AiP74LVC541
Octal Buffer/Line Driver; 3-state

Product Specification

Specification Revision History:

Version	Date	Description
2017-10-A1	2017-10	New
2023-04-B1	2023-04	Update the template

Contents

1、General Description

The AiP74LVC541 is an octal non-inverting buffer/line driver with 5V tolerant inputs and outputs. The 3-state outputs are controlled by the output enable inputs $\overline{OE}1$ and $\overline{OE}2$.

This device is fully specified for partial power-down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

Inputs can be driven from either 3.3V or 5V devices. When disabled, up to 5.5V can be applied to the outputs. These features allow the use of these devices as translators in mixed 3.3V and 5V applications.

Features:

- 5V tolerant inputs/outputs for interfacing with 5V logic
- Wide supply voltage range from 1.2V to 3.6V
- CMOS low power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5.5V
- Packaging information: SOP20/TSSOP20/DHVQFN20

Ordering Information:

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP74LVC541SA20.TB	SOP20	74LVC541	35 PCS/tube	80 tube/box	2800 PCS/box	Dimensions of plastic enclosure: 12.8mm×7.5mm Pin spacing: 1.27mm
AiP74LVC541TA20.TB	TSSOP20	74LVC541	70 PCS/tube	200 tube/box	14000 PCS/box	Dimensions of plastic enclosure: 6.5mm×4.4mm Pin spacing: 0.65mm

Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP74LVC541SA20.TR	SOP20	74LVC541	2000 PCS/reel	2000 PCS/box	Dimensions of plastic enclosure: 12.8mm×7.5mm Pin spacing:1.27mm
AiP74LVC541TA20.TR	TSSOP20	74LVC541	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 6.5mm×4.4mm Pin spacing:0.65mm
AiP74LVC541QE20.TR	DHVQFN20	74LVC541	3000 PCS/reel	3000 PCS/box	Dimensions of plastic enclosure: 4.5mm×2.5mm Pin spacing:0.5mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

2、Block Diagram And Pin Description

2.1、Block Diagram

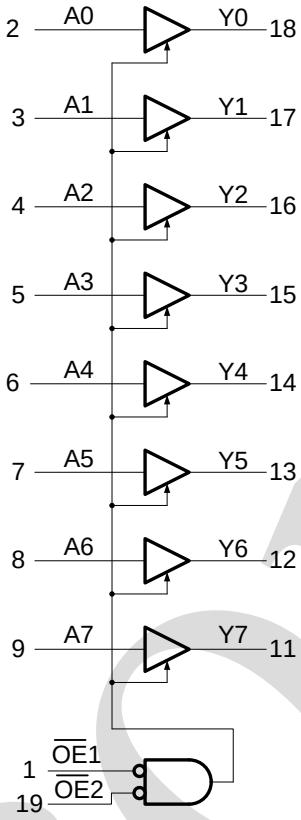


Figure 1. Functional diagram

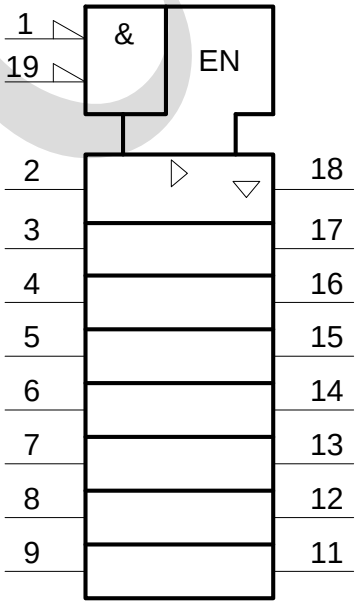
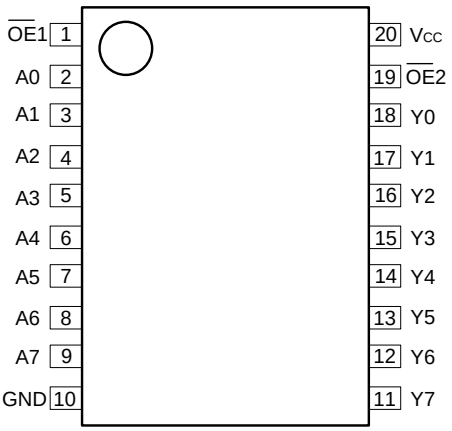
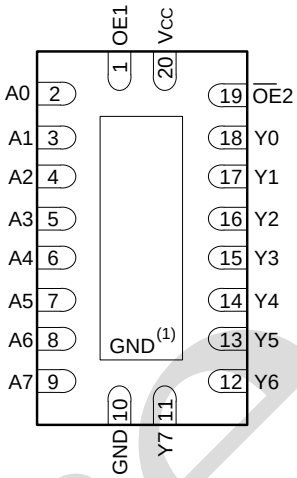


Figure 2. IEC logic symbol

2.2、Pin Configurations



SOP20/TSSOP20



DHVQFN20

Note:

(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

2.3、Pin Description

Pin No.	Pin Name	Description
1	$\overline{OE}$1	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 (0 V)
11	Y7	bus output
12	Y6	bus output
13	Y5	bus output
14	Y4	bus output
15	Y3	bus output
16	Y2	bus output
17	Y1	bus output
18	Y0	bus output
19	$\overline{OE}$2	output enable input (active LOW)
20	V_{CC}	supply voltage

2.4、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.

3、Electrical Parameter

3.1、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	6.5	V
input clamping current	I_{IK}	$V_I < 0V$	-50	-	mA
input voltage	V_I	-	-0.5	6.5	V
output clamping current	I_{OK}	$V_O > V_{CC}$ or $V_O < 0V$	-	±50	mA
output voltage	V_O	output HIGH or LOW	-0.5	V_{CC}+0.5	V
		output 3-state	-0.5	6.5	V
output current	I_O	V_O=0V to V_{CC}	-	±50	mA
supply current	I_{CC}	-	-	100	mA
ground current	I_{GND}	-	-100	-	mA
storage temperature	T_{stg}	-	-65	150	℃
total power dissipation	P_{tot}	-	-	500	mW
Soldering Temperature	T_L	10s	260		℃

Note:

[1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{CC}	-	1.65	-	3.6	V
		functional	1.2	-	-	V
input voltage	V_I	-	0	-	5.5	V
output voltage	V_O	output HIGH or LOW	0	-	V_{CC}	V
		output 3-state	0	-	5.5	V
ambient temperature	T_{amb}	in free air	-40	-	+125	℃
input transition rise and fall rate	Δt/ΔV	V_{CC}= 2.3V to 2.7V	0	-	20	ns/V
		V_{CC}= 2.7V to 3.6V	0	-	10	ns/V

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

(T_{amb}=-40℃ 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}= 1.2V		1.08	-	-	V
		V_{CC}= 1.65V to 1.95V		0.65× V_{CC}	-	-	V
		V_{CC}= 2.3V to 2.7V		1.7	-	-	V
		V_{CC}= 2.7V to 3.6V		2.0	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}= 1.2V		-	-	0.12	V
		V_{CC}= 1.65V to 1.95V		-	-	0.35× V_{CC}	V
		V_{CC}= 2.3V to 2.7V		-	-	0.7	V
		V_{CC}= 2.7V to 3.6V		-	-	0.8	V
HIGH-level output voltage	V_{OH}	V_I= V_{IH} or V_{IL}	I_O= -100uA; V_{CC}= 1.65 V to 3.6 V	V_{CC}-0.2	-	-	V
			I_O= -4mA; V_{CC}= 1.65V	1.2	-	-	V
			I_O= -8mA; V_{CC}= 2.3V	1.8	-	-	V
			I_O= -12mA; V_{CC}= 2.7V	2.2	-	-	V
			I_O= -18mA; V_{CC}= 3.0V	2.4	-	-	V
			I_O= -24mA; V_{CC}= 3.0V	2.2	-	-	V
LOW-level output voltage	V_{OL}	V_I= V_{IH} or V_{IL}	I_O= 100uA; V_{CC}= 1.65V to 3.6V	-	-	0.2	V
			I_O= 4mA; V_{CC}= 1.65V	-	-	0.45	V
			I_O= 8mA; V_{CC}= 2.3V	-	-	0.6	V
			I_O= 12mA; V_{CC}= 2.7V	-	-	0.4	V
			I_O= 24mA; V_{CC}= 3.0V	-	-	0.55	V
input leakage current	I_I	V_{CC}=3.6V; V_I=5.5V or GND		-	-	±5	uA

OFF-state output current	I_{OZ}	V_{CC}=3.6V; V_I=V_{IH} or V_{IL}; V_O=5.5V or GND	-	-	±5	uA
power-off leakage current	I_{OFF}	V_{CC}=0V; V_I or V_O=5.5V	-	-	±10	uA
supply current	I_{CC}	V_{CC}=3.6 V; V_I=V_{CC} or GND; I_O=0A	-	-	10	uA
additional supply current	ΔI_{CC}	per input pin; V_{CC}=2.7V to 3.6V; V_I= V_{CC}-0.6V; I_O=0A	-	-	500	uA
input capacitance	C_I	-	-	5	-	pF

Note:

[1] All typical values are measured at V_{CC}= 3.3 V (unless stated otherwise) and T_{amb}= 25℃.

3.3.2、DC Characteristics 2

(T_{amb}=-40℃ to +125℃, 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}= 1.2V		1.08	-	-	V
		V_{CC}= 1.65V to 1.95V		0.65× V_{CC}	-	-	V
		V_{CC}= 2.3V to 2.7V		1.7	-	-	V
		V_{CC}= 2.7V to 3.6V		2.0	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}= 1.2V		-	-	0.12	V
		V_{CC}= 1.65V to 1.95V		-	-	0.35× V_{CC}	V
		V_{CC}= 2.3V to 2.7V		-	-	0.7	V
		V_{CC}= 2.7V to 3.6V		-	-	0.8	V
HIGH-level output voltage	V_{OH}	V_I= V_{IH} or V_{IL}	I_O= -100uA; V_{CC}= 1.65 V to 3.6 V	V_{CC}-0.3	-	-	V
			I_O= -4mA; V_{CC}= 1.65V	1.05	-	-	V
			I_O= -8mA; V_{CC}= 2.3V	1.65	-	-	V
			I_O= -12mA; V_{CC}= 2.7V	2.05	-	-	V
			I_O= -18mA; V_{CC}= 3.0V	2.25	-	-	V
			I_O= -24mA; V_{CC}= 3.0V	2.0	-	-	V
LOW-level output voltage	V_{OL}	V_I= V_{IH} or V_{IL}	I_O= 100uA; V_{CC}= 1.65V to 3.6V	-	-	0.3	V
			I_O= 4mA; V_{CC}= 1.65V	-	-	0.65	V
			I_O= 8mA; V_{CC}= 2.3V	-	-	0.8	V
			I_O= 12mA; V_{CC}= 2.7V	-	-	0.6	V
			I_O= 24mA; V_{CC}= 3.0V	-	-	0.8	V
input leakage current	I_I	V_{CC}=3.6V; V_I=5.5V or GND		-	-	±20	uA
OFF-state output current	I_{OZ}	V_{CC}=3.6V; V_I=V_{IH} or V_{IL}; V_O=5.5V or GND		-	-	±20	uA

power-off leakage current	I_{OFF}	V_{CC}=0V; V_I or V_O=5.5V	-	-	±20	uA
supply current	I_{CC}	V_{CC}=3.6 V; V_I=V_{CC} or GND; I_O=0A	-	-	40	uA
additional supply current	ΔI_{CC}	per input pin; V_{CC}=2.7V to 3.6V; V_I= V_{CC}-0.6V; I_O=0A	-	-	5000	uA

Note:

[1] All typical values are measured at V_{CC}= 3.3 V (unless stated otherwise) and T_{amb}= 25℃.

3.3.3、AC Characteristics 1

(T_{amb}=-40℃ to +85℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
An to Yn propagation delay	t_{pd}	see Figure 4	V_{CC}= 1.2V	-	14.0	-	ns
			V_{CC}= 1.65V to 1.95V	1.5	6.5	13.8	ns
			V_{CC}= 2.3V to 2.7V	1.0	3.5	6.8	ns
			V_{CC}= 2.7V	1.5	3.5	5.6	ns
			V_{CC}=3.0V to 3.6V	1.0	2.9	5.1	ns
$\overline{OE}$n to Yn enable time	t_{en}	see Figure 5	V_{CC}= 1.2V	-	20.0	-	ns
			V_{CC}= 1.65V to 1.95V	1.8	7.7	16.0	ns
			V_{CC}= 2.3V to 2.7V	1.5	4.3	8.8	ns
			V_{CC}= 2.7V	1.5	4.4	7.5	ns
			V_{CC}=3.0V to 3.6V	1.0	3.5	7.0	ns
n$\overline{OE}$ to Yn disable time	t_{dis}	see Figure 5	V_{CC}= 1.2V	-	11.0	-	ns
			V_{CC}= 1.65V to 1.95V	3.0	4.9	10.3	ns
			V_{CC}= 2.3V to 2.7V	1.0	2.7	5.9	ns
			V_{CC}= 2.7V	1.5	3.7	7.0	ns
			V_{CC}=3.0V to 3.6V	1.0	3.3	6.0	ns
output skew time	$t_{sk(o)}$	-		-	-	1.0	ns
power dissipation capacitance	C_{PD}	per input; V_I= GND to V_{CC}	V_{CC}= 1.65V to 1.95V	-	7.7	-	pF
			V_{CC}= 2.3V to 2.7V	-	11.3	-	
			V_{CC}=3.0V to 3.6V	-	14.4	-	

Note:

[1] Typical values are measured at T_{amb}=25℃ and V_{CC}=1.8V, 2.5V, 2.7V, and 3.3V respectively.

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

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

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

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] 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_{olt}.

N=number of inputs switching.

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

3.3.4、AC Characteristics 2

(T_{amb}=-40℃ to +125℃, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
An to Yn propagation delay	t_{pd}	see Figure 4	V_{CC}= 1.65V to 1.95V	1.5	-	16.0	ns
			V_{CC}= 2.3V to 2.7V	1.0	-	7.9	ns
			V_{CC}= 2.7V	1.5	-	7.0	ns
			V_{CC}=3.0V to 3.6V	1.0	-	6.5	ns
$\overline{OE}$n to Yn enable time	t_{en}	see Figure 5	V_{CC}= 1.65V to 1.95V	1.8	-	18.5	ns
			V_{CC}= 2.3V to 2.7V	1.5	-	10.2	ns
			V_{CC}= 2.7V	1.5	-	9.5	ns
			V_{CC}=3.0V to 3.6V	1.0	-	9.0	ns
n$\overline{OE}$ to Yn disable time	t_{dis}	see Figure 5	V_{CC}= 1.65V to 1.95V	3.0	-	11.9	ns
			V_{CC}= 2.3V to 2.7V	1.0	-	6.8	ns
			V_{CC}= 2.7V	1.5	-	9.0	ns
			V_{CC}=3.0V to 3.6V	1.0	-	7.5	ns
output skew time	$t_{sk(o)}$	-		-	-	1.5	ns

Note:

[1] Typical values are measured at T_{amb}=25℃ and V_{CC}=1.8V, 2.5V, 2.7V, and 3.3V respectively.

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

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

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

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

4、Testing Circuit

4.1、AC Testing Circuit

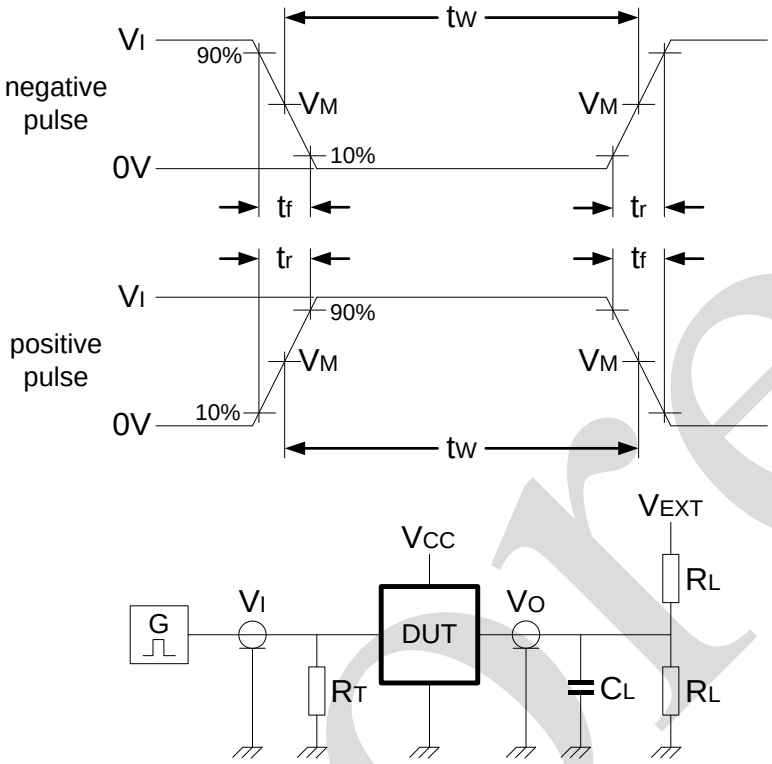


Figure 3. Test circuit for measuring switching times

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.

V_{EXT}=External voltage for measuring switching times.

4.2、AC Testing Waveforms

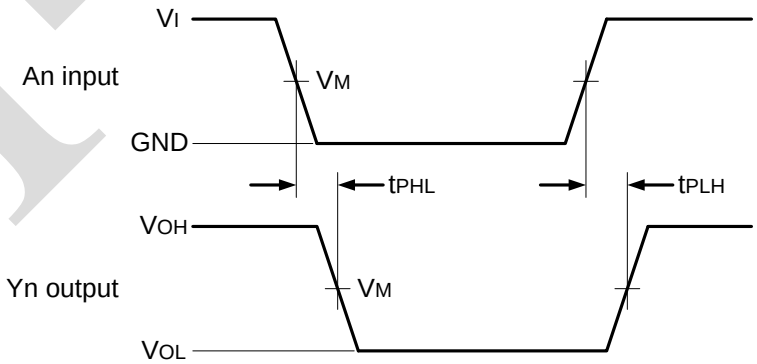


Figure 4. The input (An) to output (Yn) propagation delays

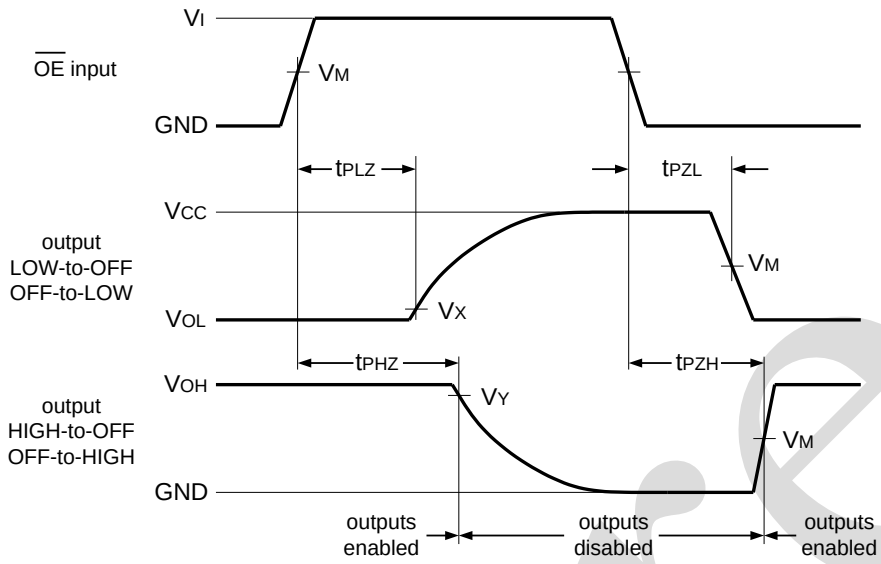


Figure 5. 3-state enable and disable times

4.3、Measurement Points

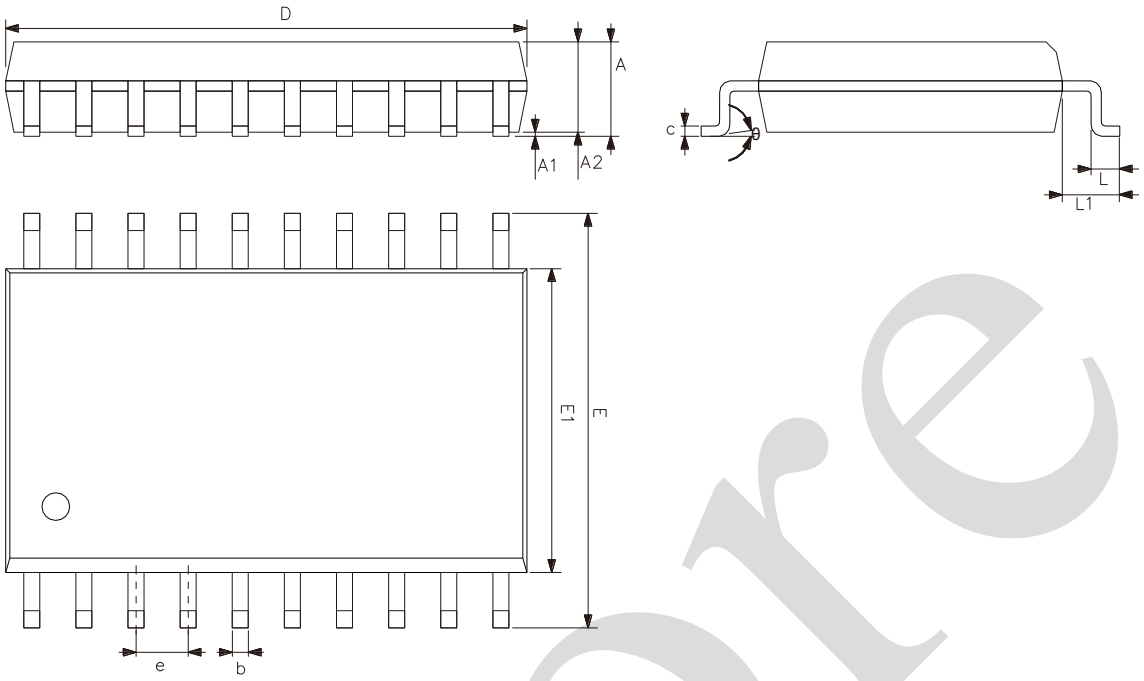
Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
1.2V	V_{CC}	$0.5\times V_{CC}$	$0.5\times V_{CC}$	V_{OL} + 0.15V	V_{OH} - 0.15V
1.65V to 1.95V	V_{CC}	$0.5\times V_{CC}$	$0.5\times V_{CC}$	V_{OL} + 0.15V	V_{OH} - 0.15V
2.3V to 2.7V	V_{CC}	$0.5\times V_{CC}$	$0.5\times V_{CC}$	V_{OL} + 0.15V	V_{OH} - 0.15V
2.7V	2.7V	1.5V	1.5V	V_{OL} + 0.3V	V_{OH} - 0.3V
3.0V to 3.6V	2.7V	1.5V	1.5V	V_{OL} + 0.3V	V_{OH} - 0.3V

4.4、Test Data

Supply voltage	Input		Load		V_{EXT}		
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
1.2V	V_{CC}	≤ 2.0ns	30pF	1kΩ	open	GND	$2\times V_{CC}$
1.65V to 1.95V	V_{CC}	≤ 2.0ns	30pF	1kΩ	open	GND	$2\times V_{CC}$
2.3V to 2.7V	V_{CC}	≤ 2.0ns	30pF	500Ω	open	GND	$2\times V_{CC}$
2.7V	2.7V	≤ 2.5ns	50pF	500Ω	open	GND	$2\times V_{CC}$
3.0V to 3.6V	2.7V	≤ 2.5ns	50pF	500Ω	open	GND	$2\times V_{CC}$

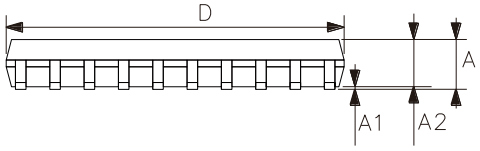
5、Package Information

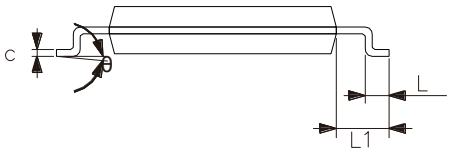
5.1、SOP20

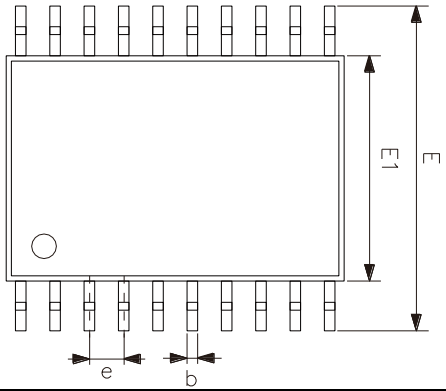


Symbol	Dimensions (mm)	
	Min.	Max.
A	2.47	2.65
A1	0.05	0.30
A2	2.20	2.44
b	0.35	0.50
c	0.15	0.30
D	12.54	12.94
E	10.00	10.60
E1	7.30	7.70
e	1.27	
L	0.40	1.05
L1	1.30	1.50
θ	0 °	8 °

5.2、TSSOP20

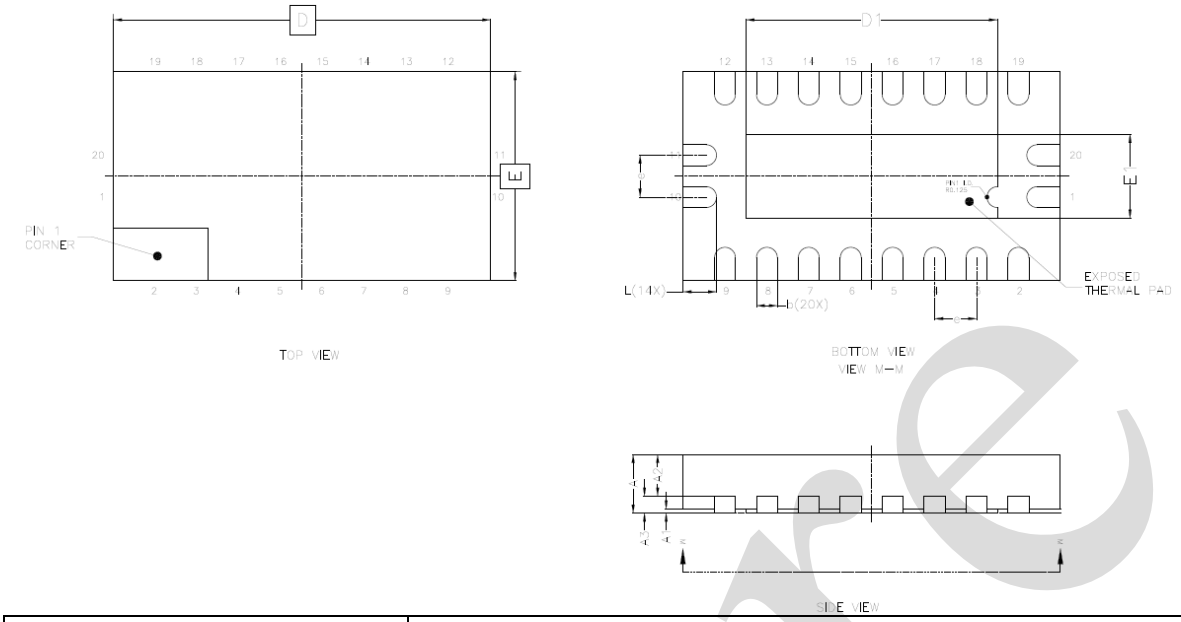






Symbol	Dimensions (mm)	
	Min.	Max.
A	-	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	6.40	6.60
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
L1	1.00	
θ	0°	8°

5.3、DHVQFN20



Symbol	Dimensions (mm)	
	Min.	Max.
A	0.80	1.00
A1	0.00	0.05
A2	0.60	0.70
A3	0.20	
D	4.40	4.60
E	2.40	2.60
e	0.50	
b	0.18	0.30
L	0.30	0.50
D1	2.70	3.15
E1	0.70	1.15

6、Statements And Notes

6.1、The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○：Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×：Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

6.2、Notes

We Recommend you to read this chapter carefully before using this product.

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