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Product Specification

XBLW SN74LS139

Dual 2-to-4 line decoder/demultiplexer

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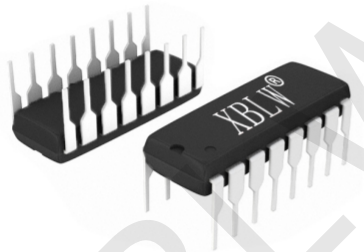
Description

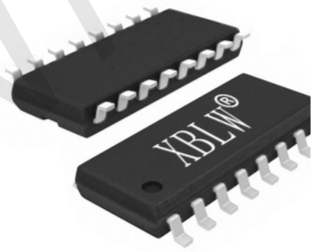
The SN74LS139 decodes two binary weighted address inputs (nA0, nA1) to four mutually exclusive outputs ($n\bar{Y}0$ to $n\bar{Y}3$). Each decoder features an enable input ($n\bar{E}$). When $n\bar{E}$ is HIGH all outputs are forced HIGH. The enable input can be used as the data input for a 1-to-4 demultiplexer application. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

Features

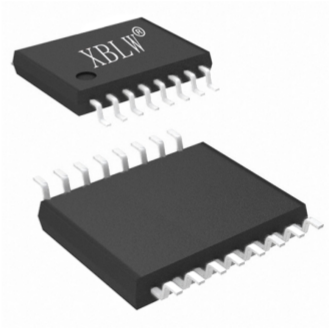
- Demultiplexing capability
- 2 independent 2-to-4 decoders
- Multifunction capability
- Suitable for memory decoding, data routing or code conversion
- Active LOW mutually exclusive outputs
- Specified from -20℃ to +85℃
- Packaging information: DIP-16/SOP-16/TSSOP-16
- Wide supply voltage range from 2.0 to 6.0 V



DIP-16



SOP-16



TSSOP-16

ORDERING INFORMATION

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74LS139N	DIP-16	74LS139N	Tube	1000Pcs/Box
XBLW SN74LS139DTR	SOP-16	74LS139	Tape	2500Pcs/Reel
XBLW SN74LS139TDTR	TSSOP-16	74LS139	Tape	3000Pcs/Reel

Block Diagram

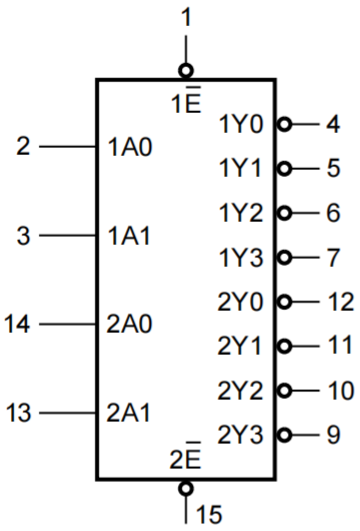


Figure 1. Logic symbol

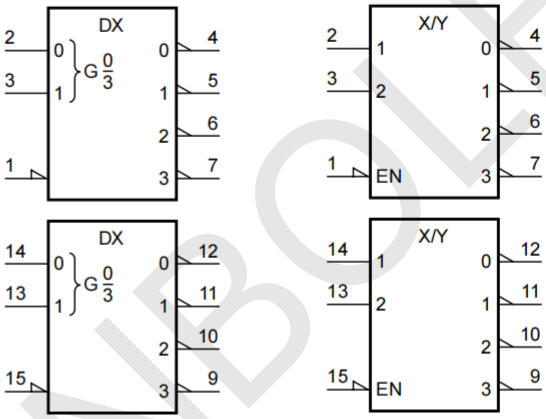


Figure 2. IEC logic symbol

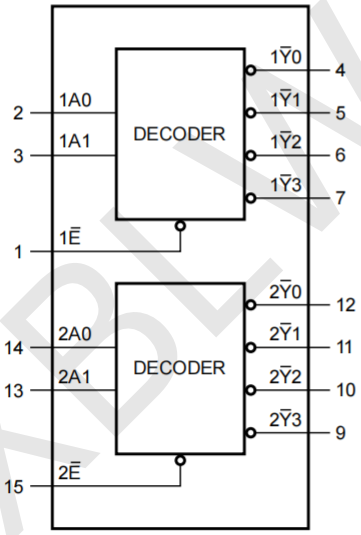


Figure 3. Functional diagram

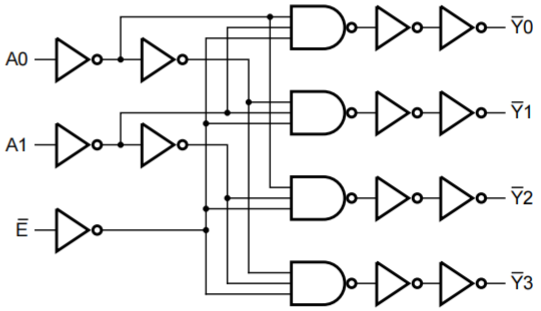
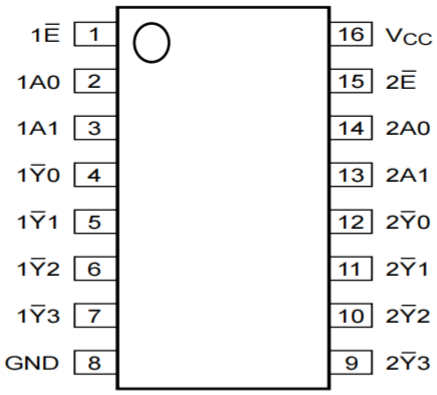


Figure 4. Logic diagram(one decodr/demultiplexer)

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	1$\bar{E}$	enable input(active LOW)
2	1A0	address input
3	1A1	address input
4	1$\bar{Y}$0	output(active LOW)
5	1$\bar{Y}$1	output(active LOW)
6	1$\bar{Y}$2	output(active LOW)
7	1$\bar{Y}$3	output(active LOW)
8	GND	ground(0V)
9	2$\bar{Y}$3	output(active LOW)
10	2$\bar{Y}$2	output(active LOW)
11	2$\bar{Y}$1	output(active LOW)
12	2$\bar{Y}$0	output(active LOW)
13	2A1	address input
14	2A0	address input
15	2$\bar{E}$	enable input(active LOW)
16	VCC	Supply voltage

Function Table

Control	Input		Output			
$\overline{nE}$	nA1	nA0	$n\overline{Y3}$	$n\overline{Y2}$	$n\overline{Y1}$	$n\overline{Y0}$
H	X	X	H	H	H	H
L	L	L	H	H	H	L
L	L	H	H	H	L	H
L	H	L	H	L	H	H
L	H	H	L	H	H	H

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

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	V_O=-0.5V to V_{CC}+0.5V		-	±25	mA
supply current	I_{CC}	-		-	50	mA
ground current	I_{GND}	-		-50	-	mA
storage temperature	T_{stg}	-		-65	+150	℃
total power dissipation	P_{tot}	-		-	500	mW
soldering temperature	T_L	10s	DIP	245		℃
			SOP	250		

Note:

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

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

[3] For (T)SSOP16 packages: above 60℃ 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}	-	-20	-	+85	℃

Electrical Characteristics

DC Characteristics 1

(T_{amb}=25°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=Vcc or GND;V_{CC}=6.0V		-	-	±0. 1	μA
OFF-state output current	I_{OZ}	V_I=VH or V_{IL};Vo=V_{CC} or GND; V_{CC}=6.0V		-	-	±0.5	μA
supply current	I_{CC}	V_I=V_{CC} or GND;I_O=0A;V_{CC}=6.0V		-	-	8.0	μA
input capacitance	C_I	-		-	3.5	-	pF

DC Characteristics 2

(T_{amb}=-20℃to +85℃, 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	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	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	-	-	V
			I_O=-20uA;V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA;V_{CC}=6.0V	5.9	-	-	V
			I_O=-4.0mA;V_{CC}=4.5V	3.	-	-	V
			I_O=-5.2mA;V_{CC}=6.0V	845.	-	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA;V_{CC}=2.0V	34	-	0. 1	V
			I_O=20uA;V_{CC}=4.5V	-	-	0. 1	V
			I_O=20uA;V_{CC}=6.0V	-	-	0. 1	V
			I_O=4.0mA;V_{CC}=4.5V	-	-	0.33	V
			I_O=5.2mA;V_{CC}=6.0V	-	-	0.33	V
input leakage current	I_I	Vi= V_{CC} or GND;V_{CC}=6.0V		-	-	±1.0	μA
OFF-state output currend	I_{OZ}	V_I=V_{IH} or V_{IL};V_O=V_{CC} or GND;V_{CC}=6.0V		- -	-	±5.0	μA
supply current	I_{CC}	Vi=Vcc or GND;Io=0A;V_{CC}=6.0V		-	-	80	μA

AC Characteristics 1

(T_{amb}=25°C, GND =0V, C_L=50pFunless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Propagation delay	t_{pd}	nAn to $n\bar{Y}n$ see Figure6[1]	V_{CC}=2.0V	-	39	145	ns
			V_{CC}=4.5V	-	14	29	ns
			VCC=5.0V;CL= 15pF	-	11	-	ns
			V_{CC}=6.0V	-	11	25	ns
		$\bar{n}E$ to $n\bar{Y}n$ see Figure7[2]	V_{CC}=2.0V	-	33	135	ns
			V_{CC}=4.5V	-	12	27	ns
			VCC=5.0V;CL= 15pF	-	10	-	ns
			V_{CC}=6.0V	-	10	23	ns
transition time	t_t	$n\bar{Y}n$;see Figure6 and Figure7[2]	V_{CC}=2.0V	-	19	75	ns
			V_{CC}=4.5V	-	7	15	ns
			V_{CC}=6.0V	-	6	13	ns
power dissipation capacitance	C_{PD}	C_L=50pF;f=1MHz;V_I=GND to V_{CC}[3]		-	42	-	pF

Note:

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

[2]t_t is the same as t_{THL} and t_{TLH}.

[3]C_{PD} is used to determine the dynamic power dissipation (P_D in uW).

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

N=number of inputs switching;

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

AC Characteristics 2

(T_{amb}=-20℃to +85℃,GND=0V,C_L=50pF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Propagation delay	t_{pd}	nAn to $n\bar{Y}n$ see Figure6[1]	V_{CC}=2.0V	-	-	180	ns
			V_{CC}=4.5V	-	-	36	ns
			V_{CC}=6.0V	-	-	31	ns
		$\bar{n}E$ to $n\bar{Y}n$ see Figure7[1]	V_{CC}=2.0V	-	-	170	ns
			V_{CC}=4.5V	-	-	34	ns
			V_{CC}=6.0V	-	-	29	ns
transition time	t_t	$n\bar{Y}n$;see Figure6 and Figure7[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}.

Testing Circuit

AC Testing Circuit

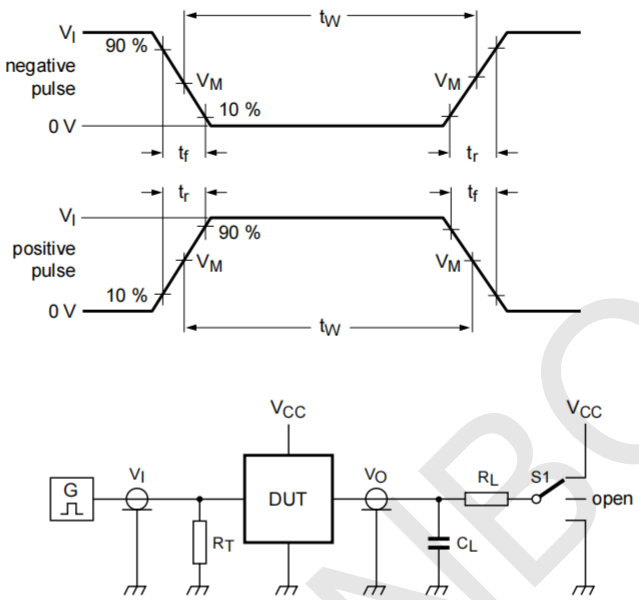


Figure 5. Test circuit for measuring switching times

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

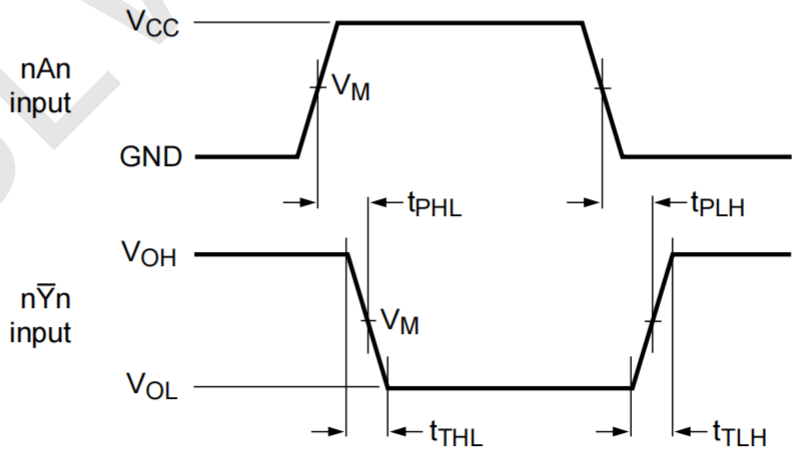


Figure 6. Propagation delay input (nAn) to output (nȲn) and transition time output (nȲn)

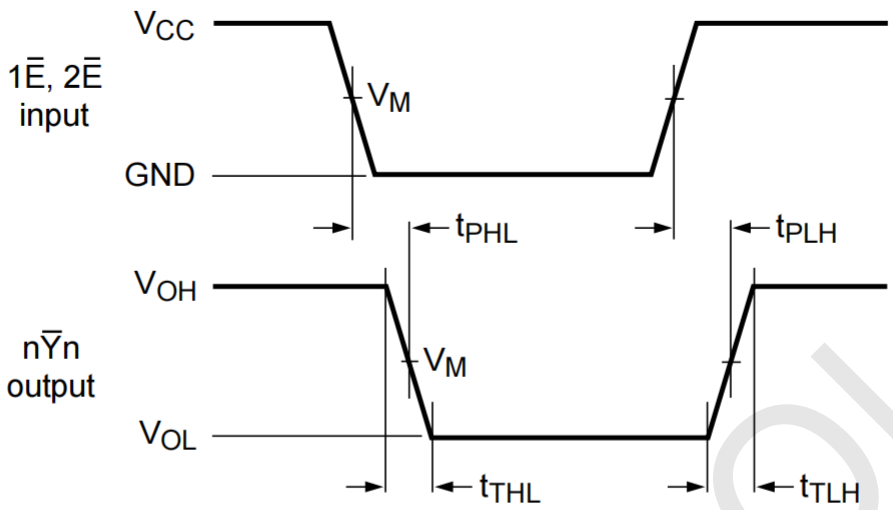


Figure 7. Propagation delay enable input (nĒ) to output (nȲn) and transition time output (nȲn)

Measurement Points

Type	Input	Output
	V_M	V_M
SN74LS139	0.5×V_{CC}	0.5×V_{CC}

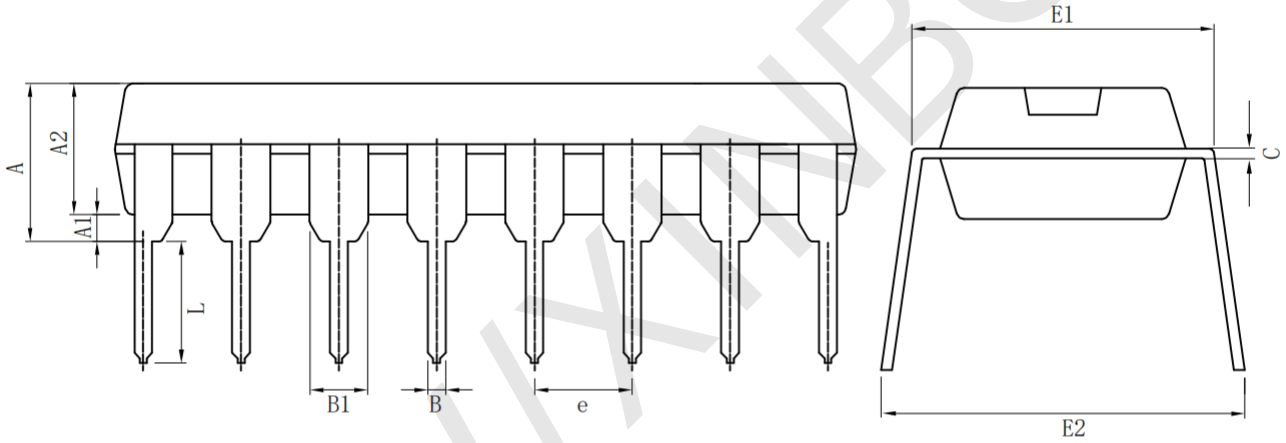
Test Data

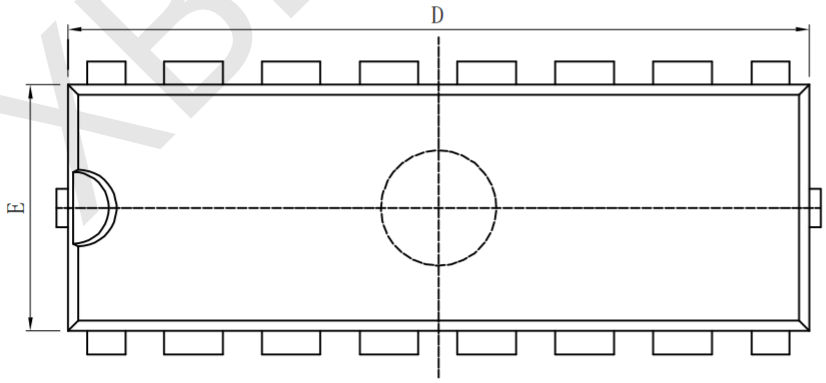
Type	Input		Load		S1 position		
	V_I	t_r,t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
SN74LS139	V_{CC}	6.0ns	15pF,50pF	1KΩ	open	GND	V_{CC}

Package Information

· DIP-16

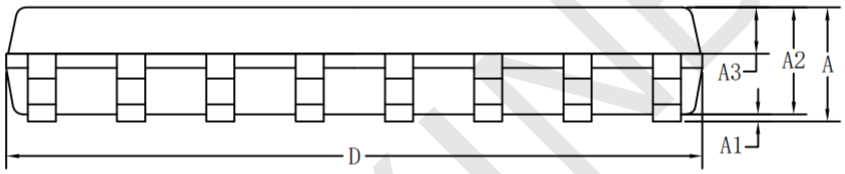
Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	3.710	4.310	A	0.146	0.170
A1	0.510		A1	0.020	
A2	3.200	3.600	A2	0.126	0.142
B	0.380	0.570	B	0.015	0.022
B1	1.524(BSC)		B1	0.060(BSC)	
C	0.204	0.360	C	0.008	0.014
D	18.80	19.20	D	0.740	0.756
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

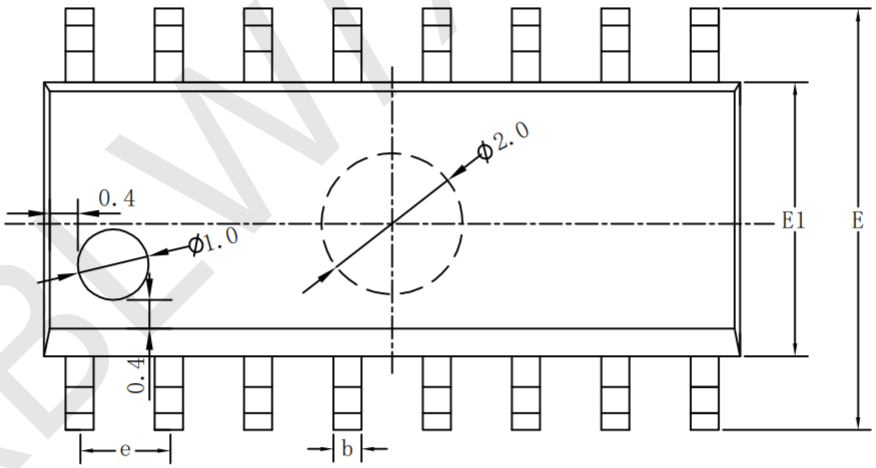


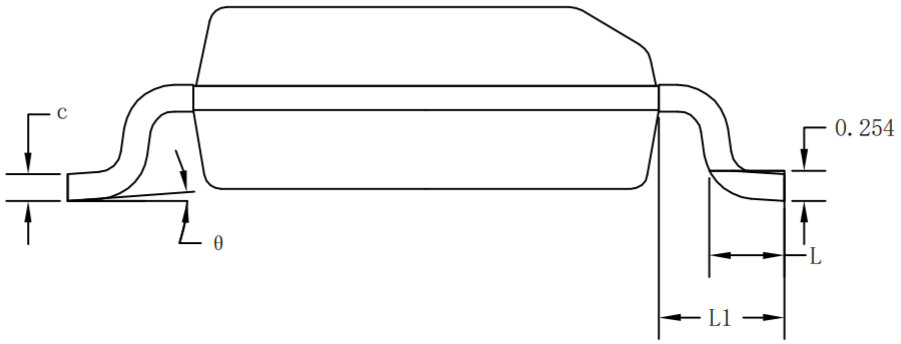


· SOP-16

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°

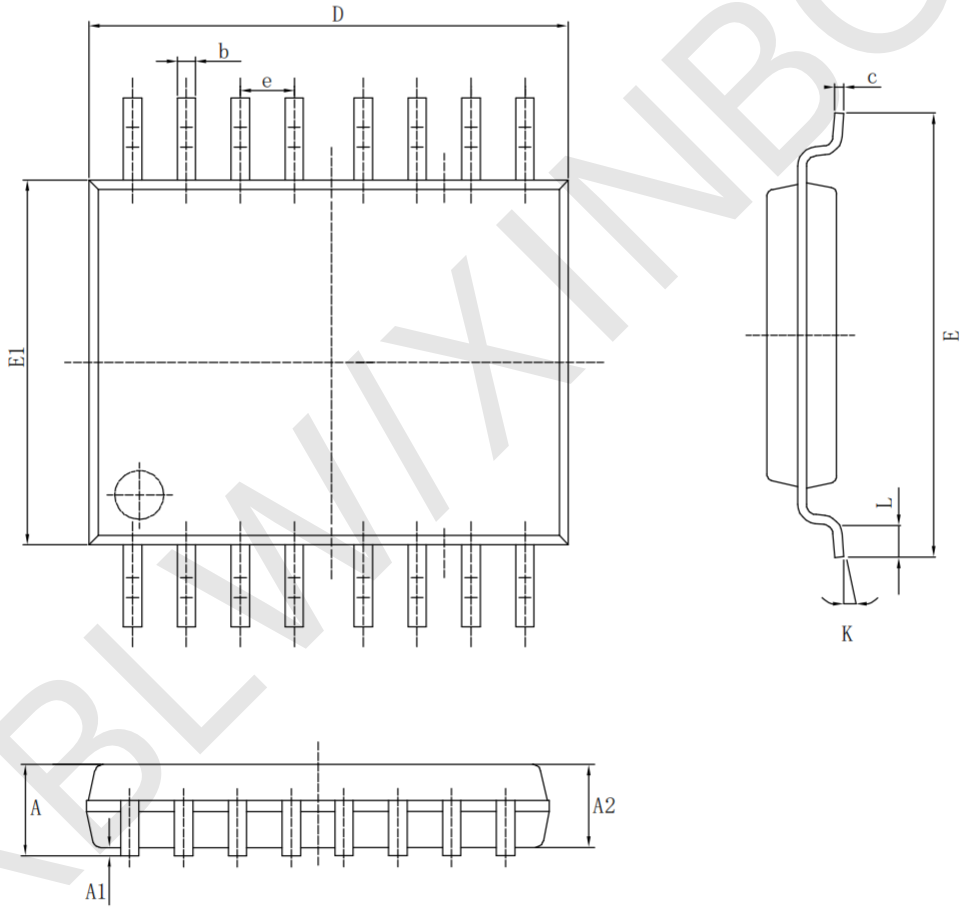






· TSSOP-16

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



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