



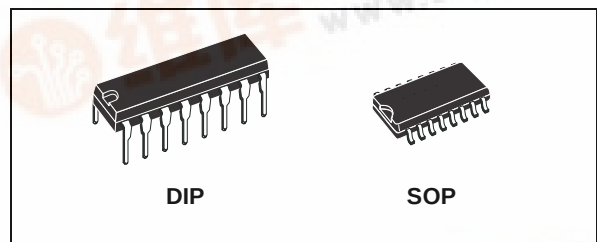
## HCF40100B

### 32-STAGE STATIC LEFT/RIGHT SHIFT REGISTER

- FULLY STATIC OPERATION
- SHIFT LEFT/SHIFT RIGHT CAPABILITY
- MULTIPLE PACKAGE CASCADING
- RECIRCULATE CAPABILITY
- LIFO OR FIFO CAPABILITY
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- QUIESCENT CURRENT SPECIF. 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

HCF40100B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. HCF40100B is a 32-stage shift register containing 32 D-Type master slave flip-flops. The data present at the SHIFT RIGHT INPUT is synchronously transferred into the first register stage with the positive CLOCK edge, provided the LEFT/RIGHT CONTROL is at a low level, the RECIRCULATE CONTROL is at a high level, and the CLOCK INHIBIT is low. If the LEFT/RIGHT control and the RECIRCULATE CONTROL are both at a high level, data at the SHIFT LEFT INPUT is synchronously transferred into the 32nd

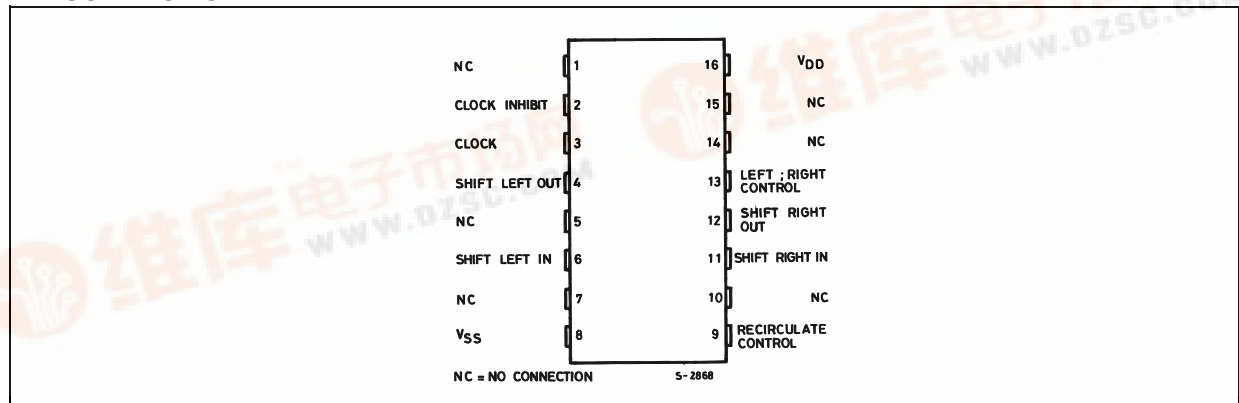


#### ORDER CODES

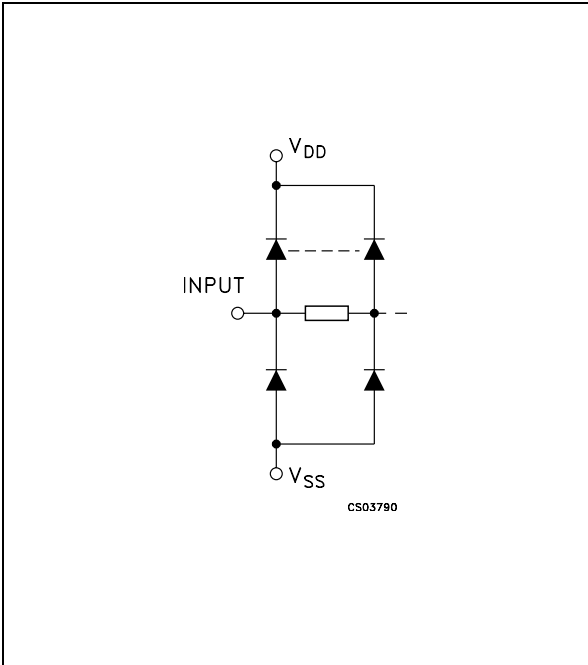
| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | HCF40100BEY |                |
| SOP     | HCF40100BM1 | HCF40100M013TR |

register stage with the positive CLOCK transition, provided the CLOCK INHIBIT is low. The state of the LEFT/RIGHT CONTROL, RECIRCULATE CONTROL, and CLOCK INHIBIT should not be changed when the CLOCK is high. Data is synchronously shifted one stage left or one stage right depending on the state of the LEFT/RIGHT CONTROL, with the positive CLOCK edge. Data clocked into the first of 32 register states is available at the SHIFT LEFT or SHIFT RIGHT OUTPUT respectively, on the next negative CLOCK transition (see Data Transfer Table). No shifting occurs on the positive CLOCK edge if the CLOCK INHIBIT line is at a high level. With the RECIRCULATE CONTROL low, data in the 32nd stage is shifted into the first stage when the LEFT/RIGHT CONTROL is low and from the 1st stage to the 32nd stage when the LEFT/RIGHT CONTROL is high.

#### PIN CONNECTION



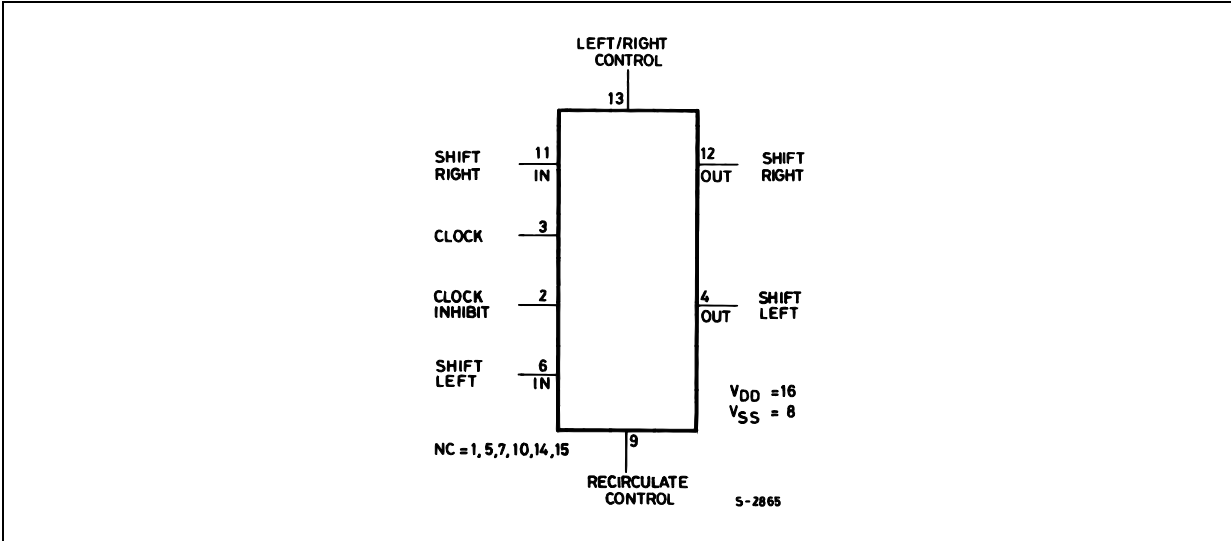
IINPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No              | SYMBOL              | NAME AND FUNCTION       |
|---------------------|---------------------|-------------------------|
| 11                  | SHIFT RIGHT IN      | Shift Right In          |
| 6                   | SHIFT LEFT IN       | Shift Left In           |
| 12                  | SHIFT RIGHT OUT     | Shift Right Out         |
| 4                   | SHIFT LEFT OUT      | Shift Left Out          |
| 3                   | CLOCK               | Clock                   |
| 2                   | CLOCK INHIBIT       | Clock Inhibit           |
| 13                  | LEFT/RIGHT CONTROL  | Left/Right Control      |
| 9                   | RECIRCULATE CONTROL | Recirculate Control     |
| 1, 5, 7, 10, 14, 15 | NC                  | Not Connected           |
| 8                   | VSS                 | Negative Supply Voltage |
| 16                  | VDD                 | Positive Supply Voltage |

FUNCTIONAL DIAGRAM



## TRUTH TABLES

## CONTROL

| Left/Right Control | Clock Inhibit | Recirculate Control | Action      | Input Bit Origin  |
|--------------------|---------------|---------------------|-------------|-------------------|
| H                  | L             | H                   | Shift Left  | Shift Left Input  |
| H                  | L             | L                   | Shift Left  | Stage 1           |
| L                  | L             | H                   | Shift Right | Shift Right Input |
| L                  | L             | L                   | Shift Right | Stage 32          |
| X                  | H             | X                   | No Shift    | -                 |

## DATA TRANSFER

| INITIAL STATE |               |                | CLOCK                                                                               | Resulting State  |        |
|---------------|---------------|----------------|-------------------------------------------------------------------------------------|------------------|--------|
| Data Input    | Clock Inhibit | Internal Stage | Level Change                                                                        | Internal Stage Q | Output |
| L             | L             | X              |    | L                | NC     |
| X             | L             | L              |    | NC               | L      |
| H             | L             | X              |   | H                | NC     |
| X             | L             | H              |  | NC               | H      |
| X             | H             | H              | X                                                                                   | NC               | NC     |

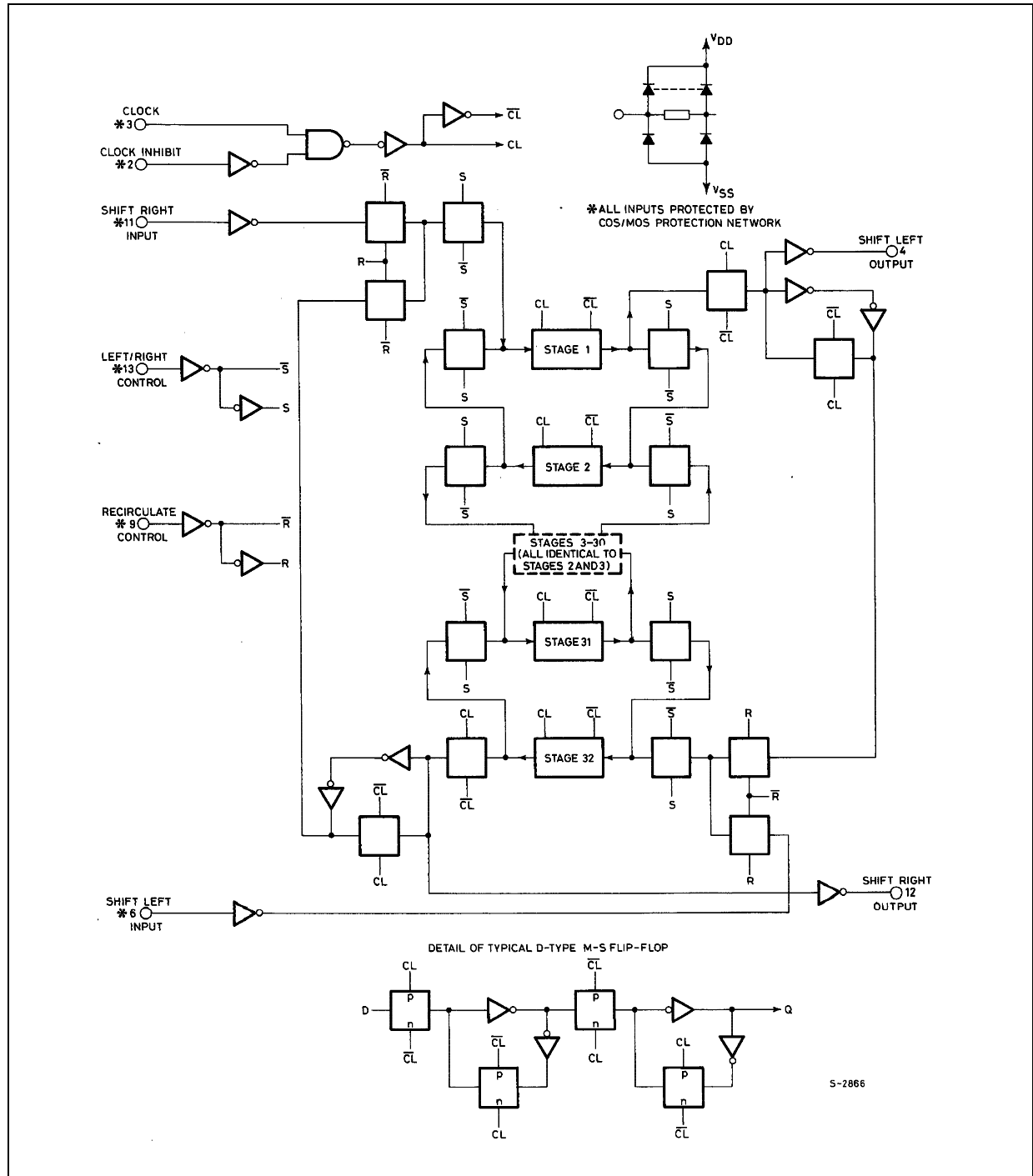
X : Don't Care

NC : No Change

For Shift-Right Mode: Data Input = SHIFT RIGHT INPUT (Pin 11); Internal Stage = Stage1 (Q1); Output = SHIFT LEFT OUTPUT (Pin 4).  
 For Shift-Left Mode: Data Input = SHIFT LEFT INPUT (Pin 6); Internal Stage = Stage32 (Q32); Output = SHIFT RIGHT OUTPUT (Pin 12).

# HCF40100B

## 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   |

## HCF40100B

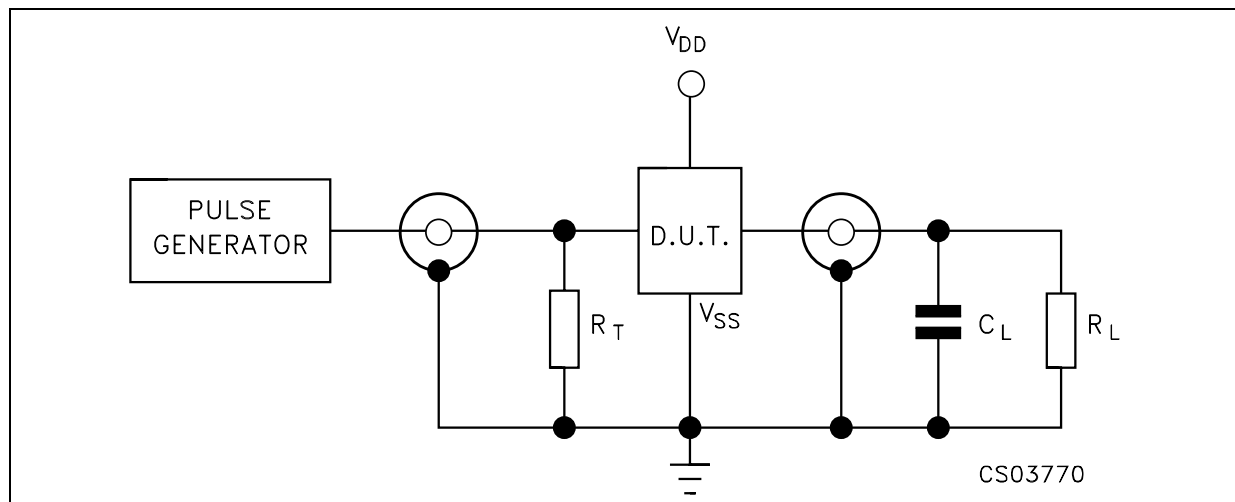
### DC SPECIFICATIONS

| Symbol          | Parameter                 | Test Condition        |                       |                          |                        | Value                 |                   |      |             |      |              |      | Unit |
|-----------------|---------------------------|-----------------------|-----------------------|--------------------------|------------------------|-----------------------|-------------------|------|-------------|------|--------------|------|------|
|                 |                           | V <sub>I</sub><br>(V) | V <sub>O</sub><br>(V) | I <sub>O</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                      |                       | 0.04              | 5    |             | 150  |              | 150  | μA   |
|                 |                           | 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 <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                      | -1.36                 | -3.2              |      | -1.1        |      | -1.1         |      | mA   |
|                 |                           | 0/5                   | 4.6                   | <1                       | 5                      | -0.44                 | -1                |      | -0.36       |      | -0.36        |      |      |
|                 |                           | 0/10                  | 9.5                   | <1                       | 10                     | -1.1                  | -2.6              |      | -0.9        |      | -0.9         |      |      |
|                 |                           | 0/15                  | 13.5                  | <1                       | 15                     | -3.0                  | -6.8              |      | -2.4        |      | -2.4         |      |      |
| 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

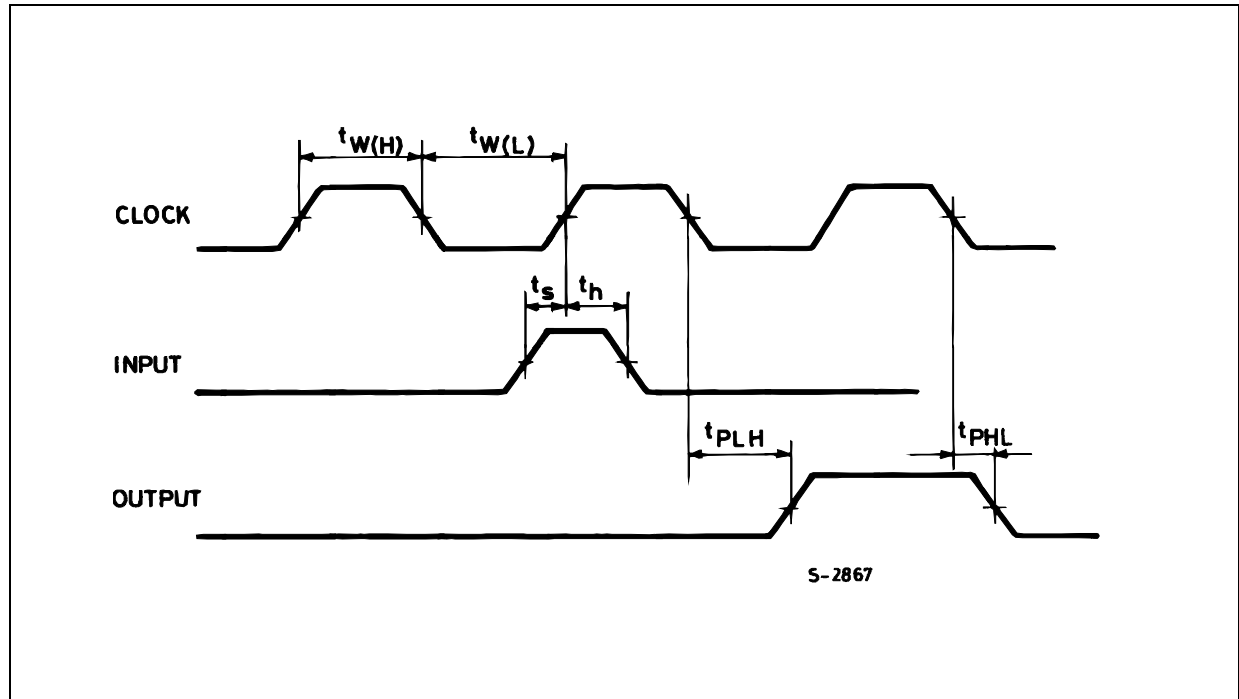
**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 200\text{K}\Omega$ ,  $t_r = t_f = 20\text{ ns}$ )

| Symbol              | Parameter                          | Test Condition |  | Value (*) |      |      | Unit |
|---------------------|------------------------------------|----------------|--|-----------|------|------|------|
|                     |                                    | $V_{DD}$ (V)   |  | Min.      | Typ. | Max. |      |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time             | 5              |  |           | 360  | 720  | ns   |
|                     |                                    | 10             |  |           | 165  | 330  |      |
|                     |                                    | 15             |  |           | 115  | 230  |      |
| $t_{THL}$ $t_{TLH}$ | Transition Time                    | 5              |  |           | 100  | 200  | ns   |
|                     |                                    | 10             |  |           | 50   | 100  |      |
|                     |                                    | 15             |  |           | 40   | 80   |      |
| $t_{setup}$         | Data Setup Time                    | 5              |  | 100       | 50   |      | ns   |
|                     |                                    | 10             |  | 20        | 10   |      |      |
|                     |                                    | 15             |  | 10        | 5    |      |      |
| $t_{hold}$          | Data Hold Time                     | 5              |  | 275       | 170  |      | ns   |
|                     |                                    | 10             |  | 100       | 75   |      |      |
|                     |                                    | 15             |  | 75        | 50   |      |      |
| $t_W$               | Clock Input Pulse Width Low Level  | 5              |  | 450       | 225  |      | ns   |
|                     |                                    | 10             |  | 230       | 115  |      |      |
|                     |                                    | 15             |  | 190       | 95   |      |      |
| $t_W$               | Clock Input Pulse Width High Level | 5              |  | 280       | 140  |      | ns   |
|                     |                                    | 10             |  | 150       | 75   |      |      |
|                     |                                    | 15             |  | 140       | 70   |      |      |
| $f_{CL}$            | Maximum Clock Input Frequency      | 5              |  | 1         | 2    |      | MHz  |
|                     |                                    | 10             |  | 2.5       | 5    |      |      |
|                     |                                    | 15             |  | 3         | 6    |      |      |

(\*) 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) $R_L = 200\text{K}\Omega$  $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

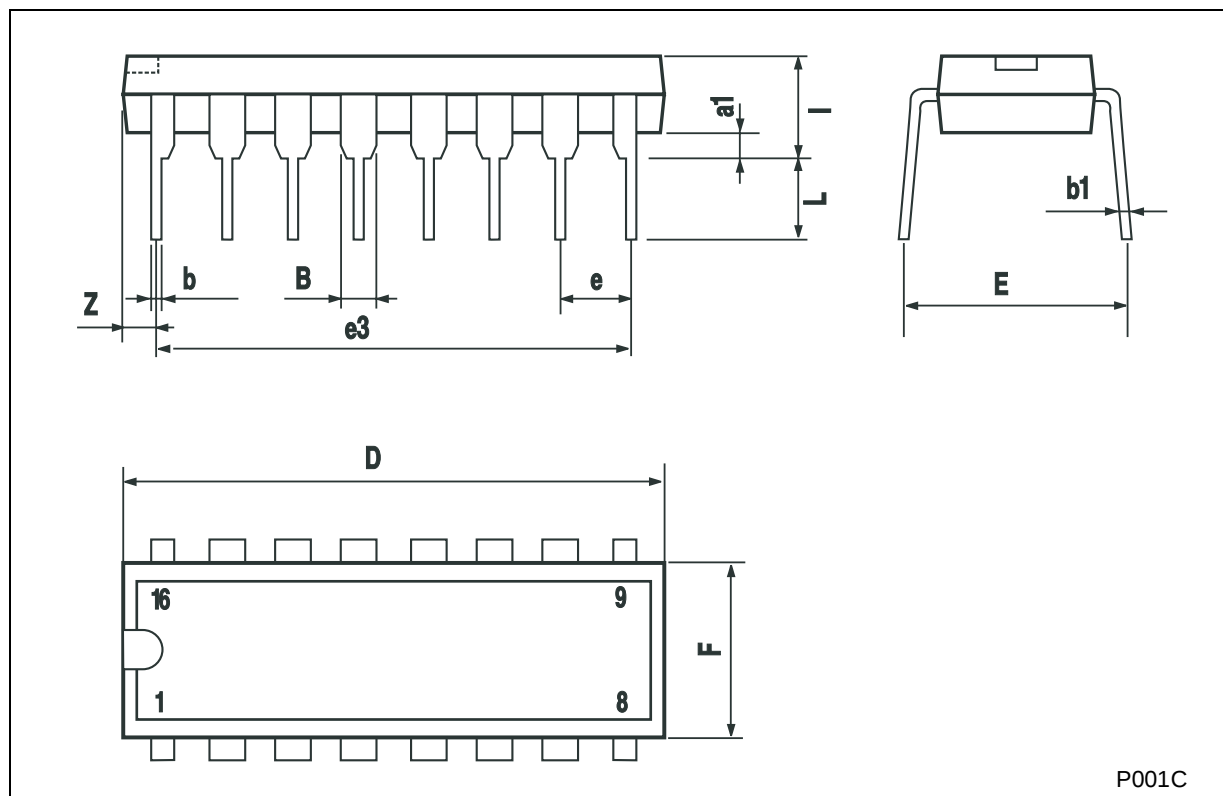
## HCF40100B

**WAVEFORM : PROPAGATION DELAY, DATA SETUP, TIME, CLOCK PULSE WIDTH** ( $f=1\text{MHz}$ ; 50% duty cycle)



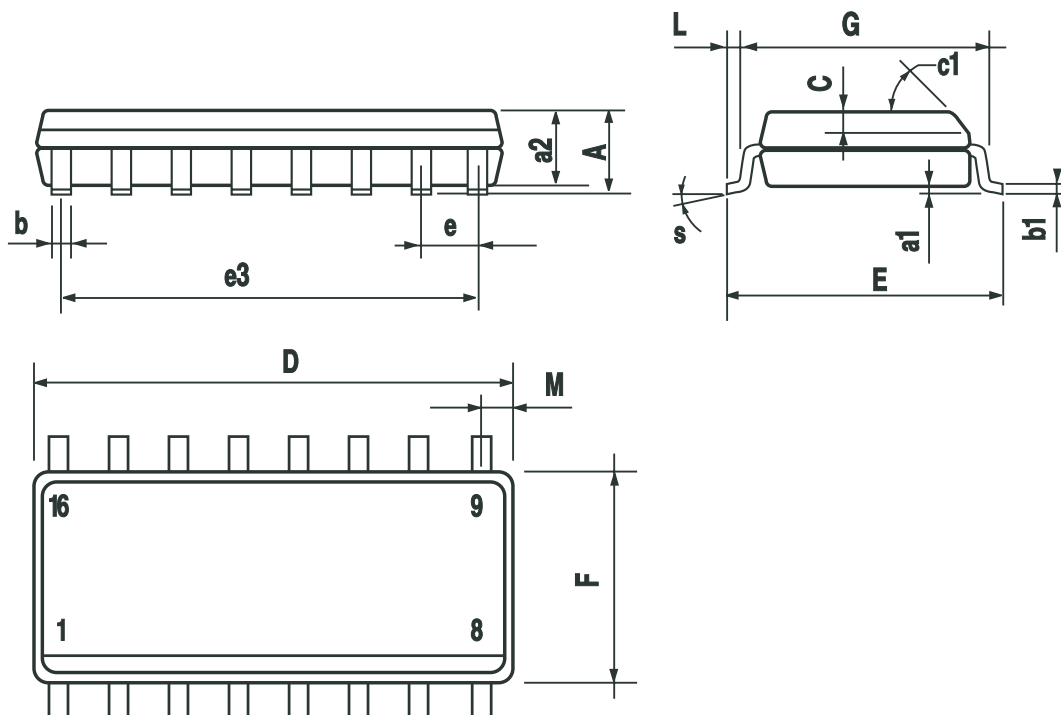
**Plastic DIP-16 (0.25) MECHANICAL DATA**

| 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 |



## 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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