Ordering Information

74 LVC 245A xxx -13

Logic Device	Function	Package	Packing
74 : Logic Prefix	245 : Octal Bus Transceiver with 3-state Outputs	T20 : TSSOP-20 Q20 : QFN-20	**-13 : 13" Tape & Reel**

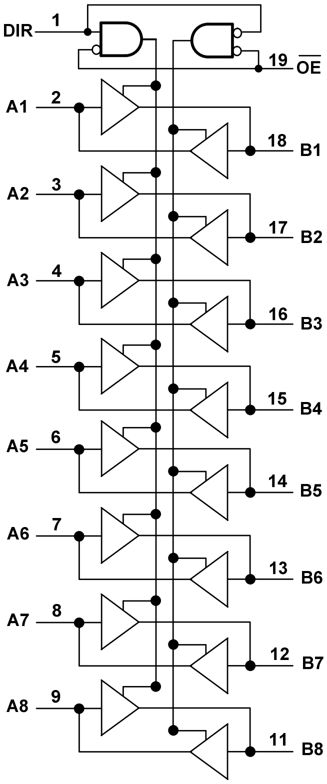
Part Number	Package Code	Package (Note 4 & 5)	Package Size	13" Tape and Reel	
				Quantity	Part Number Suffix
74LVC245AT20-13	T20	TSSOP-20	6.4mm X 6.5mm X 1.2mm 0.65 mm lead pitch	2500/Tape & Reel	-13
74LVC245AQ20-13	Q20	V-QFN4525-20	2.5mm X 4.5mm X 0.95mm 0.50 mm lead pitch	2500/Tape & Reel	-13

Notes: 4. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.
5. V-QFN4525-20 is a JEDEC recognized naming convention that specifies the package thickness category as V and the number 4525 describes the package as 4.5mm X 2.5mm.

Pin Descriptions

Pin Number	Pin Name	Description
1	DIR	Output Enable 1
2	1A1	Data Input
3	2Y4	Data Output
4	1A2	Data Input
5	2Y3	Data Output
6	1A3	Data Input
7	2Y2	Data Output
8	1A4	Data Input
9	2Y1	Data Output
10	GND	Ground
11	2A1	Data Input
12	1Y4	Data Output
13	2A2	Data Input
14	1Y3	Data Output
15	2A3	Data Input
16	1Y2	Data Output
17	2A4	Data Input
18	1Y1	Data Output
19	$\overline{2OE}$	Output Enable 2
20	Vcc	Supply Voltage

Logic Diagram



Function Table

INPUTS		Operation
$\overline{OE}$	DIR	
L	L	B Data to A Bus
L	H	A Data to B Bus
H	X	Bus Isolation

Absolute Maximum Ratings (Notes 6 & 7)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
ESD MM	Machine Model ESD Protection	200	V
V_{CC}	Supply Voltage Range	-0.5 to +7.0	V
V_I	Input Voltage Range note 3	-0.5 to +7.0	V
I_{IK}	Input Clamp Current $V_I < 0V$	-20	mA
I_{OK}	Output Clamp Current $V_O < 0V$	-50	mA
I_O	Continuous Output Current -0.5V < V_O V_{CC} +0.5V	±50	mA
I_{CC}	Continuous Current Through V_{CC}	100	mA
I_{GND}	Continuous Current Through GND	-100	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_{TOT}	Total Power Dissipation	500	mW

Notes: 6. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

7. Forcing the maximum allowed voltage could cause a condition exceeding the maximum current or conversely forcing the maximum current could cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.

Recommended Operating Conditions (Note 8)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage	Operating	1.65	3.6	V
		Data Retention Only	1.5	—	V
V_I	Input Voltage	—	0	5.5	V
V_O	Output Voltage	—	0	V_{CC}	V
I_{OH}	High-Level Output Current	V_{CC} = 1.65V	—	-4	mA
		V_{CC} = 2.3V	—	-8	
		V_{CC} = 2.7V	—	-12	
		V_{CC} = 3.0V	—	-24	
I_{OL}	Low-Level Output Current	V_{CC} = 1.65V	—	4	mA
		V_{CC} = 2.3V	—	8	
		V_{CC} = 2.7V	—	12	
		V_{CC} = 3.0V	—	24	
Δt/ΔV	Input Transition Rise or Fall Rate		—	10	ns/V
T_A	Operating Free-Air Temperature		-40	+125	°C

Note: 8. Unused inputs should be held at V_{CC} or ground.

Electrical Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Max	Min	Max	
V_{IH}	High-Level Input Voltage		1.65V to 1.95V	V_{CC} X 0.65	—	V_{CC} X 0.65	—	V
			2.3V to 2.7V	1.7	—	1.7	—	
			3.0V to 3.6V	2	—	2	—	
V_{IL}	Low-Level input Voltage		1.65V to 1.95V	—	V_{CC} X 0.35	—	V_{CC} X 0.35	V
			2.3V to 2.7V	—	0.7	—	0.7	
			3.0V to 3.6V	—	0.8	—	0.8	
V_{OH}	High-Level Output Voltage	I_{OH} = -50µA	1.65V to 3.6V	V_{CC} -0.2	—	V_{CC} -0.3	—	
		I_{OH} = -4mA	1.65V	1.2	—	1.05	—	
		I_{OH} = -8mA	2.3V	1.7	—	1.65	—	V
		I_{OH} = -12mA	2.7V	2.2	—	2.05	—	
			3.0V	2.4	—	2.48	—	
		I_{OH} = -24mA	3.0V	2.3	—	2.0	—	
V_{OL}	Low-Level Output Voltage	I_{OL} = 100µA	1.65V to 3.6V	—	0.2	—	0.3	V
		I_{OL} = 4mA	1.65V	—	0.45	—	0.65	
		I_{OL} = 8mA	2.3V	—	0.60	—	0.80	
		I_{OL} = 12mA	2.7V	—	0.40	—	0.60	
		I_{OL} = 24mA	3.0V	—	0.55	—	0.80	
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0 or 5.5V	0V	—	±10	—	20	µA
I_I	Input Current Control Pins	V_I = GND or 5.5V	0 to 3.6V	—	±5	—	±20	µA
I_{OZ}	Z-state Current Including Input Current I/O Pins	V_I = GND or 5.5V V_O = 0 to 5.5V	3.6V	—	±5	—	±20	µA
I_{CC}	Supply Current	V_I = GND or V_{CC}, I_O = 0	3.6V	—	10	—	40	µA
ΔI_{CC}	Additional Supply Current	One input at Vcc-0.6V Io = 0A	2.7V to 3.6V	—	500	—	5000	µA
C_i	Input Capacitance	Control Pins: V_I = GND or V_{CC}	0V to 3.6V	4.0 typical		4.0 typical		pF
		I/O Pins: V_I = GND or V_{CC}		5.5 typical		5.5 typical		

Switching Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Ty	Max	Min	Max	Min	Max	
t_{PD}	Propagation Delay A_N to B_N or B_N to A_N	Figure 1	1.8V ± 0.15V	1	6.0	12.2	1	12.7	1	16.9	ns
			2.5V ± 0.2V	1	3.9	8.1	1	8.5	1	9.1	
			2.7V	1	4.2	8.7	1	9.6	1	9.9	
			3.3V ± 0.3	1.5	3.8	8.1	1.5	8.7	1.5	9.2	
t_{EN}	Enable Time $\overline{OE}$ to A_N or $\overline{OE}$ to B_N	Figure 1	1.8V ± 0.15V	1	7	14.8	1	15.3	1	22.5	ns
			2.5V ± 0.2V	1	4.5	10	1	10.5	1	12.4	
			2.7V	1	5.4	9.3	1	9.5	1	12.0	
			3.3V ± 0.3	1.5	4.4	8.3	1.5	8.5	1.5	11.0	
t_{DIS}	Disable Time $\overline{OE}$ to A_N or $\overline{OE}$ to B_N	Figure 1	1.8V ± 0.15V	1	7.8	16.5	1	17	1	14.2	ns
			2.5V ± 0.2V	1	4	9	1	9.5	1	8.2	
			2.7V	1	4.4	8.3	1	8.5	1	10.0	
			3.3V ± 0.3	1.7	4.1	7.3	1.7	7.5	1.7	9.0	
$t_{sk(0)}$	Output Skew Time		3.3V ± 0.3	—	—	1.0	—	—	—	1.5	ns

Operating Characteristics

T_A = +25°C

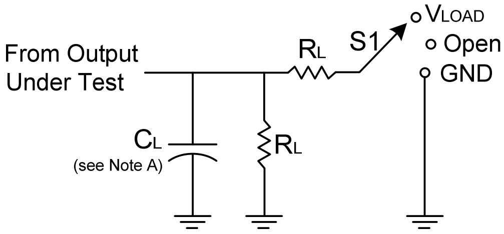
Symbol	Parameter	Test Conditions	V_{CC}	Typ	Unit
C_{pd}	Power dissipation capacitance per gate	F = 10MHz Outputs Enabled	1.8V ± 0.15V	9.9	pF
			2.5V ± 0.2V	10.2	
			3.3V ± 0.3V	10.6	

Package Characteristics

Symbol	Parameter	Package	Test Conditions	Min	Typ.	Max	Unit
θ_{JA}	Thermal Resistance Junction-to-Ambient	TSSOP-20	(Note 9)	—	74	—	°C/W
θ_{JC}	Thermal Resistance Junction-to-Case	TSSOP-20	(Note 9)	—	15	—	°C/W
θ_{JA}	Thermal Resistance Junction-to-Ambient	V-QFN4525-20	(Note 9)	—	67	—	°C/W
θ_{JC}	Thermal Resistance Junction-to-Case	V-QFN4525-20	(Note 9)	—	20	—	°C/W

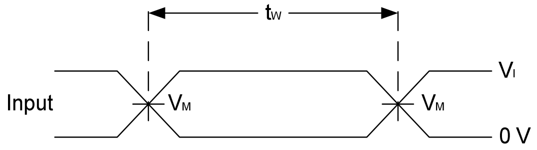
Note: 9. Test conditions for TSSOP-20 and V-QFN4525-20: Devices mounted on 4 layer FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout per JESD 51-7.

Parameter Measurement Information

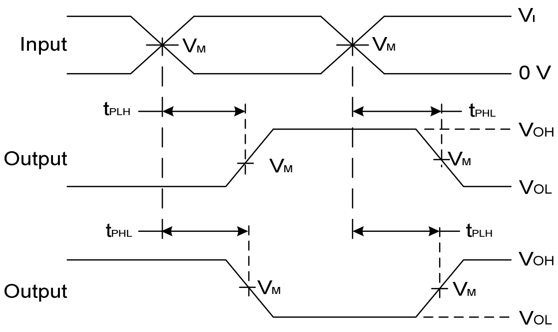


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

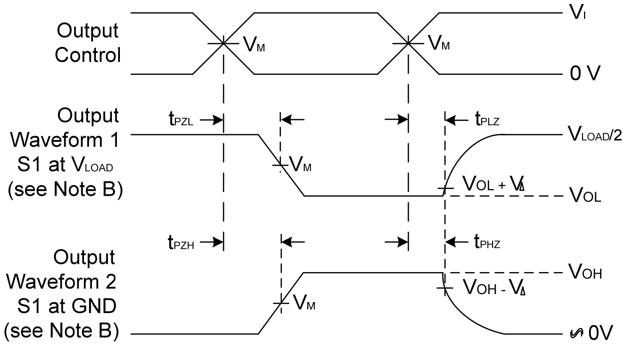
V_{CC}	Inputs		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
1.8V±0.15V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	30pF	1KΩ	0.15V
2.5V±0.2V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	30pF	500Ω	0.15V
2.7V	2.7V	≤2.5ns	1.5V	6V	50pF	500Ω	0.3V
3.3V±0.3V	2.7V	≤2.5ns	1.5V	6V	50pF	500Ω	0.3V



Voltage Waveform Pulse Duration



**Voltage Waveform Propagation Delay Times
Inverting and Non Inverting Outputs**



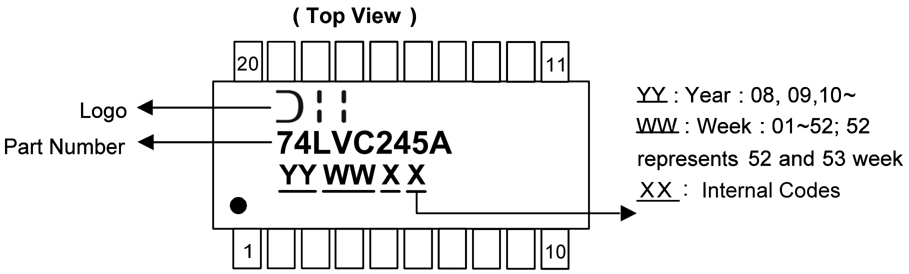
**Voltage Waveform Enable and Disable Times
Low and High Level Enabling**

Notes:
- A. Includes test lead and test apparatus capacitance.
- B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
- C. Inputs are measured separately one transition per measurement.
- D. t_{PLZ} and t_{PHZ} are the same as $t_{dis.}$
- E. t_{PZL} and t_{PZH} are the same as t_{EN0}
- F. t_{PLH} and t_{PHL} are the same as $t_{PD.}$

Figure 1 Load Circuit and Voltage Waveforms

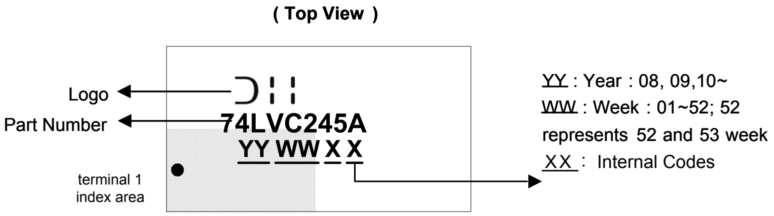
Marking Information

(1) TSSOP20



Part Number	Package
74LVC245AT20	TSSOP-20

(2) QFN-20 (V-QFN4525-20)

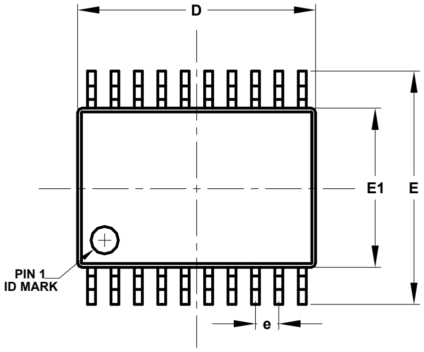


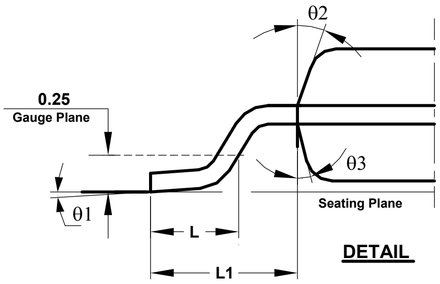
Part Number	Package
74LVC245AQ20	V-QFN4525-20

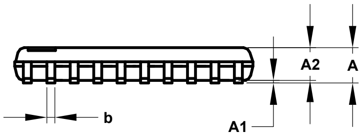
Package Outline Dimensions (All Dimensions in mm)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

(1) TSSOP-20

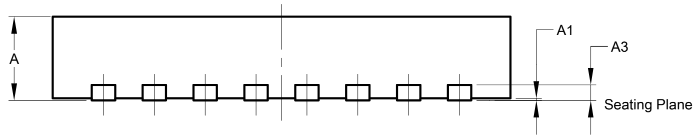


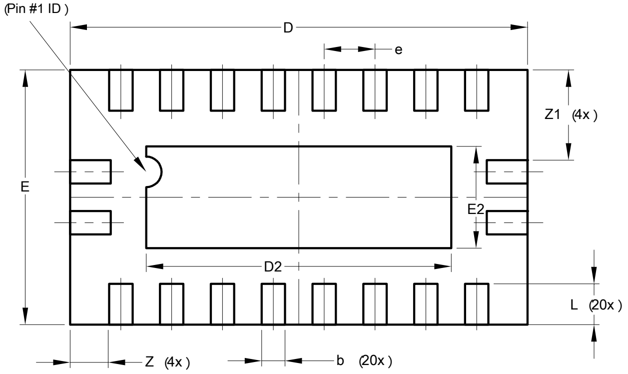




TSSOP-20			
Dim	**Min**	**Max**	**Typ**
A	-	1.20	-
A1	0.05	0.15	-
A2	0.80	1.05	-
b	0.19	0.30	-
c	0.09	0.20	-
D	6.40	6.60	6.50
E	6.20	6.60	6.40
E1	4.30	4.50	4.40
e	0.65 BSC		
L	0.45	0.75	0.60
L1	1.0 REF		
θ1	0°	8°	-
θ2	10°	14°	12°
θ3	10°	14°	12°
All Dimensions in mm			

(2) QFN-20 (V-QFN4525-20)



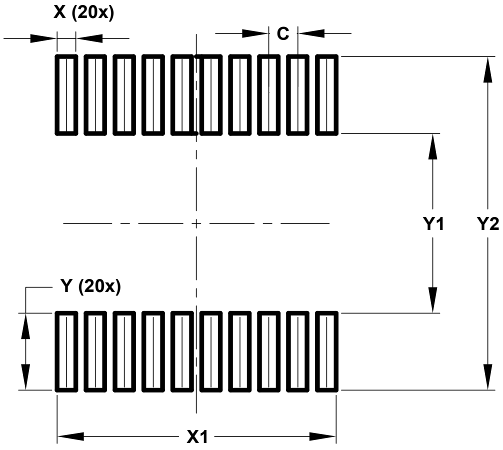


V-QFN4525-20			
Dim	**Min**	**Max**	**Typ**
A	0.75	0.85	0.80
A1	0.00	0.05	0.02
A3	-	-	0.15
b	0.18	0.30	0.23
D	4.45	4.55	4.50
D2	2.85	3.15	3.00
E	2.45	2.55	2.50
E2	0.85	1.15	1.00
e	0.50BSC		
L	0.30	0.50	0.40
Z	-	-	0.385
Z1	-	-	0.885
All Dimensions in mm			

Suggested Pad Layout

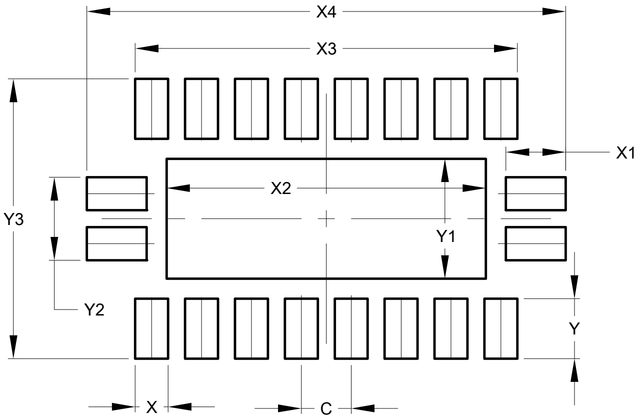
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

(1) TSSOP-20



Dimensions	Value (in mm)
C	0.650
X	0.420
X1	6.270
Y	1.789
Y1	4.160
Y2	7.720

(2) QFN-20 (V-QFN4525-20)



Dimensions	Value (in mm)
C	0.500
X	0.330
X1	0.600
X2	3.200
X3	3.830
X4	4.800
Y	0.600
Y1	1.200
Y2	0.830
Y3	2.800

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