



# CD40103

## 8-bit synchronous binary down counter

### Product Specification

#### Specification Revision History:

Version	Date	Description
2021-11-A1	2021-11	New
2021-12-A2	2021-12	Modify Ordering Information
2023-04-B1	2023-04	Update the template



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## 1、General Description

The CD40103 is an 8-bit synchronous down counter. It has control inputs for enabling or disabling the clock (CP), for clearing the counter to its maximum count and for presetting the counter either synchronously or asynchronously. In normal operation, the counter is decremented by one count on each positive-going transition of the clock (CP). Counting is inhibited when the terminal enable input ( ) is HIGH. The terminal count output ( ) goes LOW when the count reaches zero if ( ) is LOW, and remains LOW for one full clock period. When the synchronous preset enable input ( ) is LOW, data at the jam input (P0 to P7) is clocked into the counter on the next positive-going clock transition regardless of the state of ( ). When the asynchronous preset enable input ( ) is LOW, data at the jam input (P0 to P7) is asynchronously forced into the counter regardless of the state of ( ), ( ), or CP. The jam inputs (P0 to P7) represent a single 8-bit binary word. When the master reset input ( ) is LOW, the counter is asynchronously cleared to its maximum count (decimal 255) regardless of the state of any other input. If all control inputs except ( ) are HIGH at the time of zero count, the counters will jump to the maximum count, giving a counting sequence of 256 clock pulses long. Device may be cascaded using the ( ) input and the TC output, in either a synchronous or ripple mode. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### Features:

- Cascadable
- Synchronous or asynchronous preset
- Low-power dissipation
- CMOS input levels
- 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
CD40103BE(LX)	DIP16	CD40103BE	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
CD40103B(LX)	SOP16	CD40103B	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
CD40103P(LX)	TSSOP16	CD40103P	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
CD40103BDR(LX)	SOP16	CD40103B	2500 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
CD40103PR(LX)	TSSOP16	CD40103P	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

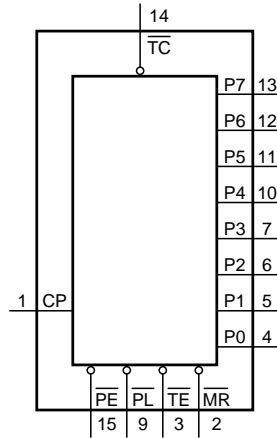


Figure 1. Functional diagram

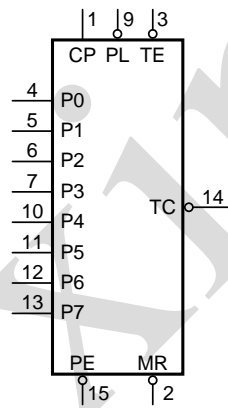


Figure 2. Logic symbol

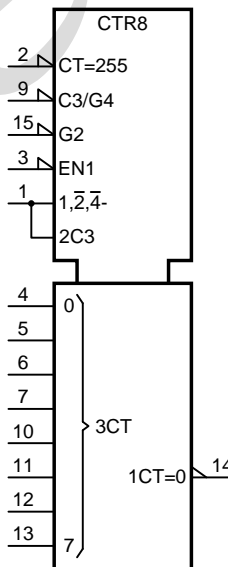


Figure 3. IEC logic symbol

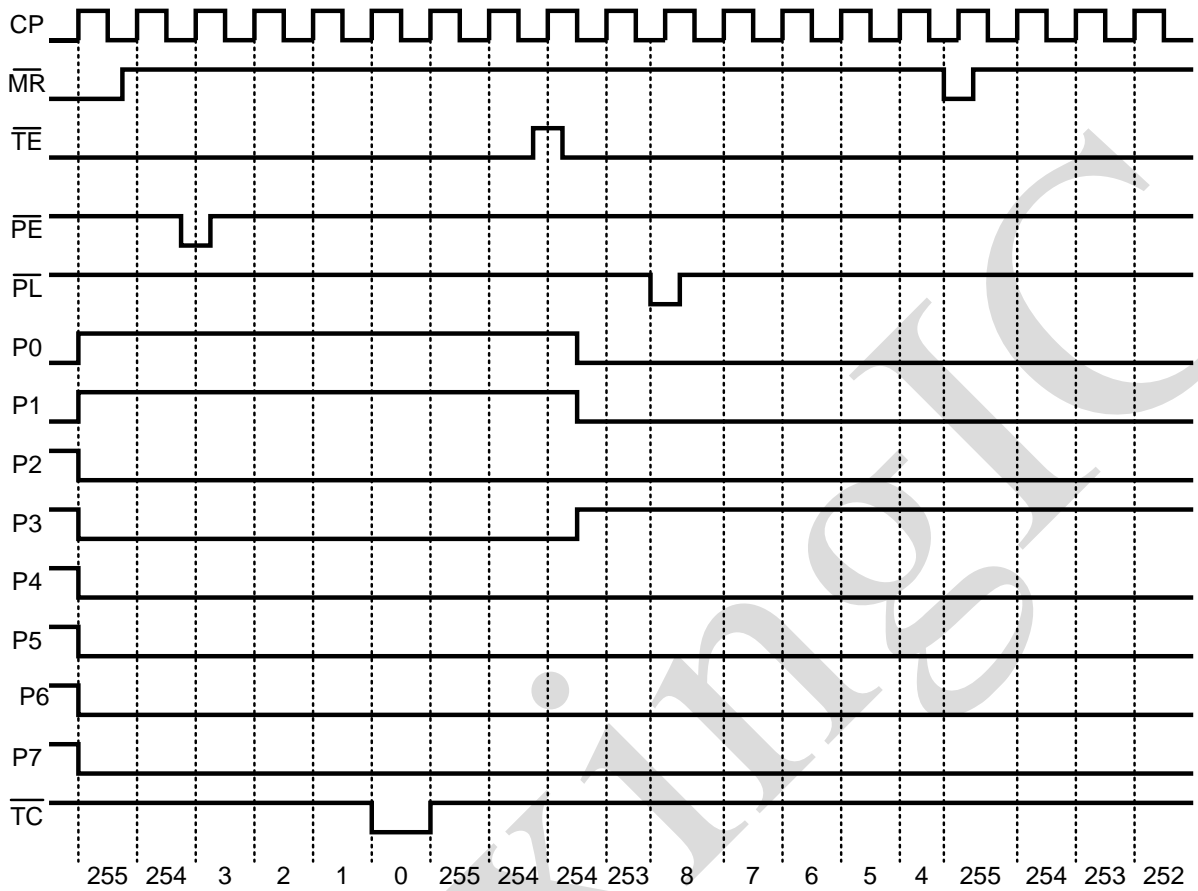


Figure 4. Timing diagram

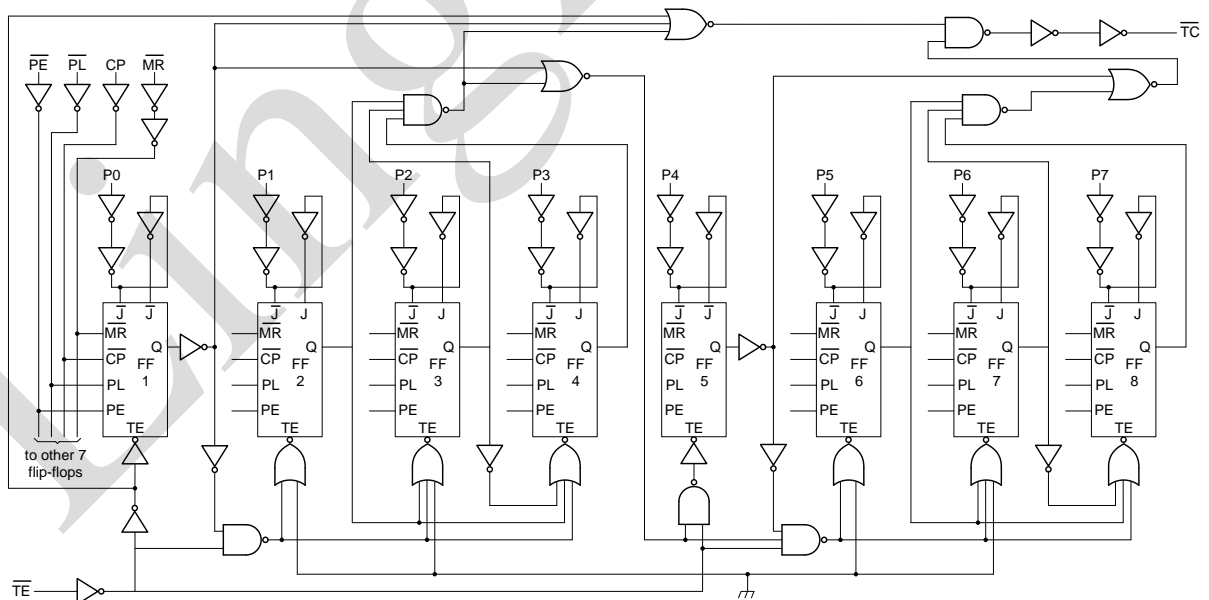
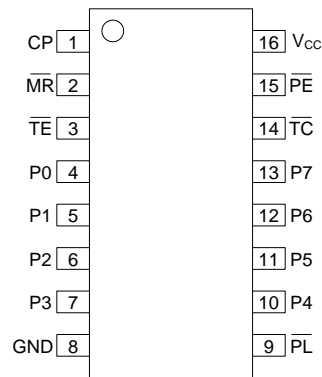


Figure 5. Logic diagram



## 2.2、Pin Configurations



## 2.3、Pin Description

Pin No.	Pin Name	Description
1	CP	clock input (LOW-to-HIGH, edge-triggered)
2		asynchronous master reset input (active LOW)
3		terminal enable input (active LOW)
4	P0	jam input 0
5	P1	jam input 1
6	P2	jam input 2
7	P3	jam input 3
8	GND	ground (0 V)
9		asynchronous preset enable input (active LOW)
10	P4	jam input 4
11	P5	jam input 5
12	P6	jam input 6
13	P7	jam input 7
14		terminal count output (active LOW)
15		synchronous preset enable input (active LOW)
16	V <sub>CC</sub>	positive supply voltage

## 2.4、Function table

Control inputs				Preset mode	Action	
MR	PL	PE	TE			
L	X	X	X	asynchronous	clear to maximum count	
H	L	X	X	asynchronous	preset asynchronously	
	H	L	X	synchronous	preset on next LOW-to HIGH clock transition	
		H	L	L	synchronous	count down
			H	H	synchronous	inhibit counter

Note:

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

Clock connected to CP.

Synchronous operation: changes occur on the LOW-to-HIGH CP transition.

Jam inputs: MSD=P7, LSD=P0.





## 3、Electrical Parameter

### 3.1、Absolute Maximum Ratings

( $T_{amb}=25^{\circ}\text{C}$ , voltage 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	$I_{IK}$	$V_I < -0.5\text{V}$ or $V_I > V_{CC} + 0.5\text{V}^{[1]}$	-	$\pm 20$	mA
output clamping current	$I_{OK}$	$V_O < -0.5\text{V}$ or $V_O > V_{CC} + 0.5\text{V}^{[1]}$	-	$\pm 20$	mA
output current	$I_O$	$V_O = -0.5\text{V}$ to $V_{CC} + 0.5\text{V}$	-	$\pm 25$	mA
supply current	$I_{CC}$	-	-	+50	mA
ground current	$I_{GND}$	-	-50	-	mA
storage temperature	$T_{stg}$	-	-65	+150	$^{\circ}\text{C}$
total power dissipation	$P_{tot}$	-	-	500	mW
soldering temperature	$T_L$	10s	DIP	245	$^{\circ}\text{C}$
			SOP/TSSOP	260	$^{\circ}\text{C}$

Note:

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>CD40103</b>						
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
input transition rise and fall rate	$\Delta t / \Delta V$	$V_{CC} = 2.0\text{V}$	-	-	625	ns/V
		$V_{CC} = 4.5\text{V}$	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{V}$	-	-	83	ns/V
ambient temperature	$T_{amb}$	-	-40	-	+125	$^{\circ}\text{C}$



### 3.3、Electrical Characteristics

#### 3.3.1、DC Characteristics 1

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>CD40103</b>							
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 $V_{IL}$	$I_O=-20\mu A; V_{CC}=2.0V$	1.9	2.0	-	V
			$I_O=-20\mu A; V_{CC}=4.5V$	4.4	4.5	-	V
			$I_O=-20\mu A; V_{CC}=6.0V$	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 $V_{IL}$	$I_O=20\mu A; V_{CC}=2.0V$	-	0	0.1	V
			$I_O=20\mu A; V_{CC}=4.5V$	-	0	0.1	V
			$I_O=20\mu A; V_{CC}=6.0V$	-	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; $V_{CC}=6.0V$	-	-	$\pm 1.0$	$\mu A$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0A; V_{CC}=6.0V$	-	-	8.0	$\mu A$	
input capacitance	$C_I$	-	-	3.5	-	pF	



### 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	
<b>CD40103</b>							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=2.0\text{V}$	1.5	-	-	V	
		$V_{CC}=4.5\text{V}$	3.15	-	-	V	
		$V_{CC}=6.0\text{V}$	4.2	-	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=2.0\text{V}$	-	-	0.5	V	
		$V_{CC}=4.5\text{V}$	-	-	1.35	V	
		$V_{CC}=6.0\text{V}$	-	-	1.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I = V_{IH}$ or $V_{IL}$	$I_O = -20\mu\text{A}; V_{CC} = 2.0\text{V}$	1.9	-	-	V
			$I_O = -20\mu\text{A}; V_{CC} = 4.5\text{V}$	4.4	-	-	V
			$I_O = -20\mu\text{A}; V_{CC} = 6.0\text{V}$	5.9	-	-	V
			$I_O = -4.0\text{mA}; V_{CC} = 4.5\text{V}$	3.84	-	-	V
			$I_O = -5.2\text{mA}; V_{CC} = 6.0\text{V}$	5.34	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I = V_{IH}$ or $V_{IL}$	$I_O = 20\mu\text{A}; V_{CC} = 2.0\text{V}$	-	-	0.1	V
			$I_O = 20\mu\text{A}; V_{CC} = 4.5\text{V}$	-	-	0.1	V
			$I_O = 20\mu\text{A}; V_{CC} = 6.0\text{V}$	-	-	0.1	V
			$I_O = 4.0\text{mA}; V_{CC} = 4.5\text{V}$	-	-	0.33	V
			$I_O = 5.2\text{mA}; V_{CC} = 6.0\text{V}$	-	-	0.33	V
input leakage current	$I_I$	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{V}$	-	-	$\pm 1.0$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC}$ or GND; $I_O = 0\text{A}; V_{CC} = 6.0\text{V}$	-	-	80	$\mu\text{A}$	



### 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	
<b>CD40103</b>							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=2.0\text{V}$	1.5	-	-	V	
		$V_{CC}=4.5\text{V}$	3.15	-	-	V	
		$V_{CC}=6.0\text{V}$	4.2	-	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=2.0\text{V}$	-	-	0.5	V	
		$V_{CC}=4.5\text{V}$	-	-	1.35	V	
		$V_{CC}=6.0\text{V}$	-	-	1.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I=V_{IH}$ or $V_{IL}$	$I_O=-20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	-	-	V
			$I_O=-20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	-	-	V
			$I_O=-20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	-	-	V
			$I_O=-4.0\text{mA}; V_{CC}=4.5\text{V}$	3.7	-	-	V
			$I_O=-5.2\text{mA}; V_{CC}=6.0\text{V}$	5.2	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}$	$I_O=20\mu\text{A}; V_{CC}=2.0\text{V}$	-	-	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=4.5\text{V}$	-	-	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=6.0\text{V}$	-	-	0.1	V
			$I_O=4.0\text{mA}; V_{CC}=4.5\text{V}$	-	-	0.4	V
			$I_O=5.2\text{mA}; V_{CC}=6.0\text{V}$	-	-	0.4	V
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=6.0\text{V}$	-	-	$\pm 1.0$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	160	$\mu\text{A}$	



### 3.3.4、AC Characteristics 1

( $T_{amb}=25^{\circ}C$ ,  $GND=0V$ ;  $t_r=t_f=6\text{ ns}$ ;  $C_L=50\text{ pF}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit			
<b>CD40103</b>									
propagation delay	$t_{pd}$	CP to ; see Figure 6 <sup>[1]</sup>	$V_{CC}=2.0V$	-	96	300	ns		
			$V_{CC}=4.5V$	-	35	60	ns		
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	30	-	ns		
				to ; see Figure 7	$V_{CC}=2.0V$	-	50	175	ns
					$V_{CC}=4.5V$	-	18	35	ns
					$V_{CC}=6.0V$	-	14	30	ns
				to ; see Figure 8	$V_{CC}=2.0V$	-	102	315	ns
					$V_{CC}=4.5V$	-	37	63	ns
					$V_{CC}=6.0V$	-	30	53	ns
HIGH to LOW propagation delay	$t_{PHL}$	to ; see Figure 8	$V_{CC}=2.0V$	-	83	275	ns		
			$V_{CC}=4.5V$	-	30	55	ns		
			$V_{CC}=6.0V$	-	24	47	ns		
transition time	$t_t$	see Figure 7 <sup>[2]</sup>	$V_{CC}=2.0V$	-	19	75	ns		
			$V_{CC}=4.5V$	-	7	15	ns		
			$V_{CC}=6.0V$	-	6	13	ns		
pulse width	$t_w$	CP HIGH or LOW; see Figure 6	$V_{CC}=2.0V$	165	22	-	ns		
			$V_{CC}=4.5V$	33	8	-	ns		
			$V_{CC}=6.0V$	28	6	-	ns		
				LOW; see Figure 8	$V_{CC}=2.0V$	125	39	-	ns
					$V_{CC}=4.5V$	25	14	-	ns
					$V_{CC}=6.0V$	21	11	-	ns
				LOW; see Figure 8	$V_{CC}=2.0V$	125	33	-	ns
					$V_{CC}=4.5V$	25	12	-	ns
					$V_{CC}=6.0V$	21	10	-	ns
recovery time	$t_{rec}$	to CP, to CP; see Figure 9	$V_{CC}=2.0V$	100	-	-	ns		
			$V_{CC}=4.5V$	20	-	-	ns		
			$V_{CC}=6.0V$	18	-	-	ns		
set-up time	$t_{su}$	to CP; see Figure 10	$V_{CC}=2.0V$	75	-	-	ns		
			$V_{CC}=4.5V$	15	-	-	ns		
			$V_{CC}=6.0V$	13	-	-	ns		
			to CP; see Figure 11	$V_{CC}=2.0V$	150	-	-	ns	
				$V_{CC}=4.5V$	30	-	-	ns	
				$V_{CC}=6.0V$	26	-	-	ns	
			Pn to CP; see Figure 10	$V_{CC}=2.0V$	75	-	-	ns	
				$V_{CC}=4.5V$	15	-	-	ns	
				$V_{CC}=6.0V$	13	-	-	ns	
hold time	$t_h$	to CP; see Figure 10	$V_{CC}=2.0V$	0	-	-	ns		
			$V_{CC}=4.5V$	0	-	-	ns		
			$V_{CC}=6.0V$	0	-	-	ns		
		to CP;	$V_{CC}=2.0V$	0	-	-	ns		



		see Figure 11	V <sub>CC</sub> =4.5V	0	-	-	ns
			V <sub>CC</sub> =6.0V	0	-	-	ns
		Pn to CP; see Figure 10	V <sub>CC</sub> =2.0V	0	-	-	ns
			V <sub>CC</sub> =4.5V	0	-	-	ns
			V <sub>CC</sub> =6.0V	0	-	-	ns
maximum frequency	f <sub>max</sub>	see Figure 6	V <sub>CC</sub> =2.0V	3.0	10	-	MHz
			V <sub>CC</sub> =4.5V	15	29	-	MHz
			V <sub>CC</sub> =5.0V; C <sub>L</sub> =15pF	-	32	-	MHz
			V <sub>CC</sub> =6.0V	18	35	-	MHz
power dissipation capacitance	C <sub>PD</sub>	V <sub>I</sub> =GND to V <sub>CC</sub> <sup>[3]</sup>		-	24	-	pF

Note:

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub>, t<sub>PLH</sub>.

[2] t<sub>i</sub> is the same as t<sub>THL</sub>, t<sub>TLH</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in uW).

P<sub>D</sub>=C<sub>PD</sub>×V<sub>CC</sub><sup>2</sup>×f<sub>i</sub>×N+∑(C<sub>L</sub>×V<sub>CC</sub><sup>2</sup>×f<sub>o</sub>) where:

f<sub>i</sub>=input frequency in MHz;

f<sub>o</sub>=output frequency in MHz;

C<sub>L</sub>=output load capacitance in pF;

V<sub>CC</sub>=supply voltage in V;

N=number of inputs switching;

∑(C<sub>L</sub>×V<sub>CC</sub><sup>2</sup>×f<sub>o</sub>)=sum of outputs.



### 3.3.5、AC Characteristics 2

( $T_{amb}=-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $\text{GND}=0\text{V}$ ;  $t_r=t_f=6\text{ ns}$ ;  $C_L=50\text{ pF}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>CD40103</b>							
propagation delay	$t_{pd}$	CP to ; see Figure 6 <sup>[1]</sup>	$V_{CC}=2.0\text{V}$	-	-	375	ns
			$V_{CC}=4.5\text{V}$	-	-	75	ns
			$V_{CC}=6.0\text{V}$	-	-	64	ns
		to ; see Figure 7	$V_{CC}=2.0\text{V}$	-	-	220	ns
			$V_{CC}=4.5\text{V}$	-	-	44	ns
			$V_{CC}=6.0\text{V}$	-	-	37	ns
		to ; see Figure 8	$V_{CC}=2.0\text{V}$	-	-	395	ns
			$V_{CC}=4.5\text{V}$	-	-	79	ns
			$V_{CC}=6.0\text{V}$	-	-	40	ns
HIGH to LOW propagation delay	$t_{PHL}$	to ; see Figure 8	$V_{CC}=2.0\text{V}$	-	-	345	ns
			$V_{CC}=4.5\text{V}$	-	-	69	ns
			$V_{CC}=6.0\text{V}$	-	-	59	ns
transition time	$t_t$	see Figure 7 <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	$t_w$	CP HIGH or LOW; see Figure 6	$V_{CC}=2.0\text{V}$	205	-	-	ns
			$V_{CC}=4.5\text{V}$	41	-	-	ns
			$V_{CC}=6.0\text{V}$	35	-	-	ns
		LOW; see Figure 8	$V_{CC}=2.0\text{V}$	155	-	-	ns
			$V_{CC}=4.5\text{V}$	31	-	-	ns
			$V_{CC}=6.0\text{V}$	26	-	-	ns
		LOW; see Figure 8	$V_{CC}=2.0\text{V}$	155	-	-	ns
			$V_{CC}=4.5\text{V}$	31	-	-	ns
			$V_{CC}=6.0\text{V}$	26	-	-	ns
recovery time	$t_{rec}$	to CP, to CP; see Figure 9	$V_{CC}=2.0\text{V}$	120	-	-	ns
			$V_{CC}=4.5\text{V}$	24	-	-	ns
			$V_{CC}=6.0\text{V}$	22	-	-	ns
set-up time	$t_{su}$	to CP; see Figure 10	$V_{CC}=2.0\text{V}$	95	-	-	ns
			$V_{CC}=4.5\text{V}$	19	-	-	ns



		to CP; see Figure 11	$V_{CC}=6.0V$	16	-	-	ns
			$V_{CC}=2.0V$	190	-	-	ns
			$V_{CC}=4.5V$	38	-	-	ns
			$V_{CC}=6.0V$	33	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=2.0V$	95	-	-	ns
			$V_{CC}=4.5V$	19	-	-	ns
$V_{CC}=6.0V$	16		-	-	ns		
hold time	$t_h$	to CP; see Figure 10	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
		to CP; see Figure 11	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
maximum frequency	$f_{max}$	see Figure 6	$V_{CC}=2.0V$	2.4	-	-	MHz
			$V_{CC}=4.5V$	12	-	-	MHz
			$V_{CC}=6.0V$	14	-	-	MHz
		to CP; see Figure 11	$V_{CC}=4.5V$	0	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=4.5V$	0	-	-	ns
maximum frequency	$f_{max}$	see Figure 6;	$V_{CC}=4.5V$	12	-	-	MHz

Note:

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

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

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in uW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  where:

$f_i$ =input frequency in MHz;

$f_o$ =output frequency in MHz;

$C_L$ =output load capacitance in pF;

$V_{CC}$ =supply voltage in V;

$N$ =number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$ =sum of outputs.





### 3.3.6、AC Characteristics 3

( $T_{amb} = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $GND = 0\text{V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>CD40103</b>							
propagation delay	$t_{pd}$	CP to ; see Figure 6 <sup>[1]</sup>	$V_{CC} = 2.0\text{V}$	-	-	450	ns
			$V_{CC} = 4.5\text{V}$	-	-	90	ns
			$V_{CC} = 6.0\text{V}$	-	-	77	ns
		to ; see Figure 7	$V_{CC} = 2.0\text{V}$	-	-	265	ns
			$V_{CC} = 4.5\text{V}$	-	-	53	ns
			$V_{CC} = 6.0\text{V}$	-	-	45	ns
		to ; see Figure 8	$V_{CC} = 2.0\text{V}$	-	-	475	ns
			$V_{CC} = 4.5\text{V}$	-	-	95	ns
			$V_{CC} = 6.0\text{V}$	-	-	81	ns
HIGH to LOW propagation delay	$t_{PHL}$	to ; see Figure 8	$V_{CC} = 2.0\text{V}$	-	-	415	ns
			$V_{CC} = 4.5\text{V}$	-	-	83	ns
			$V_{CC} = 6.0\text{V}$	-	-	71	ns
transition time	$t_t$	see Figure 7 <sup>[2]</sup>	$V_{CC} = 2.0\text{V}$	-	-	110	ns
			$V_{CC} = 4.5\text{V}$	-	-	22	ns
			$V_{CC} = 6.0\text{V}$	-	-	19	ns
pulse width	$t_w$	CP HIGH or LOW; see Figure 6	$V_{CC} = 2.0\text{V}$	250	-	-	ns
			$V_{CC} = 4.5\text{V}$	50	-	-	ns
			$V_{CC} = 6.0\text{V}$	43	-	-	ns
		LOW; see Figure 8	$V_{CC} = 2.0\text{V}$	190	-	-	ns
			$V_{CC} = 4.5\text{V}$	38	-	-	ns
			$V_{CC} = 6.0\text{V}$	32	-	-	ns
LOW;	$V_{CC} = 2.0\text{V}$	190	-	-	ns		



		see Figure 8	$V_{CC}=4.5V$	38	-	-	ns
			$V_{CC}=6.0V$	32	-	-	ns
recovery time	$t_{rec}$	to CP, CP; see Figure 9	$V_{CC}=2.0V$	132	-	-	ns
			$V_{CC}=4.5V$	26	-	-	ns
			$V_{CC}=6.0V$	24	-	-	ns
set-up time	$t_{su}$	to CP; see Figure 10	$V_{CC}=2.0V$	110	-	-	ns
			$V_{CC}=4.5V$	22	-	-	ns
			$V_{CC}=6.0V$	19	-	-	ns
		to CP; see Figure 11	$V_{CC}=2.0V$	225	-	-	ns
			$V_{CC}=4.5V$	45	-	-	ns
			$V_{CC}=6.0V$	38	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=2.0V$	110	-	-	ns
			$V_{CC}=4.5V$	22	-	-	ns
			$V_{CC}=6.0V$	19	-	-	ns
hold time	$t_h$	to CP; see Figure 10	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
		to CP; see Figure 11	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
maximum frequency	$f_{max}$	see Figure 6	$V_{CC}=2.0V$	2.0	-	-	MHz
			$V_{CC}=4.5V$	10	-	-	MHz
			$V_{CC}=6.0V$	12	-	-	MHz
set-up time	$t_{su}$	to CP; see Figure 10	$V_{CC}=4.5V$	30	-	-	ns
		to CP; see Figure 11	$V_{CC}=4.5V$	60	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=4.5V$	30	-	-	ns
hold time	$t_h$	to CP; see Figure 10	$V_{CC}=4.5V$	2	-	-	ns
		to CP; see Figure 11	$V_{CC}=4.5V$	0	-	-	ns
		Pn to CP; see Figure 10	$V_{CC}=4.5V$	0	-	-	ns
maximum frequency	$f_{max}$	see Figure 6;	$V_{CC}=4.5V$	10	-	-	MHz



Note:

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

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

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in uW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  where:

$f_i$ =input frequency in MHz;

$f_o$ =output frequency in MHz;

$C_L$ =output load capacitance in pF;

$V_{CC}$ =supply voltage in V;

$N$ =number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$ =sum of outputs.

## 4、Testing Circuit

### 4.1、AC Testing Waveforms

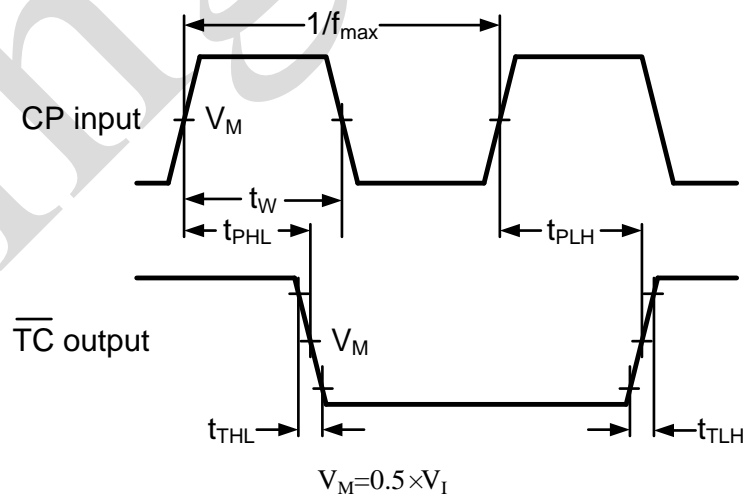


Figure 6. Waveforms showing the clock input (CP) to propagation delays, the clock pulse width, the output transition times and the maximum clock pulse frequency

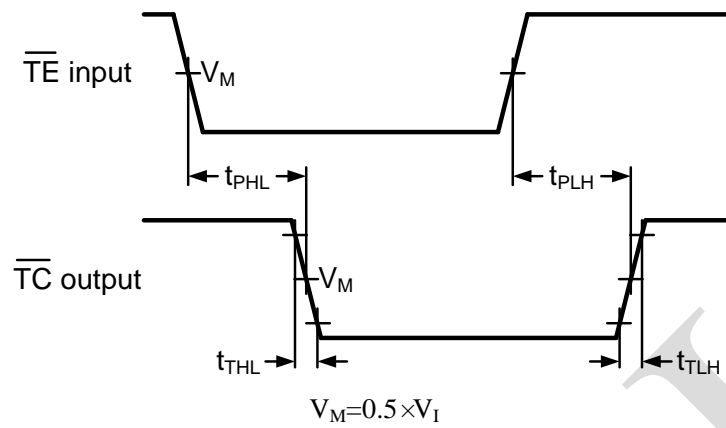


Figure 7. Waveforms showing the  $\overline{TE}$  to  $\overline{TC}$  propagation delays

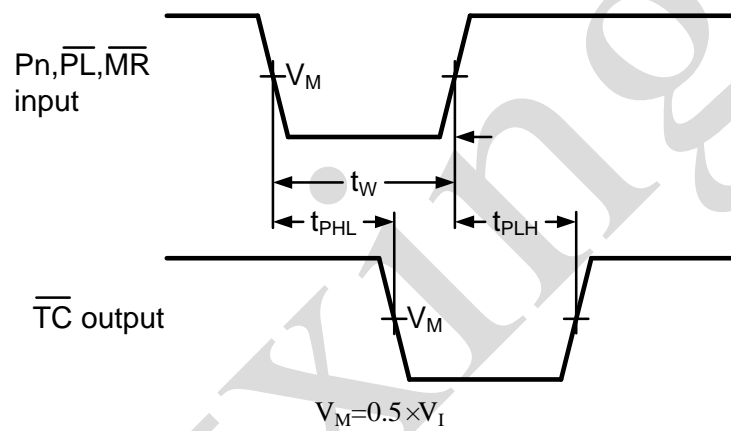


Figure 8. Waveforms showing  $\overline{Pn}, \overline{PL}, \overline{MR}$  to  $\overline{TC}$  propagation delays

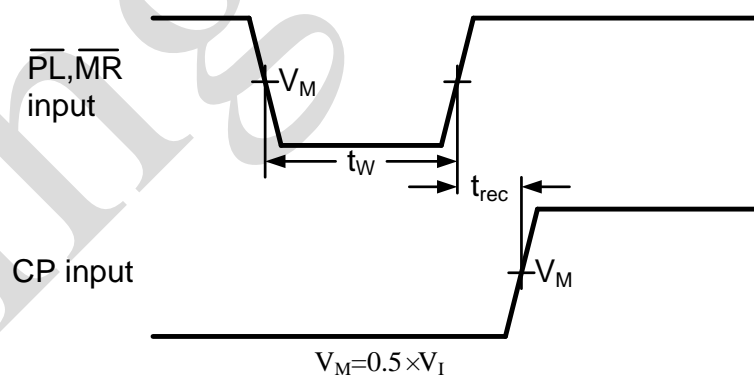
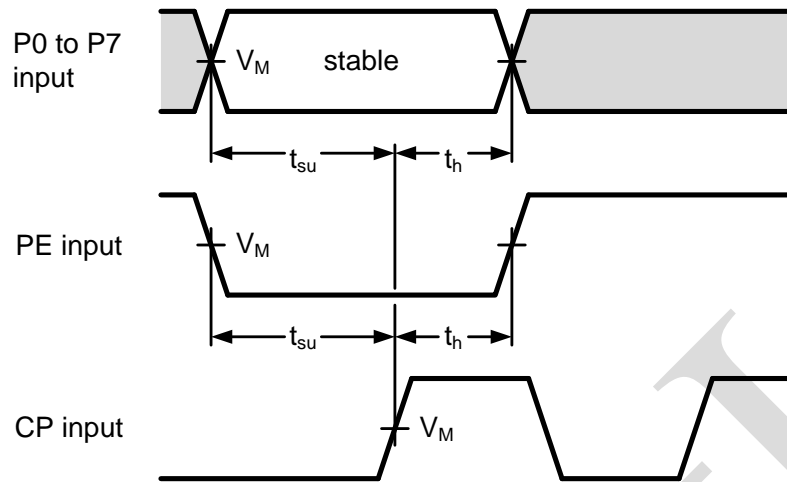


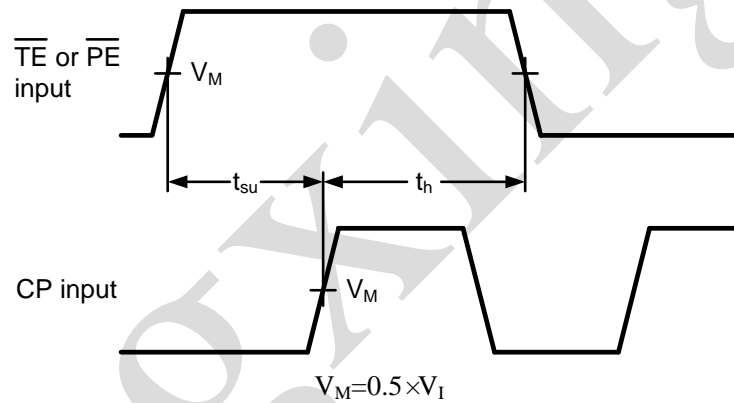
Figure 9. Waveforms showing removal time for  $\overline{PL}, \overline{MR}$  and  $\overline{CP}$



The shaded areas indicate when the input is permitted to change for predictable output performance.

$$V_M = 0.5 \times V_I$$

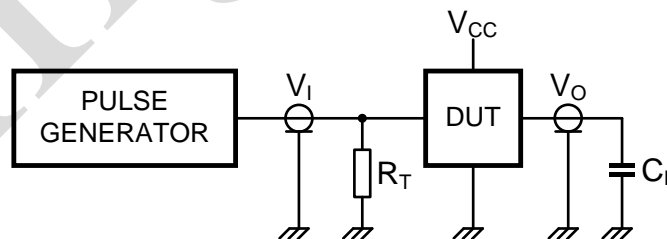
Figure 10. Waveforms showing hold and set-up times for Pn, PE to CP



$$V_M = 0.5 \times V_I$$

Figure 11. Waveforms showing hold and set-up times for TE or PE to CP

## 4.2、 AC Testing Circuit



Definitions for test circuit:

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

$C_L$  = Load capacitance including jig and probe capacitance.

Figure 12. Test circuit for measuring switching times



### 4.3、Test Data

Supply	Input		Load
$V_{CC}$	$V_I$	$t_r, t_f$	$C_L$
2.0V	$V_{CC}$	6ns	50pF
4.5V	$V_{CC}$	6ns	50pF
5.0V	$V_{CC}$	6ns	15pF
6.0V	$V_{CC}$	6ns	50pF

### 5、Typical Application Circuit And Application Note

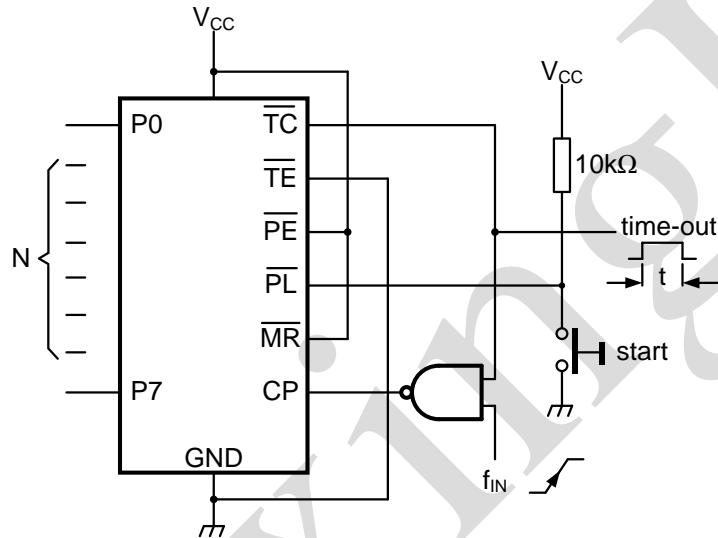


Figure 13. Programmable timer

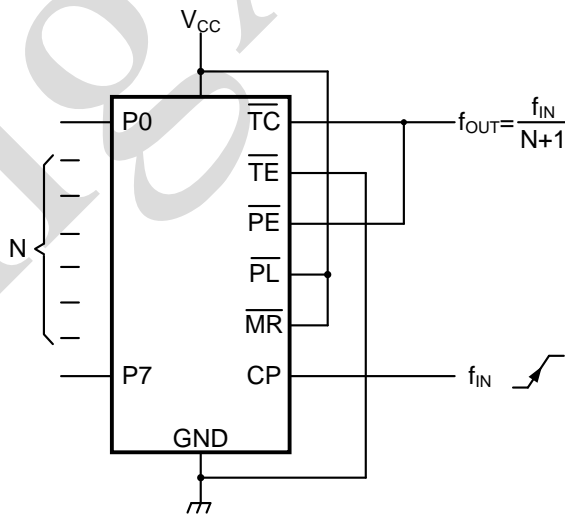
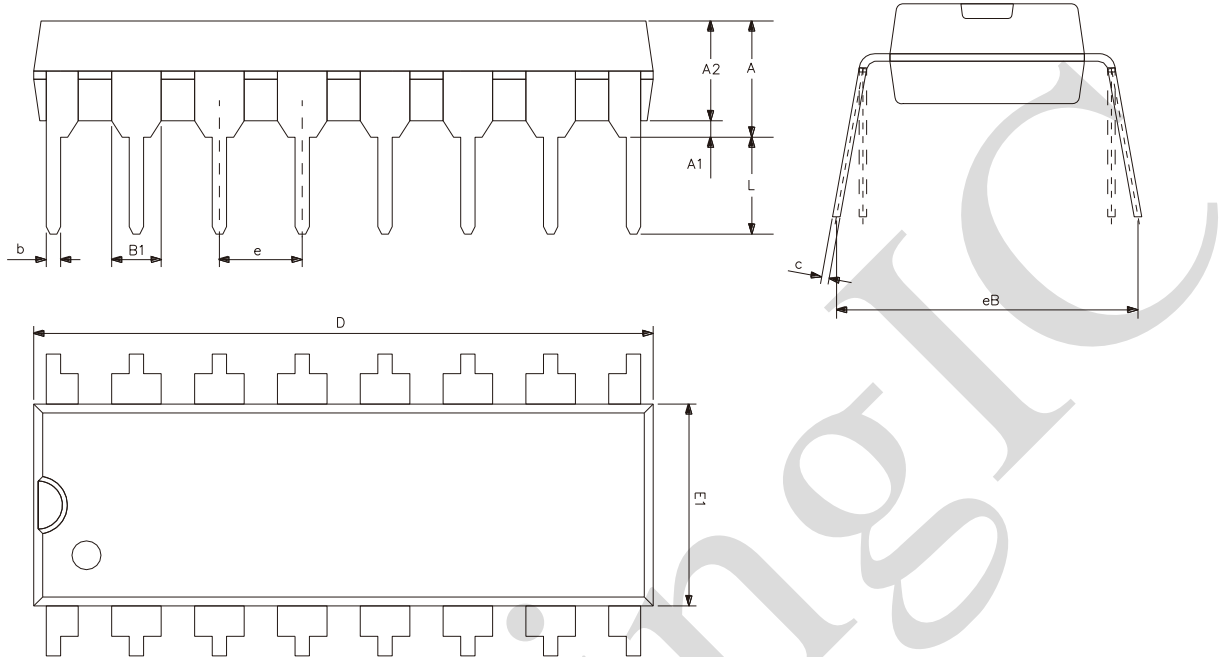


Figure 14. Divide-by-N counter



## 6、Package Information

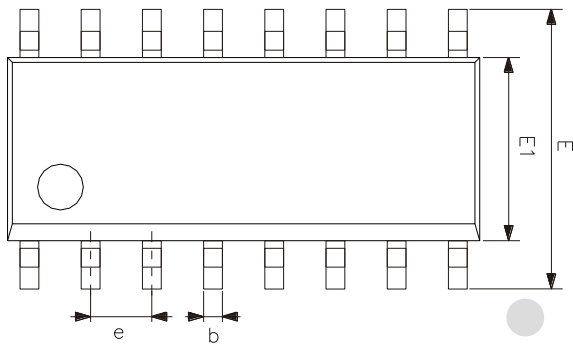
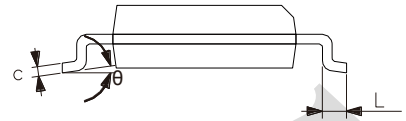
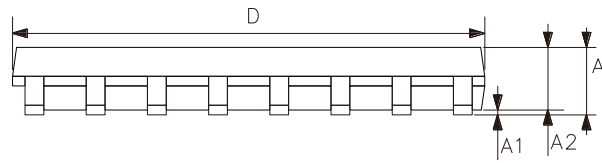
### 6.1、DIP16



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



## 6.2、SOP16

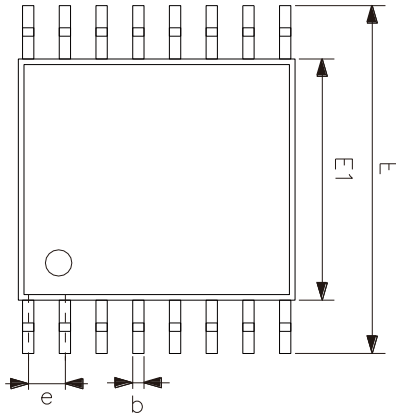
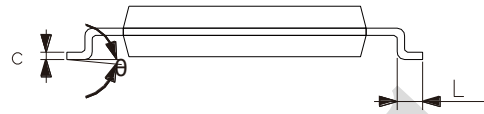
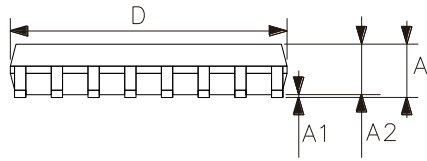


Symbol	Dimensions (mm)	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
$\theta$	0°	8°





## 6.3、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
$\theta$	0°	8°



## 7、 Statements And Notes

### 7.1、 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.									

### 7.2、 Notes

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