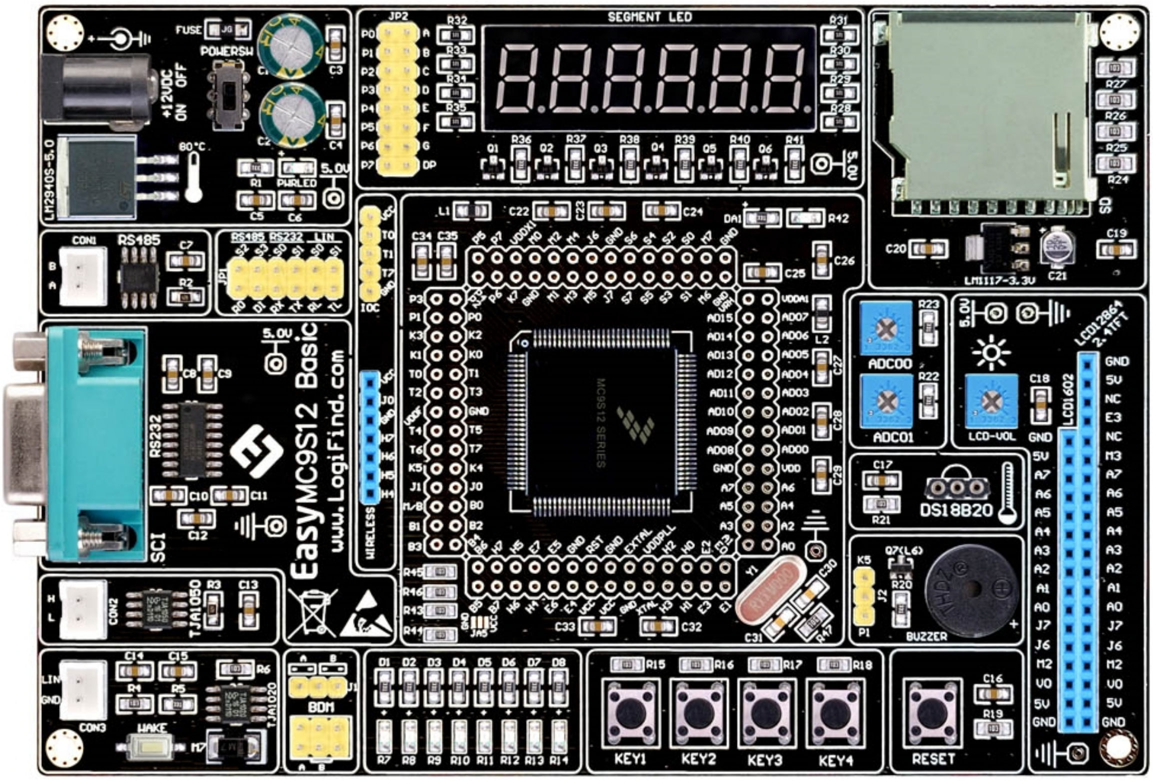

easyMC9S12 Basic
User Manual
For
MC9S12XS Series MCU

Rev 1.0

Date：2019.11.11

Editor：Jeff

To our valued customers

I want to express my thanks to you for being interested in our products and for having confidence in **LogiFind Tech CO., Ltd**. The primary aim of our company is to design and produce high quality electronic products and to constantly improve the performance thereof in order to better suit your needs.

Please share your thoughts and feelings regarding our operation so that we can serve you better in the future. I thank you for your continued support and patronage.
Your Dream is our Destination!

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Sincerely,

Jeff·W

Owner and General Manager
of LogiFind Tech CO., Ltd.

Contents

Chapter 1．About easyMC9S12 Basic

1.1 What is easyMC9S12 Basic

easyMC9S12 Basic development board is a multi-functional development platform based on Freescale (NXP) MC9S12 Series MCU. Especially for those who want to get started with automotive electronics, this is an excellent development platform. The hardware resources of the development board are rich and the layout is clear. It has many common modules on this board like CAN,LIN,SD card,LCD Socket,Segment LED display,Keys,Buzzer,RS232,RS485,1-Wire DS18B20 and LEDs.And we provide over 60 sample sources for these modules.It will make it easier for you to master the MC9S12 series MCUs. This part will briefly introduce the functions of easymc9s12 basic development board, so that users can quickly understand the functions of the development board.

1.2 What's on easyMC9S12 Basic

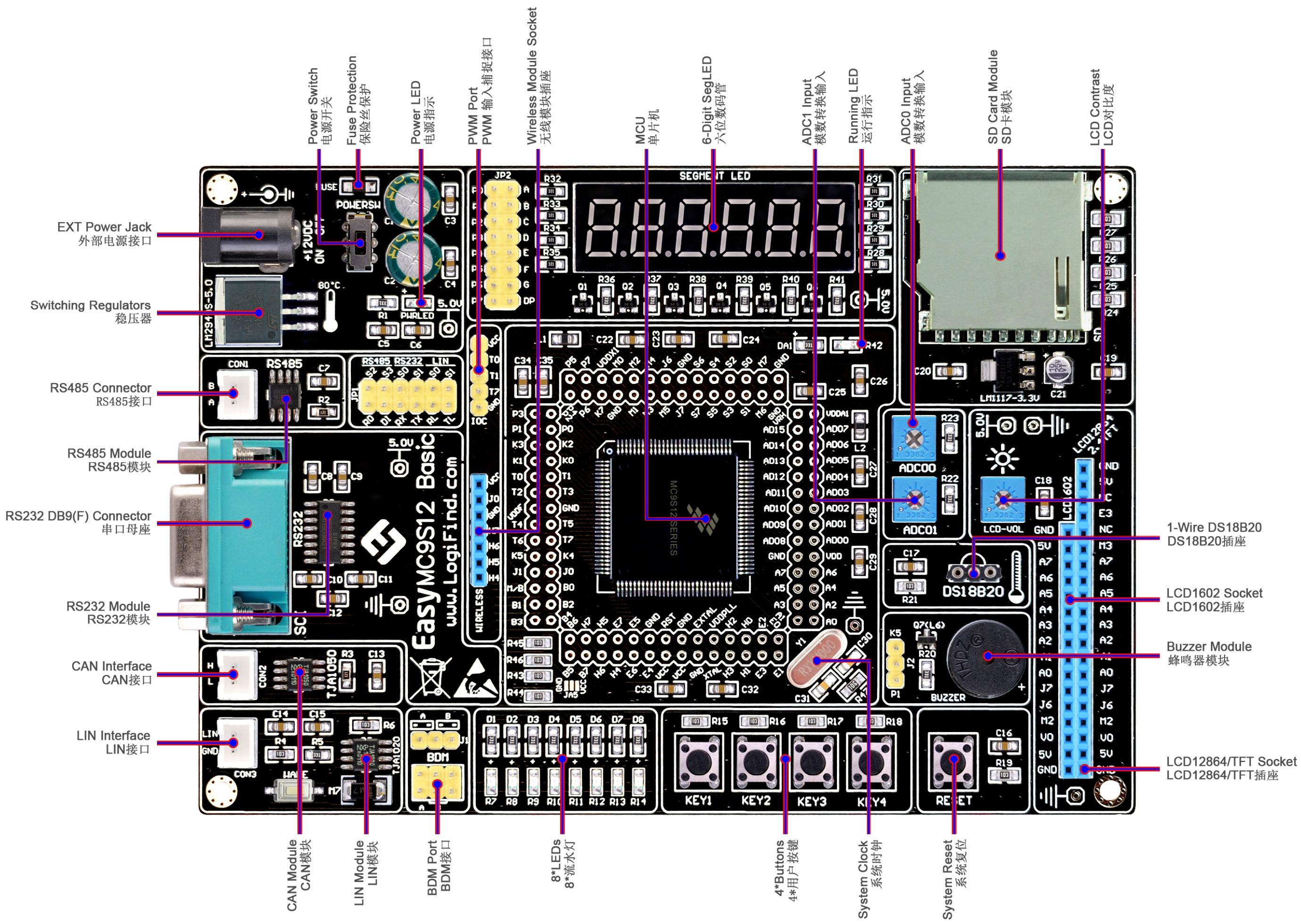

Figure 1-1 easyMC9S12 Basic Hardware Resources

1.3 Features

The easyMC9S12 Basic development board has the following functional modules:

●Power Circuit Supply：external DC12V input,On-board +5V regulator,On-board +3.3V regulator.
●LED： 8 User LED Indicators.
●Button：4 User Push Button Switches.
●Sound：1 Buzzer.
●SCI：1 RS-232 Serial Data Physical Layer Transceiver
●LIN Bus：Enhanced TJA1020 LIN Physical Layer Transceiver
●CAN Bus：1 High-Speed TJA1050 CAN Physical Layer Transceiver
●485 Bus：1 SP485 Module.
●AD：2 AD input AD00 and AD01.
●TIM：Timer inside.
●PWM：PWM output.
●IIC interface.
●SPI interface.
●Socket for Wireless.
●6-digit LED Display module.
●Socket for LCD12864 Display Module.
●Socket for LCD1602 Display Module.
●Socket for 2.4” 240*320TFT Display module.
●Socket for DS18B20 temperature sensor.
●Socket for SD card.
●BDM header for external BDM cable support.
●MC9S12 small system.

1.4 Power Supply Requirement

Connecting the external DC12V is the only way to power the development board.

1.5 Programmer/Debugger Requirement

An external programmer/Debugger is required to download code to the MCU on the board.It supports many Programmer/Debuggers like USBDM etc.

Chapter 2．Installing CodeWarrior

SYSTEM REQUIREMENTS

Hardware	PC with 1 GHz Intel® Pentium®-compatible processor 512 MB of RAM (1 GB recommended) CD-ROM drive Depending on host-target connection: Parallel Port, 9-pin Serial Port, or USB Port
Operating System	Microsoft® Windows® 2000 or Windows® XP
Disk Space	2 GB total 1.7 GB on Windows system disk

Figure 2-1 System requirement

Double click on the “CW_HC12_v5.1_SPECIAL.exe” file in the CD ROM and start to install.The installation method is very simple and will not be described here.

Chapter3．Create a New Project

1. In your PC,click on “Start>All>Freescale CodeWarrior> CodeWarrior development studio for S12(X) V5.1>CodeWarriorIDE” to run the CodeWarrior IDE or directly Run it with the shortcut created.

2.Choose **“File > New Project”** to create a new project from a stationery - the **HC(S)12(X) Microcontrollers New Project** wizard screen appears.

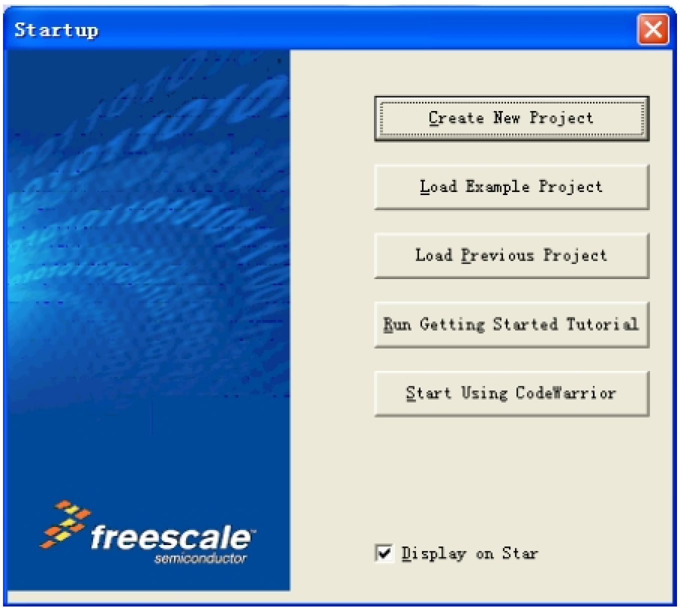

Figure 3-1

3.In the tree navigate to the family and select derivative, for example **HCS12X> HCS12XS Family > MC9S12XS128**.(Take **MC9S12XS128** for example) As shown as the **Figure 3-2** and **Figure 3-3.**

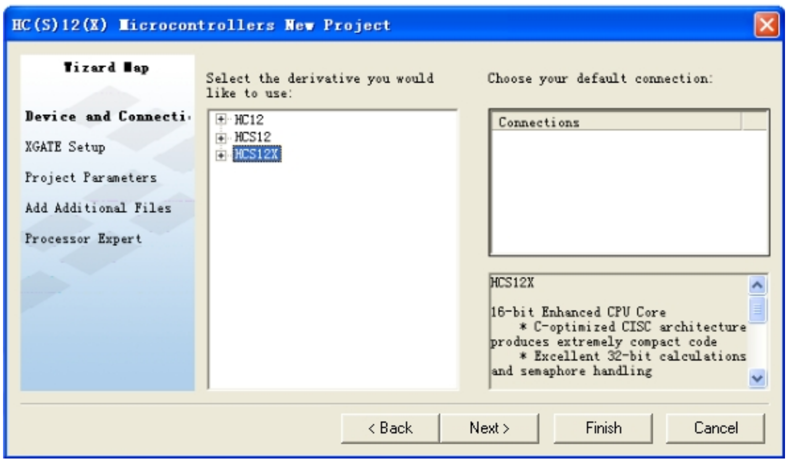

Figure 3-2 HC(S) 12(X) Microcontrollers New Project Screen

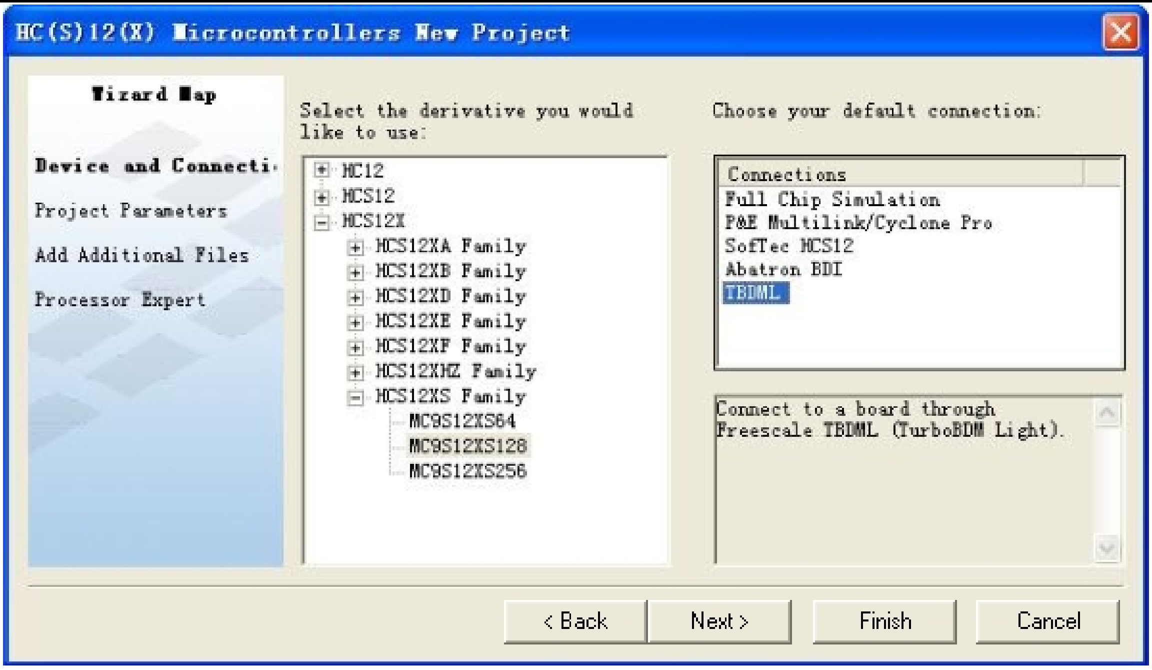

Figure 3-3 HC(S) 12(X) Microcontrollers New Project Screen

4.Select the connection by clicking on the appropriate connection,we select TBDML here.

5.Click **"Next"** to continue. The **Project Parameters** screen appears.

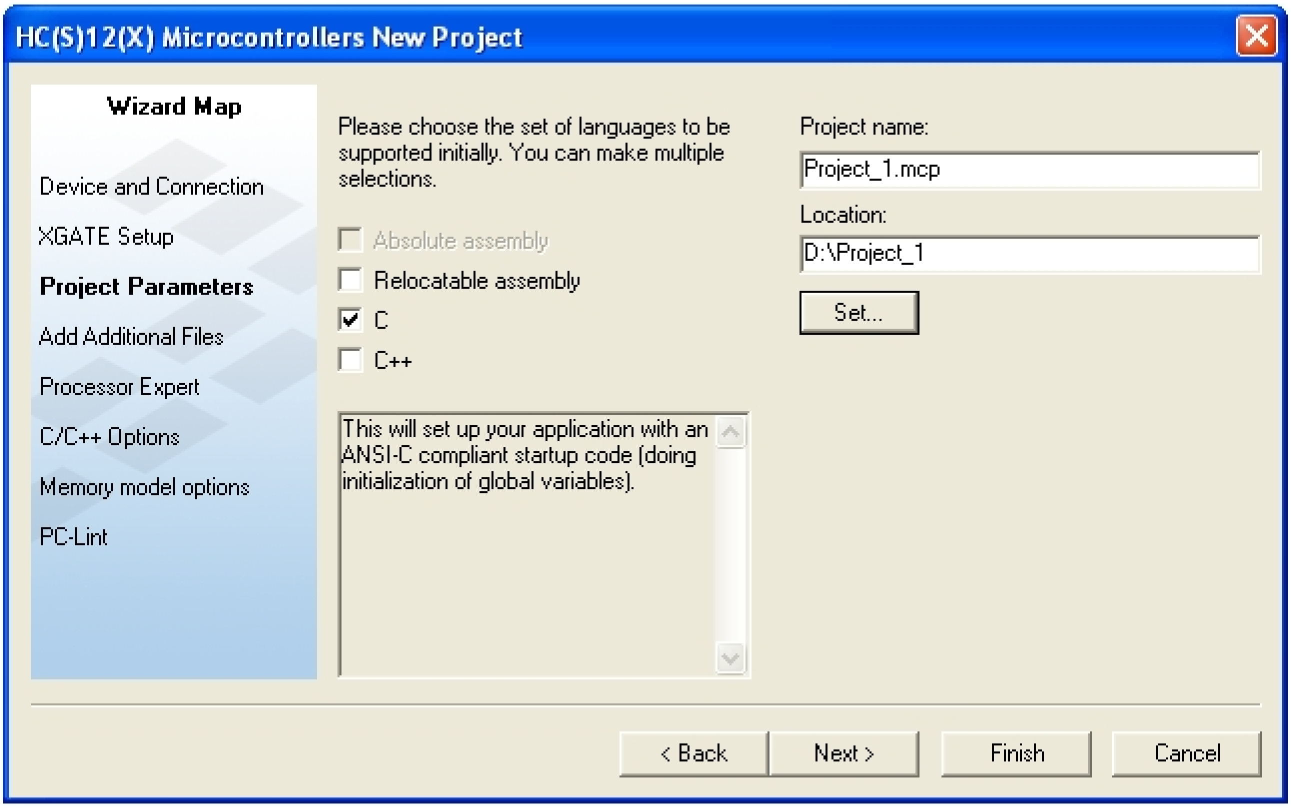

Figure 3-4

6.Select the language format by checking its checkbox. As shown as **Figure 3-4**.

7.In the **Project name** textbox, type the name of your new project. As shown as **Figure 3-4**.

8.Click **"Next"** to continue. The **Add Additional Files** screen appears. As shown as **Figure 3-5**.

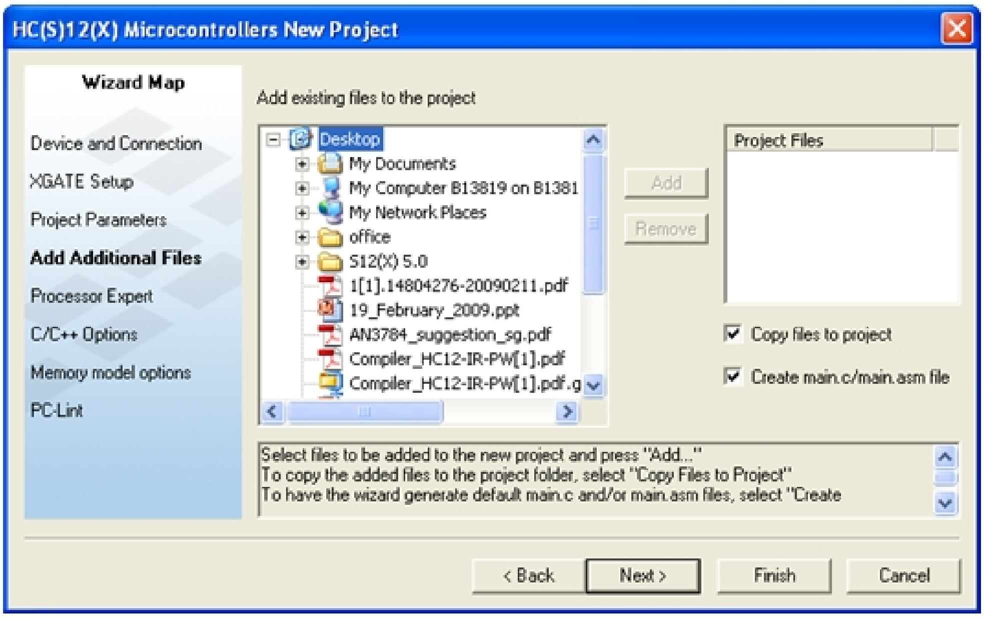

Figure 3-5 Add Additional Files Screen

9.Select files to be added to the new project and click **Add** button. You can also ignore this step and click **"Next"** to continue. As shown as **Figure 3-5**.

10. The **Processor Expert** screen appears. As shown as **Figure 3-6.**

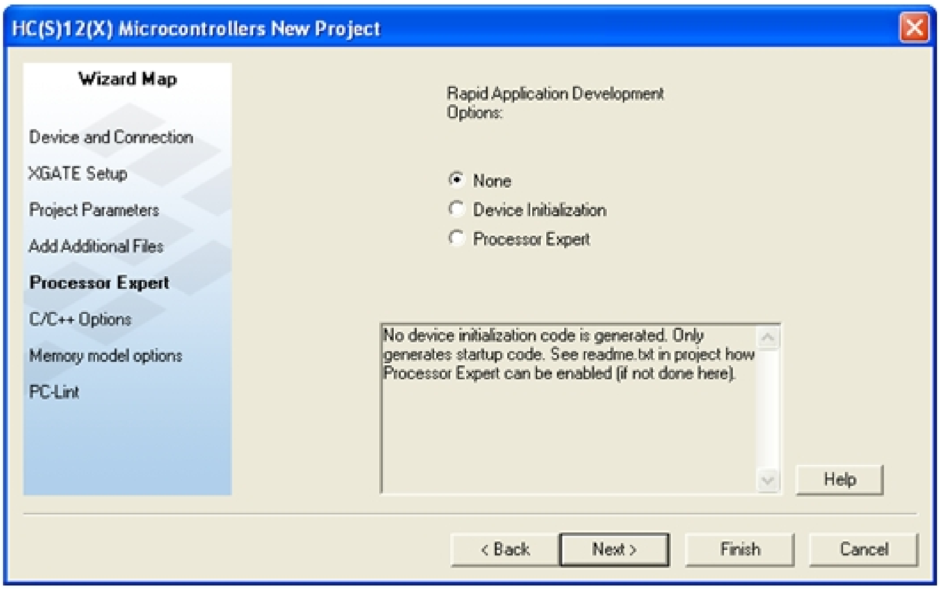

Figure 3-6 Processor Expert Screen

11.Click **"Next"** to continue. The **C/C++ Options** screen appears. As shown as **Figure 3-7**.

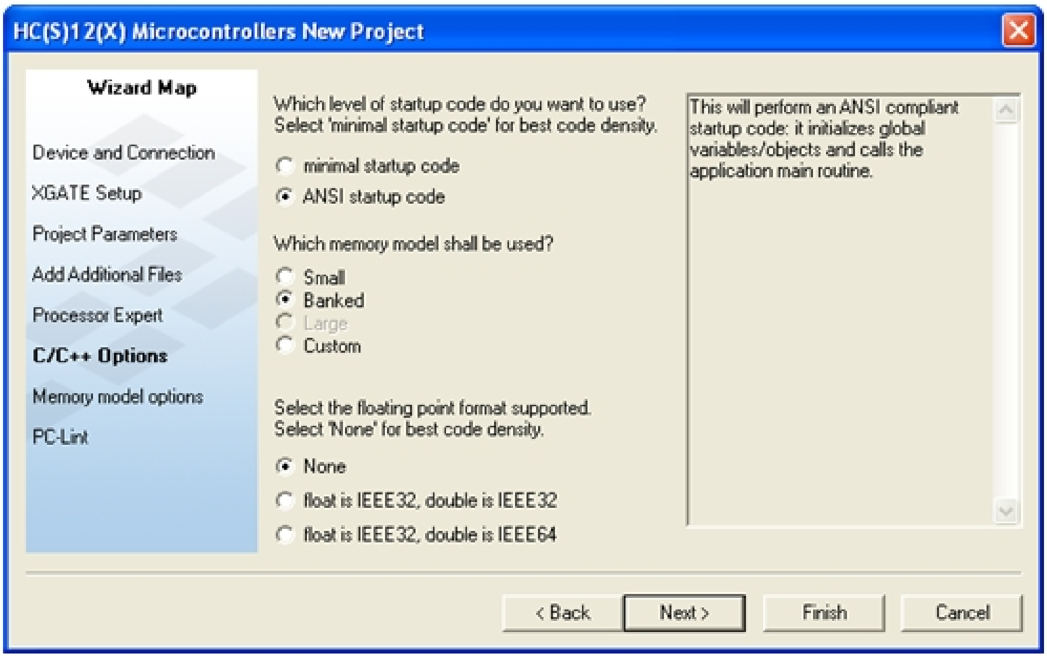

Figure 3-7 C/C++ Options Screen

12.The C/C++ options screen lets you select the level of **Startup Code** you wish to produce. Set as shown as **Figure 3-7** and click **"Next"** to continue.

13. The **Memory model options** screen appears. The Memory model options are available for derivatives from HCS12X family. As shown as **Figure 3-8**.

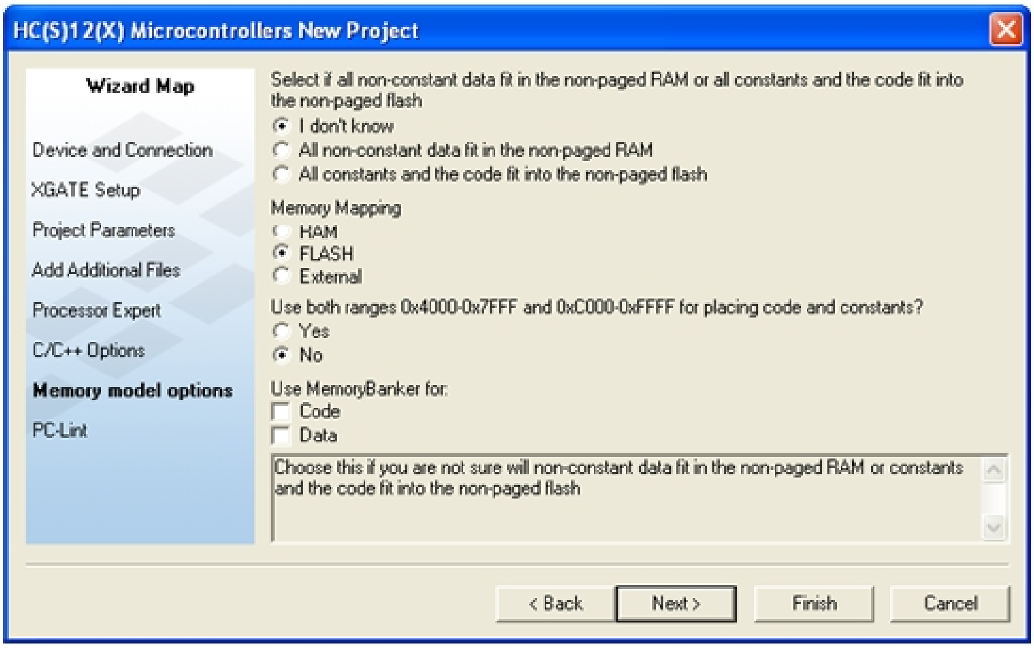

Figure 3-8 Memory model options Screen

14.Click **“Next”** to continue. The **PC-lint** options screen appears. As shown as **Figure 3-9**.

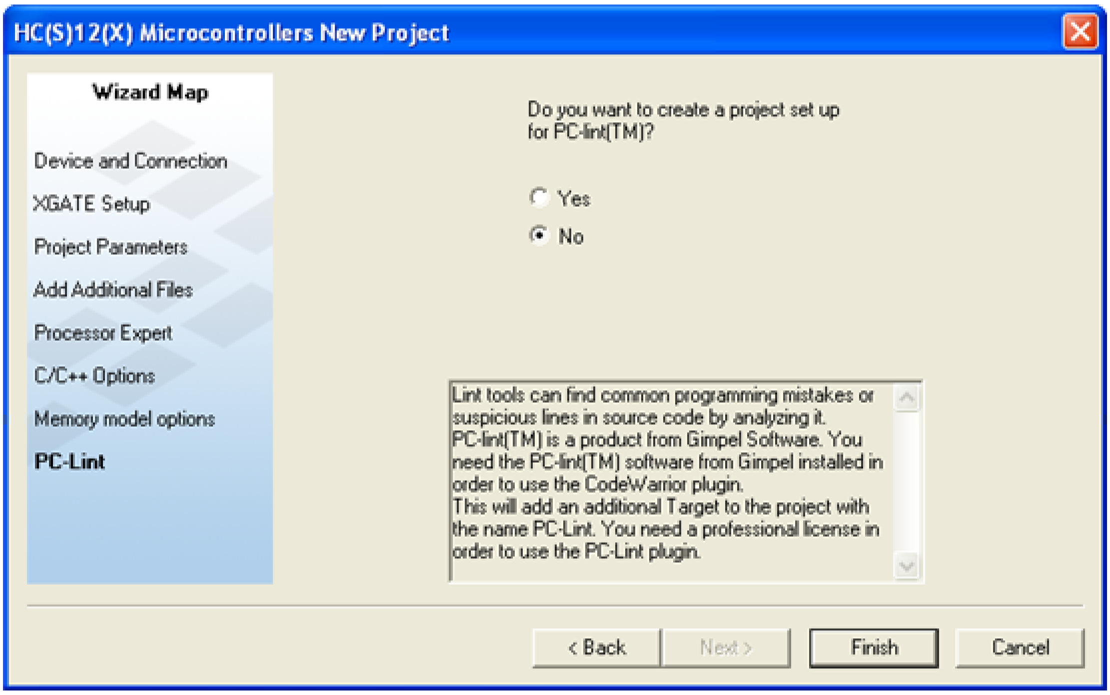

Figure 3-9 PC-lint Options Screen

15.Click the **“Finish”** button. The IDE opens(As shown as **Figure 3-10**). Click “**main.c**”,you add and modify the source code.

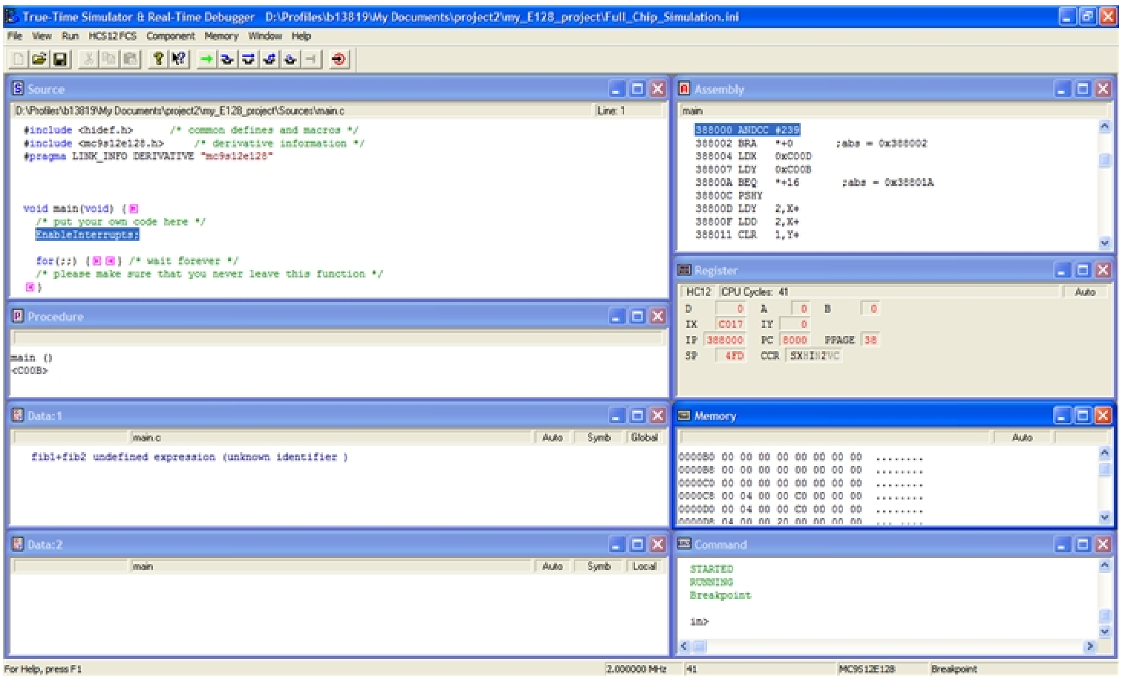

Figure 3-10 PC-lint Options Screen

Chapter 4: Hardware Details

4.1 Power Supply

easyMC9S12 Basic Board contains power supply that creates stable voltage **5V** and **3.3V** and current levels necessary for powering each part of the board. Power supply section contains two power regulators: L**7805**, which generates **5V**, and **LM1117-3.3** which creates **3.3V** power supply. The board can be powered only by using external DC12V (on adapter connector Jack "+12VDC"). Upon providing the power using external power source you can turn on power supply by using switch(**POWERSW**). LED (**PWRLED**) will indicate the presence of power supply.

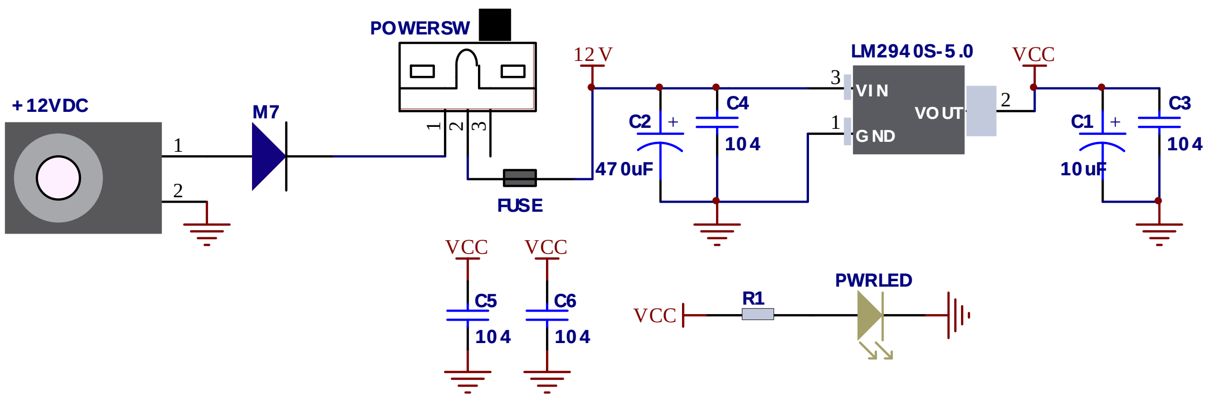

Figure 4-1

4.2 Eight LEDs

LED (Light-Emitting Diode) is a highly efficient electronic light source. When connecting LEDs, it is necessary to place a current limiting resistor in series so that LEDs are provided with the current value specified by the manufacturer. The current varies from 0.2mA to 20mA, depending on the type of the LED and the manufacturer. **easyMC9S12 Basic** board uses low-current LEDs with typical current consumption of 0.2mA or 0.3mA, depending of VCC voltage selection. Board contains 8 LEDs which can be used for visual indication of the logic state on PORT pins. An active LED indicates that a logic low (0) is present on the pin.In this application,the 8 LEDs are connected to **PB.**

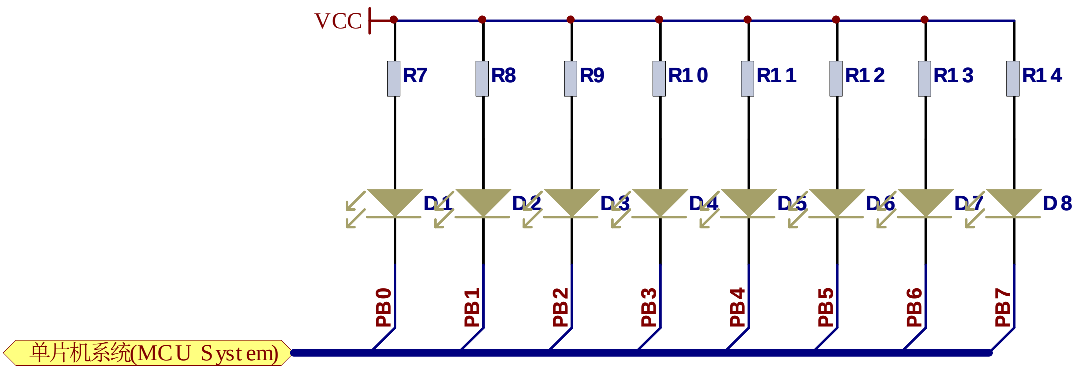

Figure 4-2

4.3 Piezo Buzzer

Piezoelectricity is the charge which accumulates in certain solid materials in response to mechanical pressure,but also providing the charge to the **piezo** electric material causes it to physically deform. One of the most widely used applications of piezoelectricity is the production of sound generators, called piezo buzzers. **Piezo buzzer** is an electric component that comes in different shapes and sizes, which can be used to create sound waves when provided with analog electrical signal. **easyMC9S12 Basic** comes with **piezo buzzer** which can be connected to IO **PP1** or **PK5** of microcontroller via connector (**J2**). **Buzzer** is driven by a NPN transistor **Q7** (**L7**). Microcontrollers can create sound by generating a PWM(Pulse Width Modulated) signal – a square wave signal, which is nothing more than a sequence of logic zeros and ones. Frequency of the square signal determines the pitch of the generated sound, and duty cycle of the signal can be used to increase or decrease the volume in the range from 0% to 100% of the duty cycle. You can generate PWM signal using hardware capture-compare module, which is usually available in most microcontrollers, or by writing a custom software which emulates the desired signal waveform.

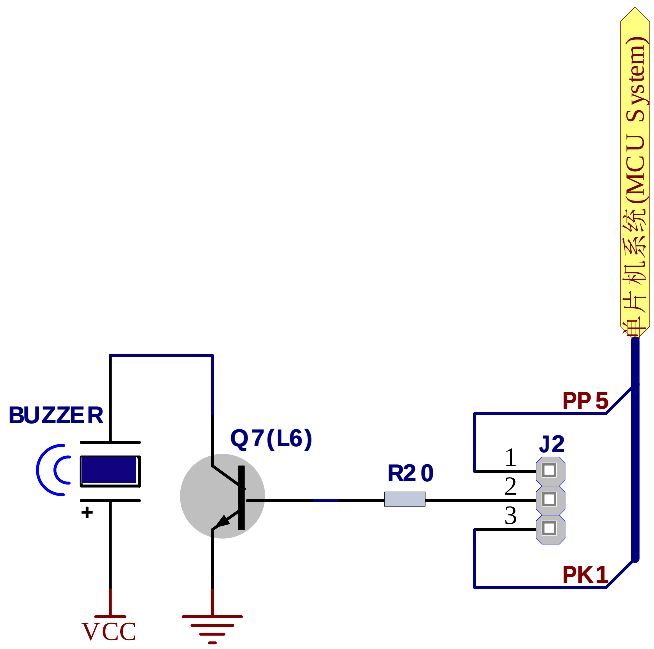

Figure 4-3

4.4 ADC Input

Digital signals have two discrete states, which are decoded as high and low, and interpreted as logic 1 and logic 0. Analog signals, on the other hand, are continuous, and can have any value within defined range. A/D converters are specialized circuits which can convert analog signals (voltages) into a digital representation, usually in form of an integer number. The value of this number is linearly dependent on the input voltage value. Most microcontrollers nowadays internally have A/D converters connected to one or more input pins. Some of the most important parameters of A/D converters are conversion time and resolution. Conversion time determines how fast can an analog voltage be represented in form of a digital number. This is an important parameter if you need fast data acquisition. The other parameter is resolution. Resolution represents the number of discrete steps that supported voltage range can be divided into. It determines the sensitivity of the A/D converter. Resolution is represented in maximum number of bits that resulting number occupies. Most microcontrollers have 10-bit resolution, meaning that maximum value of conversion can be represented with 10 bits,which converted to integer is 2^10=1024. This means that supported voltage range, for example from 0-3.3V, can be divided into 1024 discrete steps of about 3.222mV. **easyMC9S12 Basic** provides two interfaces in form of potentiometer for simulating analog input voltages.In ths application,the two ADC inputs(potentiometer **ADC00** and **ADC01**) are respectively connected to **PAD00** and **PAD01**.

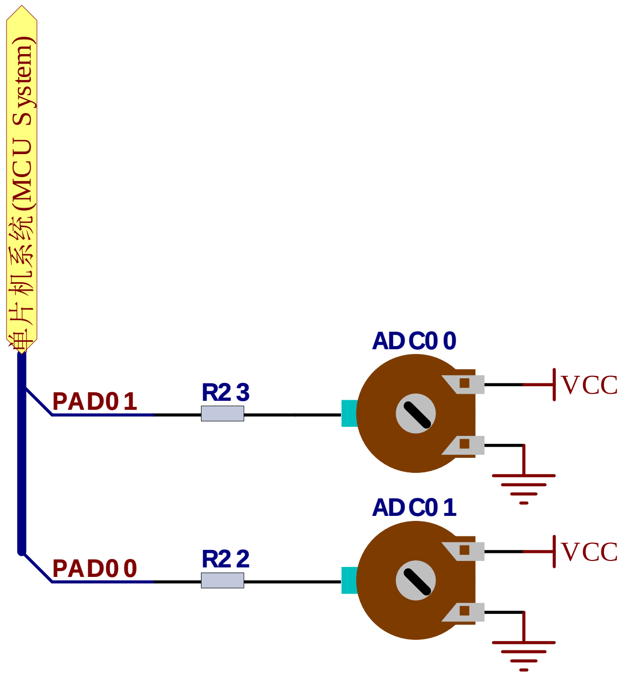

Figure 4-4

4.5 Four Keys

The logic state of all microcontroller digital inputs may be changed using push keys. In this application,four keys are respectively connected to IO **PH0~PH3**. When no key is not pressed, due to the pull-up resistor **R15-R18**, the level detected by the MCU is high,and when the key is pressed, the level detected by the MCU is low.

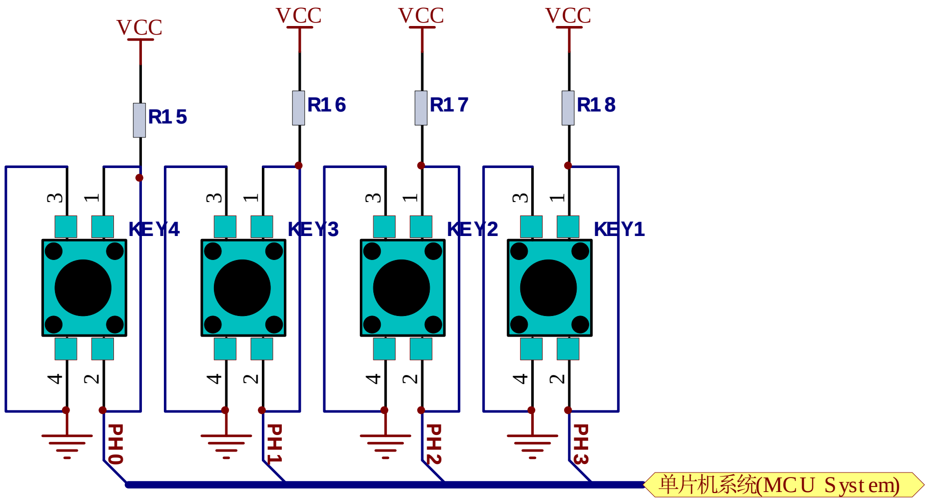

Figure 4-5

4.6 RS485 Bus

RS-485 is a standard defining the electrical characteristics of drivers and receivers for use in serial communications systems. Electrical signaling is balanced and multipoint systems are supported. Digital communications networks implementing the standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi-drop configuration. These characteristics make such networks useful in industrial environments and similar applications.

The **RS-485** module enables the development system to communicate to external devices whose operation is in compliance with the **RS-485** standard. The connection between this module and one of these devices is established via a screw connector (**CON1**). In order to turn on this module,the **RE/DE** pin on **RS485** chip is already connected to **PM7**,and at the same time, it is necessary to enable the connection on the **"RS485"** position on the **"JP1"** jumper.

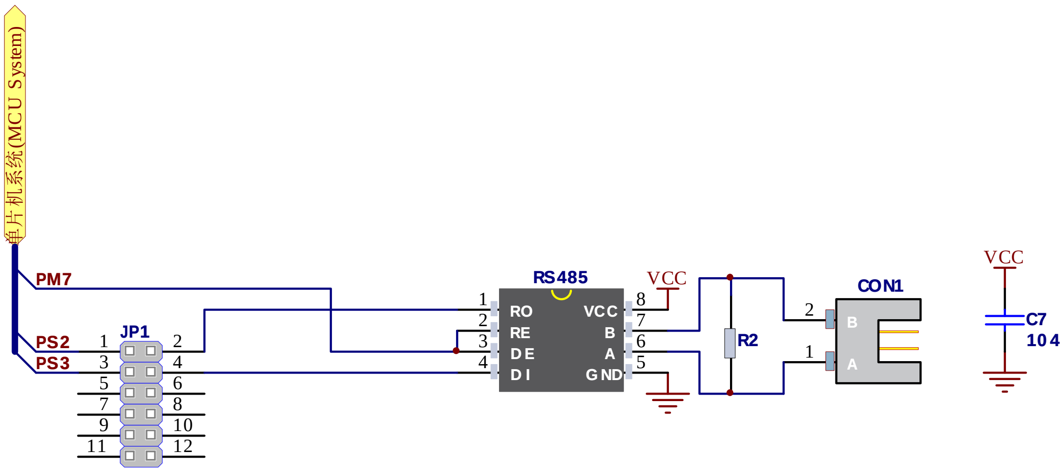

Figure 4-6

4.7 SCI

The MC9S12 series MCUs have the serial communication interface (**SCI**) module.And the SCI allows asynchronous serial communications with peripheral devices and other MCUs.

easyMC9S12 Basic equips a RS232 module for the communication between the board and the PC using SCI. In order to turn on this module, it is necessary to enable the connection on the **"RS232"** position on the **"JP1"** jumper.

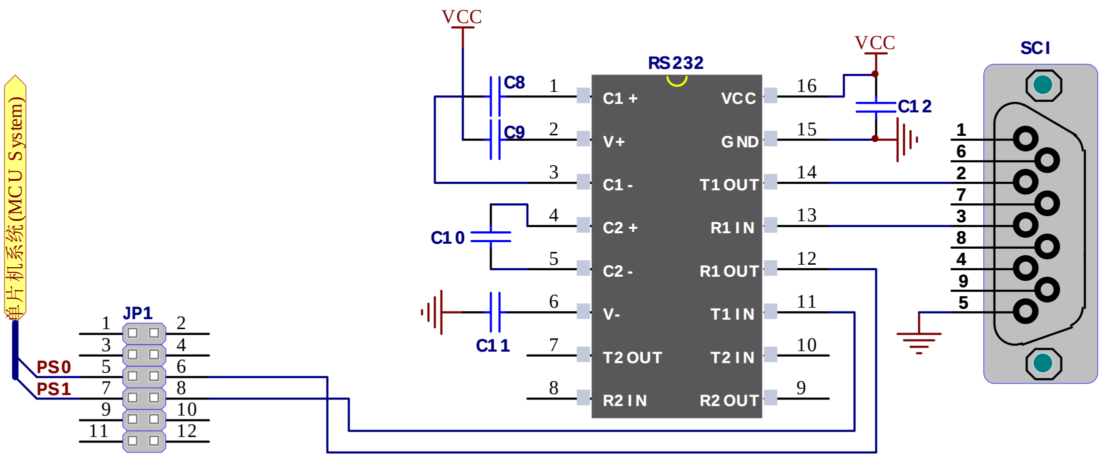

Figure 4-7

4.8 LIN Bus

LIN (local interconnect network) is a kind of low-cost serial communication network, which is used to realize the distributed electronic system control in automobile. LIN aims to provide auxiliary functions for the existing vehicle network (like CAN bus), so LIN bus is an auxiliary bus network.
In the communication between intelligent sensor and brake device, LIN bus can greatly reduce the cost more than CAN bus. **easyMC9S12 Basic** equips a LIN Bus module using a TJA1020 chip.
The connection between this module and one of these devices is established
via a screw connector (**CON3**). In order to turn on this module, it is necessary to enable the connection on the **"LIN"** position on the **"JP1"** jumper.

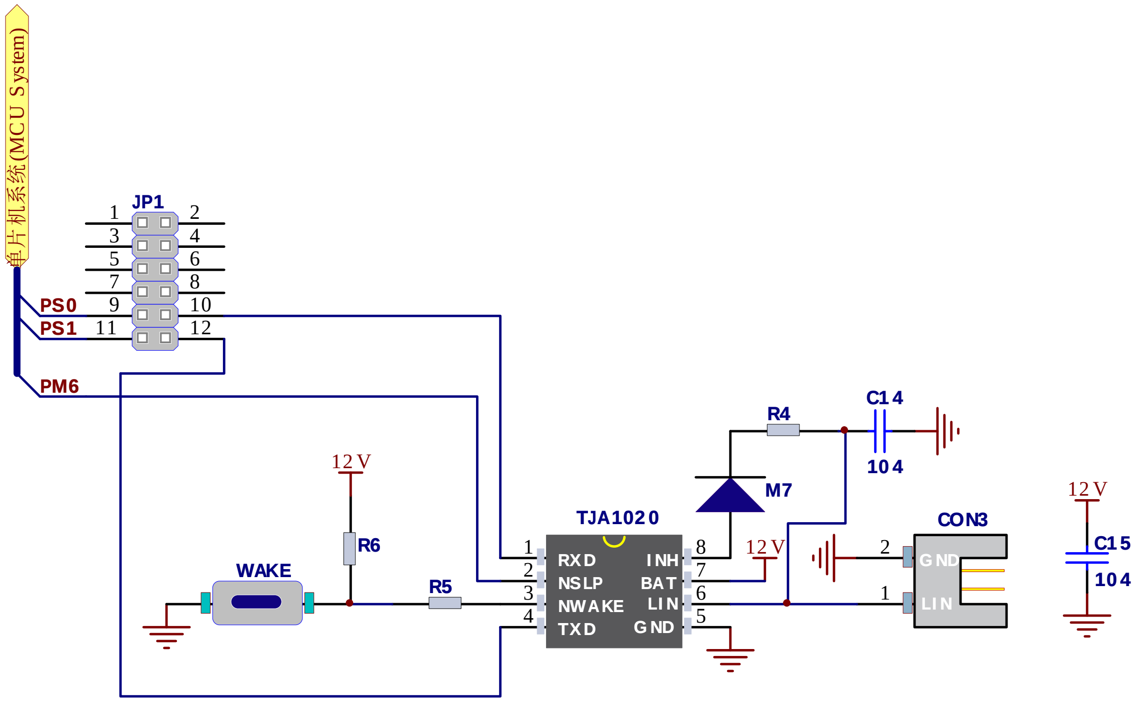

Figure 4-8

4.9 1-WIRE DS18B20 Circuit Module

DS18B20 is a digital temperature sensor that uses 1-wire® interface for it's operation. It is capable of measuring temperatures within the range of -55 to 128°C, and provides ±0.5°C accuracy for temperatures within the range of -10 to 85°C. It requires 3V to 5.5V power supply for stable operation. It takes maximum of 750ms for the **DS18B20** to calculate temperature with 9-bit resolution. 1-wire® serial communication enables data to be transferred over a single communication line, while the process itself is under the control of the master microcontroller. The advantage of such communication is that only one microcontroller pin is used. Multiple sensors can be connected on the same line. All slave devices by default have a unique ID code, which enables the master device to easily identify all devices sharing the same interface. **easyMC9S12 Basic** provides a separate socket for the DS18B20. Communication line with the microcontroller is connected to the IO **"PJ1"**.

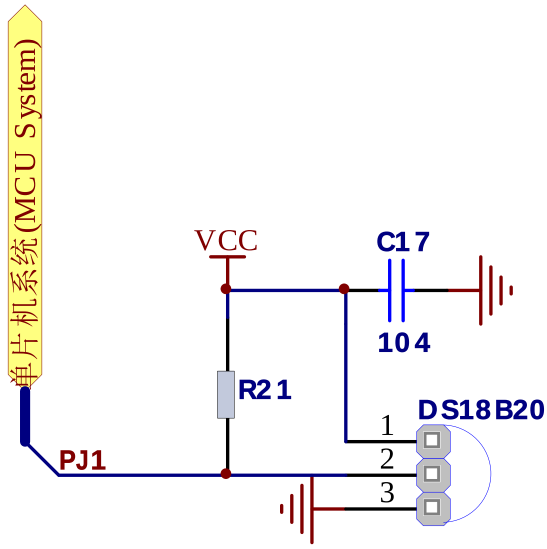

Figure 4-9

4.10 CAN Bus

Freescale's scalable controller area network definition is based on the MSCAN12 definition.The module is a communication controller implementing the CAN 2.0A/B protocol as defined in the Bosch specification dated September 1991. Though not exclusively intended for automotive applications, CAN protocol is designed to meet the specific requirements of a vehicle serial data bus: real-time processing, reliable operation in the EMI environment of a vehicle, cost-effectiveness, and required bandwidth.MSCAN uses an advanced buffer arrangement resulting in predictable real-time behavior and simplified application software.**easyMC9S12 Basic** equips a TJA1020 chip and use **CAN0 (PM0/RXCAN0 and PM1/TXCAN0)** to drive it.

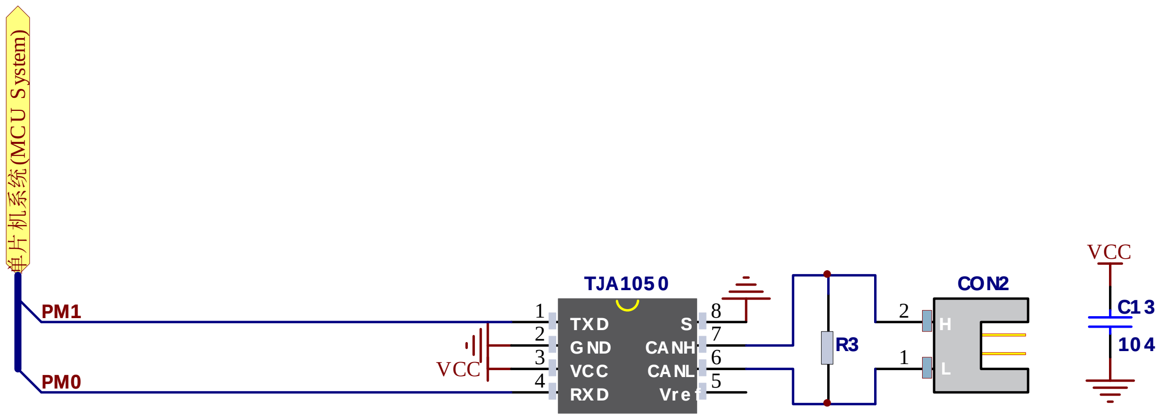

Figure 4-10

4.11 6-Digit SEGLED Display

One seven segment digit consist of 7+1 LEDs which are arranged in a specific formation which can be used to represent digits from 0 to 9 and even some letters. One additional LED is used for marking the decimal dot, in case you want to write a decimal point in the desired segment. The **easyMC9S12 Basic** contains six of these digits put together to form 6-digit segled display. Driving such a display is done using multiplexing techniques. Data lines are shared between segments, and therefore the same segment LEDs in each digit are connected in parallel. Each digit has it's unique digit select line, which is used to enable the digit to which the data is currently being sent. By multiplexing data through all six segments fast enough, you create an illusion that all six segments are in operation simultaneously. This is possible because human eye has a slower reaction time than the mention changes. This way you can represent numbers in decimal or hexadecimal form. Eight data lines that are common for all the digits are connected to **PP0-PP7** via **JP2**, and digit select lines are connected to **PK0-PK5** directly.

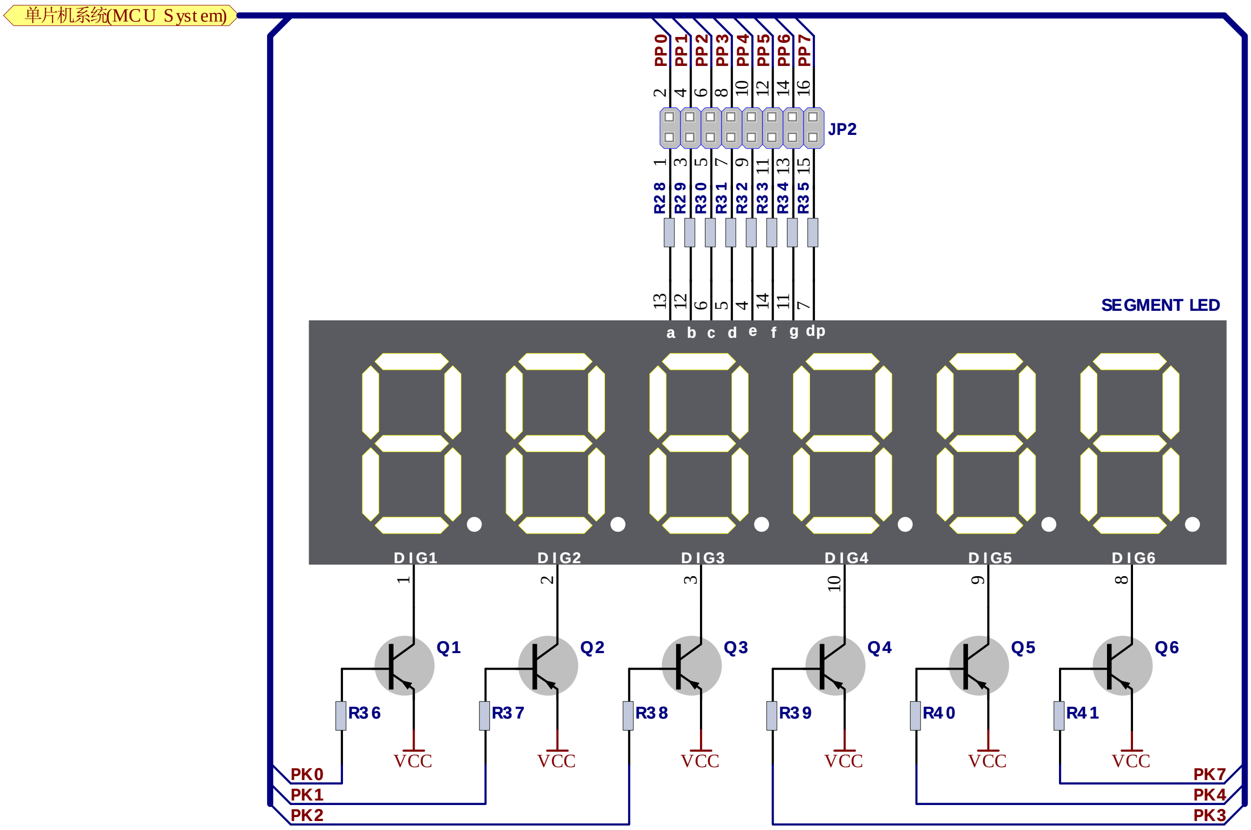

Figure 4-11

4.12 LCD 2x16 characters (Socket)

Liquid Crystal Displays or LCDs are cheap and popular way of representing information to the end user of some electronic device. Character LCDs can be used to represent standard and custom characters in the predefined number of fields. The **easyMC9S12 Basic** provides the connector and the necessary interface for supporting 2x16 character LCDs. This type of display has two rows consisted of 16 character fields. Each field is a 7x5 pixel matrix. This Board equips an universal socket **"LCD1602"** allowing you to install 16x2 LCD very easily.

Connector pinout explained

1-GND

2-5V

3-Vo,LCD contrast level from potentiometer **1602-VOL**

4-RS,Register Select Signal

5-E,Display Enable

6-R/W,Determines whether display is in Read or Write mode. It's always connected to GND, leaving the display in Write mode all the time.

7~14-Data Port,Display is supported in 8-bit data mode.

15-LED+,Connection with 5V

16-LED-,Connection with GND

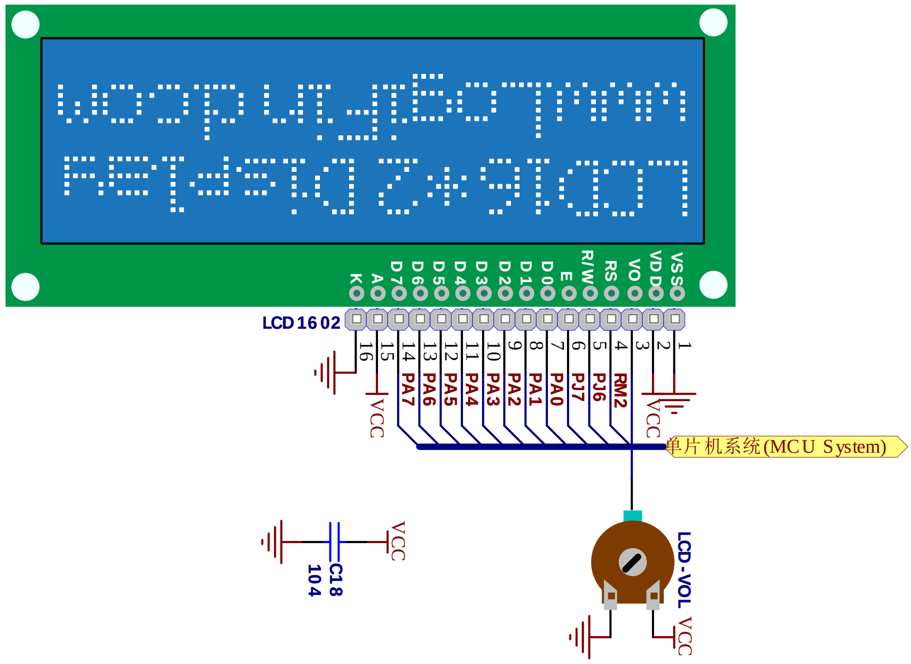

Figure 4-12-1

> **IMPORTANT:**
> Make sure to Place the LCD1602 in the right direction.
> Make sure to turn off the power supply before placing LCD onto the board. Otherwise your display can be permanently damaged.

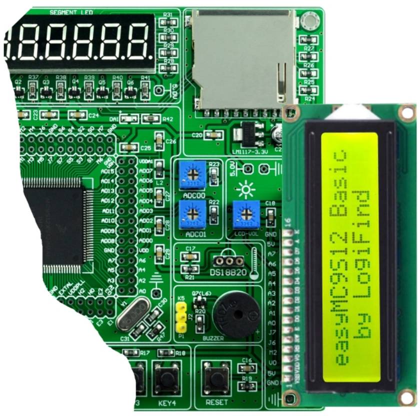

Figure 4-12-2

4.13 GLCD 128x64 Socket)

Graphical Liquid Crystal Displays, or GLCDs are used to display monochromatic graphical content, such as text, images, humanmachine interfaces and other content. **easyMC9S12 Basic** provides the connector and necessary interface for supporting GLCD with resolution of 128x64 pixels and proper PINOUTs.It is compatible with the most popular LCD12864 in the market with KS108 or ST7920 display controller.The example we provide is only for LCD12864 with ST7920 display controller. **The board** equips an universal socket **"LCD12864&TFT"** allowing you to install 128*64 Graphical LCD very easily.

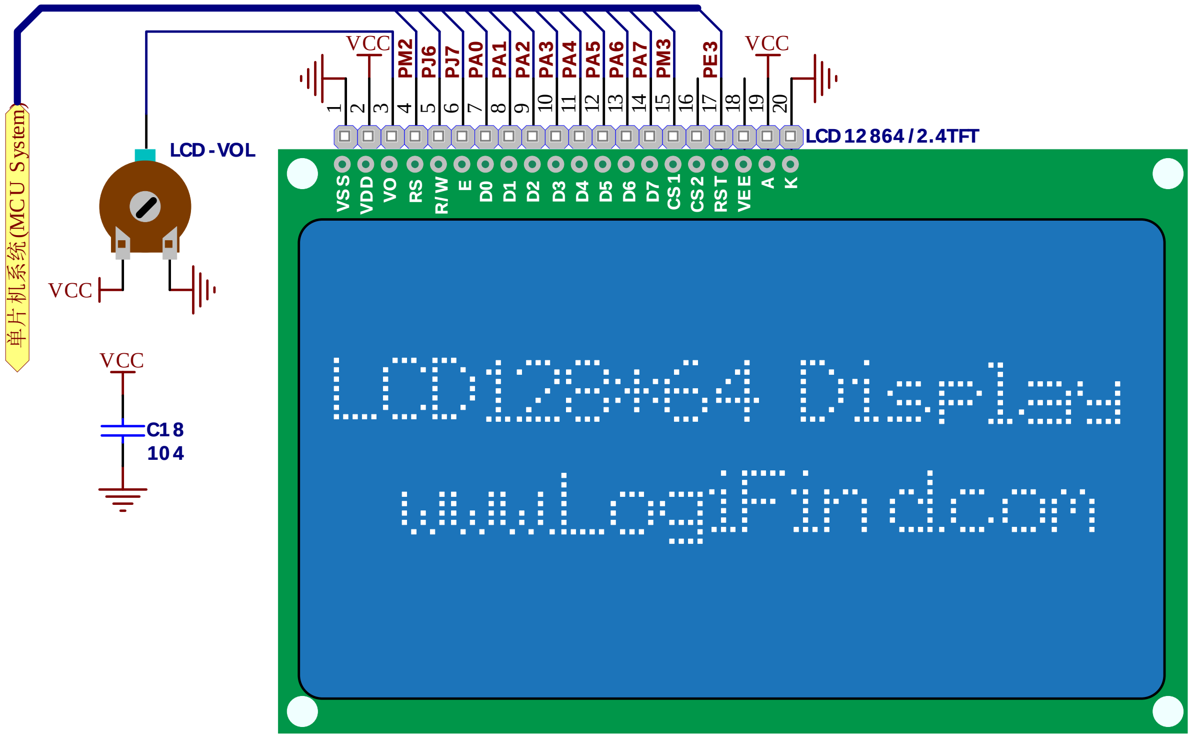

Figure 4-13-1

> **IMPORTANT:**
> Make sure to Place the LCD12864 in the right direction.
> Make sure to turn off the power supply before placing LCD onto the board. Otherwise your display can be permanently damaged.

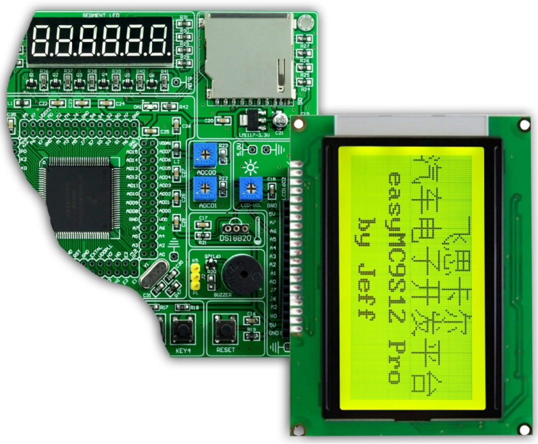

Figure 4-13-2

4.14 2.4" 240*320 TFT (Socket)

easyMC9S12 Basic provides the connector and necessary interface for supporting the 2.4" 240*320 TFT display module by **LogiFind**. The TFT display module share the socket **"LCD12864&TFT"** with LCD12864 display module,but the TFT display module only uses 18pin,not 20pin.See the following figure for the installing method of the TFT.

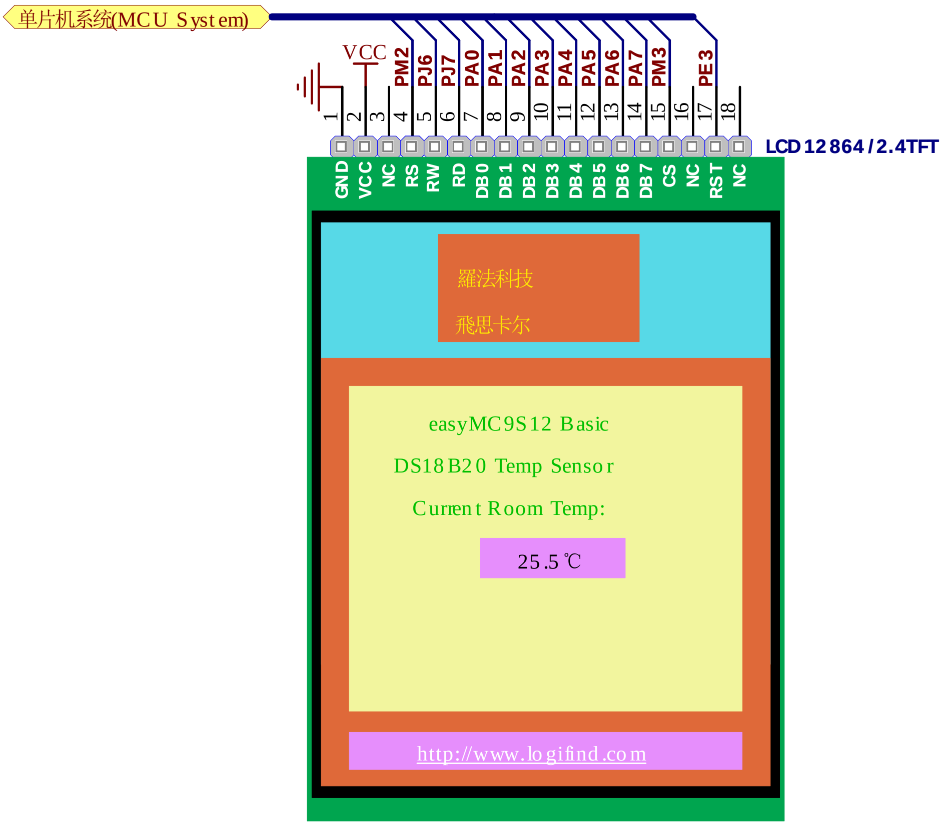

Figure 4-14-1

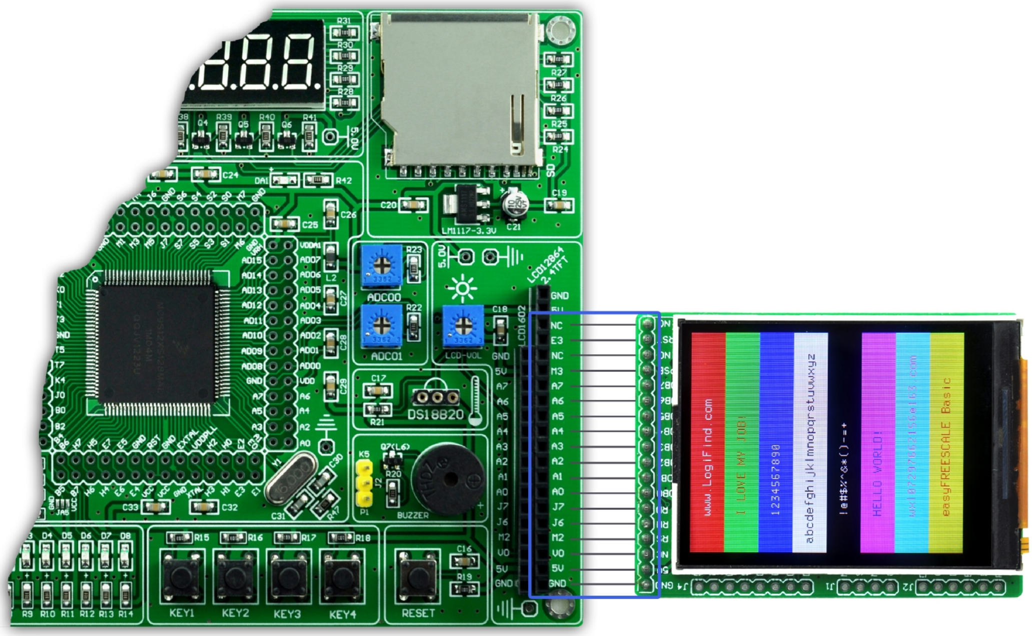

Figure 4-14-2

4.15 IOC Interface

easyMC9S12 Basic brings out several special pins **PT0,PT1** and **PT7** for Tim experiments.

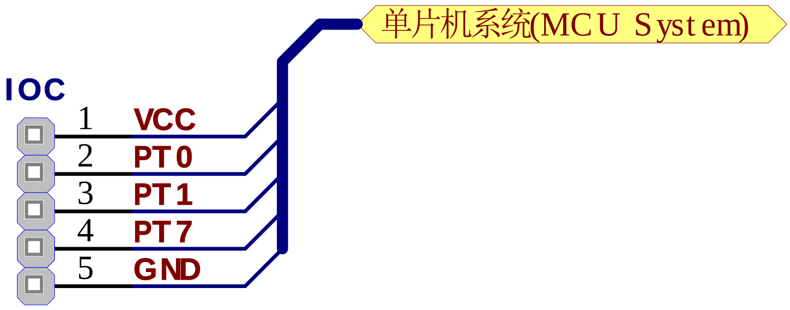

Figure 4-15

4.16 PT2272 Wireless Module(Socket)

easyMC9S12 Basic equips a socket “Wireless” for common **PT2272** Remote Control Decoder module.

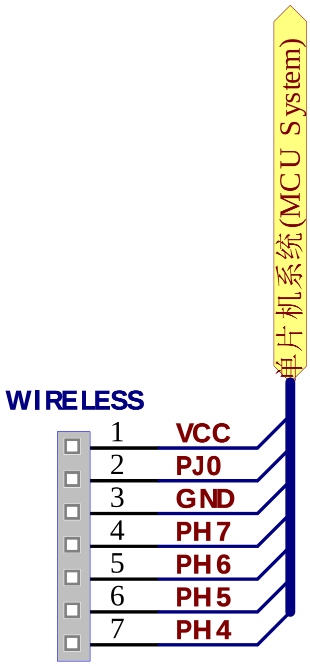

Figure 4-16-1

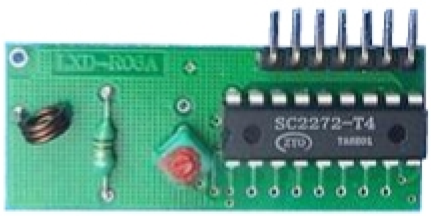

Figure 4-16-2

4.17 SD Card

Secure Digital (SD) is a non-volatile memory card format developed for use in portable devices. It comes in different packages and memory capacities. It is mostly used for storing large amounts of data. **easyMC9S12 Basic** features the **SD card slot.** It uses standard **SPI** user interface with minimum additional electronics, mainly used for stabilizing communication lines which can be significantly distorted at high transfer rates. Special ferrite is also provided to compensate the voltage and current glitch that can occur when pushing-in and pushing-out **SD** card into the socket.
In order to access SD card, you must enable **SPI** communication lines via connecting the **SD card** Module to the **SPI** pins of microcontroller.

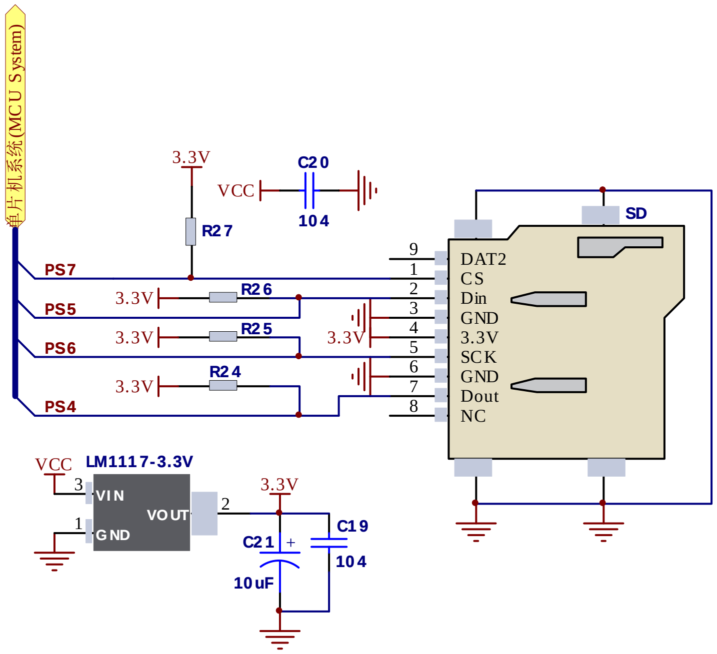

Figure 4-17

4.18 System Reset

easyMC9S12 Basic uses low level trigger reset.

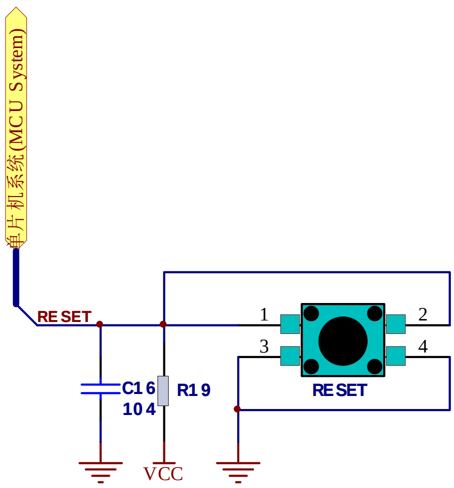

Figure 4-18

4.19 Small System Circuit

DA1 is an indicator LED for system running indicating, which is controlled by IO **PK4**. Debugging and programming interface BDM port is equped. **Y1** is a 16MHz crystal for system clock.

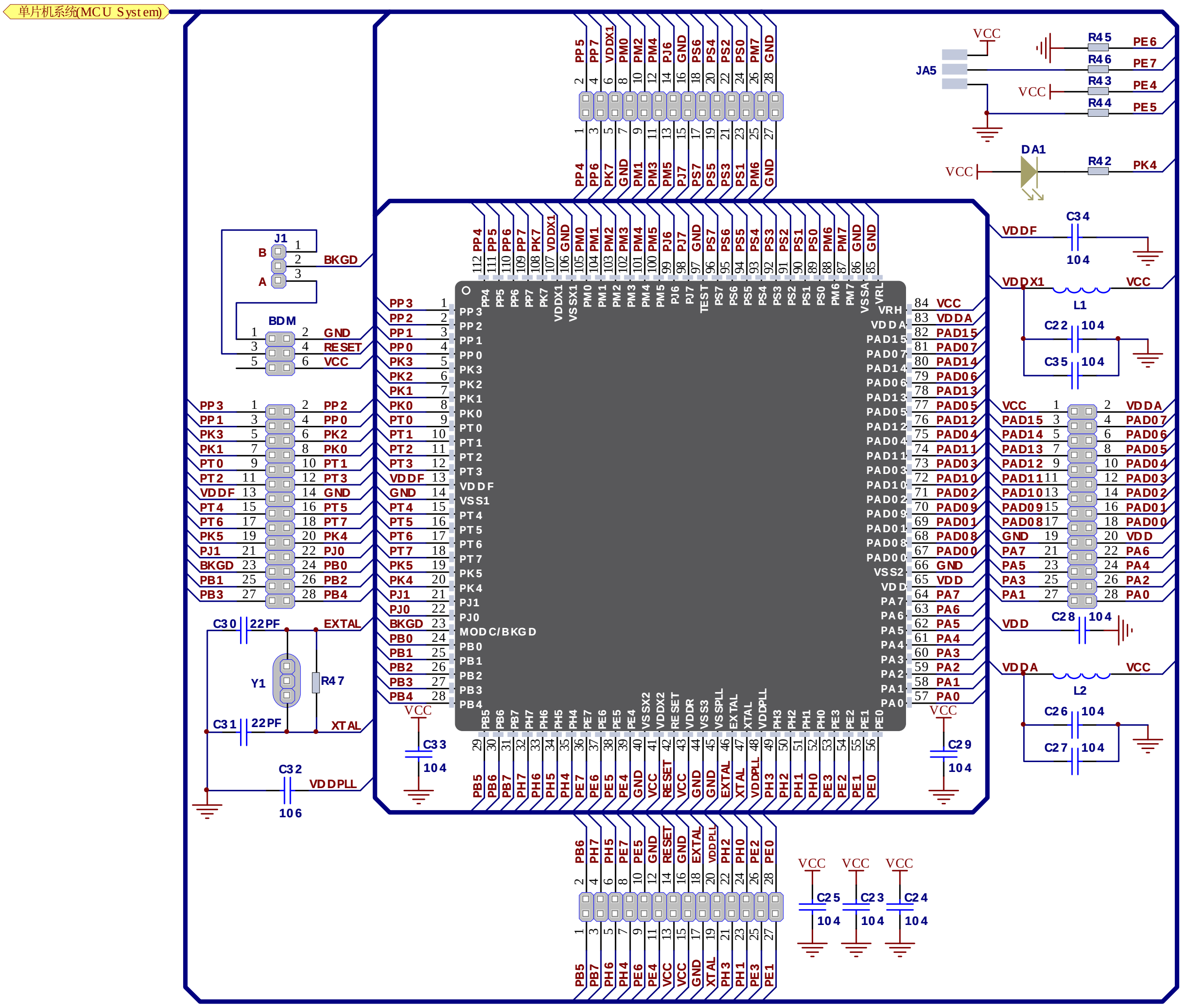

Figure 4-23

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