# WHM0110N

## 0.9- 1.3 GHz LOW NOISE WIDE BAND AMPLIFIER

**REV C**
**February 2017**

## Key Features

- 0.9 ~ 1.3 GHz
- **0.50 dB** Noise Figure
- 30.0 dBm Output $IP_3$
- 18.0 dB Gain
- +/-1.0 dB Gain Flatness
- 15.0 dBm $P_{1dB}$
- 1.35:1 VSWR Fully Matched
- Single Power Supply
- >300 Years MTBF
- RoHS Compliant
- MSL-1 Moisture Sensitivity Level

## Product Description

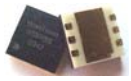
CAUTION: ELECTROSTATIC DISCHARGE SENSITIVE

WHM0110N is integrated with WanTcom proprietary low noise amplifier technologies, high frequency micro electronic assembly techniques, and high reliability designs to realize optimum low noise figure, wideband, and high performances together. With single +5.0V DC operation, the amplifier has optimal input and output matching in the specified frequency range at 50-Ohm impedance system. The amplifier has standard WHM-1 surface mount package.

The amplifier is designed to meet the rugged standard of MIL-STD-883g.

## Applications

- GPS
- Avionics
- Defense
- Security System
- Measurement
- Fixed Wireless



## Specifications

Summary of the key electrical specifications at room temperature

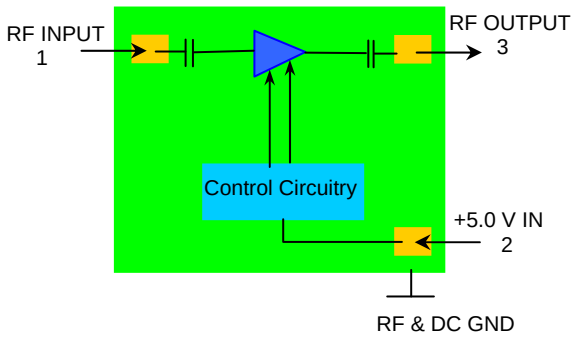
| Index | Testing Item | Symbol | Test Constraints | Min | Nom | Max | Unit |
|---|---|---|---|---|---|---|---|
| 1 | Gain | $S_{21}$ | 0.9 – 1.3 GHz | | **18** | **20** | dB |
| 2 | Gain Variation | $\Delta G$ | Every 100 MHz | | +/-0.25 | | dB |
| 3 | Input VSWR | $SWR_1$ | 0.9 – 1.3 GHz | | 1.35:1 | 1.5:1 | Ratio |
| 4 | Output VSWR | $SWR_2$ | 0.9 – 1.3 GHz | | 1.35:1 | 1.5:1 | Ratio |
| 5 | Reverse Isolation | $S_{12}$ | 0.9 – 1.3 GHz | 20 | 22 | | dB |
| 6 | Noise Figure | NF | 0.9 – 1.3 GHz | | **0.5** | **0.6** | dB |
| 7 | Output Power 1dB Compression Point | $P_{1dB}$ | 0.9 – 1.3 GHz | 13 | 15 | | dBm |
| 8 | Output-Third-Order Interception Point | $IP_3$ | Two-Tone, $P_{out}$ = 0 dBm each, 1 MHz separation | 26 | 30 | | dBm |
| 9 | Current Consumption | $I_{dd}$ | $V_{dd}$= +5.0 V | 40 | 50 | | mA |
| 10 | Power Supply Operating Voltage | $V_{dd}$ | | +4.5 | +5 | +5.5 | V |
| 11 | Thermal Resistance | $R_{th,c}$ | Junction to case | | | 215 | °C/W |
| 12 | Operating Temperature | $T_o$ | | -55 | | +100 | °C |
| 13 | Maximum Input CW RF Power | $P_{IN, MAX}$ | DC – 6.0 GHz | | | 10 | dBm |

## Absolute Maximum Ratings

| Parameters | Units | Ratings |
|---|---|---|
| DC Power Supply Voltage | V | 7.0 |
| Drain Current | mA | 80 |
| Total Power Dissipation | mW | 400 |
| Input CW RF Power | dBm | 10 |
| Channel Temperature | °C | 150 |
| Storage Temperature | °C | -65 ~ 150 |
| Operating Temperature | °C | -55 ~ +100 |
| Thermal Resistance | °C/W | 215 |

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

## Functional Block Diagram




## Ordering Information

| Model Number | WHM0110N |
|---|---|

Waffle pack with the capacity of 100 pieces (10 x 10) is used for the packing. Contact factory for tape and reel packing option for higher volume order.

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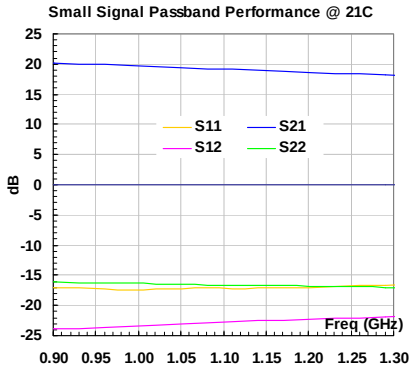
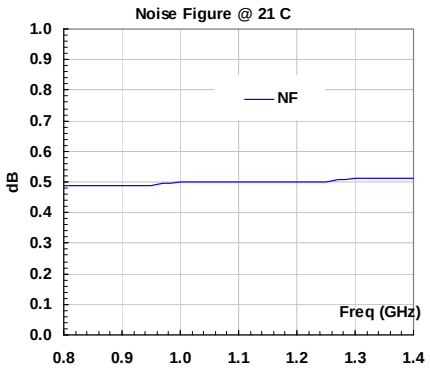
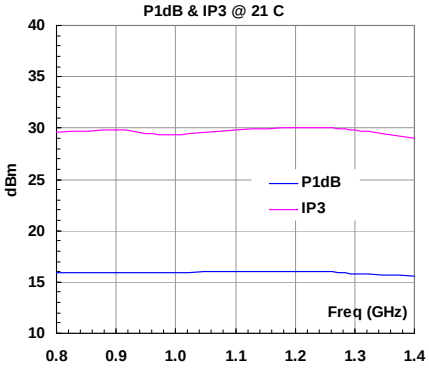
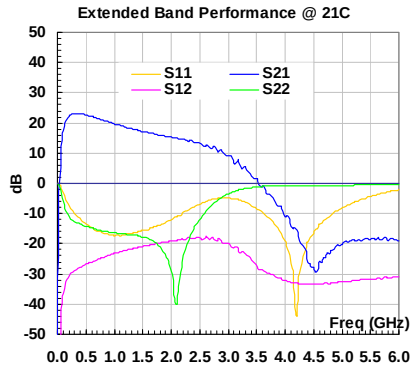
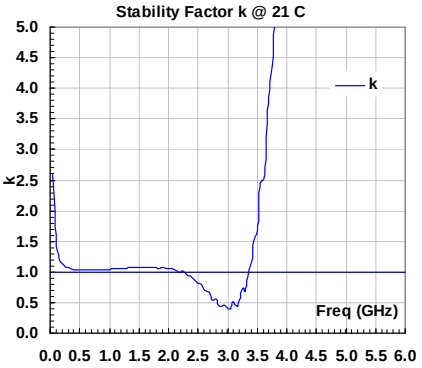
## Typical Data



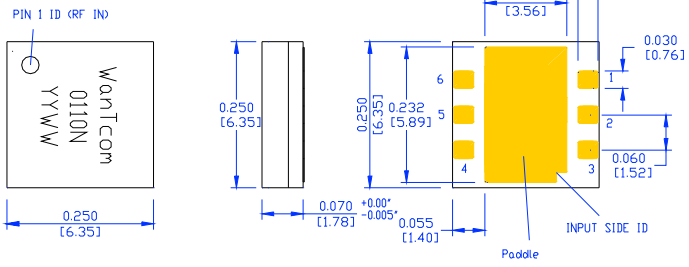



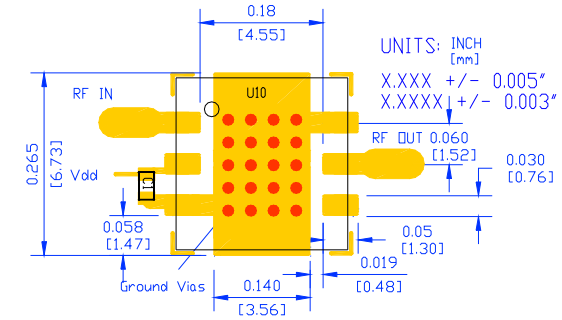




## Outline, WHM-1

| PIN | 1 | 2 | 3 | 4 | 5 | 6 | Paddle |
|---|---|---|---|---|---|---|---|
| FUNCTION | RF IN | +5V IN | NC | +5V OPT | RF OUT | NC | GND |




## Foot Print/Motherboard Layout




NOTE:

1. THE BACKSIDE NEEDS TO BE METAL GROUND LAYER
2. GROUND VIA DIAMETER IS 0.024" (0.61 mm);
3. C1 IS 0.01 UF OR LARGER VALUE CAPACITOR
4. MATERIAL: FR-4, 4000-13, or RO4003, etc.
5. USE PROPER WIDTH FOR 50-OHM LINES FOR OTHER PCB MATERIAL

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## Application Notes:

### A. Motherboard Layout

The similar motherboard layout example is shown in **Fig. 1**. 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 +5.0V DC voltage is applied at Pin 2. For +5.0V line trace length being longer than 6 inches without a decoupling capacitor, a 0.01 uF de-coupling capacitor, $C_1$, with minimum rating voltage of 10V is needed across the +5.0V pin to ground. The capacitor must be rated in the temperature range of -55 $^0$C to 100 $^0$C to ensure the entire circuit work in the specified temperature range.

No DC block capacitor is required at input and output RF ports. The NC pins connected to ground are recommended.

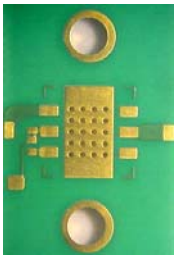

**Fig. 1** Motherboard foot print

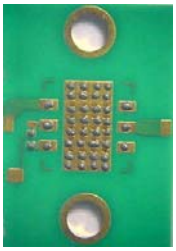

**Fig. 2** Dispensed solder paste

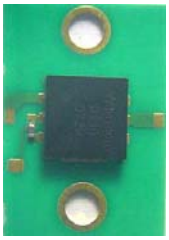

**Fig. 3** Assembled part

### B. Assembly

The regular low temperature and none clean solder paste such as SN63/Pb37 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 240 $^0$C. Thus, melting temperature of the solder paste should be below 220 $^0$C for assembling WHM series amplifier on the test board to reduce the possible damage. The temperature melting point of the SN63/Pb37 solder paste is around 183 $^0$C and is suitable for the assembly purpose.

For RoHS purpose, low temperature RoHS compliant Bismuth based solder paste such as SN60Bi40 is required. Regular RoHS solder paste SAC 305 will cause the LNA chip damaged permanently.

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

For volume assembly, a stencil with 0.004" (0.10 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.

### C. Electrical Testing and Fine Tuning

The amplifier is designed to be fully matched at the input and output ports. Any tuning is not needed. However, when connecting the assembled amplifier to a device such as a SMA connector or a filter, the connecting point or joint point could affect mainly the return loss at the port due to the non-ideal 50-Ohm impedance of the device. By varying the connection feature size such as the solder amount to get the optimum return loss or best matching result at the interface. This fine-tuning has little effect on the other performance such as gain, noise figure, $P_{1dB}$, or $IP_3$.

During the fine-tuning process, a vector network analyzer can be used to monitoring the return loss at the port while varying the feature size of the joint point. Varying the connection feature size until the optimum return loss is achieved.

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