



Package Style: QFN, 10-pin, 1.75mmx1.75mmx0.5mm

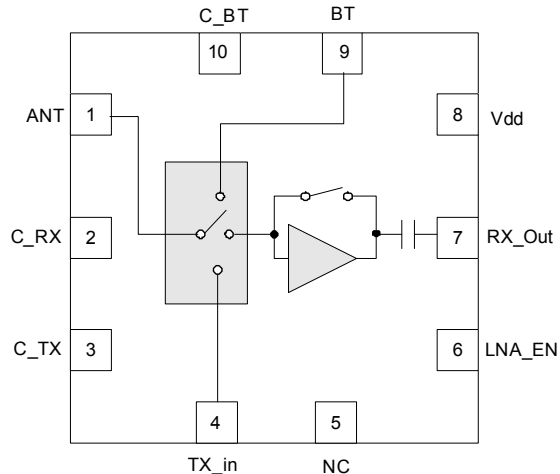


Features

- Single Supply Voltage 3.0V to 4.5V
- Integrated SP3T Switch and LNA with Bypass
- Typical gain is 12dB and 2.0dB NF in RX Mode Pin-to-Pin

Applications

- IEEE802.11b/g/n WiFi Applications
- Portable Battery-Powered Equipment
- WiFi/Bluetooth® Combination Devices



Functional Block Diagram

Product Description

The RF5521 is designed specifically for high-performance WiFi applications in the 2.4GHz to 2.5GHz ISM band, including Personal Media Players (PMPs), digital cameras, and WiFi enabled handsets.

The RF5521 integrates the LNA with bypass and an SP3T switch of a Front-End solution for WiFi and Bluetooth® combination systems. The integrated input and output match reduces the number of external components, keeping cost down and utilizing minimum layout area for implementation. The RF5521 is provided in an ultra small 1.75 mmx1.75mmx0.5mm 10-pin QFN package. This LNA+Switch front-end solution meets or exceeds the specification requirements of IEEE 802.11 b/g/n WiFi RF systems.

Ordering Information

| | |
|---------------|----------------------------------|
| RF5521 | Standard 25 piece bag |
| RF5521SR | Standard 100 piece reel |
| RF5521TR7 | Standard 2500 piece reel |
| RF5521PCK-410 | Fully Assembled Evaluation Board |

Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---------------------------------------|-------------|--------------------|
| DC Supply Voltage | 5.5 | V |
| Stability, Output VSWR | 5:1 | |
| Antenna Port Nominal Impedance | 50 | Ω |
| Full Spec Compliant Temperature Range | -10 to +75 | $^{\circ}\text{C}$ |
| Storage Temperature | -40 to +150 | $^{\circ}\text{C}$ |
| Moisture Sensitivity Level | MSL2 | |
| LNA Input Power (no damage) | 5 | dBm |



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 2011/65/EU (at time of this document revision).

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| Parameter | Specification | | | Unit | Condition |
|---------------------------------|---------------|------|------|---------------|--|
| | Min. | Typ. | Max. | | |
| Compliance | | | | | IEEE802.11b/g/n, FCC CFR 15.247, .205, .209, EN & JDEC. VDD=3.3V, LNA_EN=2.85V, Temp=+25 $^{\circ}\text{C}$, Freq=2.4GHz to 2.5GHz, unless noted otherwise. |
| Operating Frequency | 2.4 | | 2.5 | GHz | |
| LNA Voltage Supply (V_{DD}) | 3.0 | 3.3 | 4.5 | V | |
| LNA Enable Voltage (LNA_En) | 2.70 | 2.85 | 4.5 | V | LNA Enabled |
| | 0 | | 0.2 | V | LNA Off. |
| Switch Control Voltage "HIGH" | 2.4 | | 4.5 | V | |
| Switch Control Voltage "LOW" | | | 0.2 | V | |
| LNA Bypass (LNA_EN) | 2.7 | | 4.5 | V | LNA Bypass Disabled |
| | | | 0.2 | V | LNA Bypass Enabled |
| LNA Current | | | | | |
| LNA V_{DD} | 4.5 | 7 | 14 | mA | LNA in "On" state. |
| | | | 5 | μA | LNA in "Off" state. |
| LNA Enable | | | 1 | mA | LNA Enabled. |
| LNA Bypass | | | 1 | mA | LNA Bypass Mode. |
| Gain, WiFi Rx | 9 | 12 | 14 | dB | WiFi ANT-RX, (LNA_EN High) |
| Bypass Mode | -5.0 | -4.0 | -3.0 | dB | WiFi ANT-RX, (LNA_EN Low) |
| Noise Figure | | | | | VDD > 3.0V, including switch |
| WiFi Rx | | 2.0 | 3.0 | dB | WiFi RX Mode. |
| Bypass Mode | | 4.0 | 5.0 | dB | LNA Bypass. |
| Passband Ripple | -0.2 | | +0.2 | dB | WiFi RX Mode. |
| | -0.2 | | +0.2 | dB | WiFi ANT-BT |
| Output Return Loss | 7.5 | 12 | 20 | dB | LNA ON |
| WiFi Input/Output Impedance | | 50 | | Ω | No external matching. |

| Parameter | Specification | | | Unit | Condition |
|------------------------------------|---------------|------|------|------|--|
| | Min. | Typ. | Max. | | |
| BT and TX Switch Parameters | | | | | |
| Frequency | 2.4 | | 2.5 | GHz | |
| TX Insertion Loss | | 0.6 | 1.0 | dB | ANT-BT, TX-ANT |
| | | 3.8 | 4.0 | dB | C_BT (ANT-BT) and C_RX (ANT-RX) On simultaneously. |
| BT Insertion Loss | | 0.9 | 1.2 | dB | ANT-BT |
| | | 3.8 | 4.0 | dB | C_BT (ANT-BT) and C_RX (ANT-RX) On simultaneously. |
| Passband Ripple | -0.2 | | +0.2 | dB | |
| Input P1dB | | 28 | | dBm | Switch ports only. |
| TX Output Power | 21 | 23 | | dBm | C_TX>3.0V; 1% composite EVM (note 1) |
| Input Return Loss | 9 | 10 | 20 | dB | BT input (pin-1) and TX input (pin-4) |
| Output Return Loss | 9 | 10 | 20 | dB | BT output (pin-9) and TX output (pin-1) |
| Current Consumption | | | 10 | μA | Switch Leakage Current |
| Port Impedance | | | | | All ports. |
| Input | | 50 | | Ω | Receive |
| Output | | 50 | | Ω | Transmit |
| Isolation | 18 | 20 | 28 | dB | TX-BT (ANT to BT port in TX mode); and TX-RX (ANT to RX port in TX mode) |
| Switch Control Voltage | | | | | |
| High | 2.5 | | 4.5 | V | C_TX, C_RX, C_BT |
| Low | | | 0.2 | V | |
| Switch Control Current | | | 20 | μA | Per control line. |
| Switch Control Speed | | 50 | | nsec | |
| ESD Human Body Model (HBM) | 500 | | | V | Class 1B; JESD22-A114 |
| ESD Charge Device Model (CDM) | 650 | | | V | Class III; JESD22-C101 |

Note 1: Assumes system EVM<0.5% for input signal.

Switch Control Logic

| MODE | Switch Controls | | | |
|------------------------------|-----------------|------|------|--------|
| | C BT | C RX | C TX | LNA EN |
| WiFi Receive | LOW | HIGH | LOW | HIGH |
| WiFi Bypass | LOW | HIGH | LOW | LOW |
| Bluetooth® | HIGH | LOW | LOW | LOW |
| WiFi Transmit | LOW | LOW | HIGH | LOW |
| Simultaneous WiFi/BT Receive | HIGH | HIGH | LOW | HIGH |

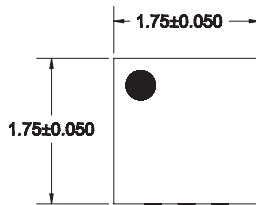
*The FEM can be placed in receive WiFi and Bluetooth® modes simultaneously with increased insertion loss.

| Pin | Function | Description |
|-----|----------|--|
| 1 | ANT | This is a common port (antenna). It is matched at 50Ω. |
| 2 | C_RX | Receive mode control voltage. See switch truth table for proper level. |
| 3 | C_TX | Transmit mode control voltage. See switch truth table for proper level. |
| 4 | TX IN | RF input for the 802.11 b/g PA. Input is matched to 50Ω. |
| 5 | NC | No connect pin. |
| 6 | LNA_EN | This pin enables the LNA. A logic HIGH enables the LNA. |
| 7 | RX_OUT | Receive port for 802.11 b/g band. Internally matched to 50Ω. DC-block provided internally. |
| 8 | VDD | Supply voltage to the LNA. |
| 9 | BT | RF bi-directional ports for Bluetooth™. Input is matched to 50Ω. |
| 10 | C_BT | Bluetooth™ mode control voltage. See switch truth table for proper level. |

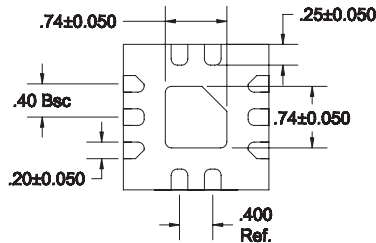
Package Drawing

Top View

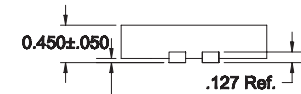
Note: Pads are NiPdAu plated.



TOP VIEW

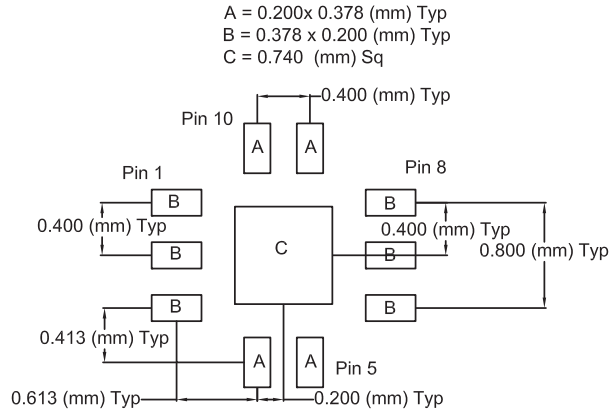


BOTTOM VIEW

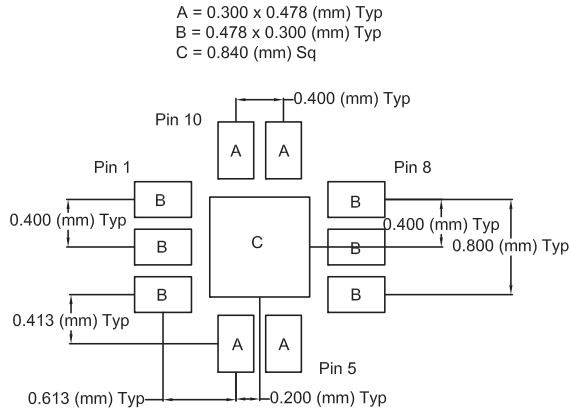


SIDE VIEW

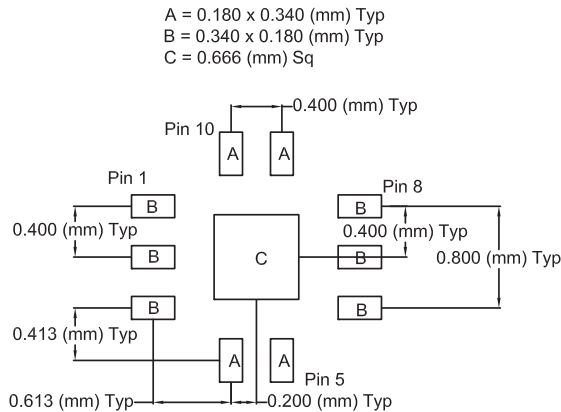
PCB Metal Land Pattern



PCB Solder Mask Pattern

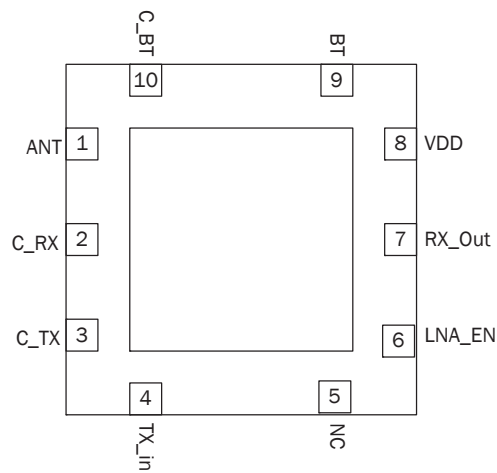


PCB Stencil Pattern

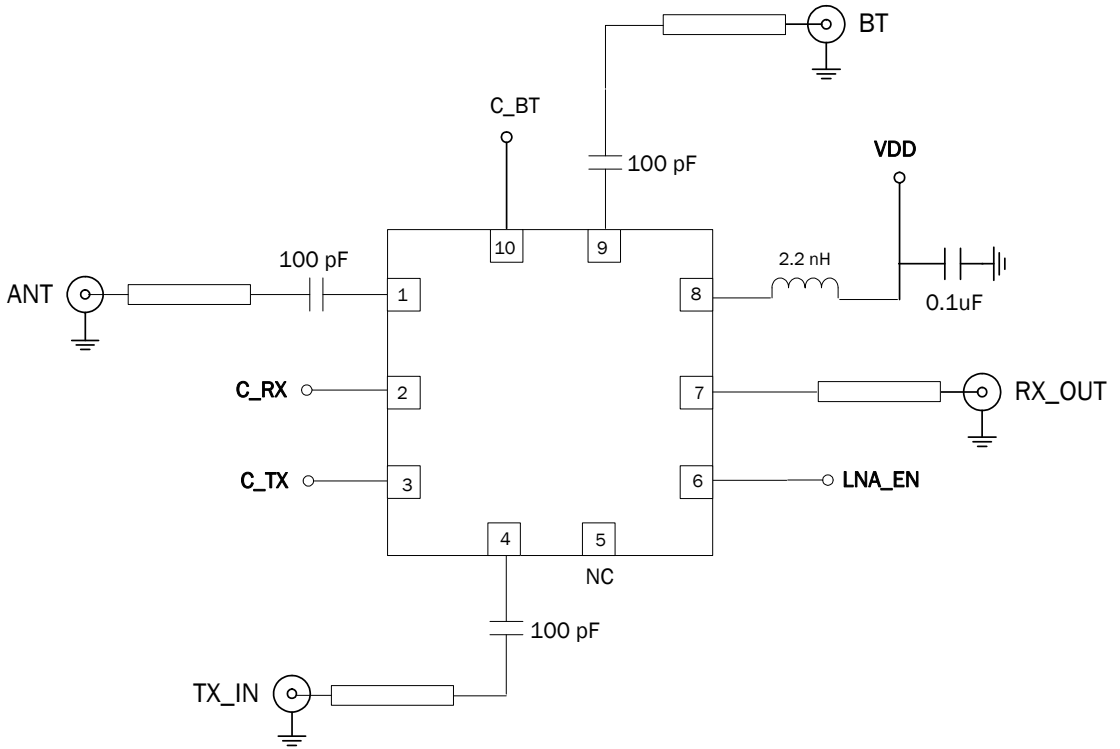


Pin Out

Top View

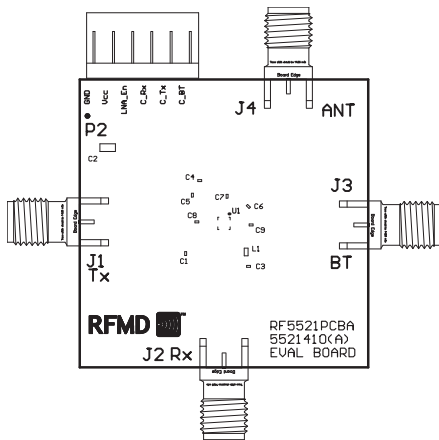


Evaluation Board Schematic

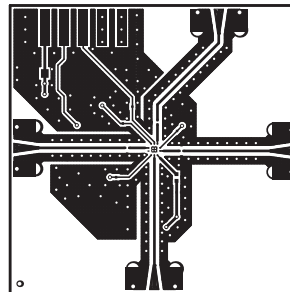


Evaluation Board Layout

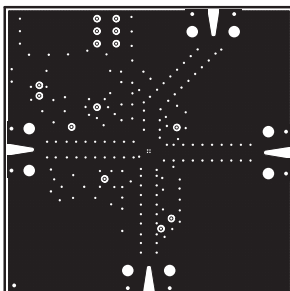
Board size: 1.5" x 1.5", Board thickness: 0.032", Board Material FR-4, Multi-Layer



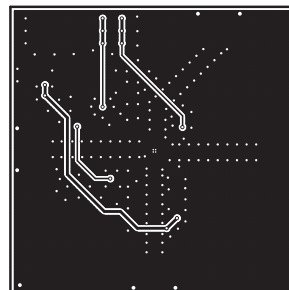
Top Silk



Top Signal

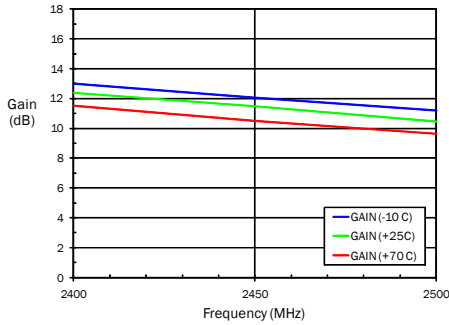


Mid-1

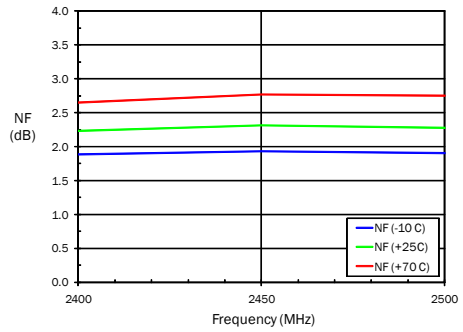


Bottom

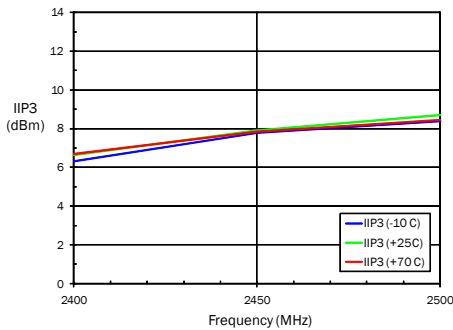
RF5521: GAIN versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, LNA_EN=2.8v, C_RX=2.8v, C_TX=0v, C_BT=0v)



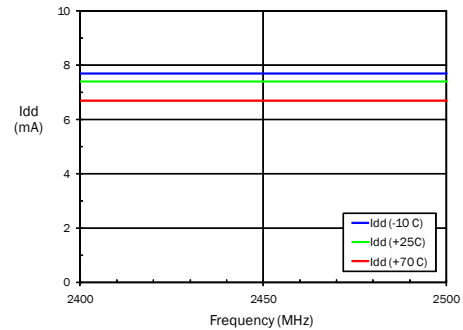
RF5521: NF versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, LNA_EN=2.8v, C_RX=2.8v, C_TX=0v, C_BT=0v)



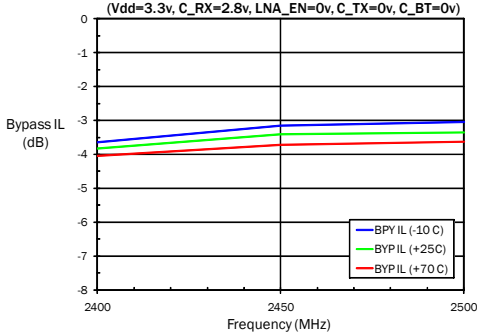
RF5521: INPUT IP3 versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, LNA_EN=2.8v, C_RX=2.8v, C_TX=0v, C_BT=0v)



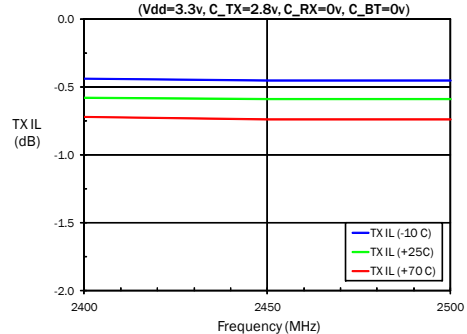
RF5521: CURRENT versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, LNA_EN=2.8v, C_RX=2.8v, C_TX=0v, C_BT=0v)



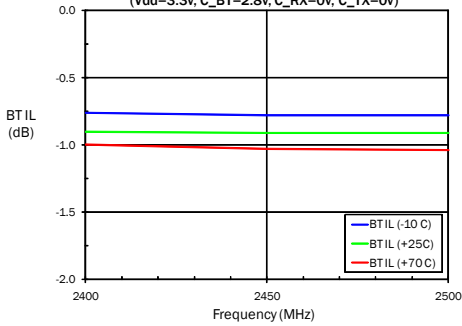
RF5521: BYPASS MODE INSERTION LOSS versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, C_RX=2.8v, LNA_EN=0v, C_TX=0v, C_BT=0v)



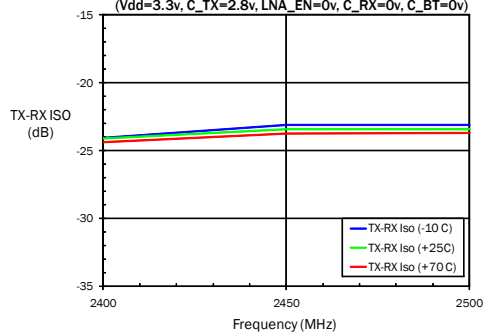
RF5521: TRANSMIT MODE INSERTION LOSS versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, C_TX=2.8v, C_RX=0v, C_BT=0v)



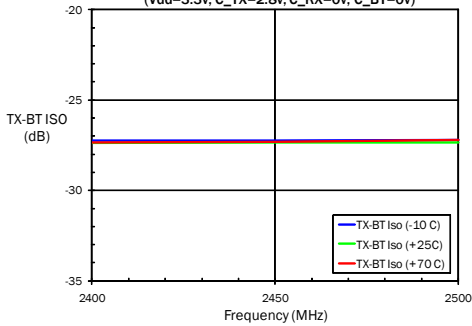
RF5521: BLUETOOTH MODE INSERTION LOSS versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, C_BT=2.8v, C_RX=0v, C_TX=0v)



RF5521: TRANSMIT TO RECEIVE ISOLATION versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, C_TX=2.8v, LNA_EN=0v, C_RX=0v, C_BT=0v)



RF5521: TRANSMIT TO BLUETOOTH ISOLATION versus FREQUENCY and TEMPERATURE
(Vdd=3.3v, C_TX=2.8v, C_RX=0v, C_BT=0v)



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