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FSA2275 / FSA2275A — DPDT (0.5 Ω) HiFi Audio Switch w/ Negative Swing

Features

- V_{DD} Operating Range: 2.5 to 5.5 V
- External Capacitor Connection for Pop and Click Noise Suppression
- Power-Off Protection on Common Ports
- R_{ON} = 0.5 Ω (Typ.) at 2.5 V V_{DD}
- THD+N = -105 dB; 2 V_{RMS}, 20 kΩ Load; f = 1 kHz
- X_{TALK} = -134 dB at 1 V_{RMS}, 50 Ω Load; f = 1 kHz
- Off Isolation = -103 dB at 1 V_{RMS}, 50 Ω Load; f = 1 kHz
- 12-Lead UMLP 1.8 mm x 1.8 mm
- Removed R_{SHUNT} resistors for FSA2275A

Applications

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

Description

The FSA2275 / FSA2275A is a high-performance, Double-Pole Double-Throw (DPDT) analog switch with negative swing audio capability. The FSA2275 / FSA2275A features ultra-low audio R_{ON} of 0.5 Ω (typical) at 2.5 V V_{CC}. The FSA2275 / FSA2275A operates over a V_{CC} range of 2.5 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 FSA2275 / FSA2275A features THD+N specifications that target a Hi-Fidelity audio quality into both 32 Ω headphones and line out type loads (>600 Ω).

The FSA2275A removes the shunt resistors which improve noise immunity.

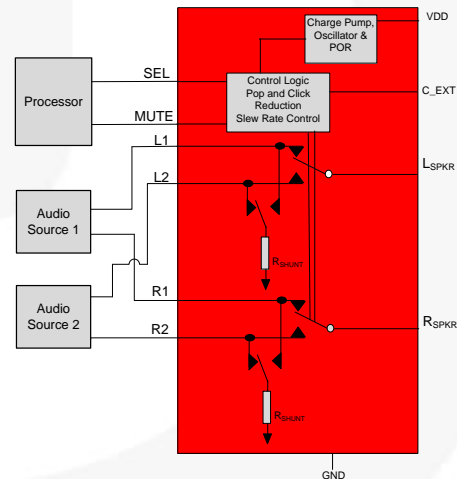


Figure 1. Application Block Diagram

Ordering Information

Part Number	Operating Temperature Range	Top Mark	Package Description	Packing Method
FSA2275UMX	-40 to 85°C	NJ	12-Lead, UMLP, Quad, JEDEC MO252, 1.8 mm x1.8 mm	5000 Units Tape and Reel
FSA2275AUMX		EX		

Pin Configuration

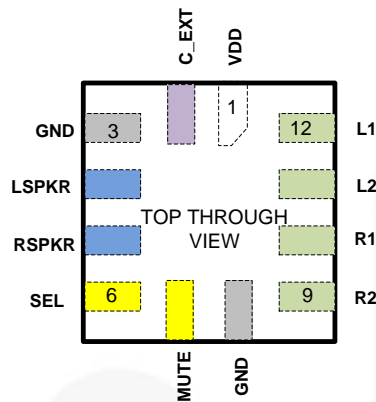


Figure 2. Pin Assignment (Top Through View)

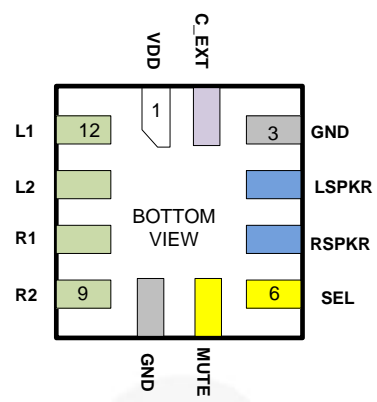


Figure 3. Pin Assignment (Bottom View)

Pin Descriptions

Pin	Name	Description
1	VDD	Power Supply (2.5 to 5.5 V)
2	C_EXT	Slow Turn On External Capacitor
3	GND	Ground
4	LSPKR	Audio L _{SPPKR} Common I/O Port
5	RSPKR	Audio R _{SPPKR} 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 _{SHUNT(s)} connect to L2/R2 (FSA2275 only)
0	1	L2 = L _{SPKR} ; R2 = R _{SPKR}	R _{SHUNT(s)} connect to L1/R1 (FSA2275 only)
1	0	L1 ≠ L _{SPKR} ; L2 ≠ L _{SPKR} ; R1 ≠ R _{SPKR} ; R2 ≠ R _{SPKR} (All Paths Hi-Z)	R _{SHUNT(s)} OPEN (FSA2275 only)
1	1	L1 ≠ L _{SPKR} ; L2 ≠ L _{SPKR} ; R1 ≠ R _{SPKR} ; R2 ≠ R _{SPKR} (All Paths Hi-Z)	R _{SHUNT(s)} OPEN (FSA2275 only)

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 _{DD}	Supply/Control Voltage		-0.3	6.0	V
V _{CNTRL}	Control Input Voltage	SEL, MUTE	-0.3	6.0	V
V _{SW}	DC Switch I/O Voltage	L1, L2, R1, R2, L _{SPKR} , R _{SPKR}	-3.5	3.5	V
I _{IK}	ESD Input Diode Current			-50	mA
I _{SW}	Switch I/O Current			700	mA
ESD	Human Body Model, ANSI/ESDA/ JEDEC JS-001-2012	All Pins	5		kV
	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
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. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter		Min.	Typ.	Max.	Unit
V _{DD}	Supply Voltage		2.5	3.3	5.5	V
V _{SW}	DC Switch I/O Voltage	L1, L2, R1, R2, L _{SPKR} , R _{SPKR}	-3.0		3.0	V
V _{CNTRL}	Control Input Voltage	SEL, MUTE	0	3.6	V _{DD}	V
I _{SW}	DC Switch I/O Current			100		mA
T _A	Ambient Operating Temperature		-40	25	+85	°C

DC Characteristics

$V_{DD} = 2.5 \text{ V to } 5.5 \text{ V}$, $V_{DD} (\text{Typ.}) = 3.3 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$, and $T_A (\text{Typ.}) = 25^\circ\text{C}$, unless otherwise specified.⁽¹⁾

Symbol	Parameter	Condition	V_{DD} (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
V_{IH}	V_{CNTRL} Pin Input High Voltage (SEL, MUTE)	$C_{EXT} = \text{FLOAT}$		1.6		V_{DD}	V
V_{IL}	V_{CNTRL} Pin Input Low Voltage (SEL, MUTE)	$C_{EXT} = \text{FLOAT}$		0		0.4	V
I_{ON}	Switch-to-GND ON Leakage Current	$L1, R1, L2, R2 = -3 \text{ V to } 3 \text{ V}$, $L_{SPKR}, R_{SPKR} = \text{Float}$ ($I_{SW} = 0 \text{ mA}$) $\text{MUTE} = \text{LOW}$, $\text{SEL} = 0$ or V_{DD} $C_{EXT} = \text{FLOAT}$, Figure 6	2.5 to 5.5	-1.0	0.1	1.0	μA
I_{NO_MUTE}	Switch-to-GND OFF Leakage Current (when Muted)	$L1, R1, L2, R2 = -3 \text{ V to } 3 \text{ V}$, $L_{SPKR}, R_{SPKR} = \text{Float}$ ($I_{SW} = 0 \text{ mA}$) $\text{MUTE} = \text{HIGH}$, $\text{SEL} = 0$ or V_{DD} $C_{EXT} = \text{FLOAT}$, Figure 5	2.5 to 5.5	-1.0	0.1	1.0	μA
I_{OFF}	Input Leakage Current ⁽²⁾	$L1, R1, L2, R2 = -3 \text{ V to } 3 \text{ V}$, $L_{SPKR}, R_{SPKR} = \text{Float}$ ($I_{SW} = 0 \text{ mA}$) $\text{MUTE} = \text{LOW}$, $\text{SEL} = 0$ or V_{DD} , $C_{EXT} = \text{FLOAT}$	0	-1.0	0.1	1.0	μA
I_{IN}	Control Input Leakage Current ⁽³⁾ (SEL, MUTE)	$L1, R1, L2, R2 = -3 \text{ V to } 3 \text{ V}$, $L_{SPKR}, R_{SPKR} = \text{Float}$ ($I_{SW} = 0 \text{ mA}$), $C_{EXT} = \text{FLOAT}$	2.5 to 5.5	-0.5	0.1	0.5	μA
I_{DD}	V_{DD} Supply Current	$\text{MUTE} = \text{LOW}$, $\text{SEL} = 0$ or V_{DD} , $C_{EXT} = \text{FLOAT}$	5.5		7	18	μA
I_{DDZ}	V_{DD} Hi-Z Supply Current	$\text{MUTE} = \text{HIGH}$, $\text{SEL} = 0$ or V_{DD} , $C_{EXT} = \text{FLOAT}$	5.5			1	μA
I_{DDT}	Increase in I_{DD} per Control Voltage	$\text{MUTE} = \text{LOW}$, $\text{SEL} = 0$ or 1.8 V $\text{SEL} = \text{LOW}$, $\text{MUTE} = 0$ or 1.8 V $C_{EXT} = \text{FLOAT}$	5.5			15	μA
R_{ON}	Switch On Resistance	$I_{SW} = 100 \text{ mA}$, $V_{SW} = -3 \text{ V to } 3 \text{ V}$ $C_{EXT} = \text{FLOAT}$, Figure 4	2.5 to 5.5		0.5	1.0	Ω
ΔR_{ON}	On Resistance Matching, Channel to Channel	$I_{SW} = 100 \text{ mA}$, $V_{SW} = -3 \text{ V to } 3 \text{ V}$ $C_{EXT} = \text{FLOAT}$	2.5 to 5.5		65		$\text{m}\Omega$
R_{FLAT}	On Resistance Flatness	$I_{SW} = 100 \text{ mA}$, $V_{SW} = -3 \text{ V to } 3 \text{ V}$ $C_{EXT} = \text{FLOAT}$	2.5 to 5.5		1	8	$\text{m}\Omega$
R_{SHUNT}	Click and Pop Resistance (FSA2275 only) ($L1, L2, R1, R2, L_{SPKR}, R_{SPKR}$)	$V_{LX_RX} = 3.0 \text{ V}$, $\text{MUTE} = 0$, $\text{SEL} = 0$ or V_{DD} , $C_{EXT} = \text{FLOAT}$		6	10	14	$\text{k}\Omega$

Notes:

- Limits over the recommended temperature operating range ($T_A = -40^\circ\text{C to } +85^\circ\text{C}$) are correlated by statistical quality.
- Only valid for $V_{SW} > 0 \text{ V}$.
- $V_{MUTE} \leq V_{DD} + 0.3$ otherwise additional input leakage current may flow.

AC Characteristics

$V_{DD} = 2.5\text{ V to }5.5\text{ V}$, $V_{DD}(\text{Typ.}) = 3.3\text{ V}$. $T_A = -40^\circ\text{C to }85^\circ\text{C}$. $T_A(\text{Typ.}) = 25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	Condition	V_{DD} (V)	$T_A = -40^\circ\text{C to }+85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
$t_{\text{MUTE_ON}}$	Enable Time (MUTE to Output)	L1 = R1 = L2 = R2 = 1.5 V, $L_{\text{SPKR}}, R_{\text{SPKR}} = 50\ \Omega$ to GND, SEL = 0 or V_{DD} ; See Figure 7 and Figure 8	2.5, 3.3, 5.5	C_EXT=Float	0.4		ms
				C_EXT=0.1 μF	100		
$t_{\text{ON_MUTE}}$	Disable Time (MUTE to Output)	L1 = R1 = L2 = R2 = 1.5 V, $L_{\text{SPKR}}, R_{\text{SPKR}} = 50\ \Omega$ to GND, SEL = 0 or V_{DD} ; See Figure 7 and Figure 8	2.5, 3.3, 5.5	C_EXT=Float	20		μs
				C_EXT=0.1 μF	20		
$t_{\text{ON_SEL}}$	Turn On Time (SEL to Output)	L1 (L2) = R1 (R2) = 1.5 V, L2 (L1) = R2 (R1) = 0 V $L_{\text{SPKR}}, R_{\text{SPKR}} = 50\ \Omega$ to GND, SEL = 0 or V_{DD} ; MUTE = 0 See Figure 7 and Figure 8	2.5, 3.3, 5.5	C_EXT=Float	0.4		ms
				C_EXT=0.1 μF	100		
$t_{\text{OFF_SEL}}$	Turn On Time (SEL to Output)	L1 (L2) = R1 (R2) = 1.5 V, L2 (L1) = R2 (R1) = 0 V $L_{\text{SPKR}}, R_{\text{SPKR}} = 50\ \Omega$ to GND, SEL = 0 or V_{DD} ; MUTE = 0 See Figure 7 and Figure 8	2.5, 3.3, 5.5	C_EXT=Float	20		μs
				C_EXT=0.1 μF	20		
t_{BBM}	Break Before Make Time (SEL to Output)	L1 (L2) = R1 (R2) = 1.5 V, $L_{\text{SPKR}},$ $R_{\text{SPKR}} = 50\ \Omega$ to GND, SEL = 0 or V_{DD} ; C_EXT = FLOAT, MUTE = 0 V; See Figure 7 and Figure 9	3.3		400		μs
dV/dt_{PCS}	Pop n Click Suppression Output Voltage Ramp Rate	L1 = L2 = +60 mV, R1 = R2 = -60 mV, $L_{\text{SPKR}},$ $R_{\text{SPKR}} = 50\ \Omega$ to GND, SEL = 0 or V_{DD} ; C_EXT = 0.1 μF , MUTE = HL Transition	3.3		4.6		V/s
O_{IRR}	Off Isolation	f = 1 kHz, $R_L = 50\ \Omega$, $C_L = 0\ \text{pF}$, MUTE = 0 $V_{\text{SW}} = 1\ V_{\text{RMS}}$ Figure 11	3.3		-103		dB
				f = 1 MHz, $R_L = 50\ \Omega$, $C_L = 0\ \text{pF}$, MUTE = 0 $V_{\text{SW}} = 1\ V_{\text{RMS}}$ Figure 11		-92	
O_{IRRM}	Off Isolation-Muted	f = 1 kHz, $R_L = 50\ \Omega$, $C_L = 0\ \text{pF}$, MUTE = V_{DD} ; $V_{\text{SW}} = 1\ V_{\text{RMS}}$ Figure 11	3.3		-108		dB
				f = 1 MHz, $R_L = 50\ \Omega$, $C_L = 0\ \text{pF}$, MUTE = V_{DD} ; $V_{\text{SW}} = 1\ V_{\text{RMS}}$ Figure 11		-99	
X_{TALK}	Cross Talk (Adjacent)	f = 1 kHz, $R_L = 50\ \Omega$, $V_{\text{SW}} = 1\ V_{\text{RMS}}$ Figure 12	3.3		-134		dB
BW	-3 dB Bandwidth	$R_L = 50\ \Omega$ Figure 10	3.3		230		MHz
PSRR	Power Supply Rejection Ratio	$V_{\text{PRSS}} = V_{DD} + 100\ \text{mV}_{\text{RMS}}$ $R_L = 20\ \text{k}\Omega$ or $32\ \Omega$ (at $L_{\text{SPKR}},$ R_{SPKR}), MUTE = 0 or V_{DD} $V_{\text{SW}} = \text{GND}$ or Float	3.3	f = 217 Hz	-111		dB
				f = 1 kHz	-103		
				f = 20 kHz	-89		
THD+N	Total Harmonic Distortion + Noise	$R_L = 20\ \text{k}\Omega$, f = 1 kHz, $V_{\text{SW}} = 2\ V_{\text{RMS}}$ with A- weighted, Figure 15	3.3		0.00018		%
					-115		dB
		$R_L = 600\ \Omega$, f = 1 kHz, $V_{\text{SW}} = 2\ V_{\text{RMS}}$ with A- weighted, Figure 15	3.3		0.00018		%
					-115		dB
		$R_L = 32\ \Omega$, f = 1 kHz, $V_{\text{SW}} = 1\ V_{\text{RMS}}$ with A- weighted, Figure 15	3.3		0.00022		%
					-113		dB

Capacitance

Unless otherwise stated, $V_{DD} = 2.5\text{ V to }5.5\text{ V}$, $V_{DD}(\text{Typ.}) = 3.3\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$, and $T_A(\text{Typ.}) = 25^\circ\text{C}$.⁽⁴⁾

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 (Common Port)	$f = 1\text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias MUTE = 0 V Figure 14	3.3		22		pF
C_{OFF1}	Off Capacitance (Common Port)	$f = 1\text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias MUTE = V_{DD} Figure 13	3.3		25		pF
C_{OFF2}	Off Capacitance (Non-Common Ports)	$f = 1\text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias MUTE = 0 V Figure 13	3.3		14		pF
C_{OFF_MUTE}	Off Capacitance - MUTED (Non-Common Ports)	$f = 1\text{ MHz}$, 100 mV_{PK-PK} , 100 mV DC bias, MUTE = V_{DD}	3.3		14		pF
C_{CNTRL}	Control Input Pin Capacitance (MUTE, SEL)	$f = 1\text{ MHz}$, 100 mV_{PP} , 100 mV DC bias	0	SEL	3		pF
				MUTE	6		

Note:

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

Test Diagrams

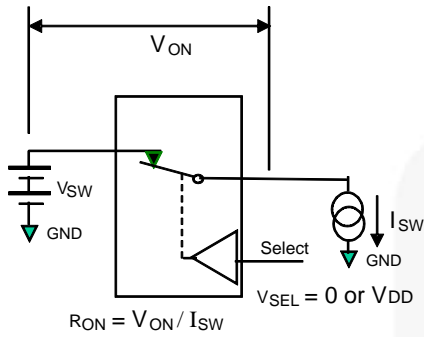


Figure 4. On Resistance

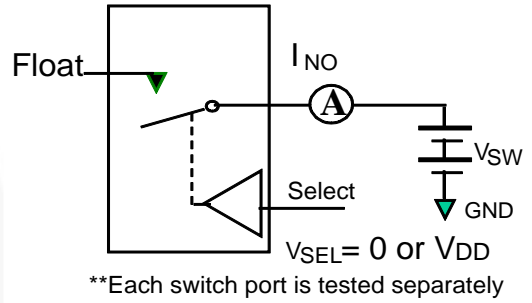


Figure 5. Off Leakage

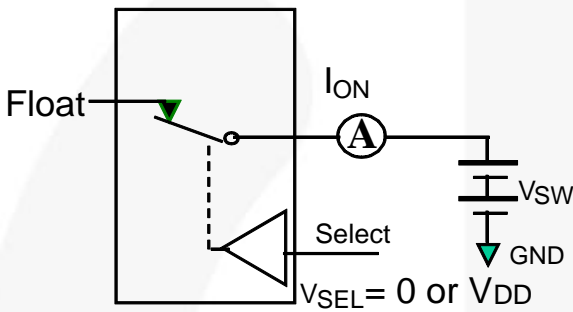


Figure 6. On Leakage

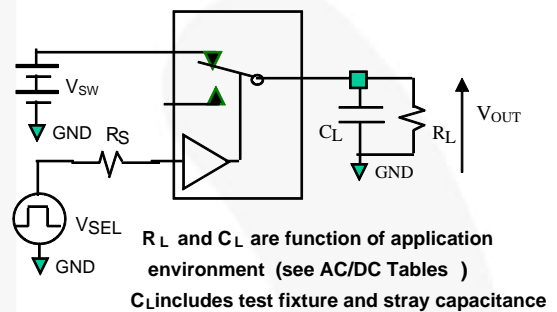


Figure 7. Test Circuit Load

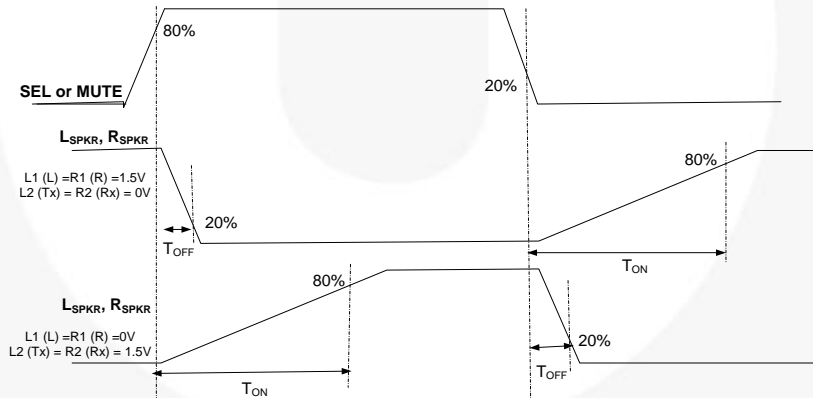


Figure 8. Turn On/Off Waveforms (SEL or MUTE to Output)

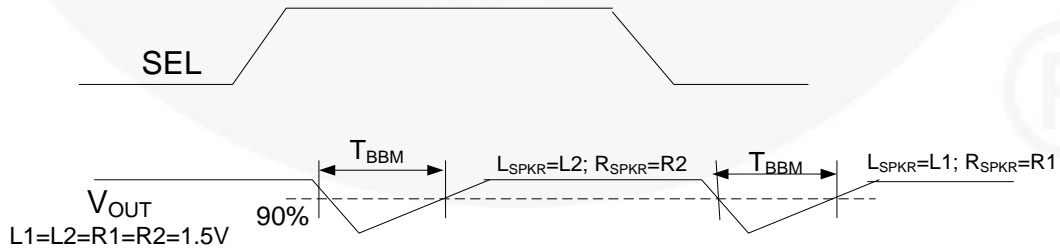


Figure 9. Break Before Make Interval Timing

Test Diagrams (Continued)

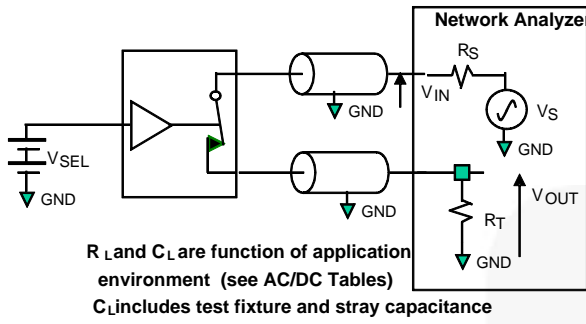
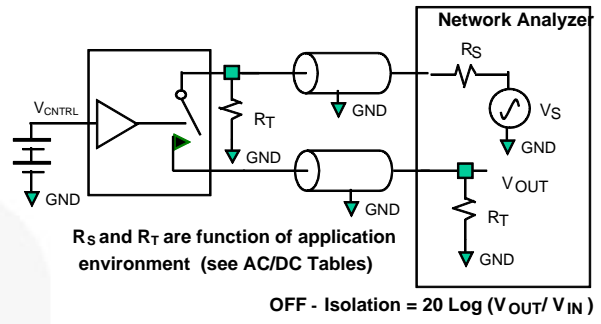
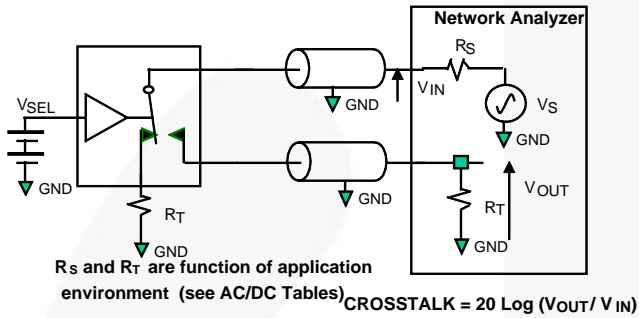


Figure 10. Bandwidth



OFF - Isolation = $20 \text{ Log } (V_{OUT} / V_{IN})$

Figure 11. Channel Off Isolation



CROSSTALK = $20 \text{ Log } (V_{OUT} / V_{IN})$

Figure 12. Adjacent Channel Crosstalk

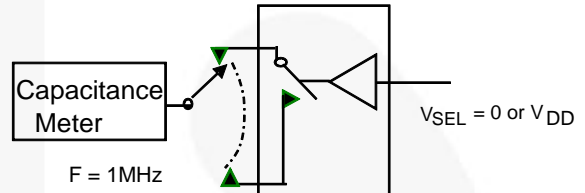


Figure 13. Channel Off Capacitance

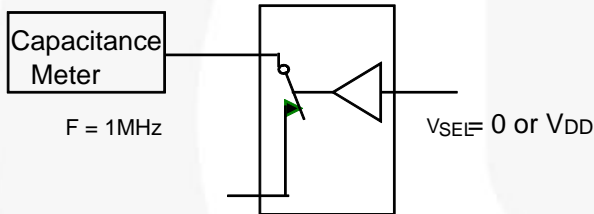


Figure 14. Channel On Capacitance

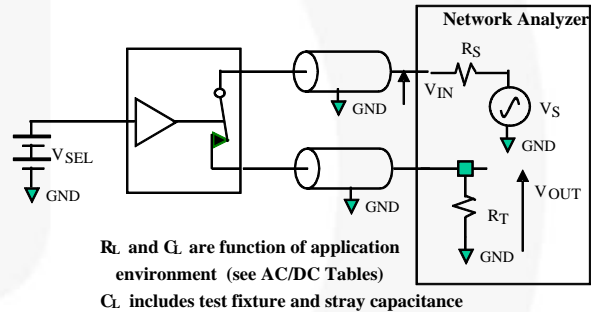
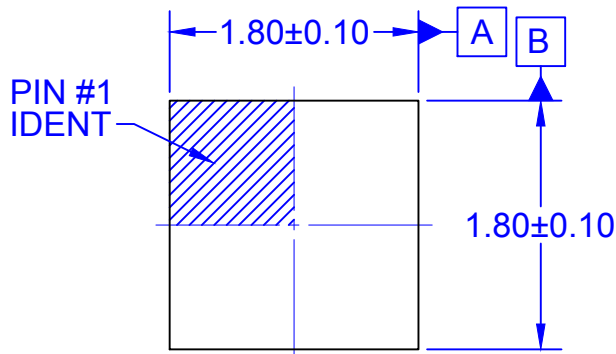
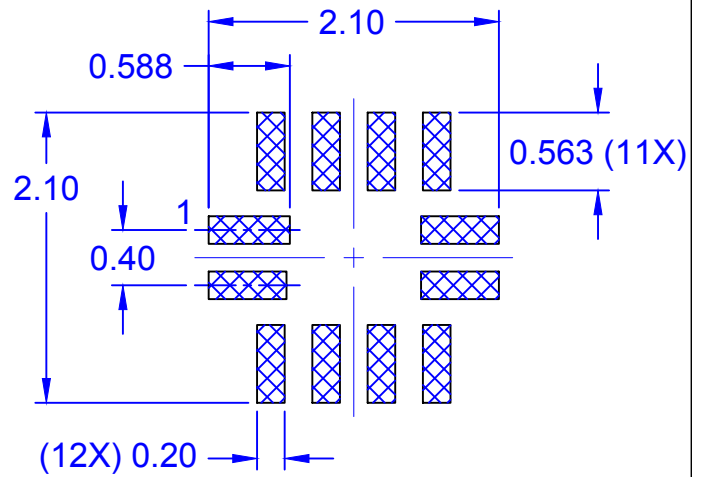


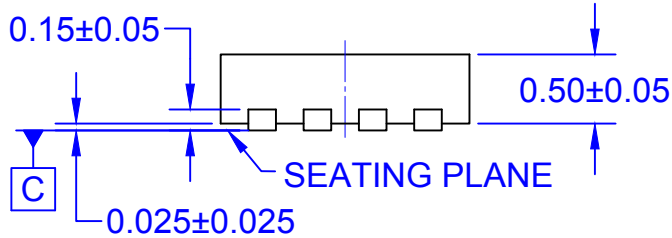
Figure 15. Total Harmonic Distortion (THD+N)



TOP VIEW



RECOMMENDED LAND PATTERN

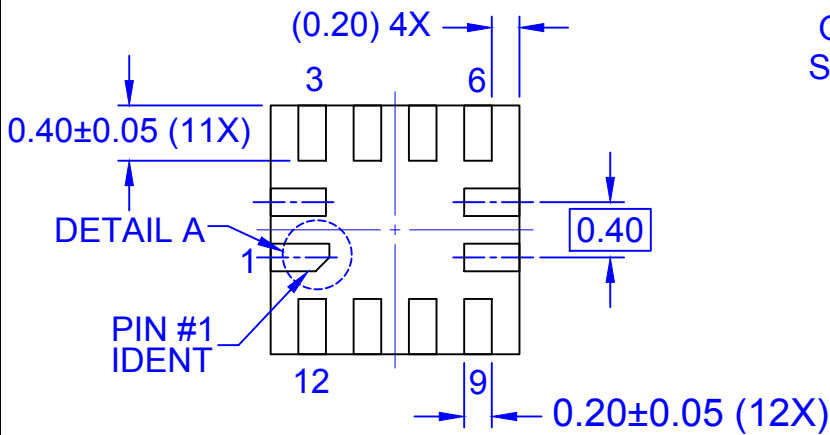


SIDE VIEW



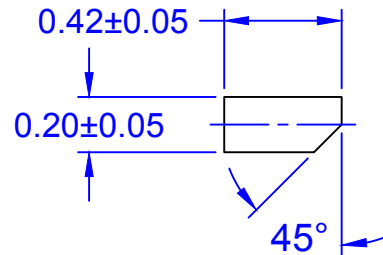
LEAD
OPTION 1
SCALE 2:1

LEAD
OPTION 2
SCALE 2:1



BOTTOM VIEW

⊕	0.10	C	A	B
	0.05	C		



DETAIL A
SCALE 2:1

NOTES:

- A. PACKAGE DOES NOT CONFORM TO ANY JEDEC STANDARD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
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