GC864-QUAD-C5 Hardware User guide

1vv0300855 Rev.0 – 2009-09-25

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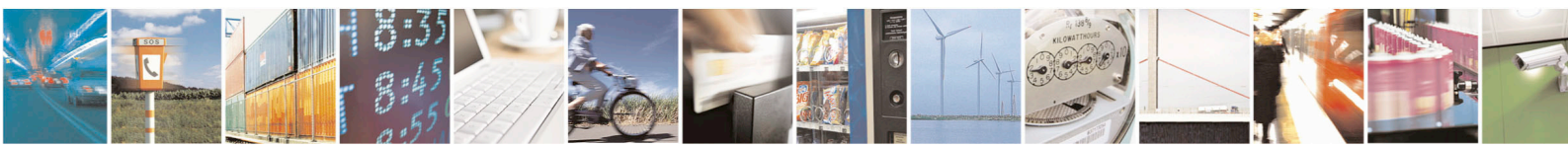
APPLICABLE PRODUCTS

PRODUCT
GC864-QUAD-C5



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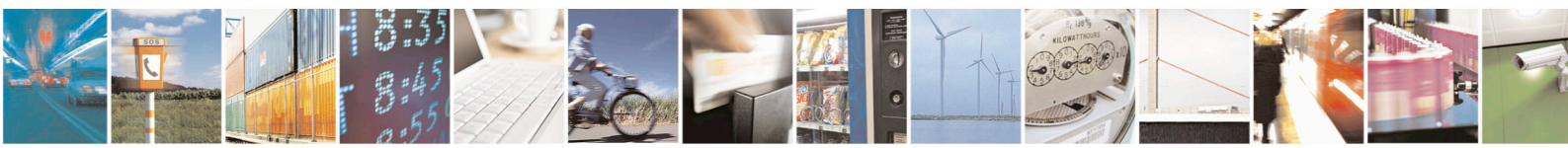
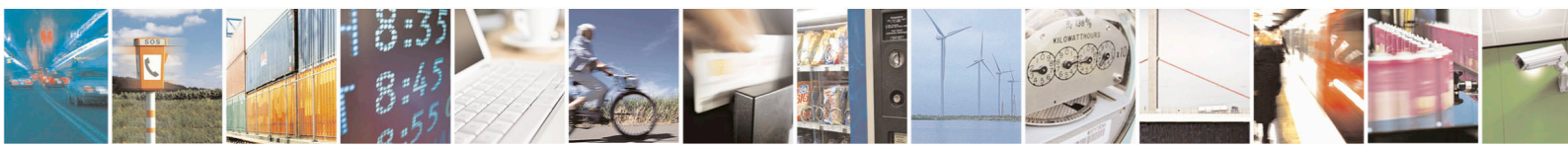
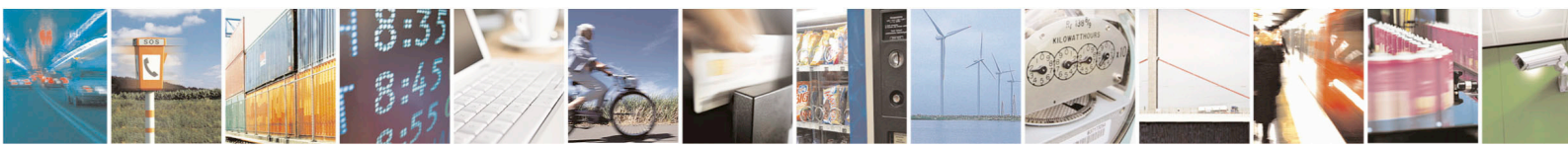


Contents





1. Introduction

1.1. Scope

The aim of this document is to point out the HW differences between the C5 Telit Clone and SIEMENS Family M55-M56 as well as slight differences in MC55i.

1.2. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit's Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

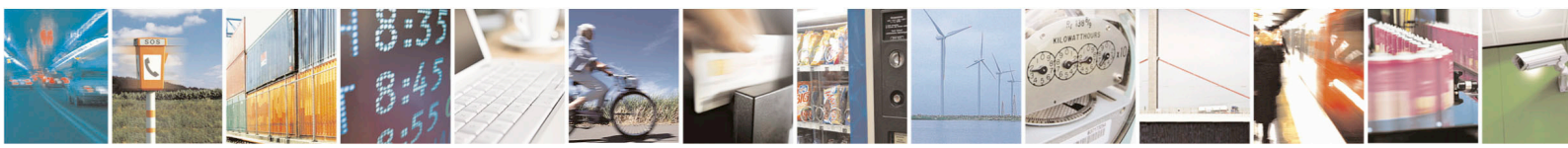
For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit's Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.



1.3. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

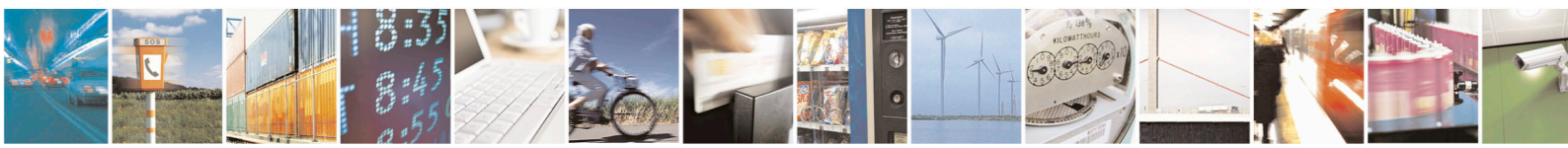
1.4. Related Documents

- GC864-QUAD-C5 Audio User guide, 1VV0300849
- GE864-QUAD/PY Hardware User Guide, 1vv0300694
- AT Commands Reference Guide, 80000ST10025a
- Digital Voice Interface Application Note, 80000NT10004a

For additional information please refer to Telit site ,products, GE864-QUAD/PY
http://www.telit.com/en/products/gsm-gprs.php

1.5. Document History

Revision	Date	Changes
0	2009-09-25	First issue



2. GENERAL CONCEPTS

2.1. View of GC864-QUAD-C5

Top side:

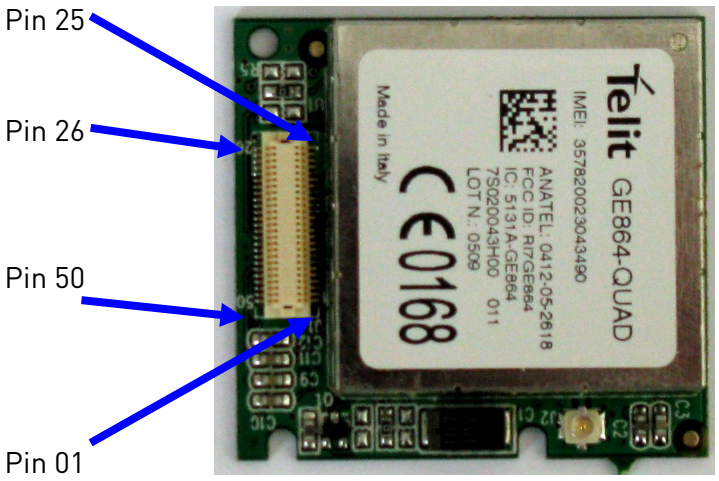


Figure 1

Bottom side:

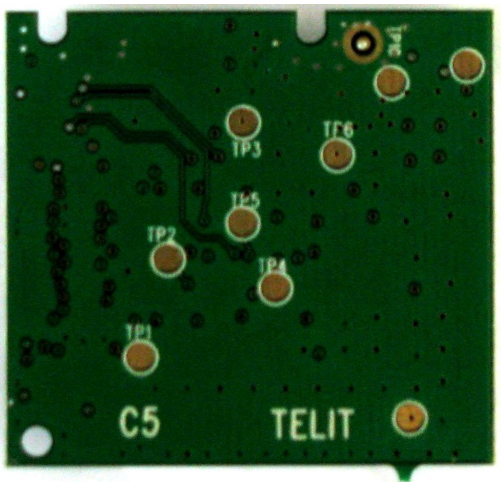
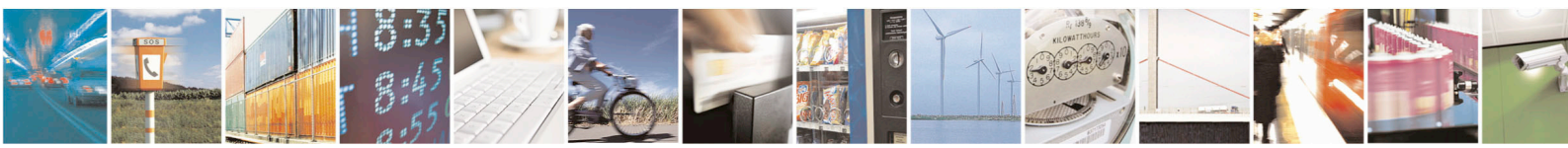


Figure 2

2.2. Description

This product is based on GE864-QUAD Telit module Quad-Band EGSM 850/900/1800/1900Mhz GSM and GPRS Class 10, support over the air firmware update by means of premium FOTA Management.



3. SYSTEM CHARACTERISTICS

3.1. GC864-QUAD-C5 MAIN FEATURES AND DIFFERENCES FROM MC55/MC56

GC864-QUAD-C5 is Quad –band EGSM 850/900/1800/1900Mhz Class 10. It is controlled via AT commands according to GSM 07.05.07.07 and Telit custom AT commands. It supports SIM Access profile, and has a supply voltage range of 3.22V – 4.5V depended on SW Version.

MC55 is a tri-band GSM/GPRS engine that works on the three frequencies GSM 900 MHz, GSM 1800 MHz and GSS1900 MHz.
MC56 is a tri-band GSM/GPRS 850MHz, GSM 1800 MHz and GSM 1900 MHz.
Both MC55 and MC56 support GPRS class 10.
MC55i is a Quad -band GSM/GPRS 850/900/1800/1900MHz Class 10.

3.2. POWER SUPPLY DIFFERENCES

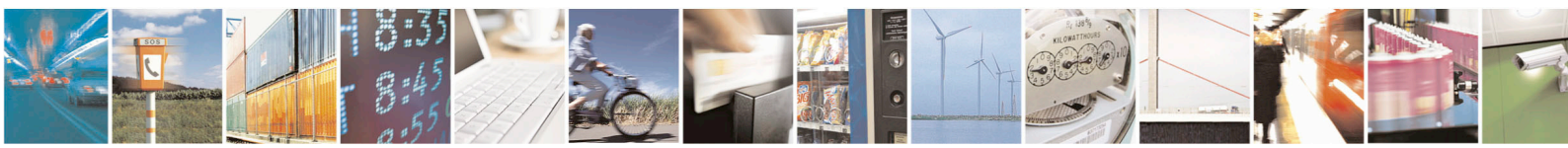
The GC864-QUAD-C5 is based on GE864 QUAD. Therefore it benefits of the supply range of the GE864-QUAD:

POWER SUPPLY REQUIREMENTS		
	SW rel. 7.02.xx4 or older	SW rel. 7.03.x00 or newer
Nominal Supply Voltage	3.8 V	3.8 V
Max Supply Voltage	4.2 V	4.5 V
Supply voltage range	3.4 V - 4.2 V	3.22 V – 4.5 V

Table 1

The supply Voltage range is 3.22V – 4.5V depended on SW Version,(3.8V recommended).
The operating voltage must not fall below 3.2 V, not even in case of voltage drop.
The GSM system is made in a way that the RF transmission is not continuous, else it is packed into bursts at a base frequency of about 216 Hz, the relative current peaks can be as high as about 2A.

The MC55/MC56 MC55i supply voltage is 3.3 V...4.8 V, Ityp ≤ 2 A during transmit burst.
The minimum operating voltage must not fall below 3.3 V, not even in case of voltage drop.



3.3. TEMPERTURE RANGE DIFFERENCES

The GC864-QUAD-C5 benefits of the extended temperature range of the GE864-QUAD, which is -40°C to +85 °C (operational).

The MC55/MC56 MC55i instead supports:

- Normal operation: -20°C to +55°C
- Restricted operation: -25°C to -20°C and +55°C to +70°C
- Ambient temperature (according to GSM 11.10) -20 +25 +55 °C
- MC55/56 has the automatic shutdown set to 70°C

3.4. DIMENSIONS

GC864-QUAD-C5 dimensions are slightly different from those of the MC55/MC56. Its size is 35mm X 37.5mm X 3mm (including application connector)

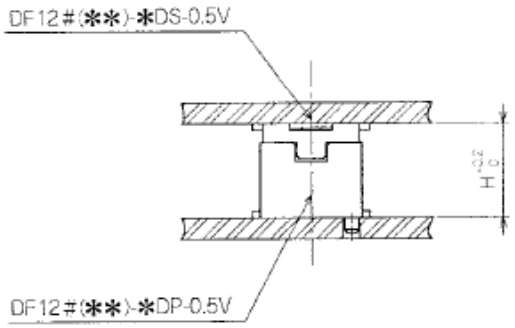
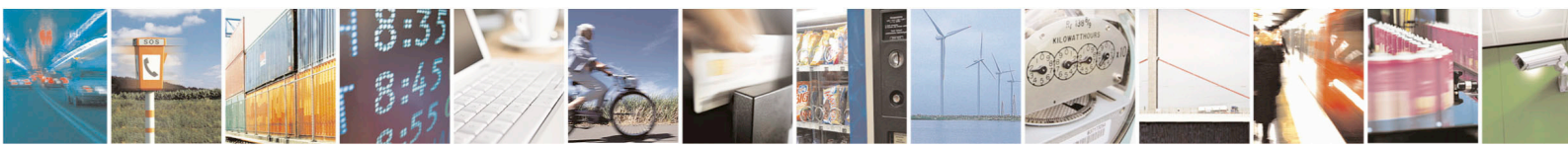


Figure 3



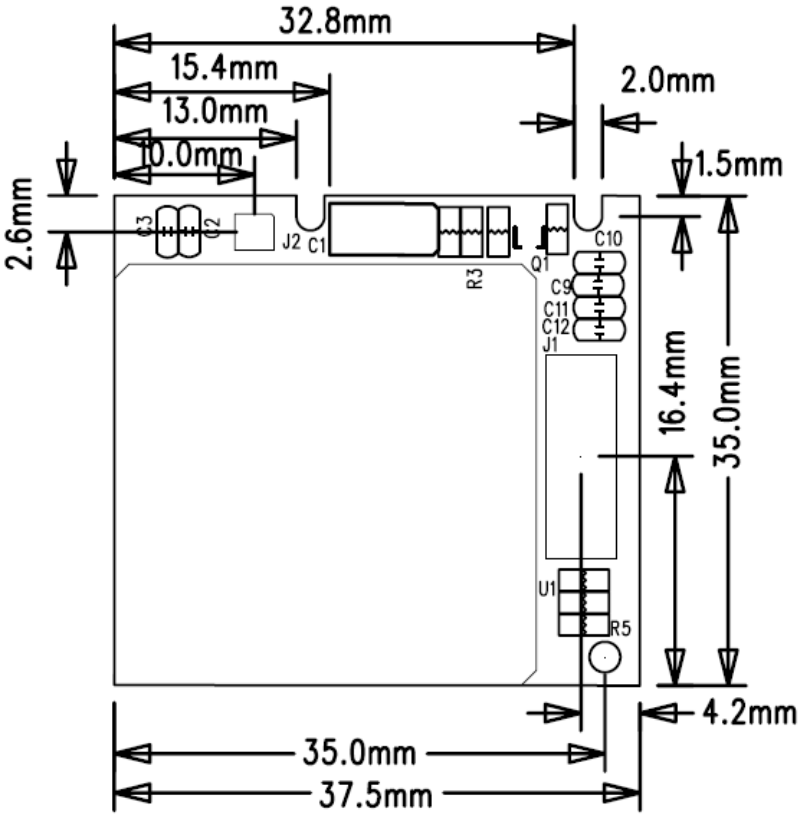


Figure 4

The size of the MC55/MC56 is:

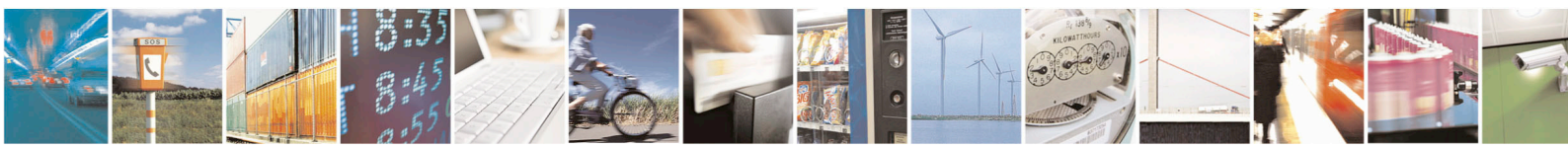
- 35±0.15 x 32.5±0.15 x 3.1±0.3 mm (including application connector)
- 35±0.15 x 32.5±0.15 x 2.95±0.2 mm (excluding application connector)

3.5. CHARGER

The charger mechanism is different in the GC864-QUAD-C5 and already includes the controller inside the module; therefore the charger is not compatible. Its interface connector does not include the charger signals.

3.6. TURN ON AND OFF

HW connection to /IGT pin.



3.6.1. ON_OFF signal on the GC864-QUAD-C5

The ON_OFF* has an internal pull-up, To Turn on the GC864-QUAD-C5 the ON_OFF* Signal must be tied low for **at least 1 second** and then released.
The maximum current that can be drawn from the ON_OFF* pin is 0.1mA.
This is a simple recommended circuit to do the connection:

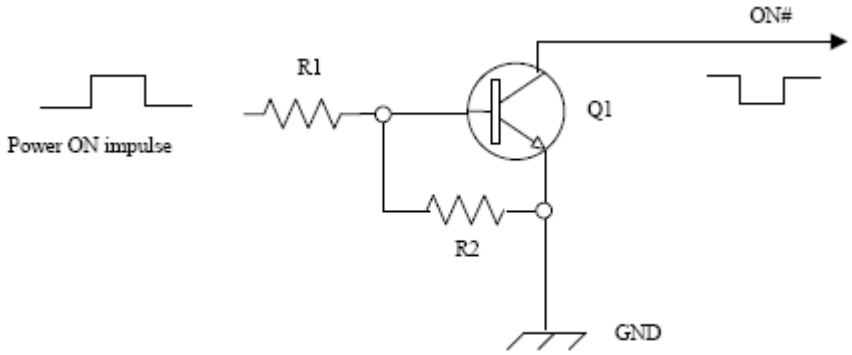


Figure 5

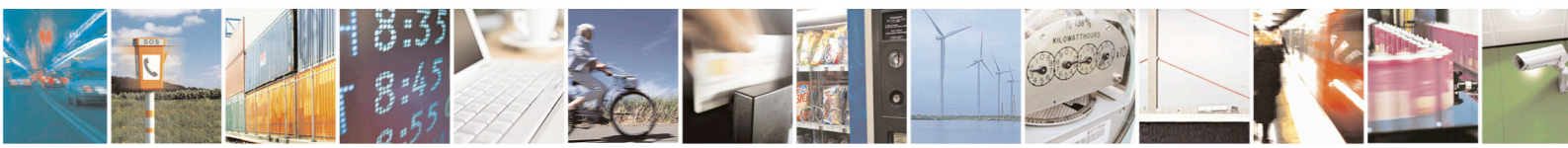
3.6.2. Turn OFF of the GC864-QUAD-C5

Turning off the device can be done in two ways

- By AT command (see AT command user guide)
- HW shut down with ON_OFF* ignal

To turn Off the module via AT COMMAND; you have to use the AT#SHDN command. It will shut down the module.

To turn off the GC864-QUAD-C5 by signal ON_OFF* this signal must be tied low for **at least 2 seconds** and then released



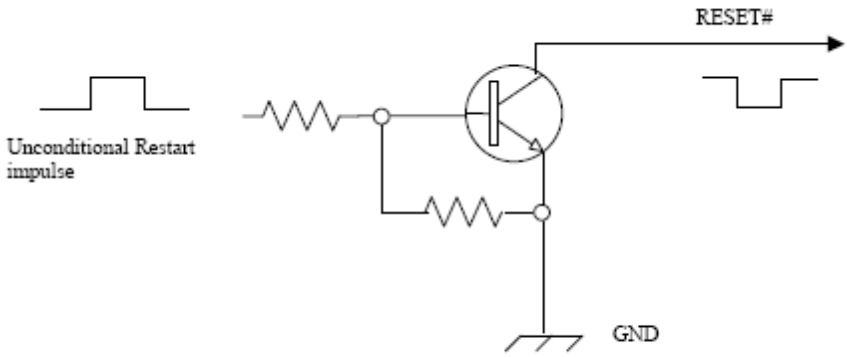


Figure 6

3.6.3. Turn ON in MC55/MC56

To switch on MC55/56 the /IGT (Ignition) signal needs to be driven to ground level **for 100ms minimum** and not before 10ms after the last VDD Falling edge. This can be accomplished using an open drain/collector driver.

In a battery operated MC55/56 application, the duration of the /IGT **signal must be 1s** minimum when the charger is connected and you may want to go from Charge only mode to Normal mode.

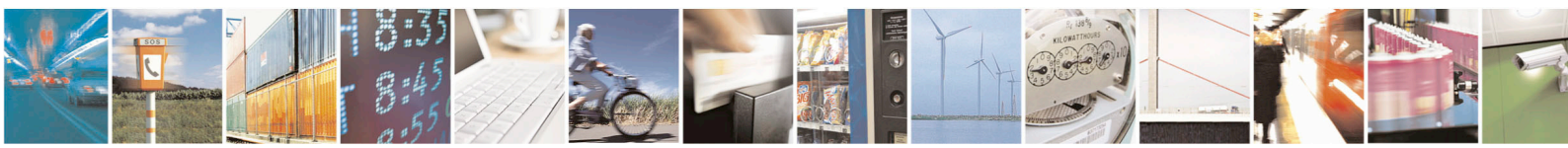
3.6.4. Turn OFF MC55/56

To turn off the MC55/MC56 there are 3 options:
• ***Normal shutdown*** *procedure*: Software controlled by sending the AT^SMSO command via the serial communication.
• ***Emergency shutdown***: Hardware driven by switching the /EMERGOFF line of the board-to-Board connector to ground = immediate shutdown of supply voltages, only applicable if the software controlled procedure fails!
• ***Automatic shutdown***:
  a) Takes effect if under voltage is detected.
  b) Takes effect if MC55/56 board temperature exceeds critical limit.

3.6.5. GC864-QUAD-C5 /RESET replacing Emergency pin in MC55/MC56

Telit /Reset pin is connected to the Emergency Pin therefore the behavior of this pin is the same as Telit /reset pin.

RESET is used to reset the module. Whenever this signal is pulled low, the module is reset. When the device is reset it stops any operation.



After the release of the reset the module is unconditionally shut down, without doing any detach operation from the network where it is registered.
This behavior is not a proper shut down because any GSM device is requested to issue a detach request on turn off. For this reason the Reset signal must not be used to normally shutting down the device, but only as an emergency exit in the rare case the device remains stuck waiting for some network response.

The RESET is internally controlled on start-up to achieve always a proper power-on reset sequence, so there is no need to control this pin on start-up. It may only be used to reset a device already on that is not responding to any command.

3.6.6. MC55/MC56 Wake-up via /RTS0 and RTS1

During the CYCLIC SLEEP modes 5, 6, 7, and 8, the /RTS0 and /RTS1 lines are conventionally used for flow control: the assertion of /RTS0 or /RTS1 indicates that the application is ready to receive data - without waking up the module.

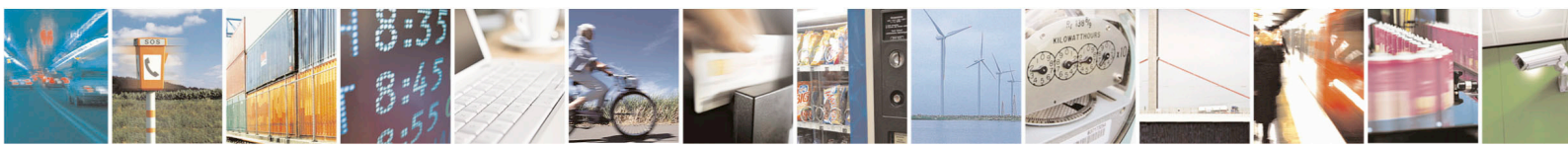
3.6.7. Turn on MC55i using the RTC (Alarm Mode)

The MC55i can power on using the RTC, which is constantly supplied from separate voltage regulator in the power supply ASIC.
The RTC provides an alert function, which allows the MC55i to wake up whilst the internal voltage regulators are off.
The PIN name is called VDDLP. It is an I/O Pin. It is recommended to supply the RTC with power, adding an external capacitor or buffer battery if no VBATT+ is applied.

Gc864-QUAD-C5 Functionality in this pin is as following:
The VRTC pin brings out the Real Time Clock supply, which is separate from the rest of the digital part, allowing having only RTC going on when all the other parts of the device is off.
To this power output a backup capacitor can be added in order to increase the RTC autonomy

NOTE:

The GC864-QUAD-C5 cannot wake the modem using RTC Interrupt.



3.7. GC864-QUAD-C5 STAT LED or RF TX Monitor option

3.7.1. GC864-QUAD-C5 STAT LED

By default the pin 13 in MAIN connector is connected to Stat led
The stat led status shows information about the network availability and call status.
The stat led usually needs an external transistor to driver an external Led.
Table 2 shows the correlation of indication and each scenario

LED status	Device Status
Permanently off	Device off
Fast blinking (Period 1s, Ton 0,5s)	Net search / Not registered / turning off
Slow blinking (Period 3s, Ton 0,3s)	Registered full service
Permanently on	a call is active

Table 2

3.7.2. MC55/MC56 SYNC PIN

SYNC pin corresponds to STAT LED function in the GC864-QUAD-C5.
As an alternative to generating the synchronization signal, the SYNC pin can be used to control a status LED.

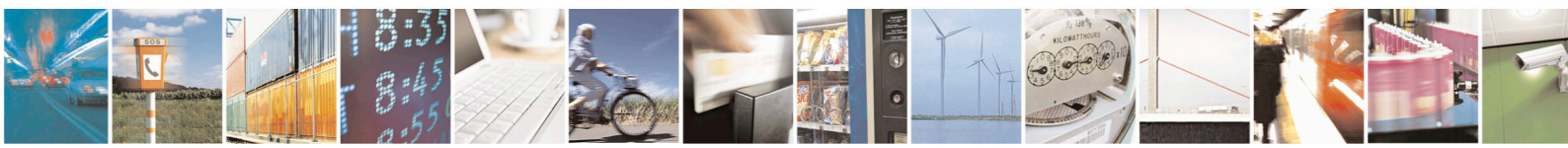
3.8. SIM CARD connectivity

The GC864-QUAD-C5 was designed to meet active high SIM Presence detect.
It can support both 1.8V and 3.0V.

MC55/MC56 can support 3.0V SIM CARD only.

MC55i can support 3.0V and 1.8V SIM CARD.

If, during startup of MC55/56, the CCIN signal on the SIM interface is high, then the status of the SIM card holder can be recognized each time the card is inserted or ejected.



NOTE:

The GC864-QUAD-C5 was designed to have the same behavior like in MC55/MC56 for CCIN Pin

3.9. UART connectivity – serial port

The serial port on the GC864-QUAD-C5 is a +2.8V UART Normal operation full UART with all the 7 RS232 signals; it differs from the PC-RS232 in the signal polarity, (RS232 is reversed). The UART are CMOS levels

Absolute Maximum Ratings –Not Functional

Parameter	Min	Max
Input level on any digital pin when on	-0.3V	+3.6V
Input voltage on analog pins when on	-0.3V	+3.0 V

Operating Range – Interface Levels (2.8V CMOS)

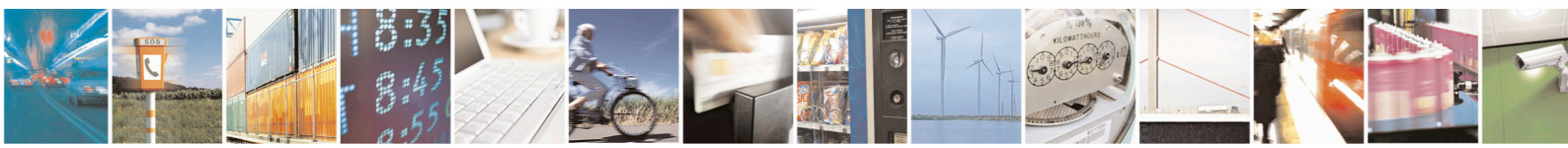
Level	Min	Max
Input high level	2.1V	3.3V
Input low level	0V	0.5V
Output high level	2.2V	3.0V
Output low level	0V	0.35V

TIP:

For a minimum implementation, only the TXD and RXD lines can be connected, the other lines can be left open provided a software flow control is implememnted.

TIP:

In order to avoid noise or interferences on the RXD lines it is suggested to add a pull up resistor (1000Kohm to 2.8V)



There is a second UART supporting TX,RX which normally use for debug and is not assembled ,it can be assembled upon customer request. Customer need to confirm with Telit that the second UART can be used for his application.

MC55/56 offers two unbalanced, asynchronous serial interfaces. The first UART is Full Flow Control; the second UART is Half Flow control. The Logic levels are 0V and 2.65V

3.10. Audio Path

3.10.1. Audio Path for GC864-QUAD-C5

- internal audio transducers → *MT/HS* (from *MicroTelephone* **or** *HandSet*)
- external audio transducers → *HF* (from *HandsFree*)
- both paths support differential options.

NOTICE:

Highlights:

- The two microphone paths have fully equivalent electrical performances

- The Echo Canceller module activate the same functionalities on both audio paths

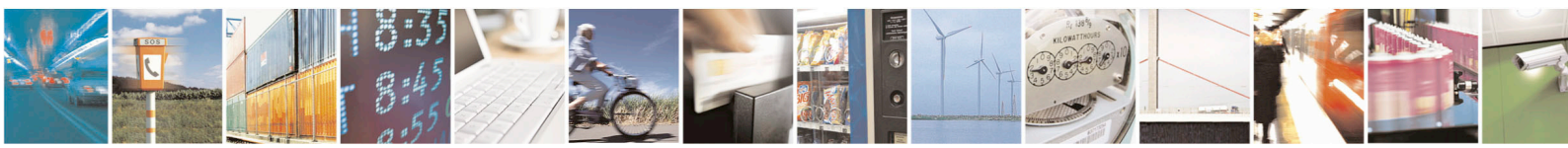
- The two speaker buffering stages offer slightly different performances (refer to Application Note 800000NT10007a)

The GC864-QUAD-C5 has DVI INTERFACE like in MC55/MC56. It is a 4 signal interface.

The DVI logic levels are:

	Min	Max	Unit
Input high level V_{IH}	1.92	3.3	V
Input low level V_{IL}	-0.2	0.55	V
Output high level V_{OH}	2.42		V
Output low level V_{OL}		0.2	V

The signals of the DVI Interface are:



Signal	Description
DVI_CLK	Data Clock
DVI_WA	Frame Synchronism (Word Alignment)
DVI_RX	Received Data
DVI_TX	Transmitted Data

3.10.2. Audio Path for MC55/MC56

- Two analog audio interfaces, each with a balanced analog microphone input and has an Analog Balanced earpiece output. The second analog interface provides a supply circuit to feed an active microphone.
- Serial digital audio interface (DAI) using PCM (Pulse Code Modulation) to encode analog Voice signals into digital bit streams.

3.10.3. AC Coupled

Audio inputs

In GC-864-QUAD-C5 hardware there are 0.1uF capacitors on MIC audio inputs in series.
Audio input lines are AC coupled,

- GC864-QUAD-C5 does not have an internal Bias to Microphone paths

WARNING:

Most applications require also bias circuits for the microphones; customer must take care of bias externally.

- **IN MC55/MC56 the Microphone Path2 Has Bias internally**
- **MIC PATH1 does not have an internal bias.**

3.10.3.1. GC864-QUAD-C5 Microphone input lines

line coupling	AC (*)
line type	Balanced
coupling capacitor	≥ 100nF
differential input resistance	50kΩ
differential input voltage	≤ 1,03V_{pp} @ *HSMicG*=0dB

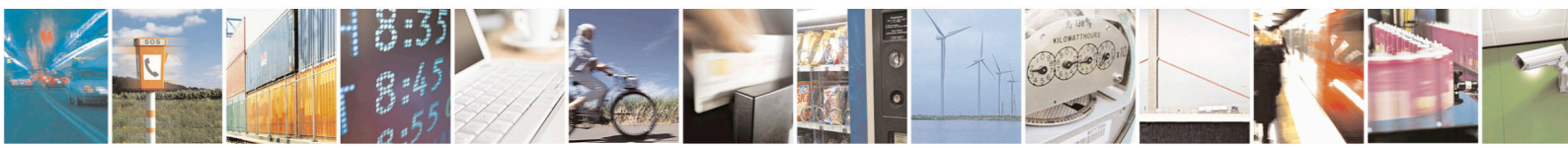


Table 2: *"Mic_MT" 1st differential microphone path*

line coupling	AC (*)
line type	Balanced
coupling capacitor	≥ 100nF
differential input resistance	50kΩ
differential input voltage	≤ 1,03V_{DD} @ *HFMicG*=0dB

Table 3: *"Mic_HF" 2nd differential microphone path*

3.10.3.2. GC864-QUAD-C5 Output lines

During the design process, remember that there are slightly different electrical performances when the load is driven directly from the internal audio amplifiers.

→ The *"Ear_MT"* lines (*EPN1* and *EPP1* from the *Differential Line-Out Drivers)* Can directly drive a ***16 Ω load*** at –12dBFS **(**)** in *Differential* configuration;

→ The "***Ear_HF***" lines (*EPPA1_2* and *EPPA2* from the *Fully Differential Power Buffers)* can directly drive a ***16Ω load*** in *Differential* or *Single Ended* Configuration.

There is no difference if the amplifiers drive an external amplifier.

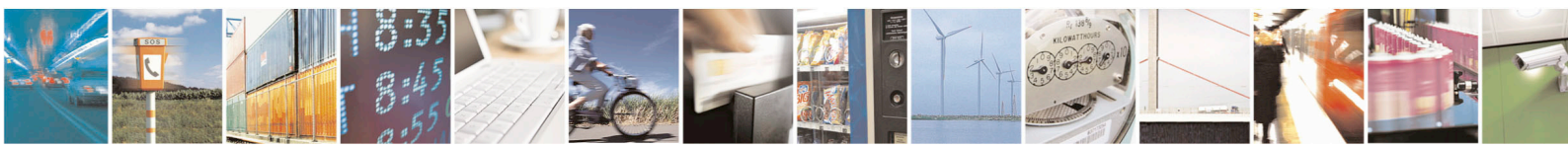
NOTE:

In GC864-QUAD-C5 we suggest to drive the loads differentially from both receive drivers, thus the output swing is doubled.
The OEM circuitry shall be designed to reduce the common mode noise typically generated on the ground plane and to get the maximum power output from the device (low resistance tracks).

(*) WARNING:

Using Single Ended configuration, the unused output line must be left open.

Not respecting this constraint, the output stage will be damaged.



line coupling:	DC differential
	AC single-ended
output load resistance :	≥ 14 Ω
internal output resistance:	4 Ω (*typical*)
signal bandwidth:	150 - 4000 Hz @ -3 dB
max. differential output voltage	1.31 V_{rms} (*typical, open circuit*)
differential output voltage *@ -12dBFS*	328mV_{rms} /16 Ω

Table 4: *"Ear_MT" Differential_Line-out Drivers*

(**) NOTICE:

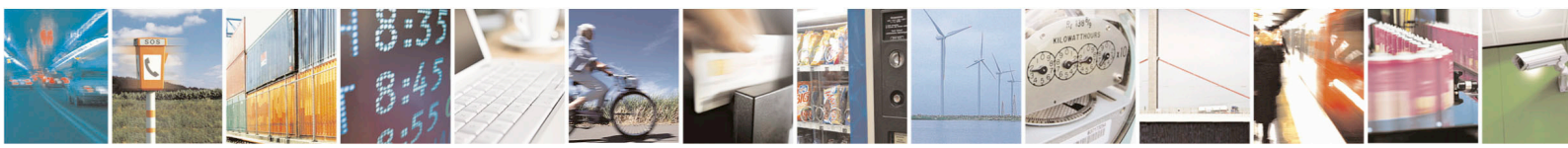
0dBFS is the normalized overall Analog Gain for each Output channel equal to *3,7*V_{pp} differential.

line coupling:	DC differential
	AC single-ended
output load resistance :	≥ 14 Ω
internal output resistance:	4 Ω (>1,7 Ω)
signal bandwidth:	150 - 4000 Hz @ -3 dB
max. differential output voltage	1.31 V_{rms} (*typical, open circuit*)
max. single ended output voltage	656 mV_{rms} (*typical, open circuit*)

Table 5: *"Ear_HF" Fully Differential Power Buffers*

3.10.3.3. MC55/MC56 Audio parameters

EPP1/2 - EPN1/2 VOmax = 3.7Vpp
MICP1 / MICN1 RI ≈ 50kΩ differential VImax = 1.03Vpp
MICP2 / MICN2 RI = 2kΩ differential VImax = 1.03Vpp



- Input voltage (peak to peak)
- MICP1 to MICN1, MICP2 toMICN2 1.03 V MAX
- Input amplifier gain in 6dB steps 0 to 42db
- Fine scaling by DSP MAX 0db
- Microphone supply voltage (MIC2 ONLY ON) , 2.65V ,2.25V ,1.85V TYP
- Microphone supply voltage off (MIC2 only OFF) = 0V

3.11. GC864-QUAD-C5 Vaux power supply

Connected on pin 13 in the ZIF Connector, attach are its characteristics

VAUX1 Power Output

A regulated power supply output is provided in order to supply small devices from the module. This output is active when the module is ON and goes OFF when the module is shut down.

The operating range characteristics of the supply are:

Operating Range – VAUX1 power supply

	Min	Typical	Max
Output voltage	2.75V	2.85V	2.95V
Output current			100mA
Output bypass capacitor (inside the module)			2.2µF

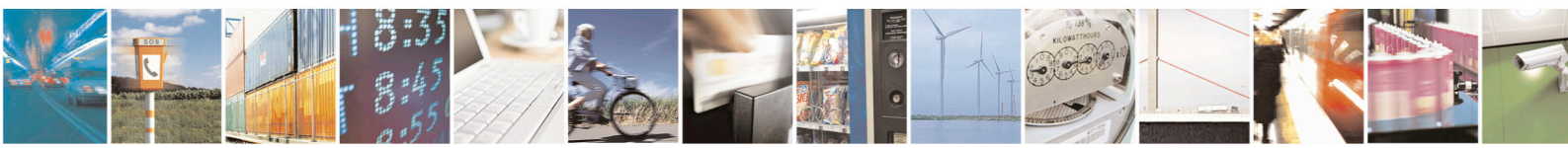
3.11.1. Vaux Replace the VDD in MC55/MC56 power supply

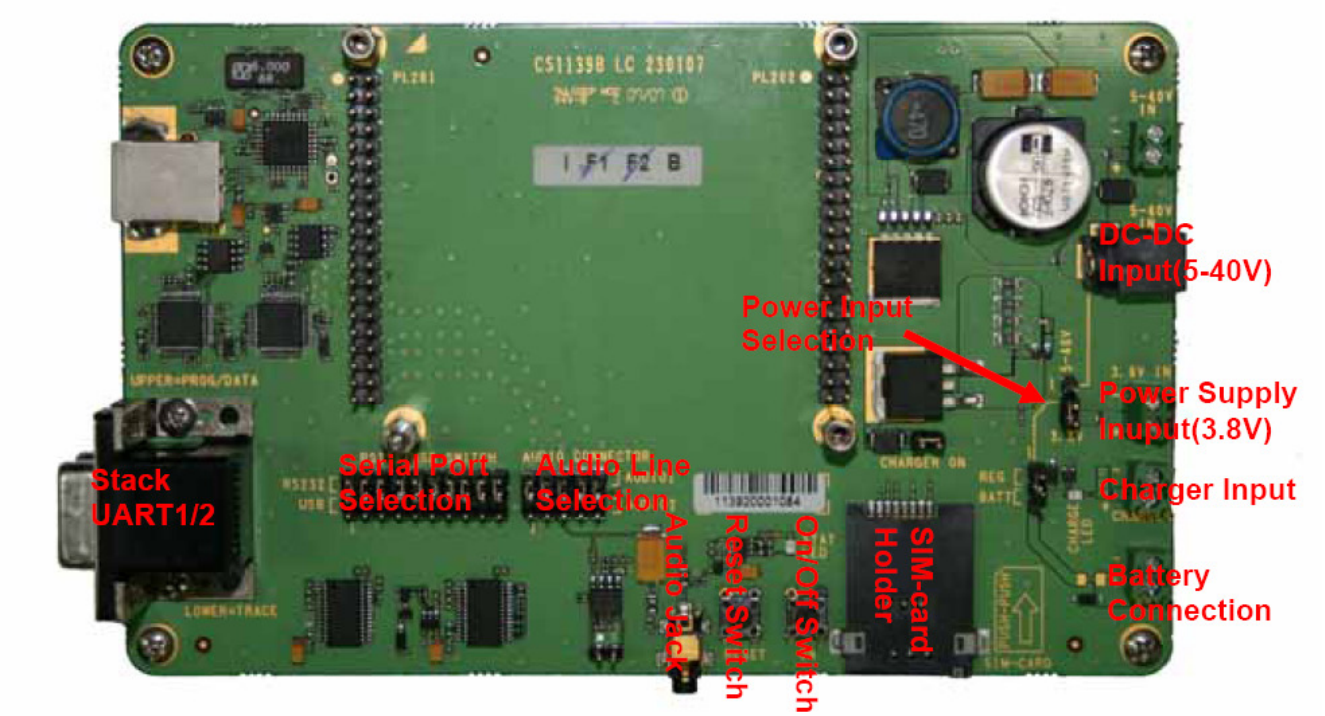
The VDD is a Supply voltage, e.g. for an external LED or level shifter.
The external digital logic must not cause any spikes or glitches on voltage VDD.
Not available in POWER DOWN mode,
VDD signalizes the "ON" state of the module.
VDDmin = 2.84V, VDDmax = 2.96V , Imax = -10mA, CLmax = 1µF

3.12. GC864-QUAD-C5 to EVK2 Connectivity

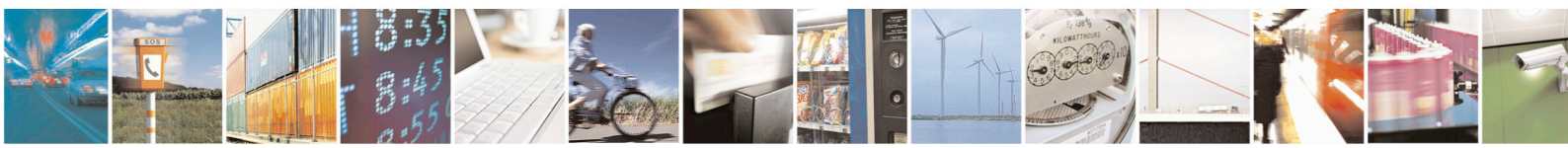
It is possible to connect C5 to EVK2 to perform functional tests, operating AT Command, making a call etc.

The HW needed for this connectivity is EVK2 which is described in the picture below

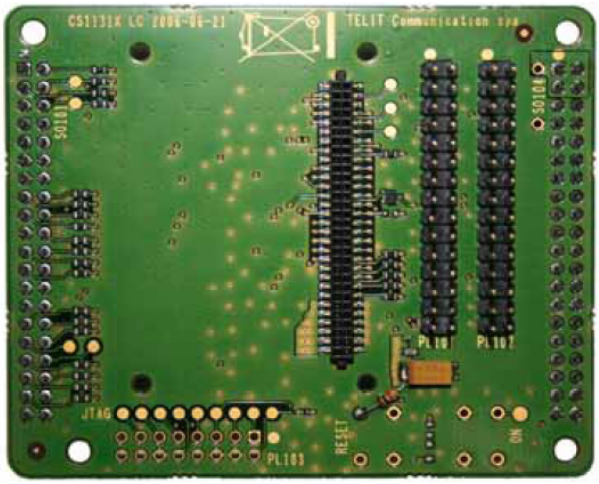




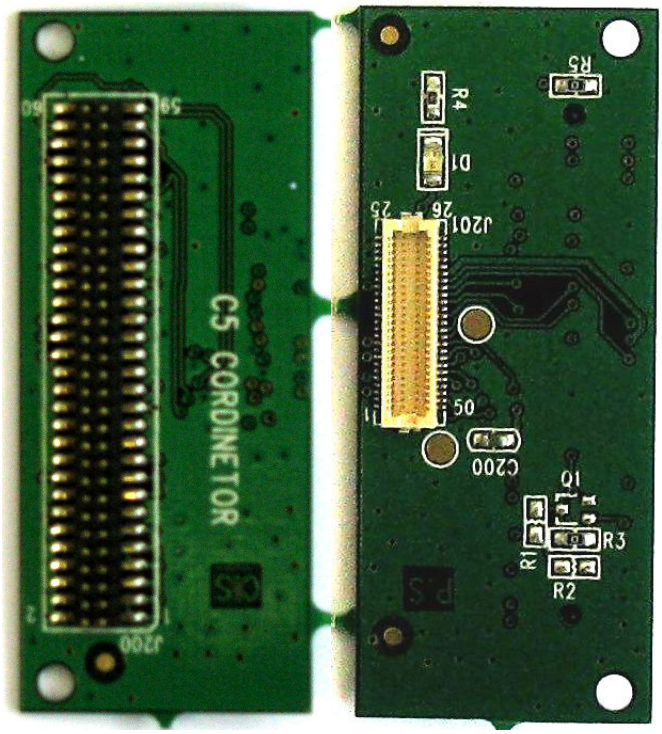
A GC864-QUAD-C2 interface board must be connected to connector PL201, PL202 of EVK2 above. This is a balcony PCB which connect to EVK2.



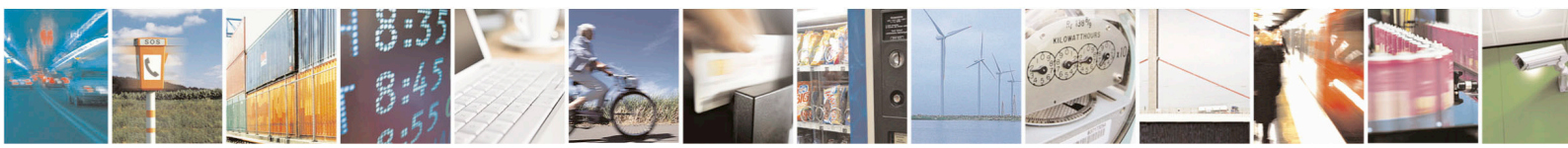
GC864-QUAD-C2 INTERFACE board picture:



On Top of The GC864-QUAD-C2 Interface board an adaptor connected for GC864-QUAD-C5 must be connected to the 80 pin Female connector on GC864-QUAD-C2 interface GC864-QUAD-C5 adaptor is small PCB both sides looks:



Using all of the PCB's described in paragraph 1.17 enabling to connect the GC864-QUAD-C5 operate it and test it

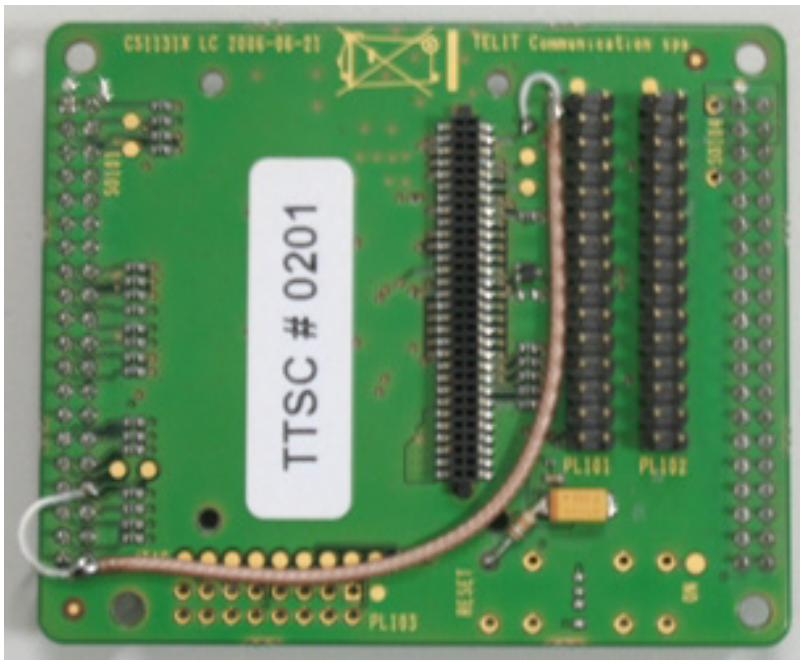


3.12.1. Audio operational with GC864-QUAD-C2 Interface board

MT PATH:
The Mic/Ear MT audio Path in the Gc864-QUAD-C5 working with GC864-QUAD-C2 interface board is differential

HF PATH:
In Hands Free (HF) path, the GC864-QUAD-C2 interface board was designed as single ended while the GC864-QUAD-C5 is differential, in order to operate the audio in differential mode at HF path, the HW must be adjust

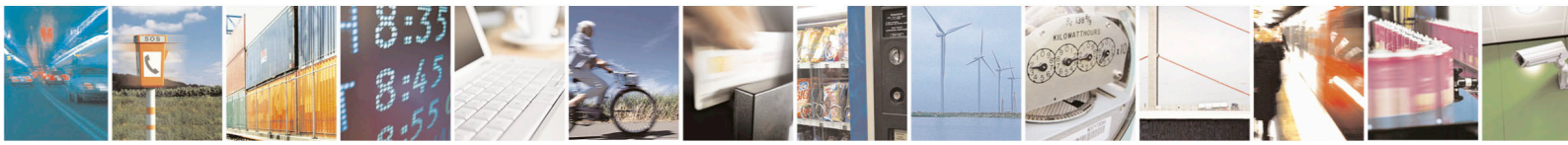
- In the adaptor R5 must be removed, it is the resistor at top corner at the Wright picture
- In GC864-QUAD-C2 a coaxial cable must be connected between two tests point as in the picture below;



- Doing this connection will change the HF Microphone path from single ended to Differential mode

- TP103 in the GC864-QUAD-C2 Interface board need to be connect to TP107 the cable must be Coaxial and connected both sides to ground

At speaker HF path adjustment must be done as well:



- TP102 must be connected to TP106 connection via coaxial cable as well

The adjustment above mentioned in paragraph 1.17.1 will change the Mode of the HF (Hands Free) path from single ended to differential mode.

These modifications will enable operating the HF audio mode with good performance

3.13. Abbreviation symbols

BOM	Bill Of Materials
GPIO	General Purpose Input / Output
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
IO	Input / Output
RF	Radio Frequency
RX	Receive
TX	Transmit
TBD	To Be Defined
N.C	Not connected
GND	Ground
DVI	Digital voice interface