

芯伯乐®
X I N B O L E

Product Specification

XBLW SN74LS112

Dual negative-edge triggered JK flip-flop

WEB | www.xinboleic.com

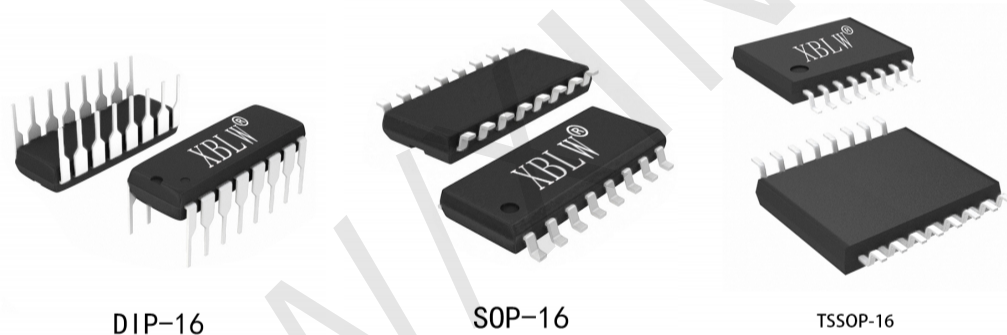


Description

The SN74LS112 is a dual negative-edge triggered JK flip-flop.

Features

- Supply voltage range: 2-6V
- Temperature range:-20°C to +85°C
- Packaging information: DIP-16/SOP-16/TSSOP-16



DIP-16

SOP-16

TSSOP-16

Ordering Information

| Product Model | Package Type | Marking | Packing | Packing Qty |
|--------------------|--------------|----------|---------|--------------|
| XBLW SN74LS112N | DIP-16 | 74LS112N | Tube | 1000Pcs/Box |
| XBLW SN74LS112DTR | SOP-16 | 74LS112 | Tape | 2500Pcs/Reel |
| XBLW SN74LS112TDTR | TSSOP-16 | 74LS112 | Tape | 3000Pcs/Reel |

Block Diagram

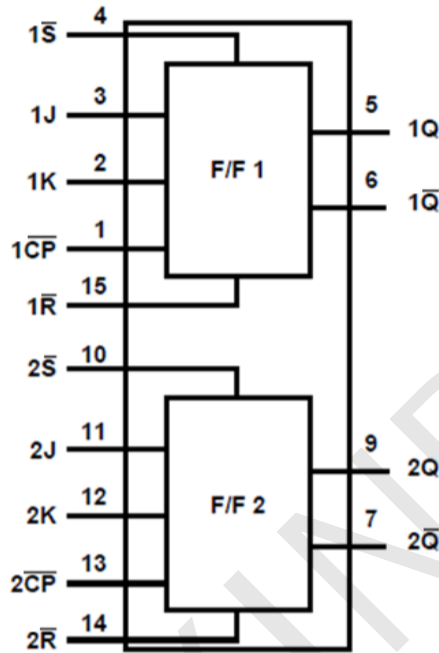
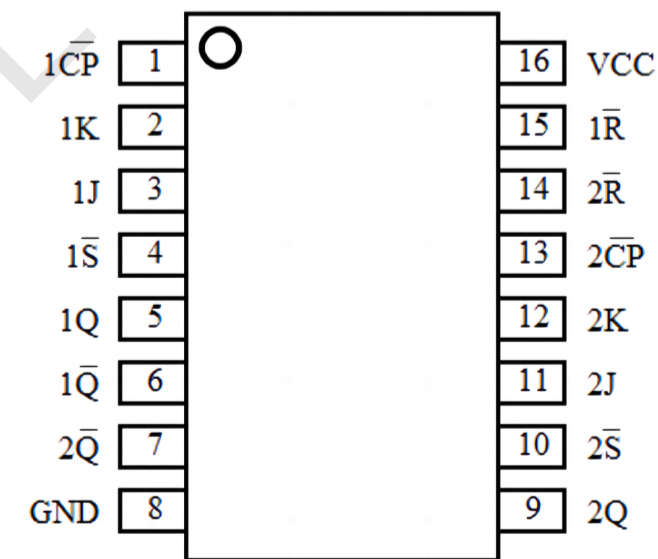


Figure 1. Functional diagram

Pin Configurations



Pin Description

| Pin No. | Pin Name | Description |
|---------|------------------|---|
| 1 | $\overline{1CP}$ | clock input (HIGH-to-LOW; edge-triggered) |
| 2 | 1K | data input |
| 3 | 1J | data input |
| 4 | $\overline{1S}$ | set input (active LOW) |
| 5 | 1Q | true flip-flop output |
| 6 | $\overline{1Q}$ | complement flip-flop output |
| 7 | $\overline{2Q}$ | complement flip-flop output |
| 8 | GND | ground (0V) |
| 9 | 2Q | true flip-flop output |
| 10 | $\overline{2S}$ | set input (active LOW) |
| 11 | 2J | data input |
| 12 | 2K | data input |
| 13 | $\overline{2CP}$ | clock input (HIGH-to-LOW; edge-triggered) |
| 14 | $\overline{2R}$ | reset input (active LOW) |
| 15 | $\overline{1R}$ | reset input (active LOW) |
| 16 | VCC | supply voltage |

Function Table

| Inputs | | | | | Outputs | |
|----------------|----------------|-----------------|---|---|-----------|----------------|
| \overline{S} | \overline{R} | \overline{CP} | J | K | Q | \overline{Q} |
| L | H | X | X | X | H | L |
| H | L | X | X | X | L | H |
| L | L | X | X | X | H(Note 1) | H(Note 1) |
| H | H | ↓ | L | L | No Change | |
| H | H | ↓ | H | L | H | L |
| H | H | ↓ | L | H | L | H |
| H | H | ↓ | H | H | Toggle | |
| H | H | H | X | X | No Change | |

H= High Level (Steady State) L= Low Level (Steady State) X= Don't Care

↓= High-to-Low Transition

NOTE 1 : Output states unpredictable if both S and R go High simultaneously after both being low at the same time

Electrical Parameter

Absolute Maximum Ratings

($T_{amb}=25^{\circ}\text{C}$, All voltage referenced to V_{ss} , unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Max. | Unit |
|-------------------------|-----------|--|-----------|----------|--------------------|
| supply voltage | V_{CC} | - | -0.5 | +7 | V |
| ground current | I_{GND} | - | -50 | - | mA |
| input clamping current | I_{IK} | $V_I < -0.5\text{V}$ or $V_I > V_{CC}+0.5\text{V}$ | - | ± 20 | mA |
| output clamping current | I_{OK} | $V_O < -0.5\text{V}$ or $V_O > V_{CC}+0.5\text{V}$ | - | ± 20 | mA |
| output current | I_O | $-0.5\text{V} < V_O < V_{CC}+0.5\text{V}$ | - | ± 25 | mA |
| storage temperature | T_{stg} | - | -65 | +150 | $^{\circ}\text{C}$ |
| soldering temperature | T_L | 10s | DIP | 245 | $^{\circ}\text{C}$ |
| | | | SOP/TSSOP | 260 | |

Electrical Characteristics

DC Characteristics

($T_{amb} = -20^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

| Parameter | Symbol | V _{CC} | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------|-----------------|--|------|------|---------|---------|
| HIGH-level input voltage | V _{IH} | 2.0V | - | 1.5 | 1.2 | - | V |
| | | 4.5V | - | 3.15 | 2.4 | - | V |
| | | 6.0V | - | 4.2 | 3.2 | - | V |
| LOW-level input voltage | V _{IL} | 2.0V | - | - | 0.8 | 0.5 | V |
| | | 4.5V | - | - | 2.1 | 1.35 | V |
| | | 6.0V | - | - | 2.8 | 1.8 | V |
| HIGH-level output voltage | V _{OH} | 2.0V | I _O =-20 μ A | 1.9 | 2.0 | - | V |
| | | 4.5V | I _O =-20 μ A | 4.4 | 4.5 | - | V |
| | | 6.0V | I _O =-20 μ A | 5.9 | 6.0 | - | V |
| | | 4.5V | I _O =-4.0mA | 3.84 | 4.32 | - | V |
| | | 6.0V | I _O =-5.2mA | 5.34 | 5.81 | - | V |
| LOW-level output voltage | V _{OL} | 2.0V | I _O =20 μ A | - | 0 | 0.1 | V |
| | | 4.5V | I _O =20 μ A | - | 0 | 0.1 | V |
| | | 6.0V | I _O =20 μ A | - | 0 | 0.1 | V |
| | | 4.5V | I _O =4.0mA | - | 0.15 | 0.33 | V |
| | | 6.0V | I _O =5.2mA | - | 0.16 | 0.33 | V |
| input leakage current | I _I | 6.0V | V _I =V _{CC} or GND | - | - | ± 1 | μ A |
| supply current | I _{CC} | 6.0V | V _I =V _{CC} or GND; I _O =0A | - | - | 80 | μ A |

AC Characteristics

 ($T_{amb} = -20^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{SS} = 0\text{V}$, unless otherwise specified.)

| Parameter | Symbol | Vcc | Conditions | Min. | Typ. | Max. | Unit | |
|----------------------------------|-------------------------------------|----------------------|----------------------|--------------|------|------|------|-----|
| nCP̄ to nQ propagation delay | t _{PLH} , t _{PHL} | 2.0V | C _L =50pF | see Figure 5 | - | 55 | 220 | ns |
| | | 4.5V | C _L =50pF | | - | 20 | 44 | ns |
| | | 5.0V | C _L =15pF | | - | 17 | - | ns |
| | | 6.0V | C _L =50pF | | - | 16 | 37 | ns |
| nCP̄ to nQ̄ propagation delay | | 2.0V | C _L =50pF | see Figure 5 | - | 55 | 220 | ns |
| | | 4.5V | C _L =50pF | | - | 20 | 44 | ns |
| | | 5.0V | C _L =15pF | | - | 17 | - | ns |
| | | 6.0V | C _L =50pF | | - | 16 | 37 | ns |
| nR̄ to nQ̄, nQ propagation delay | | 2.0V | C _L =50pF | see Figure 6 | - | 58 | 225 | ns |
| | | 4.5V | C _L =50pF | | - | 21 | 45 | ns |
| | | 5.0V | C _L =15pF | | - | 18 | - | ns |
| | | 6.0V | C _L =50pF | | - | 17 | 38 | ns |
| nS̄ to nQ̄, nQ propagation delay | 2.0V | C _L =50pF | see Figure 6 | - | 50 | 295 | ns | |
| | 4.5V | C _L =50pF | | - | 18 | 39 | ns | |
| | 5.0V | C _L =15pF | | - | 15 | - | ns | |
| | 6.0V | C _L =50pF | | - | 14 | 33 | ns | |
| transition time | t _{THL} , t _{TLH} | 2.0V | C _L =50pF | see Figure 5 | - | 19 | 95 | ns |
| | | 4.5V | C _L =50pF | | - | 7 | 19 | ns |
| | | 6.0V | C _L =50pF | | - | 6 | 16 | ns |
| nCP̄ HIGH or LOW pulse width | t _w | 2.0V | C _L =50pF | see Figure 5 | 100 | 22 | - | ns |
| | | 4.5V | C _L =50pF | | 20 | 8 | - | ns |
| | | 6.0V | C _L =50pF | | 17 | 6 | - | ns |
| nS̄, nR̄ LOW pulse width | | 2.0V | C _L =50pF | see Figure 6 | 100 | 22 | - | ns |
| | | 4.5V | C _L =50pF | | 20 | 8 | - | ns |
| | | 6.0V | C _L =50pF | | 17 | 6 | - | ns |
| nR̄ to nCP̄ recovery time | t _{rec} | 2.0V | C _L =50pF | see Figure 6 | 125 | 22 | - | ns |
| | | 4.5V | C _L =50pF | | 25 | 8 | - | ns |
| | | 6.0V | C _L =50pF | | 21 | 6 | - | ns |
| nS̄ to nCP̄ recovery time | | 2.0V | C _L =50pF | see Figure 6 | 100 | -19 | - | ns |
| | | 4.5V | C _L =50pF | | 20 | -7 | - | ns |
| | | 6.0V | C _L =50pF | | 17 | -6 | - | ns |
| nJ and nK ton CP̄ set-up time | t _{su} | 2.0V | C _L =50pF | see Figure 5 | 100 | 19 | - | ns |
| | | 4.5V | C _L =50pF | | 20 | 7 | - | ns |
| | | 6.0V | C _L =50pF | | 17 | 6 | - | ns |
| nJ and nK ton CP̄ hold time | t _h | 2.0V | C _L =50pF | see Figure 5 | 0 | -11 | - | ns |
| | | 4.5V | C _L =50pF | | 0 | -4 | - | ns |
| | | 6.0V | C _L =50pF | | 0 | -3 | - | ns |
| maximum frequency | f _{max} | 2.0V | C _L =50pF | see Figure 5 | 4.8 | 20 | - | MHz |
| | | 4.5V | C _L =50pF | | 24 | 60 | - | MHz |
| | | 5.0V | C _L =15pF | | - | 66 | - | MHz |
| | | 6.0V | C _L =50pF | | 28 | 71 | - | MHz |

Testing Circuit

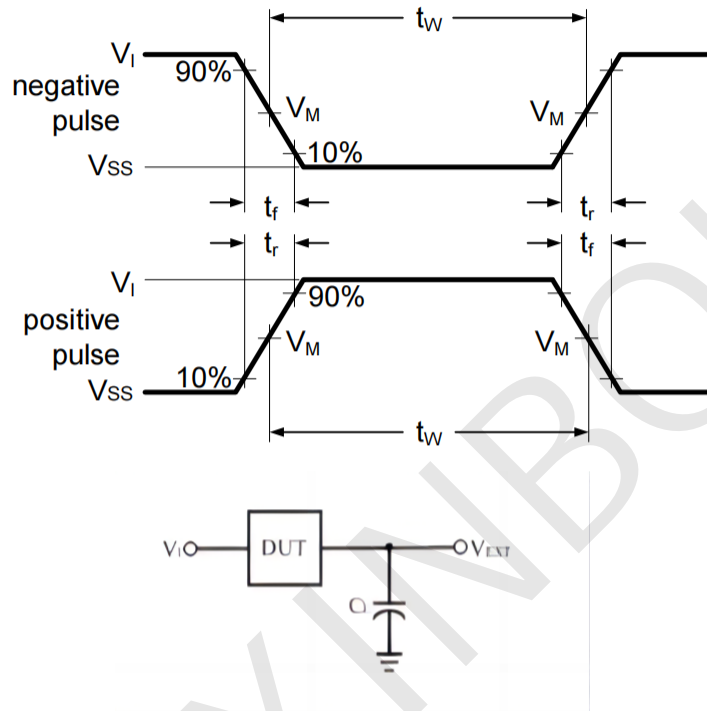


Figure 2 Load circuit

C_L includes probe and jig capacitance.

AC Testing Waveforms

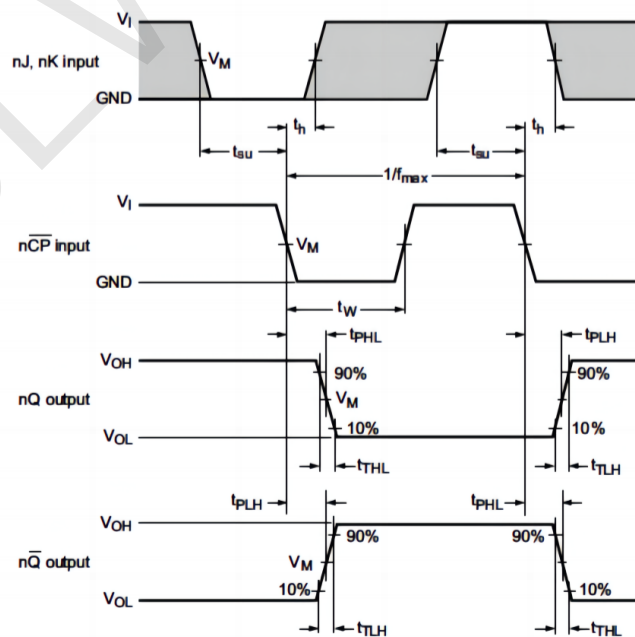


Figure 3 Clock propagation delays, output transition time, pulse width, set-up, hold times, and maximum frequency

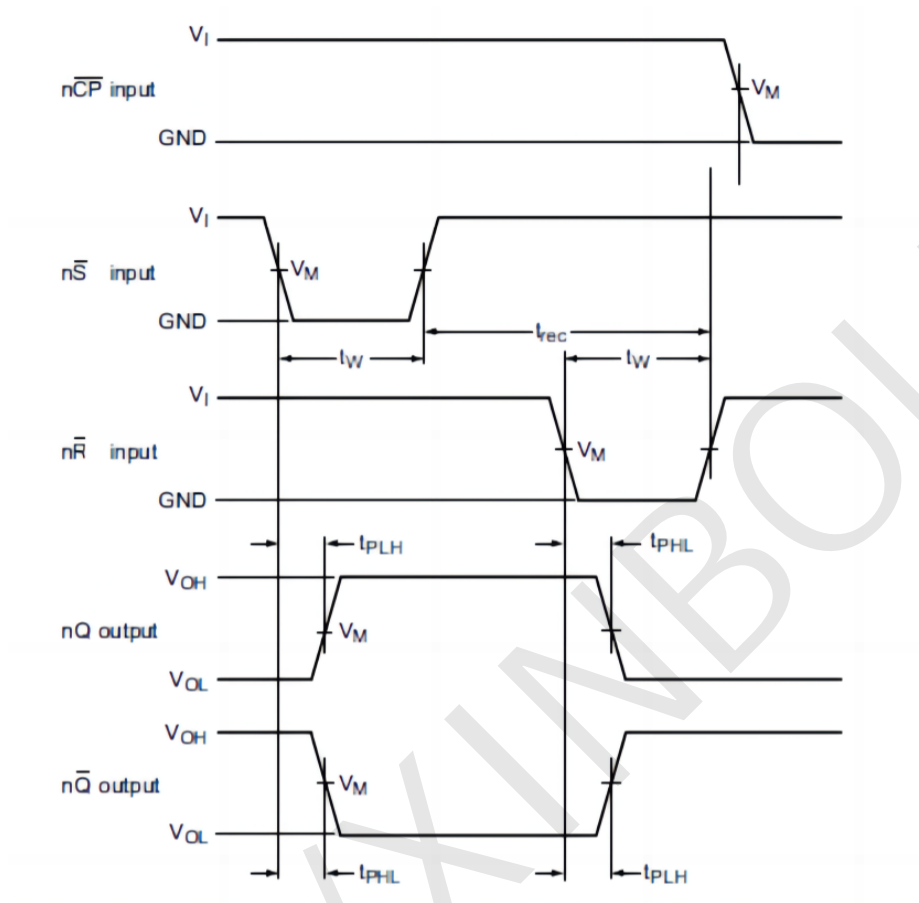


Figure 4 Set and reset propagation delays, pulse widths and recovery time

Measurement Points

| Type | Input | | Output | |
|-----------|---------------------|---------------------|---------------------|---------------------|
| | V_M | V_M | V_X | V_Y |
| SN74LS112 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $0.1 \times V_{CC}$ | $0.9 \times V_{CC}$ |

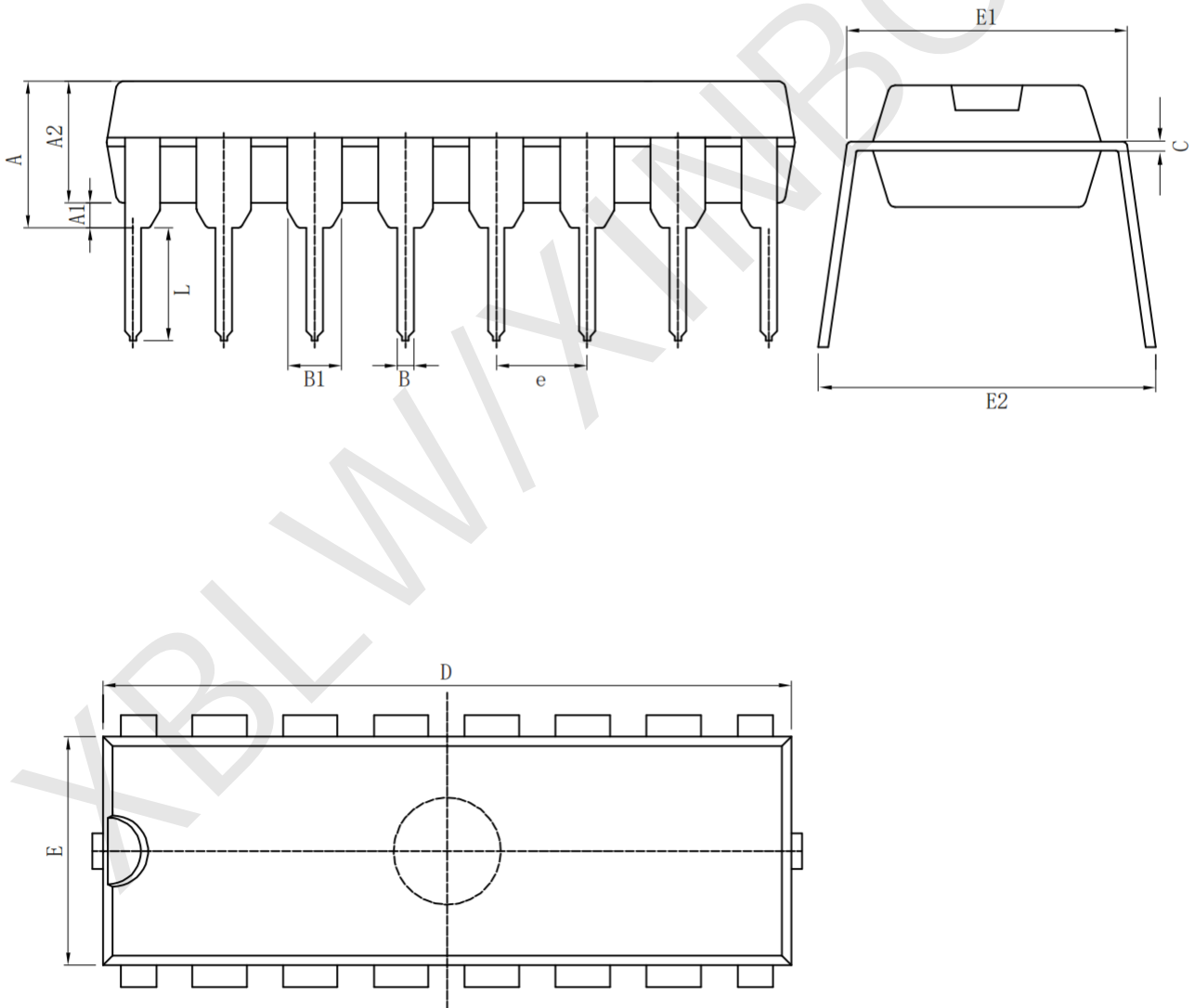
Test Data

| Type | Input | | Load | V_{EXT} | | |
|-----------|----------|-------------|-------|-------------------|-------------------|-------------------|
| | V_I | $t_r = t_f$ | C_L | t_{PLH}/t_{PHL} | t_{PLZ}/t_{PZL} | t_{PHZ}/t_{PZH} |
| SN74LS112 | V_{CC} | 6.0ns | 50pF | Open | V_{CC} | GND |

Package Information

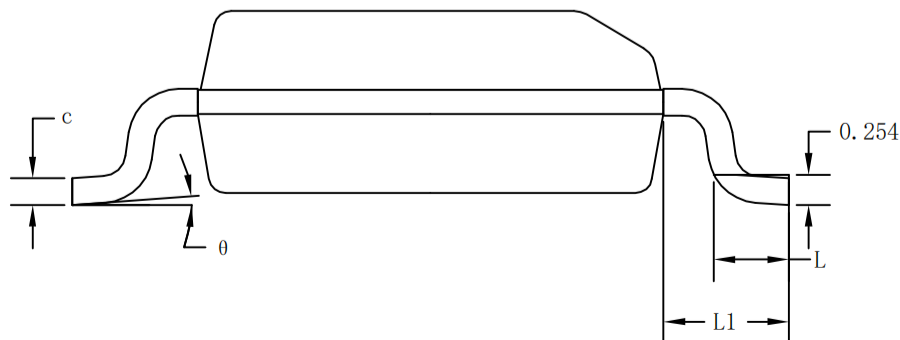
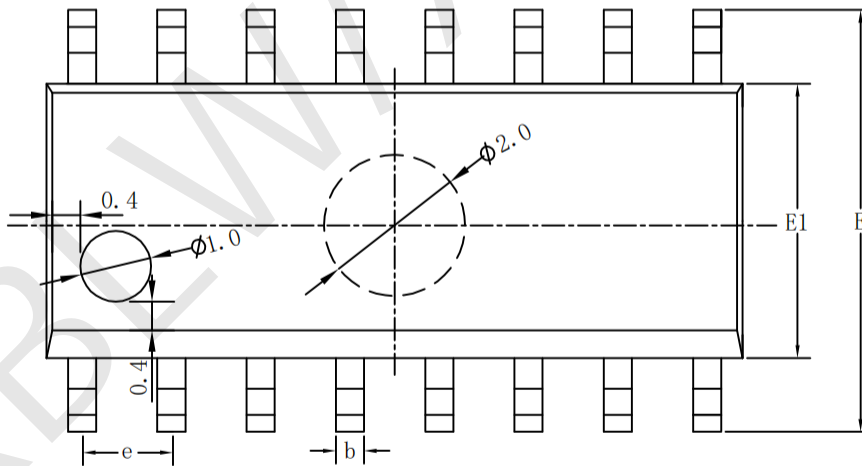
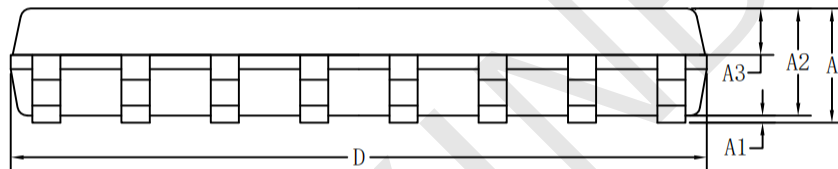
· DIP-16

| Symbol | Size | Dimensions In Millimeters | | Symbol | Size | Dimensions In Inches | |
|--------|------|---------------------------|----------|--------|------|----------------------|----------|
| | | Min(mm) | Max(mm) | | | Min(in) | Max(in) |
| A | | 3.710 | 4.310 | A | | 0.146 | 0.170 |
| A1 | | 0.510 | | A1 | | 0.020 | |
| A2 | | 3.200 | 3.600 | A2 | | 0.126 | 0.142 |
| B | | 0.380 | 0.570 | B | | 0.015 | 0.022 |
| B1 | | 1.524 (BSC) | | B1 | | 0.060 (BSC) | |
| C | | 0.204 | 0.360 | C | | 0.008 | 0.014 |
| D | | 18.80 | 19.20 | D | | 0.740 | 0.756 |
| E | | 6.200 | 6.600 | E | | 0.244 | 0.260 |
| E1 | | 7.320 | 7.920 | E1 | | 0.288 | 0.312 |
| e | | 2.540 (BSC) | | e | | 0.100 (BSC) | |
| L | | 3.000 | 3.600 | L | | 0.118 | 0.142 |
| E2 | | 8.400 | 9.000 | E2 | | 0.331 | 0.354 |



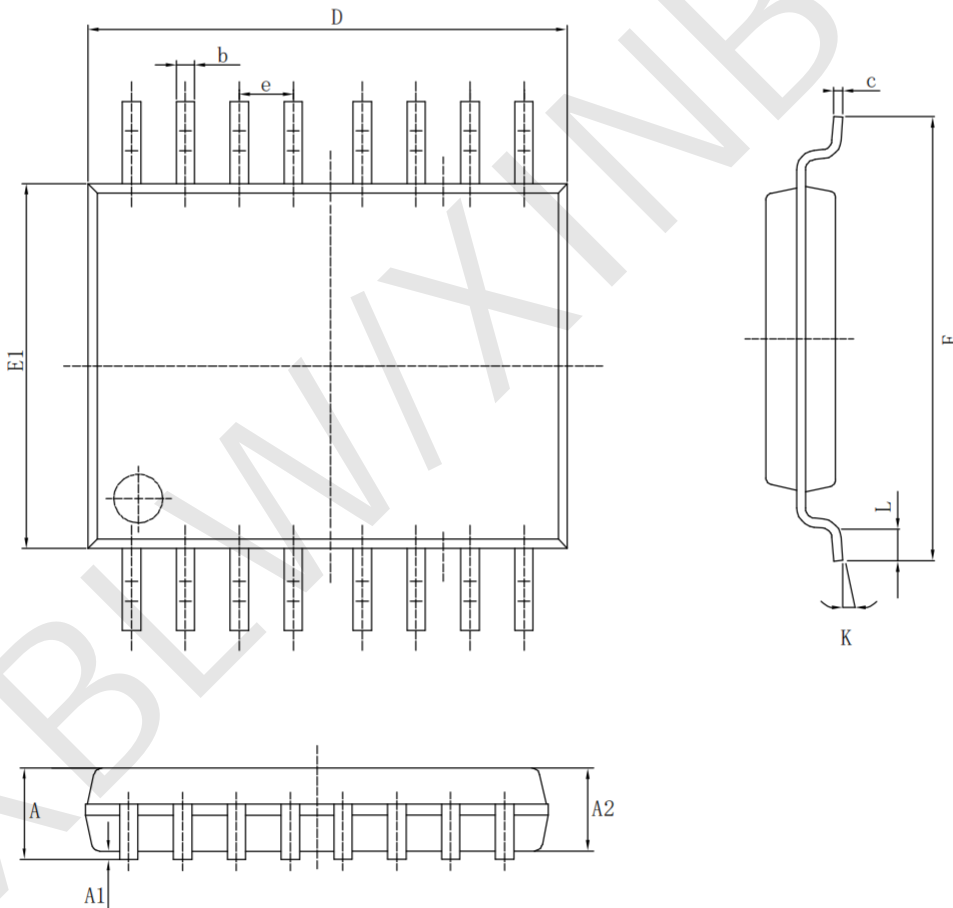
· SOP-16

| Symbol | Dimensions In Millimeters | | | Symbol | Dimensions In Inches | | |
|--------|---------------------------|---------|---------|--------|----------------------|---------|---------|
| | Min(mm) | Nom(mm) | Max(mm) | | Min(in) | Nom(in) | Max(in) |
| A | 1.500 | 1.600 | 1.700 | A | 0.059 | 0.063 | 0.067 |
| A1 | 0.100 | 0.150 | 0.250 | A1 | 0.004 | 0.006 | 0.010 |
| A2 | 1.400 | 1.450 | 1.500 | A2 | 0.055 | 0.057 | 0.059 |
| A3 | 0.600 | 0.650 | 0.700 | A3 | 0.024 | 0.026 | 0.028 |
| b | 0.300 | 0.400 | 0.500 | b | 0.012 | 0.016 | 0.020 |
| c | 0.150 | 0.200 | 0.250 | c | 0.006 | 0.008 | 0.010 |
| D | 9.800 | 9.900 | 10.00 | D | 0.386 | 0.390 | 0.394 |
| E | 5.800 | 6.000 | 6.200 | E | 0.228 | 0.236 | 0.244 |
| E1 | 3.850 | 3.900 | 3.950 | E1 | 0.152 | 0.154 | 0.156 |
| e | 1.27 (BSC) | | | e | 0.050 (BSC) | | |
| L | 0.500 | 0.600 | 0.700 | L | 0.020 | 0.024 | 0.028 |
| L1 | 1.05 (BSC) | | | L1 | 0.041 (BSC) | | |
| θ | 0° | 4° | 8° | θ | 0° | 4° | 8° |



· TSSOP-16

| Symbol | Dimensions In Millimeters | | Symbol | Dimensions In Inches | |
|--------|---------------------------|----------|--------|----------------------|----------|
| | Min (mm) | Max (mm) | | Min (in) | Max (in) |
| A | | 1.200 | A | | 0.047 |
| A1 | 0.050 | 0.150 | A1 | 0.002 | 0.006 |
| A2 | 0.800 | 1.050 | A2 | 0.031 | 0.041 |
| b | 0.190 | 0.300 | b | 0.007 | 0.012 |
| c | 0.090 | 0.200 | c | 0.004 | 0.0089 |
| D | 4.900 | 5.100 | D | 0.193 | 0.201 |
| E | 6.200 | 6.600 | E | 0.244 | 0.260 |
| E1 | 4.300 | 4.480 | E1 | 0.169 | 0.176 |
| e | 0.65 (BSC) | | e | 0.0256 (BSC) | |
| K | 0° | 8° | K | 0° | 8° |
| L | 0.450 | 0.750 | L | 0.018 | 0.030 |



Statement

- XBLW reserves the right to modify the product manual without prior notice! Before placing an order, customers need to confirm whether the obtained information is the latest version and verify the completeness of the relevant information.
- Any semi-guide product is subject to failure or malfunction under specified conditions. It is the buyer's responsibility to comply with safety standards when using XBLW products for system design and whole machine manufacturing. And take the appropriate safety measures to avoid the potential in the risk of loss of personal injury or loss of property situation!
- XBLW product has not been licensed for life support, military and aerospace applications, and therefore XBLW is not responsible for any consequences arising from its use in these areas.
- If any or all XBLW products (including technical data, services) described or contained in this document are subject to any applicable local export control laws and regulations, they may not be exported without an export license from the relevant authorities in accordance with such laws.
- The specifications of any and all XBLW products described or contained in this document specify the performance, characteristics, and functionality of said products in their standalone state, but do not guarantee the performance, characteristics, and functionality of said products installed in Customer's products or equipment. In order to verify symptoms and conditions that cannot be evaluated in a standalone device, the Customer should ultimately evaluate and test the device installed in the Customer's product device.
- XBLW documentation is only allowed to be copied without any alteration of the content and with the relevant authorization. XBLW assumes no responsibility or liability for altered documents.
- XBLW is committed to becoming the preferred semiconductor brand for customers, and XBLW will strive to provide customers with better performance and better quality products.