

BittWare Inc.

TS-Lib TS101

Integer Optimised DSP Library
for the TigerSHARC TS101 DSP

Cycle Performance Manual

Version 2.1.0



TS-Lib Optimised DSP Library for the TigerSHARC

Library Cycle Performance Tables

The TS-Lib performance tables in this document lists the cycles for each routine in the library. The given cycles assume optimal data array placement in the internal DSP memory, so that parallel read and writes to the algorithms required data does not create any data bus stalls.

Memory usage can impact upon the cycle performance, the full library documentation includes memory configuration profiles that demonstrate the affect of array placement in memory. The ADSP-TS101S libraries include dm/pm routine entry point versions that uniquely identify the impact using the two data memory blocks. The ADSP-TS20xS processors possess multiple data memory sections therefore only the best-case and worst-case memory configuration cycle counts are documented. The worst-case memory configuration occurs when all arrays are held in the same memory section. The best-case memory configuration occurs when all arrays are held in different memory sections. The majority of the routines are also described with a cycle formula that indicates the cycle performance of the code in more detail. This can be broken into two parts, an initial overhead, which is normally a constant number of cycles, and a value based upon the input dimensions.

The published cycles are based upon the results from latest ADSP TigerSHARC silicon that was available when the library was tested and released. The BTB (and Caching for TS201) is enabled for all cycle performance tests.

Routine Naming Post-Fix

Each of the library routines is prefixed with the letters ez.. A postfix denotes the data-type (and hence the library from which the routine originates). They are as follows:

Floating-point library:

- `_f` : floating-point (using 128-bit quad-word memory access)
- `_sf` : floating-point with vector stride parameter

Fixed-point library:

- `_fr16` : fixed-point 16-bit fractional (using 128-bit quad-word memory access)
- `_fr32` : fixed-point 32-bit fractional (using 128-bit quad-word memory access)

Integer library:

- `_i` : integer (using 128-bit quad-word memory access)
- `_si` : integer with vector stride parameter

Memory Striding Routines

To increase functional versatility, the floating-point and 32-bit integer libraries include memory-striding versions of routines. These do not use the full quad-word data bandwidth since a stride greater than one accesses non-consecutive memory locations. The striding routines are fully optimised with this memory access overhead in-mind. The user should be aware that when using these routines, the performance may be reduced by up to four times, compared with a fully optimised routine. (All performance-metrics are documented for assessment).

Vector 2 Input Mathematic Routines

Functionality	Routine Name	Cycles (array size)
Scalar-Vector Subtraction	ez_ssubv_i	546 cycles (1024 points)
	ez_ssubv_si	1,065 cycles (1024 points)
Vector Addition	ez_vaddv_i	547 cycles (1024 points)
	ez_vaddv_si	2,094 cycles (1024 points)
Vector Dot Product	ez_vdotv_i	562 cycles (1024 points)
	ez_vdotv_si	2,089 cycles (1024 points)
Vector Multiplication	ez_vmulv_i	547 cycles (1024 points)
	ez_vmulv_si	2,094 cycles (1024 points)
Vector Subtraction	ez_vsubv_i	547 cycles (1024 points)
	ez_vsubv_si	2,094 cycles (1024 points)
Vector-Scalar Addition	ez_vadds_i	546 cycles (1024 points)
	ez_vadds_si	1,065 cycles (1024 points)
Vector-Scalar Multiplication	ez_vmuls_i	546 cycles (1024 points)
	ez_vmuls_si	1,065 cycles (1024 points)
Vector-Scalar Subtraction	ez_vsubs_i	546 cycles (1024 points)
	ez_vsubs_si	1,065 cycles (1024 points)

Vector 3 Input Mathematic Routines

Functionality	Routine Name	Cycles (array size)
Vector Addition, Scalar Multiplication	ez_vaddvmuls_i	555 cycles (1024 points)
	ez_vaddvmuls_si	2,096 cycles (1024 points)
Vector Addition, Scalar Multiplication	ez_vaddsmulv_i	555 cycles (1024 points)
	ez_vaddsmulv_si	2,100 cycles (1024 points)
Vector Addition, Vector Addition	ez_vaddvaddv_i	1,072 cycles (1024 points)
	ez_vaddvaddv_si	2,098 cycles (1024 points)

Vector 3 Input Mathematic Routines cont...

Functionality	Routine Name	Cycles (array size)
Vector Addition, Vector Multiplication	ez_vaddvmulv_i	810 cycles (1024 points)
Vector Addition, Vector Subtraction	ez_vaddvsubv_i	2,098 cycles (1024 points)
Vector Multiplication, Scalar Addition	ez_vaddvsubv_si	1,072 cycles (1024 points)
Vector Multiplication, Scalar Multiplication	ez_vmulvadds_i	2,098 cycles (1024 points)
Vector Multiplication, Scalar Subtraction	ez_vmulvadds_si	552 cycles (1024 points)
Vector Multiplication, Vector Addition	ez_vmulvmuls_i	2,096 cycles (1024 points)
Vector Multiplication, Vector Multiplication	ez_vmulvmuls_si	1,070 cycles (1024 points)
Vector Subtraction, Scalar Addition	ez_vmulvsubv_i	2,096 cycles (1024 points)
Vector Subtraction, Scalar Subtraction	ez_vmulvsubv_si	552 cycles (1024 points)
Vector Subtraction, Vector Addition	ez_vmulvsubv_si	2,096 cycles (1024 points)
Vector Subtraction, Vector Multiplication	ez_vmulvaddv_i	810 cycles (1024 points)
Vector Subtraction, Vector Subtraction	ez_vmulvaddv_si	2,098 cycles (1024 points)
Vector Sub by, Vector Multiplication	ez_vmulvmulv_i	1,072 cycles (1024 points)
Vector Subtraction, Scalar Addition	ez_vmulvmulv_si	2,098 cycles (1024 points)
Vector Subtraction, Scalar Multiplication	ez_vmulvsubv_i	810 cycles (1024 points)
Vector Subtraction, Scalar Subtraction	ez_vmulvsubv_si	2,098 cycles (1024 points)
Vector Subtraction, Vector Addition	ez_vsubbyvmulv_i	812 cycles (1024 points)
Vector Subtraction, Vector Multiplication	ez_vsubbyvmulv_si	2,098 cycles (1024 points)
Vector Subtraction, Vector Subtraction	ez_vsubvadds_i	1,070 cycles (1024 points)
Vector Subtraction, Vector Addition	ez_vsubvadds_si	2,096 cycles (1024 points)
Vector Subtraction, Vector Multiplication	ez_vsubvmuls_i	555 cycles (1024 points)
Vector Subtraction, Vector Subtraction	ez_vsubvmuls_si	2,096 cycles (1024 points)
Vector Subtraction, Vector Addition	ez_vsubvsubv_i	1,070 cycles (1024 points)
Vector Subtraction, Vector Multiplication	ez_vsubvsubv_si	2,096 cycles (1024 points)
Vector Subtraction, Vector Subtraction	ez_vsubvaddv_i	1,072 cycles (1024 points)
Vector Subtraction, Vector Multiplication	ez_vsubvaddv_si	2,098 cycles (1024 points)
Vector Subtraction, Vector Subtraction	ez_vsubvmulv_i	810 cycles (1024 points)
Vector Subtraction, Vector Multiplication	ez_vsubvmulv_si	2,098 cycles (1024 points)

Vector 3 Input Mathematic Routines cont...

Functionality	Routine Name	Cycles (array size)
Vector Subtraction, Vector Subtraction	ez_vsubvsubv_i	1,072 cycles (1024 points)
Vector-Scalar Addition, Scalar Multiplication	ez_vsubvsubv_si	2,098 cycles (1024 points)
Vector-Scalar Multiplication, Scalar Addition	ez_vaddsmuls_i	554 cycles (1024 points)
Vector-Scalar Multiplication, Scalar Addition	ez_vaddsmuls_si	1,079 cycles (1024 points)
Vector-Scalar Multiplication, Scalar Subtraction	ez_vmulsadds_i	554 cycles (1024 points)
Vector-Scalar Multiplication, Scalar Subtraction	ez_vmulsadds_si	1,079 cycles (1024 points)
Vector-Scalar Multiplication, Vector Addition	ez_vmulssubs_i	554 cycles (1024 points)
Vector-Scalar Multiplication, Vector Addition	ez_vmulssubs_si	1,079 cycles (1024 points)
Vector-Scalar Multiplication, Vector Subtraction	ez_vmulsaddv_i	555 cycles (1024 points)
Vector-Scalar Multiplication, Vector Subtraction	ez_vmulsaddv_si	2,100 cycles (1024 points)
Vector-Scalar Subtraction, Scalar Multiplication	ez_vmulssubv_i	555 cycles (1024 points)
Vector-Scalar Subtraction, Scalar Multiplication	ez_vmulssubv_si	2,100 cycles (1024 points)
Vector-Scalar Subtraction, Vector Multiplication	ez_vsubsmuls_i	554 cycles (1024 points)
Vector-Scalar Subtraction, Vector Multiplication	ez_vsubsmulv_i	1,079 cycles (1024 points)
Vector-Scalar Subtraction, Vector Multiplication	ez_vsubsmulv_si	555 cycles (1024 points)
Vector-Scalar Subtraction, Vector Multiplication	ez_vsubsmulv_si	2,100 cycles (1024 points)

Vector 4 Input Mathematic Routines

Functionality	Routine Name	Cycles (array size)
Vector Addition, mult. by, Vector Addition	ez_vaddvmulbyvaddv_i	1,071 cycles (1024 points)
Vector Addition, mult. by, Vector Subtraction	ez_vaddvmulbyvaddv_si	3,130 cycles (1024 points)
Vector Addition, mult. by, Vector Subtraction	ez_vaddvmulbyvsubv_i	1,071 cycles (1024 points)
Vector Mult., added to, Vector Mult.	ez_vaddvmulbyvsubv_si	3,130 cycles (1024 points)
Vector Mult., added to, Vector Mult.	ez_vmulvaddbyvmulv_i	1,071 cycles (1024 points)
Vector Mult., subtract a, Vector Mult.	ez_vmulvaddbyvmulv_si	3,130 cycles (1024 points)
Vector Mult., subtract a, Vector Mult.	ez_vmulvsubbyvmulv_i	1,071 cycles (1024 points)
Vector Mult., subtract a, Vector Mult.	ez_vmulvsubbyvmulv_si	3,130 cycles (1024 points)

Vector 4 Input Mathematic Routines cont...

Functionality	Routine Name	Cycles (array size)
Vector Subtraction, mult. by, Vector Subtraction	ez_vsubvmulbyvsubv_i	1,071 cycles (1024 points)
	ez_vsubvmulbyvsubv_si	3,130 cycles (1024 points)
Vector-Scalar Add., mult. by, Vector-Scalar Add.	ez_vaddsmulbyvadds_i	1,072 cycles (1024 points)
	ez_vaddsmulbyvadds_si	2,102 cycles (1024 points)
Vector-Scalar Mult., added to, Vector-Scalar Mult.	ez_vmulsaddbyvmuls_i	1,072 cycles (1024 points)
	ez_vmulsaddbyvmuls_si	2,102 cycles (1024 points)
Vector-Scalar Mult., sub. by, Vector-Scalar Mult.	ez_vmulssubbyvmuls_i	1,072 cycles (1024 points)
	ez_vmulssubbyvmuls_si	2,102 cycles (1024 points)
Vector-Scalar Sub., mult. by, Vector-Scalar Sub.	ez_vsubsmulbyvsubs_i	1,072 cycles (1024 points)
	ez_vsubsmulbyvsubs_si	2,102 cycles (1024 points)

Vector Standard Operations

Functionality	Routine Name	Cycles (array size)
Vector Absolute	ez_vabs_i	556 cycles (1024 points)
	ez_vabs_si	1,062 cycles (1024 points)
Vector Clear	ez_vclr_i	289 cycles (1024 points)
	ez_vclr_si	1,055 cycles (1024 points)
Vector Fill	ez_vfill_i	289 cycles (1024 points)
	ez_vfill_si	1,055 cycles (1024 points)
Vector Negate	ez_vneg_i	556 cycles (1024 points)
	ez_vneg_si	1,062 cycles (1024 points)
Vector Negative Absolute	ez_vnabs_i	1,063 cycles (1024 points)
	ez_vnabs_si	1,074 cycles (1024 points)
Vector Reverse	ez_vrev_i	1,325 cycles (1024 points)
	ez_vrev_si	2,088 cycles (1024 points)
Vector Swap	ez_vswap_i	550 cycles (1024 points)
	ez_vswap_si	2,084 cycles (1024 points)

Vector Test

Functionality	Routine Name	Cycles (array size)
Vector Equal	ez_veq_i	1,573 cycles (1024 points)
	ez_veq_si	2,093 cycles (1024 points)
Vector Logic Greater than Zero Test	ez_vlg_i	1,067 cycles (1024 points)
	ez_vlg_si	2,096 cycles (1024 points)
Vector Logic Greater than/or Equal Test	ez_vlge_i	1,067 cycles (1024 points)
	ez_vlge_si	2,096 cycles (1024 points)
Vector Logic Less than Zero Test	ez_vll_i	1,067 cycles (1024 points)
	ez_vll_si	2,096 cycles (1024 points)
Vector Logic Less than/or Zero Test	ez_vlle_i	1,067 cycles (1024 points)
	ez_vlle_si	2,096 cycles (1024 points)
Vector Logic Not Zero Test	ez_vlne_i	1,067 cycles (1024 points)
	ez_vlne_si	2,096 cycles (1024 points)
Vector Logic Zero Test	ez_vle_i	1,067 cycles (1024 points)
	ez_vle_si	2,096 cycles (1024 points)
Vector Not-Equal	ez_vneq_i	1,573 cycles (1024 points)
	ez_vneq_si	2,093 cycles (1024 points)

Threshold Operations

Functionality	Routine Name	Cycles (array size)
Vector Clip	ez_vclip_i	1,328 cycles (1024 points)
	ez_vclip_si	32 cycles (1024 points)
Vector Clip	ez_vkclip_i	1,332 cycles (1024 points)
	ez_vkclip_si	2,871 cycles (1024 points)
Vector Limit	ez_vlimit_i	814 cycles (1024 points)
	ez_vlimit_si	1,590 cycles (1024 points)

Threshold Operations cont...

Functionality	Routine Name	Cycles (array size)
Vector Threshold	ez_vthrsh_i	812 cycles (1024 points)
Vector Threshold	ez_vthrsh_si	1,583 cycles (1024 points)
Vector Threshold	ez_vthres_i	816 cycles (1024 points)
Vector Threshold	ez_vthres_si	1,587 cycles (1024 points)

Logic Operations

Functionality	Routine Name	Cycles (array size)
Vector Logical And	ez_vlandv_i	547 cycles (1024 points)
Vector Logical And	ez_vlandv_si	2,094 cycles (1024 points)
Vector Logical And-And	ez_vlandvlandv_i	957 cycles (1024 points)
Vector Logical Exor	ez_vlexorv_i	547 cycles (1024 points)
Vector Logical Exor	ez_vlexorv_si	2,094 cycles (1024 points)
Vector Logical Not	ez_vlnot_i	291 cycles (1024 points)
Vector Logical Not	ez_vlnot_si	1,063 cycles (1024 points)
Vector Logical Not-exor	ez_vlnexorv_i	547 cycles (1024 points)
Vector Logical Or	ez_vlorv_i	547 cycles (1024 points)
Vector Logical Or	ez_vlorv_si	2,094 cycles (1024 points)
Vector Logical Or-Not	ez_vlorvlnot_i	824 cycles (1024 points)

Shift Operations

Functionality	Routine Name	Cycles (array size)
Vector Arithmetic Shift	ez_vashift_i	547 cycles (1024 points)
Vector Logic Shift	ez_vlshift_i	548 cycles (1024 points)
Vector Rotate	ez_vrot_i	547 cycles (1024 points)
Vector Rotate Left	ez_vrotl_i	318 cycles (1024 points)
Vector Rotate Right	ez_vrotr_i	318 cycles (1024 points)

Vector Sum and Average Routines

Functionality	Routine Name	Cycles (array size)
Vector First Non-Zero	ez_vfirst_i	1,322 cycles (1024 points)
	ez_vfirst_si	2,596 cycles (1024 points)
Vector Last Non-Zero	ez_vlast_i	1,344 cycles (1024 points)
	ez_vlast_si	2,084 cycles (1024 points)
Vector Mean	ez_vmean_i	1,083 cycles (1024 points)
	ez_vmean_si	1,077 cycles (1024 points)
Vector Mean of Magnitudes	ez_vmeanm_i	1,082 cycles (1024 points)
	ez_vmeanm_si	1,085 cycles (1024 points)
Vector Mean of signed Squares	ez_vmeanss_i	1,091 cycles (1024 points)
	ez_vmeanss_si	1,092 cycles (1024 points)
Vector Mean of Squares	ez_vmeans_i	1,087 cycles (1024 points)
	ez_vmeans_si	1,080 cycles (1024 points)
Vector Range	ez_vrange_i	2,098 cycles (1024 points)
	ez_vrange_si	1,064 cycles (1024 points)
Vector Sum	ez_vsum_i	1,075 cycles (1024 points)
	ez_vsum_si	1,060 cycles (1024 points)
Vector Sum of Magnitudes	ez_vsumm_i	1,072 cycles (1024 points)
	ez_vsumm_si	1,064 cycles (1024 points)
Vector Sum of Signed Squares	ez_vsumss_i	1,081 cycles (1024 points)
	ez_vsumss_si	1,073 cycles (1024 points)
Vector Sum of Squares	ez_vsums_i	1,076 cycles (1024 points)
	ez_vsums_si	1,061 cycles (1024 points)

Vector Limits Routines

Functionality	Routine Name	Cycles (array size)
Vector Max	ez_vmax_i	559 cycles (1024 points)
	ez_vmax_si	1,059 cycles (1024 points)
Vector Max and Min	ez_vmaxmin_i	1,073 cycles (1024 points)
	ez_vmaxmin_si	1,064 cycles (1024 points)
Vector Max and Min of Magnitude	ez_vmaxminm_i	1,589 cycles (1024 points)
	ez_vmaxminm_si	1,577 cycles (1024 points)
Vector Max Index	ez_vmaxi_i	1,587 cycles (1024 points)
	ez_vmaxi_si	2,097 cycles (1024 points)
Vector Max of Magnitude	ez_vmaxm_i	1,070 cycles (1024 points)
	ez_vmaxm_si	1,065 cycles (1024 points)
Vector Max of Magnitudes Index	ez_vmaxmi_i	1,589 cycles (1024 points)
	ez_vmaxmi_si	2,102 cycles (1024 points)
Vector Maximum	ez_vmaxv_i	547 cycles (1024 points)
	ez_vmaxv_si	2,094 cycles (1024 points)
Vector Min	ez_vmin_i	557 cycles (1024 points)
	ez_vmin_si	1,059 cycles (1024 points)
Vector Min Index	ez_vmini_i	1,587 cycles (1024 points)
	ez_vmini_si	2,097 cycles (1024 points)
Vector Min of Magnitude	ez_vminm_i	1,070 cycles (1024 points)
	ez_vminm_si	1,065 cycles (1024 points)
Vector Min of Magnitude with Index	ez_vminmi_i	1,590 cycles (1024 points)
	ez_vminmi_si	2,102 cycles (1024 points)
Vector Minimum	ez_vminv_i	547 cycles (1024 points)
	ez_vminv_si	2,094 cycles (1024 points)

Matrix Limits Routines

Functionality	Routine Name	Cycles (array size)
Matrix Max	ez_mmax_i	569 cycles (1024 points)
Matrix Max Magnitude	ez_mmaxm_i	1,078 cycles (1024 points)
Matrix Max Min Magnitude	ez_mmaxminm_i	1,599 cycles (1024 points)
Matrix Min	ez_mmin_i	567 cycles (1024 points)
Matrix Min Magnitude	ez_mminm_i	1,078 cycles (1024 points)

Histogram Routines

Functionality	Routine Name	Cycles (array size)
Vector Histogram	ez_vhist_i	17,506 cycles (1024 points)

Vector Packing Routines

Functionality	Routine Name	Cycles (array size)
Vector Pack	ez_vpack_i	905 cycles (1024 points)
Vector Unpack	ez_vunpack_i	1,061 cycles (32 points)

Move Routines

Functionality	Routine Name	Cycles (array size)
Vector Move	ez_vmov_i	294 cycles (1024 points)
	ez_vmov_si	1,060 cycles (1024 points)

Misc. Routines

Functionality	Routine Name	Cycles (array size)
Endian	ez_endian.i	7,208 cycles (1024 points)
Library Copyright	ez_copyright.i	–
Library Version	ez_version.i	–