



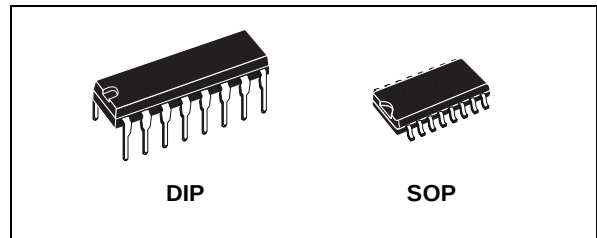
# HCF40174B

## HEX "D" TYPE FLIP-FLOP

- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT  
 $I_l = 100\text{nA}$  (MAX) AT  $V_{DD} = 18\text{V}$   $T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

### DESCRIPTION

HCF40174B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. HCF40174B consists of six identical "D" Type flip-flops having independent DATA inputs. The

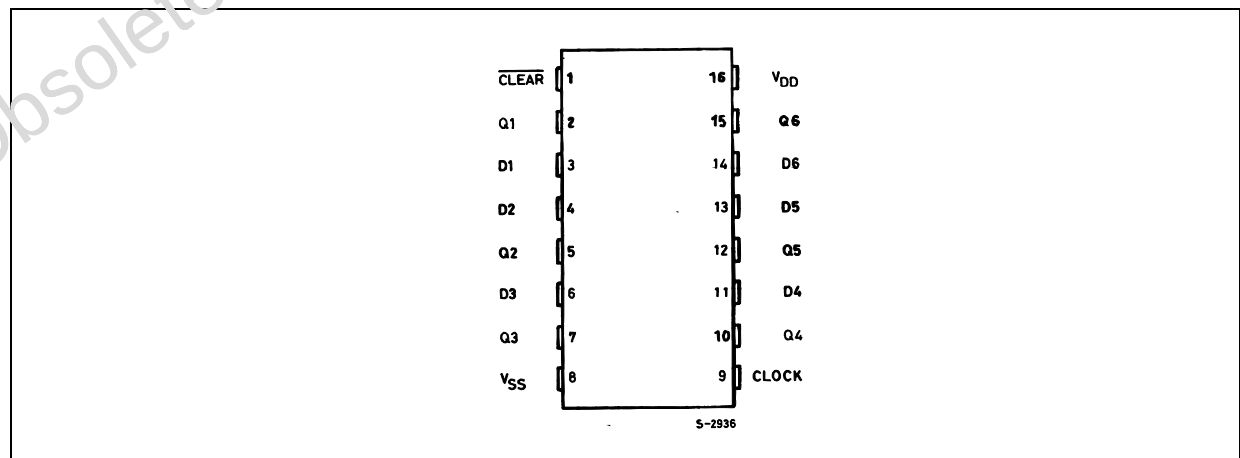


### ORDER CODES

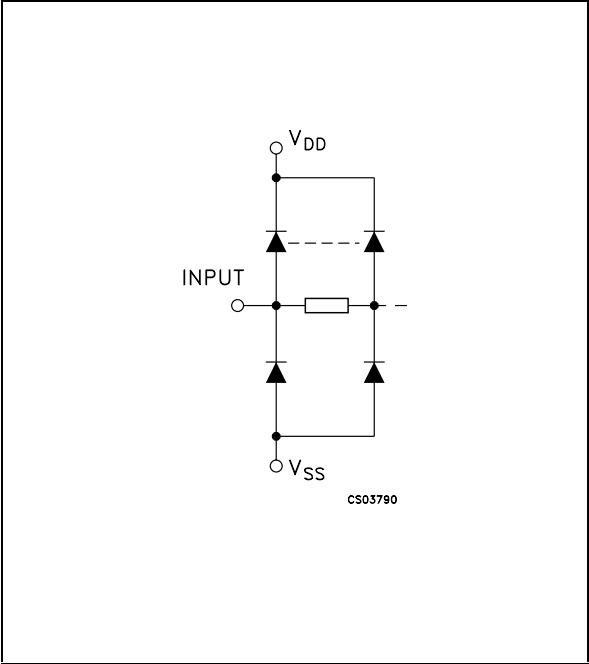
| PACKAGE | TUBE        | 1 & R          |
|---------|-------------|----------------|
| DIP     | HCF40174BEY |                |
| SOP     | HCF40174BM1 | HCF40174M013TR |

CLOCK and  $\overline{\text{CLEAR}}$  inputs are common in all six units. Data is transferred to the Q outputs on the positive-going transition of the clock pulse. All six flip-flops are simultaneously reset by a low level on the  $\overline{\text{CLEAR}}$  input.

### PIN CONNECTION



IINPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No              | SYMBOL   | NAME AND FUNCTION       |
|---------------------|----------|-------------------------|
| 3, 4, 6, 11, 13, 14 | D1 to D6 | Data Inputs             |
| 2, 5, 7, 10, 12, 15 | Q1 to Q6 | Data Outputs            |
| 9                   | CLOCK    | Common Clock Inputs     |
| 1                   | CLEAR    | Common Clear Inputs     |
| 8                   | VSS      | Negative Supply Voltage |
| 16                  | VDD      | Positive Supply Voltage |

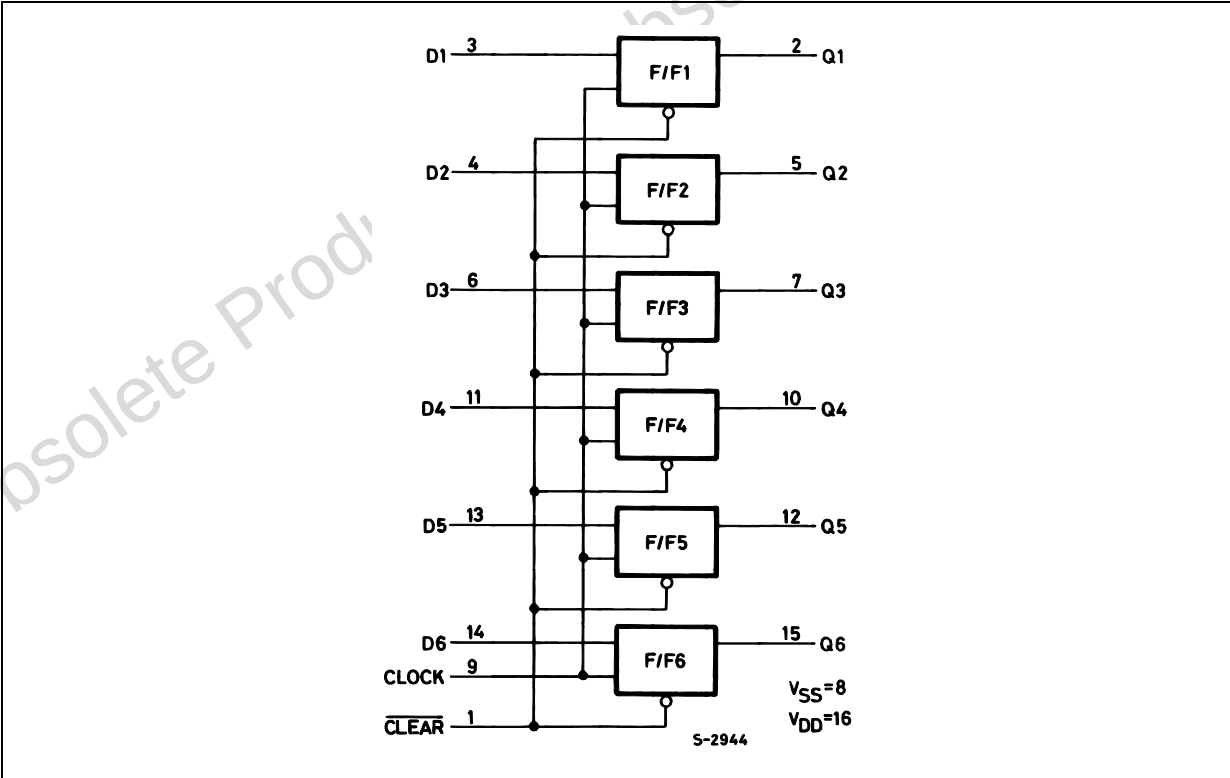
TRUTH TABLE

| INPUTS |      |              | OUTPUT |
|--------|------|--------------|--------|
| CLOCK  | DATA | <u>CLEAR</u> | Q      |
|        | L    | H            | L      |
|        | H    | H            | H      |
|        | X    | H            | NC     |
| X      | X    | L            | L      |

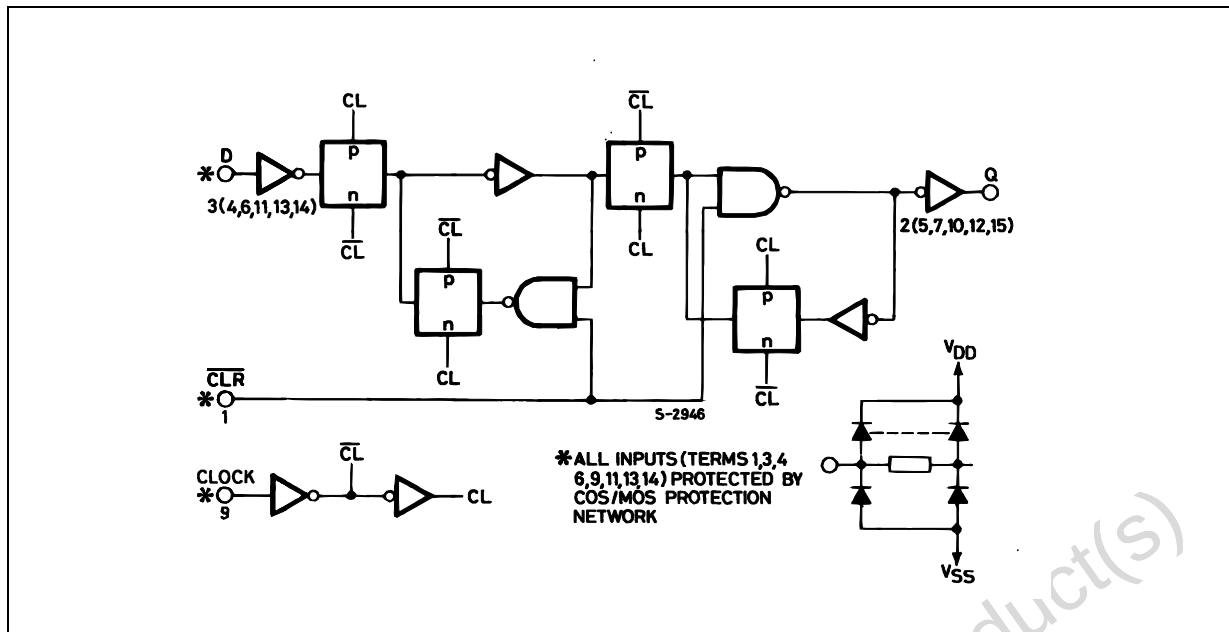
X : Don't Care

NC : NO CHANGE

FUNCTIONAL DIAGRAM



## LOGIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter                               | Value                  | Unit |
|-----------|-----------------------------------------|------------------------|------|
| $V_{DD}$  | Supply Voltage                          | -0.5 to +22            | V    |
| $V_I$     | DC Input Voltage                        | -0.5 to $V_{DD} + 0.5$ | V    |
| $I_I$     | DC Input Current                        | $\pm 10$               | mA   |
| $P_D$     | Power Dissipation per Package           | 200                    | mW   |
|           | Power Dissipation per Output Transistor | 100                    | mW   |
| $T_{op}$  | Operating Temperature                   | -55 to +125            | °C   |
| $T_{stg}$ | Storage Temperature                     | -65 to +150            | °C   |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.  
All voltage values are referred to  $V_{SS}$  pin voltage.

## RECOMMENDED OPERATING CONDITIONS

| Symbol   | Parameter             | Value         | Unit |
|----------|-----------------------|---------------|------|
| $V_{DD}$ | Supply Voltage        | 3 to 20       | V    |
| $V_I$    | Input Voltage         | 0 to $V_{DD}$ | V    |
| $T_{op}$ | Operating Temperature | -55 to 125    | °C   |

## DC SPECIFICATIONS

| Symbol          | Parameter                 | Test Condition        |                       |                           |                        | Value                 |                   |      |             |      |              |      | Unit |
|-----------------|---------------------------|-----------------------|-----------------------|---------------------------|------------------------|-----------------------|-------------------|------|-------------|------|--------------|------|------|
|                 |                           | V <sub>I</sub><br>(V) | V <sub>O</sub><br>(V) | I <sub>OL</sub>  <br>(μA) | V <sub>DD</sub><br>(V) | T <sub>A</sub> = 25°C |                   |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                           |                       |                       |                           |                        | Min.                  | Typ.              | Max. | Min.        | Max. | Min.         | Max. |      |
| I <sub>L</sub>  | Quiescent Current         | 0/5                   |                       |                           | 5                      |                       | 0.02              | 1    |             | 30   |              | 30   | μA   |
|                 |                           | 0/10                  |                       |                           | 10                     |                       | 0.02              | 2    |             | 60   |              | 60   |      |
|                 |                           | 0/15                  |                       |                           | 15                     |                       | 0.02              | 4    |             | 120  |              | 120  |      |
|                 |                           | 0/20                  |                       |                           | 20                     |                       | 0.02              | 20   |             | 600  |              | 600  |      |
| V <sub>OH</sub> | High Level Output Voltage | 0/5                   |                       | <1                        | 5                      | 4.95                  |                   |      | 4.95        |      | 4.95         |      | V    |
|                 |                           | 0/10                  |                       | <1                        | 10                     | 9.95                  |                   |      | 9.95        |      | 9.95         |      |      |
|                 |                           | 0/15                  |                       | <1                        | 15                     | 14.95                 |                   |      | 14.95       |      | 14.95        |      |      |
| V <sub>OL</sub> | Low Level Output Voltage  | 5/0                   |                       | <1                        | 5                      |                       | 0.05              |      |             | 0.05 |              | 0.05 | V    |
|                 |                           | 10/0                  |                       | <1                        | 10                     |                       | 0.05              |      |             | 0.05 |              | 0.05 |      |
|                 |                           | 15/0                  |                       | <1                        | 15                     |                       | 0.05              |      |             | 0.05 |              | 0.05 |      |
| V <sub>IH</sub> | High Level Input Voltage  |                       | 0.5/4.5               | <1                        | 5                      | 3.5                   |                   |      | 3.5         |      | 3.5          |      | V    |
|                 |                           |                       | 1/9                   | <1                        | 10                     | 7                     |                   |      | 7           |      | 7            |      |      |
|                 |                           |                       | 1.5/13.5              | <1                        | 15                     | 11                    |                   |      | 11          |      | 11           |      |      |
| V <sub>IL</sub> | Low Level Input Voltage   |                       | 4.5/0.5               | <1                        | 5                      |                       |                   | 1.5  |             | 1.5  |              | 1.5  | V    |
|                 |                           |                       | 9/1                   | <1                        | 10                     |                       |                   | 3    |             | 3    |              | 3    |      |
|                 |                           |                       | 13.5/1.5              | <1                        | 15                     |                       |                   | 4    |             | 4    |              | 4    |      |
| I <sub>OH</sub> | Output Drive Current      | 0/5                   | 2.5                   | <1                        | 5                      | -1.1                  | -2.6              |      | -0.9        |      | -0.9         |      | mA   |
|                 |                           | 0/5                   | 4.6                   | <1                        | 5                      | -0.31                 | -0.75             |      | -0.25       |      | -0.25        |      |      |
|                 |                           | 0/10                  | 9.5                   | <1                        | 10                     | -0.68                 | -1.6              |      | -0.54       |      | -0.54        |      |      |
|                 |                           | 0/15                  | 13.5                  | <1                        | 15                     | -2.3                  | -5.4              |      | -1.84       |      | -1.84        |      |      |
| I <sub>OL</sub> | Output Sink Current       | 0/5                   | 0.4                   | <1                        | 5                      | 0.44                  | 1                 |      | 0.36        |      | 0.36         |      | mA   |
|                 |                           | 0/10                  | 0.5                   | <1                        | 10                     | 1.1                   | 2.6               |      | 0.9         |      | 0.9          |      |      |
|                 |                           | 0/15                  | 1.5                   | <1                        | 15                     | 3.0                   | 6.8               |      | 2.4         |      | 2.4          |      |      |
| I <sub>I</sub>  | Input Leakage Current     | 0/18                  | Any Input             |                           | 18                     |                       | ±10 <sup>-5</sup> | ±0.1 |             | ±1   |              | ±1   | μA   |
| C <sub>I</sub>  | Input Capacitance         |                       | Any Input             |                           |                        |                       | 5                 | 7.5  |             |      |              |      | pF   |

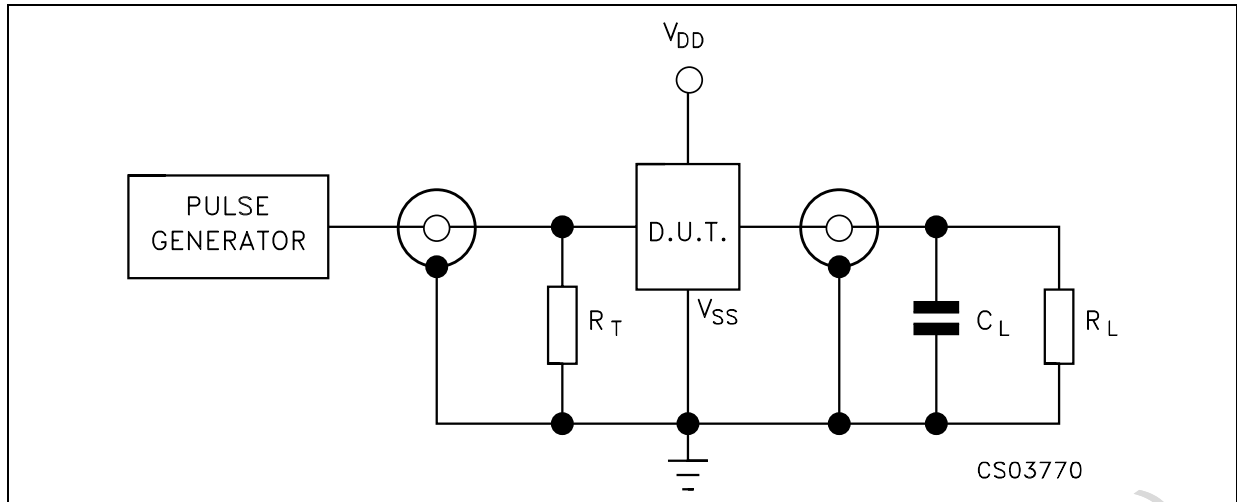
The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub>=5V, 2V min. with V<sub>DD</sub>=10V, 2.5V min. with V<sub>DD</sub>=15V

**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 200\text{K}\Omega$ ,  $t_r = t_f = 20\text{ ns}$ )

| Symbol                | Parameter                                   | Test Condition |  | Value (*) |      |      | Unit          |
|-----------------------|---------------------------------------------|----------------|--|-----------|------|------|---------------|
|                       |                                             | $V_{DD}$ (V)   |  | Min.      | Typ. | Max. |               |
| $t_{PLH}$ , $t_{PHL}$ | Propagation Delay Time :<br>Clock to Output | 5              |  |           | 150  | 300  | ns            |
|                       |                                             | 10             |  |           | 70   | 140  |               |
|                       |                                             | 15             |  |           | 50   | 100  |               |
| $t_{PHL}$             | Propagation Delay Time :<br>Clear to Output | 5              |  |           | 100  | 200  | ns            |
|                       |                                             | 10             |  |           | 50   | 100  |               |
|                       |                                             | 15             |  |           | 40   | 80   |               |
| $t_{THL}$ , $t_{TLH}$ | Transition Time                             | 5              |  |           | 100  | 200  | ns            |
|                       |                                             | 10             |  |           | 50   | 100  |               |
|                       |                                             | 15             |  |           | 40   | 80   |               |
| $t_{setup}$           | Data Setup Time                             | 5              |  | 40        | 20   |      | ns            |
|                       |                                             | 10             |  | 20        | 10   |      |               |
|                       |                                             | 15             |  | 10        | 0    |      |               |
| $t_{hold}$            | Data Hold Time                              | 5              |  | 80        | 40   |      | ns            |
|                       |                                             | 10             |  | 40        | 20   |      |               |
|                       |                                             | 15             |  | 30        | 15   |      |               |
| $t_W$                 | Clock Input Pulse Width<br>Low Level        | 5              |  | 130       | 65   |      | ns            |
|                       |                                             | 10             |  | 60        | 30   |      |               |
|                       |                                             | 15             |  | 40        | 20   |      |               |
| $t_W$                 | Clear Input Pulse Width<br>HIGH and LOW     | 5              |  | 100       | 50   |      | ns            |
|                       |                                             | 10             |  | 50        | 25   |      |               |
|                       |                                             | 15             |  | 40        | 20   |      |               |
| $t_r$ , $t_f$         | Clock Input Rise or Fall<br>Time            | 5              |  |           |      | 15   | $\mu\text{s}$ |
|                       |                                             | 10             |  |           |      | 15   |               |
|                       |                                             | 15             |  |           |      | 15   |               |
| $t_{rem}$             | Clear Removal Time                          | 5              |  | 0         | -40  |      | ns            |
|                       |                                             | 10             |  | 0         | -15  |      |               |
|                       |                                             | 15             |  | 0         | -10  |      |               |
| $f_{CL}$              | Maximum Clock Input<br>Frequency            | 5              |  | 3.5       | 7    |      | MHz           |
|                       |                                             | 10             |  | 6         | 12   |      |               |
|                       |                                             | 15             |  | 8         | 16   |      |               |

(\*) Typical temperature coefficient for all  $V_{DD}$  value is 0.3 %/°C.

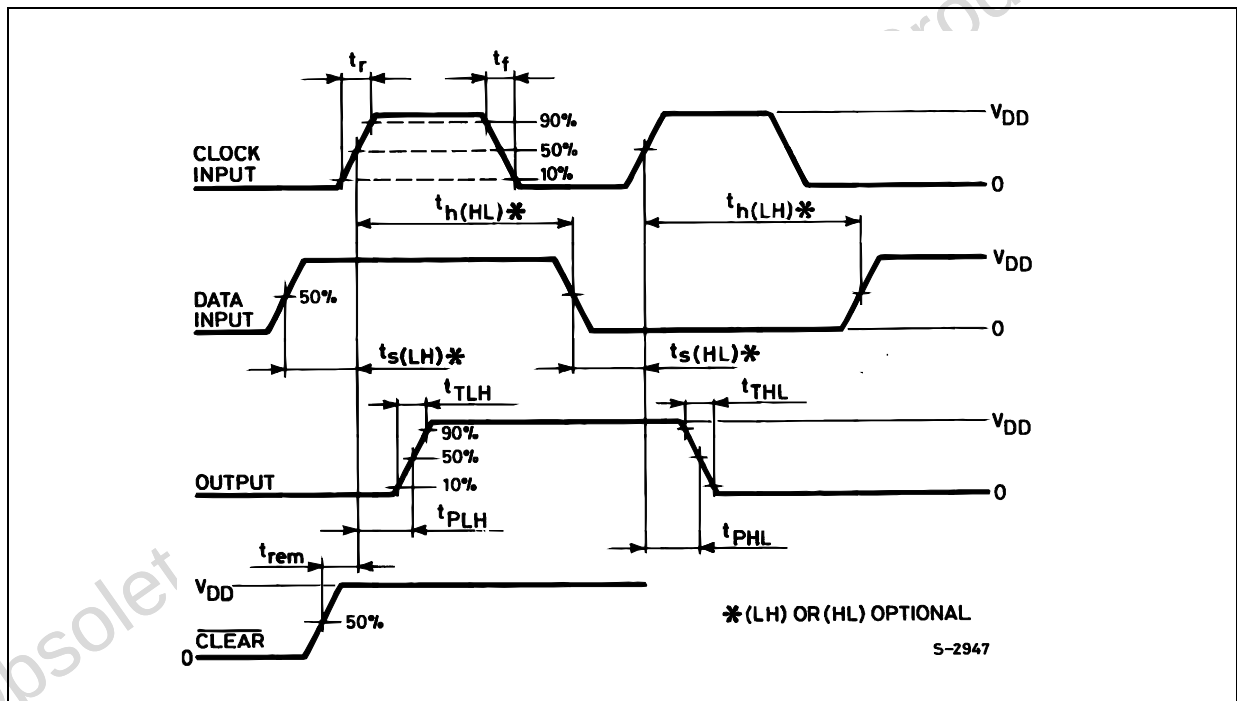
## TEST CIRCUIT



$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)

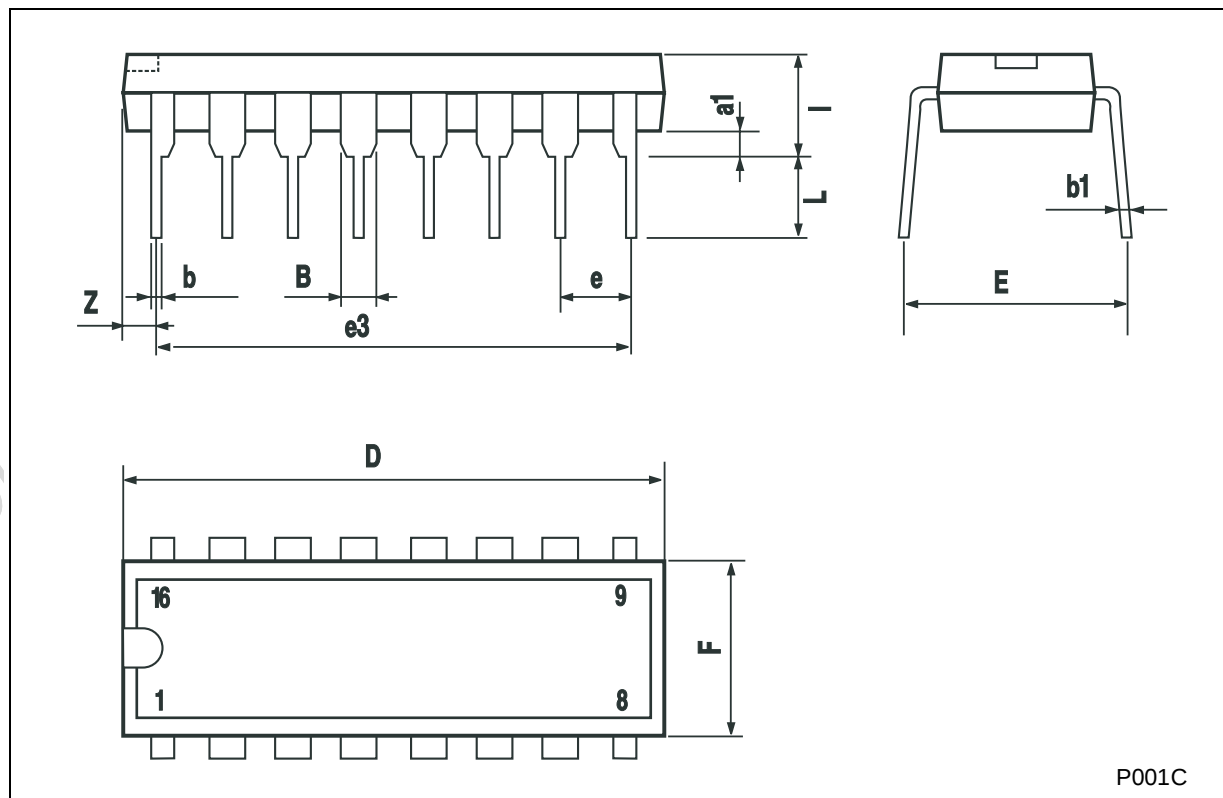
$R_L = 200\text{k}\Omega$

$R_T = Z_{\text{OUT}}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM : PROPAGATION DELAY TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)

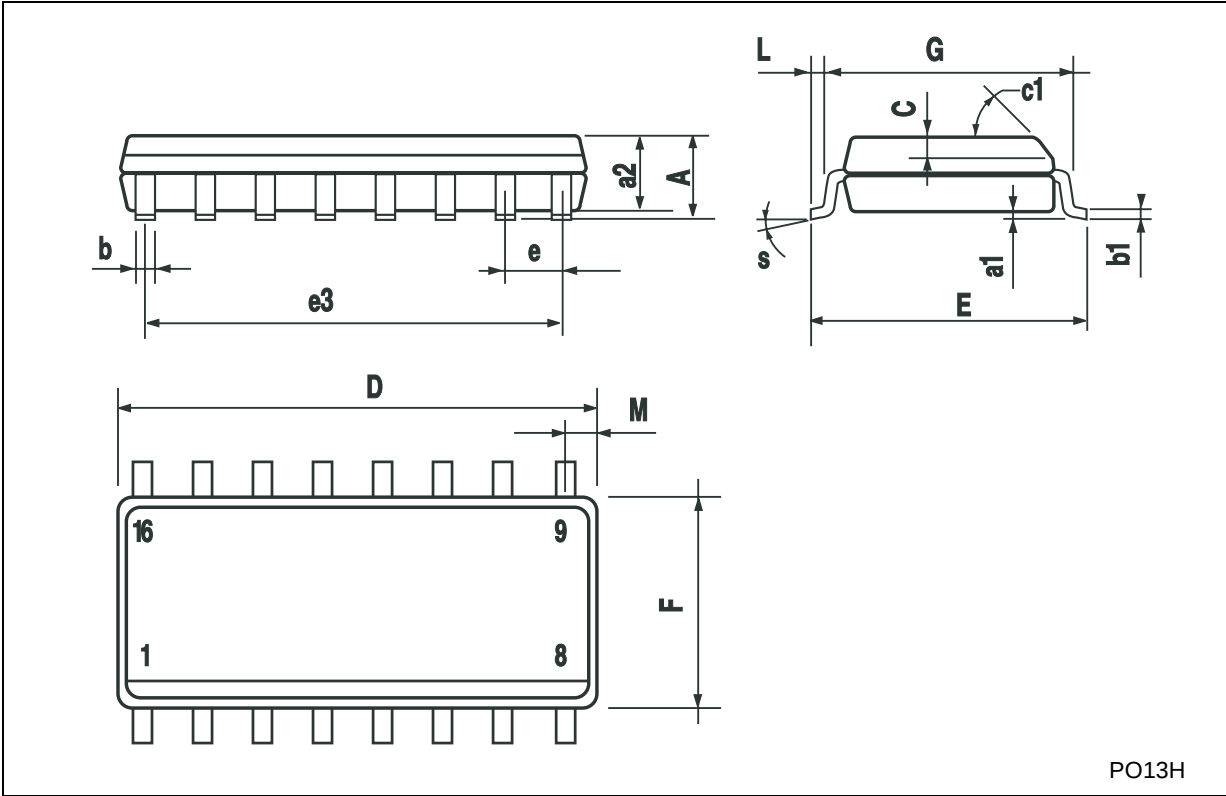
### Plastic DIP-16 (0.25) MECHANICAL DATA

| 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



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