

### Key Features



- For 50 Ohm Source Impedance
- 7T Frequency of 298 MHz
- 1.5 Ohm Input Impedance
- 0.40 dB Noise Figure
- 30.0 dBm Max  $P_{IN}$
- 20.0 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

With its low input impedance, WMA7RA 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 0.60" x 0.40" x 0.10" surface mount package.

Other frequencies and impedance available!



### Applications

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



### Specifications

Summary of the key electrical specifications at room temperature, tested in the WanTcom fixture, 80051.

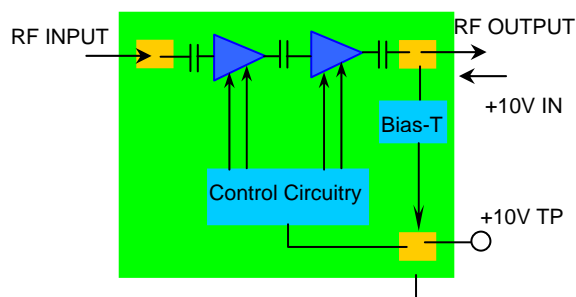
| Index | Testing Item                          | Symbol          | Test Constraints                                   | Min  | Nom     | Max     | Unit          |
|-------|---------------------------------------|-----------------|--|------|---------|---------|---------------|
| 1     | Gain                                  | $S_{21}$        | 298 MHz  | 27.5 | 28.0    | 28.5    | dB            |
| 2     | Gain Variation                        | $\Delta G$      | 298 +/- 1 MHz                                      |      | +/-0.05 | +/- 0.1 | dB            |
| 3     | Input Impedance                       | RE [ $Z_{in}$ ] | 298 MHz  |      | 1.5     | 2.0     | Ohm           |
|       |                                       | IM [ $Z_{in}$ ] | 298 MHz  | -2.0 | 0       | 2.0     | Ohm           |
| 4     | Output VSWR, 50 Ohm Impedance         | $SWR_2$         | 298 MHz  |      |         | 1.22:1  | Ratio         |
| 5     | Reverse Isolation                     | $S_{12}$        | 298 MHz  | 60   | 70      |         | dB            |
| 6     | Noise Figure                          | NF              | 298 MHz, $Z_s = 50$ Ohm                            |      | 0.40    | 0.50    | dB            |
| 7     | Output Power 1dB Compression Point    | $P_{1dB}$       | 298 MHz  | 8    | 10      |         | dBm           |
| 8     | Output-Third-Order Interception Point | $IP_3$          | Two-Tone, $P_{out} = 0$ dBm each, 1 MHz separation | 16   | 20      |         | dBm           |
| 9     | Current Consumption                   | $I_{dd}$        | $V_{dd} = +10.0$ V                                 |      | 18      |         | mA            |
| 10    | Power Supply Operating Voltage        | $V_{dd}$        |  | +7   | +10     | +11     | V             |
| 11    | Thermal Resistance                    | $R_{th,c}$      | Junction to case                                   |      |         | 215     | $^{\circ}C/W$ |
| 12    | Operating Temperature                 | $T_o$           |  | +10  |         | +60     | $^{\circ}C$   |
| 13    | Maximum RF Input Power                | $P_{IN,MAX}$    | DC - 6.0 GHz, 10% Duty Cycle, $Z_s = 50$ Ohm       |      |         | 30      | dBm           |
| 14    | Saturate Recover Time                 | $t_{sr}$        | 10% to 90% from 20 dBm Pin, $Z_s = 50$ Ohm         |      | 4       | 8       | $\mu s$       |
| 15    | ESD Protection, None Contact          | $V_{ESDN}$      | Output Port  |      |         | 16      | kV            |
| 16    | ESD Protection, Direct Contact        | $V_{ESD}$       | Output Port  |      |         | 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            | $^{\circ}C$   | 150       |
| Storage Temperature             | $^{\circ}C$   | -65 ~ 150 |
| Operating Temperature           | $^{\circ}C$   | 0 ~ +70   |
| Thermal Resistance <sup>1</sup> | $^{\circ}C/W$ | 215       |

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

### Functional Block Diagram



<sup>1</sup> The last stage transistor dominates the heat dissipation. The drain bias voltage is +6V and the drain current is 15.0 mA. The total power dissipation of the last stage transistor is thus 90 mW. The junction temperature rise  $0.09 \times 215 = 19$  ( $^{\circ}C$ ).

Specifications and information are subject to change without notice.

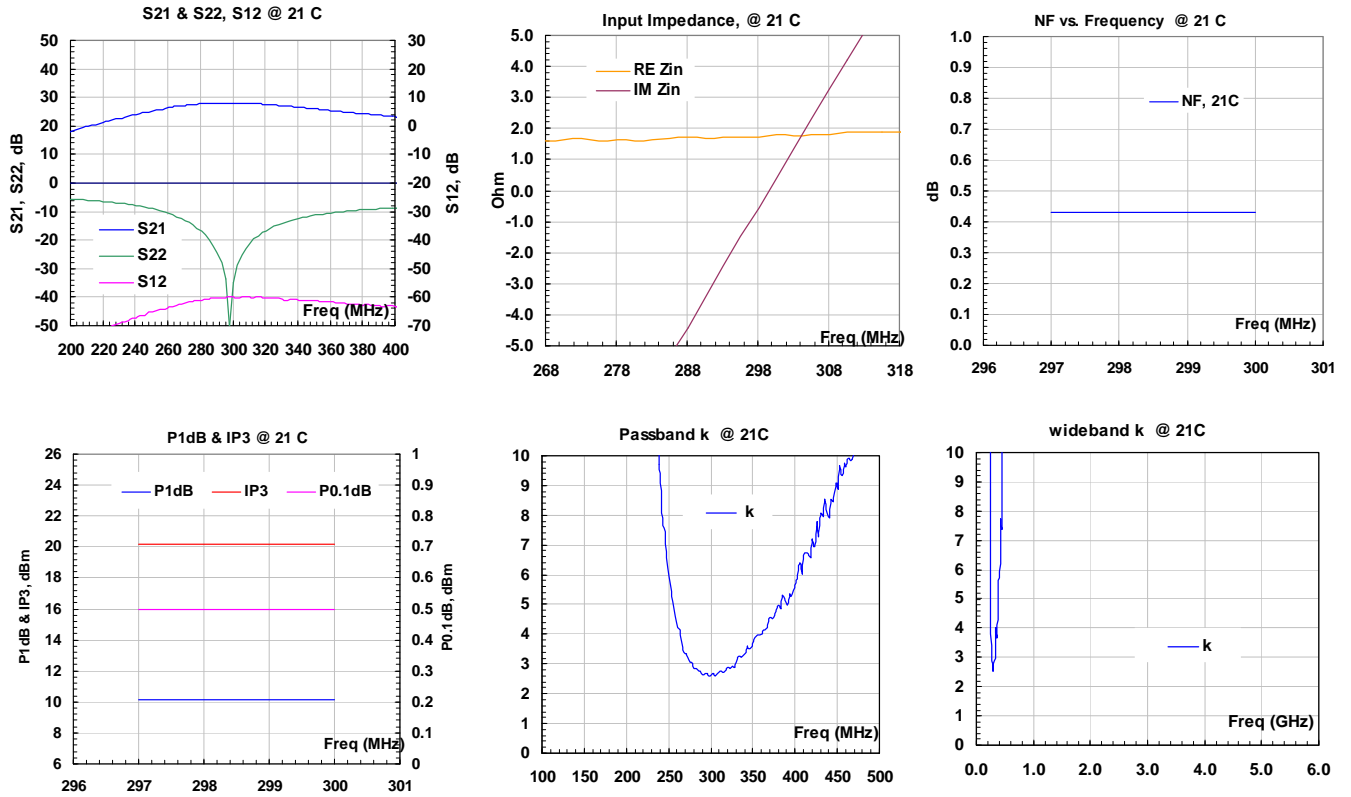


## Ordering Information

|              |        |
|--------------|--------|
| Model Number | WMA7RA |
|--------------|--------|

Waffle shell is used for the packing. Contact factory for tape and reel packing option for higher volume order.

## Typical Data



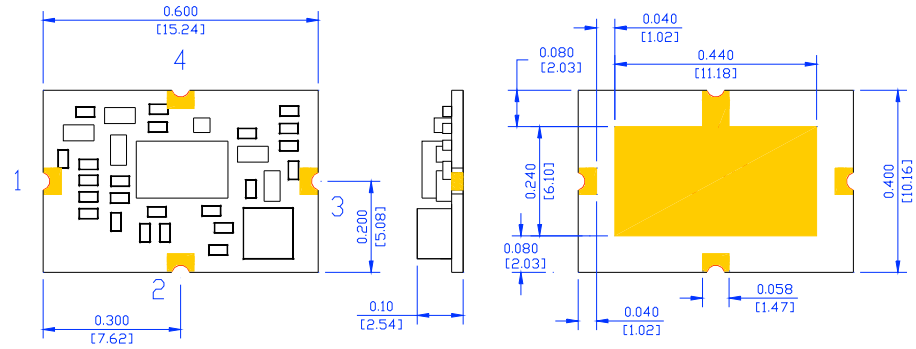
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**Outline,**

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

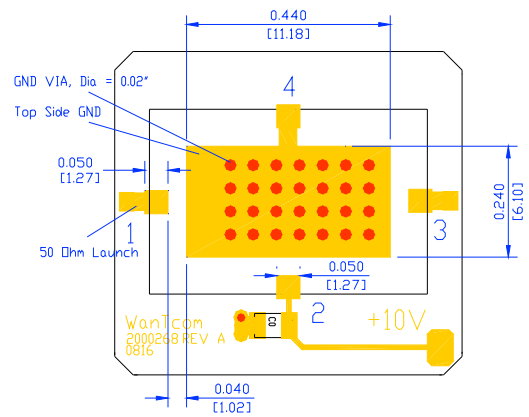
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[mm]  
FINISH: WHITE TIN



**Foot Print/Mounting Layout**

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

UNITS: INCH  
[mm]  
FINISH: WHITE TIN



## Application Notes:

### A. Motherboard Layout

The recommended motherboard layout is shown in the diagram of [Foot Print/Mounting Layout](#). Sufficient quantities 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.

In order to have stable pre-amp in the coil system, the minimum system isolation of 55 dB between the input and output soldering pads for the preamp with all the components including the coils on the feed board is required. Poor system isolation can introduce external feedback either in pass band or off band and cause the pre-amp parasitic oscillation. Measure the  $S_{12}$  or  $S_{21}$  between the input and output pads without the installation of the pre-amp is essential to insure the stable preamp operation.

The +10V DC voltage can be applied at Pin 2 or at the output Pin 3. There is a built-in bias-T at the output port to separate the RF output signal and the input +10V DC power supply. Pin 2 and Pin 3 are DC connected internally.

No DC block capacitor is required at input port.

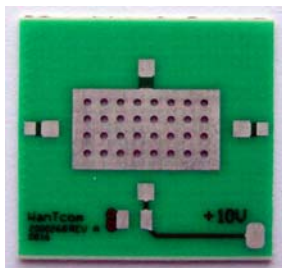


Fig. 1 Example of the test board

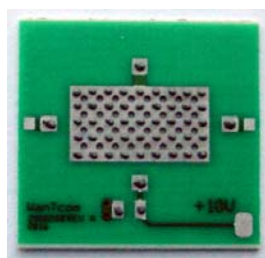


Fig. 2 Dispensed solder paste

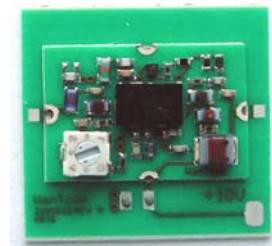


Fig. 3 Assembled preamp

### B. Assembly

The high temperature solder is used internally center chip assembly. The melting temperature point of the high temperature solder is around 240 °C. Thus, melting temperature of the solder paste should be way below 240 °C for assembling the pre-amp on the test board or feed board.

For high reliability product, Lead SN63/Pb63 solder paste, which melting temperature point being around 183 °C, is recommended for the assembly purpose.

For RoHS requirement, Bismuth based Lead free solder paste such as 60Sn/40Bi is suitable for the assembly.

**Warning: regular SAC305 RoHS reflow process will damage the pre-amp!**

The 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](http://www.wantcominc.com) website.

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