



CD4094

8-stage Shift-and-store Bus Register

Product Specification

Specification Revision History:

| Version | Date | Description |
|------------|---------|-------------|
| 2021-12-A1 | 2019-07 | New |
| | | |
| | | |
| | | |



1、General Description

The CD4094 is an 8-stage serial shift register. It has a storage latch associated with each stage for strobing data from the serial input to parallel buffered 3-state outputs QP0 to QP7. The parallel outputs may be connected directly to common bus lines. Data is shifted on positive-going clock transitions. The data in each shift register stage is transferred to the storage register when the strobe (STR) input is HIGH. Data in the storage register appears at the outputs whenever the output enable (OE) signal is HIGH.

Two serial outputs (QS1 and QS2) are available for cascading a number of CD4094 devices. Serial data is available at QS1 on positive-going clock edges to allow high-speed operation in cascaded systems with a fast clock rise time. The same serial data is available at QS2 on the next negative going clock edge. This is used for cascading CD4094 devices when the clock has a slow rise time.

It operates over a recommended V_{DD} power supply range of 3V to 15V referenced to V_{SS} (usually ground). Unused inputs must be connected to V_{DD} , V_{SS} , or another input.

Features:

- Wide supply voltage range from 3V to 15V
- Fully static operation
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40°C to $+125^{\circ}\text{C}$
- Packaging information: DIP16/SOP16/TSSOP16

**Ordering Information:****Tube packing specifications:**

| Type number | Packaging form | Marking code | Tube quantity | Boxed tube quantity | Boxed quantity | Packing box number | Packing quantity | Notes |
|--------------|----------------|--------------|----------------|---------------------|-----------------|--------------------|-------------------|--|
| CD4094BE(LX) | DIP16 | CD4094BE | 25 PCS/tube | 40 tube/box | 1000 PCS/box | 10 box/pack | 10000 PCS/pack | Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm |

Reel packing specifications:

| Type number | Packaging form | Marking code | Reel quantity | Boxed reel quantity | Packing quantity | Notes |
|---------------|----------------|--------------|------------------|---------------------|-------------------|--|
| CD4094BM(LX) | SOP16 | CD4094BM | 4000 PCS/reel | 8000 PCS/box | 64000 PCS/pack | Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm |
| CD4094BPW(LX) | TSSOP16 | CD4094 | 5000 PCS/reel | 10000 PCS/box | 80000 PCS/pack | Dimensions of plastic enclosure: 5.0mm×4.4mm 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

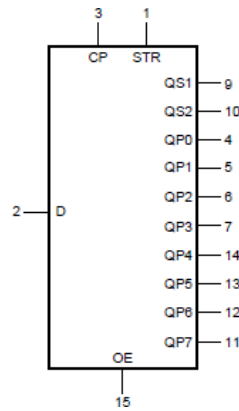


Figure 1. Logic symbol

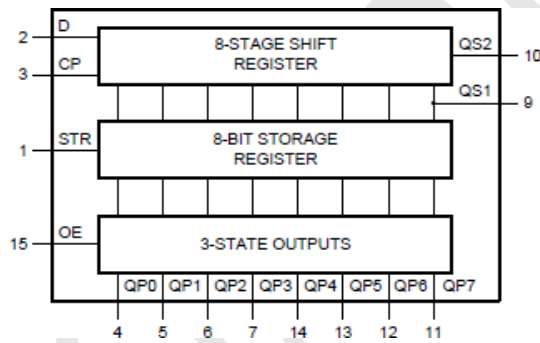


Figure 2. Functional diagram

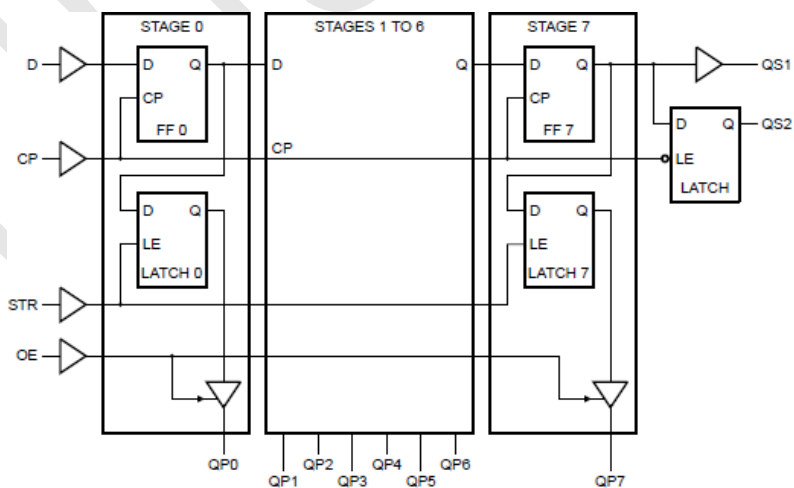


Figure 3. Logic diagram

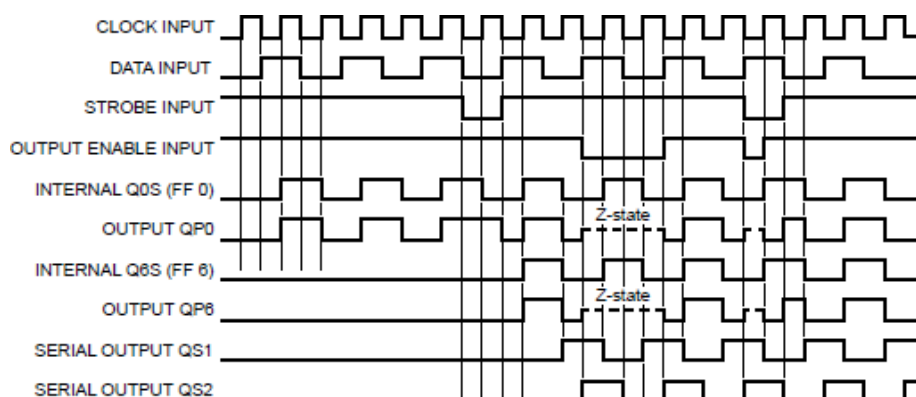
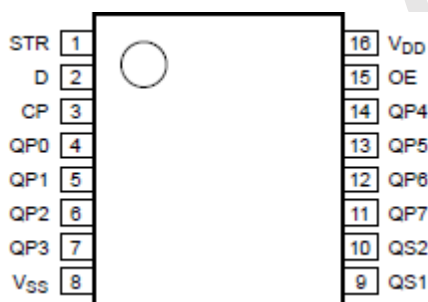


Figure 4. Timing diagram

2.2、Pin Configurations



2.3、Pin Description

| Pin No. | Pin Name | Description |
|---------|-----------------|---------------------|
| 1 | STR | strobe input |
| 2 | D | data input |
| 3 | CP | clock input |
| 4 | QP0 | parallel output |
| 5 | QP1 | parallel output |
| 6 | QP2 | parallel output |
| 7 | QP3 | parallel output |
| 8 | V _{SS} | ground (0V) |
| 9 | QS1 | serial output |
| 10 | QS2 | serial output |
| 11 | QP7 | parallel output |
| 12 | QP6 | parallel output |
| 13 | QP5 | parallel output |
| 14 | QP4 | parallel output |
| 15 | OE | output enable input |
| 16 | V _{DD} | supply voltage |



2.4、Function Table

| Input | | | | Parallel output | | Serial output | |
|-------|----|-----|---|-----------------|-------|---------------|-----|
| CP | OE | STR | D | QP0 | QPn | QS1 | QS2 |
| ↑ | L | X | X | Z | Z | Q6S | NC |
| ↓ | L | X | X | Z | Z | NC | Q7S |
| ↑ | H | L | X | NC | NC | Q6S | NC |
| ↑ | H | H | L | L | QPn-1 | Q6S | NC |
| ↑ | H | H | H | H | QPn-1 | Q6S | NC |
| ↓ | H | H | H | NC | NC | NC | Q7S |

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care; Z=HIGH-impedance OFF-state;

NC=no change; ↑=positive-going transition; ↓=negative-going transition;

Q6S=the data in register stage 6 before the LOW to HIGH clock transition;

Q7S=the data in register stage 7 before the HIGH to LOW clock 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 |
| DC input current | I_{IK} | any one input | - | ±10 | mA |
| input voltage | V_I | all inputs | -0.5 | $V_{DD}+0.5$ | V |
| storage temperature | T_{stg} | - | -65 | +150 | °C |
| total power dissipation | P_{tot} | - | - | 500 | mW |
| device dissipation | P | per output transistor | - | 100 | mW |
| Soldering temperature | T_L | 10s | DIP | 245 | °C |
| | | | SOP | 250 | °C |

Note:

[1] For DIP16 packages: above 70°C the value of P_{tot} derates linearly with 12mW/K.

[2] For SOP16 packages: above 70°C the value of P_{tot} derates linearly with 8mW/K.

[3] For (T)SSOP16 packages: above 60°C the value of P_{tot} derates linearly with 5.5mW/K.

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 | - | +85 | °C |
| data setup time | t_{su} | $V_{DD}=5V$ | 125 | - | - | ns |
| | | $V_{DD}=10V$ | 55 | - | - | ns |
| | | $V_{DD}=15V$ | 35 | - | - | ns |
| clock pulse width | t_w | $V_{DD}=5V$ | 200 | - | - | ns |
| | | $V_{DD}=10V$ | 100 | - | - | ns |
| | | $V_{DD}=15V$ | 83 | - | - | ns |



| | | | | | | |
|--------------------------|--------------------|--------------|-----|---|------|-----|
| clock input frequency | f_{\max} | $V_{DD}=5V$ | dc | - | 1.25 | MHz |
| | | $V_{DD}=10V$ | | - | 2.5 | MHz |
| | | $V_{DD}=15V$ | | - | 3 | MHz |
| clock rise and fall time | t_{rCL}, t_{fCL} | $V_{DD}=5V$ | - | - | 15 | us |
| | | $V_{DD}=10V$ | - | - | 5 | us |
| | | $V_{DD}=15V$ | - | - | 5 | us |
| strobe setup time | t_w | $V_{DD}=5V$ | 200 | - | - | ns |
| | | $V_{DD}=10V$ | 80 | - | - | ns |
| | | $V_{DD}=15V$ | 70 | - | - | ns |

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

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

| Parameter | Symbol | Conditions (V) | | | $T_{amb}=25^{\circ}C$ | | | Unit |
|---------------------------|----------|----------------|----------|----------|-----------------------|---------------|-----------|------|
| | | V_O | V_{IN} | V_{DD} | Min. | Typ. | Max. | |
| supply current | I_{DD} | - | 0, 5 | 5 | - | 0.04 | 5 | uA |
| | | - | 0, 10 | 10 | - | 0.04 | 10 | uA |
| | | - | 0, 15 | 15 | - | 0.04 | 20 | uA |
| LOW-level output current | I_{OL} | 0.4 | 0, 5 | 5 | 0.51 | 1 | - | mA |
| | | 0.5 | 0, 10 | 10 | 1.3 | 2.6 | - | mA |
| | | 1.5 | 0, 15 | 15 | 3.4 | 6.8 | - | mA |
| HIGH-level output current | I_{OH} | 4.6 | 0, 5 | 5 | -0.51 | -1 | - | mA |
| | | 2.5 | 0, 5 | 5 | -1.6 | -3.2 | - | mA |
| | | 9.5 | 0, 10 | 10 | -1.3 | -2.6 | - | mA |
| | | 13.5 | 0, 15 | 15 | -3.4 | -6.8 | - | mA |
| LOW-level output voltage | V_{OL} | - | 0, 5 | 5 | - | 0 | 0.05 | V |
| | | - | 0, 10 | 10 | - | 0 | 0.05 | V |
| | | - | 0, 15 | 15 | - | 0 | 0.05 | V |
| HIGH-level output voltage | V_{OH} | - | 0, 5 | 5 | 4.95 | 5 | - | V |
| | | - | 0, 10 | 10 | 9.95 | 10 | - | V |
| | | - | 0, 15 | 15 | 14.95 | 15 | - | V |
| LOW-level input voltage | V_{IL} | 0.5, 4.5 | - | 5 | - | - | 1.5 | V |
| | | 1, 9 | - | 10 | - | - | 3 | V |
| | | 1.5, 13.5 | - | 15 | - | - | 4 | V |
| HIGH-level input voltage | V_{IH} | 0.5, 4.5 | - | 5 | 3.5 | - | - | V |
| | | 1, 9 | - | 10 | 7 | - | - | V |
| | | 1.5, 13.5 | - | 15 | 11 | - | - | V |
| input leakage current | I_I | - | 0, 15 | 15 | - | $\pm 10^{-5}$ | ± 0.1 | uA |
| OFF-state output current | I_{OZ} | 0, 15 | 0, 15 | 15 | - | $\pm 10^{-4}$ | ± 0.4 | uA |



3.3.2、DC Characteristics 2

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

| Parameter | Symbol | Conditions (V) | | | $T_{amb}=-40^{\circ}\text{C}$ | | $T_{amb}=+85^{\circ}\text{C}$ | | Unit |
|---------------------------|----------|----------------|----------|----------|-------------------------------|-----------|-------------------------------|----------|------|
| | | V_O | V_{IN} | V_{DD} | Min. | Max. | Min. | Max. | |
| supply current | I_{DD} | - | 0, 5 | 5 | - | 5 | - | 150 | uA |
| | | - | 0, 10 | 10 | - | 10 | - | 300 | uA |
| | | - | 0, 15 | 15 | - | 20 | - | 600 | uA |
| LOW-level output current | I_{OL} | 0.4 | 0, 5 | 5 | 0.61 | - | 0.42 | - | mA |
| | | 0.5 | 0, 10 | 10 | 1.5 | - | 1.1 | - | mA |
| | | 1.5 | 0, 15 | 15 | 4 | - | 2.8 | - | mA |
| HIGH-level output current | I_{OH} | 4.6 | 0, 5 | 5 | -0.61 | - | -0.42 | - | mA |
| | | 2.5 | 0, 5 | 5 | -1.8 | - | -1.3 | - | mA |
| | | 9.5 | 0, 10 | 10 | -1.5 | - | -1.1 | - | mA |
| | | 13.5 | 0, 15 | 15 | -4 | - | -2.8 | - | mA |
| LOW-level output voltage | V_{OL} | - | 0, 5 | 5 | - | 0.05 | - | 0.05 | V |
| | | - | 0, 10 | 10 | - | 0.05 | - | 0.05 | V |
| | | - | 0, 15 | 15 | - | 0.05 | - | 0.05 | V |
| HIGH-level output voltage | V_{OH} | - | 0, 5 | 5 | 4.95 | - | 4.95 | - | V |
| | | - | 0, 10 | 10 | 9.95 | - | 9.95 | - | V |
| | | - | 0, 15 | 15 | 14.95 | - | 14.95 | - | V |
| LOW-level input voltage | V_{IL} | 0.5, 4.5 | - | 5 | - | 1.5 | - | 1.5 | V |
| | | 1, 9 | - | 10 | - | 3 | - | 3 | V |
| | | 1.5, 13.5 | - | 15 | - | 4 | - | 4 | V |
| HIGH-level input voltage | V_{IH} | 0.5, 4.5 | - | 5 | 3.5 | - | 3.5 | - | V |
| | | 1, 9 | - | 10 | 7 | - | 7 | - | V |
| | | 1.5, 13.5 | - | 15 | 11 | - | 11 | - | V |
| input leakage current | I_I | - | 0, 15 | 15 | - | ± 0.1 | - | ± 1 | uA |
| OFF-state output current | I_{OZ} | 0, 15 | 0, 15 | 15 | - | ± 0.4 | - | ± 12 | uA |



3.3.3、AC Characteristics

($T_{amb}=25^{\circ}C$, $V_{SS}=0V$, $t_r, t_f=20ns$, $C_L=50pF$, $R_L=200k\Omega$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit | |
|---|--------------------|--|--------------|------|------|------|-----|
| propagation delay time | t_{PHL}, t_{PLH} | CP to QS1; see Figure 6 | $V_{DD}=5V$ | - | 300 | 600 | ns |
| | | | $V_{DD}=10V$ | - | 125 | 250 | ns |
| | | | $V_{DD}=15V$ | - | 95 | 190 | ns |
| | | CP to QS2; see Figure 6 | $V_{DD}=5V$ | - | 230 | 460 | ns |
| | | | $V_{DD}=10V$ | - | 110 | 220 | ns |
| | | | $V_{DD}=15V$ | - | 75 | 150 | ns |
| | | CP to QPn; see Figure 6 | $V_{DD}=5V$ | - | 420 | 840 | ns |
| | | | $V_{DD}=10V$ | - | 195 | 390 | ns |
| | | | $V_{DD}=15V$ | - | 135 | 270 | ns |
| | | STR to QPn; see Figure 7 | $V_{DD}=5V$ | - | 290 | 580 | ns |
| | | | $V_{DD}=10V$ | - | 145 | 290 | ns |
| | | | $V_{DD}=15V$ | - | 100 | 200 | ns |
| HIGH to OFF-state/OFF-state to HIGH propagation delay | t_{PHZ}, t_{PZH} | OE to QPn; see Figure 8 | $V_{DD}=5V$ | - | 140 | 280 | ns |
| | | | $V_{DD}=10V$ | - | 60 | 120 | ns |
| | | | $V_{DD}=15V$ | - | 45 | 90 | ns |
| LOW to OFF-state/OFF-state to LOW propagation delay | t_{PLZ}, t_{PZL} | OE to QPn; see Figure 8 | $V_{DD}=5V$ | - | 100 | 200 | ns |
| | | | $V_{DD}=10V$ | - | 50 | 100 | ns |
| | | | $V_{DD}=15V$ | - | 40 | 80 | ns |
| pulse width | t_w | minimum HIGH strobe pulse; see Figure 7 | $V_{DD}=5V$ | - | 100 | 200 | ns |
| | | | $V_{DD}=10V$ | - | 40 | 80 | ns |
| | | | $V_{DD}=15V$ | - | 35 | 70 | ns |
| | | minimum LOW clock pulse; see Figure 6 | $V_{DD}=5V$ | - | 100 | 200 | ns |
| | | | $V_{DD}=10V$ | - | 50 | 100 | ns |
| | | | $V_{DD}=15V$ | - | 40 | 83 | ns |
| data setup time | t_{su} | D to CP; see Figure 9 | $V_{DD}=5V$ | - | 60 | 125 | ns |
| | | | $V_{DD}=10V$ | - | 30 | 55 | ns |
| | | | $V_{DD}=15V$ | - | 20 | 35 | ns |
| transition time | t_t | - | $V_{DD}=5V$ | - | 100 | 200 | ns |
| | | | $V_{DD}=10V$ | - | 50 | 100 | ns |
| | | | $V_{DD}=15V$ | - | 40 | 80 | ns |
| clock input rise and fall time | t_{rCL}, t_{fCL} | - | $V_{DD}=5V$ | 15 | - | - | us |
| | | | $V_{DD}=10V$ | 5 | - | - | us |
| | | | $V_{DD}=15V$ | 5 | - | - | us |
| maximum clock frequency | f_{max} | see Figure 6 | $V_{DD}=5V$ | 1.25 | 2.5 | - | MHz |
| | | | $V_{DD}=10V$ | 2.5 | 5 | - | MHz |
| | | | $V_{DD}=15V$ | 3 | 6 | - | MHz |
| input capacitance | C_i | any input | - | 5 | 7.5 | pF | |

Note: t_t is the same as t_{TLH} and t_{THL} .

4、Testing Circuit

4.1、AC Testing Circuit

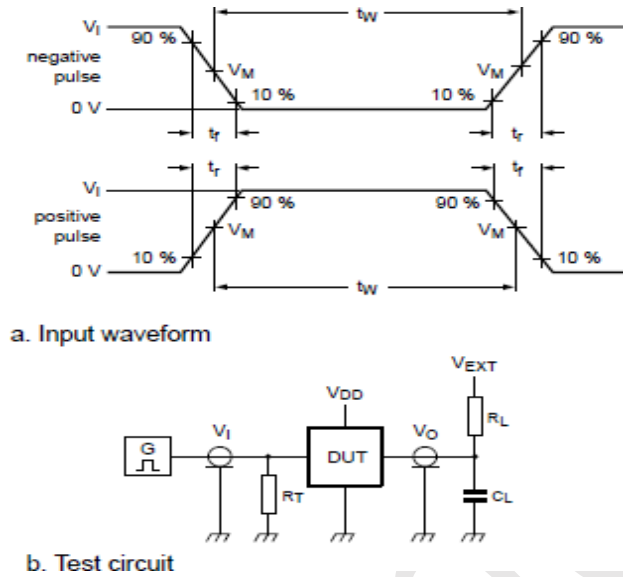


Figure 5. Test circuit for switching times

Definitions for test circuit:

DUT=Device Under Test.

C_L =Load capacitance including jig and probe capacitance.

R_T =Termination resistance should be equal to the output impedance Z_o of the pulse generator.

R_L =Load resistance.

V_{EXT} =External voltage for measuring switching times.

4.2、AC Testing Waveforms

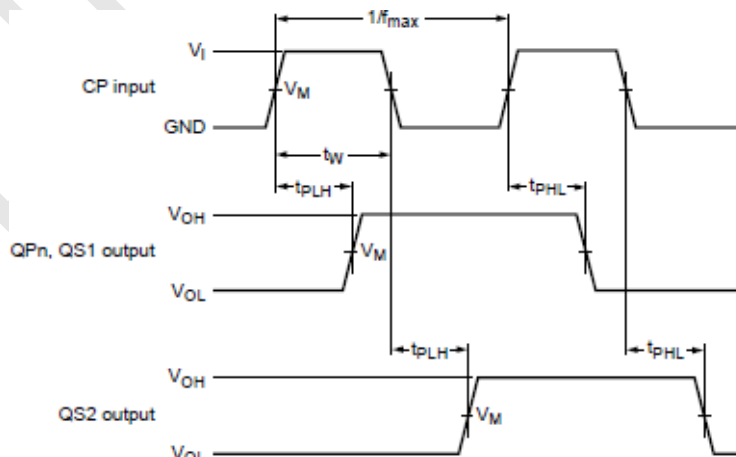


Figure 6. Clock to outputs propagation delays, and clock pulse width and maximum frequency

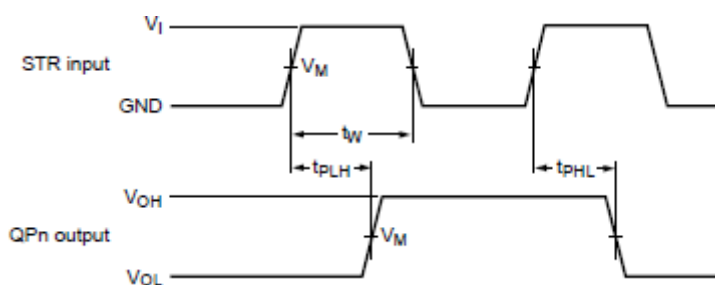


Figure 7. Strobe to output propagation delays, and strobe pulse width, set up and hold times

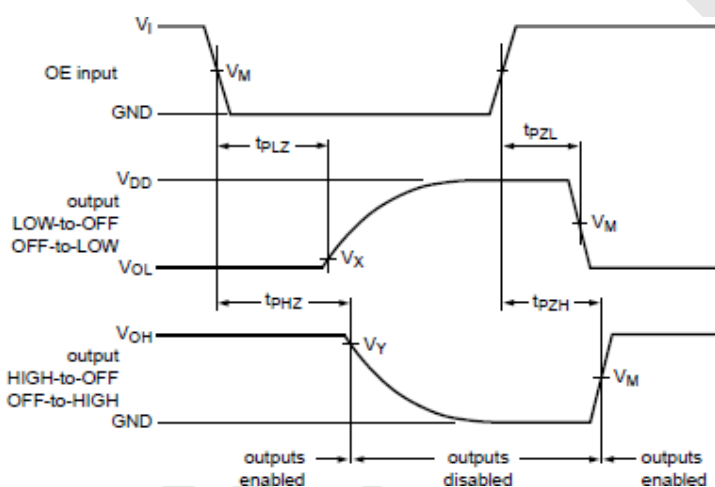


Figure 8. 3-state output enable and disable times for OE input

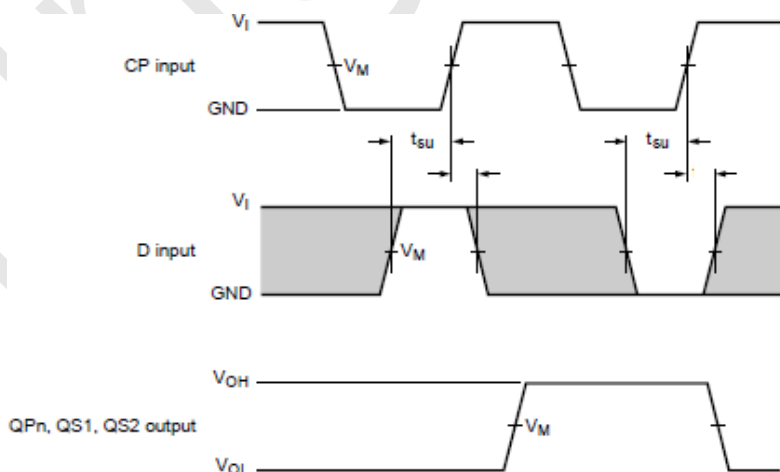


Figure 9. Data input data set up and hold times



4.3、Measurement Points

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

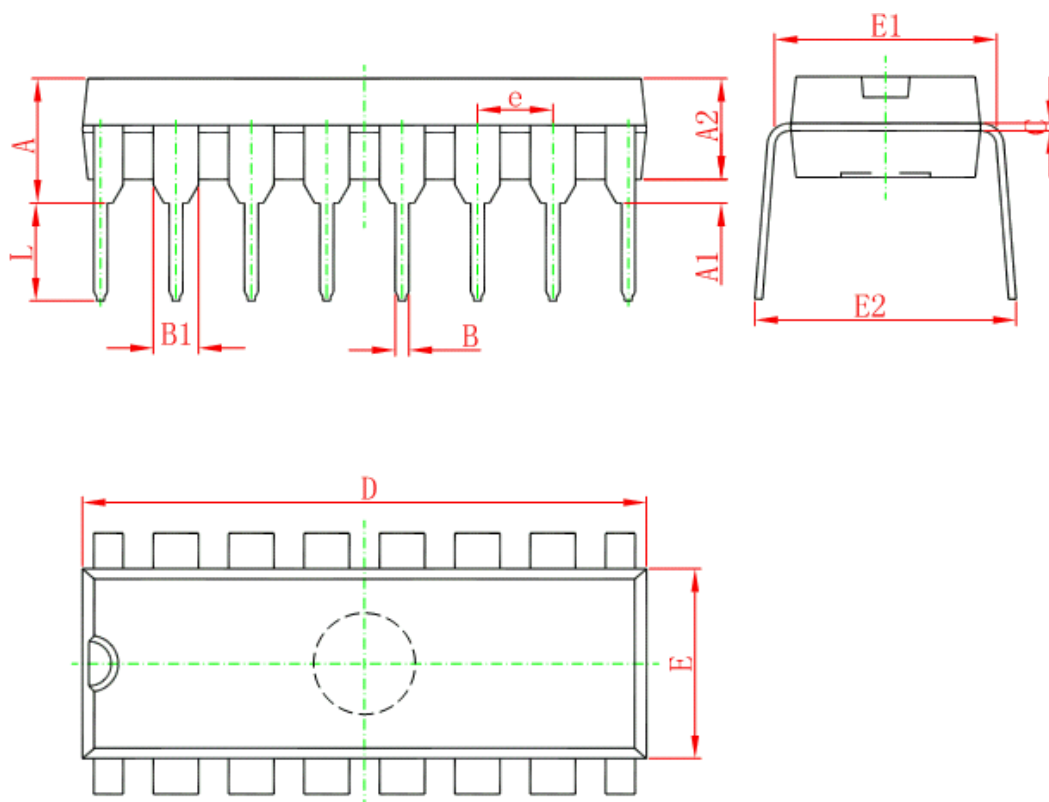
4.4、Test Data

| Supply voltage | Input | | Load | | V_{EXT} | | |
|----------------|----------------------|--------------------|-------|-------------|-------------------------|-------------------------|-------------------------|
| V_{DD} | V_I | t_r, t_f | C_L | R_L | $t_{PHL},$ t_{PLH} | $t_{PHZ},$ t_{PZH} | $t_{PLZ},$ t_{PZL} |
| 5V to 15V | V_{SS} or V_{DD} | $\leq 20\text{ns}$ | 50pF | 1k Ω | open | V_{SS} | V_{DD} |



5、Package Information

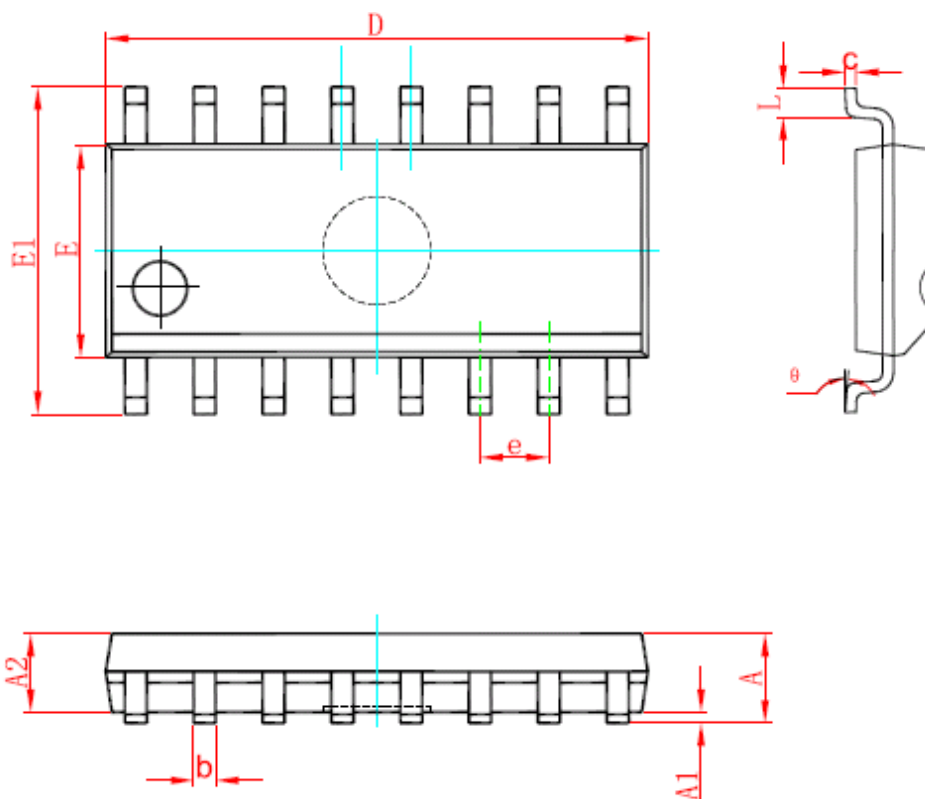
5.1、DIP16



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 3.710 | 4.310 | 0.146 | 0.170 |
| A1 | 0.510 | | 0.020 | |
| A2 | 3.200 | 3.600 | 0.126 | 0.142 |
| B | 0.380 | 0.570 | 0.015 | 0.022 |
| B1 | 1.524 (BSC) | | 0.060 (BSC) | |
| C | 0.204 | 0.360 | 0.008 | 0.014 |
| D | 18.800 | 19.200 | 0.740 | 0.756 |
| E | 6.200 | 6.600 | 0.244 | 0.260 |
| E1 | 7.320 | 7.920 | 0.288 | 0.312 |
| e | 2.540 (BSC) | | 0.100 (BSC) | |
| L | 3.000 | 3.600 | 0.118 | 0.142 |
| E2 | 8.400 | 9.000 | 0.331 | 0.354 |



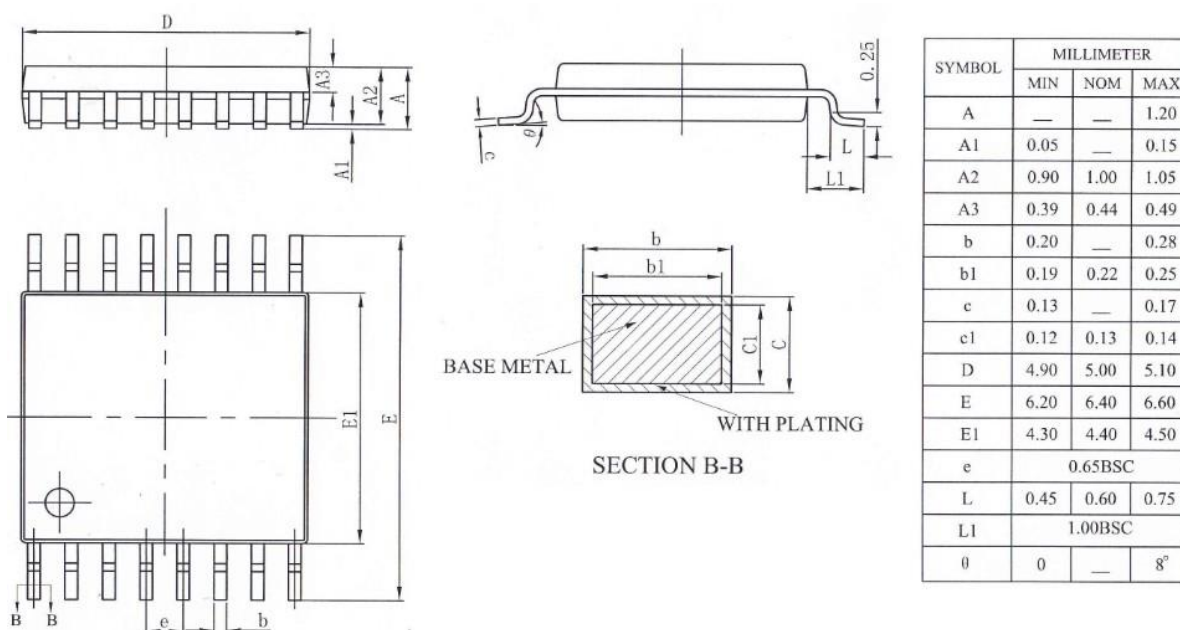
5.2、SOP16



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 9.800 | 10.200 | 0.386 | 0.402 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |



5.3、TSSOP16



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 | ○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements. | | | | | | | | | |

6.2、Notion

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

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