CMY 210 - 1960 MHz to 110 MHz Down-Converter

Application Note No. 037

The CMY 210 is a ultralinear mixer with integrated LO-buffer for frequencies up to and exceeding 2.5 GHz. A low LO-input power of typically 0 dBm is sufficient to provide a very high input intercept point of typically + 25 dBm at 3 V.
The input and output ports are 50 Ω matched. The device can be used as up- and down-converter.

Application Circuit

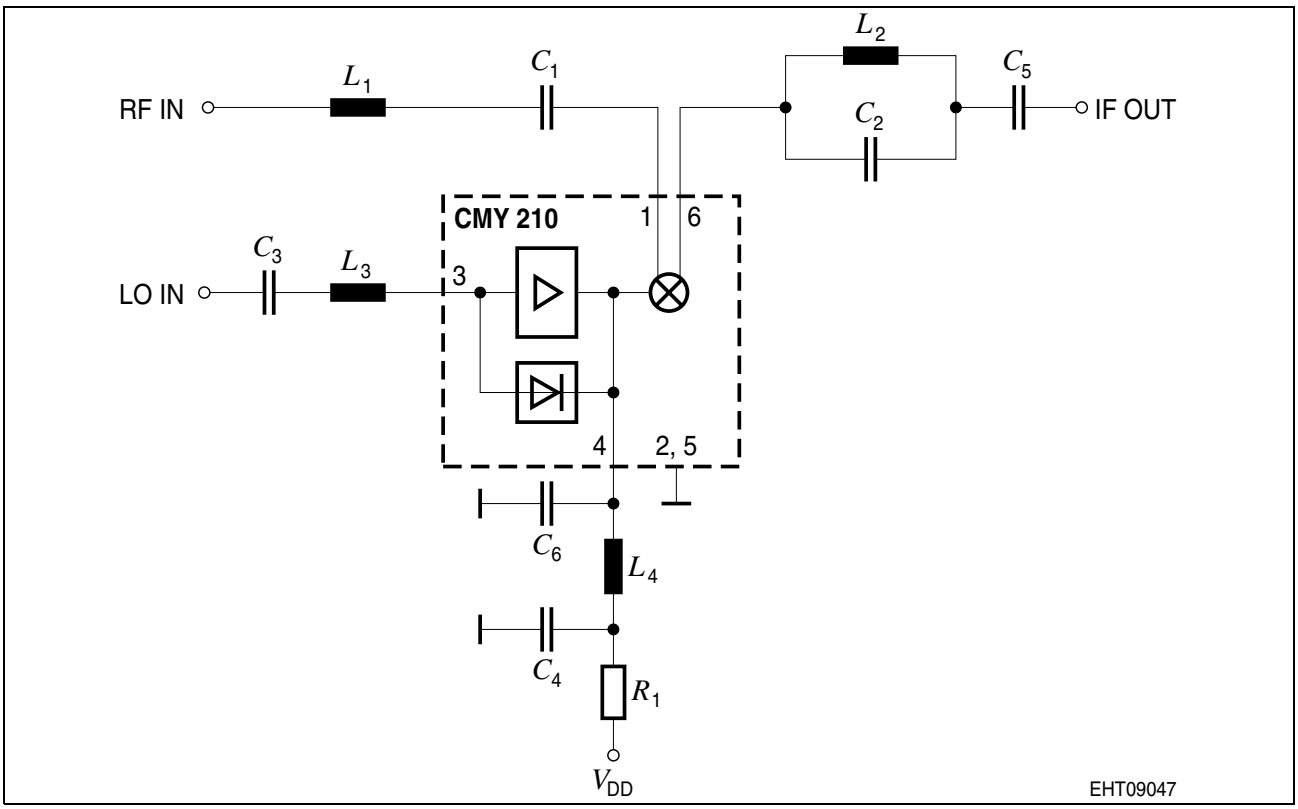


Figure 1 Application Circuit

Table 1 List of Components

L_1	3.3 nH Coilcraft 0805	C_3	12 pF 0805
L_2	3.3 nH Coilcraft 0805	C_4	12 pF 0805 parallel to 0.47 µF
L_3	2.2 - 2.7 nH or printed coil (tune for minimum power consumption)	C_5	150 pF 0805
L_4	3.3 nH Coilcraft 0805 (tune for minimum power consumption)	C_6	Not required in this application
C_1	1.8 pF 0805	R_1	Not required in this application
C_2	1.2 pF 0805		

Setup

1. In order to optimize power consumption, L_4 can be modified for minimum drain current: Switch on local oscillator at required LO-frequency and check the drain current. Adjust the LO-frequency to find the minimum current. If the minimum is detected at a lower frequency than the required LO-frequency, choose a lower value inductor for L_4; if detected at a higher frequency, choose a higher value.
2. Matching of IF- and RF-filters

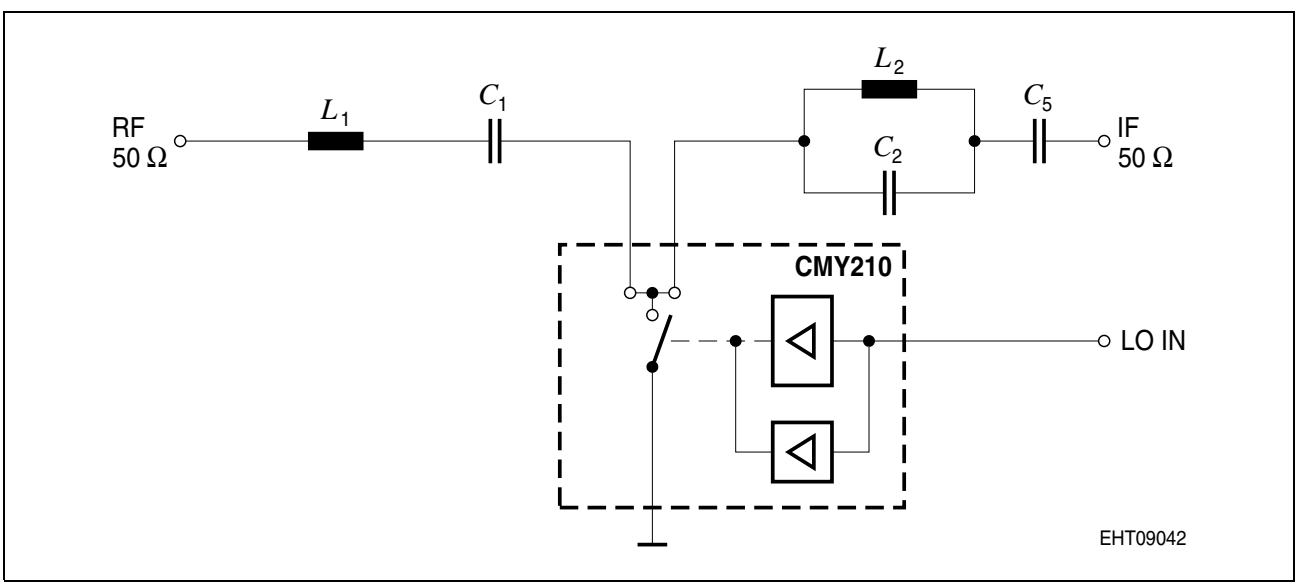


Figure 2 CMY 210 External Matching Circuit

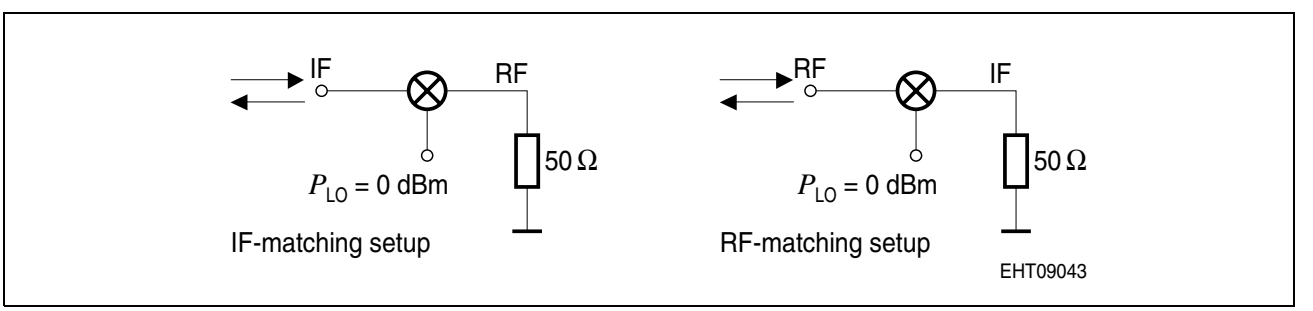


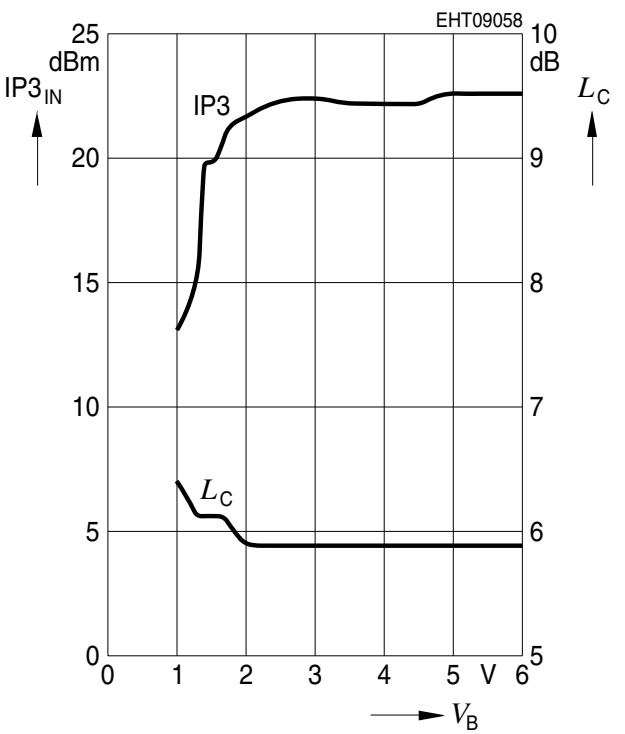
Figure 3 IF-Matching Setup and RF-Matching Setup

Usually both resonance filters (L_1, C_1 and L_2, C_2) are tuned to the RF-frequency. Filter L_1, C_1 passes the RF-frequency and reflects the IF-signal. Filter L_2, C_2 suppresses the RF-band and passes IF. An appropriate adjustment of the filters is the prerequisite to achieve a lower conversion loss. According to **Figure 2** the resonance frequency of the IF-filter L_2, C_2 ($f_{res} = 1/(2\pi\sqrt{L_2 \times C_2})$) can be adjusted to maximum reflection at f_{RF} by choosing appropriate inductors and capacitors. Correspondingly, the L_1, C_1 resonance frequency of RF-filter can be matched with minor modification of these values according to **Figure 2**. Since the IF- and RF-filters are connected with the ohmic resistor of the switching FET, matching of either filter might influence the matching parameters of the other filter.

3. At higher LO-frequencies (> 2 GHz) the gain of the LO buffer amplifier is already decreasing, causing a slightly lower IP_{3IN} and higher operating current.

4. The IP_{3IN} remains very constant with changes in operating voltage. A supply voltage of less than 2 V however will decrease the intermodulation performance. Please refer to the following figure. The conversion losses L_C are independent of the operating voltage as long as the switch transistor is not pinched off. The losses are mainly determined by the quality of IF- and RF-filters as mentioned in 2.

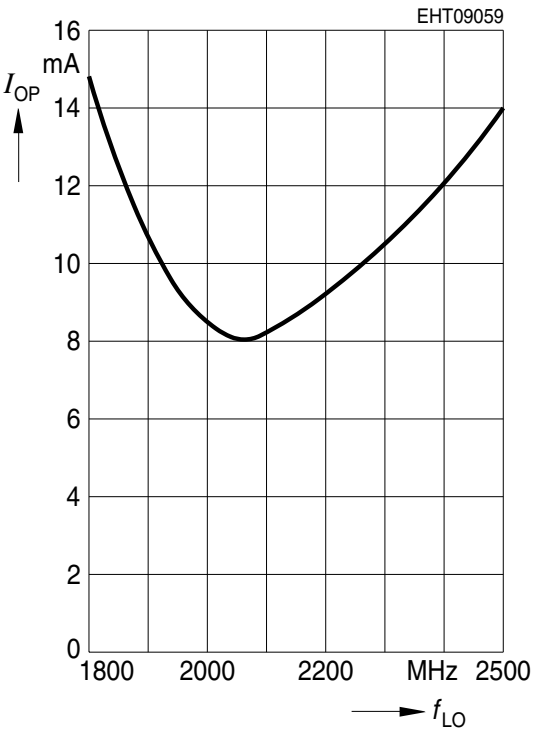
IP_{3IN}, L_C vs. Operation Voltage
f_{RF} = 1960 MHz, P_{RF} = 2x-3 dBm,
f_{LO} = 2070 MHz, P_{LO} = 0 dBm



5. The figure below shows the operating current over LO-frequency. A current minimum at approximately 2070 MHz has been obtained by tuning the circuit for this LO-frequency as described in 2.

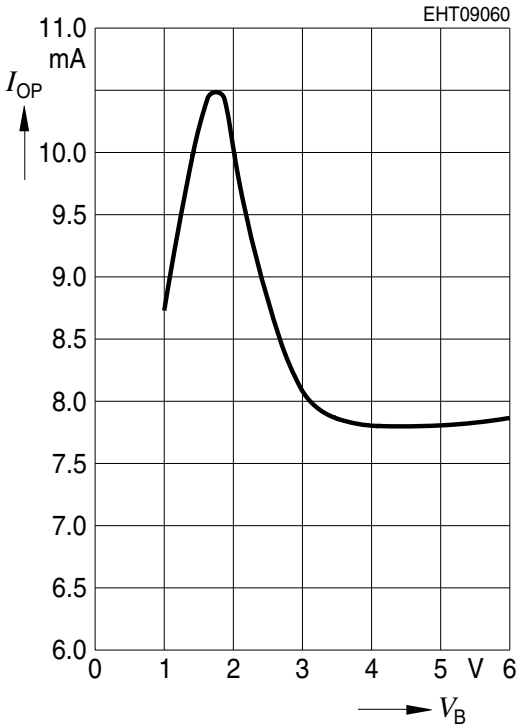
Operating Current vs. LO-Frequency

V_D = 3 V, P_{LO} = 0 dBm

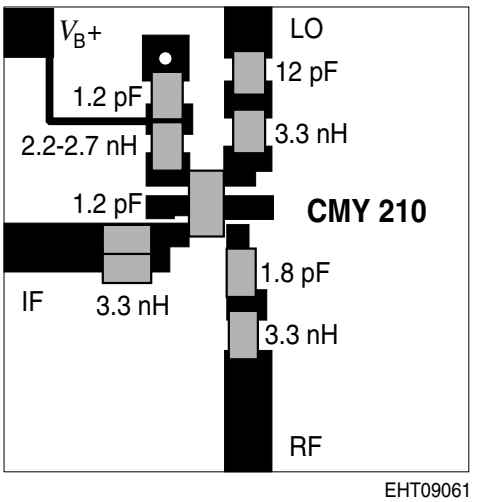


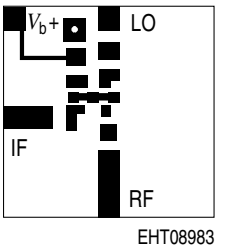
6. The operation current over the operating voltage at a fixed f_{LO} = 2070 MHz is shown in the following figure.

Operation Current vs. Operation Voltage at f_{LO} = 2070 MHz



Layout of 1960 MHz to 110 MHz Down-Converter





Actual size 20 mm × 20 mm

Figure 4 Layout of Application Board

PCB - data: Glass fiber epoxy board (double sided), ε_r = 4.8, thickness = 1.0 mm

Keydata of 1960 MHz to 110 MHz Down-Converter

(Test conditions: V_D = 3.0 V; f_{RF} = 1960 MHz ± 0.5 MHz; P_{RF} = 2 x – 3 dBm; f_{LO} = 2070 MHz; P_{LO} = 0 dBm; f_{IF} = 110 MHz; T_A = 25 °C)

Parameter	Symbol	Value	Unit
Operating current	I_{OP}	8.1	mA
Conversion Loss	L_C	5.9	dB
3rd Order Input Intercept Point	IP_{3IN}	+ 22.6	dBm
RF- /IF-Input Return Loss	IRL	> 12	dB
2nd order intermodulation (Test conditions: f_{RF} = 1960 MHz; P_{RF} = – 3 dBm; f_{LO} = 2070 MHz; P_{LO} = 0 dBm)			