

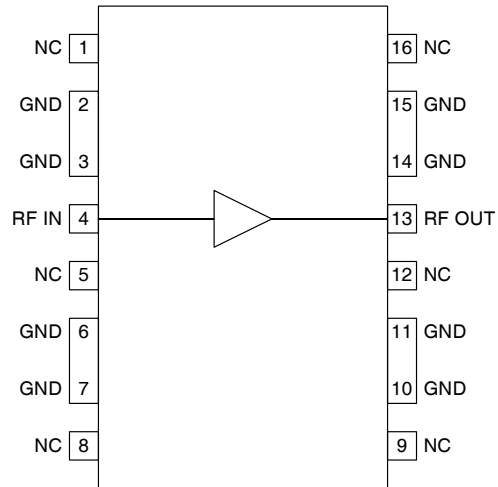
RoHS Compliant & Pb-Free Product  
Package Style: CJ2BAT0

**Features**

- DC to 3.0GHz Operation
- Internally Matched Input and Output
- 15 dB Small Signal Gain
- 4.9dB Noise Figure
- +47 dBm Output IP<sub>3</sub>
- Single 9V to 12V Power Supply

**Applications**

- CATV Distribution Amplifiers
- Cable Modems
- Broadband Gain Blocks
- Laser Diode Driver
- Return Channel Amplifier
- Base Stations



Functional Block Diagram

**Product Description**

The RF2317 is a general purpose, low-cost high-linearity RF amplifier IC. The device is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as an easily cascadable 75Ω gain block. The gain flatness of better than ±0.5dB from 50MHz to 1000MHz, and the high linearity, make this part ideal for cable TV applications. Other applications include IF and RF amplification in wireless voice and data communication products operating in frequency bands up to 3GHz. The device is self-contained with 75Ω input and output impedances and requires only two external DC biasing elements to operate as specified.

**Ordering Information**

|             |  |
|-------------|--|
| RF2317      | Linear CATV Amplifier                  |
| RF2317 PCBA | Fully Assembled Evaluation Board - 50Ω |
| RF2317 PCBA | Fully Assembled Evaluation Board - 75Ω |

**Optimum Technology Matching® Applied**

- |  |                                      |                                     |                                   |
|--|--------------------------------------|-------------------------------------|-----------------------------------|
| <input checked="" type="checkbox"/> GaAs HBT | <input type="checkbox"/> SiGe BiCMOS | <input type="checkbox"/> GaAs pHEMT | <input type="checkbox"/> GaN HEMT |
| <input type="checkbox"/> GaAs MESFET         | <input type="checkbox"/> Si BiCMOS   | <input type="checkbox"/> Si CMOS    |                                   |
| <input type="checkbox"/> InGaP HBT           | <input type="checkbox"/> SiGe HBT    | <input type="checkbox"/> Si BJT     |                                   |

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## Absolute Maximum Ratings

| Parameter                     | Rating      | Unit |
|-------------------------------|-------------|------|
| Device Current                | 250         | mA   |
| Input RF Power                | +18         | dBm  |
| Output Load VSWR              | 20:1        |      |
| Ambient Operating Temperature | -40 to +85  | °C   |
| Storage Temperature           | -40 to +150 | °C   |



**Caution!** ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

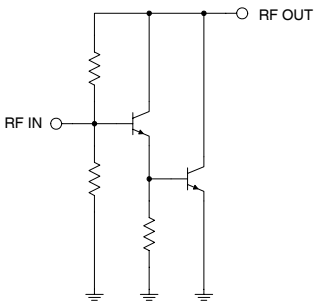
RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

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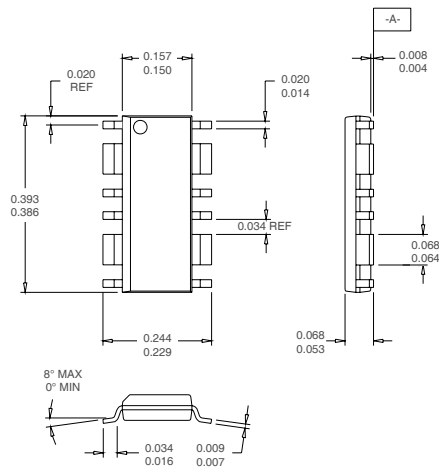
| Parameter                    | Specification |       |      | Unit  | Condition   |
|------------------------------|---------------|-------|------|-------|---|
|                              | Min.          | Typ.  | Max. |       |   |
| <b>Overall (50Ω)</b>         |               |       |      |       | T = +25 °C, I <sub>CC</sub> = 180 mA, R <sub>C</sub> = 10.2Ω, 50Ω System  |
| Frequency Range              | DC            |       | 3000 | MHz   | 3dB Bandwidth   |
| Gain                         | 13.5          | 14.3  | 15.0 | dB    |   |
| Noise Figure                 |               | 4.9   |      | dB    | From 100 MHz to 1000 MHz  |
| Input VSWR                   |               | 1.7:1 |      |       | Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range. |
| Output VSWR                  |               | 2.3:1 |      |       | Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range. |
| Output IP <sub>3</sub>       |               | +47   |      | dBm   | At 100 MHz  |
|                              | +37           | +42   |      | dBm   | At 500 MHz  |
|                              |               | +37   |      | dBm   | At 900 MHz  |
| Output IP <sub>2</sub>       |               | +55   |      | dBm   | F <sub>1</sub> = 400 MHz, F <sub>2</sub> = 500 MHz, F <sub>OUT</sub> = 100 MHz  |
| Output P <sub>1dB</sub>      |               | +25.5 |      | dBm   | At 100 MHz  |
|                              |               | +24   |      | dBm   | At 500 MHz  |
|                              |               | +22   |      | dBm   | At 900 MHz  |
| Reverse Isolation            |               | 19.5  |      | dB    |   |
| <b>Thermal</b>               |               |       |      |       |   |
| Theta <sub>JC</sub>          |               | 55    |      | °C/W  | I <sub>CC</sub> = 150 mA, P <sub>DISS</sub> = 1.2 W, T <sub>AMB</sub> = 85 °C   |
| Maximum Junction Temperature |               | 150   |      | °C    |   |
| Mean Time To Failures        |               | 3100  |      | years | T <sub>AMB</sub> = +85 °C   |
| Theta <sub>JC</sub>          |               | 58    |      | °C/W  | I <sub>CC</sub> = 180 mA, P <sub>DISS</sub> = 1.5 W, T <sub>AMB</sub> = 85 °C   |
| Maximum Junction Temperature |               | 175   |      | °C    |   |
| Mean Time To Failures        |               | 380   |      | years | T <sub>AMB</sub> = +85 °C   |
| <b>Power Supply (50Ω)</b>    |               |       |      |       |   |
| Device Voltage               |               | 8.5   |      | V     | On pin 13, I <sub>CC</sub> = 150 mA   |
|                              |               | 9.3   |      | V     | On pin 13, I <sub>CC</sub> = 180 mA   |
| Operating Current Range      | 100           | 180   | 200  | mA    | Actual current determined by V <sub>CC</sub> and R <sub>C</sub>   |

| Parameter               | Specification |       |      | Unit | Condition   |
|-------------------------|---------------|-------|------|------|---|
|                         | Min.          | Typ.  | Max. |      |   |
| <b>Overall (75Ω)</b>    |               |       |      |      | T = 25 °C, I <sub>CC</sub> = 180 mA, R <sub>C</sub> = 14.3Ω, 75Ω System   |
| Frequency Range         | DC            |       | 3000 | MHz  | 3 dB Bandwidth  |
| Gain                    |               | 15.0  |      | dB   |   |
| Noise Figure            |               | 4.8   |      | dB   | From 100 MHz to 1000 MHz  |
| Input VSWR              |               | 1.3:1 |      |      | Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range. |
| Output VSWR             |               | 1.8:1 |      |      | Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range. |
| Output IP <sub>3</sub>  |               | +49   |      | dBm  | At 100 MHz  |
|                         | +37           | +43   |      | dBm  | At 500 MHz  |
|                         |               | +38   |      | dBm  | At 900 MHz  |
| Output IP <sub>2</sub>  |               | +58   |      | dBm  | F <sub>1</sub> = 400 MHz, F <sub>2</sub> = 500 MHz, F <sub>OUT</sub> = 100 MHz  |
| Output P <sub>1dB</sub> |               | +22   |      | dBm  | At 100 MHz  |
|                         |               | +22   |      | dBm  | At 500 MHz  |
|                         |               | +21   |      | dBm  | At 900 MHz  |
| Reverse Isolation       |               | 19    |      | dB   |   |
| <b>133 Channels</b>     |               |       |      |      | 10 dBmV per channel, flat, at the input of the amplifier; I <sub>CC</sub> = 150 mA, V <sub>CC</sub> = 10.4 V                                      |
| XMOD                    |               | < -75 |      | dBc  | At 55.25 MHz  |
|                         |               | < -75 |      | dBc  | At 331.25 MHz   |
|                         |               | < -75 |      | dBc  | At 547.25 MHz   |
|                         |               | < -75 |      | dBc  | At 853.25 MHz   |
| CTB                     |               | -85   |      | dBc  | At 55.25 MHz  |
|                         |               | -85   |      | dBc  | At 331.25 MHz   |
|                         |               | -84   |      | dBc  | At 547.25 MHz   |
|                         |               | -83   |      | dBc  | At 853.25 MHz   |
| CSO + 1.25 MHz          |               | -90   |      | dBc  | At 55.25 MHz  |
|                         |               | -72   |      | dBc  | At 331.25 MHz   |
|                         |               | -69   |      | dBc  | At 853.25 MHz   |
|                         |               | -64   |      | dBc  | At 547.25 MHz   |
| CSO - 1.25 MHz          |               | -63   |      | dBc  | At 55.25 MHz  |
|                         |               | -65   |      | dBc  | At 331.25 MHz   |
|                         |               | -70   |      | dBc  | At 547.25 MHz   |
|                         |               | -90   |      | dBc  | At 853.25 MHz   |

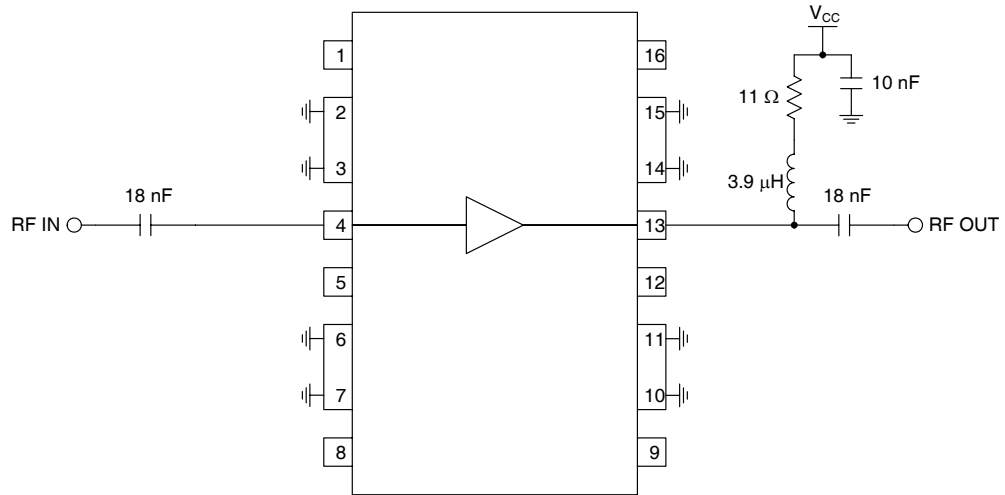
| Parameter                 | Specification |       |      | Unit | Condition   |
|---------------------------|---------------|-------|------|------|---|
|                           | Min.          | Typ.  | Max. |      |   |
| <b>133 Channels</b>       |               |       |      |      | 10 dBmV per channel, flat, at the input of the amplifier; $I_{CC} = 180\text{mA}$ , $V_{CC} = 11.4\text{V}$ |
| XMOD                      |               | < -75 |      | dBc  | At 55.25 MHz  |
|                           |               | < -75 |      | dBc  | At 331.25 MHz   |
|                           |               | < -75 |      | dBc  | At 547.25 MHz   |
|                           |               | < -75 |      | dBc  | At 853.25 MHz   |
| CTB                       |               | -89   |      | dBc  | At 55.25 MHz  |
|                           |               | -86   |      | dBc  | At 331.25 MHz   |
|                           |               | -86   |      | dBc  | At 547.25 MHz   |
|                           |               | -84   |      | dBc  | At 853.25 MHz   |
| CSO + 1.25 MHz            |               | -89   |      | dBc  | At 55.25 MHz  |
|                           |               | -74   |      | dBc  | At 331.25 MHz   |
|                           |               | -69   |      | dBc  | At 853.25 MHz   |
|                           |               | -62   |      | dBc  | At 547.25 MHz   |
| CSO - 1.25 MHz            |               | -63   |      | dBc  | At 55.25 MHz  |
|                           |               | -65   |      | dBc  | At 331.25 MHz   |
|                           |               | -71   |      | dBc  | At 547.25 MHz   |
|                           |               | -91   |      | dBc  | At 853.25 MHz   |
| <b>Power Supply (75Ω)</b> |               |       |      |      |   |
| Device Voltage            |               | 8.3   |      | V    | On pin 13, $I_{CC} = 150\text{mA}$  |
|                           |               | 8.9   |      | V    | On pin 13, $I_{CC} = 180\text{mA}$  |
| Operating Current Range   | 100           | 180   | 200  | mA   | Actual current determined by $V_{CC}$ and $R_C$   |

| Pin | Function | Description   | Interface Schematic  |
|-----|----------|---|--|
| 1   | NC       | This pin is internally not connected.   |  |
| 2   | GND      | Ground connection. Keep traces physically short and connect immediately to ground plane for best performance. Each ground pin should have a via to the ground plane.  |  |
| 3   | GND      | Same as pin 2.  |  |
| 4   | RF IN    | RF input pin. This pin is NOT internally DC blocked. A DC blocking capacitor, suitable for the frequency of operation, should be used in most applications. DC coupling of the input is not allowed, because this will override the internal feedback loop and cause temperature instability.   |  |
| 5   | NC       | This pin is internally not connected.   |  |
| 6   | GND      | Same as pin 2.  |  |
| 7   | GND      | Same as pin 2.  |  |
| 8   | NC       | This pin is internally not connected.   |  |
| 9   | NC       | This pin is internally not connected.   |  |
| 10  | GND      | Same as pin 2.  |  |
| 11  | GND      | Same as pin 2.  |  |
| 12  | NC       | This pin is internally not connected.   |  |
| 13  | RF OUT   | RF output and bias pin. Because DC is present on this pin, a DC blocking capacitor, suitable for the frequency of operation, should be used in most applications. For biasing, an RF choke in series with a resistor is needed. The DC voltage on this pin is typically 8.3V with a current of 150 mA (for 75Ω board). See device voltage versus device current plot. In lower power applications the value of $R_C$ can be increased to lower the current and $V_D$ on this pin. |  |
| 14  | GND      | Same as pin 2.  |  |
| 15  | GND      | Same as pin 2.  |  |
| 16  | NC       | This pin is internally not connected.   |  |

**Package Drawing**

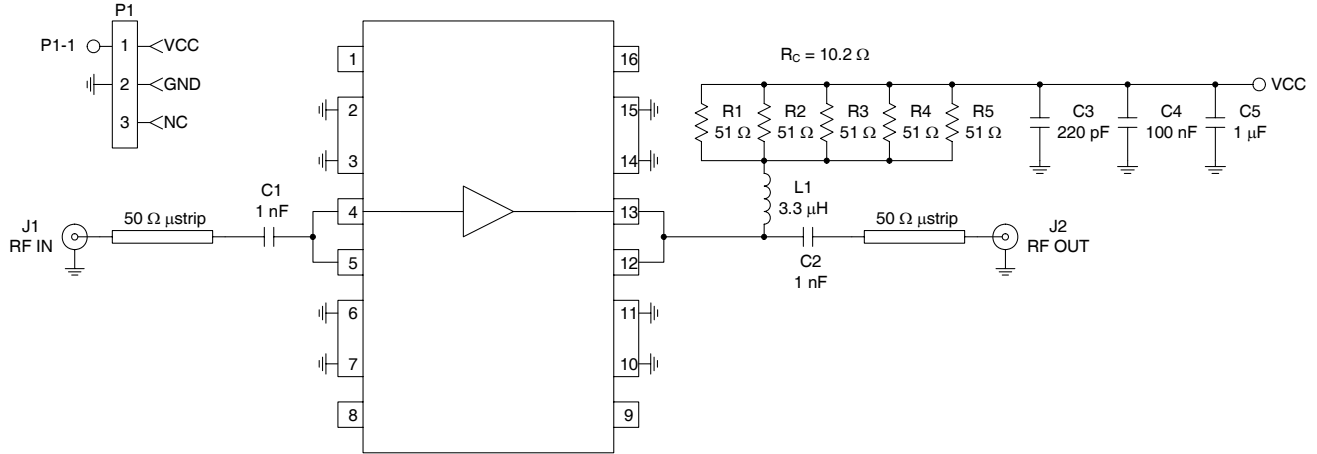


## Application Schematic 5MHz to 50MHz Reverse Path



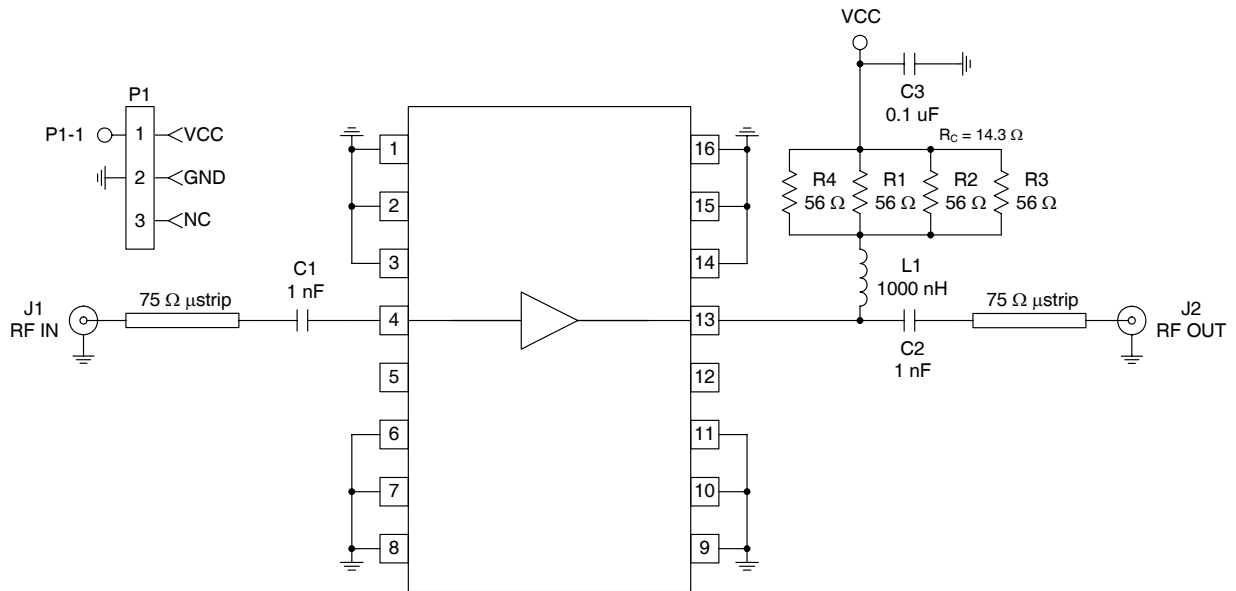
NOTES:  
Gain Flatness <0.5 dB  
Input and Output Return Loss >20 dB in 75 Ω system

## Evaluation Board Schematic - 50Ω (Download [Bill of Materials](http://www.rfmd.com) from [www.rfmd.com](http://www.rfmd.com).)



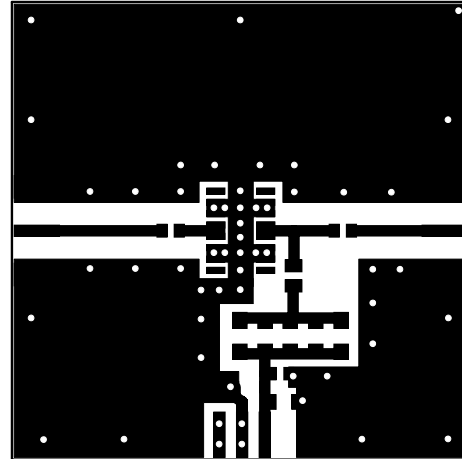
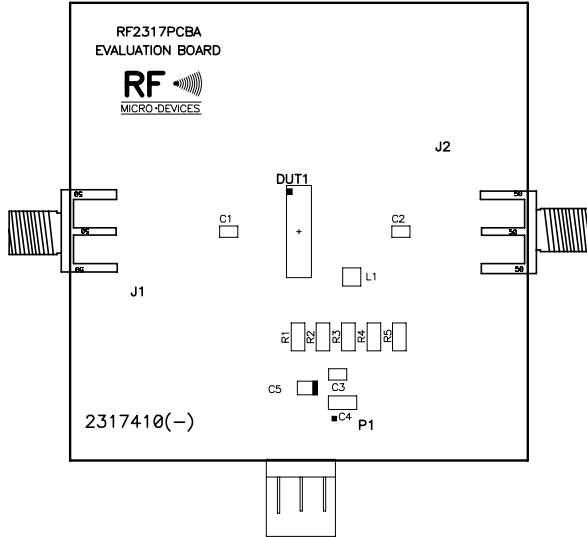
2317400 Rev -

Evaluation Board Schematic - 75Ω

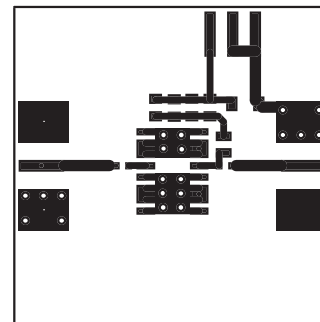
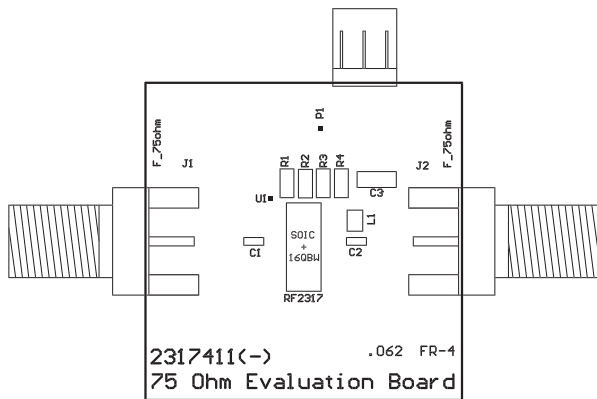


2317401 Rev -

**Evaluation Board Layout - 50Ω**  
**2.0" x 2.0"**  
**Board Thickness 0.031", Board Material FR-4**

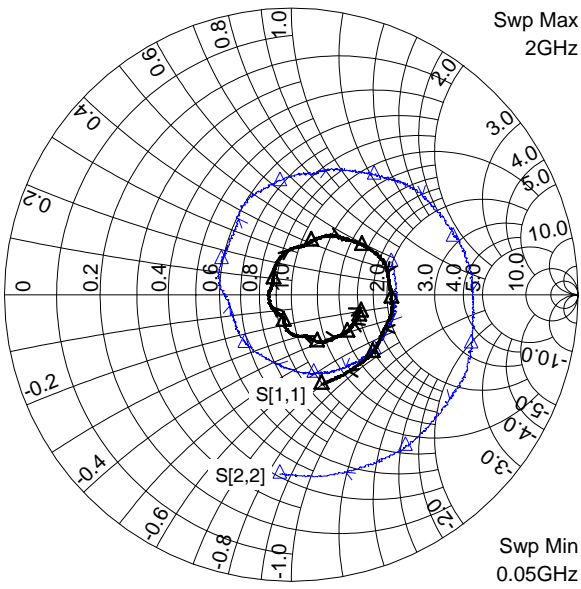


**Evaluation Board Layout - 75Ω**  
**1.40" x 1.40"**  
**Board Thickness 0.062", Board Material FR-4**

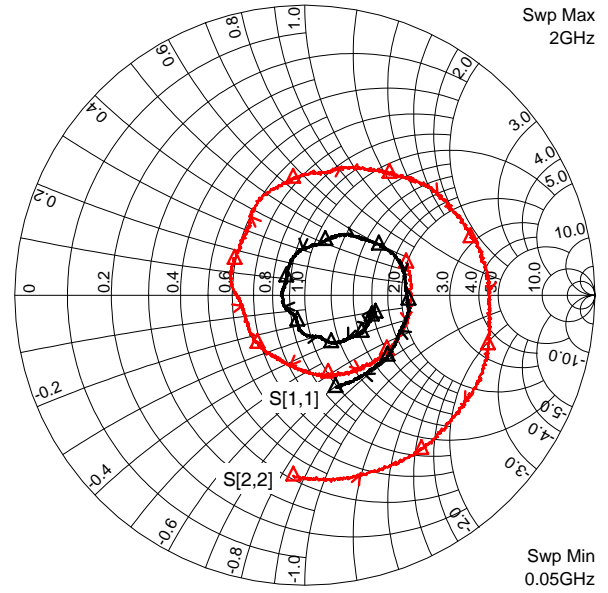


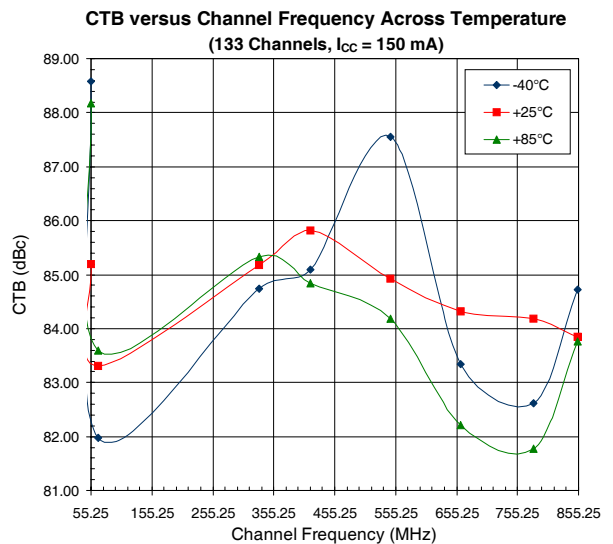
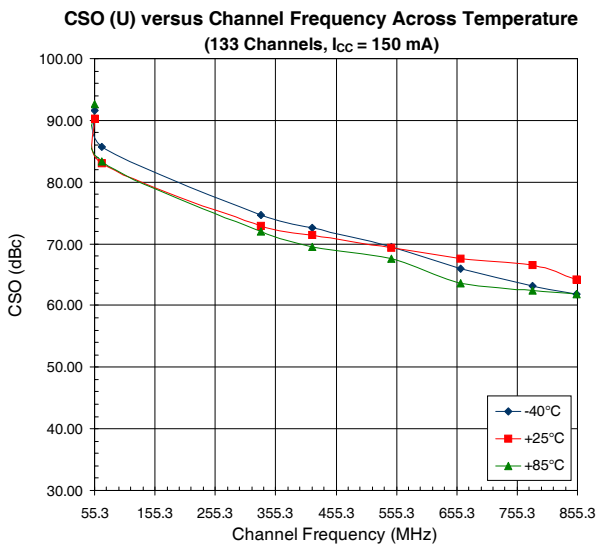
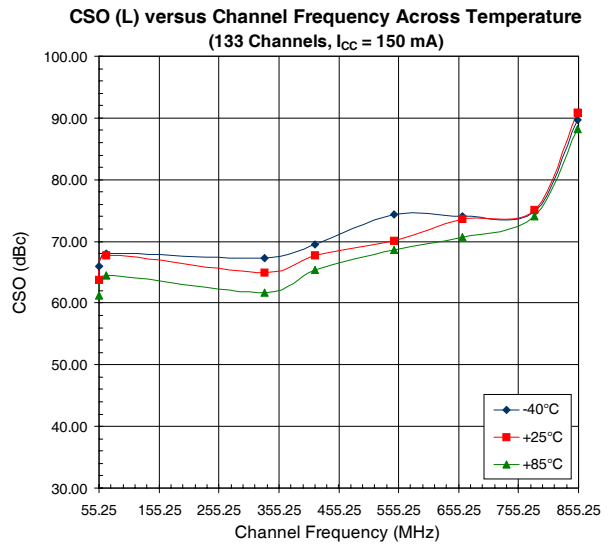
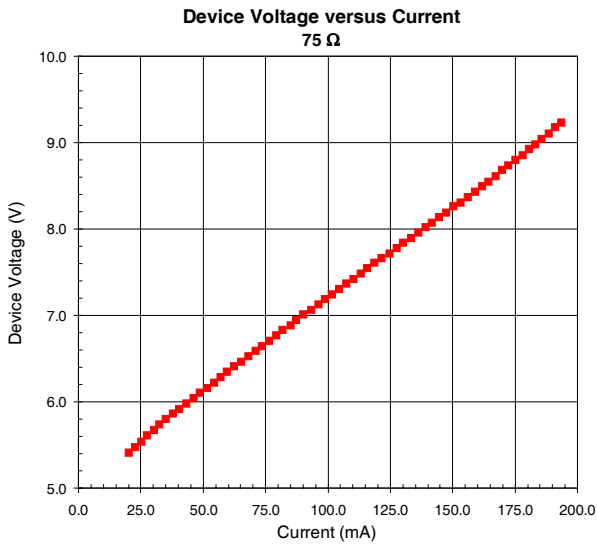
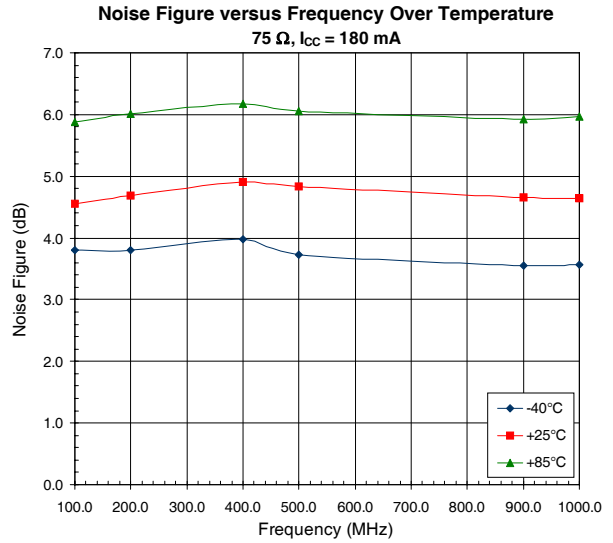
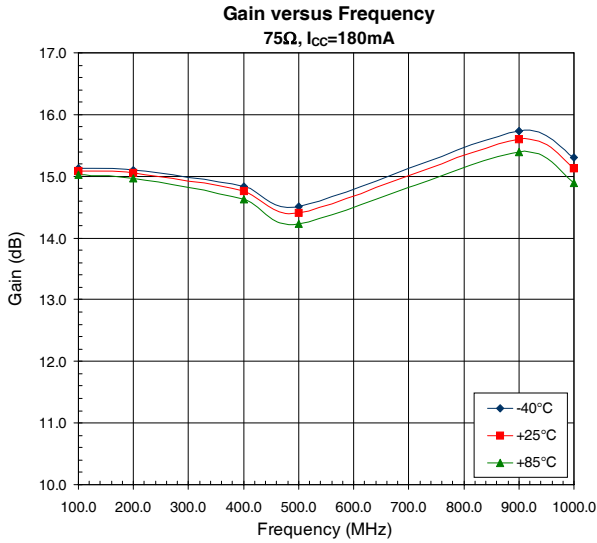


**75Ω, I<sub>CC</sub> = 150mA, Temp = +25°C**

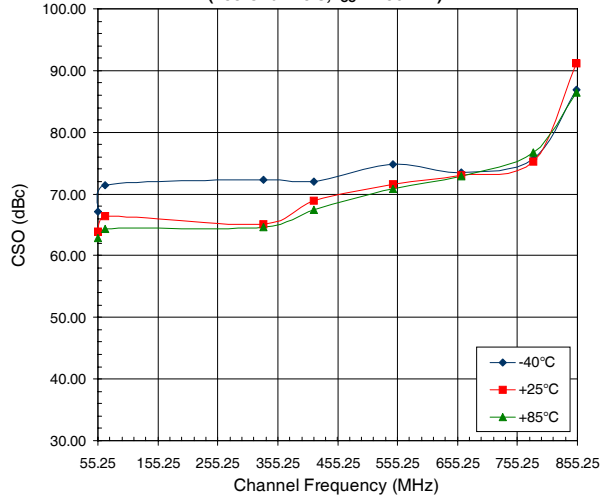


**75Ω, I<sub>CC</sub> = 180mA, Temp = +25°C**

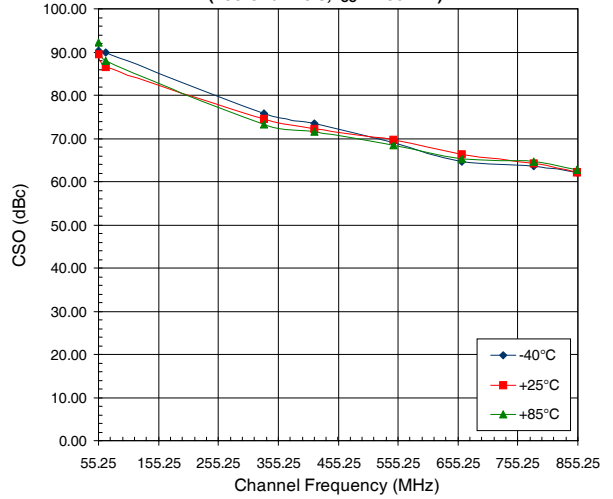




**CSO (L) versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 180 \text{ mA}$ )



**CSO (U) versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 180 \text{ mA}$ )



**CTB versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 180 \text{ mA}$ )

