

DIO3476

4:1/1:4 (0.8 Ω) Hi-Fi Audio Switch with Both Negative Swing and USB 2.0 Signal Handling Capability

Features

- Power supply voltage range: 1.65 to 5.5 V
- $R_{ON} = 0.8 \Omega$ (typ.) at 3.3 V
- THD+N = -110 dB; 2 V_{RMS} , 600 Ω load; $f = 1$ kHz
- $X_{TALK} = -120$ dB at 1 V_{RMS} , 50 Ω load; $f = 1$ kHz
- Off isolation = -110 dB at 1 V_{RMS} , 50 Ω load; $f = 1$ kHz
- Power-off protection on common ports
- Each channel can handle USB 2.0, UART or negative swing (-3 V) audio signal
- Package: QFN 2*3-18

Applications

- Mobile phones
- Tablets
- Notebook PCs
- Media players
- Docking stations
- TVs
- Set-top boxes
- LCD monitors

Descriptions

The DIO3476 is a high-performance, 4:1/1:4 (0.8 Ω) Hi-Fi audio switch with both negative swing and USB 2.0 signal handling capability. The DIO3476 features an ultra-low audio R_{ON} of 0.8 Ω (typical) at 3.3 V V_{DD} . The DIO3476 operates over a V_{DD} range of 1.65 V to 5.5 V, is made of sub-micron CMOS technology to achieve fast switching speeds, and is aimed at break-before-make operation.

The DIO3476 is advantaged in THD+N specifications which target a Hi-Fidelity audio quality into both 32 Ω headphones and line out type loads (> 600 Ω).

Application Block Diagram

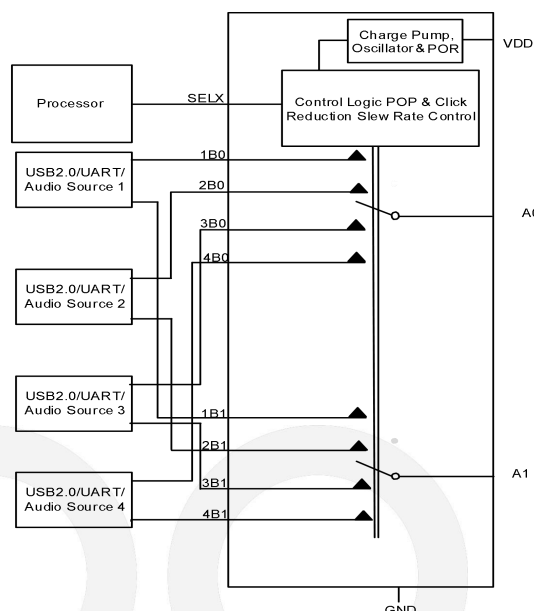
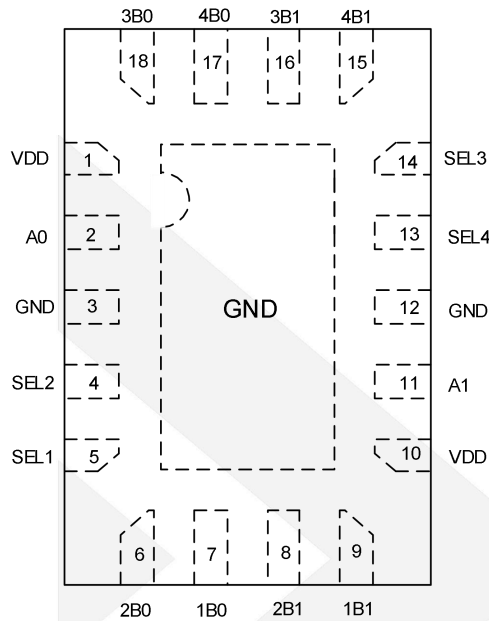


Figure 1. Application Block Diagram

Ordering Information

Order Part Number	Top Marking	RoHS	T _A	Package	
DIO3476QN18	DCDG6	Green	-40 to 85°C	QFN2*3-18	Tape & Reel, 3000

Pin Assignment



QFN2*3-18

Figure 2. Top View

Pin Descriptions

Pin Name	Description
VDD	Power supply (1.65 V to 5.5 V).
A0	USB2.0/UART/Audio left common I/O port.
GND	Ground.
SELX	Select pin.
XB0	USB2.0/UART/Audio – left channel SourceX I/O port.
XB1	USB2.0/UART/Audio – right channel SourceX I/O port.
A1	USB2.0/UART/Audio right common I/O port.
GND (exposed pad)	This pin must be connected to GND, and punch to the main GND to facilitate heat dissipation.

Note: X is a variable for 1, 2, 3, 4.



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Truth Table

SEL1	SEL2	SEL3	SEL4	Function
0	0	1	X	1B0 = A0; 1B1 = A1
0	1	1	X	2B0 = A0; 2B1 = A1
1	X	0	0	3B0 = A0; 3B1 = A1
1	X	0	1	4B0 = A0; 4B1 = A1
1	X	1	X	All paths Hi-Z

Note:

Other options are prohibited.

X: 0 or 1.

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_{DD}	Supply/control voltage		-0.3	6.0	V
V_{CNTRL}	Control input voltage		-0.3	6.0	V
V_{SW}	DC switch I/O voltage	XB0, XB1, A0, A1	-3.5	3.5	V
I_{IK}	ESD input diode current			-50	mA
I_{SW}	Switch I/O current			700	mA
ESD	Human body model	All pins	5.5		kV
	Charged device model		2		
T_A	Absolute maximum operating temperature		-40	85	°C
T_{STG}	Storage temperature		-65	150	°C

Note: X: 1, 2, 3, 4.



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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	Typ	Max	Unit
V _{DD}	Supply voltage		1.65	3.3	5.50	V
V _{SW}	DC switch I/O voltage	XB0, XB1, A0, A1	-3.0		3.0	V
V _{CNTRL}	Control input voltage		0		V _{DD}	V
I _{SW}	DC switch I/O current			100		mA
T _A	Ambient operating temperature		-40	25	85	°C

Note: X is a variable for 1, 2, 3, 4.

DC Electrical Characteristics

V_{DD} = 1.65 V to 5.5 V, V_{DD} (typ.) = 3.3 V, T_A = -40°C to 85°C, and T_A (typ.) = 25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{IH}	VCNTRL pin input high voltage		1.5			V
V _{IL}	VCNTRL pin input low voltage				0.5	V
I _{ON}	Switch-to-GND on leakage current	XB0, XB1 = -3 V to 3 V, A0, A1 = Float (I _{SW} = 0 mA)	-1		1	μA
I _{NO}	Switch-to-GND off leakage current	XB0, XB1 = -3 V to 3 V, A0, A1 = Float (I _{SW} = 0 mA)			1	μA
I _{OFF}	Input leakage current ⁽¹⁾	XB0, XB1 = -3 V to 3 V, A0, A1 = Float (I _{SW} = 0 mA)	-1		1	μA
I _{CNTRL}	Control input leakage current	XB0, XB1 = -3 V to 3 V, A0, A1 = Float (I _{SW} = 0 mA)			1	μA
I _{DD}	V _{DD} supply current			18	25	μA
I _{DDZ}	V _{DD} Hi-Z supply current				1	μA
I _{DDT}	Increase in I _{DD} per control voltage	SELX = 0 V or 1.8 V			2	μA
R _{ON}	Switch on resistance	I _{SW} = 100 mA, V _{SW} = -3 V to 3 V		0.8	1	Ω
ΔR _{ON}	On resistance matching, channel to channel	I _{SW} = 100 mA, V _{SW} = -3 V to 3 V		50		mΩ



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R_{FLAT}	On resistance flatness	$I_{\text{SW}} = 100 \text{ mA}$, $V_{\text{SW}} = -3 \text{ V to } 3 \text{ V}$		2		mΩ
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Note:

- (1) Only valid for $V_{\text{SW}} > 0 \text{ V}$.
X is a variable for 1, 2, 3, 4.

AC Electrical Characteristics

$V_{\text{DD}} = 1.65 \text{ V to } 5.5 \text{ V}$, $V_{\text{DD}} (\text{typ.}) = 3.3 \text{ V}$, $T_{\text{A}} = -40^{\circ}\text{C to } 85^{\circ}\text{C}$, and $T_{\text{A}} (\text{typ.}) = 25^{\circ}\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{ON}	Turn-on time	$\text{XB0, XB1} = 1.5 \text{ V, A0, A1} = 50 \Omega \text{ to GND}$		850		us
t_{OFF}	Turn-on time	$\text{XB0, XB1} = 1.5 \text{ V, A0, A1} = 50 \Omega \text{ to GND}$		200		ns
t_{BBM}	Break-before-make time (SELX to output)	$\text{XB0, XB1} = 1.5 \text{ V, A0, A1} = 50 \Omega \text{ to GND}$		820		us
O_{IRR}	Off isolation ⁽²⁾	$f = 1 \text{ kHz}$, $R_{\text{L}} = 50 \Omega$, $C_{\text{L}} = 0 \text{ pF}$, $V_{\text{SW}} = 1 \text{ V}_{\text{RMS}}$		-110		dB
		$f = 80 \text{ kHz}$, $R_{\text{L}} = 50 \Omega$, $C_{\text{L}} = 0 \text{ pF}$, $V_{\text{SW}} = 1 \text{ V}_{\text{RMS}}$		-80		
X_{TALK}	Cross talk (adjacent) ⁽²⁾	$f = 1 \text{ kHz}$, $R_{\text{L}} = 50 \Omega$, $V_{\text{SW}} = 1 \text{ V}_{\text{RMS}}$		-120		dB
BW	-3 dB bandwidth ⁽²⁾	$R_{\text{L}} = 50 \Omega$		480		MHz
PSRR	Power supply rejection ratio ⁽²⁾	$V_{\text{PSRR}} = V_{\text{DD}} + 100 \text{ mV}_{\text{RMS}}$ $R_{\text{L}} = 32 \Omega$ (at A0, A1, $f = 1 \text{ kHz}$, $V_{\text{SW}} = \text{GND or Float}$)		-100		dB
THD+N	Total harmonic distortion + noise ⁽²⁾	$R_{\text{L}} = 600 \Omega$, $f = 1 \text{ kHz}$, $V_{\text{SW}} = 2 \text{ V}_{\text{RMS}}$, with A-weighted		-110		dB
		$R_{\text{L}} = 32 \Omega$, $f = 1 \text{ kHz}$, $V_{\text{SW}} = 1 \text{ V}_{\text{RMS}}$, with A-weighted		-100		dB
		$R_{\text{L}} = 16 \Omega$, $f = 1 \text{ kHz}$, $V_{\text{SW}} = 0.5 \text{ V}_{\text{RMS}}$, with A-weighted		-100		dB

Note:

- (2) Guaranteed by characterization. Not production tested.
X is a variable for 1, 2, 3, 4.

Capacitance

Unless otherwise stated, $V_{DD} = 1.65 \text{ V}$ to 5.5 V , $V_{DD} (\text{typ.}) = 3.3 \text{ V}$, $T_A = -40^\circ\text{C}$ to 85°C , and $T_A (\text{typ.}) = 25^\circ\text{C}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{ON}	On capacitance (common port) ⁽³⁾	$f = 1 \text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias		20		pF
C_{OFF1}	Off capacitance (common port) ⁽³⁾	$f = 1 \text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias		20		pF
C_{OFF2}	Off capacitance non-common ports) ⁽³⁾	$f = 1 \text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias		5		pF
C_{CNTRL}	Control input pin capacitance (SELX) ⁽³⁾	$f = 1 \text{ MHz}$, 100 mV_{PP} , 100 mV DC bias		3		pF

Note:

(3). Guaranteed by characterization. Not production tested.

X is a variable for 1, 2, 3, 4.

Typical Performance Characteristics

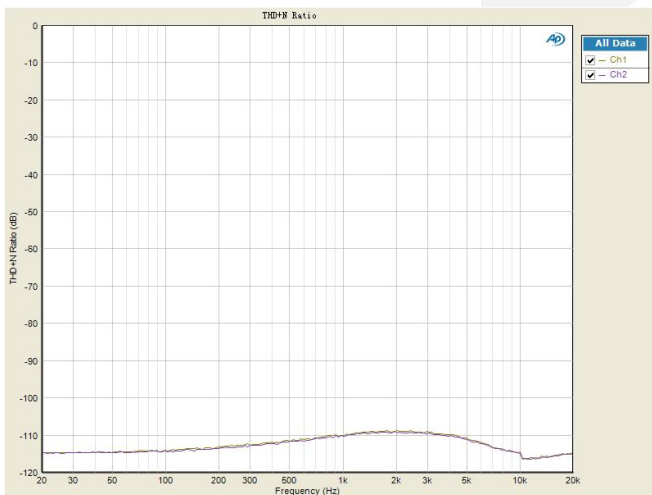


Figure 3. THD+N Ratio vs. Frequency
($V_{DD} = 3.3 \text{ V}$, $R_L = 600 \Omega$, $V_{SW} = 2 \text{ V}_{RMS}$)

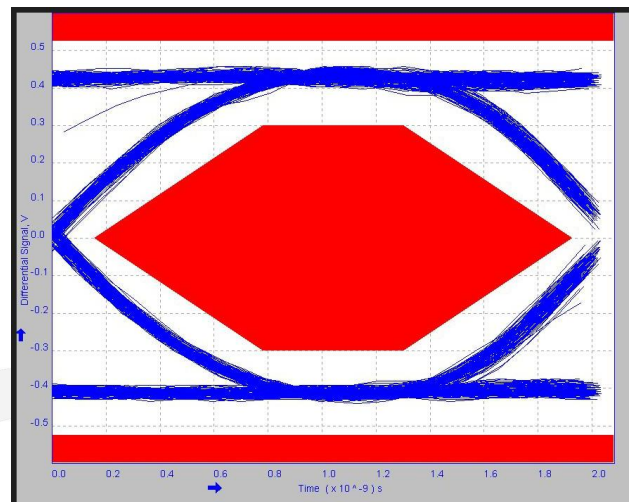


Figure 4. Eye pattern of USB 2.0

Test Diagrams

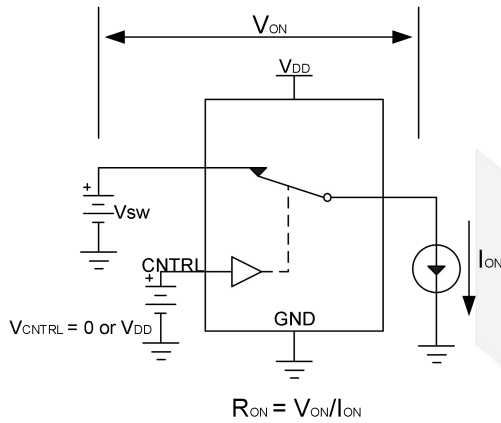


Figure 5. Switch on resistor

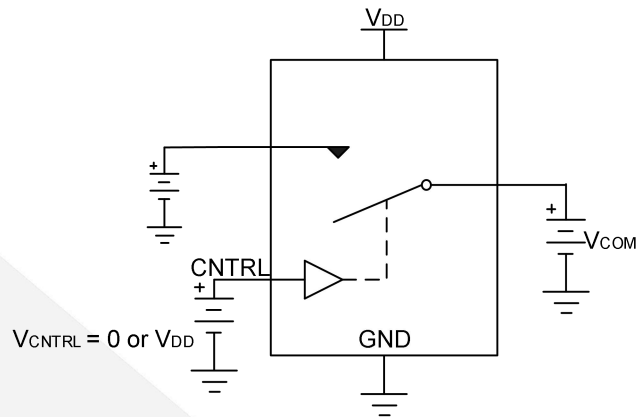


Figure 6. Switch off leakage

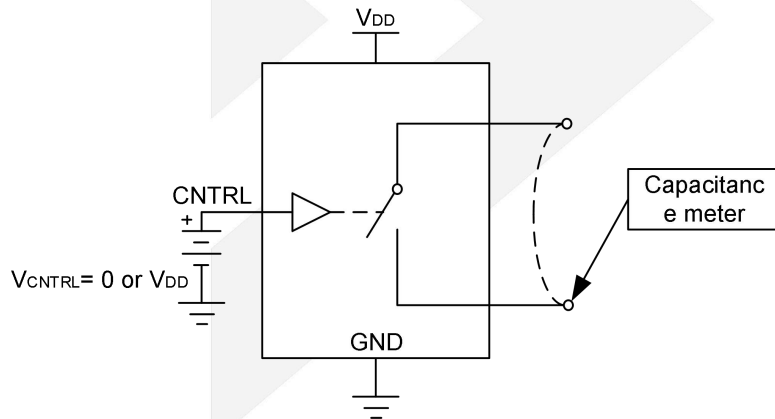


Figure 7. On/off capacitance test

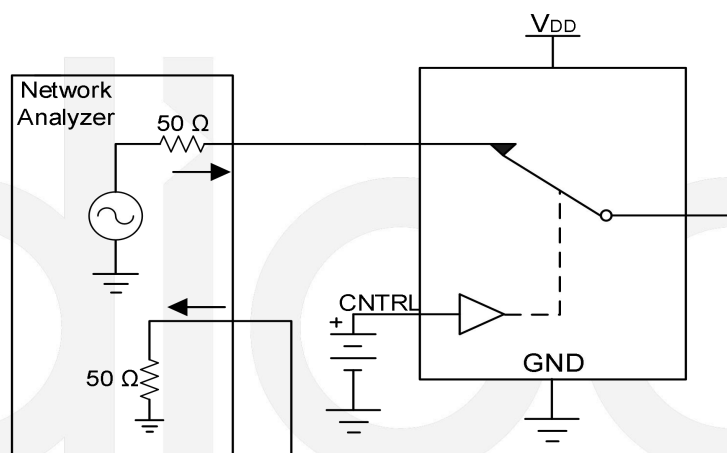


Figure 8. Bandwidth

Test Diagrams (Continued)

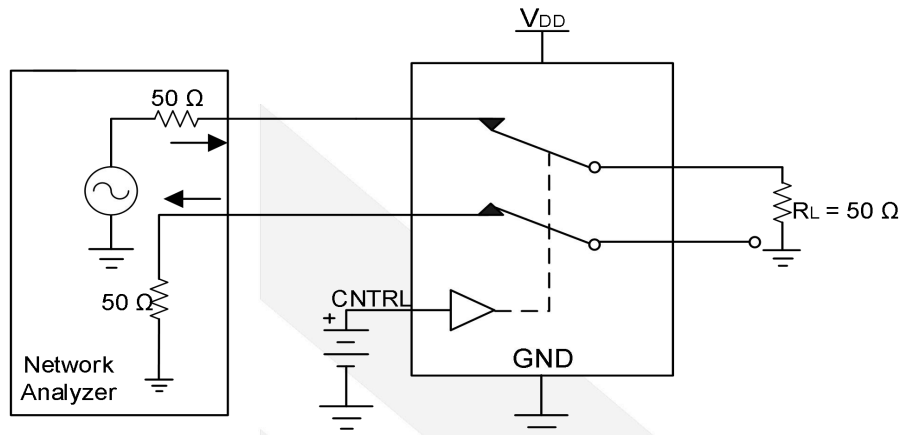


Figure 9. Channel-to-channel crosstalk

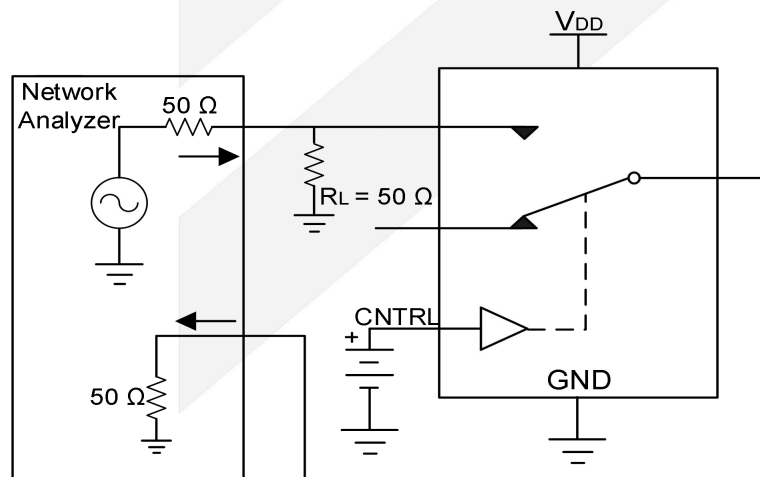


Figure 10. Off-isolation

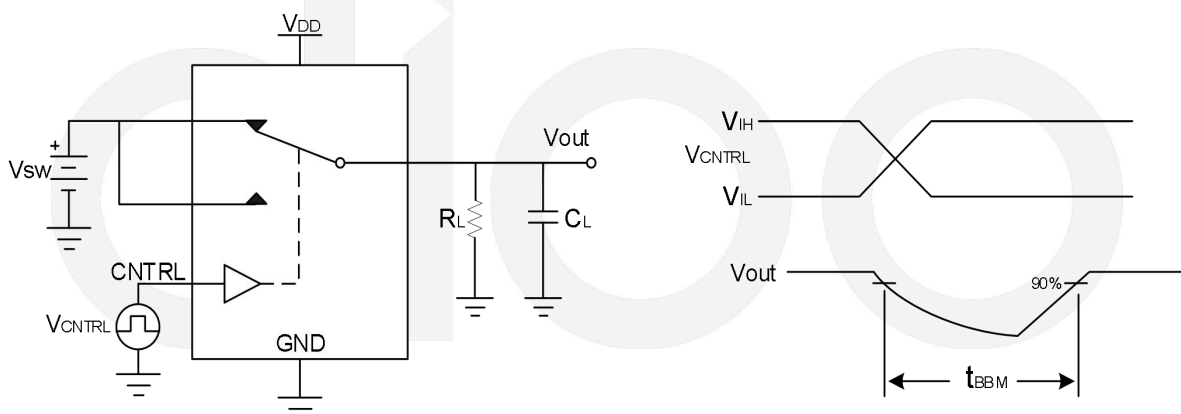


Figure 11. Break-Before-Make

Test Diagrams (Continued)

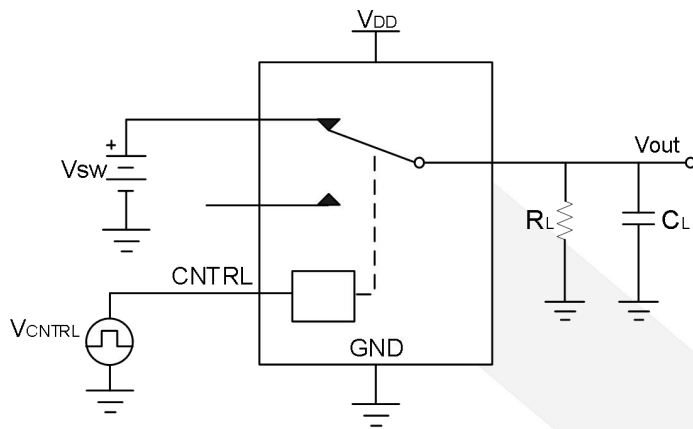
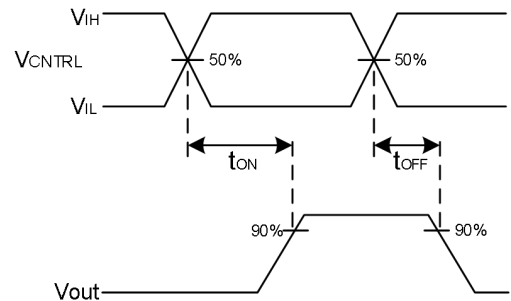
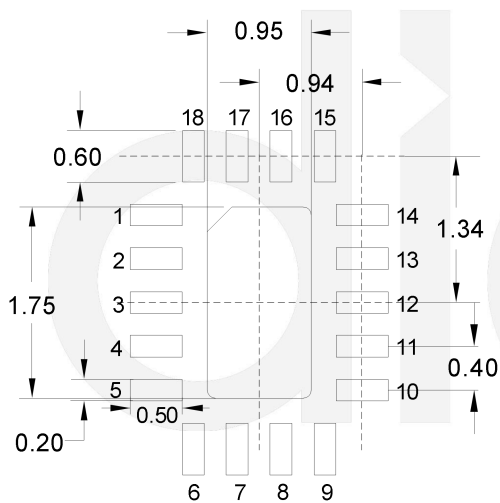
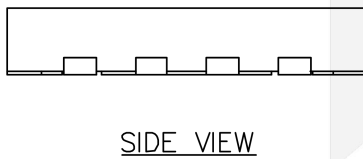
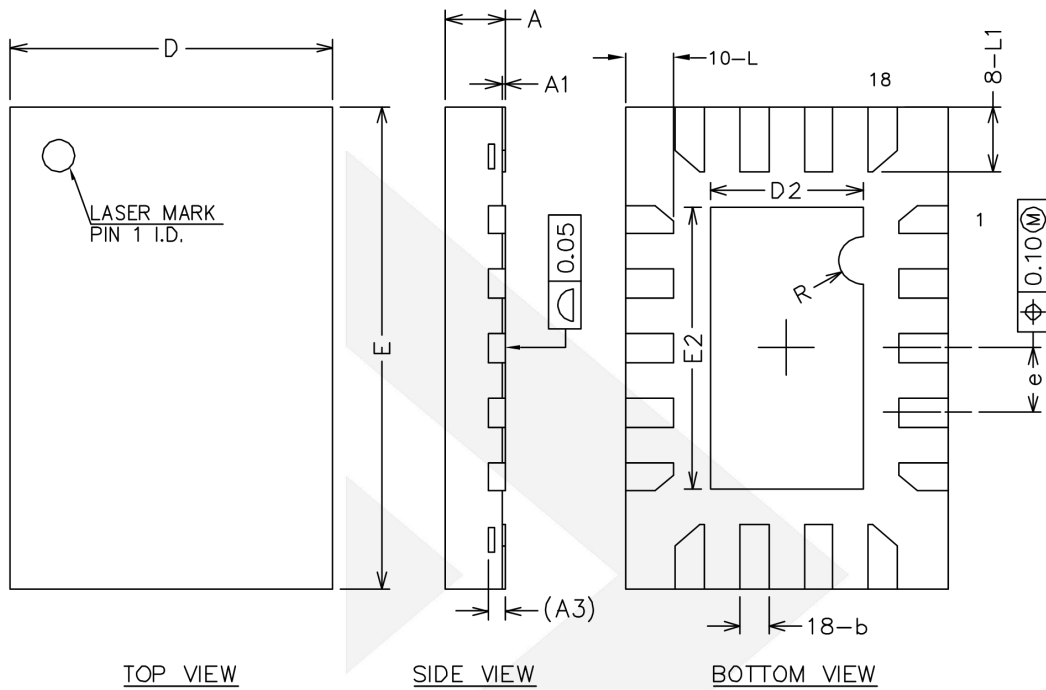


Figure 12. Turn-on/Turn-off



Physical Dimensions: QFN2*3-18



LAND PATTERN RECOMMENDATION

Common Dimensions (mm)			
Symbol	Min	Nom	Max
A	0.50	0.55	0.60
A1	0	0.02	0.05
A3	0.10 REF		
b	0.13	0.18	0.23
D	1.90	2.00	2.10
E	2.90	3.00	3.10
D2	0.85	0.95	1.05
E2	1.65	1.75	1.85
e	0.30	0.40	0.50
L	0.25	0.30	0.6
L1	0.35	0.40	0.45
R	0.15 REF		

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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.

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