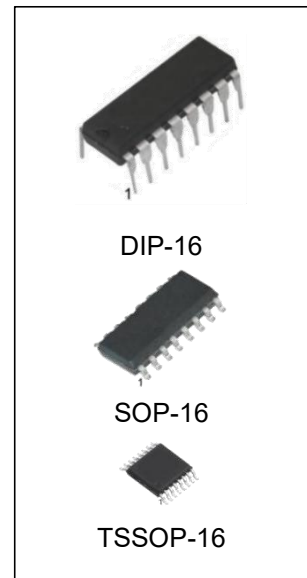


## 8-stage Shift-and-store Bus Register

### 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°C
- Packaging information: DIP16/SOP16/TSSOP16



### Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4094BE/ CD4094BN	DIP-16	CD4094B	TUBE	1000pcs/box
CD4094BM/TR	SOP-16	CD4094B	REEL	2500pcs/reel
CD4094BMT/TR	TSSOP-16	CD4094B	REEL	2500pcs/reel

## General Description

The CD4094B 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 CD4094B 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 CD4094B 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.

## Block Diagram

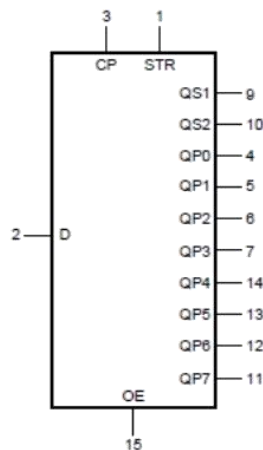


Figure 1. Logic symbol

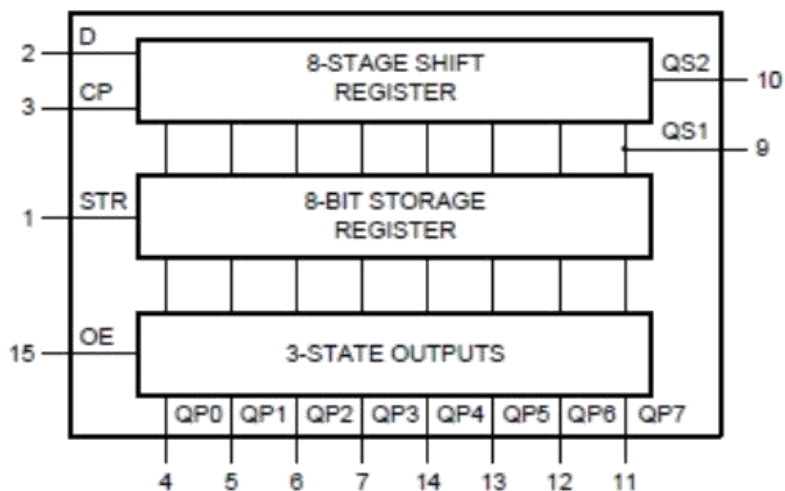


Figure 2. Functional diagram

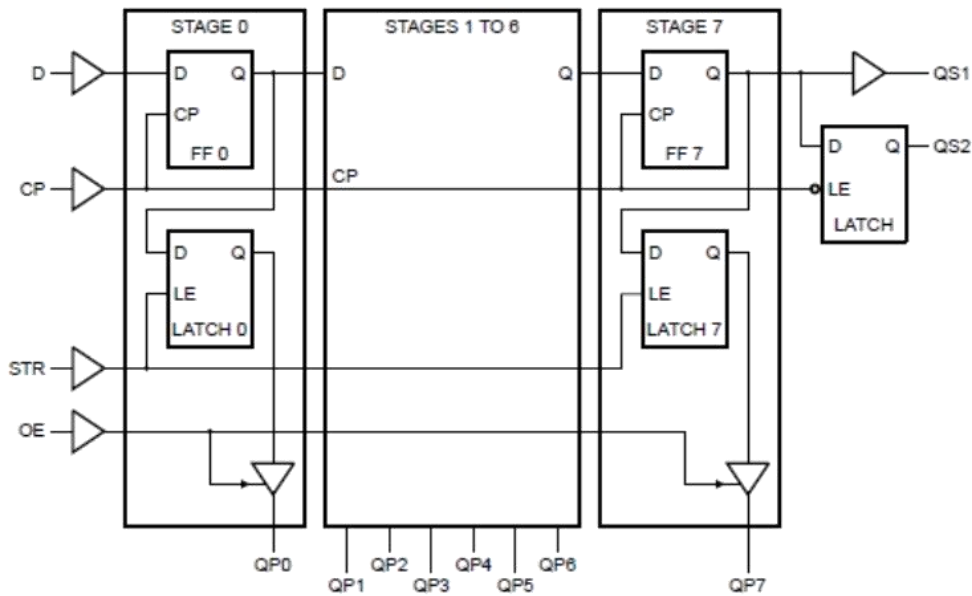


Figure 3. Logic diagram

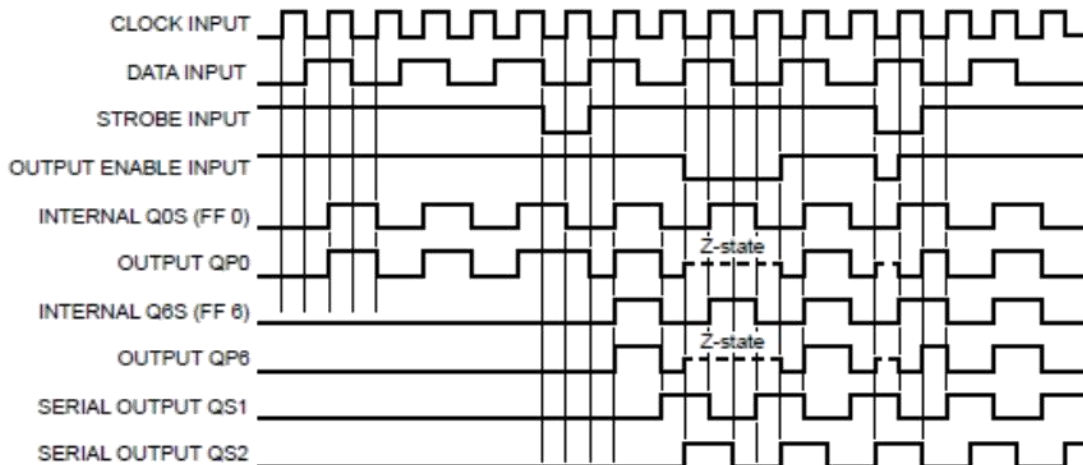


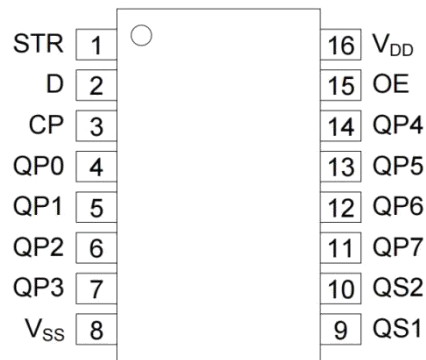
Figure 4. Timing diagram

### 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.

## Pin Configurations



DIP-16/SOP-16/TSSOP-16

## 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	VSS	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	VDD	supply voltage

## Electrical Parameter

### Absolute Maximum Ratings

(Voltages are referenced to VSS (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	-	$\pm 10$	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	260		°C

**Note:** Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

### Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	$V_{DD}$	-	3	-	15	V
ambient Temperature <sup>(1)</sup>	$T_{amb}$	in free air	-40	-	+125	°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

Note:(1) Operating temperature range: -40°C to +125°C. This product is designed for industrial grade applications. For automotive grade versions compliant with AEC-Q100, please conduct internal screening per the standard or contact our sales team for availability.

## Electrical Characteristics

### DC Characteristics 1

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

Parameter	Symbol	Conditions (V)			$T_{amb}=25^{\circ}\text{C}$			Unit
		$V_O$	$V_{IN}$	$V_{DD}$	Min.	Typ.	Max.	
supply current	$I_{DD}$	-	0, 5	5	-	-	5	$\mu\text{A}$
		-	0, 10	10	-	-	10	$\mu\text{A}$
		-	0, 15	15	-	-	20	$\mu\text{A}$
LOW-level output current	$I_{OL}$	0.4	0, 5	5	0.51	1	-	$\text{mA}$
		0.5	0, 10	10	1.3	2.6	-	$\text{mA}$
		1.5	0, 15	15	3.4	6.8	-	$\text{mA}$
HIGH-level output current	$I_{OH}$	4.6	0, 5	5	-0.51	-1	-	$\text{mA}$
		2.5	0, 5	5	-1.6	-3.2	-	$\text{mA}$
		9.5	0, 10	10	-1.3	-2.6	-	$\text{mA}$
		13.5	0, 15	15	-3.4	-6.8	-	$\text{mA}$
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	-	-	$\pm 1$	$\mu\text{A}$
OFF-state output current	$I_{OZ}$	0, 15	0, 15	15	-	-	$\pm 1$	$\mu\text{A}$

**DC Characteristics 2**

 (T<sub>amb</sub>=-40°C to +85°C, voltages are referenced to V<sub>SS</sub> (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions (V)			T <sub>amb</sub> =-40°C		T <sub>amb</sub> =+85°C		Unit
		V <sub>O</sub>	V <sub>IN</sub>	V <sub>DD</sub>	Min.	Max.	Min.	Max.	
supply current	I <sub>DD</sub>	-	0, 5	5	-	5	-	150	uA
		-	0, 10	10	-	10	-	300	uA
		-	0, 15	15	-	20	-	600	uA
LOW-level output current	I <sub>OL</sub>	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 <sub>OH</sub>	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 <sub>OL</sub>	-	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 <sub>OH</sub>	-	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 <sub>IL</sub>	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 <sub>IH</sub>	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 <sub>I</sub>	-	0, 15	15	-	±1	-	±1	uA
OFF-state output current	I <sub>OZ</sub>	0, 15	0, 15	15	-	±1	-	±12	uA

**DC Characteristics 3**

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

Parameter	Symbol	Conditions (V)			$T_{amb}=-40^{\circ}\text{C}$		$T_{amb}=+125^{\circ}\text{C}$		Unit
		$V_O$	$V_{IN}$	$V_{DD}$	Min.	Max.	Min.	Max.	
supply current	$I_{DD}$	-	0, 5	5	-	5	-	150	$\mu\text{A}$
		-	0, 10	10	-	10	-	300	$\mu\text{A}$
		-	0, 15	15	-	20	-	600	$\mu\text{A}$
LOW-level output current	$I_{OL}$	0.4	0, 5	5	0.61	-	0.36	-	$\text{mA}$
		0.5	0, 10	10	1.5	-	0.9	-	$\text{mA}$
		1.5	0, 15	15	4	-	2.4	-	$\text{mA}$
HIGH-level output current	$I_{OH}$	4.6	0, 5	5	-0.61	-	-0.36	-	$\text{mA}$
		2.5	0, 5	5	-1.8	-	-1.15	-	$\text{mA}$
		9.5	0, 10	10	-1.5	-	-0.9	-	$\text{mA}$
		13.5	0, 15	15	-4	-	-2.4	-	$\text{mA}$
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	-	$\pm 1$	-	$\pm 1$	$\mu\text{A}$
OFF-state output current	$I_{oz}$	0, 15	0, 15	15	-	$\pm 1$	-	$\pm 12$	$\mu\text{A}$

**AC Characteristics**

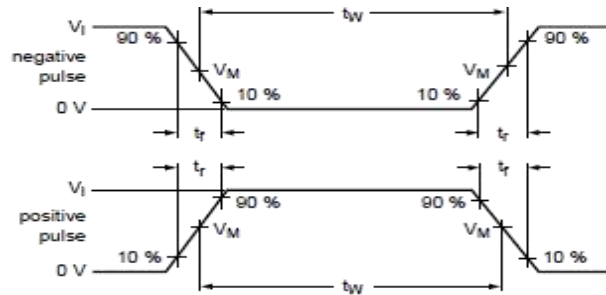
 (T<sub>amb</sub>=25°C, V<sub>SS</sub>=0V, t<sub>r</sub>, t<sub>f</sub>=20ns, C<sub>L</sub>=50pF, R<sub>L</sub>=200kΩ, unless otherwise specified.)

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

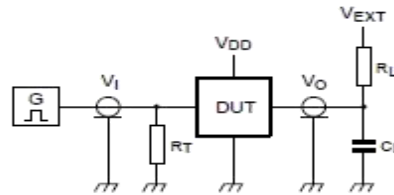
**Note:** t<sub>t</sub> is the same as t<sub>TLH</sub> and t<sub>THL</sub>.

## Testing Circuit

### AC Testing Circuit



a. Input waveform



b. Test 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.

### AC Testing Waveforms

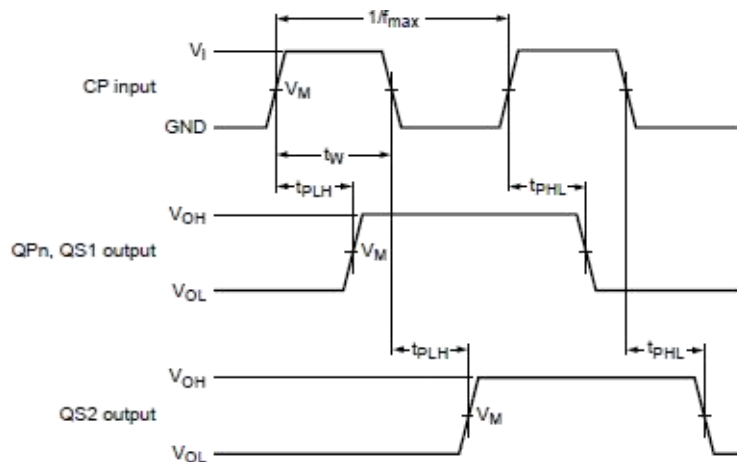


Figure 6. Clock to outputs propagation delays, and clock pulse width and maximum frequency

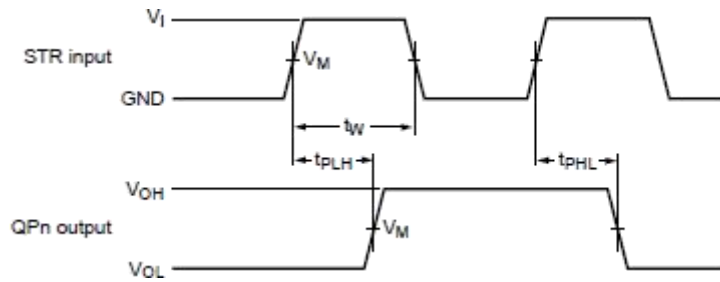


Figure 7. Strobe to output propagation delays, and strobe pulse width, set up and hold times

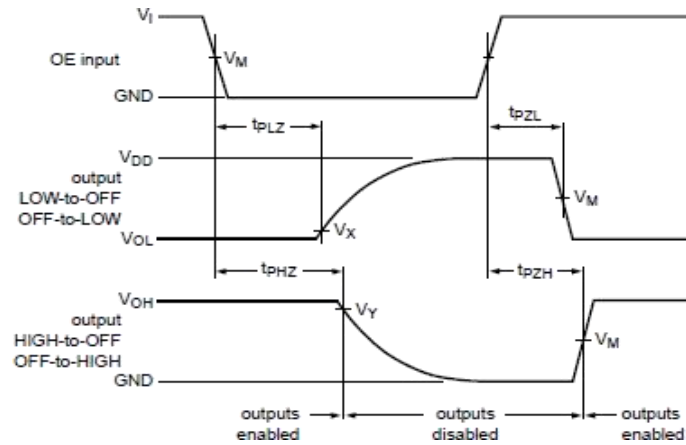


Figure 8. 3-state output enable and disable times for OE input

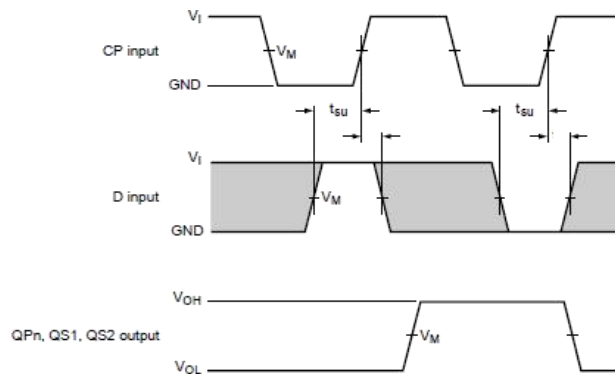


Figure 9. Data input data set up and hold times

### Measurement Points

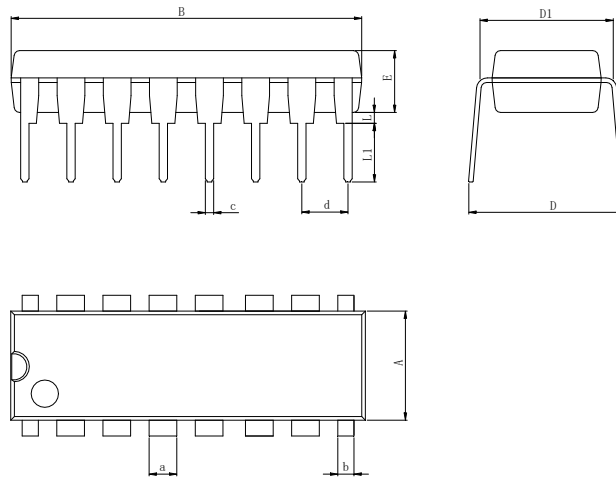
Supply voltage	Input	Output		
$V_{DD}$	$V_M$	$V_M$	$V_X$	$V_Y$
5V to 15V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$	$0.1 \times V_{DD}$	$0.9 \times V_{DD}$

### 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 $\Omega$	open	$V_{SS}$	$V_{DD}$

## Physical Dimensions

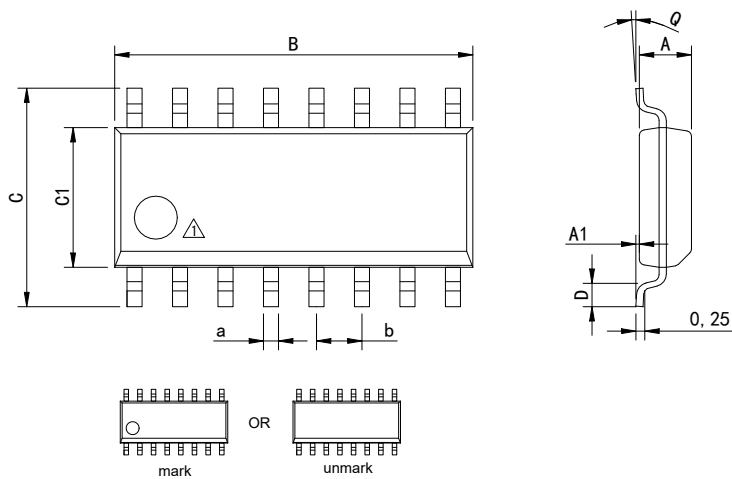
### DIP-16



Dimensions In Millimeters(DIP-16)

Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.55	0.90	0.50	

### SOP-16



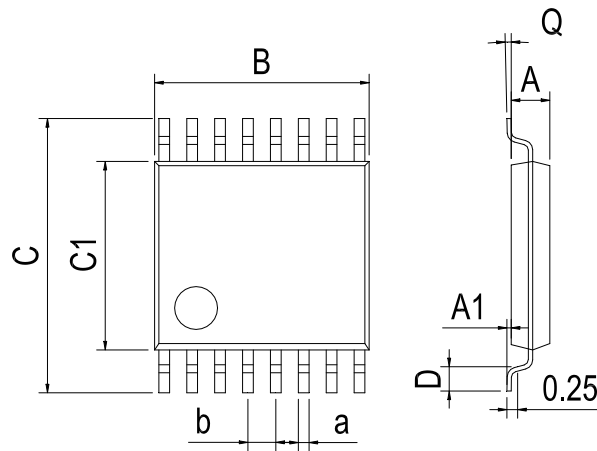
△ Package top mark may be in lower left corner or unmark

Dimensions In Millimeters(SOP-16)

Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	9.80	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	10.0	6.20	4.00	0.80	8°	0.45	

## Physical Dimensions

TSSOP-16



Dimensions In Millimeters(TSSOP-16)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	0.85	0.05	4.90	6.20	4.30	0.40	0°	0.20	0.65 BSC
Max:	0.95	0.20	5.10	6.60	4.50	0.80	8°	0.25	

## Revision History

REVISION NUMBER	DATE	REVISION	PAGE
V1.0	2014-11	New	1-15
V1.1	2021-4	Modify the package dimension diagram TSSOP-16	13
V1.2	2024-12	Document Reformatting	1-15
V1.3	2025-11	Update important statements、 Update SOP-16 Dimension drawing	12、 15

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**IMPORTANT STATEMENT:**

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