Cx51
8051/251 Development Tools
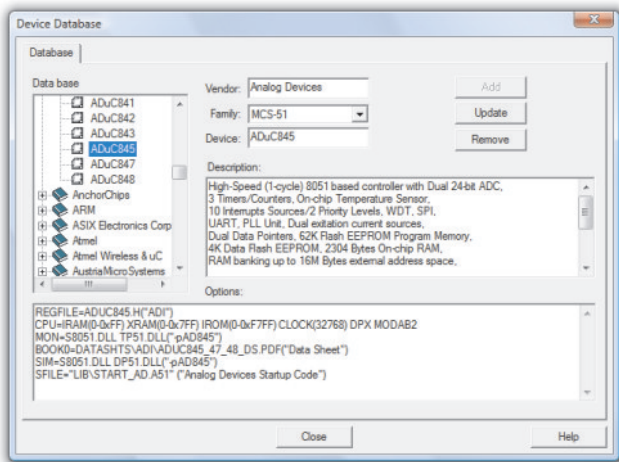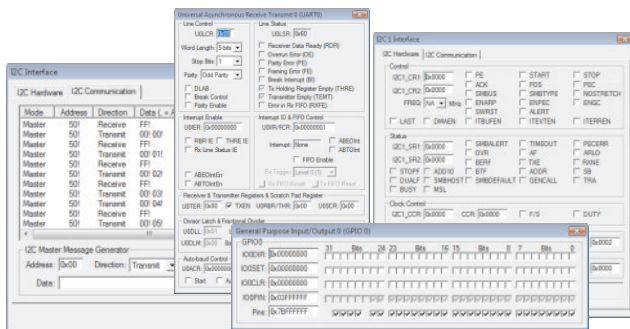
KEIL™
Tools by ARM

The Keil Cx51 ANSI C Complier supports all classic and extended 8051 device variants. Compiler extensions provide full access to all CPU resources and support up to 16MB memory. The Keil Cx51 generates code with the efficiency and speed of hand-optimized assembly. New compiler and linker optimizations shrink programs into the smallest single-chip devices.

The Keil µVision4 IDE fully integrates Cx51 Version 9 and provides control of the Compiler, Assembler, Real-Time OS, Project Manager, and Debugger in a single, intelligent environment. With support for all 8051 devices and full compatibility with emulators and third-party tools, Keil Cx51 is clearly the best choice for your 8051 project.

Supports all 8051 Variants Up to 16MB Memory

Easy-to-use IDE Supports Complete Development Cycle

Complete Device Support Including Peripheral Simulation

Drivers for Flexible Debugging in Target Hardware

To start your project, just select the device from the µVision Device Database.

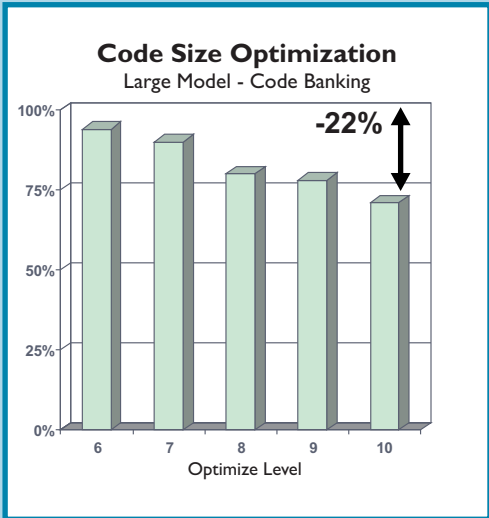### Code Size Optimization
Large Model - Code Banking

-22%

For the selected device, µVision Debugger provides dialogs with detailed peripheral information that are available with simulation and target debugging.

Keil Cx51 is the unsurpassed industry standard 8051 C Compiler. 10 optimization levels give you the ability to put more features into less memory space and provide the utmost code density for cost-sensitive single-chip designs.

Using level 10 with the LX51 Extended Linker optimizes a complete application. LX51 creates sub-routines for common code blocks and replaces LJMP/LCALL instructions with shorter AJMP/ACALL instructions wherever possible.

Cx51

ARM®

Development Tools Overview

Cx51 Compiler

The Keil 8051 and 251 development kits contain different C Compilers for optimum support of device variants. Cx51 is used as a generic term for:

- C51 Compiler for classic 8051 devices, 8051 IP cores, Dallas Contiguous Mode, and other extended devices
- CX51 Compiler for Philips 8051 MX and SmartMX
- C251 Compiler for 251 devices and 251 IP cores

The Cx51 Compiler gives complete access to all hardware components within your C source code. For example, you can control peripherals using SFR registers, write optimum interrupt code with CPU register banks, accelerate variable access with the *data, idata,* or *pdata* memory type, and use efficient bit operations or atomic bit manipulation.

8051 devices provide various physical memory spaces: fast DATA space, up to 16MB large XDATA space, and CODE space for constants. For flexible memory usage, Cx51 offers:

- Three well-defined memory models that provide the default memory allocation for variables
- Generic pointers that access all memory spaces
- Memory types that control the space for variables or pointer accesses. Memory-specific pointers reduce RAM requirements, and optimize program execution

Cx51 Compiler Highlights

- Support for all 8051 derivatives and variants
- Fast 32-bit IEEE floating-point math
- Efficient interrupt code and direct register bank control
- Bit-addressable objects
- Sophisticated syntax checking and detailed warnings
- Use of AJMP and ACALL instructions
- Memory banking for code and variables beyond 64KB
- Register parameters and dynamic register variables
- Global program-wide register optimization
- Common code block sub-routine optimization
- Use of multiple data pointers
- Use of on-chip arithmetic units
- Generic and memory-specific pointers
- Re-entrant functions and register bank independent code
- Extensive debug and source browse information
- Simple assembly language interface

LX51 Extended Linker

The standard Code Banking Linker lets you increase the program space of a classic 8051 device beyond 64KB. The LX51 Extended Linker expands device support and adds further functionality to the Keil Cx51 Compiler:

- **Linker Code Packing** analyzes an entire application and generates sub-routines for common code blocks even on code banking applications. Short AJMP and ACALL instructions replace longer LJMP and LCALL when possible
- **Incremental Linkage** allows you to split programs into several functional parts as it is required for multi-application programming or FLASH ROM updates
- **Far Memory Support** gives you access to 16MB of variable space even on a classic 8051 device and the far memory type may be used for special memory types
- Detailed **Data Type Checking** is performed across all public symbol definitions and improves software quality

RTX Tiny2 Real-Time Kernel

The RTX Tiny2 multi-tasking real-time kernel makes implementing complex, time-critical software projects easy. RTX Tiny2 is royalty-free and is fully integrated into the Keil Cx51 tool chain. It works on all classic 8051 device variants, and supports multiple DPTR and arithmetic units.

RTX Tiny2 is the successor of the popular RTX operating system and provides:

- Single chip and code banking support
- Round robin and cooperative task switching
- Task management with create and delete
- Timeout, Signal, and Ready events for task switching
- Interrupt support for sending signals to tasks
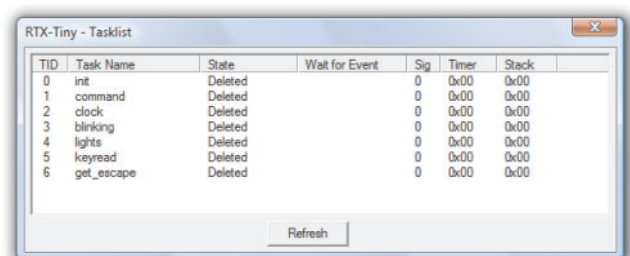
The μVision debugger includes a kernel-aware dialog for RTX Tiny2 that displays complete information about all the tasks in your program.

µVision Debugger

The µVision Debugger provides source-level debugging and includes traditional features like simple and complex breakpoints, watch windows, and execution control as well as sophisticated features like performance analyzer, code coverage, and logic analyzer.

The µVision Debugger may be configured as a Simulator where programs run on your PC; or as Target Debugger where programs run on your target hardware.

The cycle-accurate µVision Simulator is a software-only product that simulates most features of your 8051/251 device without actually having target hardware. µVision simulates a wide range of peripherals including I/O Ports, CAN, I²C, SPI, UART, A/D and D/A converter, E²PROM, and interrupt controller. The simulated peripherals depend on the device selected from the µVision Device Database.

Benefits of µVision Device Simulation

- Simulation allows software testing on your desktop with no hardware environment

- Early software debugging on a functional basis improves overall software reliability

- Simulation allows breakpoints that are not possible with hardware debuggers

- Simulation allows for optimal input signals (hardware debuggers add extra noise)

- Signal functions are easily programmed to reproduce complex, real-world input signals

- Single-stepping through signal processing algorithms is possible. External signals stop when the CPU halts

- It is easy to test failure scenarios that would destroy real hardware peripherals

The disassembly window shows CPU instructions and trace history

Peripheral dialogs display status information and aid in driver development

The Logic Analyzer shows changes to variables and signals over time

The Project Window shows all project files, and helps you manage your project

The Performance Analyzer displays execution times for program blocks

Memory and watch windows display program variables

The µVision development platform is easy to use and it helps you to quickly create embedded programs that work. The µVision editor and debugger are integrated in a single application that provides a seamless embedded project development environment for editing, simulating, Flash programming and testing in target hardware.

PK51
Professional Developer's Kit

| |
|---|
| **Keil Cx51 Compiler** |
| **RTX Tiny2 RTOS Kernel** |
| **µVision Device Database & IDE** |
| **µVision Debugger & Analysis Tools** |
| **Device Peripheral Simulation** |

Examples and Templates

Keil µVision combines project management, source editing, program debugging, and accurate device simulation in a single powerful environment. Multiple drivers are included for debugging applications running on target hardware.

- **Monitor-51** for evaluation boards and target hardware
- **MON390** for devices running in Dallas contiguous mode
- **ISD51** in-system debugger runs on standard 8051 hardware and is linked with the user application
- **EPM900** emulator/programmer for Philips LPC900 device series
- **FlashMON** for Atmel single-chip microcontrollers
- **MONADI** for Analog Devices MicroConverter
- **ULINK2** driver for Infineon XC800, NXP 952/954, and STMicroelectronics µPSD3000 devices

Other target hardware is supported by third-party drivers.

The **Keil PK51 Professional Developer's Kit** is a complete software development environment for classic and extended 8051 microcontrollers. It includes the tools you need to create, translate, and debug C and Assembly source files. Keil PK51 is easy to learn and use, yet powerful enough for the most demanding 8051 applications.

The integrated Device Database® configures the tools options for each specific microcontroller. For a complete list of supported devices, refer to www.keil.com/dd.
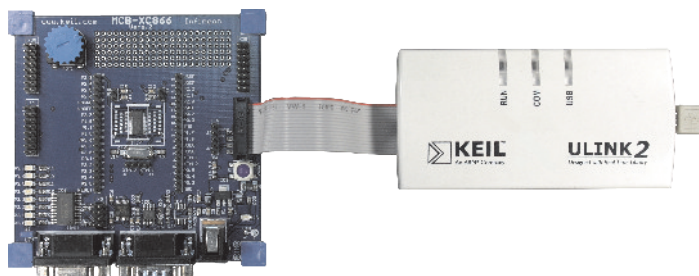
The Keil ULINK2 Debug Adapter connects to a wide range of evaluation boards. For more information refer to www.keil.com/ulink

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Program examples and detailed technical information are available from your distributor and our web site (www.keil.com).

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