

GoFast[®] for Thumb-2 and Keil

Features

- Fast
- Reentrant
- ROMable
- Conforms to IEEE 754
- “Link and Go” compiler support for Keil
- Includes complete source, test programs, project files, and startup code

Description

GoFast[®] for Thumb-2 (e.g. Cortex-M3) was carefully designed for high performance operation in embedded applications and ease of use including “link and go” compatibility with the Keil C compiler. GoFast provides ROMable, reentrant IEEE and ANSI compatible Thumb-2 floating point support. It boosts the performance of an application’s math calculations or eliminates the need for a hardware floating-point coprocessor, in order to reduce product manufacturing cost. It is delivered with full assembly source code.

Currently GoFast is offered for the ARM and Thumb-2 instruction sets, not Thumb.

Functionality

GoFast Thumb-2 offers reentrant floating point routines for both single and double precision (see table).

Floating Point Technology

GoFast is based on “Architecture Independent Technology” (AIT) and proven floating point algorithms that were developed for over a decade. The algorithms have been thoroughly tested using automated methods.

Conformance and Testing

The accuracy of each GoFast Floating Point Library is within one (least significant) bit for arithmetic functions and two bits for transcendental functions, in most cases. The IEEE 754 Floating Point Format defines special representations for underflow, overflow, and invalid operation. The GoFast routines use these formats and adhere to the IEEE 754 error handling procedures in all applicable cases. Quality assurance and testing procedures have assured proper product operation. In addition, each delivery includes target specific test programs assuring confidence of product operation.

Timings

The following table gives the times for all floating point operations, for GoFast and the Keil floating point library. The times, in microseconds, were measured using the indicated processor and evaluation board. The basic operations (add, subtract, multiply, divide, conversions, and comparisons) in the Keil C library are hand-coded and faster than those in GoFast, so the Keil versions are used instead. (If you only need these basic operations, you don’t need GoFast.) Thus, the routines linked are a mixture of both libraries, as indicated in **bold** below. GoFast provides the greatest benefit for the more complex operations, offering a 3x performance boost for some.

Microsecond Timings

Cortex-M3: STM32F103VBT6, 72 MHz, Code Int Flash, Data Int SRAM

Function	Double-Precision		Single-Precision	
	GoFast	Keil	GoFast	Keil
add	4.999	3.319	3.544	2.177
subtract	5.253	3.499	3.804	2.191
rsubtract	5.215	3.545	3.687	2.269
divide	32.633	23.420	16.678	5.359
multiply	4.852	3.591	3.030	1.960
__neg	0.892	0.856	0.737	0.698
feg	2.825	1.702	2.056	1.631
fge	2.776	2.015	2.057	1.782
fgt	2.817	2.015	2.056	1.781
fle	2.816	2.015	2.058	1.783
flt	2.776	2.014	2.056	1.783
sqrt	63.381	25.165	33.019	10.135
fmod	21.741	21.106	15.991	10.641
ldexp	2.250	1.669	1.947	1.456
frexp	1.941	1.631	1.534	1.261
modf	7.509	2.798	4.469	1.891
fabs	0.892	2.815	0.739	2.272
sin	20.105	65.259	8.085	27.340
cos	19.803	64.705	8.065	27.070
tan	52.946	89.125	22.603	32.266
exp	24.529	93.500	7.627	60.275
log	58.292	93.048	27.410	31.838
log10	60.149	104.669	27.955	37.966
atan	65.979	106.982	29.084	32.249
atan2	93.719	126.000	42.579	37.238
acos	49.841	152.490	78.884	49.510
asin	48.958	152.162	69.763	49.310
cosh	50.582	118.385	21.914	70.045
sinh	51.495	120.997	22.690	72.083
tanh	53.940	114.241	33.671	64.646
pow	82.604	262.701	36.581	130.719
floor	2.350	1.503	1.627	1.046
ceil	2.430	1.503	1.705	1.044
long to fp	2.668	3.580	2.319	1.592
ulong to fp	2.272	3.992	1.805	1.592
fp to long	1.797	1.375	1.356	1.222
fp to ulong	1.797	1.090	1.355	0.977
longlong to fp	5.941	6.809	5.605	7.085
ulonglong to fp	5.596	6.840	5.264	7.075
fp to longlong	2.682	1.549	2.291	1.375
fp to ulonglong	2.664	1.281	2.281	1.146
sgl to dbl	1.649	1.281	–	–
dbl to sgl	2.079	1.359	–	–

Times were measured on STMicro STM3210B-EVAL board with Keil v4.13a.

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