EM-LPC1700 Evaluation Board
User Manual
V1.2

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Content

Chapter 1 Overview

EM-LPC1700 is the latest generation of full function evaluation board produced by Embest for NXP ARM Cortex-M3 core-based processors. The board features comprehensive interfaces, which not only provides a good platform for application development, but also is the first choice for learners. Combining with our company's debugging tools ULINK2, it will offer you a better development environment for saving time and improving efficiency.

The features of EM-LPC1700:

- Processors: NXP LPC17xx*, the frequency up to 100MHz
- Internal Memory: up to 512KB flash memory, 64KB SRAM
- 2 RS232 Interfaces
- 2 CAN Interfaces
- 1 Ethernet Interface
- 1 JTAG Interface
- 1 ETM Interface
- 2 Cortex Debug Interfaces
- 1 LCD Display
- 1 USB Device/Host/OTG Interface
- 1 Analog Output (connected to speaker by default)
- 1 Analog Input (connected to potentiometer by default)
- RTC (with back-up battery)
- 1 Mini SD Card Interface

*__Note:__ EM-LPC1700 Evaluation Board is available in three variants: the LPC1758, LPC1766 and LPC1768.

- The LPC1758 board (Order# P758): Processor is populated with the NXP LPC1758 microcontroller, 512KB Flash memory, 80 pins, 100MHz.
- The LPC1766 (Order# P766): Processor is populated with the NXP LPC1766 microcontroller, 256KB Flash memory, 100 pins, 100MHz.
- The LPC1768 (Order# P768): Processor is populated with the NXP LPC1768 microcontroller, 512KB Flash memory, 100 pins, 100MHz.

The supplied microcontroller is the only difference between these three boards.

1.1 Product List includes

- One EM-LPC1700 board
- 2.4 inches TFT LCD（240*320）
- One Cross-serial line
- One USB A-B cable
- One Crossover network cable
- One EM-LPC1700 CD

1.2 Getting Start

Power

EM-LPC1700 is supplied power by using a standard USB connector.

- The power is supplied through a USB Device port on board; the supplied current is less than 500mA.

Connection

Connect the relevant devices together:

- The recommended configuration for a PC: CPU 2.0Ghz, 512MB memory, two USB interfaces, one COM interface, Windows XP OS(recommend to install Keil IDE, such as uvision 3)
- Connecting COM1 interface of the board to the COM interface of a PC by using a serial port cable for the information display and input; if you have a JTAG Emulator (optional), you are able to debug and develop the application by connecting to the JTAG interface of the board.
- Connecting PC's USB to the USB on board by using a USB cable for USB communication and power supply; the power LED indicates when power is applied to the board.

Hardware Theories

Please refer to EM-LPC1700schematics.pdf located in the "Document" folder of CD.

Mirror Files

Please refer to the "image" folder of CD.

Caution

1) Please insure the serial port configuration is correct.
2) Please insure the SD card is inserted tightly.
3) Playing and plugging devices is not allowed when the power is still applied to the board

1.3 Jumpers

Table1. Jumpers Setting

jumper	state	description
E/C (JP6)	**(2 3) ENET**	Connect P2.8, make CAN2 or Ethernet available
D- (JP9)	**HOST**	Set USB Line D- to HOST mode
D+ (JP8)	**HOST**	Set USB Line D+ to HOST mode
SPK (JP16)	**ON**	Through LF loudspeaker connect AOUT (P0.26) to
VBAT (JP1)	**ON**	Connect the on-board battery to VBAT pin
VDDIO (JP15)	**ON**	Provide VDDIO pin for 3.3 V DC
VDDREG(JP14)	**ON**	Provide VDDREG pin for 3.3 V DC
VBUS (JP12)	**ON**	Provide USB-B connector VBUS pin for 5V DC
UMODE (JP11)	**(2 3)ON**	Restart a software through P2.9,allows USB devices to
AD0.2 (JP7)	**ON**	Connect POT1 to AD0.2, this operation for analog input
INT0 (JP5)	**ON**	make INT0 button available
RST (JP4)	**ON**	Through the COM0. Make Reset available
ISP (JP3)	**ON**	Through the COM0. Prohibited In-System Programming
LED (JP2)	**ON**	make P1.28, P1.29, P1.31, P2.2 - P2.6 LEDs available
E/U (JP10)	**(2 3)ON**	connect P2.9 to UMODE jumper pin 1

Chapter 2 EM-LPC1700 Hardware Specification

2.1 Board Overview

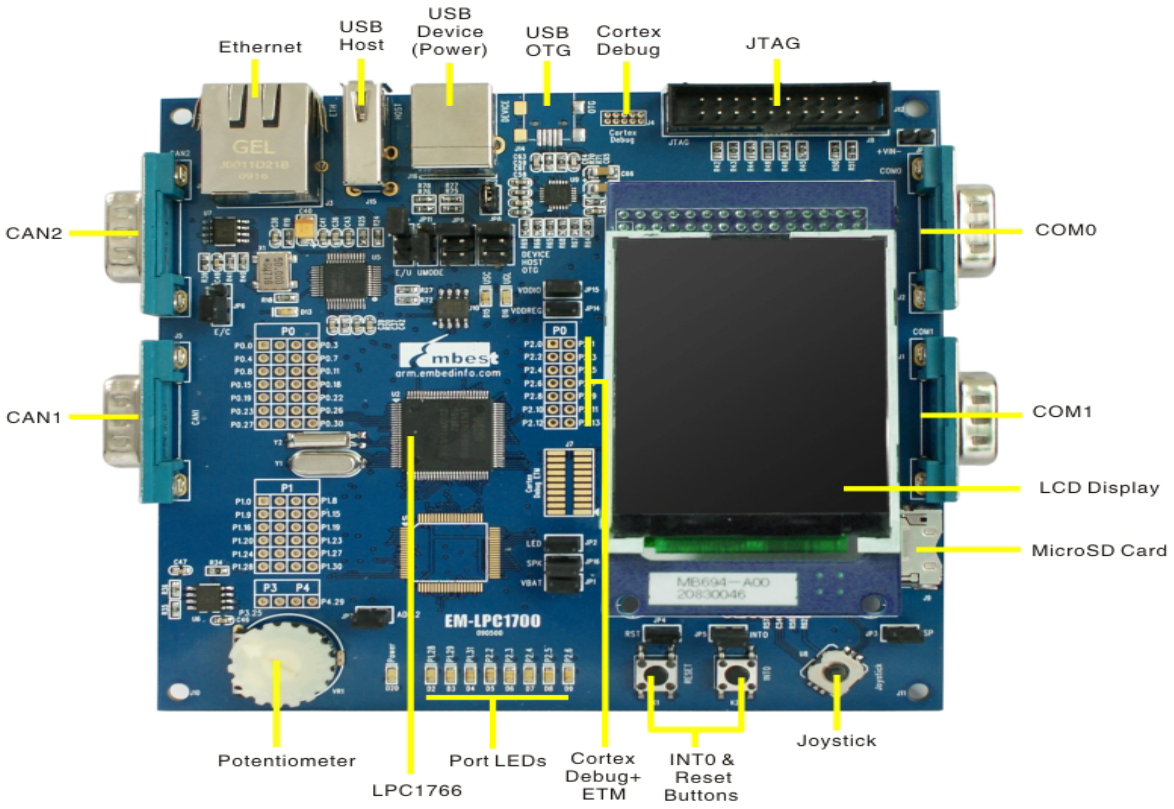


Table 2. A List of Hardware Interfaces

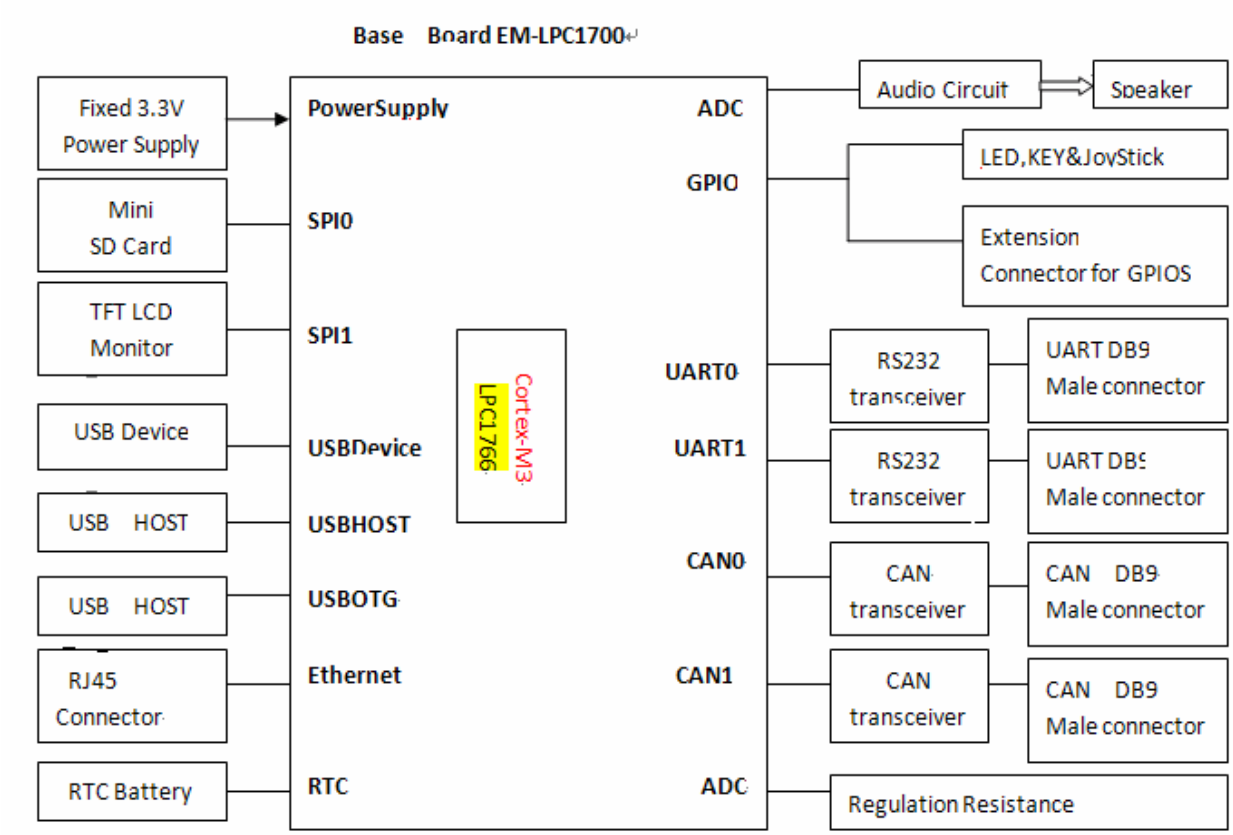
J1	USART DB9 male connector COM1
J2	USART DB9 male connector COM0
J3	RJ45 network interface
J4	Cortex Debug
J5	CAN1 DB9 male connector
J6	CAN2 DB9 male connector
J7	Cortex Debug ETM interface
J8	JTAG 20 interface
J9	Mini SD card interface
J14	USB OTG interface
J15	USB HOST interface
J16	USB Device interface
U1	LPC175x（optional）
U2	LPC176x（optional）
U3	MAX3232
U4	74LV244

U5	DM83848
U6/7	TJA1040
U9	ISP1301

2.2 Jumpers Setting

Designation	Description	Setting Option	Setting Description
JP6	CAN	1-2	Select CAN Controller
		2-3	Select Ethernet Controller
JP8/9	USB	Above	USB OTG Mode
		Middle	USB HOST Mode
		Below	USB Device Mode
JP10	USB	1-2	USB Mode
		2-3	Ethernet Controller
JP11	USB/Network		LPC1755 Chip Relevant
			LPC1755 Chip Relevant

2.3 EM-LPC1700 Block Diagram



2.4 Power Supply

EM-LPC1700 evaluation board supports two power supply modes; you can select one of the two power supply modes below through JP12 configuration.

1) Supply 5V DC through power jack (JP11) on the board.

2) Supply power through USB connecter (CON1) on the board, the current should be less than 500mA

2.5 Clock Source

EM-LPC1700 evaluation board has two clock sources:

- 32K Hz crystal as RTC clock source.
- 8M Hz crystal as MCU clock source which can be removed when internal RC clock is used as clock source.

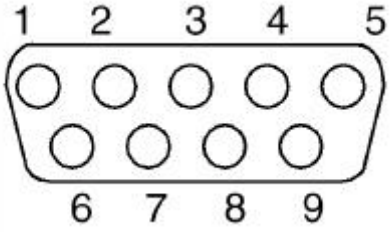
2.6 Audio

EM-LPC1700 evaluation board has recording and playing functions, the audio file can be played through the external speaker, and the jumper JP6 controls the DAC output and speaker connection.

2.7 UART

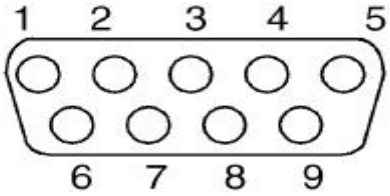
EM-LPC1700 evaluation board exports two UARTs, UART0 (COM1) and UART1 (COM2). These two UARTs are both connected to male DB9 connectors. UART2 supports RTS/CTS handshake signals.

UART0 the signal definition of RS232 DB9 male connector:



Pin No.	Function Description	Pin No.	Function Description
1	NC	6	NC
2	UART0_RXD	7	NC
3	UART0_TXD	8	NC
4	NC	9	NC
5	GND		

UART1 RS232 DB9 connecter signal definition:



Pin No.	Function Description	Pin No.	Function Description
1	NC	6	NC
2	UART1_RXD	7	JP3
3	UART1_TXD	8	NC
4	--	9	NC
5	GND		

2.8 SD Card Interface

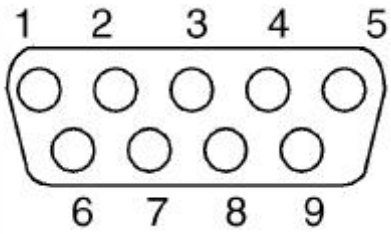
STM32 evaluation board has SD card connector and supports SD card read/write operation. SD card and EM-LPC1700 interface connection signal as follows:

Pin	SD card interface	Signal Description	LPC1700 Corresponding Pin
1	DAT2		NC
2	DAT3		P0.16
3	CMD	SD_CMD	P0.18
4	VCC		VCC3.3
5	CLK	SD_CLK	P0.15
6	VSS		GND
7	DAT0	SD_DAT0	P0.17
8	DAT1		NC
9	SW2		NC
10	SW1		P4.29
11	Sh1		GND
12	Sh2		GND
13	Sh3		GND
14	Sh4		GND

2.9 CAN Connector

EM-LPC1700 evaluation board use SN65HVD230 (U10) as CAN driver chip, CAN connecter adopts DB9 to connect wires, here pin2 provides CANL signal and pin7 provides CANH signal. These pins are connected to CAN driver chip SN65HVD230.

CAN DB9 connecter pin definition:



Pin NO.	Function Description	Pin NO.	Function Description
1 ,4,8,9	NC	7	CANH
2	CANL	3,5,6	GND

2.10 Human-Computer Interface (LCD)

Color TFT LCD

Pin NO.	Signal Description	Corresponding IO
1	CS	P0.6
2	RS	GND
3	WR/SCL	P0.7
4	RD	GND
5	RESET	RSTOUT
22	BL_GND	GND
23	BL_Control	P4.28
24	VDD	+3V3
25	VC1	+3V3
26	GND	GND
27	GND	GND
28	BL_VDD	+3V3
29	SDO	P0.8
30	SDI	P0.9

31	TCS	P0.5

2.11 Hardware Testing

(1) I/O Testing

Image file: Blinky.hex

Location of source code: Blinky

Corresponding chip manual: Datasheet\[processor].pdf

Steps: Download Blinky.hex to the FLASH of MCU

Testing phenomenon: D2-D9 blink in turn

(2) LCD Testing

Image file: LCD_Blinky.hex

Location of source code: LCD

Corresponding chip manual: Datasheet\LCD corresponding\ MR024-9325-51P-B.pdf

Steps: Download LCD_Blinky.hex to the FLASH of MCU

Testing phenomenon: D2-D9 blink, and LCD displays the LOGO and related words of Embest Co.

(3) UART Testing

Image file: UART.hex

Location of source code: UART

Corresponding chip manual: Datasheet\[processor].pdf

Steps:

1) Download UART.hex to the FLASH of MCU, connect UART0 to PC through Cross-serial line.

2) Run "Begin" -> "Program" -> "Accessory" ->"Communication" ->" Super terminal" in PC.

3) Set the attribute of COM1:

Bits Per Second: 115200

Data Bits: 8

Parity Check: NO

Stop Bits: 1

Data Flow Control: NO

Testing phenomenon: The hype terminal displays the characters that input by the keyboard.

(4) RTC Testing

Image file: rtc.hex

Location of source code: RTC

Corresponding chip manual: Datasheet\[processor].pdf

Steps: Download rtc.hex to the FLASH of MCU
Testing phenomenon: Examine the corresponding changes which the RTC related register bring about

(5) DAC SPK Testing

Image file: DAC_Test.hex
Location of source code: DAC
Corresponding chip manual: Datasheet\[processor].pdf
Steps: Download DAC_Test.hex to the FLASH of MCU
Testing phenomenon: The buzzer in LCD emits sound signals

(6) CAN&ADC Testing

Image file: CAN.hex
Location of source code: CAN
Corresponding chip manual: Documents\Datasheet\Peripherals corresponding\ lpc17xx.can.arm.pdf
Steps: Link CAN1 and CAN2 through direct serial cable, and download CAN.hex to the FLASH of MCU
Testing phenomenon: The color LCD displays the AD conversed value of CAN receive

(7) SD card Testing

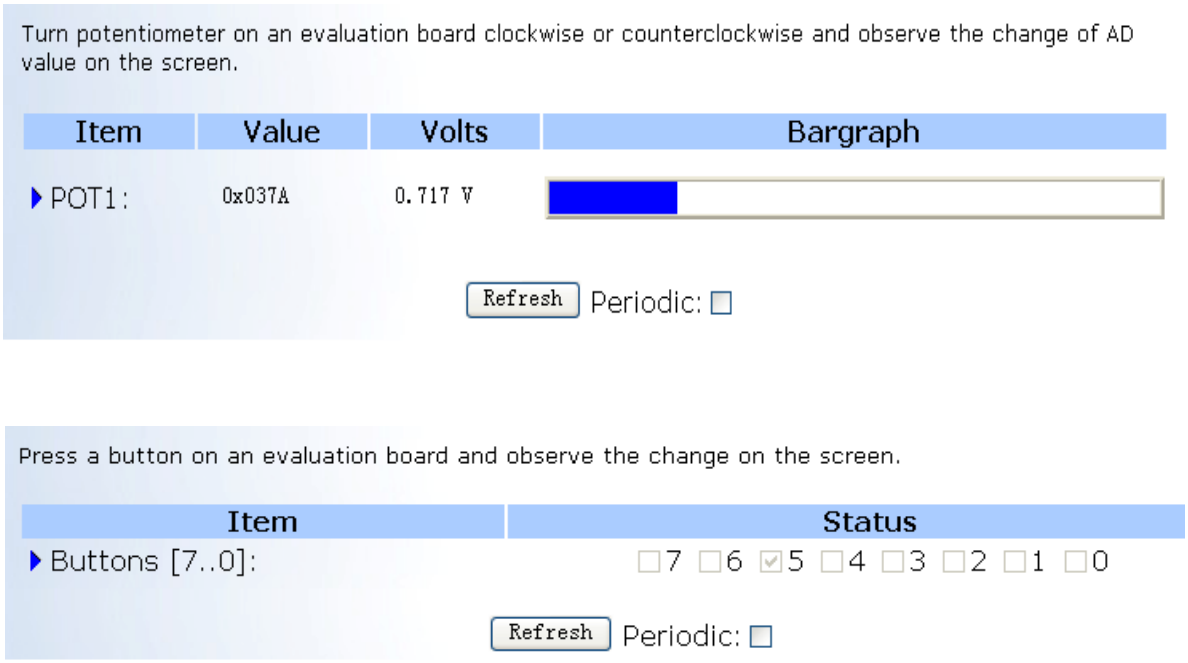
Image file: SD_test.hex
Location of source code: SD_test
Corresponding chip manual: Datasheet\[processor].pdf
Steps: According to (3) UART Testing configures hype terminal, link com1 to PC, plug in SD card, and download SD_test.hex to the FLASH of MCU
Testing phenomenon: Hype terminal displays the related information of SD card

(8) Network Testing (RL-ARM holder)

Image file: HTTPDEMO.hex
Location of source code: HTTPDEMO
Corresponding chip manual: Datasheet\[processor].pdf
Steps:
1) Download HTTPDEMO.hex to the FLASH of MCU
2) The evaluation board IP: 192.168.0.100
3) PC's configuration as follows:
IP: 192.168.0.101
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.0.254

Testing phenomenon: Input 192.168.0.100 in the IE address bar, click on AD and

BUTTON, and then it appears the following forms which show the change of AD value and Joystick's button value



(9) SD card Testing (RL-ARM holder)

Image file: SD_file.hex

Location of source code: SD_file

Corresponding chip manual:

Steps: Download SD_file.hex to the FLASH of MCU, link UART0 to PC through the Cross-serial line, and open the super terminal

Testing phenomenon: Hype terminal displays as follows:

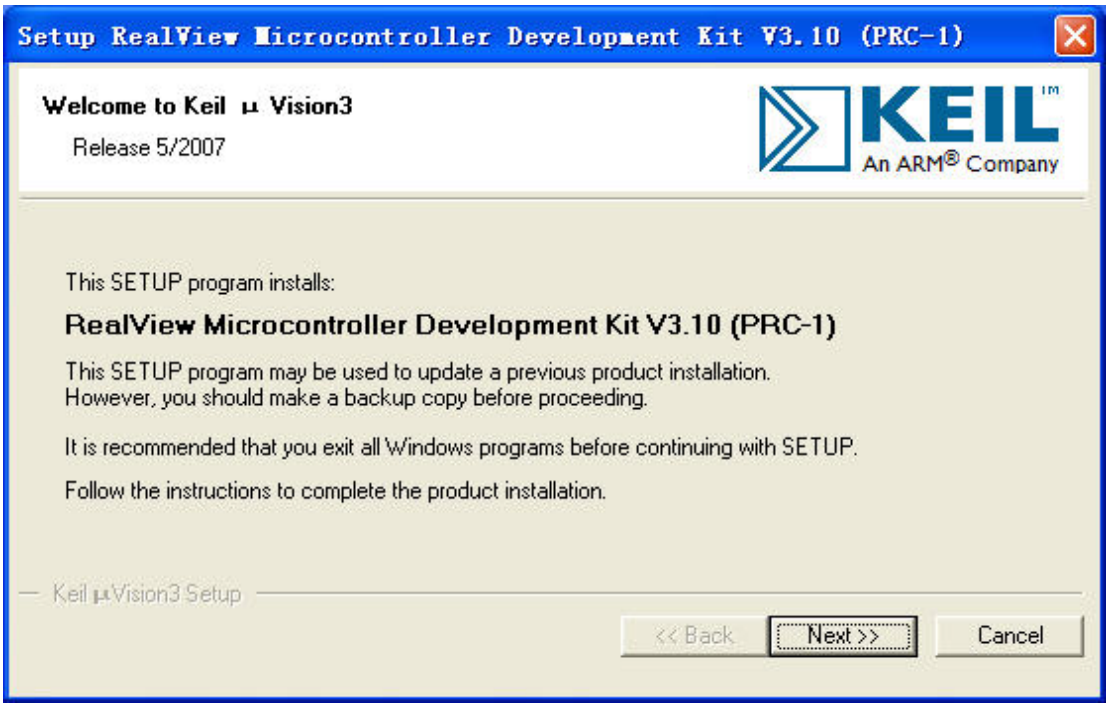
```
"+ command ------------------+ function ---------------------------------+
"| CAP \"fname\" [/A]          | captures serial data to a file
"|                            |  [/A option appends data to a file]       |
"| FILL \"fname\" [nnnn]       | create a file filled with text
"|                            |  [nnnn - number of lines, default=1000]   |
"| TYPE \"fname\"              | displays the content of a text file
"| REN \"fname1\" \"fname2\"     | renames a file 'fname1' to 'fname2'
"| COPY \"fin\" [\"fin2\"] \"fout\"| copies a file 'fin' to 'fout' file
"|                            |  ['fin2' option merges 'fin' and 'fin2']  |
"| DEL \"fname\"               | deletes a file
"| DIR \"[mask]\"              | displays a list of files in the directory
"| FORMAT [label [/FAT32]]    | formats Flash Memory Card                 |
"|                            | [/FAT32 option selects FAT32 file system] |
"| HELP  or  ?                | displays this help                        |
"+----------------------------+-------------------------------------------+
```

Chapter 3 Software development and examples

3.1 MDK Introduction

RealView MDK Development Suite is the latest software development tool released by ARM Corporation for ARM MCU embedded processors. It integrates the most advanced technology in this industry, including µVision3 IDE and RealView Compiler. RealView MDK supports ARM7、ARM9 and the latest Cortex-M3 Core Processor. It has a configuration wizard for startup code and integrates flash program module, powerful device simulation, performance analyzer and so on.

You can obtain MDK software from the CD released with EM-STM3210E Evaluation Board, or you can download the latest version from Keil website www.keil.com. Double click the installation file setup.exe; finish Keil uVision3 installation under the guidance of the installation wizard. The installation interface as follows:

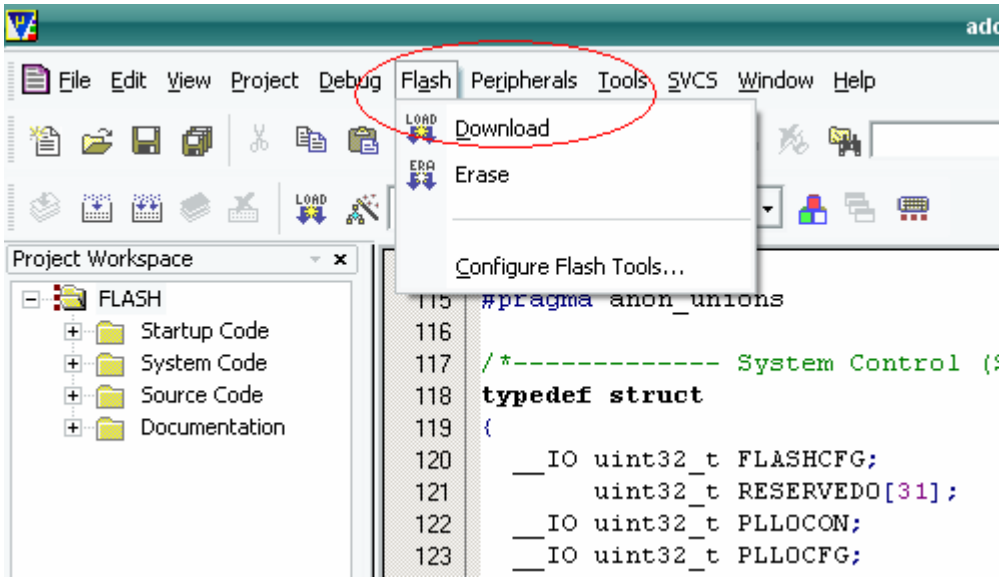


3.2 Example Operation

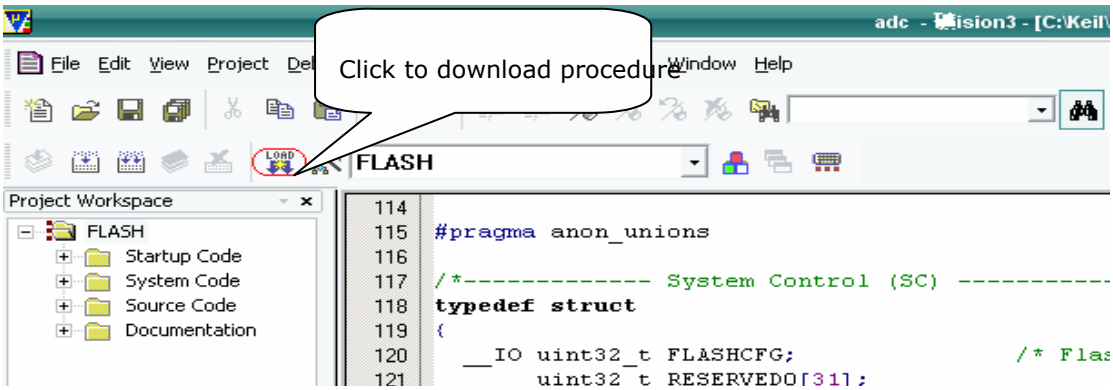
Example operation sequence（take ADC character display for example）

1) Open ADC folder, Enter ADC folder, double-click adc.Uv2 project file,then will open this project file.
2) Project file include StartUp Code（storage area of startup codes）, Source Code（storage area of main source program codes）, System Code（program library source files）and Documentation（program document description）folders.
3) Connecting the power line and emulator wire to the board (between ULINK2 and JTAG).

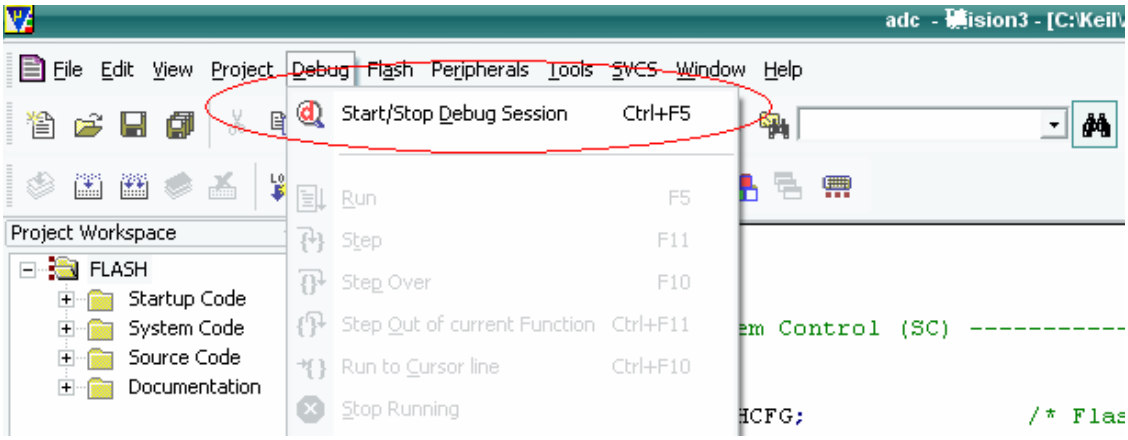
4) Click Flash/Download to download the image as follows:



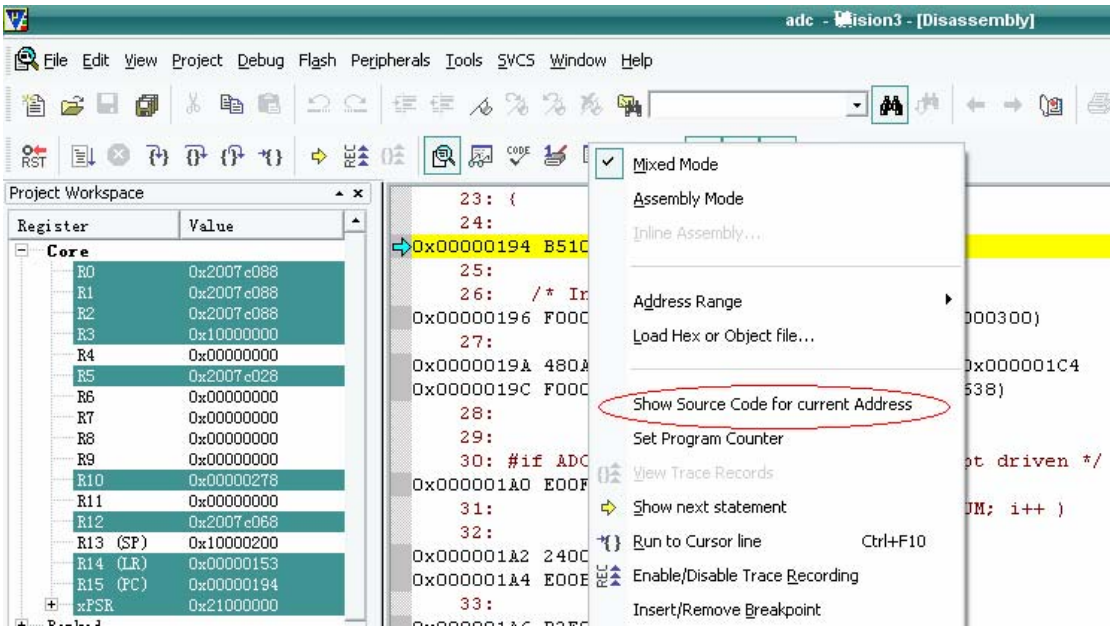
Or click the shortcut icon: to download the image.



5) After download, execute Debug/Start/Stop Debug Session(Ctrl+F5) to debug as follows:

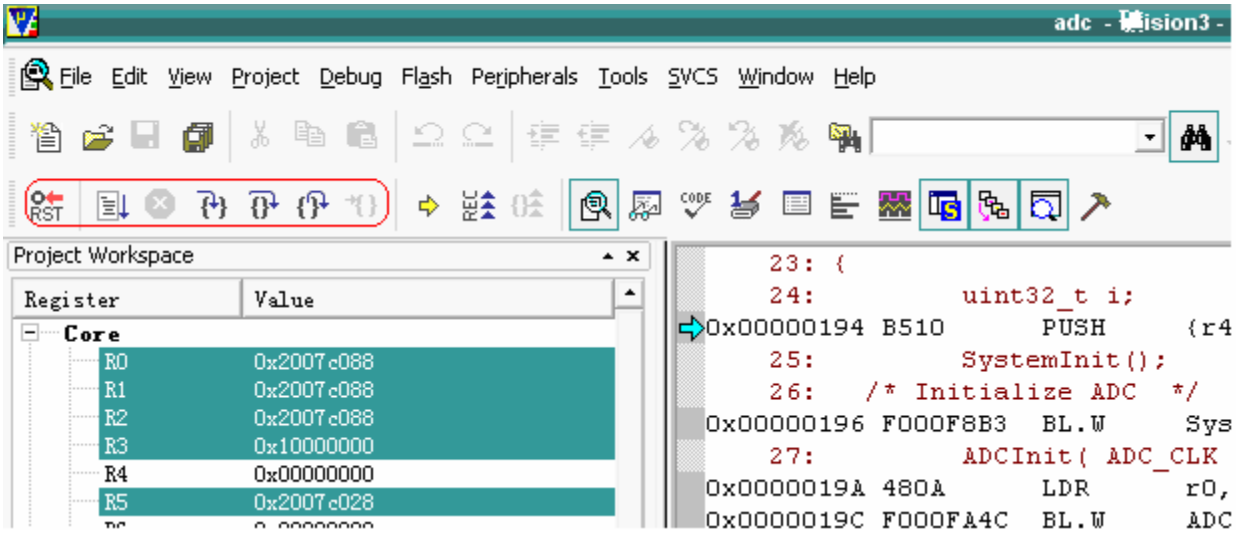


or click shortcut con:  to start debug. After that, assembly code will show in the main workspace, if you want to see source code, you can right click mouse before Step, choose "Show Source Code for current Address" As follows:



source code will appear in the workspace.

6) You can make use of the debug shortcut icon in the window to execute debug process, the icon as follows:



Appendix A: IO Assignment on EM-LPC1700 Evaluation Board

TQFP100	Pin	Type	Level		IO Assignment
			Input	Output	
1	TD0/SW0	JTAG			JTAG
2	TDI	JTAG			JTAG
3	TMS/SWDIO	JTAG			JTAG
4	TRST	JTAG			JTAG
5	TCK/SWDCLK	JTAG			JTAG
6	P0.26	I/O			JP16(DAC_SPK)
7	P0.25	I/O			ADC
8	P0.24	I/O			I/O
9	P0.22	I/O			USB
10	VDDA		3.3V		3.3V
11	VSSA		GND		GND
12	VREFP		3.3V		3.3V
13	NC	NC			NC
14	RSTOUT	O			LCD
15	VREFN				GND
16	RTCX1				RTCXIN
17	RESET				RESET
18	RTCX2				RTCXOUT
19	VBAT	I/O			VBAT
20	P1.31	I/O			LED

21	P1.30	I/O			USB
22	XTAL1				XTALIN
23	XTAL2				XTALOUT
24	P0.28				USB
25	P0.27				USB
26	P3.26	I/O			I/O
27	P3.25	I/O			I/O
28	VDD(3V3)_3				3.3V
29	P0.29	I/O			USB
30	P0.30				USB
31	VSS_0				GND
32	P1.18				USB
33	P1.19				USB
34	P1.20	I/O			Joystick
35	P1.21	I/O			I/O
36	P1.22	I/O			USB
37	P1.23	I/O			Joystick
38	P1.24				Joystick
39	P1.25				Joystick
40	P1.26	I/O			Joystick
41	VSS_1				GND
42	VDD(REG)(3V3)_1				3.3V
43	P1.27	I/O			USB
44	P1.28	I/O			LED

45	P1.29	I/O			LED
46	P0.0	I/O			CAN
47	P0.1	I/O			CAN
48	P0.10	I/O			USB
49	P0.11	I/O			USB
50	P2.13	I/O			I/O
51	P2.12				I/O
52	P2.11				I/O
53	P2.10	I/O			EINT0
54	VDD(3V3)_2				3.3V
55	VSS_2				GND
56	P0.22	I/O			USB
57	P0.21	I/O			I/O
58	P0.20	I/O			I/O
59	P0.19	I/O			I/O
60	P0.18	I/O			MINI SD
61	P0.17				MINI SD
62	P0.15				MINI SD
63	P0.16	I/O			MINI SD
64	P2.9	I/O			USB
65	P2.8	I/O			CAN
66	P2.7	I/O			CAN
67	P2.6	I/O			LED
68	P2.5	I/O			LED

69	P2.4	I/O			LED
70	P2.3	I/O			LED
71	VDD(3V3)_1		3.3V		3.3V
72	VSS_3		GND		GND
73	P2.2	I/O			LED
74	P2.1	I/O			RXD1
75	P2.0	I/O			TXD1
76	P0.9	I/O			LCD
77	P0.8	I/O			LCD
78	P0.7	I/O			LCD
79	P0.6	I/O			LCD
80	P0.5	I/O			LCD
81	P0.4	I/O			I/O
82	P4.28	I/O			LCD
83	VSS_4				GND
84	VDD(REG)(3V3)0				3.3V
85	P4.29	I/O			MINI SD
86	P1.17	I/O			Ethernet
87	P1.16	I/O			Ethernet
88	P1.15	I/O			Ethernet
89	P1.14	I/O			Ethernet
90	P1.10	I/O			Ethernet
91	P1.9	I/O			Ethernet
92	P1.8	I/O			Ethernet

93	P1.4	I/O			Ethernet
94	P1.1				Ethernet
95	P1.0				Ethernet
96	VDD(3V3)_0				3.3V
97	VSS_5				GND
98	P0.2	I/O			UART0
99	P0.3	I/O			UART0
100	RTCK	JTAG			JTAG_RTCK

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