Low Supply Signal Bypass IC

Product Preview

FSA557

The FSA557 integrates 0.3 Ω depletion and enhancement mode switches to provide a signal bypass solution when batteries of wireless devices are low or have no charge left. In addition, an optional slow gradual transition is included to suppress any undesirable artifacts (ex: click and pop) when switching between signal sources. The depletion technology allows the device to conduct signals when there is no V_{DD} available and to isolate signals when V_{DD} is present. The FSA557 is 5.5 V tolerant and can pass or isolate negative signal swings down to −1.5 V.

Features

- Dual Depletion Switches
  - Normally Closed when V_{DD} < 0.5 V
  - V_{SW}: −1.5 V to +5.5 V
  - R_{ON}: 220 mΩ (Typical)
  - THD+N: −110 dB (Typical)
- Dual Enhancement Switches
  - V_{SW}: −1.5 V to +5.5 V
  - R_{ON}: 290 mΩ (Typical)
  - THD+N: −113 dB (Typical)

Typical Applications

- Battery Powered Devices
- Wireless Headphones

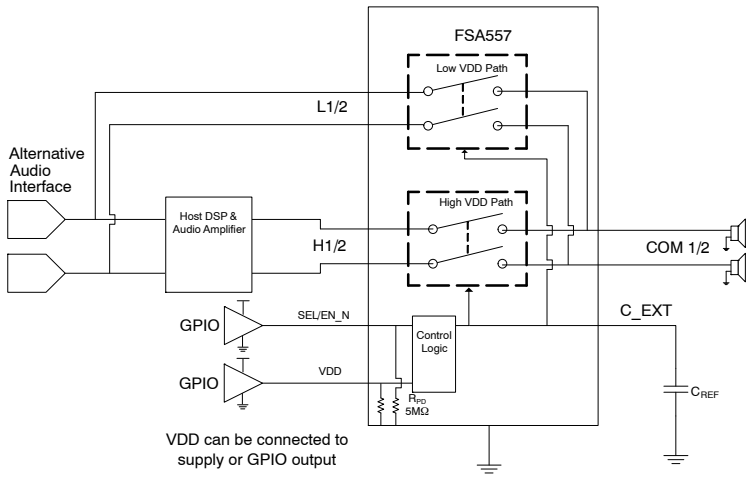
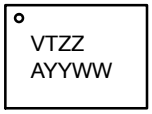


Figure 1. Application Schematic

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

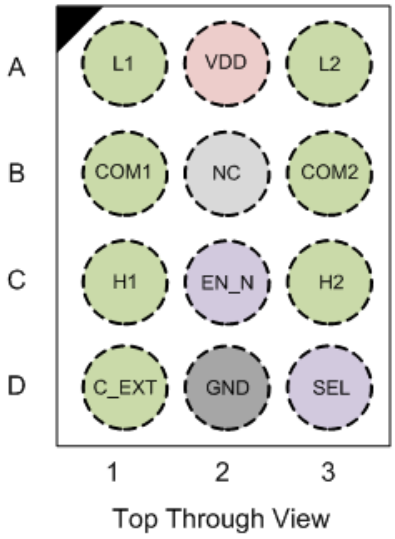
WLCSP 12
UCX SUFFIX
CASE 567ZW

MARKING DIAGRAM



VT = Specific Device Code
ZZ = 2−digit Lot Run Code
A = Assembly Location Code
YY = 2−digit Year Code
WW = Weekly Date Code (1 to 52)

PIN CONNECTIONS



Top Through View

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 7 of this data sheet.

Table 1. PIN FUNCTION DESCRIPTION

Pin No. WLCSP12	Pin Name	Description
A1	L1	Low Supply Signal Path 1
A2	VDD	Power Supply or Select Signal from Host GPIO
A3	L2	Low Supply Signal Path 2
B1	COM1	Common Port 1
B2	NC	No Connect
B3	COM2	Common Port 2
C1	H1	High Supply Signal Path 1
C2	EN_N	Path enable (active low)
C3	H2	High Supply Signal Path 2
D1	C_EXT	Capacitor Reference (Floating disables slow gradual transition)
D2	GND	Ground
D3	SEL	Path Select (Grounding forces VDD to determine path selection)

Table 2. SWITCH TRUTH TABLE

VDD	EN_N	SEL	Switch State	Notes
Low or FLOAT	X	X	COMM1/2 = L1/2	Dead battery
High	LOW OR FLOAT	LOW OR FLOAT	COMM1/2 = H1/2	Good battery
X	LOW OR FLOAT	HIGH	COMM1/2 = L1/2	Low battery
HIGH	HIGH	X	Hi−Z	Both paths disabled

NOTE: Click and pop suppression active during any switch state transition that occurs with VDD at an active HIGH level

Table 3. APPLICATION CIRCUIT COMPONENTS

Component	Manufacturer	Part Number	Value	Case Size	Voltage Rating
C_{REF}			40 nF		

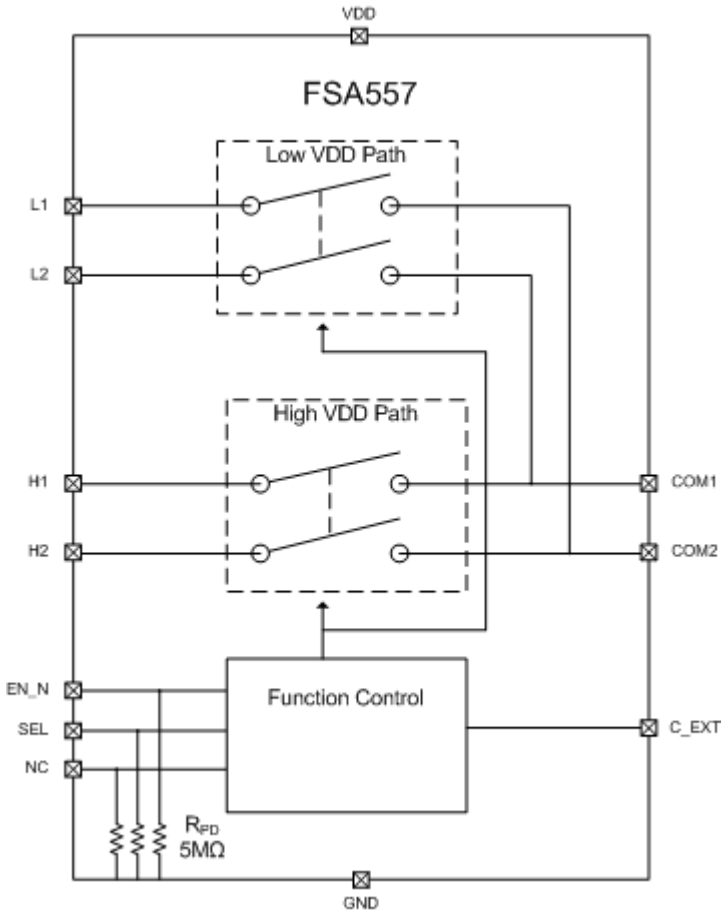


Figure 2. Functional Diagram

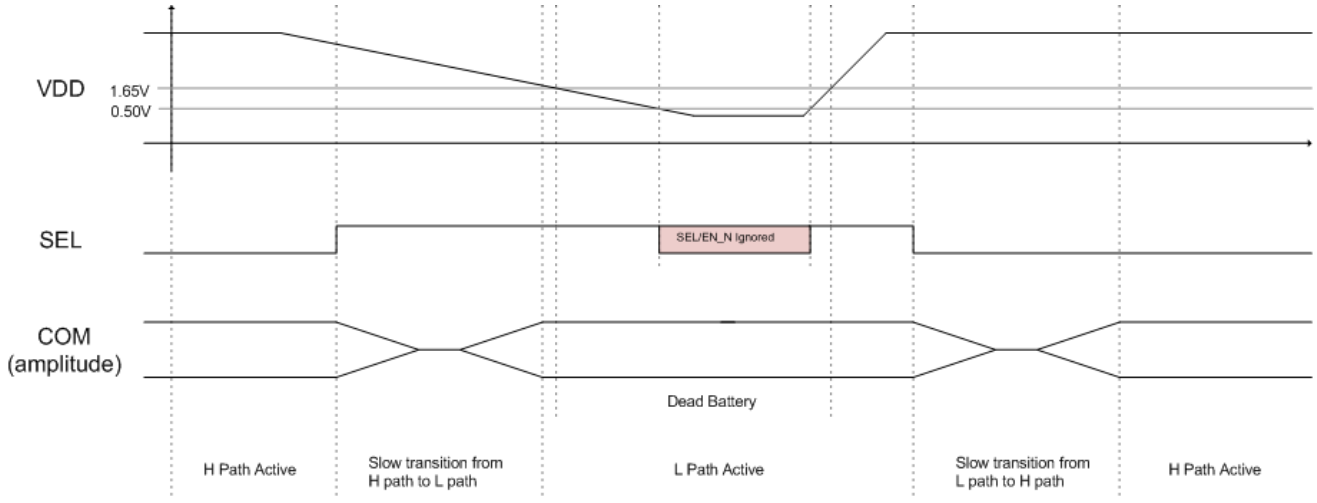


Figure 3. Low or Dead Battery Application

Table 4. MAXIMUM RATINGS

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{DD}	Supply Voltage	Slew Rate 2V/μs (rising), 1V/μs (falling)	−0.5		6.0	V
$V_{SW(ON)}$	Switch Voltage Range; L#, H#, COM#	Switch Conducting/Isolating	−2.0		6.0	V
$V_{SW(OFF)}$		Switch Isolating	−2.0		6.0	
I_{SW}	Maximum DC Switch I/O Current				350	mA
V_{CNTRL}	Control Input Voltage; SEL, EN_N		−0.3		6.0	V
T_J	Junction Temperature		−40		+150	°C
T_{STG}	Storage Temp		−65		+150	°C
T_L	Soldering Temp (10 Seconds)				+260	°C
ESD_{HBM}	Electrostatic Discharge Protection Level	Human Body Model		4.0		kV
ESD_{CDM}		Charged Device Model		2.0		
ESD_{IEC}		IEC 61000−4−2 System (Contact)		8		
		IEC 61000−4−2 System (Air Gap)		15		
Latchup	Latchup Current	JEDEC Standard: JESD78		100		mA

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.

Table 5. THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WLCSP−9 Thermal Resistance, Junction−to−Air (Note 1)	$R_{\theta JA}$	48	°C/W

1. JEDEC Standard, Still Air, 4−layer board with vias

Table 6. RECOMMENDED OPERATING RANGES

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{DD(L\#)}$	Supply Voltage Range	Low Supply Path Conducting	0.0		5.5	V
$V_{DD(H\#)}$		High Supply Path Conducting	1.65		5.5	
$V_{SW(ON)}$	Switch Voltage Range; L#, H#, COM#	Switch Conducting	−1.5		5.5	V
$V_{SW(OFF)}$		Switch Isolating	−1.5		5.5	
V_{CNTRL}	Control Input Voltage; SEL, EN_N, NC		0.0		5.5	V
T_A	Operating Ambient 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.

Table 7. ELECTRICAL CHARACTERISTICS Unless otherwise specified, typical values are for T_A = 25°C, V_{DD} = 0 V or 3.3 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{OFF}						
$I_{OFF\ (H\#)}$	Switch Off Leakage Current	V_{DD} = 0 V, High Supply Path Isolating; COM1/2 = GND; H1/2 = 5.5 V		0.01	0.50	μA
$I_{OFF\ (L\#)}$		V_{DD} = 5.5 V, Low Supply Path Isolating; COM1/2 = GND; L1/2 = 5.5 V		0.2	4.5	
R_{ON}*						
$R_{ON\ (H\#)}$	Switch On Resistance	High Supply Path Conducting; I_{SW}=100 mA, V_{SW} = −1.5 V to +5.5 V		290	500	mΩ
$R_{ON\ (L\#)}$		Low Supply Path Conducting; I_{SW} = 100 mA, V_{SW} = −1.5 V to +5.5 V		220	500	
ΔR_{ON}						
$\Delta R_{ON\ (H\#)}$	Switch On Resistance Matching	High Supply Path Conducting; I_{SW} = 100 mA, V_{SW} = −1.5 V to +5.5 V		15		mΩ
$\Delta R_{ON\ (L\#)}$		Low Supply Path Conducting; I_{SW}=100 mA, V_{SW} = −1.5 V to +5.5 V		15		
THD+N						
THD+N(H#) 1kHz	Total Harmonic Distortion + Noise	High Supply Path Conducting; R_L = 32 Ω; V_{SW} = 1 V_{RMS}; f = 1 kHz		−113		dB
THD+N(L#) 1kHz		Low Supply Path Conducting; R_L = 32 Ω; V_{SW} = 1 V_{RMS}; f = 1 kHz		−110		
OIRR						
OIRR(H#) 1kHz	Off Isolation Rejection Ratio	High Supply Path Isolating; R_L = 32 Ω; VSW = 1 V_{RMS}; f = 1 kHz		−117		dB
OIRR(H#) 20kHz		High Supply Path Isolating; R_L = 32 Ω; V_{SW} = 1 V_{RMS}; f = 20 kHz		−96		
OIRR(L#) 1kHz		Low Supply Path Isolating; R_L = 32 Ω; V_{SW} = 1 V_{RMS}; f = 1 kHz		−107		
OIRR(L#) 20kHz		Low Supply Path Isolating; R_L = 32 Ω; V_{SW} = 1 V_{RMS}; f = 20 kHz		−88		
XTALK						
XTALK(H#) 1 kHz	Crosstalk	Low Supply Path Conducting; R_L = 32 Ω; V_{SW} = 1 V_{RMS}; f = 1 kHz; Measure COM2/H1 & COM1/H2		−120		dB
XTALK(L#) 1 kHz		High Supply Path Conducting; R_L = 32 Ω; V_{SW} = 1 V_{RM}S; f = 1 kHz; Measure COM2/L1 & COM1/L2		−120		
BW						
BW(H#)	Bandwidth	High Supply Path Conducting; R_S = 50 Ω; R_L = 50 Ω; V_{SW} = 70.7 mV_{RMS}		175		MHz
BW(L#)		Low Supply Path Conducting; R_S = 50 Ω; R_L = 50 Ω; V_{SW} = 70.7 mV_{RMS}		155		
PSRR						
PSRR(H#) 217 Hz	Power Supply Rejection Ratio	High Supply Path Conducting; R_L = 32 Ω; V_DD = 3.3 V_{DC} + 100 mVAC,pk; f = 217 Hz		−112		dB
PSRR(H#) 1 kHz		High Supply Path Conducting; R_L = 32 Ω; V_{DD} = 3.3 V_{DC} + 100 mVAC,pk; f = 1 kHz		−112		
PSRR(H#) 20 kHz		High Supply Path Conducting; R_L = 32 Ω; V_{DD} = 3.3 V_{DC} + 100 mVAC,pk; f = 20 kHz		−92		
I_{DD}						
I_{DDT}	Peak Startup Supply Current	V_{DD} = 0 V to 5.5 V		2.5		mA

Table 7. ELECTRICAL CHARACTERISTICS Unless otherwise specified, typical values are for T_A = 25°C, V_{DD} = 0 V or 3.3 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{DD}						
I_{DD}	Quiescent Current	High Supply Path Conducting		65		μA
I_{SD}	Shutdown Current	Low Supply Path Conducting, V_{DD} = 3.3 V		1.25		μA
I_{DIS}	Disbale Current	Low Supply Path Conducting; V_{DD} = 0.2 V		0.05	1.0	μA
R_{PD}						
$R_{PD\ (VDD)}$	V_{DD} Pull−Down Resistance	$V_{DD} \le 0.8$ V		5.8		MΩ
$R_{PD\ (VCNTRL)}$	Pull−Down Resistance on SEL, EN_N	$V_{CNTRL} \le 5.5$ V		5.0		MΩ
$R_{PD\ (NC)}$	Pull−Down Resistance on NC	$V_{DD} = V_{NC} \le 5.5$ V		100		kΩ
V_{TH}						
V_{DDH}	V_{DD} High Voltage Threshold				1.65	V
V_{DDL}	V_{DD} Low Voltage Threshold		0.5			V
V_{DD_HYST}	V_{DD} Hysteresis			160		mV
V_{IH}	Input High Voltage Threshold	SEL, EN_N			1.5	V
V_{IL}	Input Low Voltage Threshold	SEL, EN_N	0.5			V
V_{HYST}	Input Hysteresis	SEL, EN_N		80		mV
t_{ON}						
$t_{ON\ (L\#)}$	Switch Path Turn On Time	V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = FLOAT		0.3		ms
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = 20 nF		50		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = 40 nF		100		
$t_{ON\ (H\#)}$		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = FLOAT		3.5		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 to 0.0 V; C_EXT = 20 nF		50		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = 40 nF		100		
t_{OFF}						
$t_{OFF\ (L\#)}$	Switch Path Turn Off Time	V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = FLOAT		0.6		ms
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = 20 nF		30		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = 40 nF		60		
$t_{OFF\ (H\#)}$	Switch Path Turn Off Time	V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = FLOAT		0.1		ms
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = 20 nF		30		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = 40 nF		60		

Table 7. ELECTRICAL CHARACTERISTICS Unless otherwise specified, typical values are for T_A = 25°C, V_{DD} = 0 V or 3.3 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{BBM}						
$t_{BBM\ (L\#)}$	Break Before Make Time	V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 to 3.3 V; C_EXT = FLOAT		0.2		ms
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = 20 nF		20		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 0.0 V to 3.3 V; C_EXT = 40 nF		40		
$t_{BBM\ (H\#)}$		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = FLOAT		3		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = 20 nF		20		
		V_{DD} = 3.3 V; R_L = 32 Ω; C_L = 10 pF; V_{SW} = 1.414 V; SEL = 3.3 V to 0.0 V; C_EXT = 40 nF		40		
C_{ON}						
$C_{ON\ (H\#)}$	On Capacitance	High Supply Path Conducting; V_{SW} = 100 mVDC + 100 mVAC,pk; f = 1 MHz;		45		pF
$C_{ON\ (L\#)}$		Low Supply Path Conducting; V_{SW} = 100 mVDC + 100 mVAC,pk; f = 1 MHz		35		
C_{OFF}						
$C_{OFF\ (H\#)}$	Off Capacitance	High Supply Path Isolating; V_{SW} = 100 mVDC + 100 mVAC,pk; f = 1 MHz; Measure H#;		10		pF
$C_{OFF\ (L\#)}$		Low Supply Path Isolating; V_{SW} = 100 mVDC + 100 mVAC,pk; f = 1 MHz; Measure L#;		30		
$C_{OFF\ (COM\#)}$		Both Paths Isolating; V_{SW} = 100 mVDC + 100 mVAC,pk; f = 1 MHz; Measure COM#;		40		
C_{VDD}	Supply Capacitance	V_{DD} = 3.3 V_{DC} + 100 mVAC,pk; f = 1 MHz		15		pF
f_{OSC}	On−Chip Oscillator Frequency	Note (For Reference Only)		570		kHz

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.

ORDERING INFORMATION

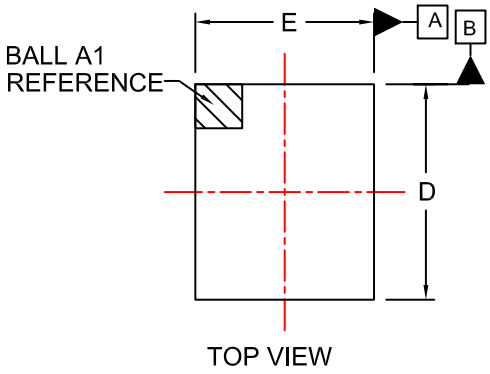
Device	Marking	Package	Shipping†
FSA557UCX	VT	WLCSP−12 0.40 mm Pitch 1.62 x 1.635 x 0.457 mm (Nominal)	3000 / Tape & Reel

†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.

FSA557

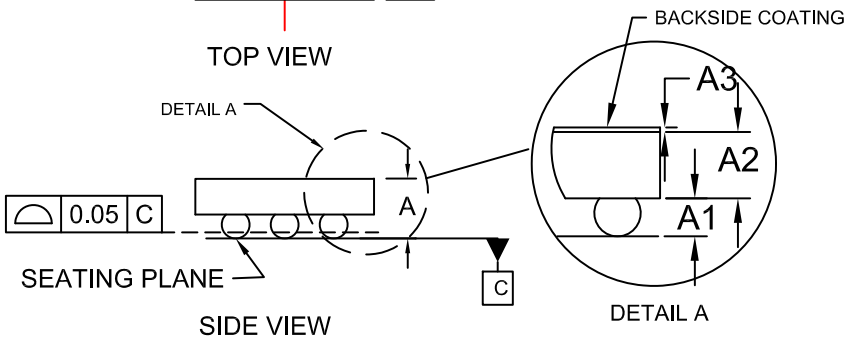
PACKAGE DIMENSIONS

WLCSP12 1.620x1.635x0.457
CASE 567ZW
ISSUE O

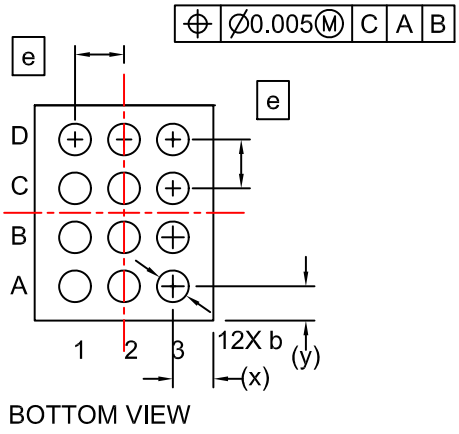


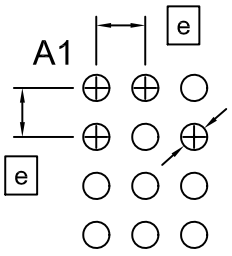
NOTES:

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	0.416	0.457	0.498
A1	0.183	0.203	0.223
A2	0.211	0.229	0.247
A3	0.022	0.025	0.028
b	0.240	0.260	0.280
D	1.605	1.635	1.665
E	1.590	1.620	1.650
e	0.40 BSC		
x	0.395	0.410	0.425
y	0.2025	0.2175	0.2325





Ø0.215 COPPER PAD (BOTTOM)

RECOMMENDED
MOUNTING FOOTPRINT
(NSMD PAD TYPE)

*For additional information on our Pb−Free strategy and soldering details, please download the On Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

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