

# FSA515

## 5 V SPST Depletion Switch with Negative Swing

### Description

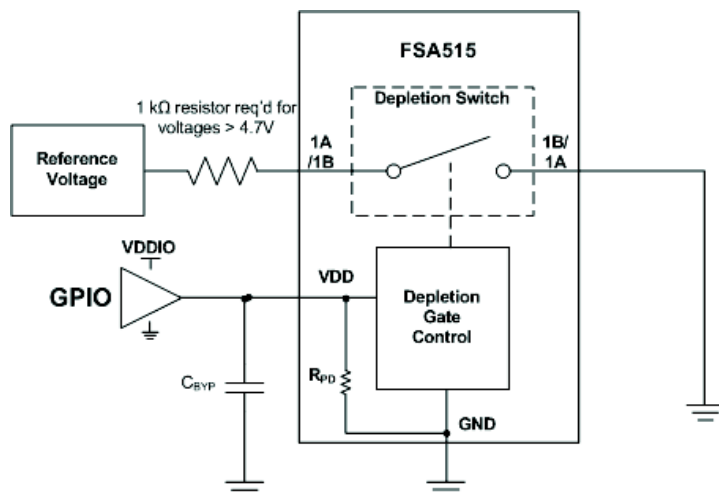
The FSA515 is a high-performance single-pole single-throw (SPST) depletion switch. The depletion technology allows the device to conduct signals when there is no  $V_{DD}$  is available and to isolate signals when  $V_{DD}$  is present. The FSA515 is 5.5 V tolerant and can pass or isolate negative signal swings down to  $-3.0$  V.

### Features

- SPST Depletion Switch
- Normally Closed when  $V_{DD} < 0.5$  V
- $V_{SW}$ :  $-3.0$  V to  $+5.5$  V
- $R_{ON}$ :  $0.7\ \Omega$  (Typical)
- $R_{FLAT}$ :  $1.1\ m\Omega$  (Typical)

### Typical Applications

- Mobile Accessories, Adapters, and Cables
- Phones, Tablets, and Laptops
- Headsets



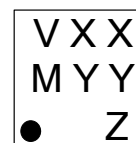
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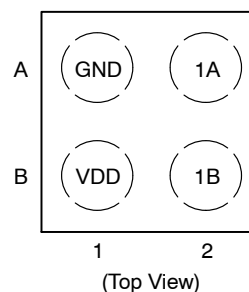
WLCSP4  
CASE 567VT

### MARKING DIAGRAM



VM = Specific Device Code  
XX = 2-digit Lot Run Code  
YY = 2-digit Date Code  
Z = 1-digit Plant Code

### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Package	Shipping†
FSA515UCX	WLCSP4 (Pb-Free)	3000 / Tape & Reel

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

Table 1. PIN FUNCTION DESCRIPTION

Pin No. (WLCSP4)	Pin Name	Description
A1	GND	Ground
A2	1A	A-Port of Switch 1 (Normally Closed)
B1	VDD	Supply Voltage (Switch is closed when Low)
B2	1B	B-Port of Switch 1 (Normally Closed)

Table 2. SWITCH TRUTH TABLE

VDD	Switch State
Low	ON (Conducting)
High	OFF (Isolating)

Table 3. RECOMMENDED EXTERNAL COMPONENT

Component	Description	Vendor	Parameter	Min	Typ	Unit
C <sub>BYP</sub>	0402, 1 nF, 10%, 6.3 V, X7R	Kemet C0402C102K9RACTU	C	0.65	1	nF
	0201, 1 nF, 10%, 6.3 V, X7R	AVX 02016C102KAT2A				

Table 4. MAXIMUM RATINGS

Rating			Symbol	Value	Unit
Supply Voltage			V <sub>DD</sub>	−0.5 to 6.0	V
Switch Voltage Range	DC Switch I/O Voltage (Switch Conducting)		V <sub>SW(ON)</sub>	−3.6 (AC) to 6.0	V
	DC Switch I/O Voltage (Switch Isolated)		V <sub>SW(OFF)</sub>	−3.6 (AC) to 6.0	V
Maximum DC Switch I/O Current			I <sub>SW</sub>	350	mA
Maximum Peak Switch I/O Current –Pulsed at 1ms duration, <10% duty cycle			I <sub>SWPEAK</sub>	500	mA
Maximum Junction Temperature			T <sub>J(max)</sub>	150	°C
Storage Temperature Range			T <sub>STG</sub>	−65 to 150	°C
ESD Capability (Note 2)	Human Body Model		ESDHBM	4	kV
	Charged Device Model		ESDCDM	2	kV
	IEC 61000–4–2 System	Contact	ESDIEC	8	kV
		Air Gap		15	kV

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. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.
2. This device series incorporates ESD protection and is tested by the following methods:  
 ESD Human Body Model tested per ANSI, ESDA, JEDEC JS–001–2012  
 ESD Charged Device Model tested per According to “EIA/JESD22–C101 Level III”  
 Latchup Current Maximum Rating: 100 mA per JEDEC standard: JESD78

Table 5. THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WLCSP4 Thermal Resistance, Junction–to–Air (Note 3)	R <sub>θJA</sub>	77.4	°C/W

3. JEDEC Standard, Still Air, 4–layer board with vias

**Table 6. RECOMMENDED OPERATING RANGES**

Rating		Symbol	Min	Max	Unit
Supply Voltage	Isolating	$V_{DD(OFF)}$	2.5	5.5	V
	Conducting	$V_{DD(ON)}$	0	0.5	V
Switch Voltage Range	Isolating	$V_{SW(OFF)}$	-3.0 (Vpk; AC)	4.7	V
	Isolating (requires 1 k $\Omega$ (typ) in series with source)		4.7	5.5	
	Conducting	$V_{SW(ON)}$	-3.0 (Vpk; AC)	4.7	V
	Isolating (requires 1 k $\Omega$ (typ) in series with source)		4.7	5.5	
Ambient Temperature		$T_A$	-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.

**Table 7. ELECTRICAL CHARACTERISTICS** Unless otherwise specified, typical values are for  $T_A=25^\circ\text{C}$ ,  $V_{DD} = 0\text{ V}$ 

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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**SWITCH DC CHARACTERISTICS**

Switch Off Leakage Current	V <sub>DD</sub> = 5 V 1B = GND	1A = 5.5 V	I <sub>OFF</sub>		0.01		μA
		1A = -1.5 V			-0.65		
	V <sub>DD</sub> = 3.3 V 1B = GND	1A = 1.4 V (Note 5)			0.01	1.5	
Switch On Resistance	I <sub>SW</sub> = 100 mA, V <sub>SW</sub> = -1.5 V to +1.5 V		R <sub>ON</sub>		0.7	1.1	Ω
	I <sub>SW</sub> = 100 mA, V <sub>SW</sub> = 0 V to +5.5 V				0.7	1.1	
On Resistance Flatness	I <sub>SW</sub> = 100 mA, V <sub>SW</sub> = -1.5 V to +1.5 V		R <sub>FLAT(ON)</sub>		1.1		mΩ
	I <sub>SW</sub> = 100 mA, V <sub>SW</sub> = 0 V to +5.5 V				1.1		

**SWITCH AC CHARACTERISTICS**

Total Harmonic Distortion Plus Noise	$V_{SW} = 1\text{ V}_{RMS}$ , Ground Centered $R_L = 32\ \Omega$ , $f = 1\text{ kHz}$		THD+N		-93		dB
Off Isolation Rejection Ratio	$V_{SW} = 1\text{ V}_{RMS}$ , Ground Centered $R_L = 32\ \Omega$	$f = 1\text{ kHz}$	OIRR		-116		dB
		$f = 20\text{ kHz}$			-97		
Bandwidth	$V_{SW} = 200\text{ mV}_{PP}$ , Ground Centered $R_L = 50\ \Omega$		BW		367		MHz

**SUPPLY CURRENTS**

Peak Startup Supply Current	$V_{DD} = 0\text{ V}$ to $5.5\text{ V}$	$I_{DDT}$		3.0		mA
Quiescent Current	$V_{DD} = 5.5\text{ V}$	$I_{DD}$	-	30		$\mu\text{A}$
Disable Current	$V_{DD} \leq 0.2\text{ V}$	$I_{DIS}$		0.05	0.50	$\mu\text{A}$

**CONTROL LOGIC**

$V_{DD}$ Pull-Down Resistance	$V_{DD} \leq 0.2\text{ V}$	$R_{PD}$		5.8		$\text{M}\Omega$
$V_{DD}$ High Voltage		$V_{DDH}$	2.5			V
$V_{DD}$ Low Voltage		$V_{DDL}$			0.5	V

**TIMING**

Switch Turn-off Time	$R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$ , $V_{DD} = 0.0\text{ V}$ to $3.0\text{ V}$ $V_{SW} = 5.0\text{ V}$ , Figure 1	$t_{OFF}$		85		$\mu\text{s}$
Switch Turn-on Time	$R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$ , $V_{DD} = 3.0\text{ V}$ to Hi-Z, $C_{BYP} = 1\text{ nF}$ , $V_{SW} = 5.0\text{ V}$ , Figure 1	$t_{ON}$		250		$\mu\text{s}$

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Performance guaranteed over the indicated operating temperature range by design and/or characterization tested at  $T_J = T_A = 25^\circ\text{C}$ .

5. Maximum is guaranteed at  $25^\circ\text{C}$ .

6. For reference only – guaranteed by design.

**Table 7. ELECTRICAL CHARACTERISTICS** Unless otherwise specified, typical values are for  $T_A=25^{\circ}\text{C}$ ,  $V_{DD} = 0\text{ V}$ 

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>CAPACITANCE</b>						
On Capacitance	$R_L = 1\text{ k}\Omega$	$C_{ON}$		14		pF
Off Capacitance	$V_{DD} = 5\text{ V}$ , $R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$	$C_{OFF}$		17		pF
Supply Capacitance	$V_{DD} = 5\text{ V}$ with $400\text{ mV}_{PP}$ , $f = 1\text{ MHz}$	$C_{VDD}$		17		pF

**OSCILLATOR FREQUENCY**

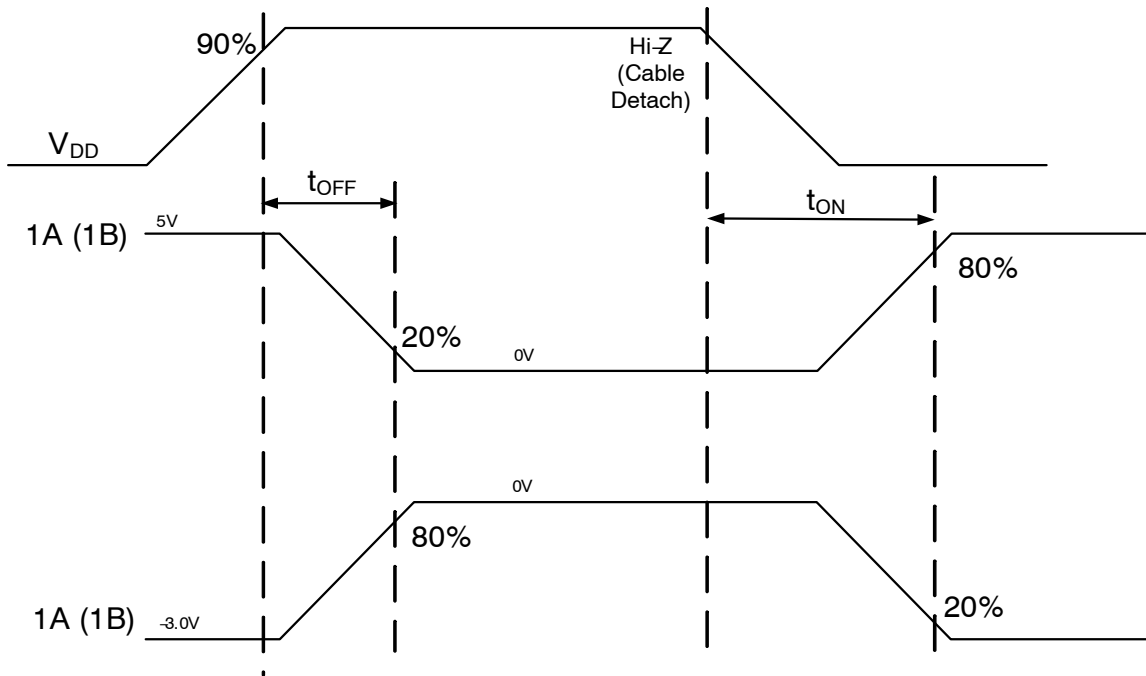
On-Chip Oscillator Frequency (Note 6)	For reference only	$f_{OSC}$		110		kHz
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Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Performance guaranteed over the indicated operating temperature range by design and/or characterization tested at  $T_J = T_A = 25^{\circ}\text{C}$ .

5. Maximum is guaranteed at  $25^{\circ}\text{C}$ .

6. For reference only – guaranteed by design.

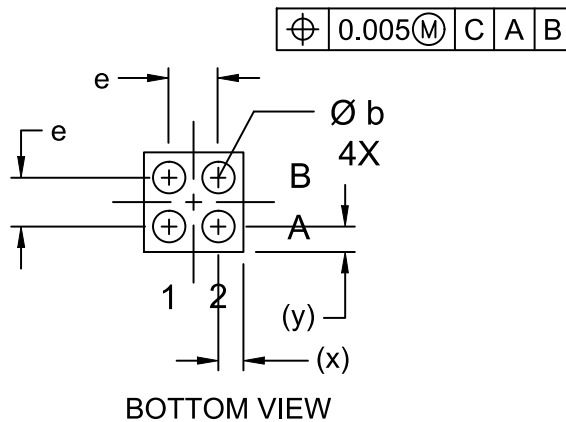
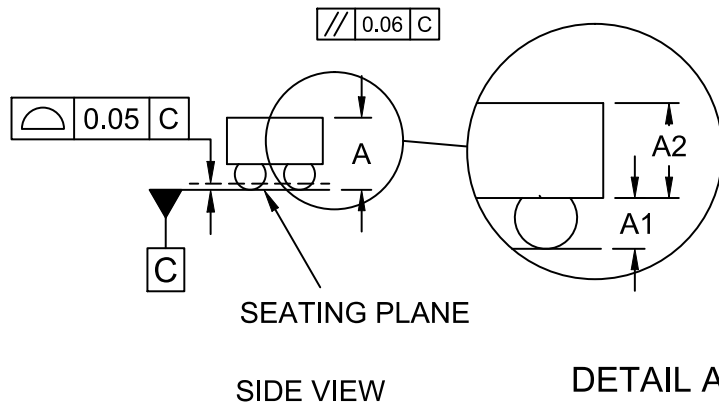
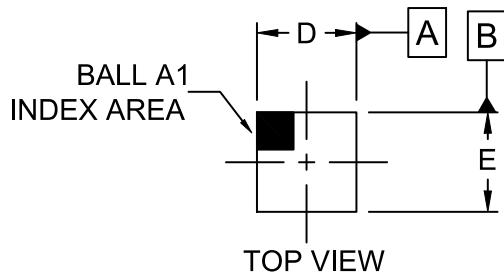
**Timing Diagram****Figure 1.  $t_{ON} / t_{OFF}$   $V_{CC}$  to Output Timing**

## PACKAGE DIMENSIONS

WLCSP4, 0.815x0.815x0.457

CASE 567VT

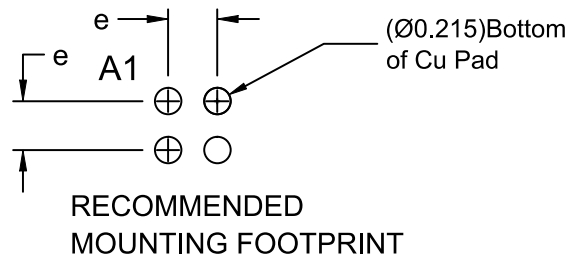
ISSUE O



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DATUM C APPLIES TO THE SPHERICAL CROWN OF THE SOLDER BALLS

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.419	0.457	0.495
A1	0.183	0.203	0.223
A2	0.236	0.254	0.272
b	0.240	0.260	0.280
D	0.785	0.815	0.845
E	0.785	0.815	0.845
e	0.40 BSC		
x	0.1925	0.2075	0.2225
y	0.1925	0.2075	0.2225



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