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#### June 2016

# FSA2276 — DPDT (0.5 $\Omega$ ) HiFi Audio Switch w/ Negative Swing

#### **Features**

- V<sub>DD</sub> Operating Range: 1.65 to 5.5 V
- External Capacitor Connection for Pop and Click Noise Suppression
- Power-Off Protection on Common Ports
- R<sub>ON</sub> = 0.5 Ω (Typ.) at 1.8 V
- THD+N = -115 dB; 2 V<sub>RMS</sub>, 20 kΩ Load; f = 1 kHz
- X<sub>TALK</sub> = -122 dB at 1 V<sub>RMS</sub>, 50 Ω Load; f = 1 kHz
- Off Isolation = -115 dB at 1 V<sub>RMS</sub>, 50  $\Omega$  Load; f = 1 kHz
- 12-Lead UMLP 1.8 mm x 1.8 mm

### **Applications**

- Mobile Phone, Tablet, Notebook PC, Media Player
- Docking Station, TV, Set-Top Box, LCD Monitor

### Description

The FSA2276 is a high-performance, Double-Pole Double-Throw (DPDT) analog switch with negative swing audio capability. The FSA2276 features ultra-low audio R<sub>ON</sub> of  $0.5\,\Omega$  (typical) at  $1.8\,V\,V_{DD}$ . The FSA2276 operates over a V<sub>DD</sub> range of  $1.65\,V$  to  $5.5\,V$ , is fabricated with sub-micron CMOS technology to achieve fast switching speeds, and is designed for break-before-make operation. To minimize pop and click during operation, the turn on ramp time is selectable using an external capacitor (C\_EXT).

The FSA2276 features THD+N specifications that target a Hi-Fidelity audio quality into both 32  $\Omega$  headphones and line out type loads (>600  $\Omega$ ).

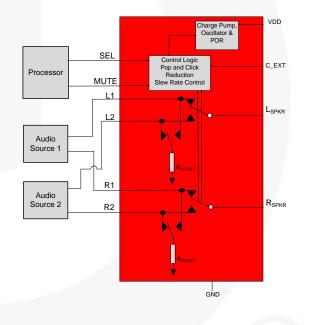


Figure 1. Application Block Diagram

Ordering Inform	nation		
Part Number	Top Mark	Package Description	
FSA2276UMX	EN	12-Lead, UMLP, Quad, JEDEC MO252, 1.8 mm x 1.8 mm	

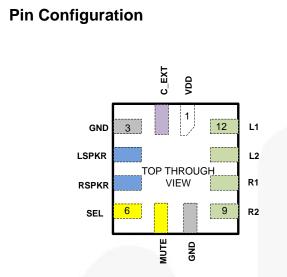


Figure 2. Pin Assignment (Top Through View)

### **Pin Descriptions**

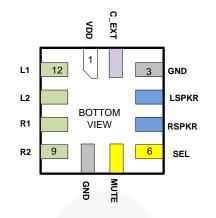


Figure 3. Pin Assignment (Bottom View)

Pin	Name	Description
1	VDD	Power Supply (1.65 to 5.5 V)
2	C_EXT	Slow Turn On External Capacitor
3	GND	Ground
4	L <sub>SPKR</sub>	Audio L <sub>SPPKR</sub> Common I/O Port
5	R <sub>SPKR</sub>	Audio R <sub>SPPKR</sub> Common I/O Port
6	SEL	Select Pin
7	MUTE	Mute Enable - Active High
8	GND	Ground
9	R2	Audio – Right Channel Source2 I/O Port
10	R1	Audio – Right Channel Source1 I/O Port
11	L2	Audio – Left Channel Source2 I/O Port
12	L1	Audio – Left Channel Source1 I/O Port

## **Truth Table**

Mute	SEL	Function	Resistor Terminations
0	0	$L1 = L_{SPKR}; R1 = R_{SPKR}$	R <sub>SHUNT(s)</sub> connect to L2/R2
0	1	$L2 = L_{SPKR}; R2 = R_{SPKR}$	R <sub>SHUNT(s)</sub> connect to L1/R1
1	0	L1 ≠ L <sub>SPKR</sub> ; L2 ≠ L <sub>SPKR</sub> ; R1 ≠ R <sub>SPKR</sub> ; R2 ≠ R <sub>SPKR</sub> (All Paths Hi-Z)	R <sub>SHUNT(s)</sub> OPEN
1	1	L1 ≠ L <sub>SPKR</sub> ; L2 ≠ L <sub>SPKR</sub> ; R1 ≠ R <sub>SPKR</sub> ; R2 ≠ R <sub>SPKR</sub> (All Paths Hi-Z)	R <sub>SHUNT(s)</sub> OPEN

## **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	Paramete	Min.	Max.	Unit		
$V_{DD}$	Supply/Control Voltage	pply/Control Voltage			V	
V <sub>CNTRL</sub>	Control Input Voltage	SEL, MUTE	-0.3	6.0	V	
$V_{\text{SW}}$	DC Switch I/O Voltage	L1, L2, R1, R2, L <sub>SPKR</sub> , R <sub>SPKR</sub>		3.5	V	
l <sub>IK</sub>	ESD Input Diode Current			-50	mA	
I <sub>SW</sub>	Switch I/O Current			700	mA	
	Human Body Model, ANSI/ESDA/ JEDEC JS-001-2012	All Pins	5			
ESD	Charged Device Model, JEDEC: JESD22-C101		2		kV	
		Contact	8			
	1EC 61000-4-2 System	IEC 61000-4-2 System Air Gap				
T <sub>A</sub>	Absolute Maximum Operating Temperature	Absolute Maximum Operating Temperature			°C	
T <sub>STG</sub>	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. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter		Min.	Тур.	Max.	Unit
V <sub>DD</sub>	Supply Voltage		1.65	1.80	5.50	V
V <sub>SW</sub>	DC Switch I/O Voltage	L1, L2, R1, R2, L <sub>SPKR</sub> , R <sub>SPKR</sub>	-3.0		3.0	V
V <sub>CNTRL</sub>	Control Input Voltage	SEL, MUTE	0		V <sub>DD</sub>	V
I <sub>SW</sub>	DC Switch I/O Current			100		mA
T <sub>A</sub>	Ambient Operating Temperatur	re la	-40	25	+85	°C

FSA2276 — DPDT (0.5  $\Omega$ ) HiFi Audio Switch w/ Negative Swing

DC Characterist	ics
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 $V_{DD}$  = 1.65 V to 5.5 V,  $V_{DD}$  (Typ.) = 1.8 V,  $T_A$  = -40°C to 85°C, and  $T_A$  (Typ.) = 25°C, unless otherwise specified.<sup>(1)</sup>

Symbol	Parameter	Condition	V <sub>DD</sub> (V)	T <sub>A</sub> =-40°C to +85°C			Unit	
				Min.	Тур.	Max.		
VIH	VCNTRL Pin Input High Voltage (SEL, MUTE)	C_EXT = FLOAT		1.17		VDD	V	
VIL	VCNTRL Pin Input Low Voltage (SEL, MUTE)	C_EXT = FLOAT C_EXT = FLOAT		0		0.5	V	
I <sub>ON</sub>	Switch-to-Gnd ON Leakage Current	L1, R1, L2, R2 = -3 V to 3 V, $L_{SPKR}$ , R <sub>SPKR</sub> = Float (I <sub>SW</sub> = 0 mA) MUTE=LOW, SEL=0 or VDD C_EXT = FLOAT, Figure 6	1.65 to 5.5	-1.0	0.1	1.0	μA	
I <sub>NO_MUTE</sub>	Switch-to-Gnd OFF Leakage Current (when Muted)	L1, R1, L2, R2 = -3 V to 3 V, $L_{SPKR}$ , R <sub>SPKR</sub> = Float (I <sub>SW</sub> = 0 mA) MUTE = HIGH, SEL = 0 or VDD C_EXT = FLOAT, Figure 5	1.65 to 5.5	-1.0	0.1	1.0	μA	
I <sub>OFF</sub>	Input Leakage Current <sup>(2)</sup>	L1, R1, L2, R2 = -3 V to 3 V, $L_{SPKR}$ , R <sub>SPKR</sub> = Float (I <sub>SW</sub> = 0 mA) MUTE = LOW, SEL = 0 or VDD, C_EXT = FLOAT	0	-1.0	0.1	1.0	μA	
I <sub>IN</sub>	Control Input Leakage Current <sup>(3)</sup> (SEL, MUTE)	L1, R1, L2, R2 = -3 V to 3 V, L <sub>SPKR</sub> , R <sub>SPKR</sub> = Float (I <sub>SW</sub> = 0 mA), C_EXT = FLOAT	1.65 to 5.5	-0.5	0.1	0.5	μA	
I <sub>DD</sub>	VDD Supply Current	MUTE = LOW, SEL = 0 or VDD, C_EXT = FLOAT	5.5		16	30	μA	
I <sub>DDZ</sub>	VDD Hi-Z Supply Current	MUTE = HIGH, SEL = 0 or VDD, C_EXT = FLOAT	5.5			1	μA	
I <sub>DDT</sub>	Increase in IDD per Control Voltage	MUTE = LOW, SEL = 0 or 1.8 V SEL = LOW, MUTE = 0 or 1.8 V C_EXT = FLOAT	5.5			1	μA	
Ron	Switch On Resistance	ISW = 100 mA, V <sub>SW</sub> = -3 V to 3 V C_EXT = FLOAT, Figure 4	1.65 to 5.5		0.5	1.0	Ω	
ΔR <sub>ON</sub>	On Resistance Matching, Channel to Channel	ISW = 100 mA, V <sub>SW</sub> = -3 V to 3 V C_EXT = FLOAT	1.65 to 5.5		30		mΩ	
R <sub>FLAT</sub>	On Resistance Flatness	ISW = 100 mA, $V_{SW}$ = -3 V to 3 V C_EXT = FLOAT	1.65 to 5.5		1		mΩ	
R <sub>SHUNT</sub>	Click and Pop Resistance (L1, L2, R1, R2, L <sub>SPKR</sub> , R <sub>SPKR</sub> )	VLX_RX = 3.0 V, MUTE = 0, SEL = 0 or VDD, C_EXT = FLOAT		6	10	14	kΩ	

#### Notes:

1. Limits over the recommended temperature operating range ( $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ ) are correlated by statistical quality.

2. Only valid for  $V_{SW} > 0 V$ .

3.  $V_{MUTE} \le V_{DD} + 0.3$  otherwise additional input leakage current may flow.

Symbol	Demonster	O an diti an		V 00	T <sub>A</sub> =-	40°C to	+85°C	11
	Parameter	Condition		V <sub>DD</sub> (V)	Min.	Тур.	Max.	Unit
	Enable Time	L1 = R1 = L2 = R2 = 1.5 V,	C_EXT = Float	1.8, 3.3		0.5		
t <sub>MUTE_ON</sub>	(MUTE to	$L_{SPKR}$ , $R_{SPKR}$ = 50 $\Omega$ to GND SEL= 0 or $V_{DD}$ ; See Figure 7	C_EXT = 0.1 µF	1.8		60		ms
	Output)	and Figure 8	C_EXT = 0.1 µF	3.3		100		
ton mute	Disable Time (MUTE to	L1 = R1= L2 = R2 = 1.5 V, L <sub>SPKR</sub> , R <sub>SPKR</sub> = 50 $\Omega$ to GND,	C_EXT = Float	1.8, 3.3		35		μs
	Output)	SEL = 0 or $V_{DD}$ ; See Figure 7 and Figure 8	C_EXT = 0.1 µF	-,		35		
		L1 (L2) = R1 (R2) = 1.5 V, L2 (L1) = R2 (R1) = 0 V	C_EXT = Float	1.8, 3.3		0.5		
t <sub>ON_SEL</sub>	Turn On Time (SEL to Output)	$L_{\text{SPKR}}$ , $R_{\text{SPKR}}$ = 50 $\Omega$ to GND,	C_EXT = 0.1 µF	1.8		50		ms
		SEL = 0 or $V_{DD}$ ; MUTE = 0 See Figure 7 and Figure 8	C_EXT = 0.1 µF	3.3		100		
t <sub>OFF_SEL</sub>	Turn On Time	L1 (L2) = R1 (R2) = 1.5 V, L2 (L1) = R2 (R1) = 0 V L <sub>SPKR</sub> , R <sub>SPKR</sub> = 50 $\Omega$ to GND,	C_EXT = Float	1.8, 3.3		20		μs
-OFT_OEE	(SEL to Output)	SEL= 0 or $V_{DD}$ ; MUTE = 0 See Figure 7 and Figure 8	C_EXT = 0.1 µF			20		F
t <sub>BBM</sub>	Break Before Make Time (SEL to Output)	L1 (L2) = R1 (R2) = 1.5 V, L <sub>SPKR</sub> , R <sub>SPKR</sub> = 50 $\Omega$ to GND,SEL = 0 or V <sub>DD</sub> ; C_EXT = FLOAT, MUTE = 0 V; See Figure 7 and Figure 9		1.8, 3.3		500		μs
O <sub>IRR</sub>	Off Isolation <sup>(4)</sup>	$      f = 1 \text{ kHz},  \text{R}_{\text{L}} = 50  \Omega,  \text{C}_{\text{L}} = 0  \text{p} \\       \text{MUTE} = 0  \text{V}_{\text{SW}} = 1  \text{V}_{\text{RMS}}  \text{Figure} $		1.8, 3.3		-115		dB
OIKK		$      f = 1 \text{ MHz},  \text{R}_{\text{L}} = 50  \Omega,  \text{C}_{\text{L}} = 0  \text{p} \\ \text{MUTE} = 0  \text{V}_{\text{SW}} = 1  \text{V}_{\text{RMS}} \text{ Figure} $		1.0, 0.0		-92		
O <sub>IRRM</sub>	Off Isolation-	$      f = 1 \text{ kHz},  \text{R}_\text{L} = 50  \Omega,  \text{C}_\text{L} = 0  \text{p} \\       \text{MUTE} = \text{V}_\text{DD} \text{; } \text{V}_\text{SW} = 1  \text{V}_\text{RMS}  \text{F} $		1.8, 3.3		-113		dB
	Muted <sup>(4)</sup>	$      f = 1 \text{ MHz},  \text{R}_{\text{L}} = 50  \Omega,  \text{C}_{\text{L}} = 0  \text{p} \\       \text{MUTE} = \text{V}_{\text{DD}};  \text{V}_{\text{SW}} = 1  \text{V}_{\text{RMS}}  \text{F} $		1.0, 0.0		-95		
X <sub>talk</sub>	Cross Talk (Adjacent) <sup>(4)</sup>	$      f = 1 \text{ kHz},  \text{R}_{\text{L}} = 50  \Omega,  \text{V}_{\text{SW}} = 1                                 $	V <sub>RMS</sub>	1.8, 3.3	1.	-122		dB
BW	-3 dB Bandwidth <sup>(4)</sup>	$R_L = 50 \Omega$ Figure 10		1.8, 3.3		380		MHz
DODD	Power Supply	$V_{PSRR} = V_{DD} + 100 \text{ mV}_{RMS}$ R <sub>L</sub> = 20 kΩ or 32 Ω ( at L <sub>SPKR</sub> ,	R <sub>L</sub> = 32 Ω	10.00		-119		
PSRR	Rejection Ratio <sup>(4)</sup>	$R_{SPKR}$ , MUTE = 0 or V <sub>DD</sub> , f = 1 kHz, V <sub>SW</sub> = GND or Floa	D 20 KO	1.8, 3.3		-105		dB
		$R_L = 20 \text{ k}\Omega$ , f = 1 kHz,	·			0.00018		%
		$V_{SW} = 2 V_{RMS}$ , With A-weighte	ed, Figure 15			-115		dB
THD+N	Total Harmonic Distortion +	$R_L$ =600 $\Omega$ , f = 1 kHz, $V_{SW}$ = 2	V <sub>RMS</sub>			0.00018		%
	Noise <sup>(4)</sup>	With A-weighted, Figure 15				-115		dB
		$R_L = 32 \Omega$ , $f = 1 \text{ kHz}$ , $V_{SW} = 1$	V <sub>RMS</sub> ,			0.00018		%
		With A-weighted, Figure 15				-115		dB

## **AC Characteristics**

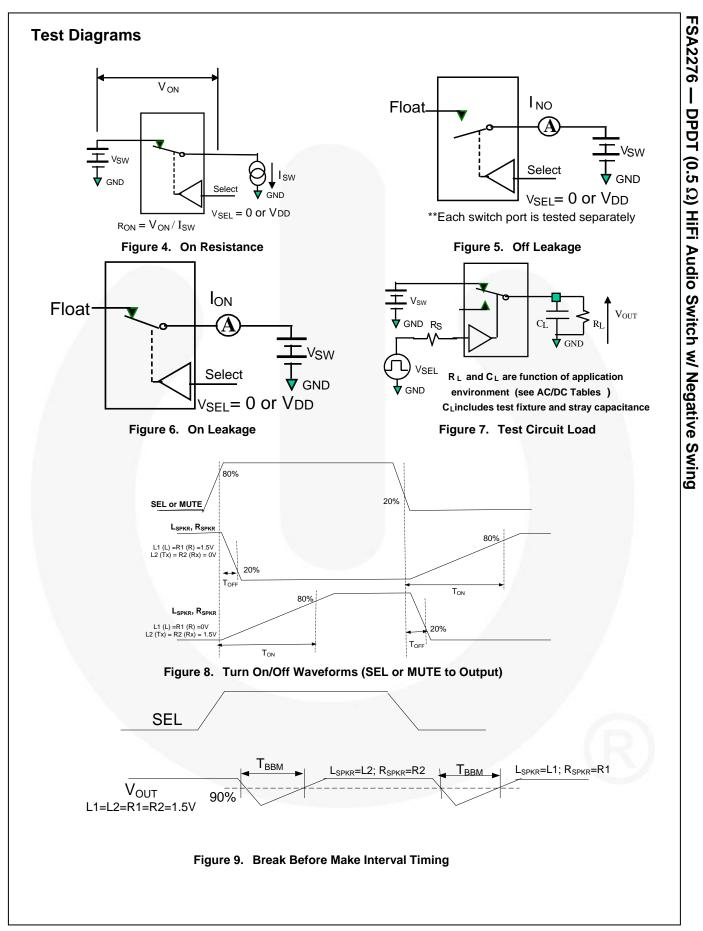
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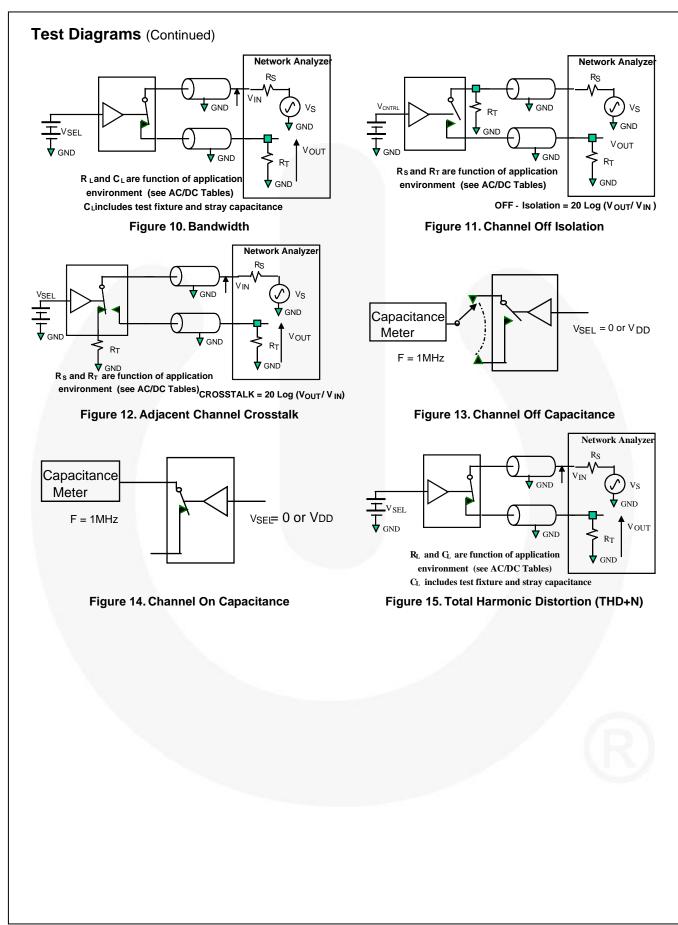
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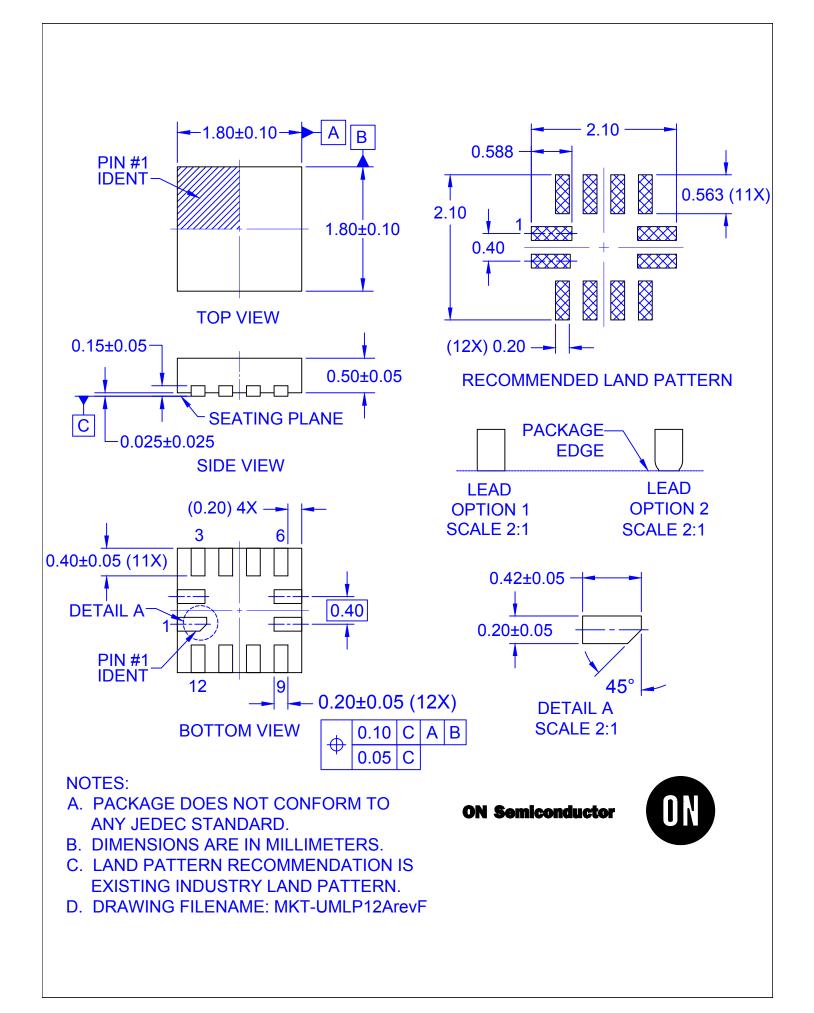
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Symbol	Parameter	Condition	V <sub>DD</sub> (V)	Min.	Тур.	Max.	pF
C <sub>ON</sub>	On Capacitance (Common Port) <sup>(6)</sup>	f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias MUTE = 0 V Figure 14	1.8, 3.3		22		pF
C <sub>OFF1</sub>	Off Capacitance (Common Port) <sup>(6)</sup>	f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias MUTE = V <sub>DD</sub> Figure 13	1.8, 3.3		25		pF
C <sub>OFF2</sub>	Off Capacitance (Non-Common Ports) <sup>(6)</sup>	f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias MUTE = 0 V Figure 13	1.8, 3.3		14		pF
Coff_mute	Off Capacitance - MUTED (Non-Common Ports) <sup>(6)</sup>	f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias, MUTE = V <sub>DD</sub>	1.8, 3.3		14		pF
C <sub>CNTRL</sub>	Control Input Pin Capacitance (MUTE, SEL) <sup>(6)</sup>	f = 1 MHz, 100 mV <sub>PP</sub> , 100 mV DC bias MUTE	- 0		3 6		pF

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