



A MATLAB Coefficient Export Function for the QF1D512

1) Introduction

The Quickfilter Pro software includes a built-in Filter Creator / Editor allowing the user to define his own filter responses for most commonly used filter types. However some users will still find a need to use other tools for filter creation to achieve responses not available using the Quickfilter Pro software, or perhaps they have an existing library of filters from previous projects they would like to use with the Quickfilter chips. For this reason the Filter Editor in Quickfilter Pro includes an option to import existing filter coefficient files for use in the Quickfilter Pro software.

MATLAB is probably the most widely used platform for filter design. This application note describes how designers can use the provided MATLAB function file, **writeQFcoeff.m**, to create floating point filter coefficients that can be imported into the Quickfilter Pro Software platform and used with the QF1D512-DK development kit for filter design and evaluation. The file also offers the option to export fixed point coefficients which can be directly written to the QF1D512's coefficient RAM in the user's application.

2) Using the Coefficient Export Function in MATLAB

The **writeQFcoeff.m** file will take a vector in MATLAB and output a text file in one of two formats: floating point or fixed point.

a) Floating Point Output

The floating point format is required for import into the Quickfilter Pro Software platform for the QF1D512-DK development kit. The function requires two parameters when a floating point output is desired:

writeQFcoeff(INPUT, FILENAME)

where:

INPUT is the MATLAB vector to be written

FILENAME is the name of the file to be written

Example: `writeQFcoeff(num, 'num.txt')`

b) Fixed Point Output

The second format is a fixed-point format suitable for use in the user's application. For example the data can be stored in EEPROM and written to the QF1D512's coefficient RAM when the device is configured by the host microcontroller. The function requires four parameters when the desired output is fixed point. The output will be written in two's-complement format with the number of bits specified by the user:

writeQFcoeff(INPUT, FILENAME, FIXED, NUMBER BITS)

where:

INPUT is the name of the vector to be written

FILENAME is the name of the file to be written

FIXED indicated that the output should be fixed-point

NUMBER BITS is the number of bits to use in the fixed-point output

Example: writeQFcoeff(num, 'num.txt', 'fixed', 32)

3) Importing Coefficient Files Using Quickfilter Pro QF1D512

a) Opening Screen

Once the QF1D512-DK hardware is installed and the software loaded, double click on the “QF Pro QF1D512” icon on your desktop. The following screen appears:

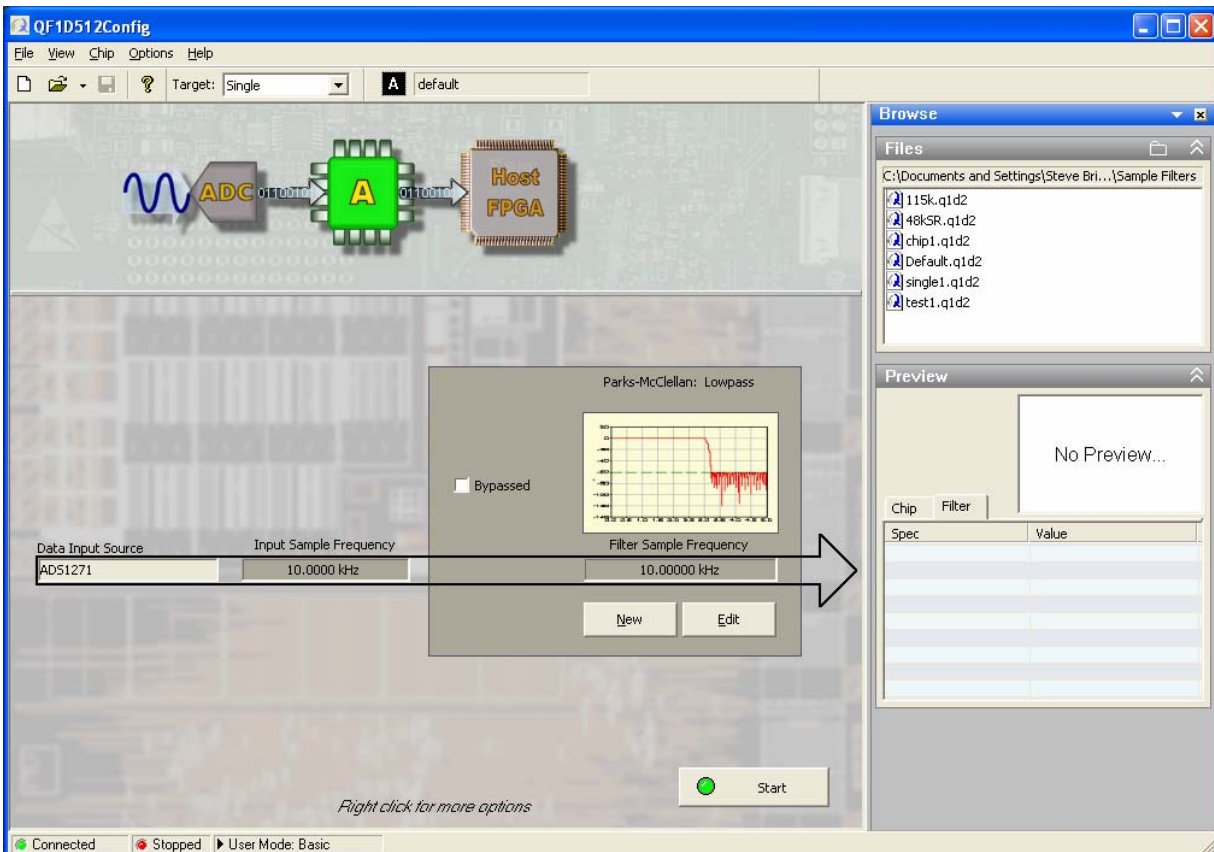


Figure 1

b) Create a New Filter

Perform one of the following steps to initiate a filter design:

- Click on “New” (Figure 2)
- Double click on the filter thumbnail window (Figure 2)
- Right click anywhere in the filter box and select “new filter” (Figure 2)
- Press Ctrl+Shift+N
- From the menu bar select “Chip / New Filter”

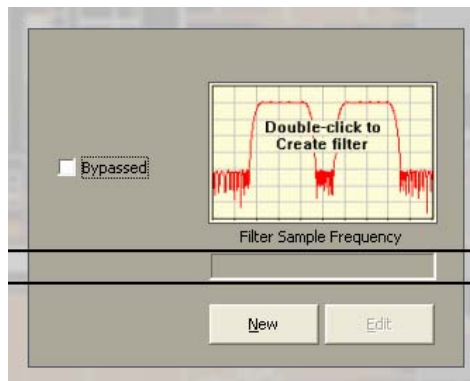


Figure 2

Click on one of the Imported Filters tiles, choosing Symmetric or Asymmetric as appropriate (Figure 3)

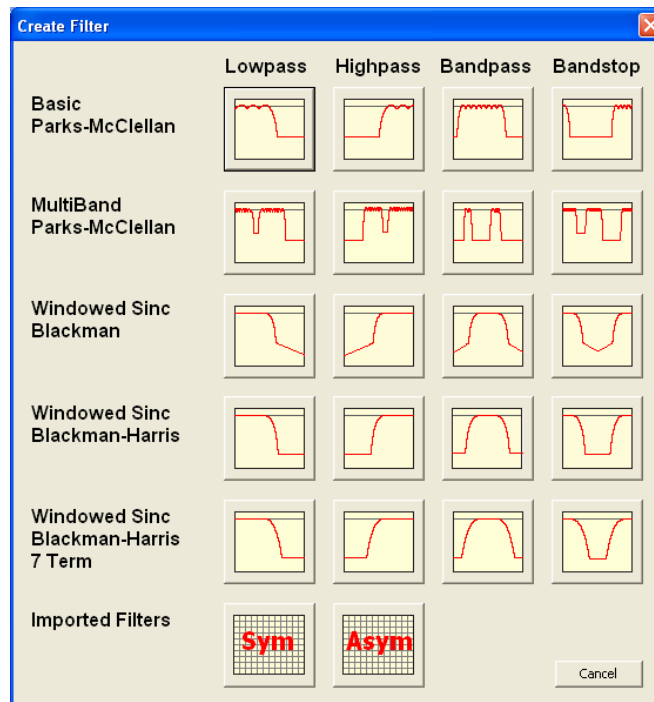


Figure 3

c) Select Import file

The dialog screen (Figure 4) appears. Browse to and select the coefficient text file (.txt file) that was created in Section 2a (floating point output) above:

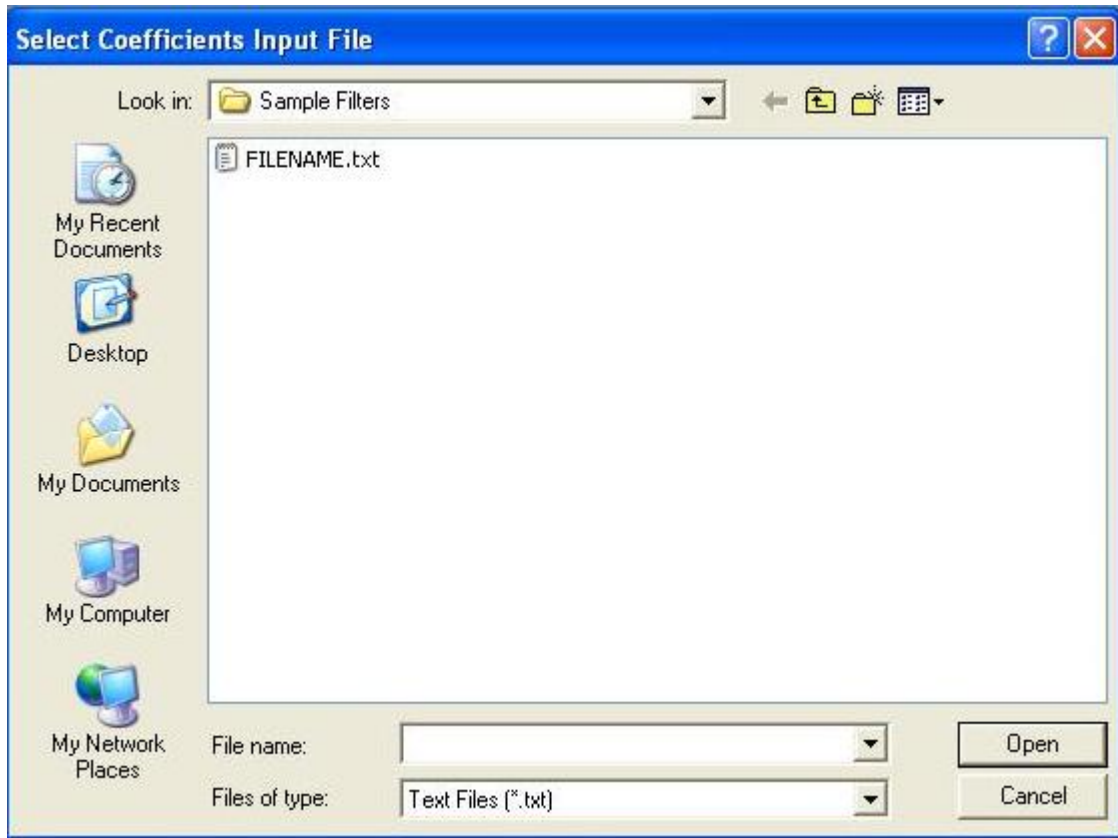


Figure 4

d) Set Sampling Rate

The Filter Editor opens and displays the contents of the file (Figure 5):

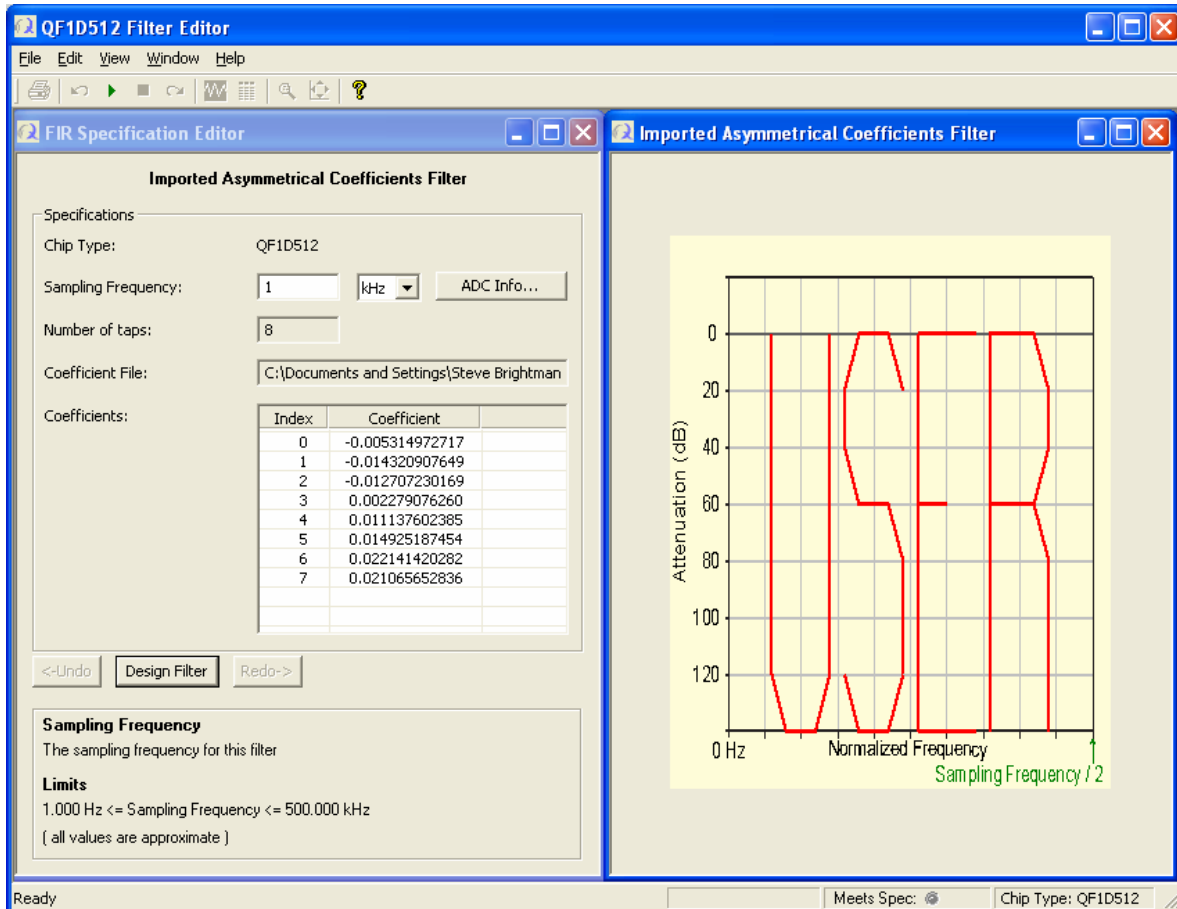


Figure 5

The coefficient values will be displayed on the left of the screen. By themselves the coefficients contain no frequency information. To use them with the QF1D512 the user must specify which sampling rate he wishes to use with the dev kit. Enter the sampling rate you wish to use in the Sampling Frequency input box. Then Click on “Design Filter”. The filter response will now be displayed (Figure 6):

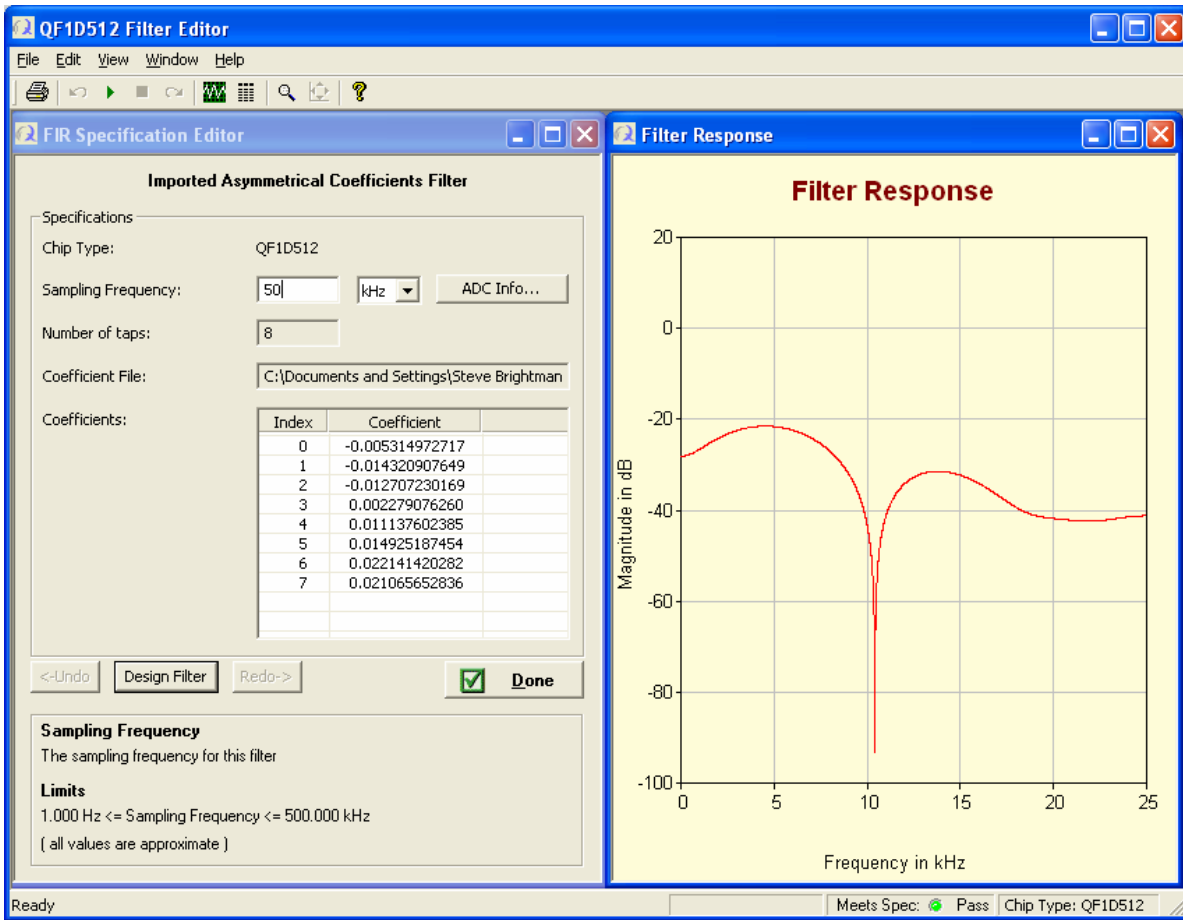


Figure 6

If desired you can also examine other response parameters such as impulse response, step response etc. For more information, refer to the QF1D512-DK Users Guide.

When finished click “Done” and you will be returned to the main configuration window. From there you can download the filter to the DK and view the resulting FFT response as usual (Figure 7):

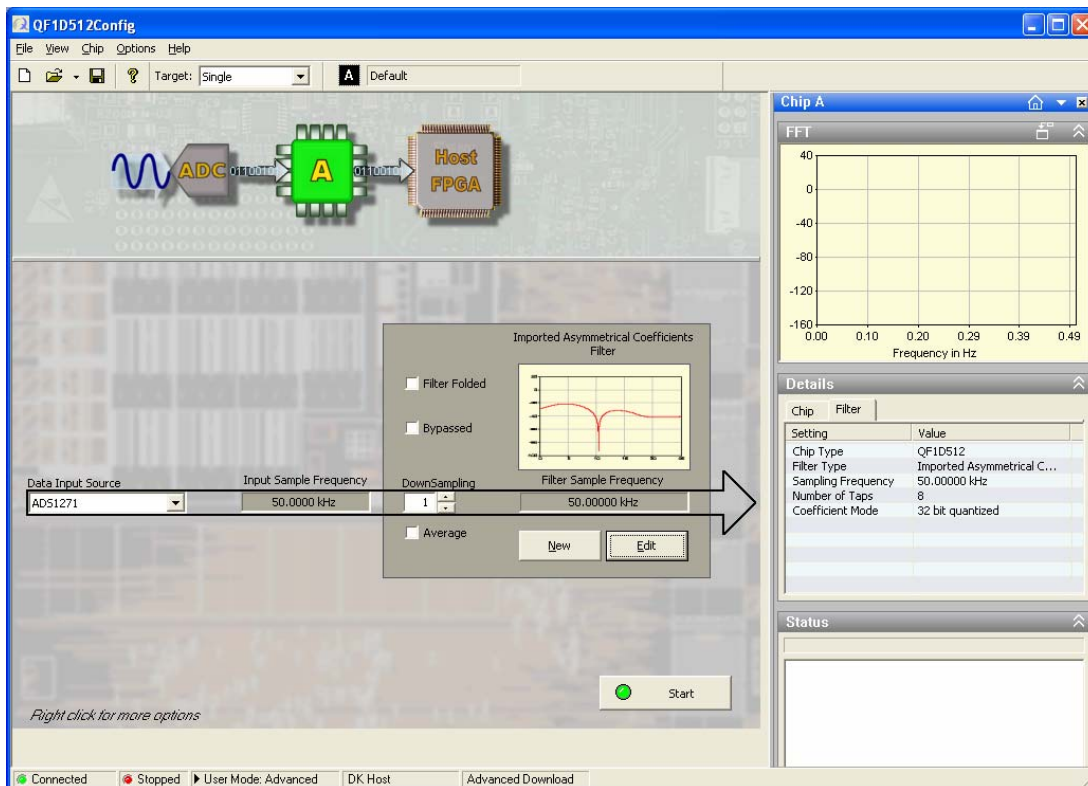


Figure 7

4) Importing Coefficients for use on other Development Platforms

The fixed point export file created in Section 2b contains the coefficients in a form suitable for loading into the QF1D512. This file can be loaded as an image file into the development platform of your choice. The coefficient values, along with the QF1D512 configuration register settings are typically stored in the host microcontroller's on-board FLASH/EEPROM or in external attached memory. The coefficients are written to the QF1D512 at runtime in the coefficient address space (from 0x0000 to 0x00FF) as 32-bit words. The Write OpCode for the coefficients is 0x86, the Read OpCode is 0x87. Refer to the QF1D512 Data Sheet for further information.

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