

Typical Applications

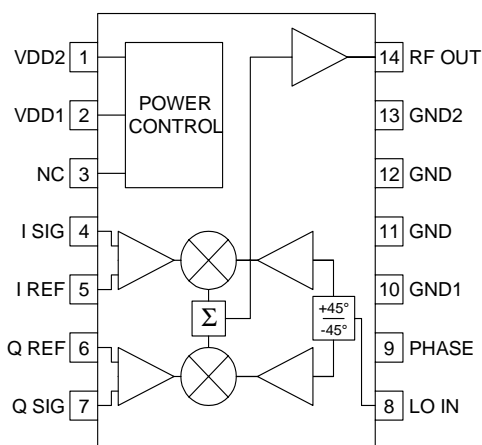
- Digital and Spread-Spectrum Systems
- GMSK, QPSK, DQPSK, QAM Modulation
- Private Mobile Radio and TETRA systems
- AM, SSB, DSB Modulation
- Image-Reject Upconverters

Product Description

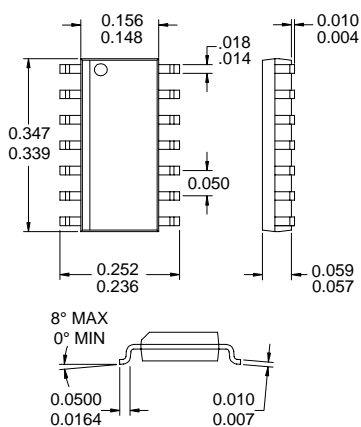
The RF2485 is a monolithic integrated universal modulation system capable of generating modulated AM, PM, or compound carriers in the VHF and UHF frequency range. The IC contains all of the required components to implement the modulation function including differential amplifiers for the baseband inputs, a 90° hybrid phase splitter, limiting LO amplifiers, two balanced mixers, a combining amplifier, and an output RF amplifier which will drive a 50Ω load. Component matching, which can only be accomplished with monolithic construction, is used to full advantage to obtain excellent amplitude balance and high phase accuracy. The unit features low power consumption, single power supply operation and adjustment free operation with no external parts required to operate the part as specified.

Optimum Technology Matching® Applied

- | | | |
|-------------------------------------|-----------------------------------|---|
| <input type="checkbox"/> Si BJT | <input type="checkbox"/> GaAs HBT | <input checked="" type="checkbox"/> GaAs MESFET |
| <input type="checkbox"/> Si Bi-CMOS | <input type="checkbox"/> SiGe HBT | <input type="checkbox"/> Si CMOS |



Functional Block Diagram



Package Style: SOIC-14

Features

- Single 5V Power Supply
- Low Power
- Excellent Amplitude and Phase Balance
- Extremely Low Broadband Noise Floor
- 200MHz to 600MHz Operation

Ordering Information

- | | |
|-------------|----------------------------------|
| RF2485 | VHF Quadrature Modulator |
| RF2485 PCBA | Fully Assembled Evaluation Board |

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Absolute Maximum Ratings

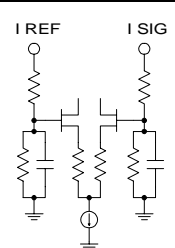
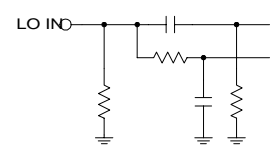
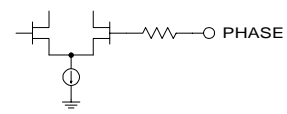
| Parameter | Rating | Unit |
|-------------------------------|--------------|-----------------|
| Supply Voltage | -0.5 to +7.5 | V _{DC} |
| Input LO and RF Levels | +10 | dBm |
| Operating Ambient Temperature | -40 to +85 | °C |
| Storage Temperature | -40 to +150 | °C |



Caution! ESD sensitive device.

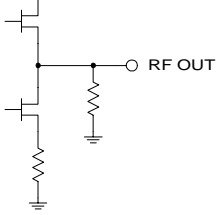
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| Parameter | Specification | | | Unit | Condition |
|---------------------------------------|---------------|-----------------------|-------|--------|--|
| | Min. | Typ. | Max. | | |
| LO Input | | | | | T=25°C, V _{DD} =5V _{DC} , I&Q inputs=2V _{PP} |
| Frequency Range | 200 | | 600 | MHz | With external 50Ω termination; see application schematic, note A. |
| Power Level | -3 | | +6 | dBm | |
| Input VSWR | | 1.2:1 | | | |
| Modulation Input | | | | | |
| Frequency Range | DC | | 100 | MHz | I & Q signals for -0.5dBm output power. I & Q signals for +5dBm output power. In-phase and quadrature signals. |
| Reference Voltage (V _{REF}) | 2.0 | | 3.0 | V | |
| Modulation (I&Q) | | V _{REF} ±0.7 | | V | |
| Modulation (I&Q) | | V _{REF} ±1.5 | | V | |
| Maximum Modulation (I&Q) | | V _{REF} ±2.5 | | V | |
| Input Resistance | | 3000 | | Ω | |
| DC Offset | | 50 | 150 | mV | |
| Amplitude Error (I/Q) | | 0.2 | | dB | I _{SIG} -I _{REF} and Q _{SIG} -Q _{REF} ; to achieve maximum carrier suppression. |
| Quadrature Phase Error | | ±1 | ±3 | ° | |
| RF Output | | | | | V _{DD} =5V, LO Power=0dBm, LO Freq=400MHz, SSB, I&Q input=0.7V _P |
| Output Power | -1.5 | -0.5 | | dBm | At 5MHz offset Unadjusted Modulation DC offset can be externally adjusted for optimum suppression. Suppression is typically better than 25dB without adjustment. |
| Output Impedance | | 50 | | Ω | |
| Output VSWR | | 1.5:1 | | | |
| Broadband Noise Floor | | -149 | -147 | dBm/Hz | |
| Sideband Suppression | 30 | 43 | | dB | |
| Carrier Suppression | 20 | 26 | | dB | |
| IM3 | -40 | -52 | | dBc | |
| TETRA Modulation | | | | | 1.7V _{P-P} TETRA Modulation LO, 450MHz @ -5.0dBm, V _{REF} 2.5V VCC=5.0V |
| Channel Power | -3.0 | -2.5 | -2.0 | dBm | |
| Adjacent Channel Power Rejection | | | | dBc | |
| 25kHz | -47.0 | -48.0 | -49.0 | dBc | |
| 50kHz | -67.0 | -68.5 | -70.0 | dBc | |
| Power Supply | | | | | |
| Voltage | | 5 | | V | Specifications |
| Current | 4.5 | | 5.5 | V | Operating Limits |
| | | 28 | 39 | mA | Operating |

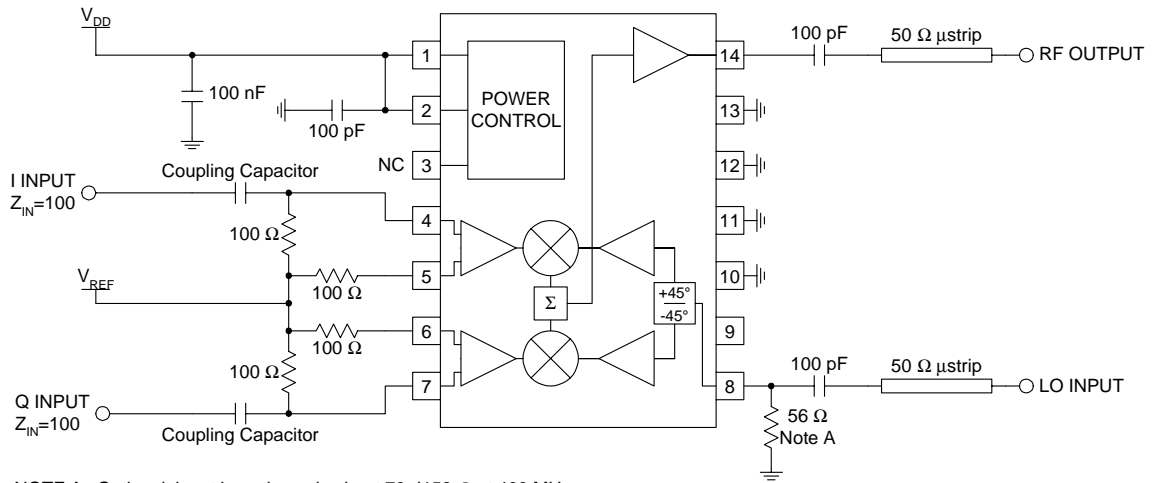
| Pin | Function | Description | Interface Schematic |
|-----|----------|---|---|
| 1 | VDD2 | Power supply for the RF Output amplifier. An external RF bypass capacitor is needed. The trace length between the pin and the bypass capacitor should be minimized. The ground side of the capacitor should connect immediately to the ground plane. | |
| 2 | VDD1 | Power supply for all other circuits. An external RF bypass capacitor is needed. | |
| 3 | NC | No connection. | |
| 4 | I SIG | Baseband input to the I mixer. This pin is DC coupled. Maximum output power is obtained when the input signal has a peak to peak amplitude of 5V. The DC level supplied to this pin should be $2.5 \pm 0.5V$. The SIG and REF inputs are inputs of a differential amplifier. Therefore the REF and SIG inputs are interchangeable. If swapping the I SIG and I REF pins, the Q SIG and Q REF also need to be swapped to maintain the correct phase. It is also possible to drive the SIG and REF inputs in a balanced mode. This will increase the gain. |  |
| 5 | I REF | Reference voltage for the I mixer. This voltage should be the same as the DC voltage supplied to the I SIG pin. To obtain a carrier suppression of better than 40dB it may be tuned $\pm 0.15V$ (relative to the I SIG DC voltage). Without tuning, it will typically be better than 25dB. | See pin 4. |
| 6 | Q REF | Reference voltage for the Q mixer. This voltage should be the same as the DC voltage supplied to the Q SIG pin. To obtain a carrier suppression of better than 40dB it may be tuned $\pm 0.15V$ (relative to the Q SIG DC voltage). Without tuning, it will typically be better than 25dB. The SIG and REF inputs are interchangeable. If swapping the I SIG and I REF pins, Q SIG and Q REF also need to be swapped to maintain correct phase. It is also possible to drive the SIG and REF inputs in a balanced mode. This will increase the gain. | Same as pin 3. |
| 7 | Q SIG | Baseband input to the Q mixer. This pin is DC coupled. Maximum output power is obtained when the input signal has a peak to peak amplitude of 5V. The DC level supplied to this pin should be $2.5 \pm 0.5V$. | Same as pin 4. |
| 8 | LO IN | The input of the phase shifting network. This high impedance input can be matched with an external 56Ω termination resistor. This pin is internally connected to ground through a $4k\Omega$ resistor. Putting a DC voltage on this pin is not recommended. However, connecting this pin to ground, e.g., through a shunt inductor, is allowed. |  |
| 9 | PHASE | This pin allows to adjust the phase of the I/Q signals. However, the control is very sensitive and hard to control. Control voltage change for a few degrees adjustment is in the order of 10mV. Device to device and temperature variation are not characterized. Therefore it is not recommended to use this pin; leave it not connected. Do NOT connect to ground. For compensating large errors in the I/Q signals supplied to the device or in control loops this pin may prove useful. |  |
| 10 | GND1 | Ground connection of the LO phase shift network. This pin should be connected directly to the ground plane. | |
| 11 | GND | Ground connection for other circuits. Keep traces short and connect to ground plane immediately. | |
| 12 | GND | Same as pin 11. | |
| 13 | GND2 | Ground connection for the RF output stage. A good ground connection is especially important at this pin to avoid interference with other circuits. | |

RF2485

Preliminary

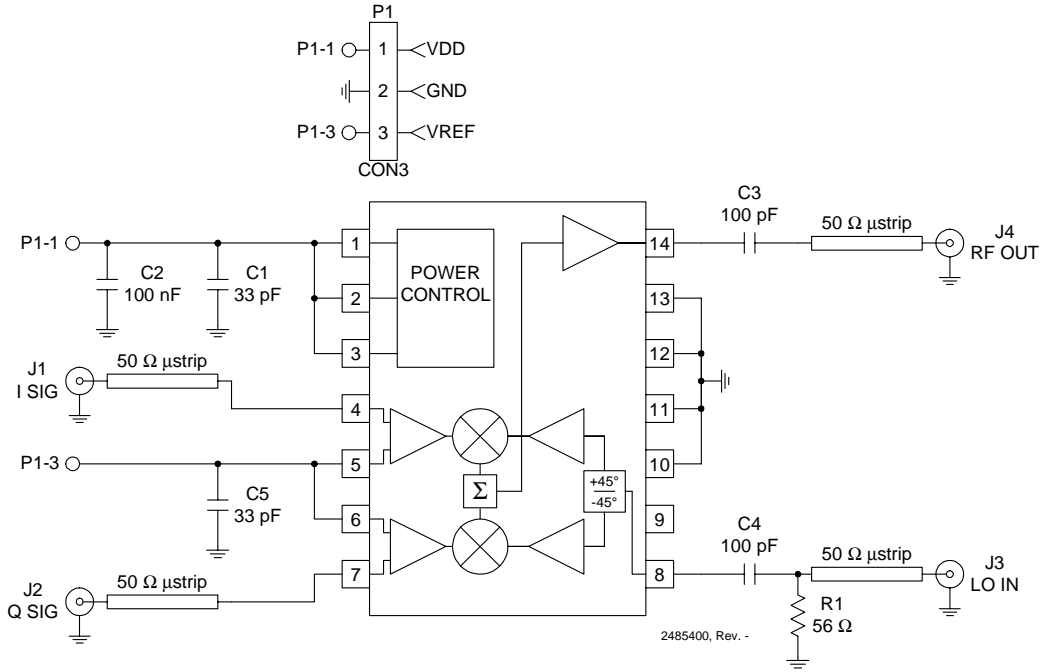
| Pin | Function | Description | Interface Schematic |
|-----|----------|---|---|
| 14 | RF OUT | 50Ω output. This pin carries a DC voltage, and an external blocking capacitor is recommended. |  |

Application Schematic

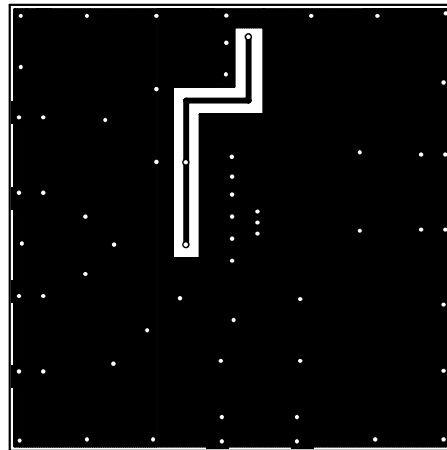
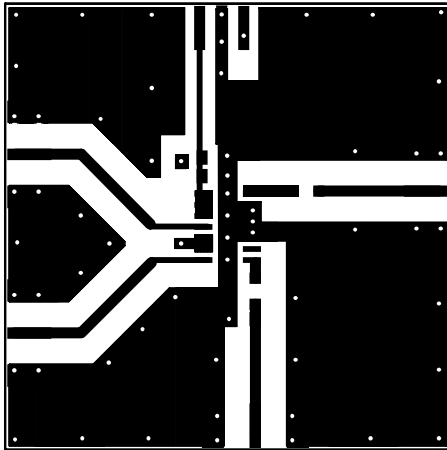
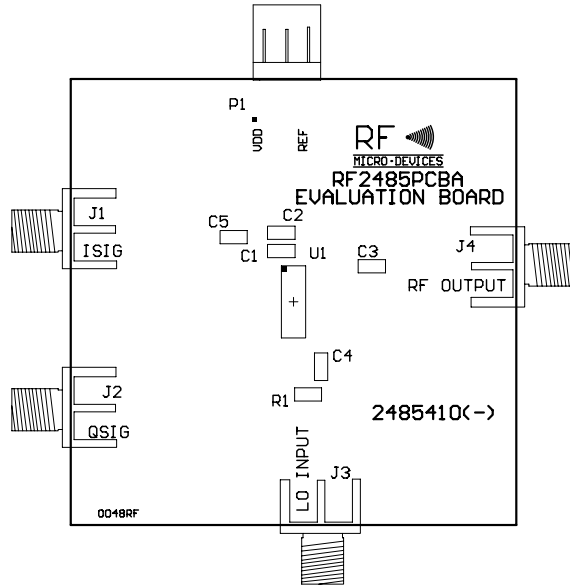


NOTE A: Optional; input impedance is about 79-J158 Ω at 400 MHz without resistor. SMD resistor mounted adjacent to package pin, grounded through a via to the ground plane.

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



Evaluation Board Layout
Board Size 2.0" x 2.0"
Board Thickness 0.031", Board Material FR-4



RF2485

Preliminary

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**MODULATORS AND
UPCONVERTERS**