XC2000 Easy Kit

Board REV. V3.1

Microcontrollers

Never stop thinking.

Edition 2008-09

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XC2000 Easy Kit

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Previous Version:

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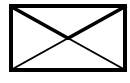

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1 Introduction

The XC2000 is a new family of 16/32-bit microcontrollers based on the high-performance C166S V2 core. The C166S V2 core more than doubles the performance of the well established C166 core while still providing code compatibility.

Applications can be developed easily. The Evaluation Board is equipped with peripherals for connection to the environment. An On Board Wiggler allows easy access to all peripherals and the core. For programming of the embedded Flash, MEMTOOL is available.

The Evaluation Board allows the easy development of XC2000 family applications with the corresponding tools. Subsequently, the applications can be downloaded and can be tested with the several powerful debuggers.

For detailed technical information about the different derivatives please refer to the XC2000 family web pages on the Infineon Internet.

The document **XC2000Board_V30** covers several product series.

The **0-Series** covers the following derivates:

- **xxx-XC2xxx-xxFxxL-xx**
- **xxx-XC27x6X-xxFxxL-xx**

The **M-Series** covers the following derivates:

- **xxx-XC22xxM-xxFxxL-xx**

The **A-Series** covers the following derivates:

- **xxx-XC23xxA-xxFxxL-xx**

The **5X-Series** covers the following derivates:

- **xxx-XC27x5X-xxFxxL-xx**

2 General Information about XC2000 Easy Kit Board

2.1 Summary of Features

- Infineon's XC2000 Controller in TQFP144/100 Package
- High Speed CAN Transceivers, LIN Transceiver, USB to UART/JTAG bridge
- 8 Low Power Status LEDs
- Easy access to all pins
- 5-DIP switches for configuration
- On board USB to JTAG / UART interface
- Powered via USB

Connectors

The XC2000 Board offers a wide variety of connectors:

- USB connector for ASC/JTAG Interface
- 4 pin header for LIN Transceiver
- 16-pin header for JTAG interface (OCDS)
- 10pin (2x5) header for CAN High Speed Transceiver (CAN1/CAN2)
- 10pin header for DAP interface

Components

- Low-Drop Voltage Regulator TLE 4274
- Step Down Voltage Regulator TLE 6365G (optional)
- Four status LED´s for Power / RESET / JTAG
- 2 x CAN-Transceiver TLE 6251
- LIN Transceiver TLE 7259
- FT2232 Dual USB to UART/JTAG interface
- SPI EEPROM 128 Kbit AT25128N
- 8 general purpose LEDs
- Potentiometer for ADC
- Reset switch

Zero Ohm Bridges

- Zero Ohm resistors give the flexibility to configure the systems functionality

2.2 Block Diagram

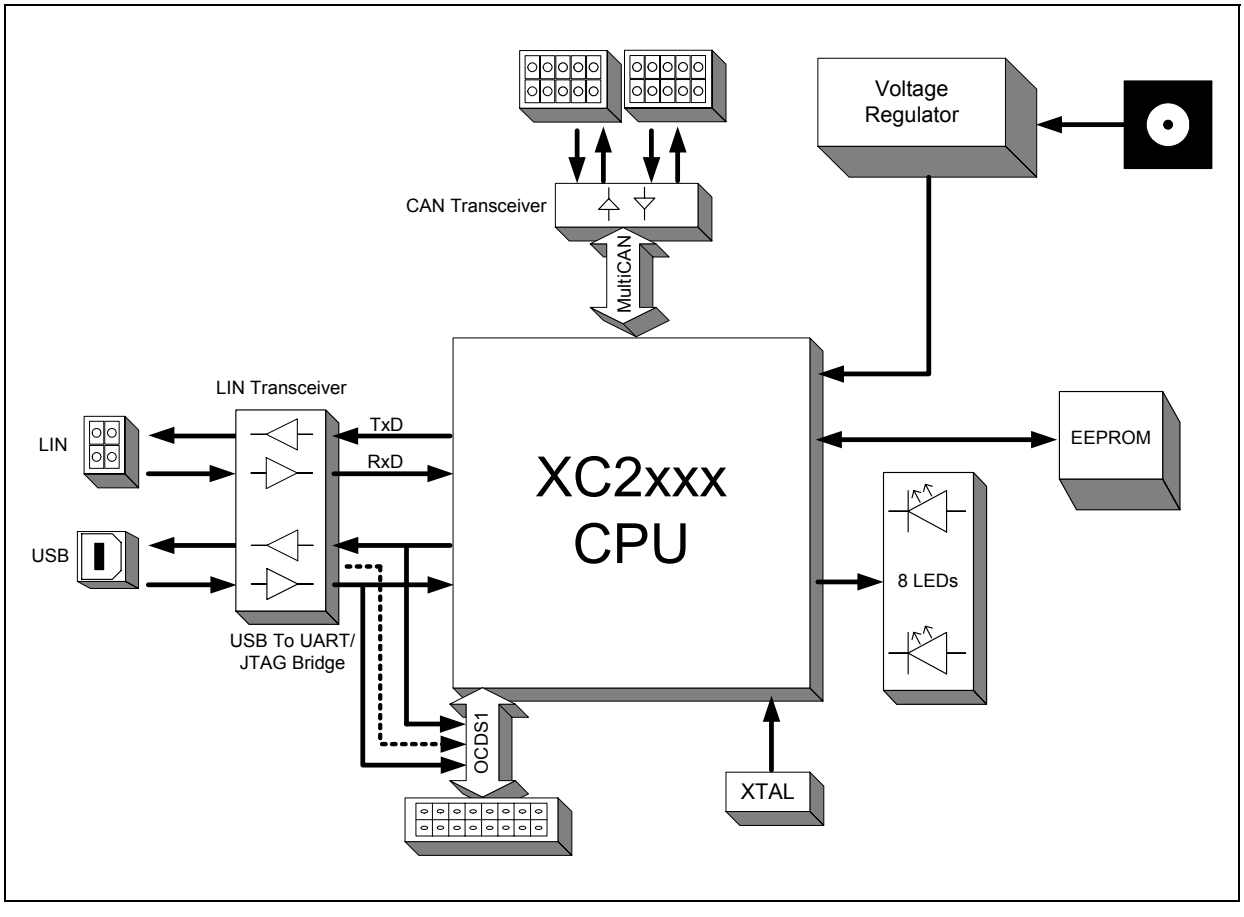


Figure 1 Block diagram of XC2000 Easy Kit layout overview

2.3 Board Overview

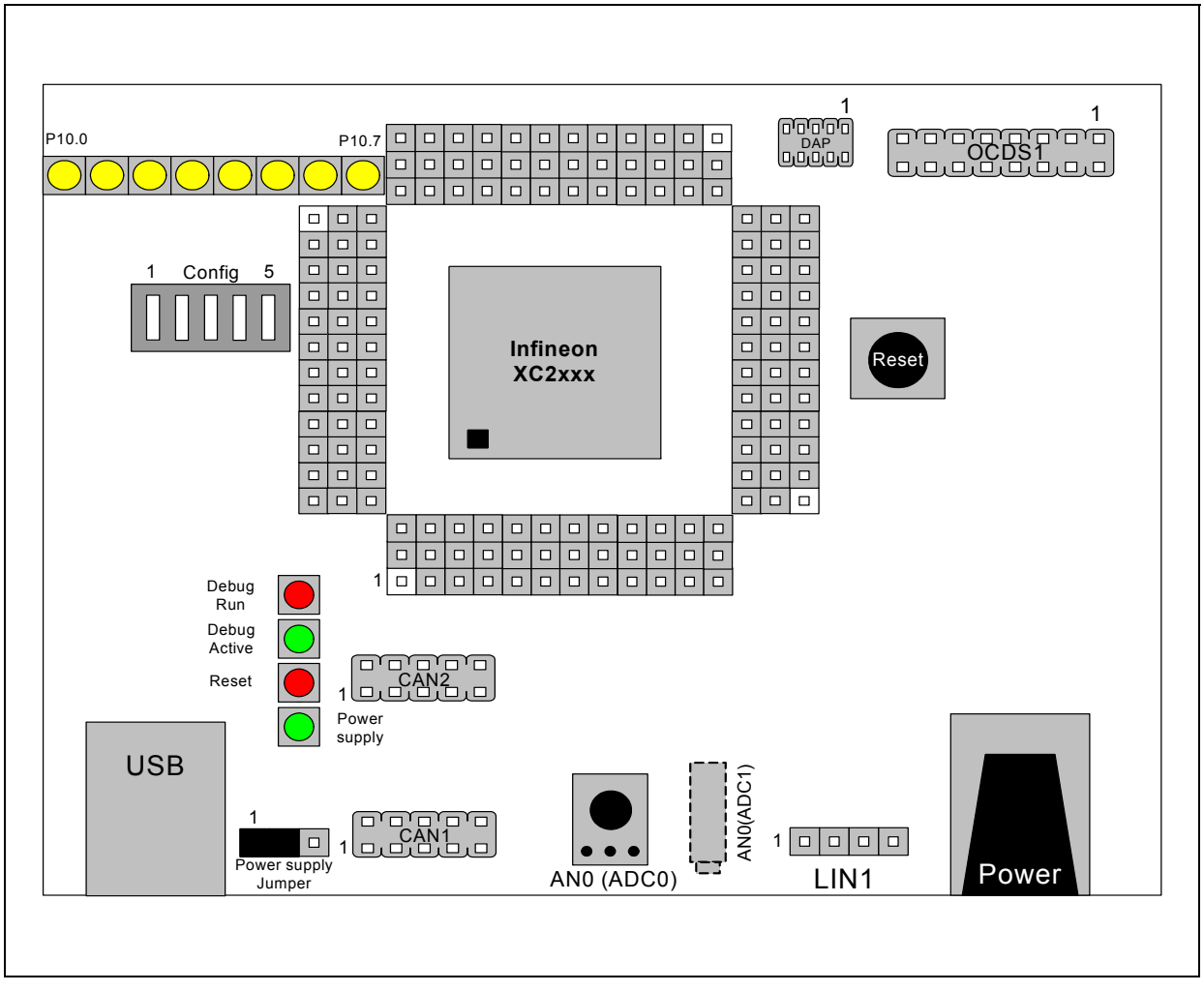


Figure 2 Top View (basic components)

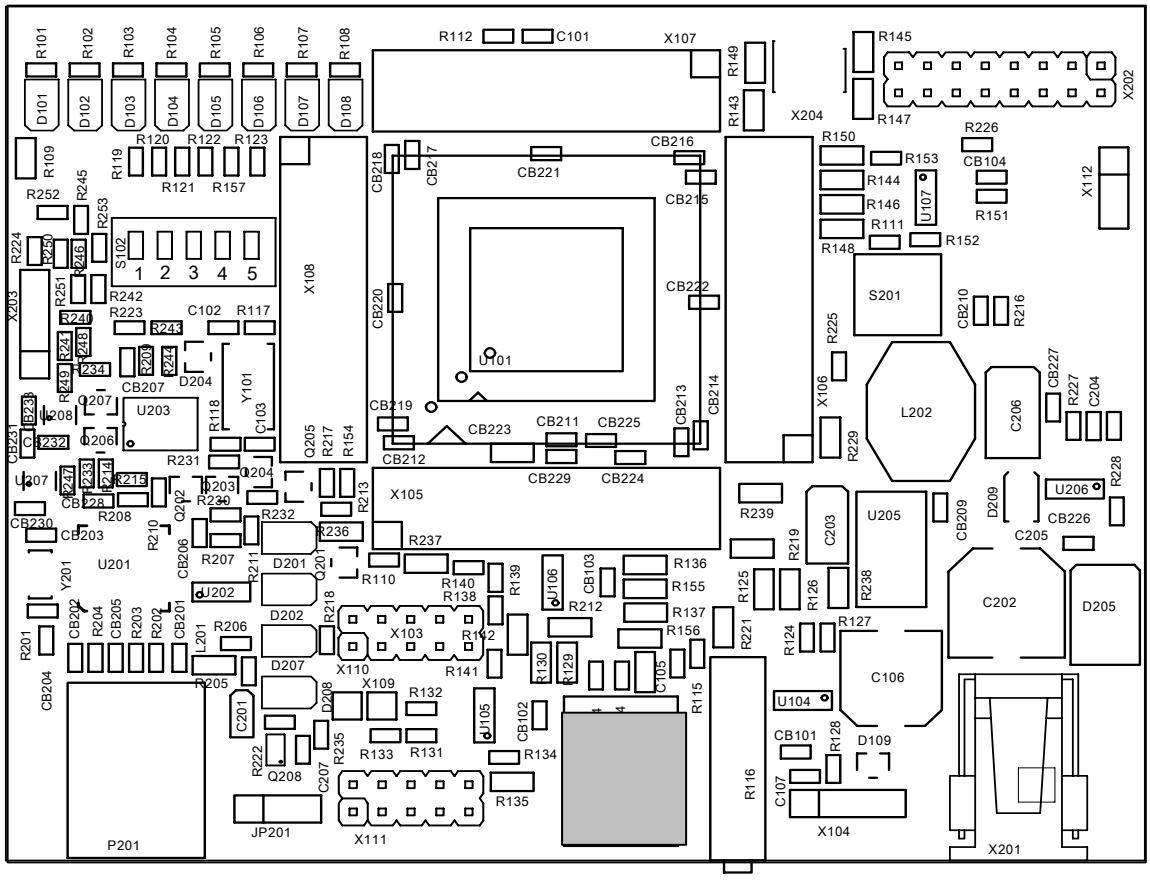


Figure 3 Top view in detail

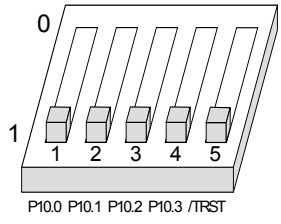
2.4 DIP Switch S102

Although most of the programmable features of the XC2000 are selected by software either during the initialization phase or repeatedly during program execution, some features must be selected earlier because they are used for the first access of the program execution.

These configurations are accomplished by latching the logic levels at a number of pins at the end of the internal reset sequence.

DIP switch S102 allows to configure the startup setting of the XC2000 during RESET. The default System Startup Configuration is shown in **Table 1**. By default all DIP Switches are OFF. The XC2000 executes a standard start from internal Flash.

Table 1 Default configuration

Name in schematic	Default configuration	Description
S102		Startup configuration: Standard start from internal Flash (Default)

2.4.1 Basic Startup Configuration for XC2x (0-Series)

Table 2 Basic Startup Configuration via External Circuitry

Startup Mode	CFG pins P10 [3]	CFG pins P10 [2]	CFG pins P10 [1]	CFG pins P10 [0]
	P10 [3 : 0][1)]			
Internal Start from Flash	x	x	1	1
Standard UART Bootloader	x	1	1	0
Enhanced UART Bootloader	x	0	1	0
SSC Bootloader	1	0	0	1
CAN Bootloader	x	1	0	1

1) x means that the level on the corresponding pin is irrelevant.

For more detailed information about the DIP switch setting please refer to **Chapter 3.1.1**, **Table 6**.

2.4.2 Basic Startup Configuration for XC2x (M / A / 5X -Series)

Table 3 Basic Startup Configuration with debug support

Startup Mode	Debug Interface	CFG pins P10 [3:0] [1] $\overline{\text{TRST}}$=1			
Internal Start from Flash	JTAG pos.B	x	0	1	1
	DAP pos.1	x	1	0	0
	from Flash [2]	x	1	1	1
	DAP pos.0	0	0	0	1
	DAP pos.2	0	1	0	1

1) x means that the level on the corresponding pin is irrelevant.

2) A defined location in Flash ($C0'01F0_H$) must contain a value (2 Bytes) for DBGPRR register and the next word-location ($C0'01F2_H$) must contain the inverse value.
If the inverse-condition does not match - the value is considered as invalid and JTAG pins at position A are configured by default.

Table 4 Basic Startup Configuration via External Circuitry

Startup Mode	Configuration pins [1]				
	$\overline{\text{TRST}}$	P10 [3 : 0]			
Internal Start from Flash	0	x	x	x	x
UART Bootloader 2.x [2]	1	x	0	1	0
UART Bootloader 7.x [3]	1	x	1	1	0
SSC Bootloader	1	1	0	0	1
CAN Bootloader	1	1	1	0	1

1) x means that the level on the corresponding pin is irrelevant.

2) 2.x means: TxD (transmit data) at P2.3 pin, RxD (receive data) at P2.4 pin.

3) 7.x means: TxD (transmit data) at P7.3 pin, RxD (receive data) at P7.4 pin.

For more detailed information about the DIP switch setting please refer to **Chapter 3.1.2**, **Table 7**.

2.5 Easy Kit Power Supply concept

The Easy Kit USB Power Supply concept enables the user to work with the Kit without an external Power Supply. If the USB power supply is not sufficient an additional regulated DC power supply can be used.

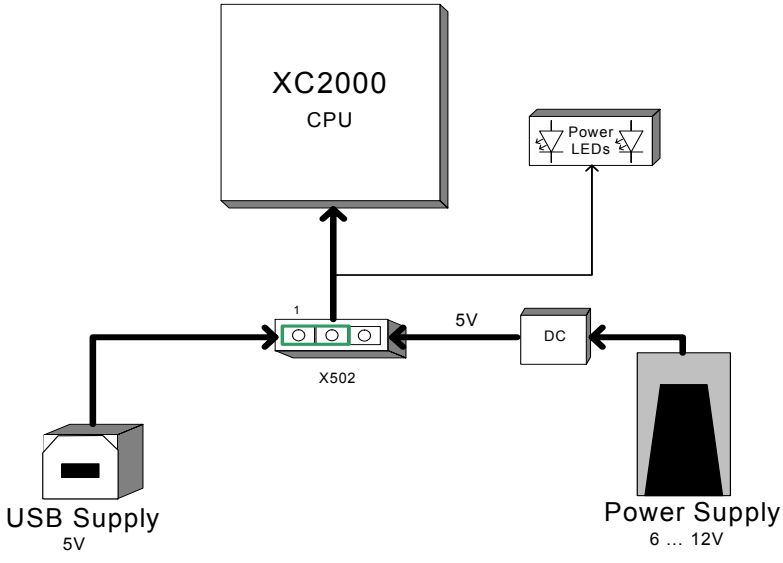
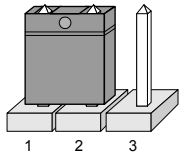
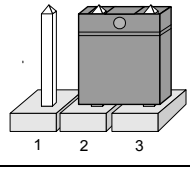


Figure 4 Easy Kit Power Supply concept

By means of the Power Supply Jumper X502, USB, or the external power Supply can be selected to run the Easy Kit. The Setup for the Jumper X502 is shown in **Table 5** below.

Table 5 Power Supply Jumper configuration

Name in schematic	Configuration	Description
X502		Power Supply via USB Interface **(Default)**
X502		Power Supply via Power Plug

The USB specification provides a 5 V supply on a single wire from which connected USB devices may draw power. The specification provides for no more than 5.25 V and no less than 4.35 V between the +ve and -ve bus power lines.

Initially, a device is only allowed to draw 100 mA. It may request more current from the upstream device in units of 100 mA up to a maximum of 500 mA. In practice, most ports will deliver the full 500 mA or more before shutting down power, even if the device hasn't requested it or even identified itself. If a (compliant) device requires more power than is available, then it cannot operate until the user changes the network (either by rearranging USB connections or by adding external power) to supply the required power.

Note: If the USB power supply is not sufficient, an external power supply is needed and the Jumper X502 setting need to be changed.

Note: In case the USB Host PC goes into Suspend Mode, an external Power Supply should be used.

2.5.1 Power Supply via Power Plug

The XC2000 Board can be supplied either with USB cable or with an external power supply. For external power supply a regulated DC power supply with **max. 12Volt/ 400mA** can be connected to the power connector. The maximum power dissipation of the used voltage regulator has to be taken into account.

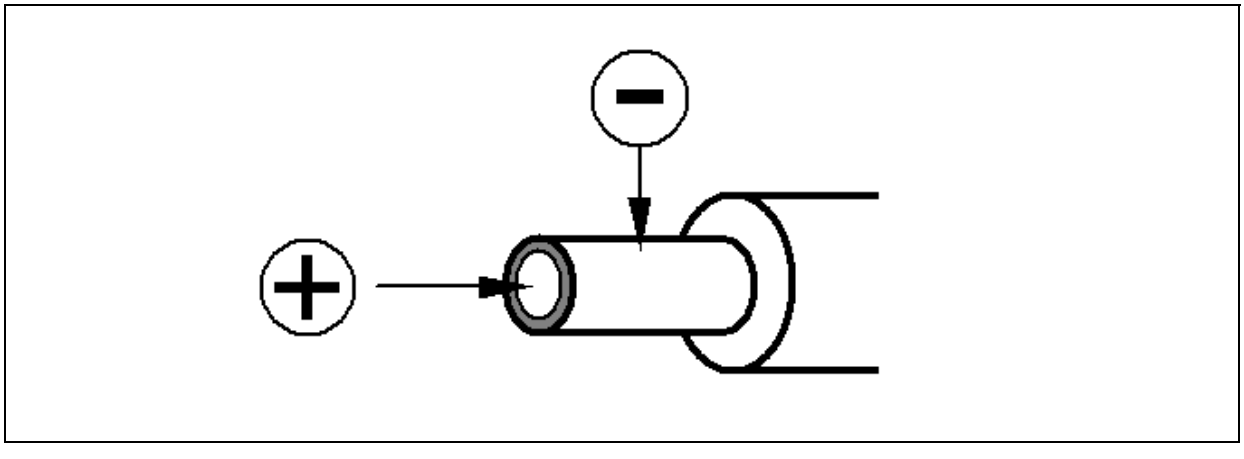


Figure 5 Power Supply

3 Information in Detail

The XC2000 family supports variety of start-up modes, allowing the user to make selections in three aspects:

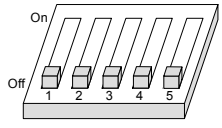
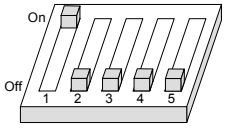
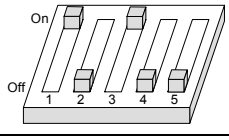
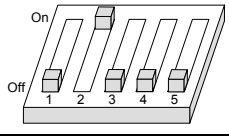
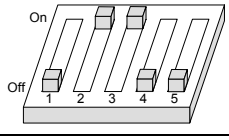
- Main functionality - where from the user code will be started (on-chip Flash, PSRAM, external memory);
- Optionally - a way for initial code-downloading into PSRAM before to start it:
  – From an external host via a communication interface - UART, CAN, SSC;
  – From Stand-by RAM (SBRAM) - after exiting a power-saving mode;
- Debug-related - either debugging will be possible, and if Yes - which debug-interface to use (JTAG, DAP, selectable pin-assignments).

The Easy Kit Board Manual covers only a limit numbers of start-up modes. For all possible start-up modes please refer to the corresponding user manual.

3.1 Switch S102

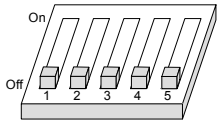
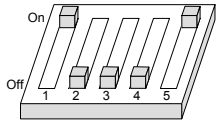
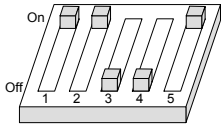
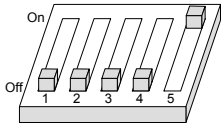
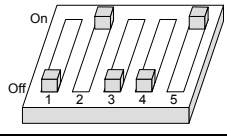
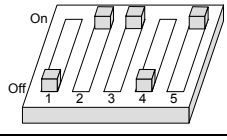
3.1.1 DIP Switch Setting XC2x (0-Series)

Table 6 DIP Switch Settings for S102

Name in schematic	Default configuration	Description
S102		Startup configuration: Standard start from internal Flash **OFF-OFF-xx-xx-xx**
S102		Startup configuration: Bootstrap loader ASC **ON-OFF-OFF-xx-xx**
S102		Startup configuration: Enhanced bootstrap loader ASC **ON-OFF-ON-xx-xx**
S102		Startup configuration Bootstrap loader CAN **OFF-ON-OFF-xx-xx**
S102		Startup configuration Bootstrap loader SSC **OFF-ON-ON-OFF-xx**
S102		Startup configuration All other positions are reserved

3.1.2 DIP Switch Setting XC2x (M / A / 5X -Series)

Table 7 DIP Switch Settings for S102

Name in schematic	Default configuration	Description
S102		Startup configuration: Standard start from internal Flash **xx-xx-xx-xx-OFF**
S102		Startup configuration: Bootstrap loader ASC **ON-OFF-OFF-xx-ON**
S102		Startup configuration: DAP Debug Mode (Pos.1) **ON-ON-OFF-xx-ON**
S102		Startup configuration: JTAG Debug Mode (Default) **OFF-OFF-OFF-xx-ON**
S102		Startup configuration: Bootstrap loader CAN **OFF-ON-OFF-OFF-ON**
S102		Startup configuration: Bootstrap loader SSC **OFF-ON-ON-OFF-ON**
S102		Startup configuration All other positions are reserved

3.2 Headers, Connectors and Components

3.2.1 USB Interface

The USB connector is used for connection to a PC. Via the USB it is possible to power the board, using the USIC0 Channel 0 as serial connection via USB and Debugging via DAS. For the pinout of USB socket see Figure 6.

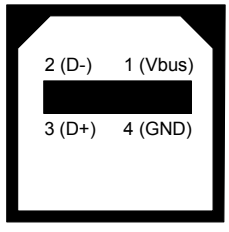


Figure 6 On-board header (P201)

3.2.2 CAN1/2 (X110, X111)

On the board are two CAN transceiver connected to the MultiCAN on XC2000 node 0 and 1. The transceivers are connected to two IDC10 plug. For the pinout of IDC10 plug see Figure 7. You can use a IDC female connector with crimpconnector, flat cable and SUB-D 9 plug with crimpconnector to have a 1:1 adapter to SUB-D 9.

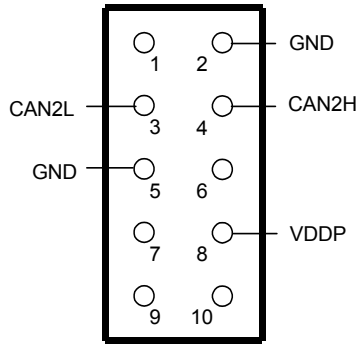


Figure 7 On-board header (X110,X111)

3.2.3 LIN Interface (X104)

The board has a connector with 4 pins for LIN. For the pinout of the connector see Figure 8. The LIN transceiver is connected to USIC1 Channel 0 module of the CPU.

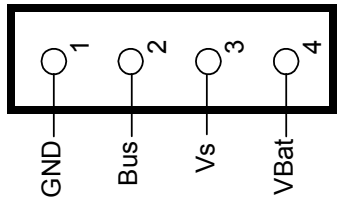


Figure 8 On-board header (X104)

3.2.4 OCDS Interface

The OCDS1 signals are connected to the IDC16 plug (X202). For pinout of the connector see Figure 9. You can connect any debugger to this connector.

The signals /BRKIN and /BRKOUT are not connected per default. If you need this signals in the connector then assemble R225 and R226 with a 0R resistor.

If you connect a debug hardware make sure that the MiniWiggler circuit is not activ (ACTIV LED is off) and on the DAP connector (X204) is no hardware connected or the hardware is tristated.

If the ACTIV LED is on, then stop the active DAS Server JTAG over USB Chip and/or remove the USB connection to the PC.

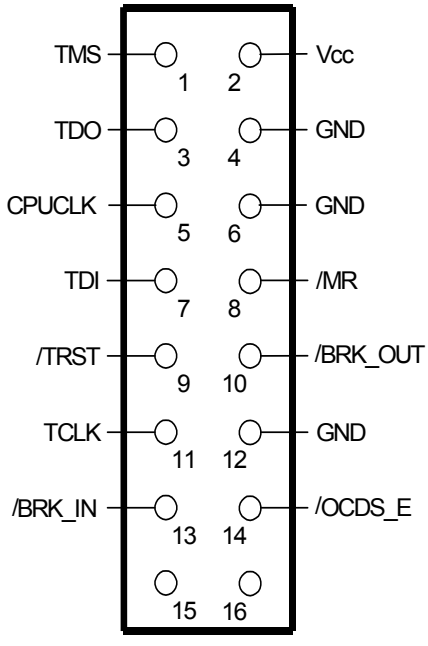


Figure 9 On-board header X202

3.2.5 DAP Interface

The board comes with a DAP connector (X204). For pinout of this connector see Figure 10. You can connect a DAP hardware here. If you use this connector make sure that the MiniWiggler is not activ (ACTIV LED is off) and a connected OCDS1 hardware is disconnected or tristated.

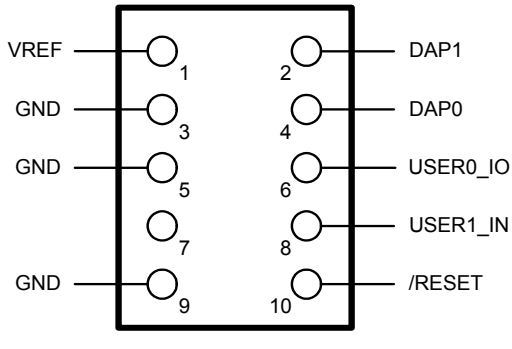


Figure 10 On-board header X204

3.2.6 ADC

On AN0 (ADC0) is a 10K potentiometer (R113) connected. You can apply a voltage between VAGND0 and VAREF0 to the AN0 channel via this potentiometer.

R116 is connected to AN0 (ADC1). The potentiometer is not assembled by default. You can assembled a potentiometer to use this connection. The footprint is prepared for a Burns potentiometer typ 3006.

3.2.7 LEDs

Port 10 pin 0 up to pin 7 are connected to single LED's (D101... D108) and can be controlled by Software. This status LED's are low active.

Table 8 LEDs description

LED number	Description
D201 (red)	Debug Run Mode (switched by DAS Server)
D202 (green)	Debug Active (Mini Wiggler circuit active)
D207 (red)	Power On Reset Active
D208 (green)	Board Voltage 5 Volt
D101 - D108 (yellow)	Status of P10L

3.2.8 Serial Eeprom

By default the USIC0 Channel1 of the XC2000 is connected to a serial EEPROM with a size of 128K (16.384 x 8). If the SSC bootstrap loader is needed the four resistors have been reconfigured as described in table 8.

Table 9 Serial Eeprom interface

Default Setting: SSC (USIC0 Channel 1)	SSC bootstrap loader (USIC0 Channel 0)
P10.5 (SCK) with R143	P2.5 (SCK) replace R143 with R144
P10.0 (SI) with R145	P2.4 (SI) replace R145 with R146
P10.7 (SO) with R147	P2.3 (SO) replace R147 with R148
P2.7 (CS) with R149	P2.6 (CS) replace R149 with R150

3.3 Pin Definition and Location

3.3.1 144 - Pinout

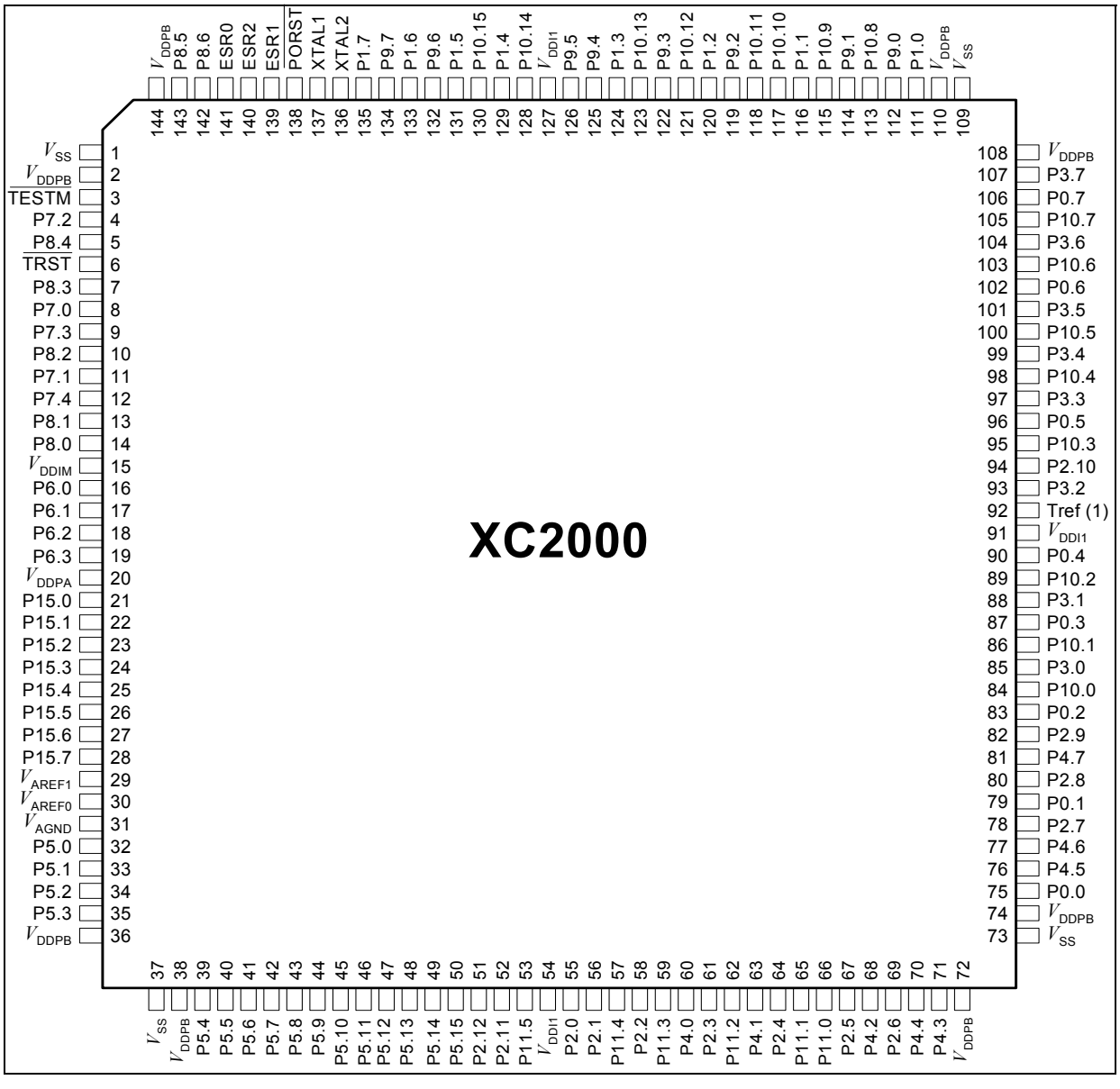


Figure 11 Pinout of the144 Pin device

Note: (1) For the M/A/5X-serie the Tref pin has been replaced by P2.13.

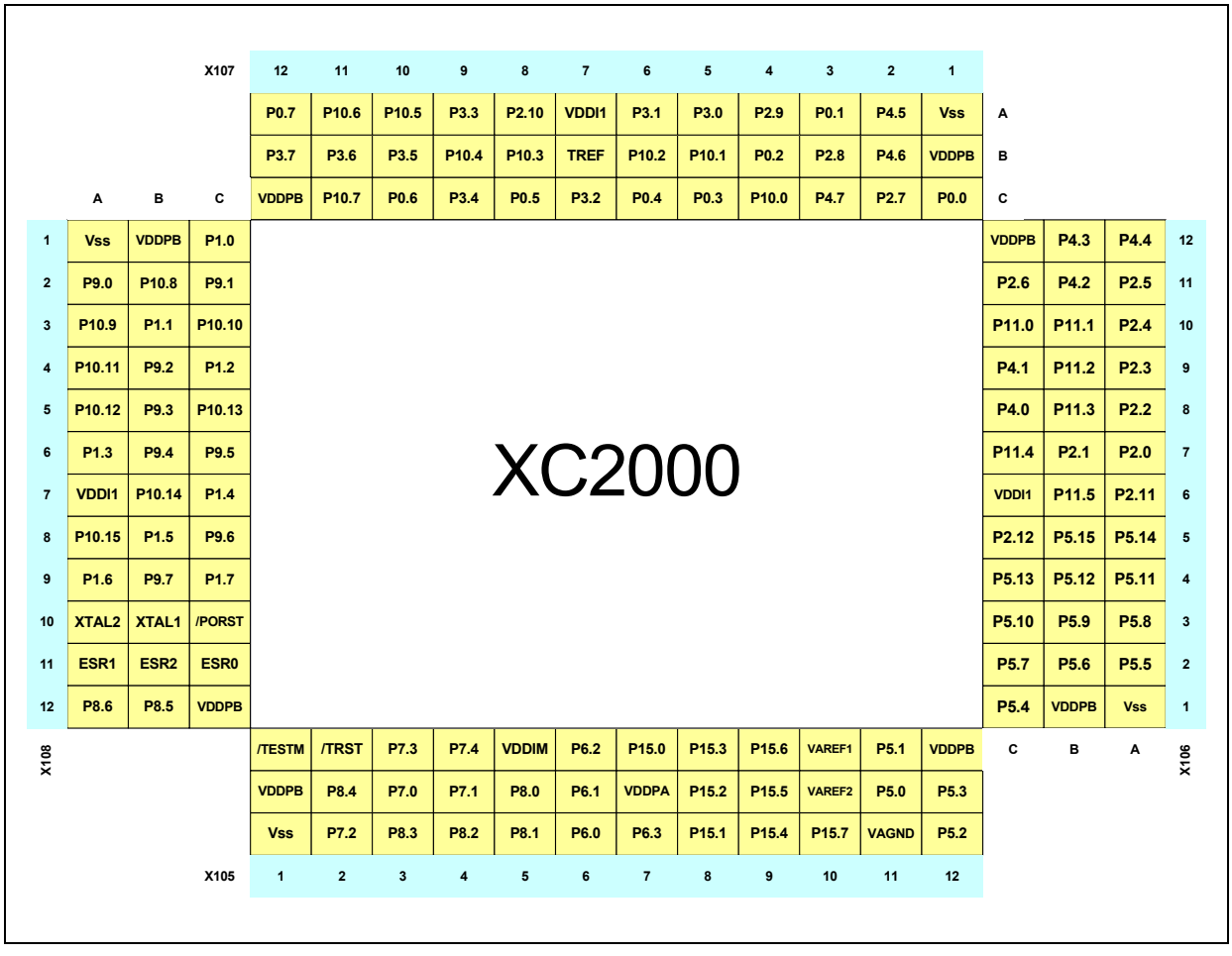


Figure 12 Pin connector of the144 pin device

3.3.2 100 - Pinout

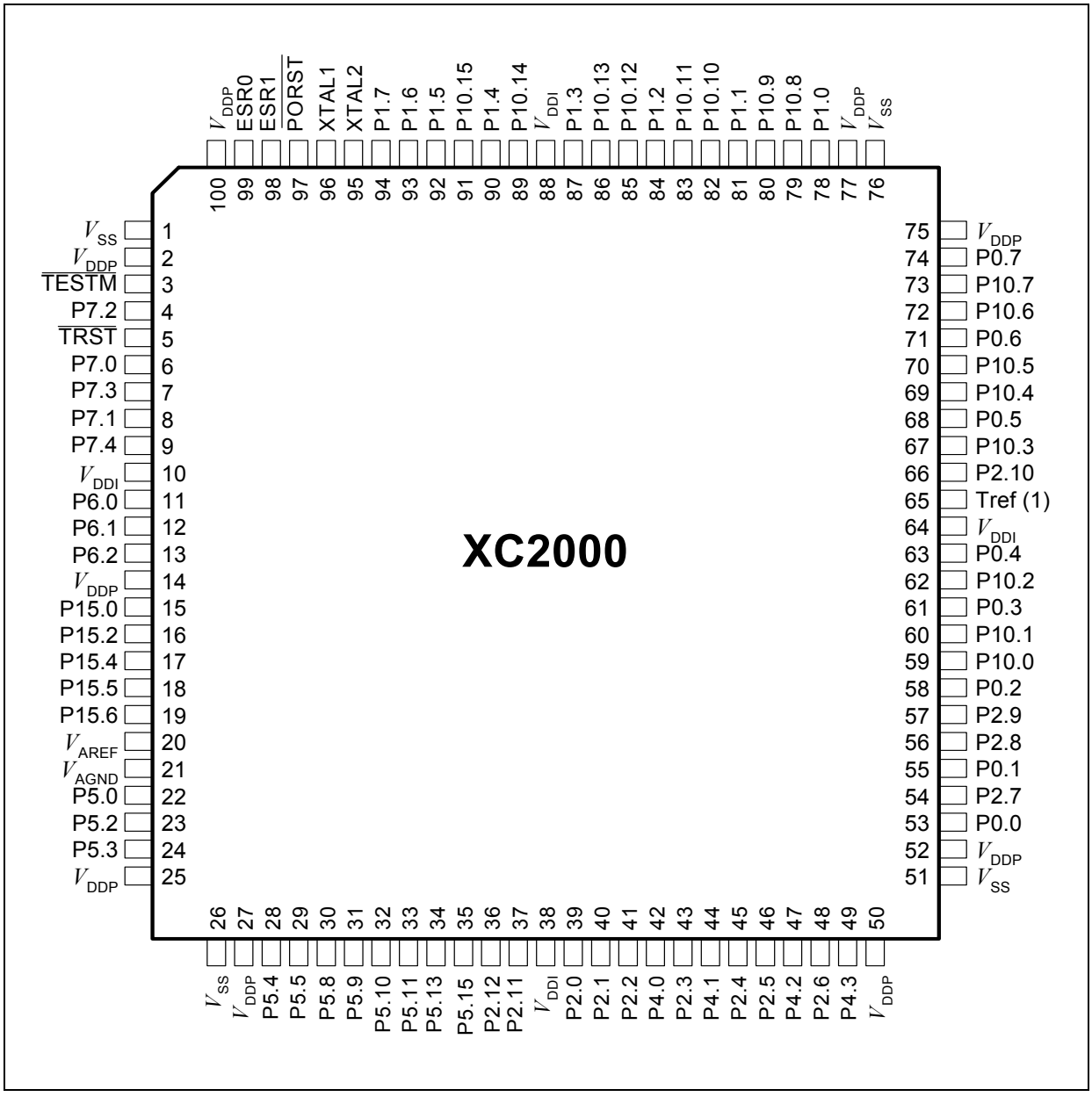


Figure 13 Pinout of the 100 pin device

Note: (1) For the M/A/5X-serie the Tref pin has been replaced by P2.13.

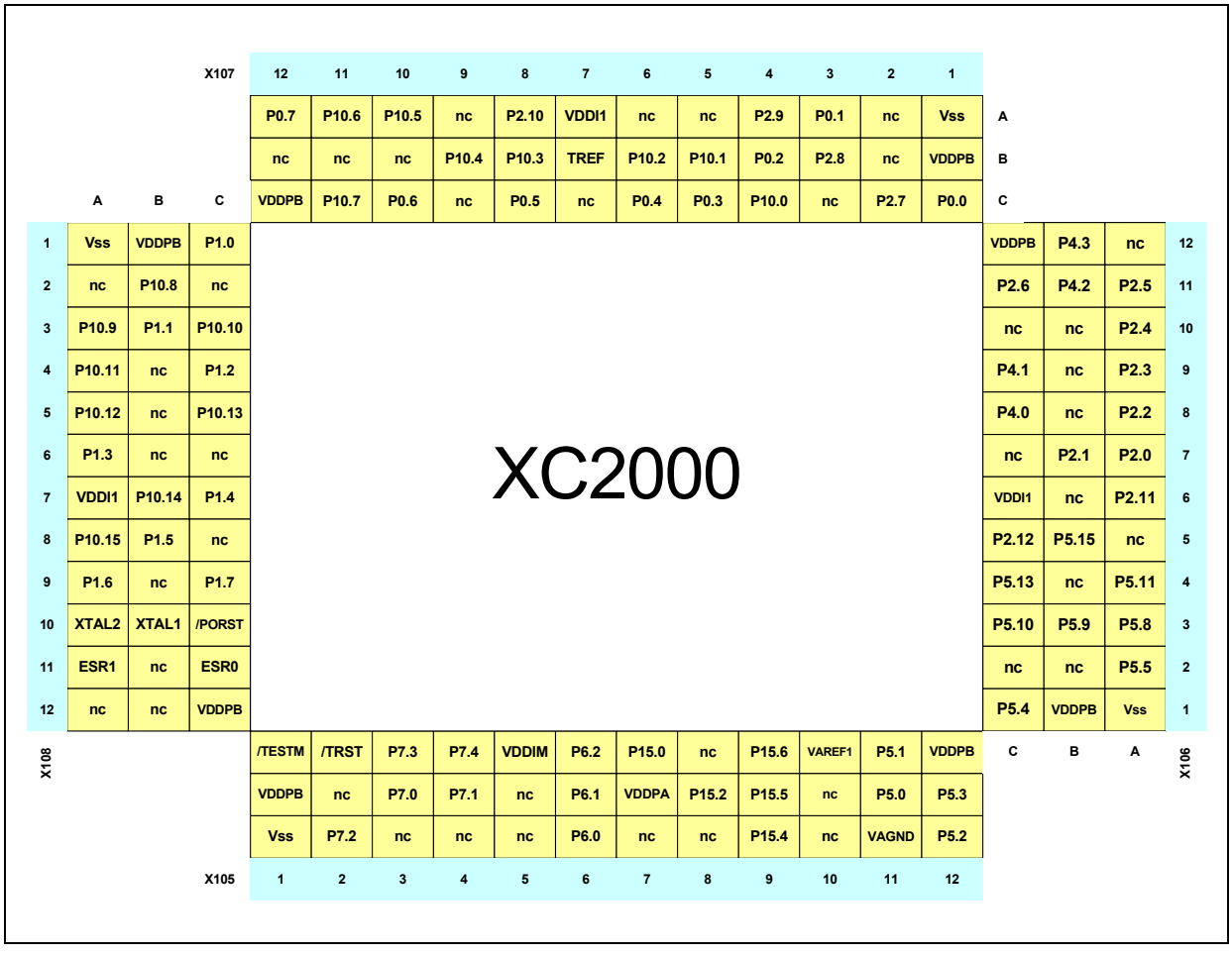


Figure 14 Pin connector of the 100 pin device

3.4 Zero Ohm Resistors

For configuration purposes several zero ohm resistors have been implemented. The functionality of these resistors are shown in the table below.

Table 10 Zero Ohm Resistors

Component	Name in schematic	Description
TLE 7259G (LIN Transceiver Board)	 R124 R125 / R126	 enable / disable connect / disconnect
TLE 6251DS (CAN Transceiver)	 R129 / R130 R136 / R137 R155 / R156 R131 R138 R135 R142 R133 / 134 R140 / 141	 connect / disconnect (CAN1) connect / disconnect (CAN2) or connect / disconnect (CAN2) enable / disable (CAN1) enable / disable (CAN2) supply Bus voltage internal / external (CAN1) supply Bus voltage internal / external (CAN2) connect Bus / disconnect Bus (CAN1) connect Bus / disconnect Bus (CAN2)
Microcontroller XC2xxx Analog reference Voltage supply	 R220 / R221 R219 R212 / R229	 change of analog reference source change of voltage supply
JTAG X202	 R225 R226	 /BRKIN (optional) /BRKOUT (optional)
AT25128N (Serial EEPROM)	 R143 / R145 R147 / R149 R144 / R146 R148 / R150	 connect to USIC1 Channel1 connect to USIC1 Channel1 connect to SSC bootstrap loader (U0C0) connect to SSC bootstrap loader (U0C0)

Table 10 Zero Ohm Resistors

Component	Name in schematic	Description
Status LED´s	R109	connect / disconnect LED´s to 5 V
Oscillator circuit	R117/R118	oscillator gain
FT2232D (USB to UART / JTAG Bridge):		
	R224	/BRKOUT (optional)
	R223	/BRKIN (optional)
JTAG-Option:	R242-R246	assembled with 0R
	R247-R253	open
DAP-Option:	R242-R246	open
	R247-R252	assembled with 0R
	R253	assembled with 47K
ASC Bootloader:		
144Pin / 100 Pin	R236-R237	assembled with 0R
	R238-R239	open
Other	R236-R237	open
	R238-R239	assembled with 0R
U203:	R210	For internal use only
EEPROM 93LC46B:	R207	If ORG functionality is needed

4 Memory Models

The memory space of the XC2000 is configured in a “Von Neumann” architecture. This means that code and data are accessed within the same linear address space.

Attached there are two examples for individual memory mapping of the XC2000 Board.

4.1 Internal Flash

As a example the XC2287-96F66L incorporates 768 Kbytes of embedded Flash memory (starting at location C0’0000$_H$) for code or constant data. It is operated from the 5Volt pad supply and requires no additional programming voltage. The Flash memory consists of three independent flash modules. Each module is 256 Kbyte wide. Each Flash array is organized in 64 physical sectors of 4 Kbytes. It combines the advantages of very fast read accesses with protected but simple writing algorithms for programming and erasing. The 128-bit code read accesses from the Flash memory realize maximum CPU performance by fetching two double word instructions (or four single word instructions) in a single access cycle.

Data integrity is enhanced by an error correction code enabling dynamic correction of single bit errors. Additionally, special margin checks are provided to detect and correct problematic bits before they lead to actual malfunctions.

The On-chip programming can be done either with a utility program, so called “Memtool” or with several other Toolchains. Memtool is using the ASC bootstrap Loader or USB JTAG wiggler (DAS). The latest version can be found on the Infineon website.

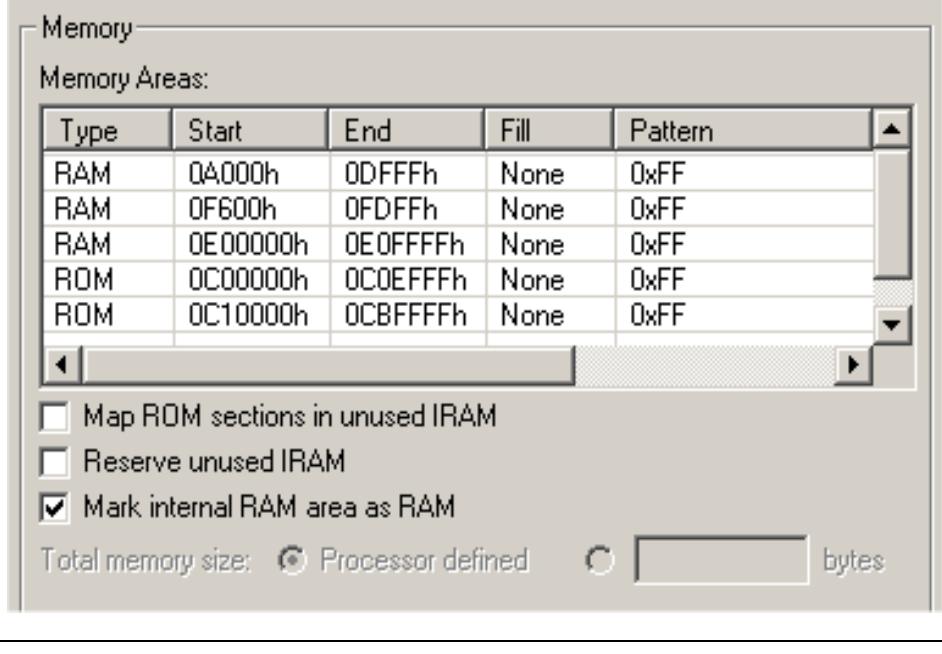


Figure 15 Example for memory mapping (internal flash, Tasking Clasic)

4.2 Internal PRAM

As a example the XC2287-96F66L provides 64 Kbytes of PSRAM (E0'0000$_H$ … E0'FFFF$_H$). The PSRAM provides fast code execution without initial delays. Therefore, it supports non-sequential code execution, for example via the interrupt vector table.

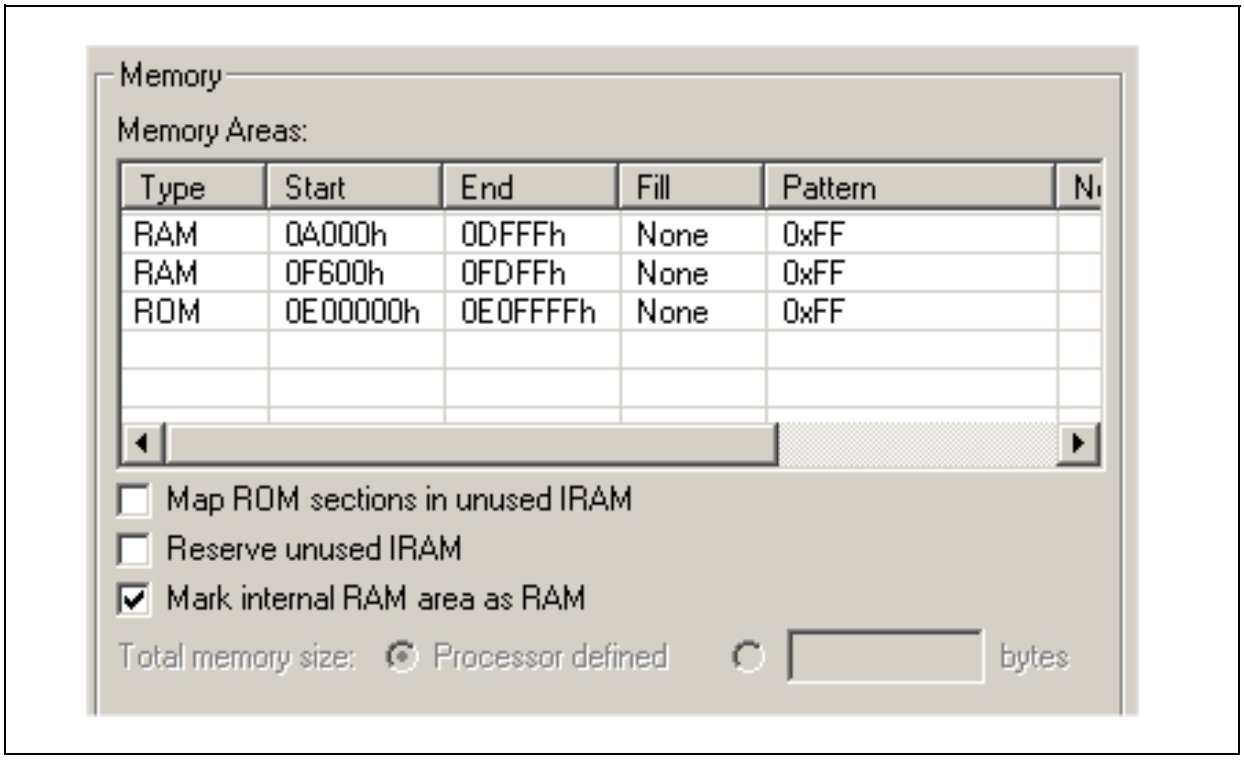


Figure 16 Memory mapping for internal PRAM (Tasking Clasic)

5 Getting Started

For the successful start up of the XC2000 Easy Kit, the following items should be done:

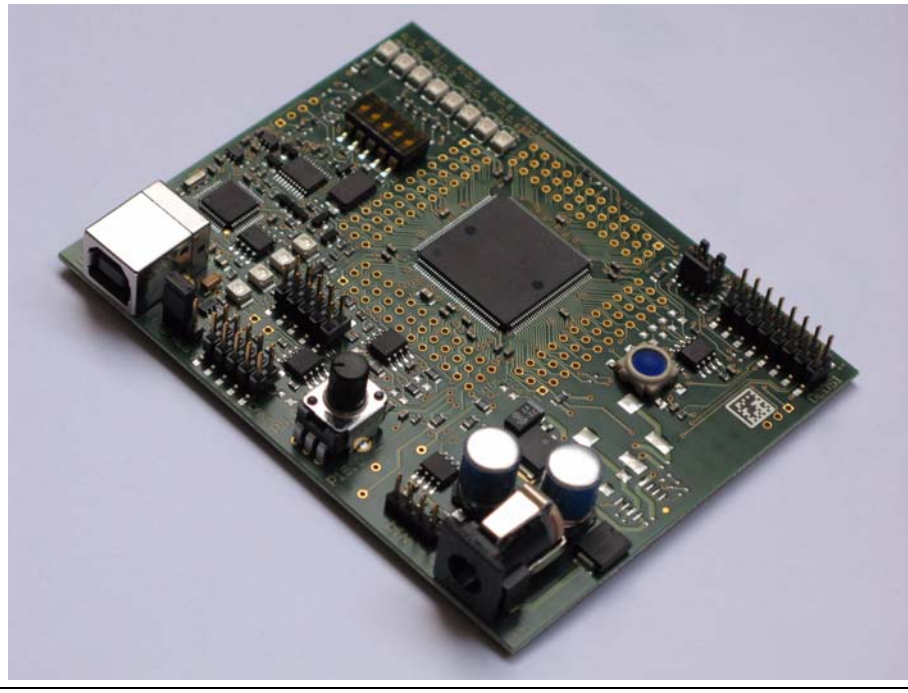


Figure 17 XC2000 Easy Kit (144-Pin)

By default a HELLO WORLD program can be executed. The following steps are needed to be successful.

1. Verify that the Jumper JP201 is in position 1-2 (powered via USB).
2. Connect USB cable with starterkit and PC.
3. Install DAS driver from starterkit CD.
4. Verify if the standard start mode is selected as described in chapter 3.1.
5. LED D105 connected with P10.0 should flash, otherwise press the Reset button.
6. Verify which COM port is activated for the FTDI - chip.
7. Execute the monitor program MTTTY from the starterkit CD.
8. Select the corresponding COM port, 19200 Baud, none parity, 8 data Bit, one stop bit, parser off.
9. Start connection (File/connect).
10. Press Reset button on the starterkit, Hello World program is running .

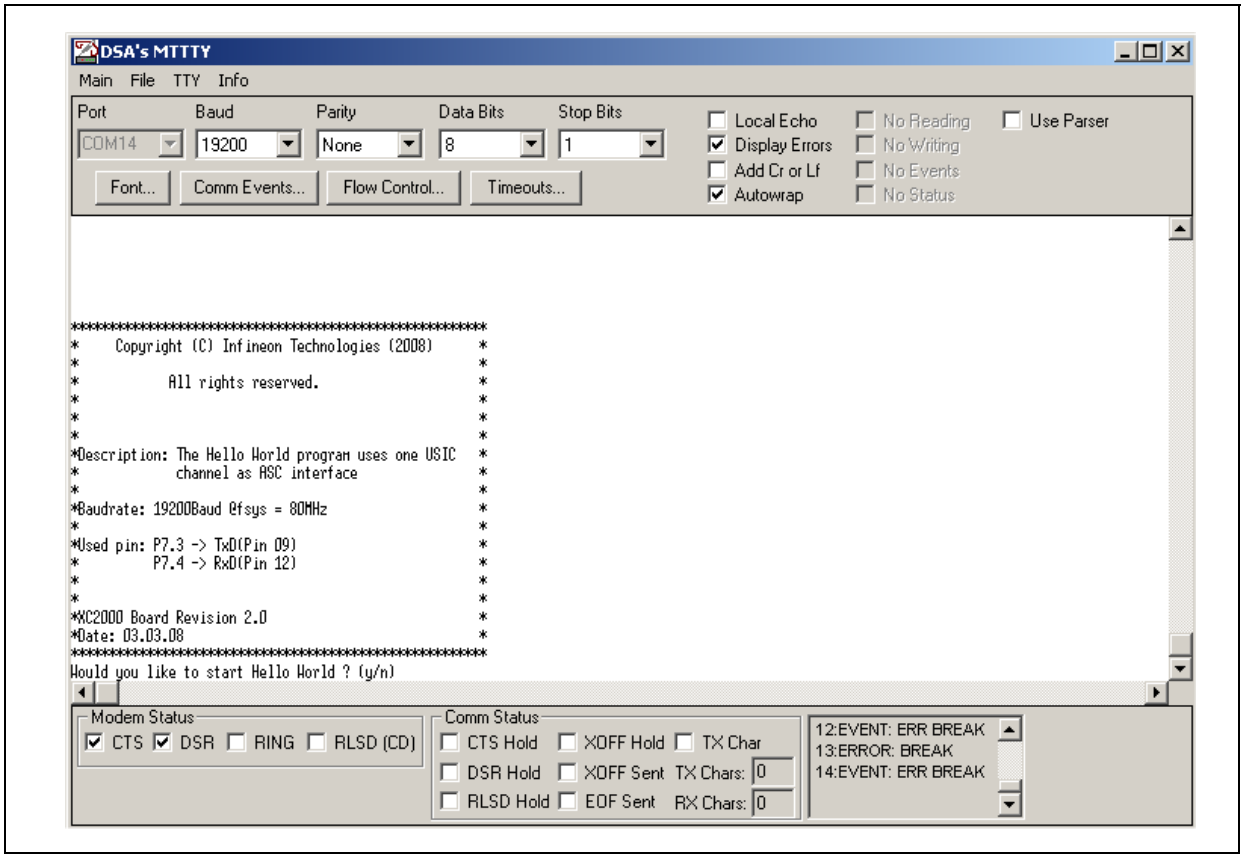


Figure 18 Monitor Program MTTTY with Hello World program

5.1 Power Supply

If more current is needed, a regulated DC power supply with max. 12 Volts should be connected to the power connector. The maximum power dissipation of the used voltage regulator has to be taken into account. By default one green LED should be active. It indicates that the embedded voltage regulator supply the microcontroller.

Please Note, the power supply is not part of the delivery !

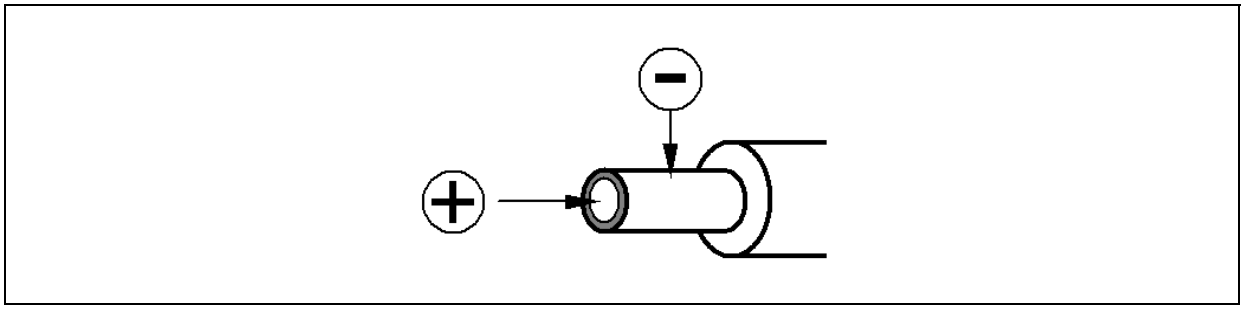


Figure 19 Power Supply Connector

5.2 OCDS Debugging Interface

The XC2000 Easy Kit offers two types of JTAG interfaces. With the FTDI chip an on board USB JTAG wiggler has been implemented. Further the USB interface allows to emulate a USB to UART bridge. Both can be done at the same time.

A simple 16 pin JTAG header can be used to connect a debugger from one of Infineon's tool suppliers. Both systems include an On-Chip Debug Support (OCDS) system, which provides convenient debugging, controlled directly by an external device via debug interface pins.

5.3 USB Interface for UART support

The USB connector is used for connection to a PC. Via the USB it is possible to power the board, using the ASC0 as serial connection via USB and Debugging via DAS. For the pinout of USB socket see Figure 6.

NOTE: Before connecting the board to the PC, make sure that the actual DAS software is installed on the PC. For actual DAS software please contact your local FAE.

The latest version of the software can also be found on the

DAS website

5.4 MemTool

Memtool is one of Infineon's solutions for programming code and data into FLASH Memory. Memtool supports on-chip FLASH Memory as well as dedicated Flash chips on the target board. It can be used either via ASC bootstrap loder mode or with USB JTAG wiggler (DAS).

5.4.1 Start Memtool

Go to Target dialog **(Target/Change)** and select as a example '**Easy Kit with XC2287**' from the list and Click 'ok'.

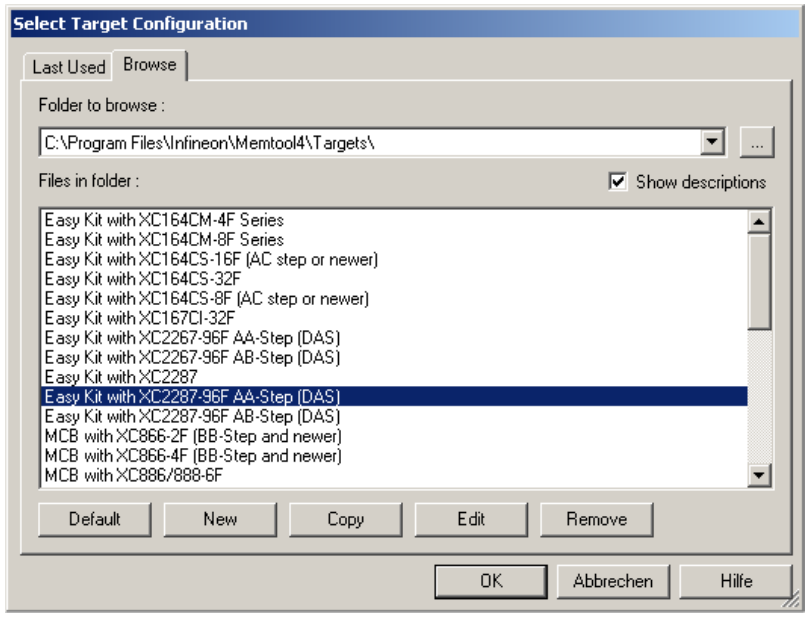


Figure 20 Configuration of the Microcontroller Type

If the requested type is not available please click on **(Default**) and pick up one from the default list. See figure 21.

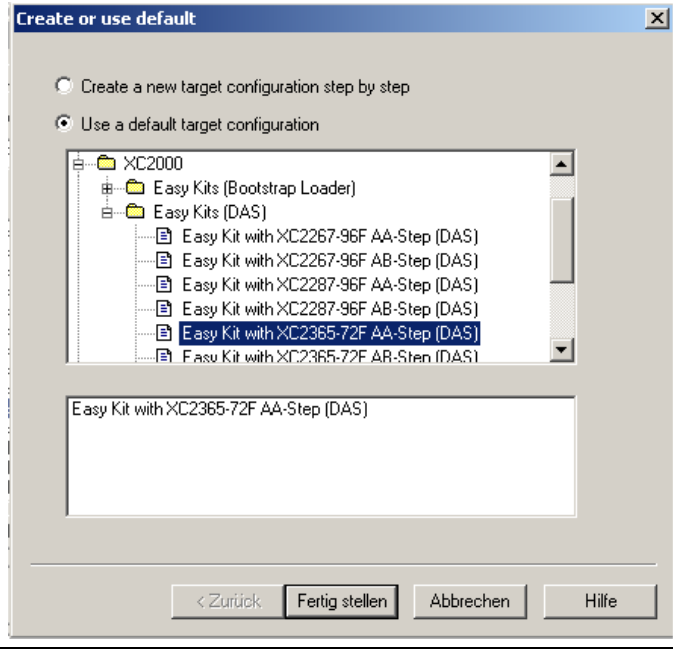


Figure 21 Default list

5.4.2 Connect to the Target

Make sure that the Starter Kit board is connected to your PC as well as to your power supply. Now press the 'connect' button in Memtool.

If the software status bar displays 'Ready for Memtool Command', you have successfully installed Memtool.

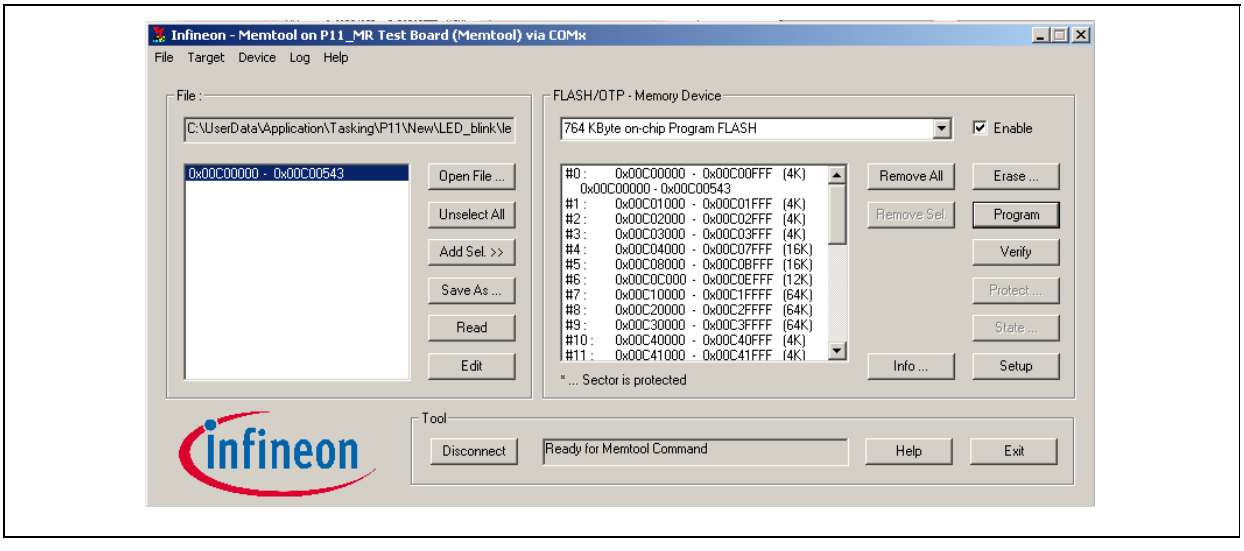


Figure 22 Successful Connection

5.4.3 Downloading of code

Click on the buttom **(Open file)** and select the source code. Click on **(Select All)** and **(Add Sel.)** In the final step click on **(Program)**. See figure 24.Ready !

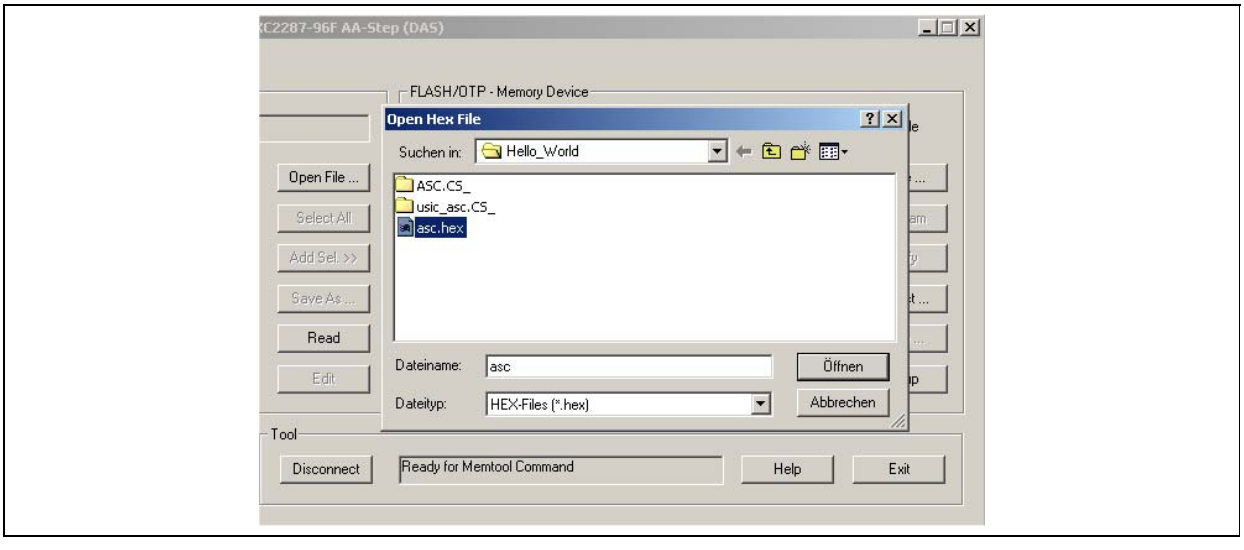


Figure 23 Load of code

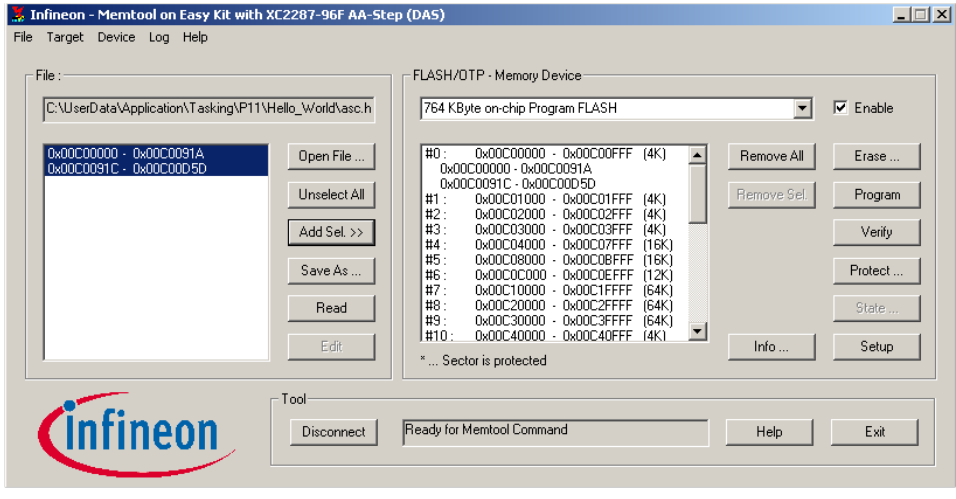
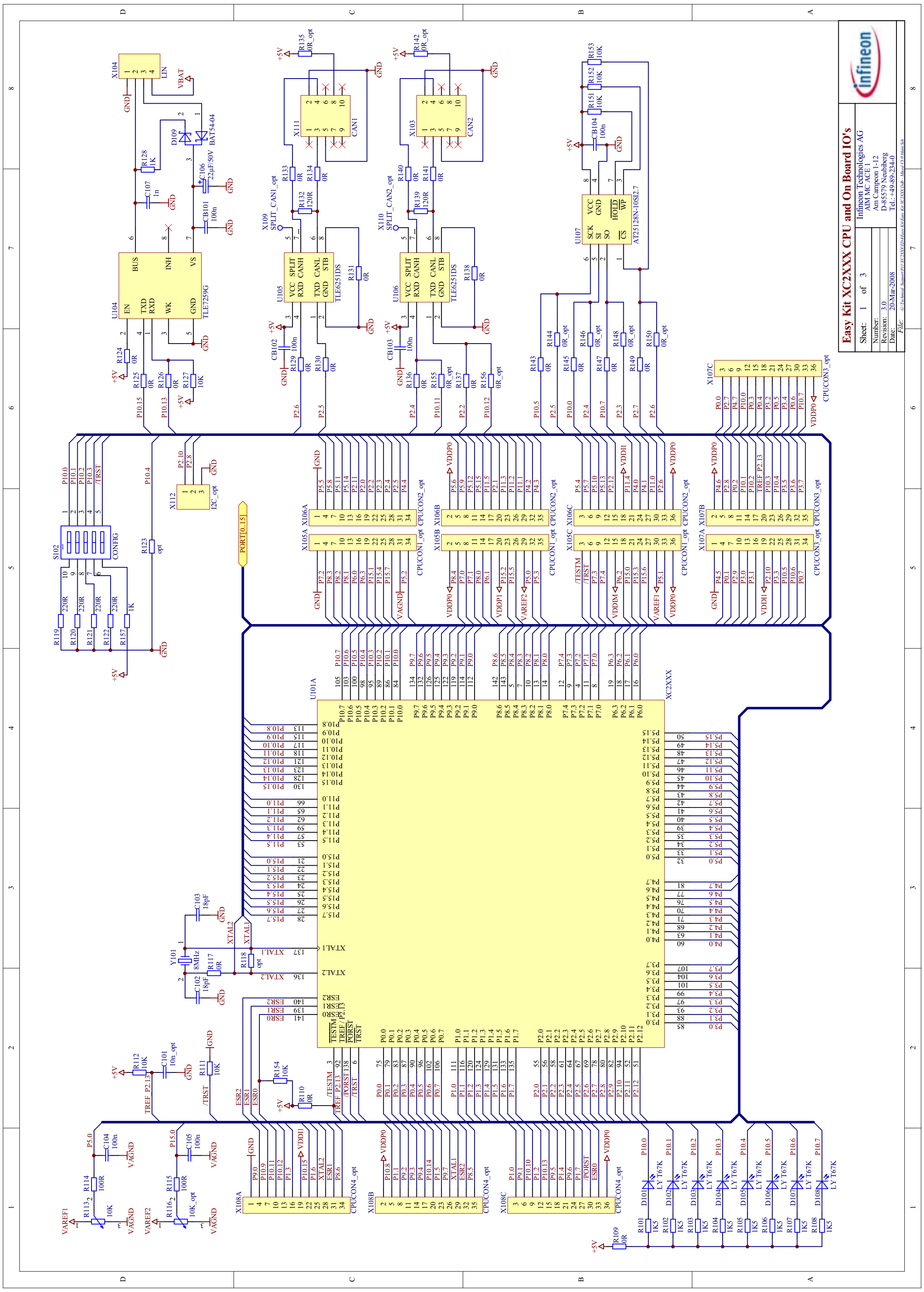


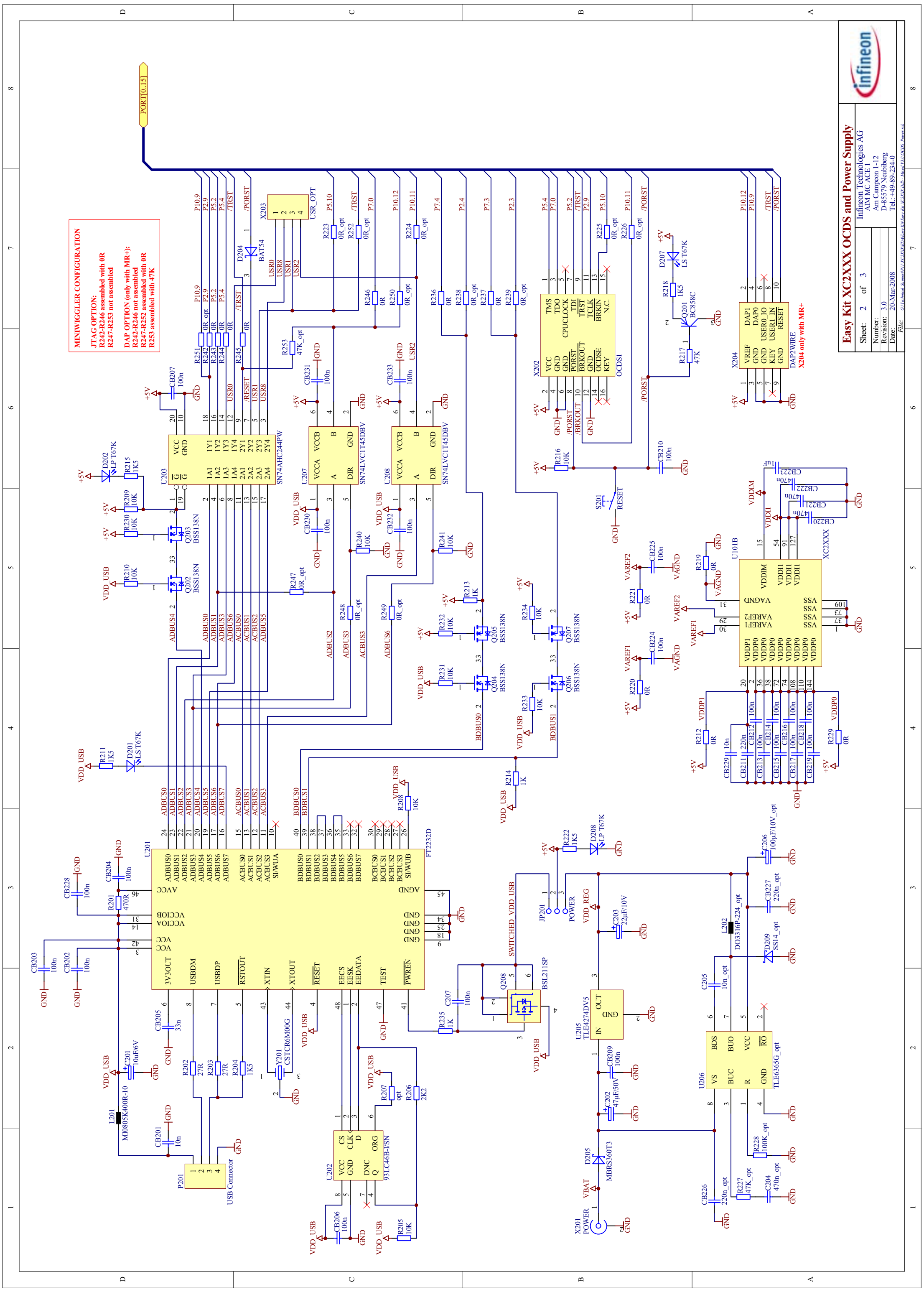
Figure 24 Program

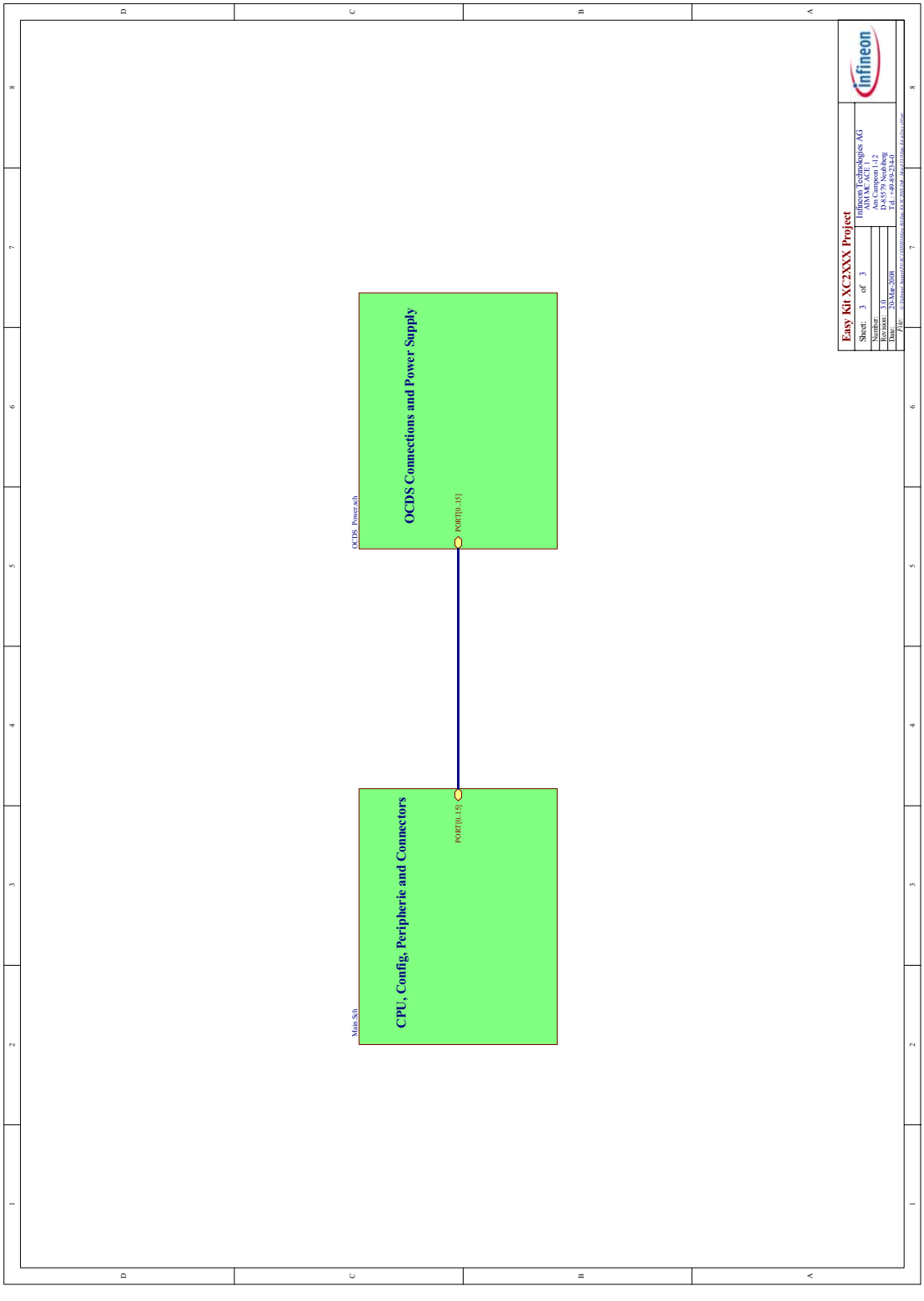
5.4.4 Execution Mode

After the code is programmed in the internal flash, disconnect from the Memtool and press the reset buttom. Now the code is executed form the XC2000.

6 Schematic


Easy Kit XC2XXX CPU and On Board IO's
Infineon Technologies AG


Easy Kit XC2XXX OCDS and Power Supply
Infineon Technologies AG


Easy Kit XC2XXX Project
Sheet: 3 of 3
Number: 3.0
Revision: 3.0
Date: 31-Mar-2008
OCDS Connections and Power Supply
OCDS_Power.sch
PORT[0..15]
CPU, Config, Peripherie and Connectors
Main.Sch
PORT[0..15]