

DFPMU coprocessor performance

The following tables describes how using of DFPMU (DCD Floating Point Mathematics Unit) as arithmetic coprocessor for DP8051/DP80390 and NIOS-II processors accelerating the system performance.

DFPMU performance in system with 8051/80390 processor has been compared to standard C library functions delivered with every commercial 8051/80390 C compiler. Both programs were executed in the same system environments. Number of clock periods were measured between input data loading into work registers and output result storing after operation.

Function	DP8051FP ¹	DP8051	Std 8051	DP8051FP architecture speed compared to	
	[clk]	[clk]	[clk]	DP8051 ²	std. 8051 ³
Addition	136 (35)	331	2 569	2.4 (10.4)	18.8 (73)
Subtraction	138 (37)	288	2 228	2.1 (9.9)	15.4 (60)
Multiplication	142 (34)	286	2 223	2.0 (9.7)	15.6 (65)
Division	157 (50)	1 218	9 122	7.7 (31.4)	58 (182)
Square Root	122 (59)	3 144	23 142	25.7 (61.0)	189 (392)
Total				8.0 (24.5)	59 (154)
Sine	321 (257)	5 195	35 861	16.1 (20.1)	111 (139)
Cosine	313 (249)	5 203	35 899	16.6 (20.5)	114 (144)
Tangent	314 (250)	7 899	55 464	25.1 (31.6)	177 (222)
Arctangent	229 (165)	4 121	29 965	18.0 (25.0)	131 (182)
Total				18.9 (24.3)	133 (172)

DP8051/DP80390+DFPMU performance

¹ – round brackets () results are concerned to DFPMU time required to compute particular function if input data are already loaded into DFPMU registers. The first value is concerned to total time required to: load data, compute function by DFPMU and return data into right place.

^{2,3} – performance is concerned to round bracket value from Note 1.

In system using NIOS-II processor, an DFPMU performance has been compared to GNU C library functions delivered with NIOS-II GNU C/C++ tools. Performance calculation is the same as in previous example.

Function	NIOS-II+DFPMU ⁰		NIOS-II ⁰		Improvement	
	NIOS II/f [CLK]	NIOS II/s [CLK]	NIOS II/f [CLK]	NIOS II/s [CLK]	NIOS II/f	NIOS II/s
Addition	70	75	340	480	4.8	6.4
Subtraction	70	75	350	490	5.0	6.5
Multiplication	60	70	280	360	4.7	5.1
Division	89	95	480	620	5.4	6.5
Square Root	80	85	700	1 100	8.8	12.9
Total					5.7	7.5
Sine	200	210	6 000	8 600	30.0	40.9
Cosine	220	230	6 300	9 500	28.6	41.3
Tangent	250	260	10 700	16 900	42.8	65.0
Arctangent	230	240	7 000	11 900	30.4	49.6
Total					32.9	49.2

32-bit NIOS-II (MUL instr. included)+DFPMU performance

⁰ – NIOS-II/s and NIOS-II/f configurations include 1 MB of SRAM; Code is speed optimized