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# FSA2567 — Low-Power, Dual SIM Card Analog Switch

## Features

- Low On Capacitance for Data Path: 10 pF Typical
- Low On Resistance for Data Path: 6 Ω Typical
- Low On Resistance for Supply Path: 0.4 Ω Typical
- Wide  $V_{CC}$  Operating Range: 1.65 V to 4.3 V
- Low Power Consumption: 1 μA Maximum
  - 15 μA Maximum  $I_{CCT}$  Over Expanded Voltage Range ( $V_{IN}=1.8$  V,  $V_{CC}=4.3$  V)
- Wide -3 db Bandwidth: > 160 MHz
- Packaged in:
  - Pb-free 16-Lead MLP & 16-Lead UMLP
- 3 kV ESD Rating, >12 kV Power/GND ESD Rating

## Applications

- Cell phone, PDA, Digital Camera, and Notebook
- LCD Monitor, TV, and Set-Top Box

## Description

The FSA2567 is a bi-directional, low-power, dual double-pole, double-throw (4PDT) analog switch targeted at dual SIM card multiplexing. It is optimized for switching the WLAN-SIM data and control signals and dedicates one channel as a supply-source switch.

The FSA2567 is compatible with the requirements of SIM cards and features a low on capacitance ( $C_{ON}$ ) of 10 pF to ensure high-speed data transfer. The  $V_{SIM}$  switch path has a low  $R_{ON}$  characteristic to ensure minimal voltage drop in the dual SIM card supply paths.

The FSA2567 contains special circuitry that minimizes current consumption when the control voltage applied to the SEL pin is lower than the supply voltage ( $V_{CC}$ ). This feature is especially valuable in ultra-portable applications, such as cell phones; allowing direct interface with the general-purpose I/Os of the baseband processor. Other applications include switching and connector sharing in portable cell phones, PDAs, digital cameras, printers, and notebook computers.

## Ordering Information

Part Number	Top Mark	Operating Temperature Range	Package
FSA2567MPX	FSA2567	-40 to +85°C	16-Lead, Molded Leadless Package (MLP) Quad, JEDEC MO-220, 3 mm Square
FSA2567UMX	GX		16-Lead, Quad, Ultrathin Molded Leadless Package (UMLP), 1.8 x 2.6 mm

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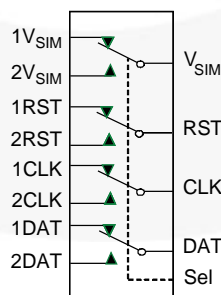
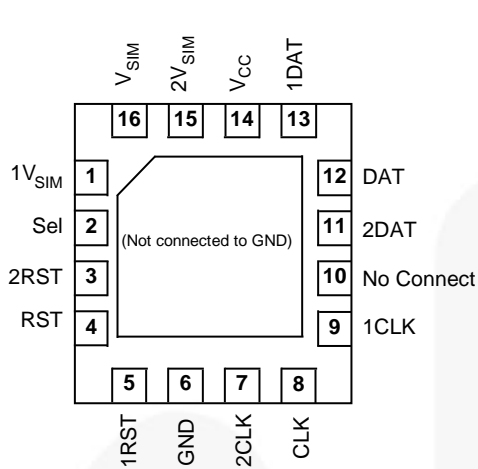
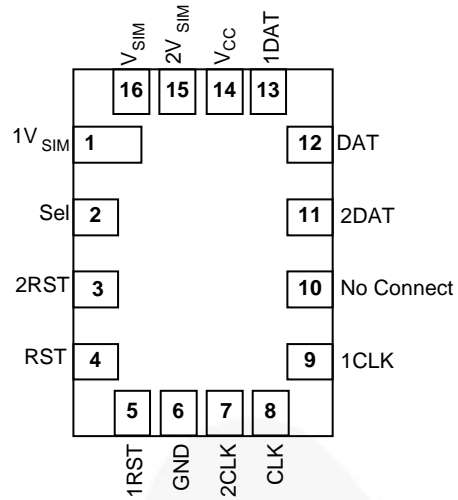


Figure 1. Analog Symbol

## Pin Assignments



**Figure 2. Pad Assignment MLP16 (Top Through View)**



**Figure 3. Pad Assignment UMLP16 (Top Through View)**

## Pin Definitions

Pin	Description
nDAT, nRST, nCLK	Multiplexed Data Source Inputs
nV <sub>SIM</sub>	Multiplexed SIM Supply Inputs
V <sub>SIM</sub> , DAT, RST, CLK	Common SIM Ports
Sel	Switch Select

## Truth Table

Sel	Function
Logic LOW	1DAT = DAT, 1RST = RST, 1CLK = CLK, 1V <sub>SIM</sub> = V <sub>SIM</sub>
Logic HIGH	2DAT = DAT, 2RST = RST, 2CLK = CLK, 2V <sub>SIM</sub> = V <sub>SIM</sub>

## 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	+5.5	V
$V_{CNTRL}$	DC Input Voltage (Sel) <sup>(1)</sup>	-0.5	$V_{CC}$	V
$V_{SW}$	DC Switch I/O Voltage <sup>(1)</sup>	-0.5	$V_{CC} + 0.3$	V
$I_{IK}$	DC Input Diode Current	-50		mA
$I_{SIM}$	DC Output Current - $V_{SIM}$		350	mA
$I_{OUT}$	DC Output Current – DAT, CLK, RST		35	mA
$T_{STG}$	Storage Temperature	-65	+150	°C
ESD	Human Body Model, JEDEC: JESD22-A114	All Pins	3	kV
		I/O to GND	12	
	Charged Device Model, JEDEC: JESD22-C101	2		

### 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	4.30	V
$V_{CNTRL}$	Control Input Voltage (Sel) <sup>(2)</sup>	0	$V_{CC}$	V
$V_{SW}$	Switch I/O Voltage	-0.5	$V_{CC}$	V
$I_{SIM}$	DC Output Current - $V_{SIM}$		150	mA
$I_{OUT}$	DC Output Current – DAT, CLK, RST		25	mA
$T_A$	Operating Temperature	-40	+85	°C

### Note:

- The control input must be held HIGH or LOW; it must not float.

## DC Electrical Characteristics

All typical values are at 25°C, 3.3 V  $V_{CC}$  unless otherwise specified.

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			Units
				Min.	Typ.	Max.	
$V_{IK}$	Clamp Diode Voltage	$I_{IN} = -18 \text{ mA}$	2.7			-1.2	V
$V_{IH}$	Input Voltage High		1.65 to 2.3	1.1			V
			2.7 to 3.6	1.3			
			4.3	1.7			
$V_{IL}$	Input Voltage Low		1.65 to 2.3			0.4	V
			2.7 to 3.6			0.5	
			4.3			0.7	
$I_{IN}$	Control Input Leakage	$V_{SW} = 0 \text{ to } V_{CC}$	4.3	-1		1	$\mu\text{A}$
$I_{nc(off)}, I_{no(off)}$	Off State Leakage	$nRST, nDAT, nCLK, nV_{SIM} = 0.3 \text{ V}$ or 3.6 V Figure 10	4.3	-60		60	nA
$R_{OND}$	Data Path Switch On Resistance <sup>(3)</sup>	$V_{SW} = 0, 1.8 \text{ V}, I_{ON} = -20 \text{ mA}$ Figure 9	1.8		7.0	12.0	$\Omega$
			$V_{SW} = 0, 2.3 \text{ V}, I_{ON} = -20 \text{ mA}$ Figure 9	2.7		6.0	
$R_{ONV}$	$V_{SIM}$ Switch On Resistance <sup>(3)</sup>	$V_{SW} = 0, 1.8 \text{ V}, I_{ON} = -100 \text{ mA}$ Figure 9	1.8		0.5	0.7	$\Omega$
			$V_{SW} = 0, 2.3 \text{ V}, I_{ON} = -100 \text{ mA}$ Figure 9	2.7		0.4	
$\Delta R_{OND}$	Data Path Delta On Resistance <sup>(4)</sup>	$V_{SW} = 0 \text{ V}, I_{ON} = -20 \text{ mA}$	2.7		0.2		$\Omega$
$I_{CC}$	Quiescent Supply Current	$V_{CTRL} = 0 \text{ or } V_{CC}, I_{OUT} = 0$	4.3			1.0	$\mu\text{A}$
$I_{CCT}$	Increase in $I_{CC}$ Current Per Control Voltage and $V_{CC}$	$V_{CTRL} = 2.6 \text{ V}, V_{CC} = 4.3 \text{ V}$	4.3		5.0	10.0	$\mu\text{A}$
		$V_{CTRL} = 1.8 \text{ V}, V_{CC} = 4.3 \text{ V}$	4.3		7.0	15.0	$\mu\text{A}$

**Notes:**

3. Measured by the voltage drop between nDAT, nRST, nCLK and relative common port pins at the indicated current through the switch. On resistance is determined by the lower of the voltage on the relative ports.
4. Guaranteed by characterization.

## AC Electrical Characteristics

All typical value are for  $V_{CC}=3.3V$  at  $25^{\circ}C$  unless otherwise specified.

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A=-40^{\circ}C$ to $+85^{\circ}C$			Units
				Min.	Typ.	Max.	
$t_{OND}$	Turn-On Time Sel to Output (DAT,CLK,RST)	$R_L = 50 \Omega$ , $C_L = 35$ pF $V_{SW} = 1.5$ V Figure 11, Figure 12	$1.8^{(5)}$		65	95	ns
			2.7 to 3.6		42	60	ns
$t_{OFFD}$	Turn-Off Time Sel to Output (DAT,CLK,RST)	$R_L = 50 \Omega$ , $C_L = 35$ pF $V_{SW} = 1.5$ V Figure 11, Figure 12	$1.8^{(5)}$		30	50	ns
			2.7 to 3.6		20	40	ns
$t_{ONV}$	Turn-On Time Sel to Output ( $V_{SIM}$ )	$R_L = 50 \Omega$ , $C_L = 35$ pF $V_{SW} = 1.5$ V Figure 11, Figure 12	$1.8^{(5)}$		55	80	ns
			2.7 to 3.6		35	55	ns
$t_{OFFV}$	Turn-Off Time Sel to Output ( $V_{SIM}$ )	$R_L = 50 \Omega$ , $C_L = 35$ pF $V_{SW} = 1.5$ V Figure 11, Figure 12	$1.8^{(5)}$		35	50	
			2.7 to 3.6		22	40	ns
$t_{PD}$	Propagation Delay <sup>(5)</sup> (DAT,CLK,RST)	$C_L = 35$ pF, $R_L = 50 \Omega$ Figure 11, Figure 13	3.3		0.25		ns
$t_{BBMD}$	Break-Before-Make <sup>(5)</sup> (DAT,CLK,RST)	$R_L = 50 \Omega$ , $C_L = 35$ pF $V_{SW1} = V_{SW2} = 1.5$ V Figure 15	2.7 to 3.6	3	18		ns
$t_{BBMV}$	Break-Before-Make <sup>(5)</sup> ( $V_{SIM}$ )	$R_L = 50 \Omega$ , $C_L = 35$ pF $V_{SW1} = V_{SW2} = 1.5$ V Figure 15	2.7 to 3.6	3	12		ns
Q	Charge Injection (DAT,CLK,RST)	$C_L = 50$ pF, $R_{GEN} = 0 \Omega$ , $V_{GEN} = 0$ V	2.7 to 3.6		10		pC
$O_{IRR}$	Off Isolation (DAT,CLK,RST)	$R_L = 50 \Omega$ , $f = 10$ MHz Figure 17	2.7 to 3.6		-60		dB
Xtalk	Non-Adjacent Channel Crosstalk (DAT,CLK,RST)	$R_L = 50 \Omega$ , $f = 10$ MHz Figure 18	2.7 to 3.6		-60		dB
BW	-3 db Bandwidth (DAT,CLK,RST)	$R_L = 50 \Omega$ , $C_L = 5$ pF Figure 16	2.7 to 3.6		475		MHz

**Note:**

5. Guaranteed by characterization.

## Capacitance

Symbol	Parameter	Conditions	T <sub>A</sub> = -40°C to +85°C			Units
			Min.	Typ.	Max.	
C <sub>IN</sub>	Control Pin Input Capacitance	V <sub>CC</sub> = 0 V		1.5		pF
C <sub>OND</sub>	RST, CLK, DAT On Capacitance <sup>(6)</sup>	V <sub>CC</sub> = 3.3 V, f = 1 MHz Figure 20		10	12	
C <sub>ONV</sub>	V <sub>SIM</sub> On Capacitance <sup>(6)</sup>	V <sub>CC</sub> = 3.3 V, f = 1 MHz Figure 20		110	150	
C <sub>OFFD</sub>	RST, CLK, DAT Off Capacitance	V <sub>CC</sub> = 3.3 V, Figure 19		3		
C <sub>OFFV</sub>	V <sub>SIM</sub> Off Capacitance	V <sub>CC</sub> = 3.3 V, Figure 19		40		

**Note:**

6. Guaranteed by characterization.

Typical Performance Characteristics

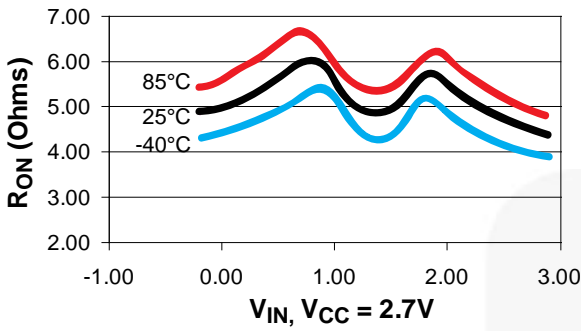


Figure 4.  $R_{ON}$  Data Path

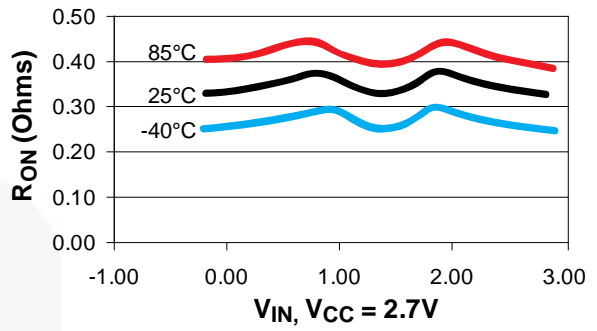


Figure 5.  $R_{ON}$   $V_{SIM}$

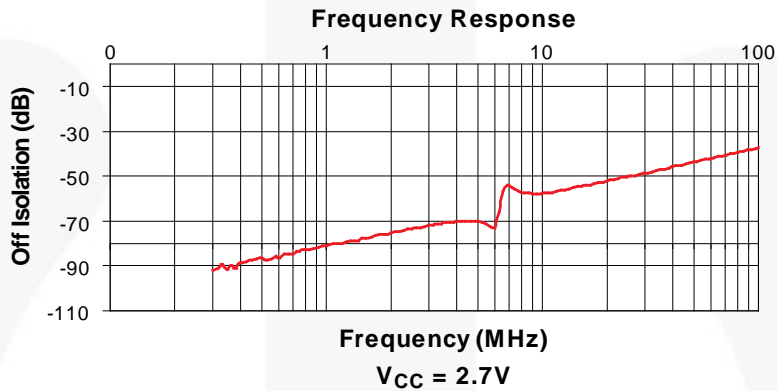


Figure 6. Off Isolation

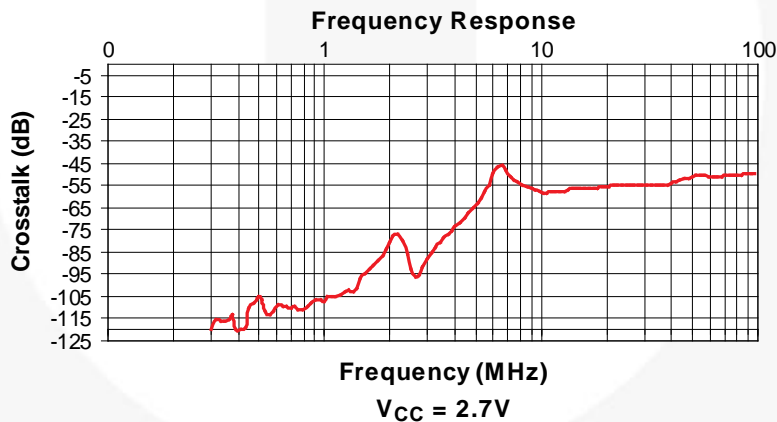


Figure 7. Crosstalk

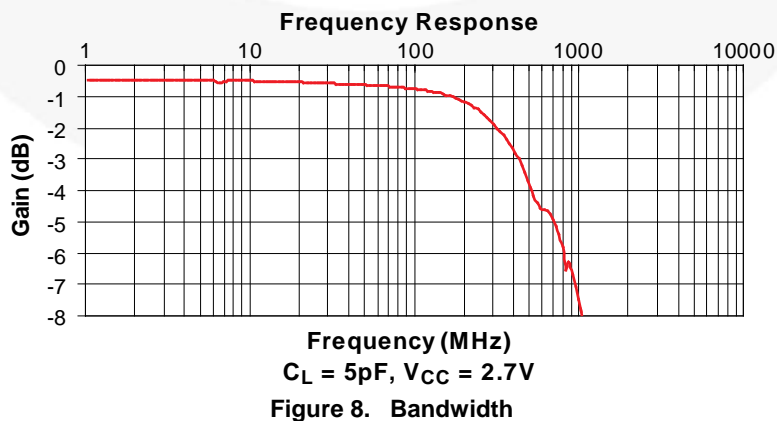
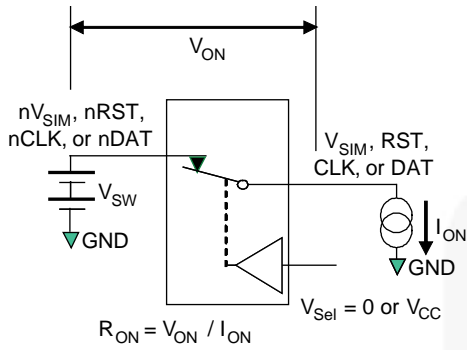


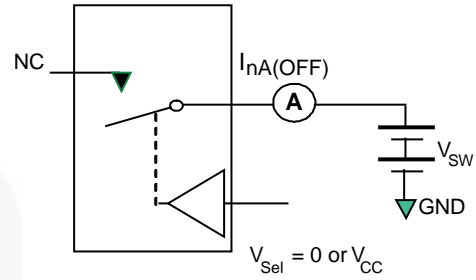
Figure 8. Bandwidth



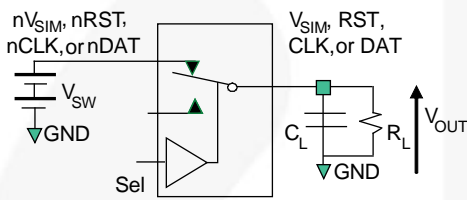
### Test Diagrams



**Figure 9. On Resistance**

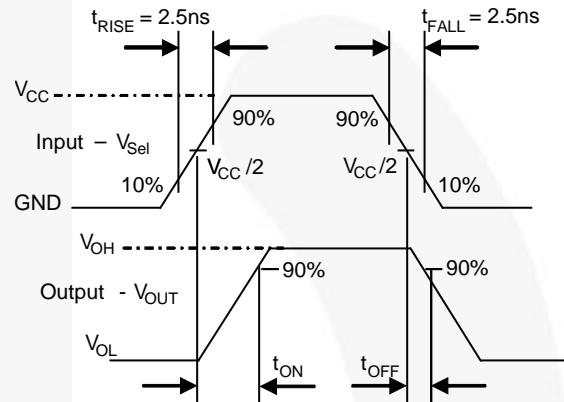


**Figure 10. Off Leakage**

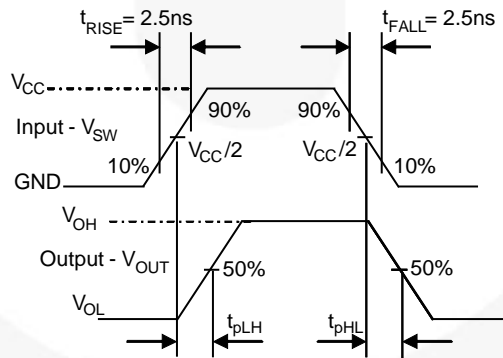


$R_L$  and  $C_L$  are functions of the application environment (see tables for specific values).  $C_L$  includes test fixture and stray capacitance.

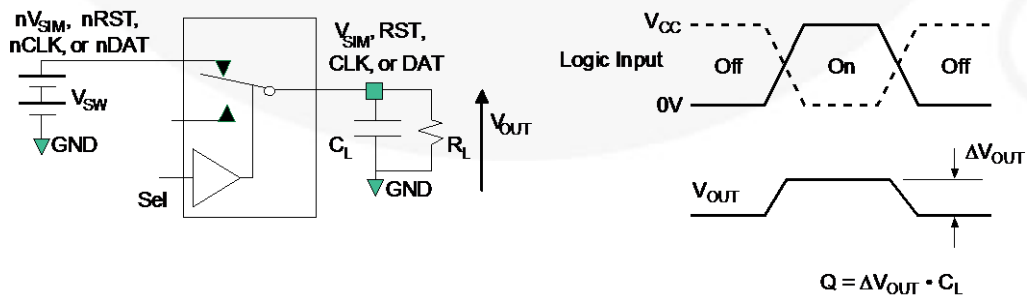
**Figure 11. AC Test Circuit Load**



**Figure 12. Turn-On / Turn-Off Waveforms**

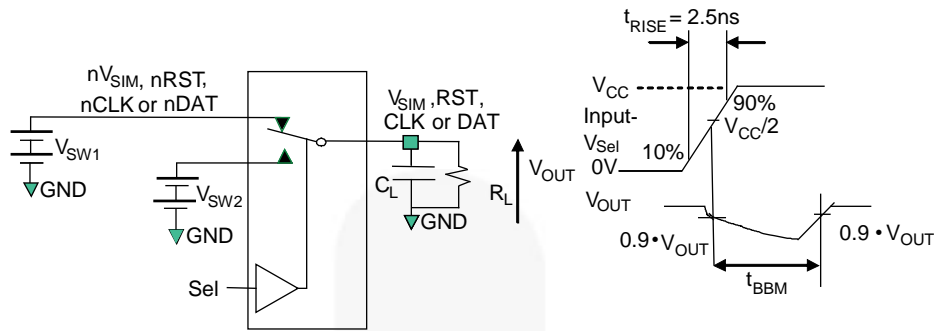


**Figure 13. Propagation Delay**



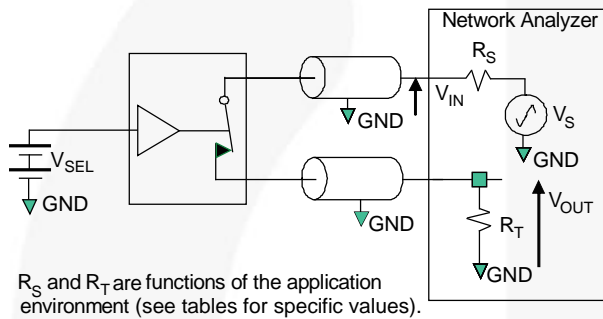
**Figure 14. Charge Injection**

**Test Diagrams (Continued)**



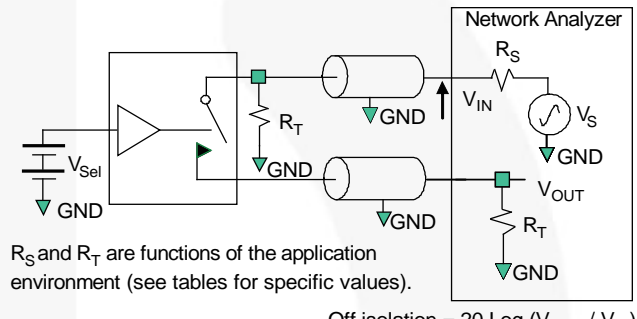
$R_L$  and  $C_L$  are functions of the application environment (see tables for specific values).  $C_L$  includes test fixture and stray capacitance.

**Figure 15. Break-Before-Make Interval Timing**



$R_S$  and  $R_T$  are functions of the application environment (see tables for specific values).

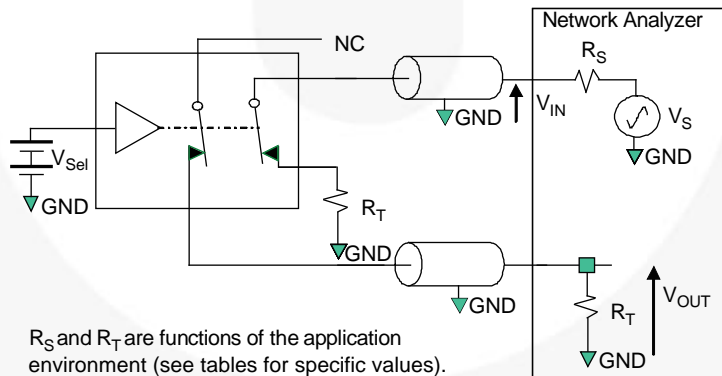
**Figure 16. Bandwidth**



$R_S$  and  $R_T$  are functions of the application environment (see tables for specific values).

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

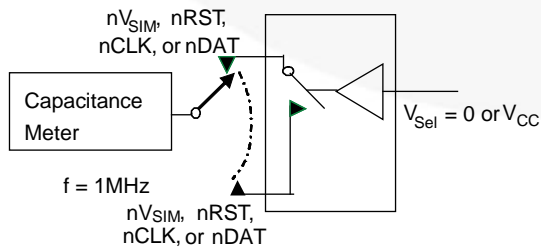
**Figure 17. Channel Off Isolation**



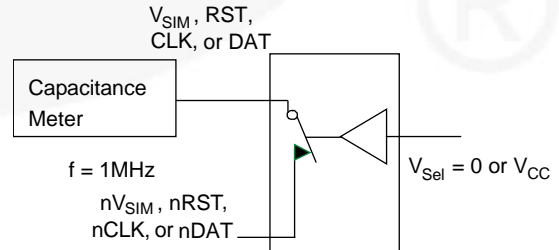
$R_S$  and  $R_T$  are functions of the application environment (see tables for specific values).

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

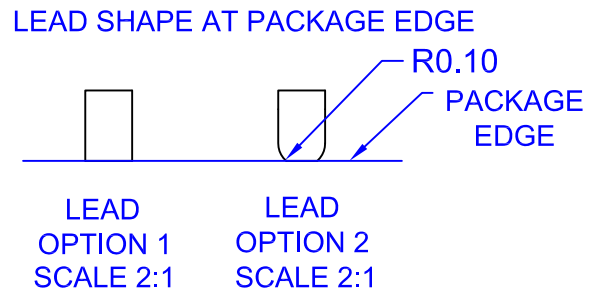
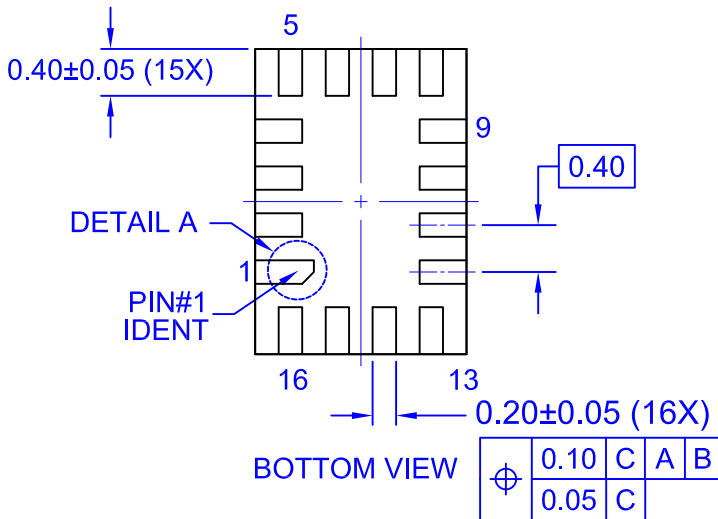
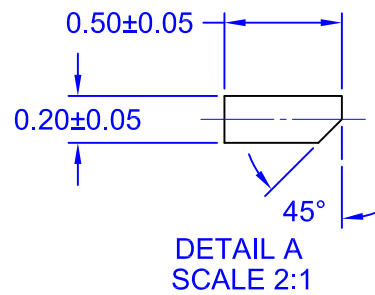
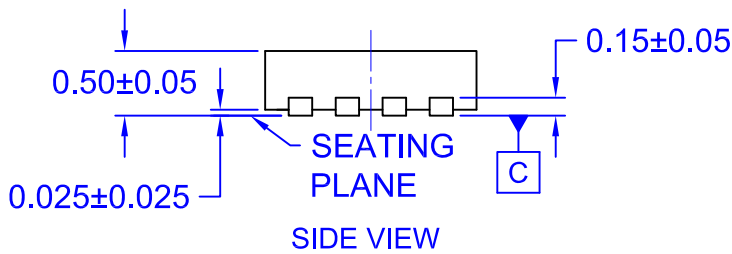
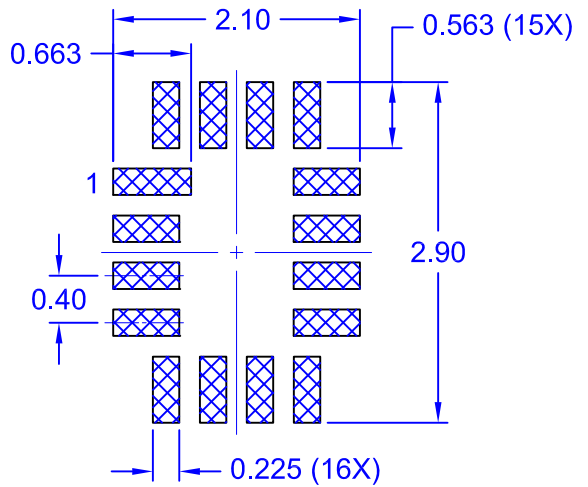
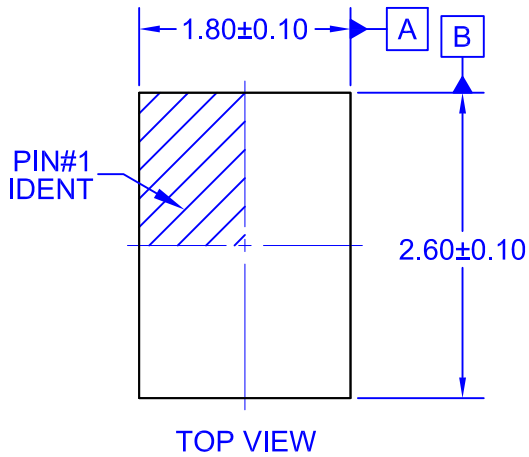
**Figure 18. Non-Adjacent Channel-to-Channel Crosstalk**



**Figure 19. Channel Off Capacitance**



**Figure 20. Channel On Capacitance**

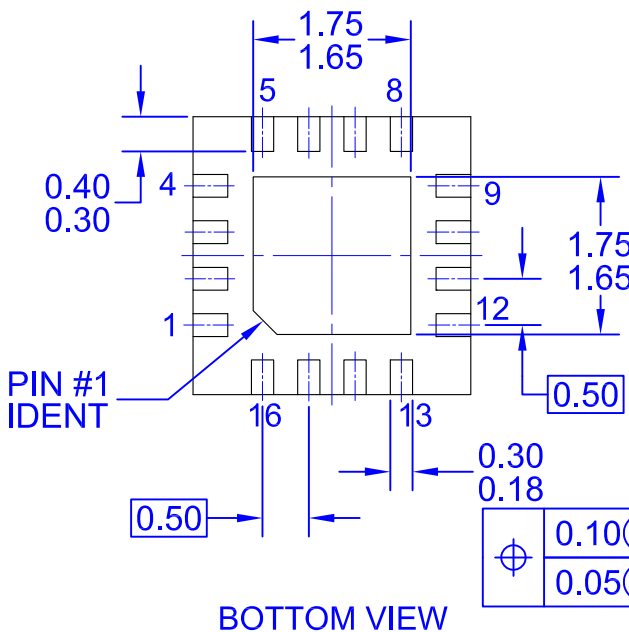
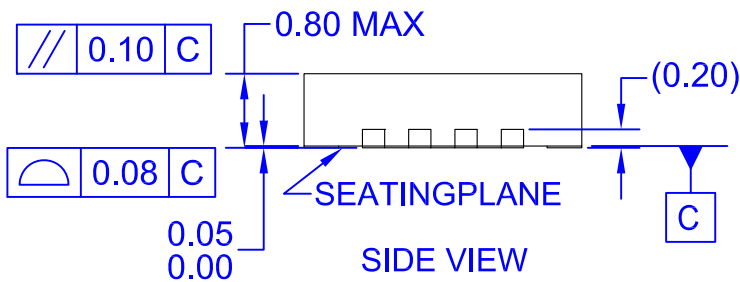
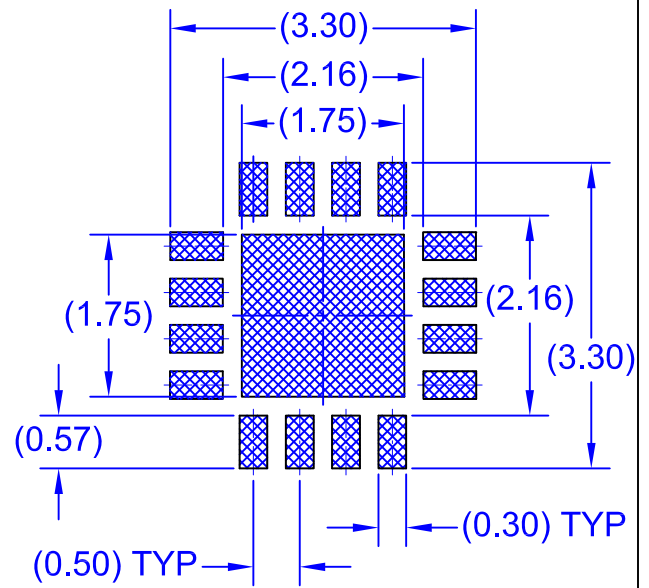
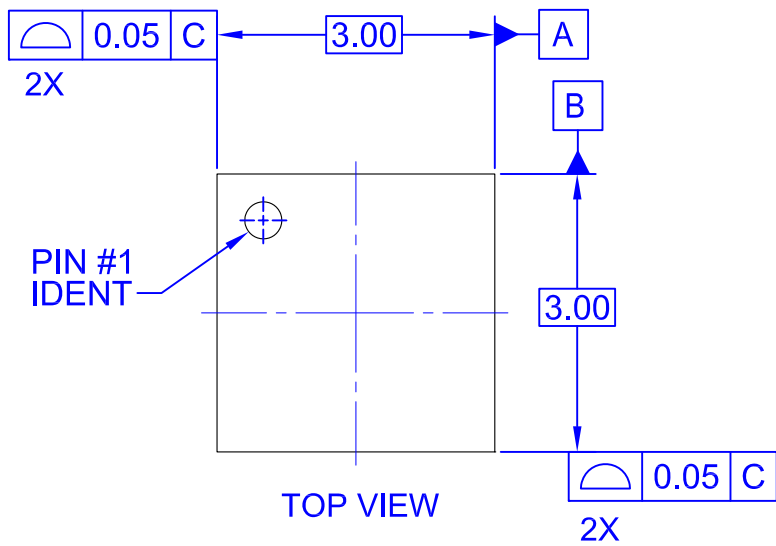


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