GIVERNyLABS

Frequency Synthesizer featuring the ATSAMD51 with 0.2 to 250MHz CMOS Output

DESCRIPTION

Have you always wanted a precise, ultra low jitter, I2C programmable CMOS Frequency Synthesizer Board which is powered and steered with a SAMD51 Cortex M4 processor? It is a really fantastic duo: one of the best frequency oscillator (SI-569) combined with an Cortex M4 CPU.

And because the board is Arduino compatible, the Frequency Synthesizer is easy to configurate and even better applications based on it can be developed very easily on the fly. The frequency synthesizer consumes almost no SAMD51 Cortex M4 processor power, so it is fully available.

This board is the similar size as the Arduino Uno, is compatible with the Adafruit Metro M4 and all of the Adafruit shields. It's got the pins where you expect and this board is powered with an ATSAMD51J19.

The on board frequency oscillator utilizes Silicon Laboratories' Si564 Ultra Series advanced 4th generation DSPLL® technology to provide an ultra-low jitter (200 fs), low phase noise clock at any output frequency. The device is user-programmed via simple commands to provide any frequency from 0.2 to 250 MHz with <1 ppb resolution and maintains exceptionally low jitter for both integer and fractional frequencies across its operating range. The frequency oscillator offers excellent reliability and frequency stability as well as guaranteed aging performance.

In addition you can use the Frequency Synthesizer Board as an I2C appliance to front end any microcomputer, e.g. the raspberry with Frequency Synthesizer and application capabilities.

The board is native USB, there's no need for a hardware USB to Serial converter as the board has built in USB support. When used to act like a serial device, the USB interface can be used by any computer to listen/send data to the board, and can also be used to launch and update code via the bootloader.

- Programmable to any frequency from 0.2 to 250 MHz with < 1 ppb resolution
- Ultra low jitter: 200fs (RMS, 12 kHz – 20 MHz), 10 MHz ≤ FCLK < 250 MHz
- Temperature stability ±20 ppm (-40 to 85 °C)
- Total stability ±50 ppm (includes temperature stability, initial accuracy, load pulling, VDD variation and 20 year aging at 70 °C)
- 10 MHz startup frequency
- Excellent PSNR and supply noise immunity: – 80 dBc Typ
- 3.3V logic, 5 V supply operation
- Dual CMOS output (complementary)
- Fast frequency adjustments on the fly over a range of +/- 950 ppm (parts-per-million) with 0.0001164 ppm resolution (continuous glitchless output)
- Cortex M4 core running at 120 MHz
- Floating point support with Cortex M4 DSP instructions

- 32.bit, 512 KB flash, 192 KB RAM
- Dual 1 MSPS DAC, dual 1 MSPS ADC (8 analog pins)
- 6 x hardware SERCOM (I2C, SPI or UART), 22 x PWM outputs
- Built in crypto engines with AES (256 bit), true RNG, Pubkey controller
- 16 x PWM outputs
- Stereo I2S input/output with MCK pin
- 10-bit Parallel capture controller (for camera/video in)

Power the Frequency Synthesizer Board with the micro USB connector to any 5V USB source or with the Vin Pin (5V).

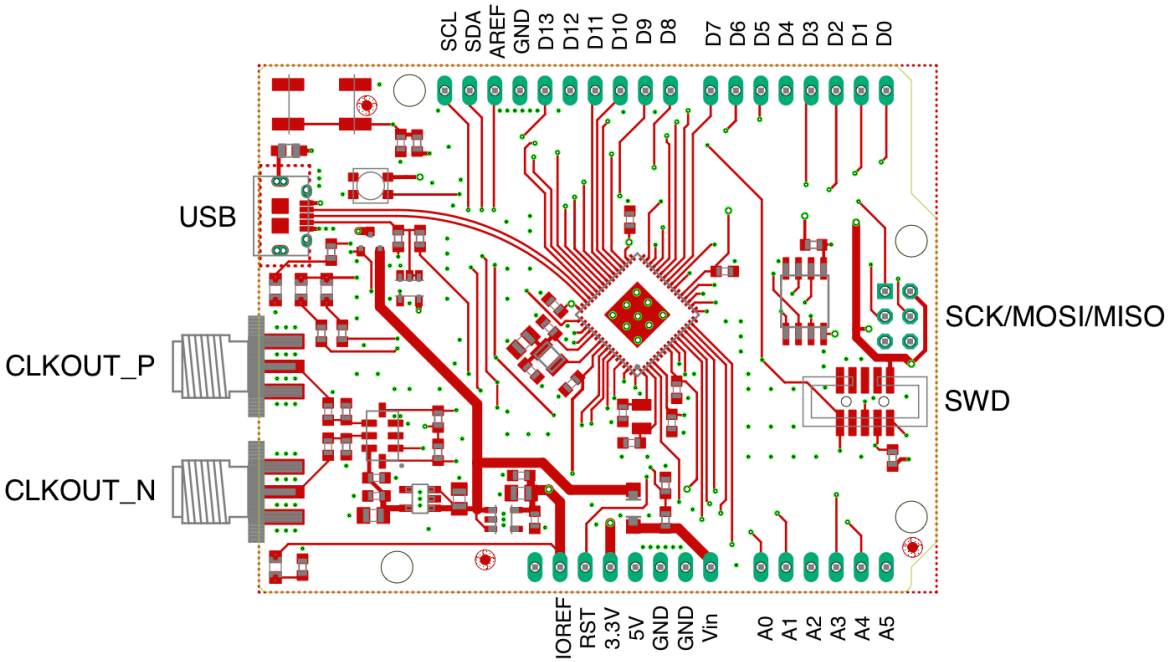
Like the METRO M4 the Frequency Synthesizer Board has 25 GPIO pins, 8 of which are analog in, and two of which is a true analog out. There's a hardware SPI port, hardware I2C port and hardware UART. Logic level is 3.3V.

Four indicator LEDs and one NeoPixel, on the front edge of the PCB, for easy debugging. One green power LED, two RX/TX LEDs for data being sent over USB, and a red LED connected. Next to the reset button there is an RGB NeoPixel that can be used for any purpose.

2 MB QSPI Flash storage chip is included on board. You can use the SPI Flash storage like a very tiny hard drive. When used in Circuit Python, the 2 MB flash acts as storage for all your scripts, libraries and files. When used in Arduino, you can read/write files to it, like a little datalogger or SD card, and then with our helper program, access the files over USB.

Easy Programming, comes pre-loaded with the UF2 bootloader (https://adafru.it/wbC), which looks like a USB storage key. Simply drag firmware on to program, no special tools or drivers needed! It can be used to load up CircuitPython or Arduino IDE (it is bossa v1.8 compatible).

PINOUTS



Frequency Synthesizer Output

- **CLKOUT_P** - clock output. The frequency is output via the SMA connector
- **CLKOUT_N** - complementary clock output. The frequency is output via the SMA connector

Power Connections

There are two primary ways to power the Frequency Synthesizer Board (please note that the power connections are different to the power connections of the Metro M4 board).

- Through the Micro USB port up at the top left
- Through the Vin Pin (5V)

The MicroUSB jack provides 5V at 500mA if plugged into any computer with a USB cable. You can plug this into any USB charger as well. When using an USB charger or the 5V Vin PIN, a higher current than 500mA can be drawn. Please note that the frequency synthesizer chip (independent of the rest of the board) requires up to 170mA.

Onboard regulators take the USB or Vin power and linearly convert it to 3.3V.

- 3.3V PIN - this is the output from the 3.3V regulator, it can supply 500mA peak
- 5V PIN - this is the voltage from the Micro USB port
- GND PIN - this is the common ground for all power and logic
- 5V Vin PIN - as an alternative to the Micro USB port, the board can be supplied with 5 Volts via this pin

General Purpose I/O

- All logic is 3.3V
- All of the pins except SCL can do PWM output (A0 and A1 have true analog output instead)
- All pins can be interrupt inputs
- Since the General Purpose I/O is compatible with the Metro M4 board, we refer to the Metro M4 Product Description at this point

Configuring Output Frequency via C/C++ code using the Arduino IDE

The Frequency Synthesizer Board contains a fixed frequency crystal and a frequency synthesis IC (SI-569) using Silicon Labs patented DSPLLTM technology, enclosed in a standard hermetically sealed crystal oscillator package. The crystal provides the reference frequency used by the DSPLL frequency synthesis IC. The output frequency of the frequency oscillator can be dynamically set via I2C register settings in the DSPLL frequency synthesis IC. DSPLL technology provides unmatched frequency flexibility with superior output jitter/ phase noise performance and part per trillion frequency accuracy. The SI-569 can be programmed via the Arduino IDE.

Consulting Services

Based on your wishes and requirements, we will be happy to advise you on the configuration and programming of the Frequency Synthesizer Board or create customer-specific hardware and software solutions.

We look forward to hearing from you at:

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