

## General Description

The AOZ6186 is a low-voltage high-speed Double-Pole, Double-Throw (DPDT) switch for switching between two USB 2.0 (480 Mbps) sources. The device features very low on capacitance (5 pF typ.) and is designed to operate from a single 1.65 V to 4.5 V supply. The AOZ6186 features an ultra-low on resistance (7  $\Omega$  typ.), and low power consumption. The device also features fast switching and guaranteed Break-Before-Make (BBM) switching, assuring the switches never short the driver.

## Features

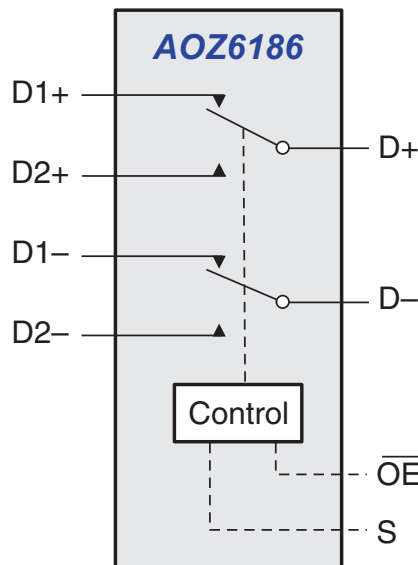
- Low On Resistance ( $R_{ON}$ ) for 3.6 V supply (7  $\Omega$ )
- Low On Capacitance ( $C_{ON}$ ) for 3.6 V supply (5 pF)
- Over-voltage tolerance (OVT) on all data ports up to 5.5 V
- QFN-10: 1.8 mm x 1.4 mm x 0.55 mm
- Broad 1.65 V to 4.50 V  $V_{CC}$  operating range
- Wide -3 dB bandwidth: 960 MHz typ.

## Applications

- Cell phone
- PDA
- Portable media player



## Typical Application



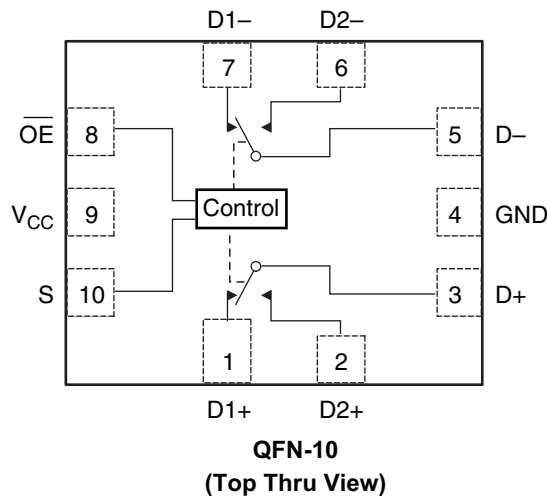
## Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ6186QT	-40 °C to +85 °C	QFN-10	Green Product



AOS Green Products use reduced levels of Halogens, and are also RoHS compliant. Please visit [www.aosmd.com/web/quality/rohs\\_compliant.jsp](http://www.aosmd.com/web/quality/rohs_compliant.jsp) for additional information.

## Pin Configuration



## Pin Description

Pin Name	Function
S	Control Input
$\overline{\text{OE}}$	Output Enable
D1+, D1-, D2+, D2-, D+, D-	Data Ports

## Truth Table

$\overline{\text{OE}}$	S	D1+, D1-	D2+, D2-
1	X	Off	Off
0	0	On	Off
0	1	Off	On

## Absolute Maximum Ratings

Exceeding the Absolute Maximum Ratings may damage the device.

Symbol	Parameter	Rating	
$V_{\text{CC}}$	Supply Voltage	-0.5 V to +5.5 V	
$V_{\text{S}}$	Switch Voltage	-0.5 V to $V_{\text{CC}} + 0.3$ V	
$V_{\text{IN}}$	Input Voltage	-0.5 V to +4.6 V	
$I_{\text{IK}}$	Minimum Input Diode Current	-50 mA	
$I_{\text{SW}}$	Switch Current	100 mA	
$T_{\text{STG}}$	Storage Temperature Range	-65 °C to +150 °C	
$T_{\text{J}}$	Maximum Junction Temperature	+150 °C	
$T_{\text{L}}$	Lead Temperature (Soldering, 10 seconds)	+260 °C	
ESD	Human Body Model	All Pins	3000 V
		I/O to GND	5000 V
		Power to GND	5000 V

## Maximum Operating Conditions

The device is not guaranteed to operate beyond the Maximum Operating Conditions.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	1.65 V to 4.5 V
$V_{IN}$	Control Input Voltage <sup>(1)</sup>	0 V to $V_{CC}$
$V_{SW}$	Switch Input Voltage	0 V to $V_{CC}$
$T_A$	Operating Temperature	-40 °C to +85 °C

**Note:**

1. Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

Unless otherwise indicated, specifications indicate a temperature range of -40 °C to +85 °C.

All typical values are at 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	$V_{CC}$ (V)	Min.	Typ.	Max.	Units
$V_{CL}$	Clamp Voltage	$I_{IN} = -18$ mA	3.0			-1.2	V
$V_{IH}$	Input Voltage HIGH		4.3	1.4			V
			2.7 to 3.6	1.3			
			2.3 to 2.7	1.1			
			1.65 to 1.95	0.9			
$V_{IL}$	Input Voltage LOW		4.3			0.7	V
			2.7 to 3.6			0.5	
			2.3 to 2.7			0.4	
			1.65 to 1.95			0.4	
$I_{IN}$	Control Input Leakage	$V_{IN} = 0$ V to $V_{CC}$	1.65 to 4.5	-1.0		1.0	$\mu$ A
$I_{OZ}$	Off State Leakage	$V_{IN} = 0$ V to $V_{CC}$	1.65 to 4.5	-1.0		1.0	$\mu$ A
$I_{OFF}$	Power OFF Leakage Current (I/O ports)	$V_{IN} = 0$ V to $V_{CC}$	0	-1.0		1.0	$\mu$ A
$R_{ON}$	On-Resistance	$I_{ON} = 8$ mA, $V_{IN} = 0$ V to 0.4 V	4.3		7	10	$\Omega$
			2.7 to 3.6		9	12	
			2.3 to 2.7		12	16	
$\Delta R_{ON}$	On-Resistance Matching	$I_{ON} = 8$ mA, $V_{IN} = 0$ V to 0.4 V	4.3		0.6		$\Omega$
			2.7 to 3.6		0.6		
			2.3 to 2.7		0.6		
$R_{FLAT} (ON)$	On-Resistance Flatness	$I_{ON} = 8$ mA, $V_{IN} = 0$ V to 0.4 V	4.3		0.4		$\Omega$
			2.7 to 3.6		1.5		
			2.3 to 2.7		1.8		
$I_{CC}$	Quiescent Supply Current	$I_{OUT} = 0$ mA	4.3			1.0	$\mu$ A
$I_{CCT}$	Increase in $I_{CC}$ per Input Control Voltage	$V_{Control} = 2.6$ V	4.3		3.0	7.0	$\mu$ A
		$V_{Control} = 1.8$ V			7.0	15.0	

## AC Electrical Characteristics

Unless otherwise indicated, specifications indicate a temperature range of -40 °C to +85 °C.

All typical values are at 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Min.	Typ.	Max.	Units
t <sub>ON</sub>	Turn-On Time	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	3.6 to 4.3		18	35	ns
			2.7 to 3.6		21	45	
			2.3 to 2.7		36	65	
			1.65 to 1.95		80	120	
t <sub>OFF</sub>	Turn-Off Time	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	3.6 to 4.3		11	30	ns
			2.7 to 3.6		11	40	
			2.3 to 2.7		14	55	
			1.65 to 1.95		59	100	
t <sub>PD</sub>	Propagation Delay	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	1.65 to 4.5		0.25		ns
t <sub>BBM</sub>	Break-Before-Make	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	1.65 to 4.5		6.2		ns
O <sub>IRR</sub>	Off Isolation	R <sub>L</sub> = 50 Ω, f = 240 MHz	1.65 to 4.5		-36		dB
X <sub>TALK</sub>	Crosstalk	R <sub>L</sub> = 50 Ω, f = 240 MHz	1.65 to 4.5		-40		dB
BW	-3 dB Bandwidth	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 0 pF	1.65 to 4.5		960		MHz

## USB Hi-Speed AC Electrical Characteristics

Unless otherwise indicated, specifications indicate a temperature range of -40 °C to +85 °C.

All typical values are at 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Min.	Typ.	Max.	Units
t <sub>SK</sub>	Skew of Opposite Transitions of the Same Output	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	1.65 to 4.5		20		ps
t <sub>J</sub>	Total Jitter	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, t <sub>r</sub> = t <sub>f</sub> = 500 ps (10% to 90%), f = 480MHz, PRBS = 2 <sup>15</sup> - 1	1.65 to 4.5		200		ps

## Capacitance

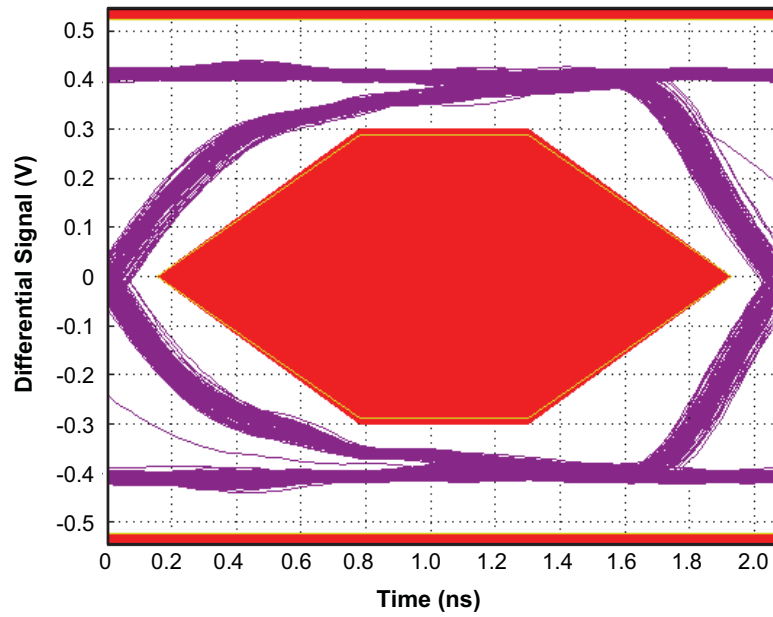
Unless otherwise indicated, specifications indicate a temperature range of -40 °C to +85 °C.

All typical values are at 25 °C unless otherwise specified.

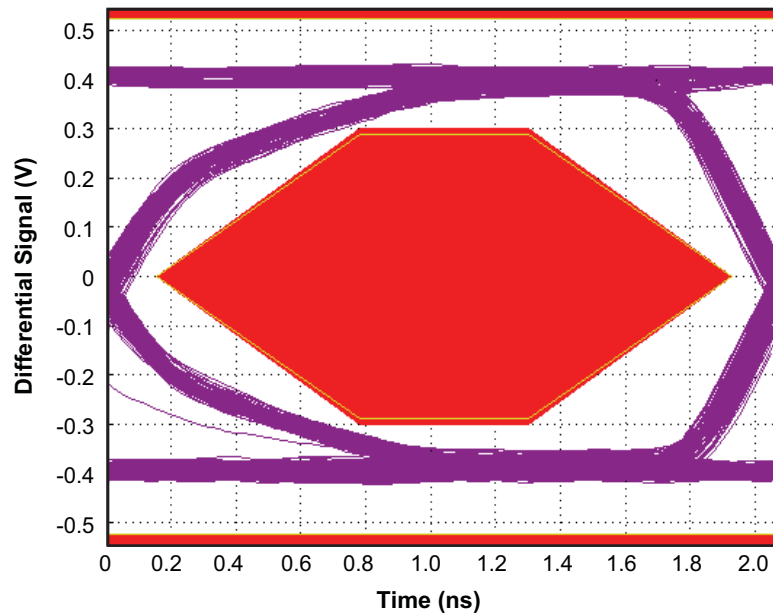
Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Min.	Typ.	Max.	Units
C <sub>IN</sub>	Control Pin Input Capacitance	1 MHz	3.3		1.7		pF
		10 MHz			1.7		
C <sub>ON</sub>	D+/D- On Capacitance	OE = 0V, f = 1 MHz	3.3		4.7		
		OE = 0V, f = 10 MHz			5.0		
C <sub>OFF</sub>	HSD1n/HSD2n Off Capacitance	OE = V <sub>CC</sub> , f = 1 MHz	3.3		1.8		
		OE = 0V, f = 10 MHz			2.0		

## Eye Patterns

480-Mbps USB Signal Without AOZ6186QT

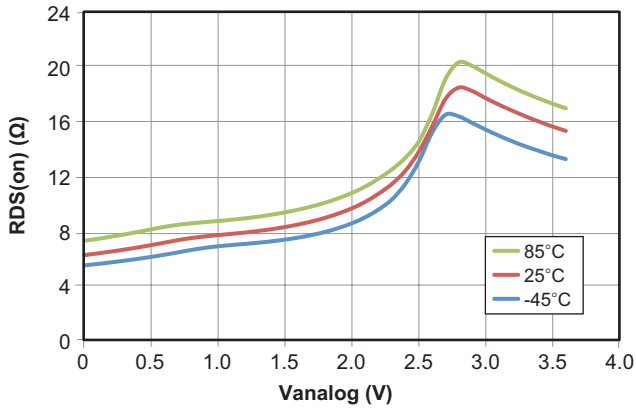


480-Mbps USB Signal With AOZ6186QT

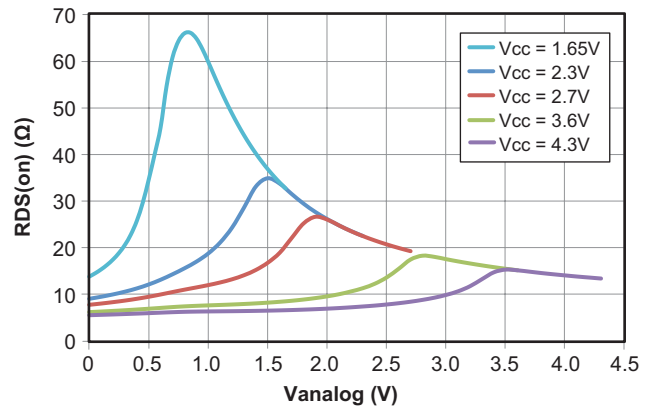


### Typical Performance Characteristics

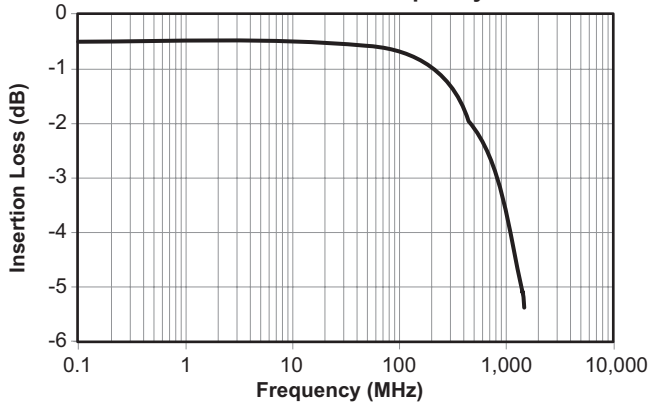
**RDS(on) vs. Analog Voltage**  
(Vcc = 3.6V)



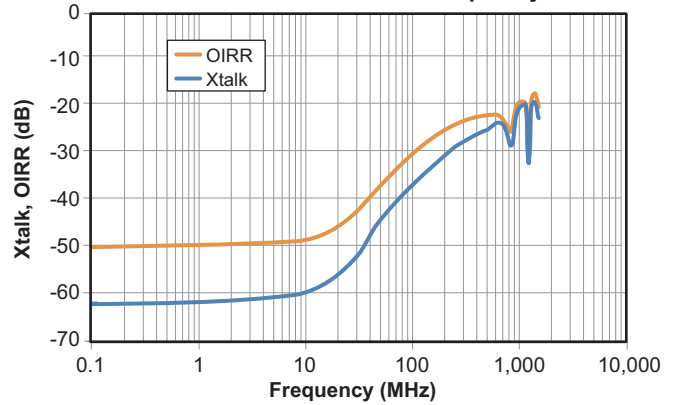
**RDS(on) vs. Analog Voltage**  
(at 25°C)



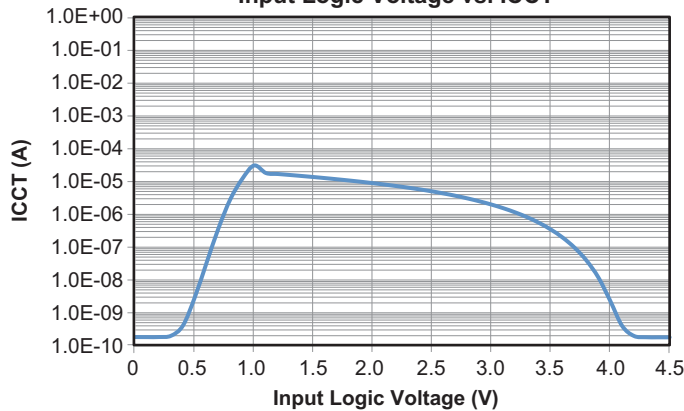
**Insertion Loss vs. Frequency**



**Xtalk and Off Isolation vs. Frequency**



**Input Logic Voltage vs. ICCT**



### AC Loading and Waveforms

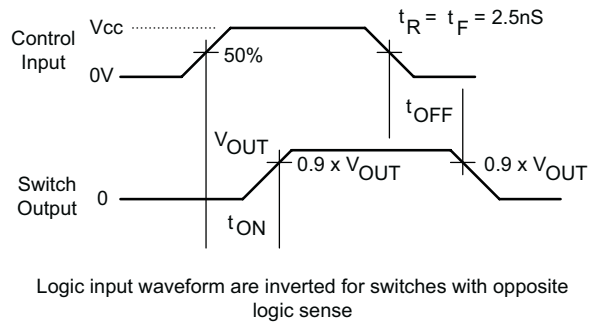
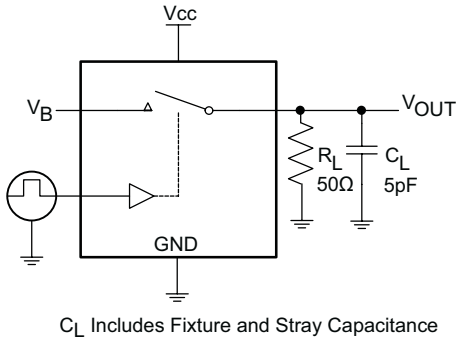


Figure 1. Turn-On/Turn-Off Timing

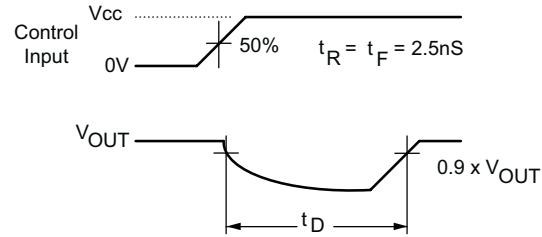
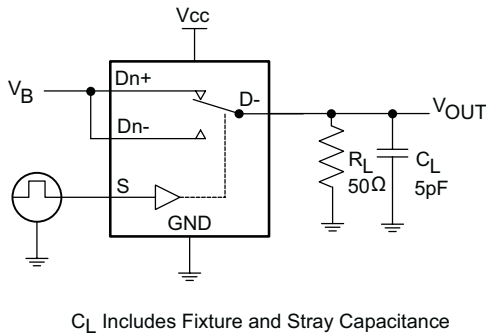


Figure 2. Break-Before-Make Timing

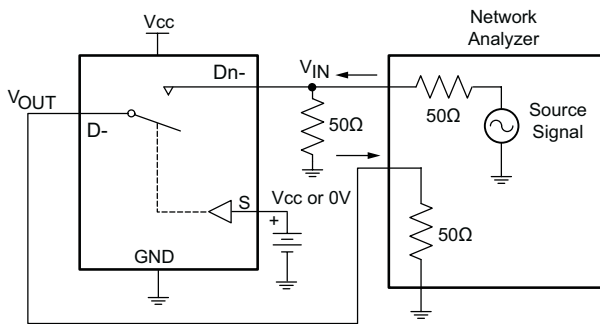


Figure 3. Off Isolation

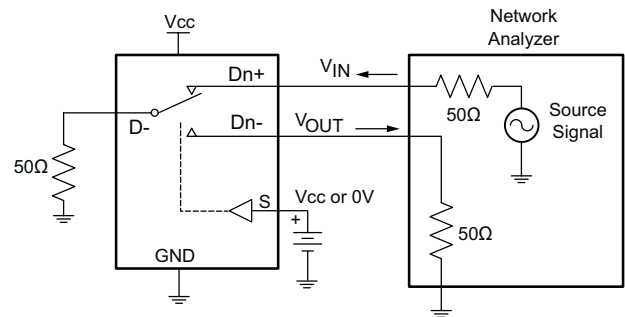


Figure 4. Crosstalk

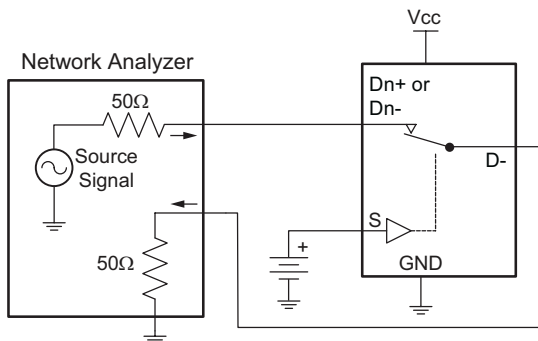


Figure 5. Bandwidth

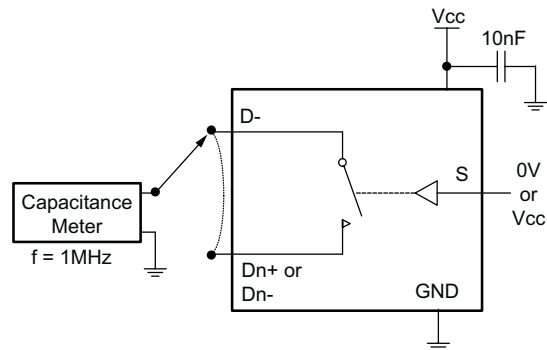
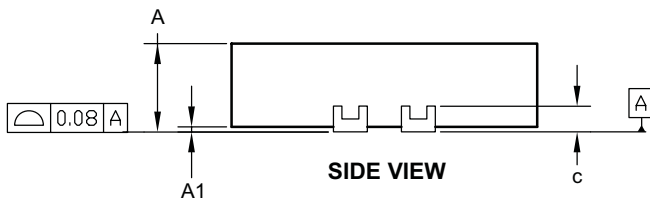
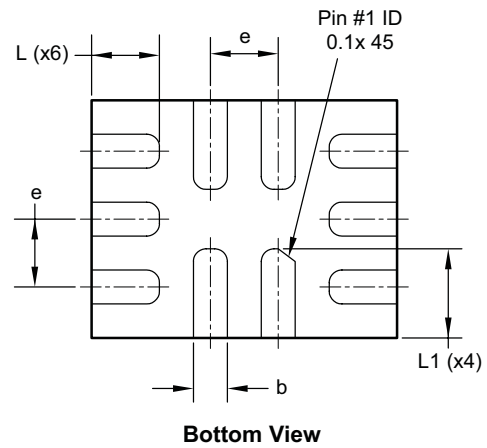
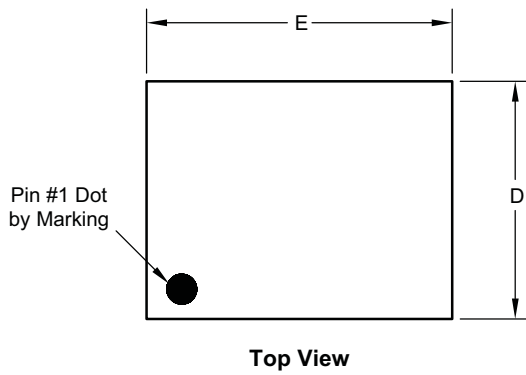
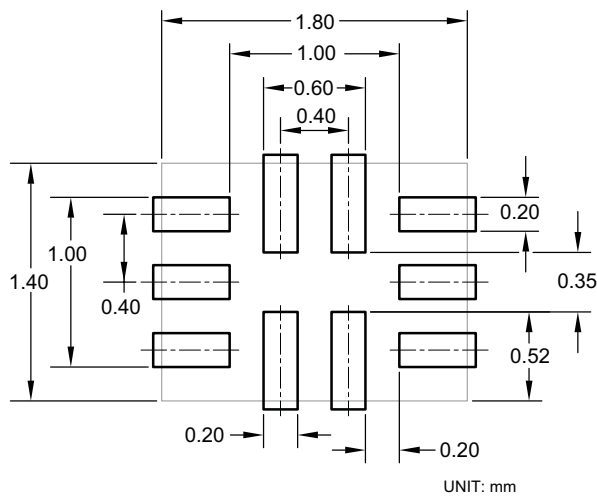


Figure 6. ON/Off Capacitance Measurement

Package Dimensions, QFN 1.8x1.4, 10L



RECOMMENDED LAND PATTERN



Dimensions in millimeters

Symbols	Min.	Nom.	Max.
A	0.50	0.55	0.60
A1	0.00	—	0.05
b	0.15	0.20	0.25
c	0.152 REF.		
D	1.35	1.40	1.45
E	1.75	1.80	1.85
e	0.40 BSC		
L	0.35	0.40	0.45
L1	0.475	0.525	0.575

Dimensions in inches

Symbols	Min.	Nom.	Max.
A	0.020	0.022	0.024
A1	0.000	—	0.002
b	0.006	0.008	0.010
c	0.006 REF.		
D	0.053	0.055	0.057
E	0.069	0.071	0.073
e	0.016 BSC		
L	0.014	0.016	0.018
L1	0.019	0.021	0.023

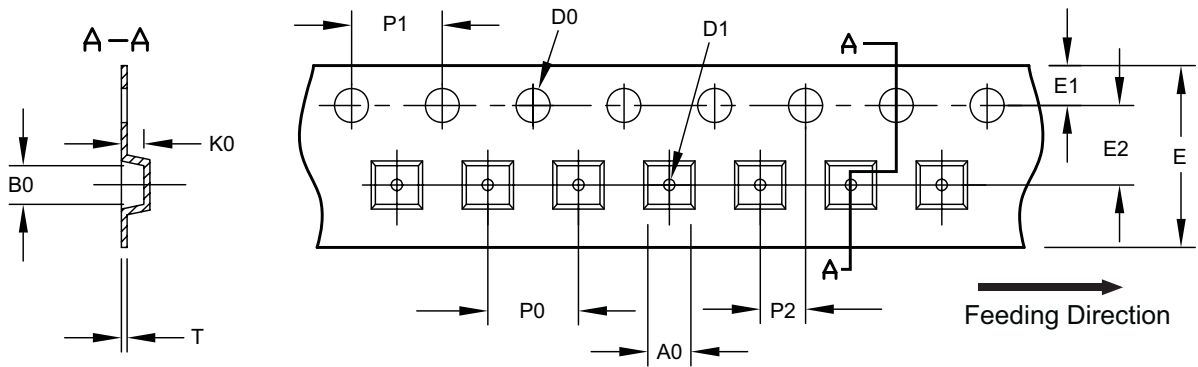
Notes:

- Controlling dimension is millimeter. Converted inch dimensions are not necessarily exact.



### Tape and Reel Dimensions, QFN 1.8x1.4, 10L

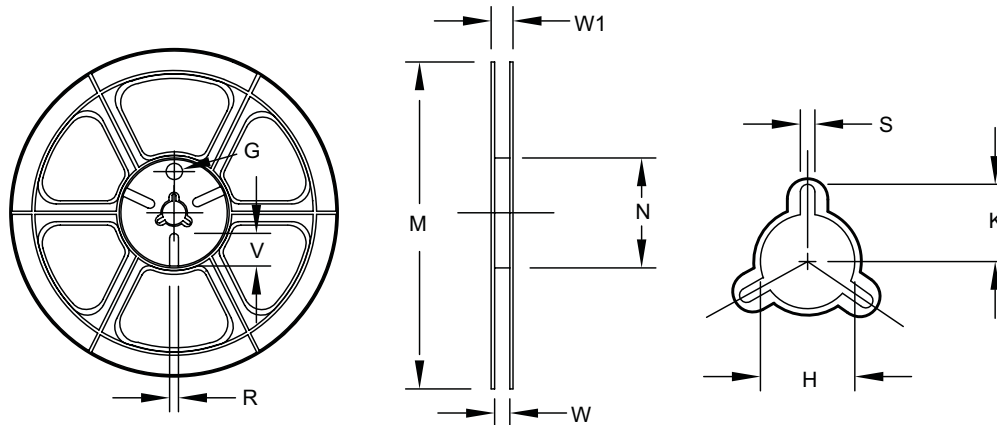
#### Carrier Tape



UNIT: mm

Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
QFN 1.8 x 1.4	1.90 ±0.05	1.70 ±0.05	1.00 ±0.05	1.50 +0.10/-0	0.50 ±0.05	8.00 +0.20/-0.10	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.254 ±0.02

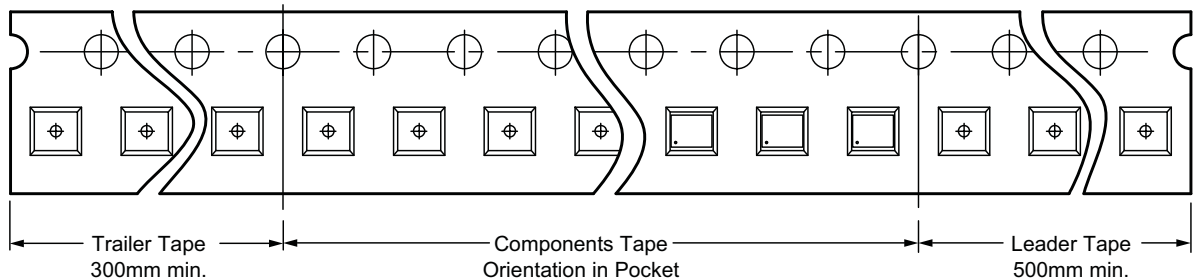
#### Reel



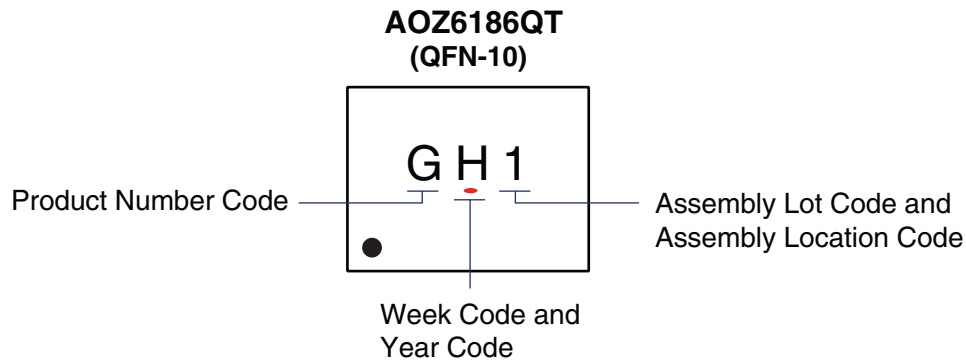
UNIT: mm

Tape Size	Reel Size	M	N	W	W1	H	K	S	G	R	V
8mm	ø178	ø178.0 ±1.0	ø70.5 ±1.0	9.0 ±0.5	11.8 ±1.1	ø13.0 +0.5/-0.2	10.25 ±0.1	2.4 ±0.1	ø9.8	N/A	N/A

#### Leader/Trailer and Orientation



**Part Marking**



**This datasheet contains preliminary data; supplementary data may be published at a later date. Alpha & Omega Semiconductor reserves the right to make changes at any time without notice.**

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|---|---|