



CD4040 (LX) 12-stage Binary Ripple Counter

Product Specification

Specification Revision History:

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



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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 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
CD4040BM(LX)	SOP16	CD4040BM	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
CD4040BPWR(LX)	TSSOP16	CD4040	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm 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 Pin spacing: 1.27mm
CD4040BPWR(LX)	TSSOP16	CD4040	5000 PCS/reel	10000 PCS/box	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

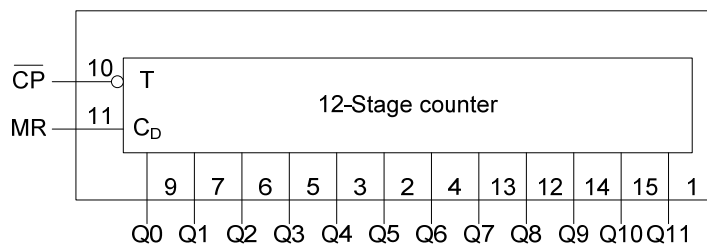


Figure 1. Functional diagram

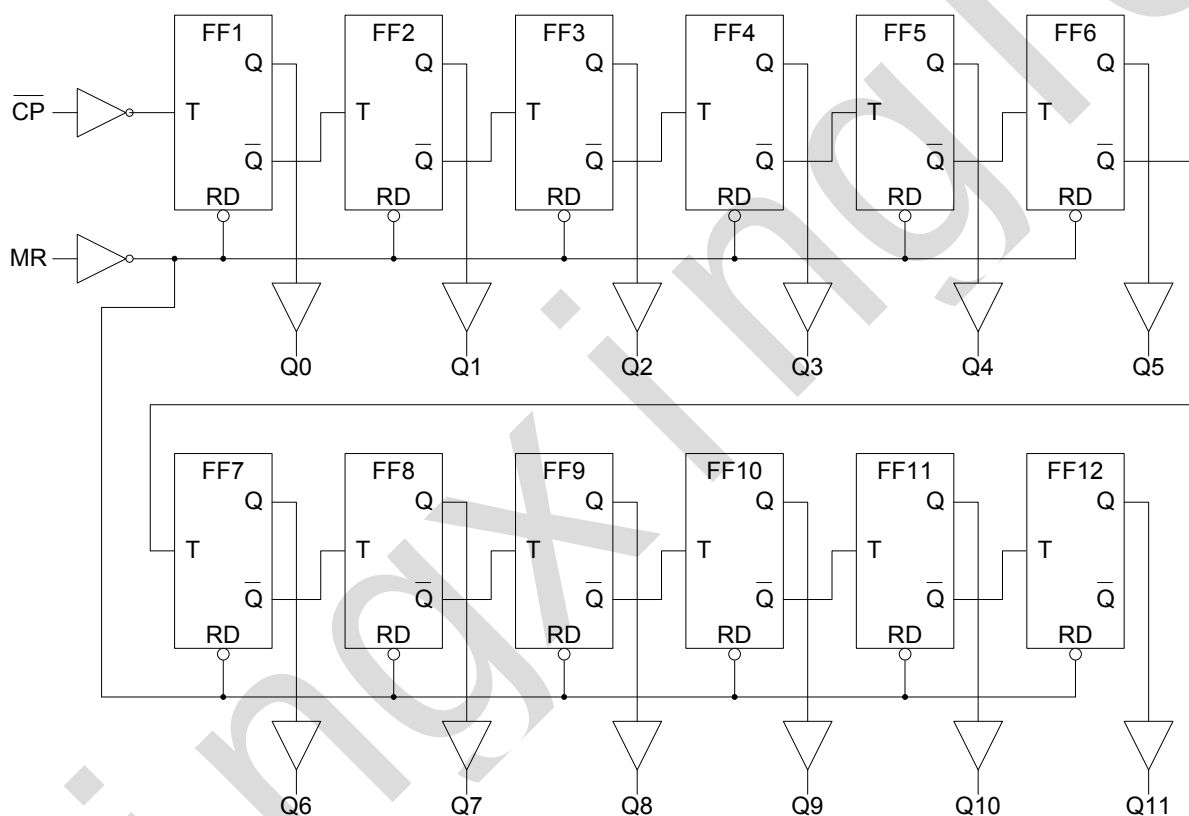
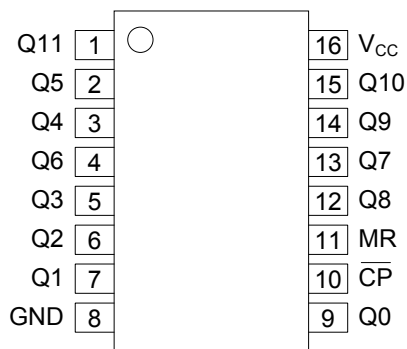


Figure 2. Logic diagram

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 _{CC}	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 _{CC}	-		-0.5	+7.0	V
input clamping current	I _{IK}	V _I <-0.5V or V _I >V _{CC} +0.5V		-	±20	mA
output clamping current	I _{OK}	V _I <-0.5V or V _I >V _{CC} +0.5V		-	±20	mA
output current	I _O	0.5V<V _O <V _{CC} +0.5V		-	±25	mA
supply current	I _{CC}	-		-	±50	mA
ground current	I _{GND}	-		-	±50	mA
storage temperature	T _{stg}	-		-65	+150	°C
soldering temperature	T _L	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 _{IH}	V _{CC} =2.0V		1.5	1.2	-	V
		V _{CC} =4.5V		3.15	2.4	-	V
		V _{CC} =6.0V		4.2	3.2	-	V
LOW-level input voltage	V _{IL}	V _{CC} =2.0V		-	0.8	0.5	V
		V _{CC} =4.5V		-	2.1	1.35	V
		V _{CC} =6.0V		-	2.8	1.8	V
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O =-20uA; V _{CC} =2.0V	1.9	2.0	-	V
			I _O =-20uA; V _{CC} =4.5V	4.4	4.5	-	V
			I _O =-20uA; V _{CC} =6.0V	5.9	6.0	-	V
			I _O =-4.0mA; V _{CC} =4.5V	3.98	4.32	-	V
			I _O =-5.2mA; V _{CC} =6.0V	5.48	5.81	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA; V _{CC} =2.0V	-	0	0.1	V
			I _O =20uA; V _{CC} =4.5V	-	0	0.1	V
			I _O =20uA; V _{CC} =6.0V	-	0	0.1	V
			I _O =4.0mA; V _{CC} =4.5V	-	0.15	0.26	V
			I _O =5.2mA; V _{CC} =6.0V	-	0.16	0.26	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =6.0V		-	-	±1	uA
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =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 _{IH}	V _{CC} =2.0V		1.5	-	-	V
		V _{CC} =4.5V		3.15	-	-	V
		V _{CC} =6.0V		4.2	-	-	V
LOW-level input voltage	V _{IL}	V _{CC} =2.0V		-	-	0.5	V
		V _{CC} =4.5V		-	-	1.35	V
		V _{CC} =6.0V		-	-	1.8	V
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O =-20uA; V _{CC} =2.0V	1.9	-	-	V
			I _O =-20uA; V _{CC} =4.5V	4.4	-	-	V
			I _O =-20uA; V _{CC} =6.0V	5.9	-	-	V
			I _O =-4.0mA; V _{CC} =4.5V	3.84	-	-	V
			I _O =-5.2mA; V _{CC} =6.0V	5.34	-	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA; V _{CC} =2.0V	-	-	0.1	V
			I _O =20uA; V _{CC} =4.5V	-	-	0.1	V
			I _O =20uA; V _{CC} =6.0V	-	-	0.1	V
			I _O =4.0mA; V _{CC} =4.5V	-	-	0.33	V
			I _O =5.2mA; V _{CC} =6.0V	-	-	0.33	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =6.0V		-	-	±1.0	uA
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =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 _{IH}	V _{CC} =2.0V		1.5	-	-	V
		V _{CC} =4.5V		3.15	-	-	V
		V _{CC} =6.0V		4.2	-	-	V
LOW-level input voltage	V _{IL}	V _{CC} =2.0V		-	-	0.5	V
		V _{CC} =4.5V		-	-	1.35	V
		V _{CC} =6.0V		-	-	1.8	V
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O =-20uA; V _{CC} =2.0V	1.9	-	-	V
			I _O =-20uA; V _{CC} =4.5V	4.4	-	-	V
			I _O =-20uA; V _{CC} =6.0V	5.9	-	-	V
			I _O =-4.0mA; V _{CC} =4.5V	3.7	-	-	V
			I _O =-5.2mA; V _{CC} =6.0V	5.2	-	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA; V _{CC} =2.0V	-	-	0.1	V
			I _O =20uA; V _{CC} =4.5V	-	-	0.1	V
			I _O =20uA; V _{CC} =6.0V	-	-	0.1	V
			I _O =4.0mA; V _{CC} =4.5V	-	-	0.4	V
			I _O =5.2mA; V _{CC} =6.0V	-	-	0.4	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =6.0V		-	-	±1.0	uA
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =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 _{pd}	$\overline{\text{CP}}$ to Q0; see Figure 4 ^[1]	V _{CC} =2.0V	-	47	150	ns
			V _{CC} =4.5V	-	17	30	ns
			V _{CC} =5.0V; C _L =15pF	-	14	-	ns
			V _{CC} =6.0V	-	14	26	ns
		Qn to Qn+1; see Figure 4	V _{CC} =2.0V	-	28	100	ns
			V _{CC} =4.5V	-	10	20	ns
			V _{CC} =5.0V; C _L =15pF	-	8	-	ns
			V _{CC} =6.0V	-	8	17	ns
HIGH to LOW Propagation delay	t _{PHL}	MR to Qn; see Figure 4	V _{CC} =2.0V	-	61	185	ns
			V _{CC} =4.5V	-	22	37	ns
			V _{CC} =6.0V	-	18	31	ns
transition time	t _t	Qn; see Figure 4 ^[2]	V _{CC} =2.0V	-	19	75	ns
			V _{CC} =4.5V	-	7	15	ns
			V _{CC} =6.0V	-	6	13	ns
pulse width	t _w	$\overline{\text{CP}}$ input, HIGH or LOW; see Figure 4	V _{CC} =2.0V	80	14	-	ns
			V _{CC} =4.5V	16	5	-	ns
			V _{CC} =6.0V	14	4	-	ns
		MR input, HIGH; see Figure 4	V _{CC} =2.0V	80	22	-	ns
			V _{CC} =4.5V	16	8	-	ns
			V _{CC} =6.0V	14	6	-	ns
recovery time	t _{rec}	MR to $\overline{\text{CP}}$; see Figure 4	V _{CC} =2.0V	50	8	-	ns
			V _{CC} =4.5V	10	3	-	ns
			V _{CC} =6.0V	9	2	-	ns
maximum frequency	f _{max}	$\overline{\text{CP}}$ input; see Figure 4	V _{CC} =2.0V	6	27	-	MHz
			V _{CC} =4.5V	30	82	-	MHz
			V _{CC} =5.0V; C _L =15pF	-	90	-	MHz
			V _{CC} =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; see Figure 4 ^[1]	$V_{CC} = 2.0\text{V}$	-	-	190 ns
			$V_{CC} = 4.5\text{V}$	-	-	38 ns
			$V_{CC} = 6.0\text{V}$	-	-	33 ns
		Qn to Qn+1; 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 Propagation delay	t_{PHL}	MR to Qn; 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; see Figure 4 ^[2]	$V_{CC} = 2.0\text{V}$	-	-	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 or LOW; 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, HIGH; 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 $\overline{CP}$; 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 frequency	f_{max}	$\overline{CP}$ input; 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 $+125^{\circ}\text{C}$, $GND = 0\text{V}$, $C_L = 50\text{pF}$, unless otherwise specified)

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

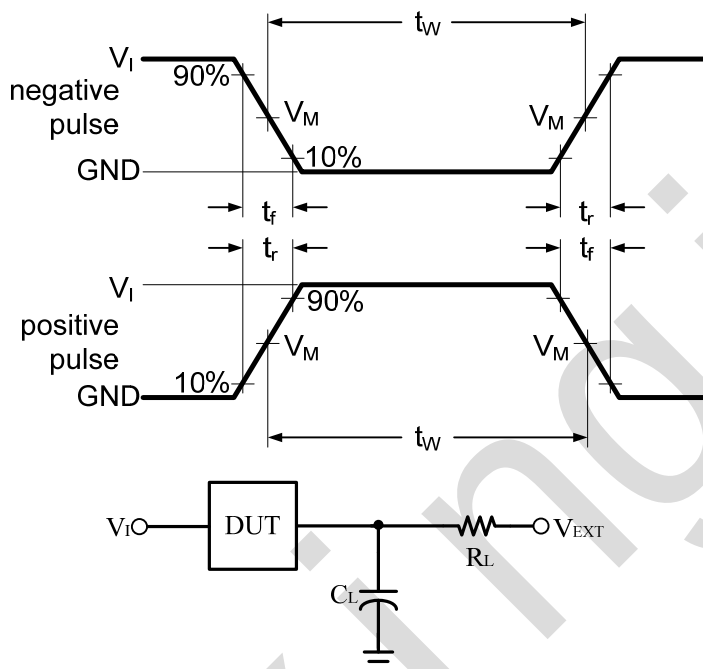


Figure 3. Test circuit for measuring switching times

C_L includes probe and jig capacitance.



4.2、AC Testing Waveforms

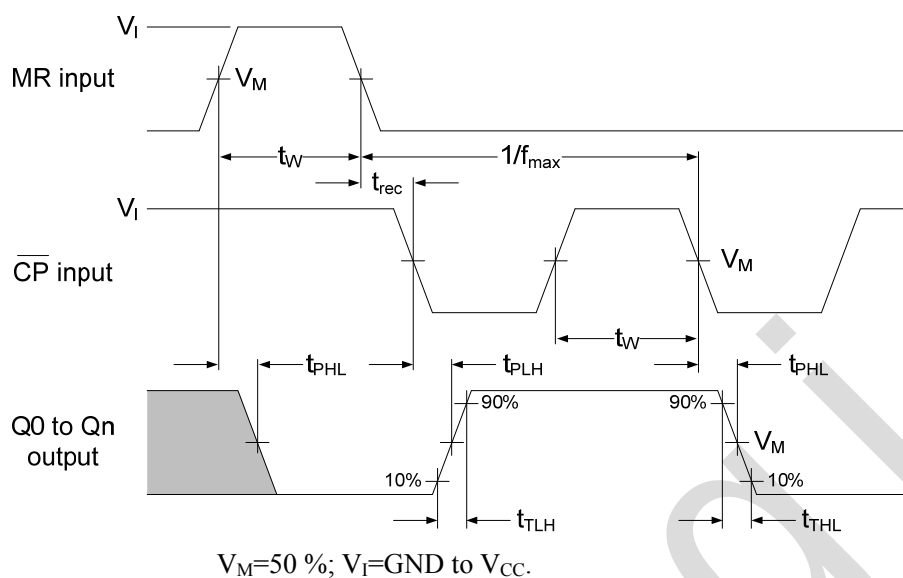


Figure 4. Clock propagation delays, pulse width, transition times, maximum pulse frequency and master resets

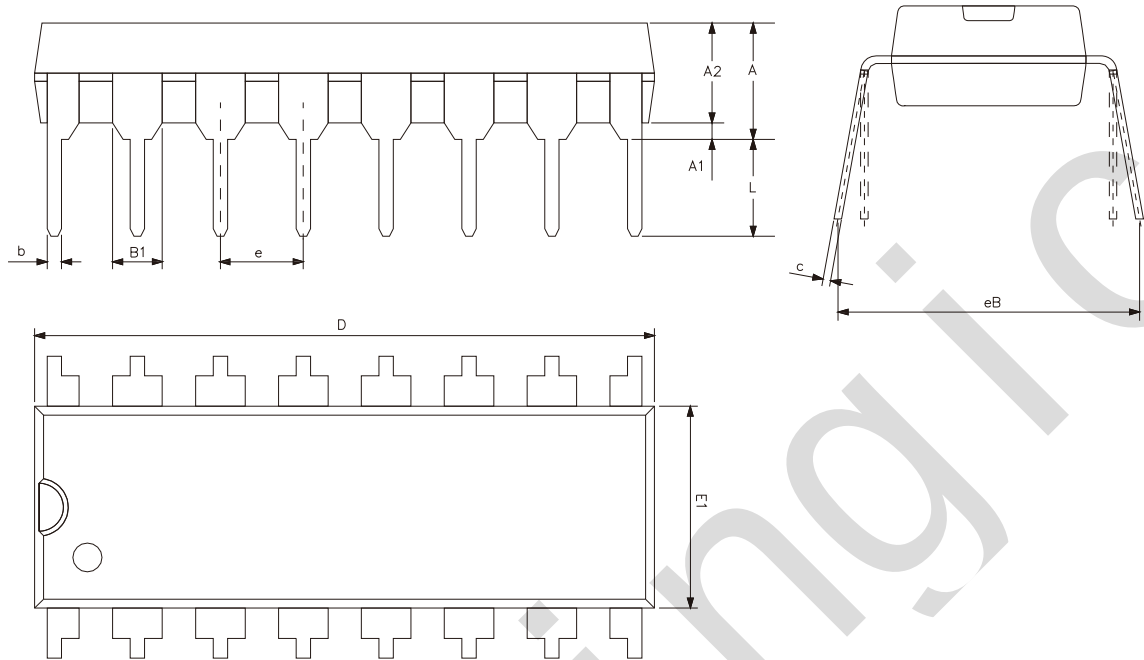
4.3、Test Data

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



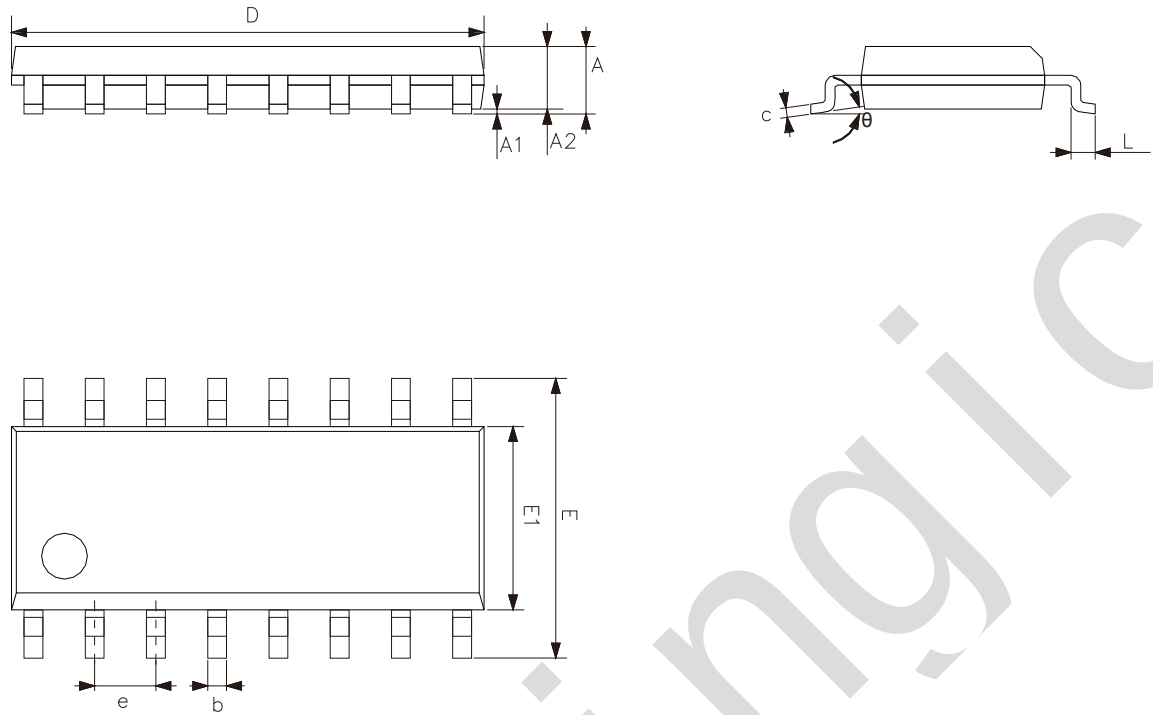
5、Package Information

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

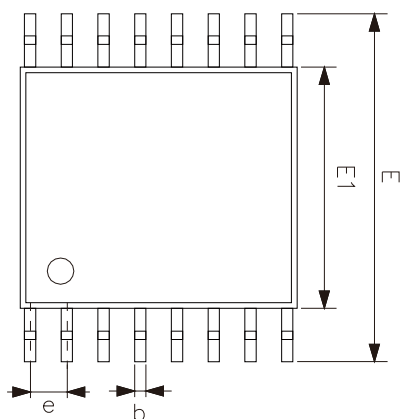
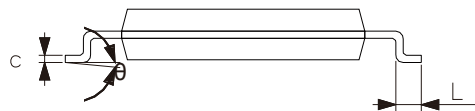
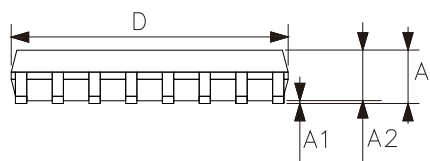
5.2、SOP16



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	○: 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、Notes

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