Wireless CPU® Q64

Hardware Differences between Q64 and GR64

Reference: **WA_DEV_Q64_PTS_002**
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Powered by the Wavecom Open AT® Software Suite

Document Information

Level	Date	History of the evolution	
001	November, 2007	Creation (Preliminary version)	

Overview

Q64 Wireless CPU® is powered by WMP100 Wireless Microprocessor® and designed for industrial applications. Q64 is pin to pin compatible to GR64001 with some restrictions. This document aims to list and detail differences between Q64 and GR64001.

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Cautions

This platform contains a modular transmitter. This device is used for wireless applications. Note that all electronics parts and elements are ESD sensitive.

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1 References

1.1 Reference documents

For more details, several documents are referenced in this specification. The WAVECOM documents references herein are provided in the WAVECOM documentation package; the general reference documents which are not WAVECOM owned are not provided in the documentation package.

1.1.1 WAVECOM reference documentation

[1] Wireless CPU® Q64 Product Technical Specification and Customer Design Guidelines

Reference: WA_DEV_Q64_PTS_001

[2] Wireless Microprocessor® WMP100 Product Technical Specification and Customer Design Guidelines

Reference: WM_DEV_WUP_PTS_005

[3] Integrator's Manual – GR64 GSM/GPRS Wireless CPU®

Reference: WI_DEV_ GR64_UGD_001

[4] AT Commands Manual for GR64 & GS64 Wireless CPU®

Reference: WI_DEV_Gx64_UGD_001

[5] AT Command Interface Guide for Open AT® Firmware v6.5

Reference: WM_DEV_OAT_UGD_035

1.2 List of abbreviations

Abbreviation	Definition
ADC	Analog to Digital Converter
AT	ATtention (prefix for modem commands)
AUX	AUXiliary
CLK	CLocK
CTS	Clear To Send
DAC	Digital to Analogue Converter
dB	Decibel
DC	Direct Current
DCS	Digital Cellular System
DSR	Data Set Ready
DTR	Data Terminal Ready
EMI	ElectroMagnetic Interference
GND	GrouND
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
I/O	Input / Output
LED	Light Emitting Diode
MAX	MAXimum
MIC	MICrophone
MIN	MINimum
RF	Radio Frequency
RFI	Radio Frequency Interference
RI	Ring Indicator
RST	ReSeT
RTC	Real Time Clock
RTS	Request To Send
RX	Receive
SCL	Serial CLock
SDA	Serial DAta
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level

Abbreviation	Definition
SPK	SPeaKer
TP	Test Point
TVS	Transient Voltage Suppressor
TX	Transmit
TYP	TYPical
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus

2 General description

2.1 General information of Q64

The Q64 is a self-contained E-GSM/GPRS 900/1800 and 850/1900 quad-band Wireless CPU®, including the characteristics listed in the subsection below.

2.1.1 Overall dimensions

- Length: 50 mm
- Width: 33 mm
- Thickness: 6.8 mm
- Weight: 11.6 g

2.1.2 GSM/GPRS Features

- 2 Watts EGSM 900/GSM 850 radio section running under 3.6 Volts
- 1 Watt GSM1800/1900 radio section running under 3.6 Volts
- Hardware GPRS class 10 capable

2.1.3 Interfaces

- Digital section running under 2.8 Volts
- 3V/1V8 SIM interface
- Power supply
- Serial links (UART)
- Analogue audio
- ADC
- PCM digital audio
- USB 2.0 slave
- I2C Serial buses
- PWM (BUZZER)
- GPIOs

2.1.4 Operating system

- Real Time Clock with calendar
- Echo Cancellation + noise reduction (quadri codec)
- Full GSM or GSM/GPRS Operating System stack

2.1.5 Connection Interfaces

The Q64 Wireless CPU® has two external connections:

- One for RF circuit:
  - MMCX connector
- One for baseband signals:
  - 60-pin I/O connector

Remark: Comparing with GR64, the antenna soldered connection in Q64 is not available.

3 Electrical Differences

3.1 Pin assignment comparison

Q64 is designed to be compatible to GR64001.

There are only few pins which show some differences.

Below table shows the pin assignment differences between GR64001 and Q64.

GR64001			Q64		
Pin	Name	Function	Pin	Name	Function
35	TX_ON	Transmit Indication	35	GPIO16	General purpose IO
41	DTM1	UART1 Transmit	41	DTM1/GPIO18	UART1 Transmit / General purpose IO (multiplex)
42	DFM1	UART1 Received	42	DFM1/GPIO17	UART1 Transmit / General purpose IO (multiplex)
45	RESERVED	-	45	USBDP	USB
46	RESERVED	-	46	USBDN	USB
49	RESERVED	-	49	VUSB	USB

3.2 Electrical level differences

The following table summarizes the main electrical level differences between Q64 and GR64001 on the board connector signals.

Type	Signal Name	GR64001 Signal Level / Configuration	Q64 Signal Level / Configuration
POWER	VCC	Vmin =3.2V Vnom=3.6V Vmax=**4.5V**	Vmin=3.2V Vnom=3.6V Vmax=**4.8V**
	CHG_IN	VMIN =**4.5V** Vmax=6V Imax=**500mA**	Vmin =**4.6V** Vmax=6V Imax=**800mA**
	VREF (OUTPUT)	VOmin=2.74V VOnom=2.8V VOmax=2.86V ILmax=**75mA**	VOmin=2.74V VOnom=2.8V VOmax=2.86V ILmax=**15mA**
UART1	DTM1/GPIO18, DFM1/GPIO17, RTS1/GPIO9, CTS1/GPIO12, DTR1/GPIO10, DSR1/GPIO7, RI/GPIO8, DCD1/GPIO11	2V8 Interface VILmin=**0V** VILmax=**0.3V** VIHmin=**2.1V** VIHmax=**2.8V** VOLmin=0V VOLmax=0.4V VOHmin=**1.88V** VOHmax=**2.8V**	2V8 Interface VILmin=**-0.5V** VILmax=**0.84V** VIHmin=**1.96V** VIHmax=**3.2V** VOLmin=0V VOLmax=0.4V VOHmin=**2.64V** VOHmax=**2.86V**
UART2	DTM3, DFM3	2V8 Interface VILmin=**0V** VILmax=**0.3V** VIHmin=**2.1V** VIHmax=**2.8V** VOLmin=0V VOLmax=0.4V VOHmin=**1.88V** VOHmax=2.8V	2V8 Interface VILmin=**-0.3V** VILmax=**0.15V** VIHmin=**1.6V** VIHmax= **3.1V** VOLmin=0V VOLmax=0.4V VOHmin=**1.87V** VOHmax=2.8V
ADC	ADIN1, ADIN2, ADIN3, ADIN4/GPIO5	10 Bit Resolution Analogue input from 0V to **2.59V**	10 Bit Resolution Analogue input from 0V to **2V**
PCM	SSPDTM, SSPDFM, SSPFS, SSPCLK	2V8 Digital Level Based On Texas Instruments SSI Standard	2V8 Digital Level IOM-2 Compatible Device

Type	Signal Name	GR64001 Signal Level / Configuration	Q64 Signal Level / Configuration
AUDIO	BUZZER	Common Emitter Connection, which needs to be driven by a transistor. VOmin =2.4V VOnom=2.8V VOmax=3.3V IOnom=8mA	Open Drain Output VOLmax=0.4V. Power transistor included inside Q64 ILmax=100mA
RTC	VRTC	VImin=1.0V VImax=2V VOnom=1.5V	VImin=1.85V VImax=2.5V VOnom=2.45V
OTHERS	TX_ON – GR64 GPIO16 – Q64	2V8 Logic (OUT ONLY) VOHmin=2V VOHnom=2.8V VOHmax=3V VOLmax=1V	2V8 GPIO (IN OR OUT) VILmin=-0.5V VILmax=0.84V VIHmin=1.96V VIHmax=3.2V VOHmin=2.64V VOHnom=2.8V VOHmax=2.86V VOLmax=0.4V VOLmin=0V

3.3 ON/OFF Sequence

GR64 and Q64 show the similar Power-ON and Power-OFF sequence.

Power on sequence: Q64 needs to hold the low state for at least 1500ms when GR64 requires 450ms.

Warning: In some circumstances, the power on for Q64 can require up to 8 second. To guarantee the power on, the low state has to be hold during 8 seconds, or the application has to receive "OK" answer after sending "AT" command, or receive a WIND indicator from Q64.

Power off sequence: Q64 and GR64 are equivalent for waveform and timing.

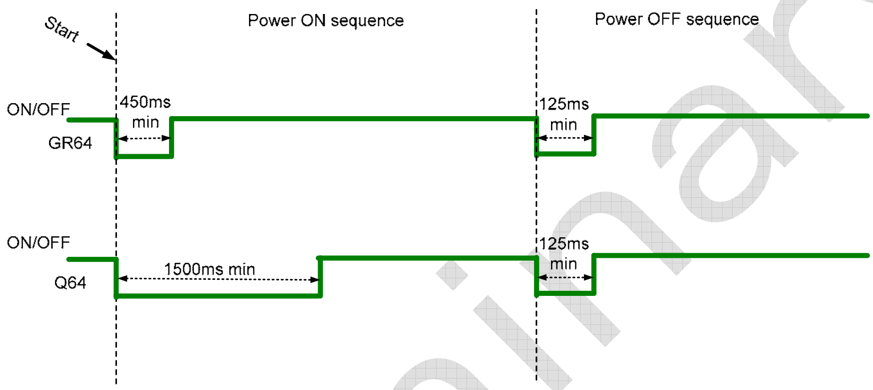


Figure 1: Power-ON and Power-OFF sequence between GR64 and Q64

3.4 VREF

GR64 provides a voltage reference interface for user applications (VREF).

In case of GR64002, VREF can be set as an input, this input to drive internal level shifter to determine the GR64002 digital interface from 1.8V to 5.5V. Digital level will be equal to the voltage applied on VREF by the application.

This feature is not available for GR64001 and Q64, in which VREF pin is a 2.8V output.

Below table shows the electrical characteristics comparison in GR64001 and Q64.

Signal	Parameter	Min	Typ	Max	Unit
VREF (GR64001 case)	Output Voltage	2.74	2.8	2.86	V
	Output Current			80	mA
VREF (Q64 case)	Output Voltage	2.74	2.8	2.86	V
	Output Current			15	mA

3.5 SIM Interface

Q64 and GR64 provide interface for 1.8V and 3.0V SIM cards. For both GR64 and Q64, decoupling capacitor is necessary for the SIM card supply (SIMVCC), however, in case of Q64, 100nF decoupling capacitor has to be used instead of 2.2µF for GR64.

Also, it is recommended to have Transient Voltage Suppressor diodes (TVS) on the signal connected to the SIM socket in order to prevent any Electrostatics Discharge.

TVS diodes with low capacitance (less than 10 pF) have to be connected on SIMCLK and SIMDAT signals to avoid any disturbance of the rising and falling edge.

These types of diodes are mandatory for the Full Type Approval. They shall be placed as close as possible to the SIM socket.

The following references can be used: DALC208SC6 from ST Microelectronics

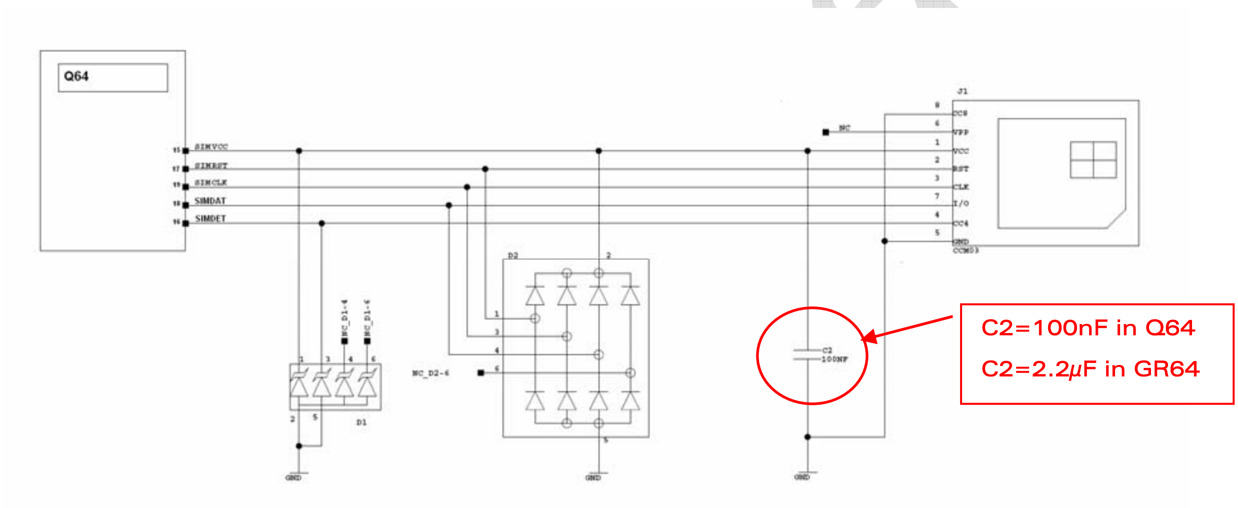


Figure 2: Example of SIM Socket implementation

3.6 UART1 multiplex with GPIO

There are some differences between the UART1 interface in GR64 and Q64, which are related to the multiplexing with GPIO signals.

GR64 Signals	Multiplex with	Q64 Signals	Multiplex with	Description
DTM1	-	DTM1/GPIO18	GPIO18	Transmit serial data
DFM1	-	DFM1/GPIO17	GPIO17	Receive serial data
RTS1/GPIO9	GPIO9	RTS1/GPIO9	GPIO9	Request To Send
CTS1/GPIO12	GPIO12	CTS1/GPIO12	GPIO12	Clear To Send
DTR1/GPIO10	GPIO10	DTR1/GPIO10	GPIO10	Data Terminal Ready
DSR1/GPIO7	GPIO7	DSR1/GPIO7	GPIO7	Data Set Ready
RI/GPIO8	GPIO8	RI/GPIO8	GPIO8	Ring Indicator
DCD1/GPIO11	GPIO11	DCD1/GPIO11	GPIO11	Data Carrier Detect

In GR64, DTM1 and DFM1 are not multiplexed with GPIO. And these two signals can still be driven as a UART interface, even if either one or more of the six GPIOs of RTS1/GPIO9, CTS1/GPIO12, DTR1/GPIO10, DSR1/GPIO7, RI/GPIO8 and DCD1/GPIO11 are allocated as GPIO.

In Q64 DTM1 and DFM1 are multiplexed with GPIO, GPIO18 and GPIO17 respectively. When the UART1 service is used, the whole multiplex signals become unavailable for other purpose. In the same way if one or more GPIOs of these eight GPIOs are allocated, the UART1 service is unavailable.

3.7 BUZZER

For GR64, the BUZZER signal needs to be connected to an inverting transistor-buffer followed by a piezoelectric transducer.

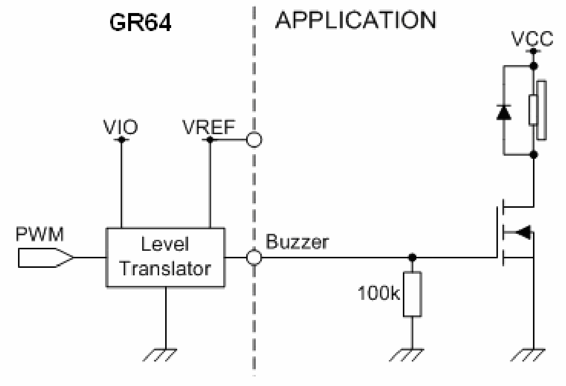


Figure 3: Example of buzzer implementation in GR64

For Q64, the BUZZER interface is different and a power transistor is included, which is an open drain output. A buzzer can be directly connected between this output and VCC. The maximum peak current is 100 mA and the maximum average current is 40 mA. A diode against transient peak voltage must be added as described below.

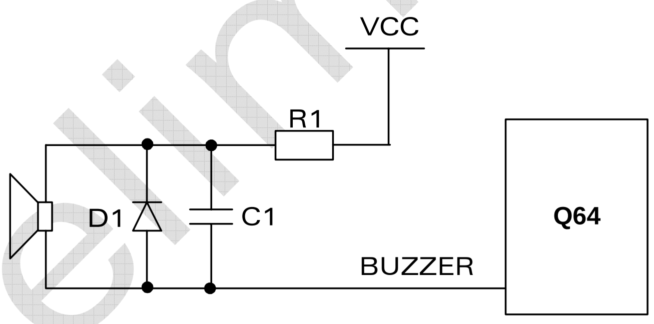


Figure 4: Example of buzzer implementation in Q64

Where:

R1 must be chosen in order to limit the current at I_{PEAK} max

C1 = 0 to 100 nF (depending on the buzzer type)

D1 = BAS16 (for example)

<u>Recommended characteristics for the buzzer:</u>

- electro-magnetic type
- Impedance: 7 to 30 Ω
- Sensitivity: 90 dB SPL min @ 10 cm
- Current: 60 to 90 mA

3.8 LED

In GR64, the LED signal is derived from a standard GPIO signal, which is either high or low level output. And user requires to implement some form of transistor circuit as shown.

In Q64, when LED signal is activated in LED/GPIO6 pin, there are only high or open states. Therefore, a pull down base resistor R1 is MANDATORY to be implemented in the transistor circuit below.

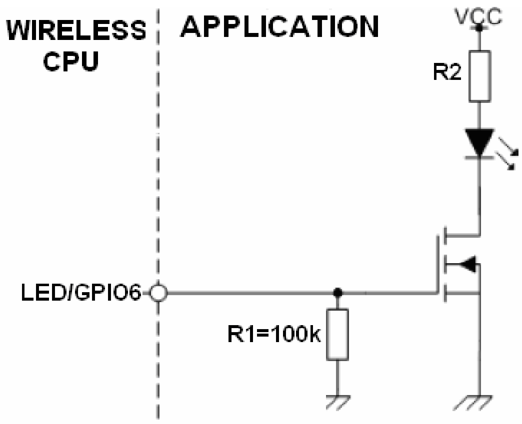


Figure 5: Example of LED implementation

3.9 VRTC

This pin is used as a back-up power supply for the internal Real Time Clock. The RTC is supported by the Q64 when VCC is available but a back-up power supply is needed to save date and hour when the VCC is switched off.

If the VCC is available, the back-up battery can be charged by the internal 2.5V power supply regulator.

Comparing with GR64, the supply voltage from the RTC battery and the charging voltage to the RTC battery are higher in Q64. Below table shows the differences between VRTC in GR64 and Q64.

Signal	State	VImin	VInom	VImax	Vonom	Unit
VRTC (in GR64)	I/O	1.85		2.5	2.45	V
VRTC (in Q64)	I/O	1.0	1.8	2	1.5	V

3.10 USB

This feature is only supported by Q64 (not available on GR64).

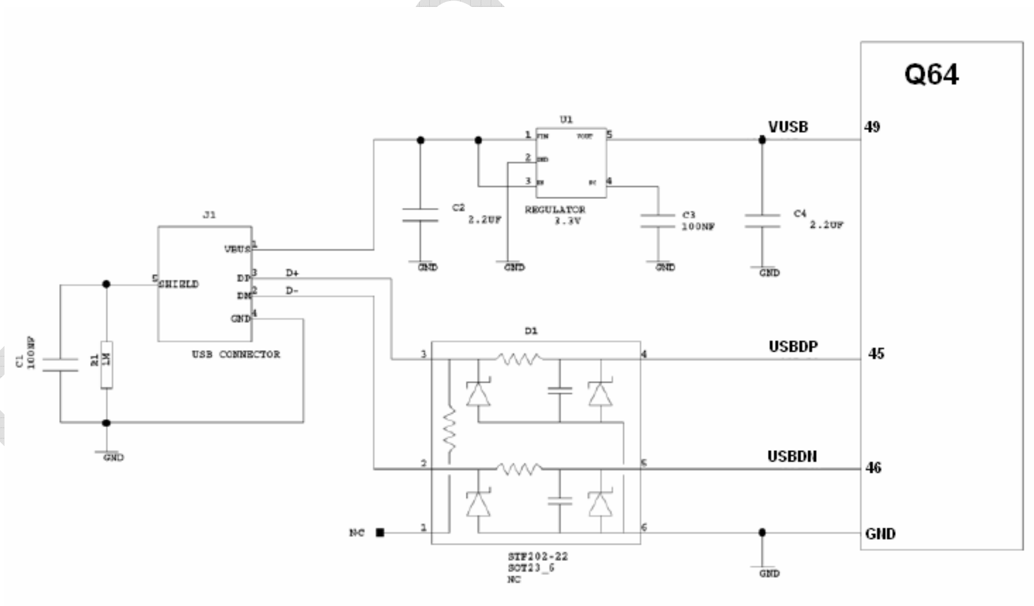
A 3 wires USB slave interface is available. It is compliant to USB 2.0 protocol signaling, but it is not compliant with electrical interface (VUSB being 3.3V instead of 5V for the USB standard). The USB interface signals are VUSB, USBDP and USBDN.

Pin description

Signal	Pin number	I/O	I/O type	Description
VUSB	49	I	3V3	USB Power Supply
USBDP	45	I/O	3V3	Differential data interface positive
USBDN	46	I/O	3V3	Differential data interface negative

A 5V to 3.3V voltage regulator is needed between the external interface power in line (+5V) and the module line (VUSB). Also, an EMI/RFI filter with ESD diode is required.

A typical USB circuitry is shown below:



Recommended components

- R1: 1MOhm
- C1, C3: 100nF
- C2, C4: 2.2µF
- D1: STF2002-22 from SEMTECH

- U1: LP2985AIM 3.3V from NATIONAL SEMICONDUCTOR

The regulator used is a 3.3V regulator. It is supplied via J1 when the USB wire is connected.

The EMI/RFI filter with ESD protection is D1. The D1 internal pull-up resistor used to detect full speed is not connected as it is embedded in the Wireless CPU®.

R1 and C1 must be closed to J1.

3.11 PCM Interface

PCM interface is not the same standard for GR64 and Q64. Electrical interface is compatible but sequence and timing refer to different standards as detailed below:

GR64

The PCM digital audio interface for GR64 is based upon the Texas Instruments SSI standard. The SSP interface can be programmed for data frame sizes between 4 to 16 bits. The clock rate is fixed to 128kHz. For standard GSM voice a 13-Bit PCM data word is embedded in a 16-bit word frame.

In Q64

The PCM interface allows the connectivity with audio standard peripherals, which are

- IOM-2 compatible device on physical level
- Master mode only with 6 slots by frame, user only on slot 0
- Bit rate single clock mode at 768 kHz only
- 16 bits data word MSB first only
- Linear Law only (no compression law)
- Long Frame Synchronization only The frame synchronization signal delivers an 8 kHz frequency pulse that synchronizes the frame data in and the frame data out.

Please refer to [1] Wireless CPU® Q64 Product Technical Specification and Customer Design Guidelines for more information on its PCM interface.

3.12 Antenna Diagnostics

GR64 provides antenna diagnostics using AT*E2ANTDI AT command to determine the antenna connection through an ADC Antenna sense voltage return value.

This feature is not supported by Q64.

3.13 TX_ON

In GR64, TX_ON (pin 35) indicates the GSM transceiver is transmitting RF signals.

This feature is not supported by Q64 and it is replaced by a 2V8 GPIO interface, which is named as GPIO16 (pin 35).

3.14 SERVICE/Programming

The SERVICE interface is flash memory programming enable input.

For GR64, this signal is not needed to perform normal SW-updating through “Updater”, but it is needed to support special service tools from Wavecom.

For Q64, the SW-updating is done by XMODEM download. Same as GR64, this signal is needed to support special service tools from Wavecom.

Signal	State	Operating Mode	Comments
SERVICE (GR64 case)	0	Normal Use	No Download
	0	Download via “Updater”	Download by using “Updater”
	1	Download specific	Need WAVECOM PC Software
SERVICE (Q64 case)	0	Normal Use	No Download
	0	Download via XMODEM	AT command for Download AT+WDWL
	1	Download specific(*)	Need WAVECOM PC Software

(*) It is highly recommended to pull the ON/OFF signal to low during software update using Wavecom specific software.

4 Mechanical Differences

Q64 is pin to pin and size compatible with GR64. They are in same board size and board to board height.

4.1 Overall dimensions

		GR64001	Q64
Length		50 mm	50 mm
Width		33 mm	33 mm
Weight		8 g	11.6 g
Thickness	Exclude RF connector	4.0 mm	6.7 mm
	Include RF Connector	6.8 mm	6.8 mm

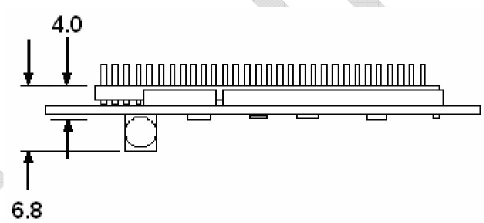


Figure 6: Thickness of GR64001 Wireless CPU® (including shieding can, PCB and the components on the top layer)

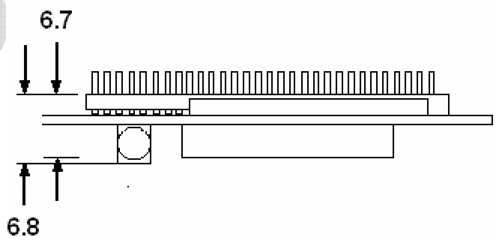


Figure 7: Thickness of Q64 Wireless CPU® (including shieding can, PCB and WMP100)

Please refer Section 4.3 for the details mechanical drawing of Wireless CPU® Q64 and GR64001.

4.2 Interface Description

The pictures below show the mechanical design of the Wireless CPU® along with the positions of the different connectors and mounting holes.

On the top side, Wavecom Wireless Microprocessor® WMP100 and a MMCX RF connector are mounted.

On the bottom side, same as GR64, components inside are protected with tin coated steel ASI 1008/1010 covers that meet the environmental and EMC requirements.

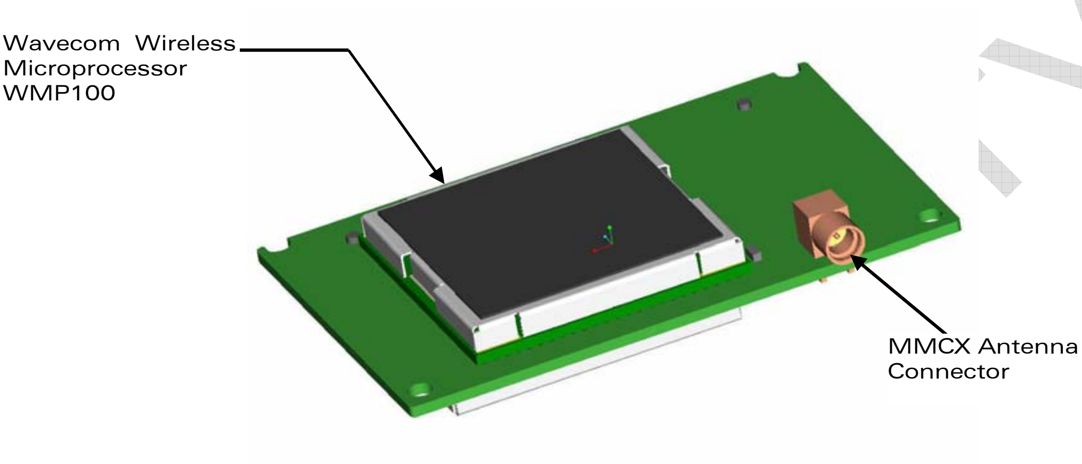


Figure 8: Wireless CPU® Q64 viewed from above

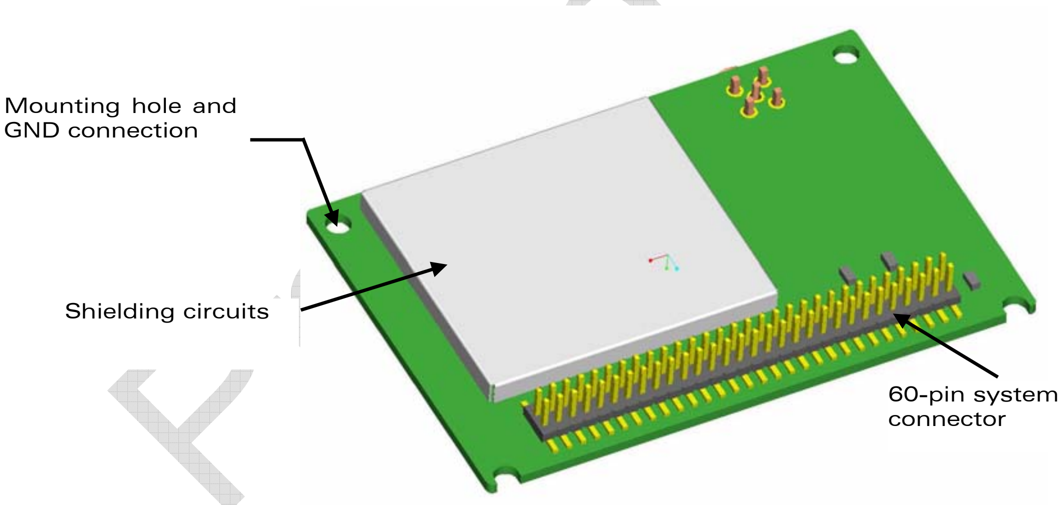
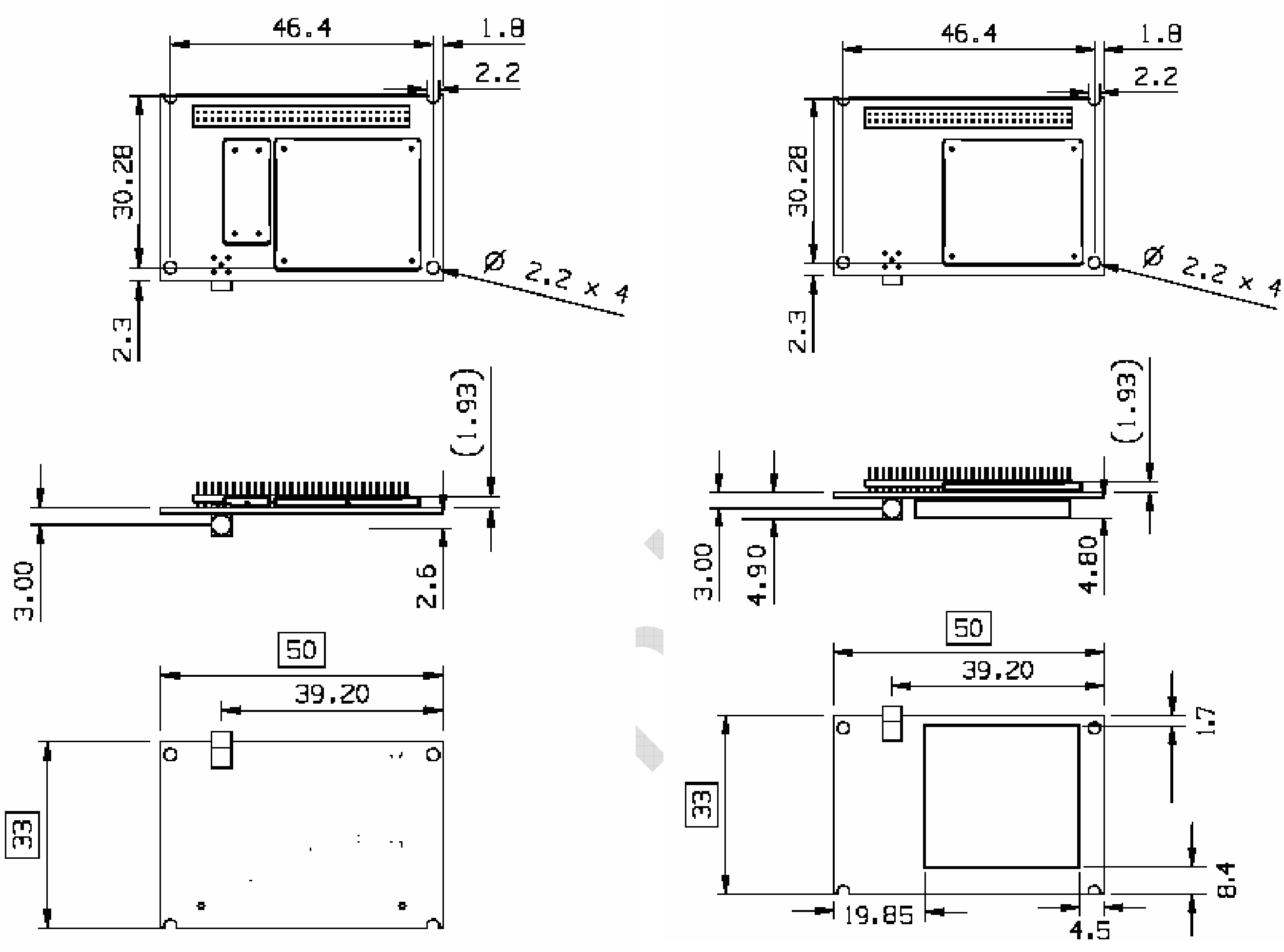


Figure 9: Wireless CPU® Q64 viewed from below

4.3 Physical Dimensions



GR64001 Wireless CPU®

Q64 Wireless CPU®

Figure 10: Dimensions of the Q64 and GR64001 Wireless CPU®

Measurements are given in millimetres.