# RF2317

LINEAR CATV AMPLIFIER

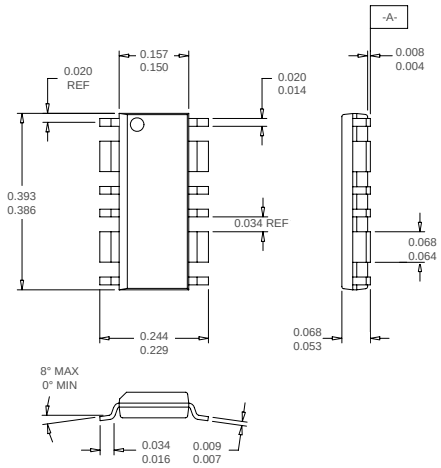
***RoHS Compliant & Pb-Free Product***

## Typical Applications

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

## Product Description

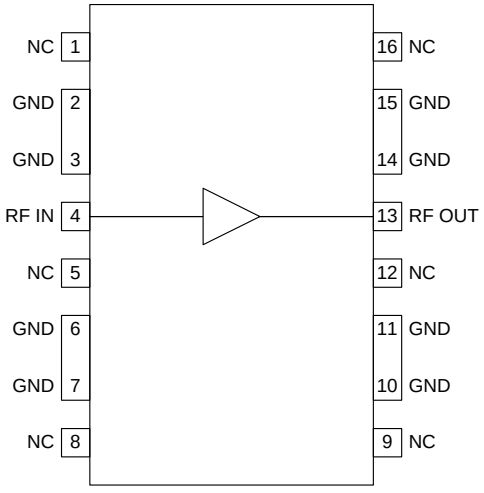
The RF2317 is a general purpose, low-cost high-linearity RF amplifier IC. The device is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as an easily cascadable 75Ω gain block. The gain flatness of better than ±0.5dB from 50MHz 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.




Package Style: CJ2BAT0

### Optimum Technology Matching® Applied

- ☐ Si BJT
- ☑ GaAs HBT
- ☐ GaAs MESFET
- ☐ Si Bi-CMOS
- ☐ SiGe HBT
- ☐ Si CMOS
- ☐ InGaP/HBT
- ☐ GaN HEMT
- ☐ SiGe Bi-CMOS




Functional Block Diagram

## Features

- DC to 3.0GHz Operation
- Internally Matched Input and Output
- 15dB Small Signal Gain
- 4.9dB Noise Figure
- +47dBm Output $IP_3$
- Single 9V to 12V Power Supply

### Ordering Information

| | |
|---|---|
| RF2317 | Linear CATV Amplifier |
| RF2317 PCBA | Fully Assembled Evaluation Board - 50Ω |
| RF2317 PCBA | Fully Assembled Evaluation Board - 75Ω |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http://www.rfmd.com

## 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 |

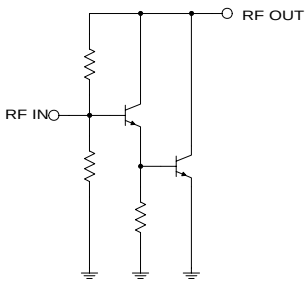
**Caution!** ESD sensitive device.



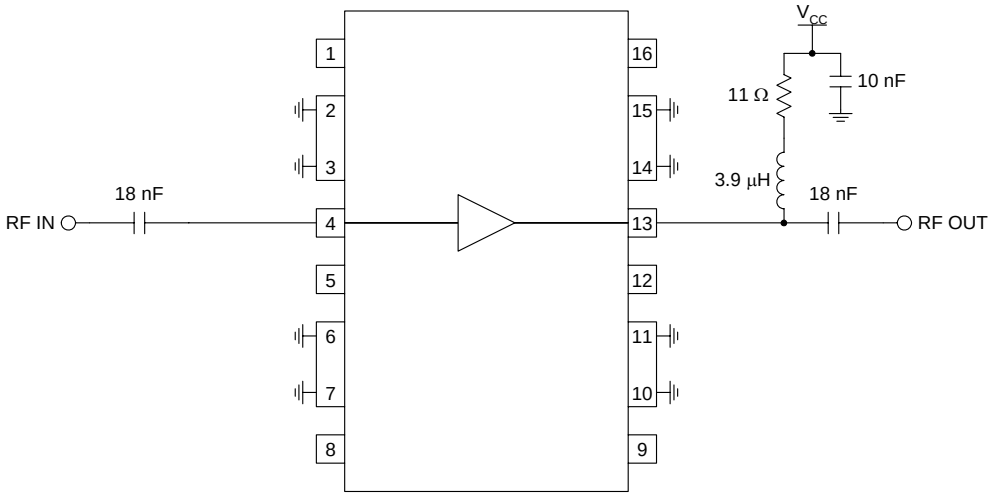
| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| **Overall (50Ω)** | | | | | T=+25°C, $I_{CC}$=180mA, $R_C$=10.2Ω, 50Ω System |
| Frequency Range | DC | | 3000 | MHz | 3dB Bandwidth |
| Gain | 13.5 | 14.3 | 15.0 | dB | |
| Noise Figure | | 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 | | | Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range. |
| Output $IP_3$ | | +47 | | dBm | At 100MHz |
| | +37 | +42 | | dBm | At 500MHz |
| | | +37 | | dBm | At 900MHz |
| Output $IP_2$ | | +55 | | dBm | $F_1$=400MHz, $F_2$=500MHz, $F_{OUT}$=100MHz |
| Output $P_{1dB}$ | | +25.5 | | dBm | At 100MHz |
| | | +24 | | dBm | At 500MHz |
| | | +22 | | dBm | At 900MHz |
| Reverse Isolation | | 19.5 | | dB | |
| **Thermal** | | | | | |
| $Theta_{JC}$ | | 55 | | °C/W | $I_{CC}$=150mA, $P_{DISS}$=1.2W, $T_{AMB}$=85°C |
| Maximum Junction Temperature | | 150 | | °C | |
| Mean Time To Failures | | 3100 | | years | $T_{AMB}$=+85°C |
| $Theta_{JC}$ | | 58 | | °C/W | $I_{CC}$=180mA, $P_{DISS}$=1.5W, $T_{AMB}$=85°C |
| Maximum Junction Temperature | | 175 | | °C | |
| Mean Time To Failures | | 380 | | years | $T_{AMB}$=+85°C |
| **Power Supply (50Ω)** | | | | | |
| Device Voltage | | 8.5 | | V | On pin 13, $I_{CC}$=150mA |
| | | 9.3 | | V | On pin 13, $I_{CC}$=180mA |
| Operating Current Range | 100 | 180 | 200 | mA | Actual current determined by $V_{CC}$ and $R_C$ |

| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| **Overall (75Ω)** | | | | | T=25°C, $I_{CC}$=180mA, $R_C$=14.3Ω, 75Ω System |
| Frequency Range | DC | | 3000 | MHz | 3dB Bandwidth |
| Gain | | 15.0 | | dB | |
| Noise Figure | | 4.8 | | dB | From 100MHz to 1000MHz |
| 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 $IP_3$ | | +49 | | dBm | At 100MHz |
| | +37 | +43 | | dBm | At 500MHz |
| | | +38 | | dBm | At 900MHz |
| Output $IP_2$ | | +58 | | dBm | $F_1$=400MHz, $F_2$=500MHz, $F_{OUT}$=100MHz |
| Output $P_{1dB}$ | | +22 | | dBm | At 100MHz |
| | | +22 | | dBm | At 500MHz |
| | | +21 | | dBm | At 900MHz |
| Reverse Isolation | | 19 | | dB | |
| **133 Channels** | | | | | 10dBmV per channel, flat, at the input of the amplifier; $I_{CC}$=150mA, $V_{CC}$=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 |

| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| **133 Channels** | | | | | 10dBmV per channel, flat, at the input of the amplifier; $I_{CC}$=180mA, $V_{CC}$=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, $I_{CC}$=150mA |
| | | 8.9 | | V | On pin 13, $I_{CC}$=180mA |
| Operating Current Range | 100 | 180 | 200 | mA | Actual current determined by $V_{CC}$ and $R_C$ |

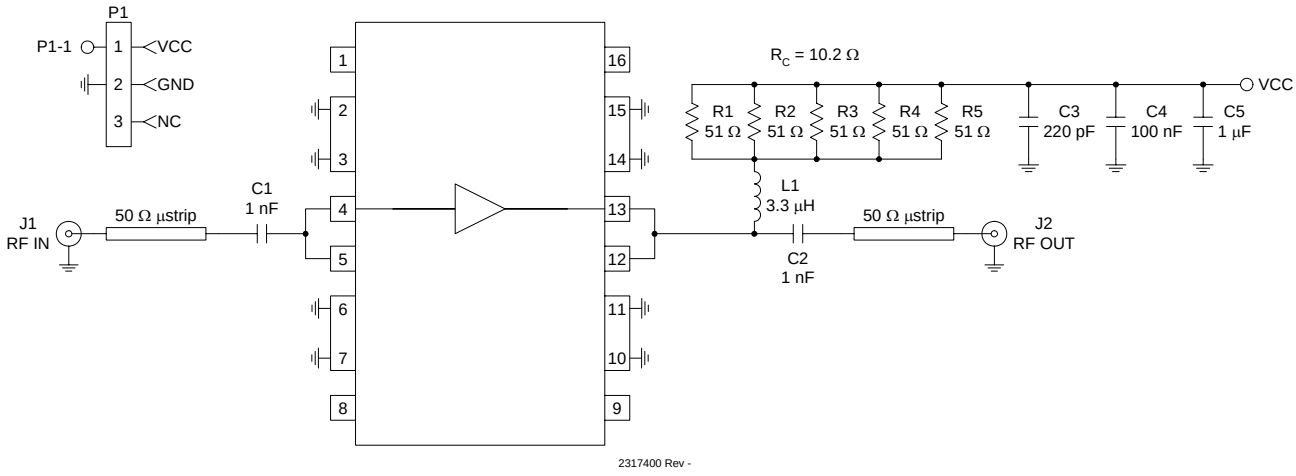
| Pin | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 | NC | This pin is internally not connected. | |
| 2 | GND | Ground connection. Keep traces physically short and connect immediately to ground plane for best performance. Each ground pin should have a via to the ground plane. | |
| 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 150mA (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. | |

## Application Schematic
## 5MHz to 50MHz Reverse Path

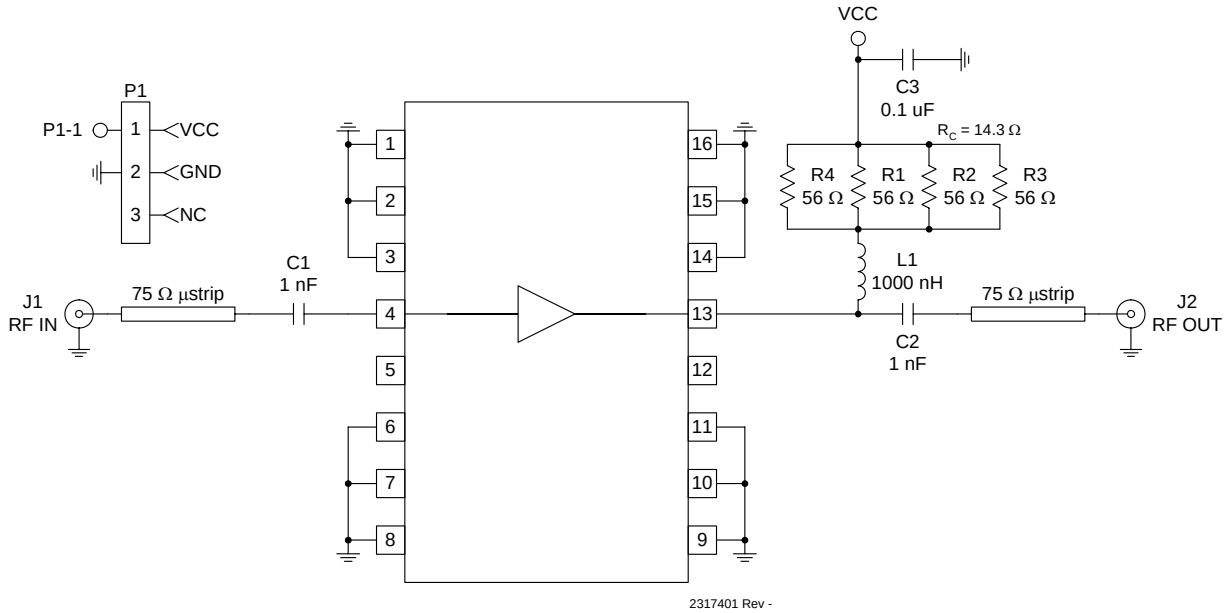



NOTES:
Gain Flatness <0.5 dB
Input and Output Return Loss >20 dB in 75 Ω system

## Evaluation Board Schematic - 50Ω
(Download Bill of Materials from www.rfmd.com.)

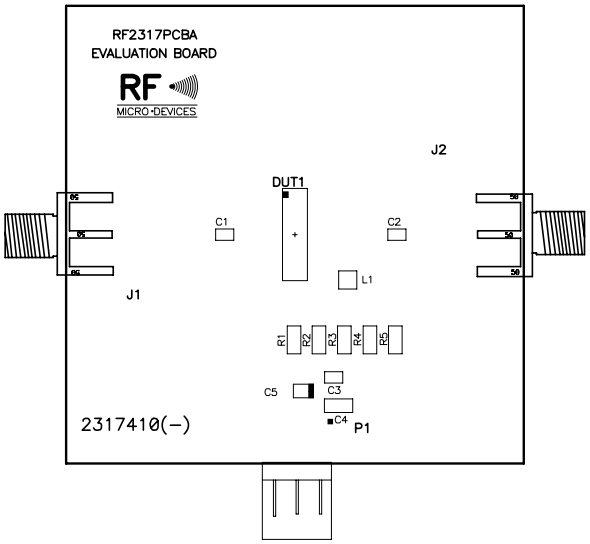


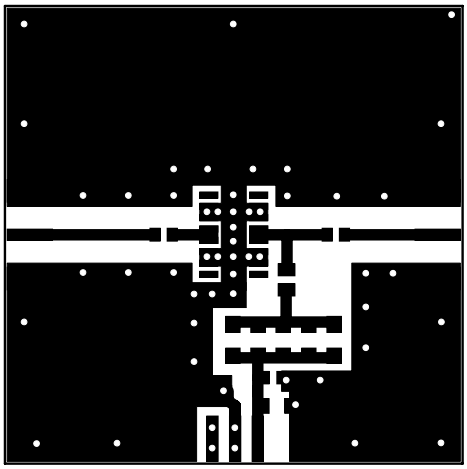
# Evaluation Board Schematic - 75Ω



## Evaluation Board Layout - 50Ω
2.0” x 2.0”

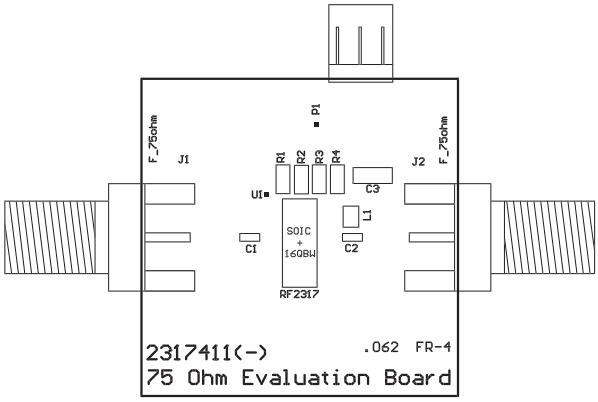
Board Thickness 0.031”, Board Material FR-4

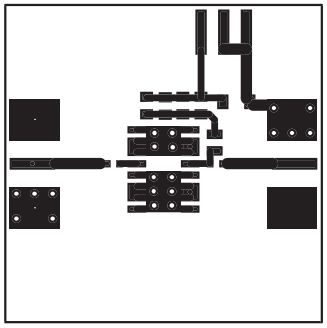


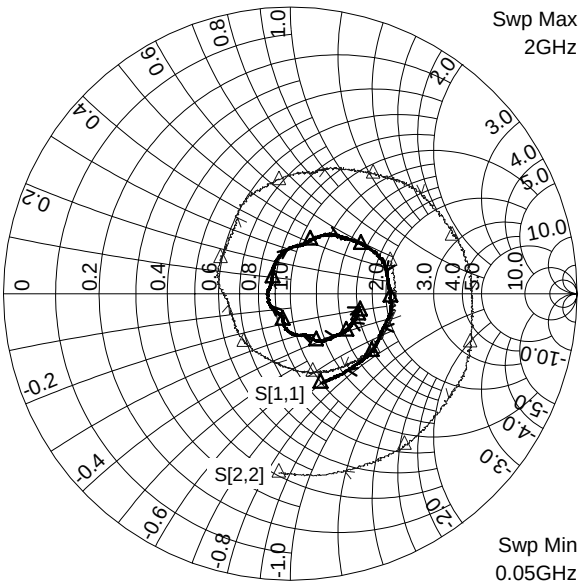
## Evaluation Board Layout - 75Ω
1.40” x 1.40”

Board Thickness 0.062”, Board Material FR-4

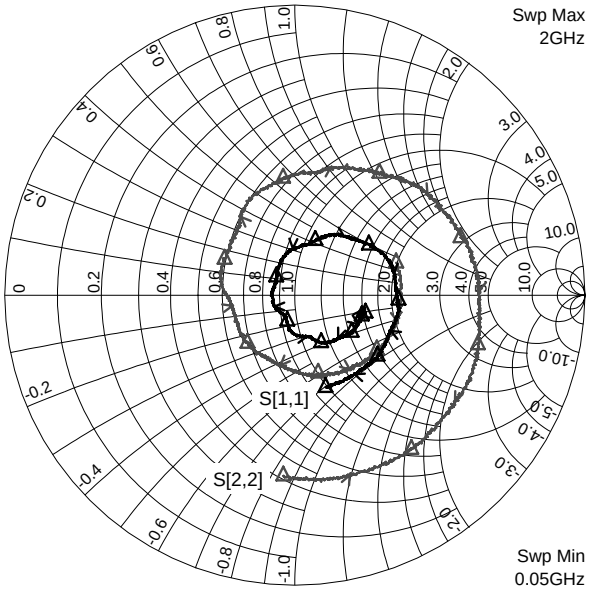


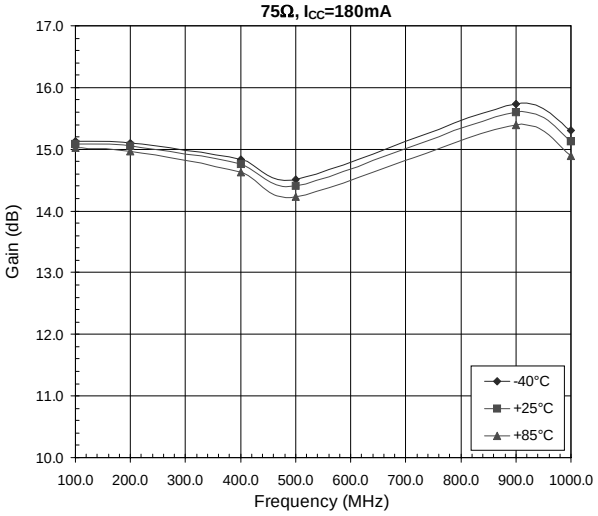
**75Ω, $I_{CC}$ = 150mA, Temp = +25°C**



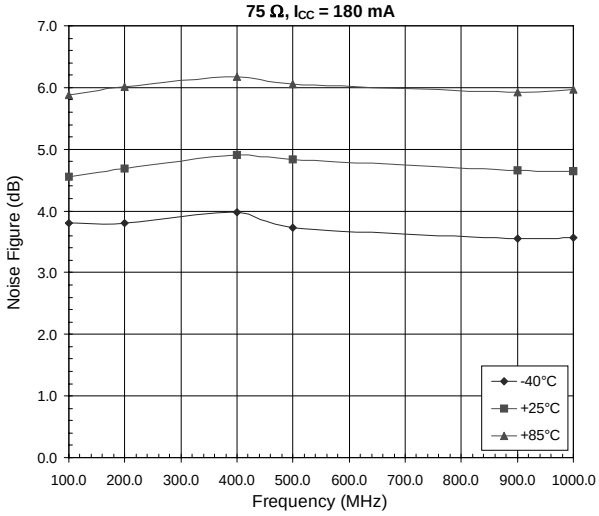

**75Ω, $I_{CC}$ = 180mA, Temp = +25°C**



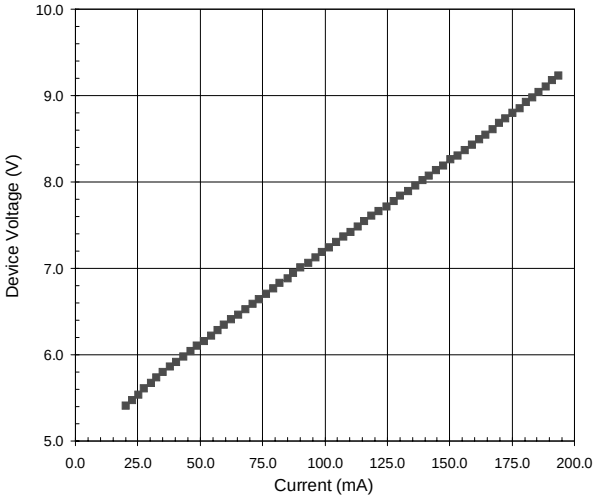
**Gain versus Frequency**
**75Ω, $I_{CC}$=180mA**



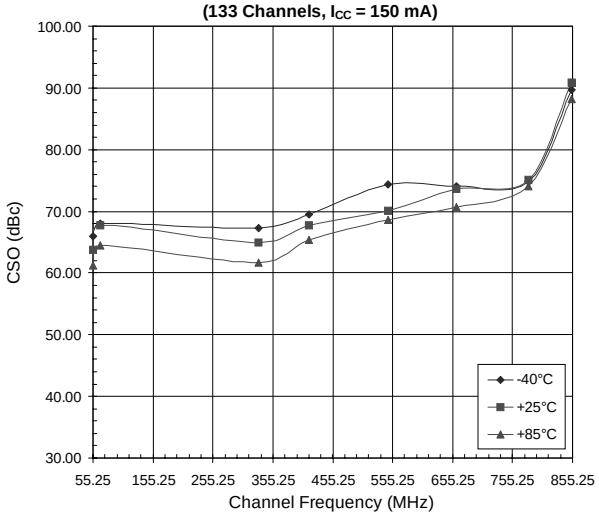

**Noise Figure versus Frequency Over Temperature**
**75 Ω, $I_{CC}$ = 180 mA**



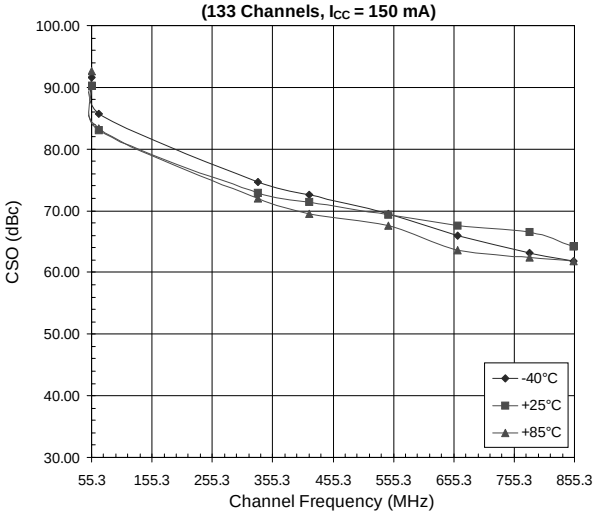

**Device Voltage versus Current**
**75 Ω**



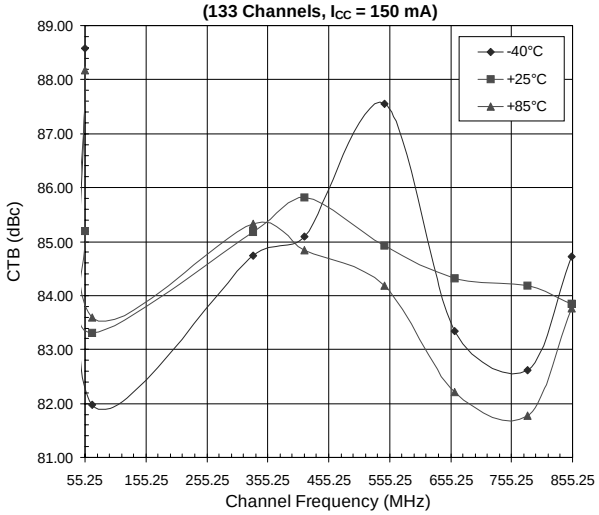

**CSO (L) versus Channel Frequency Across Temperature**
**(133 Channels, $I_{CC}$ = 150 mA)**



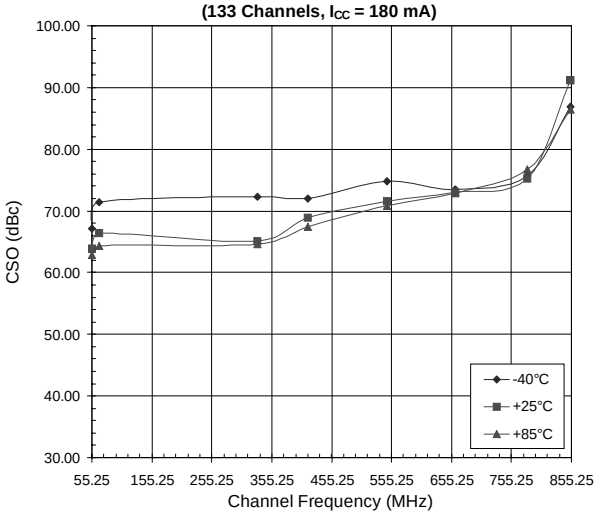

**CSO (U) versus Channel Frequency Across Temperature**
**(133 Channels, $I_{CC}$ = 150 mA)**



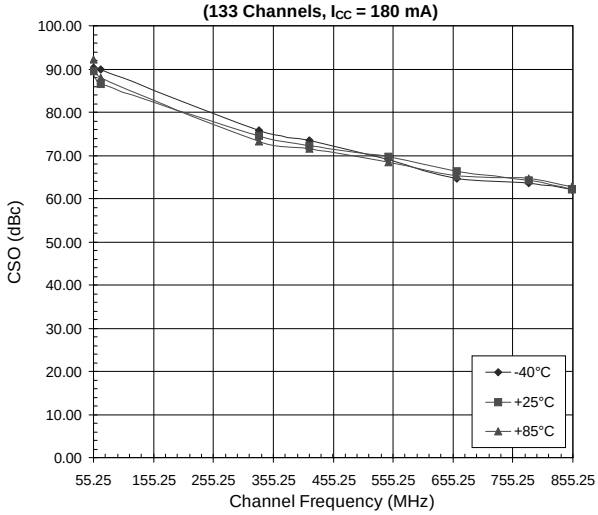

**CTB versus Channel Frequency Across Temperature**
**(133 Channels, $I_{CC}$ = 150 mA)**



**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)**