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XINBOLE

Product Specification

XBLW SN74LS42

BCD to Decimal Decoder（1-of-10）

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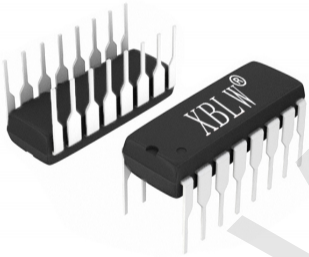
Description

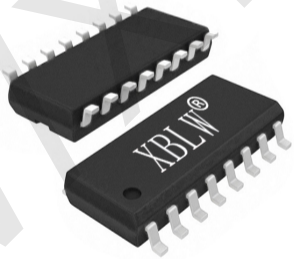
The SN74LS42 is a one often BCD to decimal decoder. It accepts four BCD inputs (0A to 3A) and provides ten mutually exclusive outputs (0$\overline{Y}$ to 9$\overline{Y}$). The logic design ensures that all outputs are HIGH when binary codes greater than nine are applied to the inputs. The most significant input (3A) produces an useful inhibit function when the device is used as a 1-of-8 decoder. The 3A input can also be used as the data input in an 8 -output 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

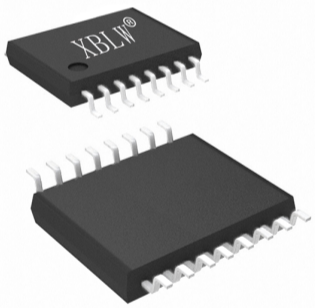
- Mutually exclusive outputs
- 1-of-8 demultiplexing capability
- Outputs disabled for input codes above nine
- Specified from -20°C to +85°C
- Packaging information: DIP-16/SOP-16/TSSOP-16



DIP-16



SOP-16



TSSOP-16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74LS42N	DIP-16	74LS42N	Tube	1000Pcs/Box
XBLW SN74LS42DTR	SOP-16	74LS42	Tape	2500Pcs/Reel
XBLW SN74LS42TDTR	TSSOP-16	74LS42	Tape	3000Pcs/Reel

Block Diagram

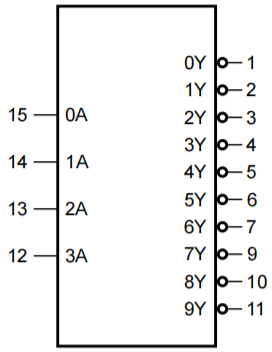


Figure 1. Logic symbol

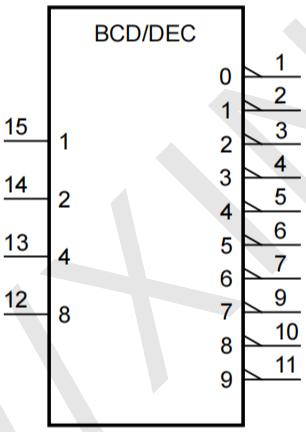


Figure 2. IEC logic symbol

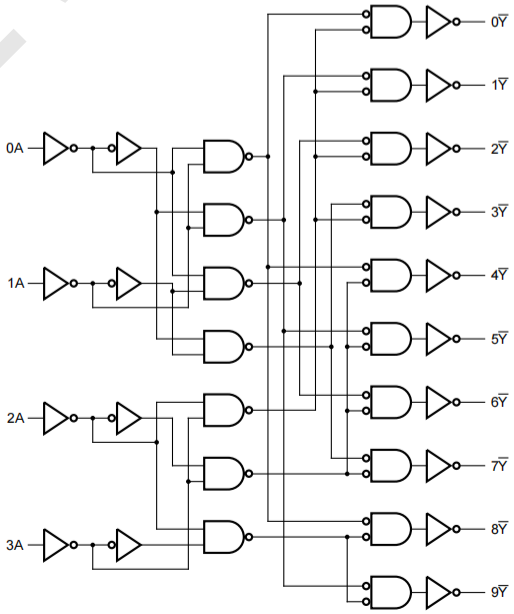


Figure 3. Logic diagram

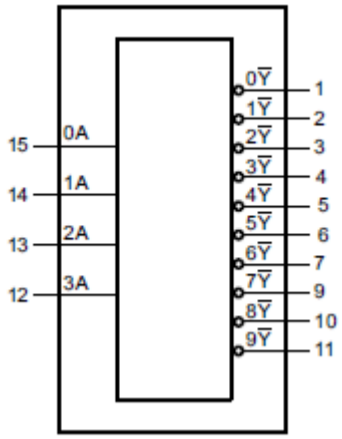
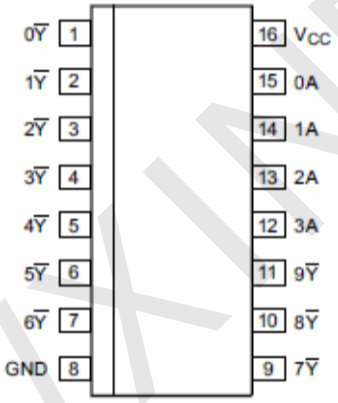


Figure 4. Functional diagram

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	$0\overline{Y}$	multiplexer output
2	$1\overline{Y}$	multiplexer output
3	$2\overline{Y}$	multiplexer output
4	$3\overline{Y}$	multiplexer output
5	$4\overline{Y}$	multiplexer output
6	$5\overline{Y}$	multiplexer output
7	$6\overline{Y}$	multiplexer output
8	GND	ground (0V)
9	$7\overline{Y}$	multiplexer output
10	$8\overline{Y}$	multiplexer output
11	$9\overline{Y}$	multiplexer output
12	3A	data input
13	2A	data input
14	1A	data input
15	0A	data input
16	V_{CC}	supply voltage

Function Table

Input				Output									
3A	2A	1A	0A	$0\bar{Y}$	$1\bar{Y}$	$2\bar{Y}$	$3\bar{Y}$	$4\bar{Y}$	$5\bar{Y}$	$6\bar{Y}$	$7\bar{Y}$	$8\bar{Y}$	$9\bar{Y}$
L	L	L	L	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	H	H	L	H	H	H	H	H	H	H
L	L	H	H	H	H	H	L	H	H	H	H	H	H
L	H	L	L	H	H	H	H	L	H	H	H	H	H
L	H	L	H	H	H	H	H	H	L	H	H	H	H
L	H	H	L	H	H	H	H	H	H	L	H	H	H
L	H	H	H	H	H	H	H	H	H	H	L	H	H
H	L	L	L	H	H	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L
H	L	H	L	H	H	H	H	H	H	H	H	H	H
H	L	H	H	H	H	H	H	H	H	H	H	H	H
H	H	L	L	H	H	H	H	H	H	H	H	H	H
H	H	L	H	H	H	H	H	H	H	H	H	H	H
H	H	H	L	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H	H	H

Note: H=HIGH voltage level; L=LOW voltage level.

Testing Circuit

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		

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℃, 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}=-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	3.84	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.34	-	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	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	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		-	-	80	uA

AC Characteristics 1

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
nA to nȲ Propagation delay	t_{pd}	see Figure 6[1]	V_{CC}=2.0V	-	47	150	ns
			V_{CC}=4.5V	-	17	30	ns
			V_{CC}=5.0V; C_L= 15pF	-	17	-	ns
			V_{CC}=6.0V	-	14	26	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	13	ns
Power dissipation capacitance	C_{PD}	per package; V_I=GND to V_{CC}[3]		-	37	-	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} isused to determine the dynamic power dissipation (P_D in uW).

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

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

AC Characteristics 2

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
nA to nȲ Propagation delay	t_{pd}	see Figure 6[1]	V_{CC}=2.0V	-	-	190	ns
			V_{CC}=4.5V	-	-	38	ns
			V_{CC}=6.0V	-	-	33	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}.

Testing Circuit

AC Testing Circuit

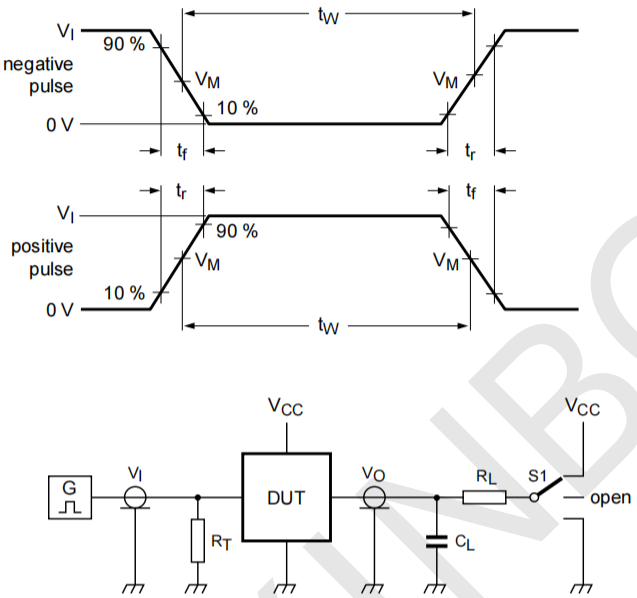


Figure 5. Test circuit for measuring switching times

Definitions for test circuit:
C_L=Load capacitance includingjig and probe capacitance.
R_T=Termination resistance should be equal to the output impedance Z_o ofthe pulse generator. R_L=Load resistance.
S1=Test selection switch

AC Testing Waveforms

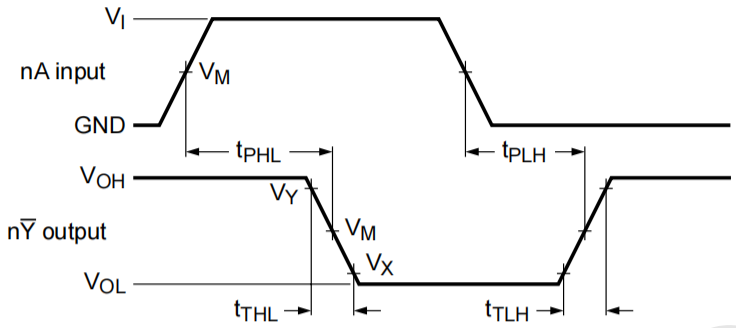


Figure 6. Input (nA) to output ($n\bar{Y}$) propagation delays and output transition times

Measurement Points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
SN74LS42	0.5 ×Vcc	0.5 ×Vcc	0.1 ×Vcc	0.9 ×Vcc

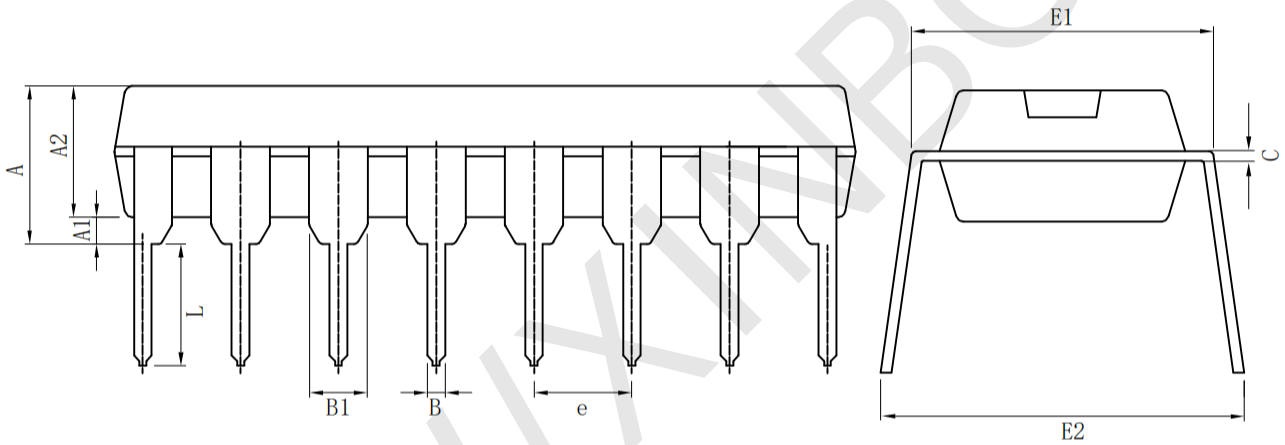
Test Data

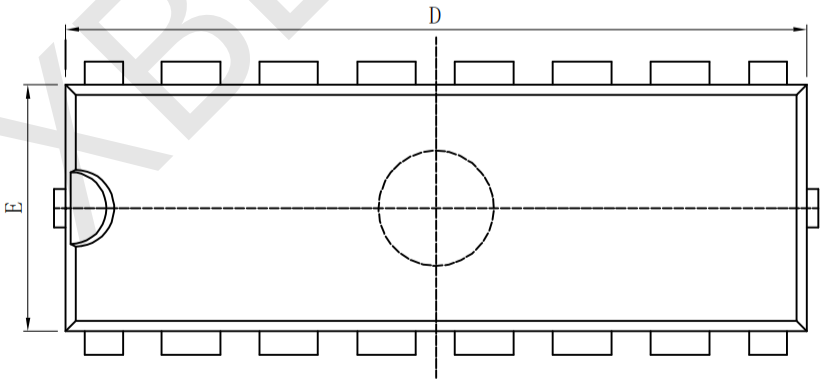
Type	Input		Load		S1 position
	V_I	t_r ,t_f	C_L	R_L	t_{PLH}, t_{PHL}
SN74LS42	Vcc	6ns	15pF, 50pF	1k Ω	open

PackageInformation

· DIP-16

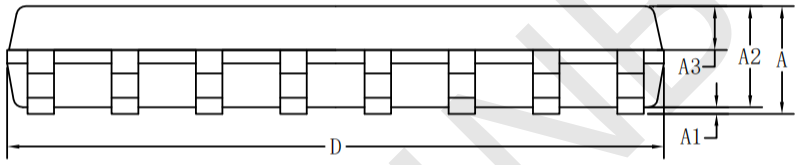
Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	3.710	4.310	A	0.146	0.170
A1	0.510		A1	0.020	
A2	3.200	3.600	A2	0.126	0.142
B	0.380	0.570	B	0.015	0.022
B1	1.524(BSC)		B1	0.060(BSC)	
C	0.204	0.360	C	0.008	0.014
D	18.80	19.20	D	0.740	0.756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

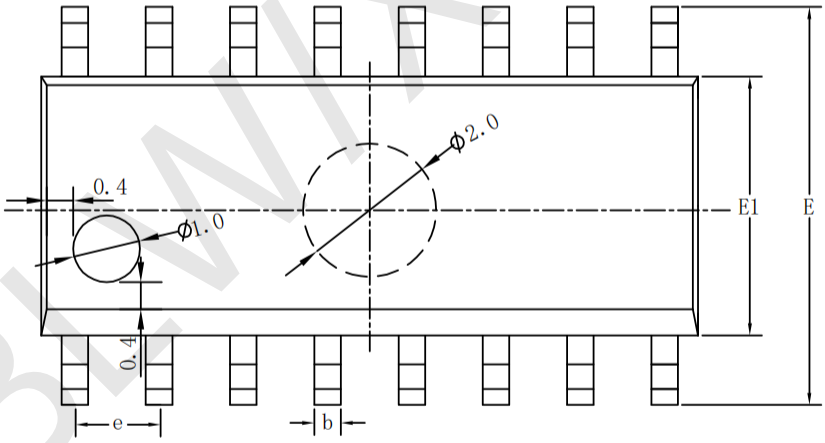


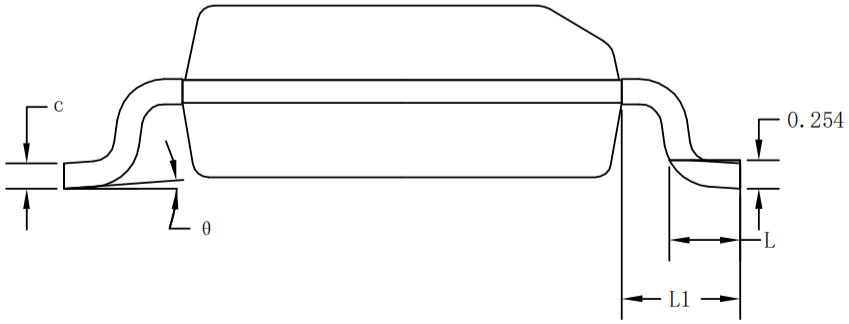


· SOP-16

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°

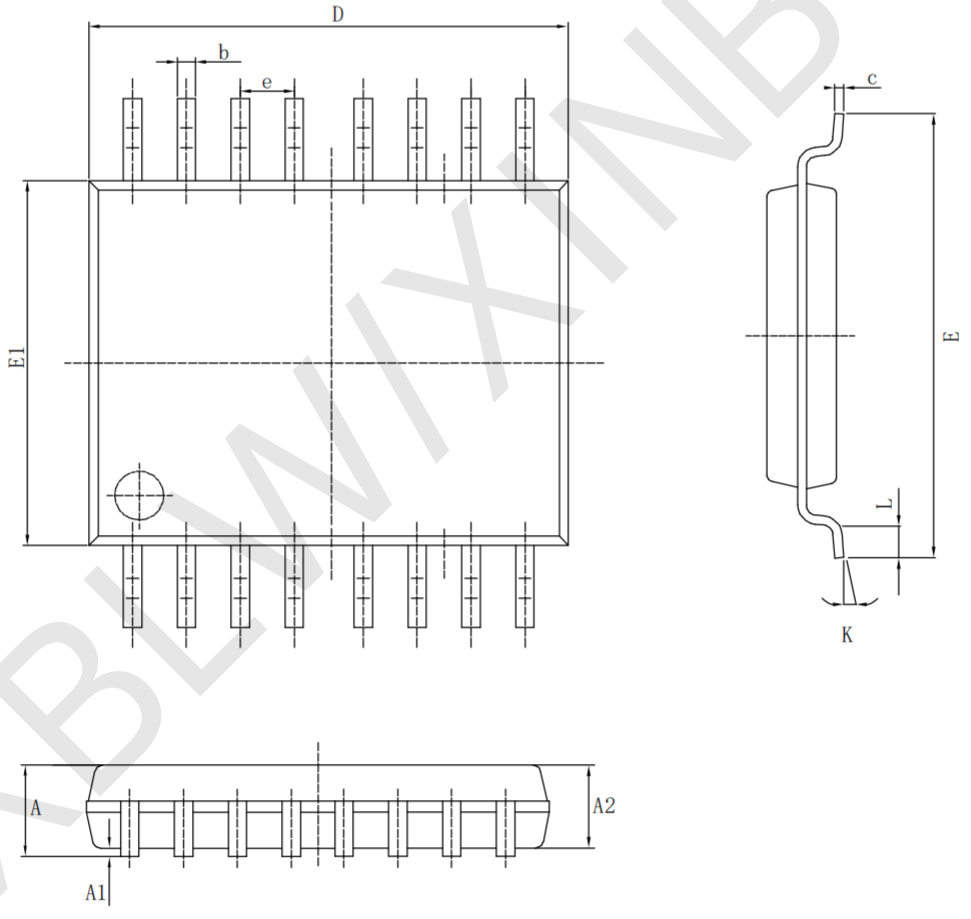






· TSSOP-16

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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