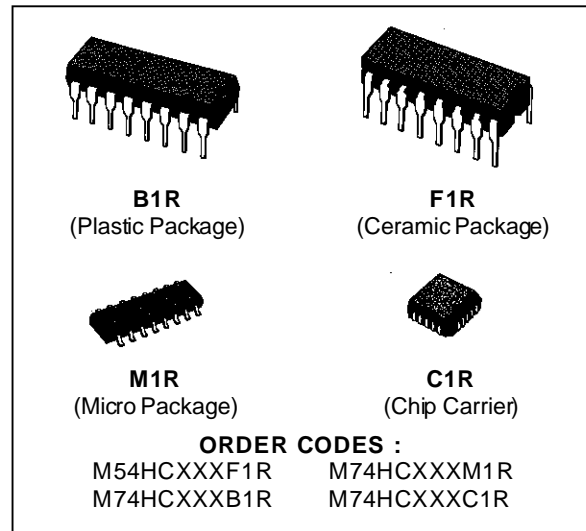


## HC352: DUAL 4 CHANNEL MULTIPLEXER(INV.)

## HC353: DUAL 4 CHANNEL MULTIPLEXER 3 STATE OUTPUT(INV.)

- HIGH SPEED  
 $t_{PD} = 12 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25 \text{ }^\circ\text{C}$
- OUTPUT DRIVE CAPABILITY  
 10 LSTTL LOADS
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- SYMMETRICAL OUTPUT IMPEDANCE  
 $I_{OL} = |I_{OH}| = 4 \text{ mA (MIN.)}$
- HIGH NOISE IMMUNITY  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- WIDE OPERATING VOLTAGE RANGE  
 $V_{CC} \text{ (OPR)} = 2 \text{ V TO } 6 \text{ V}$
- PIN AND FUNCTION COMPATIBLE  
 WITH 54/74LS352/353



### DESCRIPTION

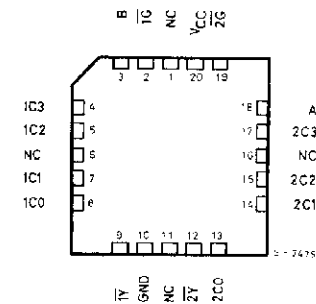
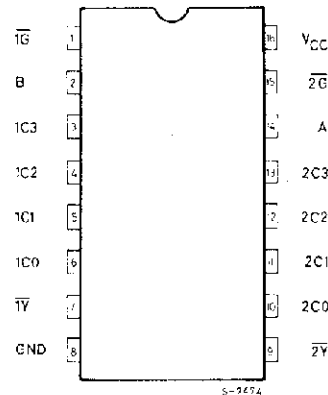
The M54/74HC352 and M54/74HC353 are high speed CMOS DUAL 4 CHANNEL MULTIPLEXERS INVERTING fabricated with silicon gate C<sup>2</sup>MOS technology.

Both achieve high speed operation, similar to equivalent LSTTL while maintaining the CMOS low power dissipation. The designer has a choice of complementary output (HC352) and 3 state output (HC353). Each of these data (1C0-1C3, 2C0-2C3) is selected by the two address inputs A and B.

Separate strobe inputs ( $1\bar{G}$ ,  $2\bar{G}$ ) are provided for each of the two four line sections. Taking the strobe input ( $1\bar{G}$ ,  $2\bar{G}$ ) high inhibits the outputs. The output of HC352 is fixed at logic low level and the output of HC353 has a high impedance, unconditionally.

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

### PIN CONNECTIONS (top view)



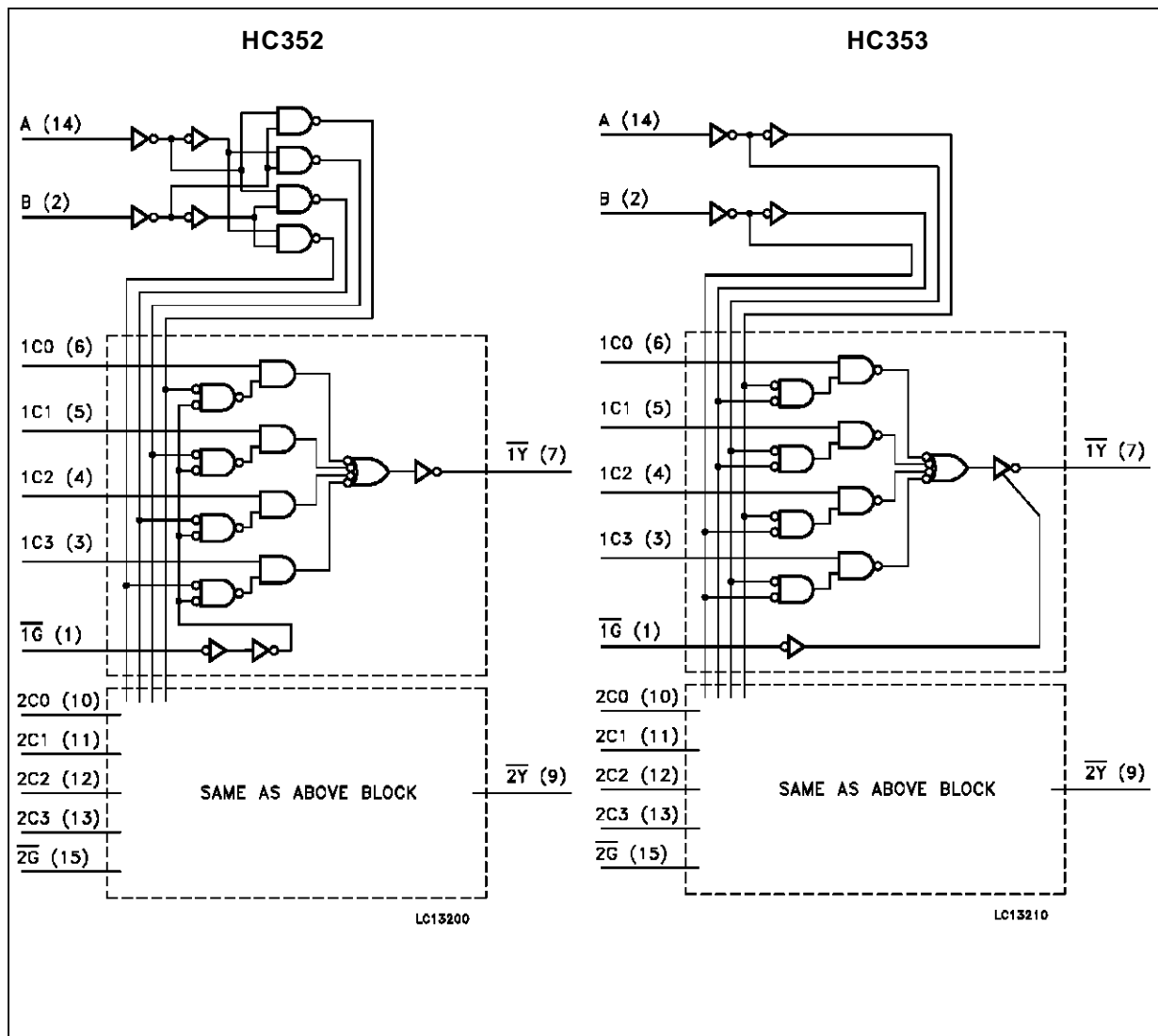
# M54/M74HC352/353

## TRUTH TABLE

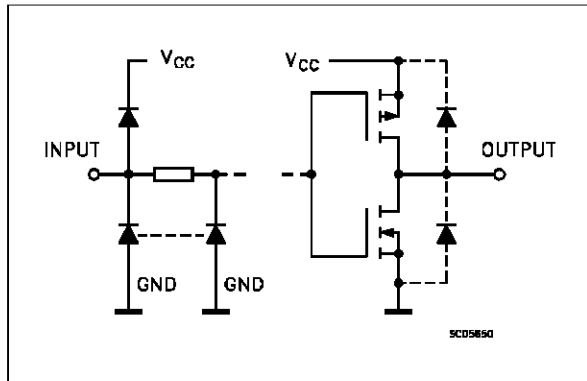
| SELECT INPUTS |   | DATA INPUTS    |                |                |                | STROBE | OUTPUT $\bar{Y}$ |       |
|---------------|---|----------------|----------------|----------------|----------------|--------|------------------|-------|
| B             | A | C <sub>0</sub> | C <sub>1</sub> | C <sub>2</sub> | C <sub>3</sub> | G      | HC352            | HC353 |
| X             | X | X              | X              | X              | X              | H      | H                | Z     |
| L             | L | L              | X              | X              | X              | L      | H                | H     |
| L             | L | H              | X              | X              | X              | L      | L                | L     |
| L             | H | X              | L              | X              | X              | L      | H                | H     |
| L             | H | X              | H              | X              | X              | L      | L                | L     |
| H             | L | X              | X              | L              | X              | L      | H                | H     |
| H             | L | X              | X              | H              | X              | L      | L                | L     |
| H             | H | X              | X              | X              | L              | L      | H                | H     |
| H             | H | X              | X              | X              | H              | L      | L                | L     |

X: Don't Care  
Z: High Impedance

## LOGIC DIAGRAM



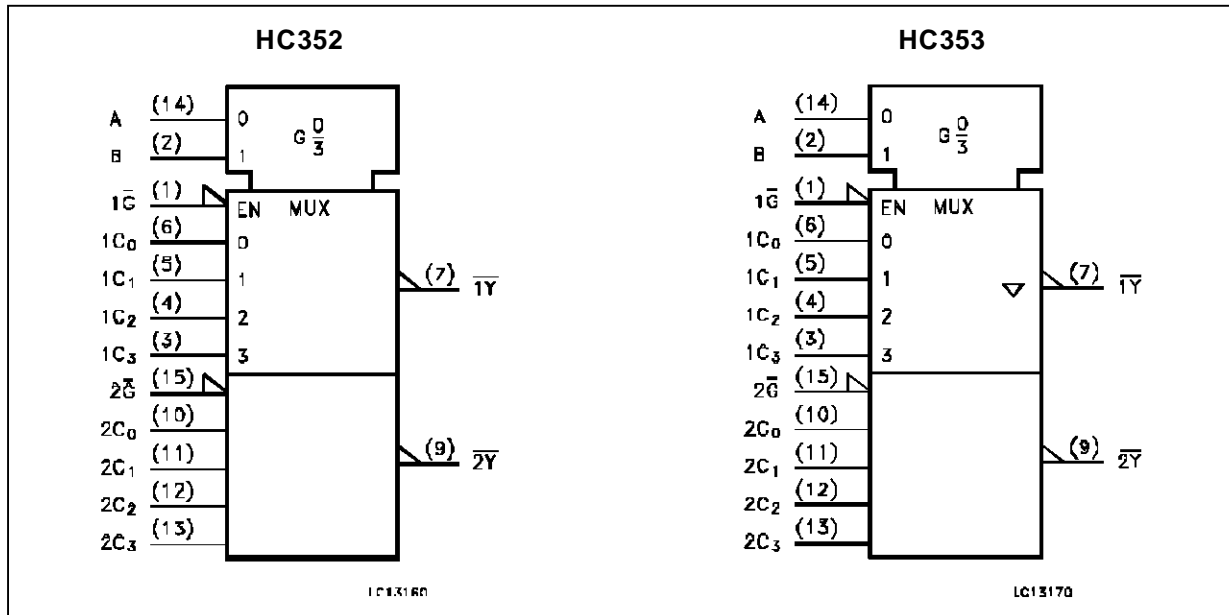
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No         | SYMBOL                             | NAME AND FUNCTION          |
|----------------|------------------------------------|----------------------------|
| 1, 15          | 1G, 2G                             | Output Enable Inputs       |
| 6, 5, 4, 3     | 1C <sub>0</sub> to 1C <sub>3</sub> | Data Input from Source 1   |
| 7              | 1Y                                 | Data Outputs from Source 1 |
| 9              | 2Y                                 | Data Outputs from Source 2 |
| 10, 11, 12, 13 | 2C <sub>0</sub> to 2C <sub>3</sub> | Data Input from Source 2   |
| 14, 2          | A, B                               | Common Data Select Inputs  |
| 8              | GND                                | Ground (0V)                |
| 16             | V <sub>CC</sub>                    | Positive Supply Voltage    |

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

| Symbol                              | Parameter                                    | Value                         | Unit |
|-------------------------------------|--|-------------------------------|------|
| V <sub>CC</sub>                     | Supply Voltage                               | -0.5 to +7                    | V    |
| V <sub>I</sub>                      | DC Input Voltage                             | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| V <sub>O</sub>                      | DC Output Voltage                            | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>                     | DC Input Diode Current                       | ± 20                          | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current                      | ± 20                          | mA   |
| I <sub>O</sub>                      | DC Output Source Sink Current Per Output Pin | ± 25                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current         | ± 50                          | mA   |
| P <sub>D</sub>                      | Power Dissipation                            | 500 (*)                       | mW   |
| T <sub>stg</sub>                    | Storage Temperature                          | -65 to +150                   | °C   |
| T <sub>L</sub>                      | 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/M74HC352/353

### 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: <b>M54HC Series</b><br><b>M74HC Series</b> | -55 to +125<br>-40 to +85 | °C<br>°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

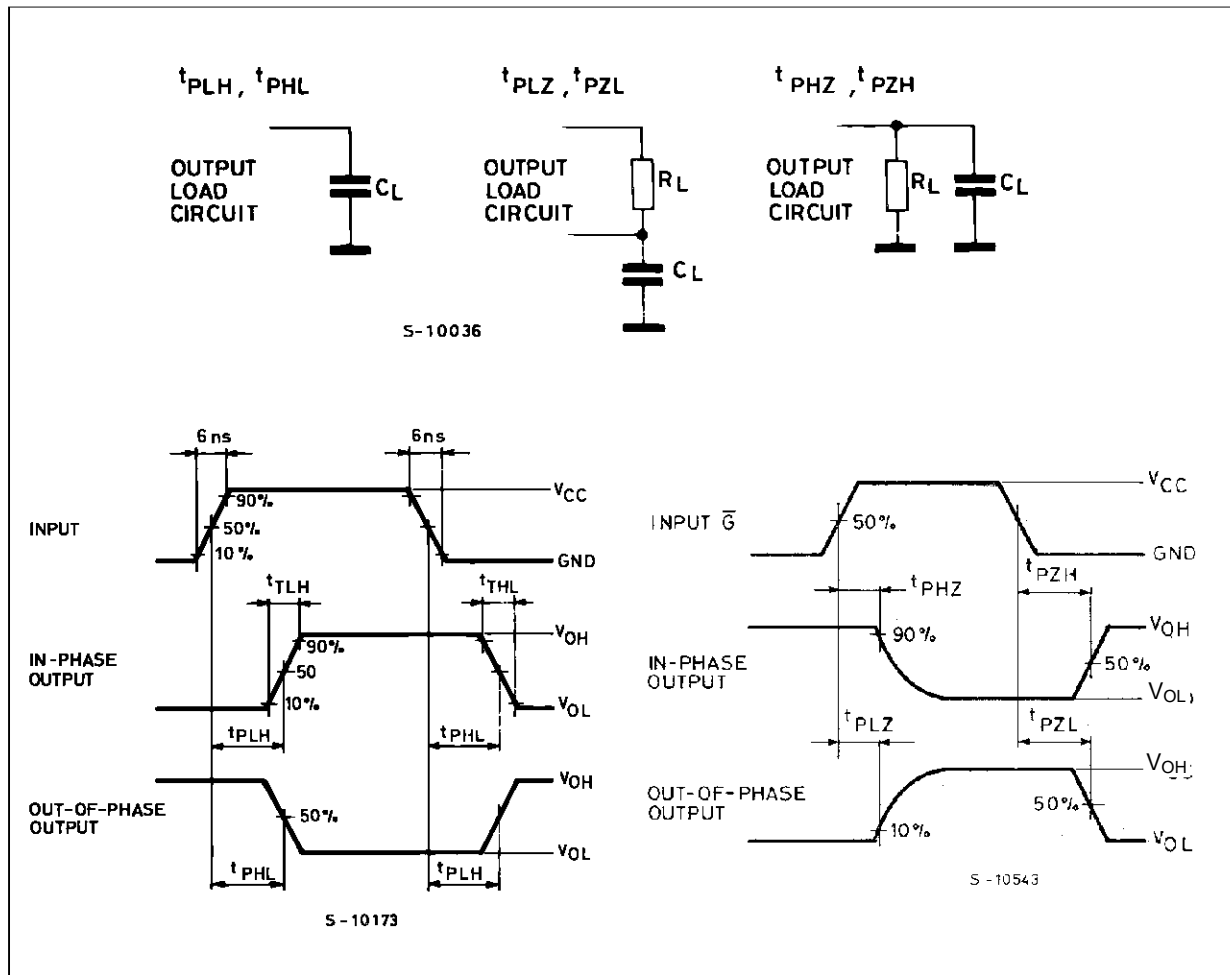
| Symbol   | Parameter                                    | Test Conditions            |   | Value                                 |      |           |                                      |         |                                       | Unit          |               |      |
|----------|--|----------------------------|---|---------------------------------------|------|-----------|--------------------------------------|---------|---------------------------------------|---------------|---------------|------|
|          |  |                            |   | $T_A = 25\text{ °C}$<br>54HC and 74HC |      |           | $-40\text{ to }85\text{ °C}$<br>74HC |         | $-55\text{ to }125\text{ °C}$<br>54HC |               |               |      |
|          |  |                            |   | Min.                                  | Typ. | Max.      | Min.                                 | Max.    | Min.                                  |               | Max.          |      |
| $V_{IH}$ | High Level Input Voltage                     | $V_{CC}$ (V)               |   |                                       |      |           |                                      |         |                                       | V             |               |      |
|          |  | 2.0                        |   |                                       | 1.5  |           |                                      | 1.5     |                                       |               |               |      |
|          |  | 4.5                        |   |                                       | 3.15 |           |                                      | 3.15    |                                       |               |               |      |
| $V_{IL}$ | Low Level Input Voltage                      | 2.0                        |   |                                       |      |           | 0.5                                  |         | 0.5                                   | V             |               |      |
|          |  | 4.5                        |   |                                       |      |           | 1.35                                 |         | 1.35                                  |               |               |      |
|          |  | 6.0                        |   |                                       |      |           | 1.8                                  |         | 1.8                                   |               |               |      |
| $V_{OH}$ | High Level Output Voltage                    | $V_I = V_{IH}$ or $V_{IL}$ | $I_O = -20\text{ }\mu\text{A}$                      | 2.0                                   | 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   | $I_O = -4.0\text{ mA}$                | 4.18 | 4.31      |                                      | 4.13    |                                       | 4.10          |               |      |
|          |  |                            |   |                                       | 6.0  | 5.68      | 5.8                                  |         | 5.63                                  |               |               | 5.60 |
| $V_{OL}$ | Low Level Output Voltage                     | $V_I = V_{IH}$ or $V_{IL}$ | $I_O = 20\text{ }\mu\text{A}$                       | 2.0                                   |      | 0.0       | 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   | $I_O = 4.0\text{ mA}$                 | 0.17 | 0.26      |                                      | 0.33    |                                       | 0.40          |               |      |
|          |  |                            |   |                                       | 6.0  | 0.18      | 0.26                                 |         | 0.33                                  |               |               | 0.40 |
| $I_I$    | Input Leakage Current                        | 6.0                        | $V_I = V_{CC}$ or GND                               |                                       |      | $\pm 0.1$ |                                      | $\pm 1$ |                                       | $\mu\text{A}$ |               |      |
| $I_{OZ}$ | 3 State Output Off State Current (for HC353) | 6.0                        | $V_I = V_{IH}$ or $V_{IL}$<br>$V_O = V_{CC}$ or GND |                                       |      | $\pm 0.5$ |                                      | $\pm 5$ |                                       | $\pm 10$      | $\mu\text{A}$ |      |
| $I_{CC}$ | Quiescent Supply Current                     | 6.0                        | $V_I = V_{CC}$ or GND                               |                                       |      | 4         |                                      | 40      |                                       | 80            | $\mu\text{A}$ |      |

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

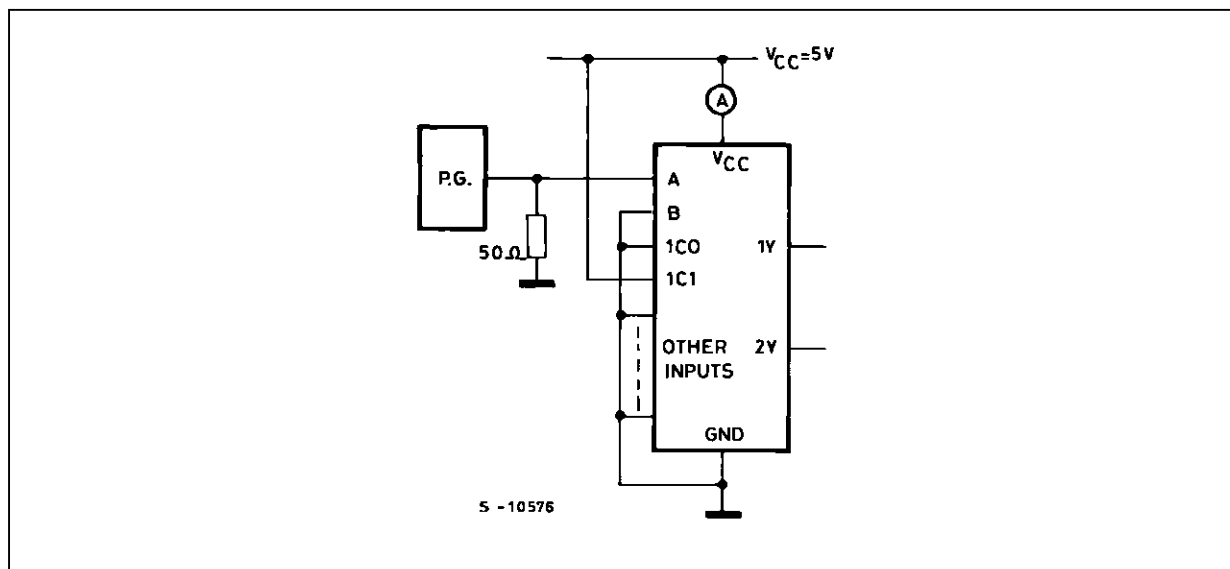
| Symbol                 | Parameter   | Test Conditions |                          | Value   |          |      |   |      |  | Unit |      |
|------------------------|---|-----------------|--------------------------|---|----------|------|---|------|--|------|------|
|                        |   | $V_{CC}$<br>(V) |                          | $T_A = 25\text{ }^\circ\text{C}$<br>54HC and 74HC |          |      | $-40$ to $85\text{ }^\circ\text{C}$<br>74HC |      | $-55$ to $125\text{ }^\circ\text{C}$<br>54HC |      |      |
|                        |   |                 |                          | Min.  | Typ.     | Max. | Min.  | Max. | Min.   |      | Max. |
| $t_{TLH}$<br>$t_{THL}$ | Output Transition Time                                      | 2.0             |                          |   | 30       | 75   |   | 95   |  | 110  | ns   |
|                        |   | 4.5             |                          |   | 8        | 15   |   | 19   |  | 22   |      |
|                        |   | 6.0             |                          |   | 7        | 13   |   | 16   |  | 19   |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Time<br>( $C_n - \bar{Y}$ )<br>for HC352  | 2.0             |                          |   | 56       | 115  |   | 145  |  | 175  | ns   |
|                        |   | 4.5             |                          |   | 14       | 23   |   | 29   |  | 35   |      |
|                        |   | 6.0             |                          |   | 12       | 20   |   | 25   |  | 30   |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Time<br>( $A, B - \bar{Y}$ )<br>for HC352 | 2.0             |                          |   | 80       | 150  |   | 190  |  | 225  | ns   |
|                        |   | 4.5             |                          |   | 20       | 30   |   | 38   |  | 45   |      |
|                        |   | 6.0             |                          |   | 17       | 26   |   | 33   |  | 38   |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Time<br>( $\bar{G} - Y$ )<br>for HC352    | 2.0             |                          |   | 40       | 85   |   | 105  |  | 130  | ns   |
|                        |   | 4.5             |                          |   | 10       | 17   |   | 21   |  | 26   |      |
|                        |   | 6.0             |                          |   | 9        | 14   |   | 18   |  | 22   |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Time<br>( $C_n - \bar{Y}$ )<br>for HC353  | 2.0             |                          |   | 64       | 125  |   | 155  |  | 95   | ns   |
|                        |   | 4.5             |                          |   | 16       | 25   |   | 31   |  | 38   |      |
|                        |   | 6.0             |                          |   | 14       | 21   |   | 26   |  | 32   |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Time<br>( $A, B - \bar{Y}$ )<br>for HC353 | 2.0             |                          |   | 84       | 150  |   | 190  |  | 225  | ns   |
|                        |   | 4.5             |                          |   | 21       | 30   |   | 38   |  | 45   |      |
|                        |   | 6.0             |                          |   | 18       | 26   |   | 33   |  | 38   |      |
| $t_{PZL}$<br>$t_{PZH}$ | Output Enable Time<br>( $\bar{G} - \bar{Y}$ )<br>for HC353  | 2.0             | $R_L = 1\text{ K}\Omega$ |   | 64       | 115  |   | 145  |  | 175  | ns   |
|                        |   | 4.5             |                          |   | 16       | 23   |   | 29   |  | 35   |      |
|                        |   | 6.0             |                          |   | 14       | 20   |   | 25   |  | 30   |      |
| $t_{PLZ}$<br>$t_{PHZ}$ | Output Disable Time<br>( $\bar{G} - \bar{Y}$ )<br>for HC353 | 2.0             | $R_L = 1\text{ K}\Omega$ |   | 44       | 100  |   | 125  |  | 150  | ns   |
|                        |   | 4.5             |                          |   | 11       | 20   |   | 25   |  | 30   |      |
|                        |   | 6.0             |                          |   | 9        | 17   |   | 21   |  | 26   |      |
| $C_{IN}$               | Input Capacitance   |                 |                          |   | 5        | 10   |   | 10   |  | 10   | pF   |
| $C_{PD}$ (*)           | Power Dissipation Capacitance                               |                 | for HC352<br>for HC353   |   | 63<br>61 |      |   |      |  |      | 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.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

SWITCHING CHARACTERISTICS TEST WAVEFORMS

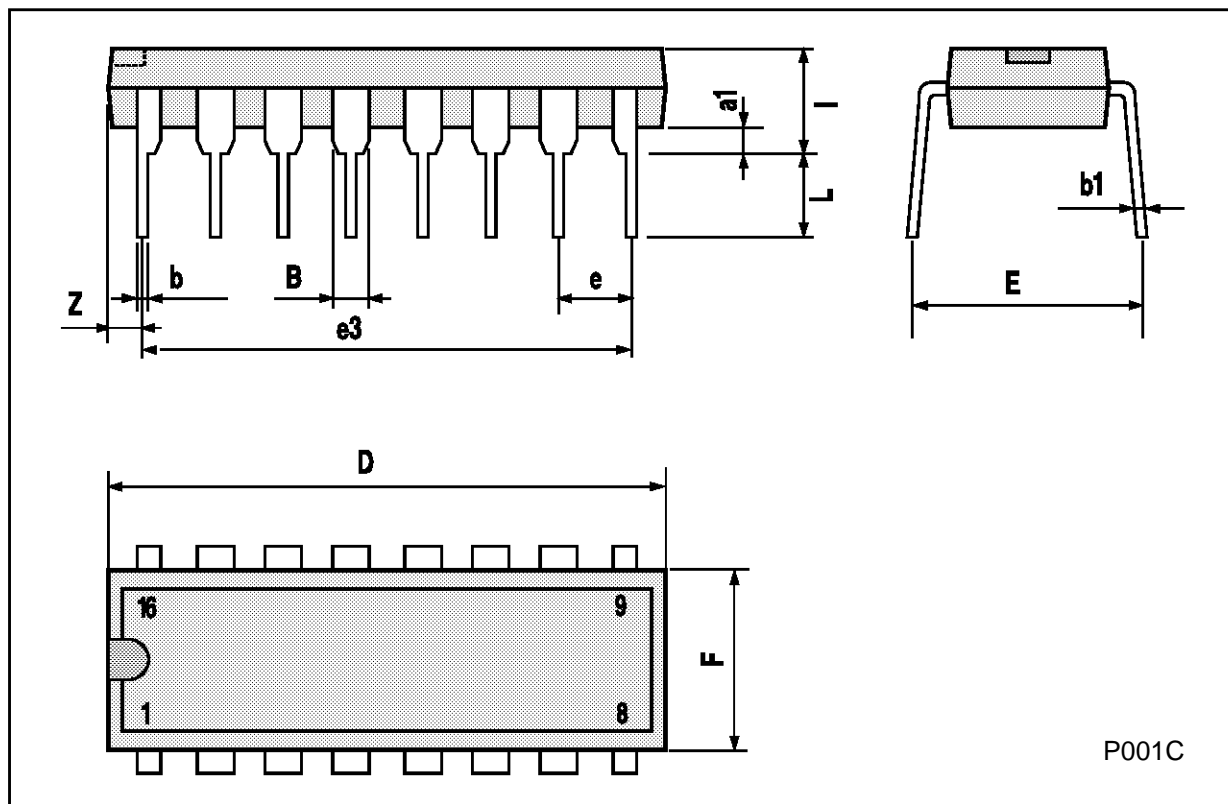


TEST CIRCUIT  $I_{CC}$  (Opr.)



## 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 |



**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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