SPEC CPU®2017 Floating Point Rate Result

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

$SPECrate®2017\_fp\_base = 723$

$SPECrate®2017\_fp\_peak = 752$
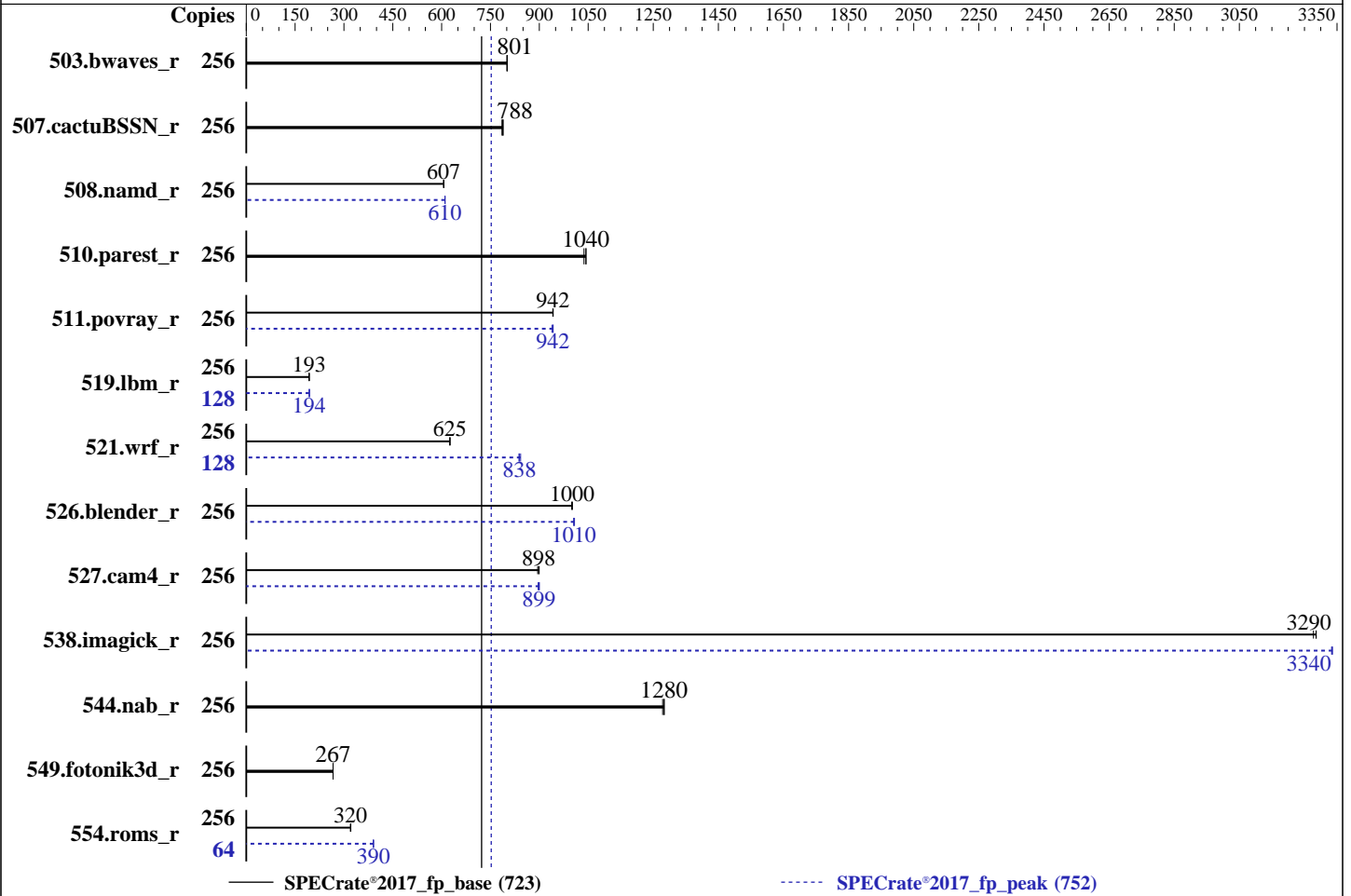
CPU2017 License: 9082
Test Sponsor: GIGA-BYTE TECHNOLOGY CO., LTD.
Tested by: GIGA-BYTE TECHNOLOGY CO., LTD.

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Feb-2022

Benchmark	Copies	Result
503.bwaves_r	256	801
507.cactuBSSN_r	256	788
508.namd_r	256	607 / 610
510.parest_r	256	1040
511.povray_r	256	942 / 942
519.lbm_r	256 / 128	193 / 194
521.wrf_r	256 / 128	625 / 838
526.blender_r	256	1000 / 1010
527.cam4_r	256	898 / 899
538.imagick_r	256	3290 / 3340
544.nab_r	256	1280
549.fotonik3d_r	256	267
554.roms_r	256 / 64	320 / 390

SPECrate®2017_fp_base (723)
SPECrate®2017_fp_peak (752)

Hardware

CPU Name: AMD EPYC 7773X
  Max MHz: 3500
  Nominal: 2200
Enabled: 128 cores, 2 chips, 2 threads/core
Orderable: 1,2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
  L2: 512 KB I+D on chip per core
  L3: 768 MB I+D on chip per chip, 96 MB shared / 8 cores
  Other: None
Memory: 1 TB (16 x 64 GB 4Rx4 PC4-3200V-L)
Storage: 1 x 3.2 TB PCIE NVME SSD
Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP2 (x86_64)
  5.3.18-22-default
  5.3.18-22-default
Compiler: C/C++/Fortran: Version 3.2.0 of AOCC
Parallel: No
Firmware: Version M07 released Sep-2021
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: jemalloc: jemalloc memory allocator library v5.1.0
Power Management: BIOS set to prefer performance at the cost of additional power usage

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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	256	3204	801	**3205**	**801**	3205	801	256	3204	801	**3205**	**801**	3205	801
507.cactuBSSN_r	256	411	789	413	785	**411**	**788**	256	411	789	413	785	**411**	**788**
508.namd_r	256	401	606	**401**	**607**	401	607	256	398	610	399	610	**398**	**610**
510.parest_r	256	642	1040	646	1040	**642**	**1040**	256	642	1040	646	1040	**642**	**1040**
511.povray_r	256	634	943	**635**	**942**	635	941	256	**635**	**942**	637	939	634	942
519.lbm_r	256	**1397**	**193**	1398	193	1396	193	128	**697**	**194**	697	194	697	194
521.wrf_r	256	**917**	**625**	917	626	917	625	128	342	838	340	843	**342**	**838**
526.blender_r	256	389	1000	**390**	**1000**	390	1000	256	388	1010	**388**	**1010**	387	1010
527.cam4_r	256	498	900	500	895	**499**	**898**	256	500	896	497	900	**498**	**899**
538.imagick_r	256	**194**	**3290**	194	3290	194	3280	256	191	3330	191	3340	**191**	**3340**
544.nab_r	256	**336**	**1280**	336	1280	337	1280	256	**336**	**1280**	336	1280	337	1280
549.fotonik3d_r	256	3742	267	3743	267	**3743**	**267**	256	3742	267	3743	267	**3743**	**267**
554.roms_r	256	1267	321	1270	320	**1270**	**320**	64	261	390	260	391	**261**	**390**
SPECrate®2017_fp_base =		**723**												
SPECrate®2017_fp_peak =		**752**												

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/
```

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 limit
'ulimit -l 2097152' was used to set environment locked pages in memory limit

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

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty_ratio=8' run as root.
To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.
To free node-local memory and avoid remote memory usage,
'sysctl -w vm.zone_reclaim_mode=1' run as root.
```

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Operating System Notes (Continued)

```
To clear filesystem caches, 'sync; sysctl -w vm.drop_caches=3' run as root.
To disable address space layout randomization (ASLR) to reduce run-to-run
variability, 'sysctl -w kernel.randomize_va_space=0' run as root.

To enable Transparent Hugepages (THP) for all allocations,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
      "/home/cpu2017_XA1/amd_rate_aocc320_milanx_A_lib/lib;/home/cpu2017_XA1/a
      md_rate_aocc320_milanx_A_lib/lib32:"
MALLOC_CONF = "retain:true"
```

General Notes

```
Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using OpenSUSE 15.2

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.

jemalloc: configured and built with GCC v4.8.2 in RHEL 7.4 (No options specified)
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2
```

Platform Notes

```
BIOS settings:
cTDP = 280
Determinism Slider set to Power
SMT set to auto
IOMMU set to enable
Package Power Limit set to 280
EDC set to 300
EDC Platform Limit set to 300
NUMA nodes per socket set to NPS4
```

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Standard Performance Evaluation Corporation (info@spec.org)   https://www.spec.org/

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Platform Notes (Continued)

```
4-link xGMI max speed set to 18Gbps
Memory Interleaving set to Disabled

 Sysinfo program /home/cpu2017_XA1/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on localhost Sat Feb 12 01:51:31 2022

 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 7773X 64-Core Processor
       2  "physical id"s (chips)
       256 "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 : 64
       siblings  : 128
       physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
       53 54 55 56 57 58 59 60 61 62 63
       physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
       53 54 55 56 57 58 59 60 61 62 63

 From lscpu from util-linux 2.33.1:
       Architecture:        x86_64
       CPU op-mode(s):      32-bit, 64-bit
       Byte Order:          Little Endian
       Address sizes:       48 bits physical, 48 bits virtual
       CPU(s):              256
       On-line CPU(s) list: 0-255
       Thread(s) per core:  2
       Core(s) per socket:  64
       Socket(s):           2
       NUMA node(s):        16
       Vendor ID:           AuthenticAMD
       CPU family:          25
       Model:               1
       Model name:          AMD EPYC 7773X 64-Core Processor
       Stepping:            2
       CPU MHz:             1808.919
       CPU max MHz:         2200.0000
       CPU min MHz:         1500.0000
       BogoMIPS:            4400.20
       Virtualization:      AMD-V
```

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Platform Notes (Continued)

```
        L1d cache:            32K
        L1i cache:            32K
        L2 cache:             512K
        L3 cache:             98304K
        NUMA node0 CPU(s):    0-7,128-135
        NUMA node1 CPU(s):    8-15,136-143
        NUMA node2 CPU(s):    16-23,144-151
        NUMA node3 CPU(s):    24-31,152-159
        NUMA node4 CPU(s):    32-39,160-167
        NUMA node5 CPU(s):    40-47,168-175
        NUMA node6 CPU(s):    48-55,176-183
        NUMA node7 CPU(s):    56-63,184-191
        NUMA node8 CPU(s):    64-71,192-199
        NUMA node9 CPU(s):    72-79,200-207
        NUMA node10 CPU(s):   80-87,208-215
        NUMA node11 CPU(s):   88-95,216-223
        NUMA node12 CPU(s):   96-103,224-231
        NUMA node13 CPU(s):   104-111,232-239
        NUMA node14 CPU(s):   112-119,240-247
        NUMA node15 CPU(s):   120-127,248-255
        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 cpuid extd_apicid aperfmperf pni pclmulqdq
    monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c
    rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
    osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb
    cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsgsbase
    bmi1 avx2 smep bmi2 invpcid cqm rdt_a rdseed adx smap clflushopt clwb sha_ni
    xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local
    clzero irperf xsaveerptr wbnoinvd arat npt lbrv svm_lock nrip_save tsc_scale
    vmcb_clean flushbyasid decodeassists pausefilter pfthreshold v_vmsave_vmload vgif
    umip pku ospke vaes vpclmulqdq rdpid overflow_recov succor smca

  /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: 16 nodes (0-15)
    node 0 cpus: 0 1 2 3 4 5 6 7 128 129 130 131 132 133 134 135
    node 0 size: 64318 MB
    node 0 free: 63955 MB
    node 1 cpus: 8 9 10 11 12 13 14 15 136 137 138 139 140 141 142 143
    node 1 size: 64506 MB
    node 1 free: 64314 MB
    node 2 cpus: 16 17 18 19 20 21 22 23 144 145 146 147 148 149 150 151
    node 2 size: 64508 MB
```

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Platform Notes (Continued)

```
        node 2 free: 63869 MB
        node 3 cpus: 24 25 26 27 28 29 30 31 152 153 154 155 156 157 158 159
        node 3 size: 64506 MB
        node 3 free: 64286 MB
        node 4 cpus: 32 33 34 35 36 37 38 39 160 161 162 163 164 165 166 167
        node 4 size: 64508 MB
        node 4 free: 64332 MB
        node 5 cpus: 40 41 42 43 44 45 46 47 168 169 170 171 172 173 174 175
        node 5 size: 64506 MB
        node 5 free: 64318 MB
        node 6 cpus: 48 49 50 51 52 53 54 55 176 177 178 179 180 181 182 183
        node 6 size: 64474 MB
        node 6 free: 64301 MB
        node 7 cpus: 56 57 58 59 60 61 62 63 184 185 186 187 188 189 190 191
        node 7 size: 64494 MB
        node 7 free: 64323 MB
        node 8 cpus: 64 65 66 67 68 69 70 71 192 193 194 195 196 197 198 199
        node 8 size: 64508 MB
        node 8 free: 64360 MB
        node 9 cpus: 72 73 74 75 76 77 78 79 200 201 202 203 204 205 206 207
        node 9 size: 64506 MB
        node 9 free: 64353 MB
        node 10 cpus: 80 81 82 83 84 85 86 87 208 209 210 211 212 213 214 215
        node 10 size: 64508 MB
        node 10 free: 64233 MB
        node 11 cpus: 88 89 90 91 92 93 94 95 216 217 218 219 220 221 222 223
        node 11 size: 64506 MB
        node 11 free: 64292 MB
        node 12 cpus: 96 97 98 99 100 101 102 103 224 225 226 227 228 229 230 231
        node 12 size: 64508 MB
        node 12 free: 64349 MB
        node 13 cpus: 104 105 106 107 108 109 110 111 232 233 234 235 236 237 238 239
        node 13 size: 64506 MB
        node 13 free: 64345 MB
        node 14 cpus: 112 113 114 115 116 117 118 119 240 241 242 243 244 245 246 247
        node 14 size: 64508 MB
        node 14 free: 64349 MB
        node 15 cpus: 120 121 122 123 124 125 126 127 248 249 250 251 252 253 254 255
        node 15 size: 64504 MB
        node 15 free: 64351 MB
        node distances:
        node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
          0:  10  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
          1:  11  10  12  12  12  12  12  12  32  32  32  32  32  32  32  32
          2:  12  12  10  11  12  12  12  12  32  32  32  32  32  32  32  32
          3:  12  12  11  10  12  12  12  12  32  32  32  32  32  32  32  32
          4:  12  12  12  12  10  11  12  12  32  32  32  32  32  32  32  32
```

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Platform Notes (Continued)

```
     5:  12  12  12  12  11  10  12  12  32  32  32  32  32  32  32  32
     6:  12  12  12  12  12  12  10  11  32  32  32  32  32  32  32  32
     7:  12  12  12  12  12  12  11  10  32  32  32  32  32  32  32  32
     8:  32  32  32  32  32  32  32  32  10  11  12  12  12  12  12  12
     9:  32  32  32  32  32  32  32  32  11  10  12  12  12  12  12  12
    10:  32  32  32  32  32  32  32  32  12  12  10  11  12  12  12  12
    11:  32  32  32  32  32  32  32  32  12  12  11  10  12  12  12  12
    12:  32  32  32  32  32  32  32  32  12  12  12  12  10  11  12  12
    13:  32  32  32  32  32  32  32  32  12  12  12  12  11  10  12  12
    14:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  10  11
    15:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  10

 From /proc/meminfo
    MemTotal:       1056641824 kB
    HugePages_Total:        0
    Hugepagesize:        2048 kB

 /sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
    performance

 /usr/bin/lsb_release -d
    SUSE Linux Enterprise Server 15 SP2

 From /etc/*release* /etc/*version*
    os-release:
       NAME="SLES"
       VERSION="15-SP2"
       VERSION_ID="15.2"
       PRETTY_NAME="SUSE Linux Enterprise Server 15 SP2"
       ID="sles"
       ID_LIKE="suse"
       ANSI_COLOR="0;32"
       CPE_NAME="cpe:/o:suse:sles:15:sp2"

 uname -a:
    Linux localhost 5.3.18-22-default #1 SMP Wed Jun 3 12:16:43 UTC 2020 (720aeba) x86_64
    x86_64 x86_64 GNU/Linux

 Kernel self-reported vulnerability status:

 CVE-2018-12207 (iTLB Multihit):            Not affected
 CVE-2018-3620 (L1 Terminal Fault):         Not affected
 Microarchitectural Data Sampling:          Not affected
 CVE-2017-5754 (Meltdown):                  Not affected
 CVE-2018-3639 (Speculative Store Bypass):  Mitigation: Speculative Store
                                            Bypass disabled via prctl and
                                            seccomp
```

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Platform Notes (Continued)

```
CVE-2017-5753 (Spectre variant 1):                  Mitigation: usercopy/swapgs
                                                    barriers and __user pointer
                                                    sanitization
CVE-2017-5715 (Spectre variant 2):                  Mitigation: Full AMD retpoline,
                                                  IBPB: conditional, IBRS_FW, STIBP:
                                                    always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort):            Not affected

run-level 3 Feb 12 01:13

SPEC is set to: /home/cpu2017_XA1
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/nvme0n1p7 xfs   1.9T   88G  1.8T   5% /home

From /sys/devices/virtual/dmi/id
   Vendor:         GIGABYTE
   Product:        R282-Z90-00
   Product Family: Server
   Serial:         GKM7N1112A0058

Additional information from dmidecode 3.2 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.
  Memory:
     16x Samsung M386A8K40DM2-CWE 64 GB 4 rank 3200
     16x Unknown Unknown

BIOS:
   BIOS Vendor:    GIGABYTE
   BIOS Version:   M07
   BIOS Date:      09/03/2021
   BIOS Revision:  5.22

(End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C                  | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
                   | 544.nab_r(base, peak)
------------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
```

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Compiler Version Notes (Continued)

```
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-------------------------------------------------------------------------


==========================================================================
C++              | 508.namd_r(base, peak) 510.parest_r(base, peak)
--------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-------------------------------------------------------------------------


==========================================================================
C++, C           | 511.povray_r(base, peak) 526.blender_r(base, peak)
--------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-------------------------------------------------------------------------


==========================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
--------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
```

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SPEC CPU®2017 Floating Point Rate Result

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

SPECrate®2017_fp_base = 723

SPECrate®2017_fp_peak = 752

CPU2017 License: 9082
Test Sponsor: GIGA-BYTE TECHNOLOGY CO., LTD.
Tested by: GIGA-BYTE TECHNOLOGY CO., LTD.

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Feb-2022

Compiler Version Notes (Continued)

```
--------------------------------------------------------------------------

==========================================================================
Fortran           | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                  | 554.roms_r(base, peak)
--------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
--------------------------------------------------------------------------

==========================================================================
Fortran, C        | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
--------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
--------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
```
clang
```

C++ benchmarks:
```
clang++
```

Fortran benchmarks:
```
flang
```

Benchmarks using both Fortran and C:
```
flang clang
```

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

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

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SPECrate®2017_fp_peak = 752

CPU2017 License: 9082		**Test Date:**	Feb-2022
Test Sponsor:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Hardware Availability:**	Mar-2022
Tested by:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Software Availability:**	Feb-2022

Base Compiler Invocation (Continued)

Benchmarks using Fortran, C, and C++:
```
clang++ clang flang
```

Base Portability Flags

503.bwaves_r: `-DSPEC_LP64`
507.cactuBSSN_r: `-DSPEC_LP64`
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 -Mbyteswapio -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:
```
-m64 -flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-arrays
-mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-loop-fusion -z muldefs -lamdlibm -ljemalloc -lflang
```

C++ benchmarks:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -flto
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -mllvm -enable-partial-unswitch
```

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

SPECrate®2017_fp_base = 723

SPECrate®2017_fp_peak = 752

CPU2017 License: 9082

Test Sponsor: GIGA-BYTE TECHNOLOGY CO., LTD.

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Test Date: Feb-2022

Hardware Availability: Mar-2022

Software Availability: Feb-2022

Base Optimization Flags (Continued)

C++ benchmarks (continued):
```
-mllvm -unroll-threshold=100 -finline-aggressive
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false
-mllvm -enable-loop-fusion -z muldefs -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:
```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -Hz,1,0x1 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -Kieee -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-loop-fusion
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -lamdlibm -ljemalloc -lflang
```

Benchmarks using both Fortran and C:
```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-arrays
-mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-loop-fusion -Hz,1,0x1 -Kieee -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -lamdlibm -ljemalloc -lflang
```

Benchmarks using both C and C++:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -flto
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
```

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

SPECrate®2017_fp_base = 723

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CPU2017 License: 9082		**Test Date:**	Feb-2022
Test Sponsor:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Hardware Availability:**	Mar-2022
Tested by:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Software Availability:**	Feb-2022

Base Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):
```
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-arrays
-mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-loop-fusion -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -mllvm -extra-vectorizer-passes
-mllvm -convert-pow-exp-to-int=false -z muldefs -lamdlibm -ljemalloc
-lflang
```

Benchmarks using Fortran, C, and C++:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -flto
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-arrays
-mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-loop-fusion -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -mllvm -extra-vectorizer-passes
-mllvm -convert-pow-exp-to-int=false -Hz,1,0x1 -Kieee -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -lamdlibm -ljemalloc -lflang
```

Base Other Flags

C benchmarks:
```
-Wno-unused-command-line-argument
```

C++ benchmarks:
```
-Wno-unused-command-line-argument
```

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

SPECrate®2017_fp_base = 723

SPECrate®2017_fp_peak = 752

CPU2017 License: 9082　　　　　　　　　　　　　　　　　　**Test Date:** Feb-2022
Test Sponsor: GIGA-BYTE TECHNOLOGY CO., LTD.　　　　**Hardware Availability:** Mar-2022
Tested by: GIGA-BYTE TECHNOLOGY CO., LTD.　　　　　**Software Availability:** Feb-2022

Base Other Flags (Continued)

Fortran benchmarks:
```
-Wno-unused-command-line-argument
```

Benchmarks using both Fortran and C:
```
-Wno-unused-command-line-argument
```

Benchmarks using both C and C++:
```
-Wno-unused-command-line-argument
```

Benchmarks using Fortran, C, and C++:
```
-Wno-unused-command-line-argument
```

Peak Compiler Invocation

C benchmarks:
```
clang
```

C++ benchmarks:
```
clang++
```

Fortran benchmarks:
```
flang
```

Benchmarks using both Fortran and C:
```
flang clang
```

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

Benchmarks using Fortran, C, and C++:
```
clang++ clang flang
```

Peak Portability Flags

```
Same as Base Portability Flags
```

Peak Optimization Flags

C benchmarks:

(Continued on next page)

GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

SPECrate®2017_fp_base = 723

SPECrate®2017_fp_peak = 752

CPU2017 License: 9082		**Test Date:**	Feb-2022
Test Sponsor:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Hardware Availability:**	Mar-2022
Tested by:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Software Availability:**	Feb-2022

Peak Optimization Flags (Continued)

```
519.lbm_r: -m64 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -lamdlibm -ljemalloc
```

```
538.imagick_r: Same as 519.lbm_r
```

```
544.nab_r: basepeak = yes
```

C++ benchmarks:

```
508.namd_r: -m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-finline-aggressive -mllvm -unroll-threshold=100
-flv-function-specialization -mllvm -enable-licm-vrp
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -lamdlibm -ljemalloc
```

```
510.parest_r: basepeak = yes
```

Fortran benchmarks:

```
503.bwaves_r: basepeak = yes
```

```
549.fotonik3d_r: basepeak = yes
```

```
554.roms_r: -m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
```

SPEC CPU®2017 Floating Point Rate Result

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GIGA-BYTE TECHNOLOGY CO., LTD.

R282-Z90
(AMD EPYC 7773X, 2.2GHz)

SPECrate®2017_fp_base = 723

SPECrate®2017_fp_peak = 752

CPU2017 License: 9082		**Test Date:**	Feb-2022
Test Sponsor:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Hardware Availability:**	Mar-2022
Tested by:	GIGA-BYTE TECHNOLOGY CO., LTD.	**Software Availability:**	Feb-2022

Peak Optimization Flags (Continued)

554.roms_r (continued):
```
-Hz,1,0x1 -mllvm -fuse-tile-inner-loop -lamdlibm
-ljemalloc -lflang
```

Benchmarks using both Fortran and C:

521.wrf_r:
```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -Mrecursive -lamdlibm
-ljemalloc -lflang
```

527.cam4_r:
```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-force-vector-interleave=1 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -O3 -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-Mrecursive -Hz,1,0x1 -mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -lamdlibm -ljemalloc
-lflang
```

Benchmarks using both C and C++:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -Wl,-mllvm -Wl,-enable-licm-vrp
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -fstruct-layout=7
-mllvm -unroll-threshold=50 -fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true -mllvm -function-specialize
```

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R282-Z90
(AMD EPYC 7773X, 2.2GHz)

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Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Feb-2022

Peak Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):
```
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-finline-aggressive -mllvm -unroll-threshold=100 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -lamdlibm -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
 507.cactuBSSN_r: basepeak = yes
```

Peak Other Flags

C benchmarks:
```
-Wno-unused-command-line-argument
```

C++ benchmarks:
```
-Wno-unused-command-line-argument
```

Fortran benchmarks:
```
-Wno-unused-command-line-argument
```

Benchmarks using both Fortran and C:
```
-Wno-unused-command-line-argument
```

Benchmarks using both C and C++:
```
-Wno-unused-command-line-argument
```

Benchmarks using Fortran, C, and C++:
```
-Wno-unused-command-line-argument
```

The flags files that were used to format this result can be browsed at
  http://www.spec.org/cpu2017/flags/aocc320-flags-A1.html
  http://www.spec.org/cpu2017/flags/GIGA-BYTE-Platform-SPECcpu2017-Flags-V1.0-MilanX.html

You can also download the XML flags sources by saving the following links:
  http://www.spec.org/cpu2017/flags/aocc320-flags-A1.xml
  http://www.spec.org/cpu2017/flags/GIGA-BYTE-Platform-SPECcpu2017-Flags-V1.0-MilanX.xml

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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