

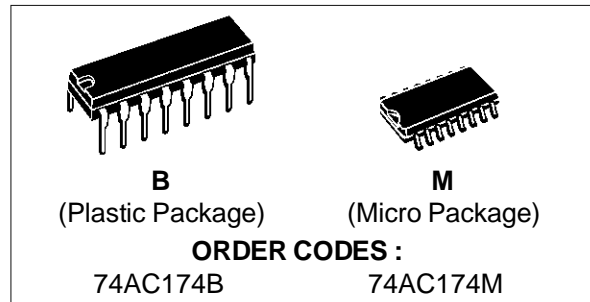
## HEX D-TYPE FLIP FLOP WITH CLEAR

- HIGH SPEED:  
 $f_{MAX} = 125 \text{ MHz (TYP.) at } V_{CC} = 5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 8 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- 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 174
- IMPROVED LATCH-UP IMMUNITY

### DESCRIPTION

The AC174 is an high-speed CMOS HEX D-TYPE FLIP FLOP WITH CLEAR fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is ideal for low power applications maintaining high speed operation similar to equivalent Bipolar Schottky

### PRELIMINARY DATA



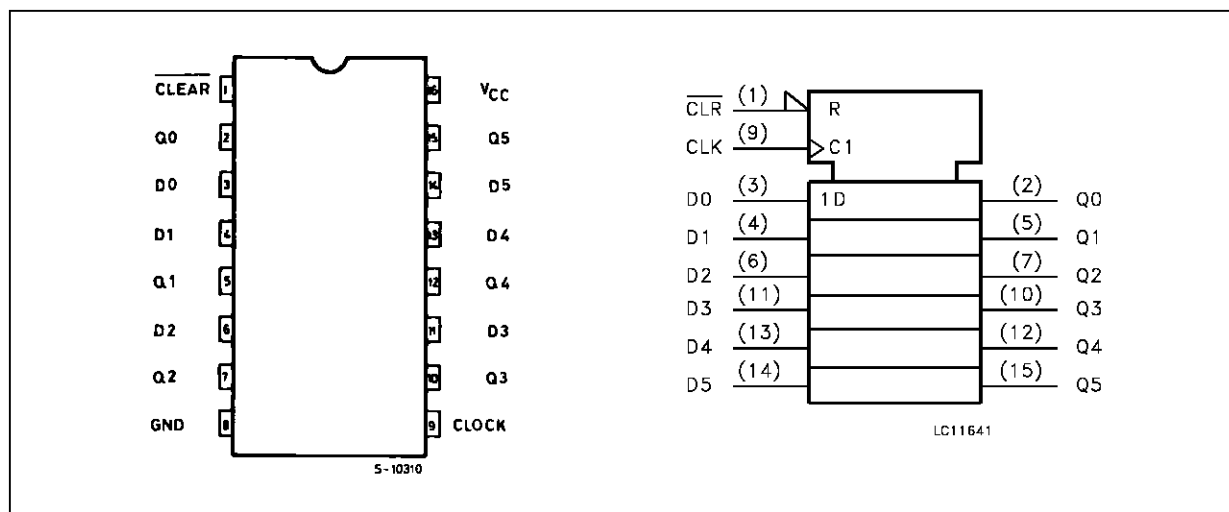
TTL.

Information signals applied to D inputs are transferred to the Q output on the positive going edge of the clock pulse.

When the CLEAR input is held low, the Q outputs are held low independently of the other inputs .

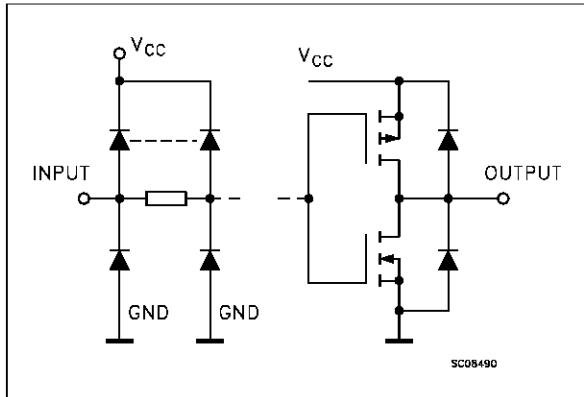
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# 74AC174

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

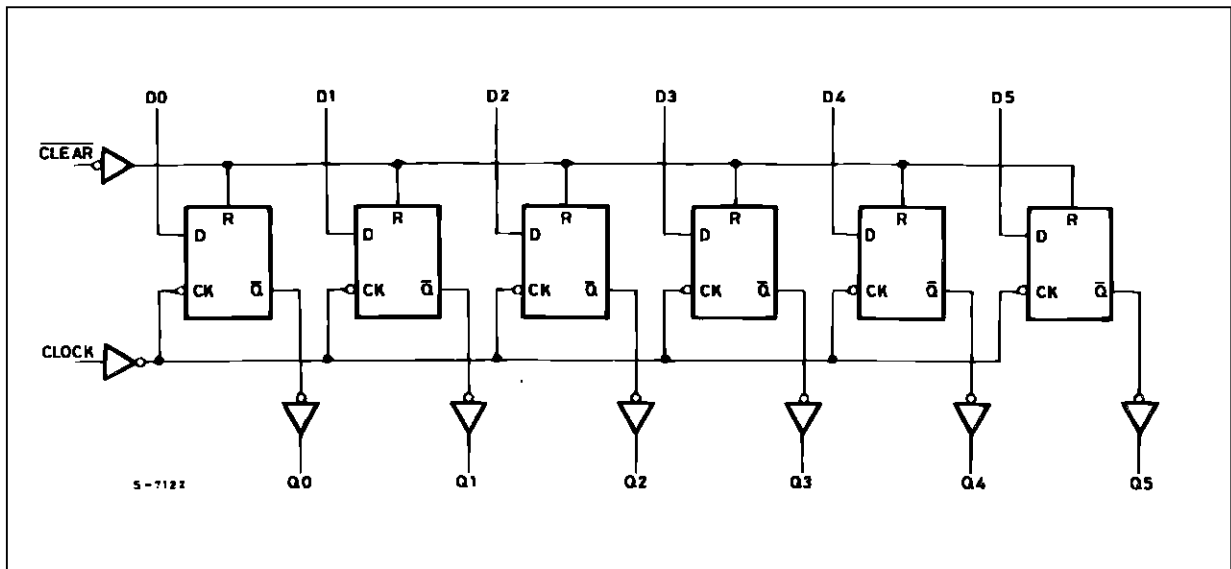
| PIN No              | SYMBOL                    | NAME AND FUNCTION                         |
|---------------------|---------------------------|-------------------------------------------|
| 1                   | $\overline{\text{CLEAR}}$ | Asynchronous Master Reset (Active LOW)    |
| 2, 5, 7, 10, 12, 15 | Q0 to Q5                  | Flip-Flop Output                          |
| 3, 4, 6, 11, 13, 14 | D0 to D5                  | Data Inputs                               |
| 9                   | CLOCK                     | Clock Input (LOW-to-HIGH, Edge-Triggered) |
| 8                   | GND                       | Ground (0V)                               |
| 16                  | Vcc                       | Positive Supply Voltage                   |

## TRUTH TABLE

| INPUTS                    |   |       | OUTPUTS        | FUNCTION  |
|---------------------------|---|-------|----------------|-----------|
| $\overline{\text{CLEAR}}$ | D | CLOCK | Q              |           |
| L                         | X | X     | L              | CLEAR     |
| H                         | L |       | L              |           |
| H                         | H |       | H              |           |
| H                         | X |       | Q <sub>n</sub> | NO CHANGE |

X: Don't Care

## LOGIC DIAGRAM



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 | ± 300                         | 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 |   |
|------------------|---------------------------------------|------------------------|--------------------------------------------------------------------------|-------------------------|------|-------|--------------|------|------|---|
|                  |                                       | V <sub>CC</sub><br>(V) |                                                                          | T <sub>A</sub> = 25 °C  |      |       | -40 to 85 °C |      |      |   |
|                  |                                       |                        |                                                                          | 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                                  |                         |      | 8     |              | 80   | 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 |      |
|--------------------------------------|---------------------------------------------|-------------------------------------------|--|------------------------|------------------------|-------------|-----------|--------------|------|------|
|                                      |                                             |                                           |  | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25 °C |             |           | -40 to 85 °C |      |      |
|                                      |                                             |                                           |  |                        | Min.                   | Typ.        | Max.      | Min.         |      | Max. |
| 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> |  | 1.5<br>1.5             | 8.5<br>6.0             | 11.0<br>8.0 |           | 12.0<br>9.0  | ns   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>CLR to Q          | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  | 1.5<br>1.5             | 9.0<br>7.0             | 11.0<br>9.0 |           | 12.0<br>10.0 | ns   |      |
| t <sub>wL</sub>                      | CLR pulse Width, LOW                        | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 1.0<br>1.0             | 5.5<br>5.0  |           | 7.0<br>5.0   | ns   |      |
| t <sub>w</sub>                       | CK pulse Width                              | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 1.0<br>1.0             | 5.5<br>5.0  |           | 7.0<br>5.0   | ns   |      |
| t <sub>s</sub>                       | Setup Time Q to CK HIGH<br>or LOW           | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 2.5<br>2.0             | 6.5<br>5.0  |           | 7.0<br>5.5   | ns   |      |
| t <sub>h</sub>                       | Hold Time Q to CK HIGH<br>or LOW            | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 1.0<br>0.5             | 3.0<br>3.0  |           | 3.0<br>3.0   | ns   |      |
| t <sub>REM</sub>                     | Recovery Time $\overline{\text{CLR}}$ to CK | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  |                        | 0<br>0                 | 2.5<br>2.0  |           | 2.5<br>2.0   | ns   |      |
| f <sub>MAX</sub>                     | Maximum Clock Frequency                     | 3.3 <sup>(*)</sup><br>5.0 <sup>(**)</sup> |  | 90<br>100              | 100<br>125             |             | 70<br>100 |              | MHz  |      |

(\*) Voltage range is 3.3V ± 0.3V

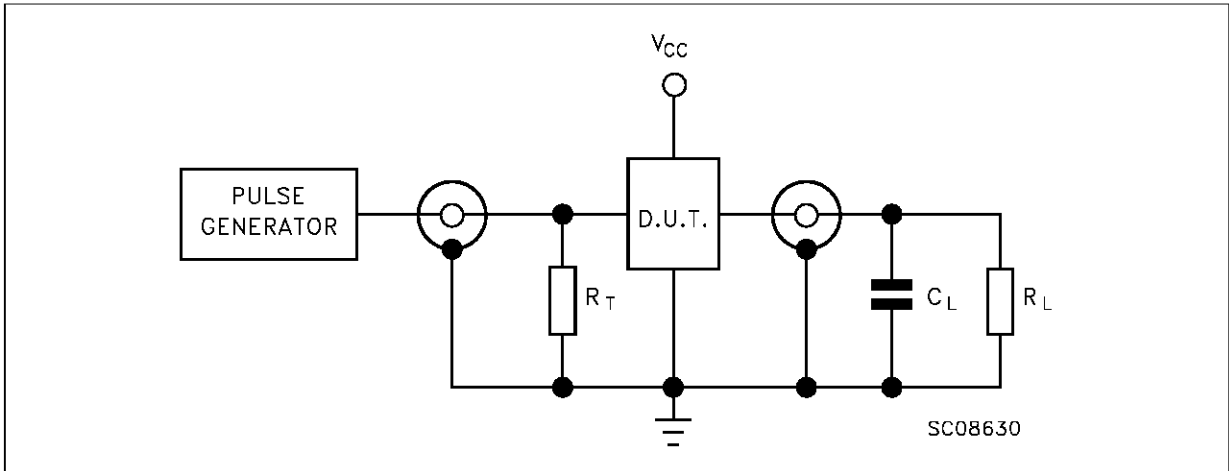
(\*\*) Voltage range is 5V ± 0.5V

**CAPACITIVE CHARACTERISTICS**

| Symbol          | Parameter                                 | Test Conditions |                          | Value                  |                        |      |      |              | Unit |      |
|-----------------|-------------------------------------------|-----------------|--------------------------|------------------------|------------------------|------|------|--------------|------|------|
|                 |                                           |                 |                          | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                 |                                           |                 |                          |                        | Min.                   | Typ. | Max. | Min.         |      | Max. |
| C <sub>IN</sub> | Input Capacitance                         | 5.0             |                          |                        | 4                      |      |      |              | pF   |      |
| C <sub>PD</sub> | Power Dissipation<br>Capacitance (note 1) | 5.0             | f <sub>IN</sub> = 10 MHz |                        | TBD                    |      |      |              | pF   |      |

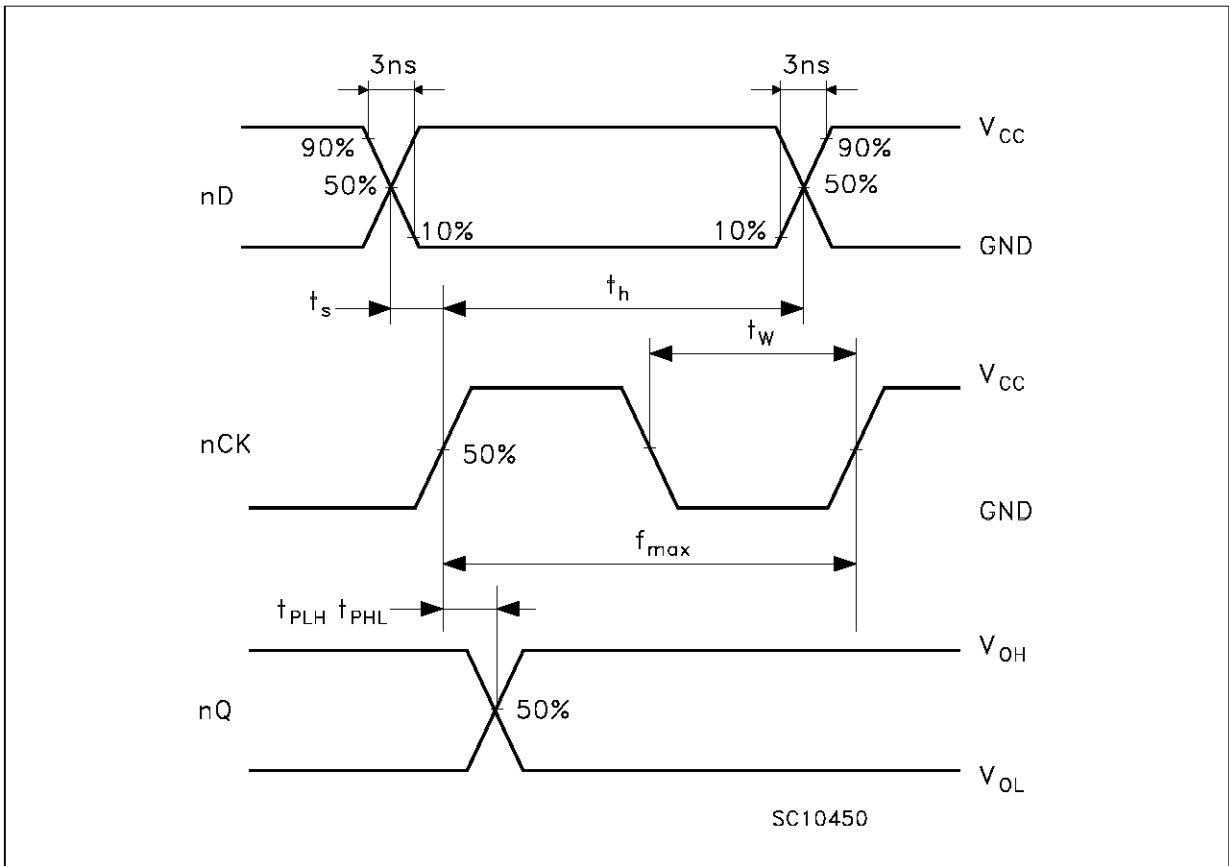
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN}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

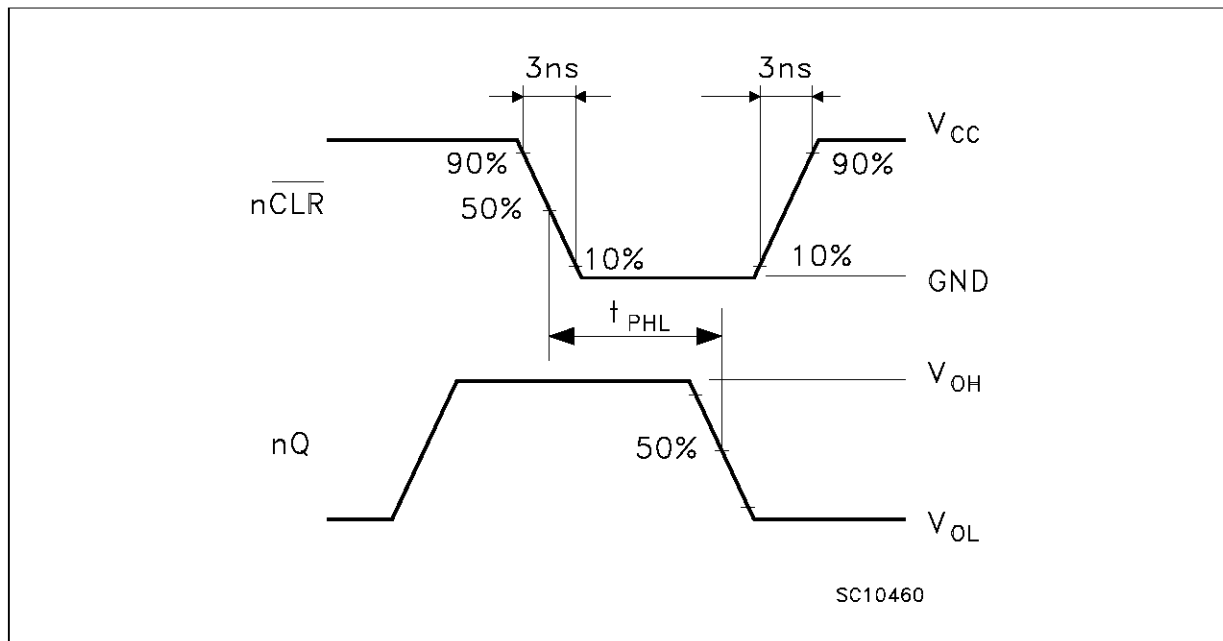
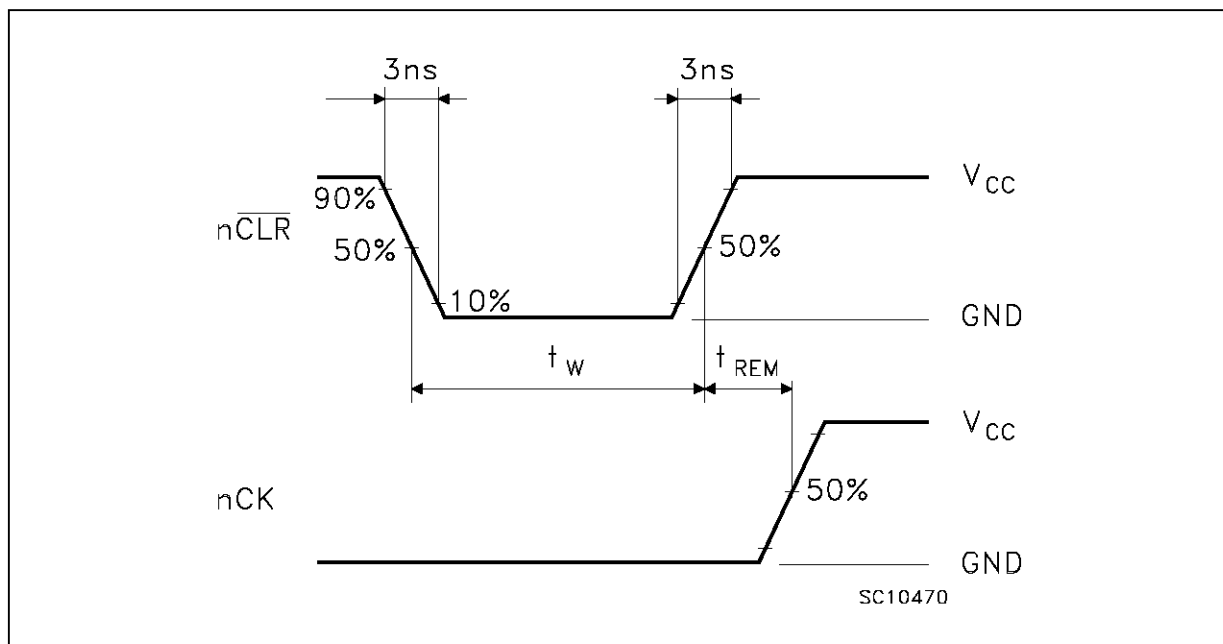
TEST CIRCUIT



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

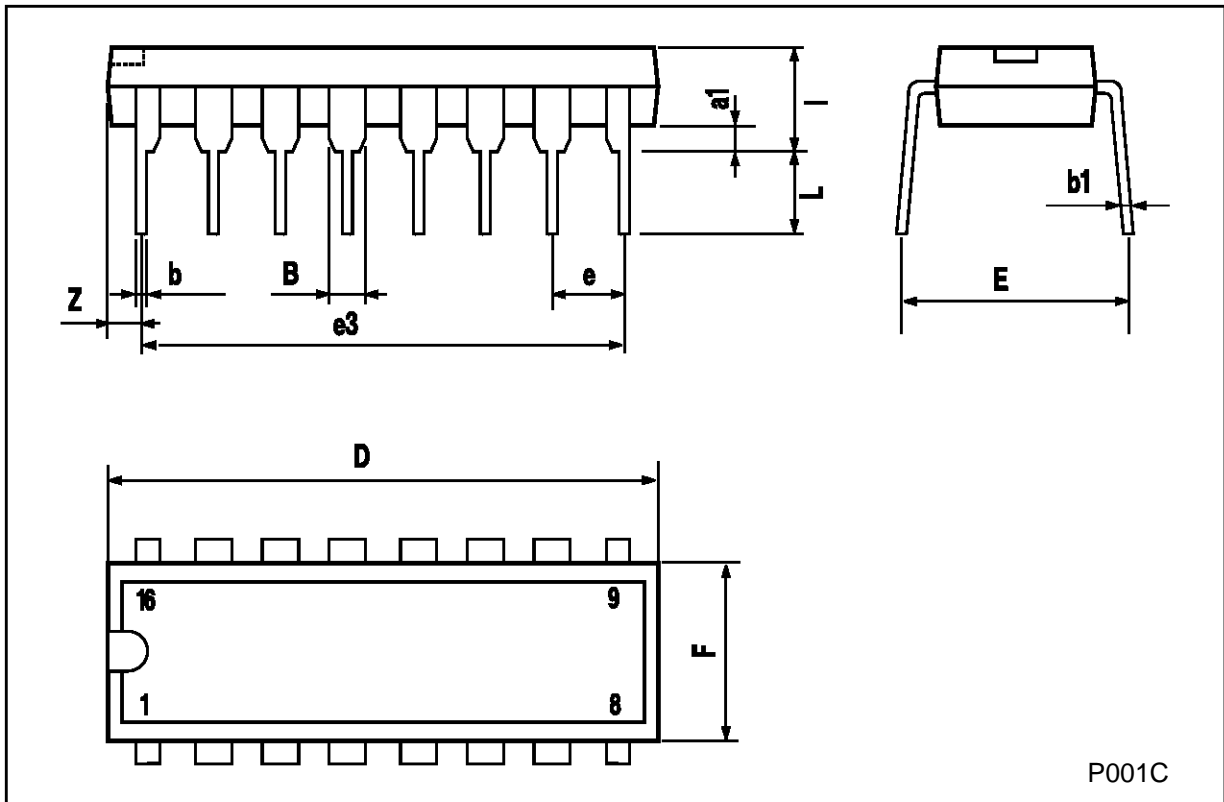
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)



**WAVEFORM 2: PROPAGATION DELAYS** ( $f=1\text{MHz}$ ; 50% duty cycle)**WAVEFORM 3: RECOVERY TIME** ( $f=1\text{MHz}$ ; 50% duty cycle)

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

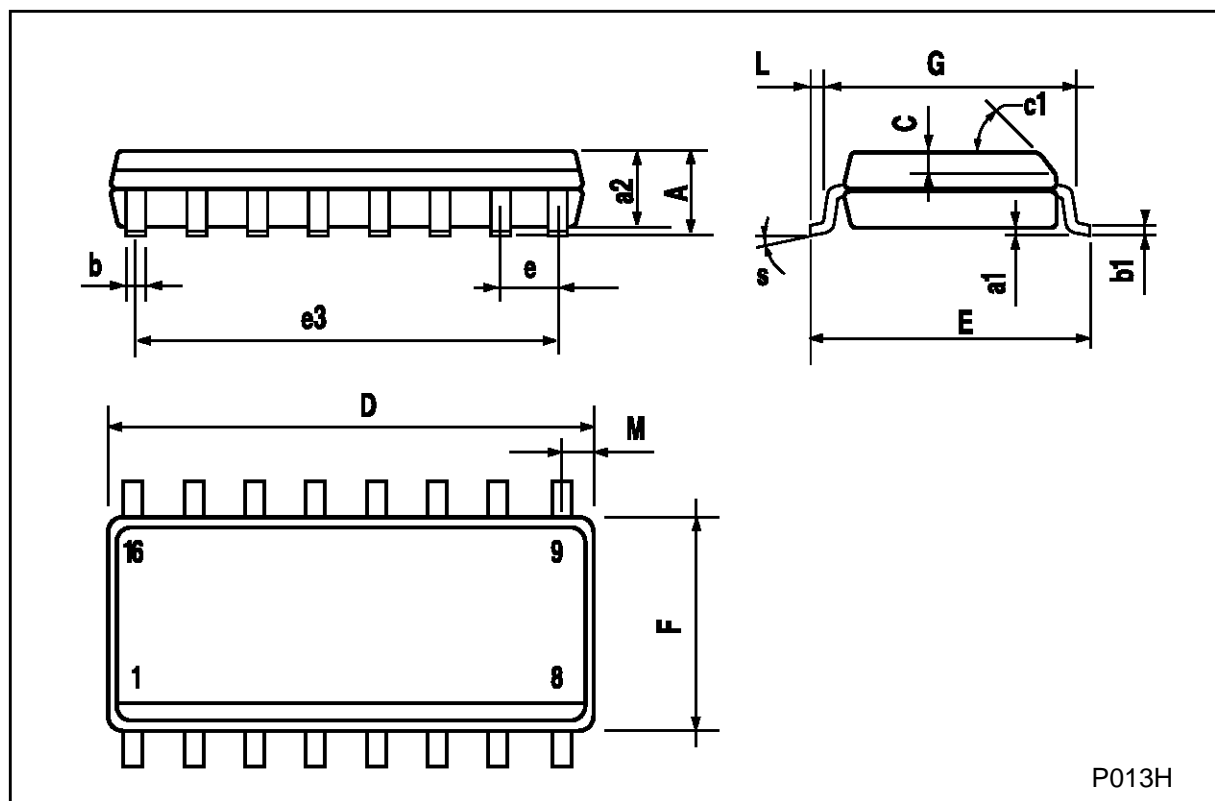
| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 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 |
| l    |      |       | 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  | 0.004 |       | 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.)  |      |      |       |       |       |



Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1997 SGS-THOMSON Microelectronics - Printed in Italy - All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A

This datasheet has been download from:

[www.datasheetcatalog.com](http://www.datasheetcatalog.com)

Datasheets for electronics components.