Ver 1.5

# BCT642

## Low-Power, Three-Port , High-Speed MIPI Switch

## GENERAL DESCRIPTION

The BCT642 is a bi-directional, low-power, high-speed analog switch. The pin out is designed to ease differential signal layout and is configured as a triple-pole, double-throw switch (TPDT). The BCT642 is optimized for switching between two MIPI devices, such as cameras or LCD displays and on-board Multimedia Application Processors (MAP).

The BCT642 is compatible with the requirements of Mobile Industry Processor Interface (MIPI). The low-capacitance design allows the BCT642 to switch signals that exceed 500MHz in frequency. Superior channel-to-channel crosstalk immunity minimizes interference and allows the transmission of high-speed differential signals and single-ended signals, as described by the MIPI specification. BCT642 is a direct replacement for FSA642.

## FEATURES

- Low On Capacitance:7.0pF Typical
- Low On Resistance:7.0Ω Typical
- Wide -3db Bandwidth:1G Hz Typical
- 24-Lead QFN (2.5 x 3.4mm) Package

## APPLICATIONS

Dual Camera Applications for Cell Phones
Dual LCD Applications for Cell Phones, Digital Camera Displays, and Viewfinders

## ORDERING INFORMATION

| Order Number | Package Type | Temperature Range | Marking | QTY/Reel |
|---|---|---|---|---|
| BCT642EGG-TR | QFN-24(2.5 mmx 3.4 mm) | -40°C to +85°C | 642 | 3000 |

## TYPICAL OPERATING CIRCUIT

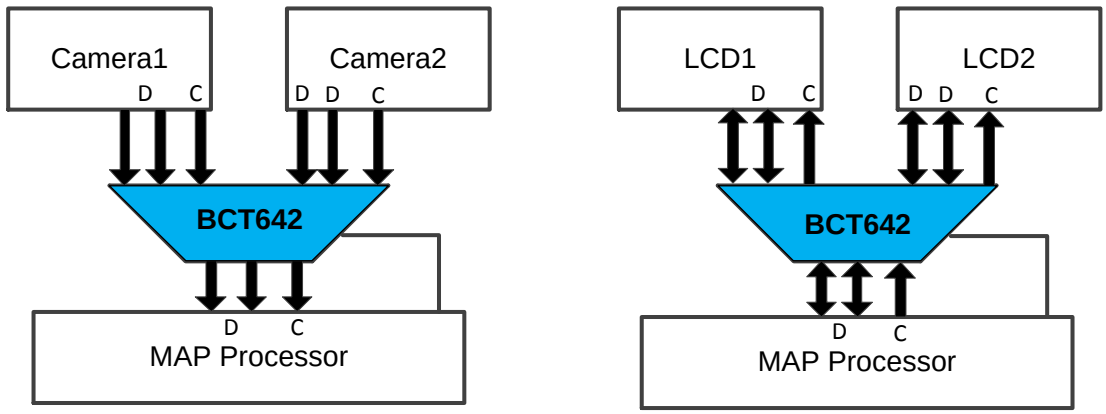



**Figure 1. Application Block Diagram**

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ($V_{CC}$)….....-0.5V to +5.25V
DC Input Voltage (SEL, /OE)[1]..... .....-0.5V to $V_{CC}$V
DC Switch I/O Voltage.....-0.5V to $V_{CC}$+0.3V
DC Input Diode Current.....-50mA
DC Output Current …….....50mA
Storage Temperature Range.....-65℃ to +150℃
Junction Temperature.....150℃
Operating Temperature Range.....-40℃ to +85℃
Lead Temperature (Soldering, 10 sec).....260℃
ESD Susceptibility
All Pins.....4KV

## 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.

## RECOMMENDED OPERATING CONDTIONS

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications.

| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 2.65 | 4.3 | V |
| $V_{CTRL}$ | Control Input Voltage(SEL,/OE)[2] | 0 | $V_{CC}$ | V |
| $V_{SW}$ | Switch I/O Voltage | -0.5 | $V_{CC}$ | V |
| $T_A$ | Operating Temperature | -40 | +85 | ℃ |

**Notes:**
1. The input and output negative ratings maybe exceed if the input and output diode current ratings are observed.
2. The control input must be held HIGH or LOW; it must not float.

## PIN CONFIGURATION

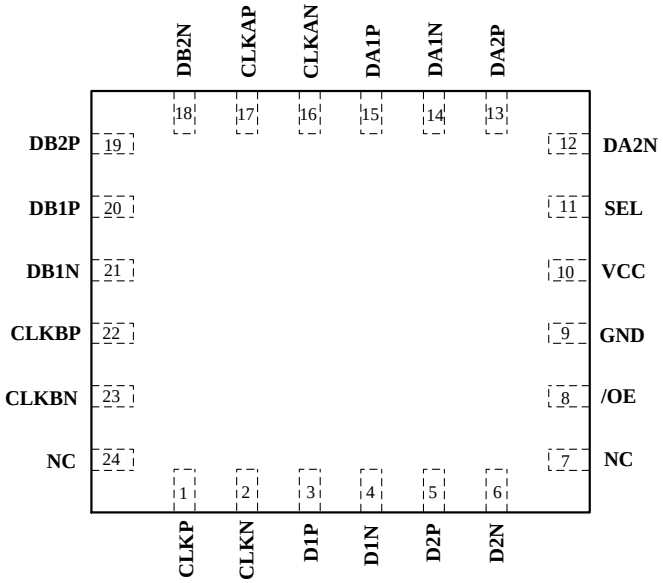



**Figure2. Pin Configuration(Top Through View)**

## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---|---|---|
| 1, 2 | CLKP, CLKN | Clock Path (Common) |
| 3, 4 | D1P, D1N | Data Path 1 (Common) |
| 5, 6 | D2P, D2N | Data Path2 (Common) |
| 7, 24 | NC | No Connect (Float) |
| 8 | /OE | Output Enable (Active Low) |
| 9 | GND | Ground |
| 10 | VCC | Power |
| 11 | SEL | Select (0=A,1=B) |
| 12, 13 | DA2N, DA2P | Data Path (A2) |
| 14, 15 | DA1N, DA1P | Data Path (A1) |
| 16, 17 | CLKAN, CLKAP | Clock Path (A) |
| 18, 19 | DB2N, DB2P | Data Path (2B) |
| 20, 21 | DB1P, DB1N | Data Path (1B) |
| 22, 23 | CLKBP, CLKBN | Clock Path (B) |

## FUNCTIONAL DIAGRAM

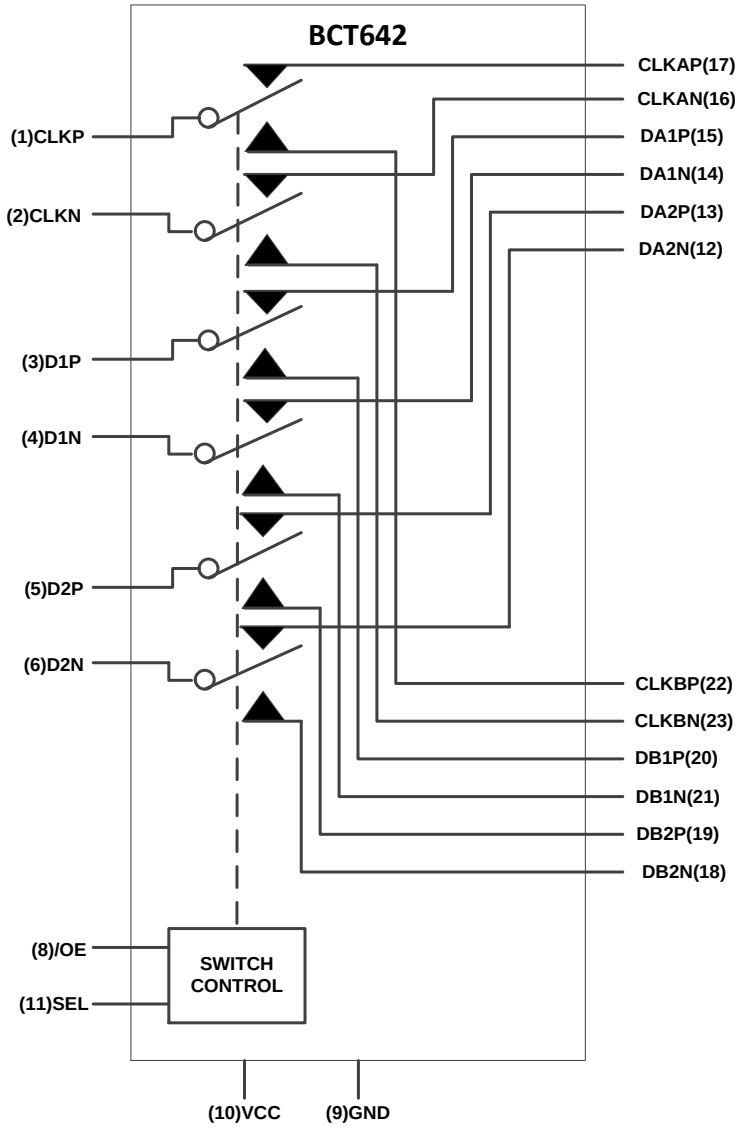



**Figure3. Functional Diagram**

## TRUTH TABLE

| SEL | /OE | Function |
|---|---|---|
| Don't care | HIGH | Disconnect |
| LOW | LOW | D1, D2, CLK=DA1, DA2, CLKA |
| HIGH | LOW | D1, D2, CLK=DB1, DB2, CLKB |

## DC ELECTRICAL CHARACTERISTICS

( All typical values are $T_A$ = 25℃, unless otherwise specified.)

| PARAMETER | SYM | CONDITIONS | $V_{CC}$ (V) | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Clamp Diode Voltage | $V_{IK}$ | $I_{IN}$=-18mA | 2.775 | | | -1.2 | V |
| Control Input Leakage | $I_{IN}$ | $V_{SW}$=0 to 4.3V | 4.3 | -1 | | 1 | uA |
| Input Voltage High | $V_{IH}$ | $V_{IN}$=0 to $V_{CC}$ | 2.65 to 2.775 | 1.3 | | | V |
| | | | 4.3 | 1.7 | | | |
| Input Voltage Low | $V_{IL}$ | $V_{IN}$=0 to $V_{CC}$ | 2.65 to 2.775 | | | 0.5 | V |
| Off-State Leakage | $I_{OZ}$ | A,B=+0.3V to $V_{CC}$-0.3 | 4.3 | -2 | | 2 | uA |
| Quiescent Supply Current | $I_{CC}$ | $V_{CNTRL}$=0 or $V_{CC}$, $I_{OUT}$=0 | 4.3 | | | 1 | uA |
| Increase in $I_{CC}$ Current Per Control Voltage and $V_{CC}$ | $I_{CCT}$ | $V_{CNTRL}$=1.8V | 2.775 | | | 1.5 | uA |

## DC ELECTRICAL CHARACTERISTICS, LOW-SPEED MODE

( All typical values are $T_A$ = 25℃, unless otherwise specified.)

| PARAMETER | SYM | CONDITIONS | $V_{CC}$ (V) | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| LS Switch On Resistance(3) | $R_{ON}$ | $V_{SW}$=1.2V,$I_{ON}$=-10mA | 2.65 | | 10 | 14 | Ω |
| LS Delta $R_{ON}$(4) | $\Delta R_{ON}$ | $V_{SW}$=1.2V, $I_{ON}$=-10mA (Intra-pair) | 2.65 | | 0.65 | | Ω |

**Notes:**

3. Measured by the voltage drop between A/B and CLK/Dn pins at the indicated current through the switch.
4. Guaranteed by characterization

## DC ELECTRICAL CHARACTERISTICS, HIGH-SPEED MODE

( All typical values are $T_A$ = 25℃, unless otherwise specified.)

| PARAMETER | SYM | CONDITIONS | $V_{CC}$ (V) | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| HS Switch On Resistance(5) | $R_{ON}$ | $V_{SW}$=0.4V,$I_{ON}$=-10mA | 2.65 | | 7 | 9.5 | Ω |
| HS Delta $R_{ON}$(6) | $\Delta R_{ON}$ | $V_{SW}$=0.4V, $I_{ON}$=-10mA (Intra-pair) | 2.65 | | 0.65 | | Ω |

**Notes:**

5. Measured by the voltage drop between A, B, and Dn pins at the indicated current through the switch.
6. Guaranteed by characterization

## AC ELECTRICAL CHARACTERISTICS

( All values are at $R_L$=50Ω and $R_S$=50Ω and all typical values are $V_{CC}$=2.775V at $T_A$=25℃ unless otherwise specified.)

| PARAMETER | SYM | CONDITIONS | $V_{CC}$ (V) | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Off Isolation(7) | $Q_{IRR}$ | f=100MHz, $R_T$=50Ω | 2.775 | | -35 | | dB |
| Non-Adjacent Channel Crosstalk(7) | Xtalk | f=100MHz, $R_T$=50Ω | 2.775 | | -55 | | dB |
| -3db Bandwidth(7) | BW | CL=0pF, $R_T$=50Ω | 2.775 | | 1.0 | | GHz |
| Turn-On Time SEL, /OE to Output | $t_{ON}$ | $C_L$=5pF, $V_{SW}$=1.2V | 2.65 to 2.775 | | 20 | 37 | ns |
| Turn-Off Time SEL, /OE to Output | $t_{OFF}$ | $C_L$=5pF, $V_{SW}$=1.2V | 2.65 to 2.775 | | 15 | 27 | ns |
| Propagation Delay(7) | $t_{PD}$ | $C_L$=5pF | 2.775 | | 0.25 | | ns |
| Break-Before-Make Time | $t_{BBM}$ | $C_L$=5pF $V_{SW1}$=$V_{SW2}$=1.2V | 2.65 to 2.775 | 3 | 5 | 8 | ns |

**Note:**
7. Guaranteed by characterization.

## AC ELECTRICAL CHARACTERISTICS

(All typical values are $V_{CC}$=2.775V at $T_A$=25℃ unless otherwise specified.)

| PARAMETER | SYM | CONDITIONS | $V_{CC}$ (V) | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Channel-to-Channel Skew Across Multiple Parts(8,9) | $t_{SK(Part\_Part)}$ | $V_{SW}$=0.2V $diff_{PP}$, $C_L$=5pF | 2.775 | | 40 | 80 | ps |
| Channel-to-Channel Skew Within a Single Part(8) | $t_{SK(Chl-Chl)}$ | $V_{SW}$=0.2V $diff_{PP}$, $C_L$=5pF | 2.775 | | 15 | 30 | ps |
| Skew of Opposite Transitions in the Same Differential Channel(8) | $t_{SK(Pulse)}$ | $V_{SW}$=0.2V $diff_{PP}$, $C_L$=5pF | 2.775 | | 10 | 20 | ps |

**Notes:**
8. Guaranteed by characterization.
9. Assumes the same $V_{CC}$ and temperature for all device.

## CAPACITANCE

| PARAMETER | SYM | CONDITIONS | $V_{CC}$ (V) | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Control Pin Input Capacitance(10) | $C_{IN}$ | $V_{CC}$=0V | 0 | | 1.5 | | pF |
| Dn/CLK-On Capacitance(10) | $C_{ON}$ | /OE=0V, f=1MHz | 2.775 | | 7 | | |
| Dn/CLK Off Capacitance(10) | $C_{OFF}$ | /OE=2.775V, f=1MHz | 2.775 | | 2.5 | | |

**Note:**
10. Guaranteed by characterization.

## TEST DIAGRAMS

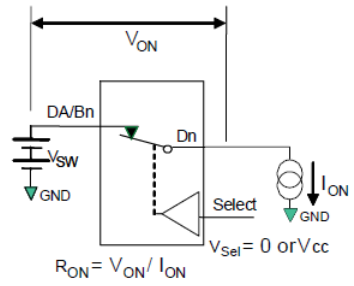



**Figure 4. On Resistance**

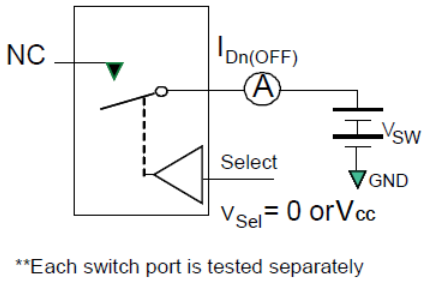



**Figure 5. Off Leakage**

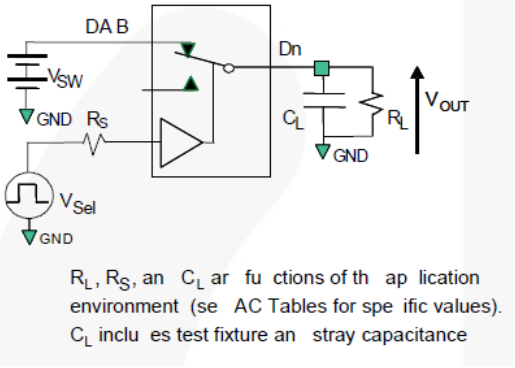



**Figure 6. AC Test Circuit Board**

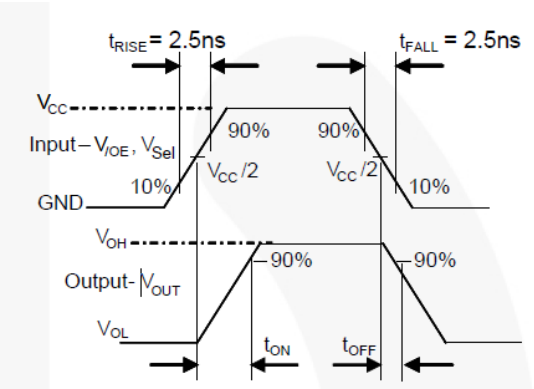



**Figure 7. Turn-On/Turn-Off waveform**

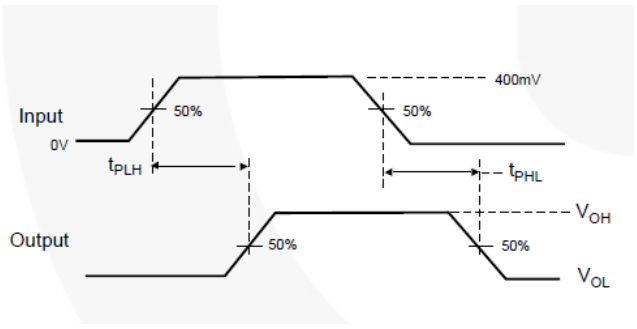



**Figure 8. Propagation Delay($t_R t_F$-500ps)**

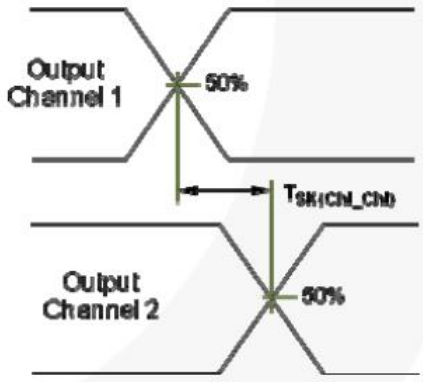



**Figure 9. Channel to Channel Skew**

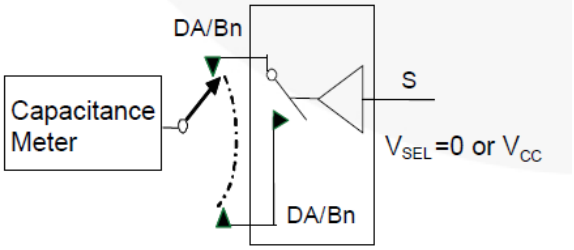



**Figure 10. Channel Off Capacitance**

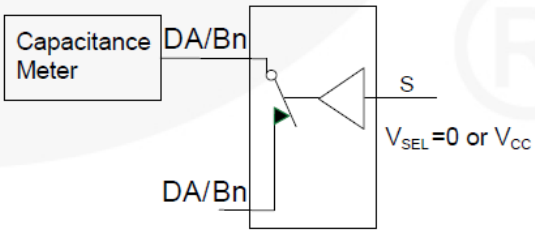



**Figure 11. Channel On Capacitance**

## TEST DIAGRAMS(CONTINUED)

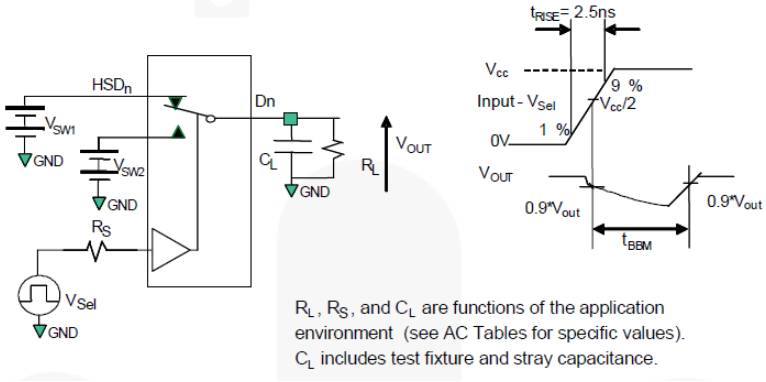



**Figure 12. Break-Before-Make Interval Timing**

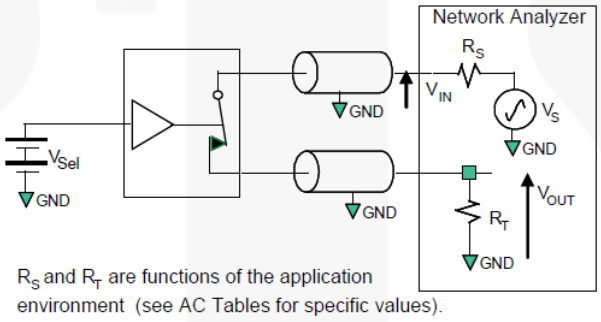



**Figure 13. Bandwidth**

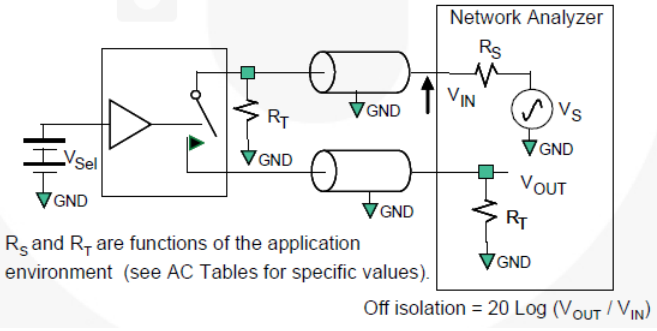



**Figure 14. Channel Off Isolation**

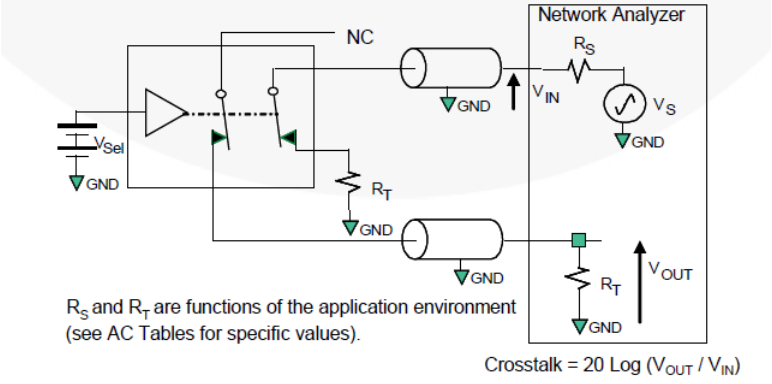
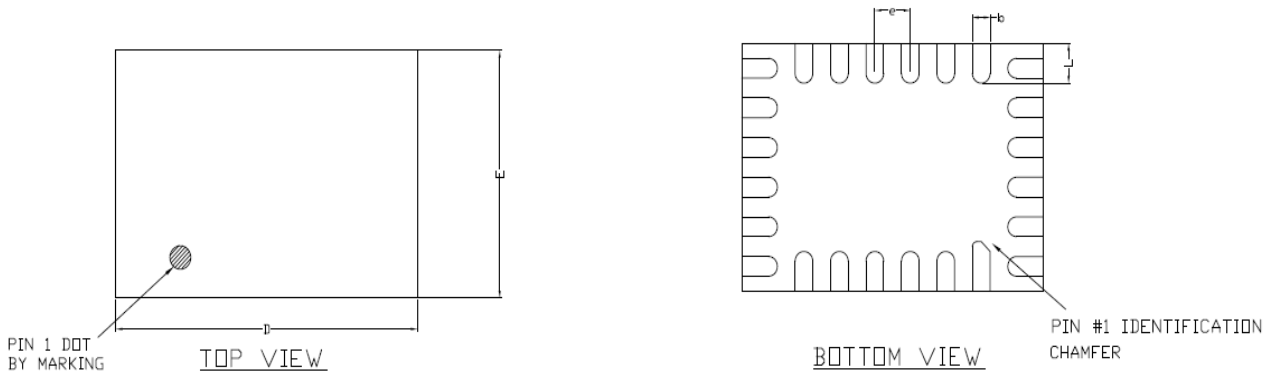



**Figure 15. Non-Adjacent Channel-to-Channel Crosstalk**

# PACKAGE OUTLINE DIMENSIONS




| COMMON DIMENSIONS(MM) | | | |
|---|---|---|---|
| PKG. | W\VERY VERY THIN | | |
| REF. | MIN. | NOM. | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | – | 0.05 |
| A3 | | 0.2 REF. | |
| D | 3.35 | 3.40 | 3.45 |
| E | 2.45 | 2.50 | 2.55 |
| b | 0.15 | 0.20 | 0.25 |
| L | 0.30 | 0.40 | 0.50 |
| e | 0.40 BSC | | |

**Remark:**

**Lead Finish:NiPdAu**

**Figure 16. 24-Lead QFN(2.5mm x 3.4mm) Package**