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June 2016

FSA2276 — DPDT (0.5 Ω) HiFi Audio Switch w/ Negative Swing

Features

- V_{DD} Operating Range: 1.65 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 1.8 V
- THD+N = -115 dB; 2 V_{RMS}, 20 kΩ Load; f = 1 kHz
- X_{TALK} = -122 dB at 1 V_{RMS}, 50 Ω Load; f = 1 kHz
- Off Isolation = -115 dB at 1 V_{RMS}, 50 Ω 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_{ON} of 0.5 Ω (typical) at 1.8 V V_{DD}. The FSA2276 operates over a V_{DD} 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 Ω headphones and line out type loads (>600 Ω).

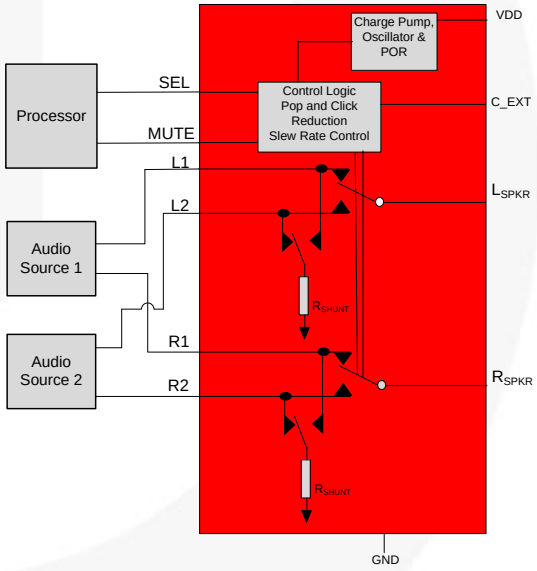


Figure 1. Application Block Diagram

Ordering Information

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

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Pin Configuration

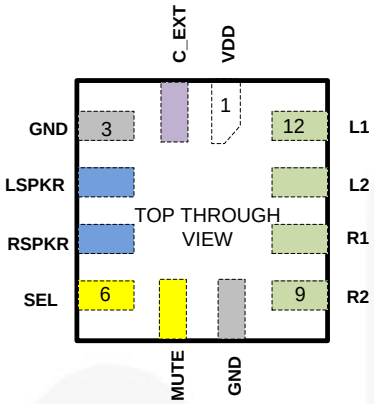


Figure 2. Pin Assignment (Top Through View)

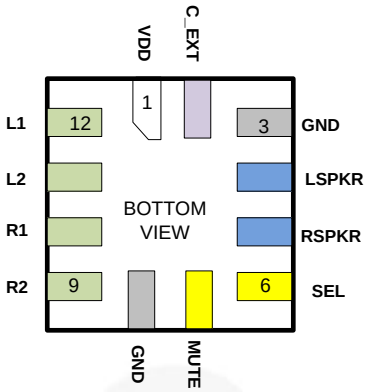


Figure 3. Pin Assignment (Bottom View)

Pin Descriptions

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_{SPKR}	Audio L_{SPPKR} Common I/O Port
5	R_{SPKR}	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
0	1	L2 = L_{SPKR}; R2 = R_{SPKR}	$R_{SHUNT(s)}$ connect to L1/R1
1	0	L1 ≠ L_{SPKR}; L2 ≠ L_{SPKR}; R1 ≠ R_{SPKR}; R2 ≠ R_{SPKR} (All Paths Hi-Z)	$R_{SHUNT(s)}$ OPEN
1	1	L1 ≠ L_{SPKR}; L2 ≠ L_{SPKR}; R1 ≠ R_{SPKR}; R2 ≠ R_{SPKR} (All Paths Hi-Z)	$R_{SHUNT(s)}$ OPEN

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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_{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		1.65	1.80	5.50	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		V_{DD}	V
I_{SW}	DC Switch I/O Current			100		mA
T_A	Ambient Operating Temperature		-40	25	+85	°C

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DC Characteristics

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.[1]

Symbol	Parameter	Condition	V_{DD} (V)	T_A=-40°C to +85°C			Unit
				Min.	Typ.	Max.	
V_{IH}	VCNTRL Pin Input High Voltage (SEL, MUTE)	C_EXT = FLOAT		1.17		VDD	V
V_{IL}	VCNTRL Pin Input Low Voltage (SEL, MUTE)	C_EXT = FLOAT C_EXT = FLOAT		0		0.5	V
I_{ON}	Switch-to-Gnd ON Leakage Current	L1, R1, L2, R2 = -3 V to 3 V, L_{SPKR}, R_{SPKR} = Float (I_{SW} = 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_{NO_MUTE}	Switch-to-Gnd OFF Leakage Current (when Muted)	L1, R1, L2, R2 = -3 V to 3 V, L_{SPKR}, R_{SPKR} = Float (I_{SW} = 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_{OFF}	Input Leakage Current[2]	L1, R1, L2, R2 = -3 V to 3 V, L_{SPKR}, R_{SPKR} = Float (I_{SW} = 0 mA) MUTE = LOW, SEL = 0 or VDD, C_EXT = FLOAT	0	-1.0	0.1	1.0	µA
I_{IN}	Control Input Leakage Current[3] (SEL, MUTE)	L1, R1, L2, R2 = -3 V to 3 V, L_{SPKR}, R_{SPKR} = Float (I_{SW} = 0 mA), C_EXT = FLOAT	1.65 to 5.5	-0.5	0.1	0.5	µA
I_{DD}	VDD Supply Current	MUTE = LOW, SEL = 0 or VDD, C_EXT = FLOAT	5.5		16	30	µA
I_{DDZ}	VDD Hi-Z Supply Current	MUTE = HIGH, SEL = 0 or VDD, C_EXT = FLOAT	5.5			1	µA
I_{DDT}	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
R_{ON}	Switch On Resistance	ISW = 100 mA, V_{SW} = -3 V to 3 V C_EXT = FLOAT, Figure 4	1.65 to 5.5		0.5	1.0	Ω
ΔR_{ON}	On Resistance Matching, Channel to Channel	ISW = 100 mA, V_{SW} = -3 V to 3 V C_EXT = FLOAT	1.65 to 5.5		30		mΩ
R_{FLAT}	On Resistance Flatness	ISW = 100 mA, V_{SW} = -3 V to 3 V C_EXT = FLOAT	1.65 to 5.5		1		mΩ
R_{SHUNT}	Click and Pop Resistance (L1, L2, R1, R2, L_{SPKR}, R_{SPKR})	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°C to +85°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.

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AC Characteristics

V_{DD} = 1.65 V to 5.5 V, V_{DD} (Typ.) = 1.8 V. T_A = -40°C to 85°C. T_A (Typ.) = 25°C, unless otherwise specified.

Symbol	Parameter	Condition		V_{DD} (V)	T_A=- 40°C to +85°C			Unit
					Min.	Typ.	Max.	
t_{MUTE_ON}	Enable Time (MUTE to Output)	L1 = R1 = L2 = R2 = 1.5 V, L_{SPKR} , R_{SPKR} = 50 Ω to GND SEL= 0 or V_{DD}; See Figure 7 and Figure 8	C_EXT = Float	1.8, 3.3		0.5		ms
			C_EXT = 0.1 µF	1.8		60		
			C_EXT = 0.1 µF	3.3		100		
t_{ON_MUTE}	Disable Time (MUTE to Output)	L1 = R1= L2 = R2 = 1.5 V, L_{SPKR} , R_{SPKR} = 50 Ω to GND, SEL = 0 or V_{DD}; See Figure 7 and Figure 8	C_EXT = Float	1.8, 3.3		35		µs
			C_EXT = 0.1 µF			35		
t_{ON_SEL}	Turn On Time (SEL to Output)	L1 (L2) = R1 (R2) = 1.5 V, L2 (L1) = R2 (R1) = 0 V L_{SPKR} , R_{SPKR} = 50 Ω to GND, SEL = 0 or V_{DD}; MUTE = 0 See Figure 7 and Figure 8	C_EXT = Float	1.8, 3.3		0.5		ms
			C_EXT = 0.1 µF	1.8		50		
			C_EXT = 0.1 µF	3.3		100		
t_{OFF_SEL}	Turn On Time (SEL to Output)	L1 (L2) = R1 (R2) = 1.5 V, L2 (L1) = R2 (R1) = 0 V L_{SPKR} , R_{SPKR} = 50 Ω to GND, SEL= 0 or V_{DD}; MUTE = 0 See Figure 7 and Figure 8	C_EXT = Float	1.8, 3.3		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_{SPKR}, R_{SPKR} = 50 Ω to GND,SEL = 0 or V_{DD}; C_EXT = FLOAT, MUTE = 0 V; See Figure 7 and Figure 9		1.8, 3.3		500		µs
O_{IRR}	Off Isolation[4]	f = 1 kHz, R_L = 50 Ω, C_L = 0 pF, MUTE = 0 V_{SW} =1 V_{RMS} Figure 11		1.8, 3.3		-115		dB
		f = 1 MHz, R_L = 50 Ω, C_L = 0 pF, MUTE = 0 V_{SW} = 1 V_{RMS} Figure 11				-92		
O_{IRRM}	Off Isolation-Muted[4]	f = 1 kHz, R_L = 50 Ω, C_L = 0 pF, MUTE = V_{DD}; V_{SW} = 1 V_{RMS} Figure 11		1.8, 3.3		-113		dB
		f = 1 MHz, R_L = 50 Ω, C_L = 0 pF, MUTE = V_{DD}; V_{SW} = 1 V_{RMS} Figure 11				-95		
X_{TALK}	Cross Talk (Adjacent) [4]	f = 1 kHz, R_L = 50 Ω, V_{SW} = 1 V_{RMS} Figure 12		1.8, 3.3		-122		dB
BW	-3 dB Bandwidth[4]	R_L = 50 Ω Figure 10		1.8, 3.3		380		MHz
PSRR	Power Supply Rejection Ratio[4]	V_{PSRR} = V_{DD} + 100 mV_{RMS} R_L = 20 kΩ or 32 Ω (at L_{SPKR}, R_{SPKR}), MUTE = 0 or V_{DD}, f = 1 kHz, V_{SW} = GND or Float)	R_L = 32 Ω	1.8, 3.3		-119		dB
			R_L = 20 kΩ			-105		
THD+N	Total Harmonic Distortion + Noise[4]	R_L = 20 kΩ, f = 1 kHz, V_{SW} = 2 V_{RMS}, With A-weighted, Figure 15				0.00018		%
						-115		dB
		R_L=600 Ω, f = 1 kHz, V_{SW} = 2 V_{RMS} With A-weighted, Figure 15				0.00018		%
						-115		dB
		R_L = 32 Ω, f = 1 kHz, V_{SW} = 1 V_{RMS} , With A-weighted, Figure 15				0.00018		%
						-115		dB

Note:

4. Guaranteed by characterization. Not production tested.

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Capacitance

Unless otherwise stated, 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.[5]

Symbol	Parameter	Condition		V_{DD} (V)	T_A=- 40°C to +85°C			Unit
					Min.	Typ.	Max.	
C_{ON}	On Capacitance (Common Port) [6]	f = 1 MHz, 100 mV_{PK-PK}, 100 mV DC bias MUTE = 0 V Figure 14		1.8, 3.3		22		pF
C_{OFF1}	Off Capacitance (Common Port) [6]	f = 1 MHz, 100 mV_{PK-PK}, 100 mV DC bias MUTE = V_{DD} Figure 13		1.8, 3.3		25		pF
C_{OFF2}	Off Capacitance (Non-Common Ports) [6]	f = 1 MHz, 100 mV_{PK-PK}, 100 mV DC bias MUTE = 0 V Figure 13		1.8, 3.3		14		pF
C_{OFF_MUTE}	Off Capacitance - MUTED (Non-Common Ports) [6]	f = 1 MHz, 100 mV_{PK-PK}, 100 mV DC bias, MUTE = V_{DD}		1.8, 3.3		14		pF
C_{CNTRL}	Control Input Pin Capacitance (MUTE, SEL) [6]	f = 1 MHz, 100 mV_{PP}, 100 mV DC bias	SEL	0		3		pF
			MUTE			6		

Notes:

5. Limits over the recommended temperature operating range (T_A=-40°C to +85°C) are correlated by statistical quality control methods.
6. Guaranteed by characterization. Not production tested.

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Test Diagrams

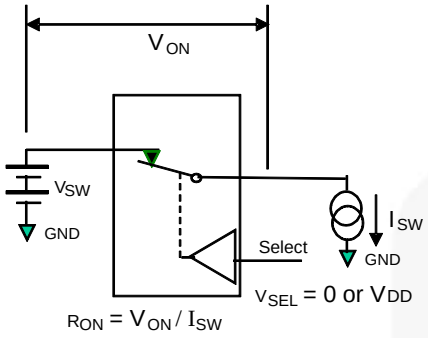


Figure 4. On Resistance

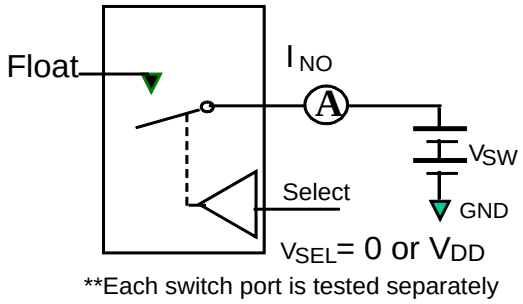


Figure 5. Off Leakage

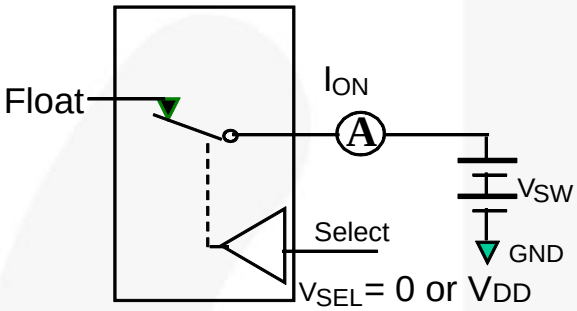


Figure 6. On Leakage

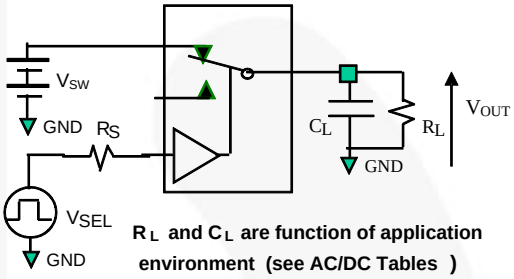


Figure 7. Test Circuit Load

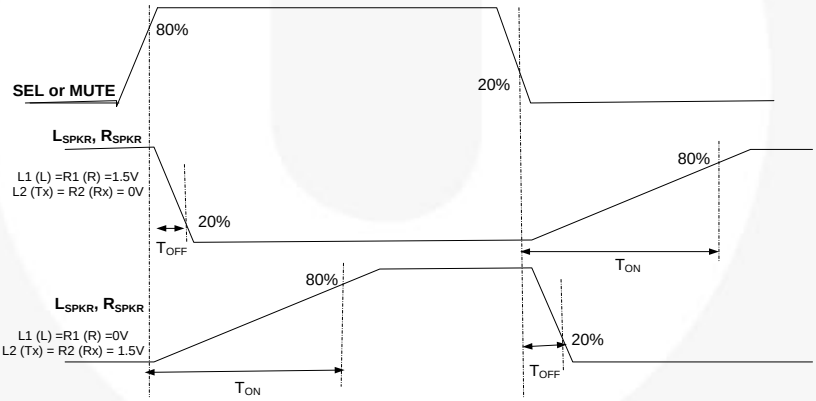


Figure 8. Turn On/Off Waveforms (SEL or MUTE to Output)

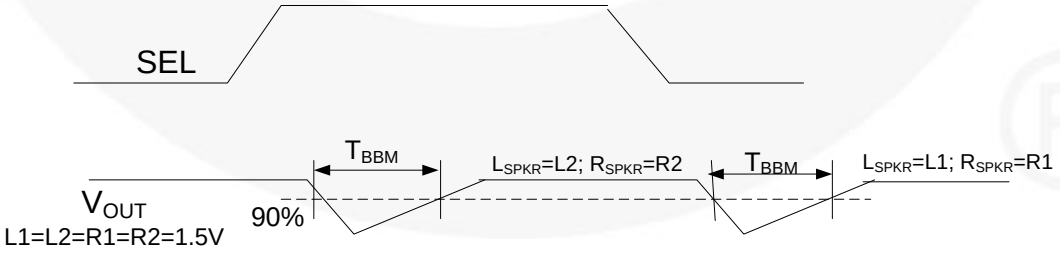
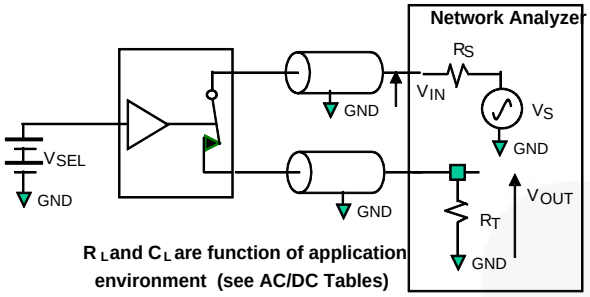


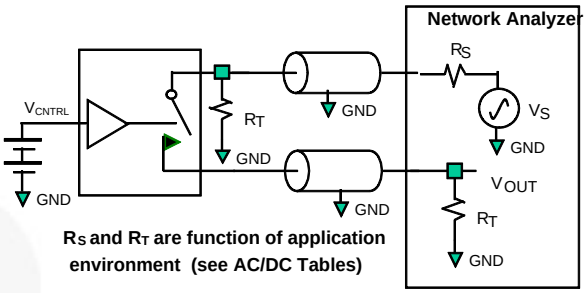
Figure 9. Break Before Make Interval Timing

Test Diagrams (Continued)



RL and CL are function of application environment (see AC/DC Tables)
CL includes test fixture and stray capacitance

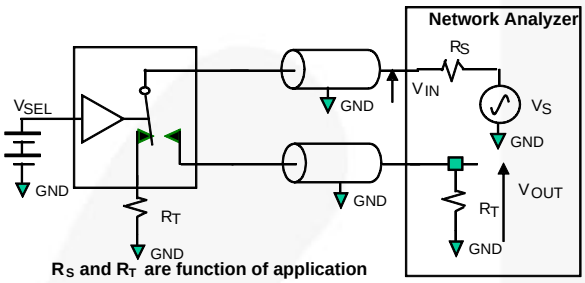
Figure 10. Bandwidth



RS and RT are function of application environment (see AC/DC Tables)

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

Figure 11. Channel Off Isolation



RS and RT are function of application environment (see AC/DC Tables)

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

Figure 12. Adjacent Channel Crosstalk

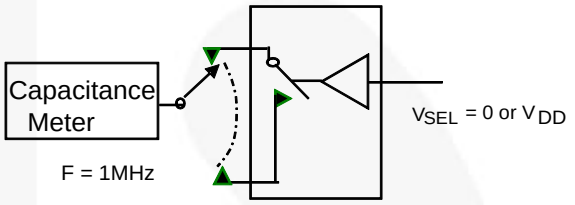


Figure 13. Channel Off Capacitance

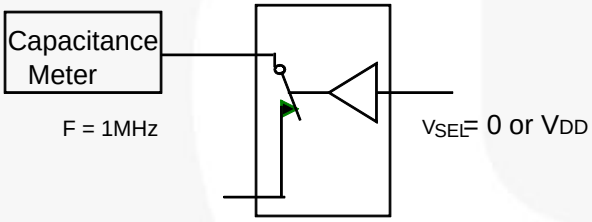
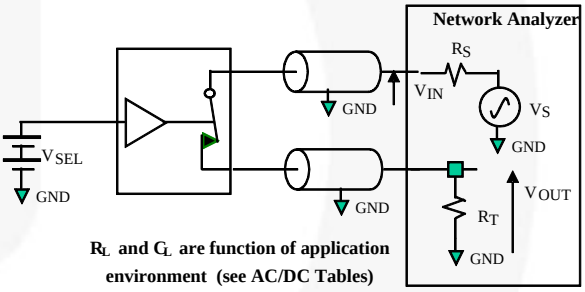
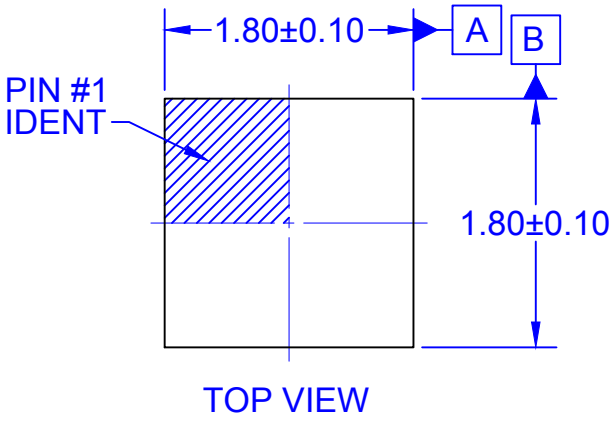


Figure 14. Channel On Capacitance

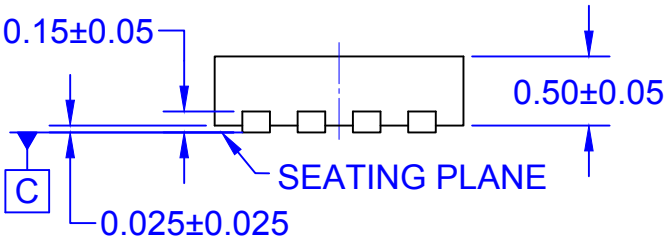


RL and CL are function of application environment (see AC/DC Tables)
CL includes test fixture and stray capacitance

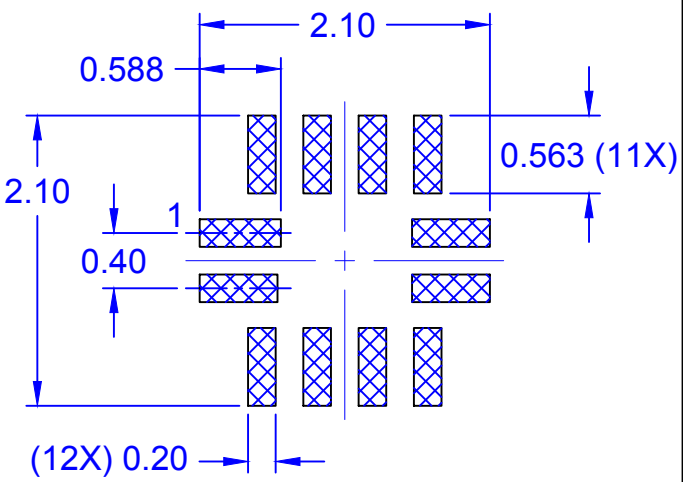
Figure 15. Total Harmonic Distortion (THD+N)



TOP VIEW



SIDE VIEW

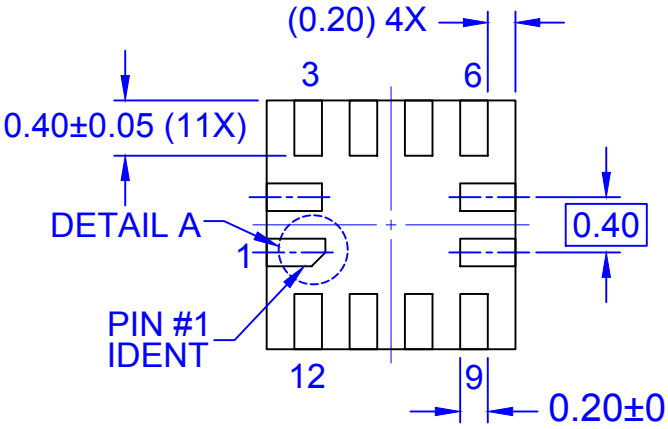


RECOMMENDED LAND PATTERN



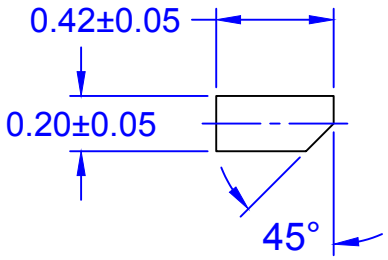
LEAD
OPTION 1
SCALE 2:1

LEAD
OPTION 2
SCALE 2:1



BOTTOM VIEW

⌖	0.10	C	A	B
	0.05	C		



DETAIL A
SCALE 2:1

NOTES:

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