

Hardware Manual

GSM/GPRS MODULE CHIP-GM01

Order No.

CHIP-GM01

566813



Table of Contents

| | | |
|--------|---|----|
| 1 | Overview | 3 |
| 2 | Features | 4 |
| 3 | Pin Description | 5 |
| 3.1 | Digital Interface | 5 |
| 3.1.1 | Signal Description | 7 |
| 3.2 | Antenna Connector | 8 |
| 4 | Interface Description | 9 |
| 4.1 | Operating modes | 9 |
| 4.2 | Switching Operating Modes | 9 |
| 5 | Characteristics | 10 |
| 5.1 | Absolute Maximum Ratings | 10 |
| 5.2 | Recommended Operating Ranges | 10 |
| 5.2.1 | GSM/GPRS features | 11 |
| 6 | PCB Board Design | 12 |
| 6.1 | Mounting | 12 |
| 6.1.1 | Connector | 12 |
| 6.1.2 | SIM-Card-Holder | 13 |
| 6.1.3 | Spacer | 14 |
| 6.2 | Power Supply | 14 |
| 7 | Mechanical Characteristics | 16 |
| 8 | Accessories | 17 |
| 9 | Regulatory Information | 18 |
| 9.1 | Declaration of Conformity | 19 |
| 9.2 | IC and FCC Compliance for CHIP-GM01 | 20 |
| 9.2.1 | IC Compliance | 20 |
| 9.3 | Compliance with RoHS directive | 21 |
| 10 | Guidelines for Efficient and Safe Use | 22 |
| 10.1 | General | 22 |
| 10.2 | Product Care | 23 |
| 10.3 | Radio Frequency Exposure | 23 |
| 10.4 | Electronic Equipment | 23 |
| 10.5 | Potentially Explosive Atmospheres | 24 |
| 10.6 | Safety Compliance | 24 |
| 10.6.1 | Power Supply | 24 |
| 11 | Type Approval and Compliance | 25 |
| 12 | History | 26 |

1 Overview

The CHIP-GM01 from Beck IPC has been developed for an easy integration of GSM/GPRS into industrial devices.

The provided software API-library is ready to use together with a SC123/SC143 or SC23 only.

The module minimizes the work needed to implement GSM/GPRS in a device as it provides all hardware, type approval, EMC certification etc. It is developed for reliable, high demanding industrial devices/applications. It requires no external components except an antenna to transfer an IPC@CHIP into a GSM/GPRS device.

2 Features

- Serial connection
- Supported standards:
 - GSM CSD service
 - GPRS service
 - Short message service (SMS)
- High performance/throughput
- Wide temperature range
- Power save control

3 Pin Description

3.1 Digital Interface

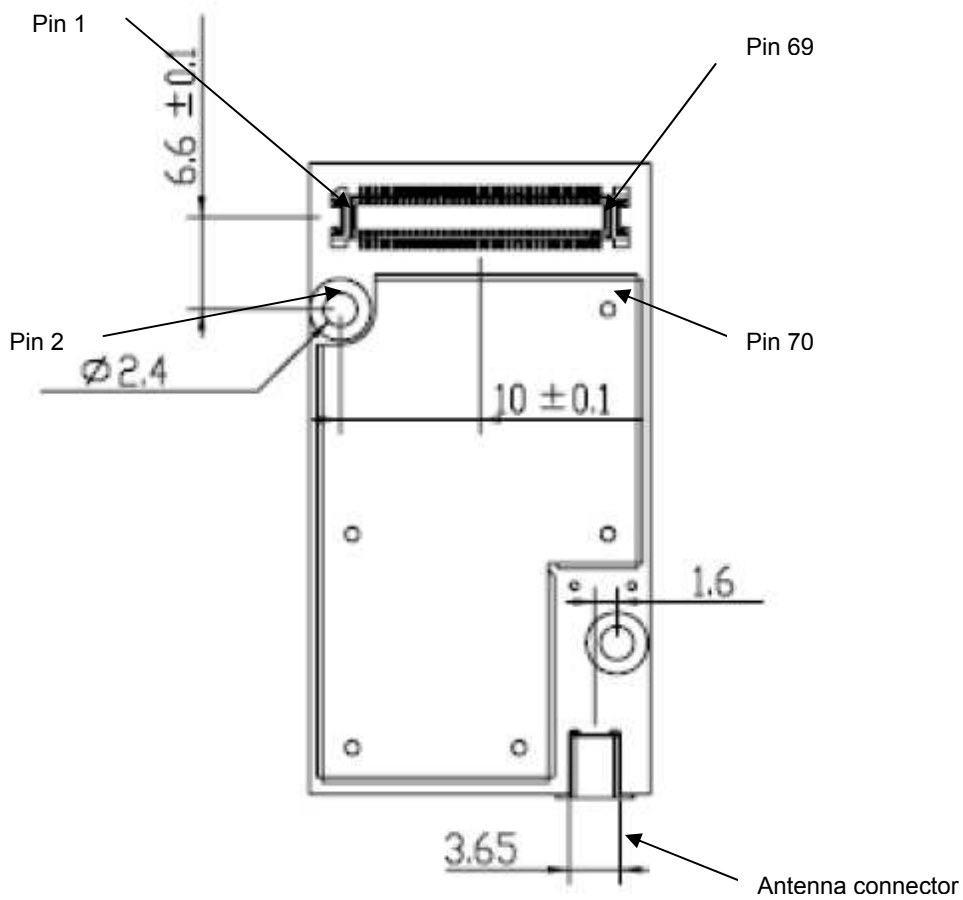


Figure 3-1: Connectors of the GM01 looking from the bottom side

| Signal | Pin | | Signal |
|--------------|-----|----|-----------------------|
| GND | 1 | 2 | GND |
| GND | 3 | 4 | GND |
| VCC | 5 | 6 | VCC |
| VCC | 7 | 8 | VCC |
| RTS | 9 | 10 | USB_VBUS ¹ |
| RXD | 11 | 12 | USB_DP ¹ |
| DSR | 13 | 14 | USB_DN ¹ |
| CTS | 15 | 16 | ² |
| DCD | 17 | 18 | ² |
| DTR | 19 | 20 | ² |
| TXD | 21 | 22 | ² |
| RI | 23 | 24 | ² |
| RESET | 25 | 26 | ² |
| ² | 27 | 28 | ² |
| ² | 29 | 30 | ² |
| ² | 31 | 32 | ² |
| ² | 33 | 34 | ² |
| ² | 35 | 36 | ² |
| ² | 37 | 38 | ² |
| ² | 39 | 40 | ² |
| ² | 41 | 42 | ² |
| ² | 43 | 44 | SIM_RST |
| ² | 45 | 46 | SIM_CLK |
| ² | 47 | 48 | SIM_VCC_3V |
| GPRS | 49 | 50 | SIM_PD |
| IGN | 51 | 52 | SIM_DIO |
| ² | 53 | 54 | ² |
| ² | 55 | 56 | ² |
| ² | 57 | 58 | ² |
| ² | 59 | 60 | ² |
| ² | 61 | 62 | ² |
| ² | 63 | 64 | ² |
| ² | 65 | 66 | ² |
| ² | 67 | 68 | ² |
| ² | 69 | 70 | ² |

¹ not yet supported

² Reserved for future use, do not connect.

³ All serial signals are logic level.

3.1.1 Signal Description

| Signal Name | Description | I/O | Active H/L | Internal PU/PD | Parameter | Conditions | Level | | | | |
|-----------------|-------------------------|-----|------------|----------------|----------------------|------------------------------------|---------|------|------|-------------------|-----|
| | | | | | | | Min. | Typ. | Max. | Unit | |
| Power | | | | | | | | | | | |
| GND | Ground | | | | | | | | | | |
| VCC | DC power supply | | | | | V_{IN} I_{MAX} I_{OFF} | 3.3 | 3.6 | 4.2 | V A μ A | |
| Serial | | | | | | | | | | | |
| TXD | UART TxD | I | L | 100k PU | V_{IH} | $I_{OUT} \leq 4 \text{ mA}$ | 2.0 | 2.8 | 3.0 | V | |
| RXD | UART RxD | O | L | | V_{IL} | | | | | | |
| RTS | UART RTS | I | L | 100k PU | V_{OH} | | 2.6 | 2.8 | 0 | 0.3 | V |
| CTS | UART CTS | O | L | | | | | | | | |
| DTR | UART DTR | I | L | 100k PU | V_{OL} | | 0 | 0.3 | 0.3 | V | |
| DSR | UART DSR | O | L | | | | | | | | |
| DCD | UART DCD | O | L | | | | | | | | |
| RI | UART RI | O | L | | | | | | | | |
| SIM Card | | | | | | | | | | | |
| SIM_PD_N | SIM presence detect | I | L | 100k PU | V_{IH} V_{IL} | Per ISO 7816-3IC specifications | 2.0 | 2.8 | 3.0 | V V | |
| SIM_VCC | SIM supply | O | H | | V_{OH} | | | | | | 2.7 |
| SIM_RST_N | SIM reset | O | L | | V_{OH} | | SIM_VCC | 0 | 0.4 | V | |
| SIM_DIO | SIM serial data | I/O | H | 5.1k PU | V_{OL} | | | | | | |
| SIM_CLK | SIM clock | O | H | | | | | | | | |
| Control | | | | | | | | | | | |
| IGN | Ignition input | I | H | 15k PU | V_{IH} V_{IL} | | 2.0 | VCC | 16 | V V | |
| RESET_N | Reset signal output | O | L | | V_{OH} V_{OL} | $I_{OUT} \leq 4 \text{ mA}$ | 2.6 | 2.8 | 0 | V V | |
| GPRS | GPRS coverage indicator | O | L | | V_{OH} V_{OL} | $I_{OUT} \leq 4 \text{ mA}$ | 2.6 | 2.8 | 0 | V V | |

| Signal Name | Description | I/O | Active H/L | Internal PU/PD | Parameter | Conditions | Level | | | |
|-------------|---------------------|-----|------------|----------------|-----------|-----------------------|-------|------|------|------|
| | | | | | | | Min. | Typ. | Max. | Unit |
| USB | | | | | | | | | | |
| USB_VBUS | USB bus power | I | H | | V_{IH} | Per USB Specification | 4.5 | 5.0 | 5.25 | V |
| | | | | | V_{IL} | | | 0 | 0.2 | |
| USB_DP | USB bus serial data | I/O | H | | V_{IH} | Rev. 1.1 | 3.0 | 3.3 | 3.6 | V |
| | | | | | V_{IL} | | | 0 | 0.8 | V |
| USB_DN | USB bus serial data | I/O | L | | V_{OH} | | 3.0 | 3.3 | | V |
| | | | | | V_{OL} | | | 0 | 0.3 | V |

3.2 Antenna Connector

The antenna connector is an RF MMCX-connector. To connect an external antenna, an MMCX to SMA adapter cable is needed.

4 Interface Description

The main interface of the GM01 is a standard serial connection (UART) with two data-signals, handshake (RTS, CTS) and status-lines (DTR, DSR). So the GM01 can be handled like any serial interface. The module supports baud rates from 300 baud to 115,2 kbaud. The serial connection is logic-levelled, using 0-3 VDC.

The reset output is used to indicate a reset of the module. The reset output and the GPRS output can be connected to any PIO of the SC1x3/SC23, to any other digital logic or left unconnected if not needed.

4.1 Operating modes

The GM01 indicates its operating mode using the PIOs mentioned above.

| Mode | Description | Feature |
|-------------|--|--|
| Not Powered | VCC supply is disconnected. | The GM01 is off. Any signals connected to the interface connector must be set low or tri-state. |
| RESET | Valid VCC supply RESET_N signal is enabled (low) | The GM01 interfaces are off. Any signals connected to the interface connector must be set low or tri-stated. |
| Idle | RESET_N signal is disabled (high). CTS_N and DSR_N signals are enabled (low). | The GM01 is fully active, registered to the GSM network and ready to communicate. This is the default power-up mode. |
| Sleep | RESET_N signal is high; CTS_N signal is disabled. | The GM01 is in low power mode. The application interfaces are disabled, but GM01 continues to monitor the GSM network. |
| GPRS data | RESET_N signal is high, | A GSM/GPRS data transfer is in progress. When the call terminates, GM01 returns to the last operating state (Idle or Sleep). |

4.2 Switching Operating Modes

In order to switch the GM01 from RESET mode to Idle mode the IGN pin has to be activated. The new status (idle) is indicated by the RESET pin and the CTS pin. The RESET pin turns to inactive (high) and the CTS pin is asserted to low after a short time. The device is switched off by switching IGN back to low. The sleep mode is entered and left by software.

5 Characteristics

5.1 Absolute Maximum Ratings

| Parameter | Min | Max | Unit |
|---|-----|-----|------|
| Storage Temperature | -40 | +85 | °C |
| Supply Voltage (V_{CC}) | 0 | 4.5 | V |
| Digital Input Signals (GM01 powered on); Except for IGN, VBUS, USB_DP, USB_DN | 0 | 3 | V |
| Digital Input Signals (GM01 powered off); Except for IGN, VBUS, USB_DP, USB_DN | 0 | 0.2 | V |
| IGN | 0 | 16 | V |
| VBUS | 0 | 5.5 | V |
| USB_DP, USB_DN | 0 | 5 | V |

Table 5-1: Absolute Maximum Ratings

5.2 Recommended Operating Ranges

(Under operating ranges unless otherwise noted)

Note: Exposure to conditions beyond those listed here may adversely affect the lifetime and reliability of the device.

| Parameter | Min | Typ | Max | Unit |
|------------------------------|-----|------|-----|------|
| Supply Voltage (V_{CC}) | 3.3 | | 4.2 | V |
| Current consumption | | | | |
| RESET mode | | 50 | | µA |
| Idle mode | | 20 | | mA |
| Sleep mode | | 3.3 | | mA |
| GPRS Class 10 – 2 TX slot | | 500 | | mA |
| 3 RX slot | | | | |
| Max. TX burst current | | 2000 | | mA |
| Operating temperature | -20 | | +75 | °C |

Table 5-2: Recommended Operating Ranges

5.2.1 GSM/GPRS features

| Parameter | Data |
|---------------------------------------|---|
| RF output power max. GSM 850/900 | Class 4, max. 33 ± 2 dBm |
| RF output power max. DCS 1800/PCS1900 | Class 1, max. 30 ± 2 dBm |
| GPRS | Multi-slot class 10 (4 Rx/2 Tx/5 Sum) Max downlink BR 85.6 kbps Coding scheme CS1-CS4 |
| CSD | Max BR 14.4 kbps |
| SMS | MO/MT Text and PDU modes Cell broadcast |
| Character Sets | UTF8 UCS2 ASCII GSM 8859-1 |
| Status-Indicators | GSM/GPRS coverage Reset |

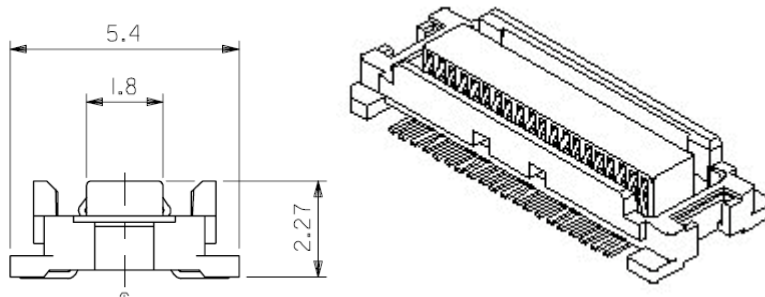
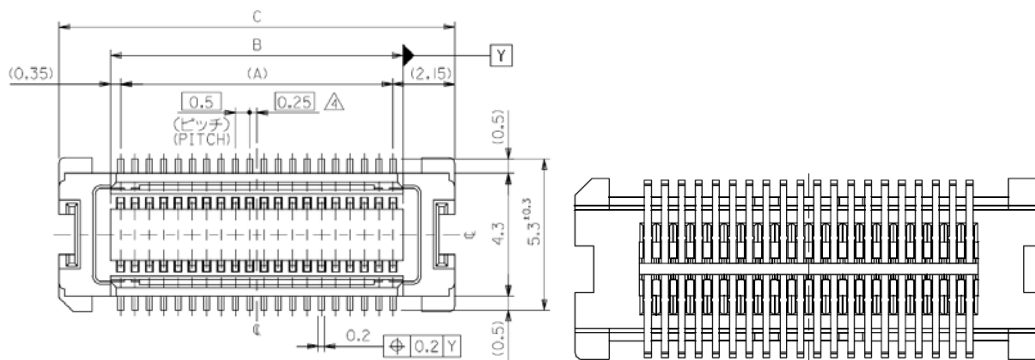
Table 5-3: GSM features

6 PCB Board Design

6.1 Mounting

6.1.1 Connector

One-Piece Interface – Board to Board connector

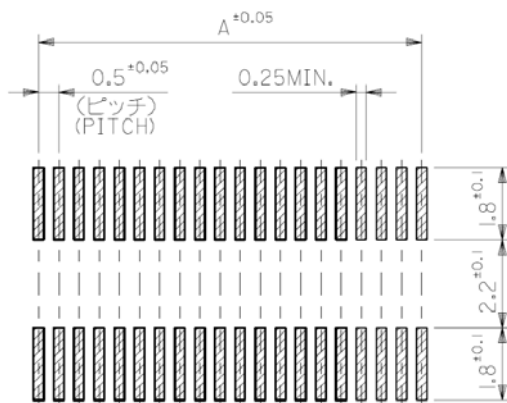


Dimensions: A: 17 mm
 B: 17.7 mm
 C: 21.3 mm

Beck Order No.: 567527 (CHIP-GM-EMC01)

Molex Order No.: 52991-0708

Layout Suggestion:



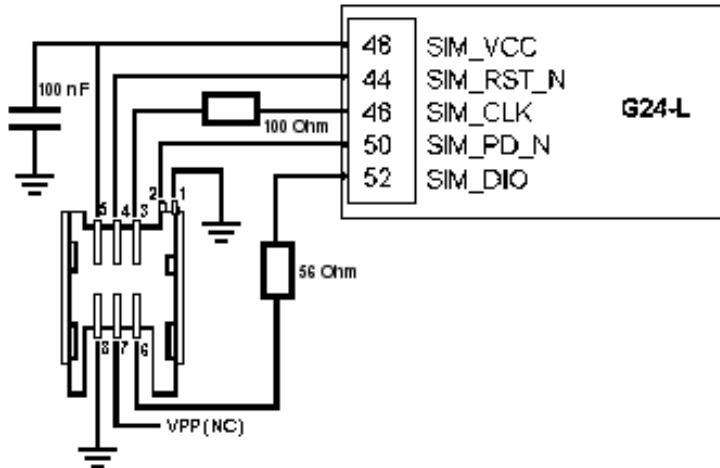
6.1.2 SIM-Card-Holder

A 100 nF capacitor shall be placed at SIM_VCC line next to the SIM-card-holder.

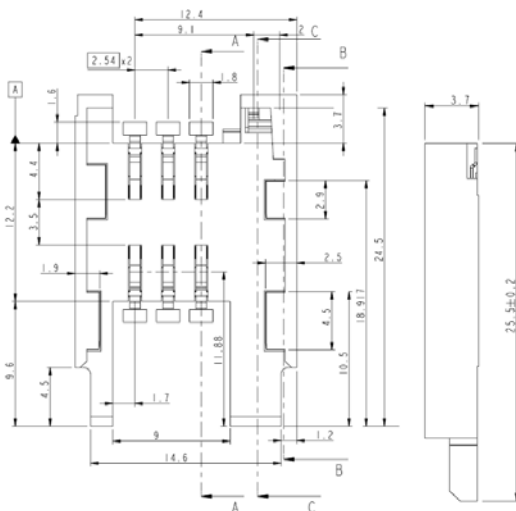
A 56 Ohm series resistor shall be placed in the SIM_DIO line.

A 100 Ohm series resistor shall be placed in the SIM_CLK line.

Schematic example:



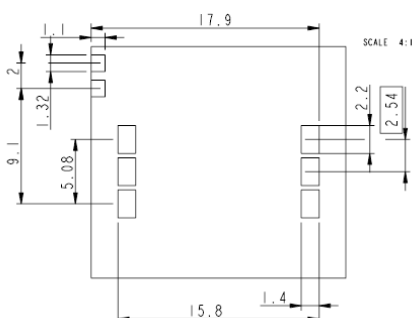
A SIM-Card-Holder is available at BECK:



Beck Order No.: 567529 (CHIP-GM-SIM01)

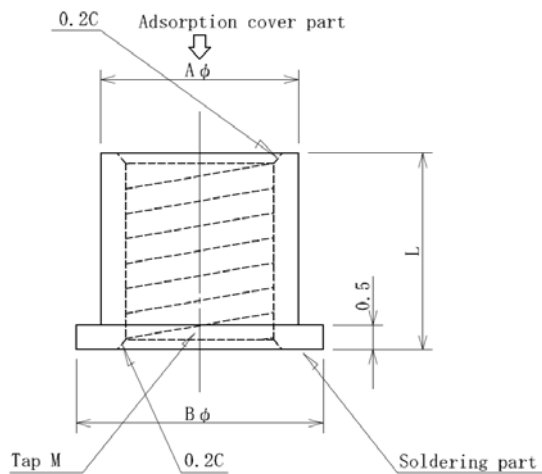
FCI: 7111S1615A02LF

Layout Suggestion:



6.1.3 Spacer

For proper mechanical fixation two spacers are needed. They are soldered to the PCB and provide metric thread M3.



Dimensions: A: 4.0 mm
 B: 5.0 mm
 L: 3.0 mm
 M: M3

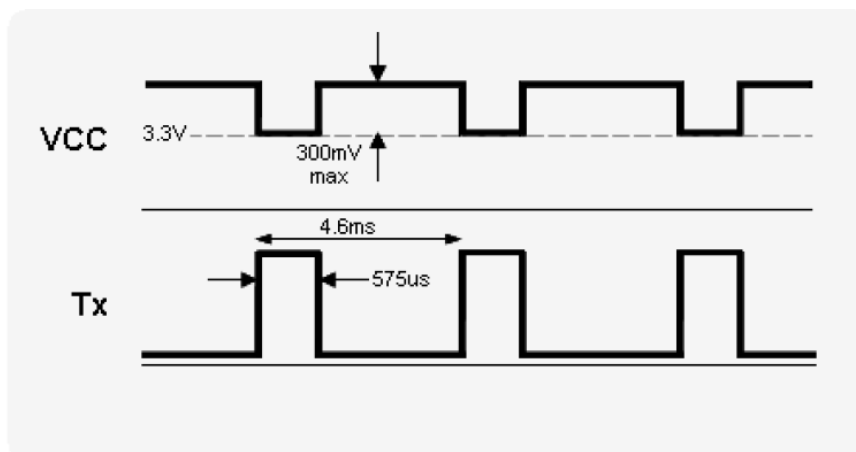
Beck Order No.: 567528 (CHIP-GM-SP01)

MAC8 Order Number: 2SSA-3.0

6.2 Power Supply

Special care must be taken when designing the power supply of the GM01. The single external DC power source indirectly supplies all the digital and analog interfaces, but also directly supplies the RF power amplifier (PA). Therefore, any degradation in the power supply performance, due to losses, noises or transients, will directly affect the GM01 performance.

The burst-mode operation of the GSM transmission and reception, draws instantaneous current surges from the power supply, which causes temporary voltage drops of the power supply level. The transmission bursts consume the most instantaneous current, and therefore cause the largest voltage drop. If the voltage drops are not minimized, the frequent voltage fluctuations may degrade the GM01 performance.



Transmission power drops

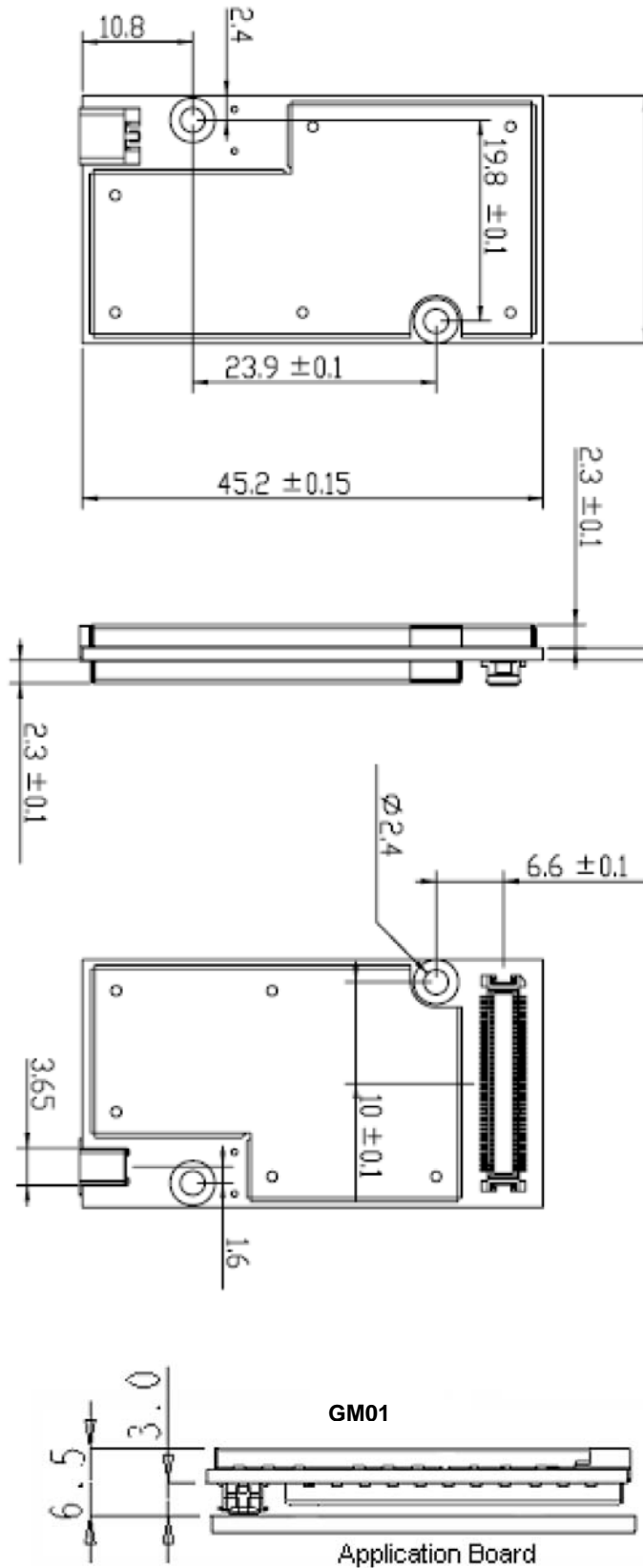
It is recommended that the voltage drops during a transmit burst will not exceed 300mV, measured on the G24-L interface connector. In any case, the G24-L supply input must not drop below the minimum operating level during a transmit burst. Dropping below the minimum operating voltage may degrade the module performance.

To minimize the losses and transients on the power supply lines, it is recommended to follow these guidelines:

- Use a 1000 μ F, or greater, low ESR capacitor on the G24-L supply inputs. The capacitor should be located as near to the G24-L interface connector as possible.
- Use low impedance power source, cabling and board routing.
- Use cabling and routing as short as possible.

| Capacitor | Usage | Description |
|---------------|----------------------------|---|
| 1000 μ F | GSM Transmit current surge | Minimizes power losses during transmit bursts. Use maximum possible value. |
| 10 nF, 100 nF | Digital switching noise | Filters digital logic noises from clocks and data sources |
| 8.2 pF, 10 pF | 1800/1900 MHz GSM EMI | Filters transmission bands |
| 33 pF, 39 pF | 850/900 MHz GMS EMI | Filters transmission bands |

7 Mechanical Characteristics



8 Accessories

| Accessory | Description | Approval for use in USA and Canada | Manufactur / Order No. |
|------------------------------------|---|------------------------------------|---|
| Pigtail: MMCX to SMA adapter cable | Cable length 130mm | no | 2J antenna conceptor / C05C88-015 130mm |
| Antenna: SMA M 90 dgr | vertical polarization, +2.2dBi gain, size 96.5 mm, SMA male connector 90° | no | 2J antenna conceptor / 2J010 |

9 Regulatory Information

The G24-L module is compliant with applicable FCC, IC and European R&TTE requirements. The integrated system incorporating the GM01 module may be subject to further regulations and standards. Motorola strongly recommends that the system integrator seeks professional advice regarding the regulations and standards that apply to their product.

The Federal Communications Commission (FCC) requires application for certification of digital devices in accordance with CFR Title 47, Part 2 and Part 15. This includes Electromagnetic Energy Exposure (EME) testing. As the GM01 modem is not a standalone transceiver but is an integrated module, the GM01 cannot be tested by itself for EME certification. It is, however, the integrator's responsibility to have the completed device tested for EME certification.

The module is compliant to European R&TTE directive requirements; however the complete system (host plus GM01 module) may be subject to R&TTE or other directives (for instance the EMC directive 2004/108/EC). Motorola strongly recommends that the system integrator seek professional advice regarding the applicable standards and directives, and most efficient route to demonstrating compliance, and required product markings.

The GM01 module is compliant to FCC, IC and R&TTE requirements allowing use within Europe and North America. Use in other regions may require regional "type approvals" which the manufacturer of the final product integration or reseller will be responsible for procuring. Many regional type approvals are based upon compliance to FCC, R&TTE, ETSI and other standards that the GM01 is compliant with. It is strongly recommended that professional advice be sought before placing the finished integrated product on the market to establish local approval and marking requirements.

9.1 Declaration of Conformity



We, **Beck IPC GmbH**
Grüninger Weg 24
35415 Pohlheim-Garbenteich, Germany

declare under our sole responsibility that our product:

CHIP-GM01 (566813)

to which this declaration relates, conforms to the following product specifications:

R&TTE Directive 1999/5/EC

The following harmonized standards and normative documents are those to which the product's conformance is declared, by specific reference to the essential requirements of Article 3 of the directive.

Article 3.1.a: Not applicable for this type of product.

Article 3.1.b: EN 301 489-1

EN 301 489-7

Article 3.2: EN 301 511

02.02.09 Pohlheim-Garbenteich, Germany

Thomas Schumacher

Business manager of Beck IPC GmbH

9.2 IC and FCC Compliance for CHIP-GM01

9.2.1 IC Compliance

The following paragraphs must be addressed by the integrator to ensure their host is in compliance to the GM01 FCC grant and/or the FCC grant of the host device.

CFR 47 Part 15.19 specifies label requirements

The following text may be on the product, user's manual, or container.

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.

CFR 47 Part 15.21 Information to user

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

CFR 47 Part 15.105 Information to the user

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

Note: The unit must be installed in a manner that provides a minimum separation distance of 20 cm or more between the antenna and persons and must not be co-located or operate in conjunction with any other antenna or transmitter to satisfy FCC RF exposure requirements for mobile transmitting devices.

9.2.1.1 Antenna

The module type CHIP-GM01 is for OEM integrations only. In the end-user product the module shall be professionally installed in such a manner that only the authorized antennas can be used.

Antenna Installation

- The antenna installation must provide a minimum separation distance of 20 cm from users and nearby persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

- The combined cable loss and antenna gain must not exceed +6.8 dBi (850 band). The combined cable loss and antenna gain must not exceed +2.2 dBi and total system output must not exceed 2.0W EIRP in the PCS (1900) band in order to comply with the EIRP limit of 24.232 (b). OEM installers must be provided with antenna installation instruction and transmitter operating conditions for satisfying RF exposure compliance.
- For system integrations requiring higher antenna gain, or position closer than 20cm from the body, SAR compliance testing of the completed product will be required. It is strongly recommended that the system integrator seeks the advice of a suitably accredited test laboratory to develop a test plan and carry out necessary testing.

9.2.1.2 Caution

Any changes or modifications NOT explicitly APPROVED by BECK IPC could cause the module to cease to comply with FCC rules part 15, and thus void the user's authority to operate the equipment.

9.3 Compliance with RoHS directive



The CHIP-GM01 is produced according to the RoHS (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment) directive and complies with the directive.

10 Guidelines for Efficient and Safe Use

10.1 General

Read this information before using your GM01 module.

Note: Changes or modifications to the product not expressly approved by Beck IPC GmbH will void the user's authority to operate the equipment.

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Motorola, Inc. assumes no liability for the customer's failure to comply with these requirements. The safety precautions listed below represent warnings of certain dangers of which we are aware. You, as the user of this product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Ground the instrument

Only suitably qualified individuals should work on the product and host system. Consideration should be given to the safest grounding arrangement for the host application.

Do not operate in an explosive atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Do not service or adjust alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid is present. There are no user serviceable parts inside the GM01 module.

Keep away from live circuits

Operating personnel must:

- not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly, or component replacement, or any internal adjustment
- not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed
- always disconnect power and discharge circuits before touching them

Do not substitute parts or modify equipment

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of equipment. Contact Motorola Warranty and Repair for service and repair to ensure that safety features are maintained.

10.2 Product Care

- Do not expose your product to liquid or moisture.
- Do not expose your product to extreme hot or cold temperature (see section 5.2 for further information)
- Do not expose your product to lit candles, cigarettes, cigars, open flames, etc.
- Do not drop, throw or try to bend your product since rough treatment could damage your product.
- Do not attempt to disassemble your product. Doing so will void warranty. The product does not contain consumer serviceable or replaceable components. Service should only be performed by Beck IPC.
- Do not paint your product as the paint could prevent normal use.
- If you will not be using your product for a while, store it in a place that is dry, free from damp, dust and extreme heat and cold.
- The cooling of the end product shall not negatively be influenced by the installation of the module.

10.3 Radio Frequency Exposure

The GM01 module contains a small radio transmitter and receiver. During communication via GPRS/PSM the GM01 Module receives and transmits radio frequency (RF) electromagnetic fields (microwaves) in the frequency range 800 to 1900 MHz. The output power of the radio transmitter is very low.

When using the GM01 module, you will be exposed to some of the transmitted RF energy. This exposure is well below the prescribed limits in all national and international RF safety standards and regulations.

10.4 Electronic Equipment

Most modern electronic equipment, for example, in hospitals and cars, is shielded from RF energy. However, certain electronic equipment is not. Therefore:

Note: This equipment emits RF energy in the ISM (Industrial, Scientific, Medical) band. Please insure that all medical devices used in proximity to this device meet appropriate susceptibility specifications for this type of RF energy.

10.5 Potentially Explosive Atmospheres

Turn off your electronic device before entering an area with potentially explosive atmosphere. It is rare, but your electronic device could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas, such as petrol station, below deck 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.

10.6 Safety Compliance

In order to fulfil the safety standard EN 60950-1:2001 the CHIP-GM01 must be supplied by a Class-2 Limited Power Source.

10.6.1 Power Supply

TheGMT01 module must be supplied by a limited power source according to EN 60950-1.

- Connect your power supply only to designated power-sources as marked on the product.
- Make sure all cords and cable are positioned so that they will not be stepped on, tripped over or otherwise subject to damage or stress.
- To reduce risk of electric shock, unplug the unit from any power source before attempting to clean it.

11 Type Approval and Compliance

Type Approval

- » R&TTE (Europe)
- » FCC/CFR 47 part 15,22 ,24
- » IC (Industry Canada)
- » GCF 3.27.1
- » NAPRD 3.14.0

Certifications and Compliance

- » R&TTE - LVD 2006/95/EC

EMC Directive: 89/336/EEC

- » EN 301 489-1
- » EN 301 489-7

Safety compliance

- » EN 60950

12 History

| Revision | Date | Author | Comments |
|----------|------------|----------|-----------------------------------|
| V0.00 | 18.11.2008 | T. Kurth | initial version |
| V0.1 | 12.03.2009 | T. Kurth | TXEN removed, minor changes |
| V1.0 | 24.04.2009 | T. Kurth | First release IGN added at 3.1 |
| | | | |
| | | | |
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