

Description

The 74LVC374A provides eight edge-triggered D-type flip-flops featuring 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing buffer registers, input/output (I/O) ports, bidirectional bus drivers, and working registers. On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs. A buffered output-enable (\overline{OE}) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components. \overline{OE} does not affect internal operations of the latch. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The '374A is functionally identical to the '574A, but the '574 has a different pin arrangement.

The device is designed for operation with a power supply range of 1.65V to 3.6V. The device is fully specified for partial power down applications using I_{OFF} .

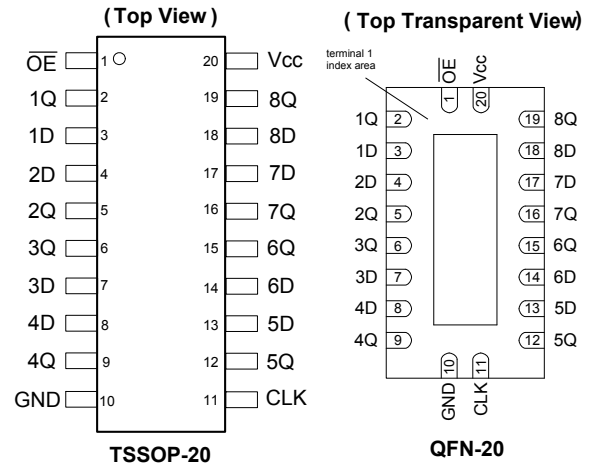
Features

- Supply Voltage Range from 1.65V to 3.6V
- Sinks or Sources 24mA at $V_{CC} = 3V$
- CMOS Low Power Consumption
- I_{OFF} Supports Partial Power Down Operation
- Inputs or Outputs Accept Up to 5.5V
- Inputs Can Be Driven by 3.3V or 5V Allowing for Mixed Voltage Applications
- Schmitt Trigger Action at All Inputs
- Typical V_{OLP} (Quiet Output Ground Bounce) Less Than 0.8V with $V_{CC} = 3.3V$ and $T_A = +25^\circ C$
- Typical V_{OHV} (Quiet Output dynamic VOH) Greater than 2.0V with $V_{CC} = 3.3V$ and $T_A = +25^\circ C$
- ESD Protection Tested per JESD 22
 - Exceeds 200-V Machine Model (A115)
 - Exceeds 2000-V Human Body Model (A114)
 - Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 250mA per JESD 78, Class I
- All devices are:
 - **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
 - **Halogen and Antimony Free. "Green" Device (Note 3)**

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
3. Halogen and Antimony free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

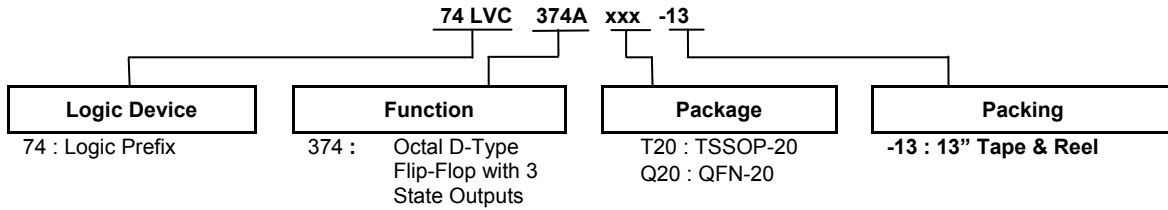
Pin Assignments



Applications

- General Purpose Logic
- Bus Driving
- Power Down Signal Isolation
- Wide array of products such as:
 - PCs, Notebooks, Netbooks, Ultrabooks
 - Networking Computer Peripherals, Hard Drives, CD/DVD ROM
 - TV, DVD, DVR, Set Top Box

Ordering Information



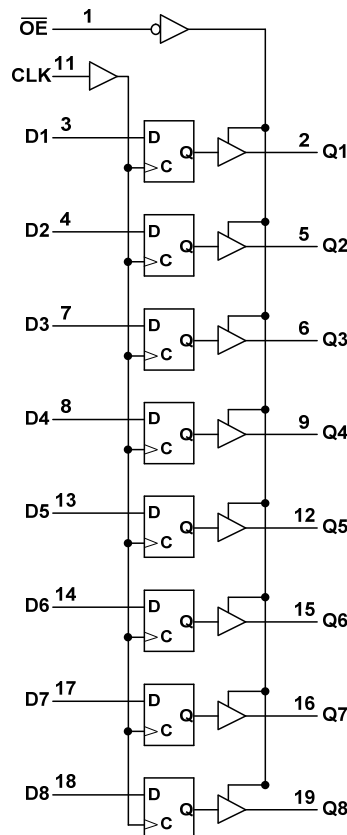
Part Number	Package Code	Package (Note 4 & 5)	Package Size	13" Tape and Reel	
				Quantity	Part Number Suffix
74LVC374AT20-13	T20	TSSOP-20	6.4mm X 6.5mm X 1.2mm 0.65 mm lead pitch	2500/Tape & Reel	-13
74LVC374AQ20-13	Q20	V-QFN4525-20	2.5mm X 4.5mm X 0.95mm 0.50 mm lead pitch	2500/Tape & Reel	-13

- 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	OE	Output Enable
2	Q1	Latch Output
3	D1	Data Input
4	D2	Data Input
5	Q2	Latch Output
6	Q3	Latch Output
7	D3	Data Input
8	D4	Data Input
9	Q4	Latch Output
10	GND	Ground
11	CLK	Clock
12	Q5	Latch Output
13	D5	Data Input
14	D6	Data Input
15	Q6	Latch Output
16	Q7	Latch Output
17	D7	Data Input
18	D8	Data Input
19	Q8	Latch Output
20	Vcc	Supply Voltage

Logic Diagram



Function Table

(Each Latch)			
INPUTS			OUTPUT
OE	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q ₀
H	X	X	Z

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	-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:
- 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.
 - 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 = +85°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	—	V
		I _{OH} = -4mA	1.65V	1.2	—	1.05	—	
		I _{OH} = -8mA	2.3V	1.7	—	1.65	—	
		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	uA
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 V _{CC} -0.6V I _O = 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		5.5 typical		5.5 typical		

Switching Characteristics

Symbol	Parameter	Test Conditions	V _{CC}	T _A = +25°C			-40°C to +85°C		+85°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
f _{MAX}	Maximum Frequency	Figure 1	1.8V ± 0.15V	35	40		35		30		Mhz
			2.5V ± 0.3V	50	60		50		45		
			2.7V	80	100		80		64		
			3.3V ± 0.3V	100	125		100		80		
t _w	Pulse Width CLK	Figure 1	1.8V ± 0.15V	5.0	2.5		5.0		5.5		ns
			2.5V ± 0.3V	4.0	2.0		4.0		4.5		
			2.7V	3.3	1.7		3.3		3.5		
			3.3V ± 0.3V	3.0	1.5		3.0		3.5		
t _{SU}	Set-up Time D _N to CLK	Figure 1	1.8V ± 0.15V	4.0	2.0		4.0		4.5		ns
			2.5V ± 0.3V	3.0	1.5		3.0		3.5		
			2.7V	2.0	1.0		2.0		2.5		
			3.3V ± 0.3V	2.0	1.0		2.0		2.5		
t _H	Hold Time D _N to CLK	Figure 1	1.8V ± 0.15V	3.0	1.5		3.0		3.5		ns
			2.5V ± 0.3V	2.0	1.0		2.0		2.5		
			2.7V	1.5	1.0		1.5		2.0		
			3.3V ± 0.3V	1.5	1.0		1.5		2.0		
t _{PD}	Propagation Delay CLK to Q _N	Figure 1	1.8V ± 0.15V	1	6	12.2	1	13.5	1	16.9	ns
			2.5V ± 0.3V	1	3.9	8.5	1	9.0	1	8.7	
			2.7V	1	4.2	7.8	1	8.1	1	9.5	
			3.3V ± 0.3V	1.5	3.8	6.8	1.5	7.0	1.5	8.0	
t _{EN}	Enable Time \overline{OE} to Q _N	Figure 1	1.8V ± 0.15V	1	7.8	16.5	1	17	1	14.2	ns
			2.5V ± 0.3V	1	4	9	1	9.5	1	8.2	
			2.7V	1	4.4	8.3	1	8.5	1	10.0	
			3.3V ± 0.3V	1.7	4.1	7.3	1.7	7.5	1.7	9.0	
t _{DIS}	Disable Time \overline{OE} to Q _N	Figure 1	1.8V ± 0.15V	1	7.8	16.5	1	17	1	14.2	ns
			2.5V ± 0.3V	1	4	9	1	9.5	1	8.2	
			2.7V	1	4.4	8.3	1	8.5	1	10.0	
			3.3V ± 0.3V	1.7	4.1	7.3	1.7	7.5	1.7	9.0	
t _{DIS}	Disable Time \overline{OE} to Q _N	Figure 1	1.8V ± 0.15V	1	7.8	16.5	1	17	1	14.2	ns
			2.5V ± 0.3V	1	4	9	1	9.5	1	8.2	
			2.7V	1	4.4	8.3	1	8.5	1	10.0	
			3.3V ± 0.3V	1.7	4.1	7.3	1.7	7.5	1.7	9.0	
t _{sk(0)}	Output Skew Time		3.3V ± 0.3V			1.0			1.5	ns	

Operating Characteristics

 T_A = +25°C

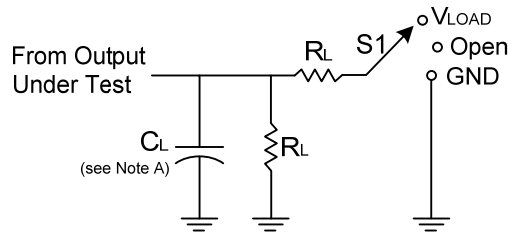
Symbol	Parameter	Test Conditions	V _{CC}	Typ	Unit
C _{pd}	Power dissipation capacitance per gate	F = 10 MHz Outputs Enabled	1.8V ± 0.15V	9.9	pF
			2.5V ± 0.3V	10.2	
			3.3V ± 0.3V	10.6	

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

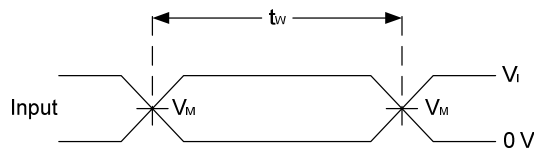
Note: 9. Test conditions for TSSOP-20 and V-QFN4525-20: Devices mounted on 4 layer FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout per JESD 51-7.

Parameter Measurement Information

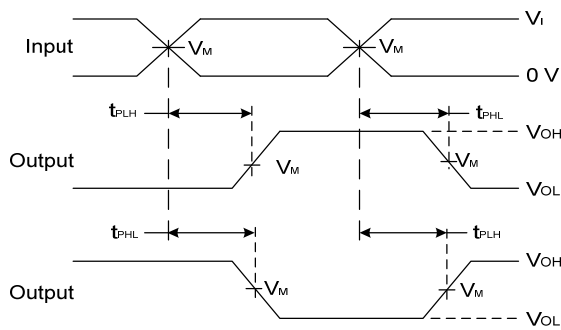


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

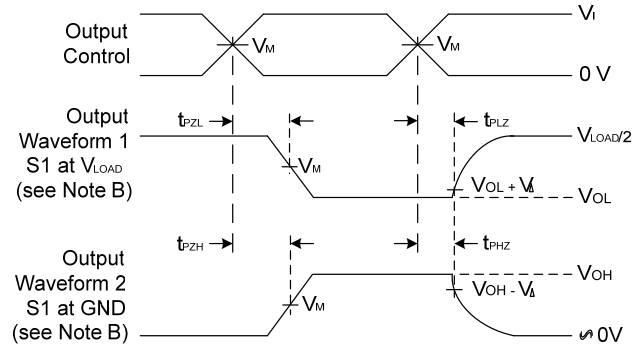
V_{CC}	Inputs		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_i	t_r/t_f					
$1.8V \pm 0.15V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	1K Ω	0.15V
$2.5V \pm 0.2V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 Ω	0.15V
2.7V	2.7V	$\leq 2.5ns$	1.5V	6V	50pF	500 Ω	0.3V
$3.3V \pm 0.3V$	2.7V	$\leq 2.5ns$	1.5V	6V	50pF	500 Ω	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**

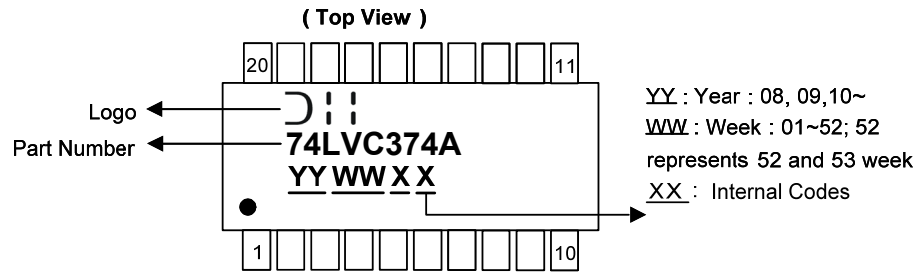
- Notes:
- A. Includes test lead and test apparatus capacitance.
 - B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
 - C. Inputs are measured separately one transition per measurement.
 - D. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - E. t_{PZL} and t_{PZH} are the same as t_{ENO}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

Figure 1 Load Circuit and Voltage Waveforms

NEW PRODUCT

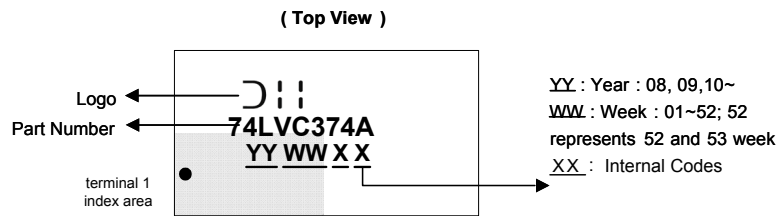
Marking Information

(1) TSSOP20



Part Number	Package
74LVC374AT20	TSSOP-20

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

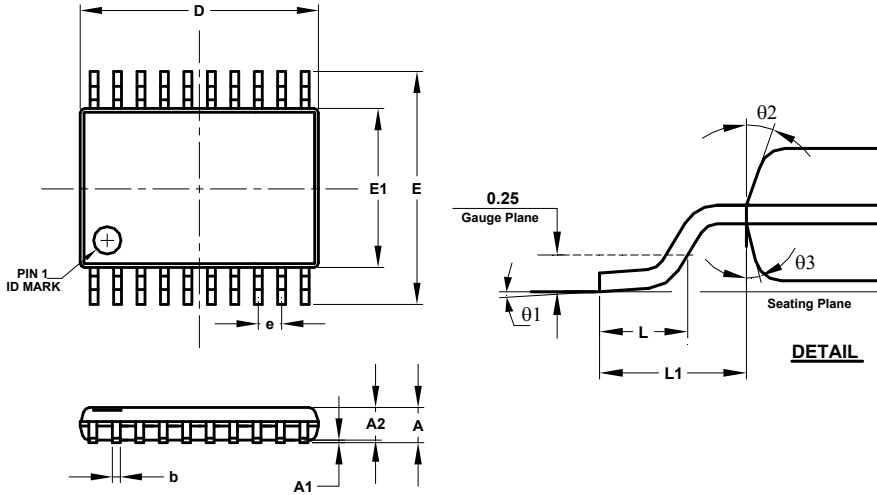


Part Number	Package
74LVC374AQ20	V-QFN4525-20

Package Outline Dimensions (All Dimensions in mm)

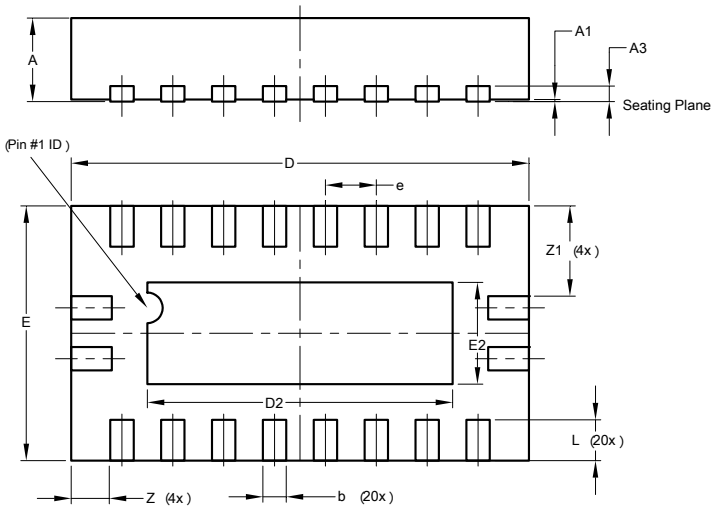
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

(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		
theta1	0°	8°	-
theta2	10°	14°	12°
theta3	10°	14°	12°
All Dimensions in mm			

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



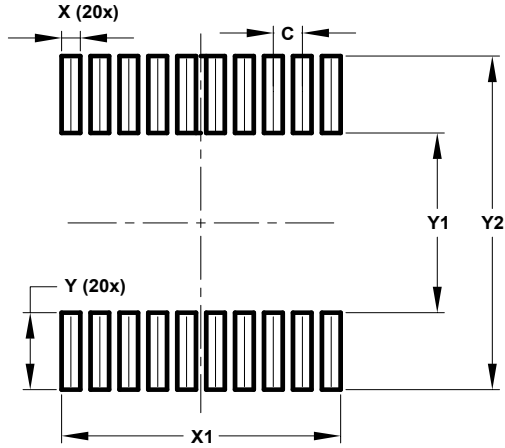
V-QFN4525-20			
Dim	Min	Max	Typ
A	0.75	0.85	0.80
A1	0.00	0.05	0.02
A3	-	-	0.15
b	0.18	0.30	0.23
D	4.45	4.55	4.50
D2	2.85	3.15	3.00
E	2.45	2.55	2.50
E2	0.85	1.15	1.00
e	0.50BSC		
L	0.30	0.50	0.40
Z	-	-	0.385
Z1	-	-	0.885
All Dimensions in mm			

NEW PRODUCT

Suggested Pad Layout

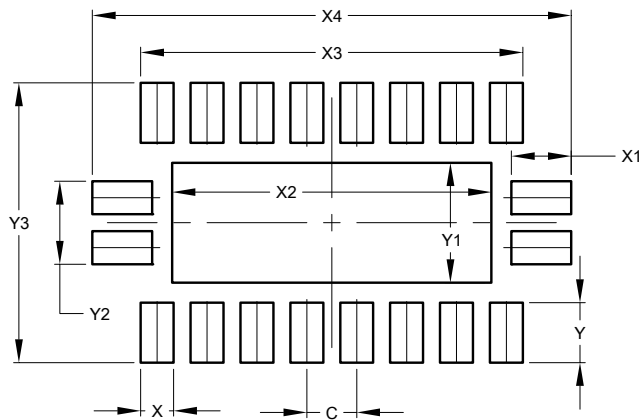
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

(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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