Direct Digital Synthesiser

HF Instruments
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Background

The AD9850 is an extremely useful DDS chip which allows any frequency from DC up to about 40MHz to be generated with tiny step sizes. The chip accepts a master clock frequency up to 120MHz and generates any output frequency up to about 1/3 of the master frequency. Resolution is 2^{-32} times the master frequency (about one four-billionth). For example, a 100MHz reference frequency could be used to make a VFO covering 0 to 30MHz with a resolution of less than 0.025Hz.

The problem with the chip is that it is tricky to program, requiring a long serial word to set its various parameters. It is also rather difficult to assemble manually because it comes in a 28 pin Shrink SO package with a lead pitch of 0.65mm. The HF DDS PCB was developed to overcome these problems. It accommodates the AD9850 chip and a PIC micro-controller which converts simple ASCII RS232 commands into the serial words required by the DDS chip. It also incorporates space for a voltage regulator and output filter components onto a single convenient PCB.

Application

While this product was developed specifically to achieve an improvement in resolution, the system has the advantage of offering outstanding frequency accuracy and very low phase noise when driven from a sufficiently accurate reference frequency source. The DDS can be clocked with any frequency up to 120MHz (40 MHz maximum output). One LF data communications application uses a 5MHz input derived from an off-air master reference. This allows outputs up to 1.7 MHz with 0.001 Hz resolution and 0.01ppm frequency accuracy which is needed for LF sub-Hz bandwidth communications.

Build

The board is supplied either bare or with an AD9850 DDS chip pre-soldered. The most difficult part of the PCB build is soldering the AD9850's twenty-eight 0.65mm spaced pins. If this is too challenging, purchase the board with the chip fitted and the build is then within the capabilities of any moderately competent PCB assembler.

The board mostly uses surface mount components (large 1206 size) but with a conventional DIL PIC in a socket for easy firmware changes. This allows custom code to be used where an alternative interface such as a keypad or rotary encoder is needed.

The user must provide a reference frequency signal in the range up to 120MHz. A suitable output filter must also be designed and implemented on the board. Sample designs are available showing suitable component values for different frequency ranges.

Operation

Resident software allows the DDS source to be controlled with ASCII commands over a plain RS232 link, for example from a PC using a simple terminal programme such as Hyperterminal. This approach also allows custom software written for a PC to generate PSK/FSK etc.

Programming the chip involves sending the board a "multiplier" number which defines the output frequency in terms of the master frequency divided by 2^{-32} .

Should the operator wish, then he can write alternative PIC software to accommodate different interfaces such as a keyboard or rotary encoder etc. Firmware changes are easily carried out because a conventional DIL PIC in a socket has been used. Apart from this, however, the basic design uses mainly surface mounted components of the large 1206 package type.

Dimensions**:** 45 x 55 x 5mm

Prices

DDS Board: £8.00 + vat. Post and Packing is £2.00 to UK addresses
DDS Board with fitted AD9850: £40.00 +vat. Post and Packing is £2.00 to UK addresses