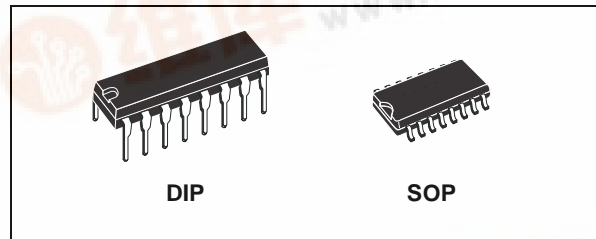




HCF4538B

DUAL MONOSTABLE MULTIVIBRATOR

- RETRIGGERABLE/RESETTABLE CAPABILITY
- TRIGGER AND RESET PROPAGATION DELAYS INDEPENDENT OF R_X , C_X
- TRIGGERING FROM LEADING OR TRAILING EDGE
- Q AND \bar{Q} BUFFERED OUTPUT AVAILABLE
- SEPARATE RESETS
- WIDE RANGE OF OUTPUT PULSE WIDTHS
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- SCHMITT TRIGGER INPUT ALLOWS UNLIMITED RISE AND FALL TIMES ON +TR AND -TR INPUTS
- INPUT LEAKAGE CURRENT
 $I_1 = 100\text{nA (MAX) AT } V_{DD} = 18\text{V } T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



ORDER CODES

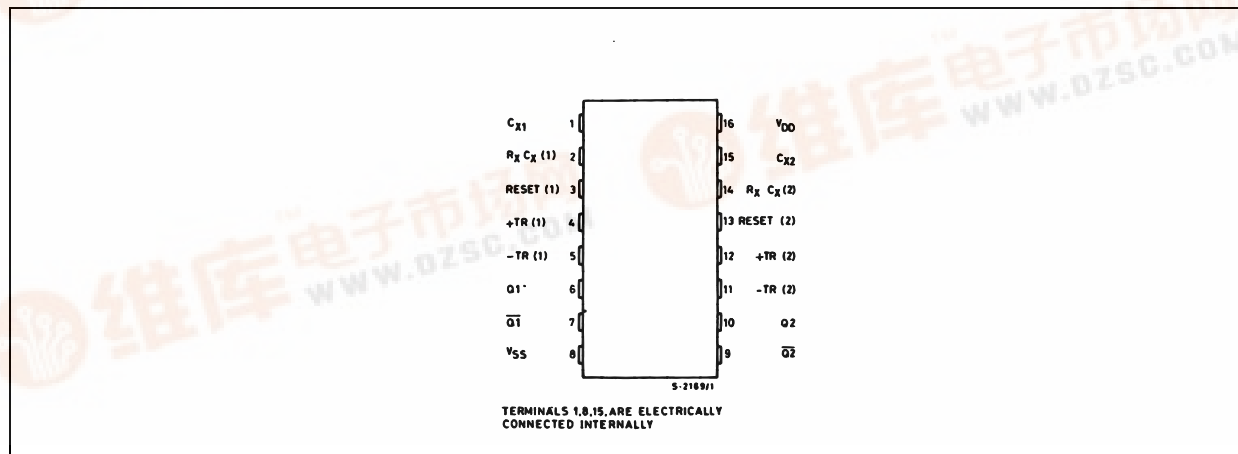
| PACKAGE | TUBE | T & R |
|---------|------------|---------------|
| DIP | HCF4538BEY | |
| SOP | HCF4538BM1 | HCF4538M013TR |

DESCRIPTION

The HCF4538B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. The HCF4538B dual precision monostable multivibrator provides stable retriggerable/resettable one-shot operation for any fixed voltage

timing application. An external resistor (R_X) and an external capacitor (C_X) control the timing and accuracy for the circuit. Adjustment of R_X and C_X provides a wide range of output pulse widths from the Q and \bar{Q} terminals. The time delay from trigger input to output transition (trigger propagation delay) and the time delay from reset input to output transition (reset propagation delay) and the time delay from reset input to output transition (reset propagation delay) are independent of R_X and C_X . Precision control of output pulse width is achieved through linear CMOS techniques. Leading edge triggering (+TR) and trailing edge triggering (-TR) inputs are provided for triggering

PIN CONNECTION

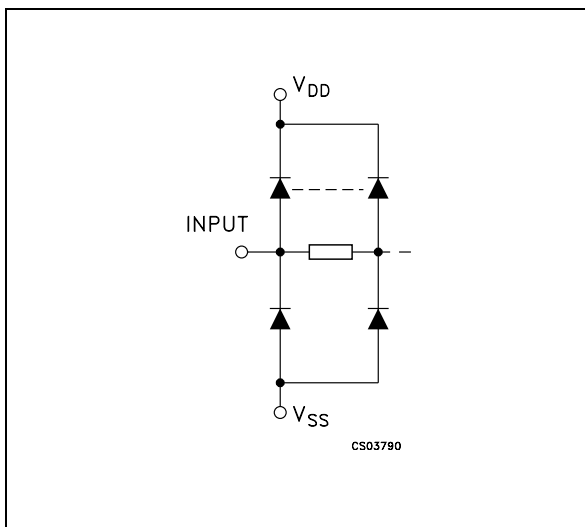


HCF4538B

from either edge of an input pulse. An unused +TR input should be tied to V_{SS} . An unused -TR input should be tied to V_{DD} . A RESET (on low level) is provided for immediate termination of the output pulse or to prevent output pulses when power is turned on. An unused RESET input should be tied to V_{DD} . However, if an entire section of the HCF4538B is not used, its inputs must be tied to either V_{DD} or V_{SS} (see table 1). In normal operation the circuit triggers (extends the output

pulse one period) on the application of each new trigger pulse. For operation in the non-retiggerable mode, Q is connected to -TR when leading edge triggering (+TR) is used or Q is connected to +TR when trailing edge triggering (-TR) is used. The time period (T) for this multivibrator can be calculated by : $T = R_X C_X$. The min. value of external resistance, R_X , is $4K\Omega$. The max. and min. values of external capacitance, C_X , are $100\ \mu F$ and $5nF$, respectively.

IINPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------|--------------------------------|--|
| 4, 12 | +TR | Trigger Inputs (Low to High, Edge-Triggered) |
| 5, 11 | -TR | Trigger Inputs (High to Low, Edge-Triggered) |
| 3, 13 | RESET | Direct Reset Inputs (Active Low) |
| 1, 15 | C_X1, C_X2 | External Capacitor Connections |
| 2, 14 | $R_X C_X1$ $R_X C_X2$ | External Resistor/Capacitor Connections |
| 6, 10 | Q1, Q2 | Pulse Outputs |
| 7, 9 | $\overline{Q1}, \overline{Q2}$ | Complementary Pulse Outputs |
| 8 | V_{SS} | Negative Supply Voltage |
| 16 | V_{DD} | Positive Supply Voltage |

Terminals 1, 8, 15 are electrically connected internally

FUNCTIONAL DIAGRAM

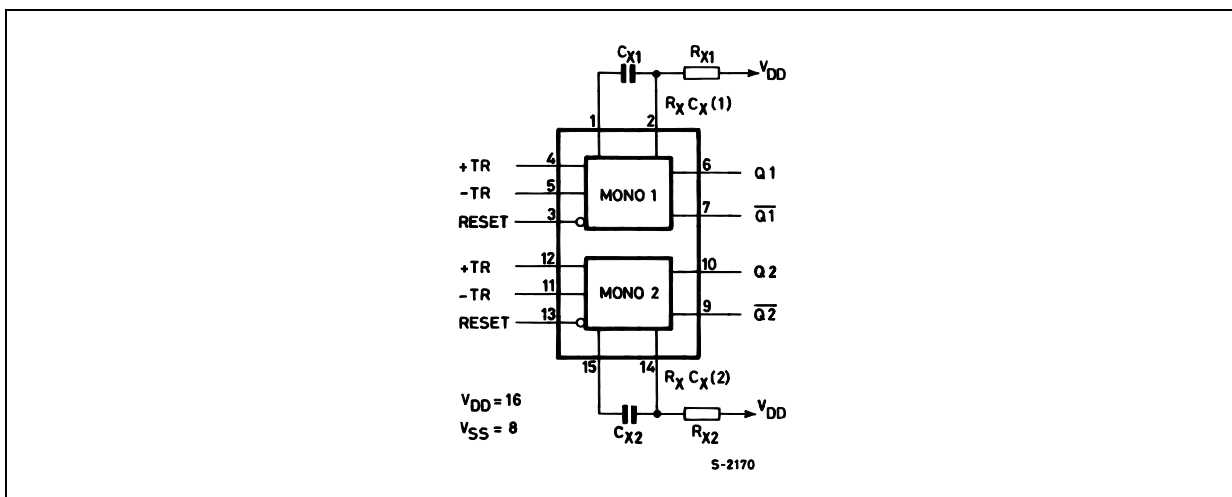


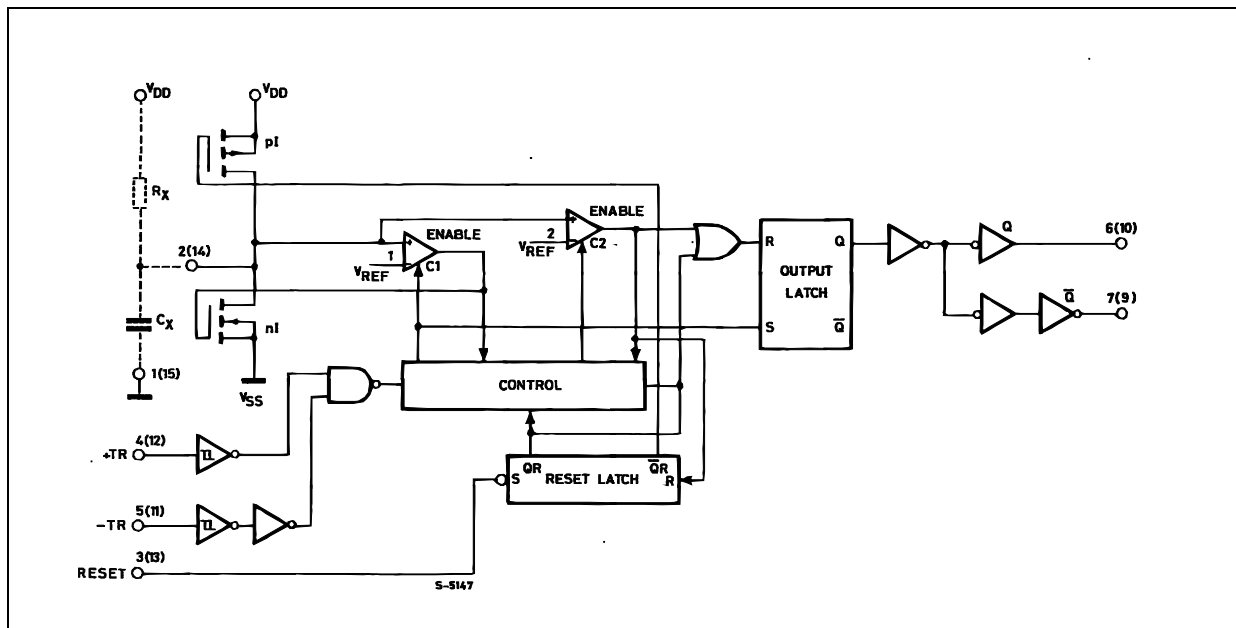
TABLE 1 : Functional Terminal Connections

| FUNCTION | V _{DD} to Term. N° | | V _{SS} to Term. N° | | Input Pulse to Term. N° | | Other Connections | |
|---|-----------------------------|----------|-----------------------------|----------|-------------------------|----------|-------------------|----------|
| | Mono (1) | Mono (2) | Mono (1) | Mono (2) | Mono (1) | Mono (2) | Mono (1) | Mono (2) |
| Leading Edge Trigger/Retriggerable | 3, 5 | 11, 13 | | | 4 | 12 | | |
| Leading Edge Trigger/Non Retriggerable | 3 | 13 | | | 4 | 12 | 5, 7 | 11, 9 |
| Trailing Edge Trigger/Retriggerable | 3 | 13 | 4 | 12 | 5 | 11 | | |
| Trailing Edge Trigger/Non Retriggerable | 3 | 13 | | | 5 | 11 | 4, 6 | 12, 10 |

A Retriggerable one-shot multivibrator has an output pulse width which is extended on full time period (T) after application of the last trigger pulse.

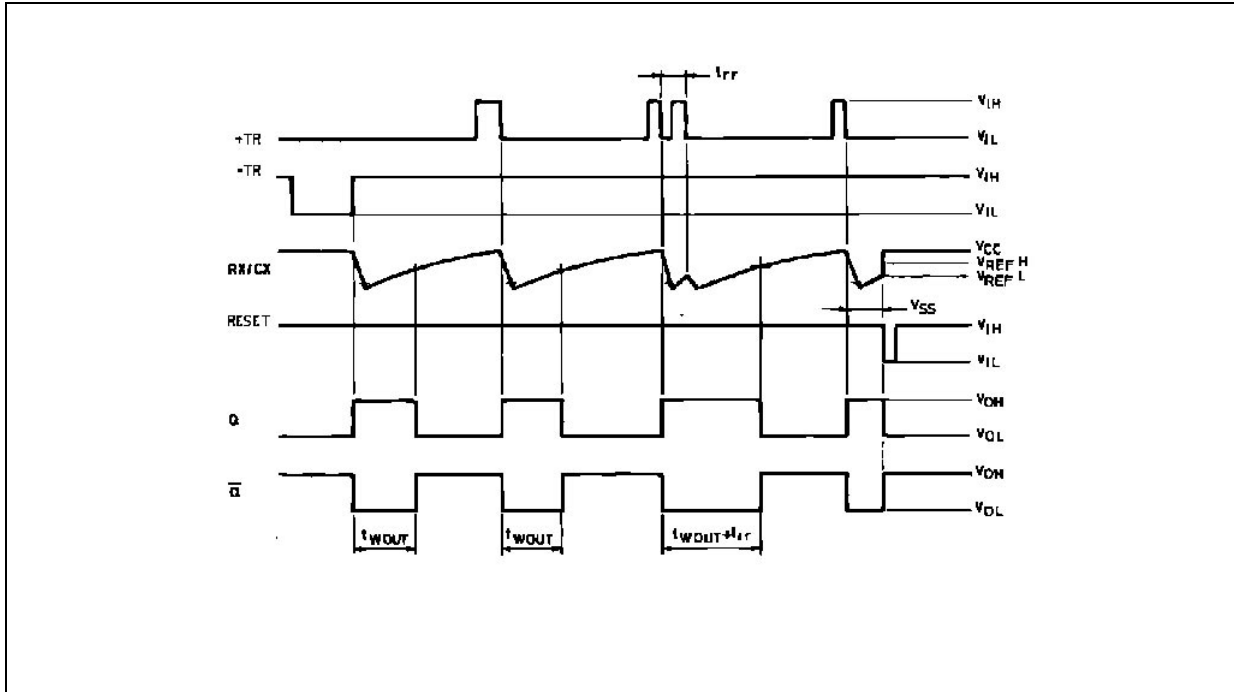
A Non-Retriggerable one-shot multivibrator has a time period (T) referenced from the application of the first trigger pulse.

LOGIC DIAGRAM



HCF4538B

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 | ± 10 | mA |
| P_D | Power Dissipation per Package | 200 | mW |
| | Power Dissipation per Output Transistor | 100 | mW |
| T_{op} | Operating Temperature | -55 to +125 | $^{\circ}\text{C}$ |
| T_{stg} | Storage Temperature | -65 to +150 | $^{\circ}\text{C}$ |

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 | $^{\circ}\text{C}$ |

DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | | | Value | | | | | | Unit | |
|-----------------|---------------------------|-----------------------|-----------------------|---------------------------------|------------------------|-----------------------|---------------|-----------|-------------|---------|--------------|---------|---------|
| | | V _I (V) | V _O (V) | I _{OL} (μ A) | V _{DD} (V) | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| I _L | Quiescent Current | 0/5 | | | 5 | | 0.04 | 5 | | 150 | | 150 | μ A |
| | | 0/10 | | | 10 | | 0.04 | 10 | | 300 | | 300 | |
| | | 0/15 | | | 15 | | 0.04 | 20 | | 600 | | 600 | |
| | | 0/20 | | | 20 | | 0.08 | 100 | | 3000 | | 3000 | |
| V _{OH} | 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 _{OL} | 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 _{IH} | 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 _{IL} | 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 _{OH} | Output Drive Current | 0/5 | 2.5 | <1 | 5 | -1.6 | -3.2 | | -1.3 | | -1.3 | | mA |
| | | 0/5 | 4.6 | <1 | 5 | -0.51 | -1 | | -0.42 | | -0.42 | | |
| | | 0/10 | 9.5 | <1 | 10 | -1.3 | -2.6 | | -1.1 | | -1.1 | | |
| | | 0/15 | 13.5 | <1 | 15 | -3.4 | -6.8 | | -2.8 | | -2.8 | | |
| I _{OL} | Output Sink Current | 0/5 | 0.4 | <1 | 5 | -0.51 | 1 | | -0.42 | | -0.42 | | mA |
| | | 0/10 | 0.5 | <1 | 10 | -1.3 | 2.6 | | -1.1 | | -1.1 | | |
| | | 0/15 | 1.5 | <1 | 15 | -3.4 | 6.8 | | -2.8 | | -2.8 | | |
| I _I | Input Leakage Current | 0/18 | Any Input | | 18 | | $\pm 10^{-5}$ | ± 0.1 | | ± 1 | | ± 1 | μ A |
| C _I | Input Capacitance | | Any Input | | | | 5 | 7.5 | | | | | pF |

The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

HCF4538B

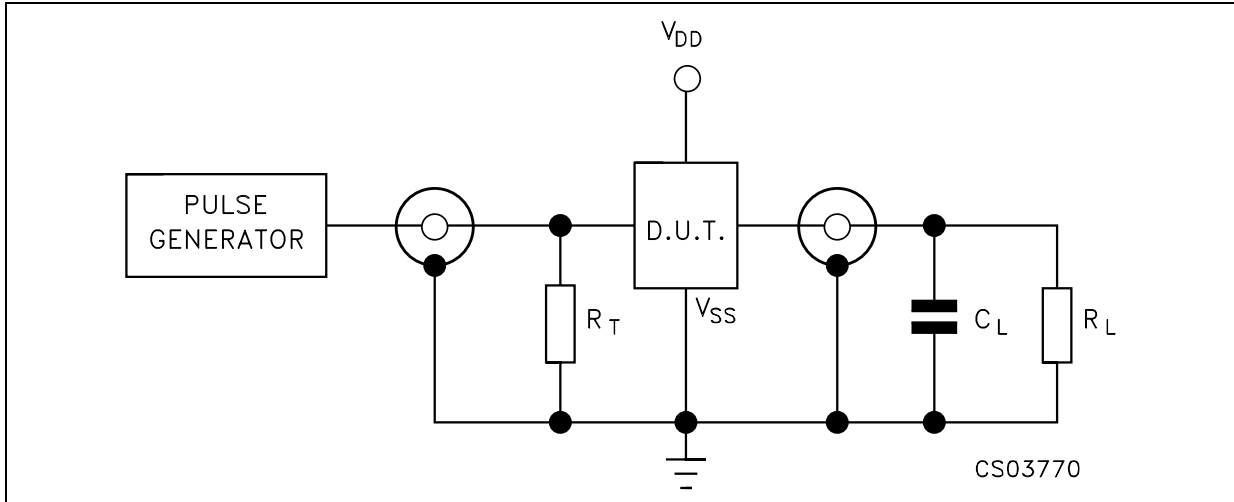
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{pF}$, $R_L = 200\text{K}\Omega$, $t_r = t_f = 20\text{ ns}$)

| Symbol | Parameter | Test Condition | | Value (*) | | | Unit |
|---------------------|---|----------------|-------------------------|-----------|---------|------|---------------|
| | | V_{DD} (V) | | Min. | Typ. | Max. | |
| t_{TLH} t_{THL} | Transition Time | 5 | | | 100 | 200 | ns |
| | | 10 | | | 50 | 100 | |
| | | 15 | | | 40 | 80 | |
| t_{PLH} t_{PHL} | Propagation Delay Time +TR or -TR to Q or \bar{Q} | 5 | | | 300 | 600 | ns |
| | | 10 | | | 150 | 300 | |
| | | 15 | | | 100 | 200 | |
| t_{PLH} t_{PHL} | Propagation Delay Time Reset to Q or \bar{Q} | 5 | $R_L = 1\text{K}\Omega$ | | 250 | 500 | ns |
| | | 10 | | | 125 | 250 | |
| | | 15 | | | 95 | 190 | |
| t_{WH} t_{WL} | Minimum Input Pulse Width +TR, -TR or Reset | 5 | $R_L = 1\text{K}\Omega$ | | 80 | 140 | ns |
| | | 10 | | | 40 | 80 | |
| | | 15 | | | 30 | 60 | |
| t_{WT} | Output Pulse Width - Q or \bar{Q} ($C_X = 0.005\ \mu\text{F}$, $R_X =$ $10\text{K}\Omega$ ⁽¹⁾) | 5 | | 57 | 60.6 | 64.5 | μs |
| | | 10 | | 55 | 58.9 | 63.0 | |
| | | 15 | | 55 | 59.1 | 63.5 | |
| t_{WT} | Output Pulse Width - Q or \bar{Q} ($C_X = 0.1\ \mu\text{F}$, $R_X =$ $100\text{K}\Omega$) | 5 | | 9.4 | 9.97 | 10.5 | ms |
| | | 10 | | 9.4 | 9.95 | 10.6 | |
| | | 15 | | 9.5 | 10.0 | 10.6 | |
| t_{WT} | Output Pulse Width - Q or \bar{Q} ($C_X = 10\ \mu\text{F}$, $R_X =$ $100\text{K}\Omega$) | 5 | | 0.95 | 1.0 | 1.06 | s |
| | | 10 | | 0.95 | 1.0 | 1.06 | |
| | | 15 | | 0.96 | 1.0 | 1.07 | |
| t_W | Pulse Width Match Between Circuits in Same Package : $(100(T_1 - T_2)/T_1)$ ($C_X = 0.1\ \mu\text{F}$, $R_X = 100\text{K}\Omega$) | 5 | | | ± 1 | | % |
| | | 10 | | | ± 1 | | |
| | | 15 | | | ± 1 | | |
| t_{rr} | Minimum Retrigger Time | 5 | | 0 | | | ns |
| | | 10 | | 0 | | | |
| | | 15 | | 0 | | | |
| C_{IN} | Input Capacitance | Any Input | | | 5 | 7.5 | pF |

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

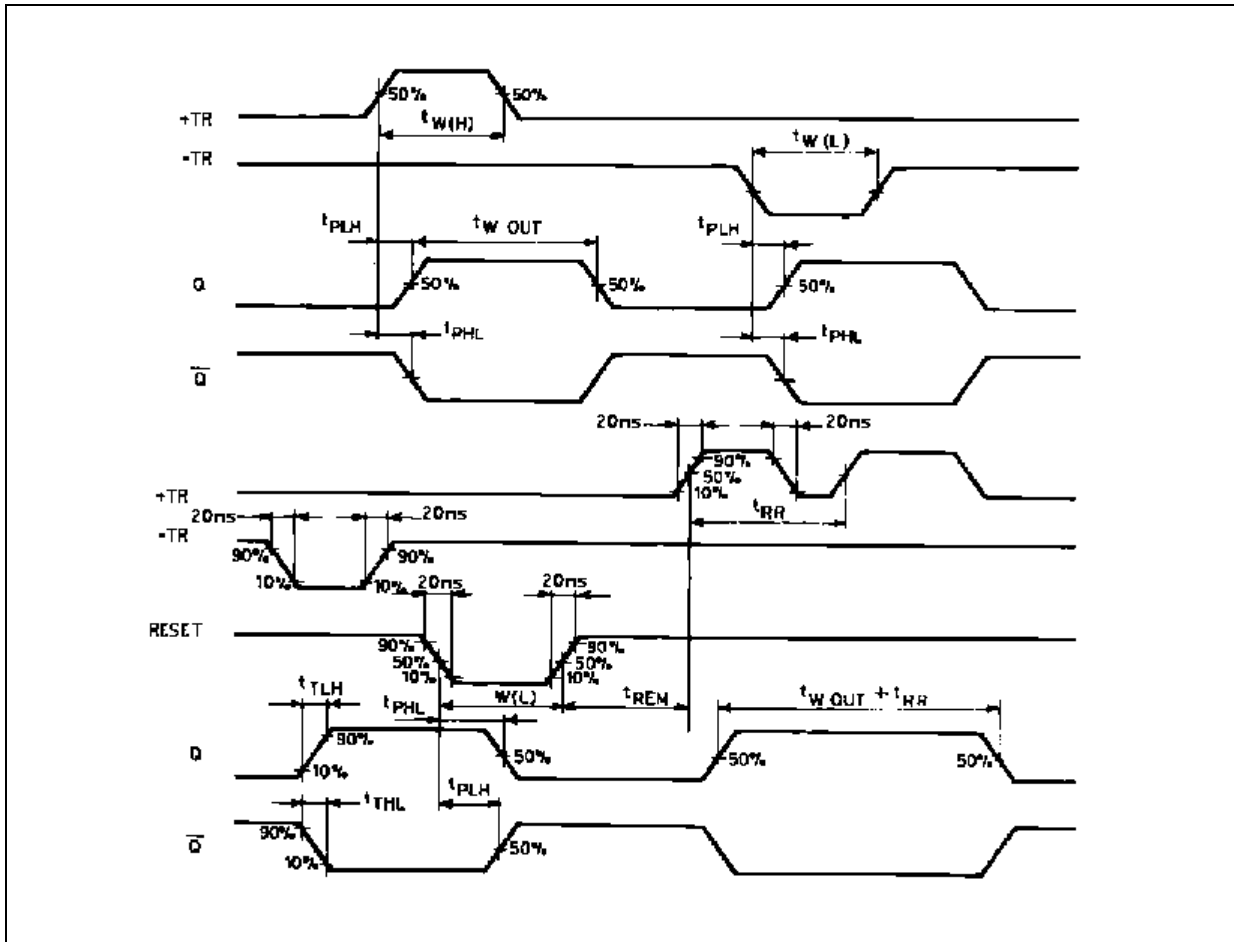
(1) Minimum R_X value = 4K Ω , minimum C_X value = 5000 pF

TEST CIRCUIT



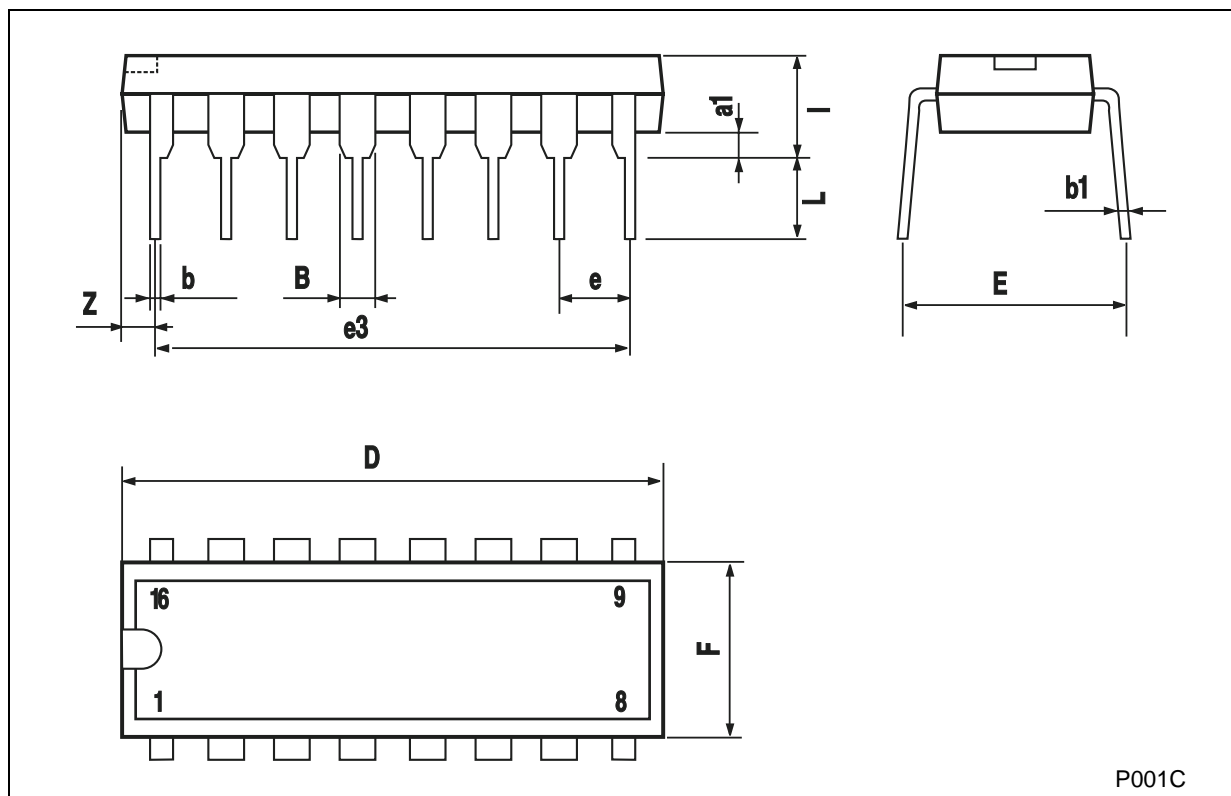
$C_L = 50\text{pF}$ or equivalent (includes jig and probe capacitance)
 $R_L = 200\text{K}\Omega$
 $R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

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



Plastic DIP-16 (0.25) MECHANICAL DATA

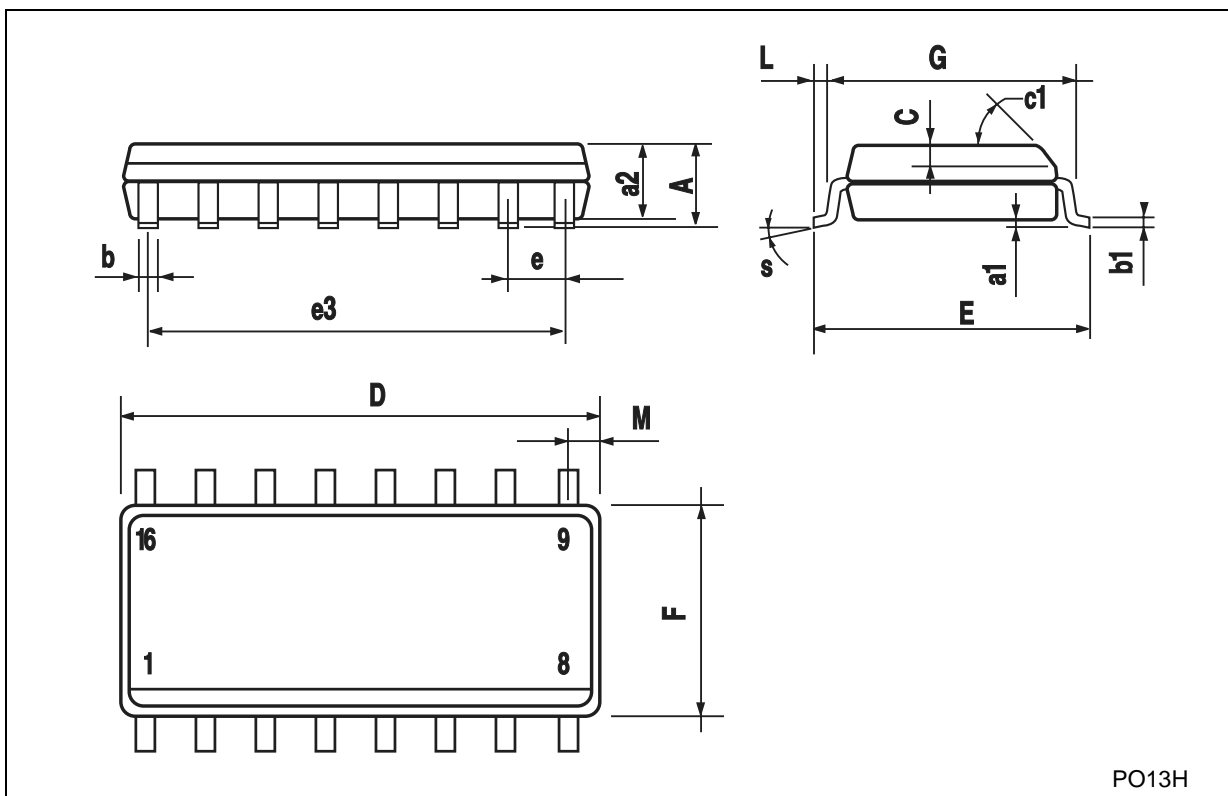
| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | |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



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

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