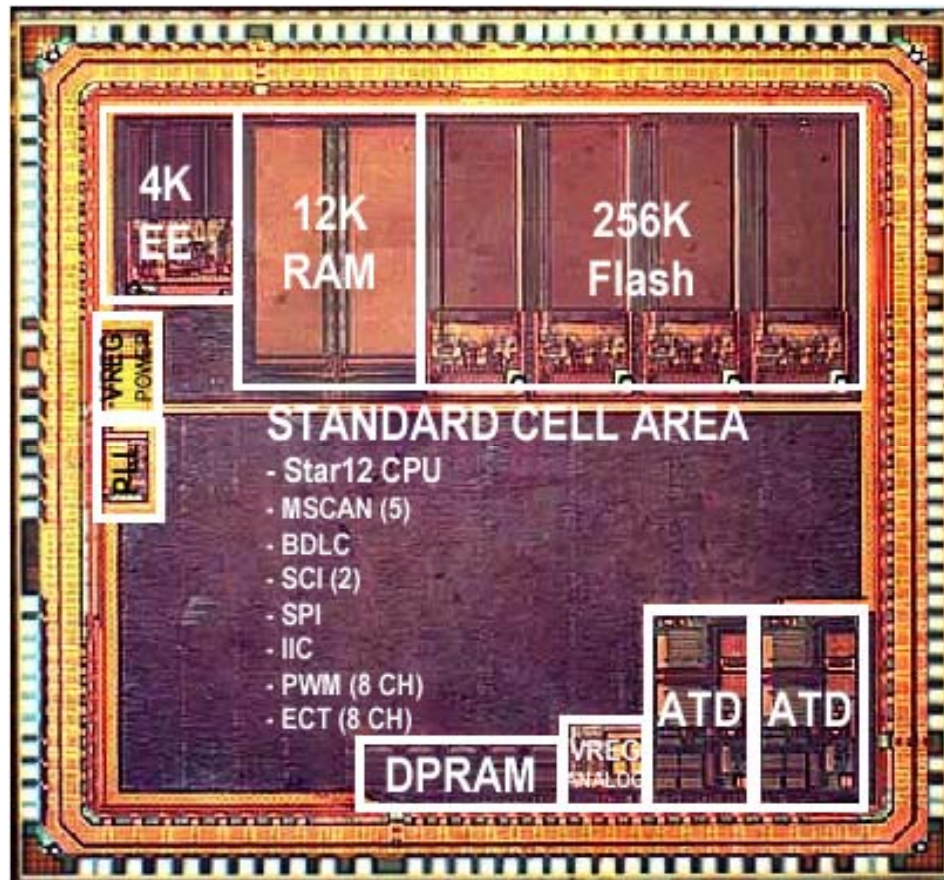


# MC9S12DP256/DG128

## Hardware & Basic System Design



# Chinese Textbook

## 单片机 嵌入式应用的在线开发方法

本书是历经18位单片机在线开发方法的一本专著,这种方法是多年来开发单片机应用的主要方法,强调在线开发和方便使用的原则。这本书也是为清华大学研究生和课程“嵌入式实时系统与单片机应用”编写教材的参考资料。

本书是为嵌入式应用开发工程师写的。由于18位单片机比8位单片机复杂,所以对期望易于开发产品而又不是18位单片机的工程师,采用我们提供的开发工具,并快速将系统开发并移植搭建起来,边开发、边学习,是多种好处的办法。

本书给出了相关开发工具的使用方法,全部源代码程序,并附光盘上还有大量网上下载的应用案例、工具与资料。



此处放丛书名 此处放丛书名

单片机嵌入式应用的在线开发方法

清华大学出版社

(B)

此处放丛书名 此处放丛书名

## 单片机 嵌入式应用的在线开发方法

邵贝贝 著



清华大学出版社

定价: 00.00 元

封面设计: 华 森

# CPU12 Reference Book



*S12CPUV2*

*Reference Manual*

*HCS12*  
*Microcontrollers*

S12CPUV2/D  
Rev. 0  
7/2003

MOTOROLA.COM/SEMICONDUCTORS

# 9S12 Documentation

## Device User Guide

**MC9S12DP256 Device User Guide**

**HCS12 V1.5 Core User Guide**

## Block User Guides

**PIM\_9DP256 Block User Guide (Port Integrate Module)**

**FTS256K Block User Guide (Flash)**

**EETS4K Block User Guide (EEPROM)**

**CRG Block User Guide (Clock Reset Generator)**

**ECT\_16B8C Block User Guide (Enhanced Capture Timer)**

**ATD\_10B16C Block User Guide (A/D)**

**SCI Block User Guide**

**SPI Block User Guide**

**PWM\_8B8C Block User Guide**

**Inter-Integrated Circuit(IIC)Block Guide**

**MSCAN Block User Guide**

**VREG Block User Guide (Voltage Regulator)**

**BYTE FLIGHT Block Guide**

# Reference Manual (Hardware)

22 pages (2.1M)

Data book

**9S12DT128B manual**  
**9S12DP256B manual**

DOCUMENT NUMBER  
9S12DP256BDGV2/D

## **MC9S12DP256B** **Device User Guide** **V02.14**

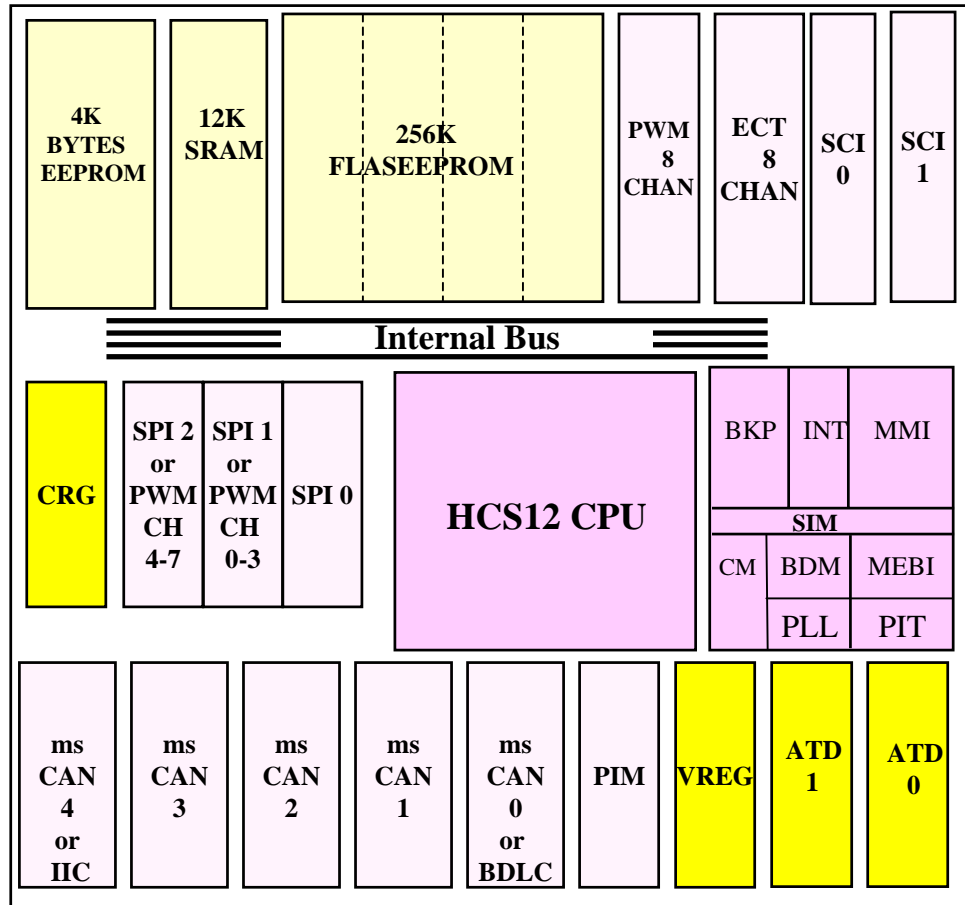
**Covers also**

**MC9S12DT256C, MC9S12DJ256C,  
MC9S12DG256C, MC9S12DT256B,  
MC9S12DJ256B, MC9S12DG256B  
MC9S12A256B**

Original Release Date: 29 Mar 2001  
Revised: Mar 5, 2003  
Motorola, Inc

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# HCS12 Building Blocks



- **HCS12 CPU Core & System Integration Module**
- **Support Modules: Vreg & Clocks & Reset Generator**
- **Memories: Flash, RAM, EEPROM**
- **Peripherals: SCI, SPI, CAN, IIC, PWM, ATD, Timer, etc.**

- **16-bit HCS12 CPU**

Upward compatible with HC11

20-bit ALU

Instruction pipe

Enhanced indexed addressing

- **SIM (System Integ. module)**

MEB (Multiplexed External Bus)

MMC (Module Mapping Control)

BKP (Breakpoints)

BDM (Background Debug Mode)

- **Clocks Reset Generator (CRG)**

low current oscillator, PLL, reset,

clocks, COP watchdog,

Real time interrupt, clock

monitoring

## Main Features:

- **On-chip Voltage Regulator**

2.25 to 2.75V Digital Supply Voltage

4.75V to 5.25V Analog and I/O Voltage

- **Technology: 0.25 micron CMOS**

50 MHz CPU equivalent to

25MHz bus

operation (66/33MHz in design)

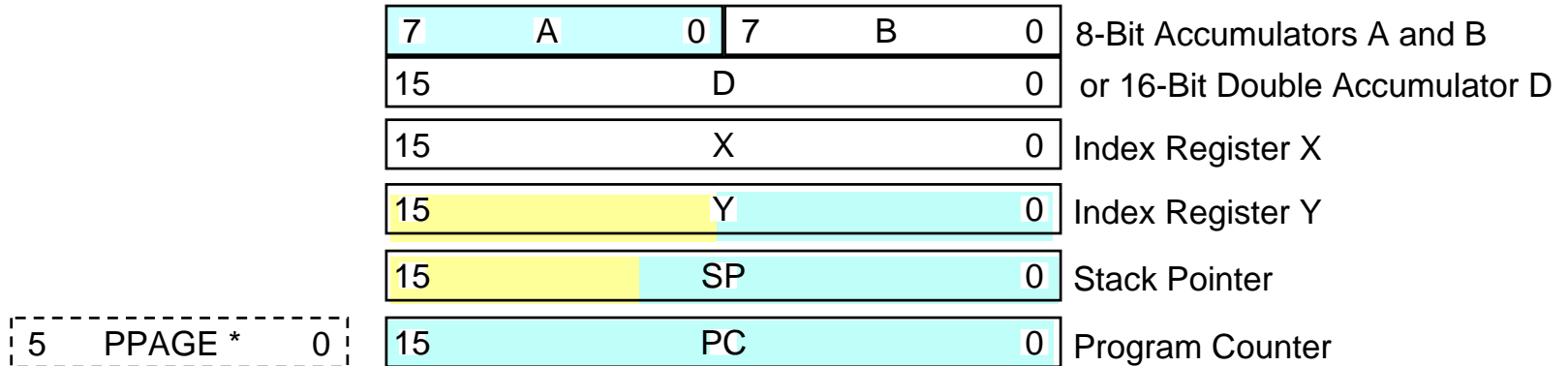
# Peripherals

- **2 x Serial Communications Interface (SCI)**
- **3 x Serial Peripheral interface (SPI)**
- **up to 5 x 1M b/s, CAN 2.0 A, B msCAN module**
- **Byte Data Link Controller (BDLC)**
- **Inter-IC Bus (IIC)**
- **10-bit Analog-to-Digital Converter**
- **Standard 8 channel Timer**
- **Enhanced Capture Timer (ECT)**
- **PWM module**
- **Stepper Motor controller**



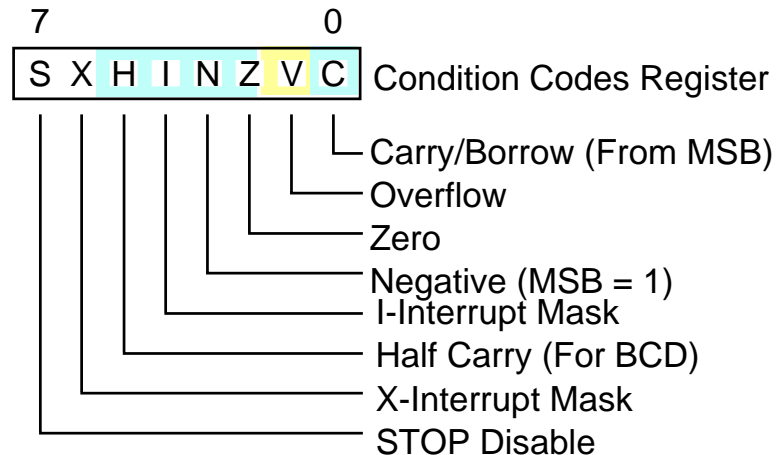
# HCS12 CPU

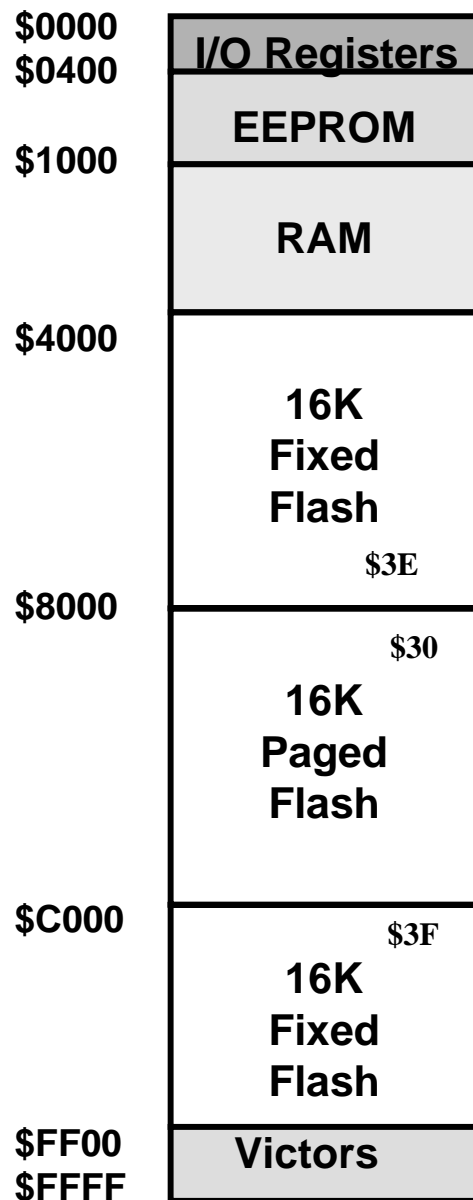
## 68HC11 = 68HC12 = HCS12 Programmers Model



- ◆ **Source code compatible**
- ◆ **Identical stack frame**
- ◆ **\* PPAGE used by CALL & Return To Call (RTC).  
(paged HC(S)12 only)**

- HC05 / HC08 / HCS12
- HC08 / HCS12



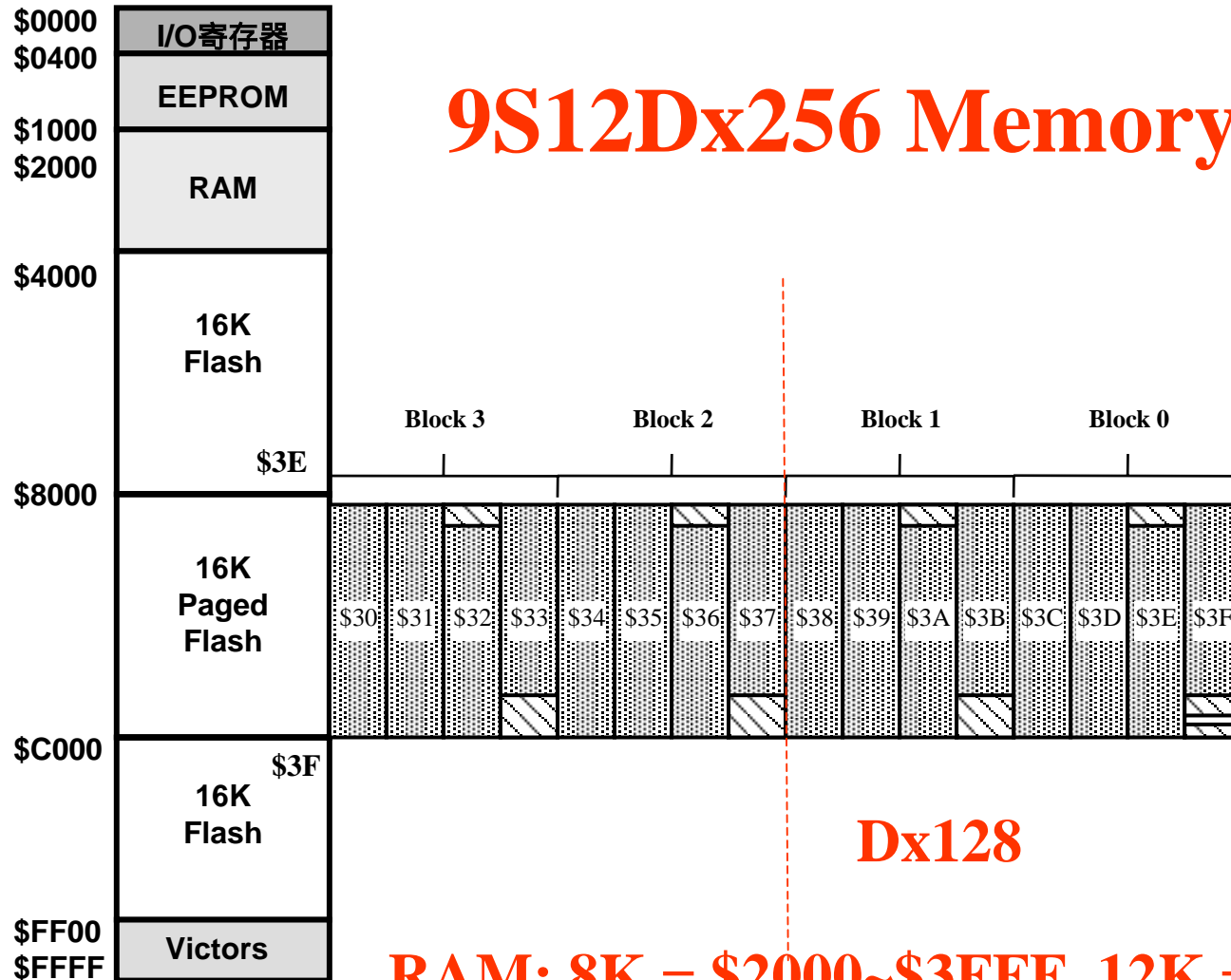


# Addressing Map

Addressing Space: 64K

**Advantage: application program is very compact.**

# 9S12Dx256 Memory Map

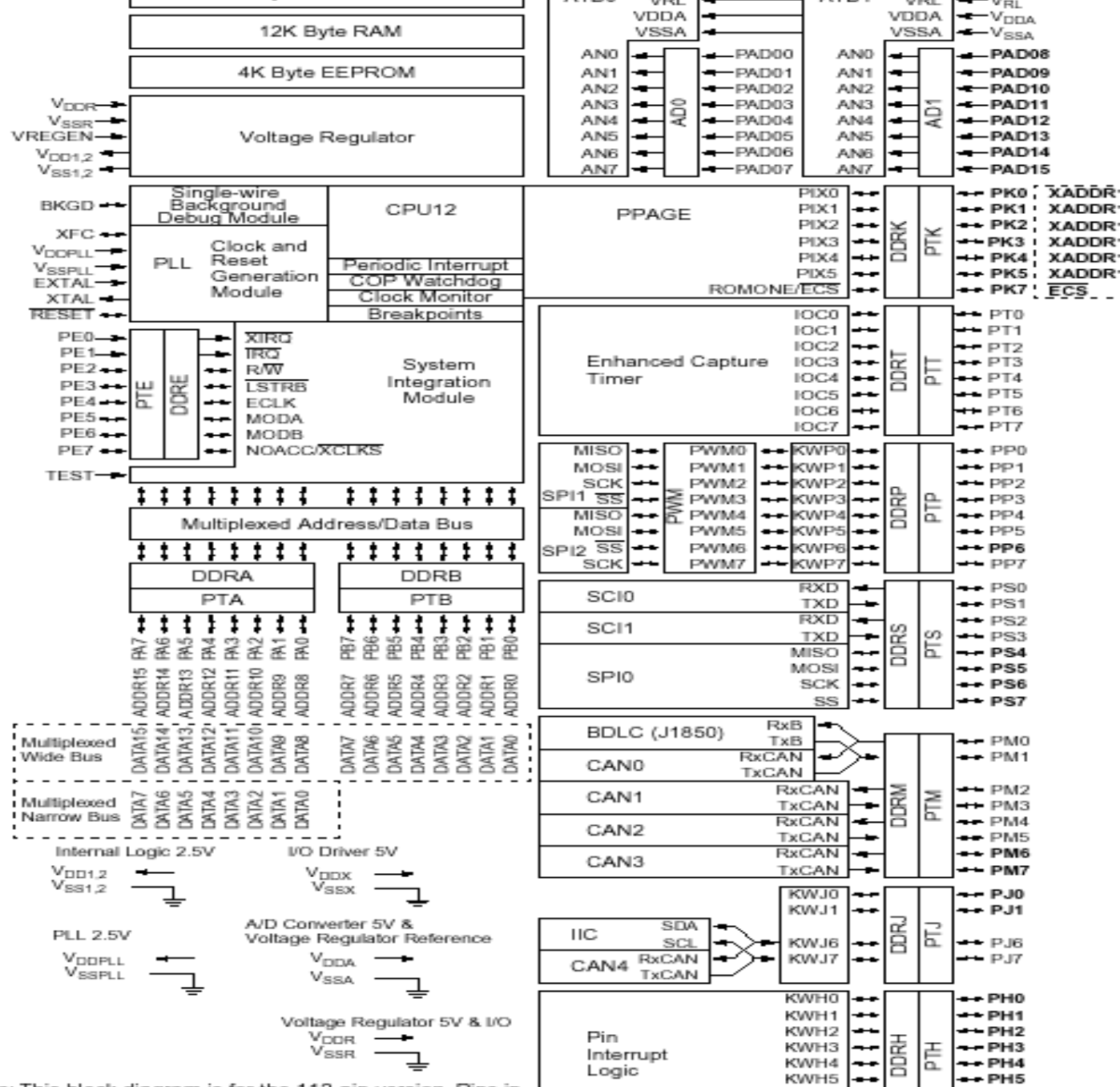


**Dx128**

**RAM: 8K = \$2000~\$3FFF, 12K = \$1000~\$3FFF**

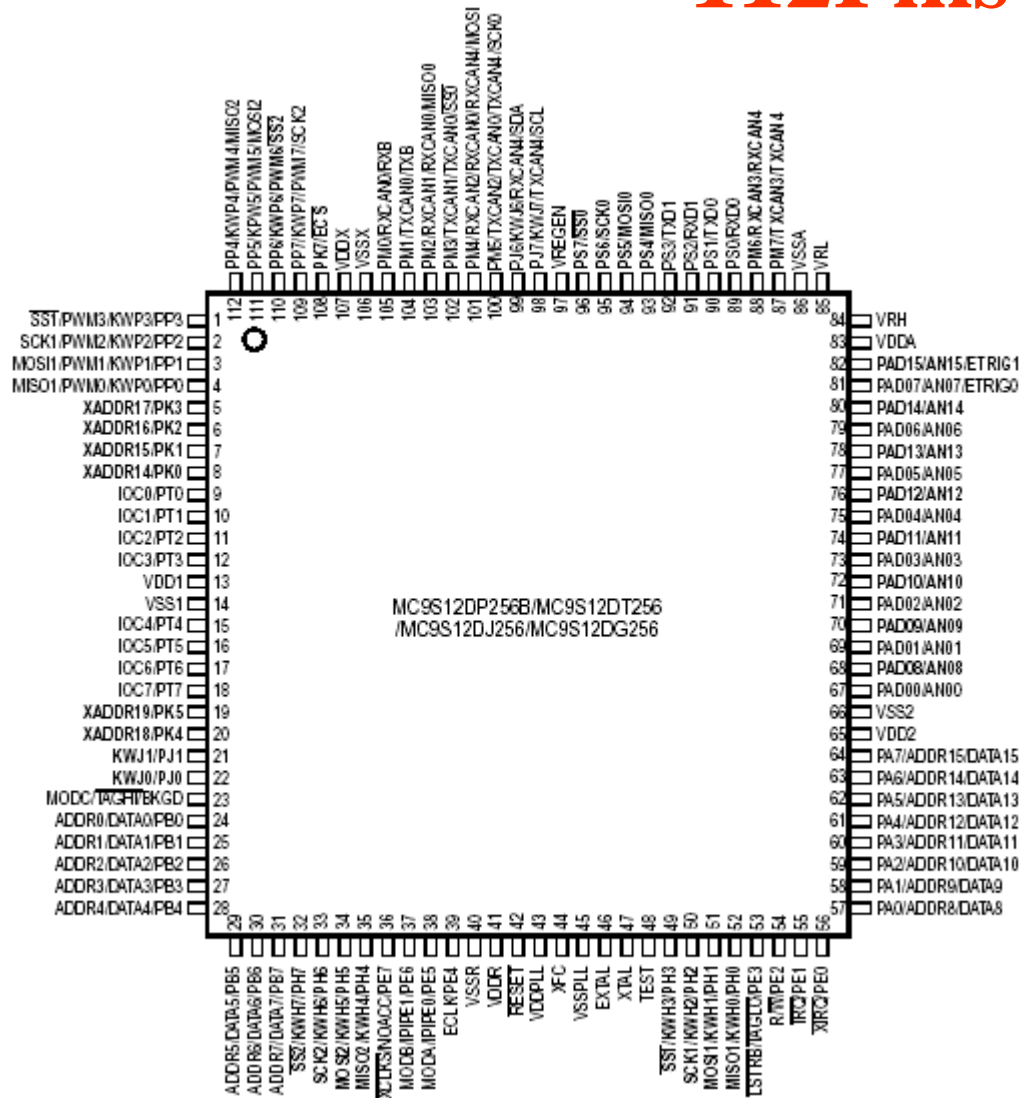
**Multi tasks?**

# IC9S12DP256

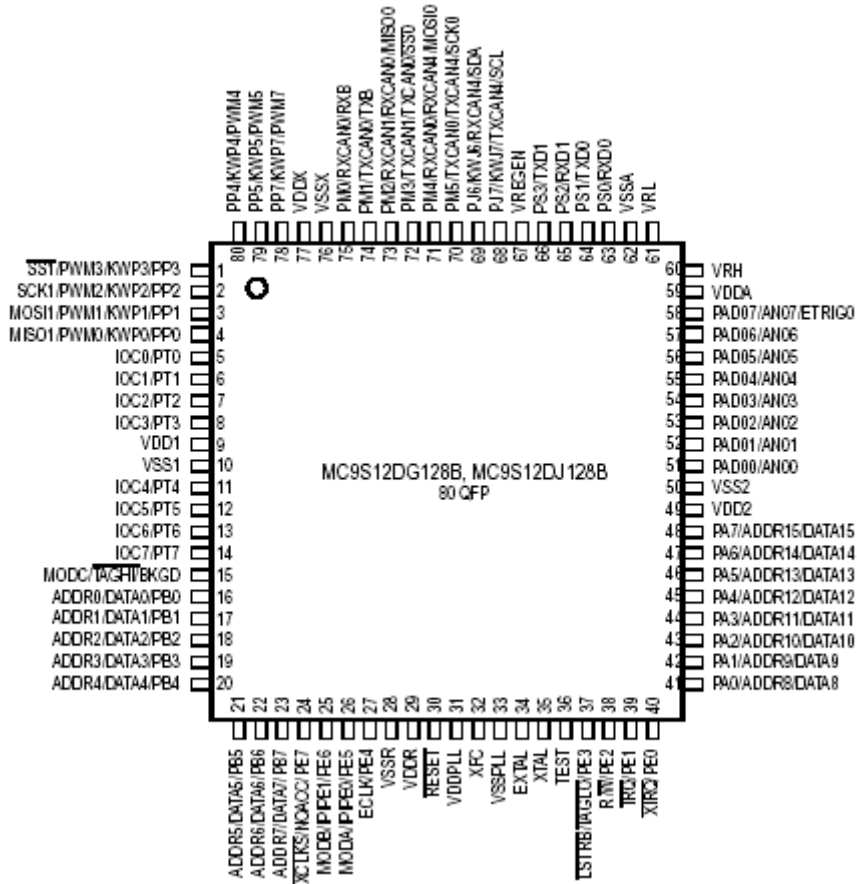


Note: This block diagram is for the 112-pin version. Pins in

# 112Pins Package

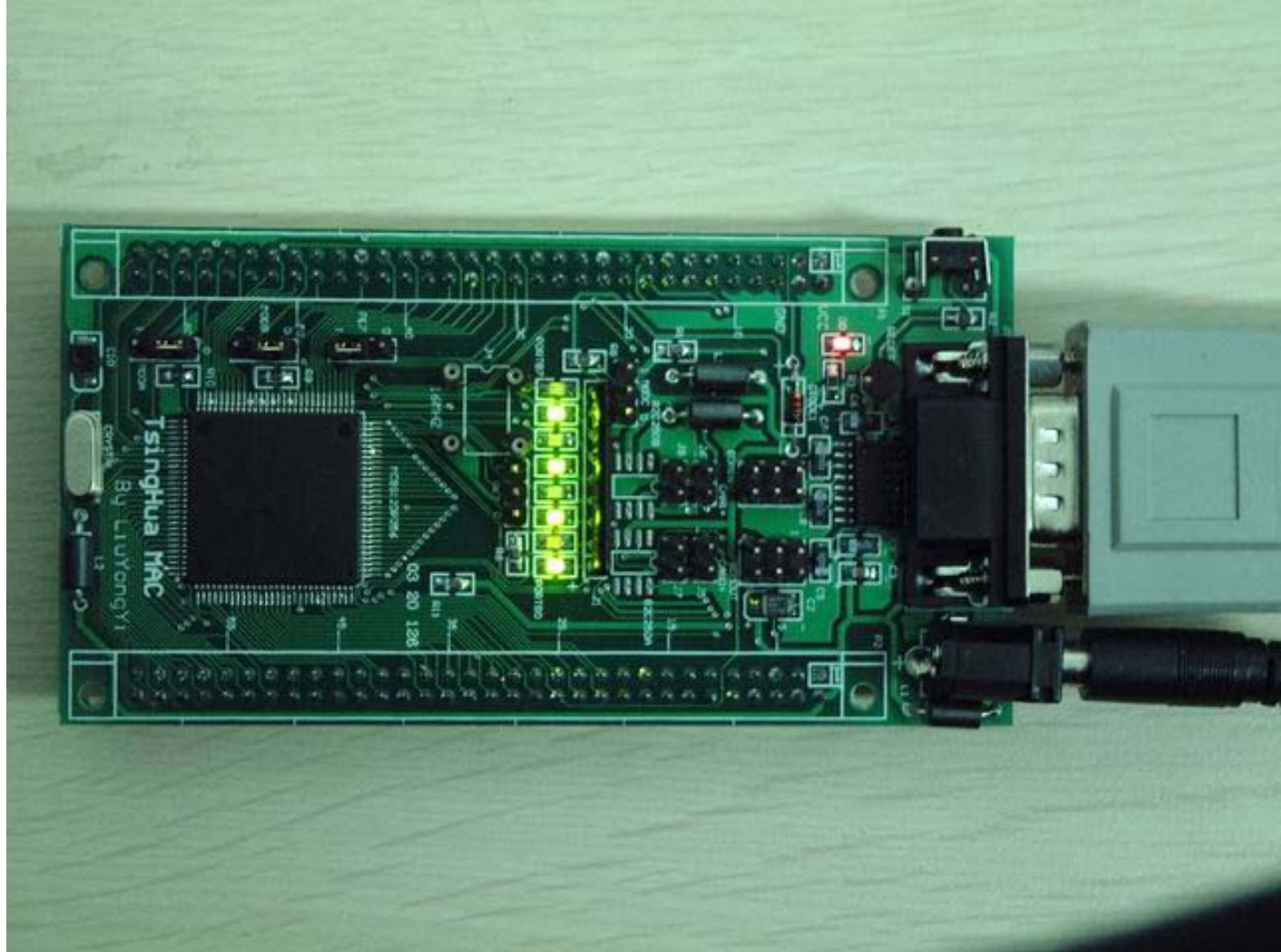


# 80 Pins Package



**-32, Port A, B, K, AD0**  
**Is not extracted**

# Basic System

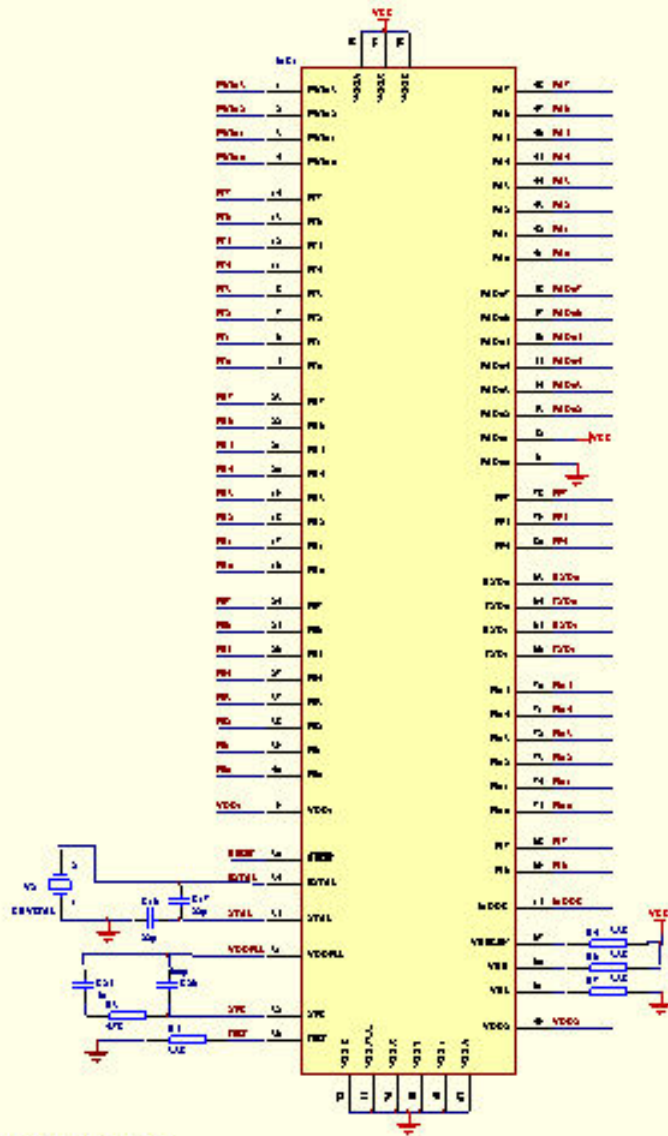


# MCU Basic System

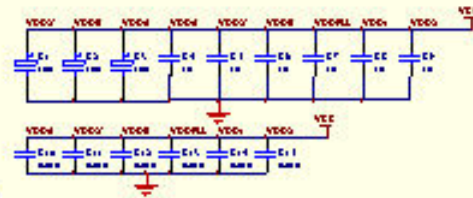
- **To make MCU work, users must provide:**
  - **Power supply**
    - **Power for CPU, clock, PLL, Analog.....**
  - **Clock**
    - **Crystal, Ceramic, RC, PLL,.....**
  - **Reset**
    - **Power on reset, push button**
  - **User communication port**
    - **RS-232C talk to PC**
  - **Program**
    - **Boot loader or Monitor/debug or Application Program**
  - **Port for done load program**
    - **BDM**



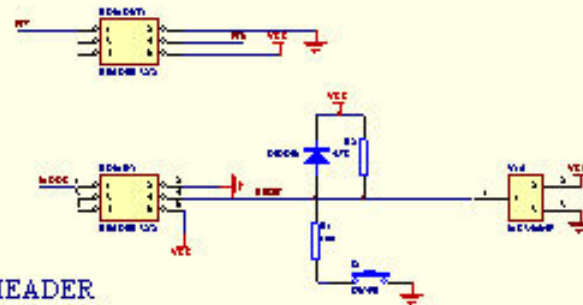
# Basic System of S12



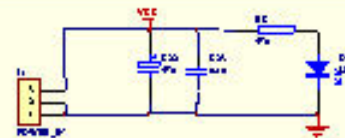
MC9S12DG128



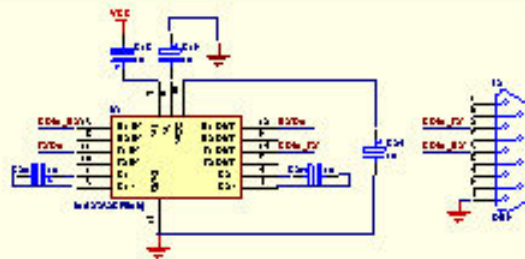
## FILTER



BDM HEADER



POWER



SCI COMMUNICATION

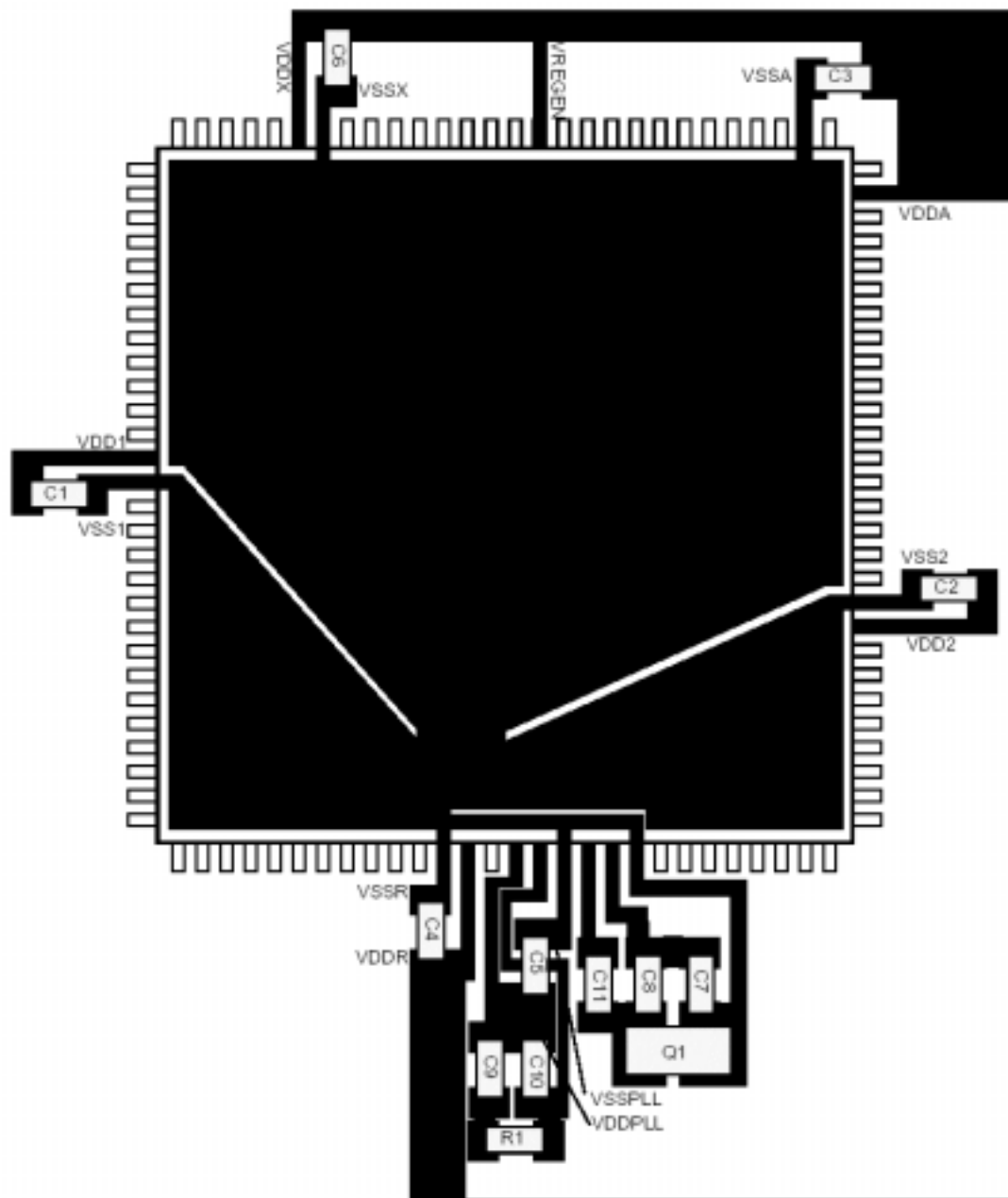
# HCS12 Power Supplies

- **Vddr:** Supplies regulator and **Ports A,B,E,H** - connect to 5V and bypass with 100 nF
- **Vdd1,2:** Outputs from 2.5V regulator. Supply **core** - bypass with 47-220 nF depending upon EMC results.
- **Vddpll:** Output from 2.5V regulator. Supplies **Osc. and PLL** - bypass with 22-100 nF
- **Vdda:** Supply to **A/D**. Connect to 5V and bypass with 22-100 nF
- **Vrh:** **Reference for A/D**. Connect to 5V and bypass with 10 nF
- **Vddx:** Supply for **all ports** except those supplied by Vddr. Connect to 5V and bypass with 47-220 nF. Add 10 uF if big loads are switched.

# HCS12 Power Supplies

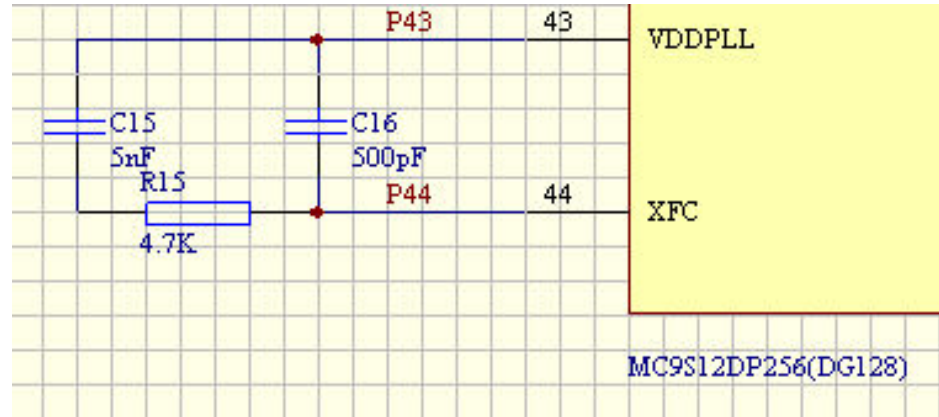
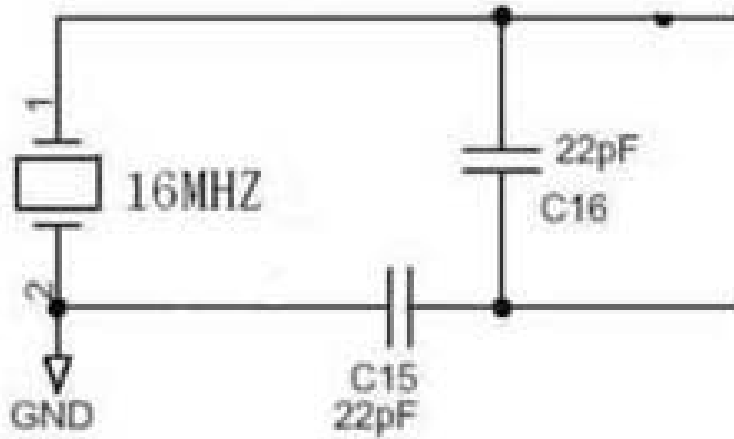
**Table A-1 Absolute Maximum Ratings<sup>1</sup>**

Num	Rating	Symbol	Min	Max	Unit
1	I/O, Regulator and Analog Supply Voltage	$V_{DD5}$	-0.3	6.0	V
2	Digital Logic Supply Voltage <sup>2</sup>	$V_{DD}$	-0.3	3.0	V
3	PLL Supply Voltage <sup>2</sup>	$V_{DDPLL}$	-0.3	3.0	V
4	Voltage difference $V_{DDX}$ to $V_{DDR}$ and $V_{DDA}$	$\Delta V_{DDX}$	-0.3	0.3	V
5	Voltage difference $V_{SSX}$ to $V_{SSR}$ and $V_{SSA}$	$\Delta V_{SSX}$	-0.3	0.3	V
6	Digital I/O Input Voltage	$V_{IN}$	-0.3	6.0	V
7	Analog Reference	$V_{RH}, V_{RL}$	-0.3	6.0	V
8	XFC, EXTAL, XTAL inputs	$V_{ILV}$	-0.3	3.0	V
9	TEST input	$V_{TEST}$	-0.3	10.0	V
10	Instantaneous Maximum Current Single pin limit for all digital I/O pins <sup>3</sup>	$I_D$	-25	+25	mA



**Be  
Careful  
during  
layout  
your PCB**

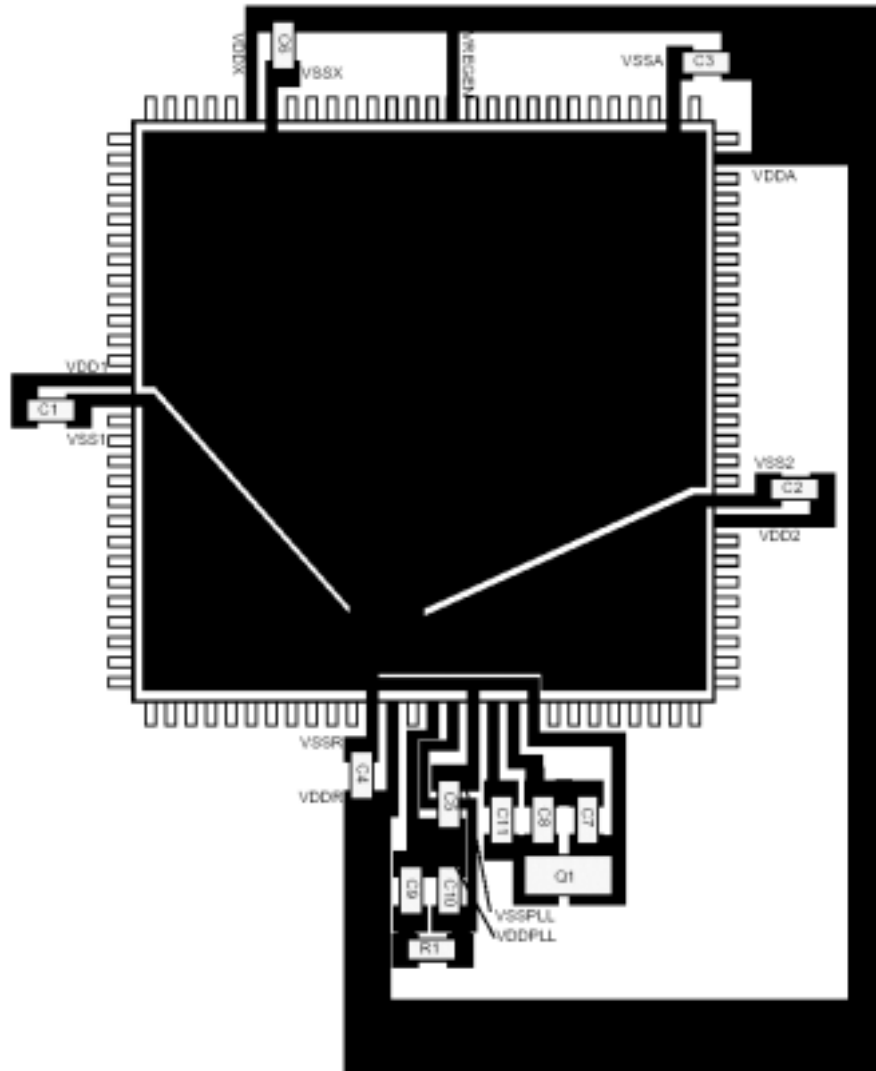
# Clock Circuit



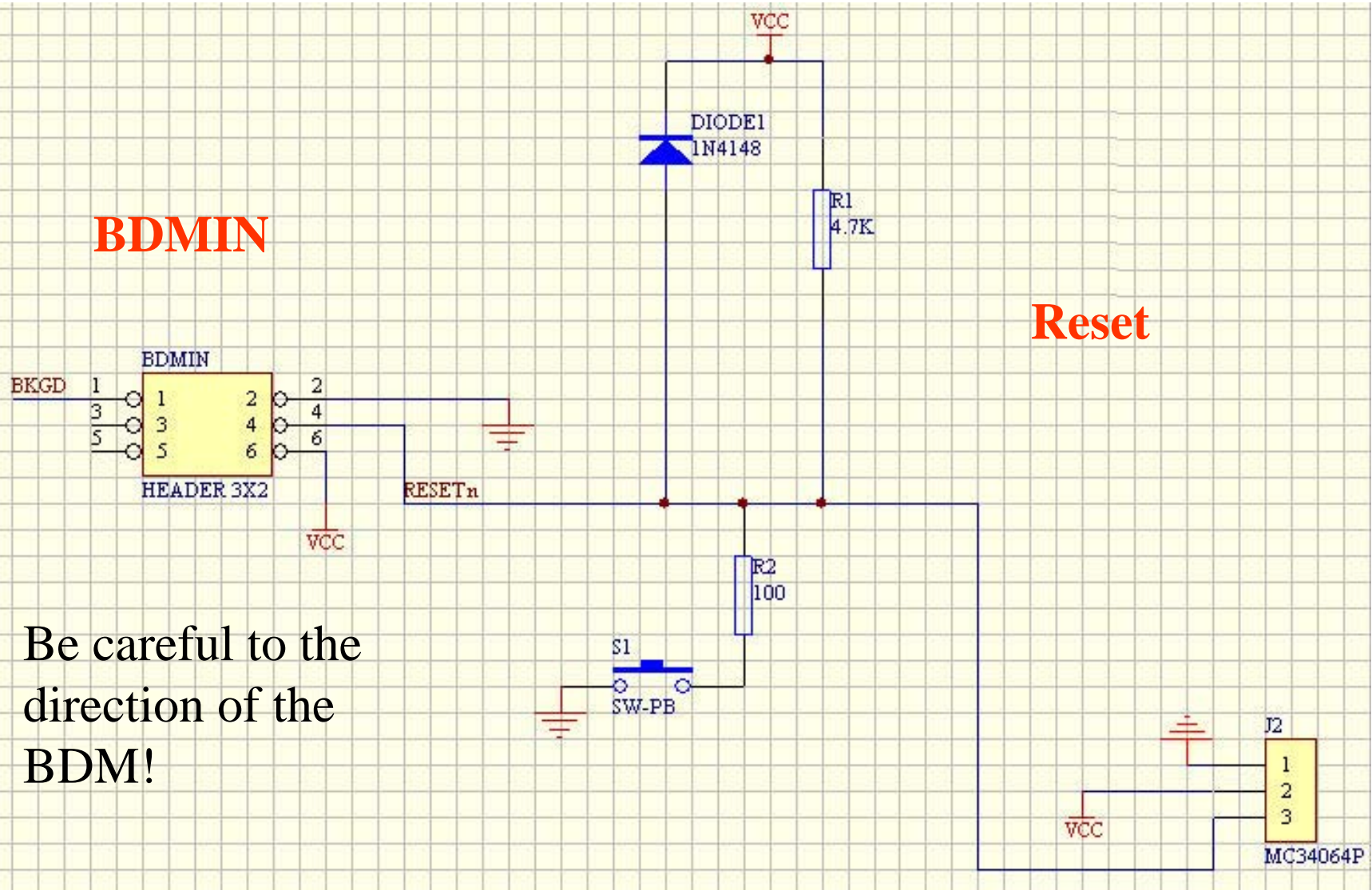
**8/16MHz Crystal Recommended**  
**Other Selection:**  
**Powered Oscillator**  
**Ceramic**  
**RC**  
.....

**Filter for PLL**

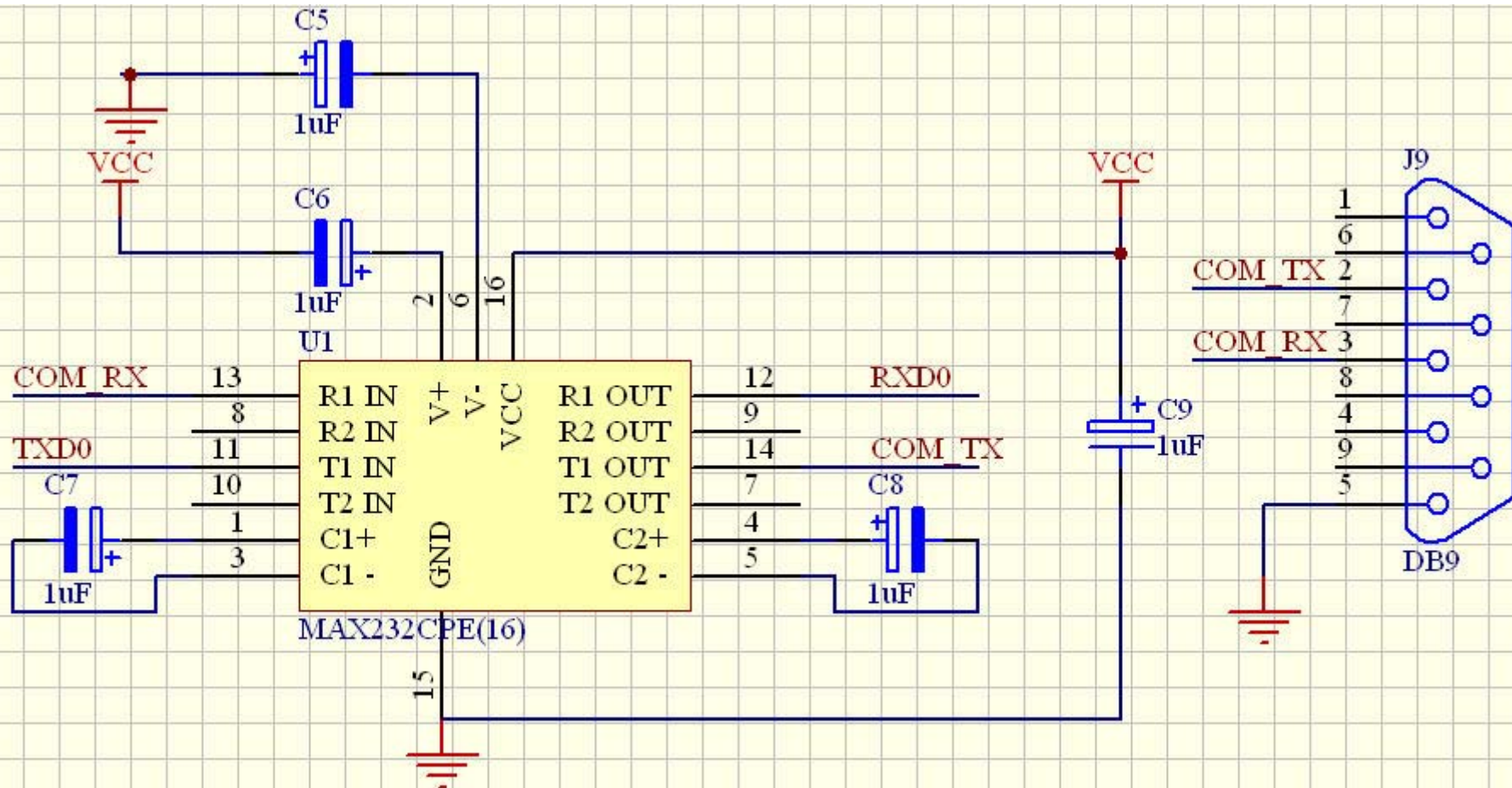
# Clock PCB Layout Notes



# Reset & BDM



# RS-232 Driver





# 8 Operating Modes

Use jumpers to select the following mode:

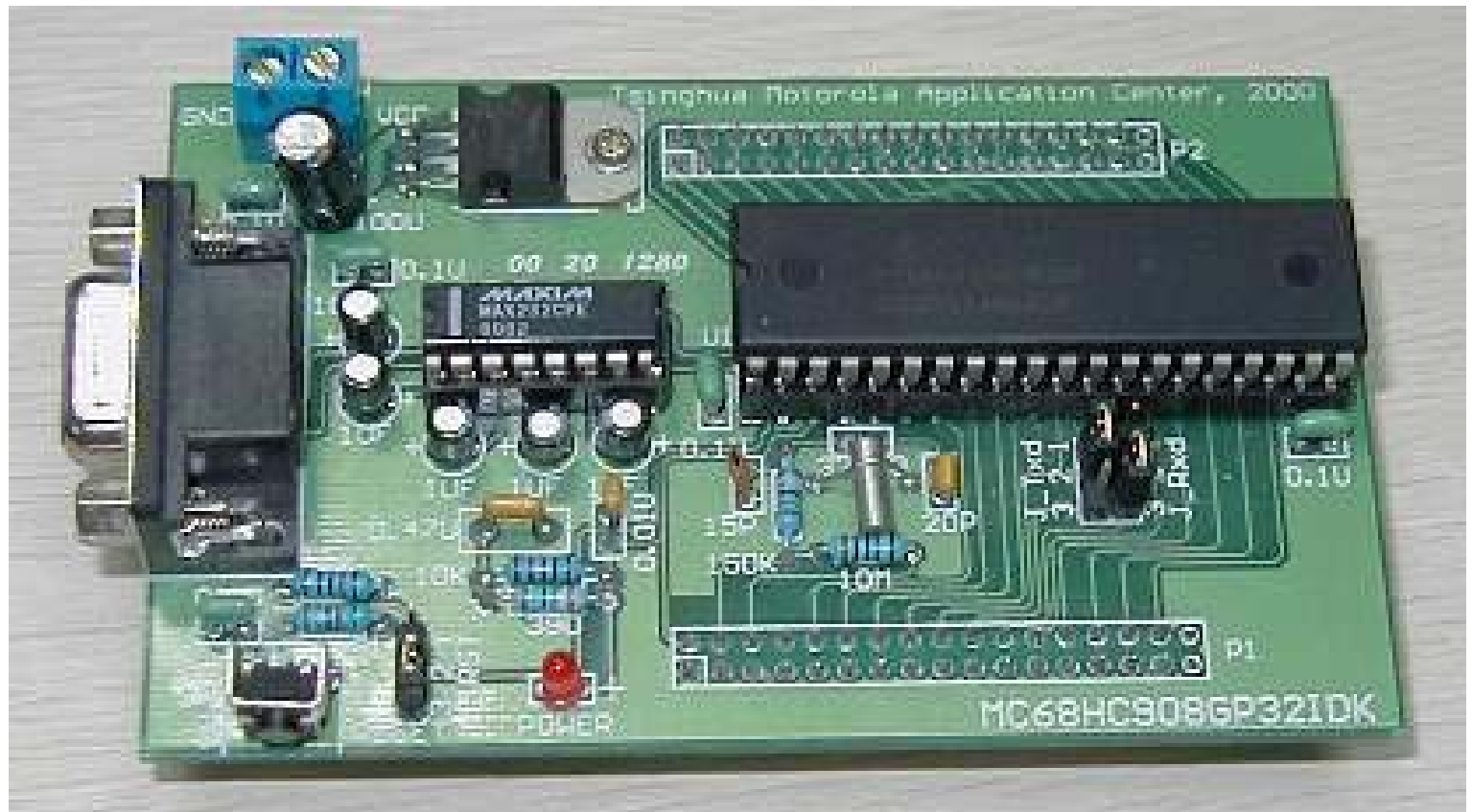
- **Normal single chip mode**
- **Special single chip mode**
- **Normal wide expanded mode**
- **Normal narrow expanded mode**
- **Emulation wide extend mode**
- **Emulation narrow expanded mode**
- **Special peripheral mode**
- **Special test mode (factory use only)**

**Do not change to other mode!**

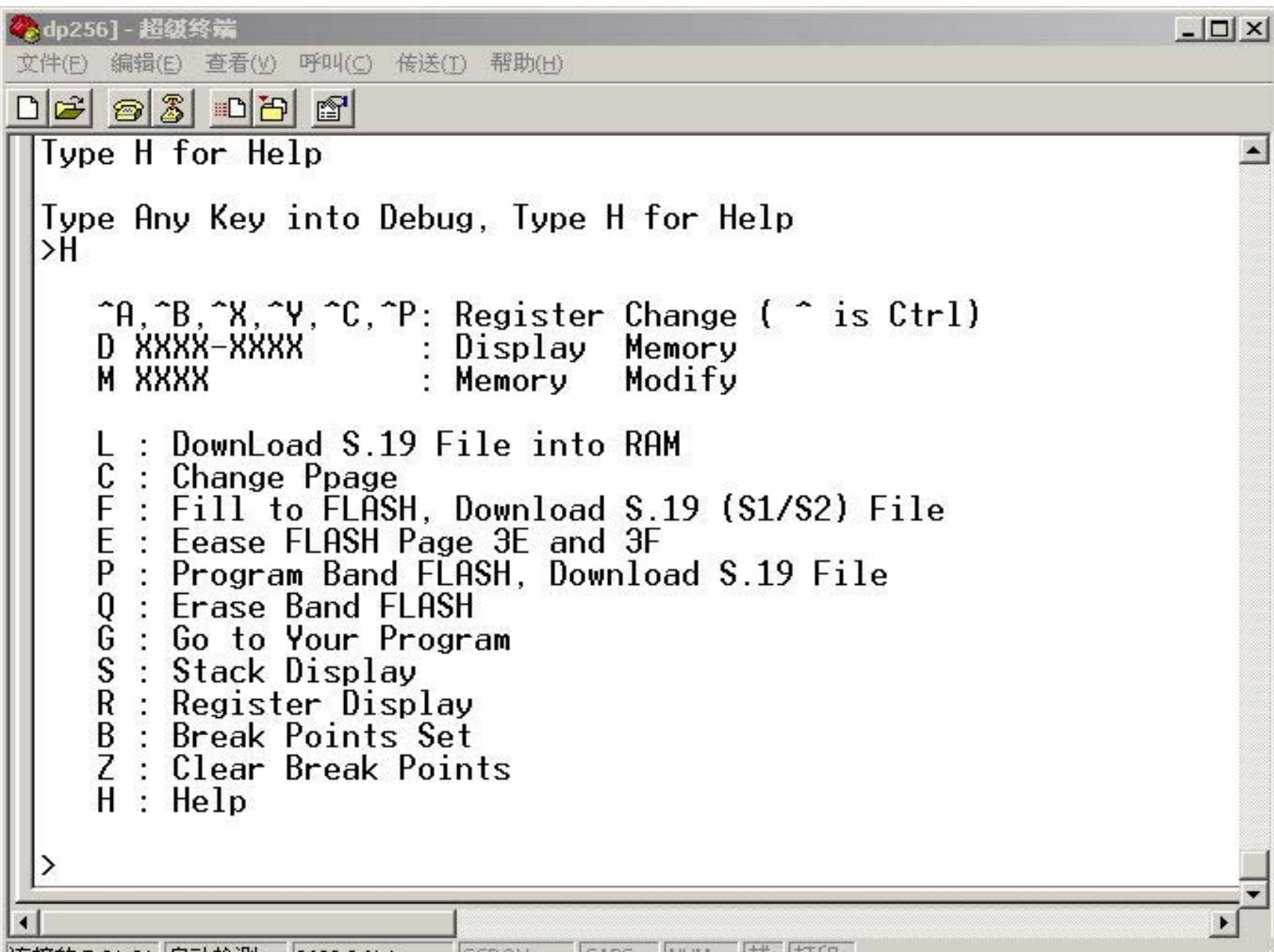
# Others on the Board

- 8 LED on the Port B
  - Direction register address: \$03
    - Write \$FF : output
  - Data register address: \$01
    - Write %01010101 on/off/on/off... LED
- CAN
  - Driver not mounted
- BDM out
  - For BDM tool

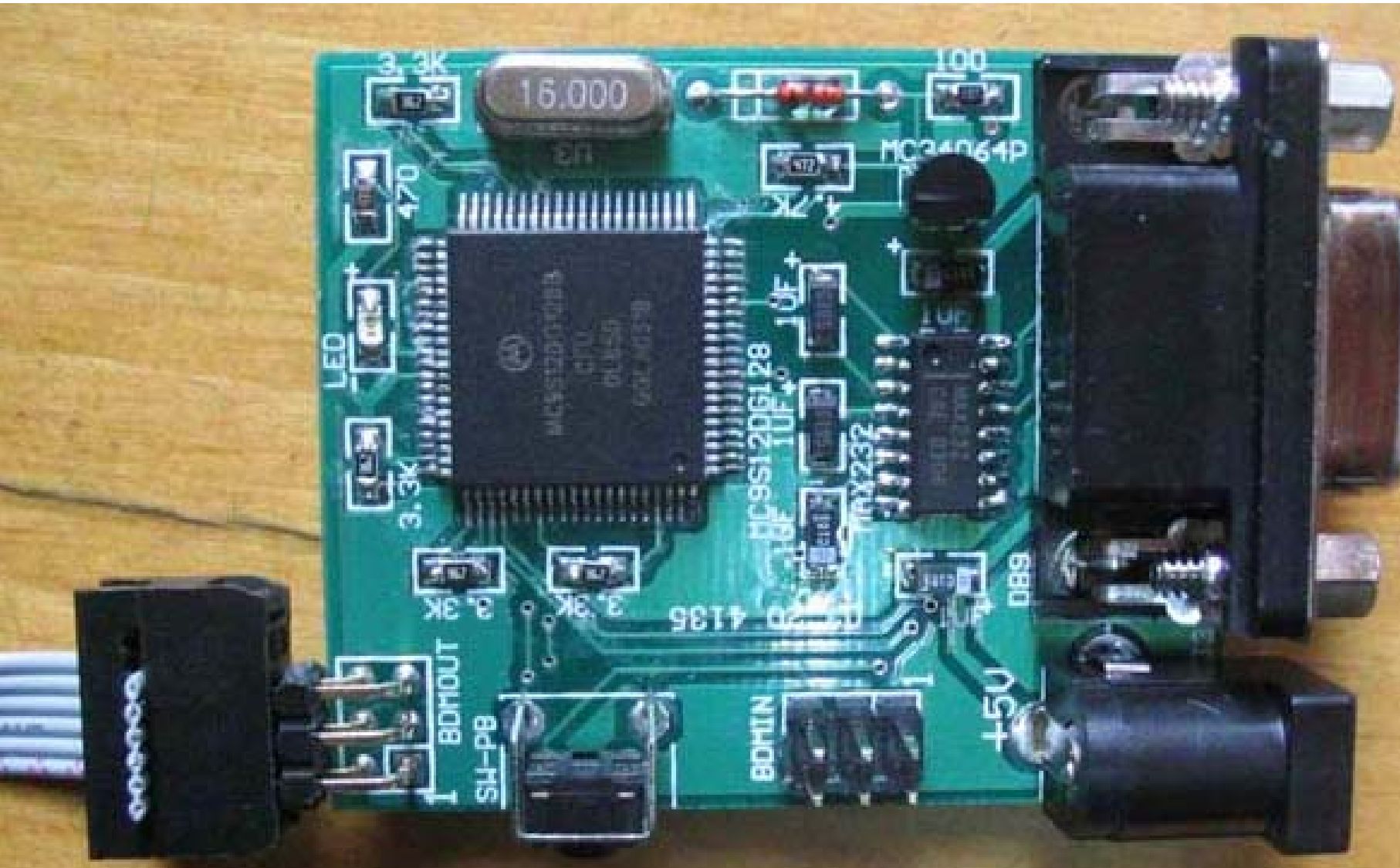
# Same Developing Methods for 8 Bits MCU MC68HC908GP32



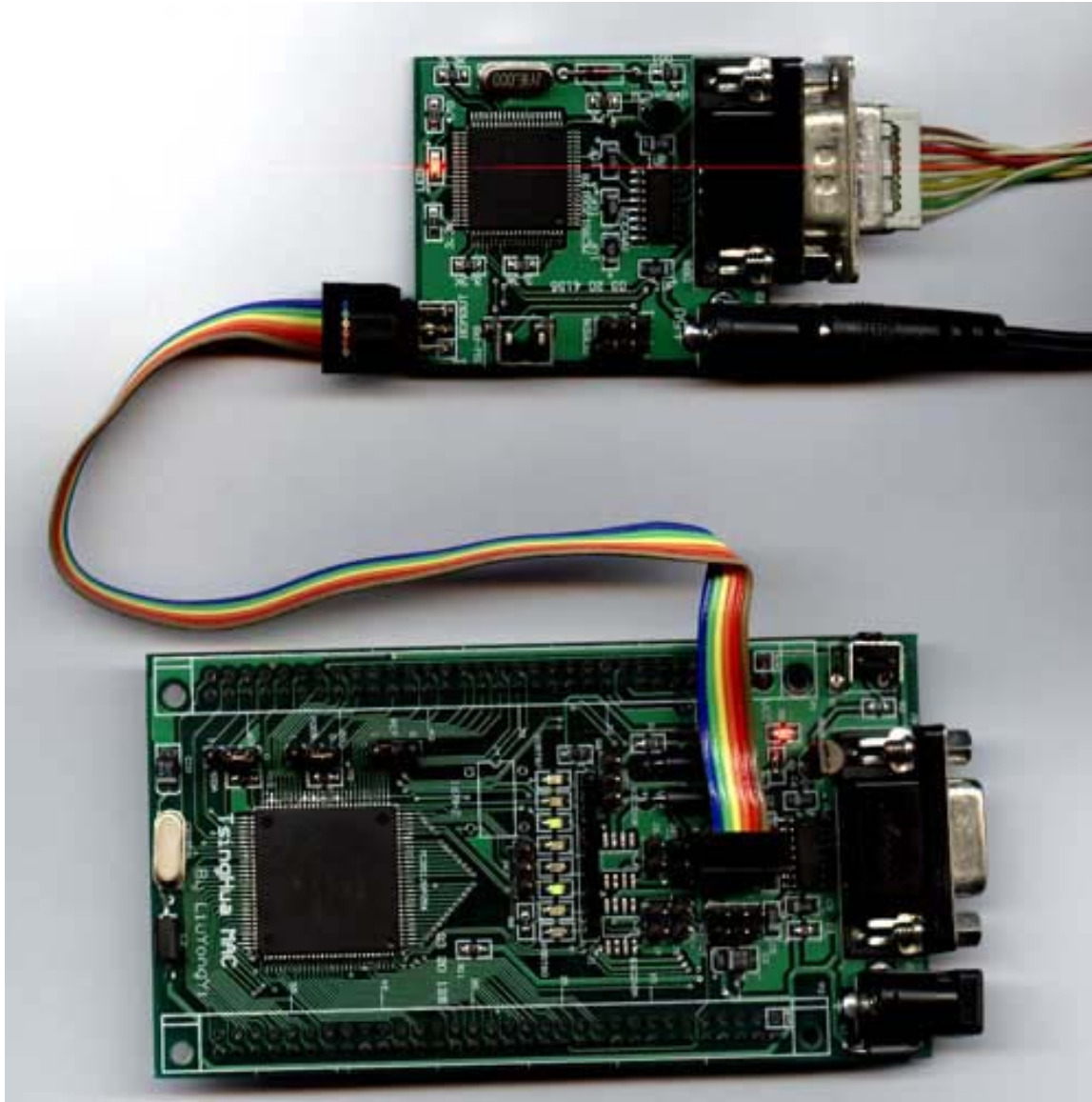
# Monitor/Debug Program



# BDM Tool for S12



# Use BDM Tool Download Program





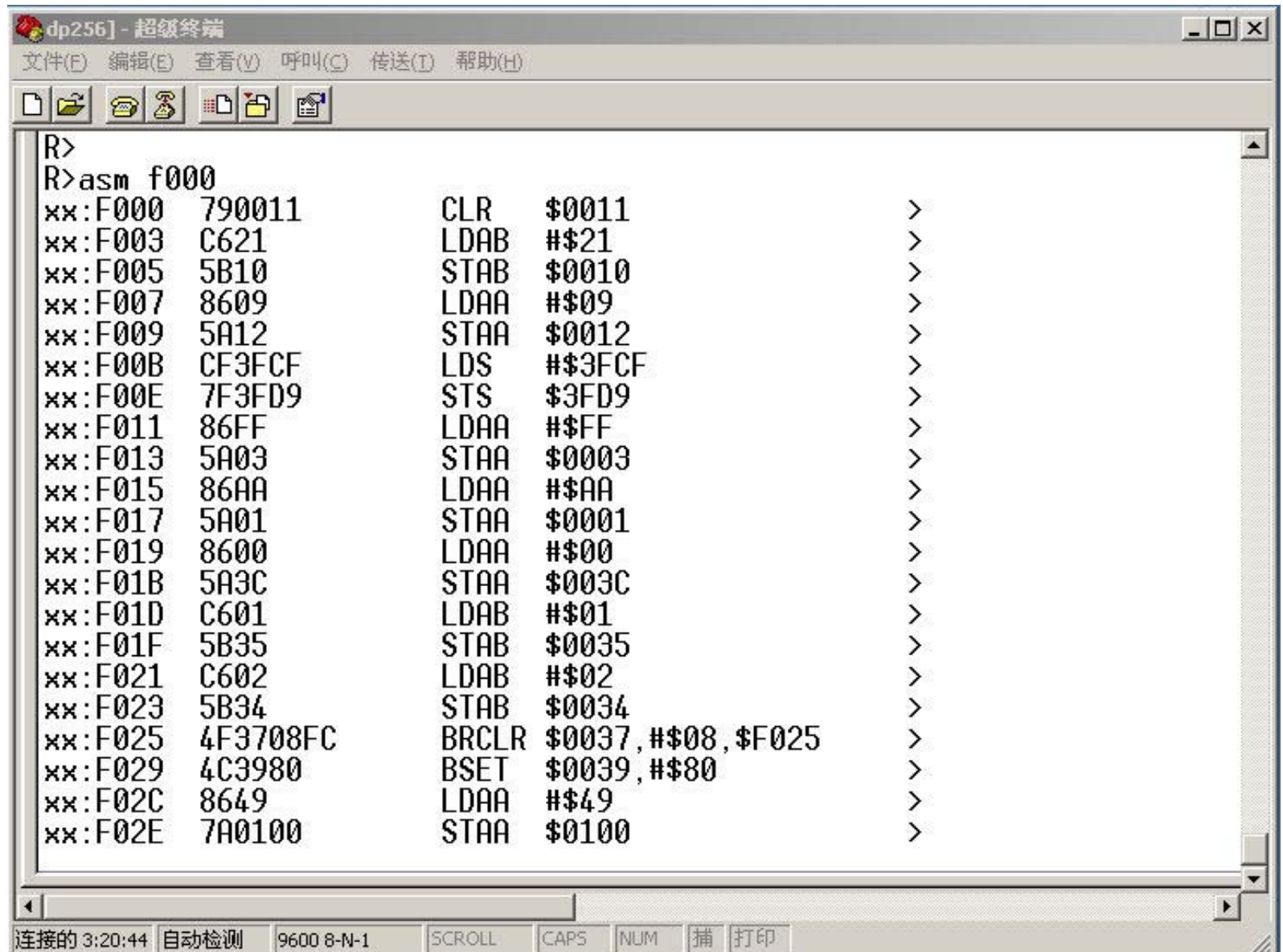
# D Command, Display Memory

```
dp256] - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)

>D 4000-40ff
- 4000 FE 40 40 FD 40 3E 27 0E 35 ED 31 EC 31 69 70 04 .@@.@>' .5.1.1ip.
- 4010 34 FB 31 03 26 F2 FE 40 42 EC 31 27 0B ED 31 18 4.1.&..@B.1'..1.
- 4020 0A 30 70 04 34 F9 20 F1 3D 1E 40 39 02 03 FF 40 .0p.4. .=.@9...@
- 4030 3C 07 CD 15 FB 00 03 20 F0 00 40 C1 36 01 00 01 <.....@.6...
- 4040 40 50 40 EC 00 00 40 54 00 00 40 56 00 00 40 56 @P@...@T..@V..@V
- 4050 30 00 00 02 FF FF DC 44 26 FC DC 44 27 FC FE 30 0.....D&..D'..0
- 4060 00 08 7E 30 00 8E 00 08 26 04 C6 7E 5B 01 FC 30 ..~0....&..~[..0
- 4070 00 8C 00 07 26 04 C6 BD 5B 01 FC 30 00 8C 00 06 ....&...[..0....
- 4080 26 04 C6 DB 5B 01 FC 30 00 8C 00 05 26 04 C6 E7 &...[..0....&...
- 4090 5B 01 FC 30 00 8C 00 04 26 04 C6 E7 5B 01 FC 30 [...0....&...[..0
- 40A0 00 8C 00 03 26 04 C6 DB 5B 01 FC 30 00 8C 00 02 ....&...[..0....
- 40B0 26 04 C6 BD 5B 01 FC 30 00 04 24 04 C6 7E 5B 01 &...[..0...$.~[.
- 40C0 3D C6 80 5B 46 86 03 5A 4D C7 87 7C 30 00 53 5B =..[F..ZM..|0.S[
- 40D0 03 5B 01 20 14 16 40 56 FC 30 00 8C 00 08 2D F5 .[...@V.0....-.
- 40E0 C7 87 7C 30 00 C6 05 5B 4D 20 EA 3D 00 00 FF FF ..|0...[M .=-...
- 40F0 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF .....
```

连接的 0:00:49 自动检测 9600 8-N-1 SCROLL CAPS NUM 捕 打印

# ASM/DASM Command in BDM Mode



```
R>
R>asm f000
xx:F000 790011 CLR $0011 >
xx:F003 C621 LDAB #$21 >
xx:F005 5B10 STAB $0010 >
xx:F007 8609 LDAA #$09 >
xx:F009 5A12 STAA $0012 >
xx:F00B CF3FCF LDS #$3FCF >
xx:F00E 7F3FD9 STS $3FD9 >
xx:F011 86FF LDAA #$FF >
xx:F013 5A03 STAA $0003 >
xx:F015 86AA LDAA #$AA >
xx:F017 5A01 STAA $0001 >
xx:F019 8600 LDAA #$00 >
xx:F01B 5A3C STAA $003C >
xx:F01D C601 LDAB #$01 >
xx:F01F 5B35 STAB $0035 >
xx:F021 C602 LDAB #$02 >
xx:F023 5B34 STAB $0034 >
xx:F025 4F3708FC BRCLR $0037,$$08,$F025 >
xx:F029 4C3980 BSET $0039,$$80 >
xx:F02C 8649 LDAA #$49 >
xx:F02E 7A0100 STAA $0100 >
```

连接的 3:20:44 自动检测 9600 8-N-1 SCROLL CAPS NUM 捕 打印