## Nano DDS VFO Rev_2 Assembly Manual

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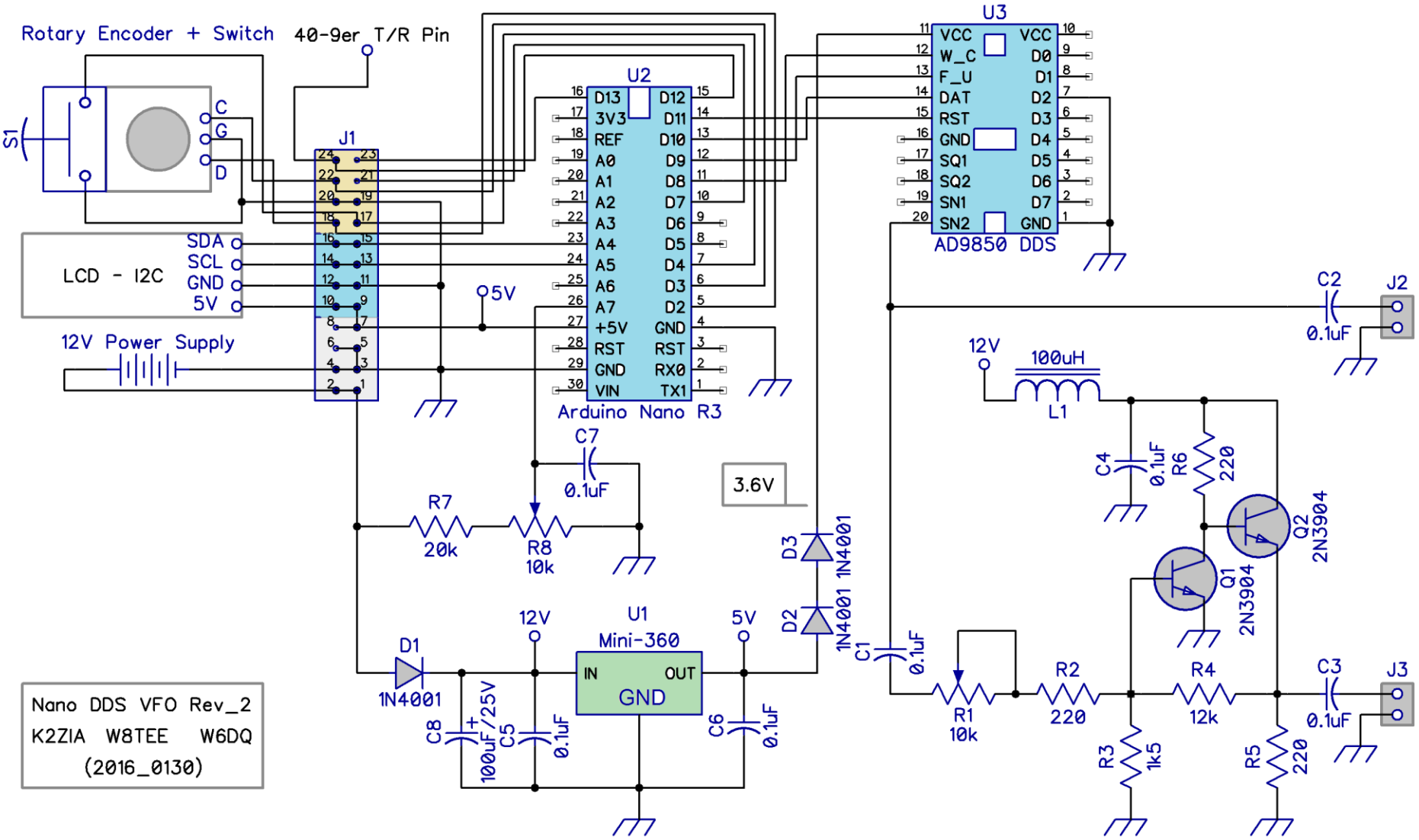
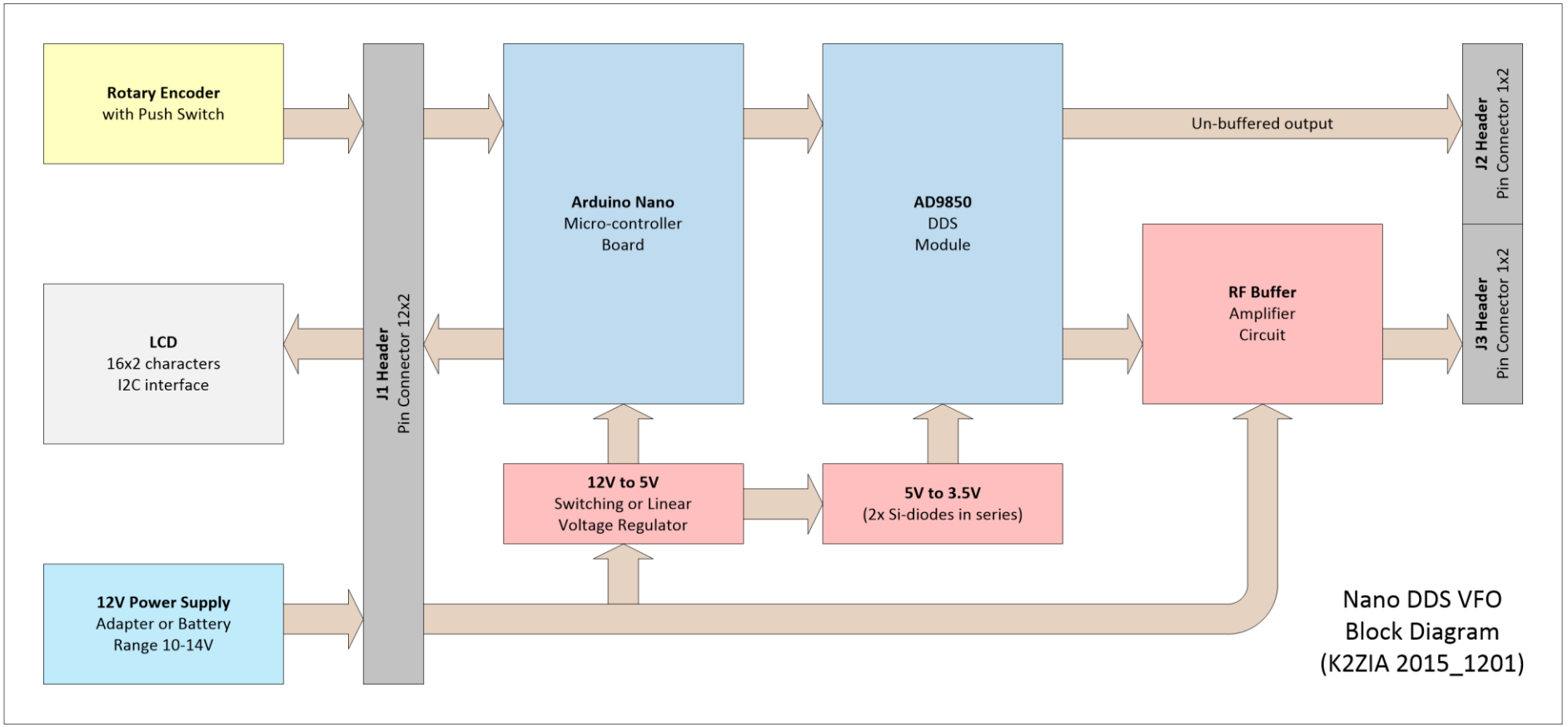
Nano DDS VFO is a modification of the original VFO design in Arduino™ Projects for Amateur Radio by Dr. Jack Purdum and Dennis Kidder

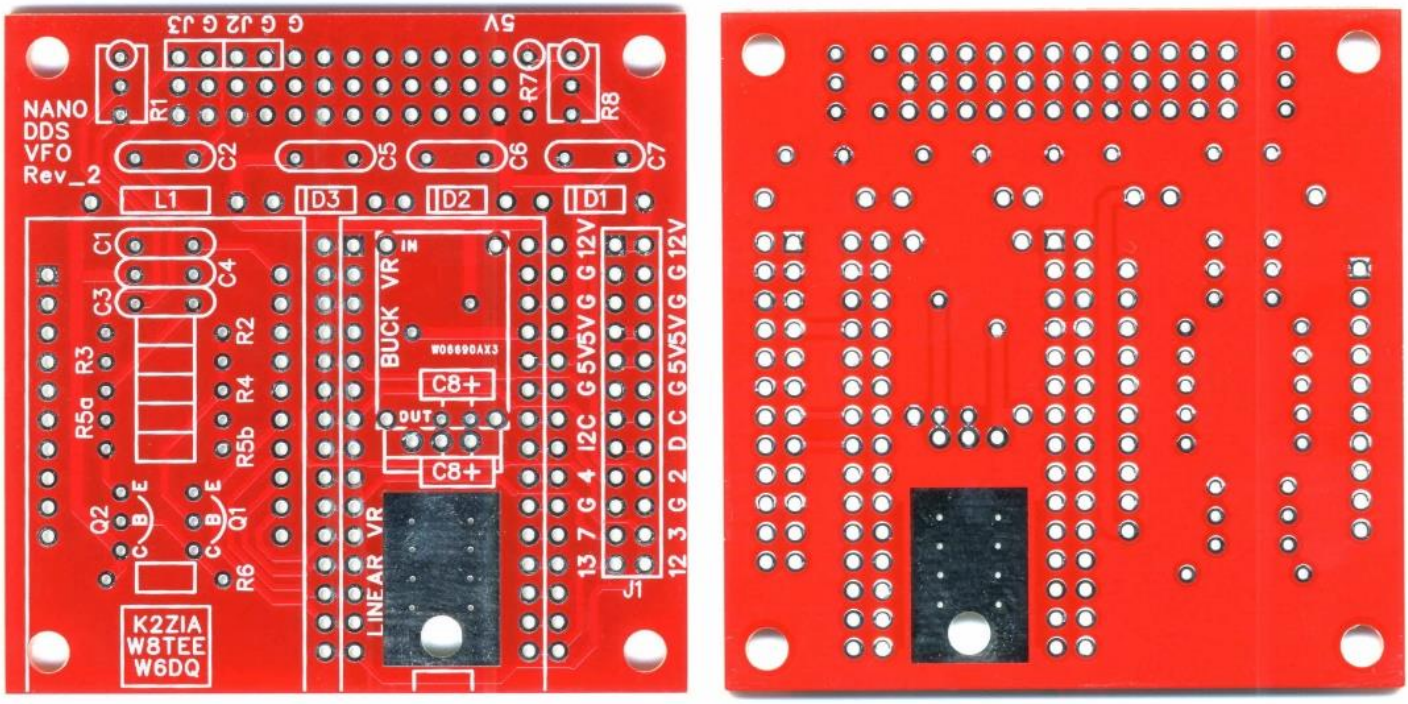
### Schematic Diagram:




R2,R3,R4,R7 are **¼ Watt**; R5,R6 are 220 Ohm **½ Watt** (or two 470 Ohm **¼ Watt** in parallel)


Rotary Encoder
with Push Switch
LCD
16x2 characters
I2C interface
12V Power Supply
Adapter or Battery
Range 10-14V
J1 Header
Pin Connector 12x2
Arduino Nano
Micro-controller
Board
12V to 5V
Switching or Linear
Voltage Regulator
AD9850
DDS
Module
5V to 3.5V
(2x Si-diodes in series)
Un-buffered output
RF Buffer
Amplifier
Circuit
J2 Header
Pin Connector 1x2
J3 Header
Pin Connector 1x2
Nano DDS VFO
Block Diagram
(K2ZIA 2015_1201)

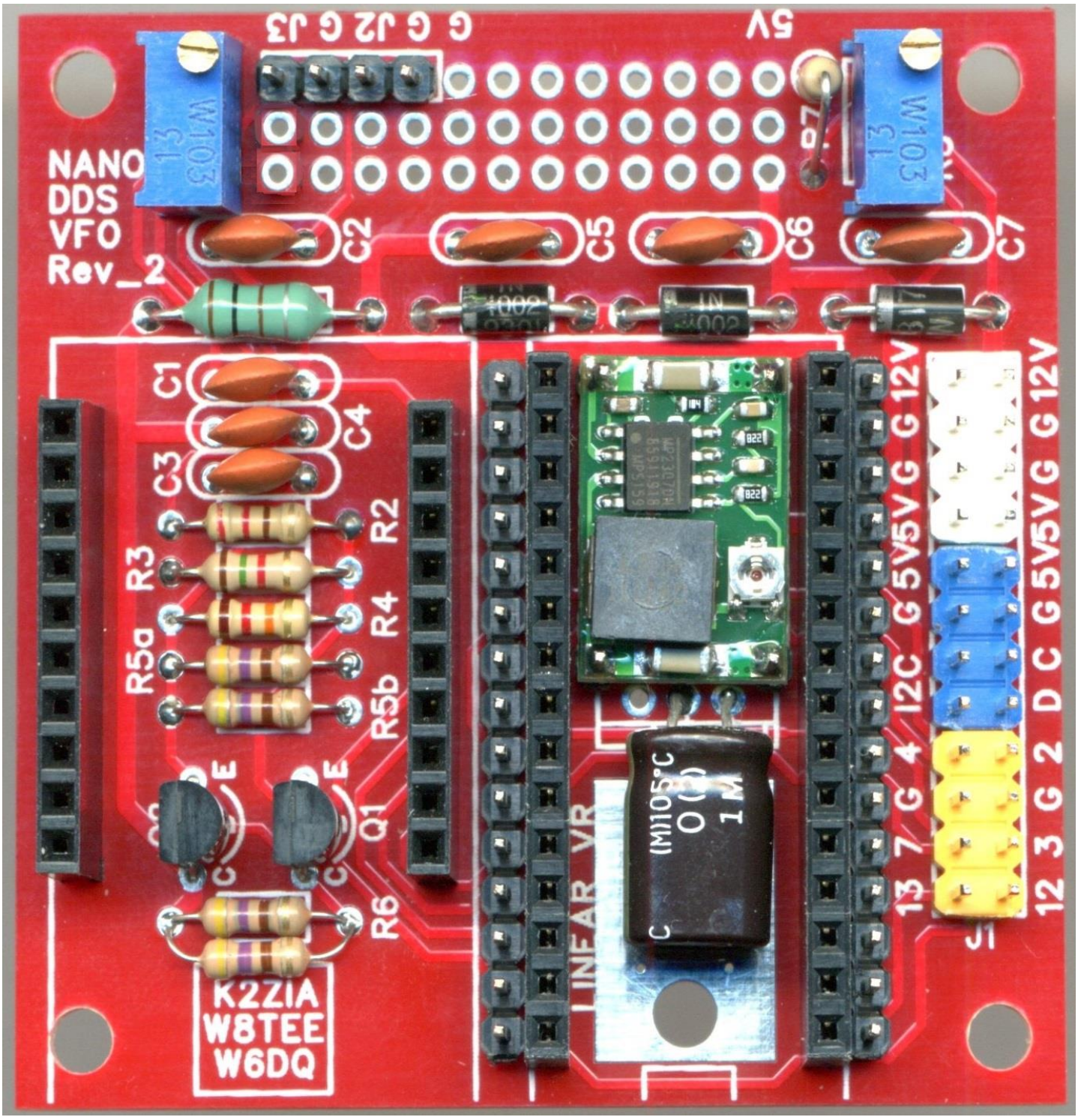
## Printed Circuit Board (Top and Bottom Sides):




## List of Parts (to be soldered on the PCB):

| SN | Item Name | Identification Code | Schematic & PCB Reference | Kit Quantity |
|---|---|---|---|---|
| 1 | Printed Circuit Board | | PCB | 1 |
| 2 | Header-socket-10pin | | U3 socket | 2 |
| 3 | Header-socket-15pin | | U2 socket | 2 |
| 4 | Header-pins-2x4-white | | J1-A | 1 |
| 5 | Header-pins-2x4-yellow | | J1-B | 1 |
| 6 | Header-pins-2x4-blue | | J1-C | 1 |
| 7 | Header-pins-1x4-black | | U1,J2,J3 | 2 |
| 8 | Volt-Reg-Mini-360 | Circuit Module | U1 | 1 |
| 9 | Transistor-2N2222A | Emitter-Base-Collector (Front View) | Q1,Q2 | 2 |
| 10 | Diode-1N4001 | White band on cathode | D1,D2,D3 | 3 |
| 11 | Inductor-100uH | Brown-Black-Brown-Silver | L1 | 1 |
| 12 | Capacitor-100nF-50V | Ceramic-104 | C1 thru C7 | 7 |
| 13 | Capacitor-100uF-25V | Electrolytic-100uF-25V | C8 | 1 |
| 14 | Resistor-TrimPot-10k | Plastic-103 | R1,R8 | 2 |
| 15 | Resistor-220-1/4W | Red-Red-Brown-Gold | R2 | 1 |
| 16 | Resistor-1k5-1/4W | Brown-Green-Red-Gold | R3 | 1 |
| 17 | Resistor-12k-1/4W | Brown-Red-Orange-Gold | R4 | 1 |
| 18 | Resistor-470-1/4W | Yellow-Violet-Brown-Gold | R5a,R5b | 2 |
| 19 | Resistor-470-1/4W | Yellow-Violet-Brown-Gold | R6a,R6b | 2 |
| 20 | Resistor-20k-1/4W | Red-Black-Orange-Gold | R7 | 1 |

**Finished PC Board** (*See suggested soldering sequence and tips below, **BEFORE** soldering any components*):




The two rows of 1x15 header pins as seen in the above picture on either side of the two 1x15 header sockets, are optional (for future expansion of Nano control functions) and are not required for DDS VFO operation.

## Suggested Soldering Sequence and Tips:

**a)** **Tip:** The PCB has space for either a linear LM7805 voltage regulator, or a Mini-360 Buck voltage regulator circuit module. Use a Mini-360 circuit module for much greater power consumption efficiency.

The Mini-360 circuit module needs to be installed as close to the top surface of the VFO PCB as possible but without touching the PCB top surface, to allow sufficient gap and clearance between the Mini-360 circuit module and the Nano micro-controller module, which will sit right above the Mini-360.

Carefully break off Black 1x4 header pins into four individual header pins (to be used as stand-off legs for the Mini-360 module). Solder these leg pins to the four corner holes on the Mini-360 module, while making sure the legs are perpendicular to the module surface. Install the Mini-360 module on to the VFO PCB in the correct orientation. Module's IN+ and OUT+ legs should be in VFO PCB's IN and OUT holes respectively. Solder the Mini-360 module legs from bottom side of VFO PCB.

**b)** Solder J1 header pins – White 2x4 [Power], Blue 2x4 [I2C Bus], Yellow 2x4 [Control]

**c)** Solder G-J2-G-J3 header pins – Black 1x4

**d)** Solder a radial lead 100uF / 25V electrolytic capacitor (C8) after bending its leads and laying it on its side as seen in the above picture. Correct polarity must be observed.

**e)** Solder all ceramic caps (C1 through C7).

**f)** Solder all fixed resistors according to schematic diagram and the PCB pictures shown above.

**Tip:** Resistors R5 and R6 each consist of two 470 ohm, ¼ Watt resistors in parallel, providing an effective value of 235 ohm, ½ Watt. It is OK to use single 220 ohm, ½ Watt resistors for R5 and R6 as an alternative.

**g)** Solder the two 10k ohm trimmer potentiometers. Observe correct orientation as shown in above picture.

**h)** Solder inductor choke L1.

**i)** Solder the three rectifier diodes (D1, D2, D3) while observing correct polarity.

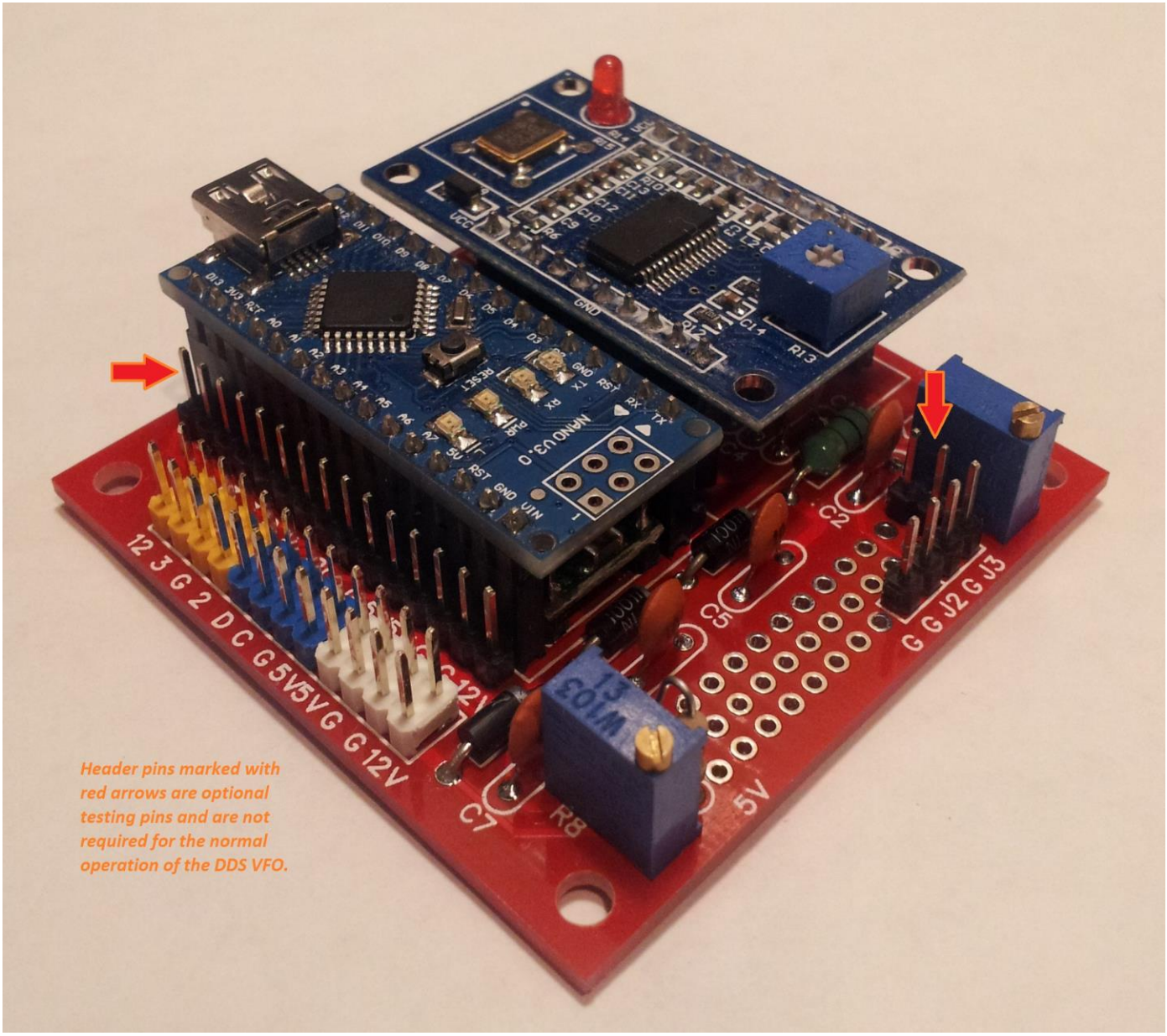
**j)** Solder the two transistors Q1 and Q2 while observing correct lead orientation (Emitter-Base-Collector, as seen from front (labeled) side of the transistor).

**k)** Solder the two 1x10 female header sockets for installing the AD9850 DDS module.

**l)** Solder the two 1x15 female header sockets for installing the Nano micro-controller module.

After the DDS VFO board is fully populated, but **BEFORE the Nano and DDS modules are plugged into their socket headers**, the output of the Mini-360 adjustable buck regulator **must be adjusted to 5.0V**. For this adjustment, connect 12V DC power to J1 pins 2 and 4 using suitable Dupont jumper wires, connect DMM probes to the 5V and G (Ground) pads near one side edge of the VFO PCB (see picture above). Slowly **rotate the tiny round trimmer potentiometer on the Mini-360 module** with a jeweler's Philips screw driver until you measure almost exactly 5.0 V on the DMM.

**m)** Install the AD9850 DDS module and the Nano micro-controller module in corresponding sockets while observing correct orientation.




**n)** Attach a suitable rotary encoder with built-in push switch to J1 control pins (Yellow) according to the schematic diagram.

**o)** Attach a 16x2 LCD module with I2C interface to the J1 I2C bus pins (Blue) according to the schematic diagram.

**p)** Attach a suitable 12V DC, 2A regulated power supply (or battery) (through an optional On/Off power switch to J1 power pins (12V-G) (White).

The DDS VFO board is now ready for firmware (software) installation and testing.

Please see **Firmware Instructions for Arduino IDE**.

*<Instructions for connecting the external components, I2C LCD, Rotary Encoder, Power Supply, to be added here>*