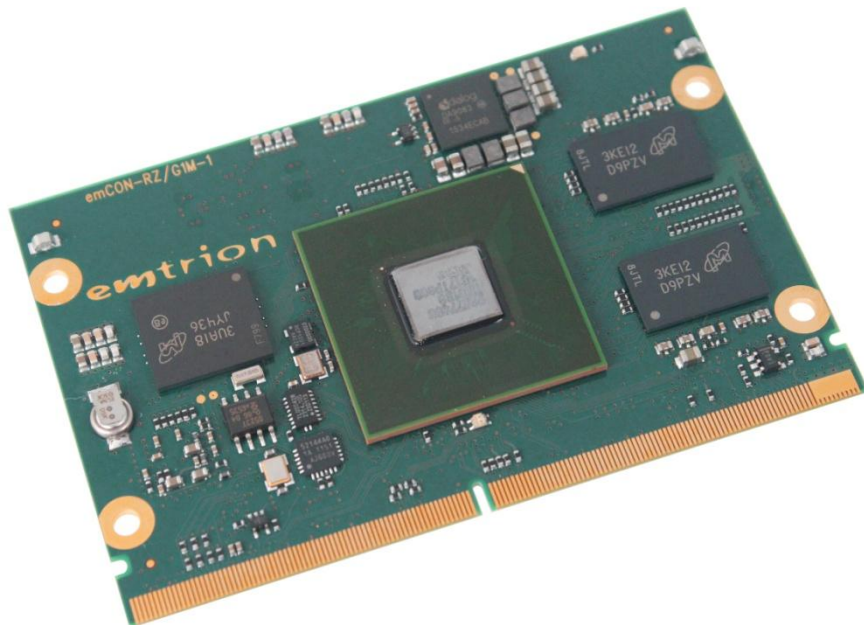


# emCON-RZ/G1C - Hardware Manual

---

Hardware Manual

V1 / 30.10.2017



© Copyright 2017 **emtrion GmbH**

All rights reserved. This documentation may not be photocopied or recorded on any electronic media without written approval. The information contained in this documentation is subject to change without prior notice. We assume no liability for erroneous information or its consequences. Trademarks used from other companies refer exclusively to the products of those companies.

Revision: **V1 / 30.10.2017**

| Rev | Date/Signature | Changes       |
|-----|----------------|---------------|
| 1   | 30.10.17/Bue   | First release |

## Contents

|        |                                       |    |
|--------|---------------------------------------|----|
| 1      | Introduction.....                     | 5  |
| 2      | Block Diagram.....                    | 6  |
| 3      | Handling Precautions.....             | 7  |
| 4      | Functional Description .....          | 8  |
| 4.1    | Processor.....                        | 8  |
| 4.1.1  | Processor Clocks .....                | 8  |
| 4.1.2  | Mode Settings .....                   | 9  |
| 4.2    | DDR3 SDRAM.....                       | 9  |
| 4.3    | NOR-Flash .....                       | 9  |
| 4.4    | eMMC .....                            | 9  |
| 4.5    | SD-Card Interface.....                | 9  |
| 4.6    | Ethernet.....                         | 10 |
| 4.7    | USB 2.0.....                          | 10 |
| 4.8    | Graphic Display Interfaces .....      | 10 |
| 4.8.1  | General.....                          | 10 |
| 4.8.2  | RGB Interface .....                   | 10 |
| 4.8.3  | LVDS Interface .....                  | 11 |
| 4.9    | Video Input.....                      | 12 |
| 4.10   | Composite Video Encoder/Decoder ..... | 12 |
| 4.11   | Audio Interface .....                 | 13 |
| 4.12   | Serial Ports.....                     | 13 |
| 4.13   | I <sup>2</sup> C Interfaces .....     | 13 |
| 4.14   | SPI Interfaces .....                  | 14 |
| 4.15   | CAN .....                             | 14 |
| 4.16   | General Purpose I/Os.....             | 14 |
| 4.17   | PWM.....                              | 15 |
| 4.18   | RTC .....                             | 15 |
| 4.19   | Status LED.....                       | 15 |
| 4.20   | Interrupts .....                      | 15 |
| 4.21   | Reset .....                           | 16 |
| 4.22   | Power Supply .....                    | 16 |
| 4.22.1 | Power Management Signals .....        | 16 |
| 5      | emCON Interface .....                 | 18 |
| 6      | Pin Assignments.....                  | 19 |
| 6.1    | J1, emCON Connector .....             | 19 |
| 7      | Signal Characteristics .....          | 23 |
| 7.1    | J1, emCON Connector .....             | 23 |
| 8      | Technical Characteristics .....       | 31 |
| 8.1    | Electrical Specifications .....       | 31 |
| 8.2    | Environmental Specifications.....     | 31 |
| 8.3    | Mechanical Specifications .....       | 31 |
| 9      | Dimensional Drawing .....             | 32 |

10 References..... 33

## 1 Introduction

The emCON-RZ/G1C module is a CPU board of emtrion's emCON-family based on the RZ/G1C processor from Renesas.

The RZ/G1C features basic functions for general-purpose and Rich Graphics applications. It is equipped with dual-core Cortex™-A7. The cores are accompanied by a variety of functions required for graphics and industrial applications. These functions include a 3D graphics accelerator, video processing unit, USB 2.0 controllers, 100 Mb Ethernet interface, CAN interface and others.

All interfaces are accessible through a 315 pin MXM type III edge connector. The pin assignment is defined by emtrion's emCON standard, which ensures a pin-to-pin compatibility within all emCON CPU modules.

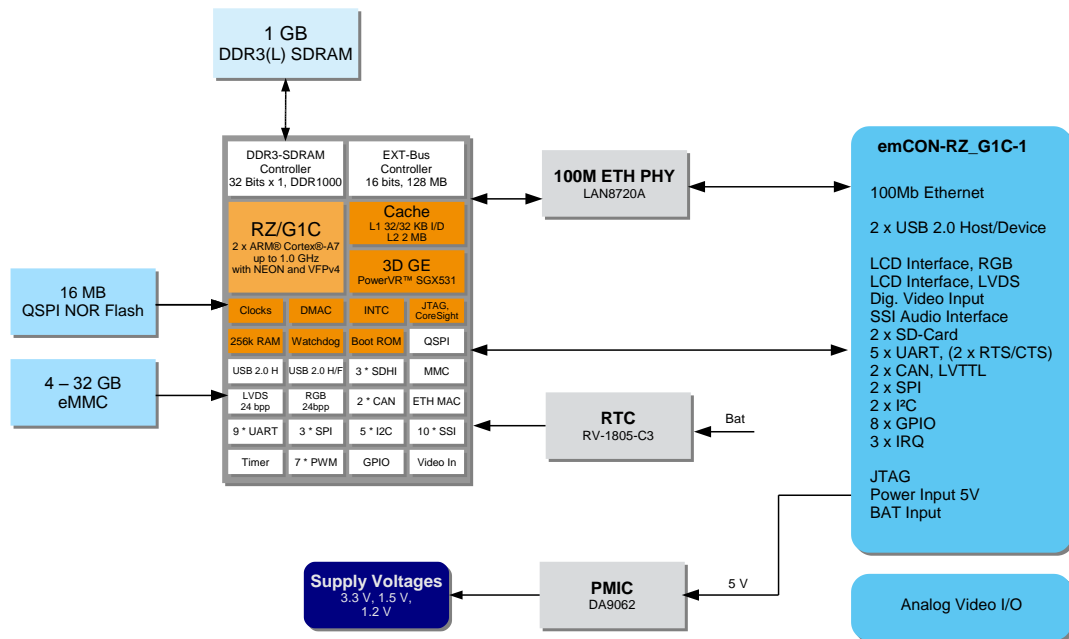
The following table lists the features and interfaces of the emCON-RZ/G1C processor module:

| <b>emCON-RZ/G1C</b>                              |
|--|
| 1 GByte DDR3L-1000 RAM                           |
| up to 32GB eMMC NAND Flash                       |
| PowerVR™ SGX531 3D graphics accelerator          |
| 1 x 10/100 Mbit Ethernet                         |
| 2 x USB 2.0 Host/Device                          |
| 1 x RGB interface, 18bit, max. 1080p (1920x1080) |
| 1 x LVDS interface, 24bit max. 1080p (1920x1080) |
| 1 x digital Video In, 8 bit                      |
| 1 x analog Video In                              |
| 1 x analog Video Out                             |
| 1 x SSI Audio                                    |
| 2 x SD Card                                      |
| 2 x CAN (LVTTTL)                                 |
| 5 x UART (LVTTTL)                                |
| 2 x SPI  |
| 2 x I2C  |
| 8 x GPIO, 3x PWM                                 |
| RTC, battery backed                              |
| JTAG   |

The module is available in commercial temperature range 0°C to 70°C and optionally in extended temperature range -40°C to 85°C.

## 2 Block Diagram

The following figure shows the block diagram of the emCON-RZ/G1C.



### **3 Handling Precautions**

Please read the following notes prior to installing the processor module. They apply to all ESD (electrostatic discharge) sensitive components:

- The module does not need any configurations before installation.
- The module does not provide any on-board ESD protection circuitry – this must be provided by the product it is used in.
- Before installing the module it is recommended that you discharge yourself by touching a grounded object.
- Be sure all tools required for installation are electrostatically discharged as well.
- Before installing (or removing) the module, unplug the power cable from your mains supply.
- Handle the board with care and try to avoid touching its components or tracks.

## 4 Functional Description

### 4.1 Processor

The emCON-RZ/G1C module is based on the processor RZ/G1C from Renesas [1]. It is equipped Dual Cortex<sup>®</sup>-A7 CPUs at 1 GHz. In addition to the CPU cores with their NEON<sup>™</sup>/VFPv4 extension and L1 and L2 Caches, the processor provides a lot of peripheral functions such as:

- DDR3-100 SDRAM controller with 32 bit data bus
- 100/1000 Mb Ethernet AVB
- 100 Mb Ethernet MAC
- Display unit with two independent channels for TFT displays with RGB and LVDS interface; resolutions up to 1080p (1920x1080) @60Hz and 24 bpp are supported
- 3D graphics engine PowerVR Series SGX531
- Two channel video input module
- Video processing unit
- Digital video Encoder and Decoder
- 2 x USB 2.0 Host with high-speed mode
- USB 2.0 Function with high-speed mode
- 3 x SD Card Host controller
- Audio interface with I2S format
- 2 x CAN controller
- 9 x UART with up to 128 byte FIFO
- 5 x I2C bus interface
- 2 x SPI interface
- JTAG debug interface

Further details of the processor can be found in the RZ/G1C Reference Manual [1].

#### 4.1.1 Processor Clocks

The processor is clocked by a 20 MHz main clock from a quartz crystal. Three internal PLLs multiply the 20 MHz clock input to the internally needed clocks. The core clock PLL (PLL0) is set to 1.6 GHz, the peripheral PLL (PLL1) is set to 1.56 GHz.

All clocks within the processor are derived from these PLL frequencies, via various software configurable dividers. More information about the RZ/G1C clock system is described in the CPG chapter of the RZ/G1C User's Manual [1].



#### 4.1.2 Mode Settings

The processor mode is configured by 31 configuration pins that are sampled at the end of reset.

All of these bits are fixed and cannot be changed by the user. The boot device is set to serial flash boot at 48.75 MHz.

#### 4.2 DDR3 SDRAM

The module incorporates two 4-Gbit DDR3(L) SDRAMs that are addressed as one 32 bits x 1 channel. The resulting RAM size is 1 GByte. The RAMs are clocked with 500 MHz (DDR3-1000 mode).

The address range of the DDR RAM is 0x40000000 – 0x7FFFFFFF.

#### 4.3 NOR-Flash

A 16 MByte QSPI NOR Flash is connected to the QSPI interface of the RZ/G1C processor. The maximum clock rate of the interface is 97.5 MHz.

#### 4.4 eMMC

To store the operating system and application data, normally an 8 GByte eMMC is available on the emCON-RZ/G1C module. It is connected to the MMC interface of the RZ/G1C using 8 data lines.

The signalling level of the MMC interface is sourced by VLDO2 of the PMIC DA9062. The default voltage is 3.3 V. It can be switched to 1.8 V by GPIO GP3\_12 for higher data rates.

The storage capacity of the eMMC can be adapted to customer's needs by soldering different chips. Please contact emtrion GmbH for your required eMMC capacity.

#### 4.5 SD-Card Interface

The RZ/G1C includes three SD Card Host interfaces. SDHI1 is used by the eMMC. The remaining two interfaces (SDHI0 and SDHI2) are connected to the SD Card interfaces SDC1 and SDC2 of the emCON connector.

The signaling voltage of both SD Card interfaces can be switched individually between 1.8 V and 3.3 V by the GPIOs GP5\_12 for SDHI0 and GP5\_19 for SDHI2. A low level selects 1.8 V and a high level selects 3.3 V.

Both interfaces can be configured to operate in Default, High Speed and SDR50 mode. Interface SDHI0 is also capable to be operated in SDR104 mode.

Watch that the active high Write Protect inputs of both interfaces are pulled high at the CPU module. The pin must be pulled low externally if a  $\mu$ SD socket is connected since these sockets do not incorporate a write protect switch.

## 4.6 Ethernet

The RZ/G1C processor incorporates two Ethernet interfaces, a 100/1000 Mbit Ethernet interface, Ethernet AVB, and a 10/100 Mbit Ethernet interface, Ethernet MAC. Only the 100 Mbit interface is available at the emCON connector, constrained by pin multiplexing.

The Ethernet MAC interface is connected to a PHY LAN8720A from Microchip by an RMII interface. The output signals of the PHY are connected to the lower data pairs of the GBE1 interface of the emCON connector. The PHY address is set to 1.

The LAN8720A is operated in REFCLK\_IN mode. A 50 MHz clock from a crystal oscillator is connected to the PHY and the ETH\_REFCLK input of the MAC inside the RZ/G1C.

The LED signals for speed and traffic are connected to specific pins of the GBE1 interface of the emCON connector.

## 4.7 USB 2.0

The RZ/G1C processor incorporates a USB 2.0 Host controller with two channels USB0 and USB1. The interface USB0 is connected to the Host interface pins of the USB 2.0 OTG port of the emCON connector. The interface USB1 is connected to the USB 2.0 Host interface of the emCON connector.

The PWEN outputs of both channels are inverted to be active low at the emCON connector.

A USB Function interface is not available.

## 4.8 Graphic Display Interfaces

### 4.8.1 General

A display unit with two independently controllable channels DU0 and DU1 is incorporated in the RZ/G1C processor. The maximum resolution of the display units is 1080 x 1920 pixels which is FullHD. The display units can either display the same image or fully independent images.

Both channels can drive digital RGB24 or YC data. Additionally one of them can be connected to a LVDs interface with 4 data pairs.

### 4.8.2 RGB Interface

The RGB interface of the RZ/G1C processor is connected to the RGB interface of the emCON connector. Only the upper 18 colour bits of the processor are used and connected to the lower 18 bits of the emCON interface.

The signal LCD\_BL\_CTRL of the emCON connector is driven by the signal PWM0 of the processor. The power control signal LCD\_BL\_EN is driven by GP4\_24. The signal LCD\_PANEL\_EN is driven by GP4\_25.

The following table summarizes the used data and control lines.

| Signal       | Description                               |
|--------------|---|
| LCD_D[17:0]  | 18 bit colour data                        |
| LCD_PCLK     | Pixel clock                               |
| LCD_HSYNC    | Horizontal synchronization signal         |
| LCD_DE       | Data enable signal                        |
| LCD_VSYNC    | Vertical synchronization signal           |
| LCD_PANEL_EN | Display power enable signal, GP4_25       |
| LCD_BL_EN    | Backlight power enable signal, GP4_24     |
| LCD_BL_CTRL  | PWM signal to control the backlight, PWM0 |

### 4.8.3 LVDS Interface

The LVDS interface of the RZ/G1C processor is connected to the LVDS1 channel of the emCON connector.

The backlight control signal LVDS1\_BL\_CTRL is driven by the pin PWM1 of the RZ/G1C processor. The pin LVDS1\_BL\_EN is driven by GP1\_22, the pin LVDS1\_PANEL\_EN is driven by GP1\_1 of the processor.

The following table summarizes the signals of the LVDS interface:

| Signal            | Description                               |
|-------------------|---|
| LVDS1_CLK_P/N     | Differential LVDS clock pair              |
| LVDS1_CH[3:0]_P/N | 4 differential LVDS data pairs            |
| LVDS1_PANEL_EN    | Display power enable signal, GP1_1        |
| LVDS1_BL_EN       | Backlight power enable signal, GP1_22     |
| LVDS1_BL_CTRL     | PWM signal to control the backlight, PWM1 |

The colour and control signal mapping to the LVDS signal pairs can be selected from 8 different modes. Typically Mode 0 is set, which results in following mapping:

| Signal   | Slot0 | Slot1 | Slot2 | Slot3 | Slot4 | Slot5 | Slot6 |
|----------|-------|-------|-------|-------|-------|-------|-------|
| LVDS_CH0 | G2    | R7    | R6    | R5    | R4    | R3    | R2    |
| LVDS_CH1 | B3    | B2    | G7    | G6    | G5    | G4    | G3    |
| LVDS_CH2 | DE    | VS    | HS    | B7    | B6    | B5    | B4    |
| LVDS_CH3 | CTL   | B1    | B0    | G1    | G0    | R1    | R0    |

Further information on colour mapping can be found in [1].

The following table shows the RGB colour mapping of the pins LCD\_D[23:0] at the emCON connector.

| LCD_D[23:0] | RGB666 (18 bit) |
|-------------|-----------------|
| LCD_D0      | B2              |
| LCD_D1      | B3              |
| LCD_D2      | B4              |
| LCD_D3      | B5              |
| LCD_D4      | B6              |
| LCD_D5      | B7              |
| LCD_D6      | G2              |
| LCD_D7      | G3              |
| LCD_D8      | G4              |
| LCD_D9      | G5              |
| LCD_D10     | G6              |
| LCD_D11     | G7              |
| LCD_D12     | R2              |
| LCD_D13     | R3              |
| LCD_D14     | R4              |
| LCD_D15     | R5              |
| LCD_D16     | R6              |
| LCD_D17     | R7              |
| LCD_D18     | n/c             |
| LCD_D19     | n/c             |
| LCD_D20     | n/c             |
| LCD_D21     | n/c             |
| LCD_D22     | n/c             |
| LCD_D23     | n/c             |

## 4.9 Video Input

The emCON-RZ/G1C processor incorporates a video input module with two channels. They can be used with different digital video sources, such as video CODECs or CMOS camera modules.

The interface VIN0 of the RZ/G1C processor is connected as 8-bit parallel interface to the CPI1 interface pins of the emCON connector. The serial MIPI interface CSI2 of the emCON connector is unused.

## 4.10 Composite Video Encoder/Decoder

The emCON-RZ/G1C processor incorporates a video encoder with 10 bit DAC for NTSC/PAL composite output signal. It also incorporates a video decoder with ADC and sync separator for two channel NTSC/PAL composite input signal.

Since the emCON connector does not provide contacts for analogue video input and output the output signal and the input channel 1 are available at a separate 5-pin connector of type Molex PicoBlade™. The input is terminated by a 75Ω resistor. 3.3 V supply is provided to add external video circuits to the signals.

## 4.11 Audio Interface

The audio interfaces SSI0 and SSI4 of the RZ/G1C processor are connected to the I2S audio interface pins of the emCON connector. SSI4 is the output channel, SSI0 is the input channel. Both channels have individual word select and clock signals so that they can be operated with different data formats and clock rates.

An external audio CODEC with I2S interface can directly be connected to the interface pins.

Since the audio interface clocks are derived from the internal processor clock M2φ with 195 MHz they do not fit perfectly to the needed audio frequencies. For example the frequency error at 44.1 kHz sample rate is 0.13%. To get exact audio frequencies an external audio clock source can be connected to the emCON pin I2S\_MCLK which is connected to the pin AUDIO\_CLKA input of the RZ/G1C processor.

## 4.12 Serial Ports

The emCON-RZ/G1C processor incorporates a couple of serial ports with different characteristics. At the emCON connector five UART interfaces are available; two of them incorporate modem control lines.

The serial interfaces HSCIF1, HSCIF2, SCIF-3, SCIF-4 and SCIF-5 of the RZ/G1C processor are connected to the emCON connector. The following table shows the usage of the UART interfaces:

| RZ/G1C peripheral | emCON interface | Modem Control |
|-------------------|-----------------|---------------|
| HSCIF1_A          | UART_A          | RTS/CTS       |
| HSCIF2            | UART_B          | RTS/CTS       |
| SCIF-3_A          | UART_C          | not available |
| SCIF-4_A          | UART_D          | not available |
| SCIF-5_C          | UART_E          | not available |

HSCIF1 at UARTA is used as standard debug and console interface (Terminal).

## 4.13 I<sup>2</sup>C Interfaces

The RZ/G1C processor incorporates six I<sup>2</sup>C interfaces. Three of them are used; the interfaces I2C2, I2C3 and I2C4.

The interfaces I2C2 and I2C3 are connected to the interfaces I2C1 and I2C2 of the emCON connector. The interface I2C4 is used on board to connect the PMIC and the RTC to the processor.

The I2C components on the module have the following characteristics:

| Function        | Device | Interface | High Level | I <sup>2</sup> C Address (7bit) |
|-----------------|--------|-----------|------------|---------------------------------|
| PMIC            | DA9062 | I2C4      | 3.3 V      | 0x58                            |
| Real Time Clock | RV1805 | I2C4      | 3.3 V      | 0x69                            |

The interfaces at the emCON connector operate with 400 kHz clock and have 2K2 pull-up resistors to 3.3 V.

#### 4.14 SPI Interfaces

The RZ/G1C processor incorporates three SPI interfaces MSIOF<sub>x</sub> and two QSPI interfaces. The pins of the QSPI interface QSPI1 are multiplexed with the SPI interface MSIOF0. The emCON connector provides pins for a 1-bit SPI interface and a 4-bit QSPI interface.

By default the interface QSPI of the RZ/G1C processor is connected to the interface SPI1 of the emCON connector. Alternatively the SPI interface MSIOF0 can be connected to the interface SPI1 of the emCON interface.

The following table shows the pin routing for SPI1 of the emCON interface:

| RZ/G1C QSPI1 | RZ/G1C MSIOF0 | emCON interface |
|--------------|---------------|-----------------|
| CLK          | MSIOF0_SCK_A  | SPI1_SCK        |
| SSL#         | MSIOF0_SS2_A# | SPI1_CS0#       |
| IO0          | MSIOF0_RXD_A  | SPI1_D0         |
| IO1          | MSIOF0_TXD_A  | SPI1_D1         |
| IO2          | -             | SPI1_D2         |
| IO3          | MSIOF0_SS1_A# | SPI1_D3         |

The interface MSIOF2 of the RZ/G1C processor is connected to the SPI2 interface of the emCON connector.

#### 4.15 CAN

The RZ/G1C processor incorporates two CAN controllers, which comply with the ISO11898-1 specification. The CAN protocol specification 2.0B, with standard and extended message frames, is supported. The maximum baud rate is 1Mbps.

The TX and RX signals of both interfaces are routed to the emCON connector as LVTTTL signals.

The interface CAN0\_B of the processor is connected to the interface CAN1 of the emCON connector. The interface CAN1\_A is connected to the interface CAN2.

CAN transceivers must be added externally.

#### 4.16 General Purpose I/Os

The emCON interface provides eight dedicated GPIO pins which are directly connected to the RZ/G1C processor. The following table shows the signal connections:

| emCON Signal | RZ/G1C Pin | Direction |
|--------------|------------|-----------|
| GPIO_1       | GP5_0      | In/Out    |
| GPIO_2       | GP5_1      | In/Out    |
| GPIO_3       | GP5_2      | In/Out    |
| GPIO_4       | GP5_3      | In/Out    |
| GPIO_5       | GP5_4      | In/Out    |
| GPIO_6       | GP5_5      | In/Out    |
| GPIO_7       | GP5_6      | In/Out    |

| GPIO_8 | GP5_7 | In/Out |
|--------|-------|--------|
|--------|-------|--------|

All signals have LVTTTL level and can drive up to +/-4 mA when configured as output.

#### 4.17 PWM

The RZ/G1C processor incorporates seven PWM timers. Two of them are directly connected to the emCON connector:

| emCON Signal  | PWM Channel | Usage             |
|---------------|-------------|-------------------|
| LCD_BL_CTRL   | PWM0        | Backlight dimming |
| LVDS1_BL_CTRL | PWM1        | Backlight dimming |
| PWM_FAN       | -           | Fan speed control |

PWN\_FAN is not needed. Due to the low power consumption of the processor there is no need for a fan.

The signal level of the PWM outputs is 3.3V. The output drive strength is +/-4 mA.

#### 4.18 RTC

To enable time keeping while the module is powered off a RTC RV-1805-C3 from Micro Crystal is populated. The RTC is connected to I<sup>2</sup>C interface I2C4 of the RZ/G1C processor. The 7-bit I<sup>2</sup>C address of the RTC is 0x69.

The RTC is buffered by a local super capacitor, which is charged while the supply of the board is on. The charging time is about 30 min. The fully charged capacitor buffers the RTC for typically 70 days. Additionally a 3.3 V battery can be connected externally at the pin VBAT of the emCON connector. The battery current consumption of the RTC is below 60 nA.

#### 4.19 Status LED

A bicolour LED is connected to the pins GP3\_27 and GP3\_28 of the RZ/G1C processor.

If only GP3\_27 is high the LED is lighting red, if only GP3-28 is high the LED is lighting green. If both bits are high the LED is lighting yellow.

#### 4.20 Interrupts

The RZ/G1C processor has an integrated interrupt controller that analyzes all interrupt sources, prioritizes them and outputs the interrupt with the highest priority to the CPU core. The interrupts can be configured to be edge triggered on rising or falling edge or to be level sensitive on high or low level.

The emCON connector specifies six interrupt inputs. Two of them are provided for touch interface controllers. Three additional inputs are generous interrupt inputs. The last interrupt input is provided as power fail input.

Four interrupts inputs are connected to the RZ/G1C processor.

The following table shows the interrupt connections of the emCON connector:

| emCON Signal | RZ/G1C Pin  |
|--------------|-------------|
| IRQ_TOUCH1#  | <b>IRQ4</b> |
| IRQ_TOUCH2#  | -           |
| IRQ_1        | <b>IRQ5</b> |
| IRQ_2        | <b>IRQ6</b> |
| IRQ_3        | -           |
| POWERFAIL#   | <b>NMI</b>  |

The interrupt inputs at the emCON connector are pulled high by 10 kΩ resistors.

#### 4.21 Reset

There are several ways to cause a power reset of the board:

- 3.3V supply voltage fails
- the signal RESI# of the emCON connector is driven low
- the signal JTAG\_RESI# of the emCON connector is driven low
- setting the SHUTDOWN bit in the PMIC DA9062
- clearing the bit RESOUT in register RSTOUTCR of the processor RZ/G1C
- expiration of the watchdog timer

All resets cause hardware resets of the whole board.

The duration of the reset signal is min. 100 μs. To reset external devices the reset signal is driven to pin RESO# of the emCON connector.

#### 4.22 Power Supply

The power consumption of the module is **1.5 A** at +5V, +/- 5%. The current consumption depends on the software running.

All supply voltages that are needed for the processor and the other components are generated on board by the Power Management Chip DA9062 from Dialog Semiconductor.

The output voltages of the PMICs can be configured via the I<sup>2</sup>C interface I2C4. The 7-bit I<sup>2</sup>C address of the PMIC DA9062 is 0x58.

##### 4.22.1 Power Management Signals

###### POWER\_ON\_BASE

While the 3.3 V supply of the CPU module is switched off, it must be ensured that no external peripherals with 3.3 V interface are driving input pins. Otherwise unintended current flow might happen across the data lines.



The signal POWER\_ON\_BASE is used to switch off the 3.3 V supply of external components. The signal is high while the 3.3 V supply on the module is active. Otherwise the signal is low. The power switch must be realized on the carrier board.

**POWERFAIL#**

The signal POWERFAIL# is an input to signalize a power fail condition. The signal is connected to the NMI input of the RZ/G1C processor.

**BAT**

The pin BAT at the emCON connector is used as battery input for the RTC's backup power supply. The typical power consumption of the RTC at the BAT pin is  $< 0.5 \mu\text{A}$ .

## 5 emCON Interface

All interface signals of the board are available at the emCON connector.

The emCON interface is a 314 pos MXM connector. These sockets are available from various manufacturers.

The pin assignment is emtrion specific and match for the most needs of interfaces for actual embedded designs. Depending on the features of the CPUs every emtrion CPU module will use a subset of the emCON connector. More details can be found in emtrion's emCON specification.

Usage details of the connector and its electrical and mechanical characteristics can be found further down in this document.

### **Notes:**

The pin assignment of the emCON connector is ONLY compatible with devices of emtrion's emCON-family. Insertion into a socket with another pin assignment may damage the emCON-RZ/G1C module and the carrier board.

Most of the pins are directly connected with the processor RZ/G1Cx.

## 6 Pin Assignments

### 6.1 J1, emCON Connector

Type MXM, 314 pos

Compatible carrier board connector: Aces 91782-3140M-001

| Pin  | Signal         | Interface            |               | Signal        | Pin  |               |     |
|------|----------------|----------------------|---------------|---------------|------|---------------|-----|
| 1E20 | GND            | <b>Power Supply</b>  |               | VCC_5V        | 2E20 |               |     |
| 1E19 | GND            |                      |               | VCC_5V        | 2E19 |               |     |
| 1E18 | GND            |                      |               | VCC_5V        | 2E18 |               |     |
| 1E17 | GND            |                      |               | VCC_5V        | 2E17 |               |     |
| 1E16 | GND            |                      |               | VCC_5V        | 2E16 |               |     |
| 1E15 | GND            |                      |               | VCC_5V        | 2E15 |               |     |
| 1E14 | GND            |                      |               | VCC_5V        | 2E14 |               |     |
| 1E13 | GND            |                      |               | VCC_5V        | 2E13 |               |     |
| 1E12 | GND            |                      |               | VCC_5V        | 2E12 |               |     |
| 1E11 | GND            |                      |               | VCC_5V        | 2E11 |               |     |
| 1E10 | BAT            |                      |               | (VCC_STANDBY) | 2E10 |               |     |
| 1E9  | n/c            | <b>Manufacturing</b> |               | n/c           | 2E9  |               |     |
| 1E8  | n/c            |                      |               | <b>MISC</b>   |      | POWER_ON_BASE | 2E8 |
| 1E7  | n/c            |                      |               |               |      | IRQ4          | 2E7 |
| 1E6  | RESET_IN#      |                      |               |               |      | n/c           | 2E6 |
| 1E5  | n/c            |                      |               |               |      | IRQ5          | 2E5 |
| 1E4  | JTAG_TRST#     |                      |               |               |      | IRQ6          | 2E4 |
| 1E3  | JTAG_TMS       |                      |               |               |      | n/c           | 2E3 |
| 1E2  | JTAG_TDO       |                      |               |               |      | RESO#         | 2E2 |
| 1E1  | JTAG_TDI       |                      |               |               |      | RESET_IN#     | 40  |
| 1    | JTAG_TCK       |                      |               |               |      | POWERFAIL#    | 2   |
| 3    | 1.8 V JTAG_VCC | (VCC_STANDBY)        | 4             |               |      |               |     |
| 5    | JTAG_TCK       | n/c                  | 6             |               |      |               |     |
| 7    | GND            | <b>POWER</b>         | n/c           | 8             |      |               |     |
| 9    | HSCIF1_RXD     | <b>UART-A</b>        | n/c           | 10            |      |               |     |
| 11   | HSCIF1_TXD     |                      | <b>POWER</b>  | 12            |      |               |     |
| 13   | HSCIF1_RTS     |                      | <b>UART-C</b> | 14            |      |               |     |
| 15   | HSCIF1_CTS     |                      | SCIF3_RXD     | 16            |      |               |     |
| 17   | HSCIF2_RXD     |                      | SCIF3_TXD     | 18            |      |               |     |
| 19   | HSCIF2_TXD     | <b>UART-B</b>        | SCIF4_RXD     | 20            |      |               |     |
| 21   | HSCIF2_RTS     |                      | <b>UART-D</b> | 22            |      |               |     |
| 23   | HSCIF2_CTS     |                      | <b>UART-E</b> | 24            |      |               |     |
| 25   | GND            | <b>POWER</b>         |               | GND           | 26   |               |     |
| 27   | GPIO5_0        | <b>GPIOs</b>         |               | n/c           | 28   |               |     |
| 29   | GPIO1_1        |                      |               | n/c           | 30   |               |     |
| 31   | GPIO1_2        |                      |               | n/c           | 32   |               |     |
| 33   | GPIO1_3        |                      |               | n/c           | 34   |               |     |
| 35   | GPIO5_4        |                      |               | GND           | 36   |               |     |
| 37   | GPIO5_5        |                      |               | n/c           | 38   |               |     |
|      |                | <b>PCIe</b>          |               |               |      |               |     |

|   |            |                    |                  |                    |     |     |  |
|---|------------|--------------------|------------------|--------------------|-----|-----|--|
| 39  | GPIO5_6    |                    |                  | n/c                | 40  |     |  |
| 41  | GPIO5_7    |                    |                  | n/c                | 42  |     |  |
| 43  | GND        | <b>POWER</b>       |                  | n/c                | 44  |     |  |
| 45  | n/c        | <b>RGB IF</b>      |                  | GND                | 46  |     |  |
| 47  | n/c        |                    |                  | n/c                | 48  |     |  |
| 49  | n/c        |                    |                  | n/c                | 50  |     |  |
| 51  | n/c        |                    |                  | n/c                | 52  |     |  |
| 53  | n/c        |                    |                  | n/c                | 54  |     |  |
| 55  | n/c        |                    |                  | GND                | 56  |     |  |
| 57  | LCD_D17    |                    |                  | n/c                | 58  |     |  |
| 59  | LCD_D16    |                    |                  | n/c                | 60  |     |  |
| 61  | LCD_D15    |                    |                  | GND                | 62  |     |  |
| 63  | LCD_D14    |                    |                  | n/c                | 64  |     |  |
| 65  | LCD_D13    |                    |                  | n/c                | 66  |     |  |
| 67  | LCD_D12    |                    |                  | n/c                | 68  |     |  |
| 69  | GND        |                    |                  | n/c                | 70  |     |  |
| 71  | LCD_D11    |                    |                  | GND                | 72  |     |  |
| 73  | LCD_D10    |                    |                  | n/c                | 74  |     |  |
| 75  | LCD_D9     |                    |                  | n/c                | 76  |     |  |
| 77  | LCD_D8     |                    |                  | n/c                | 78  |     |  |
| 79  | LCD_D7     |                    |                  | n/c                | 80  |     |  |
| 81  | LCD_D6     |                    |                  | <b>POWER</b>       | GND | 82  |  |
| 83  | LCD_D5     |                    |                  | <b>RFU</b>         | n/c | 84  |  |
| 85  | LCD_D4     |                    |                  |                    | n/c | 86  |  |
| 87  | LCD_D3     |                    |                  | <b>CPI2 Camera</b> | n/c | 88  |  |
| 89  | LCD_D2     |                    |                  |                    | n/c | 90  |  |
| 91  | LCD_D1     |                    |                  |                    | n/c | 92  |  |
| 93  | LCD_D0     |                    |                  |                    | n/c | 94  |  |
| 95  | LCD_DOTCLK |                    |                  |                    | n/c | 96  |  |
| 97  | LCD_HSYNC  |                    |                  |                    | n/c | 98  |  |
| 99  | LCD_VSYNC  |                    |                  |                    | n/c | 100 |  |
| 101   | LCD_DE     |                    |                  |                    | n/c | 102 |  |
| 103   | PWM0       |                    |                  | n/c                | 104 |     |  |
| 105   | GP4_24     |                    |                  | n/c                | 106 |     |  |
| 107   | GP4_25     |                    |                  | n/c                | 108 |     |  |
| 109   | CAN1_RX    | <b>CAN2</b>        | <b>CAN1</b>      | CAN0_RX            | 110 |     |  |
| 111   | CAN1_TX    |                    |                  | CAN0_TX            | 112 |     |  |
| 113   | GND        | <b>POWER</b>       | <b>POWER</b>     | GND                | 114 |     |  |
| 115   | QSPI1_SCK  | <b>SPI 1</b>       | <b>SPI 2</b>     | MSIOF2_SS2#        | 116 |     |  |
| 117   | QSPI1_SSL# |                    |                  | MSIOF2_SS1#        | 118 |     |  |
| 119   | QSPI1_IO0  |                    |                  | MSIOF2_TXD         | 120 |     |  |
| 121   | QSPI1_IO1  |                    |                  | MSIOF2_RXD         | 122 |     |  |
| 123   | QSPI1_IO2  |                    |                  | MSIOF2_SCK         | 124 |     |  |
| 125   | QSPI1_IO3  |                    |                  |                    |     |     |  |
| <b>The pins 126 - 132 are used for mechanical coding and not available as electrical pins</b> |            |                    |                  |                    |     |     |  |
| 133   | VIN0_D0    | <b>VIN3 Camera</b> | <b>MIPI_CSI2</b> | n/c                | 134 |     |  |

|     |             |                      |                     |           |     |
|-----|-------------|----------------------|---------------------|-----------|-----|
| 135 | VIN0_D1     |                      | <b>Camera</b>       | n/c       | 136 |
| 137 | VIN0_D2     |                      |                     | n/c       | 138 |
| 139 | VIN0_D3     |                      |                     | n/c       | 140 |
| 141 | VIN0_D4     |                      |                     | n/c       | 142 |
| 143 | VIN0_D5     |                      |                     | n/c       | 144 |
| 145 | VIN0_D6     |                      |                     | n/c       | 146 |
| 147 | VIN0_D7     |                      |                     | n/c       | 148 |
| 149 | VIN0_CLK    |                      |                     | n/c       | 150 |
| 151 | VIN0_HSYNC  |                      |                     | n/c       | 152 |
| 153 | VIN0_VSYNC  |                      | <b>POWER</b>        | GND       | 154 |
| 155 | GND         | <b>POWER</b>         |                     | SCL2      | 156 |
| 157 | PWM1        |                      | <b>I2C1</b>         | SDA2      | 158 |
| 159 | GP1_22      | <b>LVDS1 Control</b> |                     | SCL3      | 160 |
| 161 | GP1_1       |                      | <b>I2C2</b>         | SDA3      | 162 |
| 163 | GND         | <b>POWER</b>         |                     | n/c       | 164 |
| 165 | LVDS_D0_P   |                      |                     | n/c       | 166 |
| 167 | LVDS_D0_N   |                      |                     | n/c       | 168 |
| 169 | LVDS_D1_P   |                      |                     | n/c       | 170 |
| 171 | LVDS_D1_N   |                      |                     | n/c       | 172 |
| 173 | LVDS_D2_P   |                      |                     | n/c       | 174 |
| 175 | LVDS_D2_N   |                      |                     | n/c       | 176 |
| 177 | LVDS_D3_P   |                      |                     | n/c       | 178 |
| 179 | LVDS_D3_N   |                      |                     | n/c       | 180 |
| 181 | LVDS_CLK_P  |                      |                     | n/c       | 182 |
| 183 | LVDS_CLK_N  |                      | <b>POWER</b>        | GND       | 184 |
| 185 | GND         | <b>POWER</b>         |                     | n/c       | 186 |
| 187 | n/c         |                      |                     | n/c       | 188 |
| 189 | n/c         | <b>SPDIF</b>         |                     | n/c       | 190 |
| 191 | SSI_D0      |                      |                     | n/c       | 192 |
| 193 | SSI_D4      |                      |                     | n/c       | 194 |
| 195 | SSI_WS4     |                      |                     | n/c       | 196 |
| 197 | SSI_SCK4    |                      |                     | n/c       | 198 |
| 199 | SSI_WS0129  |                      |                     | n/c       | 200 |
| 201 | SSI_SCK0129 |                      |                     | n/c       | 202 |
| 203 | ACLK        |                      | <b>POWER</b>        | GND       | 204 |
| 205 | n/c         |                      |                     | n/c       | 206 |
| 207 | n/c         |                      |                     | n/c       | 208 |
| 209 | n/c         | <b>SATA</b>          | <b>HDMI Control</b> | n/c       | 210 |
| 211 | n/c         |                      |                     | n/c       | 212 |
| 213 | GND         | <b>POWER</b>         | <b>POWER</b>        | GND       | 214 |
| 215 | n/c         |                      |                     | GND       | 216 |
| 217 | USB0_DP     |                      |                     | USB1_DP   | 218 |
| 219 | USB0_DN     |                      |                     | USB1_DN   | 220 |
| 221 | USB0_VBUS   |                      |                     | USB1_VBUS | 222 |
| 223 | USB0_OC#    |                      |                     | USB1_OC#  | 224 |
| 225 | USB0_PEN#   | <b>USB OTG</b>       | <b>USB Host</b>     | USB2_PEN# | 226 |
|     |             |                      | <b>USB3.0</b>       | n/c       | 226 |

|     |                  |                  |                  |                  |                  |     |
|-----|------------------|------------------|------------------|------------------|------------------|-----|
| 227 | n/c              |                  |                  | n/c              | 228              |     |
| 229 | n/c              |                  | <b>POWER</b>     | GND              | 230              |     |
| 231 | GND              | <b>POWER</b>     | <b>USB3.0</b>    | n/c              | 232              |     |
| 233 | n/c              |                  |                  | n/c              | 234              |     |
| 235 | n/c              |                  | <b>POWER</b>     | GND              | 236              |     |
| 237 | GND              | <b>POWER</b>     | <b>SD Card 2</b> | SD2_CLK          | 238              |     |
| 239 | SD0_CLK          | <b>SD Card 1</b> |                  | SD2_CMD          | 240              |     |
| 241 | SD0_CMD          |                  |                  | SD2_D0           | 242              |     |
| 243 | SD0_D0           |                  |                  | SD2_D1           | 244              |     |
| 245 | SD0_D1           |                  |                  | SD2_D2           | 246              |     |
| 247 | SD0_D2           |                  |                  | SD2_D3           | 248              |     |
| 249 | SD0_D3           |                  |                  | SD2_CD#          | 250              |     |
| 251 | SD0_CD#          |                  |                  | SD2_WP           | 252              |     |
| 253 | SD0_WP           |                  |                  | <b>POWER</b>     | GND              | 254 |
| 255 | GND              |                  |                  | <b>POWER</b>     | <b>Ethernet2</b> | n/c |
| 257 | ETH_TXP          |                  | <b>Ethernet1</b> | n/c              |                  | 258 |
| 259 | ETH_TXN          | n/c              |                  | 260              |                  |     |
| 261 | ETH_RXP          | n/c              |                  | 262              |                  |     |
| 263 | ETH_RXN          | n/c              |                  | 264              |                  |     |
| 265 | n/c              | n/c              |                  | 266              |                  |     |
| 267 | n/c              | n/c              |                  | 268              |                  |     |
| 269 | n/c              | n/c              |                  | 270              |                  |     |
| 271 | n/c              | <b>POWER</b>     |                  | GND              |                  | 272 |
| 273 | GND              | <b>POWER</b>     |                  | <b>Ethernet2</b> |                  | n/c |
| 275 | ETH_LED_100M#    | <b>Ethernet1</b> |                  |                  | n/c              | 276 |
| 277 | n/c              |                  | n/c              |                  | 278              |     |
| 279 | ETH_LED_TRAFFIC# |                  | n/c              |                  | 280              |     |
| 281 | n/c              |                  |                  |                  |                  |     |

## 7 Signal Characteristics

Abbreviations:

AI analogue input  
 AO analogue output  
 A I/O analogue bidirectional  
 I digital input  
 O digital output  
 I/O digital bidirectional  
 O(OD) digital open drain output

PU xK x K $\Omega$  pullup resistor  
 PD xK x K $\Omega$  pulldown resistor  
 SR xR x  $\Omega$  series resistor  
 IPU xK processor internal x K $\Omega$  pullup resistor  
 IPD xK transistor internal x K $\Omega$  pulldown resistor

### 7.1 J1, emCON Connector

| Name              | RZ/G1C Pin | GPIO | Direction | Termination | Volt | Max. Current | Description              |
|-------------------|------------|------|-----------|-------------|------|--------------|--------------------------|
| <b>Ethernet 1</b> |            |      |           |             |      |              |                          |
| ETH_TXP           | -          | -    | A I/O     | -           | -    | N/A          | ETH diff. transmit pair  |
| ETH_TXN           | -          | -    | A I/O     | -           | -    | N/A          |                          |
| ETH_RXP           | -          | -    | A I/O     | -           | -    | N/A          | ETH diff. receive pair   |
| ETH_RXN           | -          | -    | A I/O     | -           | -    | N/A          |                          |
| ETH_LED_100#      | -          | -    | O         | -           | 3.3V | 20mA         | 10/100# Speed indication |
| ETH_LED_TRAFFIC#  | -          | -    | O         | -           | 3.3V | 20mA         | Traffic indication       |

| USB Host  |       |        |     |   |      |      |  |
|-----------|-------|--------|-----|---|------|------|--|
| USBH_PEN# | #AD30 | GP5_22 | O   |   | 3.3V | 32mA | USB power enable                         |
| USBH_OC#  | AC30  | GP5_23 | I   | - | 3.3V | N/A  | USB overcurrent signal from power switch |
| USBH_DP   | AK31  | -      | I/O | - | -    | N/A  | USB 2.0 diff. data pair                  |
| USBH_DM   | AJ31  | -      | I/O | - | -    | N/A  |  |

| USB OTG     |      |        |     |        |             |      |                                     |
|-------------|------|--------|-----|--------|-------------|------|-------------------------------------|
| USBOTG_ID   | AC29 | GP5_20 | I   | PU 10K | 3.3V        | N/A  | USB ID signal for OTG functionality |
| USBOTG_PEN# | AC28 | GP5_18 | O   | -      | 3.3V        | 16mA | Host: USB power                     |
| USBOTG_OC#  | AD28 | GP5_19 | I   | PU 10K | 3.3V        | N/A  | Host: USB overcurrent               |
| USBOTG_VBUS | AD28 | GP5_19 | I   | PD 32K | 4.2V – 5.5V | N/A  | Device: VBUS                        |
| USBOTG_DP   | AF31 | -      | I/O | -      | -           | N/A  | USB 2.0 diff. data pair             |
| USBOTG_DM   | AE31 | -      | I/O | -      | -           | N/A  |                                     |

| UART       |      |        |   |        |      |     |                    |
|------------|------|--------|---|--------|------|-----|--------------------|
| UART-A_TXD | AH5  | GP0_21 | O | PU 10K | 3.3V | 8mA | UART transmit data |
| UART-A_RXD | AL5  | GP0_24 | I | -      | 3.3V | N/A | UART receive data  |
| UART-A_RTS | AJ5  | GP0_22 | O | -      | 3.3V | 8mA | UART modem control |
| UART-A_CTS | AJ4  | GP0_25 | I | -      | 3.3V | N/A | UART modem control |
| UART-B_TXD | T28  | GP4_23 | O | PU 10K | 3.3V | 8mA | UART transmit data |
| UART-B_RXD | T26  | GP4_22 | I | -      | 3.3V | N/A | UART receive data  |
| UART-B_RTS | V31  | GP4_25 | O | -      | 3.3V | 8mA | UART modem control |
| UART-B_CTS | R25  | GP4_24 | I | -      | 3.3V | N/A | UART modem control |
| UART-C_TXD | AE5  | GP1_18 | O | -      | 3.3V | 4mA | UART transmit data |
| UART-C_RXD | AC1  | GP1_12 | I | -      | 3.3V | N/A | UART receive data  |
| UART-D_TXD | AK11 | GP5_30 | O | PU 10K | 3.3V | 4mA | UART transmit data |
| UART-D_RXD | AJ11 | GP5_31 | I | -      | 3.3V | N/A | UART receive data  |



|            |     |        |   |   |      |     |                    |
|------------|-----|--------|---|---|------|-----|--------------------|
| UART-E_TXD | AH1 | GP1_21 | O | - | 3.3V | 4mA | UART transmit data |
| UART-E_RXD | AD2 | GP1_20 | I | - | 3.3V | N/A | UART receive data  |

### CAN

|         |     |       |   |        |      |     |                   |
|---------|-----|-------|---|--------|------|-----|-------------------|
| CAN1_TX | P30 | GP4_4 | O | -      | 3.3V | 8mA | CAN transmit data |
| CAN1_RX | P29 | GP4_5 | I | PU 10K | 3.3V | N/A | CAN receive data  |
| CAN2_TX | P27 | GP4_6 | O | -      | 3.3V | 8mA | CAN transmit data |
| CAN2_RX | R26 | GP4_7 | I | PU 10K | 3.3V | N/A | CAN receive data  |

### LCD (RGB Display)

|            |      |        |   |   |      |     |                        |
|------------|------|--------|---|---|------|-----|------------------------|
| LCD_PIXCLK | Y25  | GP5_2  | O | - | 3.3V | 8mA | LCD dot clock          |
| LCD_DISP   | W26  | GP5_16 | O | - | 3.3V | 8mA | LCD data enable signal |
| LCD_VSYNC  | U30  | GP4_15 | O | - | 3.3V | 8mA | LCD frame sync         |
| LCD_HSYNC  | U31  | GP4_14 | O | - | 3.3V | 8mA | LCD line sync          |
| LCD_D0     | V26  | GP5_8  | O | - | 3.3V | 8mA | LCD B2                 |
| LCD_D1     | V27  | GP5_9  | O | - | 3.3V | 8mA | LCD B3                 |
| LCD_D2     | U26  | GP5_10 | O | - | 3.3V | 8mA | LCD B4                 |
| LCD_D3     | U25  | GP5_11 | O | - | 3.3V | 8mA | LCD B5                 |
| LCD_D4     | Y31  | GP5_12 | O | - | 3.3V | 8mA | LCD B6                 |
| LCD_D5     | V25  | GP5_13 | O | - | 3.3V | 8mA | LCD B7                 |
| LCD_D6     | AA30 | GP4_27 | O | - | 3.3V | 8mA | LCD G2                 |
| LCD_D7     | W25  | GP4_30 | O | - | 3.3V | 8mA | LCD G3                 |
| LCD_D8     | V28  | GP5_7  | O | - | 3.3V | 8mA | LCD G4                 |
| LCD_D9     | W28  | GP5_14 | O | - | 3.3V | 8mA | LCD G5                 |
| LCD_D10    | W29  | GP5_15 | O | - | 3.3V | 8mA | LCD G6                 |
| LCD_D11    | AB28 | GP5_4  | O | - | 3.3V | 8mA | LCD G7                 |
| LCD_D12    | P26  | GP4_16 | O | - | 3.3V | 8mA | LCD R2                 |
| LCD_D13    | U29  | GP4_17 | O | - | 3.3V | 8mA | LCD R3                 |
| LCD_D14    | U27  | GP4_18 | O | - | 3.3V | 8mA | LCD R4                 |

|              |      |        |   |   |      |     |                                  |
|--------------|------|--------|---|---|------|-----|----------------------------------|
| LCD_D15      | T25  | GP4_19 | O | - | 3.3V | 8mA | LCD R5                           |
| LCD_D16      | V29  | GP4_20 | O | - | 3.3V | 8mA | LCD R6                           |
| LCD_D17      | U28  | GP4_21 | O | - | 3.3V | 8mA | LCD R7                           |
| LCD_PANEL_EN | Y30  | GP4_29 | O | - | 3.3V | 8mA | LCD panel power enable           |
| LCD_BL_EN    | AA29 | GP4_28 | O | - | 3.3V | 8mA | LCD backlight power enable       |
| LCD_BL_CTRL  | AG6  | PWM4   | O | - | 3.3V | 8mA | LCD backlight brightness control |

### LVDS 1

|               |      |      |   |        |      |     |                                   |
|---------------|------|------|---|--------|------|-----|-----------------------------------|
| LVDS_CLK_P    | AG17 | -    | O | -      | 1,8V | N/A | LVDS diff clock pair              |
| LVDS_CLK_N    | AG18 | -    | O | -      | 1,8V | N/A |                                   |
| LVDS_TX0_P    | AJ18 | -    | O | -      | 1,8V | N/A | LVDS diff data pair               |
| LVDS_TX0_N    | AJ19 | -    | O | -      | 1,8V | N/A |                                   |
| LVDS_TX1_P    | AG19 | -    | O | -      | 1,8V | N/A | LVDS diff data pair               |
| LVDS_TX1_N    | AG20 | -    | O | -      | 1,8V | N/A |                                   |
| LVDS_TX2_P    | AL18 | -    | O | -      | 1,8V | N/A | LVDS diff data pair               |
| LVDS_TX2_N    | AL17 | -    | O | -      | 1,8V | N/A |                                   |
| LVDS_TX3_P    | AJ17 | -    | O | -      | 1,8V | N/A | LVDS diff data pair               |
| LVDS_TX3_N    | AJ16 | -    | O | -      | 1,8V | N/A |                                   |
| LVDS_PANEL_EN | -    | -    | O | PD 2K2 | 3.3V | 4mA | LVDS panel power enable           |
| LVDS_BL_EN    | -    | -    | O | PD 2K2 | 3.3V | 4mA | LVDS backlight power enable       |
| LVDS_BL_CTRL  | AH6  | PWM5 | O | -      | 3.3V | 8mA | LVDS backlight brightness control |

### CPI1 (Camera Input)

|         |     |       |   |   |      |     |                        |
|---------|-----|-------|---|---|------|-----|------------------------|
| VIN0_D0 | AF9 | GP0_0 | I | - | 3.3V | 8mA | Video image input data |
| VIN0_D1 | AG9 | GP0_1 | I | - | 3.3V | 8mA | Video image input data |
| VIN0_D2 | AH9 | GP0_2 | I | - | 3.3V | 8mA | Video image input data |
| VIN0_D3 | AJ9 | GP0_3 | I | - | 3.3V | 8mA | Video image input data |
| VIN0_D4 | AK9 | GP0_4 | I | - | 3.3V | 8mA | Video image input data |
| VIN0_D5 | AL9 | GP0_5 | I | - | 3.3V | 8mA | Video image input data |

|             |     |        |   |   |      |     |                        |
|-------------|-----|--------|---|---|------|-----|------------------------|
| VIN0_D6     | AF8 | GP0_6  | I | - | 3.3V | 8mA | Video image input data |
| VIN0_D7     | AG8 | GP0_7  | I | - | 3.3V | 8mA | Video image input data |
| VIN0_PIXCLK | AK1 | GP1_23 | I | - | 3.3V | 8mA | Video clock            |
| VIN0_HSYNC  | AE3 | GP1_16 | I | - | 3.3V | 8mA | Video line sync        |
| VIN0_VSYNC  | AE4 | GP1_17 | I | - | 3.3V | 4mA | Video frame sync       |

#### SD Card Interface 1

|          |    |       |     |        |           |      |               |
|----------|----|-------|-----|--------|-----------|------|---------------|
| SDC1_D0  | W2 | GP3_2 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC1_D1  | V7 | GP3_3 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC1_D2  | V6 | GP3_4 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC1_D3  | V5 | GP3_5 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC1_CMD | V4 | GP3_1 | I/O | PU 47K | 1.8V/3.3V | 16mA | CMD signal    |
| SDC1_CLK | V1 | GP3_0 | O   | SR 22R | 1.8V/3.3V | 16mA | SDC clock     |
| SDC1_CD# | W3 | GP3_6 | I   | PU 10K | 3.3V      | N/A  | Card detect   |
| SDC1_WP  | W4 | GP3_7 | I   | PD 10K | 3.3V      | N/A  | Write protect |

#### SD Card Interface 2

|          |    |        |     |        |           |      |               |
|----------|----|--------|-----|--------|-----------|------|---------------|
| SDC2_D0  | R5 | GP3_18 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC2_D1  | R4 | GP3_19 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC2_D2  | R3 | GP3_20 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC2_D3  | T5 | GP3_21 | I/O | PU 47K | 1.8V/3.3V | 16mA | SDC data      |
| SDC2_CMD | T4 | GP3_17 | I/O | PU 47K | 1.8V/3.3V | 16mA | CMD signal    |
| SDC2_CLK | R1 | GP3_16 | O   | SR 22R | 1.8V/3.3V | 16mA | SDC clock     |
| SDC2_CD# | T2 | GP3_22 | I   | PU 10K | 3.3V      | N/A  | Card detect   |
| SDC2_WP  | T3 | GP3_23 | I   | PD 10K | 3.3V      | N/A  | Write protect |

#### SPI1

|           |     |        |   |  |      |     |                     |
|-----------|-----|--------|---|--|------|-----|---------------------|
| SPI1_SS0# | R27 | GP4_10 | O |  | 3.3V | 8mA | SPI slave select    |
| SPI1_SS1# | T31 | GP4_11 | O |  | 3.3V | 8mA | SPI slave select    |
| SPI1_SCK  | R31 | GP4_8  | O |  | 3.3V | 8mA | SPI clock           |
| SPI1_MISO | R29 | GP4_13 | I |  | 3.3V | 8mA | SPI data from slave |

|           |     |        |   |  |      |     |                   |
|-----------|-----|--------|---|--|------|-----|-------------------|
| SPI1_MOSI | T29 | GP4_12 | O |  | 3.3V | 8mA | SPI data to slave |
|-----------|-----|--------|---|--|------|-----|-------------------|

### SPI2

|           |     |        |   |  |      |     |                     |
|-----------|-----|--------|---|--|------|-----|---------------------|
| SPI2_SS0# | AL2 | GP0_30 | O |  | 3.3V | 8mA | SPI slave select    |
| SPI2_SS1# | AH3 | GP0_31 | O |  | 3.3V | 8mA | SPI slave select    |
| SPI2_SCK  | AL4 | GP0_27 | O |  | 3.3V | 8mA | SPI clock           |
| SPI2_MISO | AL3 | GP0_29 | I |  | 3.3V | 8mA | SPI data from slave |
| SPI2_MOSI | AK3 | GP0_28 | O |  | 3.3V | 8mA | SPI data to slave   |

### I2C1

|          |      |   |          |        |      |      |                        |
|----------|------|---|----------|--------|------|------|------------------------|
| I2C1_SCL | AG15 | - | I/O      | PU 2K2 | 3.3V | 15mA | I <sup>2</sup> C clock |
| I2C1_SDA | AF15 | - | I/O (OD) | PU 2K2 | 3.3V | 15mA | I <sup>2</sup> C data  |

### I2C2

|          |      |       |          |        |      |     |                        |
|----------|------|-------|----------|--------|------|-----|------------------------|
| I2C2_SCL | AC27 | GP5_5 | I/O      | PU 2K2 | 3.3V | 8mA | I <sup>2</sup> C clock |
| I2C2_SDA | AB27 | GP5_6 | I/O (OD) | PU 2K2 | 3.3V | 8mA | I <sup>2</sup> C data  |

### Audio SSI

|            |     |        |     |  |      |     |                             |
|------------|-----|--------|-----|--|------|-----|-----------------------------|
| AUDIO_RXD  | AD4 | GP1_27 | I   |  | 3.3V | N/A | Audio input data            |
| AUDIO_TXD  | AD5 | GP1_26 | O   |  | 3.3V | 4mA | Audio output data           |
| AUDIO_TXC  | AC5 | GP1_24 | I/O |  | 3.3V | 4mA | Audio transmit bit clock    |
| AUDIO_TXFS | AC6 | GP1_25 | I/O |  | 3.3V | 4mA | Audio transmit frame select |
| AUDIO_RXC  | AC5 | GP1_24 | I/O |  | 3.3V | 4mA | Audio receive bit clock     |
| AUDIO_RXFS | AC6 | GP1_25 | I/O |  | 3.3V | 4mA | Audio receive frame select  |
| ACLK       | W31 | GP4_26 | I   |  | 3.3V | N/A | Audio master clock          |

### General Purpose I/O

|       |     |       |     |  |      |     |                        |
|-------|-----|-------|-----|--|------|-----|------------------------|
| GPIO1 | AG1 | GP1_0 | I/O |  | 3.3V | 8mA | digital input / output |
| GPIO2 | AG2 | GP1_1 | I/O |  | 3.3V | 8mA | digital input / output |
| GPIO3 | AG3 | GP1_2 | I/O |  | 3.3V | 8mA | digital input / output |
| GPIO4 | AG4 | GP1_3 | I/O |  | 3.3V | 8mA | digital input / output |

|       |     |        |     |  |      |     |                        |
|-------|-----|--------|-----|--|------|-----|------------------------|
| GPIO5 | AD1 | GP1_10 | I/O |  | 3.3V | 8mA | digital input / output |
| GPIO6 | AJ2 | GP1_11 | I/O |  | 3.3V | 8mA | digital input / output |
| GPIO7 | AC2 | GP1_13 | I/O |  | 3.3V | 8mA | digital input / output |
| GPIO8 | AC3 | GP1_14 | I/O |  | 3.3V | 8mA | digital output only    |

### Manufacturing

|             |      |   |   |        |      |     |   |
|-------------|------|---|---|--------|------|-----|---|
| JTAG_TCK    | AE14 |   | I | PU 10K | 1.8V | N/A | JTAG clock<br>(JTAG_TCK and JTAG_RTCK are shorted)        |
| JTAG_TMS    | AF14 |   | I | PU 10K | 1.8V | N/A | JTAG mode select  |
| JTAG_TRST#  | AG16 |   | I | PD 1K  | 1.8V | N/A | JTAG test reset   |
| JTAG_TDI    | AH14 |   | I | PU 10K | 1.8V | N/A | JTAG data input   |
| JTAG_TDO    | AH12 |   | O |        | 1.8V | 1mA | JTAG data output  |
| JTAG_RTCK   | AE18 |   | O | PU 10K | 1.8V | N/A | JTAG return clock<br>(JTAG_TCK and JTAG_RTCK are shorted) |
| JTAG_MOD    | -    | - | - | -      | -    | -   | Mode selection<br>JTAG/Boundary Scan                      |
| JTAG_RESET# | -    | - | - | -      | 1.8V | N/A | JTAG reset  |
| JTAG_VCC    |      |   |   |        | 1.8V |     | JTAG voltage reference                                    |

### Miscellaneous

|               |      |        |   |        |      |      |   |
|---------------|------|--------|---|--------|------|------|---|
| IRQ_1         | AJ13 | GP5_26 | I | PU 10K | 3.3V | N/A  | Interrupt input                                   |
| IRQ_2         | AH13 | GP5_27 | I | PU 10K | 3.3V | N/A  | Interrupt input                                   |
| IRQ_3         | -    | -      | - | -      | -    | -    | Interrupt input                                   |
| IRQ_TOUCH1#   | AA25 | GP5_24 | I | PU 10K | 3.3V | N/A  | Interrupt input for touch controller              |
| POWERFAIL#    | AG12 | NMI    | I | PD 20K | 5V   | N/A  | Power Fail interrupt                              |
| PWM_FAN       | AL7  | PWM3   | O |        | 3.3V | 8mA  | PWM signal for fan control                        |
| RESI#         |      |        | I | PU 10K | 3.3V | N/A  | Reset input from carrier board                    |
| RESO#         |      |        | O |        | 3.3V | 20mA | Reset output to carrier board                     |
| POWER_ON_BASE |      |        | O |        | 3.3V | 20mA | Power enable signal for the 3.3V baseboard supply |

|                     |   |         |             |      |                                   |
|---------------------|---|---------|-------------|------|-----------------------------------|
| SUSPEND#            | O |         | 3.3V        | 20mA | Power switching signal for VCC_5V |
| ON_OFF#             | I | PU 100K | 5V          | N/A  | Power management signal           |
| <b>Power Supply</b> |   |         |             |      |                                   |
| BAT                 | - | -       | 2.0V – 3.3V | N/A  | Battery backup supply for RTC     |
| VCC_5V              | - | -       | -           | N/A  | + 5V supply                       |
| GND                 | - | -       | -           | N/A  | Ground                            |

## 8 Technical Characteristics

### 8.1 Electrical Specifications

|                            |             |
|----------------------------|-------------|
| <b>Supply voltage</b>      | 5V, +/-5%   |
| <b>Current consumption</b> | up to 1.5 A |

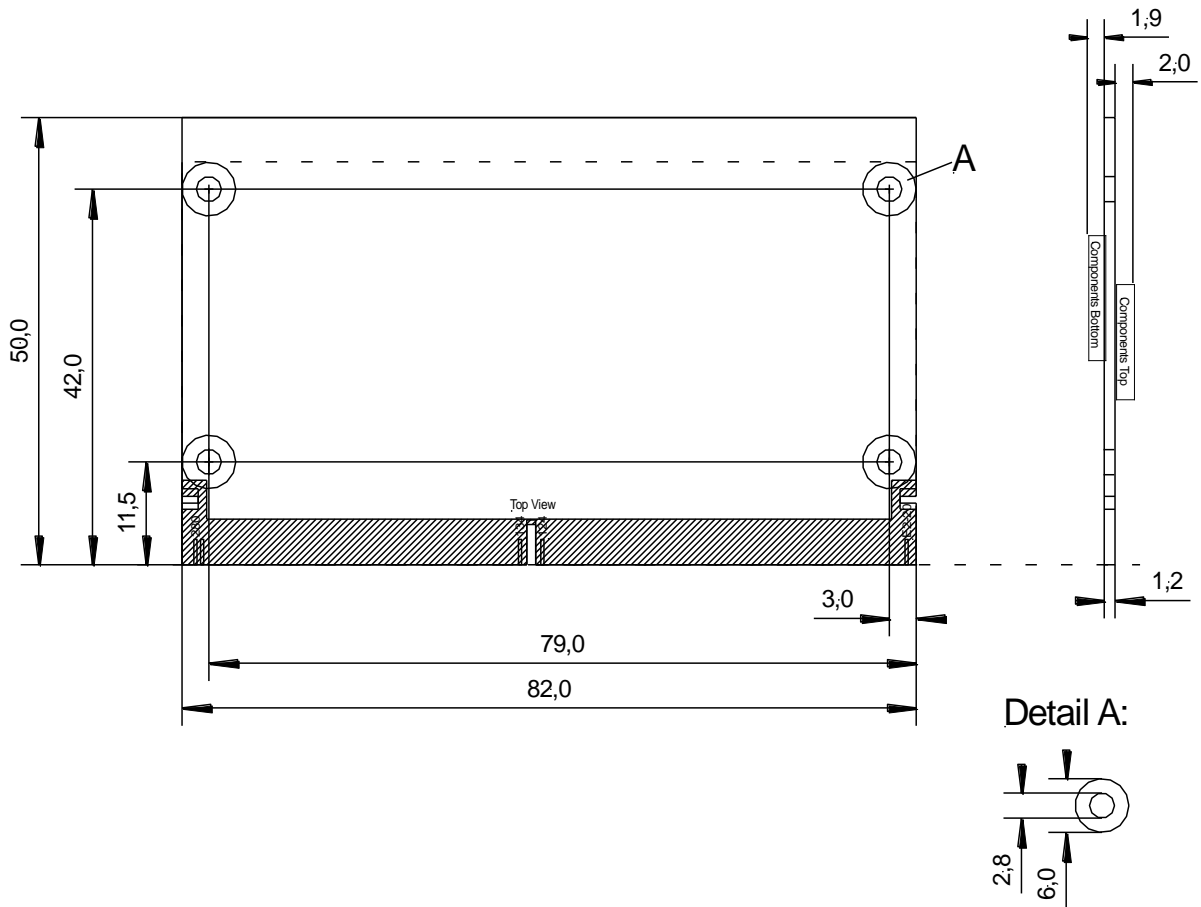
### 8.2 Environmental Specifications

|                              |                            |
|------------------------------|----------------------------|
| <b>Operating temperature</b> |                            |
| Standard:                    | 0 ... +70°C                |
| Extended:                    | -40 ... +85°C              |
| <b>Storage temperature</b>   | -40 ... +125°C             |
| <b>Relative humidity</b>     | 0 ... 95 %, non-condensing |

### 8.3 Mechanical Specifications

|                   |                                      |
|-------------------|--------------------------------------|
| <b>Weight</b>     | approx. 19 g                         |
| <b>Board</b>      | Glasepoxi FR-4, UL-listed, 10 layers |
| <b>Dimensions</b> | 82.2 mm x 50.0 mm x 5.0 mm           |

## 9 Dimensional Drawing





## 10 References

- [1] RZ/G1C  
User's Manual: Hardware  
R01UH0695EJ0040, Rev.0.40, Oct. 31, 2016