

Technical Report TR119

Device: BFP450

Application: High-OIP3 LNA for 434MHz ISM Band
Applications

Revision: Rev. 1.0

Date: 2009-Feb-11

RF and Protection Devices



Never stop thinking



1. Overview

Infineon Device: BFP450 NPN Silicon RF Bipolar Transistor

Application: 434MHz Industrial, Scientific and Medical band Application

PCB Marking: BFP740 Application Board (Using Emitter Degeneration)

2. Summary of Measurement Results

Table 2-1: Summary of Measurement Results

| Parameter | Symbol | Value | Unit | Note/Test Condition |
|--------------------|--------|-------|------|--|
| Frequency Range | Freq | 434 | MHz | |
| DC Voltage | Vcc | 2.2 | V | |
| DC Current | Icc | 47.0 | mA | |
| Gain | G | 23.8 | dB | Power@port1:-30dbm |
| Noise Figure | NF | 3.2 | dB | |
| Input Return Loss | RLin | 10.3 | dB | Including SMA connectors and PCB losses of 0.1dB |
| Output Return Loss | RLout | 14.0 | dB | |
| Reverse Isolation | IRev | 28.8 | dB | Power@port1:-30dbm |
| Input P1dB | IP1dB | -9.3 | dBm | |
| Output P1dB | OP1dB | 13.5 | dBm | |
| Input IP3 | IIP3 | 6.8 | dBm | Power@Input:-26dB Δf 1=MHz |
| Output IP3 | OIP3 | 30,6 | dBm | |
| Stability | k | >1 | -- | Stability measured from 100MHz to 10GHz |

3. Description:

This report presents the measurement results of the Low Noise Amplifier using the transistor BFP450 from Infineon Technologies for the 434MHz ISM band application. The LNA brings a gain of 23.8dB on the frequency band at 434MHz with a noise figure of 3.2dB (including the SMA connector and PCB losses). Furthermore, this Device provides an unconditionally stability from 100MHz to 10GHz.

4. Schematics:

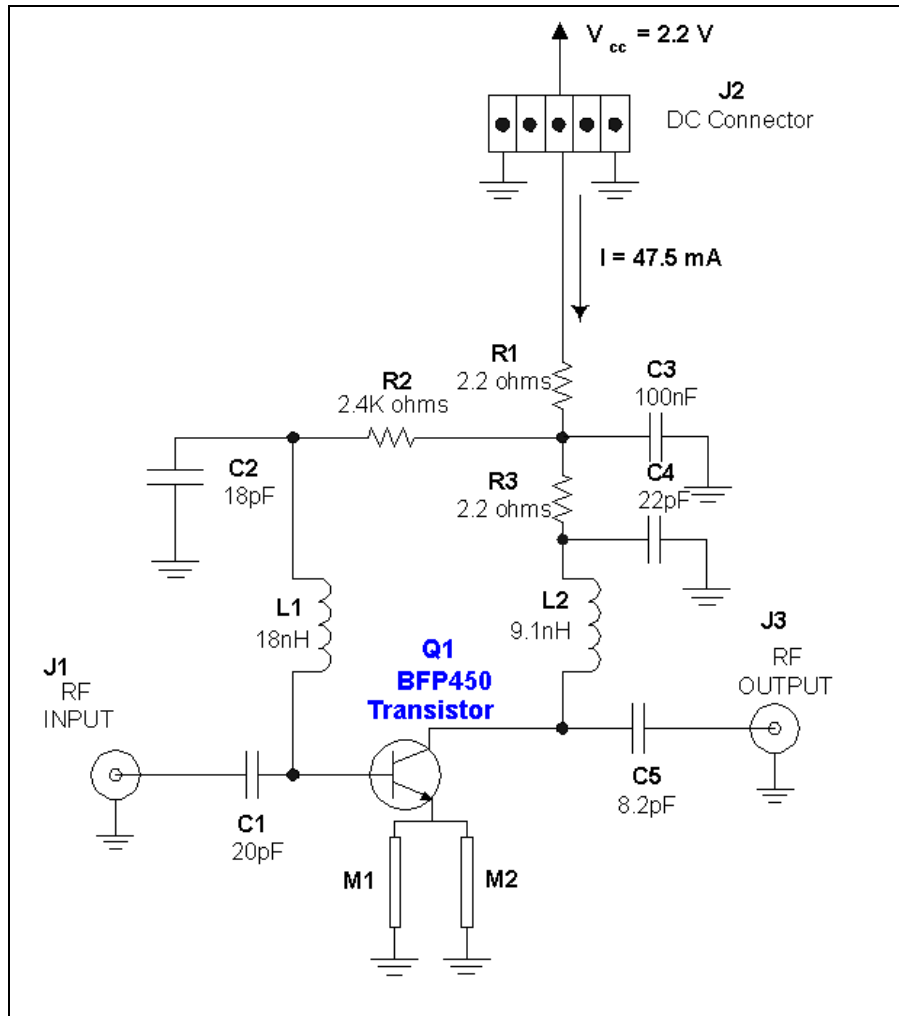


Figure 4-1: Schematics of the Application Circuit

Table 4-1: Bill of Materials

| Symbol | Value | Unit | Size | Manufacturer | Comment |
|--------|-------|------|------|--------------|--|
| C1 | 20 | pF | 0402 | various | Input DC Block |
| C2 | 18 | pF | 0402 | various | Low Frequency Ground at base Improve IIP3 |
| C3 | 100 | nF | 0603 | various | RF Bypass/RF Block |
| C4 | 22 | pF | 0402 | various | Improve IIP3 |
| C5 | 8.2 | pF | 0402 | various | Output Matching, Output DC Block |

| | | | | | |
|----|---------|-----------------|--------|-----------------------|---|
| L1 | 18 | nH | 0402 | Murata LQW15A | DC Feed, Input Matching |
| L2 | 9.1 | nH | 0402 | Murata LQW15A | DC Feed, Output Matching |
| R1 | 2.2 | Ω | 0402 | various | DC Bias, drop voltage for collector |
| R2 | 2.4 | k Ω | 0402 | various | DC Bias for Base |
| R3 | 2.2 | Ω | 0402 | various | Stability |
| M1 | 0.2x0.9 | mm ² | | | (microstrip line) width x length in mm |
| M2 | 0.2x0.9 | mm ² | | | (microstrip line) width x length in mm |
| Q1 | | | SOT343 | Infineon Technologies | BFP450 NPN bipolar transistor |

5. Measured Graphs

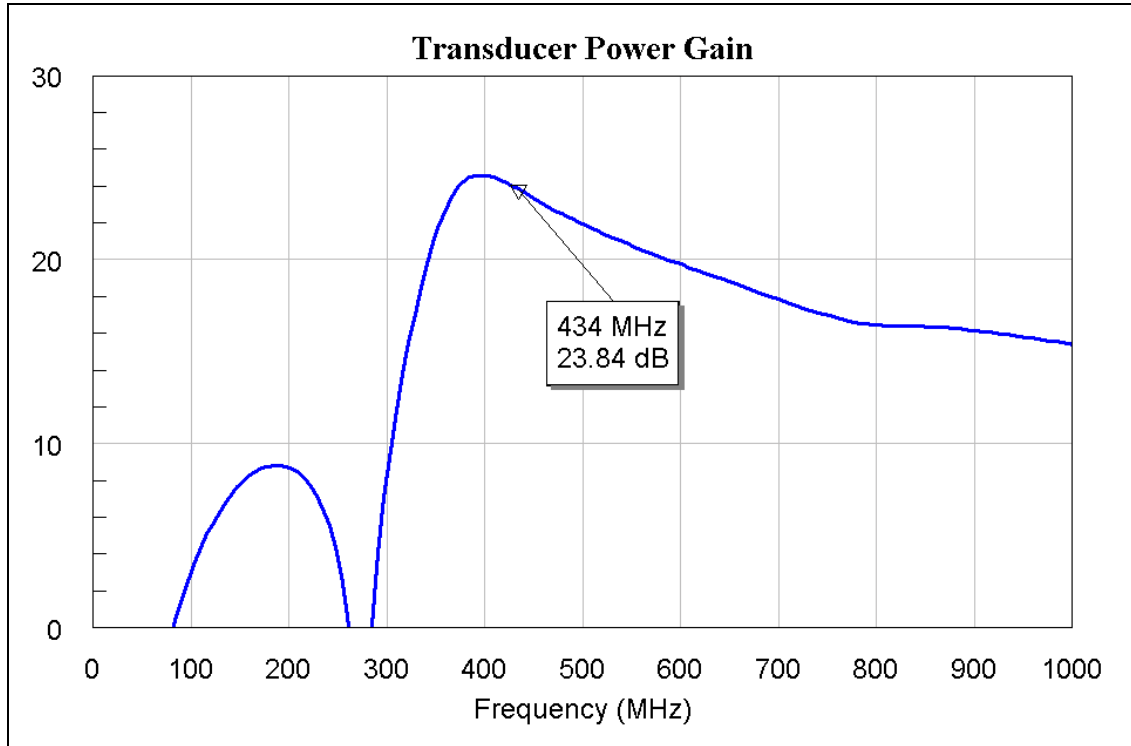


Figure 5-1: Transducer Power gain of BFP450

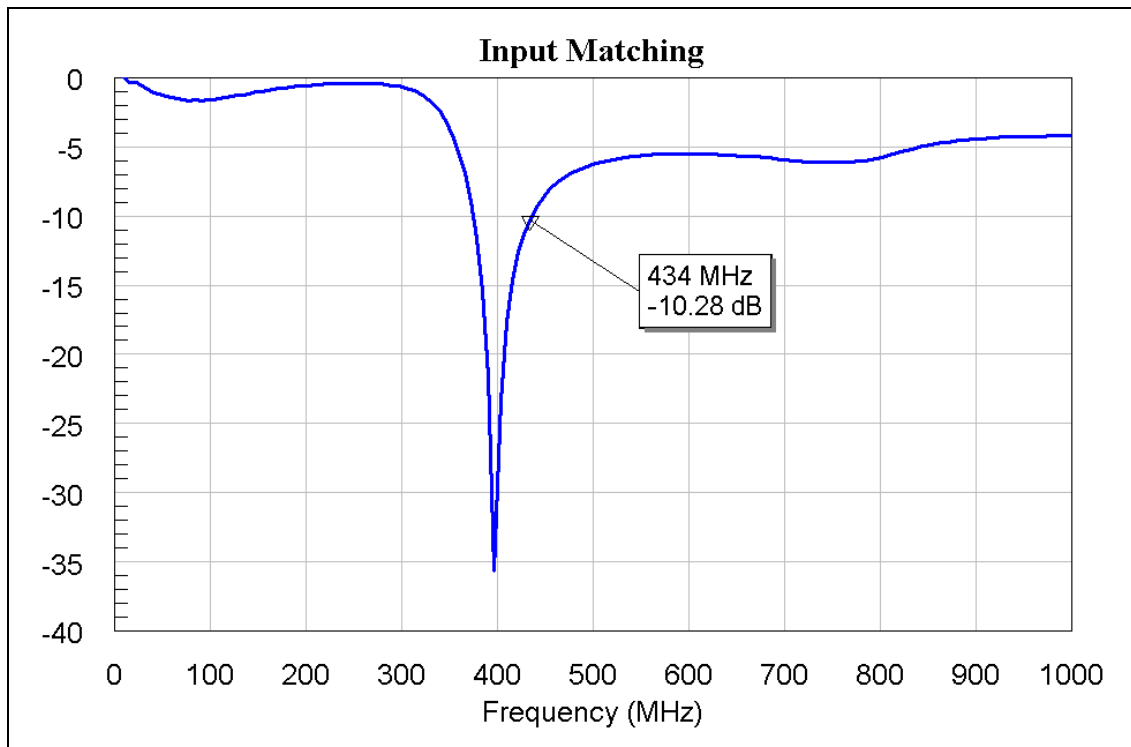


Figure 5-2: Input matching of BFP450

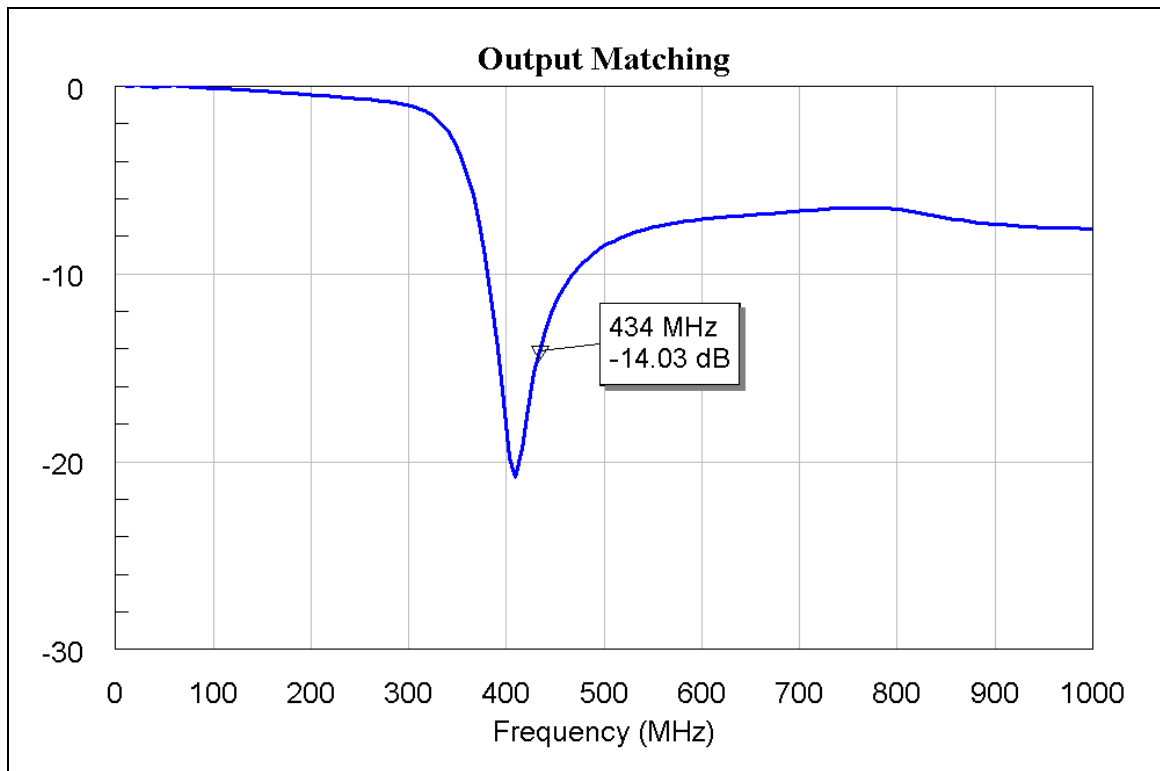


Figure 5-3: Output matching of BFP450

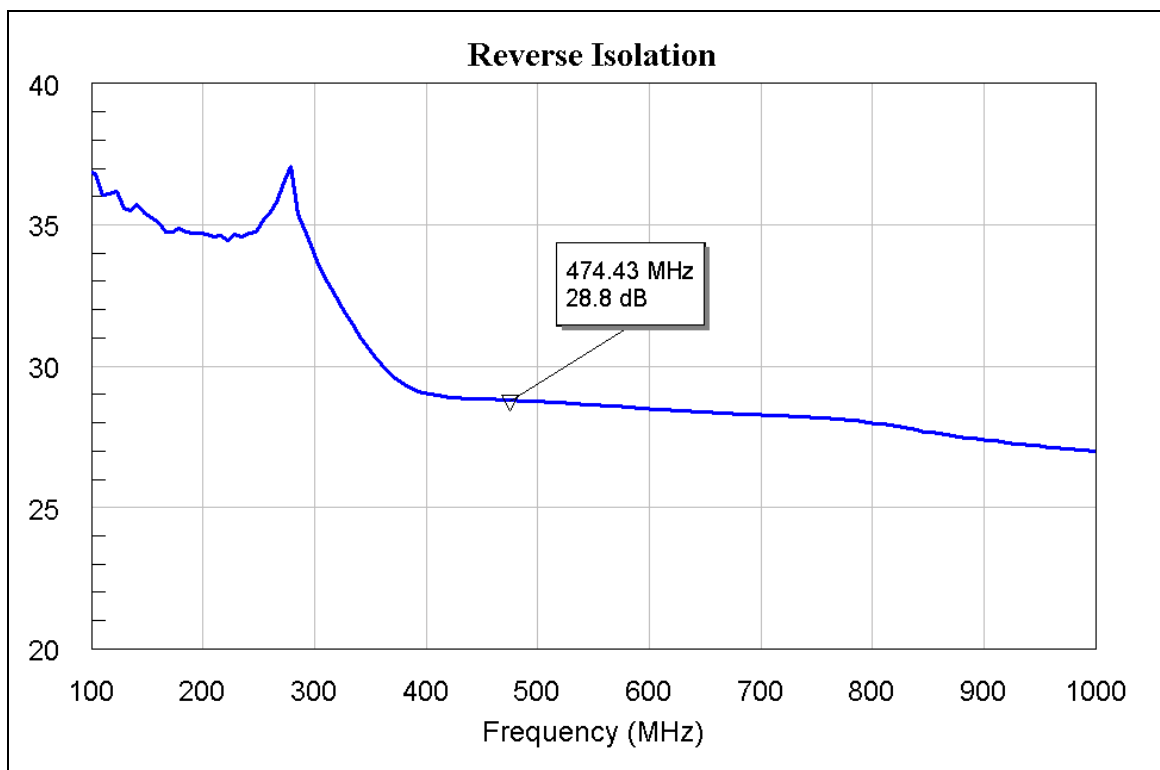


Figure 5-4: Reverse Isolation of BFP450

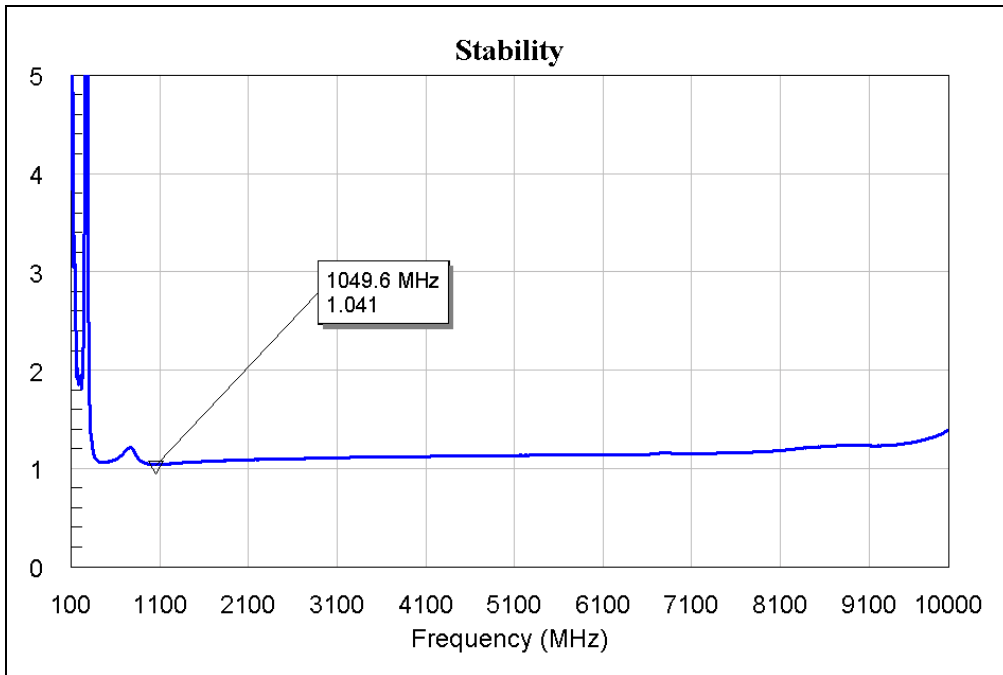


Figure 5-5: Stability of BFP450

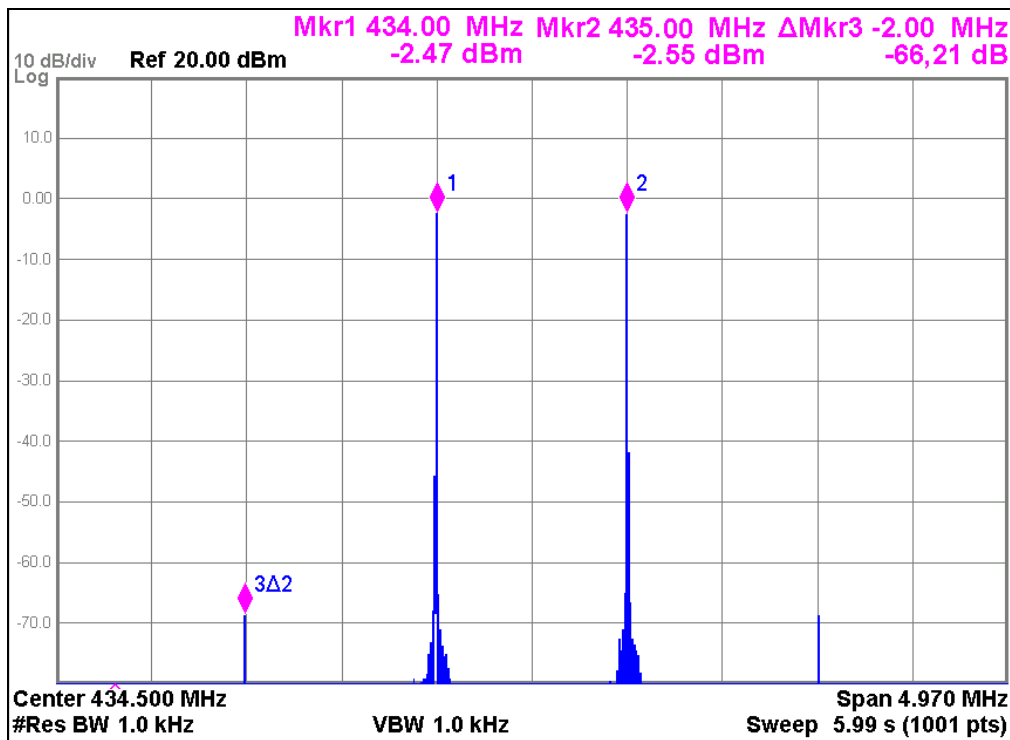


Figure 5-6: Output IP3 Measurement of the BFP450

The result of the OIP3 Measurement is

$$OIP3 = P_{f1} + \frac{(P_{f2} - P_{f3})}{2} = -2,47 + \frac{66,2}{2} = 30,6dBm$$

6. Evaluation Board and Layout Information

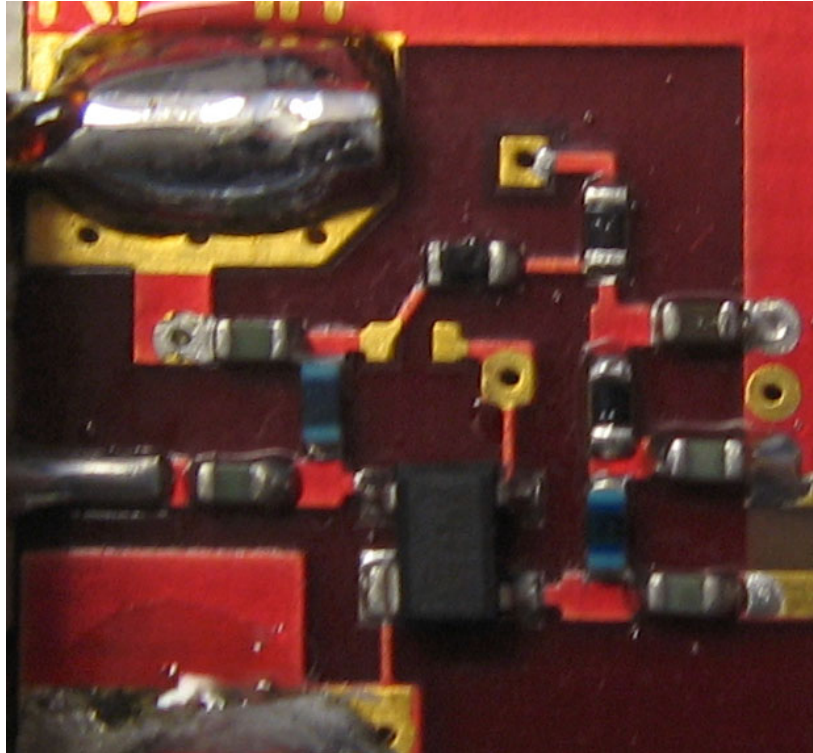


Figure 6-1: PCB Picture

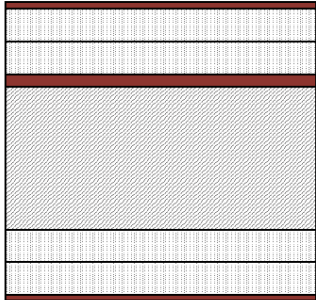
| | | |
|----------|-------------|---|
| 0.017 mm | Copper |  |
| 0.100 mm | Prepreg FR4 | |
| 0.100 mm | Prepreg FR4 | |
| 0.035 mm | Copper | |
| 0.460 mm | FR4 | |
| 0.100 mm | Prepreg FR4 | |
| 0.100 mm | Prepreg FR4 | |
| 0.100 mm | Prepreg FR4 | |
| 0.017 mm | Copper | |

Figure 6-2: Layout Information