CC864-DUAL Hardware User Guide

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Making machines talk.

Notice

OEM integrators and installers are instructed that the phrase. This device contains transmitter FCC ID: RI7CC864-DUAL must be placed on the outside of the host.

	Warning: Exposure to Radio Frequency Radiation The radiated output power of this device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should not be less than 20cm during normal operation. The gain of the antenna for Cellular band must not exceed -2.0dBi. The gain of the antenna for PCS band must not exceed -3.0dBi.

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Such changes will, nevertheless be incorporated into new editions of this document.

Printed in the US

Contents

1. Introduction

1.1. Scope

This document describes hardware solutions you can use to develop a product containing the Telit CC864-Dual module, as follows:

- Describing the basic functions of the module
- Suggesting a proper hardware solution for each function
- Describing the wrong solutions and most common errors to be avoided

This document is not intended to provide an overall description of all hardware solutions and all the products that may be designed.

The solutions suggested serve as a guide or starting point for you to be able to correctly develop a product with the Telit CC864-Dual module.

However, avoiding the wrong solutions and most common errors described here should be regarded as mandatory.

1.2. Audience

This manual is intended for hardware developers who design products that integrate the CC864-DUAL module.

1.3. Contact Information, Support

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).

1.4. Product Overview

The CC864-Dual module is a CDMA-1XRTT wireless module designed to have the same form, fit and function as its GSM/GPRS counterpart product family, the GC864-Dual.

This enables integrators and developers to design their applications once and take advantage of the global coverage and service flexibility allowed by the combination of the most prevalent cellular technologies worldwide.

With its ultra-compact design and extended operating temperature range, the Telit CC864-Dual module is the perfect platform for m2m applications, mobile data and computing devices. It also incorporates gpsOne capability for applications in mobile environments such as telematics, personal and asset tracking.

1.4.1. General Specifications

Parameter	Description
External access	Code division multiple access

CDMA protocol	CDMA2000 1x Rel A and Rel B
Data Rate	153.6 Kb/s (full-duplex)
GPS	SGPS / standalone
Vocoder	EVRC, 13kQCELP, 4GV
Operating temperature	-30° ~ +80°

1.4.2. Receiver Specifications

Parameters	Descriptions
Frequency range	Cellular: 869~894 MHz PCS: 1930~1990 MHz
Channel number	Cellular: 832 PCS: 1200
Sensitivity	Better than -104 dBm
Input dynamic range	-25dBm ~ -104 dBm

1.4.3. Transmitter Specifications

Parameters	Descriptions
Frequency range	Cellular: 824~849 MHz PCS: 1850~1910 MHz
Channel number	Cellular: 832 PCS: 1200
Power class	Cellular: Class III PCS: Class II
Power range	0.2 W (23 dBm) ~ 0.63 W (28 dBm)
Nominal power	0.27 W (24.31 dBm)

1.4.4. gpsOne Receiver Specifications

Parameters	Descriptions
Frequency range	L1, 1575.42 MHz
Receiver sensitivity	-151 dBm

1.5. Safety Recommendations

1.5.1. Local regulations

Make sure that the use of this product is allowed in the country and in the environment required.

The use of this product may be dangerous and thus must be avoided where:

- It can interface with other electronic devices in environments such as hospitals, airports, and so on.
- There is risk of explosion such as in the proximity of gasoline, oil refineries, and so on.

You are responsible to enforce country and specific environment regulations on the product. For further details refer to Chapter 1.7 for related documents.

1.5.2. Wiring and Installation

Always follow the instructions of this guide when wiring the product.

The product must be supplied with a stabilized voltage source, and the wiring must conform to security and fire prevention regulations.

The installation of the external components of the module must be handled with care in order to ensure the proper functioning of the product.

1.5.3. Electrostatic Discharge

The product must be handled with care, avoiding any contact with the pins because electrostatic discharge can damage the product.

1.5.4. R-UIM Card

The R-UIM card must also be handled with care, always following the instructions for its use.

Do not insert or remove the R-UIM when the product is in power saving mode.

1.5.5. Antennas

Every module must be equipped with a proper antenna with specific characteristics.

The antenna must be installed with care in order to avoid any interference with other electronic devices, and it must also have a minimum distance of 20 cm from the body.

In case this requirement cannot be satisfied, the system integrator must assess the final product against the applicable SAR regulations.

1.5.6. Disassembly

Do not disassemble the product.

Any evidence of tampering will void the warranty.

1.6. Document Organization

This manual contains the following chapters:

"Chapter 1: Introduction" provides a scope for this manual, target audience, contact and support information, and text conventions.

"Chapter 2: Mechanical Specifications" contains information on the dimensions of the module, the interface connector and the RF connector, and on how to include the module into external applications.

"Chapter 3: Hardware Interface Description" describes the hardware interfaces of the product and provides guidelines for using the module in various applications.

"Chapter 4: Development and Testing" provides information on how to connect the module to the Telit Evaluation Kit (EVK).

"Chapter 5: Acronyms and Abbreviations" provides definition for all the acronyms and abbreviations used in this guide.

"Appendix: Pin Allocation" specifies the allocation of the pins on the connector that is used for connecting the unit with external applications.

1.7. 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.

1.8. Related Documents

The following documents are related to this user guide:

- CC864-DUAL Product Description – (Doc No)
- CC864-DUAL Software Description – (Doc No)

1.9. Document History

Doc rev #	Date	Changes	Location in Guide
0.3	01.03.2008	First version for Peer review	
0.4	04.03.2008	Updates after review	

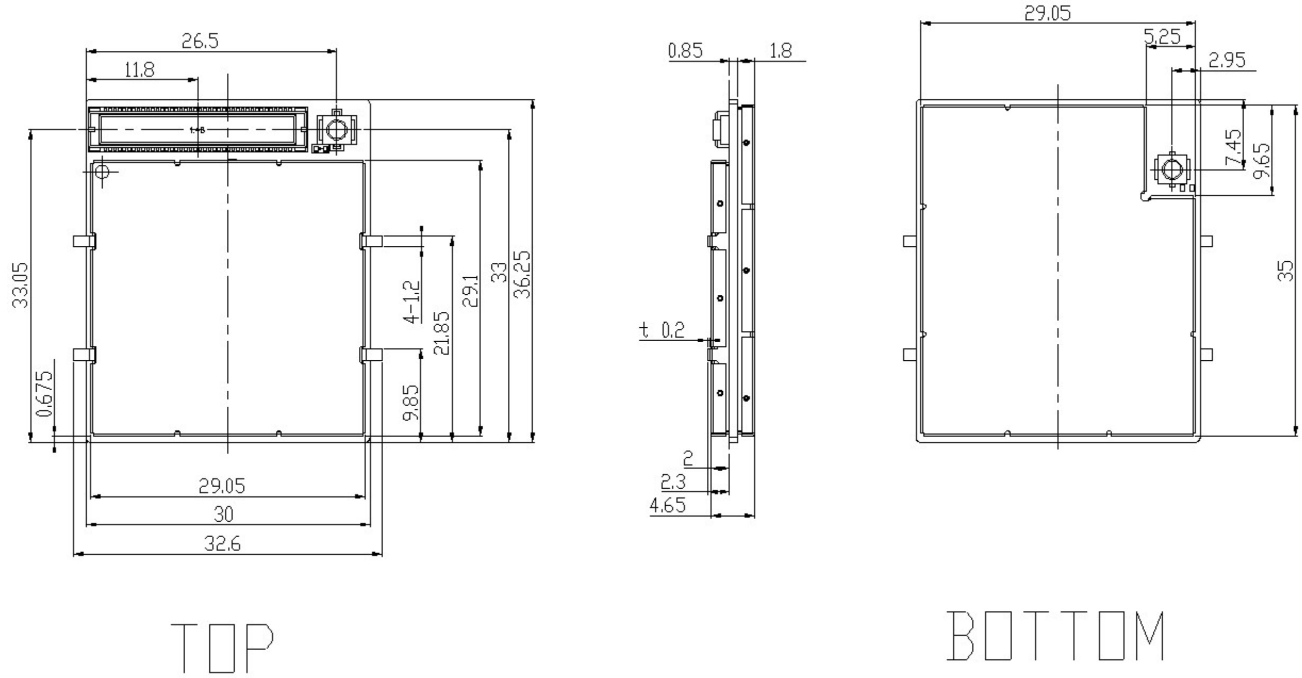
2. Mechanical Specifications

2.1. Module Dimensions

The CC864-DUAL overall dimensions are:

Length:	36.25 mm
Width:	30.00 mm*
Thickness:	4.65 mm*

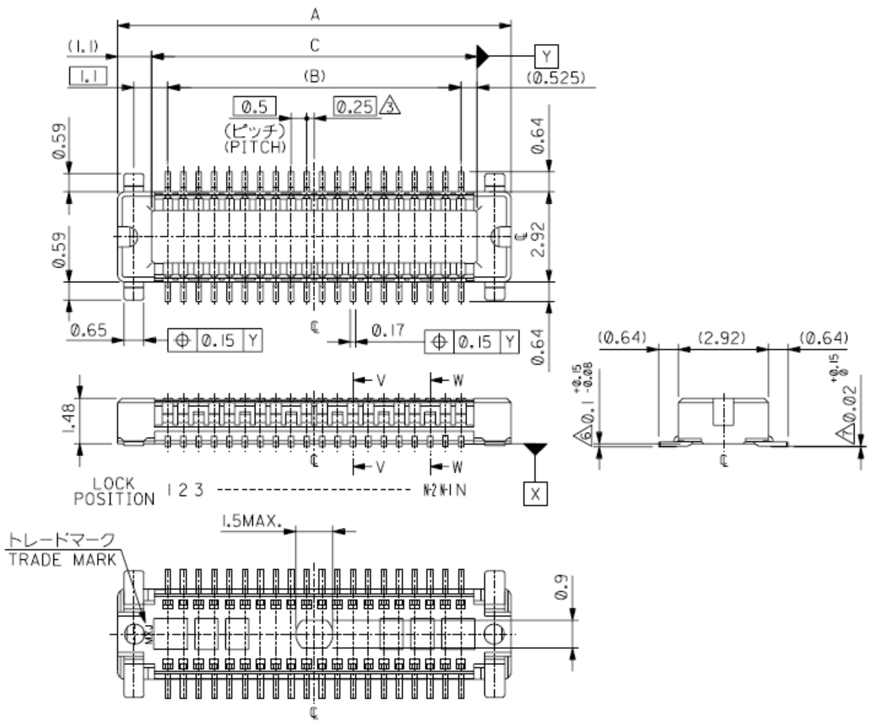
*) Excluding solder pads.



2.2. Interface Connector Specifications

The CC864-Dual module is equipped with a Molex 80-pin board-to-board connector and P/N 0539490878 (male).

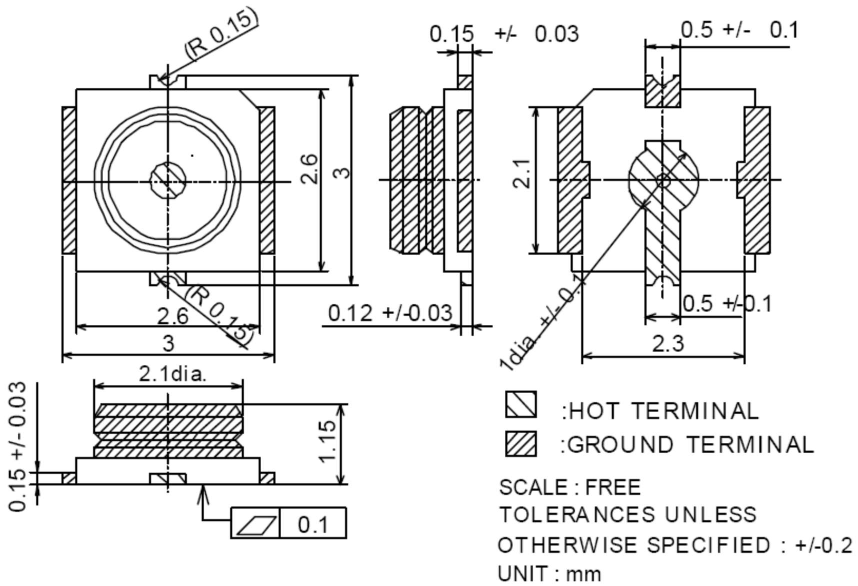
The mating part is Molex P/N 0541500878 (female).



2.3. RF Connector Specifications

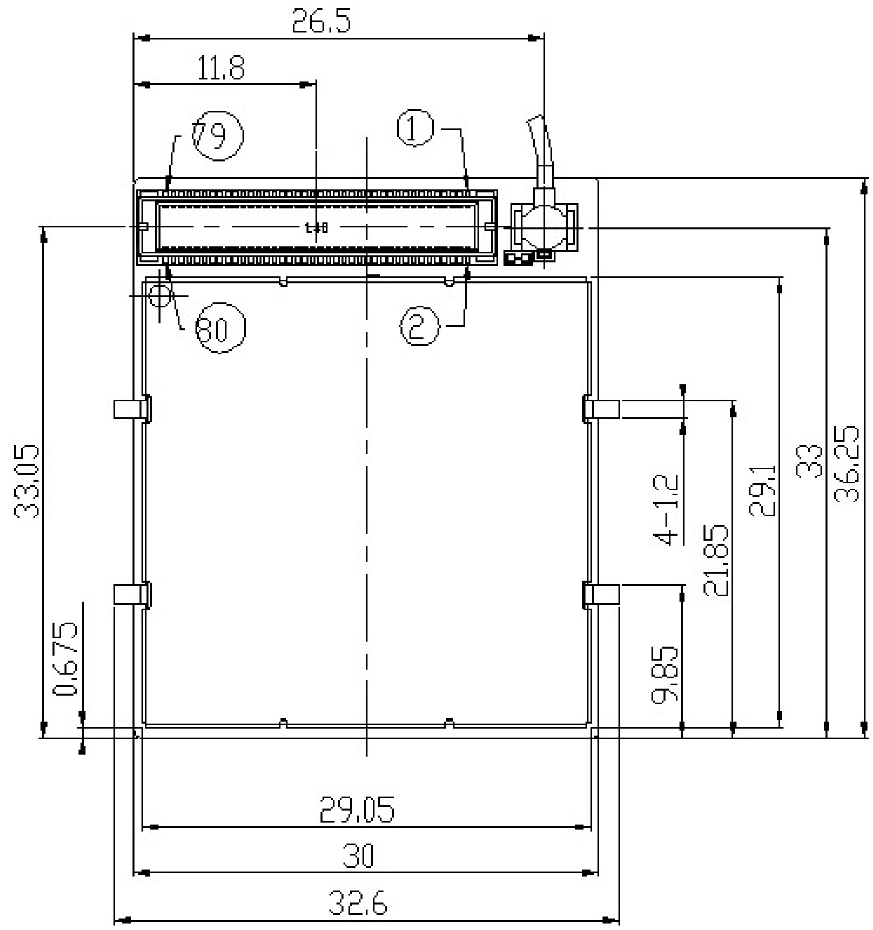
The CC864-Dual module is equipped with a Murata GSC type 50 Ohm RF connector, and P/N MM9329-2700.

The suitable counterpart is Murata MXTK92 type or MXTK88 type connector.



Mounting

The figure below shows the position of the Molex board-to-board connector and pin 1.



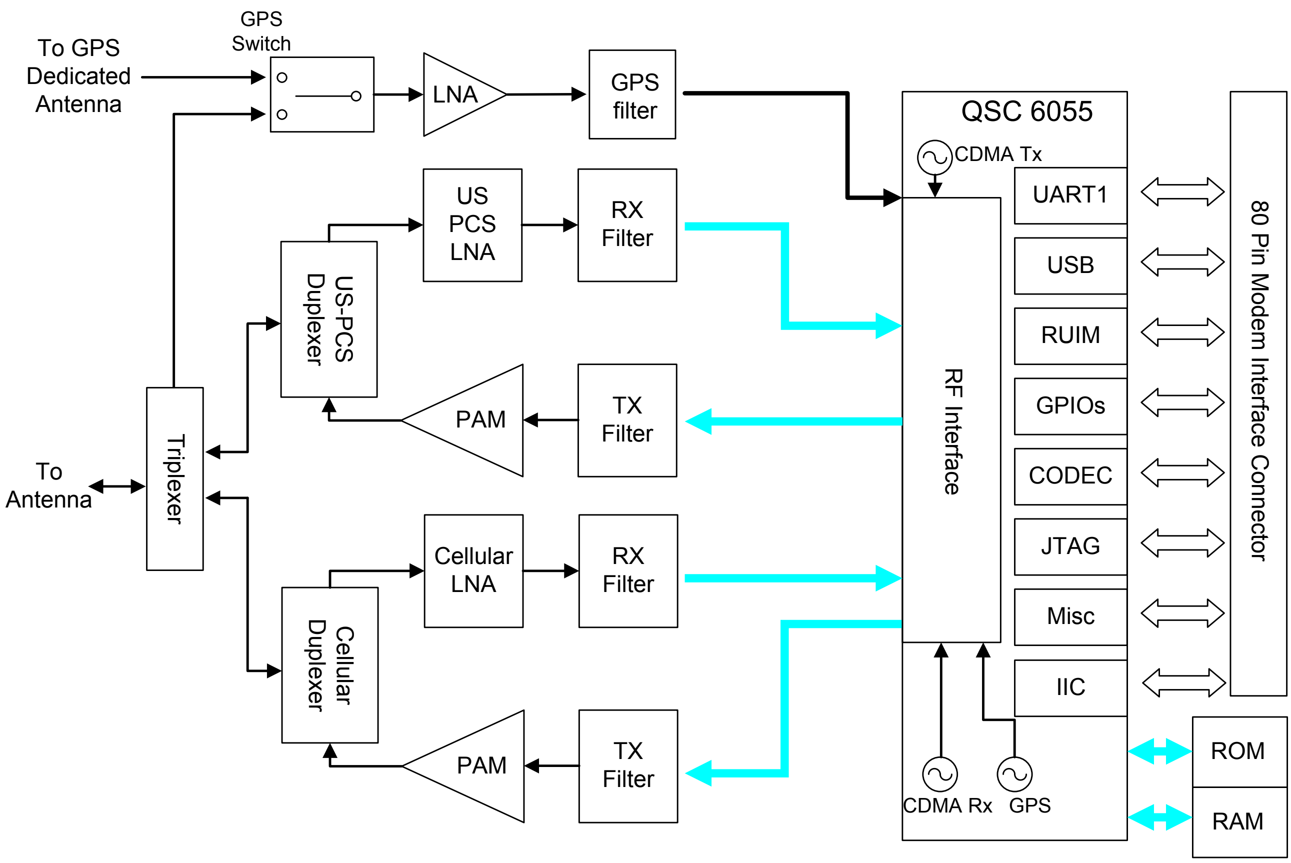
Tip: It is highly recommended to maintain a 1.5mm clearance from all wireless modems to any components, including around the solder tabs.

3. Hardware Interface Description

3.1. Overview

The CC864-Dual module has the following main interface function blocks:

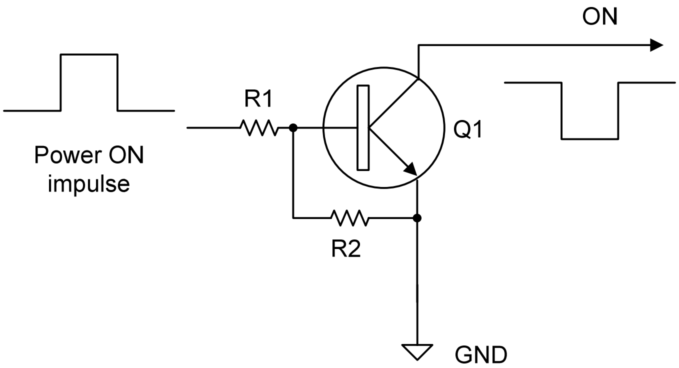
- UART1 (used for AT commands)
- USB (used for diagnostic monitoring)
- R-UIM (UART2)
- GPIOs
- Audio (includes Analog I/O audio codecs and PCM interface)
- JTAG
- Miscellaneous pins (including I^2C)



3.2. Functions for Turning On and Off the Module

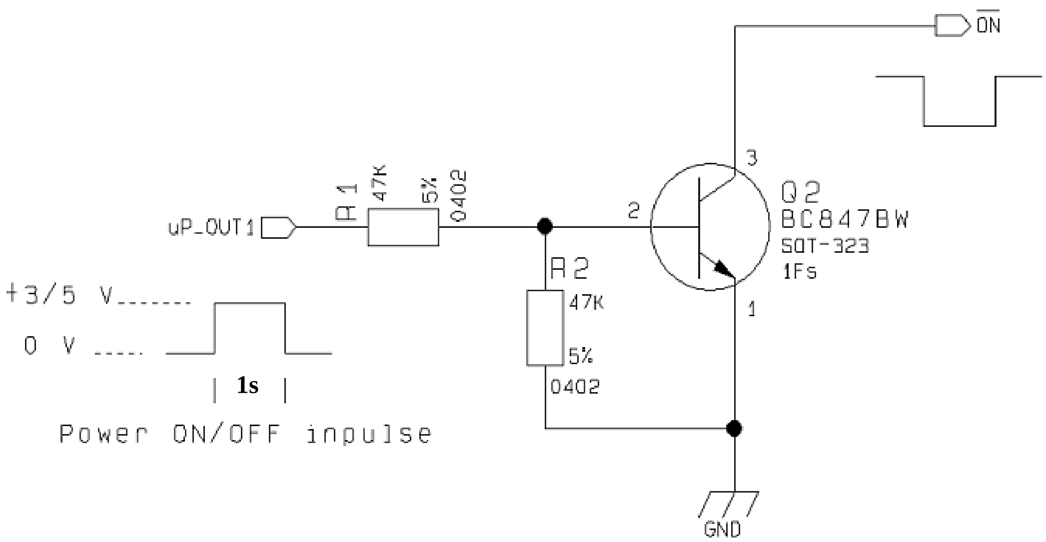
3.2.1. Turning On the CC864-Dual Module

To turn on the module the ON/OFF Pin must be tied for at least one second, and then released.

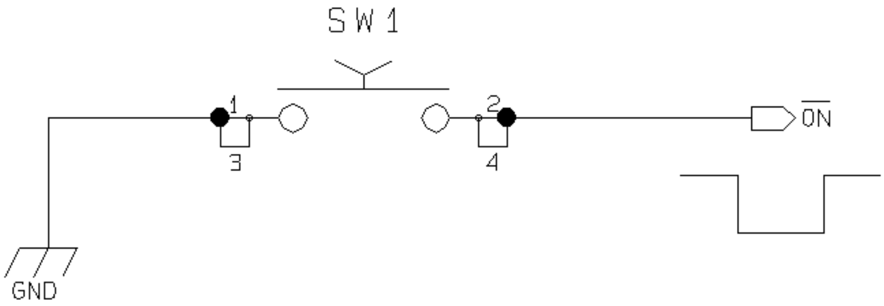


A Few Examples

1) Let's assume you need to drive the ON_OFF pin with a totem pole output of a +3/5 V microcontroller (uP_OUT1):



2) Let's assume you need to drive the ON_OFF pin directly with an ON/OFF button:



3.2.2. Turning Off the CC864-Dual Module

You can turn off the device with either a software command or a hardware shutdown circuit.

When the device is shut down either way, it issues to the network a detach request with the information that the device is not reachable any more.

Warning: Never disconnect power before the power off procedure is completed. If you do, this may cause severe damage the module primarily due to the possibility of memory corruption that renders the module inoperable.

3.2.2.1. Hardware Shutdown

To turn off the CC864-Dual module the ON/OFF Pin must be tied for at least one second, and then released.

The same circuitry and timing as for power on must be used for be used for powering off the module.

The device shuts down after you release the ON_OFF Pin.

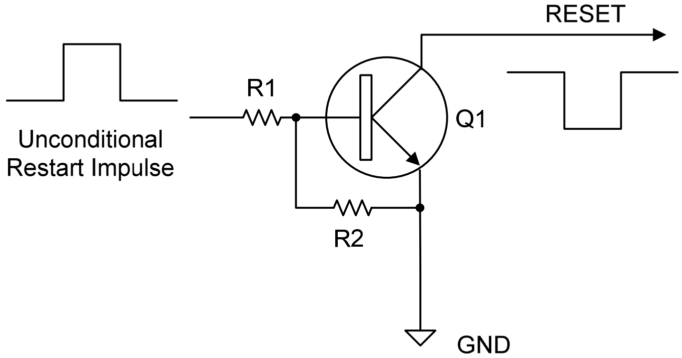
3.2.2.2. Software Shutdown

Please refer the “Software User Guide” for information on how to shut down the module using AT-commands.

3.2.3. Hardware Reset

To perform hardware reset and reboot the module, the RESET pin must be tied low for at least 200 milliseconds, and then released.

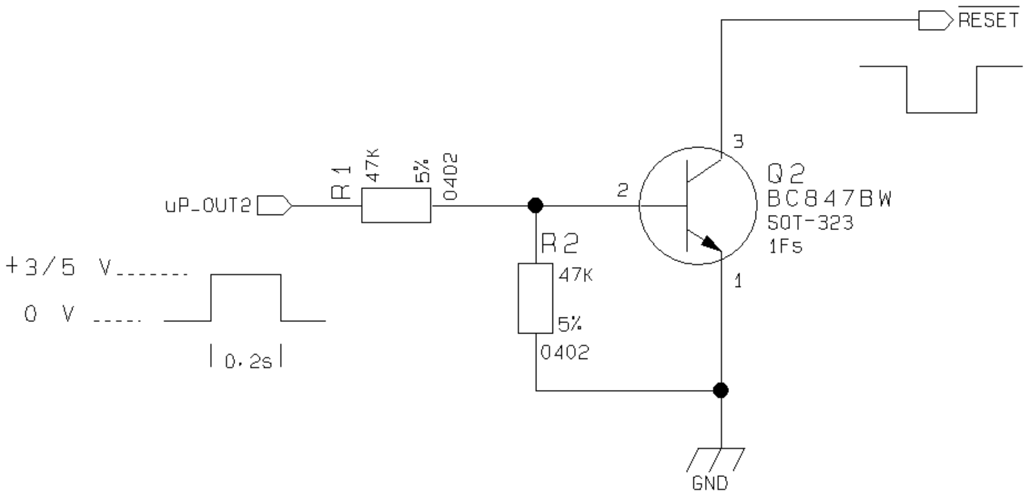
The following figure shows a sample circuit to accomplish this operation:



TIP: A hardware reset circuit should be always implemented on the host board but the host should use it as an emergency reset procedure only.

Example

Let's assume you need to drive the RESET# pad with a totem pole output of a +3/5 V microcontroller (uP_OUT2):



3.3. Power Supply

The electrical design of the power supply strongly depends on the power source from which the power is drained. We will discuss the following three common categories:

- +5V input source supply (typically PC internal regulator output)
- +12V input source supply (typically automotive)
- Battery source supply

3.3.1. +5V Input Source Power Supply Design Guidelines

The desired output for the power supply is 3.8V, hence there's not a big difference between the input source and the desired output and a linear regulator can be used. .

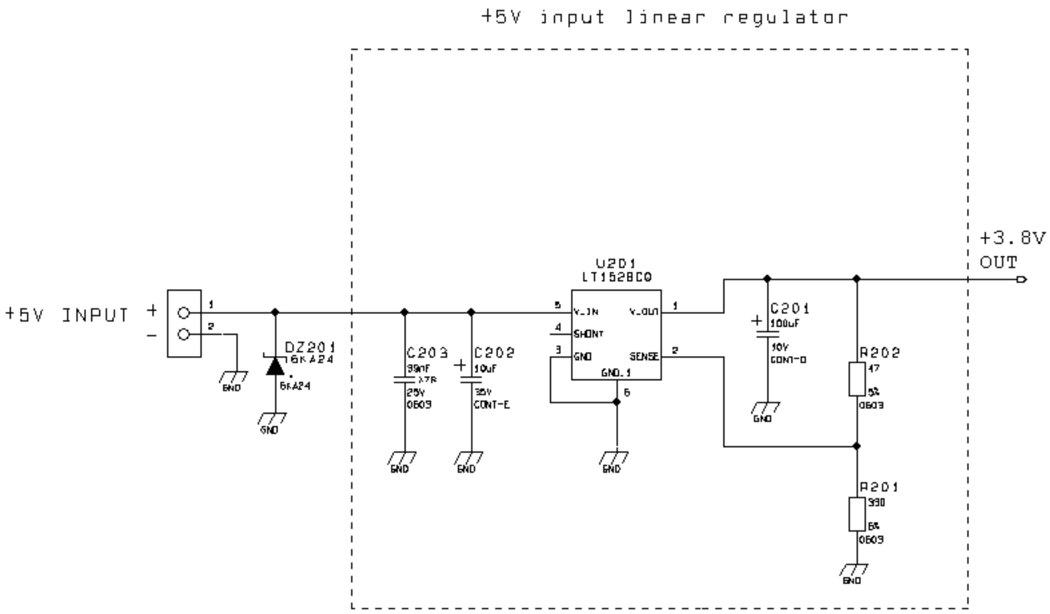
When using a linear regulator, a proper heat sink may be required in order to dissipate the heat.

A bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks close to the CC864-Dual module, a 100µF tantalum (or equivalent) capacitor is suited for this purpose.

Make sure the low ESR capacitor on the power supply output (usually a tantalum) is rated at least 10V.

A protection diode should be inserted close to the power input, in order to protect the module from power polarity inversion.

A typical example of a linear regulator with 5V input is:



3.3.2. +12V Input Source Power Supply Design Guidelines

The desired output for the power supply is 3.8V, and due to the large difference between the input voltage and the desired output, a linear regulator is not well suited and should not be used. A switching power supply is preferred because of its better efficiency with the 2A peak current load drawn by the CC864-Dual module.

When using a switching regulator, a 500 KHz or more switching frequency regulator is preferable because of its smaller inductor size and faster transient response. This allows the regulator to respond quickly to current peaks.

In any case the frequency and switching design selection is related to the application to be developed due to the fact the switching frequency could also generate EMC interferences and the application must also take this into account.

For a car PB battery the input voltage can rise up to about 16V and when choosing components, all components in the power supply must withstand this voltage.

Power supplies for automotive use are complicated and have to take a number of issues into account, such as: over voltage, reverse polarity, cranking, load dump booster batteries, forced charging etc

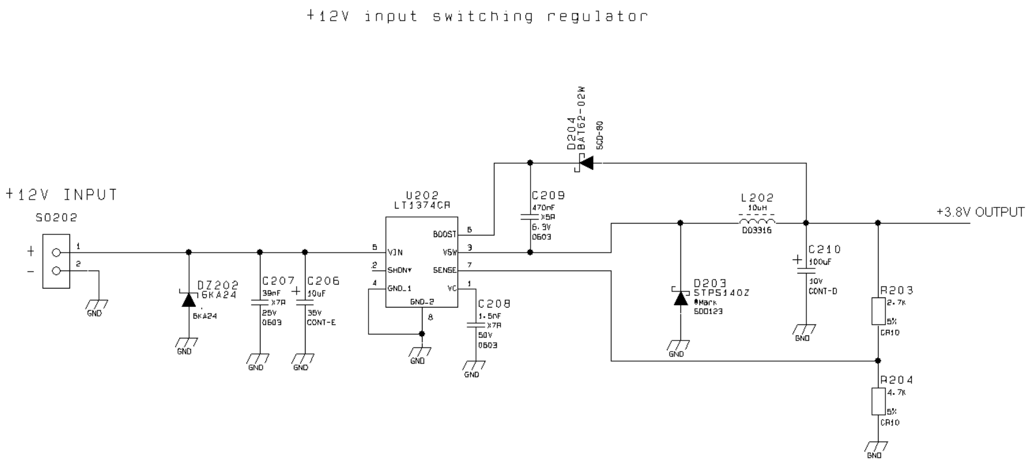
A bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks; a 100µF tantalum (or equivalent) capacitor is suitable for this purpose.

Make sure the low ESR capacitor on the power supply output (usually a tantalum) is rated at least 10V.

For car applications a spike protection diode must be inserted close to the power input, in order to clean the supply from spikes and a specific automotive grade regulator is recommended.

A protection diode (which can be the same diode as in spike protection) must be inserted close to the power input in order to save the CC864-Dual module from power polarity inversion.

A typical example of a switching regulator with 12V input is:



3.3.3. Battery Source Power Supply Design Guidelines

The desired nominal output for the power supply is 3.8V and the maximum voltage allowed is 4.2V, so that a single 3.7V lithium-ion cell battery type is ideal to supply the power to the module.

Three regular battery cells (Ni/Cd or Ni/MH 3.6V nom. battery types or 4V PB types) must **not** be used directly because their maximum voltage can rise over the absolute maximum voltage for the CC864-Dual module and damage it.

Warning: DO NOT USE any Ni-Cd, Ni-MH or Pb battery types directly connected to the module! Their use can lead to overvoltage and damage the module. USE ONLY Li-Ion battery types.

A bypass low (usually a 100uF tantalum) ESR capacitor with adequate capacity must be provided in order to cut the current absorption peaks. Make sure the low ESR capacitor (usually a tantalum) is rated at least 10V.A protection diode must be inserted close to the power input, in order to protect the module from voltage polarity inversion.

The suggested battery capacity is from 500mAh to 1000mAh.

3.3.4. Battery Charge Control Circuitry Design Guideline

The CC864-Dual module provides support circuitry for charging a lithium-ion battery, utilizing four firmware-controlled charging modes:

- Trickle charging
- Constant current charging
- Constant voltage charging
- Pulsed charging

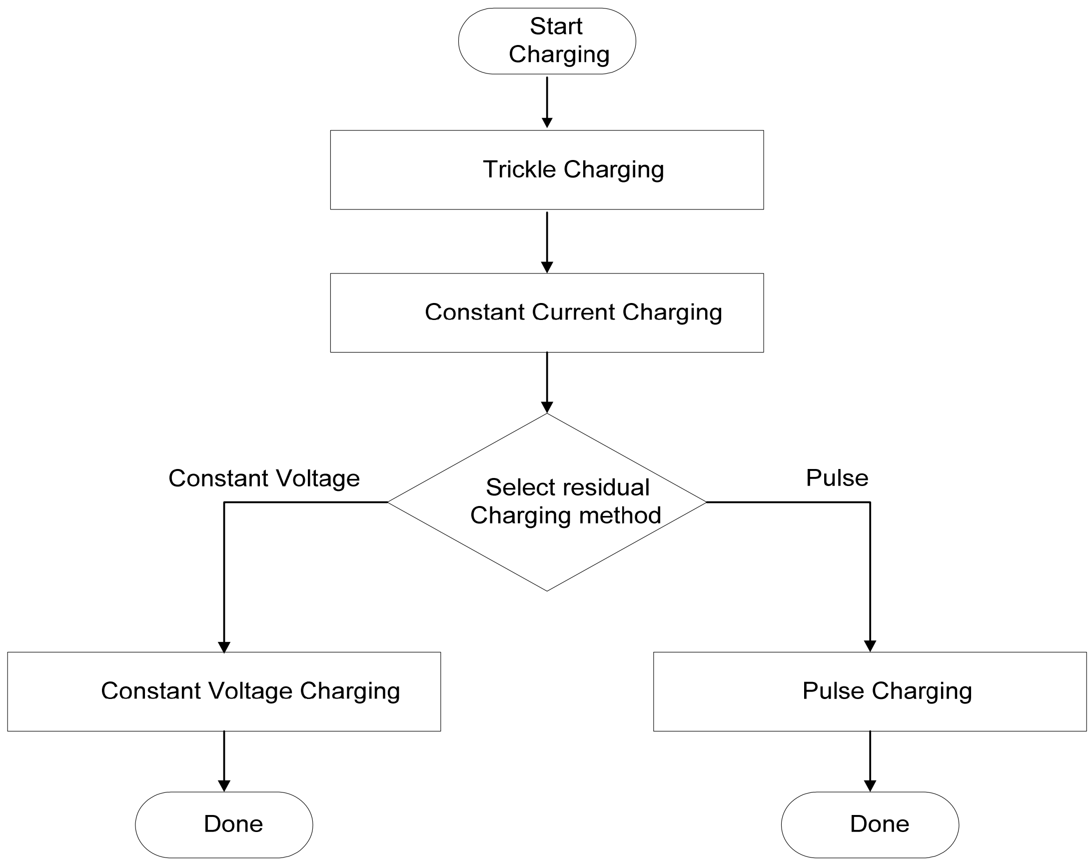
Battery voltage, external supply voltage, and total detected current measurements are available to the module firmware through the analog multiplexer, which allow the module firmware to monitor charging parameters, make decisions, and control the charging process.

Note: This process is completely transparent to the application and is controlled by the module firmware; it is described below for completeness and battery selection purposes only.

- Charging begins with trickle charging, which limits the current and avoids pulling the VDD down.
- Once a minimum battery voltage is established using trickle charging, constant current charging is enabled by the firmware in order to charge the battery quickly (this mode is sometimes called fast charging).
- When the Li-ion battery approaches its target voltage (through constant current charging), the charge is completed using either constant voltage or pulse charging.

Further description of all charging modes is provided in the sections below.

The following figure illustrates the main battery charging sequence.



3.3.4.1. Trickle Charging

The module firmware and power management circuitry provides trickle charging of the main battery when powered from VDD.

This mode is used by the module to raise a severely depleted battery's voltage to a level sufficient to begin fast charging.

Attempting fast charging with a high-current supply on a deeply discharged battery, would cause the battery do draw excessive current, pull the VDD voltage down, and possibly cause a module malfunction or shutdown due to an under-voltage lockout condition.

In order to avoid these problems, the module provides a constant, low-current charging mode: trickle charging.

Trickle charging is used by the module firmware until the main battery reaches a predefined desired threshold, which is usually about 3.0V for Li-ion batteries.

The threshold varies with battery type and application, so there is no predefined value implemented in the detection circuits.

The firmware stops the trickle charging based on battery voltage measurements and battery type.

3.3.4.2. Constant Current Charging

The Module firmware supports constant current charging of the main battery.

During constant current charging the battery is charged with a constant current of 600mA.

As the battery voltage rises and approaches its desired value of 4.2V the charging current begins to decrease, indicating the end of constant current charging and the beginning of residual charging.

The charging firmware monitors the voltage and takes the appropriate action to terminate the constant current charging mode. Charging continues with residual charging (either constant voltage or pulsed).

Note: In this application the charging firmware limits the charging current to 600mA.

3.3.4.3. Constant Voltage Charging

Once constant current charging of the lithium-ion battery is finished, the charging continues using either constant voltage or pulsed techniques.

Constant voltage charging is similar to the constant current mode:
The battery voltage is constant while the charging current decreases exponentially for the remaining charging process.

The end of the constant voltage charging is typically detected by allowing voltage operation for a pre-determined duration beyond crossing the VBATDET threshold in the internal charger IC (lasting for one and a half or two hours).

The firmware limits the predetermined duration, not allowing charging to continue indefinitely, because charging for too long can damage the battery.

3.3.4.4. Pulse Charging

Pulse charging is implemented by switching the pass transistor on the internal charger IC on and off.

The module and external electronics must draw minimal current so the battery's open circuit voltage can be measured accurately during the off interval.

Pulse charging, compared to constant voltage charging:

- Provides better voltage accuracy
- Reaches full charge more quickly
- Dissipates less transistor power when switching from constant current charging

Pulse charging is enabled through firmware control, and it uses the same hardware as constant current or constant voltage charging, but repetitiously opens and closes the pass transistor to deliver current pulses to the battery

One purpose of pulsed operation is to check and recheck the battery's open circuit voltage, confirming a full charger before terminating the process.

3.3.5. Thermal Design Guidelines

The thermal design for the module and its power supply needs to take the following parameters into account:

Average current consumption during transmission at Max level (23~24dBm)	Cellular : 500mA PCS : 580mA
Average current consumption during transmission at Min level (-50dBm)	Cellular : 130mA PCS : 140mA
Average current during Idle mode (when receiver circuit is on, transmitter circuit is off)	100mA
Average current during sleep mode when receiver/transmitter circuits are off, only baseband circuit is on)	1mA
Average current during hibernation mode (All circuits are off except alarm circuit)	2.6uA

NOTE: The average current consumption during transmissions depends on the power level at which the device is requested to transmit by the network.

Hence, the average current consumption varies significantly.

Considering the very low current during idle and sleep time, especially when the power saving function is enabled, from a thermal point of view ,it is possible to estimate that the device only draws significant current during calls.

An Example

If the device stays in transmission for a few minutes and then remains idle for an hour, the power supply always has the time to cool down between the calls. The heat sink can then be smaller than the calculated 700mA maximum RMS current, or there can be no heat sink (simple chip package).

In average network conditions, the device is requested to transmit at a lower power level than the maximum, and thus the current consumption is less than 700mA.

For these reasons, the thermal design is rarely a concern and the using the ground plane where the power supply chip is placed as the heat sink can be enough to ensure good thermal conditions and avoid overheating.

The generated heat is primarily conducted to the ground plane under the module and the ambient air by convection, so you must ensure that your application can dissipate the heat as required.

3.3.6. Power Supply PCB Layout Guidelines

Telit recommends that the power supply for the CC864-DUAL module to be designed to meet the higher demands of a GSM/UMTS module.

The power supply will be slightly over-dimensioned for a CDMA module, but will allow for the easy transition to another technology, if need be (GSM/UMTS 2A vs. CDMA 1A peak current consumption).

The power supply implementation must have a low ESR capacitor on the output to smooth the current peaks and should include a protection diode on the power supply input to protect the supply from spikes and polarity inversion.

The placement of these components is crucial for the correct operation of the circuitry and application.

A misplaced component can be ineffective or even decrease the power supply performance:

- The Bypass low ESR capacitor must be placed close to the module power input pads or in the case the power supply is a switching type it can be placed close to the inductor to cut the ripple provided the PCB trace from the capacitor to the module is wide enough to ensure no voltage drops during the transmission current peaks.
- The protection diode must be placed close to the input connector where the power source is drained.
- The PCB traces from the input connector to the power regulator IC must be wide enough to ensure no voltage drops occur during the transmission current peaks.
  (GSM/UMTS specific consideration) Note that this is not made in order to save power loss but especially to avoid the voltage drops on the power line at the current peaks frequency of 216 Hz that will reflect on all the components connected to that supply, introducing a noise floor at the burst base frequency. For this reason, while a voltage drop of 300-400 mV may be acceptable from the power loss point of view, the same voltage drop may not be acceptable from the noise point of view.
  If your application doesn't have audio interface but only uses the data feature of the GSM /UMTS Wireless Modem, then this noise may not be so disturbing and power supply layout design can be more forgiving.
- The PCB traces to module and the Bypass capacitor must be wide enough to ensure no significant voltage drops occur during the GSM 2A/CDMA 1A current peaks.
  This is for the same reason as the previous point. Try to keep this trace as short as possible.
- The PCB traces connecting the Switching output to the inductor and the switching diode must be kept as short as possible by placing the inductor and the diode very close to the power switching IC (only for switching power supply). This is done in order to reduce the radiated field (noise) at the switching frequency (usually 100-500 kHz).
- The use of a good common ground plane is suggested.
- The placement of the power supply on the board should be done in such a way to guarantee that the high current return paths in the ground plane are not overlapped to any noise sensitive circuitry as the microphone amplifier/buffer or earphone amplifier.

The power supply input cables/traces should be kept separate from noise sensitive lines such as microphone/earphone cables/traces.

3.4. Antenna Requirements

Parameter	Descriptions
Frequency range (CDMA)	Tx: 824MHz ~ 849Mhz, Rx: 869Mhz ~ 894MHz
Frequency range (PCS)	Tx: 1850MHz ~ 1910MHz, Rx: 1930MHz ~ 1990MHz
Frequency range (GPS)	1575.42MHz
Impedance	50 Ohm
Recommended VSWR	< 2
Radiation pattern	Omni-directional
Polarization	Vertical

Note: if the device is developed for the US and/or Canadian market, it must comply with the FCC and/or IC approval requirements.

3.4.1. Antenna Installation Guideline

Install the antenna in a place covered by the CDMA signal.

The antenna must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

The antenna must be installed according to the antenna manufacturer instructions.

Warning: The antenna must not be installed inside metal cases.

3.5. Logic level Specification

The CC864-Dual module serial port is the core of the interface between the module and the host hardware.

Depending on the serial port type of the host hardware, a level translator circuit may be needed for the system to function properly. The only configuration that does not need a level translation is interfacing to a 2.8V UART.

On the CC864-Dual module there are two UART ports, one is for UART1 and the other is for R-UIM/UART2. It differs from the standard PC RS232C in signal polarity (where RS232 is reversed) and in levels.

Where not specifically stated, the interface circuits work at 2.8V CMOS logic levels.

The following tables show the logic level specifications for the CC864-Dual module interface circuits:

Operating Range – Interface levels (2.8V CMOS)

Parameter	Min	Max
VIH (input high level)	1.76 V	3.0 V
VIL (input low level)	-0.3 V	0.95 V
VOH (output high level)	2.25 V	2.7 V
VOL (output low level)	0.0 V	0.45 V

Operating Range – Interface levels (1.8V CMOS)

Parameter	Min	Max
VIH (input high level)	1.2V	2.1V
VIL (input low level)	-0.3V	0.63V
VOH (output high level)	1.35V	1.8V
VOL (output low level)	0.0V	0.45V

3.6. UART1 - Serial Interfaces

The CC864-Dual module is capable of providing up to two universal asynchronous (UART) ports.

The UART can also be used as the module's serial data port for test and debug, and can support additional interface functions such as an external keypad or ringer.

The UART1 can also be used to load and/or upgrade system firmware (in addition to the USB port).

Default setting is UART1 for the AT-commands and UART2 for R-UIM

The following table lists the signals of the CC864-Dual module serial port:

RS232 Pin Nr	Signal	PIN Number	Name	Usage
1	C109/DCD	32	Data Carrier Detect	Output from the CC864-Dual that indicates the carrier presence
2	C104/RXD	26	Transmit line	Output transmit line of CC864-Dual UART
3	C103/TXD	25	Receive line	Input receive of the CC864-Dual UART
4	C108/DTR	29	Data Terminal Ready	Input to the CC864-Dual controlling the DTE READY condition
5	GND	5,6,7	Ground	Ground
6	C107/DSR	27	Data Set Ready	Output from the CC864-Dual indicating the module is ready
7	C105/RTS	31	Request to Send	Input to the CC864-Dual controlling the hardware flow
8	C106/CTS	28	Clear to Send	Output from the CC864-Dual controlling the hardware flow
9	C125/RING	30	Ring Indicator	Output from the CC864-Dual

				indicating the incoming call condition

NOTE: According to V.24, the RXD and TXD signal names are referred to from the application side, therefore, on the module side, these signals are referred to in the opposite direction: TXD on the application side will be connected to the receive line (here named **TXD**/Receive line) of the module's serial port and vice versa for RXD.

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

3.6.1. RS232C Interface and Level Translation

In order to interface the module with a PC com port or a RS232 (EIA/TIA-232) application, a level translator is required.

The RS232 UART 16450, 16550, 16650 and 16750 chipsets accept signals with lower levels on the RS232 side (EIA/TIA-562), allowing for a lower voltage-multiplying ratio on the level translator.

Note that the negative signal voltage must be less than 0 V so that some form of level translation is always required.

The simplest way to translate the levels and invert the signal is by using a single chip level translator.

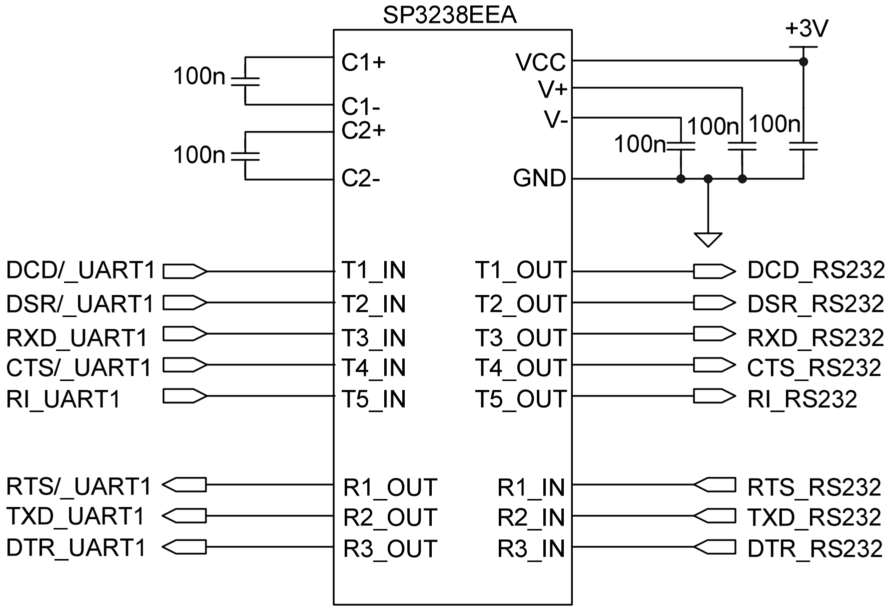
There are several of them, differing in the number of driver and receiver and in the levels.

NOTE: Always make sure you use a true RS232 level translator and **not** a translator for RS485 or any other standard.

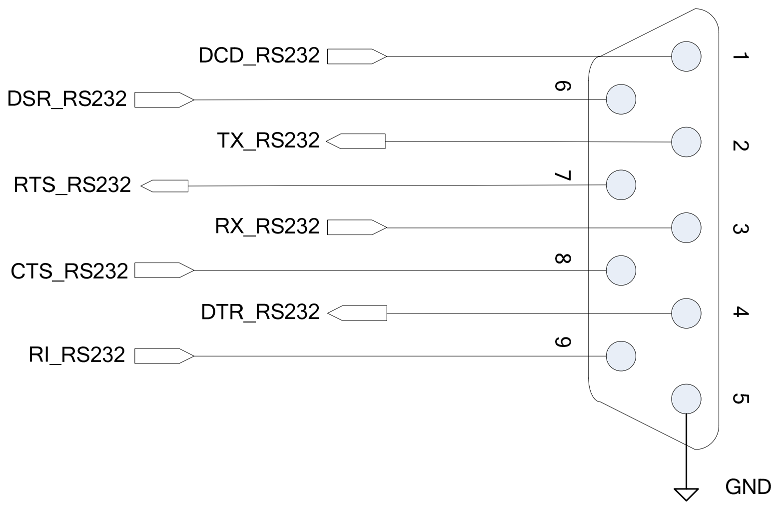
By convention, the driver is the level translator from the 0-3V UART level to the RS232 level, while the receiver is the translator from RS232 level to 0-3V UART.

In order to translate the whole set of control lines of the UART you need five drivers and three receivers.

The figure below shows an example of level translation circuitry:



The RS232 serial port lines are usually connected to a DB9 connector with the layout shown in the following figure:

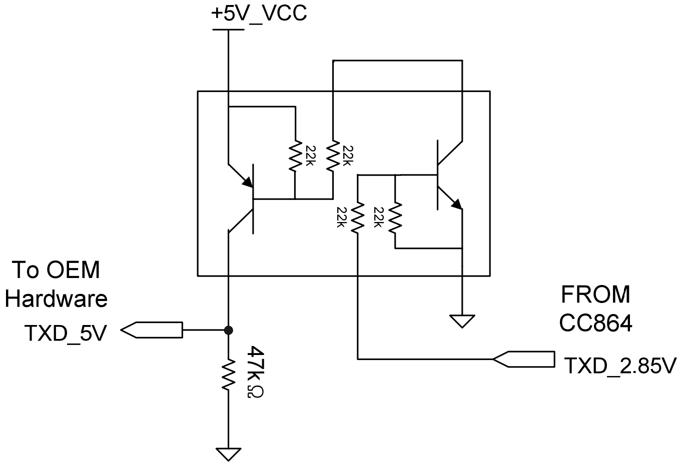


3.6.2. 5V UART Level Translation

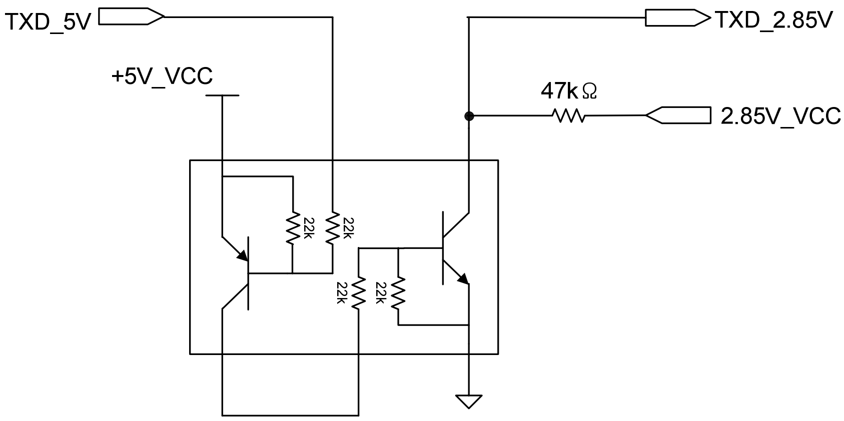
If the host application uses a microcontroller with a serial port (UART) that works at a voltage **different** from 2.8~3V, a circuitry must be provided to adapt the different levels of the two signal sets.

As for the RS232 translation, there is a selection of single chip translators, but since the translation requires very few components, a discrete design can also be used.

The following example shows a possible inexpensive translator circuit for a 5V transmitter/receiver:



The following example shows a possible inexpensive translator circuit for a 5V receiver:



3.7. External R-UIM Interface

The Removable User Identify Module (R-UIM) is a smart card for CDMA cellular applications, with the following features:

- It provides personal authentication information that allows the mobile station or handset to be connected with the network
- It enables handset independence for the user
- It can be inserted into any CDMA R-UIM equipped handset, allowing the user to receive or make calls, and also to receive other subscribed services from any R-UIM equipped handset

The internal power management circuits, R-UIM circuits, and R-UIM pins allow for 2.85V cards via a direct connection.

3.7.1. R-UIM Design Guidelines

The table below contains the pin description of R-UIM holders.

Pin No	Signal Name	Signal Description	Direction
18	VREG_RUIM	Power supply	CC864-Dual → R-UIM
19	UIM_RST	Reset signal	CC864-Dual → R-UIM
20	UIM_DATA	Serial data	CC864-Dual ↔ R-UIM
21	UIM_IN(PWR_DIS)	Power disable	CC864-Dual → R-UIM
22	UIM_CLK	Clock	CC864-Dual → R-UIM

3.8. USB Interface

The CC864-Dual module includes a universal serial bus (USB) transceiver, which operates at USB low-speed (1.5Mbits/sec) and USB full-speed (12Mbits/sec).

It is compliant with the USB 2.0 specification and can be used for diagnostic monitoring, control and data transfers.

The table below describes the USB interface signals:

Pin No	**Signal**	**Usage**
35	USB_ID	Analog input to detect the USB peripheral type. Left floating, grounded, or resistor to ground by the peripheral
48	USB_VBUS	Power supply for the internal USB transceiver. This pin is configured as an analog input or/and output depending on the type of peripheral device connected
79	USB_D+	Plus(+) line of the differential, bi-directional USB signal to/from the peripheral device
80	USB_D-	Minus(+) line of the differential, bi-directional USB signal to/from the peripheral device

3.9. Audio Interface

The CC864-DUAL contains two different bi-directional audio blocks:

- MT lines can be used for handset function
- HF lines can be used for hands-free function or earphone function

Only one of the blocks can be active at a time, selected by the AXE input pin or by an AT-command.

There are three types of audio interface configurations:

- Handset configurations (low power, typically a handset)
- Hands-free configurations (low power, typically an earphone)
- Car kit speakerphone configurations (high power, typically a speaker)

3.9.1. General Design Rules

There are several possible configurations for the audio paths, but the two main types are balanced and unbalanced microphone configurations.

You are recommended to keep the whole microphone path balanced even if this means having two wires connecting the microphone instead of one needed in the unbalanced case.

NOTE: The balanced circuitry is preferred because of its good common mode noise rejection.

TIP: Keep the analog microphone traces on the PCB and any wires as short as possible and make sure that the microphone traces on the PCB do not cross or run parallel to noisy traces (especially power traces).

TIP: If your application requires an unbalanced microphone, keep the traces on the PCB balanced and unbalance the path as close as possible to the microphone or wire connector.

TIP: Put a ground trace connected to the ground plane by several vias all around the microphone lines in order to simulate a shielded trace on the PCB.

The module provides two audio paths in the receive section; only one of the paths can be active at a time, selectable by the AXE input signal or with an A- command.

The table below lists the audio connections that can be used for the CC864-Dual module.

Pin number	Pin name	Pin type	Functional description
16	MIC_MT-	AI	Microphone #1 input (-)
15	MIC_MT+	AI	Microphone #1 input (+)
14	MIC_HF-	AI	Microphone #2 input (-)
13	MIC_HF+	AI	Microphone #2 input (+)
10	EAR_HF-	AO	Headphone output #1 (right side)
9	EAR_HF+	AO	Headphone output #2 (left side)
12	EAR_MT+	AO	Earphone amplifier output (+)
11	EAR_MT-	AO	Earphone amplifier output (-)

3.9.2. Handset Interface

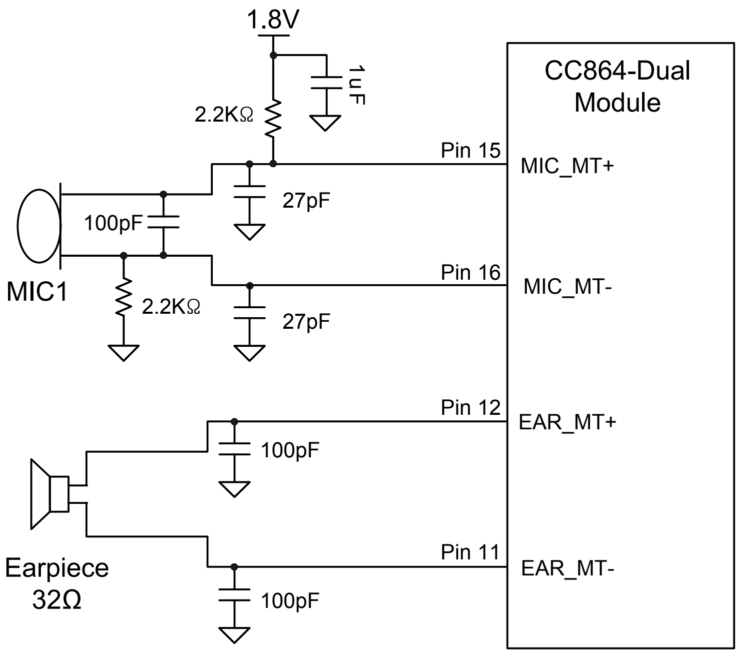
The earpiece output pins are connected directly to the handset earpiece, each with its own bypass capacitor.

The capacitor value is selected to optimize performance in each design, but a value of 100pF or less is suggested.

The output power for the differential EAR1 output is typically 50mW for a full-scale +3dBm sine wave into a 32 Ohm speaker.

Each microphone pin requires a 2.2K bias resistor. The positive microphone terminal is connected to the Bias power (1.8V) through one of the 2.2K resistors. The 1.8V output provides up to 1mA bias current for the microphone. In addition, each connection includes a bypass capacitor (27pF is used in the example below), and a 100pF capacitor is connected across the differential pair near the earpiece.

The following figure shows a typical “handset”-interface.



3.9.3. Headset Interface

This configuration uses a standard mono single-ended microphone interface.

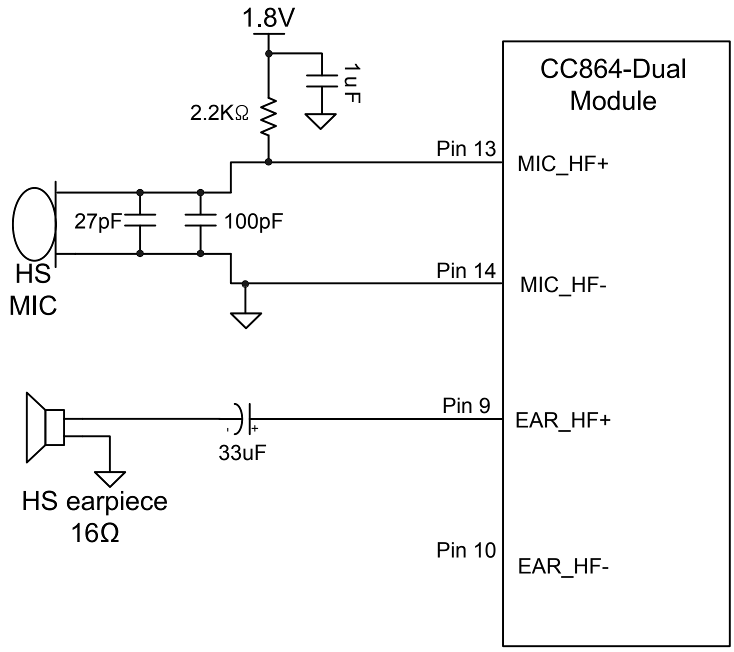
The positive input contains the signal and is AC-coupled directly to the microphone, while the negative input is AC-coupled to ground. A 100pF capacitor is connected across the two AC-coupling capacitors on the microphone side.

A 27pF capacitor bypasses the microphone output.

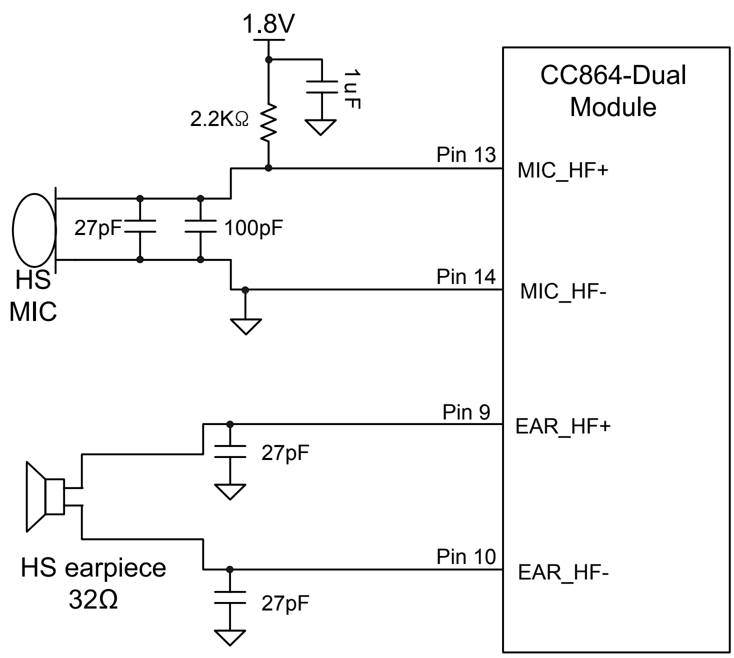
The positive microphone terminal is connected to the bias voltage (1.8V) through a 2.2 Ohm bias resistor. The 1.8V output provides up to 1 mA bias current for the microphone.

The bias power is bypassed by a 0.1uF capacitor.

The figure below shows the basic “headset”-configuration.



The module also supports a differential “headset” interface as shown in the figure below.



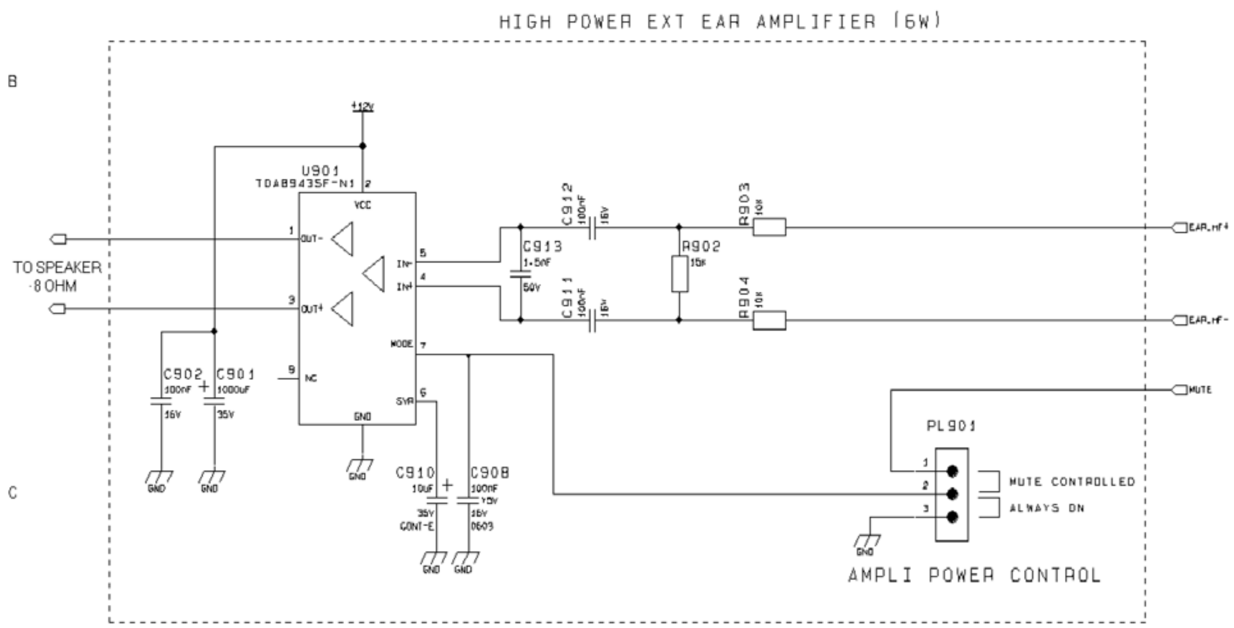
3.9.4. Car Kit Speakerphone Interface

For the “car kit speaker phone”configuration, the power output requirement is usually at least 4W; therefore an amplifier is required to boost the CC864-Dual audio output.

The design of the amplifier should comply with the following guidelines:

- The input to the amplifier must be taken from the “EAR_HF” audio path of the module.
- The amplifier must have a mute control to be used while not in conversation to eliminate the background noise, and to save power.
- The power to the amplifier must be decoupled as much as possible from the CC864-Dual module power supply, by either keeping separate wires or by placing bypass capacitors of adequate value close to the amplifier power input Pins.
- The biasing voltage of the amplifier must be stabilized with low ESR (for example, a tantalum) capacitor of adequate value.

The figure below shows an example of car kit amplifier schematic.



3.10. PCM Interface

The CC864-Dual module can support PCM interface. It can runs at 128kHz ~ 2.048Mhz. The PCM interface enables communication with an external CODEC to support hands-free application. Linear, μ-law, and A-law CODECs are supported by the PCM interface.
PCM interface can be configured and controlled by either direct register access through the CODEC_CTL register, or by the aDSP CODEC configuration command.
To change CODEC_CTL register, use AT-command.

AT-command is
AT#DVI=<mode>[,<dviport>,<clockmode>].

Pin Number	Name	I/O	Description	Level
36	PCM_CLOCK	I/O	PCM_CLOCK	CMOS 2.8V
63	TGPIO_10/PCM_TX	I/O	TGPIO10 Configurable GPIO/PCM_TX	CMOS 2.8V
65	TGPIO_18/PCM_RX	I/O	TGPIO18 Configurable GPIO/PCM_RX	CMOS 2.8V
71	TGPIO_17/PCM_SYNC	I/O	TGPIO17 Configurable GPIO/PCM_SYNC	CMOS 2.8V

3.11. I^{2}C Bus Interface

The I^{2}C is a two-wire bus for Inter-IC communication widely supported by peripheral components.

Two wires (or lines); serial data (SDA) and serial clock (SCL) carry information between the connected devices.

Each device is recognized by a unique address (whether it's a microcontroller, memory, LCD driver, stereo DAC, or keyboard interface) and can operate as either a transmitter or receiver, depending on the device function.

Pin No	Name	Description
33	SCL	Serial BUS Clock
34	SDA	Serial BUS Data

3.12. ADC/DAC Interface

The CC864-Dual module provides three ADC converters and one DAC converter.

Pin No	Name	Description
37	ADC_IN1	Analog/Digital converter input
38	ADC_IN2	Analog/Digital converter input
39	ADC_IN3	Analog/Digital converter input
40	DAC_OUT	Digital/Analog converter output

3.12.1. ADC Converter

3.12.1.1. Description

The CC864-Dual module provides three on-board ADC converters.

Parameter	Min	Max
Input Voltage Range	0V	2.5 V
Resolution		10 bit
Accuracy		8 bit
Clock rate		2.4Mhz

Analog measurement output or sensor output (battery voltage, temperature etc) can be connected to the ADC pin with proper signal conditioning and be read by an AT-command.

3.12.1.2. Using ADC Converter

An AT-command is available to use the ADC function

The command is

AT#ADC=1,2

The read value is expressed in mV

Refer to SW User Guide or AT Commands Reference Guide for the full description of this function.

3.12.2. DAC Converter

3.12.2.1. Description

The CC864-Dual module provides a digital to analog converter (DAC).

Parameter	Min	Max
Input Voltage Range	0V	2.8 V
Resolution		8 bit
Clock rate		4.8Mhz

The precision is 8 bits so, if we consider that the maximum voltage is 2V, the integrated voltage could be calculated with the following formula:

Integrated output voltage = (2 × value)/255

3.12.2.2. Enabling the DAC

An AT-command is available to use the DAC function

The command is

AT#DAC[=<enable>[,<value>]]

<value> - scale factor of the integrated output voltage(0…255 -8 bit precision) and must be present if <enable>=1

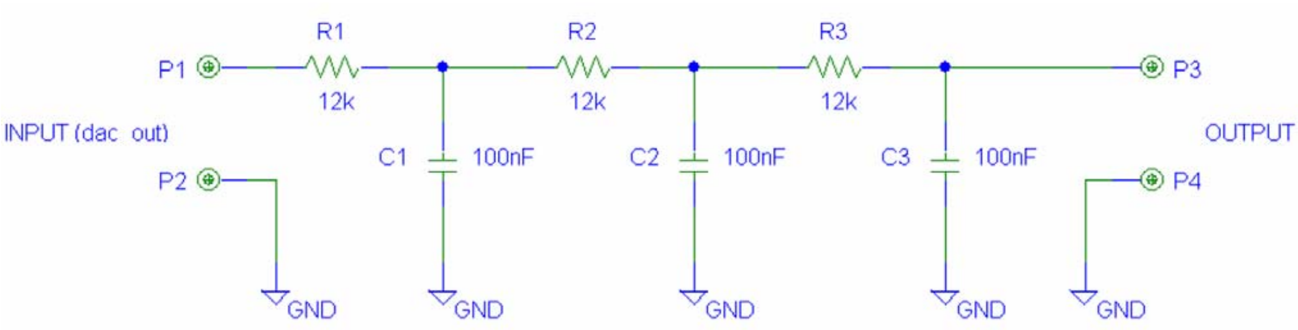
Refer to the SW User Guide or AT commands Reference Guide for the full description of this function.

3.12.2.3. Low Pass Filter Example

The DAC pin drives out the PDM (Pulse Density Modulation) signal. It is a square wave output.

The application needs an additional RC filter to convert the PDM output to an analog signal.

The figure below shows an example of Low Pass filter. Final tuning is needed to find the exact values of resistors and capacitors for the target application.



3.13. General Purpose I/O

The general purpose I/O Pins can be configured to act in three different ways:

- **Input:** Input Pins can only be read. They report the digital value (high or low) present on the Pin at the read time.
- **Output:** output Pins can be written or queried. They can be used to set the value of the Pin output.
- **Alternate function (internally controlled):** An alternate function pin is internally controlled by the CC864-Dual firmware and acts depending on the currently selected function.

Pin	Signal	I/O	Function	Type	Default state	On_OFF state	Alternative Function
70	TGPIO_01	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
74	TGPIO_02	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
66	TGPIO_03	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	AUDIO MUTE
59	TGPIO_04	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	CONVERSATION
78	TGPIO_05	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	RFTXMON
68	TGPIO_06	I/O	Configurable GPIO	CMOS 2.8V	Input		ALARM
73	TGPIO_07	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	BUZZER
67	TGPIO_08	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	POWER_SAVING
76	TGPIO_09	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
63	TGPIO_10	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	PCM_TX
57	TGPIO_11	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	VIBRATOR
62	TGPIO_12	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	CALL_KEY

77	TGPIO_13	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	ACTIVE
60	TGPIO_14	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
61	TGPIO_15	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
75	TGPIO_16	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
71	TGPIO_17	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	PCM_SYNC
65	TGPIO_18	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	PCM_RX
56	TGPIO_19	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
58	TGPIO_20	I/O	Configurable GPIO	CMOS 2.8V	Input	Low	
72	TGPIO_21	I/O	Configurable GPIO	CMOS 2.8V	Input	High	
64	TGPIO_22	I/O	Configurable GPIO	CMOS 1.8V	Input	Low	

Warning: TGPIO_22 has 1.8V CMOS level tolerance. This is to be compatible with the Telit Unified Form Factor.

3.13.1. Using a GPIO pin as Input

The GPIO pins, when used as input, can be connected to a digital output of another device to report its status, provided this device has interface levels compatible with the 2.8V CMOS levels of the GPIO.

3.13.2. Using a GPIO pin as Output

The GPIO pins, when used as outputs, can drive 2.8V CMOS digital devices or compatible hardware.

When set as outputs, the pins have a push-pull output and therefore the pull-up resistor can be omitted.

3.13.3. TGPIO_03/AUDIO MUTE

This pin can be used to mute audio e.g. when an external audio amplifier is used for the car kit speaker function.

It is always desirable to have a mute control on the amplifier, in order to turn it off while the device is not sending signal to the output, so that the amplifier background noise which may be audible during idle condition is cut off.

3.13.4. TGPIO_04/RF Transmission Control

When configured as RF transmission controlinput, this pin permits disabling the transmitter when the GPIO is set to low by the application.

3.13.5. TGPIO_05/RFTXMON

When configured as RFTMON output, this pin is controlled by the CC864-Dual only.

It is High when the transmitter is active, and Low when the transmitter activity is completed.

For example, if a call is started, the line is high during all of the conversation (RF Transmit) and low after the call is hung up.

3.13.6. TGPIO_06/ALARM

This pin, when configured as alarm output, is controlled by the CC864-Dual.

It goes high when the alarm starts, and low again after the issue of a dedicated AT-command.

You can use this output to power up the module itself or the external application at the alarm time, giving you the possibility to program a timely system wake-up to perform periodic actions while completely turning off either the application or the module during sleep periods, considerably reducing power consumption.

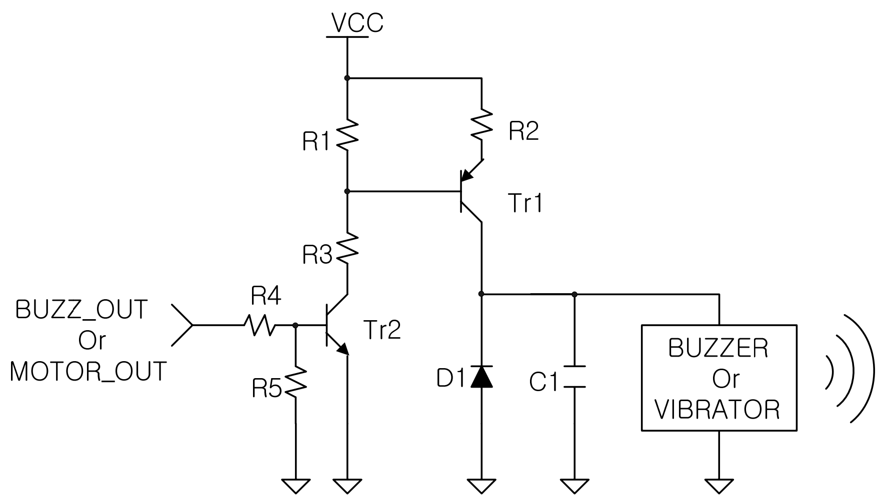
Refer to SW User Guide or AT commands Reference Guide for the full description of this function.

3.13.7. TGPIO_07/BUZZER

This pin, when configured as buzzer output, is controlled by the module.

It drives a buzzer driver with appropriate square waves, and permits your application to easily implement the buzzer feature with ringing tones, melody played at the call incoming, tone playing on SMS incoming, or simply playing a tone or melody when needed by your application.

The following figure shows an example of the TGPIO_07/BUZZER configuration:



3.13.8. TGPIO_08/POWER_SAVING

When configured as power saving, the host gives this signal to the module, setting the module into power saving mode.

This signal is active low.

When the module enters power saving mode, every active items, including the UART port is turned off, so that current consumption is considerably reduced.

3.13.9. TGPIO_11/VIBRATOR

When configured as vibrator output, this pin is controlled by the module and it starts with appropriate square waves.

For a reference, see the Buzzer circuitry in section 3.13.7.

3.13.10. TGPIO_12/CALL_KEY

When configured as call key, this pin is used to connect outgoing call or to respond to incoming call.

If automatic answer is disabled, the equivalent AT command is “ATA”.

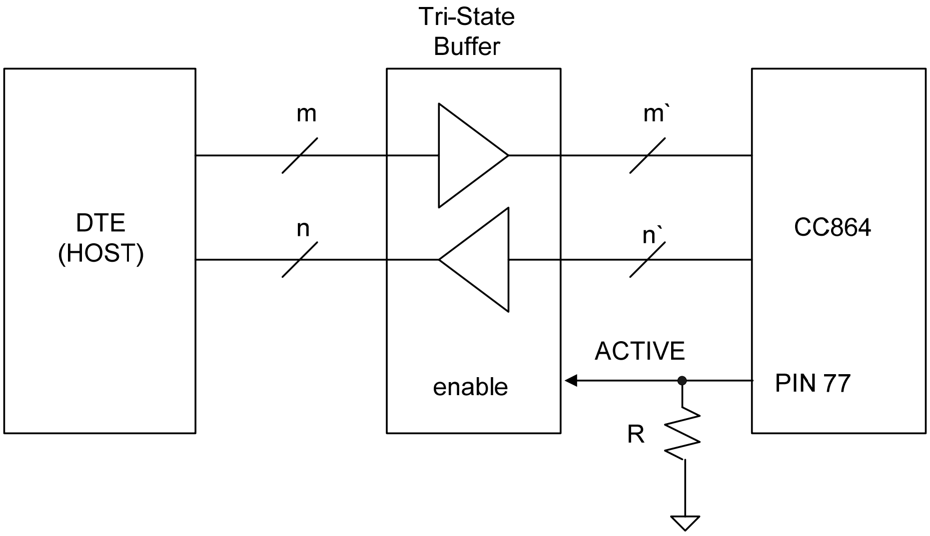
3.13.11. TGPIO_13/ACTIVE

When configured as active, this signal is used as a control signal to enable the buffer between the module and the host.

When the reset procedure and boot sequence is successful, the module drives the signal active high, and its output is low when the module is powered off.

Therefore, an external pull-down resistor is needed to define the state at power off if this feature is used.

Note: Using buffers for most signals (except ON/OFF, RESET, STAT_LED) between the module and the host to prevent leakage currents from the host (while powered on) to the module (while powered off) is recommended. Leakage current can cause a reset failure in the module.



3.14. Miscellaneous Interface Signals

3.14.1. VAUX1

A regulated power supply output is provided in order to supply small devices from the module itself.

This output is active when the module is on, and shuts off when the module is shut down.

The operating range characteristics of the supply are listed in the table below:

Operating Range –VAUX1 Power supply

Parameters	Min	Typical	Max
Output voltage	2.75V	2.85V	2.90V
Output current			150mA
Output bypass capacitor			1uF

3.14.2. VRTC

The VRTC pin brings out the real time clock supply, which is separated from the rest of the module's internal power supply, allowing the RTC to operate when all the other parts of the devices are turned off.

A backup capacitor can be added to this pin.

The backup capacitor is charged when the module is on, and it supplies power to the RTC circuit when the module is turned off.

3.14.3. STAT_LED

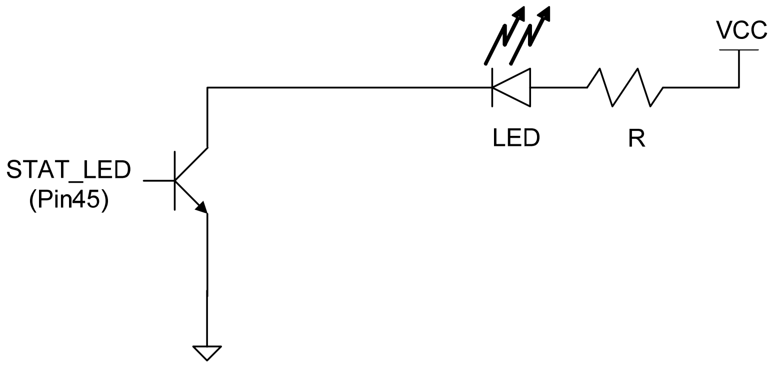
This pin is an open collector output signal.

The STAT_LED pin status shows information on the network service availability and Call status.

In the CC864-Dual module, the STAT_LED usually needs an external transistor to drive an external LED.

Therefore, the status indicated in the following table is reversed with respect to the pin status.

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



3.14.4. PWRMON

This pin is internally connected to a power source of the internal interface voltage corresponding to the 2.8V CMOS high level.

If the reset procedure or boot sequence is finished successfully, PWRMON is changed to high state.

3.14.5. AXE

This pin can be used for audio path switching.

You can select the handset path or hand free path with this signal.

State	Audio Path
Low	Handset mode (Tx: MIC_MT+/-, Rx:EAR_MT+/-)
High	Hands free mode (Tx:MIC_HF+/-, Rx:EAR_HF+/- or EAR_HF+)

If this pin is set to a low state, the module uses the handset audio path. And if set to a high state, the module changes the audio path to hands free mode from handset mode.

4. Development and Testing

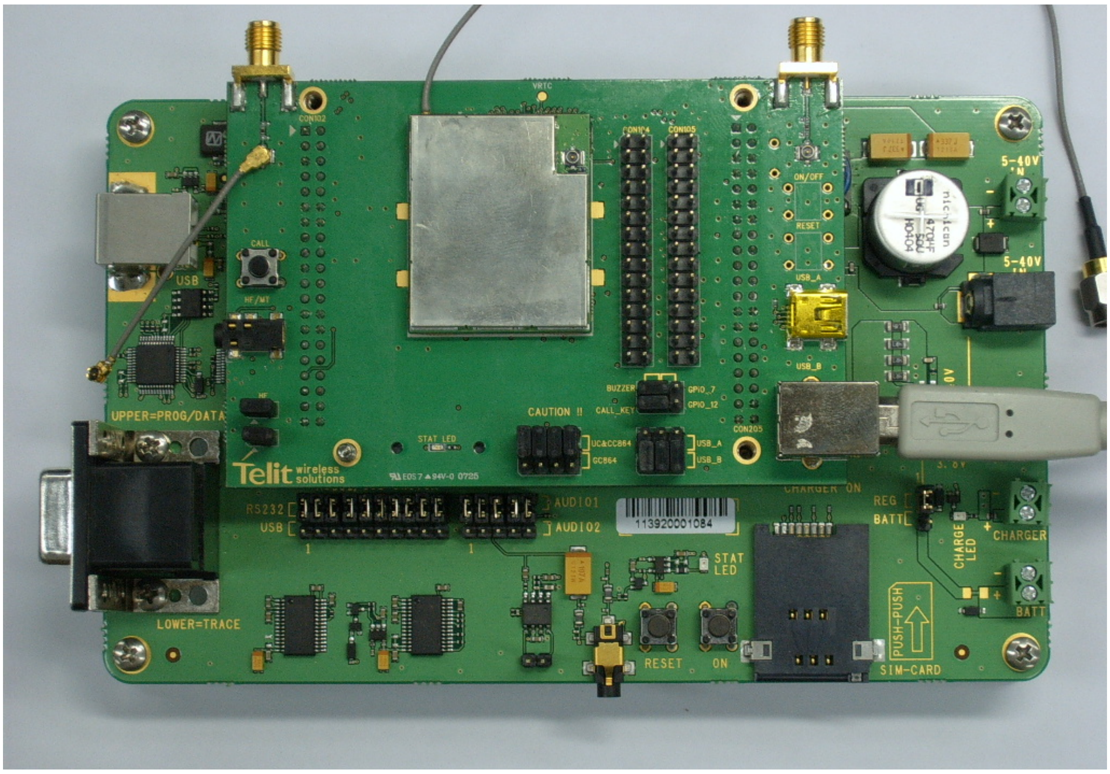
In order to assist you with the development of your Telit CC864-Dual module based application, Telit can supply the EVK2 Evaluation kit with appropriate power supply, R-UIM card housing, RS232 serial port level translator, direct UART connection, USB connection, Handset, Headset and Hands-free(car kit) audio and antenna.

The EVK2 provides a fully functional reference solution for a data/phone application.

The standard serial RS232 9-pin interface connector and USB interface provided on the evaluation kit allow the connection of the EVK2 system to a PC or other DTE.

The development of the application utilizing the Telit CC864-Dual module must use proper designs of all the interfaces to and from the module (for example, power supply, audio paths, level translators), otherwise a decrease in the performance will be introduced or, in the worst case, a faulty design can even lead to an operational failure of the module.

In order to assist the hardware designer, the EVK2 board presents a series of different solutions, which cover the most common design requirements on the market, and which can be easily integrated in the OEM design as building blocks or can be taken or can be taken as starting points to develop a specific solution.



5. Acronyms and Abbreviations

Term	Definition
ADC	Analog-to-Digital Converter
CDMA	Code Division Multiple Access
DAC	Digital-to-Analog Converter
EVRC	Enhanced Variable Rate CODEC
GPIO	General Purpose Input / Output
GPS	Global Positioning System
HF	Hands-free
I2C	Inter-Integrated Circuit
JDR	Jammer Detector
JTAG	Joint Test Action Group(ANSI/ICEEE Std. 1149.1-1990)
MT	Micro Telephone or HandSet (MT or HS)
PCM	Pulse Coded Modulation
PDM	Pulse Density Modulation (in a DAC)
RTC	Real Time Clock
R-UIM	Removable User Identity Module
S-GPS	Simultaneous-GPS
TGPIO	Telit General Purpose Input / Output
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
VAUX	Voltage Auxiliary
ZIF	Zero Intermediate Frequency

6. Appendix: Pin Allocation

The table below lists the complete pin allocation on the system connector of the CC864-DUAL.

Pin	Signal	I/O	Function	Internal Pull up	Type
Power Supply					
1	VBATT	-	Main power supply		Power
2	VBATT	-	Main power supply		Power
3	VBATT	-	Main power supply		Power
4	VBATT	-	Main power supply		Power
5	GND	-	Ground		Power
6	GND	-	Ground		Power
7	GND	-	Ground		Power
Audio					
8	AXE	I	Hands free switching	100K	CMOS 2.8V
9	EAR_HF+	AO	Hands free ear output, phase+		Audio
10	EAR_HF-	AO	Hands free ear output, phase-		Audio
11	EAR_MT+	AO	Handset earphone signal output, phase+		Audio
12	EAR_MT-	AO	Handset earphone signal output, phase-		Audio
13	MIC_HF+	AI	Hands free microphone input ; phase+, nominal level 3mVrms		Audio
14	MIC_HF-	AI	Hands free microphone input ; phase-, nominal level 3mVrms		Audio
15	MIC_MT+	AI	Handset microphone signal input ; phase+, nominal level 50mVrms		Audio
16	MIC_MT-	AI	Handset microphone signal input ; phase-, nominal level 50mVrms		Audio
R-UIM Card Interface					
18	VREG_RUIM	-	Power supply for the UIM		2.8V
19	UIM_RST	O	Reset		2.8V
20	UIM_DATA	I/O	Data I/O		2.8V
21	UIM_IN	I	Presence(active low)	47K	2.8V
22	UIM_CLK	O	Clock		2.8V
QCOM Diagnostic Monitor					
23	RX_TRACE	I	RX Data for debug monitor		CMOS 2.8V
24	TX_TRACE	O	TX Data for debug monitor		CMOS 2.8V
Program / Data + Hw Flow Control					
25	C103/TXD	I	Serial data input (TXD) from DTE		CMOS 2.8V
26	C104/RXD	O	Serial data output to DTE		CMOS 2.8V
27	C107/DSR	O	Output for Data set ready signal (DSR) to		CMOS

			DTE		2.8V
28	C106/CTS	O	Output for Clear to send signal (CTS) to DTE		CMOS 2.8V
29	C108/DTR	I	Input for Data terminal ready signal (DTR) from DTE		CMOS 2.8V
30	C125/RING	O	Output for Ring indicator signal (RI) to DTE		CMOS 2.8V
31	C105/RTS	I	Input for Request to send signal (RTS) from DTE		CMOS 2.8V
32	C109/DCD	O	Output for Data carrier detect signal (DCD) to DTE		CMOS 2.8V
			I^2C		
33	SCL	I/O	IIC Hardware interface		CMOS 2.8V
34	SDA	I/O	IIC Hardware interface		CMOS 2.8V
			USB		
35	USB_ID	I	USB_ID input	47K	CMOS 2.8V
48	USB_VBUS	AI/AO	USB_VBUS power supply		5V
79	USB_D+	I/O	USB Data(USB Internal Transceiver In/Output)		2.8V~3.6V
80	USB_D-	I/O	USB Data(USB Internal Transceiver In/Output)		2.8V~3.6V
			DAC and ADC		
37	ADC_IN1	AI	Analog/Digital converter input		A/D
38	ADC_IN2	AI	Analog/Digital converter input		A/D
39	ADC_IN3	AI	Analog/Digital converter input		A/D
40	DAC_OUT	AO	Digital/Analog converter output		D/A(PWM)
			PCM		
36	PCM_CLOCK	I/O	Telit GPIO Configurable GPIO		CMOS 2.8V
63	TGPIO_10/PCM_TX	I/O	Telit GPIO10 Configurable GPIO		CMOS 2.8V
65	TGPIO_18/PCM_RX	I/O	Telit GPIO18 Configurable GPIO		CMOS 2.8V
71	TGPIO_17/PCM_SYNC	I/O	Telit GPIO17 Configurable GPIO		CMOS 2.8V
			Miscellaneous Functions		
45	STAT_LED	O	Status indicator led		CMOS 1.8V
46	GND	-	Ground		Ground
49	PWRMON	O	Power ON Monitor		CMOS 2.8V
50	VAUX1	-	Power output for external accessories (AT command driven)		2.85V/ 150mA
51	CHARGE	AI	Charger input Li-Ion		Power

52	CHARGE	AI	Charger input Li-Ion		Power
53	ON/OFF*	I	Input command for switching power ON or OFF (toggle command). The pulse to be sent to the CC864-DUAL must be equal or greater than 1 second.	47kΩ	Pull up to VBTT
54	RESET*	I	Reset input		
55	VRTC				Power
Telit GPIO					
56	TGPIO_19	I/O	Telit GPIO19 Configurable GPIO		CMOS 2.8V
57	TGPIO_11/VIBRATOR	I/O	Telit GPIO11 Configurable GPIO/Vibrator		CMOS 2.8V
58	TGPIO_20	I/O	Telit GPIO20 Configurable GPIO		CMOS 2.8V
59	TGPIO_04/CONVERSATION	I/O	Telit GPIO4 Configurable GPIO/ Conversation		CMOS 2.8V
60	TGPIO_14	I/O	Telit GPIO14 Configurable GPIO		CMOS 2.8V
61	TGPIO_15	I/O	Telit GPIO15 Configurable GPIO		CMOS 2.8V
62	TGPIO_12/AUDIO CALL BUTTON	I/O	Telit GPIO12 Configurable GPIO/ Audio Call Button		CMOS 2.8V
64	TGPIO_22	I/O	Telit GPIO22 Configurable GPIO		CMOS 1.8V
66	TGPIO_03/AUDIO MUTE	I/O	Telit GPIO03 Configurable GPIO/ Audio Mute		CMOS 2.8V
67	TGPIO_08/POWER_SAVING	I/O	Telit GPIO08 Configurable GPIO/ Power saving mode		CMOS 2.8V
68	TGPIO_06/ALARM	I/O	Telit GPIO06 Configurable GPIO/ Power wakeup		CMOS 2.8V
70	TGPIO_01	I/O	Telit GPIO01 Configurable GPIO		CMOS 2.8V
72	TGPIO_21	I/O	Telit GPIO21 Configurable GPIO		CMOS 2.8V
73	TGPIO_07/BUZZER	I/O	Telit GPIO07 Configurable GPIO/ Buzzer		CMOS 2.8V(PWM)
74	TGPIO_02	I/O	Telit GPIO02 Configurable GPIO		CMOS 2.8V
75	TGPIO_16	I/O	Telit GPIO16 Configurable GPIO		CMOS 2.8V
76	TGPIO_09	I/O	Telit GPIO09 Configurable GPIO		CMOS 2.8V
77	TGPIO_13/ACTIVE	I/O	Telit GPIO13 Configurable GPIO/ ACTIVE pin to protect current leakage		CMOS 2.8V
78	TGPIO_05/RFTXMON	I/O	Telit GPIO05 Configurable GPIO/ Transmitter ON monitor		CMOS 2.8V
Reserved					

17						
41						
42						
43						
44						
47						
69						
80						

Warning: All reserved pins must be left open and unconnected; they may not be used for any routing purposes on the application PCB (NC/NR pins). They are reserved for internal Telit use or future expansion.