



# SN74HC/HCT160 (LX) Presettable Synchronous BCD Decade Counter; Asynchronous Reset

## Product Specification

### Specification Revision History:

Version	Date	Description
2021-11-A2	2021-11	Modify Ordering Information; Modify ambient temperature to $-40^{\circ}\text{C}$ ~ $+125^{\circ}\text{C}$ .
2021-12-A3	2021-12	Modify Ordering Information



## 1、General Description

The SN74HC/HCT160 is a synchronous presettable decade counter with an internal look-ahead carry. Synchronous operation is provided by having all flip-flops clocked simultaneously on the positive-going edge of the clock (CP). The outputs (Q0 to Q3) of the counters may be preset HIGH or LOW. A LOW at the parallel enable input ( $\overline{PE}$ ) disables the counting action and causes the data at the data inputs (D0 to D3) to be loaded into the counter on the positive-going edge of the clock. Preset takes place regardless of the levels at count enable inputs (CEP and CET). A LOW at the master reset input ( $\overline{MR}$ ) sets Q0 to Q3 LOW regardless of the levels at input pins CP,  $\overline{PE}$ , CET and CEP (thus providing an asynchronous clear function). The look-ahead carry simplifies serial cascading of the counters. Both CEP and CET must be HIGH to count. The CET input is fed forward to enable the terminal count output (TC). The TC output thus enabled will produce a HIGH output pulse of a duration approximately equal to a HIGH output of Q0. This pulse can be used to enable the next cascaded stage. The maximum clock frequency for the cascaded counters is determined by the CP to TC propagation delay and CEP to CP set-up time, according to the following formula:

$$f_{\max} = 1 / (t_{p(\max)}(\text{CP to TC}) + t_{\text{SU}}(\text{CEP to CP}))$$

Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### Features:

- Input levels:
  - For SN74HC160: CMOS level
  - For SN74HCT160: TTL level
- Synchronous counting and loading
- 2 count enable inputs for n-bit cascading
- Asynchronous reset
- Positive-edge triggered clock
- Specified from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- Packaging information: DIP16/SOP16/TSSOP16



## Ordering Information:

### Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
SN74HC160N (LX)	DIP16	SN74HC160N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
SN74HCT160N (LX)	DIP16	SN74HCT160N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm

### Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
SN74HC160DR (LX)	SOP16	SN74HC160	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
SN74HCT160DR (LX)	SOP16	SN74HCT160	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
SN74HC160PWR (LX)	TSSOP16	SN74HC160	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm
SN74HCT160PWR (LX)	TSSOP16	SN74HCT160	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

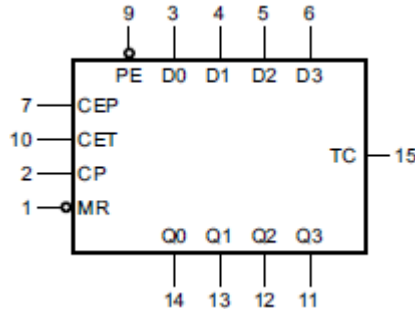


Figure 1. Logic symbol

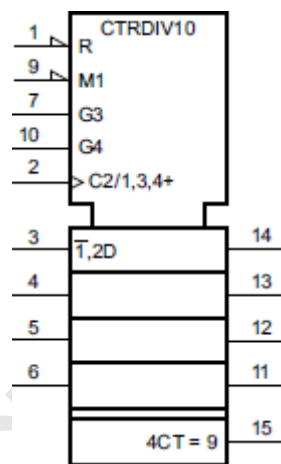


Figure 2. IEC logic symbol

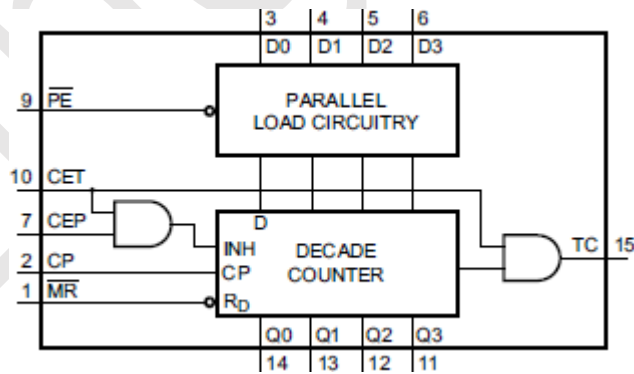


Figure 3. Functional diagram

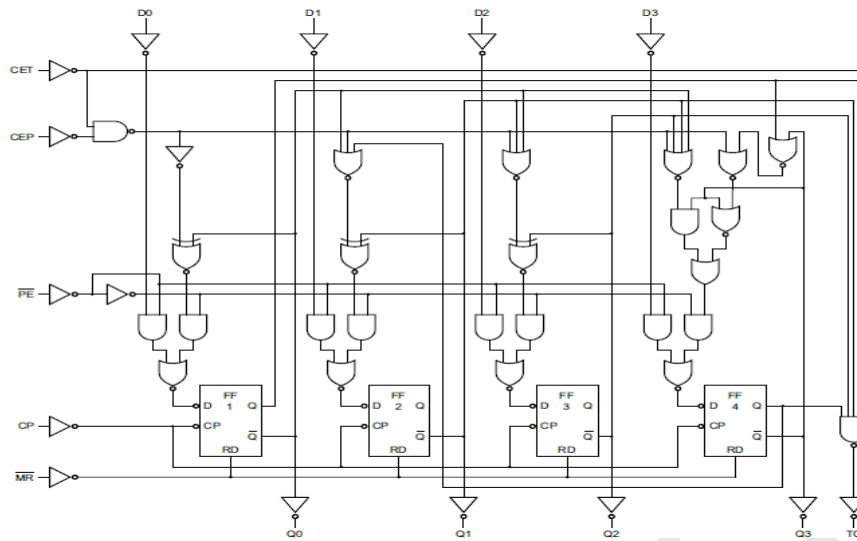


Figure 4. Logic diagram

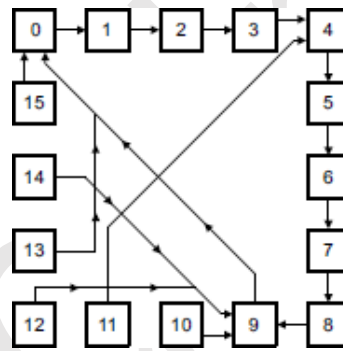


Figure 5. State diagram

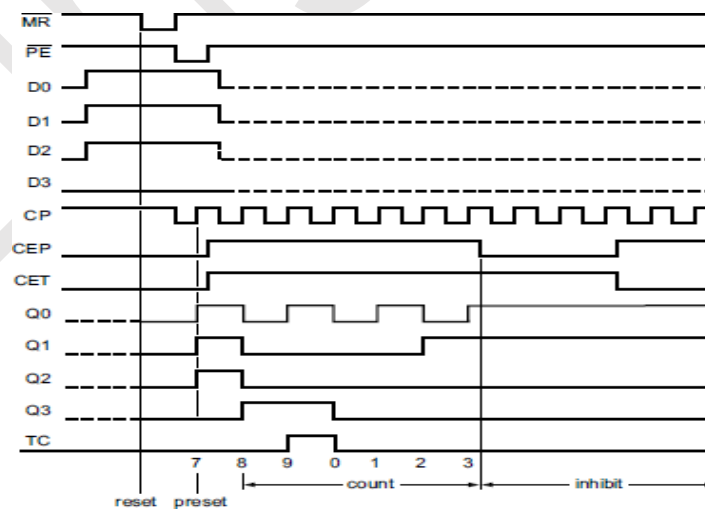
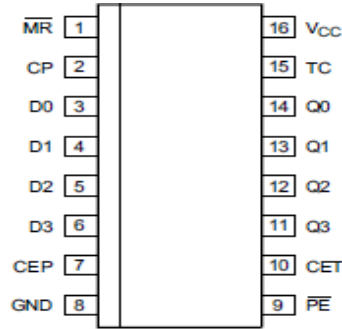


Figure 6. Typical timing sequence



## 2.2、Pin Configurations



## 2.3、Pin Description

Pin No.	Pin Name	Description
1	MR	asynchronous master reset (active LOW)
2	CP	clock input (LOW-to-HIGH, edge triggered)
3	D0	data input
4	D1	data input
5	D2	data input
6	D3	data input
7	CEP	count enable input
8	GND	ground (0V)
9	PE	parallel enable input (active LOW)
10	CET	count enable carry input
11	Q3	flip-flop output
12	Q2	flip-flop output
13	Q1	flip-flop output
14	Q0	flip-flop output
15	TC	terminal count output
16	V <sub>CC</sub>	supply voltage



## 2.4、Function Table

Operating mode	Input						Output	
	MR	CP	CEP	CET	PE	Dn	Qn	TC
reset (clear)	L	X	X	X	X	X	L	L
parallel load	H	↑	X	X	l	l	L	L
	H	↑	X	X	l	h	H	[2]
count	H	↑	h	h	h	X	count	[2]
hold (do nothing)	H	X	l	X	h	X	q <sub>n</sub>	[2]
	H	X	X	l	h	X	q <sub>n</sub>	L

Note:

[1] H=HIGH voltage level; L=LOW voltage level; X=don't care; ↑=LOW-to-HIGH clock transition;

l=LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;

h=HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;

q<sub>n</sub>=lower case letters indicate the state of the referenced output one set-up time prior to the LOW-to-HIGH CP transition.

[2] The TC output is HIGH when CET is HIGH and the counter is at terminal count (HLLH).

## 3、Electrical Parameter

### 3.1、Absolute Maximum Ratings

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Max.	Unit
supply voltage	V <sub>CC</sub>	-	-0.5	+7.0	V
input clamping current	I <sub>IK</sub>	V <sub>I</sub> < -0.5V or V <sub>I</sub> > V <sub>CC</sub> +0.5V	-	±20	mA
output clamping current	I <sub>OK</sub>	V <sub>O</sub> < -0.5V or V <sub>O</sub> > V <sub>CC</sub> +0.5V	-	±20	mA
output current	I <sub>O</sub>	-0.5V < V <sub>O</sub> < V <sub>CC</sub> +0.5V	-	±25	mA
supply current	I <sub>CC</sub>	-	-	+50	mA
ground current	I <sub>GND</sub>	-	-50	-	mA
storage temperature	T <sub>stg</sub>	-	-65	+150	°C
total power dissipation	P <sub>tot</sub>	-	-	500	mW
soldering temperature	T <sub>L</sub>	10s	DIP	245	°C
			SOP	250	

Note:

[1] For DIP16 packages: above 70°C the value of P<sub>tot</sub> derates linearly with 12mW/K.

[2] For SOP16 packages: above 70°C the value of P<sub>tot</sub> derates linearly with 8mW/K.

[3] For (T)SSOP16 packages: above 60°C the value of P<sub>tot</sub> derates linearly with 5.5mW/K.



### 3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>SN74HC160</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	$\Delta t/\Delta V$	$V_{CC}=2.0V$	-	-	625	ns/V
		$V_{CC}=4.5V$	-	1.67	139	ns/V
		$V_{CC}=6.0V$	-	-	83	ns/V
ambient temperature	$T_{amb}$	-	-40	-	+105	°C
<b>SN74HCT160</b>						
supply voltage	$V_{CC}$	-	4.5	5.0	5.5	V
input voltage	$V_I$	-	0	-	$V_{CC}$	V
output voltage	$V_O$	-	0	-	$V_{CC}$	V
input transition rise and fall rate	$\Delta t/\Delta V$	$V_{CC}=4.5V$	-	1.67	139	ns/V
ambient temperature	$T_{amb}$	-	-40	-	+105	°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>SN74HC160</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; $V_{CC}=6.0V$	-	-	$\pm 0.1$	$\mu A$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0A; V_{CC}=6.0V$	-	-	8.0	$\mu A$	





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input capacitance	$C_I$	-	-	3.5	-	pF	
<b>SN74HCT160</b>							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=4.5V$ to $5.5V$		2.0	1.6	- V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=4.5V$ to $5.5V$		-	1.2	0.8 V	
HIGH-level output voltage	$V_{OH}$	$V_I=V_{IH}$ or $V_{IL}$ ; $V_{CC}=4.5V$	$I_O=-20\mu A$	4.4	4.5	- V	
			$I_O=-4.0mA$	3.98	4.32	- V	
LOW-level output voltage	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}$ ; $V_{CC}=4.5V$	$I_O=20\mu A$	-	0	0.1 V	
			$I_O=4.0mA$	-	0.15	0.26 V	
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=5.5V$		-	-	$\pm 0.1$ $\mu A$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=5.5V$		-	-	8.0 $\mu A$	
additional supply current	$\Delta I_{CC}$	per input pin; $V_I=V_{CC}-2.1V$ ; other inputs at $V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=4.5V$ to $5.5V$	pin $\overline{MR}$	-	95	342	$\mu A$
			pin CP	-	110	396	$\mu A$
			pin CEP and Dn	-	25	90	$\mu A$
			pin CET	-	75	270	$\mu A$
			pin $\overline{PE}$	-	30	108	$\mu A$
input capacitance	$C_I$	-	-	3.5	-	pF	

### 3.3.2 、 DC Characteristics 2

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC160</b>							
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 $V_{IL}$	$I_O=-20\mu A$ ; $V_{CC}=2.0V$	1.9	-	-	V
			$I_O=-20\mu A$ ; $V_{CC}=4.5V$	4.4	-	-	V
			$I_O=-20\mu A$ ; $V_{CC}=6.0V$	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 $V_{IL}$	$I_O=20\mu A$ ; $V_{CC}=2.0V$	-	-	0.1	V
			$I_O=20\mu A$ ; $V_{CC}=4.5V$	-	-	0.1	V
			$I_O=20\mu A$ ; $V_{CC}=6.0V$	-	-	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



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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; $I_O=0A$ ; $V_{CC}=6.0V$	-	-	80	$\mu A$	
<b>SN74HCT160</b>							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=4.5V$ to 5.5V	2.0	-	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=4.5V$ to 5.5V	-	-	0.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I=V_{IH}$ or $V_{IL}$ ; $V_{CC}=4.5V$	$I_O=-20\mu A$	4.4	-	-	V
			$I_O=-4.0mA$	3.84	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}$ ; $V_{CC}=4.5V$	$I_O=20\mu A$	-	-	0.1	V
			$I_O=4.0mA$	-	-	0.33	V
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=5.5V$	-	-	$\pm 1.0$	$\mu A$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=5.5V$	-	-	80	$\mu A$	
additional supply current	$\Delta I_{CC}$	per input pin; $V_I=V_{CC}-2.1V$ ; other inputs at $V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=4.5V$ to 5.5V	pin MR	-	-	427.5	$\mu A$
			pin CP	-	-	495	$\mu A$
			pin CEP and Dn	-	-	112.5	$\mu A$
			pin CET	-	-	337.5	$\mu A$
			pin PE	-	-	135	$\mu A$

### 3.3.3 、 DC Characteristics 3

( $T_{amb}=-40^{\circ}C$  to  $+105^{\circ}C$ , voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC160</b>							
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 $V_{IL}$	$I_O=-20\mu A$ ; $V_{CC}=2.0V$	1.9	-	-	V
			$I_O=-20\mu A$ ; $V_{CC}=4.5V$	4.4	-	-	V
			$I_O=-20\mu A$ ; $V_{CC}=6.0V$	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 $V_{IL}$	$I_O=20\mu A$ ; $V_{CC}=2.0V$	-	-	0.1	V
			$I_O=20\mu A$ ; $V_{CC}=4.5V$	-	-	0.1	V
			$I_O=20\mu A$ ; $V_{CC}=6.0V$	-	-	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; $V_{CC}=6.0V$	-	-	$\pm 1.0$	$\mu A$	



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supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=6.0V$		-	-	160	$\mu A$
<b>SN74HCT160</b>							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=4.5V$ to $5.5V$		2.0	-	-	V
LOW-level input voltage	$V_{IL}$	$V_{CC}=4.5V$ to $5.5V$		-	-	0.8	V
HIGH-level output voltage	$V_{OH}$	$V_I=V_{IH}$ or $V_{IL}$ ; $V_{CC}=4.5V$	$I_O=-20\mu A$	4.4	-	-	V
			$I_O=-4.0mA$	3.7	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}$ ; $V_{CC}=4.5V$	$I_O=20\mu A$	-	-	0.1	V
			$I_O=4.0mA$	-	-	0.4	V
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=5.5V$		-	-	$\pm 1.0$	$\mu A$
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=5.5V$		-	-	160	$\mu A$
additional supply current	$\Delta I_{CC}$	per input pin; $V_I=V_{CC}-2.1V$ ; other inputs at $V_{CC}$ or GND; $I_O=0A$ ; $V_{CC}=4.5V$ to $5.5V$	pin MR	-	-	465.5	$\mu A$
			pin CP	-	-	539	$\mu A$
			pin CEP and Dn	-	-	122.5	$\mu A$
			pin CET	-	-	367.5	$\mu A$
			pin PE	-	-	147	$\mu A$

### 3.3.4 、 AC Characteristics 1

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit			
<b>SN74HC160</b>									
propagation delay	$t_{pd}$	CP to Qn; see Figure 8 <sup>[1]</sup>	$V_{CC}=2.0V$	-	61	185	ns		
			$V_{CC}=4.5V$	-	22	37	ns		
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	19	-	ns		
		CP to TC; see Figure 8	$V_{CC}=2.0V$	-	69	215	ns		
			$V_{CC}=4.5V$	-	25	43	ns		
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	21	-	ns		
		CET to TC; see Figure 9	$V_{CC}=2.0V$	-	47	150	ns		
			$V_{CC}=4.5V$	-	17	30	ns		
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	14	-	ns		
		High to LOW propagation delay	$t_{PHL}$	MR to Qn; see Figure 10	$V_{CC}=2.0V$	-	69	210	ns
					$V_{CC}=4.5V$	-	25	42	ns
					$V_{CC}=5.0V$ ; $C_L=15pF$	-	21	-	ns
MR to TC; see Figure 10	$V_{CC}=2.0V$			-	69	220	ns		
	$V_{CC}=4.5V$			-	25	44	ns		
	$V_{CC}=5.0V$ ; $C_L=15pF$			-	21	-	ns		
	$V_{CC}=2.0V$			-	20	37	ns		
	$V_{CC}=4.5V$			-	20	36	ns		
	$V_{CC}=6.0V$			-	20	37	ns		



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transition time	$t_t$	see Figure 8 and Figure 9 <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 8	$V_{CC}=2.0V$	80	22	-	ns
			$V_{CC}=4.5V$	16	8	-	ns
			$V_{CC}=6.0V$	14	3	-	ns
		$\bar{MR}$ LOW; see Figure 10	$V_{CC}=2.0V$	80	28	-	ns
			$V_{CC}=4.5V$	16	10	-	ns
			$V_{CC}=6.0V$	14	8	-	ns
recovery time	$t_{rec}$	$\bar{MR}$ to CP;	$V_{CC}=2.0V$	100	30	-	ns
		see Figure 10	$V_{CC}=4.5V$	20	11	-	ns
			$V_{CC}=6.0V$	17	9	-	ns
set-up time	$t_{su}$	Dn to CP; see Figure 11	$V_{CC}=2.0V$	80	22	-	ns
			$V_{CC}=4.5V$	16	8	-	ns
			$V_{CC}=6.0V$	14	6	-	ns
		$\bar{PE}$ to CP; see Figure 11	$V_{CC}=2.0V$	135	41	-	ns
			$V_{CC}=4.5V$	27	15	-	ns
			$V_{CC}=6.0V$	23	12	-	ns
		CEP, CET to CP; see Figure 12	$V_{CC}=2.0V$	200	63	-	ns
			$V_{CC}=4.5V$	40	23	-	ns
			$V_{CC}=6.0V$	34	18	-	ns
hold time	$t_h$	Dn to CP; see Figure 11	$V_{CC}=2.0V$	0	-17	-	ns
			$V_{CC}=4.5V$	0	-6	-	ns
			$V_{CC}=6.0V$	0	-5	-	ns
		$\bar{PE}$ to CP; see Figure 11	$V_{CC}=2.0V$	0	-41	-	ns
			$V_{CC}=4.5V$	0	-15	-	ns
			$V_{CC}=6.0V$	0	-12	-	ns
		CEP, CET to CP; see Figure 12	$V_{CC}=2.0V$	0	-58	-	ns
			$V_{CC}=4.5V$	0	-21	-	ns
			$V_{CC}=6.0V$	0	-17	-	ns
maximum frequency	$f_{max}$	CP; see Figure 8	$V_{CC}=2.0V$	6	18	-	MHz
			$V_{CC}=4.5V$	30	55	-	MHz
			$V_{CC}=5.0V; C_L=15pF$	-	61	-	MHz
			$V_{CC}=6.0V$	35	66	-	MHz
power dissipation capacitance	$C_{PD}$	$f_i=1MHz; V_I=GND$ to $V_{CC}$ <sup>[3]</sup>	-	39	-	pF	
<b>SN74HCT160</b>							
propagation delay	$t_{pd}$	CP to Qn; see Figure 8 <sup>[1]</sup>	$V_{CC}=4.5V$	-	25	43	ns
			$V_{CC}=5.0V; C_L=15pF$	-	21	-	ns
		CP to TC; see Figure 8	$V_{CC}=4.5V$	-	28	48	ns
			$V_{CC}=5.0V; C_L=15pF$	-	24	-	ns
		CET to TC; see Figure 9	$V_{CC}=4.5V$	-	17	35	ns
		$V_{CC}=5.0V; C_L=15pF$	-	14	-	ns	



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High to LOW propagation delay	$t_{PHL}$	MR to Qn; see Figure 10	$V_{CC}=4.5V$	-	27	50	ns
			$V_{CC}=5.0V; C_L=15pF$	-	23	-	ns
		MR to TC; see Figure 10	$V_{CC}=4.5V$	-	30	50	ns
			$V_{CC}=5.0V; C_L=15pF$	-	26	-	ns
transition time	$t_t$	$V_{CC}=4.5V$ ; see Figure 8, 9 <sup>[2]</sup>		-	7	15	ns
pulse width	$t_w$	CP HIGH or LOW; $V_{CC}=4.5V$ ; see Figure 8		16	8	-	ns
		MR LOW; $V_{CC}=4.5V$ ; see Figure 10		20	11	-	ns
recovery time	$t_{rec}$	MR to CP; $V_{CC}=4.5V$ ; see Figure 10		20	9	-	ns
set-up time	$t_{su}$	Dn to CP; $V_{CC}=4.5V$ ; see Figure 11		18	10	-	ns
		PE to CP; $V_{CC}=4.5V$ ; see Figure 11		30	18	-	ns
		CEP, CET to CP; $V_{CC}=4.5V$ ; see Figure 12		50	30	-	ns
hold time	$t_h$	Dn to CP; $V_{CC}=4.5V$ ; see Figure 11		0	-8	-	ns
		PE to CP; $V_{CC}=4.5V$ ; see Figure 11		0	-13	-	ns
		CEP, CET to CP; $V_{CC}=4.5V$ ; see Figure 12		0	-21	-	ns
maximum frequency	$f_{max}$	CP; see Figure 8	$V_{CC}=4.5V$	16	28	-	MHz
			$V_{CC}=5.0V; C_L=15pF$	-	31	-	MHz
power dissipation capacitance	$C_{PD}$	$f_i=1MHz; V_i=GND$ to $V_{CC}-1.5V$ <sup>[3]</sup>		-	34	-	pF

Note:

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

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

[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.

### 3.3.5 AC Characteristics 2

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC160</b>							
propagation delay	$t_{pd}$	CP to Qn; see Figure 8 <sup>[1]</sup>	$V_{CC}=2.0V$	-	-	230	ns
			$V_{CC}=4.5V$	-	-	46	ns
			$V_{CC}=6.0V$	-	-	39	ns
		CP to TC; see Figure 8	$V_{CC}=2.0V$	-	-	270	ns
			$V_{CC}=4.5V$	-	-	54	ns
			$V_{CC}=6.0V$	-	-	46	ns
		CET to TC;	$V_{CC}=2.0V$	-	-	190	ns
			$V_{CC}=4.5V$	-	-	38	ns



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		see Figure 9	$V_{CC}=6.0V$	-	-	33	ns		
High to LOW propagation delay	$t_{PHL}$	MR to Qn; see Figure 10	$V_{CC}=2.0V$	-	-	265	ns		
			$V_{CC}=4.5V$	-	-	53	ns		
			$V_{CC}=6.0V$	-	-	45	ns		
		MR to TC; see Figure 10	$V_{CC}=2.0V$	-	-	275	ns		
			$V_{CC}=4.5V$	-	-	55	ns		
			$V_{CC}=6.0V$	-	-	47	ns		
transition time	$t_t$	see Figure 8 and Figure 9 <sup>[2]</sup>	$V_{CC}=2.0V$	-	-	95	ns		
			$V_{CC}=4.5V$	-	-	19	ns		
			$V_{CC}=6.0V$	-	-	16	ns		
pulse width	$t_w$	CP HIGH or LOW; see Figure 8	$V_{CC}=2.0V$	100	-	-	ns		
			$V_{CC}=4.5V$	20	-	-	ns		
		MR LOW; see Figure 10	$V_{CC}=6.0V$	17	-	-	ns		
			$V_{CC}=2.0V$	100	-	-	ns		
			$V_{CC}=4.5V$	20	-	-	ns		
			$V_{CC}=6.0V$	17	-	-	ns		
recovery time	$t_{rec}$	MR to CP; see Figure 10	$V_{CC}=2.0V$	125	-	-	ns		
			$V_{CC}=4.5V$	25	-	-	ns		
			$V_{CC}=6.0V$	21	-	-	ns		
set-up time	$t_{su}$	Dn to CP; see Figure 11	$V_{CC}=2.0V$	100	-	-	ns		
			$V_{CC}=4.5V$	20	-	-	ns		
			$V_{CC}=6.0V$	17	-	-	ns		
		PE to CP; see Figure 11	$V_{CC}=2.0V$	170	-	-	ns		
			$V_{CC}=4.5V$	34	-	-	ns		
			$V_{CC}=6.0V$	29	-	-	ns		
		CEP, CET to CP; see Figure 12	$V_{CC}=2.0V$	250	-	-	ns		
			$V_{CC}=4.5V$	50	-	-	ns		
			$V_{CC}=6.0V$	43	-	-	ns		
hold time	$t_h$	Dn to CP; see Figure 11	$V_{CC}=2.0V$	0	-	-	ns		
			$V_{CC}=4.5V$	0	-	-	ns		
			$V_{CC}=6.0V$	0	-	-	ns		
		PE to CP; see Figure 11	$V_{CC}=2.0V$	0	-	-	ns		
			$V_{CC}=4.5V$	0	-	-	ns		
			$V_{CC}=6.0V$	0	-	-	ns		
		CEP, CET to CP; see Figure 12	$V_{CC}=2.0V$	0	-	-	ns		
			$V_{CC}=4.5V$	0	-	-	ns		
			$V_{CC}=6.0V$	0	-	-	ns		
		maximum frequency	$f_{max}$	CP; see Figure 8	$V_{CC}=2.0V$	4.8	-	-	MHz
					$V_{CC}=4.5V$	24	-	-	MHz
					$V_{CC}=6.0V$	28	-	-	MHz
<b>SN74HCT160</b>									
		CP to Qn; see Figure 8 <sup>[1]</sup>	$V_{CC}=4.5V$	-	-	54	ns		



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propagation delay	$t_{pd}$	CP to TC; see Figure 8	$V_{CC}=4.5V$	-	-	60	ns
		CET to TC; see Figure 9	$V_{CC}=4.5V$	-	-	44	ns
High to LOW propagation delay	$t_{PHL}$	MR to Qn; see Figure 10	$V_{CC}=4.5V$	-	-	63	ns
		MR to TC; see Figure 10	$V_{CC}=4.5V$	-	-	63	ns
transition time	$t_t$	$V_{CC}=4.5V$ ; see Figure 8, 9 <sup>[2]</sup>		-	-	19	ns
pulse width	$t_w$	CP HIGH or LOW; $V_{CC}=4.5V$ ; see Figure 8		20	-	-	ns
		MR LOW; $V_{CC}=4.5V$ ; see Figure 10		25	-	-	ns
recovery time	$t_{rec}$	MR to CP; $V_{CC}=4.5V$ ; see Figure 10		25	-	-	ns
set-up time	$t_{su}$	Dn to CP; $V_{CC}=4.5V$ ; see Figure 11		25	-	-	ns
		PE to CP; $V_{CC}=4.5V$ ; see Figure 11		44	-	-	ns
		CEP, CET to CP; $V_{CC}=4.5V$ ; see Figure 12		63	-	-	ns
hold time	$t_h$	Dn to CP; $V_{CC}=4.5V$ ; see Figure 11		0	-	-	ns
		PE to CP; $V_{CC}=4.5V$ ; see Figure 11		0	-	-	ns
		CEP, CET to CP; $V_{CC}=4.5V$ ; see Figure 12		0	-	-	ns
maximum frequency	$f_{max}$	CP; see Figure 8	$V_{CC}=4.5V$	13	-	-	MHz

Note:

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

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

### 3.3.6 AC Characteristics 3

( $T_{amb}=-40^{\circ}C$  to  $+105^{\circ}C$ , GND=0V;  $t_r=t_f=6ns$ ;  $C_L=50pF$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC160</b>							
propagation delay	$t_{pd}$	CP to Qn; see Figure 8 <sup>[1]</sup>	$V_{CC}=2.0V$	-	-	280	ns
			$V_{CC}=4.5V$	-	-	56	ns
			$V_{CC}=6.0V$	-	-	48	ns
		CP to TC; see Figure 8	$V_{CC}=2.0V$	-	-	325	ns
			$V_{CC}=4.5V$	-	-	65	ns
			$V_{CC}=6.0V$	-	-	55	ns
		CET to TC; see Figure 9	$V_{CC}=2.0V$	-	-	225	ns
			$V_{CC}=4.5V$	-	-	45	ns
			$V_{CC}=6.0V$	-	-	38	ns
High to LOW propagation delay	$t_{PHL}$	MR to Qn; see Figure 10	$V_{CC}=2.0V$	-	-	315	ns
			$V_{CC}=4.5V$	-	-	63	ns
			$V_{CC}=6.0V$	-	-	54	ns
		MR to TC; see Figure 10	$V_{CC}=2.0V$	-	-	330	ns
			$V_{CC}=4.5V$	-	-	66	ns
			$V_{CC}=6.0V$	-	-	56	ns



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transition time	$t_t$	see Figure 8 and Figure 9 <sup>[2]</sup>	$V_{CC}=2.0V$	-	-	110	ns
			$V_{CC}=4.5V$	-	-	22	ns
			$V_{CC}=6.0V$	-	-	19	ns
pulse width	$t_w$	CP HIGH or LOW; see Figure 8	$V_{CC}=2.0V$	120	-	-	ns
			$V_{CC}=4.5V$	24	-	-	ns
			$V_{CC}=6.0V$	20	-	-	ns
		MR LOW; see Figure 10	$V_{CC}=2.0V$	120	-	-	ns
			$V_{CC}=4.5V$	24	-	-	ns
			$V_{CC}=6.0V$	20	-	-	ns
recovery time	$t_{rec}$	MR to CP; see Figure 10	$V_{CC}=2.0V$	150	-	-	ns
			$V_{CC}=4.5V$	30	-	-	ns
			$V_{CC}=6.0V$	26	-	-	ns
set-up time	$t_{su}$	Dn to CP; see Figure 11	$V_{CC}=2.0V$	120	-	-	ns
			$V_{CC}=4.5V$	24	-	-	ns
			$V_{CC}=6.0V$	20	-	-	ns
		PE to CP; see Figure 11	$V_{CC}=2.0V$	205	-	-	ns
			$V_{CC}=4.5V$	41	-	-	ns
		CEP, CET to CP; see Figure 12	$V_{CC}=6.0V$	35	-	-	ns
			$V_{CC}=2.0V$	300	-	-	ns
			$V_{CC}=4.5V$	60	-	-	ns
			$V_{CC}=6.0V$	51	-	-	ns
hold time	$t_h$	Dn to CP; see Figure 11	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
		PE to CP; see Figure 11	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
		CEP, CET to CP; see Figure 12	$V_{CC}=2.0V$	0	-	-	ns
			$V_{CC}=4.5V$	0	-	-	ns
			$V_{CC}=6.0V$	0	-	-	ns
maximum frequency	$f_{max}$	CP; see Figure 8	$V_{CC}=2.0V$	4.0	-	-	MHz
			$V_{CC}=4.5V$	20	-	-	MHz
			$V_{CC}=6.0V$	24	-	-	MHz
<b>SN74HCT160</b>							
propagation delay	$t_{pd}$	CP to Qn; see Figure 8 <sup>[1]</sup>	$V_{CC}=4.5V$	-	-	65	ns
		CP to TC; see Figure 8	$V_{CC}=4.5V$	-	-	72	ns
		CET to TC; see Figure 9	$V_{CC}=4.5V$	-	-	53	ns
High to LOW propagation delay	$t_{PHL}$	MR to Qn; see Figure 10	$V_{CC}=4.5V$	-	-	75	ns
		MR to TC; see Figure 10	$V_{CC}=4.5V$	-	-	75	ns
transition time	$t_t$	$V_{CC}=4.5V$ ; see Figure 8, 9 <sup>[2]</sup>		-	-	22	ns





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pulse width	$t_w$	CP HIGH or LOW; $V_{CC}=4.5V$ ; see Figure 8	24	-	-	ns	
		MR LOW; $V_{CC}=4.5V$ ; see Figure 10	30	-	-	ns	
recovery time	$t_{rec}$	MR to CP; $V_{CC}=4.5V$ ; see Figure 10	30	-	-	ns	
set-up time	$t_{su}$	Dn to CP; $V_{CC}=4.5V$ ; see Figure 11	30	-	-	ns	
		PE to CP; $V_{CC}=4.5V$ ; see Figure 11	53	-	-	ns	
		CEP, CET to CP; $V_{CC}=4.5V$ ; see Figure 12	75	-	-	ns	
hold time	$t_h$	Dn to CP; $V_{CC}=4.5V$ ; see Figure 11	0	-	-	ns	
		PE to CP; $V_{CC}=4.5V$ ; see Figure 11	0	-	-	ns	
		CEP, CET to CP; $V_{CC}=4.5V$ ; see Figure 12	0	-	-	ns	
maximum frequency	$f_{max}$	CP; see Figure 8	$V_{CC}=4.5V$	11	-	-	MHz

Note:

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

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

## 4、Testing Circuit

### 4.1、AC Testing Circuit

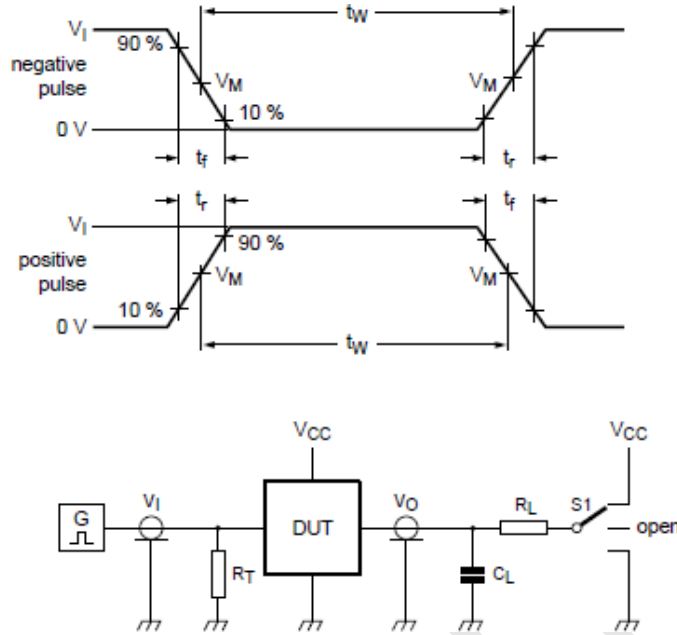


Figure 7. Test circuit for measuring switching times

Definitions for test circuit:

$C_L$ =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.

S1=Test selection switch

### 4.2、AC Testing Waveforms

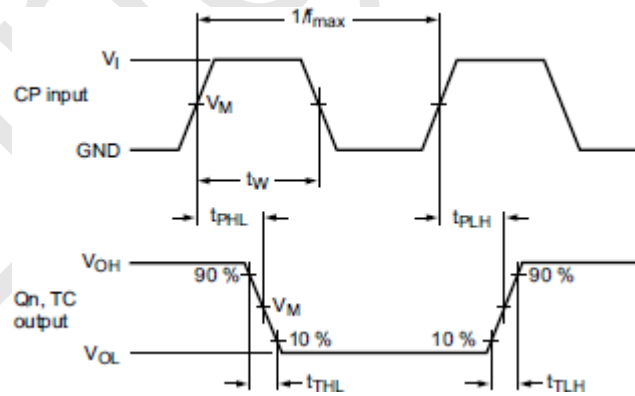


Figure 8. The clock (CP) to outputs (Qn, TC) propagation delays, pulse width, output transition times and maximum frequency

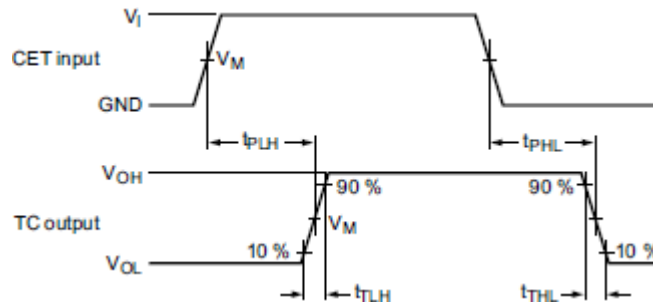


Figure 9. The count enable carry input (CET) to terminal count output (TC) propagation delays and output transition times

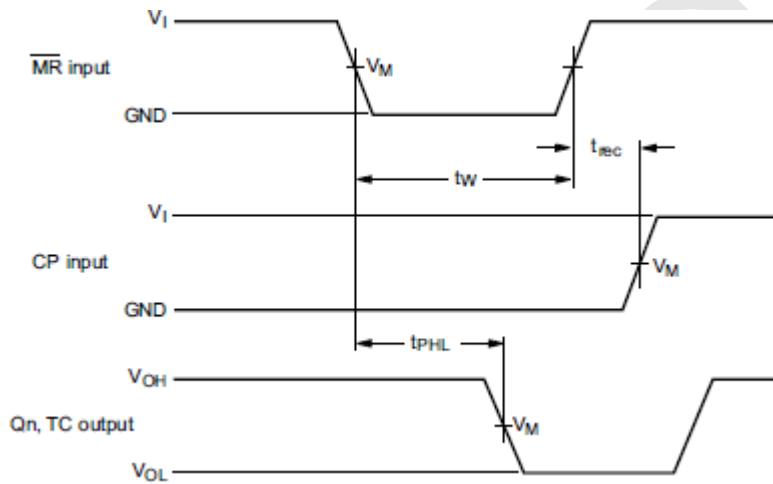


Figure 10. The master reset ( $\overline{\text{MR}}$ ) pulse width, master reset to output (Qn, TC) propagation delays, and the master reset to clock (CP) recovery times

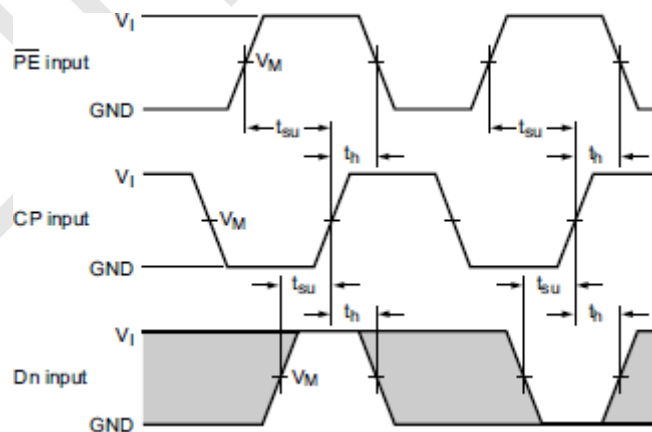


Figure 11. The data input (Dn) and parallel enable input ( $\overline{\text{PE}}$ ) set-up and hold times

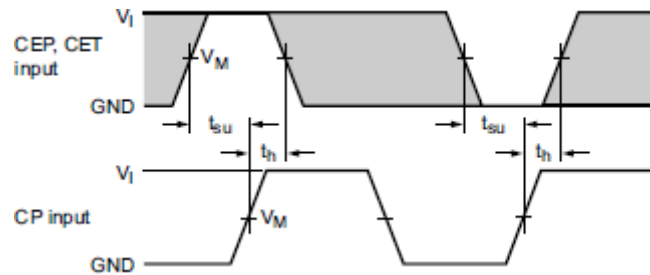


Figure 12. The count enable input (CEP) and count enable carry input (CET) set-up and hold times

### 4.3 、 Measurement Points

Type	Input		Output
	$V_I$	$V_M$	$V_M$
SN74HC160	GND to $V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
SN74HCT160	GND to 3V	1.3V	1.3V

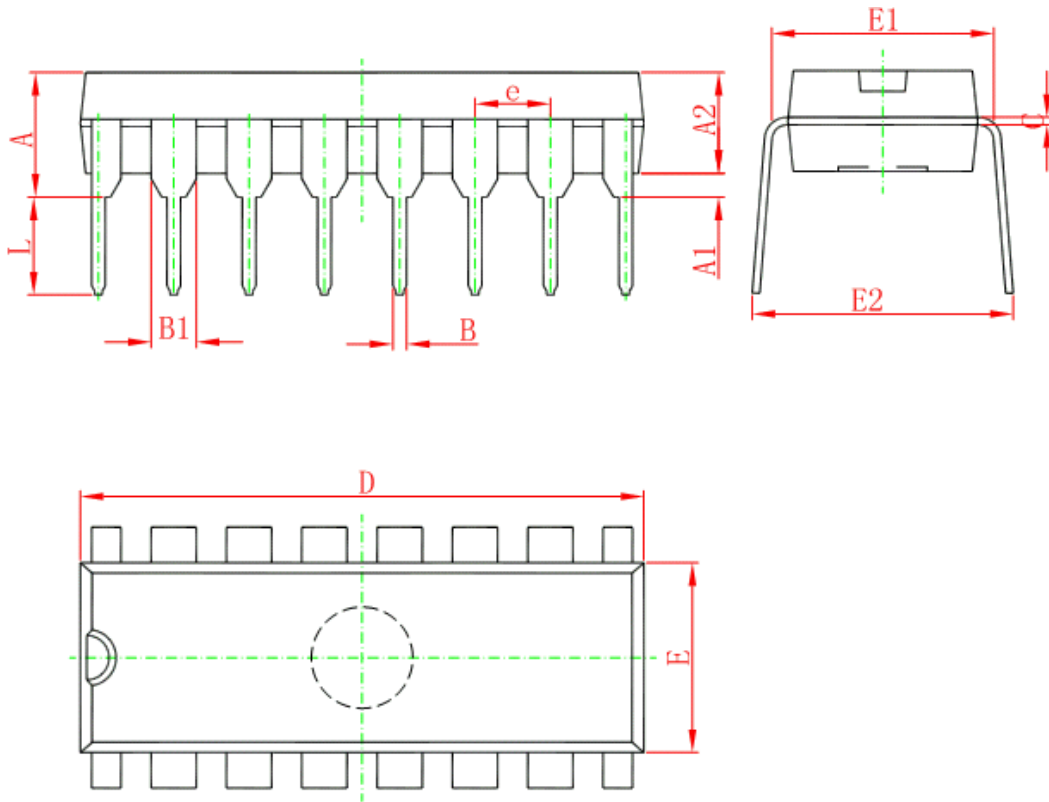
### 4.4 、 Test Data

Type	Input		Load		S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$
SN74HC160	$V_{CC}$	6ns	15pF, 50pF	1k $\Omega$	open
SN74HCT160	3V	6ns	15pF, 50pF	1k $\Omega$	open



## 5、Package Information

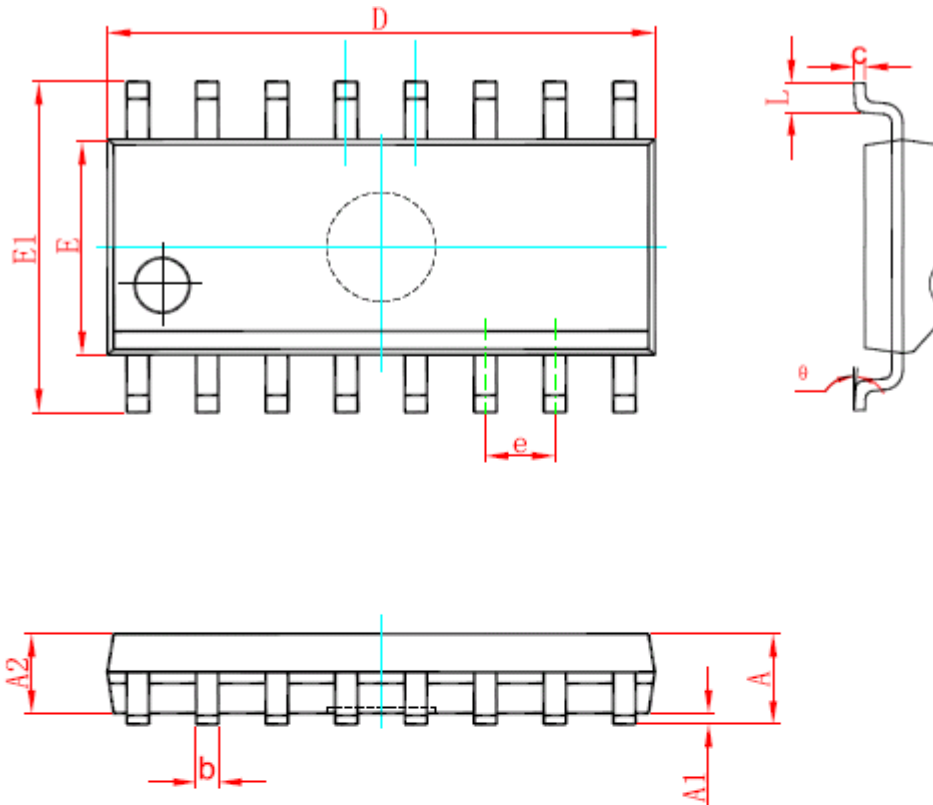
### 5.1、DIP16



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



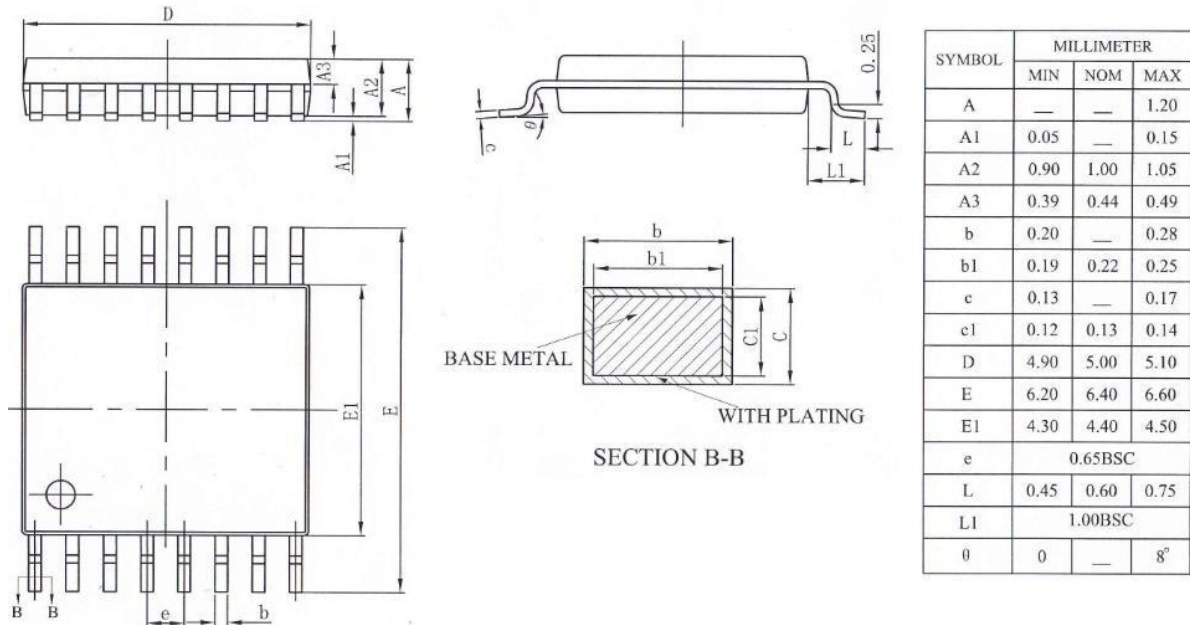
## 5.2、SOP16



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;

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;

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