# BCT4321N
## USB2.0 Hi-Speed and Audio Switches with Negative Signal Capability

## GENERAL DESCRIPTION

The BCT4321N is a double-pole double-throw (DPDT) analog switch with multiplexes USB2.0 and negative signal 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 (2.5Ω). 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.

The BCT4321N is available in Green QFN1.4X1.8-10 packages. It operates over an ambient temperature range of -40°C to +85°C.

## FEATURES

- $V_{CC}$ Operating Range: 2.7V to 5.0V
- -3dB Bandwidth: 720MHz(USB Mode)
- Off Isolation: 66dB @1MHz
- Crosstalk Rejection: 86dB @1MHz
- Low ON Resistance:
    2.5-ohm at VCC = 3.6 V (Audio Mode)
    8.5-ohm at VCC = 3.6 V (USB Mode)
- Analog Signal Range:
    $V_{CC}$-6.5V to $V_{CC}$-2 (Audio Mode)
    0V to VCC (USB Mode)
- Audio Channel Shunt Resistors for Pop & Click Noise Reduction
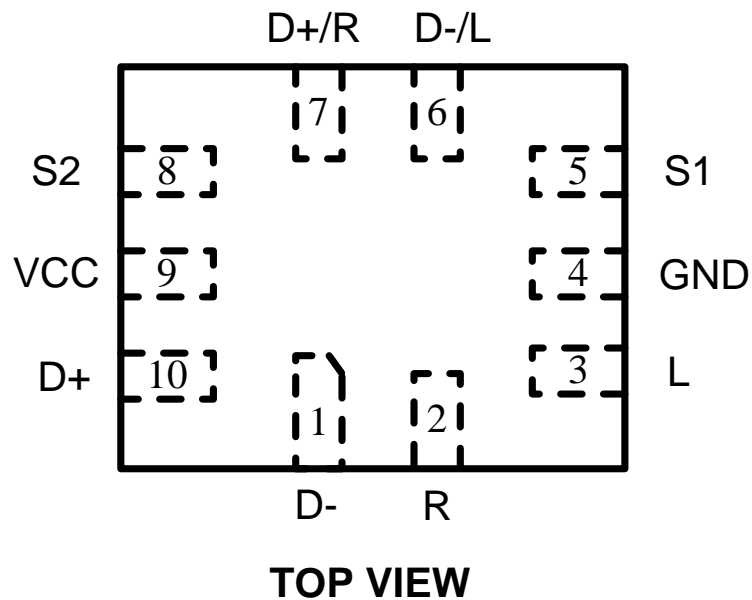- Power-off Protection on Common D+/R，D-/L Ports

## APPLICATIONS

Cell Phones
Hi-Fi Audio Switching
USB 2.0 High Speed Data Switching
USB 3.x Type C Switching

## ORDERING INFORMATION

| Order Number | Package Type | Temperature Range | Marking | QTY/Reel |
|---|---|---|---|---|
| BCT4321NETB-TR | QFN1.4X1.8-10 | -40°C to +85°C | AQX | 3000 |

## PIN CONFIGURATION



**TOP VIEW**

## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|-----|------|----------|
| 1 | D- | USB data bus DATA- |
| 2 | R | Audio right |
| 3 | L | Audio left |
| 4 | GND | Power Ground |
| 5 | S1 | Logic Control Input 1 |
| 6 | D-/L | USB and audio common connector ports. |
| 7 | D+/R | USB and audio common connector ports. |
| 8 | S2 | Logic Control Input 2 |
| 9 | VCC | Power Supply |
| 10 | D+ | USB data bus DATA+ |

## Truth Table

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

## LOGIC DIAGRAM
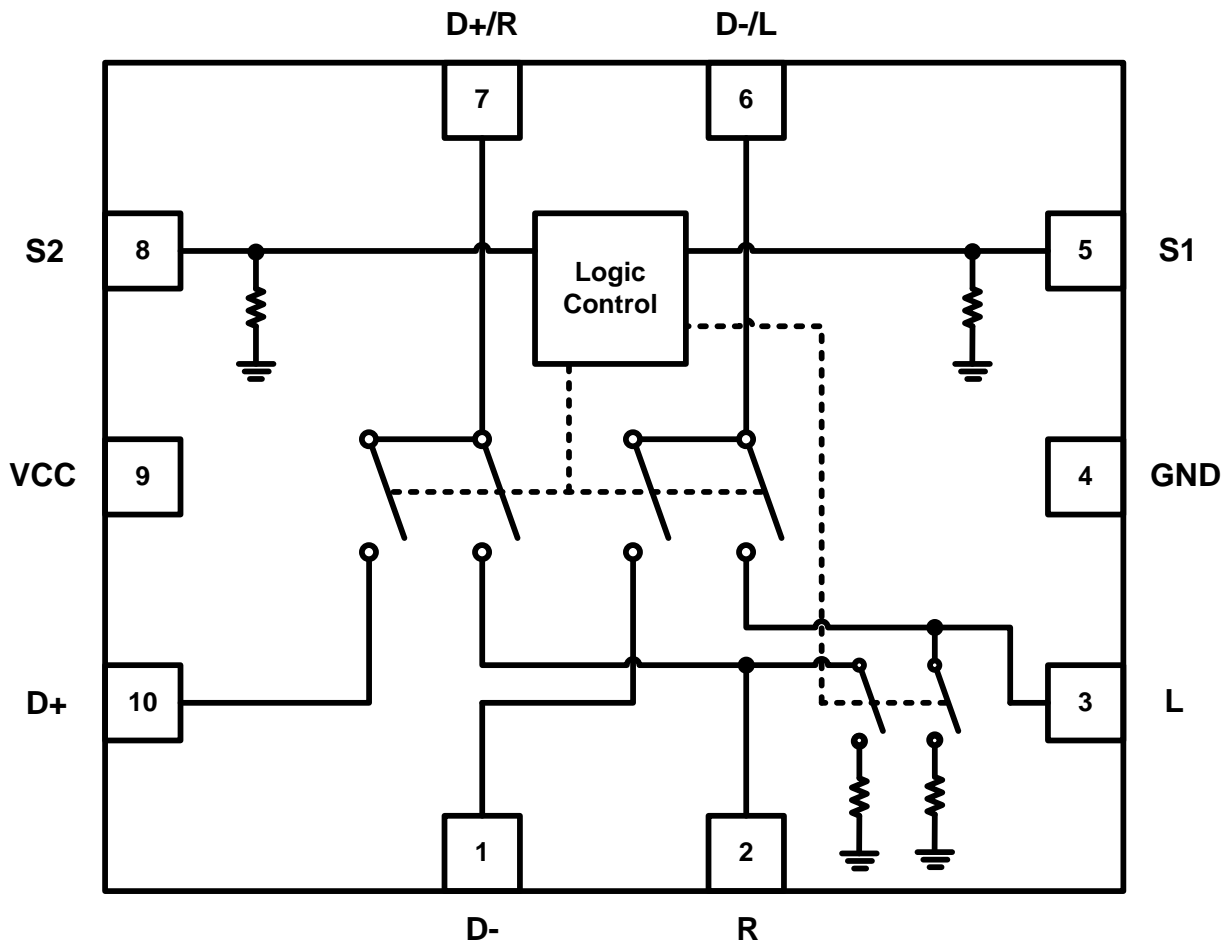
## TYPICAL APPLICATION CIRCUIT
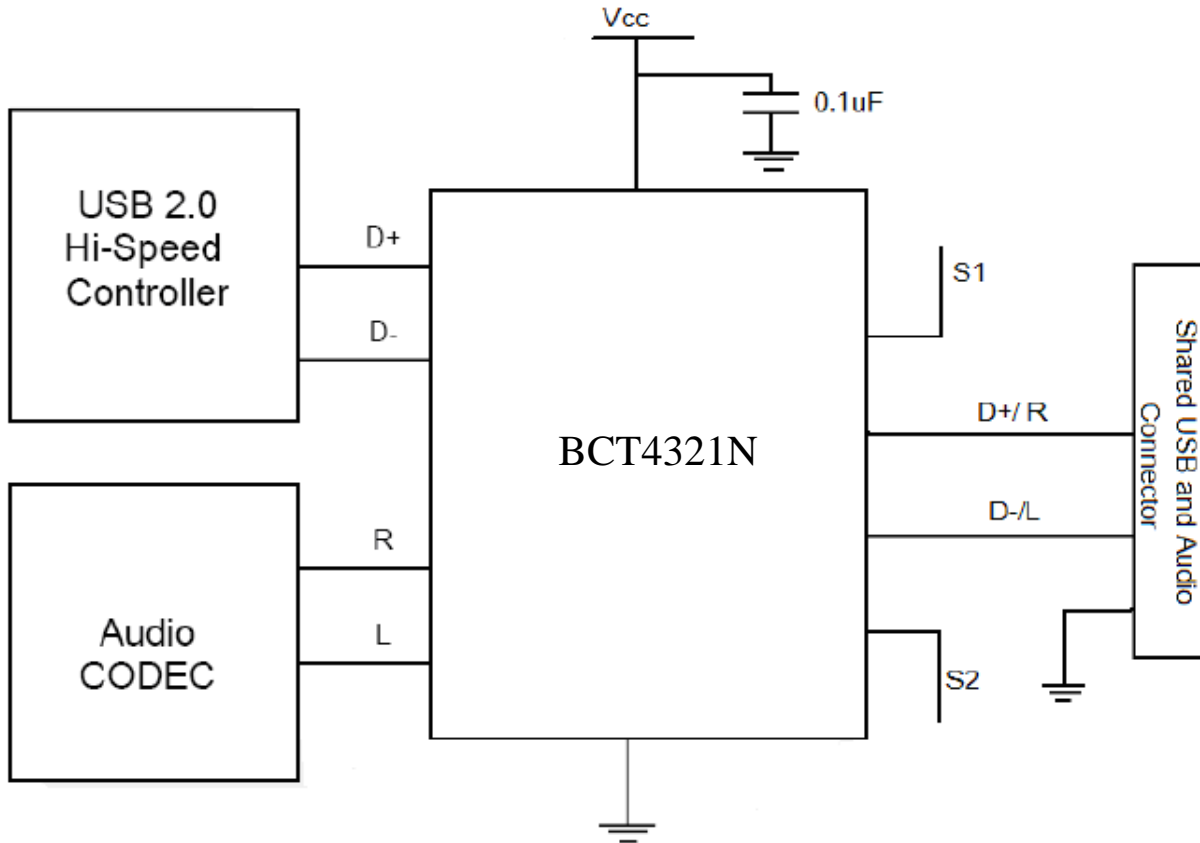
## ABSOLUTE MAXIMUM RATINGS

VCC, S1，S2 to GND.......................................................................................-0.65V to +5.25V

All Other Pins to GND.............................................................$V_{CC}$-6.5V to ($V_{CC}$ + 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

 

     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.

## CAUTION

  This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. Broadchip recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

  Broadchip reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact Broadchip sales office to get the latest datasheet.

## ELECTRICAL CHARACTERISTICS

(VCC = 2.7V to 5.0V, TA = -40°C to +85°C, unless otherwise noted. Typical values are at VCC = 3.6V, TA = +25°C.) (Note 1)

| PARAMETER | SYM | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **POWER SUPPLY** | | | | | | |
| Supply Voltage Range | $V_{CC}$ | | 2.7 | | 5.0 | V |
| Supply Current | $I_{CC}$ | $V_{CC}$=3.6V, S1,S2=0 or $V_{CC}$, D+/-,R/L,D-/L,D+/R = floating | | 0.02 | 1 | uA |
| **USB SWITCH** | | | | | | |
| Analog Signal Range | | USB mode, D+, D-, D+/R, D-/L | 0 | | $V_{CC}$ | V |
| On-Resistance | $R_{ON}$ | $I_{SW}$ = 8mA, $V_{D+}$, $V_{D-}$ = 0 to $V_{CC}$ | | 8.5 | | Ω |
| On-Resistance Match | $\triangle R_{ON}$ | $I_{SW}$ = 8mA, $V_{D+}$, $V_{D-}$ =0 to $V_{CC}$ (Note2) | | 0.5 | | Ω |
| On-Resistance Flatness | RFLAT | $I_{SW}$ = 8mA, $V_{D+}$, $V_{D-}$ = 0 to $V_{CC}$ (Note 3) | | 2.5 | | Ω |
| D+,D- Off-Leakage Current | $I_{OFF}$ | Audio mode ,$V_{D+/R}$, $V_{D-/L}$ = floating | | | 100 | nA |
| D+,D-, On-Leakage Current | $I_{ON}$ | USB mode, $V_{D+/R}$, $V_{D-/L}$ = floating | | | 100 | nA |
| **AUDIO SWITCH** | | | | | | |
| Analog Signal Range | | Audio mode ,R, L, D+/R, D-/L | $V_{CC}$ -6.5 | | $V_{CC}$ -2 | V |
| On-Resistance | $R_{ON}$ | $I_{SW}$ =60mA, $V_R$, $V_L$ = -1V to 1V | | 2.5 | | Ω |
| On-Resistance Match | $\triangle R_{ON}$ | $I_{SW}$ =60mA, $V_R$, $V_L$ = -1V to 1V (Note 2) | | 0.2 | | Ω |
| On-Resistance Flatness | RFLAT | $I_{SW}$ =60mA, $V_R$, $V_L$ = -1V to 1V (Note 3) | | 0.4 | | Ω |
| Shunt Resistance | $R_{SH}$ | USB mode, $I_L$ , $I_R$ = 5mA | | 4 | | KΩ |
| **DIGITAL INPUTS** | | | | | | |
| Input-Logic High | $V_{IH}$ | $V_{CC}$ =2.7 – 5.0V | 1.7 | | | V |
| Input-Logic Low | $V_{IL}$ | $V_{CC}$ =2.7 – 5.0V | | | 0.5 | V |
| Input Leakage Current High | $I_{IH}$ | $V_{CC}$ = $V_{IN}$ = 3.6 | | 2.5 | 10 | uA |
| Input Leakage Current Low | $I_{IL}$ | $V_{CC}$ =3.6V, $V_{IN}$ = 0V | -1 | | 1 | uA |

# ELECTRICAL CHARACTERISTICS

(VCC = 2.7V to 5.0V, TA = -40°C to +85°C, unless otherwise noted. Typical values are at VCC = 3.6V, TA = +25°C.) (Note 1)

| PARAMETER | SYM | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Turn-On Time | $T_{ON}$ | $V_R$ or $V_L$ or $V_{D+}$ or $V_{D-}$ = 1.5V, RL = 50Ω, CL = 35pF, (Figure 2) | | 20 | 50 | nS |
| Turn-Off Time | $T_{OFF}$ | $V_R$ or $V_L$ or $V_{D+}$ or $V_{D-}$ = 1.5V, RL = 50Ω, CL = 35pF, (Figure 2) | | 15 | 50 | nS |
| Break-Before-Make Time | $T_{BBM}$ | $V_R$ , $V_{D+}$ , $V_L$ , $V_{D-}$ = 1.5V  RL = 50Ω, CL = 35pF, (Figure 1) | 2 | 15 | | nS |
| On-Channel Bandwidth -3dB | BW | USB mode, RL = 50Ω, (Figure 4) | | 720 | | MHz |
| Off-Isolation | $Q_{IRR}$ | D+/R, D-/L = 0.5 $V_{PP}$, RL = 50Ω, f = 1MHz, CL = 5pF, Figure 5 (Note 4) | | -66 | | dB |
| Crosstalk | $X_{TALK}$ | D+/R, D-/L = 0.5 $V_{PP}$, RL = 50Ω, f = 1MHz, CL = 5pF, | | -86 | | dB |
| Total Harmonic Distortion Plus Noise (Audio) | THD+N | Audio mode, f = 20Hz to 20kHz; $V_R$ or $V_L$ =0.5 $V_{PP}$ , RL = 32Ω, | | 0.02 | | % |
| D+,D- Off-Capacitance | $C_{OFF}$ | Audio mode, f = 1MHz, (Figure 3) | | 5 | | pF |
| D+,D- On-Capacitance | $C_{ON}$ | USB mode, f = 1MHz, $V_{D+/R}$ or $V_{D-/L}$ =floating, (Figure 3) | | 7 | | pF |

NOTES:

Note 1: Devices are 100% tested at TA = +25°C. Limits across the full temperature range are guaranteed by design and correlation.
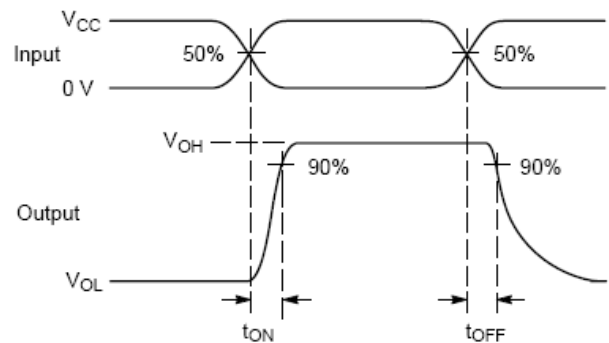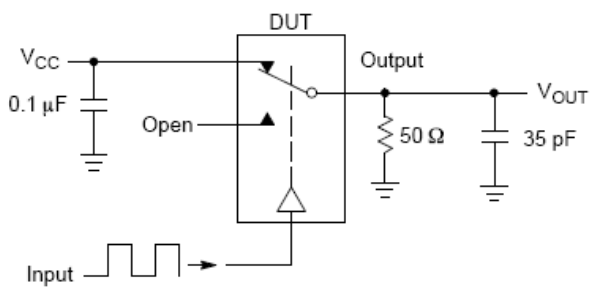
Note 2: ΔRON = RON(MAX) - RON(MIN).

Note 3: Flatness is defined as the difference between the maximum and minimum value of on-resistance, as measured over the specified analog signal ranges.
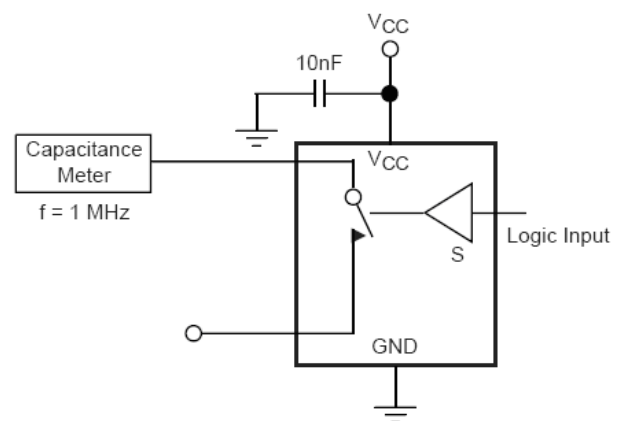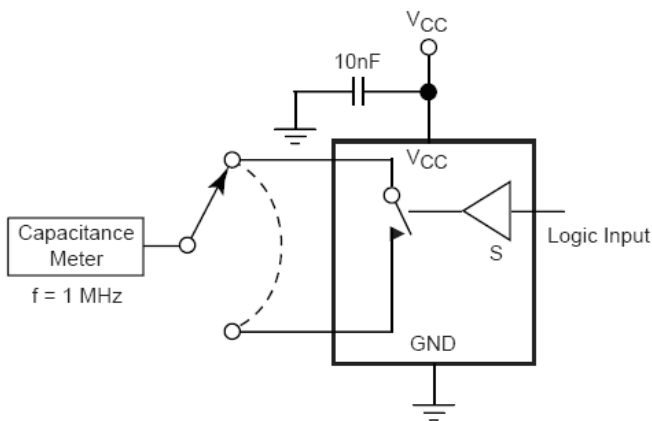
Note 4: Between any two switches.

## Test Diagram
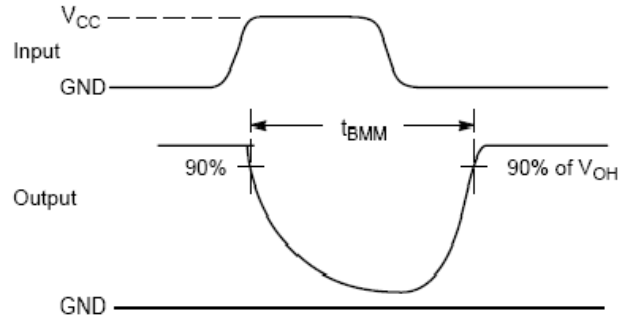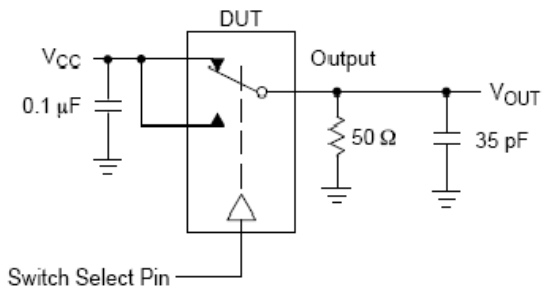


**Figure 1. tBBM (Time Break-Before-Make)**



**Figure 2. t$_{ON/OFF}$**
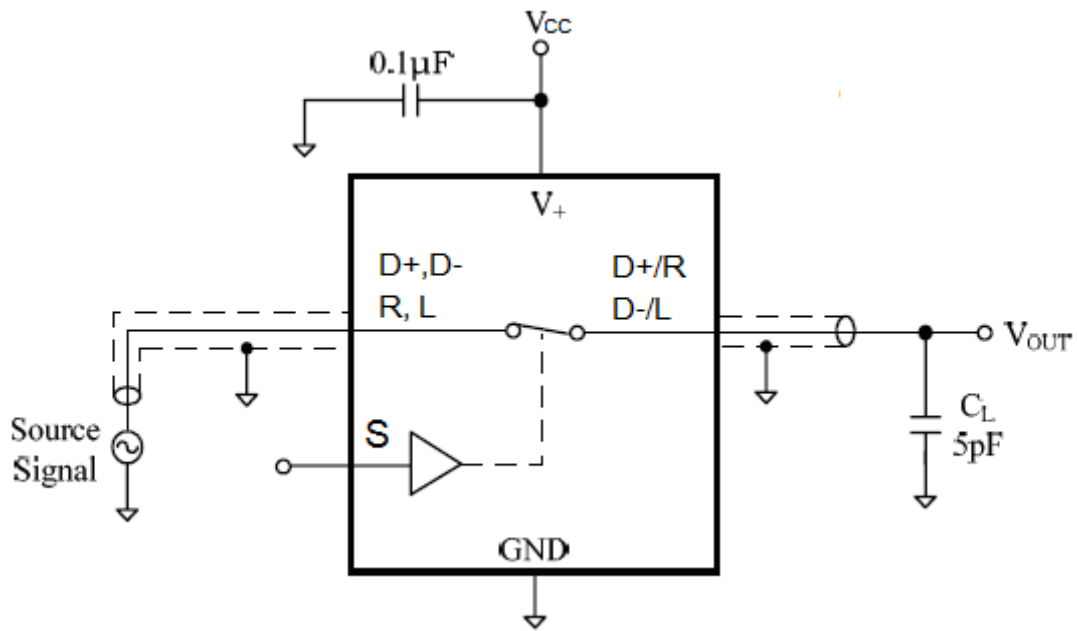


**Figure 3. Channel ON/OFF Capacitance**

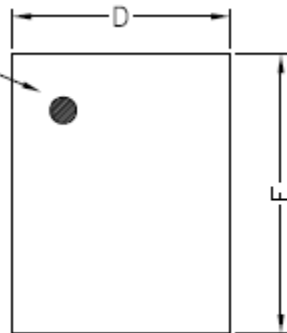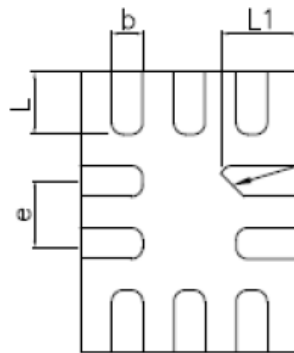**Figure 4. Bandwidth -3dB**

## PACKAGE OUTLINE DIMENSIONS

### QFN1.4x1.8-10
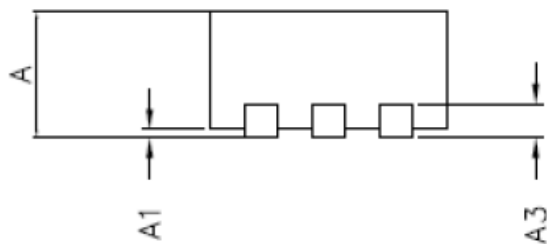


| COMMON DIMENSIONS(mm) | | | |
|---|---|---|---|
| **PKG** | **UT:ULTRA THIN** | | |
| **REF** | **MIN** | **NOM** | **MAX** |
| **A** | 0.50 | 0.55 | 0.60 |
| **A1** | 0.00 | -- | 0.05 |
| **A3** | 0.15 REF | | |
| **D** | 1.35 | 1.40 | 1.45 |
| **E** | 1.75 | 1.80 | 1.85 |
| **b** | 0.15 | 0.20 | 0.25 |
| **L** | 0.30 | 0.40 | 0.50 |
| **L1** | 0.40 | 0.50 | 0.60 |
| **e** | 0.40 BSC | | |

## PCB Layout Pattern: QFN1.4x1.8-10
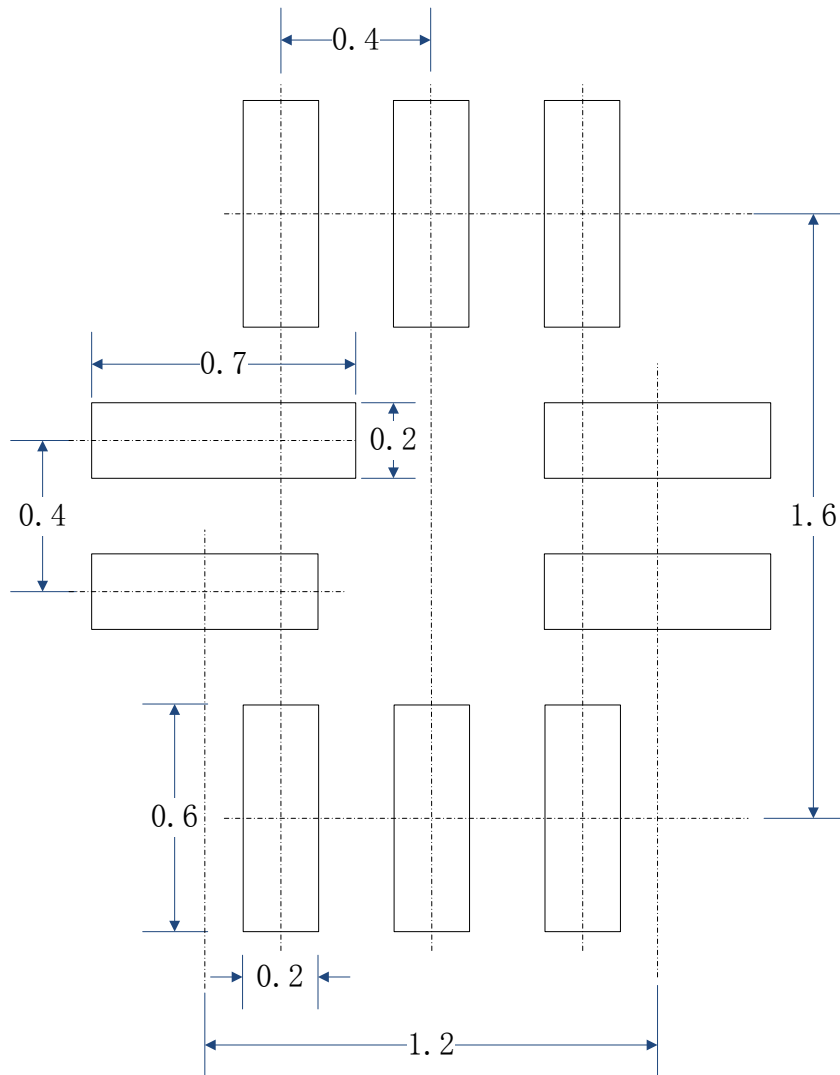


**RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)