



0.5 – 4.0 GHz LOW NOISE AMPLIFIER WHM0545AE¹

WHM0545AE LNA is a low noise figure, wideband, and high linear SMT packaged amplifiers with unconditional stable design. The amplifier offers typical 1.10 dB noise figure, 26.0 dB gain, and 27 dBm output IP₃ at the frequency range from 0.5 GHz to 4.0 GHz of DCS, PCS, 3G, ISM, S, and C bands.



WHM0545AE LNA is most suitable for cellular base stations, wireless data communications, tower top receiver amplifiers, last-mile wireless communication systems, and wireless measurement applications.

WHM0545AE is designed to meet the rugged standards of MIL-STD-202, and MIL-STD-883.

Preliminary

Key Features:

| | |
|--------------------------------|---|
| Impedance: | 50 Ohm |
| MTBF ² : | >600,000 hrs (68 Years) |
| LGA (land grid array) package: | 6-pin |
| Unconditional Stable: | $k > 1$ |
| Low Noise: | 1.10 dB |
| Output IP ₃ : | 27 dBm |
| Gain: | 26.0 dB |
| P _{1dB} : | 14.0 dBm |
| Single Power Supply: | 65 mA @ +5V |
| Frequency Range: | 0.5 ~ 4.0 GHz |
| Operating Temperature: | -40 ~ +85 °C |
| VSWR: | 1.6:1 maximum |
| Small Size: | 0.30" x 0.30" x 0.065" (7.62 mm x 7.62 mm x 1.65 mm) |
| Built-in Functions: | DC blocks at input and output, temperature compensation circuits, and auto DC biases. |

Absolute Maximum Ratings³:

| Symbol | Parameters | Units | Absolute Maximum |
|---------------------|-------------------------------|-------|------------------|
| V _{dd} | DC Power Supply Voltage | V | 7.0 |
| I _{dd} | Drain Current | mA | 80 |
| P _{diss} | Total Power Dissipation | mW | 400 |
| P _{In,Max} | RF Input Power | dBm | 10 |
| T _{ch} | Channel Temperature | °C | 150 |
| T _{STG} | Storage Temperature | °C | -65 ~ 150 |
| T _{O,MAX} | Maximum Operating Temperature | °C | -55 ~ 100 |
| R _{th,c} | Thermal Resistance | °C/W | 215 |

¹ Specifications are subject to change without notice.

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

³ Operation of this device above any one of these parameters may cause permanent damage.

**Specifications:**

a) **Table 1** Summary of the electrical specifications WHM0545AE at room temperature

| Index | Testing Item | Symbol | Test Constraints | Nom (RT) | Min | Max | Unit |
|-------|---------------------------------------|---------------|---|----------|------|---------|-------|
| 1 | Gain | S_{21} | 0.5 – 4.0 GHz | 26 | 24 | 28 | dB |
| 2 | Gain Variation | ΔG | 0.5 – 4.0 GHz | +/- 1 | | +/- 1.3 | dB |
| 3 | Input VSWR | $VSWR_1$ | 0.5 – 4.0 GHz | 1.5:1 | | 1.6:1 | Ratio |
| 4 | Output VSWR | $VSWR_2$ | 0.5 – 4.0 GHz | 1.35:1 | | 1.6:1 | Ratio |
| 5 | Reverse Isolation | S_{12} | 0.5 – 4.0 GHz | 50 | 45 | | dB |
| 6 | Noise figure | NF | 0.5 – 4.0 GHz | 1.10 | | 1.30 | dB |
| 7 | Output Power 1dB compression Point | P_{1dB} | 0.5 – 4.0 GHz | 14 | 12 | | dBm |
| 8 | Output-Third-Order Interception point | IP_3 | Two-Tone, P_{out} +0 dBm each, 1 MHz separation | 26 | 24 | | dBm |
| 9 | Current Consumption | I_{dd} | $V_{dd} = +5 V$ | 65 | | | mA |
| 10 | Power Supply Voltage | V_{dd} | | +5 | +4.7 | +5.3 | V |
| 11 | Thermal Resistance | $R_{th,c}$ | Junction to case | | | 215 | °C/W |
| 12 | Operating Temperature | T_o | | | -40 | +85 | °C |
| 13 | Maximum Average RF Input Power | $P_{IN, MAX}$ | DC – 12.0 GHz | | | 10 | dBm |

b) Passband Frequency Response

As shown in **Figure 1**, the typical gain of the WHM0545AE is 26.0 dB across 0.5 to 4.0 GHz. The typical input and output VSWR are 1.5:1 dB and 1.35:1 across the frequency of 0.5 to 4.0 GHz.

Figure 2 shows the measured P_{1dB} and IP_3 of the WHM0545AE. The typical P_{1dB} and IP_3 are 14 dBm and 26dBm in the frequency range of 0.5 to 4.0 GHz, respectively.

Figure 3 illustrates the measured noise figure performance at full temperature. The measured results include the test fixture loss of approximately 0.10 dB. The noise figure is 0.90 ~ 1.10 dB across the frequency range of 0.50 to 4.0 GHz at room temperature.

Figure 4 demonstrates the stability factor k of the amplifier. It is greater than 1.0 in any frequency band and the amplifier is unconditional stable.

Figure 5 is the block diagram of internal circuit of WHM0545AE. It is a two-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 6 demonstrates the application schematic diagram of WHM0545AE. It may require one external decoupling capacitor of 0.01 uF to build a LNA with WHM0545AE. The +5V DC can be applied at Pin 3. No DC block capacitor is required for both input and output RF ports. The NC pins connected to ground are recommended. For +5V line trace length being longer than 6 inch without a decoupling capacitor, an additional 0.01 ~ 0.1 uF decoupling capacitor with minimum rating voltage of 10V may be needed across the +5V line to ground. The capacitor must be rated in the temperature range of -40 °C to 85 °C to ensure the entire circuit working in the specified temperature range.

Figure 7 shows the mechanical outline and recommended motherboard layout of WHM0545AE. Plenty of ground vias on the motherboard are essential for the RF grounding. The width of the 50-Ohm lines at the input and output RF ports may be different for different property of the substrate.

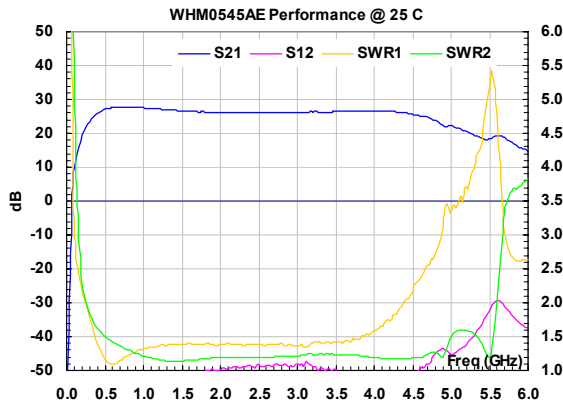


FIG. 1 Typical small signal performance.

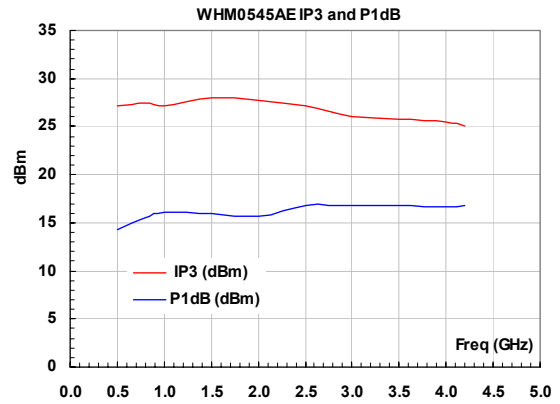


FIG. 2 Typical P_{1dB} and IP_3 at room temperature.

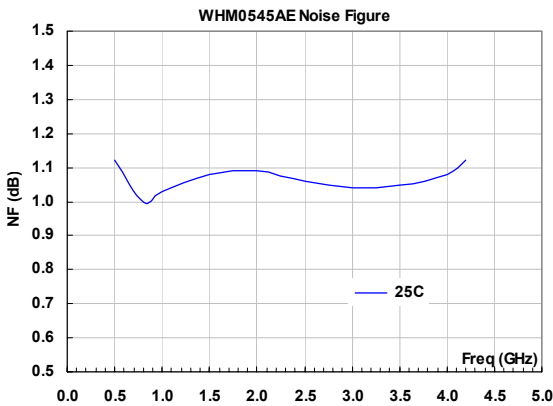


FIG. 3 Noise figure performance at full temperature

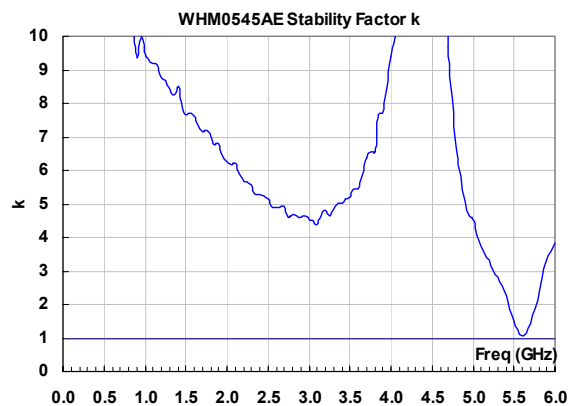


FIG. 4 Measured stability factor k

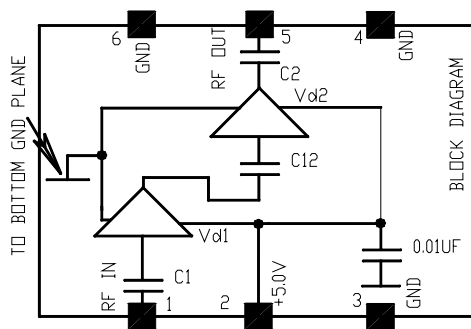


FIG. 5 Block diagram of internal circuit.

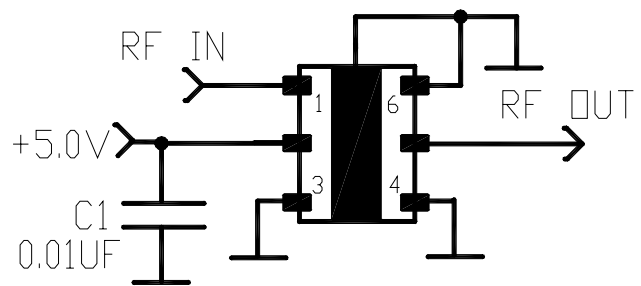


FIG. 6 Typical application schematic for WHM0545AE



WHM0545AE Mechanical Outline, WHM-2:

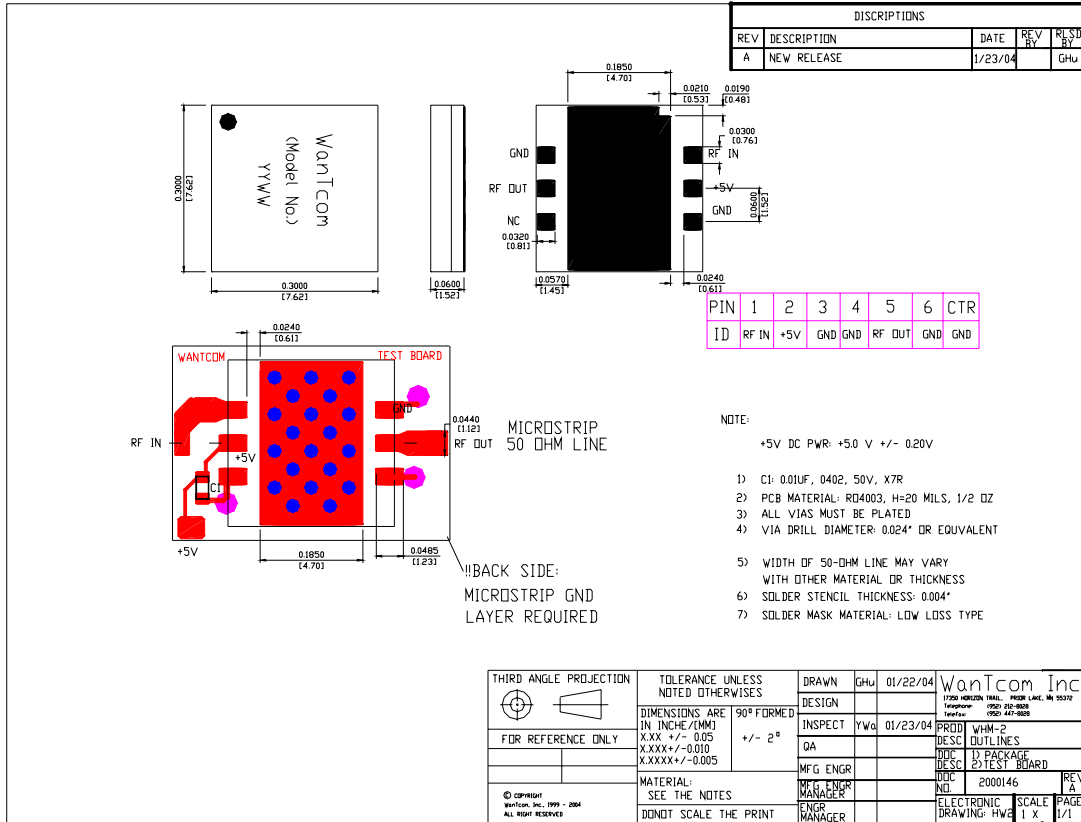


FIG. 7 WHM0545AE outline

Ordering Information

| | |
|---------------------|-----------|
| Model Number | WHM0545AE |
|---------------------|-----------|

Waffle pack with the capacity of 81 pieces (9 x 9) is used for the packing. Contact factory for tape and reel packing option for higher volume requirements.