Chip164

Microcontroller DIP-Chip

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General Description

The Chip164 is a high performance microcontroller DIP-Chip. Its small form factor allows the Chip164 to be easily inserted into standard DIL40 sockets as well as into target hardware.

The kernel of this module is given by the Infineon C164 microcontroller. It provides 128k Byte Flash as code memory and 128k Byte RAM as data memory.

An on board CAN transceiver allows direct connections to a CAN bus according ISO11898. A version without CAN transceiver for opto-isolated applications is available (see ordering information).

In Circuit Programming will be done with the C164 internal bootstrap loader via serial interface.

With the EASY215 there is a version with integrated PLC (IEC-61131-3 programmable) operating system available. This PLC-chip includes CANopen master functionality.

Features

- **Microcontroller C164CI-LM**
- **24 MHz internal clock frequency**
- **Bootstrap Loader**
- **Capture / Compare unit**
- **Watchdog timer**
- **Power management**
- **8 digital input or analog input 10bit**
- **2 digital I/O or CAN I/O**
- **22 digital I/O or special function port**
- **2k Byte controller internal RAM**
- **128k Byte Flash**
- **128k Byte RAM**
- **CAN bus ISO11898 transceiver 82C251**
- **Asynchronous serial interface (TTL-level)**
- **Synchronous serial interface**
- **Temperature range 0°-70° (other on request)**
- **Package DIL 40**

Applications

The Chip164 Module is optimized for automotive and industrial applications such as:

- **PLC, control kernels or minicomputer**
- **Several intelligent Interfaces**
- **Interface converter (Rs232 <--> CAN)**
- **Sensor controller**
- **Intelligent CAN node**
- **Decentralized I/O modules**
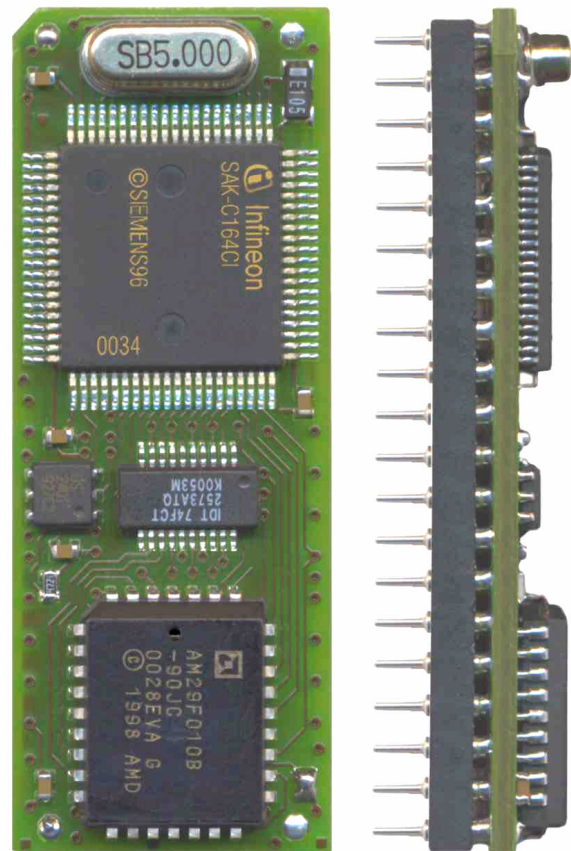
Ordering Information

Chip164 with CAN transceiver on board

Part	Temp. Range	Package
Chip164-24A	0 ^{o}C to 70 ^{o}C	DIL 40

Chip164 without CAN transceiver

Part	Temp. Range	Package
Chip164-24B	0 ^{o}C to 70 ^{o}C	DIL 40

Evaluation board (without Chip164)

Part	Description
EASY20x-EVA	Evaluation board to use with Chip164 microcontroller module

Chip164-Tools
The Download-Software FlashJet, several examples, startup files and demo projects may be downloaded from our web site.

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Pin Assignment

```
          VCC  □  1        40  □  P5_3
        BOOT#  □  2        39  □  P5_2
         P1_8  □  3        38  □  P5_1
         P1_9  □  4        37  □  P5_0
        P1_10  □  5        36  □  P8_1
        P1_11  □  6        35  □  P8_0
        P1_15  □  7        34  □  P5_4
        P1_14  □  8        33  □  P5_6
        P1_13  □  9        32  □  P5_5
        P1_12  □ 10        31  □  P5_7
          TxD  □ 11        30  □  P3_4
          RxD  □ 12        29  □  P3_6
         MRST  □ 13        28  □  P1_7
         MTSR  □ 14        27  □  P1_6
         SCLK  □ 15        26  □  P1_5
         CANH  □ 16        25  □  P1_4
         CANL  □ 17        24  □  P1_3
       RESET#  □ 18        23  □  P1_2
          GND  □ 19        22  □  P1_1
          GND  □ 20        21  □  P1_0
```

Pin Listing

Pin No.	Pin Name	Funktion
1	VCC	5V Power Supply
2	BOOT#	Boots Trap Loader
3 to 5	P1_8 to P1_10	- Digital I/O Port 1.8 –Port 1.10 - Capture Compare I/O of CAPCOM6 - Fast external interrupt input
6	P1_11	- Digital in- or output - Fast external interrupt input - Timer 7 input
7 to 10	P1_15 to P1_12	- Digital I/O Port 1.15 .. P1.12 - Capture Compare I/O of CAPCOM2
11	TXD*	- Digital in- or output Port 3.10 - Asynchronous serial interface transmit data (TTL-Level)
12	RXD*	- Digital in- or output Port 3.11 - Asynchronous serial interface receive data (TTL-Level)

Pin No.	Pin Name	Funktion
13	MRST	- Digital in- or output Port 3.8 - Synchronous serial interface Master receive Slave transmit
14	MTSR	- Digital in- or output Port 3.9 - Synchronous serial interface Master transmit Slave receive
15	SCLK	- Digital in- or output Port 3.13 - Synchronous serial interface Shift clock in- or output
16	CANH	*J1 open:* Receiver input of CAN module *No CAN transceiver, J1 closed:* - Digital in- or output Port 4.5 - Signal CAN Rx (receive)
17	CANL	*J1 open:* - Transmitter output of CAN module *No CAN transceiver, J1 closed:* - Digital in- or output Port 4.6 - Signal CAN Tx (transmit)
18	RESET#	Reset in- and output active low
19, 20	GND	Ground
21 to 28	P1_0 to P1_7	- Digital in-/output Port 1.0 - 1.7 - Capture Compare I/O of CAPCOM6
29	P3_6	- Digital in- or output Port 3.6 - Timer 3 count input
30	P3_4	- Digital in- or output Port 3.4 - Timer 3 extern. up/down input
31	P5_7	- Digital input Port 5.7 - Analog input channel 7 - Timer 4 count input
32	P5_5	- Digital input Port 5.5 - Analog input channel 5 - Timer 4 extern. up/down input
33	P5_6	- Digital input Port 5.6 - Analog input channel 6 - Timer 2 count input
34	P5_4	- Digital input Port 5.4 - Analog input channel 4 - Timer 2 extern. up/down input
35	P8_0	- Digital in-/output Port 8.0 - Capture / Compare I/O of CAPCOM2
36	P8_1	- Digital in-/output Port 8.1 - Capture / Compare I/O of CAPCOM2
37 to 40	P5_0 to P5_3	- Digital input Port 5.0 to P5.3 - Analog input channels 0 - 3

- **Pins are used also for in circuit programming of Chip164 with the boots trap loader.**

Handling the Device

Preventing latch up

The Chip164 is a CMOS device and may suffer latch up under the following conditions:
1) A voltage higher than VCC or lower than GND is applied to any pin.
2) Absolute maximum ratings are exceeded

BOOT#

Forcing a low level to this Pin during reset activates the Boots Trap Mode. See Chapter 'Interface'.

Handling unused Pins

Do not leave unused input pins open. This might cause malfunction of the device.

Power Supply Pins

Make sure that all ground and power supply pins are connected. Connect at least one ceramic capacitors of 100 nF and a tantalium capacitor of 1 µF between VCC and GND as close as possible to the device.

Output pins

All output pins for digital signals have a push/pull driver. All input / output pins are high impedance or default configured as input during reset. The Chip164 does not support internal pull up/down resistors. Use external components where needed.

Pull up/down resistors

The Chip164 does not support internal pull up/down resistors. Use external components where needed.

Pin Description

Most of the module pins are connected to the microcontroller directly. So refer for pins and the ports special functions to the 'Infineon C164 Users Manual'. See chapter "additional Literature".

VCC, GND: Power Supply Pins

Make sure that all ground and power supply pins are connected. VCC is +5V DC. Connect decoupling capacitors as close as possible to the device. See chapter "Recommended Operation Conditions" for details.

TXD, RXD: Asynchronous / Synchronous Serial Interface

The Asynchronous / Synchronous Serial Interface ASC0 provides serial communication between the Chip164 and other devices. The ASC0 supports full-duplex asynchronous communication up to 625 Kbaud and half-duplex synchronous communication up to 2,5 Mbaud.
On the Chip164 this interface is used for the In Circuit programming of the on board Flash memory using the boots trap loader of the C164 controller.

Boots Trap Mode: In boots trap mode, Jumper J3 must be closed or Pin BOOT# must have a low level during reset, the TXD and RXD pins are the transmitter and receiver pins of the asynchronous serial interface which is used for in circuit programming of the Chip164 Flash memory. The signals of these pins have TTL levels. So if you need a connection to a PC or another RS232 device, you have to add a RS232 driver circuit like it is shown by the followed figure.
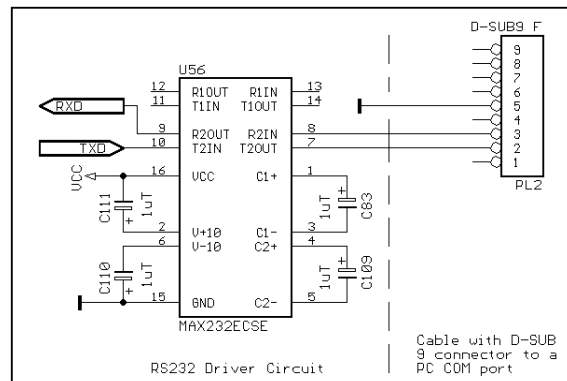
(Such a circuit is also needed with the FLASHJET programming tool)

Normal operation: For normal operation you may use these pins with own asynchronous or synchronous interface conditions in your application software.
If you need RS232 level, you can implement the same circuit, shown at the figure, in your application. See 'Infineon C164 Users Manual' for details.

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MRST, MTSR, SCLK: High-Speed Synchronous Serial Interface

The High-Speed Synchronous Serial Interface SSC provides flexible high-speed communication between the Chip164 and other microcontrollers. The SSC supports full-duplex and half-duplex communication up to 5 MBaud. The serial clock signal can be generated by the SSC itself (master mode) or be received from an external master (slave mode). Data width, clock polarity and phase are programmable. This allows communication with SPI compatible devices. See 'Infineon C164 Users Manual' for details.

CANH, CANL CAN Interface

The CAN Bus with its associated protocol allows communication between a number of stations which are connected to this bus with high efficiency. (Transfer speed up to 1 Mbaud) The integrated CAN Module handles the transmission and reception of CAN frames in accordance with the CAN specification V2.0 part B (active) completely auto-nomous. The on-chip CAN module can receive and transmit standard frames with 11-bit identifiers as well as extended frames with 29-bit identifiers. It provides full CAN functionality. The CAN ground signal is connected to module ground.
The Chip164 is available with and without the CAN transceiver.

Chip164 without CAN transceiver:
The Version without the on board CAN transceiver provides a user specific (opto isolated) CAN driver circuit at the application. Therefore the Jumpers J1 and J2 have to be closed. In this condition the CANH pin is connected to signal CANRX and CANL to CANTX (TTL level).

Chip164 with CAN transceiver:
With the on board CAN transceiver it is possible to connect the board directly to a two wire CAN bus associated to ISO11898.

Note: It is not allowed to close Jumper J1 or J2 if a CAN transceiver is on board. This might cause permanent damage to the device.

RESET#: Reset input/output pin

The internal reset chip does the power up reset. It pulls the RESET# line low for more then 50 ms. So it is possible to reset external components during power up using this signal.
The reset pin can also be used as reset input. For a correct device reset by external components, force a low level longer than 50 ms to the input RESET#.

Note: Do never drive low impedance high level to the RESET# pin. Use an open drain driver or a push button for this condition.

On Chip Memory

The memory space of the Chip 164 is configured in "Von Neumann" architecture. All memory elements will be selected by a chip select signal generated from the C164 internal chip select unit. The external bus is realized as a multiplexed 8-bit bus. Therefore and for an optimized bus configuration the registers SYSCON, BUSCONx and ADRSELx must be loaded with the correct values during the start up.

Following values are used in our startup:
SYSCON   = 0204h

See 'Infineon C164 Users Manual' for details.

You can find a standard startup file on the web site

U5 External RAM Memory

The external RAM size is 128 kByte and will be addressed by the C164 internal chip select line CS1. This size and the address space must be defined in the register ADDRSEL1. Signal timing and other bus access conditions must be set in the register BUSCON1.

Recommended values:
BUSCON1   = 0C67Eh
ADDRSEL1   = 00205h

The address rang for external RAM addressing is set with register ADDRSEL1. For smaller applications it is recommended to copy the complete code from external flash memory to RAM and then work only with RAM memory. This gives the advantage to use the same linker settings with your debugging tool and your release software.
The start164.a66 file uses this feature.

U3 External Flash Memory

The external Flash size is 128 kByte and works with the C164 internal chip select CS0. This Size and the address space must not to be reserved by the register ADRSEL1 to ADRSEL4. Signal timing and

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other bus access conditions must be set in the register BUSCON0.

Recommended values:
BUSCON0   = 046Dh
➔ Address range is the undefined range (rest)

The Flash memory type is an AMD 29F010. It's a device with 8 x 16 kByte pages.

See 'Infineon C164 Users Manual' and 'AMD Flash Datasheet' for details

Internal XRAM Memory

The internal XRAM memory size is 4 KByte. The address range is E000H to EFFFH. See 'Infineon C164 Users Manual' for details.

Internal RAM Memory

The internal RAM memory size is 1 KByte. The address range is F600H to FDFFH. See 'Infineon C164 Users Manual' for details.

U6 Silicon Serial Number (option)

The U6 is a DALAS DS2401 silicon serial number. Its internal ROM is accessed via a single data line. The 48-bit serial number, 8-bit family code and 8-bit CRC are retrieved using the DALAS 1-Wire protocol. This protocol defines bus transactions in terms of bus state during specified time slots that are initiated on the falling edge of sync pulses from the bus master. See 'DALAS DS2401 Datasheet' for details.

Software-Download

For software download your application board must provide serial line driver. See chapter "TXD, RXD: Asynchronous / Synchronous Serial Interface" for further details.

Use the Software FlashJet for downloading your application software to the Chip164's Flash memory.

The FlashJet software uses the C164's integrated boots trap loader. For activation of the boot mode you must force a low level to pin BOOT# (pin 2) or close jumper J3 during reset. Soldering might do this

but also closing the jumper only for the reset time using a screw driver or anything else is enough.

Steps for download:

1) Connect your application board to a serial interface of your PC.
2) Provide power supply to your application board
3) Start FlashJet software on your PC
4) Select file to download
5) Close jumper J3 on Chip164 or force low level to Pin2 (BOOT#)
6) Reset Chip164
7) Start download on FlashJet software
8) After download remove GND level from signal BOOT#
9) With the next reset, the Chip164 will start the downloaded program

Jumper-Plan

Placeplan

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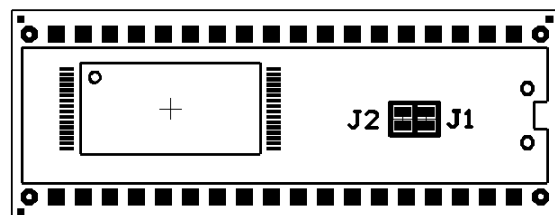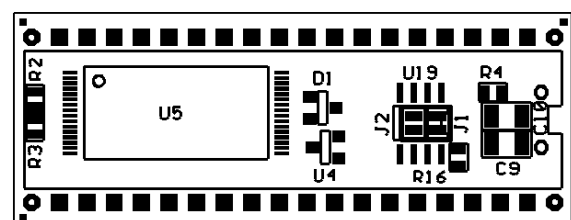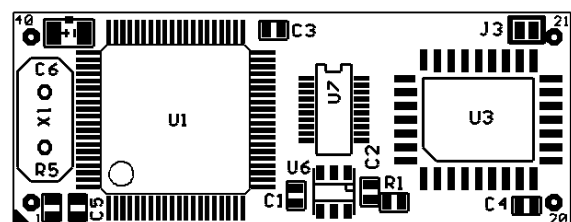
Absolute Maximum Ratings

Stresses greater than those listed parameters may cause permanent damage to the device. Functional operation should be restricted to recommended operation conditions. Exposure to absolute maximum rating conditions for extended times may affect reliability.

Parameter	Symbol	Rated Value		Units	Remarks
		Min.	Max.		
Power supply voltage	VCC	VSS – 0.3	VSS + 6.0	V	
Input voltage	Vi	VSS – 0.3	VSS + 6.0	V	Vi < VCC + 0.3V
Output voltage	Vo	VSS – 0.3	VSS + 6.0	V	Vo < VCC + 0.3V
Maximum Power dissipation	P_{MAX}		300	mW	
Operating temperature	T_A	0	+70	^{o}C	
Storing temperature	T_A	-55	+150	^{o}C	

See also C164 Datasheet for additional details

Recommended Operation Conditions and Characteristics

Functional operation should be restricted to recommended operation conditions.

Parameter	Symbol	Rated Value			Units	Remarks
		Min.	Typ.	Max.		
Power supply voltage	VCC	4.5	5.0	5.5	V	
Power supply current	I_{CC}		70	100	mA	All inputs V_{IL} or V_{IH} All output pins open

See also C164 Datasheet for additional details
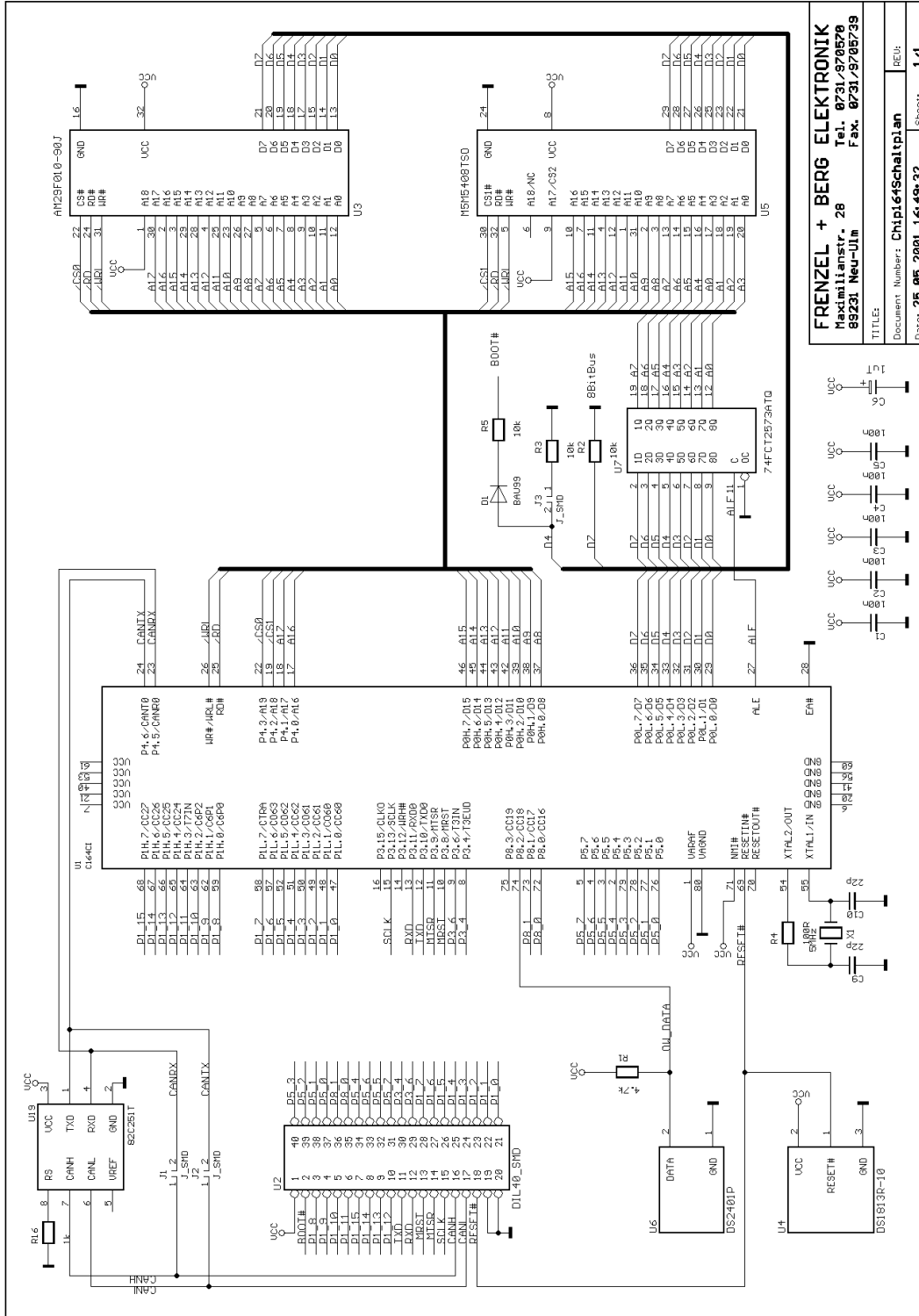
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Schematic

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Package Dimension

The package dimension of the the Chip164 (DIL-40) is 52,0 x 20,0 x 14,0 (L x W x H). Unit milimeters.

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