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November 2014

FSA551
Dual SPST Depletion Mode Audio Switch

Features

- Dual SPST

- Depletion Mode Technology

- -3 dB Bandwidth: 240 MHz

- V_{CC-OFF}: 1.5 V to 3.0 V

- V_{CC-ON}: 0 V to 0.2 V

- V_{SW-OFF}: -0.3 V to 3 V

- V_{SW-ON}: -0.3 V to 3 V

- R_{ON}: 0.38 Ω Typical

- R_{ON} Flat: 0.01 Ω (Typical)

- THD+N: 0.0005% (Typical)

- Fairchild Green, RoHS Compliant, Halogen Free

Description

The FSA551 is a high-performance dual single-pole single-throw (SPST x 2) audio switch. The Depletion Mode 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 Mode gate control allows the FSA551 to achieve excellent THD+N performance while consuming minimal power.

Related Resources

- FSA551 Evaluation Board

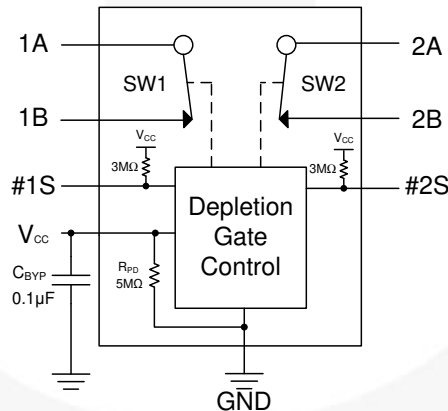## Applications

- Smart Phones

- Tablets, Ultra Books

Figure 1.   Top Level Block Diagram

Ordering Information

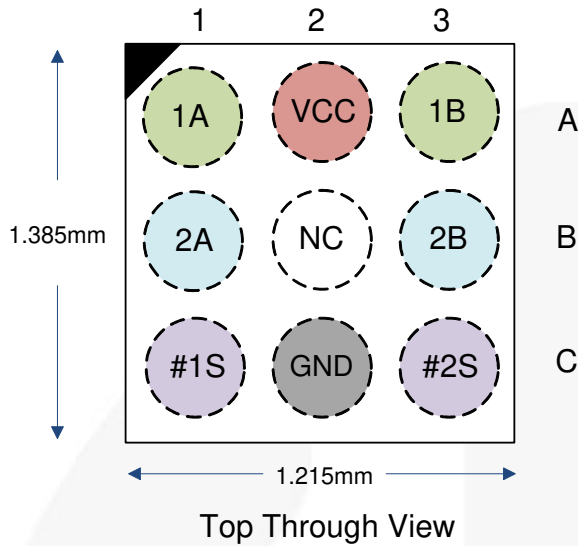| Part Number	Operating Temperature Range	Top Mark	Package	Packing Method
FSA551UCX	-40 to 85°C	U9	9-Ball WLCSP, 0.40 mm Pitch, 1.215 x 1.385 x 0.58 mm (Nominal)	3000 Units on Tape & Reel

Pin Configuration
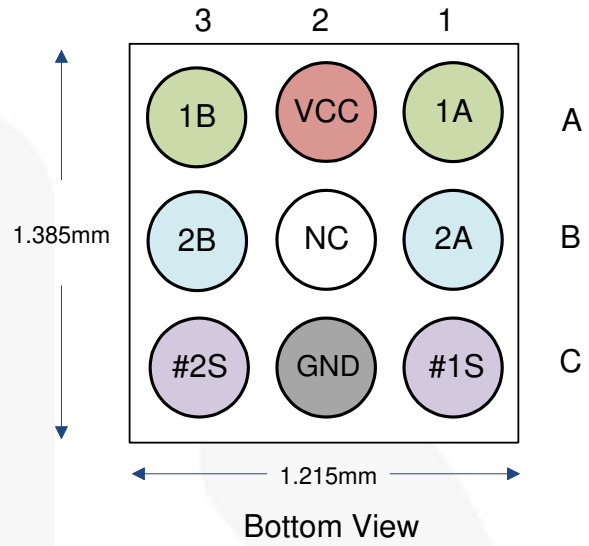

Figure 2. Top Through View

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	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.   Depletion Mode Control 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

Table 2.   Recommended External Component

Component	Description	Vendor	Parameter	Min.	Typ.	Unit
C_{BYP}	0.1 µF, 10%, 6.3 V, X5R, 0201	Murata GRM033R60J104K	C	0.65	0.1	µF

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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	4.6	V
V_{CNTRL}	Control Input Voltage	#1S, #2S	-0.5	4.6	V
$V_{SW(ON)}$	DC Switch I/O Voltage (Switch Conducting)	1A, 1B, 2A, 2B	-0.5	3.3	V
$V_{SW(OFF)}$	DC Switch I/O Voltage (Switch Isolated)	1A, 1B, 2A, 2B	-0.5	3.3	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		5	
	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	-0.3	3.0	V
$V_{SW(OFF)}$	DC Switch I/O Voltage	Switch Isolated	-0.3	3.0	V
V_{CNTRL}	Control Input Voltage	#1S, #2S	0	3.0	V

DC Electrical Characteristics

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

Symbol	Parameter	Condition	V_{CC} (V)	T_A=-40°C to +85°C Min.	Typ.	Max.	Unit
$V_{CC(HYS)}$	Supply Voltage Hysteresis				450		mV
I_{ON}	Switch-to-GND Leakage Current (Switch Conducting)	1A=2.6 V, 1B=Float, 2A=2.6 V, 2B=Float	0		0.1	5	µA
I_{OFF}	Switch-to-GND Leakage Current (Switch Isolated)	1A =2.6 V, 1B=GND, 2A=2.6 V, 2B=GND, #1S=#2S=V_{CC}	1.8		0.1	10	µA
I_{CCT}	Increase in I_{CC} per Control Voltage	#1S or #2S=1.2 V	3.0		7	15	µA
R_{ON}	Switch On Resistance	I_{SW}=100 mA, V_{SW}=-0.3 V to 3 V	0		0.38	0.60	Ω
ΔR_{ON}	Switch On Resistance Difference, Channel to Channel	I_{SW}=100 mA, V_{SW}=-0.3 V to 3 V	0		0.01		Ω
$R_{FLAT(ON)}$	On Resistance Flatness	I_{SW}=100 mA, V_{SW}=-0.3 V to 3 V	0		0.01		Ω
R_{PD}	V_{CC} Pull-Down Resistance		<0.2		5.0		MΩ
R_{PU}	Control Pull-Up Resistance		<0.2		3.0		MΩ
I_{CC}	Quiescent Supply Current	Switch Isolated, #1S=#2S=V_{CC}	1.5 - 3.0		70	120	µA
		Switch On	0.2		0.1	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=2 kΩ, C_L=10 pF, V_{SW}=3 V, (Measured 90/10%), Figure 5	1.8 → 0		445		μs
t_{OFF}	Turn-Off Time V_{CC} to Output	R_L=2 kΩ, C_L=10 pF, V_{SW}=3 V, (Measured 90/10%), Figure 5	0 → 1.8		175		μs
t_{ONS}	Turn-On Time Control Pin	$_nA$=2 kΩ to 2.85 V, $_nB$=1 Ω//10 pF to GND, #$_nS$= 1.8 → 0 V, (Measured 20/80%), Figure 5	1.8		205		μs
t_{OFFS}	Turn-Off Time Control Pin	$_nA$=2 kΩ to 2.85 V, $_nB$=1 Ω//10 pF to GND, #$_nS$= 0 → 1.8 V, (Measured 20/80%), Figure 4, Figure 5	1.8		29		μs
O_{IRRA}	Port A Off Isolation	$_nA$=2 kΩ to GND, $_nB$=1 Ω to GND, #$_nS$=V_{CC}, Port B V_{SW}=600 mV_{PP} Ground Referenced, (Measure at f=20 kHz), Figure 7	1.8		-75		dB
O_{IRRB}	Port B Off Isolation	$_nA$=2 kΩ to 2.85 V, $_nB$=1 Ω to GND, #$_nS$=V_{CC}, Port A V_{DC} + 300 m$V_{PP(AC)}$, (Measure at f=20 kHz), Figure 6	1.8		-100		dB
BW	-3dB Bandwidth	R_L=2 kΩ, C_L=0 pF	0		240		MHz
THD+N	Total Harmonic Distortion + Noise	R_L=2 kΩ, f=20 Hz to 20 kHz, DC Bias=0 V, V_{SW}=600 mV_{PP}, Measurement BW < 22 kHz	0		0.0005		%

Capacitance

Symbol	Parameter	Condition	V_{CC} (V)	T_A= +25°C			Unit
				Min.	Typ.	Max.	
C_{ON}	On Capacitance	f=1 MHz, 400 mV_{PP}, 1A, 1B, 2A, 2B	0		21		pF
C_{OFF}	Off Capacitance	f=1 MHz, 400 mV_{PP}, 1A, 1B, 2A, 2B, #1S=#2S=V_{CC}	1.8		25		pF
C_{CTRL}	Control Pin Capacitance	f=1 MHz, 400 mV_{PP}, #1S, #2S	1.8		2.5		pF

Oscillator Frequency

Symbol	Parameter	Condition	V_{CC} (V)	T_A= +25°C			Unit
				Min.	Typ.	Max.	
f_{OSC}	Oscillator Frequency[1]	Oscillator Enabled	1.8		775		kHz
$f_{OSC\%}$	Oscillator Frequency Tolerance Over Process & Temperature[1]	Oscillator Enabled	1.8			30	%

Note:
1. Parameters guaranteed by Design and Characterization.

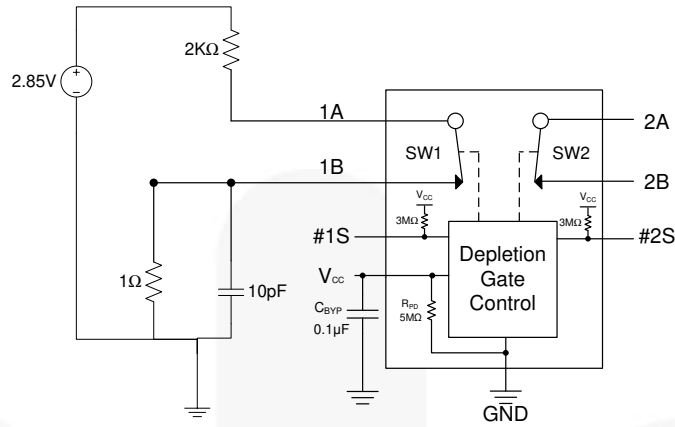# Timing Diagrams

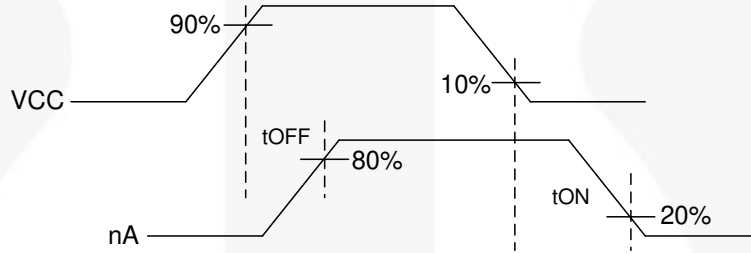**Figure 4.** t_{ON}/t_{OFF}, t_{ONS}/t_{OFF}

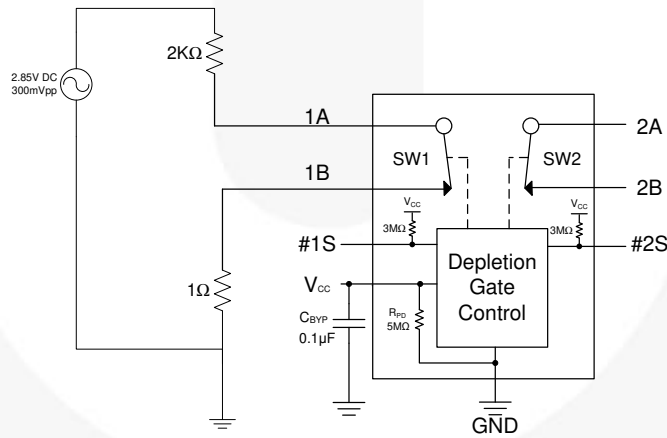**Figure 5.   Turn-On / Turn-Off Timing**

Figure 6.   Off Isolation (B Port)
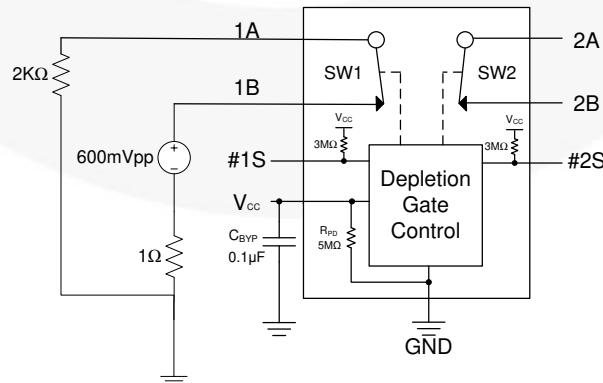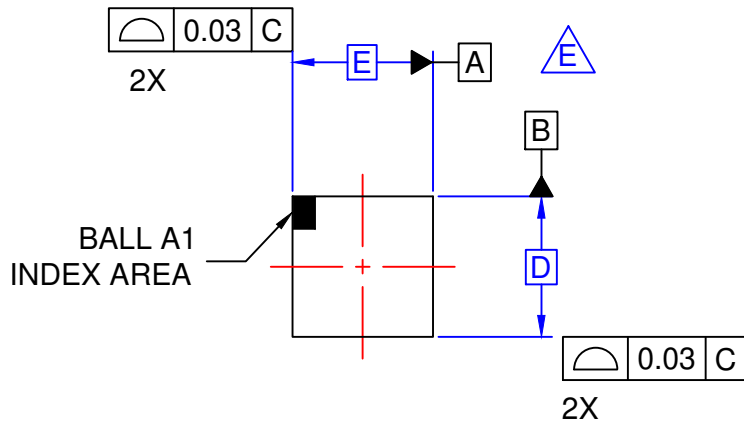
Figure 7.   Off Isolation (A Port) / Cross Talk

Product-Specific Dimensions

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

TOP VIEW

⌒ | 0.03 | C
2X

E ▶ A

⬡ E

B

BALL A1
INDEX AREA

D

⌒ | 0.03 | C
2X
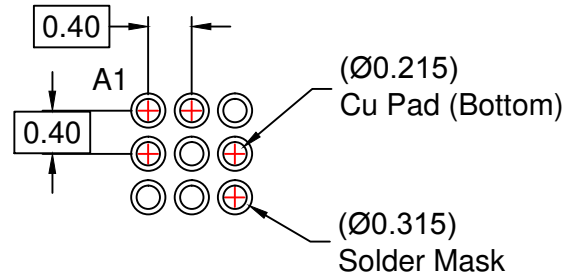
RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)

0.40

A1

0.40

(Ø0.215)
Cu Pad (Bottom)

(Ø0.315)
Solder Mask

SIDE VIEWS

∥ | 0.06 | C

0.581±0.038

⌒ | 0.05 | C

C

⬡ D

SEATING
PLANE

0.378±0.018

0.203±0.020
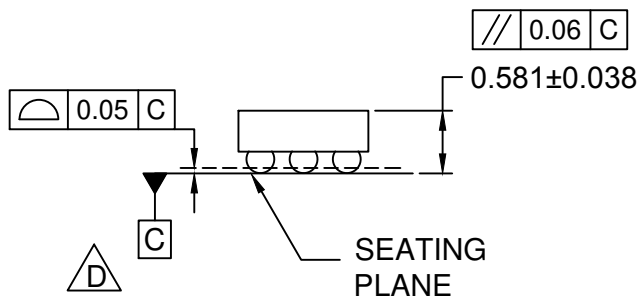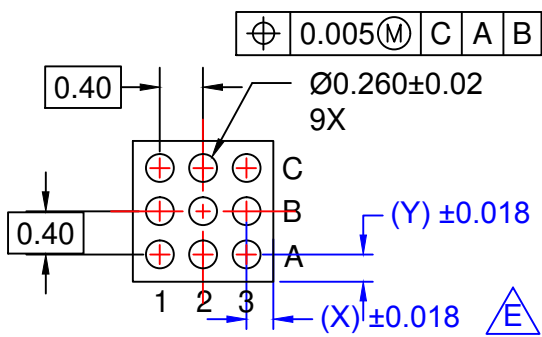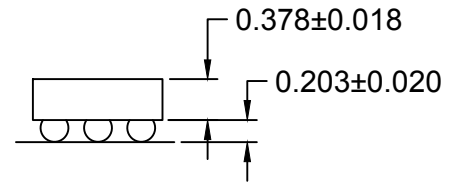
NOTES

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

BOTTOM VIEW

⊕ | 0.005Ⓜ | C | A | B

0.40

Ø0.260±0.02
9X

0.40

C
B
A

(Y) ±0.018

1 2 3

(X) ±0.018   ⬡E

ON Semiconductor

ON

PUBLICATION ORDERING INFORMATION