



### DESCRIPTION

The AL244 is an octal non-inverting buffer/driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs  $\overline{1OE}$  and  $2\overline{OE}$ . A High on  $\overline{OE}$  causes the outputs to assume a high impedance OFF-state.

$V_{CC}$  supporting operating voltage from 1.65 V to 5.5 V.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor, the minimum value of the resistor is determined by the current-sinking capability of the driver.

The AL244 is available in SOP20 and TSSOP20 Packages.

### FEATURES

- Power-Supply Range: 1.65V ~ 5.5V
- $V_{CC}$  Isolation: If  $V_{CC}$  is at GND, Both Ports are in the High-Impedance State.
- $I_{OFF}$ : Supports Partial-Power-Down Mode Operation
- Extended Temperature: -40°C to +125°C

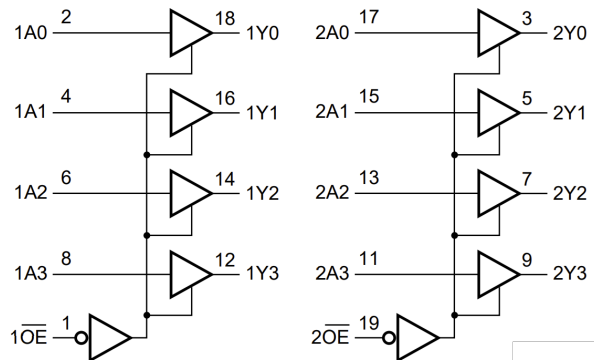
### APPLICATION

- Network Switches
- Power Infrastructures
- PCs and Notebooks
- Wearable Health and Fitness Devices
- Tests and Measurements

### ORDERING INFORMATION

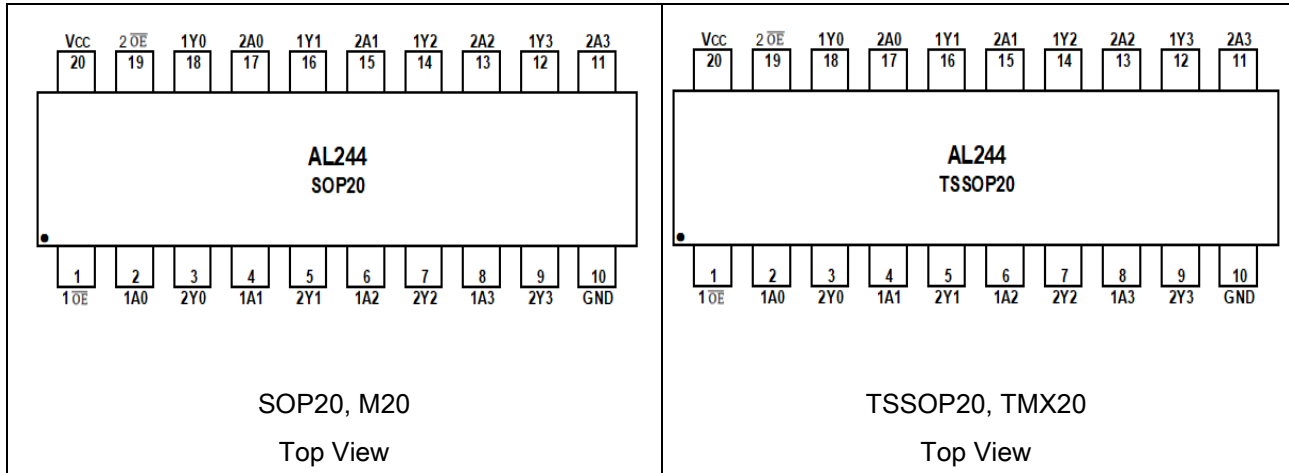
Package Type	Part Number	
SOP20 SPQ:1,500pcs/Reel	M20	AL244M20R
		AL244M20VR
TSSOP20 SPQ:4,000pcs/Reel	TMX20	AL244TMX20R
		AL244TMX20VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

### LOGIC SYMBOL





**PIN DESCRIPTION**



PIN#		Symbol	I/O	Function
SOP20	TSSOP20			
1	1	$\overline{1OE}$	I	Output Enable (Active Low). Pull $\overline{1OE}$ High to Place all Outputs in 3-State Mode.
2	2	1A0	I	Input
3	3	2Y0	O	Output
4	4	1A1	I	Input
5	5	2Y1	O	Output
6	6	1A2	I	Input
7	7	2Y2	O	Output
8	8	1A3	I	Input
9	9	2Y3	O	Output
10	10	GND	G	Ground.
11	11	2A3	I	Input
12	12	1Y3	O	Output
13	13	2A2	I	Input
14	14	1Y2	O	Output
15	15	2A1	I	Input
16	16	1Y1	O	Output
17	17	2A0	I	Input
18	18	1Y0	O	Output
19	19	$\overline{2OE}$	I	Output Enable (Active Low). Pull $\overline{2OE}$ High to Place all Outputs in 3-State Mode.
20	20	Vcc	P	Supply Voltage. $1.65V \leq V_{cc} \leq 5.5V$

I=Input, O=Output, P=Power



## FUNCTION TABLE

Inputs		Output
$\overline{OE}$	A Port	Y Port
L	H	H
L	L	L
H	X	Hi-Z

H=High Voltage Level

L=Low Voltage Level

X=Don't Care

Z=High Impedance OFF-State

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)

$V_{CC}$ , Supply Voltage Range		-0.5V ~ + 6.5V
$V_I$ , Input Voltage Range <sup>(1)</sup>	A Port	-0.5V ~ + 6.5V
	Control Inputs	-0.5V ~ + 6.5V
$V_O$ , Voltage Range Applied to any Output in the High-Impedance or Power-Off State <sup>(1)</sup>	Y Port	-0.5V ~ + 6.5V
$V_O$ , Voltage Range Applied to any Output in the High or Low State <sup>(1) (2)</sup>	Y Port	-0.5V ~ + $V_{CC} + 0.5V$
$I_{IK}$ , Input Clamp Current	$V_I < 0$	-50mA
$I_{OK}$ , Output Clamp Current	$V_O < 0$	-50mA
$I_O$ , Continuous Output Current		±50mA
$I_O$ , Continuous Current through $V_{CCA}$ , $V_{CCB}$ or GND		±100mA
$T_J$ , Junction Temperature		150°C
$T_{STG}$ , Storage Temperature		-65°C ~ +150°C

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(2) The value of  $V_{CC}$  is provided in the Recommended Operating Conditions table.

## ESD RATINGS

Parameter	Symbol	Min	Unit
Human-Body Model (HBM)	$V_{(ESD)}$ Electrostatic Discharge	±3000	V
Machine Model (MM)		±400	



**RECOMMENDED OPERATING CONDITIONS**

V<sub>CC</sub> is the supply voltage associated with the input port and output port.

Parameter	Symbol	Conditions	Min	Max	Unit	
Supply Voltage	V <sub>CC</sub>	-	1.65	5.5		
High-Level Input Voltage	V <sub>IH</sub>	Inputs	V <sub>CC</sub> =1.65 V ~1.95 V	V <sub>CC</sub> x 0.65	-	V
			V <sub>CC</sub> = 2.3 V ~2.7 V	1.7	-	
			V <sub>CC</sub> =3 V ~3.6 V	2	-	
			V <sub>CC</sub> =4.5 V ~5.5 V	V <sub>CC</sub> x 0.7	-	
Low-Level Input Voltage	V <sub>IL</sub>	Inputs	V <sub>CC</sub> =1.65 V ~1.95 V	-	V <sub>CC</sub> x 0.35	V
			V <sub>CC</sub> = 2.3 V ~2.7 V	-	0.7	
			V <sub>CC</sub> =3 V ~3.6 V	-	0.8	
			V <sub>CC</sub> =4.5 V ~5.5 V	-	V <sub>CC</sub> x 0.3	
Input Voltage	V <sub>I</sub>	-	0	5.5	V	
Output Voltage	V <sub>O</sub>	-	0	V <sub>CC</sub>	V	
High-Level Output Current	I <sub>OH</sub>	V <sub>CC</sub> =1.65V ~1.95V	-	-4	mA	
		V <sub>CC</sub> = 2.30 V ~2.70 V	-	-8		
		V <sub>CC</sub> =3V ~3.60 V	-	-24		
		V <sub>CC</sub> =4.50V ~5.50V	-	-32		
Low-Level Output Current	I <sub>OL</sub>	V <sub>CC</sub> =1.65V ~1.95V	-	4	mA	
		V <sub>CC</sub> = 2.30 V ~2.70 V	-	8		
		V <sub>CC</sub> =3V ~3.60 V	-	24		
		V <sub>CC</sub> =4.50V ~5.50V	-	32		
Input Transition Rise or Fall Rate	Δt/Δv	Date Inputs	V <sub>CC</sub> =1.65V ~1.95V	-	20	ns/V
			V <sub>CC</sub> = 2.30 V ~2.70 V	-	20	
			V <sub>CC</sub> =3V ~3.60 V	-	10	
			V <sub>CC</sub> =4.50V ~5.50V	-	5	
Operating Free-Air Temperature	T <sub>A</sub>	-	-40	125	°C	

\*All unused or driven (floating) data inputs (I/Os) of the device must be held at logic HIGH or LOW (preferably V<sub>CC</sub> or GND) to ensure proper device operation and minimize power.

\*All unused control inputs must be held at V<sub>CC</sub> or GND to ensure proper device operation and minimize power consumption.

\*For V<sub>CC</sub> values not specified in the data sheet, V<sub>IH</sub> min = V<sub>CC</sub> × 0.7 V, V<sub>IL</sub> max = V<sub>CC</sub> × 0.3V.



**ELECTRICAL CHARACTERISTICS**

T<sub>A</sub> = +25°C (unless otherwise noted)

Symbol	Conditions	Min	Typ.	Max	Unit	
V <sub>OH</sub>	I <sub>OH</sub> = -100µA, V <sub>I</sub> = V <sub>IH</sub> , V <sub>CC</sub> = 1.65V ~ 4.5V	V <sub>CC</sub> ~0.1	-	-	V	
	I <sub>OH</sub> = -4mA, V <sub>I</sub> = V <sub>IH</sub> , V <sub>CC</sub> = 1.65V	1.2	-	-		
	I <sub>OH</sub> = -8mA, V <sub>I</sub> = V <sub>IH</sub> , V <sub>CC</sub> = 2.3V	1.9	-	-		
	I <sub>OH</sub> = -24mA, V <sub>I</sub> = V <sub>IH</sub> , V <sub>CC</sub> = 3V	2.4	-	-		
	I <sub>OH</sub> = -32mA, V <sub>I</sub> = V <sub>IH</sub> , V <sub>CC</sub> = 4.5V	3.8	-	-		
V <sub>OL</sub>	I <sub>OL</sub> = -100µA, V <sub>I</sub> = V <sub>IL</sub> , V <sub>CC</sub> = 1.65V ~ 4.5V	-	-	0.1	V	
	I <sub>OL</sub> = 4mA, V <sub>I</sub> = V <sub>IL</sub> , V <sub>CC</sub> = 1.65V			0.45		
	I <sub>OL</sub> = 8mA, V <sub>I</sub> = V <sub>IL</sub> , V <sub>CC</sub> = 2.3V			0.30		
	I <sub>OL</sub> = 24mA, V <sub>I</sub> = V <sub>IL</sub> , V <sub>CC</sub> = 3V			0.55		
	I <sub>OL</sub> = 32mA, V <sub>I</sub> = V <sub>IL</sub> , V <sub>CC</sub> = 4.5V			0.55		
I <sub>I</sub>	V <sub>I</sub> = 5.5V or GND, V <sub>CC</sub> = 5.5V	+25°C	-	-	±1	µA
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5V, V <sub>CC</sub> = 0V	+25°C	-	-	±1	µA
		-40°C ~ +125°C	-	-	±2	
I <sub>oz</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND, $\overline{OE}$ = V <sub>IH</sub> , V <sub>CC</sub> = 1.65V ~ 5.5V	+25°C	-	-	±1	µA
		-40°C ~ +125°C	-	-	±2	
I <sub>CC</sub> V <sub>CC</sub> supply current	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0, V <sub>CC</sub> = 1.65V ~ 5.5V	+25°C	-	-	1	µA
		-40°C ~ +125°C	-	-	5	
		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0, V <sub>CC</sub> = 0V	-40°C ~ +125°C	-	-	
ΔI <sub>CC</sub>	One A port at V <sub>CC</sub> - 0.6V, Y port = open, V <sub>CC</sub> = 3V~5.5V	-40°C ~ +125°C	-	-	50	µA
C <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>CC</sub> = 3.30V	+25°C	-	8.50	-	pF
C <sub>O</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>CC</sub> = 3.30V	+25°C	-	8.50	-	pF

**SWITCHING CHARACTERISTICS**

Symbol	From (Input)	To (Output)	V <sub>CC</sub> = 1.8V ±0.15V		V <sub>CC</sub> = 2.5V ±0.2V		V <sub>CC</sub> = 3.3V ±0.3V		V <sub>CC</sub> = 5V ±0.5V		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>PLH</sub>	An	Yn	1.7	21.6	1.3	9.1	1.0	7.4	0.8	7.1	ns
t <sub>PHL</sub>											
t <sub>PHZ</sub>	$\overline{OE}$	Yn	2.4	32.2	1.9	12.9	1.7	12	1.3	10.2	ns
t <sub>PLZ</sub>											
t <sub>PZH</sub>	$\overline{OE}$	Yn	1.8	31.9	1.5	16	1.2	12.6	0.9	10.8	ns
t <sub>PZL</sub>											

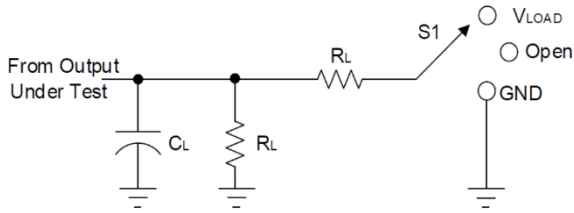
**OPERATING CHARACTERISTICS**

Parameter	Symbol	Conditions	V <sub>CC</sub> =1.8V	V <sub>CC</sub> =2.5V	V <sub>CC</sub> =3.3V	V <sub>CC</sub> =5V	Unit
			Typ.	Typ.	Typ.	Typ.	
Outputs Enabled	C <sub>pd</sub>	C <sub>L</sub> = 0, f = 10MHz, tr = tf = 1ns	42	42	43	44	pF
Outputs Disabled			2	2	2	3	

Power dissipation capacitance per transceiver

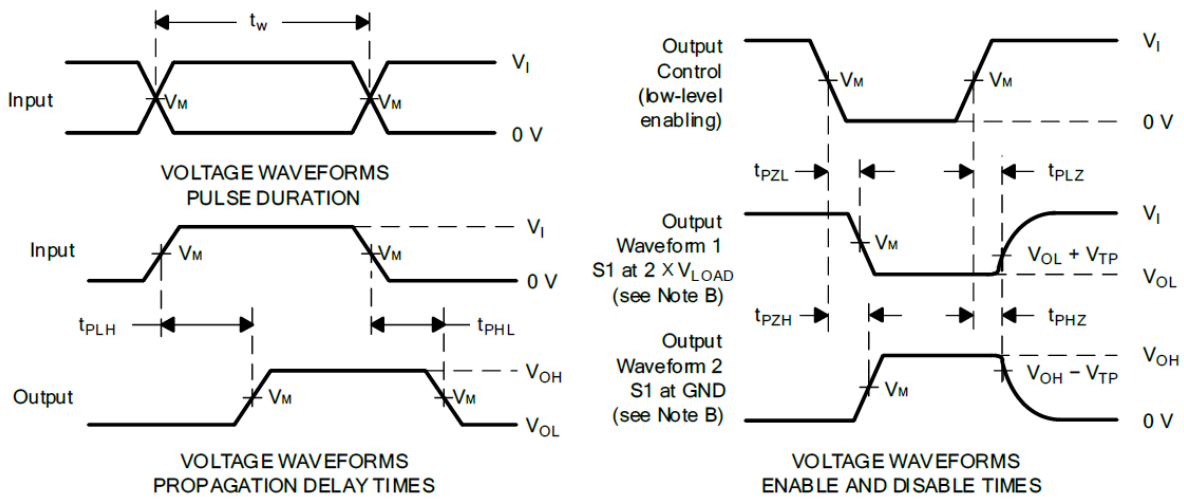


**PARAMETER MEASUREMENT INFORMATION**



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PIZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$V_I$	$V_M$	$C_L$	$R_L$	$V_{TP}$
$1.8V \pm 0.15V$	$V_{CC}$	$V_{CC}/2$	15pF	2k $\Omega$	0.15V
$2.5V \pm 0.2V$	$V_{CC}$	$V_{CC}/2$	15pF	2k $\Omega$	0.15V
$3.3V \pm 0.3V$	2.7V	1.5V	15pF	2k $\Omega$	0.3V
$5V \pm 0.5V$	2.7V	1.5V	15pF	2k $\Omega$	0.3V



**Fig 1. Load Circuit and Voltage Waveforms**

- (A)  $C_L$  includes probe and jig capacitance.
- (B) Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- (C) All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $v/dt \geq 1V/ns$ .
- (D) The outputs are measured one at a time, with one transition per measurement.
- (E) All parameters and waveforms are not applicable to all devices.



## TYPICAL CHARACTERISTICS

T<sub>A</sub>=25°C, V<sub>CC</sub> =5V (unless otherwise noted)

Fig 1. Voltage vs. Current

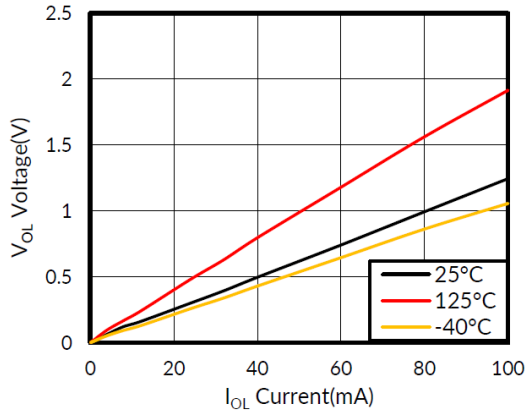
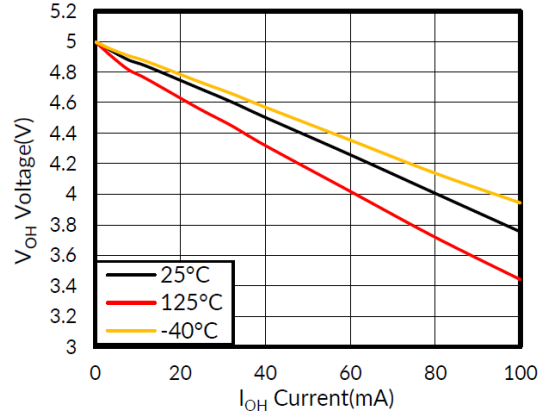
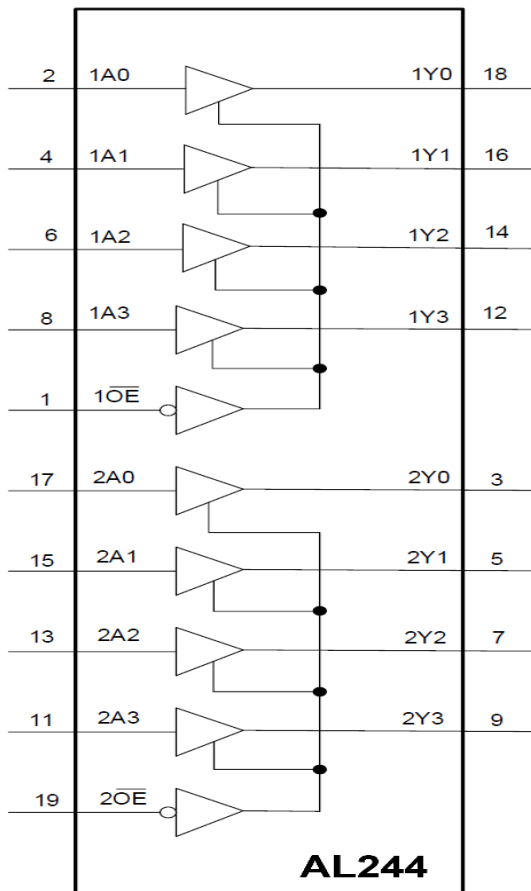


Fig 2. Voltage vs. Current

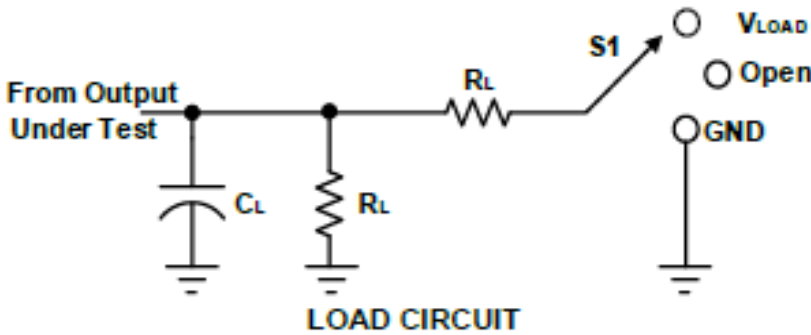


## BLOCK DIAGRAM



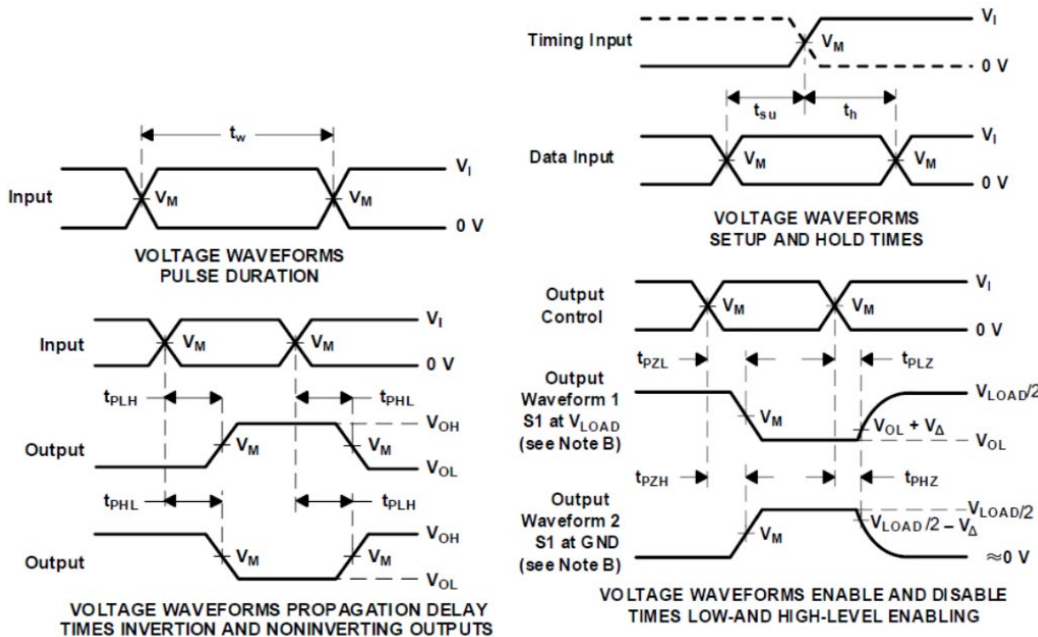


**PARAMETER MEASUREMENT INFORMATION**



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PZL}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$V_I$	$V_M$	$C_L$	$R_L$	$V_{TP}$
$1.8V \pm 0.15V$	$V_{CC}$	$V_{CC}/2$	15pF	2k $\Omega$	0.15V
$2.5V \pm 0.2V$	$V_{CC}$	$V_{CC}/2$	15pF	2k $\Omega$	0.15V
$3.3V \pm 0.3V$	2.7V	1.5V	15pF	2k $\Omega$	0.3V
$5V \pm 0.5V$	2.7V	$V_{CC}/2$	15pF	2k $\Omega$	0.3V



**Fig 1. Load Circuit and Voltage Waveforms**

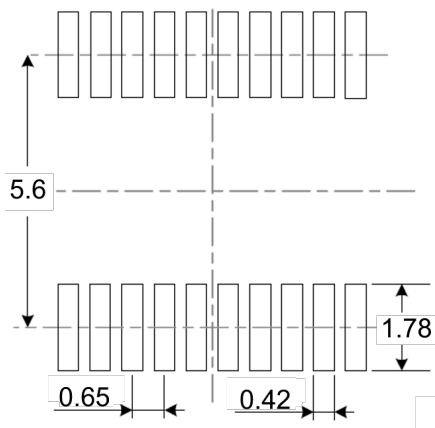
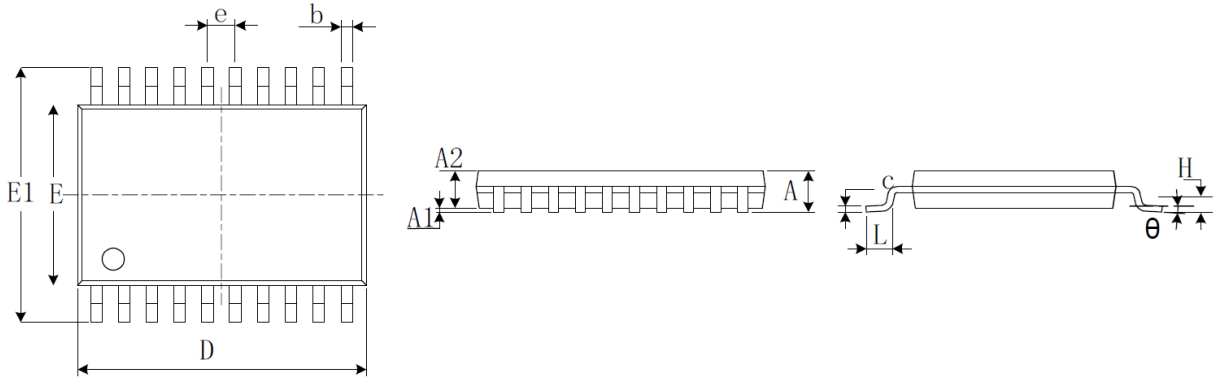
- (A)  $C_L$  includes probe and jig capacitance.
- (B) Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.  
Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- (C) All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_o = 50 \Omega$ .
- (D) The outputs are measured one at a time, with one transition per measurement.
- (E) All parameters and waveforms are not applicable to all devices.





**PACKAGE INFORMATION**

Dimension in TSSOP20 Package (Unit: mm)

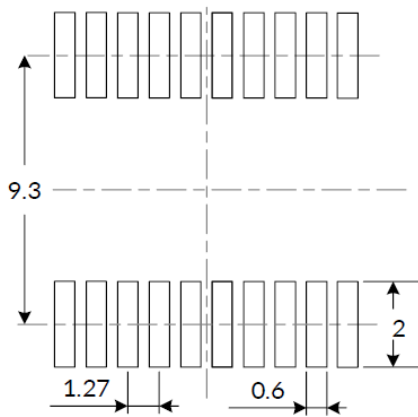
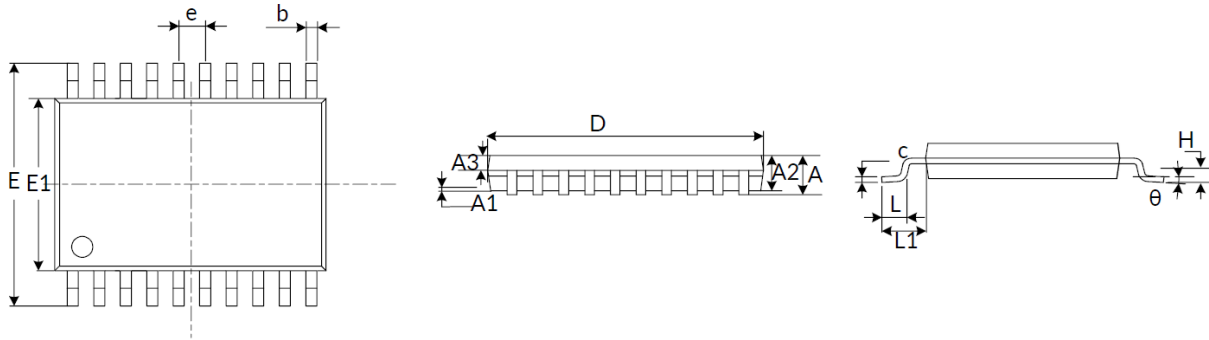


RECOMMENDED LAND PATTERN

Symbol	Millimeters	
	Min	Max
A	-	1.200
A1	0.050	0.150
A2	0.800	1.050
b	0.200	0.280
c	0.130	0.170
D	6.400	6.600
e	0.650 BSC	
E	4.300	4.500
E1	6.200	6.600
L	0.450	0.750
H	0.250 TYP.	
$\theta$	0°	8°



Dimension in SOP20 Package (Unit: mm)



**RECOMMENDED LAND PATTERN**

Symbol	Millimeters	
	Min	Max
A	-	2.650
A1	0.100	0.300
A2	0.250	2.350
A3	0.970	1.070
b	0.390	0.470
c	0.250	0.290
D	12.700	12.900
E	10.100	10.500
E1	7.400	7.600
e	1.270 BSC.	
L	0.700	1.000
H	0.250 TYP.	
θ	0°	8°
L1	1.400 REF.	



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