



# CD40175 (LX) Quad D-type flip-flop

## Product Specification

### Specification Revision History:

| Version    | Date    | Description        |
|------------|---------|--------------------|
| 2023-04-A1 | 2023-04 | New                |
| 2024-04-A2 | 2024-04 | Modify the content |
|            |         |                    |
|            |         |                    |



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## 1、General Description

The CD40175 is a quad edge-triggered D-type flip-flop.

### Features:

- Supply voltage range:3V to 15V
- Temperature range:-40℃ to +125℃
- Packaging information: DIP16/SOP16

### Ordering Information:

#### Tube packing specifications:

| Part number   | Packaging form | Marking code | Tube quantity  | Boxed tube quantity | Boxed quantity  | Notes                                                                  |
|---------------|----------------|--------------|----------------|---------------------|-----------------|------------------------------------------------------------------------|
| CD40175BE(LX) | DIP16          | CD40175BE    | 25<br>PCS/tube | 40<br>tube/box      | 1000<br>PCS/box | Dimensions of plastic enclosure:<br>19.0mm×6.4mm<br>Pin spacing:2.54mm |

#### Reel packing specifications:

| Part number   | Packaging form | Marking code | Reel quantity | Boxed reel quantity | Notes                                                                  |
|---------------|----------------|--------------|---------------|---------------------|------------------------------------------------------------------------|
| CD40175BM(LX) | SOP16          | CD40175BM    | 4000PCS/reel  | 8000PCS/box         | Dimensions of plastic enclosure:<br>10.0mm×3.9mm<br>Pin spacing:1.27mm |

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

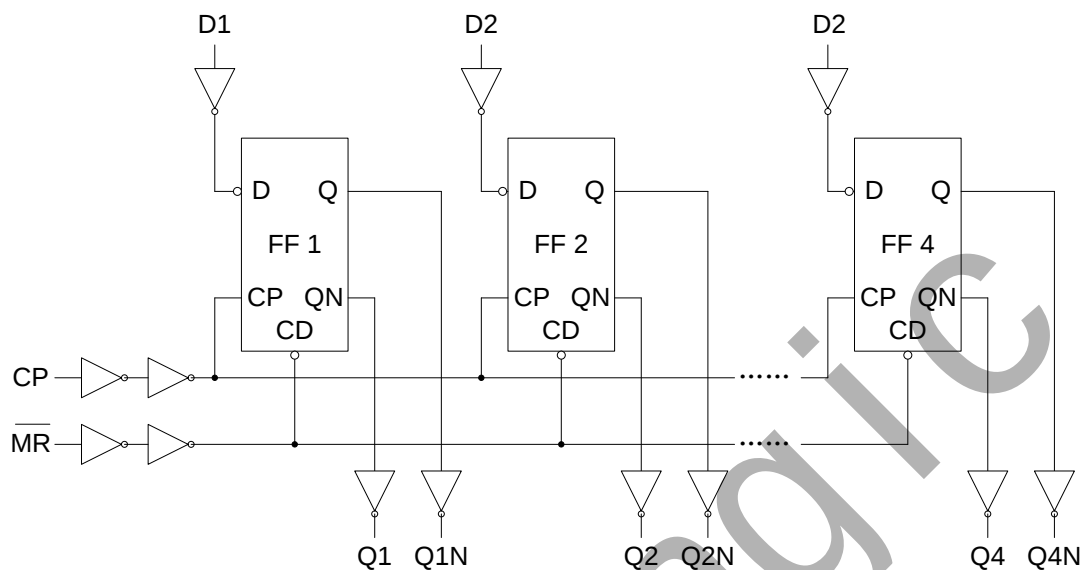
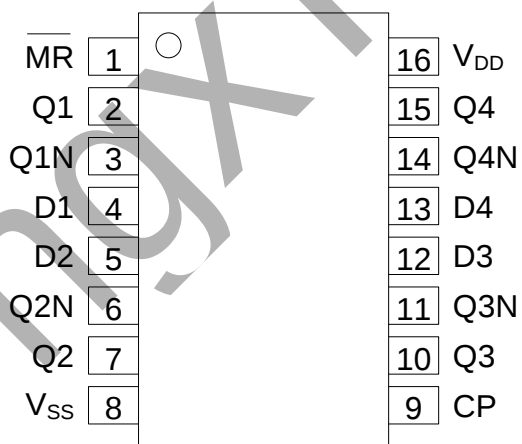


Figure 1. Functional diagram

### 2.2、Pin Configurations





## 2.3、Pin Description

| Pin No. | Pin Name               | Description                   |
|---------|------------------------|-------------------------------|
| 1       | $\overline{\text{MR}}$ | master reset input            |
| 2       | Q1                     | buffered output               |
| 3       | Q1N                    | complementary buffered output |
| 4       | D1                     | data input                    |
| 5       | D2                     | data input                    |
| 6       | Q2N                    | complementary buffered output |
| 7       | Q2                     | buffered output               |
| 8       | $V_{SS}$               | ground supply voltage         |
| 9       | CP                     | clock input                   |
| 10      | Q3                     | buffered output               |
| 11      | Q3N                    | complementary buffered output |
| 12      | D3                     | data input                    |
| 13      | D4                     | data input                    |
| 14      | Q4N                    | data input                    |
| 15      | Q4                     | buffered output               |
| 16      | $V_{DD}$               | supply voltage                |

## 2.4、Function Table

| Input |   |                        | Output    |
|-------|---|------------------------|-----------|
| CP    | D | $\overline{\text{MR}}$ | Qn        |
| ↑     | H | H                      | H         |
| ↑     | L | H                      | L         |
| ↓     | X | H                      | no change |
| X     | X | L                      | L         |

Note:

H=HIGH voltage level; L=LOW voltage level. X=don't care;

↑=positive-going transition; ↓= negative-going transition.

## 3、Electrical Parameter

### 3.1、Absolute Maximum Ratings

(Voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

| Parameter             | Symbol    | Conditions    | Min. | Max.         | Unit |
|-----------------------|-----------|---------------|------|--------------|------|
| supply voltage        | $V_{DD}$  | -             | -0.5 | +18          | V    |
| input voltage         | $V_I$     | all inputs    | -0.5 | $V_{DD}+0.5$ | V    |
| DC input current      | $I_{IK}$  | any one input | -    | ±10          | mA   |
| storage temperature   | $T_{stg}$ | -             | -65  | +150         | °C   |
| soldering temperature | $T_L$     | 10s           | DIP  | 245          | °C   |
|                       |           |               | SOP  | 260          |      |



## 3.2、Recommended Operating Conditions

| Parameter           | Symbol    | Conditions  | Min. | Typ. | Max. | Unit |
|---------------------|-----------|-------------|------|------|------|------|
| supply voltage      | $V_{DD}$  | -           | 3    | -    | 15   | V    |
| ambient temperature | $T_{amb}$ | in free air | -40  | -    | +125 | °C   |

## 3.3、Electrical Characteristics

### 3.3.1、DC Characteristics 1

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

| Parameter                 | Symbol   | $V_{DD}$ | Conditions                                   | Min.  | Typ. | Max.    | Unit          |
|---------------------------|----------|----------|----------------------------------------------|-------|------|---------|---------------|
| HIGH-level input voltage  | $V_{IH}$ | 5V       | -                                            | 3.5   | -    | -       | V             |
|                           |          | 10V      | -                                            | 7     | -    | -       | V             |
|                           |          | 15V      | -                                            | 11    | -    | -       | V             |
| LOW-level input voltage   | $V_{IL}$ | 5V       | -                                            | -     | -    | 1.5     | V             |
|                           |          | 10V      | -                                            | -     | -    | 3       | V             |
|                           |          | 15V      | -                                            | -     | -    | 4       | V             |
| HIGH-level output voltage | $V_{OH}$ | 5V       | $ I_O  < 1\mu\text{A}$                       | 4.95  | -    | -       | V             |
|                           |          | 10V      | $ I_O  < 1\mu\text{A}$                       | 9.95  | -    | -       | V             |
|                           |          | 15V      | $ I_O  < 1\mu\text{A}$                       | 14.95 | -    | -       | V             |
| LOW-level output voltage  | $V_{OL}$ | 5V       | $ I_O  < 1\mu\text{A}$                       | -     | -    | 0.05    | V             |
|                           |          | 10V      | $ I_O  < 1\mu\text{A}$                       | -     | -    | 0.05    | V             |
|                           |          | 15V      | $ I_O  < 1\mu\text{A}$                       | -     | -    | 0.05    | V             |
| HIGH-level output current | $I_{OH}$ | 5V       | $V_O = 4.6\text{V}$                          | -     | -    | -0.34   | mA            |
|                           |          | 5V       | $V_O = 2.5\text{V}$                          | -     | -    | -1.3    | mA            |
|                           |          | 10V      | $V_O = 9.5\text{V}$                          | -     | -    | -0.55   | mA            |
|                           |          | 15V      | $V_O = 13.5\text{V}$                         | -     | -    | -1.65   | mA            |
| LOW-level output current  | $I_{OL}$ | 5V       | $V_O = 0.4\text{V}$                          | 0.34  | -    | -       | mA            |
|                           |          | 10V      | $V_O = 0.5\text{V}$                          | 0.46  | -    | -       | mA            |
|                           |          | 15V      | $V_O = 1.5\text{V}$                          | 1.4   | -    | -       | mA            |
| input leakage current     | $I_I$    | 15V      | $V_I = 15\text{V}$ or GND                    | -     | -    | $\pm 2$ | $\mu\text{A}$ |
| supply current            | $I_{DD}$ | 5V       | $V_I = 5\text{V}$ or GND; $I_O = 0\text{A}$  | -     | -    | 7.5     | $\mu\text{A}$ |
|                           |          | 10V      | $V_I = 10\text{V}$ or GND; $I_O = 0\text{A}$ | -     | -    | 15      | $\mu\text{A}$ |
|                           |          | 15V      | $V_I = 15\text{V}$ or GND; $I_O = 0\text{A}$ | -     | -    | 30      | $\mu\text{A}$ |



## 3.3.2、DC Characteristics 2

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

| Parameter                 | Symbol   | $V_{DD}$ | Conditions                               | Min.  | Typ. | Max.    | Unit          |
|---------------------------|----------|----------|------------------------------------------|-------|------|---------|---------------|
| HIGH-level input voltage  | $V_{IH}$ | 5V       | -                                        | 3.5   | -    | -       | V             |
|                           |          | 10V      | -                                        | 7     | -    | -       | V             |
|                           |          | 15V      | -                                        | 11    | -    | -       | V             |
| LOW-level input voltage   | $V_{IL}$ | 5V       | -                                        | -     | -    | 1.5     | V             |
|                           |          | 10V      | -                                        | -     | -    | 3       | V             |
|                           |          | 15V      | -                                        | -     | -    | 4       | V             |
| HIGH-level output voltage | $V_{OH}$ | 5V       | $ I_O <1\mu\text{A}$                     | 4.95  | -    | -       | V             |
|                           |          | 10V      | $ I_O <1\mu\text{A}$                     | 9.95  | -    | -       | V             |
|                           |          | 15V      | $ I_O <1\mu\text{A}$                     | 14.95 | -    | -       | V             |
| LOW-level output voltage  | $V_{OL}$ | 5V       | $ I_O <1\mu\text{A}$                     | -     | -    | 0.05    | V             |
|                           |          | 10V      | $ I_O <1\mu\text{A}$                     | -     | -    | 0.05    | V             |
|                           |          | 15V      | $ I_O <1\mu\text{A}$                     | -     | -    | 0.05    | V             |
| HIGH-level output current | $I_{OH}$ | 5V       | $V_O=4.6\text{V}$                        | -     | -    | -0.3    | mA            |
|                           |          | 5V       | $V_O=2.5\text{V}$                        | -     | -    | -1.15   | mA            |
|                           |          | 10V      | $V_O=9.5\text{V}$                        | -     | -    | -0.45   | mA            |
|                           |          | 15V      | $V_O=13.5\text{V}$                       | -     | -    | -1.4    | mA            |
| LOW-level output current  | $I_{OL}$ | 5V       | $V_O=0.4\text{V}$                        | 0.29  | -    | -       | mA            |
|                           |          | 10V      | $V_O=0.5\text{V}$                        | 0.38  | -    | -       | mA            |
|                           |          | 15V      | $V_O=1.5\text{V}$                        | 1.2   | -    | -       | mA            |
| input leakage current     | $I_I$    | 15V      | $V_I=15\text{V}$ or GND                  | -     | -    | $\pm 4$ | $\mu\text{A}$ |
| supply current            | $I_{DD}$ | 5V       | $V_I=5\text{V}$ or GND; $I_O=0\text{A}$  | -     | -    | 7.5     | $\mu\text{A}$ |
|                           |          | 10V      | $V_I=10\text{V}$ or GND; $I_O=0\text{A}$ | -     | -    | 15      | $\mu\text{A}$ |
|                           |          | 15V      | $V_I=15\text{V}$ or GND; $I_O=0\text{A}$ | -     | -    | 30      | $\mu\text{A}$ |

## 3.3.3、AC Characteristics 1

( $T_{amb}=-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{SS}=0\text{V}$ , unless otherwise specified.)

| Parameter                                                       | Symbol             | $V_{DD}$ | Conditions               | Min. | Typ. | Max. | Unit |
|-----------------------------------------------------------------|--------------------|----------|--------------------------|------|------|------|------|
| propagation delay time                                          | $t_{PHL}, t_{PLH}$ | 5V       | CP to Qn<br>See Figure 4 | -    | 70   | 140  | ns   |
|                                                                 |                    | 10V      |                          | -    | 30   | 65   | ns   |
|                                                                 |                    | 15V      |                          | -    | 20   | 45   | ns   |
| $\overline{\text{MR}}$ to Qn HIGH to LOW propagation delay time | $t_{PHL}$          | 5V       | See Figure 5             | -    | 70   | 140  | ns   |
|                                                                 |                    | 10V      |                          | -    | 30   | 65   | ns   |
|                                                                 |                    | 15V      |                          | -    | 25   | 50   | ns   |
| transition time                                                 | $t_{THL}, t_{TLH}$ | 5V       | See Figure 4             | -    | 60   | 120  | ns   |
|                                                                 |                    | 10V      |                          | -    | 30   | 60   | ns   |
|                                                                 |                    | 15V      |                          | -    | 20   | 40   | ns   |
| set-up time                                                     | $t_{su}$           | 5V       | See Figure 5             | 60   | 30   | -    | ns   |
|                                                                 |                    | 10V      |                          | 20   | 10   | -    | ns   |
|                                                                 |                    | 15V      |                          | 15   | 5    | -    | ns   |
| hold time                                                       | $t_{hold}$         | 5V       |                          | 25   | -5   | -    | ns   |
|                                                                 |                    | 10V      |                          | 10   | 0    | -    | ns   |
|                                                                 |                    | 15V      |                          | 10   | 0    | -    | ns   |



|                                         |            |     |  |    |     |   |     |
|-----------------------------------------|------------|-----|--|----|-----|---|-----|
| minimum clock pulse width;LOW           | $t_{WCPL}$ | 5V  |  | 90 | 45  | - | ns  |
|                                         |            | 10V |  | 35 | 15  | - | ns  |
|                                         |            | 15V |  | 25 | 10  | - | ns  |
| minimum $\overline{MR}$ pulse width;LOW | $t_{WMRL}$ | 5V  |  | 80 | 40  | - | ns  |
|                                         |            | 10V |  | 30 | 15  | - | ns  |
|                                         |            | 15V |  | 20 | 10  | - | ns  |
| recovery time for $\overline{MR}$       | $t_{RMR}$  | 5V  |  | 0  | -30 | - | ns  |
|                                         |            | 10V |  | 0  | -20 | - | ns  |
|                                         |            | 15V |  | 0  | -15 | - | ns  |
| maximum clock pulse frequency           | $f_{max}$  | 5V  |  | 5  | 11  | - | MHZ |
|                                         |            | 10V |  | 15 | 30  | - | MHZ |
|                                         |            | 15V |  | 20 | 45  | - | MHZ |

### 3.3.4、AC Characteristics 2

( $T_{amb} = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{SS} = 0\text{V}$ , unless otherwise specified.)

| Parameter                                                | Symbol             | $V_{DD}$ | Conditions               | Min. | Typ. | Max. | Unit |
|----------------------------------------------------------|--------------------|----------|--------------------------|------|------|------|------|
| propagation delay time                                   | $t_{PHL}, t_{PLH}$ | 5V       | CP to Qn<br>See Figure 4 | -    | -    | 168  | ns   |
|                                                          |                    | 10V      |                          | -    | -    | 78   | ns   |
|                                                          |                    | 15V      |                          | -    | -    | 54   | ns   |
| $\overline{MR}$ to Qn HIGH to LOW propagation delay time | $t_{PHL}$          | 5V       | See Figure 5             | -    | -    | 168  | ns   |
|                                                          |                    | 10V      |                          | -    | -    | 78   | ns   |
|                                                          |                    | 15V      |                          | -    | -    | 60   | ns   |
| transition time                                          | $t_{THL}, t_{TLH}$ | 5V       | See Figure 4             | -    | -    | 144  | ns   |
|                                                          |                    | 10V      |                          | -    | -    | 72   | ns   |
|                                                          |                    | 15V      |                          | -    | -    | 48   | ns   |
| set-up time                                              | $t_{su}$           | 5V       | See Figure 5             | 72   | -    | -    | ns   |
|                                                          |                    | 10V      |                          | 24   | -    | -    | ns   |
|                                                          |                    | 15V      |                          | 18   | -    | -    | ns   |
| hold time                                                | $t_{hold}$         | 5V       |                          | 30   | -    | -    | ns   |
|                                                          |                    | 10V      |                          | 12   | -    | -    | ns   |
|                                                          |                    | 15V      |                          | 12   | -    | -    | ns   |
| minimum clock pulse width; LOW                           | $t_{WCPL}$         | 5V       |                          | 108  | -    | -    | ns   |
|                                                          |                    | 10V      |                          | 42   | -    | -    | ns   |
|                                                          |                    | 15V      |                          | 30   | -    | -    | ns   |
| minimum $\overline{MR}$ pulse width; LOW                 | $t_{WMRL}$         | 5V       |                          | 96   | -    | -    | ns   |
|                                                          |                    | 10V      |                          | 36   | -    | -    | ns   |
|                                                          |                    | 15V      |                          | 24   | -    | -    | ns   |
| recovery time for $\overline{MR}$                        | $t_{RMR}$          | 5V       |                          | 0    | -    | -    | ns   |
|                                                          |                    | 10V      |                          | 0    | -    | -    | ns   |
|                                                          |                    | 15V      |                          | 0    | -    | -    | ns   |
| maximum clock pulse frequency                            | $f_{max}$          | 5V       |                          | 4    | -    | -    | MHZ  |
|                                                          |                    | 10V      |                          | 12   | -    | -    | MHZ  |
|                                                          |                    | 15V      |                          | 16   | -    | -    | MHZ  |



## 4、Testing Circuit

### 4.1、AC Testing Circuit

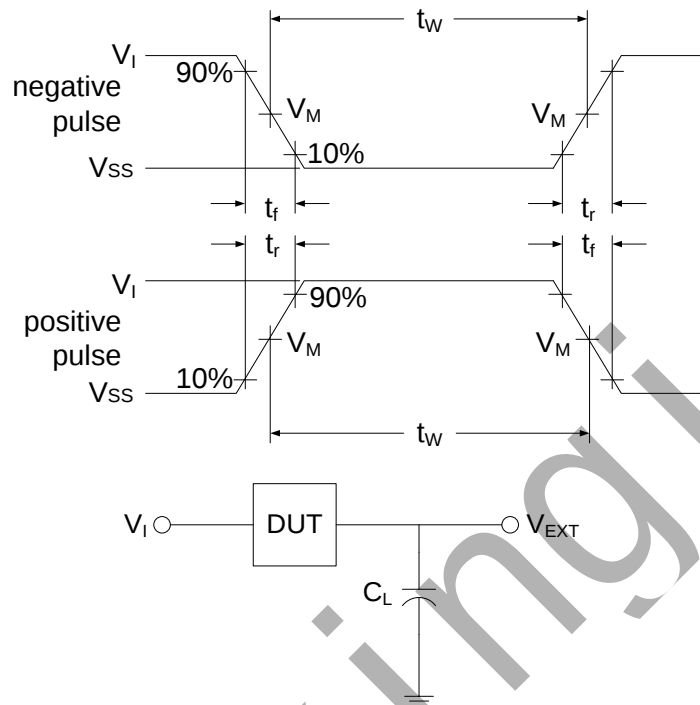


Figure 3. Load circuit

$C_L$  includes probe and jig capacitance.

### 4.2、Test Data

| Supply voltage | Input    |                    | Load  | $V_{EXT}$         |                   |                   |
|----------------|----------|--------------------|-------|-------------------|-------------------|-------------------|
| $V_{DD}$       | $V_I$    | $t_r = t_f$        | $C_L$ | $t_{PLH}/t_{PHL}$ | $t_{PLZ}/t_{PZL}$ | $t_{PHZ}/t_{PZH}$ |
| 5V to 15V      | $V_{DD}$ | $\leq 20\text{ns}$ | 50pF  | Open              | $V_{DD}$          | $V_{SS}$          |

### 4.3、AC Testing Waveforms

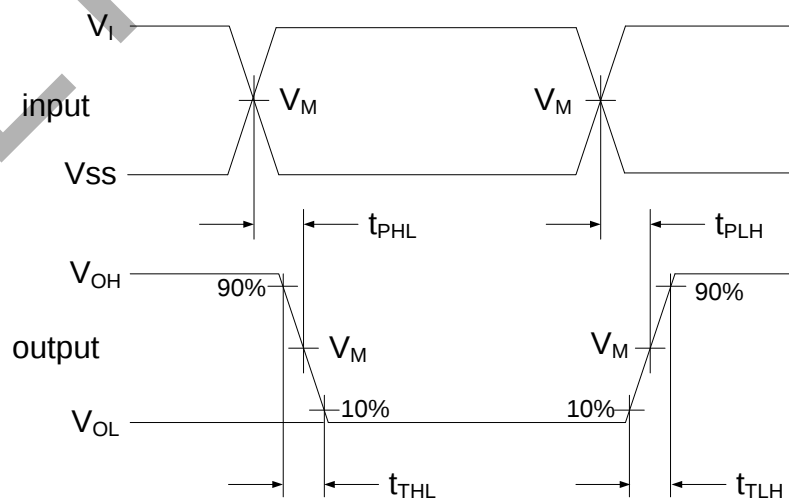


Figure 4. Propagation delay, output transition time

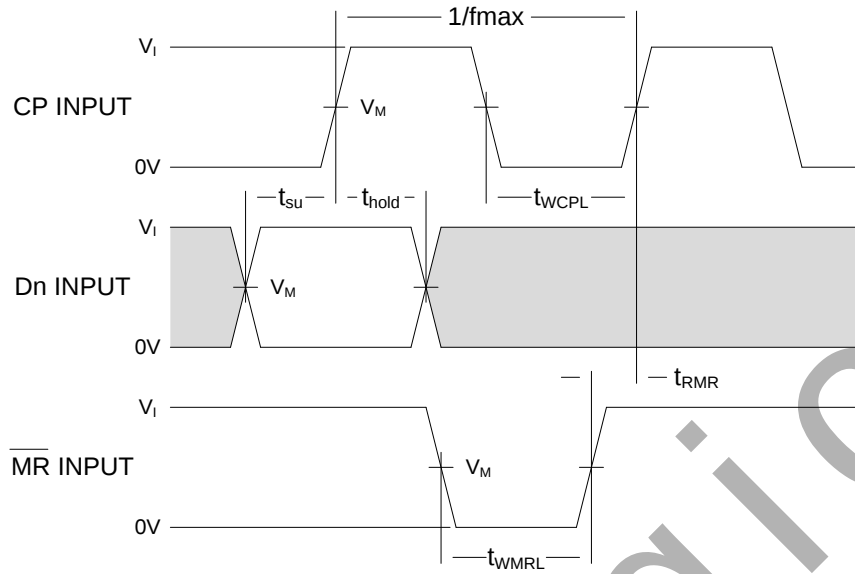


Figure 5. Minimum pulse widths for CP and  $\overline{MR}$ ,  $\overline{MR}$  to CP recovery time, and set-up and hold time for Dn to CP

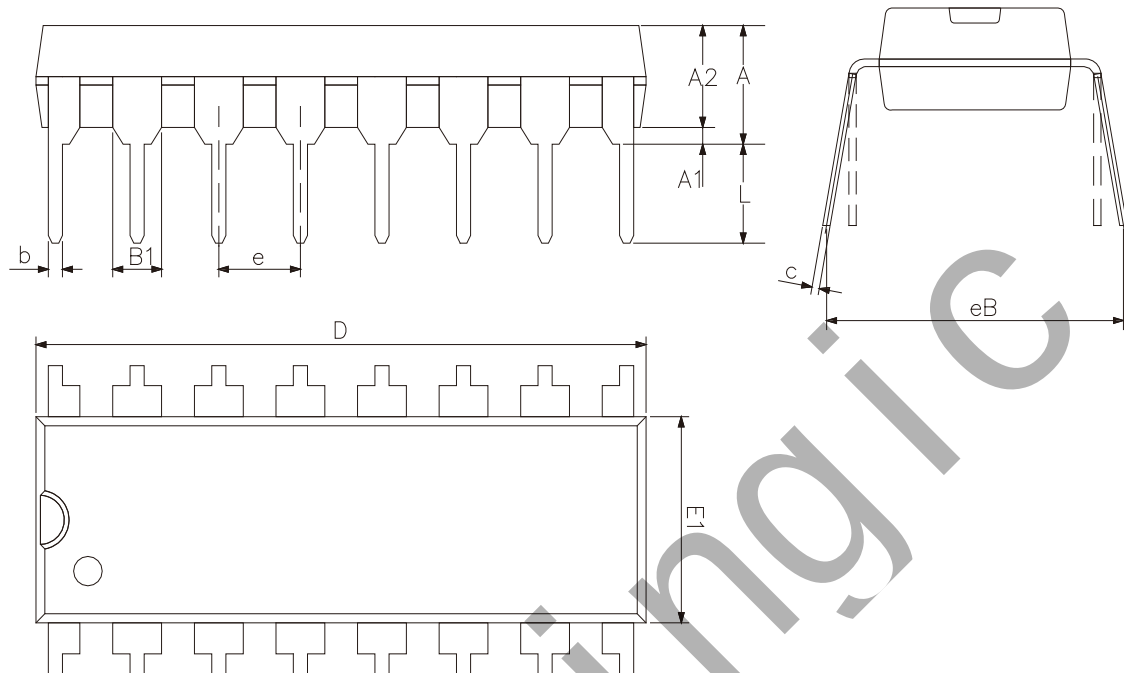
#### 4.4、Measurement Points

| Supply voltage | Input               | Output              |                     |                     |
|----------------|---------------------|---------------------|---------------------|---------------------|
| $V_{DD}$       | $V_M$               | $V_M$               | $V_X$               | $V_Y$               |
| 5V to 15V      | $0.5 \times V_{DD}$ | $0.5 \times V_{DD}$ | $0.1 \times V_{DD}$ | $0.9 \times V_{DD}$ |



## 5、Package Information

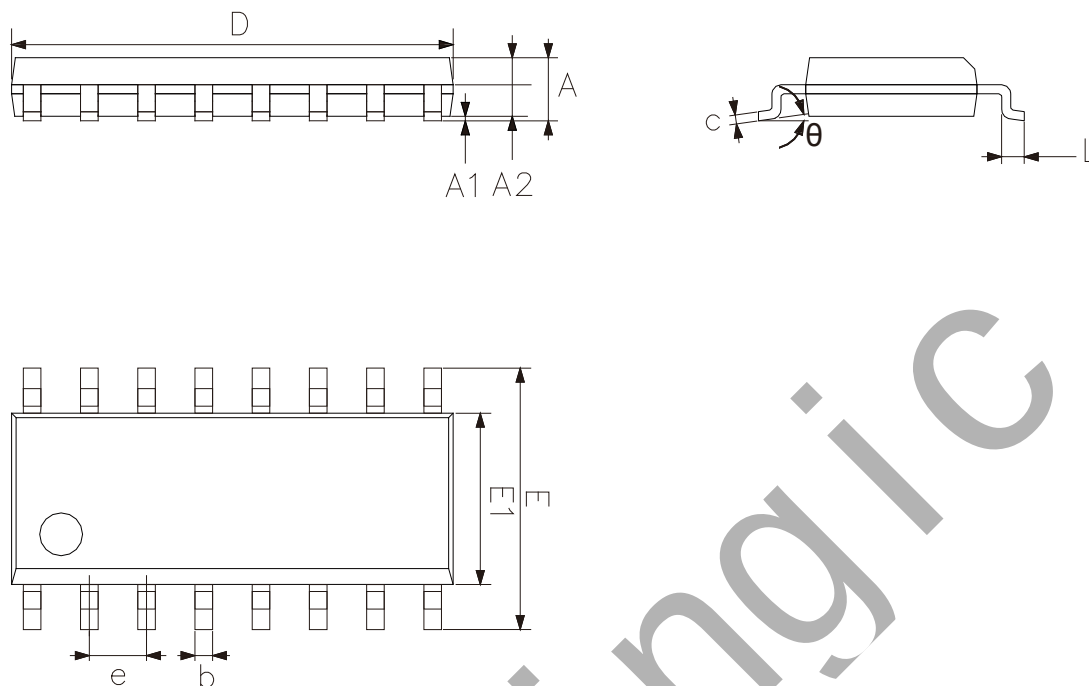
### 5.1、DIP16



| 2023/12/A | Dimensions In Millimeters |       |
|-----------|---------------------------|-------|
| Symbol    | Min                       | Max   |
| A2        | 3.20                      | 3.60  |
| A1        | 0.51                      | —     |
| A         | 3.60                      | 5.33  |
| L         | 3.00                      | —     |
| 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



| 2023/12/A | Dimensions In Millimeters |       |
|-----------|---------------------------|-------|
| Symbol    | 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°    |



## 6、Statements And Notes

Recommended carefully reading this information before the use of this product;

The information in this document are subject to change without notice;

This information is using to the reference only, the company is not responsible for any loss;

The company is not responsible for the any infringement of the third party patents or other rights of the responsibility.

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