

DIO3212

High-Bandwidth and Low on-Resistance Analog Switch

Features

- Overvoltage tolerance (OVT)
- Operating voltage: 2.3 V to 5 V
- Low on-resistance: 5.7 Ω (typ.) at 3.0 V_{CC}
- High off-isolation
- Low crosstalk
- Low C_{ON}: 5 pF
- Low power consumption
- Wide -3 dB bandwidth
- Low distortion
- Green packaged: QFN2*1.5-10, MSOP10 and DFN3*3-10
- ± 2 kV CDM ESD rating
 ± 5.5 kV I/O to GND HBM ESD rating

Descriptions

The DIO3212 is a low power, dual SPDT 2-port, high-speed analog switch. It handles bi-directional signal flow and is optimized for switching a high-speed (480 Mbps) source.

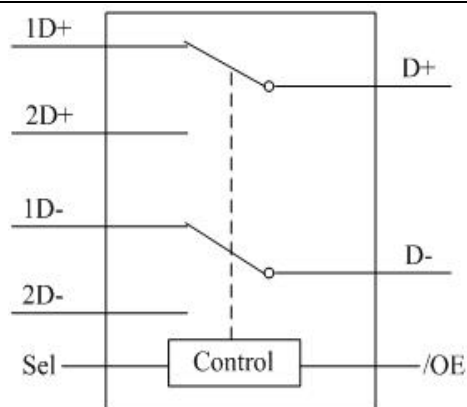
The DIO3212 has a high channel-to-channel noise isolation and a low bit-to-bit skew which allows it to pass high-speed differential signals with good signal integrity. Each switch offers little or no attenuation of the high-speed signals at the outputs.

The DIO3212 contains special circuitry on the D+/D- pins, which can tolerate up to 5.25 V when the USB devices are either powered off or powered on.

Applications

- Cell phones
- PDAs and MP3s
- Portable instrumentation
- Battery powered communications
- Computer peripherals

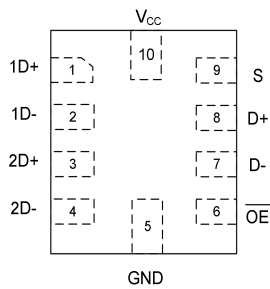
Block Diagram



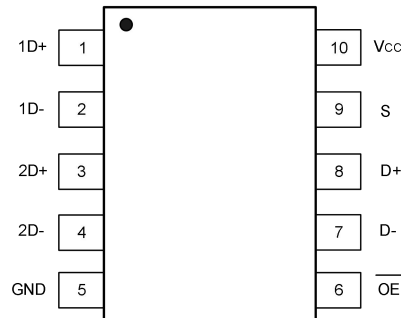
Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T _A	Package	
DIO3212QN10	YWGB	1	Green	-40 to 85°C	QFN2*1.5-10	Tape & Reel, 3000
DIO3212DN10	D3212	3	Green	-40 to 85°C	DFN3*3-10	Tape & Reel, 5000
DIO3212MP10	DIO3212	3	Green	-40 to 85°C	MSOP-10	Tape & Reel, 3000

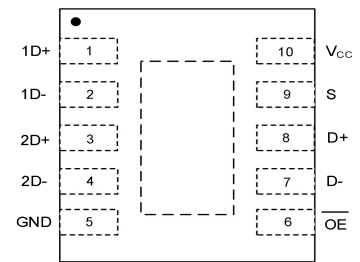
Pin Assignment



QFN2*1.5-10



MSOP-10



DFN3*3-10

Figure 1. Top view

Pin Descriptions

Pin Name	Description
/OE	Switch enable
Sel	Switch select
V _{CC}	Power
GND	Power
D+, D-	USB data bus
1D+, 1D-	Multiplexed source inputs
2D+, 2D-	Multiplexed source inputs

Truth Table

Sel	/OE	Function
X	H	Disconnect
L	L	D to 1D
H	L	D to 2D



DIO3212

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply voltage	-0.5	5	V
V_{SW}	DC switch voltage	-0.5	6	V
V_{IN}	DC input voltage	-0.5	6	V
$V_{D+/D-}$	D+/D- DC voltage ⁽¹⁾	-0.3	9	V
I_{SW}	On-state switch current	-120	120	mA
	Continuous current through V_{CC} or GND	-100	100	mA
T_{STG}	Storage temperature range	-65	150	°C
θ_{JA}	DFN2*1.5-10 package		48.7	°C/W
	QFN3*3-10 package		243	°C/W
ESD	HBM, JEDEC: JESD22-A114 (I/O to GND)		±5500	V
	CDM, JEDEC: JESD22-C101		±2000	

Note:

(1) This rating only applies to the D+/D- pin with respect to GND. V_{CC} must be powered within the recommended operating conditions of 2.3 V to 5 V and the $\overline{OE}$ pin must be logic high for this rating to be applicable. Any condition where V_{CC} is unpowered or the $\overline{OE}$ pin is not high must reference the rest of the Absolute Maximum Ratings Table.

Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply voltage	2.3	5	V
V_{IN}	Control input voltage	0	V_{CC}	V
V_{SW}	Switch input voltage	0	V_{CC}	V
T_A	Operating temperature	-40	85	°C



DIO3212

High-bandwidth and Low on-resistance Analog switch

DC Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IH}	Input voltage high	$V_{CC} = 3.0\text{ V}$	1.5			V
V_{IL}	Input voltage low	$V_{CC} = 3.0\text{ V}$			0.6	V
I_{IN}	Control input leakage	$V_{CC} = 3.6\text{ V}, 2.7\text{ V}, 0\text{ V},$ $V_{IN} = 0\text{ V to } 3.6\text{ V}$	-10		10	μA
I_{OFF}	V_{CC} off leakage current	$V_{CC} = 0\text{ V}, V_{SW} = 0\text{ V to } 3.6\text{ V}$	-2		2	μA
I_{CC}	Quiescent supply current	$V_{CC} = 3.6\text{ V}, 2.7\text{ V}, V_{IN} = V_{CC}$ or GND, Switch ON or OFF			40	μA
I_{CCT}	I_{CC} current per control voltage	$V_{IN} = 1.8\text{ V}, V_{CC} = 3.6\text{ V}$			10	μA
		$V_{IN} = 1.8\text{ V}, V_{CC} = 2.7\text{ V}$			10	
R_{ON}	Switch-on resistance See Figure 9	$V_{CC} = 3.0\text{ V}$ $V_{SW} = 0.4\text{ V}, I_{SW} = -8\text{ mA}$		5.7	9.5	Ω
ΔR_{ON}	On-resistance matching between channels	$V_{CC} = 3.0\text{ V}$ $V_{SW} = 0.4\text{ V}, I_{SW} = -8\text{ mA}$		0.1		Ω
$R_{FLT(ON)}$	On-resistance flatness	$V_{CC} = 3.0\text{ V}$ $V_{SW} = 0.4\text{ V}, I_{SW} = -8\text{ mA}$		1		Ω

AC Electrical Characteristics

All typical value are at $V_{CC} = 3.3\text{ V} \pm 10\%$, $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{ON}	Turn-on time	$V_{SW} = 1.8\text{ V}, R_L = 50\ \Omega, C_L = 5\text{ pF}, V_{CC} = 2.3\text{ V}$		60		ns
t_{OFF}	Turn-off rime	$V_{SW} = 1.8\text{ V}, R_L = 50\ \Omega, C_L = 5\text{ pF}, V_{CC} = 2.3\text{ V},$		60		ns
$t_{pd}^{(1)}$	Propagation delay	$R_L = 50\ \Omega, C_L = 5\text{ pF},$ see Figure 17		0.25		ns
OIRR	Off isolation	$V_{CC} = 2.3\text{ V to } 5\text{ V}, R_L = 50\ \Omega, f = 240\text{ MHz},$ switch OFF		-40		dB
X_{TALK}	Crosstalk	$V_{CC} = 2.3\text{ V to } 5\text{ V}, R_L = 50\ \Omega, f = 240\text{ MHz},$ switch ON		-42		dB
BW	-3dB bandwidth	Signal = 0 dBm, see Figure 12				
		$R_L = 50\ \Omega$	1			GHz
		$R_L = 50\ \Omega, C_L = 5\text{ pF}$		650		MHz

Note:

- (1) Guaranteed by design.
- (2) Specifications subject to change without notice.

Capacitance

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{ON}	On capacitance	$V_{CC} = 3.3\text{ V}, 2.5\text{ V},$ switch on $V_{SW} = 3.3\text{ V}$ or 0 V, see Figure 11		5		pF



DIO3212

Typical Performance Characteristics

High-bandwidth and Low on-resistance Analog switch

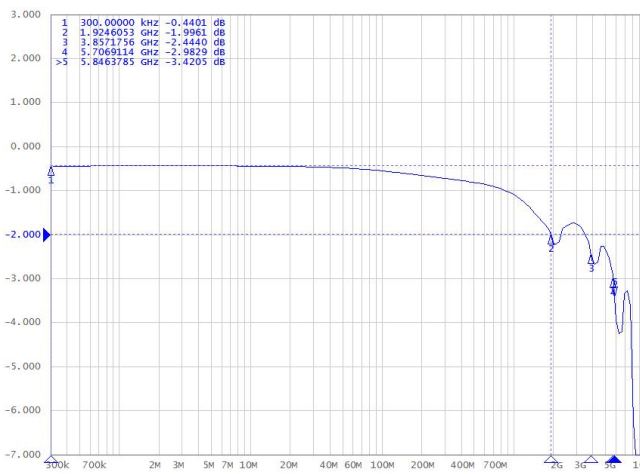


Figure 2. Differential S21 vs. Frequency USB switch

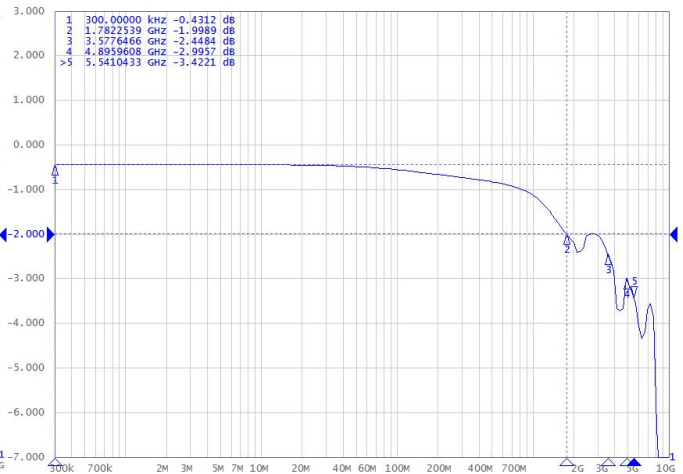


Figure 3. Differential S21 vs. Frequency MHL switch

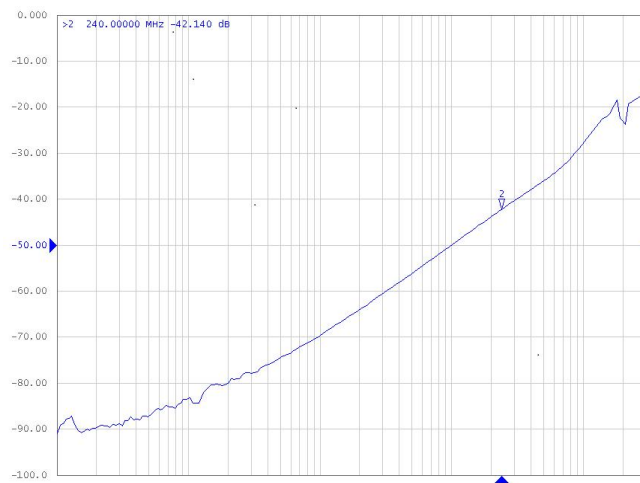


Figure 4. Crosstalk vs. Frequency for USB path

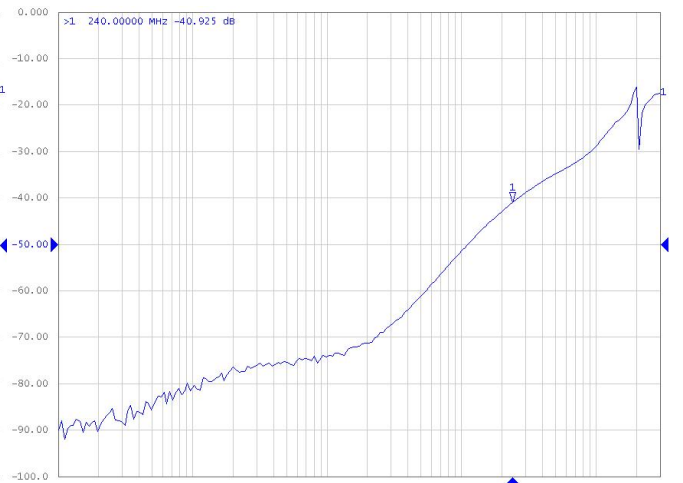


Figure 5. Crosstalk vs. Frequency for MHL path

Typical Performance Characteristics (Continued)

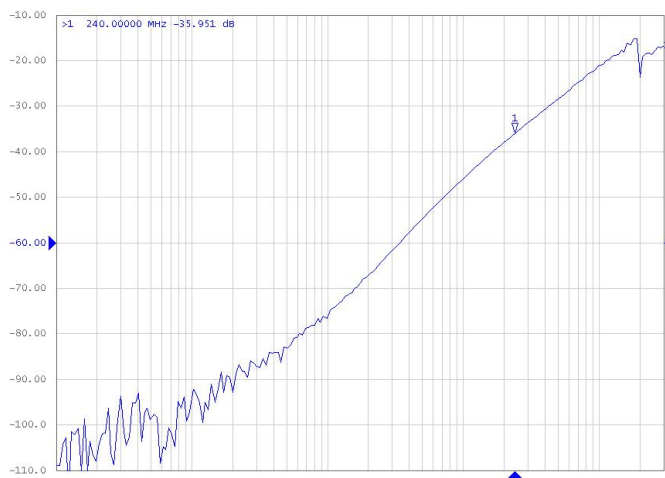


Figure 6. Off isolation vs. Frequency for USB path

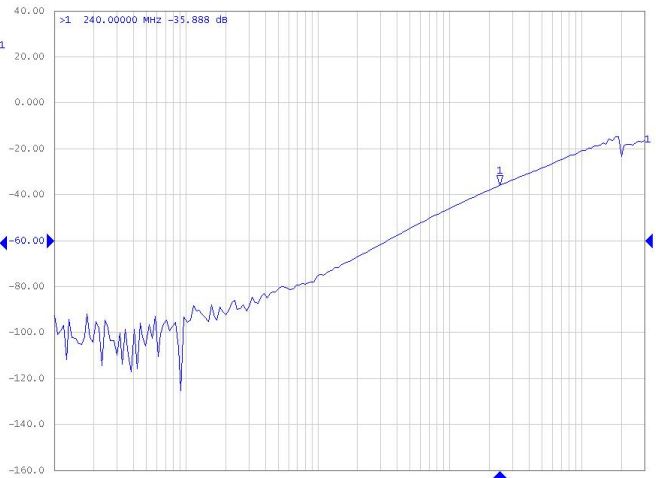


Figure 7. Off isolation vs. Frequency for MHL path

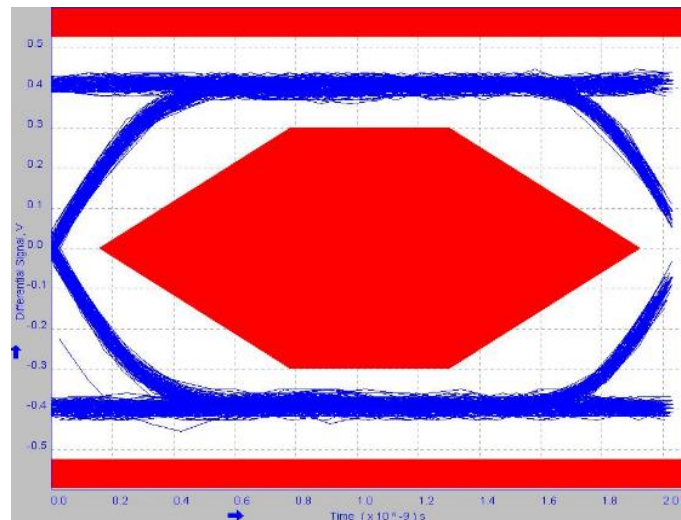


Figure 8. 480-Mbps USB2.0 eye pattern for USB switch

with DIO3212

Test Diagrams

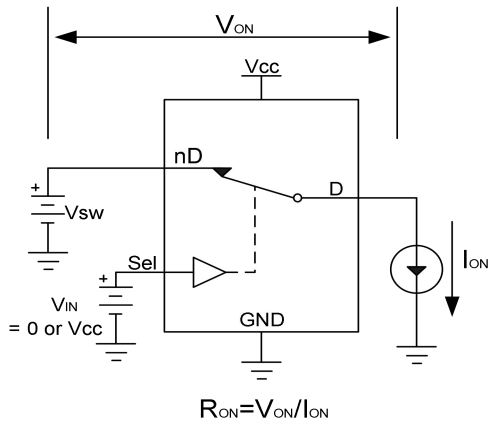


Figure 9. Switch on resistor

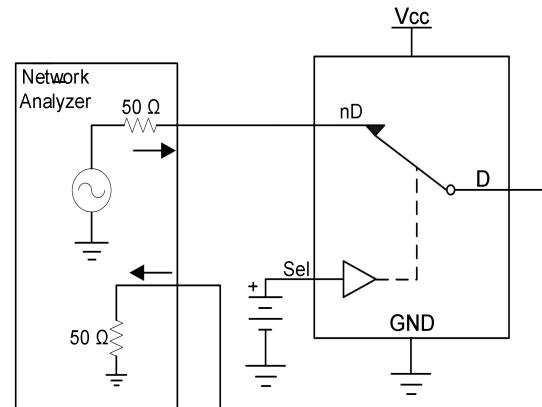


Figure 12. Bandwidth

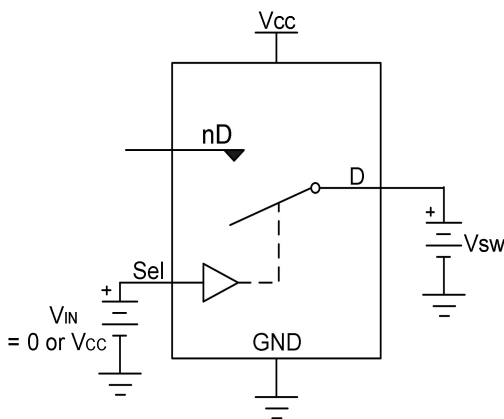


Figure 10. Switch off leakage

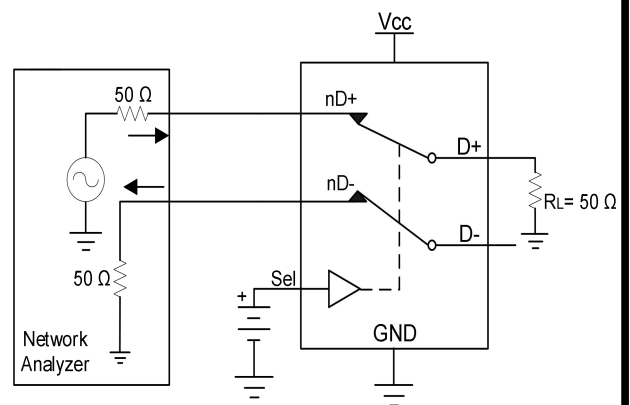


Figure 13. Channel-to-channel crosstalk

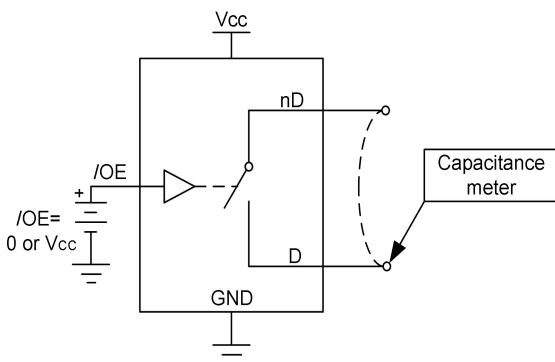


Figure 11. On/off capacitance test

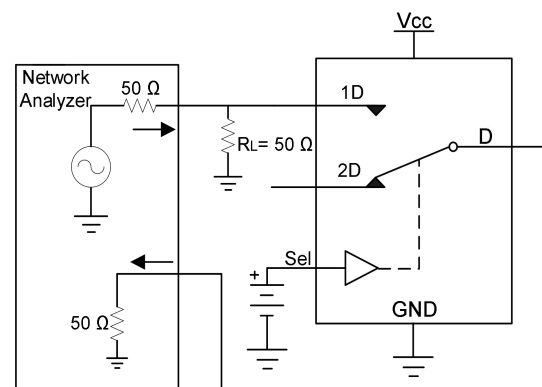


Figure 14. Off-isolation

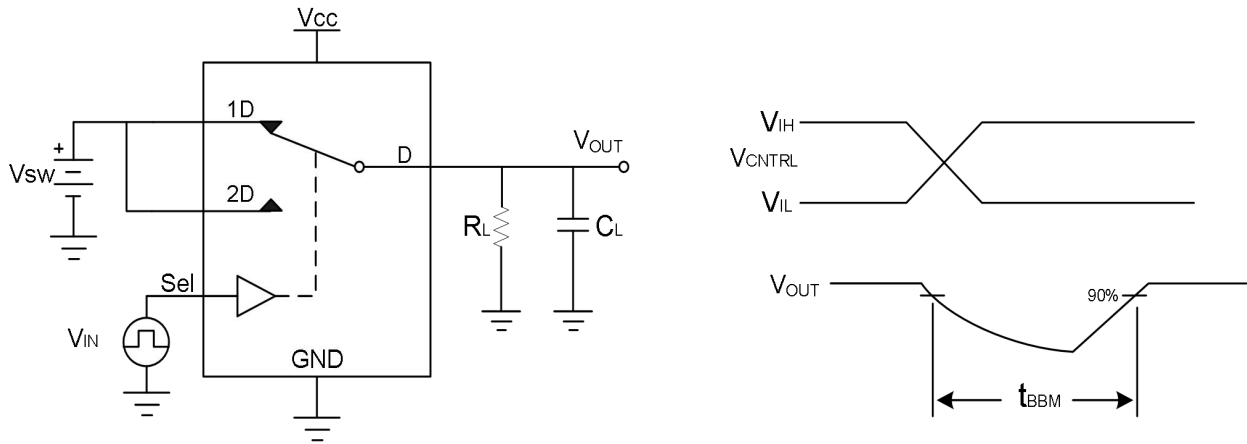


Figure 15. Break-before-make

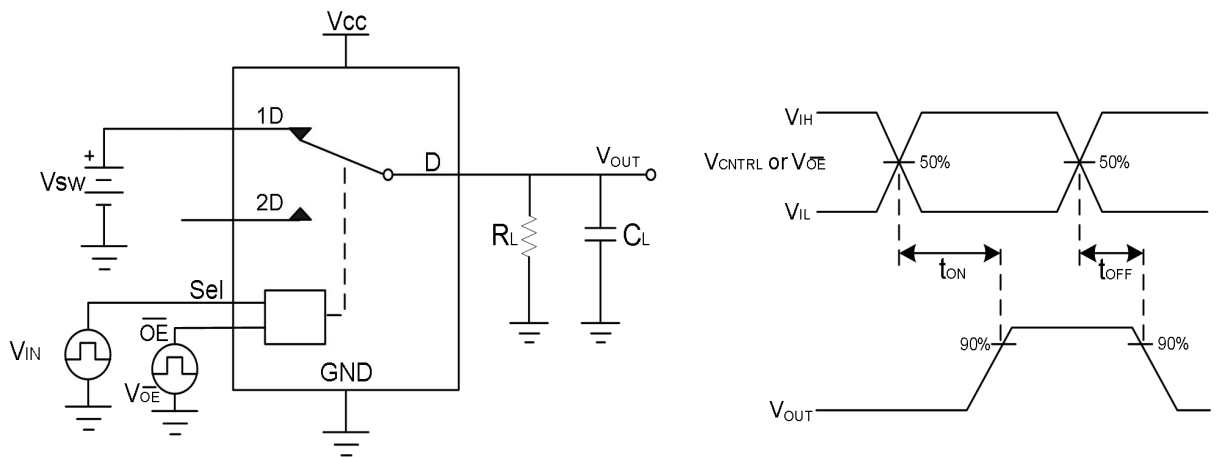


Figure 16. Turn-on/Turn-off

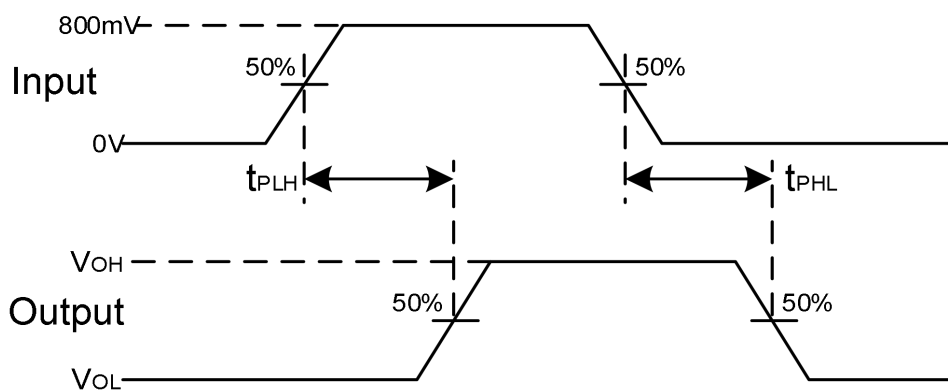
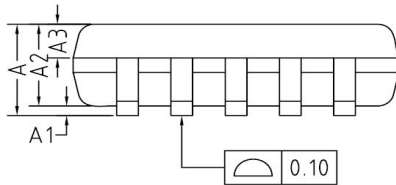
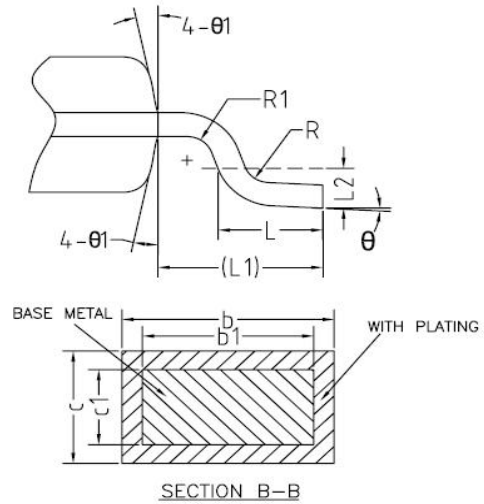
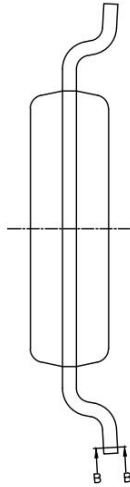
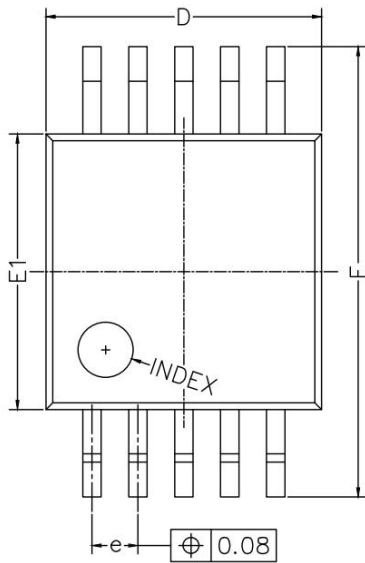


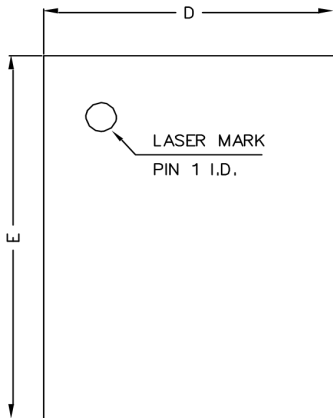
Figure 17. Propagation delay

Physical Dimensions: MSOP-10

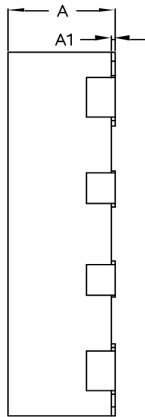


Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.10
A1	0	0.10	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.18	-	0.27
b1	0.17	0.20	0.23
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.75	4.90	5.05
E1	2.90	3.00	3.10
e	0.40	0.50	0.60
L	0.40	0.55	0.70
L1	0.95 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
θ	0°	-	8°
θ1	9°	12°	15°

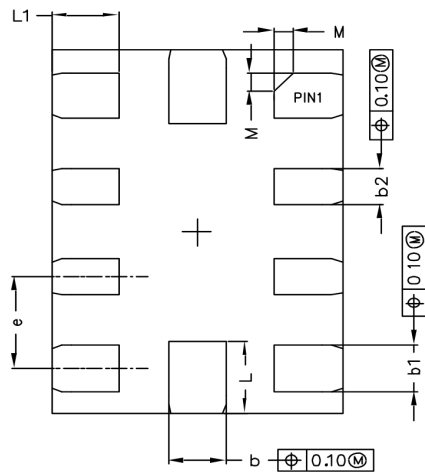
Physical Dimensions: QFN2*1.5-10



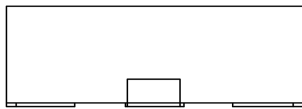
TOP VIEW



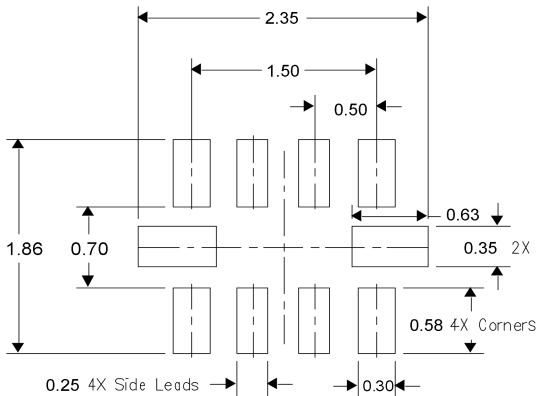
SIDE VIEW



BOTTOM VIEW



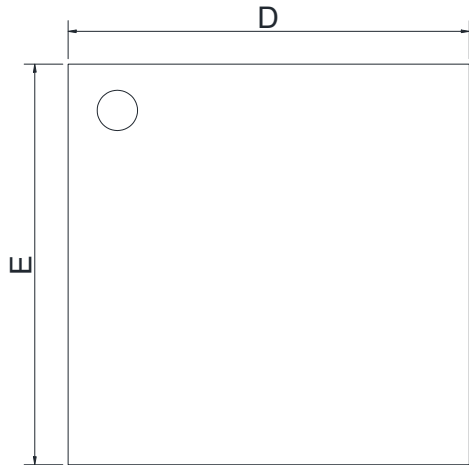
SIDE VIEW



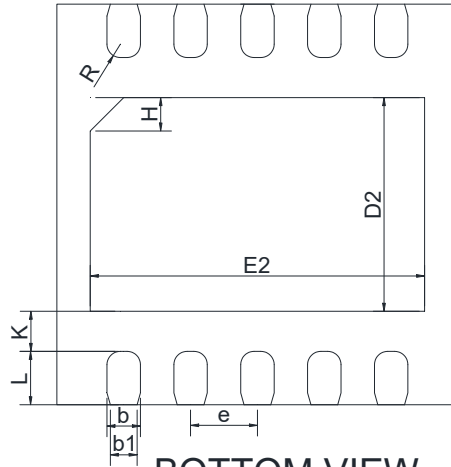
Recommended Land Pattern

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
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		

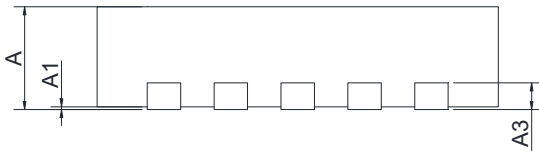
Physical Dimensions: DFN3*3-10



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.20	0.25	0.30
b1	0.20 REF		
D	2.90	3.00	3.10
E	2.90	3.00	3.10
D2	1.50	1.60	1.70
E2	2.40	2.50	2.60
e	0.40	0.50	0.60
H	0.20 REF		
K	0.20	-	-
L	0.30	0.40	0.50
R	0.13	-	-

CONTACT US

Dioo is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as cell phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to <http://www.dioo.com> for a complete list of Dioo product families.

For additional product information or full datasheet, please contact our sales department or representatives.