

GoFast[®] for ARM and GNU GCC ARM

Features

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

Description

GoFast[®] for ARM was carefully designed for high performance operation in embedded applications and ease of use including “link and go” compatibility with the GNU GCC compiler. GoFast provides ROMable, reentrant IEEE and ANSI compatible ARM 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 ARM offers the following reentrant floating point routines, for both single and double precision:

- **intrinsic basic operations + - * /**
- **intrinsic conversions**
- **sqrt**
- **sin, cos, tan**
- **asin, acos, atan, atan2**
- **sinh, cosh, atanh**
- **log, log10, exp, pow**
- **floor, ceil, fabs**
- **modf, fmod, frexp, ldexp**

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 tables give the times for all floating point operations, for GoFast and the GNU GCC 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 GNU GCC library are hand-coded and faster than those in GoFast, so the GNU GCC 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, typically offering a 2x to 3x performance boost.

Microsecond Timings

ARM7: AT91SAM7X256-EK, 48 MHz, Internal Flash, GCC v4.4.1

Function	Double-Precision		Single-Precision	
	GoFast	GNU	GoFast	GNU
add	4.822	3.806	3.806	2.659
subtract	5.074	3.799	3.779	2.814
multiply	4.674	3.334	3.008	2.057
divide	32.438	22.356	16.650	5.725
sqrt	63.384	50.835	33.136	17.603
exp	24.556	101.055	7.759	55.894
log	58.298	103.429	27.531	55.842
log10	60.154	115.334	28.074	63.799
sin	20.132	77.748	8.217	48.893
cos	19.832	79.160	8.198	49.934
tan	52.953	149.342	22.725	87.206
asin	48.970	134.666	69.860	65.574
acos	49.851	128.082	78.975	62.616
atan	65.977	96.755	29.203	52.429
atan2	93.489	136.486	42.537	68.699
pow	82.380	340.638	36.542	193.091
tanh	53.949	152.922	33.785	79.452
sinh	51.509	158.234	22.812	83.242
cosh	50.591	126.249	22.037	63.574
modf	7.544	6.339	4.603	3.658
fmod	21.554	35.667	15.963	24.328
fabs	0.931	1.067	0.873	0.835
floor	2.388	6.555	1.763	4.856
ceil	2.468	6.565	1.838	4.862
ldexp	2.094	9.275	1.927	8.059
frexp	1.980	2.426	1.669	2.057
cmp	2.843	1.821	2.152	1.533
fp to long	1.949	1.418	1.528	1.294
fp to ulong	1.892	1.184	1.470	1.090
long to fp	2.725	2.742	2.454	2.188
ulong to fp	2.329	2.704	1.941	2.264
fp to longlong	2.716	11.869	2.350	11.674
fp to ulonglong	2.701	7.701	2.338	8.004
longlong to fp	5.978	2.939	5.718	2.294
sgl to dbl	1.708	1.068	–	–
dbl to sgl	2.192	1.281	–	–

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