



## GDD-600 Floating Point DSP Vector Library for TMS320C64xx/TMS320DM64xx.

The present release of the GDD-600 is a thoroughly coded port of the earlier GDD-300 floating-point library to a fixed-point TMS320C64xx/TMS320DM64xx devices. The library provides with the full functionality of the GDD-300 and uses both newer C64xx instruction set and hardware features like extended registers file and also implements assembly optimized floating-point math software simulated functions. These functions would also improve performance of the user-programmed floating point operations code, while keeping the highest level of accuracy, comparable to the native floating-point arithmetic of TMS320C67xx hardware.

The library is a set of over 100 functions and macros that perform commonly used DSP operations like Fast Fourier Transform, Fast Hartley Transform, Discrete Cosine Transform, FIR/IIR filters, coordinate transformations, vector operations, complex number arithmetic operations, pseudo-random numbers generation, data conditioning (spectral windows) operations. These operations are performed on the IEEE-754 floating point format numbers. There is also a set of data conversions functions to convert floating-point data to/from integer and Q15 fixed-point formats.

The library implements complete Level 1 BLAS (Basic Linear Algebra Subroutines) standard.

The library is supported for use in any development environment using TI Code Generation Tools for the TMS320C64xx DSP.

The library can be used in various application areas such as DSP, audio/video processing, linear algebra, engineering, control, robotics, military and consuming. The user's manual (shared with the GDD-300 library) gives the details on using library functions.

## FUNCTIONS

- **Transforms**
  - Initialize Complex FFT twiddle factor table
  - Complex Forward FFT
  - Complex Inverse FFT
  - Complex Forward/Inverse FFT (driver)
  - Initialize Real FFT twiddle factor table
  - Real Forward FFT
  - Real Inverse FFT
  - Initialize FHT twiddle factor table
  - Forward/Inverse Fast Hartley Transform (FHT)
  - Convert FHT to real FFT
  - Convert real FFT to FHT
  - Initialize Complex CT twiddle factor table
  - Real Forward Cosine Transform
  - Real Inverse Cosine Transform

- **DSP Functions**

- Linear auto-covariation (autocorrelation) function
- Linear cross-covariation (crosscorrelation) function
- General Form Difference Equation (IIR Filter)
- Difference Equation with two zeroes and two poles (IIR Filter)
- Linear convolution
- FIR filter (macro)
- Decimation and FIR filter
- Convert to dB (power/voltage units)
- Histogram Accumulation
- Auto-Spectrum Accumulation
- Cross-Spectrum Accumulation
- Coherence Function
- Transfer Function
- Exponential Averaging
- Linear Averaging
- Hanning (cosine) window
- Hamming window
- Blackman window
- Bartlett window
- Parzen window
- Welch window

- **Vector Operations (REAL data)**

- Index of a vector entry with maximum magnitude
- Index of a vector entry with minimum magnitude
- Index of the maximum vector element
- Index of the minimum vector element
- Sum of absolute values of vector elements
- Sum of vector elements
- L2 (Euclidean) Norm of a vector
- Copy vector to a vector
- Fill a vector with a constant
- Dot (inner) product
- Swap two vectors
- Scale a vector, add to another vector (macro)
- Scale a vector, add to another vector, store to an output vector
- Add a constant to a vector (macro)
- Add a constant to a vector, store to an output vector
- Scale a vector (macro)
- Scale a vector, store to an output vector
- Add entries of two vectors (macro)
- Add entries of two vectors, store to an output vector
- Subtract entries of two vectors (macro)
- Subtract entries of two vectors, store to an output vector
- Multiply entries of two vectors (macro)
- Multiply entries of two vectors, store to an output vector
- Divide entries of two vectors (macro)
- Divide entries of two vectors, store to an output vector
- Construct Givens plane rotations
- Apply Givens plane rotations (macro)
- Apply Givens plane rotations, different input/output vectors

- **Vector Operations (COMPLEX data)**
  - Index of a vector entry with maximum magnitude
  - Index of a vector entry with minimum magnitude
  - Sum of absolute values of vector elements
  - Sum of vector elements
  - L2 (Euclidean) Norm of a vector
  - Copy vector to a vector
  - Fill a vector with a constant
  - Dot (inner) product, conjugate first vector
  - Dot (inner) product
  - Swap two vectors
  - Scale a vector, add to another vector (macro)
  - Scale a vector, add to another vector, store to an output vector
  - Scale a conjugated vector, add to another vector (macro)
  - Scale a conjugated vector, add to another vector, store to an output vector
  - Add a constant to a vector (macro)
  - Add a constant to a vector, store to an output vector
  - Scale a vector (macro)
  - Scale a vector, store to an output vector
  - Scale a vector by a real scalar (macro)
  - Scale a vector by a real scalar, store to an output vector
  - Add entries of two vectors (macro)
  - Add entries of two vectors, store to an output vector
  - Subtract entries of two vectors (macro)
  - Subtract entries of two vectors, store to an output vector
  - Multiply entries of two vectors (macro)
  - Multiply entries of two vectors, store to an output vector
  - Divide entries of two vectors (macro)
  - Divide entries of two vectors, store to an output vector
  - Construct Givens plane rotations
  - Apply Givens plane rotations (macro)
  - Apply Givens plane rotations, different input/output vectors
  
- **Data Conversions**
  - Rectangular to polar coordinate transform
  - Polar to rectangular coordinate transform
  - Combine two real arrays into a complex array
  - Split a complex array into two real arrays
  - Convert a Q15 array into a real array
  - Convert a real array into a Q15 array
  - Convert a 32-bit integer array into a real array
  - Convert a real array into a 32-bit integer array

- **Scalar Operations**

- Compute bit-reversed number of 16 bit short integer
- Compute bit-reversed number of 32 bit integer
- Square root of sum of squares
- Sum of magnitudes of real and imaginary parts of a complex number
- Magnitude of a complex number
- Conjugate of a complex number
- Square root of a complex number
- Complex sign transfer
- Add two complex numbers
- Add two complex numbers, conjugate first number
- Add two complex numbers, conjugate second number
- Multiply two complex numbers
- Multiply two complex numbers, conjugate first number
- Multiply two complex numbers, conjugate second number
- Multiply two complex numbers, add a complex number
- Multiply two complex numbers, add a complex number, conjugate second number
- Multiply two complex numbers, add a complex number, conjugate third number
- Divide two complex numbers
- Divide two complex numbers, conjugate first number
- Divide two complex numbers, conjugate second number
- Subtract two complex numbers
- Subtract two complex numbers, conjugate first number
- Subtract two complex numbers, conjugate second number
- Base e (natural) logarithm of a complex number
- Base e exponential function of a complex number
- Cosine of a complex number
- Sine of a complex number
- Complex number raised to an integer power
- Complex number raised to a complex number power

- **Miscellaneous**

- In-place bit-reverse permutation of a real array
- In-place bit-reverse permutation of a complex array
- Bit-reversed copy of a real array
- Bit-reversed copy of a complex array
- Conjugated copy of a complex array
- Negated copy of a real array
- Negated copy of a complex array
- Magnitudes of entries of a complex array
- Reciprocal entries of a real array
- Parameters of machine real arithmetic
- Parameters of machine complex arithmetic
- Set (restore) state of the random generator
- Get (save) state of the random generator
- Get maximum integer random number (macro)
- Integer Uniform Random Number Generator
- Fill a vector with random numbers on (a,b)
- Floating Point (0,1) Uniform Random Number Generator (macro)
- Floating Point (a,b) Uniform Random Number Generator (macro)