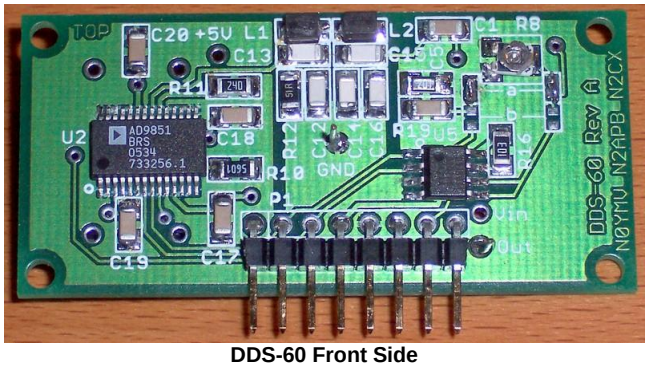
DDS-60

Quick Assembly Guide

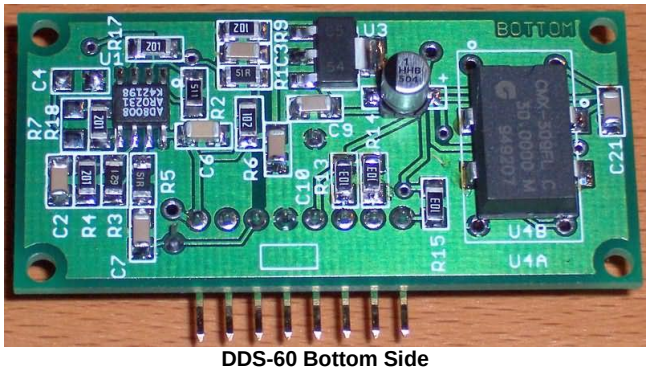
... a modular way to add stable DDS-based signal generation to your next transceiver or VFO project

How many ways can you use a self-contained, high-precision dc-60 MHz signal source contained on a 1" x 2" plug-in circuit board? How about as a stand-alone VFO, a signal generator for your bench, a replacement LO for your QRP transceiver, or perhaps as the heart of an antenna analyzer! Control it with your favorite microcontroller, or even hang it off the parallel port of your PC. Any way you do it, you'll be generating quality signals for less than $50.



DDS-60 Front Side

(NOTES: R19 and C5 happen to be installed in reversed positions on the board in this photo. The circuit is electrically equivalent. R16 and the IC shown on the right are no longer provided in the kit.)



DDS-60 Bottom Side

(NOTES: R7 and C4 positions are empty. Components are unused and are not provided in the kit.).

The DDS-60 is a self-contained functional module that generates a top-notch RF signal by using a small pc board to contain just the bare DDS essentials – an Analog Devices AD9851 DDS chip, a clock oscillator, a 5th-order elliptic filter and an adjustable-level RF amplifier. Additionally, an onboard 5V regulator is provided so you only need provide a single 12V battery or power supply ranging anywhere from 8-12V DC. The three digital control lines, the power supply, and the output signal are all available on a pin header at the board edge. This 8-position pin header serves to allow the DDS-60 to be plugged into and used in many projects on your bench, regardless of which microcontroller is employed. Just provide a single strip socket (e.g., a 16-pin IC socket split lengthwise) on the project board and plug in the DDS-60. A cable connected to the parallel printer port of your PC can even be used in conjunction with public domain PC software to control the DDS-60. See the Controller section in the full manual for a number of custom solutions illustrating easy control of the DDS-60.

Once your controller-of-choice serially loads the control word into the DDS, the raw waveform is generated and presented to an elliptic filter that removes unwanted high-end frequency components, resulting in a signal of sufficient quality to serve as a local oscillator for a transceiver. We regularly see great signal quality, with harmonic content typically reduced more than 40 dB below the fundamental.

The signal generated by the DDS is quite small so we use an AD8008 low power amplifier to provide about 18 dB of gain to boost the signal to about 2V-to-3V pp, which is quite usable in a variety of applications. This amplifier chip offers unconditional stability (k>1) and yields spectrally-clean signals. It is an ideal signal source for making impedance measurements in the Micro908 Antenna Analyst and other demanding applications. A trimpot allows precise manual control of the desired output level. The design provides a good signal using supply voltages from 12V all the way down to 8V, thus conveniently allowing for battery operation. The amplified signal is then available for use as a 50-ohm source input signal. If not used as an input to any other component or module, the output should be terminated with a 50-ohm load for the stated specifications to be realized.

Technical Support

The full manual is located online at http://midnightdesignsolutions.com/dds60, and we maintain a Builders Notes page with useful kit information. If you still have questions or need technical assistance, contact the designers: George Heron, N2APB (n2apb@midnightdesignsolutions.com) or Joe Everhart, N2CX (n2cx@verizon.net).

DDS-60 Parts List

QTY	Designator	Description
3	R1, R5, R12	Resistor, 51, 1206 SMD
1	R2	Resistor, 560, 1206 SMD
1	R8	Trimpot, 500, SMD
1	R3	Resistor, 620, SMD 1206
3	R4, R17, R18	Resistor, 200, SMD 1206
2	R6, R9	Resistor, 1K, SMD 1206
1	R10	Resistor, 5.6K, SMT, 1206
2	R11, R19	Resistor, 24, 1206 SMD
3	R13, R14, R15	Resistor, 10K, 1206 SMT
12	C1, C2, C3, C5, C7, C9, C10, C17, C18, C19, C20, C21	Capacitor, 1206 SMD, 0.1uF 25V
1	C6	Capacitor, 0.22 uF, SMD 1206
1	C8	Capacitor, electrolytic, SMD, 1.0uF, 50V
2	C13, C15	Capacitor, 1206 SMD, 15pF 25V
1	C12	Capacitor, 1206 SMD, 47pF 25V
1	C16	Capacitor, 1206 SMD, 82pF 25V
1	C14	Capacitor, 1206 SMD, 100pF 25V
2	L1, L2	Inductor, 0.10uH, 1206 SMD
1	U1	Integrated circuit, op amp, AD8008
1	U2	DDS integrated circuit, 28 pin SSOP
1	U3	Integrated circuit, 5V voltage reg, SOT-223
1	U4	Oscillator, 30 MHz, SMT
1	P1	Pin Header, 0.1", 8 pin
1	PCB	PC Board

Basic Assembly Steps

1) Need help assembling all these small components? See the note on page 1 about Kit Builders.
2) Attach all SMT integrated circuits. For each IC location, tin pad 1, carefully position the IC observing orientation, and solder pin 1 in place. Solder the opposite-corner pin while ensuring that all pins are over the respective pads. Solder remaining pins to pads. If needed, remove excess solder with solder braid. (Solder the larger ground tab of U3 to the pad opposite the three smaller pins.)
3) Attach trimpot R8 by tinning one pad first, then carefully hold the trim pot in place with tweezers, and re-heat the pad. Solder the other two pads. Measure about 250 ohms from wiper pad to either end pad to ensure successful connection.
4) Attach all SMT resistors. Sequentially attach each value group to the board, according to the order arranged on the SMT Card. For each resistor location, tin one pad, hold resistor in place and reheat that pad to attach. Solder other end to pad.
5) Attach all SMT capacitors in the same manner as above.
6) Attach inductors L1 and L2 in the same manner as above.
7) Attach capacitor C8 (silver can) in same manner as above. Side without black mark goes to + pad.
8) Attach oscillator U4 with notched end "up". See photo.
9) Attach pinheader P1 to the top of board – see photo.
10) Install jumpers at the 'a' set of pads. (The 'b' set of pads are for an option that is no longer offered.)

Initial Test & Adjustment

1) Observe P1 connections and apply 8-12V dc power.
2) Observe approx 5V p-p clock waveform at U4 output.
3) While driving DDS-60 card with appropriate controller generating 10 MHz waveform, observe ~200mV p-p at DDS output and at R1/C1 input to RF amp.
4) Adjust R8 to obtain approx 2V-to-3V pp at RF Out.