



**Caution:**

- 1) Always handle products in the ESD safe environment!
- 2) Regular RoHS reflow process will damage WHM and WMA series amplifiers!!



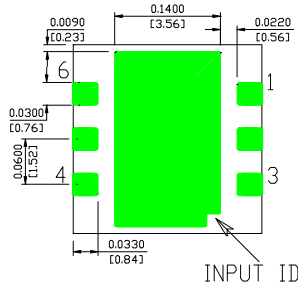
## ASSEMBLY WHM AND WMA AMPLIFIERS ON TEST PCBS

### 1. Introduction

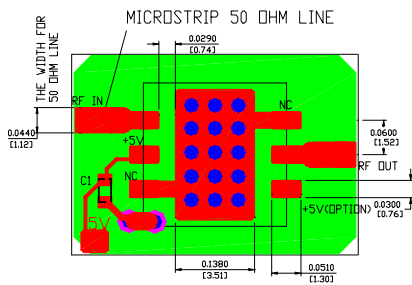
The WHM and WMA series amplifier chips and modules provide excellent RF performance with drop-in miniature SMT mounting convenience. Assembling an amplifier correctly on a test board is critical for the performance and reliability. In this application note, the solder reflow procedures are recommended in the both laboratory and production environments.

### 2. Foot print and its test board

**Figure 1** shows the bottom side of one WHM series amplifier example, WHM25-1525AE, 2.2 ~2.6 GHz low noise amplifier. The center paddle serves as the ground pad. Pin 1 is the RF input, Pin 2 or Pin 4 for +5V DC power supply. These two pins are connected internally inside the module. Pin 3 and Pin 6 are non-connection (NC) pins. Pin 5 is the RF output.



**Figure 1** Bottom side of WHM25-1525AE



**Figure 2** Test board foot print for WHM25-1525AE

**Figure 2** is the test board for WHM25-1525AE. There are ground vias (in blue color) to connect the top ground layer (in red color) to the bottom ground plane of the microstrip. The 0.1 uF capacitor (C1) is the de-coupling capacitor for +5V DC power supply. 50-Ohm microstrip lines are used

for both RF input and output to communicate the RF signals to the amplifier module.

### 3. Low Temperature Solder Paste Requirement

#### a) WHM series amplifiers

The high temperature solder is used internally for WHM series amplifiers assembly. The melting temperature point of the high temperature solder is around 240 °C. Thus, melting temperature of the solder paste should be way below 240 °C for assembling WHM series amplifiers on the test board.

For high reliability product, Lead SN63/Pb63 solder paste, which melting temperature point being around 183 °C, is recommended for the assembly.

For RoHS compliance requirement, Bismuth based Lead free solder paste such as 60Sn/40Bi is suitable for the assembly.

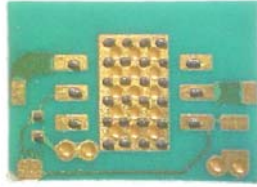
#### b) WMA series amplifier modules

The RoHS compliance solder paste used for assembling WMA series amplifiers is 91.8Sn3.4Ag4.8Bi. The melting point is 213 °C. Bismuth based Lead free solder paste such as 40Sn/60Bi is suitable for the assembly. The actual reflow peak temperature shall be controlled under 195 °C to prevent the solder joints melted on the amplifier modules during the second reflow operation.

**Warning: regular SAC305 RoHS reflow process will damage the WHM and WMA products!**

### 4. Solder reflow in a lab environment

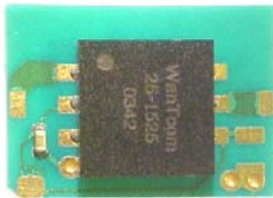
For low volume assembly purpose, the low temperature solder paste can be dispensed by a needle manually or compressed air driven method. **Figure 3** shows the example of the dispensed solder paste pattern. Each solder paste dot is in the diameter of 0.005” ~ 0.010” (0.125 ~ 0.250 mm). **Figure 4** illustrates the assembled WHM25-1525AE before the reflow. Then, the assembly can be put on top of a hot plate which the central area temperature is set and stabled at about 200 °C. Make sure the assembled part is put at the edge of the hot plate to start with and gradually moved toward to the center of the hot plate. It simulates the production reflow temperature profile from the low temperature zones to high temperature zones. The edge of the hot plate has lower temperature than that in the central area. The components may move or even jump if the assembled part was put directly on the center hot area right away without the pre-heating process.



**Figure 3** The dispensed solder paste pattern.

The whole assembly then can be washed with regular PCB cleaning process such as alcohol.

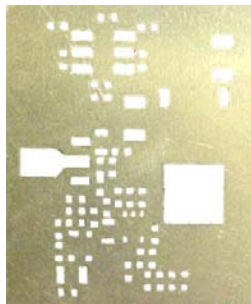
The other reflow method is directly put the soldering iron tip on the back of the assembly until all the solder paste being melt. However, this is not recommended since there is little control on the reflow temperature.



**Figure 4** Assembled WHM25-1525AE before reflow

#### 4. Solder assembly and reflow in a high volume production environment

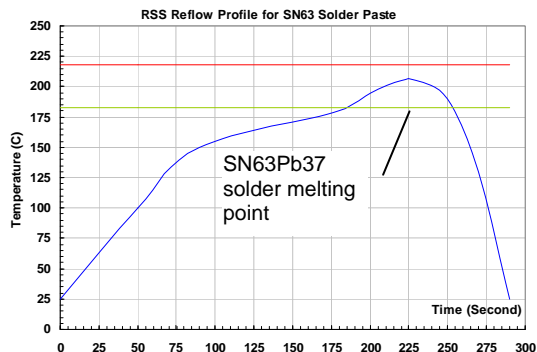
The solder stencil and solder printing process are recommended for the high volume production assembly. The solder stencil is made out a steel sheet with the thickness of 0.003" to 0.005" (0.08 ~ 0.125 mm). The openings are either chemical etched or laser cut per Gerber file of the test board. **Figure 5** shows one example of a 0.004" thick stencil.



**Figure 5** An example of a 0.004" thick stencil.

**Figure 6**, as an example, illustrates a recommended solder reflow temperature profile using SN63/Pb37 solder paste for WHM series amplifiers. It is Ramp-Soak-Spike (RSS) profile. The temperatures are the actual measured temperature on the PCB assembly. The temperature setting of the reflow oven needs to be calibrated accordingly.

As shown in **Figure 6**, the RSS profile starts with a steep ramp up to about 150 °C within a target time of 90 seconds at a maximum temperature rise rate of 2 ~ 3 °C/second. Following the ramp zone, the profile soaks the assembly between 150 ~ 170 °C for approximately 90 seconds. After the soak, the PCB assembly will enter the spike temperature zone, where the PCB assembly will be reflowed above 183 °C for about 60 seconds. However, the peak temperature should not reach 220 °C or beyond or the WHM module may be damaged or performance changed due to the fact that the internal solder starts to melt. The last zone is the cool down period. The cool down rate of the profile should be controlled within about 4 °C/second. The faster cool down rate will result in a finer grain solder structure and a stronger and shinier solder joint. However, exceeding 4 °C/second cool rate could result in a thermal shock to the PCB assembly.



**Figure 6** Recommended RSS solder reflow temperature profile for WHM series amplifiers

For WMA series amplifier modules reflow process on a customer's feed board, lower temperature solder paste reflow process is required. The peak temperature shall not exceed 195 °C. Due to the complexity of a MRI feed board and its reflow fixture, always have the proper reflow profile to prevent the damage of the amplifier. Consult with WanTcom technical personals if it is needed.

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