

Big-Endian Digital Signal Processing Library (DSPLIB) for TMS320C64x

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Software Applications

ABSTRACT

The digital signal processing library (DSPLIB) is a set of C-callable, assembly-optimized functions commonly used in signal processing applications. While TMS320C64x supports both little- and big-endian modes for better system integration, the DSPLIB has been provided in little-endian mode only. Therefore, there has been a strong request for big-endian support from users who need to use big-endian mode for their system development. To fulfill this urgent request, the DSPLIB functions have been converted from little endian to big endian in either linear assembly or hand assembly. This application note presents the usage of the big-endian DSPLIB for TMS320C64x.

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1 Introduction

TMS320C64x is an advanced digital signal processor well suited for real-time signal processing applications. It supports both little- and big-endian modes for flexible system integration. To help users reduce the time-to-market in their system development with TMS3420C64x, a set of highly-optimized signal processing functions named the digital signal processing library (DSPLIB) has been provided. While the DSPLIB has been widely accepted and utilized, it is provided in little-endian mode only, and thus there has been a strong request for big-endian support from users who need to use big-endian mode for their system development.

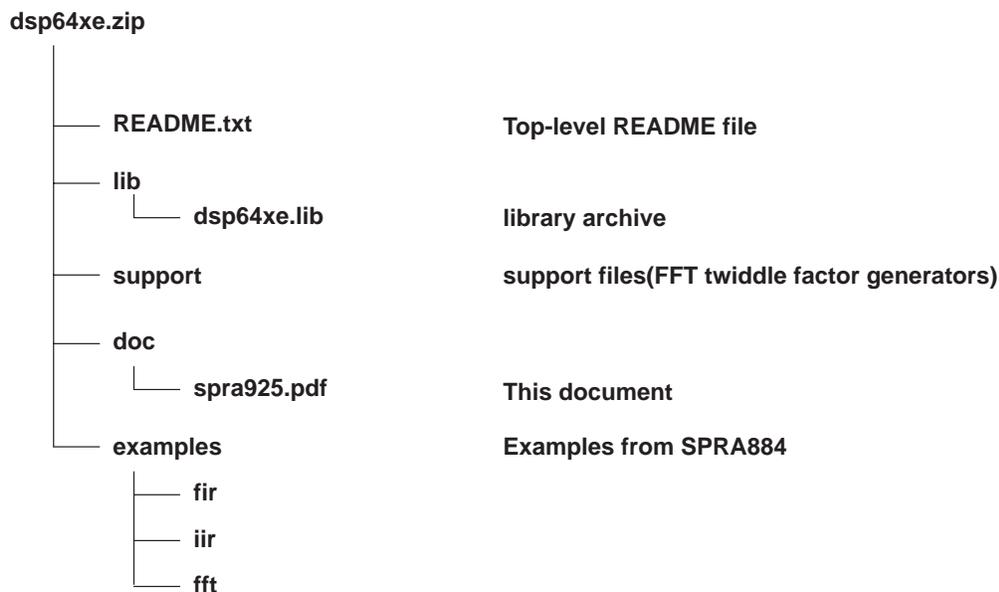
The C64x DSPLIB includes 40 functions in seven categories as listed in Table 1. A total of 17 functions are identified as the functions requiring big-endian conversion. Note that four functions in the FFT category (i.e., DSP_bitrev_cplx, DSP_radix2, DSP_r4fft, and DSP_fft) are eliminated from the conversion because they are obsolete and users are encouraged to use other FFT functions better optimized for C64x.

Some functions are converted to big-endian in linear-assembly since the performance degradation with the linear assembly is marginal compared to the hand-optimized implementation. Due to this reason, the code size and performance of a big-endian DSPLIB function might be worse compared to the corresponding little-endian function.

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2 Setup and Use

The archive has the following structure.



The `lib` directory contains the library archives. The `support` directory contains twiddle factor generators for big-endian FFT functions. When you set up a project, you can add the big-endian DSPLIB by choosing `dsp64xe.lib` (instead of `dsp64x.lib`). The header files for the little-endian DSPLIB (typically found in `ti\c6400\dsplib\include`) can be used for the big-endian DSPLIB as well.

Table 1. Big-Endian Support for DSPLIB Functions

Category	Function	Endian Mode	Big Endian Needed?	Implementation
Adaptive filtering	DSP_firlms2	Neutral		
Correlation	DSP_autocor	Little	Y	Hand assembly
FFT	DSP_bitrev_cplx	Little	Obsolete	
	DSP_radix2	Little	Obsolete	
	DSP_r4fft	Little	Obsolete	
	DSP_fft	Little	Obsolete	
	DSP_fft16x16r	Little	Y	Linear assembly
	DSP_fft16x16t	Little	Y	Linear assembly
	DSP_fft16x32	Little	Y	Hand assembly
	DSP_fft32x32	Little	Y	Linear assembly
	DSP_fft32x32s	Little	Y	Hand assembly
	DSP_ift16x32	Little	Y	Linear assembly
	DSP_ift32x32	Little	Y	Linear assembly

Table 1. Big-Endian Support for DSPLIB Functions (Continued)

Category	Function	Endian Mode	Big Endian Needed?	Implementation
Filtering	DSP_fir_cplx	Little	Y	Hand assembly
	DSP_fir_gen	Little	Y	Hand assembly
	DSP_fir_r4	Little	Y	Hand assembly
	DSP_fir_r8	Little	Y	Hand assembly
	DSP_fir_sym	Little	Y	Linear assembly
	DSP_iir	Neutral		
	DSP_iirlat	Little	Y	Hand assembly
Math	DSP_dotp_sqr	Neutral		
	DSP_dotprod	Neutral		
	DSP_maxval	Neutral		
	DSP_maxidx	Neutral		
	DSP_minval	Neutral		
	DSP_mul32	Neutral		
	DSP_neg32	Neutral		
	DSP_recip16	Neutral		
	DSP_vecsumsq	Neutral		
	DSP_w_vec	Neutral		
Matrix	DSP_mat_mul	Little	Y	Hand assembly
	DSP_mat_trans	Little	Y	Hand assembly
Misc.	DSP_bexp	Neutral		
	DSP_blk_move	Neutral		
	DSP_blk_eswap16	Neutral		
	DSP_blk_eswap32	Neutral		
	DSP_blk_eswap64	Neutral		
	DSP_fltq15	Neutral		
	DSP_minerror	Little	Y	Hand assembly
DSP_q15tofl	Neutral			

Note that the big-endian DSPLIB functions are used in the same way as the little-endian functions. The only exception is that FFT functions require twiddle factors in a different format, which can be created by the enclosed big-endian twiddle factor generators. The example directory contains FIR, IIR, and FFT examples adopted from the *Signal Processing Examples with C64x Digital Signal Processing Library (SPRA884)*. For more information on the usage of each DSPLIB function, refer to the *TMS320C64x Signal Processing Library Programmer's Reference (SPRU565)*.

3 References

1. *Signal Processing Examples with C64x Digital Signal Processing Library (SPRA884)*
2. *TMS320C64x DSP Library Programmer's Reference (SPRU565)*

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