

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.

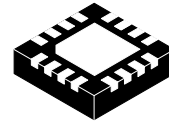
The FSA2567 contains special circuitry that minimizes current consumption when the control voltage applied to the SEL pin is lower than the supply voltage (V_{CC}). This feature is especially valuable in ultra-portable applications, such as cell phones; allowing direct interface with the general-purpose 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

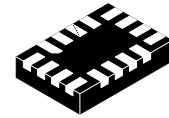
- Low On Capacitance for Data Path: 10 pF Typical
- Low On Resistance for Data Path: 6 Ω Typical
- Low On Resistance for Supply Path: 0.4 Ω Typical
- Wide V_{CC} Operating Range: 1.65 V to 4.3 V
- Low Power Consumption: 1 μ A Maximum
 - ♦ 15 μ A Maximum I_{CCT} Over Expanded Voltage Range ($V_{IN} = 1.8$ 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

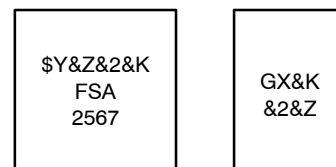


WQFN16 3x3, 0.5P
CASE 510BS



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.

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.

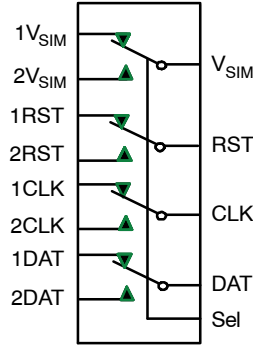


Figure 1. Analog Symbol

PIN ASSIGNMENTS

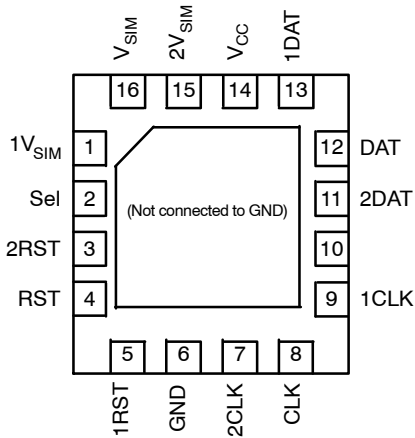


Figure 2. Pad Assignment MLP16
(Top Through View)

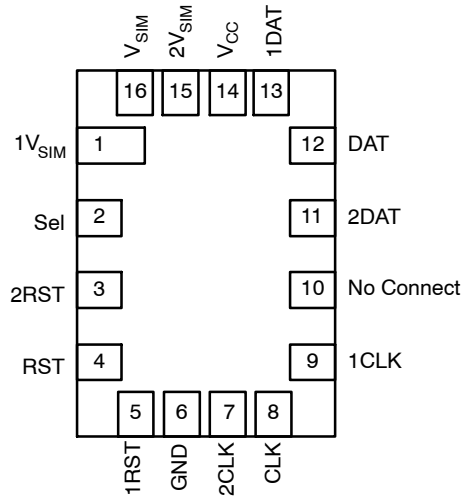


Figure 3. Pad Assignment UMLP16
(Top Through View)

PIN DESCRIPTION

Pin No.	Description
nDAT, nRST, nCLK	Multiplexed Data Source Inputs
nV _{SIM}	Multiplexed SIM Supply Inputs
V _{SIM} , DAT, RST, CLK	Common SIM Ports
Sel	Switch Select

TRUTH TABLE

Sel	Function
Logic LOW	1DAT = DAT, 1RST = RST, 1CLK = CLK, 1V _{SIM} = V _{SIM}
Logic HIGH	2DAT = DAT, 2RST = RST, 2CLK = CLK, 2V _{SIM} = V _{SIM}

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V _{CC}	Supply Voltage		−0.5	+5.5	V
V _{CNTRL}	DC Input Voltage (Sel) (Note 1)		−0.5	V _{CC}	V
V _{SW}	DC Switch I/O Voltage (Note 1)		−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	

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 _{CC}	Supply Voltage	1.65	4.30	V
V _{CNTRL}	Control Input Voltage (Sel) (Note 2)	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
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.

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	$V_{SW} = 0 \text{ to } V_{CC}$	4.3	–1	–	1	μA
$I_{nc(off)}, I_{no(off)}$	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)	$V_{SW} = 0, 1.8 \text{ V}, I_{ON} = -20 \text{ mA}$ Figure 9	1.8	–	7.0	12.0	Ω
		$V_{SW} = 0, 2.3 \text{ V}, I_{ON} = -20 \text{ mA}$ Figure 9	2.7	–	6.0	10.0	
R_{ONV}	V_{SIM} Switch On Resistance (Note 3)	$V_{SW} = 0, 1.8 \text{ V}, I_{ON} = -100 \text{ mA}$ Figure 9	1.8	–	0.5	0.7	Ω
		$V_{SW} = 0, 2.3 \text{ V}, I_{ON} = -100 \text{ mA}$ Figure 9	2.7	–	0.4	0.6	
ΔR_{OND}	Data Path Delta On Resistance (Note 4)	$V_{SW} = 0 \text{ V}, I_{ON} = -20 \text{ mA}$	2.7	–	0.2	–	Ω
I_{CC}	Quiescent Supply Current	$V_{CNTRL} = 0 \text{ or } V_{CC}, I_{OUT} = 0$	4.3	–	–	1.0	μA
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	μA
		$V_{CNTRL} = 1.8 \text{ V}, V_{CC} = 4.3 \text{ V}$	4.3	–	7.0	15.0	μA

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 values are for $V_{CC} = 3.3\text{ V}$ at 25°C unless otherwise specified.)

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

5. Guaranteed by characterization.

CAPACITANCE

Symbol	Parameter	Conditions	$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			Unit
			Min	Typ	Max	
C_{IN}	Control Pin Input Capacitance	$V_{CC} = 0\text{ V}$	–	1.5	–	pF
C_{OND}	RST, CLK, DAT On Capacitance (Note 6)	$V_{CC} = 3.3\text{ V}$, $f = 1\text{ MHz}$, Figure 20	–	10	12	
C_{ONV}	V_{SIM} On Capacitance (Note 6)	$V_{CC} = 3.3\text{ V}$, $f = 1\text{ MHz}$, Figure 20	–	110	150	
C_{OFFD}	RST, CLK, DAT Off Capacitance	$V_{CC} = 3.3\text{ V}$, Figure 19	–	3	–	
C_{OFFV}	V_{SIM} Off Capacitance	$V_{CC} = 3.3\text{ V}$, Figure 19	–	40	–	

6. Guaranteed by characterization.

TYPICAL PERFORMANCE CHARACTERISTICS

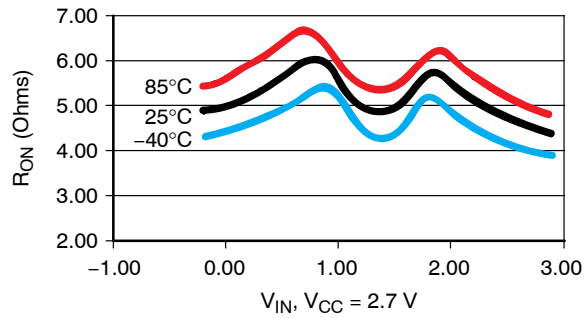
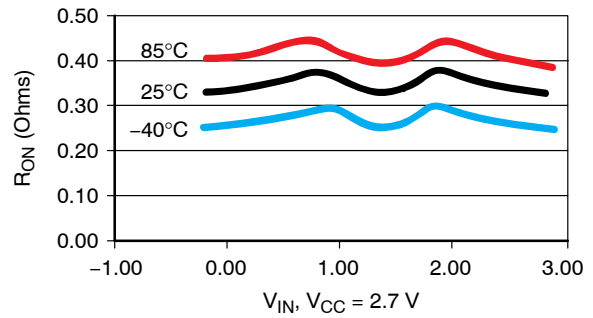
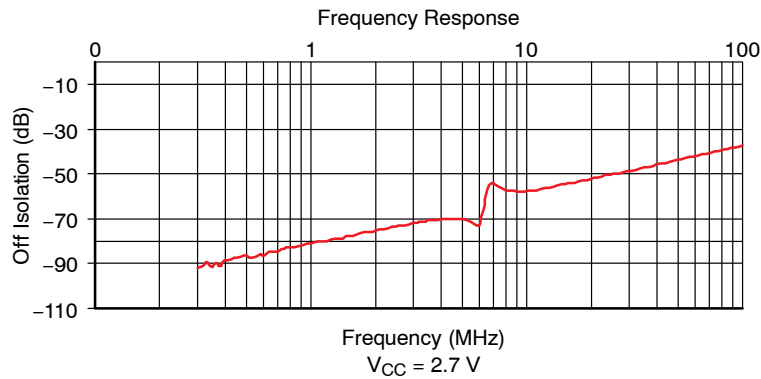
Figure 4. R_{ON} Data PathFigure 5. R_{ON} V_{SIM} 

Figure 6. Off Isolation

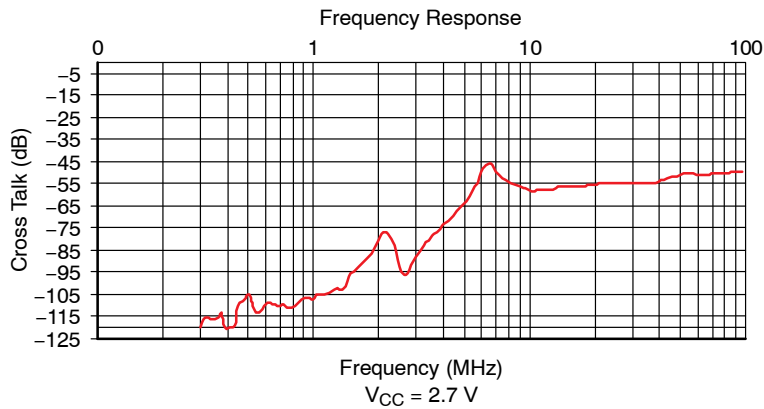


Figure 7. Crosstalk

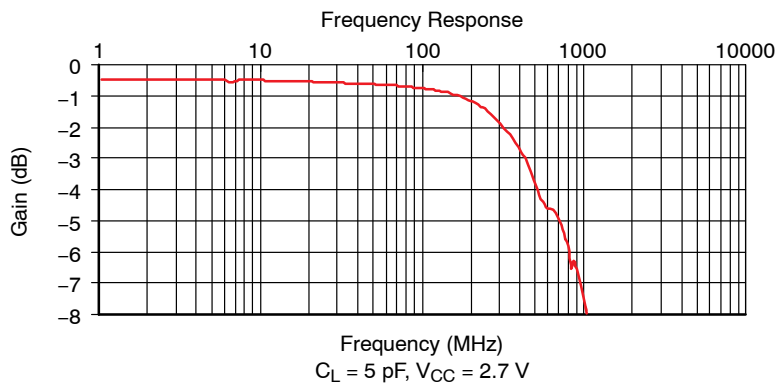


Figure 8. Bandwidth

TEST DIAGRAMS

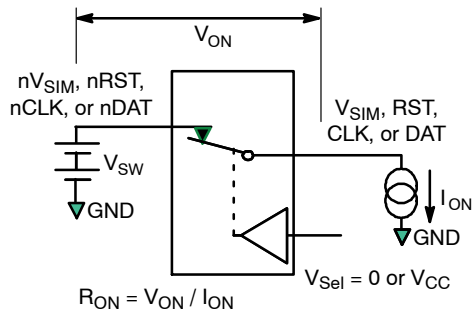


Figure 9. On Resistance

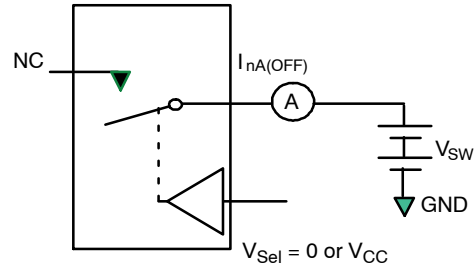
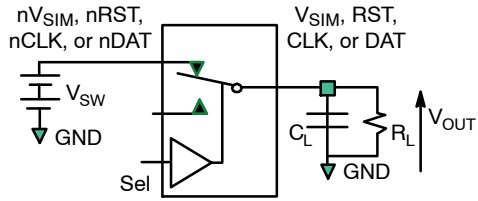


Figure 10. Off Leakage



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

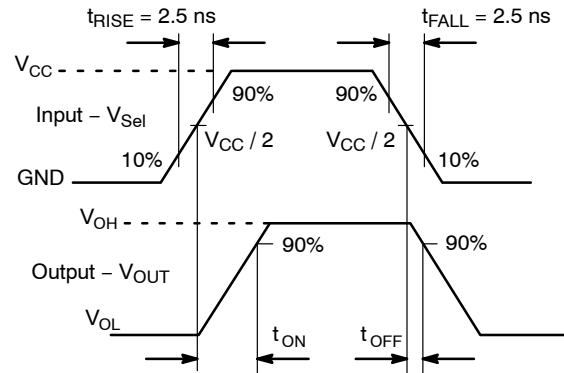


Figure 12. Turn-On / Turn-Off Waveforms

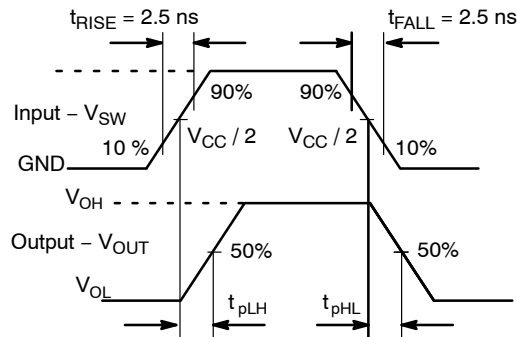


Figure 13. Propagation Delay

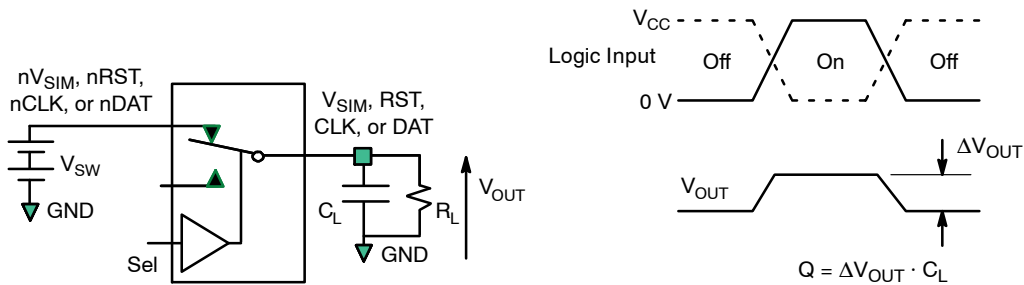


Figure 14. Charge Injection

TEST DIAGRAMS (Continued)

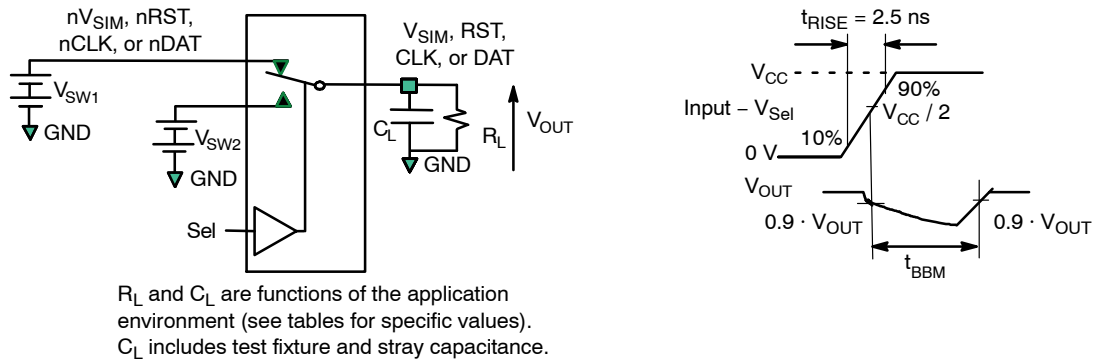


Figure 15. Break-Before-Make Interval Timing

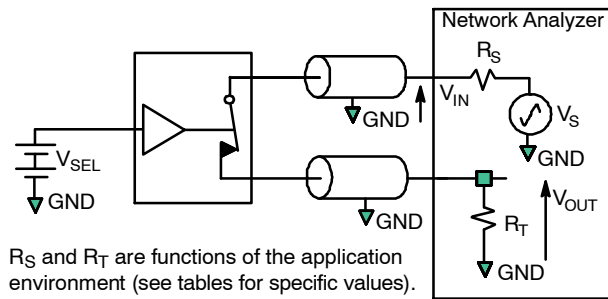
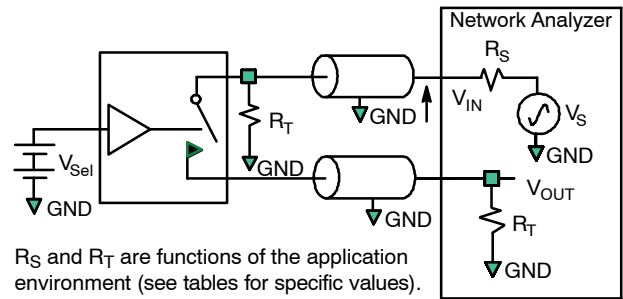
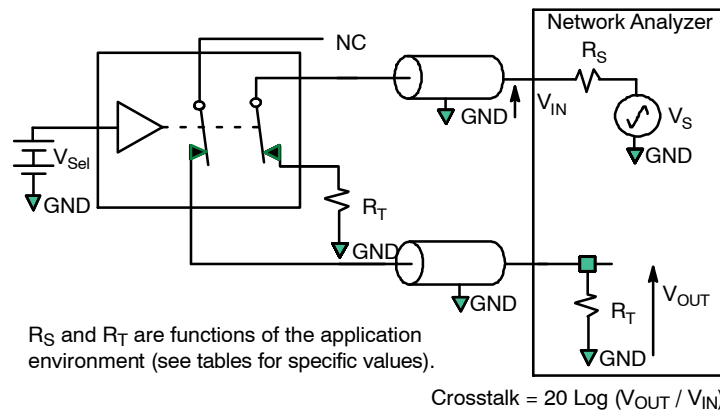


Figure 16. Bandwidth



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

Figure 17. Channel Off Isolation



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

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

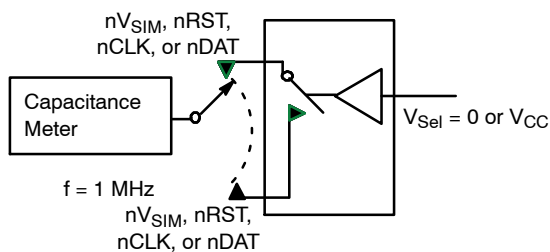


Figure 19. Channel Off Capacitance

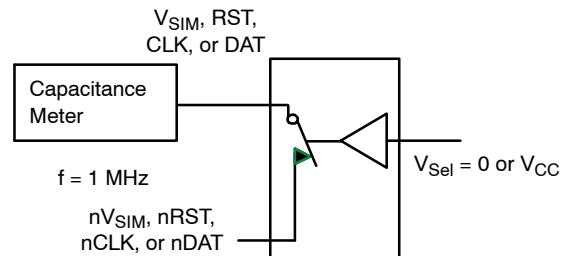
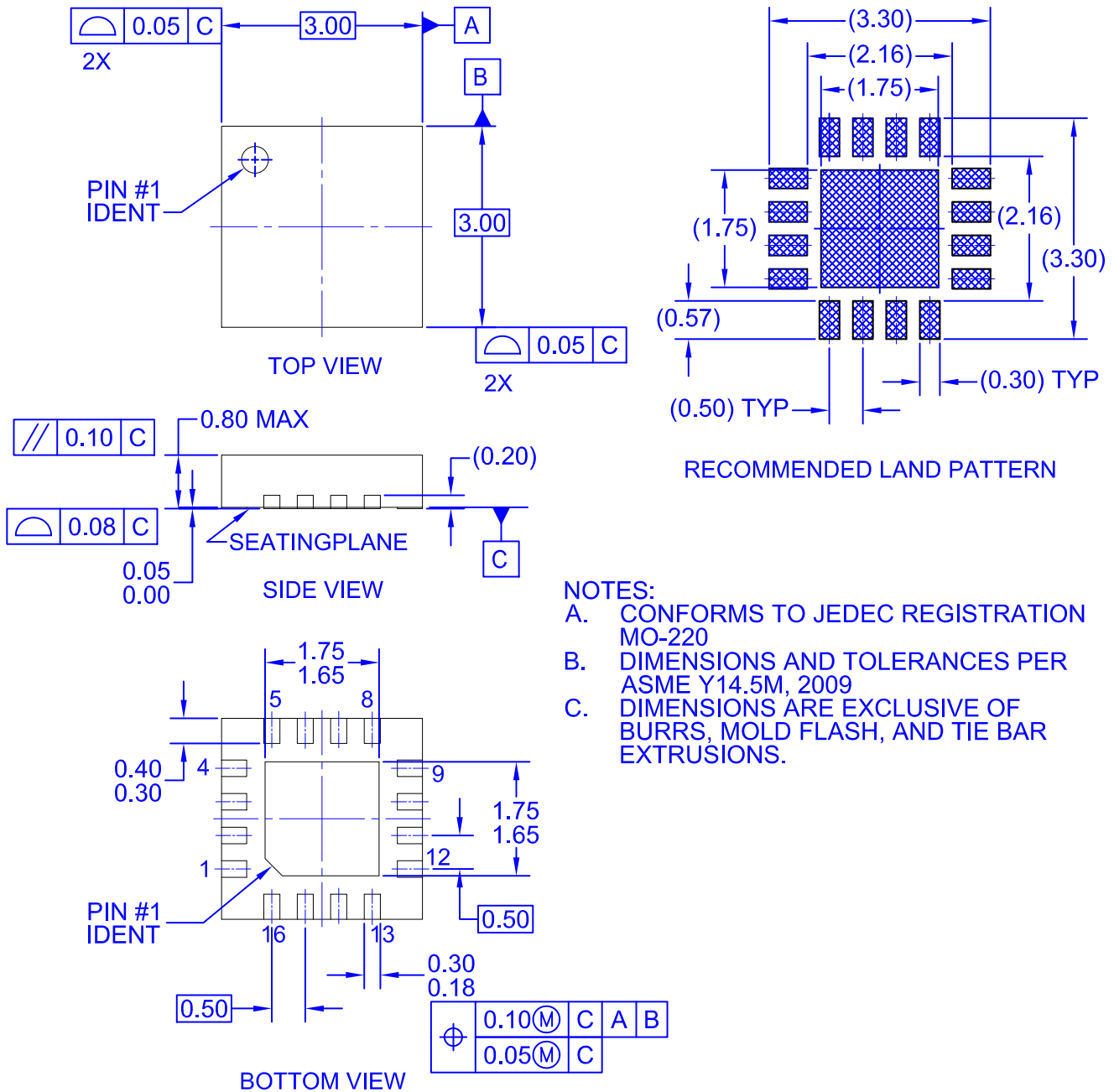


Figure 20. Channel On Capacitance

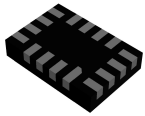
WQFN16 3x3, 0.5P
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DATE 31 AUG 2016

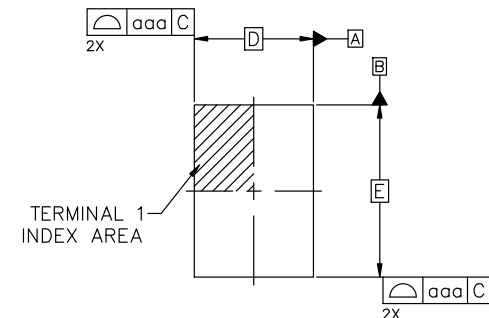


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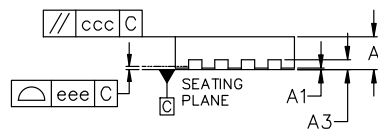
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UQFN16 1.80x2.60x0.50, 0.40P
CASE 523BF
ISSUE A

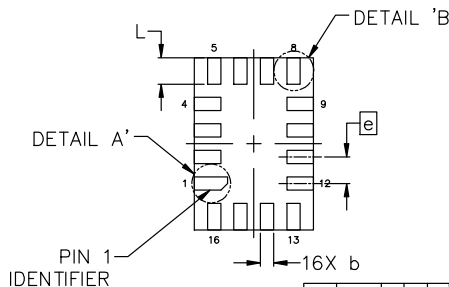
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TOP VIEW



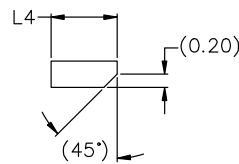
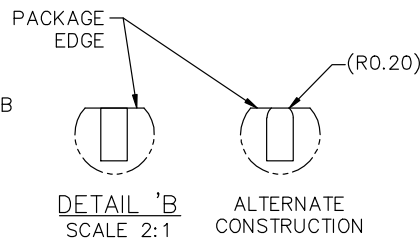
SIDE VIEW



BOTTOM VIEW

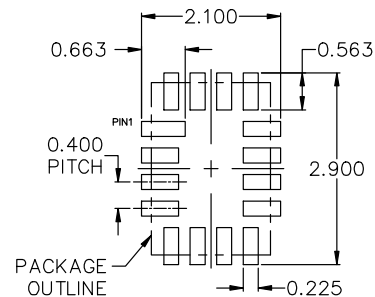
NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS, DEGREES IN ANGLE.
3. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
4. TERMINAL SHAPE MAY VARY ACCORDING TO PACKAGE SUPPLIER, SEE TERMINAL SHAPE VARIANTS.


DETAIL 'A'
SCALE 2:1

DETAIL 'B'
SCALE 2:1

ALTERNATE
CONSTRUCTION

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0.00	---	0.05
A3	0.10	0.15	0.20
b	0.15	0.20	0.25
D	1.80 BSC		
E	2.60 BSC		
e	0.40 BSC		
L	0.35	0.40	0.45
L4	0.45	0.50	0.55
TOLERANCES FOR FEATURE CONTROL FRAME			
aaa	0.05		
bbb	0.10		
ccc	0.10		
ddd	0.05		
eee	0.05		



RECOMMENDED MOUNTING FOOTPRINT*

*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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