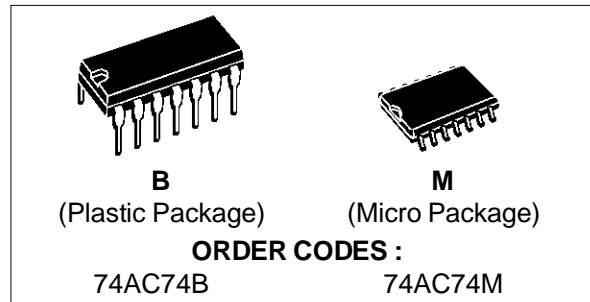


## DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR

- HIGH SPEED:  
 $f_{MAX} = 300 \text{ MHz (TYP.) at } V_{CC} = 5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- 50Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24 \text{ mA (MIN)}$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC} \text{ (OPR)} = 2\text{V to } 6\text{V}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 74
- IMPROVED LATCH-UP IMMUNITY

### DESCRIPTION

The AC74 is an advanced high-speed CMOS OCTAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.



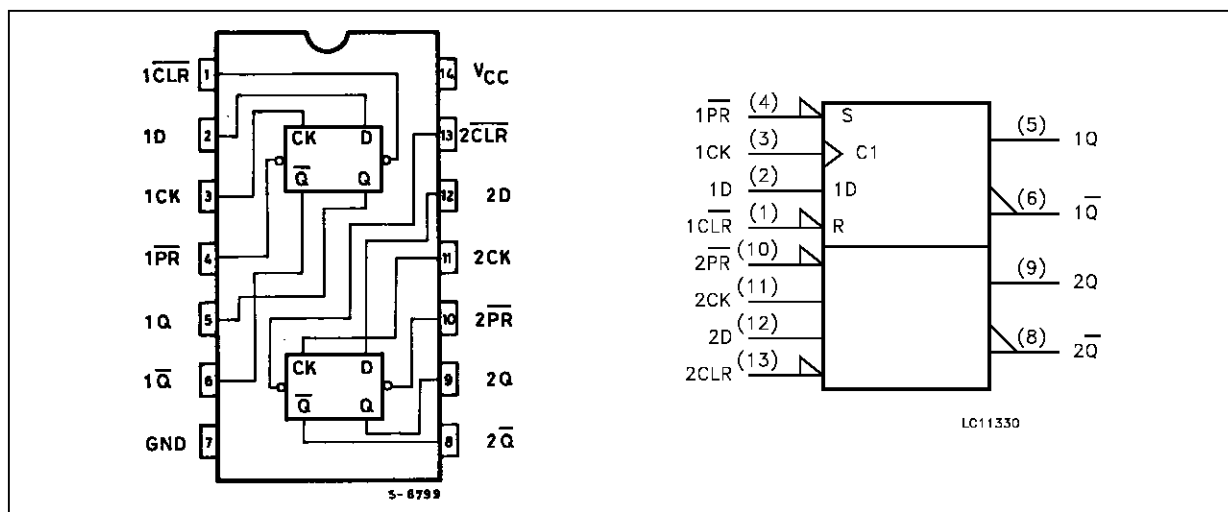
A signal on the D INPUT is transferred to the Q OUTPUT during the positive going transition of the clock pulse.

CLEAR and PRESET are independent of the clock and accomplished by a low setting on the appropriate input.

It is ideal for low power applications maintaining high speed operation similar to equivalent Bipolar Schottky TTL.

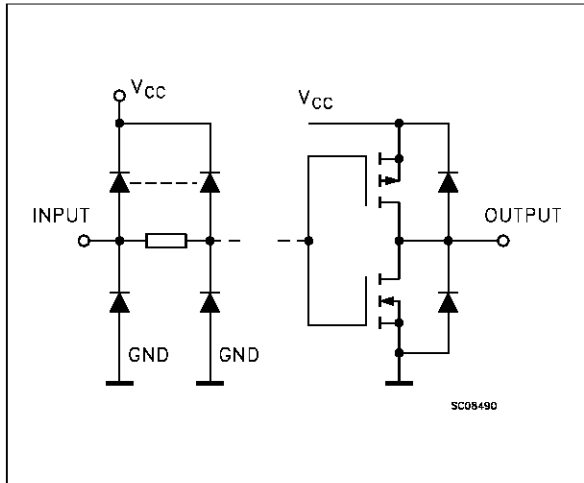
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# 74AC74

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

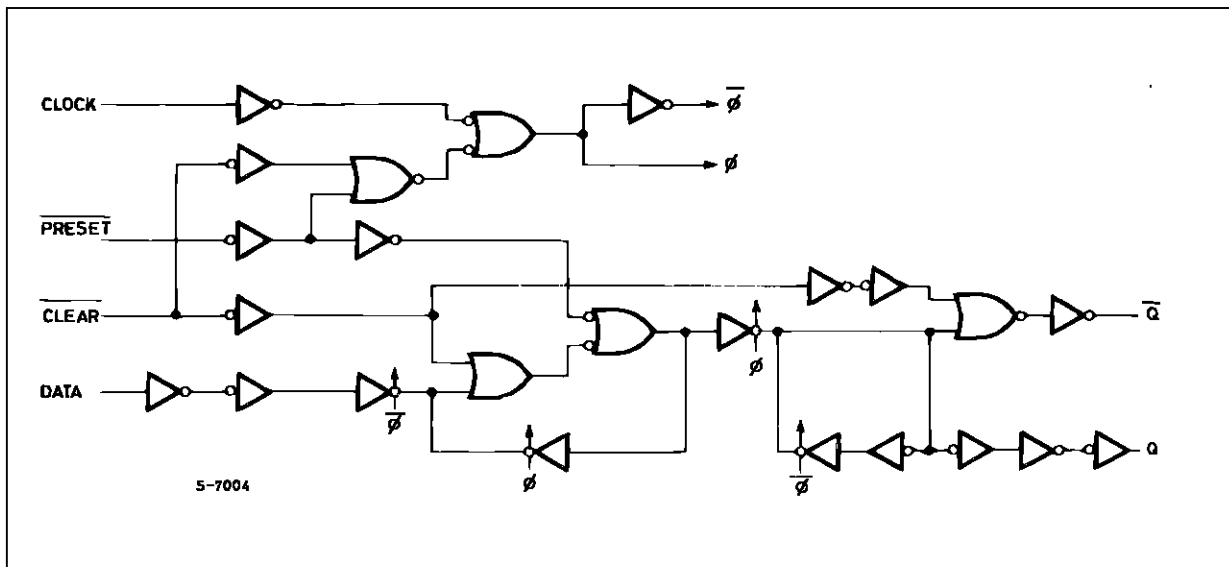
| PIN No | SYMBOL                                | NAME AND FUNCTION                         |
|--------|---------------------------------------|---|
| 1, 13  | $\overline{1CLR}$ , $\overline{2CLR}$ | Asynchronous Reset - Direct Input         |
| 2, 12  | 1D, 2D                                | Data Inputs                               |
| 3, 11  | 1CK, 2CK                              | Clock Input (LOW-to-HIGH, Edge-Triggered) |
| 4, 10  | $\overline{1PR}$ , $\overline{2PR}$   | Asynchronous Set - Direct Input           |
| 5, 9   | 1Q, 2Q                                | True Flip-Flop Outputs                    |
| 6, 8   | $\overline{1Q}$ , $\overline{2Q}$     | Complement Flip-Flop Outputs              |
| 7      | GND                                   | Ground (0V)                               |
| 14     | V <sub>CC</sub>                       | Positive Supply Voltage                   |

## TRUTH TABLE

| INPUTS           |                 |   |    | OUTPUTS        |                  | FUNCTION  |
|------------------|-----------------|---|----|----------------|------------------|-----------|
| $\overline{CLR}$ | $\overline{PR}$ | D | CK | Q              | $\overline{Q}$   |           |
| L                | H               | X | X  | L              | H                | CLEAR     |
| H                | L               | X | X  | H              | L                | PRESET    |
| L                | L               | X | X  | H              | H                |           |
| H                | H               | L |    | L              | H                |           |
| H                | H               | H |    | H              | L                |           |
| H                | H               | X |    | Q <sub>n</sub> | $\overline{Q}_n$ | NO CHANGE |

X: Don't Care

## LOGIC DIAGRAMS



This logic diagram has not be used to estimate propagation delays

**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                    | ± 50                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 200                         | mA   |
| 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 condition is not implied.

**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:   | -40 to +85           | °C   |
| dt/dv           | Input Rise and Fall Time V <sub>CC</sub> = 3.0, 4.5 or 5.5 V(note 1) | 8                    | ns/V |

1) V<sub>IN</sub> from 30% to 70% of V<sub>CC</sub>

## DC SPECIFICATIONS

| Symbol           | Parameter                             | Test Conditions |  | Value                   |      |       |              |      | Unit |      |
|------------------|---------------------------------------|-----------------|--|-------------------------|------|-------|--------------|------|------|------|
|                  |                                       |                 |  | T <sub>A</sub> = 25 °C  |      |       | -40 to 85 °C |      |      |      |
|                  |                                       |                 |  | V <sub>CC</sub> (V)     | Min. | Typ.  | Max.         | Min. |      | Max. |
| V <sub>IH</sub>  | High Level Input Voltage              | 3.0             | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> - 0.1 V                     | 2.1                     | 1.5  |       | 2.1          |      | V    |      |
|                  |                                       | 4.5             |  | 3.15                    | 2.25 |       | 3.15         |      |      |      |
|                  |                                       | 5.5             |  | 3.85                    | 2.75 |       | 3.85         |      |      |      |
| V <sub>IL</sub>  | Low Level Input Voltage               | 3.0             | V <sub>O</sub> = 0.1 V or<br>V <sub>CC</sub> - 0.1 V                     |                         | 1.5  | 0.9   |              | 0.9  | V    |      |
|                  |                                       | 4.5             |  |                         | 2.25 | 1.35  |              | 1.35 |      |      |
|                  |                                       | 5.5             |  |                         | 2.75 | 1.65  |              | 1.65 |      |      |
| V <sub>OH</sub>  | High Level Output Voltage             | 3.0             | V <sub>I</sub> <sup>(*)</sup> =<br>V <sub>IH</sub> or<br>V <sub>IL</sub> | I <sub>O</sub> = -50 μA | 2.9  | 2.99  |              | 2.9  | V    |      |
|                  |                                       | 4.5             |  | I <sub>O</sub> = -50 μA | 4.4  | 4.49  |              | 4.4  |      |      |
|                  |                                       | 5.5             |  | I <sub>O</sub> = -50 μA | 5.4  | 5.49  |              | 5.4  |      |      |
|                  |                                       | 3.0             |  | I <sub>O</sub> = -12 mA | 2.56 |       |              | 2.46 |      |      |
|                  |                                       | 4.5             |  | I <sub>O</sub> = -24 mA | 3.86 |       |              | 3.76 |      |      |
|                  |                                       | 5.5             |  | I <sub>O</sub> = -24 mA | 4.86 |       |              | 4.76 |      |      |
| V <sub>OL</sub>  | Low Level Output Voltage              | 3.0             | V <sub>I</sub> <sup>(*)</sup> =<br>V <sub>IH</sub> or<br>V <sub>IL</sub> | I <sub>O</sub> = 50 μA  |      | 0.002 | 0.1          |      | 0.1  | V    |
|                  |                                       | 4.5             |  | I <sub>O</sub> = 50 μA  |      | 0.001 | 0.1          |      | 0.1  |      |
|                  |                                       | 5.5             |  | I <sub>O</sub> = 50 μA  |      | 0.001 | 0.1          |      | 0.1  |      |
|                  |                                       | 3.0             |  | I <sub>O</sub> = 12 mA  |      |       | 0.36         |      | 0.44 |      |
|                  |                                       | 4.5             |  | I <sub>O</sub> = 24 mA  |      |       | 0.36         |      | 0.44 |      |
|                  |                                       | 5.5             |  | I <sub>O</sub> = 24 mA  |      |       | 0.36         |      | 0.44 |      |
| I <sub>I</sub>   | Input Leakage Current                 | 5.5             | V <sub>I</sub> = V <sub>CC</sub> or GND                                  |                         |      |       | ±0.1         |      | ±1   | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current              | 5.5             | V <sub>I</sub> = V <sub>CC</sub> or GND                                  |                         |      |       | 4            |      | 40   | μA   |
| I <sub>OLD</sub> | Dynamic Output Current<br>(note 1, 2) | 5.5             | V <sub>OLD</sub> = 1.65 V max  |                         |      |       |              |      | 75   | mA   |
| I <sub>OHD</sub> |                                       |                 | V <sub>OHD</sub> = 3.85 V min  |                         |      |       |              |      | -75  | mA   |

1) Maximum test duration 2ms, one output loaded at time

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50 Ω.

(\*) All outputs loaded.

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50 \text{ pF}$ ,  $R_L = 500 \Omega$ , Input  $t_r = t_f = 3 \text{ ns}$ )

| Symbol                               | Parameter                                   | Test Condition                            |  | Value                  |              |            |              |           | Unit |
|--------------------------------------|---|---|--|------------------------|--------------|------------|--------------|-----------|------|
|                                      |   |   |  | T <sub>A</sub> = 25 °C |              |            | -40 to 85 °C |           |      |
|                                      |   |   |  | V <sub>CC</sub> (V)    | Min.         | Typ.       | Max.         | Min.      |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>CK to Q           | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 7<br>5       | 13<br>10   |              | 14<br>11  | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>PR or CLR to Q    | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 6<br>4.5     | 12<br>9    |              | 13<br>10  | ns   |
| t <sub>w</sub>                       | Pulse Width HIGH or<br>LOW, CK or PR or CLR | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 1.5<br>1.5   | 5<br>4     |              | 7<br>5    | ns   |
| t <sub>s</sub>                       | Setup Time D to CK<br>HIGH or LOW           | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | -0.2<br>-0.2 | 4<br>3     |              | 4<br>3    | ns   |
| t <sub>h</sub>                       | Hold Time D to CK<br>HIGH or LOW            | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 0.2<br>0.2   | 2<br>2     |              | 3<br>3    | ns   |
| t <sub>REM</sub>                     | Removal Time<br>PR or CLR to CK             | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | -1<br>-0.7   | 1<br>1     |              | 1<br>1    | ns   |
| f <sub>MAX</sub>                     | Maximum Clock<br>Frequency                  | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 100<br>140   | 300<br>300 |              | 90<br>130 | MHz  |

(\*) Voltage range is 3.3V ± 0.3V

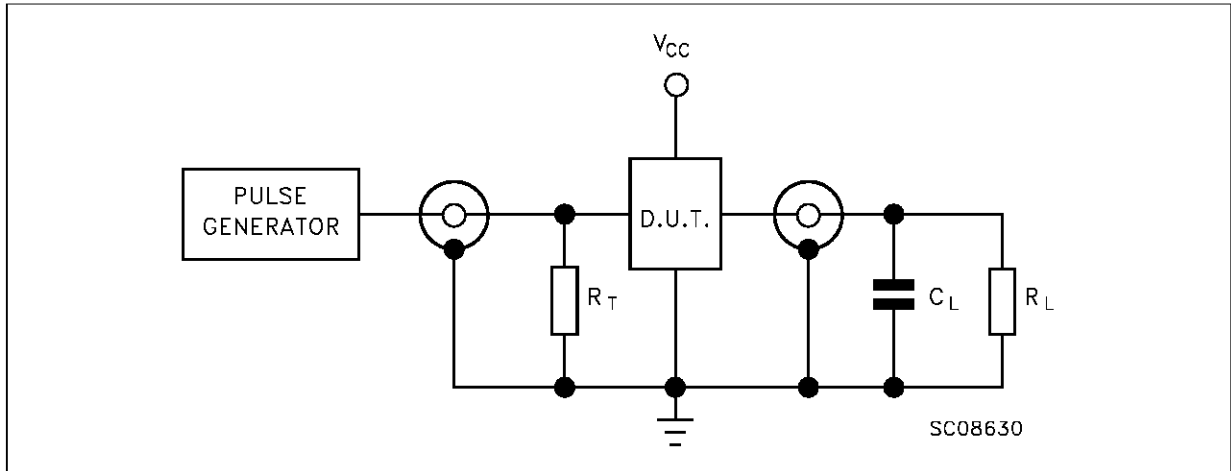
(\*\*) Voltage range is 5V ± 0.5V

**CAPACITIVE CHARACTERISTICS**

| Symbol          | Parameter                                 | Test Conditions |  | Value                  |      |      |              |      | Unit |
|-----------------|---|-----------------|--|------------------------|------|------|--------------|------|------|
|                 |   |                 |  | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                 |   |                 |  | V <sub>CC</sub> (V)    | Min. | Typ. | Max.         | Min. |      |
| C <sub>IN</sub> | Input Capacitance                         | 5.0             |  |                        | 4    |      |              |      | pF   |
| C <sub>PD</sub> | Power Dissipation<br>Capacitance (note 1) | 5.0             |  |                        | 35   |      |              |      | pF   |

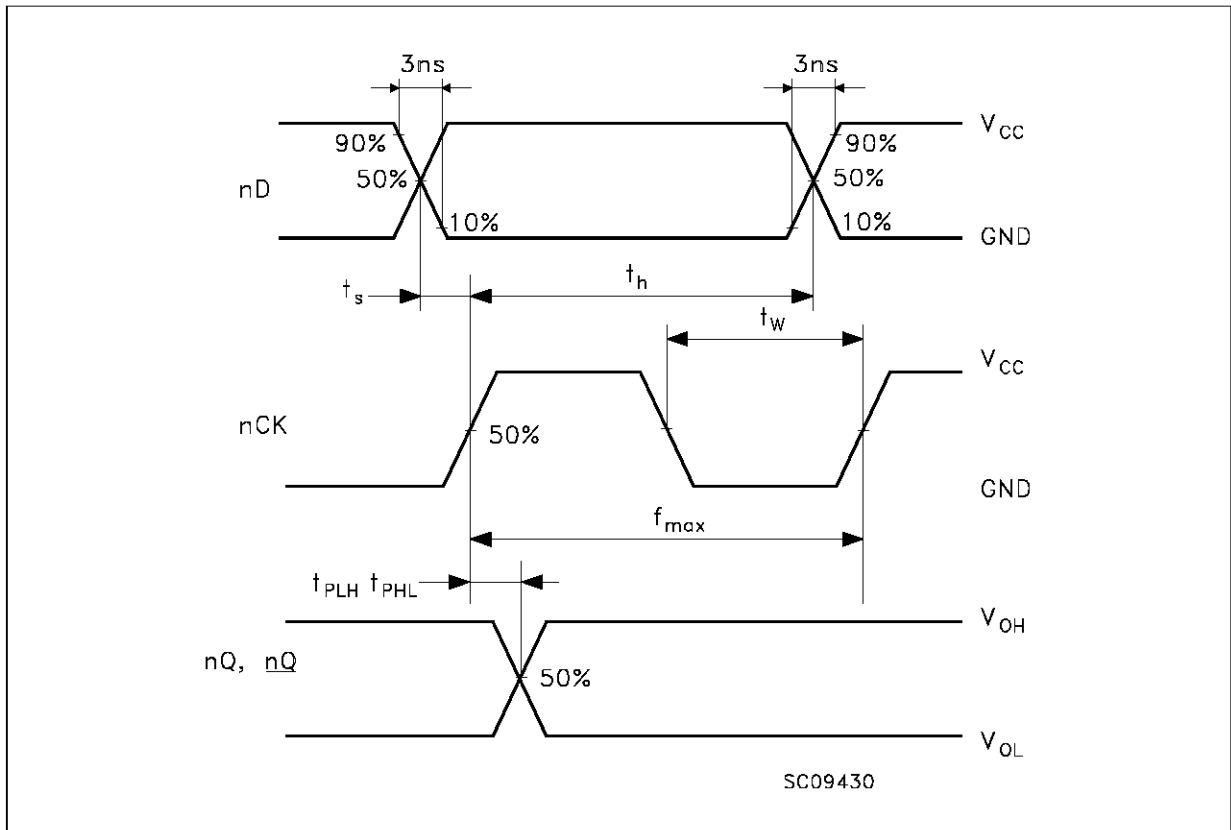
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN}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

TEST CIRCUIT

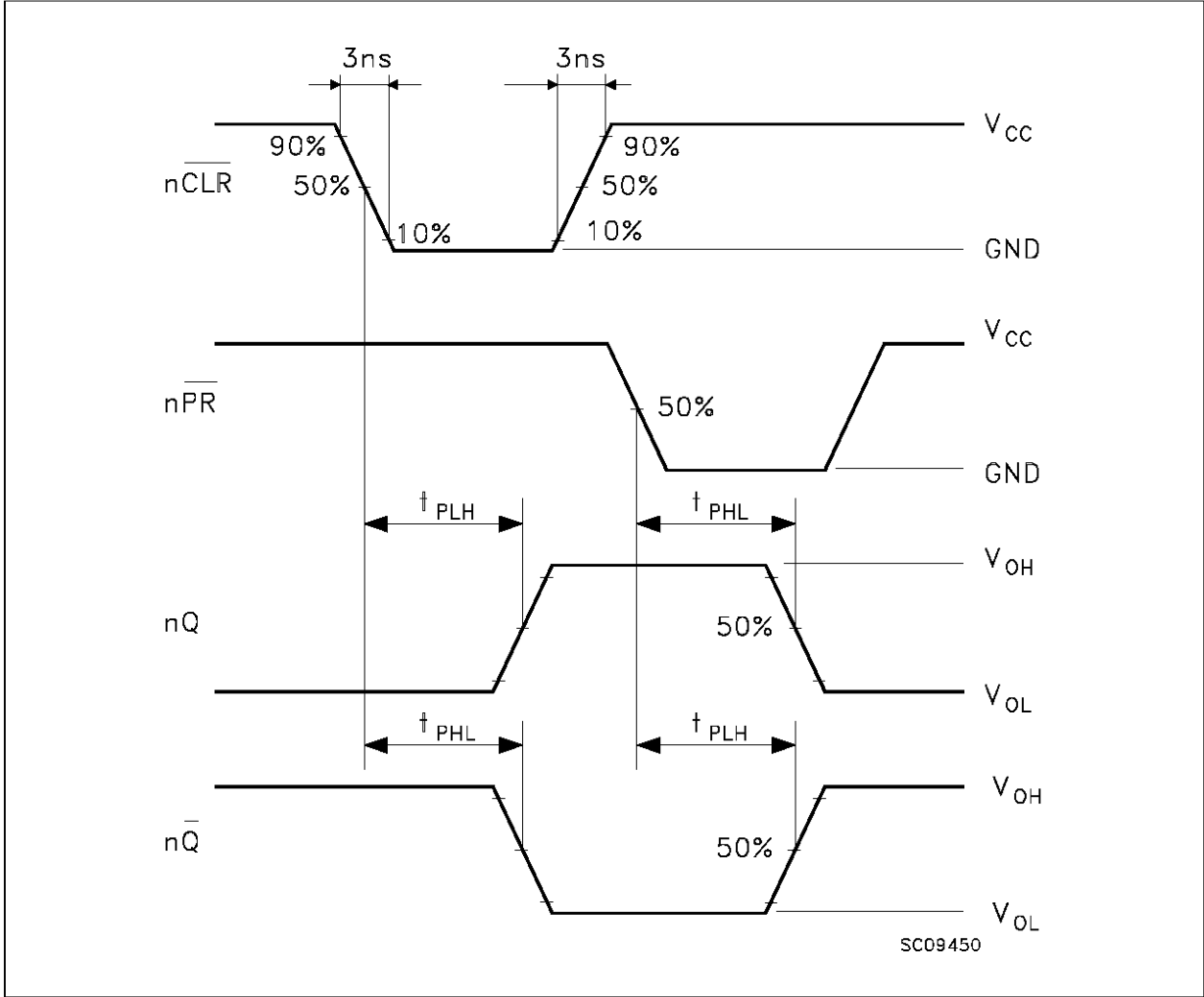


$C_L = 50\text{ pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_T = 500\Omega$  or equivalent  
 $R_T = Z_{out}$  of pulse generator (typically  $50\Omega$ )

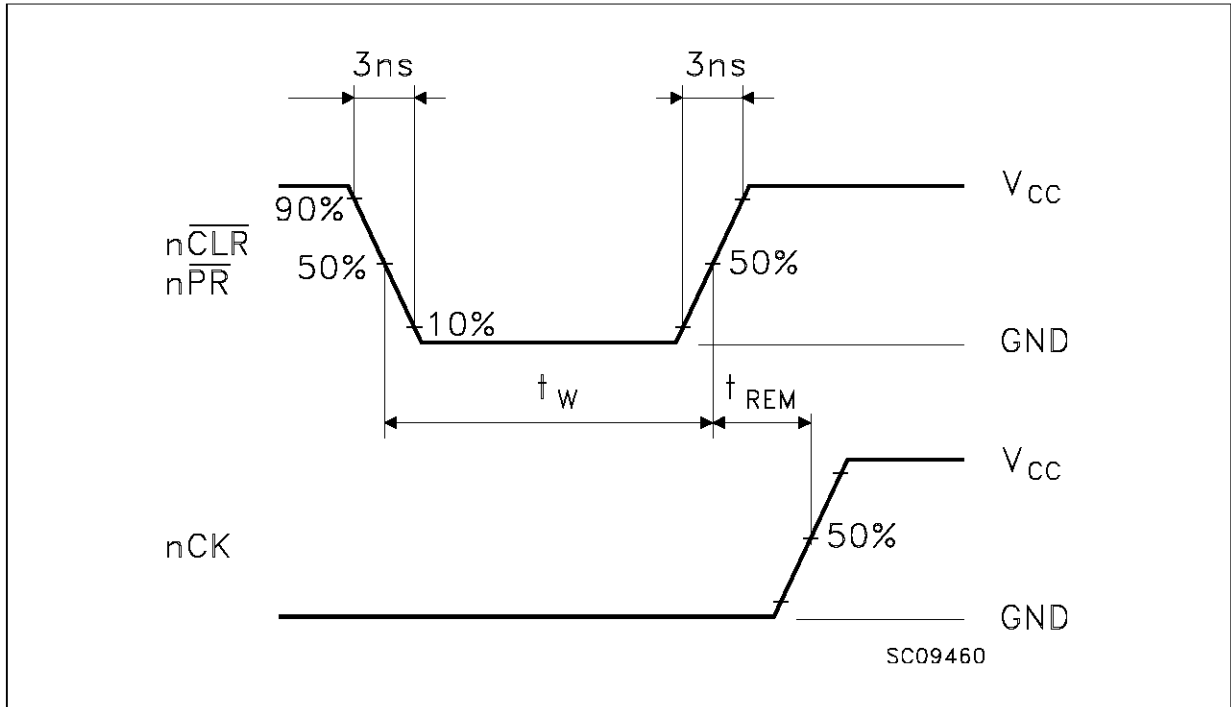
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)



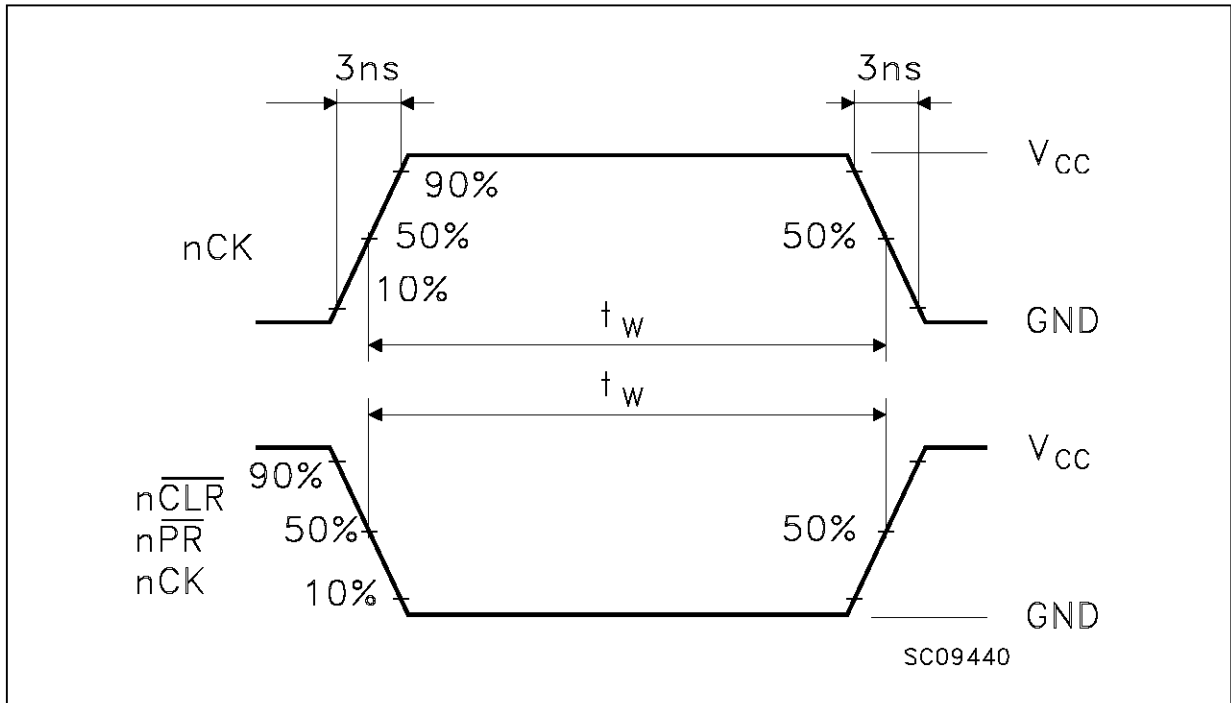
WAVEFORM 2: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



WAVEFORM 3: RECOVERY TIMES (f=1MHz; 50% duty cycle)



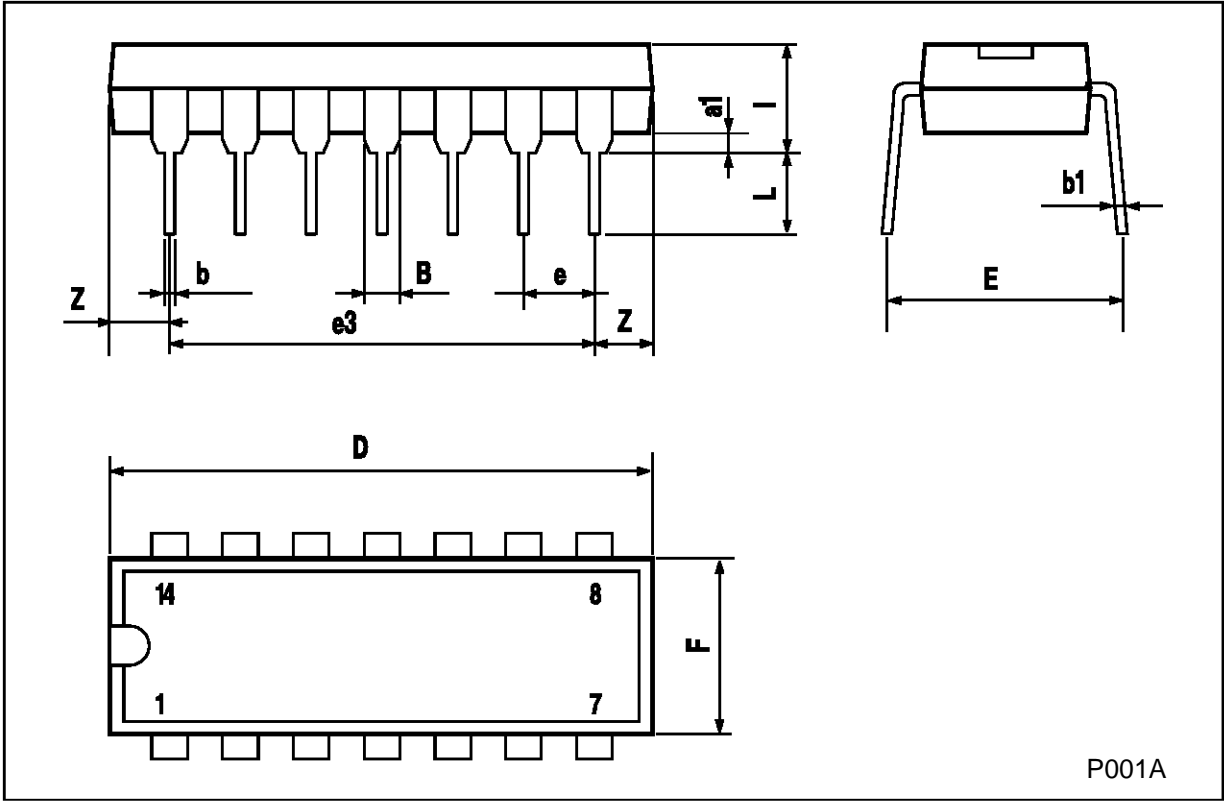
WAVEFORM 3: PULSE WIDTH





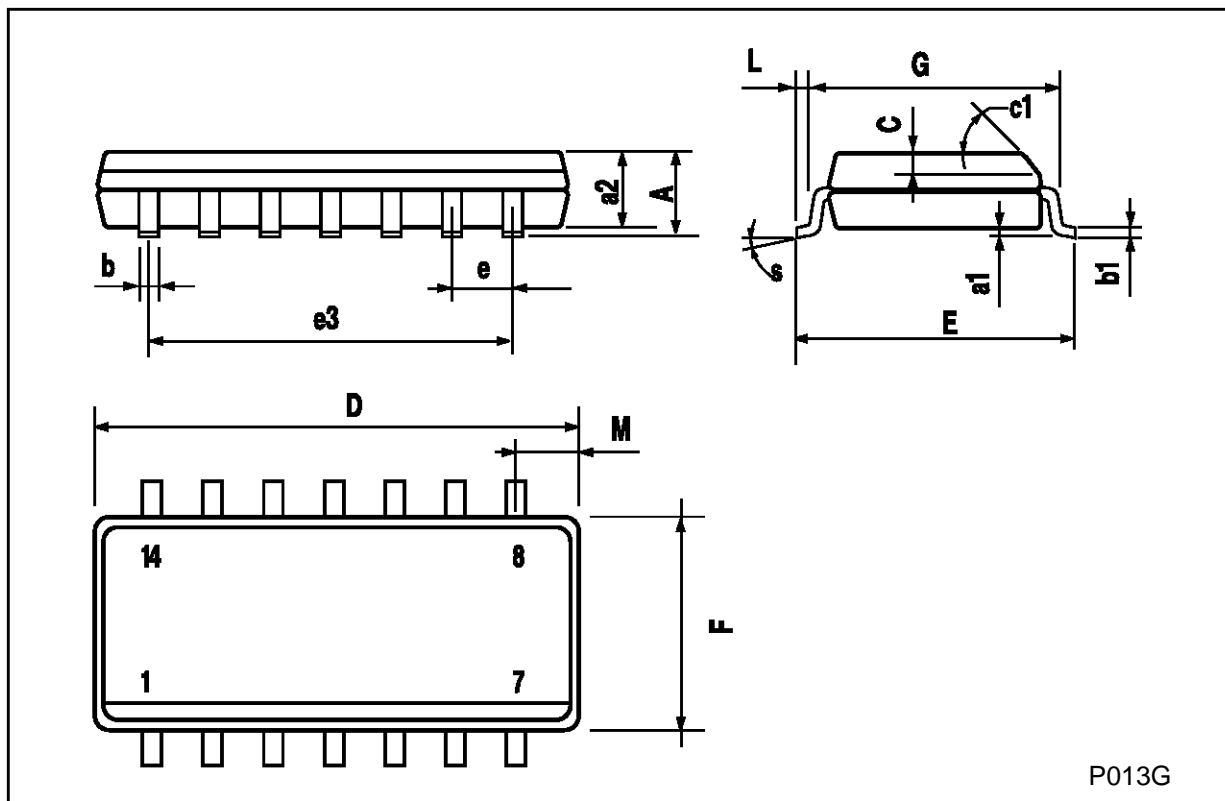
**Plastic DIP14 MECHANICAL DATA**

| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 1.39 |       | 1.65 | 0.055 |       | 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   |      | 15.24 |      |       | 0.600 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| l    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    | 1.27 |       | 2.54 | 0.050 |       | 0.100 |



## SO14 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    | 8.55      |      | 8.75 | 0.336 |       | 0.344 |
| E    | 5.8       |      | 6.2  | 0.228 |       | 0.244 |
| e    |           | 1.27 |      |       | 0.050 |       |
| e3   |           | 7.62 |      |       | 0.300 |       |
| 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    |           |      | 0.68 |       |       | 0.026 |
| S    | 8 (max.)  |      |      |       |       |       |



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