Roadstar v2 datasheet

rev1.1

powered by CINTERION WIRELESS MODULES

Contents

Document history

Preceding document: **"Roadstar v2 datasheet rev01.0"**
New document: **" Roadstar v2 datasheet rev01.1"**

Chapter	What is new
---	Added new pictures, electrical and mechanical characteristics

1. Introduction

This document describes the hardware of HCP Roadstar v2, with interface specifications, electrical and mechanical characteristics.

Roadstar v2 is intended to use as track and trace device for locating of vehicles, tracks etc.

1.1 Related documents

[1] TC65i AT command set
[2] TC65i Hardware interface description
[3] Quectel L10_HD_v1.01
[4] Quectel L10_GPS_Protocol_v1.01
[5] "Programmer To Programmer instruction V3.2" HCP
[6] JAVA UsersGuide v19 - cinterion

1.2 Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
ATC	AT Cellular
BTS	Base Transceiver Station
CB	Cell Broadcast
CODEC	Coder-Decoder
CPU	Central Processing Unit
DCE	Data Circuit terminating Equipment
DSP	Digital Signal Processor
DSR	Data Set Ready
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FDMA	Frequency Division Multiple Access
FR	Full rate
G.C.F.	GSM Conformity Forum
GSM	Global Standard for Mobile Communication
HF	Hands-free
HR	Half rate
HW	Hardware
IC	Integrated Circuit
IF	Intermediate Frequency
IMEI	International Mobile Equipment Identifier
I/O	Input/ Output
IGT	Ignition
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
Li-Ion	Lithium-Ion
LVD	Low voltage Directive
Mbps	Mbits per second
MMI	Machine Machine Interface
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NC	Not Connected
NTC	Negative Temperature Coefficient
PA	Power Amplifier
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCS	Personal Communication System

Abbreviation	Description
PDU	Protocol Data Unit
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory
RF	Radio frequency
RI	Ring Indication
ROM	Read Only Memory
RX	Receive direction
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
SW	Software
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TX	Transmit direction
UART	Universal Asynchronous Receiver and Transmitter
VAD	Voice Activity Detection
ZIF	Zero Insertion Force

Table 1. Terms and Abbreviations

1.3 Safety Precautions

Safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal from HCP d.o.o.

Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. HCP d.o.o assumes no liability for customer's failure to comply with these precautions.

	When in hospitals or other health care facilities, observe the restrictions on the use of mobiles. Switch off the cellular terminal or mobile if to be instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy. The operation of cardiac pacemakers, other implanted medical equipment and hearing 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 manufacturer 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. This personal subgroup always should check the distance to the mobile
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot 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. Check the local and actual laws about these themes.
	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 electrical 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 while driving 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 operation can constitute a safety hazard. Check the actual and local laws about these themes.
 	**IMPORTANT!** Cellular terminals or mobiles operate using radio signals and cellular networks. In that case connections cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls. Remember, in order to make calls or receive calls the cellular terminal or mobile must be switched on 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 a valid SIM card to be properly inserted in the cellular terminal or mobile.
	If a power supply unit is used to supply the device it must meet the demands placed on SELV circuits in accordance with EN60950. The maximum permissible connection length between the device and the supply source should not exceed 3m.
	According to the guidelines for human exposure to radio frequency energy, an antenna connected to the FME jack of the device should be placed at least 20cm away from human bodies.

2. Product Concept

2.1 Key Features of TC65i GSM/GPRS module

Feature	Implementation
General	
Incorporates Cinterion TC65i module	The TC65i module handles all processing of data within the Roadstar v2 device.
Frequency bands	Quad band: GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900
Power supply	Single supply voltage 8V to 30V DC
Ambient operating temperature according to IEC 60068-2	Normal operation: -30°C to +70°C Restricted operation: -30°C to -40°C, +70°C to +75°C
Housing color	RED
RoHS	All hardware components fully compliant with EU RoHS Directive
GSM/GPRS features	
Data transfer	GPRS: - Multislot Class 12 - Full PBCCH support - Mobile Station Class B - Coding Scheme 1 – 4 CSD: - V.110, RLP, non-transparent - 2.4, 4.8, 9.6, 14.4kbps - USSD PPP-stack for GPRS data transfer
SMS	- Point-to-point MT and MO - Cell broadcast - Text and PDU mode - Storage: SIM card plus 25 SMS locations in mobile equipment - Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 1

Feature	Implementation
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion
Java platform	Java Virtual Machine with APIs for amongst others AT Parser, Serial Interface, FlashFileSystem and TCP/IP Stack. **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 applica-tions. The memory space available for Java programs is around 1.7 MB in the flash file system and around 400k RA M. Application code and data share the space in the flash file system and in RAM.
SIM Application Toolkit	SAT Release 99
TCP/IP stack	Access by AT commands
Remote SIM Access	TC65i supports Remote SIM Access. RSA enables TC65i to use a remote SIM card via its serial interface and an external application, in addition to the SIM card locally attached to the dedicated lines of the application interface. The connection between the external application and the remote SIM card can be a Bluetooth wireless link or a serial link. The necessary protocols and procedures are implemented according to the “SIM Access Profile Interoperability Specification of the Bluetooth Special Interest Group”.
Firmware update	Generic update from host application over serial interface.
Watchdog	Integrated hardware watchdog circuit on board.
Interfaces	
Serial interface	RS232 interface over mini USB b type connector
SIM interface	Supported SIM cards: 3V, 1.8V
GSM Antenna	SMA antenna connector
GPS Antenna	SMA antenna connector
Status LED	LED for signalizing device status
10-pin micro-fin connector	Power supply and GPIO pins

Table 2. Key feature of GSM/GPRS TC65i module

2.2 Key Features of Quectel L10

Feature	Implementation
Receiver Type	- GPS L1 1575.42MHz C/A Code - 66 search channels, 22 simultaneous tracking channels
Sensitivity	- Cold Start (Autonomous) -147dBm - Reacquisition -160dBm - Hot start -160dBm - Tracking -165dBm
Time-To-First-Fix	- Cold Start (Autonomous) -147dBm - Warm Start (Autonomous) 35s average - Hot Start (Autonomous) <1.2s - EPO, BEE 5~10s - SUPL 5~10s
Position Accuracy	- Without Aid 3.0 m 2D-RMS - DGPS 2.5 m
Max Update Rate	- 5Hz
Accuracy of 1PPS Signal	- Typical accuracy 61 ns - Time pulse adjustable from 1ms to 999ms, default 100ms
Velocity Accuracy	- Without Aid 0.1 m/s - DGPS 0.05m/s
Acceleration Accuracy	- Without Aid 0.1 m/s² - DGPS 0.05m/s²
Dynamic Performance	- Maximum Altitude 18,000 m - Maximum Velocity 515m/s - Acceleration 4G

Table 3. Key feature of GPS Quectel L10 module

3. Interface Description

3.1 Overview

Roadstar v2 provides following connectors for power supply, GPIO pins and antenna interface.

- Mini USB B type connector for RS232 interface
- Molex micro-fit 10-pin connector for power supply and GPIO pins
- SMA antenna connector for GSM
- SMA antenna connector for GPS
- Status LED

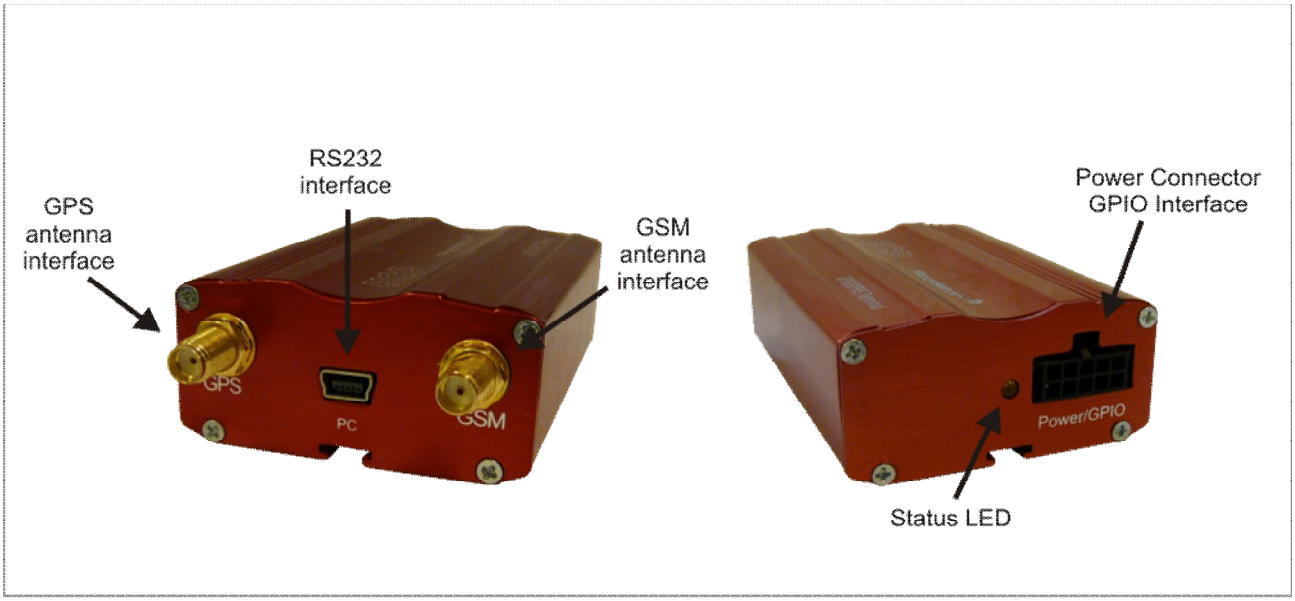


Figure 1. Front and rear view of Roadstar v2

3.2 Block Diagram

Figure 2. shows block diagram of Roadstar v2 where you can see some basic examples of connection with vehicle.

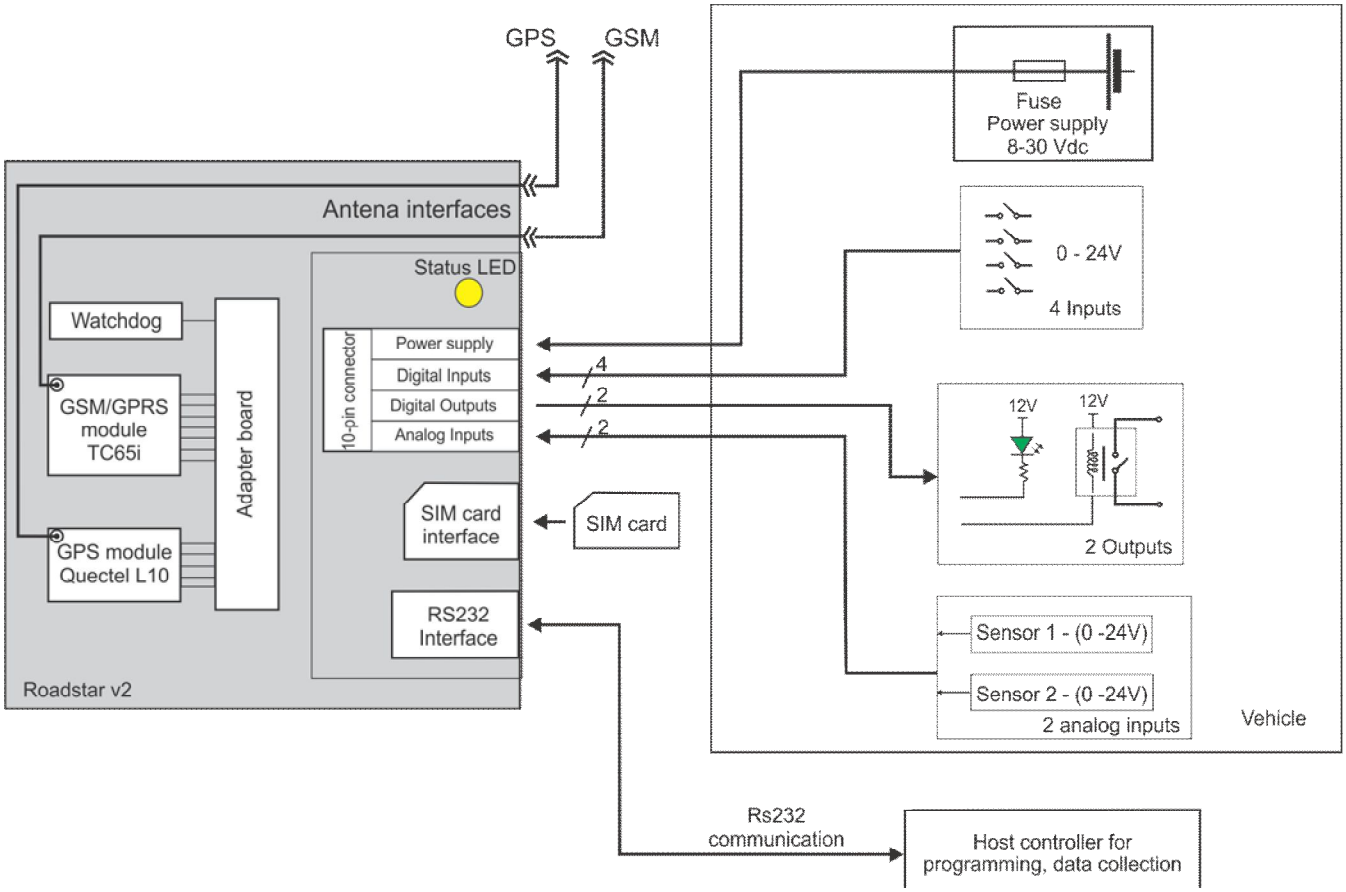


Figure 2. Block diagram of Roadstar v2

3.3 Roadstar v2 Circuit block diagram

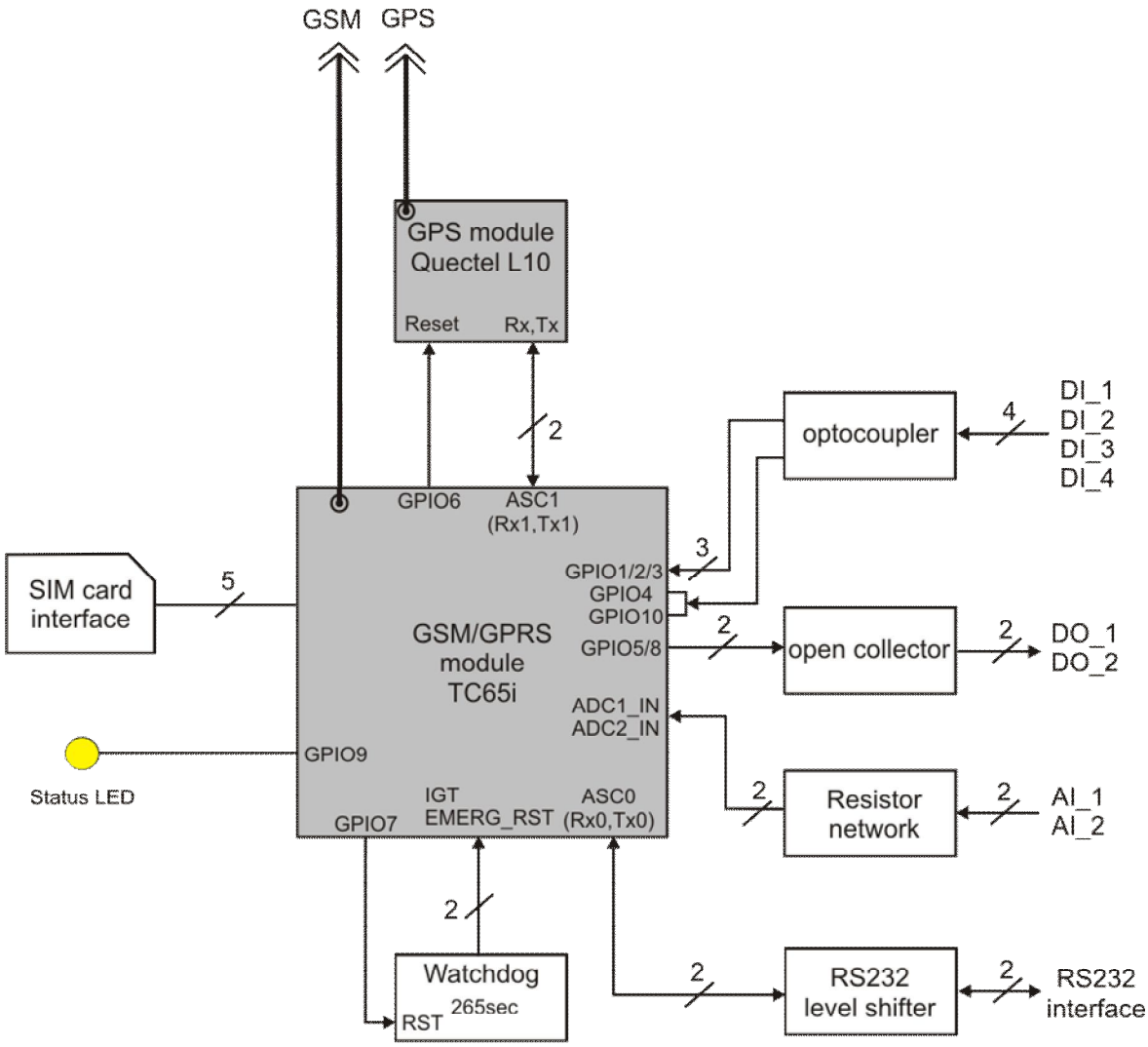


Figure 3. Circuit Block diagram of Roadstar v2

Figure3. shows internal connections between GMS modul and GPS module along with inputs/outputs and watchdog timer.

Table bellow shows internal connections of Roadstar v2, between Power/GPIO connector, GSM module and GPS module.

TC65i	Power/GPIO connector	Parameters
ASC0 – Rx0,Tx0	---	Communication with external device
ASC1 – Rx1,Tx1	---	Communication between GSM and GPS module
GPIO1	DI_1	Digital input 1
GPIO2	DI_2	Digital input 2
GPIO3	DI_3	Digital input 3
GPIO4/GPIO10*	DI_4	Digital input 4 (pulse counter)
GPIO5	DO_1	Digital output 1
GPIO6	--	Reset GPS modem
GPIO7	--	Reset watchdog timer
GPIO8	DO_2	Digital output 2
GPIO9	--	Status LED

Table 4. Internal connections

*GPIO4 and GPIO10 of GSM module are internally connected. Basically input on DI_4 will go to both GPIO pins GPIO4 and GPIO10. Advantage of GIO10 is that you can configure it as pulse counter for pulse rates from 0 to 1000 pulses per second.

For more information about GPIO pins of GSM module TC65i and how to configure them from please refer to [1] and [2].

3.4 Watchdog

Roadstar v2 has a hardware watchdog circuit on board. Watchdog resets GSM module inside Roadstar v2 every 200 seconds as a protection in case that software in GSM module get stack.

To reset watchdog timer, sotware in GSM module has to give logic “1” (positive impuls) on its GPIO7 pin for at least 200ms every 200 seconds.
Best way is to give logic “1” on GPIO7 every 2 minutes (120seconds).

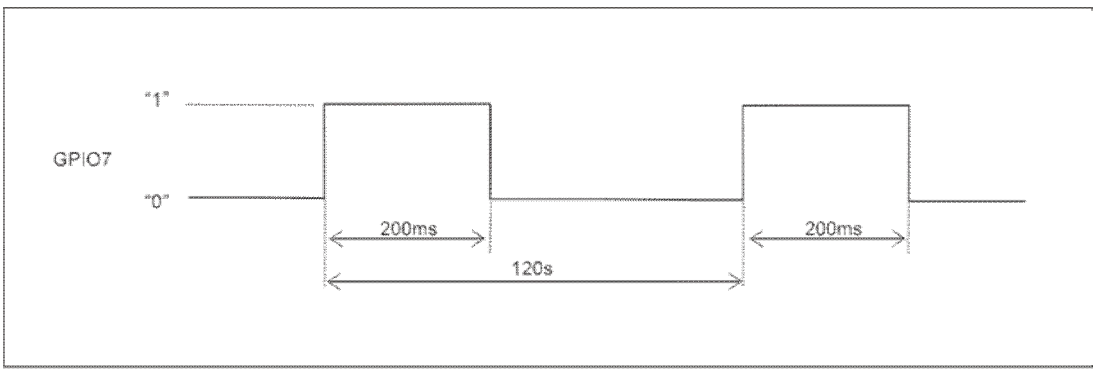


Figure 4. GSM module GPIO7 reset impuls for watchdog timer

3.5 Operating Modes of GSM module inside Roadstar v2

The table below briefly summarizes the various operating modes referred to in the following sections.

Mode	Function	
Normal operation	GSM/GPRS SLEEP	Various power save modes set with AT+CFUN command. Software is active to minimum extent. If the module was registered to the GSM network in IDLE mode, it is registered and paging with the BTS in SLEEP mode, too. Power saving can be chosen at different levels: The NON-CYCLIC SLEEP mode (AT+CFUN=0) disables the AT interface. The CYCLIC SLEEP modes AT+CFUN=7 and 9 alternatingly activate and deactivate the AT interfaces to allow permanent access to all AT commands.
	GSM IDLE	Software is active. Once registered to the GSM network, paging with BTS is carried out. The module is ready to send and receive.
	GSM TALK	Connection between two subscribers is in progress. Power consumption depends on network coverage individual settings, such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.
	GPRS IDLE	Module is ready for GPRS data transfer, but no data is currently sent or received. Power consumption depends on network settings and GPRS configuration (e.g. multislot settings).
	GPRS DATA	GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / down-link data rates and GPRS configuration (e.g. used multislot settings).
POWER DOWN	Normal shutdown after sending the AT^SMSO	

Table 5. Operating modes of Roadstar v2

3.6 Power Supply and GPIO pins

The power supply of the Roadstar v2 has to be a single voltage source of 8V to 30V capable of providing a peak current (pulsed 2x577ms at T=4.615ms) of about 1.2A at 12V during an active transmission.

The uplink burst causes strong ripple (drop) on the power lines. The drop voltage should not exceed 1V, but the absolute minimum voltage during drops must be >7.6V.
The Roadstar v2 is protected from supply voltage reversal.

Figure 5. Power supply connector

Pin	Singal name	Use	Parameters
1	Vcc	Possitive power supply	8V – 30V DC
2	DI_2	Digital input 2	0V – 24V DC
3	DI_1	Digital input 1	0V – 24V DC
4	DI_4 and A impulsator	Digital input 4	0V – 24V DC
5	GND	Ground	0V
6	DI_3	Digital input 3	0V – 24V DC
7	DO_1	Digital output 1	200mA
8	DO_2	Digital output 2	200mA
9	AI_1	Analog input 1	0V – 24V DC
A	AI_2	Analog input 2	0V – 24V DC

Table 6. Power supply connector pins

About parameters of digital input/output voltage/current capability look at the chapters about input/output channel characteristics.

3.6.1 Turn Roadstar v2 GSM module on

Roadstar v2 GMS module switches on automaticly when power supply is attached. After start-up, the GSM module enters the net searching state.

After startup of the GSM module the RS232 lines are in an undefined state for approx. 900ms. This may cause undefined characters to be transmitted over the RS232 lines during this period.

3.6.2 Reset Roadstar v2 GSM modul

One way to reset Roadstar v2 GSM module is entering AT command AT+CFUN=x,1. For details on AT+CFUN please see [1], [2].

Other ways for restarting Roadstar v2 GSM module is:

- automatically by integrated watchdog timer on every 265seconds.

3.6.3 Turn off Roadstar v2 GSM modul

Normal shutdown:

- To turn off the Roadstar v2 GSM modul use the AT^SMSO command, rather than disconnecting the power supply adapter.

This procedure lets the Roadstar v2 GSM modul log off from the network and allows the software to enter a secure state and save data before disconnecting the power supply. After AT^SMSO has been entered the GSM modul returns the following result codes:

^SMSO: MS OFF
OK
^SHUTDOWN

The "^SHUTDOWN" result code indicates that the GSM module turns off in less than 1 second. After the shutdown procedure is complete the GSM module enters the POWER DOWN mode.

3.6.4 Disconnecting power supply

Before disconnecting the power supply from the Vcc pin, make sure that the Roadstar v2 is in a safe condition. The best way is to wait 1s after the "^SHUTDOWN" result code has been indicated.

3.6.5 Automatic thermal shutdown

On-board NTC measures the temperature of the built-in Roadstar v2 GSM module. If over- or under temperature is detected on the module the Roadstar v2 GSM module automatically shuts down to avoid thermal damage to the system.

The automatic shutdown procedure is equivalent to the power-down initiated with the AT^SMSO command, i.e. Roadstar v2 GSM module logs off from the network and the software enters a secure state avoiding loss of data. In IDLE mode it takes typically one minute to deregister from the network and to switch off.

Alert messages transmitted before the Roadstar v2 switches off are implemented as Unso-licited Result codes (URCs). For details see the description of AT^SCTM command provided in [1] and [2].

Thermal shutdown will be deferred if a critical temperature limit is exceeded, while an emergency call or a call to a predefined phone number is in progress, or during a two minute guard period after power up. See [1] for details.

3.7 RS-232 Interface

Over RS232 interface, external device, PC or other control device with RS232 interface, communicate with Roadstar v2.

Figure 6. RS232 pin assignment (mini USB B connector)

Pin	Singal name	Input/Output	Function
1	NC	--	Not connected
2	Tx	Output	Transmit data
3	Rx	Input	Receive data
4	NC	--	Not connected
5	GND	--	ground

Table 7. RS232 pin assigment

The RS-232 interface is implemented as a serial asynchronous transmitter and receiver conforming to ITU-T V.24 Interchange Circuits DCE. It is configured for 8 data bits, no parity and 1 stop bit, and can be operated at bit rates from 300bps to 921,600kbps. Autobauding supports bit rates from 1200bps to 460,800bps.

3.8 SIM interface

Roadstar v2 provides SIM interface with automatic detection for 1.8V and 3V SIM cards in accordance with GSM11.12 Phase 2.
The card holder is a six wire interface according to GSM 11.11 with detection whether or not a SIM card is inserted.

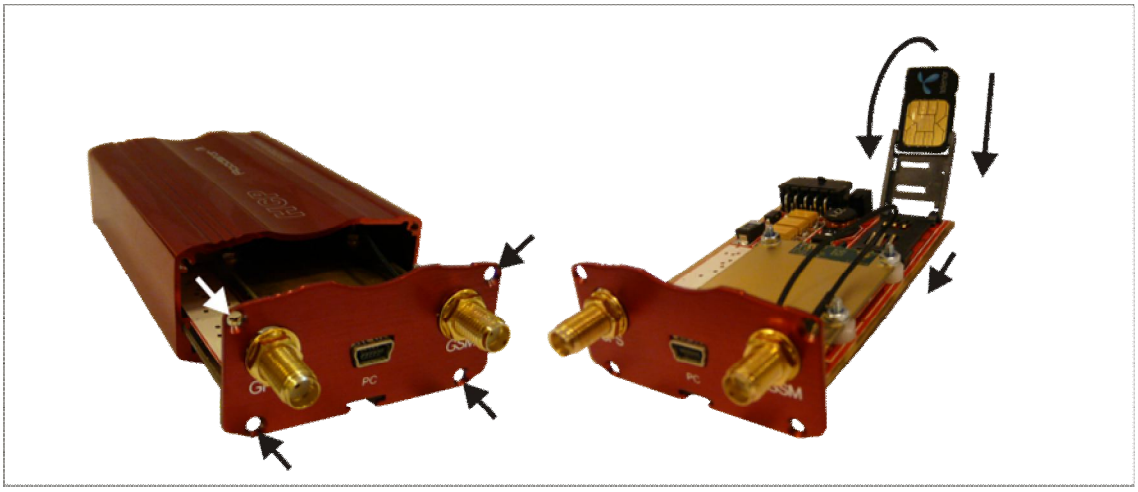


Figure 7. SIM interface

SIM card interface is placed inside the Roadstar v2 housing. Unscrew four screws marked on the left part of figure 6. and gently pull out pc board of Roadstar v2 and insert SIM card on place marked on the right part of the picture on figure 6.
After placing SIM card, push back pc board of Roadstar v2 and screw four screws back.

Removing and inserting the SIM card during operation requires the software to be reinitialized. Therefore, after reinserting the SIM card it is necessary to restart Roadstar v2 GSM module.

Note: *No guarantee can be given, nor any liability accepted, if loss of data is encountered afterremoving the SIM card during operation. Also, no guarantee can be given for properly initializing any SIM card that the user inserts after having removed a SIM card during operation. In this case, the application must restart the GSM module in Roadstar v2.*

3.9 Status LED

Status LED is used for displaying operating status of the Roadstar v2 tracking device, depending on how it's programmed.

Figure 8. Status LED on Roadstar v2

Status LED is driven by GPIO9 pin of GSM module inside Roadstar v2 (look at the figure 3.) so depending on the user request, flashing of the status LED can be controlled.

3.10 Antenna interface

The external antennas for GSM and GPS are connected via the Roadstar v2 SMA antenna connectors, look at figure 8.

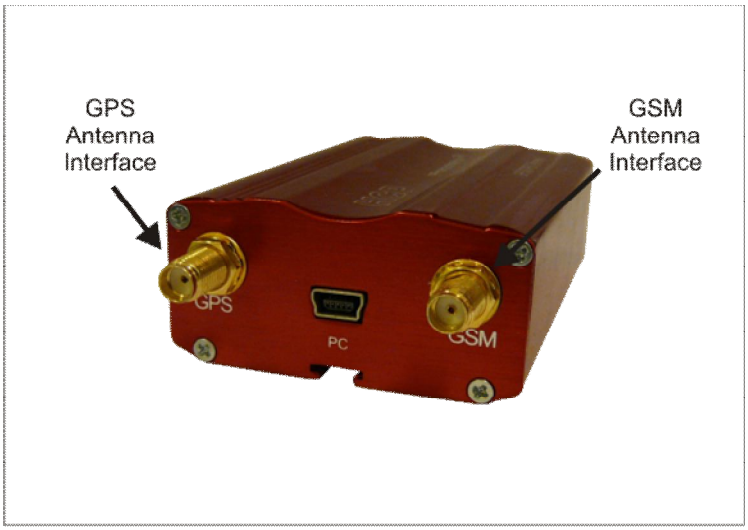


Figure 9. Antenna interface – SMA jack

An internal antenna cable adapts the antenna reference point of GSM module (antenna connector type U.FL-R-SMT from Hirose) to the SMA connector

- Cable loss of the internal cable
  <0.4dB @ 900MHz
  <0.6dB @ 1800MHz
- The system impedance is 50Ω
- In every case, for good RF performance the return loss of the customer application's antenna should be better than 10dB (VSWR < 2).

- Roadstar v2 GSM modul withstands a total mismatch at this connector when transmitting with power control level for maximum RF power.

4. Electrical and Environmental Characteristics

4.1 Apsolute Maximum Ratings

Parameter	Pin / Parameter	Min.	Max.	Unit
Supply voltage	Vcc	8	30	V
RS232 input voltage range	TxD	-20	+20	V
	RxD	-0.3	+5.3	V
Digital inputs	DI_1, DI_2, DI_3, DI_4	-4	40	V
Digital outputs	DO_1,DO_2	--	40	V
Analog inputs	AI_1, AI_2	--	24	V
Immunity against ESD	RS232 lines	-15	+15	kV
Protection Class	IP50(avoid exposing Roadstar v2 to liquid or moisture)		IP50	

Table 8. Apsolute maximum ratings

4.2 Recommended Operating conditions

Parameter	Pin / Parameter	Min.	Typ.	Max.	Unit
Supply voltage	Vcc	8	12	30	V
Supply current	Ic			500	mA
Operating temperature	--	-30	+25	+65	°C

Table 9. Recommended operating conditions

4.3 Digital Inputs

All input channels are optoisolated. On figure 9. you can see simplified schematic of digital inputs.

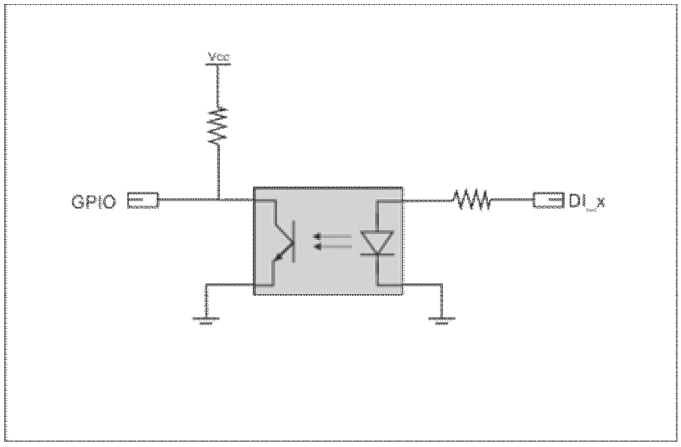


Figure 10. Input channels schematic

GPIO pin on GSM module is in state low “0“ when positive voltage is applied (reversed logic) to one of digital inputs DI_x (x=1,2,3,4).

Parameter	Signal name	Min	Typ	Max	Unit
Voltage input low	V_{IL}	-4	--	1	V
Voltage input high	V_{IH}	2	--	24	V
Forward current	I_F	--	--	50	mA

Table 10. Input channels electrical characteristics

4.4 Digital Outputs

Output pins will give GROUND for outside when GPIO pin on GSM module gives logic “1” . On figure 10. you can see simplified schematic of digital outputs with example of connection with relay.

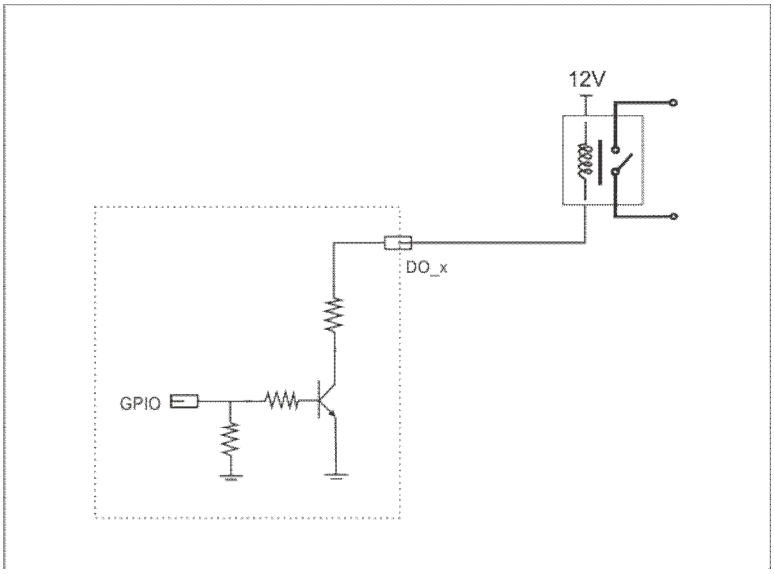


Figure 11. Output channels schematic

Parameter	Signal name	Min	Typ	Max	Unit
Output channel current capability	I	--	--	200	mA
Output channel voltage capability	V	--	--	30	V

Table 11. Output channels electrical characteristics

4.5 Analog Inputs

On figure 11. you can see simplified schematic of analog inputs.

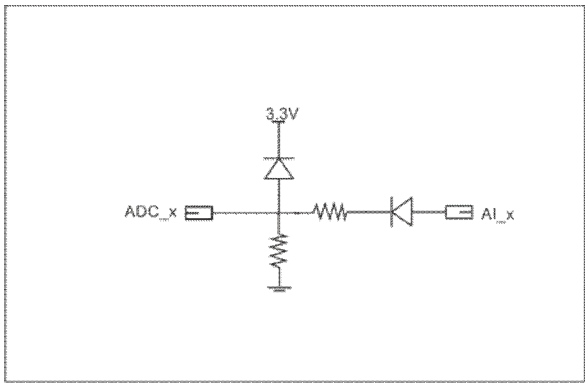


Figure 12. Analog channels schematic

Signal name	Min	Typ	Max	Unit
AI_x (x=1,2)	0	--	24	V

Table 12. Analog input channels electrical characteristics

Analog inputs go over resistor network to GSM module analog inputs.
More information about analog inputs on GSM module TC65i please refer to [1] and [2].

For instructions about ADC reading, look at the [5] “Programmer To Programmer instruction V3.2” for RoadstarV2, where you will find some examples with java code.

4.6 Storage Conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-40 +85	°C	ETS 300 019-2-1: T1.2, IEC 68-2-1 Ab ETS 300 019-2-1: T1.2, IEC 68-2-2 Bb
Humidity relative: Low High Condens.	10 90 at 30°C 90-100 at 30°C	%	--- ETS 300 019-2-1: T1.2, IEC 68-2-56 Cb Cb ETS 300 019-2-1: T1.2, IEC 68-2-30 Db Db
Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m²	ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Chemically active substances	Not recomm.		EC TR 60271-3-1: 1C1L
Mechanically active substances	Not recomm.		IEC TR 60271-3-1: 1S1

Table 13. Storage conditions

The conditions stated above are only valid for devices in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

4.7 Electrical Specifications of the Application Interface

4.7.1 RS232 interface

Param.	Description	Conditions	Min.	Typ	Max.	Unit
V_{OUT}	Transmitter output voltage RxD	@3KΩ to GND	±5			V
R_{OUT}	Transmitter output resistance RxD		300	10M		Ω
R_{IN}	Resistance TxD		3	5	7	kΩ
V_{IN}	Receiver input voltage range TxD		-25		+25	V
V_{LOW}	Input threshold low				0.8	V
V_{HIGH}	Input threshold high		2			
Baudrate		Autobauding	1,200		460,800	bps
		Fixed range	300		921,600	bps
RS232 cable				1.8	2	m

Table 14. RS232 interface

4.7.2 GPS antenna specification

Antenna type	Specification
Passive antenna	Center frequency: 1575.42 MHz Band Width: >20 MHz Gain: >0dB Polarization: RHCP or Linear
Active antenna	Center frequency: 1575.42 MHz Band Width: >5 MHz Minimum gain: 15-20dB(compensate signal loss in RF cable) Maximum noise figure: 1.5dB Maximum gain: 50dB Polarization: RHCP or Linear

Table 15. GPS antenna interface

For more information about GPS antenna interface please refer to [3].

4.7.3 GSM Antenna interface

Parameter		Min.	Typ.	Max.	Unit
Frequency range Uplink (MS → BTS)	GSM 850	824		849	MHz
	E-GSM 900	880		915	MHz
	GSM 1800	1710		1785	MHz
	GSM 1900	1850		1910	MHz
Frequency range Downlink (BTS → MS)	GSM 850	869		894	MHz
	E-GSM 900	925		960	MHz
	GSM 1800	1805		1880	MHz
	GSM 1900	1930		1990	MHz
RF power @ ARP with 50Ω load	GSM 850	31	33	35	dBm
	E-GSM 900	31	33	35	dBm
	GSM 1800	28	30	32	dBm
	GSM 1900	28	30	32	dBm

Table 16. Antena interface

Please refer to [2] for more information about antenna interface (air interface).

5. Mechanical Characteristics

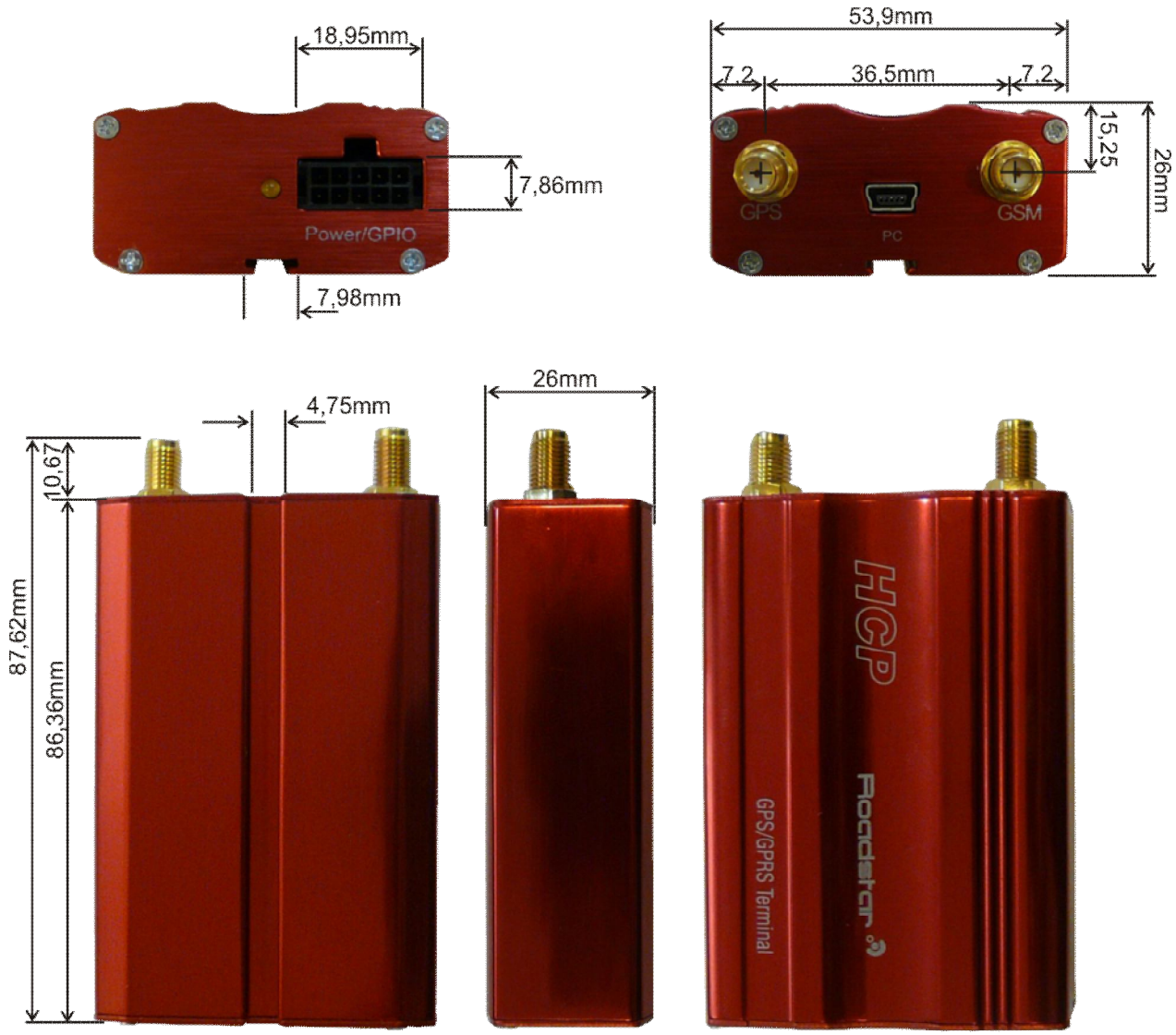
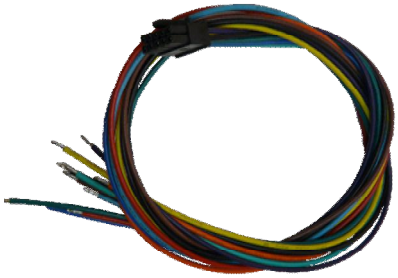


Figure 13. Mechanical characteristics

*all dimensions are in milimeters

6. List of Parts and Accessories

Description	Supplier	Picture
Roadstar v2	**HCP d.o.o**	
10-pin power and GPIO cable	**HCP d.o.o**	
RS232 cable (mini USB – SUB D9)	**HCP d.o.o**	
GSM & GPS antenna	**HCP d.o.o**	

HCP d.o.o.
Mirka Tomica – pasaz
37000 Krusevac
SERBIA

Phn. +381.37.445.401
+381.37.418.790
Fax. +381.37.448.351

Website www.hcp.rs

Sales email: sales@hcp.rs

Support: support@hcp.rs

Development: rnd@hcp.rs