



WHM0020AE

20 - 1700 MHz LOW NOISE WIDE BAND AMPLIFIER

REV C
February 2018

Key Features



- 20 – 1700 MHz
- 0.65 dB Noise Figure
- 32.0 dBm Output IP₃
- 17.0 ~ 22.0 dB Gain
- 19.0 dBm P_{1dB}
- 1.45:1 VSWR Fully Matched
- Single Power Supply
- RoHS Compliant
- MSL-1 Moisture Sensitivity Level

Product Description

WHM0020AE is integrated with WanTcom proprietary low noise amplifier technologies, high frequency microelectronics assembly techniques, and high reliability designs to realize optimum low noise figure, wideband, and high performances together. With single +3.3V DC low power operation, the amplifier has optimal input and output matching in the specified frequency range at 50-Ohm impedance system. The amplifier has standard 0.35" x 0.25" x 0.08" surface mount package.

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

CAUTION:



ELECTROSTATIC DISCHARGE SENSITIVE

Applications

- Mobile Infrastructures
- WiMAX
- C-Band
- Defense
- Security System
- Measurement
- Fixed Wireless



Specifications

Summary of the key electrical specifications at room temperature

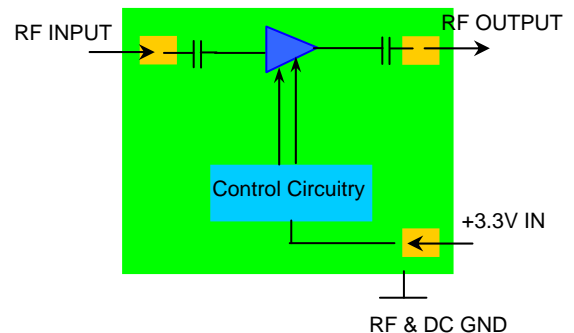
Index	Testing Item	Symbol	Test Constraints	Min	Nom	Max	Unit
1	Gain	S ₂₁	20 – 1700 MHz	16		23	dB
2	Gain Variation	ΔG	Every 100 MHz			+/- 0.25	dB
3	Input VSWR	SWR ₁	20 – 1700 MHz		1.45:1	1.7:1	Ratio
4	Output VSWR	SWR ₂	20 – 1700 MHz		1.45:1	1.5:1	Ratio
5	Reverse Isolation	S ₁₂	20 – 1700 MHz	20			dB
6	Noise Figure	NF	100 – 1700 MHz		0.65	0.85	dB
			20 – 100 MHz			1.5	
7	Output Power 1dB Compression Point	P _{1dB}	20 – 1700 MHz	17	19		dBm
8	Output-Third-Order Interception Point	IP ₃	Two-Tone, P _{out} = 0 dBm each, 1 MHz separation	30	32		dBm
9	Current Consumption	I _{dd}	V _{dd} = +3.3 V		60		mA
10	Power Supply Operating Voltage	V _{dd}		+3.0	+3.3	+3.6	V
11	Thermal Resistance	R _{th,c}	Junction to case			220	°C/W
12	Operating Temperature	T _o		-40		+85	°C
13	Maximum Input CW RF Power	P _{IN, MAX}	DC – 6.0 GHz			13	dBm

Absolute Maximum Ratings

Parameters	Units	Ratings
DC Power Supply Voltage	V	4.0
Drain Current	mA	100
Total Power Dissipation	mW	330
RF Input Power	dBm	13
Junction Temperature	°C	150
Storage Temperature	°C	-65 ~ 150
Operating Temperature	°C	-40 ~ +85
Thermal Resistance	°C/W	220

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

Functional Block Diagram



Ordering Information

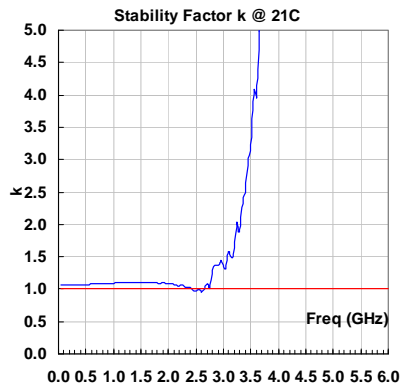
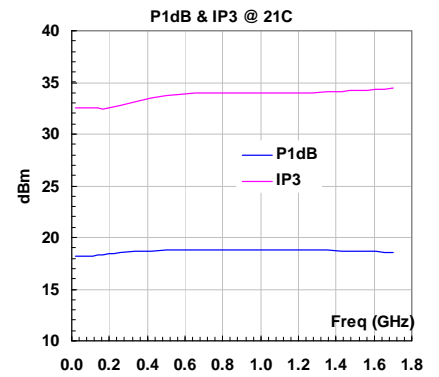
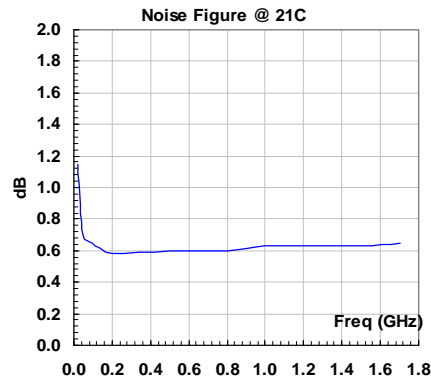
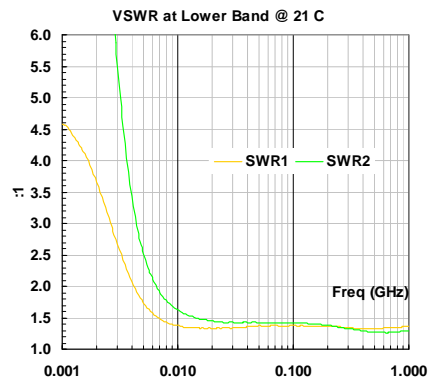
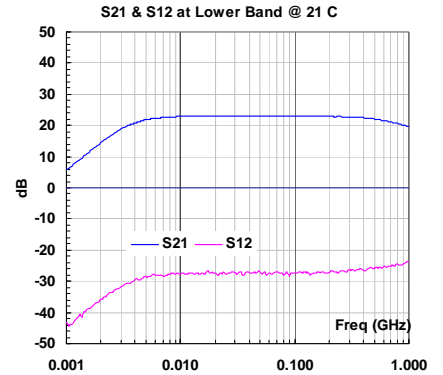
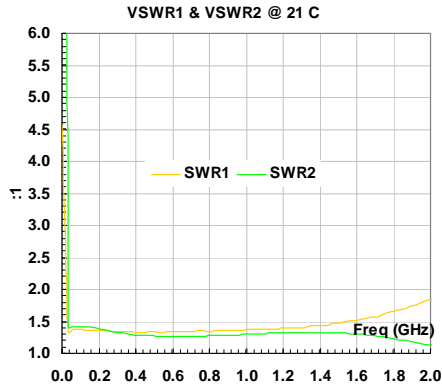
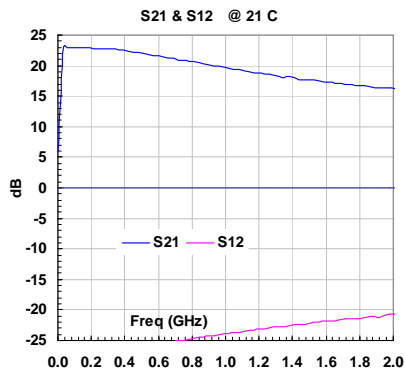
Model Number	WHM0020AE
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ESD resistance tube of 25 pieces is used for the packing. Contact factory for tape and reel packing option for higher volume order.

Specifications and information are subject to change without notice.



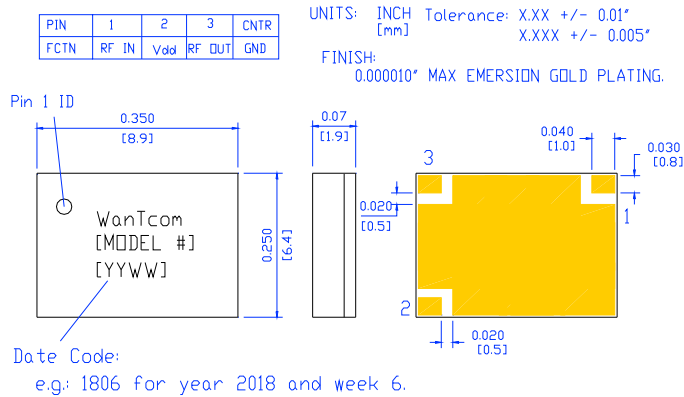
Typical Data



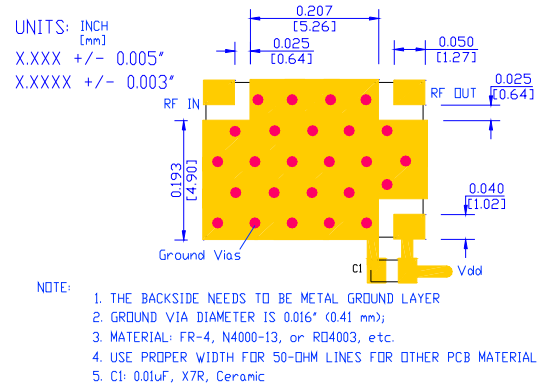
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Outline, WHM-5



Foot Print



Application Notes:

A. Pull-up Resistor, R₁

For +5.0V DC power operation, a pull-up resistor, R₁ of 28.0 Ohms resistor is required. The R₁ drops the voltage from +5V to +3.3V and also provides a negative feedback for the DC bias current. This feedback is particular important for the temperature stability and the DC current consistency between each amplifier module in the volume production.

For DC voltage other than 5.0V, the R₁ value is determined by the following equation:

$$R_1 = (V_{dd} - 3.3V) / 60 \text{ mA}$$

Make sure the R₁ power rating is sufficient for the reliability consideration. For +5V operation and using 0402 size SMT resistor, two (2) 56.0 Ohm resistors in parallel are required to form the 28.0 Ohm value in order to satisfy the total power consumption of the resistor:

$$(+5V - 3.3V)^2 / 28.0 \text{ Ohm} = 0.103W$$

Typical 0402 size resistor has 0.0625 W rating. Two (2) pieces of 56 Ohm resistors have total 0.125W power dissipation.

B. Motherboard Layout

The recommended motherboard layout is shown in **Fig. 1**. Sufficient numbers of ground vias on the center pad are essential for the RF grounding and LNA heat dissipation. The width of the 50-Ohm microstrip lines at the input and output RF ports may be different for different property of the PCB substrate. The ground plane on the backside of the PCB 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 +3.3V DC voltage is applied to Pin 2 of the LNA. For +3.3V line trace length being longer than 6 inches without a decoupling capacitor, a 0.10 uF de-coupling capacitor, C₁, with minimum rating voltage of 10V is needed across the +3.3V pin to ground. The capacitor must be rated in the temperature range of -55 °C to 100 °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 amplifier has built-in DC block capacitors at the input and output ports.

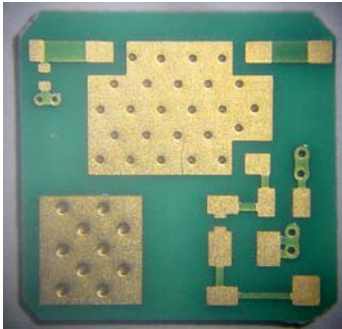


Fig. 1 Motherboard Sample

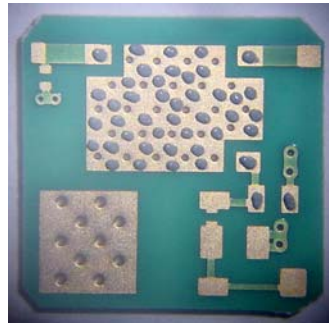


Fig. 2 Dispensed solder paste

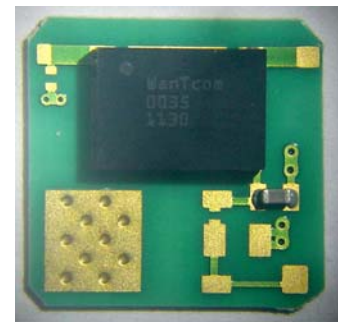


Fig. 3 Assembled part

C. Assembly

The regular low temperature and no clean solder paste such as SN63Pb37 is recommended. The high temperature solder has been used internally for the WHM series amplifier assembly. The melting temperature point of the internal high temperature solder is around 230 °C. Thus, melting temperature of the solder paste should be below 217 °C for assembling WHM series amplifier on the test board to reduce the possible damage to the amplifier. The temperature melting point of the SN63Pb37 solder paste is around 183 °C and is suitable for the assembly purpose.

For RoHS purpose assembly, the Bismuth based low temperature solder paste such as SN60Bi40 is required.

Regular RoHS solder paste SAC305 and its process will damage the amplifier!

The solder paste can be dispensed by a needle manually or driven by a compressed air source. **Fig. 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) range.

For volume assembly, a stencil with 0.004" to 0.006" (0.10 mm to 0.15 mm) thickness is recommended to print the solder paste on the circuit board.

Fig. 3 illustrates the assembled LNA on the motherboard.

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

D. 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 points or joint points could affect mainly the return losses at the ports due to the non-ideal 50-Ohm impedance of the devices connected to the amplifier. By varying the connection feature size such as the solder amount to get the optimum return losses 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 losses at the ports while varying the feature size of the joint points. Varying the connection feature size until the optimum return losses are achieved.
