



# AiP74HC/HCT85

## 4-bit Magnitude Comparator

### Product Specification

**Specification Revision History:**

Version	Date	Description
2012-06-A1	2012-06	New
2021-11-A2	2021-11	Modify Ordering Information; Modify ambient temperature to -40°C ~+105°C and add electrical characteristics of -40°C ~+105°C
2021-12-A3	2021-12	Modify Ordering Information



## 1、 General Description

The AiP74HC/HCT85 is a 4-bit magnitude comparator that can be expanded to almost any length. They perform comparison of two 4-bit binary, BCD or other monotonic codes and present the three possible magnitude results at the outputs ( $Q_{A>B}$ ,  $Q_{A=B}$  and  $Q_{A<B}$ ). The 4-bit inputs are weighted (A0 to A3 and B0 to B3), where A3 and B3 are the most significant bits. For proper compare operation the expander inputs ( $I_{A>B}$ ,  $I_{A=B}$  and  $I_{A<B}$ ) to the least significant position must be connected as follows:  $I_{A<B}=I_{A>B}=\text{LOW}$  and  $I_{A=B}=\text{HIGH}$ . For words greater than 4-bits, units can be cascaded by connecting outputs  $Q_{A>B}$ ,  $Q_{A=B}$  and  $Q_{A<B}$  to the corresponding inputs of the significant comparator. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### Features:

- Wide supply voltage range from 2.0 to 6.0V
- CMOS low power dissipation
- Input levels:
  - For AiP74HC85: CMOS level
  - For AiP74HCT85: TTL level
- Specified from  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$
- Packaging information: DIP16/SOP16/TSSOP16

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

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP74HC85DA16.TB	DIP16	74HC85	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HCT85DA16.TB	DIP16	74HCT85	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP74HC85SA16.TB	SOP16	74HC85	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP74HCT85SA16.TB	SOP16	74HCT85	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP74HC85TA16.TB	TSSOP16	74HC85	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm
AiP74HCT85TA16.TB	TSSOP16	74HCT85	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
AiP74HC85SA16.TR	SOP16	74HC85	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HCT85SA16.TR	SOP16	74HCT85	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP74HC85TA16.TR	TSSOP16	74HC85	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm
AiP74HCT85TA16.TR	TSSOP16	74HCT85	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

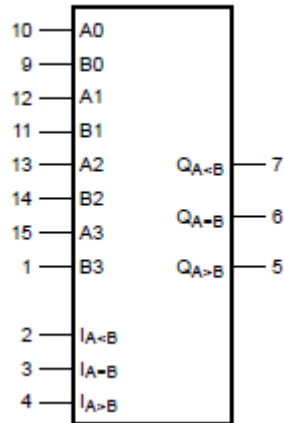


Figure 1. Logic symbol

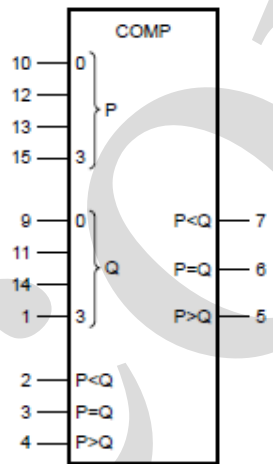


Figure 2. IEC logic symbol

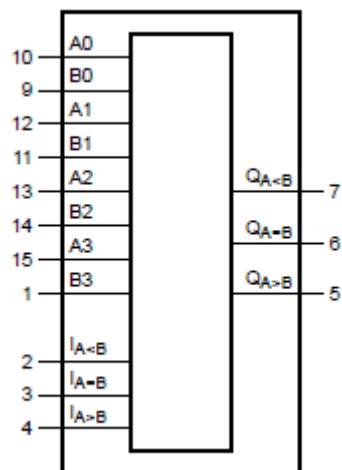


Figure 3. Functional diagram

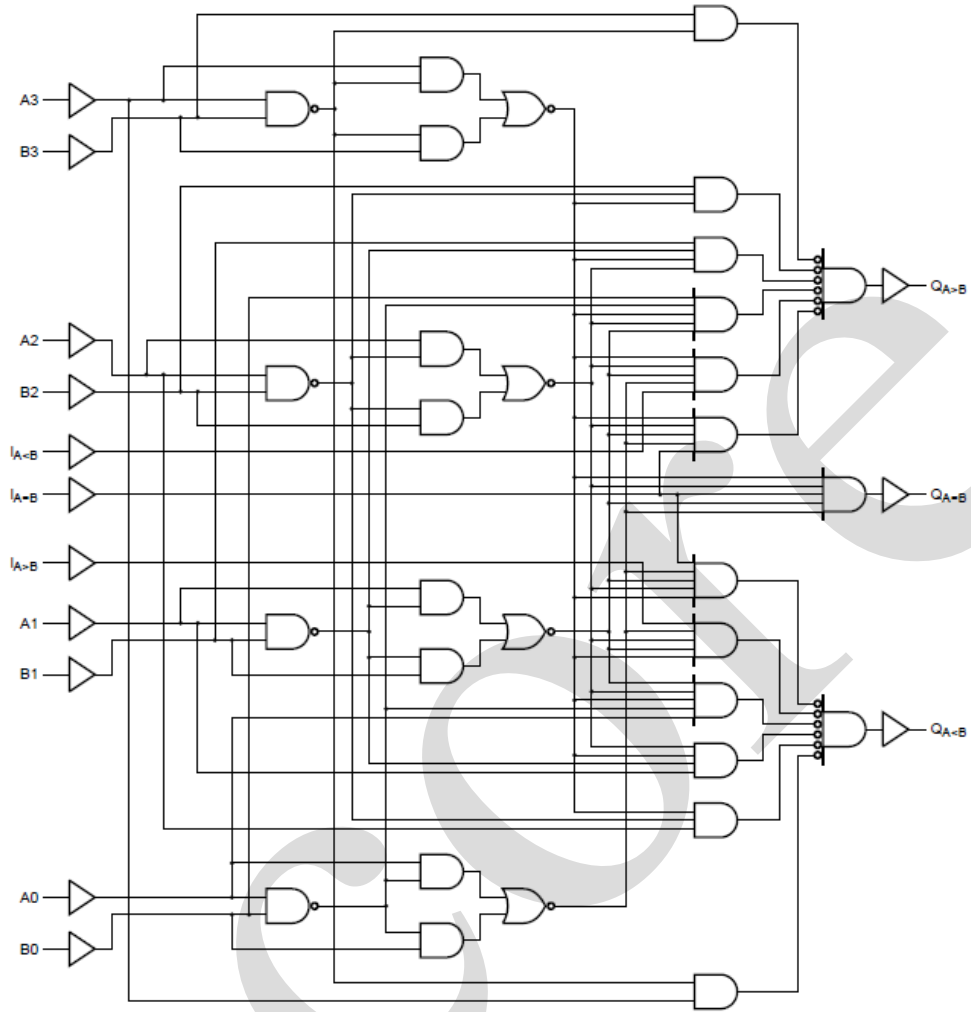
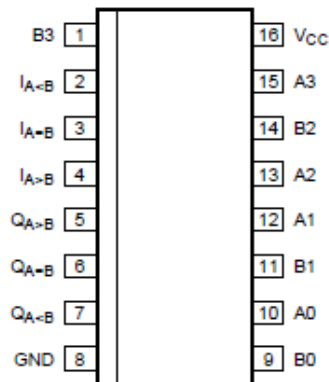


Figure 4. Logic diagram

## 2.2. Pin Configurations





## 2.3、Pin Description

Pin No.	Pin Name	Description
1	B3	word B input
2	I <sub>A&lt;B</sub>	A<B expansion input
3	I <sub>A=B</sub>	A=B expansion input
4	I <sub>A&gt;B</sub>	A>B expansion input
5	Q <sub>A&gt;B</sub>	A>B output
6	Q <sub>A=B</sub>	A=B output
7	Q <sub>A&lt;B</sub>	A<B output
8	GND	ground (0V)
9	B0	word B input
10	A0	word A input
11	B1	word B input
12	A1	word A input
13	A2	word A input
14	B2	word B input
15	A3	word A input
16	V <sub>CC</sub>	supply voltage

## 2.4、Function Table

Comparing input				Cascading input			Output		
A3, B3	A2, B2	A1, B1	A0, B0	I <sub>A&gt;B</sub>	I <sub>A&lt;B</sub>	I <sub>A=B</sub>	Q <sub>A&gt;B</sub>	Q <sub>A&lt;B</sub>	Q <sub>A=B</sub>
A3>B3	X	X	X	X	X	X	H	L	L
A3<B3	X	X	X	X	X	X	L	H	L
A3=B3	A2>B2	X	X	X	X	X	H	L	L
A3=B3	A2<B2	X	X	X	X	X	L	H	L
A3=B3	A2=B2	A1>B1	X	X	X	X	H	L	L
A3=B3	A2=B2	A1<B1	X	X	X	X	L	H	L
A3=B3	A2=B2	A1=B1	A0>B0	X	X	X	H	L	L
A3=B3	A2=B2	A1=B1	A0<B0	X	X	X	L	H	L
A3=B3	A2=B2	A1=B1	A0=B0	H	L	L	H	L	L
A3=B3	A2=B2	A1=B1	A0=B0	L	H	L	L	H	L
A3=B3	A2=B2	A1=B1	A0=B0	L	L	H	L	L	H
A3=B3	A2=B2	A1=B1	A0=B0	X	X	H	L	L	H
A3=B3	A2=B2	A1=B1	A0=B0	H	H	L	L	L	L
A3=B3	A2=B2	A1=B1	A0=B0	L	L	L	H	H	L

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



## 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 $V_I > V_{CC}+0.5V$	-	$\pm 20$	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
storage temperature	$T_{stg}$	-	-65	+150	$^{\circ}C$
total power dissipation	$P_{tot}$	-	-	500	mW
soldering temperature	$T_L$	10s	DIP	245	$^{\circ}C$
			SOP	250	

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
<b>AiP74HC85</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	$^{\circ}C$
<b>AiP74HCT85</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	$\Delta t/\Delta V$	$V_{CC}=2.0V$	-	-	-	ns/V
		$V_{CC}=4.5V$	-	1.67	139	ns/V
		$V_{CC}=6.0V$	-	-	-	ns/V
ambient temperature	$T_{amb}$	-	-40	-	+105	$^{\circ}C$





## 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	
<b>AiP74HC85</b>							
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	$V_{OH}$	$V_I=V_{IH}$ 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	$V_{OL}$	$V_I=V_{IH}$ 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	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=6.0\text{V}$	-	-	$\pm 0.1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	8.0	$\mu\text{A}$	
input capacitance	$C_I$	-	-	3.5	-	pF	
<b>AiP74HCT85</b>							
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	$V_{OH}$	$V_I=V_{IH}$ 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	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}; V_{CC}=4.5\text{V}$	$I_O=20\mu\text{A}$	-	0	0.1	V
			$I_O=4.0\text{mA}$	-	0.15	0.26	V
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=5.5\text{V}$	-	-	$\pm 0.1$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=5.5\text{V}$	-	-	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; $I_O=0\text{A}; V_{CC}=4.5\text{V}$ to $5.5\text{V}$	$I_{A<B}$ and $I_{A>B}$ inputs	-	100	360	$\mu\text{A}$
			$I_{A=B}$ inputs	-	150	540	$\mu\text{A}$
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	
<b>AiP74HC85</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	$\mu\text{A}$	
<b>AiP74HCT85</b>							
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	$V_{OH}$	$V_I=V_{IH}$ 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	$V_{OL}$	$V_I=V_{IH}$ or $V_{IL}; V_{CC}=4.5\text{V}$	$I_O=20\mu\text{A}$	-	-	0.1	V
			$I_O=4.0\text{mA}$	-	-	0.33	V
input leakage current	$I_I$	$V_I=V_{CC}$ or GND; $V_{CC}=5.5\text{V}$	-	-	$\pm 1.0$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=5.5\text{V}$	-	-	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; $I_O=0\text{A}; V_{CC}=4.5\text{V}$ to $5.5\text{V}$	$I_{A<B}$ and $I_{A>B}$ inputs	-	-	450	$\mu\text{A}$
			$I_{A=}$ and $I_{B=}$ inputs	-	-	675	$\mu\text{A}$



### 3.3.3、DC Characteristics 3

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>AiP74HC85</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	$\mu\text{A}$	
<b>AiP74HCT85</b>							
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	$V_{OH}$	$V_I = V_{IH}$ or $V_{IL}; V_{CC} = 4.5\text{V}$	$I_O = -20\mu\text{A}$	4.4	-	-	V
			$I_O = -4.0\text{mA}$	3.7	-	-	V
LOW-level output voltage	$V_{OL}$	$V_I = V_{IH}$ or $V_{IL}; V_{CC} = 4.5\text{V}$	$I_O = 20\mu\text{A}$	-	-	0.1	V
			$I_O = 4.0\text{mA}$	-	-	0.4	V
input leakage current	$I_I$	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{V}$	-	-	$\pm 1.0$	$\mu\text{A}$	
supply current	$I_{CC}$	$V_I = V_{CC}$ or GND; $I_O = 0\text{A}; V_{CC} = 5.5\text{V}$	-	-	160	$\mu\text{A}$	
additional supply current	$\Delta I_{CC}$	per input pin; $V_I = V_{CC} - 2.1\text{V};$ other inputs at $V_{CC}$ or GND; $I_O = 0\text{A};$ $V_{CC} = 4.5\text{V}$ to $5.5\text{V}$	$I_{A<B}$ and $I_{A>B}$ inputs	-	-	490	$\mu\text{A}$
			$I_{A=B}$ inputs	-	-	735	$\mu\text{A}$



### 3.3.4. AC Characteristics 1

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>AiP74HC85</b>							
propagation delay	$t_{pd}$	An, Bn to $Q_{A>B}$ ; An, Bn to $Q_{A<B}$ ; see Figure 6 <sup>[1]</sup>	$V_{CC}=2.0V$	-	63	195	ns
			$V_{CC}=4.5V$	-	23	39	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	20	-	ns
			$V_{CC}=6.0V$	-	18	33	ns
		An, Bn to $Q_{A=B}$ ; see Figure 6	$V_{CC}=2.0V$	-	58	175	ns
			$V_{CC}=4.5V$	-	21	35	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	18	-	ns
			$V_{CC}=6.0V$	-	17	30	ns
		$I_{A=B}$ or $I_{A>B}$ to $Q_{A<B}$ ; $I_{A<B}$ or $I_{A=B}$ to $Q_{A>B}$ ; see Figure 6	$V_{CC}=2.0V$	-	50	140	ns
			$V_{CC}=4.5V$	-	18	28	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	15	-	ns
			$V_{CC}=6.0V$	-	14	24	ns
		$I_{A=B}$ to $Q_{A=B}$ ; see Figure 6	$V_{CC}=2.0V$	-	39	120	ns
			$V_{CC}=4.5V$	-	14	24	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	11	-	ns
			$V_{CC}=6.0V$	-	11	20	ns
transition time	$t_t$	see Figure 6 <sup>[2]</sup>	$V_{CC}=2.0V$	-	19	75	ns
			$V_{CC}=4.5V$	-	7	15	ns
			$V_{CC}=6.0V$	-	6	13	ns
power dissipation capacitance	$C_{PD}$	per package; $V_I=GND$ to $V_{CC}$ <sup>[3]</sup>	-	18	-	pF	
<b>AiP74HCT85</b>							
propagation delay	$t_{pd}$	An, Bn to $Q_{A>B}$ ; An, Bn to $Q_{A<B}$ ; see Figure 6 <sup>[1]</sup>	$V_{CC}=4.5V$	-	26	44	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	22	-	ns
		An, Bn to $Q_{A=B}$ ; see Figure 6	$V_{CC}=4.5V$	-	24	40	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	20	-	ns
		$I_{A=B}$ or $I_{A>B}$ to $Q_{A<B}$ ; $I_{A<B}$ or $I_{A=B}$ to $Q_{A>B}$ ; see Figure 6	$V_{CC}=4.5V$	-	18	31	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	15	-	ns
		$I_{A=B}$ to $Q_{A=B}$ ; see Figure 6	$V_{CC}=4.5V$	-	18	31	ns
			$V_{CC}=5.0V$ ; $C_L=15pF$	-	15	-	ns
transition time	$t_t$	$V_{CC}=4.5V$ ; see Figure 6 <sup>[2]</sup>	-	7	15	ns	
power dissipation capacitance	$C_{PD}$	per package; $V_I=GND$ to $V_{CC}-1.5V$ <sup>[3]</sup>	-	20	-	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).

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



$f_i$ =input frequency in MHz;  $f_o$ =output frequency in MHz;

$C_L$ =output load capacitance in pF;

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

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

### 3.3.5、AC Characteristics 2

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>AiP74HC85</b>							
propagation delay	$t_{pd}$	An, Bn to $Q_{A>B}$ ; An, Bn to $Q_{A<B}$ ; see Figure 6 <sup>[1]</sup>	$V_{CC}=2.0\text{V}$	-	-	245	ns
			$V_{CC}=4.5\text{V}$	-	-	49	ns
			$V_{CC}=6.0\text{V}$	-	-	42	ns
		An, Bn to $Q_{A=B}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	-	220	ns
			$V_{CC}=4.5\text{V}$	-	-	44	ns
			$V_{CC}=6.0\text{V}$	-	-	37	ns
		$I_{A=B}$ or $I_{A>B}$ to $Q_{A<B}$ ; $I_{A<B}$ or $I_{A=B}$ to $Q_{A>B}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	-	175	ns
			$V_{CC}=4.5\text{V}$	-	-	35	ns
			$V_{CC}=6.0\text{V}$	-	-	30	ns
		$I_{A=B}$ to $Q_{A=B}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	-	150	ns
			$V_{CC}=4.5\text{V}$	-	-	30	ns
			$V_{CC}=6.0\text{V}$	-	-	26	ns
transition time	$t_t$	see Figure 6 <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
<b>AiP74HCT85</b>							
propagation delay	$t_{pd}$	An, Bn to $Q_{A>B}$ ; An, Bn to $Q_{A<B}$ ; see Figure 6 <sup>[1]</sup>	$V_{CC}=4.5\text{V}$	-	-	55	ns
			$V_{CC}=4.5\text{V}$	-	-	50	ns
		$I_{A=B}$ or $I_{A>B}$ to $Q_{A<B}$ ; $I_{A<B}$ or $I_{A=B}$ to $Q_{A>B}$ ; see Figure 6	$V_{CC}=4.5\text{V}$	-	-	39	ns
			$V_{CC}=4.5\text{V}$	-	-	39	ns
transition time	$t_t$	$V_{CC}=4.5\text{V}$ ; see Figure 6 <sup>[2]</sup>	-	-	19	ns	

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

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>AiP74HC85</b>							
propagation delay	$t_{pd}$	An, Bn to $Q_{A>B}$ ; An, Bn to $Q_{A<B}$ ; see Figure 6 <sup>[1]</sup>	$V_{CC}=2.0\text{V}$	-	-	295	ns
			$V_{CC}=4.5\text{V}$	-	-	59	ns
			$V_{CC}=6.0\text{V}$	-	-	50	ns
		An, Bn to $Q_{A=B}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	-	265	ns
			$V_{CC}=4.5\text{V}$	-	-	53	ns
			$V_{CC}=6.0\text{V}$	-	-	45	ns
		$I_{A=B}$ or $I_{A>B}$ to $Q_{A<B}$ ; $I_{A<B}$ or $I_{A=B}$ to $Q_{A>B}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	-	210	ns
			$V_{CC}=4.5\text{V}$	-	-	42	ns
			$V_{CC}=6.0\text{V}$	-	-	36	ns
		$I_{A=B}$ to $Q_{A=B}$ ; see Figure 6	$V_{CC}=2.0\text{V}$	-	-	180	ns
			$V_{CC}=4.5\text{V}$	-	-	36	ns
			$V_{CC}=6.0\text{V}$	-	-	31	ns
transition time	$t_t$	see Figure 6 <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
<b>AiP74HCT85</b>							
propagation delay	$t_{pd}$	An, Bn to $Q_{A>B}$ ; An, Bn to $Q_{A<B}$ ; see Figure 6 <sup>[1]</sup>	$V_{CC}=4.5\text{V}$	-	-	66	ns
			$V_{CC}=4.5\text{V}$	-	-	60	ns
		$I_{A=B}$ or $I_{A>B}$ to $Q_{A<B}$ ; $I_{A<B}$ or $I_{A=B}$ to $Q_{A>B}$ ; see Figure 6	$V_{CC}=4.5\text{V}$	-	-	47	ns
			$V_{CC}=4.5\text{V}$	-	-	47	ns
transition time	$t_t$	$V_{CC}=4.5\text{V}$ ; see Figure 6 <sup>[2]</sup>	-	-	22	ns	

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

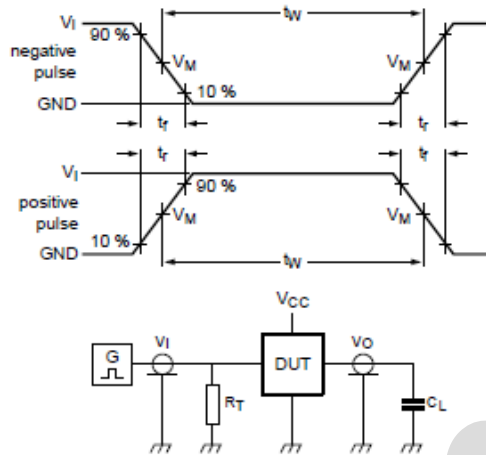


Figure 5. Test circuit for measuring switching times

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.

### 4.2、AC Testing Waveforms

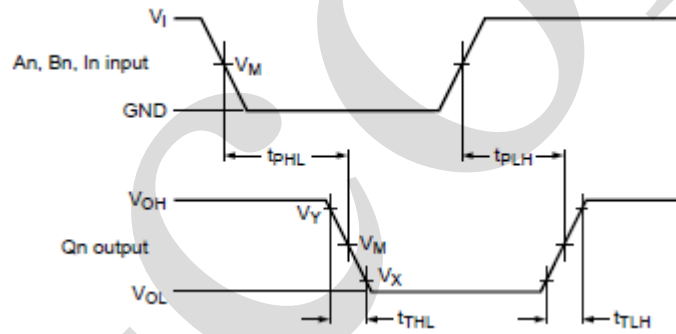


Figure 6. Word A inputs (An), word B inputs (Bn) and expansion inputs (In) to the outputs (Qn) propagation delays and the output transition times

### 4.3、Measurement Points

Type	Input		Output		
	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
AiP74HC85	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$
AiP74HCT85	3V	1.3V	1.3V	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$

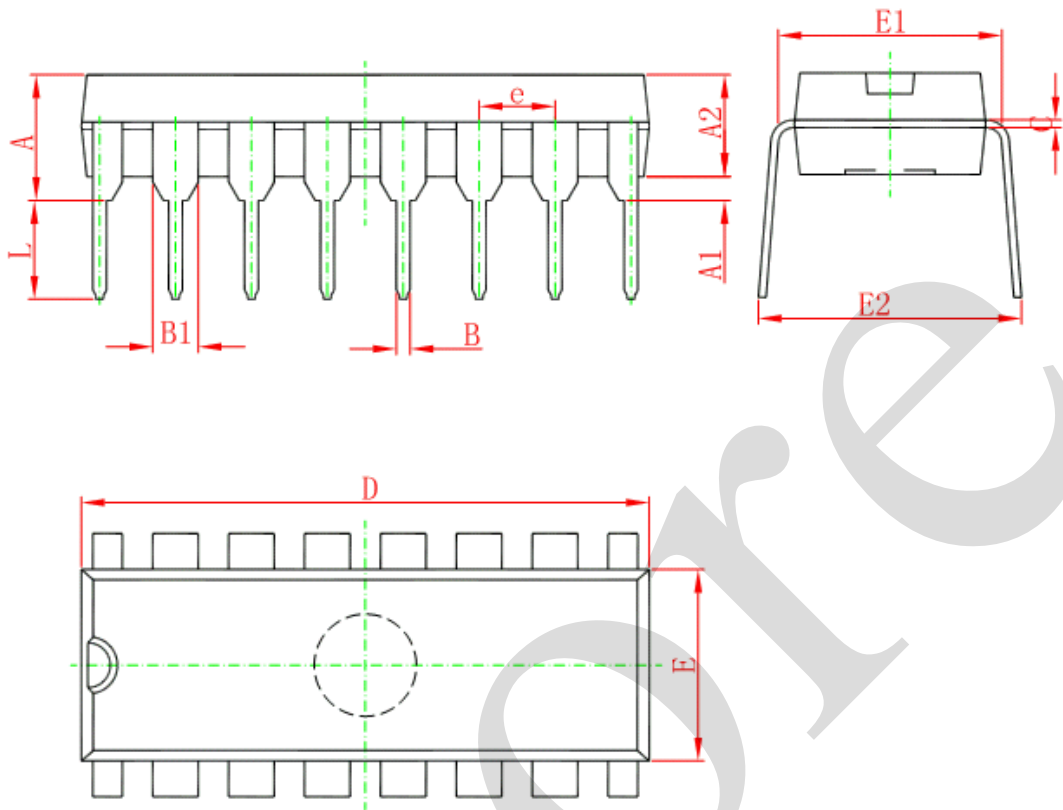
### 4.4、Test Data

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
AiP74HC85	$V_{CC}$	6ns	15pF, 50pF	$t_{PHL}, t_{PLH}$
AiP74HCT85	3V	6ns	15pF, 50pF	$t_{PHL}, t_{PLH}$



## 5、Package Information

### 5.1、DIP16

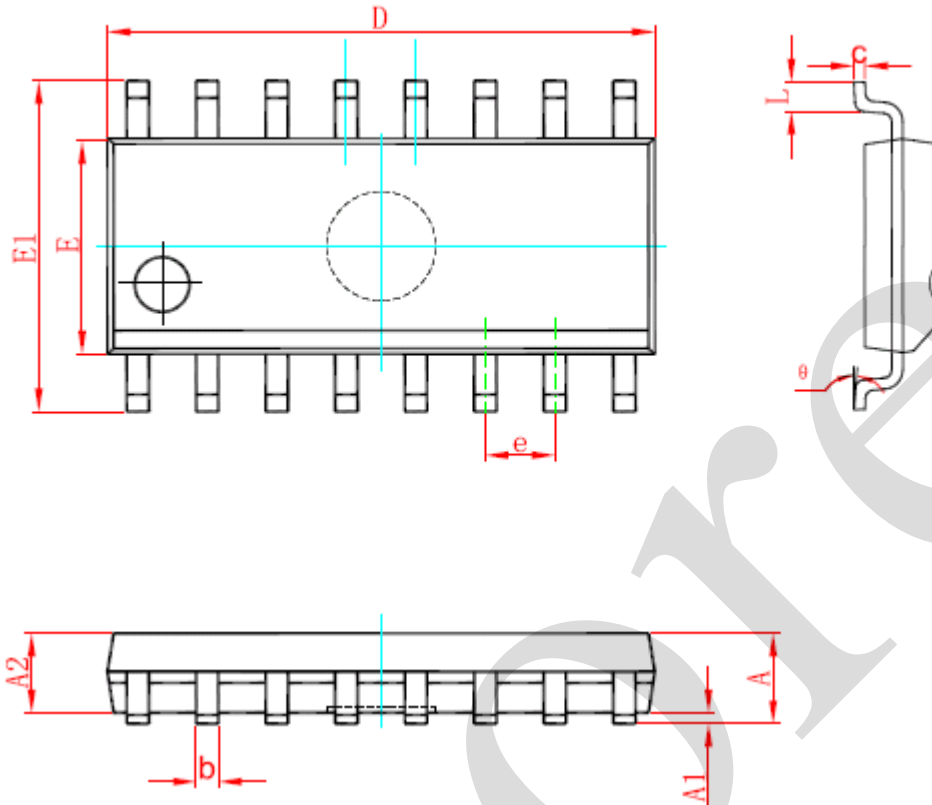


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.360	0.008	0.014
D	18.800	19.200	0.740	0.756
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
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





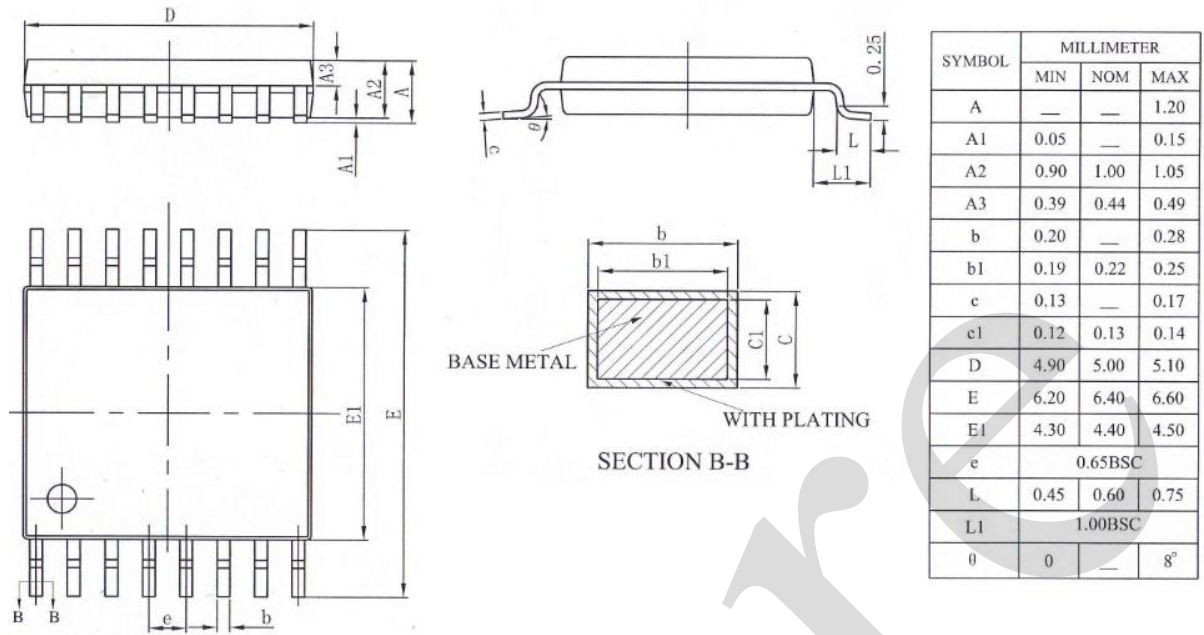
## 5.2、SOP16



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;

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[LMV331W5-7\(MS\)](#) [MCP6561UT-E\(MS\)](#)