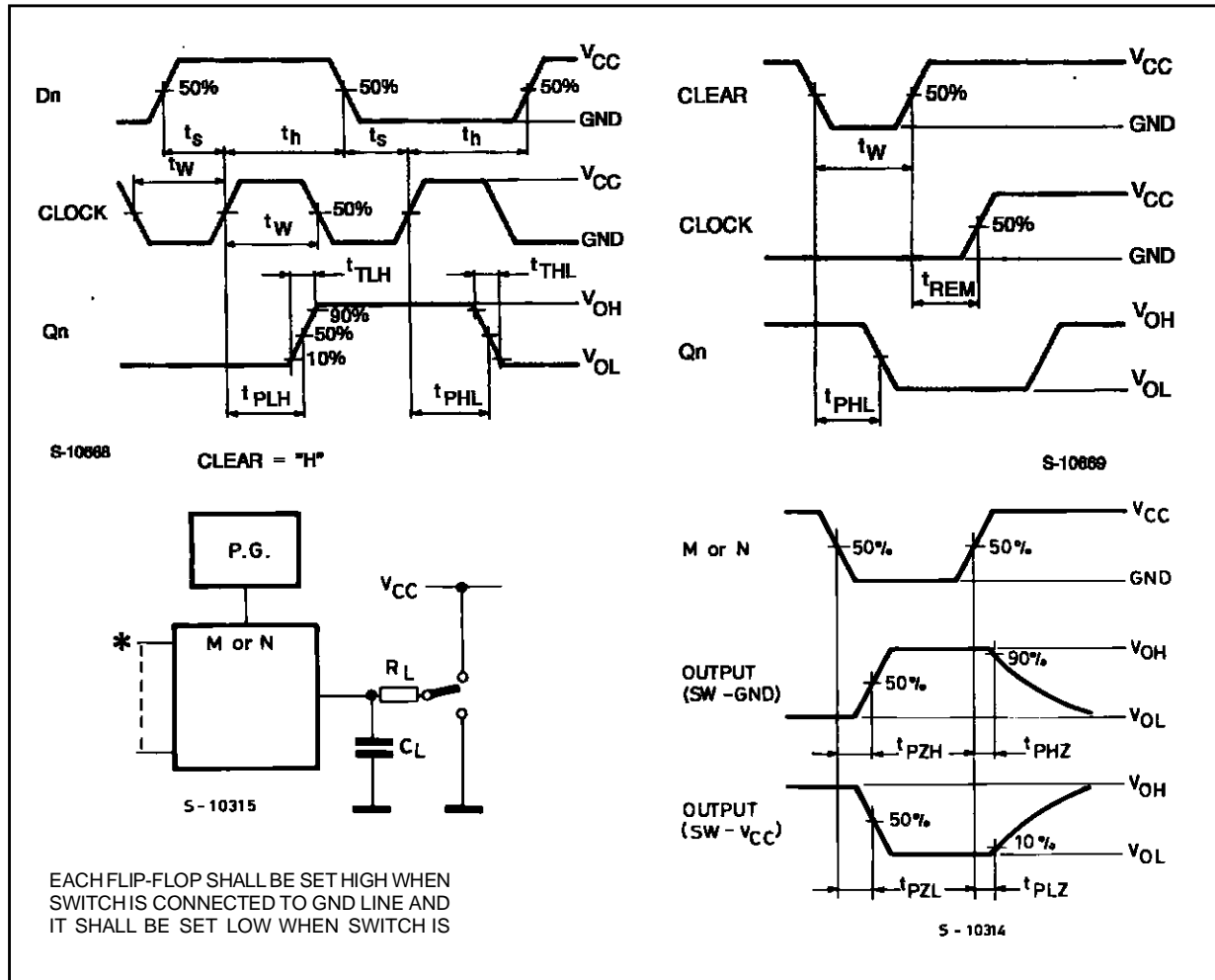
M54/M74HC173

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

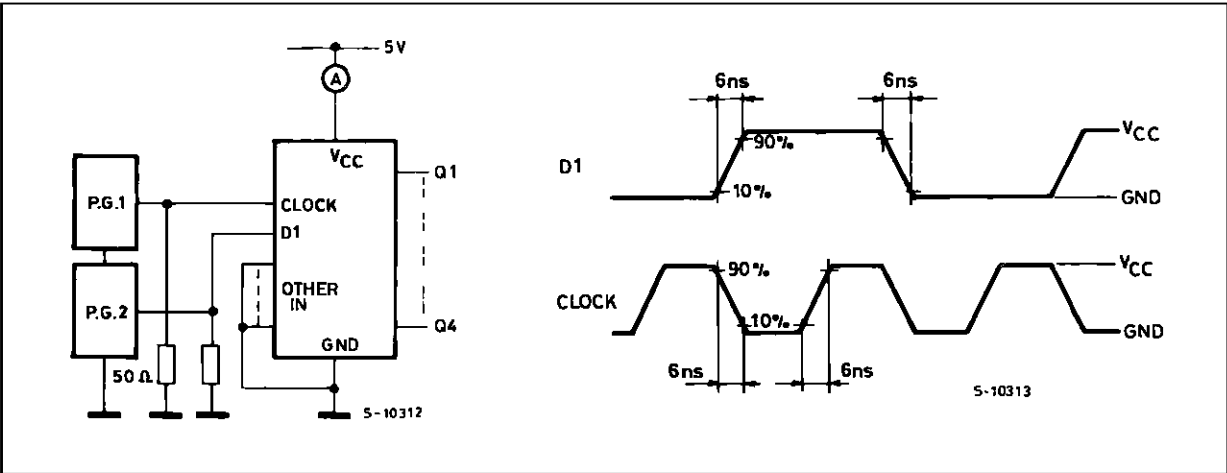
| Symbol | Parameter | Test Conditions | | | Value | | | | | | Unit | |
|---------------------|-------------------------------|---------------------|---------------------|--|---|------|------|----------------------|------|-----------------------|------|------|
| | | V _{CC} (V) | C _L (pF) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t _{REM} | Minimum Removal 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 _{PD} (*) | Power Dissipation Capacitance | | | | 50 | | | | | | 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} • V_{CC} • f_{IN} + I_{CC}/4 (per circuit)

SWITCHING CHARACTERISTICS TEST WAVEFORM



TEST CIRCUIT I_{CC} (Opr.)



Plastic DIP16 (0.25) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |



P001C

Ceramic DIP16/1 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 20 | | | 0.787 |
| B | | | 7 | | | 0.276 |
| D | | 3.3 | | | 0.130 | |
| E | 0.38 | | | 0.015 | | |
| e3 | | 17.78 | | | 0.700 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 0.016 | | 0.022 |
| H | 1.17 | | 1.52 | 0.046 | | 0.060 |
| L | 0.22 | | 0.31 | 0.009 | | 0.012 |
| M | 0.51 | | 1.27 | 0.020 | | 0.050 |
| N | | | 10.3 | | | 0.406 |
| P | 7.8 | | 8.05 | 0.307 | | 0.317 |
| Q | | | 5.08 | | | 0.200 |



SO16 (Narrow) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



P013H

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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