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XINBOLE

Product Specification

XBLW SN74LS541

Octal Buffer/Line Driver; 3-state

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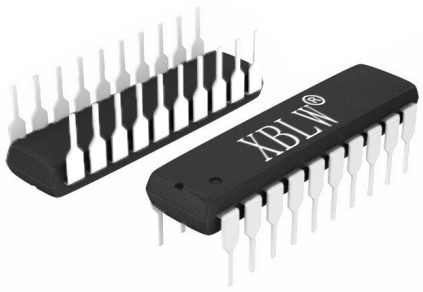
Description

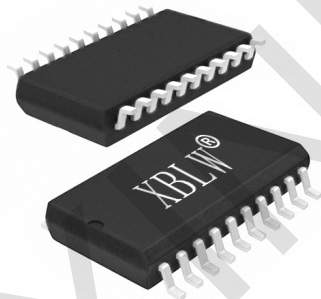
The SN74LS541 is a octal non-inverting buffer/line driver with 3-state outputs. The device features two output enables ($\overline{OE1}$ and $\overline{OE2}$). A HIGH on OEn causes the outputs to assume a high-impedance OFF-state. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

Features

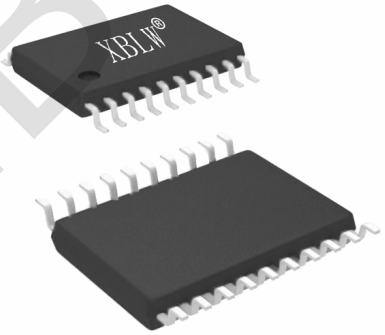
- Non-Inverting outputs
- Specified from -20℃ to +85℃
- Packaging information: DIP-20/SOP-20/TSSOP-20



DIP-20



SOP-20



TSSOP-20

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74LS541N	DIP-20	74LS541N	Tube	720Pcs/Box
XBLW SN74LS541DTR	SOP-20	74LS541	Tape	2000Pcs/Reel
XBLW SN74LS541TDTR	TSSOP-20	74LS541	Tape	2000Pcs/Reel

Block Diagram

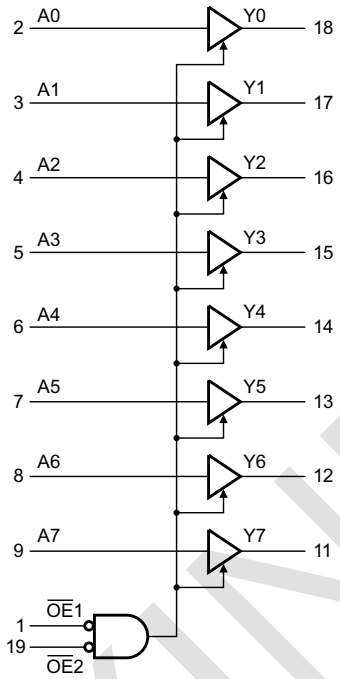


Figure 1. Logic symbol

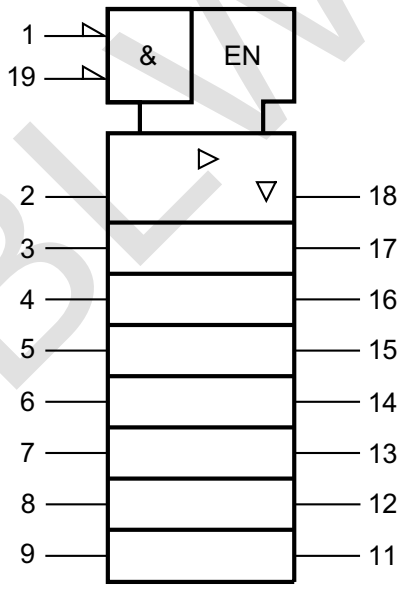


Figure 2. IEC logic symbol

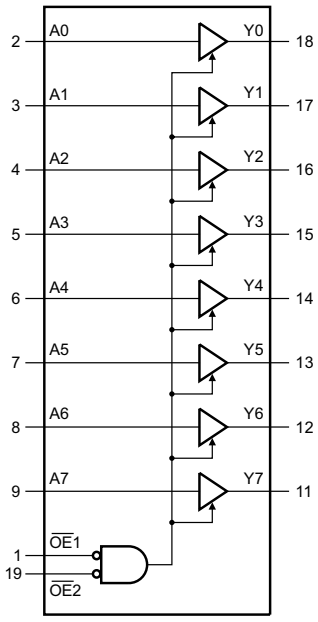


Figure 3. Functional diagram

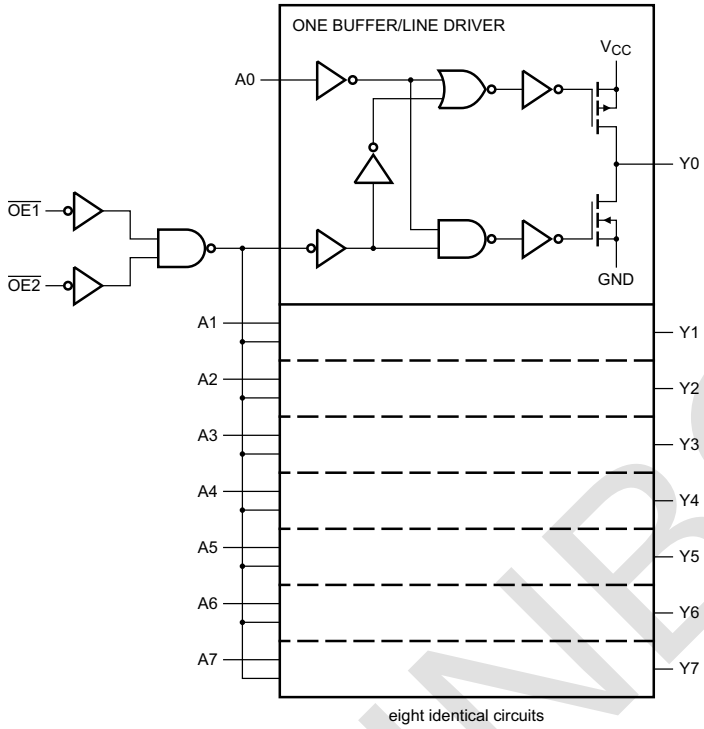
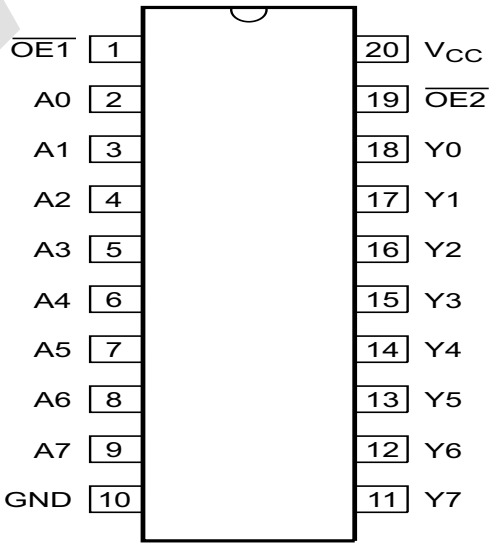


Figure 4. Logic diagram

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	$\overline{OE1}$	output enable input (active LOW)
2	A0	data input
3	A1	data input
4	A2	data input
5	A3	data input
6	A4	data input
7	A5	data input
8	A6	data input
9	A7	data input
10	GND	ground (0V)
11	Y7	data output
12	Y6	data output
13	Y5	data output
14	Y4	data output
15	Y3	data output
16	Y2	data output
17	Y1	data output
18	Y0	data output
19	$\overline{OE2}$	output enable input (active LOW)
20	V_{CC}	supply voltage

Function Table

Input			Output
$\overline{OE1}$	**$\overline{OE2}$**	**An**	**Yn**
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	X	Z

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care; Z=high-impedance OFF-state.

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		-	±35	mA
supply current	I_{CC}	-		-	70	mA
ground current	I_{GND}	-		-70	-	mA
storage temperature	T_{stg}	-		-65	+150	℃
total power dissipation	P_{tot}	-		-	500	mW
Soldering temperature	T_L	10s	DIP	245		℃
			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	Δt/ΔV	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=-6.0mA; V_{CC}=4.5V	3.98	4.32	-	V
			I_O=-7.8mA; 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=6.0mA; V_{CC}=4.5V	-	0.15	0.26	V
			I_O=7.8mA; 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
OFF-state output current	I_{OZ}	V_I=V_{IH} orV_{IL}; V_{CC}=6.0V; V_O=V_{CC} or GND		-	-	±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=-6.0mA; V_{CC}=4.5V	3.84	-	-	V
			I_O=-7.8mA; 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=6.0mA; V_{CC}=4.5V	-	-	0.33	V
			I_O=7.8mA; 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
OFF-state output current	I_{OZ}	V_I=V_{IH} or$V_{IL;}$ V_{CC}=6.0V; V_O=V_{CC} or GND		-	-	±5.0	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
An to Yn propagation delay	t_{pd}	see Figure 6	V_{CC}=2.0V	-	33	115	ns
			V_{CC}=4.5V	-	12	23	ns
			V_{CC}=5.0V; C_L=15pF	-	10	-	ns
			V_{CC}=6.0V	-	10	20	ns
$\overline{OE}$n to Yn enable time	t_{en}	see Figure 7	V_{CC}=2.0V	-	55	160	ns
			V_{CC}=4.5V	-	20	32	ns
			V_{CC}=6.0V	-	16	27	ns
$\overline{OE}$n to Yn disable time	t_{dis}	see Figure 7	V_{CC}=2.0V	-	61	160	ns
			V_{CC}=4.5V	-	22	32	ns
			V_{CC}=6.0V	-	18	27	ns
transition time	t_t	see Figure 6	V_{CC}=2.0V	-	14	60	ns
			V_{CC}=4.5V	-	5	12	ns
			V_{CC}=6.0V	-	4	10	ns
power dissipation capacitance	C_{PD}	per buffer; V_I=GND to V_{CC}		-	37	-	pF

Note:
[1] t_{pd} is the same as t_{PLH} and t_{PHL}.
[2] t_{en} is the same as t_{PZL} and t_{PZH}.
[3] t_{dis} is the same as t_{PLZ} and t_{PHZ}.
[4] t_t is the same as t_{THL} and t_{TLH}.
[5] 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
An to Yn propagation delay	t_{pd}	see Figure 6	V_{CC}=2.0V	-	-	145	ns
			V_{CC}=4.5V	-	-	29	ns
			V_{CC}=6.0V	-	-	25	ns
$\overline{OE}$n to Yn enable time	t_{en}	see Figure 7	V_{CC}=2.0V	-	-	200	ns
			V_{CC}=4.5V	-	-	40	ns
			V_{CC}=6.0V	-	-	34	ns
$\overline{OE}$n to Yn disable time	t_{dis}	see Figure 7	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	V_{CC}=2.0V	-	-	75	ns
			V_{CC}=4.5V	-	-	15	ns
			V_{CC}=6.0V	-	-	13	ns

Note:

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

[2] t_{en} is the same as t_{PZL} and t_{PZH}.

[3] t_{dis} is the same as t_{PLZ} and t_{PHZ}.

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

Measurement Points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
SN74LS541	0.5×V_{CC}	0.5×V_{CC}	0.1×V_{CC}	0.9×V_{CC}

Test Data

Type	Input		Load		S1 position		
	V_I	t_r ,t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
SN74LS541	V_{CC}	6ns	15pF, 50pF	1kΩ	open	GND	V_{CC}

Testing Circuit

AC Testing Circuit

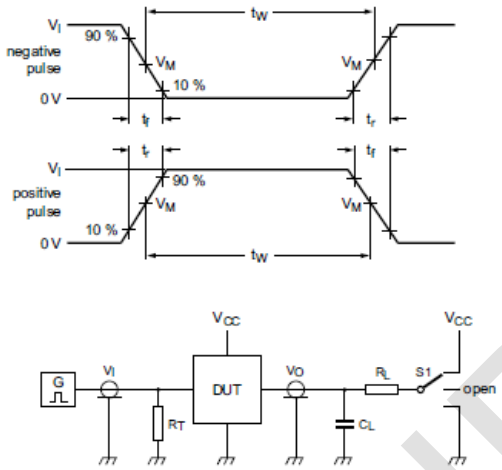


Figure 5. Test circuit for measuring switching times

Definitions for test circuit: R_L=Load resistance.
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.
S1=Test selection switch.

AC Testing Waveforms

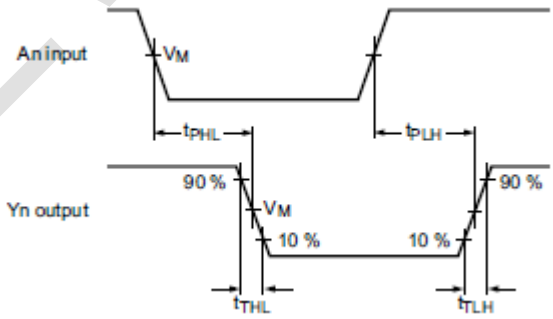


Figure 6. Input to output propagation delays

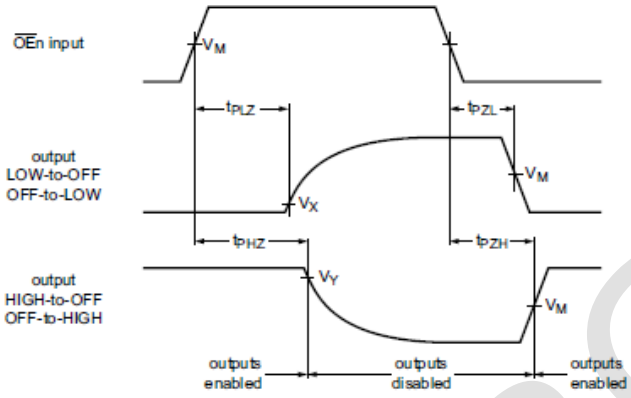
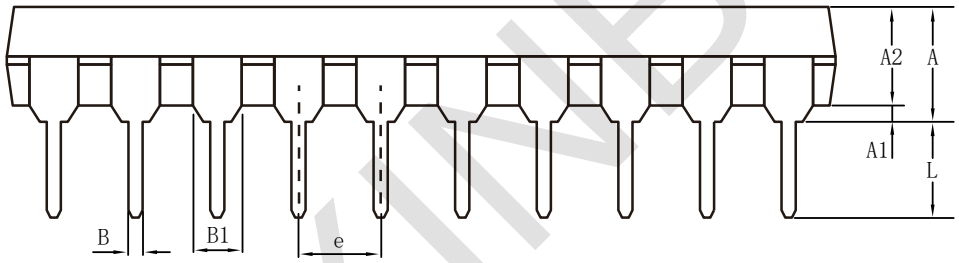


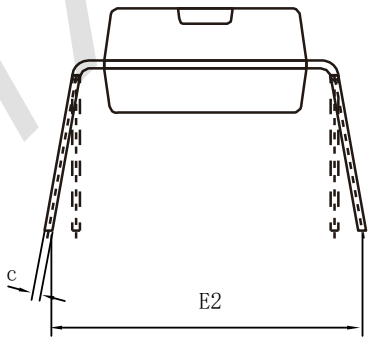
Figure 7. 3-state enable and disable times

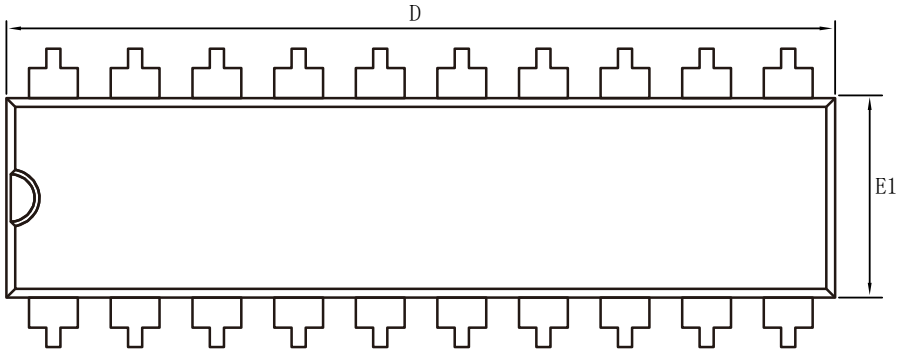
Package Information

· DIP-20

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	3.600	5.330	A	0.142	0.210
A1	0.510		A1	0.020	
A2	3.200	3.600	A2	0.126	0.142
B	0.360	0.530	B	0.014	0.021
B1	1.52(BSC)		B1	0.060(BSC)	
c	0.204	0.360	c	0.008	0.014
D	25.70	26.54	D	1.010	1.040
E1	6.200	6.750	E1	0.244	0.260
E2	7.620	9.300	E2	0.300	0.366
e	2.54(BSC)		e	0.100(BSC)	
L	3.000	3.600	L	0.118	0.142

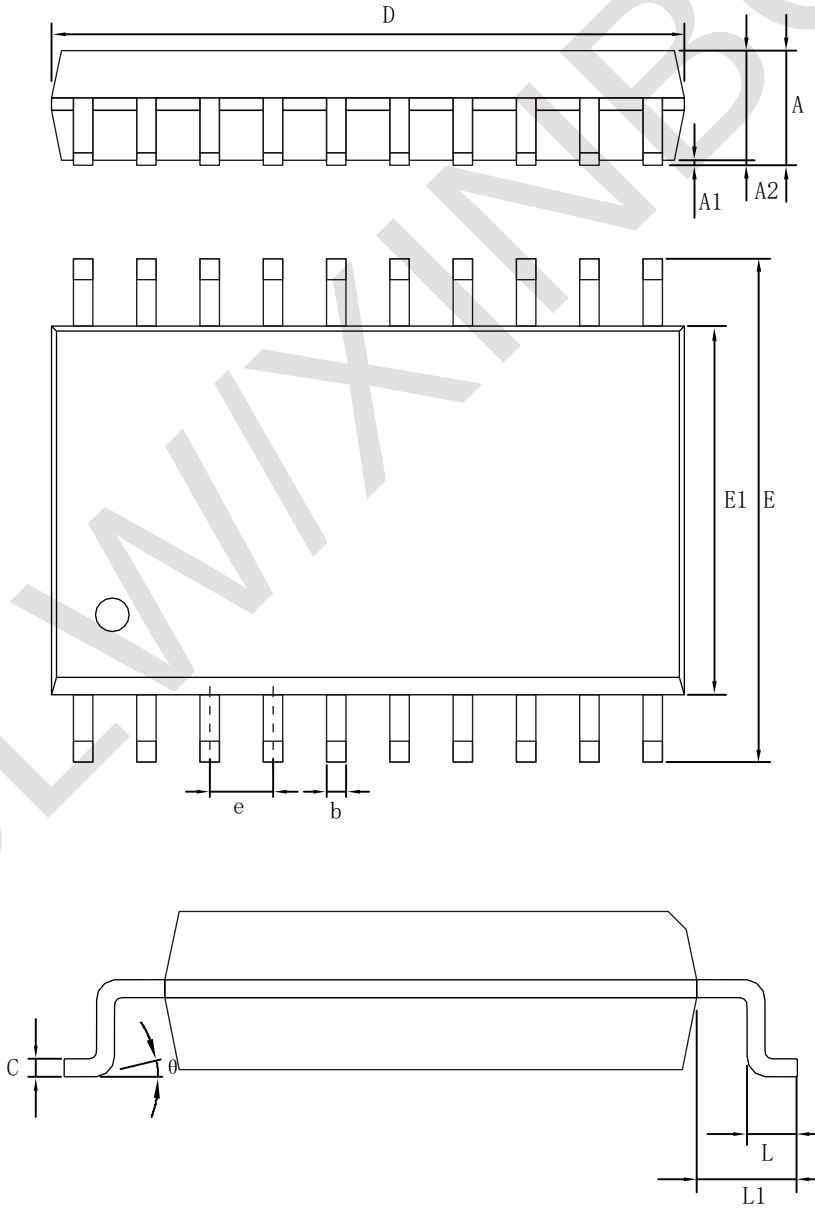






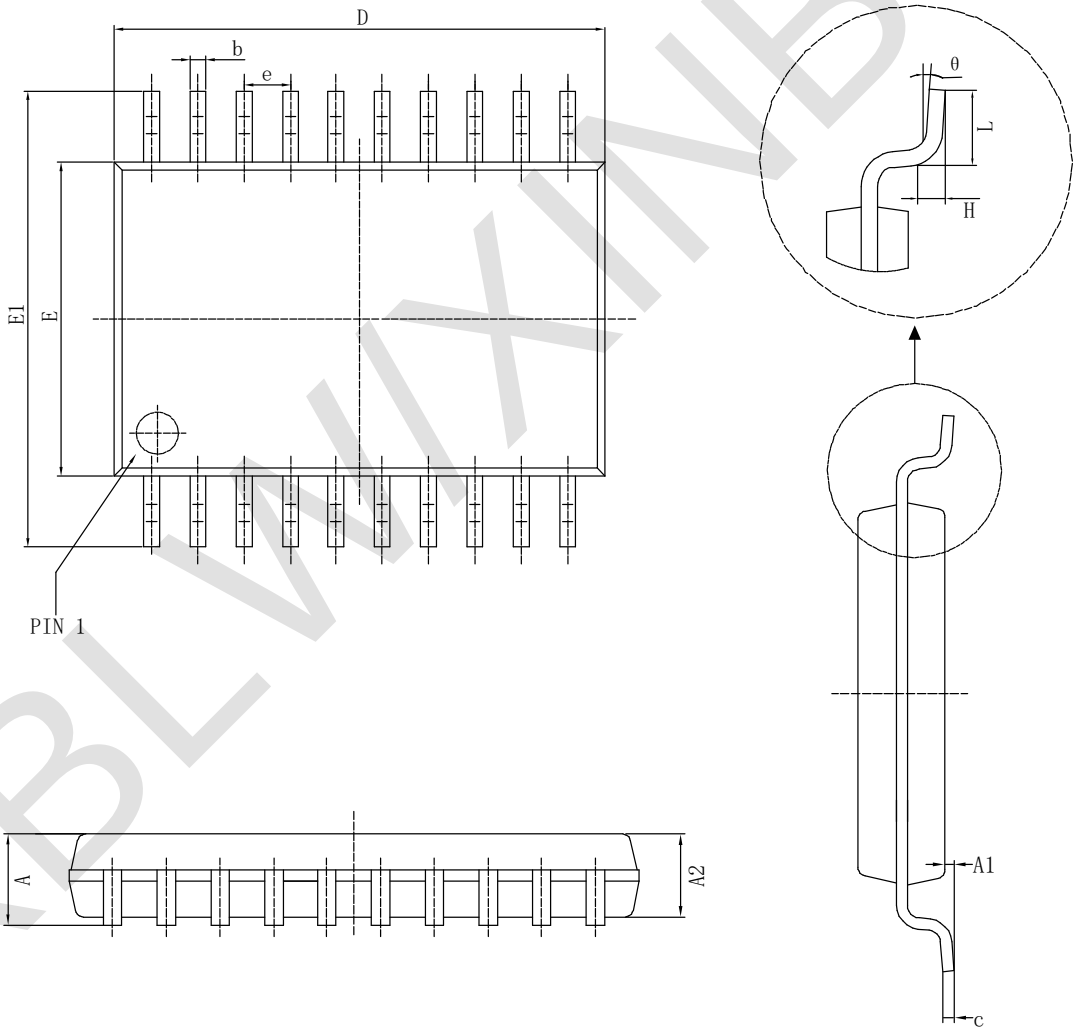
· SOP-20

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	2.470	2.650	A	0.097	0.104
A1	0.050	0.300	A1	0.002	0.012
A2	2.200	2.440	A2	0.087	0.096
b	0.350	0.500	b	0.014	0.020
c	0.150	0.300	c	0.006	0.012
D	12.54	12.94	D	0.494	0.509
E	10.00	10.60	E	0.394	0.417
E1	7.300	7.700	E1	0.287	0.303
e	1.270(BSC)		e	0.050(BSC)	
L	0.400	1.050	L	0.016	0.041
L1	1.300	1.500	L1	0.051	0.059
θ	0°	8°	θ	0°	8°



· TSSOP-20

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
D	6.400	6.600	D	0.252	0.259
E	4.300	4.500	E	0.169	0.177
b	0.190	0.300	b	0.007	0.012
c	0.090	0.200	c	0.004	0.008
E1	6.250	6.550	E1	0.246	0.258
A		1.200	A		0.047
A2	0.800	1.000	A2	0.031	0.039
A1	0.050	0.150	A1	0.002	0.006
e	0.65(BSC)		e	0.026(BSC)	
L	0.500	0.700	L	0.020	0.028
H	0.25(TYP)		H	0.01(TYP)	
θ	1°	7°	θ	1°	7°



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