



Package Style: CJ2BATO

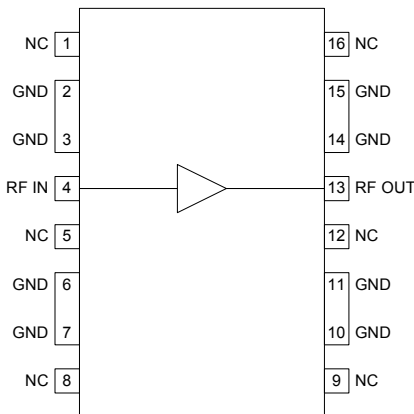


## Features

- DC to 3.0GHz Operation
- Internally Matched Input and Output
- 15dB Small Signal Gain
- 4.8dB Noise Figure at 900MHz
- 38dBm Output IP3 at 900MHz
- 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     | Sample bag with 25 pieces            |
| RF2317SR   | 7" Sample reel with 100 pieces       |
| RF2317TR7  | 7" Reel with 750 pieces              |
| RF2317TR13 | 13" Reel with 2500 pieces            |
| RF2317 50Ω | 1000MHz PCBA with 5-piece sample bag |
| RF2317 75Ω | 1000MHz PCBA with 5-piece sample bag |

## 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"/> BIFET HBT |
| <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.

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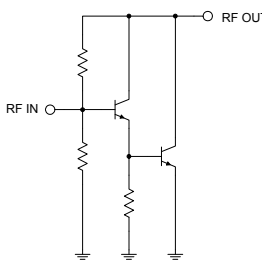
RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

| Parameter                    | Specification |       |      | Unit  | Condition                                                                                                                                         |
|------------------------------|---------------|-------|------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | Min.          | Typ.  | Max. |       |                                                                                                                                                   |
| <b>Overall (50Ω)</b>         |               |       |      |       | T = +25 °C, I <sub>CC</sub> = 180mA, 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 100MHz to 1000MHz                                                                                                                            |
| 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 |      |       |                                                                                                                                                   |
| Output IP <sub>3</sub>       |               | +47   |      | dBm   | At 100MHz                                                                                                                                         |
|                              | +37           | +42   |      | dBm   | At 500MHz                                                                                                                                         |
|                              |               | +37   |      | dBm   | At 900MHz                                                                                                                                         |
| Output IP <sub>2</sub>       |               | +55   |      | dBm   | F <sub>1</sub> = 400MHz, F <sub>2</sub> = 500MHz, F <sub>OUT</sub> = 100MHz                                                                       |
| Output P <sub>1dB</sub>      |               | +25.5 |      | dBm   | At 100MHz                                                                                                                                         |
|                              |               | +24   |      | dBm   | At 500MHz                                                                                                                                         |
|                              |               | +22   |      | dBm   | At 900MHz                                                                                                                                         |
| Reverse Isolation            |               | 19.5  |      | dB    |                                                                                                                                                   |
| <b>Thermal</b>               |               |       |      |       |                                                                                                                                                   |
| Theta <sub>JC</sub>          |               | 55    |      | °C/W  | I <sub>CC</sub> = 150mA, P <sub>DISS</sub> = 1.2W, 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> = 180mA, P <sub>DISS</sub> = 1.5W, 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> = 150mA                                                                                                                |
|                              |               | 9.3   |      | V     | On pin 13, I <sub>CC</sub> = 180mA                                                                                                                |
| Operating Current Range      | 100           | 180   | 200  | mA    | Actual current determined by V <sub>CC</sub> and R <sub>C</sub>                                                                                   |
| <b>Overall (75Ω)</b>         |               |       |      |       | T = 25 °C, I <sub>CC</sub> = 180mA, R <sub>C</sub> = 14.3Ω, 75Ω System                                                                            |
| Frequency Range              | DC            |       | 3000 | MHz   | 3dB Bandwidth                                                                                                                                     |
| Gain                         |               | 15.0  |      | dB    |                                                                                                                                                   |
| Noise Figure                 |               | 4.8   |      | dB    | From 100MHz to 1000MHz                                                                                                                            |

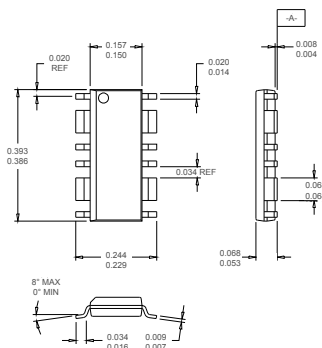
| Parameter                        | Specification |       |      | Unit | Condition                                                                                                                                         |
|----------------------------------|---------------|-------|------|------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | Min.          | Typ.  | Max. |      |                                                                                                                                                   |
| <b>Overall (75Ω) (continued)</b> |               |       |      |      | T = 25 °C, I <sub>CC</sub> = 180mA, R <sub>C</sub> = 14.3Ω, 75Ω System                                                                            |
| 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 |      |      |                                                                                                                                                   |
| Output IP3                       |               | +49   |      | dBm  | At 100MHz                                                                                                                                         |
|                                  | +37           | +43   |      | dBm  | At 500MHz                                                                                                                                         |
|                                  |               | +38   |      | dBm  | At 900MHz                                                                                                                                         |
| Output IP2                       |               | +58   |      | dBm  | F <sub>1</sub> = 400MHz, F <sub>2</sub> = 500MHz, F <sub>OUT</sub> = 100MHz                                                                       |
| Output P1dB                      |               | +22   |      | dBm  | At 100MHz                                                                                                                                         |
|                                  |               | +22   |      | dBm  | At 500MHz                                                                                                                                         |
|                                  |               | +21   |      | dBm  | At 900MHz                                                                                                                                         |
| Reverse Isolation                |               | 19    |      | dB   |                                                                                                                                                   |
| <b>133 Channels</b>              |               |       |      |      | 10dBmV per channel, flat, at the input of the amplifier; I <sub>CC</sub> = 150mA, V <sub>CC</sub> = 10.4V                                         |
| XMOD                             |               | <-75  |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | <-75  |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | <-75  |      | dBc  | At 547.25MHz                                                                                                                                      |
|                                  |               | <-75  |      | dBc  | At 853.25MHz                                                                                                                                      |
| CTB                              |               | -85   |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | -85   |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | -84   |      | dBc  | At 547.25MHz                                                                                                                                      |
|                                  |               | -83   |      | dBc  | At 853.25MHz                                                                                                                                      |
| CSO + 1.25MHz                    |               | -90   |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | -72   |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | -69   |      | dBc  | At 853.25MHz                                                                                                                                      |
|                                  |               | -64   |      | dBc  | At 547.25MHz                                                                                                                                      |
| CSO - 1.25MHz                    |               | -63   |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | -65   |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | -70   |      | dBc  | At 547.25MHz                                                                                                                                      |
|                                  |               | -90   |      | dBc  | At 853.25MHz                                                                                                                                      |
| <b>133 Channels</b>              |               |       |      |      | 10dBmV per channel, flat, at the input of the amplifier; I <sub>CC</sub> = 180mA, V <sub>CC</sub> = 11.4V                                         |
| XMOD                             |               | <-75  |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | <-75  |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | <-75  |      | dBc  | At 547.25MHz                                                                                                                                      |
|                                  |               | <-75  |      | dBc  | At 853.25MHz                                                                                                                                      |
| CTB                              |               | -89   |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | -86   |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | -86   |      | dBc  | At 547.25MHz                                                                                                                                      |
|                                  |               | -84   |      | dBc  | At 853.25MHz                                                                                                                                      |
| CSO + 1.25MHz                    |               | -89   |      | dBc  | At 55.25MHz                                                                                                                                       |
|                                  |               | -74   |      | dBc  | At 331.25MHz                                                                                                                                      |
|                                  |               | -69   |      | dBc  | At 853.25MHz                                                                                                                                      |
|                                  |               | -62   |      | dBc  | At 547.25MHz                                                                                                                                      |

|                         |     |     |     |     |                                                                 |
|-------------------------|-----|-----|-----|-----|-----------------------------------------------------------------|
| CSO - 1.25MHz           |     | -63 |     | dBc | At 55.25MHz                                                     |
|                         |     | -65 |     | dBc | At 331.25MHz                                                    |
|                         |     | -71 |     | dBc | At 547.25MHz                                                    |
|                         |     | -91 |     | dBc | At 853.25MHz                                                    |
| Power Supply (75Ω)      |     |     |     |     |                                                                 |
| Device Voltage          |     | 8.3 |     | V   | On pin 13, I <sub>CC</sub> = 150mA                              |
|                         |     | 8.9 |     | V   | On pin 13, I <sub>CC</sub> = 180mA                              |
| Operating Current Range | 100 | 180 | 200 | mA  | Actual current determined by V <sub>CC</sub> and R <sub>C</sub> |

## Pin Names and Descriptions

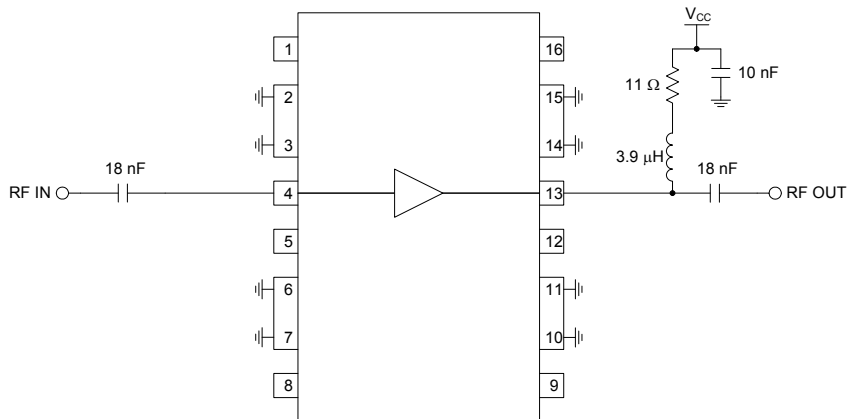
| Pin | Name   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 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 150mA (for 75 $\Omega$ 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

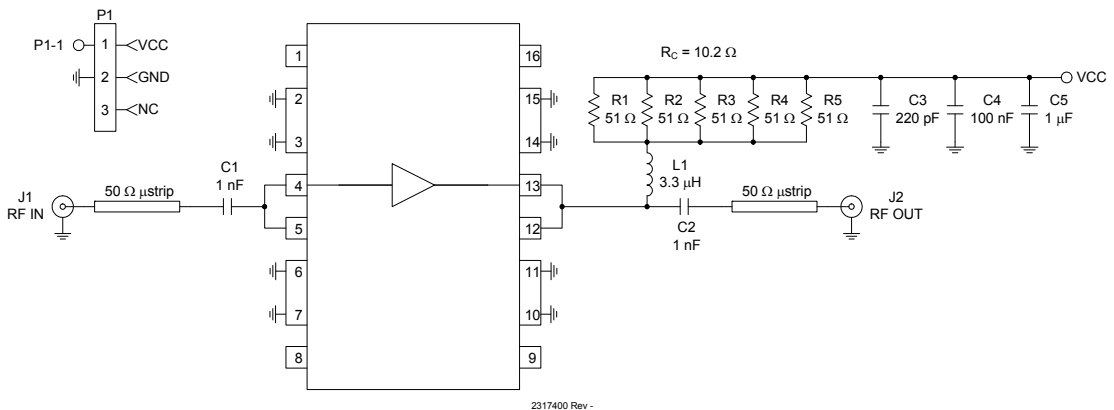


NOTES:

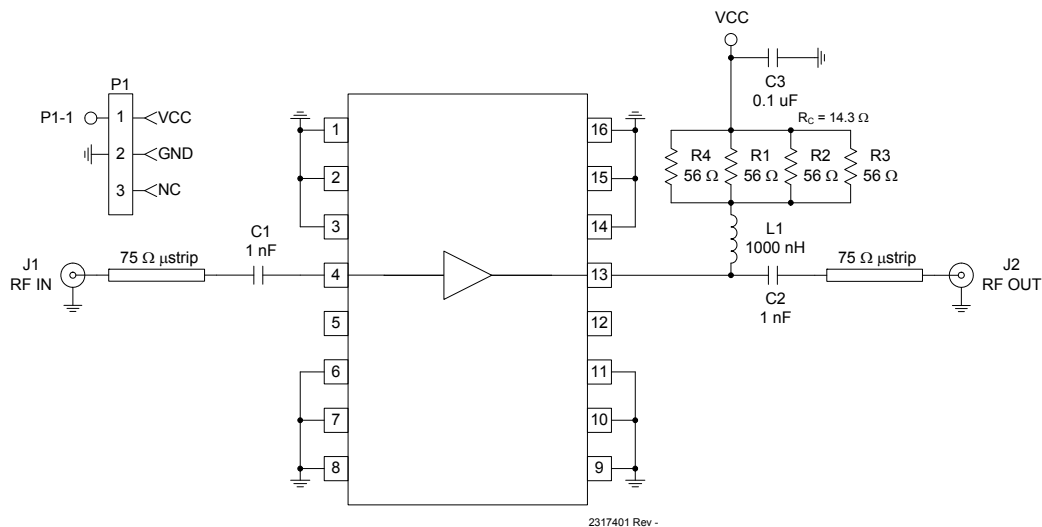
Gain Flatness <0.5 dB

Input and Output Return Loss >20 dB in 75  $\Omega$  system

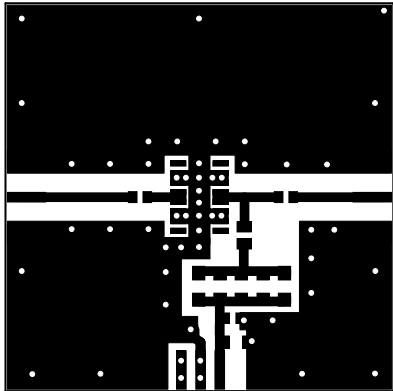
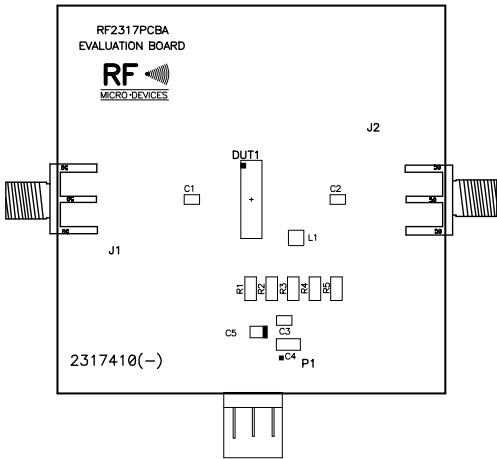
**Evaluation Board Schematic - 50Ω**  
(Download **Bill of Materials** from [www.rfmd.com](http://www.rfmd.com).)



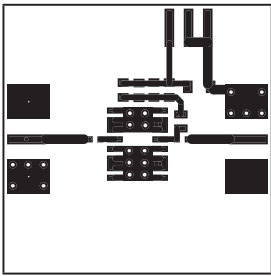
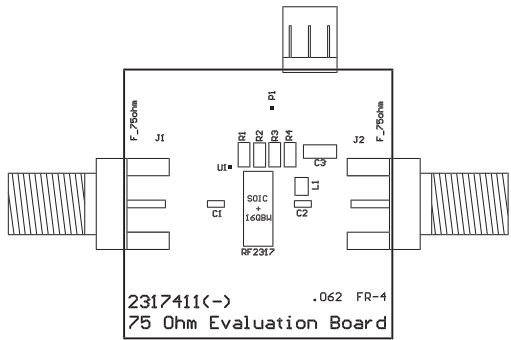
## Evaluation Board Schematic - 75Ω



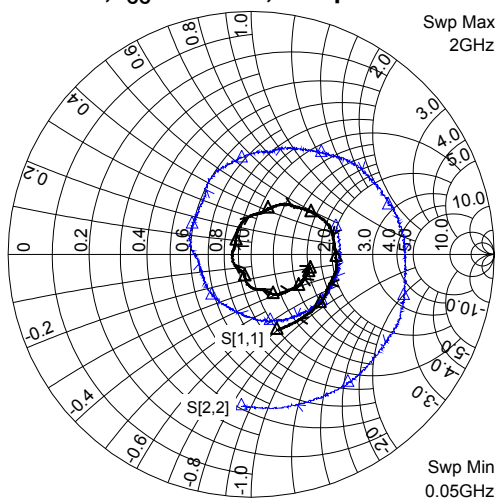
## Evaluation Board Layout - 50Ω 2.0" x 2.0" Board Thickness 0.031", Board Material FR-4



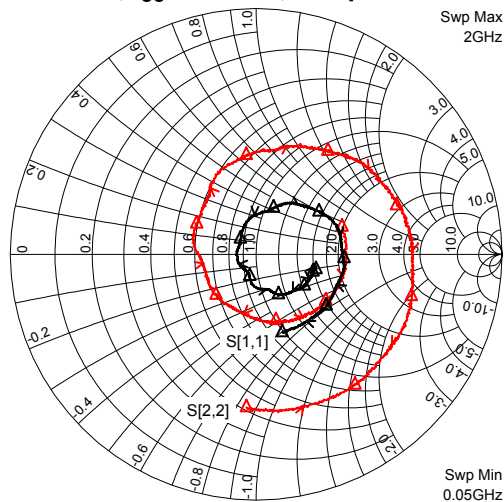
## Evaluation Board Layout - 75Ω 1.40" x 1.40" Board Thickness 0.062", Board Material FR-4



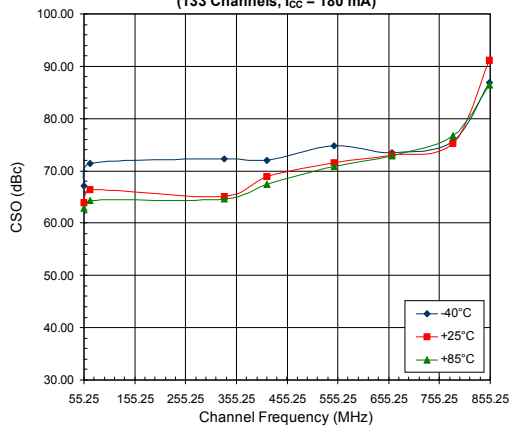
**75Ω,  $I_{CC} = 150\text{mA}$ , Temp = +25°C**



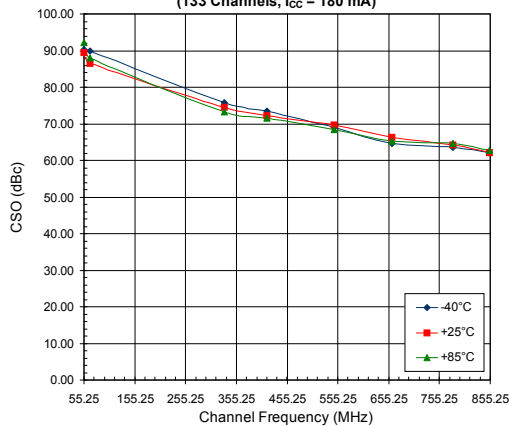
**75Ω,  $I_{CC} = 180\text{mA}$ , Temp = +25°C**



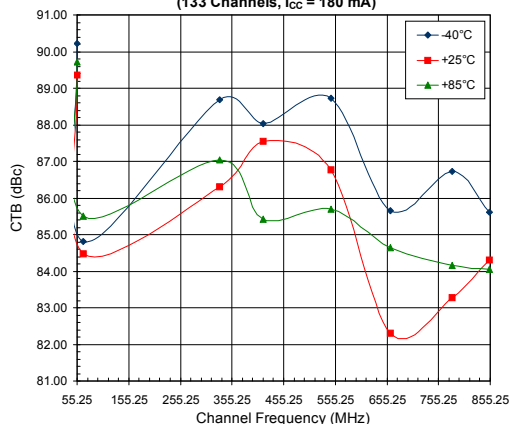
**CSO (L) versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 180$  mA)



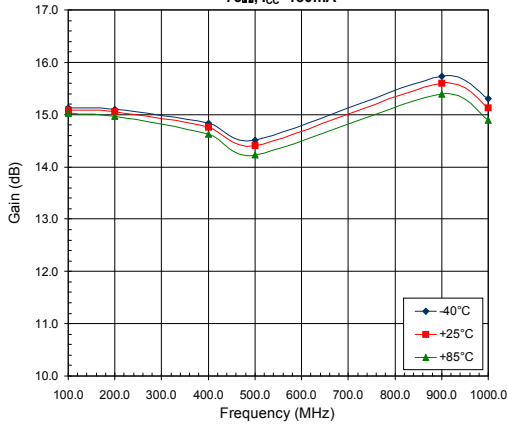
**CSO (U) versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 180$  mA)



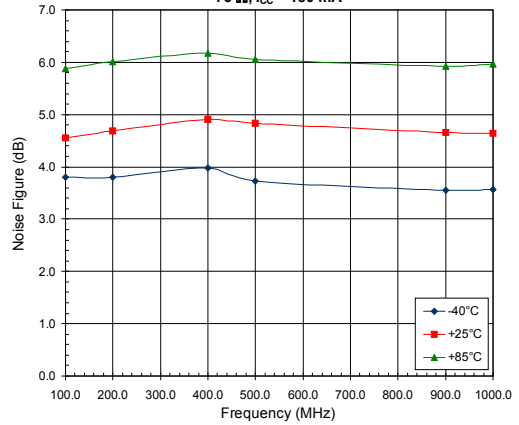
**CTB versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 180$  mA)



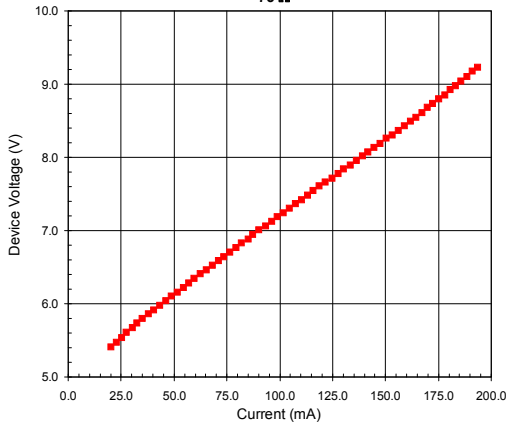
**Gain versus Frequency**  
75  $\Omega$ ,  $I_{CC}=180\text{mA}$



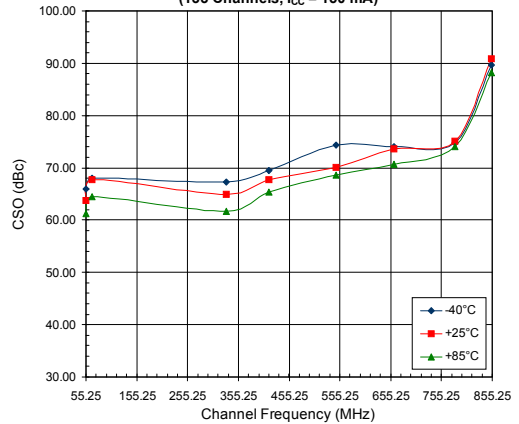
**Noise Figure versus Frequency Over Temperature**  
75  $\Omega$ ,  $I_{CC} = 180\text{ mA}$



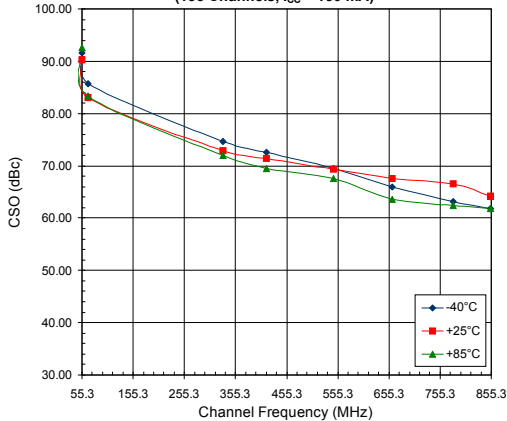
**Device Voltage versus Current**  
75  $\Omega$



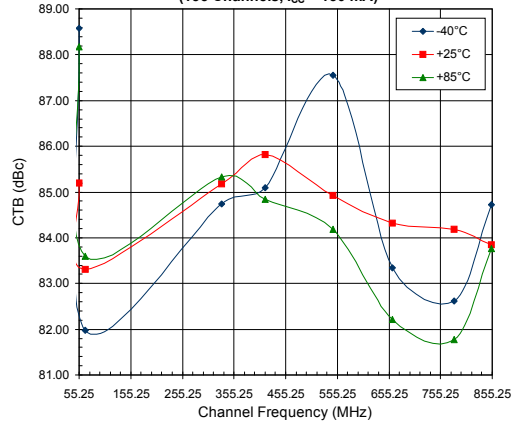
**CSO (L) versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 150\text{ mA}$ )



**CSO (U) versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 150\text{ mA}$ )



**CTB versus Channel Frequency Across Temperature**  
(133 Channels,  $I_{CC} = 150\text{ mA}$ )



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