Version

1.2

FUJITSU MICROELECTRONICS EUROPE

Development tools for 16LX Family

MCU64 Board User Guide

DEVELOPMENT TOOLS FOR 16LX FAMILY

MCU64 Board User Guide

Table of Content

Chapter

1

What is in This Guide

What you'll find inside this guide and few words about its organization

The MCU64 Board is designed as a replaceable CPU board of the Devkit16 development kit. However, this guide describes how to use the MCU64 board as a standalone board.

- Board features and technical specification chapter provides necessary technical and operational information
- FLASH It! chapter explains how to store final application in DevKit16 CPU or external FLASH.
- Board Description chapter provides explanation how to control the board configuration and detailed description of the board including all DIP switches, jumpers and connectors.
- Power supply requirements chapter
- Revisions and errors list
- Appendix includes schematics of the board and other technical references

WHAT IS NOT INCLUDED IN THIS GUIDE

This guide is not detailed manual for the CPU, parts and software tools. Please find more in the following resources:

- **MCU, Softune Workbench and tools – FUJITSU Micros CD ROM (Ver 3.0 or higher)**
- **Processor Expert(TM) and tools – DEVKIT16 Software CD ROM**
- **Parts and other HW components – datasheets of their producers**

Please visit DevKit16 WEB site www.processorexpert.com/devkit16 for news and giveaways. You can also register in order to obtain news by mail.

For MCUs and Fujitsu technologies please visit FUJITSU WEB site http://ww.fujitsu-fme.com.

When you need additional CPU personality board please call your nearest FUJITSU subsidiary or authorised FUJITSU distributor. You should specify:

- **version of CPU you need**
- **CPU soldered or in socket. Socket version is provided for users who want to use the FUJITSU emulator**

Chapter

2

MCU64 Board Features and Technical Specification

This chapter introduces features of MCU64 board and provides necessary technical and operational information for DevKit16.

The MCU64 board was designed as a replaceable part of the Devkit16. So, it contains only few features and the rest is provided by the Devkit16 Mainboard.

FEATURES

- Position for a PQFP64 processor or NQPACK socket
- Support for both the MB90F497 and MB90F562* CPUs
- connectors for all CPU pins
- a Bus Interface connector for main board connection
- a Device Bus connector
- a power supply supervisor IC with reset generation
- RST buttons
- DIP switch for setting the CPU mode
- High speed (in socket) and low speed quartzes
- Serial port connector
- 5V power supply regulator
- power supply connector for external power source and DC power supply circuitry

*The MB90F562 can not be used with Devkit16, because it does not support the external bus mode

Chapter

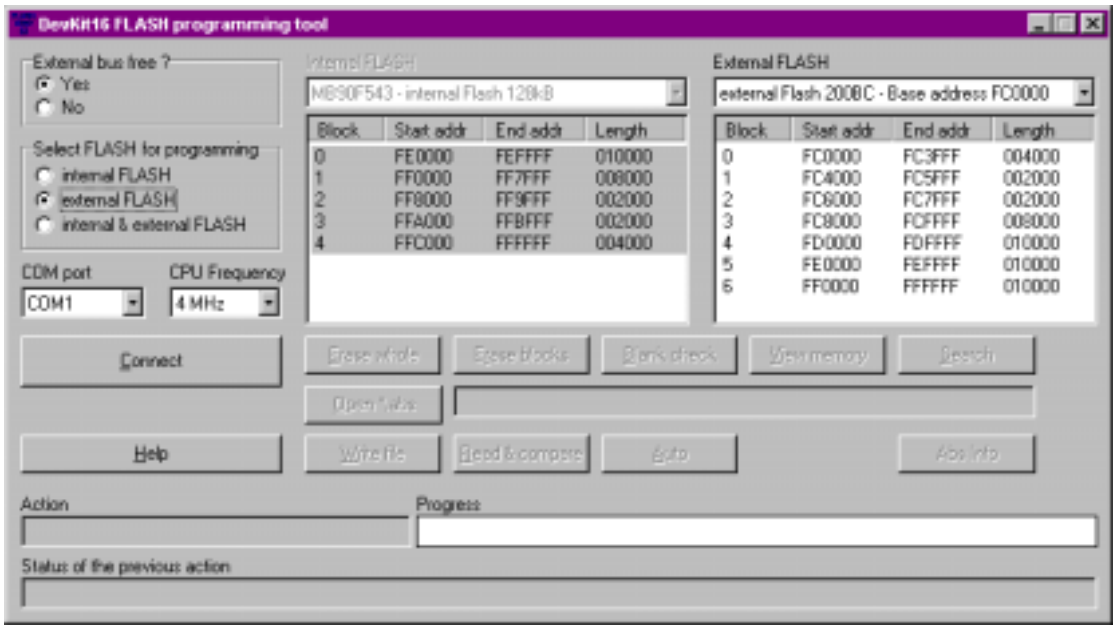
3

Flash It!

If the CPU mounted on the MCU64 board has a FLASH memory, the DevKit16 FLASH Programming Tool can be used to program it.

OVERVIEW OF THE DEVKIT16 FLASH PROGRAMMING TOOL

DevKit16 FLASH Programming Tool provides standard operations (check/program/verify) for CPU Internal FLASH memory, Mainboard FLASH or both.



With the standalone CPU board, it is possible to program only the internal FLASH. The check-box "External bus free ?" should be set to "no" (this tells the SW not to use the FPGA UART). The Flashtool will guide you to set the proper mode on the CPU board DIP switches. The communication will run on 9600Bd only, and only CPU FLASH can be programmed.

- Please see the Flashtool help for further information. Also, the latest update of Flashtool can be found at http://www.processorexpert.com/devkit16/download.

Chapter

4

Board Description

This chapter provides detailed description of CPU board including all DIP switches, jumpers and connectors.

MCU64 board can work standalone or in connection with the Mainboard. If the Mainboard is in use, **please switch all switches on CPU board configuration DIP to OFF.**

BOARD OVERVIEW

The board is designed as a low cost board, which provides compatibility for different CPUs on Interface Bus and the Device Bus level. Additionally, header pins compatible to CPU pins are provided.

This part contains description of:

- Connectors
- Jumpers, buttons and switches
- Board layout

CONNECTORS

K1: Bus Interface connector

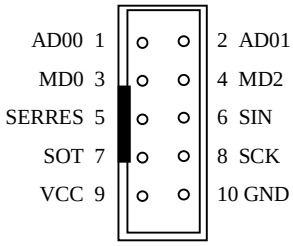
This connector serves for connecting the CPU board to the Mainboard.

K2: Device Bus connector

This connector provides connection to CPU peripherals.

Note: For the pinout of these connectors, please see the attachments section of this manual.

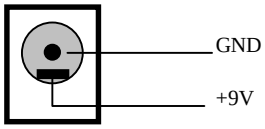
K7: CPU Serial interface connector



The serial interface connector should be used only when the CPU board is not connected to the mainboard, because mainboard connects its own serial (RS232) interface to the UART0 and UART1 CPU signals. To be able to use the K7 connector, please refer to the description of J7, J8, J9 jumpers later in this section.

> **Warning**: if you want to use the K7 connector when Mainboard is connected to the CPU board, you have to disconnect the serial interface selected by J7-J9 from the RS232 drivers on the Mainboard. To achieve this, remove jumpers on positions 3-4, 5-6 from both the J21 and J22 headers on the Mainboard. Also, when the Async. Serial programming mode is set on the Mainboard *System control DIP switches*, the FPGA UART RS232 driver is connected to UART0 or UART1 (depending on the setting of the UART0/1 switch) after reset. If you want to use K7 also in that case, remove the 3-4, 5-6 jumpers on the J23 as well.

K9: power supply connector



Before applying the power to the Devkit16, check the polarity of your power chord plug – the GND must be in the center, while the +9V on the shell of the connector. Even thought the DevKit16 power lines are protected by a diode on the power input, do not ever apply power with the opposite polarity. Also, make sure that the power supply complies to the specifications in chapter ***MCU64 board Power Supply Requirements.***

K3, K4, K5, K6: CPU pins connectors – with the MB90F497 CPU

K3

INT1	1	o	o	2	INT2
AN0	3	o	o	4	AN1
AN2	5	o	o	6	AN3
AN4	7	o	o	8	AN5
AN6	9	o	o	10	AN7
AVCC	11	o	o	12	AVR
AGND	13	o	o	14	INT0
X0A	15	o	o	16	X1A

K4

INT3	17	o	o	18	MD0
RSTX	19	o	o	20	MD1
MD2	21	o	o	22	X0
X1	23	o	o	24	GND
AD00	25	o	o	26	AD01
AD02	27	o	o	28	AD03
AD04	29	o	o	30	AD05
AD06	31	o	o	32	AD07

K5

AD08/IN0	33	o	o	34	AD09/IN1
AD10/IN2	35	o	o	36	AD11/IN3
AD12/PPG0	37	o	o	38	AD13/PPG1
AD14/PPG2	39	o	o	40	AD15/PPG3
A16/TIN0	41	o	o	42	A17/TOUT0
A18/TIN1	43	o	o	44	A19/TOUT1
A20/INT4	45	o	o	46	A21/INT5
A22/INT6	47	o	o	48	A23/INT7

K6

GND	49	o	o	50	ALE/SOT0
RDX/SCK0	51	o	o	52	WRLX/SIN0
WRHX	53	o	o	54	HRQ
HAKX	55	o	o	56	VCC
C	57	o	o	58	RDY/FRCK
CLK/ADTG	59	o	o	60	SIN1
SCK1	61	o	o	62	SOT1
TX	63	o	o	64	RX

K3, K4, K5, K6: CPU pins connectors – with the MB90F562 CPU

K3

PPG4	1	o	o	2	PPG5
AN0	3	o	o	4	AN1
AN2	5	o	o	6	AN3
AN4	7	o	o	8	AN5
AN6	9	o	o	10	AN7
AVCC	11	o	o	12	AVR
AGND	13	o	o	14	SIN1
SOT1	15	o	o	16	SCK1

K4

IN7/DTTI	17	o	o	18	MD0
RSTX	19	o	o	20	MD1
MD2	21	o	o	22	X0
X1	23	o	o	24	GND
P00	25	o	o	26	P01
P02	27	o	o	28	P03
P04	29	o	o	30	P05
P06	31	o	o	32	P07

K5

INT0	33	o	o	34	INT1
INT2	35	o	o	36	INT3
INT4	37	o	o	38	INT5
INT6	39	o	o	40	FRCK
TIN0	41	o	o	42	TO0
TIN1	43	o	o	44	TO1
IN0	45	o	o	46	IN1
IN2	47	o	o	48	IN3

K6

GND	49	o	o	50	RTO0
RTO1	51	o	o	52	RTO2
RTO3	53	o	o	54	RTO4
RTO5	55	o	o	56	VCC
C	57	o	o	58	SIN0
SOT0	59	o	o	60	SCK0
PPG0	61	o	o	62	PPG1
PPG2	63	o	o	64	PPG3

J10: VCC connector

1: VCC
2: VCC
3: VCC
4: VCC

J11: GND connector

1: GND
2: GND
3: GND
4: GND
5: GND
6: GND

J13: Supply for the whole board

When SHORT, the +5V from the voltage regulator is connected to board VCC. This jumper must be removed when using an external +5V power supply to avoid current flowing back to the regulator.

J2: Supply for CPU

When SHORT, the VCC is connected to CPU's VCC pins. Before removing this jumper, remove the J3 (AVCC to CPU) jumper as well to completely disconnect the power from the CPU.

J3: Analog Supply for CPU

When SHORT, board's VCC is connected to CPU's AVcc pin.

J4: Analog Ground for CPU

When SHORT, board's GND is connected to CPU's AGND pin.

J5: Analog Reference Voltage for CPU

This jumper selects the voltage for the AVR CPU pin.

1-2 position – the board's VCC is connected to CPU's AVR pin.

2-3 position – the board's GND is connected to CPU's AVR pin.

When the jumper is removed, the voltage at the AVR pin is set to 4V

J7, J8, J9: UART0/1 selection for the K7 connector

These jumpers select, which of the two UART0, UART1 interfaces signals will be connected to the pins of the K7 connector. If all of these jumpers are in

1-2 position - the UART1 interface signals will be connected to the K7

2-3 position – the UART0 interface signals will be connected to the K7 connector.

Default setting: the UART1 signals are connected to the K7.

Note: The J7 jumper selects between SCK1 and SCK0, J8 between SIN1 and SIN0 and J9 between SOT1 and SOT0

Warning: if you want to use the K7 connector when Mainboard is connected to the CPU board, you have to disconnect the selected serial interface (UART0 or UART1) from the RS232 drivers on the Mainboard. To achieve this, remove jumpers on positions 3-4, 5-6 from both the J21 and J22 headers on the Mainboard. Also, when the Mainboard is connected to the CPU board and the Async. Serial programming mode is set on the Mainboard *System control DIP switches*, the FPGA UART is connected to UART0 or UART1 (depending on the setting of the UART0/1 switch) after reset. If you want to use K7 also in that case, remove the 3-4, 5-6 jumpers on the J23.

J19, J20: I²C software emulation jumpers

These jumpers allow using Mainboard I^2C connector/EEPROM memory even in the case, when CPU itself doesn't provide the I^2C interface. When both of these jumpers are SHORT, the CPU's HRQ signal is connected to the Mainboard SDA signal (via J19) and #HAK signal is connected to SCL signal. An user can then program the #HAK, HRQ signals to behave as I^2C interface.

J21, J22, J23, J24: External bus or UART0 selection jumpers

When the MB90F497 CPU is used, these jumpers allow to select whether the Mainboard external bus signals ALE, #RD, #WRL and CLK should be connected to the P30/ALE/SOT0, P31/RDX/SCK0, P32/WRLX/SIN0 and P37/ADTG/CLK CPU pins, or the UART0 and ADTG Mainboard signals should be connected there.
In the 2-3 position, these CPU pins will be connected to the Mainboard external bus. In the 1-2 position, the CPU pins will be connected to the UART0 & ADTG Mainboard signals.
Note: in the external bus mode of the CPU, these high-speed external bus signals should not be connected to the Mainboard UART0 interface (in case of WRLX/SIN0 it is even impossible). However, in the single chip mode of the CPU, an user may want to use the UART0. Also, he may want the Mainboard devices (e.g., external memories or the FPGA) that are connected to the external bus, to be passive, so he can use the ports P0-P3 as general I/O or as the PPGs, timers and so on. To make the Mainboard external bus devices passive, the J22 and J23 jumpers must be put to their 1-2 position, so that RDX and WRLX signals will be always '1' (thanks to pullups R17 on the MCU64 board and R78, R79 on the Mainboard) .

J25-J30: CPU type selection

When the CPU type, mounted on the board, is the MB90F562, these jumpers should be in the 1-2 position. When the CPU type is MB90F497, these jumpers should be in the 2-3 position.
Note: if the CPU type is MB90F562, the MCU64 board can not be used with Devkit16! Also, with this CPU, the low speed crystal should be removed !

J15, J16: Low speed XTAL jumpers

When short, these jumpers connect the 32.768 kHz crystal to the Bus Interface connector X1A, X0A pins.

J17, J18: High speed XTAL jumpers

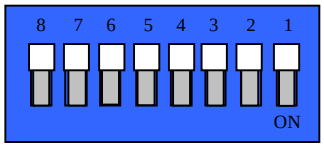
When short, these jumpers connect the 4MHz crystal to the Bus Interface connector X0, X1 pins.

SW1 – Reset button

This button can be used for reseting the CPU.

SW3 – CPU DIP switches

1: MD0
2: MD1
3: MD2
4: S-R
7: AD00 (P00)
8: AD01 (P01)



These switches should be used only when using the CPU board without Mainboard, or with the FPGA disabled (see the description of J29 in the Mainboard section).

1:MD0, 2:MD1, 3:MD2 – these switches are connected to CPU pins MD0, MD1, MD2. In the ON position, a switch pulls the signal connected to it to log '0'. The setting of these switches affects the mode of the processor.

The description of all the modes for the MB90F497 is in the following table:

MD2	MD1	MD0	AD00/ P00	AD01 /P01	Mode name	Reset vector area	External data bus witdth
ON	ON	ON	OFF	OFF	External vector mode 0	External	8
ON	ON	OFF	OFF	OFF	External vector mode 1	External	16
ON	OFF	ON	OFF	OFF	External vector mode 2	External	16
ON	OFF	OFF	OFF	OFF	Internal vector mode	Internal	(Mode data)
OFF	ON	ON	X	X	Reserved		
OFF	ON	OFF	X	X	Reserved		
OFF	OFF	ON	ON	ON	Async serial programming		
OFF	OFF	OFF	X	X	Reserved		

The description of all the modes for the MB90F562 is in the following table:

MD2	MD1	MD0	AD00/ P00	AD01 /P01	Mode name	Reset vector area	External data bus witdth
ON	ON	ON	OFF	OFF	Setting not allowed		
ON	ON	OFF	OFF	OFF			
ON	OFF	ON	OFF	OFF			
ON	OFF	OFF	OFF	OFF	Internal vector mode	Internal	(Mode data)
OFF	ON	ON	X	X	Setting not allowed		
OFF	ON	OFF	X	X			
OFF	OFF	ON	ON	ON	Async serial programming		
OFF	OFF	OFF	X	X	PROM programming		

4: S-R – if ON, this switch connects the RES pin of the K7 connector to the CPU's #RST signal.

7: AD00, 8:AD01 – if ON, the AD00/P00 and AD01/P01 signals are pulled to log. '0' level. This setting must be done for bringing processor to the Serial programming mode.

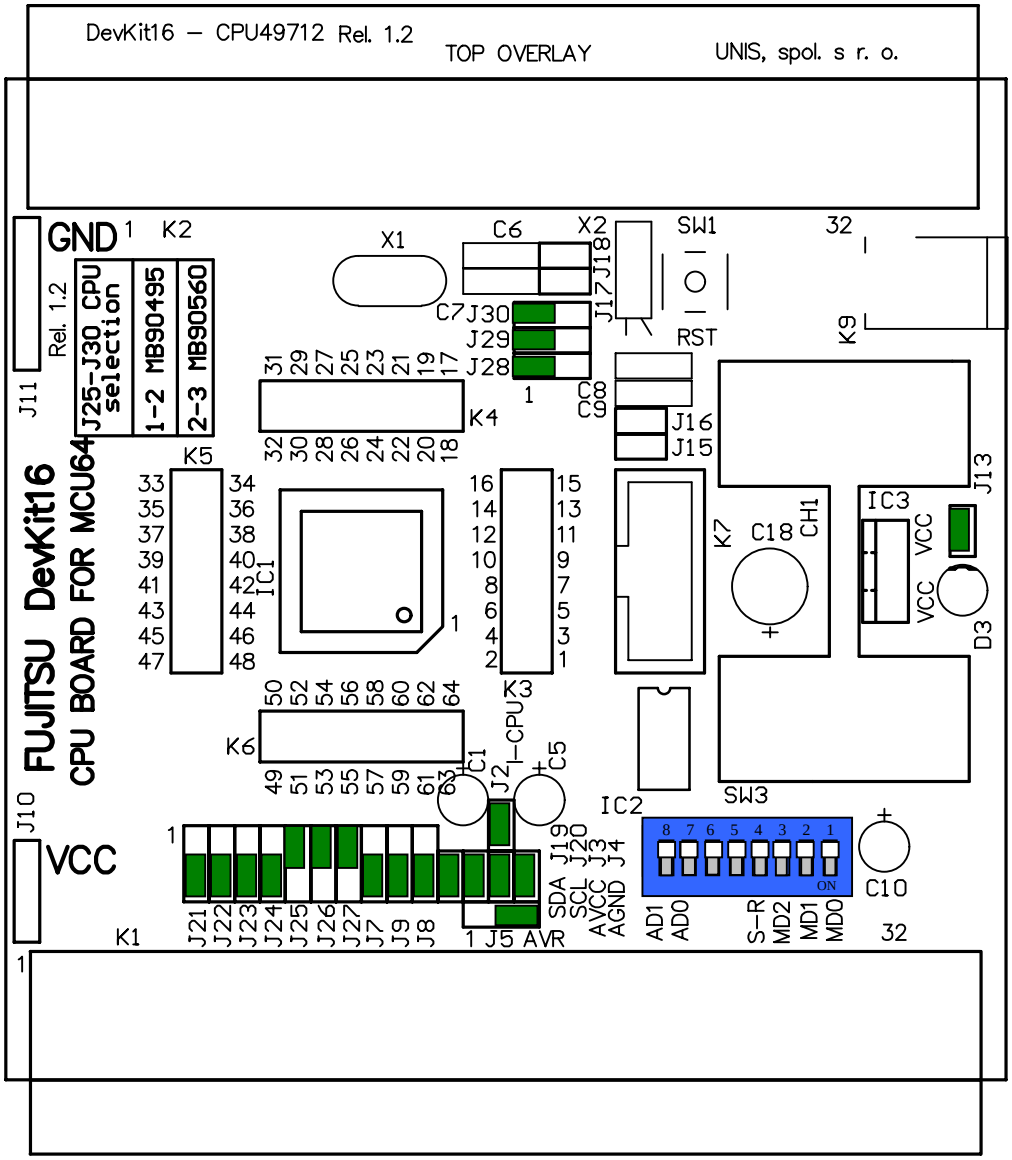


Figure 1: CPU board layout and default jumper settings for MBF497 and external bus mode

DEFAULT HW SETTINGS

These jumpers come in the SHORT position as a default factory setting:

J2: The CPU is connected to the +5V power supply through this jumper
J3: The CPU AVCC supply pin is connected +5V power supply through this jumper
J4: The CPU AGND supply pin is connected to the GND through this jumper
J5: The CPU AVR pin is connected to the +5V voltage through this jumper
J7-9: The CPU UART1 signals are connected to the K7 connector
J13: The board is powered from the +5V from the power supply voltage regulator
J19: The CPU HRQ pin is connected to the SDA Mainboard signal
J20: The CPU #HAK pin is connected to the SCL Mainboard signal
J21, J22, J23, J24: The Mainboard external bus signals are connected to the P30/ALE/SOT0, P31/RDX/SCK0, P32/WRLX/SIN0 and P37/ADTG/CLK CPU pins.
J25-J30: The Mainboard serial UART0,1 signals are connected to the UART pins of MB90F497

Chapter

5

CPU Board Power Supply Requirements

CPU board does not come with power supply, please check, if your power supply match the requirements before you plug it to the CPU board!

Power supply voltage: **9V**

Power supply current (CPU board MB90F497 with Main board connected):

- Single chip CPU mode, no external peripheral connected: **290mA max.**
- External bus mode, no peripheral connected: **350mA**
- External bus with:
    - keyboard connected: **450mA** typical, but can vary with the keyboard used (most of modern AT keyboard uses max. 100mA. User should check his keyboard current requirements before connecting the keyboard to the DevKit16 Mainboard).
    - keyboard and VGA interface connected: **650mA**

WE RECOMMEND USING 9V STABILIZED POWER SUPPLY WITH 1.5A (MIN.) OUTPUT CURRENT. IF THE POWER SUPPLY CAN NOT DELIVER CURRENTS AS SPECIFIED IN THE SPECIFICATION ABOVE, THE DEVKIT16 WILL NOT WORK PROPERLY – THE BOARD WILL BE PERIODICALLY RESET BY THE MB3771 POWER SUPPLY SUPERVISOR.

Warning: If the DevKit16 is powered using the on-board stabilizer, the supply current must not exceed the 1A limit of the stabilizer. Before connecting any peripheral to the DevKit16, please check that its power supply current requirements does not cause this limit to be exceeded.

Chapter

6

Warranty and Disclaimer

To the maximum extent permitted by applicable law, Fujitsu Microelectronics Europe GmbH restricts its warranties and its liability for the **DEVKIT16 and all its deliverables** (eg. software, application examples, target boards, evaluation boards, etc.), its performance and any consequential damages, on the use of the Product in accordance with (i) the terms of the License Agreement and the Sale and Purchase Agreement under which agreements the Product has been delivered, (ii) the technical descriptions and (iii) all accompanying written materials. In addition, to the maximum extent permitted by applicable law, Fujitsu Microelectronics Europe GmbH disclaims all warranties and liabilities for the performance of the Product and any consequential damages in cases of unauthorised decompiling and/or reverse engineering and/or disassembling. **Note, the DEVKIT16 and all its deliverables are intended and must only be used in an evaluation laboratory environment**.

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Should one of the above stipulations be or become invalid and/or unenforceable, the remaining stipulations shall stay in full effect.

Chapter

7

Revision and Error List

The following bugs have been found with the board and need to be observed when working with this tool:

Date	Revisions - Errors	Revised Version
05.06.2000	Version 1.0 is valid for CPU Board ver. 1.2.	V1.0
17.07.2000	Typos corrected. A note about the usage of the MB90F562 and the MCU64 board in connection with Devkit16 board added to page 4.	V1.1
4.08.2000	The “3.3V power supply regulator” note removed from page 4.	V1.2

Table1: List of found errors and revisions

Chapter

8

Appendix

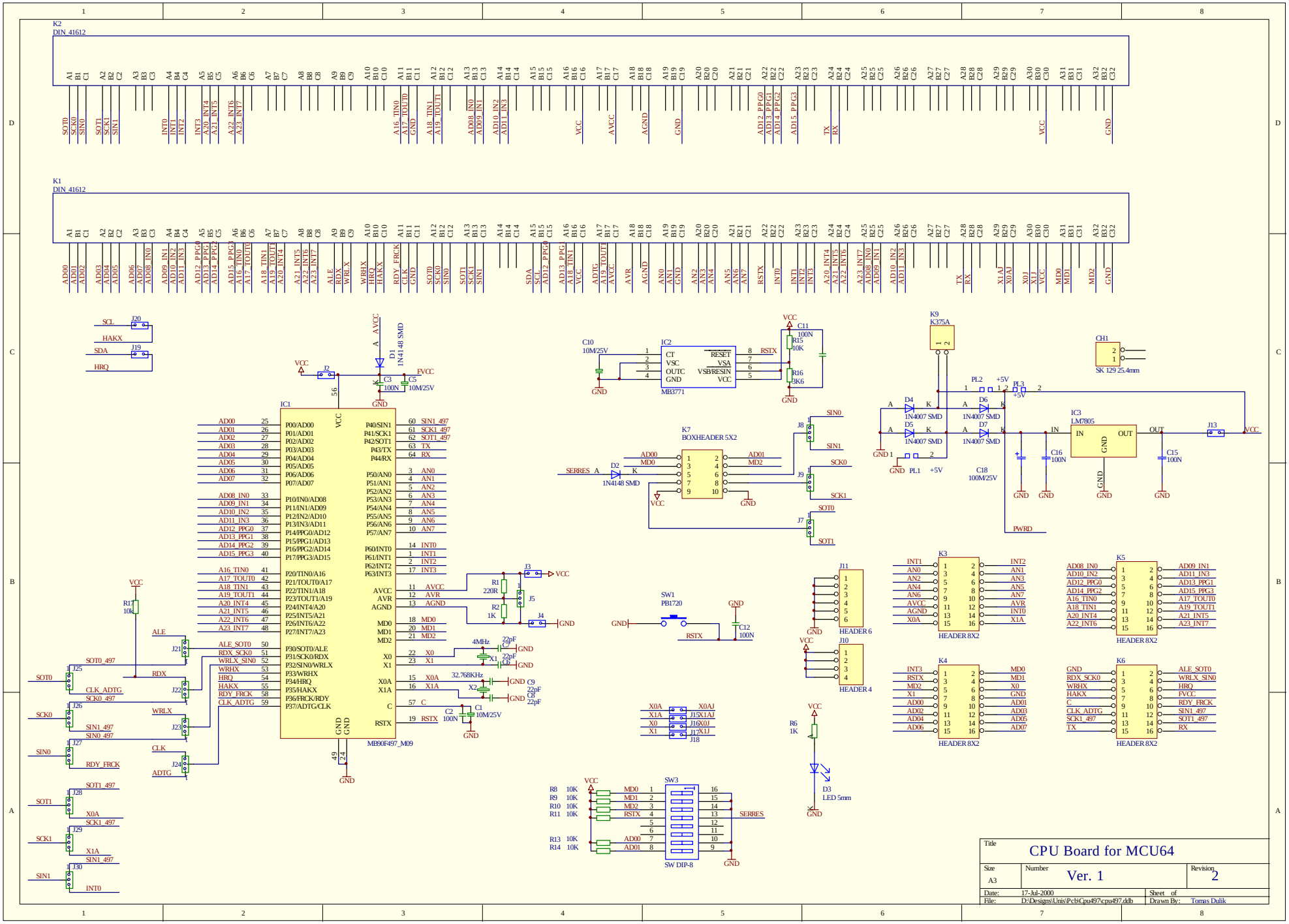
Here you will find Interface bus and Device Bus description and CPU board schematics.

Device Bus (K2) and Interface Bus (K1) connectors pins (with the MB90F497 CPU):

DIN Conn. PIN	**Device Bus**		**Interface Bus**		
PIN NO.	CPU Pin Nr.	Function	CPU PIN Nr.	SIGNAL	2nd Function
A1	50	SOT0	25	AD00	P00
B1	51	SCK0	26	AD01	P01
C1	52	SIN0	27	AD02	P02
A2	62	SOT1	28	AD03	P03
B2	61	SCK1	29	AD04	P04
C2	60	SIN1	30	AD05	P05
A3			31	AD06	P06
B3			32	AD07	P07
C3			33	AD08/IN0	P10
A4	14	INT0	34	AD09/IN1	P11
B4	1	INT1	35	AD10/IN2	P12
C4	2	INT2	36	AD11/IN3	P13
A5	17	INT3	37	AD12/PPG0	P14
B5	45	INT4	38	AD13/PPG1	P15
C5	46	INT5	39	AD14/PPG2	P16
A6	47	INT6	40	AD15/PPG3	P17
B6	48	INT7	41	A16/TIN0	P20
C6			42	A17/TOUT0	P21
A7			43	A18/TIN1	P22
B7			44	A19/TOUT1	P23
C7			45	A20/INT4	P24
A8			46	A21/INT5	P25
B8			47	A22/INT6	P26
C8			48	A23/INT7	P27
A9			50	ALE/SOT0	P30
B9			51	RDX/SCK0	P31
C9			52	WRLX/SIN0	P32
A10			53	WRHX	P33
B10			54	HRQ	P34

DIN Conn. PIN	Device Bus		Interface Bus		
PIN NO.	CPU Pin Nr.	Function	CPU PIN Nr.	SIGNAL	2nd Function
C10			55	HAKX	P35
A11	41	TIN0	58	RDY/FRCK	P36
B11	42	TOUT0	59	CLK/ADTG	P37
C11		GND		GND	GND
A12	43	TIN1	50	SOT0	
B12	44	TOUT1	51	SCK0	
C12			52	SIN0	
A13			62	SOT1	P42
B13	33	IN0	61	SCK1	P41
C13	34	IN1	60	SIN1	P40
A14	35	IN2			
B14	36	IN3			
C14					
A15				SDA	
B15				SCL	
C15			37	AD12/PPG0	P14
A16			38	AD13/PPG1	P15
B16			43	A18/TIN1	P22
C16		VCC		VCC	
A17				ADTG	
B17			44	A19/TOUT1	P23
C17		AVCC	11	AVCC	
A18			12	AVR	
B18					
C18		AGND	13	AGND	
A19			3	AN0	P50
B19			4	AN1	P51
C19		GND		GND	GND
C20			5	AN2	P52
A21			6	AN3	P53
C20			7	AN4	P54
A21			8	AN5	P55
B21			9	AN6	P56
C21			10	AN7	P57
A22	37	PPG0	19	RSTX	
B22	38	PPG1			
C22	39	PPG2	14	INT0	P60
A23	40	PPG3	1	INT1	P61
B23			2	INT2	P62
C23			17	INT3	P63
A24	63	TX	45	A20/INT4	P24
B24	64	RX	46	A21/INT5	P25
C24			47	A22/INT6	P26
A25			48	A23/INT7	P27
B25			33	AD08/IN0	P10
C25			34	AD09/IN1	P11
A26			35	AD10/IN2	P12
B26			36	AD11/IN3	P13
C26					
A27					
B27				NC(SGO)	
C27				NC(SGA)	

DIN Conn. PIN	Device Bus		Interface Bus		
PIN NO.	CPU Pin Nr.	Function	CPU PIN Nr.	SIGNAL	2nd Function
A28			63	TX	P43
B28			64	RX	P44
C28					
A29					
B29				X1AJ	
C29				X0AJ	
A30				X0J	
B30				X1J	
C30		VCC		VCC	
A31			18	MD0	
B31			20	MD1	
C31				NC	
A32			21	MD2	
B32				NC	
C32		GND		GND	


K2
DIN_41612
K1
DIN_41612
IC1
MB90F497_M09
IC2
MB3771
IC3
LM7805
K7
BOXHEADER 5X2
SW1
PB1720
SW3
SW DIP-8
K3
HEADER 8X2
K4
HEADER 8X2
K5
HEADER 8X2
K6
HEADER 8X2
J10
HEADER 4
J11
HEADER 6
CH1
SK 129 25.4mm
K9
K375A
PWRD
Title
CPU Board for MCU64
Size
A3
Number
Ver. 1
Revision
2
Date:
17-Jul-2000
File:
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Drawn By:
Tomas Dulik