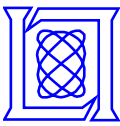




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# **VSIPL and SAR Performance on Multiple Generations of Intel® Processors**

**Peter Carlston,  
Platform Architect,  
Embedded Computing Division  
Intel Corporation**

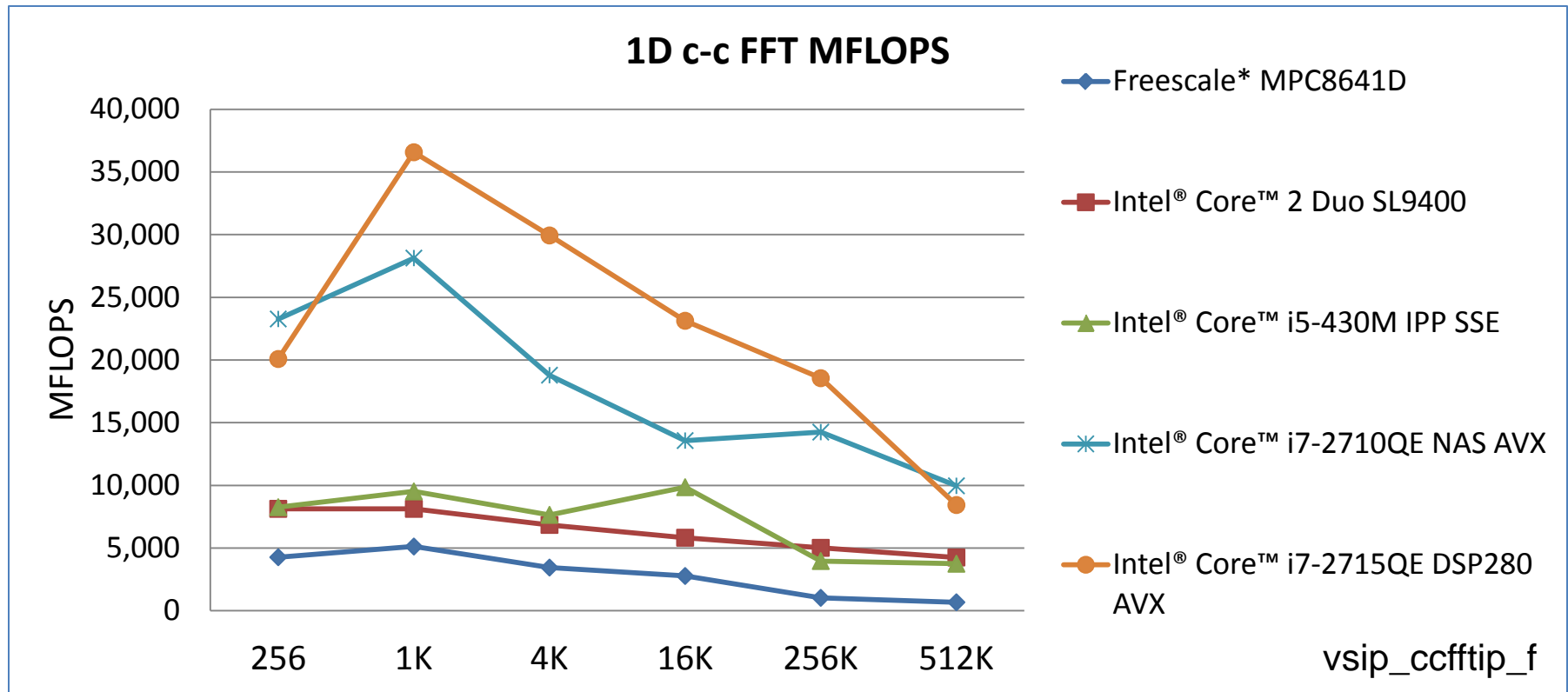


# VS IPL and SAR Benchmark Systems

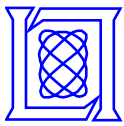
- **Benchmark Systems and Methodology**
  - **Freescale MCP8641D (2007) @ 1 GHz**
    - GE Fanuc DSP230 single board computer; AXISLib VS IPL 2.3; VxWorks 6.6; 2 cores; 1MB cache/core; ~25W max processor power
  - **Intel Core 2 Duo SL9400 (2008) @ 1.86 GHz**
    - HP 2530P Laptop; N.A. Software VS IPL Beta for Intel Architecture; Linux; 2 cores; 6 MB shared cache; 31.5 W max power incl. chipset
  - **Intel Core i5-430M (2010) @ 2.0 GHz (fixed)**
    - Acer Aspire AS5741-6823 Laptop; N.A. Software VS IPL AVX Beta; Linux; 2 cores; 3MB shared cache; ~39W max power incl. chipset
  - **Intel Core i7 2710QE (2011) @ 2.0 GHz (fixed)**
    - Intel 'Emerald Lake' Customer Ref. Board; N.A. Software VS IPL AVX Beta; 4 cores; 6MB shared cache; Linux; ~51W max power incl. chipset
  - **Intel Core i7-2715QE (2011) @ 2.1 GHz; Intel Turbo Boost enabled**
    - GE Intelligent Platforms DSP280; AXISLib-AVX Beta; 1.0; Scientific Linux 6.0 x64, Kernel 2.6.32; ~51W max power incl. chipset
- **VS IPL Tests conducted by GE-IP and NA Software 2009-2011**
  - Single Thread tests only; data in warm caches where possible
- **SAR/SARMTI Tests conducted by NA Software, 2010**



# VSIPL 1D FFT Relative Performance

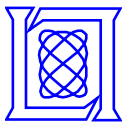


- **2008 Intel processor vs Freescale: Clock speed benefits Intel <256K points; 6M L2 cache benefits Intel > 256K points**
- **2010 Intel processor: Minor or no improvement vs 2008 Intel processor**
- **2011 Intel processor: Major micro-architecture enhancement: 2x load/store bandwidth; ring bus; 256-bit SIMD registers (Intel® AVX)**



# VSIPL and SAR Performance on Multiple Generations of Intel® Processors

VSIPL* Function	Intel® Core™ Processor 2011 vs Freescale* MPC-8641D	Intel® Core™ Processors 2010 vs 2008	Intel® Core™ Processors 2011 vs 2008	Intel® Core™ Processors 2011 vs 2010	Intel® Core™ i7-2011 AVX vs SSE
1D FFT	5 – 14 X	< 1.1X	2.4 - 3.5 X	2.3 – 3.5 X	1.2 - 1.8 X
Multiple 1D FFT	5.4 – 10.4 X		2.5 – 3.3 X	2.6 – 3.7 X	1.3 – 1.6X
2D FFT, non-square matrices	No Data			2 – 2.3 X	0.7 – 1.3X
2D FFT, smaller square matrices				2.3 – 3.1 X	1.1 – 1.6 X
Complex Matrix Transpose	7 – 26 X	< 1.1X	0.6 – 2.14 X	2 – 4.1 X	None
Vector Multiply	4.6 – 72 X		2.3 – 8.3 X	2.1 – 4.5 X	1 – 2.9 X
Vector Sine	1.1 – 1.4 X		3.6 – 3.7 X	3.1 – 4.7 X	0.4 – 1.8 X
Vector Cosine	1.1 – 1.4 X		2.2 – 2.6 X	2.8 – 2.9 X	1.4 X
Vector Square Root	2.6 – 4.5 X		2.3 – 3.2 X	2.3 – 2.9 X	1.2 -2.1 X
Vector Scatter	No Data			4.2 – 8.2x	1.5 – 4.1 X
Vector Gather				2.5 – 4.8x	1.5 – 4.1 X



# SAR/SARMTI Performance on 2010 and 2011 Intel® Processors

N.A. Software Algorithm	System	2 Threads (cores)	4 Threads (cores)
SAR	Intel® Core™ i7-2710QE with Intel® AVX 1.0 (2011)	0.059 s	0.027 s
	Intel® Core™ i5-430M with Intel SSE 4.2 (2010)	0.135 s	0.121 s*
	Intel® Core™ i7-2710QE Speed Up	2.3X	4.4X
SARMTI	Intel® Core™ i7-2710QE with Intel® AVX 1.0 (2011)	6.03 s	3.841 s
	Intel® Core™ i5-430M with Intel SSE 4.2 (2010)	15.197 s	13.667 s*
	Intel® Core™ i7-2710QE Speed Up	2.5X	3.5X

- Core for core, the 2011 Intel® processor performs >2X better on these algorithms
- Running with 4 threads yields a 3-4X performance benefit (additional 12W max thermal design power)

\* 4 thread timings utilize Intel Hyper Threading since only a 2-core version is available.