



# SPEC® CPU2017 Floating Point Rate Result

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## Supermicro

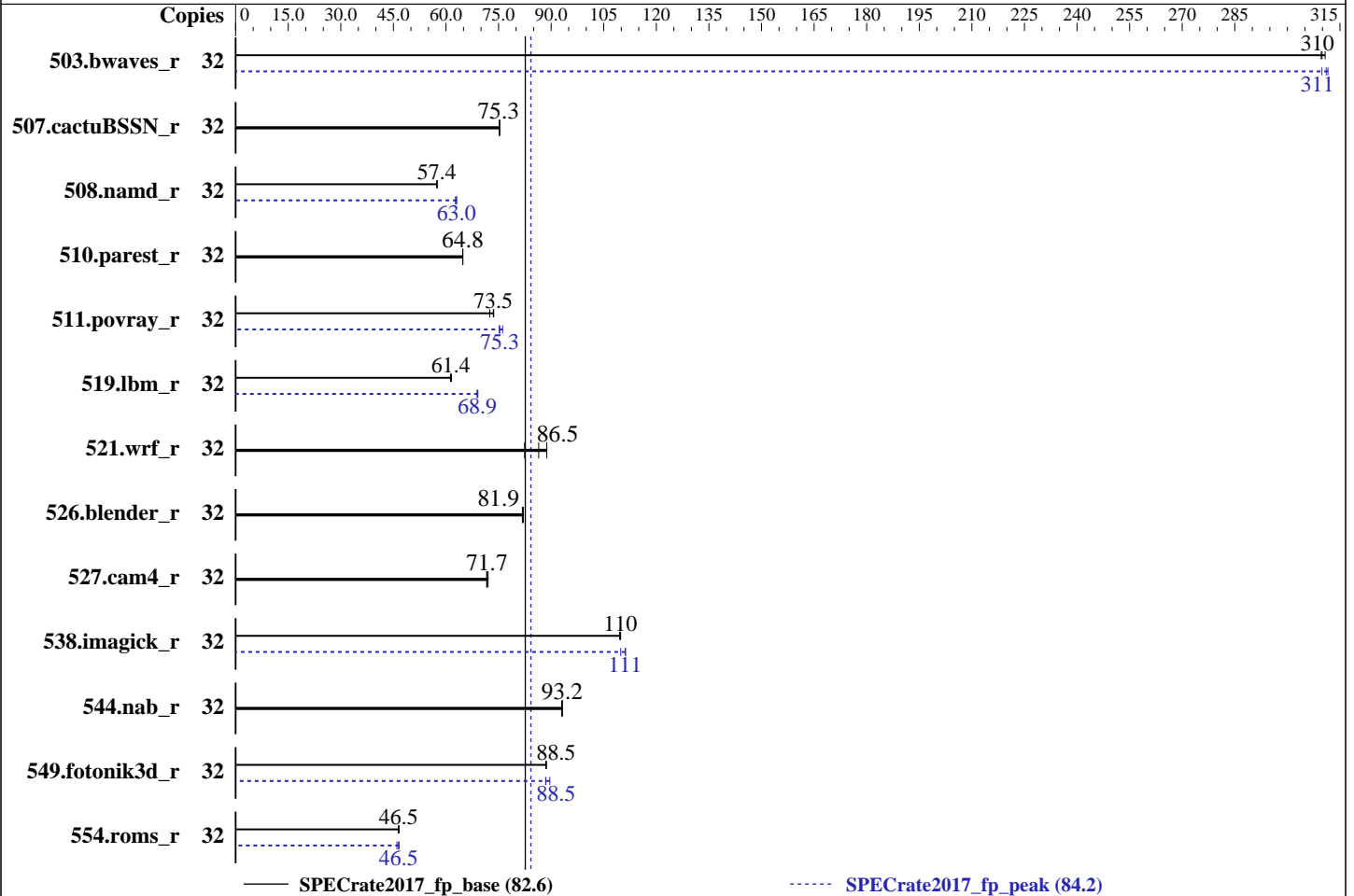
A+ Server 1113S-WN10RT  
(H11SSW-NT, AMD EPYC 7281)

SPECrate2017\_fp\_base = 82.6

SPECrate2017\_fp\_peak = 84.2

CPU2017 License: 001176  
Test Sponsor: Supermicro  
Tested by: Supermicro

Test Date: Nov-2018  
Hardware Availability: Sep-2018  
Software Availability: Feb-2018



### Hardware

CPU Name: AMD EPYC 7281  
 Max MHz.: 2700  
 Nominal: 2100  
 Enabled: 16 cores, 1 chip, 2 threads/core  
 Orderable: 1 chip  
 Cache L1: 64 KB I + 32 KB D on chip per core  
 L2: 512 KB I+D on chip per core  
 L3: 32 MB I+D on chip per chip, 4 MB shared / 2 cores  
 Other: None  
 Memory: 512 GB (8 x 64 GB 4Rx4 PC4-2666V-L)  
 Storage: 1 x 200 GB SATAIII SSD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 12 SP3 (x86\_64)  
 kernel 4.4.114-94.11-default  
 Compiler: C/C++: Version 1.0.0 of AOCC  
 Fortran: Version 4.8.2 of GCC  
 Parallel: No  
 Firmware: Supermicro BIOS version 1.0 released Sep-2018  
 File System: xfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 64-bit  
 Other: jemalloc general purpose malloc implementation  
 V4.5.0



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## Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	32	1033	311	1036	310	<b>1036</b>	<b>310</b>	32	1036	310	<b>1032</b>	<b>311</b>	1030	312
507.cactuBSSN_r	32	539	75.2	<b>538</b>	<b>75.3</b>	538	75.3	32	539	75.2	<b>538</b>	<b>75.3</b>	538	75.3
508.namd_r	32	529	57.4	<b>529</b>	<b>57.4</b>	529	57.5	32	485	62.7	482	63.1	<b>483</b>	<b>63.0</b>
510.parest_r	32	1292	64.8	<b>1292</b>	<b>64.8</b>	1292	64.8	32	1292	64.8	<b>1292</b>	<b>64.8</b>	1292	64.8
511.povray_r	32	1031	72.5	1015	73.6	<b>1016</b>	<b>73.5</b>	32	981	76.2	994	75.2	<b>992</b>	<b>75.3</b>
519.lbm_r	32	548	61.6	550	61.3	<b>550</b>	<b>61.4</b>	32	490	68.9	488	69.1	<b>489</b>	<b>68.9</b>
521.wrf_r	32	870	82.4	808	88.8	<b>829</b>	<b>86.5</b>	32	870	82.4	808	88.8	<b>829</b>	<b>86.5</b>
526.blender_r	32	594	82.1	596	81.8	<b>595</b>	<b>81.9</b>	32	594	82.1	596	81.8	<b>595</b>	<b>81.9</b>
527.cam4_r	32	<b>781</b>	<b>71.7</b>	782	71.6	777	72.0	32	<b>781</b>	<b>71.7</b>	782	71.6	777	72.0
538.imagick_r	32	<b>725</b>	<b>110</b>	727	110	725	110	32	716	111	<b>716</b>	<b>111</b>	725	110
544.nab_r	32	578	93.2	<b>578</b>	<b>93.2</b>	579	93.0	32	578	93.2	<b>578</b>	<b>93.2</b>	579	93.0
549.fotonik3d_r	32	1406	88.7	1409	88.5	<b>1409</b>	<b>88.5</b>	32	1410	88.4	1391	89.6	<b>1409</b>	<b>88.5</b>
554.roms_r	32	<b>1094</b>	<b>46.5</b>	1095	46.4	1091	46.6	32	<b>1094</b>	<b>46.5</b>	1091	46.6	1105	46.0

SPECrate2017\_fp\_base = 82.6

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## Compiler Notes

The AMD64 AOCC Compiler Suite is available at  
<http://developer.amd.com/amd-aocc/>

The AOCC Gold Linker plugin was installed and used for the link stage.

The AOCC Fortran Plugin version 1.0 was used to leverage AOCC optimizers with gfortran. It is available here:  
<http://developer.amd.com/amd-aocc/>

## Submit Notes

The config file option 'submit' was used.  
'numactl' was used to bind copies to the cores.  
See the configuration file for details.

## Operating System Notes

'ulimit -s unlimited' was used to set environment stack size  
'ulimit -l 2097152' was used to set environment locked pages in memory limit

runspec command invoked through numactl i.e.:  
numactl --interleave=all runspec <etc>

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### Operating System Notes (Continued)

Set dirty\_ratio=8 to limit dirty cache to 8% of memory  
Set swappiness=1 to swap only if necessary  
Set zone\_reclaim\_mode=1 to free local node memory and avoid remote memory  
sync then drop\_caches=3 to reset caches before invoking runcpu

dirty\_ratio, swappiness, zone\_reclaim\_mode and drop\_caches were  
all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages were enabled for this run (OS default)

### General Notes

Environment variables set by runcpu before the start of the run:

LD\_LIBRARY\_PATH = "/home/cpu2017/amd1704-rate-libs-revD/64:/home/cpu2017/amd1704-rate-libs-revD/32:"  
MALLOC\_CONF = "lg\_chunk:28"

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.4 jemalloc, a general purpose malloc implementation, was obtained at <https://github.com/jemalloc/jemalloc/releases/download/4.5.0/jemalloc-4.5.0.tar.bz2> jemalloc was built with GCC v4.8.5 in RHEL v7.2 under default conditions.

jemalloc uses environment variable MALLOC\_CONF with values narenas and lg\_chunk:

narenas: sets the maximum number of arenas to use for automatic multiplexing of threads and arenas.

lg\_chunk: set the virtual memory chunk size (log base 2). For example,

lg\_chunk:21 sets the default chunk size to 2<sup>21</sup> = 2MiB.

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.

Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1) is mitigated in the system as tested and documented.

Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2) is mitigated in the system as tested and documented.

### Platform Notes

BIOS Settings:

Determinism Slider = Power

Sysinfo program /home/cpu2017/bin/sysinfo

Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9

running on linux-pm02 Sat Nov 24 04:59:21 2018

SUT (System Under Test) info as seen by some common utilities.

For more information on this section, see

<https://www.spec.org/cpu2017/Docs/config.html#sysinfo>

From /proc/cpuinfo

model name : AMD EPYC 7281 16-Core Processor

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### Platform Notes (Continued)

```
1 "physical id"s (chips)
32 "processors"
cores, siblings (Caution: counting these is hw and system dependent. The following
excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
cpu cores : 16
siblings  : 32
physical 0: cores 0 1 4 5 8 9 12 13 16 17 20 21 24 25 28 29
```

From lscpu:

```
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:             Little Endian
CPU(s):                 32
On-line CPU(s) list:   0-31
Thread(s) per core:    2
Core(s) per socket:    16
Socket(s):              1
NUMA node(s):          4
Vendor ID:              AuthenticAMD
CPU family:             23
Model:                  1
Model name:             AMD EPYC 7281 16-Core Processor
Stepping:               2
CPU MHz:                2100.000
CPU max MHz:            2100.0000
CPU min MHz:            1200.0000
BogoMIPS:               4200.16
Virtualization:        AMD-V
L1d cache:              32K
L1i cache:              64K
L2 cache:               512K
L3 cache:               4096K
NUMA node0 CPU(s):     0-3,16-19
NUMA node1 CPU(s):     4-7,20-23
NUMA node2 CPU(s):     8-11,24-27
NUMA node3 CPU(s):     12-15,28-31
Flags:                  fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm
constant_tsc rep_good nopl nonstop_tsc extd_apicid amd_dcm aperfmperf eagerfpu pni
pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c
rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l2 mwaitx arat cpb
hw_pstate retpoline retpoline_amd npt lbrv svm_lock nrip_save tsc_scale vmcb_clean
flushbyasid decodeassists pausefilter pfthreshold vmmcall avic fsgsbase bmlil avx2
smep bmi2 rdseed adx smap clflushopt sha_ni xsaveopt xsavec xgetbv1 clzero irperf
ibpb overflow_recov succor smca
```

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### Platform Notes (Continued)

```
/proc/cpuinfo cache data
cache size : 512 KB
```

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a physical chip.

```
available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 16 17 18 19
node 0 size: 128826 MB
node 0 free: 128655 MB
node 1 cpus: 4 5 6 7 20 21 22 23
node 1 size: 129022 MB
node 1 free: 128875 MB
node 2 cpus: 8 9 10 11 24 25 26 27
node 2 size: 129022 MB
node 2 free: 128871 MB
node 3 cpus: 12 13 14 15 28 29 30 31
node 3 size: 129021 MB
node 3 free: 128876 MB
node distances:
node 0 1 2 3
0: 10 16 16 16
1: 16 10 16 16
2: 16 16 10 16
3: 16 16 16 10
```

```
From /proc/meminfo
MemTotal: 528274456 kB
HugePages_Total: 0
Hugepagesize: 2048 kB
```

```
From /etc/*release* /etc/*version*
SuSE-release:
SUSE Linux Enterprise Server 12 (x86_64)
VERSION = 12
PATCHLEVEL = 3
# This file is deprecated and will be removed in a future service pack or release.
# Please check /etc/os-release for details about this release.
os-release:
NAME="SLES"
VERSION="12-SP3"
VERSION_ID="12.3"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP3"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp3"
```

```
uname -a:
```

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### Platform Notes (Continued)

Linux linux-pm02 4.4.114-94.11-default #1 SMP Thu Feb 1 19:28:26 UTC 2018 (4309ff9)  
x86\_64 x86\_64 x86\_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2017-5754 (Meltdown): Not affected  
CVE-2017-5753 (Spectre variant 1): Mitigation: Barriers  
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline + IBPB

run-level 3 Nov 23 14:06

SPEC is set to: /home/cpu2017

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda4	xfs	145G	5.7G	139G	4%	/home

Additional information from dmidecode follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

BIOS American Megatrends Inc. 1.0 09/04/2018  
Memory:

8x NO DIMM NO DIMM  
8x Samsung M386A8K40BM2-CTD 64 GB 4 rank 2667

(End of data from sysinfo program)

### Compiler Version Notes

=====  
CC 519.lbm\_r(base, peak) 538.imagick\_r(base, peak) 544.nab\_r(base, peak)  
-----

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin  
-----

=====  
CXXC 508.namd\_r(base, peak) 510.parest\_r(base, peak)  
-----

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
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### Compiler Version Notes (Continued)

=====  
CC 511.povray\_r(base, peak) 526.blender\_r(base, peak)  
=====

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)

Target: x86\_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)

Target: x86\_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin  
=====

FC 507.cactuBSSN\_r(base, peak)  
=====

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)

Target: x86\_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

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AOCC.LLVM.4.0.0.B35.2017\_04\_26)

Target: x86\_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

GNU Fortran (GCC) 4.8.2

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under the terms of the GNU General Public License.

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=====

FC 503.bwaves\_r(base, peak) 549.fotonik3d\_r(base, peak) 554.roms\_r(base,  
peak)  
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### Compiler Version Notes (Continued)

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=====  
CC 521.wrf\_r(base, peak) 527.cam4\_r(base, peak)  
=====

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AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

### Base Compiler Invocation

C benchmarks:  
clang

C++ benchmarks:  
clang++

Fortran benchmarks:  
clang gfortran

Benchmarks using both Fortran and C:  
clang gfortran

Benchmarks using both C and C++:  
clang++ clang

Benchmarks using Fortran, C, and C++:  
clang++ clang gfortran

### Base Portability Flags

503.bwaves\_r: -DSPEC\_LP64  
507.cactuBSSN\_r: -DSPEC\_LP64

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## Base Portability Flags (Continued)

```
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.lbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_CASE_FLAG -fconvert=big-endian -DSPEC_LP64
526.blender_r: -funsigned-char -D__BOOL_DEFINED -DSPEC_LP64
527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64
```

## Base Optimization Flags

### C benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -ffast-math -march=znver1 -fstruct-layout=2
-mllvm -unroll-threshold=100 -fremap-arrays -mno-avx2
-mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp -z muldefs
-ljemalloc
```

### C++ benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -march=znver1 -mllvm -unroll-threshold=100 -finline-aggressive
-fremap-arrays -mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp
-z muldefs -ljemalloc
```

### Fortran benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -mavx -madx -funroll-loops -ffast-math -z muldefs
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc
-lgfortran -lamdlibm
```

### Benchmarks using both Fortran and C:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -ffast-math -march=znver1 -fstruct-layout=2
-mllvm -unroll-threshold=100 -fremap-arrays -mno-avx2
-mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp -mavx -madx
-funroll-loops -z muldefs -fplugin=dragonegg.so
```

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## Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):

```
-fplugin-arg-dragonegg-llvm-option=-merge-constant  
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc  
-lgfortran -lamdlibm
```

Benchmarks using both C and C++:

```
-flto -Wl,-plugin-opt=-merge-constant  
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp  
-O3 -ffast-math -march=znver1 -fstruct-layout=2  
-mllvm -unroll-threshold=100 -fremap-arrays -mno-avx2  
-mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp  
-finline-aggressive -z muldefs -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-flto -Wl,-plugin-opt=-merge-constant  
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp  
-O3 -ffast-math -march=znver1 -fstruct-layout=2  
-mllvm -unroll-threshold=100 -fremap-arrays -mno-avx2  
-mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp  
-finline-aggressive -mavx -madx -funroll-loops -z muldefs  
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant  
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc
```

## Peak Compiler Invocation

C benchmarks:

```
clang
```

C++ benchmarks:

```
clang++
```

Fortran benchmarks:

```
clang gfortran
```

Benchmarks using both Fortran and C:

```
clang gfortran
```

Benchmarks using both C and C++:

```
clang++ clang
```

Benchmarks using Fortran, C, and C++:

```
clang++ clang gfortran
```



# SPEC CPU2017 Floating Point Rate Result

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## Supermicro

A+ Server 1113S-WN10RT  
(H11SSW-NT, AMD EPYC 7281)

SPECrate2017\_fp\_base = 82.6

SPECrate2017\_fp\_peak = 84.2

CPU2017 License: 001176  
Test Sponsor: Supermicro  
Tested by: Supermicro

Test Date: Nov-2018  
Hardware Availability: Sep-2018  
Software Availability: Feb-2018

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:

```
519.lbm_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -ljemalloc
```

538.imagick\_r: Same as 519.lbm\_r

544.nab\_r: basepeak = yes

C++ benchmarks:

```
508.namd_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-finline-aggressive -mllvm -unroll-threshold=100
-fremap-arrays -mllvm -inline-threshold=1000 -ljemalloc
```

510.parest\_r: basepeak = yes

Fortran benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx2 -madox -funroll-loops
-ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000 -ljemalloc
-lgfortran -lamdlibm
```

Benchmarks using both Fortran and C:

521.wrf\_r: basepeak = yes

527.cam4\_r: basepeak = yes

Benchmarks using both C and C++:

```
511.povray_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
```

(Continued on next page)



# SPEC CPU2017 Floating Point Rate Result

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**CPU2017 License:** 001176  
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**Tested by:** Supermicro

**Test Date:** Nov-2018  
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**Software Availability:** Feb-2018

## Peak Optimization Flags (Continued)

511.povray\_r (continued):  
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays  
-mllvm -inline-threshold=1000 -finline-aggressive  
-ljemalloc

526.blender\_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN\_r: basepeak = yes

The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.2018-11-13.html>  
<http://www.spec.org/cpu2017/flags/gcc.2018-02-16.html>  
<http://www.spec.org/cpu2017/flags/Supermicro-Platform-Settings-V1.2-Naples-revD.html>

You can also download the XML flags sources by saving the following links:

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.2018-11-13.xml>  
<http://www.spec.org/cpu2017/flags/gcc.2018-02-16.xml>  
<http://www.spec.org/cpu2017/flags/Supermicro-Platform-Settings-V1.2-Naples-revD.xml>

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