

Product Specification

XBLW SN74HC147
10-to-4 Line Priority Encoder

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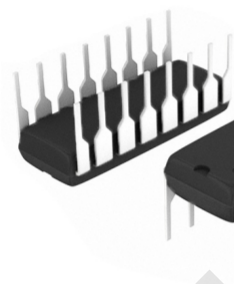
Description

The SN74HC147 is a 9-input priority encoders accept data from nine active LOW inputs ($\bar{A}0$ to $\bar{A}8$) and provide a binary representation on the four active LOW outputs ($\bar{Y}0$ to $\bar{Y}3$). A priority is assigned to each input so that when two or more inputs are simultaneously active, the input with the highest priority is represented on the output, with input line $\bar{A}8$ having the highest priority.

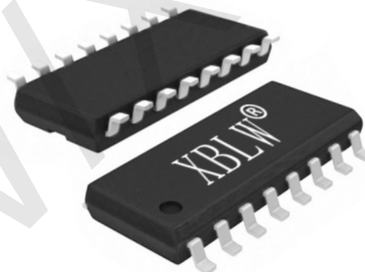
The devices provide the 10-line to 4-line priority encoding function by use of the implied decimal "zero". The "zero" is encoded when all nine data inputs are HIGH, forcing all four outputs HIGH.

Features

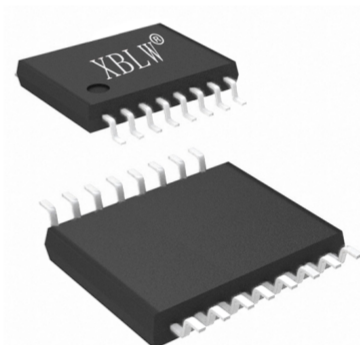
- Encodes 10-line decimal to 4-line BCD
- Useful for 10-position switch encoding
- Used in code converters and generators
- Specified from -40°C to +125°C
- Packaging information: DIP-16/SOP-16/TSSOP-16



DIP-16



SOP-16



TSSOP-16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74HC147N	DIP-16	74HC147N	Tube	1000Pcs/Box
XBLW SN74HC147DTR	SOP-16	74HC147	Tape	2500Pcs/Reel
XBLW SN74HC147TDTR	TSSOP-16	74HC147	Tape	3000Pcs/Reel

Block Diagram

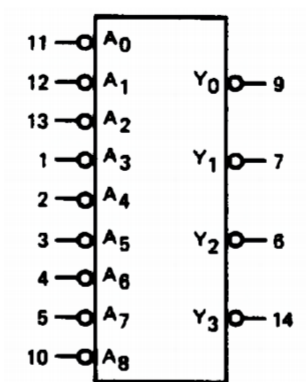


Figure 1. Logic symbol

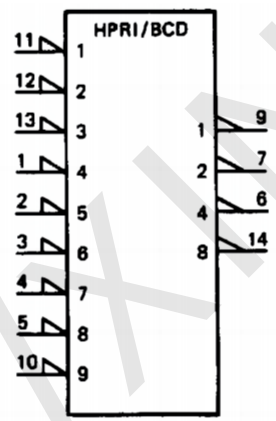


Figure 2. IEC logic symbol

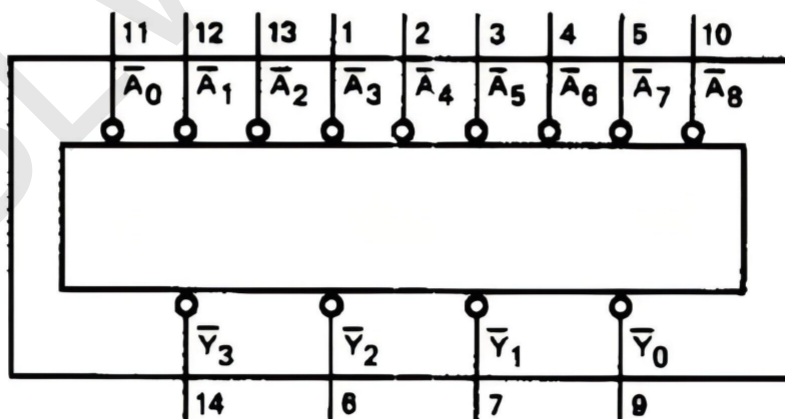


Figure 3. Functional diagram

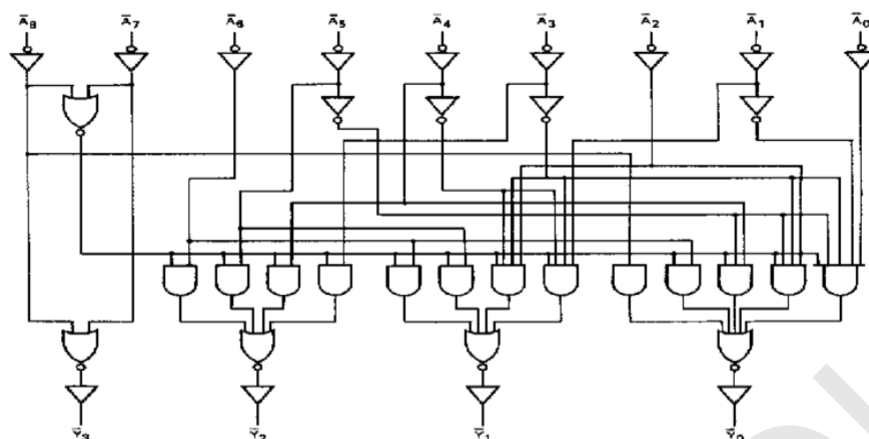
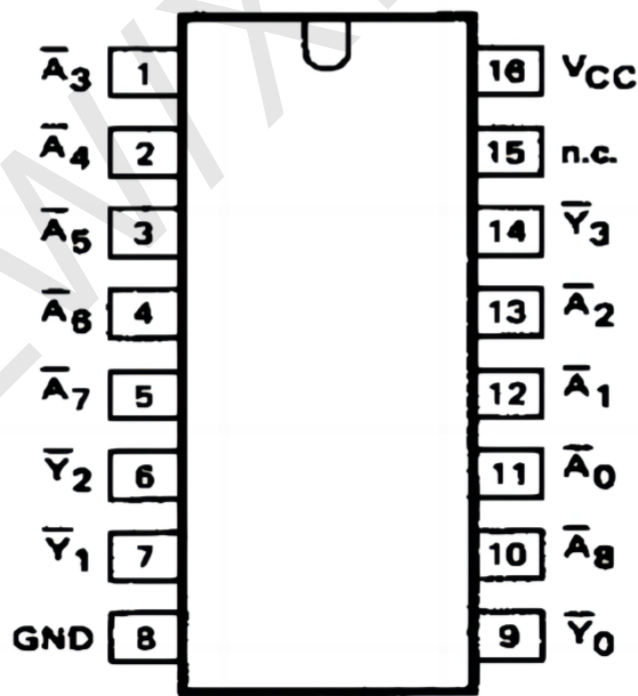


Figure 4. Logic diagram

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	$\bar{A}3$	decimal data input (active LOW)
2	$\bar{A}4$	decimal data input (active LOW)
3	$\bar{A}5$	decimal data input (active LOW)
4	$\bar{A}6$	decimal data input (active LOW)
5	$\bar{A}7$	decimal data input (active LOW)
6	$\bar{Y}2$	BCD address output (active LOW)
7	$\bar{Y}1$	BCD address output (active LOW)
8	GND	ground (0V)
9	$\bar{Y}0$	BCD address output (active LOW)
10	$\bar{A}8$	decimal data input (active LOW)
11	$\bar{A}0$	decimal data input (active LOW)
12	$\bar{A}1$	decimal data input (active LOW)
13	$\bar{A}2$	decimal data input (active LOW)
14	$\bar{Y}3$	BCD address output (active LOW)
15	n.c.	not connected
16	V _{cc}	supply voltage

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

Function Table

Input									Output			
$\bar{A}0$	$\bar{A}1$	$\bar{A}2$	$\bar{A}3$	$\bar{A}4$	$\bar{A}5$	$\bar{A}6$	$\bar{A}7$	$\bar{A}8$	$\bar{Y}3$	$\bar{Y}2$	$\bar{Y}1$	$\bar{Y}0$
H	H	H	H	H	H	H	H	H	H	H	H	H
X	X	X	X	X	X	X	X	L	L	H	H	L
X	X	X	X	X	X	X	L	H	L	H	H	H
X	X	X	X	X	X	L	H	H	H	L	L	L
X	X	X	X	X	L	H	H	H	H	L	L	H
X	X	X	X	L	H	H	H	H	H	L	H	L
X	X	X	L	H	H	H	H	H	H	L	H	H
X	X	L	H	H	H	H	H	H	H	H	L	L
X	L	H	H	H	H	H	H	H	H	H	L	H
L	H	H	H	H	H	H	H	H	H	H	H	L

Electrical Parameter

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 $V_I > V_{CC}+0.5V$	-	± 20	mA
output clamping current	I_{OK}	$V_O < -0.5V$ or $V_O > V_{CC}+0.5V$	-	± 20	mA
output current	I_O	$-0.5V < V_O < V_{CC}+0.5V$	-	± 25	mA
supply current	I_{CC}	-	-	+50	mA
ground current	I_{GND}	-	-50	-	mA
storage temperature	T_{stg}	-	-65	+150	°C
total power dissipation	P_{tot}	-	-	500	mW
soldering temperature	T_L	10s	DIP	245	°C
			SOP/TSSOP	260	

Note:

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

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

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

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
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	-	+125	°C

Electrical Characteristics

DC Characteristics 1

($T_{amb}=25^{\circ}C$, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V _{IH}	V _{CC} =2.0V		1.5	1.2	-	V
		V _{CC} =4.5V		3.15	2.4	-	V
		V _{CC} =6.0V		4.2	3.2	-	V
LOW-level input voltage	V _{IL}	V _{CC} =2.0V		-	0.8	0.5	V
		V _{CC} =4.5V		-	2.1	1.35	V
		V _{CC} =6.0V		-	2.8	1.8	V
HIGH-level output voltage	V _{OH}	V _I =V _{IH} or V _{IL}	I _O =-20uA; V _{CC} =2.0V	1.9	2.0	-	V
			I _O =-20uA; V _{CC} =4.5V	4.4	4.5	-	V
			I _O =-20uA; V _{CC} =6.0V	5.9	6.0	-	V
			I _O =-4.0mA; V _{CC} =4.5V	3.98	4.32	-	V
			I _O =-5.2mA; V _{CC} =6.0V	5.48	5.81	-	V
LOW-level output voltage	V _{OL}	V _I =V _{IH} or V _{IL}	I _O =20uA; V _{CC} =2.0V	-	0	0.1	V
			I _O =20uA; V _{CC} =4.5V	-	0	0.1	V
			I _O =20uA; V _{CC} =6.0V	-	0	0.1	V
			I _O =4.0mA; V _{CC} =4.5V	-	0.15	0.26	V
			I _O =5.2mA; V _{CC} =6.0V	-	0.16	0.26	V
input leakage current	I _I	V _I =V _{CC} or GND; V _{CC} =6.0V		-	-	±1.0	uA
supply current	I _{CC}	V _I =V _{CC} or GND; I _O =0A; V _{CC} =6.0V		-	-	8.0	uA
input capacitance	C _I	-		-	3.5	-	pF

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
HIGH-level input voltage	V_{IH}	$V_{CC}=2.0\text{V}$	1.5	-	-	V
		$V_{CC}=4.5\text{V}$	3.15	-	-	V
		$V_{CC}=6.0\text{V}$	4.2	-	-	V
LOW-level input voltage	V_{IL}	$V_{CC}=2.0\text{V}$	-	-	0.5	V
		$V_{CC}=4.5\text{V}$	-	-	1.35	V
		$V_{CC}=6.0\text{V}$	-	-	1.8	V
HIGH-level output voltage	V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = -20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	-	V
			$I_O = -20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	-	V
			$I_O = -20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	-	V
			$I_O = -4.0\text{mA}; V_{CC}=4.5\text{V}$	3.84	-	V
			$I_O = -5.2\text{mA}; V_{CC}=6.0\text{V}$	5.34	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = 20\mu\text{A}; V_{CC}=2.0\text{V}$	-	-	0.1
			$I_O = 20\mu\text{A}; V_{CC}=4.5\text{V}$	-	-	0.1
			$I_O = 20\mu\text{A}; V_{CC}=6.0\text{V}$	-	-	0.1
			$I_O = 4.0\text{mA}; V_{CC}=4.5\text{V}$	-	-	0.33
			$I_O = 5.2\text{mA}; V_{CC}=6.0\text{V}$	-	-	0.33
input leakage current	I_I	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC}=6.0\text{V}$	-	-	± 1.0	μA
supply current	I_{CC}	$V_I = V_{CC} \text{ or } \text{GND}; I_O = 0\text{A}; V_{CC}=6.0\text{V}$	-	-	80	μA

DC Characteristics 3

($T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	$V_{CC}=2.0\text{V}$	1.5	-	-	V
		$V_{CC}=4.5\text{V}$	3.15	-	-	V
		$V_{CC}=6.0\text{V}$	4.2	-	-	V
LOW-level input voltage	V_{IL}	$V_{CC}=2.0\text{V}$	-	-	0.5	V
		$V_{CC}=4.5\text{V}$	-	-	1.35	V
		$V_{CC}=6.0\text{V}$	-	-	1.8	V
HIGH-level output voltage	V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = -20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	-	V
			$I_O = -20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	-	V
			$I_O = -20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	-	V
			$I_O = -4.0\text{mA}; V_{CC}=4.5\text{V}$	3.7	-	V
			$I_O = -5.2\text{mA}; V_{CC}=6.0\text{V}$	5.2	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = 20\mu\text{A}; V_{CC}=2.0\text{V}$	-	-	0.1
			$I_O = 20\mu\text{A}; V_{CC}=4.5\text{V}$	-	-	0.1
			$I_O = 20\mu\text{A}; V_{CC}=6.0\text{V}$	-	-	0.1
			$I_O = 4.0\text{mA}; V_{CC}=4.5\text{V}$	-	-	0.4
			$I_O = 5.2\text{mA}; V_{CC}=6.0\text{V}$	-	-	0.4
input leakage current	I_I	$V_I = V_{CC} \text{ or } \text{GND}; V_{CC}=6.0\text{V}$	-	-	± 1.0	μA
supply current	I_{CC}	$V_I = V_{CC} \text{ or } \text{GND}; I_O = 0\text{A}; V_{CC}=6.0\text{V}$	-	-	160	μA

AC Characteristics 1

($T_{amb}=25^{\circ}C$, $GND=0V$, $t_r=t_f=6ns$, $C_L=50pF$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
$\bar{A}_n$ to $\bar{Y}_n$ propagation delay	t_{pd}	see Figure 6 ^[1]	$V_{CC}=2.0V$	-	50	160	ns
			$V_{CC}=4.5V$	-	18	32	ns
			$V_{CC}=5.0V$; $C_L=15pF$	-	15	-	ns
			$V_{CC}=6.0V$	-	14	27	ns
transition time	t_t	see Figure 6 ^[2]	$V_{CC}=2.0V$	-	19	75	ns
			$V_{CC}=4.5V$	-	7	15	ns
			$V_{CC}=6.0V$	-	6	6	ns
power dissipation capacitance	C_{PD}	$V_I=GND$ to V_{CC} ^[3]		-	30	-	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 μW).

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

AC Characteristics 2

($T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $GND = 0V$, $t_r = t_f = 6\text{ns}$, $C_L = 50\text{pF}$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
An to Yn propagation delay	t _{pd}	see Figure 6 ^[1]	V _{CC} =2.0V	-	-	200	ns
			V _{CC} =4.5V	-	-	40	ns
			V _{CC} =6.0V	-	-	34	ns
transition time	t _t	see Figure 6 ^[2]	V _{CC} =2.0V	-	-	95	ns
			V _{CC} =4.5V	-	-	19	ns
			V _{CC} =6.0V	-	-	16	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} .

AC Characteristics 3

($T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $GND = 0V$, $t_r = t_f = 6\text{ns}$, $C_L = 50\text{pF}$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
An to Yn propagation delay	t _{pd}	see Figure 6 ^[1]	V _{CC} =2.0V	-	-	240	ns
			V _{CC} =4.5V	-	-	48	ns
			V _{CC} =6.0V	-	-	41	ns
transition time	t _t	see Figure 6 ^[2]	V _{CC} =2.0V	-	-	110	ns
			V _{CC} =4.5V	-	-	22	ns
			V _{CC} =6.0V	-	-	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} .

Testing Circuit

AC Testing Circuit

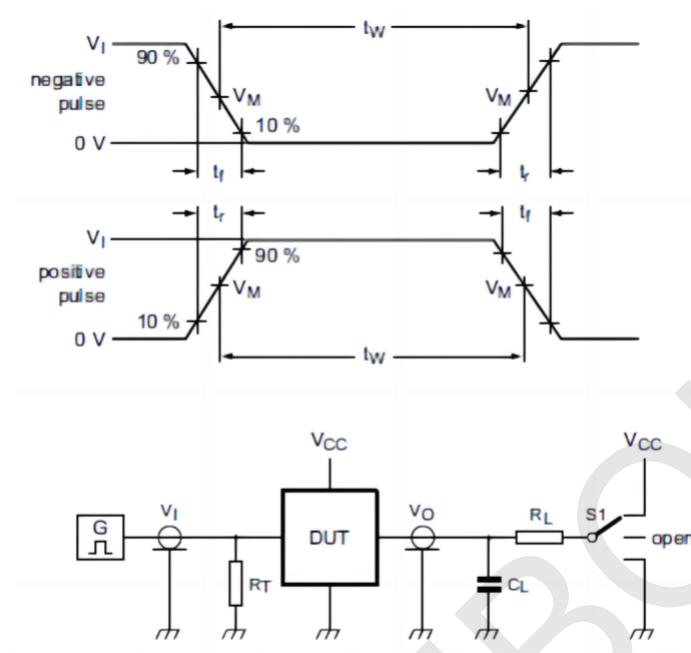


Figure 5. Test circuit for measuring switching times

Definitions for test circuit:

C_L =Load capacitance including jig and probe capacitance.

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

R_L =Load resistance.

$S1$ =Test selection switch

AC Testing Waveforms

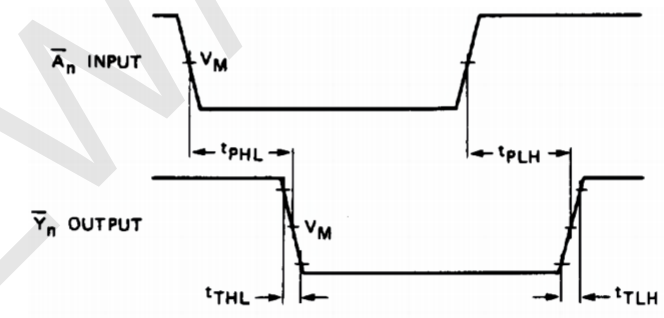


Figure 6. Input ($\bar{A}_n$) to output ($\bar{Y}_n$) propagation delays and output transition times

Measurement Points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
SN74HC147	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$

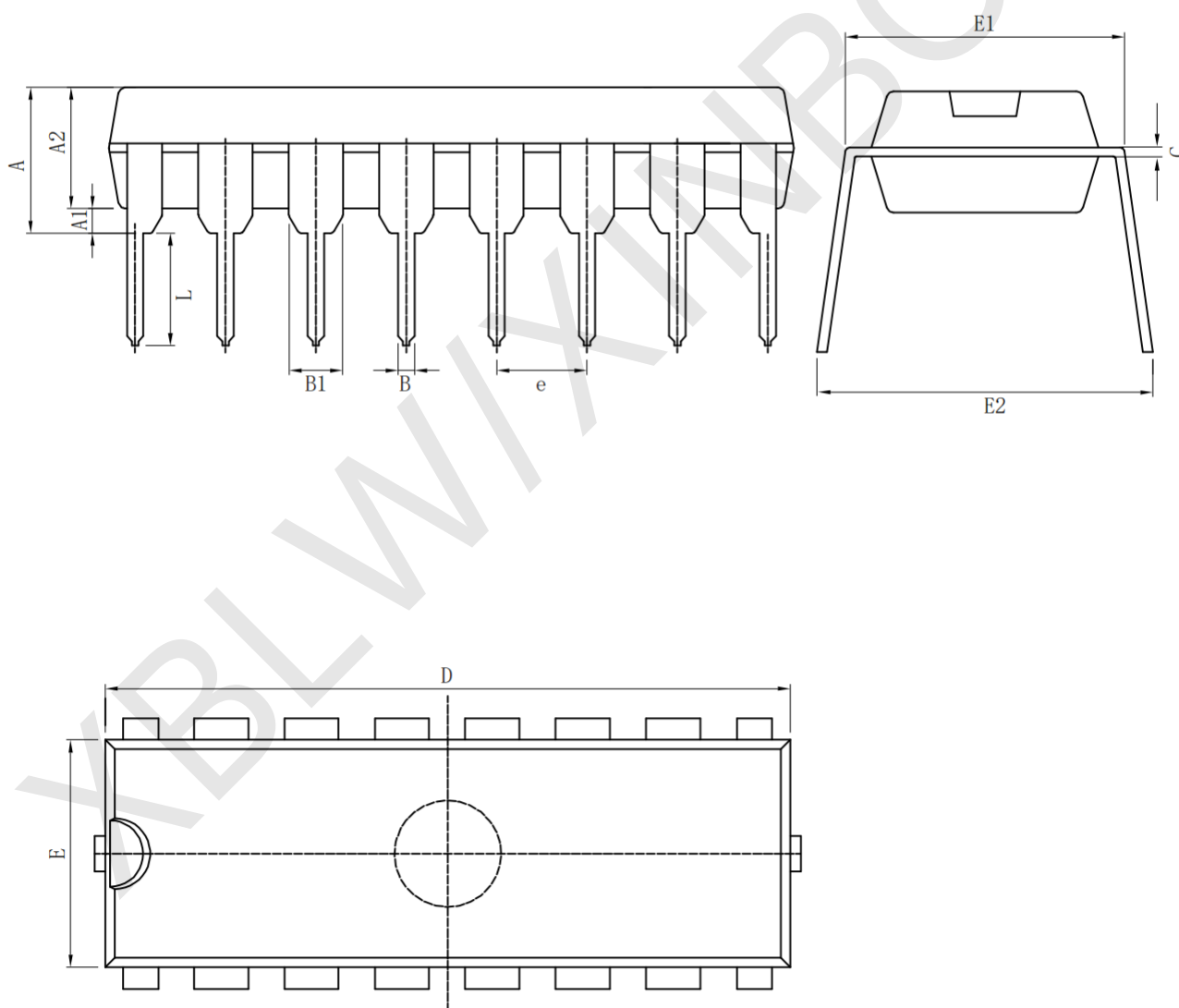
Test Data

Type	Input		Load		S1 position
	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}
SN74HC147	V_{CC}	6ns	15pF, 50pF	1k Ω	open

Package Information

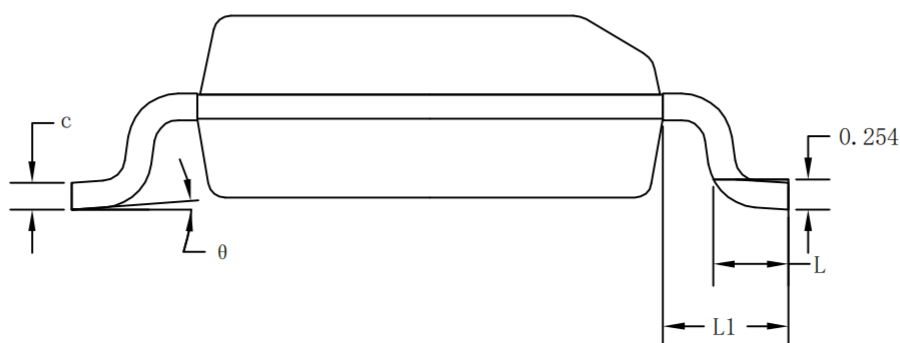
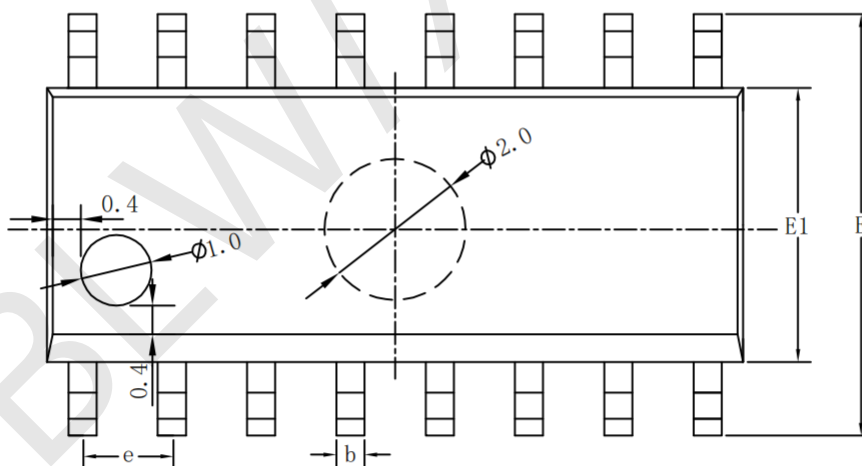
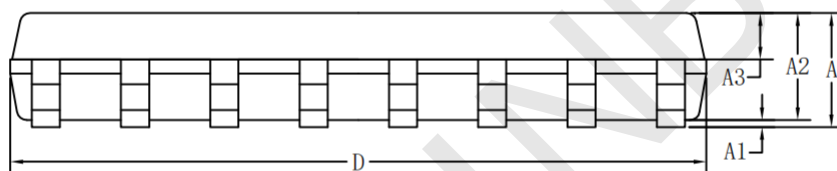
· DIP-16

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



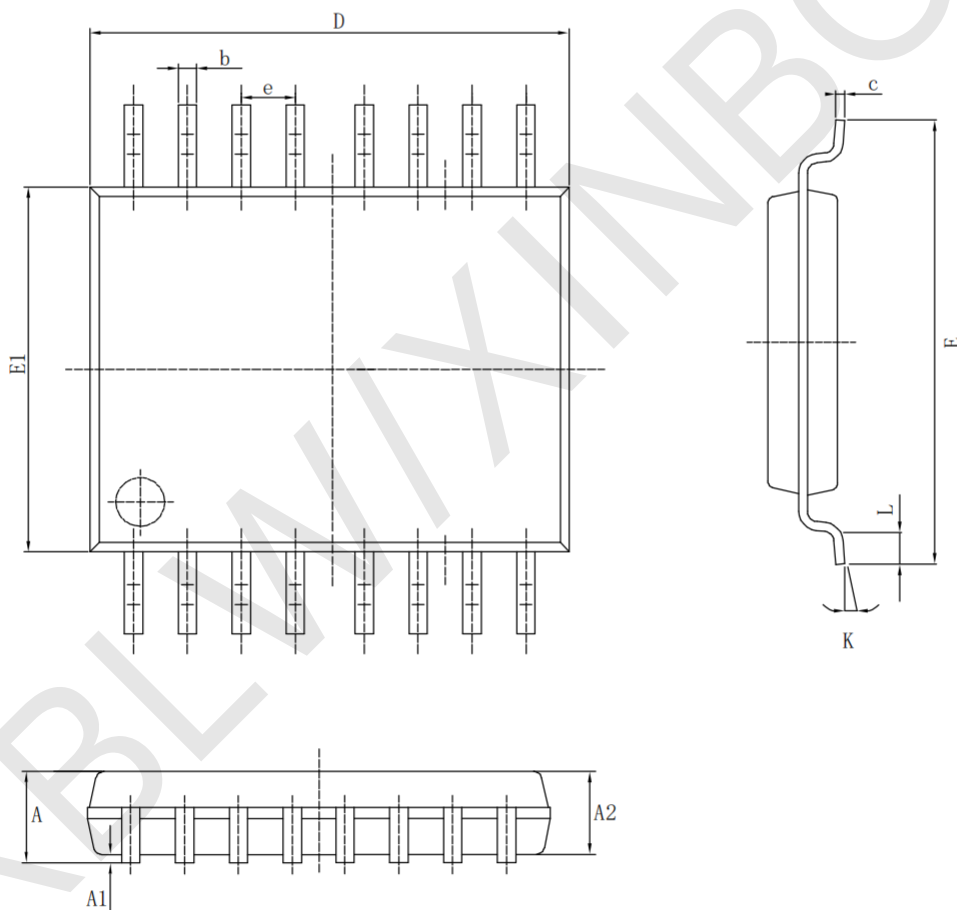
· SOP-16

Symbol \ Size	Dimensions In Millimeters			Symbol \ Size	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

Size Symbol	Dimensions In Millimeters		Size 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!
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