芯 伯 乐®
XINBOLE

Product Specification

XBLW ULN2003AB

Seven Channel Darlington Transistor Arrays

WEB | www.xinboleic.com

RoHS

Descriptions

ULN2003AB is high-voltage, high-current Seven Darlington arrays each containing seven open collector Darlington pairs with common emitters. Each channel is rated at 500 mA and can withstand peak currents of 600 mA. Suppression diodes are included for inductive load driving.The circuit is designed with a continuous diode, which can be used to drive the relay, stepper motor and other inductive loads. Single channel Darlington tube collector can output 500mA current. Higher output current capability is achieved by connecting Darlington tubes in parallel. The circuit can be widely used in relay driver, lighting driver, display driver (LED), stepper motor driver and logic buffer.It is useful for driving a wide range of loads including relay DC motors, LED display filament lamps, high-power buffers, 5V TTL, CMOS and other industry-standard logical circuit.
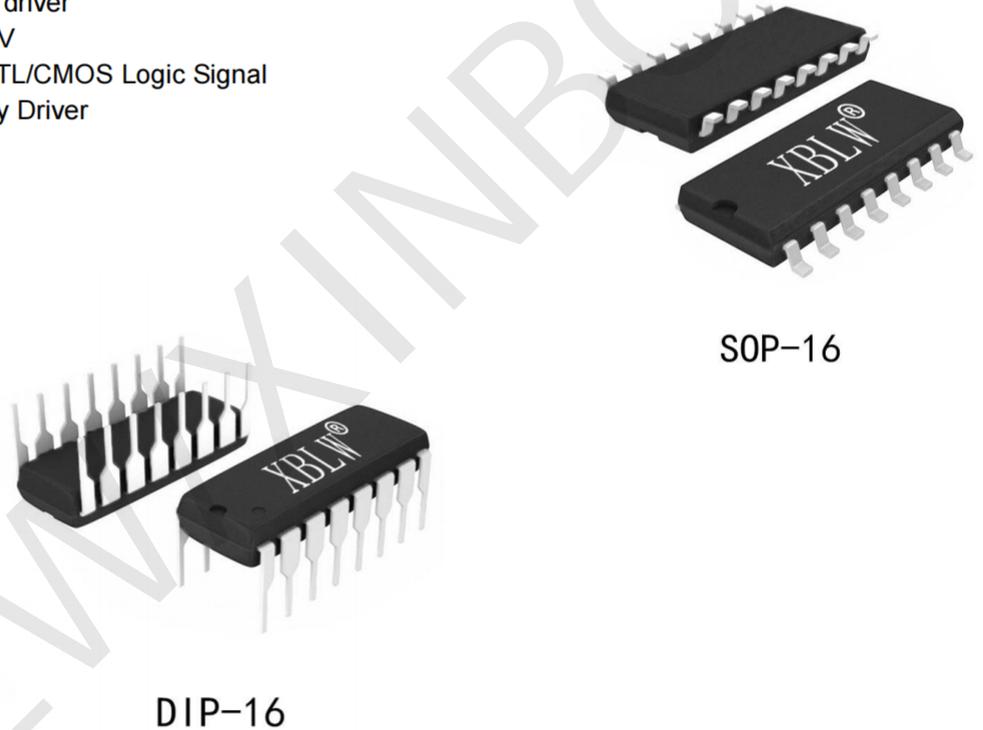
This chip is available in DIP-16 or SOP-16 package.

Features

➢ Output current 500 mA per driver
➢ Withstand High Voltage 50V
➢ Input Pins Compatible to TTL/CMOS Logic Signal
➢ A Wide Application in Relay Driver

Applications

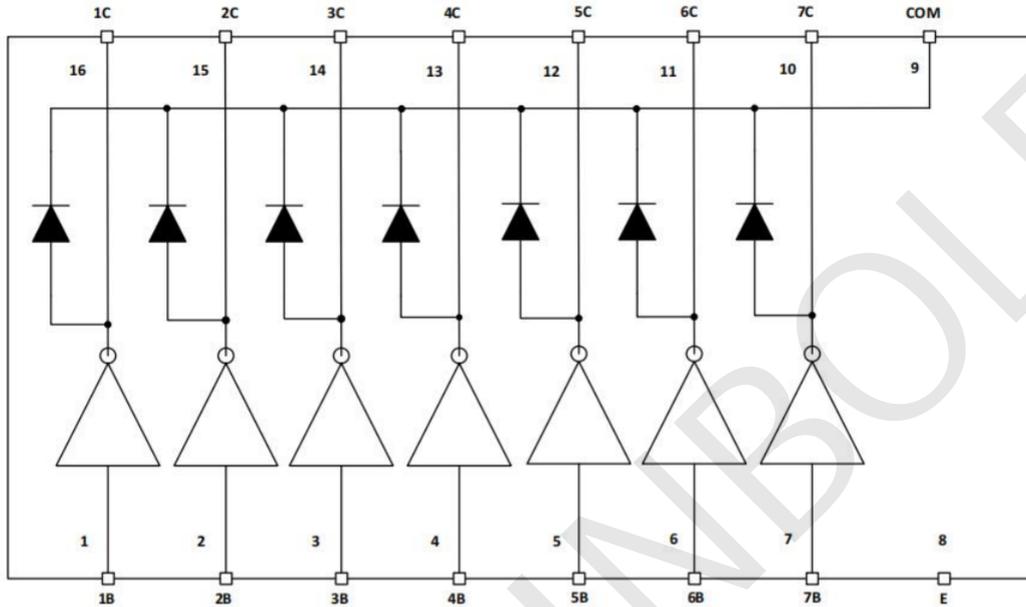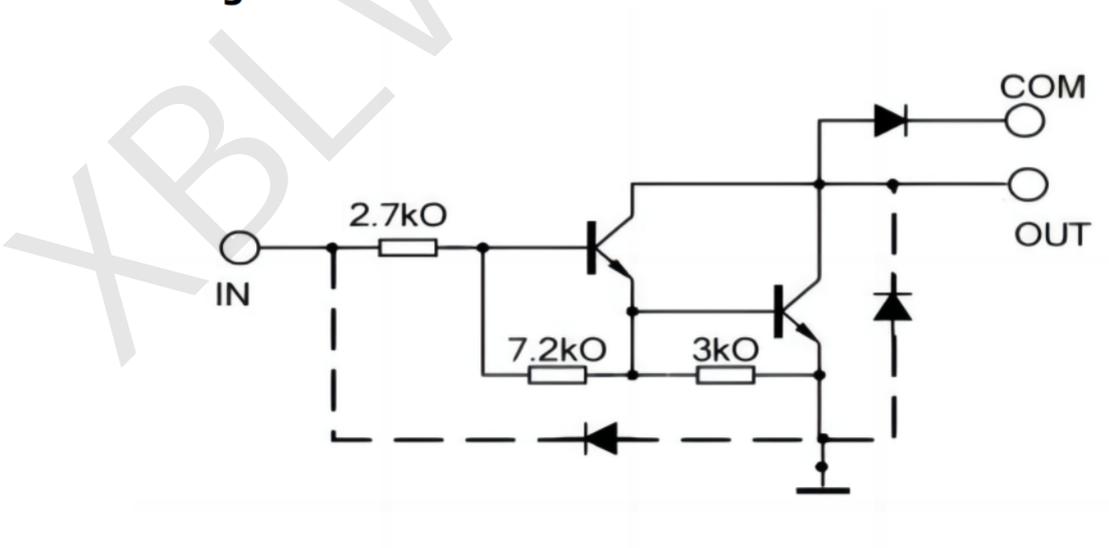➢ Relay Driver
➢ Lamps Driver
➢ Display Driver

SOP-16

DIP-16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW ULN2003ABN	DIP-16	ULN2003ABN	Tube	1000Pcs/Box
XBLW ULN2003ABDTR	SOP-16	ULN2003AB	Tape	2500Pcs/Reel

Logic Diagram

Circuit Diagram

Pins Configuration
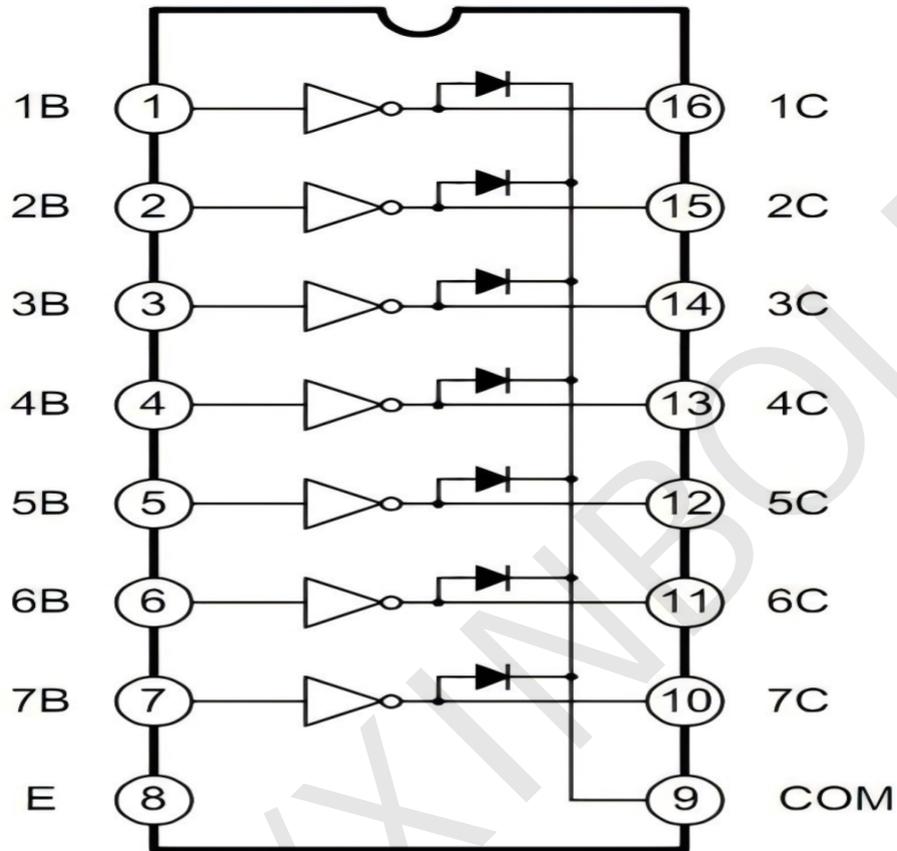
Pins Description

No.	Name	Type	Description
1	1B	I	Input 1
2	2B	I	Input 2
3	3B	I	Input 3
4	4B	I	Input 4
5	5B	I	Input 5
6	6B	I	Input 6
7	7B	I	Input 7
8	E	-	Ground
9	COM	-	Common Free Wheeling Diodes
10	7C	O	Output 7
11	6C	O	Output 6
12	5C	O	Output 5
13	4C	O	Output 4
14	3C	O	Output 3
15	2C	O	Output 2
16	1C	O	Output 1

Absolute Maximum Ratings（T_A=25℃）

Parameter		Symbol	Unit
Collector-Emitter Voltage		V_{CE}	50V
Com Voltage		V_{COM}	50V
Input Voltage		V_I	30V
Collector Peak Current		I_{CP}	500mA
Output Clamp Current		I_{OK}	500mA
Emitter Maximum Current		I_{ET}	-2.5A
Junction-To-Ambient Thermal Resistance[1][2][3]	SOP16	θ_{JA}	63℃/W
	DIP16	θ_{JA}	50℃/W
Maximum Junction Temperature[2]		T_J	150℃
Welding Temperature（10s）		T_W	260℃
Storage Temperature Range		T_S	-65 to +150℃

Note：

1. The maximum power consumption can be calculated according to the following relationship：$P_D=(T_J-T_A)/\theta_{JA}$;

2. T_J Indicate the junction temperature at which the circuit operates，T_A Indicate the ambient temperature at which the circuit operates；

3. The calculation method for packaging thermal resistance follows：JESD51-7。

Recommended Operating Conditions （T_A=25℃,unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Collector-Emitter Voltage	V_{CE}		0	50	V
Output Current	I_{OUT}	Continuous output T_A=+85℃，T_J=120℃		100	mA/ch
Input Voltage	V_{IN}		0	24	V
Input voltage (output on)	$V_{IN(ON)}$	I_{OUT}=400mA	2.8	24	V
Input voltage (output off)	$V_{IN(OFF)}$		0	0.7	V
Clamp Diode Reverse Voltage	VR			50	V
Clamp Forward Current	I_F			350	mA
Operating Temperature Range	T_A		-20	+85	℃
Storage Temperature Range	T_J		-20	+125	℃
Power Dissipation	SOP16 P_D	T_A=+25℃		1.25	W
		T_A=+85℃		0.65	
	DIP16 P_D	T_A=+25℃		1.47	W
		T_A=+85℃		0.76	

Note ：

1. T_A represents the ambient temperature at which the circuit operates；

2. The calculation method for circuit power consumption is:$P_D=V_{CE(ON)n}×I_{Cn}+ V_{INn}×I_{INn}$；

3. In Note 2, $V_{CE(ON)n}$ represents the conduction voltage drop of the corresponding channel, IC n represents the average load current of the corresponding channel, V_{INn} represents the average high-level signal input current of the corresponding channel, and I_{INn} represents the average signal input current of the corresponding channel. (Among them, n=1, 2, 3, 4, 5, 6, 7)

Electrical Characteristics（T$_A$=25℃）

Parameter	Symbol	Test Diagrams	Test Conditions		Min.	Typ.	Max.	Unit
On-State Input Voltage	V$_{IN(ON)}$	Figure 6	V$_{CE}$=2V	I$_C$=200mA		1.9	2.4	V
				I$_C$=250mA		2	2.7	
				I$_C$=300mA		2.1	3	
Collector-Emitter Saturation Voltage	V$_{CE(SAT)}$	Figure 5	V$_I$=2.4V	I$_C$=30mA		0.78	1	V
				I$_C$=60mA		0.82	1.1	
				I$_C$=120mA		0.9	1.2	
				I$_C$=240mA		1.1	1.4	
				I$_C$=350mA		1.25	1.6	
Input Current	I$_I$	Figure 4	I$_C$=60mA	V$_I$=12V		4	5.3	mA
				V$_I$=6V		1.7	2.2	
				V$_I$=4.5V		1.1	1.6	
				V$_I$=2.4V		0.35	0.7	
Clamp Forward Voltage	V$_F$	Figure 8	I$_F$=350mA			1.6	2	V
Collector Cutoff Current	I$_{CEX}$	Figure 1	V$_{CE}$=50V，I$_I$=0			-	50	uA
Collector Voltage Withstand	V$_{CE}$	Figure 1	V$_{CE}$=50V，I$_I$=0		50			V
Clamp Reverse Current	I$_R$	Figure 7	V$_R$=50V			-	50	uA
Clamp diode reverse withstand voltage	V$_R$	Figure 7	V$_R$=50V		50			V
Propagation Delay Time, Low- To High-Level Output	t$_{PLH}$	Figure 9	VL=12V，RL=45Ω			0.15	1	us
Propagation Delay Time, High- To Low-Level Output	t$_{PHL}$	Figure9	VL=12V，RL=45Ω			0.15	1	us

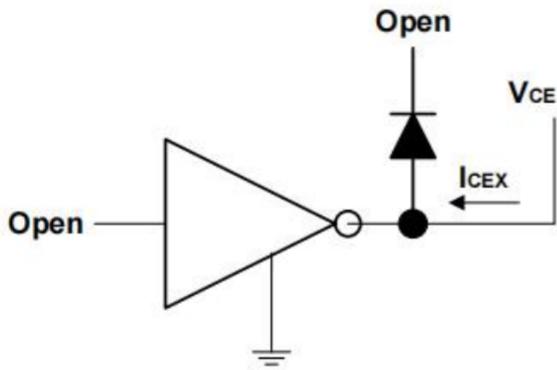## Test Parameter Diagram

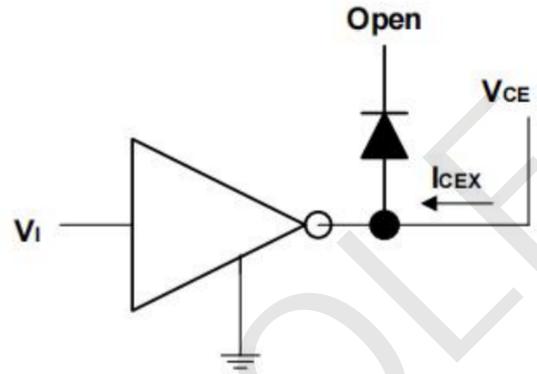Figure 1 I_{CEX} Test Circuit
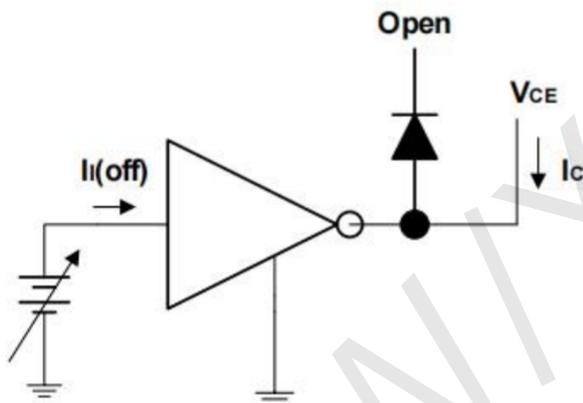

Figure 2 I_{CEX} Test Circuit

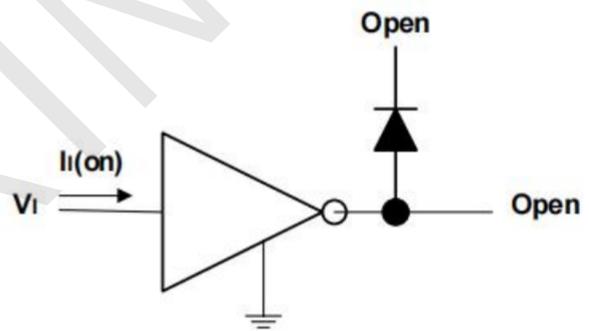Figure 3 $I_{I(off)}$ Test Circuit

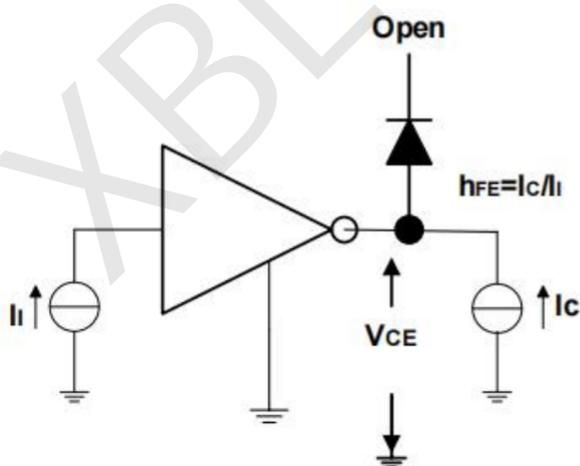Figure 4 I_I Test Circuit

Figure 5 h_{FE} and $V_{CE(sat)}$ Test Circuit
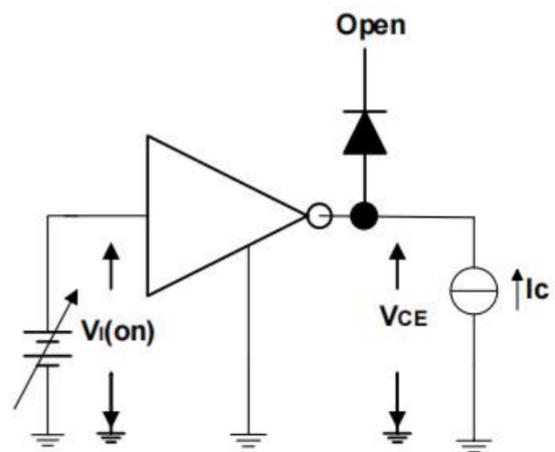

Figure 6 $V_{I(on)}$ Test Circuit
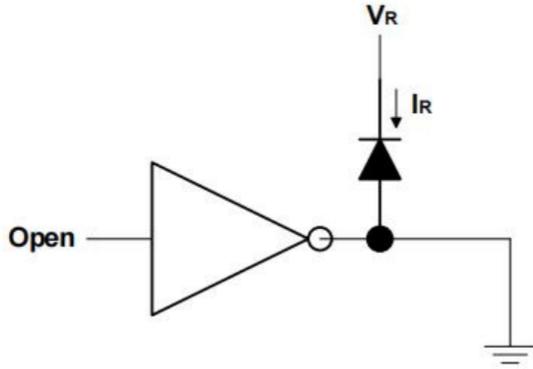
Figure 7 I_R Test Circuit

Figure 8 V_F Test Circuit

VOLTAGE WAVEFORMS
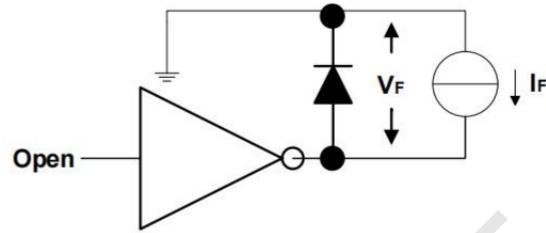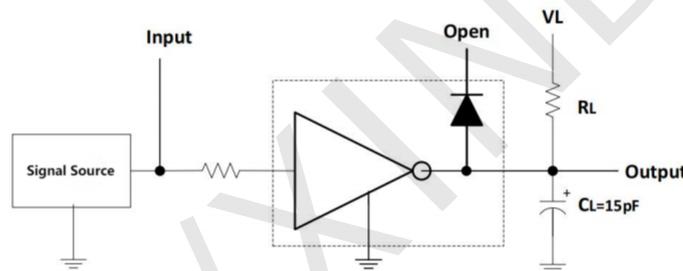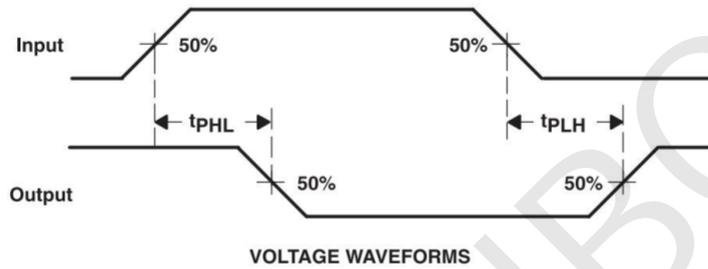

Figure 9 Transmission delay waveform and testing circuit
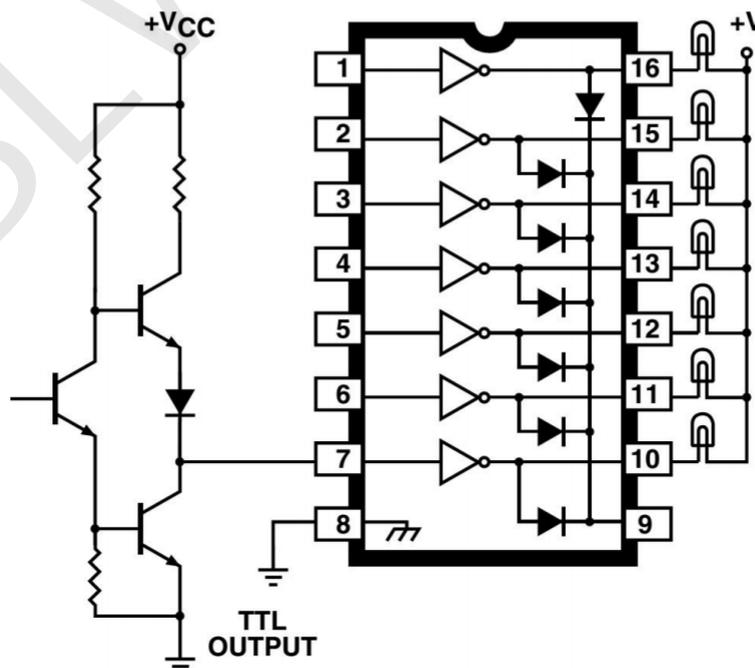(capacitance load is parasitic capacitance of oscilloscope probe)

Typical Applications

**Figure 10** ULN2OO3AB device used as LED light driver

Package Information

· DIP-16

Size Symbol	Dimensions In Millimeters		Size Symbol	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
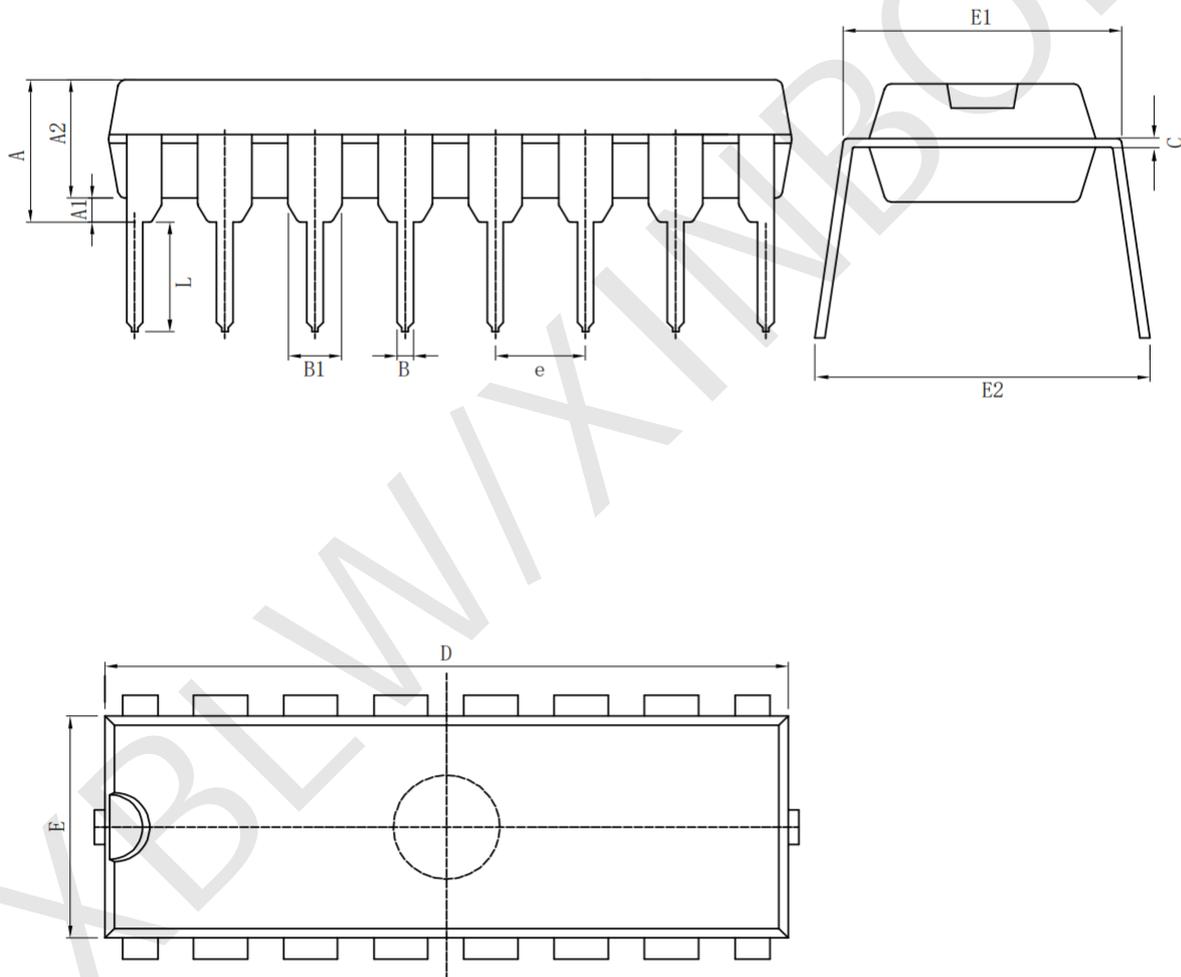
· SOP-16

Size Symbol	Dimensions In Millimeters			Size 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°
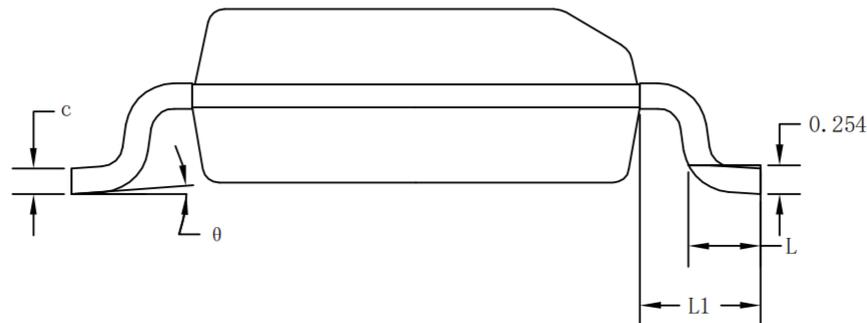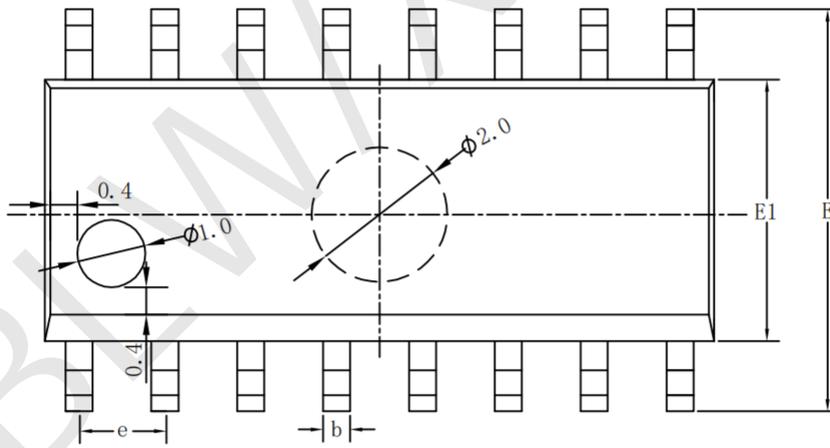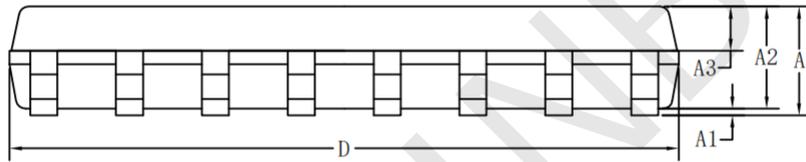
Statement：

■ 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 semiconductor product may malfunction under specified conditions. When using XBLW products for system design and overall manufacturing, the buyer is responsible for complying with safety standards and taking appropriate safety measures to avoid risks that may cause personal injury or property damage.

■ XBLW products have not been licensed for life support, military, and aerospace applications, and therefore XBLW is not responsible for any consequences arising from the use of this product 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.