# WMA1R0C

## 1.0T LOW NOISE PRE-AMPLIFIER

**REV C**
**August 2022**

## Key Features

- For 50 Ohm Source Impedance
- 1.0T Frequency of 42.5 MHz
- 1.5 Ohm Input Impedance
- 0.45 dB Noise Figure
- 30.0 dBm Max $P_{IN}$
- 23.0 dBm Output $IP_3$
- 28.0 dB Gain
- 10.0 dBm $P_{1dB}$
- 1.22:1 Output VSWR
- Unconditional Stable, *k*>1
- Single Power Supply
- Non Magnetic

## Product Description

CAUTION: ELECTROSTATIC DISCHARGE SENSITIVE

With its low input impedance, WMA1R0C is designed for 50 Ohm source impedance multi-channel coil applications. The pre-amp maintains excellent noise figure performance over source impedance variation that either comes from the different loads to the coils or not ideal design implementation of the coils. Moreover, the pre-amp allows higher source impedance design to increase the blocking impedance while maintaining superior SNR due to large equal noise circles. The amplifier has 0.50" x 0.40" x 0.10" surface mount package.

## Applications

- Magnetic Resonance Imaging
- RF Measurement
- Medical
- Current Sensor

## Specifications

Summary of the key electrical specifications at room temperature

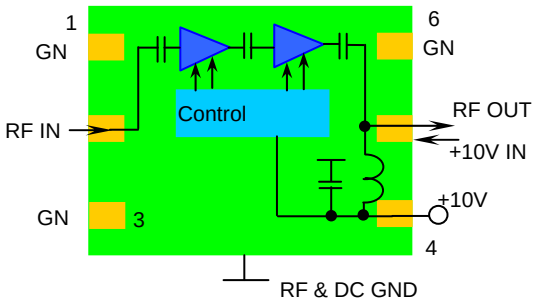
| Index | Testing Item | Symbol | Test Constraints | Min | Nom | Max | Unit |
|---|---|---|---|---|---|---|---|
| 1 | Gain | $S_{21}$ | 42.5 MHz | 27.5 | 28.0 | 28.5 | dB |
| 2 | Gain Variation | ΔG | 42.5 MHz +/- 1 MHz | | +/-0.05 | +/- 0.1 | dB |
| 3 | Input Impedance | RE [Zin] | 42.5 MHz, with 80050 test fixture | 1.2 | 1.5 | 2.0 | Ohm |
| | | IM [Zin] | 42.5 MHz, with 80050 test fixture | -2.0 | 0 | 2.0 | Ohm |
| 4 | Output VSWR, 50 Ohm Impedance | $SWR_2$ | 42.5 MHz | | | 1.22:1 | Ratio |
| 5 | Reverse Isolation | $S_{12}$ | 42.5 MHz | 60 | 70 | | dB |
| 6 | Noise Figure | NF | 42.5 MHz, $Z_s$ = 50 Ohm | | 0.48 | 0.60 | dB |
| 7 | Output Power 1dB Compression Point | $P_{1dB}$ | 42.5 MHz | 8 | 10 | | dBm |
| 8 | Output-Third-Order Interception Point | $IP_3$ | Two-Tone, $P_{out}$ = 0 dBm each, 1 MHz separation | 20 | 23 | | dBm |
| 9 | Current Consumption | $I_{dd}$ | $V_{dd}$= +10.0 V | | 18 | | mA |
| 10 | Power Supply Operating Voltage | $V_{dd}$ | | +7 | +10 | +12 | V |
| 11 | Thermal Resistance | $R_{th,c}$ | Junction to case | | | 220 | °C/W |
| 12 | Operating Temperature | $T_o$ | | +10 | | +60 | °C |
| 13 | Maximum RF Input Power | $P_{IN, MAX}$ | DC – 6.0 GHz, 10% Duty Cycle, | | | 30 | dBm |
| 14 | Saturate Recover Time | $t_{sr}$ | 10% to 90% from 20 dBm Pin, $Z_s$ = 50 Ohm | | 4 | 8 | uS |
| 15 | ESD Protection, None Contact | $V_{ESDN}$ | RF Input and Output Ports | | | 16 | kV |
| 16 | ESD Protection, Direct Contact | $V_{ESD}$ | RF Input and Output Ports | | | 6 | kV |

## Absolute Maximum Ratings

| Parameters | Units | Ratings |
|---|---|---|
| DC Power Supply Voltage | V | 12.0 |
| Drain Current | mA | 30 |
| Total Power Dissipation | mW | 350 |
| RF Input Power, 10% Duty Cycle | dBm | 30 |
| Junction Temperature | °C | 150 |
| Storage Temperature | °C | -65 ~ 150 |
| Operating Temperature | °C | 0 ~ +70 |
| Thermal Resistance[1] | °C/W | 220 |

Operation of this device beyond any one of these parameters may cause permanent damage.

## Functional Block Diagram




[1] The last stage transistor dominates the heat dissipation. The drain bias voltage is +3.5V and the drain current is 10.0 mA. The total power dissipation of the last stage transistor is thus 35 mW. The junction temperature arise 0.035 x 220 = 7.7 (°C).

Specifications and information are subject to change without notice.



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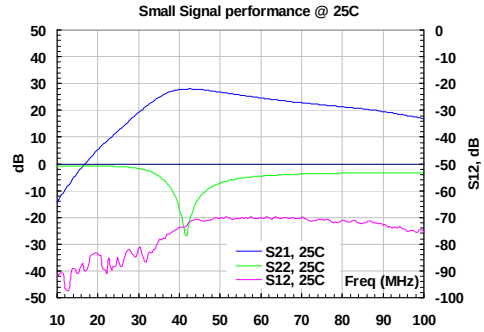
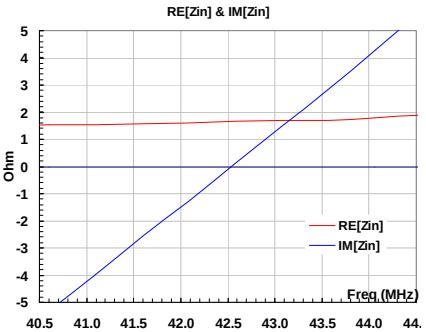
## Ordering Information

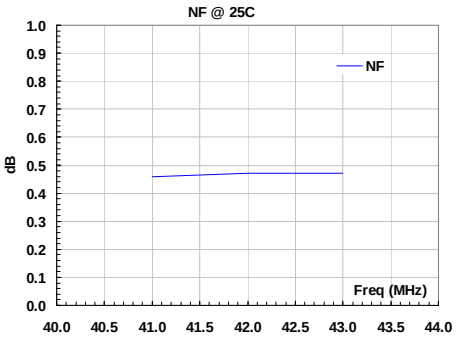
| Model Number | WMA1R0C |
|---|---|

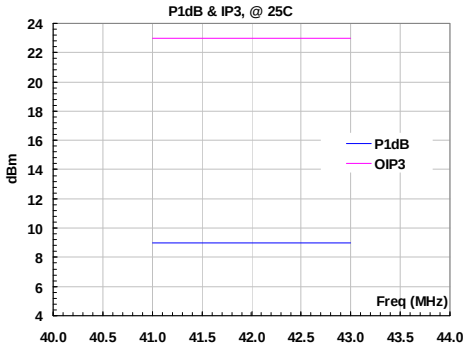
ESD pack is used for the packing. Contact factory for tape and reel packing option for higher volume order.

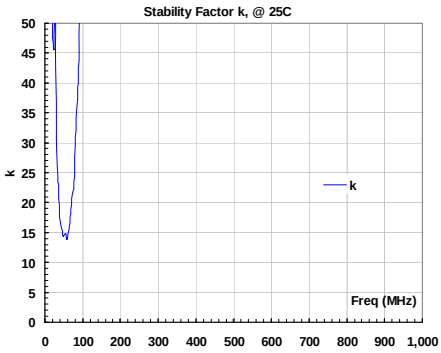
## Typical Data



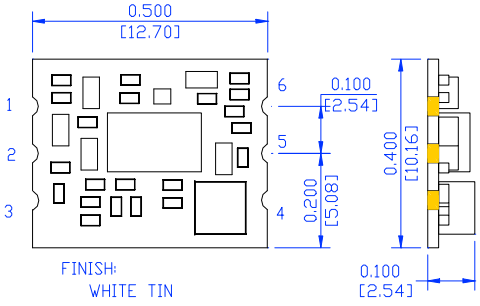



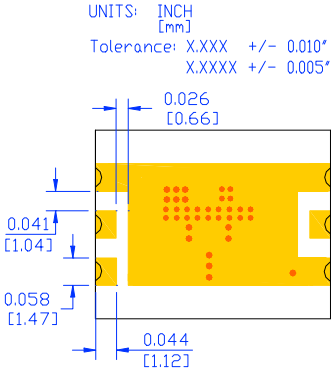



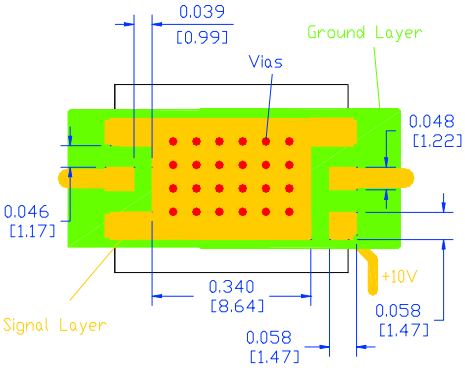

## Outline

| PIN | 1 | 2 | 3 | 4 | 5 | 6 | CNTR |
|---|---|---|---|---|---|---|---|
| FCTN | GND | IN | GND | NC/10V | OUT/10V | GND | GND |




## Foot Print/Mounting Layout







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## Application Notes:

### A. Motherboard Layout

The recommended motherboard layout is shown in diagram of **Foot Print/Mounting Layout**. Sufficient numbers of ground vias on center ground pad are essential for the RF grounding. The width of the 50-Ohm microstrip lines at the input and output RF ports may be different for different property of the substrate. The ground plane on the backside of the substrate is needed to connect the center ground pad through the vias. The ground plane is also essential for the 50-Ohm microstrip line launches at the input and output ports.

The +10V DC voltage is applied at Pin 4 or at the output Pin 5. There is a built-in bias-T at the output port to separate the RF output signal and input +10V DC power supply.

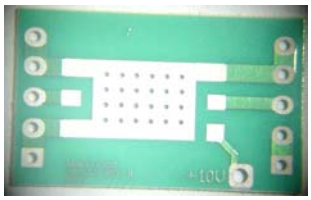

**Fig. 1** Example of the motherboard

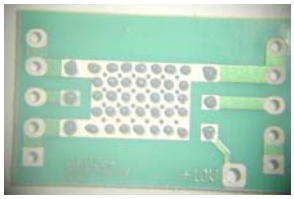

**Fig. 2** Dispensed solder paste

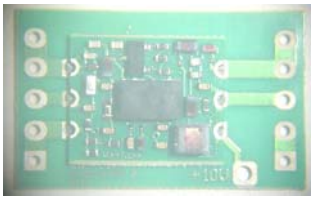

**Fig. 3** Assembled

### B. Assembly

The regular low temperature and none clean solder paste such as SN63 is recommended. The high temperature solder has been used internally for the WHM series amplifier assembly. The melting temperature point of the high temperature solder is around 217 ~ 220 $^{0}$C. Thus, melting temperature of the solder paste should be below 217 $^{0}$C for assembling WHM series amplifier on the test board to reduce the possible damage. The temperature melting point of the SN63 solder paste is around 183 $^{0}$C and is suitable for the assembly purpose.

The SN63 solder paste can be dispensed by a needle manually or driven by a compressed air. **Figure 2** shows the example of the dispensed solder paste pattern. Each solder paste dot is in the diameter of 0.005” ~ 0.010” (0.125 ~ 0.250 mm).

For volume assembly, a stencil with 0.006” (0.15 mm) is recommended to print the solder paste on the circuit board.

For more detail assembly process, refer to AN-109 at www.wantcominc.com website.

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