



### 1.3 – 1.85 GHz LOW NOISE AMPLIFIER WHM1318R<sup>1</sup>

WHM1318R LNA is a low noise figure, wideband, and high linearity SMT packaged amplifiers. The amplifier offers typical 1.0 dB noise figure, 21 dBm P<sub>1dB</sub>, and 17.5 dB gain at the frequency range from 1.3 GHz to 1.85 GHz and usable from 1.1 to 2.0 GHz of GPS, DCS, PCS, and 3 G bands. WHM1318R LNA is most suitable for cellular base stations, wireless data communications, tower top receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications.



WHM1318R is designed to meet the rugged standard of MIL-STD-883 and RoHS compliant.

#### Key Features:

# Preliminary

RoHS Complied:	Yes
Impedance:	50 Ohm
MTBF <sup>2</sup> :	>1,000,000 hrs (114 Years)
LGA (land grid array) Package:	6-pin
Low Noise:	1.0 dB
Output IP <sub>3</sub> :	34.0 dBc at -5.0 dBm input power each tone
Gain:	17.5 dB
P <sub>1dB</sub> :	21.0 dBm
Single Power Supply:	75 mA @ +5V
Frequency Range:	1.3 ~ 1.85 GHz and extendable from 1.1 GHz to 2.0 GHz range
Operating Temperature:	-40 ~ +85 °C
Return Losses:	18 dB Typical
Small Size:	0.25" x 0.25" x 0.060" (6.35 mm x 6.35 mm x 1.52 mm)
Built-In Functions:	DC blocks at input and output, temperature compensation circuits, and auto DC biases.

#### Absolute Maximum Ratings<sup>3</sup>:

Symbol	Parameters	Units	Absolute Maximum
V <sub>dd</sub>	DC Power Supply Voltage	V	6
I <sub>dd</sub>	Drain Current	mA	90
P <sub>diss</sub>	Total Power Dissipation	mW	400
P <sub>In,Max</sub>	RF Input Power	dBm	10
T <sub>ch</sub>	Channel Temperature	°C	150
T <sub>STG</sub>	Storage Temperature	°C	-55 ~ 125
T <sub>O,MAX</sub>	Maximum Operating Temperature	°C	-40 ~ 85
R <sub>th,c</sub>	Thermal Resistance	°C/W	215

<sup>1</sup> Specifications are subject to change without notice.

<sup>2</sup> MTBF: Mean Time Between Failure, Per TR-NWT-000332, ISSUE 3, SEPTEMBER, 1990, T=40°C

<sup>3</sup> Operation of this device above any one of these parameters may cause permanent damage.



## Specifications:

a) **Table 1** Summary of the electrical specifications WHM1318R at room temperature

Index	Testing Item	Symbol	Test Constraints	Nom (RT)	Min	Max	Unit
1	Gain	$S_{21}$	1.3 – 1.85 GHz	17.5			dB
2	Gain Variation	$\Delta G$	1.3 – 1.85 GHz	+/- 0.50		+/- 0.75	dB
3	Input Return Loss	$S_{11}$	1.3 – 1.85 GHz	18	14		dB
4	Output Return Loss	$S_{22}$	1.3 – 1.85 GHz	18	14		dB
5	Reverse Isolation	$S_{12}$	1.3 – 1.85 GHz	20	18		dB
6	Noise figure	NF	1.3 – 1.85 GHz	1.0		1.2	dB
7	Output Power 1dB compression Point	$P_{1dB}$	1.3 – 1.85 GHz	21.0	19.0		dBm
8	Output-Third-Order Interception point	$IP_3$	Two-Tone, $P_{in} = -5.0$ dBm each, 1 MHz separation	36.0	32.0		dBc
9	Current Consumption	$I_{dd}$	$V_{dd} = +5$ V	75			mA
10	Power Supply Voltage	$V_{dd}$		+5	+4.7	+5.3	V
11	Thermal Resistance	$R_{th,c}$	Junction to case			215	$^{\circ}C/W$
12	Operating Temperature	$T_o$			-40	+85	$^{\circ}C$
13	Maximum Average RF Input Power	$P_{IN,MAX}$	DC – 12.5 GHz			10	dBm

## b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WHM1318R is 17.5 across 1.3 GHz to 1.85 GHz. The typical input and output return losses are 20 dB across the frequency of 1.3 GHz to 1.85 GHz.

**Figure 2** shows the extended frequency band performance at full temperature range. The LNA works from 1.1 GHz to 2.0 GHz frequency range.

**Figure 3** shows the measured  $P_{1dB}$  and  $IP_3$  of the WHM1318R. The typical  $P_{1dB}$  and  $IP_3$  are 21.0 dBm and 36.0 dBc at the input signal power level of  $-5.0$  dBm each tone in the frequency range of 1.3 GHz to 1.85 GHz, respectively.

**Figure 4** illustrates the measured noise figure performance at room temperature. The measured results include the test fixture loss of approximately 0.05 dB to 0.10 dB depending on the frequency. The noise figure is 1.0 dB across the frequency range of 1.3 GHz to 1.85 GHz at room temperature. At  $85^{\circ}C$ , WHM1318R is expected to have 0.20 dB noise figure increases. At  $-40^{\circ}C$ , WHM1318R will have approximately 0.20 dB less noise figure than that at room temperature.

**Figure 5** demonstrates the stability factor  $k$  of the amplifier. The  $k$  values are slightly below 1.0 in some frequency ranges. Carefully selecting the load and source impedances is desired to maintain the LNA stability.

**Figure 6** is the block diagram of internal circuit of WHM1318R. It is one stage amplifier with the DC block capacitors at the input and output RF ports. All the RF matching networks, DC bias circuitries, and temperature compensation circuits are built in.

**Figure 7** shows the mechanical outline and recommended motherboard layout of WHM1318R. Plenty of ground vias on the motherboard are essential for the RF grounding and the thermal dissipation. The width of the 50-Ohm lines at the input and output RF ports may be different for different property of the substrate.

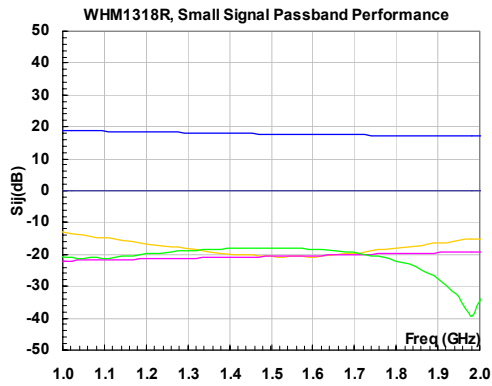


FIG. 1 Passband small signal performance.

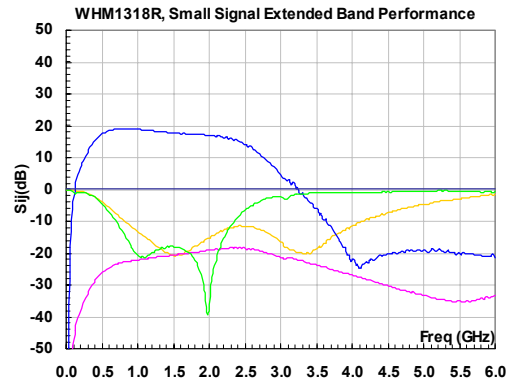


FIG. 2 Extended band Small signal performance

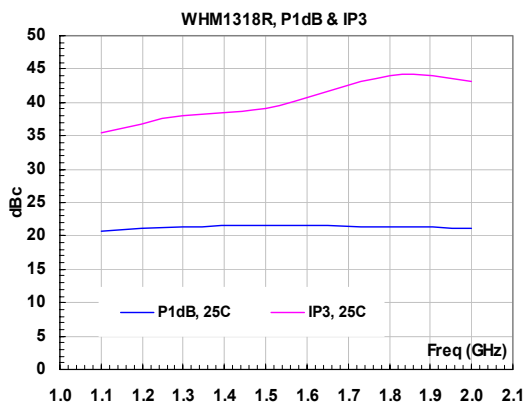


FIG. 3 Typical P<sub>1dB</sub> and IP<sub>3</sub> at room temperature.

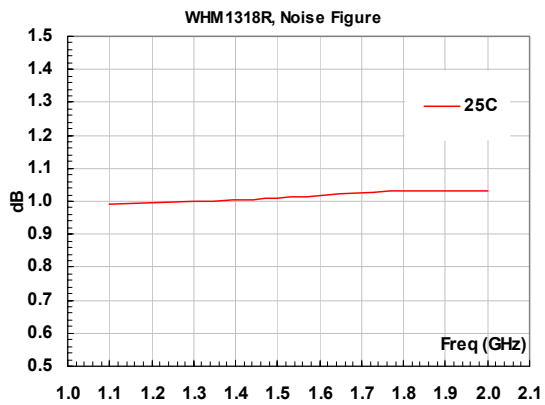


FIG. 4 Noise figure performance

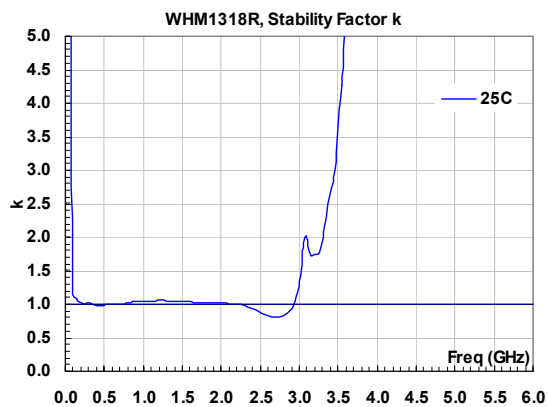


FIG. 5 Stability factor *k*

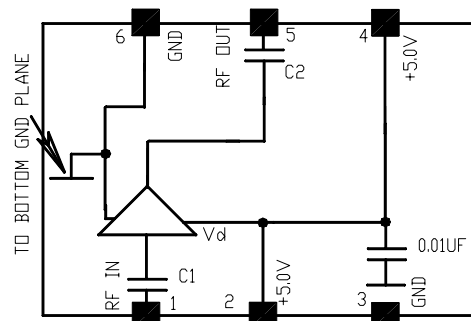


FIG. 6 Block diagram of internal circuit.



WHM1318R Mechanical Outline, WHM-1:

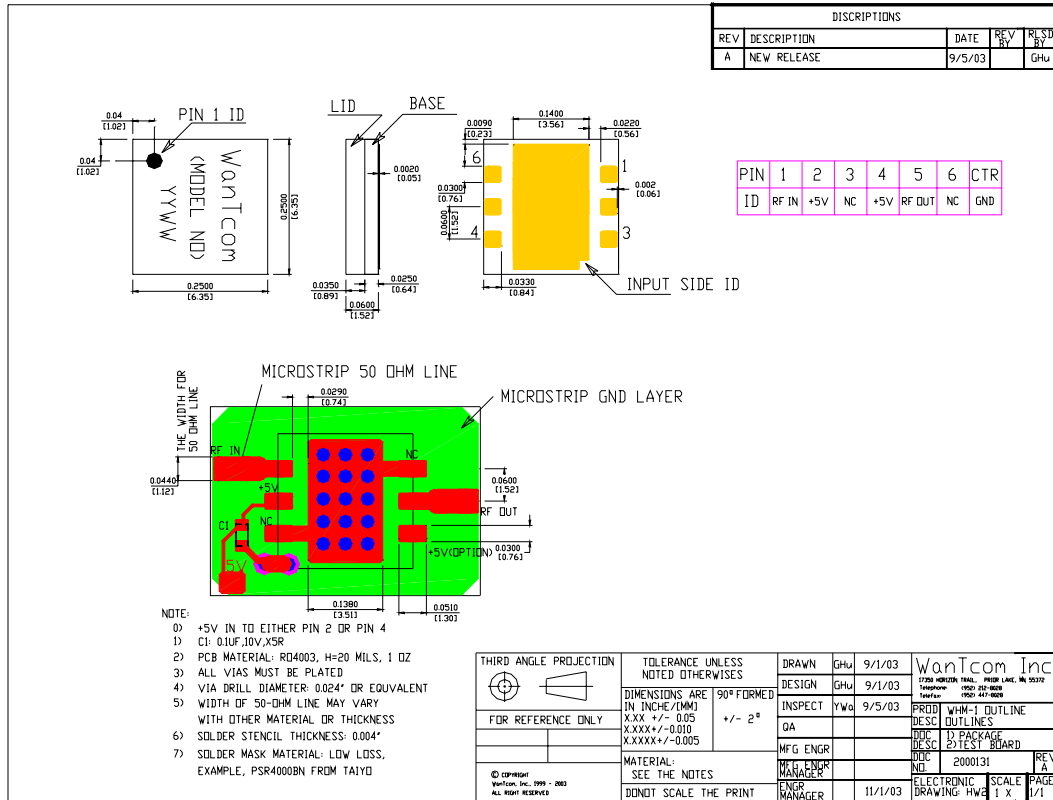


FIG. 7 WHM1318R outline

Ordering Information

<b>Model Number</b>	WHM1318R
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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 requirements.

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