

DIO3001

Low-Power, USB 2.0 High-Speed Switch

Description

The DIO3001 is a low-power, dual SPDT 2-port high-speed analog switch. It handles bidirectional signal flow optimized for switching a high-speed (480 Mbps) source or a full-speed (12 Mbps) source.

The DIO3001 has a high channel-to-channel noise isolation and a low bit-to-bit skew which allows it to pass high-speed differential signals with good signal integrity. Each switch offers little or no attenuation of the high-speed signals at the outputs.

The DIO3001 contains special circuitry on the D+/D- pins, which can tolerate up to 5.5 V when the USB devices are either powered off or powered on.

The DIO3001 is available in a Green package: QFN2*1.5-10.

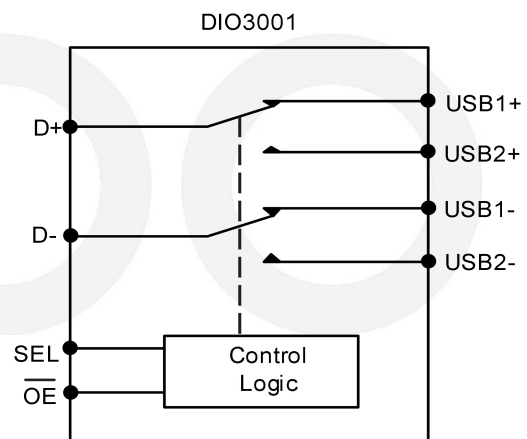
Features

- Super high bandwidth (-3 dB): 1.8 GHz
- V_{CC} operation at 2.3 V to 5.5 V
- Low C_{ON} : 5 pF (typ.)
- Low R_{ON} : 5.5 Ω (typ.)
- Low power consumption: 1 μ A (max.)
- Low I_{CCT} : 0.5 μ A (typ.) at $V_{CNTRL} = 1.8$ V, $V_{CC} = 3.6$ V
- Packaged in Green QFN2*1.5-10
- ± 6 kV HBM ESD on all pins
- Power-Off/On protection on common ports
- D+/D- pins tolerance up to 5.5 V

Applications

- Telematics control units
- Automotive cluster displays
- Front and rear cameras

Block Diagram



■ Ordering Information

Part Number	Top Marking	RoHS	T _A	Package	
DIO3001QN10	YW3A	Green	-40 to 85°C	QFN2*1.5-10	Tape & Reel, 3000

If you encounter any issue in the process of using the device, please contact our customer service at marketing@diao.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@diao.com. Your feedback is invaluable for us to provide a better user experience.

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1. Pin Assignment and Functions

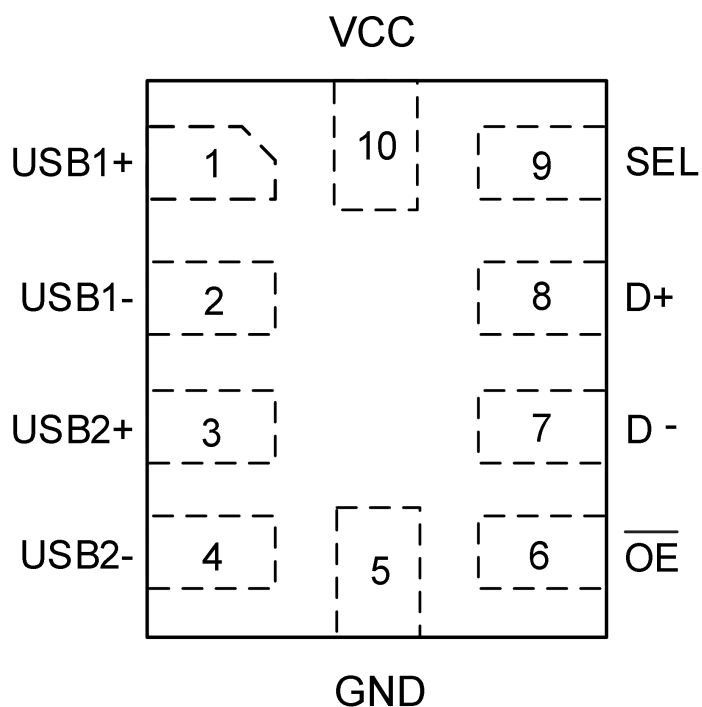


Figure 1. QFN2*1.5-10 (Top view)

Table 1. Pin descriptions

Pin Name	Description
/OE	Switch enable
SEL	Switch select
D+, D-	USB data bus
USB1±, USB2±	Multiplexed source inputs

Table 2. Truth table

Sel	/OE	Function
X	H	Disconnect
L	L	D+, D- = USB1+, USB1-
H	L	D+, D- = USB2+, USB2-

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply voltage	-0.3	6.0	V
V_{CNTRL}	DC input voltage (S, /OE)	-0.3	V_{CC}	V
V_{SW}	DC input I/O voltage	-0.3	$V_{CC} + 0.3$	V
	DC input I/O voltage (D+/D-)	-0.3	6.0	V
I_{IK}	DC input diode current	-50		mA
I_{OUT}	DC output current		50	mA

3. Recommended Operating Condition

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply voltage	2.3	5.5	V
V_{CNTRL}	Control input voltage (S, /OE)	0	V_{CC}	V
V_{SW}	Switch I/O voltage (USB1 $\pm$, USB2 $\pm$)	0	V_{CC}	V
	Switch I/O voltage (D+, D-)	0	5.5	V
T_A	Operating temperature	-40	85	°C

4. ESD Ratings

When a statically-charged person or object touches an electrostatic discharge sensitive device, the electrostatic charge might be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage might occur to the device due to localized overheating.

Model	Condition	Rating	Unit
ESD	HBM, JEDEC: JESD22-A114 all pins	± 6	kV

5. DC Electrical Characteristics

All typical value are at $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Typ	Max	Unit
V_{IH}	Input voltage high		3.0 to 3.6	0.85			V
V_{IL}	Input voltage low		3.0 to 3.6			0.35	V
I_{IN}	Control input leakage	$V_{SW} = 0$ to V_{CC}	3.6	-2		2	μA
I_{OZ}	Off-state leakage	$0 \leq D_n, \text{USB1}\pm, \text{USB2}\pm \leq 3.6$ V	3.6	-1		1	μA
I_{OFF}	Power-off leakage current (all common ports)	$V_{SW} = 0$ V to 3.6 V, see Figure 3	0	-1		1	μA
R_{ON}	ON-state resistance	$V_{SW} = 0.4$ V, $I_{ON} = 8$ mA, see Figure 2	3.3		5.5	8	Ω
ΔR_{ON}	ON-state resistance match between + and - paths	$V_{SW} = 0.4$ V, $I_{ON} = 8$ mA	3.3		0.1		Ω
I_{CC}	Quiescent supply current	$V_{CTRL} = 0$ or V_{CC} ,	3.6		0.4	1	μA
I_{CCT}	Increase in I_{CC} current per control voltage and V_{CC}	$V_{CTRL} = 1.8$ V	3.6		0.5	1	μA

Note:

(1) Specifications subject to change without notice.

6. AC Electrical Characteristics

All typical value are for $V_{CC} = 3.3$ V at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	Temp($^\circ\text{C}$)	Min	Typ	Max	Unit
t_{ON}	Turn-on time S, /OE to output	$R_L = 50 \Omega$, $C_L = 5$ pF, $V_{SW} = 0.8$ V, see Figure 9	3.0 to 3.6	full		2		μs
t_{OFF}	Turn-off time S, /OE to output	$R_L = 50 \Omega$, $C_L = 5$ pF, $V_{SW} = 0.8$ V, see Figure 9	3.0 to 3.6	full		20		ns
t_{PD}	Propagation delay	$R_L = 50 \Omega$, $C_L = 5$ pF	3.3	25 $^\circ\text{C}$		0.25		ns
				full			5.0	ns
t_{BBM}	Break-before-make	$R_L = 50 \Omega$, $C_L = 5$ pF, $V_{SW} = 0.8$ V, see Figure 8	3.0 to 3.6	25 $^\circ\text{C}$		12		ns
				full	10		28	ns
OIRR	Off isolation	$R_L = 50 \Omega$, $f = 240$ MHz, see Figure 7	3.0 to 3.6	25 $^\circ\text{C}$		-37		dB
Xtalk	Non-adjacent channel crosstalk	$R_L = 50 \Omega$, $f = 240$ MHz, see Figure 6	3.0 to 3.6	25 $^\circ\text{C}$		-42		dB
BW	-3dB bandwidth	$R_L = 50 \Omega$, $C_L = 0$ pF, see Figure 5	3.0 to 3.6	25 $^\circ\text{C}$		1.8		GHz
$t_{SK(P)}$	Skew of opposite transitions of the same output	$R_L = 50 \Omega$, $C_L = 5$ pF	3.0 to 3.6	25 $^\circ\text{C}$		20		ps

Note:

(1) Specifications subject to change without notice.

7. Capacitance

Symbol	Parameter	Conditions	Temp(°C)	Min	Typ	Max	Unit
$C_{IN}^{(1)}$	Control pin input capacitance	$V_{CC} = 0\text{ V}$	25°C		1.2		pF
C_{ON}	D+/D- on capacitance	$V_{CC} = 3.3\text{ V}$, /OE = 0 V, $f = 240\text{ MHz}$, see Figure 4	25°C		5		
$C_{OFF}^{(1)}$	USB1±, USB2± off capacitance	V_{CC} and /OE = 3.3 V, see Figure 4	25°C		2		

Note:

(1) Guaranteed by design.

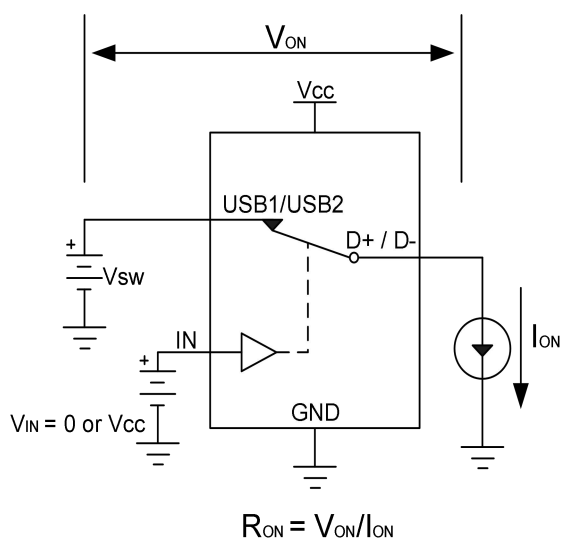


Figure 2. Switch on resistor

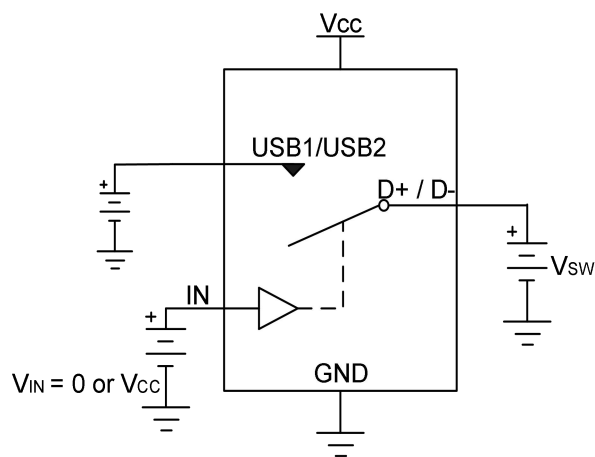


Figure 3. Switch off leakage

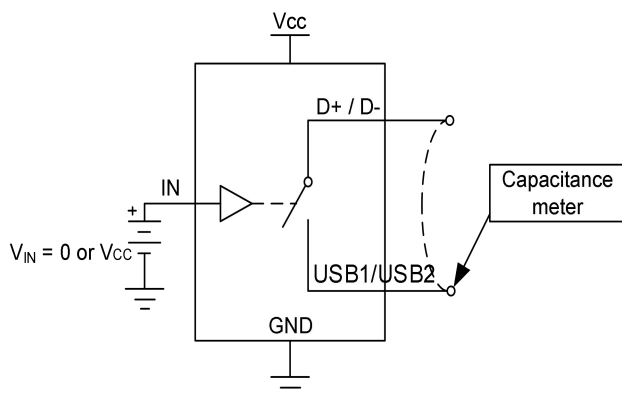


Figure 4. Channel on/off capacitance

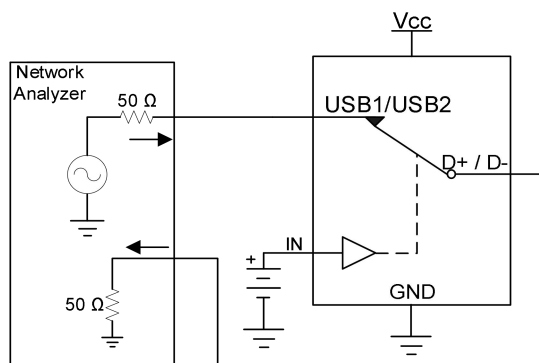


Figure 5. Bandwidth

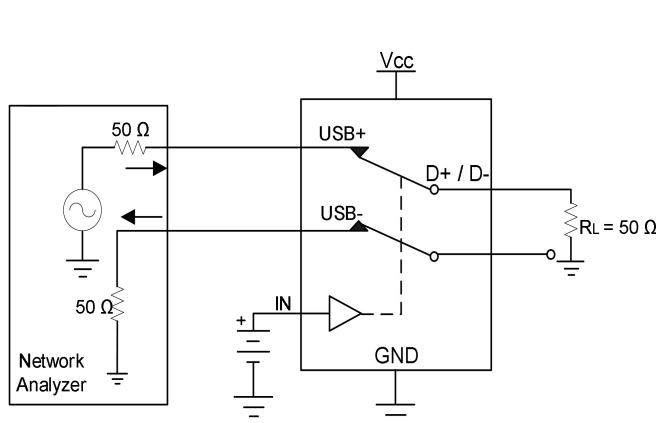


Figure 6. Channel-to-channel crosstalk

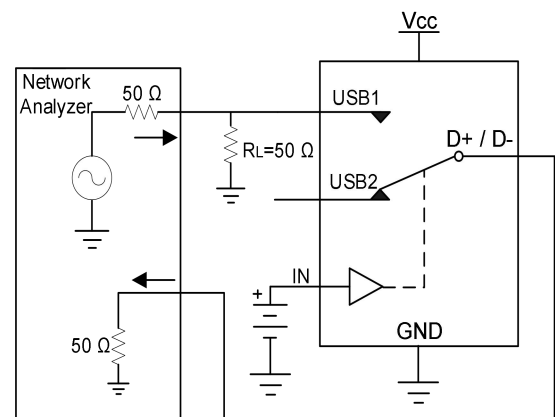


Figure 7. Off-isolation

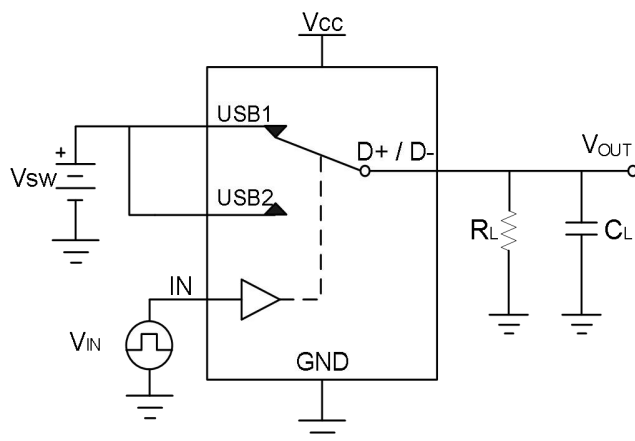


Figure 8. Break-before-make

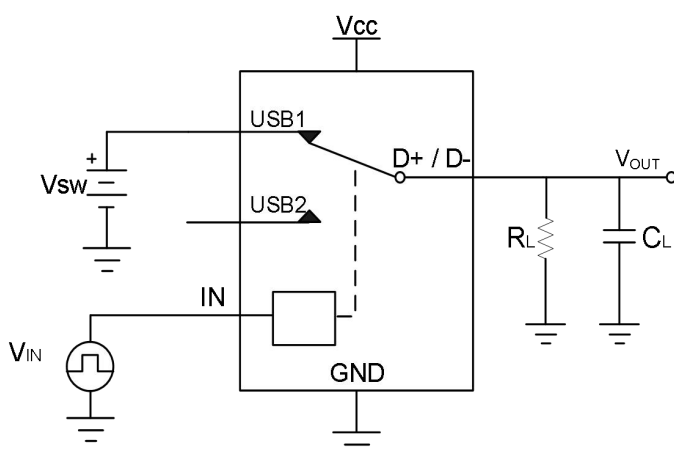
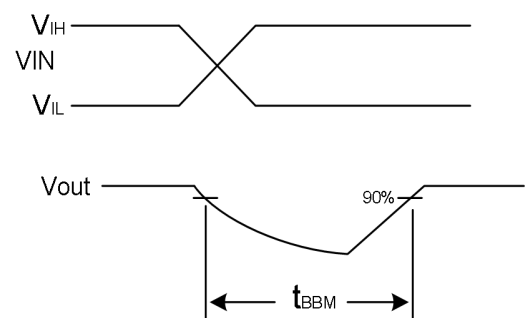
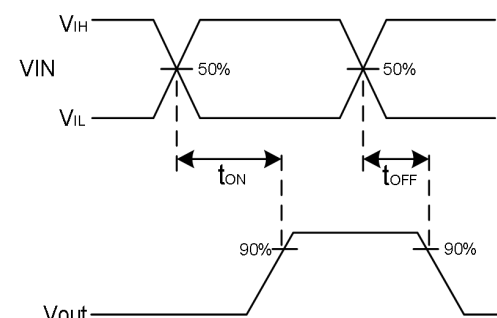


Figure 9. Turn-on/turn-off



8. Typical Characteristics

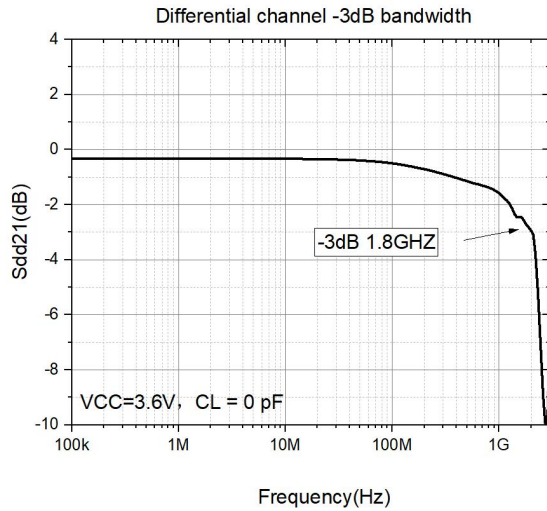


Figure 10. Differential channel -3 dB bandwidth

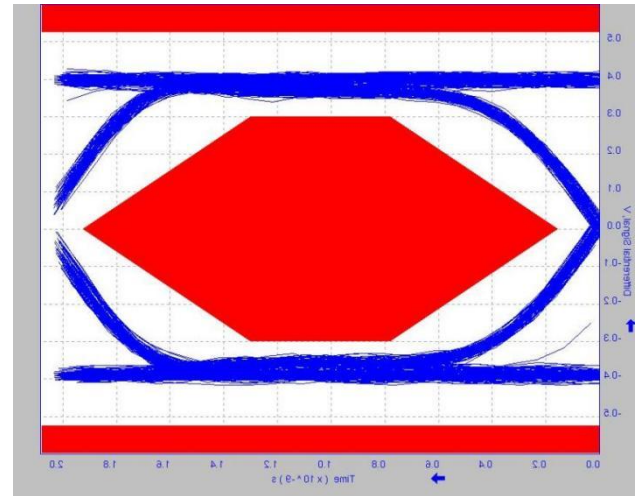


Figure 11. Eye pattern

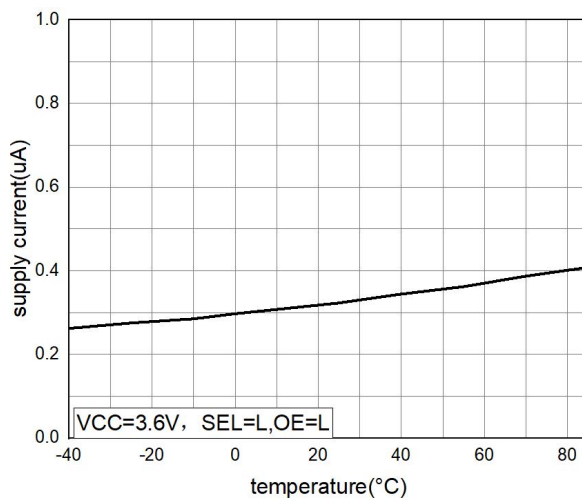


Figure 12. Supply current vs. Temperature

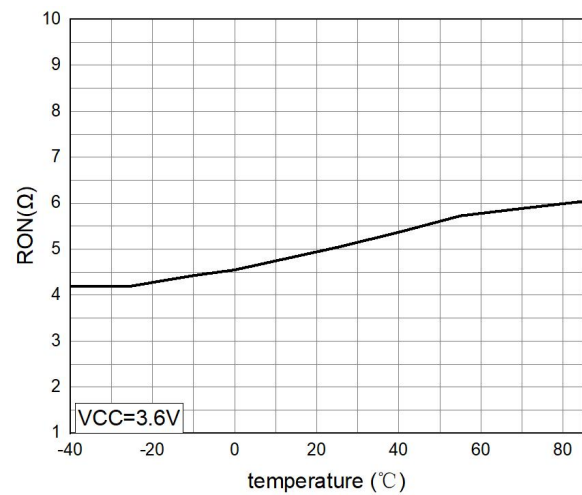


Figure 13. RON vs. Temperature

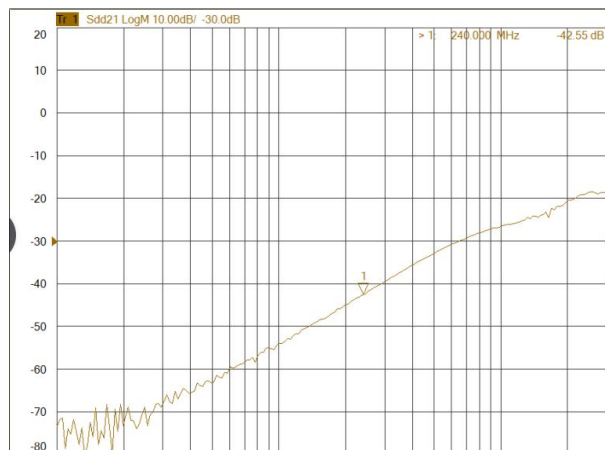


Figure 14. Crosstalk vs. Frequency

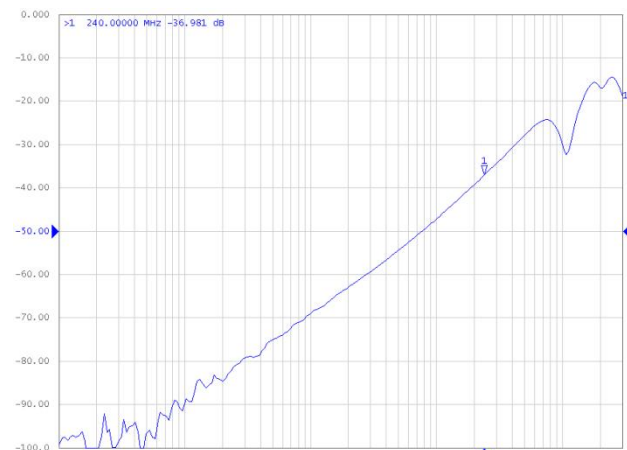
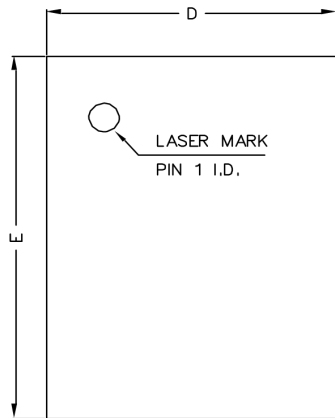
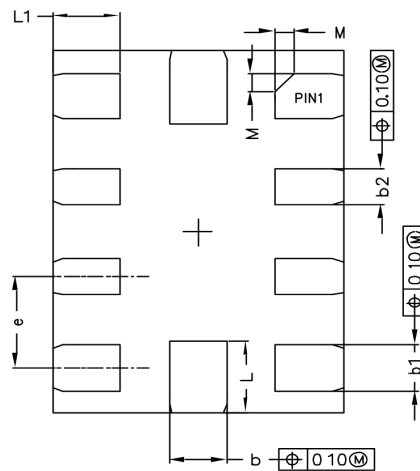


Figure 15. Off-isolation vs. Frequency

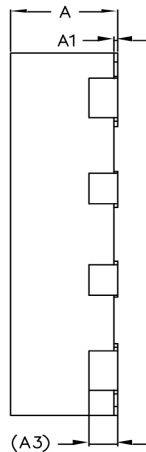
9. Physical Dimensions: QFN2*1.5-10



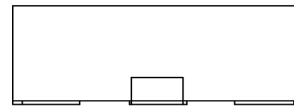
TOP VIEW



BOTTOM VIEW



SIDE VIEW



SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.50	0.55	0.60
A1	0	0.02	0.05
A3	0.152 REF		
b	0.25	0.30	0.35
b1	0.20	0.25	0.30
b2	0.15	0.20	0.25
D	1.45	1.50	1.55
E	1.95	2.00	2.05
e	0.40	0.50	0.60
L	0.35	0.40	0.45
L1	0.30	0.35	0.40
M	0.10 REF		

2,35

1,50

0,50

1,86

0,70

0,63

0,35 2X

0,58 4X Corners

0,25 4X Side Leads

0,30

0,05 Solder Mask Clearance

0,05

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