

# **RF110**

# **2400 MHz ISM Band Power Amplifier**

## **Data Sheet**

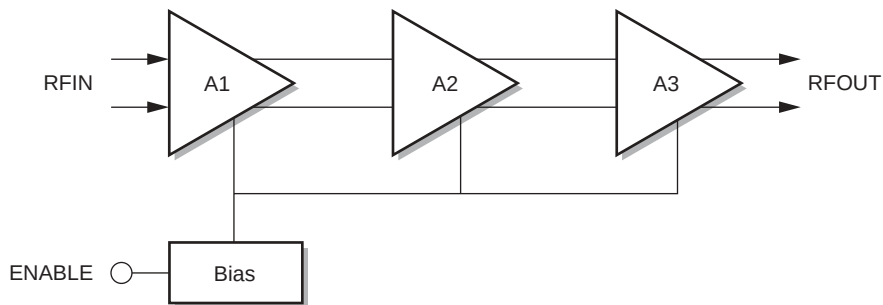


## RF110

### *2400 MHz ISM Band Power Amplifier*

The RF110 is a three-stage class AB-type power amplifier for 2400–2483.5 MHz Industrial, Scientific, Medical (ISM) band applications. It delivers output power proportional to the input signal power, making it ideal for applications with smoothlinearity requirements.

#### Functional Block Diagram



#### Distinguishing Features

- ◆ Class AB-type RF power amplifier
- ◆ Differential inputs and outputs
- ◆ 100 mW peak envelope output power
- ◆ Very fast settling from standby mode to active mode
- ◆ Efficient high output power operation
- ◆ Requires few external components
- ◆ Low power sleep mode
- ◆ 20-pin TSSOP package

#### Applications

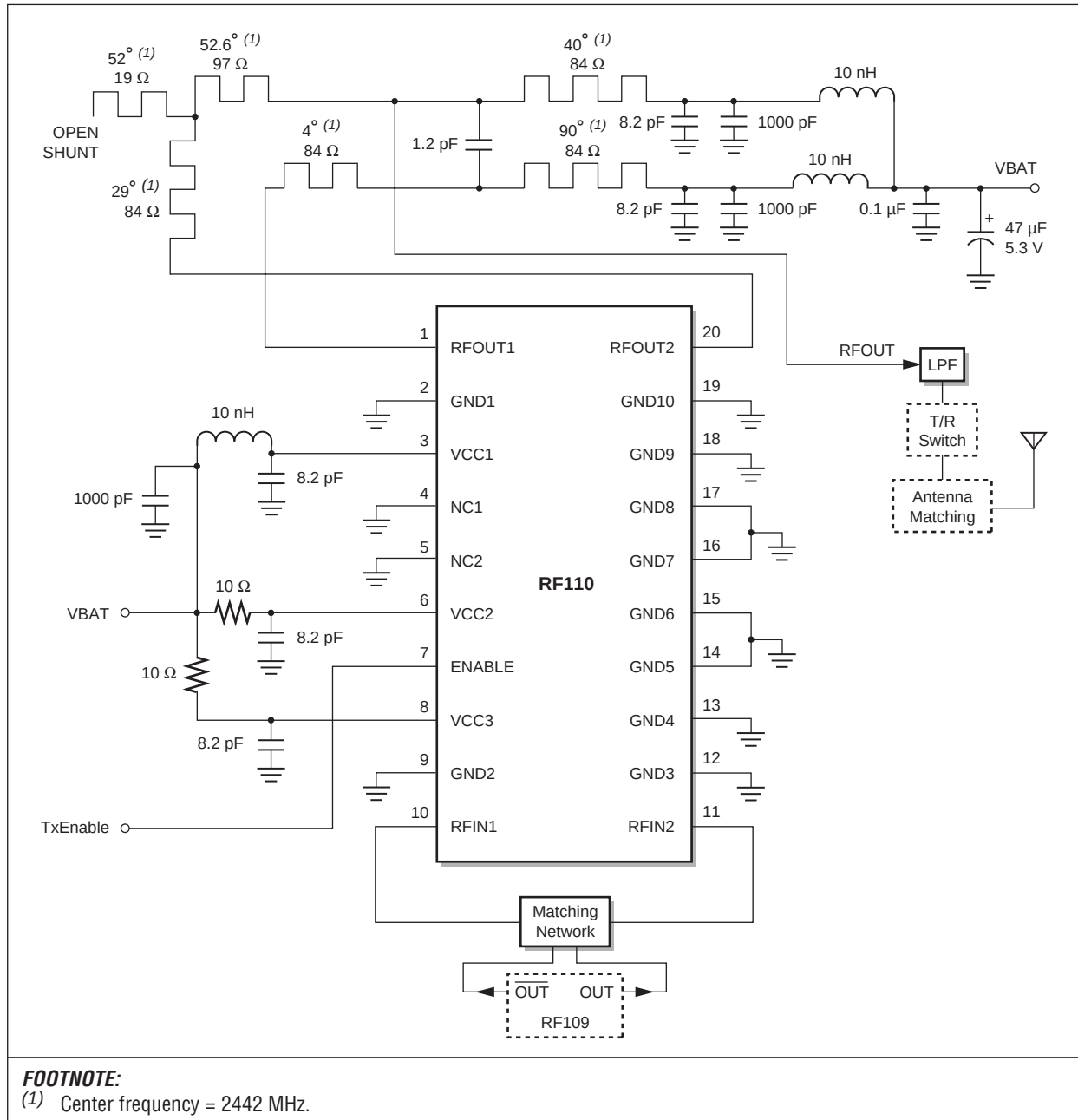
- ◆ Direct sequence spread spectrum systems
- ◆ Frequency hopping spread spectrum systems
- ◆ Wireless LANs
- ◆ Wireless modems
- ◆ Wireless security
- ◆ Inventory control systems
- ◆ Cordless telephones
- ◆ Remote monitoring



## Technical Description

The RF110 is a three-stage, class AB-type RF power amplifier. A class AB power amplifier allows a wide range of output powers without excessive idle power dissipation. Figure 1 shows a typical application circuit for the RF110.

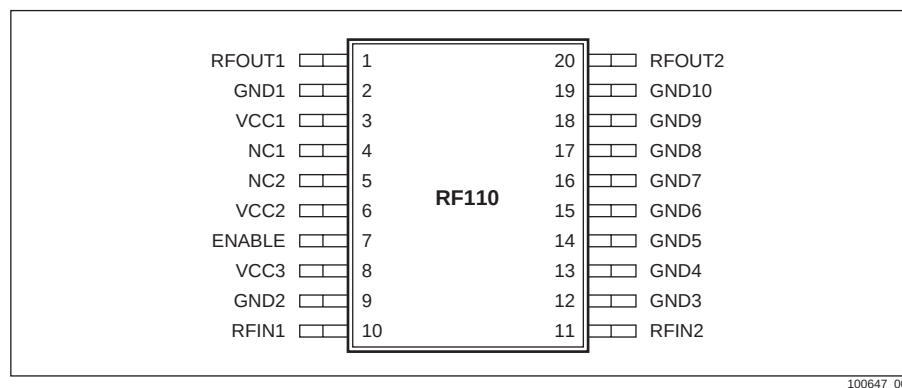
**Figure 1. RF106 Typical Application Circuit**



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The RF110 is operational in the 2400 MHz ISM band with supply voltage ranging from 3.0V to 4.5V. It is available in a small 20-pin TSSOP package, shown in Figure 2.

**Figure 2. RF110 Pin Signals — 20-Pin TSSOP**



## Recommendations on Layout and Implementation

### Matching

An input matching network and an output matching network are required for maximum power gain.

The output matching network must provide the optimum load resistance to the RF110 outputs as well as convert the differential signals to a single-ended signal into a 50  $\Omega$  load. The output matching network should present a differential impedance of approximately 59-j10  $\Omega$  to the output of the RF110, with a 180° phase difference between the two branches.

The values of the matching network components depend on layout, Printed Wire Board (PWB) material and dimensions.

### Bypassing

All Vcc pins should have proper bypassing. The decoupling capacitors should be placed very close to the pins.

A bypass capacitor of 8.2 pF and a decoupling capacitor of 1 nF are recommended. Due to layout variations, the optimum value of the capacitor may vary.

### General Grounding Requirements

All ground pins should have minimum trace inductance to ground. If a ground plane cannot be provided right at the pins, the vias to ground plane should be placed as close to the pins as possible. There should be one via for each ground pin, unless otherwise specified. If the ground plane is at the bottom layer, two vias per pin in parallel may be required.

Pins 14–15 and 16–17 are recommended to be isolated from the top layer ground.

Pins 2, 9, 12, and 19 are recommended to be tied together on the top layer isolated from the top layer ground.

NC pins are not used in the circuit and should be connected to ground as shown in Figure 1.

## ESD Sensitivity

The RF110 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper Electrostatic Discharge (ESD) precautions.

## Interface Description

[Table 1](#) describes the pin signals for the RF110.

**Table 1. Pin Signal Descriptions**

| Pin No. | Name   | Description                                   |
|---------|--------|-----------------------------------------------|
| 1       | RFOUT1 | Amplifier positive RF output                  |
| 2       | GND1   | Ground                                        |
| 3       | VCC1   | Power supply (positive)                       |
| 4       | NC1    | No connect. Recommended to connect to ground. |
| 5       | NC2    | No connect. Recommended to connect to ground. |
| 6       | VCC2   | Power supply (positive)                       |
| 7       | ENABLE | Amplifier enable (active high)                |
| 8       | VCC3   | Power supply (positive)                       |
| 9       | GND2   | Ground                                        |
| 10      | RFIN1  | Amplifier positive RF input                   |
| 11      | RFIN2  | Amplifier negative RF input                   |
| 12      | GND3   | Ground                                        |
| 13      | GND4   | Ground                                        |
| 14      | GND5   | Ground                                        |
| 15      | GND6   | Ground                                        |
| 16      | GND7   | Ground                                        |
| 17      | GND8   | Ground                                        |
| 18      | GND9   | Ground                                        |
| 19      | GND10  | Ground                                        |
| 20      | RFOUT2 | Amplifier negative RF output                  |

## Specifications

Table 2 lists the absolute maximum ratings for the RF110. Table 3 lists the electrical specifications for the RF110.

**Table 2. Absolute Maximum Ratings**

| Parameter                                                          | Minimum | Maximum         | Unit |
|--------------------------------------------------------------------|---------|-----------------|------|
| Supply voltage (V <sub>CC</sub> ) <sup>(1)</sup>                   |         | +5              | V    |
| Input voltage range <sup>(1)</sup>                                 | GND     | V <sub>CC</sub> | V    |
| Power dissipation at high output power mode                        |         | 700             | mW   |
| Ambient operating temperature (T <sub>A</sub> )                    | −10     | +70             | °C   |
| Storage temperature                                                | −40     | +125            | °C   |
| <b>FOOTNOTE:</b><br><sup>(1)</sup> Voltages are referenced to GND. |         |                 |      |

**Table 3. RF110 Electrical Specifications**

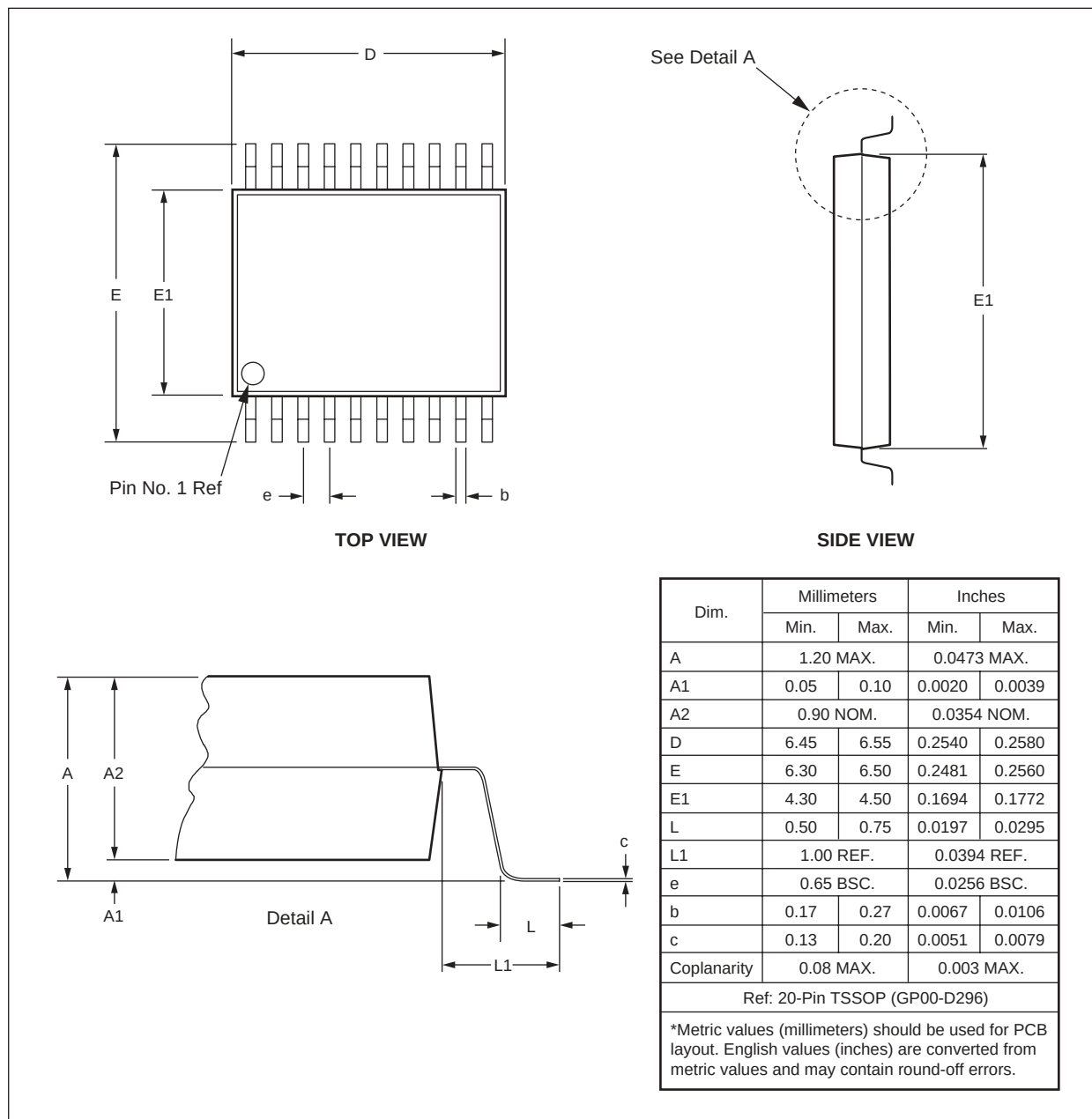
| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Minimum | Typical                  | Maximum | Units                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------|---------|----------------------|
| Operating power supply range <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3.0     | 3.6                      | 4.5     | V                    |
| Gain variation vs. frequency (2400–2500 MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         | ±0.6                     | ±1.5    | dB                   |
| Peak Envelope output Power (PEP) <sup>(2), (3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 17.5    | 20                       | 22.5    | dBm                  |
| RF small signal gain <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         | 25.5                     |         | dB                   |
| Total supply current:<br>Output power = 20 dBm PEP <sup>(2), (3)</sup><br>= 10 dBm PEP <sup>(2), (5)</sup><br>= 0 dBm PEP <sup>(2), (6)</sup><br>Standby <sup>(7)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | 120<br>100<br>95<br>< 10 |         | mA<br>mA<br>mA<br>μA |
| IM3: PEP = 21 dBm <sup>(2), (3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         | −21                      | −16     | dBc                  |
| Output VSWR for unconditional stability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |                          | 10:1    | —                    |
| RF output-to-input isolation @ 2450 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | 50                       |         | dB                   |
| RF input impedance (differential)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         | 70 + j20                 |         | Ω                    |
| RF output impedance (differential)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         | 52 − j14                 |         | Ω                    |
| P1 dBm compression point <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | −11     | −8                       |         | dBm                  |
| V <sub>IH</sub> for ENABLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.9     |                          |         | V                    |
| V <sub>IL</sub> for ENABLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                          | 0.8     | V                    |
| I <sub>IH</sub> for ENABLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         | 10                       | 60      | μA                   |
| I <sub>IL</sub> for ENABLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | −20     | −1                       |         | μA                   |
| <b>FOOTNOTE:</b><br><sup>(1)</sup> The specifications in Table 3 are guaranteed at a supply voltage of 3.6 VDC and T <sub>a</sub> = 25 °C.<br><sup>(2)</sup> All PEP specifications are for two input sinusoids at 2440 MHz and 2450 MHz. PEP is calculated from the average power assuming a peak-to-average ratio of 3 dB. Output power loss due to the recommended output-matching network is included in the values in Table 3.<br><sup>(3)</sup> Input PEP = −3 dBm (differential). (Under this condition, RF110 output power is compressing. The output peak-to-average ratio is approximately 2 dB.)<br><sup>(4)</sup> Single sinusoidal input.<br><sup>(5)</sup> Input PEP = −15 dBm (differential).<br><sup>(6)</sup> Input PEP = −25 dBm (differential).<br><sup>(7)</sup> When ENABLE (pin 7) is low. |         |                          |         |                      |



## Device Dimensions

Package dimensions for the RF110 are given in [Figure 3](#).

**Figure 3. Package Dimensions — 20-Pin TSSOP**



100647\_004



## Ordering Information

| Model Number | Package | Operating Temperature |
|--------------|---------|-----------------------|
| RF-110-12    | —       | —                     |

## Revision History

| Revision | Level | Date            | Description     |
|----------|-------|-----------------|-----------------|
| A        |       | Jan. 19, 2000   | Initial release |
| B        |       | August 26, 2002 | Minor changes   |

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