WHM02R

100 KHz- 3.0 GHz LOW NOISE WIDE BAND

REV D
May 2024

Key Features

- 100 kHz ~ 3.0 GHz
- 0.75 dB Noise Figure
- 34.0 dBm Output IP_3
- 14.0 dB ~ 23.0 dB Gain
- 21.0 dBm P_{1dB}
- 1.4:1 VSWR
- Single Power Supply
- >68 Years MTBF
- ROHS Compliant
- MSL-1 Moisture Sensitivity Level

Product Description

CAUTION: ELECTROSTATIC DISCHARGE SENSITIVE

WHM02R 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 +3.0V~+4.0V DC operation, the amplifier has optimal input and output matching in the specified frequency range at 50-Ohm impedance system. The amplifier has standard 0.12" x 0.12" x 0.06" surface mount package.

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

Applications

- Mobile Infrastructures
- GPS
- CATV/DBS
- Defense
- Security System
- Measurement
- Fixed Wireless

Specifications

Summary of the key electrical specifications at room temperature with configuration 100 KHz – 500 MHz LNA

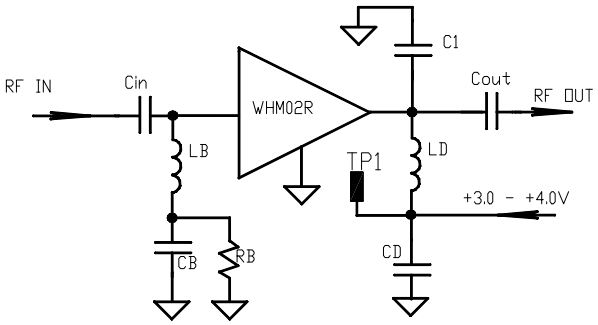
Index	Testing Item	Symbol	Test Constraints	Min	Nom	Max	Unit
1	Gain	S_{21}	100 kHz – 500 MHz		23		dB
2	Gain Variation	ΔG	100 kHz – 500 MHz		+/-0.7		dB
3	Input Return Loss	S_{11}	100 kHz – 500 MHz	14	18		dB
4	Output Return Loss	S_{22}	100 kHz – 500 MHz	14	18		dB
5	Reverse Isolation	S_{12}	100 kHz – 500 MHz	20	25		dB
6	Noise Figure	NF	100 MHz – 500 MHz		0.80	1.0	dB
			10 MHz – 100 MHz		1.0	2.0	dB
7	Output Power 1dB Compression Point	P_{1dB}	100 kHz – 500 MHz, 75 mA @ 3.5V	20	21		dBm
8	Output-Third-Order Interception Point	IP_3	Two-Tone, P_{out} = 0 dBm each, 1 MHz separation		34		dBm
9	Current Consumption	I_{dd}	V_{dd}= +3.50V		75		mA
10	Power Supply Voltage	V_{dd}		+3.0	+3.5	+4.0	V
11	Thermal Resistance	$R_{th,c}$	Junction to case			215	°C/W
12	Operating Temperature	T_o		-40		+85	°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	5.5
Drain Current	mA	120
Total Power Dissipation	mW	300
RF Input Power	dBm	10
Junction 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.

Application Schematic



Ordering Information

Model Number	WHM02R

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. Contact factory for tape and reel packing option.

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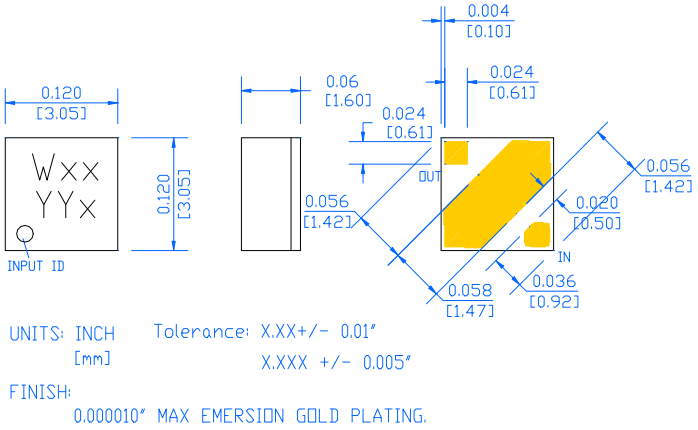
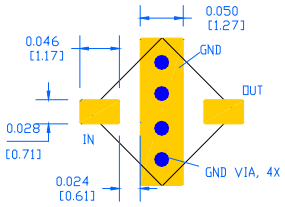
Outline



Foot Print



Typical Applications:

With proper setting L_B and L_D for the RF chokes in the DC bias paths, DC block capacitors C_{in} and C_{out}, and C_1, different band high frequency low noise medium power amplifier can be formed simply using WHM02R. C_B and C_D are the de-coupling capacitors. R_B is used to set the bias current. The higher R_B value is, the larger the DC bias current will be. R_B value is in the range of 130 ~ 220 Ohm depending on the drain voltage and the drain current.

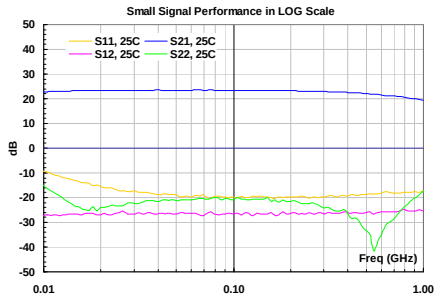
LB and LD need to be resonant free in the passband. Conical coil are recommended for the extended passband applications.

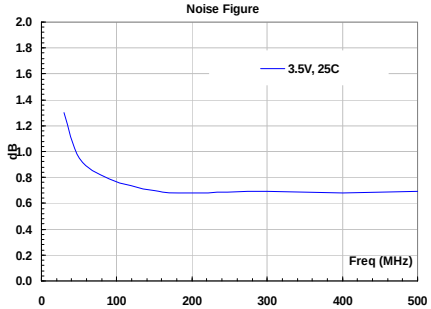
For +5.0V DC power supply instead of 3.0V to 4.0V operation, a voltage drop resistor, R_D, can be in series between the +5.0V and the amplifier. This configuration will help to reduce the sensitivity of the DC bias current to R_B value and environmental temperature variation. Different R_D values can be calculated for different drain DC bias current and voltage settings. For 3.5V drain voltage and 75 mA bias current with +5.0V power supply, the total voltage drop on R_D is 1.5V and R_D value is thus 20 Ohm. A regular 0402 size of 20 Ohm resistor does not have enough power rating for that. Instead, two 40 Ohm resistors are in parallel to share the power dissipation.

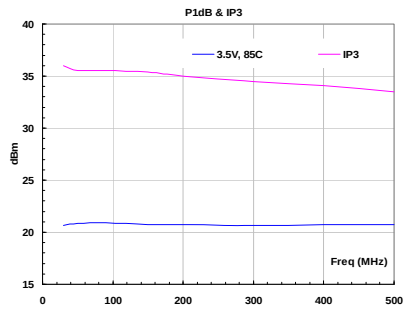
1. 30 MHz – 500 MHz wide band low noise medium power amplifier

Table 1 BOM of 30 MHz – 500 MHz LNA

Site	QTY	Description	Pkg	Mfgr Part No.	Mfgr
C_{in}, C_{out}, C_B, C_D	4	CAP, 0.01uF 50 V 5% X7R	0402	GRM155R71H103KA88D	Murata
C_1	1	CAP, 1.0pf 50V COG	0402	ECJ-0EC1H010C	Panasonic
L_B, L_D	2	IND, 1.0 uH	1008	PM1008-1R0K-RC	J.W. Miller
* R_B	1	RES, 169 OHM 1% 1/16W	0402	ERJ-2RKF1690X	Panasonic
IC	1	LNA	M3	WHM02R	WanTcom







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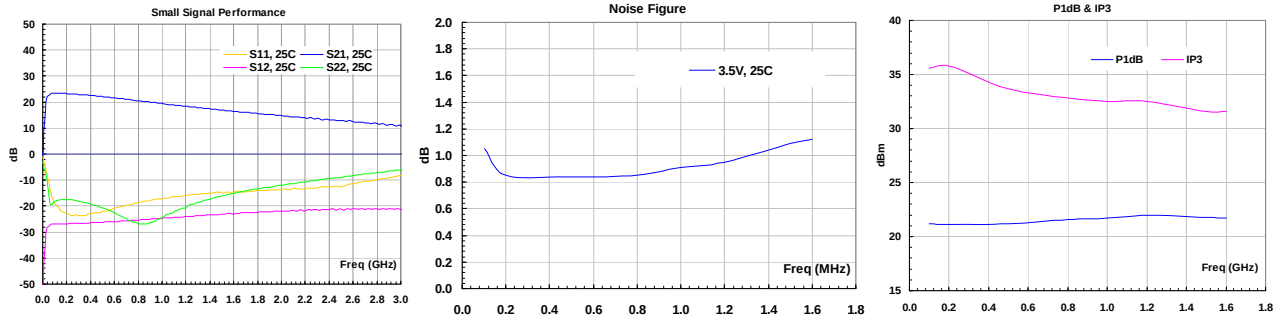
2. 0.1 GHz – 1.6 GHz wide band low noise medium power amplifier

Table 2 BOM of 0.1 GHz – 1.6 GHz LNA

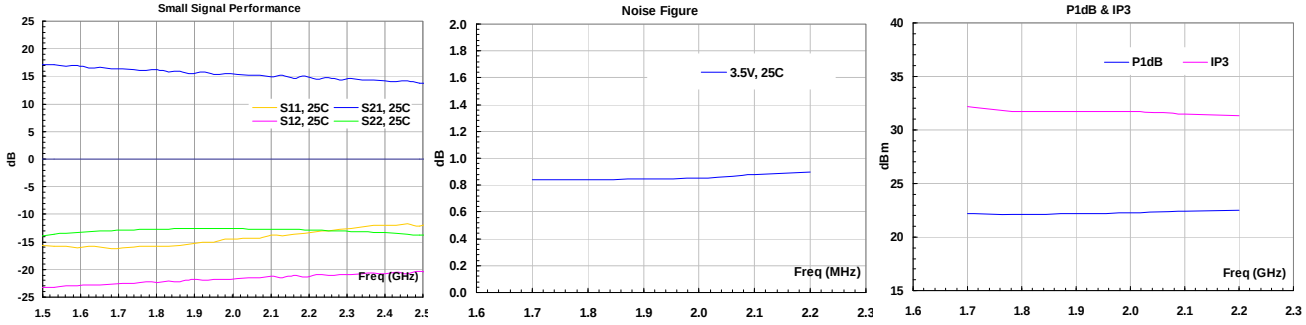
Site	QTY	Description	Pkg	Mfgr Part No.	Mfgr
C_{in}, C_{out}, C_B, C_D	4	CAP, 0.01uF 50 V 5% X7R	0402	GRM155R71H103KA88D	Murata
C_1	1	CAP, 1.0pf 50V COG	0402	ECJ-0EC1H010C	Panasonic
L_B, L_D	2	IND, 220 nH	0603	LQW18ANR27J00D	Murata
* R_B	1	RES, 169 OHM 1% 1/16W	0402	ERJ-2RKF1690X	Panasonic
IC	1	LNA	M3	WHM02R	WanTcom



3. 1.7 GHz – 2.2 GHz wide band low noise medium power amplifier

Table 3 BOM of 1.7 GHz – 2.2 GHz LNA

Site	QTY	Description	Pkg	Mfgr Part No.	Mfgr
Cin	1	CAP, 5.0pF±0.25pF 50V	0402	ECJ-0EC1H050C	Panasonic
Cout	1	CAP, 3.0pF±0.25pF 50V	0402	ECJ-0EC1H030C	Panasonic
C_B, C_D	2	CAP, 0.01uF 50 V 5% X7R	0402	GRM155R71H103KA88D	Murata
C_1	1	CAP, 0.3pF 50V 0402 COG	0402	GRM1555C1HR30CZ01D	Murata
L_B	1	IND, 220 nH	0603	LQW18ANR27J00D	Murata
L_D	1	IND, 15 nH SMD	0603	LQW18AN15NJ00D	Murata
* R_B	1	RES, 169 OHM 1% 1/16W	0402	ERJ-2RKF1690X	Panasonic
IC	1	LNA	M3	WHM02R	WanTcom



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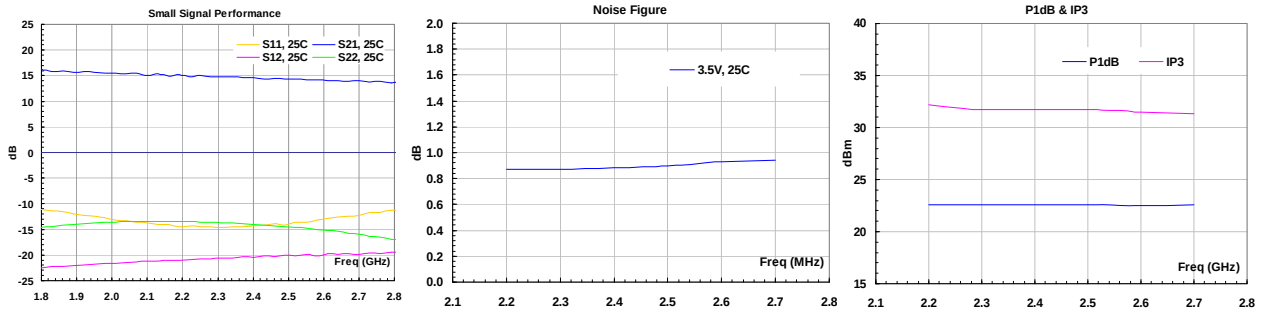
4. 2.2 GHz – 2.7 GHz wide band low noise medium power amplifier

Table 4 BOM of 2.2 GHz – 2.7 GHz LNA

Site	QTY	Description	Pkg	Mfgr Part No.	Mfgr
Cin	1	CAP, 2.0pF 50V 0402 SMD	0402	GRM1555C1H2R0BZ01E	Murata
Cout	1	CAP, 2.4pF 50V 0402 SMD	0402	GRM1555C1H2R4BZ01E	Murata
C_B, C_D	2	CAP, 0.01uF 50 V 5% X7R	0402	GRM155R71H103KA88D	Murata
C_1	1	EMPTY	0402	---	---
L_B	1	IND, 100 nH	0603	LQW18ANR10J00D	Murata
L_D	1	IND, 10 nH SMD	0603	LQW18AN10NJ00D	Murata
* R_B	1	RES, 169 OHM 1% 1/16W	0402	ERJ-2RKF1690X	Panasonic
IC	1	LNA	M3	WHM02R	WanTcom



Application Notes:

A. Assembly

The regular SAC305 RoHS is not recommended and will cause permanent damage to the amplifier. Refers to the important application note AN-109, https://www.wantcominc.com/Application_Notes/AN-109.pdf

B. 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 affect 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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