

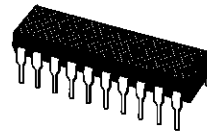


# SGS-THOMSON MICROELECTRONICS

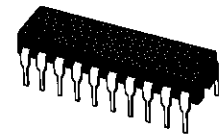
## M54HCT240/241/244PU M74HCT240/241/244PU

### OCTAL BUS BUFFERS WITH PULL-UP INPUT NETWORK

- HIGH SPEED  
 $t_{PD} = 14 \text{ ns (TYP.)}$  at  $V_{CC} = 5V$
- LOW POWER DISSIPATION  
 $I_{CCH} = 200 \mu A \text{ (TYP.)}$  at  $T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS  
 $V_{IH} = 2V \text{ (MIN.)}$   $V_{IL} = 0.8V \text{ (MAX.)}$
- CURRENT SOURCES ON DATA INPUTS  
ELIMINATE THE NEED OF EXTERNAL PULL-UP RESISTORS
- OUTPUT DRIVE CAPABILITY  
15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- PIN AND FUNCTION COMPATIBLE  
WITH 54/74LS240/241/244



**B1R**  
(Plastic Package)



**F1R**  
(Ceramic Package)



**M1R**  
(Micro Package)

#### ORDER CODES :

M54HCTXXXPUF1R M74HCTXXXPUM1R  
M74HCTXXXPUB1R

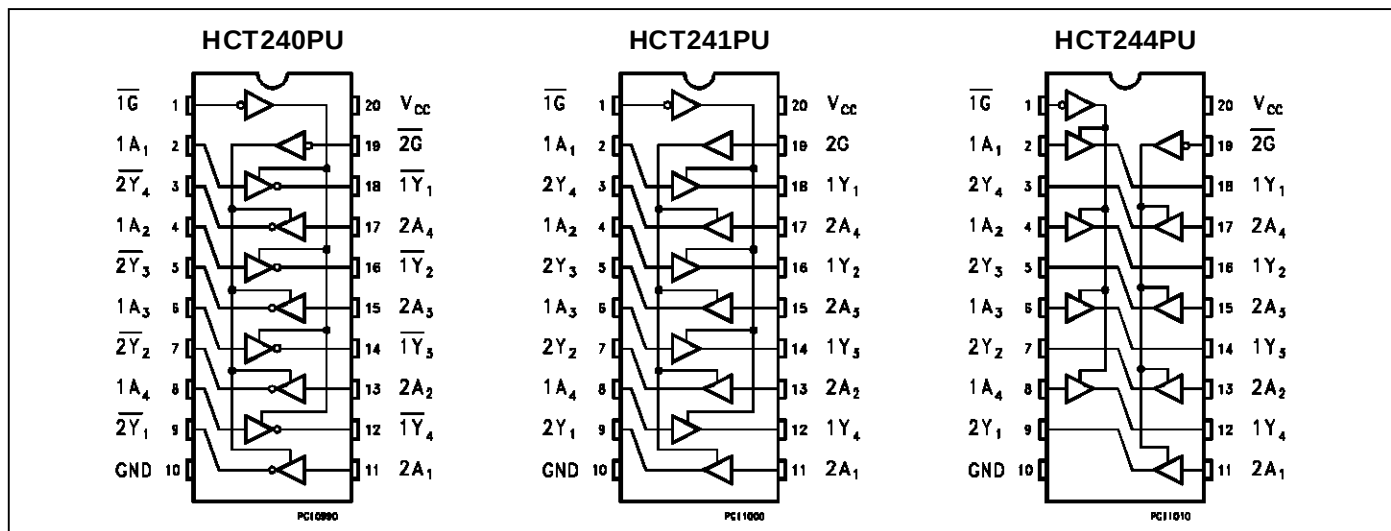
#### DESCRIPTION

The M54/74HCT240PU, HCT241PU and HCT244PU are high speed CMOS OCTAL BUS BUFFERS fabricated in silicon gate C<sup>2</sup>MOS technology.

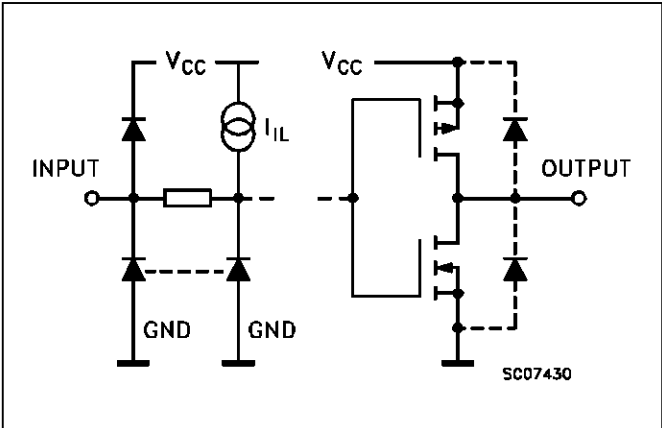
They have the same high speed performance of their non-PU counterpart, plus a unique input topology which incorporates a constant current source for each data input. This results in a small  $I_{IL}$  ( $-150 \mu A$  Typ.) which can fix any data input in the HIGH Logic Level when it is left floating, thus eliminating the need of external pull-up resistor network.

This feature makes these devices particularly suitable in all applications where a data bus needs to be interfaced to manual controls like: rotary selectors, keyboards, dip-switches, etc. The inputs are compatible with TTL, NMOS and CMOS output voltage levels. They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. 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 (HCT240PU)

| PIN No         | SYMBOL                               | NAME AND FUNCTION       |
|----------------|--------------------------------------|-------------------------|
| 1              | $\overline{1G}$                      | Output Enable Input     |
| 2, 4, 6, 8     | 1A1 to 1A4                           | Data Inputs             |
| 9, 7, 5, 3     | $\overline{2Y1}$ to $\overline{2Y4}$ | Data Outputs            |
| 11, 13, 15, 17 | 2A1 to 2A4                           | Data Inputs             |
| 18, 16, 14, 12 | $\overline{1Y1}$ to $\overline{1Y4}$ | Data Outputs            |
| 19             | $\overline{2G}$                      | Output Enabel Input     |
| 10             | GND                                  | Ground (0V)             |
| 20             | VCC                                  | Positive Supply Voltage |

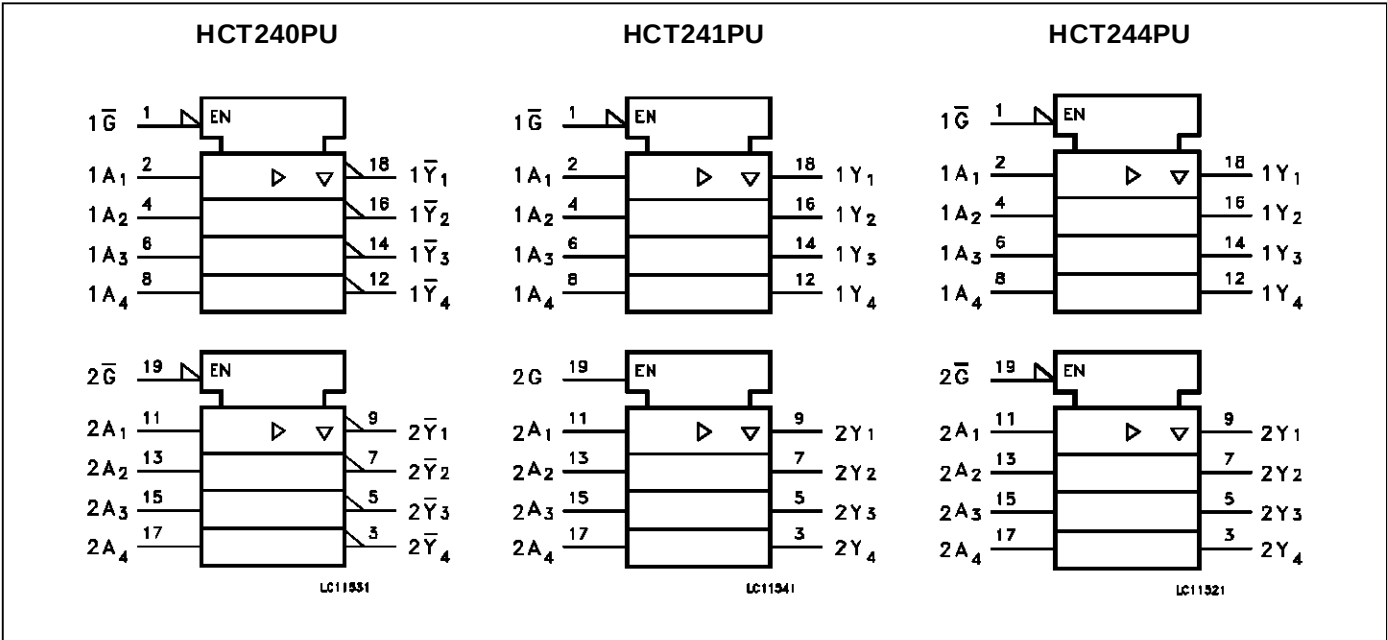
PIN DESCRIPTION (HCT241PU)

| PIN No         | SYMBOL          | NAME AND FUNCTION       |
|----------------|-----------------|-------------------------|
| 1              | $\overline{1G}$ | Output Enable Input     |
| 2, 4, 6, 8     | 1A1 to 1A4      | Data Inputs             |
| 9, 7, 5, 3     | 2Y1 to 2Y4      | Data Outputs            |
| 11, 13, 15, 17 | 2A1 to 2A4      | Data Inputs             |
| 18, 16, 14, 12 | 1Y1 to 1Y4      | Data Outputs            |
| 19             | 2G              | Output Enabel Input     |
| 10             | GND             | Ground (0V)             |
| 20             | VCC             | Positive Supply Voltage |

PIN DESCRIPTION (HCT244PU)

| PIN No         | SYMBOL          | NAME AND FUNCTION       |
|----------------|-----------------|-------------------------|
| 1              | $\overline{1G}$ | Output Enable Input     |
| 2, 4, 6, 8     | 1A1 to 1A4      | Data Inputs             |
| 9, 7, 5, 3     | 2Y1 to 2Y4      | Data Outputs            |
| 11, 13, 15, 17 | 2A1 to 2A4      | Data Inputs             |
| 18, 16, 14, 12 | 1Y1 to 1Y4      | Data Outputs            |
| 19             | $\overline{2G}$ | Output Enabel Input     |
| 10             | GND             | Ground (0V)             |
| 20             | VCC             | Positive Supply Voltage |

IEC LOGIC SYMBOLS

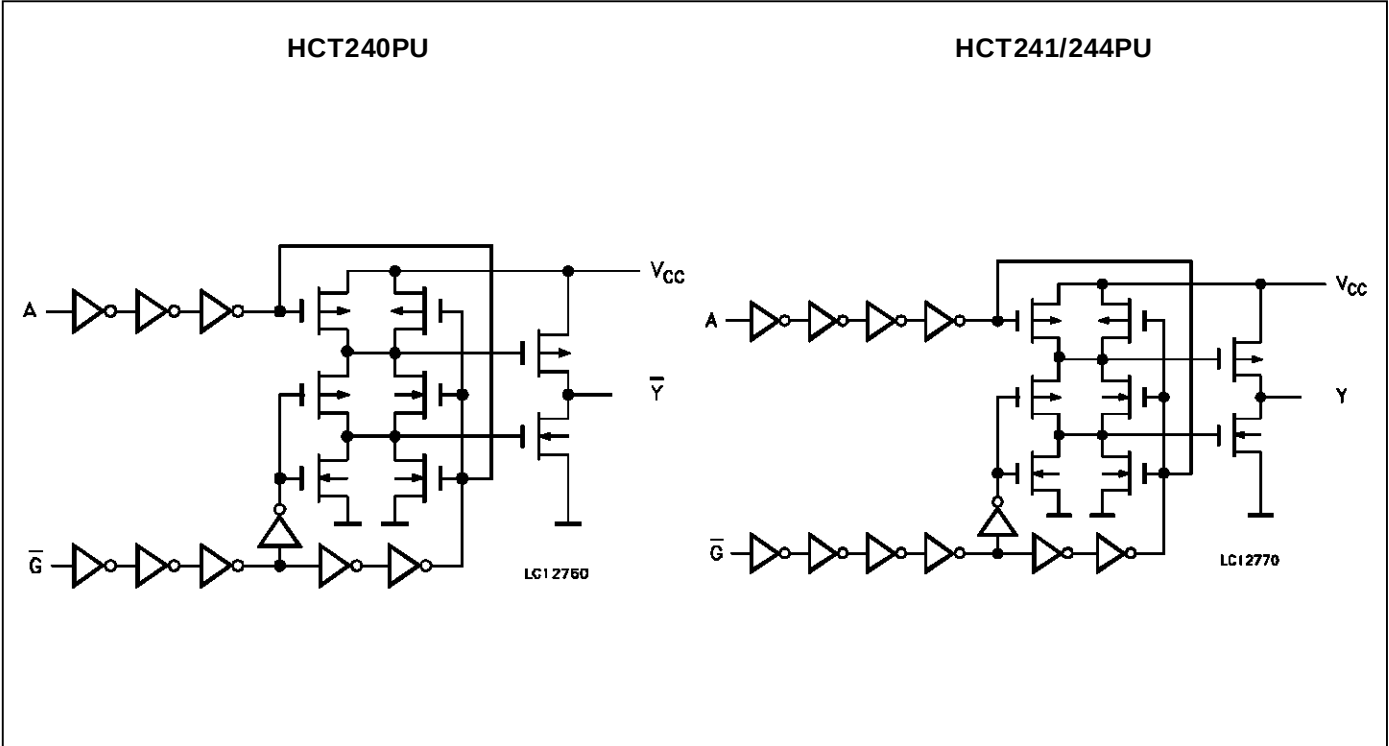


TRUTH TABLE

| INPUT          |              |    | OUTPUT                     |               |               |
|----------------|--------------|----|----------------------------|---------------|---------------|
| $\overline{G}$ | G (HCT241PU) | An | $\overline{Yn}$ (HCT240PU) | Yn (HCT241PU) | Yn (HCT244PU) |
| L              | H            | L  | H                          | L             | L             |
| L              | H            | H  | L                          | H             | H             |
| H              | L            | X  | Z                          | Z             | Z             |

X: "H" or "L"  
Z: High impedance

CIRCUIT SCHEMATIC (1/8 PACKAGE)



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                       | $\pm 20$               | mA          |
| $I_{OK}$              | DC Output Diode Current                      | $\pm 20$               | mA          |
| $I_O$                 | DC Output Source Sink Current Per Output Pin | $\pm 35$               | mA          |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current                | $\pm 70$               | mA          |
| $P_D$                 | Power Dissipation                            | 500 (*)                | mW          |
| $T_{stg}$             | Storage Temperature                          | -65 to +150            | $^{\circ}C$ |
| $T_L$                 | Lead Temperature (10 sec)                    | 300                    | $^{\circ}C$ |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.  
(\*) 500 mW:  $\equiv 65^{\circ}C$  derate to 300 mW by 10mW/ $^{\circ}C$ :  $65^{\circ}C$  to  $85^{\circ}C$

**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                                        |
| $T_{op}$   | Operating Temperature: <b>M54HC Series</b><br><b>M74HC Series</b> | -55 to +125<br>-40 to +85 | $^{\circ}\text{C}$<br>$^{\circ}\text{C}$ |
| $t_r, t_f$ | Input Rise and Fall Time ( $V_{CC} = 4.5$ to $5.5\text{V}$ )      | 0 to 500                  | ns                                       |

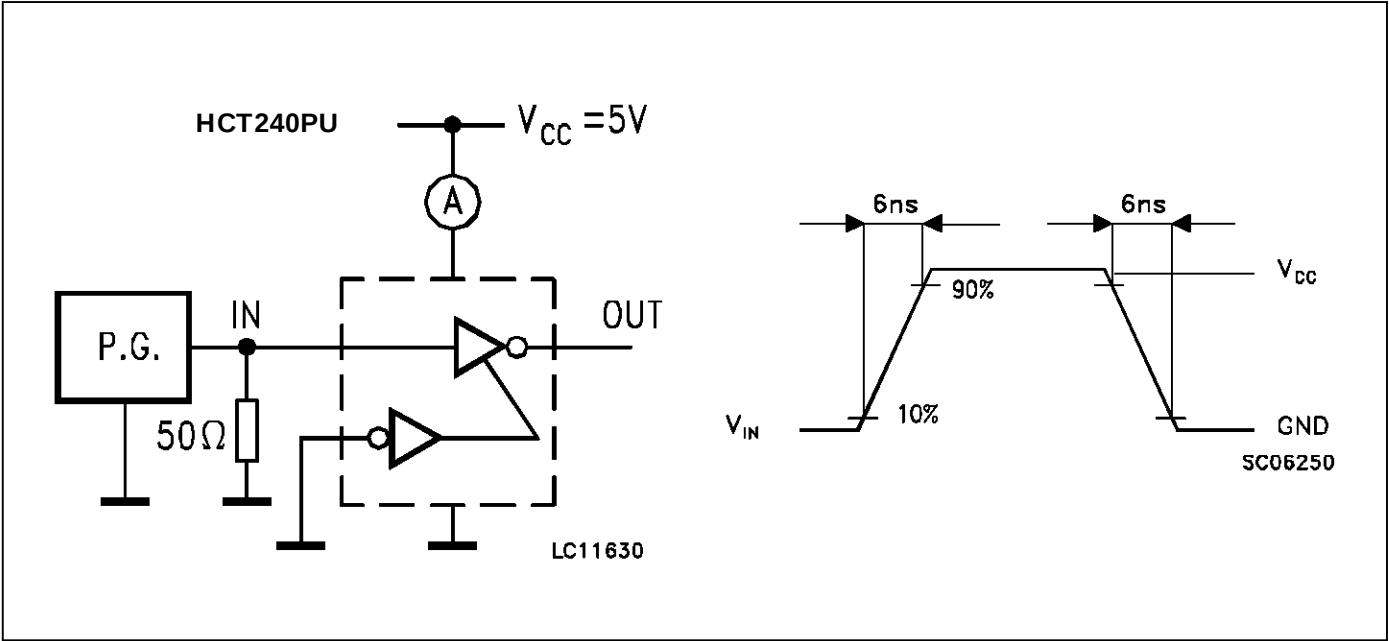
**DC SPECIFICATIONS**

| Symbol           | Parameter                            | Test Conditions        |                                                                                                 |                                         | Value |      |                      |      |                       |      | Unit |    |
|------------------|--------------------------------------|------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------|-------|------|----------------------|------|-----------------------|------|------|----|
|                  |                                      | V <sub>CC</sub><br>(V) |                                                                                                 | T <sub>A</sub> = 25 °C<br>54HC and 74HC |       |      | -40 to 85 °C<br>74HC |      | -55 to 125 °C<br>54HC |      |      |    |
|                  |                                      |                        |                                                                                                 | Min.                                    | Typ.  | Max. | Min.                 | Max. | Min.                  | Max. |      |    |
| V <sub>IH</sub>  | High Level Input Voltage             | 4.5 to 5.5             |                                                                                                 |                                         | 2.0   |      |                      | 2.0  |                       | 2.0  |      | V  |
| V <sub>IL</sub>  | Low Level Input Voltage              | 4.5 to 5.5             |                                                                                                 |                                         |       |      | 0.8                  |      | 0.8                   |      | 0.8  | V  |
| V <sub>OH</sub>  | High Level Output Voltage            | 4.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                             | I <sub>O</sub> =-20 μA                  | 4.4   | 4.5  |                      | 4.4  |                       | 4.4  |      | V  |
|                  |                                      |                        |                                                                                                 | I <sub>O</sub> =-6.0 mA                 | 4.18  | 4.31 |                      | 4.13 |                       | 4.10 |      |    |
| V <sub>OL</sub>  | Low Level Output Voltage             | 4.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                             | I <sub>O</sub> = 20 μA                  |       | 0.0  | 0.1                  |      | 0.1                   |      | 0.1  | V  |
|                  |                                      |                        |                                                                                                 | I <sub>O</sub> = 6.0 mA                 |       | 0.17 | 0.26                 |      | 0.33                  |      | 0.4  |    |
| I <sub>IL</sub>  | Input Low Current                    | 4.5                    | V <sub>I</sub> = 0.4 V                                                                          |                                         | -50   | -130 | -250                 | -30  | -350                  | -20  | -400 | mA |
|                  |                                      | 5.5                    |                                                                                                 |                                         | -50   | -180 | -300                 | -30  | -400                  | -20  | -450 |    |
| I <sub>IN</sub>  | input Leakage Current (EN inp.)      | 5.5                    | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                        |                                         |       |      | ±0.1                 |      | ±1.0                  |      | ±1.0 | μA |
| I <sub>OZ</sub>  | 3 State Output Off State Current     | 5.5                    | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                                         |       |      | ±0.5                 |      | ±5.0                  |      | ±10  | μA |
| I <sub>CCH</sub> | Quiescent Supply Current             | 5.5                    | V <sub>I</sub> = V <sub>CC</sub>                                                                |                                         |       | 200  | 600                  |      | 800                   |      | 1000 | μA |
| ΔI <sub>CC</sub> | Additional worst case supply current | 5.5                    | Per Input pin<br>V <sub>I</sub> = 0.5V or 2.4V<br>Other Inputs at V <sub>CC</sub> or GND        |                                         |       |      | 3.0                  |      | 3.9                   |      | 4.0  | mA |

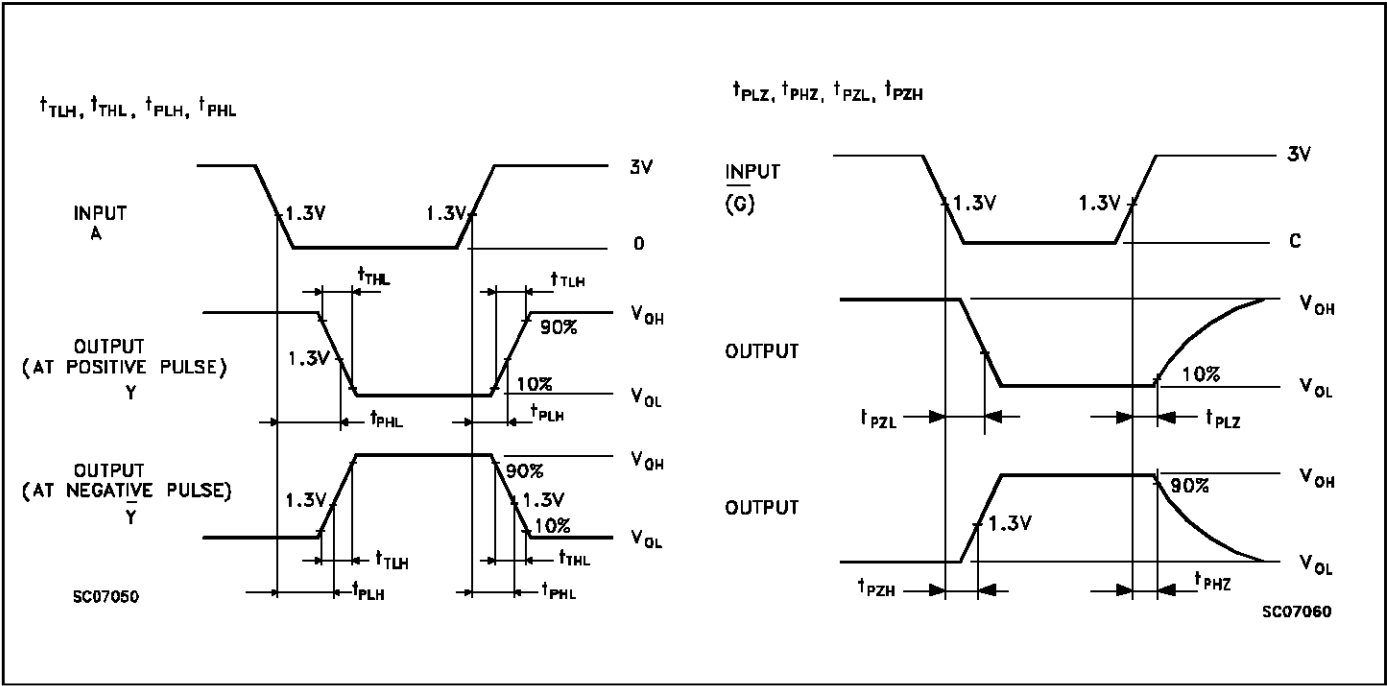
AC ELECTRICAL CHARACTERISTICS (Input  $t_r = t_f = 6\text{ ns}$ )

| Symbol                               | Parameter                            | Test Conditions        |                        |                      | Value                                   |      |      |                      |      |                       | Unit |      |
|--------------------------------------|--------------------------------------|------------------------|------------------------|----------------------|-----------------------------------------|------|------|----------------------|------|-----------------------|------|------|
|                                      |                                      | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |                      | T <sub>A</sub> = 25 °C<br>54HC and 74HC |      |      | -40 to 85 °C<br>74HC |      | -55 to 125 °C<br>54HC |      |      |
|                                      |                                      |                        |                        |                      | Min.                                    | Typ. | Max. | Min.                 | Max. | Min.                  |      | Max. |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time               | 4.5                    | 50                     |                      |                                         | 7    | 12   |                      | 15   |                       | 18   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time (for 240)     | 4.5                    | 50                     |                      |                                         | 18   | 28   |                      | 35   |                       | 42   | ns   |
|                                      |                                      | 4.5                    | 150                    |                      |                                         | 22   | 34   |                      | 43   |                       | 51   | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time (for 241/244) | 4.5                    | 50                     |                      |                                         | 20   | 31   |                      | 39   |                       | 47   | ns   |
|                                      |                                      | 4.5                    | 150                    |                      |                                         | 24   | 37   |                      | 46   |                       | 56   | ns   |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Output Enable Time                   | 4.5                    | 50                     | R <sub>L</sub> = 1KΩ |                                         | 22   | 34   |                      | 43   |                       | 51   | ns   |
|                                      |                                      | 4.5                    | 150                    | R <sub>L</sub> = 1KΩ |                                         | 26   | 40   |                      | 50   |                       | 60   | ns   |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Output Disable Time                  | 4.5                    | 50                     | R <sub>L</sub> = 1KΩ |                                         | 25   | 36   |                      | 45   |                       | 54   | ns   |
| C <sub>IN</sub>                      | Input Capacitance                    |                        |                        |                      |                                         | 5    | 10   |                      | 10   |                       | 10   | pF   |
| C <sub>PD</sub> (*)                  | Power Dissipation Capacitance        |                        |                        |                      |                                         | 100  |      |                      |      |                       |      | pF   |

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

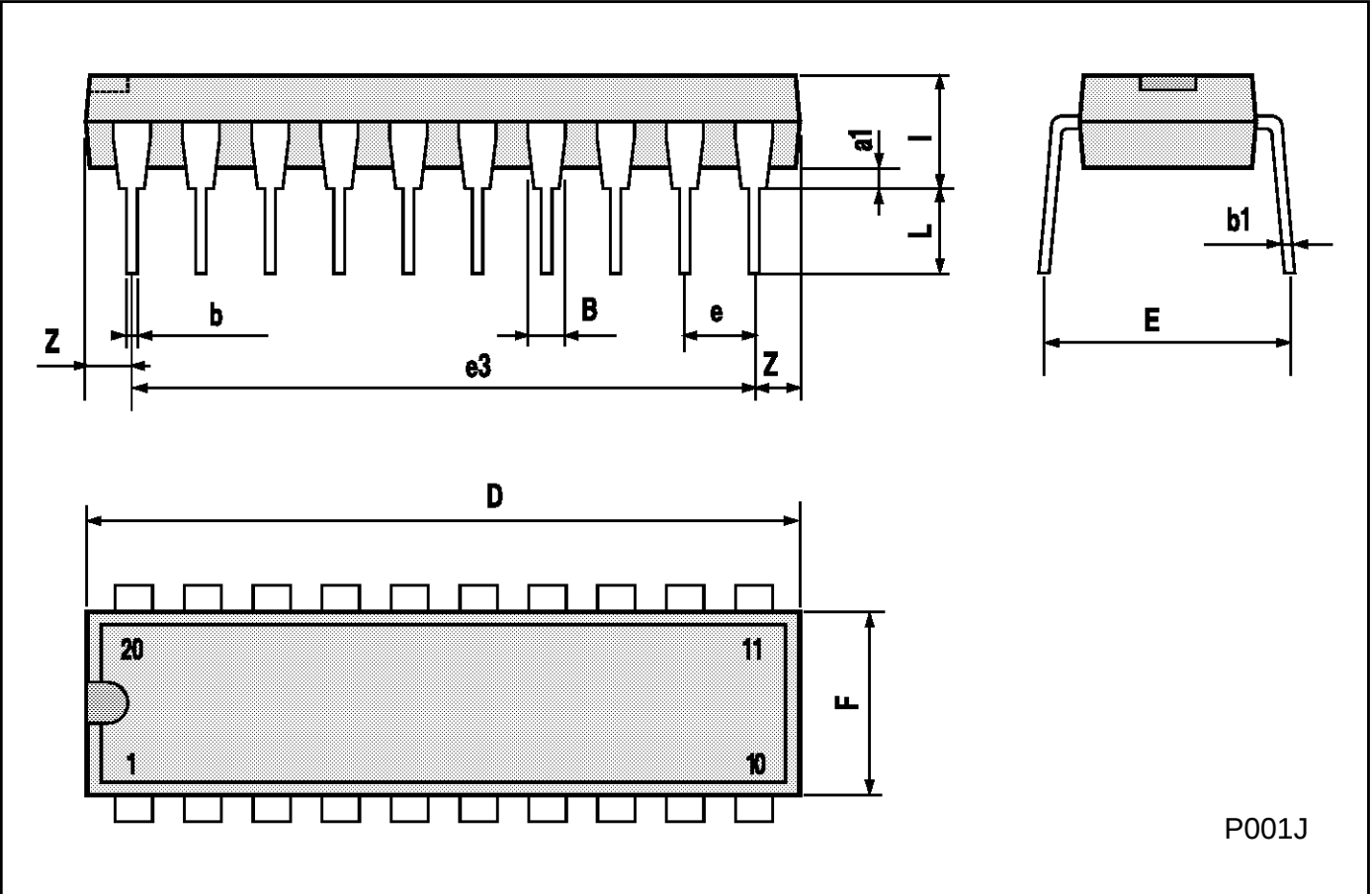


SWITCHING CHARACTERISTICS TEST WAVEFORM



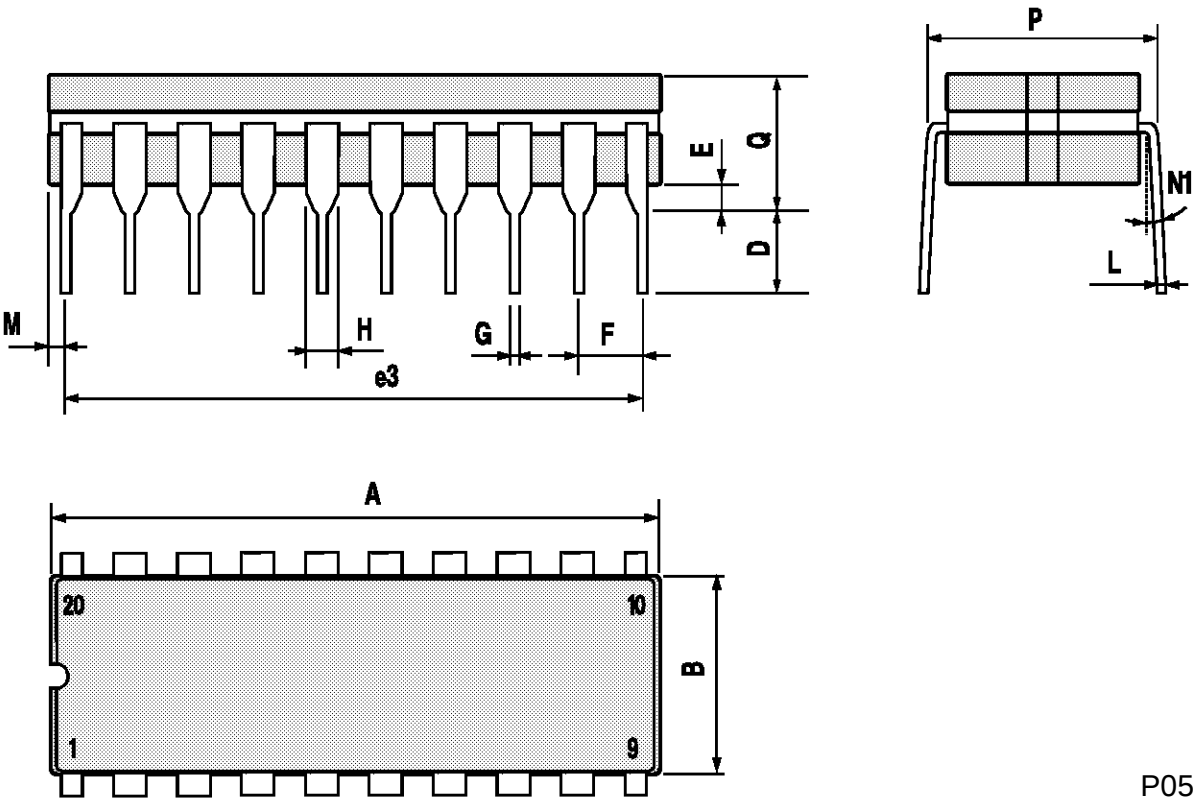
Plastic DIP20 (0.25) MECHANICAL DATA

| 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 |



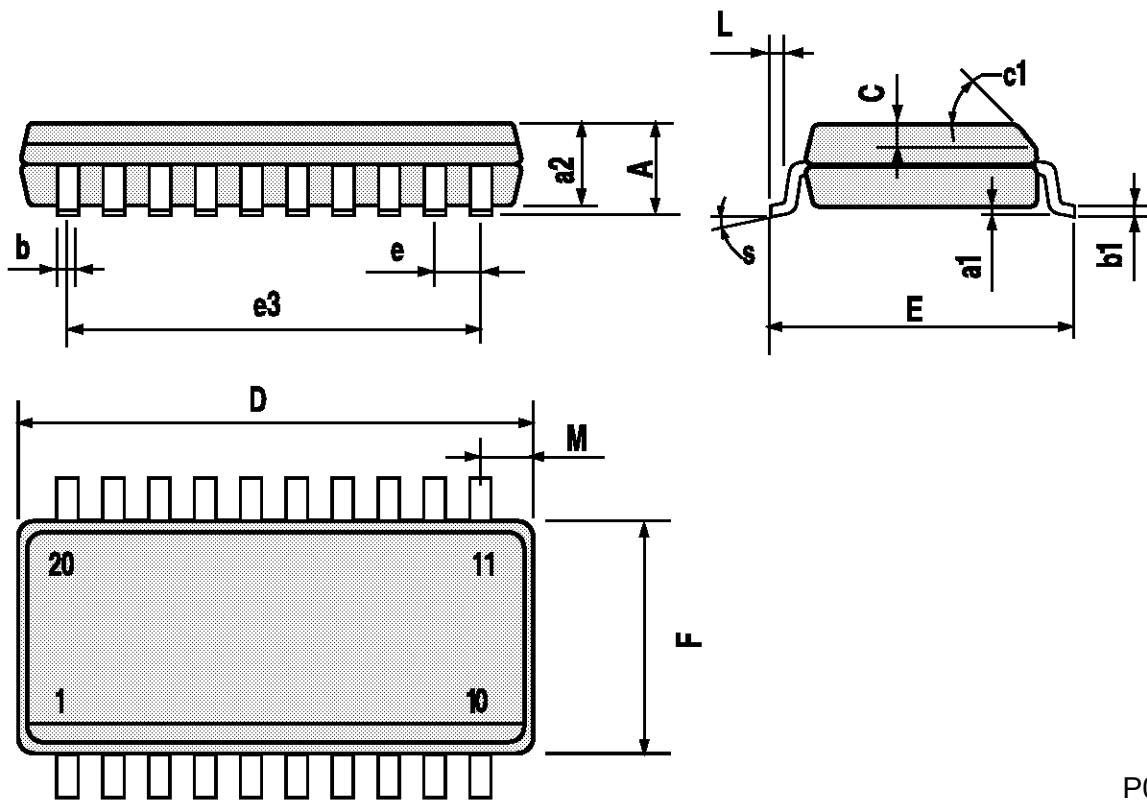
Ceramic DIP20 MECHANICAL DATA

| 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.)  |       |       |       |       |       |



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