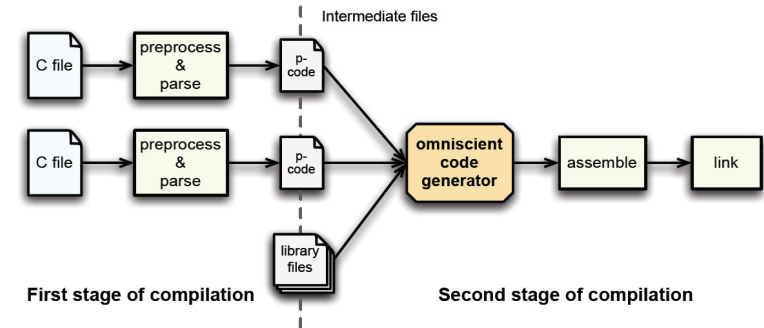




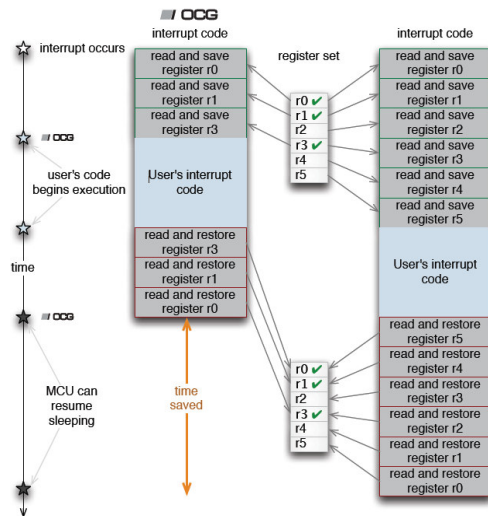
HI-TECH C PRO: Denser Code, Better Performance

HI-TECH C PRO for the PIC32 MCU Family ANSI C Compiler is enabled with Omniscient Code Generation™ (OCG), a whole-program compilation technology, to facilitate more intelligent, state-of-the-art code generation and enhances product usability.

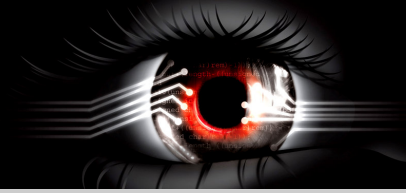
Omniscient Code Generation, has been developed to read and process all C source modules in one step. Rather than relying completely on the linker to uncover errors in independently compiled modules, an OCG compiler completes the initial stages of compilation for each module separately, but defers object code generation until the point at which a view of the whole program is available. Information gathered from a global view of the compiled program, can be used to provide better detection of potential errors in the user's code, and to better optimize the output.



The HI-TECH C PRO Compiler offers faster interrupt handling and 40% smaller code saving you time, space and money.



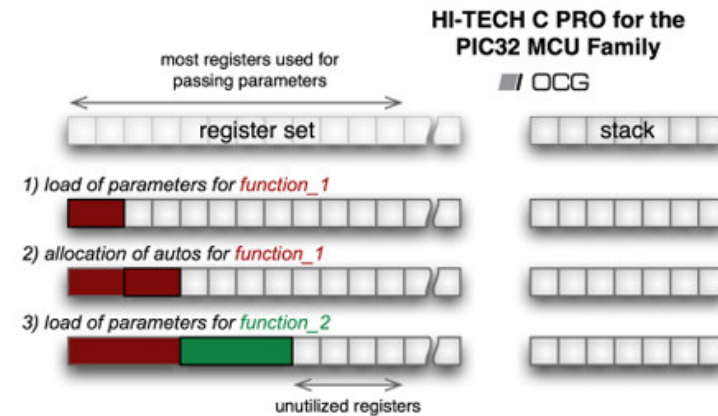
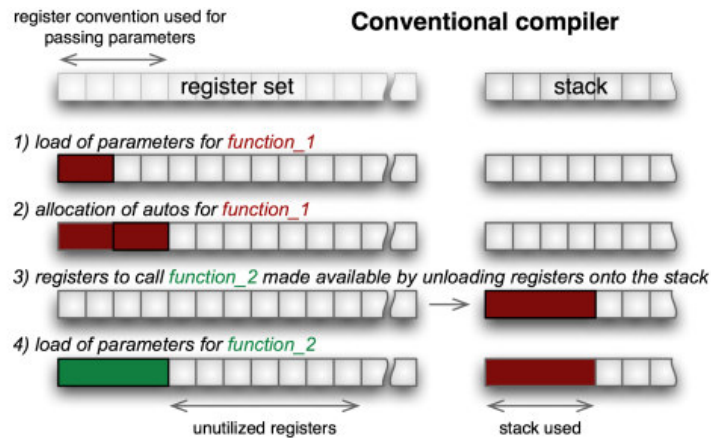
Faster Interrupt Handling. Since the HI-TECH C PRO knows the register usage of every function in the entire program, including interrupts and any functions that are called by the interrupt code, it also knows exactly which registers need to be saved and restored for each interrupt routine. The HI-TECH C PRO compiler saves only those registers that are necessary, reducing the size of the interrupt context switching code, and decreasing the number of cycles required to execute the interrupt routine.



Memory Optimization for Better Power and Performance. Since the HI-TECH C PRO compiler knows how and when every variable in the program will be accessed, it has the ability to optimize the allocation of every variable between either the stack or the registers. The optimization is based on the frequency of use and type of each variable. Variables that are used intensively can be allocated to registers, which have no cycle penalty. All register and stack allocations are always optimized to elicit the best overall performance for the entire program. This highly refined optimization of memory both boosts performance and minimizes power consumption by keeping frequently used data in locations that have the shortest access time.

Register Coverage. Conventional compilers such as GCC-based ones, use a strict set of registers for passing parameters, typically no more than four. They work this way because a function that is called may be in a different C module, and the compiler cannot "see" what register requirements that function may have. By having a parameter passing convention, it will always know the registers in which the parameters are passed. The problem this presents (as shown in the diagram below) is that if another function needs to be called, the same registers must be used and the current contents must be preserved on the stack, consuming time and memory.

The HI-TECH C PRO compiler can see the entire program and can simply use different registers for passing parameters. By knowing which registers are and are not available, OCG can optimize register usage without any arbitrary constraints. When there are two- or three-deep function calls, it allocates parameters for different functions into non-overlapping register sets, often eliminating the need to store parameters into memory completely. This results in better utilization of the available registers, fewer cycles wasted moving parameters between the stack and the registers, and less RAM usage. It also contributes to smaller code size by reducing or eliminating the need for code to save registers to the stack.





Competitive Comparison	HI-TECH C Compilers		Competitor Compilers
	HI-TECH C PRO for the PIC32 MCU Family	HI-TECH C PRO for the PIC32 MCU Family (Lite Mode)	GCC-based compilers
OPTIMIZATIONS			
Omniscient Code Generation™ Compilation Technology	✓	✗	✗
Overall optimization level	Very high	Minimal	High
Reduces overhead required for interrupt context switching	✓	✓	✗
Dynamic register allocation for parameter passing	✓	✗	✗
Number of registers available for function parameters	All registers are available	None	4 registers - must be a0 - a3
Registers need to be preserved over function calls	Only when all other registers are exhausted	✓	✓
The effect of optimizations on the ability to debug	Little or no effect	Little or no effect	Extremely hard to debug with full optimizations
Register cycling for improved pipeline performance	✓	✗	✗
Branch/load delay optimizations	✓	✗	✓
Automatic inlining of selected library routines for improved speed	✓	✗	✓
Customized runtime startup routine	✓	✓	✗
Pointer optimizations based on knowledge of targets	✓	✗	✗
Runtime startup code automatically initializes the device for best performance	✓	✓	✗
<code>Printf</code> library code footprint	Compiler eliminates all unused features of <code>printf</code> for smallest footprint	Compiler eliminates all unused features of <code>printf</code> for smallest footprint	The entire <code>printf</code> routine is provided even when not all features are required



Competitive Comparison (continued)	HI-TECH C Compilers		Competitor Compilers
	HI-TECH C PRO for the PIC32 MCU Family	HI-TECH C PRO for the PIC32 MCU Family (Lite Mode)	GCC-based compilers
USABILITY / FEATURES			
Can identify inconsistent definitions across modules	✓	✓	Some
Number of Interrupt Handling Schemes	11	11	2
Compiler support for RAM vectors, i.e. ISRs can service different vectors at runtime	✓	✓	✗
Unlimited Memory Usage	✓	✓	✓
Automatically analyzes user assembly and object code files	✓	✓	✗
Eliminates the need for many non-standard C qualifiers and compiler options	✓	✓	✗
Header includes required in each C file (except for the Std C Library)	1	1	At least 1
Individual libraries for various optimization levels and instruction sets	Not required. Required library code is built and optimized with the user code	Not required. Required library code is built and optimized with the user code	Libraries are required for each optimization/ISA type
Full C library code source provided	✓	✓	✗
Built-in cycle accurate delay routine	✓	✓	✗
Automatic generation of configuration words	✓	✓	✗
Transparent and direct access to SFR atomic bit operation addresses	✓	✓	No, user code must explicitly access the addresses
C-level access to CP0 Registers	✓	✓	No, only through inline assembly
Full or mixed MIPS16 and MIPS32 code allowed	✓	✓	✓
<code>printf</code> library functionality	Compiler automatically detects and implements <code>printf</code> features required by program	Compiler automatically detects and implements <code>printf</code> features required by program	The entire <code>printf</code> routine is provided even when not all features are required
Integrates into HI-TECH Software's IDE, HI-TIDE™ 3	✓	✓	✗
Fully integrates into MPLAB IDE. MPLAB ICD2 and MPLAB REAL ICE	✓	✓	✓
Compiler message can be displayed in multiple languages	Yes - English, French, German	Yes - English, French, German	No, English only
Runs on all platforms: Windows (including 64-bit Vista), Linux and Mac OS X	✓	✓	No, Windows only