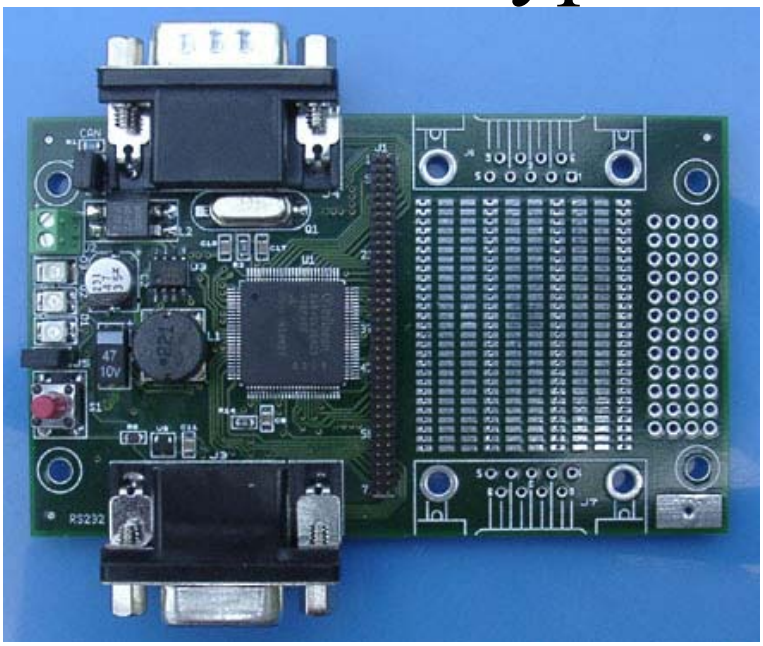
# XC164CS Prototype Board



**Features:**

- Small PCB (95 x 57 mm) with ground plane.
  - Designed to fit inside a Pac Tec FLX-4624 ABS enclosure
- Infineon XC164CS 16-bit single-chip microcontroller
  - 166SV2 core
  - 25 ns instruction cycle time at 40 MHz clock
  - 128 KByte Flash memory
  - 6 KByte SRAM
  - Interrupt system with 16 priority levels and 75 sources
  - DMA facilities (PEC transfers).
  - 14 ADC channels 10 or 8 bit resolution, 10 channels are connected to the extension header
  - TwinCAN (Rev 2.0B active)
  - 2 serial channels (USARTs)
  - Motor controller (including brush-less DC)
  - Real Time Clock
  - 100 pin TQFP package
- 10 – 35 supply voltage DC/DC converter
  - Green power indicator LED
- D-Sub-9 RS232 connector with RTS and CTS handshake signals
- D-Sub-9 CAN connector
- Jumper for CAN 120 ohm terminating resistor
- Reset push button
  - Red RSTOUT indicator LED
- BSL jumper for bootstrap loader start up
- Yellow general purpose LED
- 72 way extension header for nearly all microcontroller ports
- Large double sided SMD prototyping area, optimised for SMD shapes:
  - 0603, 0805, 1206
  - SOT-23, SOT-89, SOT-223
  - SO-8, SO-14, SO-16
  - And other shapes
- Small 0.1” grid area for through-hole components e.g. Headers, DIL-16, TO-220
- Footprints for 2 additional D-Sub-9 connectors.
- Large GND pad measurement reference e.g. oscilloscope probe
- Programmed with firmware suitable for:
  - Simple IO operations
  - Efficient CAN/RS232 converter.

## Introduction

The XC164CS prototype board is designed for rapid development of small systems including the Infineon XC164CS microcontroller and communication, sensor and/or actuator electronics. It is meant for use as a prototype platform for hardware and software development in a laboratory environment.

Without any additional electronics the board can be used as an RS232 to CAN converter. RTS and CTS signals are available for hardware handshake. The programmed firmware can be used for RS232 to CAN conversion and basic IO operations such as writing and reading IO pins. If you want anything else you will have to program the microcontroller yourself or find someone to do it for you.

## PCB

The board is a 4-layer printed circuit board. One of the inner layers is solely used as ground plane. The board dimensions are 57 x 95 mm. It has 4 mounting holes.

The PCB is designed to fit inside an ABS enclosure from Pac Tec Gmbh: FLX-4624 or FLXT-4624. Obviously you have to make slots for the connectors.

**Attention: The board is electrostatic discharge sensitive. Always observe proper precautions such as personnel grounding when handling the board.**

## XC164CS

The XC164CS is a small powerful 16-bit single-chip microcontroller from Infineon with many on-chip peripherals. Please refer to Infineon (www.infineon.com) for datasheets and user's manuals.

The on-chip Flash module provides powerful protection of data and code against undesired erasure, modification or read-access. This makes the device suitable for copy sensitive applications.

## Programming

Compilers and assemblers are available from several parties including Tasking (www.tasking.com) and Keil (www.keil.com ). The Memtool from Infineon is a fine tool for programming the on-chip Flash memory. Just place the BSL jumper, press the reset button and the prototype board is ready for connection to the Memtool. After programming remove the jumper and press the reset button again to start execution of the program

## Debugging

Minimon_XC16x is a free tool from Infineon that can be used for debugging by means of the RS232 link just like the Memtool. Alternatively you can use the On-Chip Debug Support (OCDS) system. All JTAG interface signals are available on the extension port. As the JTAG connector is not standardized you should make an adapter cable specifically for your JTAG debugging tool. Your compiler vendor presumably can supply you with various debugging tools.

Finally you may opt for a low-tech trial and error approach. The number of Special Function Registers (SFR) that need a value different from the default is really small:

- Disable or set the watchdog timer.
- Set PLLCON = 07384H to generate 40 MHz from the 10 MHz oscillator.
- Set SYSCON3 to disable or enable all the peripherals you need e.g. the value 0 will enable all peripherals.

In order to get started first write a small program that controls the general purpose LED. Next expand the program to output messages on the RS232 (or CAN) link. Don't forget to set the direction bits of the output pins involved.

**Power supply**

The board has a 2-way terminal block for DC power supply connection. A small '+' on the board indicates the position of the positive lead. The negative lead is connected to the ground plane. The board is protected against reverse power connection. The supply voltage is rated between 10 and 35 V. Without any additional electronics the board dissipates 1.0 W typically. The supply voltage is available on the extension port. Additional electronics should not draw more current than about 500 mA from this pin.

The supply voltage is converted into 5.0 V, which is used by the microcontroller and other components. The 5.0 V is also available on the extension port. Maximum total current is limited by the converter circuit to 0.5 A. Additional electronics should not draw more current than about 300 mA from this 5.0 V supply.

**RS232**

The board has a female D-Sub-9 connector with the following pinning:

1. Not connected
2. TXD
3. RXD
4. Not connected
5. GND
6. Not connected
7. CTS
8. RTS
9. Not connected

You can use a straight cable between your computer and the prototype board. You may even plug the board directly in the serial connector of you PC (after removing the screwlocks).

**CAN**

The board has a male D-Sub-9 connector with the following pinning:

1. Not connected
2. CAN_L
3. GND
4. Not connected
5. Not connected
6. GND
7. CAN_H
8. Not connected
9. Not connected

A 120 ohm terminating resistor is included on the board. The resistor is disconnected when the jumper adjacent to the CAN connector is removed.

**Extension Port**

The board contains a 1.27 mm pitch double row header with the following pinning that is used as extension port:

1. Primary voltage
2. 5.0 volt supply
3. GND
4. GND
5. P1H-7
6. P1H-6
7. P1H-5
8. P1H-4
9. P1H-3
10. P1H-2
11. P1H-1
12. P1H-0
13. P1L-7
14. P1L-6
15. P1L-5
16. P1L-4
17. P1L-3
18. P1L-2
19. P1L-1
20. P1L-0
21. P0H-7
22. P0H-6
23. P0H-5
24. P0H-4
25. P0H-3
26. P0H-2
27. P0H-1
28. P0H-0
29. P0L-7
30. P0L-6
31. P0L-5
32. P0L-4
33. P0L-3
34. P0L-2
35. P0L-1
36. P0L-0
37. EA
38. ALE
39. WR
40. RD
41. P4-3
42. P4-2
43. P4-1
44. P4-0
45. P3-15
46. P3-13
47. P3-12
48. P3-9
49. P3-8
50. P3-7
51. P3-6
52. P3-5
53. P3-4
54. P3-3
55. P3-2
56. P3-1
57. TRST
58. GND
59. P5-11
60. P5-10
61. P5-7
62. P5-6
63. P5-5
64. P5-4
65. P5-3
66. P5-2
67. P5-1
68. P5-0
69. P9-1
70. P9-0
71. NMI
72. RSTOUT

The extension port has a primary supply voltage pin, a 5.0 V pin and 3 GND pins. The other pins are directly connected to microcontroller pins. In fact nearly all port pins of the XC164CS are available on the extension port:

- Ports P0 is connected completely.
- Ports P1 is connected completely.
- Port P3 is connected completely except P3-10 and P3-11, which are used for RS232.
- Port P4 is connected partly. The 4 chip select lines are connected but the higher address bits A20…A23 are not connected.
- Port P5 is connected partly. 10 out of the 14 inputs are connected.
- Port P9 is connected partly. Only P9-0 and P9-1 are available. They can be used for the second CAN interface. The other pins are already used for the first CAN interface and for the RTS and CTS signals of the RS232 interface.
- Port P20 is connected completely and includes: EA, ALE, RD, WR and RSTOUT.
- NMI and TRST are connected.

Note that pin P3-6 is also connected to the yellow LED. In the same manner RSTOUT is connected to the red LED.

Although the smallest system is achieve when the microcontroller is used in single-chip mode, which is selected after a hardware reset by default, it is possible to use the External Bus Controller (EBC) for a connection to external memories. All the necessary signals are present on the extension port. Please refer to the XC164CS User's manuals for details.

The extension port may be used to connect a second board with peripheral electronics. In addition components on the prototype area may be connected to the header pins. These connections are typically soldered on the bottom side of the PCB using thin wire and a soldering iron with a micro tip.

For debugging purposes the JTAG and break signals are present on the extension port:
50. BRKIN
52. BRKOUT
53. TMS
54. TDO
55. TDI
56. TCK
57. TSRT
58. GND

As the JTAG connector is not standardized you should make an adapter cable specifically for your JTAG debugging tool.

**Prototyping area**
Almost half the board space is available for prototyping. The prototyping space includes a large double sided SMD prototyping area optimised for SMD components. It consists of 10 columns of 27 rectangular pads. In 4 columns the pads have vias connecting them to the pads on the other side. None of the pads have predefined functions. By utilizing both sides compact circuits may be achieved with minimal wire overhead.

You will need some soldering skills when mounting and wiring SMD components. We advise the usage of 1/0.25 mm solid core wire (30 AWG) or smaller and a soldering iron with a 0.25 mm round tip.

The board has footprints for 2 additional D-Sub-9 connectors. They can be used for example for a second RS232 and/or a second CAN interface.

The board has a 2.54 mm pitch grid area consisting of 4 x 12 round pads meant for through-hole components. For instance Headers, DIL components or TO-220 shapes.

**Frameware**
At delivery the microcontroller is programmed with frameware. This software contains basic IO functions and an efficient RS232 to CAN converter. Baudrates of both the RS232 link and the CAN controller can be programmed in a wide range up to 1 Mbaud. A windows application and a DLL are available to test the board and to demonstrate basic IO operation. The DLL communicates with the Frameware via the RS232 link with RTS/CTS handshake using a compact protocol. The DLL provides a straight forward programming interface.

In the Frameware the Flash read/write protection is not activated. The frameware can be erased easily with a Flash Programming tool.