# BCT4221

## High-Speed & Low-Ron DPDT Analog Switch

### General Description

The BCT4221 double-pole double-throw (DPDT) analog switch multiplexes Hi-speed (480MHz) USB and audio analog signals. One Channel has wide bandwidth and low bit-to-bit skew allow it to pass high-speed differential signals with good signal integrity. Another channel has ultra Low on resistance (1.0 Ω) . Each switch is bidirectional and offers little or no attenuation of the signals at the outputs. Industry-leading advantages include a propagation delay of less than 250ps, resulting from its low channel resistance and low I/O capacitance. Their high channel-to-channel crosstalk rejection results in minimal noise interference.

### Features

♦ VCC Operating Range: 1.65V to 5.0V

♦ Low ON Resistance: 1.0-ohms at 5.0V (Audio Mode)

♦ Rail-to-Rail Signal Range

♦ ON-Resistance Matching: 0.2 Ω (Audio Mode)

♦ ON-Resistance Flatness: 0.1Ω (Audio Mode)

♦ High Off Isolation: 57dB at 10MHz

♦ 54dB (10MHz) Crosstalk Rejection

♦ Break-Before-Make Switching

♦ -3dB Bandwidth: 700MHz (USB Mode),

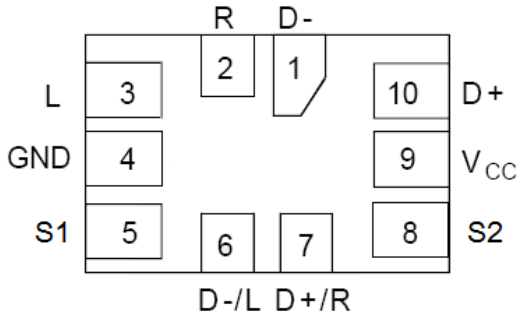
♦ Replace for FSA221

♦ Space-Saving, 10-Pin QFN 1.4mmX1.8mm

### Applications

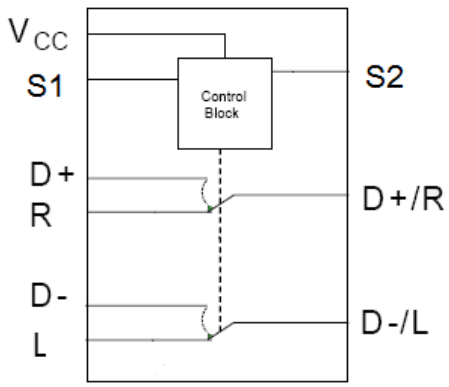
- Cell Phones
- Digital Still Cameras
- PDAs and Palmtop Devices
- MP3/MP4 Players

### Pin Configurations




**(BCT4221 Top View)**

### Logic Diagram




**Audio Mode:** D+/R = R , D-/L = L
**USB Mode:** D+/R = D+ , D-/L = D-

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## Ordering Information

| Ordering Code | Package Description | Temp Range | Top Marking |
|---|---|---|---|
| BCT4221ETB-TR | 10-pin WQFN 1.4X1.8 | –40℃ to +85℃ | AOX |

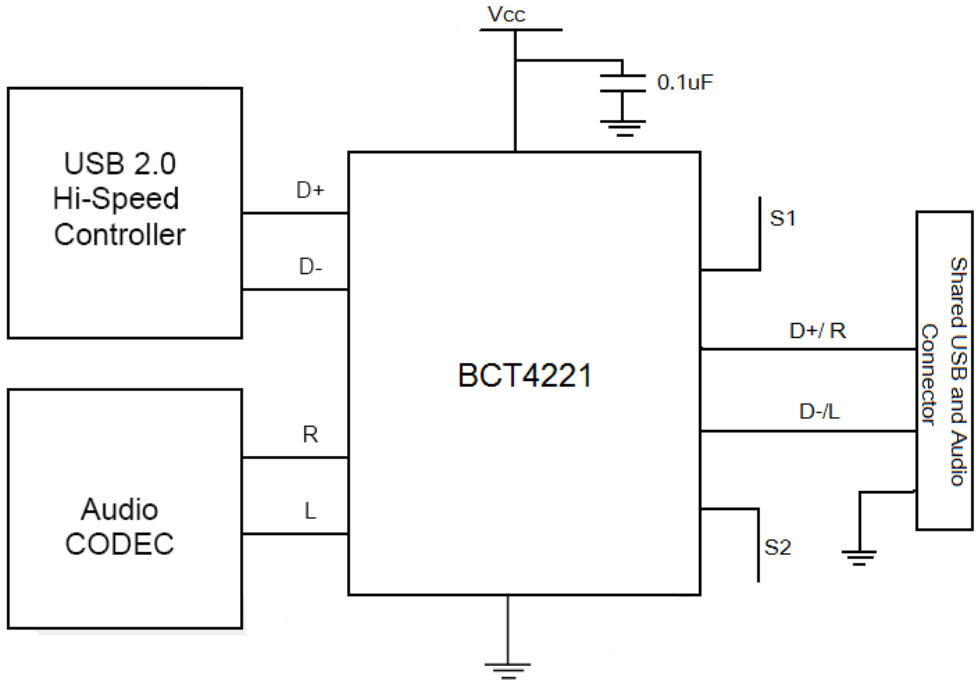
## Pin Definitions

| Pin | Name | Description |
|---|---|---|
| 9 | Vcc | Power Supply |
| 5 | S1 | Logic Control Input |
| 8 | S2 | Logic Control Input |
| 10,1 | D+, D- | USB data bus input sources. |
| 2, 3 | R, L | Audio right and left input sources. |
| 7, 6 | D+/R, D-/L | USB and audio common connector ports. |

## Truth Table

| S1 | S2 | Audio Mode | USB Mode | Remarks |
|---|---|---|---|---|
| 0 | 0 | OFF | ON | USB Communication |
| 0 | 1 | OFF | ON | USB Communication |
| 1 | 0 | OFF | ON | USB Communication |
| 1 | 1 | ON | OFF | Audio On |

## Typical Application Circuit



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## Absolute Maximum Ratings

VCC, S1 , S2 to GND..... .....-0.65V to +5.25V
All Other Pins to GND (Note 1).....-0.65V to (VCC + 0.3V)
Continuous Current (D+/-,R/L, D+/R,D-/L)..... ±400mA
Peak Current (D+/-,R/L, D+/R,D-/L)..
(pulsed at 1ms, 10% duty cycle).....±500mA

Continuous Power Dissipation (TA = +70°C)
10-Pin TQFN (derate 15.6mW/°C above +70°C) .....1.25W
Operating Temperature Range .....-40°C to +85°C
Storage Temperature Range.....-65°C to +150°C
Junction Temperature.....+150°C
Lead Temperature (soldering, 10s).....+300°C

Note 1: Signals on D+/-,R/L, D+/R,D-/L exceeding VCC or GND are clamped by internal diodes. Limit forward-diode current to maximum current rating.

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

## Electrical Characteristics

(VCC = 2.7V to 4.2V, TA = TMIN to TMAX, unless otherwise noted. Typical values are at VCC = 3.3V, TA = +25°C.) (Note 2)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| POWER SUPPLY | | | | | | | |
| Supply Voltage Range | VCC | | | 1.6 | | 5.0 | V |
| Supply Current | ICC | VCC = 3.6V, S_ = 0 or VCC, D+/-,R/L, D+/R,D-/L = floating | | | 0.02 | 1 | uA |
| ***High Speed Mode(USB2.0)*** | | | | | | | |
| Analog Signal Range | | D+,D-, D+/R,D-/L | | -0.6 | | VCC | V |
| On-Resistance | RON | $I_{D-/L}$=8mA, $V_{D+,}$ $V_{D-}$ = 0 to VCC (Note 3) | | | 8.5 | 12 | Ω |
| On-Resistance Match | ΔRON | $I_{D+/R}$= 8mA or $I_{D-/L}$=8mA, $V_{D+,}$ $V_{D-}$ = 1.2v (Note 3,4) | | | 2.2 | | Ω |
| On-Resistance Flatness | RFLAT | $I_{D+/R}$= 8mA or $I_{D-/L}$=8mA, $V_{D+,}$ $V_{D-}$ = 0.6,1.8v (Note 5) | | | 1.5 | | Ω |
| D+,D-,R,L,Off-Leakage Current | IOFF | $V_{D+/R}$,$V_{D-/L}$, $V_{D+,}$ $V_{D-}$ = 0.6,1.8v,or floating (Note 5) | | | 50 | 100 | nA |
| D+/R,D-/L On-Leakage Current | ION | $V_{D+/R}$,$V_{D-/L}$, $V_{D+,}$ $V_{D-}$ = floating (Note 5) | | | 50 | 100 | nA |
| ***Low Ron Mode(Audio):*** | | | | | | | |
| Analog Signal Range | | R,L, D+/R,D-/L | | -0.6 | | VCC | V |
| On-Resistance | RON | $I_{D-/L}$=8mA, $V_{R,}$ $V_{L,}$ = 0 to VCC | | | 1.0 | 1.5 | Ω |
| On-Resistance Match | ΔRON | $I_{D+/R}$= 8mA or $I_{D-/L}$=8mA, $V_{R,}$ $V_{L,}$ = 1.2v (Note 3,4) | | | 0.2 | | Ω |
| On-Resistance Flatness | RFLAT | $I_{D+/R}$= 8mA or $I_{D-/L}$=8mA, $V_{R,}$ $V_{L,}$ = 0.6,1.8v (Note 5) | | | 0.1 | | Ω |
| D+,D-,R,L,Off-Leakage Current | IOFF | $V_{D+/R}$,$V_{D-/L}$, $V_{R,}$ $V_{L,}$ = 0.6,1.8v,or floating (Note 5) | | | 50 | 100 | nA |
| D+/R,D-/L On-Leakage Current | ION | $V_{D+/R}$,$V_{D-/L}$, $V_{R,}$ $V_{L,}$ = floating (Note 5) | | | 50 | 100 | nA |

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## Electrical Characteristics (continued)

(VCC = 2.7V to 4.2V, TA = TMIN to TMAX, unless otherwise noted. Typical values are at VCC = 3.3V, TA = +25°C.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Turn-On Time | $T_{ON}$ | $V_{D+}$ , $V_{D-}$, , $V_R$ or $V_L$ = 1.5V, RL = 50Ω, CL = 35pF, Figure 2 | | 20 | 50 | ns |
| Turn-Off Time | $T_{OFF}$ | $V_{D+}$ , $V_{D-}$, , $V_R$ or $V_L$ = 1.5V, RL = 50Ω, CL = 35pF, Figure 2 | | 15 | 50 | ns |
| Break-Before-Make Time | $T_{BBM}$ | $V_{D+}$ , $V_{D-}$, , $V_R$ or $V_L$ = 1.5V, RL = 50Ω, CL = 35pF, Figure 1 | 2 | 15 | | ns |
| On-Channel Bandwidth -3dB | BW | RL = 50Ω, D+.D- to $D_{+/R}$, $D_{-/L}$, Figure 4 | | 700 | | MHz |
| On-Channel Bandwidth -3dB | BW | RL = 50Ω, R, L to $D_{+/R}$, $D_{-/L}$, Figure 4 | | 40 | | MHz |
| Off-Isolation | VISO | $D_{+/R}$, $D_{-/L}$ = 1VRMS, RL = 50Ω, f = 100kHz, CL = 5pF, Figure 4 (Note 7) | | -66 | | dB |
| Crosstalk | VCT | $D_{+/R}$, $D_{-/L}$, RL = 50Ω, f = 100kHz, CL = 5pF, Figure 6 | | -86 | | dB |
| Total Harmonic Distortion Plus Noise (Audio) | THD+N | f = 20Hz to 20kHz; $V_R$ or $V_L$ $D_{+/R}$, $D_{-/L}$,= $0.5V_{P-P}$; RL = 32Ω | | 0.02 | | % |
| D+,D- Off-Capacitance | $C_{D+}$(OFF), $C_{D-}$(OFF) | f = 1MHz, $V_{D+}$ = $V_{D-}$ = 1.5V, Figure 5 | | 5 | | pF |
| D+/R,D-/L On-Capacitance | $C_{D+/R}$(OFF), $C_{D-/L}$(OFF) | f = 1MHz, $V_{D+/R}$ = $V_{D-/L}$ = 1.5V, Figure 5 | | 7 | | pF |
| **DIGITAL INPUTS** | | | | | | |
| Input-Logic High | $V_{IH}$ | VCC=2.7V to 3.3V, | 1.5 | | | V |
| Input-Logic Low | $V_{IL}$ | VCC=2.7V to 3.3V, | | | 0.5 | V |
| Input-Logic High | $V_{IH}$ | VCC=3.3 to 4.2V, | 1.7 | | | V |
| Input-Logic Low | $V_{IL}$ | VCC=3.3 to 4.2V, | | | 0.8 | V |
| Input Leakage Current | $I_{IN}$ | $V_{IN\_}$ = 0 or VCC , | | | ±1 | uA |

Note 2: Devices are 100% tested at TA = +25°C. Limits across the full temperature range are guaranteed by design and correlation.
Note 3: RON and RON matching specifications are guaranteed by design,
Note 4: ΔRON = RON(MAX) - RON(MIN).
Note 5: Flatness is defined as the difference between the maximum and minimum value of on-resistance, as measured over the specified analog signal ranges.
Note 6: Guaranteed by design, not production tested.
Note 7: Between any two switches.

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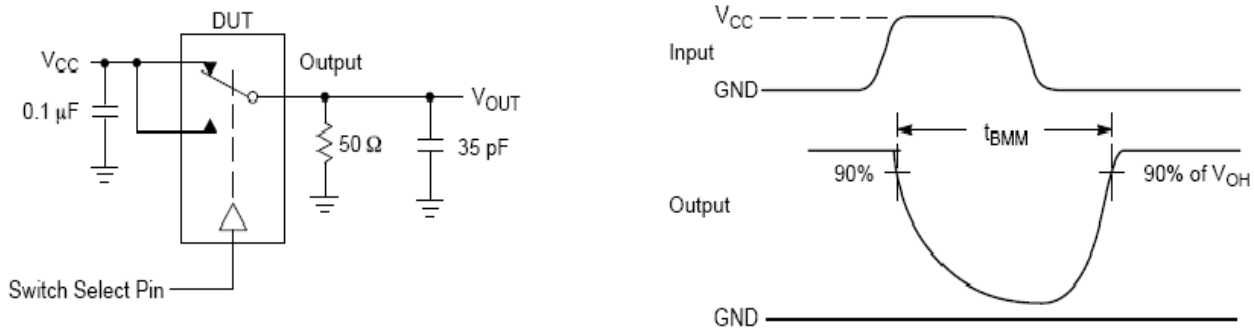


Figure 1. $t_{BBM}$ (Time Break-Before-Make)

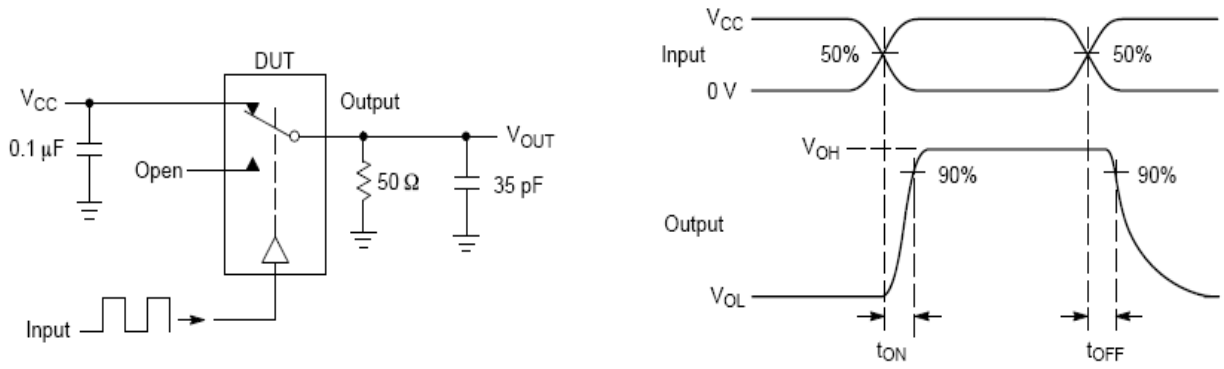


Figure 2. $t_{ON/OFF}$

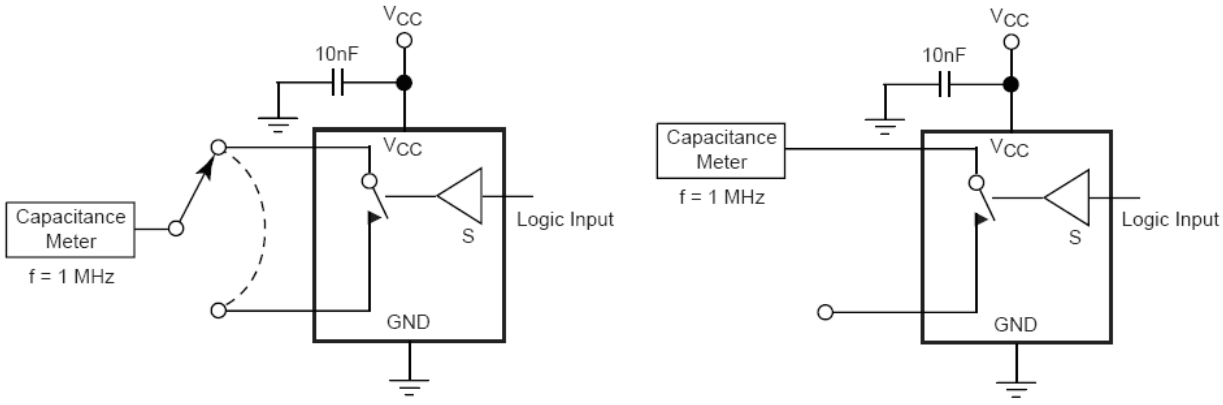


Figure 3. Channel ON/OFF Capacitance

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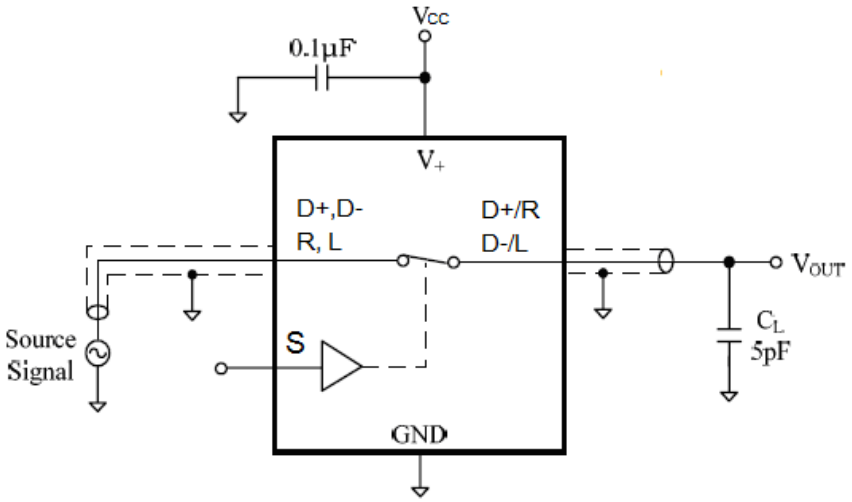


Figure 4. Bandwidth -3dB

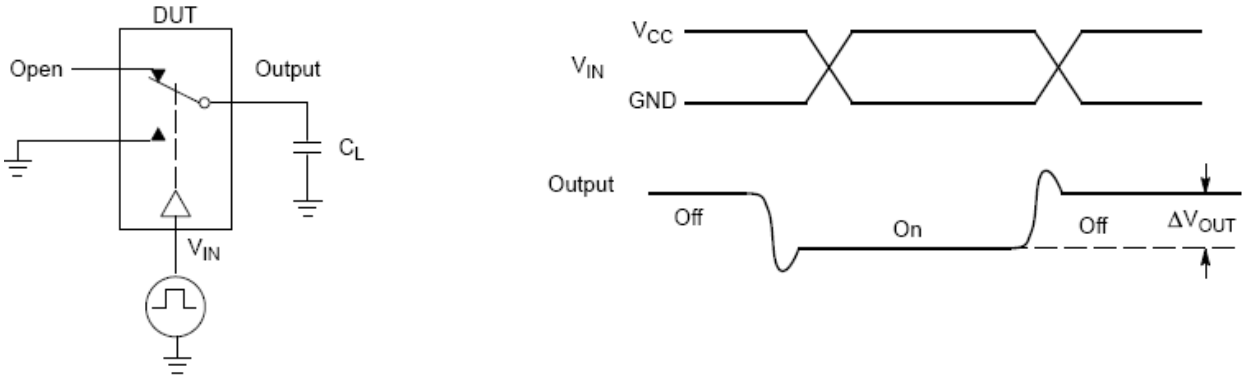


Figure 5. Charge Injecting (Q)

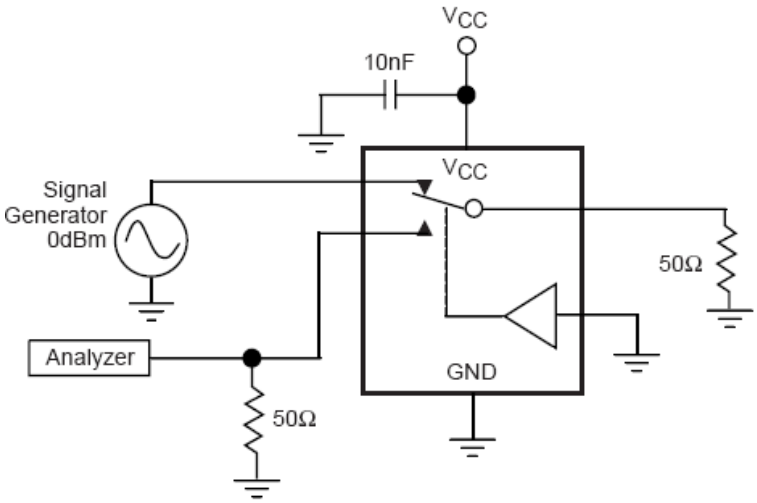


Figure 6. Crosstalk

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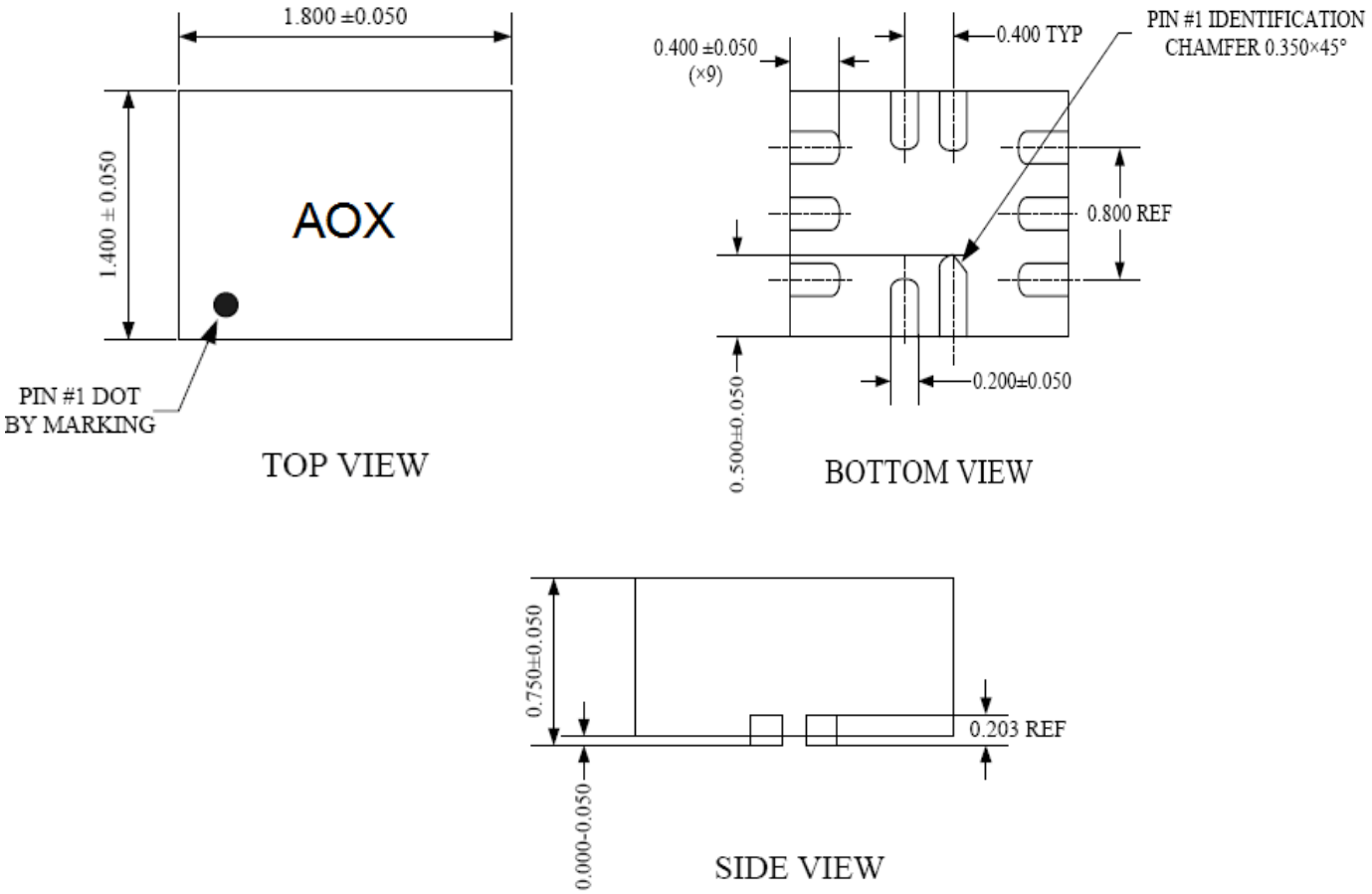
## Package Information




**Note: All linear dimensions are in millimeters.**