# xPC56XXMB User Manual


xPC56XXMBUM
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P&E Microcomputer Systems, Inc.
P.O. Box 2044
Woburn, MA 01888
617-923-0053
http://www.pemicro.com

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# 1 OVERVIEW

The xPC56XXMB Motherboard is an evaluation system supporting Freescale's MPC56xx microprocessors. The complete system consists of an xPC56XXMB Motherboard and an xPC56xxADPT Mini-Module (not included) which plugs into the motherboard. Different Mini-Modules are available for evaluating the different devices in the MPC56xx family of microprocessors. The evaluation system (Motherboard & Mini-Module) allows full access to the CPU, all of the CPU's I/O signals, and the motherboard peripherals (such as CAN, SCI, LIN).

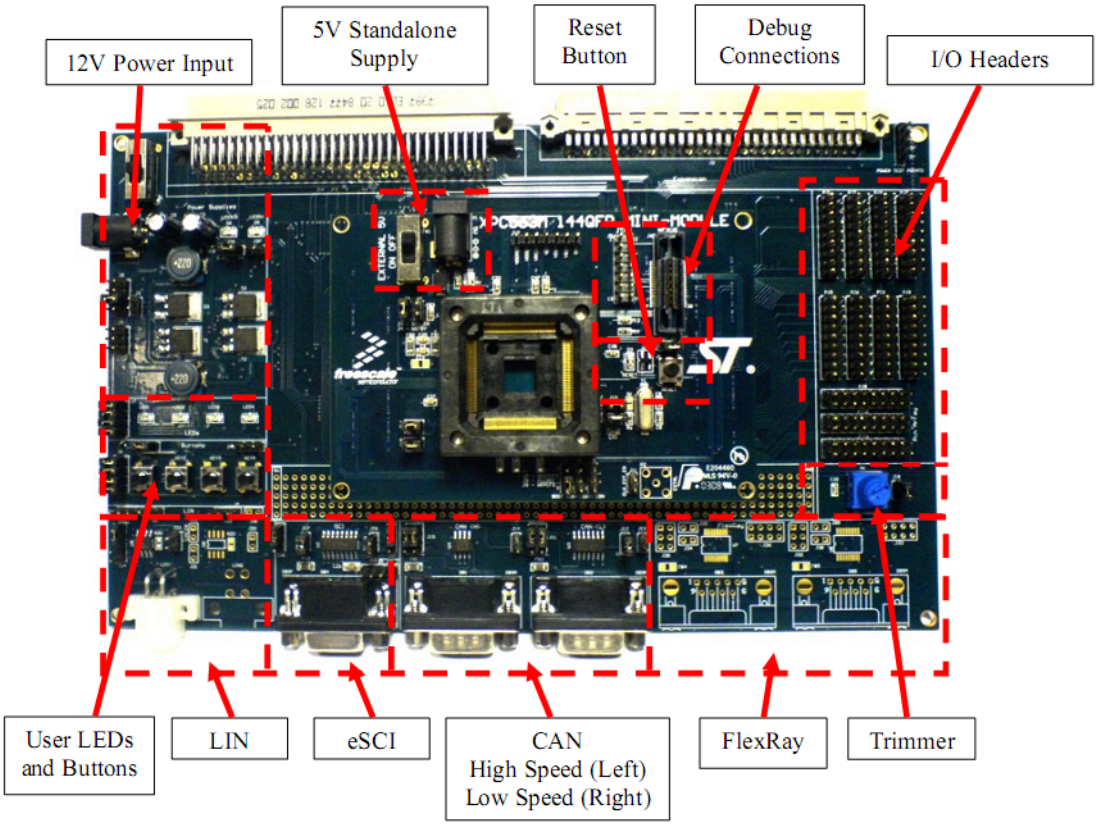


**Figure 1-1: Overview of the xPC56XXMB with Mini-Module (not included)**

## 1.1 Package Contents

An xPC56XXMB Evaluation Kit includes the following items:

- One xPC56XXMB Motherboard
- One xPC56XX Resources CD-ROM
- Freescale Warranty Card

## 1.2 Supported Devices

To work with a specific device in the MPC56xx family of microprocessors, the correct Mini-Module (not included) must be used to plug into the xPC56XXMB motherboard. Below is a list of all available Mini-Modules and their supported devices:

**xPC560BADPT100S Mini-Module:** Supports MPC5604BEMLL
**xPC560BADPT144S Mini-Module:** Supports MPC5604BEMLQ
**xPC560BADPT208S Mini-Module:** Supports MPC5604BEMMG

**xPC560PADPT100S Mini-Module:** Supports MPC5604PEFMLL
**xPC560PADPT144S Mini-Module:** Supports MPC5604PEFMLQ

**xPC560SADPT144S Mini-Module:** Supports MPC5606SEMLQ
**xPC560SADPT176S Mini-Module:** Supports MPC5606SEMLU
**xPC560SADPT208S Mini-Module:** Supports MPC5606SEMMG

**xPC563MADPT144S Mini-Module:** Supports MPC5633MMLQ80
**xPC563MADPT208S Mini-Module:** Supports MPC5633MMMG80

## 1.3 Recommended Materials

- Freescale device reference manual and datasheet
- xPC56XXMB schematic
- Mini-Module hardware manual and schematics

## 1.4 Handling Precautions

Please take care to handle the package contents in a manner such as to prevent electrostatic discharge.

# 2 HARDWARE FEATURES

## 2.1 xPC56XXMB Board Features

- ON/OFF Power Switch w/ LED indicators
- A 12VDC power supply input barrel connector
- Onboard ST Microelectronics L9758 regulator provides three different power voltages simultaneously: 5V, 3.3V, and 1.2V
- Onboard peripherals can be configured to operate at 5V or 3.3V logic levels
- Two CAN channels with jumper enables
  - One CAN channel with High-Speed transceiver and DB9 male connector
  - One CAN channel with Low-Speed Fault Tolerant and High-Speed transceiver (selectable with jumpers) and DB9 male connector
- Two LIN channels with jumper enables
  - One channel with transceiver and pin header connector populated
  - One channel with footprints only
- One SCI channel with jumper enables
  - Transceiver with DB9 female connector
- Two FlexRay channels with jumper enables
  - One channel with transceiver and DB9 male connector
  - One channel with footprint only
- Four user push buttons with jumper enables and polarity selection
- Four user LED’s with jumper enables
- One potentiometer for analog voltage input
- Pin array for accessing all I/O signals
- Expansion connectors for accessing all I/O signals
- Development zone with 0.1” spacing and SOIC footprint prototyping

- Specifications:
  - Board Size 5.5” x 9.0”
  - 12VDC Center Positive power supply with 2.5/5.5mm barrel connector

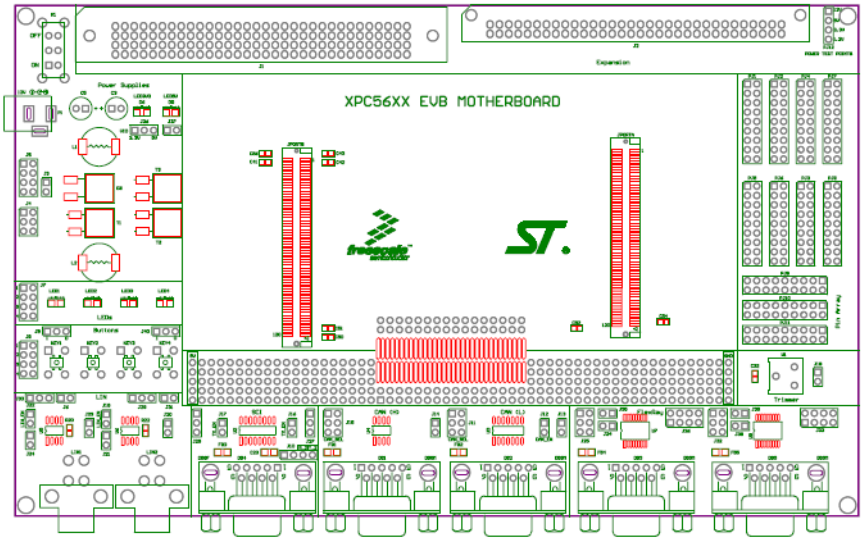


**Figure 2-2: xPC56XXMB Top Component Placement**

## 2.2 Pin Numbering for Jumpers

Jumpers for both the xPC56XXMB motherboard have a rounded corner to indicate the position of pin 1. See examples below for the numbering convention used in this manual for jumper settings.

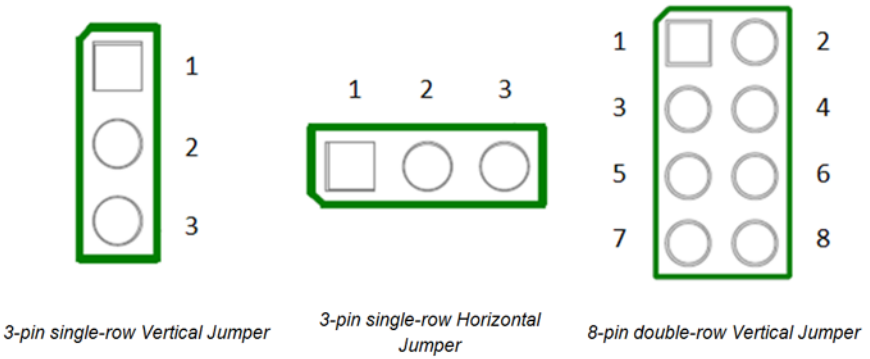


**Figure 2-3: Pin Numbering**

# 3 xPC56XXMB HARDWARE & JUMPER SETTINGS

## 3.1 Power Supplies

The xPC56XXMB obtains its power from the 12VDC Center Positive input barrel connector. The following jumpers are used to configure the power supply output:

### J3 – VSA Tracking Regulator Configuration

| Jumper Setting | Effect |
|---|---|
| On | The ST L9758 tracking regulator VSA tracks the input voltage at its TRACK_REF pin. |
| Off (default) | The ST L9758 tracking regulator VSA tracks 5V |

### J4 – VPROG Regulators Control

| Jumper Setting | Position | Effect |
|---|---|---|
| 1+2 | On | $V_{KAM}$ regulator output is programmed to 1V |
| | Off (default) | $V_{KAM}$ regulator output is programmed to 1.5V |
| 3+4 | On | $V_{STBY}$ regulator output is programmed to 2.6V |
| | Off (default) | $V_{STBY}$ regulator output is programmed to 3.3V |

| | | |
|---|---|---|
| 5+6 | On | $V_{DLL}$ regulator output is programmed to 2.6V |
| | Off (default) | $V_{DLL}$ regulator output is programmed to 3.3V |

**J5 – Regulators Enable & Standby**

| Jumper Setting | Position | Effect |
|---|---|---|
| 1+2 | On | The power regulator is always on |
| | Off (default) | The power regulator is in standby if jumpers 5+6 are also in the “off” position |
| 3+4 | On | VSB, VSC, and VSD tracking regulators are disabled |
| | Off (default) | VSB, VSC, and VSD tracking regulators are enabled |
| 5+6 | On (default) | The power regulator is always on |
| | Off | The power regulator is in standby if jumpers 1+2 are also in the “off” position |
| 7+8 | On | $V_{DLL}$ and $V_{CORE}$ regulators are disabled |
| | Off (default) | $V_{DLL}$ and $V_{CORE}$ regulators are enabled |

### J36 – VIO Peripherals Logic Level

| Jumper Setting | Effect |
|---|---|
| 1+2 | Onboard peripherals are configured for 3.3V logic |
| 2+3 (default) | Onboard peripherals are configured for 5V logic |

### J37 – VBat low voltage detection

| Jumper Setting | Effect |
|---|---|
| On | Low battery detection is enabled |
| Off (default) | Low battery detection is disabled |

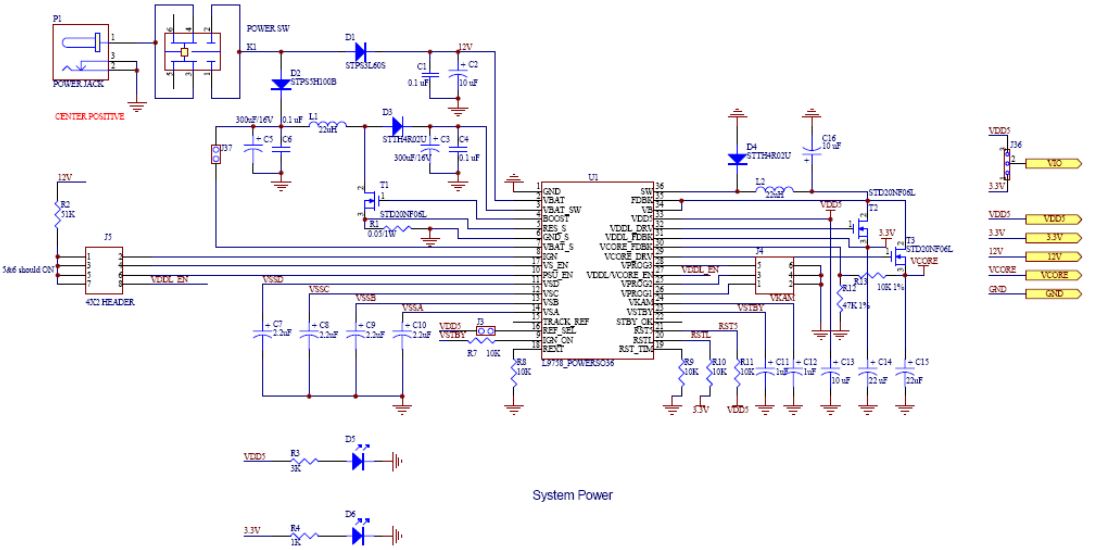


**Figure 3-1: Power Supply circuitry schematic**

## 3.2 LEDs

There are four user LEDs available on the xPC56XXMB. All LEDs are active low.

### J7 – LEDs Enable

Controls whether the LEDs on the xPC56XXMB motherboard are connected to I/O pins of the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|

| | |
|---|---|
| 1+2 (default on) | LED1 connected to processor I/O pin |
| 3+4 (default on) | LED2 connected to processor I/O pin |
| 5+6 (default on) | LED3 connected to processor I/O pin |
| 7+8 (default on) | LED4 connected to processor I/O pin |

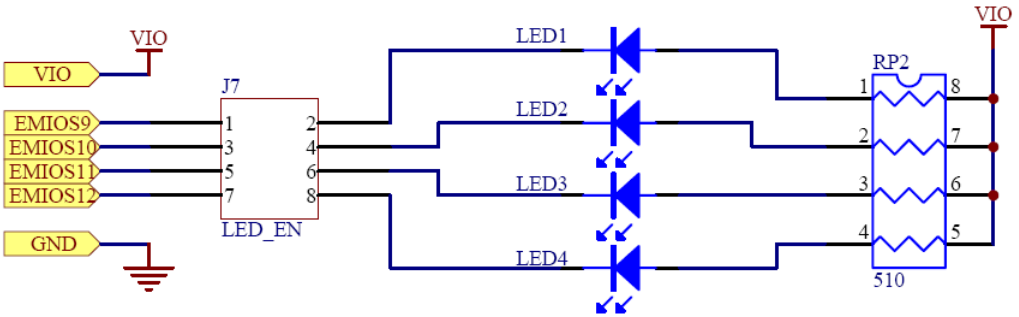


**Figure 3-2: LEDs circuitry schematic**

## 3.3 Buttons

There are four user buttons available on the xPC56XXMB.

### J8 – Buttons Enable

Controls whether the buttons on the xPC56XXMB motherboard are connected to I/O pins of the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the

Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 (default on) | KEY1 connected to processor I/O pin |
| 3+4 (default on) | KEY2 connected to processor I/O pin |
| 5+6 (default on) | KEY3 connected to processor I/O pin |
| 7+8 (default on) | KEY4 connected to processor I/O pin |

**J9 – Buttons Driving Configuration**

Selects whether the buttons drive logic high or drive logic low when pressed.

| Jumper Setting | Effect |
|---|---|
| 1+2 | When pressed, buttons will send logic high to the connected I/O pin |
| 2+3 (default) | When pressed, buttons will send logic low to the connected I/O pin |

**J40 – Buttons Idle Configuration**

Selects whether the I/O pins are pulled logic high or pulled logic low. This controls the defaultlogic level of the I/O pins when the buttons are not

pressed.

| Jumper Setting | Effect |
|---|---|
| 1+2 (default) | I/O pins connected to the buttons are pulled up to logic high |
| 2+3 | I/O pins connected to the buttons are pulled down to logic low |

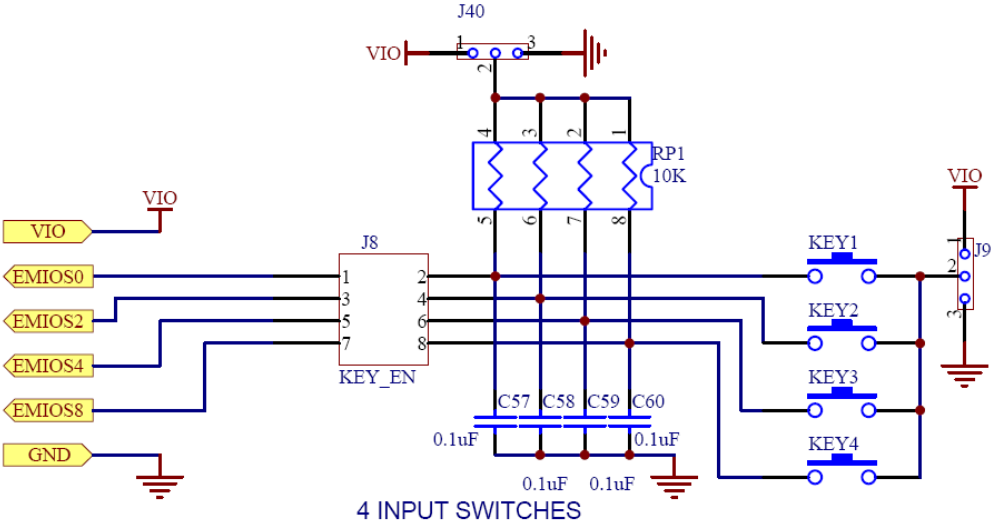


**Figure 3-3: Buttons circuitry schematic**

## 3.4 LIN

There are footprints for two LIN connections on the xPC56XXMB. By default, one LIN circuit is assembled (LIN1) and the other circuit is left unpopulated (LIN2).

**J6 – LIN1 pin2 configuration**

| Jumper Setting | Effect |
|---|---|
| On | Pin 2 of the LIN1 connector is connected to 12V |
| Off (default) | Pin 2 of the LIN1 connector is not connected to 12V |

**J22 – LIN1 enable**

| Jumper Setting | Effect |
|---|---|
| On (default) | Enables the LIN1 transceiver |
| Off | Disables the LIN1 transceiver |

**J23 – LIN1 master selection**

| Jumper Setting | Effect |
|---|---|
| On | LIN1 is configured as a master node |
| Off (default) | LIN1 is configured as a slave node |

**J24 – LIN1 pin1 configuration**

| Jumper Setting | Effect |
|---|---|

| | |
|---|---|
| On | Pin 1 of the LIN1 connector is connected to 12V |
| Off (default) | Pin 1 of the LIN1 connector is not connected to 12V |

**J27 – LIN1/SCI TxD selection**

Controls whether the TxD pin on LIN1 or SCI is connected to the default I/O pin on the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The LIN1 TxD pin is connected to a processor I/O pin. This should be set if enabling LIN1. |
| 2+3 | The SCI TxD pin is connected to a processor I/O pin. |

**J28 – LIN1/SCI RxD selection**

Controls whether the RxD pin on LIN1 or SCI is connected to the default I/O pin on the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The LIN1 RxD pin is connected to a processor I/O pin. This should be set if enabling LIN1. |
| 2+3 | The SCI RxD pin is connected to a processor I/O pin. |

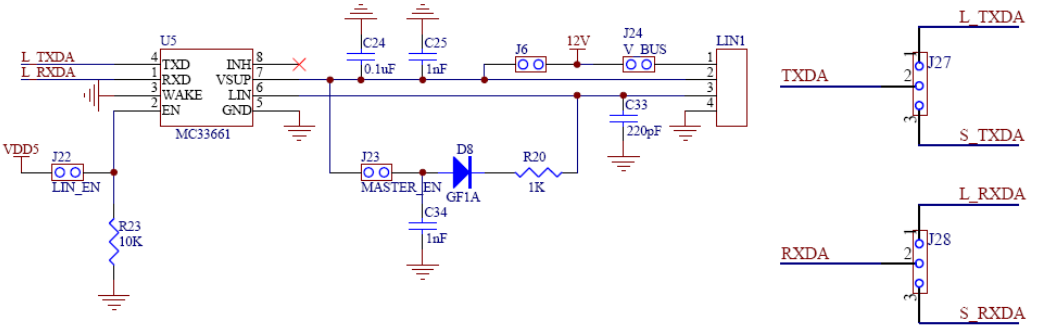


**Figure 3-4: LIN1 Schematic**

### J31 – LIN2 pin2 configuration

| Jumper Setting | Effect |
|---|---|
| On | Pin 2 of the LIN2 connector is connected to 12V |
| Off (default) | Pin 2 of the LIN2 connector is not connected to 12V |

### J19 – LIN2 enable

| Jumper Setting | Effect |
|---|---|
| On | Enables the LIN2 transceiver |
| Off (default) | Disables the LIN2 transceiver |

### J20 – LIN2 master selection

| Jumper Setting | Effect |
|---|---|
| On | LIN2 is configured as a master node |
| Off (default) | LIN2 is configured as a slave node |

### J21 – LIN2 pin1 configuration

| Jumper Setting | Effect |
|---|---|
| On | Pin 1 of the LIN2 connector is connected to 12V |
| Off (default) | Pin 1 of the LIN2 connector is not connected to 12V |

### J29 – LIN2/SCI TxD selection

Controls whether the TxD pin on LIN2 or SCI is connected to the default I/O pin on the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The LIN2 TxD pin is connected to a processor I/O pin. This should be set if enabling LIN2. |
| 2+3 | The SCI TxD pin is connected to a processor I/O pin. |

**J30 – LIN2/SCI RxD selection**

Controls whether the RxD pin on LIN2 or SCI is connected to the default I/O pin on the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The LIN2 RxD pin is connected to a processor I/O pin. This should be set if enabling LIN2. |
| 2+3 | The SCI RxD pin is connected to a processor I/O pin. |

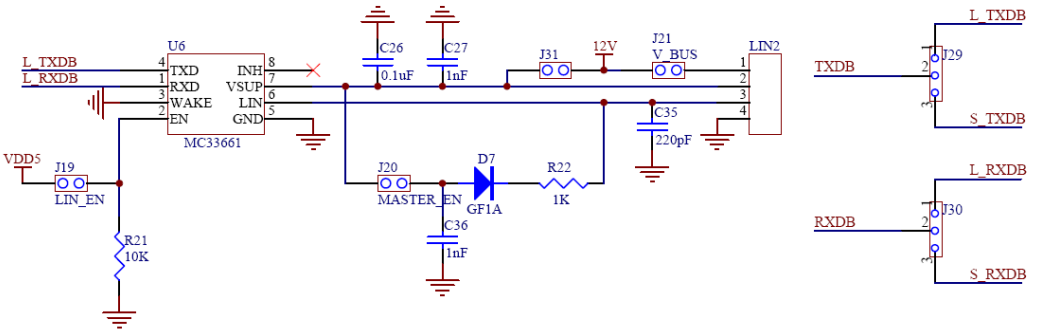


**Figure 3-5: LIN2 schematic (Not populated by default)**

## 3.5 SCI

One SCI interface is available on the xPC56XXMB.

**J16 – SCI TxD Enable**

| Jumper Setting | Effect |
|---|---|
| On (default) | Enables SCI transmit |
| Off | Disables SCI transmit |

**J17 – SCI RxD Enable**

| Jumper Setting | Effect |
|---|---|
| On (default) | Enables SCI receive |
| Off | Disables SCI receive |

**J27 – LIN1/SCI TxD selection**

Controls whether the TxD pin on LIN1 or SCI is connected to the default I/O pin on the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The LIN1 TxD pin is connected to a processor I/O pin. |
| 2+3 | The SCI TxD pin is connected to a processor I/O pin. This should be set if enabling SCI. |

**J28 – LIN1/SCI RxD selection**

Controls whether the RxD pin on LIN1 or SCI is connected to the default I/O pin on the processor. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The LIN1 RxD pin is connected a processor I/O pin. |
| 2+3 | The SCI RxD pin is connected to a processor I/O pin. This should be set if enabling SCI. |

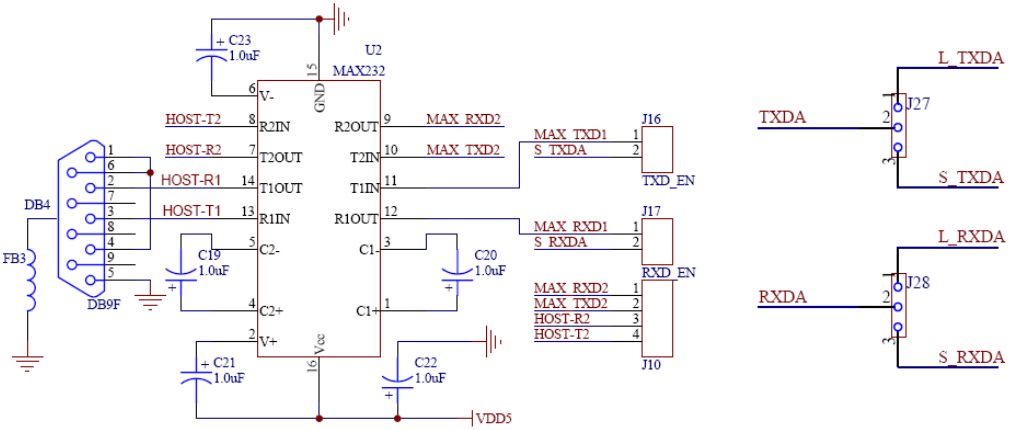


**Figure 3-6: SCI schematic**

## 3.6 CAN

Two CAN interfaces are implemented on the xPC56XXMB: a high-speed CAN interface and a low-speed CAN interface.

### J14 – CAN (H) Transmit Enable

| Jumper Setting | Effect |
|---|---|
| On | Enables CAN transmission |
| Off (default) | Disables CAN transmission |

### J15 – CAN (H) TxD/RxD Enable

Controls which I/O pins on the processor are connected to the TxD and RxD pins on CAN (H). The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+3 (default) | The RxD pin of the CAN (H) interface is connected to a processor I/O pin. |
| 3+5 | The RxD pin of the CAN (H) interface is connected to a processor I/O pin. |
| 2+4 (default) | The TxD pin of the CAN (H) interface is connected to a processor I/O pin. |
| 4+6 | The TxD pin of the CAN (H) interface is connected to a processor I/O pin. |

### J13 – CAN (L) CTE

| Jumper Setting | Effect |
|---|---|

| | |
|---|---|
| On | Enables CAN transmission |
| Off (default) | Disables CAN transmission |

**J11 – CAN (L) TxD/RxD Enable**

Controls which I/O pins on the processor are connected to the TxD and RxD pins on CAN (L). The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+3 | The RxD pin of the CAN (L) interface is connected to a processor I/O pin. |
| 3+5 (default) | The RxD pin of the CAN (L) interface is connected to a processor I/O pin. |
| 2+4 | The TxD pin of the CAN (L) interface is connected to a processor I/O pin. |
| 4+6 (default) | The TxD pin of the CAN (L) interface is connected to a processor I/O pin. |

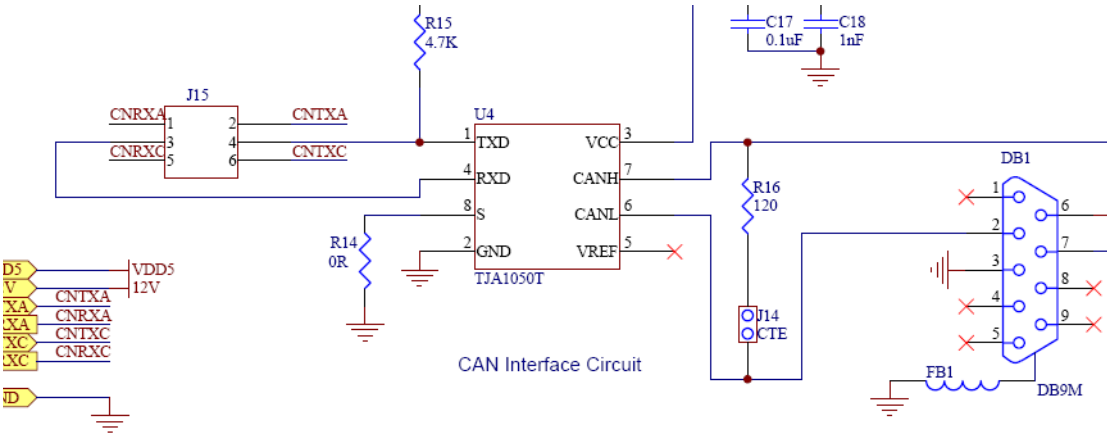


**Figure 3-7: High Speed CAN schematic**

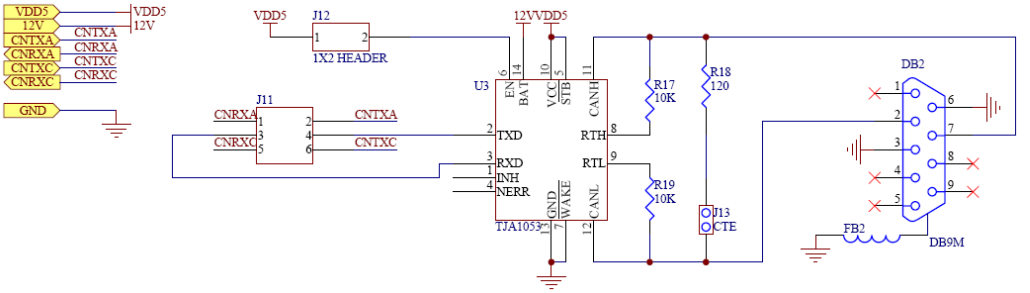


**Figure 3-8: Low Speed CAN schematic**

## 3.7 FlexRay

The xPC56XXMB has footprints for two FlexRay interfaces. However, only one circuit is assembled by default. The FlexRay circuit comprises of two DB9 connectors. DB3 contains signals for both FlexRay channels and is compatible with major FlexRay tools. DB5 contains channel B signal, thereby also allowing 2 separate FlexRay connectors for channel A and channel B operation.

### J25 – FlexRay Bus Driver 1 Enable

Controls which I/O pins on the processor are connected to the TxD and RxD pins on FlexRay Bus Driver. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 (default on) | The TXD pin on the FlexRay Bus Driver is connected to a processor I/O pin. |
| 3+4 (default on) | The TXEN pin on the FlexRay Bus Driver is connected to a processor I/O pin. |
| 5+6 (default on) | The RXD pin on the FlexRay Bus Driver is connected to a processor I/O pin. |

### J26 – FlexRay Bus Driver 1 Pull-up Enable

Controls which pins on the FlexRay Bus Driver are pulled up.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The BGE pin on the FlexRay Bus Driver is pulled up to 5V |
| 3+4 | The STBN pin on the FlexRay Bus Driver is pulled up to 5V |
| 5+6 (default on) | The EN pin on the FlexRay Bus Driver is pulled up to 5V |

| | |
|---|---|
| 7+8 (default on) | The WAKE pin on the FlexRay Bus Driver is pulled up to 5V |

**J34 & J35 FlexRay 1 Terminal Resistor Connection**

| Jumper Setting | Effect |
|---|---|
| On | Terminal resistors connected |
| Off (default) | Terminal resistors not connected |

**J32 – FlexRay Bus Driver 2 Enable**

Controls which I/O pins on the processor are connected to the TxD and RxD pins on FlexRay Bus Driver. The exact pins used are dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The TXD pin on the FlexRay Bus Driver is connected to a processor I/O pin. |
| 3+4 | The TXEN pin on the FlexRay Bus Driver is connected to a processor I/O pin. |
| 5+6 | The RXD pin on the FlexRay Bus Driver is connected to a processor I/O pin. |

**J33 – FlexRay Bus Driver 2 Pull-up Enable**

Controls which pins on the FlexRay Bus Driver are pulled up.

| Jumper Setting | Effect |
|---|---|
| 1+2 | The BGE pin on the FlexRay Bus Driver is pulled up to 5V |
| 3+4 | The STBN pin on the FlexRay Bus Driver is pulled up to 5V |
| 5+6 | The EN pin on the FlexRay Bus Driver is pulled up to 5V |
| 7+8 | The WAKE pin on the FlexRay Bus Driver is pulled up to 5V |

**J38 & J39 – FlexRay 2 Terminal Resistor Connection**

| Jumper Setting | Effect |
|---|---|
| On | Terminal resistors connected |
| Off (default) | Terminal resistors not connected |

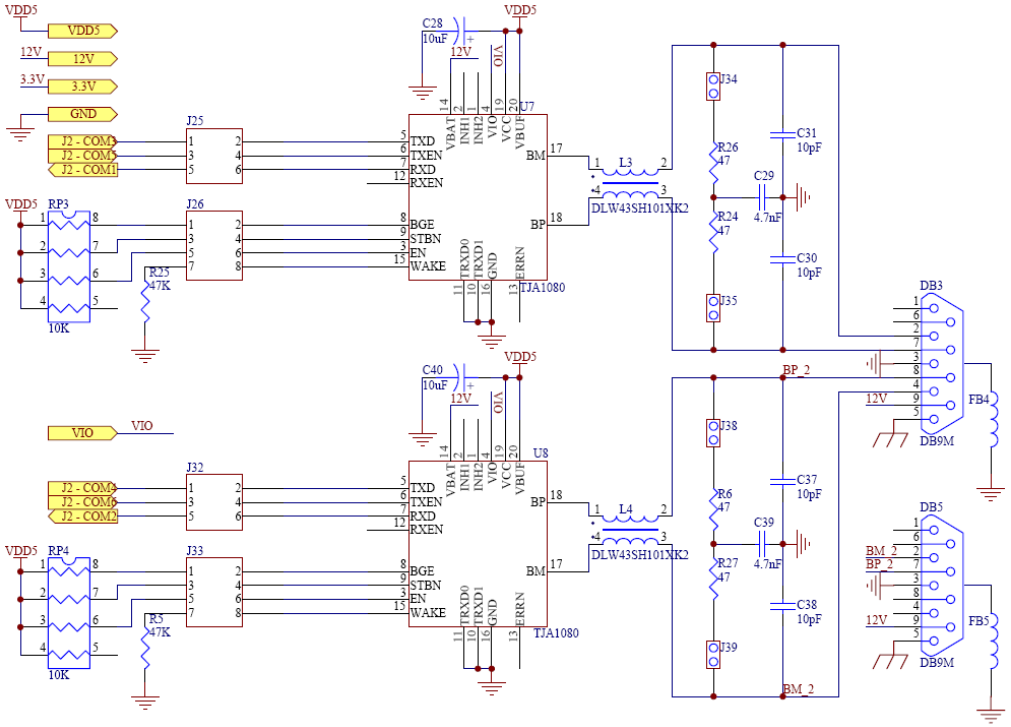


**Figure 3-9: FlexRay schematic**

## 3.8 Potentiometer

A potentiometer is available on the xPC56XXMB to allow an analog voltage input.

### J18 – POT Enable

| Jumper Setting | Effect |
|---|---|

| | |
|---|---|
| On (default) | The potentiometer wiper terminal is connected to a processor I/O pin. The exact pin used is dependent on the specific Mini-Module plugged into the motherboard. Please refer to the Mini-Module hardware manual for more details. |
| Off | The potentiometer wiper terminal is left disconnected. |

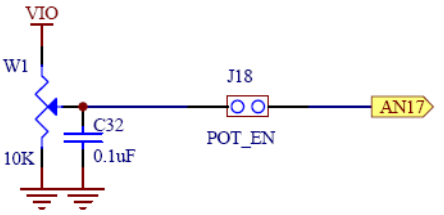


**Figure 3-10: Potentiometer schematic**

# 4 DEBUGGING/PROGRAMMING xPC56XX MOTHERBOARD

P&E provides hardware and software tools for debugging and programming the xPC56XXMB (with Mini-Module, sold separately).

P&E's USB-ML-PPCNEXUS and Cyclone MAX offer two effective hardware solutions, depending on your needs. The USB-ML-PPCNEXUS is a development tool that will enable you to debug your code and program it onto your target. The Cyclone MAX is a more versatile and robust development tool with advanced features and production programming capabilities, as well as Ethernet support.

More information is available below to assist you in choosing the appropriate development tool for your needs.

## 4.1 Hardware Solutions At A Glance

The USB-ML-PPCNEXUS offers an affordable and compact solution for your development needs, and allows debugging and programming to be accomplished simply and efficiently. Those doing rapid development will find the USB-ML-PPCNEXUS easy to use and fully capable of fast-paced debugging and programming.

The Cyclone MAX is a more complete solution designed for both development and production. The Cyclone MAX features multiple communications interfaces (including USB, Ethernet, and Serial), stand-alone programming functionality, high speed data transfer, a status LCD, and many other advanced capabilities.

Below is an overview of the features and intended use of the USB-ML-PPCNEXUS and Cyclone MAX.

## 4.2 USB-ML-PPCNEXUS Key Features

- Programming and debugging capabilities
- Compact and lightweight
- Communication via USB 2.0
- Supported by P&E software and Freescale's CodeWarrior

## 4.3 Cyclone MAX Key Features

- Advanced programming and debugging capabilities, including:

- PC-Controlled and User-Controlled Stand-Alone Operation
- Interactive Programming via Host PC
- In-Circuit Debugging, Programming, and Testing
- Compatible with Freescale's ColdFireV2/3/4, PowerPC 5xx/8xx/55xx/56xx, and ARM7 microcontroller families
- Communication via USB, Serial, and Ethernet Ports
- Multiple image storage
- LCD screen menu interface
- Supported by P&E software and Freescale's CodeWarrior

## 4.4 Working With P&E's USB-ML-PPCNEXUS


**Figure 4-1: P&E's USB-ML-PPCNEXUS**

### 4.4.1 Product Features & Implementation

P&E's USB-ML-PPCNEXUS Interface (USB-ML-PPCNEXUS) connects your target to your PC and allows the PC access to the debug mode on Freescale's PowerPC 5xx/8xx/55xx/56xx microcontrollers. It connects between a USB port on a Windows 2000/XP/2003/Vista machine and a standard 14-pin JTAG/Nexus connector on the target.

By using the USB-ML-PPCNEXUS Interface, the user can take advantage of the background debug mode to halt normal processor execution and use a PC to control the processor. The user can then directly control the target's execution, read/write registers and memory values, debug code on the processor, and program internal or external FLASH memory devices. The USB-ML-PPCNEXUS enables you to debug, program, and test your code on your board.

### 4.4.2 Software

The USB-ML-PPCNEXUS Interface works with Codewarrior as well as P&E's in-circuit debugger and flash programmer to allow debug and flash programming of the target processor. P&E's USB-ML-PPCNEXUS Development Packages come with the USB-ML-PPCNEXUS Interface, as well as flash programming software, in-circuit debugging software, Windows IDE, and register file editor.

## 4.5 Working With P&E's Cyclone MAX


**P&E's Cyclone MAX**

### 4.5.1 Product Features & Implementation

P&E's Cyclone MAX is an extremely flexible tool designed for debugging, testing, and in-circuit flash programming of Freescale's ColdFireV2/3/4, PowerPC 5xx/8xx/55xx/56xx, and ARM7 microcontrollers. The Cyclone MAX connects your target to the PC via USB, Ethernet, or Serial Port and enables you to debug your code, program, and test it on your board. After development is complete the Cyclone MAX can be used as a production tool on your manufacturing floor.

For production, the Cyclone MAX may be operated interactively via Windows-based programming applications as well as under batch or .dll commands from a PC. Once loaded with data by a PC it can be disconnected and operated manually in a stand-alone mode via the LCD menu and control buttons. The Cyclone MAX has over 3Mbytes of non-volatile memory, which allows the on-board storage of multiple programming images. When connected to a PC for programming or loading it can communicate via the ethernet, USB, or serial interfaces.

### 4.5.2 Software

The Cyclone MAX comes with intuitive configuration software and interactive programming software, as well as easy to use automated control software. The Cyclone MAX also functions as a full-featured debug interface, and is supported by Freescale's CodeWarrior as well as development software from P&E.

P&E's Cyclone MAX is also available bundled with additional software as part of various Development Packages. In addition to the Cyclone MAX, these Development Packages include in-circuit debugging software, flash programming software, a Windows IDE, and register file editor.

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# Freescale Controller Continuum

68HC08/S08/RS08/(S)12(X) ColdFire® V1 ColdFire® V2/V3/V4 PowerPC® Nexus® ARM®


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P&E Micrcomputer Systems, Inc.
P.O. Box 2044
Woburn, MA 01888

www.pemicro.com

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