



# CD4040 (LX) 12-stage Binary Ripple Counter

## Product Specification

### Specification Revision History:

| Version    | Date    | Description |
|------------|---------|-------------|
| 2023-08-A1 | 2023-08 | New         |
|            |         |             |
|            |         |             |
|            |         |             |



# Contents

|                                                                                   |           |
|-----------------------------------------------------------------------------------|-----------|
| <b>1、General Description.....</b>                                                 | <b>1</b>  |
| <b>2、Block Diagram And Pin Description .....</b>                                  | <b>4</b>  |
| 2.1、Block Diagram.....                                                            | 4         |
| 2.2、Pin Configurations .....                                                      | 4         |
| 2.3、Pin Description.....                                                          | 5         |
| 2.4、Function Table .....                                                          | 5         |
| <b>3、Electrical Parameter .....</b>                                               | <b>6</b>  |
| 3.1、Absolute Maximum Ratings.....                                                 | 6         |
| 3.2、Recommended Operating Conditions .....                                        | 6         |
| 3.3、Electrical Characteristics.....                                               | 7         |
| 3.3.1、DC Characteristics 1 .....                                                  | 7         |
| 3.3.2、DC Characteristics 2 .....                                                  | 8         |
| 3.3.3、DC Characteristics 3 .....                                                  | 9         |
| 3.3.4、AC Characteristics 1 .....                                                  | 10        |
| 3.3.5、AC Characteristics 2 .....                                                  | 11        |
| 3.3.6、AC Characteristics 3 .....                                                  | 12        |
| <b>4、Testing Circuit .....</b>                                                    | <b>13</b> |
| 4.1、AC Testing Circuit .....                                                      | 13        |
| 4.2、AC Testing Waveforms.....                                                     | 14        |
| 4.3、Test Data .....                                                               | 14        |
| <b>5、Package Information .....</b>                                                | <b>15</b> |
| 5.1、DIP16.....                                                                    | 15        |
| 5.2、SOP16.....                                                                    | 16        |
| 5.3、TSSOP16.....                                                                  | 17        |
| <b>6、Statements And Notes .....</b>                                               | <b>18</b> |
| 6.1、The name and content of Hazardous substances or Elements in the product ..... | 18        |
| 6.2、Notes.....                                                                    | 18        |



## 1、General Description

The CD4040 is a 12-stage binary ripple counter with a clock input ( $\overline{CP}$ ), an overriding asynchronous master reset input (MR) and twelve parallel outputs (Q0 to Q11). Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### Features:

- Specified from -40°C to +125°C
- Packaging information: DIP16/SOP16/TSSOP16



**Ordering Information:**

**Tube packing specifications:**

| Part number    | Packaging form | Marking code | Tube quantity  | Boxed tube quantity | Boxed quantity   | Notes                                                                |
|----------------|----------------|--------------|----------------|---------------------|------------------|----------------------------------------------------------------------|
| CD4040BE(LX)   | DIP16          | CD4040BE     | 25<br>PCS/tube | 40<br>tube/box      | 1000<br>PCS/box  | Dimensions of plastic enclosure: 19.0mm×6.4mm<br>Pin spacing: 2.54mm |
| CD4040BM(LX)   | SOP16          | CD4040BM     | 50<br>PCS/tube | 200<br>tube/box     | 10000<br>PCS/box | Dimensions of plastic enclosure: 10.0mm×3.9mm<br>Pin spacing: 1.27mm |
| CD4040BPWR(LX) | TSSOP16        | CD4040       | 96<br>PCS/tube | 200<br>tube/box     | 19200<br>PCS/box | Dimensions of plastic enclosure: 5.0mm×4.4mm<br>Pin spacing: 0.65mm  |



**Reel packing specifications:**

| Part number    | Packaging form | Marking code | Reel quantity | Boxed reel quantity | Notes                                                                |
|----------------|----------------|--------------|---------------|---------------------|----------------------------------------------------------------------|
| CD4040BM(LX)   | SOP16          | CD4040BM     | 4000 PCS/reel | 8000 PCS/box        | Dimensions of plastic enclosure: 10.0mm×3.9mm<br>Pin spacing: 1.27mm |
| CD4040BPWR(LX) | TSSOP16        | CD4040       | 5000 PCS/reel | 10000 PCS/box       | Dimensions of plastic enclosure: 5.0mm×4.4mm<br>Pin spacing: 0.65mm  |

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.



## 2、Block Diagram And Pin Description

### 2.1、Block Diagram

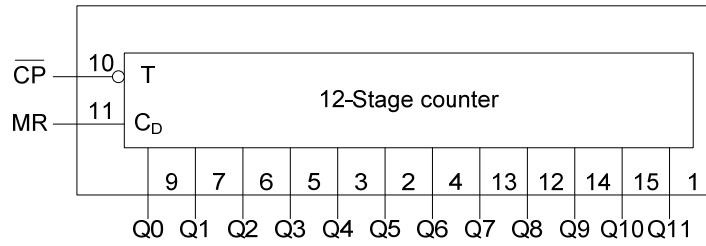


Figure 1. Functional diagram

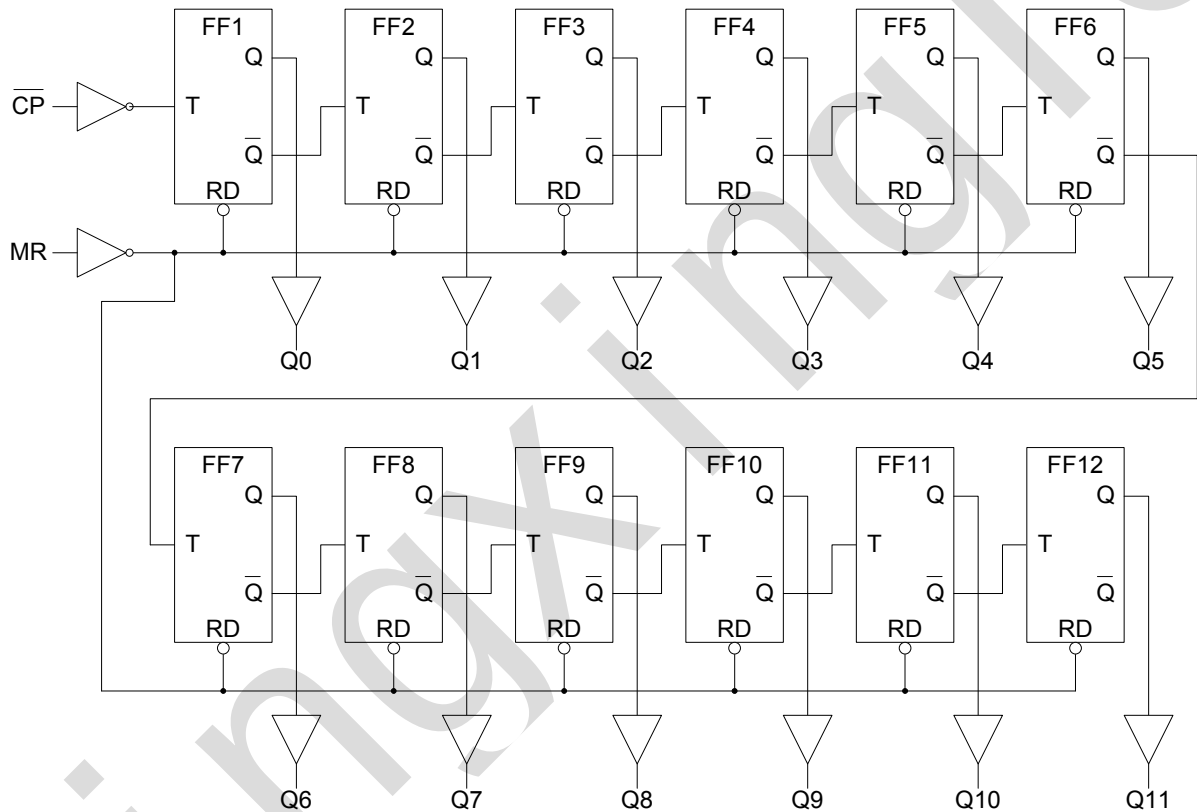
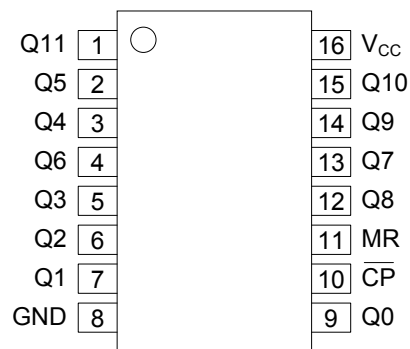


Figure 2. Logic diagram

### 2.2、Pin Configurations





### 2.3、Pin Description

| Pin No. | Pin Name               | Description                               |
|---------|------------------------|-------------------------------------------|
| 1       | Q11                    | output 11                                 |
| 2       | Q5                     | output 5                                  |
| 3       | Q4                     | output 4                                  |
| 4       | Q6                     | output 6                                  |
| 5       | Q3                     | output 3                                  |
| 6       | Q2                     | output 2                                  |
| 7       | Q1                     | output 1                                  |
| 8       | GND                    | ground (0V)                               |
| 9       | Q0                     | output 0                                  |
| 10      | $\overline{\text{CP}}$ | clock input (HIGH-to-LOW, edge-triggered) |
| 11      | MR                     | master reset input (active HIGH)          |
| 12      | Q8                     | output 8                                  |
| 13      | Q7                     | output 7                                  |
| 14      | Q9                     | Output 9                                  |
| 15      | Q10                    | output 10                                 |
| 16      | V <sub>CC</sub>        | positive supply voltage                   |

### 2.4、Function Table

| Input                  |    | Output    |
|------------------------|----|-----------|
| $\overline{\text{CP}}$ | MR | Q0 to Q11 |
| ↑                      | L  | no change |
| ↓                      | L  | count     |
| X                      | H  | L         |

Note:

H=HIGH voltage level;

L=LOW voltage level;

X=don't care;

↑=LOW-to-HIGH clock transition;

↓=HIGH-to-LOW clock transition.



### 3、Electrical Parameter

#### 3.1、Absolute Maximum Ratings

( $T_{amb}=25^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified)

| Characteristic          | Symbol           | Conditions                                                     |           | Min. | Max. | Unit |
|-------------------------|------------------|----------------------------------------------------------------|-----------|------|------|------|
| supply voltage          | V <sub>CC</sub>  | -                                                              |           | -0.5 | +7.0 | V    |
| input clamping current  | I <sub>IK</sub>  | V <sub>I</sub> <-0.5V or V <sub>I</sub> >V <sub>CC</sub> +0.5V |           | -    | ±20  | mA   |
| output clamping current | I <sub>OK</sub>  | V <sub>I</sub> <-0.5V or V <sub>I</sub> >V <sub>CC</sub> +0.5V |           | -    | ±20  | mA   |
| output current          | I <sub>O</sub>   | 0.5V<V <sub>O</sub> <V <sub>CC</sub> +0.5V                     |           | -    | ±25  | mA   |
| supply current          | I <sub>CC</sub>  | -                                                              |           | -    | ±50  | mA   |
| ground current          | I <sub>GND</sub> | -                                                              |           | -    | ±50  | mA   |
| storage temperature     | T <sub>stg</sub> | -                                                              |           | -65  | +150 | °C   |
| soldering temperature   | T <sub>L</sub>   | 10s                                                            | DIP       | 245  |      | °C   |
|                         |                  |                                                                | SOP/TSSOP | 260  |      | °C   |

#### 3.2、Recommended Operating Conditions

| Parameter           | Symbol    | Conditions | Min. | Typ. | Max.     | Unit               |
|---------------------|-----------|------------|------|------|----------|--------------------|
| supply voltage      | $V_{CC}$  | -          | 2.0  | 5.0  | 6.0      | V                  |
| input voltage       | $V_I$     | -          | 0    | -    | $V_{CC}$ | V                  |
| output voltage      | $V_O$     | -          | 0    | -    | $V_{CC}$ | V                  |
| ambient temperature | $T_{amb}$ | -          | -40  | -    | +125     | $^{\circ}\text{C}$ |



### 3.3、Electrical Characteristics

#### 3.3.1、DC Characteristics 1

( $T_{amb}=25^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified)

| Parameter                 | Symbol          | Conditions                                                                        |                                               | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------|------|------|------|------|
| HIGH-level input voltage  | V <sub>IH</sub> | V <sub>CC</sub> =2.0V                                                             |                                               | 1.5  | 1.2  | -    | V    |
|                           |                 | V <sub>CC</sub> =4.5V                                                             |                                               | 3.15 | 2.4  | -    | V    |
|                           |                 | V <sub>CC</sub> =6.0V                                                             |                                               | 4.2  | 3.2  | -    | V    |
| LOW-level input voltage   | V <sub>IL</sub> | V <sub>CC</sub> =2.0V                                                             |                                               | -    | 0.8  | 0.5  | V    |
|                           |                 | V <sub>CC</sub> =4.5V                                                             |                                               | -    | 2.1  | 1.35 | V    |
|                           |                 | V <sub>CC</sub> =6.0V                                                             |                                               | -    | 2.8  | 1.8  | V    |
| HIGH-level output voltage | V <sub>OH</sub> | V <sub>I</sub> =V <sub>IH</sub> or V <sub>IL</sub>                                | I <sub>O</sub> =-20uA; V <sub>CC</sub> =2.0V  | 1.9  | 2.0  | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-20uA; V <sub>CC</sub> =4.5V  | 4.4  | 4.5  | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-20uA; V <sub>CC</sub> =6.0V  | 5.9  | 6.0  | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-4.0mA; V <sub>CC</sub> =4.5V | 3.98 | 4.32 | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-5.2mA; V <sub>CC</sub> =6.0V | 5.48 | 5.81 | -    | V    |
| LOW-level output voltage  | V <sub>OL</sub> | V <sub>I</sub> =V <sub>IH</sub> or V <sub>IL</sub>                                | I <sub>O</sub> =20uA; V <sub>CC</sub> =2.0V   | -    | 0    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =20uA; V <sub>CC</sub> =4.5V   | -    | 0    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =20uA; V <sub>CC</sub> =6.0V   | -    | 0    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =4.0mA; V <sub>CC</sub> =4.5V  | -    | 0.15 | 0.26 | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =5.2mA; V <sub>CC</sub> =6.0V  | -    | 0.16 | 0.26 | V    |
| input leakage current     | I <sub>I</sub>  | V <sub>I</sub> =V <sub>CC</sub> or GND; V <sub>CC</sub> =6.0V                     |                                               | -    | -    | ±1   | uA   |
| supply current            | I <sub>CC</sub> | V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A; V <sub>CC</sub> =6.0V |                                               | -    | -    | 8    | uA   |



### 3.3.2、DC Characteristics 2

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified)

| Parameter                 | Symbol          | Conditions                                                                        |                                               | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------|------|------|------|------|
| HIGH-level input voltage  | V <sub>IH</sub> | V <sub>CC</sub> =2.0V                                                             |                                               | 1.5  | -    | -    | V    |
|                           |                 | V <sub>CC</sub> =4.5V                                                             |                                               | 3.15 | -    | -    | V    |
|                           |                 | V <sub>CC</sub> =6.0V                                                             |                                               | 4.2  | -    | -    | V    |
| LOW-level input voltage   | V <sub>IL</sub> | V <sub>CC</sub> =2.0V                                                             |                                               | -    | -    | 0.5  | V    |
|                           |                 | V <sub>CC</sub> =4.5V                                                             |                                               | -    | -    | 1.35 | V    |
|                           |                 | V <sub>CC</sub> =6.0V                                                             |                                               | -    | -    | 1.8  | V    |
| HIGH-level output voltage | V <sub>OH</sub> | V <sub>I</sub> =V <sub>IH</sub> or V <sub>IL</sub>                                | I <sub>O</sub> =-20uA; V <sub>CC</sub> =2.0V  | 1.9  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-20uA; V <sub>CC</sub> =4.5V  | 4.4  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-20uA; V <sub>CC</sub> =6.0V  | 5.9  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-4.0mA; V <sub>CC</sub> =4.5V | 3.84 | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-5.2mA; V <sub>CC</sub> =6.0V | 5.34 | -    | -    | V    |
| LOW-level output voltage  | V <sub>OL</sub> | V <sub>I</sub> =V <sub>IH</sub> or V <sub>IL</sub>                                | I <sub>O</sub> =20uA; V <sub>CC</sub> =2.0V   | -    | -    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =20uA; V <sub>CC</sub> =4.5V   | -    | -    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =20uA; V <sub>CC</sub> =6.0V   | -    | -    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =4.0mA; V <sub>CC</sub> =4.5V  | -    | -    | 0.33 | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =5.2mA; V <sub>CC</sub> =6.0V  | -    | -    | 0.33 | V    |
| input leakage current     | I <sub>I</sub>  | V <sub>I</sub> =V <sub>CC</sub> or GND; V <sub>CC</sub> =6.0V                     |                                               | -    | -    | ±1.0 | uA   |
| supply current            | I <sub>CC</sub> | V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A; V <sub>CC</sub> =6.0V |                                               | -    | -    | 80   | uA   |



### 3.3.3、DC Characteristics 3

( $T_{amb} = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified)

| Parameter                 | Symbol          | Conditions                                                                        |                                               | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------|------|------|------|------|
| HIGH-level input voltage  | V <sub>IH</sub> | V <sub>CC</sub> =2.0V                                                             |                                               | 1.5  | -    | -    | V    |
|                           |                 | V <sub>CC</sub> =4.5V                                                             |                                               | 3.15 | -    | -    | V    |
|                           |                 | V <sub>CC</sub> =6.0V                                                             |                                               | 4.2  | -    | -    | V    |
| LOW-level input voltage   | V <sub>IL</sub> | V <sub>CC</sub> =2.0V                                                             |                                               | -    | -    | 0.5  | V    |
|                           |                 | V <sub>CC</sub> =4.5V                                                             |                                               | -    | -    | 1.35 | V    |
|                           |                 | V <sub>CC</sub> =6.0V                                                             |                                               | -    | -    | 1.8  | V    |
| HIGH-level output voltage | V <sub>OH</sub> | V <sub>I</sub> =V <sub>IH</sub> or V <sub>IL</sub>                                | I <sub>O</sub> =-20uA; V <sub>CC</sub> =2.0V  | 1.9  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-20uA; V <sub>CC</sub> =4.5V  | 4.4  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-20uA; V <sub>CC</sub> =6.0V  | 5.9  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-4.0mA; V <sub>CC</sub> =4.5V | 3.7  | -    | -    | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =-5.2mA; V <sub>CC</sub> =6.0V | 5.2  | -    | -    | V    |
| LOW-level output voltage  | V <sub>OL</sub> | V <sub>I</sub> =V <sub>IH</sub> or V <sub>IL</sub>                                | I <sub>O</sub> =20uA; V <sub>CC</sub> =2.0V   | -    | -    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =20uA; V <sub>CC</sub> =4.5V   | -    | -    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =20uA; V <sub>CC</sub> =6.0V   | -    | -    | 0.1  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =4.0mA; V <sub>CC</sub> =4.5V  | -    | -    | 0.4  | V    |
|                           |                 |                                                                                   | I <sub>O</sub> =5.2mA; V <sub>CC</sub> =6.0V  | -    | -    | 0.4  | V    |
| input leakage current     | I <sub>I</sub>  | V <sub>I</sub> =V <sub>CC</sub> or GND; V <sub>CC</sub> =6.0V                     |                                               | -    | -    | ±1.0 | uA   |
| supply current            | I <sub>CC</sub> | V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A; V <sub>CC</sub> =6.0V |                                               | -    | -    | 160  | uA   |



### 3.3.4、AC Characteristics 1

( $T_{amb}=25^{\circ}\text{C}$ ,  $GND=0\text{V}$ ,  $C_L=50\text{pF}$ , unless otherwise specified)

| Parameter                        | Symbol           | Conditions                                                    |                                             | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|---------------------------------------------------------------|---------------------------------------------|------|------|------|------|
| propagation delay                | t <sub>pd</sub>  | $\overline{\text{CP}}$ to Q0;<br>see Figure 4 <sup>[1]</sup>  | V <sub>CC</sub> =2.0V                       | -    | 47   | 150  | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | -    | 17   | 30   | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =5.0V; C <sub>L</sub> =15pF | -    | 14   | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | -    | 14   | 26   | ns   |
|                                  |                  | Qn to Qn+1;<br>see Figure 4                                   | V <sub>CC</sub> =2.0V                       | -    | 28   | 100  | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | -    | 10   | 20   | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =5.0V; C <sub>L</sub> =15pF | -    | 8    | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | -    | 8    | 17   | ns   |
| HIGH to LOW<br>Propagation delay | t <sub>PHL</sub> | MR to Qn;<br>see Figure 4                                     | V <sub>CC</sub> =2.0V                       | -    | 61   | 185  | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | -    | 22   | 37   | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | -    | 18   | 31   | ns   |
| transition time                  | t <sub>t</sub>   | Qn;<br>see Figure 4 <sup>[2]</sup>                            | V <sub>CC</sub> =2.0V                       | -    | 19   | 75   | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | -    | 7    | 15   | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | -    | 6    | 13   | ns   |
| pulse width                      | t <sub>w</sub>   | $\overline{\text{CP}}$ input, HIGH<br>or LOW;<br>see Figure 4 | V <sub>CC</sub> =2.0V                       | 80   | 14   | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | 16   | 5    | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | 14   | 4    | -    | ns   |
|                                  |                  | MR input,<br>HIGH;<br>see Figure 4                            | V <sub>CC</sub> =2.0V                       | 80   | 22   | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | 16   | 8    | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | 14   | 6    | -    | ns   |
| recovery time                    | t <sub>rec</sub> | MR to $\overline{\text{CP}}$ ;<br>see Figure 4                | V <sub>CC</sub> =2.0V                       | 50   | 8    | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | 10   | 3    | -    | ns   |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | 9    | 2    | -    | ns   |
| maximum<br>frequency             | f <sub>max</sub> | $\overline{\text{CP}}$ input;<br>see Figure 4                 | V <sub>CC</sub> =2.0V                       | 6    | 27   | -    | MHz  |
|                                  |                  |                                                               | V <sub>CC</sub> =4.5V                       | 30   | 82   | -    | MHz  |
|                                  |                  |                                                               | V <sub>CC</sub> =5.0V; C <sub>L</sub> =15pF | -    | 90   | -    | MHz  |
|                                  |                  |                                                               | V <sub>CC</sub> =6.0V                       | 35   | 98   | -    | MHz  |

Note:

[1]  $t_{pd}$  is the same as  $t_{PHL}$ ,  $t_{PLH}$ .

[2]  $t_t$  is the same as  $t_{THL}$ ,  $t_{TLH}$ .



### 3.3.5、AC Characteristics 2

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $GND = 0\text{V}$ ,  $C_L = 50\text{pF}$ , unless otherwise specified)

| Parameter                        | Symbol    | Conditions                                             | Min.                   | Typ. | Max. | Unit   |
|----------------------------------|-----------|--------------------------------------------------------|------------------------|------|------|--------|
| propagation delay                | $t_{pd}$  | $\overline{CP}$ to Q0;<br>see Figure 4 <sup>[1]</sup>  | $V_{CC} = 2.0\text{V}$ | -    | -    | 190 ns |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | -    | -    | 38 ns  |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | -    | -    | 33 ns  |
|                                  |           | Qn to Qn+1;<br>see Figure 4                            | $V_{CC} = 2.0\text{V}$ | -    | -    | 125 ns |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | -    | -    | 25 ns  |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | -    | -    | 21 ns  |
| HIGH to LOW<br>Propagation delay | $t_{PHL}$ | MR to Qn;<br>see Figure 4                              | $V_{CC} = 2.0\text{V}$ | -    | -    | 230 ns |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | -    | -    | 46 ns  |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | -    | -    | 39 ns  |
| transition time                  | $t_t$     | Qn;<br>see Figure 4 <sup>[2]</sup>                     | $V_{CC} = 2.0\text{V}$ | -    | -    | 95 ns  |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | -    | -    | 19 ns  |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | -    | -    | 16 ns  |
| pulse width                      | $t_w$     | $\overline{CP}$ input, HIGH<br>or LOW;<br>see Figure 4 | $V_{CC} = 2.0\text{V}$ | 100  | -    | - ns   |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | 20   | -    | - ns   |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | 17   | -    | - ns   |
|                                  |           | MR input,<br>HIGH;<br>see Figure 4                     | $V_{CC} = 2.0\text{V}$ | 100  | -    | - ns   |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | 20   | -    | - ns   |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | 17   | -    | - ns   |
| recovery time                    | $t_{rec}$ | MR to $\overline{CP}$ ;<br>see Figure 4                | $V_{CC} = 2.0\text{V}$ | 65   | -    | - ns   |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | 13   | -    | - ns   |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | 11   | -    | - ns   |
| maximum<br>frequency             | $f_{max}$ | $\overline{CP}$ input;<br>see Figure 4                 | $V_{CC} = 2.0\text{V}$ | 4.8  | -    | - MHz  |
|                                  |           |                                                        | $V_{CC} = 4.5\text{V}$ | 24   | -    | - MHz  |
|                                  |           |                                                        | $V_{CC} = 6.0\text{V}$ | 28   | -    | - MHz  |

Note:

[1]  $t_{pd}$  is the same as  $t_{PHL}$ ,  $t_{PLH}$ .

[2]  $t_t$  is the same as  $t_{THL}$ ,  $t_{TLH}$ .



### 3.3.6、AC Characteristics 3

( $T_{amb} = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $GND = 0V$ ,  $C_L = 50pF$ , unless otherwise specified)

| Parameter                        | Symbol           | Conditions                                             |                       | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|--------------------------------------------------------|-----------------------|------|------|------|------|
| propagation delay                | t <sub>pd</sub>  | $\overline{CP}$ to Q0;<br>see Figure 4 <sup>[1]</sup>  | V <sub>CC</sub> =2.0V | -    | -    | 225  | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | -    | -    | 45   | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | -    | -    | 38   | ns   |
|                                  |                  | Qn to Qn+1;<br>see Figure 4                            | V <sub>CC</sub> =2.0V | -    | -    | 150  | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | -    | -    | 30   | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | -    | -    | 26   | ns   |
| HIGH to LOW<br>Propagation delay | t <sub>PHL</sub> | MR to Qn;<br>see Figure 4                              | V <sub>CC</sub> =2.0V | -    | -    | 280  | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | -    | -    | 56   | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | -    | -    | 48   | ns   |
| transition time                  | t <sub>t</sub>   | Qn;<br>see Figure 4 <sup>[2]</sup>                     | V <sub>CC</sub> =2.0V | -    | -    | 110  | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | -    | -    | 22   | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | -    | -    | 19   | ns   |
| pulse width                      | t <sub>w</sub>   | $\overline{CP}$ input, HIGH<br>or LOW;<br>see Figure 4 | V <sub>CC</sub> =2.0V | 120  | -    | -    | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | 24   | -    | -    | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | 20   | -    | -    | ns   |
|                                  |                  | MR input,<br>HIGH;<br>see Figure 4                     | V <sub>CC</sub> =2.0V | 120  | -    | -    | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | 24   | -    | -    | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | 20   | -    | -    | ns   |
| recovery time                    | t <sub>rec</sub> | MR to $\overline{CP}$ ;<br>see Figure 4                | V <sub>CC</sub> =2.0V | 75   | -    | -    | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | 15   | -    | -    | ns   |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | 13   | -    | -    | ns   |
| maximum<br>frequency             | f <sub>max</sub> | $\overline{CP}$ input;<br>see Figure 4                 | V <sub>CC</sub> =2.0V | 4    | -    | -    | MHz  |
|                                  |                  |                                                        | V <sub>CC</sub> =4.5V | 20   | -    | -    | MHz  |
|                                  |                  |                                                        | V <sub>CC</sub> =6.0V | 24   | -    | -    | MHz  |

Note:

[1]  $t_{pd}$  is the same as  $t_{PHL}$ ,  $t_{PLH}$ .

[2]  $t_t$  is the same as  $t_{THL}$ ,  $t_{TLH}$ .

## 4、Testing Circuit

### 4.1、AC Testing Circuit

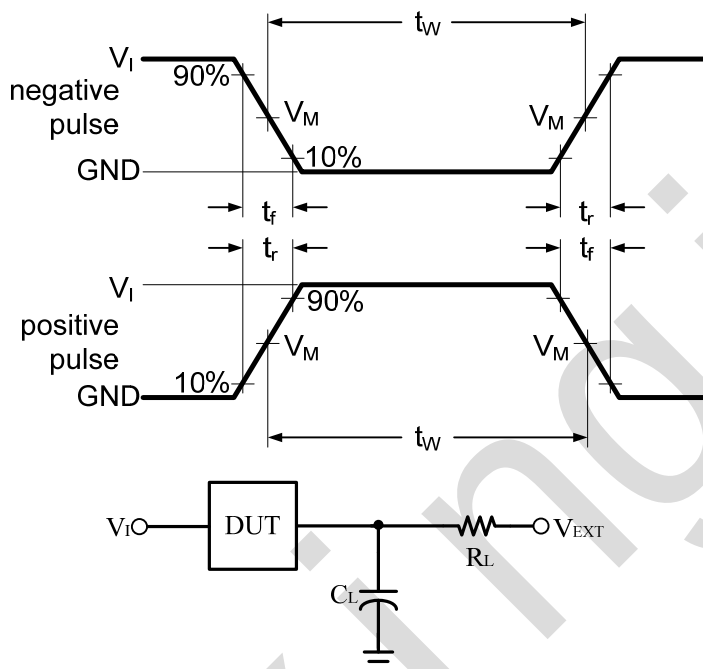


Figure 3. Test circuit for measuring switching times

$C_L$  includes probe and jig capacitance.



## 4.2、AC Testing Waveforms

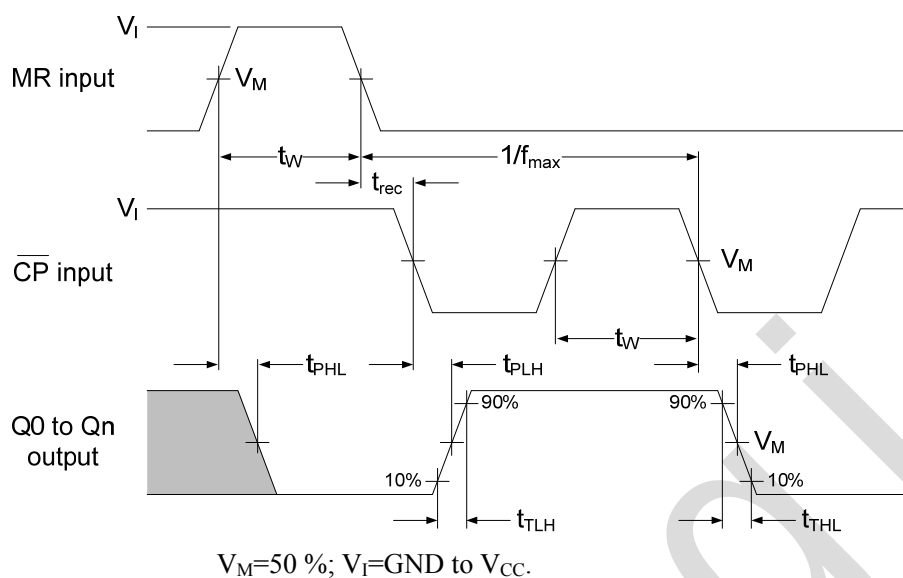


Figure 4. Clock propagation delays, pulse width, transition times, maximum pulse frequency and master resets

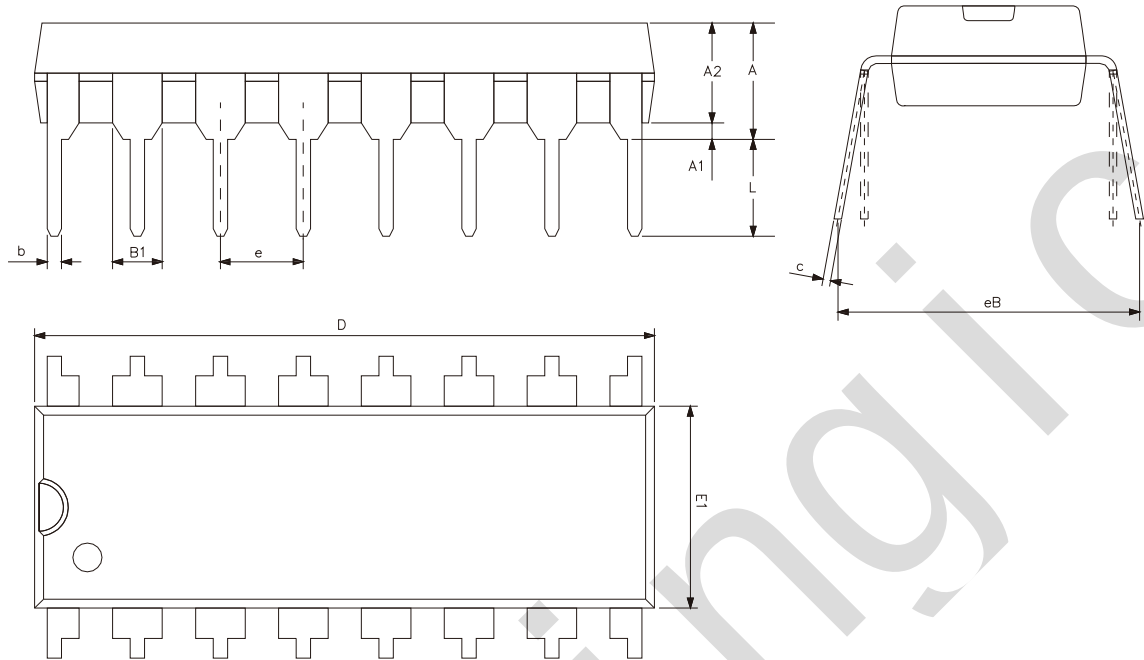
## 4.3、Test Data

| Input    |            | Load       | Test               |
|----------|------------|------------|--------------------|
| $V_I$    | $t_r, t_f$ | $C_L$      |                    |
| $V_{CC}$ | 6ns        | 15pF, 50pF | $t_{PHL}, t_{PLH}$ |



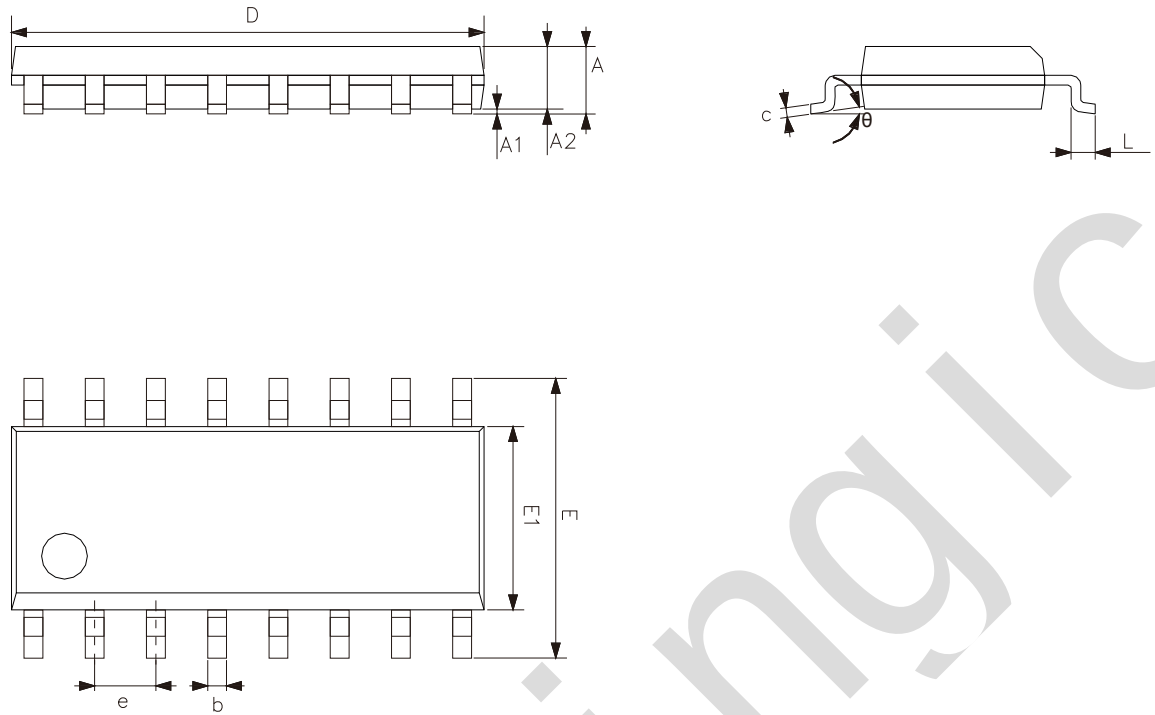
## 5、Package Information

### 5.1、DIP16



| Symbol | Dimensions (mm) |       |
|--------|-----------------|-------|
|        | Min.            | Max.  |
| A2     | 3.20            | 3.60  |
| A1     | 0.51            | -     |
| A      | 3.60            | 5.33  |
| L      | 3.00            | 3.60  |
| b      | 0.36            | 0.56  |
| B1     | 1.52            |       |
| D      | 18.80           | 19.94 |
| E1     | 6.20            | 6.60  |
| e      | 2.54            |       |
| c      | 0.20            | 0.36  |
| eB     | 7.62            | 9.30  |

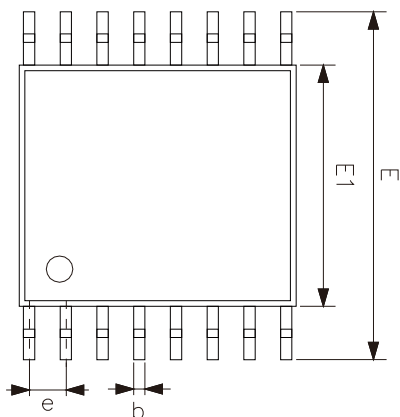
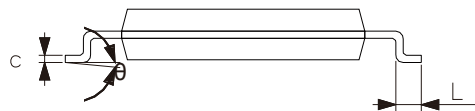
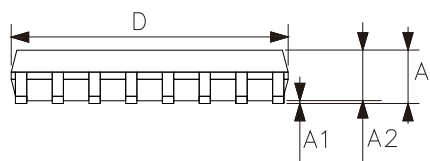
## 5.2、SOP16



| Symbol | Dimensions (mm) |       |
|--------|-----------------|-------|
|        | Min.            | Max.  |
| A      | 1.35            | 1.80  |
| A1     | 0.10            | 0.25  |
| A2     | 1.25            | 1.55  |
| b      | 0.33            | 0.51  |
| c      | 0.19            | 0.25  |
| D      | 9.50            | 10.10 |
| E      | 5.80            | 6.30  |
| E1     | 3.70            | 4.10  |
| e      | 1.27            |       |
| L      | 0.35            | 0.89  |
| θ      | 0°              | 8°    |



### 5.3、TSSOP16



| Symbol | Dimensions (mm) |      |
|--------|-----------------|------|
|        | Min.            | Max. |
| A      | -               | 1.20 |
| A1     | 0.05            | 0.15 |
| A2     | 0.80            | 1.05 |
| b      | 0.19            | 0.30 |
| c      | 0.09            | 0.20 |
| D      | 4.90            | 5.10 |
| E1     | 4.30            | 4.50 |
| E      | 6.20            | 6.60 |
| e      | 0.65            |      |
| L      | 0.45            | 0.75 |
| θ      | 0°              | 8°   |



## 6、Statements And Notes

### 6.1、The name and content of Hazardous substances or Elements in the product

| Part name               | Hazardous substances or Elements                                                                                                                                                                                                                                                 |                               |                               |                               |                          |                                |                   |                       |                           |                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------|--------------------------------|-------------------|-----------------------|---------------------------|----------------------|
|                         | Lead and lead compounds                                                                                                                                                                                                                                                          | Mercury and mercury compounds | Cadmium and cadmium compounds | Hexavalent chromium compounds | Polybrominated biphenyls | Polybrominated biphenyl ethers | Dibutyl phthalate | Butylbenzyl phthalate | Di-2-ethylhexyl phthalate | Diisobutyl phthalate |
| Lead frame              | ○                                                                                                                                                                                                                                                                                | ○                             | ○                             | ○                             | ○                        | ○                              | ○                 | ○                     | ○                         | ○                    |
| Plastic resin           | ○                                                                                                                                                                                                                                                                                | ○                             | ○                             | ○                             | ○                        | ○                              | ○                 | ○                     | ○                         | ○                    |
| Chip                    | ○                                                                                                                                                                                                                                                                                | ○                             | ○                             | ○                             | ○                        | ○                              | ○                 | ○                     | ○                         | ○                    |
| The lead                | ○                                                                                                                                                                                                                                                                                | ○                             | ○                             | ○                             | ○                        | ○                              | ○                 | ○                     | ○                         | ○                    |
| Plastic sheet installed | ○                                                                                                                                                                                                                                                                                | ○                             | ○                             | ○                             | ○                        | ○                              | ○                 | ○                     | ○                         | ○                    |
| explanation             | <p>○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard.</p> <p>×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.</p> |                               |                               |                               |                          |                                |                   |                       |                           |                      |

### 6.2、Notes

We recommend you to read this chapter carefully before using this product.

The information in this chapter is provided for reference only and Lingxing disclaims any express or implied warranties, including but not limited to applicability, special application or non-infringement of third party rights.

This product is not suitable for critical equipment such as life-saving, life-sustaining or safety equipment. It is also not suitable for applications that may result in personal injury, death, or serious property or environmental damage due to product malfunction or failure. Lingxing will not be liable for any damages incurred by the customers at their own risk for such applications.

The customer is responsible for conducting all necessary tests Lingxing's application to avoid failure in the application or the application of the customer's third party users. Lingxing does not accept any liability.

The Company reserves the right to change or improve the information published in this chapter at any time. The information in this chapter are subject to change without notice. We recommend the customer to consult our sales staff before purchasing.

Please obtain related materials from Lingxing's regular channels and we are not responsible for its content if it is provided by sources other than our company.

In case of any conflict between the Chinese and English version, the version is subject to the Chinese one.