

TRC105 Discrete L-C RF Tuning Network

Introduction

This application note presents a discrete L-C tuning network for Murata's TRC105 transceiver IC, as an alternative to the standard SAW filter tuning network. The tuning network schematic is shown in Figure 1, and component values for operation at 434 MHz are shown in Table 1.

TRC105 L-C RF Tuning Network

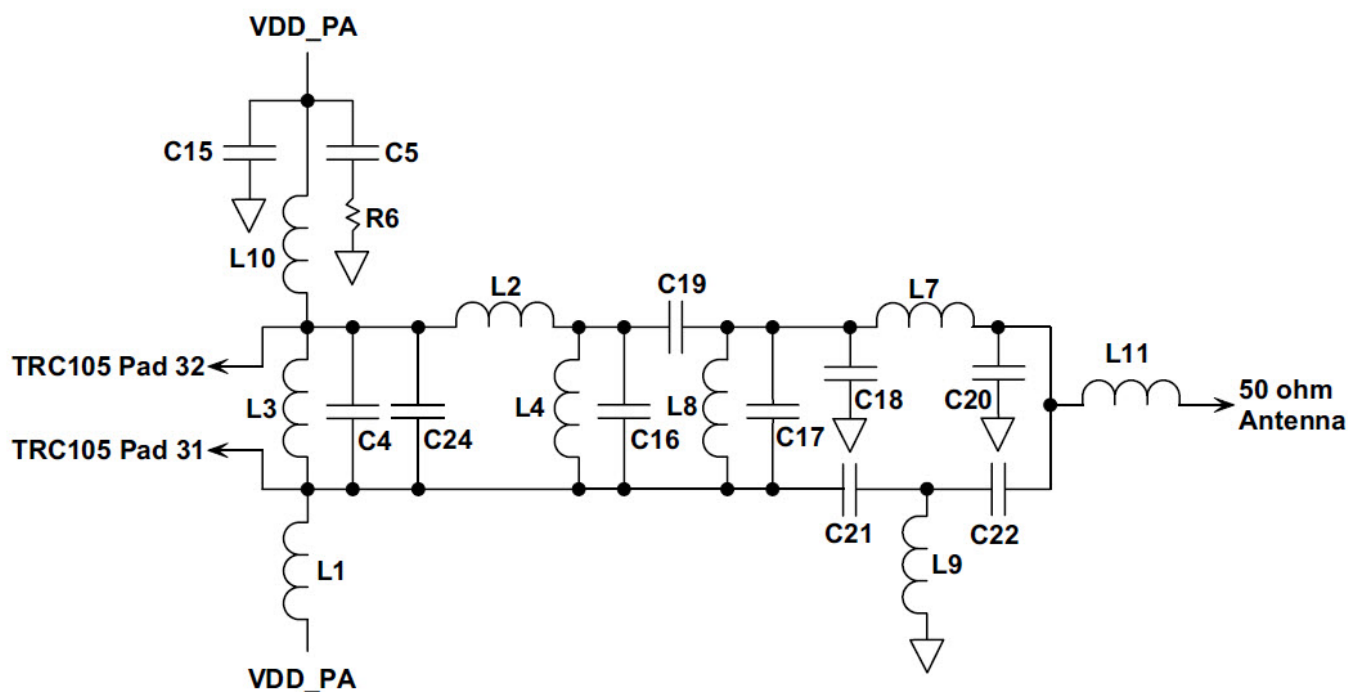


Figure 1

The tuning network consists of a three-pole band-pass filter followed by a discrete balanced-to-unbalanced balun network. L3-C4-C24, L4-C16, and L8-C17 form the three parallel-resonant sections of the band-pass filter. L2 top-couples resonant section L3-C4-C24 to resonant section L4-C16, which provides a steep roll-off above the filter's operating frequency. C19 top-couples resonant section L4-C16 to resonant section L8-C17, which provides a steep roll-off below the filter's operating frequency. C18, L7 and C20 plus C21, L9 and C22 provide the balanced-to-unbalanced balun function. L11 provides coupling to a 50 ohm antenna. L10, L1, C15, C5 and R1 provide stable decoupling between the VDD_PA power supply and the TRC103 differential RF port.

It is important to lay the tuning network out with short circuit board traces to minimize parasitics. Some adjustment of component values may be required depending on the actual circuit board design.

Component Values

| Typical Tuning Network Component Values for 434 MHz Operation | |
|---|---|
| L3, L4, L8 ¹ | SMD Inductor, 6.8 nH $\pm 2\%$, $Q \geq 75$ |
| L2 ² | SMD Inductor, 72 nH $\pm 5\%$, $Q \geq 75$ |
| L7, L9 | SMD Inductor, 33 nH $\pm 5\%$, $Q \geq 50$ |
| L1, L10 ³ | SMD Inductor, 220 nH $\pm 5\%$, $Q \geq 50$ |
| L11 (silkscreened C23) | SMD Inductor, 10 nH $\pm 5\%$, $Q \geq 50$ |
| C4, C16, C17 | SMD Capacitor, 15 ± 0.25 pF, COG, $Q \geq 100$ |
| C19 | SMD Capacitor, 2.2 ± 0.1 pF, COG, $Q \geq 100$ |
| C24 (stacked on C4) | SMD Capacitor, 1.5 ± 0.1 pF, COG, $Q \geq 100$ |
| C18, C20, C21, C22 | SMD Capacitor, 4.3 ± 0.25 pF, COG, $Q \geq 100$ |
| C15 | SMD Capacitor, 470 pF $\pm 20\%$, $Q \geq 50$ |
| C5 | SMD Capacitor, 0.047 μ F $\pm 20\%$ |
| R6 | SMD Resistor, 1 ohm $\pm 5\%$ |

Table 1

1. Coilcraft 0604HQ 1610 Series or equivalent
2. Coilcraft 1008HQ 2520 Series or equivalent
3. Toko LLQ1608-FR22 or equivalent

Example Circuit Board Layers

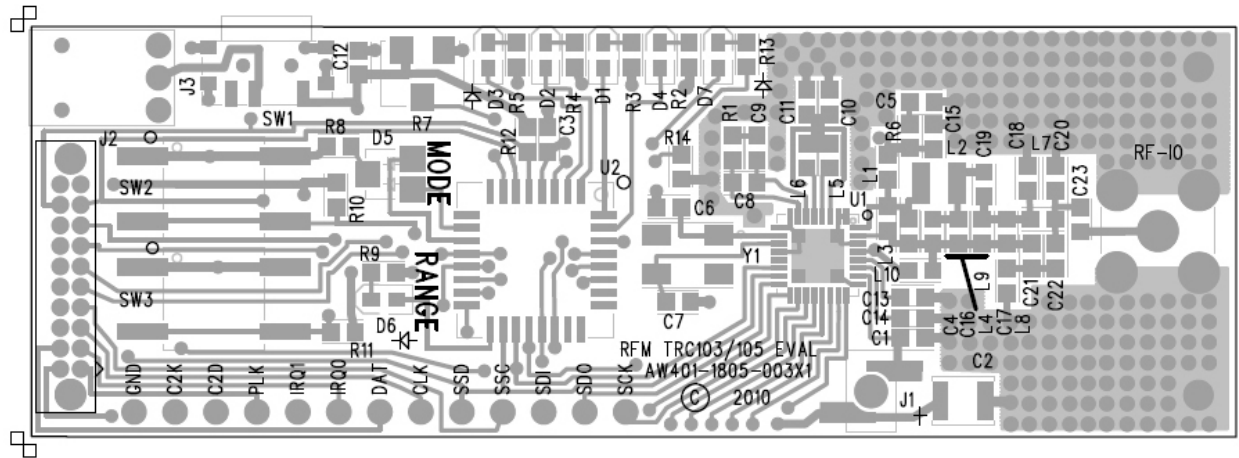


Figure 2 - Top Assembly

Figure 2 shows the TRC105 example circuit board top assembly. Note that inductor L11 is placed in the location labeled C23 on the PCB artwork. PADs PCB design files and Gerber files of the example layout are available at http://wireless.murata.com/RFM/data/trc105_pcb2.zip.

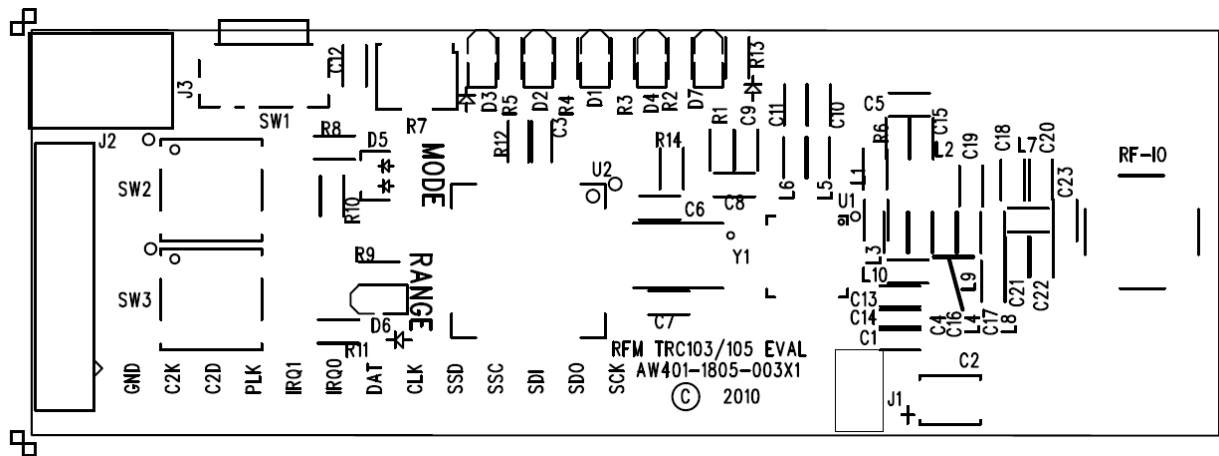


Figure 3 - Top Silkscreen

The top silkscreen is shown in Figure 3.

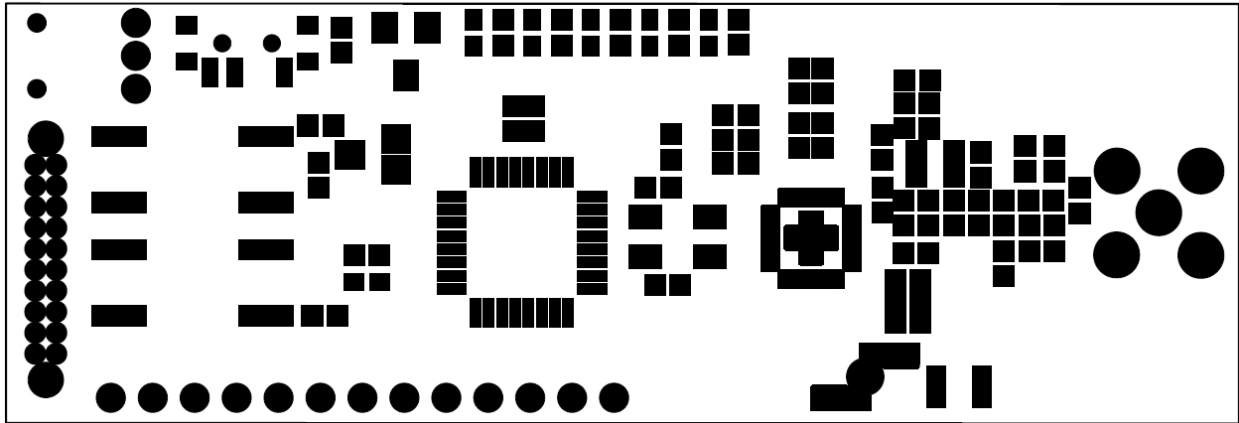


Figure 4 - Top Solder Mask

The top solder mask is shown in Figure 4.

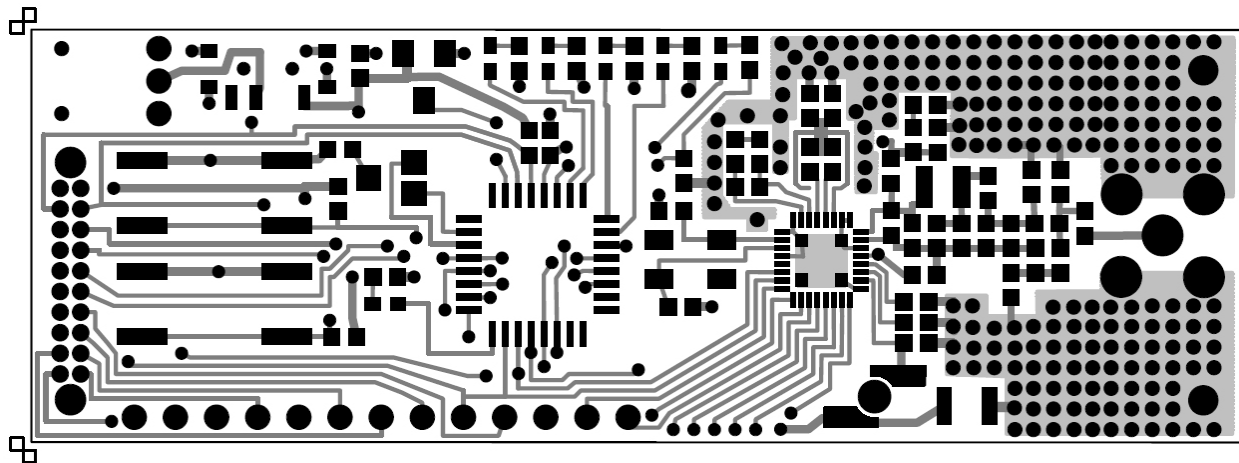


Figure 5 - Top Etch

The top etch pattern is shown in Figure 5. Using $\pm 5\%$ COG RF capacitors where specified in the bill of materials is important to performance.

| SIZE | QTY | SYM | PLATED | TOL |
|------|-----|----------------|--------|----------|
| 10 | 280 | + | YES | +/-0.003 |
| 55 | 3 | × | YES | +/-0.003 |
| 21 | 20 | □ | YES | +/-0.003 |
| 35 | 16 | ◇ | YES | +/-0.003 |
| 70 | 4 | ⊗ | YES | +/-0.003 |
| 35 | 2 | + ^A | NO | +/-0.003 |
| 48 | 2 | + ^B | NO | +/-0.003 |
| 62 | 2 | + ^C | YES | +/-0.003 |
| 80 | 1 | + ^D | NO | +/-0.003 |

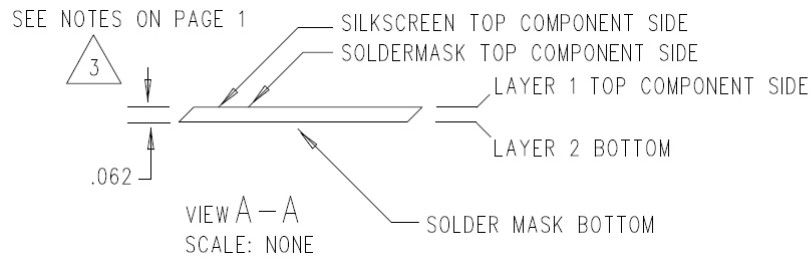
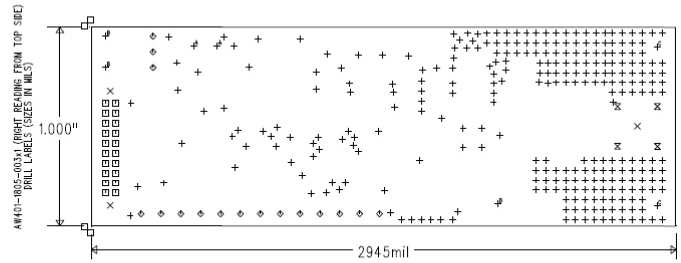


Figure 6 - Drill & Layer Data

The drill and layer data is provided in Figure 6. The example PCB is implemented on a two-sided 0.031 inch board with 1 ounce copper traces.

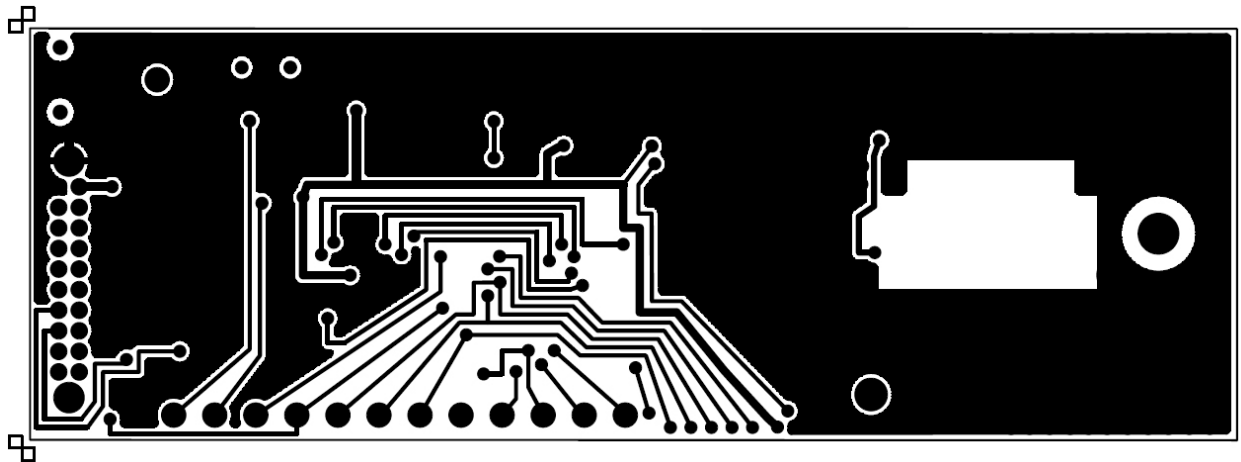


Figure 7 - Bottom Etch

Figure 7 shows the bottom etch pattern.

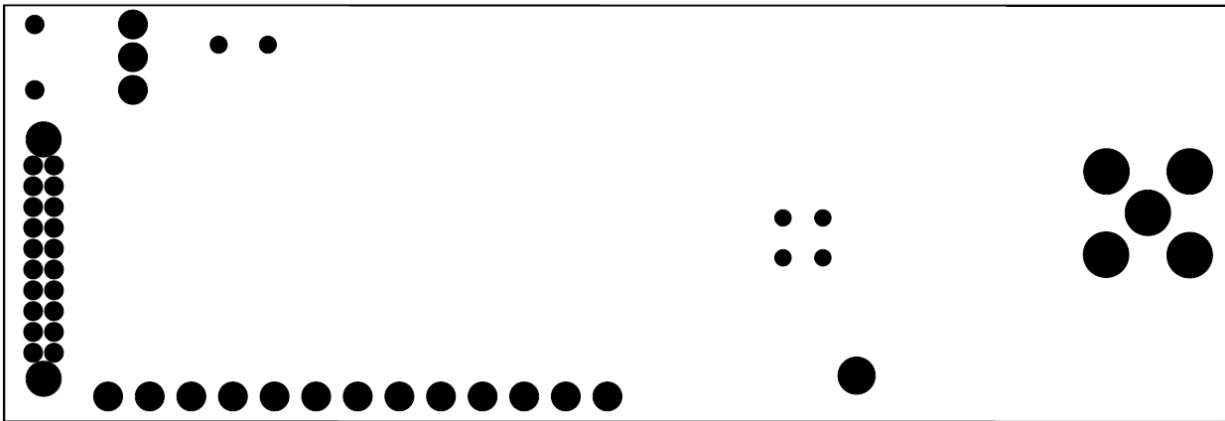


Figure 8 - Bottom Solder Mask

Figure 8 shows the bottom solder mask.

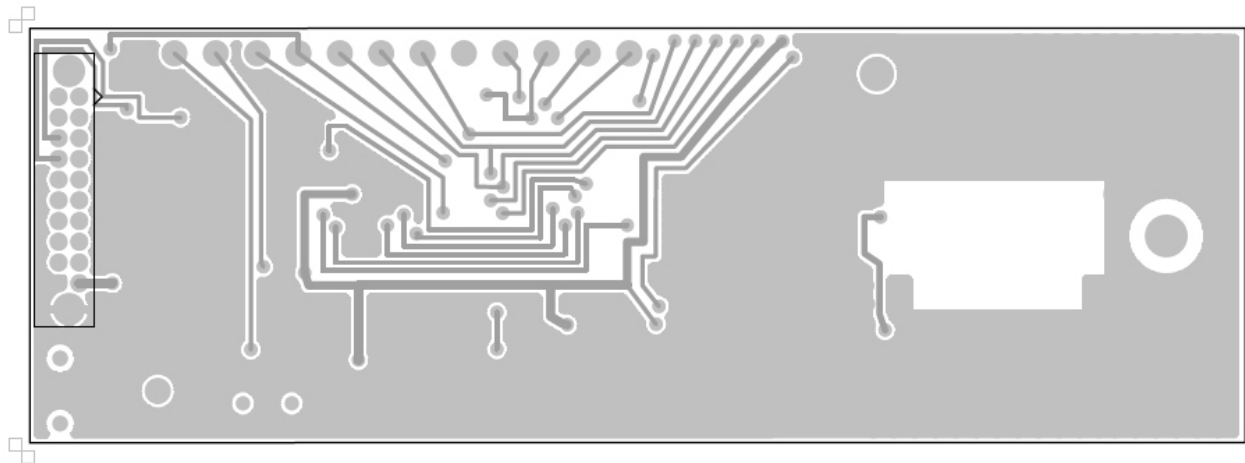


Figure 9 - Bottom Assembly

Figure 9 shows the bottom assembly.

