

Dual SPST Depletion Audio Switch with Negative Swing

FSA553

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 VCC available and to isolate signals when VCC is present. During signal conduction, the Depletion gate control allows the FSA553 to achieve excellent THD+N performance while consuming minimal power.

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)
- This Device is Pb-Free and Halide Free

Table of Contents

- FSA553 Evaluation Board

Applications

- Smart Phones
- Tablets, Ultra Books

Block Diagram

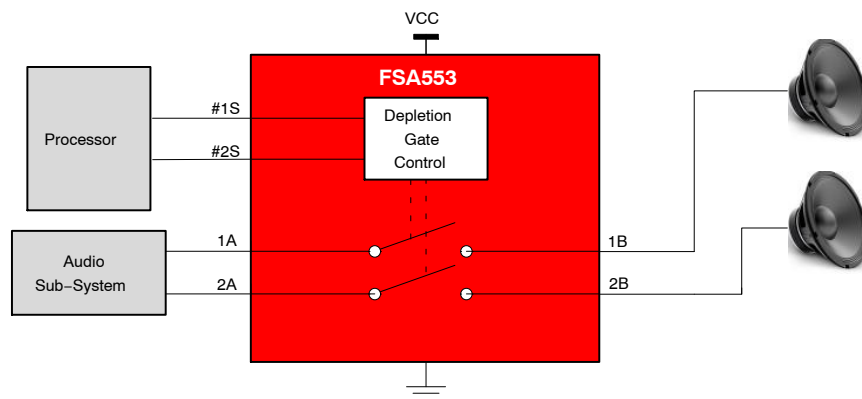
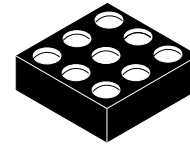


Figure 1. Application Block Diagram



WLCSP9 1.385x1.215x0.581
CASE 567SV

MARKING DIAGRAM



NG = Specific Device Code
 &K = 2-Digits Lot Run Traceability Code
 &. = Pin One Dot
 &2 = 2-Digit Date Code
 &Z = Assembly Plant Code

*Date Code orientation and/or position may vary depending upon manufacturing location.

ORDERING INFORMATION

Device	Package	Shipping [†]
FSA553UCX	WLCSP9 (Pb-Free)	3000 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](http://www.onsemi.com/BRD8011/D).

Pin Configuration

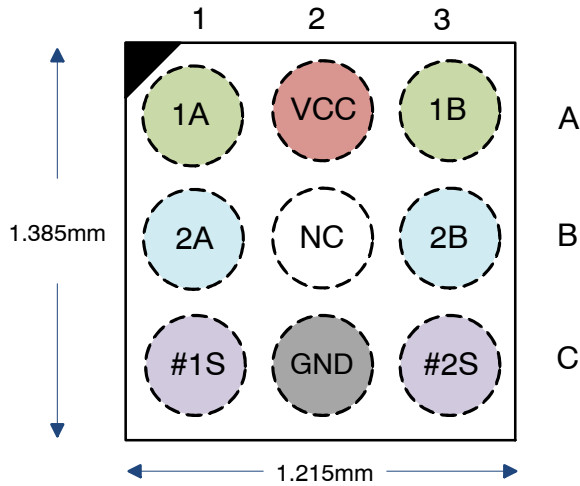


Figure 2. Top Through View

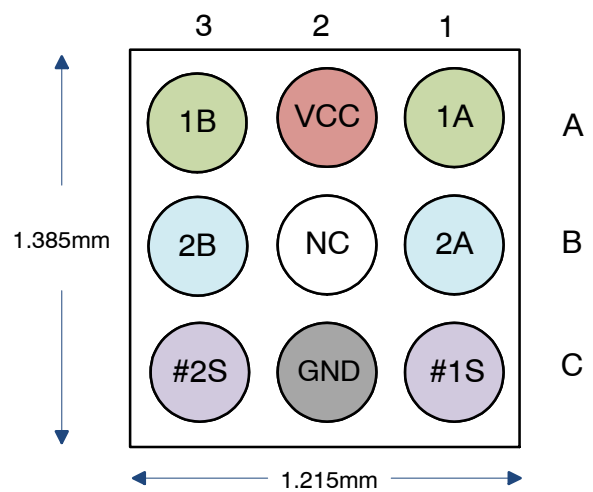


Figure 3. Bottom View

PIN DESCRIPTION

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)

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

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 C 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

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS

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 Input Voltage	Switch Conducting	−1.5	1.5	V
V _{SW(OFF)}	DC Switch I/O Input Voltage	Switch Isolated	−1.5	1.5	V
V _{CNTRL}	Select Input Voltage	#1S, #2S	0	3.0	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

FSA553

DC ELECTRICAL CHARACTERISTICS (Typical values are for $T_A = 25^\circ\text{C}$ unless otherwise specified.)

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			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	$I_{SW} = 100\text{ mA}$, $V_{SW} = -1.5\text{ V to } +1.5\text{ V}$	0		0.40	0.80	Ω
ΔR_{ON}	Switch On Resistance Difference, Channel to Channel	$I_{SW} = 100\text{ mA}$, $V_{SW} = -1.5\text{ V to } +1.5\text{ V}$	0		0.01		Ω
$R_{FLAT(ON)}$	On Resistance Flatness	$I_{SW} = 100\text{ mA}$, $V_{SW} = -1.5\text{ V to } +1.5\text{ V}$	0		0.01		Ω
R_{PD}	V_{CC} Pull-Down Resistance		<0.2		5.0		M Ω
R_{PU}	Select Pull-Up Resistance		<0.2		3.0		M Ω
I_{CC}	Quiescent Supply Current	Switch Isolated, #1S = #2S = V_{CC}	1.5 to 3.0		80		μA
		Switch On	0.2		0.5		
V_{IH}	Select Pin Input High Voltage		1.5 to 3.0	1.2			V
V_{IL}	Select Pin Input Low Voltage		1.5 to 3.0			0.55	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

FSA553

AC ELECTRICAL CHARACTERISTICS (Typical values are for $T_A = 25^\circ\text{C}$ unless otherwise specified.)

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

CAPACITANCE (Typical values are for $T_A = 25^\circ\text{C}$ unless otherwise specified.)

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			Unit
				Min	Typ	Max	
C _{ON}	On Capacitance	$V_{SW} = 400\ \text{mV}_{pp}$, $f = 1\ \text{MHz}$,	0		21		pF
C _{OFF}	Off Capacitance	$V_{SW} = 400\ \text{mV}_{pp}$, $f = 1\ \text{MHz}$, #1S = #2S = V_{CC}	1.8		25		pF
C _{CTRL}	Select Pin Capacitance	#nS = $400\ \text{mV}_{pp}$, $f = 1\ \text{MHz}$	1.8		5		pF

FSA553

TIMING DIAGRAMS

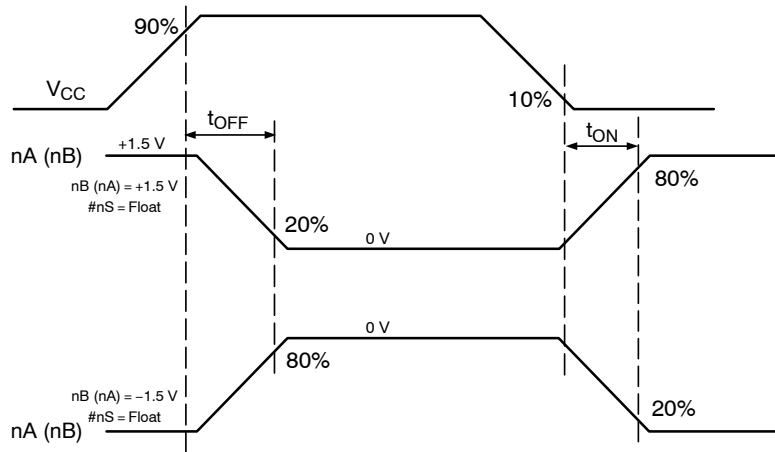


Figure 4. t_{ON}/t_{OFF} V_{CC} to Output Timing

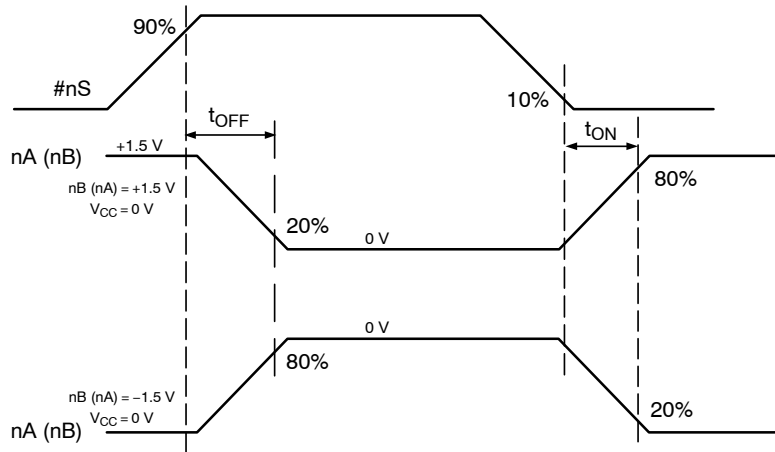


Figure 5. t_{ON}/t_{OFF} Select ($\#nS$) to Output Timing

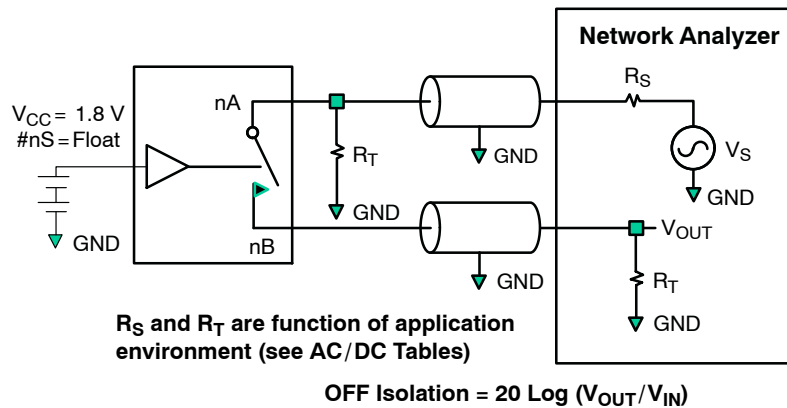


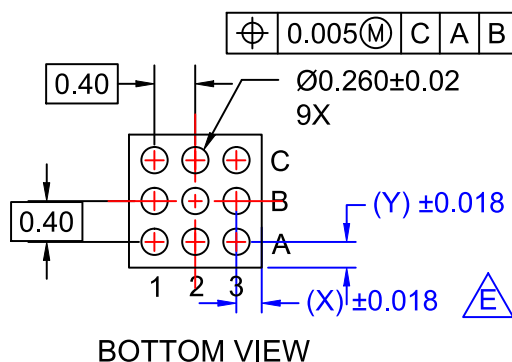
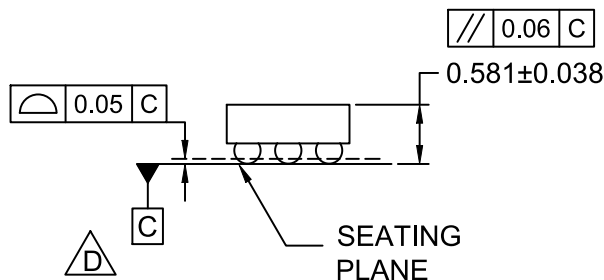
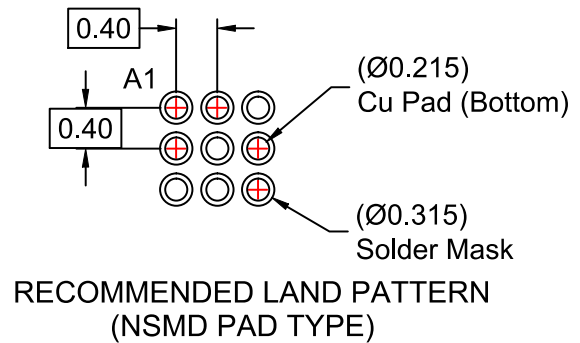
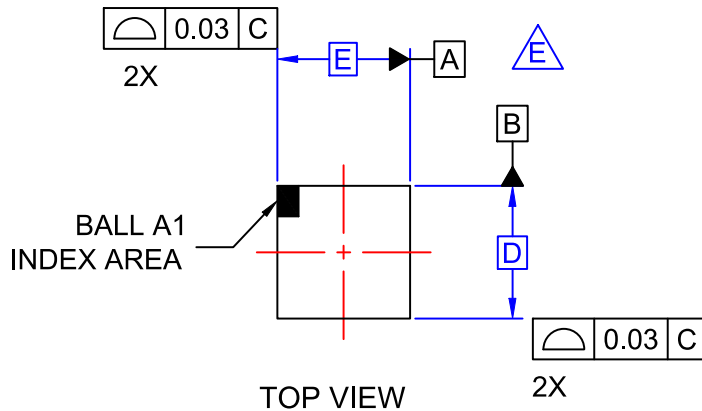
Figure 6. OFF Isolation

PRODUCT-SPECIFIC DIMENSIONS

E	D	X	Y
1.215±0.03 mm	1.385±0.03 mm	0.2075	0.2925

WLCSP9 1.385x1.215x0.581
CASE 567SV
ISSUE O

DATE 30 NOV 2016



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.

DOCUMENT NUMBER:	98AON16623G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	WLCSP9 1.385x1.215x0.581	PAGE 1 OF 1

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales