

# Low-Power, Dual SIM Card Analog Switch

## FSA2567

### 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.

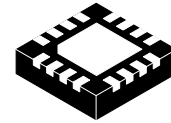
The FSA2567 contains special circuitry that minimizes current consumption when the control voltage applied to the SEL pin is lower than the supply voltage ( $V_{CC}$ ). This feature is especially valuable in ultra-portable applications, such as cell phones; allowing direct interface with the general-purpose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

### Features

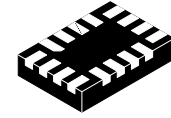
- Low On Capacitance for Data Path: 10 pF Typical
- Low On Resistance for Data Path: 6  $\Omega$  Typical
- Low On Resistance for Supply Path: 0.4  $\Omega$  Typical
- Wide  $V_{CC}$  Operating Range: 1.65 V to 4.3 V
- Low Power Consumption: 1  $\mu$ A Maximum
  - ◆ 15  $\mu$ A Maximum  $I_{CCT}$  Over 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

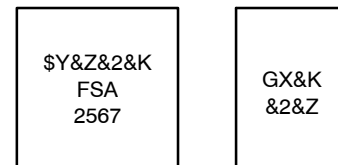


WQFN16 3x3, 0.5P  
CASE 510BS



UQFN16 1.8x2.6, 0.4P  
CASE 523BF

### MARKING DIAGRAM



GX, FSA2567 = Device Code  
 \$Y = onsemi Logo  
 &Z = Assembly Plant Code  
 &2 = 2-Digit Date Code  
 &K = 2-Digits Lot Run Traceability Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FSA2567

## ORDERING INFORMATION

Part Number	Top Mark	Operating Temperature Range	Package	Shipping†
FSA2567MPX	FSA2567	-40 to +85°C	16-Lead, Molded Leadless Package (MLP) Quad, JEDEC MO-220, 3 mm Square	3000 / Tape & Reel
FSA2567UMX	GX		16-Lead, Quad, Ultrathin Molded Leadless Package (UMLP), 1.8 x 2.6 mm	5000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

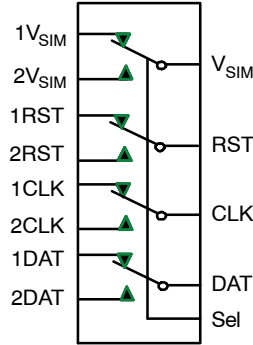


Figure 1. Analog Symbol

## PIN ASSIGNMENTS

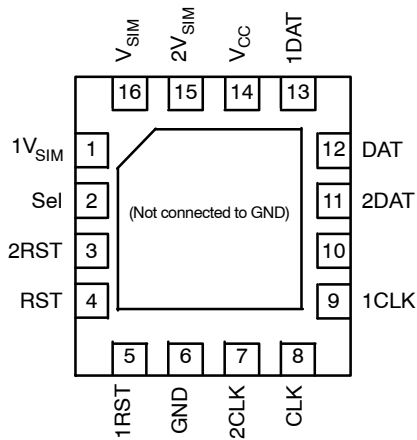


Figure 2. Pad Assignment MLP16 (Top Through View)

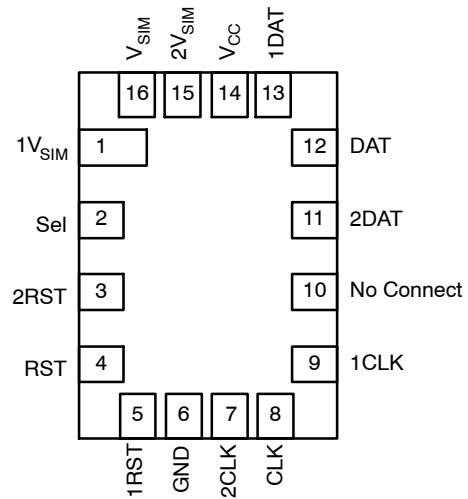


Figure 3. Pad Assignment UMLP16 (Top Through View)

## PIN DESCRIPTION

Pin No.	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

# FSA2567

## 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

Symbol	Parameter	Min	Max	Unit	
V <sub>CC</sub>	Supply Voltage	-0.5	+5.5	V	
V <sub>CNTRL</sub>	DC Input Voltage (Sel) (Note 1)	-0.5	V <sub>CC</sub>	V	
V <sub>SW</sub>	DC Switch I/O Voltage (Note 1)	-0.5	V <sub>CC</sub> + 0.3	V	
I <sub>IK</sub>	DC Input Diode Current	-50	-	mA	
I <sub>SIM</sub>	DC Output Current – V <sub>SIM</sub>	-	350	mA	
I <sub>OUT</sub>	DC Output Current – DAT, CLK, RST	-	35	mA	
T <sub>STG</sub>	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	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	1.65	4.30	V
V <sub>CNTRL</sub>	Control Input Voltage (Sel) (Note 2)	0	V <sub>CC</sub>	V
V <sub>SW</sub>	Switch I/O Voltage	-0.5	V <sub>CC</sub>	V
I <sub>SIM</sub>	DC Output Current – V <sub>SIM</sub>	-	150	mA
I <sub>OUT</sub>	DC Output Current – DAT, CLK, RST	-	25	mA
TA	Operating Temperature	-40	+85	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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

# FSA2567

## DC ELECTRICAL CHARACTERISTICS (All typical values are at 25°C, 3.3 V $V_{CC}$ unless otherwise specified.)

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			Unit
				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	$V_{SW} = 0$ 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 (Note 3)	$V_{SW} = 0$ , 1.8 V, $I_{ON} = -20\text{ mA}$ Figure 9	1.8	-	7.0	12.0	$\Omega$
		$V_{SW} = 0$ , 2.3 V, $I_{ON} = -20\text{ mA}$ Figure 9	2.7	-	6.0	10.0	
$R_{ONV}$	$V_{SIM}$ Switch On Resistance (Note 3)	$V_{SW} = 0$ , 1.8 V, $I_{ON} = -100\text{ mA}$ Figure 9	1.8	-	0.5	0.7	$\Omega$
		$V_{SW} = 0$ , 2.3 V, $I_{ON} = -100\text{ mA}$ Figure 9	2.7	-	0.4	0.6	
$\Delta R_{OND}$	Data Path Delta On Resistance (Note 4)	$V_{SW} = 0\text{ V}$ , $I_{ON} = -20\text{ mA}$	2.7	-	0.2	-	$\Omega$
$I_{CC}$	Quiescent Supply Current	$V_{CNTRL} = 0$ or $V_{CC}$ , $I_{OUT} = 0$	4.3	-	-	1.0	$\mu\text{A}$
$I_{CCT}$	Increase in $I_{CC}$ Current Per Control Voltage and $V_{CC}$	$V_{CNTRL} = 2.6\text{ V}$ , $V_{CC} = 4.3\text{ V}$	4.3	-	5.0	10.0	$\mu\text{A}$
		$V_{CNTRL} = 1.8\text{ V}$ , $V_{CC} = 4.3\text{ V}$	4.3	-	7.0	15.0	$\mu\text{A}$

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.

# FSA2567

## AC ELECTRICAL CHARACTERISTICS (All typical values are for $V_{CC} = 3.3\text{ V}$ at $25^\circ\text{C}$ unless otherwise specified.)

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to 85°C			Unit
				Min	Typ	Max	
t <sub>OND</sub>	Turn-On Time Sel to Output (DAT, CLK, RST)	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF V <sub>SW</sub> = 1.5 V Figure 11, Figure 12	1.8 (Note 5)	-	65	95	ns
			2.7 to 3.6	-	42	60	ns
t <sub>OFFD</sub>	Turn-Off Time Sel to Output (DAT, CLK, RST)	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF V <sub>SW</sub> = 1.5 V Figure 11, Figure 12	1.8 (Note 5)	-	30	50	ns
			2.7 to 3.6	-	20	40	ns
t <sub>ONV</sub>	Turn-On Time Sel to Output (V <sub>SIM</sub> )	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF V <sub>SW</sub> = 1.5 V Figure 11, Figure 12	1.8 (Note 5)	-	55	80	ns
			2.7 to 3.6	-	35	55	ns
t <sub>OFFV</sub>	Turn-Off Time Sel to Output (V <sub>SIM</sub> )	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF V <sub>SW</sub> = 1.5 V Figure 11, Figure 12	1.8 (Note 5)	-	35	50	
			2.7 to 3.6	-	22	40	ns
t <sub>PD</sub>	Propagation Delay (Note 5) (DAT, CLK, RST)	C <sub>L</sub> = 35 pF, R <sub>L</sub> = 50 Ω Figure 11, Figure 13	3.3	-	0.25	-	ns
t <sub>BBMD</sub>	Break-Before-Make (Note 5) (DAT, CLK, RST)	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF V <sub>SW1</sub> = V <sub>SW2</sub> = 1.5 V Figure 15	2.7 to 3.6	3	18	-	ns
t <sub>BBMV</sub>	Break-Before-Make (Note 5) (V <sub>SIM</sub> )	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF V <sub>SW1</sub> = V <sub>SW2</sub> = 1.5 V Figure 15	2.7 to 3.6	3	12	-	ns
Q	Charge Injection (DAT, CLK, RST)	C <sub>L</sub> = 50 pF, R <sub>GEN</sub> = 0 Ω, V <sub>GEN</sub> = 0 V	2.7 to 3.6	-	10	-	pC
O <sub>IRR</sub>	Off Isolation (DAT, CLK, RST)	R <sub>L</sub> = 50 Ω, f = 10 MHz Figure 17	2.7 to 3.6	-	-60	-	dB
Xtalk	Non-Adjacent Channel Crosstalk (DAT, CLK, RST)	R <sub>L</sub> = 50 Ω, f = 10 MHz Figure 18	2.7 to 3.6	-	-60	-	dB
BW	-3 db Bandwidth (DAT, CLK, RST)	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF Figure 16	2.7 to 3.6	-	475	-	MHz

5. Guaranteed by characterization.

## CAPACITANCE

Symbol	Parameter	Conditions	T <sub>A</sub> = -40°C to 85°C			Unit
			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 (Note 6)	V <sub>CC</sub> = 3.3 V, f = 1 MHz, Figure 20	-	10	12	
C <sub>ONV</sub>	V <sub>SIM</sub> On Capacitance (Note 6)	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	-	

6. Guaranteed by characterization.

TYPICAL PERFORMANCE CHARACTERISTICS

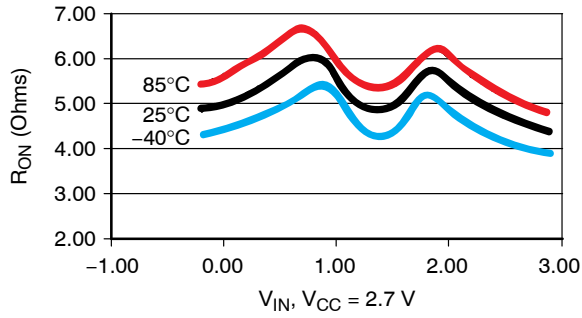


Figure 4. RON Data Path

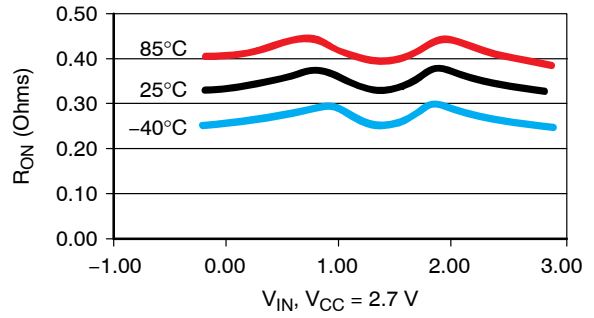


Figure 5. RON Vsim

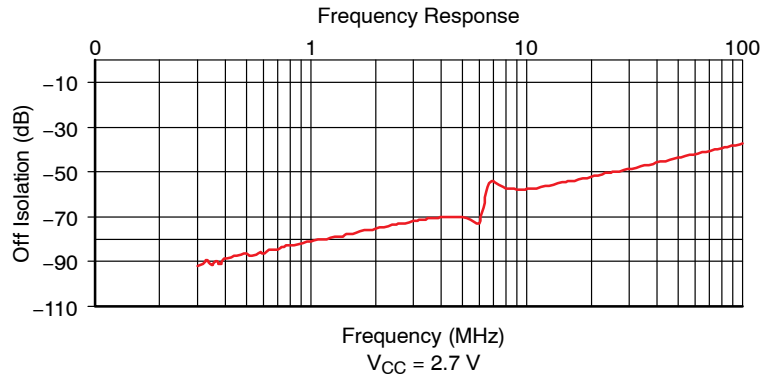


Figure 6. Off Isolation

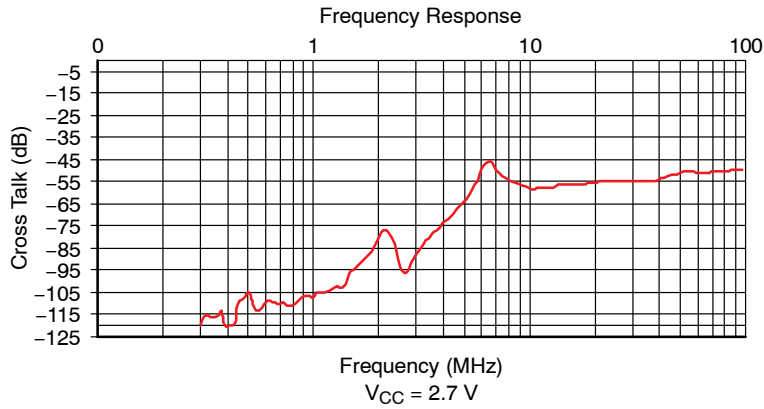


Figure 7. Crosstalk

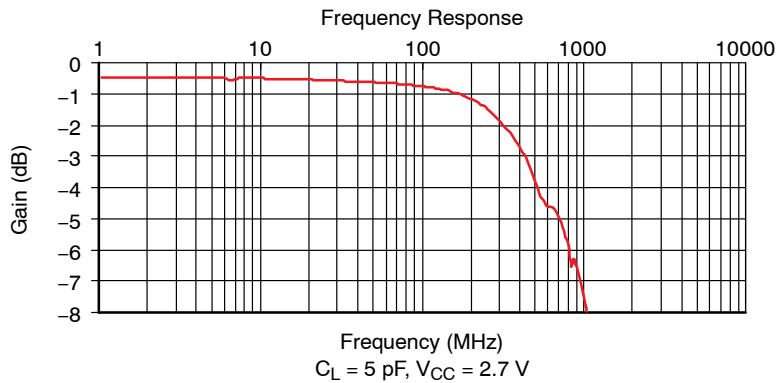


Figure 8. Bandwidth

TEST DIAGRAMS

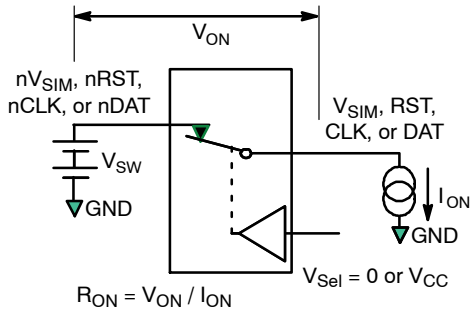


Figure 9. On Resistance

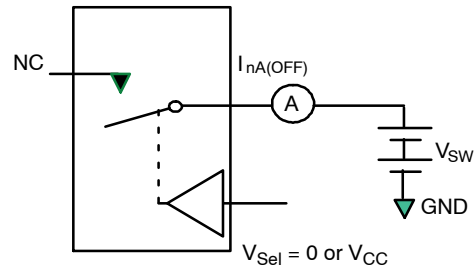
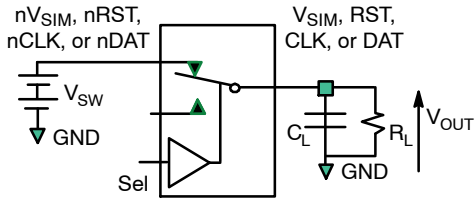


Figure 10. Off Leakage



$R_L$  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

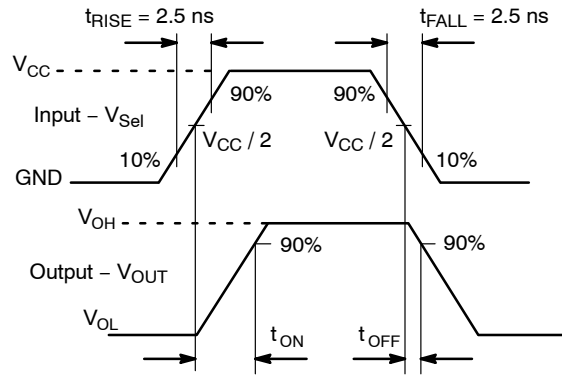


Figure 12. Turn-On / Turn-Off Waveforms

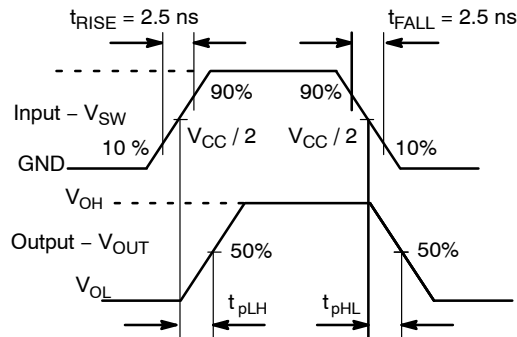


Figure 13. Propagation Delay

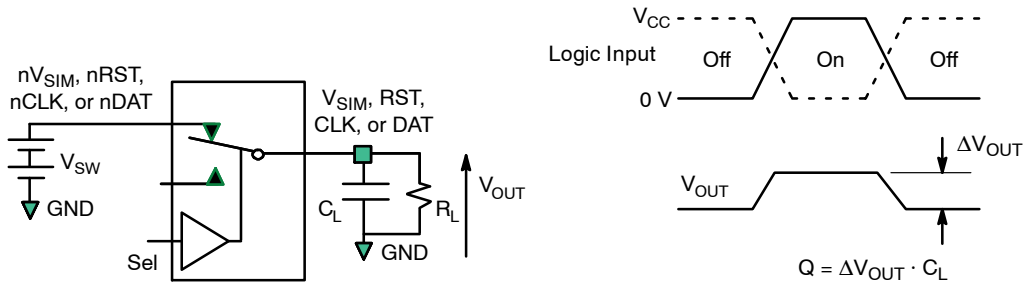


Figure 14. Charge Injection

TEST DIAGRAMS (Continued)

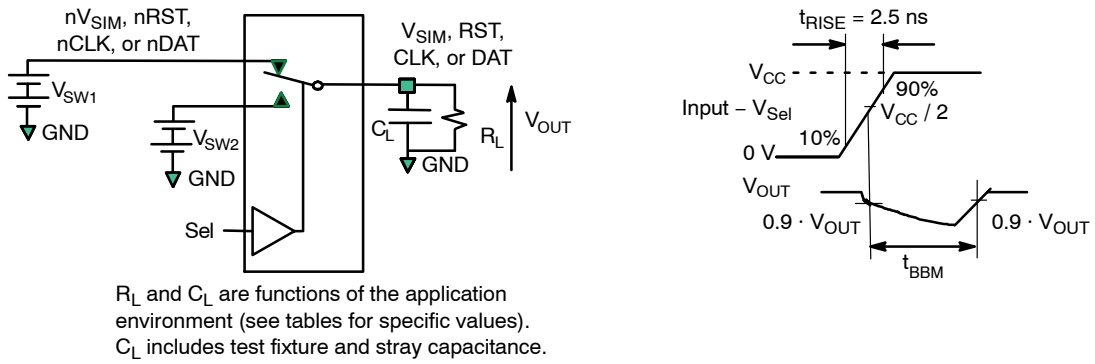


Figure 15. Break-Before-Make Interval Timing

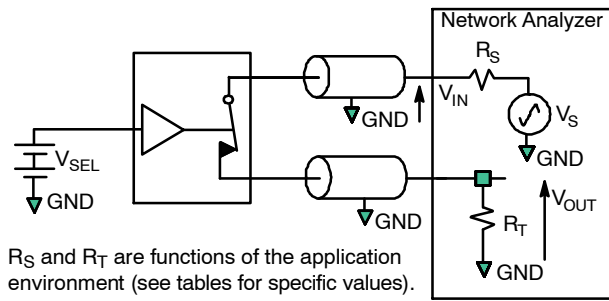
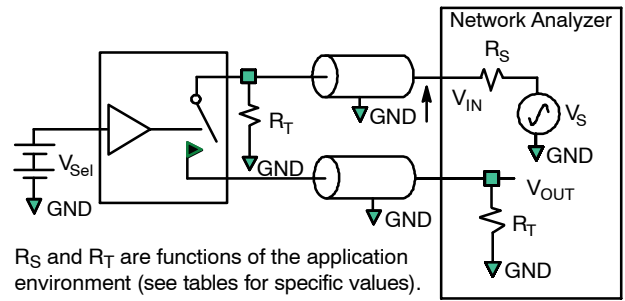
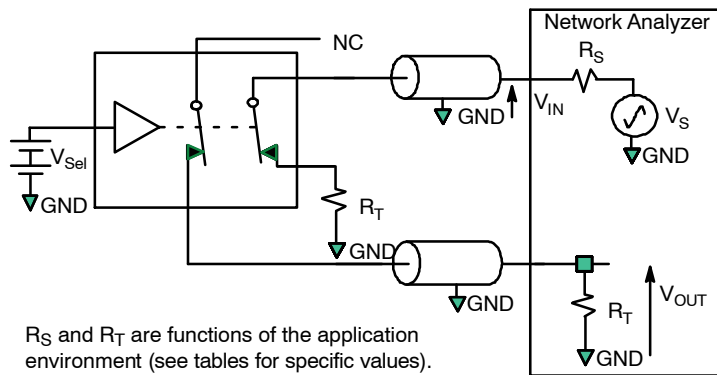


Figure 16. Bandwidth



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

Figure 17. Channel Off Isolation



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

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

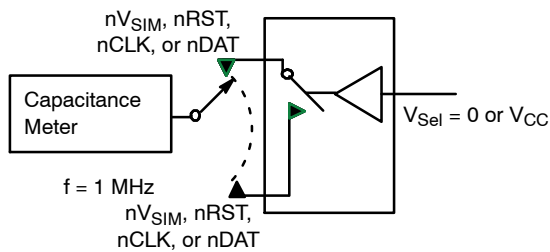


Figure 19. Channel Off Capacitance

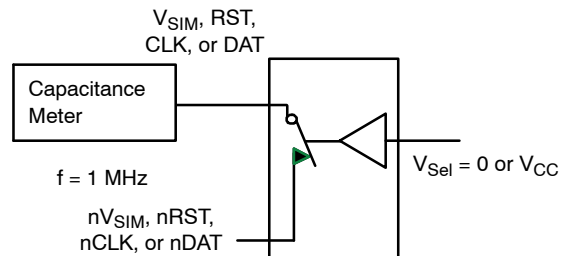


Figure 20. Channel On Capacitance



# MECHANICAL CASE OUTLINE

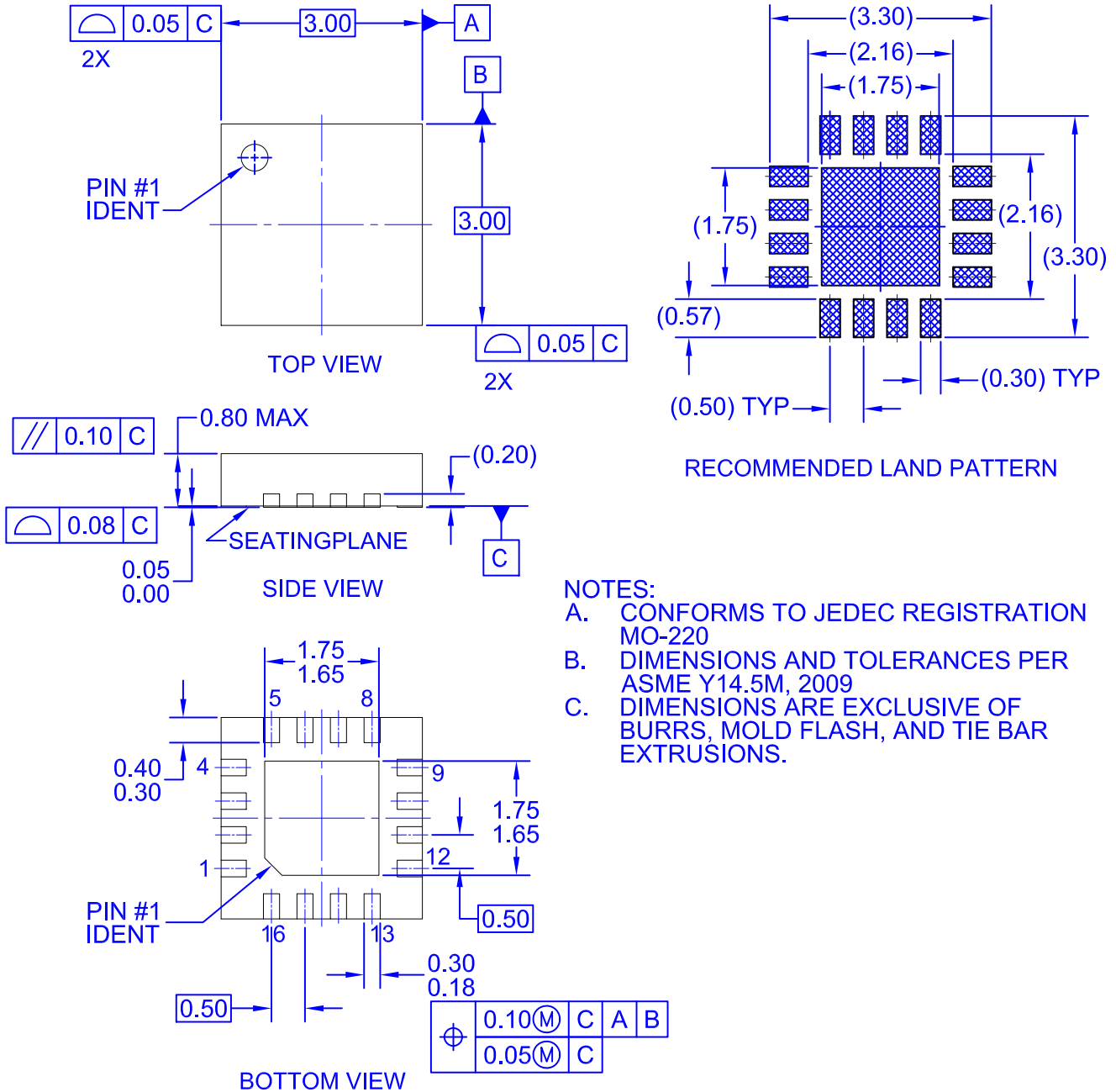
## PACKAGE DIMENSIONS

ON Semiconductor®



WQFN16 3x3, 0.5P  
CASE 510BS  
ISSUE O

DATE 31 AUG 2016



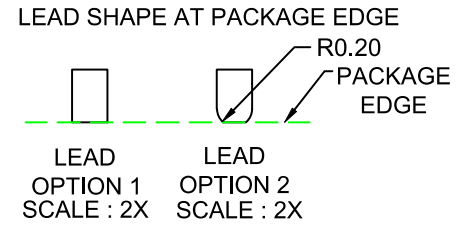
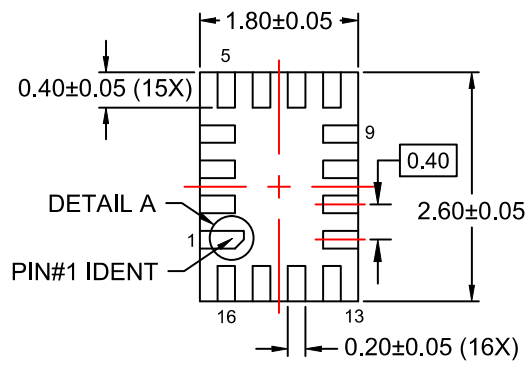
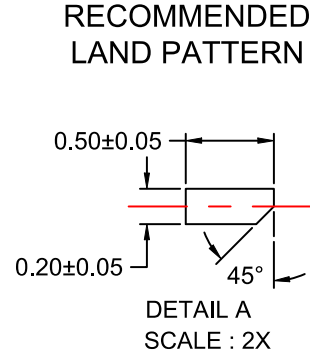
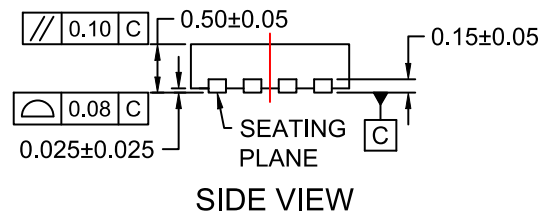
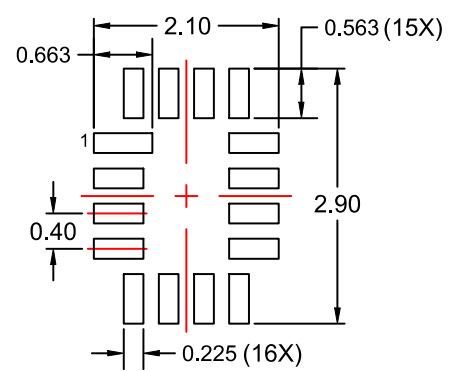
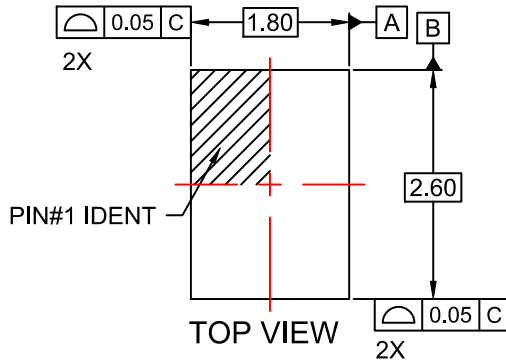
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**UQFN16 1.8x2.6, 0.4P**  
CASE 523BF  
ISSUE O

DATE 31 OCT 2016



**NOTES:**

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC STANDARD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
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