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# FSA1259A

## Low-Voltage, 1 Ω Dual SPST Analog Switch with Power-Off Isolation

### Features

- Power-Off Isolation ( $V_{CC}=0\text{ V}$ )
- 1 Ω On Resistance ( $R_{ON}$ ) for 4.5V  $V_{CC}$
- 0.25 Ω Maximum  $R_{ON}$  Flatness for 4.5 V  $V_{CC}$
- Space-Saving, US8 Surface Mount Package
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.50 V
- Fast Turn-On and Turn-Off Times
- Break-Before-Make Enable Circuitry

### Description

The FSA1259A is a high-performance, dual, Single-Pole / Single-Throw (SPST) analog switch. The device features ultra-low  $R_{ON}$  of 1 Ω at 4.5 V  $V_{CC}$  and operates over the wide  $V_{CC}$  range of 1.65 V to 5.50 V.

The FS1259A allows for reduced input thresholds on the select pins.

The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation.

### Applications

- Cellular Phone
- Portable Media Player
- PDA

### Ordering Information

Part Number	Top Mark	Operating Temperature Range	Package	Packing Method
FSA1259AK8X	59A	-40°C to +85°C	8-Lead US8, JEDEC MO-187, Variation CA, 3.0 mm Wide	3000 Units Tape and Reel

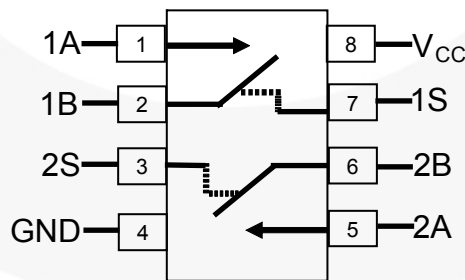


Figure 1. Analog Symbols

## Pin Assignments

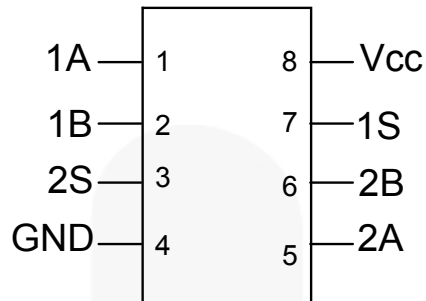


Figure 2. Pin Assignments (Top View)

## Pin Definitions

Pin #	Name	Description
1	1A	Data Port
2	1B	Data Port
3	2S	Control Input
4	GND	Ground
5	2A	Data Port
6	2B	Data Port
7	1S	Control Input
8	V <sub>cc</sub>	Supply Voltage

## Truth Table

Control Input (S)	Function
LOW	Disconnected
HIGH	A Connected to B

## 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 Voltage	-0.5	7.0	V
$V_{SW}$	Switch Voltage <sup>(1)</sup>	-0.5	$V_{CC} + 0.5$	V
$V_{IN}$	Input Voltage <sup>(1)</sup>	-0.5	6.5	V
$I_{IK}$	Input Diode Current		-50	mA
$I_{SW}$	Switch Current (Continuous)		200	mA
$I_{SWPEAK}$	Peak Switch Current (Pulsed at 1 ms Duration, <10% Duty Cycle)		400	mA
$P_D$	Power Dissipation at 85°C		3.0	μW
$T_{STG}$	Storage Temperature Range	-65	+150	°C
$T_J$	Maximum Junction Temperature		+150	°C
$T_L$	Lead Temperature (Soldering, 10 seconds)		+260	°C
ESD	Human Body Model (JEDEC: JESD22-A114)		8000	V
	Charged Device Model (JEDEC: JESD22-C101)		2000	V
	Machine Model (JEDEC: JESD22-A115)		350	V

**Note:**

- The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

## 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 them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	1.65	5.50	V
$A_{SEL}$	Control Input Voltage <sup>(2)</sup>	0	$V_{CC}$	V
$V_{SW}$	Switch Input Voltage	0	$V_{CC}$	V
$T_A$	Operating Temperature	-40	+85	°C
$\theta_{JA}$	Thermal Resistance, Still Air		215	°C/W

**Note:**

- Control Input must be held HIGH or LOW; it must not float.

## Electrical Characteristics

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Unit
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	Input Voltage High	4.50 to 5.50					1.0		V
		3.00 to 3.60					1.0		
		2.30 to 2.70					0.95		
		1.65 to 1.95					0.95		
V <sub>IL</sub>	Input Voltage Low	4.50 to 5.50						0.75	V
		3.00 to 3.60						0.65	
		2.30 to 2.70						0.55	
		1.65 to 1.95						0.5	
I <sub>IN</sub>	Control Input Leakage	5.50	V <sub>IN</sub> =0 or V <sub>CC</sub>	-10		10	-50	50	nA
		3.60	V <sub>IN</sub> =0 or V <sub>CC</sub>	-2		2	-20	20	
		2.70	V <sub>IN</sub> =0 or V <sub>CC</sub>	-2		2	-20	20	
		1.95	V <sub>IN</sub> =0 or V <sub>CC</sub>	-2		2	-20	20	
I <sub>NO(OFF)</sub>	Off-Leakage Current	5.50	A=1 V, B=4.5V or B=4.5 V, A= 1V	-10		10	-50	50	nA
		3.60	A=1 V, B=3.0 V or B=3.0 V, A=1 V	-5		5	-50	50	
		2.70	A=0.5 V, B=2.3 V or B=2.3, A=0.5 V	-5		5	-50	50	
		1.95	A=0.3 V, B=1.65 V or B=1.65, A=0.3 V	-5		5	-50	50	
I <sub>NO(ON)</sub>	On-Leakage Current of Port B	5.50	A=Floating; B=4.5 V, 1 V	-5		5	-50	50	nA
		3.60	A=Floating; B=3.0 V, 1 V	-2		2	-20	20	
		2.70	A=Floating; B=2.3 V, 0.5 V	-2		2	-20	20	
		1.95	A=Floating; B=1.65 V, 0.3 V	-2		2	-20	20	
I <sub>A(ON)</sub>	On-Leakage Current of Port A	5.50	A=1 V, 4.5 V; B=Floating	-5		5	-50	50	nA
		3.60	A=1 V, 3.0 V; B=Floating	-2		2	-20	20	
		2.70	A=0.5 V, 2.3; B=Floating	-2		2	-20	20	
		1.95	A=0.3 V, 1.65 V; B=Floating	-2		2	-20	20	
I <sub>OFF</sub>	Power Off Leakage Current of Port A & Port B	0	A=0 to 5.5 V; B=0 to 5.5 V	-1		1	-10	10	μA

### Electrical Characteristics (Continued)

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Unit
				Min.	Typ.	Max.	Min.	Max.	
R <sub>PEAK</sub>	Peak On Resistance	4.50	I <sub>OUT</sub> =-100 mA, 1B or 2B=0 to V <sub>CC</sub>		0.8	1.0		1.2	Ω
		3.00	I <sub>OUT</sub> =-100 mA, 1B or 2B=0 to V <sub>CC</sub>		1.0	1.5		1.8	
		2.30	I <sub>OUT</sub> =-8 mA, 1B or 2B=0 to V <sub>CC</sub>		1.5	2.0		2.5	
		1.65	I <sub>OUT</sub> =-2 mA, 1B or 2B=0 to V <sub>CC</sub>	T <sub>A</sub> =25, 85°C		5.0	12.0		
T <sub>A</sub> =-40°C				20.0					
R <sub>ON</sub>	Switch On Resistance <sup>(3)</sup>	4.50	I <sub>OUT</sub> =-100 mA, 1B or 2B=2.5 V		0.70	0.85		1.00	Ω
		3.00	I <sub>OUT</sub> =-100 mA, 1B or 2B=2.0 V		0.9	1.3		1.6	
		2.30	I <sub>OUT</sub> =-8 mA, 1B or 2B=1.8V		1.4	2.0		2.4	
		1.65	I <sub>OUT</sub> =-2 mA, 1B or 2B=1.5 V		2.0	2.5		3.5	
ΔR <sub>ON</sub>	On Resistance Matching Between Channels <sup>(4)</sup>	4.50	I <sub>OUT</sub> =-100 mA, 1B or 2B=2.5 V		0.05	0.10		0.10	Ω
		3.00	I <sub>OUT</sub> =-100 mA, 1B or 2B=2.0 V		0.10	0.15		0.15	
		2.30	I <sub>OUT</sub> =-8 mA, 1B or 2B=1.8 V		0.15	0.20		0.20	
		1.65	I <sub>OUT</sub> =-2 mA, 1B or 2B=1.5 V		0.15	0.40		0.40	
R <sub>FLAT(ON)</sub>	On Resistance Flatness <sup>(5)</sup>	4.50	I <sub>OUT</sub> =-100 mA, 1B or 2B=1.0 V, 1.5 V, 2.5 V		0.10	0.25		0.25	Ω
		3.00	I <sub>OUT</sub> =-100 mA, 1B or 2B=0.8 V, 2.0 V		0.1	0.3		0.3	
		2.30	I <sub>OUT</sub> =-8 mA, 1B or 2B=0.8 V, 1.8 V		0.2	1.0		1.0	
		1.65	I <sub>OUT</sub> =-2 mA, 1B or 2B=0.6 V, 1.5 V		1.5				
I <sub>CC</sub>	Quiescent Supply Current	5.50	V <sub>IN</sub> =0 or V <sub>CC</sub> , I <sub>OUT</sub> =0		5	50		500	nA
		3.60	V <sub>IN</sub> =0 or V <sub>CC</sub> , I <sub>OUT</sub> =0		1	25		300	
		2.70	V <sub>IN</sub> =0 or V <sub>CC</sub> , I <sub>OUT</sub> =0		1	20		250	
		1.95	V <sub>IN</sub> =0 or V <sub>CC</sub> , I <sub>OUT</sub> =0		1	15		150	
I <sub>CC(T)</sub>	Increase in I <sub>CC</sub> per Control Input	4.5 to 5.5	Asel=1.8 V		25			40	μA

**Notes:**

3. On resistance is determined by the voltage drop between the A and B pins at the indicated current through the switch.
4. ΔR<sub>ON</sub>=R<sub>ON</sub> maximum – R<sub>ON</sub> minimum; measured at identical V<sub>CC</sub>, temperature, and voltage.
5. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

## AC Electrical Characteristics

All typical values are at  $V_{CC}=1.8\text{ V}, 2.5\text{ V}, 3.0\text{ V}, 5.0\text{ V}$  at  $25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	$V_{CC}$ (V)	Conditions	$T_A=+25^\circ\text{C}$			$T_A=-40\text{ to }+85^\circ\text{C}$		Unit	Figure
				Min.	Typ.	Max.	Min.	Max.		
$t_{ON}$	Turn-On Time	4.50 to 5.50	1B or 2 B= $V_{CC}$ , $R_L=50\ \Omega$ , $C_L=35\ \text{pF}$	1.0	4.0	7.5	1.0	9.0	ns	Figure 11
		3.00 to 3.60		1.5	6.0	9.5	1.0	10.0		
		2.30 to 2.70		2.0	8.0	10.0	1.0	12.0		
		1.65 to 1.95		3.0	14.0	18.0	1.0	20.0		
$t_{OFF}$	Turn-Off Time	4.50 to 5.50	1B or 2B= $V_{CC}$ , $R_L=50\ \Omega$ , $C_L=35\ \text{pF}$	4.5	13.0	17.0	3.5	20.0	ns	Figure 11
		3.00 to 3.60		4.5	13.5	17.0	3.0	20.0		
		2.30 to 2.70		4.5	16.0	20.0	3.0	23.0		
		1.65 to 1.95		5.0	24.0	33.0	4.0	36.0		
Q	Charge Injection	4.50 to 5.50	$C_L=1.0\ \text{nF}$ , $V_{GEN}=0\ \text{V}$ , $R_{GEN}=0\ \Omega$		15				pC	Figure 13
		3.00 to 3.60			11					
		2.30 to 2.70			8					
		1.65 to 1.95			6					
OIRR	Off-Isolation	1.8 to 5.0	$f=1\ \text{MHz}$ , $R_L=50\ \Omega$		-60				dB	Figure 12
Xtalk	Crosstalk	1.8 to 5.0	$f=1\ \text{MHz}$ , $R_L=50\ \Omega$		-73				dB	Figure 12
BW	-3 db Bandwidth	4.50 to 5.50	$R_L=50\ \Omega$		240				MHz	Figure 15
		3.00 to 3.60			240					
		2.30 to 2.70			240					
		1.65 to 1.95			240					
THD	Total Harmonic Distortion	1.8	$R_L=600\ \Omega$ , $V_{IN}=0.5\ \text{V}_{PP}$ , $f=20\ \text{Hz to } 20\ \text{kHz}$		.003				%	Figure 16
		5.0			.001					Figure 16

## Capacitance

Symbol	Parameter	$V_{CC}$ (V)	Conditions	$T_A=+25^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
$C_{IN}$	Control Pin Input Capacitance	0	$f=1\ \text{MHz}$ Figure 14		3		pF
$C_{OFF}$	B Port Off Capacitance	1.65 to 5.50	$f=1\ \text{MHz}$ Figure 14		21		pF
$C_{ON}$	A Port On Capacitance	1.65 to 5.50	$f=1\ \text{MHz}$ Figure 14		47		pF

## Typical Performance Characteristics

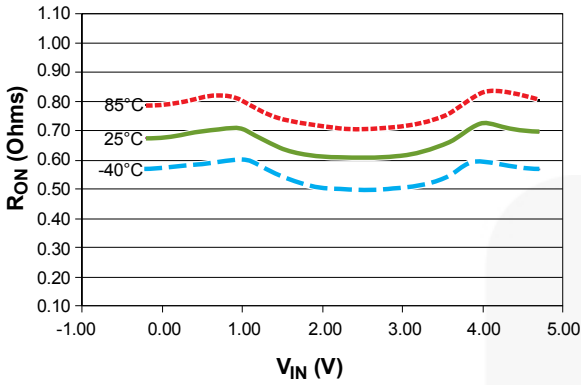


Figure 3. On Resistance ( $V_{CC}=4.5\text{ V}$ )

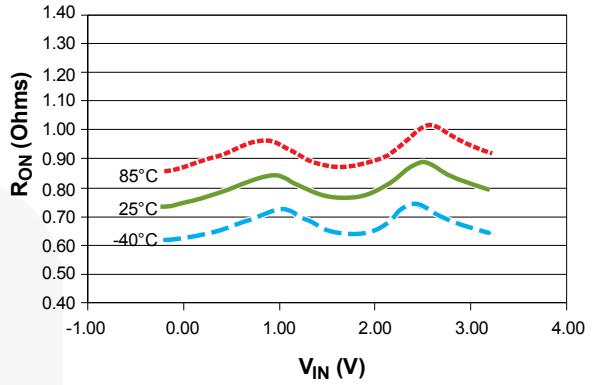


Figure 4. On Resistance ( $V_{CC}=3.0\text{ V}$ )

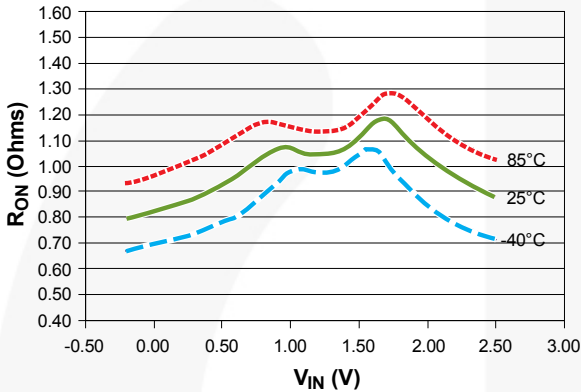


Figure 5. On Resistance ( $V_{CC}=2.3\text{ V}$ )

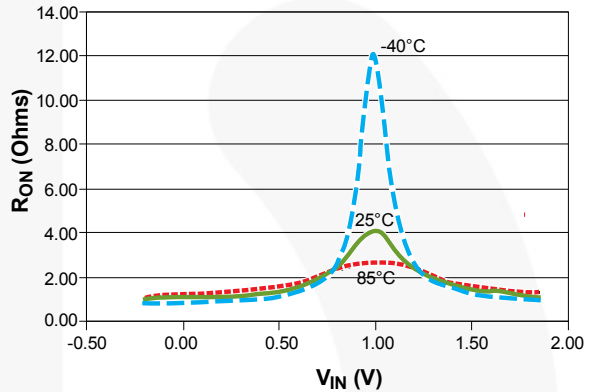


Figure 6. On Resistance ( $V_{CC}=1.65\text{ V}$ )

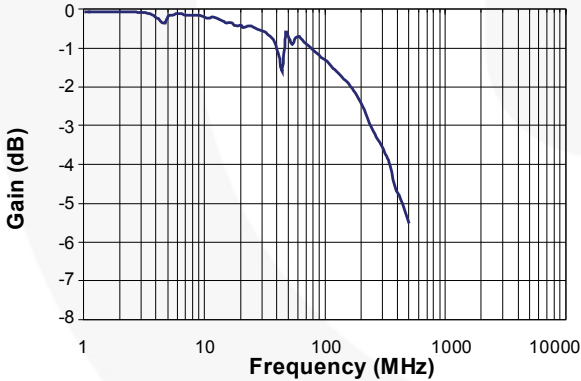


Figure 7. Frequency Response ( $V_{CC}=5.5\text{ V}$ ,  $C_L=0\text{ pF}$ )

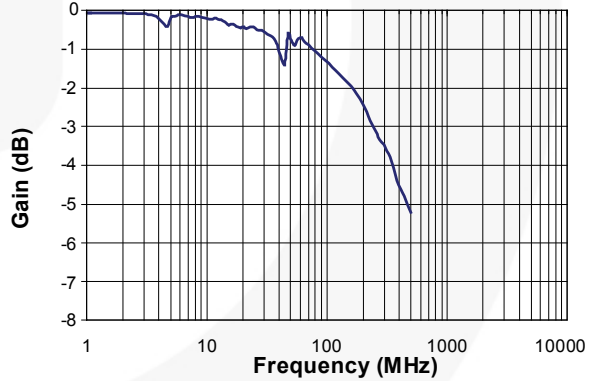


Figure 8. Frequency Response ( $V_{CC}=3.3\text{ V}$ ,  $C_L=0\text{ pF}$ )

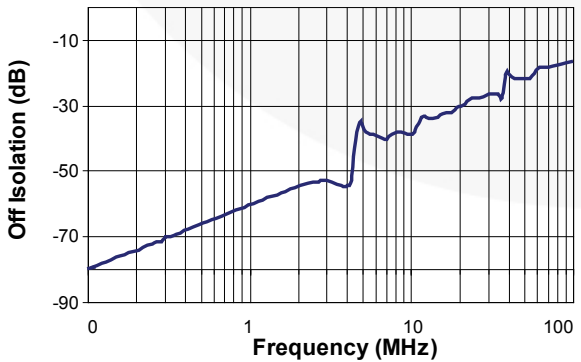


Figure 9. Frequency Response ( $V_{CC}=5.0\text{ V}$ ,  $C_L=0\text{ pF}$ )

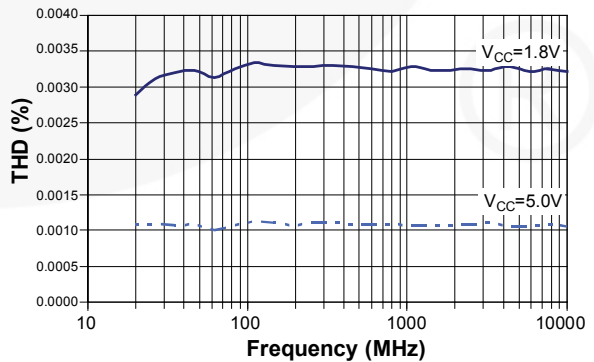
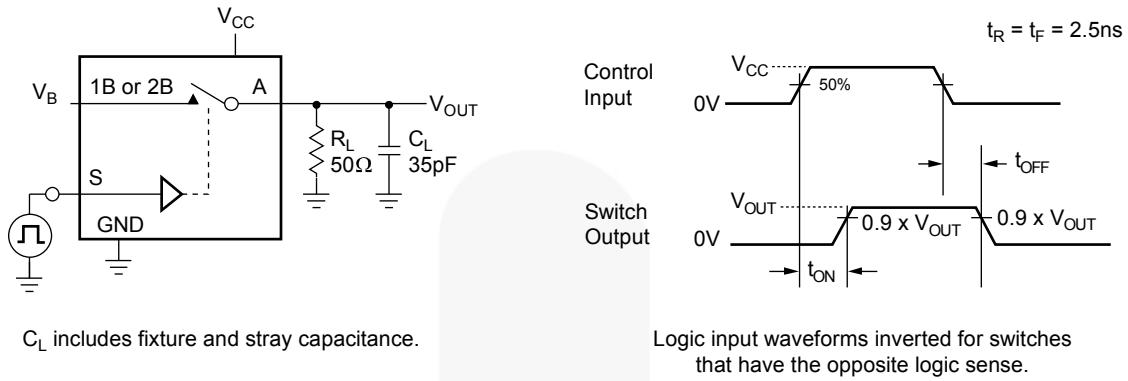


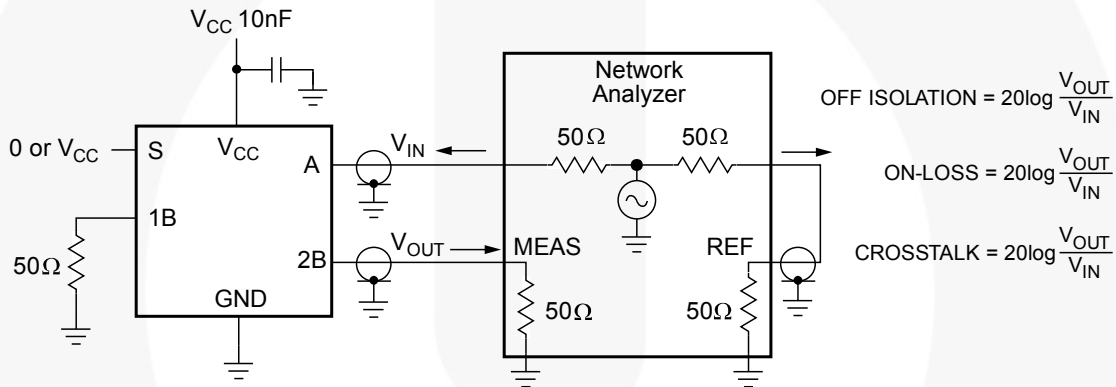
Figure 10. Total Harmonic Distortion



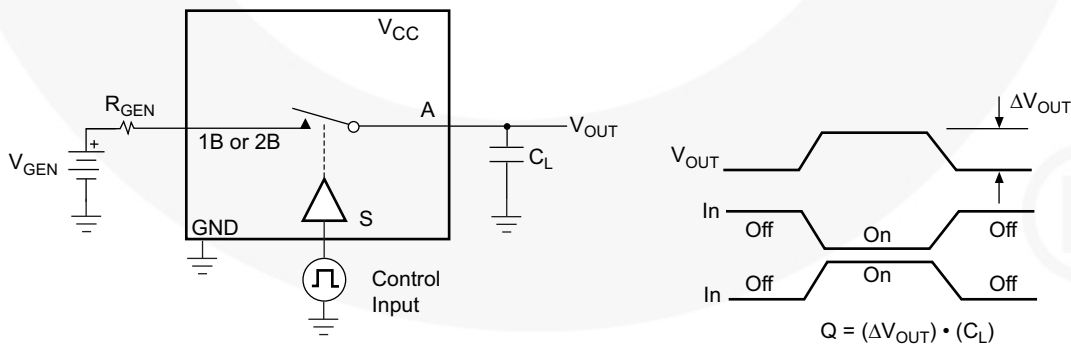
### Test Diagrams



**Figure 11. Turn On / Off Timing**

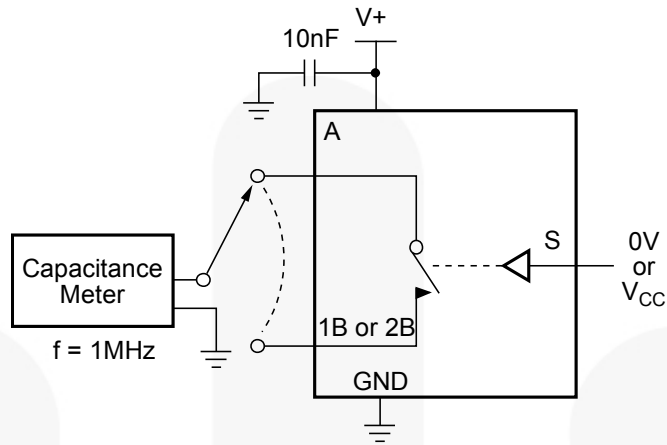


**Figure 12. Off Isolation and Crosstalk**

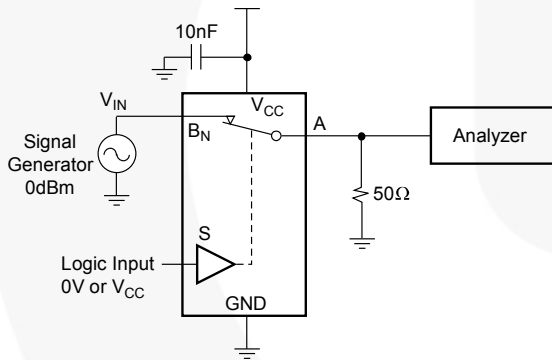


**Figure 13. Charge Injection**

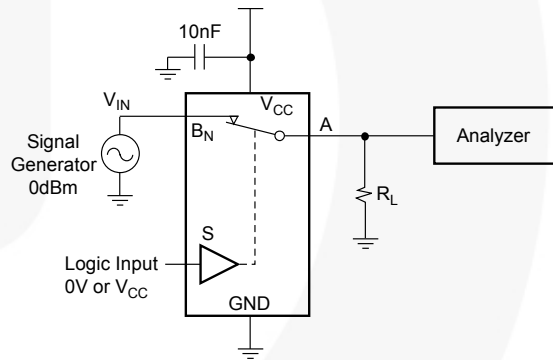
**Test Diagrams** (Continued)



**Figure 14. On / Off Capacitance Measurement Setup**

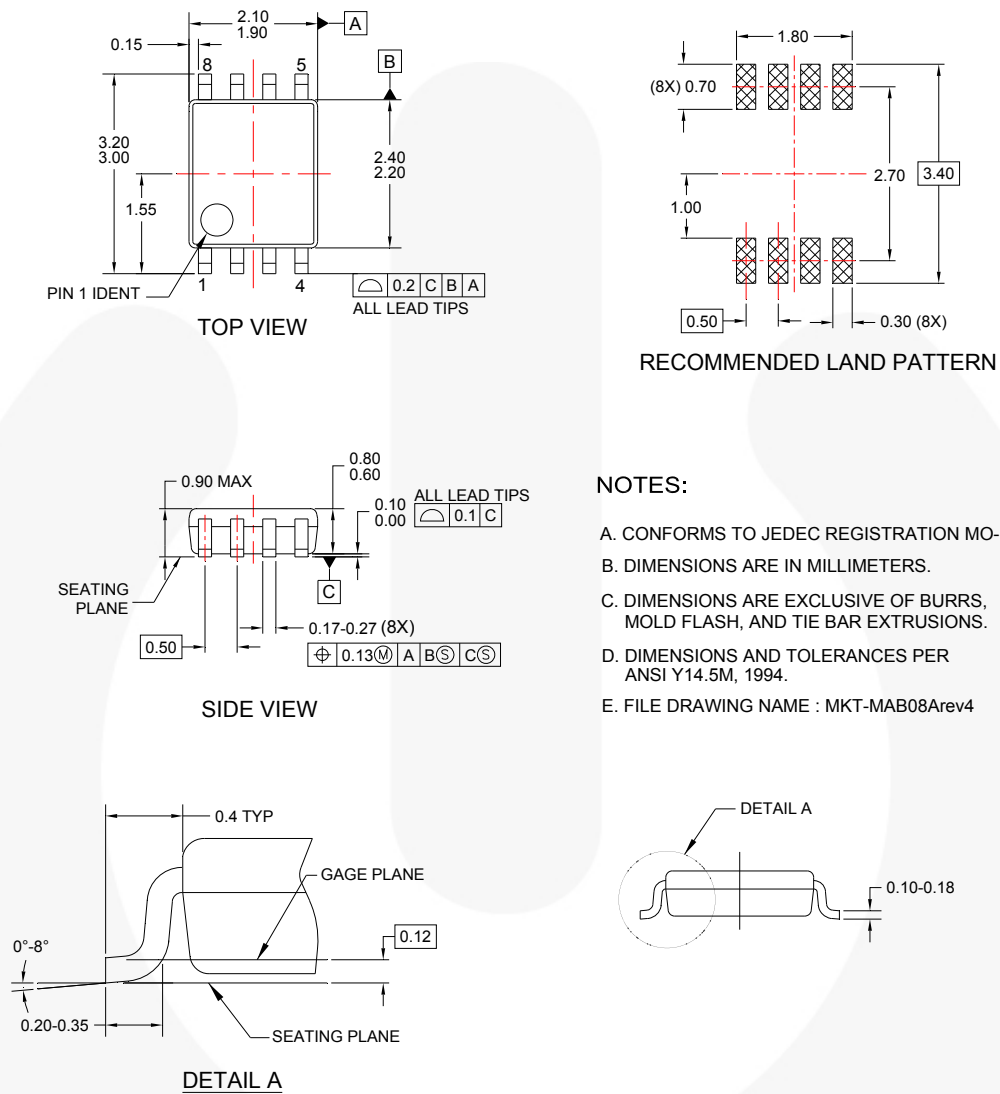


**Figure 15. Bandwidth**



**Figure 16. Harmonic Distortion**

## Physical Dimensions



**Figure 17. 8-Lead US8, JEDEC MO-187, Variation CA, 3.0 mm Wide Package**

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[http://www.fairchildsemi.com/packing\\_dwg/PKG-MAB08A\\_HANABK.pdf](http://www.fairchildsemi.com/packing_dwg/PKG-MAB08A_HANABK.pdf)



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**Definition of Terms**

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Rev. 168

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