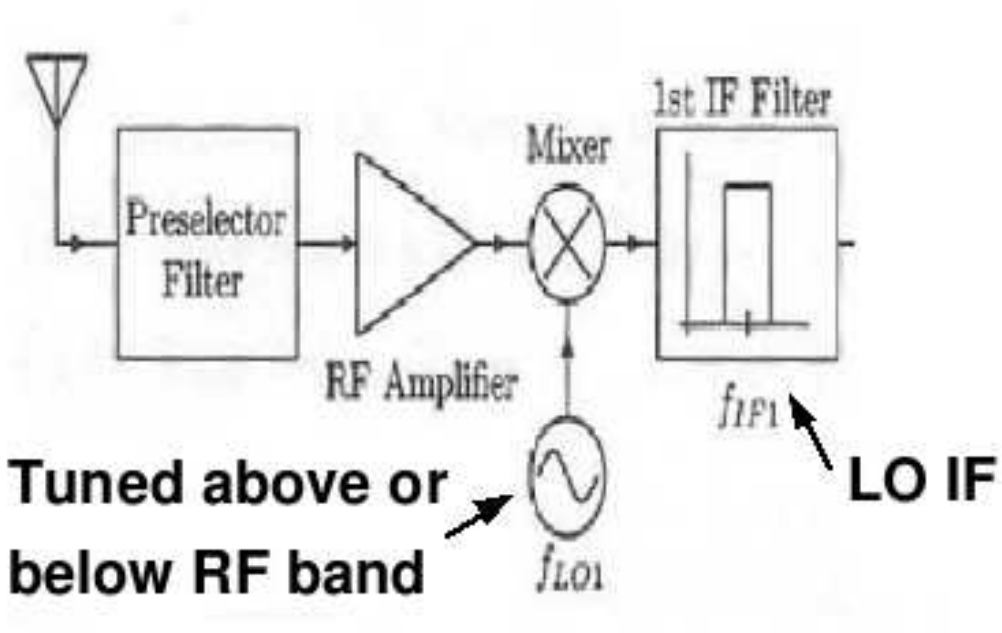
Project ENGN4545

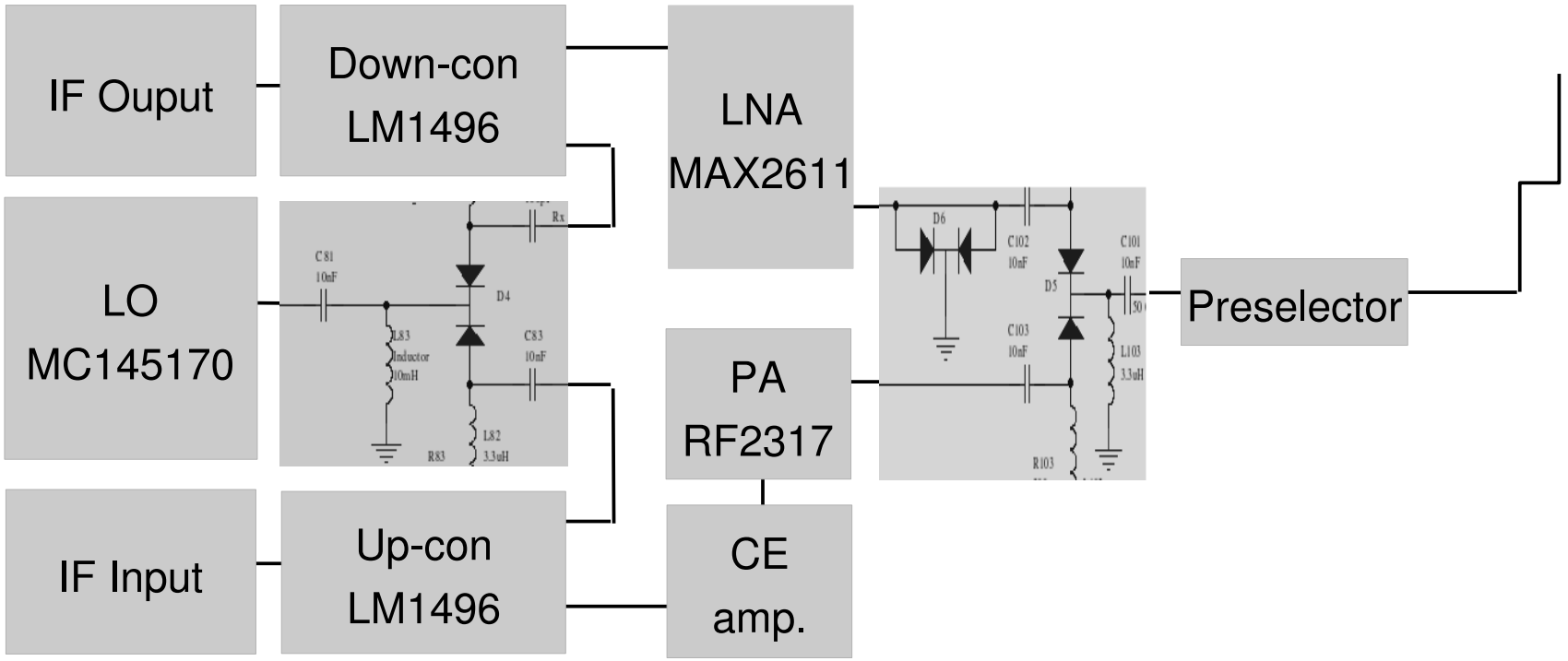
- Project description
- Introduction to the Radiofrequency chips used in the projects.
- Review of Lecture10

Low Intermediate Frequency Receiver

- The LOW IF can be digitised to avoid the 90^o phase shifter.
- Has an image problem like all superhets.



Transceiver 1

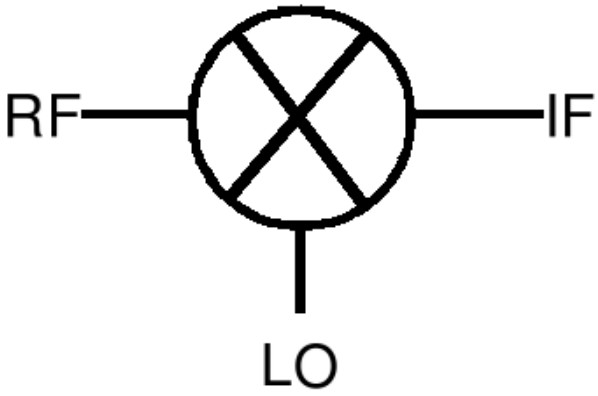


Transceiver 1

- Worth 40% of mark.
- Mark of 60% of this for the logbook, scrap book and description and dead bug results for the frequency synthesiser.
- 20% for the PCB layout design and description (Eagle files).
- 20% for the working circuit and tests.
- Need eagle PCB designs in by the end of the week.

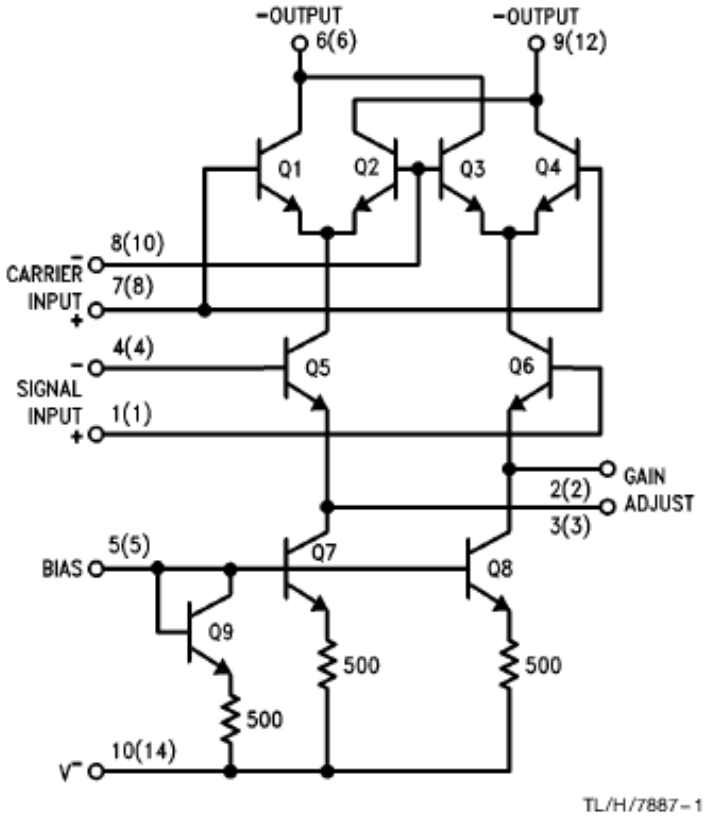
Mixers

- Mathematically, mixers are multipliers.
- Terminology in the following figure and loosely: $IF = RF \times LO$.
- Multiplication of sine waves produces sines waves of different frequencies (trig formulae).



LM1496 Balanced Modulator Demodulator

- VHF frequencies only.



Numbers in parentheses show DIP connections.

LM1496 Balanced Modulator Demodulator: How does it work

MAX2611 LNA

19-1094; Rev 2; 4/05

EVALUATION KIT AVAILABLE

MAXIM

DC-to-Microwave, Low-Noise Amplifier

MAX2611

General Description

The MAX2611 is a low-voltage, low-noise amplifier for use from DC to microwave frequencies. Operating from a single +5V supply, it has a 3dB bandwidth of 1100MHz. The MAX2611's low noise figure and high drive capability make it ideal for a variety of transmit, receive, and buffer applications.

In a typical application, the only external components needed are input and output blocking capacitors and a V_{CC} series resistor. To improve gain and output power, an RF choke can be added in series to the bias resistor.

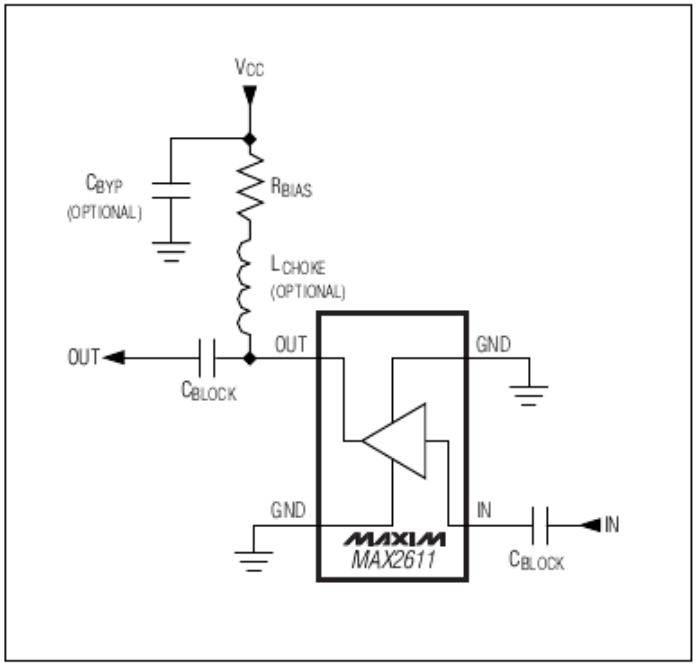
The MAX2611 comes in a 4-pin SOT143 package, requiring minimal board space.

Features

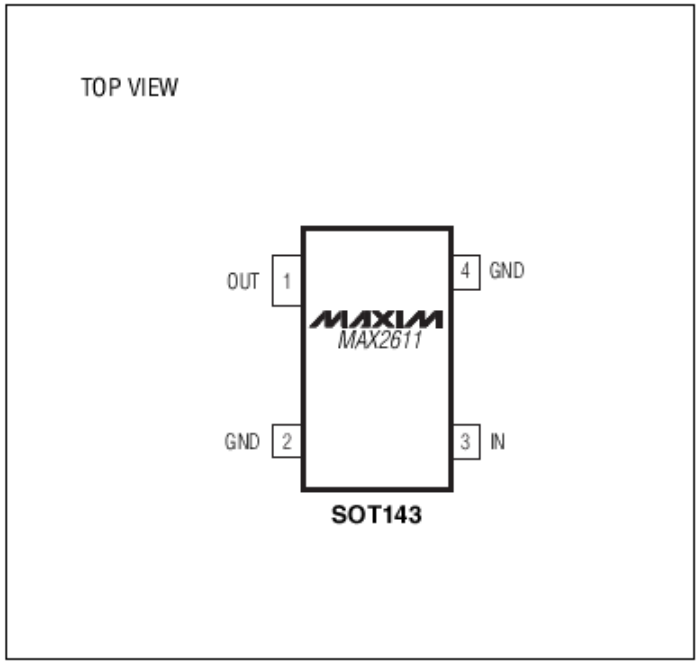
- ♦ **Single +5V Supply Operation**
- ♦ **3dB Bandwidth: DC to 1100MHz**
- ♦ **High Gain: 18dB at 500MHz**
- ♦ **Low Noise Figure: 3.5dB at 500MHz**
- ♦ **High Drive Capability: +3dBm at 16mA I_D**
- ♦ **Ultra-Small SOT143 Package**

MAX2611 LNA

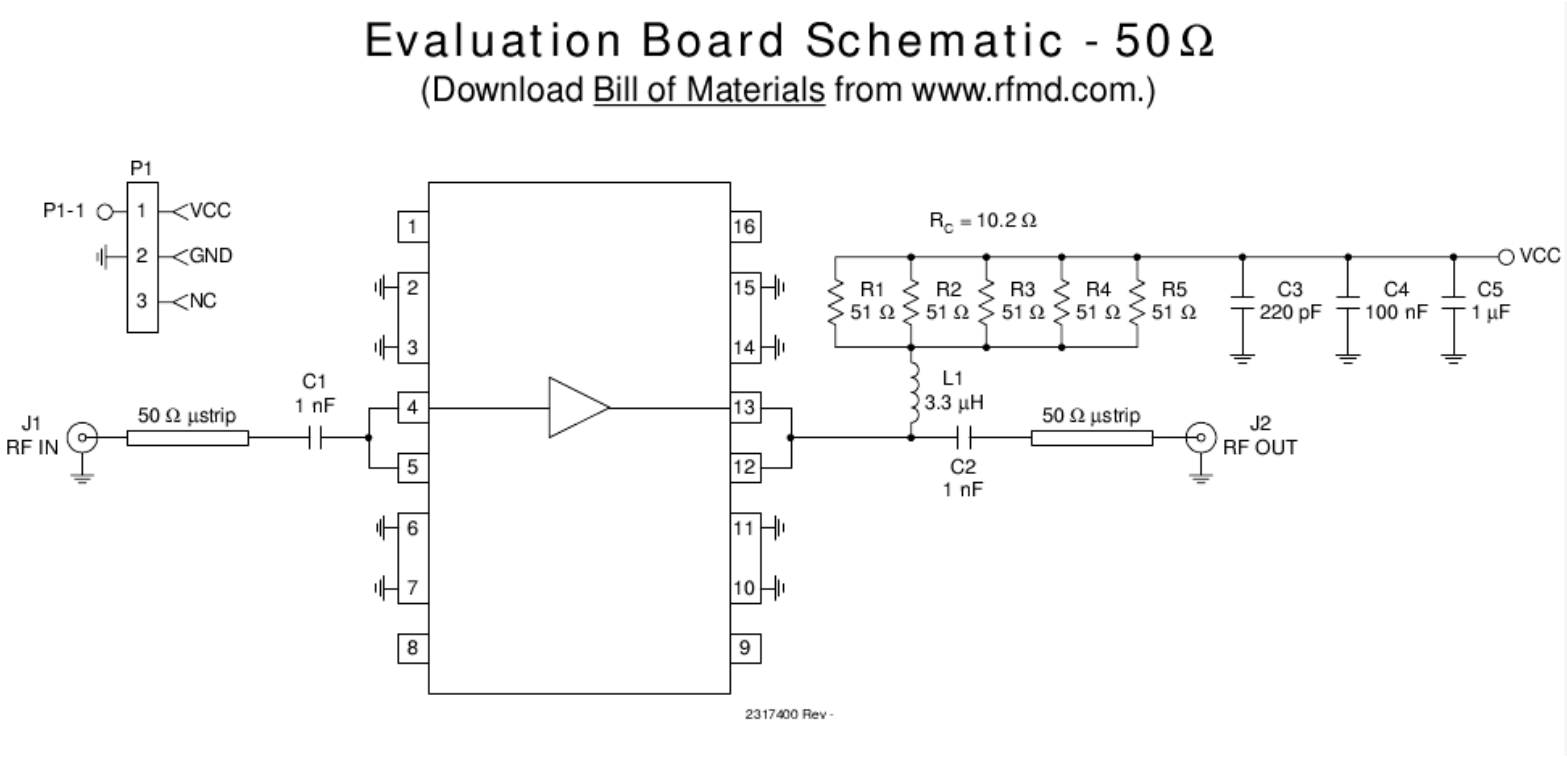
Typical Operating Circuit



Pin Configuration



RF2317



PIN diodes

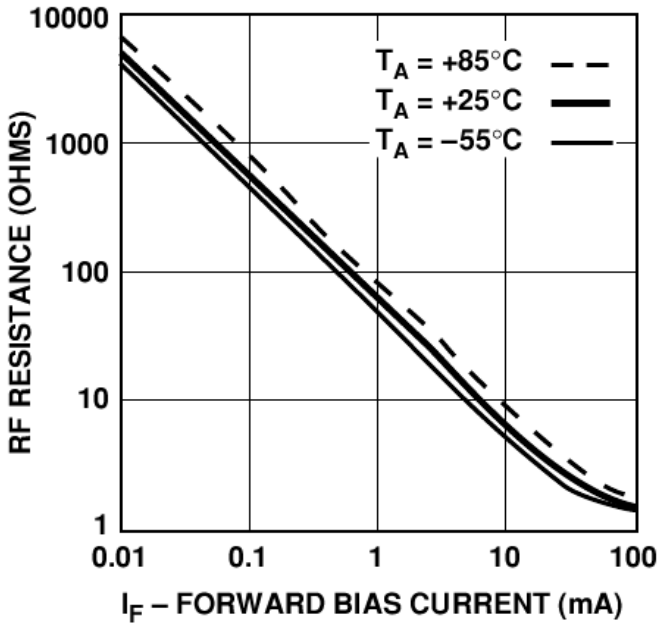
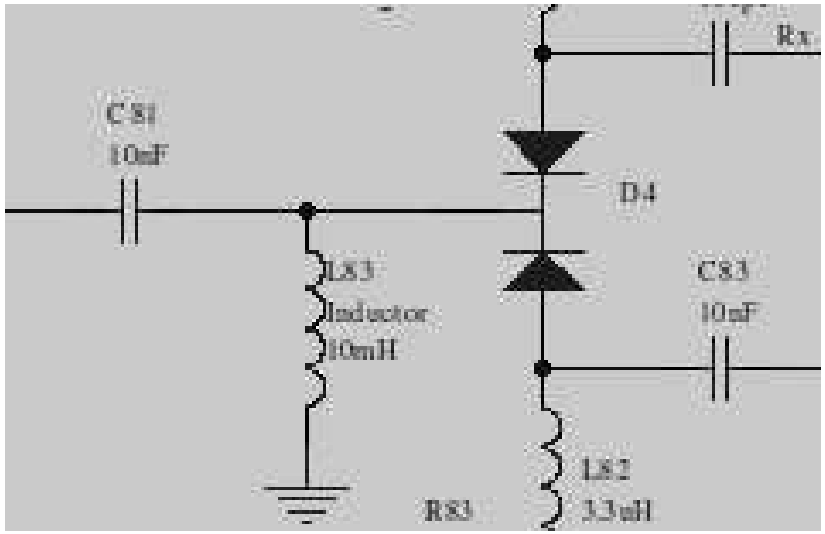
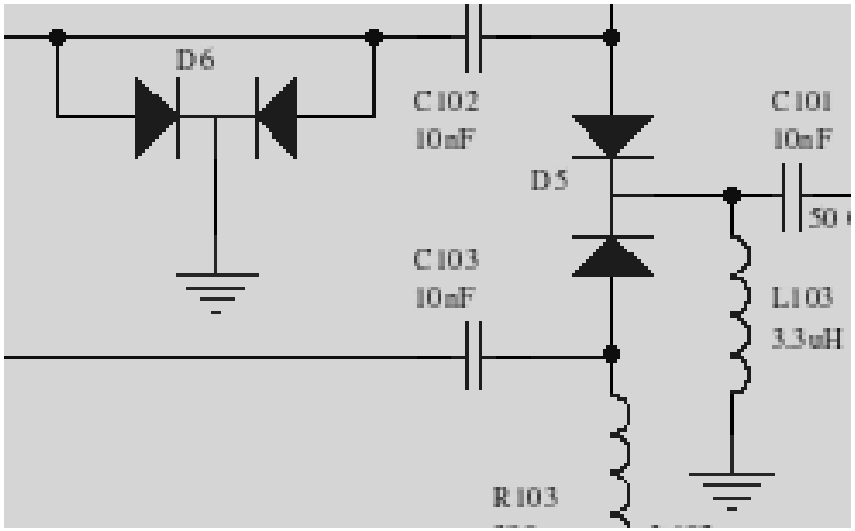


Figure 2. RF Resistance vs. Forward Bias Current.

PIN diodes


Rx
C81
10nF
D4
L83
Inductor
10mH
C83
10nF
L82
3.3nH
R83


D6
C102
10nF
C101
10nF
D5
C103
10nF
L103
3.3nH
R103

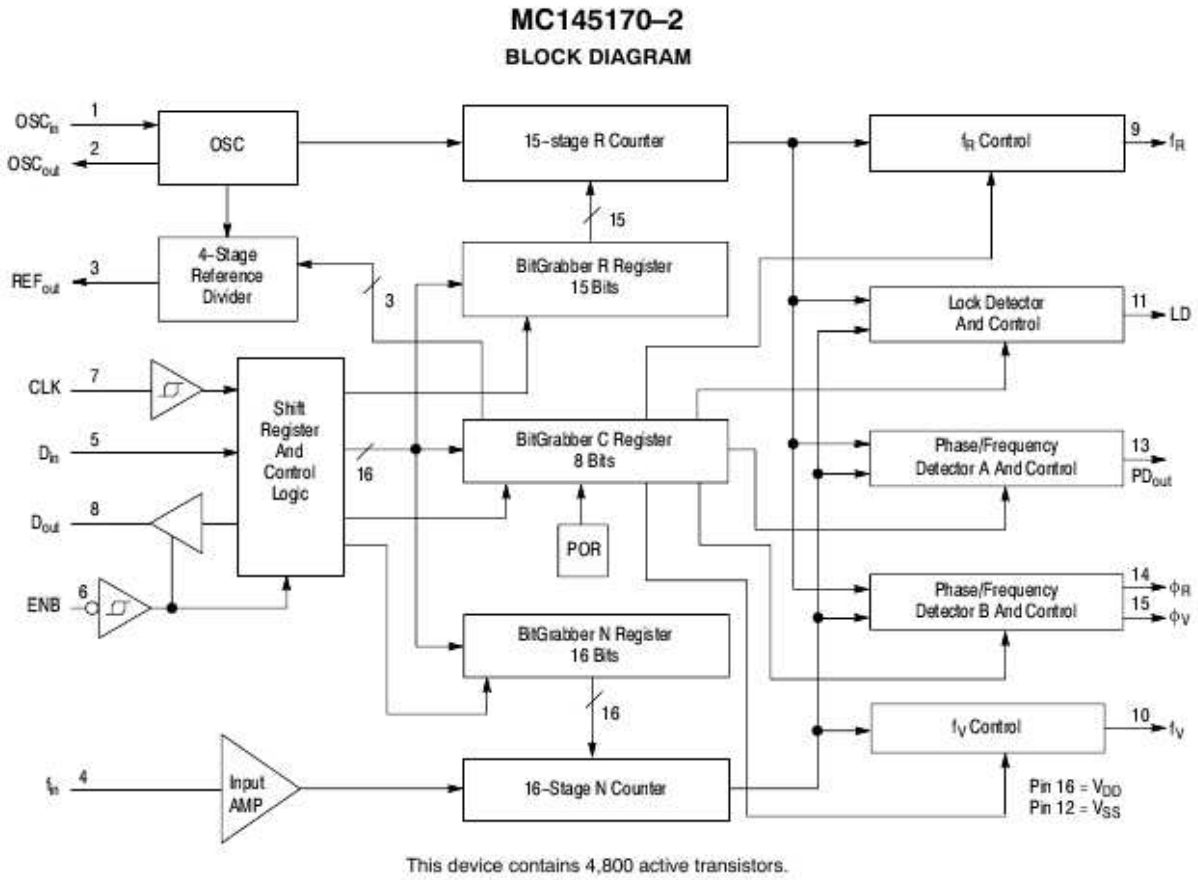
Frequency Synthesisers

- Phase lock loop (PLL) and voltage controlled oscillator (VCO)
- Direct Digital Synthesiser (DDS).

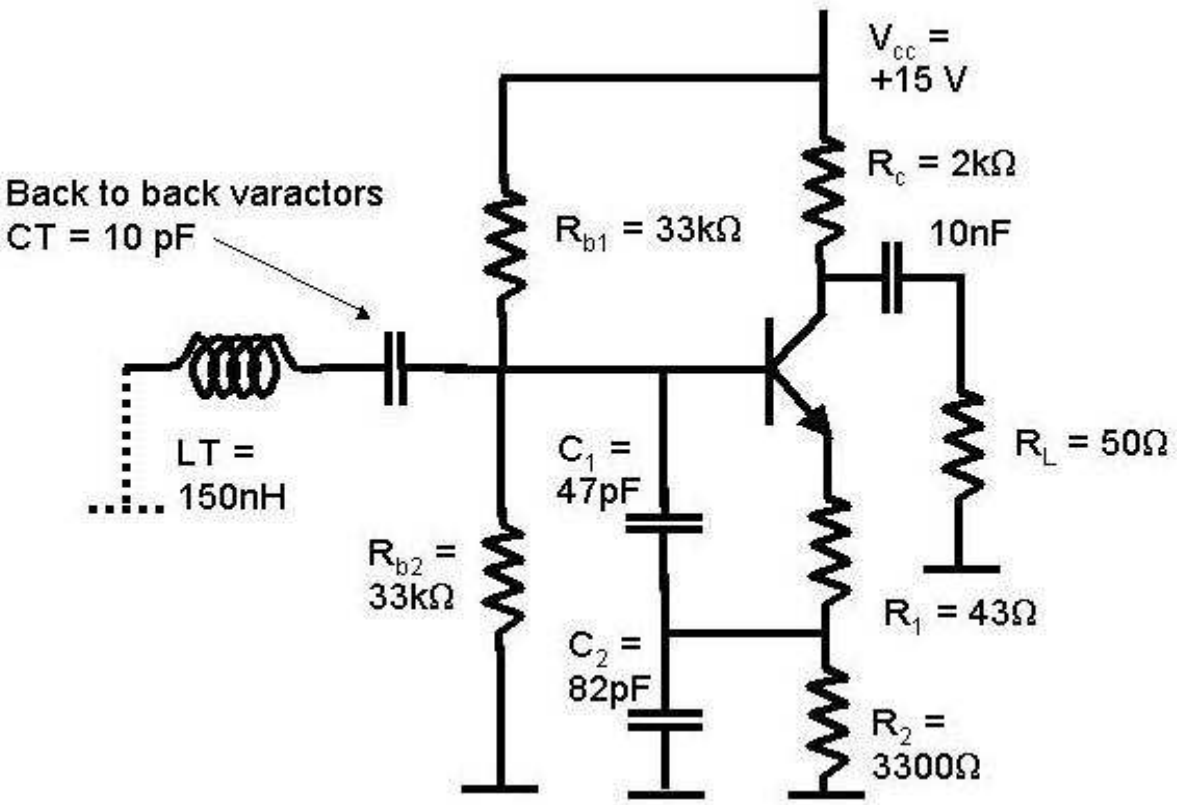
The MC145170

- Operates up to 185 MHz. But no internal VCO.
- R Counter Division Range: 1 and 5 to 32,767
- N Counter Division Range: 40 to 65,535
- Special patented bit grabbing interface to set the PLL parameters such as N and R prescaler values.

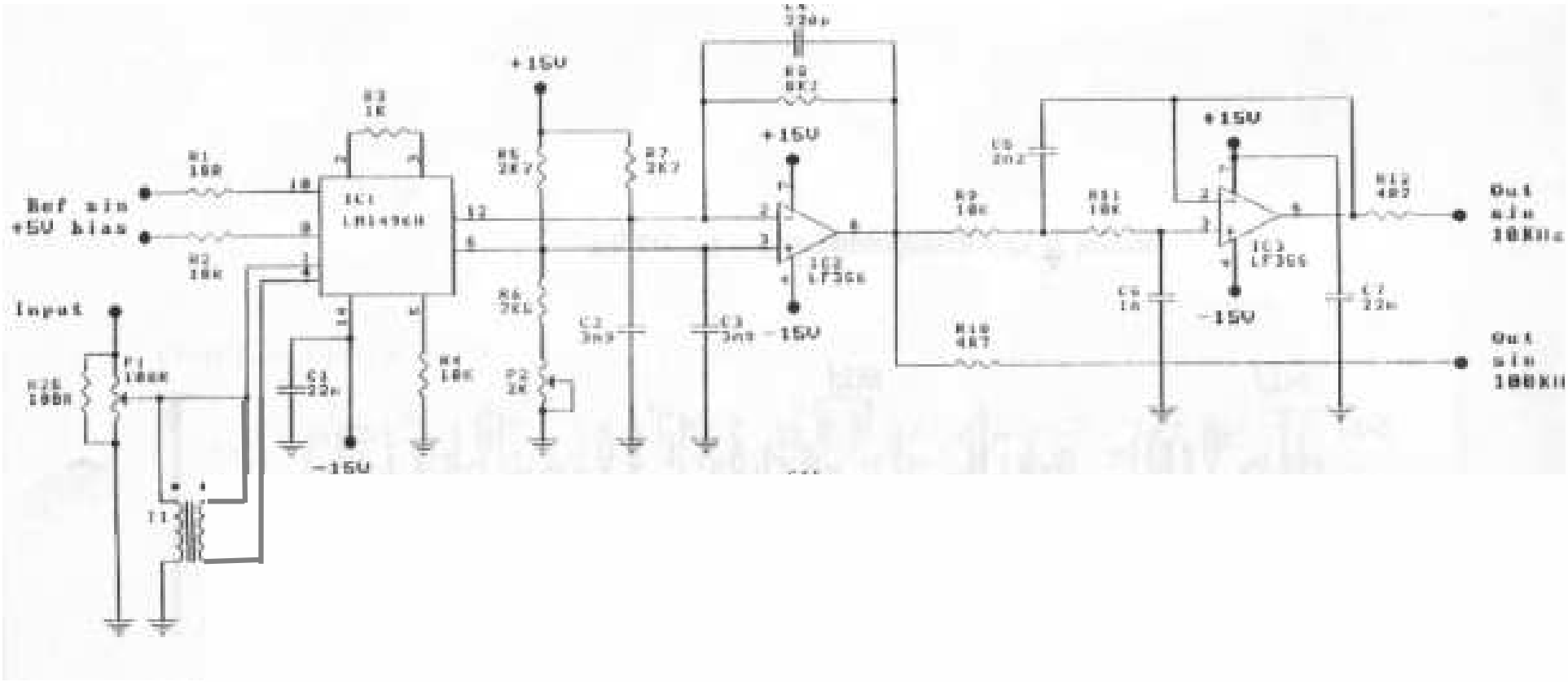
The MC145170



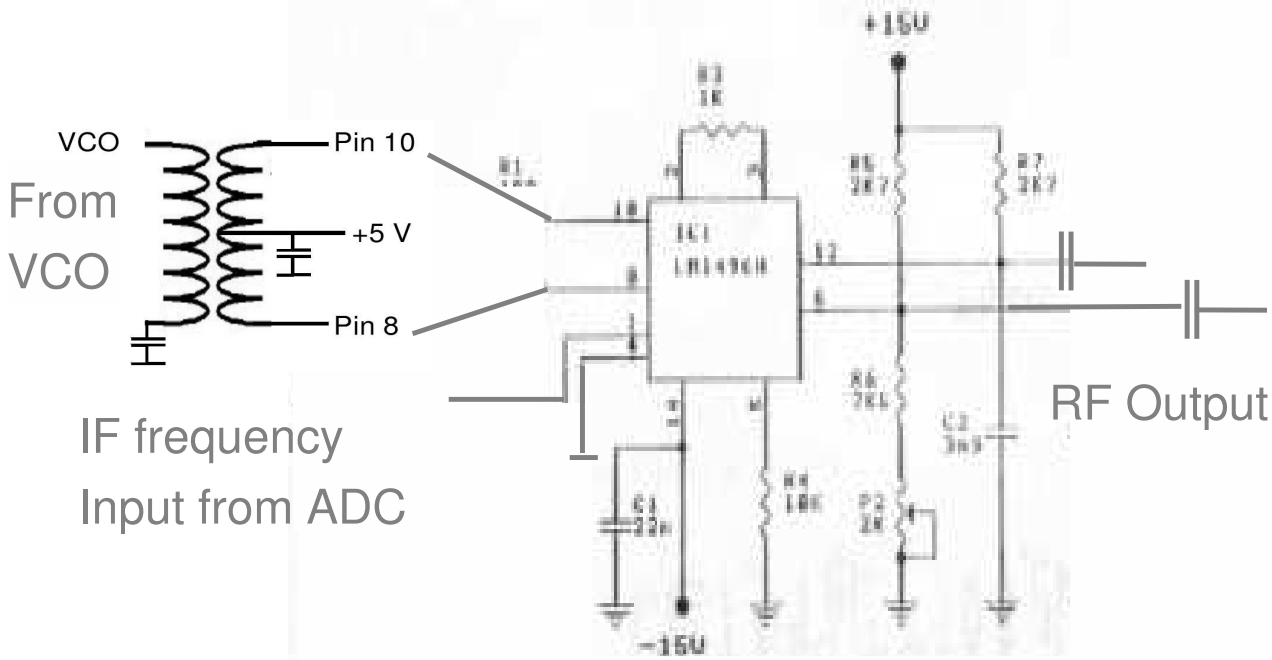
The Voltage Controlled Oscillator



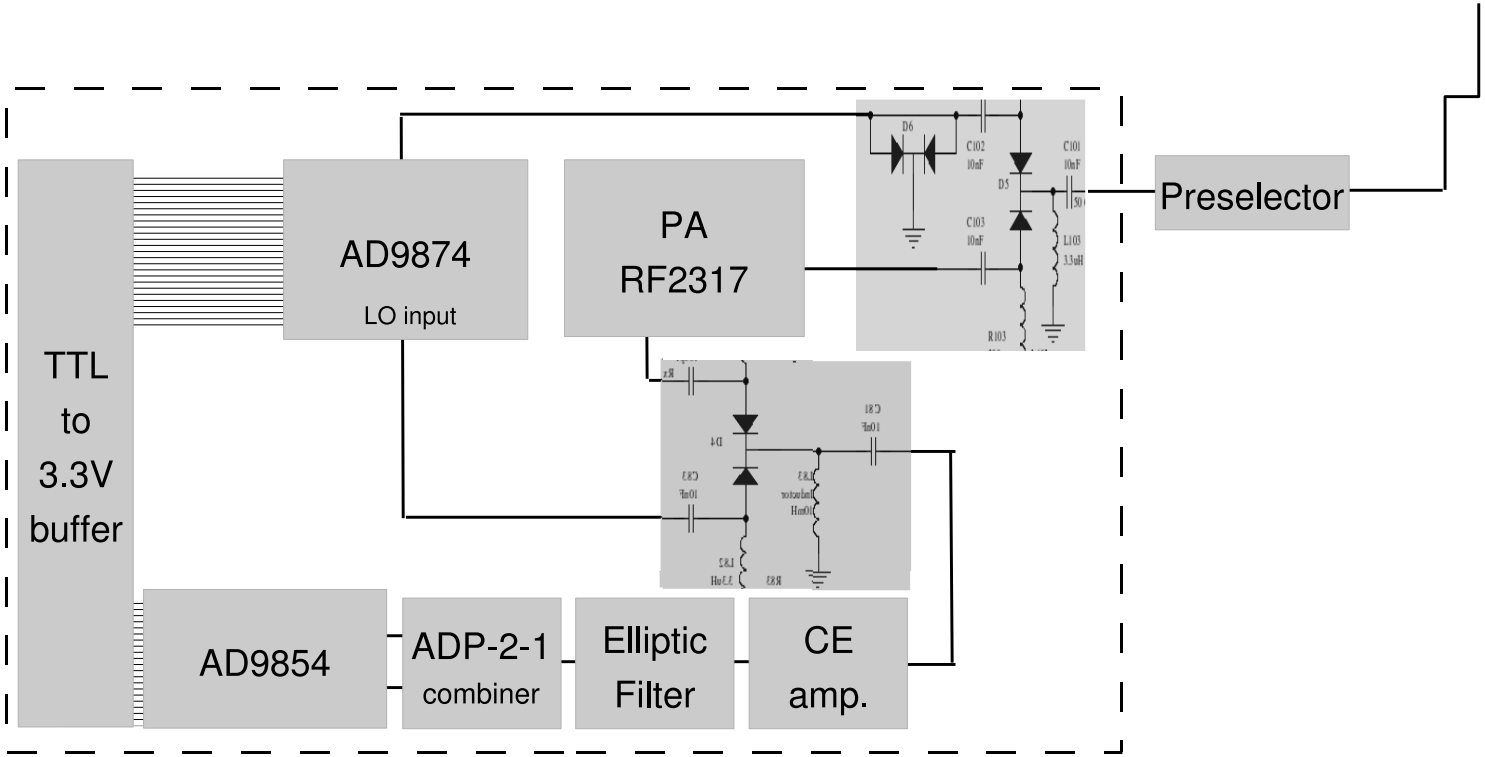
The Demodulator



The Modulator



Transceiver 2



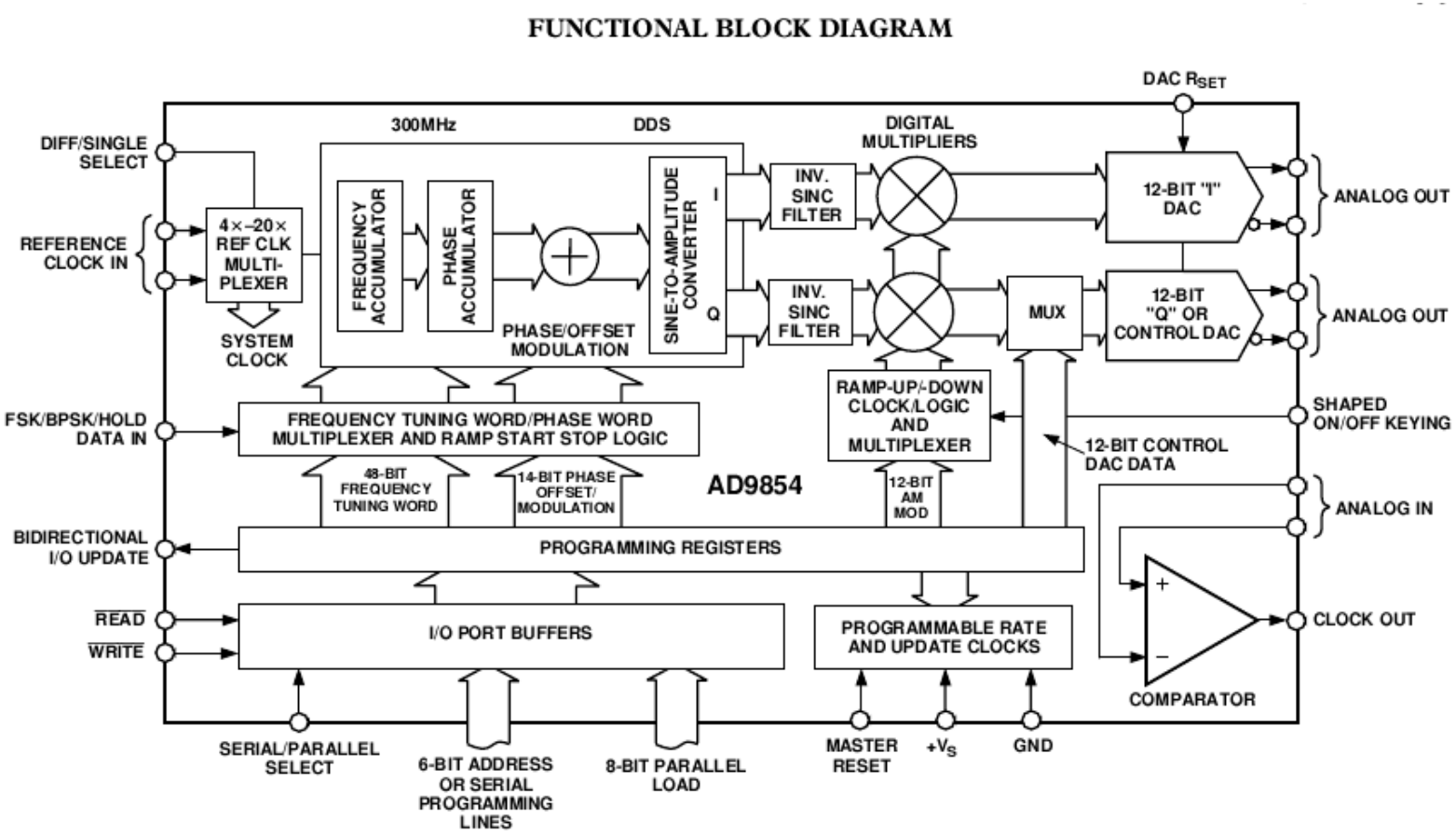
Transceiver 2

- Integrated. Plug-n-play.
- Need to read the datasheets for the AD9854 and AD9874 carefully.
- Also read http://www.arrl.org/tis/info/pdf/030304qex020.pdf
- Cheaper and faster in the long run.
- Ideal for those who wish to experience state of the art and are good at RF PCB design and soldering.
- Cannot do a breadboard dead-bug prototype. Start with a PCB layout. I.E. start EAGLE (or whatever) design immediately.

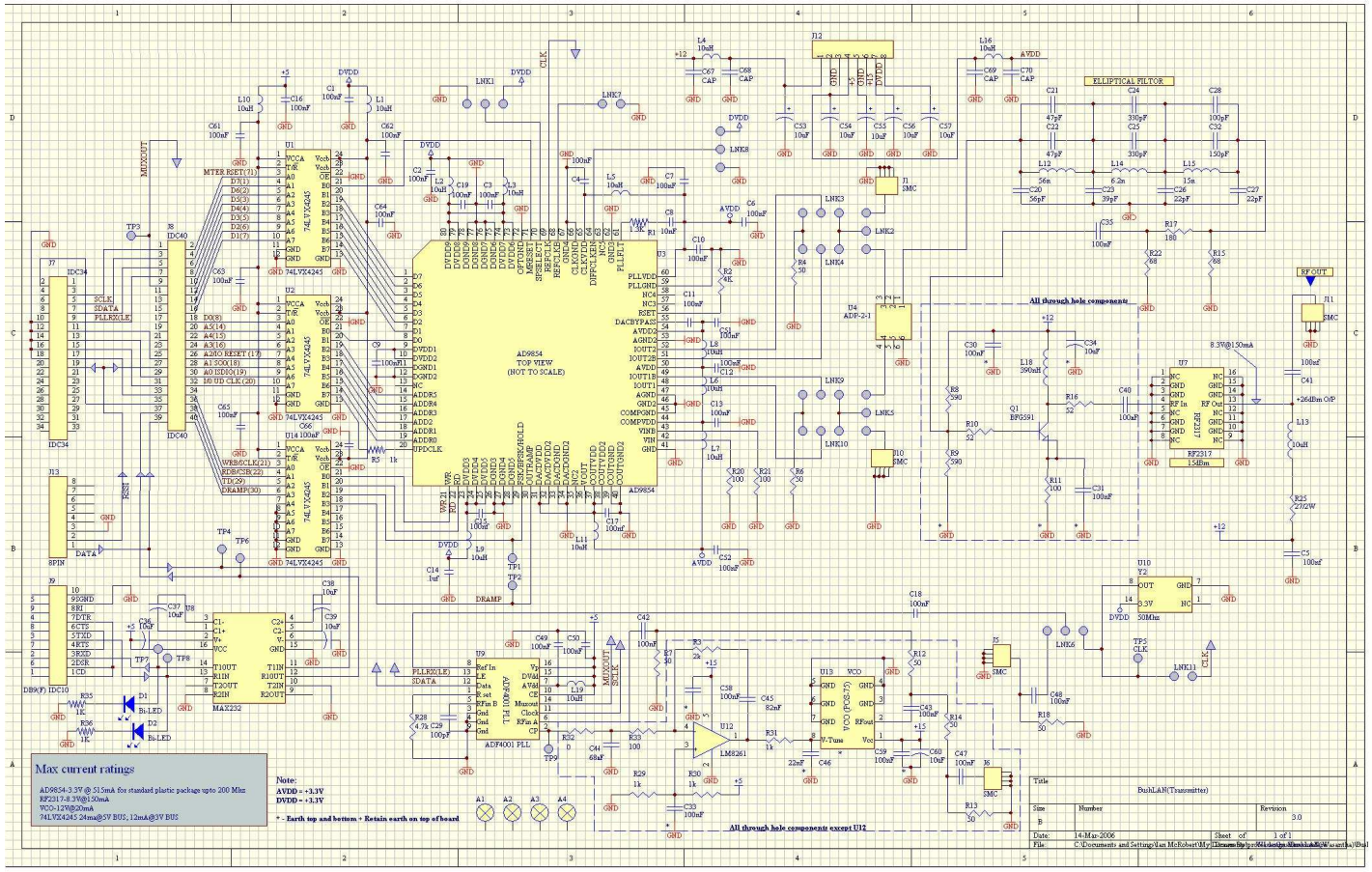
Transceiver 1

- Worth 40% of mark.
- 40% For logbook and scrapbook and general description in the report.
- 40% for the PCB layout design and description (Eagle files).
- 20% for the working circuit and tests.
- Need eagle PCB designs in by the end of the week.

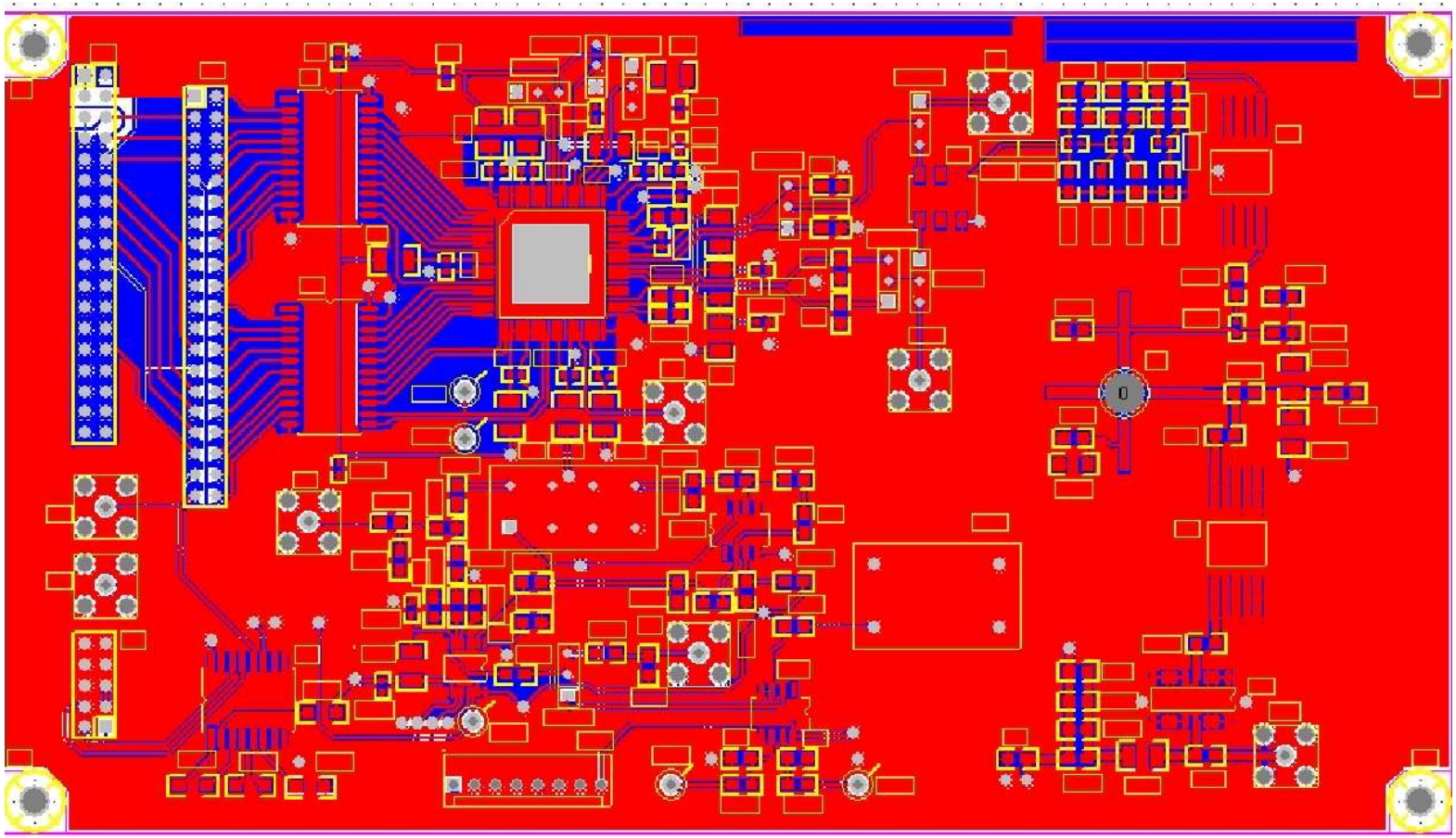
AD9854 Direct Digital Synthesiser



AD9854 Circuit



AD9854 Layout



AD9874 IF Digitising Subsystem

- Input impedance about 400 Ω. See p 22 of the data sheet.
- DOUTA/DOUTB are differential outputs. Suggest AD8561 caparator as on the Eval Board schematic.
- Very important to have a ground plane on the lower layer.
- Dont forget about decoupling caps for power supply
- Separate the AVDD and DVDD.
- Lots of IO = 37 in total.
- Do we need to have IO buffering? If not we need to provide DVDD on the IDC connector pin.
- Power supply for PIN diodes... need 10 mA per diode.

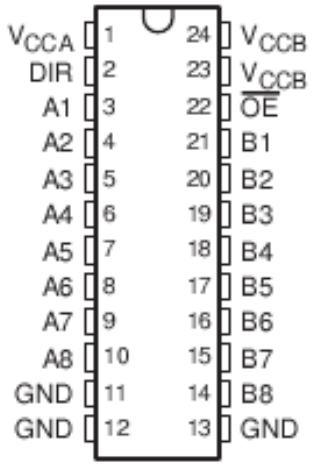
Dual Supply Bus Transceiver

SN74LVC8T245
8-BIT DUAL-SUPPLY BUS TRANSCEIVER
WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

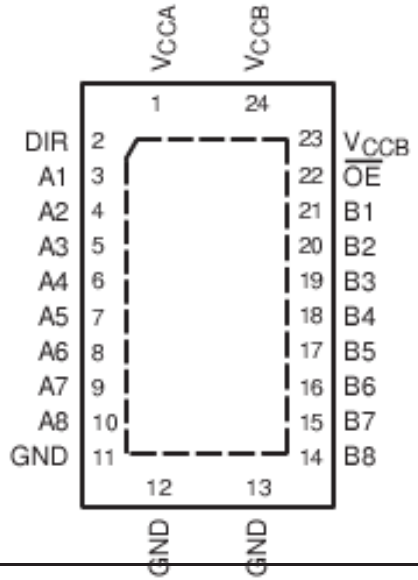
SCES584 – JULY 2004

- Control Inputs V_{IH}/V_{IL} Levels Are Referenced to V_{CCA} Voltage
- V_{CC} Isolation Feature – If Either V_{CC} Input Is at GND, All I/O Ports Are in the High-Impedance State
- I_{off} Supports Partial-Power-Down Mode Operation
- Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.65-V to 5.5-V Power-Supply Range

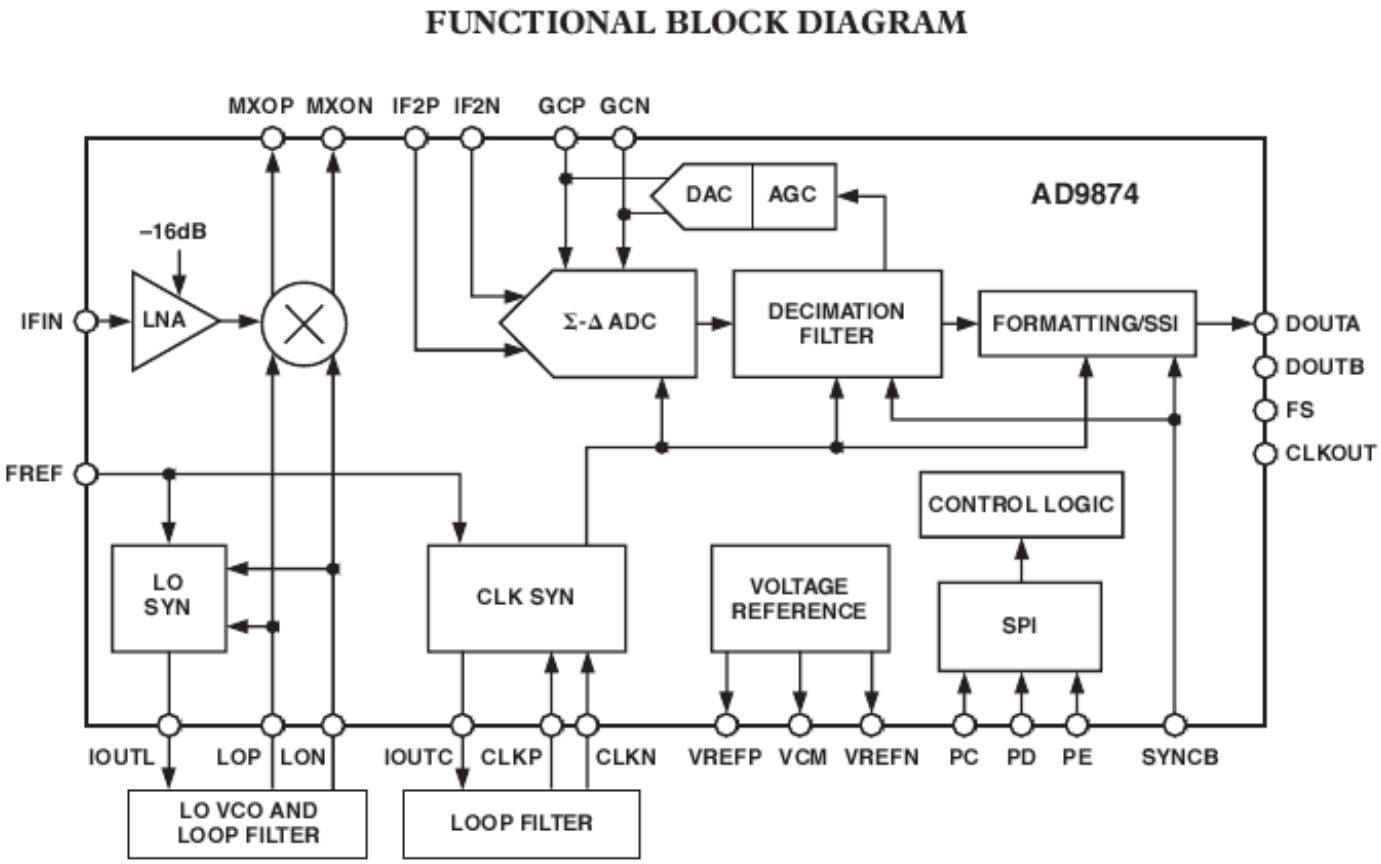
DGV OR PW PACKAGE
(TOP VIEW)



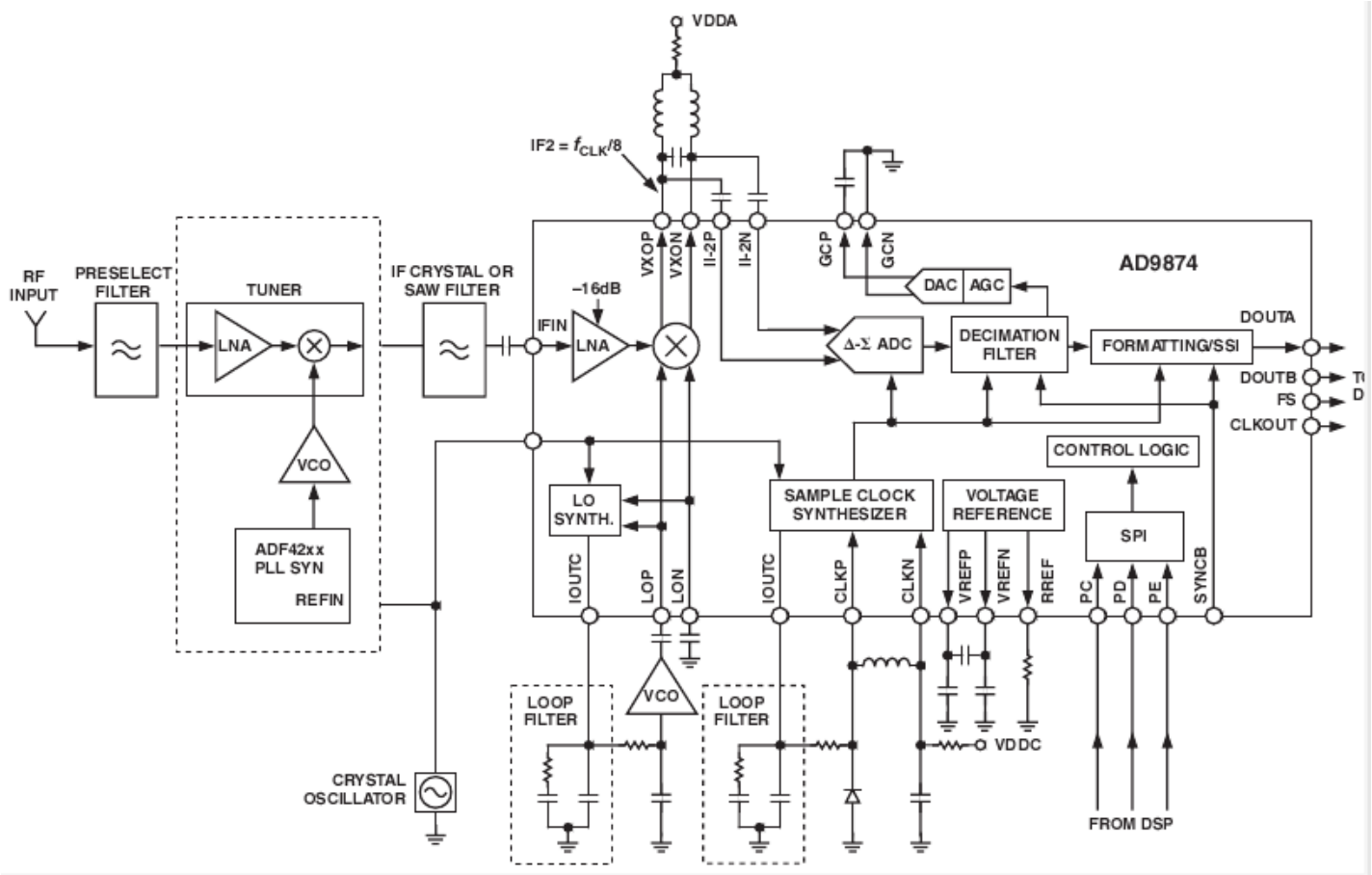
RGY PACKAGE
(TOP VIEW)



AD9874 IF Digitising Subsystem



The AD9874 based superhet



AD9874 Circuit

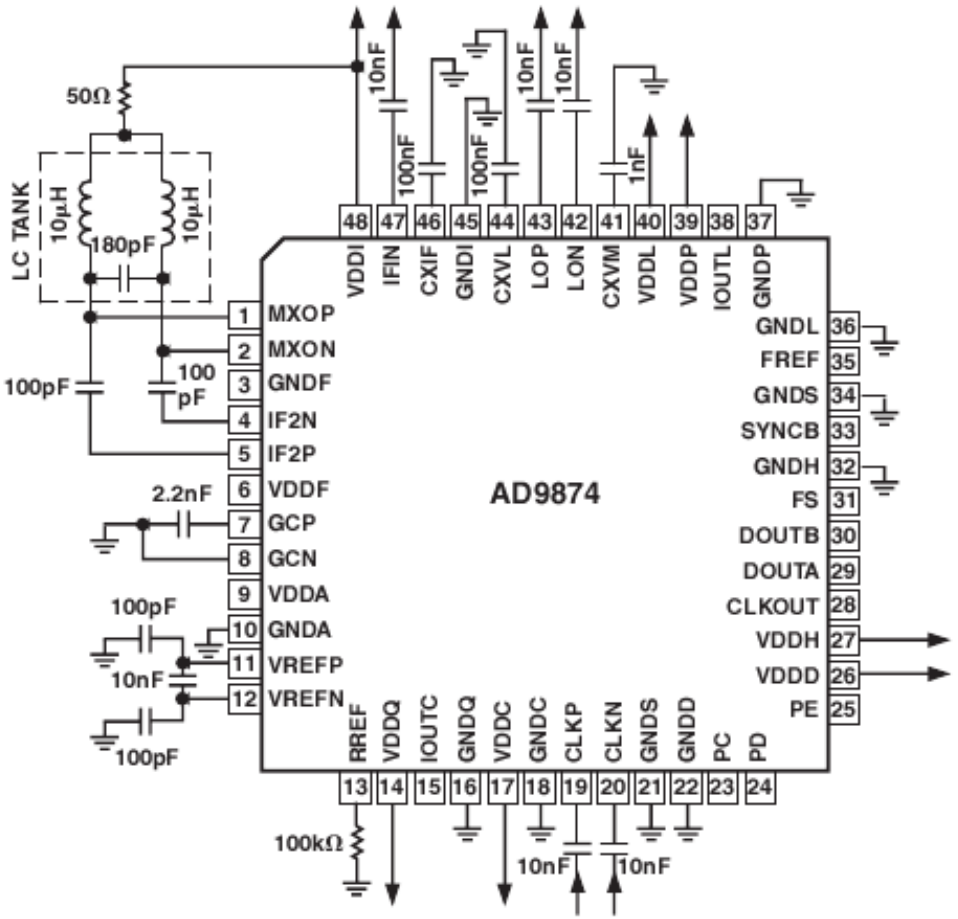


Figure 26. Example Circuit Showing Recommended Component Values