

# USB Type-C Analog Audio Switch with Protection Function

## FSA4476

### Description

FSA4476 is a high performance USB Type-C port multimedia switch which supports analog audio headsets. FSA4476 allows the sharing of a common USB Type-C port to pass USB2.0 signal, analog audio, sideband use wires and analog microphone signal. FSA4476 also supports high voltage on CC port, SBU port and USB port on USB Type-C receptacle side. In addition, FSA4476 supports USB Type-C dead battery application and dual power supply with VBAT rail and VBUS rail.

### Features

- Power Management
  - ◆ Primary Power Supply: VBAT, 2.7 V to 5.5 V
  - ◆ Second Power Supply VBUS, 4.0 V to 20 V
- USB High Speed (480 Mbps) Switch:
  - ◆ -3 dB Bandwidth: 1 GHz
  - ◆ 3  $\Omega$  R<sub>ON</sub> Typical
- Audio Switch
  - ◆ Negative Rail Capability: -3 V to +3 V
  - ◆ THD+N = -110 dB; 1 V<sub>RMS</sub>, f = 20 Hz~20 kHz, 32  $\Omega$  Load
  - ◆ 0.6  $\Omega$  R<sub>ON</sub> Typical
- High Voltage Protection
  - ◆ 20 V DC Protection on CC Port and SBU Port
  - ◆ 16 V DC Protection on DP/R and DN/L Port
- Over Voltage Protection:
  - ◆ 5.8 V (Typ) on CC Port
  - ◆ 4.5 V (Typ) on SBU Port
  - ◆ 4.5 V (Typ) on DP/R and DN/L Port
- OMTP and CTIA Pinout Support
- Support Audio Sense Path
- Support Dead Battery
- 25-ball WLCSP Package (2.03 mm x 2.03 mm)
- This is a Pb-Free Device

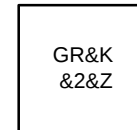
### Applications

- Mobile Phone, Tablet, Notebook PC, Media Player



WLCSP25, 2.03x2.03x0.586  
CASE 567UP

### MARKING DIAGRAM



GR = Device Code  
 &K = 2-Digits Lo Run Traceability Code  
 &2 = 2-Digit Date Code  
 &Z = Assembly Plant Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 12 of this data sheet.

# FSA4476

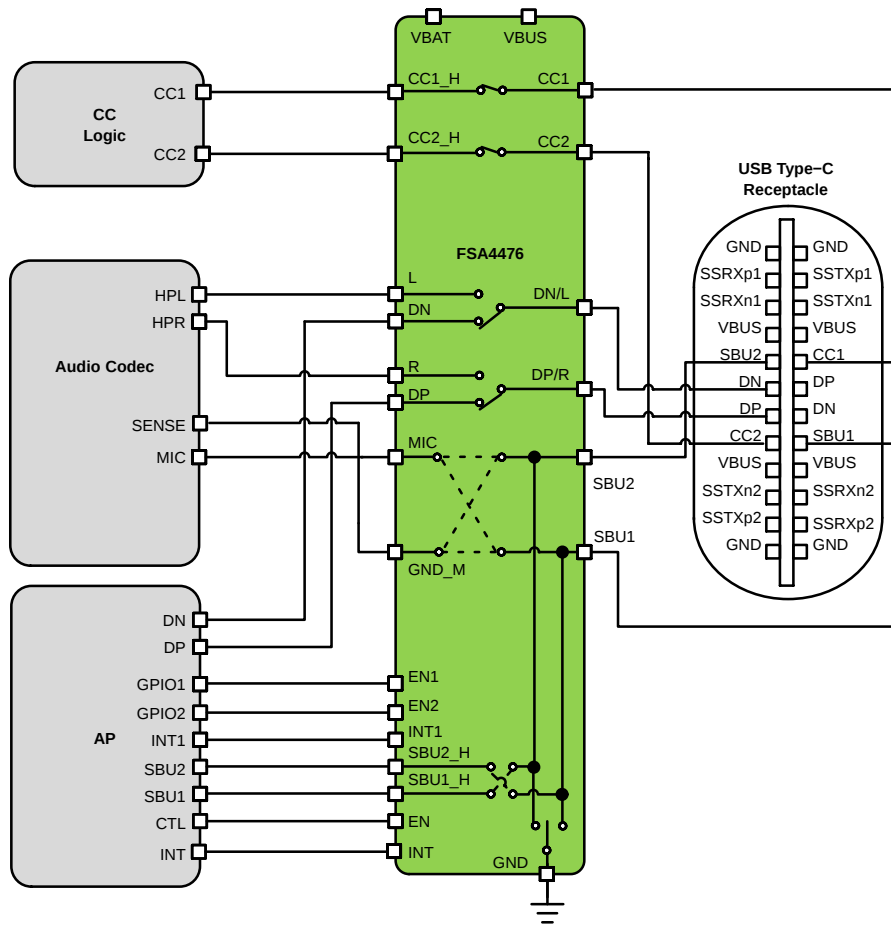


Figure 1. Application Block Diagram

## PIN CONFIGURATION

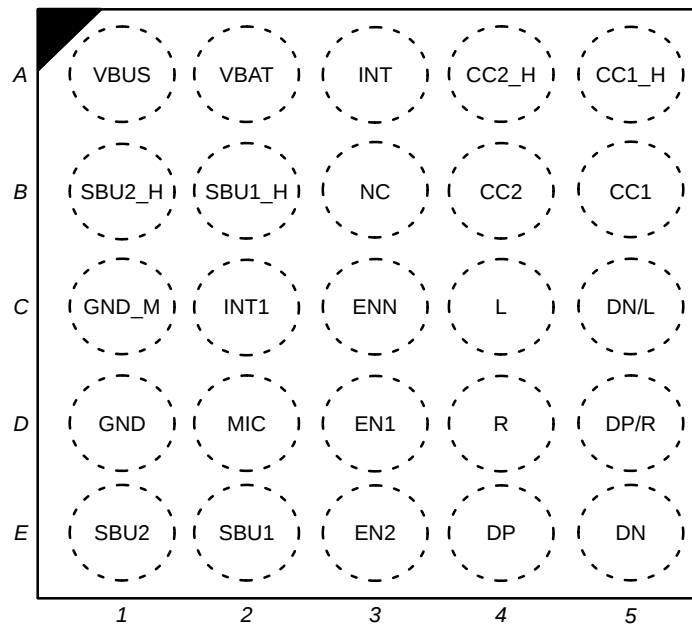


Figure 2. Pin Assignment (Top Through View)

## PIN DESCRIPTIONS

| Name   | Ball | Description                                                                                                         |
|--------|------|---------------------------------------------------------------------------------------------------------------------|
| VBUS   | A1   | Power Supply                                                                                                        |
| VBAT   | A2   | Power Supply                                                                                                        |
| GND    | D1   | Ground                                                                                                              |
| DP/R   | D5   | USB Positive Data/Right Audio Common Line                                                                           |
| DN/L   | C5   | USB Negative Data/Left Audio Common Line                                                                            |
| DP     | E4   | Positive DataLine for USB signals                                                                                   |
| DN     | E5   | Negative DataLine for USB signals                                                                                   |
| L      | C4   | Left Line for Audio Signals                                                                                         |
| R      | D4   | Right Line for Audio Signals                                                                                        |
| SBU1   | E2   | Sideband Use Wire 1 Common Line                                                                                     |
| SBU2   | E1   | Sideband Use Wire 2 Common Line                                                                                     |
| MIC    | D2   | Microphone, connects to microphone pre-amplifier                                                                    |
| GND_M  | C1   | Sense Pin to Detect GND offset                                                                                      |
| SBU1_H | B2   | Host Side Sideband Use Wire 1                                                                                       |
| SBU2_H | B1   | Host Side Sideband Use Wire 2                                                                                       |
| CC1    | B5   | Configuration Channel 1                                                                                             |
| CC2    | B4   | Configuration Channel 2                                                                                             |
| CC1_H  | A5   | Host Side Configuration Channel 1                                                                                   |
| CC2_H  | A4   | Host Side Configuration Channel 2                                                                                   |
| INT    | A3   | OVP Interrupt Output, active low (open drain)                                                                       |
| INT1   | C2   | Interrupt Output Signal; During EN1=1, INT1 is low active (open drain output) when CC1_H < 1.2 V and CC2_H < 1.2 V. |
| ENN    | C3   | Chip Enable, active low, internal pull-down by 1Mohm.                                                               |
| EN1    | D3   | Logic Configuration Input 1                                                                                         |
| EN2    | E3   | Logic Configuration Input 2                                                                                         |
| NC     | B3   | No Connect                                                                                                          |

## TRUTH TABLE

| Power | ENN | EN1,EN2 | CC Switch    | Headset Detection | USB Switch                      | Audio Switch                  | MIC SW / GND_M SW                                  | SBU Bypass Switch                       |
|-------|-----|---------|--------------|-------------------|---------------------------------|-------------------------------|----------------------------------------------------|-----------------------------------------|
| OFF   | X   | XX      | Dead battery | OFF               | OFF                             | OFF                           | OFF                                                | OFF                                     |
| ON    | H   | XX      | OFF          | OFF               | OFF                             | OFF                           | OFF                                                | OFF                                     |
| ON    | L   | 00      | ON           | OFF               | ON:<br>DP/R to DP<br>DN/L to DN | OFF                           | OFF                                                | ON:<br>SBU1 to SBU1_H<br>SBU2 to SBU2_H |
| ON    | L   | 01      | ON           | OFF               | ON:<br>DP/R to DP<br>DN/L to DN | OFF                           | OFF                                                | ON:<br>SBU1 to SBU2_H<br>SBU2 to SBU1_H |
| ON    | L   | 10      | ON           | ON                | OFF                             | ON:<br>DP/R to R<br>DN/L to L | ON:<br>SBU1 to MIC<br>SBU2 to GND_M<br>SBU2 to GND | OFF                                     |
| ON    | L   | 11      | ON           | ON                | OFF                             | ON:<br>DP/R to R<br>DN/L to L | ON:<br>SBU2 to MIC<br>SBU1 to GND_M<br>SBU1 to GND | OFF                                     |

## ABSOLUTE MAXIMUM RATINGS

| Symbol                    | Parameter                                              |                                                                             | Min  | Max  | Unit |
|---------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------|------|------|------|
| V <sub>BAT</sub>          | Supply Voltage from VBAT                               |                                                                             | -0.5 | 6.5  | V    |
| V <sub>BUS</sub>          | Supply Voltage from VBUS                               |                                                                             | -0.5 | 28   | V    |
| V <sub>VICC</sub>         | V <sub>CCx</sub> , to GND                              |                                                                             | -0.5 | 20   | V    |
| V <sub>VCC_H</sub>        | V <sub>CCx_H</sub> , to GND                            |                                                                             | -0.5 | 6.5  | V    |
| V <sub>SW_USB/Audio</sub> | V <sub>DP_R</sub> to GND, V <sub>DN_L</sub> to GND     |                                                                             | -3.5 | 16   | V    |
| V <sub>SW_USB</sub>       | V <sub>DP</sub> to GND, V <sub>DN</sub> to GND         |                                                                             | -0.5 | 6.5  | V    |
| V <sub>SW_Audio</sub>     | V <sub>L</sub> to GND, V <sub>R</sub> to GND           |                                                                             | -3.5 | +3.5 | V    |
| V <sub>SBU</sub>          | V <sub>SBU1</sub> to GND, V <sub>SBU2</sub> to GND     |                                                                             | -0.5 | 20   | V    |
| V <sub>SBU_H</sub>        | V <sub>SBU1_H</sub> to GND, V <sub>SBU2_H</sub> to GND |                                                                             | -0.5 | 6.5  | V    |
| V <sub>I/O</sub>          | MIC, GND_M, INT, INT1 to GND                           |                                                                             | -0.5 | 6.5  | V    |
| V <sub>CNTRL</sub>        | Control Input Voltage                                  | ENN, ENx                                                                    | -0.5 | 6.5  | V    |
| I <sub>CCSW</sub>         | CC Switch Current                                      |                                                                             | -    | 1.25 | A    |
| I <sub>SW_Audio</sub>     | Switch I/O Current, Audio Path                         |                                                                             | -250 | 250  | mA   |
| I <sub>SW_USB</sub>       | Switch I/O Current, USB Path                           |                                                                             | -    | 100  | mA   |
| I <sub>SW_MIC</sub>       | Switch I/O Current, MIC to SBU1 or SBU2                |                                                                             | -    | 50   | mA   |
| I <sub>SW_GND_M</sub>     | Switch I/O Current, GND_M to SBU1 or SBU2              |                                                                             | -    | 100  | mA   |
| I <sub>SW_GND</sub>       | Switch I/O Current, GND to SBU1 or SBU2                |                                                                             | -    | 500  | mA   |
| I <sub>IK</sub>           | DC Input Diode Current                                 |                                                                             | -50  | -    | mA   |
| ESD                       | Human Body Model, ANSI/ESDA/JEDEC JS-001-2012          | Connector Side and Power Pins: VBUS, VBAT, CC1, CC2, SBU1, SBU2, DP/R, DN/L | 4    | -    | kV   |
|                           |                                                        | Host Side Pins: The Rest Pins                                               | 2    | -    |      |
|                           | Charged Device Model, JEDEC: JESD22-C101               |                                                                             | 1    | -    |      |
| T <sub>A</sub>            | Absolute Maximum Operating Temperature                 |                                                                             | -40  | +85  | °C   |
| T <sub>STG</sub>          | Storage Temperature                                    |                                                                             | -65  | +150 | °C   |

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.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol | Parameter | Min | Max | Max | Unit |
|--------|-----------|-----|-----|-----|------|
|--------|-----------|-----|-----|-----|------|

**POWER**

|      |                |     |   |     |   |
|------|----------------|-----|---|-----|---|
| VBAT | Supply Voltage | 2.7 | – | 5.5 | V |
| VBUS | Supply Voltage | 4.0 | – | 20  | V |

**USB SWITCH**

|         |                                                                                                   |   |   |     |   |
|---------|---------------------------------------------------------------------------------------------------|---|---|-----|---|
| VSW_USB | V <sub>DP</sub> to GND, V <sub>DN</sub> to GND, V <sub>DP/Rto</sub> GND, V <sub>DN/L</sub> to GND | 0 | – | 4.0 | V |
|---------|---------------------------------------------------------------------------------------------------|---|---|-----|---|

**AUDIO SWITCH**

|           |                                                                                                 |    |   |     |   |
|-----------|-------------------------------------------------------------------------------------------------|----|---|-----|---|
| VSW_Audio | V <sub>DP/Rto</sub> GND, V <sub>DN/L</sub> to GND, V <sub>L</sub> to GND, V <sub>R</sub> to GND | –3 | – | +3  | V |
| VSW_MIC   | MIC to GND                                                                                      | 0  | – | 3.6 | V |

**SBU SWITCH**

|       |                                                                                                            |   |   |     |   |
|-------|------------------------------------------------------------------------------------------------------------|---|---|-----|---|
| VVSBU | V <sub>SBU1</sub> to GND, V <sub>SBU2</sub> to GND, V <sub>SBU1_H</sub> to GND, V <sub>SBU2_H</sub> to GND | 0 | – | 4.0 | V |
|-------|------------------------------------------------------------------------------------------------------------|---|---|-----|---|

**CC SWITCH**

|        |                             |   |   |      |   |
|--------|-----------------------------|---|---|------|---|
| VVICC  | V <sub>CCx</sub> , to GND   | 0 | – | 5.5  | V |
| VVCC_H | V <sub>CCx_H</sub> , to GND | 0 | – | 5.5  | V |
| ICCSW  | CC Switch Current           |   | – | 1.25 | A |

**CONTROL VOLTAGE (ENN, ENX)**

|     |                    |     |   |     |   |
|-----|--------------------|-----|---|-----|---|
| VIH | Input Voltage High | 1.3 | – | –   | V |
| VIL | Input Voltage Low  | –   | – | 0.5 | V |

**OPERATING TEMPERATURE**

|    |                               |     |    |     |    |
|----|-------------------------------|-----|----|-----|----|
| TA | Ambient Operating Temperature | –40 | 25 | +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.

# FSA4476

**DC CHARACTERISTICS** (VBAT = 2.7 V to 5.5 V or VBUS = 4.0 V to 20 V, VBAT (Typ.) = 4.3 V or VBUS (Typ.) = 5 V, T<sub>A</sub> = -40°C to 85°C, and T<sub>A</sub> (Typ.) = 25°C, unless otherwise specified.) (Note 1)

| Symbol           | Parameter           | Condition | Power        | T <sub>A</sub> = -40°C to +85°C |     |     | Unit |
|------------------|---------------------|-----------|--------------|---------------------------------|-----|-----|------|
|                  |                     |           |              | Min                             | Typ | Max |      |
| I <sub>CC</sub>  | VBAT Supply Current |           | VBAT = 4.3 V | -                               | 25  | -   | μA   |
| I <sub>CCZ</sub> | Quiescent Current   |           | VBAT = 4.3 V | -                               | 5   | -   | μA   |

## USB/AUDIO COMMON PINS

|                      |                                                 |                            |                                           |      |     |     |    |
|----------------------|-------------------------------------------------|----------------------------|-------------------------------------------|------|-----|-----|----|
| I <sub>OZ</sub>      | Off Leakage Current of Port DP/R and DN/L       | DN/L, DP/R = -3 V to 4.0 V | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -3.0 | -   | 3.0 | μA |
| I <sub>OFF</sub>     | Power-Off Leakage Current of Port DP/R and DN/L | DN/L, DP/R = 0 V to 4.0 V  | Power off                                 | -3.0 | -   | 3.0 | μA |
| V <sub>OV_TRIP</sub> | Input OVP Lockout                               | Rising edge                | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | 4.2  | 4.5 | 4.8 | V  |
| V <sub>OV_HYS</sub>  | Input OVP Hysteresis                            |                            |                                           | -    | 0.3 | -   | V  |

## AUDIO SWITCH

|                    |                                                        |                                                         |                                           |      |     |     |    |
|--------------------|--------------------------------------------------------|---------------------------------------------------------|-------------------------------------------|------|-----|-----|----|
| I <sub>ON</sub>    | On Leakage Current of Audio Switch                     | DN/L, DP/R = -3 V to 3.0 V, DP, DN, R, L = Float        | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -2.0 | 0.1 | 2.0 | μA |
| I <sub>OFF</sub>   | Power-Off Leakage Current on L and R                   | L, R = 0 V to 3 V                                       | Power off                                 | -1.0 | -   | 1.0 | μA |
| R <sub>ON</sub>    | Switch On Resistance                                   | I <sub>SW</sub> = 100 mA, V <sub>SW</sub> = -3 V to 3 V | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -    | 0.6 | -   | Ω  |
| R <sub>SHUNT</sub> | Pull Down Resistor on R/L Pin when Audio Switch is Off | L = R = 3 V                                             |                                           | 6    | 10  | 14  | kΩ |

## USB SWITCH

|                     |                                        |                                                 |                                           |      |     |     |    |
|---------------------|----------------------------------------|-------------------------------------------------|-------------------------------------------|------|-----|-----|----|
| I <sub>ON</sub>     | On Leakage Current of USB Switch       | DN/L, DP/R = 0 V to 4.0 V, DP, DN, R, L = Float | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -3.0 | 1.0 | 3.0 | μA |
| I <sub>OZ</sub>     | Off Leakage Current of Port DP and DN  | DN, DP = 0 V to 4.0 V                           |                                           | -3.0 | -   | 3.0 | μA |
| I <sub>OFF</sub>    | Power-Off Leakage Current on DP and DN | DN, DP = 0 V to 4.0 V                           | Power off                                 | -3.0 | -   | 3.0 | μA |
| R <sub>ON_USB</sub> | USB Switch On Resistance               | I <sub>SW</sub> = 8 mA, V <sub>SW</sub> = 0.4 V | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -    | 3   | -   | Ω  |

## CC SWITCH

|                      |                                              |                                                  |                                           |      |     |      |    |
|----------------------|----------------------------------------------|--------------------------------------------------|-------------------------------------------|------|-----|------|----|
| I <sub>ON</sub>      | On Leakage Current of CC Switch              | V <sub>sw</sub> from 0 V to 3.6 V                | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -1.5 | -   | 2.0  | μA |
| R <sub>ON</sub>      | CC Path On Resistance                        | I <sub>OUT</sub> = 200 mA, V <sub>SW</sub> = 5 V |                                           | -    | 300 | -    | mΩ |
| V <sub>OV_TRIP</sub> | Input OVP Lockout                            | Rising edge                                      |                                           | 5.6  | 5.8 | 6.1  | V  |
| V <sub>OV_HYS</sub>  | Input OVP Hysteresis                         |                                                  |                                           | -    | 0.3 | -    | V  |
| R <sub>d</sub>       | Dead Battery Pull Down Resistance            | 350 μA on CCx pin                                | VBAT < 2.4 V and VBUS < 3.5 V             | 4.08 | 5.1 | 6.12 | kΩ |
| V <sub>THR_H</sub>   | CCx_H High Threshold under Headset Detection | EN1 = H                                          | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -    | 1.5 | -    | V  |
| V <sub>THR_L</sub>   | CCx_Hlow Threshold under Headset Detection   | EN1 = H                                          |                                           | -    | 1.2 | -    | V  |

## SBU COMMON PINS

|                      |                                        |                   |                                           |      |     |     |    |
|----------------------|----------------------------------------|-------------------|-------------------------------------------|------|-----|-----|----|
| I <sub>OZ</sub>      | Off Leakage Current of Port SBUx       | SBUx = 0 V to 4 V | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -3.0 | -   | 3.0 | μA |
| I <sub>OFF</sub>     | Power-Off Leakage Current of Port SBUx | SBUx = 0 V to 4 V | Power off                                 | -3.0 | -   | 3.0 | μA |
| V <sub>OV_TRIP</sub> | Input OVP Lockout                      | Rising edge       | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | 4.2  | 4.5 | 4.8 | V  |
| V <sub>OV_HYS</sub>  | Input OVP Hysteresis                   |                   |                                           | -    | 0.3 | -   | V  |

# FSA4476

**DC CHARACTERISTICS** (VBAT = 2.7 V to 5.5 V or VBUS = 4.0 V to 20 V, VBAT (Typ.) = 4.3 V or VBUS (Typ.) = 5 V, T<sub>A</sub> = -40°C to 85°C, and T<sub>A</sub> (Typ.) = 25°C, unless otherwise specified.) (Note 1) (continued)

| Symbol | Parameter | Condition | Power | T <sub>A</sub> = -40°C to +85°C |     |     | Unit |
|--------|-----------|-----------|-------|---------------------------------|-----|-----|------|
|        |           |           |       | Min                             | Typ | Max |      |

## MIC SWITCH

|                  |                                  |                                             |                                           |      |   |     |    |
|------------------|----------------------------------|---------------------------------------------|-------------------------------------------|------|---|-----|----|
| I <sub>ON</sub>  | On Leakage Current of MIC Switch | SBUx = 0 V to 3.6 V, MIC is floating        | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -3.0 | - | 3.0 | μA |
| I <sub>OZ</sub>  | Off Leakage Current on MIC       | MIC = 0 V to 3.6 V                          |                                           | -1.0 | - | 1.0 | μA |
| I <sub>OFF</sub> | Power Off Leakage Current on MIC | MIC = 0 V to 3.6 V                          | Power off                                 | -1.0 | - | 1.0 | μA |
| R <sub>ON</sub>  | MIC Switch On Resistance         | MIC = 0 V to 3.6 V, I <sub>sw</sub> = 30 mA | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -    | 2 | -   | Ω  |

## GND\_M SWITCH

|                  |                                    |                         |                                           |      |     |     |    |
|------------------|------------------------------------|-------------------------|-------------------------------------------|------|-----|-----|----|
| I <sub>OZ</sub>  | Off Leakage on GND_M               | GND_M = 0 V to 3.6 V    | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -2.0 | -   | 2.0 | μA |
| I <sub>OFF</sub> | Power Off Leakage Current on GND_M | GND_M = 0 V to 3.6 V    | Power off                                 | -1.0 | -   | 1.0 | μA |
| R <sub>ON</sub>  | GND_M Switch On Resistance         | I <sub>sw</sub> = 30 mA | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -    | 0.5 | -   | Ω  |

## SBU BYPASS SWITCH

|                 |                                         |                                              |                                           |      |   |     |    |
|-----------------|-----------------------------------------|----------------------------------------------|-------------------------------------------|------|---|-----|----|
| I <sub>ON</sub> | On Leakage Current of SBU Bypass Switch | SBUx = 0 V to 4 V, SBUx_H is floating        | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | -1.0 | - | 2.0 | μA |
| I <sub>OZ</sub> | Off Leakage Current on SBUx_H           | SBUx_H = 0 V to 4 V                          |                                           | -1.0 | - | 1.0 | μA |
| R <sub>ON</sub> | SBU Bypass Switch On Resistance         | SBUx = 0 V to 3.6 V, I <sub>sw</sub> = 50 mA |                                           | -    | 3 | -   | Ω  |

## INTERNAL GND SWITCH

|                 |                                   |                          |                                           |   |    |              |    |
|-----------------|-----------------------------------|--------------------------|-------------------------------------------|---|----|--------------|----|
| R <sub>ON</sub> | Internal GND Switch On Resistance | I <sub>sw</sub> = 200 mA | VBAT: 2.7 V to 5.5 V or VBUS: 4 V to 20 V | - | 75 | 110 (Note 2) | mΩ |
|-----------------|-----------------------------------|--------------------------|-------------------------------------------|---|----|--------------|----|

1. Limits over the recommended temperature operating range (T<sub>A</sub> = -40°C to +85°C) are correlated by statistical quality.
2. Guaranteed by characterization, not production tested.

# FSA4476

**AC CHARACTERISTICS** (VBAT = 2.7 V to 5.5 V or VBUS = 4.0 V to 20 V, VBAT (Typ.) = 4.3 V or VBUS (Typ.) = 5 V, T<sub>A</sub> = -40°C to 85°C, T<sub>A</sub> (Typ.) = 25°C, unless otherwise specified.)

| Symbol | Parameter | Condition | Power | T <sub>A</sub> = -40°C to +85°C |     |     | Unit |
|--------|-----------|-----------|-------|---------------------------------|-----|-----|------|
|        |           |           |       | Min                             | Typ | Max |      |

## AUDIO SWITCH

|                   |                                                                                       |                                                                                                  |                             |   |      |   |     |
|-------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------|---|------|---|-----|
| t <sub>ON</sub>   | Turn On Time (Note 3)                                                                 | DP/R = DN/L = 1.5 V,<br>R <sub>L</sub> = 50 Ω                                                    | VBAT: 4.3 V<br>or VBUS: 5 V | – | 55   | – | μs  |
| t <sub>OFF</sub>  | Turn OFF Time (Note 3)                                                                | DP/R = DN/L = 1.5 V,<br>R <sub>L</sub> = 50 Ω                                                    |                             | – | 2    | – | μs  |
| X <sub>TALK</sub> | Cross Talk (Adjacent) (Note 3)                                                        | f = 1 kHz, R <sub>L</sub> = 50 Ω,<br>V <sub>SW</sub> = 1 V <sub>RMS</sub>                        |                             | – | –110 | – | dB  |
| BW                | –3 dB Bandwidth (Note 3)                                                              | R <sub>L</sub> = 50 Ω                                                                            |                             | – | 950  | – | MHz |
| O <sub>IRR</sub>  | Off Isolation (Note 3)                                                                | f = 1 kHz, R <sub>L</sub> = 50 Ω,<br>C <sub>L</sub> = 0 pF, V <sub>SW</sub> = 1 V <sub>RMS</sub> |                             | – | –100 | – | dB  |
| THD+N             | Total Harmonic Distortion + Noise<br>Performance with A- Weighting<br>Filter (Note 3) | R <sub>L</sub> = 600 Ω,<br>f = 20 Hz–20 kHz,<br>V <sub>SW</sub> = 2 V <sub>RMS</sub>             |                             | – | –110 | – | dB  |
|                   |                                                                                       | R <sub>L</sub> = 32 Ω,<br>f = 20 Hz–20 kHz,<br>V <sub>SW</sub> = 1 V <sub>RMS</sub>              |                             | – | –110 | – | dB  |
|                   |                                                                                       | R <sub>L</sub> = 16 Ω,<br>f = 20 Hz–20 kHz,<br>V <sub>SW</sub> = 0.5 V <sub>RMS</sub>            |                             | – | –108 | – | dB  |

## USB SWITCH

|                  |                                                               |                                                                                                  |                             |   |      |     |     |
|------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------|---|------|-----|-----|
| t <sub>ON</sub>  | Turn-on Time (Note 3)                                         | DP/R = DN/L = 1.5 V,<br>R <sub>L</sub> = 50 Ω                                                    | VBAT: 4.3 V<br>or VBUS: 5 V | – | 40   | –   | μs  |
| t <sub>OFF</sub> | Turn-off Time (Note 3)                                        | DP/R = DN/L = 1.5 V,<br>R <sub>L</sub> = 50 Ω                                                    |                             | – | 1    | –   | μs  |
| BW               | –3 dB Bandwidth (Note 3)                                      | R <sub>L</sub> = 50 Ω                                                                            |                             | – | 1    | –   | GHz |
| O <sub>IRR</sub> | Off Isolation (Note 3) between DP,<br>DN and Common Node Pins | f = 1 kHz, R <sub>L</sub> = 50 Ω,<br>C <sub>L</sub> = 0 pF, V <sub>SW</sub> = 1 V <sub>RMS</sub> |                             | – | –100 | –   | dB  |
| t <sub>OVP</sub> | DP/R and DN/L Pins OVP<br>Response Time (Note 3)              | R <sub>L</sub> = 50 Ω, V <sub>sw</sub> = 3.5 V to<br>5.5 V                                       |                             | – | 0.5  | 1.5 | μs  |

## CC SWITCH

|                  |                                        |                                                                                 |                             |   |     |   |     |
|------------------|----------------------------------------|---------------------------------------------------------------------------------|-----------------------------|---|-----|---|-----|
| t <sub>ON</sub>  | Turn-On Time (Note 3)                  | V <sub>ICCX</sub> = 5 V, R <sub>L</sub> = 5 kΩ                                  | VBAT: 4.3 V<br>or VBUS: 5 V | – | 0.5 | – | ms  |
| t <sub>OFF</sub> | Turn-Off Time (Note 3)                 | V <sub>ICCX</sub> = 5 V, R <sub>L</sub> = 5 kΩ                                  |                             | – | 3   | – | μs  |
| BW               | PD Traffic Bandwidth (Note 3)          | R <sub>L</sub> = 50 Ω                                                           |                             | – | 25  | – | MHz |
| t <sub>OVP</sub> | CCx Pins OVP Response Time<br>(Note 3) | R <sub>L</sub> = 25 Ω, C <sub>L</sub> = 200 pF,<br>V <sub>SW</sub> : 4 V to 7 V |                             | – | 0.6 | 1 | μs  |

## SBUX BYPASS SWITCH

|                  |                                         |                                                                                                 |                             |   |     |   |     |
|------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------|---|-----|---|-----|
| t <sub>OVP</sub> | SBUX Pins OVP Response Time<br>(Note 3) | R <sub>L</sub> = 50 Ω, V <sub>sw</sub> = 3.5 V to<br>5.5 V                                      | VBAT: 4.3 V<br>or VBUS: 5 V | – | 0.6 | 1 | μs  |
| t <sub>ON</sub>  | Turn-On Time (Note 3)                   | I <sub>sw</sub> on SBUX = 1 mA and<br>clamp to 2 V, R <sub>L</sub> on MIC and<br>SBUX_H = 1 kΩ, |                             | – | 12  | – | μs  |
| t <sub>OFF</sub> | Turn-OFF Time (Note 3)                  | GND_M = 100 mV, series<br>50 Ω on GND_M pin                                                     |                             | – | 1   | – |     |
| BW               | Bandwidth (Note 3)                      | R <sub>L</sub> = 50 Ω                                                                           |                             | – | 25  | – | MHz |

**AC CHARACTERISTICS** (VBAT = 2.7 V to 5.5 V or VBUS = 4.0 V to 20 V, VBAT (Typ.) = 4.3 V or VBUS (Typ.) = 5 V, T<sub>A</sub> = -40°C to 85°C, T<sub>A</sub> (Typ.) = 25°C, unless otherwise specified.) (continued)

| Symbol                        | Parameter                     | Condition                                                                                                                                                  | Power                    | T <sub>A</sub> =−40°C to +85°C |     |     | Unit |
|-------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|-----|------|
|                               |                               |                                                                                                                                                            |                          | Min                            | Typ | Max |      |
| MIC/GND_M/INTERNAL GND SWITCH |                               |                                                                                                                                                            |                          |                                |     |     |      |
| t <sub>ON_MIC</sub>           | Turn-On Time (Note 3)         | I <sub>sw</sub> on SBU <sub>x</sub> = 1 mA and clamp to 2 V, R <sub>L</sub> on MIC and SBU <sub>x_H</sub> = 1 kΩ, GND_M = 100 mV, series 50 Ω on GND_M pin | VBAT: 4.3 V or VBUS: 5 V | –                              | 10  | –   | μs   |
| t <sub>ON_GND_M</sub>         |                               |                                                                                                                                                            |                          | –                              | 60  | –   |      |
| t <sub>ON_GND</sub>           |                               |                                                                                                                                                            |                          | –                              | 950 | –   |      |
| t <sub>OFF_MIC</sub>          | Turn-OFF Time (Note 3)        |                                                                                                                                                            |                          |                                | 1   | –   |      |
| t <sub>OFF_GND_M</sub>        |                               |                                                                                                                                                            |                          | –                              | 1   | –   |      |
| t <sub>OFF_GND</sub>          |                               |                                                                                                                                                            |                          | –                              | 1   | –   |      |
| BW                            | MIC Switch Bandwidth (Note 3) | R <sub>L</sub> = 50 Ω                                                                                                                                      |                          | –                              | 25  | –   | MHz  |

**INTERRUPT DELAY**

|                         |                              |                                             |                          |   |   |   |    |
|-------------------------|------------------------------|---------------------------------------------|--------------------------|---|---|---|----|
| T <sub>DELAY_INT</sub>  | INT Response Delay (Note 3)  | INT pull up by 10k resistor to valid power  | VBAT: 4.3 V or VBUS: 5 V | – | 5 | – | μs |
| T <sub>DELAY_INT1</sub> | INT1 Response Delay (Note 3) | INT1 pull up by 10k resistor to valid power |                          | – | 5 | – |    |

3. Guaranteed by characterization, not production tested

**CAPACITANCE** (Unless otherwise stated VBAT = 2.7 V to 5.5 V or VBUS = 4.0 V to 20 V, VBAT (Typ.) = 4.3 V or VBUS (Typ.) = 5 V, T<sub>A</sub> = -40°C to 85°C, and T<sub>A</sub> (Typ.) = 25°C.)

| Symbol                     | Parameter                                    | Condition                                                     | Power                    | T <sub>A</sub> = -40°C to +85°C |     |     | Unit |
|----------------------------|----------------------------------------------|---------------------------------------------------------------|--------------------------|---------------------------------|-----|-----|------|
|                            |                                              |                                                               |                          | Min                             | Typ | Max |      |
| C <sub>ON_USB/Audio</sub>  | On Capacitance (Common Port) (Note 4)        | f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias           | VBAT: 4.3 V or VBUS: 5 V | –                               | 7   | –   | pF   |
| C <sub>OFF_USB/Audio</sub> | Off Capacitance (Common Port) (Note 4)       | f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias           |                          | –                               | 7   | –   | pF   |
| C <sub>OFF_USB</sub>       | Off Capacitance (Non-Common Ports) (Note 4)  | f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias Figure 12 |                          | –                               | 2   | –   | pF   |
| C <sub>OFF_SBUx_H</sub>    | Off Capacitance (Non-Common Ports) (Note 4)  | f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias           |                          | –                               | 12  | –   | pF   |
| C <sub>OFF_SBUx</sub>      | Off Capacitance (Common Ports) (Note 4)      | f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias           |                          | –                               | 140 | –   | pF   |
| C <sub>ON_SBUx</sub>       | On Capacitance (Common Port) (Note 4)        | f = 1 MHz, 100 mV <sub>PK-PK</sub> , 100 mV DC bias           |                          | –                               | 150 | –   | pF   |
| C <sub>CNTRL</sub>         | Control Input Pin Capacitance (ENx) (Note 4) | f = 1 MHz, 100 mV <sub>PP</sub> , 100 mV DC bias              |                          | –                               | 6   | –   | pF   |
|                            |                                              | ENx, ENN                                                      |                          |                                 |     |     |      |

4. Guaranteed by characterization, not production tested

## APPLICATION INFORMATION

### Dead Battery

FSA44776 supports dead battery application. When power is not applied to FSA4476 and it is attached to a Source device, then the Source would pull up the CC line connected through the cable. FSA4476 in response would turn on the pull-down that will bring the CC voltage to a range that the Source can detect an attach event and turn on VBUS.

### Headset detection

FSA4476 integrates headset unplug detection function by detecting the CCx\_H voltage. The headset detection is only active during audio switch on status (EN1 = 1). When headset is attached (both CC1\_H and CC2\_H are Low), the flag signal is sent low to host controller by INT1 (INT1 = low). Once either of CCx\_H = High (CCx\_H > 1.5 V), INT1 will be released to high by external pull up resistor.

## POWER SUPPLY CONFIGURATION

| VBUS    | VBAT    | Power Supply     |
|---------|---------|------------------|
| Invalid | Invalid | Max (VBAT, VBUS) |
| Valid   | Invalid | VBUS             |
| Invalid | Valid   | VBAT             |
| Valid   | Valid   | VBAT             |

## TEST DIAGRAMS

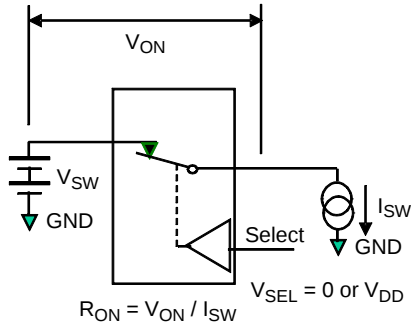


Figure 3. On Resistance

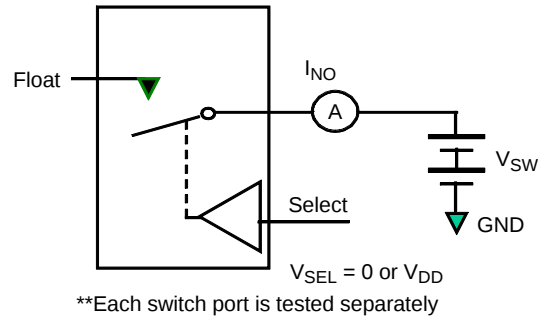
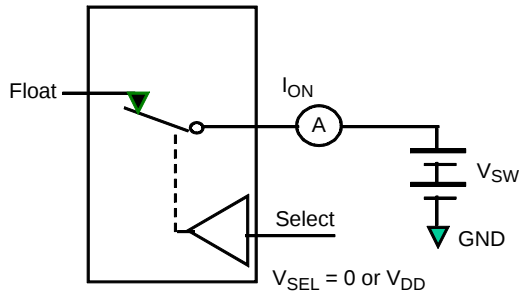
Figure 4. Off Leakage ( $I_{OZ}$ )

Figure 5. On Leakage

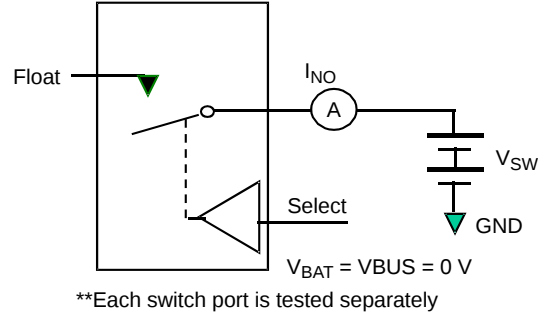
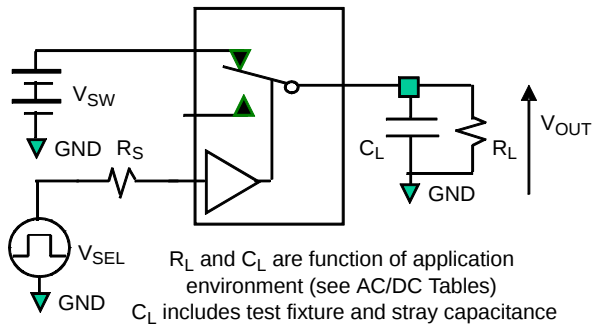
Figure 6. Power Off Leakage ( $I_{OFF}$ )

Figure 7. Test Circuit Load

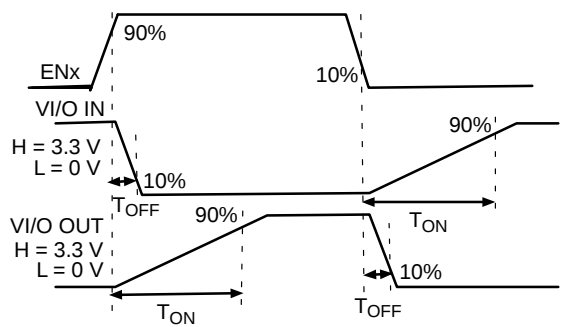


Figure 8. Turn On/Off Waveforms

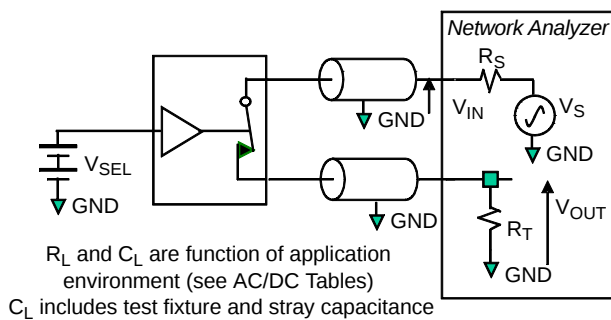


Figure 9. Bandwidth

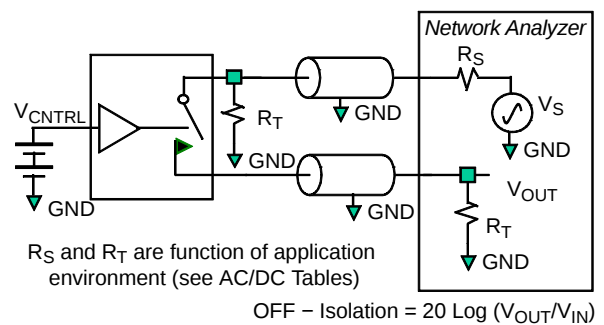


Figure 10. Channel Off Isolation

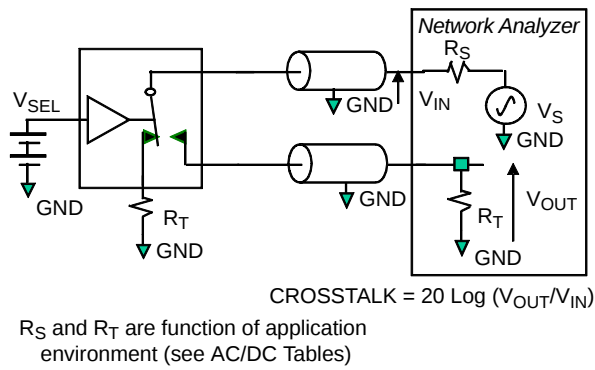


Figure 11. Adjacent Channel Crosstalk

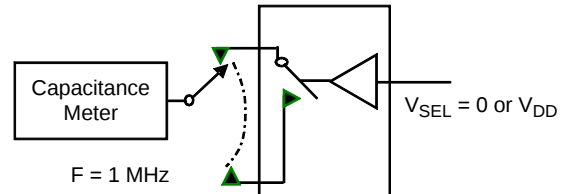


Figure 12. Channel Off Capacitance

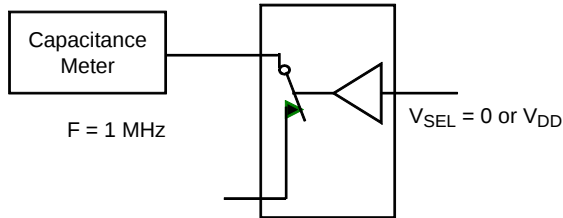


Figure 13. Channel On Capacitance

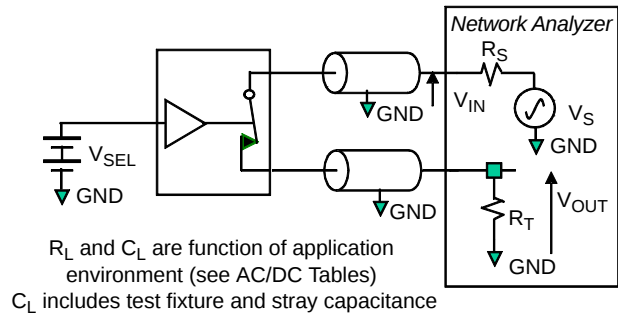


Figure 14. Total Harmonic Distortion (THD+N)

## ORDERING INFORMATION

| Part Number | Top Mark | Package Description                        | Shipping <sup>†</sup> |
|-------------|----------|--------------------------------------------|-----------------------|
| FSA4476UCX  | GR       | 25 Ball WLCSP25, 2.03x2.03x0.586 (Pb-Free) | 3000 / Tape & Reel    |

<sup>†</sup>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.



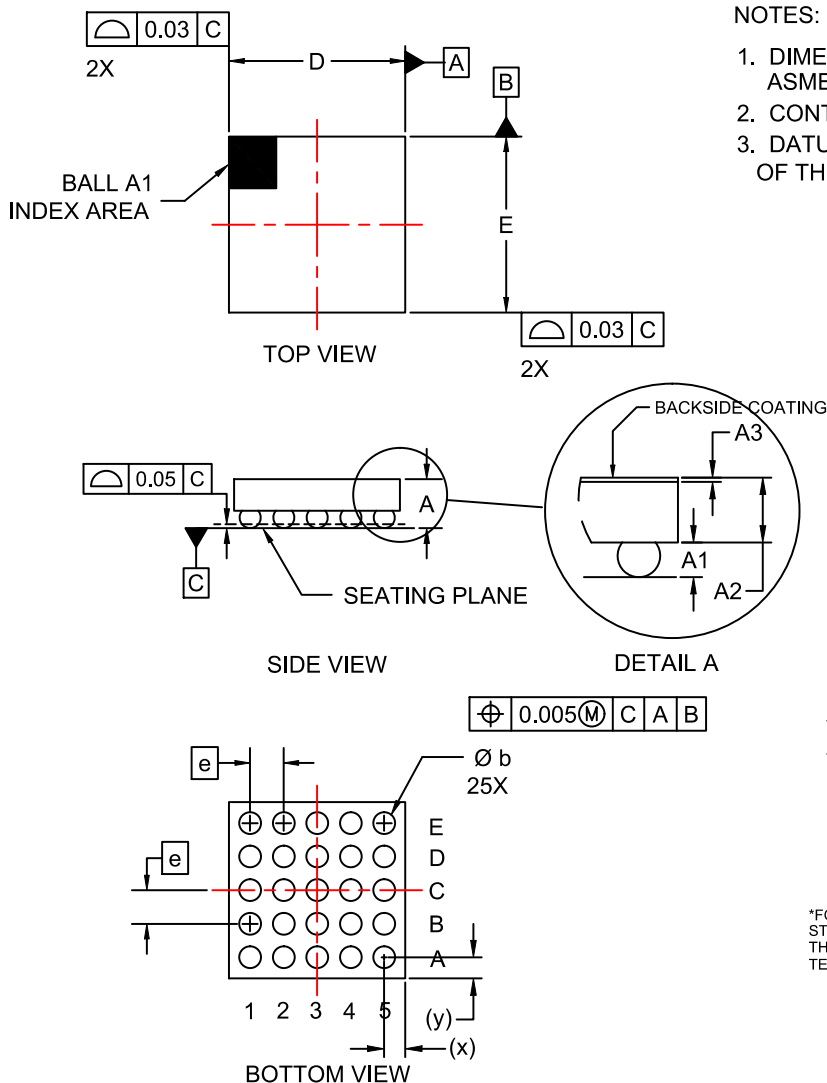
SCALE 4:1

WLCSP25, 2.03x2.03x0.586

CASE 567UP

ISSUE A

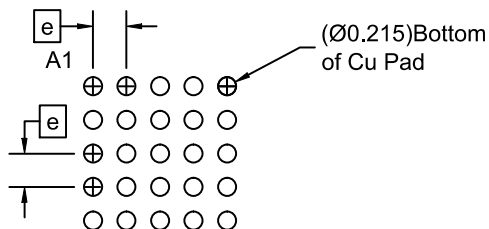
DATE 21 MAY 2019



### 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 | MIN.       | NOM.  | MAX.  |
|-----|------------|-------|-------|
| A   | 0.547      | 0.586 | 0.625 |
| A1  | 0.188      | 0.208 | 0.228 |
| A2  | 0.337      | 0.353 | 0.369 |
| A3  | 0.022      | 0.025 | 0.028 |
| b   | 0.24       | 0.26  | 0.28  |
| D   | 2.00       | 2.03  | 2.06  |
| E   | 2.00       | 2.03  | 2.06  |
| e   | 0.40 BASIC |       |       |
| x   | 0.200      | 0.215 | 0.230 |
| y   | 0.200      | 0.215 | 0.230 |



### 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, SOLDERM/D.

DOCUMENT NUMBER: 98AON64860G

Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.

DESCRIPTION: WLCSP25, 2.03x2.03x0.586

PAGE 1 OF 1

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**onsemi Website:** [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative