April 2015

FSA553
Dual SPST Depletion Audio Switch with Negative Swing

Features

- Dual SPST Depletion Switch
- Normally Closed when VCC < 0.2 V
- Switches Configurable through Select Pins
- V_{SW}: -1.5 V to +1.5 V
- R_{ON}: 0.4 Ω (Typical)
- R_{FLAT} < 0.01 Ω (Typical)
- THD+N: -104 dB (Typical)
- OIRR: -78 dB (Typical)

Description

The FSA553 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 FSA553 to achieve excellent THD+N performance while consuming minimal power.

Related Resources

- FSA553 Evaluation Board

Applications

- Smart Phones
- Tablets, Ultra Books

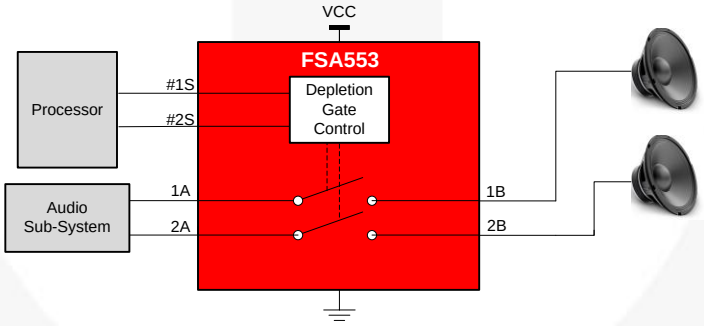
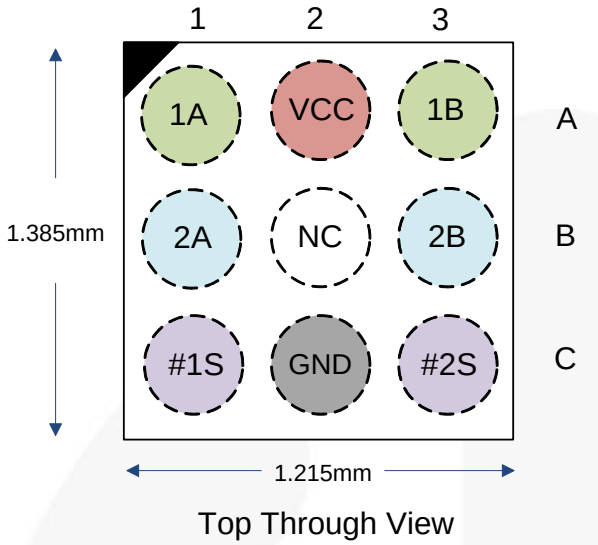


Figure 1. Application Block Diagram

Ordering Information

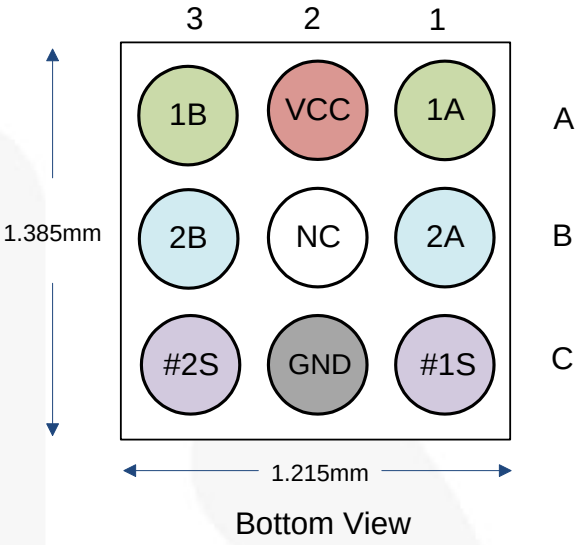
Part Number	Operating Temperature Range	Top Mark	Package	Packing Method
FSA553UCX	-40 to 85°C	NG	9-Ball WLCSP, 0.40 mm Pitch, 1.215 x 1.385 x 0.58 mm (Nominal)	3000 Units on Tape & Reel

Pin Configuration



Top Through View

Figure 2. Top Through View



Bottom View

Figure 3. Bottom View

Pin Descriptions

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	V_{CC}	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)

Table 1. Switch Truth Table

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 Ratings

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	-2.0	2.0	V
$V_{SW(OFF)}$	DC Switch I/O Voltage (Switch Isolated)	1A, 1B, 2A, 2B	-2.0	2.0	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	I/O Ports		7	kV
		All Other Pins		4	
	Charged Device Model, JEDEC: JESD22-C101			2	
	IEC 61000-4-2 System	Contact		8	
		Air Gap		15	
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; #1S=#2S=HIGH)		1.5	3.0	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	3.0	V

DC Electrical Characteristics

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

Symbol	Parameter	Condition		V_{CC} (V)	T_A=-40°C to +85°C			Unit
					Min.	Typ.	Max.	
$V_{CC(HYS)}$	Supply Voltage Hysteresis					450		mV
I_{ON}	Switch ON Leakage Current	nA=-0.5 V, 0.5 V, 1.5 V, -1.5 V, nB=Float, #1S=#2S=Float		0		0.1		µA
I_{OFF}	Switch OFF Leakage Current	nA=-0.5 V, 0.5 V, 1.5 V, -1.5 V, nB=GND, #1S=#2S=V_{CC}		1.8		0.5		µA
I_{CCT}	Increase in I_{CC} for each Select Pin	#1S=V_{CC}, #2S=1.2 V, #1S=1.2 V, #2S=V_{CC}		3.0		7		µA
R_{ON}	Switch On Resistance	I_{SW}=100 mA, V_{SW}=-1.5 V to +1.5 V		0		0.40	0.80	Ω
ΔR_{ON}	Switch On Resistance Difference, Channel to Channel	I_{SW}=100 mA, V_{SW}=-1.5 V to +1.5 V		0		0.01		Ω
$R_{FLAT(ON)}$	On Resistance Flatness	I_{SW}=100 mA, V_{SW}=-1.5 V to +1.5 V		0		0.01		Ω
R_{PD}	V_{CC} Pull-Down Resistance			<0.2		5.0		MΩ
R_{PU}	Select Pull-Up Resistance			<0.2		3.0		MΩ
I_{CC}	Quiescent Supply Current	#1S=#2S=0 V or Float	Switch Isolated	1.5 – 3.0		80		µA
			Switch Conducting	0.2		0.5		
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			0.55	V

AC Electrical Characteristics

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

Symbol	Parameter	Condition		V_{CC} (V)	T_A=- 40°C to +85°C			Unit
					Min.	Typ.	Max.	
t_{ON}	Turn-On Time V_{CC} to Output	R_L=32 Ω, C_L=10 pF, #nS=Float, Figure 4	V_{SW}=1.5 V	1.8 → 0		450		µs
			V_{SW}=-1.5 V	1.8 → 0		350		
t_{OFF}	Turn-Off Time V_{CC} to Output	R_L=32 Ω, C_L=10 pF, #nS=Float, Figure 4	V_{SW}=1.5 V	0 → 1.8		250		µs
			V_{SW}=-1.5 V	0 → 1.8		150		
t_{ONS}	Turn-On Time Select Pin	R_L=32 Ω, C_L=10 pF, #nS=V_{CC} → 0, Figure 5	V_{SW}=1.5 V	1.8		350		µs
			V_{SW}=-1.5 V	1.8		300		
t_{OFFS}	Turn-Off Time Select Pin	R_L=32 Ω, C_L=10 pF, #nS=0 → V_{CC}, Figure 5	V_{SW}=1.5 V	1.8		150		µs
			V_{SW}=-1.5 V	1.8		50		
BW	-3 dB Bandwidth	V_{SW}= 600 mV_{p-p}, R_L=50 Ω; C_L=5 pF,		0		200		MHz
THD+N	Total Harmonic Distortion + Noise	V_{SW}=1 V_{RMS}, R_L=32 Ω, f=1 kHz	Non A-weighted	0		-104		dB
			A-weighted			-107		dB
O_{IRR}	Port Off Isolation	V_{SW}= 0.707 V_{RMS}, R_L=32 Ω, f=20 Hz to 100 kHz, Figure 6		1.8	-70	-82		dB
X_{TALK}	Cross Talk	V_{SW}=1 V_{RMS}, f=100 kHz, R_L=32 Ω		1.8		-75		dB
		V_{SW}=1 V_{RMS} f = 20 kHz, R_L=32 Ω				-100		
PSRR	Power Supply Rejection Ratio	Switch Isolating, V_{Ripple}=V_{CC}+300 mV_{p-p} , R_L=32 Ω	217Hz	1.8		-80		dB
			1 kHz			-77		
			20 kHz			-73		

Capacitance

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

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

Timing Diagrams

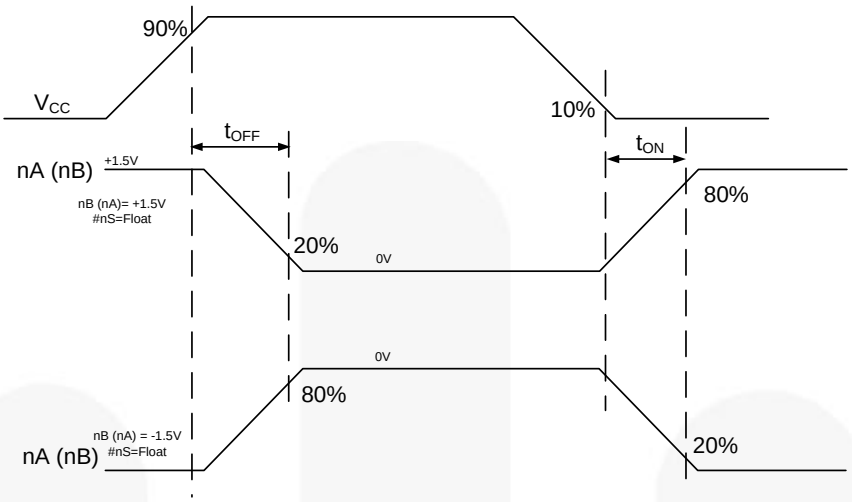


Figure 4. t_{ON}/t_{OFF} V_{CC} to Output Timing

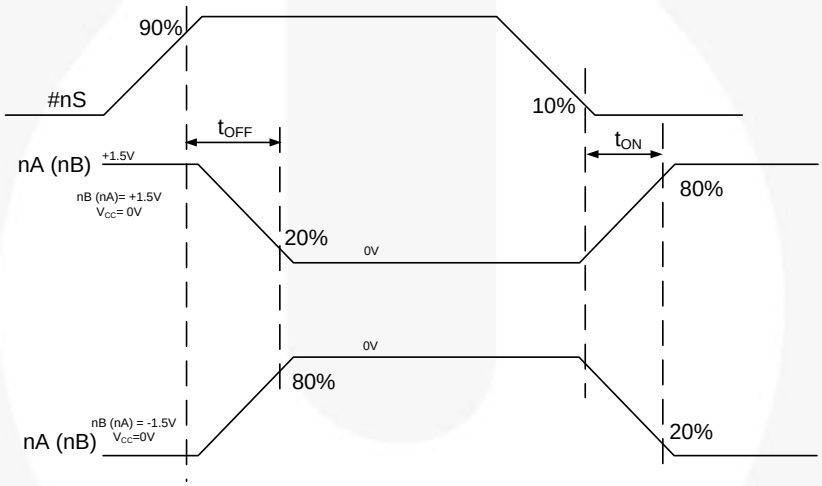
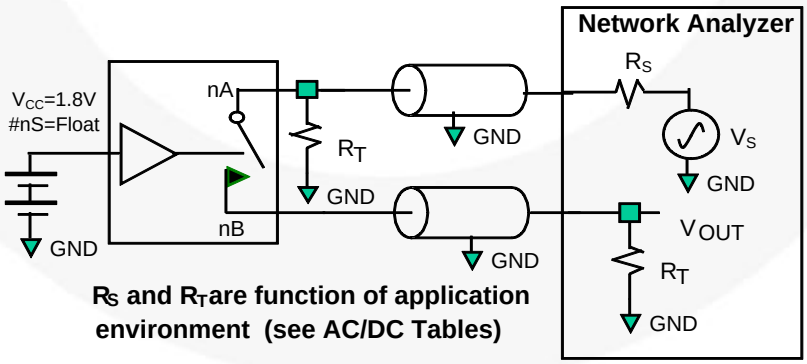


Figure 5. t_{ON}/t_{OFF} Select (#nS) to Output Timing



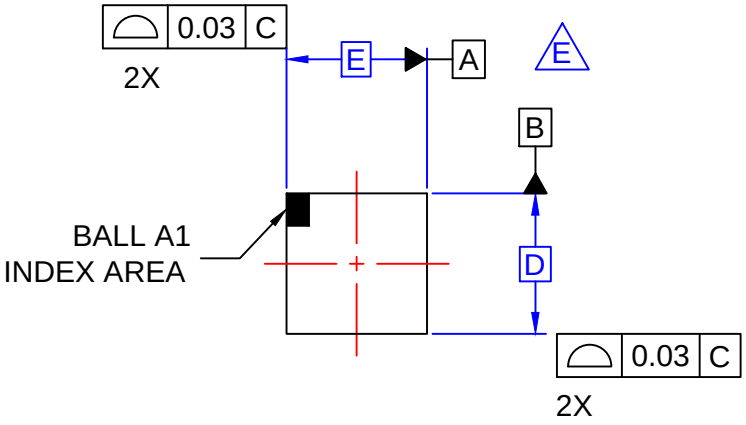
R_S and R_T are function of application environment (see AC/DC Tables)

OFF Isolation = 20 Log (V_{OUT}/V_{IN})

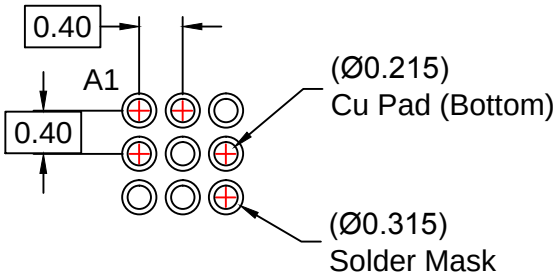
Figure 6. OFF Isolation

Product-Specific Dimensions

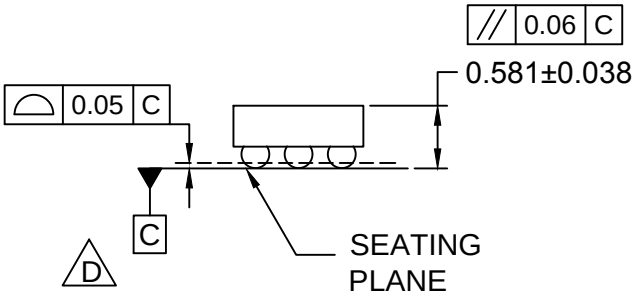
E	D	X	Y
1.215±.03 mm	1.385±.03 mm	0.2075 mm	0.2925 mm

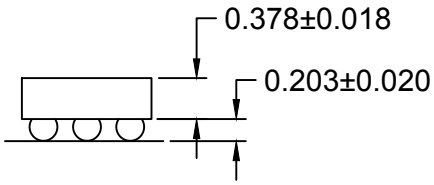


TOP VIEW

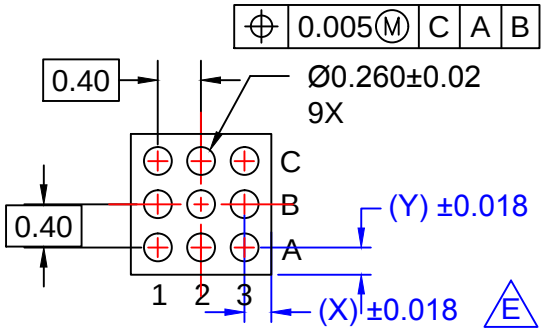


RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)





SIDE VIEWS



BOTTOM VIEW

NOTES

A. NO JEDEC REGISTRATION APPLIES.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCE PER ASME Y14.5M, 2009.
D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
E. FOR DIMENSIONS D,E,X, AND Y SEE PRODUCT DATASHEET.
F. DRAWING FILNAME: MKT-UC009Ak rev3

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