STM32F103ZE ARM-CM3 Board
User Manual
V1.0

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Chapter 1 Overview

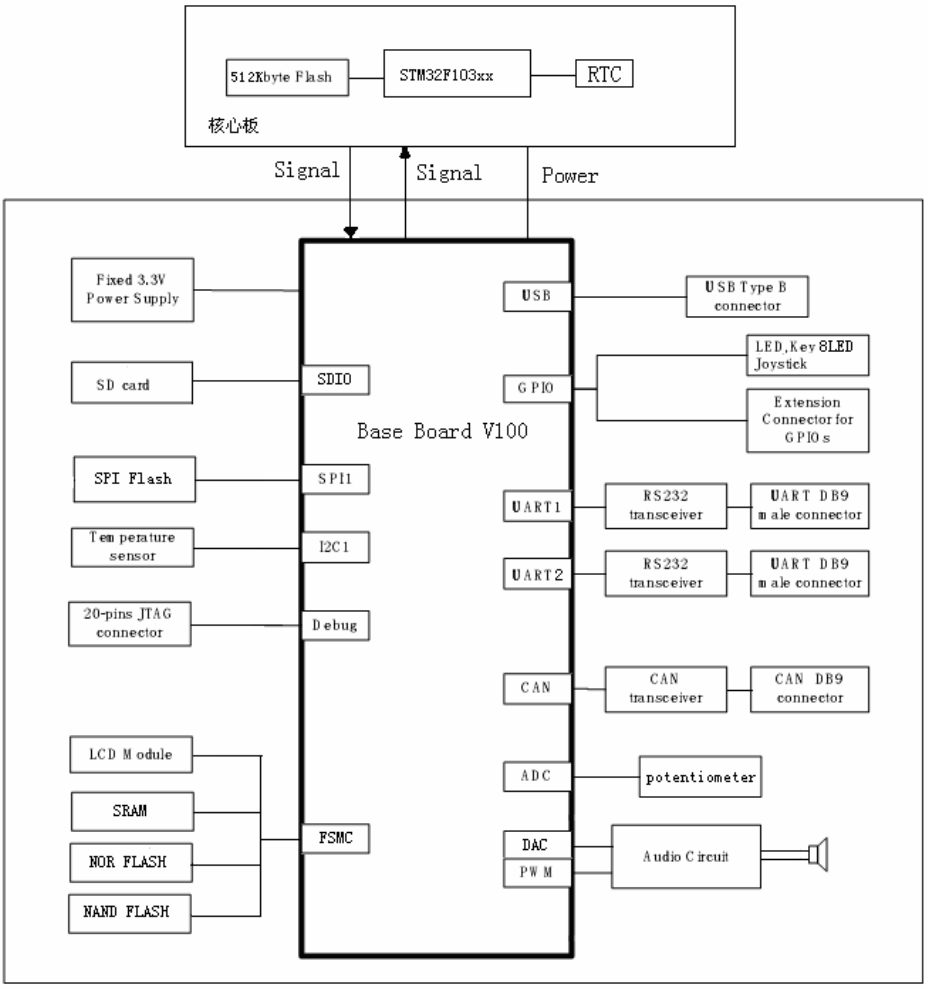
The STM32F103ZE is an ARM embedded evaluation board produced by Embest, integrate the STMicroelectronic ARM Cortex-M3 core-based processor STM32F103ZE, operating at a 72 MHz frequency, with 512KB Flash memory and 64KB SRAM. The board features USB, CAN, SD Card interface, TFT-LCD, RS232 serial interface, four 26-pin user extended interface, etc. Plenty of software examples, which can be used in Keil MDK environment, are accompanied in CDROM.

Features:

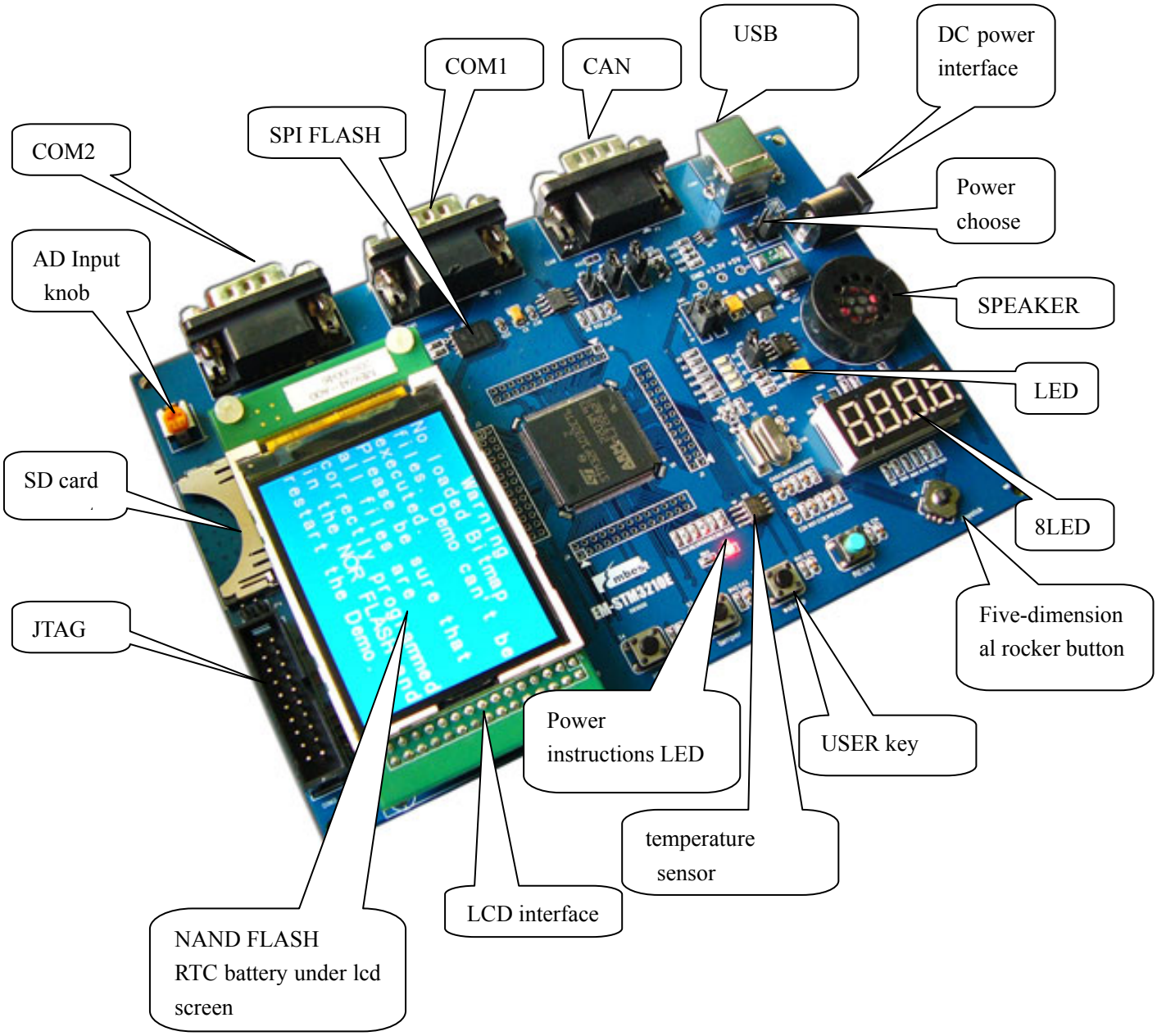
- Processor：STM32F103ZE，Frequency：72MHz
- 2MB NOR FLASH
- 128KB SRAM
- 128MB NAND FLASH
- 8M byte SPI Flash
- RTC(Including back-up battery)
- Start jumper settings
- Optional two-way power：5VDC and USB
- an SD memory card interface
- TFT-LCD interface
- A temperature sensor
- An audio DAC output
- 20Pin JTAG debug interface
- Two RS232 serial port
- A USB Device interface
- A rocker handle with four functions to control the direction
- Four keys with functions: Reset, Wakeup, Temper and User button four Led lights
- Four LED lighter
- Four 8-LED output
- a CAN bus interface which lead by the DB9 interface
- a AD input
- Four user's interface with 26Pin

Chapter 2 Hardware Introduction

2.0 STM32F103ZE function module



2.1 Interface overview



Peripherals	Description
CN1	Power JACK
P1	UART1 / Male DB9 COM2
P2	UART1 / Male DB9 COM1
P3	CAN / Male DB9
S1	RESET KEY
S2	WAKEUP KEY
S3	TAMPER KEY
S4	USER KEY

CON1	USB Device(B)Interface
CON2	SD Card Interface
CON3	JTAG Interface
CON5	FSMC LCD Interface
J1	break-out pads 1
J2	break-out pads 2
J3	break-out pads 3
J4	break-out pads 4
U3	NAND FLASH
U4	SPI FLASH
U5	NOR FLASH
U6	SRAM
U8	JOYSTICK

2.2 Jumper List

No. jumper	description	Set options	Setting description
JP1	USB related	1-2	Disconnect the USB signal connection
		2-3	connect the USB signal connection
JP2	CAN related	1-2	CAN work in the high-speed mode
		2-3	CAN work in the Standby mode
JP3	CAN related	Short access	CAN load
JP4	Debug related	Short access	Connect the TRST line of the Rest and the debug port

		Cut Off	Not connect the TRST line of the Rest and the debug port
JP5	Power supply options (Note: only one of the group can be short access)	1-2	Choose USB power supply
		3-4	Choose Power Jack DC power supply
JP6	DAC related	Short access	To connect the DAC output and SPEAKER
		disconnection	To disconnect the DAC output and SPEAKER

2.3 Power

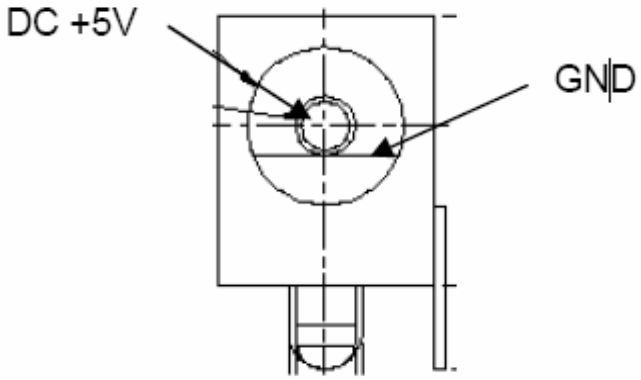
STM32F103ZE Board has two power supplies; you can choose one of the following ways to supply power through JP5:

(1) Through the motherboard power CN1 supply 5V DC.

(2) Through the motherboard USB port (CON1) supply power, the power current is less than 500mA.

The DC5V on the motherboard input (CN1) signal is negative, as follows:

The outside signal of DC5V input side (CN1) is negative, the inside is the opposite, please see the following figure:



2.4 Start selection

STM32F103ZE Board can get started thought following three ways:

■ Start from the user's flash memory

■ Start from the system memory

■ Start from the embedded SRAM

Setting the sub-panel DIP switches (SW1 and SW2) to select the start-up mode

SW1	SW2	Start-up mode
x	0	Start from the user's flash memory

0	1	Start from the system memory
1	1	Start from the embedded SRAM

2.5 Clock source

STM32F103ZE evaluation board has two clock sources:
■ 32KHz as the RTC clock source
■ 8MHz as the MCU clock source

2.6 Reset

STM32F103ZE evaluation board has two ways to reset:
■ Use the reset button (s1) on Evaluation Board
■ If short connected JP4, then use the JTAG debug port to reset

2.7 Audio

STM32F103ZE Board can play audio files through external Speaker. The JP6 is used to control the connection between DAC output and the Speaker.

2.8 Flash

STM32F103ZE evaluation board expanded 8MB of SPI flash. Through the SPI1 port, the chip election of this FLASH is controlled by PB2 port.

2.9 NAND Flash

STM32F103ZE evaluation board expanded 128MB of NAND Flash（For further details, see schematic）.

2.10 NOR Flash

STM32F103ZE evaluation board expanded 2MB of NOR Flash（For further details, see schematic）.

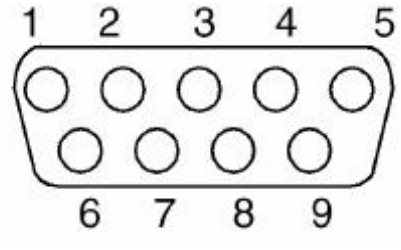
2.11 SRAM

STM32F103ZE evaluation board expanded 128KB of SRAM（For further details, see schematic）.

2.12 Serial port

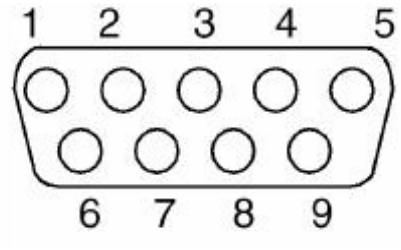
STM32F103ZE evaluation board has two UART: UART1 (COM1) and UART2 (COM2). Two serial ports are connected to the public DB9 connector. UART2 is support to the RTS / CTS handshake signals.

UART2 RS232 : the signal definition of Male DB9 connector：



Pin No.	Functional Description	Pin No.	Functional Description
1	NC	6	Connect to pin 4
2	UART2_RXD	7	UART2_RTS
3	UART2_TXD	8	UART2_CTS
4	Connect to pin 6	9	N C
5	GND		

UART1 RS232 : the signal definition of public DB9 connector：



Pin No.	Functional Description	Pin No.	Functional Description
1	NC	6	Connect to pin 4
2	UART1_RXD	7	Connect to pin 8
3	UART1_TXD	8	Connect to pin 7
4	Connect to pin 6	9	N C
5	GND		

2.13 SD Card Interface

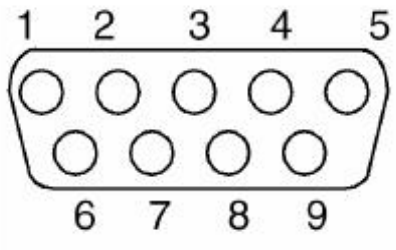
STM32F103ZE evaluation board integrates SD card interface, supports for read/write function of SD cards. Their connection signals are as follows.

Pin No.	SD card interface signal	Functional Description	The counterpart of STM32 pin
1	CD/DAT3	SD_DAT3	PC11
2	CMD	SD_CMD	PD2
3	VSS1		GND
4	VDD		+3V3
5	CLK	SD_CLK	PC12

6	VSS2		GND
7	DAT0	SD_DAT0	PC8
8	DAT1	SD_DAT1	PC9
9	DAT2	SD_DAT2	PC10
10	WP		NC
11	NCD	SD_NCD	PF11
12	PAD1		GND
13	PAD2		GND

2.14 CAN Interface

The STM32F103ZE board uses SN65HVD230 (U10) as CAN driver. CAN interface uses a DB9 connector, in which pin 2 provides CANL signal and pin 7 provides CANH signal. These pins connect to the driver chip of SN65HVD230 CAN.



The definition of CAN DB9 connector：

Pin No.	**Functional Description**	**Pin No.**	**Functional Description**
1 ,4,8,9	NC	7	CANH
2	CANL	3,5,6	GND

2.15 Temperature Senior

The STLM75M2E temperature sensors of I2C interface is connected to the I2C1 interface (at STM32F103ZE development board). Two separately N-channel enhanced MOS-FET is used for the levels conversion, making the different voltage devices can access to the same I2C bus.

2.16 USB

STM32F103ZE supports for USB2.0，through the USB B-type interface it can do the USB full-speed communication. Meanwhile, through this USB interface, we can provide 5V DC (500mA current limited) for the board.

2.17 Debug Interface

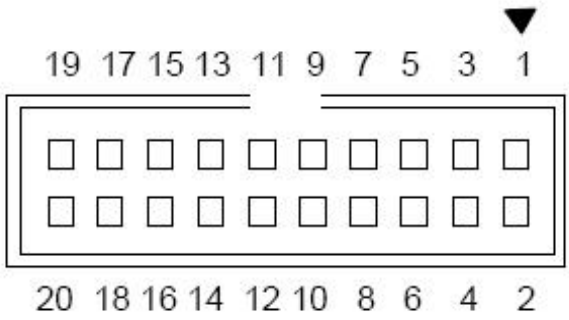
STM32F103ZE evaluation board has two debug interfaces:

■ CON3: the standard 20-pin JTAG debug interface;

■ 7 pin（SWDIO），9 pin（SWCLK）are used for SWD debug interface in CON3，and support the new ARM

Cortex-M3 serial debug.

The definition of JTAG debug interface as follows:



Pin No.	Functional Description	Pin No.	Functional Description
1	3.3V	2	3.3V
3	TRST	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	RTCK	12	GND
13	TDO	14	GND
15	RESET	16	GND
17	DBGRQ	18	GND
19	DBGACK	20	GND

2.18 LCD Interface

Color TFT LCD

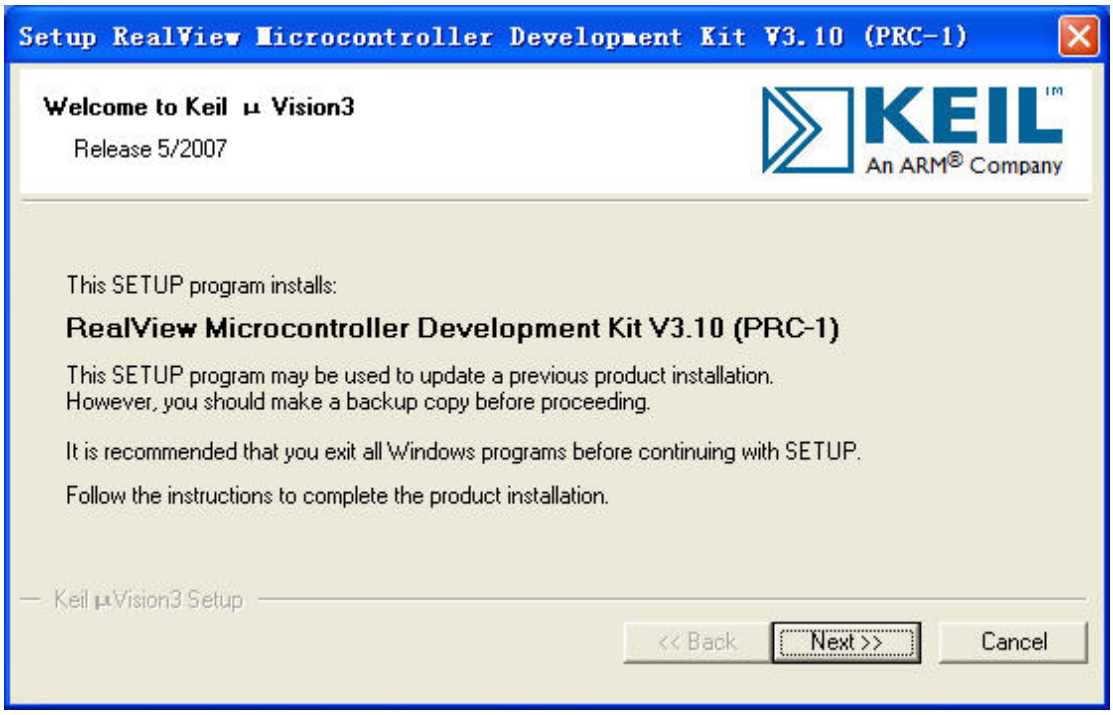
Pin No.	Functional Description	I /O port
1	CS	PG12
2	RS	PF0
3	WR/SCL	PD5
4	RD	PD4
5	RESET	RESET
22	BL_GND	GND
23	BL_Control	+3V3
24	VDD	+3V3
25	VC1	+3V3
26	GND	GND
27	GND	GND
28	BL_VDD	+3V3
29	SDO	NC
30	SDI	NC

Chapter 3 Software development and relevant program examples

3.1 MDK introduction

RealView MDK Development Suite is the latest software development tool of ARM Limited Corporation for all kinds of 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 STM32F103ZE 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 Introduction

STM32F103ZE Evaluation Board has provided abundant examples; they can be compiled and run in Keil uVision3 directly.

Experiment Name	Function Description
8LED	Control the 8 Nixie tubes through GPIO.
ADC	When the conversion value of ADC CHANNEL14 beyond the simulative watchdog's upper limit or lower limit, it will enter into AWD interrupt and control LED1 in interrupt processing function.
AUDIO	The program writes the audio file (wave format) into SPI

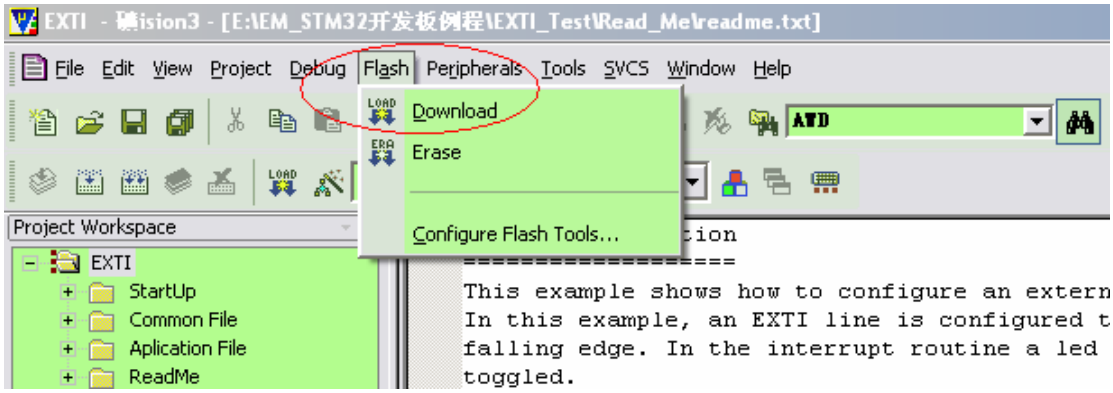
	Flash, reads the audio file from SPI Flash and output it through SPEAKER.
BKP	Read or write the backup register, check if it is correct or not, and trigger the relevant LED at the same time.
CAN	In experiment, CAN communication works in loopback mode, transmit or receive a group data at the speed of 100Kb/s, and when the speed reaches to 500Kb/s, it will transmit or receive data using interrupt mode. This implements the CAN interface's self-check function.
CortexM3	The program demonstrates how to use CortexM3's bit management to execute read, write and the variable control of reading SRAM.
CRC	Generate CRC error-detecting code through CRC module.
DAC	Implement DA conversion through DAC module
DEBUG	The program simulates the condition when the fault parameter is transmitted, the fault source will be printed in USART1 and LCD, and it implements the debug simulation function.
DMA	The program demonstrates how to transmit a group data with DMA channel (from FLASH memory to RAM memory) and the transmission state.
EXTI	This program shows how to configure an interrupt line to get an interrupt and trigger the interrupt processing program.
FLASH	Implement the Erase, Read and Write operation on Flash's definite address, and checkout the written data, lastly read it to FLASH and print it through USART1 and LCD.
GPIO	This program has set a variety of ways to control GPIO, it also simulates the transport control line which is used to control JTAG by kernel, it will disconnect the JTAG when trigger an external interrupt.
IWDG	Using SYSTICK interrupt to reload IWDG counter (every time 350MS).
LCD	Control LCD to show chars and colorful picture through FSMC interface.
NandFlash	Implement the read and write operation to NandFlash through FSMC, and the result of operation is shown by LED, USART1 and LCD.
NorFlash	Implement the read and write operation of external NorFlash through FSMC, and the result of operation is shown by LED, USART1 and LCD.
NVIC	Nested Vector Interrupt Control, it links with three clocks, and trigger the LED using interrupt.
PWR	Control system into STOP mode, and system woke up by EXTI interrupt.
RCC	This program demonstrates how to configure the clocks of all kinds of interface using chip clock's manage function, and it

	implements the switch automatically between internal clock and external clock.
RTC	Use for clock manage, when startup, if it has not set clock's time, it will have a tip to set time, then it can show time, and the clock's time can hold when power down because of on board battery.
SDIO	Implement read and write operation of SD card through SDIO.
SPI	SPI mode can control the read and write operation on M25P64 FLASH.
SRAM	Implement the read and write operation of external SRAM through FSMC, and the result of operation is shown by LED、USART1 and LCD.
SYSTICK	It shows how to configure SYSTICK to get 1ms output.
TIM1	Through configuration, it can output clock waveform with different duty cycle.
TIM	Configure the clock function, output different frequency value, trigger four LEDs respectively.
Tsensor	Get temperature data through hyper sensitivity digital temperature sensor, the result shows by USART1 and LCD, it gathers the real-time temperature data.
USART	Communicate with PC through crossover serial port line (115200b/s).
USB（JoyStickMouse）	Communicate with PC through USB protocol; it can control the position of the mouse in screen by direction keys in rocker key-press.
USB（Mass_Storage）	Implement the conversion between USB data and SD card storage interface through USB interface, after plug SD card and the board is power on, the PC system can identify the storage device automatically, then we can read and write the files.
USB（Virtual Com）	This program demonstrates the virtual COM port through USB port, users can output data through normal COM 1 (or 0), and this data can be shown by virtual COM port (but it need to configure the drive program of virtual COM port before experiment).
USB（Device_Firmware_Upgrade）	Download this program to FLASH (after update the drive program), it will add a USB hardware device in PC, then we can control this device through the software in PC.
WWDG	This program demonstrates how to set and update the count value of watchdog counter, when this value is 0 it will trigger the corresponding interrupt.

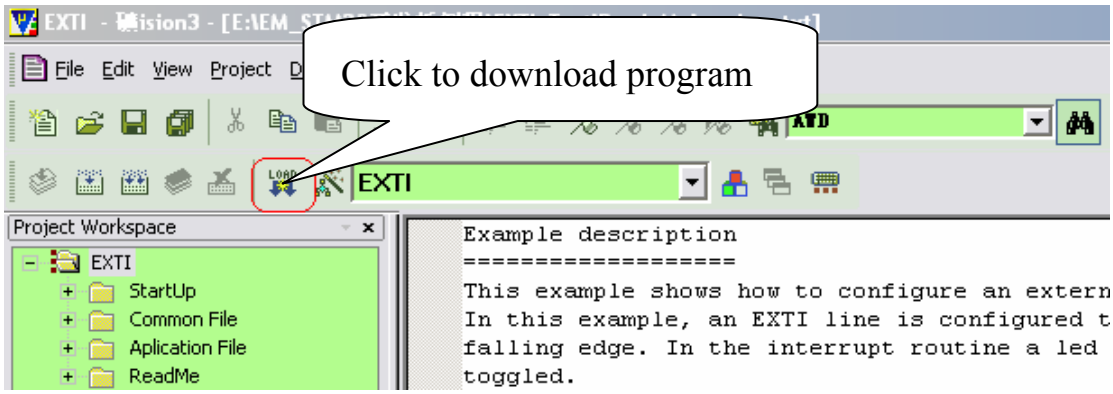
3.3 Example Operation

Operating sequence of one program（take the case of EXTI_Test）

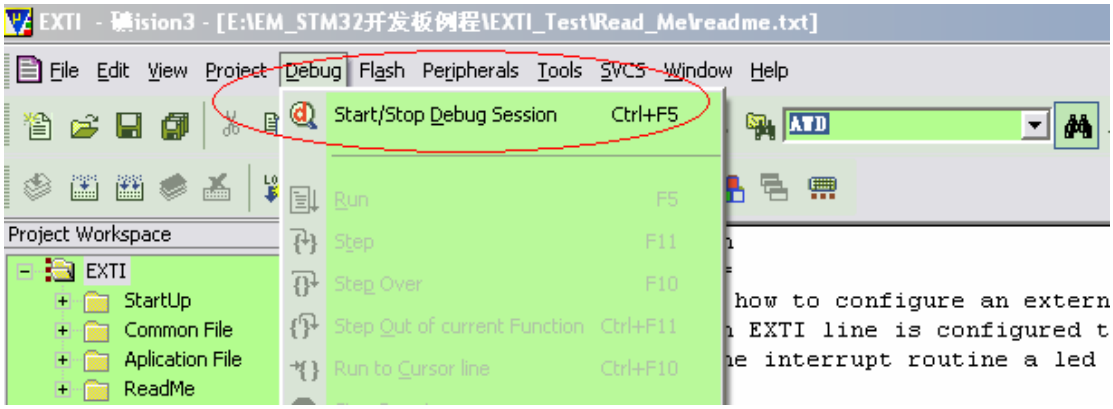
1. Open EXTI_Test folder（There are 6 files：Project - store project files，Inc- store head files，Src- store source files，Listing- store link files，Run_In_Flash- store compile files，Read_Me- store document description），Enter into Project folder, double-click EXTI.Uv2 project file， then will open this project file。
2. This project file includes StartUp（storage area of startup codes）,Application File（storage area of main source program codes）,Common File（source program's files library）,ReadMe（the program's document description）folders。
3. Link the power line and emulator line (between ULINK2 and JTAG）
4. Click Flash/Download to download the program：as follows:



Or click this shortcut icon：



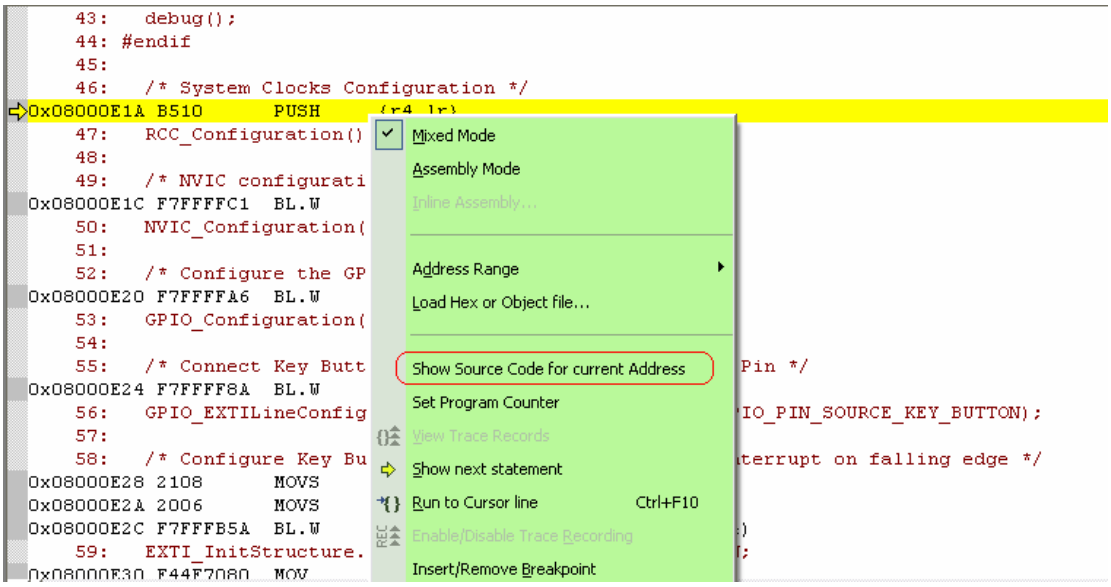
5. After download, execute Debug/Start/Stop Debug Session(Ctrl+F5) to have a debug，as follows：



Or shortcut icon：  to enter into debug。

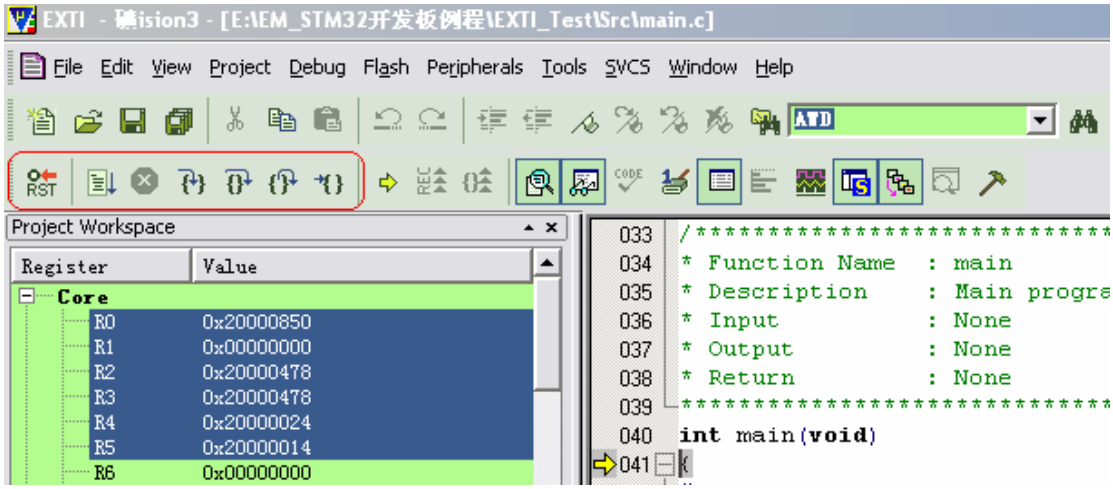
After click, the main displaying area will show assembly code, if you want to see source codes, you can

right click mouse before Step, choose “Show Source Code for current Address”. As follows：



There will show source codes。

6． We can make use of the shortcut debug icon in window execute the Debug process, the icon as follows：



Appendix A: The IO Distribution of STM32F103ZE Evaluation Board

TQFP100	Pins	Type	Level		The IO assign of STM32F103ZE Evaluation Board
			Input	Output	
1	PE2	I/O			A23
2	PE3	I/O			A19
3	PE4	I/O			A20
4	PE5	I/O			A21
5	PE6	I/O			A22
6	VBAT	Input			VBAT
7	PC13	I/O			Tamper Button
8	PC14	I/O			X1(OSC32_IN)
9	PC15	I/O			X1(OSC32_OUT)
10	PF0	I/O			A0
11	PF1	I/O			A1
12	PF2	I/O			A2
13	PF3	I/O			A3
14	PF4	I/O			A4
15	PF5	I/O			A5
16	VSS5				GND
17	VDD5				+3V3
18	PF6	I/O			LED1
19	PF7	I/O			LED2
20	PF8	I/O			LED3
21	PF9	I/O			LED4
22	PF10	I/O			PF10
23	OSC_IN				OSC_IN
24	OSC_OUT				OSC_OUT
25	NRST	Input			RESET Button
26	PC0	I/O			PC0
27	PC1	I/O			PC1
28	PC2	I/O			PC2
29	PC3	I/O			PC3
30	VSSA				GND
31	VREF-				GND
32	VREF+				+3V3
33	VDDA				+3V3
34	PA0/WKUP	I/O			WAKEUP
35	PA1	I/O			PA1

36	PA2	I/O			TXD2
37	PA3	I/O			RXD2
38	VSS4				GND
39	VDD4				+3V3
40	PA4	I/O			DAC_OUT1
41	PA5	I/O			SPI1_CLK
42	PA6	I/O			SPI1_MISO
43	PA7	I/O			SPI1_MOSI
44	PC4	I/O			PC4
45	PC5	I/O			PC5
46	PB0	I/O			PB0
47	PB1	I/O			PB1
48	PB2	I/O			SPI1_CS
49	PF11	I/O			SD_NCD
50	PF12	I/O			A6
51	VSS6				GND
52	VDD6				+3V3
53	PF13	I/O			A7
54	PF14	I/O			A8
55	PF15	I/O			A9
56	PG0	I/O			A10
57	PG1	I/O			A11
58	PE7	I/O			D4
59	PE8	I/O			D5
60	PE9	I/O			D6
61	VSS7				GND
62	VDD7				+3V3
63	PE10	I/O			D7
64	PE11	I/O			D8
65	PE12	I/O			D9
66	PE13	I/O			D10
67	PE14	I/O			D11
68	PE15	I/O			D12
69	PB10	I/O			PB10
70	PB11	I/O			PB11
71	VSS1				GND
72	VDD1				+3V3
73	PB12	I/O			PB12
74	PB13	I/O			PB13
75	PB14	I/O			USB_DIS
76	PB15	I/O			PB15
77	PD8	I/O			D13
78	PD9	I/O			D14
79	PD10	I/O			D15
80	PD11	I/O			A16

81	PD12	I/O			A17
82	PD13	I/O			A18
83	VSS8				GND
84	VDD8				+3V3
85	PD14	I/O			D0
86	PD15	I/O			D1
87	PG2	I/O			A12
88	PG3	I/O			A13
89	PG4	I/O			A14
90	PG5	I/O			A15
91	PG6	I/O			FSMC_INT2
92	PG7	I/O			JOY_SEL
93	PG8	I/O			USER
94	VSS9				GND
95	VDD9				+3V3
96	PC6	I/O			PC6
97	PC7	I/O			PC7
98	PC8	I/O			SD_DATA0
99	PC9	I/O			SD_DATA1
100	PA8	I/O			BL_CN
101	PA9	I/O			TXD1
102	PA10	I/O			RXD1
103	PA11	I/O			USB_DM
104	PA12	I/O			USB_DP
105	PA13	I/O			TMS
106	NC				
107	VSS2				GND
108	VDD2				+3V3
109	PA14	I/O			TCK
110	PA15	I/O			TDI
111	PC10	I/O			SD_DATA2
112	PC11	I/O			SD_DATA3
113	PC12	I/O			SD_CLK
114	PD0	I/O			D2
115	PD1	I/O			D3
116	PD2	I/O			SD_CMD
117	PD3	I/O			JOY_DOWN
118	PD4	I/O			FSMC_NOE
119	PD5	I/O			FSMC_NWE
120	VSS10				GND
121	VDD10				+3V3
122	PD6	I/O			FSMC_NWAIT
123	PD7	I/O			FSMC_NCE2
124	PG9	I/O			FSMC_NE2
125	PG10	I/O			FSMC_NE3

126	PG11	I/O			PG11
127	PG12	I/O			FSMC_NE4
128	PG13	I/O			JOY_RIGHT
129	PG14	I/O			JOY_LEFT
130	VSS11				GND
131	VDD11				+3V3
132	PG15	I/O			JOY_UP
133	PB3	I/O			TDO
134	PB4	I/O			TRST
135	PB5	I/O			TEMP_INT
136	PB6	I/O			TEMP_SCL
137	PB7	I/O			TEMP_SDA
138	BOOT0				SW1
139	PB8	I/O			CAN_RX
140	PB9	I/O			CAN_TX
141	PE0	I/O			FSMC_NBL0
142	PE1	I/O			FSMC_NBL1
143	VSS3				GND
144	VDD3				+3V3

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