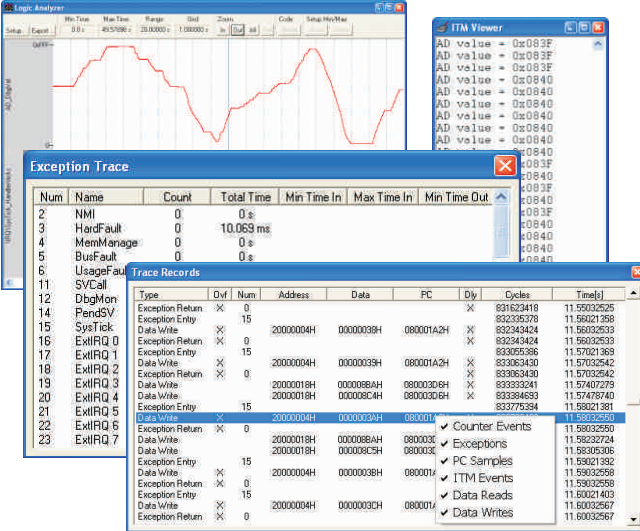


ULINKPro Debug and Trace Unit

ULINK®Pro is a new debug unit that allows real-time data and instruction trace streaming via USB.

Features	ULINK2	ULINKPro
Run control debug (ARM & Cortex-Mx)	Yes	Yes
Run control debug (8051 & C166)	Yes	-
Data Trace (Cortex-M3)	Yes	Yes
Instruction Trace (Cortex-M3)	-	Yes
Performance		
JTAG Clock speed	10MHz	50MHz
Flash Download	28KByte/s	600KByte/s
Data Trace streaming	500Kbit/s	100Mbit/s

Data Trace: available for Cortex™-M3 based devices using Serial Wire Viewer (SWV) or ETM™.



The screenshot displays several windows from the Keil IDE. At the top left is the Logic Analyzer window showing a waveform. To its right is the ITM Viewer window displaying a list of AD values. Below these is the Exception Trace window with a table of exceptions:

Num	Name	Count	Total Time	Min Time In	Max Time In	Min Time Out
2	NMI	0	0 s			
3	HardFault	0	10.053 ms			
4	MemManage	0	0 s			
5	BusFault	0	0 s			
6	UsageFault	0	0 s			
11	SVCall					
12	DbgMon					
14	PendSV					
15	SysTick					
16	ExtIRQ 0					
17	ExtIRQ 1					
18	ExtIRQ 2					
19	ExtIRQ 3					
20	ExtIRQ 4					
21	ExtIRQ 5					
22	ExtIRQ 6					
23	ExtIRQ 7					

Below the Exception Trace window is the Trace Records window, which includes a list of events with checkboxes for Counter Events, Exceptions, PC Samples, ITM Events, Data Reads, and Data Writes.

Data Trace Windows provide information from the running target for program data, exceptions, variables, and printf-style outputs

Instruction (ETM) Trace: requires a Cortex-M3 device with ETM. It records instruction by instruction program execution.

More information: www.keil.com/ULINKPro

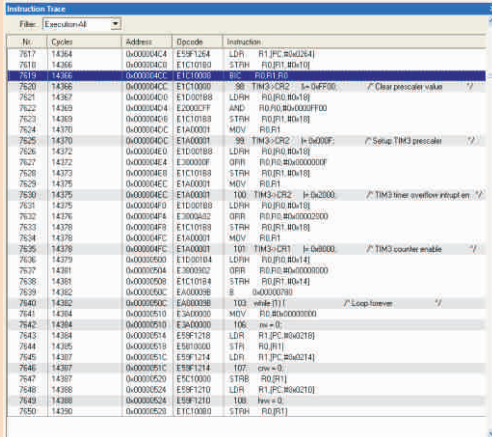
µVision4
Enhanced for Productivity

ULINKPro
Fast Debug and Trace Unit

Keil Cx51 and C166
Latest Devices and Features

RTOS & Middleware
New Features and Improvements

MDK-ARM and MPS
Cortex MCU Development



The screenshot shows the Instruction Trace window with a table of instructions:

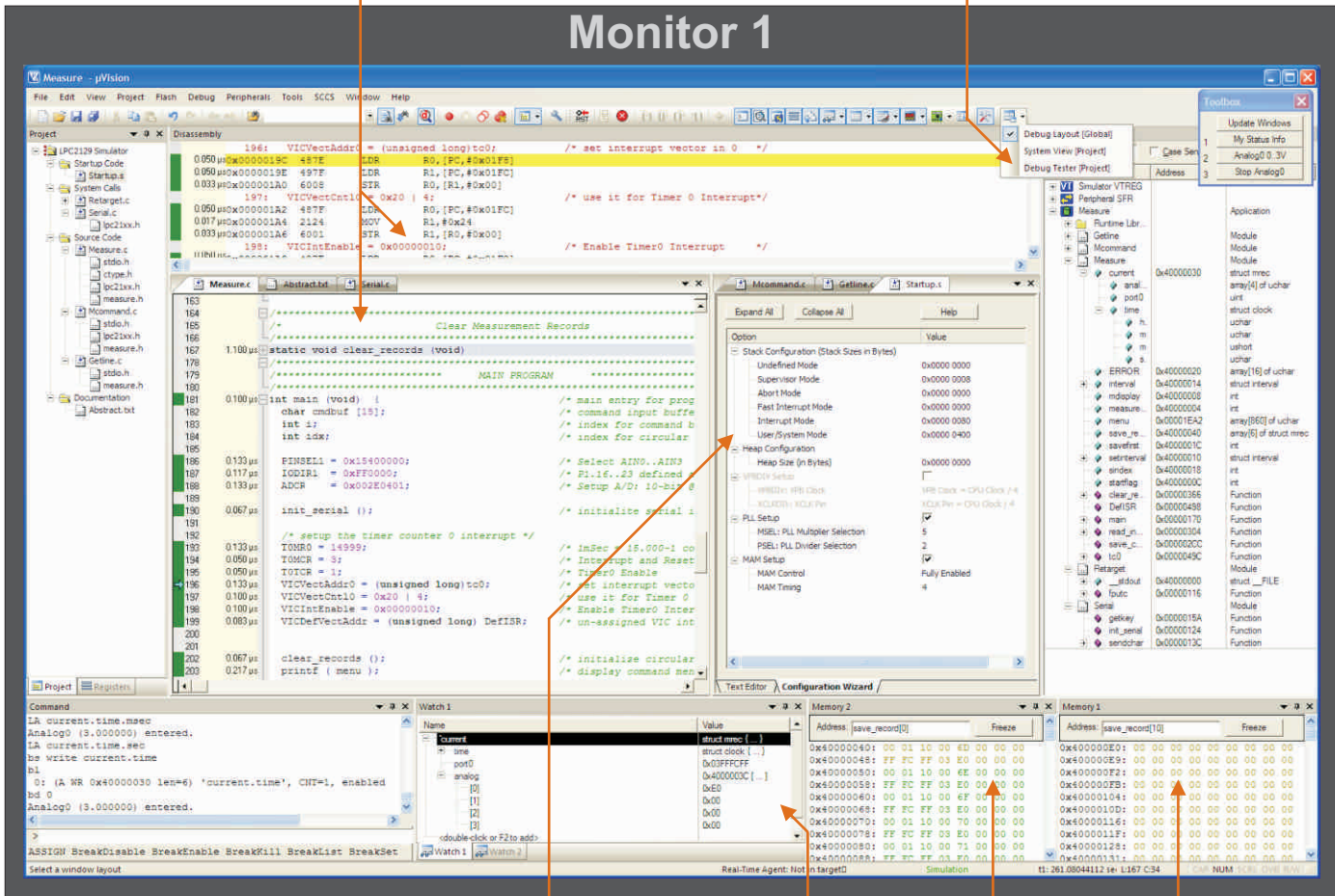
No.	Counter	Address	Opcode	Instruction
7617	14364	0x00004C4	E5F1264	LDR R1, #PC, #0x264
7618	14365	0x00004C8	EC1C100	STRH R0, #R1, #0x18
7619	14366	0x00004CC	E111000	BIC R0, #R1, #0
7620	14366	0x00004CC	E1C1000	SHL TIM3->CR2, #0x00000000, #0
7621	14367	0x00004D0	E1C0200	LDRH R0, #R1, #0x18
7622	14369	0x00004D4	E2002FF	AND R0, #R0, #0x00000000
7623	14369	0x00004D4	E1C1000	STRH R0, #R1, #0x18
7624	14370	0x00004E0	E1A0001	MOV R0, #R1
7625	14370	0x00004E0	E1A0001	MOV R0, #R1
7626	14372	0x00004E4	E1C0000	LDRH R0, #R1, #0x18
7627	14372	0x00004E4	E30000F	ORR R0, #R0, #0x0000000F
7628	14373	0x00004E8	E1C1000	STRH R0, #R1, #0x18
7629	14375	0x00004EC	E1A0001	MOV R0, #R1
7630	14375	0x00004EC	E1A0001	MOV R0, #R1
7631	14375	0x00004E0	E1C0000	LDRH R0, #R1, #0x18
7632	14376	0x00004F4	E300042	ORR R0, #R0, #0x00002000
7633	14378	0x00004F8	E1C1000	STRH R0, #R1, #0x18
7634	14378	0x00004FC	E1A0001	MOV R0, #R1
7635	14378	0x00004FC	E1A0001	MOV R0, #R1
7636	14379	0x0000500	E1C0000	LDRH R0, #R1, #0x18
7637	14381	0x0000504	E300002	ORR R0, #R0, #0x00000000
7638	14381	0x0000508	E1C1000	STRH R0, #R1, #0x18
7639	14382	0x000050C	E400000	IT, #0, #0x00000000
7640	14382	0x000050C	E400000	IT, #0, #0x00000000
7641	14384	0x0000510	E3A0000	MOV R0, #0
7642	14384	0x0000510	E3A0000	MOV R0, #0
7643	14384	0x0000514	E5F1218	LDR R1, #PC, #0x218
7644	14385	0x0000518	E8B1000	STR R0, #R1
7645	14387	0x000051C	E5F1214	LDR R1, #PC, #0x214
7646	14387	E5F1214	IT, #0, #0x00000000	
7647	14387	0x0000520	EXC1000	STRB R0, #R1
7648	14388	0x0000524	E5F1210	LDR R1, #PC, #0x210
7649	14388	0x0000528	E5F1210	IT, #0, #0x00000000
7650	14390	0x000052C	E1C0000	STRH R0, #R1

Instruction Trace on Cortex-M3 enables instruction by instruction analysis of application behavior

µVision4 IDE and Debugger

The **Disassembly Window** and **Source Windows** are fully synchronized making program debugging and cursor navigation easier.

Debug Restore Views allow you to save multiple window layouts. You can quickly select the view which best suits your program analysis.



The **Configuration Wizard** provides an easy way to set up tool and device parameters for your application. The dialogs are based on the specific device selected from the µVision4 integrated Device Database.

µVision4 enables you to drag and drop individual windows anywhere on the visual surface. This increases your flexibility, for instance, you may have multiple memory and variable watch windows.

The flexible window management system introduced in µVision4 enables you to use multiple monitors and provides complete control over window placement. This new interface allows you to make better use of your screen space and to organise multiple windows.

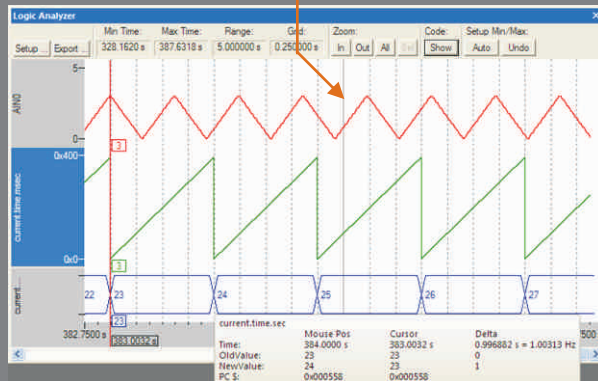
Application development often requires working with more than one project at the same time, for instance working on a bootloader and application programs. The µVision **Multi-Project Workspace** combines several projects and simplifies the build and debug process of such applications.

Visit www.keil.com/uv4 for more information about µVision4.

The **Logic Analyzer** is used to graphically display variable changes in simulation or from data trace captured on a Cortex-M3 based MCU.

Call Stack Window allows you to view current call nesting including variable values. By clicking on a function name you can browse to the location where it was called.

Monitor 2



Stack Frames	Value/Address
sendchar()	
putchar()	0x00000056
< 00001e36() >	
< 0000150c() >	
measure_display()	0x40000454
display	0x00000006
i	
main()	
cmdbuf	0x40000478: "D"
i	< invisible >
idx	< invisible >

Module-Function	Calls	TimeSec	Time%
Measure		111.825	99%
int_send	1	0.367 µs	0%
sendchar	2533	3.029 s	3%
getkey	14	97.43 s	96%
Measure		764.143 ms	1%
Startup		32.304 ms	0%
Resetarg		781.983 µs	0%
Microcommand		47.400 µs	0%
Callline		10.717 µs	0%

Symbol	Memory Spaces	arm
time	data	data
label	data	data
line	data	data
main	data	data
display	data	data
measure_display	data	data
measurement_ritual	data	data
menu	data	data
member	data	data

- C:\Flash\INC\WC2287.sfr
- Analog Digital Converter 0
- Analog Digital Converter 1
- ADC Interrupt Control
- Register Bank Selection
- CAN Interrupt Control Registers
- CAN
- Capture Compare Unit
- CPU Register
- Interrupt Control
- Flash Kernel
- Interrupt
- CPU Register 2
- Ports
- PEC Channel
- Program Flash Interrupt
- Processor Register 3
- Real Time Clock
- SCU
- UART
- Pointer 2

Property	Value
ADC_IRQ_INTERRUPTED	0x00000000

Property	Value
CAN_FDRH @0x00200000	0x00000000
RESUME	Not acknowledged...
SUSREQ	not requested
ENHW	DISCLK cannot...
DISCLK	Clock generat...
CAN_LISTIH @0x00200100	0x00000000
CAN_LISTIL @0x00200104	0x00000000
CAN_LISTIH @0x00200108	0x00000000
CAN_LISTIL @0x0020010C	0x00000000

The **Source Browser** displays information about symbol and variable definitions and their usage in your program. You can navigate through your source code using the F12 key and the Source Browser window.

The µVision4 **System Viewer** windows provide information of device peripheral register contents. Detailed status information is available and can be changed directly from within the System Viewer window.

The µVision Device Simulation has been updated to support many new devices such as Infineon XC88x, SiLABS C8051Fxx, Atmel SAM7/9, and Cortex-M3 MCUs from Luminary, NXP, and Toshiba. These models can be expanded to include additional peripherals using AGSI DLLs.

To connect to various target hardware, µVision supports interfaces for many debug adapters including ADI miDAS-Link, Atmel SAM-ICE, Infineon DAS, and ST-Link. µVision has also been expanded to support data and instruction trace capabilities for ARM and Cortex MCUs.

RTX - Faster and Smaller

RTX now supports multi-threading for standard ANSI C run-time library functions. The RAM requirements are reduced; and the Cortex-M3 implementation has been further enhanced for execution speed. RTX is available for most ARM and Cortex-Mx processor-based MCUs.

Flash File System

New features of RL-Flash:

Faster SD Card Interface

By implementing a file cache the speed for reading and writing to SD cards is increased by at least 4 times.

FAT32 File Support

A FAT32 file system, sub-folders and long file names are now supported. Sub-folders and long file names may also be used with the FAT12 or FAT16 file systems.

More information: www.keil.com/rl-arm

Cx51

µVision4 will be introduced into the Keil Cx51 tools during Q2/09. Additions to Cx51 include new ULINK2 flash and debug support for the Infineon XC800 family and the NXP LPC952/954 family debug interface.

New Device Support in Cx51 Development Tools		
Analog Devices	Energy Measurement	ADE5xx, ADE7xx
Evatronix	Configurable 8051 IP	R8051XC, T8051
Infineon	Embedded Power ICs	TLE78xx, XC878
NXP	General Purpose	LPC95x, 93xx
Ramtron	F-RAM Enhanced	VR551Lxx
Silicon Labs	Analog Mixed Signal	F36x, F41x, F9xx, T600
Syntek	General Purpose	STK603x

More information: www.keil.com/C51

CI66

The Keil CI66 tools use the System Viewer windows to provide information for all Infineon XC2000 and XE166 device peripherals. New device support has been added for the latest XC22xx, XC23xx, XC27xx, and XE16x families.

µVision4 will be added to Keil CI66 development tools during Q2/09.

More information: www.keil.com/CI66

TCPnet Networking Suite

TCP/IP and UDP are easy to implement using the **TCPnet** Networking Suite provided within the ARTX166 Advanced RTOS and RL-ARM Real-Time Library.

New enhancements to TCPnet include:

Ajax Support

The HTTP Server has been expanded to support the **XMLHttpRequest** object enabling data to be retrieved from the server asynchronously (in the background), for dynamic screen updates.

HTTP File Upload

This new feature allows uploading of files via a standard web browser e.g. to upload a new firmware or configuration.

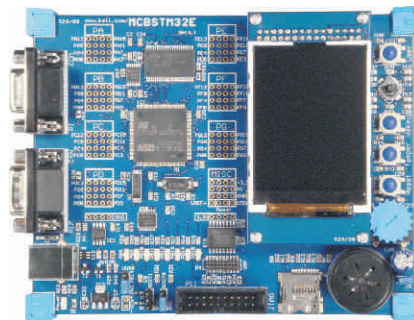
Multicast UDP Datagrams (IGMP)

Datagrams can be sent simultaneously to several devices using the Internet Group Management Protocol.

New Evaluation Boards

- **MCB1700** - NXP (Cortex-M3) with Ethernet, CAN, USB-Host/OTG, QVGA LCD and MicroSD card
- **MCBTMPM330** - Toshiba (Cortex-M3) with 512KB Flash, 32KB SRAM, ETM, ADC, UART's, and 79 GPIO
- **MCBSTM32E** - ST (Cortex-M3) with QVGA LCD, ETM, USB, joystick, and MicroSD card interface
- **MCB2470** - NXP (ARM7TDMI) with Ethernet, CAN, USB-Host/OTG, and QVGA LCD with Touchscreen
- **MCB2900** - NXP (ARM968E-S) with USB Host/OTG, Dual CAN, LIN and QVGA LCD
- **MCBZ32AN** - Zilog (ARM922T) with 32MB SDRAM, 4MB NOR Flash, USB OTG, and MicroSD card interface

More information: www.keil.com/boards



MCBSTM32E for evaluation of the STM32E family

Development Tools for ARM and Cortex-Mx Devices

MDK-ARM

In addition to the new features available in μ Vision4, MDK-ARM v4.0 includes new compiler enhancements, and is the first tool kit to be compliant with the CMSIS standard.

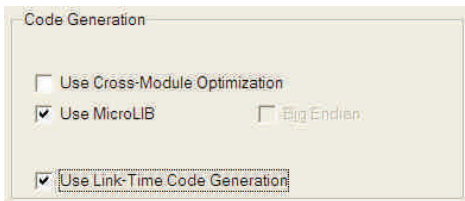
ARM Cortex-M0 Support

MDK-ARM now supports the ARM Cortex-M0 processor-based devices being released by several MCU vendors.

Link-Time Code Generation

Enables multi-file compilation that performs the following additional code optimizations:

- Function in-lining across modules
- Removing un-referenced variables and functions
- Optimizing memory accesses by re-arranging variables
- Re-using memory pools where possible



Link-Time code generation is selected in the μ Vision Options - Target dialog

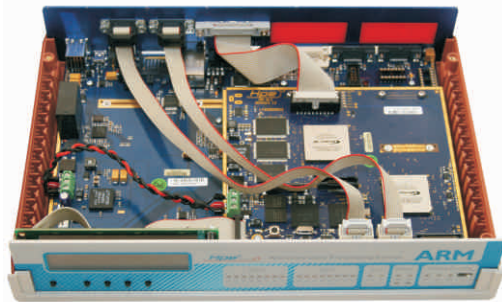
More information: www.keil.com/arm

Microcontroller Prototyping System

The ARM MPS provides a system in which you can prototype a custom Cortex-Mx processor-based design.

The Microcontroller Prototyping System (MPS) features:

- Cortex-M3 or Cortex-M0 processor operating at up to 50MHz in FPGA
- Altera Stratix III (EP3SL50) FPGA for system prototyping
- CAN, FlexRay, RS232, DVI, USB, Ethernet, Audio, MMC
- Free synthesis and Place and Route Tool



MPS for Cortex-Mx processor-based designs

The platform is delivered with a comprehensive example AHB system allowing you to quickly add your own and third-party IP; it also includes MDK-ARM (Eval) & ULINK2 enabling fast software development.

More information regarding MPS is available at:

www.arm.com/products/DevTools/mps.html

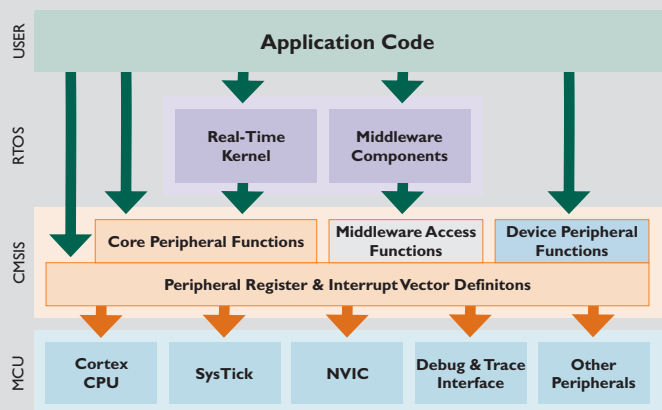
Cortex Microcontroller Software Interface Standard (CMSIS)

CMSIS provides common standard for interfacing software applications to peripherals, RTOS, and middleware components used on ARM Cortex-M3 and Cortex-M0 processor-based devices.

As part of CMSIS, ARM provides the following software layers for various compiler implementations:

- **Core Peripheral Access Layer:** name and address definitions, helper functions for core register and peripheral access, and a device independent interface for RTOS Kernels including debug channel definitions.
- **Middleware Access Layer:** common methods to access device specific peripherals used by middleware components.

Further information and download: www.onArm.com

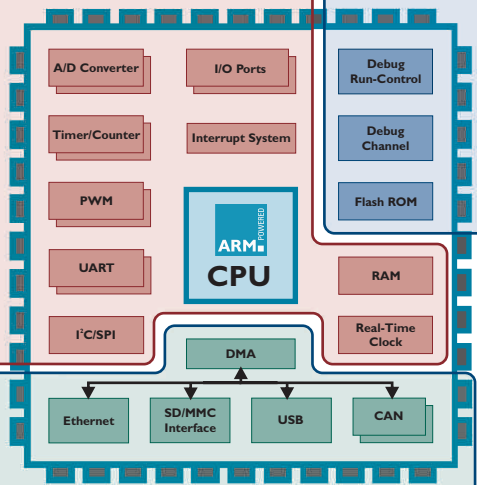
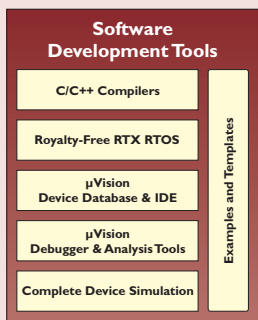


CMSIS Overview

Microcontroller Development Tools

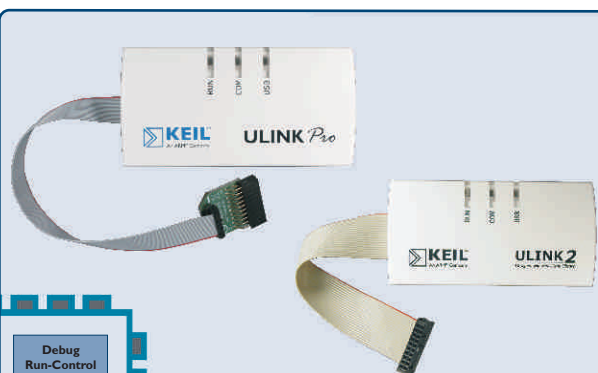
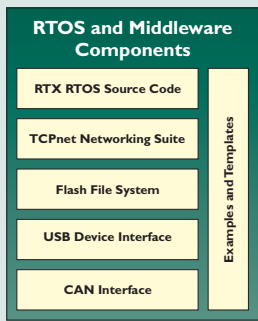
C and C++ Development Tools

- Best-in-class Keil and ARM compilers for small, fast code
- Genuine Keil μ Vision[®] IDE/Debugger/Simulator
- Fast development and verification using Device Simulation
- Easy device configuration with Device Database support for more than 1,700 devices



RTOS and Middleware

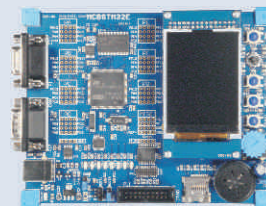
- Easy implementation of complex applications
- Royalty-free RTX Real-Time Kernel
- TCP/IP Suite with Server Applications
- File System for ROM and Memory Cards
- Direct support for USB and CAN interfaces



ULINK[®] USB Adapters

- Debugging and Flash Download
- ARM device support
- Data Trace for Cortex-M3
- ARM Instruction Trace (ULINKPro)
- 8 and 16-bit support (ULINK2)

Evaluation Boards



Keil provides a wide range of evaluation boards for 8, 16 and 32-bit devices

Europe:

Keil
Bretonischer Ring 16
85630 Grasbrunn
Germany

Phone +49 89 / 45 60 40 - 0
Support +49 89 / 45 60 40 - 24
FAX +49 89 / 46 81 62
Email sales.intl@keil.com
support.intl@keil.com

United States:

Keil
1501 10th Street, Suite 110
Plano, Texas 75074
USA

Phone +1 800 348 8051
+1 972 312 1107
FAX +1 972 312 1159
Email sales.us@keil.com
support.us@keil.com



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