



M74HC4518

DUAL DECADE COUNTER

- HIGH SPEED :
 $f_{MAX} = 60 \text{ MHz (TYP.) at } V_{CC} = 6V$
- LOW POWER DISSIPATION:
 $I_{CC} = 4\mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 4\text{mA (MIN.)}$
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- PIN AND FUNCTION COMPATIBLE WITH
 74 SERIES 4518



ORDER CODES

| PACKAGE | TUBE | T & R |
|---------|--------------|-----------------|
| DIP | M74HC4518B1R | |
| SOP | M74HC4518M1R | M74HC4518RM13TR |
| TSSOP | | M74HC4518TTR |

DESCRIPTION

The M74HC4518 is an high speed CMOS DUAL BINARY COUNTER fabricated with silicon gate C²MOS technology.

It consist of two identical internally synchronous 4-stage counters. The counter stages are D-TYPE flip-flops having interchangeable CLOCK and ENABLE inputs for incrementing on either the positive-going or negative-going transition.

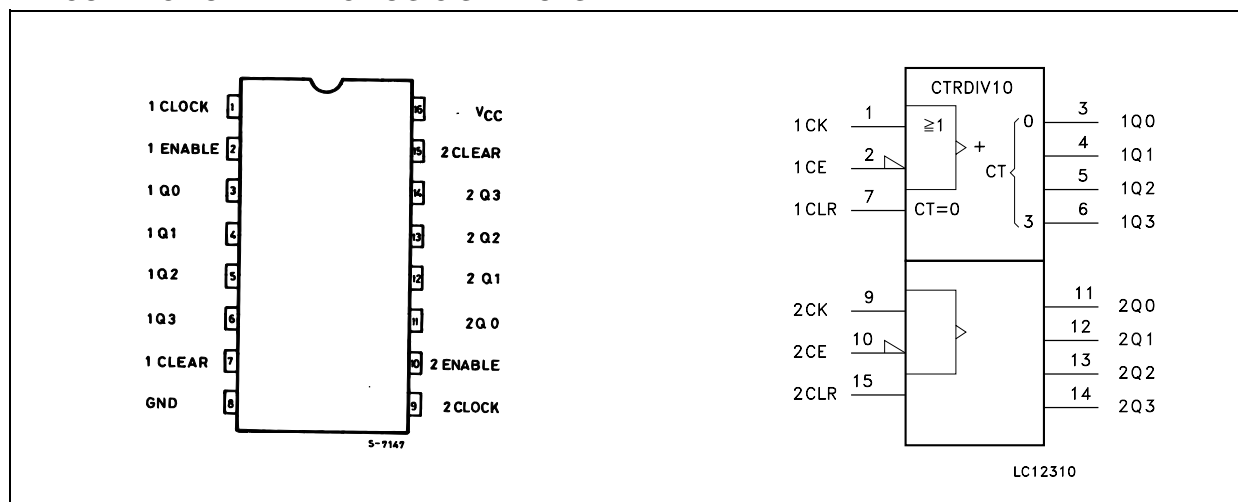
For single-unit operation the ENABLE input is maintained "high" and the counter advances on

each positive-going transition of the CLOCK. The counters are cleared by high levels on their clear lines.

The counter can be cascaded in the ripple mode by connecting Q4 to the enable input of the subsequent counter while the clock input of the latter is held permanently low.

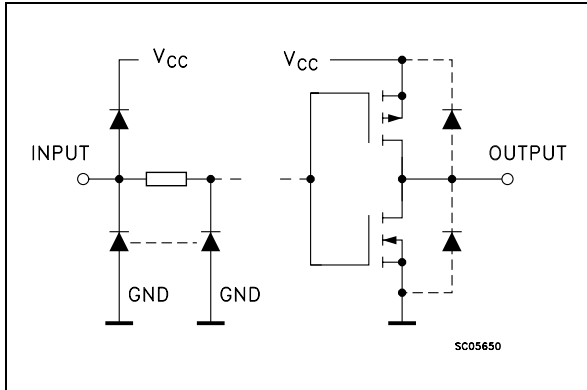
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS



M74HC4518

INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

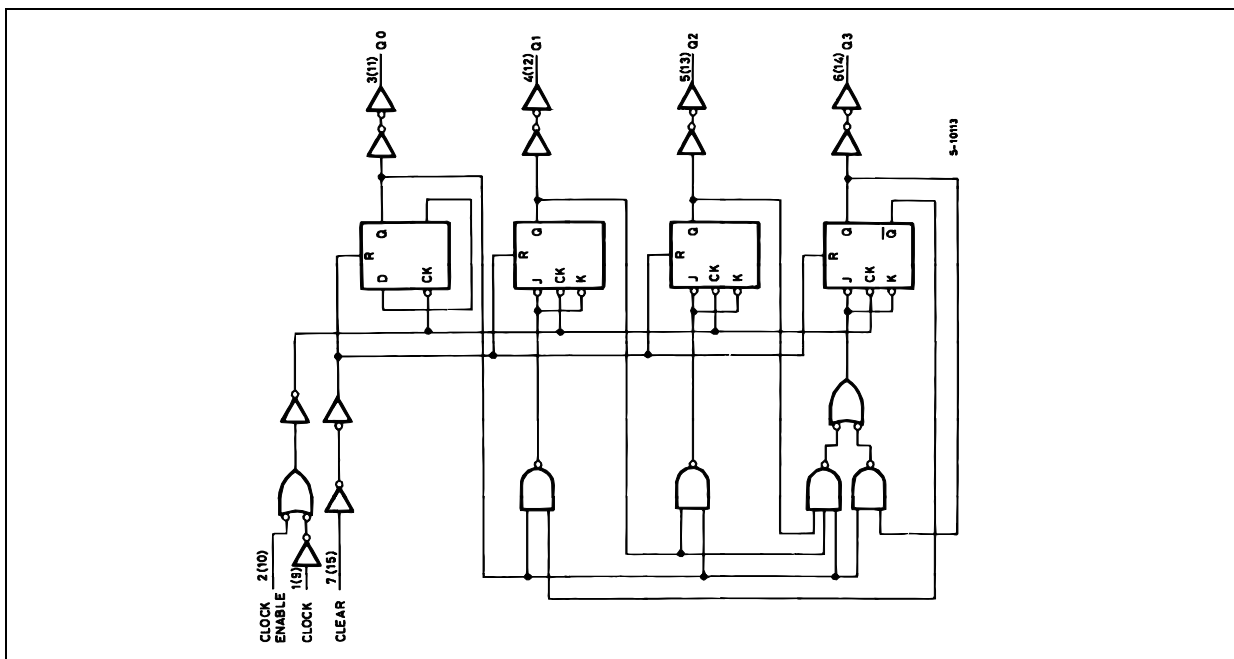
| PIN No | SYMBOL | NAME AND FUNCTION |
|----------------|------------------|--|
| 1, 9 | 1CLOCK, 2CLOCK | Clock Inputs (LOW to HIGH, Edge-Triggered) |
| 2, 10 | 1ENABLE, 2ENABLE | Clock Enable Inputs |
| 3, 4, 5, 6 | 1Q0 to 1Q3 | Data Outputs |
| 7, 15 | 1CLEAR, 2CLEAR | Asynchronous Reset Inputs (Active LOW) |
| 11, 12, 13, 14 | 2Q0 to 2Q3 | Data Outputs |
| 8 | GND | Ground (0V) |
| 16 | Vcc | Positive Supply Voltage |

TRUTH TABLE

| INPUTS | | | FUNCTION |
|--------|--------|-------|-------------------|
| CLOCK | ENABLE | CLEAR | |
| | H | L | INCREMENT COUNTER |
| L | | L | INCREMENT COUNTER |
| | X | L | NO CHANGE |
| X | | L | NO CHANGE |
| | L | L | NO CHANGE |
| H | | L | NO CHANGE |
| X | X | H | Q0 THRU Q3=L |

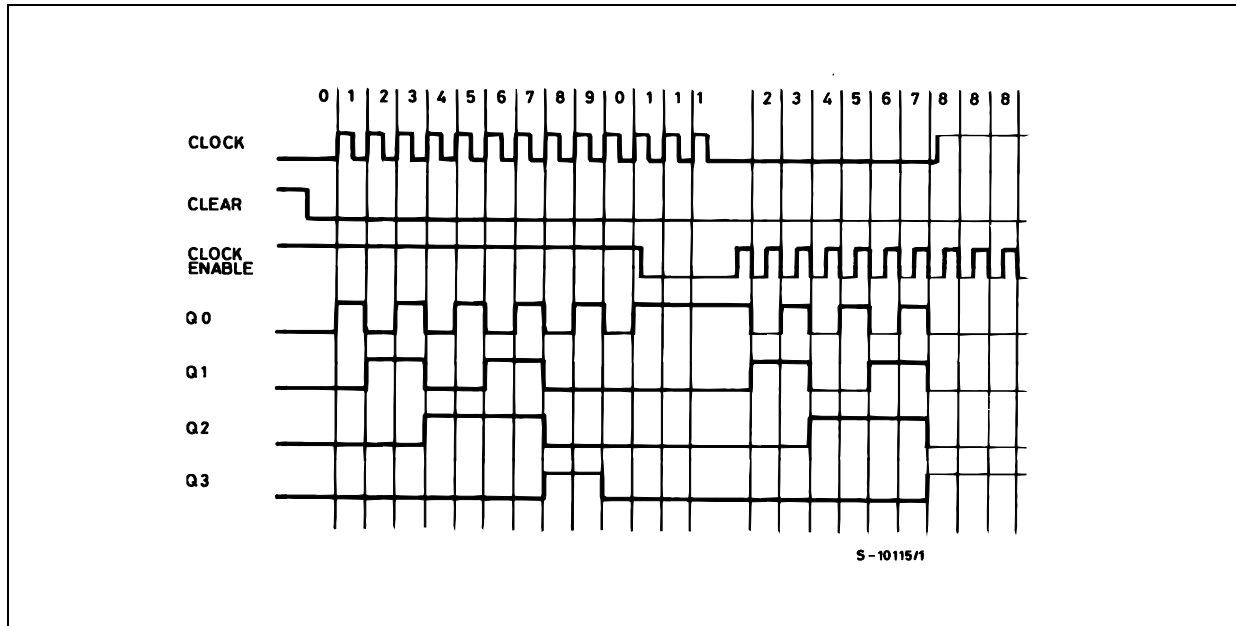
X : Don't Care
Z : High Impedance

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

TIMING CHART



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 | $^{\circ}C$ |
| 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 conditions is not implied.

(*) 500mW at 65 $^{\circ}C$; derate to 300mW by 10mW/ $^{\circ}C$ from 65 $^{\circ}C$ to 85 $^{\circ}C$

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) | | $T_A = 25^\circ\text{C}$ | | | $-40 \text{ to } 85^\circ\text{C}$ | | $-55 \text{ to } 125^\circ\text{C}$ | | |
| | | | | 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 | $I_O = -20 \mu\text{A}$ | 1.9 | 2.0 | | 1.9 | | 1.9 | | V |
| | | 4.5 | $I_O = -20 \mu\text{A}$ | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | $I_O = -20 \mu\text{A}$ | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | $I_O = -4.0 \text{ mA}$ | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | $I_O = -5.2 \text{ mA}$ | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| V_{OL} | Low Level Output Voltage | 2.0 | $I_O = 20 \mu\text{A}$ | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | $I_O = 20 \mu\text{A}$ | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | $I_O = 20 \mu\text{A}$ | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | $I_O = 4.0 \text{ mA}$ | | 0.17 | 0.26 | | 0.37 | | 0.40 | |
| | | 6.0 | $I_O = 5.2 \text{ mA}$ | | 0.18 | 0.26 | | 0.37 | | 0.40 | |
| I_I | Input Leakage Current | 6.0 | $V_I = V_{CC} \text{ or GND}$ | | | ± 0.1 | | ± 1 | | ± 1 | μA |
| I_{CC} | Quiescent Supply Current | 6.0 | $V_I = V_{CC} \text{ or GND}$ | | | 4 | | 40 | | 80 | μA |

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

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|--------------------------|---|-----------------|--|--------------------------|------|------|-----------------------------|------|------------------------------|------|------|
| | | | | $T_A = 25^\circ\text{C}$ | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t_{TLH} t_{THL} | Output Transition Time | V_{CC} (V) | | | 30 | 75 | | 95 | | 110 | ns |
| | | | | | 8 | 15 | | 19 | | 22 | |
| | | | | | 7 | 13 | | 16 | | 19 | |
| t_{PLH} t_{PHL} | Propagation Delay Time (CK, ENABLE - Qn) | V_{CC} (V) | | | 72 | 160 | | 200 | | 240 | ns |
| | | | | | 22 | 32 | | 40 | | 48 | |
| | | | | | 18 | 27 | | 34 | | 41 | |
| t_{PHL} | Propagation Delay Time (CLR - Qn) | V_{CC} (V) | | | 65 | 150 | | 190 | | 225 | ns |
| | | | | | 20 | 30 | | 38 | | 45 | |
| | | | | | 16 | 26 | | 33 | | 38 | |
| f_{MAX} | Maximum Clock Frequency | V_{CC} (V) | | 6 | 23 | | 4.8 | | 4 | | MHz |
| | | | | 30 | 51 | | 24 | | 20 | | |
| | | | | 35 | 60 | | 28 | | 24 | | |
| $t_{W(H)}$ $t_{W(L)}$ | Minimum Pulse Width (CLOCK ,ENABLE) | V_{CC} (V) | | | 25 | 75 | | 95 | | 110 | ns |
| | | | | | 6 | 15 | | 19 | | 22 | |
| | | | | | 5 | 13 | | 16 | | 19 | |
| $t_{W(L)}$ | Minimum Pulse Width (CLEAR) | V_{CC} (V) | | | 20 | 75 | | 95 | | 110 | ns |
| | | | | | 5 | 15 | | 19 | | 22 | |
| | | | | | 4 | 13 | | 16 | | 19 | |
| t_{REM} | Minimum Removal Time (CLEAR) | V_{CC} (V) | | | 21 | 50 | | 60 | | 75 | ns |
| | | | | | 3 | 10 | | 12 | | 15 | |
| | | | | | 3 | 9 | | 11 | | 13 | |

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|----------|--|----------------|--|--------------------------|------|------|-----------------------------|------|------------------------------|------|------|
| | | | | $T_A = 25^\circ\text{C}$ | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| C_{IN} | Input Capacitance | | | | 5 | 10 | | 10 | | 10 | pF |
| C_{PD} | Power Dissipation Capacitance (note 1) | | | | 38 | | | | | | pF |

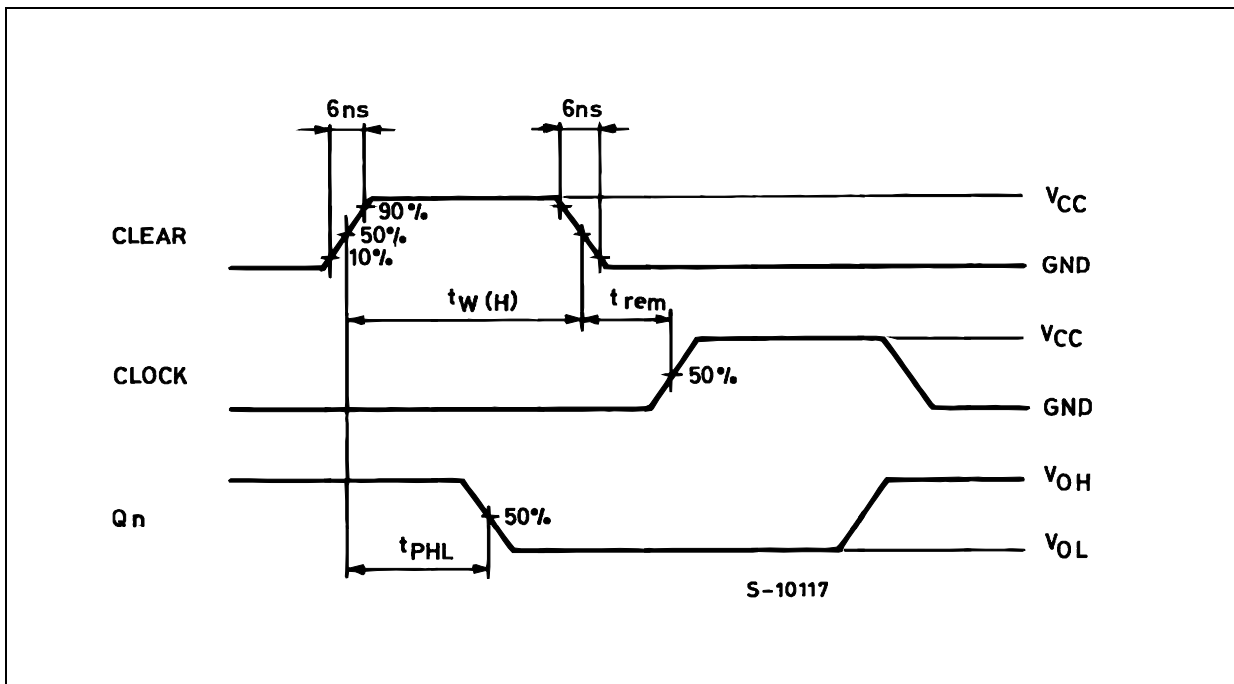
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2$ (per Counter)

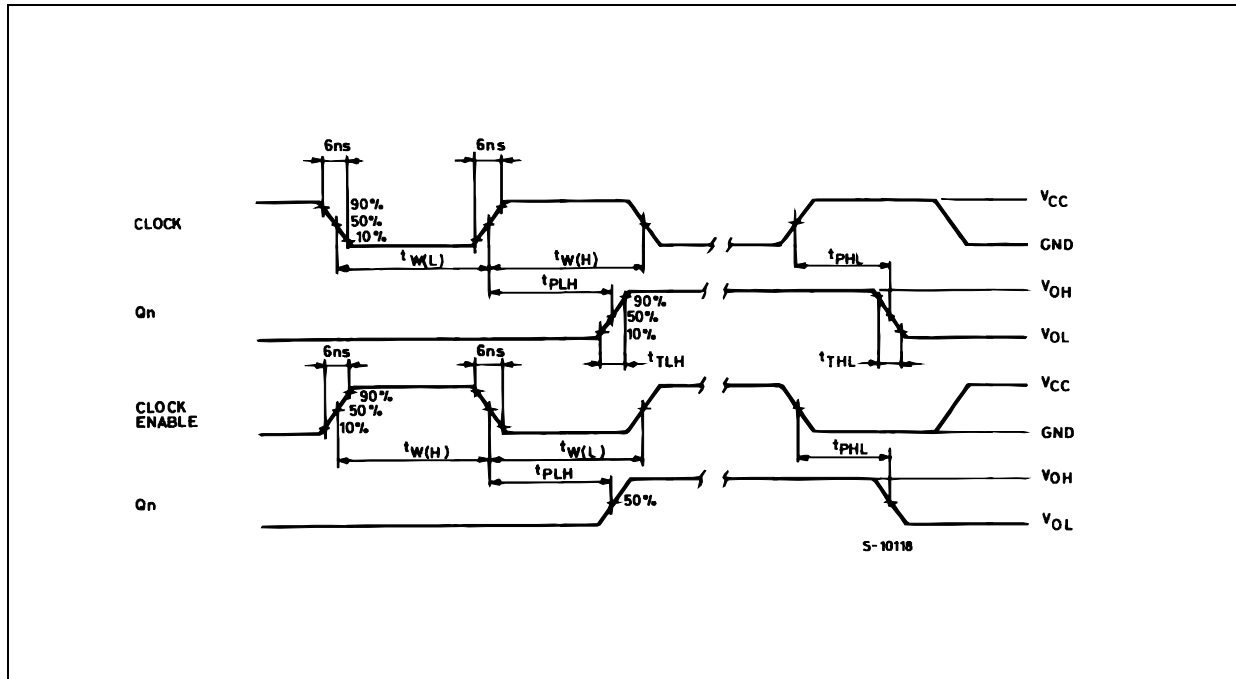
TEST CIRCUIT



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

WAVEFORM 1: MINIMUM PULSE WIDTH AND REMOVAL TIME ($f=1\text{MHz}$; 50% duty cycle)



WAVEFORM 2 : PROPAGATION DELAY TIME, MINIMUM PULSE WIDTH($f=1\text{MHz}$; 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

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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