

### General Description

The MSI2021 is a dual single-pole double-throw (dual SPDT) analog device aimed for analog signals switching applications in various portable electrical devices. It is especially designed for negative stereo audio signals switching applications in mobile phones.

The MSI2021 features very low on-channel resistance allowing little attenuation and distortion during bi-directional audio signal routing. High crosstalk and off-isolation result in minimum noise interference with good signal integrity. Also the device features very low current consumption during standby and idle mode making longer battery operation in portable devices.

The MSI2021 is available in ultra small Halogen-Free 10 leads 1.4 x 1.8 QFN package and can operate over -40°C to +85°C ambient temperature range. For more detailed information, please contact your local MagnaChip sales office in world-wide or visit MagnaChip's website at [www.magnachip.com](http://www.magnachip.com).

### Features

- ±8kV Human Body Model (HBM) ESD protection on all pins
- Low  $R_{ON}$  : 0.4Ω (typical) @ 3.0V  $V_{DD}$
- -3dB bandwidth : >50MHz (typical)
- Low supply current in standby mode (<1μA) and under wide control voltage range
- High channel crosstalk: -70dB @ 3.0V  $V_{DD}$
- Power-Off protection ( $V_{DD}=0V$ ) and power-On protection ( $V_{DD}\neq 0V$ ) on COMA & COMB tolerate up to 4.3V
- $V_{DD}+0.5V$  signals can be handled under  $V_{DD}$  supply voltage condition
- Halogen-Free 10 leads 1.4mm x 1.8mm QFN package

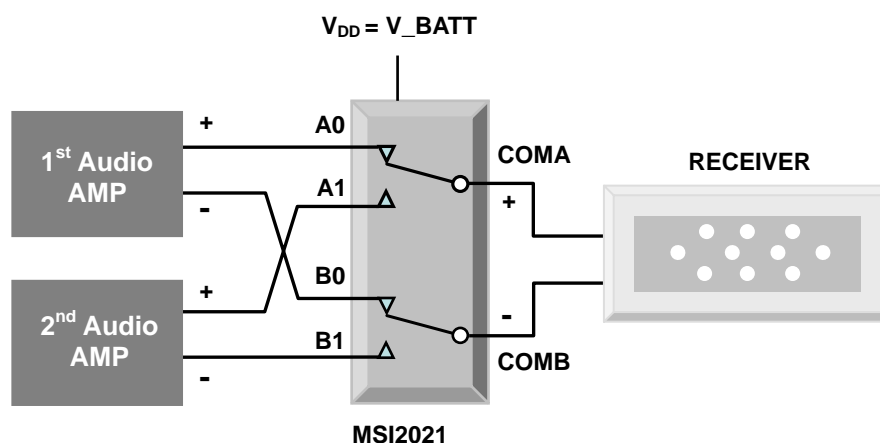
### Applications

- Analog Signal Switching Block
- Negative Stereo Audio Switching
- Switching application in portable devices (Cell phone, PDAs, Notebook Computers)

### Ordering Information

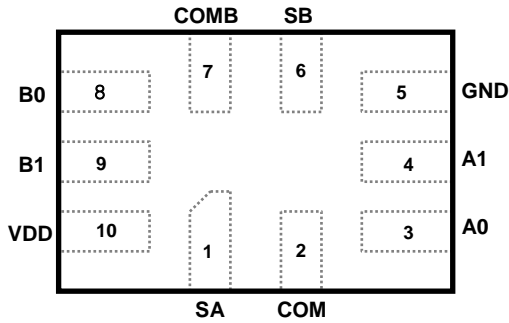
Part Number	Top Marking	Ambient Temperature Range	Package [mm]	RoHS Status
MSI2021QH	S2U	-40°C to +85°C	1.4mm x 1.8mm x 0.5mm, 10 leads QFN	Halogen-Free

### Typical Application

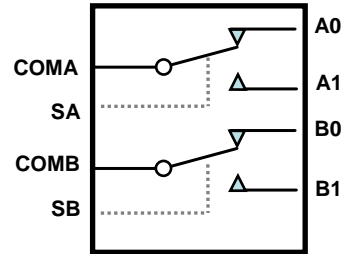


## Pin Configuration

**10 pins QFN Package  
(Top View)**



**Block Diagram**



## Pin Description

Pin Assignment	Description
SA	Select Pin
SB	Select Pin
COMA, COMB	Common Data Ports
A0, A1, B0, B1	Data Ports
VDD	DC Supply voltage Input Pin
GND	Ground Pin

## Truth Table

SA/SB	Function
L	Select 0 port (COMA=A0, COMB=B0)
H	Select 1 port (COMA=A1, COMB=B1)

## Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit	
V <sub>DD</sub>	DC Supply Voltage on VDD pin	-0.5	5.5	V	
V <sub>SAB</sub>	Control Input Voltage (SA, SB)	-0.5	V <sub>DD</sub> +0.3V	V	
V <sub>IN/OUT</sub>	In/Out Voltage in Analog IO pins	A0, A1, B0, B1	V <sub>DD</sub> -4.3	V <sub>DD</sub> +0.3	V
I <sub>IN/OUT</sub>	In/Out Current in Analog IO pins		350	mA	
I <sub>IN/OUT_PEAK</sub>	Peak Current in Analog IO pins (1ms Duration @10% Duty Cycle)		500	mA	
ESD	HBM on All Pins		8	kV	
T <sub>S</sub>	Storage Temperature	-65	150	°C	

**Note 1:** Stresses beyond the above listed maximum ratings may damage the device permanently. Operating above the recommended conditions for extended time may stress the device and affect device reliability. Also the device may not operate normally above the recommended operating conditions. These are stress ratings only.

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V <sub>DD</sub>	Supply Voltage	1.65	4.3	V
V <sub>SAB</sub>	Control Input Voltage (SA, SB)	0	V <sub>DD</sub>	V
V <sub>IN/OUT</sub>	In/Out Voltage in Analog IO Voltage	V <sub>DD</sub> -4.3	V <sub>DD</sub>	V
T <sub>A</sub>	Operating Temperature	-40	85	°C

## DC Electrical Characteristics

All listed typical values are tested at T<sub>A</sub>=25°C unless otherwise specified.

Symbol	Parameter	Test Conditions	V <sub>DD</sub> (V)	Min	Typ	Max	Unit
V <sub>SAB_H</sub>	Control Input High Voltage	1.65 ≤ V <sub>DD</sub> < 2.3V	1.65	0.9			V
		2.3 ≤ V <sub>DD</sub> < 2.8V	2.6	1.4			
		2.8 ≤ V <sub>DD</sub> < 3.7V	3.3	1.5			
		V <sub>DD</sub> = 4.3V	4.3	1.7			
V <sub>SAB_L</sub>	Control Input Low Voltage	1.65 ≤ V <sub>DD</sub> < 2.8V	1.65			0.4	V
		2.8 ≤ V <sub>DD</sub> < 3.7V	3.3			0.5	
		V <sub>DD</sub> =4.3V	4.3			0.6	
I <sub>SAB</sub>	Control Input Leakage Current	V <sub>SAB</sub> = 0 and V <sub>DD</sub>	4.3	-1		1	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>DD</sub> =4.3V, V <sub>SAB</sub> =0 or V <sub>DD</sub> , I <sub>IN/OUT</sub> =0A	4.3			1.0	μA
I <sub>CCT</sub>	Increase in I <sub>CC</sub> on V <sub>DD</sub> pin per Control Voltage	V <sub>SAB</sub> =2.6V	4.3		4	10.0	μA
		V <sub>SAB</sub> =1.8V	4.3		12	30	
I <sub>LEAK_OFF</sub>	OFF State Leakage Current on A* & B* (See Figure 1)	0.3 < V <sub>IN/OUT</sub> ≤ V <sub>DD</sub> - 0.3	4.3	-2		2	μA
I <sub>LEAK_ON</sub>	ON State Leakage Current on COMA & COMB (See Figure 1)	0.3 < V <sub>IN/OUT</sub> ≤ V <sub>DD</sub> - 0.3	4.3	-2		2	μA
I <sub>OFF</sub>	Power OFF Leakage Current on COMA & COMB (See Figure 1)	V <sub>IN/OUT</sub> = 4.3V	0			±45	μA
R <sub>ON</sub>	On-Resistance (See Figure 2)	V <sub>IN/OUT</sub> = V <sub>DD</sub> -4.3V, 0.7 and V <sub>DD</sub> , I <sub>IN/OUT</sub> = 100mA	1.65		1.0		Ω
			3.0		0.4		
			4.3		0.3		
Δ R <sub>ON</sub>	On-Resistance Match Between Channels (Note 1)	V <sub>IN/OUT</sub> = 0.7V, I <sub>IN/OUT</sub> = 100mA	1.65		1.0		Ω
			3.0		0.06		
			4.3		0.04		
R <sub>FLAT_ON</sub>	R <sub>ON</sub> Flatness (Note 2)	V <sub>IN/OUT</sub> = V <sub>DD</sub> -4.3V, and 0.7V, I <sub>IN/OUT</sub> = 100mA	1.65		0.6		Ω
			3.0		0.3		
			4.3		0.2		

**Note 1:** Δ R<sub>ON(MAX)</sub> = | R<sub>ON\_MAX</sub>(A0, A1, B0, or B1)-R<sub>ON\_MIN</sub>(A0, A1, B0, or B1) | @ Same T<sub>A</sub>, input voltage, and Supply voltage.

**Note 2:** R<sub>FLAT\_ON</sub> is defined as the difference between the maximum and minimum value of R<sub>ON</sub> measured over specified V<sub>IN/OUT</sub> range.

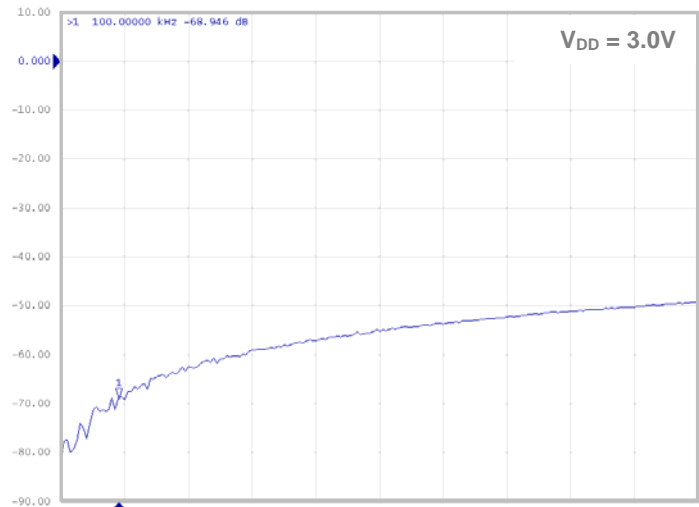
## AC Electrical Characteristics

All listed typical values are tested at  $T_A=25^{\circ}\text{C}$  unless otherwise specified.

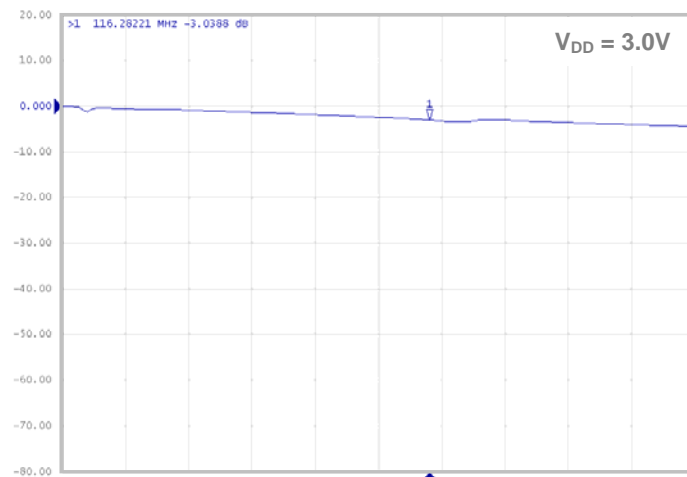
Symbol	Parameter	Test Conditions	V <sub>DD</sub> (V)	Min	Typ	Max	Unit
<b>Time &amp; Frequency</b>							
t <sub>ON</sub>	Turn-On Time (See Figure 3)	V <sub>IN/OUT</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, V <sub>SAB_H</sub> = V <sub>DD</sub> , V <sub>SAB_L</sub> = 0	4.3			100	ns
t <sub>OFF</sub>	Turn-Off Time (See Figure 3)	V <sub>IN/OUT</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, V <sub>SAB_H</sub> = V <sub>DD</sub> , V <sub>SAB_L</sub> = 0	4.3			70	ns
THD	Total Harmonic Distortion (See Figure 4)	R <sub>L</sub> = 32Ω, V <sub>IN/OUT</sub> = 2Vpp freq = 20 ~ 20kHz	4.3		0.01		%
			1.65		0.5		
t <sub>BBM</sub>	Break-Before-Make Delay Time (See Figure 5) (Note 1)	V <sub>IN/OUT</sub> = 1.5V, R <sub>L</sub> = R <sub>S</sub> = 50Ω, C <sub>L</sub> = 35pF	1.65 ~ 4.3		15		ns
BW	-3dB Bandwidth (See Figure 6)	R <sub>L</sub> = R <sub>S</sub> = 50Ω, C <sub>L</sub> = 0pF Signal level = 0dBm	1.65 ~ 4.3		>50		MHz
<b>Isolation &amp; Crosstalk</b>							
O <sub>IRR</sub>	Off Isolation (See Figure 7) (Note 1)	f = 100KHz, R <sub>L</sub> = R <sub>S</sub> = 50Ω	1.65 ~ 4.3		-70		dB
X <sub>TALK</sub>	Channel Crosstalk (See Figure 8) (Note 1)	f = 100KHz, R <sub>L</sub> = R <sub>S</sub> = 50Ω	1.65 ~ 4.3		-70		dB
<b>Capacitance</b>							
C <sub>IN</sub>	Control Pin Input Capacitance (Note 1)	f = 1MHz	0		2.5		pF
C <sub>ON</sub>	ON Capacitance (See Figure 9) (Note 1)	f = 1MHz	3.3		120		pF
C <sub>OFF</sub>	OFF Capacitance (See Figure 10) (Note 1)	f = 1MHz	3.3		50		pF
Q	Charge Injection (See Figure 11) (Note 1)	CL=1.0nF, Q = C <sub>L</sub> • ΔV <sub>OUT</sub>	1.65 ~ 4.3		30		pF

**Note 1:** These parameters are not production tested: Guaranteed by design correlation.

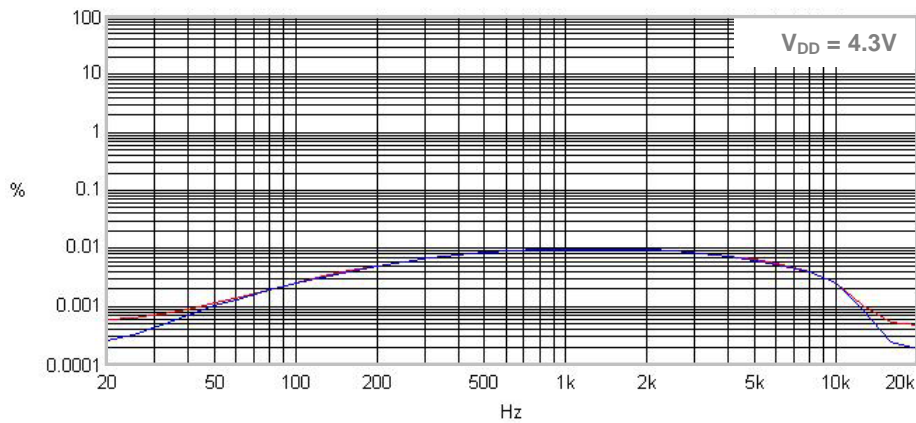
Typical Operating Characteristics



Off-Isolation

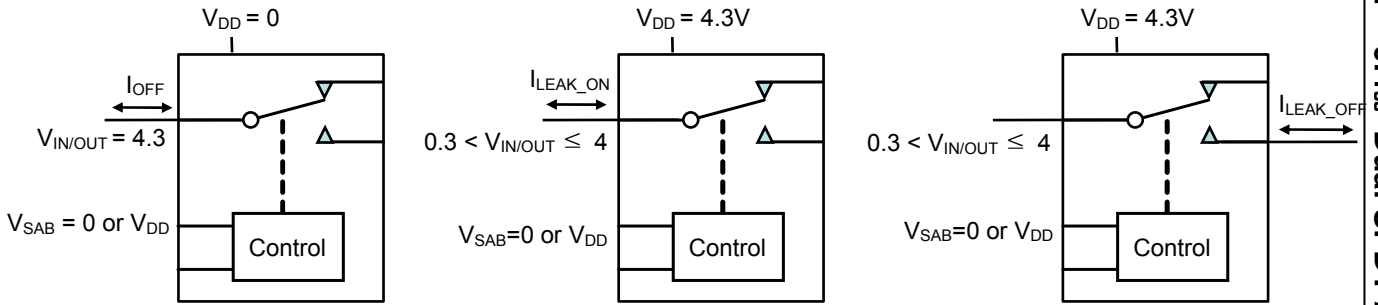


-3dB Bandwidth

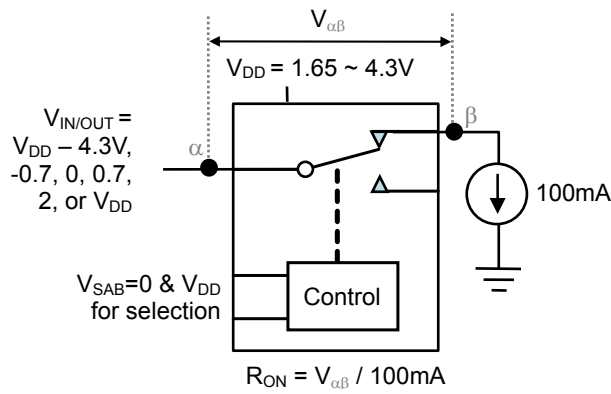


THD

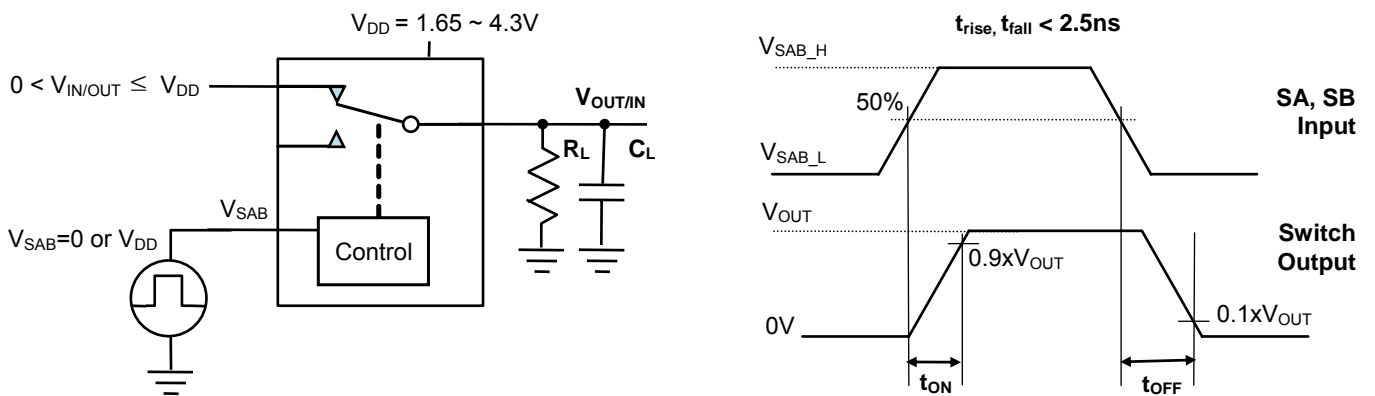
**Test Diagrams**



**Figure 1.  $I_{OFF}$  &  $I_{LEAK\_ON/OFF}$  test circuit**



**Figure 2.  $R_{ON}$  test circuit**



**Figure 3.  $t_{ON}$ ,  $t_{OFF}$  test circuit**

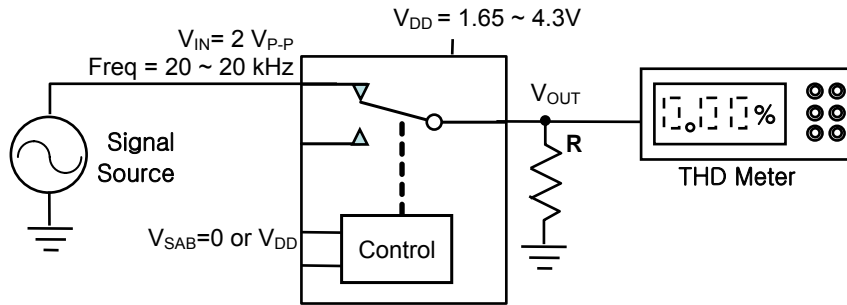


Figure 4. Total Harmonic Distortion

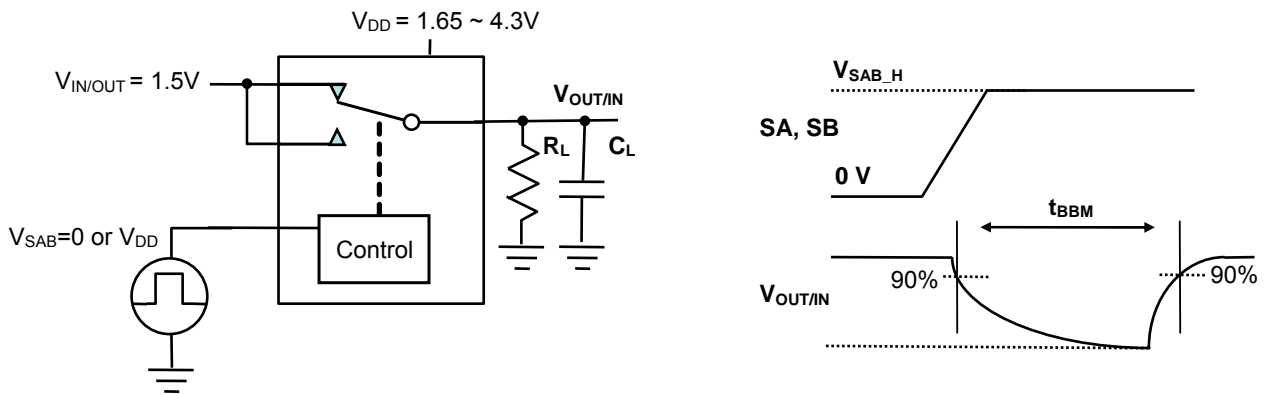


Figure 5. Break-Before-Make time

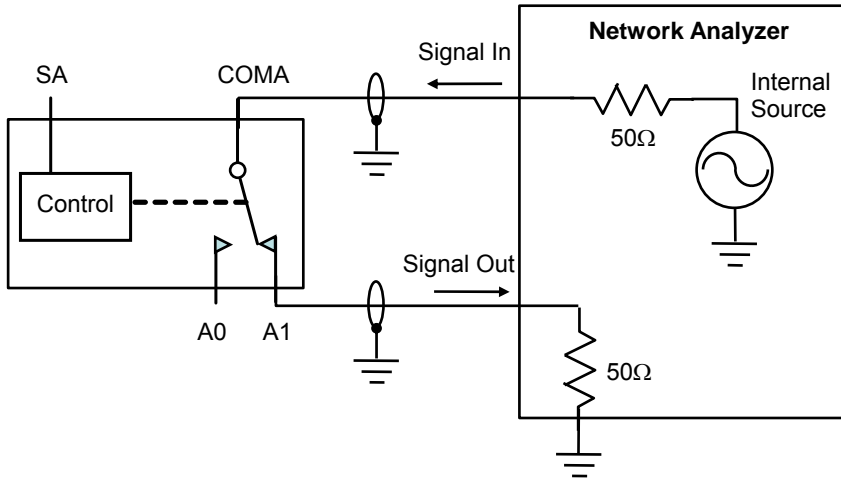


Figure 6. -3dB Bandwidth

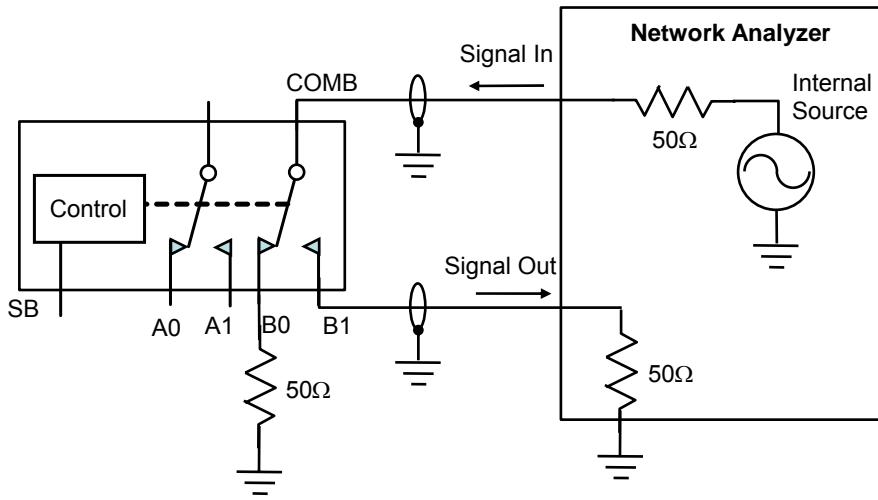


Figure 7. Off Isolation

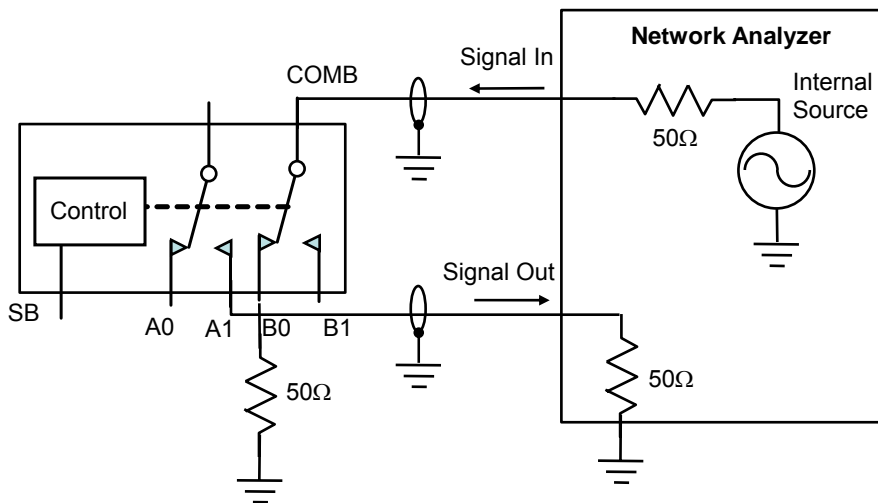
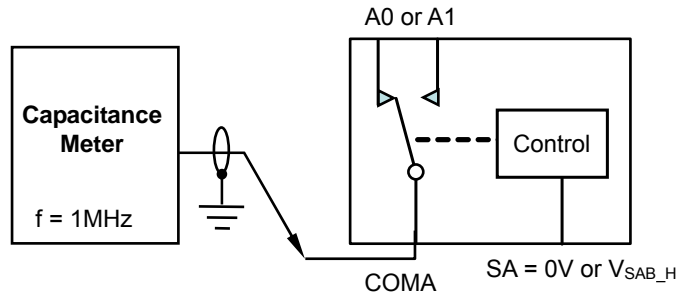
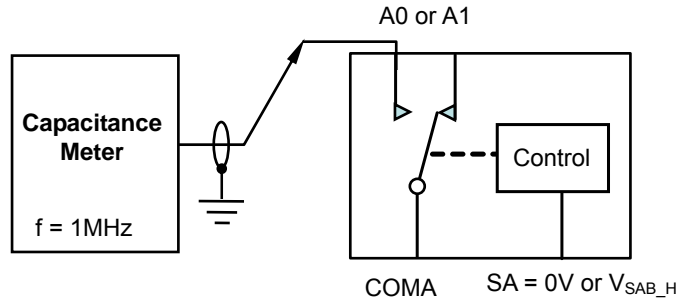


Figure 8. Channel Crosstalk

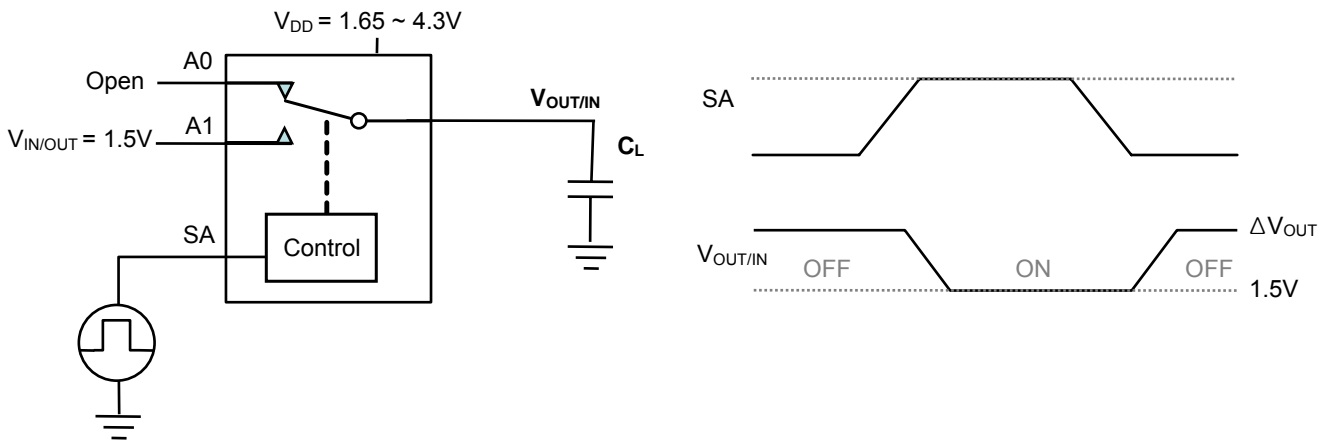




**Figure 9. ON Capacitance**



**Figure 10. OFF Capacitance**

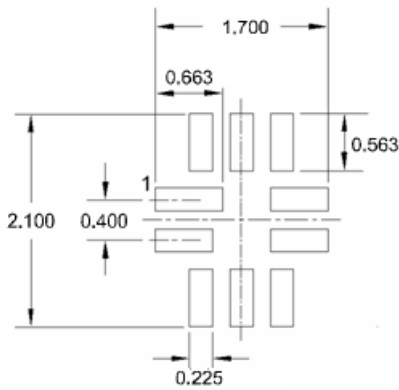
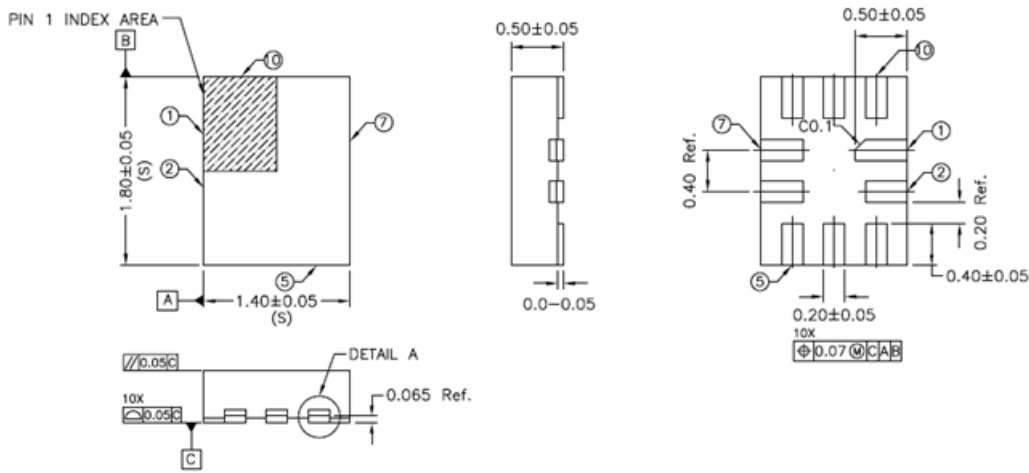


**Figure 11. Charge Injection**

## Physical Dimensions

### 10-pin, 1.4mmX1.8mm Thin QFN

Dimensions are in millimeters



NOTE :

1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.05 mm.
3. WARPAGE SHALL NOT EXCEED 0.05 mm.
4. PACKAGE LENGTH / PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC.(S)
5. REFER JEDEC MO-236/MO-248

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