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GENERAL DESCRIPTION

The XRP77XXEVB-XCM (Exar Configuration Module) is a board that is designed to assist in the customer in the programming and bring-up of Power^{XR} Digital PWM controllers on a customer board. The XCM has a USB connection on the one side for connection to a PC and control through PowerArchitect^{TM} software. On the right opposite side of the XCM is a 10-pin connector which is used to connect to the user's system board in order to communicate to any of the supported Power^{XR} ICs.

The XCM includes a uC with on-board flash so that when powered from the system board, it can act as a boot loader to the Power^{XR} controller.

This board is compatible with the; XRP7704, XRP7708, XRP7740, XRP7713, and XRP7714.

UPDATE – XRP7724 enabled boards with updated firmware. See "Compatibility", "Using I2C Communication" and "Pass Through Mode"

EVALUATION BOARD MANUAL
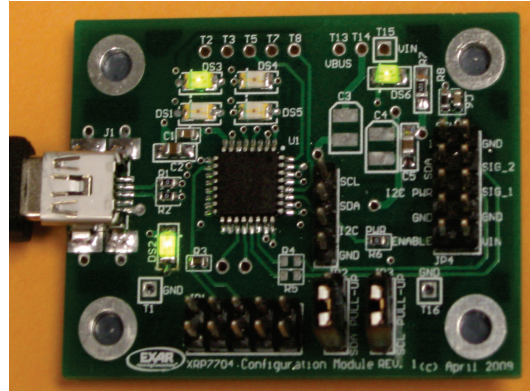
FEATURES

- **USB to I^{2}C Communication for Power^{XR} Devices**
- **Boot Loader Functionality**
  - Avoids programming the NVM until final configuration known
- **Powered by USB or System Board**
- **Enables Rapid Prototyping**
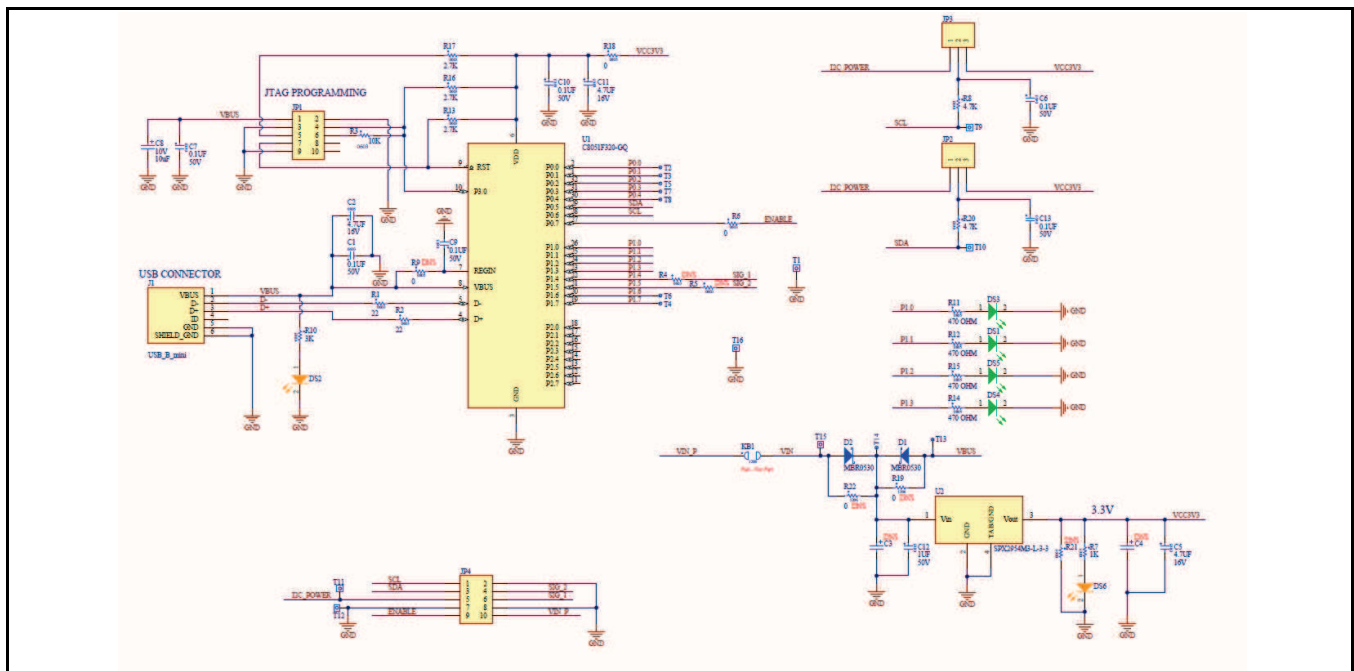
EVALUATION BOARD SCHEMATICS

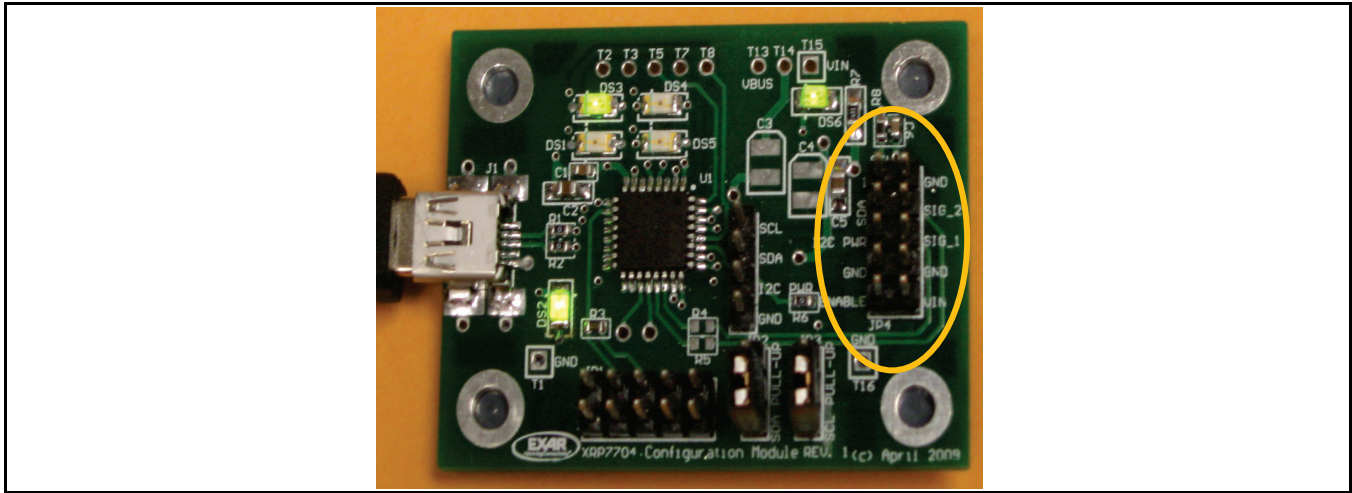Figure 1: XRP77XXEVB-XCM Evaluation Board Schematics

PIN ASSIGNMENT

Figure 2: XRP77XXEVB-XCM JP4 Pin Assignment

PIN DESCRIPTION

Name	Pin Number	Description
SCL	JP4 PIN1	I2C Clock
GND	JP4 PIN2	Ground
SDA	JP4 PIN3	I2C Data
Reserved	JP4 PIN4	
I^2C Power	JP4 PIN5	Connect to the preferred IO voltage. Only required when a voltage other than 3.3V is desired.
Reserved	JP4 PIN6	
GND	JP4 PIN7	Ground
GND	JP4 PIN8	Ground
ENABLE	JP4 PIN9	Connects to the EN pin of the XRP77XX. This is an input to the XCM board.
VIN	JP4 PIN10	Can connect to voltages from 4.5V to 30V

ORDERING INFORMATION

Part Number	Description
XRP77XXEVB-XCM	Exar Configuration Module

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USING THE EVALUATION BOARD

OPERATING ASSUMPTIONS

The following are the basic assumptions for the operation of the XCM.

- Only one I^2C Master is active at any time on the customer board. The user must ensure that only 1 master is active on the I^2C lines at the same time. This could entail Host in Reset, Host communication lines disabled, etc.

- The user must connect the appropriate signals to from the system board to the XCM JP4. At a minimum; SDA, SCL, and GND must be connected.

- VIN and ENABLE must also be connected, if the customer wants the XCM board to operate in "Standalone Mode".

Using I^2C Communication

The XCM has an on board linear regulator to provide power to the uC and provides power to the I^2C lines. The internal pull-up resistors are 4.7kohm. By changing the position of the jumpers on JP2 and JP3, the pull-up resistors can be connected to either the 3.3V provided on the XCM or to the I^2C Power connected to JP4 Pin 5. In Figure 2 the jumpers are configured to use the on board 3.3V. Moving them to the other position connects the pull-up resistors to the external I^2C Power.

IMPORTANT: When using the XCM with XRP7713EVB or XRP7714EVB demo boards, the jumpers should be configured to use the 3.3V provided on the XCM. When using with the XRP7724EVB board, the jumpers should be moved to the other position to use the pull-up resistors already installed on the XRP7724EVB.

If the system board already has pull-up resistors, then the jumpers can simply be removed. This is the most likely scenario for a system intended to interact with the programmable features of the Power^{XR} device on the system board.

COMMUNICATION WITH THE XCM

If the XCM is connected to the PC before starting the PowerArchitect^{TM} software, the software should recognize the presence of the board automatically. If the board is connected after the software is started, the user will need to click on "File", then "Board Search" for the software to find the board.

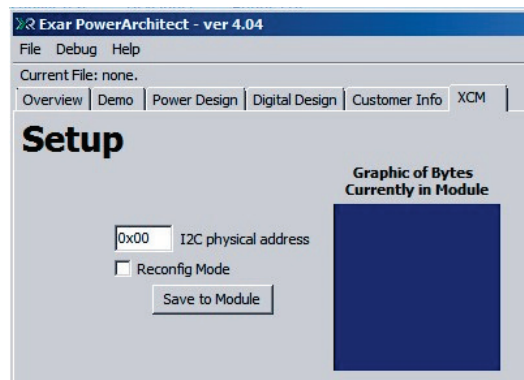Once the board is identified, the software will add a tab called "XCM" as shown in Figure 3.

Figure 3: PowerArchitect^{TM} XCM Tab

LED INDICATORS:

There are 6 LEDs on the board.

There are four LEDs grouped in the upper left hand corner of the board as shown in Figure 3.

These are defined as:

DS3: USB Operation

GUI is communicating to XCM (solid on when USB is connected)

DS4: Reconfig Mode

The XCM will boot load the supported device with the stored configuration the ENABLE pin transitions from Low to High.

DS1: USB Activity

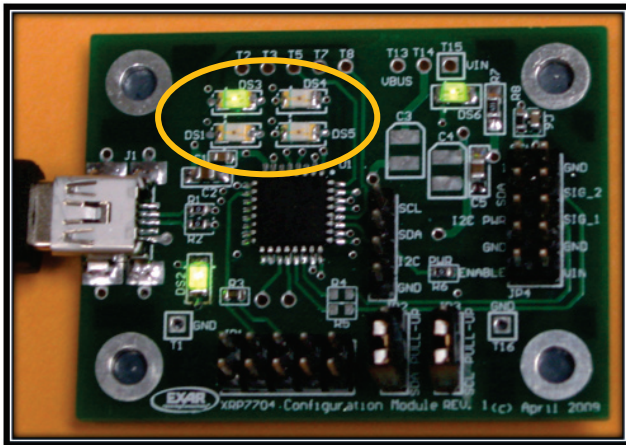Flashes based upon the USB activity between the XCM and the PC.

Figure 4: XCM LED Indicators

DS5: I2C Activity

Flashes based upon the I^{2}C activity between the XCM and the XRP77XX.

DS3: USB Power

There is a fifth LED just to the right of the USB connector, which will be on permanently as long as USB power is applied to the XCM.

DS6: 3.3V Power

The sixth LED is in the upper right hand corner. This indicates the LDO is generating 3.3V and the uC is powered.

OPERATING THE XCM

Here are the two basic operating modes of the XCM.

- Pass Through Mode: The XCM is getting its power from the USB, and the PowerArchitect^{TM} GUI is operational. In this mode, the "USB Operating" LED DS3 will be on.

- Standalone Mode: The XCM is getting its power from VIN of the Customer Board; the GUI is not operational. In this mode, the XCM acts as a boot loader to the supported device.

PASS THROUGH MODE

When in USB Mode, the XCM supports pass-thru mode from the PC running PowerArchitect^{TM} to the supported device on the designer's system board. This operation allows writes/reads to either the shadow registers or Non-Volatile Memory of the supported device

- XCM receives commands from the GUI (over USB), and translates them via I^{2}C if the ENABLE pin is logic HIGH.

- The GUI has the option to write a given configuration to NVM or Shadow Registers of the supported device.

- XCM also supports reads from the supported device shadow and NVM registers for display in PowerArchitect^{TM}.

STANDALONE MODE

UPDATE: Since the XRP7724 is Flash memory based, this mode is not required nor supported for the XRP7724.

The XCM allows the GUI to save a configuration into Flash on the XCM. In order to enable the boot loader functionality, the "Reconfig Mode" box must be checked. When there is a stored configuration on the XCM flash, the GUI will indicate the presence of that information in the "Graphic of Bytes" box. To store a configuration to the XCM, click the "Same to Module" button.
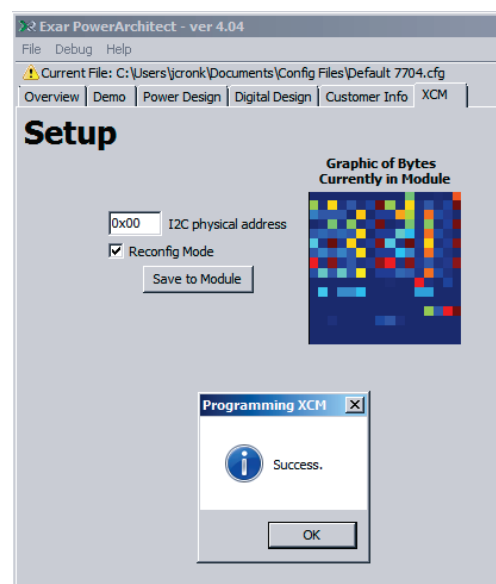

Figure 5: XCM Loaded for Standalone Mode

Note that only one configuration can be stored in the XCM. When storing the configuration onto the XCM, a "Success" window will pop up. After clicking "OK" there can be a noticeable delay in the software.

Powering the XCM

In order to operate, the XCM must have power provided either by connecting the VIN pin on JP4 to a power source from the system board or from USB power.

The XCM's on board linear regulator has a maximum input voltage of 30V, so whatever voltage source is powering the Power^{XR} device on the system board can be connected to the XCM.

Downloading the Configuration

The XCM will download the configuration stored on the XCM FLASH memory on every reset of the supported device. It does by monitoring the ENABLE Pin for a LOW to HIGH transition.

The XCM automatically downloads the saved Flash configuration into the supported device shadow registers via I^{2}C. The register data is loaded in a specific order to prevent mis-operation of the supported device. The XCM first configures Fault Ignore settings, downloads channel information, and finally configures the channel and GPIO enables.

One could imagine the result, if the channel was enabled before the control loop PID coefficients were loaded.

NVM Programming

When in Standalone Mode, the primary intention for the XCM is to act as a boot loader into the shadow RAM. However, by installing a jumper between pins 2-4 on JP1, the XCM will program the NVM. There are no diagnostics in this mode. If a device's NVM has already been programmed, it cannot be re-programmed. If a changed configuration is attempted to be programmed into a previously programmed part, erroneous behavior is highly likely. The reason for including this function is for the developer who has concluded their evaluation and wishes to

quickly program the NVM of the Power^{XR} device on additional systems.

WHEN THINGS DO NOT WORK

The following are potential issues that may cause improper or no operation.

- SCL, SDA, or GND are swapped.
- Check that the I2C pull-up resister jumpers on JP2 and JP3 are in place. Or correctly configured for your system.
- If you made your own ribbon cable with a 10 pin connector and accidentally attach it reversed, you just tied VIN to SCL and damaged the uC. Time for a new XCM.
- You are using 2 foot long wires hanging loose creating an inductive loop which is blocking the I2C communication. Twisting them together should reduce the inductance.
- You can communicate to the part when it is not operating, but when you turn on the switching channels, communication stops. This is difficult to fix because the most likely cause is ground bounce caused by poor grounding practices. See ANP-32, "Practical Layout Guidelines for Power^{XR} Designs"
- Another possibility if communication is not working is a long ground loop causing noise. One could put an isolator on the I2C line, but using a notebook computer with the power adapter disconnected works as well.

COMPATIBILITY

With the release of the XRP7724 the firmware of the XCM has been updated. This has resulted in a compatibility issue when being used with PowerArchitect™ 4.21 and earlier revisions. XCMs which have updated firmware will be labeled "V62". If this XCM is first powered by the USB cable and discovered by PowerArchitect™ 4.21, the demo panel may show erroneous information (see Figure 7). However, if the XRP7704/08/40 or XRP7713/4 is first connected to the XCM then powered before connecting the USB cable, normal operation will occur. Future versions of PowerArchitect™ 4.xx will eliminate this compatibility issue.
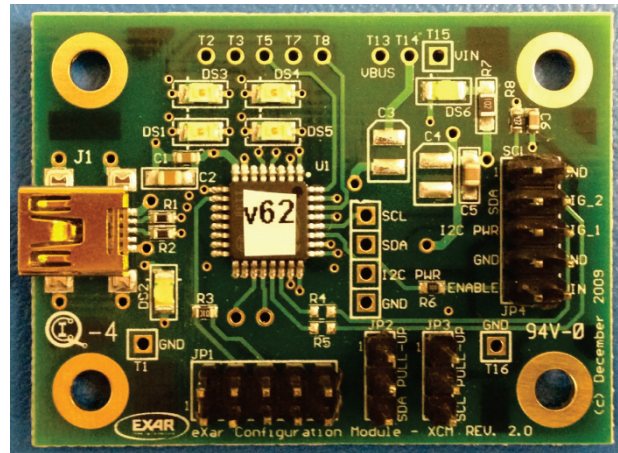
Figure 6 XCM with updated firmware
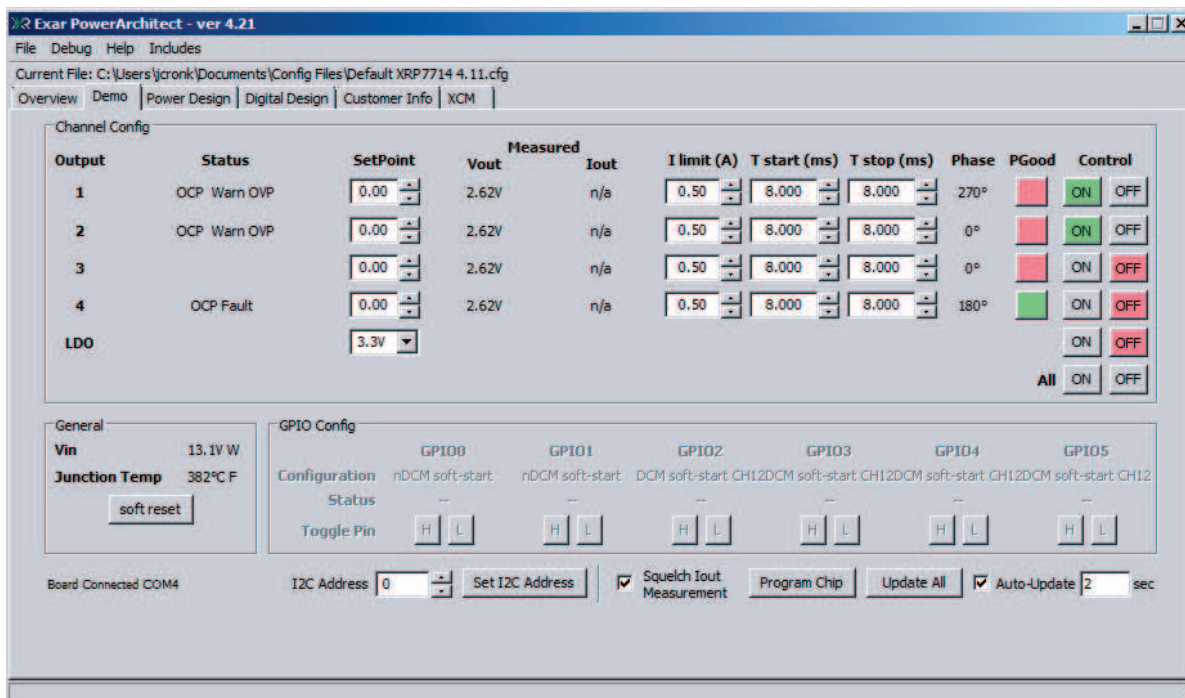
Figure 7 PowerArchitect™ 4.21 Demo Tab when XRP7724 configured XCM not powered in proper sequence

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COMPATIBILITY WITH SYSTEMS THAT PULL I2C LINES UP ON THE MAIN BOARD

In systems where I2C lines are pulled up on main board (not on XCM through JP2/3; JP2/3 open) the pull-up level will sag under heavy communication load on the bus. Although we have not seen issues with this arrangement, it would be possible to have communication problems especially if serial resistors were used on SDA and SCL lines. To eliminate the issue users have a couple of options:

- Remove pull-up resistors on their board and use 3.3V pull-up option on XCM (shorting pins 2 and 3 on JP2/3)
- If the pull up rail used to pull I2C lines up on the user's board is routed to JP4 pin 5 (signal name I2C_POWER) of XCM, this voltage can be used to pull the lines up on XCM (shorting pins 1 and 2 on JP2/3). The pull-up resistors on user's board shall be removed in this case.
- If using pull-up resistors on user's board is the only option, capacitors C6 and C13 on XCM shall be removed and JP2/JP3 shall be open (no jumpers installed).

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EVALUATION BOARD SCHEMATICS
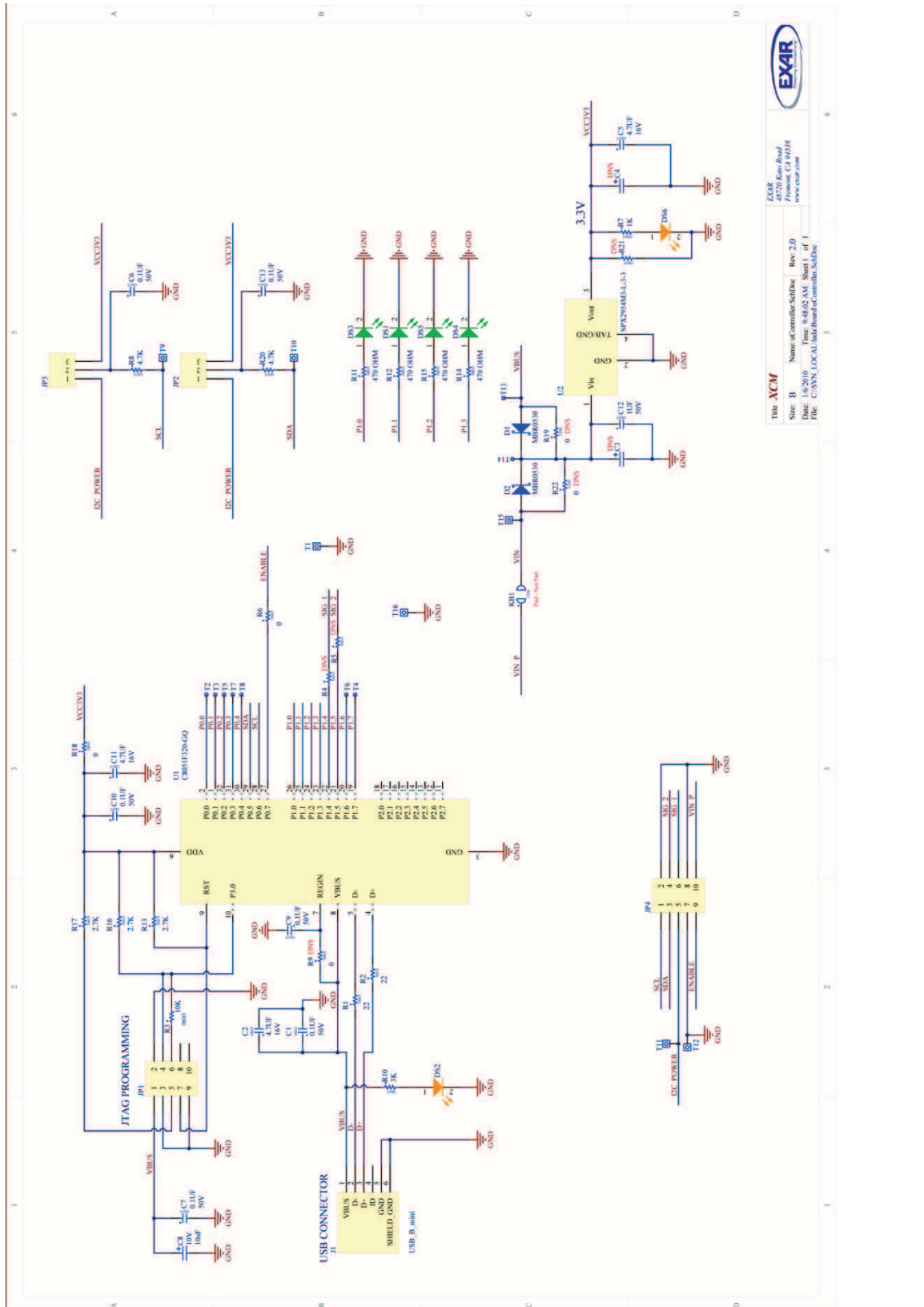
BILL OF MATERIAL

| Ref.	Qty	Manufacturer	Part Number	Size	Component
	1				PCB REV2.0
U1	1	Silicon Laboratories	C8051F320-GQ	LQFP-32	IC 8051 MCU 16K FLASH 32LQFP
U2	1	EXAR	SPX2954M3-L-3-3	SOT-223	IC REG LDO 3.3V SOT-223
D1, D2	2	Fairchild	MBR0530T1	SOD-323	DIODE SCHOTTKY 500mA 30V
DS2, DS6	2	Wurth Elektronik	150120EAS75000	1206p	LED AMBER SMD
DS1, DS3, DS4, DS5	4	Wurth Elektronik	150120EVS75000	1206p	LED GREEN SMD
C1, C6, C7, C9, C10, C13	6	MURATA	GRM188R71H104K	0603	Cap, .1UF, 50V, X7R, 10%, 0603 SMD
C2, C5, C11	3	MURATA	GRM21BR71C475KA73	0805	C_Chip_4.7uF_16V_X7R_0805 SMD
C8	1	Vishay	293D106X9010B2TE3	B TANT CAP	Cap, Tantalum 10uF 10V, CASE B
C12	1	MURATA	GRM21BR71H105KA12L	0805	Cap, Ceramic, 1uF 50V, X7R, 10% 0805
R1, R2	2	PANASONIC	ERJ-3EKF22R0V	0603	Res 22 OHM 1% 0603 SMD
R3	1	ROHM	MCR03EZPFX1002	0603	RES 10K 1/10W 1% 0603
R6	1	PANASONIC	ERJ-3GEY0R00V	0603	Res 0 OHM 0603 SMD
R7	1	PANASONIC	ERJ-6ENF1001V	0805	RES 1K OHM 1/8W 5% 0805 SMD
R10	1	PANASONIC	ERJ-6GEYJ302V	0805	RES 3K OHM 1/8W 5% 0805 SMD
R11, R12, R14, R15	4	PANASONIC	ERJ-6GEYJ471V	0805	RES 470 OHM 1/8W 5% 0805
R8, R20	2	PANASONIC	ERJ-3EKF4701V	0603	RES 4.7K OHM 1/10W 1% 0603 SMD
R18	1	PANASONIC	ERJ-6GEY0R00V	0805	Res 0 OHM 0805 SMD
R13, R16, R17	3	PANASONIC	ERJ-3EKF2701V	0603	RES 2.7K OHM 1/10W 1% 0603 SMD
KB1	1	PANASONIC	ERJ-8GEY0R00V	1206	Res 0 OHM 1206 SMD
J1	1	Wurth Elektronik	65100516121	USB_B_mini	CONN RECEPT MINIUSB R/A 5POS SMD
JP1, JP4	2	Wurth Elektronik	61308021121	HDR2X5	CONN Header 5x2, 0.1 inch
JP2, JP3	2	Wurth Elektronik	61304011121	HDR1X3	CONN HEADER 3POS 0.1 VERT GOLD
T9, T10, T11, T12	4				TEST POINT

EVALUATION BOARD LAYOUT
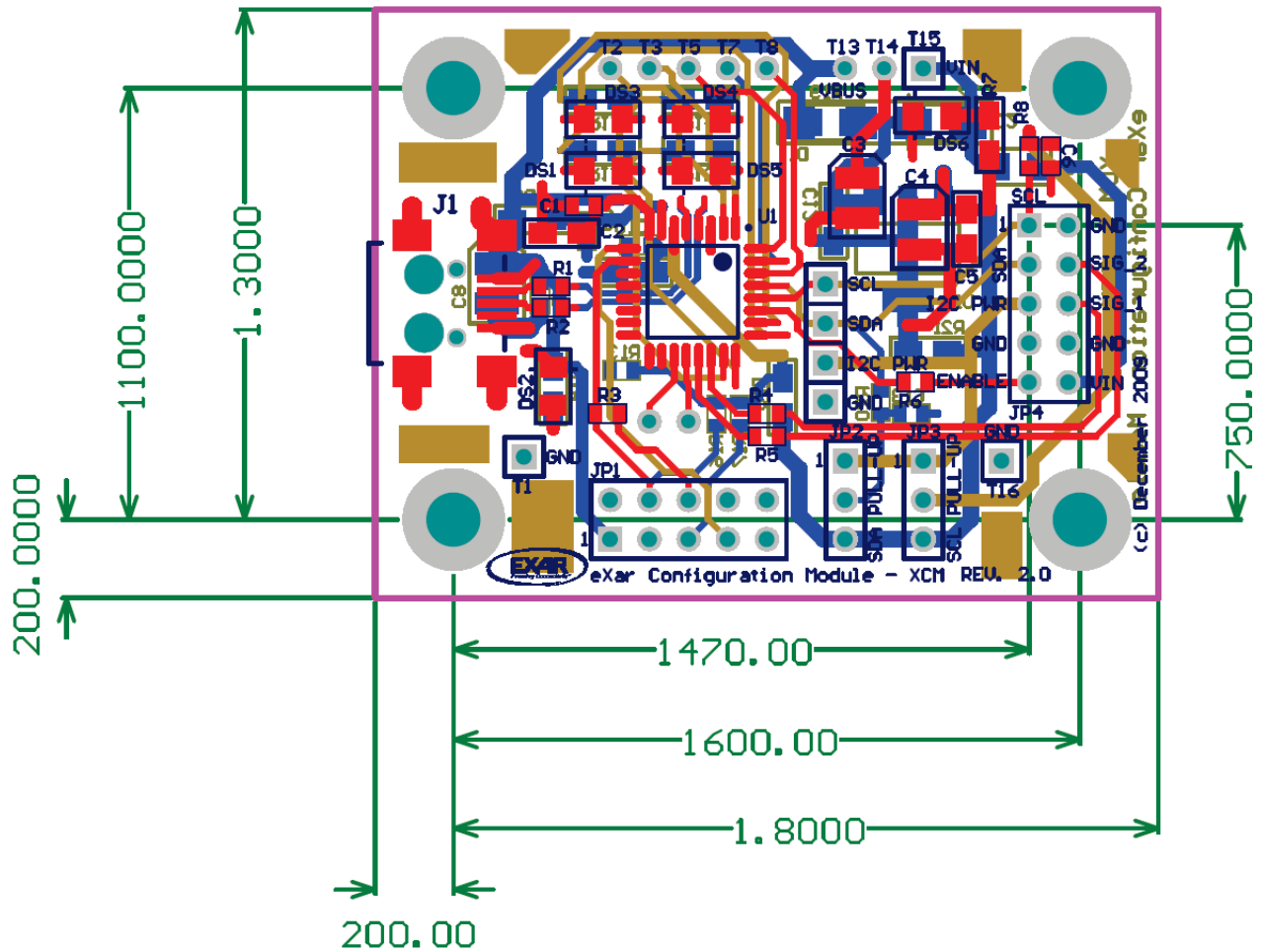
DOCUMENT REVISION HISTORY

Revision	Date	Description
1.0.0	04/28/2011	Initial release of document
1.2.0	10/01/2012	Added information on XRP7724 compatible XCM boards. See jumper settings and compatibility with PowerArchitect™ 4.21 or earlier.
1.3.0	01/28/2013	Added a note for using the module in systems where I2C pull-ups are on the other board and JP2/3 are open on the XCM module
1.3.1	10/14/2013	Updated the bill of materials section

BOARD REVISION HISTORY

Board Revision	Date	Description
2.0	Dec 2009	Initial release of evaluation board

FOR FURTHER ASSISTANCE

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Exar Technical Documentation: http://www.exar.com/TechDoc/default.aspx?

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NOTICE