

# **M5208EVB-RevB**

## 32-bit Microcontroller User Manual

Version 1.0

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- 2) This device must accept any interference that may cause any undesired operation

This equipment has been tested and found to comply with the requirements of ETSI EN301 489-1 V1.4.1. It bears the CE marking for sale and operation within Europe.

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

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- 2) this device must accept any interference, including interference that may cause undesired operation of the device.

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**NOTE:** The abbreviation, IC, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

## Caution

**CAUTION:** This device is susceptible to electrostatic discharge (ESD) and surge phenomenon. Always use ESD precautions when handling this device.

**CAUTION:** Changes or modifications to this equipment, not expressly approved by the manufacturer could void the user's authority to operate the equipment.

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# Glossary

BDM	Background Debug Mode. Mode. A non-intrusive method of taking control of the MCF5208 through a debug program running on a host PC.
DCE	Data Communication Equipment.
DDR	Data Direction Register. A register whose bits correspond to the function of a set of digital I/O pins. The convention on the M5208EVB is to use 0 for input, 1 for output.
DMA	Direct Memory Access. Ability to copy a block of data from one device to another without the intervention of the CPU.
DTE	Data Terminal Equipment.
Duty Cycle	The fraction of high time of a PWM signal versus the period of the signal.
Eclipse	A multi-purpose, extensible integrated development environment.
GCC	GNU Compiler Collection. A public license GNU compiler.
GDB	GNU Debugger. A public license GNU debugger.
GPIO	General Purpose Input/Output. These are 3.3V level signals on the M5208EVB.
GPL	GNU General Public License.
Header	Single or double row of pins on a circuit board to which connectors may be attached.
IDE	Integrated Development Environment. An set of software tools that share a single interface used for writing, compiling and debugging programs.
IRQ	Interrupt Request. The ability of a module or external pin to request servicing of the interrupt controller. An IRQ stops the current execution of a program and jumps to a piece of code found in the interrupt vector table.
LSB	Least Significant Byte.
MSB	Most Significant Byte.
PIT	Periodic Interrupt Timer. A timer that can generate interrupts at regular intervals.
PWM	Pulse Width Modulation. A pseudo-analog signal that is toggled at a high frequency. The analog value between 0 and 3.3V is determined by the signal's duty cycle.
WDT	Watchdog Timer. A timer that resets the MCF5208 if the running program gets caught in an infinite loop or branches incorrectly.

# Nomenclature

Periodically, reference is made to entities in a generic manner using the italicized letter *n* to indicate that there are many numbered entities with the same name. For example, *DAT<sub>n</sub>* applies to all bits in the DAT register.

The naming conventions used for signals are shown in Table 1.

**Table 1: Signal Nomenclature**

<b>Name</b>	<b>Type</b>	<b>Logic Value</b>	<b>Term</b>
SIGNAL	Active High	0	Asserted
		1	Negated
*SIGNAL	Active Low	0	Negated
		1	Asserted

# Introduction

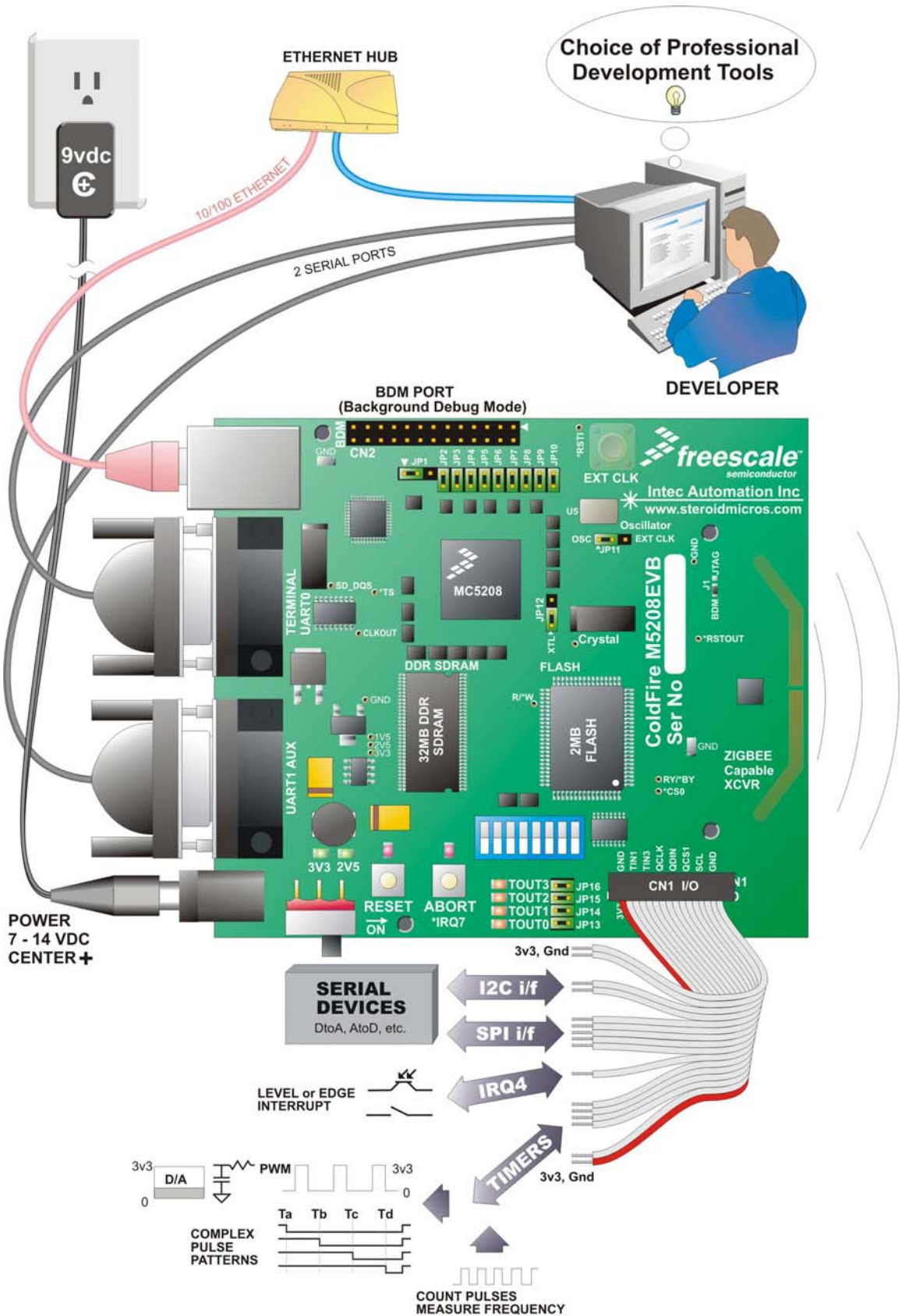
The M5208EVB is a convenient platform for evaluating many of the capabilities of the MCF5208 MPU. It offers a head start in terms of hardware development around this MPU. The software packages that accompany this evaluation board provide a head start in terms of software development.

The MCF5208 is a highly configurable MPU. While the M5208EVB does not make it possible to explore all the configuration possibilities of this MPU, it does provide a fair amount of functionality. This is further supplemented by the inclusion of a ZigBee capable transceiver, as shown in Figure 1.

With a 10/100 Ethernet controller and the ability to interface to up to 256MB (not Mb) of fast DDR SDRAM, the MCF5208 can support large operating systems and open up new software opportunities. To demonstrate this, the M5208EVB is shipped with uClinux and sample web pages pre-installed, allowing it to serve web pages “right out of the box”.



Figure 1 – M5208EVB Capabilities



# M5208EVB Modules

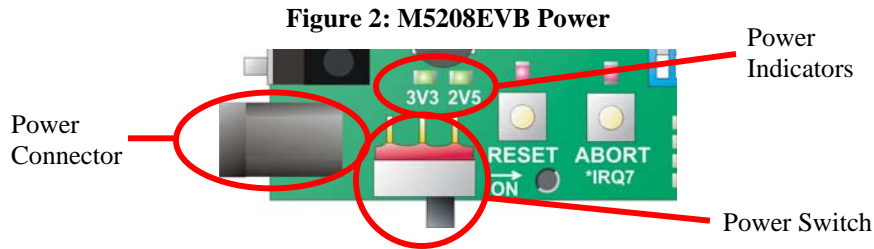
The M5208EVB is made up of modules. Some modules correspond to on-chip ColdFire peripherals. Other modules correspond to on-board peripherals and added features. These modules are:

- [Power System](#) – +7-14VDC input, regulated on board to provide necessary processor and peripheral voltages
- [Reset](#) Control circuitry and reset configuration switches
- [Clock](#) selection circuitry for on-board crystal, on-board oscillator or external oscillator
- [Serial](#) module – 2 level translated serial ports
- [Background Debug Mode \(BDM\)](#) port
- [I/O Header](#) providing access to several MCF5208 signals for off board use
- [DMA Timer](#) module
- [Interrupt Request Subsystem \(IRQ\)](#)
- [QSPI](#) module
- [I<sup>2</sup>C](#) module
- [Memory](#) – 2MB external flash, 32 MB external DDR SDRAM and a foot print for a 128KB external SRAM
- [WatchDog Timer \(WDT\)](#) module
- [Ethernet, PHY](#) and RJ45 connector
- [ZigBee capable transceiver](#)
- [Resident firmware](#) (dBUG monitor)
- [Operating System](#) (uClinux)

Some of these features are associated with connectors as shown Figure 1. This adds up to a rich assortment of features.

## Power System

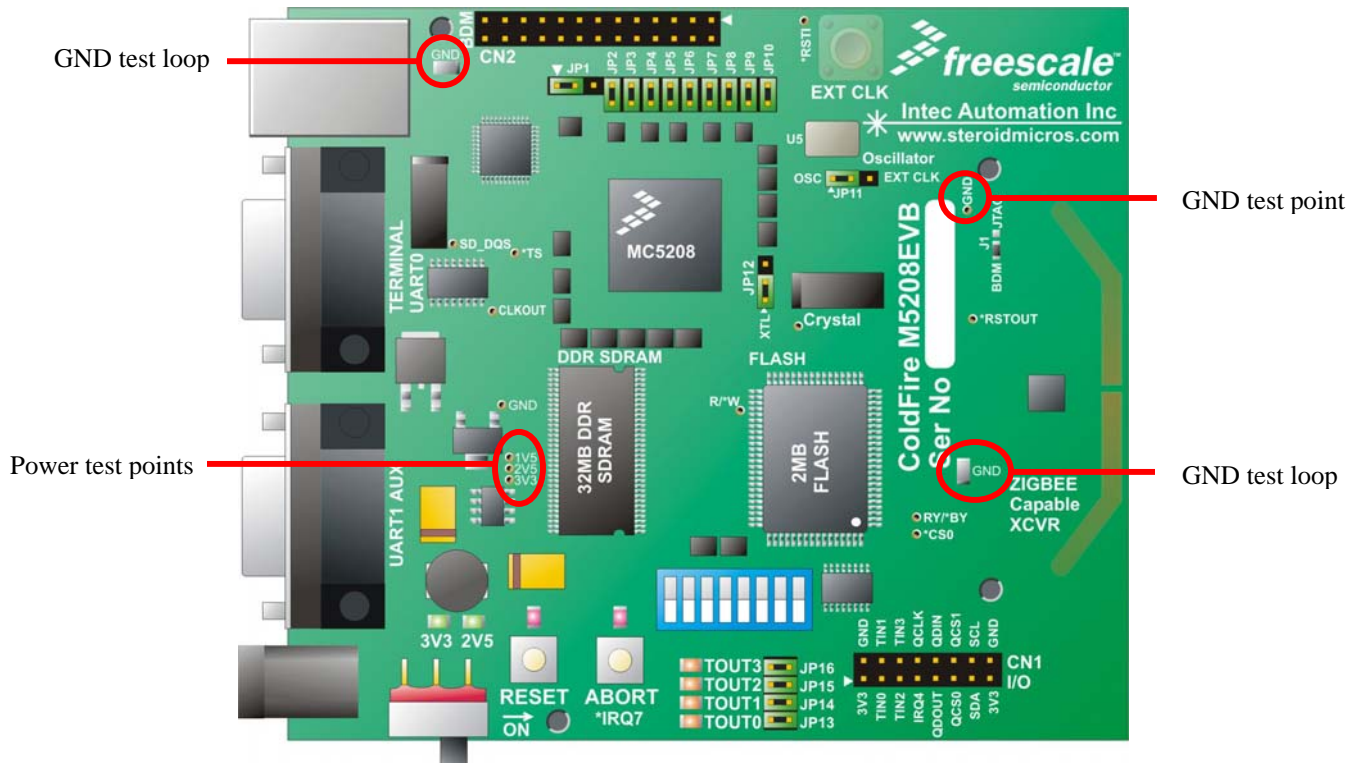
The **center positive** 5.5/2.1mm power jack for the M5208EVB accepts inputs ranging from +7V to +14V DC, capable of at least 3 watts. A slider switch connects the power to the board. When this switch is in the ON position power is connected to the board; otherwise all circuits on the board are isolated from the input power. A resettable Polyswitch fuse protects the power supply against a short on the board. Two green LEDs between the power connector and power switch indicate when the board is powered. The location of these indicators is shown in Figure 2.



**Table 2: M5208EVB Voltage Levels**

Voltage	Max Current	Signal Name	Description
3.3V	1A	EVDD	External I/O supply voltage.
2.5V	500mA	SDVDD	External Bus supply voltage. Used by DDR SDRAM, flash and SRAM.
1.5V	200mA	PLLVDD, IVDD	PLL and Internal Core supply voltage.
1.25V	-	VREF	DDR reference voltage.

**Figure 3: Power Test Points**

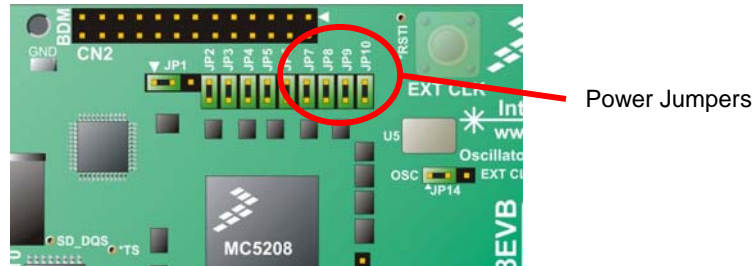


Each supply voltage can be measured at a labeled test point on the M5208EVB and Ground can be accessed at 2 test clips and one test point as shown in Figure 3.

## Power Jumpers

Several jumpers make it possible to measure the current draw to the various MCF5208 processor power inputs or to isolate them from the power supplies. These jumpers are listed in Table 3.

**Figure 4: Power Jumpers**



**Table 3: Power Jumper Descriptions**

JP7	<b>ON</b>	<b>Connect Core, PLL filter to 1.5V</b>
	OFF	Disconnect Core, PLL filter from 1.5V
JP8	<b>ON</b>	<b>Connect Core to 1.5V (w/ JP7 ON)</b>
	OFF	Disconnect Core from 1.5V
JP9	<b>ON</b>	<b>Connect MPU I/O rail to 3.3V</b>
	OFF	Disconnect MPU I/O rail from 3.3V
JP10	<b>ON</b>	<b>Connect External Bus to 2.5V</b>
	OFF	Disconnect External Bus from 2.5V

All the power jumpers are described in [Appendix A](#) and on Sheet 12 of the [M5208EVB schematic](#).

## Low Voltage Detection

The ColdFire5208 processor does not have internal low-voltage detection circuitry to detect intermittent power levels. The voltage supervisor on the reset debounce circuit (Sheet 11 of the [schematic](#)) serves as a voltage supervisor that resets the processor if the external voltage (3.3V) drops below 3.15V.

### **WARNING:**

To avoid damage to the M5208EVB, only attach a coaxial **center positive** (2.1 mm) plug.

Draw from any power pin on a header to an external circuit, in excess of 100ma, may damage the board.

# Reset

There are 3 ways to reset the M5208EVB:

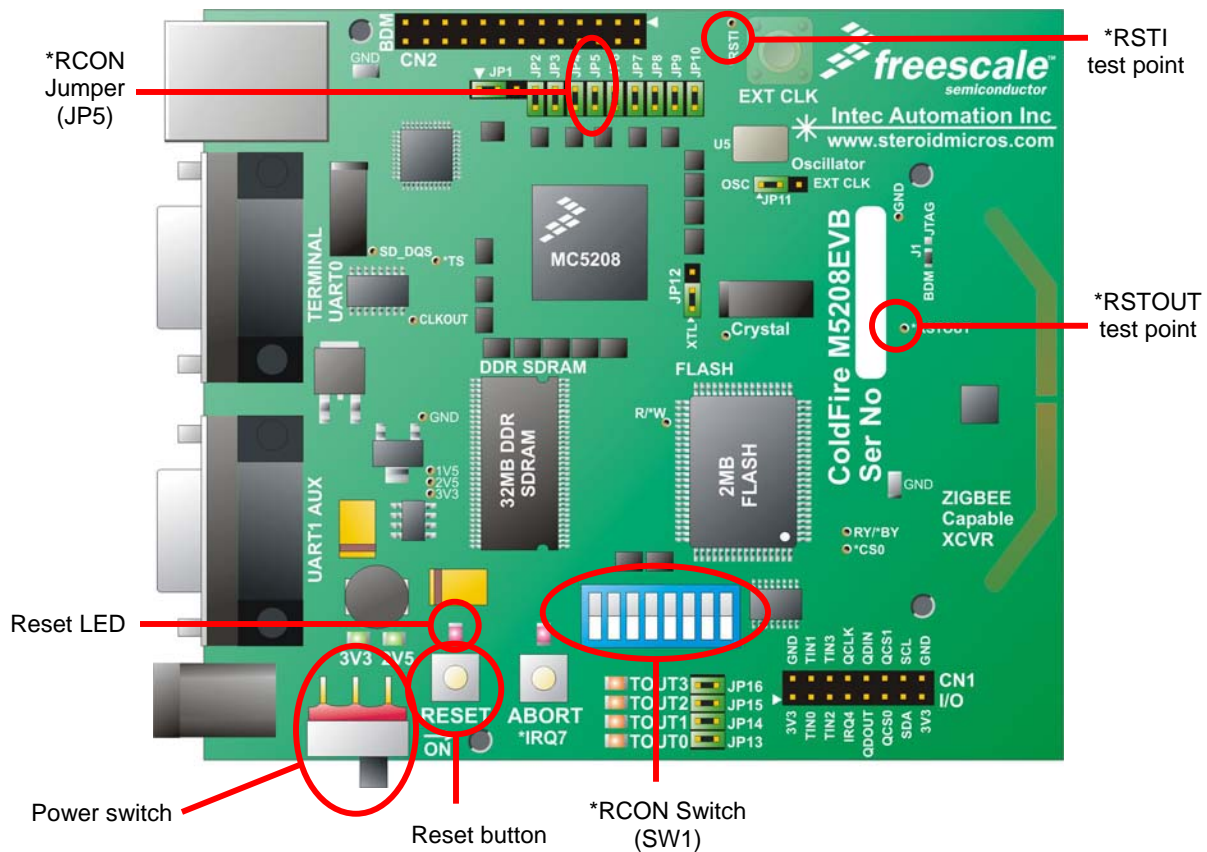
**Power-on reset** – accomplished by power cycling the board: switch the power switch to the OFF position then back to the ON position or remove and reconnect the power cable. The contents of all volatile memory (iRAM and SDRAM) will be lost.

**External reset** – asserted by pressing the Reset button or by issuing a reset command through the BDM pod using software on the PC. The contents of volatile memory are preserved.

**Software reset** – invoked with the ‘reset’ command to dBUG monitor, the ‘reboot’ command in uClinux, or by setting bit 7 in the RCR register (see MCF5208 Reference Manual, “Chapter 10 Reset Controller Module”). The contents of volatile memory are preserved.

In all 3 cases, when the board is reset, all registers are reset to their default state.

**Figure 5: Reset Signal and Switch Locations**



## Startup Configuration

The MCF5208 configuration depends on 9 signals: \*RCON, D9 and D[7:1] which are sampled when the MPU comes out of reset. When \*RCON is asserted (the shunt on JP5 is on), the MCF5208 reads its configuration options from the data signals which are driven high or low by the 8 rocker switches on SW1. Configuration options are shown in Table 4. If \*RCON is negated (JP5 OFF), the MCF5208 takes the default reset configuration values shown in Table 5.



**Table 4: RCON Mode Configuration Selection (\*RCON = 0 ← JP5 ON)**

Selection		Configuration
<b>SW1-1</b>		<b>PLL Mode</b>
OFF		166.67MHz Core bus, 83.33MHz External Bus operation
ON		88MHz Core bus, 44MHz External Bus operation (Note 1)
<b>SW1-2</b>		<b>Oscillator Mode</b>
OFF		Crystal oscillator mode
ON		Oscillator bypass mode
<b>SW1-3</b>	<b>SW1-4</b>	<b>Boot Port Size</b>
OFF	OFF	16-bit port
OFF	ON	32-bit port
ON	OFF	32-bit port
ON	ON	8-bit port
<b>SW1-5</b>		<b>Output Pad Drive Strength</b>
OFF		High drive strength
ON		Low drive strength
<b>SW1-6</b>		<b>LIMP Mode</b>
OFF		Normal operation; PLL drives internal clocks.
ON		LIMP mode; low-power clock divider drives internal clocks.
<b>SW1-7</b>		<b>Oscillator Frequency Select</b>
OFF		16MHz is used as input to processor
ON		16.67MHz is used as input to processor
<b>SW1-8</b>		<b>Chip Select Configuration</b>
OFF		A[23:22] = A[23:22]
ON		A[23:22] = *FB_CS[5:4]

NOTE: Default setting for each switch is OFF

**Table 5: Default RCON Values (\*RCON = 1; ← JP5 OFF)**

Selection	Default Mode
PLL Mode	88MHz Core bus, 44MHz External Bus operation (Note 1)
Oscillator Mode	Crystal oscillator mode
Boot Port Size	32-bit port
Output Pad Drive Strength	Low drive strength
LIMP Mode	Normal operation; PLL drives internal clocks.
Oscillator Frequency Select	16MHz is used as input to processor
Chip Select Configuration	A[23:22] = A[23:22]

**Note 1: Caution!** Loss of Functionality.

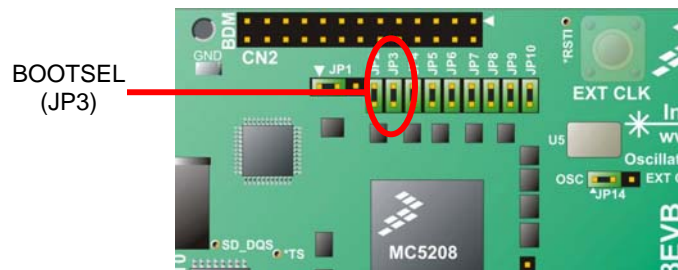
Running the PLL at 88/44MHz will run the DDR out of spec. The DDR will be inaccessible under this configuration.

## Boot Select

This jumper determines whether the dBUG monitor executes a program in flash, or, whether dBUG remains as the only active program.

When the M5208EVB powers on, dBUG monitor immediately initializes the board. Then it looks to the BOOTSEL signal to determine its behavior. BOOTSEL is tied to JP3. If BOOTSEL is asserted (JP3 is ON) and the board's [Autorun](#) parameter is set, then dBUG monitor will run the program it has saved in flash. By default this program is uClinux, but can be replaced with any user program. If BOOTSEL is negated (JP3 is OFF), then dBUG monitor will present the dBUG prompt at the console and await user input.

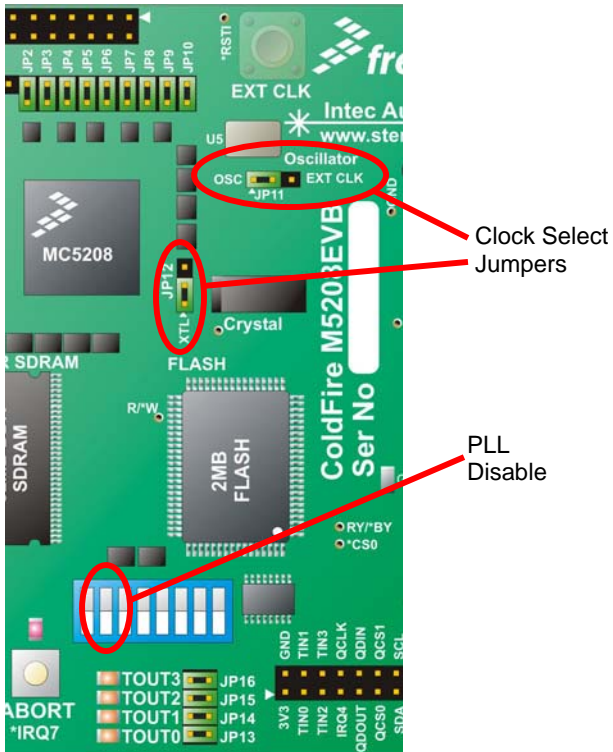
**Figure 6 - Boot Select Jumper**



## Clock Input

There are 3 options for providing the clock input to the MCF5208. Table 6 shows valid combinations of settings for SW1-2, JP5, JP11 and JP12 to select the clock input (Figure 7), as shown in Table 6.

**Figure 7: Clocking Selection**



**Table 6: Clock Source Selection**

SW1-2	JP5	JP11	JP12	Clock Selection
-	OFF	-	1-2	16MHz Crystal
OFF	ON	-	1-2	16MHz Crystal
ON	ON	1-2	2-3	16MHz Oscillator
ON	ON	1-2	2-3	External Oscillator

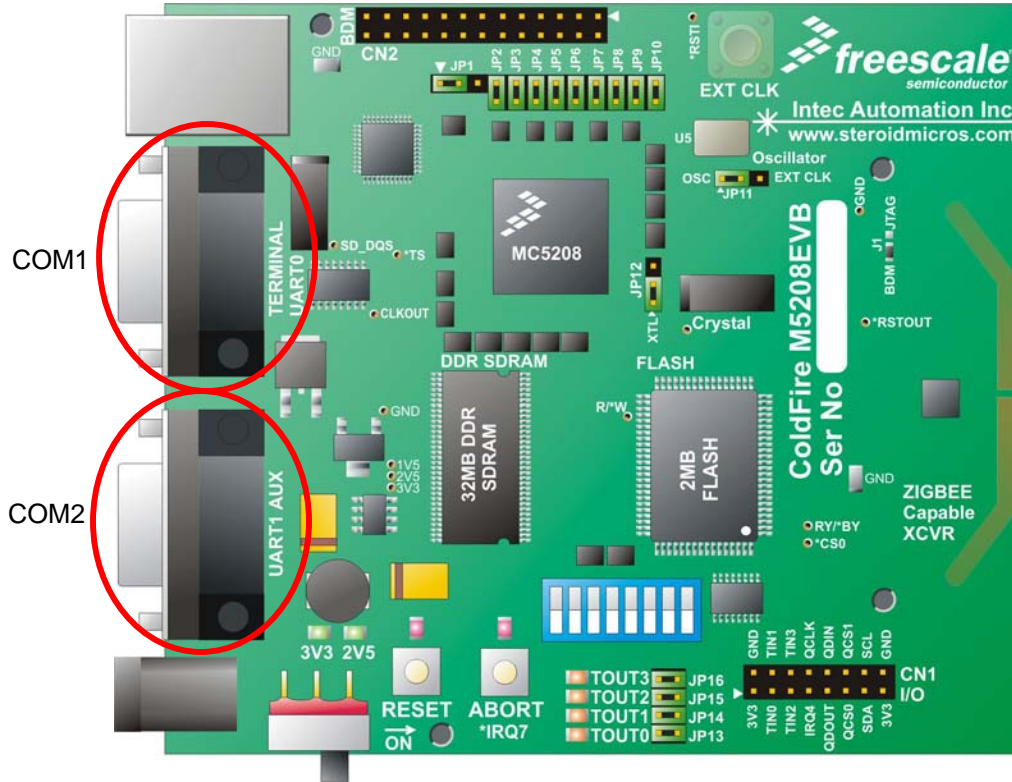
**Warning!** Using any combination of settings not included in this table can damage the PLL circuit on the MCF5208. Ensure that only these combinations are used when power is applied to the board.



## Serial Ports

The M5208EVB has two COM ports with RS232 level signals. They normally connect to a host PC.

Figure 8: M5208EVB Serial Ports



COM1 is specifically used for serial debugging a user program with the dBUG monitor or, for uClinux terminal.

COM2 is available for user I/O and for redirecting console I/O during a serial debugging session. The female DB9 serial connectors have standard DCE pinouts and connect directly to a DTE device such as a PC. There are no hardware handshaking signals on COM1 or COM2.

COM3 (UART2) signals are available on CN1. The Tx and Rx signals are multiplexed with TIN0 and TOUT2, respectively. See [I/O Header](#) and “Chapter 24: UART Module” of the MCF5208 Reference Manual for more details.

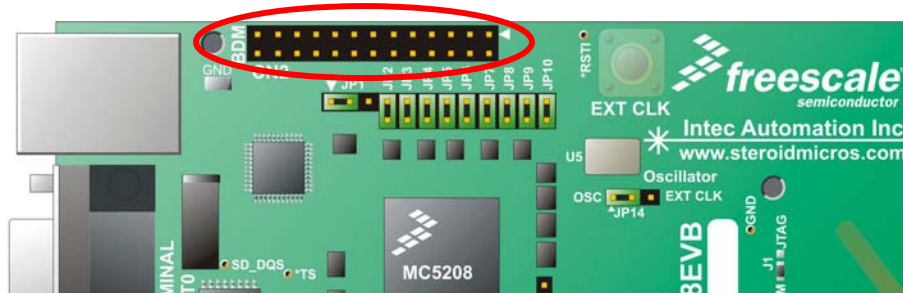
## Serial Debugging

Serial debugging requires the use of 2 COM ports if the user program contains any console I/O (i.e. printf or getc). This is because the serial dBUG monitor ties up COM1 and console I/O is typically redirected to COM2.

## BDM/JTAG Port

While serial debugging using the on-board dBUG monitor is adequate for many applications, Background Debug Mode (BDM) debugging makes it possible for a BDM debugger to have total control of the processor, even after a program has crashed. BDM debugging is able to monitor the processor status at any time, without interfering with the processor execution. If JTAG is enabled, the JTAG signals from the MCF5208 come out to the BDM header.

**Figure 9: CN2 – BDM Port**



**Table 7: CN2 – BDM Port Signals**

Direction	Signal	Pins	Signal	Direction
-	-	1 2	*BKPT	IN
-	GND	3 4	DSCLK	IN
-	GND	5 6	TCLK	IN
IN	*RSTI	7 8	DSI	IN
-	3V3	9 10	DSO	OUT
-	GND	11 12	PST3	OUT
OUT	PST2	13 14	PST1	OUT
OUT	PST0	15 16	DDATA3	OUT
OUT	DDATA2	17 18	DDATA1	OUT
OUT	DDATA0	19 20	GND	-
-	-	21 22	-	-
-	GND	23 24	PSTCLK	OUT
-	1V5	25 26	*TA	IN

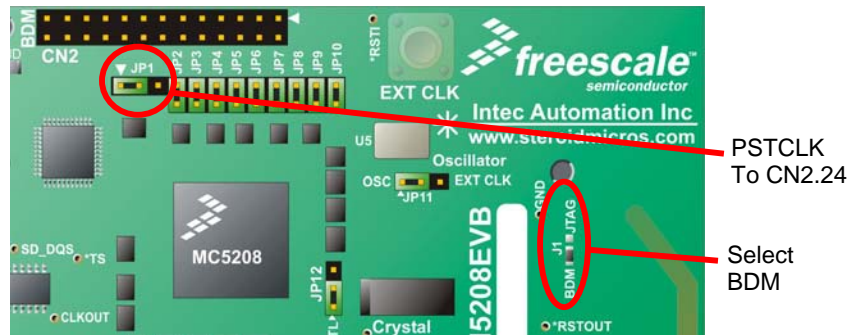
Pin 25 on the BDM header is connected to 1V5 through JP2, which is fitted by default. This jumper is required for some of the legacy BDM pods that connect pins 9 & 25 of the BDM interface internally. More recent debug pods support both core & I/O voltages. The BDM pod supplied with the M5208EVBEVB supports both voltages and requires JP2 to be fitted.

## JTAG\_EN

J1 is a 2-position shorting pad for a 0 ohm 0603 resistor (Figure 10). By default pads 1-2 are shorted, enabling BDM mode on the processor. This configures all the signals on the BDM header, CN2, with their BDM functions as described in “Chapter 26 Debug Module” of the MCF5208 Reference Manual. In BDM

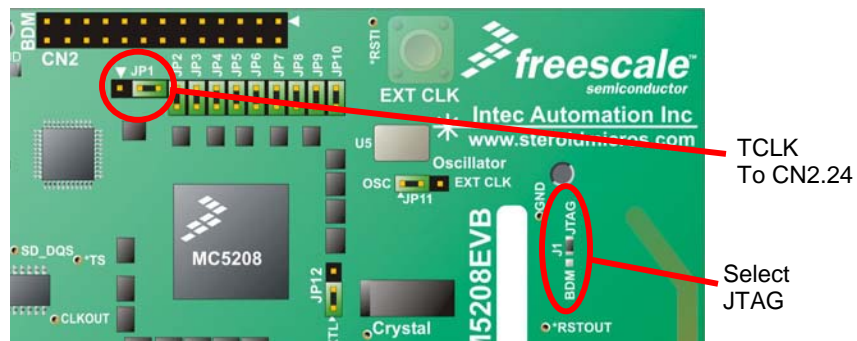
mode, JP1 should be fitted across pins 1-2 to connect TCLK/PSTCLK, configured as PSTCLK, to pin 24 of CN2.

**Figure 10: BDM – JTAG Set Up for BDM**



The BDM header also serves as a port for JTAG signals if the 0 ohm resistor on J1 is soldered across pads 2-3. “Chapter 27 IEEE 1149.1 Test Access Port (JTAG)” of the MCF5208 Reference Manual describes the functions of the JTAG signals. In JTAG mode, JP1 should be fitted across pins 2-3 to connect TCLK/PSTCLK, configured as TCLK to pin 6 of CN2.

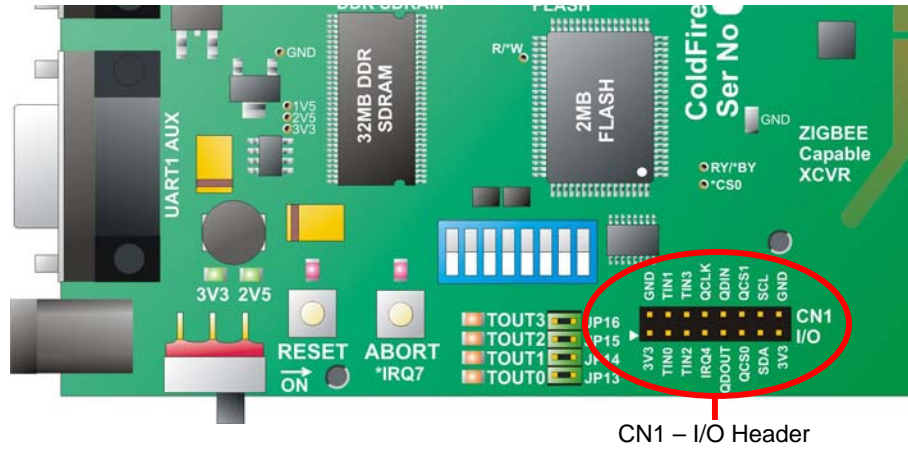
**Figure 11: BDM – JTAG Set Up for JTAG**



## I/O Header

One header provides access to a number of the MCF5208's signals. The location of CN1 is shown below in Figure 12.

**Figure 12: CN1 – I/O Header**



CN1 is a 2x8 double row header that provides access to the DMA timer, QSPI, IRQ, and I2C signals. All these signals can also be configured as general purpose I/O. A mapping of these signals and their associated functions is shown in Table 8.

**Table 8: CN1 I/O Header Pin Mapping**

Alt 2	Alt 1	GPIO	Signal			Signal	GPIO	Alt 1	Alt 2
-	-	-	3V3	1	2	GND	-	-	-
U2TXD	DT0OUT	PTIMER0	DT0IN	3	4	DT1IN	PTIMER1	DT1OUT	U2RXD
*U2RTS	DT2OUT	PTIMER2	DT2IN	5	6	DT3IN	PTIMER3	DT3OUT	*U2CTS
-	*DREQ0	PIRQ4	*IRQ4	7	8	QSPI_CLK	PQSPI0	I2C_SCL	-
-	I2C_SDA	PQSPI1	QSPI_DOUT	9	10	QSPI_DIN	PQSPI2	*DREQ0	*U2CTS
QSPI_CS0	DT0IN	PUARTL3	U0CTS	11	12	U1CTS	PUARTL7	DT1IN	QSPI_CS1
-	U2RXD	PFECI2C0	I2C_SDA	13	14	I2C_SCL	PFECI2C1	U2TXD	-
-	-	-	3V3	15	16	GND	-	-	-

**Legend:**  Special Function  GPIO SIGNAL

## DMA Timers

There are 4 32-bit DMA Timers on the MCF5208. Each timer is associated with a single input capture (IC) signal and a single output compare (OC) signal. The two signals are multiplexed onto a single pin on the 196 MAPBGA package, so only one function, either DT $n$ IN or DT $n$ OUT, can be enabled at a time.

The tic rate for each timer can be set, through its prescaler, to a frequency ranging from 20.26 KHz to 83 MHz. The timers can operate in a free-run mode where the timer counts up to 0xFF FF FF FF then wraps to 0, or they can run in restart mode where the timer will reset to 0 once the compare value is reached.

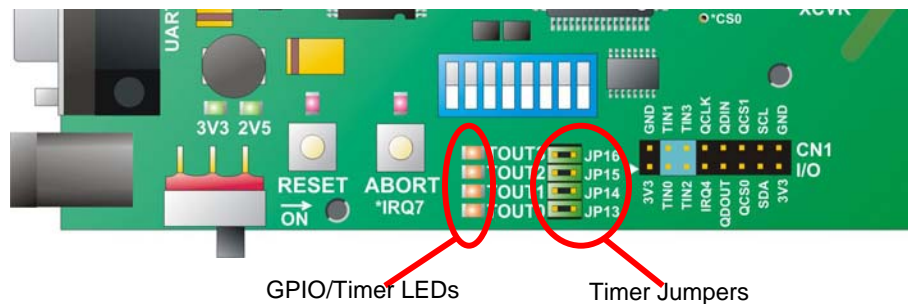
Each DMA Timer module can be configured to fire an interrupt when an input event (IC) or a reference compare match is detected (OC).

The DMA Timer pins are shown in blue on CN1 in Figure 13. They can be independently configured as GPIO. Configuring a pin for I/O will disable any timer functionality associated with the pin, but will not affect the timer itself. Configuring a pin for its timer function will disable its GPIO function.

When timer signals are configured as digital outputs or as timer outputs, they can be connected to LEDs through jumpers JP13 – JP16. These jumpers are shown in Figure 13.

As shown in Table 8, pins 3 – 6 on CN1 are the DMA Timer pins. A full description of the functions of these signals is in MCF5208 Reference Manual Ch. 22: DMA Timers.

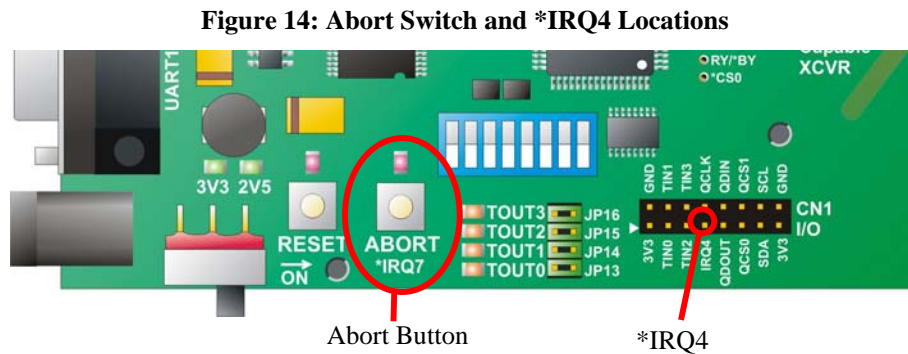
**Figure 13: DMA Timer LED Locations**



## IRQ

The MCF5208 EPOR module has 3 signals (IRQ1, IRQ4 and IRQ7) that can be individually configured as digital inputs or outputs or they can be configured to be edge or level sensitive interrupt signals. If a signal is configured for edge detection, it can detect on a rising edge, falling edge or both. All IRQ pins are configured as digital input out of reset. \*IRQ1 is used as in interrupt from the [MC13192 ZigBee Capable Transceiver](#). IRQ7 is connected to the Abort button on the M5208EVB. When the board first starts up, the dBUG monitor configures \*IRQ7 as a falling edge interrupt. This leaves \*IRQ4 for user control.

The location of the Abort switch and \*IRQ4 pin is shown in Figure 14.



## Interrupt Level and Priority

An understanding of the interrupt level and priority scheme on the MCF5208 can be helpful.

The MCF5208 has sources of interrupts. Each is assigned a number ranging from 1 for IRQ1 to 62 for bus error. These are hard wired. With the exception of the IRQ signals, each interrupt source (eg. source 4, PITO/PCSRO[PIF] PIT interrupt flag) can be assigned an interrupt level, 1 being the lowest level, 7 being the highest (serviced first). Any number of interrupts can be set to the same level. When multiple interrupts at the same level fire, they are processed in reverse order of their source number. That is, the lowest source gets serviced last. And, the IRQ signals correspond to the lowest sources, as shown in Table 9.

**Table 9: IRQ Pin Priority**

Signal	Source/Priority
*IRQ1	1
*IRQ4	2
*IRQ7	3

This interrupt scheme can have interesting side effects. For instance, in the [absurd] case where the Ethernet interrupts were set to level 7, the level 7 interrupt fired by pressing the Abort button would not be serviced until the CPU had finished servicing the Ethernet interrupts.

dBUG monitor sets the \*IRQ7 level to level 7. Internal interrupt sources should not be set to level 7 or the Abort functionality of dBUG monitor will be compromised.

The MCF5208's interrupt scheme is covered in great detail in Freescale's MCF5208 Reference Manual Ch. 14 – Interrupt Controller Module and Ch. 15 – Edge Port Module.

## **Abort Button**

When this tactile switch is pressed, the \*IRQ7 signal is asserted. When the M5208EVB is running under control of the dBUG monitor, a level 7 interrupt will be triggered. The dBug monitor will terminate the user program and the CPU context will be displayed on the host PC, followed by the dBug prompt. This assumes that the M5208EVB is connected serially to a host PC running a serial terminal program such as HyperTerminal.

uClinux does not implement the abort functionality. However this button can be used as a general purpose input for user interaction with an application.

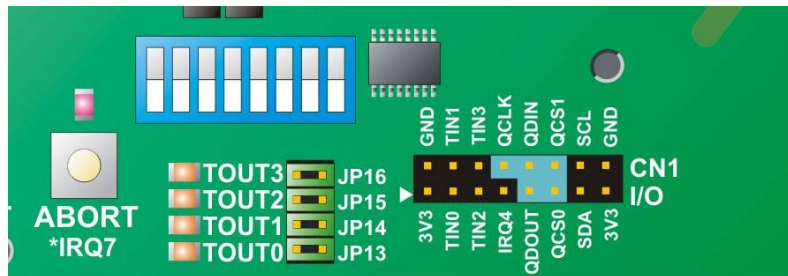
This signal is debounced and is held low for up to 700ms after the button is released.



## QSPI

The QSPI module allows high-speed serial communication with SPI devices such as a serial flash, real time clock, AtoD and DtoA converters, etc. Two QSPI chip select signals and the QSPI bus signals are available on pins 8 – 12 on CN1 (See [I/O Header](#)). A third QSPI chip select is used on-board to interact with the ZigBee capable transceiver. The QSPI signals are shown in blue in Figure 15.

**Figure 15: QSPI Signals on CN1**



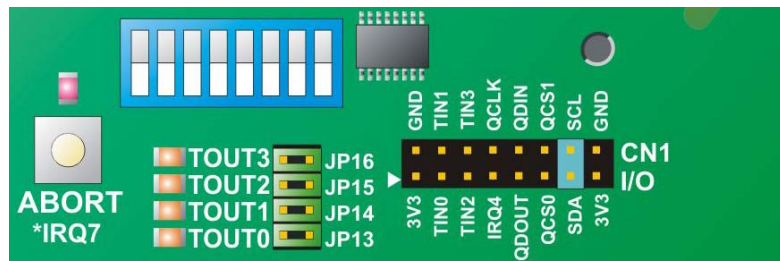
In addition to the QSPI function, these signals can be configured as GPIO through the GPIO module. See the MCF5208 Reference Manual Ch 13: General Purpose I/O Module for more information.



## I<sup>2</sup>C

The I<sup>2</sup>C module is 2-wire serial bus used for communication with I<sup>2</sup>C devices serial flash, real time clock, etc. The I<sup>2</sup>C signals, SDA and SCL are brought out to pins 13 and 14 on CN1. These signals are configured through the I<sup>2</sup>C module on the MCF5208. These signals are shown in blue in Figure 16.

Figure 16: I<sup>2</sup>C Signals on CN1



## Memory and Storage

The M5208EVB has 4 types of memory available to the user:

- 16KB Internal (on-chip) SRAM
- 128KB External SRAM (optional)
- 32MB External DDR SDRAM
- 2MB External Flash

Figure 19 shows the memory mapping of these memory blocks. All the external memory devices run and interface at 2.5V. This allows a single bus to interface all devices without the need for buffers.

### Internal SRAM

The MCF5208's 16KB on-chip SRAM is fast single-cycle memory making it ideal for the user program stack. dBUG monitor initially maps the internal SRAM to 0x80 00 00 00.

### External SRAM

Pads for a 2.5V 64K x 16-bit SRAM (IDT IDT71T016SA12PH) are located beneath the M5208EVB. This part can be attached for benchmarking purposes. It is driven by \*FB\_CS1.

### External DDR SDRAM

The M5208EVB has a fast 16M x 16-bit DDR SDRAM for both data storage and program execution. Typically the user program is loaded from flash into SDRAM and run from SDRAM. The program can also be loaded through a serial port or Ethernet.

### External Flash

External flash consists of a 2MB Am29BDD160G. It is selected by \*FB\_CS0. This 2.5V flash is organized as 512K x 16-bits. It is made up of 8 x 8KB sectors, 30 x 64KB sectors and 8 x 8KB sectors. A sector is the smallest block of memory that can be erased.

The M5208EVB's external flash is shipped pre-loaded with the dBug monitor, the uClinux kernel and uClinux services. On start up, the dBUG monitor is set up to check if there is an executable in flash. If so, it starts execution of this program, which, as shipped, would be uClinux. As shipped, the flash memory map looks like Figure 17.

uClinux is the default user program shipped with the M5208EVB. A different user program may be saved into external flash using dBUG monitor at the expense of overwriting uClinux. However uClinux may be restored painlessly into external flash at anytime by reprogramming the m5208evb.s19 flash image with CFflasher. Getting a program to run under uClinux is done through the RC file, which is analogous to a DOS Autoexec.bat file.

## Programming Flash

A user program can be programmed into flash using several techniques. The dBUG monitor supports saving a program compiled to run from flash with the ‘dl’ command. See [Appendix C - dBUG Monitor](#) for a description of this and other useful dBUG commands.

**Figure 17: 2MB Flash with uClinux (as Shipped)**

dBUG monitor	0x00000000 : 0x0003FFFF
uClinux JFFS2 File System (on EVB as shipped)	0x00040000 : 0x000DFFFF
Compressed uClinux kernel & services (linked for DDR SDRAM)	0x000E0000 : 0x001FFFFFFF

dBUG monitor’s ‘dfl’ command allows the user to save an executable file to flash. In order to execute this file, dBUG first copies it to DRAM and then runs it from there. Consequently, the program must be linked to run out of DRAM. With this command, a flash program is stored at the top of flash, just below a 32-byte program information block which allows dBUG to find the code, come time to execute it. The mapping of a user program in flash is shown in Figure 18.

The total space consumed by any program is the size of the program + 32 bytes rounded-up to the nearest 64K sector boundary.

**Figure 18: 2MB Flash with User Program**

dBUG monitor	0x00000000 : 0x0003FFFF
Data storage	0x00040000 : 0x000(X-1)FFFF
User Program (linked for DDR SDRAM)	0x000X0000 : 0x001FFFDF
Program Info Block (32 bytes)	0x001FFFE0 0x001FFFFF

## Running from Flash

The ‘gfl’ command will execute a program saved in external flash using the ‘dfl’ command. The program can also be run automatically when the board resets by setting the **Autorun** parameter to ON in dBUG. If **Autorun** is set and JP1 is on, dBUG monitor will attempt to run a program in flash as directed by the program information block at the top of flash.

If **Autorun** has been set and the user wishes not to have the program run automatically, remove the jumper from JP1. Under this configuration, dBUG will always boot to the dBUG prompt. Table 10 shows the possible settings and their actions out of reset.

Because the program is copied to DRAM and executed from there, it must be linked for execution from DRAM.

**Table 10: dBUG Boot Configuration**

Action	JP3	Autorun
Boot to dBUG>	OFF	-
Boot to dBUG>	ON	OFF
Autorun user program (typically uClinux)	ON	ON

As shipped, the user program on the M5208EVB is uClinux. When JP1 is fitted, dBUG monitor will load uClinux into DDR SRAM and run it. uClinux can be configured to load a user program saved in the flash file system. “/etc/rc” is a script that is executed upon booting uClinux. This script should contain the path and name of the program to be run automatically. Initially, “/etc/rc” contains “/usr/interactive\_demo” which serves a number of web pages including an interactive page that allows the user to interact with the 4 timer LEDs on the M5208EVB.

## Memory Mapping

The M5208EVB memory map is shown below in Figure 19. Any memory access to a location not specified in Figure 19 is an undefined operation and may result in a bus access error and should be avoided. This memory mapping is dependent on a user program being linked with the Intec memory mapping and using the dBUG monitor.

**Figure 19: dBUG M5208EVB Memory Map**

<b>External Flash (2MB)</b> *FB_CS0	Vector Table	0x00000000 : 0x00003FFF
	Parameters	0x00004000 : 0x00005FFF
	dBUG Code + Data	0x00006000 : 0x0003FFFF
	Flash File System and uClinux	0x00040000 : 0x001FFFFFFF
		0x00200000 : 0x0FFFFFFF
<b>Optional External SRAM (128KB)</b> *FB_CS1		0x10000000 : 0x1001FFFF
		0x10020000 : 0x3FFFFFFF
<b>DDR SDRAM (32MB)</b> SD_CS	Vector Table + dBUG Data (Copied at boot)	0x40000000
	64K dBUG heap	:
	↓↓↓↓↓↓↓	:
	↑↑↑↑↑↑↑	:
	3K dBUG Stack (HEAP_END + 3K)	:
	Unused	0x4001FFFF
		0x40020000 : 0x41FFFFFF
	User Code   ↓↓↓↓↓↓↓	0x40020000
	User Data    ↓↓↓↓↓↓↓	:
	Unused	0x41FFFFFF
		0x42000000 : 0x7FFFFFFF
<b>Fast Internal SRAM (16K)</b>	↑↑↑↑↑↑↑	0x80000000 : 0x80003FFF
	User Stack (Typical)	0x80004000 : 0xFBFFFFFF
<b>Peripheral Registers</b>	See Freescale MCF5208 Reference Manual for more information.	0xFC000000 : 0xFFFFFFFF

## Watchdog Timer

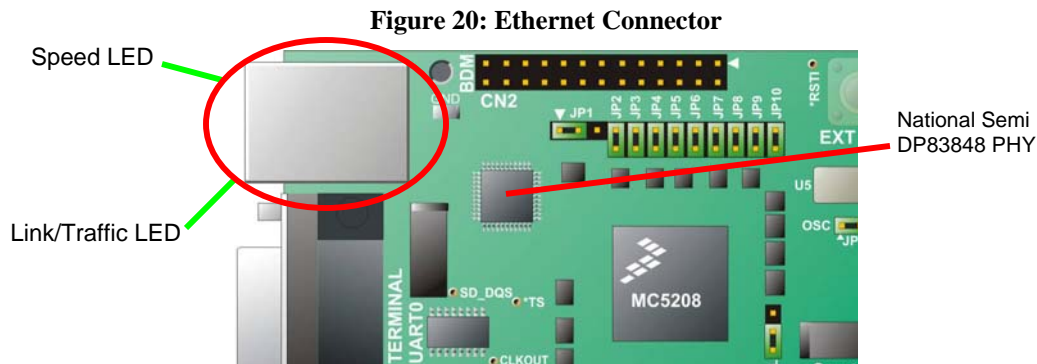
The MCF5208 has a Watchdog Timer (WDT) which can be used to reset the board in the event a program has entered an unexpected state. When the watchdog timer is enabled, it must be serviced periodically to ensure that it does not time out and reset the MPU. Servicing consists of writing a 0x5555 and 0xAAAA sequence to the Watchdog Service Register. Once enabled, the watchdog timer cannot be disabled without resetting the MPU.

## Ethernet

The M5208EVB supports 10/100 Ethernet through a brand new, soon to be released PHY chip from National Semiconductor, the DP83848. It can auto-negotiate connection speed and can switch its Tx and Rx lines to suit the polarity of the connection (Auto-MDIX feature). Crossover Ethernet cables are never required. The RJ45 connector has 2 LEDs which convey information, as summarized in Table 11.

**Table 11: Ethernet Indicator LEDs**

LED	State	Significance
Speed	On	100Mbps
	Off	10Mbps
Link/Traffic	On	Good link
	Blink	Traffic
	Off	No link



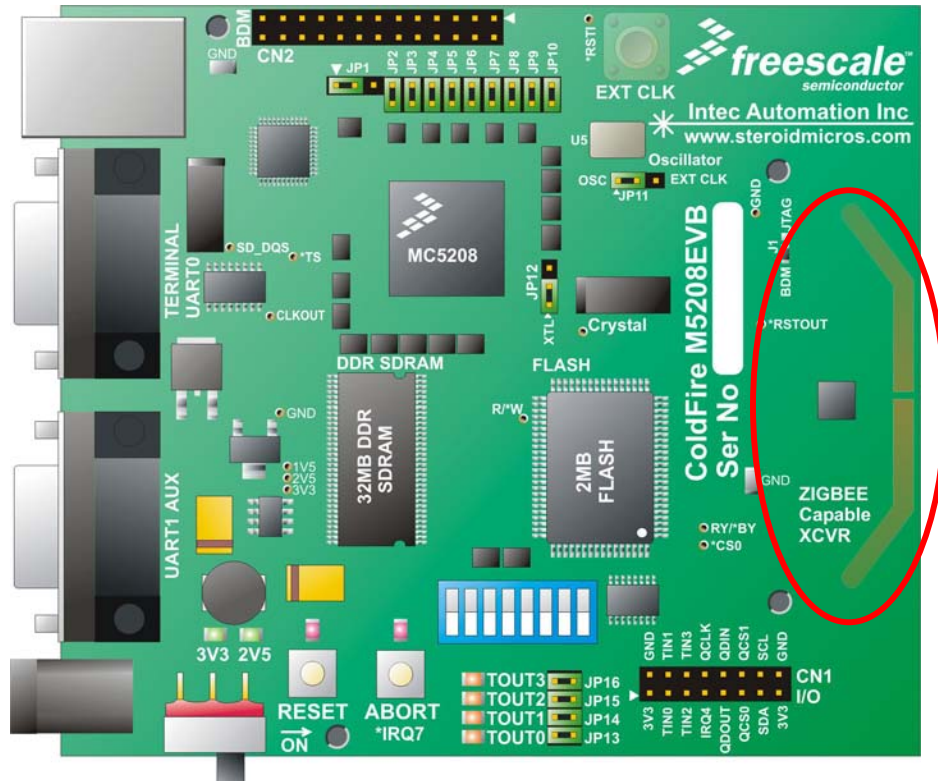
## Advanced Users

The Ethernet PHY chip on board is configured to support Auto-negotiation of 10 and 100 base-T speeds, full-duplex and half-duplex connections. The MII interface to the PHY chip is connected to the MCF5208 MII serial management allowing the MPU complete control over the PHY. The PHY has an address of 0x01. For further information about the PHY and its internal registers, see the National Semiconductor DP83848 PHY Data Sheet. The physical Ethernet interface (PHY) can be accessed under uClinux using a command line tool called "[mii-tool](#)".

## ZigBee Capable Transceiver

A MC13192 ZigBee Capable Transceiver chip and printed circuit board antenna have been integrated on the M5208EVB to demonstrate the ease of integration of this ZigBee capable transceiver with the MCF5208.

**Figure 21: ZigBee Capable Transceiver Location**



The MC13192 interfaces to the MCF5208 via the QSPI lines and some GPIO signals. The additional GPIO are required to realize the full functionality of the MC13192 chip. The signal connections are shown below.

**Table 12: MC13192 Connections**

MCF5208 Signal	MC13192 Signal
QSPI_CLK	SPICLK
QSPI_DIN	MISO
QSPI_DOUT	MOSI
U0RTS/QSPI_CS0	RTXEN
U1RTS/QSPI_CS1	*ATTN
QSPI_CS2	*CE
*RSTOUT	*RST
*IRQ1	*IRQ
*TS	GPIO1/OUT_OF_IDLE
*FB_CS3	GPIO2/CRC_VALID



For information on communicating with the MC13192, refer to the MC13192 Data Sheet and MC13192 Reference Manual. The SMAC source code shows using the MC13192 transceiver in a simple application.

## FCC Certification

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 3) This device may not cause harmful interference, and
- 4) This device must accept any interference that may cause any undesired operation

This equipment has been tested and found to comply with the requirements of ETSI EN301 489-1 V1.4.1. It bears the CE marking for sale and operation within Europe.

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

## IC Certification

Operation is subject to the following two conditions:

- 3) this device may not cause interference, and
- 4) this device must accept any interference, including interference that may cause undesired operation of the device.

L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes :

- 3) il ne doit pas produire de brouillage et
- 4) 2) l'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

**NOTE:** The abbreviation, IC, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

## Caution

**CAUTION:** This device is susceptible to electrostatic discharge (ESD) and surge phenomenon. Always use ESD precautions when handling this device.

**CAUTION:** Changes or modifications to this equipment, not expressly approved by the manufacturer could void the user's authority to operate the equipment.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Relocate the M5208EVB and reorient serial or Ethernet cables attached to it.
- Reorient or relocate the receiving antenna.
- Increase the separation between the M5208EVB and receiver.
- Power the M5208EVB from an outlet that is on a different circuit than the receiver.

# **Appendix A**

## **Jumpers, Switches, Pinouts & Specifications**

## Jumpers

Table A-1 lists each jumper and its function on the M5208EVB. The default position of the jumper is shown in bold. A quick reference of the jumper functions is silk screened onto the bottom side of the board.

**Table A-1: Jumper Settings and Function**

Jumper	Settings	Function
JP1	<b>1-2</b>	<b>Connect TCLK/PSTCLK to pin 24 of BDM CN2</b>
	2-3	Connect TCLK/PSTCLK to pin 6 of BDM CN2
JP2	<b>ON</b>	<b>Connect 1.5V to pin 25 of BDM CN2</b>
	OFF	Disconnect 1.5V from pin 25 of BDM CN2
JP3	<b>ON</b>	<b>Boot uClinux (or user program)</b>
	OFF	Boot dBUG
JP4	<b>ON</b>	<b>Disable TEST mode</b>
	OFF	Enable TEST mode
JP5	<b>ON</b>	<b>Enable reset configuration</b>
	OFF	Disable reset configuration
JP6	<b>ON</b>	<b>DDR mode</b>
	OFF	SDR mode
JP7	<b>ON</b>	<b>Connect Core, PLL filter to 1.5V</b>
	OFF	Disconnect Core, PLL filter from 1.5V
JP8	<b>ON</b>	<b>Connect Core to 1.5V (w/ JP7 ON)</b>
	OFF	Disconnect Core from 1.5V
JP9	<b>ON</b>	<b>Connect MPU I/O rail to 3.3V</b>
	OFF	Disconnect MPU I/O rail from 3.3V
JP10	<b>ON</b>	<b>Connect MPU External Bus to 2.5V</b>
	OFF	Disconnect MPU External Bus from 2.5V
JP11	<b>1-2</b>	<b>Clock source select: Oscillator</b>
	2-3	Clock source select: External oscillator (CN7)
JP12	<b>1-2</b>	<b>Clock source select: Crystal</b>
	2-3	Clock source select: Oscillator
JP13	<b>ON</b>	<b>Enable/Disable TOUT3 LED</b>
	OFF	Disable TOUT3 LED
JP14	<b>ON</b>	<b>Enable/Disable TOUT2 LED</b>
	OFF	Disable TOUT2 LED
JP15	<b>ON</b>	<b>Enable/Disable TOUT1 LED</b>
	OFF	Disable TOUT1 LED
JP16	<b>ON</b>	<b>Enable/Disable TOUT0 LED</b>
	OFF	Disable TOUT0 LED

JP1 – Selects either pin 6 or pin 24 of the CN2 to be connected to the TCLK/PSTCLK signal from the M5208EVB. TCLK is used when JTAG mode is enabled; PSTCLK is used when BDM mode is enabled. (see JTAG\_EN).

JP2 – This jumper is required for some of the legacy BDM cables that connect pins 9 & 25 of the BDM interface internally. More recent cables support both core & I/O voltages. Please check with your BDM cable supplier. The BDM cable supplied with the M5208EVB supports both core and I/O voltages and requires JP5 to be fitted.

JP3 – When fitted this jumper causes dBUG monitor to automatically load a program and run it. Typically this program is uClinux (as shipped). See Appendix C and the SBCTools Programmer Reference for more information on the Autorun feature of dBUG monitor. When this jumper is open, dBUG monitor will not run any user program and instead display the dBUG prompt on the terminal and wait for input.

JP4 – When fitted this jumper disables the factory test mode of the MCF5208. This jumper is normally always fitted.

JP5 – When fitted this jumper asserts the \*RCON signal and causes the MCF5208 to load the CCR register based on the signals D9, D[7:1]. These signals are conditioned out of reset by the DIP switch. See the MCF5208 Reference Manual, (Ch 9 Chip Configuration Register) for more information on the reset configuration.

JP6 – This jumper selects between DDR and SDR mode for the SDRAM module. Should always be fitted to support DDR mode.

JP7 – When fitted connects 1.5V to the PLL filter and to JP8.

JP8 – When fitted connects the processor core voltage to 1.5V. JP7 must also be fitted.

JP9 – When fitted connects the processor I/O voltage to 3.3V. Also connects JP11 to 3.3V.

JP10 – When fitted connects the processor external bus voltage to 2.5V.

JP11 – This jumper selects between an external oscillator and an off-board frequency source. This jumper is only relevant if JP15 is in position 1-2. By default it is set to position 2-3 to

JP12 – This jumper selects between the on board crystal or an external oscillator. It is in position 1-2 by default to select the on-board crystal.

JP13 – This jumper connects TOUT3 to its LED. It is normally fitted.

JP14 – This jumper connects TOUT2 to its LED. It is normally fitted.

JP15 – This jumper connects TOUT1 to its LED. It is normally fitted.

JP16 – This jumper connects TOUT0 to its LED. It is normally fitted.

## Switches

Several switches on the M5208EVB are used to control the board's configuration and operation. The switches are listed in Table A-2.

**Table A-2: Switch Functions**

Switches	Function
Power Switch	Isolates M5208EVB from power supply.
Reset Button	Asserts the *RSTI signal forcing the MCF5208 and peripheral systems to reset.
Abort Button	Asserts the *IRQ7 signal causing an interrupt in the MCF5208. This interrupt is handled by dBUG monitor.
Configuration Switch	Determines the out of reset configuration of the MCF5208.

## Reset Configuration Switches

The DIP switch on the M5208EVB determines the MCF5208's personality out of reset when the \*RCON signal is held low (JP5 is fitted).

**Table A-3: Reset Configuration Switch Functions**

<b>SW1-1</b>		<b>PLL Mode</b>
OFF		166.67MHz Core bus, 83.33MHz External Bus operation
ON		88MHz Core bus, 44MHz External Bus operation (Note 1)
<b>SW1-2</b>		<b>Oscillator Mode</b>
OFF		Crystal oscillator mode
ON		Oscillator bypass mode
<b>SW1-3</b>	<b>SW1-4</b>	<b>Boot Port Size</b>
OFF	OFF	16-bit port
OFF	ON	32-bit port
ON	OFF	32-bit port
ON	ON	8-bit port
<b>SW1-5</b>		<b>Output Pad Drive Strength</b>
OFF		High drive strength
ON		Low drive strength
<b>SW1-6</b>		<b>LIMP Mode</b>
OFF		Normal operation; PLL drives internal clocks.
ON		LIMP mode; low-power clock divider drives internal clocks.
<b>SW1-7</b>		<b>Oscillator Frequency Select</b>
OFF		16MHz is used as input to processor
ON		16.67MHz is used as input to processor
<b>SW1-8</b>		<b>Chip Select Configuration</b>
OFF		A[23:22] = A[23:22]
ONN		A[23:22] = *FB_CS[5:4]

## LEDs

The LEDs on the M5208EVB indicate the status of the board and can be used by user programs as indicators. The LEDs' colours and their functions are listed below.

**Table A-4: LED Functions**

Signal	LED Colour	Description
2.5V	Green	External Bus power indicator
3.3V	Green	I/O power indicator
*RSTOUT	Red	Reset indicator: LED will light when the board is resetting.
*IRQ7 (Abort Button)	Red	Abort indicator: LED will light when *IRQ7 is asserted.
TOUT3	Amber	Timer/GPIO LED: LED off = low, LED on = high
TOUT2	Amber	Timer/GPIO LED: LED off = low, LED on = high
TOUT1	Amber	Timer/GPIO LED: LED off = low, LED on = high
TOUT0	Amber	Timer/GPIO LED: LED off = low, LED on = high

## Electrical Specifications

The maximum source/sink current on I/O varies depending on the pin it is attached to. Table A-5 shows the maximum source/sink current on the I/O header by pin.

**Table A-5: CN1 Drive Strength by Pin**

Drive Strength	Pin		Drive Strength
-	1	2	-
8/16mA	3	4	8/16mA
8/16mA	5	6	8/16mA
4mA	7	8	8/16mA
8/16mA	9	10	8/16mA
4mA	11	12	4mA
8/16mA	13	14	8/16mA
-	15	16	-

## Header Pinouts

### CN1 – I/O Header

Def Func	Alt RTL Pin	Alt RTL Function	RTL Pin	RTL GPIO Port (Note 1)	RTL GPIO Port (Note 1)	RTL Pin	Alt RTL Function	Alt RTL Pin	Def Func
3V3	-	-	-	-	1 2	-	-	-	GND
GPIO	DT0IN	DMA Timer	PIN0	_TIMER	3 4	_TIMER	PIN1	PIN1	GPIO
GPIO	DT2IN	DMA Timer	PIN2	_TIMER	5 6	_TIMER	PIN3	PIN3	GPIO
GPIO	-	IRQ	PIN4	_IRQ	7 8	_QSPI	PIN0	-	GPIO
GPIO	-	-	PIN1	_QSPI	9 10	_QSPI	PIN2	-	GPIO
GPIO	-	-	PIN3	_UART	11 12	_UART	PIN7	-	GPIO
GPIO	-	-	PIN0	_I2C	13 14	_I2C	PIN1	-	GPIO
3V3	-	-	-	-	15 16	-	-	-	GND

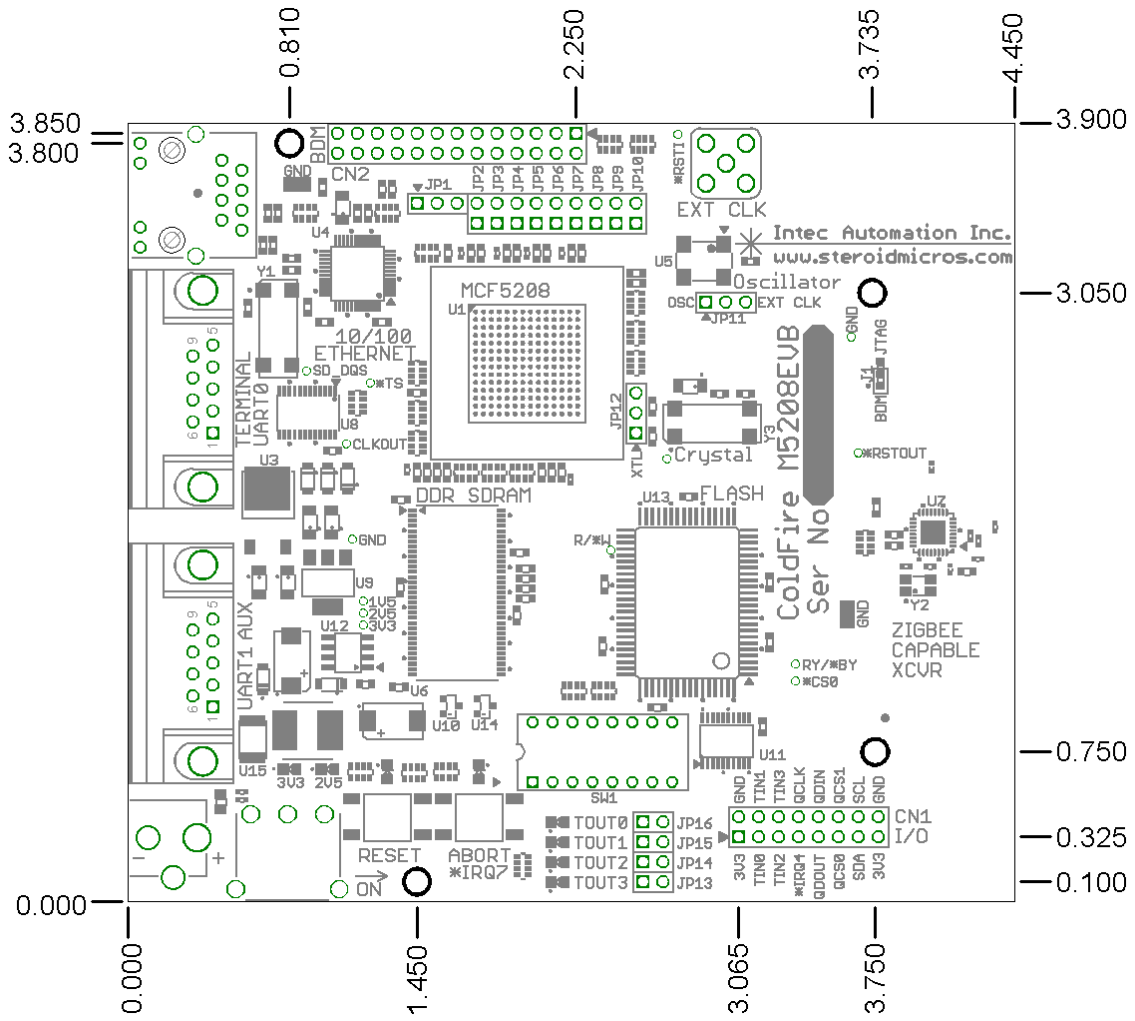
NOTE 1: To create the port name, prepend “EV\_B\_DIO\_PORT” i.e. EV\_B\_DIO\_PORT\_TIMER is the constant used to access any of the DMA Timer pins as GPIO.

### CN2 – BDM Header

Alt Func	Def Func	MCF Signal	RTL Port	RTL Pin	RTL Port	RTL Pin	MCF Signal	Def Func	Alt Func
-	-	-	-	-	1 2	-	*BKPT	-	-
-	GND	-	-	-	3 4	-	DSCLK	-	-
-	GND	-	-	-	5 6	-	TCLK	-	-
-	-	*RSTI	-	-	7 8	-	DSI	-	-
-	-	3V3	-	-	9 10	-	DSO	-	-
-	GND	-	-	-	11 12	-	PST3	-	-
-	-	PST2	-	-	13 14	-	PST1	-	-
-	-	PST0	-	-	15 16	-	DDATA3	-	-
-	-	DDATA2	-	-	17 18	-	DDATA1	-	-
-	-	DDATA0	-	-	19 20	-	-	GND	-
-	-	-	-	-	21 22	-	-	-	-
-	GND	-	-	-	23 24	-	CLKOUT	-	-
-	-	3V3	-	-	25 26	-	*TA	-	-



# Coordinates



# **Appendix B**

## **M5208EVB Schematics**

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DDR SDRAM	Sheet 2
Serial Communications	Sheet 3
Power Supply	Sheet 4
Reset Configuration	Sheet 5
10/100 Ethernet	Sheet 6
BDM Connector	Sheet 7
I/O Header	Sheet 8
Flash & SRAM	Sheet 9
ZigBee Transceiver	Sheet 10
Reset & IRQ	Sheet 11
MCU Power Rails	Sheet 12
Clock	Sheet 13

### Revision History

Rev.	Date	Designer	Comments
A	18 Apr. 05	G Rouse	Initial release.
B	30 Aug. 05	G Rouse	Changed U3 to ST LD29080. Changed U9-VIN to 3V3. Removed unnecessary jumpers. Renamed jumpers. Added 10K pullup to *ATTN. Rationalized resistors into resistor packs. Renamed MCF5208 signal names for consistency with MCF5208RM.pdf.

## M5208EVB Evaluation Board

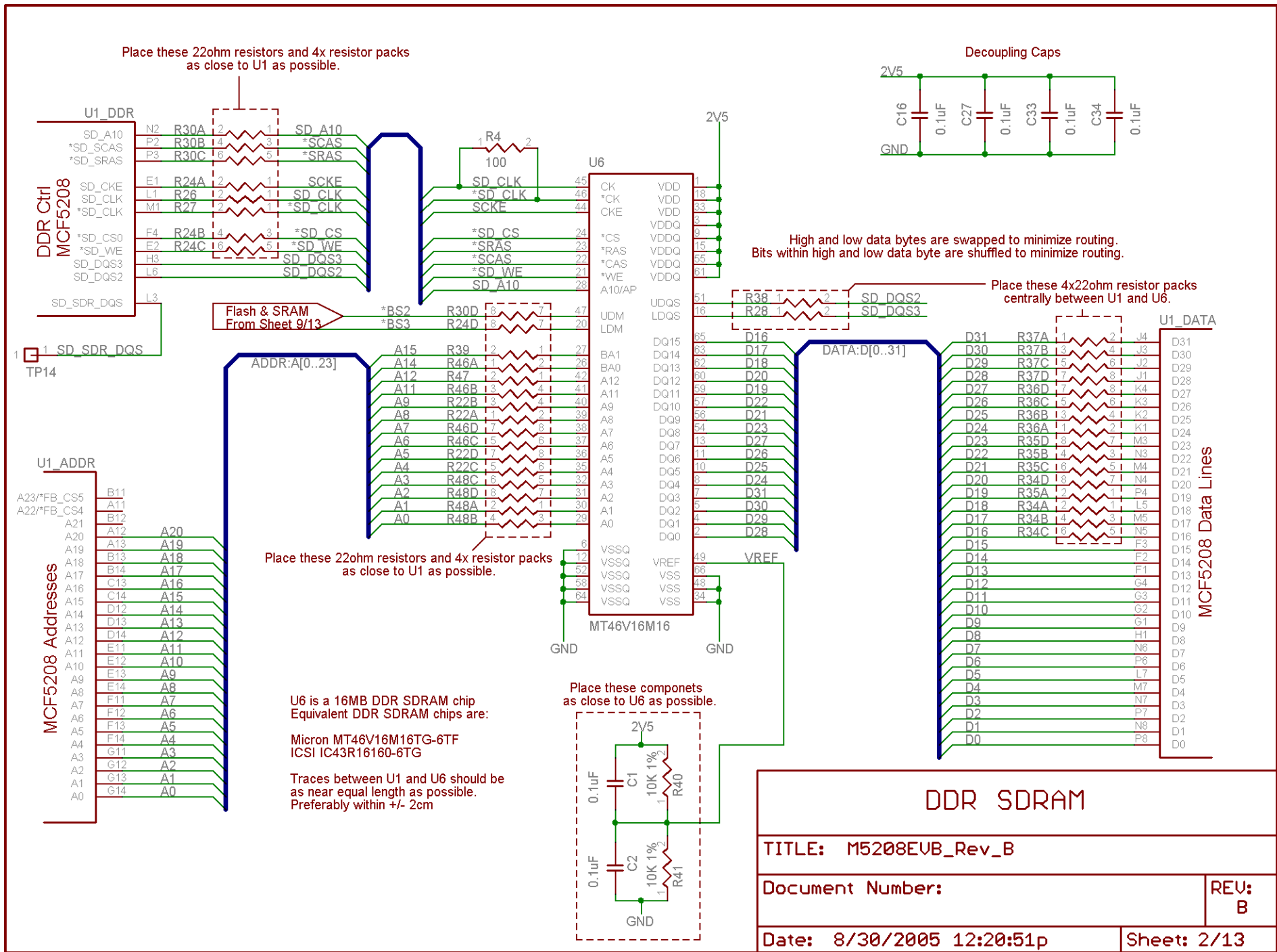
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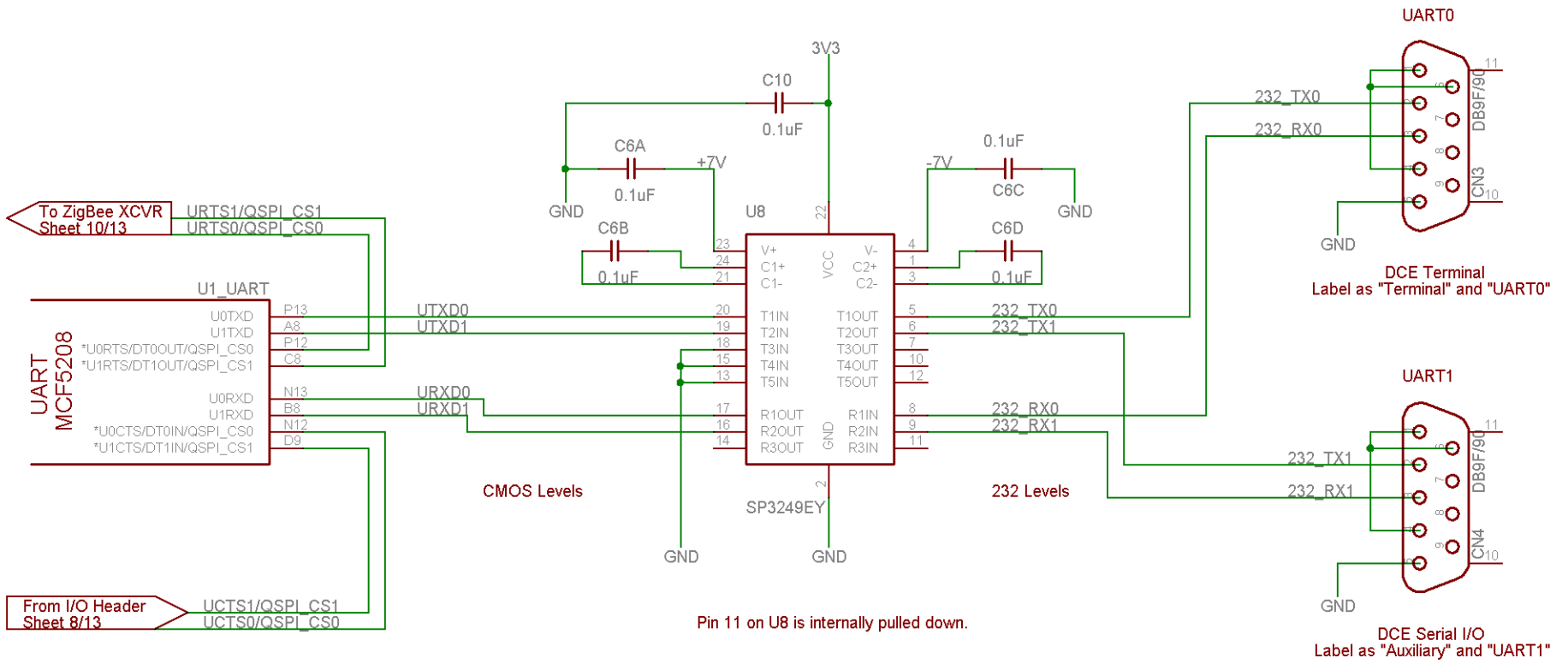
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REV:  
B

Date: 8/30/2005 12:20:51p

Sheet: 1/13

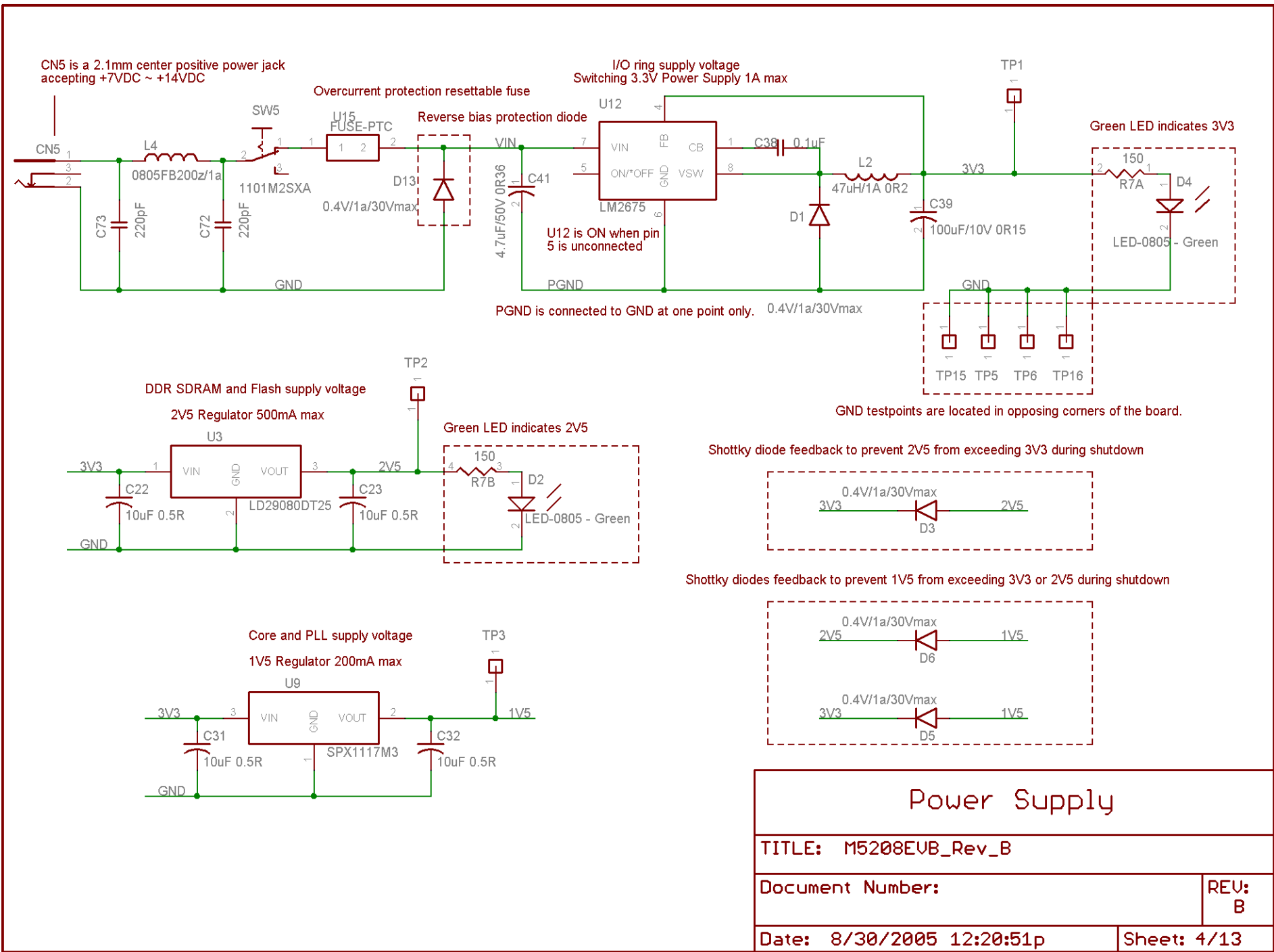


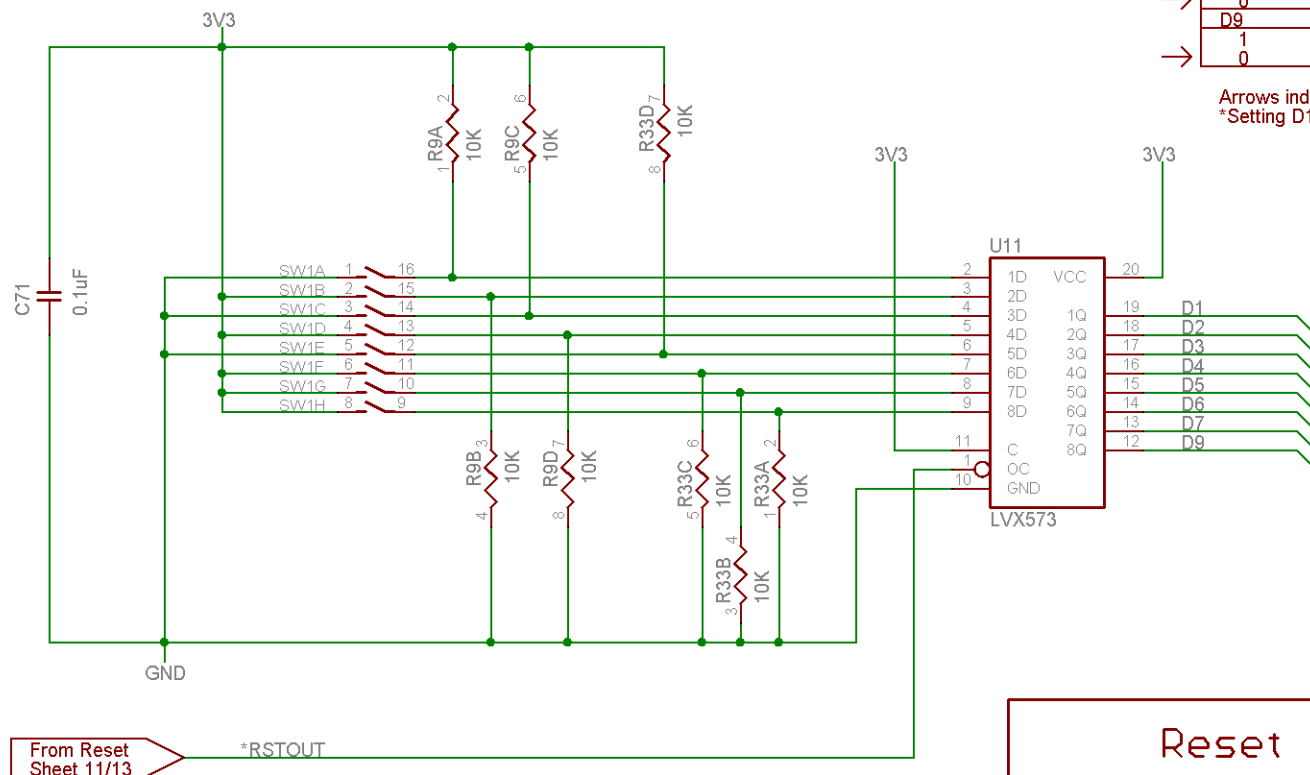


Pin 11 on U8 is internally pulled down.

Add pulldowns resistors to U0TXD and U1TXD to prevent these lines from floating during reset.

<h1>Serial Communications</h1>	
TITLE: M5208EVB_Rev_B	
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### Reset Configuration

→	D1	PLL Mode
	1	166.67/83.33 MHz operation
	0	88/44 MHz operation *
→	D2	Oscillator Mode
	1	Oscillator bypass mode
	0	Crystal oscillator mode
→	D[4:3]	Boot port size
	00, 11	32-bit port
	01	16-bit port
	10	8-bit port
→	D5	Output pad drive strength
	1	High drive strength
	0	Low drive strength
→	D6	Limp mode
	1	Limp mode
	0	Normal PLL mode
→	D7	Clock Frequency Input
	1	16.67 MHz
	0	16 MHz
→	D9	Chip select configuration
	1	A[23:22] = *CS[5:4]
	0	A[23:22] = A[23:22]

Arrows indicate default settings  
 \*Setting D1 = 0 will run DDR out of spec.

### Reset Configuration

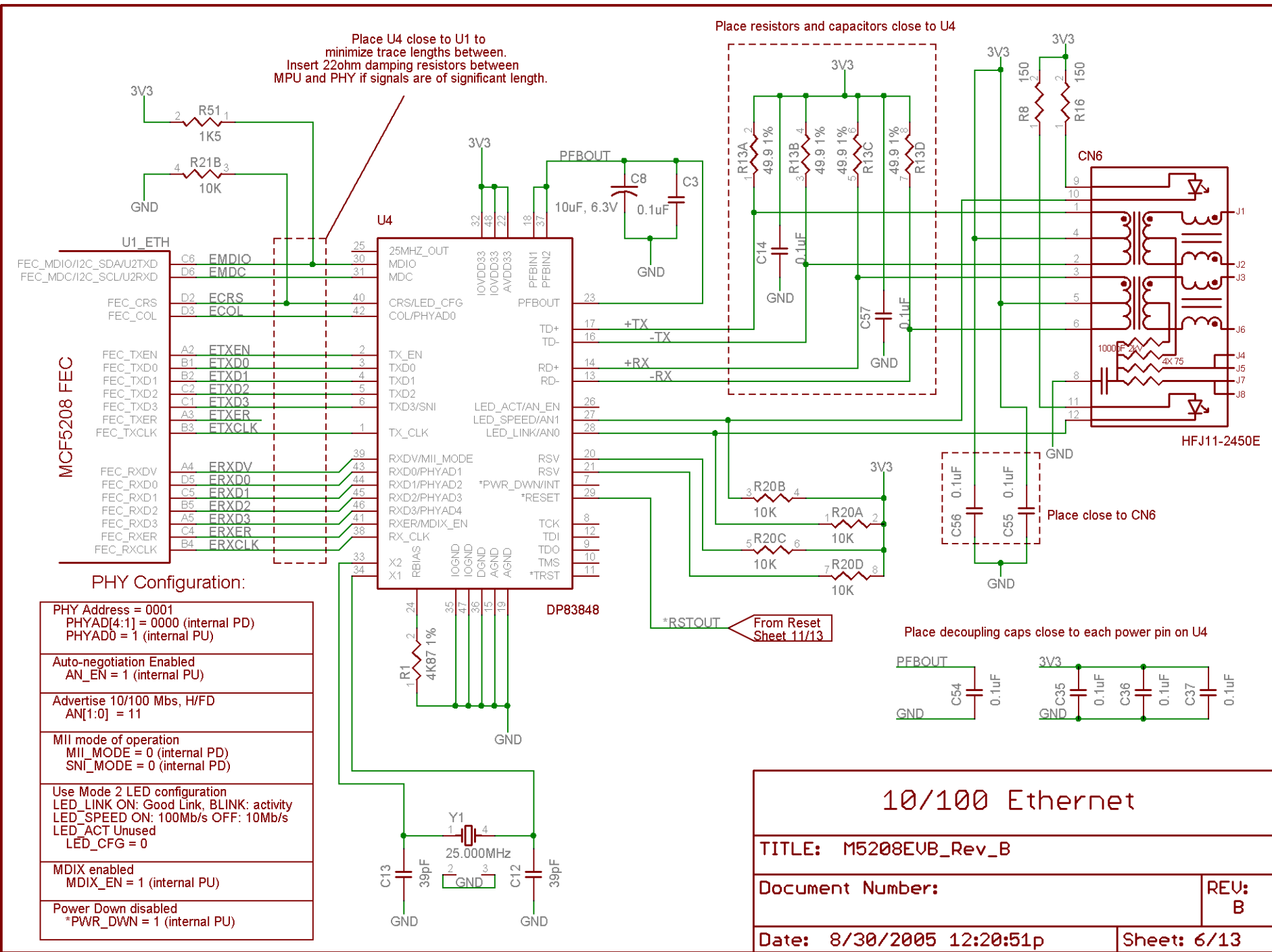
TITLE: M5208EVB\_Rev\_B

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B

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Sheet: 5/13

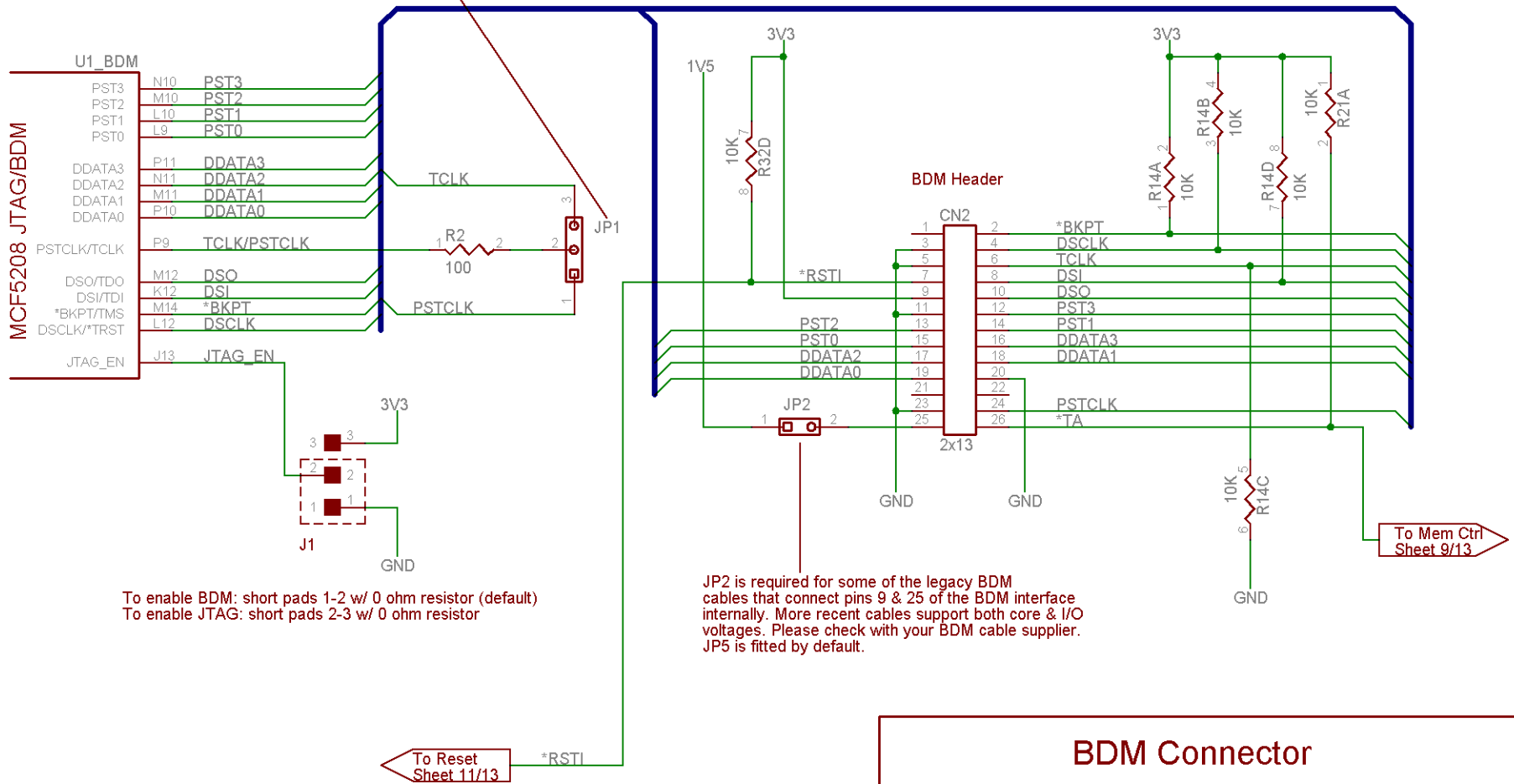


<h1>10/100 Ethernet</h1>	
TITLE: M5208EVB_Rev_B	
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JP1: Fit 1-2 to enable PSTCLK on CN2 (default)  
Fit 2-3 to enable TCLK on CN2

BDM signal traces should not exceed 3 inches  
PST[3:0] and DDATA[3:0] trace lengths should be equal.



To enable BDM: short pads 1-2 w/ 0 ohm resistor (default)  
To enable JTAG: short pads 2-3 w/ 0 ohm resistor

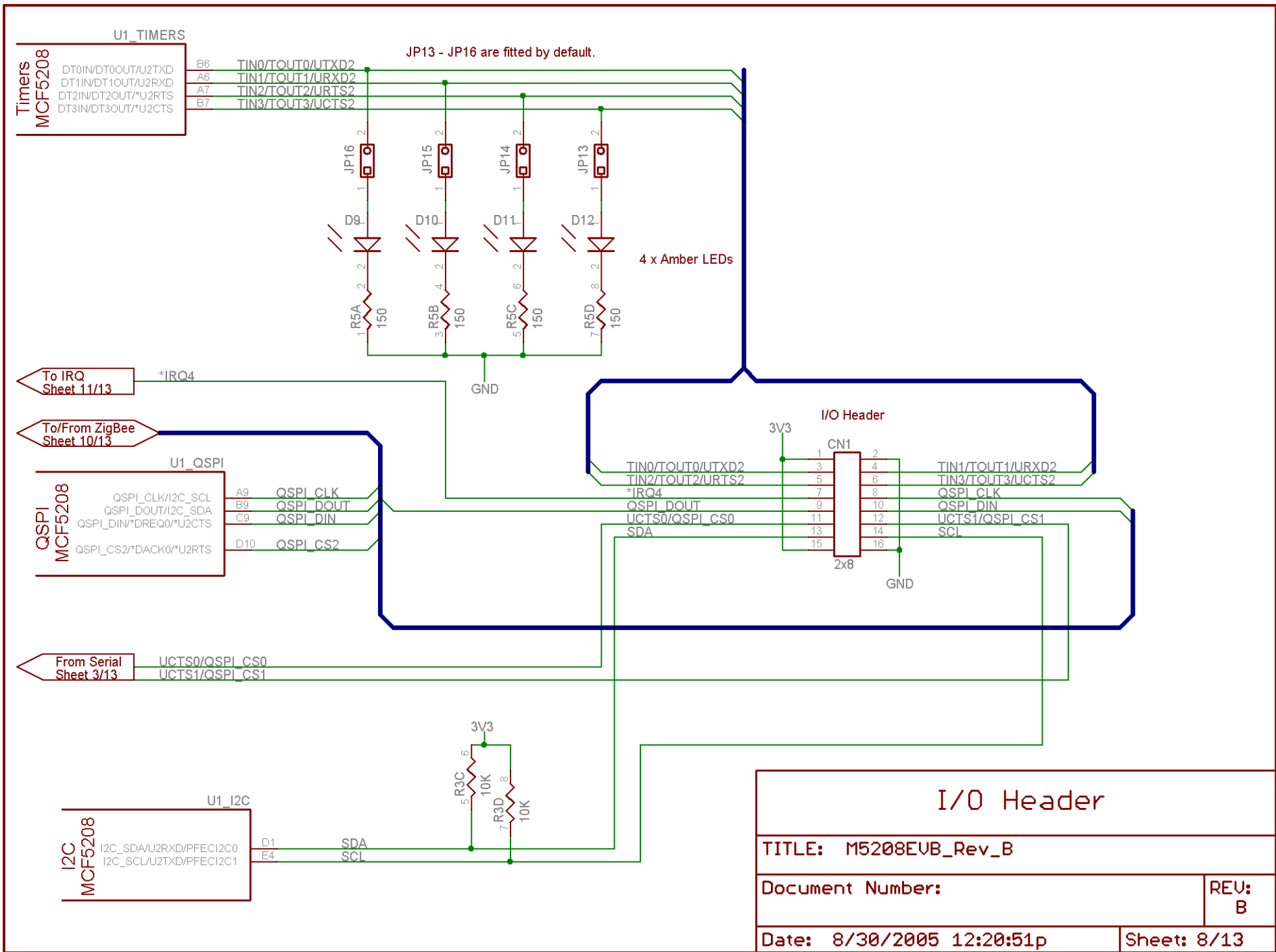
JP2 is required for some of the legacy BDM cables that connect pins 9 & 25 of the BDM interface internally. More recent cables support both core & I/O voltages. Please check with your BDM cable supplier. JP5 is fitted by default.

To Reset Sheet 11/13

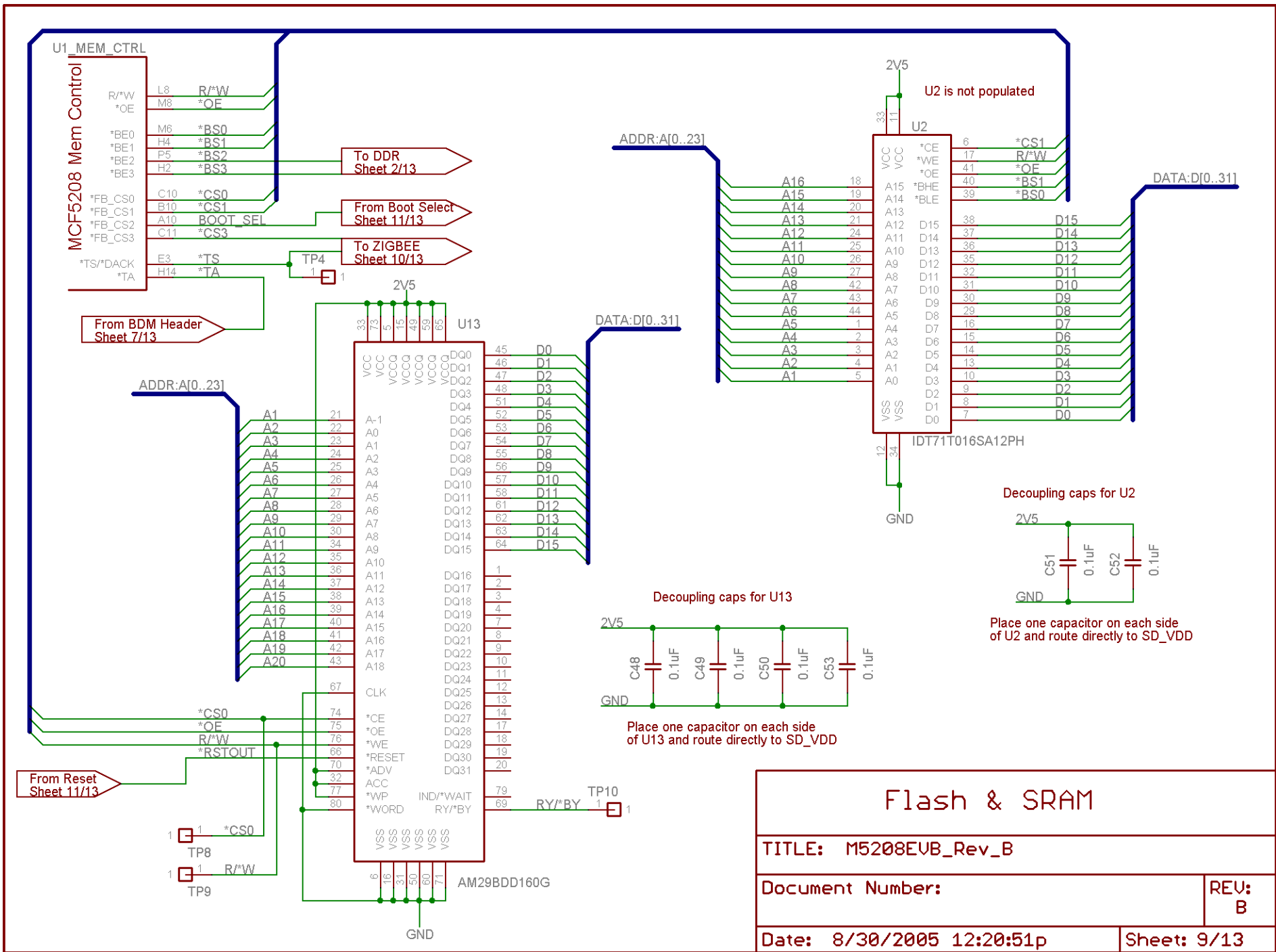
To Mem Ctrl Sheet 9/13

### BDM Connector

TITLE: M5208EVB_Rev_B	
Document Number:	REV: B
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<b>I/O Header</b>	
TITLE: M5208EVB_Rev_B	
Document Number:	REV: B
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# Flash & SRAM

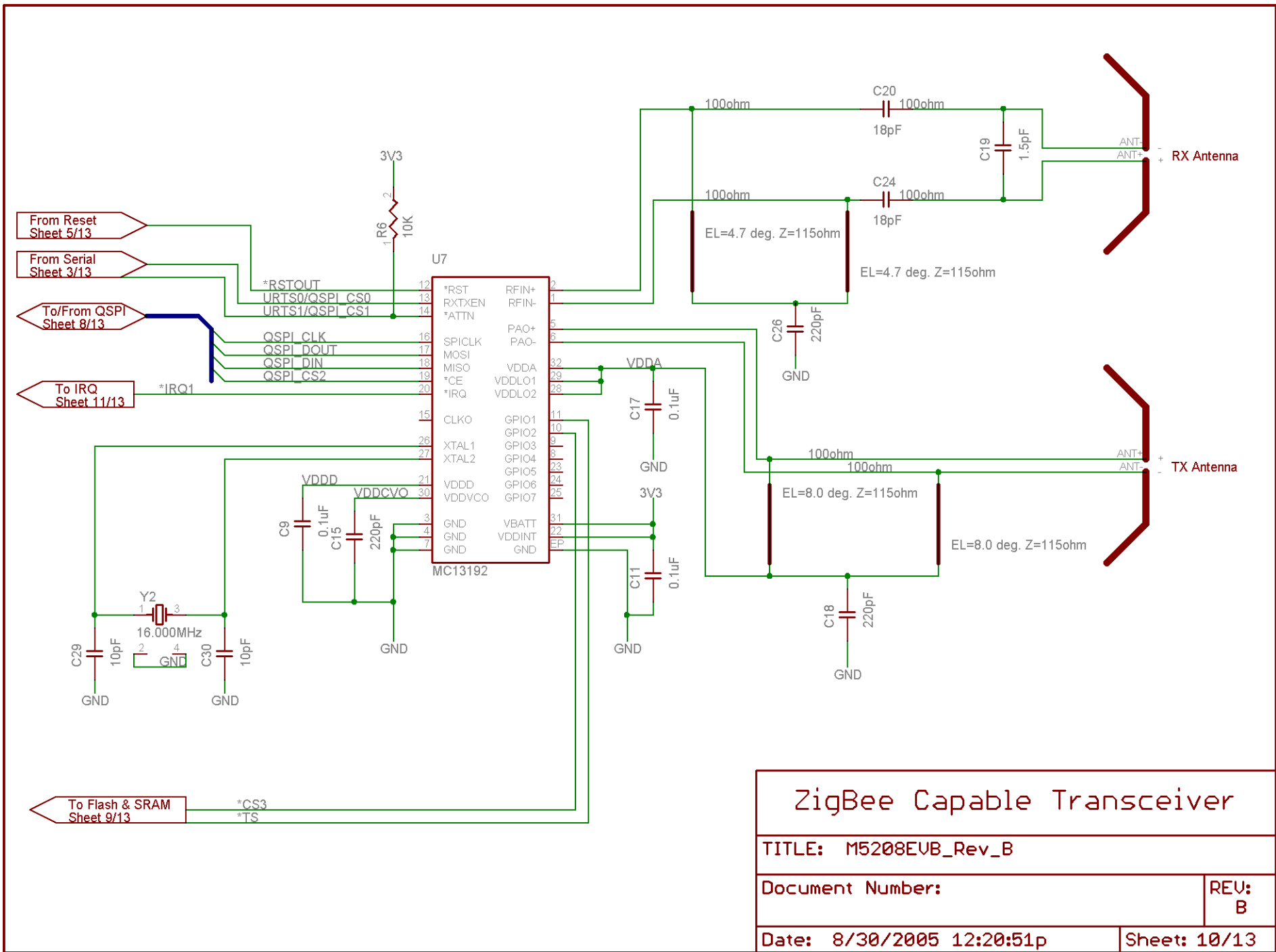
TITLE: M5208EVB\_Rev\_B

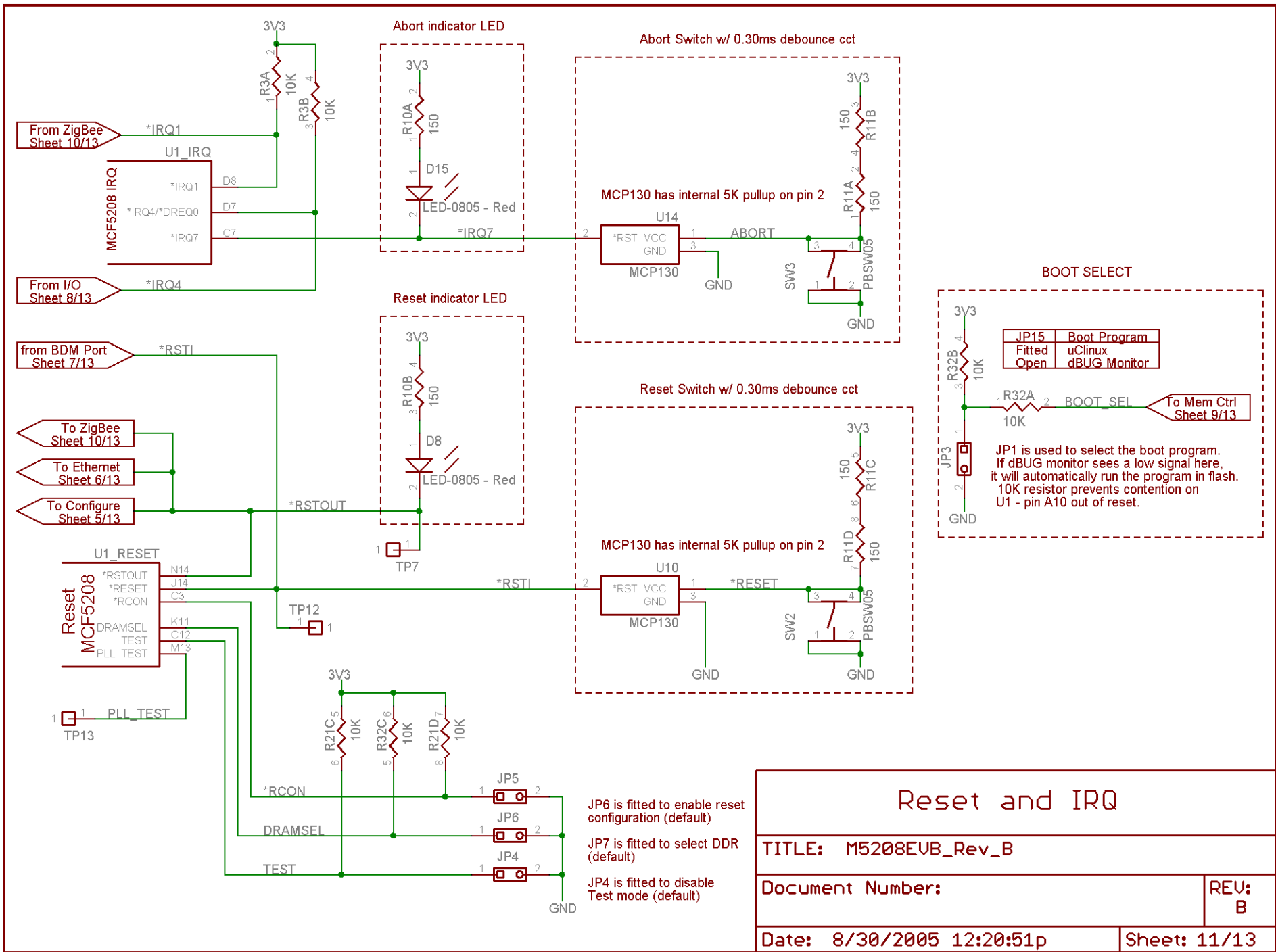
Document Number:

REV:  
B

Date: 8/30/2005 12:20:51p

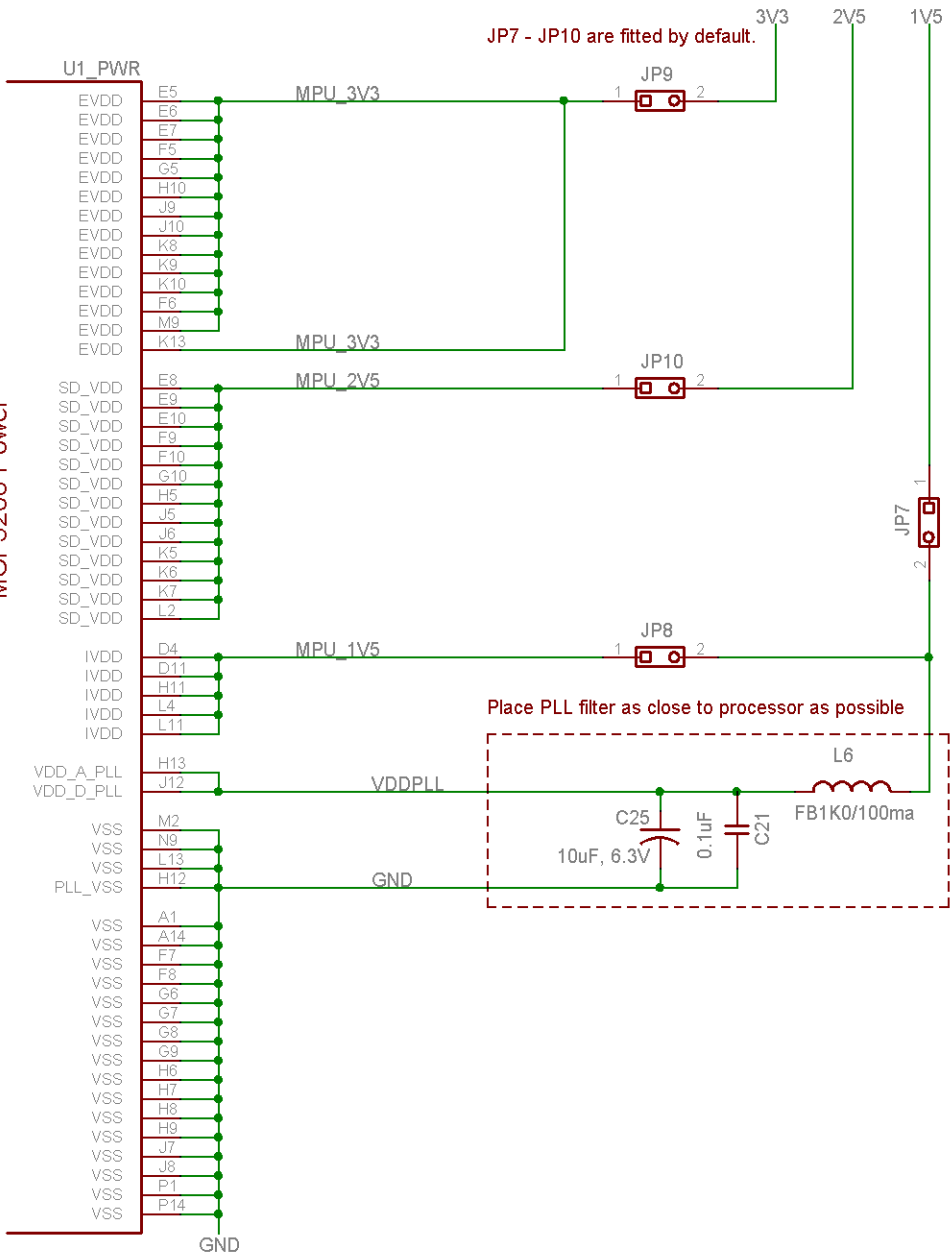
Sheet: 9/13



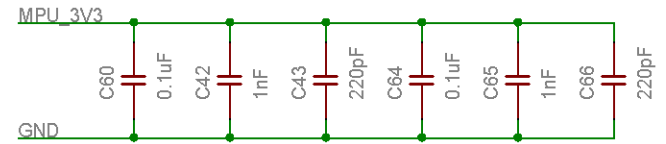


<h2>Reset and IRQ</h2>	
TITLE: M5208EVB_Rev_B	
Document Number:	REV: B
Date: 8/30/2005 12:20:51p	Sheet: 11/13

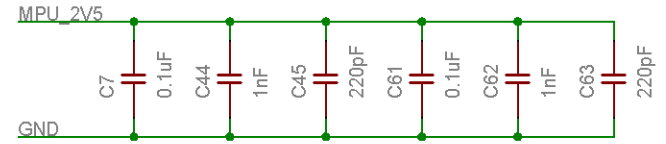
MCF5208 Power



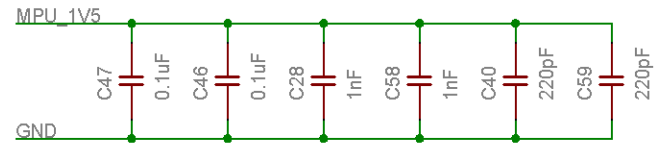
3.3V Decoupling



2.5V Decoupling



1.5V Decoupling



MCU Power Rails

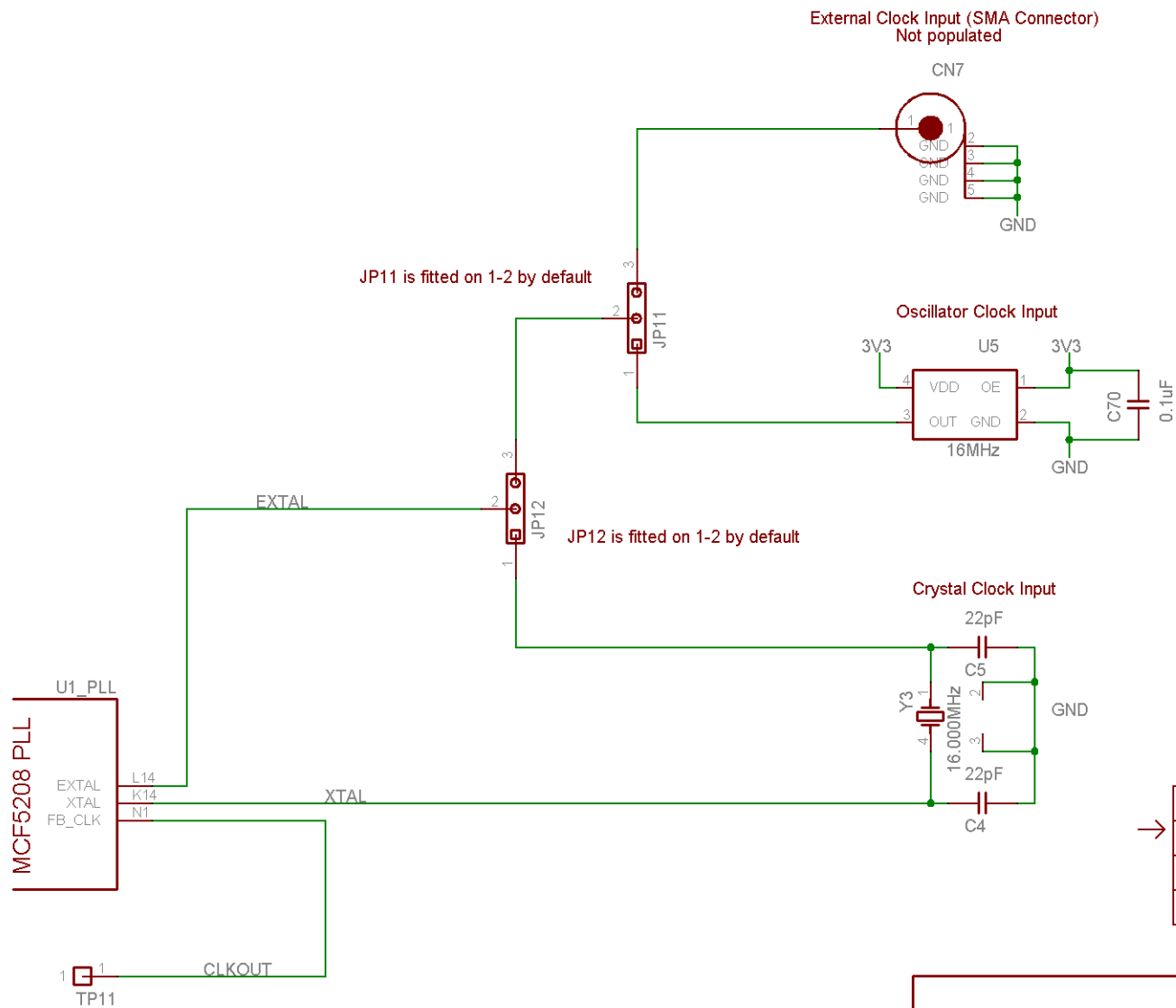
TITLE: M5208EVB\_Rev\_B

Document Number:

REV:  
B

Date: 8/30/2005 12:20:51p

Sheet: 12/13



Clock Input Selection

Clock Source	JP11	JP12
16MHz Crystal	1-2	---
16MHz Oscillator	2-3	1-2
External Clock	2-3	2-3

## Clock

TITLE: M5208EVB\_Rev\_B

Document Number:

REV:  
B

Date: 8/30/2005 12:20:51p

Sheet: 13/13

# **Appendix C**

## **dBUG Monitor**



## dBUG Monitor

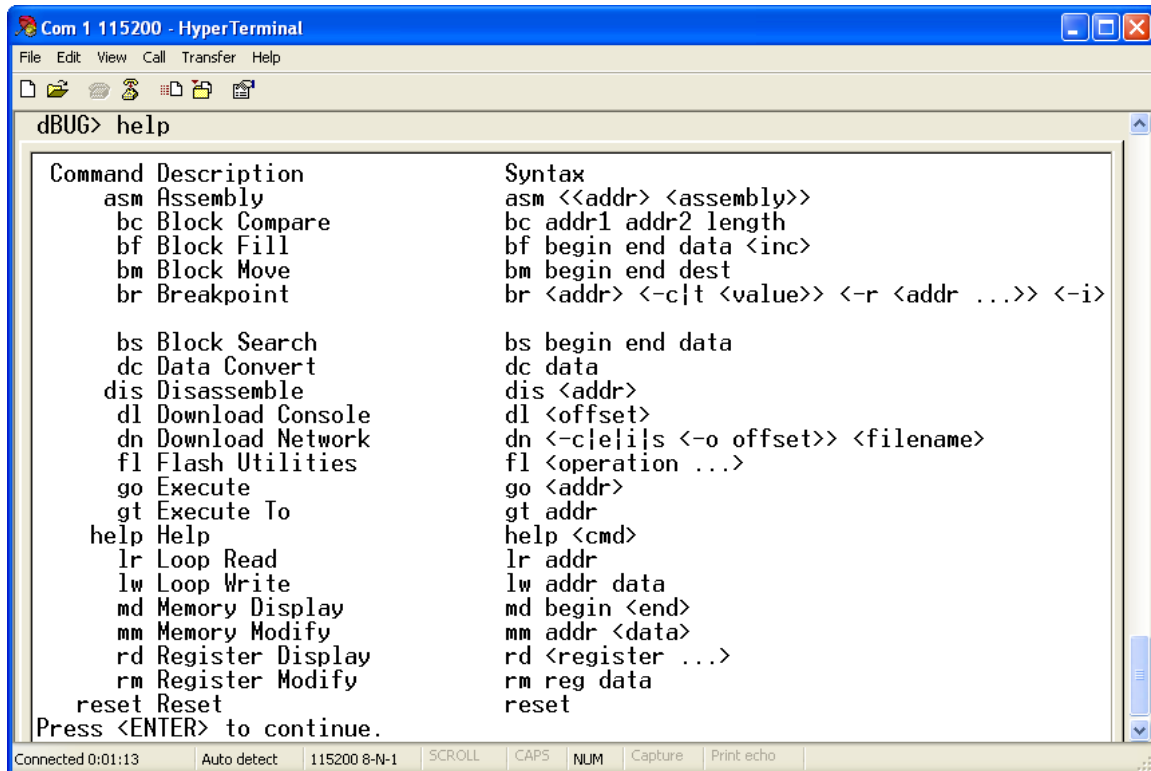
dBUG is a program that runs on the target SBC, that interacts serially with a console or debugger program on the PC. It also interacts with the user program that runs on the SBC. dBUG provides a mechanism for downloading, running and debugging programs without a BDM pod. It also stores board parameters (such as the IP address); handles user program boot-up; can handle user program interrupts, and can act as an interface for the user program's console I/O.

## Basic concepts

The dBUG Monitor is a versatile program that carries out a number of services and can be used in different ways.

## dBUG and Serial Console Program

A developer can interact directly with dBUG through any serial console program such as HyperTerminal, using dBUG's command line interface. That is, a developer can load, debug and run his program without the need of a specialized debug program. dBUG offers a rich assortment of commands, and, in fact, some commands can only be accessed through a console program. The full list of dBUG commands can be viewed by typing "Help" after the "dBUG>" prompt, when accessing the SBC through a serial console program.



The screenshot shows a HyperTerminal window titled "Com 1 115200 - HyperTerminal". The window contains the following text:

```
dBUG> help
```

Command	Description	Syntax
asm	Assembly	asm <<addr> <assembly>>
bc	Block Compare	bc addr1 addr2 length
bf	Block Fill	bf begin end data <inc>
bm	Block Move	bm begin end dest
br	Breakpoint	br <addr> <-c t <value>> <-r <addr ...>> <-i>
bs	Block Search	bs begin end data
dc	Data Convert	dc data
dis	Disassemble	dis <addr>
dl	Download Console	dl <offset>
dn	Download Network	dn <-c e i s <-o offset>> <filename>
fl	Flash Utilities	fl <operation ...>
go	Execute	go <addr>
gt	Execute To	gt addr
help	Help	help <cmd>
lr	Loop Read	lr addr
lw	Loop Write	lw addr data
md	Memory Display	md begin <end>
mm	Memory Modify	mm addr <data>
rd	Register Display	rd <register ...>
rm	Register Modify	rm reg data
reset	Reset	reset

Press <ENTER> to continue.

At the bottom of the window, there is a status bar with the following information: Connected 0:01:13, Auto detect, 115200 8-N-1, SCROLL, CAPS, NUM, Capture, Print echo.

## **dBUG and Autorun**

On startup, dBUG checks if JP3 is installed and if it is, then dBUG attempts to boot a program stored in external flash. A program can be stored into external flash by using the “dfi” or “dnfi” commands detailed below and in the dBUG user manual.

## **The World as Seen by dBUG**

dBUG resides in the bottom 256K of the M5208EVB external flash. On startup, dBUG maps the 16MB SDRAM and accesses it as follows:

- It sets up (DDR) SDRAM from 0x40000000 to 0x41FFFFFF.
- It uses the lower 128K of SDRAM, that is, 0x40000000 to 0x4001FFFF for its vector table, data and stack. Consequently this memory space is out of bounds to the user program.
- It expects the user program to always start at 0x40020000 in SDRAM.
- A user program can use the MCF5208’s on-chip SRAM for stack space, since it is very fast and dBUG does not use this memory.

## **Using dBUG**

### **Setting dBug Parameters**

dBUG stores several parameters on the SBC that determine dBUG’s behaviour. Resetting or repowering the board will not affect the values of these parameters:

- **Base** -The numeral base used by dBUG for entry and display of all numbers [16].
- **Baud** - The baud rate shared by the SBC’s Primary and Secondary serial connection [115200].

### **Setting Board Parameters**

dBUG stores several parameters on the SBC that determine the SBC’s behavior. Resetting or repowering the board will not affect the values of these parameters. Some of these parameters are:

- **Watchdog** - When On, the watchdog timer is left enabled on the MCF5208 and must be fed by the user program or the watchdog will reset the board after ~5 seconds.
- **Server** - The IP address of a PC running a TFTP server. This setting is used for network downloads.
- **Client** - The IP address of the board.
- **Gateway** - The IP address of the gateway for the LAN that the board is connected to.
- **Netmask** - The netmask of the LAN that the board is connected to.
- **DNS** - The IP address of a DNS server, used for resolving a URL to IP address.
- **Ethaddr** -The MAC address.

The values of these parameters can be displayed on the console screen with the “show” command. Each value can be individually set using the “set” command. The “set” command takes two parameters: the name of the parameter and the new value of the parameter.

## Downloading Programs

User programs can be downloaded to the M5208EVB via the serial connection or a network connection.

A serial download is done using the “dl” command. The “dl” command puts the dBUG monitor into a state where it waits for an s-record download of the user program. Using HyperTerminal, click on Transfer → Send Text File... and select the s-record to download. dBUG stores the program starting at 0x40020000.

A network download is done using the “dn” command. Before the “dn” command can be issued the dBUG parameters must be set correctly. The necessary parameters are Server, Client, Gateway, Netmask, Filename, Filetype and Ethaddr. Once these are set, issuing the “dn” command will download the specified file from the specified server IP address.

## Programming Flash

The “dfi” command is used to program the permanent storage on the M5208EVB. This command behaves exactly like the “dl” command but adds the feature of saving the downloaded program to external flash. For example, to save a program to the external flash, a user types “dfi” presses return, then transfer the s-record as with the “dl” command.

## Running Programs

A program is run using the “go” command with a start address (0x40020000) or the “gfl” command. Programs compiled for dBUG should always start at address 0x40020000. The “gfl” command will determine if a program is present in external flash, and then it will copy it to 0x40020000 in SDRAM and run it.

## Killing Programs

The “kfl” command will destroy a program stored in external flash. If a valid program exists in the specified location, then it is marked as dead, and will not be run by either the Autorun feature or the gfl command.

## dBUG Help

More information can be found on dBUG by typing “help” at the command prompt. The “help” command lists all the dBUG commands and a description of the syntax of the command.

## dBUG Updates

To update dBUG use either the dldbug command or the P&E background debug module (BDM) with the CFFlasher program. The M5208EVB is shipped with a combined dBUG and uClinux image. The factory image can be found on this CD under “Software\Firmware” directory m5208evb.s19.

# **Appendix D**

## **uClinux Commands**

## Useful uClinux Commands

The following commands are widely used on all Linux based systems including uClinux. These are just a summary of useful commands; more documentation can be found for each of these commands at <http://man.linuxquestions.org>. Also typing “help” at the uClinux prompt “/>” will provide a complete listing of the command available.

### File System Manipulation

- *ls* – list directory contents
- *cd* – change directory
- *mkdir* – make directory
- *rm* – remove file
- *rmdir* – remove directory
- *cp* – copy a file
- *mv* – move a file
- *cat* - view a file on standard output
- *mount* – mount a file system on top of a device
  - e.g.: />mount -t jffs2 /dev/mtdblock1 /mnt/flash
- *smbmount* – mount a remote file share
  - e.g.: />smbmount //192.168.2.98/workspace /mnt/workspace -o username=Mike,password=mike
- *sync* – synchronize cached files in RAM to disk

### Network

#### ifconfig

The ifconfig command is used to view and edit network information such as IP address and subnet mask

- *ifconfig eth0* – display IP address and other network parameters
- *ifconfig eth0 [ip] netmask [netmask]* – Set IP address to [ip] and netmask to [netmask]
- *ifconfig -h* – display help on the ifconfig command

## **route**

The route command is used to view or edit network routing information.

- *route* – display network routing table
- *route add default gw [gateway]* – Add the default gateway to the routing table
- *route -h* – display help for the route command

## **mii-tool**

The mii-tool command is used to get and set low-level physical information from the network interface, such as speed and duplex.

- *mii-tool* – display the physical Ethernet properties
- *mii-tool -v* – display more information (verbose)
- *mii-tool -v -v* – most verbose setting (includes raw dump of PHY chip registers in Hex)
- *mii-tool -restart* – reset the physical Ethernet interface chip
- *mii-tool -h* – help for the mii-tool command

## **Date/Time**

### **date**

The date command will show or set the system date as kept by the kernel while running. This date will reset every time the board is rebooted. If you would like to keep the time accurate, you must use a battery backed RTC with the “hwclock” utility.

- *date* – view the current system date
- *date [MMDDhhmm[YYYY]]* – set the system date time

## **System**

### **proc file system**

The proc file system provides diagnostics for the entire system. To view the diagnostics use the cat command in the /proc directory.

- *cat /proc/cpuinfo* – displays stats about the CPU brand and speed
- *cat /proc/interrupts* – statistics on interrupts
- *cat /proc/mounts* – information on mounted filesystems

- *more...* browse through the /proc directory and subdirectories to see more diagnostics.

## **ps**

The ps command shows information about the current running processes in the system.

- *ps* – display information including the process id of each process in the system.

## **shutdown**

The shutdown command is the **only** way to correctly shutdown uClinux without causing potential file system damage. The shutdown command will attempt to gracefully close all processes and eventually kill them, synchronize the cached file system information to disk and terminate operation.

- *shutdown -h now* – Shutdown the system and hang in an endless loop (requires hard reset to boot up again)
- *shutdown -r now* – Shutdown the system and perform a software reset, if Autorun is on uClinux will boot up again.
- *shutdown* – display usage information for the shutdown command

# **Appendix E**

## **uClinux Drivers**



## ***uClinux Device Drivers***

The following sections describe the various device drivers in uClinux that are importance to user application development. There are other drivers available in the `/dev` directory that are not included in this list because they are exclusively used by the kernel.

### **ips (IPS)**

The “ips” driver has been developed by Intec to support the run time library under uClinux. The internal peripheral system (ips) driver provides user applications with access to the hardware registers. User applications should never use the ips driver directly, but instead simply call functions from the run time library provided.

### **mtd[x]/mtdblock[x] (External Flash)**

The memory technology device (mtd) driver is for accessing the external flash device. On the Wildfire board this device provides access to the on board serial flash. To make use of the mtd driver a file system should be mounted on top of it. The Journaling Flash File System (JFFS2) is designed for these type of flash devices which require sector erases before writes. To use the mtd driver issue the following command at either the command line or from the rc file (done by default with the M5208EVB as shipped in the etc/rc file).

1. Create a directory if not already created (`/>mkdir /mnt/flash`)
2. Mount the file system (`/>mount -t jffs2 /dev/mtdblock1 /mnt/flash`)
3. To erase a device use the raw char driver (`/>eraseall /dev/mtd1`). This will erase all data on the device and is in fact like formatting the device.

For the M5208EVB the partitions are as follows:

1. mtd0, mtblock0 – 256K dBUG partition
2. mtd1, mtblock1 – 640K JFFS2 partition
3. mtd2, mtblock2 – 1152K compressed Kernel image

Only the **mtd1** partition should be used in most cases. Altering the other partitions could cause problems booting the board and will require the board to be re-flashed with the BDM pod.

Once mounted the directory can be used like any other and will retain its data between power cycles.

## **ram (RAM)**

The ram driver allows a file system to be mounted in RAM. A special RAM disk is created by default on startup from the rc script when uClinux boots. The **/var** directory will boast fast access, but will not retain its contents between system reboots. It is not likely that a user application will need to use this driver directly, but instead simply use the /var directory for fast file access.

## **ttyS (COM Ports)**

The ttyS drivers provide access to the serial ports under uClinux. The ttyS driver can be configured in many ways to allow ASCII and binary communications. The number after the ttyS represents which port to use.

- ttyS0 – uart0 – COM1 (used as console)
- ttyS1 – uart1 – COM2
- ttyS2 – uart2 – COM3

See the uDemoSerial for a comprehensive example on using the serial device driver under uClinux.