



AiP74HC/HCT160

Presettable Synchronous BCD Decade Counter; Asynchronous Reset

Product Specification

Specification Revision History:

Version	Date	Description
2012-06-A1	2012-06	New
2023-04-B1	2023-04	Update the template



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1、 General Description

The AiP74HC/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:

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

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 AiP74HC160: CMOS level
 - For AiP74HCT160: TTL level
- Synchronous counting and loading
- 2 count enable inputs for n-bit cascading
- Asynchronous reset
- Positive-edge triggered clock
- 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
AiP74HC160DA16.TB	DIP16	74HC160	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HCT160DA16.TB	DIP16	74HCT160	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HC160SA16.TB	SOP16	74HC160	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP74HCT160SA16.TB	SOP16	74HCT160	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP74HC160TA16.TB	TSSOP16	74HC160	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
AiP74HCT160TA16.TB	TSSOP16	74HCT160	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
AiP74HC160SA16.TR	SOP16	74HC160	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HCT160SA16.TR	SOP16	74HCT160	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HC160TA16.TR	TSSOP16	74HC160	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm
AiP74HCT160TA16.TR	TSSOP16	74HCT160	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

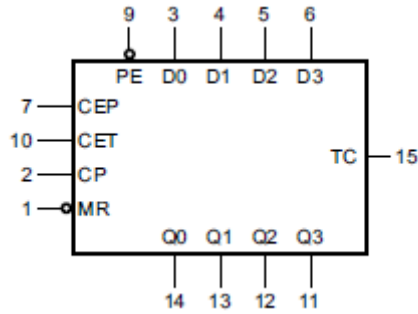


Figure 1. Logic symbol

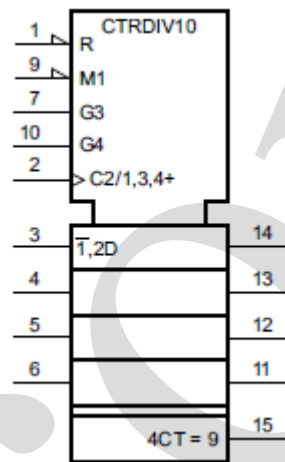


Figure 2. IEC logic symbol

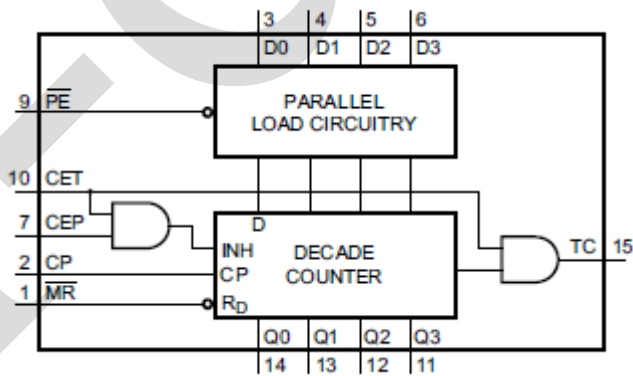


Figure 3. Functional diagram

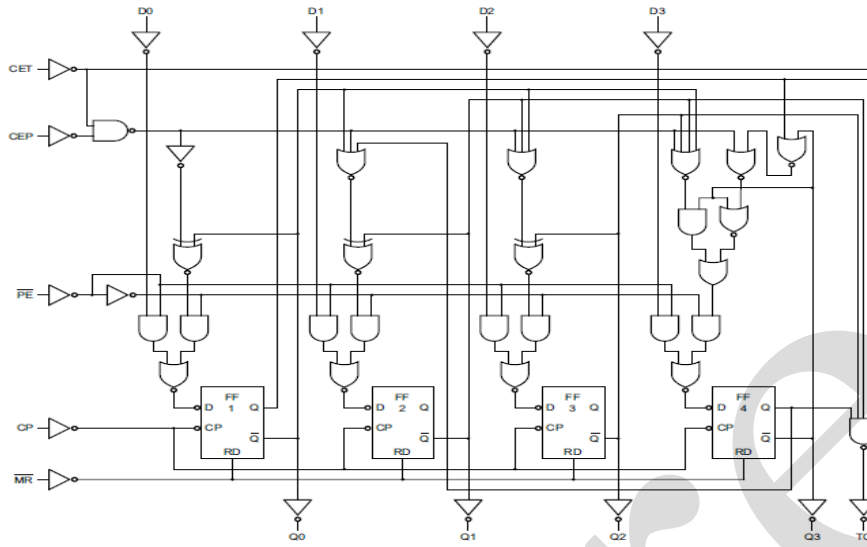


Figure 4. Logic diagram

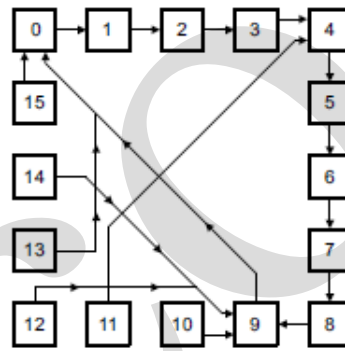


Figure 5. State diagram

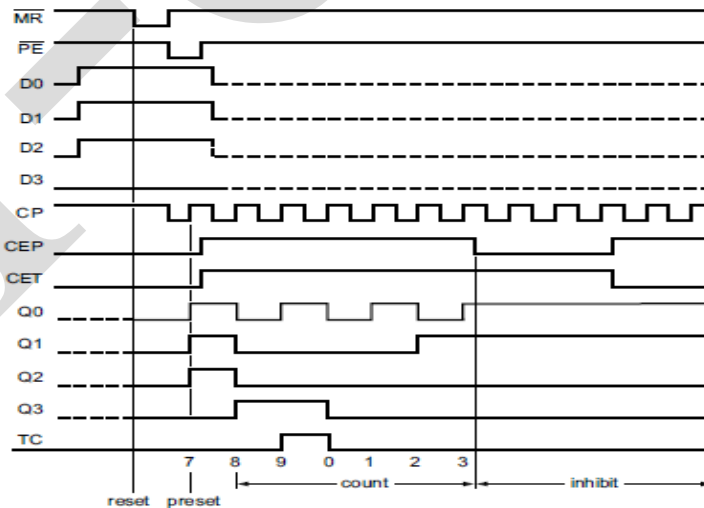
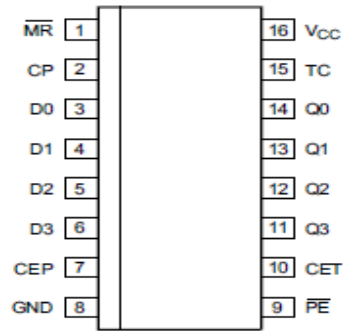


Figure 6. Typical timing sequence



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 _{CC}	supply voltage



2.4、Function Table

Operating mode	Input						Output	
	$\overline{\text{MR}}$	CP	CEP	CET	$\overline{\text{PE}}$	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 _n	[2]
	H	X	X	l	h	X	q _n	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_n=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 _{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 _O < -0.5V or V _O > 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
total power dissipation	P _{tot}	-	-	500	mW
soldering temperature	T _L	10s	DIP	245	°C
			SOP/TSSOP	260	



3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AiP74HC160						
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	-	+125	°C
AiP74HCT160						
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	-	+125	°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	
AiP74HC160							
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; $V_{CC}=6.0V$	-	-	± 1.0	μA	
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A; V_{CC}=6.0V$	-	-	8.0	μA	
input capacitance	C_I	-	-	3.5	-	pF	
AiP74HCT160							



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; $V_{CC}=5.5V$		-	-	± 1.0	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A; V_{CC}=5.5V$		-	-	8.0	μA
additional supply current	ΔI_{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	-	-	342	μA
			pin CP	-	-	396	μA
			pin CEP and Dn	-	-	90	μA
			pin CET	-	-	270	μA
			pin PE	-	-	108	μA
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	
AiP74HC160							
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
input leakage current	I_I	$V_I=V_{CC}$ or GND; $V_{CC}=6.0V$		-	-	± 1.0	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A; V_{CC}=6.0V$		-	-	80	μA
AiP74HCT160							
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; $V_{CC}=5.5V$		-	-	± 1.0	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A$; $V_{CC}=5.5V$		-	-	80	μA
additional supply current	ΔI_{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}	-	-	427.5	μA
			pin CP	-	-	495	μA
			pin CEP and Dn	-	-	112.5	μA
			pin CET	-	-	337.5	μA
			pin \overline{PE}	-	-	135	μA

3.3.3、DC Characteristics 3

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
AiP74HC160							
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; $V_{CC}=6.0V$		-	-	± 1.0	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A$; $V_{CC}=6.0V$		-	-	160	μA
AiP74HCT160							
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; $V_{CC}=5.5V$		-	-	± 1.0	μA
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0A$; $V_{CC}=5.5V$		-	-	160	μA
additional supply current	ΔI_{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}	-	-	465.5	μA
			pin CP	-	-	539	μA
			pin CEP and Dn	-	-	122.5	μA
			pin CET	-	-	367.5	μA
			pin PE	-	-	147	μA

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			
AiP74HC160									
propagation delay	t_{pd}	CP to Qn; see Figure 8 ^[1]	$V_{CC}=2.0V$	-	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	$V_{CC}=6.0V$	-	18	31	ns		
			$V_{CC}=2.0V$	-	69	215	ns		
			$V_{CC}=4.5V$	-	25	43	ns		
			$V_{CC}=5.0V$; $C_L=15pF$	-	21	-	ns		
			$V_{CC}=6.0V$	-	20	31	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}	\overline{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		
$V_{CC}=6.0V$	-				20	36	ns		
\overline{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		
	$V_{CC}=6.0V$			-	20	37	ns		
transition time	t_t			see Figure 8 and Figure 9 ^[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			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		
		\overline{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}	\overline{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
		\overline{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
		\overline{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}	$f_i=1MHz; V_I=GND \text{ to } V_{CC}^{[3]}$	-	39	-	pF	
AiP74HCT160							
propagation delay	t_{pd}	CP to Qn; see Figure 8 ^[1]	$V_{CC}=4.5V$	-	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
High to LOW propagation delay	t_{PHL}	\overline{MR} to Qn; see Figure 10	$V_{CC}=4.5V$	-	27	50	ns
			$V_{CC}=5.0V; C_L=15pF$	-	23	-	ns
		\overline{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 ^[2]		-	7	15	ns
pulse width	t_w	CP HIGH or LOW; $V_{CC}=4.5V$; see Figure 8		16	8	-	ns
		\overline{MR} LOW; $V_{CC}=4.5V$; see Figure 10		20	11	-	ns
recovery time	t_{rec}	\overline{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
		\overline{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
		\overline{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 $V_{CC}-1.5V^{[3]}$		-	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).

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

 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°C to +85°C, GND=0V; $t_r=t_f=6ns$; $C_L=50pF$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
AiP74HC160							
propagation delay	t_{pd}	CP to Qn; see Figure 8 ^[1]	$V_{CC}=2.0V$	-	-	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; see Figure 9	$V_{CC}=2.0V$	-	-	190	ns
			$V_{CC}=4.5V$	-	-	38	ns
			$V_{CC}=6.0V$	-	-	33	ns
High to LOW propagation delay	t_{PHL}	\overline{MR} to Qn; see Figure 10	$V_{CC}=2.0V$	-	-	265	ns
			$V_{CC}=4.5V$	-	-	53	ns
			$V_{CC}=6.0V$	-	-	45	ns
		\overline{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 ^[2]	$V_{CC}=2.0V$	-	-	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



		$\overline{\text{MR}}$ 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}	$\overline{\text{MR}}$ 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
		$\overline{\text{PE}}$ 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
		$\overline{\text{PE}}$ 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
AiP74HCT160							
propagation delay	t_{pd}	CP to Qn; see Figure 8 ^[1]	$V_{CC}=4.5V$	-	-	54	ns
		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}	$\overline{\text{MR}}$ to Qn; see Figure 10	$V_{CC}=4.5V$	-	-	63	ns
		$\overline{\text{MR}}$ to TC; see Figure 10	$V_{CC}=4.5V$	-	-	63	ns
transition time	t_t	$V_{CC}=4.5V$; see Figure 8, 9 ^[2]		-	-	19	ns
pulse width	t_w	CP HIGH or LOW; $V_{CC}=4.5V$; see Figure 8		20	-	-	ns
		$\overline{\text{MR}}$ LOW; $V_{CC}=4.5V$; see Figure 10		25	-	-	ns
recovery time	t_{rec}	$\overline{\text{MR}}$ 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
		$\overline{\text{PE}}$ 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
		\bar{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 $+125^{\circ}C$, $GND=0V$; $t_r=t_f=6ns$; $C_L=50pF$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
AiP74HC160							
propagation delay	t_{pd}	CP to Qn; see Figure 8 ^[1]	$V_{CC}=2.0V$	-	-	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}	\bar{MR} to Qn; see Figure 10	$V_{CC}=2.0V$	-	-	315	ns
			$V_{CC}=4.5V$	-	-	63	ns
			$V_{CC}=6.0V$	-	-	54	ns
		\bar{MR} to TC; see Figure 10	$V_{CC}=2.0V$	-	-	330	ns
			$V_{CC}=4.5V$	-	-	66	ns
			$V_{CC}=6.0V$	-	-	56	ns
transition time	t_t	see Figure 8 and Figure 9 ^[2]	$V_{CC}=2.0V$	-	-	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
		\bar{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}	\bar{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
		\bar{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		
		\overline{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
AiP74HCT160									
propagation delay	t_{pd}	CP to Qn; see Figure 8 ^[1]	$V_{CC}=4.5V$	-	-	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}	\overline{MR} to Qn; see Figure 10	$V_{CC}=4.5V$	-	-	75	ns		
		\overline{MR} to TC; see Figure 10	$V_{CC}=4.5V$	-	-	75	ns		
transition time	t_t	$V_{CC}=4.5V$; see Figure 8, 9 ^[2]		-	-	22	ns		
pulse width	t_w	CP HIGH or LOW; $V_{CC}=4.5V$; see Figure 8		24	-	-	ns		
		\overline{MR} LOW; $V_{CC}=4.5V$; see Figure 10		30	-	-	ns		
recovery time	t_{rec}	\overline{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		
		\overline{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		
		\overline{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

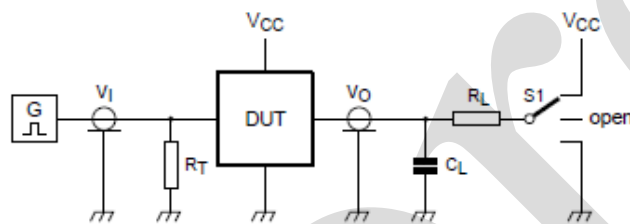
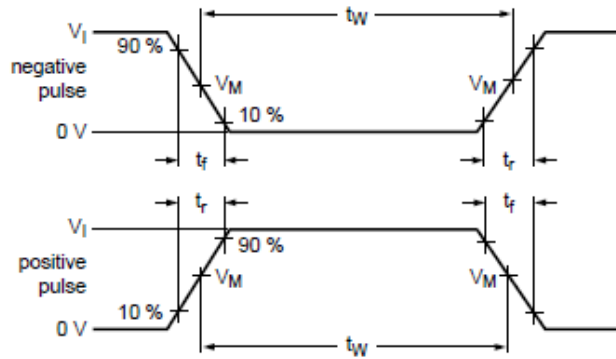


Figure 7. Test circuit for measuring switching times

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

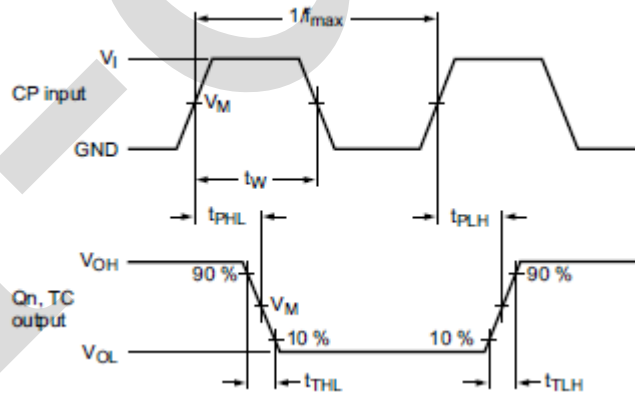


Figure 8. The clock (CP) to outputs (Qn, TC) propagation delays, pulse width, output transition times and maximum frequency

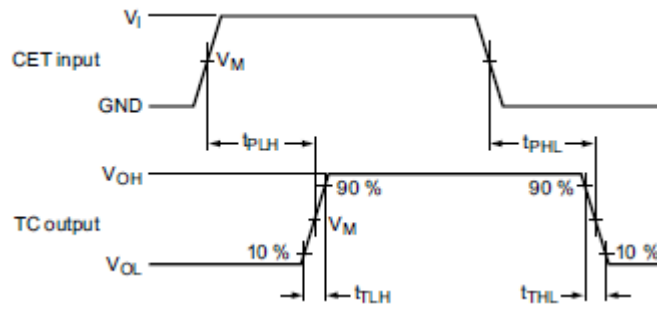


Figure 9. The count enable carry input (CET) to terminal count output (TC) propagation delays and output transition times

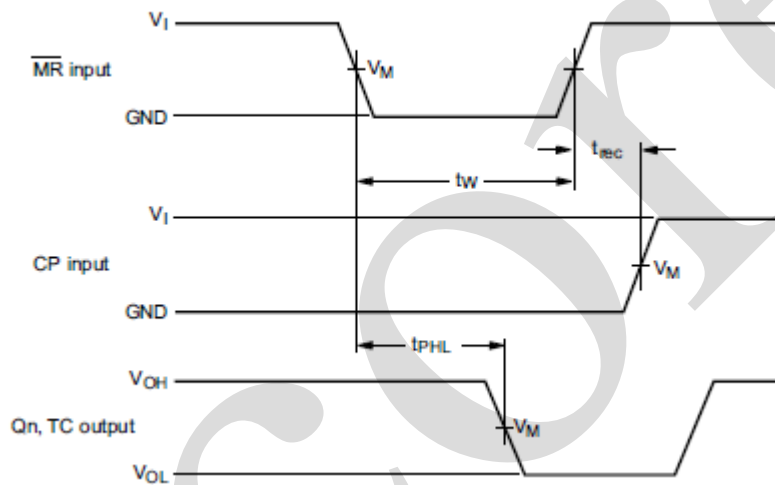


Figure 10. The master reset (MR) pulse width, master reset to output (Qn, TC) propagation delays, and the master reset to clock (CP) recovery times

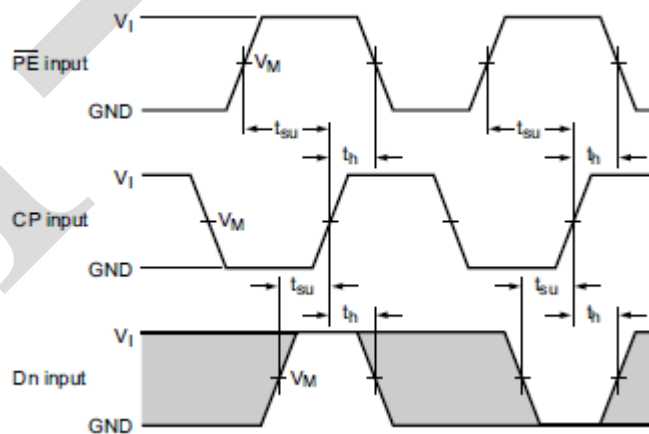


Figure 11. The data input (Dn) and parallel enable input (PE) set-up and hold times

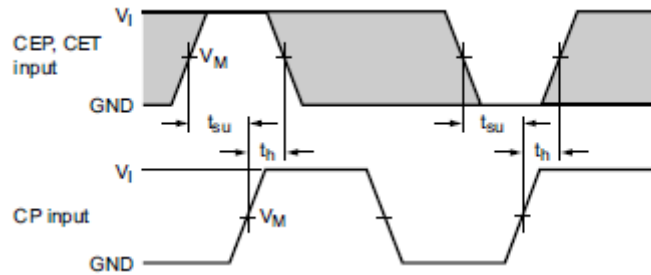


Figure 12. The count enable input (CEP) and count enable carry input (CET) set-up and hold times

4.3、 Measurement Points

Type	Input		Output
	V_I	V_M	V_M
AiP74HC160	GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
AiP74HCT160	GND to 3V	1.3V	1.3V

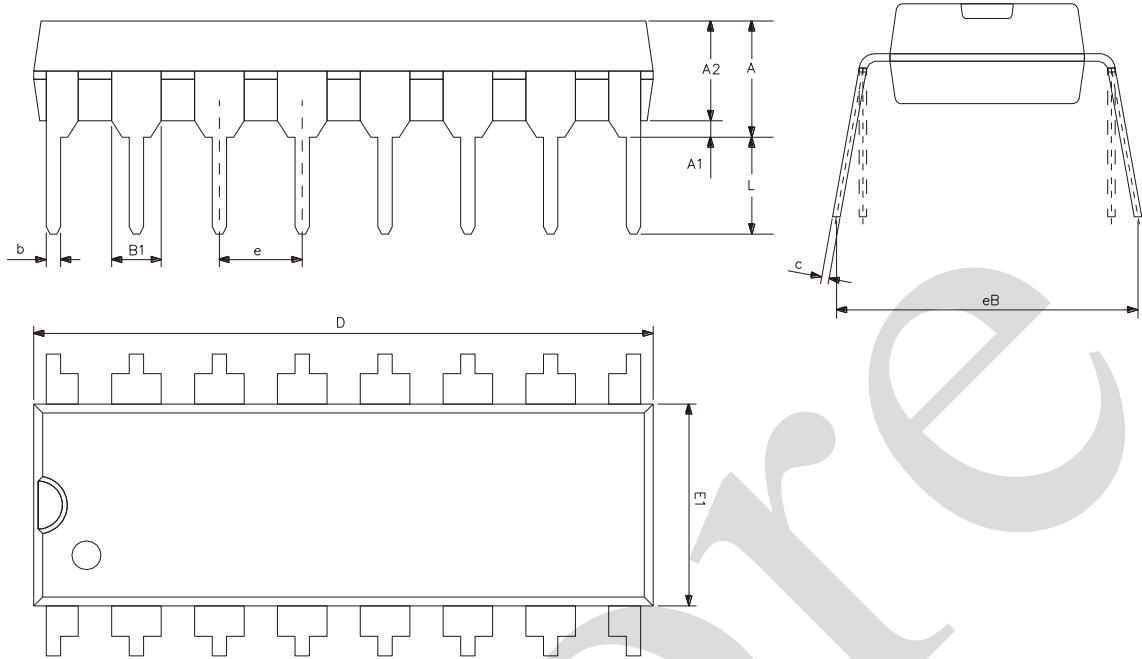
4.4、 Test Data

Type	Input		Load		S1 position
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}
AiP74HC160	V_{CC}	6ns	15pF, 50pF	1k Ω	open
AiP74HCT160	3V	6ns	15pF, 50pF	1k Ω	open



5、Package Information

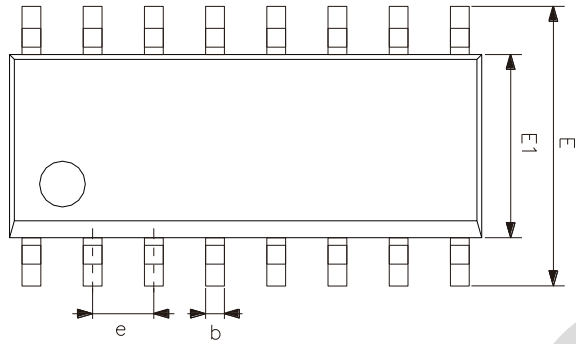
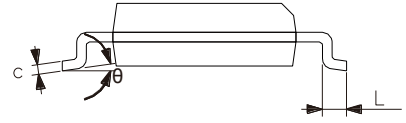
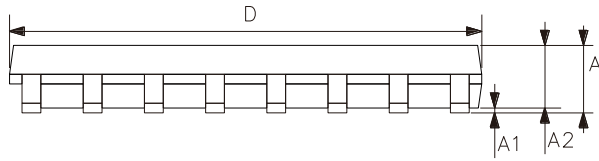
5.1、DIP16



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



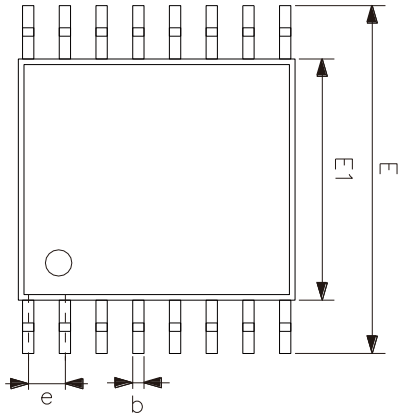
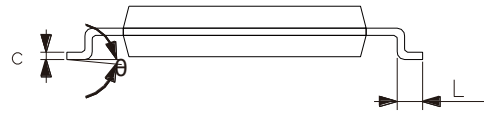
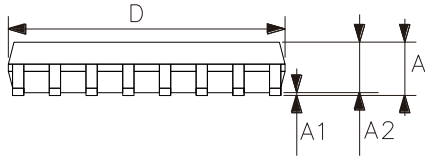
5.2、SOP16



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

We Recommend you to read this chapter carefully before using this product.

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