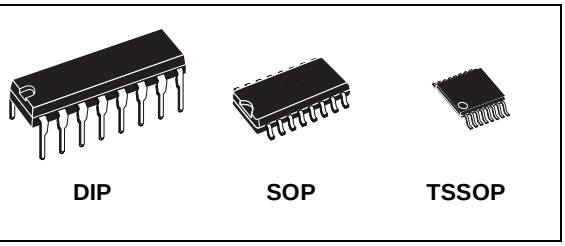
# M74HC75

## 4 BIT D TYPE LATCH

- HIGH SPEED :
  $t_{PD}$ = 11ns (TYP.) at $V_{CC}$ = 6V
- LOW POWER DISSIPATION:
  $I_{CC}$ =2µA(MAX.) at $T_A$=25°C
- HIGH NOISE IMMUNITY:
  $V_{NIH} = V_{NIL}$ = 28 % $V_{CC}$ (MIN.)
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ = 4mA (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 75



DIP SOP TSSOP

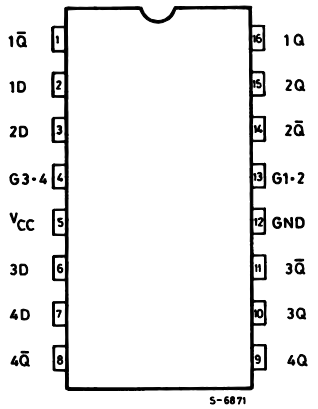
### ORDER CODES

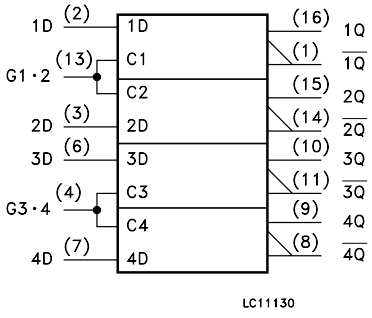
| PACKAGE | TUBE | T & R |
|---|---|---|
| DIP | M74HC75B1R | |
| SOP | M74HC75M1R | M74HC75RM13TR |
| TSSOP | | M74HC75TTR |

### DESCRIPTION

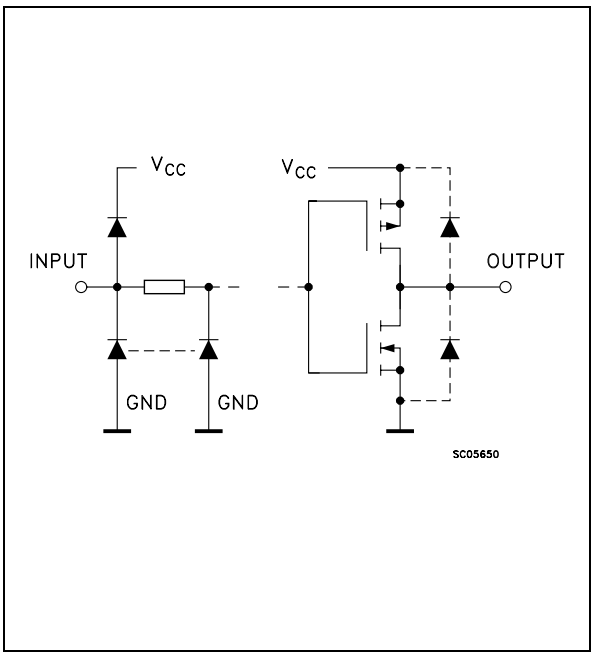
The M74HC75 is an high speed CMOS 4 BIT D TYPE LATCH fabricated with silicon gate $C^2MOS$ technology.
It contains two groups of 2 bit latches controlled by an enable input (G1•2 or G3•4). These two latch groups can be used in different circuits. Each latch has Q and $\overline{Q}$ outputs (1Q - 4$\overline{Q}$ and 1Q - 4$\overline{Q}$). The data applied to the data input is transferred to the Q and $\overline{Q}$ outputs when the enable input is taken high and the outputs will follow the data input as long as the enable input is kept high. When the enable input is taken low, the information data applied to the data input is retained at the outputs. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



## IINPUT AND OUTPUT EQUIVALENT CIRCUIT



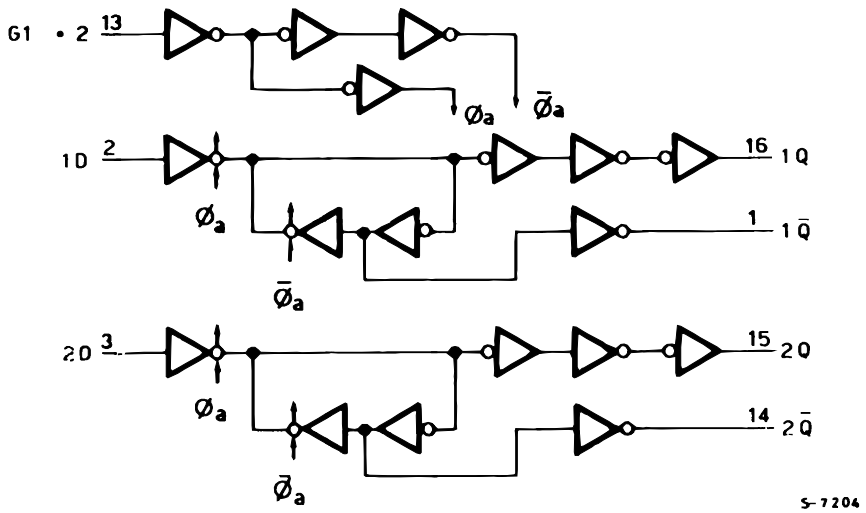

## PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 1, 14, 11, 8 | $1\overline{Q}$ to $4\overline{Q}$ | Complementary Latch Outputs |
| 2, 3, 6, 7 | 1D to 4D | Data Inputs |
| 4 | G3 • 4 | Latch Enable Input, latches 3 and 4 |
| 13 | G1 • 2 | Latch Enable Input, latches 1 and 2 |
| 16, 15, 10, 9 | 1Q to 4Q | Latch Outputs |
| 12 | GND | Ground (0V) |
| 5 | $V_{CC}$ | Positive Supply Voltage |

## TRUTH TABLE

| INPUTS | | OUTPUTS | | FUNCTION |
|---|---|---|---|---|
| D | G | Q | $\overline{Q}$ | |
| L | H | L | H | |
| H | H | H | L | |
| X | L | Qn | $\overline{Q}$n | LATCH |

## LOGIC DIAGRAM



## 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 Current | ± 25 | mA |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | ± 50 | 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 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 |
|---|---|---|---|---|
| $V_{CC}$ | 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 | | -55 to 125 | °C |
| $t_r$, $t_f$ | Input Rise and Fall Time | $V_{CC}$ = 2.0V | 0 to 1000 | ns |
| | | $V_{CC}$ = 4.5V | 0 to 500 | ns |
| | | $V_{CC}$ = 6.0V | 0 to 400 | ns |

## DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | 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 | $I_O$=-20 µA | 1.9 | 2.0 | | 1.9 | | 1.9 | | V |
| | | 4.5 | $I_O$=-20 µA | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | $I_O$=-20 µA | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | $I_O$=-4.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | $I_O$=-5.2 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| $V_{OL}$ | Low Level Output Voltage | 2.0 | $I_O$=20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | $I_O$=20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | $I_O$=20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | $I_O$=4.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| | | 6.0 | $I_O$=5.2 mA | | 0.18 | 0.26 | | 0.33 | | 0.40 | |
| $I_I$ | Input Leakage Current | 6.0 | $V_I$ = $V_{CC}$ or GND | | | ± 0.1 | | ± 1 | | ± 1 | µA |
| $I_{CC}$ | Quiescent Supply Current | 6.0 | $V_I$ = $V_{CC}$ or GND | | | 2 | | 20 | | 40 | µA |

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

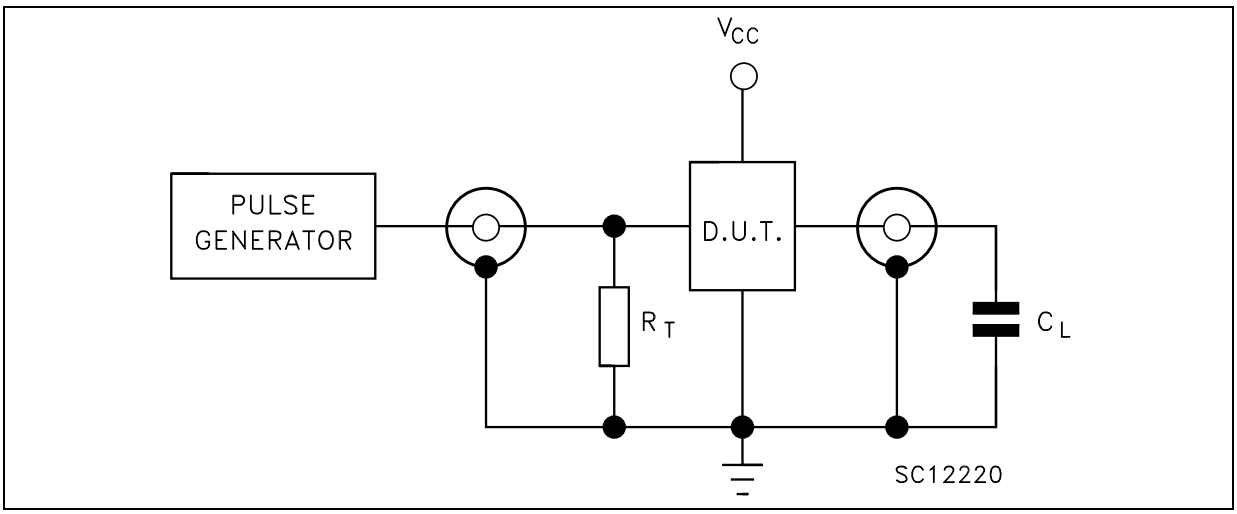
| Symbol | Parameter | Test Condition | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $t_{TLH}$ $t_{THL}$ | Output Transition Time | 2.0 | | | 25 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 7 | 15 | | 19 | | 22 | |
| | | 6.0 | | | 6 | 13 | | 16 | | 19 | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time (DATA - Q) | 2.0 | | | 36 | 110 | | 140 | | 165 | ns |
| | | 4.5 | | | 12 | 22 | | 28 | | 33 | |
| | | 6.0 | | | 10 | 19 | | 24 | | 28 | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time (G-Q) | 2.0 | | | 40 | 125 | | 155 | | 190 | ns |
| | | 4.5 | | | 13 | 25 | | 31 | | 38 | |
| | | 6.0 | | | 11 | 21 | | 26 | | 32 | |
| $t_{W(H)}$ | Minimum Pulse Width (G) | 2.0 | | | 18 | 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 | | 65 | | 75 | ns |
| | | 4.5 | | | | 10 | | 13 | | 15 | |
| | | 6.0 | | | | 9 | | 11 | | 13 | |
| $t_h$ | Minimum Hold Time | 2.0 | | | | 25 | | 30 | | 40 | ns |
| | | 4.5 | | | | 5 | | 6 | | 8 | |
| | | 6.0 | | | | 4 | | 5 | | 7 | |

**CAPACITIVE CHARACTERISTICS**

| Symbol | Parameter | Test Condition | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°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 | | | 30 | | | | | | pF |

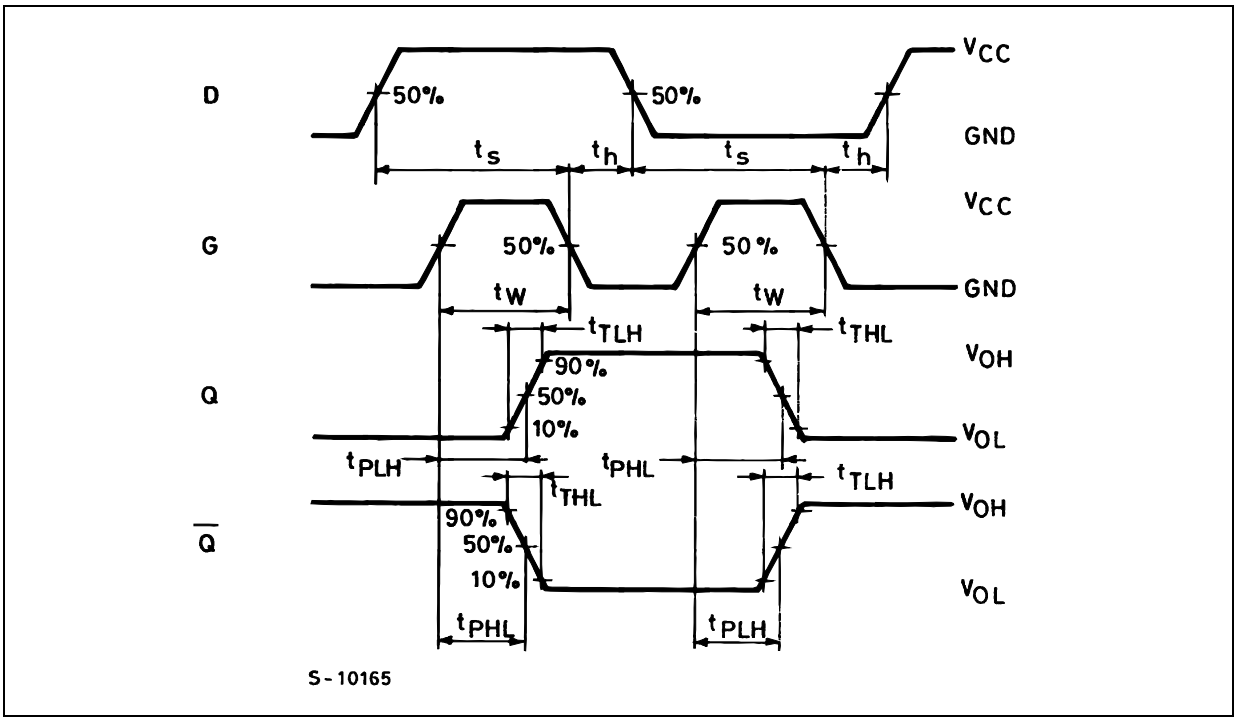
1) $C_{PD}$ is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

## TEST CIRCUIT



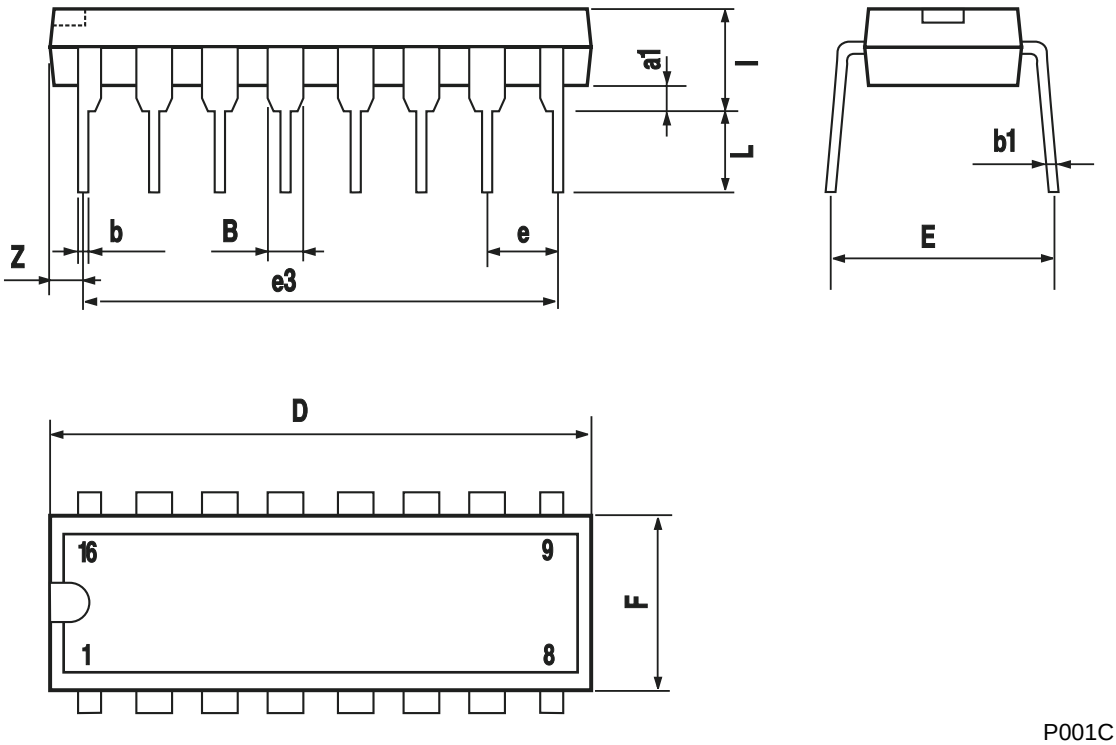

$C_L$ = 50pF or equivalent (includes jig and probe capacitance)
$R_T$ = $Z_{OUT}$ of pulse generator (typically 50Ω)

## SWITCHING CHARACTERISTICS TEST WAWEFORM (f=1MHz; 50% duty cycle)



## Plastic DIP-16 (0.25) MECHANICAL DATA

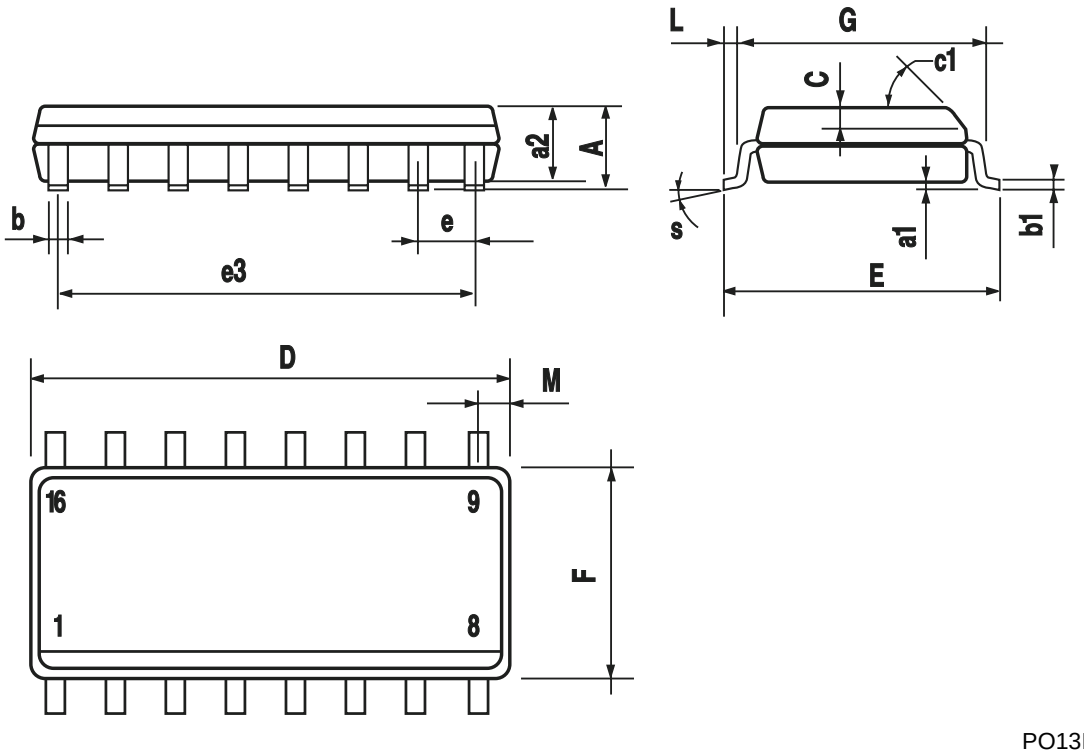
| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 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 |




P001C

## SO-16 MECHANICAL DATA

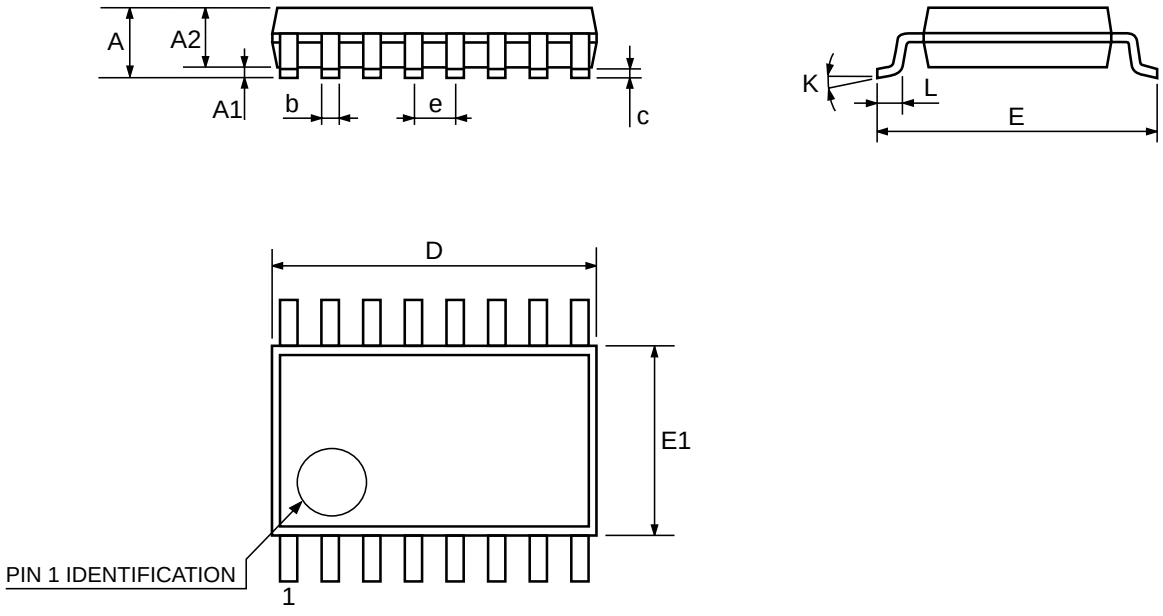
| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.003 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 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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