

3.0 V TO 4.2V, ISM BAND TRANSMIT/RECEIVE MODULE WITH DIVERSITY TRANSFER SWITCH

Package: LGA, 32-pin, 8mm x 8mm x 1.2mm



RF3858

RF3858

RFMD 💷

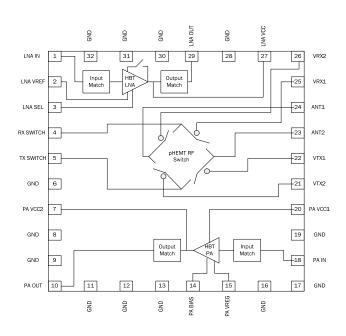
RF3858

Features

- Integrated LNA, PA and Transfer Switch
- Small From Factor 8.0mm x 8.0mm x 1.2mm
- 50 Ω Inputs and Outputs
- Low Insertion Loss, High Isolation Transfer Switch
- 31.5dBm PA Output Power
- Low PA Harmonic Content

Applications

- 868MHz/900MHz ISM Band Application
- Single Chip RF Front End Module
- Portable Battery Powered Equipment
- Wireless Automatic Metering Applications



Functional Block Diagram

Product Description

The RF3858 is a single-chip front-end module (FEM) for applications in the 868MHz/900MHz Band. The RF3858 addresses the need for aggressive size reduction for typical portable equipment RF front-end design and greatly reduces the number of components outside of the core chipset thus minimizing the footprint and assembly cost of the overall solution. The RF 3858 contains an integrated 1 Watt PA, TX/RX transfer switch, LNA with bypass mode, and matching components. The RF3858 is packaged in a 32-pin, 8.0mm x 8.0mm x 1.2mm over molded laminated package with backside ground which greatly minimizes next level board space and allow for simplified integration .

| | Optimum Technology M | latching® Applied | |
|-------------|----------------------|-------------------|-----------|
| 🔀 GaAs HBT | SiGe BiCMOS | 🔀 GaAs pHEMT | 🗌 GaN HEN |
| GaAs MESFET | Si BiCMOS | Si CMOS | RF MEMS |
| 🔲 InGaP HBT | □SiGe HBT | 🗌 Si BJT | |

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Absolute Maximum Ratings

| Parameter | Rating | Unit |
|-------------------------------|-------------|------|
| Overall | | |
| DC Supply Voltage | +5.0 | V |
| Operating Ambient Temperature | -40 to +85 | °C |
| Storage Temperature | -40 to +150 | °C |
| Low Noise Amplifier | | |
| DC Supply Current | 32 | mA |
| Input RF Power | 5 | dBm |
| Power Amplifier | | |
| DC Supply Current | 1200 | mA |
| Input RF Power | 10 | dBm |
| Transmit/Receive Switch | | |
| Input RF Power | 33 | 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 EUDirective 2002/95/EC (at time of this document revision).

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| Dowowotow | Specification | | | 11.21 | | |
|-----------------------------------------------------|---------------|------------|------|----------|--------------------------------------------------------------------------------------------|--|
| Parameter | Min. | Min. Typ. | | Unit | Condition | |
| Low Noise Amplifier | | | | | | |
| Frequency Range | 868 | 902 to 928 | | MHz | | |
| High Gain Mode | | | | | | |
| Gain | 17 | 21 | 23.5 | dB | Over LNA V _{CC} , LNA V _{REF} , Temperature, and Frequency | |
| Noise Figure | | 1.3 | 1.5 | dB | $LNAV_{REF} = LNAV_{CC} = 3.3V$ | |
| Input IP3 | -4.5 | -1 | | dBm | T _{AMB} = +25°C, LNA V _{CC} = 3.3V | |
| Input Gain Compression | -15 | | | dBm | | |
| Input Return Loss | | -8 | -5 | dB | | |
| Output Return Loss | | -8 | -6 | dB | | |
| LNA Operating Current | | | 15 | mA | LNA V _{REF} = LNA V _{CC} = 3.3V | |
| LNA Enable | | | 1 | mA | | |
| Stability, Input VSWR | 10:1 | | | | All phase angles | |
| Output Spurious | | | -70 | dBc | | |
| Low Gain Mode | | | | | Gain Select>1.8V | |
| Gain | -7 | -6 | | dB | | |
| Input IP3 | 15.5 | 17 | | dBm | T _{AMB} = +25 °C, LNA V _{CC} = 3.3V | |
| Current Drain | | 1.5 | 3 | mA | | |
| Power Amplifier | | | | | | |
| Frequency Range | 868 | 902 to 928 | | MHz | | |
| PA V _{CC1} = PA V _{CC2} = PA BIAS | 3.0 | 4.0 | | V | | |
| PA V _{REG} | 2.75 | 2.85 | 2.95 | V | | |
| Pout | | 31.5 | | dBm | Saturated power output | |
| Gain | 27 | 30 | | dB | PA V _{CC1} = PA V _{CC2} = PA BIAS= 4V, | |
| | | | | | over temperature and frequency | |
| Output Harmonic Levels | | | | | | |
| 2 nd | | | -40 | dBc | | |
| 3 rd through 10 th | | | -70 | dBc | PA V_{CC1} = PA V_{CC2} = PA BIAS= 4V, | |
| | | | | | over temperature and frequency | |
| Efficiency | 40 | | | % | 31.5dBm output, PA V _{CC1} = PA V _{CC2} = PA BIAS, 2.85V VREG | |
| Input Return Loss | 9 | | | dB | | |
| Output Spurious | | | -70 | dBc | | |
| Stability | | 10:1 | | | All phase angles | |
| • · · | | 7:1 | | | All phase angles, -40°C | |
| Current | | 0.7 | 1.0 | <u> </u> | | |
| Operating | | 0.7 | 1.0 | A | 31.5dBm output, PA V _{CC1} = PA V _{CC2} = PA BIAS, 2.85V _{VREG} | |
| Bias Only | | | 200 | mA | Idle current, no RF at input | |
| IREG | | 2 | 5 | mA | | |
| Leakage Current | | 0.1 | 0.9 | μA | Over V _{CC} , Frequency, and Temperature | |

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3.0 V TO 4.2V, ISM BAND TRANSMIT/RECEIVE MODULE WITH DIVERSITY TRANSFER SWITCH

| Transmit/receive Switch | | | | | |
|------------------------------------------|-----|------------|-----|------|--------------------------------------------|
| Frequency Range | 868 | 902 to 928 | | MHz | |
| Insertion Loss | | | | | |
| TX to ANT1 or ANT2 | | 0.85 | 1.4 | dB | |
| RX to ANT1 or ANT2 | | .95 | 1.4 | dB | |
| Any Path (1800MHz to 1860MHz) | 2 | | | dB | |
| Any Path (2700MHz to 2790MHz) | 2 | | | dB | |
| Any Path (>3600MHz) | 15 | | | dB | |
| Isolation (All Paths) | 18 | | | dB | |
| Input IP3 | 55 | | | dBm | |
| Thermal Resistance | | 47.8 | | °C/W | 4V Vcc, 2.85V VREG, 31dBm PouT, TREF= 85°C |
| Output Harmonic Levels | | | | | |
| 2 nd | | | -60 | dBc | |
| 3 rd through 10 th | | | -80 | dBc | |
| Input 1dB Gain Compression | 30 | 32 | | dBm | |
| Return Loss (All Ports) | 18 | | | dB | Active ports only |
| Switch Control Logic HIGH | 2.6 | | 3.5 | V | |
| Switch Control Logic LOW | 0 | | 0.2 | V | |
| Switch Control Current | | | 5 | μA | VTX2, VRX1, and VRX2 |
| | | | 40 | μA | VTX1 |
| Transition Time | | | 2 | μs | Settle to 0.25dB of final value |

| Connected Path | RX SW to ANT1 | RX SW to ANT2 | TX SW to ANT1 | TX SW to ANT2 |
|----------------|---------------|---------------|---------------|---------------|
| VRX1 | High | Low | Low | Low |
| VRX2 | Low | High | Low | Low |
| VTX1 | Low | Low | High | Low |
| VTX2 | Low | Low | Low | High |

*Switch Control Logic High=Min 2.6V to Max 3.5V

*Switch Control Logic Low-Min 0.0V to Max 0.2V

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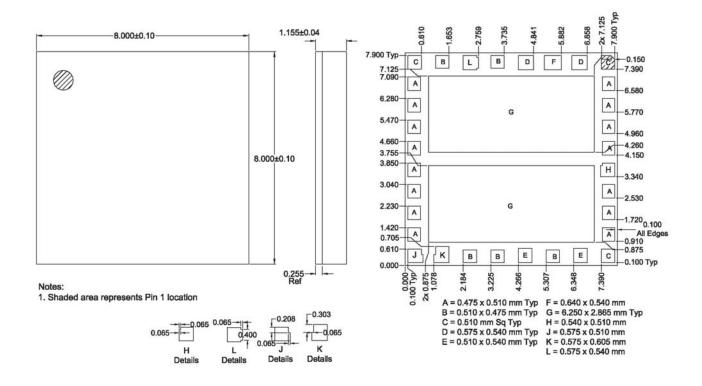
| Pin | Function | Description | | | | | |
|----------|--------------------|-----------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 1 | LNA IN | RF Input to the low noise amplifier, 50 Ω nominal impedance. | | | | | |
| 2 | LNA VREF | Voltage to set the bias level to the LNA, 3.0V nominal, can be used to shut the LNA off or to adjust the quiescent current. | | | | | |
| 3 | LNA SELECT | A logic low selects the high gain mode of the LNA, logic high selects the low gain mode. | | | | | |
| 4 | RX SWITCH INPUT | RF port from the Switch going to the LNA input, 50 Ω nominal impedance. | | | | | |
| 5 | TX SWITCH INPUT | RF port from the Switch going to the PA input, 50 Ω nominal impedance. | | | | | |
| 6 | GND | Ground. | | | | | |
| 7 | PA VCC2 | Voltage supply for the Power Amplifier, nominal voltage is 3.6V. | | | | | |
| 8 | GND | Ground. | | | | | |
| 9 | GND | Ground. | | | | | |
| 10 | PA OUT | RF output from the Power Amplifier, 50 Ω nominal impedance. | | | | | |
| 11 | GND | Ground. | | | | | |
| 12 | GND | Ground. | | | | | |
| 13 | GND | Ground. | | | | | |
| 14 | PA BIAS | Voltage supply for the Power Amplifier bias network, nominal voltage is 3.6V. | | | | | |
| 15 | PA VREG | /oltage to set the bias level of the Power Amplifier, nominal voltage is 2.85V. | | | | | |
| 16 | GND | Ground. | | | | | |
| 17 | GND | Ground. | | | | | |
| 18 | PA IN | RF Input to the Power Amplifier, 50 Ω nominal impedance. | | | | | |
| 19 | GND | Ground. | | | | | |
| 20 | PA VCC1 | Voltage supply for the Power Amplifier, nominal voltage is 3.6V | | | | | |
| 21 | VTX2 | Logic input to the Switch, see Logic Table below. | | | | | |
| 22 | VTX1 | Logic input to the Switch, see Logic Table below. | | | | | |
| 23 | ANT2 | RF port from the Switch going to Antenna 1, 50 Ω nominal impedance. | | | | | |
| 24 | ANT1 | RF port from the Switch going to Antenna 2, 50 Ω nominal impedance. | | | | | |
| 25 | VRX1 | Logic input to the Switch, see Logic Table below. | | | | | |
| 26 | VRX2 | Logic input to the Switch, see Logic Table below. | | | | | |
| 27 | LNA VCC | LNA Collector Voltage, nominal voltage is 3.0V. | | | | | |
| 28 | GND | Ground. | | | | | |
| 29 | LNA OUT | RF Output from the low noise amplifier, 50 Ω nominal impedance. | | | | | |
| 30 | GND | Ground. | | | | | |
| 31 | GND | Ground. | | | | | |
| 32 | GND | Ground. | | | | | |
| Pkg Base | GND | The central metal base of package provides DC and RF GND as well as heat sink for the amplifier. | | | | | |

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Package Drawing

All units in μm. Pin A= 510 x 475 Pin B= 510 x 510 Pin C= 475 x 510

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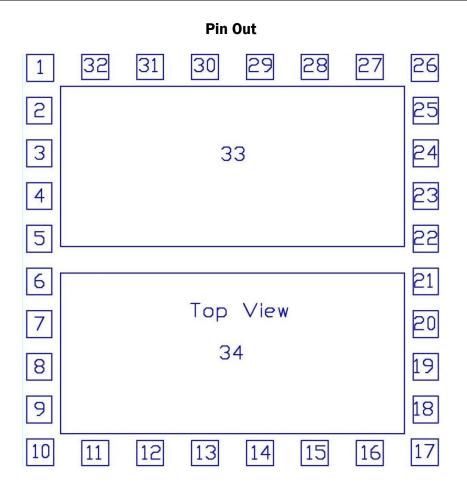


7.950 Typ 2x 7.200 7.900 Typ -6.857 -2x 7.125 0.808 3 784 825 8.907 0.660 .767 BBF 717.1 2.758 3.734 775 7.950 Typ-C D D F в E 8 С 7.900 Typ 7.200 7.340 C D F D В Е в C 7.124 7.140 7 390 A A 7.090 6.530 A A 6.330 6.580 A A 6.280 G 5.720 A A G 5.770 5.520 A A 5.470 A 4.910 A 4.710 -4.960 -4.185 A 3 4,660 4.260 A 3.900 A 3.822 3.850-A 3.290 A -3.340 3.090 A 3.040 A A A -2.480 -2.530 2.280 G G A A 2.230 A A 1.670 -1.720 1.470 A A 1.420 A A 0.860 -0.910 0.660 -0.807 0.610 C С Е B Е в в E c С Ε Е B E в в -0.050 Typ 0.000 Typ--0.100 Typ 0.000 Typ 0.050 Typ7 2x 0.800-2.133 1215 5.256 340 2× 0.875-3.174 3.297 2 83 3.224 4.285 5.306 347 380 8:988] $\begin{array}{l} A=0.675 \ x \ 0.810 \ mm \ Typ \\ B=0.610 \ x \ 0.575 \ mm \ Typ \\ C=0.610 \ mm \ Sq \ Typ \\ D=0.675 \ x \ 0.840 \ mm \ Typ \\ E=0.810 \ x \ 0.840 \ mm \ Typ \\ F=0.740 \ x \ 0.640 \ mm \ G \\ a=6.400 \ x \ 3.015 \ mm \ Typ \\ \end{array}$ F = 0.640 x 0.540 mm G = 6.250 x 2.865 mm Typ POB METAL LAND PATTERN PCB SOLDER MASK PATTERN 2 -4x 7.027 4x 4.877 4x 2.727 -7.874 7 -6.831 -2.726 -3.705 4.749 -5.790 0.584 688 PIN1 7.874 Typ-В В C D E C F D 3x 7.058 7.416 7.064 A A 6.606 G G G 6 254 -3x 5.852 M A 3x 5.534 -5.796 5.444 A Α G G G 4 986 4.634 -3x 4.328 R A 4.176 3.824-3x 3.680-A A -3.365 G G G 3.014-A A 3x 2.156-2.556 2.204 -3x 2.474 A A 1.746 G G G 1.394 3x 0.950 0.935 A 0.584 С C E E В Е B в -0.126 Typ 0.000 Typ-0.000 Typ-0.126 Typ-4x 0.972-4x 3.122-4x 5.273-1.168 2.209 3.250-1.291 5.331 3.373 7.418 A = 0.428 x 0.459 mm Tvp A = 0.425 x 0.459 mm Typ B = 0.459 x 0.428 mm Typ C = 0.459 mm Sq Typ D = 0.518 x 0.486 mm Typ E = 0.459 x 0.486 mm Typ F = 0.576 x 0.486 m G = 1.755 x 1.206 mm Typ PCB STENCIL PATTERN

Thermal vias for center slug "G" should be incorporated into the PCB design. The number and size of thermal vias will depend on the application. Example of the number and size of vias can be found on the RFMD Evaluation board layout.

PCB Patterns

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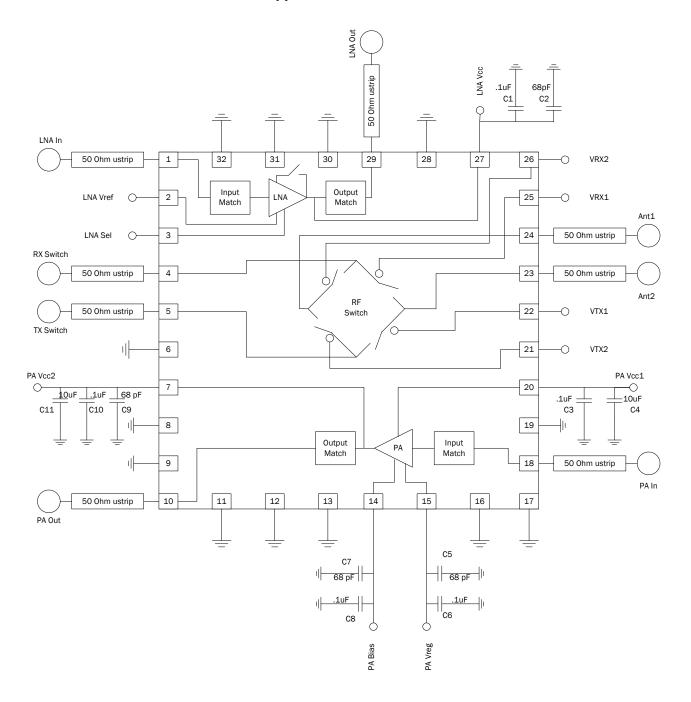
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Application Schematic





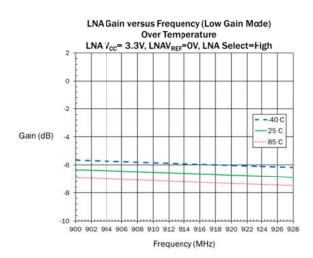
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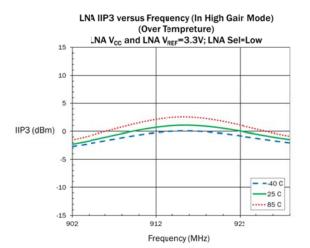
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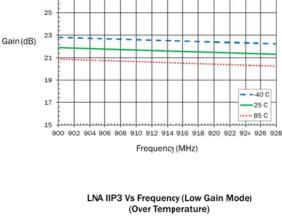
LNA Gain versus Frequency (High Gain Mode)

Over Temperature

LNA V_{cc} and LNA V_{REF}=3.3V; LNA Sel=Low

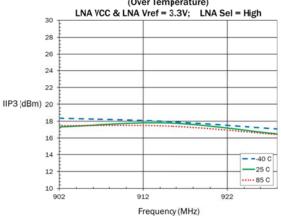


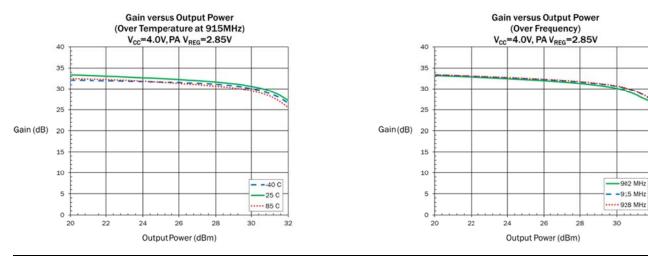




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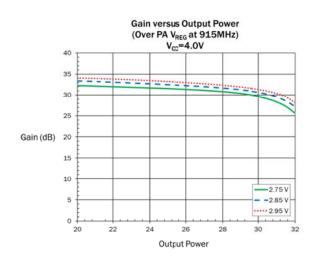
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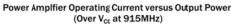
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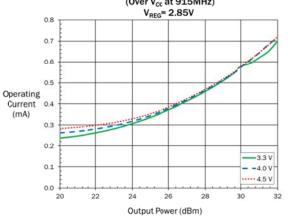


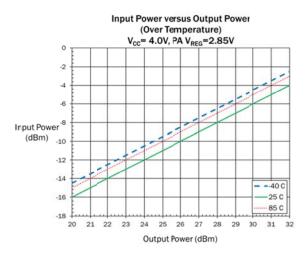
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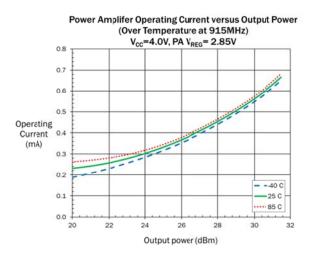
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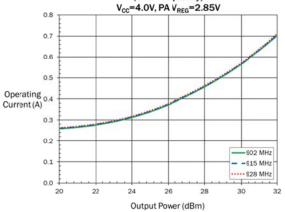


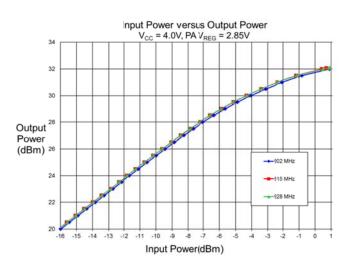






Power Amplfier Operating Current versus Output Power (Over Frequency)





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Ordering Information

| Ordering Code | Description |
|---------------|------------------------------------------------------------|
| RF3858 | Standard 25 piece bag |
| RF3858SR | Standard 100 piece reel |
| RF3858TR13 | Standard 25 piece reel |
| RF3858PCK-410 | Fully Assembled Evaluation board and 5 loose sample pieces |

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