MB89PV480 Evaluation Board
User's Guide

Rev 1.0

Vers. 1.0

Revision History

Revision #	Date	Comments
1.0	01/27/2003	New Revision

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Figures and Tables

1.General Description

1.1. Overview

This Evaluation board shows the capabilities of the popular Fujitsu MB89PV480 series Microcontrollers. It is intended for low cost, low power and small information message display purpose.

The MB89PV480 Evaluation Board makes use of Fujitsu F2MC- 8L series Microcontroller MB89PV480CF-101. It is a piggyback evaluation device of MB89480 series having LCD controller/driver on chip.

1.2. Purpose

The main purpose of designing this evaluation board is to show the following applications:

1) Hardware interface of Microcontroller with alphanumeric segmented LCD panel
2) Software application for using on chip LCD controller/driver
3) Hardware and software applications using resources available on micro controller apart from LCDC/driver like Watch pre-scalar, Buzzer, external interrupts and general purpose IO ports
4) Piggyback evaluation device that enables user to connect to emulator for development and debugging purpose.

1.3. Board Features

Following are the key application features of the demo board:

1) Mounted Piggyback evaluation device for connecting to F2MC-8L emulator system for development and debugging
2) 8 digit alphanumeric, 14 segment LCD display, with intensity adjustment provided on socket for user to play with the display of his choice or the one provided on the board
3) Sample programs for various peripherals of microcontroller
4) Switches for simulating external interrupts and reset
5) Supports MQFP-64 pin package
6) Default 10MHz crystal, but option for changing the crystal
7) User LEDs
8) UART interface
9) All pins routed to headers (edge connectors) for debugging and development
10) Prototyping area

1.4. MB89480 Series Device Features

MB89480 Series belongs to F2MC-8L Microcontrollers family. It has following features

- Supports high speed operation using 12.5MHz main clock and has minimum instruction execution time of 0.32usec
- 16K or 32K Bytes memory depending on mask ROM, OTP or piggyback option
- Operating voltage varies from 2.2V to 5.5V depending on the selected device. MB89PV480 supports 2.7V to 5.5V
- On chip LCD controller/driver with max 31segments and 4 commons
- Booster option for LCD driving can be selected by mask option
- Buzzer function with seven selectable frequencies
- Support several peripherals like UART/SIO, 8ch, 10bit ADC, PPG and PWM
- Available in packages like QFP(FPT-64P-M09), SHDIP (DIP-64P-M01) and only evaluation device in MQFP (MQP-64C-P01) package

1.4.1 Available Devices of the series

Mask ROM: MB89485/L
OTP: MB89P485/L

Evaluation device: MB89PV480

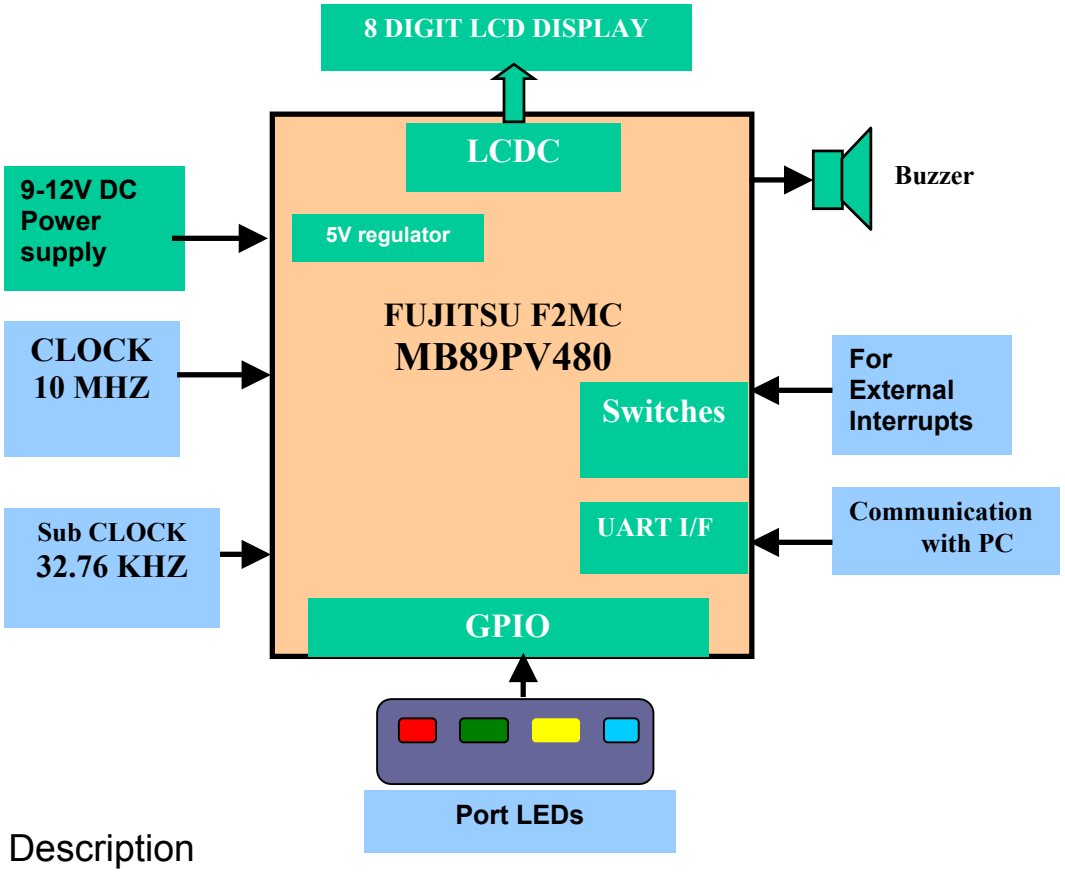
1.5 Deliverables

- MB89PV480 Demo board with mounted MB89PV480CF-101 device (without booster)
- 9-12V DC power supply adapter
- MB89PV480 Evaluation Board User's Manual
- CD ROM Containing Sample project files, Hardware manual and data sheets

2. Hardware Description

Figure 1 is a functional block diagram of the evaluation board. This target board is mainly designed to help user to quick start their design and for their development, debugging and testing.

Figure 1: Functional Block Diagram



2.1 Board Description

The MB89PV480 Evaluation board is specifically designed to support MB89480 series devices with mounted MB89PV480 piggyback evaluation device. This piggyback evaluation device enables user to connect F2MC-8L emulator system for debugging. By using programmed piggyback EPROM with this evaluation device, board can be used for Demo and also for testing the developed code. The evaluation board supports MQP-64P-P01 (Rectangle QFP64 package, 1.0mm, 16x22mm) package.

If the board is used as an emulator target board, corresponding probe cable MB2144-202 should be plugged in to piggyback evaluation device and then hooked either to F2MC-8L compact ICE (In–Circuit Emulator) or to MB2144-505/MB2144-508 emulation pod of regular ICE.

All the pins of the micro controller are connected to the edge connectors P1 and P2 and hence are directly available for user development and testing.

By default the board is working with a 10MHz crystal as the main oscillation clock and 32.7628KHz as sub clock. A RS232 transceiver provided on the board generates the adequate RS232 levels for the receive (RXD) and transmit (TXD) lines of asynchronous mode UART functionality peripheral.

The on board regulator allows to connect a DC input voltage between 7.5V to 12V. In case of any modifications of the board, the user has to take care for the complete power consumption. There are totally five pushbutton switches provided on the board: one reset button
Switch S1 (RST) and other four S2 (INT21), S3 (INT20), S4 (INT10) and S5 (INT11) pushbutton switches that can be used for external interrupts.

Green power LED D2 indicates power supply to the board. If the jumper JP7(Power) is not shorted, power LED D2 will not glow. This jumper is provided for isolation of power supply to the board from regulator.

User LEDs D4 (port 06) and D5 (port 05) are connected to IO port bits 5 and 6 of PORT0.

Buzzer/sounder FDK EE2108K is provided on the board to test buzzer function of the device.

Alphanumeric LCD is mounted on the socket for ease of use and development. This series has the capability to interface with 31segx4 common LCD. Since some segment pins share common pins with ADC, external interrupts and ports are provided with jumper settings JP1 to JP6. When AN0, AN1, AN2 and AN3 of ADC pins are used, then device can only be interfaced with 28 segments of the LCD. Potentiometer VR1 provided at drive pin of LCD, is for its intensity adjustment purpose.

2.2 Jumper, Switch and LED Functions

Following Tables lists out the jumpers/pin functionality, Switches, LEDs and Test points available on the board. Shaded areas indicate default jumper settings.

Table -1 Jumper Settings

Function	MB89PV480 Pin#	Jumpers	Description
P12/SEG25/INT12	20	JP1	**Short JP1:** when SEG25 to be connected to LCD U4
			Open JP1: Isolate LCD U4 and to use P12 or INT12
P13/SEG26/INT13	21	JP2	**Short JP2:** when SEG26 to be connected to LCD U4
			Open JP2: Isolate LCD U4 and to use P13 or INT13
P14/SEG27/AN0	30	JP3	**Short JP3:** when SEG27 to be connected to LCD U4 **without internal booster use**
			Open JP3: Isolate LCD U4 and to use P14 or AN0

P15/SEG28/AN1	31	JP4	**Short JP4:** when SEG28 to be connected to LCD U4 **without internal booster use**
			Open JP4: Isolate LCD U4 and to use P15 or AN1
P10/SEG23/INT10	18	JP5	**Short JP5:** when switch S4 to be connected to MCU
			Open JP5: To use LCD U4 and to isolate P10 or INT10 (S4)
P11/SEG24/INT11	19	JP6	**Short JP6:** when switch S5 to be connected to MCU
			Open JP6: To use LCD U4 and to isolate P11 or INT11 (S5)
Power	57	JP7	**Short JP7:** 5V power supply to whole board
			Open JP7: To isolate power from regulator output

Table -2 Push button functions

Function	MB89PV480 Pin#	Switch
External INT10	18	S4 (INT10)
External INT11	19	S5 (INT11)
External INT20~	43	S3 (INT20)
External INT21~	42	S2 (INT21)

Table -3 LED Indications

Function	LED	
Power Indication	Green LED D2	5V power supply
RST Indication	Red LED D3	Reset indication via UART
Port P06	Orange LED D4	GPIO port bit P06 indication
Port P05	Green LED D5	GPIO port bit P05 indication

2.2 Related Products

1. FMPDC-MB89PV480-ADPB Simple dummy adapter board for development from Fujitsu-HKDC
2. MSE1001C F2MC-8L compact ICE
3. MB2144-202 Probe Cable
4. MB2141A/B Main ICE Unit
5. MB2144-505/508 F2MC-8L POD

2.3 Connectors

2.3.1 Edge Connectors P1 and P2

The following table describes pin details of edge connectors or headers P1 and P2 provided on the board. P1-1 to 32 are connected to the pins 1 to 32 of microcontroller U1 and P2-33 to 64 are connected to pins 33-64 of microcontroller. The odd pin numbers are located on one side and even pin numbers are located on the other side of the connector. On the PCB, the corresponding pin numbers are accordingly marked next to the connector pins for reference.

Table- 4 Edge Connector P1

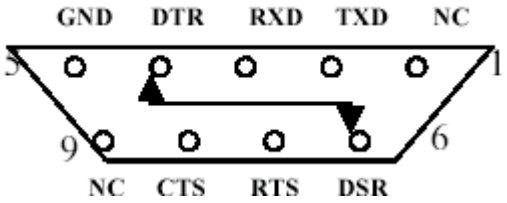
P1	MB89PV480 Pin Number	MB89PV480 Pin Function	P1	MB89PV480 Pin Number	MB89PV480 Pin Function
P1-1	1	SEG7	**P1-17**	17	P57
P1-2	2	P40/SEG8	**P1-18**	18	P10/SEG23/INT10
P1-3	3	P41/SEG9	**P1-19**	19	P11/SEG24/INT11
P1-4	4	P42/SEG10	**P1-20**	20	P12/SEG25/INT12
P1-5	5	P43/SEG11	**P1-21**	21	P13/SEG26/INT13
P1-6	6	P44/SEG12	**P1-22**	22	X0A
P1-7	7	P45/SEG13	**P1-23**	23	X1A
P1-8	8	P46/SEG14	**P1-24**	24	C
P1-9	9	P47/SEG15	**P1-25**	25	Vss
P1-10	10	P50/SEG16	**P1-26**	26	X0
P1-11	11	P51/SEG17	**P1-27**	27	X1
P1-12	12	P52/SEG18	**P1-28**	28	MODE
P1-13	13	P53/SEG19	**P1-29**	29	RST~
P1-14	14	P54/SEG20	**P1-30**	30	P14/SEG27/AN0
P1-15	15	P55/SEG21	**P1-31**	31	P15/SEG28/AN1
P1-16	16	P56/SEG22	**P1-32**	32	P16/SEG29/AN2

Table- 5 Edge Connector P2

P2	MB89PV480 Pin Number	MB89PV480 Pin Function	P1	MB89PV480 Pin Number	MB89PV480 Pin Function
P2-33	33	P17/SEG30/AN3	**P2-49**	49	P25/C0/EC2
P2-34	34	AVcc	**P2-50**	50	V0/SEG0
P2-35	35	AVss	**P2-51**	51	P26/V1/TO1
P2-36	36	P07/INT27/BUZ	**P2-52**	52	P27/V2/EC1
P2-37	37	P06/INT26/PPG	**P2-53**	53	V3
P2-38	38	P05/INT25/PWC	**P2-54**	54	P31/COM3
P2-39	39	P04/INT24	**P2-55**	55	P30/COM2
P2-40	40	P03/INT23	**P2-56**	56	COM1
P2-41	41	P02/INT22	**P2-57**	57	Vcc
P2-42	42	P01/INT21	**P2-58**	58	COM0
P2-43	43	P00/INT20	**P2-59**	59	SEG1
P2-44	44	P20/PWM	**P2-60**	60	SEG2
P2-45	45	P21/SCK	**P2-61**	61	SEG3
P2-46	46	P22/SO	**P1-62**	62	SEG4
P2-47	47	P23/SI	**P2-63**	63	SEG5
P2-48	48	P24/C1/TO2	**P2-64**	64	SEG6

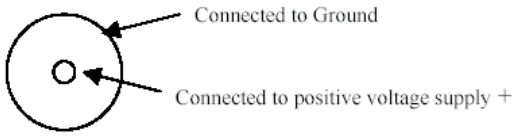
2.3.2 Serial Interface Connector X2

The following diagram show the connections of the 9-pin female D-Sub connector X2 that is used for serial asynchronous interface with microcontroller through transceiver U3.



2.3.3 Power Connector X1

The following figure shows the power connection DC power jack X1. This connector is used to connect external regulated DC power supply voltage (7.5V-12V) to the evaluation board. It is recommended to use 7.5V Dc supply to keep minimum power dissipation.



3. Connection to F2MC-8L In-Circuit Emulator (ICE)

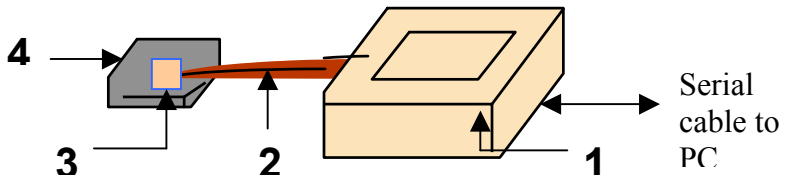
There are two ICE systems that could be used along with target evaluation board for debugging.

3.1 With F2MC-8L Compact ICE

Following units are required along with this target board to be connected to compact ICE as shown the below Figure 2.

1: MSE1001C Compact ICE
2:Probe cable MB2144-202
3:Evaluation device MB89PV480CF-101- Already available mounted on the target board
4: Target board:MB89PV480 Evaluation board

Figure 2: Compact ICE

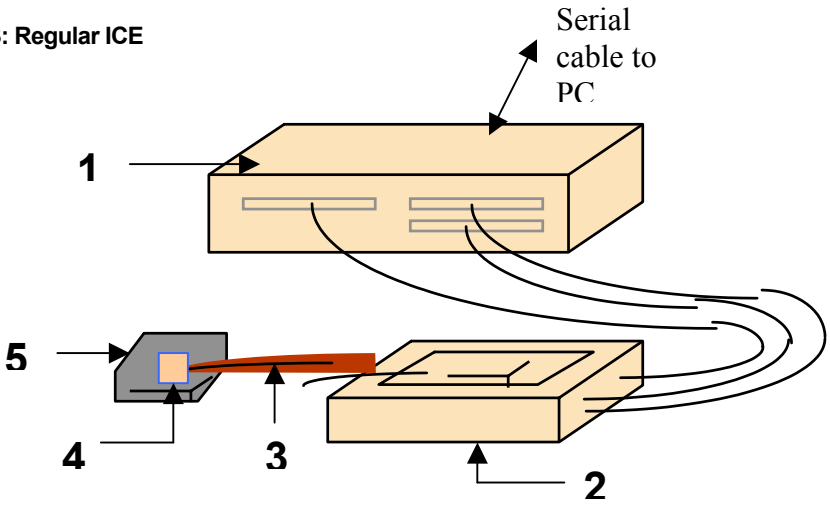


3.2 With F2MC-8L Regular ICE

Following units are required along with this target board to be connected to compact ICE as shown the below Figure 2.

1: MB2141A/B Regular ICE main Unit
2: Emulation Pod MB2144-505 or MB2144-508
3: Probe cable MB2144-202
3: Evaluation device MB89PV480CF-101- Already available mounted on the target board
4: Target board:MB89PV480 Evaluation board

Figure 3: Regular ICE



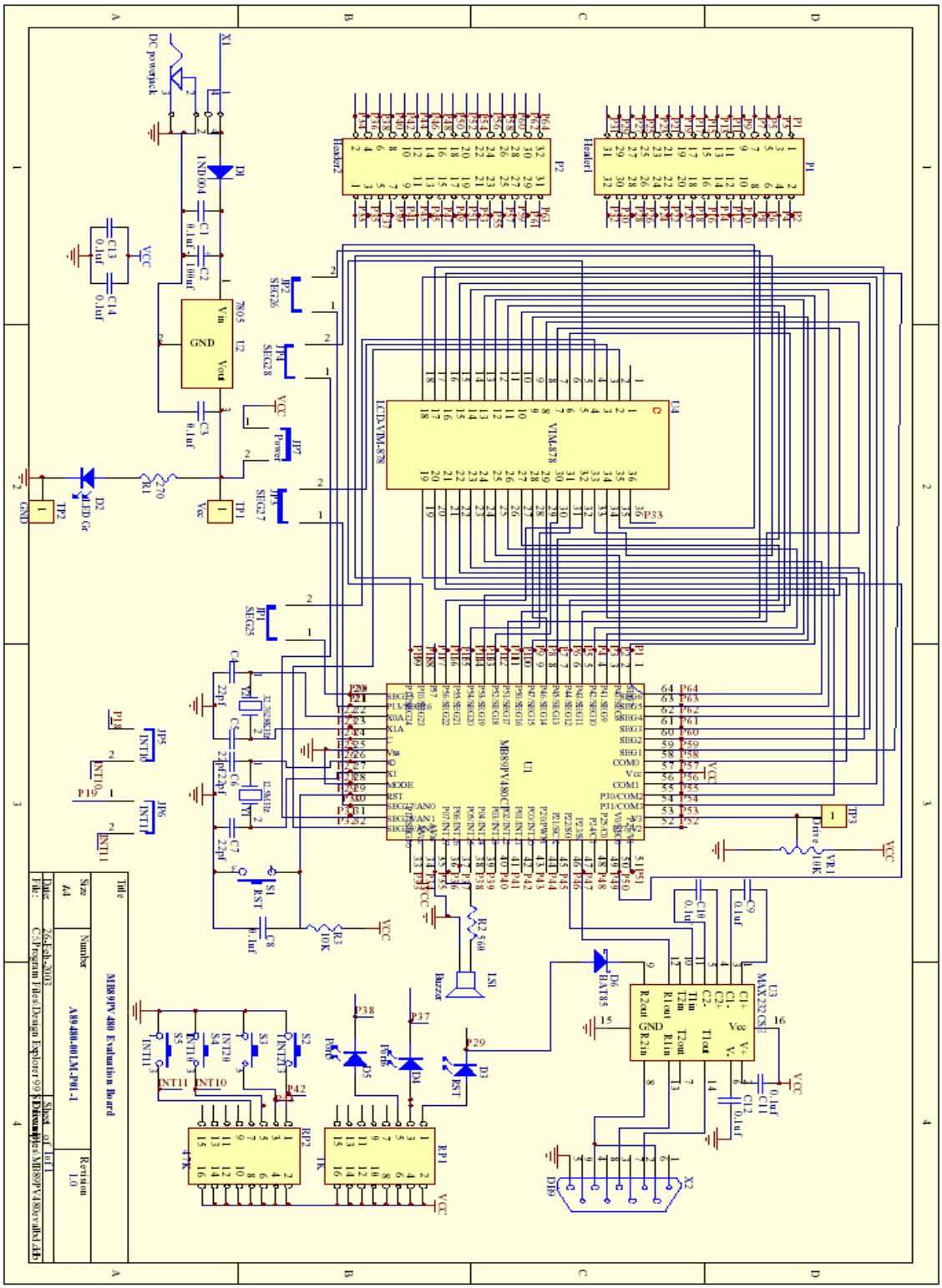
4.0 BOM, Schematic and Drawings

4.1 BOM of MB89PV480 evaluation Board

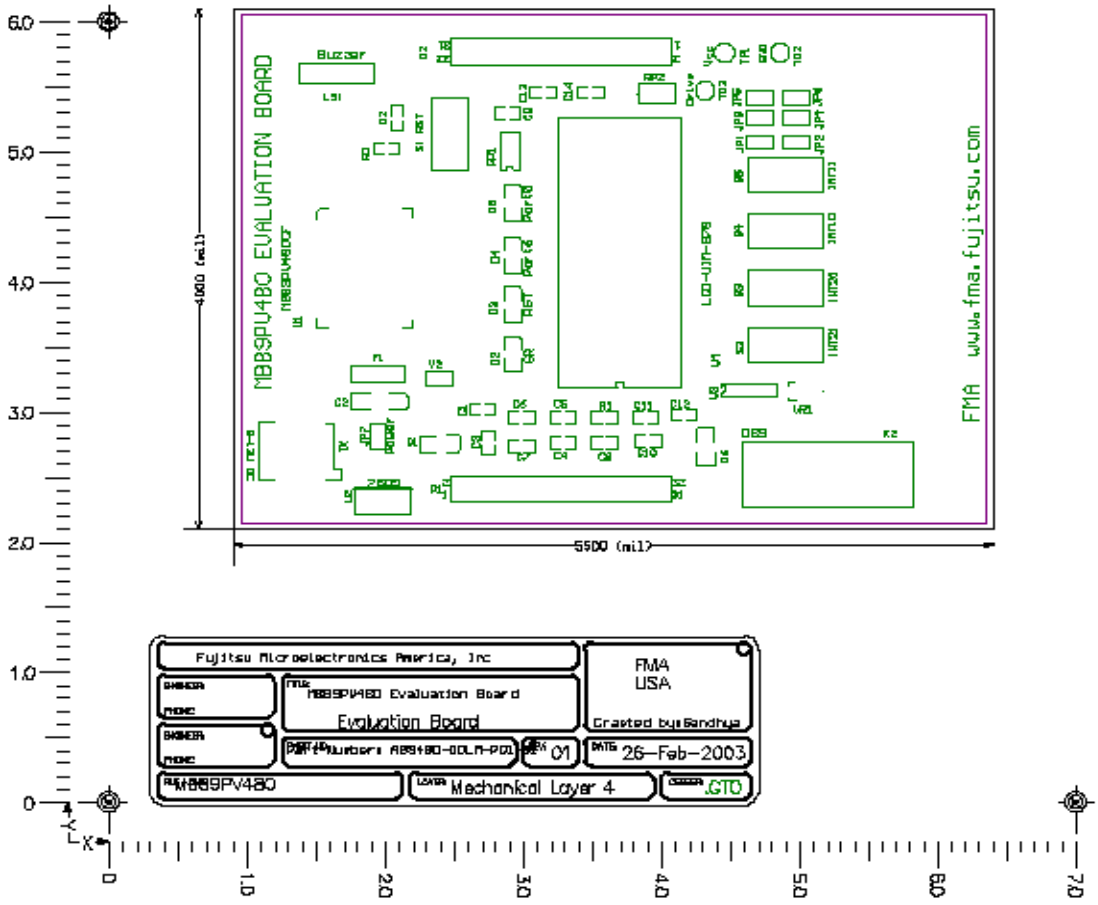
MB89PV480 evalution Board Bill of Materials

Part Type	Designator	Footprint		Description	Source	Part Number
0.1uf	C8		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C13		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C14		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C1		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C12		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C9		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C10		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C3		805	Capacitor	Digikey	PCC1840CT-ND
0.1uf	C11		805	Capacitor	Digikey	PCC1840CT-ND
1K	RP1	RESARRAY		Res Pack	Digikey	742C163-102-JCT-ND
1ND004	D1	MELF1		Diode	Digikey	DL4004MSCT-ND
10K	R3		805	Resistor	Digikey	311-103-CCT-ND
10K	VR1	SOT-23		variable Res	Digikey	ST4B103CT-ND
12.5MHz	Y1	XTAL1		Crystal	Digikey	X443-ND
22pf	C4		805	Capacitor	Digikey	PCC220CNCT-ND
22pf	C5		805	Capacitor	Digikey	PCC220CNCT-ND
22pf	C7		805	Capacitor	Digikey	PCC220CNCT-ND
22pf	C6		805	Capacitor	Digikey	PCC220CNCT-ND
32.7628KHz	Y2	RAD0.1		Crystal	Digikey	300-1003-ND
47K	RP2	RESARRAY			Digikey	742C163473JCT-ND
100uf	C2		805	Capacitor	Digikey	PCE3197-CT-ND
270	R1		805	Resistir, 1/8w	Digikey	311-270-CCT-ND
560	R2		805	Resistor, 1/8w	Digikey	311-560-CCT-ND
7805	U2	SFM-T3/A2.4V			Digikey	NJM7805-FA-ND
BAT85	D6	MELF1		Schottky Diode	Digikey	SGL41-40GICT-ND
Buzzer	LS1	RAD0.2			FDK	EE2108K-40R-3V
DB9	X2	DB-9/F			Digikey	A2100-ND
DC powerjack	X1	POWERJACK			Digikey	CP-002APJ-ND
Drive	TP3	TESTPOINT		Connector	Digikey	5011K-ND
GND	TP2	TESTPOINT		Connector	Digikey	5011K-ND
Header1	P1	HDR2X16		Header	Digikey	S2012-32-ND
Header2	P2	HDR2X16		Header	Digikey	S2012-32-ND
INT10	JP5	RAD0.2		Jumper	Digikey	S1012-36-ND
INT10	S4	SOT1-25			E-switch	TL3301SPF160QJ
INT11	JP6	RAD0.2		Jumper	Digikey	S1012-36-ND
INT11	S5	SOT1-25			E-switch	TL3301SPF160QJ
INT20	S3	SOT1-25			E-switch	TL3301SPF160QJ
INT21	S2	SOT1-25			E-switch	TL3301SPF160QJ
LCD-VIM-878	U4	LCD		VIM-878 LCD dis	Varitronix	
LED Gr	D2		3528		Digikey	P504CT-ND
MAX232CSE	U3	SO-16		Isolated RS-485	Differential E	Max202-CSE
MB89PV480CI	U1	QFP64-2		MCU	Fujitsu	MB89PV480CF-101
Port5	D5		3528		Digikey	
Port6	D4		3528		Digikey	
RST	D3		3528		Digikey	
RST	S1	SOT1-25			E-switch	TL3301SPF160QJ
SEG25	JP1	RAD0.2		Jumper	Digikey	S1012-36-ND
SEG26	JP2	RAD0.2		Jumper	Digikey	S1012-36-ND
SEG27	JP3	RAD0.2		Jumper	Digikey	S1012-36-ND
SEG28	JP4	RAD0.2		Jumper	Digikey	S1012-36-ND
Vcc	TP1	TESTPOINT		Connector	Digikey	5010K-ND
Heat Sink					Digikey	HS212-ND
Power	JP7	HDR1X2		Jumper	Digikey	S1012-36-ND

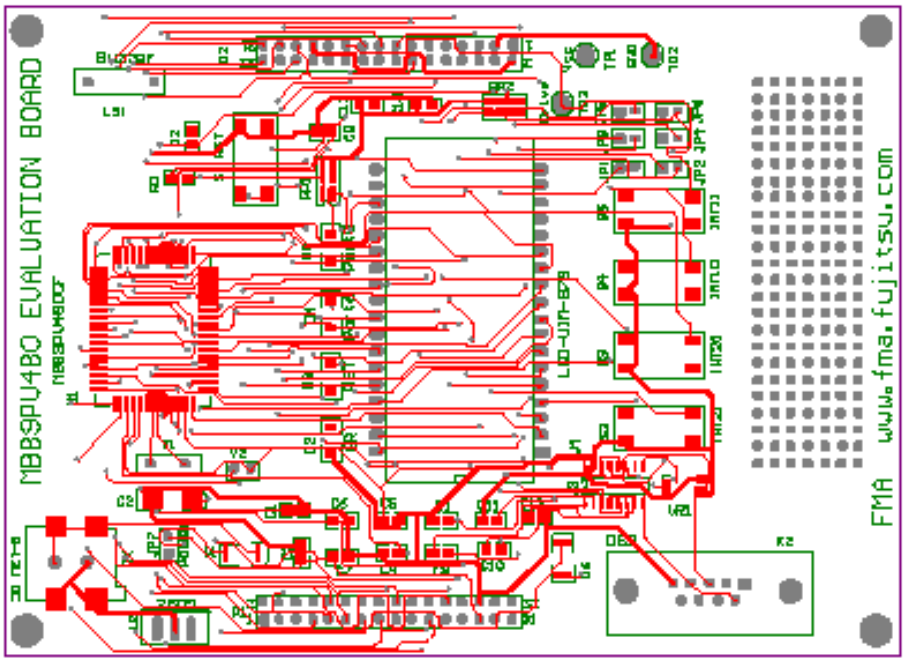
4.2 Schematic of MB89PV480 Evaluation Board



4.3 Top Assembly of MB89PV480 Evaluation Board



4.4 PCB layout of MB89PV480 evaluation Board



5.0 References

1. Fujitsu MCU product CD ROM version 3.3A/3.4A
2. MB89480 series data sheet
3. MB89480 series Hardware manual
4. FMA website link http://www.fma.fujitsu.com/micro/