RoHS Compliant
HALOGEN-FREE

MagnaChip

MSI2021

0.4Ω Dual SPDT Analog Switch with Negative Swing Feature

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*.

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}≠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

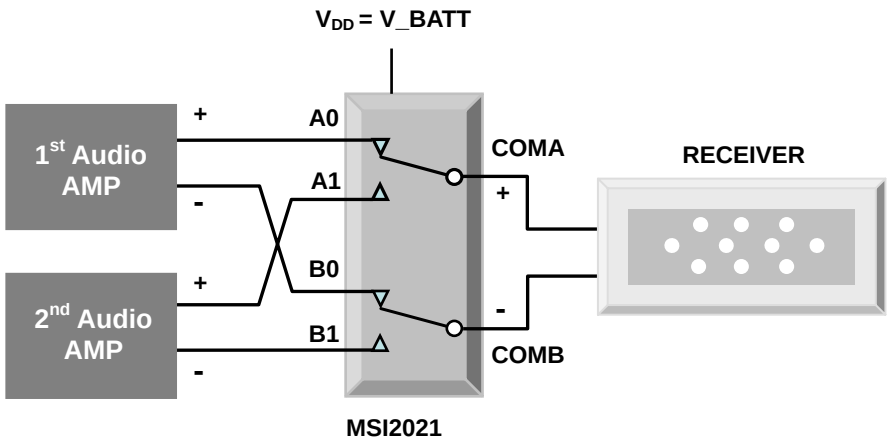
Applications

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

Ordering Information

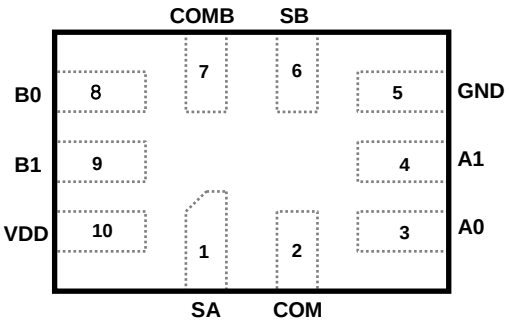
Part Number	Top Marking	Ambient Temperature Range	Package [mm]	RoHS Status
MSI2021QH	S2U	-40℃ to +85℃	1.4mm x 1.8mm x 0.5mm, 10 leads QFN	Halogen-Free

Typical Application

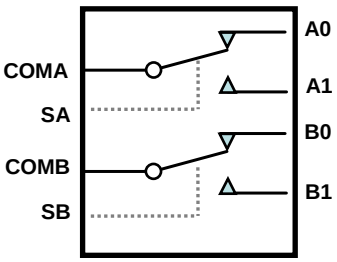


Pin Configuration

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_{DD}	DC Supply Voltage on VDD pin		-0.5	5.5	V
V_{SAB}	Control Input Voltage (SA, SB)		-0.5	V_{DD}+0.3V	V
$V_{IN/OUT}$	In/Out Voltage in Analog IO pins	A0, A1, B0, B1	V_{DD}-4.3	V_{DD}+0.3	V
$I_{IN/OUT}$	In/Out Current in Analog IO pins			350	mA
I_{IN/OUT_PEAK}	Peak Current in Analog IO pins (1ms Duration @10% Duty Cycle)			500	mA
ESD	HBM on All Pins			8	kV
T_S	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_{DD}	Supply Voltage	1.65	4.3	V
V_{SAB}	Control Input Voltage (SA, SB)	0	V_{DD}	V
$V_{IN/OUT}$	In/Out Voltage in Analog IO Voltage	V_{DD}-4.3	V_{DD}	V
T_A	Operating Temperature	-40	85	°C

DC Electrical Characteristics

All listed typical values are tested at T_A=25°C unless otherwise specified.

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

Note 1: △$R_{ON(MAX)}$ = | R_{ON_MAX}(A0, A1, B0, or B1)-R_{ON_MIN}(A0, A1, B0, or B1) | @ Same T_A, input voltage, and Supply voltage.
Note 2: R_{FLAT_ON} is defined as the difference between the maximum and minimum value of R_{ON} measured over specified $V_{IN/OUT}$ range.

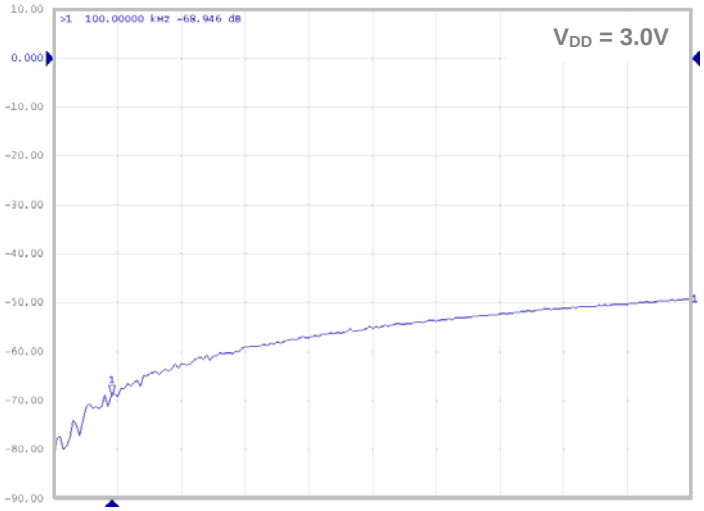
AC Electrical Characteristics

All listed typical values are tested at T_A=25°C unless otherwise specified.

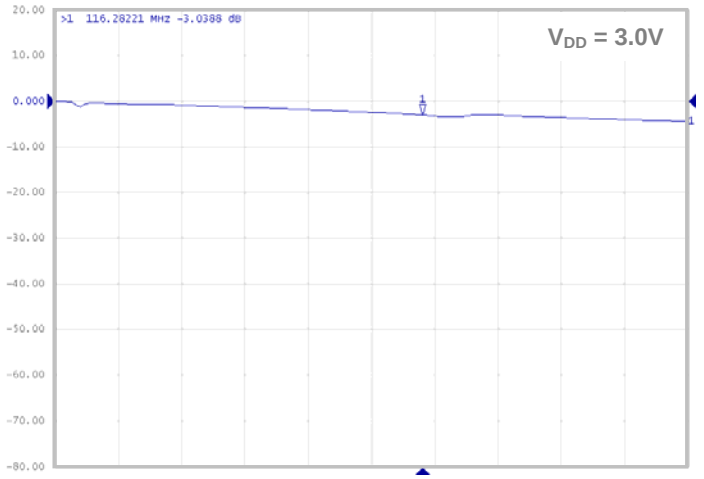
Symbol	Parameter	Test Conditions	V_{DD}(V)	Min	Typ	Max	Unit
Time & Frequency							
t_{ON}	Turn-On Time (See Figure 3)	$V_{IN/OUT}$ = 1.5V, R_L = 50Ω, C_L = 35pF, V_{SAB_H} = V_{DD}, V_{SAB_L} = 0	4.3			100	ns
t_{OFF}	Turn-Off Time (See Figure 3)	$V_{IN/OUT}$ = 1.5V, R_L = 50Ω, C_L = 35pF, V_{SAB_H} = V_{DD}, V_{SAB_L} = 0	4.3			70	ns
THD	Total Harmonic Distortion (See Figure 4)	R_L = 32Ω, $V_{IN/OUT}$ = 2Vpp freq = 20 ~ 20kHz	4.3		0.01		%
			1.65		0.5		
t_{BBM}	Break-Before-Make Delay Time (See Figure 5) (Note 1)	$V_{IN/OUT}$ = 1.5V, R_L = R_S = 50Ω, C_L = 35pF	1.65 ~ 4.3		15		ns
BW	-3dB Bandwidth (See Figure 6)	R_L = R_S = 50Ω, C_L = 0pF Signal level = 0dBm	1.65 ~ 4.3		>50		MHz
Isolation & Crosstalk							
O_{IRR}	Off Isolation (See Figure 7) (Note 1)	f = 100KHz, R_L = R_S = 50Ω	1.65 ~ 4.3		-70		dB
X_{TALK}	Channel Crosstalk (See Figure 8) (Note 1)	f = 100KHz, R_L = R_S = 50Ω	1.65 ~ 4.3		-70		dB
Capacitance							
C_{IN}	Control Pin Input Capacitance (Note 1)	f = 1MHz	0		2.5		pF
C_{ON}	ON Capacitance (See Figure 9) (Note 1)	f = 1MHz	3.3		120		pF
C_{OFF}	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_L • ΔV_{OUT}	1.65 ~ 4.3		30		pF

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

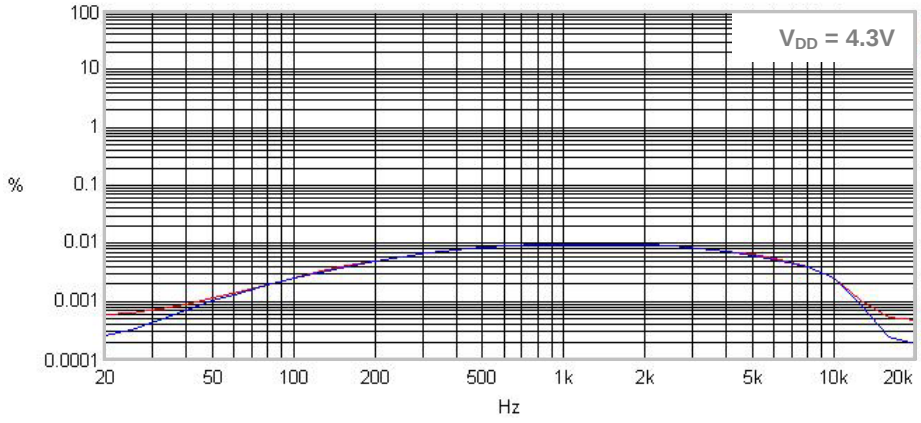
Typical Operating Characteristics



Off-Isolation



-3dB Bandwidth



THD

Test Diagrams

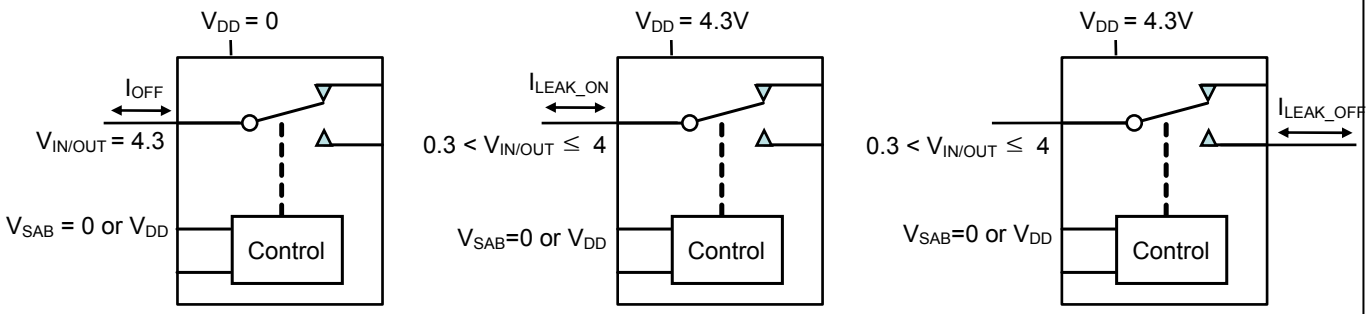


Figure 1. I_{OFF} & $I_{LEAK\_ON/OFF}$ test circuit

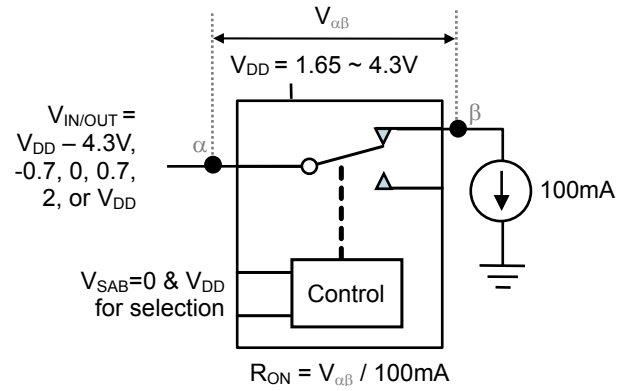


Figure 2. R_{ON} test circuit

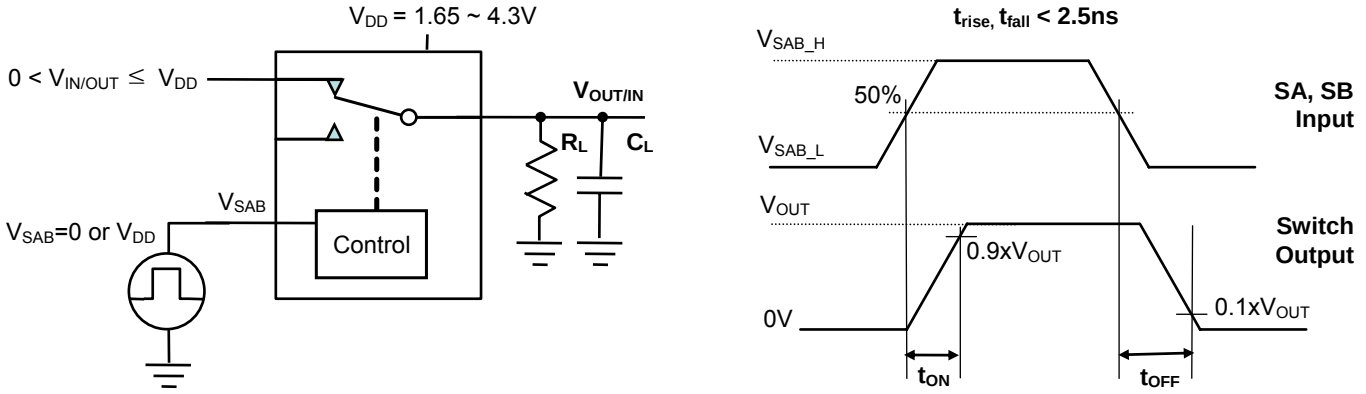


Figure 3. t_{ON}, t_{OFF} test circuit

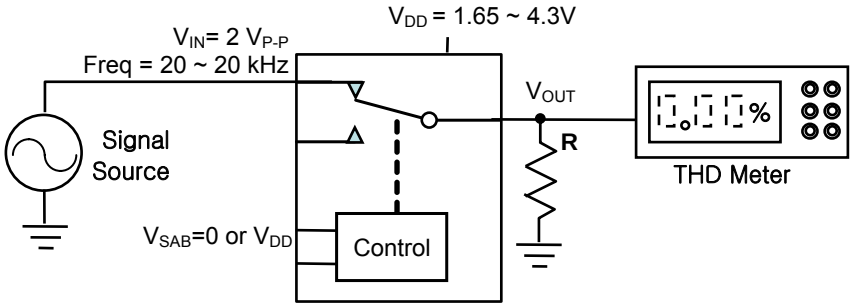


Figure 4. Total Harmonic Distortion

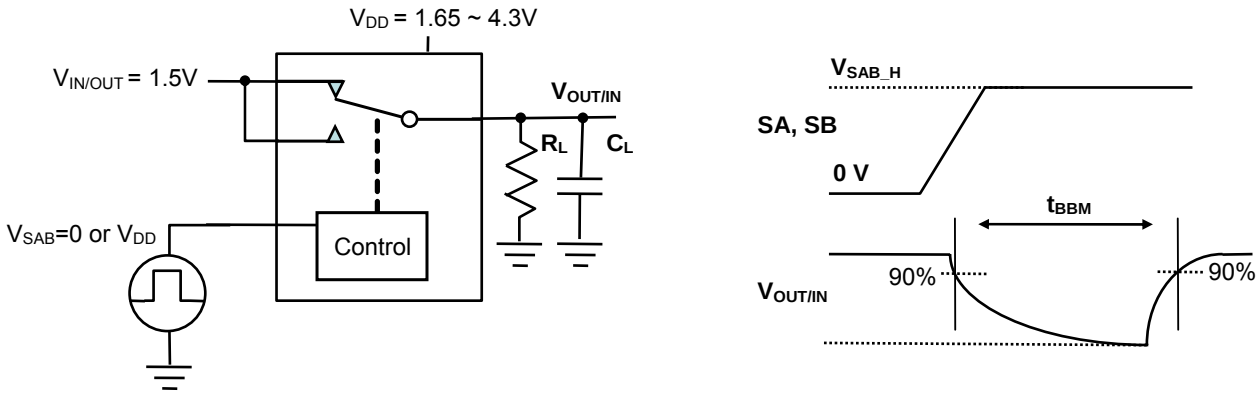


Figure 5. Break-Before-Make time

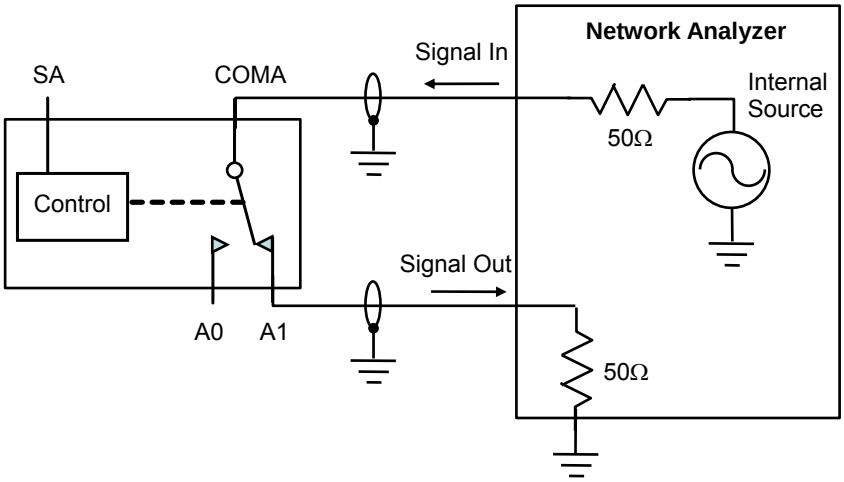


Figure 6. -3dB Bandwidth

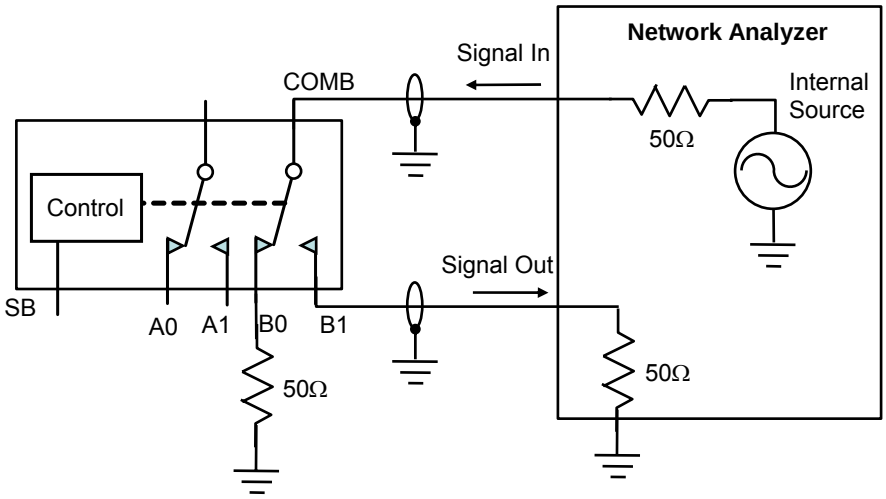


Figure 7. Off Isolation

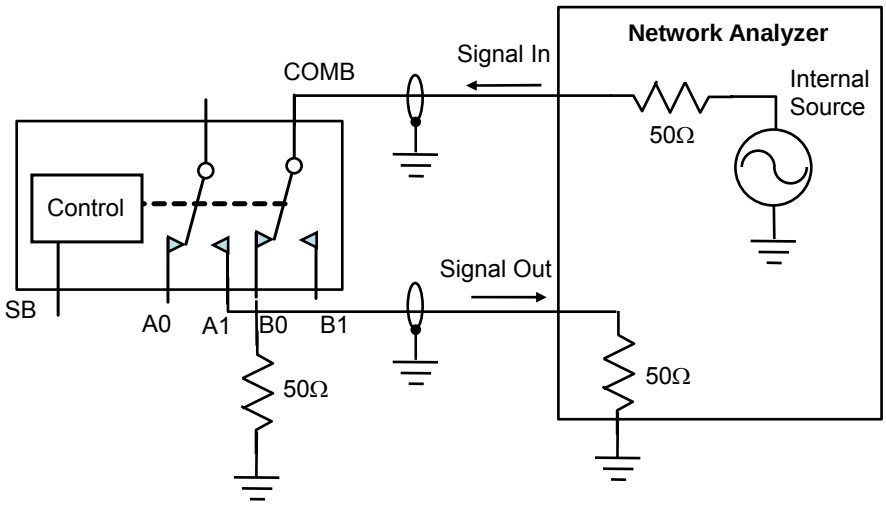


Figure 8. Channel Crosstalk

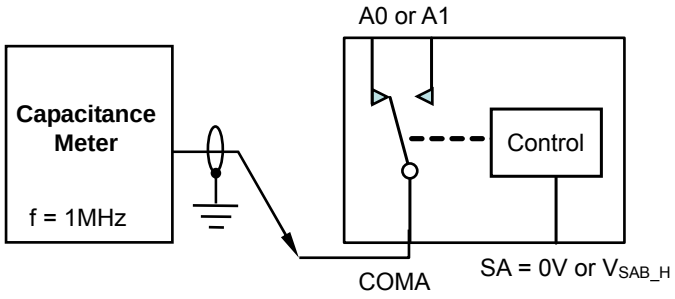


Figure 9. ON Capacitance

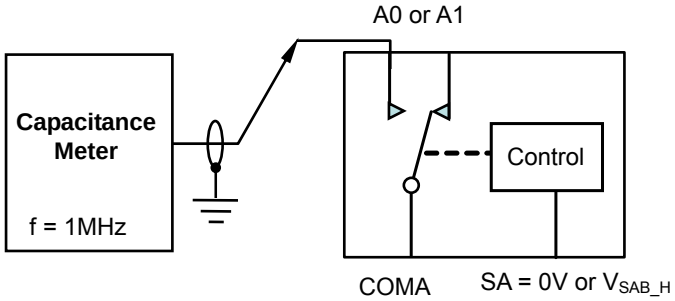


Figure 10. OFF Capacitance

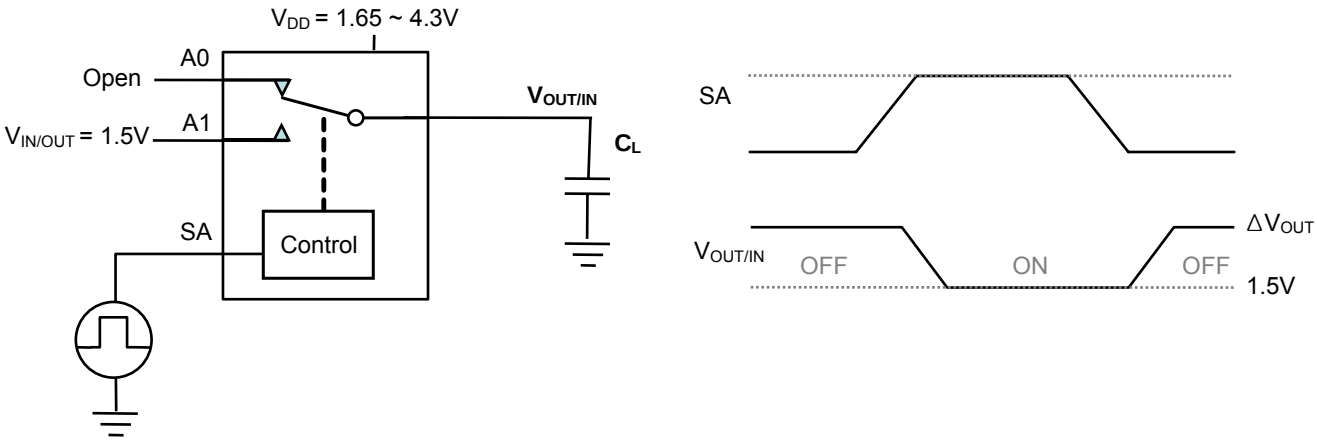
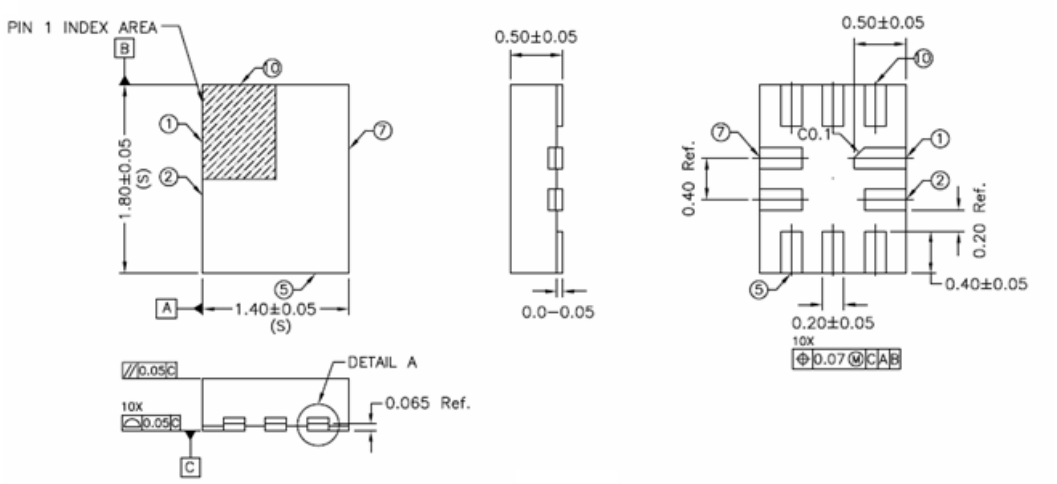


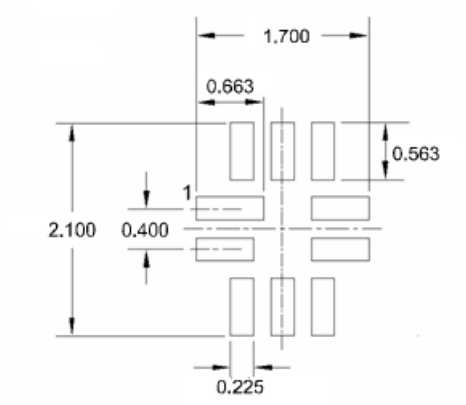
Figure 11. Charge Injection

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.
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