



# M74HC365

## HEX BUS BUFFER WITH 3 STATE OUTPUTS (NON INVERTING)

- HIGH SPEED:  
 $t_{PD} = 10\text{ns}$  (TYP.) at  $V_{CC} = 6\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (MIN.)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 6\text{mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 365



### ORDER CODES

| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | M74HC365B1R |                |
| SOP     | M74HC365M1R | M74HC365RM13TR |
| TSSOP   |             | M74HC365TTR    |

### DESCRIPTION

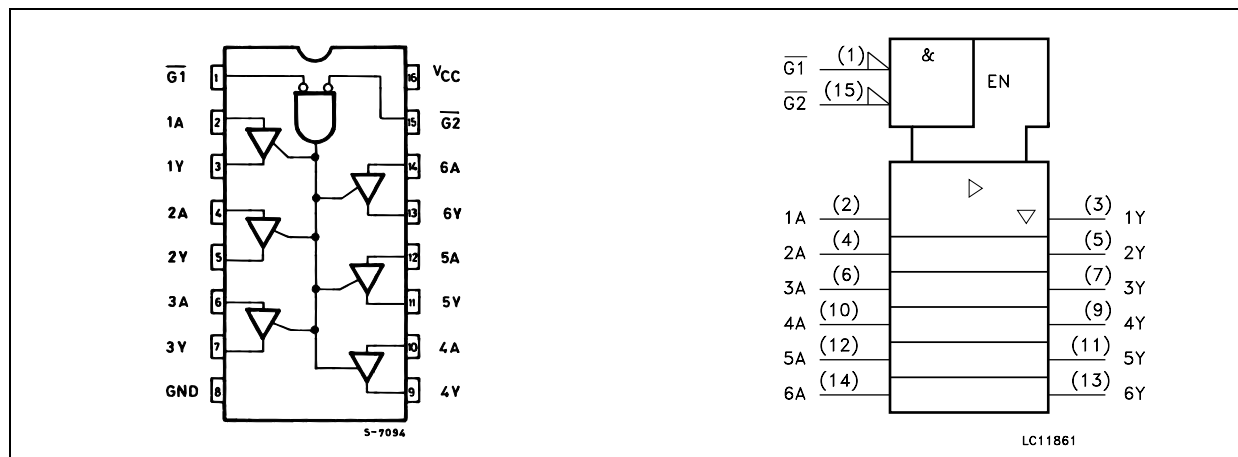
The 74HC365 is an advanced high-speed CMOS HEX BUS BUFFER (3-STATE) fabricated with silicon gate C<sup>2</sup>MOS technology.

All six buffers are controlled by the combination of two enable inputs ( $\overline{G1}$  and  $\overline{G2}$ ); all outputs of these buffers are enabled only when both  $\overline{G1}$  and

$\overline{G2}$  inputs are held low, under all other conditions these outputs are disabled in a high-impedance state.

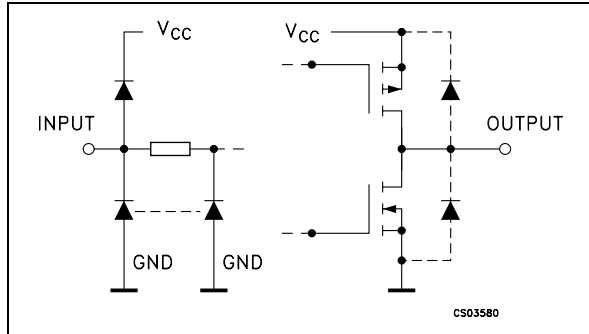
The M74HC365 has non inverting outputs. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# M74HC365

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

| PIN No              | SYMBOL                         | NAME AND FUNCTION       |
|---------------------|--------------------------------|-------------------------|
| 1, 15               | $\overline{G1}, \overline{G2}$ | Output Enable Inputs    |
| 2, 4, 6, 10, 12, 14 | 1A to 6A                       | Data Inputs             |
| 3, 5, 7, 9, 11, 13  | 1Y to 6Y                       | Data Outputs            |
| 8                   | GND                            | Ground (0V)             |
| 16                  | V <sub>CC</sub>                | Positive Supply Voltage |

## TRUTH TABLE

| INPUTS          |                 |                | OUTPUTS |
|-----------------|-----------------|----------------|---------|
| $\overline{G1}$ | $\overline{G2}$ | A <sub>n</sub> | Y       |
| L               | L               | L              | L       |
| L               | L               | H              | H       |
| H               | X               | X              | Z       |
| X               | H               | X              | Z       |

X : Don't Care  
Z : High Impedance

## 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 Current                    | ± 35                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 70                          | 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 conditions is not implied

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 65°C to 85°C

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                | Value                  | Unit      |    |
|---------------------------------|--------------------------|------------------------|-----------|----|
| V <sub>CC</sub>                 | Supply Voltage           | 2 to 6                 | V         |    |
| V <sub>I</sub>                  | Input Voltage            | 0 to V <sub>CC</sub>   | V         |    |
| V <sub>O</sub>                  | Output Voltage           | 0 to V <sub>CC</sub>   | V         |    |
| T <sub>op</sub>                 | Operating Temperature    | -55 to 125             | °C        |    |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time | V <sub>CC</sub> = 2.0V | 0 to 1000 | ns |
|                                 |                          | V <sub>CC</sub> = 4.5V | 0 to 500  | ns |
|                                 |                          | V <sub>CC</sub> = 6.0V | 0 to 400  | ns |

## DC SPECIFICATIONS

| Symbol          | Parameter                             | Test Condition         |  | Value                 |      |       |             |      |              | Unit |      |
|-----------------|---------------------------------------|------------------------|--|-----------------------|------|-------|-------------|------|--------------|------|------|
|                 |                                       | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25°C |      |       | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                                       |                        |  | Min.                  | Typ. | Max.  | Min.        | Max. | Min.         |      | Max. |
| V <sub>IH</sub> | 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 <sub>IL</sub> | 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 <sub>OH</sub> | High Level Output Voltage             | 2.0                    | I <sub>O</sub> =-20 μA   | 1.9                   | 2.0  |       | 1.9         |      | 1.9          |      | V    |
|                 |                                       | 4.5                    | I <sub>O</sub> =-20 μA   | 4.4                   | 4.5  |       | 4.4         |      | 4.4          |      |      |
|                 |                                       | 6.0                    | I <sub>O</sub> =-20 μA   | 5.9                   | 6.0  |       | 5.9         |      | 5.9          |      |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =-6.0 mA  | 4.18                  | 4.31 |       | 4.13        |      | 4.10         |      |      |
|                 |                                       | 6.0                    | I <sub>O</sub> =-7.8 mA  | 5.68                  | 5.8  |       | 5.63        |      | 5.60         |      |      |
| V <sub>OL</sub> | Low Level Output Voltage              | 2.0                    | I <sub>O</sub> =20 μA  |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  | V    |
|                 |                                       | 4.5                    | I <sub>O</sub> =20 μA  |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                                       | 6.0                    | I <sub>O</sub> =20 μA  |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =6.0 mA   |                       | 0.17 | 0.26  |             | 0.33 |              | 0.40 |      |
|                 |                                       | 6.0                    | I <sub>O</sub> =7.8 mA   |                       | 0.18 | 0.26  |             | 0.33 |              | 0.40 |      |
| I <sub>I</sub>  | Input Leakage Current                 | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND  |                       |      | ± 0.1 |             | ± 1  |              | ± 1  | μA   |
| I <sub>OZ</sub> | High Impedance Output Leakage Current | 6.0                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                       |      | ± 0.5 |             | ± 5  |              | ± 10 | μA   |
| I <sub>CC</sub> | Quiescent Supply Current              | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> 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 Condition  |               | Value                     |      |      |                                    |      |                                     | Unit |      |    |
|---------------------|------------------------------------|-----------------|---------------|---------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|----|
|                     |                                    | $V_{CC}$<br>(V) | $C_L$<br>(pF) | $T_A = 25^\circ\text{C}$  |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |    |
|                     |                                    |                 |               | 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   |                                    | 19   |                                     | 18   |      |    |
|                     |                                    | 6.0             |               |                           | 6    | 10   |                                    | 13   |                                     | 15   |      |    |
| $t_{PLH} \ t_{PHL}$ | Propagation Delay Time             | 2.0             | 50            |                           | 38   | 90   |                                    | 115  |                                     | 135  | ns   |    |
|                     |                                    | 4.5             |               |                           | 12   | 18   |                                    | 23   |                                     | 27   |      |    |
|                     |                                    | 6.0             |               |                           | 10   | 15   |                                    | 20   |                                     | 23   |      |    |
|                     |                                    | 2.0             | 150           |                           | 51   | 130  |                                    | 165  |                                     | 195  | ns   |    |
|                     |                                    | 4.5             |               |                           | 17   | 26   |                                    | 33   |                                     | 39   |      |    |
|                     |                                    | 6.0             |               |                           | 14   | 22   |                                    | 28   |                                     | 33   |      |    |
| $t_{PZL} \ t_{PZH}$ | High Impedance Output Enable Time  | 2.0             | 50            | $R_L = 1 \text{ K}\Omega$ |      | 64   | 130                                |      | 165                                 |      | 195  | ns |
|                     |                                    | 4.5             |               |                           |      | 16   | 26                                 |      | 33                                  |      | 39   |    |
|                     |                                    | 6.0             |               |                           |      | 14   | 22                                 |      | 28                                  |      | 33   |    |
|                     |                                    | 2.0             | 150           | $R_L = 1 \text{ K}\Omega$ |      | 76   | 150                                |      | 190                                 |      | 225  | ns |
|                     |                                    | 4.5             |               |                           |      | 19   | 30                                 |      | 38                                  |      | 45   |    |
|                     |                                    | 6.0             |               |                           |      | 16   | 26                                 |      | 32                                  |      | 38   |    |
| $t_{PLZ} \ t_{PHZ}$ | High Impedance Output Disable Time | 2.0             | 50            | $R_L = 1 \text{ K}\Omega$ |      | 42   | 130                                |      | 165                                 |      | 195  | ns |
|                     |                                    | 4.5             |               |                           |      | 18   | 26                                 |      | 33                                  |      | 39   |    |
|                     |                                    | 6.0             |               |                           |      | 15   | 22                                 |      | 28                                  |      | 33   |    |

**CAPACITIVE CHARACTERISTICS**

| Symbol   | Parameter                              | Test Condition  |  | Value                    |      |      |                                    |      |                                     | Unit |      |
|----------|--|-----------------|--|--------------------------|------|------|------------------------------------|------|-------------------------------------|------|------|
|          |  | $V_{CC}$<br>(V) |  | $T_A = 25^\circ\text{C}$ |      |      | $-40 \text{ to } 85^\circ\text{C}$ |      | $-55 \text{ to } 125^\circ\text{C}$ |      |      |
|          |  |                 |  | Min.                     | Typ. | Max. | Min.                               | Max. | Min.                                |      | Max. |
| $C_{IN}$ | Input Capacitance                      | 5.0             |  |                          | 5    | 10   |                                    | 10   |                                     | 10   | pF   |
| $C_{PD}$ | Power Dissipation Capacitance (note 1) | 5.0             |  |                          | 27   |      |                                    |      |                                     |      | pF   |

1)  $C_{PD}$  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.  $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6$  (per gate)

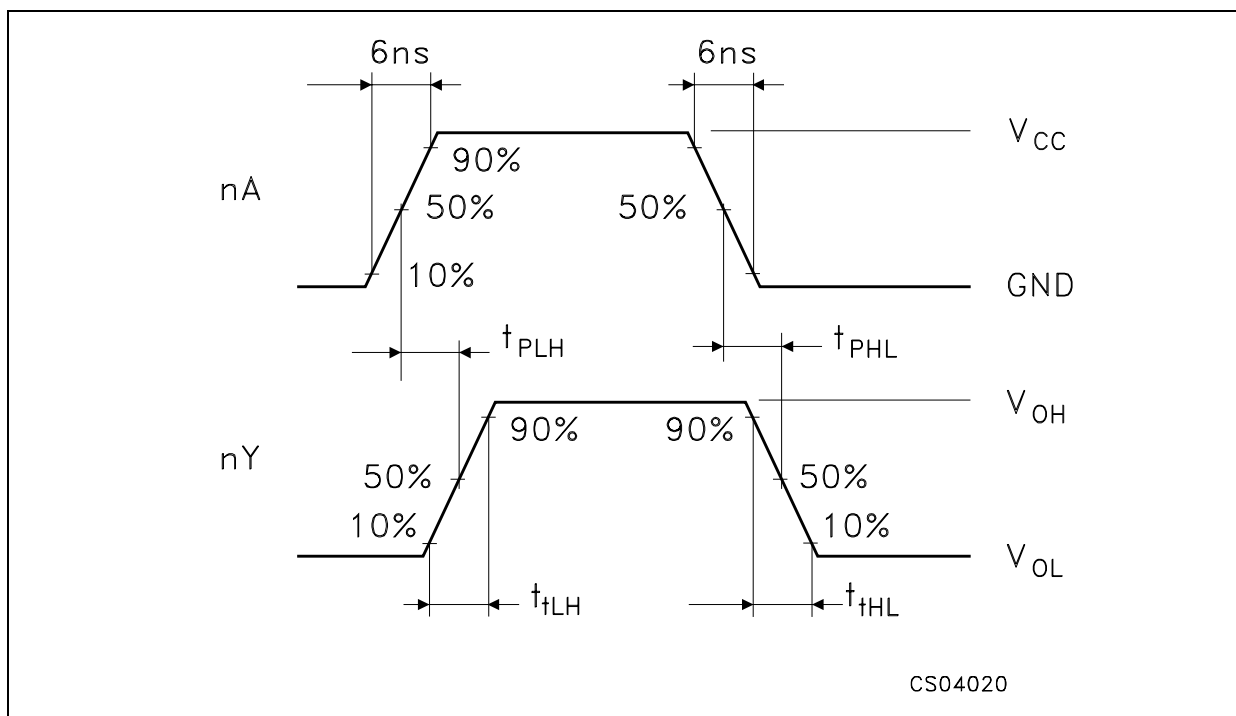
TEST CIRCUIT



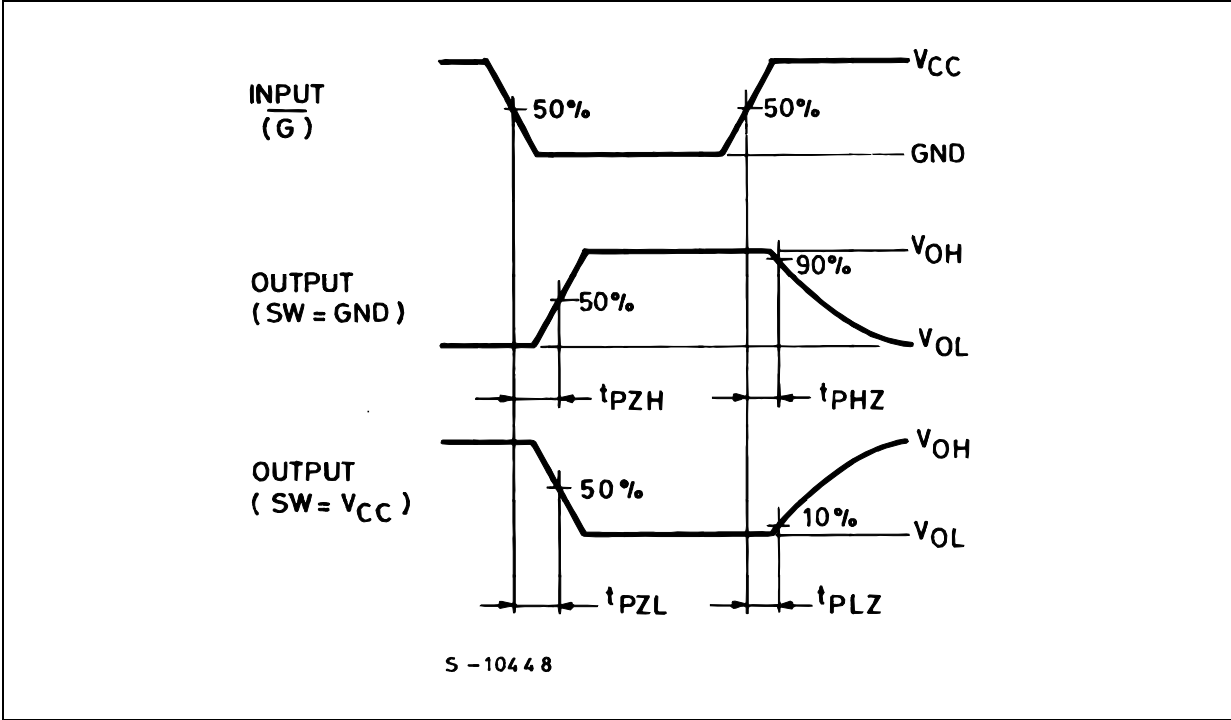
| TEST                  | SWITCH   |
|-----------------------|----------|
| $t_{PLH}$ , $t_{PHL}$ | Open     |
| $t_{PZL}$ , $t_{PLZ}$ | $V_{CC}$ |
| $t_{PZH}$ , $t_{PHZ}$ | GND      |

$C_L = 50\text{pF}/150\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_1 = 1\text{K}\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM 1: PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)

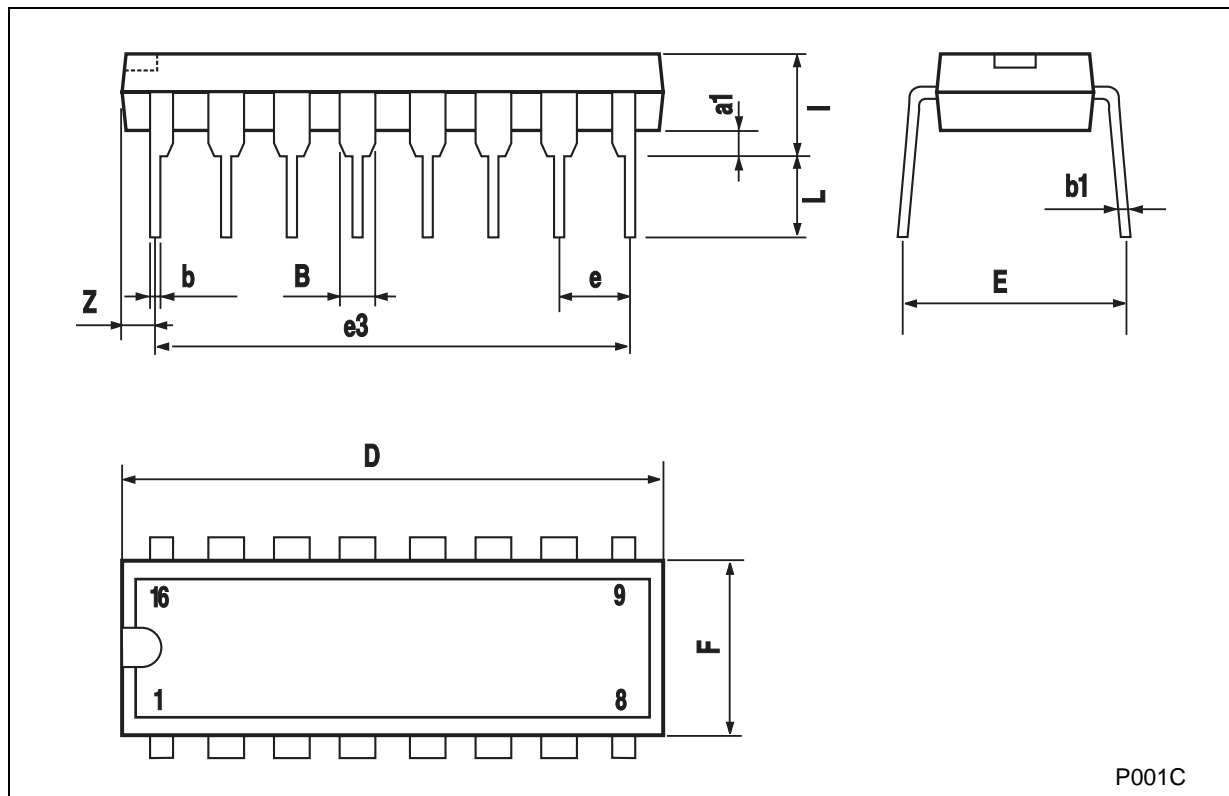


WAVEFORM 2 : OUTPUT ENABLE AND DISABLE TIMES (f=1MHz; 50% duty cycle)



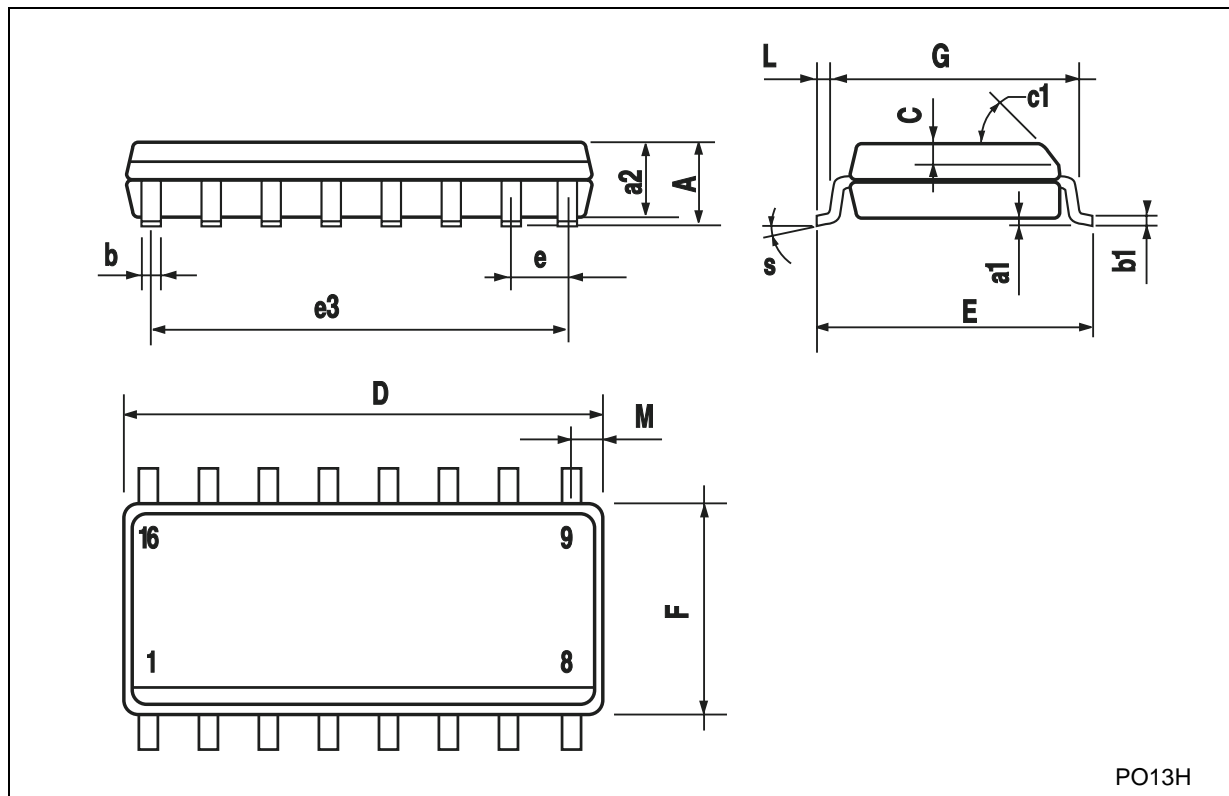
### Plastic DIP-16 (0.25) MECHANICAL DATA

| 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 |



## SO-16 MECHANICAL DATA

| DIM. | mm.        |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.2  | 0.003 |       | 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.)  |      |      |       |       |       |



PO13H



## TSSOP16 MECHANICAL DATA

| DIM. | mm.  |          |      | inch  |            |        |
|------|------|----------|------|-------|------------|--------|
|      | MIN. | TYP.     | MAX. | MIN.  | TYP.       | MAX.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0089 |
| D    | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |



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