



# AiP74LVC2G74

## Single D-type flip-flop with set and reset; positive edge trigger

### Product Specification

#### Specification Revision History:

| Version    | Date    | Description                                                                               |
|------------|---------|-------------------------------------------------------------------------------------------|
| 2017-05-A1 | 2017-05 | New                                                                                       |
| 2021-12-A2 | 2021-12 | Modify ordering information                                                               |
| 2022-02-A3 | 2022-02 | Modify ambient temperature to -40℃~+105℃ and add electrical characteristics of -40℃~+105℃ |
| 2022-03-A4 | 2022-03 | Modify ordering information note 1                                                        |



## 1、General Description

The AiP74LVC2G74 is a single positive-edge triggered D-type flip-flop with individual data (D) inputs, clock (CP) inputs, set ( $\bar{S}D$ ) and reset ( $\bar{R}D$ ) inputs, and complementary Q and  $\bar{Q}$  outputs.

This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing damaging backflow current through the device when it is powered down.

The set and reset are asynchronous active LOW inputs and operate independently of the clock input. Information on the data input is transferred to the Q output on the LOW-to-HIGH transition of the clock pulse. The D inputs must be stable, one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

### Features:

- Wide supply voltage range from 1.65V to 5.5V
- 5 V tolerant outputs for interfacing with 5 V logic
- $\pm 24mA$  output drive ( $V_{CC}=3.0V$ )
- CMOS low power consumption
- Latch-up performance exceeds 250mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5V
- Specified from  $-40^{\circ}C$  to  $+105^{\circ}C$
- Packaging information: TSSOP8/VSSOP8

### Ordering Information:

#### Reel packing specifications:

| Part number        | Packaging form | Marking code | Reel quantity | Boxed reel quantity | Notes                                                               |
|--------------------|----------------|--------------|---------------|---------------------|---------------------------------------------------------------------|
| AiP74LVC2G74TA8.TR | TSSOP8         | ARXX         | 3000 PCS/reel | 3000 PCS/box        | Dimensions of plastic enclosure: 3.0mm×3.0mm<br>Pin spacing: 0.65mm |
| AiP74LVC2G74YA8.TR | VSSOP8         | ARXX         | 3000 PCS/reel | 3000 PCS/box        | Dimensions of plastic enclosure: 2.0mm×2.3mm<br>Pin spacing: 0.50mm |

Note 1: “XX” refers to variable content, meaning year and package batch serial number.

Note 2: 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

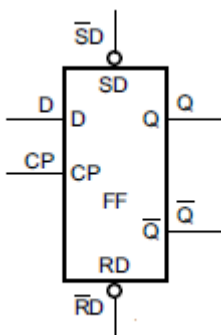


Figure 1. Logic symbol

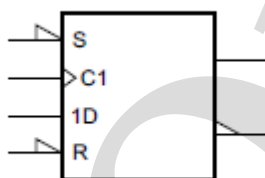


Figure 2. IEC logic symbol

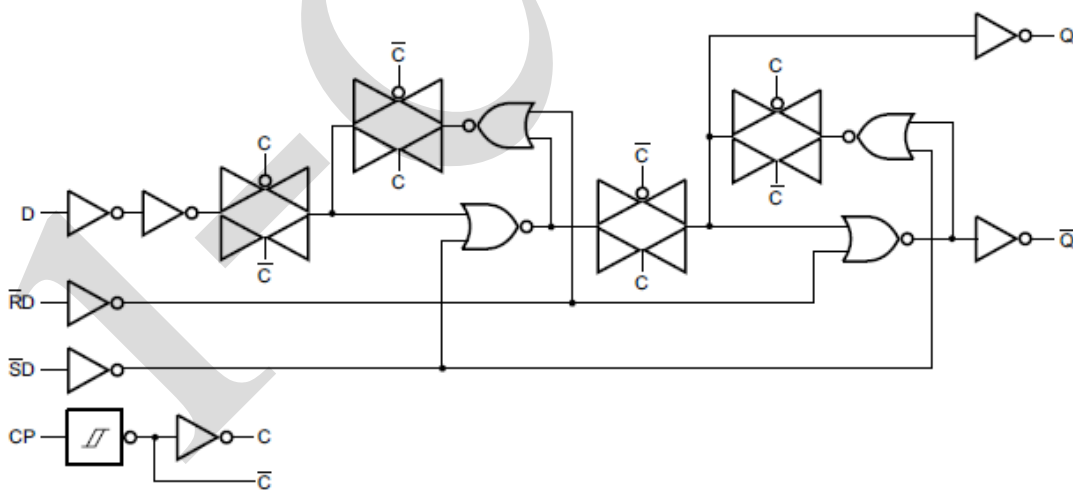
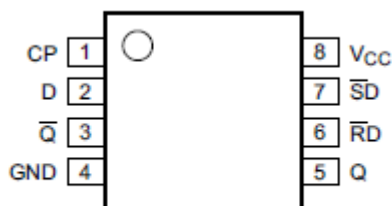


Figure 3. Logic diagram



## 2.2、Pin Configurations



## 2.3、Pin Description

| Pin No. | Pin Name        | Description                                  |
|---------|-----------------|----------------------------------------------|
| 1       | CP              | clock input (LOW-to-HIGH, edge-triggered)    |
| 2       | D               | data input                                   |
| 3       | $\bar{Q}$       | complement output                            |
| 4       | GND             | ground (0V)                                  |
| 5       | Q               | true output                                  |
| 6       | $\bar{RD}$      | asynchronous reset-direct input (active LOW) |
| 7       | $\bar{SD}$      | asynchronous set-direct input (active LOW)   |
| 8       | V <sub>CC</sub> | supply voltage                               |

## 2.4、Function Table

Function table for asynchronous operation

| Input      |            |    |   | Output |           |
|------------|------------|----|---|--------|-----------|
| $\bar{SD}$ | $\bar{RD}$ | CP | D | Q      | $\bar{Q}$ |
| L          | H          | X  | X | H      | L         |
| H          | L          | X  | X | L      | H         |
| L          | L          | X  | X | H      | H         |

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

Function table for synchronous operation

| Input      |            |    |   | Output           |                 |
|------------|------------|----|---|------------------|-----------------|
| $\bar{SD}$ | $\bar{RD}$ | CP | D | Q <sub>n+1</sub> | $\bar{Q}_{n+1}$ |
| H          | H          | ↑  | L | L                | H               |
| H          | H          | ↑  | H | H                | L               |

Note: H=HIGH voltage level; L=LOW voltage level; ↑=LOW-to-HIGH CP transition;  
Q<sub>n+1</sub>=state after the next LOW-to-HIGH CP 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 | +6.5         | V    |
| input clamping current  | $I_{IK}$  | $V_I < 0V$                   | -50  | -            | mA   |
| input voltage           | $V_I$     | -                            | -0.5 | +6.5         | V    |
| output clamping current | $I_{OK}$  | $V_O > V_{CC}$ or $V_O < 0V$ | -    | $\pm 50$     | mA   |
| output voltage          | $V_O$     | Active mode                  | -0.5 | $V_{CC}+0.5$ | V    |
|                         |           | Power-down mode; $V_{CC}=0V$ | -0.5 | +6.5         | V    |
| output current          | $I_O$     | $V_O=0V$ to $V_{CC}$         | -    | $\pm 50$     | mA   |
| supply current          | $I_{CC}$  | -                            | -    | 100          | mA   |
| ground current          | $I_{GND}$ | -                            | -100 | -            | mA   |
| total power dissipation | $P_{tot}$ | -                            | -    | 300          | mW   |
| storage temperature     | $T_{stg}$ | -                            | -65  | +150         | °C   |
| Soldering temperature   | $T_L$     | 10s                          | 250  |              | °C   |

Note:

[1] For TSSOP8 package: above 55°C the value of  $P_{tot}$  derates linearly with 2.5mW/K.

[2] For VSSOP8 package: above 110°C the value of  $P_{tot}$  derates linearly at 8mW/K.

### 3.2、Recommended Operating Conditions

| Parameter                           | Symbol              | Conditions                   | Min. | Typ. | Max.     | Unit |
|-------------------------------------|---------------------|------------------------------|------|------|----------|------|
| supply voltage                      | $V_{CC}$            | -                            | 1.65 | -    | 5.5      | V    |
| input voltage                       | $V_I$               | -                            | 0    | -    | 5.5      | V    |
| output voltage                      | $V_O$               | Active mode                  | 0    | -    | $V_{CC}$ | V    |
|                                     |                     | Power-down mode; $V_{CC}=0V$ | 0    | -    | 5.5      | V    |
| ambient temperature                 | $T_{amb}$           | -                            | -40  | -    | +105     | °C   |
| input transition rise and fall rate | $\Delta t/\Delta V$ | $V_{CC}=1.65V$ to $2.7V$     | -    | -    | 20       | ns/V |
|                                     |                     | $V_{CC}=2.7V$ to $5.5V$      | -    | -    | 10       | ns/V |

**3.3、Electrical Characteristics****3.3.1、DC Characteristics 1**(T<sub>amb</sub>= -40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

| Parameter                 | Symbol           | Conditions                                                                                           |                                                           | Min.                   | Typ. | Max.                   | Unit |
|---------------------------|------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------|------|------------------------|------|
| HIGH-level input voltage  | V <sub>IH</sub>  | V <sub>CC</sub> =1.65V to 1.95V                                                                      |                                                           | 0.65 × V <sub>CC</sub> | -    | -                      | V    |
|                           |                  | V <sub>CC</sub> =2.3V to 2.7V                                                                        |                                                           | 1.7                    | -    | -                      | V    |
|                           |                  | V <sub>CC</sub> =2.7V to 3.6V                                                                        |                                                           | 2.0                    | -    | -                      | V    |
|                           |                  | V <sub>CC</sub> =4.5V to 5.5V                                                                        |                                                           | 0.7 × V <sub>CC</sub>  | -    | -                      | V    |
| LOW-level input voltage   | V <sub>IL</sub>  | V <sub>CC</sub> =1.65V to 1.95V                                                                      |                                                           | -                      | -    | 0.35 × V <sub>CC</sub> | V    |
|                           |                  | V <sub>CC</sub> =2.3V to 2.7V                                                                        |                                                           | -                      | -    | 0.7                    | V    |
|                           |                  | V <sub>CC</sub> =2.7V to 3.6V                                                                        |                                                           | -                      | -    | 0.8                    | V    |
|                           |                  | V <sub>CC</sub> =4.5V to 5.5V                                                                        |                                                           | -                      | -    | 0.3 × V <sub>CC</sub>  | V    |
| HIGH-level output voltage | V <sub>OH</sub>  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                  | I <sub>O</sub> =-100uA;<br>V <sub>CC</sub> =1.65V to 5.5V | V <sub>CC</sub> -0.1   | -    | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-4mA; V <sub>CC</sub> =1.65V              | 1.2                    | 1.54 | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-8mA; V <sub>CC</sub> =2.3V               | 1.9                    | 2.15 | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-12mA; V <sub>CC</sub> =2.7V              | 2.2                    | 2.50 | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-24mA; V <sub>CC</sub> =3.0V              | 2.3                    | 2.62 | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-32mA; V <sub>CC</sub> =4.5V              | 3.8                    | 4.11 | -                      | V    |
| LOW-level output voltage  | V <sub>OL</sub>  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                  | I <sub>O</sub> =100uA;<br>V <sub>CC</sub> =1.65V to 5.5V  | -                      | -    | 0.10                   | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =4mA; V <sub>CC</sub> =1.65V               | -                      | 0.07 | 0.45                   | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =8mA; V <sub>CC</sub> =2.3V                | -                      | 0.12 | 0.30                   | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =12mA; V <sub>CC</sub> =2.7V               | -                      | 0.17 | 0.40                   | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =24mA; V <sub>CC</sub> =3.0V               | -                      | 0.33 | 0.55                   | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =32mA; V <sub>CC</sub> =4.5V               | -                      | 0.39 | 0.55                   | V    |
| input leakage current     | I <sub>I</sub>   | V <sub>I</sub> =5.5V or GND;<br>V <sub>CC</sub> =0V to 5.5V                                          |                                                           | -                      | ±0.1 | ±1                     | uA   |
| power-off leakage current | I <sub>OFF</sub> | V <sub>I</sub> or V <sub>O</sub> =5.5V; V <sub>CC</sub> =0V                                          |                                                           | -                      | ±0.1 | ±2                     | uA   |
| supply current            | I <sub>CC</sub>  | V <sub>I</sub> =5.5V or GND; I <sub>O</sub> =0A;<br>V <sub>CC</sub> =1.65V to 5.5V                   |                                                           | -                      | 0.1  | 4                      | uA   |
| additional supply current | ΔI <sub>CC</sub> | per pin; V <sub>I</sub> =V <sub>CC</sub> -0.6V;<br>I <sub>O</sub> =0A; V <sub>CC</sub> =2.3V to 5.5V |                                                           | -                      | 5    | 500                    | uA   |
| input capacitance         | C <sub>I</sub>   | -                                                                                                    |                                                           | -                      | 4.0  | -                      | pF   |

Note: All typical values are measured at T<sub>amb</sub>=25°C.

**3.3.2、DC Characteristics 2**(T<sub>amb</sub>= -40°C to +105°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

| Parameter                 | Symbol           | Conditions                                                                                           | Min.                                                      | Typ.                 | Max.                   | Unit |
|---------------------------|------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----------------------|------------------------|------|
| HIGH-level input voltage  | V <sub>IH</sub>  | V <sub>CC</sub> =1.65V to 1.95V                                                                      | 0.65 × V <sub>CC</sub>                                    | -                    | -                      | V    |
|                           |                  | V <sub>CC</sub> =2.3V to 2.7V                                                                        | 1.7                                                       | -                    | -                      | V    |
|                           |                  | V <sub>CC</sub> =2.7V to 3.6V                                                                        | 2.0                                                       | -                    | -                      | V    |
|                           |                  | V <sub>CC</sub> =4.5V to 5.5V                                                                        | 0.7 × V <sub>CC</sub>                                     | -                    | -                      | V    |
| LOW-level input voltage   | V <sub>IL</sub>  | V <sub>CC</sub> =1.65V to 1.95V                                                                      | -                                                         | -                    | 0.35 × V <sub>CC</sub> | V    |
|                           |                  | V <sub>CC</sub> =2.3V to 2.7V                                                                        | -                                                         | -                    | 0.7                    | V    |
|                           |                  | V <sub>CC</sub> =2.7V to 3.6V                                                                        | -                                                         | -                    | 0.8                    | V    |
|                           |                  | V <sub>CC</sub> =4.5V to 5.5V                                                                        | -                                                         | -                    | 0.3 × V <sub>CC</sub>  | V    |
| HIGH-level output voltage | V <sub>OH</sub>  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                  | I <sub>O</sub> =-100uA;<br>V <sub>CC</sub> =1.65V to 5.5V | V <sub>CC</sub> -0.1 | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-4mA; V <sub>CC</sub> =1.65V              | 0.95                 | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-8mA; V <sub>CC</sub> =2.3V               | 1.7                  | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-12mA; V <sub>CC</sub> =2.7V              | 1.9                  | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-24mA; V <sub>CC</sub> =3.0V              | 2.0                  | -                      | V    |
|                           |                  |                                                                                                      | I <sub>O</sub> =-32mA; V <sub>CC</sub> =4.5V              | 3.4                  | -                      | V    |
| LOW-level output voltage  | V <sub>OL</sub>  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                  | I <sub>O</sub> =100uA;<br>V <sub>CC</sub> =1.65V to 5.5V  | -                    | -                      | 0.10 |
|                           |                  |                                                                                                      | I <sub>O</sub> =4mA; V <sub>CC</sub> =1.65V               | -                    | -                      | 0.70 |
|                           |                  |                                                                                                      | I <sub>O</sub> =8mA; V <sub>CC</sub> =2.3V                | -                    | -                      | 0.45 |
|                           |                  |                                                                                                      | I <sub>O</sub> =12mA; V <sub>CC</sub> =2.7V               | -                    | -                      | 0.60 |
|                           |                  |                                                                                                      | I <sub>O</sub> =24mA; V <sub>CC</sub> =3.0V               | -                    | -                      | 0.80 |
|                           |                  |                                                                                                      | I <sub>O</sub> =32mA; V <sub>CC</sub> =4.5V               | -                    | -                      | 0.80 |
| input leakage current     | I <sub>I</sub>   | V <sub>I</sub> =5.5V or GND;<br>V <sub>CC</sub> =0V to 5.5V                                          | -                                                         | -                    | ±1                     | uA   |
| power-off leakage current | I <sub>OFF</sub> | V <sub>I</sub> or V <sub>O</sub> =5.5V; V <sub>CC</sub> =0V                                          | -                                                         | -                    | ±2                     | uA   |
| supply current            | I <sub>CC</sub>  | V <sub>I</sub> =5.5V or GND; I <sub>O</sub> =0A;<br>V <sub>CC</sub> =1.65V to 5.5V                   | -                                                         | -                    | 4                      | uA   |
| additional supply current | ΔI <sub>CC</sub> | per pin; V <sub>I</sub> =V <sub>CC</sub> -0.6V;<br>I <sub>O</sub> =0A; V <sub>CC</sub> =2.3V to 5.5V | -                                                         | -                    | 500                    | uA   |

Note: All typical values are measured at T<sub>amb</sub>=25°C.

**3.3.3、AC Characteristics 1**(T<sub>amb</sub>=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

| Parameter         | Symbol           | Conditions                                     |                                 | Min. | Typ. | Max. | Unit |
|-------------------|------------------|------------------------------------------------|---------------------------------|------|------|------|------|
| propagation delay | t <sub>pd</sub>  | CP to Q, $\bar{Q}$ ;<br>see Figure 5           | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | 6.0  | 13.4 | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | 3.5  | 7.1  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 1.0  | 3.5  | 7.1  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | 3.5  | 5.9  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | 2.5  | 4.1  | ns   |
|                   |                  | $\bar{SD}$ to Q, $\bar{Q}$ ;<br>see Figure 6   | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | 6.0  | 12.9 | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | 3.5  | 7.0  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 1.0  | 3.5  | 7.0  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | 3.0  | 5.9  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | 2.5  | 4.1  | ns   |
|                   |                  | $\bar{RD}$ to Q, $\bar{Q}$ ;<br>see Figure 6   | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | 5.0  | 12.9 | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | 3.5  | 7.0  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 1.0  | 3.5  | 7.0  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | 3.0  | 5.9  | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | 2.5  | 4.1  | ns   |
| pulse width       | t <sub>w</sub>   | CP HIGH or LOW;<br>see Figure 5                | V <sub>CC</sub> =1.65V to 1.95V | 6.2  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 2.7  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 2.7  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 2.7  | 1.3  | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 2.0  | -    | -    | ns   |
|                   |                  | $\bar{SD}$ and $\bar{RD}$ LOW;<br>see Figure 6 | V <sub>CC</sub> =1.65V to 1.95V | 6.2  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 2.7  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 2.7  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 2.7  | 1.6  | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 2.0  | -    | -    | ns   |
| recovery time     | t <sub>rec</sub> | $\bar{SD}$ or $\bar{RD}$ ;<br>see Figure 6     | V <sub>CC</sub> =1.65V to 1.95V | 1.9  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 1.4  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 1.3  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | +1.2 | -3.0 | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | -    | -    | ns   |
| set-up time       | t <sub>su</sub>  | D to CP;<br>see Figure 5                       | V <sub>CC</sub> =1.65V to 1.95V | 2.9  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 1.7  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 1.7  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 1.3  | 0.5  | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 1.1  | -    | -    | ns   |
| hold time         | t <sub>h</sub>   | D to CP;<br>see Figure 5                       | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =2.7V           | 1.0  | -    | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | 0.6  | -    | ns   |
|                   |                  |                                                | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | -    | -    | ns   |
| maximum frequency | f <sub>max</sub> | CP;<br>see Figure 5                            | V <sub>CC</sub> =1.65V to 1.95V | 80   | -    | -    | MHz  |
|                   |                  |                                                | V <sub>CC</sub> =2.3V to 2.7V   | 175  | -    | -    | MHz  |



|                               |                 |                                                               |                               |     |     |   |     |
|-------------------------------|-----------------|---------------------------------------------------------------|-------------------------------|-----|-----|---|-----|
|                               |                 |                                                               | V <sub>CC</sub> =2.7V         | 175 | -   | - | MHz |
|                               |                 |                                                               | V <sub>CC</sub> =3.0V to 3.6V | 175 | 280 | - | MHz |
|                               |                 |                                                               | V <sub>CC</sub> =4.5V to 5.5V | 200 | -   | - | MHz |
| Power dissipation capacitance | C <sub>PD</sub> | V <sub>CC</sub> =3.3V; V <sub>I</sub> =GND to V <sub>CC</sub> |                               | -   | 15  | - | pF  |

Note:

[1] Typical values are measured at T<sub>amb</sub>=25°C and V<sub>CC</sub>=1.8V, 2.5V, 2.7V, 3.3V and 5.0V respectively.

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

### 3.3.4、AC Characteristics 2

(T<sub>amb</sub>=-40°C to +105°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

| Parameter         | Symbol          | Conditions                                  |                                 | Min. | Typ. | Max. | Unit |
|-------------------|-----------------|---------------------------------------------|---------------------------------|------|------|------|------|
| propagation delay | t <sub>pd</sub> | CP to Q, $\bar{Q}$ ; see Figure 5           | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | -    | 13.4 | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | -    | 7.1  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.7V           | 1.0  | -    | 7.1  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | -    | 5.9  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | -    | 4.1  | ns   |
|                   |                 | $\bar{S}D$ to Q, $\bar{Q}$ ; see Figure 6   | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | -    | 12.9 | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | -    | 7.0  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.7V           | 1.0  | -    | 7.0  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | -    | 5.9  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | -    | 4.1  | ns   |
|                   |                 | $\bar{R}D$ to Q, $\bar{Q}$ ; see Figure 6   | V <sub>CC</sub> =1.65V to 1.95V | 1.5  | -    | 12.9 | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.3V to 2.7V   | 1.0  | -    | 7.0  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.7V           | 1.0  | -    | 7.0  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =3.0V to 3.6V   | 1.0  | -    | 5.9  | ns   |
|                   |                 |                                             | V <sub>CC</sub> =4.5V to 5.5V   | 1.0  | -    | 4.1  | ns   |
| pulse width       | t <sub>w</sub>  | CP HIGH or LOW; see Figure 5                | V <sub>CC</sub> =1.65V to 1.95V | 6.2  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.3V to 2.7V   | 2.7  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.7V           | 2.7  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =3.0V to 3.6V   | 2.7  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =4.5V to 5.5V   | 2.0  | -    | -    | ns   |
|                   |                 | $\bar{S}D$ and $\bar{R}D$ LOW; see Figure 6 | V <sub>CC</sub> =1.65V to 1.95V | 6.2  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.3V to 2.7V   | 2.7  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =2.7V           | 2.7  | -    | -    | ns   |
|                   |                 |                                             | V <sub>CC</sub> =3.0V to 3.6V   | 2.7  | -    | -    | ns   |
|                   |                 |                                             |                                 |      |      |      |      |



|  |  |  |                           |      |   |   |     |
|--|--|--|---------------------------|------|---|---|-----|
|  |  |  | $V_{CC}=4.5V$ to $5.5V$   | 2.0  | - | - | ns  |
|  |  |  | $V_{CC}=1.65V$ to $1.95V$ | 1.9  | - | - | ns  |
|  |  |  | $V_{CC}=2.3V$ to $2.7V$   | 1.4  | - | - | ns  |
|  |  |  | $V_{CC}=2.7V$             | 1.3  | - | - | ns  |
|  |  |  | $V_{CC}=3.0V$ to $3.6V$   | +1.2 | - | - | ns  |
|  |  |  | $V_{CC}=4.5V$ to $5.5V$   | 1.0  | - | - | ns  |
|  |  |  | $V_{CC}=1.65V$ to $1.95V$ | 2.9  | - | - | ns  |
|  |  |  | $V_{CC}=2.3V$ to $2.7V$   | 1.7  | - | - | ns  |
|  |  |  | $V_{CC}=2.7V$             | 1.7  | - | - | ns  |
|  |  |  | $V_{CC}=3.0V$ to $3.6V$   | 1.3  | - | - | ns  |
|  |  |  | $V_{CC}=4.5V$ to $5.5V$   | 1.1  | - | - | ns  |
|  |  |  | $V_{CC}=1.65V$ to $1.95V$ | 1.5  | - | - | ns  |
|  |  |  | $V_{CC}=2.3V$ to $2.7V$   | 1.0  | - | - | ns  |
|  |  |  | $V_{CC}=2.7V$             | 1.0  | - | - | ns  |
|  |  |  | $V_{CC}=3.0V$ to $3.6V$   | 1.0  | - | - | ns  |
|  |  |  | $V_{CC}=4.5V$ to $5.5V$   | 1.0  | - | - | ns  |
|  |  |  | $V_{CC}=1.65V$ to $1.95V$ | 80   | - | - | MHz |
|  |  |  | $V_{CC}=2.3V$ to $2.7V$   | 175  | - | - | MHz |
|  |  |  | $V_{CC}=2.7V$             | 175  | - | - | MHz |
|  |  |  | $V_{CC}=3.0V$ to $3.6V$   | 175  | - | - | MHz |
|  |  |  | $V_{CC}=4.5V$ to $5.5V$   | 200  | - | - | MHz |

Note:

[1] Typical values are measured at  $T_{amb}=25^{\circ}C$  and  $V_{CC}=1.8V, 2.5V, 2.7V, 3.3V$  and  $5.0V$  respectively.

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

## 4、Testing Circuit

### 4.1、AC Testing Circuit

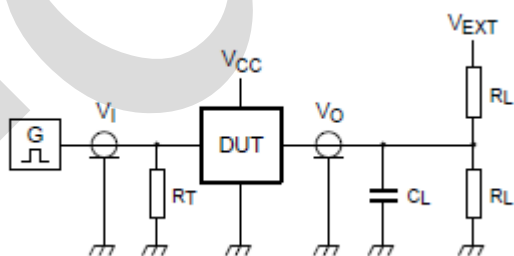


Figure 4. Test circuit for measuring switching times

Definitions for test circuit:

$R_L$ =Load resistance.

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

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

$V_{EXT}$ =External voltage for measuring switching times.



## 4.2、AC Testing Waveforms

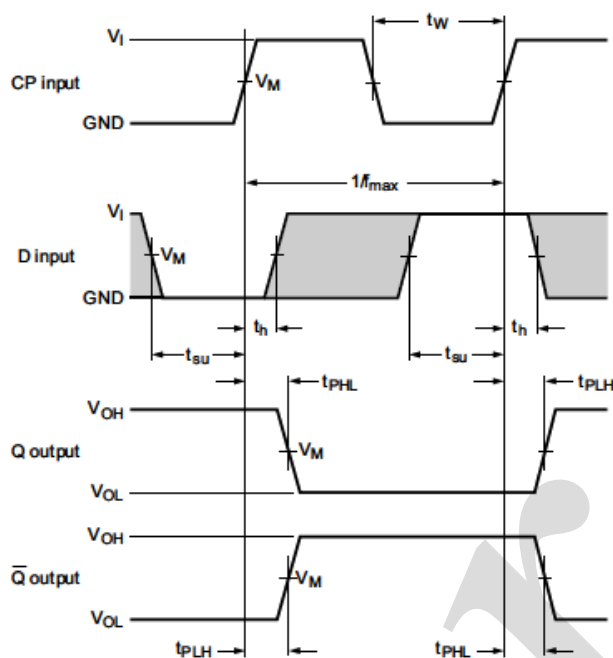


Figure 5. The clock input (CP) to output (Q,  $\bar{Q}$ ) propagation delays, the clock pulse width, the D to CP set-up, the CP to D hold times and the maximum frequency

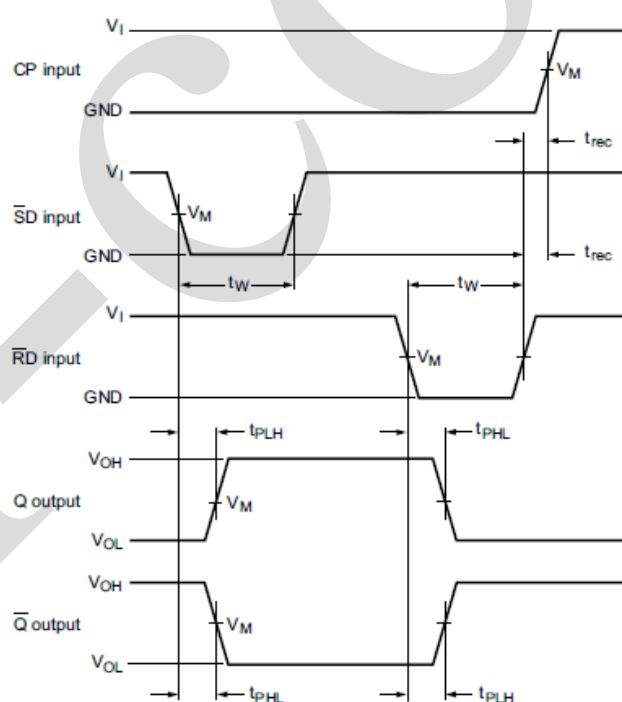


Figure 6. The set ( $\bar{S}D$ ) and reset ( $\bar{R}D$ ) input to output (Q,  $\bar{Q}$ ) propagation delays, the set and reset pulse widths and the  $\bar{R}D$  to CP recovery time



## 4.3、Measurement Points

| Supply voltage | Input               | Output              |
|----------------|---------------------|---------------------|
| $V_{CC}$       | $V_M$               | $V_M$               |
| 1.65V to 1.95V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.3V to 2.7V   | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.7V           | 1.5V                | 1.5V                |
| 3.0V to 3.6V   | 1.5V                | 1.5V                |
| 4.5V to 5.5V   | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |

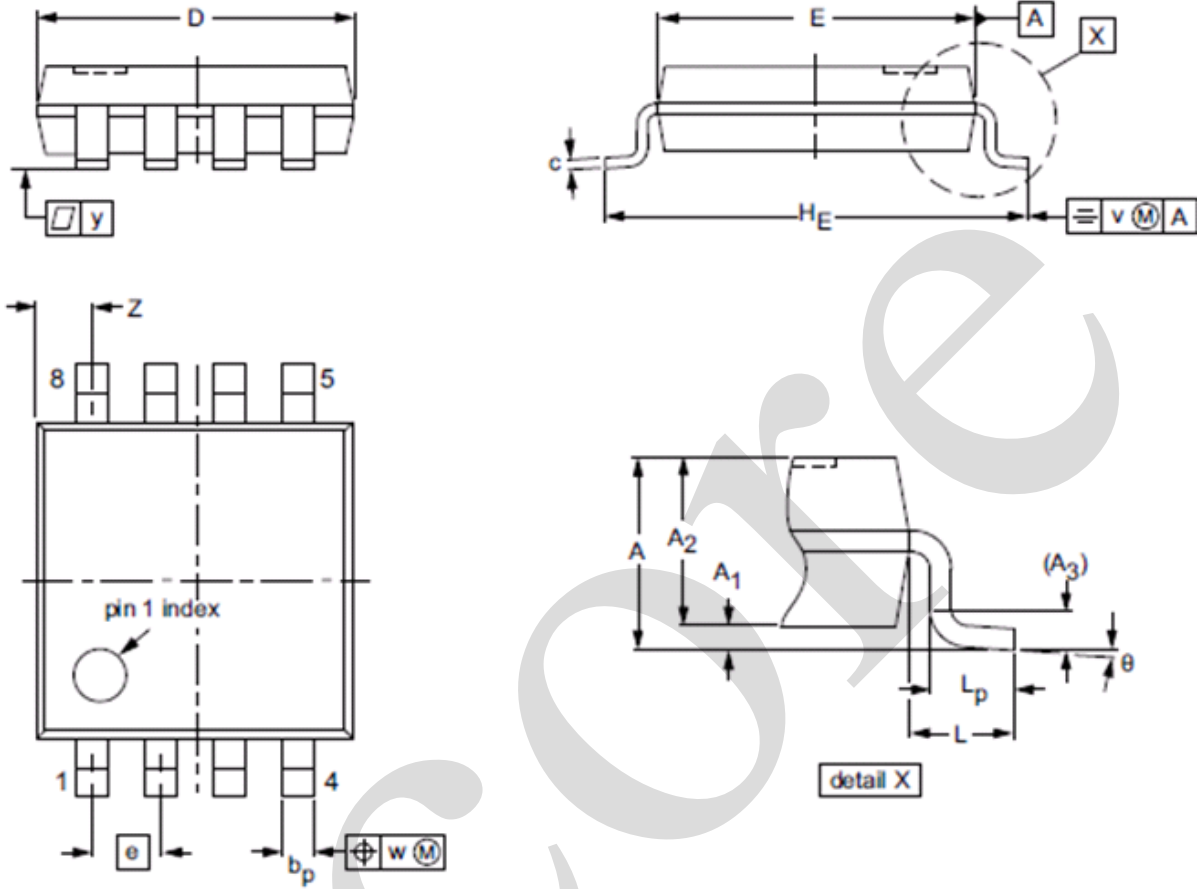
## 4.4、Test Data

| Supply voltage | Input    |              | Load  |              | $V_{EXT}$               |                         |                         |
|----------------|----------|--------------|-------|--------------|-------------------------|-------------------------|-------------------------|
| $V_{CC}$       | $V_I$    | $t_r = t_f$  | $C_L$ | $R_L$        | $t_{PLH},$<br>$t_{PHL}$ | $t_{PZH},$<br>$t_{PHZ}$ | $t_{PZL},$<br>$t_{PLZ}$ |
| 1.65V to 1.95V | $V_{CC}$ | $\leq 2.0ns$ | 30pF  | 1k $\Omega$  | open                    | GND                     | $2 \times V_{CC}$       |
| 2.3V to 2.7V   | $V_{CC}$ | $\leq 2.0ns$ | 30pF  | 500 $\Omega$ | open                    | GND                     | $2 \times V_{CC}$       |
| 2.7V           | 2.7V     | $\leq 2.5ns$ | 50pF  | 500 $\Omega$ | open                    | GND                     | 6V                      |
| 3.0V to 3.6V   | 2.7V     | $\leq 2.5ns$ | 50pF  | 500 $\Omega$ | open                    | GND                     | 6V                      |
| 4.5V to 5.5V   | $V_{CC}$ | $\leq 2.5ns$ | 50pF  | 500 $\Omega$ | open                    | GND                     | $2 \times V_{CC}$       |



## 5、Package Information

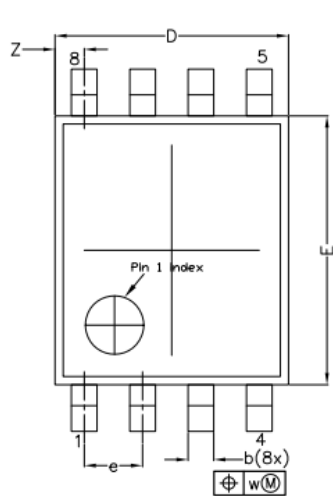
### 5.1、TSSOP8



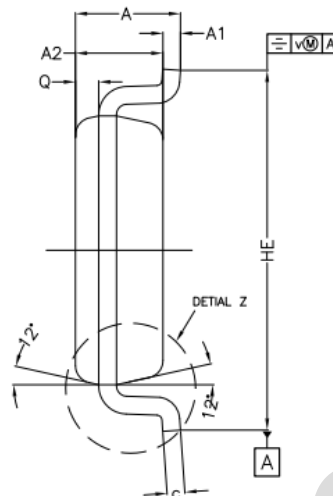
| UNIT | A<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L   | L <sub>p</sub> | v   | w    | y   | Z <sup>(1)</sup> | θ        |
|------|-----------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|-----|----------------|-----|------|-----|------------------|----------|
| mm   | 1.1       | 0.15<br>0.00   | 0.95<br>0.75   | 0.25           | 0.38<br>0.22   | 0.18<br>0.08 | 3.1<br>2.9       | 3.1<br>2.9       | 0.65 | 4.1<br>3.9     | 0.5 | 0.47<br>0.33   | 0.2 | 0.13 | 0.1 | 0.70<br>0.35     | 8°<br>0° |



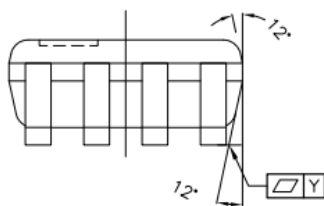
## 5.2、VSSOP8



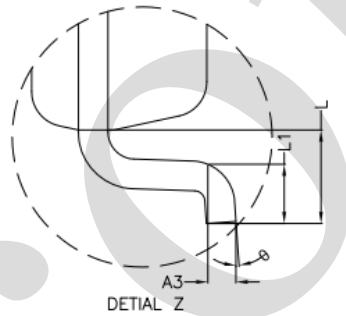
TOP VIEW



SIDE VIEW



SIDE VIEW



DETAIL Z

\* CONTROLLING DIMENSION : MM

| SYMBOL | MILLIMETER |      |      |
|--------|------------|------|------|
|        | MIN.       | NOM. | MAX. |
| A      | ---        | ---  | 1.00 |
| A1     | 0.00       | ---  | 0.15 |
| A2     | 0.60       | 0.75 | 0.85 |
| A3     | ---        | 0.12 | ---  |
| Q      | 0.19       | 0.20 | 0.21 |
| b      | 0.17       | 0.22 | 0.27 |
| c      | 0.08       | ---  | 0.23 |
| D      | 1.90       | 2.00 | 2.10 |
| E      | 2.20       | 2.30 | 2.40 |
| HE     | 3.00       | 3.10 | 3.20 |
| e      | 0.50 bsc   |      |      |
| L      | 0.40 bsc   |      |      |
| L1     | 0.15       | ---  | 0.40 |
| Y      | ---        | 0.10 | ---  |
| v      | ---        | 0.20 | ---  |
| w      | ---        | 0.08 | ---  |
| Z      | 0.10       | ---  | 0.40 |
| θ      | 0°         | ---  | 8°   |

### NOTES

1.0 COPLANARITY APPLIES TO LEADS, CORNER LEADS AND DIE ATTACH PAD.



## 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             | <p>○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard.</p> <p>×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.</p> |                               |                               |                               |                          |                                |                   |                       |                           |                      |

### 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.