DIO1553

Dual SPST Depletion Audio Switch with Negative Swing

Features

- **Dual SPST Depletion Switch**
- **Normally Closed when V_{CC}<0.2V**
- **Switches Configurable through Select Pins**
- **V_{SW}: -1.5V to 1.5V**
- **R_{ON}: 0.35Ω (Typical)**
- **R_{FLAT}<0.01Ω (Typical)**
- **THD+N: -103dB (Typical)**
- **OIRR: -88dB (Typical)**

Applications

- **Smart Phones**
- **Tablets, Ultra Books**

Descriptions

The DIO1553 is a high-performance dual single-pole single-throw (SPST x 2) audio switch. The Depletion technology allows the device to conduct signals when there is no V_{CC} available and to isolate signals when V_{CC} is present. During signal conduction, the Depletion gate control allows the DIO1553 to achieve excellent THD+N performance while consuming minimal power.

Typical Applications
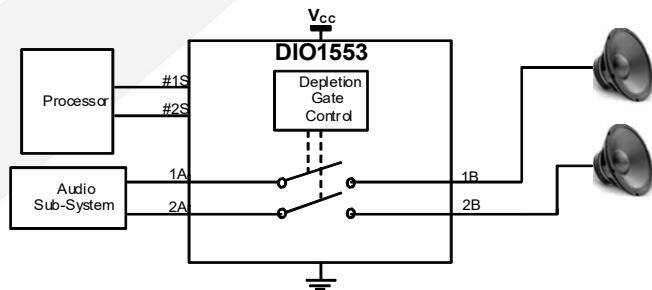
Figure 1. Application Block Diagram

Ordering Information

Order Part Number	Top Marking		T_A		Package	
DIO1553WL9	1553	Green	-40 to 85°C	WLCSP-9	Tape & Reel, 3000

Pin Configuration
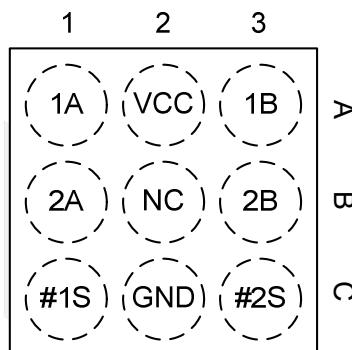
WLCSP-9

Figure 2. Pin Assignment (Top View)

Pin Definitions

Pin #	Name	Type	Description
A1	1A	Depletion I/O	A-Port of Switch 1 (Normally Closed)
A3	1B	Depletion I/O	B-Port of Switch 1 (Normally Closed)
C1	#1S	Control	Select to Enable/Disable SW1 (Enable LOW)
A2	VCC	Power Supply / Control	Power Supply Input
B2	NC	No Connect	Do Not Connect
C2	GND	Ground	Ground
B1	2A	Depletion I/O	A-Port of Switch 2 (Normally Closed)
B3	2B	Depletion I/O	B-Port of Switch 2 (Normally Closed)
C3	#2S	Control	Select to Enable/Disable SW2 (Enable LOW)

Truth Table (Table 1)

V_{cc}	#1S	#2S	Switch 1	Switch 2
LOW	X	X	ON	ON
HIGH	HIGH	HIGH	OFF	OFF
HIGH	LOW	HIGH	ON	OFF
HIGH	HIGH	LOW	OFF	ON

Absolute maximum Rating

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{CC}	Supply/Control Voltage		-0.5	4.3	V
V_{CNTRL}	Select Input Voltage	#1S, #2S	-0.5	4.3	V
$V_{SW(ON)}$	DC Switch I/O Voltage (Switch Conducting)	1A, 1B, 2A, 2B	-2	2	V
$V_{SW(OFF)}$	DC Switch I/O Voltage (Switch Isolated)	1A, 1B, 2A, 2B	-1.8	V_{CC}	V
I_{SW}	Switch I/O Current	V_{CC}=0 V (Switch Conducting)		350	mA
I_{SWPEAK}	Peak Switch Current	Pulsed at 1 ms Duration,<10% Duty Cycle		500	mA
ESD	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012		6.5		kV
T_A	Absolute Maximum Operating Temperature		-40	85	°C
θ_{JA}	Thermal Resistance, Junction-to-Ambient	2S2P JEDEC std. PCB		97	°C/W
T_{STG}	Storage Temperature		-65	150	°C

Recommended 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. Fairchild does not recommend exceeding these ratings or designing to Absolute Maximum Ratings.

Symbol	Parameter		Min.	Max.	Unit
$V_{CC(ON)}$	Supply Voltage with Depletion Switch Conducting (1A=1B; 2A=2B)		0	0.2	V
$V_{CC(OFF)}$	Supply Voltage with Depletion Switch Isolated (1A≠1B; 2A≠2B);		1.6	3	V
$V_{SW(ON)}$	DC Switch I/O Voltage	Switch Conducting	-1.5	1.5	V
$V_{SW(OFF)}$	DC Switch I/O Voltage	Switch Isolated	-1.5	1.5	V
V_{CNTRL}	Select Input Voltage	#1S, #2S	0	3	V

DC Electrical Characteristics

Unless otherwise specified, typical values are for T_A=25°C.

Symbol	Parameter	Condition		T_A=-40°C to 85°C				
				Vcc (V)	Min.	Typ.	Max.	Unit
$V_{CC(HYS)}$	Supply Voltage Hysteresis					180		mV
I_{ON}	Switch ON Leakage Current	nA=-0.5V, 0.5V, 1.5V, -1.5V, nB=Float, #1S=#2S=Float		0		0.1		µA
I_{OFF}	Switch OFF Leakage Current	nA=-0.5V, 0.5V, 1.5V, -1.5V, nB=GND, #1S=#2S=V_{CC}		1.8		0.5		µA
I_{CCT}	Increase in ICC for each Select Pin	#1S=V_{CC}, #2S=1.2V,		3		7		µA
		#1S=1.2V, #2S=V_{CC}						
R_{ON}	Switch On Resistance	I_{SW}=100mA, V_{SW}=-1.5V to 1.5V		0		0.35		Ω
ΔR_{ON}	Switch On Resistance Difference, Channel to Channel	I_{SW}=100mA, V_{SW}=-1.5V to 1.5V		0		0.01		Ω
$R_{FLAT(ON)}$	On Resistance Flatness	I_{SW}=100mA, V_{SW}=-1.5V to 1.5V		0		0.01		Ω
R_{PD}	V_{CC} Pull-Down Resistance			<0.2		1.5		MΩ
R_{PU}	Select Pull-Up Resistance			<0.2		3		MΩ
I_{CC}	Quiescent Supply Current	#1S=#2S=0V or Float	Switch Isolated	1.5 – 3.0		50		µA
			Switch Conducting	0.2		0.2		
V_{IH}	Select Pin Input High Voltage			1.5 – 3.0	1.2			V
V_{IL}	Select Pin Input Low Voltage			1.5 – 3.0			0.5	V

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AC Electrical Characteristics

Unless otherwise specified, typical values are for T_A=25°C.

Symbol	Parameter	Condition		T_A=-40°C to 85°C				
				Vcc (V)	Min.	Typ.	Max.	Unit
t_{ON}	Turn-On Time V_{CC} to Output	R_L=32Ω, C_L=10pF	V_{SW}=1.5 V	1.8 → 0		1		μs
		#nS=Float, Figure 3	V_{SW}=-1.5 V	1.8 → 0		1		
t_{OFF}	Turn-Off Time V_{CC} to Output	R_L=32Ω, C_L=10pF	V_{SW}=1.5 V	0 → 1.8		130		μs
		#nS=Float, Figure 3	V_{SW}=-1.5 V	0 → 1.8		170		
t_{ONS}	Turn-On Time Select Pin	R_L=32Ω, C_L=10pF	V_{SW}=1.5 V	1.8		180		μs
		#nS=V_{CC} → 0, Figure 4	V_{SW}=-1.5 V	1.8		180		
t_{OFFS}	Turn-Off Time Select Pin	R_L=32Ω, C_L=10pF	V_{SW}=1.5 V	1.8		55		μs
		#nS=0 → V_{CC}, Figure 4	V_{SW}=-1.5 V	1.8		100		
BW	-3 dB Bandwidth	V_{SW}= 600mVp-p, R_L=50Ω; C_L=5pF		0		340		MHz
THD+N	Total Harmonic Distortion+Noise	V_{SW}=1V_{RMS}, R_L=32Ω, f=1kHz	Non A-weighted	0		-103		dB
			A-weighted			-107		dB
OIRR	Port Off Isolation	V_{SW}= 0.707V_{RMS}, R_L=32Ω, f=20Hz to 100kHz, Figure 5		1.8	-70	-88		dB
X_{TALK}	Cross Talk	V_{SW}=1V_{RMS}, f=20kHz, R_L=32Ω		1.8		-100		dB
		V_{SW}=1 V_{RMS}, f=100kHz, R_L=32Ω				-75		
PSRR	Power Supply Rejection Ratio	Switch Isolating, V_{Ripple}=V_{CC}+300 mVp-p , R_L=32Ω	217Hz	1.8		-80		dB
			1kHz			-77		
			20kHz			-73		

Capacitance

Unless otherwise specified, typical values are for T_A=25°C.

| Symbol	Parameter	Condition	T_A=-40°C to 85°C				
			Vcc (V)	Min.	Typ.	Max.	Unit
C_{ON}	On Capacitance	V_{SW}=400mVPP, f=1MHz,	0		21		pF
C_{OFF}	Off Capacitance	V_{SW}=400mVPP, f=1MHz, #1S=#2S=V_{CC}	1.8		25		pF
C_{CTRL}	Select Pin Capacitance	#nS=400mVPP, f=1MHz,	1.8		5		pF

Timing Diagrams
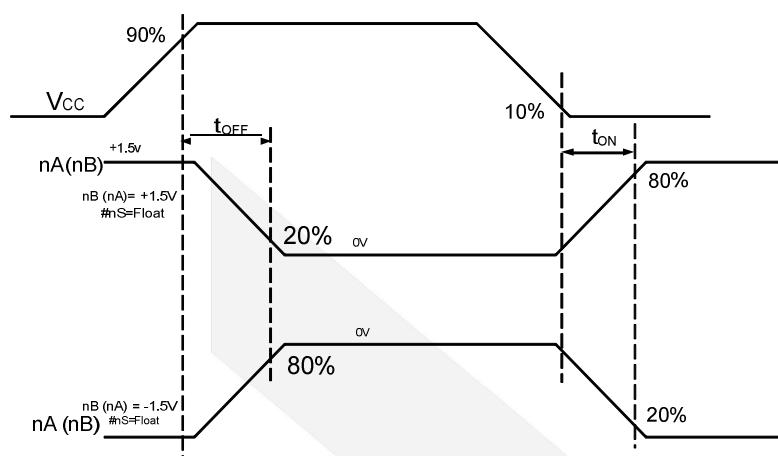
Figure 3. t_{ON}/t_{OFF} VCC to Output Timing
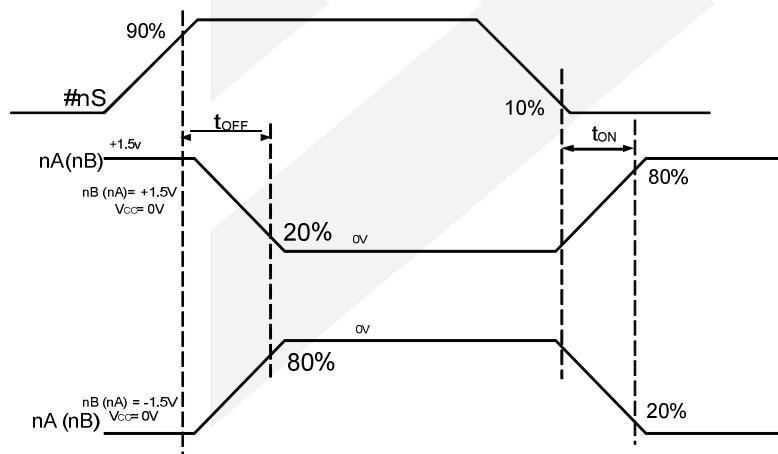

**Figure 4. t_{ON}/t_{OFF} Select (#nS) to Output Timing**

R_S and R_T are function of application

OFF Isolation $= 20Log(V_{OUT}/V_{IN})$
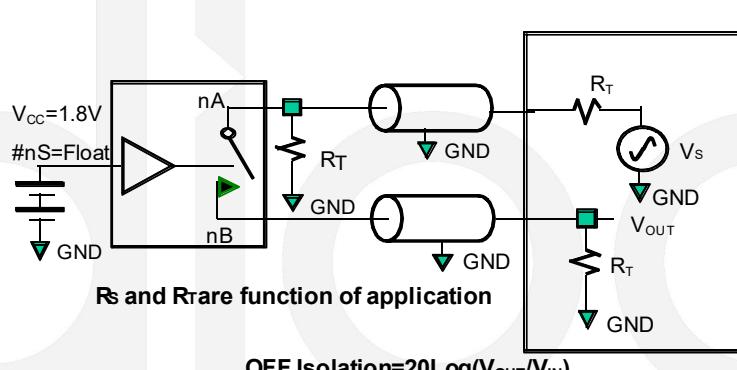
Figure 5. OFF Isolation

# Typical Performance Characteristics

ICC vs. VCC

Supply Current vs. Supply Voltage

ICC VS. Temperature

Supply Current vs. Temperature

Ron

Switch On Resistance vs. Switch Voltage

OIRR

Off Isolation vs. Frequency

THD (A-Weighted)

THD+N Ration vs. Frequency

THD (Non A-Weighted)

THD+N Ration vs. Frequency

DIO1553
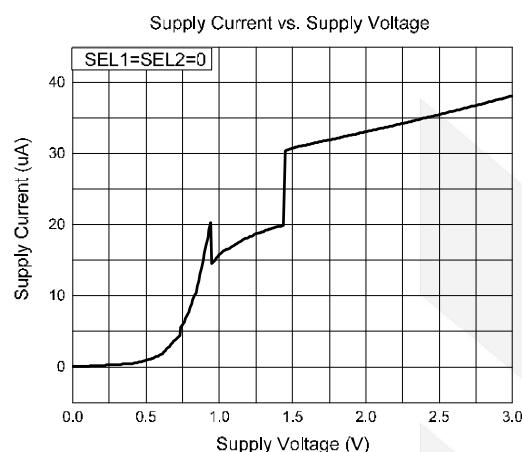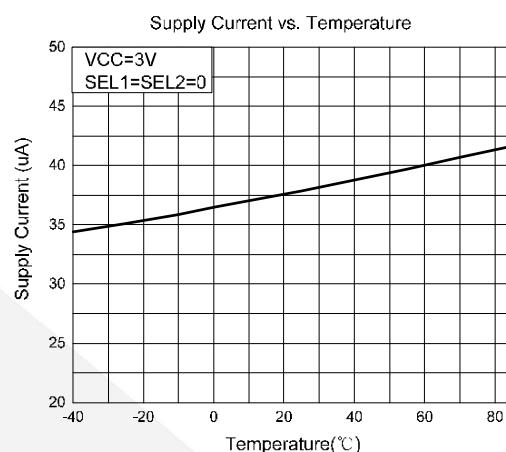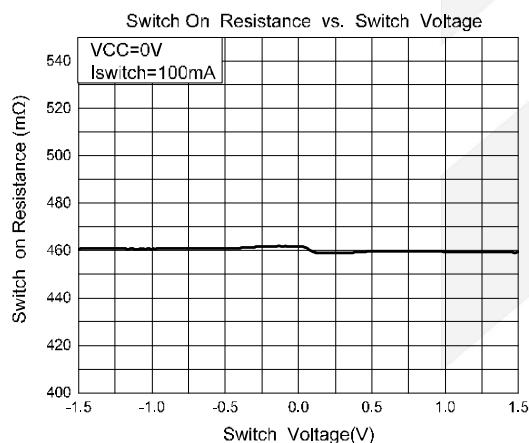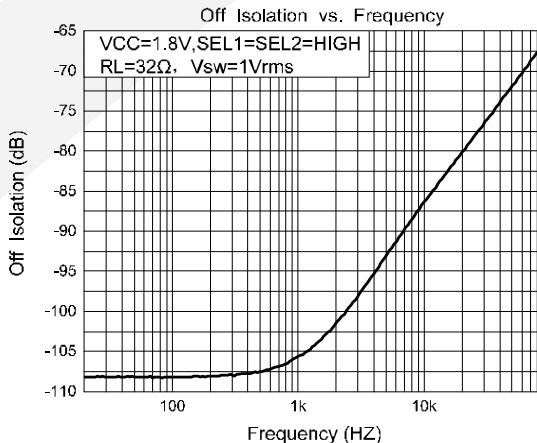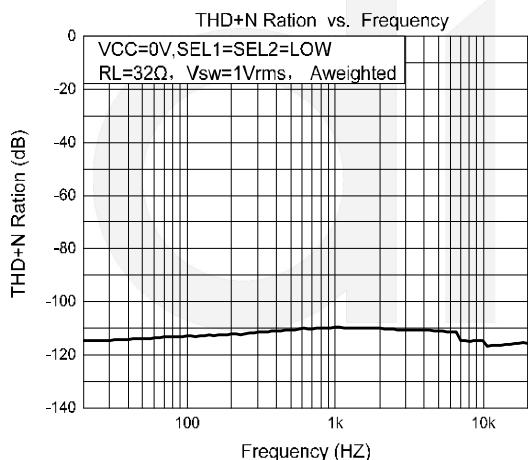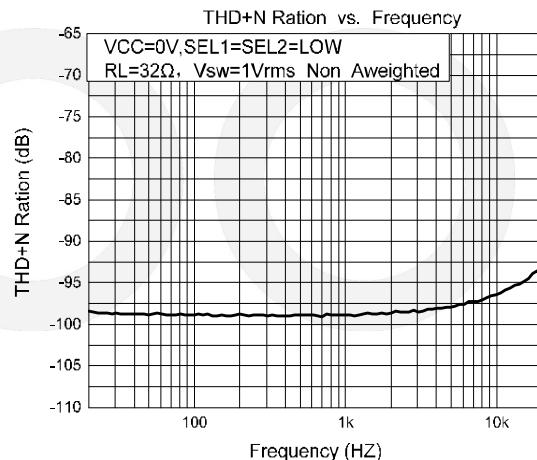
Physical Dimensions: WLCSP-9

Dual SPST Depletion Audio Switch with Negative Swing
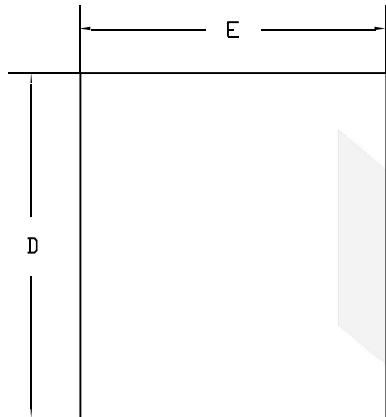
TOP VIEW
(MARK SIDE)
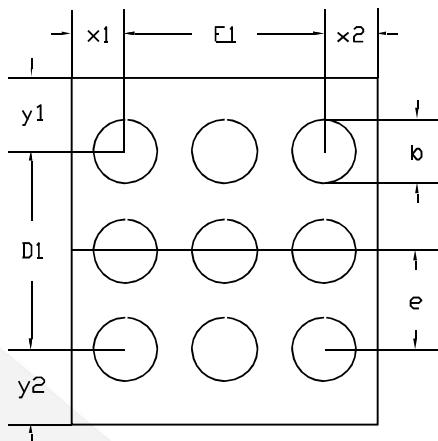
BOTTOM VIEW
(BALL SIDE)
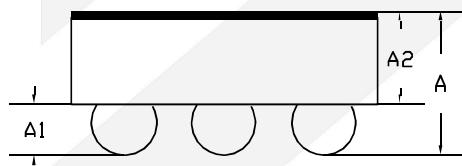
SIDE VIEW

NOTES:
ALL WAFER ORIENTATION NOTCH DOWN

Symbol	Min.	NOM.	Max.
A	0.541	0.581	0.624
A1	0.183	0.203	0.223
A2	0.358	0.378	0.398
D	1.365	1.385	1.405
D1		0.800BSC	
E	1.195	1.215	1.235
E1		0.800BSC	
b	0.23	0.26	0.29
e		0.400BSC	
x1		0.2075REF	
x2		0.2075REF	
y1		0.2925REF	
y2		0.2925REF	

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