



# AiP74HC/HCT165

## 8-bit Parallel-in, Serial out Shift Register

### Product Specification

**Specification Revision History:**

Version	Date	Description
2019-07-A1	2019-07	New



## 1、 General Description

The AiP74HC/HCT165 is 8-bit serial or parallel-in/serial-out shift registers. The device features a serial data input (DS), eight parallel data inputs (D0 to D7) and two complementary serial outputs (Q7 and  $\bar{Q}7$ ). When the parallel load input ( $\bar{PL}$ ) is LOW the data from D0 to D7 is loaded into the shift register asynchronously. When  $\bar{PL}$  is HIGH data enters the register serially at DS. When the clock enable input ( $\bar{CE}$ ) is LOW data is shifted on the LOW-to-HIGH transitions of the CP input. A HIGH on  $\bar{CE}$  will disable the CP input. Inputs are overvoltage tolerant to 15V. This enables the device to be used in HIGH-to-LOW level shifting applications.

### Features:

- Input levels:  
For AiP74HC165: CMOS level  
For AiP74HCT165: TTL level
- Asynchronous 8-bit parallel load
- Synchronous serial input
- Specified from -40°C to +85°C
- Packaging information: DIP16/SOP16/TSSOP16

**Ordering Information:****Tube packing specifications:**

Type number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Packing box number	Packing quantity	Notes
AiP74HC165DA.TB	DIP16	74HC165	25 PCS/tube	40 tube/box	1000 PCS/box	10 box/pack	10000 PCS/pack	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HCT165DA.TB	DIP16	74HCT165	25 PCS/tube	40 tube/box	1000 PCS/box	10 box/pack	10000 PCS/pack	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HC165SA.TB	SOP16	74HC165	50 PCS/tube	200 tube/box	10000 PCS/box	5 box/pack	50000 PCS/pack	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP74HCT165SA.TB	SOP16	74HCT165	50 PCS/tube	200 tube/box	10000 PCS/box	5 box/pack	50000 PCS/pack	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP74HC165TA.TB	TSSOP16	74HC165	96 PCS/tube	120 tube/box	19200 PCS/box	10 box/pack	192000 PCS/pack	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
AiP74HCT165TA.TB	TSSOP16	74HCT165	96 PCS/tube	120 tube/box	19200 PCS/box	10 box/pack	192000 PCS/pack	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

**Reel packing specifications:**

Type number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Packing quantity	Notes
AiP74HC165SA.TR	SOP16(1)	74HC165	2500 PCS/reel	5000 PCS/box	20000 PCS/pack	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HCT165SA.TR	SOP16(1)	74HCT165	2500 PCS/reel	5000 PCS/box	20000 PCS/pack	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HC165SA.TR	SOP16(2)	74HC165	2500 PCS/reel	2500 PCS/box	40000 PCS/pack	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HCT165SA.TR	SOP16(2)	74HCT165	2500 PCS/reel	2500 PCS/box	40000 PCS/pack	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HC165TA.TR	TSSOP16	74HC165	2500 PCS/reel	5000 PCS/box	40000 PCS/pack	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm
AiP74HCT165TA.TR	TSSOP16	74HCT165	2500 PCS/reel	5000 PCS/box	40000 PCS/pack	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

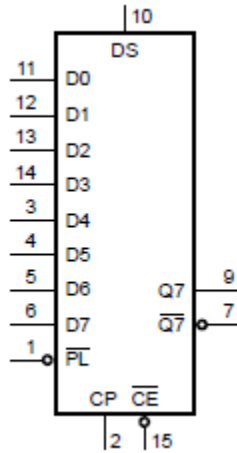


Figure 1. Logic symbol

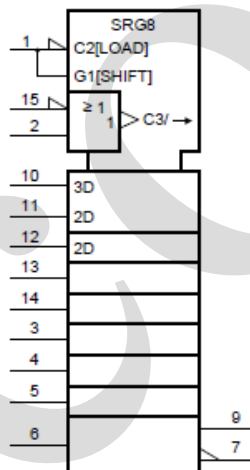


Figure 2. IEC logic symbol

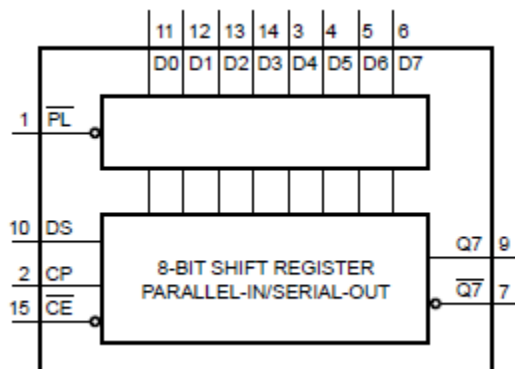


Figure 3. Functional diagram

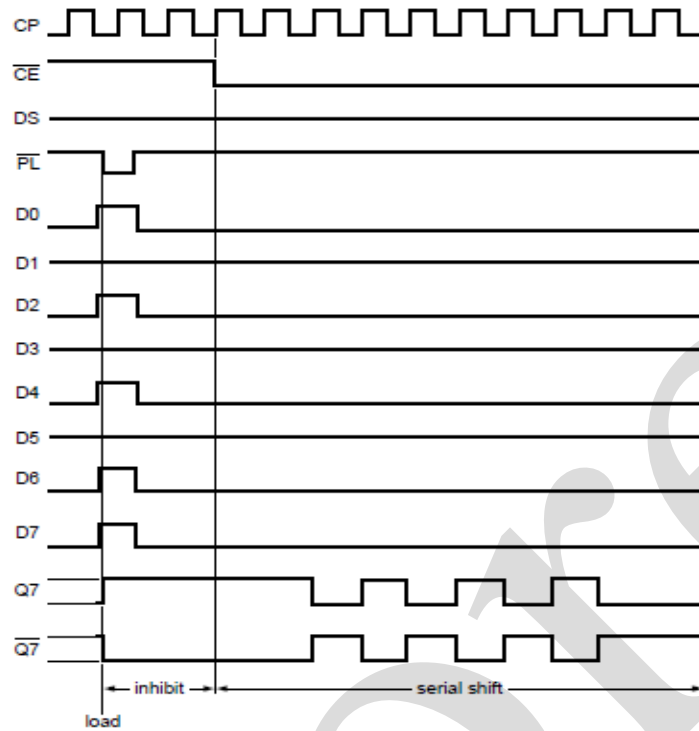
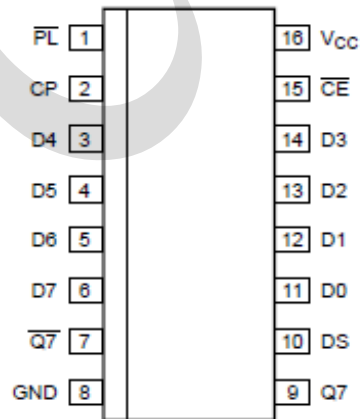


Figure 4. Timing diagram

## 2.2. Pin Configurations





## 2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{PL}$	asynchronous parallel load input (active LOW)
2	CP	clock input (LOW-to-HIGH, edge-triggered)
3	D4	parallel data input (also referred to as Dn)
4	D5	parallel data input (also referred to as Dn)
5	D6	parallel data input (also referred to as Dn)
6	D7	parallel data input (also referred to as Dn)
7	$\overline{Q7}$	complementary output from the last stage
8	GND	ground (0V)
9	Q7	serial output from the last stage
10	DS	serial data input
11	D0	parallel data input (also referred to as Dn)
12	D1	parallel data input (also referred to as Dn)
13	D2	parallel data input (also referred to as Dn)
14	D3	parallel data input (also referred to as Dn)
15	$\overline{CE}$	clock enable input (active LOW)
16	V <sub>CC</sub>	supply voltage

## 2.4、Function Table

Operating mode	Input					Qn register		Output	
	$\overline{PL}$	$\overline{CE}$	CP	DS	D0 to D7	Q0	Q1 to Q6	Q7	$\overline{Q7}$
parallel load	L	X	X	X	L	L	L to L	L	H
	L	X	X	X	H	H	H to H	H	L
serial shift	H	L	↑	l	X	L	q0 to q5	q6	$\overline{q6}$
	H	L	↑	h	X	H	q0 to q5	q6	$\overline{q6}$
	H	↑	L	l	X	L	q0 to q5	q6	$\overline{q6}$
	H	↑	L	h	X	H	q0 to q5	q6	$\overline{q6}$
hold "do nothing"	H	H	X	X	X	q0	q1 to q6	q7	$\overline{q7}$
	H	X	H	X	X	q0	q1 to q6	q7	$\overline{q7}$

Note: H=HIGH voltage level;

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

L=LOW voltage level; ↑=LOW-to-HIGH clock transition;

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

q=state of the referenced output one set-up time prior to the LOW-to-HIGH clock transition;

X=don't care;

↑=LOW-to-HIGH clock transition.



## 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	V
input clamping current	$I_{IK}$	$V_I < -0.5V$ or $V_I > V_{CC}+0.5V$	-	$\pm 20$	mA
output clamping current	$I_{OK}$	$V_O < -0.5V$ or $V_O > V_{CC}+0.5V$	-	$\pm 20$	mA
output current	$I_O$	$-0.5V < V_O < V_{CC}+0.5V$	-	$\pm 25$	mA
supply current	$I_{CC}$	-	-	50	mA
ground current	$I_{GND}$	-	-50	-	mA
total power dissipation	$P_{tot}$	-	-	500	mW
storage temperature	$T_{stg}$	-	-65	+150	$^{\circ}C$
soldering temperature	$T_L$	10s	DIP	245	$^{\circ}C$
			SOP	250	$^{\circ}C$

Note:

[1] For DIP16 packages: above  $70^{\circ}C$  the value of  $P_{tot}$  derates linearly with 12mW/K.

[2] For SOP16 packages: above  $70^{\circ}C$  the value of  $P_{tot}$  derates linearly with 8mW/K.

[3] For (T)SSOP16 packages: above  $60^{\circ}C$  the value of  $P_{tot}$  derates linearly with 5.5mW/K.

### 3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AiP74HC165						
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	-	+85	$^{\circ}C$
AiP74HCT165						
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	$\Delta t/\Delta V$	$V_{CC}=2.0V$	-	-	-	ns/V
		$V_{CC}=4.5V$	-	1.67	139	ns/V
		$V_{CC}=6.0V$	-	-	-	ns/V
ambient temperature	$T_{amb}$	-	-40	-	+85	$^{\circ}C$





### 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	
AiP74HC165							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=2.0\text{V}$	1.5	1.2	-	V	
		$V_{CC}=4.5\text{V}$	3.15	2.4	-	V	
		$V_{CC}=6.0\text{V}$	4.2	3.2	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=2.0\text{V}$	-	0.8	0.5	V	
		$V_{CC}=4.5\text{V}$	-	2.1	1.35	V	
		$V_{CC}=6.0\text{V}$	-	2.8	1.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O=-20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	2.0	-	V
			$I_O=-20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	4.5	-	V
			$I_O=-20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	6.0	-	V
			$I_O=-4.0\text{mA}; V_{CC}=4.5\text{V}$	3.98	4.32	-	V
			$I_O=-5.2\text{mA}; V_{CC}=6.0\text{V}$	5.48	5.81	-	V
LOW-level output voltage	$V_{OL}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O=20\mu\text{A}; V_{CC}=2.0\text{V}$	-	0	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=4.5\text{V}$	-	0	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=6.0\text{V}$	-	0	0.1	V
			$I_O=4.0\text{mA}; V_{CC}=4.5\text{V}$	-	0.15	0.26	V
			$I_O=5.2\text{mA}; V_{CC}=6.0\text{V}$	-	0.16	0.26	V
input leakage current	$I_I$	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC}=6.0\text{V}$	-	-	$\pm 0.1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC} \text{ or } \text{GND}; I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	8	$\mu\text{A}$	
input capacitance	$C_I$	-	-	3.5	-	pF	
AiP74HCT165							
HIGH-level input voltage	$V_{IH}$	$V_{CC}=4.5\text{V to } 5.5\text{V}$	2.0	1.6	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC}=4.5\text{V to } 5.5\text{V}$	-	1.2	0.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC}=4.5\text{V}$	$I_O=-20\mu\text{A}$	4.4	4.5	-	V
			$I_O=-4.0\text{mA}$	3.98	4.32	-	V
LOW-level output voltage	$V_{OL}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O=20\mu\text{A}; V_{CC}=4.5\text{V}$	-	0	0.1	V
			$I_O=5.2\text{mA}; V_{CC}=6.0\text{V}$	-	0.16	0.26	V
input leakage current	$I_I$	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC}=6.0\text{V}$	-	-	$\pm 0.1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC} \text{ or } \text{GND}; I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	8.0	$\mu\text{A}$	
additional supply current	$\Delta I_{CC}$	per input pin; $V_I = V_{CC}-2.1\text{V};$ other inputs at $V_{CC}$ or GND; $V_{CC}=4.5\text{V to } 5.5\text{V}$	Dn and DS inputs	-	35	126	$\mu\text{A}$
			CP, $\bar{C}\bar{E}$ , and $\bar{P}\bar{L}$ inputs	-	65	234	$\mu\text{A}$
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	
AiP74HC165							
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	$V_{OH}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = -20\mu\text{A}; V_{CC} = 2.0\text{V}$	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	$V_{OL}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = 20\mu\text{A}; V_{CC} = 2.0\text{V}$	-	-	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	$I_I$	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC} = 6.0\text{V}$	-	-	$\pm 1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC} \text{ or } \text{GND}; I_O = 0\text{A}; V_{CC} = 6.0\text{V}$	-	-	80	$\mu\text{A}$	
AiP74HCT165							
HIGH-level input voltage	$V_{IH}$	$V_{CC} = 4.5\text{V to } 5.5\text{V}$	2.0	-	-	V	
LOW-level input voltage	$V_{IL}$	$V_{CC} = 4.5\text{V to } 5.5\text{V}$	-	-	0.8	V	
HIGH-level output voltage	$V_{OH}$	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5\text{V}$	$I_O = -20\mu\text{A}$	4.4	-	-	V
			$I_O = -4.0\text{mA}$	3.84	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = 20\mu\text{A}; V_{CC} = 4.5\text{V}$	-	-	0.1	V
			$I_O = 5.2\text{mA}; V_{CC} = 6.0\text{V}$	-	-	0.33	V
input leakage current	$I_I$	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC} = 6.0\text{V}$	-	-	$\pm 1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC} \text{ or } \text{GND}; I_O = 0\text{A}; V_{CC} = 6.0\text{V}$	-	-	80	$\mu\text{A}$	
additional supply current	$\Delta I_{CC}$	per input pin; $V_I = V_{CC} - 2.1\text{V};$ other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5\text{V to } 5.5\text{V}$	Dn and DS inputs	-	-	157.5	$\mu\text{A}$
			CP, $\bar{C}\bar{E}$ , and $\bar{P}\bar{L}$ inputs	-	-	292.5	$\mu\text{A}$



### 3.3.3、AC Characteristics 1

( $T_{amb}=25^{\circ}\text{C}$ ,  $\text{GND}=0\text{V}$ ,  $C_L=50\text{pf}$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit			
AiP74HC165									
propagation delay	$t_{pd}$	CP, $\overline{\text{CE}}$ to Q7, $\overline{\text{Q7}}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	52	165	ns		
			$V_{CC}=4.5\text{V}$	-	19	33	ns		
			$V_{CC}=5.0\text{V}; C_L=15\text{pF}$	-	16	-	ns		
				$\overline{\text{PL}}$ to Q7, $\overline{\text{Q7}}$ ; see Figure 7	$V_{CC}=2.0\text{V}$	-	50	165	ns
					$V_{CC}=4.5\text{V}$	-	18	33	ns
					$V_{CC}=5.0\text{V}; C_L=15\text{pF}$	-	15	-	ns
				D7 to Q7, $\overline{\text{Q7}}$ ; see Figure 8	$V_{CC}=2.0\text{V}$	-	36	120	ns
					$V_{CC}=4.5\text{V}$	-	13	24	ns
					$V_{CC}=5.0\text{V}; C_L=15\text{pF}$	-	11	-	ns
		transition time	$t_t$	Q7, $\overline{\text{Q7}}$ output; see Figure 6	$V_{CC}=2.0\text{V}$	-	19	75	ns
					$V_{CC}=4.5\text{V}$	-	7	15	ns
					$V_{CC}=6.0\text{V}$	-	6	13	ns
pulse width	$t_w$	CP input HIGH or LOW; see Figure 6	$V_{CC}=2.0\text{V}$	80	17	-	ns		
			$V_{CC}=4.5\text{V}$	16	6	-	ns		
			$V_{CC}=6.0\text{V}$	14	5	-	ns		
		$\overline{\text{PL}}$ input LOW; see Figure 7	$V_{CC}=2.0\text{V}$	80	14	-	ns		
			$V_{CC}=4.5\text{V}$	16	5	-	ns		
			$V_{CC}=6.0\text{V}$	14	4	-	ns		
recovery time	$t_{rec}$	$\overline{\text{PL}}$ to CP, $\overline{\text{CE}}$ ; see Figure 7	$V_{CC}=2.0\text{V}$	100	22	-	ns		
			$V_{CC}=4.5\text{V}$	20	8	-	ns		
			$V_{CC}=6.0\text{V}$	17	6	-	ns		
set-up time	$t_{su}$	DS to CP, $\overline{\text{CE}}$ ; see Figure 9	$V_{CC}=2.0\text{V}$	80	11	-	ns		
			$V_{CC}=4.5\text{V}$	16	4	-	ns		
			$V_{CC}=6.0\text{V}$	14	3	-	ns		
		$\overline{\text{CE}}$ to CP and CP to $\overline{\text{CE}}$ ; see Figure 9	$V_{CC}=2.0\text{V}$	80	17	-	ns		
			$V_{CC}=4.5\text{V}$	16	6	-	ns		
			$V_{CC}=6.0\text{V}$	14	5	-	ns		
		Dn to $\overline{\text{PL}}$ ; see Figure 10	$V_{CC}=2.0\text{V}$	80	22	-	ns		
			$V_{CC}=4.5\text{V}$	16	8	-	ns		
			$V_{CC}=6.0\text{V}$	14	6	-	ns		
hold time	$t_h$	DS to CP, $\overline{\text{CE}}$ and Dn to $\overline{\text{PL}}$ ; see Figure 9	$V_{CC}=2.0\text{V}$	5	2	-	ns		
			$V_{CC}=4.5\text{V}$	5	2	-	ns		
			$V_{CC}=6.0\text{V}$	5	2	-	ns		
		$\overline{\text{CE}}$ to CP and CP to $\overline{\text{CE}}$ ; see Figure 9	$V_{CC}=2.0\text{V}$	5	-17	-	ns		
			$V_{CC}=4.5\text{V}$	5	-6	-	ns		
			$V_{CC}=6.0\text{V}$	5	-5	-	ns		
maximum frequency	$f_{max}$	CP input; see Figure 6	$V_{CC}=2.0\text{V}$	6	17	-	MHz		
			$V_{CC}=4.5\text{V}$	30	51	-	MHz		



			$V_{CC}=5.0V; C_L=15pF$	-	56	-	MHz
			$V_{CC}=6.0V$	35	61	-	MHz
power dissipation capacitance	$C_{PD}$	per package; $V_I=GND$ to $V_{CC}$		-	35	-	pF
<b>AiP74HCT165</b>							
propagation delay	$t_{pd}$	CP, $\overline{CE}$ to Q7, $\overline{Q7}$ ; see Figure 6	$V_{CC}=4.5V$	-	17	34	ns
			$V_{CC}=5.0V; C_L=15pF$	-	14	-	ns
		$\overline{PL}$ to Q7, $\overline{Q7}$ ; see Figure 7	$V_{CC}=4.5V$	-	20	40	ns
			$V_{CC}=5.0V; C_L=15pF$	-	17	-	ns
		D7 to Q7, $\overline{Q7}$ ; see Figure 8	$V_{CC}=4.5V$	-	14	28	ns
$V_{CC}=5.0V; C_L=15pF$	-		11	-	ns		
transition time	$t_t$	Q7, $\overline{Q7}$ output; see Figure 6	$V_{CC}=4.5V$	-	7	15	ns
pulse width	$t_w$	CP input; see Figure 6	$V_{CC}=4.5V$	16	6	-	ns
		$\overline{PL}$ input; see Figure 7	$V_{CC}=4.5V$	20	9	-	ns
recovery time	$t_{rec}$	$\overline{PL}$ to CP, $\overline{CE}$ ; see Figure 7	$V_{CC}=4.5V$	20	8	-	ns
set-up time	$t_{su}$	DS to CP, $\overline{CE}$ ; see Figure 9	$V_{CC}=4.5V$	20	2	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Figure 9	$V_{CC}=4.5V$	20	7	-	ns
		Dn to $\overline{PL}$ ; see Figure 10	$V_{CC}=4.5V$	20	10	-	ns
hold time	$t_h$	DS to CP, $\overline{CE}$ and Dn to $\overline{PL}$ ; see Figure 9	$V_{CC}=4.5V$	7	-1	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Figure 9	$V_{CC}=4.5V$	0	-7	-	ns
maximum frequency	$f_{max}$	CP input; see Figure 6	$V_{CC}=4.5V$	26	44	-	MHz
			$V_{CC}=5.0V; C_L=15pF$	-	48	-	MHz
power dissipation capacitance	$C_{PD}$	per package; $V_I=GND$ to $V_{CC-1.5V}$		-	35	-	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).

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

$f_i$ =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;

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

### 3.3.4、 AC Characteristics 2

( $T_{amb}=-40^{\circ}C$  to  $+85^{\circ}C$ ,  $GND=0V$ ,  $C_L=50pf$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
AiP74HC165							
propagation delay	$t_{pd}$	CP, $\bar{C}E$ to Q7, $\bar{Q}7$ ; see Figure 6	$V_{CC}=2.0V$	-	-	205	ns
			$V_{CC}=4.5V$	-	-	41	ns
			$V_{CC}=6.0V$	-	-	35	ns
		$\bar{P}L$ to Q7, $\bar{Q}7$ ; see Figure 7	$V_{CC}=2.0V$	-	-	205	ns
			$V_{CC}=4.5V$	-	-	41	ns
			$V_{CC}=6.0V$	-	-	35	ns
		D7 to Q7, $\bar{Q}7$ ; see Figure 8	$V_{CC}=2.0V$	-	-	150	ns
			$V_{CC}=4.5V$	-	-	30	ns
			$V_{CC}=6.0V$	-	-	26	ns
transition time	$t_t$	Q7, $\bar{Q}7$ output; see Figure 6	$V_{CC}=2.0V$	-	-	95	ns
			$V_{CC}=4.5V$	-	-	19	ns
			$V_{CC}=6.0V$	-	-	16	ns
pulse width	$t_w$	CP input HIGH or LOW; see Figure 6	$V_{CC}=2.0V$	100	-	-	ns
			$V_{CC}=4.5V$	20	-	-	ns
			$V_{CC}=6.0V$	17	-	-	ns
		$\bar{P}L$ input LOW; see Figure 7	$V_{CC}=2.0V$	100	-	-	ns
			$V_{CC}=4.5V$	20	-	-	ns
			$V_{CC}=6.0V$	17	-	-	ns
recovery time	$t_{rec}$	$\bar{P}L$ to CP, $\bar{C}E$ ; see Figure 7	$V_{CC}=2.0V$	125	-	-	ns
			$V_{CC}=4.5V$	25	-	-	ns
			$V_{CC}=6.0V$	21	-	-	ns
set-up time	$t_{su}$	DS to CP, $\bar{C}E$ ; see Figure 9	$V_{CC}=2.0V$	100	-	-	ns
			$V_{CC}=4.5V$	20	-	-	ns
			$V_{CC}=6.0V$	17	-	-	ns
		$\bar{C}E$ to CP and CP to $\bar{C}E$ ; see Figure 9	$V_{CC}=2.0V$	100	-	-	ns
			$V_{CC}=4.5V$	20	-	-	ns
			$V_{CC}=6.0V$	17	-	-	ns
		Dn to $\bar{P}L$ ; see Figure 10	$V_{CC}=2.0V$	100	-	-	ns
			$V_{CC}=4.5V$	20	-	-	ns
			$V_{CC}=6.0V$	17	-	-	ns
hold time	$t_h$	DS to CP, $\bar{C}E$ and Dn to $\bar{P}L$ ; see Figure 9	$V_{CC}=2.0V$	5	-	-	ns
			$V_{CC}=4.5V$	5	-	-	ns
			$V_{CC}=6.0V$	5	-	-	ns
		$\bar{C}E$ to CP and CP to $\bar{C}E$ ; see Figure 9	$V_{CC}=2.0V$	5	-	-	ns
			$V_{CC}=4.5V$	5	-	-	ns
			$V_{CC}=6.0V$	5	-	-	ns



maximum frequency	f <sub>max</sub>	CP input; see Figure 6	V <sub>CC</sub> =2.0V	5	-	-	MHz
			V <sub>CC</sub> =4.5V	24	-	-	MHz
			V <sub>CC</sub> =6.0V	28	-	-	MHz
<b>AiP74HCT165</b>							
propagation delay	t <sub>pd</sub>	CP, $\overline{CE}$ to Q7, $\overline{Q7}$ ; see Figure 6	V <sub>CC</sub> =4.5V	-	-	43	ns
		$\overline{PL}$ to Q7, $\overline{Q7}$ ; see Figure 7	V <sub>CC</sub> =4.5V	-	-	50	ns
		D7 to Q7, $\overline{Q7}$ ; see Figure 8	V <sub>CC</sub> =4.5V	-	-	35	ns
transition time	t <sub>t</sub>	Q7, $\overline{Q7}$ output; see Figure 6	V <sub>CC</sub> =4.5V	-	-	19	ns
pulse width	t <sub>w</sub>	CP input; see Figure 6	V <sub>CC</sub> =4.5V	20	-	-	ns
		$\overline{PL}$ input; see Figure 7	V <sub>CC</sub> =4.5V	25	-	-	ns
recovery time	t <sub>rec</sub>	$\overline{PL}$ to CP, $\overline{CE}$ ; see Figure 7	V <sub>CC</sub> =4.5V	25	-	-	ns
set-up time	t <sub>su</sub>	DS to CP, $\overline{CE}$ ; see Figure 9	V <sub>CC</sub> =4.5V	25	-	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Figure 9	V <sub>CC</sub> =4.5V	25	-	-	ns
		Dn to $\overline{PL}$ ; see Figure 10	V <sub>CC</sub> =4.5V	25	-	-	ns
hold time	t <sub>h</sub>	DS to CP, $\overline{CE}$ and Dn to $\overline{PL}$ ; see Figure 9	V <sub>CC</sub> =4.5V	9	-	-	ns
		$\overline{CE}$ to CP and CP to $\overline{CE}$ ; see Figure 9	V <sub>CC</sub> =4.5V	0	-	-	ns
maximum frequency	f <sub>max</sub>	CP input; see Figure 6	V <sub>CC</sub> =4.5V	21	-	-	MHz

Note:

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

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

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

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

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;

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



## 4、Testing Circuit

### 4.1、AC Testing Circuit

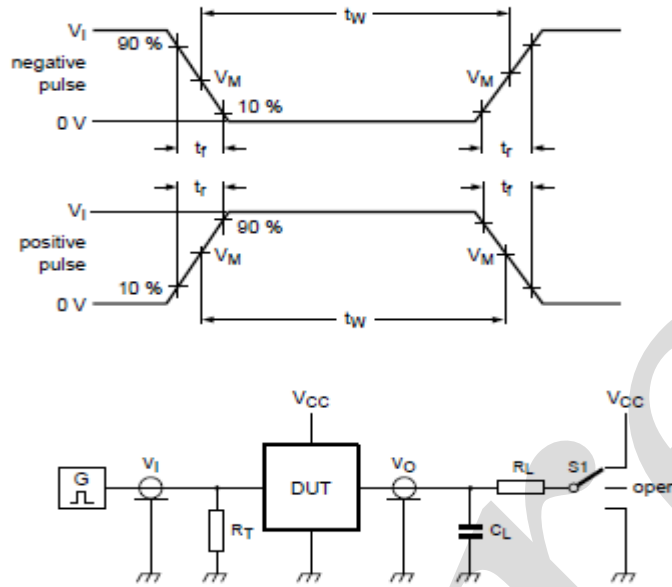


Figure 5. Test circuit for measuring switching times

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

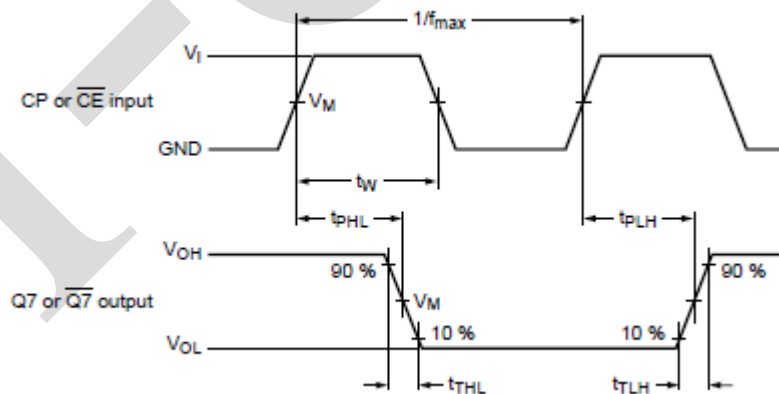


Figure 6. The clock (CP) or clock enable ( $\overline{CE}$ ) to output ( $Q7$  or  $\overline{Q7}$ ) propagation delays, the clock pulse width, the maximum clock frequency and the output transition times

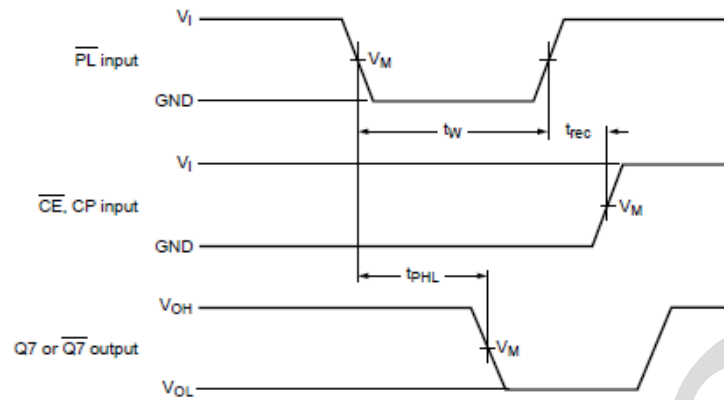


Figure 7. The parallel load ( $\overline{PL}$ ) pulse width, the parallel load to output (Q7 or  $\overline{Q7}$ ) propagation delays, the parallel load to clock (CP) and clock enable ( $\overline{CE}$ ) recovery time

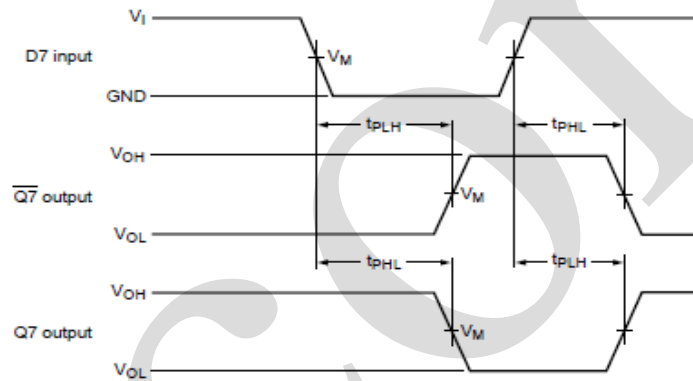


Figure 8. The data input (D7) to output (Q7 or  $\overline{Q7}$ ) propagation delays when  $\overline{PL}$  is LOW

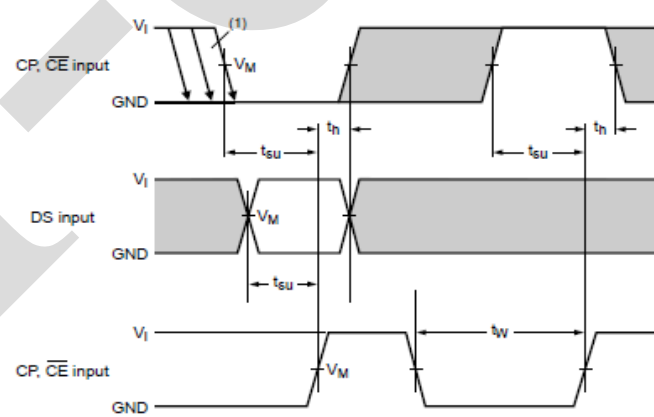


Figure 9. The set-up and hold times from the serial data input (DS) to the clock (CP) and clock enable ( $\overline{CE}$ ) inputs, from the clock enable input ( $\overline{CE}$ ) to the clock input (CP) and from the clock input (CP) to the clock enable input ( $\overline{CE}$ )



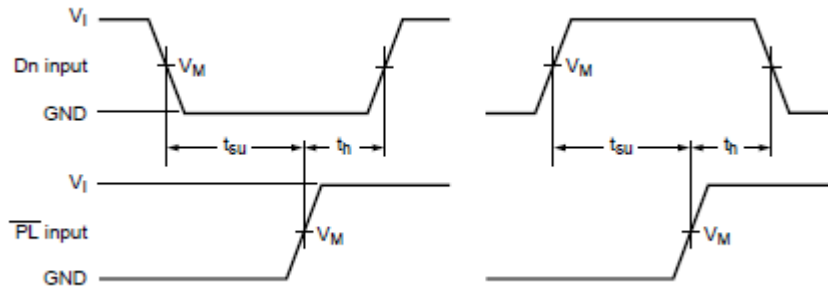


Figure 10. The set-up and hold times from the data inputs (Dn) to the parallel load input ( $\overline{PL}$ )

#### 4.3、 Measurement Points

Type	Input		Output
	$V_I$	$V_M$	$V_M$
AiP74HC165	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
AiP74HCT165	3V	1.3V	1.3V

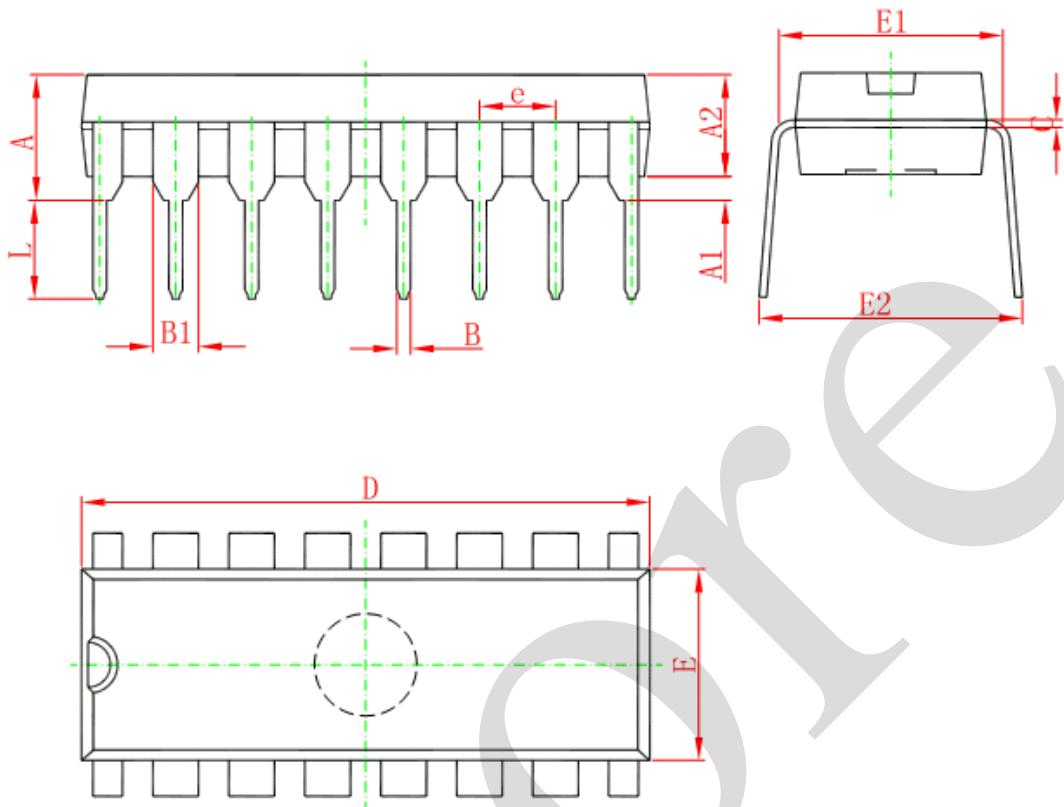
#### 4.4、 Test Data

Type	Input		Load		S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$
AiP74HC165	$V_{CC}$	6.0ns	15pF, 50pF	1k $\Omega$	open
AiP74HCT165	3.0V	6.0ns	15pF, 50pF	1k $\Omega$	open



## 5、 Package Information

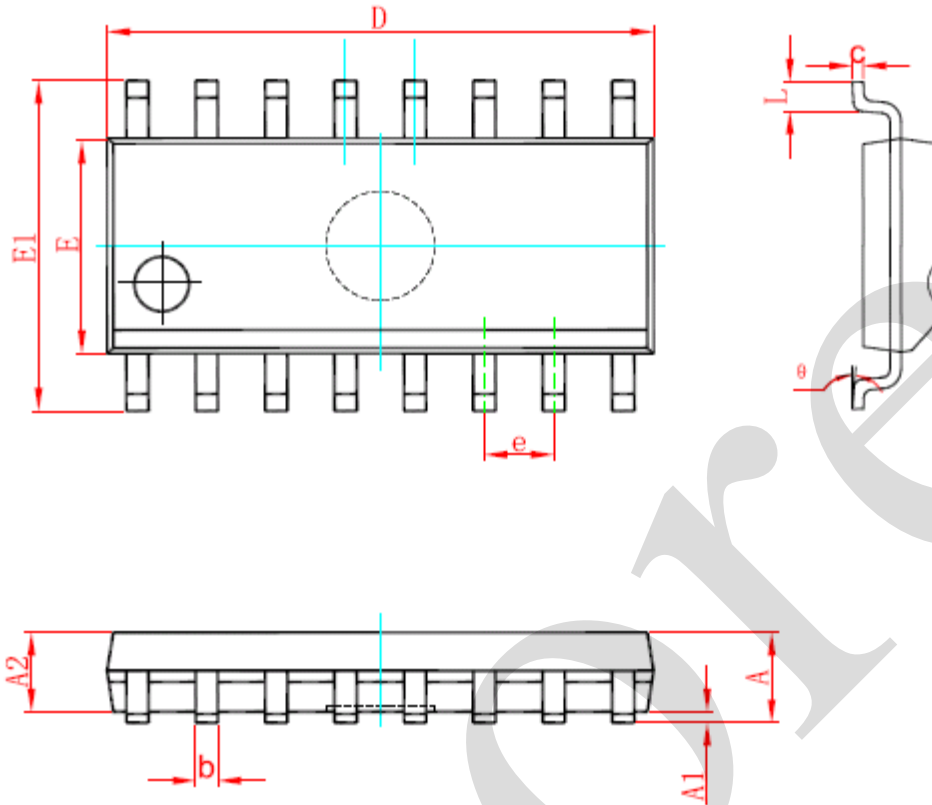
### 5.1、 DIP16



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



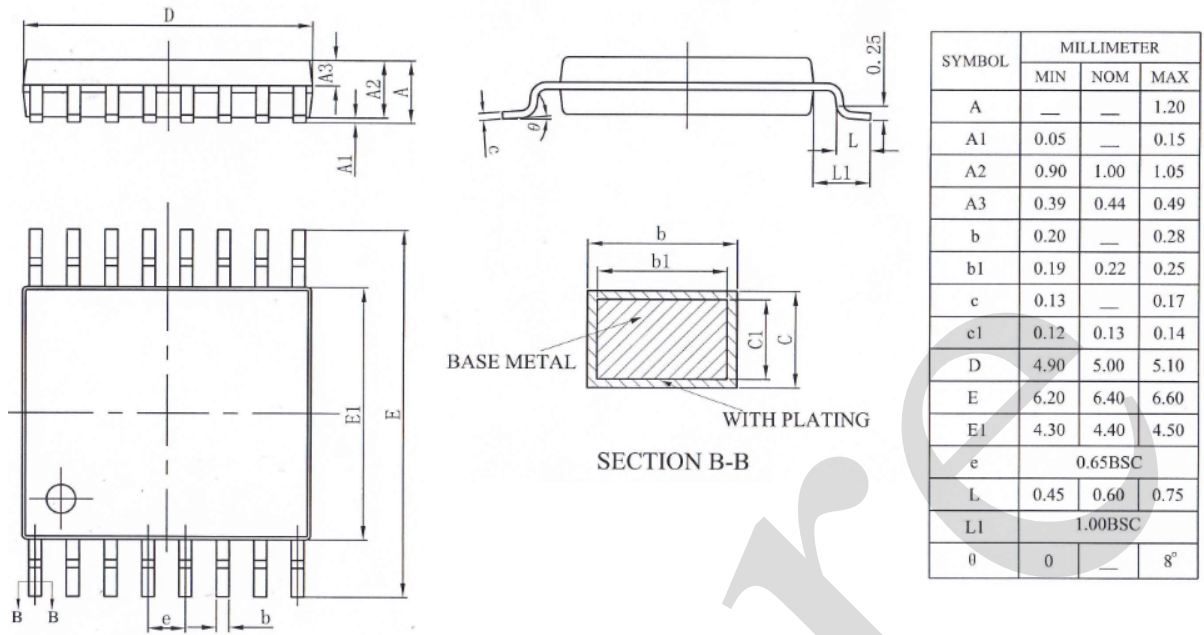
## 5.2、SOP16



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;

The company is not responsible for the any infringement of the third party patents or other rights of the responsibility.