Octal Buffer/Line Driver; 3-State

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
* Specified from -40'C to +105'C

Packaging Information

* SOIC-20
* TSSOP-20
* DHVQFN20

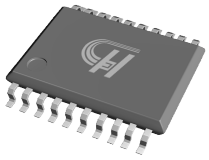
General Description

The HCR74LVC541 is an octal non-inverting buffer /line driver with 5V tolerant inputs and outputs.

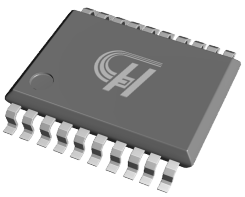
The 3-state outputs are controlled by the outpout enable inputs ($\overline{OE}1$ and $\overline{OE}2$).

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

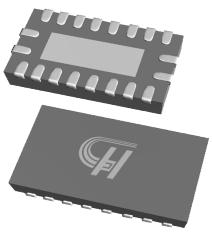
Inputs can be driven from either 3.3V or 5.0V devices. When disabled, up to 5.5V can be applied to the outputs. These features allow the use of these devices as translators in mixed 3.3V and 5.0V applications.



TSSOP-20



SOIC-20



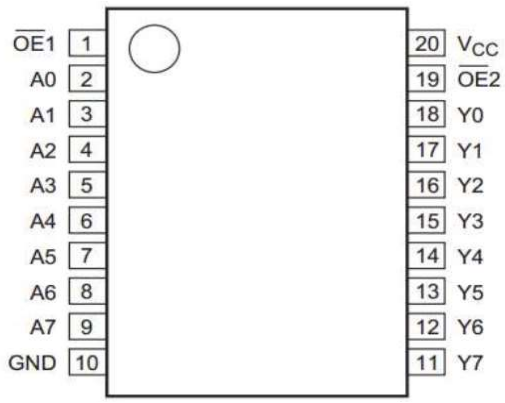
DHVQFN20

Figure 1. Package Type of HCR74LVC541

Octal Buffer/Line Driver; 3-State

Pin Configuration

TSSOP-20/SOIC-20(Top View)



DHVQFN20(Top View)

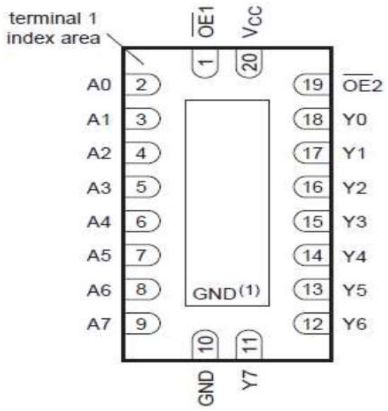


Figure 2. Pin Configuration of HCR74LVC541 (Top View)

Pin Function Table

Pin	NAME	FUNCTION
1	$\overline{OE}1$	Output enable input (active LOW)
2	A0	Date Input
3	A1	Date Input
4	A2	Date Input
5	A3	Date Input
6	A4	Date Input
7	A5	Date Input
8	A6	Date Input
9	A7	Date Input
10	GND	Ground (0V)
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	Vcc	Supply voltage

Octal Buffer/Line Driver; 3-State

LOGIC SYMBOL

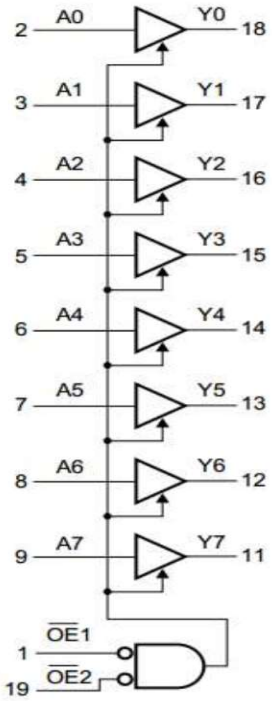


Figure 3. Logic Symbol

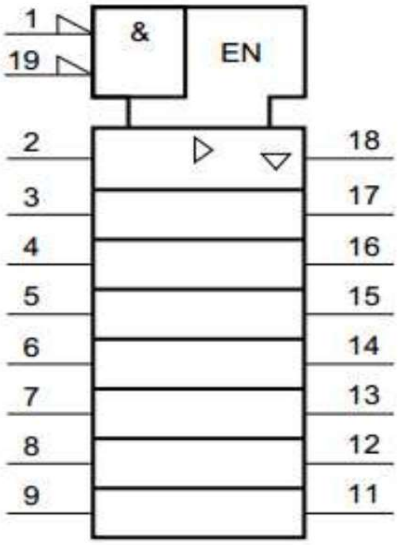


Figure 4. IEC Logic Symbol

Functional and Logic Diagram

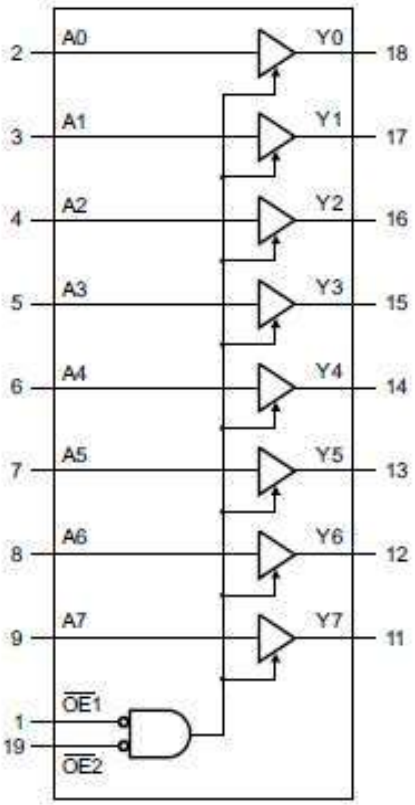


Figure 5. Functional Diagram

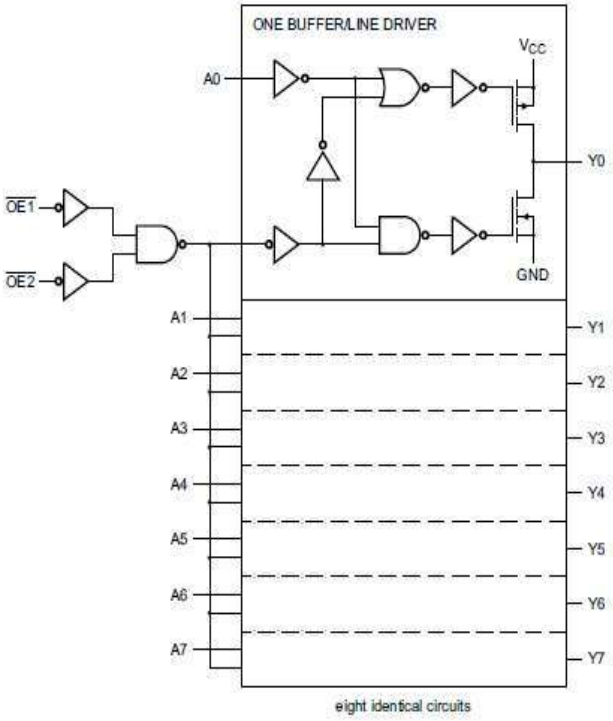
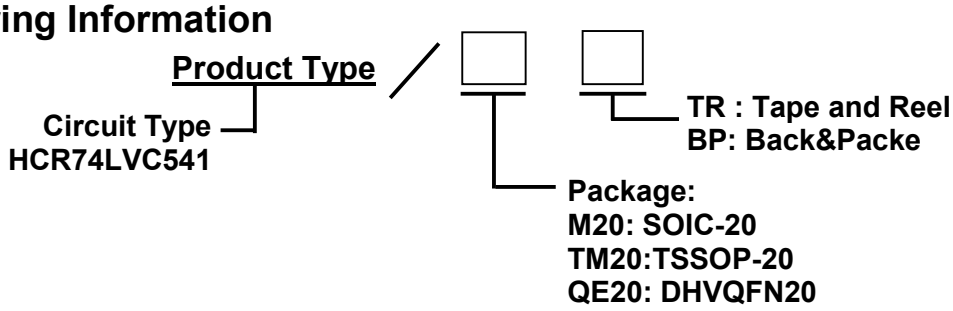


Figure 6. Logic Diagram

Octal Buffer/Line Driver; 3-State

Ordering Information



Ordering Code

Part Number	Marking	Temperature Range	Package	Quantity per Reel
HCR74LVC541/M20TR	HCR74LVC541	-40'C to +105'C	SOIC-20	2K/TR
HCR74LVC541/M20BP	HCR74LVC541	-40'C to +105'C	SOIC-20	2.8K/Box
HCR74LVC541/TM20TR	HCR74LVC541	-40'C to +105'C	TSSOP-20	4K/TR
HCR74LVC541/TM20BP	HCR74LVC541	-40'C to +105'C	TSSOP-20	14K/Box
HCR74LVC541/QE20TR	HCR74LVC541	-40'C to +105'C	DHVQFN20	3K/TR

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; ↑=LOW-to-HIGH clock transition;

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	Test Condition	Min	Type	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	
Output Current	I_O	V_O = 0V to V_{CC}	-	-	±50	mA
Supply Current	I_{CC}	-	-	-	100	mA
Ground Current	I_{GND}	-	-100	-	-	mA
Power Dissipation	P_{tot}	Tamb=-40 to +105'C; note 4	-	-	500	mW
Storage temperature	T_{stg}		-65	-	+150	'C
Soldering Temperature	T_L	10S	-	-	250	'C

Note 4: For SOP-20 pacakges: above 70'C the value of Ptot derates linearly with 8mW/K.

For TSSOP-20 pacakges: above 60'C the value of Ptot derates linearly with 5.5mW/K.

For DHVQFN20 pacakges: above 60'C the value of Ptot derates linearly with 4.5mW/K.

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	
Ambient temperature	T_{amb}	in free air	-40	-	+105	'C
Input transition rise and fall rate	$\Delta t/\Delta V$	V_{CC}=2.3V to 2.7V	0	-	20	ns/V
		V_{CC}=2.7V to 3.6V	0	-	10	ns/V

Octal Buffer/Line Driver; 3-State

ELECTRICAL CHARACTERISTICS

DC Characteristics-1

(Tamb=-40' to +85'C, Voltages are referenced to GND(ground=0V), unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Type	Max	Unit
High Level Input Voltage	V_{IH}	V_{CC}=1.2V		1.08	-	-	V
		V_{CC}=1.65V to 1.95V		0.65X V_{CC}	-	-	
		V_{CC}=2.3V to 2.7V		1.7	-	-	
		V_{CC}=2.7V to 3.6V		2.0	-	-	
Low Level Input Voltage	V_{IL}	V_{CC}=1.2V		-	-	0.12	V
		V_{CC}=1.65V to 1.95V		-	-	0.35X V_{CC}	
		V_{CC}=2.3V to 2.7V		-	-	0.7	
		V_{CC}=2.7V to 3.6V		-	-	0.8	
High-Level Output Voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-100uA; V_{CC}=1.65V to 3.6V	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		-	±0.1	±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		-	±0.1	±5	uA
Power-off Leakage Current	I_{OFF}	V_{CC}=0V; V_I or V_O=5.5V		-	±0.1	±10	uA
Supply Current	I_{CC}	V_{CC}=3.6V; V_I=V_{CC} or GND; I_O=0A		-	0.1	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		-	5	500	uA
Input Capacitance	C_I	-		-	5	-	pF

Note: 【1】All typical values are measured at V_{CC}=3.3V(unless stated otherwise) and Tamb=25'C.

ELECTRICAL CHARACTERISTICS

DC Characteristics-2

(Tamb=-40' to +105'C, Voltages are referenced to GND(ground=0V), unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Type	Max	Unit
High Level Input Voltage	V_{IH}	V_{CC}=1.2V		1.08	-	-	V
		V_{CC}=1.65V to 1.95V		0.65X V_{CC}	-	-	
		V_{CC}=2.3V to 2.7V		1.7	-	-	
		V_{CC}=2.7V to 3.6V		2.0	-	-	
Low Level Input Voltage	V_{IL}	V_{CC}=1.2V		-	-	0.12	V
		V_{CC}=1.65V to 1.95V		-	-	0.35X V_{CC}	
		V_{CC}=2.3V to 2.7V		-	-	0.7	
		V_{CC}=2.7V to 3.6V		-	-	0.8	
High-Level Output Voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-100uA; V_{CC}=1.65V to 3.6V	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}=3.6V; 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}=3.3V(unless stated otherwise) and Tamb=25'C.

AC CHARACTERISTICS-1

(Tamb= -40'C to +85'C, voltages are referenced to GND (GND=0V); unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Type	Max	Unit
An to Yn Propagation Delay	t_{Pd}	See Figure 8	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 9	V_{CC}=1.2V	-	20	-	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 9	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 Tamb=25'C and VCC=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_{PZL} and t_{PZH} .

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] CPD is used to determine the dynamic power dissipation(PD in uW).

$PD=(C_{PD}XV_{CC}^2XfiXN)+\Sigma(C_LXV_{CC}^2Xfo)$ where:

fi=input frequency in MHz;

fo=output frequency in MHz;

CL=output load capacitance in pF;

VCC=supply voltage in Volt;

N=number of inputs switching;

$\Sigma(C_LXV_{CC}^2Xfo)$=sum of outputs.

AC CHARACTERISTICS-2

(Tamb= -40'C to +105'C, voltages are referenced to GND (GND=0V); unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Type	Max	Unit
An to Yn Propagation Delay	t_{Pd}	See Figure 4	Vcc=1.65V to 1.95V	1.5	-	16.0	ns
			Vcc=2.3V to 2.7V	1.0	-	7.9	ns
			Vcc=2.7V	1.5	-	7.0	ns
			Vcc=3.0V to 3.6V	1.0	-	6.5	ns
$\overline{OE}$n to Yn enable time	t_{en}	See Figure 5	Vcc=1.65V to 1.95V	1.8	-	18.5	ns
			Vcc=2.3V to 2.7V	1.5	-	10.2	ns
			Vcc=2.7V	1.5	-	9.5	ns
			Vcc=3.0V to 3.6V	1.0	-	9.0	ns
n$\overline{OE}$ to Yn disable time	t_{dis}	See Figure 5	Vcc=1.65V to 1.95V	3.0	-	11.9	ns
			Vcc=2.3V to 2.7V	1.0	-	6.8	ns
			Vcc=2.7V	1.5	-	9.0	ns
			Vcc=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 Tamb=25'C and VCC=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_{PZL} and t_{PZH} .

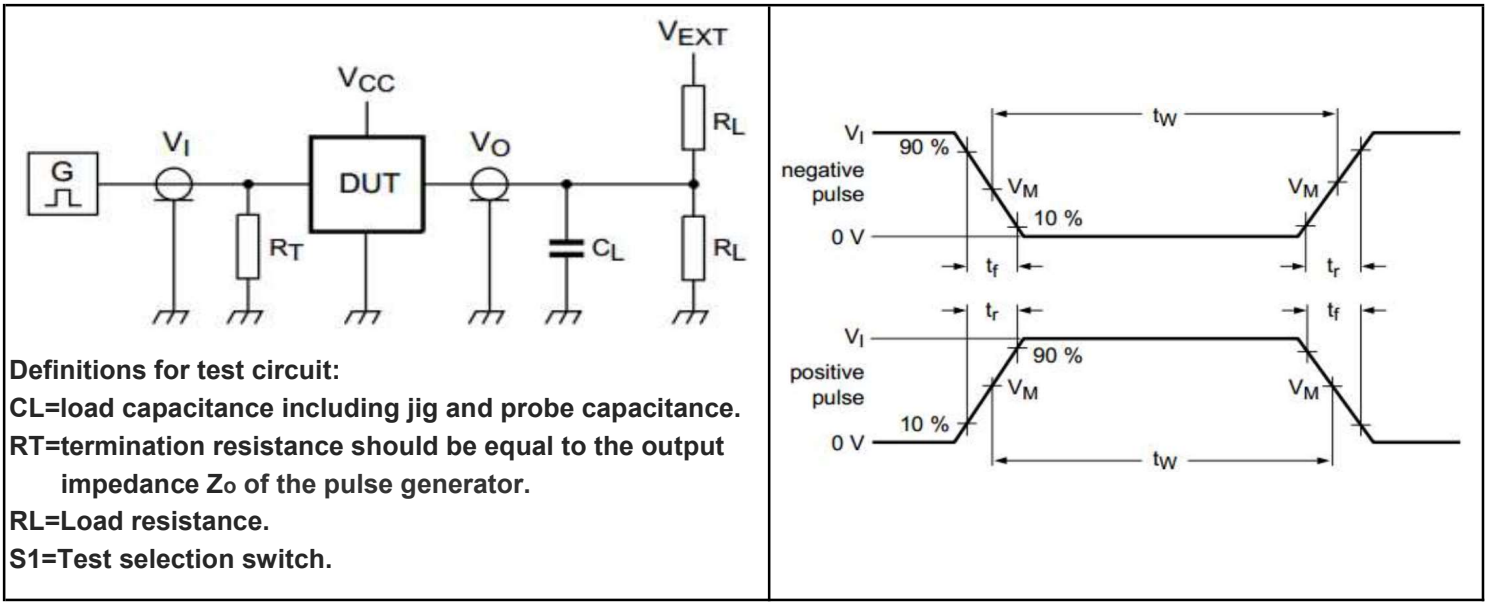
t_{dis} is the same as t_{PLZ} and t_{PHZ} .

[3] Skew between any two outputs of the same package switching in the same direction.

This parameter is guaranteed by design.

Testing Circuit

AC Testing Circuit



Definitions for test circuit:
CL=load capacitance including jig and probe capacitance.
RT=termination resistance should be equal to the output impedance Z_o of the pulse generator.
RL=Load resistance.
S1=Test selection switch.

Figure 7. Test Circuit for Measuring Switching Times

AC Testing Waveforms

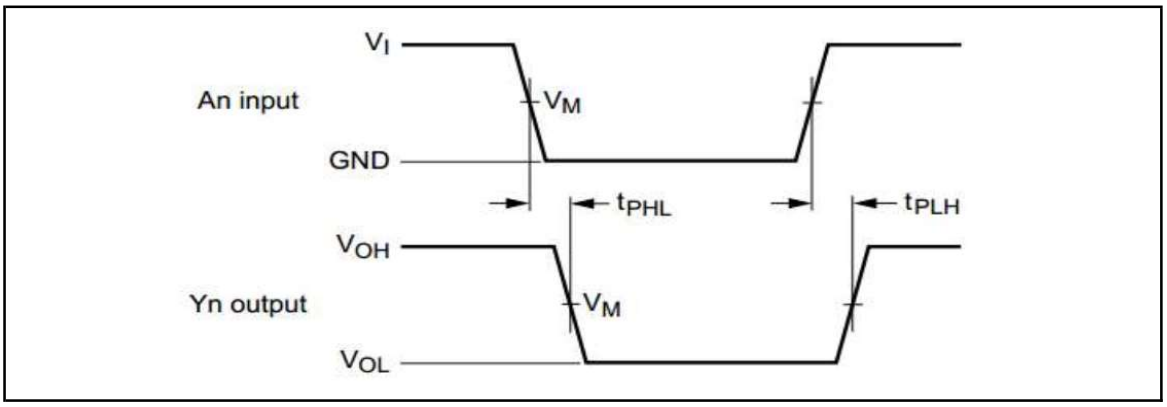


Figure 8. The input(An) to output (Yn) propagation delays

AC Testing Waveforms(Con.)

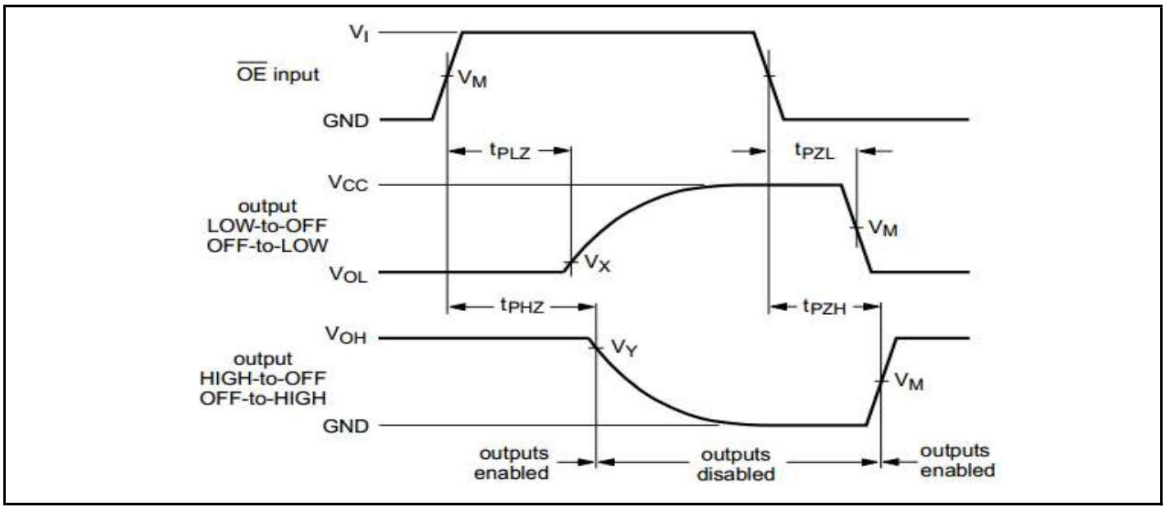


Figure 9. 3-state enable and disable times

Measurement Points

Supply Voltage	Input		Output		
VCC	VI	VM	VM	VX	VY
1.2V	VCC	0.5 X VCC	0.5 X VCC	VOL+0.15V	VOH-0.15V
1.65V to 1.95V	VCC	0.5 X VCC	0.5 X VCC	VOL+0.15V	VOH-0.15V
2.3V to 2.7V	VCC	0.5 X VCC	0.5 X VCC	VOL+0.15V	VOH-0.15V
2.7V	2.7V	1.5V	1.5V	VOL+0.3V	VOH-0.3V
3.0V to 3.6V	2.7V	1.5V	1.5V	VOL+0.3V	VOH-0.3V

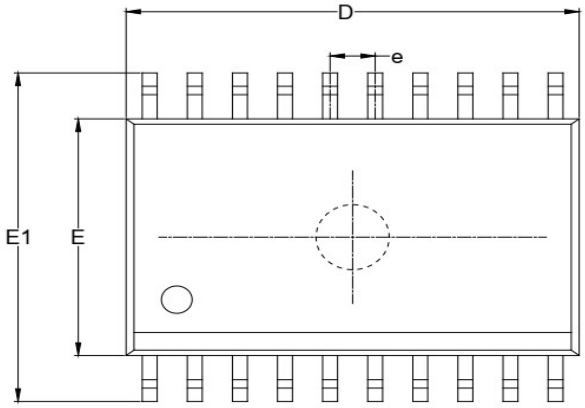
Test Data

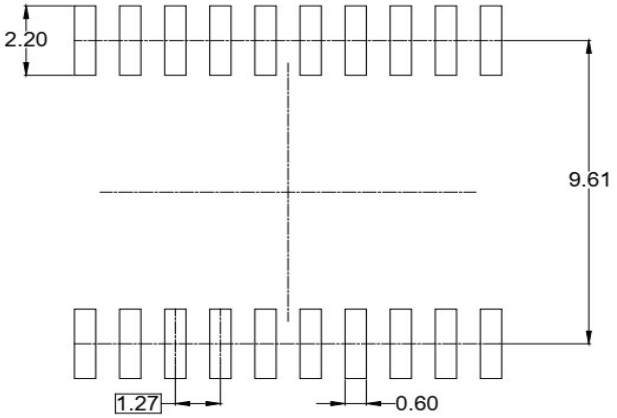
Supply Voltage	Input		Load		VEXT		
VCC	VI	tr, tf	CL	RL	tPLH, tPHL	tPZH, tPHZ	tPZL, tPLZ
1.2V	VCC	<=2.0ns	30pF	1KΩ	open	GND	2XVCC
1.65V to 1.95V	VCC	<=2.0ns	30pF	1KΩ	open	GND	2XVCC
2.3V to 2.7V	VCC	<=2.0ns	30pF	500Ω	open	GND	2XVCC
2.7V	2.7V	<=2.0ns	50pF	500Ω	open	GND	2XVCC
3.0V to 3.6V	2.7V	<=2.0ns	50pF	500Ω	open	GND	2XVCC

Octal Buffer/Line Driver; 3-State

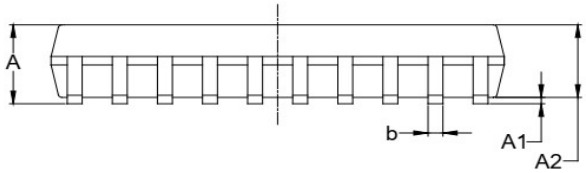
MECHANICAL DIMENSIONS.

PKG: SOIC-20 (M20) **Unit:mm**





RECOMMENDED LAND PATTERN (Unit: mm)

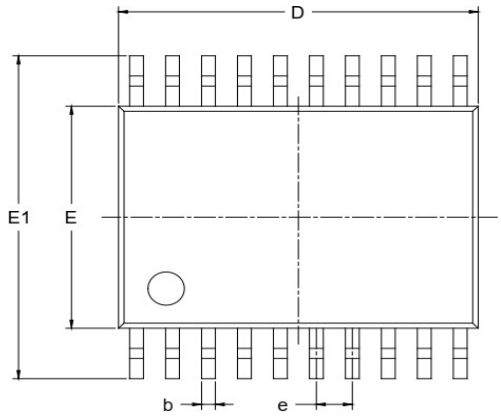


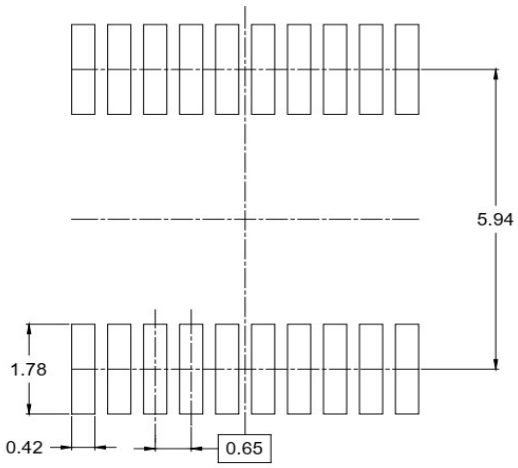
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	2.350	2.650	0.093	0.104
A1	0.100	0.300	0.004	0.012
A2	2.100	2.500	0.083	0.098
b	0.330	0.510	0.013	0.020
c	0.204	0.330	0.008	0.013
D	12.520	13.000	0.493	0.512
E	7.400	7.600	0.291	0.299
E1	10.210	10.610	0.402	0.418
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

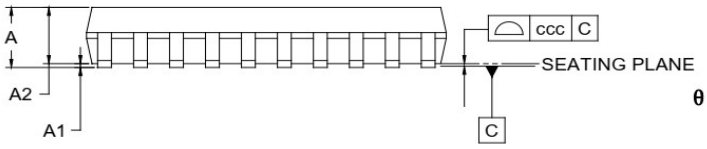
MECHANICAL DIMENSIONS(Con.)

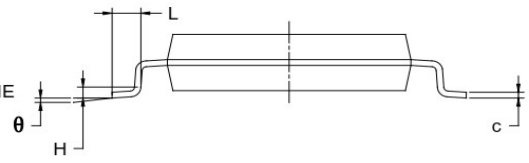
PKG: TSSOP-20 (TM20) **Unit:mm**





RECOMMENDED LAND PATTERN (Unit: mm)





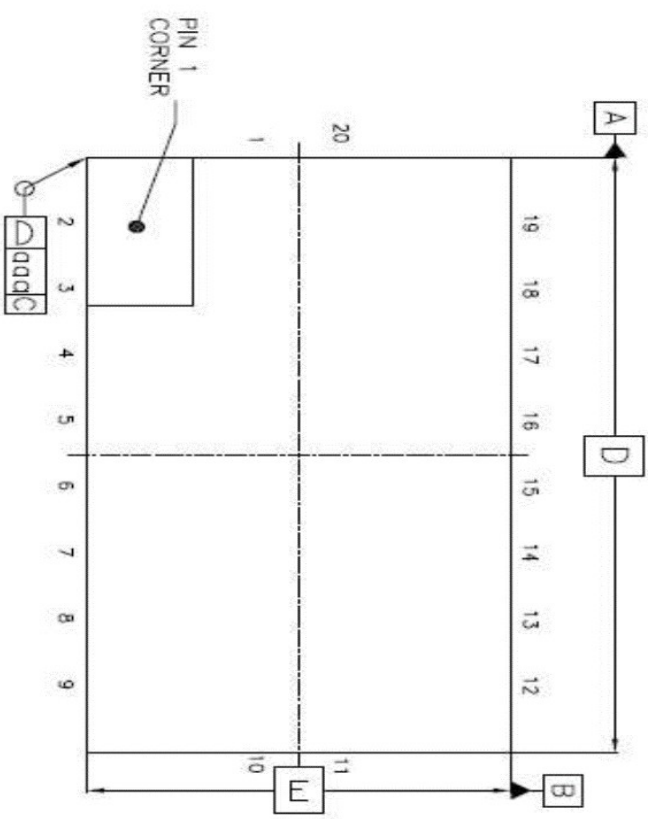
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	6.400	-	6.600
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-153.

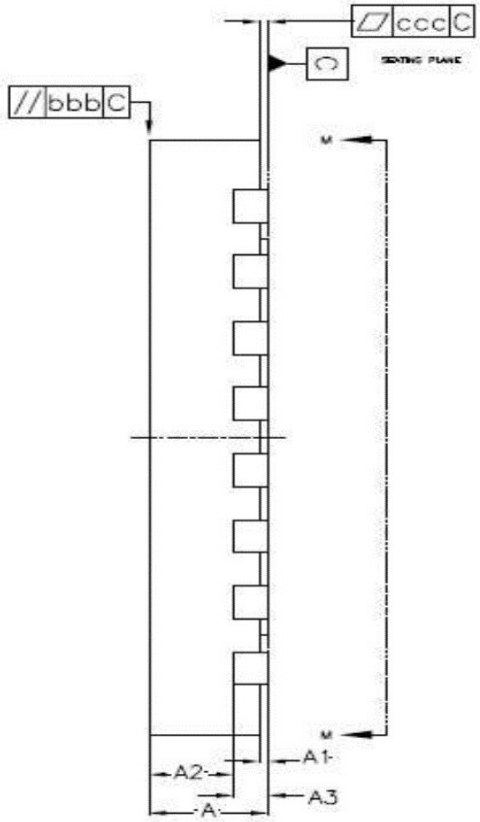
Octal Buffer/Line Driver; 3-State

MECHANICAL DIMENSIONS(Con.)

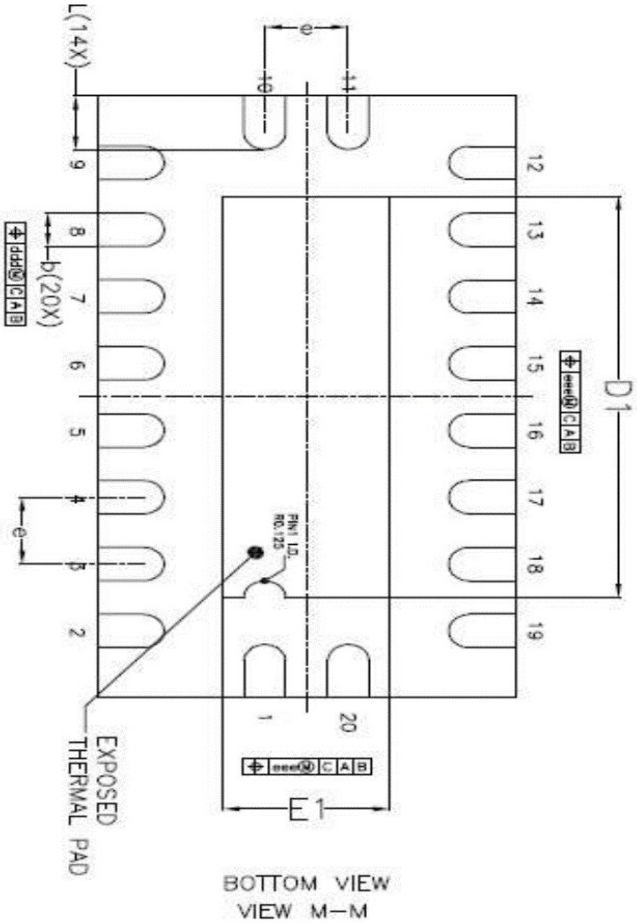
PKG: DHVQF20 (QE20) **Unit:mm**



TOP VIEW



SIDE VIEW



BOTTOM VIEW
VIEW M—M

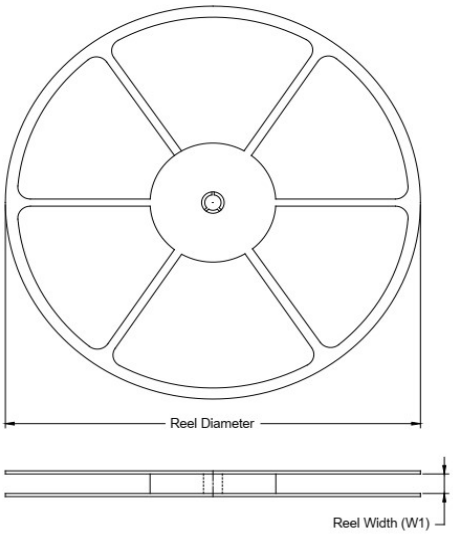
DESCRIPTION		SYMBOL	MILLIMETER		
			MIN	NOM	MAX
TOTAL THICKNESS		A	0.80	0.85	1.00
STAND OFF		A1	0.00	0.02	0.05
MOLD THICKNESS		A2	0.60	0.65	0.70
L/F THICKNESS		A3	0.203 REF		
BODY SIZE	X	D	4.40	4.50	4.60
	Y	E	2.40	2.50	2.60
LEAD PITCH		e	0.50 BSC		
LEAD WIDTH		b	0.18	0.25	0.30
LEAD LENGTH		L	0.30	0.40	0.50
EP SIZE		D1	2.85	3.00	3.15
		E1	0.85	1.00	1.15
Tolerance of form and position					
aaa		0.1			
bbb		0.1			
ccc		0.05			
ddd		0.1			
eee		0.1			

NOTES

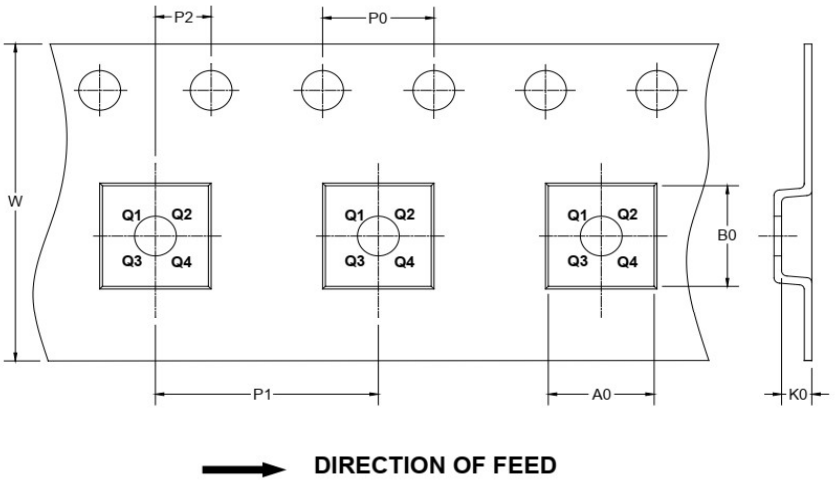
1.0 COPLANARITY APPLIES TO LEADS, CORNER LEADS AND DIE ATTACH PAD.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

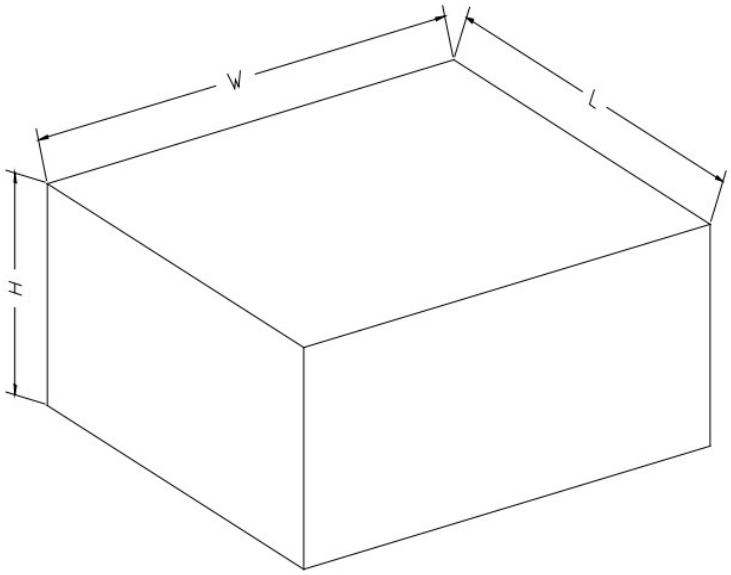


NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP-20	13"	16.4	6.80	6.90	1.50	4.0	8.0	2.0	16.0	Q1
SOIC-20	13"	24.4	10.90	13.30	3.00	4.0	12.0	2.0	24.0	Q1

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5

Statements And Notes

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	Ploybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	o	o	o	o	o	o	o	o	o	o
Plsatic resin	o	o	o	o	o	o	o	o	o	o
Chip	o	o	o	o	o	o	o	o	o	o
The lead	o	o	o	o	o	o	o	o	o	o
Plastic sheet installed	o	o	o	o	o	o	o	o	o	o
explanation	o: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. X: Indicates that the content of hazardous substances or elemuents exceeding the SJ/T11363-2006 Standard limit requirements.									

Notion

Recommended carefully reading this information before the use of this product;

The information in this document are subject to change without notice;

This information is using to the reference only, the company is not responsible for any loss;

The company is not responsible for the any infringement of the third party patents or other rights of the responsibility.