AMD EPYC™ 9xx4-series Processors
Compiler Options Quick Reference Guide

AOCC compiler (C/C++/Fortran)

Latest release: 4.1, August 2023

https://www.amd.com/en/developer/aocc.html

Architecture	
Generate instructions that runs on AMD 4th Gen EPYC ™ and AMD 4th Gen Ryzen™	-march=znver4
Generate instructions supported in the given machine	-march=native
Optimization Levels	
Disables all optimizations	-O0
Enables minimal level optimizations	-O1
Enables moderate level optimizations (Default from AOCC 4.1)	-O2/-O
Enables all optimizations that attempt to make programs run faster	-O3
Enables O3 with other aggressive optimizations that may violate strict compliance and precisions	-Ofast
Enables link time optimization	-flto
More advanced optimizations - Enables improved variants of various scalar, vector and loop transformations	-zopt
Enables advanced vector transformations	-fvector-transform -mllvm -enable-strided-vectorization
Enables loop transformations	-floop-transform
Enables advanced loop transformations	-faggressive-loop-transform
Enables memory layout optimizations	-flto -fremap-arrays -mllvm -reduce-array-computations=3
Enables function level optimizations	-flto -fitodcalls -mllvm -function-specialize -flto -finline-recursion={1..4}
Profile guided optimizations	-fprofile-instr-generate (1st invocation) -fprofile-instr-use (2nd invocation)
Enables use of OpenMP® directives	-fopenmp
Enables streaming stores to optimize memory bandwidth usage	-fnt-store

Other options	
Enables faster, less precise math operations (part of Ofast)	-ffast-math -freciprocal-math
OpenMP® threads and affinity (N number of cores)	export OMP_NUM_THREADS=N export GOMP_CPU_AFFINITY="0-{N-1}"
Link to AMD library	-L/libm-install-dir/lib -lamdlibm -lm
Enables vector library	-lamdlibm -fveclib=AMDLIBM -lm
Enables faster library	-lamdlibm -fsclrlib=AMDLIBM -lamdlibmfast -lm
For Fortran Workloads	
Compiles Fortran free form	-ffree-form

AMD Optimized Libraries

Latest release: 4.1, August 2023

https://www.amd.com/en/developer/aocl.html

AMD µProf (Performance & Power Profiler)

Latest release: 4.1 August 2023

https://www.amd.com/en/developer/uprof.html

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GNU compiler collection

Latest release: GCC 13.2 , July 2023
Recommended version: GCC 13.1 or later
http://gcc.gnu.org

Architecture	
Generate instructions that runs on AMD 4th Gen EPYC ™ and AMD 4th Gen Ryzen™	-march=znver4
Generate instructions supported in the given machine	-march=native
Optimization Levels	
Disables all optimizations (default)	-O0
Enables minimal level optimizations	-O1/ -O
Enables moderate level optimizations	-O2
Enables all optimizations that attempt to make programs run faster	-O3
Enables O3 with other aggressive optimizations that may violate strict compliance and precisions	-Ofast
Additional Optimizations	
Enables link time optimizations	-flto
Enables unrolling	-funroll-all-loops
Generates memory preload instructions	-fprefetch-loop-arrays
Enables profile-guided optimizations	-fprofile-generate (1st invocation) -fprofile-use (2nd invocation)
Enables use of OpenMP® directives	-fopenmp
Other options	
Enables compiler to use IEEE FP comparisons	-mieee-fp
Enables faster, less precise math operations	-ffast-math
Compiles Fortran free form layout	-ffree-form
OpenMP® threads and affinity (N number of cores)	export OMP_NUM_THREADS=N export GOMP_CPU_AFFINITY="0-{N-1}"
Link to AMD library	-L/libm-install-dir/lib -lamdlibm -lm

Microsoft® Visual Studio 2022

Latest release: 17.6.3, June 2023
https://visualstudio.microsoft.com/
User Guide

Architecture	
Generate instructions that runs on AMD 4th Gen EPYC ™ and AMD 4th Gen Ryzen™	/arch:[AVX|AVX2|AVX512]
Optimize for 64-bit AMD processors	/favor:AMD64
Optimization Levels	
Disable optimizations	/Od
Maximum optimizations (favor space)	/O1 [includes /Ob2]
Maximum optimizations (favor speed)	/O2 [includes /Ob2]
Enables inline expansion	/Ob (0/1/2/3)
[link.exe] Eliminates unreferenced function and/ or data	/OPT:REF
[link.exe] Performs identical COMDAT folding	/OPT:ICF
Output an informational message for loops that are auto-vectorized	/Qvec-report:[1|2]
Enables automatic parallelization of loops, used in conjunction with #pragma loop() directive	/Qpar
Output an informational message for loops that are auto-parallelized	/Qpar-report:[1|2]
Additional Optimizations	
Maintain the precision for floating-point operations through proper rounding	/fp:precise
Optimize floating-point code for speed at the expense of floating-point accuracy and correctness	/fp:fast
Whole Program Optimization (link-time code generation)	/GL
Enables Profile-guided optimizations	LTCG:PGI and /LTCG:PGO
Enables OpenMP Support	/openmp:experimental /openmp:llvm

GlibC

Latest release: 2.38, July 2023
Recommendation: 2.38 or later
https://www.gnu.org/software/libc/

Binutils

Latest release: 2.41, July 2023
Recommendation: 2.40 or later
https://www.gnu.org/software/binutils/

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Intel® oneAPI DPC++/C++ Compiler

Latest release: 2023.1.0

http://software.intel.com

Architecture	
Generate instructions that runs on AMD 4th Gen EPYC ™ and AMD 4th Gen Ryzen™	-axCORE-AVX512
Optimization Levels	
Disable all optimizations	-O0
Speed optimization without code growth	-O1
Enables optimization for speed including vectorization	-O2
Enables O2 and aggressive loop	-O3
Enables set of aggressive options to	-Ofast
Additional Optimizations	
Sets function inline level	-inline-level=<value>
Sets unroll loop maximum threshold	-unroll<value>
Disable improved precision floating divides	-no-prec-div
Enables vectorization	-vec
Enables inter procedural optimiza-	-ipo
Enables use of OpenMP® directives	-qopenmp
Enables profile generated optimiza-	-prof-gen and -prof-use
Other Options	
Enables floating point accuracy tun-	-fp-model
Compiles Fortran free form layout	-free

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