Cinterion® PDS6

Hardware Interface Overview

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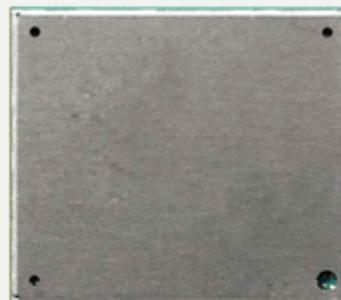
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Contents

Tables

Figures

1   Introduction

This document[1] describes the hardware of the Cinterion® PDS6 module. It helps you quickly retrieve interface specifications, electrical and mechanical details and information on the requirements to be considered for integrating further components.

1.1   Key Features at a Glance

Feature	Implementation		
General			
Frequency bands	GSM/GPRS/EDGE: Quad band 850/900/1800/1900MHz UMTS: Five band 800/850/900/1900/2100MHz		
GSM class	Small MS		
Output power (according to Release 99, V5)	PDS6: Band	RMS Target	Tolerance
	EGPRS 850(8-PSK, 1 Tx slot)	27dBm	+/- 1dB
	EGPRS 850(8-PSK, 2 Tx slot)	24dBm	+/- 1dB
	EGPRS 850(8-PSK, 3 Tx slot)	22dBm	+/- 1dB
	EGPRS 850(8-PSK, 4 Tx slot)	21dBm	+/- 1dB
	EGPRS 1900(8-PSK, 1 Tx slot)	26dBm	+/- 1dB
	EGPRS 1900(8-PSK, 2 Tx slot)	23dBm	+/- 1dB
	EGPRS 1900(8-PSK, 3 Tx slot)	21dBm	+/- 1dB
	EGPRS 1900(8-PSK, 4 Tx slot)	20dBm	+/- 1dB
	GPRS 850(GMSK, 1 Tx slot)	33dBm	+/- 1dB
	GPRS 850(GMSK, 2 Tx slot)	30dBm	+/- 1dB
	GPRS 850(GMSK, 3 Tx slot)	28dBm	+/- 1dB
	GPRS 850(GMSK, 4 Tx slot)	27dBm	+/- 1dB
	GPRS 1900(GMSK, 1 Tx slot)	30dBm	+/- 1dB
	GPRS 1900(GMSK, 2 Tx slot)	27dBm	+/- 1dB
	GPRS 1900(GMSK, 3 Tx slot)	25dBm	+/- 1dB
	GPRS 1900(GMSK, 4 Tx slot)	24dBm	+/- 1dB
	GSM 850	33dBm	+/- 1dB
	GSM 1900	30dBm	+/- 1dB
	UMTS Band 2	24dBm	+/- 1dB
	UMTS Band 5	24dBm	+/- 1dB
Power supply	3.3V to 4.5V		
Operating temperature (board temperature)	Normal operation: -30°C to +85°C Extended operation: -40°C to +90°C		
Physical	Dimensions: 33mm x 29mm x 2mm Weight: approx. 5g		
RoHS	All hardware components fully compliant with EU RoHS Directive		

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1.   The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Gemalto M2M product.

Feature	Implementation
HSPA features	
3GPP Release 6, 7	DL 7.2Mbps, UL 5.7Mbps HSDPA Cat.8 / HSUPA Cat.6 data rates Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
3GPP Release 4	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL
GSM/GPRS/EGPRS features	
Data transfer	GPRS: • Multislot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 EGPRS: • Multislot Class 12 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B CSD: • V.110, RLP, non-transparent • 9.6kbps • USSD
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus SMS locations in mobile equipment
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Gemalto M2M AT commands for RIL compatibility
Java™ Open Platform	Java™ Open Platform with • Java™ profile IMP-NG & CLDC 1.1 HI • Secure data transmission via HTTPS/SSL • Multi-threading programming and multi-application execution Major benefits: seamless integration into Java applications, ease of programming, no need for application microcontroller, extremely cost-efficient hardware and software design – ideal platform for industrial GSM applications. The memory space available for Java programs is around 8 MB in the flash file system and around 6MB RAM. Application code and data share the space in the flash file system and in RAM.
Microsoft™ compatibility	RIL for Pocket PC and Smartphone

Feature	Implementation
SIM Application Toolkit	SAT Release 99
Firmware update	Generic update from host application over ASC0 or USB modem.
Interfaces	
Module interface	Surface mount device with solderable connection pads (SMT application interface). Land grid array (LGA) technology ensures high solder joint reliability and provides the possibility to use an optional module mounting socket. For more information on how to integrate SMT modules see also [3]. This application note comprises chapters on module mounting and application layout issues as well as on SMT application development equipment.
USB	USB 2.0 High Speed (480Mbit/s) device interface, Full Speed (12Mbit/s) compliant
1 serial interface	ASC0: • 8-wire modem interface with status and control lines, unbalanced, asynchronous • Adjustable baud rates: 1,200bps to 921,600bps • Autobauding: 1,200bps to 230,400bps • Supports RTS0/CTS0 hardware flow control. • Multiplex ability according to GSM 07.10 Multiplexer Protocol.
Audio	1 analog interface (with microphone feeding) 1 digital interface (PCM)
UICC interface	Supported SIM/USIM cards: 3V, 1.8V
GPIO interface	6 GPIOs shared with fast shutdown, pulse counter, and PWM functionality
I^{2}C interface	Supports I^{2}C serial interface
SPI interface	Serial peripheral interface
ADC input	Analog-to-digital converter for general purpose voltage measurements
Antenna interface pads	50Ω
Power on/off, Reset	
Power on/off	Switch-on by hardware signal IGT Switch-off by AT command Switch off by hardware signal GPIO4/FST_SHDN instead of AT command Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly shutdown and reset by AT command Emergency reset by hardware signal EMERG_OFF and IGT
Special features	
Real time clock	Timer functions via AT commands
Phonebook	SIM and phone
TTY/CTM support	Integrated CTM modem
Evaluation kit	
Evaluation module	PDS6 module soldered onto a dedicated PCB that can be connected to an adapter in order to be mounted onto the DSB75.
DSB75	DSB75 Development Support Board designed to test and type approve Gemalto M2M modules and provide a sample configuration for application engineering. A special adapter is required to connect the PDS6 evaluation module to the DSB75.

1.2   PDS6 System Overview
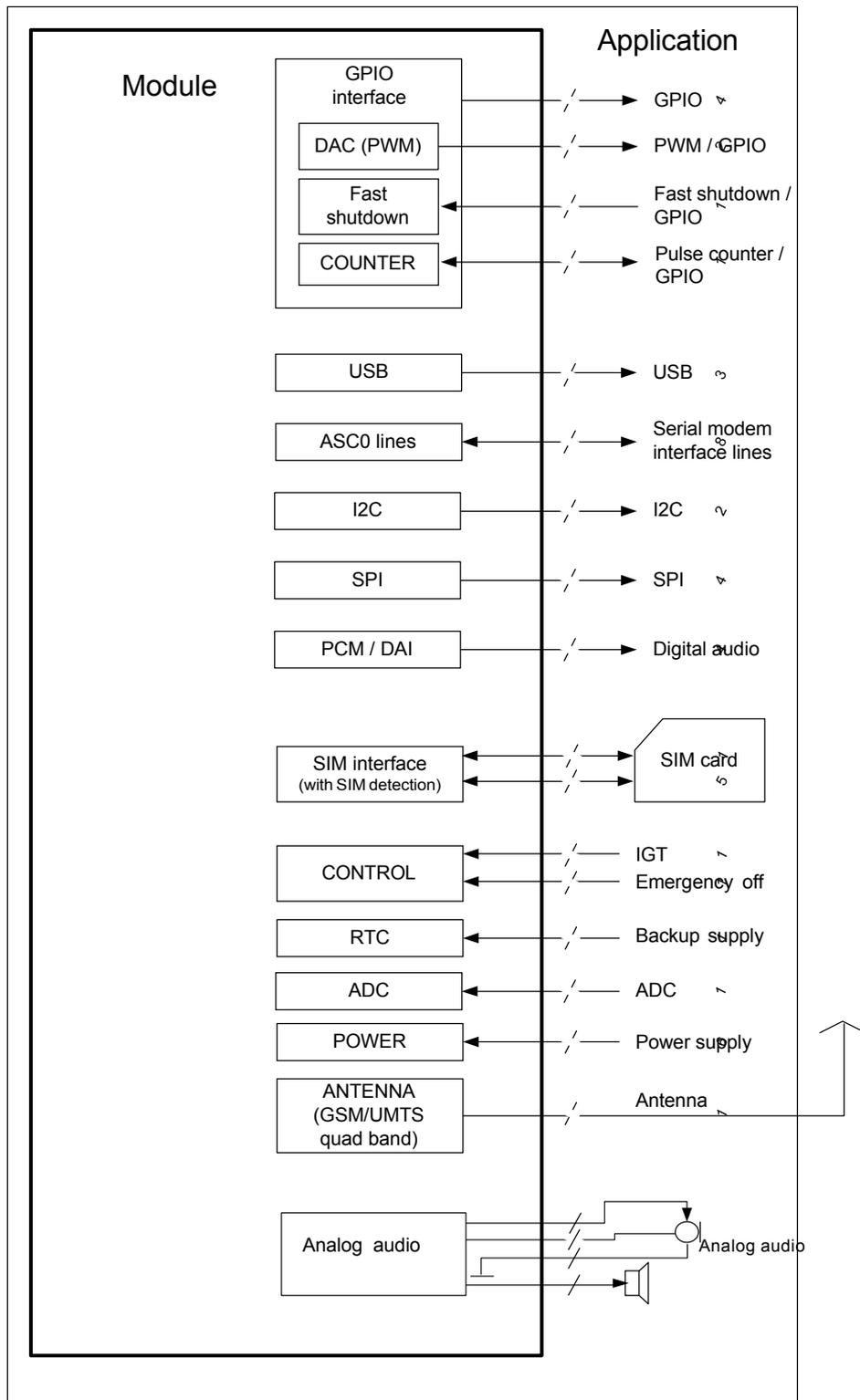
Figure 1: PDS6 system overview

2 Interface Characteristics

PDS6 is equipped with an SMT application interface that connects to the external application. The SMT application interface incorporates the various application interfaces as well as the RF antenna interface.

2.1 Application Interface

2.1.1 USB Interface

PDS6 supports a USB 2.0 High Speed (480Mbit/s) device interface that is Full Speed (12Mbit/s) compliant. The USB interface is primarily intended for use as command and data interface and for downloading firmware.

The external application is responsible for supplying the VUSB_IN line. This line is used for cable detection only. The USB part (driver and transceiver) is supplied by means of BATT+. This is because PDS6 is designed as a self-powered device compliant with the "Uni- versal Serial Bus Specification Revision 2.0"[1].
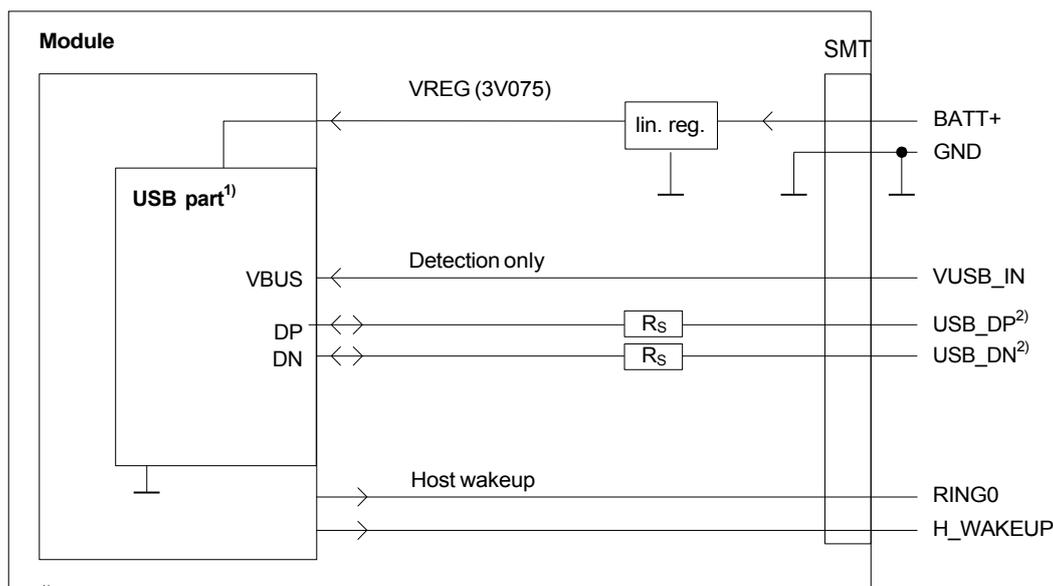
[1] All serial (including R_S) and pull-up resistors for data lines are implemented.

[2] If the USB interface is operated in High Speed mode (480MHz), it is recommended to take special care routing the data lines USB_DP and USB_DN. Application layout should in this case implement a differential impedance of 90Ohm for proper signal integrity.

Figure 2: USB circuit

To properly connect the module's USB interface to the external application, a USB 2.0 compatible connector and cable or hardware design is required. Furthermore, the USB modem driver distributed with PDS6 needs to be installed.

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1. The specification is ready for download on http://www.usb.org/developers/docs/

2.1.2 Serial Interface ASC0

PDS6 offers an 8-wire unbalanced, asynchronous modem interface ASC0 con-   forming to ITU-T V.24 protocol DCE signalling. The electrical characteristics do not comply with ITU-T V.28. The significant levels are 0V (for low data bit or active state) and 1.8V (for high data bit or inactive state).

PDS6 is designed for use as a DCE. Based on the conventions for DCE-DTE con-   nections it communicates with the customer application (DTE) using the following signals:
- Port TXD @ application sends data to the module's TXD0 signal line
- Port RXD @ application receives data from the module's RXD0 signal line
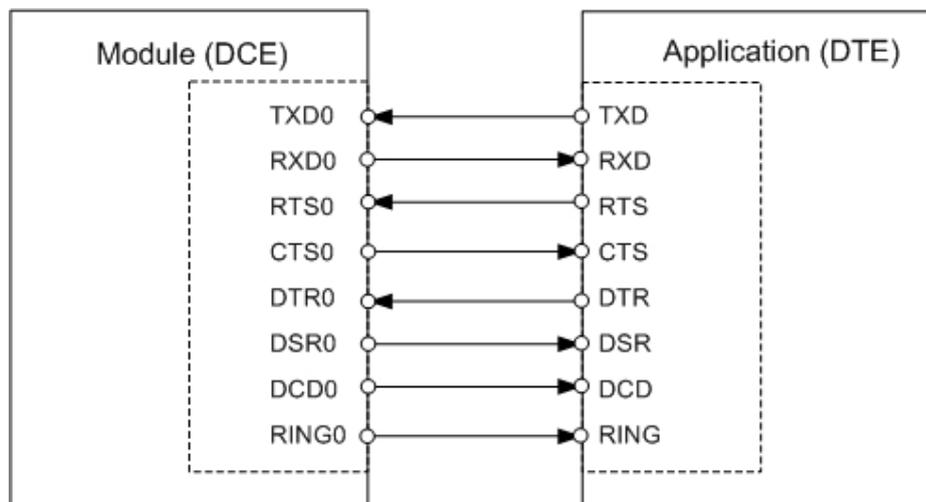
Figure 3: Serial interface ASC0

Features:
- Includes the data lines TXD0 and RXD0, the status lines RTS0 and CTS0 and, in addition, the modem control lines DTR0, DSR0, DCD0 and RING0.
- ASC0 is designed for controlling GSM/UMTS voice calls, transferring data and for controlling the module with AT commands.
- Full multiplexing capability allows the interface to be partitioned into virtual channels.
- The RING0 signal serves to indicate incoming calls and other types of URCs (Unsolicited Result Code). It can also be used to send pulses to the host application, for example to wake up the application from power saving state.
- By default configured to the setting 8 data bits, no parity and 1 stop bit.
- ASC0 can be operated at fixed bit rates from 1200bps up to 921600bps.
- Autobauding supports bit rates from 1200bps up to 230400bps.
- Supports RTS0/CTS0 hardware flow control. The hardware hand shake line RTS0 has an internal pull down resistor causing a low level signal, if the line is not used and open. Although hardware flow control is recommended, this allows communication by using only RXD and TXD lines.
- Wake up from SLEEP mode by RTS0 activation (high to low transition).

2.1.3   UICC/SIM/USIM Interface

PDS6 has an integrated UICC/SIM/USIM interface compatible with the 3GPP 31.102 and ETSI 102 221. This is wired to the host interface in order to be connected to an external SIM card holder. Five pads on the SMT application interface are reserved for the SIM interface.

The UICC/SIM/USIM interface supports 3V and 1.8V SIM cards.

The CCIN signal serves to detect whether a tray (with SIM card) is present in the card holder. Using the CCIN signal is mandatory for compliance with the GSM 11.11 recommendation if the mechanical design of the host application allows the user to remove the SIM card during operation. To take advantage of this feature, an appropriate SIM card detect switch is required on the card holder. For example, this is true for the model supplied by Molex, which has been tested to operate with PDS6 and is part of the Gemalto M2M reference equipment   submitted for type approval. See Section 7.1 for Molex ordering numbers.

Table 1: Signals of the SIM interface (SMT application interface)

Signal	Description
GND	Separate ground connection for SIM card to improve EMC.
CCCLK	Chipcard clock
CCVCC	SIM supply voltage.
CCIO	Serial data line, input and output.
CCRST	Chipcard reset
CCIN	Input on the baseband processor for detecting a SIM card tray in the holder. If the SIM is removed during operation the SIM interface is shut down immediately to prevent destruction of the SIM. The CCIN signal is by default low and will change to high level if a SIM card is inserted. The CCIN signal is mandatory for applications that allow the user to remove the SIM card during operation. The CCIN signal is solely intended for use with a SIM card. It must not be used for any other purposes. Failure to comply with this requirement may invalidate the type approval of PDS6.

Note: No guarantee can be given, nor any liability accepted, if loss of data is encountered after removing the SIM card during operation. Also, no guarantee can be given for properly initializing any SIM card that the user inserts after having removed the SIM card during operation. In this case, the application must restart PDS6.

The figure below shows a circuit to connect an external SIM card holder.
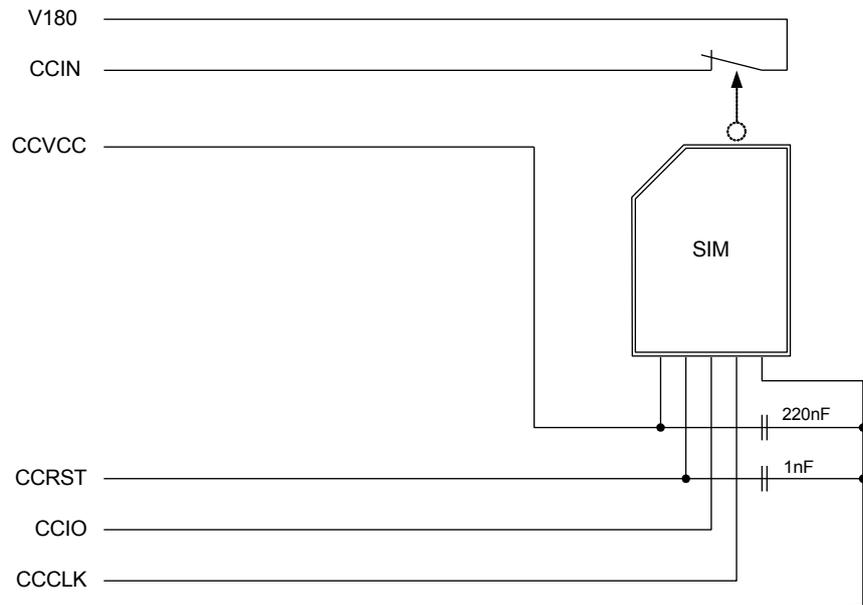
Figure 4: External UICC/SIM/USIM card holder circuit

The total cable length between the SMT application interface pads on PDS6 and the pads of the external SIM card holder must not exceed 100mm in order to meet the specifi- cations of 3GPP TS 51.010-1 and to satisfy the requirements of EMC compliance.

To avoid possible cross-talk from the CCCLK signal to the CCIO signal be careful that both lines are not placed closely next to each other. A useful approach is using a GND line to shield the CCIO line from the CCCLK line.

2.1.4 Analog Audio Interface

PDS6 has an analog audio interface with a balanced analog microphone input and a balanced analog earpiece output. A supply voltage and an analog ground connection are provided at dedicated pads.

2.1.5 Digital Audio Interface

PDS6's digital audio interface (DAI) can be used to connect audio devices capable of pulse code modulation (PCM).

2.1.6 GPIO Interface

PDS6 offers a GPIO interface with 8 GPIO lines. The GPIO lines are shared with other interfaces or functions: Fast shutdown (see Section 2.1.11.4), the PWM functionality (see Section 2.1.9), an pulse counter (see Section 2.1.10).

The following table shows the configuration variants for the GPIO pads. All variants are mutually exclusive, i.e. a pad configured for instance as fast shutdown line is locked for alternative usage as GPIO.

Table 2: GPIO lines and possible alternative assignment

GPIO	Fast Shutdown	PWM	Pulse Counter
GPIO2			
GPIO4	FST_SHDN		
GPIO5			
GPIO6		PWM2	
GPIO7		PWM1	
GPIO8			COUNTER
GPIO9			
GPIO10			

After startup, the above mentioned alternative GPIO line assignments can be configured using AT commands (see [1]). The configuration is non-volatile and available after module restart.

2.1.7 I²C Interface

I²C is a serial, 8-bit oriented data transfer bus for bit rates up to 400kbps in Fast mode. It consists of two lines, the serial data line I2CDAT and the serial clock line I2CCLK. The module acts as a single master device, e.g. the clock I2CCLK is driven by the module. I2CDAT is a bi-directional line. Each device connected to the bus is software addressable by a unique 7-bit address, and simple master/slave relationships exist at all times. The module operates as master-transmitter or as master-receiver. The customer application transmits or receives data only on request of the module.

The I²C interface can be powered via the V180 line of PDS6. If connected to the V180 line, the I²C interface will properly shut down when the module enters the Power Down mode.

Note: Good care should be taken when creating the PCB layout of the host application: The traces of I2CCLK and I2CDAT should be equal in length and as short as possible.

2.1.8 SPI Interface

The Serial Peripheral Interface (SPI) is a synchronous serial interface for control and data transfer between PDS6 and the external application. Only one application can be connected to the SPI and the interface supports only master mode. The transmission rates are up to 6.5Mbit/s. The SPI interface comprises the two data lines MOSI and MISO, the clock line SPI_CLK a well as the chip select line SPI_CS.

2.1.9 Analog-to-Digital Converter (ADC)

ADC1_IN is used for general purpose voltage measurements. ADC1_IN can be configured and read by AT command - see [1].

2.1.10 PWM Interfaces

The GPIO6 and GPIO7 interface lines can be configured as Pulse Width Modulation (PWM) interface lines PWM1 and PWM2. The PWM interface lines can be used, for example, to connect buzzers. The PWM1 line is shared with GPIO7 and the PWM2 line is shared with GPIO6 (for GPIOs see Section 2.1.5). GPIO and PWM functionality are mutually exclusive.

2.1.11 Pulse Counter

The GPIO8 line can be configured as pulse counter line COUNTER. The pulse counter interface can be used, for example, as a clock (for GPIOs see Section 2.1.5).

2.1.12 Control Signals

2.1.12.1 Network Connectivity

The STATUS line serves to indicate the module's network connectivity state and can be used to control an externally connected LED.

2.1.12.2 Power Indication Signal

The power indication signal PWR_IND notifies the on/off state of the module. High state of PWR_IND indicates that the module is switched off.

2.1.12.3 Host Wakeup

If no call, data or message transfer is in progress, the host may shut down its own USB interface to save power. If a call or other request (URC's, messages) arrives, the host can be notified of these events and be woken up again by a state transition of either the RING0 or the GPIO4 line configured as H_WAKEUP line.

2.1.12.4 Fast Shutdown

The GPIO4 interface line can be configured as fast shutdown signal line FST_SHDN. The configured FST_SHDN line is an active low control signal and must be applied for at least TBD. milliseconds. If unused this line can be left open because of a configured internal pull-up resistor.

2.2 RF Antenna Interface

The RF interface has an impedance of 50Ω. PDS6 is capable of sustaining a total   mismatch at the antenna line without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, modulation accuracy and harmonic suppression. Antenna matching networks are not included on the PDS6 module and should be placed in the host application if the antenna does not have an impedance of 50Ω.

Regarding the return loss PDS6 provides the following values in the active band:

Table 3: Return loss in the active band

State of module	Return loss of module	Recommended return loss of application
Receive	> 8dB	> 12dB
Transmit	not applicable	> 12dB

2.2.1 Antenna Installation

The antenna is connected by soldering the antenna pad (ANT_GSM) and their neighboring ground pads directly to the application's PCB.

The distance between the antenna pads and their neighboring GND pads has been optimized for best possible impedance. To prevent mismatch, special attention should be paid to these pads on the application' PCB.

The wiring of the antenna connection, starting from the antenna pad to the application's antenna should result in a 50Ω line impedance. Line width and distance to the GND plane need to be optimized with regard to the PCB's layer stack.

To prevent receiver desensitization due to interferences generated by fast transients like high speed clocks on the external application PCB, it is recommended to realize the antenna connection line using embedded Stripline rather than Micro-Stripline technology.

For type approval purposes, the use of a 50Ω coaxial antenna connector (U.FL-R-SMT) might be necessary. In this case the U.FL-R-SMT connector should be placed as close as possible to PDS6's antenna pad.

3 Operating Characteristics

3.1 Operating Modes

The table below briefly summarizes the various operating modes referred to throughout the document.

Table 4: Overview of operating modes

Mode	Function	
Normal operation	GSM / GPRS / UMTS / HSPA SLEEP	No call is in progress and the USB connection is suspended by host (or is not present) and no active communication via ASC0.
	GSM / GPRS / UMTS / HSPA IDLE	No call is in progress and the USB connection is not suspended by host (or is not present) and no active communication via ASC0.
	GSM TALK/ GSM DATA	Connection between two subscribers is in progress. Power consumption depends on the GSM network coverage and several connection settings (e.g. DTX off/on, FR/EFR/HR, hopping sequences and antenna connection). The following applies when power is to be measured in TALK_GSM mode: DTX off, FR and no frequency hopping.
	GPRS DATA	GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and GPRS configuration (e.g. used multislot settings).
	EGPRS DATA	EGPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and EGPRS configuration (e.g. used multislot settings).
	UMTS TALK/ UMTS DATA	UMTS data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
	HSPA DATA	HSPA data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
Power Down	Normal shutdown after sending the power down command. Only a voltage regulator is active for powering the RTC. Software is not active. Interfaces are not accessible. Operating voltage (connected to BATT+) remains applied.	
Airplane mode	Airplane mode shuts down the radio part of the module, causes the module to log off from the GSM/GPRS network and disables all AT commands whose execution requires a radio connection. Airplane mode can be controlled by AT command (see [1]).	

3.2   Power Supply

PDS6 needs to be connected to a power supply at the SMT application interface
- 6 lines BATT+, and GND. There are two separate voltage domains for BATT+:
- BATT+$_{BB}$ with a line for the general power management.
- BATT+$_{RF}$ with a line for the GSM power amplifier supply.

Please note that throughout the document BATT+ refers to both voltage domains and power supply lines - BATT+$_{BB}$ and BATT+$_{RF}$.

The power supply of PDS6 has to be a single voltage source at BATT+. It must be able to provide the peak current during the uplink transmission.

All the key functions for supplying power to the device are handled by the power management section of the analog controller. This IC provides the following features:

- Stabilizes the supply voltages for the baseband using low drop linear voltage regulators and a DC-DC step down switching regulator.
- Switches the module's power voltages for the power-up and -down procedures.
- SIM switch to provide SIM power supply.

4   Mechanical Dimensions, Mounting and Packaging

4.1   Mechanical Dimensions of PDS6

Figure 5 shows a 3D view[1] of PDS6 and provides an overview of the board's me- chanical dimensions. For further details see Figure 6.

Length: 33mm
Width: 29mm
Height: 2mm
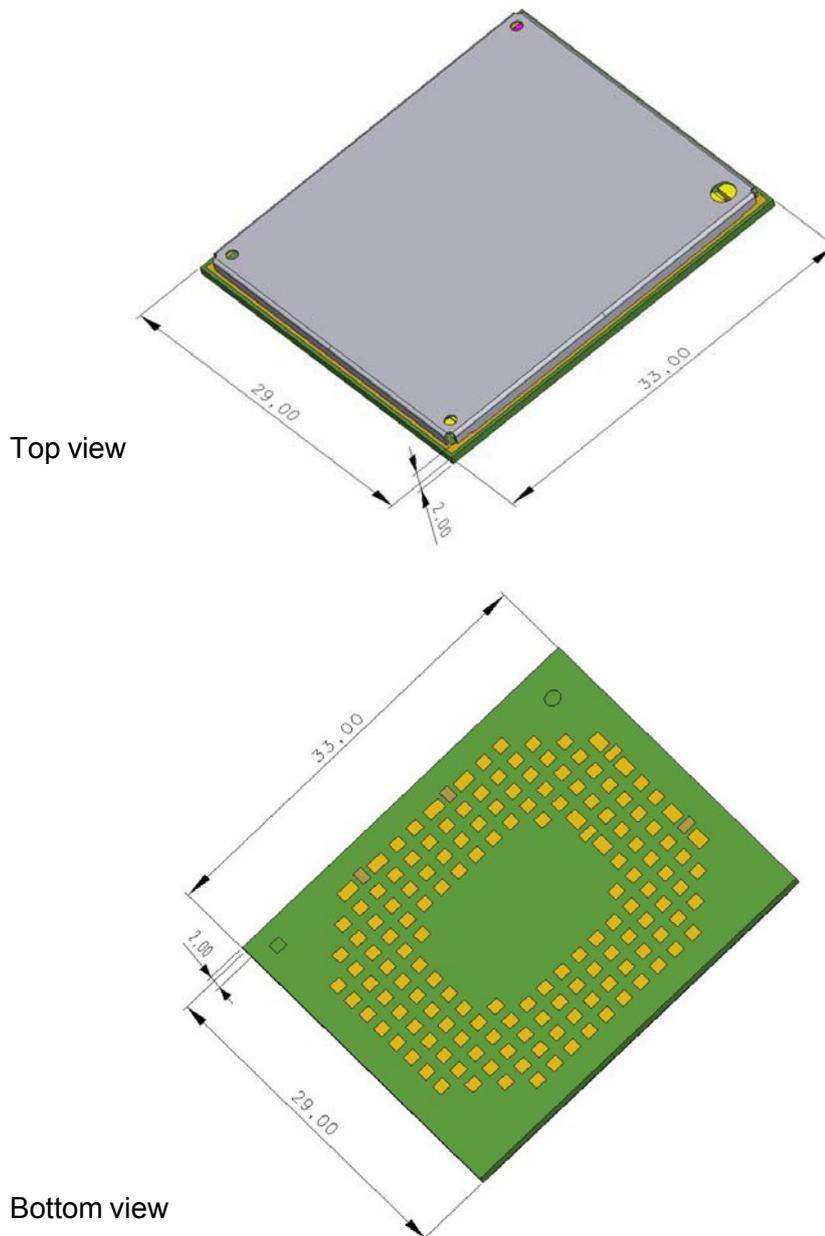
Figure 5: PDS6 – top and bottom view

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1. The coloring of the 3D view does not reflect the module's real color.

4.1 Mechanical Dimensions of PDS6

Figure 6: Dimensions of PDS6 (all dimensions in mm)

5 Regulatory and Type Approval Information

5.1 Directives and Standards

PDS6 is designed to comply with the directives and standards listed below.

It is the responsibility of the application manufacturer to ensure compliance of the final product with all provisions of the applicable directives and standards as well as with the technical specifications provided in the "PDS6 Hardware Interface Description".[1]

Table 5: Directives

1999/05/EC	Directive of the European Parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (in short referred to as R&TTE Directive 1999/5/EC). The product is labeled with the CE conformity mark is CE1588.
2002/95/EC (RoHS 1) 2011/65/EC (RoHS 2)	Directive of the European Parliament and of the Council of 27 January 2003 (and revised on 8 June 2011) on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

Table 6: Standards of North American type approval[1]

CFR Title 47	Code of Federal Regulations, Part 22 and Part 24 (Telecommunications, PCS); US Equipment Authorization FCC
OET Bulletin 65 (Edition 97-01)	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
UL 60 950-1	Product Safety Certification (Safety requirements)
NAPRD.03 V5.15	Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control PCS Type Certification Review board (PTCRB)
RSS132 (Issue2) RSS133 (Issue5)	Canadian Standard

1. Applies to the module variant PDS6 only.

Table 7: Standards of European type approval[1]

3GPP TS 51.010-1	Digital cellular telecommunications system (Release 7); Mobile Station (MS) conformance specification;
ETSI EN 301 511 V9.0.2	Global System for Mobile communications (GSM); Harmonized standard for mobile stations in the GSM 900 and DCS 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC)
GCF-CC V3.49	Global Certification Forum - Certification Criteria

1. Manufacturers of applications which can be used in the US shall ensure that their applications have a PTCRB approval. For this purpose they can refer to the PTCRB approval of the respective module.

Table 7: Standards of European type approval[1]

ETSI EN 301 489-01 V1.9.2	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements
ETSI EN 301 489-07 V1.3.1	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
ETSI EN 301 489-24 V1.5.1	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
ETSI EN 301 908-01 V5.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 1: Harmonized EN for IMT-2000, introduction and common requirements of article 3.2 of the R&TTE Directive
ETSI EN 301 908-02 V5.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
EN 62311:2008	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)
EN 60950-1:2006+ A12:2011+A11:2009+ A1:2010 IEC 60950-1:2005/ A1:2009 (second edition)	Safety of information technology equipment

1. Applies to the module variant PDS6 only.

Table 8: Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes

Table 9: Standards of the Ministry of Information Industry of the People's Republic of China

SJ/T 11363-2006	"Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products" (2006-06).
SJ/T 11364-2006	"Marking for Control of Pollution Caused by Electronic Information Products" (2006-06). According to the "Chinese Administration on the Control of Pollution caused by Electronic Information Products" (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Gemalto M2M Hardware Interface Description. Please see Table 10 for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.

Table 10: Toxic or hazardous substances or elements with defined concentration limits

部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	O	O	O	O	O	O
电路模块 (Circuit Modules)	X	O	O	O	O	O
电缆及电缆组件 (Cables and Cable Assemblies)	O	O	O	O	O	O
塑料和聚合物部件 (Plastic and Polymeric parts)	O	O	O	O	O	O

O:

表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。

Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:

表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。

Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

5.2   SAR requirements specific to portable mobiles

Mobile phones, PDAs or other portable transmitters and receivers incorporating a GSM module must be in accordance with the guidelines for human exposure to radio frequency energy. This requires the Specific Absorption Rate (SAR) of portable PDS6 based applications to be evaluated and approved for compliance with national and/or international regulations.

Since the SAR value varies significantly with the individual product design manufacturers are advised to submit their product for approval if designed for portable use. For European and US markets the relevant directives are mentioned below. It is the responsibility of the manufacturer of the final product to verify whether or not further standards, recommendations or directives are in force outside these areas.

Products intended for sale on US markets[1]

ES 59005/ANSI C95.1 Considerations for evaluation of human exposure to Electromagnetic Fields (EMFs) from Mobile Telecommunication Equipment (MTE) in the frequency range 30MHz - 6GHz

Products intended for sale on European markets

EN 50360   Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz - 3GHz)

Please note that SAR requirements are specific only for portable devices and not for mobile devices as defined below:

• Portable device:
  A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.
• Mobile device:
  A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location.

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1. Applies for the quad band module variant PDS6 only.

5.3   Reference Equipment for Type Approval

The Gemalto M2M reference setup submitted to type approve PDS6 (including a special approval adapter for the DSB75) is shown in the following figure[1]:
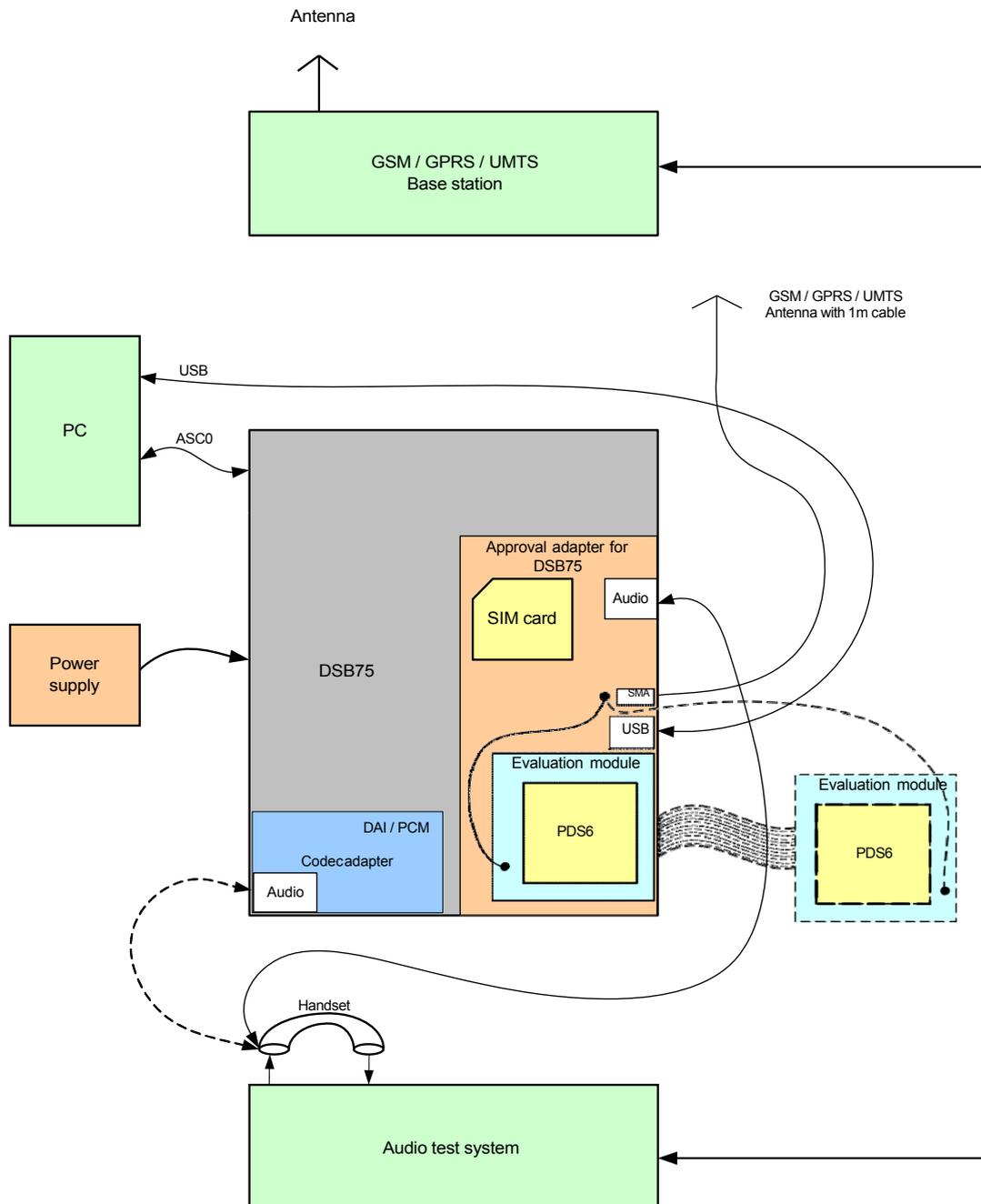
Figure 7: Reference equipment for Type Approval

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1. For RF performance tests a mini-SMT/U.FL to SMA adapter with attached 6dB coaxial attenuator is chosen to connect the evaluation module directly to the GSM/UMTS test equipment instead of employing the SMA antenna connectors on the PDS6-DSB75 adapter as shown in Figure 7. The following products are recommended:
    Hirose SMA-Jack/U.FL-Plug conversion adapter HRMJ-U.FLP(40)
    (for details see see http://www.hirose-connectors.com/ or http://www.farnell.com/
    Aeroflex Weinschel Fixed Coaxial Attenuator Model 3T/4T
    (for details see http://www.aeroflex.com/ams/weinschel/pdfiles/wmod3&4T.pdf)

5.4   Compliance with FCC and IC Rules and Regulations

The Equipment Authorization Certification for the Gemalto M2M reference application described in Section 5.3 will be registered under the following identifiers[1]:

> *FCC Identifier: QIPPDS6*
> *Industry Canada Certification Number: 7830A-PDS6*
> *Granted to Gemalto M2M GmbH*

Manufacturers of mobile or fixed devices incorporating PDS6 modules are authorized to use the FCC Grants and Industry Canada Certificates of the PDS6 modules for their own final products according to the conditions referenced in these documents. In this case, an FCC/ IC label of the module shall be visible from the outside, or the host device shall bear a second label stating "Contains FCC ID QIPPDS6", and accordingly "Contains IC 7830A-PDS6". The integration is limited to fixed or mobile categorised host devices, where a separation distance between the antenna and any person of min. 20cm can be assured during normal operating conditions. For mobile and fixed operation configurations the antenna gain, including cable loss, must not exceed the limits 2.15 dBi (850 MHz) and 2.15 dBi (1900 MHz).

IMPORTANT:
Manufacturers of portable applications incorporating PDS6 modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles (see Section 5.2 for detail).

FCC Regulations

WARNING:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two con ditions: (1) This device may not cause harmful interference, and (2) this device must accept any i nterference received, including interference that may cause undesired operation.
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

IC Regulations

IC Notice This device complies with Industry Canada license ‑
exempt RSS standard(s). Operation is subject to the following two conditions:
 1) this device may not cause interference, and
 2) this device must accept any interference, including interference that may cause undesired op
eration of the device.

 Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio e
xempts de licence.
 L'exploitation est autorisée aux deux conditions suivantes:
  (1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillag
e est susceptible d'en

This Class B digital apparatus complies with Canadian ICES ‑ 003.
Cet appareil numérique de la classe B est conforme à la norme NMB ‑ 003 du Canada.

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1. Applies only for the quad band module variant PDS6.

6   Document Information

6.1   Revision History

New document: "Cinterion® PDS6 Hardware Interface Overview" Version 01.000

Chapter	What is new
--	Initial document setup.

6.2   Related Documents

[1]   PDS6 AT Command Set [2]   PDS6
Release Note
[3]   Application Note 48: SMT Module Integration
[4]   Universal Serial Bus Specification Revision 2.0, April 27, 2000

6.3   Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-digital converter
AGC	Automatic Gain Control
ANSI	American National Standards Institute
ARFCN	Absolute Radio Frequency Channel Number
ARP	Antenna Reference Point
ASC0/ASC1	Asynchronous Controller. Abbreviations used for first and second serial interface of PDS6
B	Thermistor Constant
BER	Bit Error Rate
BTS	Base Transceiver Station
CB or CBM	Cell Broadcast Message
CE	Conformité Européene (European Conformity)
CHAP	Challenge Handshake Authentication Protocol
CPU	Central Processing Unit
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DAI	Digital Audio Interface

Abbreviation	Description
dBm0	Digital level, 3.14dBm0 corresponds to full scale, see ITU G.711, A-law
DCE	Data Communication Equipment (typically modems, e.g. Gemalto M2M module)
DCS 1800	Digital Cellular System, also referred to as PCN
DRX	Discontinuous Reception
DSB	Development Support Box
DSP	Digital Signal Processor
DSR	Data Set Ready
DTE	Data Terminal Equipment (typically computer, terminal, printer or, for example, GSM application)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EIRP	Equivalent Isotropic Radiated Power
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HR	Half Rate
I/O	Input/Output
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
LED	Light Emitting Diode
Li-Ion/Li+	Lithium-Ion
Li battery	Rechargeable Lithium Ion or Lithium Polymer battery
Mbps	Mbits per second
MMI	Man Machine Interface

Abbreviation	Description
MO	Mobile Originated
MS	Mobile Station (GSM module), also referred to as TE
MSISDN	Mobile Station International ISDN number
MT	Mobile Terminated
NTC	Negative Temperature Coefficient
OEM	Original Equipment Manufacturer
PA	Power Amplifier
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCM	Pulse Code Modulation
PCN	Personal Communications Network, also referred to as DCS 1800
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PLL	Phase Locked Loop
PPP	Point-to-point protocol
PSK	Phase Shift Keying
PSU	Power Supply Unit
PWM	Pulse Width Modulation
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory
RF	Radio Frequency
RLS	Radio Link Stability
RMS	Root Mean Square (value)
RoHS	Restriction of the use of certain hazardous substances in electrical and electronic equipment.
ROM	Read-only Memory
RTC	Real Time Clock
RTS	Request to Send
Rx	Receive Direction
SAR	Specific Absorption Rate
SAW	Surface Accoustic Wave
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SMD	Surface Mount Device
SMS	Short Message Service
SMT	Surface Mount Technology

Abbreviation	Description
SRAM	Static Random Access Memory
TA	Terminal adapter (e.g. GSM module)
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TLS	Transport Layer Security
Tx	Transmit Direction
UART	Universal asynchronous receiver-transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio

6.4   Safety Precaution Notes

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating PDS6. Manufac- turers of the cellular terminal are advised to convey the following safety information to users   and operating personnel and to incorporate these guidelines into all manuals supplied with the   product. Failure to comply with these precautions violates safety standards of design, manu- facture and intended use of the product. Gemalto M2M assumes no liability for customer's fail- ure to comply with these precautions.

♥	When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guide-lines posted in sensitive areas. Medical equipment may be sensitive to RF energy. The operation of cardiac pacemakers, other implanted medical equipment and hear-ing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufac-turer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.
✈	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it can-not be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.
🔥	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any elec-trical equipment in potentially explosive atmospheres can constitute a safety hazard.
📺	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.
🚗	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driv-ing a vehicle, unless it is securely mounted in a holder for speakerphone operation. Before making a call with a hand-held terminal or mobile, park the vehicle. Speakerphones must be installed by qualified personnel. Faulty installation or opera-tion can constitute a safety hazard.
SOS	IMPORTANT! Cellular terminals or mobiles operate using radio signals and cellular networks. Because of this, connection cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential com-munications, for example emergency calls. Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call. Some networks require that a valid SIM card be properly inserted in the cellular termi-nal or mobile.

7 Appendix

7.1 List of Parts and Accessories

Table 11: List of parts and accessories

Description	Supplier	Ordering information
PDS6	Gemalto M2M	Standard module Gemalto M2M IMEI: Packaging unit (ordering) number: L30960-N3810-A100 (PDS6) Module label number: S30960-S3810-A100-1 (PDS6) Customer IMEI mode: Packaging unit (ordering) number: L30960-N3815-A100 (PDS6) Module label number: S30960-S3815-A100-1 (PDS6)
DSB75 Evaluation Kit	Gemalto M2M	Ordering number: L36880-N8811-A100
Multi-Adapter R1 for mounting PDS6 evalu- ation modules onto DSB75	Gemalto M2M	Ordering number: L30960-N0010-A100
Approval adapter for mounting PDS6 evalu- ation modules onto DSB75	Gemalto M2M	Ordering number: L30960-N2301-A100
Evaluation Module	Gemalto M2M	Ordering number: L30960-N3811-A100 (PDS6)
Votronic Handset	VOTRONIC / Gemalto M2M	Gemalto M2M ordering number: L36880-N8301-A107 Votronic ordering number: HH-SI-30.3/V1.1/0 VOTRONIC Entwicklungs- und Produktionsgesellschaft für elektronische Geräte mbH Saarbrücker Str. 8 66386 St. Ingbert Germany Phone: +49-(0)6 89 4 / 92 55-0 Fax: +49-(0)6 89 4 / 92 55-88 Email: contact@votronic.com
SIM card holder incl. push button ejector and slide-in tray	Molex	Ordering numbers: 91228 91236 Sales contacts are listed in Table 12.

Table 12: Molex sales contacts (subject to change)

Molex For further information please click: http://www.molex.com	Molex Deutschland GmbH Otto-Hahn-Str. 1b 69190 Walldorf Germany Phone: +49-6227-3091-0 Fax: +49-6227-3091-8100 Email: mxgermany@molex.com	American Headquarters Lisle, Illinois 60532 U.S.A. Phone: +1-800-78MOLEX Fax: +1-630-969-1352
Molex China Distributors Beijing, Room 1311, Tower B, COFCO Plaza No. 8, Jian Guo Men Nei Street, 100005 Beijing P.R. China Phone: +86-10-6526-9628 Fax: +86-10-6526-9730	Molex Singapore Pte. Ltd. 110, International Road Jurong Town, Singapore 629174 Phone: +65-6-268-6868 Fax: +65-6-265-6044	Molex Japan Co. Ltd. 1-5-4 Fukami-Higashi, Yamato-City, Kanagawa, 242-8585 Japan Phone: +81-46-265-2325 Fax: +81-46-265-2365

About Gemalto

Gemalto (Euronext NL0000400653 GTO) is the world leader in digital security with 2011 annual revenues of €2 billion and more than 10,000 employees operating out of 74 offices and 14 Research & Development centers, located in 43 countries.

We are at the heart of the rapidly evolving digital society. Billions of people worldwide increasingly want the freedom to communicate, travel, shop, bank, entertain and work - anytime, everywhere - in ways that are enjoyable and safe. Gemalto delivers on their expanding needs for personal mobile services, payment security, authenticated cloud access, identity and privacy protection, eHealthcare and eGovernment efficiency, convenient ticketing and dependable machine-to-machine (M2M) applications.

Gemalto develops secure embedded software and secure products which we design and personalize. Our platforms and services manage these secure products, the confidential data they contain and the trusted end-user services they enable. Our innovations enable our clients to offer trusted and convenient digital services to billions of individuals.

Gemalto thrives with the growing number of people using its solutions to interact with the digital and wireless world.

For more information please visit
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