PCI Extreme

PCIE-100

User Guide

Reference:	WM_DEV_PCIE-100_PTS_003
Revision:	001
Date:	July, 01th 2008

Document Information

Level	Date	History of the evolution	
001	01/07/2008	Creation (Preliminary version)	EMH

Overview

This document defines and specifies the PCIE-100 Wavecom product.

Contents

Cautions

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

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1 References

1.1 References documents

For more details, several references documents can be consulted. The WAVECOM reference documents are provided in the WAVECOM documents package contrary at the general reference documents which are not WAVECOM owner.

1.1.1 WAVECOM reference document

1.1.2 General reference document

[1] PCI EXPRESS MINI CARD ELECTROMECHANICAL SPECIFICATION, REV 1.2

[2] USB2.0 standard

1.2 List of abbreviations

Abbreviation	Definition
AC	**A**lternative **C**urrent
AT	**AT**tention (prefix for modem commands)
CLK	**CL**oc**K**
CMOS	**C**omplementary **M**etal **O**xide **S**emiconductor
CS	**C**oding **S**cheme
dB	**D**eci**b**el
DCS	**D**igital **C**ellular **S**ystem
E-GSM	**E**xtended **GSM**
EMC	**E**lectro**M**agnetic **C**ompatibility
EMI	**E**lectro**M**agnetic **I**nterference
ESD	**E**lectro**S**tatic **D**ischarges
FTA	**F**ull **T**ype **A**pproval
GND	**G**rou**ND**
GPIO	**G**eneral **P**urpose **I**nput **O**utput
GPRS	**G**eneral **P**acket **R**adio **S**ervice
GSM	**G**lobal **S**ystem for **M**obile communications
LED	**L**ight **E**mitting **D**iode
na	**N**ot **A**pplicable
NOM	**NOM**inal
NTC	**N**égative **T**emperature **C**oefficient
PCB	**P**rinted **C**ircuit **B**oard
RF	**R**adio **F**requency
RST	**R**e**S**e**T**
RX	**R**eceive
SIM	**S**ubscriber **I**dentification **M**odule
SPI	**S**erial **P**eripheral **I**nterface
SPL	**S**ound **P**ressure **L**evel
SPK	**SP**ea**K**er
TBC	**T**o **B**e **C**onfirmed
TDMA	**T**ime **D**ivision **M**ultiple **A**ccess
TP	**T**est **P**oint

Abbreviation	Definition
TX	**T**ransmit
TYP	**TYP**ical
USB	**U**niversal **S**erial **B**us
VSWR	**V**oltage **S**tanding **W**ave **R**atio

.

2 Interfaces

2.1 Mini-PCI Pin Out

Pin Number	Pin Name	Description	I/O	Voltage Domain
1	NC	NC	N/A	N/A
2	VBATT	Power Supply	I	3.3V
3	NC	NC	N/A	N/A
4	GND	Power Supply	I	GND
5	NC	NC	N/A	N/A
6	NC	NC	N/A	N/A
7	NC	NC	N/A	N/A
8	SIM_POWER	SIM	O	1V8 / 2V9
9	GND	Power Supply	I	GND
10	SIM_DATA	SIM	I/O	1V8 / 2V9
11	NC	NC	N/A	N/A
12	SIM_CLK	SIM	O	1V8 / 2V9
13	NC	NC	N/A	N/A
14	SIM_RESET	SIM	O	1V8 / 2V9
15	GND	Power Supply	I	GND
16	NC	NC	N/A	N/A
17	NC	NC	N/A	N/A
18	GND	Power Supply	I	GND
19	NC	NC	N/A	N/A
20	NC	NC	N/A	N/A
21	GND	Power Supply	I	GND
22	RESET	RESET	I	3.3V
23	NC	NC	N/A	N/A
24	NC	NC	N/A	N/A
25	NC	NC	N/A	N/A
26	GND	Power Supply	I	GND
27	GND	Power Supply	I	GND
28	NC	NC	N/A	N/A
29	GND	Power Supply	I	GND
30	NC	NC	N/A	N/A

31	NC	NC	N/A	N/A
32	NC	NC	N/A	N/A
33	NC	NC	N/A	N/A
34	GND	Power Supply	I	GND
35	GND	Power Supply	I	GND
36	USB_D-	USB	I/O	3.3V
37	NC	NC	N/A	N/A
38	USB_D+	USB	I/O	3.3V
39	VBATT	Power Supply	I	3.3V
40	NC	NC	N/A	N/A
41	VBATT	Power Supply	I	3.3V
42	FLASH_LED	Status	O	Open Drain
43	GND	Power Supply	I	GND
44	NC	NC	N/A	N/A
45	NC	NC	N/A	N/A
46	NC	NC	N/A	N/A
47	NC	NC	N/A	N/A
48	NC	NC	N/A	N/A
49	NC	NC	N/A	N/A
50	GND	Power Supply	I	GND
51	NC	NC	N/A	N/A
52	VBATT	Power Supply	I	3.3V

2.2 Not Connected Pins

Not connected pins are expected to be not terminated on either the add-in card or system board side of the connector. These pins are reserved for definition with future revisions of this specification.

Non-standard use of these pins may result in incompatibilities in solutions aligned with the future revision.

2.3 Power supply

2.3.1 Electrical Characteristics

Input power Supply Voltage

	V_{MIN}	V_{NOM}	V_{MAX}	I_{MAX}	Ripple max (U_{ripp})
VBATT	3.0	3.3	3.6		**(TBD)**

2.3.2 Pin description

Signal	Pin number
VBATT	2, 39, 41, 52

2.3.3 Application

The power supply is one of the key issues in the design of a PCI Extreme product. The PCIE-100 is supplied by one single power supply VBATT.

Due to the bursted emission in GSM / GPRS, the power supply must be able to deliver high current peaks in a short time.

When designing the power supply for your application please pay specific attention to power losses. Ensure that the input voltage VBATT never drops below specification. Any voltage drops that may occur in a transmit burst should not exceed **XXX** mV.

The best approach to reducing voltage drops is to use a board-to-board connection as recommended, and a low impedance power source. The resistance of the power supply lines on the host board and of a battery pack should also be considered.

2.3.4 Power consumption

Power consumption is dependent on the configuration used. It is for this reason that the following consumption values are given for each mode, RF band and type of wireless feature needed (GSM, GPRS, EDGE and UMTS)

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

The following consumption values were obtained by performing measurements on PCIE-100 samples at a temperature of 25° C.

Three VBATT values are used to measure the consumption, $VBATT_{MIN}$ (3.0V), $VBATT_{MAX}$ (3.6V) and $VBATT_{TYP}$ (3.3V).

The average current is given for the three VBATT values.

2.3.4.1 Idle Mode power consumption

Operating mode	Parameters	I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	unit
Idle Mode			**62**		mA

2.3.4.2 GSM power consumption

Operating mode	Parameters		I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	Unit
GSM Connected Mode	850 MHz	PCL5 (TX power 33dBm)		**500**		mA
		PCL19 (TX power 5dBm)		**200**		mA
	900 MHz	PCL5 (TX power 33dBm)		**500**		mA
		PCL19 (TX power 5dBm)		**200**		mA
	1800 MHz	PCL0 (TX power 30dBm)		**450**		mA
		PCL15 (TX power 0dBm)		**200**		mA
	1900 MHz	PCL0 (TX power 30dBm)		**450**		mA
		PCL15 (TX power 0dBm)		**200**		mA

2.3.4.3 GPRS power consumption

Operating mode	Parameters		I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	Unit
GPRS (1Tx, 4Rx) Connected Mode	850 MHz	PCL5 (TX power 33dBm)		**500**		mA
		PCL19 (TX power 5dBm)		**200**		mA
	900 MHz	PCL5 (TX power 33dBm)		**500**		mA
		PCL19 (TX power 5dBm)		**200**		mA
	1800 MHz	PCL0 (TX power 30dBm)		**450**		mA
		PCL15 (TX power 0dBm)		**200**		mA
	1900 MHz	PCL0 (TX power 30dBm)		**450**		mA
		PCL15 (TX power 0dBm)		**200**		mA

Operating mode	Parameters		I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	Unit
GPRS (2Tx, 3Rx) Connected Mode	850 MHz	PCL5 (TX power 33dBm)		**690**		mA
		PCL19 (TX power 5dBm)		**255**		mA
	900 MHz	PCL5 (TX power 33dBm)		**620**		mA
		PCL19 (TX power 5dBm)		**270**		mA
	1800 MHz	PCL0 (TX power 30dBm)		**550**		mA
		PCL15 (TX power 0dBm)		**265**		mA
	1900 MHz	PCL0 (TX power 30dBm)		**550**		mA
		PCL15 (TX power 0dBm)		**265**		mA

Operating mode	Parameters		I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	Unit
GPRS (4Tx, 4Rx) Connected Mode	850 MHz	PCL5 (TX power 33dBm)		**940**		mA
		PCL19 (TX power 5dBm)		**340**		mA
	900 MHz	PCL5 (TX power 33dBm)		**780**		mA
		PCL19 (TX power 5dBm)		**360**		mA
	1800 MHz	PCL0 (TX power 30dBm)		**750**		mA
		PCL15 (TX power 0dBm)		**360**		mA
	1900 MHz	PCL0 (TX power 30dBm)		**750**		mA
		PCL15 (TX power 0dBm)		**360**		mA

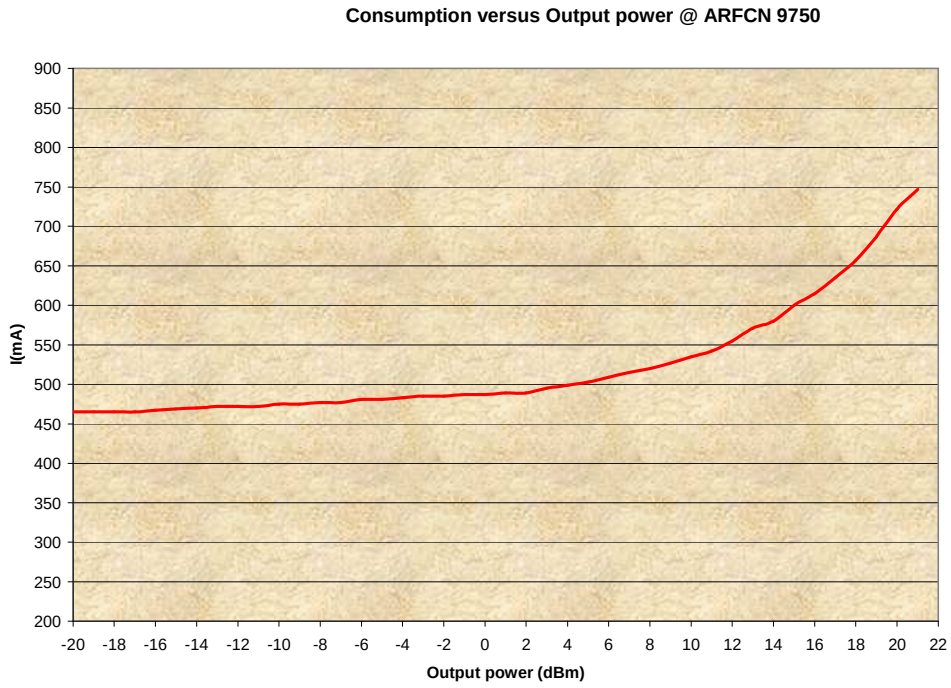
2.3.4.4 EGPRS power consumption

Operating mode	Parameters		I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	Unit
EGPRS MCS9 (1Tx, 4Rx) Connected Mode	850 MHz	PCL8 (TX power 27dBm)		**315**		mA
		PCL19 (TX power 5dBm)		**215**		mA
	900 MHz	PCL8 (TX power 27dBm)		**315**		mA
		PCL19 (TX power 5dBm)		**215**		mA
	1800 MHz	PCL2 (TX power 26dBm)		**315**		mA
		PCL15 (TX power 0dBm)		**215**		mA
	1900 MHz	PCL2 (TX power 26dBm)		**310**		mA
		PCL15 (TX power 0dBm)		**215**		mA

Operating mode	Parameters		I_{MIN} average VBATT=3.6V	I_{NOM} average VBATT=3,3V	I_{MAX} average VBATT=3,2V	Unit
EGPRS MCS9 (2Tx, 3Rx) Connected Mode	850 MHz	PCL8 (TX power 27dBm)		**445**		mA
		PCL19 (TX power 5dBm)		**285**		mA
	900 MHz	PCL8 (TX power 27dBm)		**445**		mA
		PCL19 (TX power 5dBm)		**285**		mA
	1800 MHz	PCL2 (TX power 26dBm)		**445**		mA
		PCL15 (TX power 0dBm)		**285**		mA
	1900 MHz	PCL2 (TX power 26dBm)		**445**		mA
		PCL15 (TX power 0dBm)		**285**		mA

2.3.4.5 UMTS power consumption

Power consumption in WCDMA is fully linked to required output power of the PCIE-100. Here is an evaluation of the consumption made in Band 1 on middle frequency.



2.4 SIM Interface

The Subscriber Identification Module can be directly connected to the PCIE-100 through this dedicated interface.

The SIM interface controls a 3V / 1V8 SIM. This interface is fully compliant with GSM 11.11 recommendations concerning SIM functions.

2.4.1 Features

The SIM interface controls 1.8V and 3V SIM card.

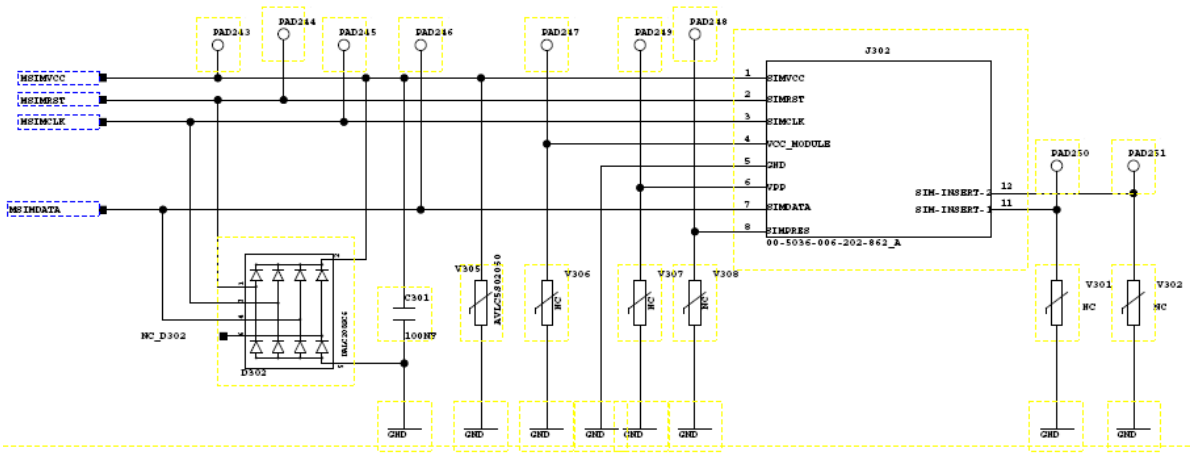
Electrical Characteristics of SIM interface

Parameter	Conditions	Minimal	Typical	Maximal	Unit
SIM_DATA					
Internal Pull Up	SIM_DATA to SIM_VCC	6,5	10	14	kOhms
Input low voltage threshold		0.3			Volts
Input high voltage threshold				VDD – 0.6	Volts
Input low current			1		mA
Input high current			20		µA
Output low voltage level				0.4	Volts
Output low voltage level		0.8 * SIM_VCC			Volts
Capacitive load			30		pF
Rise / Fall Time			0,8		µs
SIM_CLK & SIM_RST					
Digital output low level				0.4	Volts
Digital output high level		0,8 * SIM_VCC			Volts
Capacitive load				30	pF
SIM_CLK Rise / Fall Time				40	ns
SIM_CLK Rise / Fall Time				100	ns
Output low voltage level				0.4	V
Output low voltage level		0.8 * SIM_VCC			V

2.4.2 Pin description

Signal	Pin number	I/O	I/O type	Description
SIM_CLK	12	O	2V9 / 1V8	SIM Clock
SIM_RESET	14	O	2V9 / 1V8	SIM Reset
SIM_DATA	10	I/O	2V9 / 1V8	SIM Data
SIM_POWER	8	O	2V9 / 1V8	SIM Power Supply

2.4.3 Application



The SIM interface controls 1.8V and 3V SIM card. It is recommended to add Transient Voltage Suppressor diodes (TVS) on the signal connected to the SIM socket in order to prevent any Electrostatics Discharge.

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

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

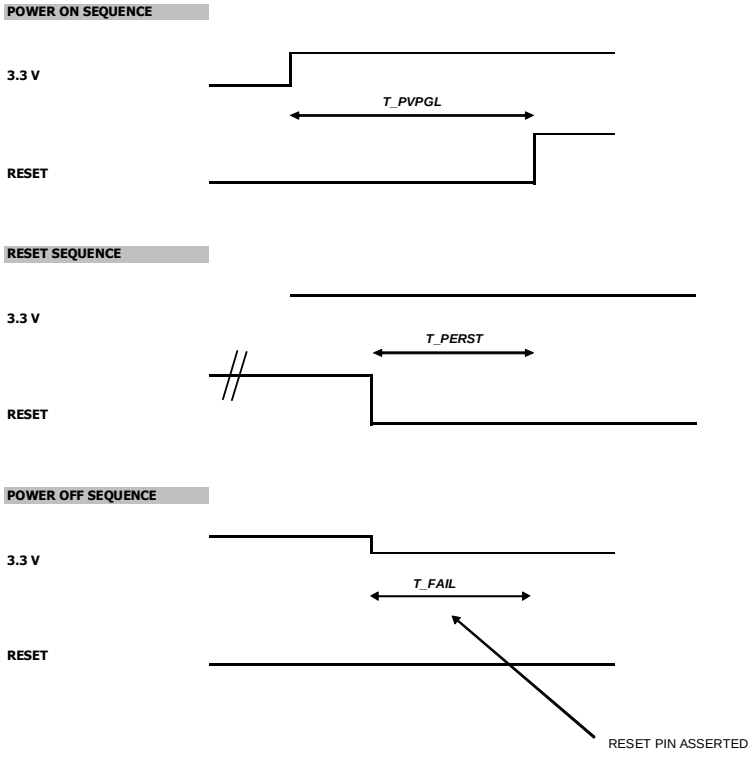
The following references can be used: DALC208SC6 from ST Microelectronics.

2.5 Reset signals

2.5.1 Features

Electrical Characteristics of the signals

Parameter		Minimum	Typ	Maximum	Unit
RESET	V_{IH}	2		3.6	V
	V_{IL}	-0.5		0.8	V
	Input Capacitance		7		pF
	Output Capacitance		30		pF
	Input leakage current	-10		10	µA
	Output Capacitance	-50		50	µA



Parameter		Minimum	Typ	Maximum	Unit
RESET	T_PVPGL		TBD		ms
	T_PERST		TBD		ms
	T_FAIL		TBD		ms

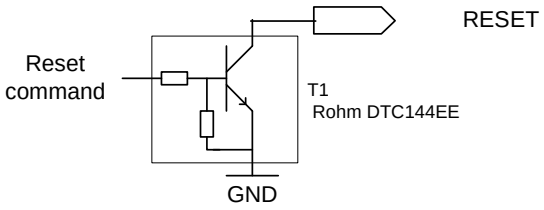
- T_PVPGL => RESET must remain active at least this long after power becomes valid
- T_PERST => When asserted, RESET must remain asserted at least this long
- T_FAIL => When power becomes invalid, RESET must be asserted within this time

2.5.2 Pin description

Signal	Pin number	I/O	I/O type	Description
RESET	22	I/O Open Drain*	3.3V	PCIE-100 Reset

2.5.3 Application

The RESET signal is de-asserted to indicate when the system power sources are within their specified voltage tolerance and are stable. RESET should be used to initialize the card functions once power sources stabilize. RESET is asserted when power is switched off and also can be used by the system to force a hardware reset on the card. The system may also use RESET to cause a warm reset of the add-in card.



Open collector or open drain transistor can be used. If an open collector is chosen, T1 can be a Rohm DTC144EE.

2.6 FLASH-LED signal

2.6.1 Features

FLASH-LED status

FLASH-LED status	PCIE-100 status
LED OFF	Radio is incapable of transmitting.
LED ON	Radio is capable of transmitting.

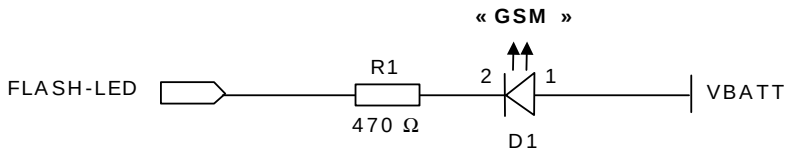
Electrical characteristics of the signal

Parameter	Condition	Minimum	Typ	Maximum	Unit
V_{OL}			0.4		V
I_{OUT}			8		mA

2.6.2 Pin description

Signal	Pin number	I/O	I/O type	Reset state	Description
FLASH-LED	42	O	Open Drain		Active Low

2.6.3 Application



R1 value can be harmonized depending of the LED (D1) characteristics.

2.7 USB 2.0 interface

A 2-wire USB slave interface is available, compiling with USB 2.0 protocol signalling. The USB interface signals are USB-DP, USB-DM and GND.

The USB interface supports USB 2.0 in all three modes (Low Speed, Full Speed, and High Speed). Because there is not a separate USB-controlled voltage bus, USB functions implemented on a PCI Express Mini Card add-in card are expected to report as self-powered devices. All enumeration, bus protocol, and bus management features for this interface are defined by Universal Serial Bus Specification, Revision 2.0.

2.7.1 Features

- 12Mbit/s full speed transfer rate
- 3.3V type compatible
- USB Soft connect feature

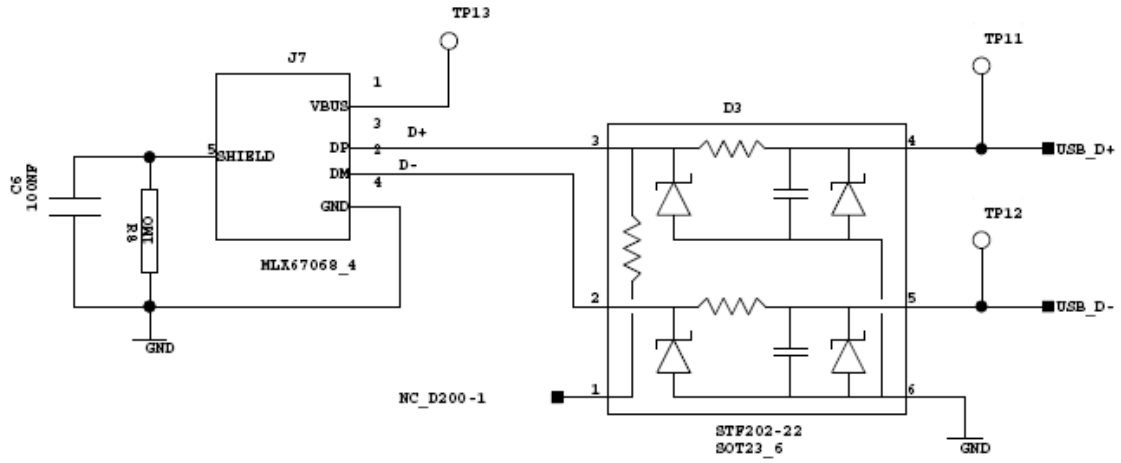
Electrical characteristics of the signals

Parameter	Min	Typical	Max	Unit
USB_D-, USB_D+	3	3.3	3.6	V

2.7.2 Pin description

Signal	Pin number	I/O	I/O type	Description
USB_D+	38	I/O	USB	Differential data interface positive
USB_D-	36	I/O	USB	Differential data interface negative

2.7.3 Application



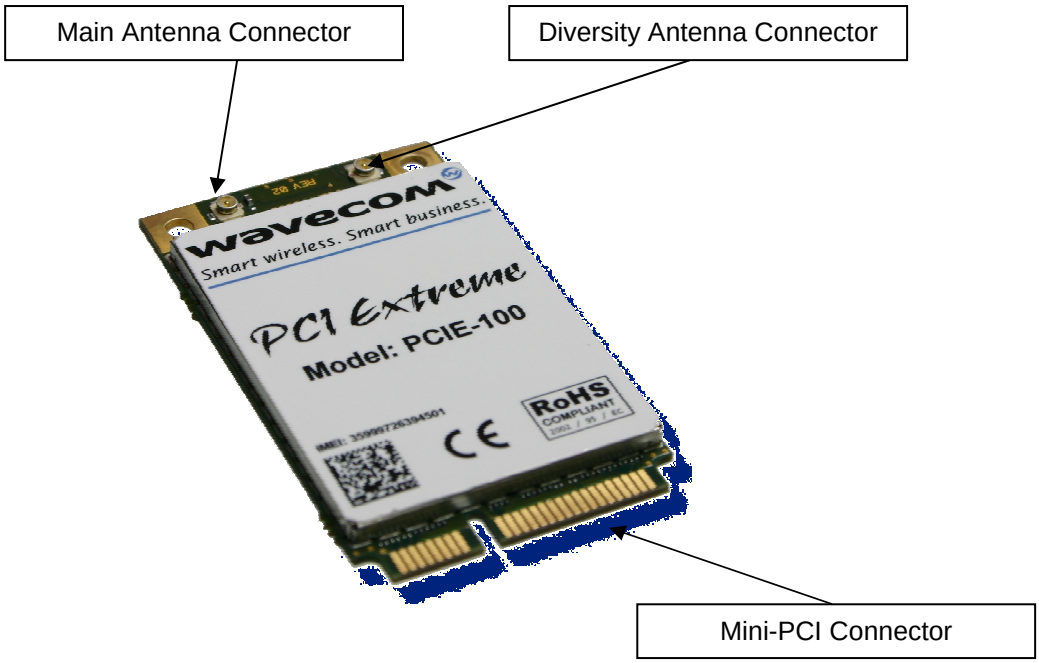
For USB interface, it is recommended to add EMI/RFI/ESD protection between PCIE-100 and USB connector like shown on previous schematic. The following references can be used: STF2002-22 from SEMTECH.

2.8 RF interface

The impedance is 50 Ohms nominal and the DC impedance is 0 Ohm. Main and diversity antenna connector are available in wavecom PCIE-100 product.

Connection of main antenna is mandatory.

Connection of diversity antenna is not mandatory, but if diversity antenna is not used, performances will reduce (especially in HSxPA)



2.8.1 RF connection

The miniature coaxial antenna connector from Hirose with following reference 331-0471-0-01 is implemented in Wavecom PCIE-100 board. A wide variety of cables with UFL connectors is offered by different suppliers.

Here are the main specifications of the RF connection

Item	Specification	Conditions	
1. Contact resistance	Center: 20 m ohms max. Outside: 10 m ohms max.	10 mA max.	
2. Insulation resistance	500 M ohms min.	100 V DC	
3. Withstanding voltage	No flashover or insulation breakdown.	200 V AC / 1 minute	
4. V.S.W.R.*	Part No.	Up to 3GHz	3 to 6GHz
	U.FL-LP-040 dia.0.81mm Coaxial Cable Assembly	1.3 Max	1.35 Max
	U.FL-LP(V)-040 dia.0.81mm Coaxial Cable Assembly	1.3 Max	1.3 Max
	U.FL-LP-069 dia.1.13mm Coaxial Cable Assembly	1.3 Max	1.4 Max
	U.FL-LP-066 dia.1.32mm Coaxial Cable Assembly	1.3 Max	1.5 Max
	U.FL-LP-062 dia.1mm Coaxial Cable Assembly	1.3 Max	1.3 Max
	U.FL-LP-088 dia.1.37mm Coaxial Cable Assembly	1.3 Max	1.4 Max
5. Center contact holding force	0.15 N min.	Measured with a ϕ 0.475 pin gauge	
6. Durability (mating/un-mating, with corresponding plug)	Contact resistance Center: 25 m ohms max. Outside: 15 m ohms max.	30 cycles	
7. Vibration	No electrical discontinuity of 1 μs min.	Frequency: 10 to 100 Hz, single amplitude of 1.5mm, acceleration of 59m/s², for 5 cycles in the direction of each of the 3 axis.	
8. Shock	No damage, cracks or parts dislocation.	Acceleration of 735 m/s², 11ms duration, sine half-wave waveform, 6 cycles in each of 3 axes.	
9. Humidity (Steady state)	No damage, cracks or parts dislocation. Insulation resistance 100 M ohms min.(when humidity high) Insulation resistance 500 M ohms min.(when dry)	96 hours at temperature of 40°C and humidity of 95%.	
10. Temperature cycle	No damage, cracks or parts dislocation. Contact resistance:25 m ohms max. (Center) 15 m ohms max. (Outside)	Temperature:-40°C→+5 to +35°C→+90°C→+5 to +35°C Time: 30 →5 max. →30 →5 max.(Minutes) 5 cycles	
11. Salt spray test	No excessive corrosion	5% salt water solution, 48 hours	

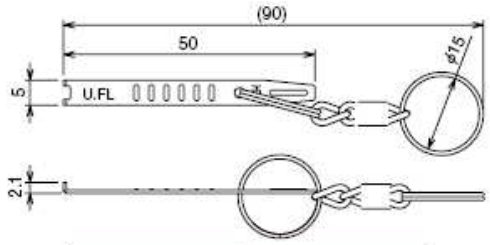
*V.S.W.R. Measurement System
The above V.S.W.R. standard values were measured using the measurement connection shown below.

An extraction tools is needed to remove the RF connector when plugged on Wavecom PCIE-100.

■Plug Extraction Tool

This jig is used for extraction from a mating condition.

Note: Part No. U.FL-LP-N-2 for U.FL-LP-040/066/088.
Part No. U.FL-LP(V)-N-2 for U.FL-LP(V)-040/U.FL-LP-062.



Part No.	CL No.
U.FL-LP-N-2	331-0494-5
U.FL-LP(V)-N-2	331-0493-2

To disconnect connectors, insert the end portion of U.FL-LP-N-2 and U.FL-LP(V)-N-2 under the connector flanges and pull off vertically, in the direction of the connector mating axis.

To mate the connectors, the mating axes of both connectors must be aligned and the connectors can be mated. The "click" will confirm fully mated connection.Do not attempt to insert on an extreme angle.

2.8.2 RF performances

TBD

3 Environmental Specifications

3.1 Temperature Range

Wavecom specifies following temperature range PCIE-100 product

Conditions	Temperature range
Operating / Class A	-20 °C to +55°C
Operating / Storage / Class B	-40 °C to +85°C (TBC)

Function Status Classification:

Class A:

The PCIE-100 shall have full function during and after an external influence. The GSM performance shall meet the minimum ETSI requirements.

Class B:

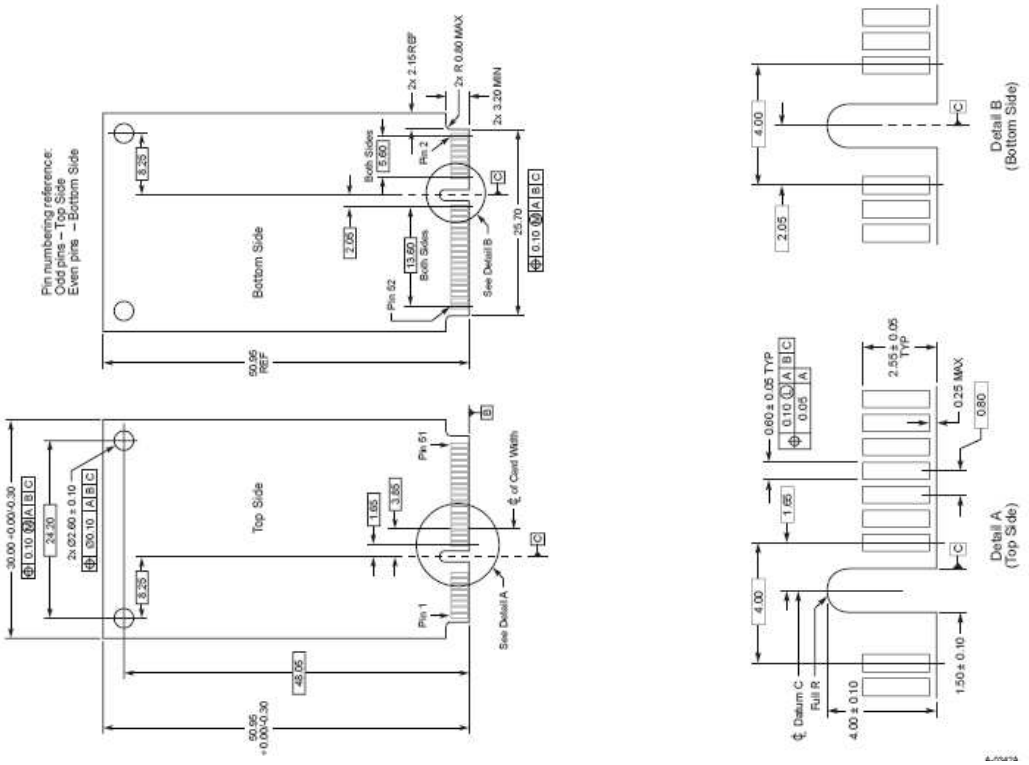
Any functions can be out of specified tolerances. All the functions will be going back to normal tolerances automatically after that the external influence has been removed. Performance is allowed to go outside of the minimum ETSI requirements, but it must be possible to connect a call and send an SMS.

3.2 Mechanical specifications

PCIE-100 is fully compatible with Mini-PCI Express Standard as described in [1]. Standard connectors and latch up solutions could be used.

3.2.1 Mechanical drawings

The next page gives main mechanical specifications of PCIE-100.



3.3 Thermal specifications

The PCIE-100 card temperature profile depends on host cooling approach including:

- Natural convection
- Forced air
- Direct attach

Location of "heat sources" near the PCIE-100 add-in card can negatively impact the thermal design. Do not place the add-in card near other host heat sources or "down wind" from such heat sources. Inadequate cooling may cause the WWAN add-in card to overheat:

4

5

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

[1] this device may not cause harmful interference, and

[2] This device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter."

Maximum antenna gain that can be used with this product is 6.9dBi for 850MHz and 3.0dBi for 1900MHz.

Peripheral devices references

5.1 Mini-PCI Connector

- Kyocera (see http://www.kyocera-elco.com)
- Molex (see http://www.molex.com)

5.2 Mini-PCI Latch Up

- Molex (see http://www.molex.com)

5.3 SIM Card Reader

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

5.4 Antenna Connector

The following cable reference has been qualified for being mounted on PCIE-100:

- RG178

5.5 GSM antenna

GSM antennas and support for antenna adaptation can be obtained from manufacturers such as:

- ALLGON (http://www.allgon.com)
- IRSCHMANN (http://www.hirschmann.com/)

6 Noises and design

6.1 EMC recommendations

The EMC tests have to be performed as soon as possible on the application to detect any possible problem.

When designing, special attention should be paid to:

- Possible spurious emission radiated by the application to the RF receiver in the receiver band
- ESD protection is mandatory for all peripherals accessible from outside (SIM, serial link, etc.)
- Biasing of the microphone inputs
- Length of the SIM interface lines (preferably <10cm)
- Ground plane: WAVECOM recommends having a common ground plane for analog / digital / RF grounds.
- Metallic case or plastic casing with conductive paint are recommended

Note:

The PCIE-100 does not include any protection against overvoltage.

6.2 Power Supply

The power supply is one of the key issues in the design of a GSM terminal. A weak power supply design could affect in particular:

- EMC performances.
- the emissions spectrum
- the phase error and frequency error

WARNING:

Careful attention should be paid to:

- **Quality of the power supply: low ripple, PFM or PSM systems should be avoided (PWM converter preferred).**
- **Capacity to deliver high current peaks in a short time (pulsed radio emission).**

7 Appendix

7.1 Standards and Recommendations

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)

Specification Reference	Title
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)
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)

Specification Reference	Title
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)
GSM 09.07 V8.0.0 (1999-08)	Digital cellular telecommunications system (Phase 2+); General requirements on interworking 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 v7.8.0 (2007-12)	Technical Specification Group GSM/EDGE ; Radio Access Network ;Digital cellular telecommunications system (Phase 2+);Mobile Station (MS) conformance specification; Part 1: Conformance specification (Release 5)
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 V3.30.1	Global Certification Forum – Certification criteria
NAPRD.03 V3.14.0 (2008-01)	North America Permanent Reference Document for PTCRB tests

7.2 Safety recommendations (for information only)

IMPORTANT: FOR THE EFFICIENT AND SAFE OPERATION OF YOUR GSM APPLICATION BASED ON PCIE-100. 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 and 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

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

(1) This device may not cause harmful interference

(2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
Maximum antenna gain that can be used with this product is 4.9dBi for 850MHz and 10.9dBi for 1900MHz

There has been some public concern about 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 fitted for use.

If you are concerned about exposure to RF energy there are things you can do to minimize 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 below guidelines.

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 extendible 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 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 a damaged antenna immediately. Consult your manual to see if you may change the antenna yourself. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.

Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the terminal and may contravene local RF emission regulations or invalidate type approval.

7.2.2 General safety

7.2.2.1 Driving

Check the laws and the 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 equipment, for example in hospitals and motor vehicles is shielded from RF energy. However RF energy may affect some improperly shielded electronic equipment.

7.2.2.3 Vehicle electronic equipment

Check 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 to have permission from a crew member to use your terminal while the aircraft is on the ground. 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 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** when in any area with a potentially explosive atmosphere. It is rare, but your application 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; 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 to be used.