

RFMD208x Application Note

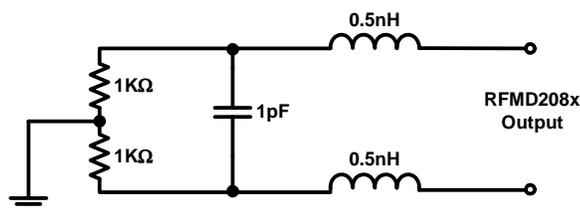
Modulator Output Match

The RFMD2080 and RFMD2081 are IQ modulators with integrated fractional-N synthesizer and VCOs. The RF output range of the modulators is from 45MHz to 2700MHz. This application note gives information on the baluns and matching that can be implemented to get best performance from these devices.

The modulator output is differential and requires a balun and simple matching circuit optimized to the specific application frequencies. The modulator output pins are also used to source current for the modulator mixer circuits, about 10mA on each pin. This is usually via a center-tapped balun or by RF chokes in the external matching circuitry to the supply.

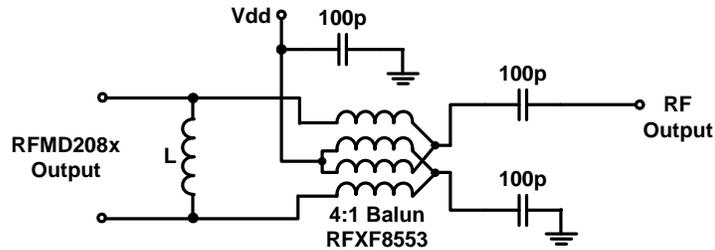
The modulator output is high impedance, consisting of approximately $2\text{K}\Omega$ resistance in parallel with some capacitance, approximately 1pF . The modulator output does not require a conjugate matching network. It is a constant current output which will drive a real differential load of typically 200Ω . Since the mixer output is a constant current source, a higher resistance load will give higher output voltage and gain. A shunt inductor can be used to resonate with the mixer output capacitance at the frequency of interest. This inductor may not be required at lower frequencies where the impedance of the output capacitance is less significant. At higher output frequencies the inductance of the bond wires (about 0.5nH on each pin) becomes more significant.

Figure 1. Simple Model of the Modulator Output

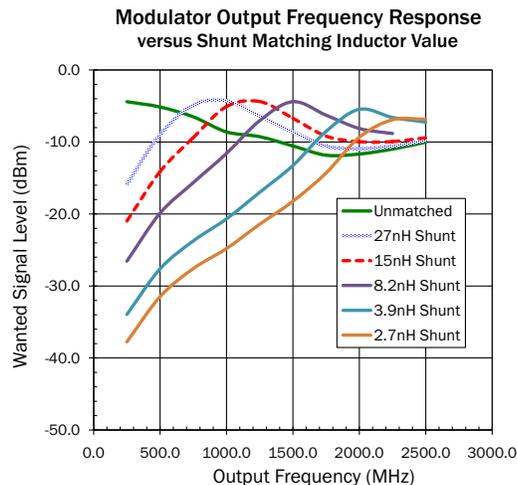


It is recommended to use a 4:1 balun on the modulator output, converting from the single ended 50Ω system to a 200Ω differential load. For most applications the RFXF8553 wideband transmission line transformer from RFMD is ideal (<http://www.rfmd.com/CS/Documents/RFXF8553DS.pdf>). It is specified to operate from 500MHz to 2500MHz, but will in fact operate well down to 45MHz for use with the RFMD208x modulators.

Figure 2. Typical Schematic for the RFMD208x Output Using the RFXF8553



The following plot shows the output frequency response for the RFMD208x modulator with the output circuit shown above. It highlights the effect of the shunt inductor L which can be used to resonate with the output capacitance of the modulator to improve gain and output power at higher frequencies. Note the 3dB loss point of the RFXF8553 transformer at 2500MHz.



For narrowband applications, and in particular for applications above 2GHz where the RFXF8553 becomes more lossy, ceramic hybrid LTCC type baluns are a good solution. These are available from many manufacturers, for example Johanson Technology and Murata. These baluns are mainly confined to the more commercial frequency ranges such as the cellular bands and the 2.4GHz ISM band. The disadvantage of ceramic baluns compared to the wideband transmission line transformer is that they will offer good common mode rejection only over a much narrower frequency range. A typical circuit for the RFMD208x modulator output is shown below.

Figure 3. Typical Schematic for the RFMD208x Output Using Ceramic Balun

