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FSA515

5 V SPST Depletion Switch with Negative Swing

Description

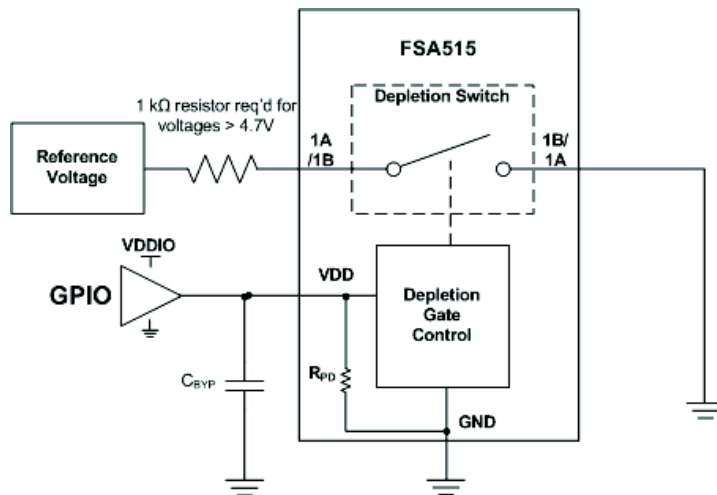
The FSA515 is a high-performance single-pole single-throw (SPST) depletion switch. The depletion technology allows the device to conduct signals when there is no V_{DD} is available and to isolate signals when V_{DD} is present. The FSA515 is 5.5 V tolerant and can pass or isolate negative signal swings 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} : 0.7Ω (Typical)
- R_{FLAT} : $1.1 \text{ m}\Omega$ (Typical)

Typical Applications

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



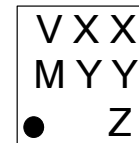
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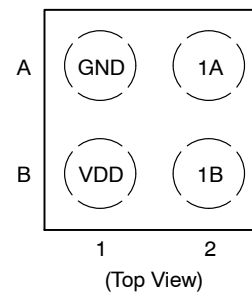
WLCSP4
CASE 567VT

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.

FSA515

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 _{BYP}	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 _{DD}	-0.5 to 6.0	V	
Switch Voltage Range	DC Switch I/O Voltage (Switch Conducting)	V _{SW(ON)}	-3.6 (AC) to 6.0	V	
	DC Switch I/O Voltage (Switch Isolated)	V _{SW(OFF)}	-3.6 (AC) to 6.0	V	
Maximum DC Switch I/O Current		I _{SW}	350	mA	
Maximum Peak Switch I/O Current - Pulsed at 1ms duration, <10% duty cycle		I _{SWPEAK}	500	mA	
Maximum Junction Temperature		T _{J(max)}	150	°C	
Storage Temperature Range		T _{STG}	-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 _{θJA}	77.4	°C/W

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

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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 Ω (typ) in series with source)		4.7	5.5	
	Conducting	$V_{SW(ON)}$	-3.0 (Vpk; AC)	4.7	V
	Isolating (requires 1 k Ω (typ) in series with source)		4.7	5.5	
Ambient Temperature		T_A	-40	85	$^{\circ}\text{C}$

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	$V_{DD} = 5\text{ V}$ $1B = \text{GND}$	$1A = 5.5\text{ V}$	I_{OFF}	0.01		μA
		$1A = -1.5\text{ V}$		-0.65		
	$V_{DD} = 3.3\text{ V}$ $1B = \text{GND}$	$1A = 1.4\text{ V}$ (Note 5)		0.01	1.5	
Switch On Resistance	$I_{SW} = 100\text{ mA}$, $V_{SW} = -1.5\text{ V}$ to $+1.5\text{ V}$		R_{ON}	0.7	1.1	Ω
	$I_{SW} = 100\text{ mA}$, $V_{SW} = 0\text{ V}$ to $+5.5\text{ V}$			0.7	1.1	
On Resistance Flatness	$I_{SW} = 100\text{ mA}$, $V_{SW} = -1.5\text{ V}$ to $+1.5\text{ V}$		$R_{FLAT(ON)}$	1.1		$\text{m}\Omega$
	$I_{SW} = 100\text{ mA}$, $V_{SW} = 0\text{ V}$ to $+5.5\text{ V}$			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 V	I_{DDT}		3.0		mA
Quiescent Current	$V_{DD} = 5.5\text{ V}$	I_{DD}	-	30		μA
Disable Current	$V_{DD} \leq 0.2\text{ V}$	I_{DIS}		0.05	0.50	μA

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 V $V_{SW} = 5.0\text{V}$, Figure 1	t_{OFF}		85		μs
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		μs

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.

- Performance guaranteed over the indicated operating temperature range by design and/or characterization tested at $T_J = T_A = 25^{\circ}\text{C}$.
- Maximum is guaranteed at 25°C .
- For reference only – guaranteed by design.

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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
CAPACITANCE						
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 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°C .

6. For reference only – guaranteed by design.

Timing Diagram

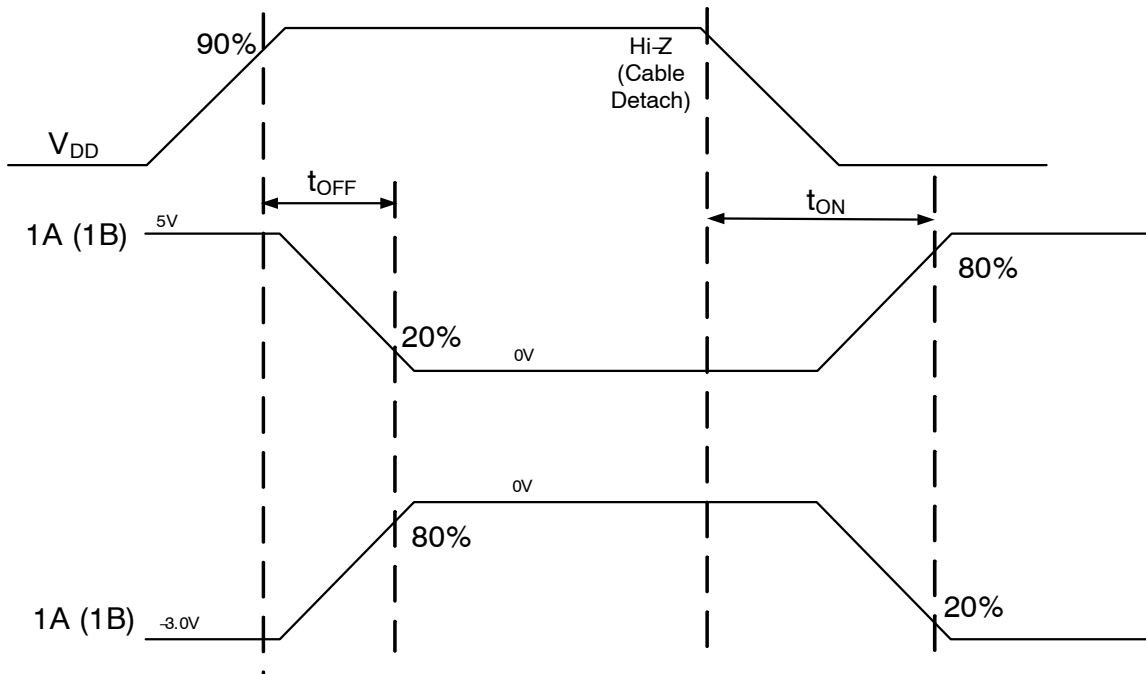
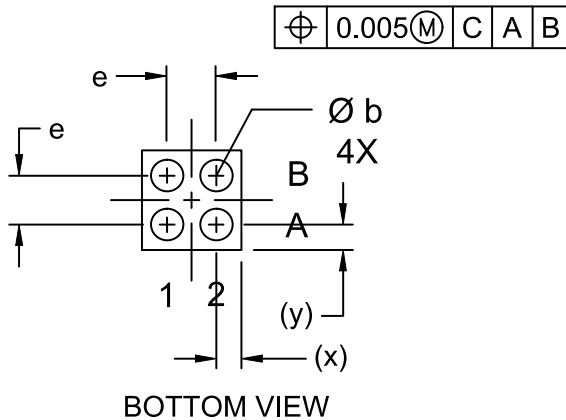
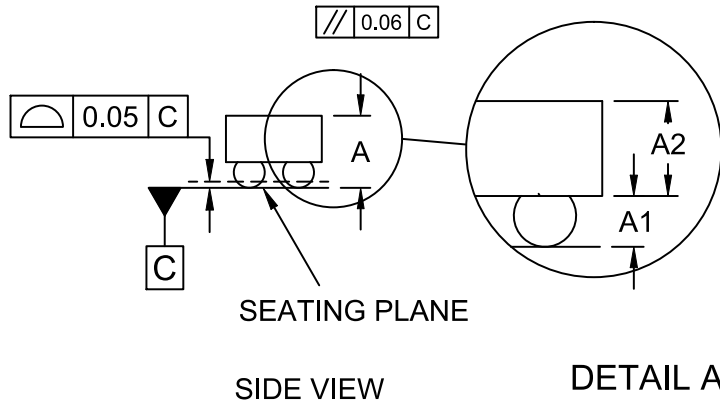
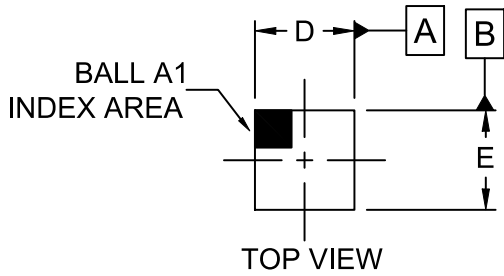


Figure 1. t_{ON} / t_{OFF} V_{CC} to Output Timing

FSA515

PACKAGE DIMENSIONS

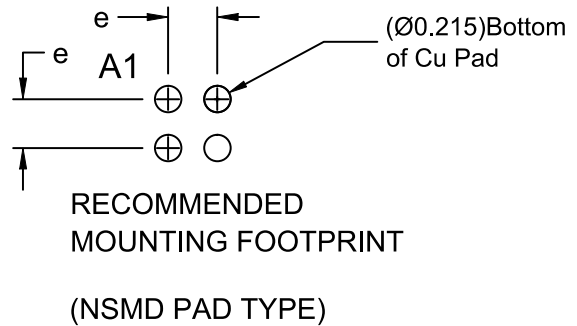
WLCSP4, 0.815x0.815x0.457
CASE 567VT
ISSUE O



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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