



Wireless CPU Q24 Series Product Technical Specification

Revision: 003

Date: November 2006

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Wireless CPU Q24 Series

Product Technical Specification

Reference: **WM_PRJ_Q24NG_PTS_001**
Revision: **003**
Date: **November 2006**




Powered by the Open AT[®] Software Suite

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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Web Site Support

General information about Wavecom and its range of products: www.wavecom.com

Specific support is available for the Q24 Classic, Plus, Extended and Auto Wireless CPU: www.wavecom.com/Q24Classic,

www.wavecom.com/Q24Plus,

www.wavecom.com/Q24Extended,

www.wavecom.com/Q24Auto

Carrier/Operator approvals: www.wavecom.com/approvals

Open AT® Introduction: www.wavecom.com/OpenAT

Developer support for software and hardware: www.wavecom.com/forum

Overview

This Product Specification document defines and specifies the Wireless CPU Q24 Series is available in four different GSM/GPRS Class 10 quad-band versions:

- **Q24 Classic:** EGSM 900/1800/850/1900 MHz version with 32 Mb of Flash memory and 16 Mb of PSRAM (32/16), T° range [-20°C / +55°C].
- **Q24 Plus:** EGSM/GPRS 900/1800/850/1900 MHz version with 32 Mb of Flash memory and 16 Mb of PSRAM (32/16), T° range [-20°C / +55°C].
- **Q24 Extended:** EGSM/GPRS 900/1800/850/1900 MHz version with 32 Mb of Flash memory and 4 Mb of SRAM (32/4), extended T° range.
- **Q24 Automotive:** EGSM/GPRS 900/1800/850/1900 MHz version with 32 Mb of Flash memory and 4 Mb of PSRAM (32/4), extended T° range.

This version is dedicated to automotive applications.

This document covers the Wireless CPU alone and do not include the programmable capabilities provided in Open AT® Software Suites.

For detailed software programming guides, refer to the documents shown in the "Reference documents" section.

Open AT® Software Suites allow developers to natively execute ANSI C software programs directly on the Wireless CPU.

Document History

| Revision | Date | List of revisions | |
|----------|----------------|--------------------------------|--|
| 001 | May 2006 | Creation (Preliminary version) | |
| 002 | September 2006 | First update | |
| 003 | November 2006 | Update | |

Contents

| | | |
|----------|--|-----------|
| 1 | References..... | 10 |
| 1.1 | Reference Documents..... | 10 |
| 1.1.1 | Wavecom Reference Documents..... | 10 |
| 1.1.2 | General Reference Documents..... | 10 |
| 1.2 | Abbreviations..... | 11 |
| 2 | General Description | 14 |
| 2.1 | General Information | 14 |
| 2.1.1 | Overall Dimensions | 14 |
| 2.1.2 | Open AT® Software Suite..... | 14 |
| 2.1.3 | GSM/GPRS Features | 15 |
| 2.1.4 | Interfaces..... | 15 |
| 2.1.5 | External RF Connection Interfaces..... | 16 |
| 2.1.6 | SIM Card Holder | 16 |
| 2.1.7 | Green Policy..... | 16 |
| 2.2 | Functional Architecture..... | 17 |
| 2.2.1 | RF Functionalities | 18 |
| 2.2.2 | Baseband Functionalities | 18 |
| 3 | Interfaces | 19 |
| 3.1 | General Purpose Connector (GPC)..... | 19 |
| 3.2 | Power Supply | 20 |
| 3.2.1 | Power Supply Description..... | 20 |
| 3.2.2 | Power Supply Recommendation | 22 |
| 3.2.3 | Power Consumption | 24 |
| 3.3 | Electrical Information for Digital I/O..... | 28 |
| 3.4 | Serial Interface..... | 28 |
| 3.4.1 | SPI Bus..... | 28 |
| 3.4.2 | SPI Auxiliary Bus | 28 |
| 3.4.3 | Two-wire Bus Interface (I ² C)..... | 29 |
| 3.5 | Keyboard Interface..... | 29 |
| 3.6 | Main Serial Link (UART1)..... | 30 |
| 3.7 | Auxiliary Serial Link (UART2) | 32 |
| 3.8 | SIM Interface | 32 |
| 3.8.1 | General Description..... | 32 |
| 3.8.2 | SIM Card Holder | 34 |
| 3.9 | General Purpose Input/Output..... | 36 |

| | | |
|----------|--|-----------|
| 3.10 | Activity Status Indication | 37 |
| 3.11 | Analog to Digital Converter (ADC)..... | 38 |
| 3.12 | Audio Interface | 38 |
| 3.12.1 | Microphone Inputs..... | 39 |
| 3.12.2 | Speaker Outputs | 42 |
| 3.13 | Buzzer Output | 44 |
| 3.13.1 | Hardware Description | 44 |
| 3.14 | Battery Charging Interface | 45 |
| 3.14.1 | Hardware Description | 45 |
| 3.14.2 | Temperature Monitoring | 47 |
| 3.14.3 | Ni-Cd / Ni-Mh Charging Algorithm | 47 |
| 3.14.4 | Li-Ion Charging Algorithm | 49 |
| 3.15 | ON / ~OFF..... | 52 |
| 3.15.1 | General Description..... | 52 |
| 3.15.2 | Operating Sequences | 53 |
| 3.16 | BOOT (optional) | 55 |
| 3.17 | Reset Signal (~RST) | 56 |
| 3.17.1 | General Description..... | 56 |
| 3.17.2 | Reset Sequence | 58 |
| 3.18 | External Interrupt (~INTR)..... | 58 |
| 3.19 | VCC output | 59 |
| 3.20 | Real Time Clock Supply (VCC_RTC) | 60 |
| 3.21 | RF Interface | 61 |
| 3.21.1 | RF Connections..... | 61 |
| 3.21.2 | RF Performance | 62 |
| 3.21.3 | Antenna Specifications | 62 |
| 4 | Technical Specifications..... | 63 |
| 4.1 | General Purpose Connector Pin-out Description..... | 63 |
| 4.2 | I/O Circuit Diagram | 67 |
| 5 | Environmental Specifications | 68 |
| 5.1 | Environmental Qualifications | 69 |
| 5.1.1 | Reflow Soldering:..... | 70 |
| 5.2 | Mechanical Specifications..... | 71 |
| 5.2.1 | Physical Characteristics | 71 |
| 5.2.2 | Mechanical Drawings | 71 |
| 6 | Connector and Peripheral Device References..... | 73 |
| 6.1 | General Purpose Connector Data Sheet | 73 |
| 6.2 | SIM Card Reader..... | 73 |
| 6.3 | Microphone | 73 |
| 6.4 | Speaker..... | 73 |

| | | |
|----------|--|-----------|
| 6.5 | Antenna Cable | 73 |
| 6.6 | RF board-to-board Connector..... | 74 |
| 6.7 | GSM Antenna | 74 |
| 7 | Appendix..... | 75 |
| 7.1 | Standards and Recommendations | 75 |
| 7.2 | Safety Recommendations (for Information only)..... | 77 |
| 7.2.1 | RF safety..... | 78 |
| 7.2.2 | General safety | 79 |

Table of Figures

| | |
|---|----|
| Figure 1: Functional architecture | 17 |
| Figure 2: Power supply during burst emission..... | 21 |
| Figure 3: Maximum voltage ripple (Uripp) versus Frequencies in GSM & DCS..... | 23 |
| Figure 4: UART1 Serial Link signals | 31 |
| Figure 5: UART2 Serial Link signals | 32 |
| Figure 6: SIM Card holder constraints | 34 |
| Figure 7: Buzzer connection | 45 |
| Figure 8: Ni-Cd / Ni-Mh charging waveform | 49 |
| Figure 9: Li-Ion full-charging waveform | 52 |
| Figure 10: Power-ON sequence diagram | 54 |
| Figure 11: Power-OFF sequence diagram | 55 |
| Figure 12: RST pin connection..... | 58 |
| Figure 13: Reset sequence diagram | 58 |
| Figure 14: Wireless CPU pin position (bottom view) | 66 |
| Figure 15: I/O Circuit Diagram..... | 67 |
| Figure 16: Q24 Classic, Q24 Plus and Q24 Extended Environmental classes..... | 69 |
| Figure 17: Q24 Automotive environmental classes | 70 |
| Figure 18: Mechanical drawing. | 71 |

1 References

1.1 Reference Documents

For more details, several reference documents may be consulted. The Wavecom reference documents are provided in the Wavecom documents package contrary to the general reference documents, which are not Wavecom owned.

1.1.1 Wavecom Reference Documents

- [1] Automotive Environmental Control Plan for Wireless CPU Q24 Series
WM_PRJ_Q24NG_DCP_001
- [2] Environmental Control Plan for Wireless CPU Q24 Series
WM_PRJ_Q24NG_DCP_002
- [3] Wireless CPU Q24 Series Customer Design Guidelines
WM_PRJ_Q24NG_PTS_002
- [4] Wireless CPU Q24 Series Process Customer Guidelines
WM_PRJ_Q24NG_PTS_003
- [5] AT Commands Interface Guide for OS 6.57
WM_ASW_OAT_UGD_0044
- [6] AT Commands Interface Guide (Bluetooth)
WM_ASW_BLU_UGD_001
- [7] ADL User Guide for Open ATA® V3.12
WM_ASW_OAT_UGD_006

1.1.2 General Reference Documents

- [8] "I²C Bus Specification", Version 2.0, Philips Semiconductor 1998
- [9] ISO 7816-3 Standard

1.2 Abbreviations

Abbreviation Description

| | |
|-------|---|
| 3GPP | Third Generation Partnership Project |
| ADC | Analog to Digital Converter |
| A/D | Analog to Digital conversion |
| AT | Attention (prefix for modem commands) |
| AUX | AUXiliary |
| CBS | Cell Broadcast Service |
| CLK | CLock |
| CMOS | Complementary Metal Oxide Semiconductor |
| CODEC | COder DECoder |
| CPU | Central Processing Unit |
| CTS | Clear To Send |
| dB | Decibel |
| DC | Direct Current |
| DCD | Data Carrier Detect |
| DCS | Digital Cellular System |
| DCXO | Digitally Controlled Crystal Oscillator |
| DR | Dynamic Range |
| DSR | Data Set Ready |
| DTR | Data Terminal Ready |
| EDGE | Enhanced Data rates for GSM Evolution |
| EGSM | Extended GSM |
| EN | Enable |
| ESD | ElectroStatic Discharges |
| ETSI | European Telecommunications Standards Institute |
| FEM | Front End Module |
| FR | Full Rate |
| GND | GrouND |
| GPI | General Purpose Input |
| GPC | General Purpose Connector |
| GPIO | General Purpose Input Output |
| GPO | General Purpose Output |
| GPRS | General Packet Radio Service |
| GSM | Global System for Mobile communications |

| Abbreviation | Description |
|---------------------|-------------------------------------|
| IF | Intermediate Frequency |
| INTR | INTeRrupt |
| I/O | Input / Output |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| LNA | Low Noise Amplifier |
| LSB | Less Significant Bit |
| MAX | MAXimum |
| MIC | MICrophone |
| MIN | MINimum |
| MMS | Multimedia Message Service |
| MS | Mobile Station |
| NOM | NOMinal |
| NTC | Negative Temperature Coefficient |
| PA | Power Amplifier |
| PBB | PolyBrominated Biphenyl |
| PBDE | PolyBrominated Diphenyl Ethers |
| PCB | Printed Circuit Board |
| PCL | Power Control Level |
| PCS | Personal Communications Services |
| PLL | Phase Lock Loop |
| RAM | Random Access Memory |
| RF | Radio Frequency |
| RI | Ring Indicator |
| RoHS | Restriction of Hazardous Substances |
| RST | ReSeT |
| RTC | Real Time Clock |
| RTS | Request To Send |
| RX | Receive |
| SCL | Serial CLock |
| SDA | Serial DAta |
| SIM | Subscriber Identification Module |
| SMS | Short Message Service |
| SPI | Serial Peripheral Interface |
| SPK | SPEaKer |

| Abbreviation | Description |
|---------------------|--|
| SRAM | Static RAM |
| TDMA | Time D ivision M ultiple A ccess |
| TU | Typical U rban fading profile |
| TUHigh | Typical U rban, H igh speed fading profile |
| TDMA | Time D ivision M ultiple A ccess |
| TX | Transmit |
| TYP | TYP ical |
| UART | Universal A synchronous R eceiver- T ransmitter |
| VLSI | Very L arge S cale I ntegration |
| VSWR | Voltage S tanding W ave R atio |

2 General Description

2.1 General Information

The Wireless CPU Q24 Series are self-contained EGSM/GPRS 900/1800 and 850/1900 quad-band Wireless CPUs with the following characteristics:

Note:

The Q24 classic is limited to GSM only (GPRS not supported).

2.1.1 Overall Dimensions

Completely shielded:

- Length: 58.4 mm
- Width: 32.2 mm
- Thickness: 3.9 mm:
 - Excluding Shielding legs
 - 6, 2 mm for Q24 Automotive, which offers either a MMS or UFL connector on the top side
- Weight: <11 g (12g for Q24 Automotive)

2.1.2 Open AT® Software Suite

Every Wavecom Wireless CPU comes with the "Open AT® Software", which has the following five elements:

- ➔ Open AT® IDEs
- ➔ Open AT® Applications
- ➔ Open AT® Plug-Ins
- ➔ Open AT® Operating Systems
- ➔ Open AT® Firmwares

The Open AT® Software Suite enables a customer to develop within the Open AT® IDE an ANSI C based Open AT® Application, which is natively executed under the Open AT® OS which may utilise one or more Open AT® Plug-Ins and connect to wireless networks, peripheral devices & companion controllers via the Open AT® Firmware.

Among other things (please refer to Open AT® Programming Guides), the Open AT® firmware offers:

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

Wireless CPU Q24 Series

General Description

The Wireless CPU Q24 Series are designed to integrate various types of specific process applications such as vertical applications (telemetry, multimedia, automotive).

The Open AT firmware offers a set of AT commands to control the Wireless CPU. With this standard Operating System, some interfaces of the Wireless CPU are not available since they are dependent on the peripheral devices connected to the Wireless CPU.



This symbol is used to indicate that the interfaces are not available with AT commands.

The Operating System is Open AT® compliant.

The Open AT OS offers a set of Open AT® AT API's to control the Wireless CPU. The limitation mentioned above is not valid in this case.

2.1.3 GSM/GPRS Features

- 2-Watt EGSM 900/GSM 850 radio section running under 3.6 volts
- 1-Watt GSM1800/1900 radio section running under 3.6 Volts
- Hardware GSM/GPRS class 10 capable (except the Wireless CPU Q24 Classic)

2.1.4 Interfaces

- Complete interfacing is through a 60-pin connector:
 - SPI and 2-wire bus interface
 - Keyboard interface
 - Two serial link interfaces (UART1 and UART2)
 - 3V/1.8V SIM interface
 - GPIOs
 - Activity status indication interface
 - Analog to digital converter
 - Analog audio
 - Buzzer interface
 - Battery charging interface
 - External interrupt
 - Power supply interface
 - Back-up battery interface
- Optional SIM holder (offered on Wireless Q24 Classic and Wireless CPU Q24 Plus)

Wireless CPU Q24 Series General Description

2.1.5 External RF Connection Interfaces

The Wireless CPU Q24 Series are available with different external RF connection configurations:

| Product reference | UFL | UFL or MMS | Antenna pad | IMP |
|-------------------|-------------|------------|-------------|-------------|
| Position | Bottom side | Top side | Top side | Bottom side |
| Q24 Classic | X | | X | X |
| Q24 Plus | X | | X | X |
| Q24 Extended | X | | X | X |
| Q24 Automotive | | X | X | X |

2.1.6 SIM Card Holder

The Wireless CPU Q24 Series are available with a SIM Card holder at the TOP:

| SIM interface location | | |
|------------------------|------------------|---------------------|
| Product reference | 60-pin connector | Optional SIM holder |
| Q24 Classic | X | X |
| Q24 Plus | X | X |
| Q24 Extended | X | |
| Q24 Automotive | X | |



Caution:

- The Wireless CPU Q24 Series does not allow two SIM Cards to be connected at the same time.
- If a Wireless CPU Q24 Classic or Q24 Plus is used with a SIM Card holder at the top, it is **mandatory** to avoid a SIM interface connection through the 60-pin General Purpose Connector (GPC).

2.1.7 Green Policy

The Wireless CPU Q24 Series are compliant with RoHS (Restriction of Hazardous Substances in Electrical and Electronic Equipment). Directive 2002/95/EC which sets limits for the use of certain restricted hazardous substances.

This directive states that "from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)".

2.2 Functional Architecture

The global architecture of the Wireless CPU Q24 Series is shown below:

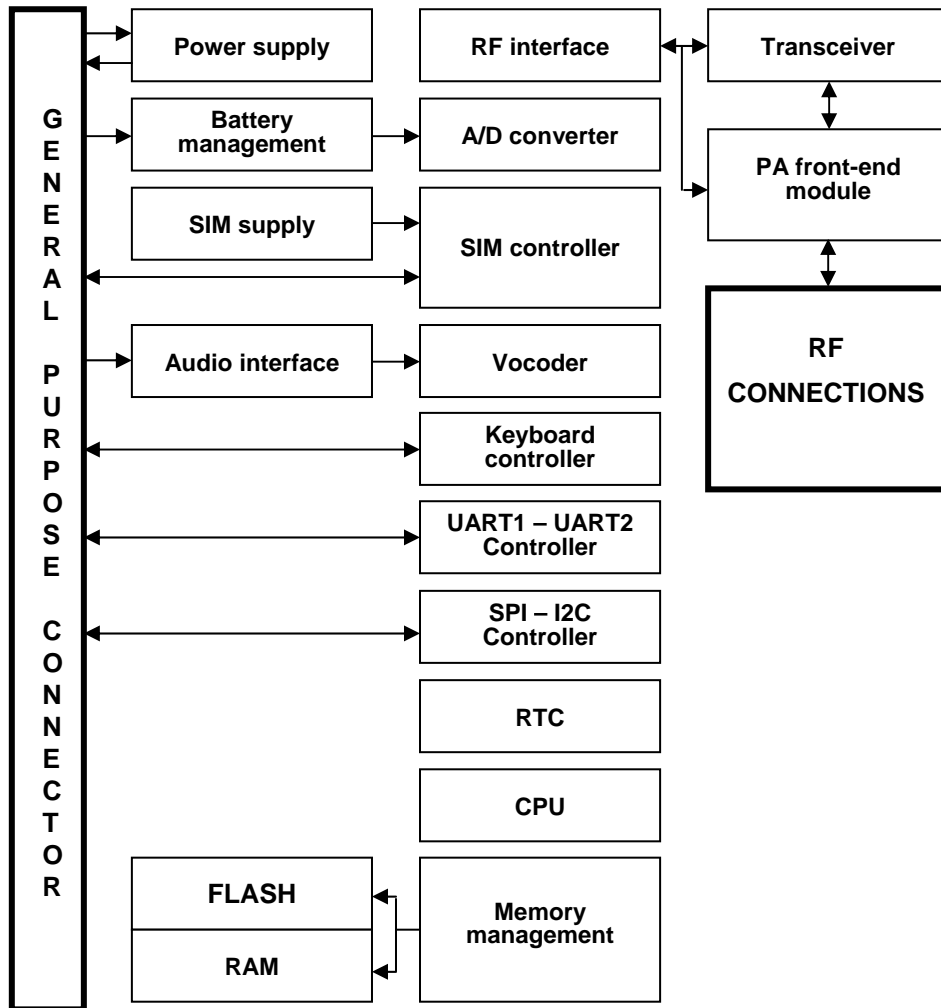


Figure 1: Functional architecture

Wireless CPU Q24 Series General Description

2.2.1 RF Functionalities

The Radio Frequency (RF) range complies with the Phase II EGSM 900/DCS 1800 and GSM 850/PCS 1900 recommendations. The frequencies are given below:

| GSM band | Transmit band (Tx) | Receive band (Rx) |
|----------|--------------------|-------------------|
| GSM 850 | 824 to 849 MHz | 869 to 894 MHz |
| EGSM 900 | 880 to 915 MHz | 925 to 960 MHz |
| DCS 1800 | 1710 to 1785 MHz | 1805 to 1880 MHz |
| PCS 1900 | 1850 to 1910 MHz | 1930 to 1990 MHz |

The Radio Frequency (RF) part is based on a specific quad-band chip. It includes a:

- Digital low-IF receiver,
- Quad-band LNAs (Low Noise Amplifier),
- Offset PLL (Phase Locked Loop) transmitter,
- Frequency synthesizer,
- Digitally controlled crystal oscillator (DCXO),
- Tx/Rx FEM (Front-End module) for quad-band GSM/GPRS.

2.2.2 Baseband Functionalities

The Wireless CPU Q24 Series digital parts are based on the PHILIPS-VLSI chip (ONE C GSM / GPRS Kernel).

This chipset uses a 0.25 μm CMOS mixed technology, which allows massive integration as well as low current consumption.

3 Interfaces

Note:

Some of the Wireless CPU Q24 Series interface signals are multiplexed in order to limit the total number of pins. But this architecture imposes some restrictions.

Example:

If the SPI bus and 2-wire bus are multiplexed and if the SPI bus is used, then the 2-wire bus is not available.



Caution:

To power-ON the Wireless CPU Q24 Series correctly and to avoid any damage, all external signals must be inactive when the Wireless CPU Q24 Series is OFF.

3.1 General Purpose Connector (GPC)

A 60-pin connector, with 0.5 mm pitch, is provided to interface the Wireless CPU Q24 Series with a customer application board containing either an LCD module, or a keyboard, a SIM connector, a battery connection, etc.

The GPC is made by the KYOCERA / AVX group with the following reference:

- 14 5087 060 930 861.

The matting connector has the following reference:

- 24 5087 060 X00 861.

For further details, refer to section "6.1 General Purpose Connector Data Sheet".

Wireless CPU Q24 Series Interfaces

The available interfaces on the GPC are shown below:

| Section | Name | OS 6.57 | | Open AT | |
|---------|-----------------------------|-----------|---------------|-----------|---------------|
| | | Supported | Not supported | Supported | Not supported |
| 3.4 | Serial interface | X | | X | |
| 3.5 | Keyboard Interface | X | | X | |
| 3.6 | Main Serial Link | X | | X | |
| 3.7 | Auxiliary Serial Link | X | | X | |
| 3.8 | SIM interface | X | | X | |
| 3.9 | General Purpose IO | X | | X | |
| 3.10 | Activity status indication | X | | X | |
| 3.11 | Analog to digital converter | X | | X | |
| 3.12 | Audio Interface | X | | X | |
| 3.14 | Battery charging interface | X | | X | |
| 3.15 | ON/~OFF | X | | X | |
| 3.16 | Boot | | X | | X |
| 3.17 | Reset | X | | X | |
| 3.18 | External interrupt | X | | X | |
| 3.19 | VCC output | X | | X | |
| 0 | Real Time Clock | X | | X | |
| 0 | RF interface | X | | X | |

3.2 Power Supply

3.2.1 Power Supply Description

The power supply is one of the key factors in the design of a GSM terminal.

Due to the burst emission in GSM / GPRS, the power supply must be able to deliver high current peaks in a short time. During these peaks, the ripple (Uripp) on the supply voltage must not exceed the limits specified, see the table "Maximum voltage ripple (Uripp) vs Frequency" given below.

- In communication mode, a GSM/GPRS class 2 terminal emits 577 μ s radio bursts every 4.615ms. (see the Figure 2: Power supply during burst emission).
- In communication mode, a GPRS class 10 terminal emits 1154 μ s radio bursts every 4.615ms.

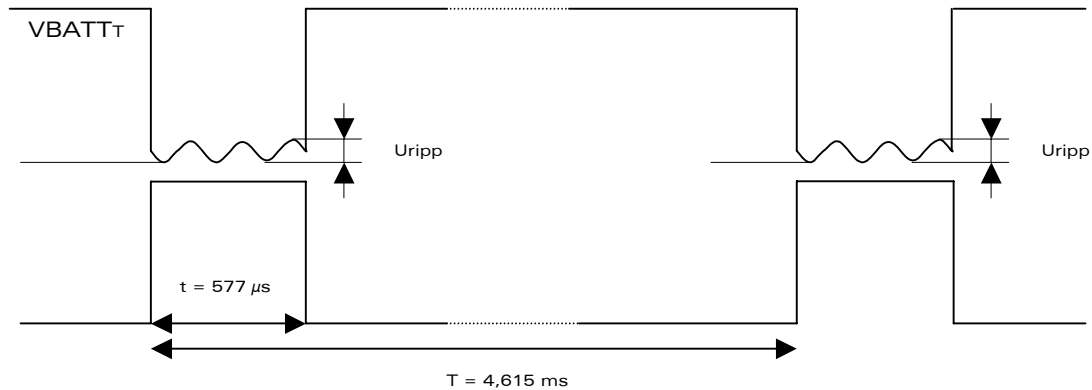


Figure 2: Power supply during burst emission

Two different inputs are provided for the power supply:

- VBATT is used to supply the RF part and
- VDD is used to supply the baseband part.

VBATT: Directly supplies the RF components with 3.6 V. It is essential to keep a minimum voltage ripple at this connection in order to avoid any phase error. In particular, VBATT supplies the RF Power Amplifier.

The current waveform is bursted with the following duty cycles:

- 1/8 of the time (around 577 μ s every 4.615 ms for GSM/GPRS class 2),
- 2/8 of the time (around 1154 μ s every 4.615 ms for GSM/GPRS class 10).

The rising time is around 10 μ s.

VDD: Supplies the +2.8 V ballast regulators of the Wireless CPU Q24 Series. It is essential to keep the voltage over 3.1 volts at any time.

Notes:

- It is possible to connect VBATT and VDD together.
- In the event of separate power supply, they must be in same state: e.g. either active or inactive at the same time.

GND: The grounding connection of the Wireless CPU Q24 Series is made through the shielding \Rightarrow The four "legs" must be soldered to a complete ground plane.

The power supply voltage for VBATT and VDD is given below:

Power supply pin-out

| Signal | Pin number |
|--------|----------------|
| VBATT | 55,57,58,59,60 |
| VDD | 11 |
| GND | Shielding legs |

Electrical characteristics

| Signal | MIN | NOM | MAX |
|--------|-------|-------|---------|
| VBATT | 3.2 V | 3.6 V | 4.5 V * |
| VDD | 3.1 V | | 4.5 V |

*Max operating Voltage Standing Wave Ratio (VSWR) 2:1.

3.2.2 Power Supply Recommendation

The VBATT voltage limits must be considered at any time.

The worst condition is during the burst period transmission, when current consumption is at its highest. During this period, the VBATT voltage is minimum:

- The output voltage of the power supply drops.
- Voltage drop is present between the power supply output and the Wireless CPU supply pins (VBATT).

To ensure a good design, **make sure that** during a transmit burst period, the total drop in voltage should not set the Wireless CPU supply voltage (VBATT) below **VBATT_{MIN} = 3.2V**.

Notes:

- During a transmit burst, Wireless CPU nominal current is 1.4A only.
- To design the Wireless CPU power supply with a margin, a target of 2A is recommended.



Caution:

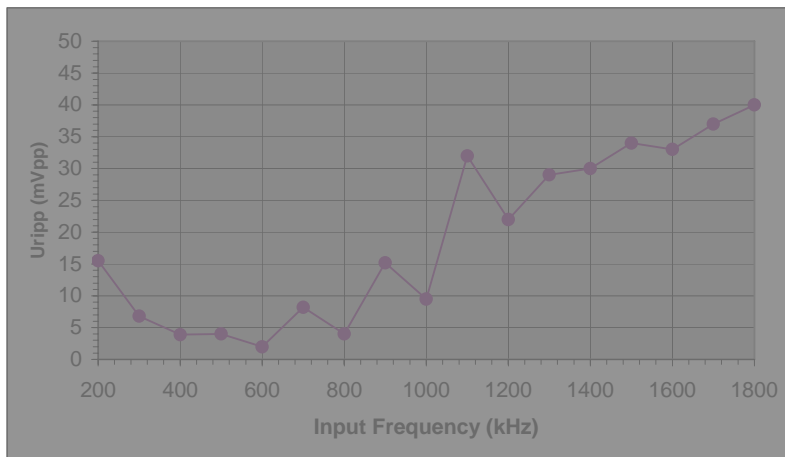
- If VBATT < 3.2V, the Wireless CPU automatically powers OFF.
- When a Wireless CPU is supplied with a battery, the total impedance (battery + contacts + protections + PCB) should be < 150mΩ to limit voltage drop-out within emission burst.
- As the radio power amplifier is directly connected to the VBATT, the Wireless CPU Q24 Series are sensitive to any voltage variation. When a DC/DC converter is used, Wavecom recommends to set the converter frequency in such a way that the resulting voltage does not exceed these values, which are given in the following table. "Maximum voltage ripple (Uripp) vs Frequency".

Wireless CPU Q24 Series

Interfaces

| Freq. (kHz) | Uripp Max (mVpp) | Freq. (kHz) | Uripp Max (mVpp) | Freq. (kHz) | Uripp Max (mVpp) |
|-------------|------------------|-------------|------------------|-------------|------------------|
| <100 | 50 | 800 | 4 | 1500 | 34 |
| 200 | 15.5 | 900 | 15.2 | 1600 | 33 |
| 300 | 6.8 | 1000 | 9.5 | 1700 | 37 |
| 400 | 3.9 | 1100 | 32 | 1800 | 40 |
| 500 | 4 | 1200 | 22 | >1900 | 40 |
| 600 | 2 | 1300 | 29 | | |
| 700 | 8.2 | 1400 | 30 | | |

To be confirmed



for $f < 100\text{kHz}$ $U_{ripp} \text{ Max} = 50\text{mVpp}$
for $f > 1800\text{kHz}$ $U_{ripp} \text{ Max} = 40 \text{ mVpp}$

Figure 3: Maximum voltage ripple (Uripp) versus Frequencies in GSM & DCS

Refer to Wireless CPU Q24 Series Customer Design Guidelines [3], for further information on power supply design.

3.2.3 Power Consumption

The Wireless CPU Q24 Series support different power consumption modes:

| Working modes | Comments |
|---------------------------|---|
| OFF mode | The Wireless CPU is in OFF mode. |
| ALARM mode | The Wireless CPU is in OFF mode with RTC block running, when an ALARM occurs, the Wireless CPU wakes-up automatically. |
| FAST idle mode | The Wireless CPU is synchronized with an RF GSM/GPRS network. The internal 26 MHz of the Wireless CPU is constantly active. |
| SLOW idle mode | The Wireless CPU is synchronized with an RF GSM/GPRS tester. The internal 26 MHz of the Wireless CPU is not constantly active. |
| FAST Standby mode | The SIM and Radio interface are deactivated via AT command or Open AT API: -The embedded application is running -The serial port remains active (AT commands are available). The internal 26 MHz of the Wireless CPU is constantly active. |
| SLOW Standby mode | This mode is similar to the FAST Standby mode. All the features are disabled (no GSM, no GPRS, no SIM and no Serial port). The internal 26 MHz of the Wireless CPU is not constantly active. |
| Communication mode | A GSM/GPRS communication is established with a RF GSM/GPRS network. |

The power consumption depends on the configuration used. It is for this reason that the following power consumption values are given for each modes, **RF bands and software used (AT or Open AT®)**.

All the following information is given, by assuming a **50 Ω** RF output.

Three VBATT values are used to measure the consumption, **VBATT_{MIN} (3.2V)**, **VBATT_{MAX} (4.5V)** and **VBATT_{TYP} (3.6V)**.

The average current is given for three VBATT values and peak current given is the maximum current peak measured with three VBATT voltages.

For more information on power consumption measurement, hardware configuration, SIM used, and software Dhystone application, see the AT Command Interface Guide or OS 6.57 [5] and Wireless CPU Q24 Series Customer Design Guidelines [3].

When Wireless CPU is in Alarm mode, no voltage must be applied to any pin of the 60-pin connector, except on the BAT-RTC (pin 56) for RTC operation or ON/~OFF (pin 6) to power-ON the Wireless CPU.

3.2.3.1 Power Consumption without Open AT® Processing

The following measurement results are relevant only when:

- There is no Open AT® application,
- The Open AT® application is disabled,

Wireless CPU Q24 Series
Interfaces

- No processing is required by the Open AT® application.

| Operating mode | | Parameters | | INOM average | IMAX average | IMAX peak | Unit | |
|----------------|----------------------------------|--------------|---------|--------------|--------------|--------------------|--------------------|----|
| OFF Mode | | VBATT= 3.6V | | 16.5 | 18 | | μA | |
| Alarm Mode | | VBATT= 3.6V | | 18.5 | 20 | | μA | |
| Fast Idle Mode | | Paging 9 | | 10.5 | 11 | 150 _{Rx} | mA | |
| | | Paging 2 | | 13 | 13.5 | 150 _{Rx} | mA | |
| Slow Idle Mode | | Paging 9 | | 2.8 | 3 | 150 _{Rx} | mA | |
| | | Paging 2 | | 5.5 | 5.8 | 150 _{Rx} | mA | |
| Fast Standby | | VBATT = 3.6V | | 9.5 | 11 | - | mA | |
| Slow Standby | | VBATT = 3.6V | | 1.5 | 2 | - | mA | |
| Connected Mode | | GSM850 | PCL5 | 217 | 225 | 1400 _{Tx} | mA | |
| | | EGSM900 | PCL19 | 90 | 95 | 250 _{Tx} | mA | |
| | | DCS1800 | PCL0 | 165 | 175 | 800 _{Tx} | mA | |
| | | PCS1900 | PCL15 | 90 | 100 | 250 _{Tx} | mA | |
| GPRS | Transfer Mode Class 8 (4Rx/1Tx) | | GSM850 | Gamma 3 | 209 | 220 | 1400 _{Tx} | mA |
| | | | EGSM900 | Gamma 17 | 87 | 90 | 250 _{Tx} | mA |
| | | | DCS1800 | Gamma 3 | 150 | 170 | 800 _{Tx} | mA |
| | | | PCS1900 | Gamma 18 | 84 | 95 | 250 _{Tx} | mA |
| | Transfer Mode Class 10 (3Rx/2Tx) | | GSM850 | Gamma 3 | 380 | 410 | 1400 _{Tx} | mA |
| | | | EGSM900 | Gamma 17 | 130 | 160 | 270 _{Tx} | mA |
| | | | DCS1800 | Gamma 3 | 258 | 290 | 800 _{Tx} | mA |
| | | | PCS1900 | Gamma 18 | 123 | 150 | 240 _{Tx} | mA |

_{Tx} means that the peak current is measured during a TX transmission burst

_{Rx} means that the peak current is measured during a RX reception burst

¹ Slow Idle mode power consumption depends on the SIM Card used.

Some SIM Cards respond faster than others, the longer the response time, the higher the consumption. The measurements were performed on a large number of 3V SIM Cards and the results in brackets shown in the above table are the minimum and maximum currents measured from among all the SIM Cards used.

3.2.3.2 Power Consumption with Open AT® Software

The power consumption with Open AT® software used is the Dhrystone application and the following consumption results were measured while performing on the Dhrystone application.

Wireless CPU Q24 Series

Interfaces

| Operating mode | | Parameters | | INOM average | IMAX average | IMAX peak | Unit | |
|----------------|----------------------------------|--------------|---------|--------------|--------------|--------------------|--------------------|----|
| OFF Mode | | VBATT = 3.6V | | 16.5 | 18 | | μA | |
| Alarm Mode | | VBATT = 3.6V | | 18.5 | 20 | | μA | |
| Fast Idle Mode | | Paging 9 | | 10.5 | 11 | 150 _{Rx} | mA | |
| | | Paging 2 | | 13 | 13.5 | 150 _{Rx} | mA | |
| Slow Idle Mode | | Paging 9 | | N/A | N/A | N/A | mA | |
| | | Paging 2 | | N/A | N/A | N/A | mA | |
| Fast Standby | | VBATT = 3.6V | | 9.5 | 11 | 150 _{Rx} | mA | |
| Slow Standby | | VBATT = 3.6V | | N/A | N/A | N/A | mA | |
| Connected Mode | | GSM850 | PCL5 | 232 | 240 | 1400 _{Tx} | mA | |
| | | EGSM900 | PCL19 | 101 | 110 | 250 _{Tx} | mA | |
| | | DCS1800 | PCL0 | 175 | 185 | 800 _{Tx} | mA | |
| | | PCS1900 | PCL15 | 100 | 110 | 250 _{Tx} | mA | |
| GPRS | Transfer Mode Class 8 (4Rx/1Tx) | | GSM850 | Gamma 3 | 209 | 220 | 1400 _{Tx} | mA |
| | | | EGSM900 | Gamma 17 | 87 | 90 | 250 _{Tx} | mA |
| | | | DCS1800 | Gamma 3 | 150 | 170 | 800 _{Tx} | mA |
| | | | PCS1900 | Gamma 18 | 84 | 95 | 250 _{Tx} | mA |
| | Transfer Mode Class 10 (3Rx/2Tx) | | GSM850 | Gamma 3 | 380 | 410 | 1400 _{Tx} | mA |
| | | | EGSM900 | Gamma 17 | 130 | 160 | 270 _{Tx} | mA |
| | | | DCS1800 | Gamma 3 | 258 | 290 | 800 _{Tx} | mA |
| | | | PCS1900 | Gamma 18 | 123 | 150 | 240 _{Tx} | mA |

3.2.3.3 Consumption Waveform

The consumption waveforms are given for an EGSM900 network configuration with AT software running on a Wireless CPU.

The VBATT voltage value is 3.6V typical.

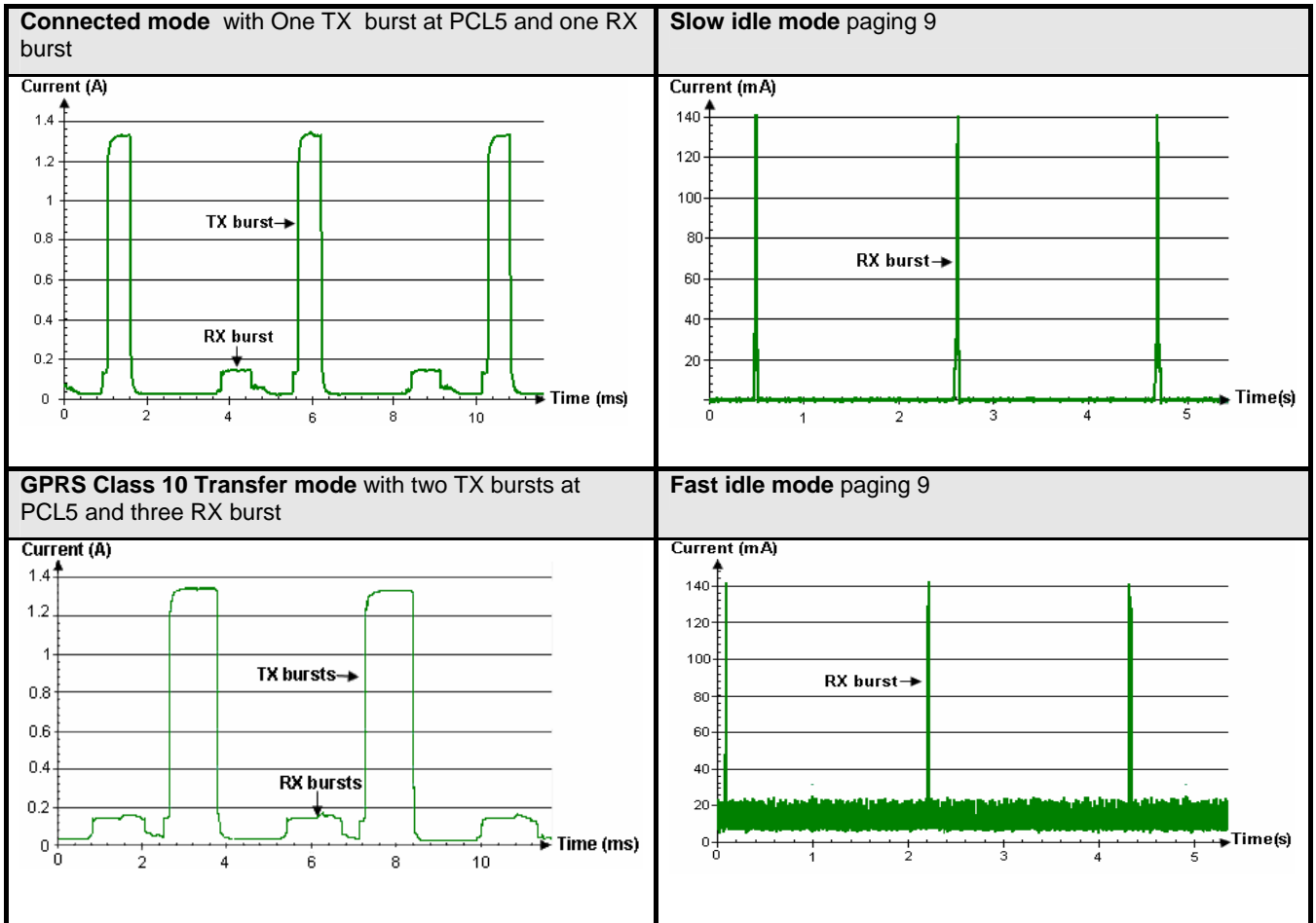
Four significant operating mode consumption waveforms are described as:

- **Connected mode** with one TX and one RX burst at PCL5 (33dBm)
- **GPRS class 10 transfer mode** with two TX bursts and three RX burst at Gamma 3 (33dBm)
- **Slow Idle mode** with a paging 9 (every 2 seconds)
- **Fast Idle mode** with a paging 9 (every 2 seconds)

Wireless CPU Q24 Series Interfaces

The following waveform shows only the current form versus time:

Current Waveform



3.3 Electrical Information for Digital I/O

All digital I/O comply with a 3 volt CMOS.

Electrical characteristics

| Parameter | I/O type | min | Max | Conditions |
|-----------|----------|--------|-------|-------------|
| VIL | CMOS | -0.5 V | 0.8 V | |
| VIH | CMOS | 2.1 V | 3.0 V | |
| VOL | 1X | -0.2V | 0.2 V | IOL = -1 mA |
| - | 2X | -0.2V | 0.2 V | IOL = -2 mA |
| - | 3X | -0.2V | 0.2 V | IOL = -3 mA |
| VOH | 1X | 2.55 V | 2.95V | IOH = 1 mA |
| - | 2X | 2.55 V | 2.95V | IOH = 2 mA |
| - | 3X | 2.55 V | 2.95V | IOH = 3 mA |

3.4 Serial Interface

3.4.1 SPI Bus

The SPI bus includes a CLK signal (SPI_CLK), an I/O signal (SPI_IO), and an EN signal (SPI_EN) complying with the SPI bus standard.

The frequency clock is programmable from 812 kHz to 13 MHz.

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|---------|-----|-----|---------------------|----------------|------------------|------------------|
| SPI_CLK | 10 | O | CMOS 1X (C5) | Pull-up to 2V8 | SPI Serial Clock | SCL |
| SPI_IO | 8 | I/O | CMOS / CMOS 1X (C2) | Pull-up to 2V8 | SPI Data | SDA |
| SPI_EN | 28 | O | CMOS 1X (C3) | 2V8 | SPI Enable | GPO3 |

(C2), (C3) and (C5): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"

3.4.2 SPI Auxiliary Bus

A second SPI Chip Enable (called SPI_AUX) must be used to add a second SPI peripheral to the Wireless CPU Q24 Series.

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|---------|-----|-----|---------------------|----------------|------------------|------------------|
| SPI_CLK | 10 | O | CMOS 1X (C5) | Pull-up to 2V8 | SPI Serial Clock | SCL |
| SPI_IO | 8 | I/O | CMOS / CMOS 1X (C2) | Pull-up to 2V8 | SPI Data | SDA |
| SPI_AUX | 26 | O | CMOS 1X (C3) | 2V8 | SPI Aux. Enable | GPO0 |

(C2), (C3) and (C5): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"

3.4.3 Two-wire Bus Interface (I²C)

The two-wire bus interface includes a CLK signal (SCL) and a DATA signal (SDA) complying with a standard two-wire bus interface.

The frequency clock is programmable either to a 96 kHz or a 400 kHz.

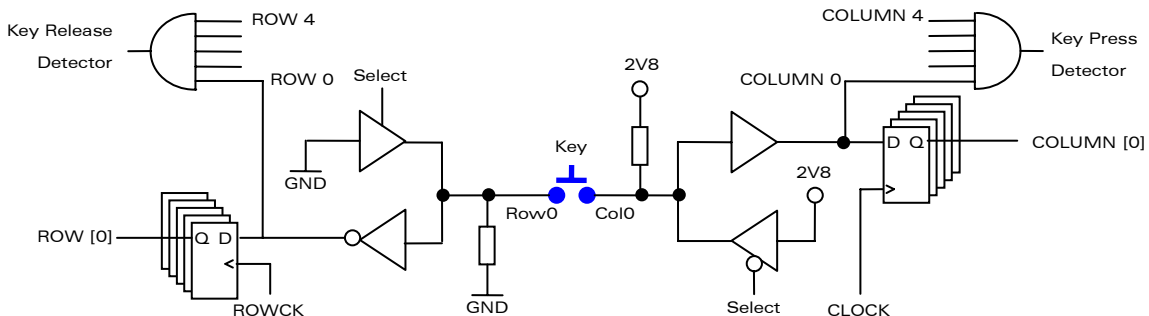
Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description |
|--------|-----|-----|--------------------|----------------|--------------|
| SCL | 10 | O | CMOS 1X (C5) | Pull-up to 2V8 | Serial Clock |
| SDA | 8 | I/O | CMOS / CMOS1X (C2) | Pull-up to 2V8 | Serial Data |

(C2) and (C5): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"

3.5 Keyboard Interface

Equivalent circuit



Wireless CPU Q24 Series

Interfaces

An AT command or open AT API allows the input key code to be obtained (see the AT+CMER command description). This code must then be processed by the application.

For a total of 25 keys (5 rows x 5 columns), the keyboard interface provides 10 connections:

- 5 rows (ROW0 to ROW4) and
- 5 columns (COL0 to COL4)

The scanning is digital, and the debouncing is performed in the Wireless CPU. No discrete components such as R, C (Resistor, Capacitor) are needed.

Pin description

| Signal | Pin number | I/O | I/O type | Reset state | Description |
|--------|------------|-----|----------------|-----------------|-------------|
| ROW0 | 13 | I/O | CMOS / CMOS 1X | Pull-down to 0V | Row scan |
| ROW1 | 15 | I/O | CMOS / CMOS 1X | Pull-down to 0V | Row scan |
| ROW2 | 17 | I/O | CMOS / CMOS 1X | Pull-down to 0V | Row scan |
| ROW3 | 19 | I/O | CMOS / CMOS 1X | Pull-down to 0V | Row scan |
| ROW4 | 21 | I/O | CMOS / CMOS 1X | Pull-down to 0V | Row scan |
| COL0 | 23 | I/O | CMOS / CMOS 1X | Pull-up to 2V8 | Column scan |
| COL1 | 25 | I/O | CMOS / CMOS 1X | Pull-up to 2V8 | Column scan |
| COL2 | 27 | I/O | CMOS / CMOS 1X | Pull-up to 2V8 | Column scan |
| COL3 | 29 | I/O | CMOS / CMOS 1X | Pull-up to 2V8 | Column scan |
| COL4 | 31 | I/O | CMOS / CMOS 1X | Pull-up to 2V8 | Column scan |

3.6 Main Serial Link (UART1)

A flexible 6-wire serial interface is available, complying with V24 protocol signaling, but not with V28 (electrical interface) due to a 2.8 volt interface.

The signals are:

- TX data (CT103/TX)
- RX data (CT104/RX)
- Request To Send (CT105/RTS)
- Clear To Send (CT106/CTS)
- Data Terminal Ready (CT108-2/DTR)
- Data Set Ready (CT107/DSR)

Wireless CPU Q24 Series Interfaces

The two additional signals are:

- Data Carrier Detect (CT109/DCD).
- Ring Indicator (CT125/RI).

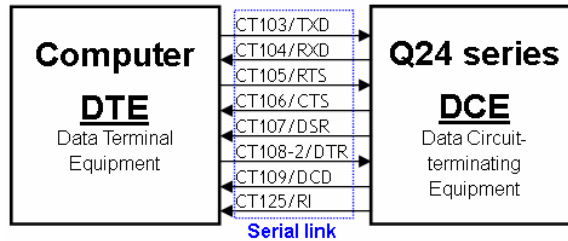


Figure 4: UART1 Serial Link signals
Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|--------------|----------------|-----|--------------|----------------|----------------------|------------------|
| CT103/TXD1 | 39 | I | CMOS | High impedance | Transmit serial data | |
| CT104/RXD1 | 32 | O | CMOS 1X (C3) | 2V8 | Receive serial data | |
| CT105/RTS1 | 30 | I | CMOS | High impedance | Request To Send | |
| CT106/CTS1 | 37 | O | CMOS 1X (C1) | 2V8 | Clear To Send | |
| CT107/DSR1 | 36 | O | CMOS 1X (C3) | 2V8 | Data Set Ready | |
| CT108-2/DTR1 | 34 | I | CMOS | High impedance | Data Terminal Ready | |
| CT109/DCD1 | 51 | O | CMOS 2X (C1) | High impedance | Data Carrier Detect | GPIO3 |
| CT125/RI1 | 54 | O | CMOS 2X (C1) | High impedance | Ring Indicator | GPIO2 |
| CT102/GND | Shielding legs | | | | Ground | |

(C1) and (C3): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"



Caution:

- The rise and fall time of the reception signals (mainly CT103) must be less than 200 ns.
- The Wireless CPU Q24 Series are designed to operate using all the serial interface signals. In particular, it is necessary to use RTS and CTS signals for hardware flow control in order to avoid data corruption during transmission.

3.7 Auxiliary Serial Link (UART2)

For specific applications, an auxiliary serial interface (UART2) is available on the Wireless CPU Q24 Series.

E.g. Bluetooth connectivity: See AT commands interface guide (Bluetooth) [5].

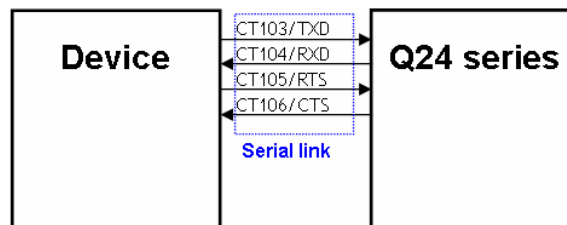


Figure 5: UART2 Serial Link signals

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|--------------|-----|-----|--------------|-----------------|----------------------|------------------|
| CT103 / TXD2 | 18 | I | CMOS (C4) | Pull down to 0V | Transmit serial data | GPI |
| CT104 / RXD2 | 20 | O | CMOS 1X (C3) | 2V8 | Receive serial data | GPO2 |
| CT106 / CTS2 | 24 | O | CMOS 2X (C1) | High impedance | Clear To Send | GPI00 |
| CT105 / RTS2 | 35 | I | CMOS | High impedance | Request To Send | GPI05 |

(C1), (C3) and (C4): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"

3.8 SIM Interface

3.8.1 General Description

The following five signals are available:

- **SIM_VCC**: SIM power supply.
- **SIM_RST**: Reset.
- **SIM_CLK**: Clock.
- **SIM_DATA**: I/O port.
- **SIM_PRES**: SIM Card detection.

The SIM interface controls a 3V / 1V8 SIM (and a 5V SIM through an external SIM driver). This interface is fully compliant with the GSM 11.12 recommendations concerning SIM functions.

Wireless CPU Q24 Series Interfaces

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description |
|----------|-----|-----|----------|----------------|------------------|
| SIM_CLK | 3 | O | 2V9/1V8 | 0V | SIM Clock |
| SIM_RST | 5 | O | 2V9/1V8 | 0V | SIM Reset |
| SIM_DATA | 7 | I/O | 2V9/1V8 | 0V | SIM Data |
| SIM_VCC | 9 | O | 2V9/1V8 | 0V | SIM Power Supply |
| SIM_PRES | 50 | I | 2V8 | High impedance | SIM Card Detect |



Caution:

Disturbances (digital noise, ESD) in the SIM signals may interrupt the Wireless CPU functionality, a good layout of these signals are recommended:

- Ground separation between SIM signals and others signals
- ESD protections

(Refer to Wireless CPU Q24 Series Customer Design Guidelines [3])

Electrical Characteristics

| Parameters | Conditions | Min | Type | Max | Unit |
|--------------------------------------|---------------------------|------------|------|------------|------|
| SIM_DATA VIH | I _{IH} = ± 20 μA | 0.7xSIMVCC | | | V |
| SIM_DATA VIL | I _{IL} = 1 mA | | | 0.3xSIMVCC | V |
| SIM_RST, SIM_CLK VOH | Source current = 20 μA | 0.9xSIMVCC | | | V |
| SIM_DATA | Source current = 20 μA | 0.8xSIMVCC | | | V |
| SIM_RST, SIM_DATA, SIM_CLK VOL | Sink current = -200 μA | | | 0.4 | V |
| SIM_VCC Output Voltage | SIMVCC = 2.9V | 2.84 | 2.90 | 2.96 | V |
| | SIMVCC = 1.8V | 1.77 | 1.8 | 1.86 | V |
| SIM_CLK Rise/Fall Time | Loaded with 30 pF | | 20 | | ns |
| SIM_RST, Rise/Fall Time | Loaded with 30 pF | | 20 | | ns |
| SIM_DATA, Rise/Fall Time | Loaded with 30 pF | | 0.7 | | μs |
| SIM_CLK Frequency | | | | 3.25 | MHz |

Note for SIM_PRES connection:

- When not used, SIM_PRES must be tied to 2V8
- When used, a **low to high** transition means that the SIM Card is inserted and a **high to low** transition means that the SIM Card is removed.

3.8.2 SIM Card Holder

An optional SIM Card holder may be placed on top of Wireless CPU. This SIM Card holder does not use the SIM_PRES signal.



Caution:

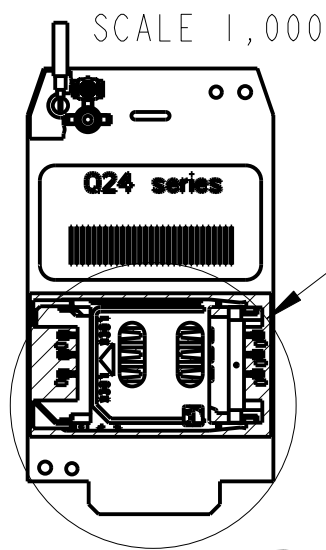
Customers are advised to verify that the SIM Card environmental specification used is compliant with the Wireless CPU Q24NG environmental specifications [3] (see the Wireless CPU Q24NG Product Technical Specification WM_PRJ_Q24NG_PTS_001). Any application must be qualified by the customer with the SIM Card in storage, transportation and operation.

Some ESD protections were placed to protect SIM form ESD stress; ESD protection position is described in Figure 6 and should be taken into account during a mechanical design.

Figure 6: SIM Card holder constraints

(see next page)

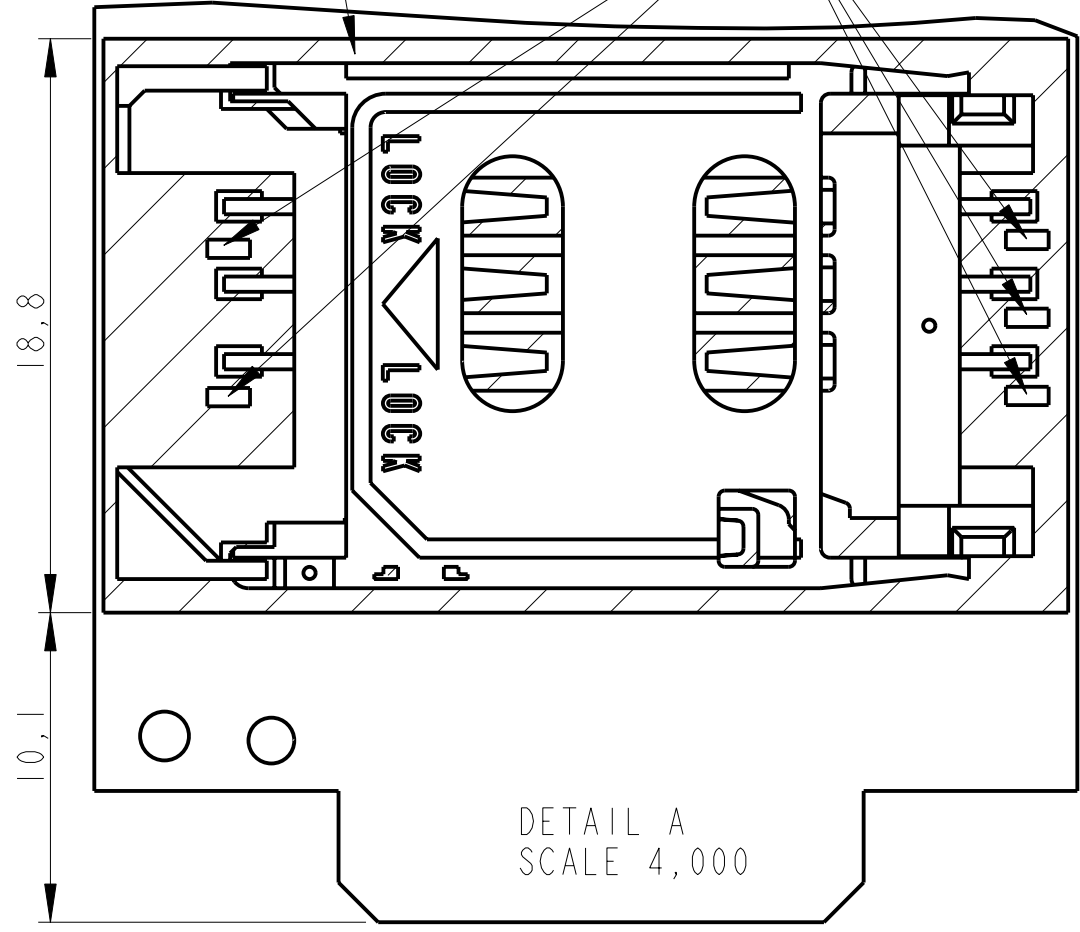
| MODIFICATION | DATE | AUTHOR | RESP. | STATUS | IND |
|--------------|----------|--------|-------|------------|-----|
| Creation | 29/09/06 | JPM | ASC | Production | A |
| | | | | | |



SEE DETAIL A

Area without components

ESD protectors



| | | | | |
|------------------|---------------------|----------------|-------------|--------------|
| Q24_SERIES | ESD PROTECTORS | TOL.GEN.: ±0,3 | | SCALE: 1,000 |
| | WM-4-600101-X-017-A | | FOLIO : 1/1 | |
| wavecom ® | | | | A |
| PRO/ENGINEER | | | | IND. |

3.9 General Purpose Input/Output

The Wireless CPU Q24 Series provide:

- 6 General Purpose I/O,
- 4 General Purpose Output,
- 1 General Purpose Input.

They are used to control any external devices such as an LCD or a Keyboard backlight.

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|--------|-----|-----|---------------------|-----------------|---------------------|------------------|
| GPI00 | 24 | I/O | CMOS / CMOS 2X (C1) | High impedance | General Purpose I/O | CT106/CTS2 |
| GPI01 | 52 | I/O | CMOS / CMOS 2X (C1) | High impedance | General Purpose O | FLASH LED |
| GPI04 | 53 | I/O | CMOS / CMOS 2X (C1) | High impedance | General Purpose I/O | |
| GPI05 | 35 | I/O | CMOS / CMOS 2X (C1) | High impedance | General Purpose I/O | CT105/RTS2 |
| GPO0 | 26 | O | CMOS 3X (C3) | 2V8 | General Purpose O | SPI_AUX |
| GPO1 | 22 | O | CMOS 3X (C3) | 0V | General Purpose O | |
| GPO2 | 20 | O | CMOS 3X (C3) | 2V8 | General Purpose O | CT104/RXD2 |
| GPO3 | 28 | O | CMOS 3X (C3) | 2V8 | General Purpose O | SPI_EN |
| GPI | 18 | I | CMOS (C4) | Pull down to 0V | General Purpose I | CT103/TXD2 |

(C1), (C3) and (C4): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"



The following GPIOs are not available (reserved) with a Wireless CPU running with an AT commands firmware:

Wireless CPU Q24 Series Interfaces

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|--------------|-----|-----|----------------|----------------|---------------------|-------------------|
| GPIO2 | 54 | I/O | CMOS / 2X (C1) | High impedance | General Purpose I/O | CT125/RI1 |
| GPIO3 | 51 | I/O | CMOS / 2X (C1) | High impedance | General Purpose I/O | CT109/DCD1 |

(C1): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"

3.10 Activity Status Indication

The activity status indication signal may be used to drive a FLASH LED through an open collector transistor.

Q24 Series LED status

| LED status | Comments | |
|--------------------|---|---|
| OFF | Wireless CPU in download mode or Wireless CPU is in OFF mode. | |
| ON | Permanent | Wireless CPU switched ON, not registered on the network. |
| Slow flash | LED ON for 200 ms, OFF for 2 s | Wireless CPU switched ON, registered on the network. |
| Quick flash | LED ON for 200 ms, OFF for 600 ms | Wireless CPU switched ON, registered on the network and communication is in progress. |

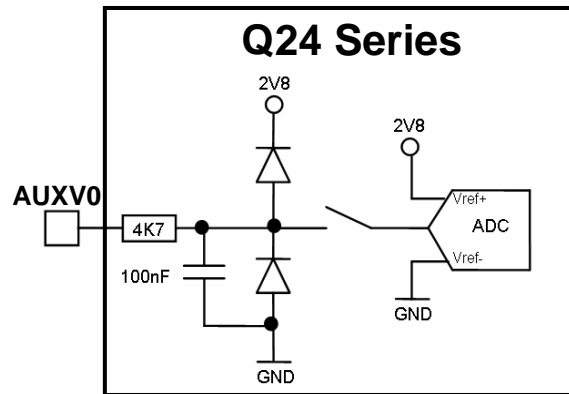
Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description | Multiplexed with |
|------------------|-----|-----|--------------|----------------|-------------|------------------|
| FLASH LED | 52 | O | CMOS 2X (C1) | High impedance | LED driving | GPIO1 |

(C1): To obtain more details on I/O type, refer to chapter "I/O Circuit diagram"

3.11 Analog to Digital Converter (ADC)

Equivalent circuit



An Analog to Digital Converter is provided by the Wireless CPU Q24 Series. This converter is a 10-bit resolution, ranging from 0 to 2.8 V.

Pin description

| Signal | Pin number | I/O | I/O type | Description |
|--------|------------|-----|----------|---------------|
| AUXV0 | 33 | I | Analog | A/D converter |

Electrical Characteristics

| Parameter | Min | Max | Unit |
|------------------------|-------|-----|--------|
| Resolution | 10 | | Bits |
| Hardware sampling rate | 17 | | Ksps/s |
| Input signal range | 0 | 2V8 | V |
| ADC reference accuracy | 0.75 | 2 | % |
| Integral accuracy | +/- 1 | | LSB |
| Differential accuracy | +/- 1 | | LSB |
| Input impedance (R) | 10 | | MΩ |
| Input impedance (C) | | 100 | nF |

3.12 Audio Interface

Two different microphone inputs and two different speaker outputs are supported. The Wireless CPU Q24 Series also include an echo cancellation feature, which allows hands-free operation.



Caution:

When speakers and microphones are exposed to the external environment, it is recommended to add ESD protection on the audio interface lines.

3.12.1 Microphone Inputs

The MIC2 inputs already include the biasing for an electret microphone, thus allowing easy connection to a handset.

The MIC1 inputs do not include an internal bias. MIC1/SPK1 may be used for a hands-free system or a handset, including biasing circuit for the microphone.

The microphone connections may be either differential or single-ended, but using a differential connection in order to reject common mode noise and TDMA noise is strongly recommended.



Caution:

While using a single-ended connection, ensure to have a good ground plane, a good filtering as well as shielding, in order to avoid any disturbance on the audio path.

3.12.1.1 Common Microphone Input Characteristics

Both microphone inputs are designed with the following audio transmit characteristics:

Internal audio filter characteristics

| Frequency | Gain |
|-------------|----------|
| 0-150 Hz | < -22 dB |
| 150-180 Hz | < -11 dB |
| 180-200 Hz | < -3 dB |
| 200-3700 Hz | 0 dB |
| >4000 Hz | < -60 dB |

The gain in the MIC inputs are internally adjusted and may be tuned from -6.5 dB to 51.3 dB by using AT commands (refer to AT commands documentation [5]).

Microphone gain versus Max input voltage

| Using Controller 1 | | Using Controller 2 | |
|--------------------|-----------------|--------------------|-----------------|
| Transmit Gain (dB) | Max Vin (mVrms) | Transmit Gain (dB) | Max Vin (mVrms) |
| +30 | 43.80 | -6.5 | 3031 |
| +33 | 31.01 | -6 | 2861 |
| +36 | 21.95 | 0 | 1434 |
| +39 | 15.54 | +9.5 | 480 |
| +42 | 11 | +10 | 454 |
| +45 | 7.79 | +30.3 | 43.80 |
| +48 | 5.51 | +30.8 | 41.36 |
| +51 | 3.9 | +50.8 | 4.14 |
| - | - | +51.3 | 3.90 |

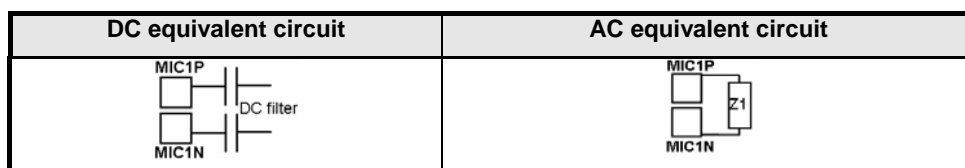
* For more details, refer to the AT commands documentation [5]

3.12.1.2 MIC1 Microphone Inputs

The MIC1 inputs are differential and **do not include internal bias**. To use these inputs with an electret microphone, bias must be generated outside the Wireless CPU Q24 Series in accordance with the characteristic of this electret microphone. These inputs are the standard inputs used either for an external headset or a hands-free kit.

The impedance of microphone 1 must be around 2 kΩ. AC coupling is already embedded in the Wireless CPU.

Equivalent circuits



Pin description

| Signal | Pin | I/O | I/O type | Description |
|--------|-----|-----|----------|-----------------------------|
| MIC1P | 42 | I | Analog | Microphone 1 positive input |
| MIC1N | 44 | I | Analog | Microphone 1 negative input |

Electrical Characteristics

| MIC1 Electrical characteristics | | | | | |
|--------------------------------------|----|-----|-----|-----|------------|
| Parameters | | Min | Typ | Max | Unit |
| DC Characteristics | - | - | - | - | V |
| AC Characteristics 100 Hz<F<5 kHz | Z1 | 80 | 120 | 160 | K Ω |

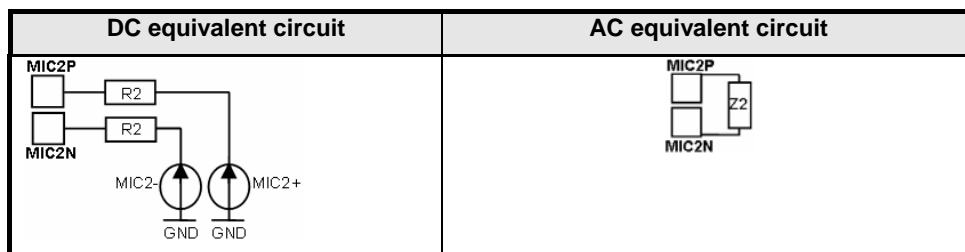
3.12.1.3 MIC2 Microphone Inputs

The MIC2 inputs are differential inputs. They already include convenient biasing for an electret microphone (0.5 mA and 2 volts). This electret microphone may be directly connected to these inputs.

The impedance of microphone 2 must be around 2 k Ω . These inputs are the standard inputs for a handset design, while MIC1 inputs may be connected either to an external headset or a hands-free kit.

AC coupling is already embedded in the Wireless CPU.

Equivalent circuit



Pin description

| Signal | Pin | I/O | I/O type | Description |
|--------|-----|-----|----------|-----------------------------|
| MIC2P | 46 | I | Analog | Microphone 2 positive input |
| MIC2N | 48 | I | Analog | Microphone 2 negative input |

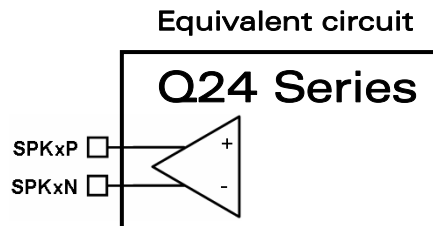
Electrical Characteristics

| MIC2 Electrical characteristics | | | | | |
|--|----------------|-------|------|-------|------------|
| Parameters | | Min | Typ | Max | Unit |
| Internal biasing DC Characteristics | MIC2- | 0.225 | 0.35 | 0.475 | V |
| | MIC2+ | 2.025 | 2.15 | 2.275 | V |
| | Output current | | 0.5 | 1 | mA |
| | R2 | 900 | 1150 | 1400 | Ω |
| AC Characteristics 100 Hz<F<5 kHz | Z2 | 1.2 | 1.5 | 1.8 | K Ω |

3.12.2 Speaker Outputs

Two speaker outputs are available: SPK1 and SPK2.

Both speaker outputs may be represented as follows:



3.12.2.1 Common Speaker Output Characteristics

The connection may be differential or single-ended, but using a differential connection to reject common mode noise and TDMA noise is strongly recommended. Moreover, in single-ended mode, the power is reduced by two, compare to the differential mode



Caution:

When using a single-ended connection, ensure to have a good ground plane, a good filtering as well as a good shielding in order to avoid any disturbance on the audio path.

Speaker outputs SPK1 and SPK2 are push-pull amplifiers and may be loaded down to 150 Ω and up to 1 nF

The impedance of the speaker amplifier outputs in differential mode is: [R ≤ 1 \$\Omega\$ +/-10 %](#).

When speaker output is not used, the speaker interface is in three states and a 20K +/-30% impedance is kept between SPK1N and SPK1P as well as SPK2N and SPK2P.

These outputs are differential and the output power may be adjusted by step of 2 dB. The output may be directly connected to a speaker.

The gain in the speaker outputs are internally adjusted and may be tuned by using AT commands (refer to the AT commands documentation [5]).

Speaker gain versus Max output voltage

| Receive Gain (dB)* | Max output level (Vrms) | Max.speaker load (Ω) |
|--------------------|-------------------------|-------------------------------|
| +2 | 1.74 | 150 |
| 0 | 1.38 | 50 |
| -2 | 1.099 | 32 |
| -4 | 0.873 | 32 |
| -6 | 0.693 | 32 |
| -8 | 0.551 | 32 |
| -10 | 0.437 | 32 |
| -12 | 0.347 | 32 |
| -14 | 0.276 | 32 |
| -16 | 0.219 | 32 |
| -18 | 0.174 | 32 |
| -20 | 0.138 | 32 |
| -22 | 0.110 | 32 |
| -24 | 0.087 | 32 |
| -26 | 0.069 | 32 |

*Analog gain: may not be significant

3.12.2.2 Speaker 1 Output

Pin description

| Signal | Pin | I/O | I/O type | Description |
|--------|-----|-----|----------|---------------------------|
| SPK1P | 41 | O | Analog | Speaker 1 positive output |
| SPK1N | 43 | O | Analog | Speaker 1 negative output |

3.12.2.3 Speaker 2 Output

Pin description

| Signal | Pin | I/O | I/O type | Description |
|--------|-----|-----|----------|---------------------------|
| SPK2P | 45 | O | Analog | Speaker 2 positive output |
| SPK2N | 47 | O | Analog | Speaker 2 negative output |

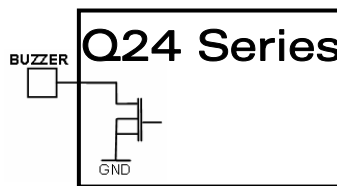
3.13 Buzzer Output

3.13.1 Hardware Description

The buzzer interface is accessible through an open drain embedded on the Wireless CPU Q24 Series.

A buzzer may be directly connected between this output and VBATT.

Equivalent circuit



Pin description

| Signal | Pin | I/O | I/O type | Description |
|--------|-----|-----|----------|---------------|
| BUZZER | 49 | O | Analog | Buzzer output |

Operating conditions

| Parameter | Condition | Min | Max | Unit |
|-----------|-----------------------------------|-----|-----|------|
| VOL | $I_{ol} = 100\text{mA}$ | | 0.4 | V |
| IPEAK | $V_{BATT} = V_{BATT \text{ Max}}$ | | 100 | mA |



Caution:

A diode against transient peak voltage must be connected as described below.

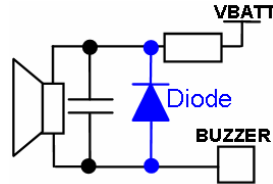


Figure 7: Buzzer connection

For the implementation of the buzzer interface, refer to the Customer Design Guidelines [3].

3.14 Battery Charging Interface

3.14.1 Hardware Description

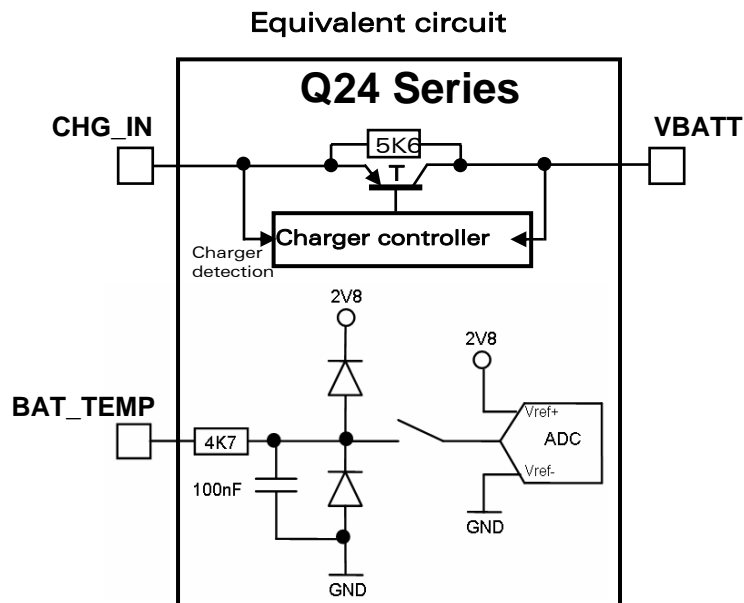


Caution:

The battery charging interface does not allow the Wireless CPU to be supplied and is only used to charge a battery connected to VBATT.

Battery charging is performed through a switching transistor connecting the VBATT signal to the Charger (CHG_IN signal).

The switching transistor is controlled by the operating system with two kinds of algorithms.



Wireless CPU Q24 Series Interfaces

The Wireless CPU Q24 Series supports three types of battery technologies:

- **Ni-Cd** (Nickel-Cadmium), which is charged with the **algorithm 0**
- **Ni-Mh** (Nickel-Métal Hydrure), which is charged with the **algorithm 0**
- **Li-Ion** (Lithium-Ion), which is charged with the **algorithm 1**

The algorithm controls the frequency and the connected time of switching transistor (T).

To select the algorithm:

- $AT+WBCM=4,0 \rightarrow$ Ni-Cd/Ni-Mh (by default)
- $AT+WBCM=4,1 \rightarrow$ Li-Ion
- $AT+WBCM=4,2 \rightarrow$ To know which algorithm is used

During the charging procedure, battery charging level is controlled.

When the operating system is not activated ($VBATT < 3V2$), the battery charging procedure remains possible by hardware control as long as the charger is plugged:

- $VBATT < 2V8$: the battery is charged through a trickle current
- $2V8 < VBATT < 3V2$: pre-charging current (min=40mA, typ=50mA, max=60mA)

The purpose of the trickle and pre-charging current is to:

- Allow the battery charging, even if $VBATT$ is too low to power-ON the Wireless CPU.
- Avoid battery damage, by preventing the battery from being discharged below the minimum battery level.

Pin description

| Signal | Pin number | I/O | I/O type | Description |
|----------|------------|-----|----------|----------------------|
| CHG_IN | 1, 2, 4 | I | Analog | Current source input |
| BAT_TEMP | 38 | I | Analog | A/D converter |

Electrical Characteristics

| Parameter | | Min | Typ | Max | Unit |
|-----------|---------------------|---------------------|-----|-----|--------|
| BAT_TEMP | Resolution | 10 | | | bits |
| | Sampling rate | 90.3 | | | Ksps/s |
| | Input Impedance (R) | | 1M | | kΩ |
| | Input Impedance (C) | | | 100 | nF |
| | Input signal range | 0 | | 2V8 | V |
| CHG_IN | | <BattLevelMax +0.5* | - | 6 | V |

* The min CHG_IN voltage depends on the battery characteristics. (see the following chapter).

3.14.2 Temperature Monitoring

Temperature monitoring is available only for the Li-Ion battery with **algorithm 1**. The BAT-TEMP ADC input must be used to sample the temperature analog signal provided by an NTC temperature sensor. The minimum and maximum temperature range may be set by an AT command (See the Li-Ion charging algorithm).

3.14.3 Ni-Cd / Ni-Mh Charging Algorithm

During the charging process of a Ni-Cd and Ni-Mh battery, it is required to tune software parameters in the Wireless CPU operating system:

AT+WBCM=<Mode>, <ChargeInd>, <BattLevelMax>, <BattLevelMin>, <TPulseInCharge>, <TPulseOutCharge>, <BattIntRes>, <BattChangeLevel > (See the AT command Interface Guide [5]).



Caution:

The parameters need to be tuned according to the battery specifications.

Wireless CPU Q24 Series Interfaces

The main parameters to be tuned are:

Parameters related to time:

- **TPulseInCharge:** Monitoring time of the VBATT voltage during a charging process (T2)
- **TPulseOutCharge:** Monitoring time of the VBATT voltage when charging process is not activated(T3)

Parameters related to voltage:

- **BattLevelMin:** Minimum VBATT voltage allowed by the battery (>3.2V)
- **BattLevelMax:** Maximum VBATT voltage allowed by the battery (<4.5V)

Ni-Cd / Ni-Mh battery and tunable parameter

| Parameter | Default value | Min | Max | Unit |
|--------------|--------------------|------|-------|------|
| T1 | 1000 (Not tunable) | | | ms |
| T2 | 100 | 100 | 10000 | ms |
| T3 | 5000 | 100 | 10000 | ms |
| BattLevelMin | 3400 | 3400 | 3800 | mV |
| BattLevelMax | 4200 | 4000 | 5000 | mV |

Ni-Cd / Ni-Mh charging process

| Charger connected: CHG_IN =VBATT+0.5V | | | |
|--|------------------|---|---|
| VBATT | Operating system | Charging status | Switching transistor (T) |
| VBATT<2V8 | Not activated | Trickle charge | Open |
| 2V8<VBATT<3V2 | Not activated | Pre-charging | 50mA typ cross the switching transistor |
| 3V2<VBATT VBATT<BattLevelMin | Activated | Charging process is automatically started | Open (T2)/Close (T1) periodically |
| BattLevelMin<VBATT VBATT<BattLevelMax | Activated | Charging process running | Open (T2)/Close (T1) periodically |
| | | Charging process not activated | VBATT is monitored periodically (T3) |
| | Deactivated | Trickle charge | Open |
| >=BattLevelMax | Activated | Charging process is ended | Open |

The graph below summarizes the charging process (charge and discharge).

Note:

A charger is connected to the CHG_IN pin of the Wireless CPU.

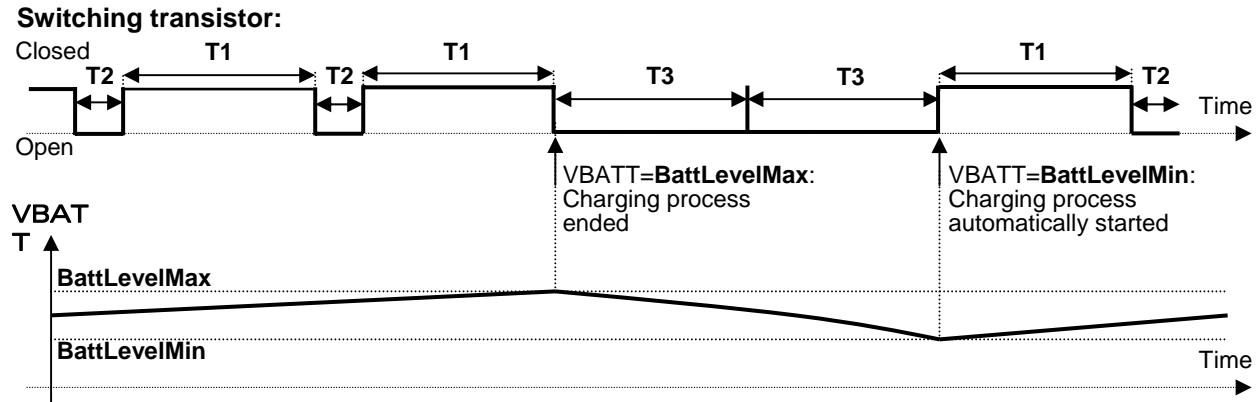


Figure 8: Ni-Cd / Ni-Mh charging waveform

3.14.4 Li-Ion Charging Algorithm

During the charging process of a Li-Ion battery, it is required to tune parameters embedded in the Wireless CPU operating system:

`AT+WBCM=<Mode>,<ChargeInd>,<TdeltaTemp>,<BattLevelMax>,<BattLevelMin>,<MaxVoltPulse>,<MaxBatteryTemp>,<MinBatteryTemp>,<Charging_Current>,<DedicatedVoltStart>,<Battery_Pulse_Charging_Timeout>,<Battery_Fast_Charging_Timeout>,<TPulseOutCharge>,<BattIntRes>,<BattChangeLevel>` (See the AT command Interface Guide [5]).



Caution:

The parameters need to be tuned according to the battery specifications.

The main parameters to be tuned are:

Parameters related to time:

- **BatteryFastChargingTimeout:** Maximum duration of the fast charging period. (T1)
- **BatteryPulseChargingTimeout:** Maximum duration of the charging pulse period.(T2)
- **TPulseOutCharge:** Monitoring time of the VBATT voltage when charging process is not activated(T3)

Parameters related to voltage:

- **BattLevelMin:** Minimum VBATT voltage allowed by the battery (>3.2V)
- **BattLevelMax:** Maximum VBATT voltage allowed by the battery (<4.5V)
- **DedicatedVoltStart:** Pulse charging is started above this threshold voltage

Parameter related to charging current:

- **ChargingCurrent:** Charging current delivered by the charger

Wireless CPU Q24 Series Interfaces

Parameters related to safety:

These parameters are important; as they ensure that the battery will not be damaged.

- **MaxVoltPulse:** Maximum VBATT over-voltage supported by the PCM of the battery (Protection Circuit Module)
- **TdeltaTemp:** Delta time interval to measure the variation of the battery temperature
- **Min_Battery_Temp_Volt:** Lowest value for battery temperature sensor voltage in mV (highest temperature with a NTC)
- **Max_Battery_Temp_Volt:** Highest value for battery temperature sensor voltage in mV (lowest temperature with a NTC)

Li-Ion battery and tunable parameters

| Parameters | Default value | Min | Max | Unit |
|-----------------------|--------------------------------------|---------------------------------------|---------------------------------------|------|
| T1 | 90 | 70 | 90 | min |
| T2 | 90 | 60 | 90 | min |
| T3 | 5000 | 100 | 10000 | ms |
| BattLevelMin | 3400 | 3400 | 3800 | mV |
| BattLevelMax | 4200 | 4000 | 5000 | mV |
| DedicatedVoltStart | 4000 | 4000 | 4199 | mV |
| ChargingCurrent | 500 | 500 | 800 | mA |
| MaxVoltPulse | 4608 | 4200 | 4608 | mV |
| TdeltaTemp | 3 | 1 | 5 | mm |
| Max_Battery_Temp_Volt | 2171 ($\approx 3^{\circ}\text{C}$) | 1816 ($\approx 14^{\circ}\text{C}$) | 2256 ($\approx 0^{\circ}\text{C}$) | mV |
| Max_Battery_Temp_Volt | 908 ($\approx 42^{\circ}$) | 831 ($\approx 45^{\circ}\text{C}$) | 1233 ($\approx 31^{\circ}\text{C}$) | mV |

Li-Ion charging process

| Charger connected: CHG_IN =VBATT+0.5V | | | |
|---|------------------|--|---|
| VBATT | Operating system | Charging status | Switching transistor (T) |
| VBATT<2V8 | Not activated | Trickle charge | Open |
| 2V8<VBATT<3V2 | Not activated | Pre-charging | 50mA typ cross the switching transistor |
| 3V2<VBATT<BattLevelMin | Activated | Fast charging process is automatically started | Close |
| BattLevelMin<VBATT VBATT< DedicatedVoltStart | Activated | Fast charging process running | Close (<T1) |
| | | Charging process not activated | VBATT is monitored periodically (T3) |
| | Deactivated | Trickle charge | Open |
| DedicatedVoltStart <VBATT VBATT<BattLevelMax | Activated | Pulse charging process running | Open (0.1s)/Close (1s) periodically (<T2) |
| | | Charging process not activated | VBATT is monitored periodically (T3) |
| | Deactivated | Trickle charge | Open |
| >=BattLevelMax | Activated | When VBATT is measured >=BattLevelMax, the open time of the switching transistor increases until it reaches 10s, then the charging process is ended. | Open: Timing increases regularly from 0.1s to 10s Close: 1s Open and close being periodical |

The graph below summarizes the charging process (charge and discharge).

Note:

A charger is connected to the CHG_IN pin of Wireless CPU.

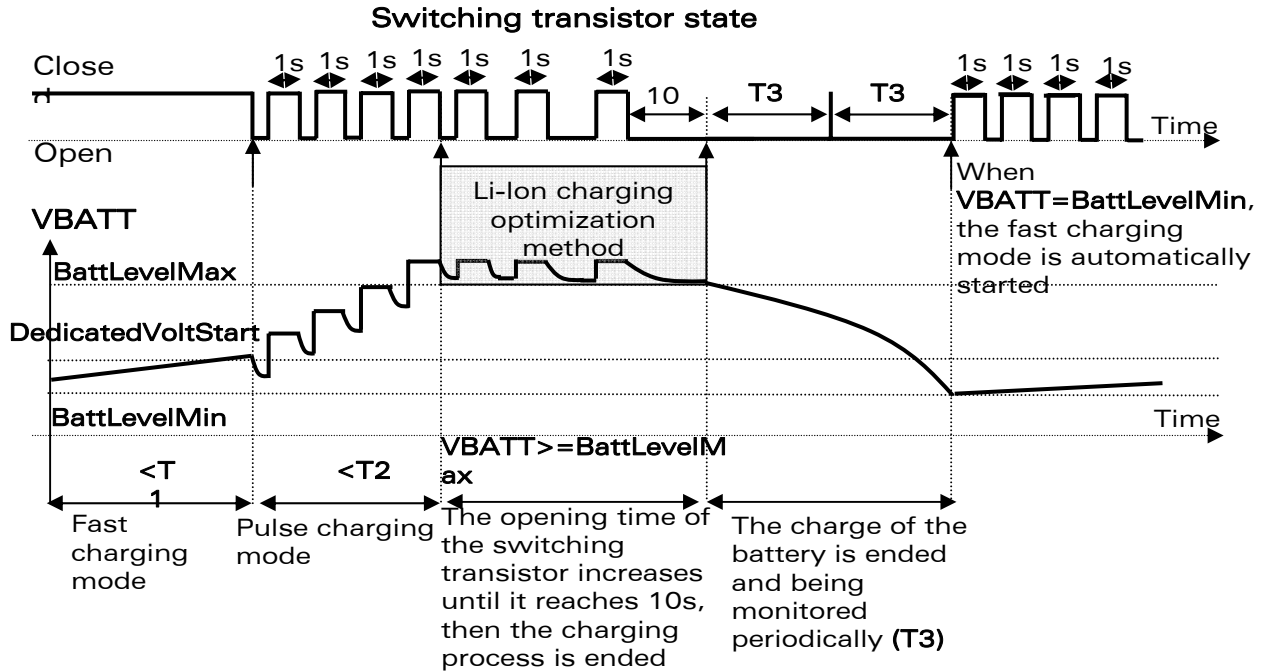


Figure 9: Li-Ion full-charging waveform

3.15 ON / ~OFF

3.15.1 General Description

This input is used to switch ON or OFF the Wireless CPU.

A high level signal must be provided on the ON/~OFF pin to switch ON the Wireless CPU.

The voltage level of this signal must be maintained between **2.4 V and 5V for a minimum of 1 s.**

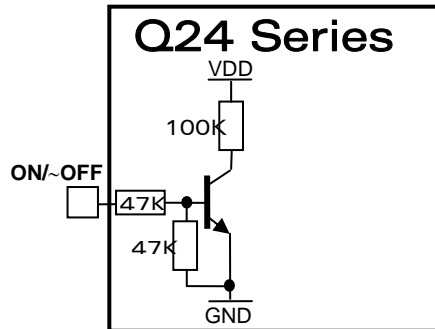
This signal may be left at high level until switched OFF.

Wireless CPU Q24 Series

Interfaces

To switch OFF the Wireless CPU, the pin ON/~OFF must be released and, through the firmware, the Wireless CPU may be switched OFF (using the AT+CPOF command).

Equivalent circuit



Pin description

| Signal | Pin | I/O | I/O type | Description |
|---------|-----|-----|----------|--------------|
| ON/~OFF | 6 | I | CMOS | Power ON/OFF |

Electrical Characteristics

| Parameters | Min | Max | Unit |
|------------|-----|-----|------|
| VIL | 0 | 0.6 | V |
| VIH | 2.4 | 5 | V |

3.15.2 Operating Sequences

3.15.2.1 Power-ON

Once the Wireless CPU is supplied, the application must set the ON/~OFF signal to high, to start the Wireless CPU power-ON sequence.

The ON/~OFF signal must be held for **1 sec minimum**. After this time, an internal mechanism maintains this on hold condition. During the power-ON sequence, an internal reset is automatically performed by the Wireless CPU for 240 ms (typical).

During this phase, any external reset should be avoided.

Wireless CPU Q24 Series

Interfaces

Once initialization is completed (timing is SIM and network dependent) the AT interface answers "OK" to the application¹. For further details, please refer to the AT commands documentation (AT+WIND, AT+WAIP).

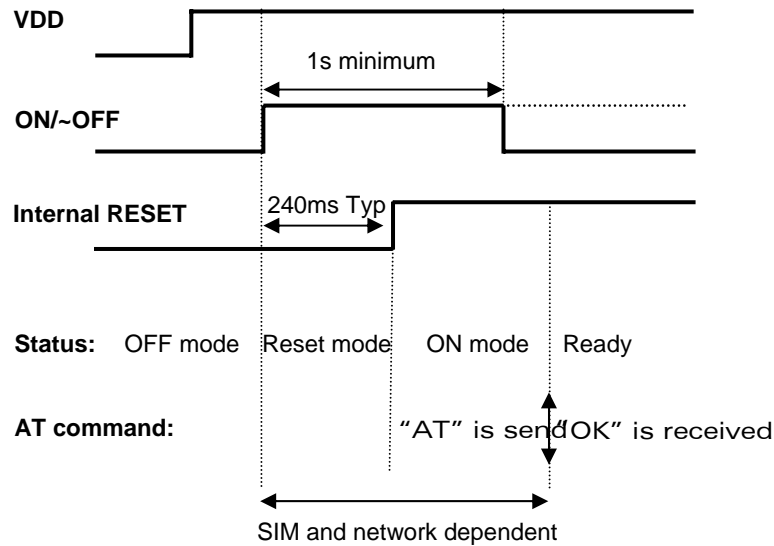


Figure 10: Power-ON sequence diagram

3.15.2.2 Power-OFF

To power-OFF the Wireless CPU correctly, the application must set the ON/~OFF signal to low and then send the AT+CPOF command to de-register from the network and switch off the Wireless CPU. Once the "OK" answer is issued, the Wireless CPU is set to OFF mode. Then the VDD may be disconnected.

¹ For this, the application must send AT↵. If the application manages hardware flow control, the AT command may be sent during the initialisation phase. Another solution is to use the AT+WIND command to obtain an unsolicited status from the Wireless CPU.

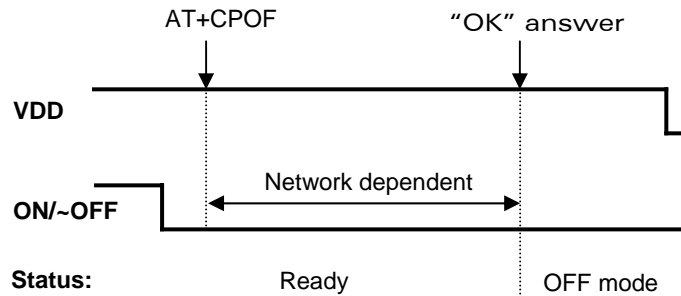


Figure 11: Power-OFF sequence diagram



Caution:

It is not allowed to power-OFF the Wireless CPU by disconnecting the supply pins VBATT and VDD.

Note:

Instead of sending AT+CPOF, use the Wireless CPU external interrupt pin (see the External interrupt)

3.16 BOOT (optional)

This input may be used to download software to the Flash memory of the Wireless CPU.

For applications based on AT commands, this is a backup download procedure (refer to document [3] Customer Design Guidelines).

The internal BOOT procedure starts when this pin is low during Wireless CPU reset.



Caution:

- This BOOT pin must be left open for normal use or Xmodem download.
- The nominal firmware download procedure uses the Xmodem.

In Internal BOOT mode, low level must be set through a 1KΩ resistor.

- BOOT = logical state 0, for download mode and
- BOOT = logical state 1, for normal mode.

Pin description

| Signal | Pin | I/O | I/O type | Reset state | Description |
|--------|-----|-----|-----------|----------------|-------------------|
| BOOT | 12 | I | CMOS (C5) | Pull-up to 2V8 | Flash Downloading |

(C5): To obtain more details on I/O type, refer to the chapter "I/O Circuit diagram"

3.17 Reset Signal (~RST)

3.17.1 General Description

The reset signal is used to force a reset procedure by providing low level, for at least **500 μ s**.

The Wireless CPU remains in reset mode as long as the ~RST signal is held low.

The reset process is activated either by the external ~RST signal or automatically by an internal signal (coming from a reset generator).

- ~RST = logical state 0, for Wireless CPU Reset and
- ~RST = logical state 1, for normal mode.

Note:

A software reset is always preferred to a hardware reset.

The automatic reset is activated during a power-ON sequence.

During a power-ON sequence, the ~RST pin of the Wireless CPU is set to the logical state 0.

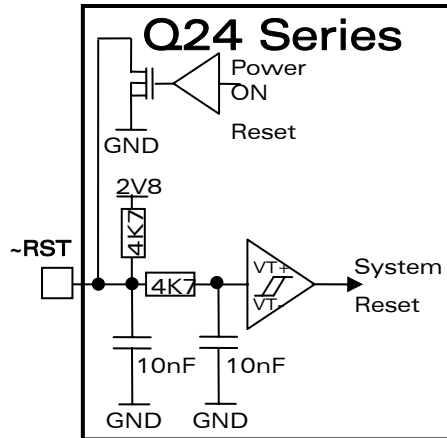


Caution:

During a power-ON sequence of the Wireless CPU, avoid to apply any voltage in the ~RST pin.

- Otherwise:
 - Wireless CPU reset procedure may not perform correctly
 - Wireless CPU may be damaged

Equivalent circuit



Pin description

| Signal | Pin number | I/O | I/O type | Description |
|--------|------------|-----|----------|-------------|
| ~RST | 14 | I/O | Schmitt | Reset |

Electrical characteristics

| Parameters | | Min | Max | Condition |
|-----------------------|-------------|------|------|-------------------|
| Hysteresis thresholds | VT- | 0.9 | 1 | |
| | VT+ | 1.7 | 1.8 | |
| ~RST | Reset state | 0 | 0.4 | IOL = -50 μ A |
| | Normal mode | 2.74 | 2.86 | IOH = 50 μ A |

This signal may also be used to provide a reset to an external device. It then behaves as an output. If no external reset is necessary, then this input may be left open.

If used (as an emergency reset), it must be driven either by an open collector or an open drain output:

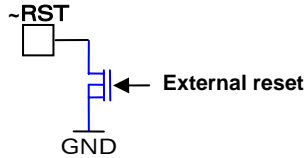


Figure 12: RST pin connection

For the implementation of the reset interface, refer to the Customer Design Guidelines

3.17.2 Reset Sequence

To activate the "emergency" reset sequence, the \sim RST signal must be set to low for **500 μ s** minimum.

As soon as the reset is completed, the AT interface answers "OK" to the application.

In this case, the application must send AT+. If the application manages hardware flow control, the AT command may be sent during the initialization phase.

Another solution is to use the AT+WIND command to obtain an unsolicited status from the Wireless CPU.

For further details, refer to the AT commands documentation [5].

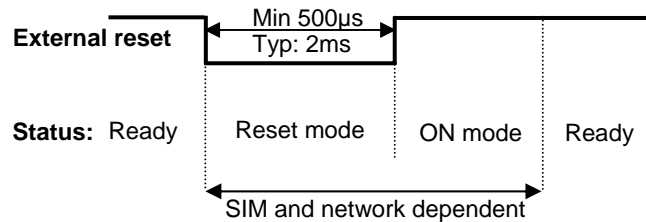


Figure 13: Reset sequence diagram

3.18 External Interrupt (\sim INTR)

The Wireless CPU Q24 Series provide an external interrupt input \sim INTR. This input is highly sensitive.

An interrupt is activated on a falling edge.

If this signal is not used, it may be left open.

If used, this input must be driven either by an open collector or an open drain output.

Pin description

| Signal | Pin number | I/O | I/O type | Reset state | Description |
|--------|------------|-----|-----------|----------------|--------------------|
| ~INTR | 16 | I | CMOS (C5) | Pull-up to 2V8 | External Interrupt |

(C5): To obtain more details on I/O type, refer to the chapter "I/O Circuit diagram"

Electrical characteristics

| Parameter | Min | Max | Unit |
|-----------|------|-----|------|
| VIL | -0.5 | 0.7 | V |
| VIH | 2.2 | 3.0 | V |

The external interrupt may be used to switch OFF the Wireless CPU. To enable this feature, AT+WFM=1, 83 must be entered:

The ON/OFF signal exists earlier in open or in low level, if an interrupt is received on the external interrupt pin, the Wireless CPU changes automatically to OFF mode, similar to an AT+CPOF command.

Notes:

- By default, this feature is not activated
- Use AT+WFM=1,84 to return to default mode

3.19 VCC output

This output may be used to power some external functions. This power supply is available when the Wireless CPU is ON.

Pin description

| Signal | Pin number | I/O | I/O type | Description |
|--------|------------|-----|----------|----------------|
| VCC | 40 | O | Supply | Digital supply |

Operating conditions

| Parameter | Condition | Min | Max | Unit |
|----------------|------------|------|------|------|
| Output voltage | I = 0 | | 2.86 | V |
| | I = 100 mA | 2.74 | | V |
| Output Current | | | 100 | mA |

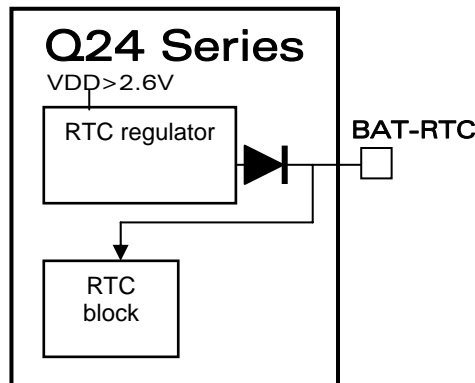
3.20 Real Time Clock Supply (VCC_RTC)

The VCC_RTC input is used to provide a back-up power supply for the internal Real Time Clock (RTC).

The RTC is supported by the Wireless CPU when power-ON, but a back-up power supply is necessary to save date and time information, when the Wireless CPU is switched off.

If the RTC is not used, this pin may be left open.

Equivalent circuit



If $VDD < 2.6V$, the RTC regulator is disabled, a back-up battery is then necessary to save date and time information.

Pin description

| Signal | Pin number | I/O | I/O type | Description |
|---------|------------|-----|----------|--------------------|
| VCC_RTC | 56 | I/O | Supply | RTC Back-up supply |

Operating conditions

| Parameter | Condition | Min | Typ | Max | Unit |
|----------------|---------------------------|------|-----|------|---------|
| Input voltage | | 2 | | 2.75 | V |
| Input current | VCC_RTC=2.5 V VDD=3.6V | | 3 | 10 | μA |
| Output voltage | VDD=3.6V, Iout=0.5mA | 2.65 | 2.7 | 2.75 | V |
| Output current | VDD=3.6, Vout=2.25V | 0.4 | 1 | 2 | mA |

3.21 RF Interface

The impedance is 50Ω nominal and the DC impedance is 0Ω.

3.21.1 RF Connections

The RF interface supports 4 type of connections:

- **U.FL Connector (on both sides)**

A wide variety of cables fitted with U.FL connectors are proposed by different suppliers.

- **MMS Connector**

The MMS connector stands on three pliable legs. The design guarantees the receptacle stability after placement. The MMS snap on mating system ensures a correct positive connection on each time.

A wide variety of cables fitted with MMS connectors are proposed by different suppliers.

- **Soldered solution**

A soldered solution is preferably based on an RG178 coaxial cable.

- **IMP connector**

This connector is dedicated to different board applications and must be soldered to the customer board. The supplier is Radiall with the following reference:

R107 064 900 or R107 064 920.

Notes:

- The Wireless CPU Q24 Series does not support an antenna switch for a car kit, but this function may be implemented externally and it may be driven using a GPIO.
- The antenna cable and connector should be selected in order to minimize losses in the frequency bands used for GSM 850/900MHz and 1800/1900MHz.
- 0.5dB may be considered as a maximum value for loss between the Wireless CPU and an external connector.
- In order to maintain the RoHS status of the Wireless CPU, Wavecom recommends that *lead-free solder wire and flux* be used for Wireless CPU assembly on the motherboard and RF cable, assembly on the Wireless CPU..

Example:

- Solder Wire: Kester 245 Cored 58 (Sn96.5Ag3Cu0.5)
- Flux: Kester 952-D6

3.21.2 RF Performance

RF performance is compliant with the ETSI recommendation ETSI TS 151 010-1.

The main parameters for a GSM receiver are:

- GSM850 Reference Sensitivity = -104 dBm Static & TUHigh
- EGSM900 Reference Sensitivity = -104 dBm Static & TUHigh
- DCS1800 Reference Sensitivity = -102 dBm Static & TUHigh
- PCS1900 Reference Sensitivity = -102 dBm Static & TUHigh
- Selectivity @ 200 kHz: > +9 dBc
- Selectivity @ 400 kHz: > +41 dBc
- Linear dynamic range: 63 dB
- Co-channel rejection: >= 9 dBc

And for Transmitters:

- Maximum output power (EGSM & GSM850): 33 dBm +/- 2 dB at ambient temperature
- Maximum output power (GSM1800 & PCS1900): 30 dBm +/- 2 dB at ambient temperature
- Minimum output power (EGSM & GSM850): 5 dBm +/- 5 dB at ambient temperature
- Minimum output power (GSM1800 & PCS1900): 0 dBm +/- 5 dB at ambient temperature

3.21.3 Antenna Specifications

The antenna must fulfill the following requirements, as specified in the table below:

- The optimum operating frequency depends on the application. A dual-band or a quad-band antenna must operate in these frequency bands and have the following characteristics:

| Characteristic | Q24 | | | |
|-----------------------|--------------------------------|------------------|----------------|------------------|
| | EGSM 900 | DCS 1800 | GSM 850 | PCS 1900 |
| TX Frequency | 880 to 915 MHz | 1710 to 1785 MHz | 824 to 849 MHz | 1850 to 1910 MHz |
| RX Frequency | 925 to 960 MHz | 1805 to 1880 MHz | 869 to 894 MHz | 1930 to 1990 MHz |
| Impedance | 50Ω | | | |
| VSWR | Rx max | 1.5 :1 | | |
| | Tx max | 1.5 :1 | | |
| Typical radiated gain | 0dBi in one direction at least | | | |

4 Technical Specifications

4.1 General Purpose Connector Pin-out Description

| Pin | Name | I/O | I/O type | Reset state | Description | Dealing with unused pins |
|-----|-------------|-----|-------------------|-----------------|--|--|
| 1 | CHG_IN | I | Supply | - | Supply for battery charging | Not connected |
| 2 | CHG_IN | I | Supply | - | Supply for battery charging | Not connected |
| 3 | SIM_CLK | O | - | 0V | Clock for SIM interface | Not connected if Q24 SIM Card holder is used |
| 4 | CHG_IN | I | Supply | - | Supply for battery charging | Not connected |
| 5 | SIM_RST | O | - | 0V | Reset for SIM interface | Not connected if Q24 SIM Card holder is used |
| 6 | ON/~OFF | I | CMOS | - | Power ON/OFF control | Must be used |
| 7 | SIM_DATA | I/O | - | 0V | I/O for SIM interface | Not connected if Q24 SIM Card holder is used |
| 8 | SDA/SPI_IO | I/O | CMOS/CMOS 1X (C2) | Pull-up to 2V8 | Two-wire interface or SPI Serial Data | Not connected |
| 9 | SIM_VCC | O | Supply | 0V | SIM Card supply | Not connected if Q24 SIM Card holder is used |
| 10 | SCL/SPI_CLK | O | CMOS 1X (C5) | Pull-up to 2V8 | Two-wire interface or SPI Serial clock | Not connected |
| 11 | VDD | I | Supply | - | Low power supply | Must be used |
| 12 | BOOT | I | CMOS (C5) | Pull-up to 2V8 | BOOT | Test point (Download purposes) |
| 13 | ROW0 | I/O | CMOS/ CMOS 1X | Pull-down to 0V | Keyboard Row | Not connected |
| 14 | ~RST | I/O | Schmitt | 0V | Reset | Test point (Debug purposes) |
| 15 | ROW1 | I/O | CMOS/ CMOS 1X | Pull-down to 0V | Keyboard Row | Not connected |
| 16 | ~INTR | I | CMOS (C5) | Pull-up to 2V8 | External interrupt | Not connected |
| 17 | ROW2 | I/O | CMOS/ CMOS 1X | Pull-down to 0V | Keyboard Row | Not connected |

Wireless CPU Q24 Series Technical Specifications

| Pin | Name | I/O | I/O type | Reset state | Description | Dealing with unused pins |
|-----|---------------------|----------|-----------------------------------|-----------------|---|--|
| 18 | GPI or CT103/TXD2 | I | CMOS (C4) | Pull-down to 0V | General Purpose Input or Transmit serial data (UART2) | Not connected |
| 19 | ROW3 | I/O | CMOS/ CMOS 1X | Pull-down to 0V | Keyboard Row | Not connected |
| 20 | GPO2 or CT104/RXD2 | O | CMOS 3X (C1) or CMOS 1X (C1) | 2V8 | General Purpose Output or Receive serial data (UART2) | Not connected |
| 21 | ROW4 | I/O | CMOS/ CMOS 1X | Pull-down to 0V | Keyboard Row | Not connected |
| 22 | GPO1 | O | CMOS 3X (C3) | 0V | General Purpose Output | Not connected |
| 23 | COL0 | I/O | CMOS/ CMOS 1X | Pull-up to 2V8 | Keyboard Column | Not connected |
| 24 | GPIO0 or CT106/CTS2 | I/O O | CMOS/CMOS 2X (C1) or CMOS 2X (C1) | High impedance | General Purpose I/O or Clear To Send (UART2) | Not connected |
| 25 | COL1 | I/O | CMOS/ CMOS 1X | Pull-up to 2V8 | Keyboard Column | Not connected |
| 26 | GPO0 or SPI_AUX | O O | CMOS 3X (C3) or CMOS 1X (C3) | 2V8 | General Purpose Output or SPI_AUX | Not connected |
| 27 | COL2 | I/O | CMOS/ CMOS 1X | Pull-up to 2V8 | Keyboard Column | Not connected |
| 28 | GPO3 or SPI_EN or | O O | CMOS 3X (C3) or CMOS 1X (C3) | 2V8 | SPI enable or General Purpose Output | Not connected |
| 29 | COL3 | I/O | CMOS/ CMOS 1X | Pull-up to 2V8 | Keyboard Column | Not connected |
| 30 | CT105/RTS1 | I | COS | High impedance | Request To Send (UART1) | 100kΩ pull-up to 2V8 with test point (download and debug purposes) |
| 31 | COL4 | I/O | CMOS/ CMOS 1X | Pull-up to 2V8 | Keyboard Column | Not connected |
| 32 | CT104/RXD1 | O | CMOS 1X (C3) | 2V8 | Receive serial data (UART1) | Test point (Download purposes) |
| 33 | AUXV0 | I | Analog | High impedance | Auxiliary ADC input 0 | Tied to GND |
| 34 | CT108-2/DTR1 | I | CMOS | High impedance | Data Terminal Ready (UART1) | 100kΩ pull-up to 2V8 with test point (download and debug purposes) |

Wireless CPU Q24 Series Technical Specifications

| Pin | Name | I/O | I/O type | Reset state | Description | Dealing with unused pins |
|-----|---------------------|----------|----------------------------------|----------------|--|--|
| 35 | GPIO5 or CT105/RTS2 | I/O I | CMOS/CMOS 2X (C1) or CMOS | High impedance | General Purpose I/O or Clear To Send (UART2) | Not connected |
| 36 | CT107/DSR1 | O | CMOS 1X (C3) | 2V8 | Data Set Ready (UART1) | Not connected |
| 37 | CT106/CTS1 | O | CMOS 1X (C1) | High impedance | Clear To Send (UART1) | Test point (Download purposes) |
| 38 | BAT_TEMP | I | Analog | High impedance | ADC input for battery temperature measurement | Tied to GND |
| 39 | CT103/TXD1 | I | CMOS | High impedance | Transmit serial data (UART1) | 100kΩ pull-up to 2V8 with test point (download and debug purposes) |
| 40 | VCC | O | Supply | 2V8 | 2.8 V digital supply output | Not connected |
| 41 | SPK1P | O | Analog | - | Speaker 1 positive output | Not connected |
| 42 | MIC1P | I | Analog | - | Microphone 1 positive input | Not connected |
| 43 | SPK1N | O | Analog | - | Speaker 1 negative output | Not connected |
| 44 | MIC1N | I | Analog | - | Microphone 1 negative input | Not connected |
| 45 | SPK2P | O | Analog | - | Speaker 2 positive output | Not connected |
| 46 | MIC2P | I | Analog | - | Microphone 2 positive input | Not connected |
| 47 | SPK2N | O | Analog | - | Speaker 2 negative output | Not connected |
| 48 | MIC2N | I | Analog | - | Microphone 2 negative input | Not connected |
| 49 | BUZZER | O | Analog | - | Buzzer output | Not connected |
| 50 | SIM_PRES | I | CMOS | High impedance | SIM Card Detect | Tied to 2V8 |
| 51 | GPIO3 or CT109/DCD1 | I/O O | CMOS/CMOS 2X (C1) or CMOS2X (C1) | High impedance | General Purpose I/O or Data Carrier Detect (UART1) | Not connected |
| 52 | GPIO1 FLASH LED | I/O O | CMOS/CMOS 2X (C1) or CMOS2X (C1) | High impedance | General Purpose I/O or Flash LED | Not connected |
| 53 | GPIO4 | I/O | CMOS/CMOS 2X (C1) | High impedance | General Purpose I/O | Not connected |

Wireless CPU Q24 Series Technical Specifications

| Pin | Name | I/O | I/O type | Reset state | Description | Dealing with unused pins |
|-----|----------------------|----------|-----------------------------------|----------------|---|--------------------------|
| 54 | GPIO2 or CT125 / RI1 | I/O O | CMOS/CMOS 2X (C1) or CMOS 2X (C1) | High impedance | General Purpose I/O or Ring Indicator (UART1) | Not connected |
| 55 | +VBATT | I | Supply | - | Battery Input | Must be used |
| 56 | VCC_RTC | I/O | Supply | 2V8 | RTC back-up supply | Not connected |
| 57 | +VBATT | I | Supply | - | Battery Input | Must be used |
| 58 | +VBATT | I | Supply | - | Battery Input | Must be used |
| 59 | +VBATT | I | Supply | - | Battery Input | Must be used |
| 60 | +VBATT | I | Supply | - | Battery Input | Must be used |

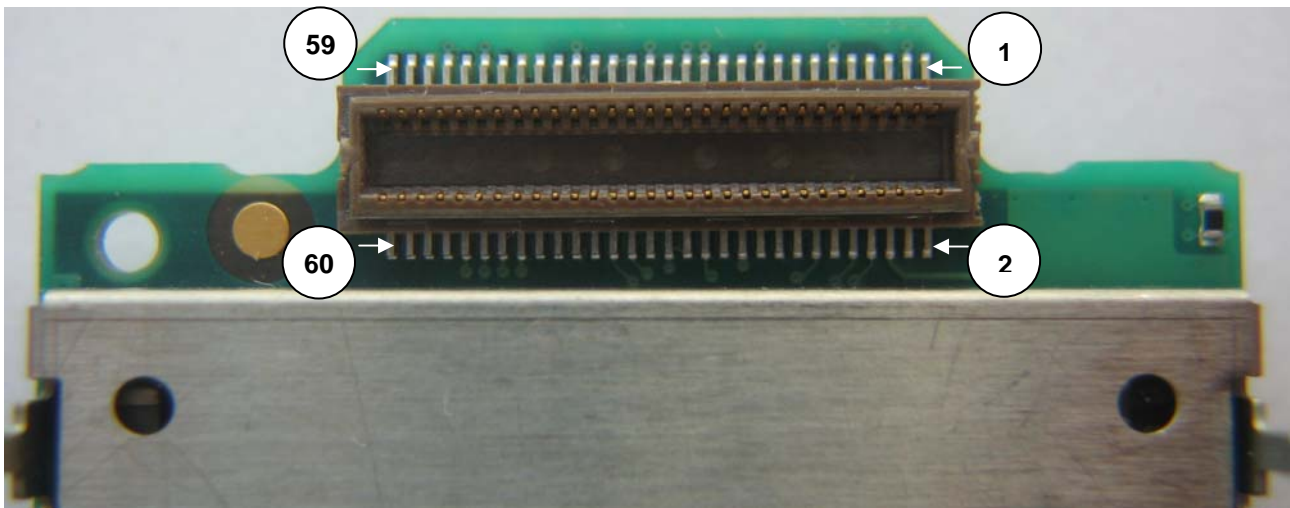


Figure 14: Wireless CPU pin position (bottom view)

4.2 I/O Circuit Diagram

The following drawings show the internal interface of the Wireless CPU Q24 Series. The type indication per interface can be found in the previous chapters.

| Type | Circuit | Type | Circuit |
|------|---------|------|---------|
| (C1) | | (C4) | |
| (C2) | | (C5) | |
| (C3) | | | |

Figure 15: I/O Circuit Diagram

5 Environmental Specifications

The Wireless CPU Q24 Classic and Q24 Plus are compliant with the following operating classes:

| Condition | Temperature range |
|---------------------|--|
| Operating / Class A | -20°C to +55°C for GSM 850 / 900 -10°C to +55°C for GSM 1800/1900 |
| Storage | -40°C to +85°C |

The Wireless CPU Q24 Automotive and Q24 Extended are compliant with the following operating classes:

| Conditions | Temperature range |
|---------------------|--|
| Operating / Class A | -20°C to +55°C for GSM 850 / 900 -10°C to +55°C for GSM 1800/1900 |
| Operating / Class B | -30°C to +75°C |
| Operating / Class C | -40°C to + 85°C |
| Storage | -40°C to + 85°C |

Classification and Wireless CPU Q24 Series:

- **Class A:**

The Wireless CPU remains fully functional, meeting GSM performance criteria in accordance with ETSI requirements, across the specified temperature range.

- **Class B:**

The Wireless CPU remains fully functional, across the specified temperature range. Some GSM parameters may occasionally deviate from the ETSI specified requirements and this deviation may not affect the ability of the Wireless CPU to connect to the cellular network and fully functional, as it does within the Class A range.

- **Class C:**

The functional requirements will not be fulfilled during external influence, but will return to fully functional automatically, after the external influence has been removed.

Wireless CPU Q24 Series Environmental Specifications

5.1 Environmental Qualifications

For the Wireless CPU Q24 Classic, Q24 Plus, and Q24 Extended, applied environmental qualifications are defined in the table below:

| TYPE OF TEST | STANDARDS | ENVIRONMENTAL CLASSES | | |
|-------------------------------|---------------------------|---|---|--|
| | | STORAGE Class 1.2 | TRANSPORTATION Class 2.3 | OPERATING (PORT USE) Class 7.3 |
| Cold | IEC 68-2.1 Ab test | -25° C 72 h | -40° C 72 h | -20° C (GSM900) 16 h -10° C (GSM1800/1900) 16h |
| Dry heat | IEC 68-2.2 Bb test | +70° C 72 h | +70° C 72 h | +55° C 16 h |
| Change of temperature | IEC 68-2.14 Na/Nb test | | -40° / +30° C 5 cycles t1 = 3 h | -20° / +30° C (GSM900) 3 cycles -10° / +30° C (GSM1800/1900): 3 cycles t1 = 3 h |
| Damp heat cyclic | IEC 68-2.30 Db test | +30° C 2 cycles 90% - 100% RH variant 1 | +40° C 2 cycles 90% - 100% RH variant 1 | +40° C 2 cycles 90% - 100% RH variant 1 |
| Damp heat | IEC 68-2.56 Cb test | +30° C 4 days | +40° C 4 days | +40° C 4 days |
| Sinusoidal vibration | IEC 68-2.6 Fc test | 5 - 62 Hz : 5 mm / s 62 - 200Hz : 2 m / s ² 3 x 5 sweep cycles | | |
| Random vibration wide band | IEC 68-3.36 Fdb test | | 5 - 20 Hz : 0.96 m2 / s ³ 20 - 500Hz : - 3 dB / oct 3 x 10 min | 10 - 12 Hz : 0.96 m2 / s ³ 12 - 150Hz : - 3 dB / oct 3 x 30 min |

Figure 16: Q24 Classic, Q24 Plus and Q24 Extended Environmental classes

For more details, refer to the document: "Environmental Control Plan" for Wireless CPU Q24 Series [2]

Electro-Static Discharge (ESD):

According to the **EN 61000-4-2** standard, the maximum ESD level supported by the Wireless CPU series on contact discharges is ± 1 kV on the 60-pin connector, ± 2 kV on the antenna connector, and ± 4 kV on the SIM Card holder.

Wireless CPU Q24 Series Environmental Specifications

For the Wireless CPU Q24 Automotive, environmental qualification applied is defined in table below:

| Test Designation | Standards | Definition / Severities |
|------------------------------------|----------------------|--|
| Resistance to Heat | IEC 60068-2-2 | Temperature: +85°C Duration: 504 h |
| Resistance to cold test | IEC 60068-2-30 Db | Storage temperature: -40±2°C Storage time: 72 h |
| Cooking Test | - | Temperature: +70 ±2°C Duration: 100 days |
| Damp heat test | IEC 60068-2-3 | Storage temperature: +40±2°C Storage humidity: 95±3% Storage time: 21 days |
| Damp heat cycle test | IEC 60068-2-30 Db | Upper temperature: +55±2°C Number of cycles: 10 |
| Temperature change | IEC 60068-2-14 Nb | Low temperature: -40±2°C High temperature: +85±2°C Total duration: 11 days |
| Thermal Shock | IEC 60068-2-14 | Low temperature: -40±2°C High temperature: +85±2°C Total duration: 200 hours |
| Resistance to sinusoidal vibration | IEC 60068-2-6 Fc | [10 Hz to 16 Hz]: ±5 mm (peak) [16 Hz to 62 Hz]: 5 g (peak) [62 Hz to 200Hz]: 3g (peak) [200 Hz to 1000 Hz] 1g (peak) Test duration: 20 cycles Sweep directions: X / Y / Z |
| Resistance to random vibration | IEC 60068-2-64 | Frequency range: 10 Hz - 2000 Hz Spectrum level: 0.1 g ² /Hz at 10 Hz 0.01 g ² /Hz at 250 Hz 0.0005 g ² /Hz at 1000 Hz 0.0005 g ² /Hz at 2000 Hz Duration: 16 h Vibration axis: X / Y / Z |
| Resistance to mechanical shock | IEC 68-2-27 | Peak acceleration: 30g / 100g / 200g Direction: ±X, ±Y, ±Z |
| ESD Test | IEC 1000-4-2 | 1 kV contact discharge on 60-pin connector 2 kV contact discharge on RF connector 4kV contact discharge on SIM interface |

Figure 17: Q24 Automotive environmental classes

For more details, refer to the document:

"Automotive Environmental Control Plan" for Wireless CPU Q24 Series [1]

5.1.1 Reflow Soldering:

The Wireless CPU Q24 Series do not support any reflow soldering.

5.2 Mechanical Specifications

5.2.1 Physical Characteristics

The Wireless CPU Q24NG sub-series have a complete self-contained shield.

- | |
|---|
| <ul style="list-style-type: none">• Dimensions : 58.4 x 32.2 x 3.9 mm external dimensions (excluding shielding pins)• Weight : <11 g (12g for Q24 Automotive) |
|---|

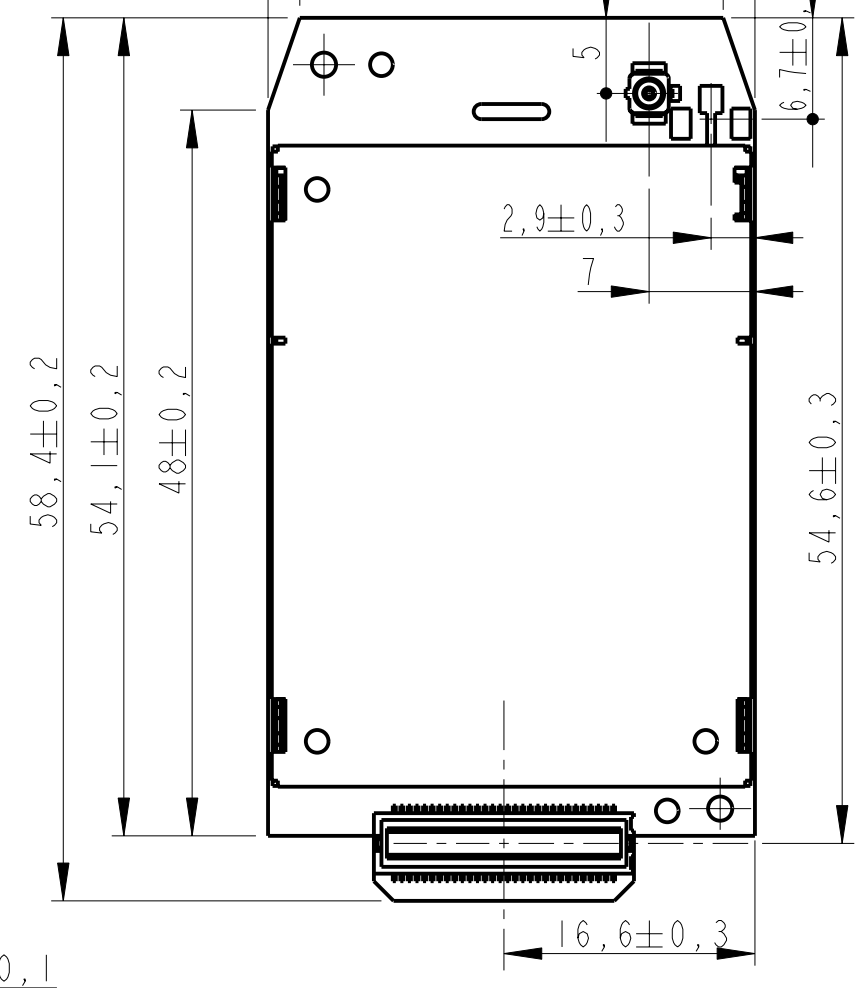
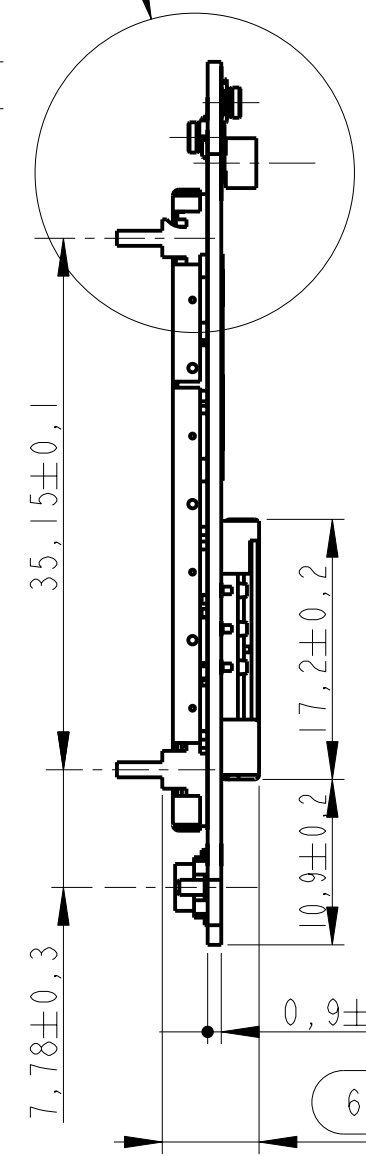
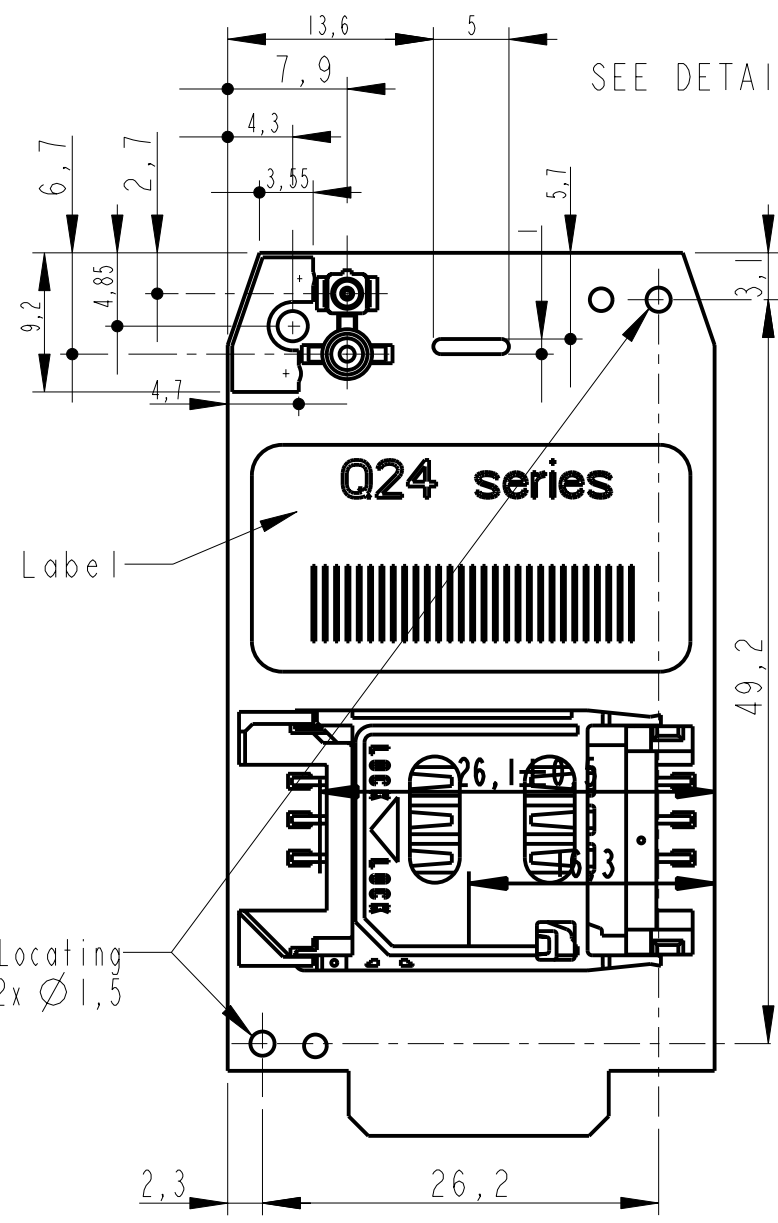
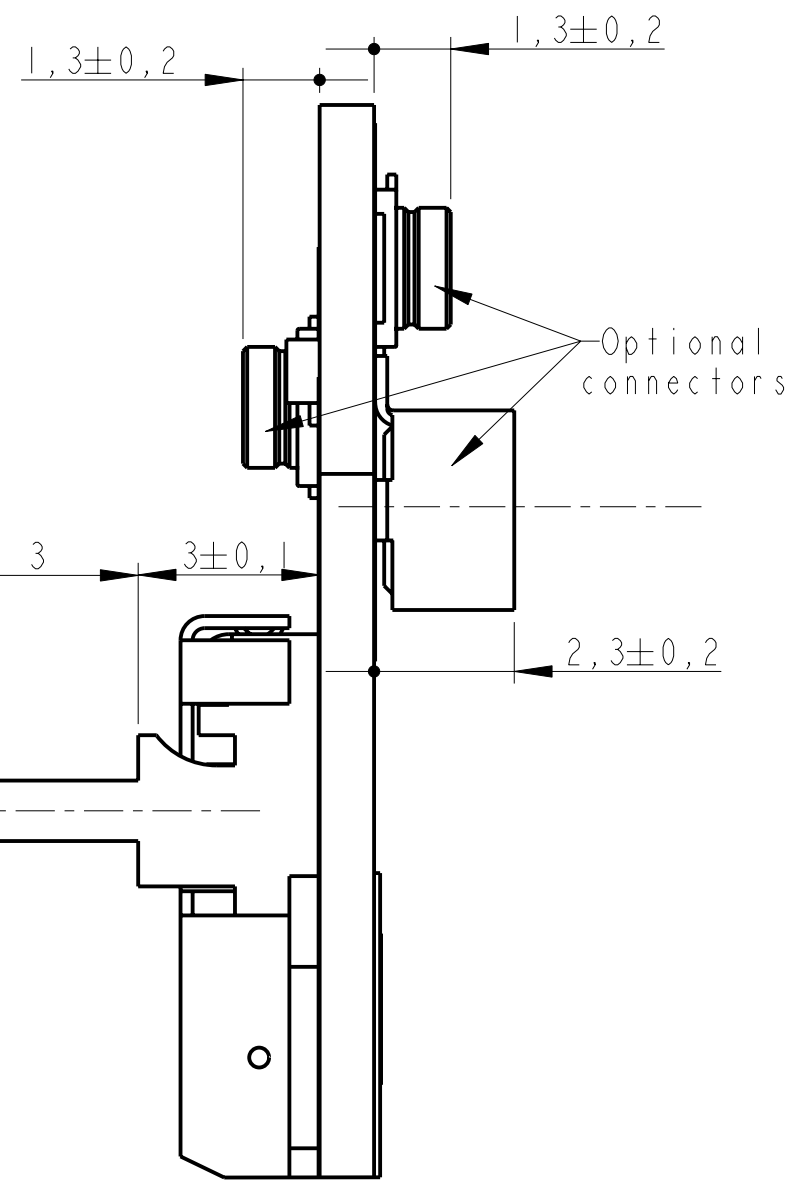
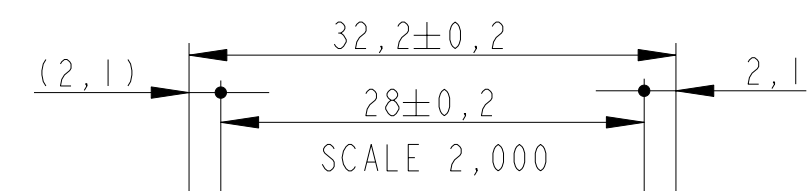
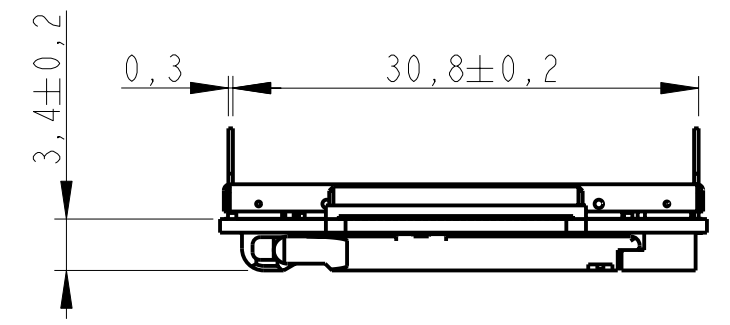
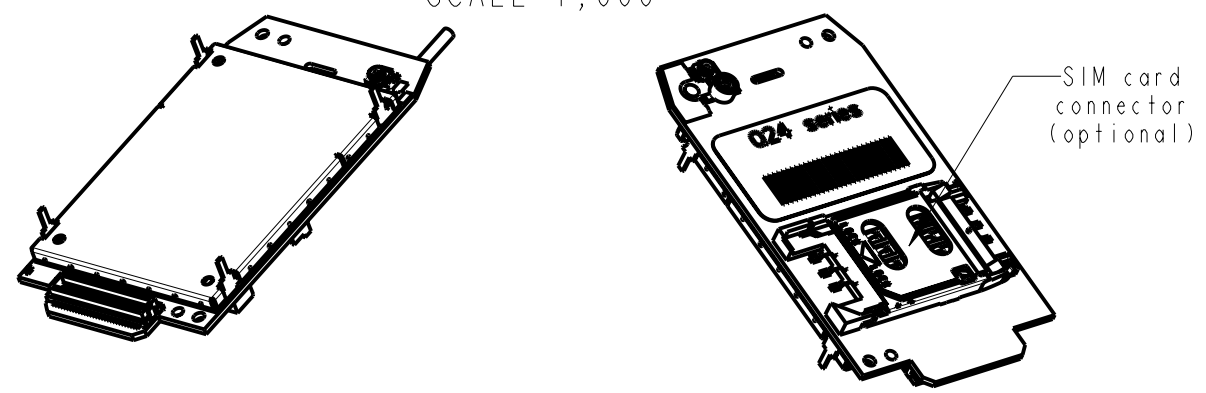
5.2.2 Mechanical Drawings

The following page gives the mechanical specifications of the Wireless CPU Q24 Series.

Figure 18: Mechanical drawing.

(see following page)

SCALE 1,000



Locating
2x Ø1,5

SEE DETAIL A

6,4^{+0,3}/_{0,2}

| | | | | |
|---------------------|--|-----------------|------------|---------------|
| Q24 Series | | GEN.TOL. : ±0,3 | | SCALE : 1,000 |
| MODULE DIMENSIONS | | DOC. | FOLIO: 1/1 | FORMAT : A3 |
| WM-3-600101-V-003-A | | | | |

wavecom®

AUTHOR : JPM
RESPONS : ASC

| | | | | | |
|-------------------|----------|--------|-------|------------|-----|
| Sim holder update | 28/09/06 | JPM | ASC | Production | B |
| Creation | 03/08/06 | JPM | ASC | Production | A |
| MODIFICATION | DATE | AUTHOR | RESP. | STATUS | IND |

| | | | | | |
|--------------|--------|--|--|--|------|
| PRO/ENGINEER | MODULE | | | | IND. |
|--------------|--------|--|--|--|------|



6 Connector and Peripheral Device References

6.1 General Purpose Connector Data Sheet

The supplier for the GPC connector is KYOCERA/ELCO, available from <http://www.avxcorp.com>.

Ref: 14 5087 060 930 861, or 19 5087 060 930 861.

6.2 SIM Card Reader

These SIM Card holder references may be used in customer application with Wireless CPU Q24 version, not already equipped with a SIM Card holder.

- ITT CANNON CCM03 series (see <http://www.ittcannon.com>)
- AMPHENOL C707 series (see <http://www.amphenol.com>)
- JAE (see <http://www.jae.com>)

Drawer type:

- MOLEX 99228-0002 (connector) / MOLEX 91236-0002 (holder) (see <http://www.molex.com>)

6.3 Microphone

Potential suppliers:

- HOSIDEN
- PANASONIC
- PEIKER

6.4 Speaker

Potential suppliers:

- SANYO
- HOSIDEN
- PRIMO
- PHILIPS

6.5 Antenna Cable

The following cable reference has been certified for mounting on the Wireless CPU Q24 Series:

- RG178

Wireless CPU Q24 Series Connector and Peripheral Device References

6.6 RF board-to-board Connector

The supplier for the IMP connector is Radiall (<http://www.radiall.com>) with the following references:

- R107 064 900.
- R107 064 920.

The supplier for the MMS connector is Radiall (<http://www.radiall.com>)

6.7 GSM Antenna

GSM antenna and support for antenna adaptation may be obtained from the manufacturers such as:

- ALLGON (<http://www.allgon.com>)
- HIRSCHMANN (<http://www.hirschmann.com>)

7 Appendix

7.1 Standards and Recommendations

GSM ETSI, 3GPP, GCF, and NAPRD03 recommendations for Phase II.

| Specification Reference | Title |
|--|--|
| 3GPP TS 45.005 v5.5.0 (2002-08) Release 5 | Technical Specification Group GSM/EDGE. Radio Access Network; Radio transmission and reception |
| GSM 02.07 V8.0.0 (1999-07) | Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features (GSM 02.07 version 8.0.0 Release 1999) |
| GSM 02.60 V8.1.0 (1999-07) | Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description, Stage 1 (GSM 02.60 version 8.1.0 Release 1999) |
| GSM 03.60 V7.9.0 (2002-09) | Technical Specification Group Services and System Aspects; Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2 (Release 1998) |
| 3GPP TS 43.064 V5.0.0 (2002-04) | Technical Specification Group GERAN; Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2 (Release 5) |
| 3GPP TS 03.22 V8.7.0 (2002-08) | Technical Specification Group GSM/EDGE. Radio Access Network; Functions related to Mobile Station (MS) in idle mode and group receive mode; (Release 1999) |
| 3GPP TS 03.40 V7.5.0 (2001-12) | Technical Specification Group Terminals; Technical realization of the Short Message Service (SMS) (Release 1998) |
| 3GPP TS 03.41 V7.4.0 (2000-09) | Technical Specification Group Terminals; Technical realization of Cell Broadcast Service (CBS) (Release 1998) |
| ETSI EN 300 903 V8.1.1 (2000-11) | Digital cellular telecommunications system (Phase 2+); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system (GSM 03.50 version 8.1.1 Release 1999) |
| 3GPP TS 04.06 V8.2.1 (2002-05) | Technical Specification Group GSM/EDGE Radio Access Network; Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification (Release 1999) |

| Specification Reference | Title |
|------------------------------------|---|
| 3GPP TS 04.08 V7.18.0 (2002-09) | Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification (Release 1998) |
| 3GPP TS 04.10 V7.1.0 (2001-12) | Technical Specification Group Core Networks; Mobile radio interface layer 3 Supplementary services specification; General aspects (Release 1998) |
| 3GPP TS 04.11 V7.1.0 (2000-09) | Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface (Release 1998) |
| 3GPP TS 45.005 v5.5.0 (2002-08) | Technical Specification Group GSM/EDGE. Radio Access Network; Radio transmission and reception (Release 5) |
| 3GPP TS 45.008 V5.8.0 (2002-08) | Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem link control (Release 5) |
| 3GPP TS 45.010 V5.1.0 (2002-08) | Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem synchronization (Release 5) |
| 3GPP TS 46.010 V5.0.0 (2002-06) | Technical Specification Group Services and System Aspects; Full rate speech; Transcoding (Release 5) |
| 3GPP TS 46.011 V5.0.0 (2002-06) | Technical Specification Group Services and System Aspects; Full rate speech; Substitution and muting of lost frames for full rate speech channels (Release 5) |
| 3GPP TS 46.012 V5.0.0 (2002-06) | Technical Specification Group Services and System Aspects; Full rate speech; Comfort noise aspect for full rate speech traffic channels (Release 5) |
| 3GPP TS 46.031 V5.0.0 (2002-06) | Technical Specification Group Services and System Aspects; Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channels (Release 5) |
| 3GPP TS 46.032 V5.0.0 (2002-06) | Technical Specification Group Services and System Aspects; Full rate speech; Voice Activity Detector (VAD) for full rate speech traffic channels (Release 5) |
| TS 100 913V8.0.0 (1999-08) | Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01 version 8.0.0 Release 1999) |

| Specification Reference | Title |
|--------------------------------------|--|
| GSM 09.07 V8.0.0 (1999-08) | Digital cellular telecommunications system (Phase 2+); General requirements on inter-working between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) (GSM 09.07 version 8.0.0 Release 1999) |
| 3GPP TS 51.010-1 v7.3.1 (2006-10) | Technical Specification Group GSM/EDGE ; Radio Access Network ;Digital cellular telecommunications system (Phase 2+);Mobile Station (MS) conformance specification; Part 1: Conformance specification (Release 7) |
| 3GPP TS 51.011 V5.0.0 (2001-12) | Technical Specification Group Terminals; Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (Release 5) |
| ETS 300 641 (1998-03) | Digital cellular telecommunications system (Phase 2); Specification of the 3 Volt Subscriber Identity Module - Mobile Equipment (SIM-ME) interface (GSM 11.12 version 4.3.1) |
| GCF-CC V3.23.1 (2006-07) | Global Certification Forum – Certification criteria |
| NAPRD03 v3.8.1 (2006-08) | North America Permanent Reference Document for PTCRB tests |

The Wireless CPU Quik Q24 series connected to a development kit board application is certified to be in accordance with the following Rules and Regulations of the Federal Communications Commission (FCC).

Power listed on the Gant is conducted for Part 22 and conducted for Part 24.

This device contains EGSM/GPRS Class 10 functions in the 900 and 1800MHz Band, which are not operational in U.S. Territories.

This device can be used only for mobile and fixed applications. The antenna(s) used for this transmitter must be installed at a distance of minimum 20 cm from all persons and must not be co-located or operated with any other antenna or transmitter.

Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Antennas used for this OEM module must not exceed 1.4 dBi gain for GSM 850 MHz and 7 dBi for GSM 1900 MHz for fixed operating configurations. For mobile operations the gain must not exceed 1.4 dBi for GSM 850 MHz and 3dBi for GSM 1900 MHz. This device is approved as a module to be installed in other devices.

Installed in portable devices, the RF exposure condition requires a separate mandatory equipment authorization for the final device.

The license module will have a FCC ID label on the module itself. The FCC ID label must be visible through a window or it must be visible when an access panel, door or cover is easily removed.

If not, a second label must be placed on the outside of the device that contains one of the following text:

FCC ID: O9EQ24CL001

FCC ID: O9EQ24CL003

FCC ID: O9EQ24PL001

FCC ID: O9EQ24PL003

FCC ID: O9EQ24PL005

FCC ID: O9EQ24PL006

FCC ID: O9EQ24AU001

FCC ID: O9EQ24AU002

FCC ID: O9EQ24EX001

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

7.2 Safety Recommendations (for Information only)



Caution:

For the efficient and safe operation of your GSM applications based on the Wireless CPU Q24 Series.

Please read this information carefully.

7.2.1 RF safety

7.2.1.1 General

Your GSM terminal is based on the GSM standard for cellular technology. The GSM standard is spread all over the world. It covers Europe, Asia and some parts of America and Africa. This is the most used telecommunication standard.

Your GSM terminal is actually a low power radio transmitter and receiver. It sends out as well as receives radio frequency energy. When you use your GSM application, the cellular system which handles your calls controls both the radio frequency and the power level of your cellular modem.

7.2.1.2 Exposure to RF Energy

There has been some public concern on possible health effects of using GSM terminals. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was safe to use.

If you are concerned about exposure to RF energy, there are things you can do to minimize the exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular terminal efficiently by following the guidelines given in the sections below.

7.2.1.3 Efficient Terminal Operation

For your GSM terminal to operate at the lowest power level, consistent with satisfactory call quality:

- If your terminal has an extendable antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However your GSM terminal operates more efficiently with the antenna when it is fully extended.
- Do not hold the antenna when the terminal is « IN USE ». Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

7.2.1.4 Antenna Care and Replacement

- Do not use the GSM terminal with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace the damaged antenna immediately. You may repair antenna to yourself by following the instruction manual provided to you. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.
- Buy or replace the antenna only from the approved suppliers list. Using of unauthorized antennas, modifications or attachments could damage the terminal and may violate local RF emission regulations or invalidate type approval.

7.2.2 General safety

7.2.2.1 Driving

Check with the laws and regulations regarding the use of cellular devices in the area where you have to drive, as you always have to comply with them. When using your GSM terminal while driving, please:

- give full attention to driving,
- pull-off the road and park before making or answering a call, if driving conditions so require.

7.2.2.2 Electronic Devices

Most electronic equipments, for example in hospitals and motor vehicles are shielded from RF energy. However, RF energy may affect some improperly shielded electronic equipment.

7.2.2.3 Vehicle Electronic Equipment

Check with your vehicle manufacturer/representative to determine if any on-board electronic equipment is adequately shielded from RF energy.

7.2.2.4 Medical Electronic Equipment

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc) to determine if they are adequately shielded from external RF energy.

Turn your terminal **OFF** in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

7.2.2.5 Aircraft

Turn your terminal OFF before boarding any aircraft.

- Use it on the ground only with crew permission.
- Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you should have prior permission from crew members, to use your terminal while the aircraft is on the ground. In order to prevent interference with cellular systems, local RF regulations prohibit using your modem while airborne.

7.2.2.6 Children

Do not allow children to play with your GSM terminal. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem, or make calls that increase your modem bills.

7.2.2.7 Blasting Areas

To avoid interfering with blasting operations, turn your unit **OFF** when you are in a « blasting area » or in areas posted: « turn off two-way radio ». Construction crew often uses remote control RF devices to set off explosives.

7.2.2.8 Potentially Explosive Atmospheres

Turn your terminal **OFF** in any area with a potentially explosive atmosphere. Though it is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations; below decks on boats;

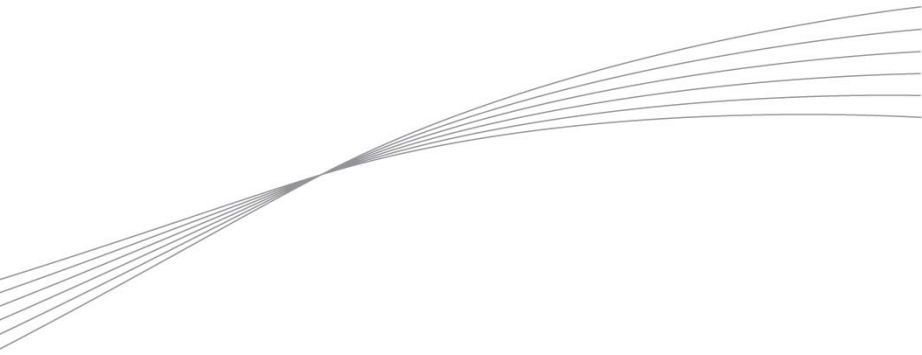
Wireless CPU Q24 Series

Appendix

fuel or chemical transfer or storage facilities; and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle, which contains your terminal or accessories.

Before using your terminal in a vehicle powered by liquefied petroleum gas (such as propane or butane), ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is used.



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