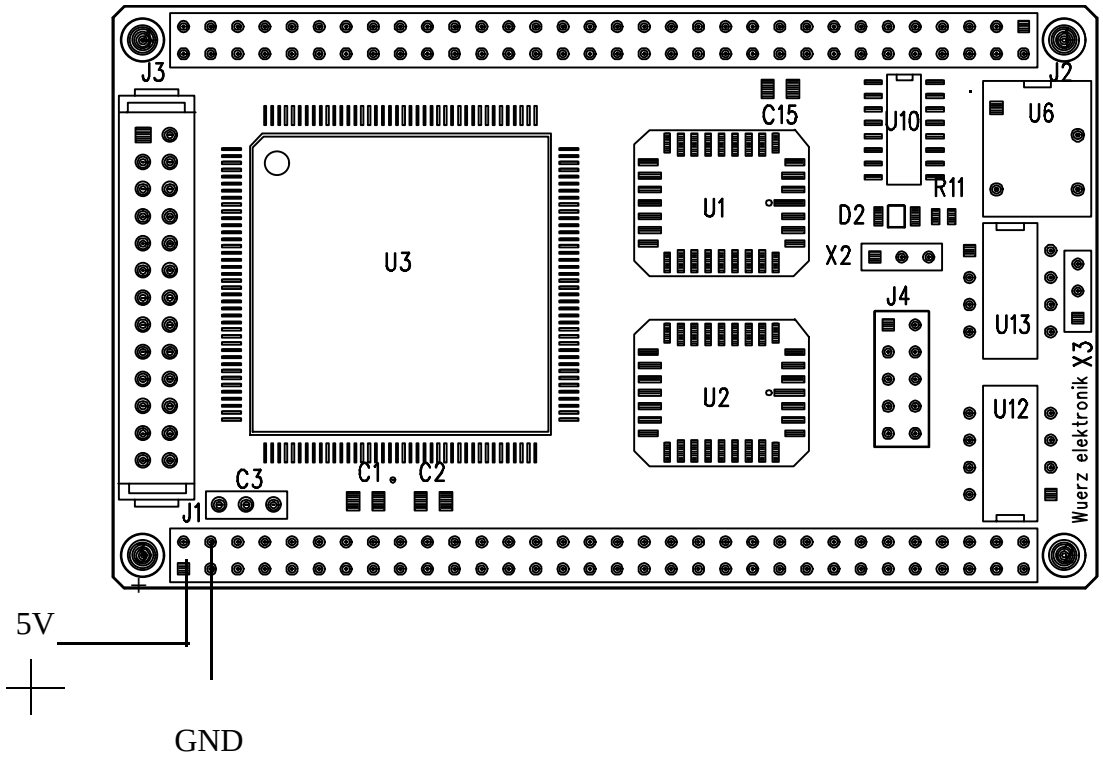
Würz elektronik



Manual

ec376

This manual describes the hardware of module ec376.
This manual does not intend to explain the system architecture of the microcontroller MC68376 to the user. It will describe module ec376 so that the user can quickly familiarize with the module.
This description has been prepared with care. We decline any responsibility for errors and their consequences. Modifications are reserved.

Status: September 1996

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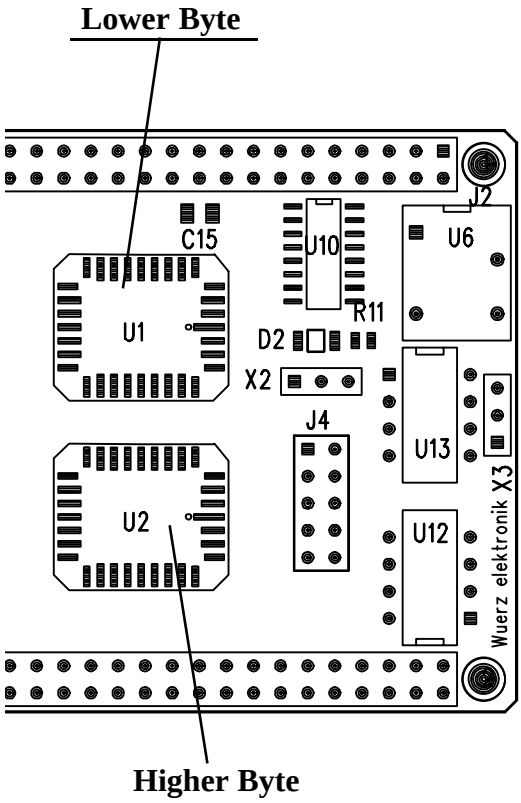
The monitor page 11

and here we go .... !

The processor

The module is equipped with the Motorola 16-bit microcontroller MC68376 (U3). This controller operates at a frequency of 20.97 MHz obtained from an external 5.243 MHz quartz.
After the reset the controller will operate at 10.48 MHz. Setting the X bit in the SYNCR register to „1“ doubles the frequency to 20.97 MHz.



Flash-EPROMs

Module ec376 is only equipped with Flash EPROMs, due to their low price. Flash EPROMs can easily be programmed from a PC printer port, using the PROG32 software. No additional programming units or adapters are needed. (The software is not supplied with the module).

The module can be equipped with different Flash EPROM types (5V). AMD 29F0XX or ATMEL AT29C0XX are recommended. AM29F010 128Kx8 or AM29F040 512Kx8 can also be used. This means that memory capacities from 256 Kbyte (128Kx16 bit) or 1 Mbyte (512Kx16 bit) are possible. Components with access times of 90 ns can be operated without wait states, Flash EPROMs with an access time of 120 ns will require 1 wait cycle.

Flash EPROMS have a /WE (write enable). The signals are available through the chip selects /CS3 and /CS4. The chip selects must be programmed so that they are only valid during WRITE. /CS3 applies to the low byte, /CS4 to the high byte. The 1 MB option requires address line A19. In this case chip select /CS6, which, depending on initialization, also serves as A19 line, must be programmed for A19. A serial-connected diode D1 and the resistor R7 between data line D3 and /RESET must be installed. At /RESET the processor must detect that /CS6=A19.

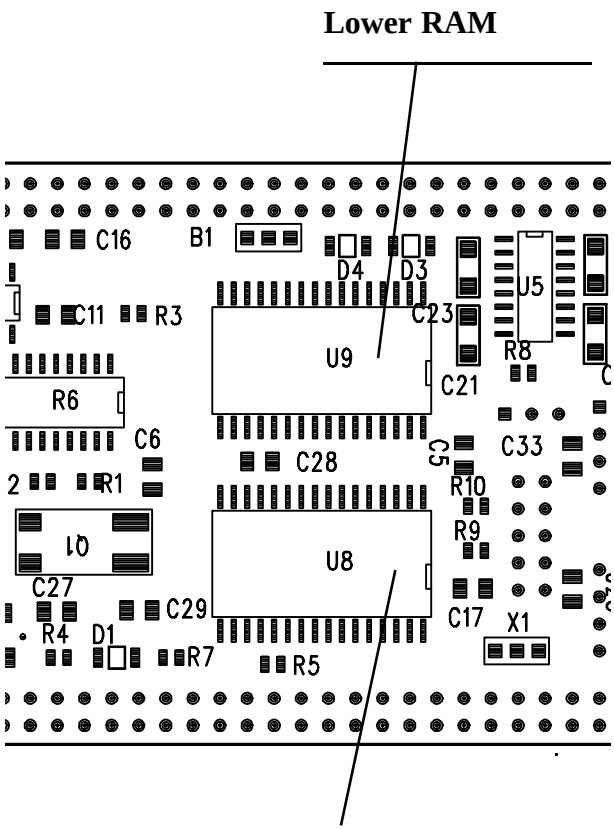
Chip selects

The processor has 12 programmable chip select outputs. The following chip selects are used in the layout, but they are also connected to the bus, where they are available to the user:
/CSBOOT for EPROMs
/CS0 to /CS2 for RAMs
/CS3 and CS4 for Flash-EPROMs (/WE)
/CS6-A19 for Flash-EPROMs 29F040
Address line A19 is needed for 512 KB Flash and or 512 KB RAM; This line is also used as /CS6. /CS6 is freely available if no such components are used.
/CS5 and /CS7 to /CS10 are freely available chip selects.

Programming the chip selects

EPROM and RAM

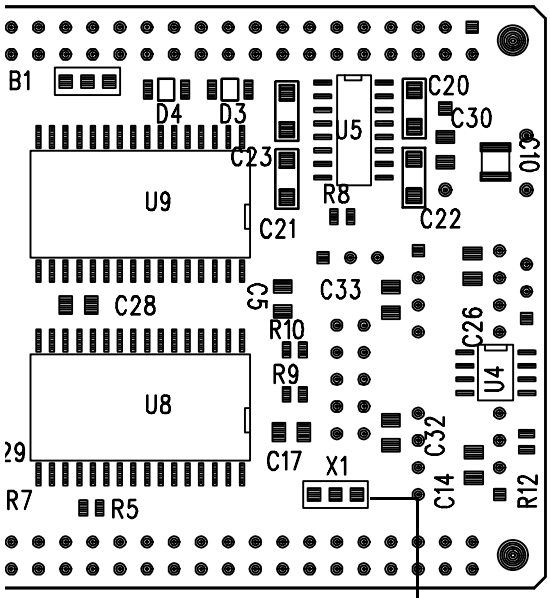
```
set Chip Selects 0,1,2 to 16-bit ports
16 Bit, Supervisor-Mode
move.w  #$00FF,CSPAR0
move.w  #$6830,CSORBT
* BOOT-EPROM Adresse $0, 1 MB
move.w  #$0005,CSBARBT   ;BOOTROM  1MB
* RAM Adresse $200000
set U8 RAM base addr to $200000,128k
move.w  #$2004,CSBAR0
set U9 RAM base addr to $200000 128 K

set Chip Select 0, upperbyte, write only
move.w  #$2004,CSBAR1
move.w  #$5030,CSOR0
set Chip Select1,lower byte write only

set Chip Select 2,to base addr $200000
move.w  #$3030,CSOR1
move.w  #$2004,CSBAR2
set Chip Select 2 both bytes,read and
write     move.w  #$7830,CSOR2
```



Please see the enclosed diskette for CS programming.

RAM

The module can be equipped with 128 Kbyte and 512 Kbyte RAM, 2 x 16 bit. Pins X1 1-2 are jumpered if 512 Kbyte types are used. The module, as supplied, is equipped with the ordered RAM type, and this jumper is already set. Basically the RAM can be accessed without wait cycles.



Jumper for RAMs
128KByte X1 2-3 default
512KByte X1 1-2

Serial interface

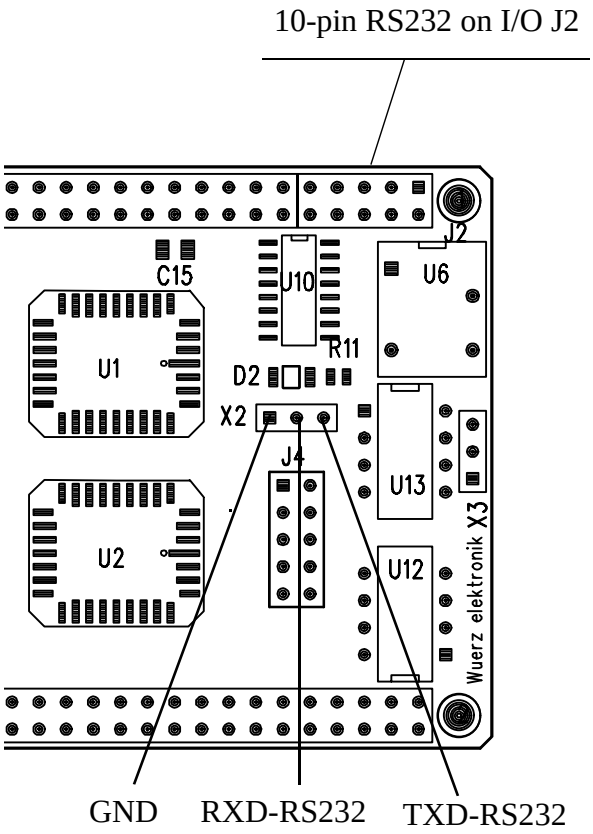
The SCI (Serial Communication Interface) allows programmable baud rates up to 655 kbit/s at 20.97 MHz. The MAX232A (U5) (116 kbit/s) is used as RS232C driver. The signals RxD-RS232, TxD-RS232 and GND are accessible at a 3-pin connector X2 at the card edge (see figure) for easy access by the user.

In addition:

The I/O bus (J2) carries the RS232 potentials RxD, TxD, CTS and RTS.

/RMC has been used for the CTS, MODCLK for the RTS signal generation.

The TTL potentials RxD and TxD of the serial interface are available on the I/O bus as well. The pin configuration (10 pin connector bar) has been designed fot connection of external RS232 or RS485 modules. These modules can be equipped with optocouplers as an option.



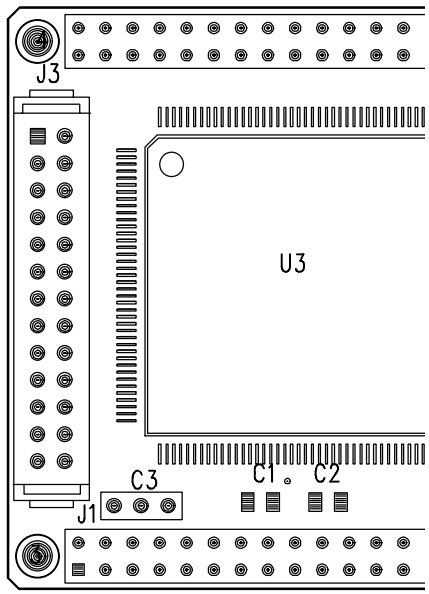
RS232 on X2 3-pin connector

J2-B		J2-A
VCC	5	GND
RXD-RS232	4	TXD-RS232
CTS-RS232	3	TXD-TTL
RTS-RS232	2	RXD-TTL
CAN-H	1	CAN-L
J2-B		J2-A

RESET and external battery

The MAX791 (U10) generates a reset at power on. An external battery can be connected to I/O bus pin J2-A11. At power-down this battery buffers the external SRAM and the processor RAM.

QADC Converter



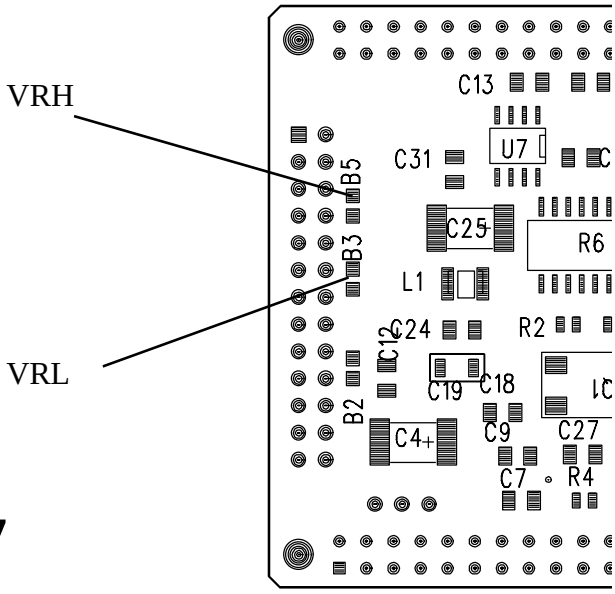
J3			J3
GND	1	2	GND
GND	3	4	GND
GND	5	6	GND
PQB6	7	8	PQB7
PQB4	9	10	PQB5
PQB2	11	12	PQB3
PQB0	13	14	PQB1
PQA6	15	16	PQA7
PQA4	17	18	PQA5
PQA2	19	20	PQA3
PQA0	21	22	PQA1
VRH	23	24	VRL
VDDA	25	26	VSSA
J3			J3

QADC converter

The pins of the 16 channel 10-bit A/D converter are accessible at connector J3. The reference voltage VRL passes a scratch-jumper B2 (zero resistânc) to AGND (Analog Ground).

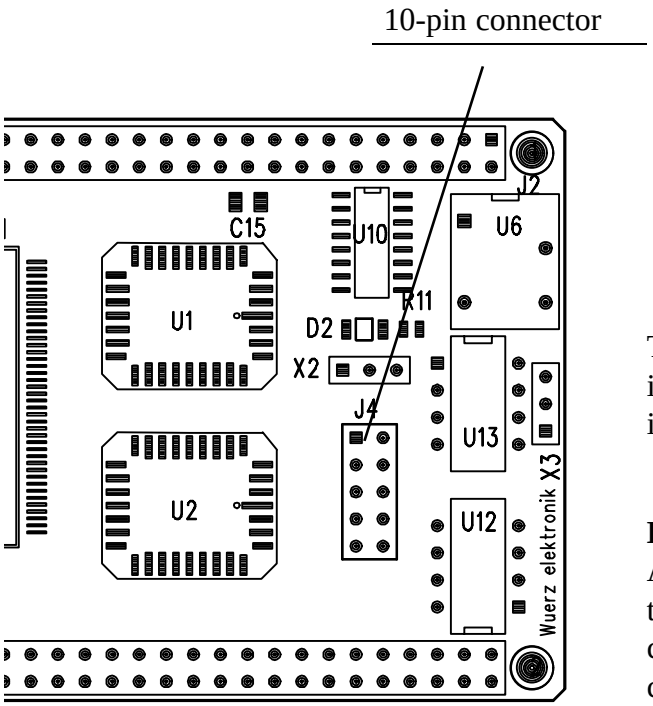
VRH is connected to analog Vcc by a scratch-jumper B3 (zero resistance). Both zero-resistance jumpers can be removed if an external reference voltage is connected to J3-23 and J3-24. The Queued Analog-to-Digital Converter Reference Manual is needed for programming the QADC.

Connector configuration QADC



Background debugger

The board has a10-pin connector. All commercial 68376 compilers and debuggers using the background mode of the 68376 can be used for the ec376 board. The pin allocation is compatible to Motorola standards.

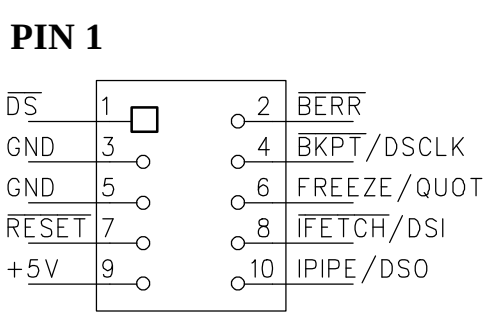


The development software runs on a PC. PC printer port and 10-pin connector of the board are connected by a special cable.

The background debugger does not need software in the target system. It is always available on the host, even if the module is not equipped with EPROMs. All internal and external modules are accessible to the serial background interface. The CPU can set hardware breakpoints; these can also be used when accessing an EPROM or data.

Flash EPROMs can be directly programmed in the sockets of the module ec376 with the BDM software; this means that the flash EPROM can be directly written from the PC after generation of the necessary protocol in the PC. An adaptation of the PC software to the specific configuration is necessary.

Background-Debugger-Interface

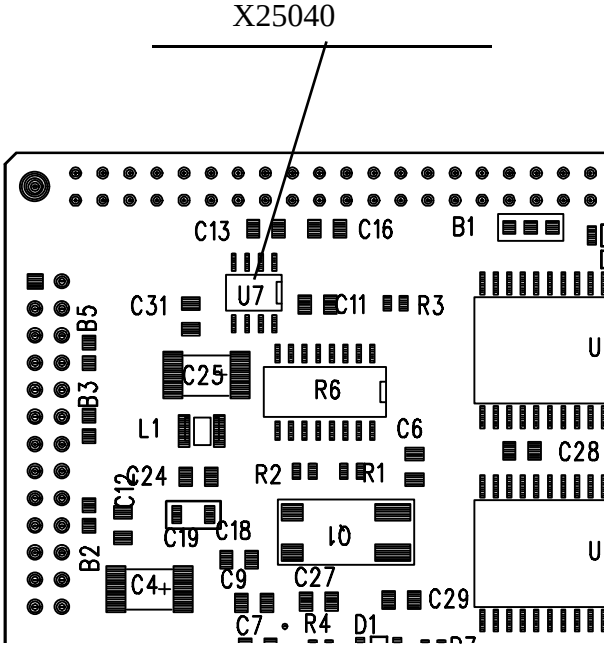


Background debugger interface

The cable on the ICD32/PROG32 debugger interface must be directed towards the board inside.

EEPROM

A serial EEPROM X25040 512x8 bit permits the storage of important data. This EEPROM is connected to the QSPI bus of the 68376. The chip select *PCS0 or *PCS3 selecting the EPPROM is defined with jumper B1 (zero resistance). The default selection is PCS0. The control software can be found on the supplied diskette under EEPROM.S.



Bus configuration of the module ec376

HSB-Bus

J1-A		J1-B
VCC	**1**	VCC
GND	**2**	GND
D15	**3**	D14
D13	**4**	D12
D11	**5**	D10
D9	6	D8
D7	7	D6
D5	8	D4
D3	9	D2
D1	10	D0
*RESET	11	*AVEC
*IRQ5	12	CLKOUT
*IRQ7	13	SIZ1
*DSACK1	14	SIZ0
*DSACK0	15	*DS
*BERR	16	*HALT
*AS	17	R/*W
*BG/*CS1	18	*BGACK/*CS2
FC0/*CS3	19	*BR/*CS0
FC2/*CS5	20	FC1/*CS4
A23/*CS10	21	A22/*CS9
A21/*CS8	22	A20/*CS7
A19/*CS6	23	A18
A17	24	A16
A15	25	A14
A13	26	A12
A11	27	A10
A9	28	**A8**
A7	29	A6
A5	30	A4
A3	31	A2
A1	32	A0
J1-A		**J1-B**

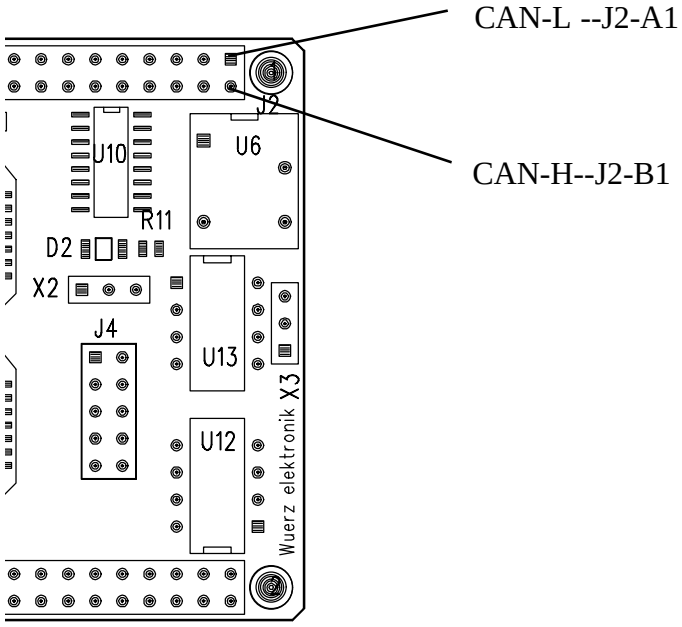
I/O Bus

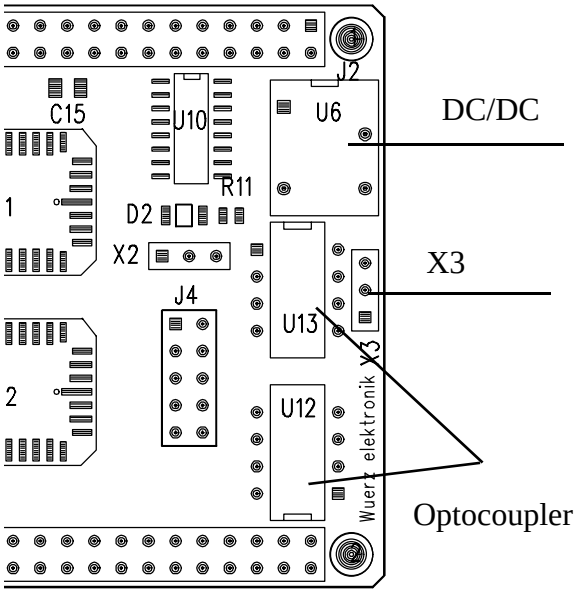
J2-B		J2-A
	32	CTM2C
CTD4	**31**	CTD3
CPWM6	**30**	CPWM5
CPWM8	**29**	CPWM7
CTD10	**28**	CTD9
TP0	27	TP1
TP2	26	TP3
TP4	25	TP5
TP6	24	TP7
TP8	23	TP9
TP10	22	TP11
TP12	21	TP13
TP14	20	TP15
	19	
MODCLK	18	T2CLK
	17	
	16	SCK
MISO	15	MOSI
*PCS0/*SS	14	*PCS1
*PCS2	13	*PCS3
WDI	12	*RESIN
WDO	11	BATT-IN
*CSBOOT	10	PFI
UBAT	9	*IRQ1
*IRQ2	8	*IRQ3
*IRQ4	7	*IRQ6
	6	
VCC	5	**GND**
RXD-RS232	4	TXD-RS232
CTS-RS232	3	TXD-TTL
RTS-RS232	2	RXD-TTL
CAN-H	1	CAN-L
J2-B		**J2-A**

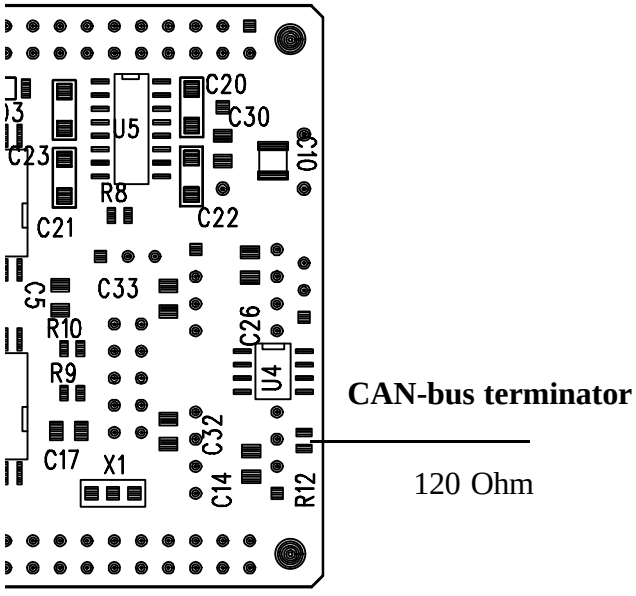
CAN Bus Interface

Both CAN signals CNTX and CNRX of the MC68376 controller are galvanically isolated from the bus by HP7100 optocouplers. A Philips 82C250T CAN transceiver (U4) is used for direct bus coupling to the CAN bus. The physical interface meets the standard ISO/DIS 11898 with transfer rates up to 1 Mbit/s.

CAN-H and CAN-L at the I/O bus







CAN-bus Connector configuration

The CAN bus signals are available at the 3-pin connector X3 and on the I/O bus.

Connector X3

X3	PIN1	PIN2	PIN3
	CAN-H	I-GND	CAN-L

CAN bus terminator 120 Ohm

A 120 Ohm bus terminator can be installed between the signal lines CANH and CANL.
R12 120 Ohm 1/8 Watt SMD type 0805.

Significance of the signals

Prozessor

D0..D15	Data
A0..A15	Address
/RESET	Resetleitung
/IRQ0../IRQ7	Interrupt Level 0..7
/R\W,	Read-Write
/CSBOOT-/CS0-/CS10	programmable Chip-selects
E	E-Clok
TP0..TP15	Time Prozessor Unit
MOSI,MISO, SCK, /SS	SPI-Bus

MAX791

/PFO	Output Power-Fail
PFI	Power Fail Input
RES-IN	Manual Reset Input
/Lowline	Output goes lowwhen VCC falls to 150mV above the reset threshold
WDI	Watchdog Input
WDO	Watchdog Output
UBAT	Output Supply Voltage

SCI RS232

RXD-RS232	Receiver RS232 Pegel
TXD-RS232	Transmitter RS232 Pegel
CTS-RS232	Clear to Send RS232 Pegel
RTS-RS232	Request to Send RS232 Pegel
TXD	TTL Level
RXD	TTL Level
VCC	Power Supply
GND	Ground

Literature and Data Sheets
MC68376

MC68336/376 User's Manual
MC68332 SIM System-Integration-Module
TPU Time-Processing-Module Reference Manual.
QADC Queued Analog-to-Digital-Converter Reference Manual

FLASH-EPROM AMD 29F010, 29F040
ATMEL At29C010A, AT29C040A

MAX791	MAXIM
MAX232A	MAXIM
X25040	Serial EEPROM XICOR

The Monitor
The monitor is a simple test monitor for the ec376 hardware. It cannot be used for software debugging.
After power-on the monitor displays „****Testmonitor*****“ and a prompt +++. The baud rate is 9600 8N1.

All commands are entered by two characters, terminated by <CR>.
The second line of the following command list shows an example.

BF Block fill
BF 200100 200200 AA
fills memory from $200100 to $200200 with $AA

CS Select address write
CS 1000
Selects address $1000. This can be used for hardware expansion testing. A value $FF is continuously written to the specified address. Exit by external RESET only.

CR Select address read
CR 1000
The specified address is read continuously. Exit by external RESET only.

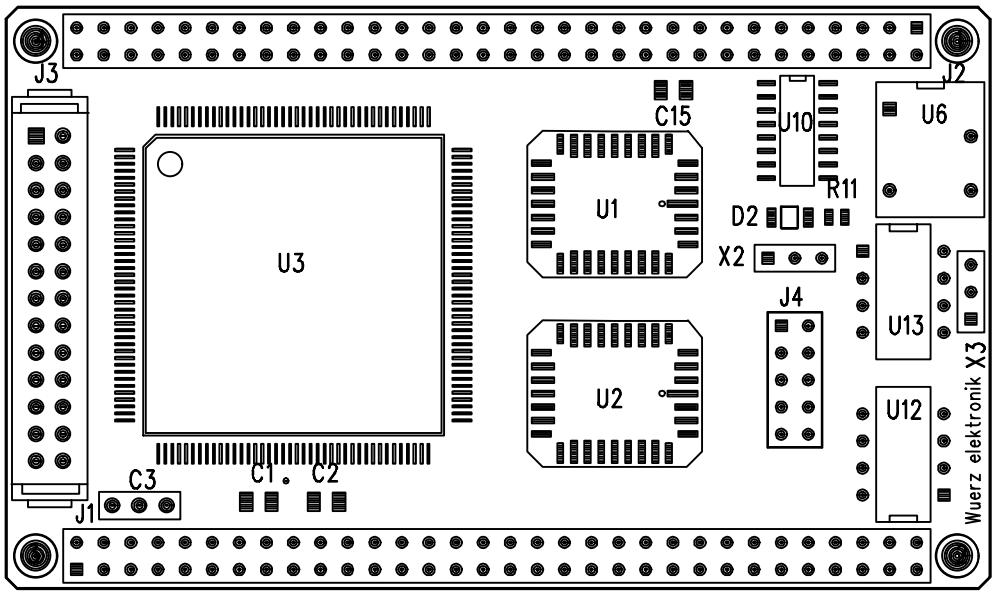
HP Help menu
HP Ouput help menu

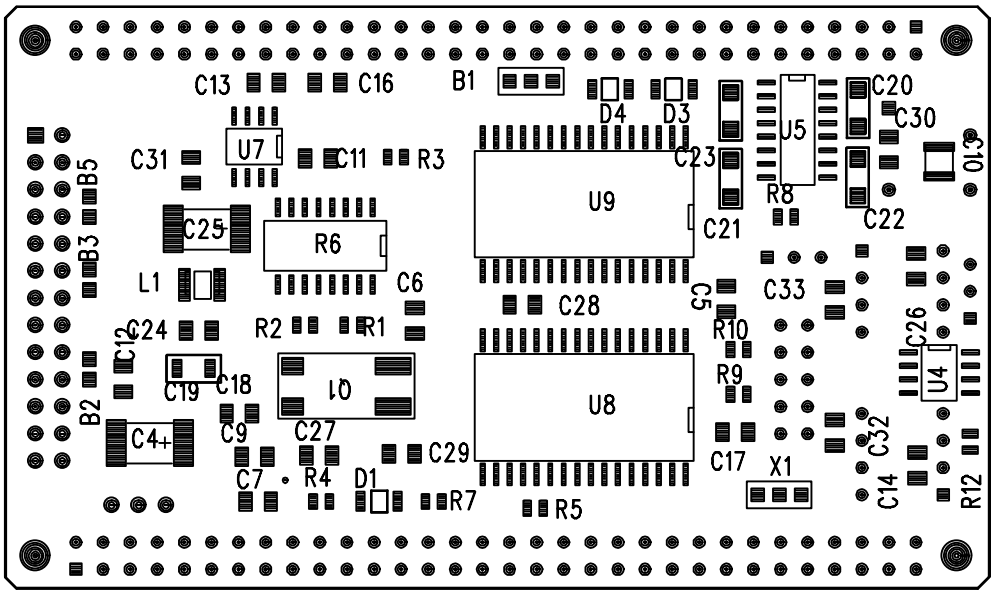
MD Memory dump
MD 200000
Dump memory, for instance at $200000. $FF values are displayed. This memory dump can be continued with <CR> when one page is filled.

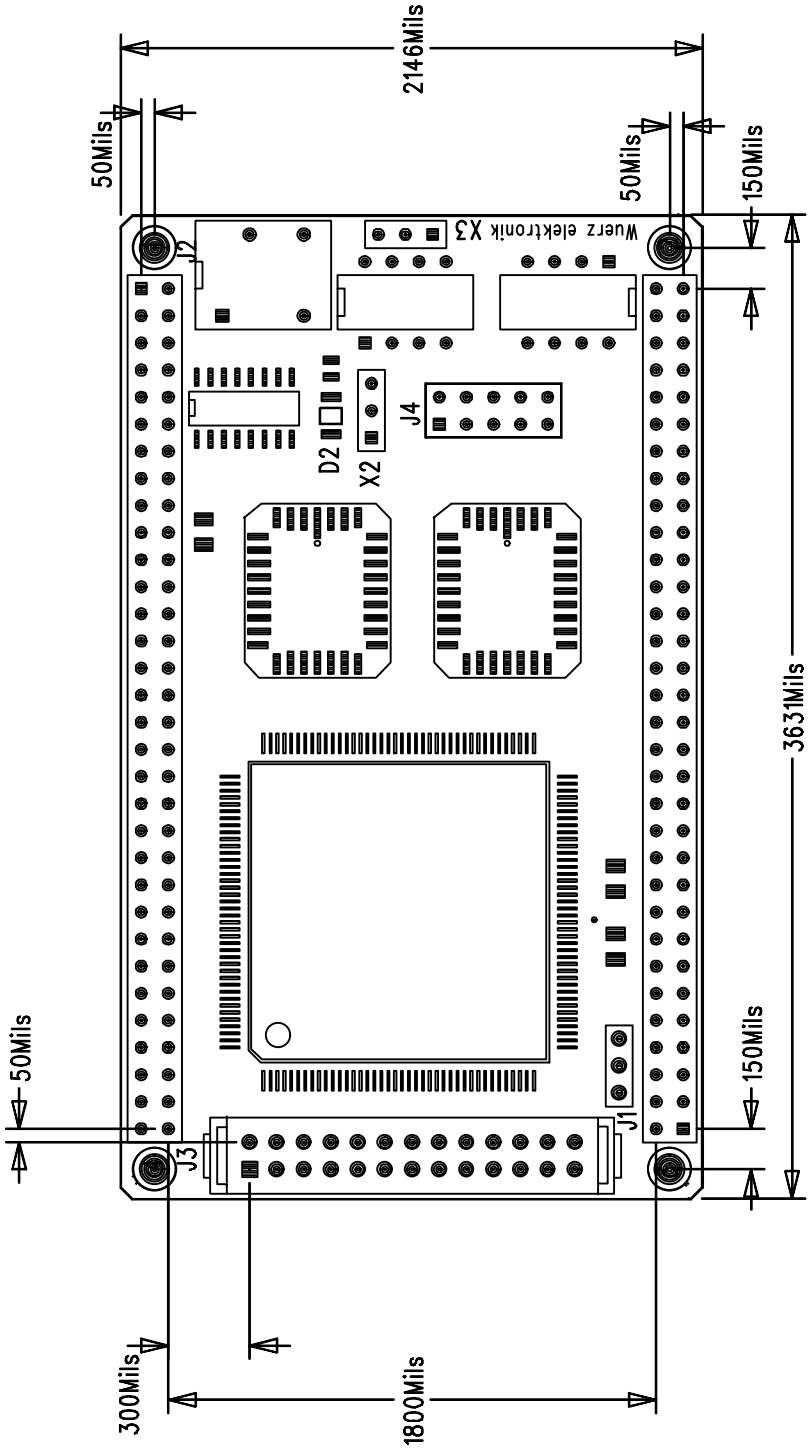
MM Memory modify
MM 5000 AA
Memory cell $5000 is written with $AA.

MS Memory show
MS 6000
15 values starting at the entered address are output.

The monitor has been (will be) expanded for the CAN interface.


J3
J2
C15
U10
U6
U1
R11
D2
U3
X2
J4
U13
X3
U2
U12
Wuerz elektronik
C3
C1
C2
J1


C13
C16
B1
D4
D3
C20
C30
U5
C10
C31
U7
C11
R3
C23
U9
B5
R8
C25
R6
C21
C22
B3
L1
C6
C33
C28
C5
C24
R2
R1
R10
C26
C12
C19
C18
R9
U4
U8
B2
C4+
C9
C27
C32
C29
C17
X1
C7
R4
D1
C14
R12
R7
R5


2146Mils
50Mils
50Mils
150Mils
3631Mils
50Mils
150Mils
300Mils
1800Mils
Wuerz elektronik X3
J2
J4
D2
X2
J1
J3