

Preliminary

DE910-DUAL Hardware User Guide

1vv0300951 Rev.1 - 2011-12-09



APPLICABILITY TABLE

PRODUCT
DE910-DUAL

PRELIMINARY



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1. Introduction

1.1. Scope

The aim of this document is the description of typical hardware solutions useful for developing a product with the Telit DE910-DUAL module.

1.2. Audience

This document is intended for Telit customers, who are integrators, about to implement their applications using our DE910-DUAL modules.

1.3. Contact Information, Support

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

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

Telit appreciates feedback from the users of our information.



1.4. Document Organization

This document contains the following chapters:

[Chapter 1: “Introduction”](#) provides a scope for this document, target audience, contact and support information, and text conventions.

[Chapter 2: “General Product Description”](#) gives an overview of the features of the product.

[Chapter 3: “DE910-DUAL Module Connections”](#) deals with the pin out configuration and layout.

[Chapter 4: “Hardware Commands”](#) How to operate the module via hardware.

[Chapter 5: “Power supply”](#) Power supply requirements and general design rules.

[Chapter 6: “Antenna”](#) The antenna connection and board layout design are the most important parts in the full product design.

[Chapter 7: “USB Port”](#) The USB port on the Telit DE910-DUAL is the core of the interface between the module and OEM hardware.

[Chapter 8: “Serial ports”](#) Refers to the serial ports of the Telit DE910-DUAL.

[Chapter 9: “Audio Section overview”](#) Refers to the audio blocks of the Base Band Chip of the DE910-DUAL Telit Module.

[Chapter 10: “General Purpose I/O”](#) How the general purpose I/O pads can be configured.

[Chapter 11: “Mounting the DE910-DUAL on the application board”](#) Mechanical dimensions and recommendations on how to mount the module on the user’s board.

[Chapter 12: “Conformity Assessment Issues”](#) provides some fundamental hints about the conformity assessment that the final application might need.

[Chapter 13: “Safety Recommendation”](#) provides some safety recommendations that must be followed by the customer in the design of the application that makes use of the Telit DE910-DUAL.

1.5. 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.



1.6. Related Documents

- Digital voice Interface Application Note, TBD
- DE910-DUAL Product description, 80392ST10096A
- R-UIM Holder Design Guide, TBD
- Telit EVK2 User Guide, 1vv0300704

PRELIMINARY



2. General Product Description

2.1. Overview

The aim of this document is the description of typical hardware solutions useful for developing a product with the Telit DE910-DUAL module.

In this document all the basic functions of a mobile phone will be taken into account; for each one of them a proper hardware solution will be suggested and eventually the wrong solutions and common errors to be avoided will be evidenced. Obviously this document cannot embrace the all hardware solutions and products that may be designed. The solutions to be avoided must be considered as mandatory. While the suggested hardware configurations must not be considered mandatory, the information given must be used as a guide and a starting point for properly developing your product with the Telit DE910-DUAL module.



NOTE:

The integration of the CDMA 1x / 1xEV-DO module within a user application must be done according to the design rules described in this manual.

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2.2. 2D Mechanical Dimensions

- Length: 28.2 mm
- Width: 28.2mm
- Thickness: 2.5mm

2.3. Weight

The module weight of DE910-DUAL is about 4.7 gram.



2.4. Environmental Requirements

2.4.1. Temperature Range

		Note
Operating Temperature Range	-30°C ~ +60°C	The module is fully functional (*) in all the temperature range, and it fully meets the 3GPP2 specifications.
	-30°C ~ +85°C	The module is fully functional (*) in all the temperature range. Temperatures outside the range -30 ~ 60 might deviate from 3GPP2 specification.
Storage and non-operating Temperature Range	-40°C ~ +85°C	

(*)Functional: the module is able to make and receive voice calls, data calls, and SMS.

2.5. RoHS Compliance

As a part of Telit's corporate policy of environmental protection, the DE910-DUAL complies with the RoHS (Restriction of Hazardous Substances) directive of the European Union (EU directive 2002/95/EG).

2.6. Operating Frequency

The operating frequencies in US cellular (BC0) and US PCS (BC1) modes comply with the 3GPP2 specifications.

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels	TX - RX offset
CDMA BC0	824 ~ 849	869 ~ 894	1 ~ 799, 991 ~ 1023	45 MHz
CDMA BC1	1850 ~ 1910	1930 ~ 1990	0 ~ 1199	80 MHz

3. DE910-DUAL Module Connections

3.1. Pin-Out

PAD	Signal	I/O	Function	Type	COMMENT
USB HS 2.0 Communication Port					
B15	USB_D+	I/O	USB differential Data(+)		
C15	USB_D-	I/O	USB differential Data(+)		
A13	VBUS	AI	Power sense for the internal USB transceiver		
Asynchronous UART – Prog. / data +HW Flow Control					
N15	C103/TXD	I	Serial data input (TXD) from DTE	1.8V	
M15	C104/RXD	O	Serial data output to DTE	1.8V	
M14	C108/DTR	I	Input for Data terminal ready signal (DTR) from DTE	1.8V	
L14	C105/RTS	I	Input for Request to send signal (RTS) from DTE	1.8V	
P15	C106/CTS	O	Output for Clear to send signal (CTS) to DTE	1.8V	
N14	C109/DCD	O	Output for Data carrier detect signal (DCD) to DTE	1.8V	
P14	C107/DSR	O	Output for Data set ready signal (DSR) to DTE	1.8V	
R14	C125/RING	O	Output for Ring indicator signal (RI) to DTE	1.8V	
Asynchronous Auxiliary UART					
D15	TX_AUX	O	Auxillary UART (TX Data to DTE)	1.8V	
E15	RX_AUX	I	Auxillary UART (RX Data from DTE)	1.8V	
SIM Card Interface					
A6	SIMCLK	O	External SIM signal – Clock	1.8/2.85V	
A7	SIMRST	O	External SIM signal – Reset	1.8/2.85V	
A5	SIMIO	I/O	External SIM signal - Data I/O	1.8/2.85V	
A4	SIMIN	I	External SIM signal - Presence (active low)	1.8V	
A3	SIMVCC	-	External SIM signal – Power supply for the SIM	1.8/2.85V	
Digital Voice interface (DVI)					
B9	DVI_WA0	I/O	Digital Voice interface (WA0)	1.8V	
B6	DVI_RX	I/O	Digital Voice interface (RX)	1.8V	
B7	DVI_TX	I/O	Digital Voice interface (TX)	1.8V	
B8	DVI_CLK	I/O	Digital Voice interface (CLK)	1.8V	
SPI					
D15	SPI_MOSI	I/O	SPI MOSI	1.8V	
E15	SPI_MISO	I/O	SPI MISO	1.8V	
F15	SPI_CLK	I/O	SPI Clock	1.8V	
H14	SPI_CS_N	I/O	SPI Chip Select	1.8V	



PAD	Signal	I/O	Function	Type	COMMENT
Digital IO					
C8	GPIO_01	I/O	GPIO_01	1.8V	
C9	GPIO_02	I/O	GPIO_02	1.8V	
C10	GPIO_03	I/O	GPIO_03	1.8V	
C11	GPIO_04	I/O	GPIO_04	1.8V	
B14	GPIO_05	I/O	GPIO_05	1.8V	
C12	GPIO_06	I/O	GPIO_06	1.8V	
C13	GPIO_07	I/O	GPIO_07	1.8V	
K15	GPIO_08	I/O	GPIO_08	1.8V	
L15	GPIO_09	I/O	GPIO_09	1.8V	
G15	GPIO_10	I/O	GPIO_10	1.8V	
RF Section					
K1	Antenna	I/O	CDMA Antenna (50Ohm)	RF	
F1	ANT_DIV	I	CDMA Antenna Diversity Input (50Ohm)	RF	
GPS Section					
R9	ANT_GPS	I	GPS Antenna (50Ohm)	RF	
R7	GPS_LNA_EN	O	Output enable for External LNA supply	1.8V	
Miscellaneous Function					
R13	RESET*	I	Reset Input	1.8V	Active Low
R12	ON_OFF*	I	Input Command for Power ON	1.8V	Active Low
C14	VRTC	AI	VRTC Backup Capacitor	Power	To be used to back up the RTC section
R11	VAUX/PWRMON	O	Supply Output for External Accessories / Power ON Monitor	1.8V	
Power Supply					
M1	VBATT	-	Main Power Supply (Baseband)	Power	
M2	VBATT	-	Main Power Supply (Baseband)	Power	
N1	VBATT_PA	-	Main Power Supply (PAM)	Power	
N2	VBATT_PA	-	Main Power Supply (PAM)	Power	
P1	VBATT_PA	-	Main Power Supply (PAM)	Power	
P2	VBATT_PA	-	Main Power Supply (PAM)	Power	
E1	GND	-	Ground		
G1	GND	-	Ground		
H1	GND	-	Ground		
J1	GND	-	Ground		
L1	GND	-	Ground		
A2	GND	-	Ground		
E2	GND	-	Ground		
F2	GND	-	Ground		
G2	GND	-	Ground		



PAD	Signal	I/O	Function	Type	COMMENT
F14	Reserved	-	Reserved		
G14	Reserved	-	Reserved		
J14	Reserved	-	Reserved		
K14	Reserved	-	Reserved		
H15	Reserved	-	Reserved		
J15	Reserved	-	Reserved		



WARNIG:

Reserved pins must not be connected.



NOTE:

Almost all pins not in use must be left disconnected. The only exceptions are the following pins:

PAD	Signal
M1,M2,N1,N2,P1,P2	VBATT & VBATT_PA
E1,G1,H1,J1,L1,A2,E2,F2,G2,H2,J2,K2,L2,R2,M3, N3,P3,R3,D4,M4,N4,P4,R4,N5,P5,R5,N6,P6,R6,P8, R8,P9,P10,R10,M12,B13,P13,E14	GND
R12	ON/OFF*
R13	RESET*
B15	USB_D+
C15	USB_D-
A13	VBUS
N15	C103/TXD
M15	C104/RXD
L14	C105/RTS
P15	C106/CTS
D15	TXD_AUX
E15	RXD_AUX

RTS must be connected to the GND (on the module side) if flow control is not used.

The above pins are also necessary to debug the application incorporating the module.



3.1.1. LGA Pads Layout

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
1		B1 RFU	C1 RFU	D1 RFU	E1 GND	F1 ANT_DIV	G1 GND	H1 GND	J1 GND	K1 ANT_MAIN	L1 GND	M1 VBATT	N1 VBATT_PA	P1 VBATT_PA	
2	A2 GND	B2 RFU	C2 RFU	D2 RFU	E2 GND	F2 GND	G2 GND	H2 GND	J2 GND	K2 GND	L2 GND	M2 VBATT	N2 VBATT_PA	P2 VBATT_PA	R2 GND
3	A3 SIMVCC	B3 RFU	C3 RFU	D3 RFU	E3 RFU	F3 RFU	G3 RFU	H3 RFU	J3 RFU	K3 RFU	L3 RFU	M3 GND	N3 GND	P3 GND	R3 GND
4	A4 SIMIN	B4 RFU	C4 RFU	D4 GND								M4 GND	N4 GND	P4 GND	R4 GND
5	A5 SIMIO	B5 RFU	C5 RFU										N5 GND	P5 GND	R5 GND
6	A6 SIMCLK	B6 DVI_RX	C6 RFU										N6 GND	P6 GND	R6 GND
7	A7 SIMRST	B7 DVI_TX	C7 RFU										N7 RFU	P7 RFU	R7 GPS_LNA_EN
8	A8 RFU	B8 DVI_CLK	C8 GPIO_01										N8 RFU	P8 GND	R8 GND
9	A9 RFU	B9 DVI_WA0	C9 GPIO_02										N9 RFU	P9 GND	R9 ANT_GPS
10	A10 RFU	B10 RFU	C10 GPIO_03										N10 RFU	P10 GND	R10 GND
11	A11 RFU	B11 RFU	C11 GPIO_04										N11 RFU	P11 RFU	R11 VAUX_PWRMON
12	A12 RFU	B12 RFU	C12 GPIO_06	D12 RFU								M12 GND	N12 RFU	P12 RFU	R12 ON_OFF/
13	A13 USB_VBUS	B13 GND	C13 GPIO_07	D13 RFU	E13 RFU	F13 RFU	G13 RFU	H13 RFU	J13 RFU	K13 RFU	L13 RFU	M13 RFU	N13 RFU	P13 GND	R13 RESET/
14	A14 RFU	B14 GPIO_05	C14 VRTC	D14 RFU	E14 GND	F14 RFU	G14 RFU	H14 SPI_CS_N	J14 RFU	K14 RFU	L14 C105/RTS	M14 C108/DTR	N14 C109/DCD	P14 C107/DSR	R14 C125/RING
15		B15 USB_D+	C15 USB_D-	D15 TX_AUX	E15 RX_AUX	F15 SPI_CLK	G15 GPIO_10	H15 RFU	J15 RFU	K15 GPIO_08	L15 GPIO_09	M15 C104/RXD	N15 C103/TXD	P15 C106/CTS	



NOTE:

The pin defined as **RES** has to be considered RESERVED and not connected on any pin in the application. The related area on the application has to be kept empty.



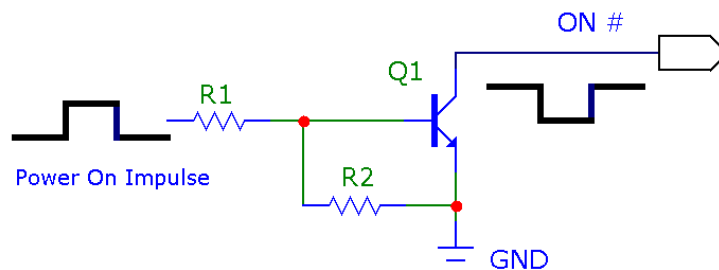
4. Hardware Commands

4.1. Turning on the DE901-DUAL module

To turn on the DE910-DUAL, the pad ON# must be tied low for at least 1 second and then released.

The maximum current that can be drained from the ON# pad is 0.1 mA.

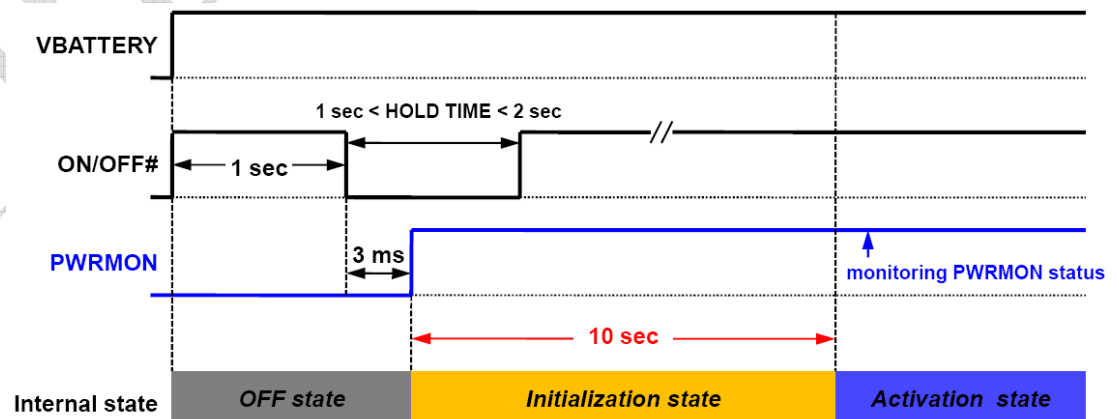
A simple circuit to power on the module is illustrated below:



4.1.1. Initialization and Activation State

Upon turning on DE910-DUAL module, the DE910-DUAL module is not active yet because the boot sequence of DE910-DUAL is still executing internally. It takes about 10 seconds to complete the initialization of the module internally.

For this reason, it would be useless to try to access DE910-DUAL during the Initialization state as below. The DE910-DUAL module needs at least 10 seconds after the PWRMON goes High to become operational by reaching the activation state.



During the *Initialization state*, any kind of AT-command is not available. DTE must wait for the *Activation state* to communicate with DE910-DUAL.

To check if the DE910-DUAL has powered on, the hardware line PWRMON must be monitored. When PWRMON goes high, the module has powered on.



NOTE:

Do not use any pull up resistor on the ON# line. It is pulled up internally. Using a pull up resistor may bring latch up problems on the DE910-DUAL power regulator and improper power on/off of the module. The line ON# must be connected only in open collector configuration.



NOTE:

In this document all the lines are inverted. Active low signals are labeled with a name that ends with "#" or with a bar over the name.

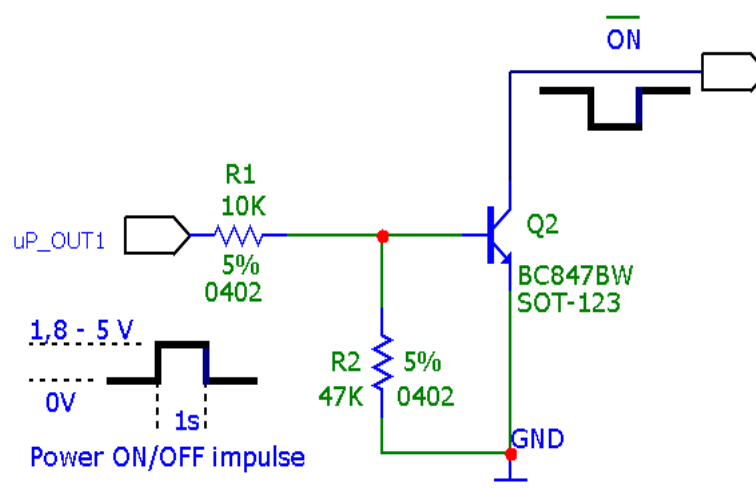


NOTE:

In order to avoid a back powering effect it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the DE910-DUAL module when the module is powered OFF or during an ON/OFF transition.

For example:

Let us assume you need to drive the ON# pad with a totem pole output of a +1.8/5 V microcontroller (uP_OUT1):



4.2. Turning off the DE901-DUAL module

Turning off the device can be done in three ways:

- By software command (see DE910-DUAL Software User Guide)
- By hardware shutdown
- By hardware unconditional reboot

When the device is shut down by software command or by hardware shutdown, it issues a detach request to the network that informs the network that the device will no longer be reachable.



NOTE:

In order to avoid a back powering effect it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the DE910-DUAL when the module is powered OFF or during an ON/OFF transition.

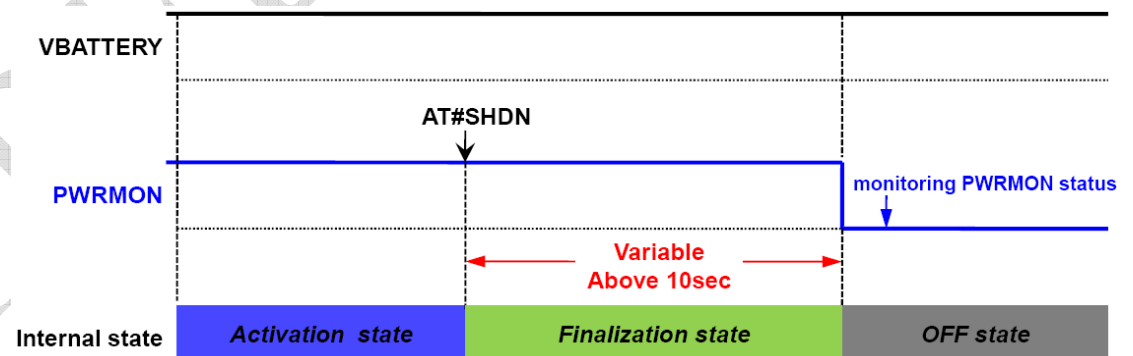
4.2.1. Shutdown by Software Command

DE910-DUAL can be shut down by a software command.

When a shutdown command is sent, DE910-DUAL goes into the finalization state and finally will shut down PWRMON at the end of this state.

The period of the finalization state can vary according to the state of the DE910-DUAL so it cannot be fixed definitely.

Normally it will be above 10 seconds after sending a shutdown command and DTE should monitor the status of PWRMON to see the actual power off.



TIP:

To check if the device has powered off hardware line PWRMON must be monitored. When PWRMON goes low, the device has powered off.



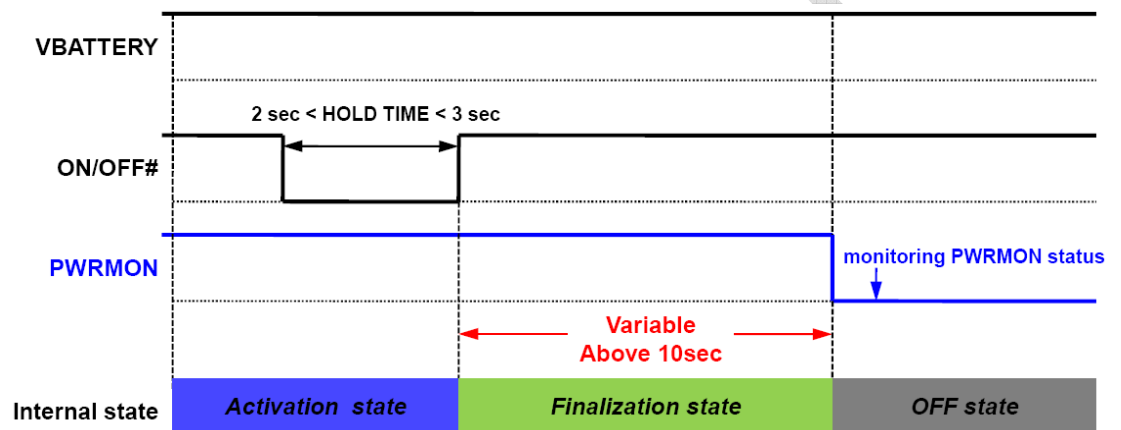
4.2.2. Hardware Shutdown

To turn OFF DE910-DUAL the pad ON/OFF# must be tied low for at least 2 seconds and then released. The same circuitry and timing for the power on must be used.

When the hold time of ON/OFF# is above 2 seconds, the DE910-DUAL goes into the finalization state and finally will shut down PWRMON at the end of this state.

The period of the finalization state can vary according to the state of the DE910-DUAL is so it cannot be fixed definitely.

Normally it will be above 10 seconds after releasing ON/OFF# and DTE should monitor the status of PWRMON to see the actual power off.



TIP:

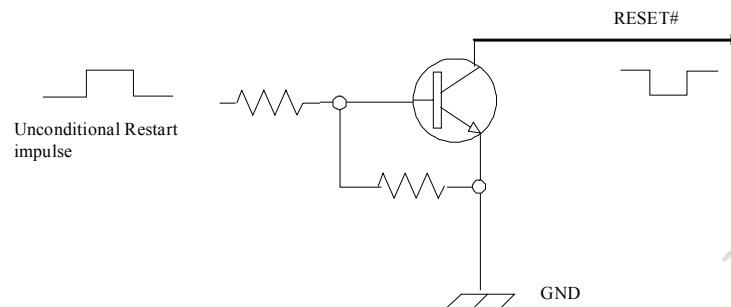
To check if the device has powered off, hardware line PWRMON must be monitored. When PWRMON goes low, the device has powered off.



4.2.3. Hardware Unconditional Reboot

To unconditionally restart the DE910-DUAL, the pad RESET# must be tied low for at least 200 milliseconds and then released.

A simple circuit to unconditionally reboot the module is illustrated below:



NOTE:

Do not use any pull up resistor on the RESET# line or any totem pole digital output. Using a pull up resistor may bring latch up problems on the DE910-DUAL power regulator and improper functioning of the module. The line RESET# must be connected only in open collector configuration.

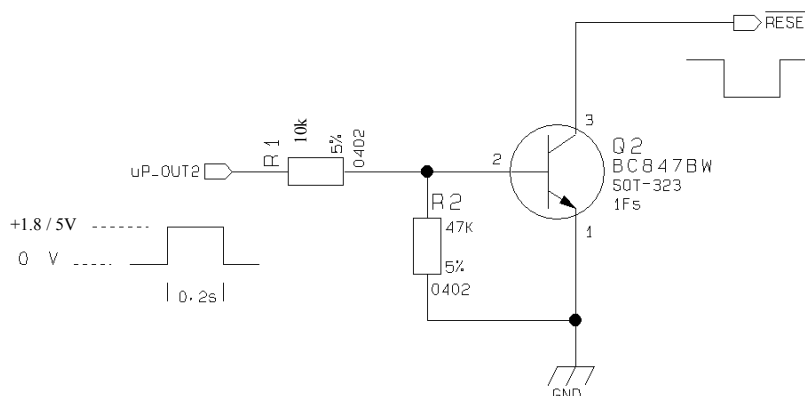


TIP:

The unconditional hardware Restart must always be implemented on the boards and the software must use it only as an emergency exit procedure.

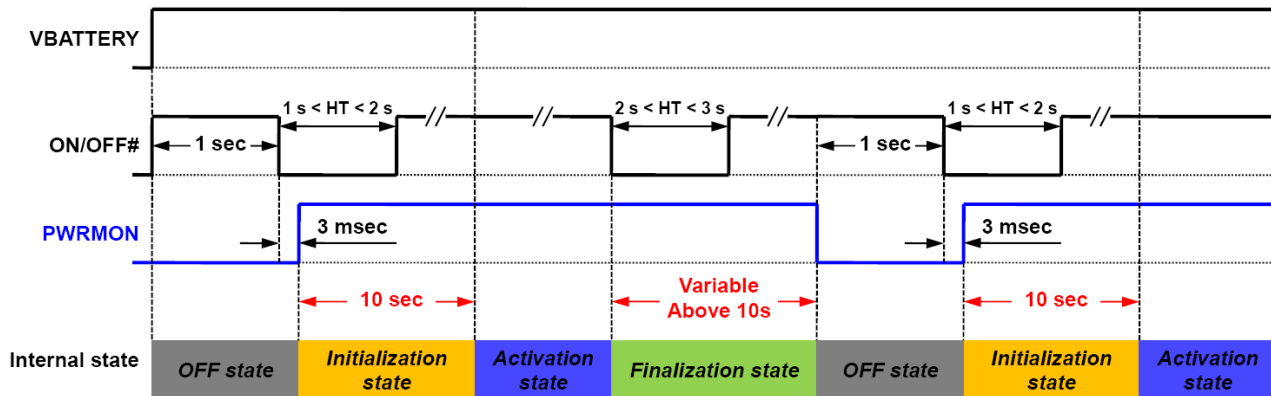
For example:

Let us assume you need to drive the RESET# pad with a totem pole output of a +1.8/5 V microcontroller (uP_OUT2):



4.3. Summary of Turning ON and OFF the Module

The chart below describes the overall sequences for turning the module ON and OFF.



PRELIMINARY



5. Power Supply

The power supply circuitry and board layout are a very important part in the full product design and they strongly reflect on the product's overall performance. Read carefully the requirements and the guidelines that follow for a proper design.

5.1. Power Supply Requirements

The external power supply must be connected to VBATT & VBATT_PA signals and must fulfill the following requirements:

Power Supply	
Nominal Supply Voltage	3.8V
Max Supply Voltage	4.2V
Supply Voltage Range	3.4V ~ 4.2V



NOTE:

The Operating Voltage Range **MUST** never be exceeded. Special care must be taken in order to fulfill min/max supply voltage requirement.



NOTE:

When the power supply voltage is lower than 3.4V, to turn ON the module, the pad ON# must be tried low for at least 3 seconds.

5.2. General Design Rules

The principal guidelines for the Power Supply Design embrace three different design steps:

- the electrical design
- the thermal design
- the PCB layout



5.2.1. Electrical Design Guidelines

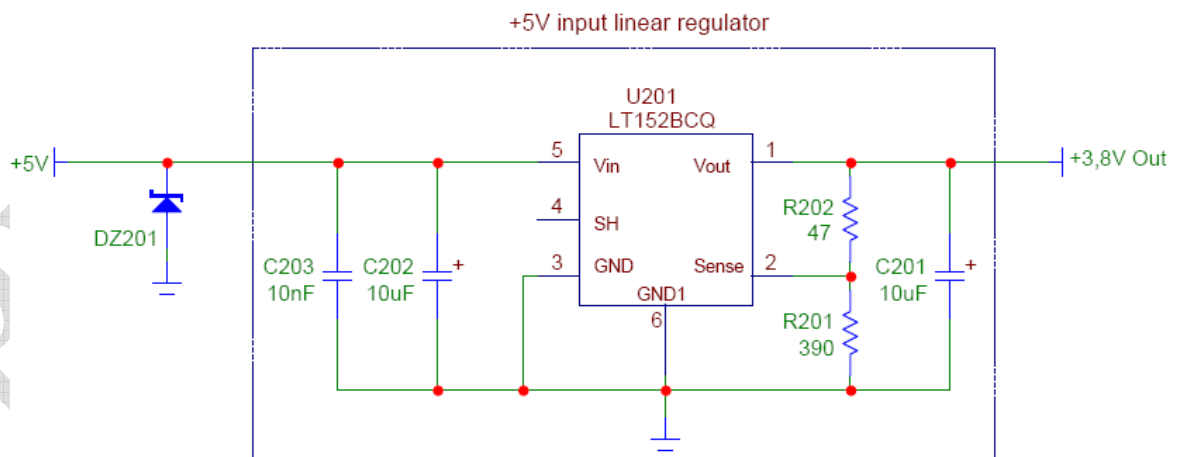
The electrical design of the power supply depends strongly on the power source where this power is drained. We will distinguish them into two categories:

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

5.2.1.1. + 5V Input Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, hence there is not a big difference between the input source and the desired output so a linear regulator can be used. A switching power supply will not be suitable because of the low drop-out requirements.
- When using a linear regulator, a proper heat sink must be provided in order to dissipate the power generated.
- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks close to the DE910-DUAL. A 100µF tantalum capacitor is usually suited.
- Make sure the low ESR capacitor on the power supply output (usually a tantalum one) is rated at least 10V.
- A protection diode must be inserted close to the power input, in order to save DE910-DUAL from power polarity inversion.

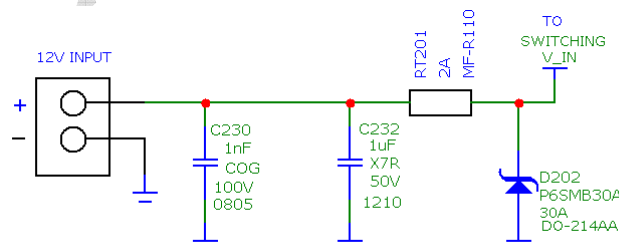
An example of linear regulator with 5V input is:



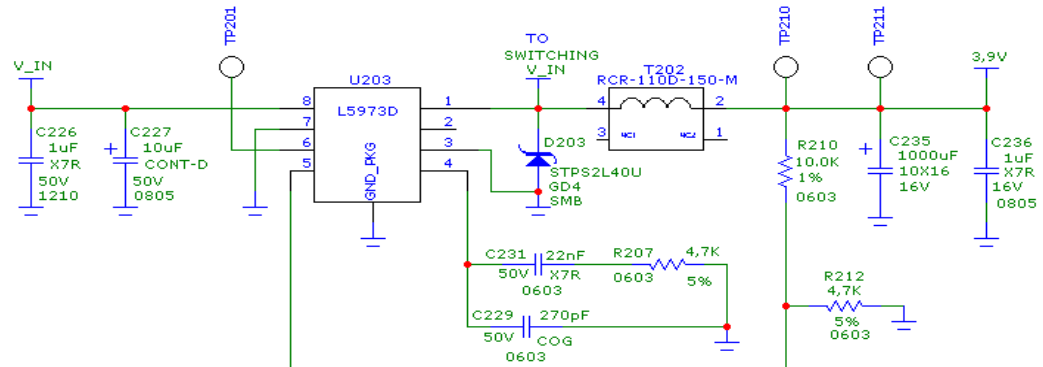
5.2.1.2. +12V Input Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, hence due to the big difference between the input source and the desired output, a linear regulator is not suitable and must not be used. A switching power supply would be preferable because of its better efficiency especially with the (TBD) peak current load represented by DE90-DUAL.
- When using a switching regulator, a 500 kHz or more switching frequency regulator is preferable because of its smaller inductor size and its faster transient response. This allows the regulator to respond quickly to the current peaks absorption.
- 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.
- For car PB battery the input voltage can rise up to 15.8V and this must be kept in mind when choosing components: all components in the power supply must withstand this voltage.
- A bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks. A 100µF tantalum capacitor is usually suited for this.
- Make sure the low ESR capacitor on the power supply output (usually a tantalum one) 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.
- A protection diode must be inserted close to the power input in order to save DE910-DUAL from power polarity inversion. This can be the same diode as for spike protection.

An example of switching regulator with 12V input is in the schematic below (it is split in 2 parts):



Switching regulator



5.2.1.3. 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. A single 3.7V lithium-ion cell battery type is ideal to supply the power to the Telit DE910-DUAL module.



WARNING:

The three 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 DE910-DUAL modem and damage it. 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 DE910-DUAL module from power polarity inversions when connecting the battery.
- The battery capacity must be at least 500mAh in order to withstand the current peaks of (TBD). The suggested battery capacity is from 500mAh to 1000mAh.

5.2.2. Thermal Design Guidelines

The thermal design for the power supply heat sink must be done with the following specifications:

- Average current consumption during CDMA 1x / 1xEV-DO transmission @PWR level max : TBD mA
- Average GPS current during GPS ON (Power Saving disabled) in DE910-DUAL : TBD mA



NOTE:

The average consumption during transmissions depends on the power level at which the device is requested to transmit via the network. The average current consumption hence varies significantly.

Considering the very low current during idle, especially if the Power Saving function is enabled, it is possible to consider from the thermal point of view that the device absorbs current significantly only during calls.

If we assume that the device stays in transmission for short periods of time (let us say few minutes) and then remains for quite a long time in idle (let us say one hour), then the power supply always has the time to cool down between the calls and the heat sink could be smaller than the calculated for TBD mA maximum RMS current. There could even be a simple chip package (no heat sink).

Moreover in average network conditions the device is requested to transmit at a lower power level than the maximum and hence the current consumption will be less than TBD mA (being usually around TBD mA).

For these reasons the thermal design is rarely a concern and the simple ground plane where the power supply chip is placed can be enough to ensure a good thermal condition and avoid overheating.

The heat generated by the DE910-DUAL must be taken into consideration during transmission at 0.25W max during calls. This generated heat will be mostly conducted to the ground plane under the DE910-DUAL. The application must be able to dissipate heat.

In the CDMA 1x/1xEV-DO mode, since DE910-DUAL emits RF signals continuously during transmission, you must pay special attention how to dissipate the heat generated.

The current consumption will be up to about TBD mA in CDMA 1x continuously at the maximum TX output power (24.5dBm). Thus, you must arrange the area on the application PCB to be as large as possible under DE910-DUAL.

You must mount DE910-DUAL on the large ground area of your application board and make many ground vias to dissipate the heat.



5.2.3. Power Supply PCB layout Guidelines

As seen in the electrical design guidelines, the power supply must have a low ESR capacitor on the output to cut the current peaks and a protection diode on the input to protect the supply from spikes and polarity inversion. The placement of these components is crucial for the correct operation of the circuitry. A misplaced component can be useless or can even decrease the power supply performance.

- The bypass low ESR capacitor must be placed close to the Telit DE910-DUAL power input pads, or if the power supply is a switching type, the capacitor can be placed close to the inductor to cut the ripple if the PCB trace from the capacitor to DE910-DUAL is wide enough to ensure a drop-less connection even during the 1A 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 when the TBD A current peaks are absorbed. While a voltage drop of hundreds of 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 does not have an audio interface but only uses the data feature of the Telit DE910-DUAL, then this noise is not as disturbing and the power supply layout design can be more forgiving.
- The PCB traces to DE910-DUAL and the Bypass capacitor must be wide enough to ensure no significant voltage drops occur when the TBD A current peaks are absorbed. This is a must for the same above-mentioned reasons. 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 must be done in a way to guarantee that the high current return paths in the ground plane are not overlapped to any noise sensitive circuitry such as the microphone amplifier/buffer or earphone amplifier.

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

6. Antenna (Antenne)

The antenna connection and board layout design are the most important parts in the full product design and they strongly reflect on the product's overall performance. Read carefully and follow the requirements and the guidelines for a proper design.

La connexion de l'antenne ainsi que la conception de la carte sont les parties les plus importantes du produit et reflètent fortement les performances globales du produit. Lisez attentivement et suivez les instructions et directives pour une conception appropriée du produit.

6.1. CDMA Antenna Requirements (Specifications de l'antenne CDMA)

The antenna for a Telit DE910-DUAL device must fulfill the following requirements:

Comme suggéré sur la description du produit, l'antenne pour un dispositif Telit DE910-DUAL doit remplir les conditions suivantes:

CDMA Antenna Requirements	
Spécification de l' antenne CDMA	
Frequency range Bande de fréquence	Depending on frequency band(s) provided by the network operator, the customer must use the most suitable antenna for that/those band(s) Dépendant des bandes de fréquence fournies par l'opérateur de réseau, le client doit utiliser l'antenne la plus appropriée pour celle/ces bandes
Bandwidth Bande de fréquence	70 MHz in CDMA BC0 140 MHz in CDMA BC1 70 mégahertz dans CDMA BC0 140 mégahertz dans CDMA BC1
Gain Gain	Gain < 5.12dBi in CDMA BC0 Gain < 6.12dBi in CDMA BC1 Gain < 5.12dBi dans CDMA BC0, Gain < 6.12dBi dans CDMA BC1
Impedance Impédance	50 Ohm
Input power Puissance d'entrée	> 24dBm Average Power in CDMA > puissance 24dBm moyenne dans CDMA



VSWR absolute max	5:1 (Limit to avoid permanent damage)
Maximum absolu de VSWR	≤ 5:1 (Limite pour éviter des dommages permanents)
VSWR recommended	2:1 (Limit to fulfill all regulatory requirement)
VSWRrecommandé	≤ 2:1 (Limite pour remplir toute la condition de normalisation)

When using the Telit DE910-DUAL, since there's no antenna connector on the module, the antenna must be connected to the DE910-DUAL antenna pad (K1) by means of a transmission line implemented in the PCB.

En utilisant le DE910-DUAL Telit, puisqu'il n'y a aucun connecteur d'antenne sur le module, l'antenne doit être reliée à la plage d'accueil de l'antenne du DE910-DUAL (K1) au moyen d'une piste de transmission prévue sur la carte.

In the case that the antenna is not directly connected at the antenna pad of the DE910-DUAL, then a PCB line is required.

Dans le cas où l'antenne n'est pas directement reliée à la plage d'accueil de l'antenne du DE910-DUAL, alors une piste du PCB est nécessaire afin de se relier à elle ou à son connecteur.

This transmission line shall fulfill the following requirements:

Cette piste de transmission remplira les conditions suivantes:

Antenna Line on PCB Requirements	
Spécification de la piste de l'antenne sur le PCB	
Characteristic Impedance	50Ohm
Impédance caractéristique	
Max Attenuation	0.3dB
Atténuation maximum	
Coupling with other signals shall be avoided	
L'accouplement avec d'autres signaux doit être évité	
Cold End (Ground Plane) of antenna shall be equipotential to the DE910-DUAL ground pads	
L'extrémité froide (plan de masse) de l'antenne sera équipotentielle aux plages du DE910-DUAL	

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

En outre si le dispositif est développé pour le marché des USA et/ou du Canada, il doit se conformer aux conditions FCC et/ou IC approuvées:



This device is to be used only for mobile and fixed application. The antenna(s) used for this transmitter 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. End-Users must be provided with transmitter operation conditions for satisfying RF exposure compliance. OEM integrators must ensure that the end user has no manual instructions to remove or install the DE910-DUAL module. Antennas used for this OEM module must not exceed 3dBi gain for mobile and fixed operating configurations.

Ce dispositif doit être employé seulement pour une application mobile et fixe. Les antennes utilisées pour cet émetteur doivent être installées à une distance d' au moins de 20 cm de toute personne et ne doivent pas être co-implantées ou opérer en même temps que n'importe quelle autre antenne ou émetteur. Les conditions de fonctionnement de l'émetteur doivent être remises aux utilisateurs conformément à la réglementation sur l'exposition aux ondes radio.

Les intégrateurs OEM doivent s'assurer que l'utilisateur n'a aucune instruction manuelle pour enlever ou installer le module DE910-DUAL. Les antennes utilisées pour ce module OEM ne doivent pas dépasser un gain de 3dBi pour des configurations mobiles et fixes.

6.2. CDMA antenna - PCB line Guidelines (Antenne CDMA - Directives pour le PCB)

- Make sure that the transmission line's characteristic impedance is 50ohm.
Assurez-vous que l'impédance caractéristique de la piste de transmission est 50ohm.
- Keep line on the PCB as short as possible since the antenna line loss shall be less than around 0.3dB.
Maintenez la piste sur la carte aussi courte que possible, puisque la perte de la piste d'antenne sera inférieure à 0.3dB.
- Line geometry should have uniform characteristics, constant cross section, avoid meanders and abrupt curves.
La géométrie de la piste doit avoir des caractéristiques uniformes, une section transversale constante, évitant les méandres et les courbes brusques.
- Any kind of suitable geometry/structure can be used for implementing the printed transmission line afferent the antenna.
N'importe quel genre de géométrie/de structure appropriées peut être utilisée pour mettre en place la piste de transmission afférente à antenne.
- If a Ground plane is required in line geometry, that plane has to be continuous and sufficiently extended so the geometry can be as similar as possible to the related canonical model.
Si un plan de masse est exigé ce plan doit être continu et suffisamment étendu afin que la géométrie soit le plus semblable possible au modèle canonique exposé.
- Keep, if possible, at least one layer of the PCB used only for the Ground plane; If possible, use this layer as reference Ground plane for the transmission line.
Gardez, si possible, au moins une couche du PCB utilisée uniquement pour le plan de masse ; Si possible, utilisez cette couche comme plan de masse de référence pour la piste de transmission.



- It is wise to surround (on both sides) of the PCB transmission line with Ground. Avoid having other signal tracks facing directly the antenna line track.
Il est sage d'entourer (des deux côtés) la piste de transmission du PCB avec la masse, en évitant d'avoir d'autres pistes de signal faisant face directement à la piste de l'antenne.
- Avoid crossing any un-shielded transmission line footprint with other tracks on different layers.
Évitez de croiser toute empreinte non protégée avec d'autres pistes sur différentes couches.
- The Ground surrounding the antenna line on PCB has to be strictly connected to the main Ground plane by means of via holes (once per 2mm at least) placed close to the ground edges facing line track.
La masse entourant la piste de l'antenne sur la carte doit être strictement relié au plan de masse principal par l'intermédiaire de trous (une fois par 2mm au moins), placés près des bords de la terre faisant face à la piste.
- Place EM noisy devices as far as possible from DE910-DUAL antenna line.
Placez les dispositifs bruyants EM aussi loin que possible de la piste de l'antenne du DE910-DUAL.
- Keep the antenna line far away from the DE910-DUAL power supply lines.
Maintenez la piste de l'antenne loin des sources d'alimentation du DE910-DUAL.
- If EM noisy devices are present on the PCB hosting the DE910-DUAL, such as fast switching ICs, take care of shielding them with a metal frame cover.
Si les dispositifs bruyants EM sont présent sur le PCB accueillant le DE910-DUAL, tel qu'un commutateur rapide IC, prenez soin de les protéger avec un capot métallique.
- If EM noisy devices are not present around the line use of geometries like Micro strip or Grounded Coplanar Waveguide are preferred since they typically ensure less attenuation when compared to a Strip line having same length.
Si aucun dispositif bruyant EM n'est présent autour de la piste, l'utilisation de géométrie comme la bande micro ou le guide d'ondes coplanaire sont recommandés, puisqu'ils assurent typiquement moins d'atténuation comparé à une bande ayant la même longueur.

6.3. CDMA Antenna installation Guidelines (Directives d'installation de l'antenne CDMA)

- Install the antenna in a place covered by the CDMA signal.
Installez l'antenne dans un endroit couvert par le signal CDMA.
- If the device antenna in the application is located greater than 20cm from the human body and there are no co-located transmitters then the Telit FCC/IC approvals can be re-used by the end product.
Si le dispositif d'antenne est situé à une distance de plus de 20cm d'une personne et qu'il n'y a aucun émetteur co-implanté alors les approbations FCC/IC de Telit peuvent être réutilisées par le produit final.
- Antenna shall not be installed inside metal cases.
L'antenne ne doit pas être installée à l'intérieur de boîtiers en métal.
- Antenna shall be installed also according antenna manufacture instructions.
L'antenne doit être installée conformément aux instructions du fabricant.

6.4. Antenna Diversity Requirements (Conditions de diversité d'antenne)

This product is including an input for a second RX antenna to improve the radio sensitivity. The function is called Antenna Diversity.

Ce produit comprend une deuxième antenne RX pour améliorer la sensibilité. La fonction s'appelle Antenna Diversity.

CDMA Antenna Diversity Requirements	
Conditions de diversité d'antenne CDMA	
Frequency range bande fréquence	Depending on frequency band(s) provided by the network operator, the customer must use the most suitable antenna for that/those band(s) Dépendant des bandes de fréquence fournies par l'opérateur de réseau, le client doit utiliser l'antenne la plus appropriée pour ces bandes
Bandwidth Largeur de bande	70 MHz in CDMA BC0 140 MHz in CDMA BC1 70 mégahertz en CDMA BC0 140 mégahertz en CDMA BC1
Impedance Impédance	50 Ohm

When using the Telit DE910-DUAL, since there's no antenna connector on the module, the antenna must be connected to the DE910-DUAL antenna pad (F1) by means of a transmission line implemented on the PCB.

En utilisant DE910-DUAL Telit, puisqu'il n'y a aucun connecteur d'antenne sur le module, l'antenne doit être reliée à la plage d'antenne de DE910-DUAL (F1) par une piste de transmission prévue sur le PCB.

In the case that the antenna is not directly connected at the antenna pad of DE910-DUAL, then a PCB line is required.

Dans le cas où l'antenne n'est pas directement connectée à la plage d'antenne du DE910-DUAL, alors une piste du PCB est nécessaire afin de se relier à elle ou à son connecteur.

6.5. GPS Antenna Requirements

The use of an active GPS antenna is required to achieve better performance especially when the GPS antenna distance from the module is quite high.

The module is provided with a Digital Output signal to enable the external LNA (pad R7).

6.5.1. Combined GPS Antenna

The use of combined CDMA/GPS antenna is not recommended. This solution could generate extremely poor GPS reception and also the combined antenna requires additional diplexer and adds a loss in the RF route.

6.5.2. Linear and Patch GPS Antenna

Using this type of antenna introduces at least 3dB of loss if compared to a circularly polarized (CP) antenna. Having a spherical gain response instead of a hemispherical gain response could aggravate the multipath behaviour & create poor position accuracy.

6.5.3. LNA and Front End Design Considerations

The optional external LNA should be dimensioned to avoid an excessive LNA gain that can introduce jamming, spurious, degrade IIP3, and saturate the receiver.

The external active antenna for the Telit DE910-DUAL device must fulfill the following requirements:

GPS Antenna Requirements	
Frequency range	1575.42MHz (GPS L1)
Bandwidth	+/- 1.023MHz
Impedance	50 Ohm

When using the Telit DE910-DUAL, since there's no antenna connector on the module, the antenna must be connected to the DE910-DUAL through the PCB with the antenna pad.

In the case that the antenna is not directly connected at the antenna pad of the DE910-DUAL, then a PCB line is required.



This line of transmission shall fulfill the following requirements:

Antenna Line on PCB Requirements	
Characteristic Impedance	50Ohm
Max Attenuation	0.3dB
Coupling with other signals shall be avoided	
Cold End (Ground Plane) of antenna shall be equipotential to the DE910-DUAL ground pads	

Furthermore if the device is developed for the US and/or Canada market, it must comply with the FCC and/or IC requirements.

This device is to be used only for mobile and fixed application.

6.5.4. GPS Antenna - PCB Line Guidelines

- Ensure that the antenna line impedance is 50ohm.
- Keep line on the PCB as short as possible to reduce the loss.
- Antenna line must have uniform characteristics, constant cross section, avoid meanders and abrupt curves.
- Keep one layer of the PCB used only for the Ground plane; if possible.
- Surround (on the sides, over and under) the antenna line on PCB with Ground. Avoid having other signal tracks directly facing the antenna line track.
- The Ground around the antenna line on PCB has to be strictly connected to the main Ground plane by placing vias once per 2mm at least.
- Place EM noisy devices as far as possible from DE910-DUAL antenna line.
- Keep the antenna line far away from the DE910-DUAL power supply lines.
- If EM noisy devices are around the PCB hosting the DE910-DUAL, such as fast switching ICs, take care of shielding of antenna line by burying it inside the layers of PCB and surround it with Ground planes; or shield it with a metal frame cover.
- If you do not have EM noisy devices around the PCB of DE910-DUAL, use a strip line on the superficial copper layer for the antenna line. The line attenuation will be lower than a buried one.

6.5.5. GPS Antenna - Installation Guidelines

- The DE901-DUAL, due to its sensitivity characteristics, is capable of performing a fix inside buildings. (In any case the sensitivity could be affected by the building characteristics i.e. shielding)
- The Antenna must not be co-located or operating in conjunction with any other antenna or transmitter.
- Antenna shall not be installed inside metal cases.
- Antenna shall be installed also according antenna manufacture instructions.



8. SPI Port (TBD)

The DE910-DUAL module is provided by one SPI interface. The SPI interface defines one handshake line for flow control and mutual wake-up of the modem and the Application Processor. The AP has the master role, that is, it supplies the clock.

The following table is listing the available signals:

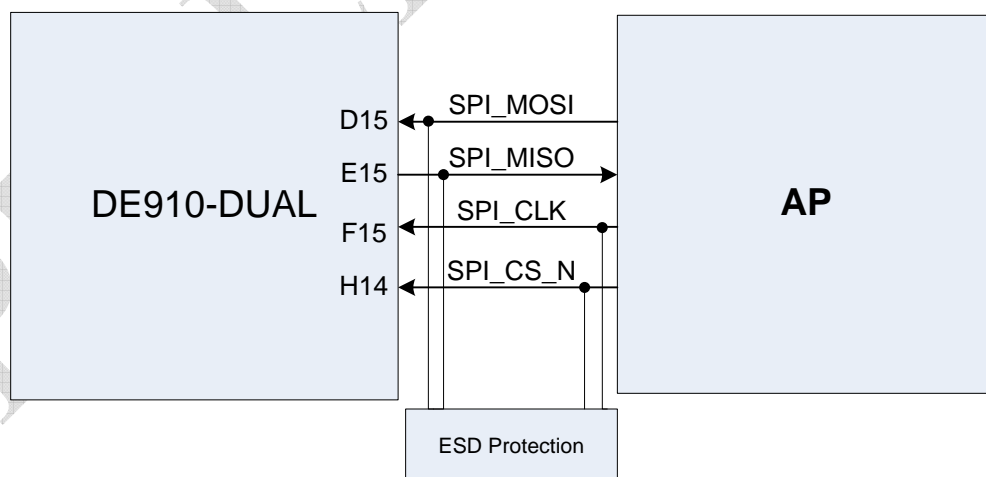
PAD	Signal	I/O	Function	Type	COMMENT
D15	SPI_MOSI	I	SPI_MOSI	B-PD 1.8V	Shared with TX_AUX
E15	SPI_MISO	O	SPI_MISO	B-PD 1.8V	Shared with RX_AUX
F15	SPI_CLK	I	SPI_CLOCK	B-PD 1.8V	
H14	SPI_CS_N	I	SPI_CS_N	B-PD 1.8V	



NOTE:

Due to shared functions, when the SPI port is used, it is not possible to use the AUX_UART function.

8.1. SPI Connections



9. Serial Port

The serial port on the Telit DE910-DUAL is the interface between the module and OEM hardware.

2 serial ports are available on the module:

- Modem Serial Port 1 (Main)
- Modem Serial Port 2 (Auxiliary)

Several configurations can be designed for the serial port on the OEM hardware.

The most common are:

- RS232 PC comport
- Microcontroller UART@1.8V(Universal Asynchronous Receiver Transmit)
- Microcontroller UART@5V or other voltages different from 1.8V

Depending on the type of serial port on the OEM hardware, a level translator circuit may be needed to make the system work.

Serial port 1 on DE910-DUAL is a +1.8V UART with all the 7 RS232 signals.

Serial port 2 is a +1.8V Auxiliary UART.

The electrical characteristics of the Serial ports are explained in the following tables:

Absolute Maximum Ratings -Not Functional

Parameter	DE910-DUAL	
	Min	Max
Input level on non-power pin with respect to ground	-	+2.3V

Operating Range - Interface levels

Level	DE910-DUAL	
	Min	Max
Input high level	1.17V	2.1 V
Input low level	-0.3V	0.63V
Output high level	1.35V	1.8V
Output low level	0V	0.45V

9.1. Modem Serial Port 1

The serial port 1 on the DE910-DUAL is a +1.8V UART with all the 7 RS232 signals. It differs from the PC-RS232 in the signal polarity (RS232 is reversed) and levels.

PAD	Signal	I/O	Function	Type	COMMENT
N14	DCD dcd_uart	-	Data Carrier Detect	B-PU 1.8V	
M15	RXD - Tx_uart		Transmit line *see Note	B-PD 1.8V	
N15	TXD - Rx_uart		Receive line *see Note	B-PD 1.8V	
M14	DTR dtr_uart	-	Data Terminal Ready	B-PU 1.8V	
P14	DSR dsr_uart	-	Data Set Ready	B-PU 1.8V	
L14	RTS rts_uart	-	Request to Send	B-PD 1.8V	
P15	CTS cts_uart	-	Clear to Send	B-PD 1.8V	
R14	RI - ri_uart		Ring Indicator	B-PU 1.8V	



NOTE:

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



NOTE:

In order to avoid a back powering effect it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the DE910-DUAL when the module is powered off or during an ON/OFF transition.



NOTE:

According to V.24, RX/TX signal names are referred to the application side. Therefore, on the DE910-DUAL side these signal are on the opposite direction: TXD on the application side will be connected to the receive line (here named TXD/ rx_uart) of the DE910-DUAL serial port and vice versa for RX.



9.2. Modem Serial Port 2

Serial port 2 on the DE910-DUAL is a +1.8V UART with only the RX and TX signals.

The signals of the DE910-DUAL serial port are:

PAD	Signal	I/O	Function	Type	COMMENT
D15	TX_AUX	O	Auxiliary UART (TX Data to DTE)	1.8V	Shared with SPI_MOSI
E15	RX_AUX	I	Auxiliary UART (RX Data to DTE)	1.8V	Shared with SPI_MISO



NOTE:

Due to the shared pins, when the Modem Serial port is used, it is not possible to use the SPI functions.



NOTE:

In order to avoid a back powering effect it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the DE910-DUAL when the module is powered off or during an ON/OFF transition.

9.3. RS232 Level Translation

In order to interface the Telit DE910-DUAL with a PC com port or a RS232 (EIA/TIA-232) application, a level translator is required. This level translator must:

- Invert the electrical signal in both directions
- Change the level from 0/1.8V to +/-15V

Actually, the RS232 UART 16450, 16550, 16650 & 16750 chipsets accept signals with lower levels on the RS232 side (EIA/TIA-562), allowing a lower voltage-multiplying ratio on the level translator. Note that the negative signal voltage must be less than 0V and hence some sort 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 a multitude of them, differing in the number of drivers and receivers and in the levels (be sure to get a true RS232 level translator not a RS485 or other standards).

By convention the driver is the level translator from the 0-1.8V UART to the RS232 level. The receiver is the translator from the RS232 level to 0-1.8V UART.

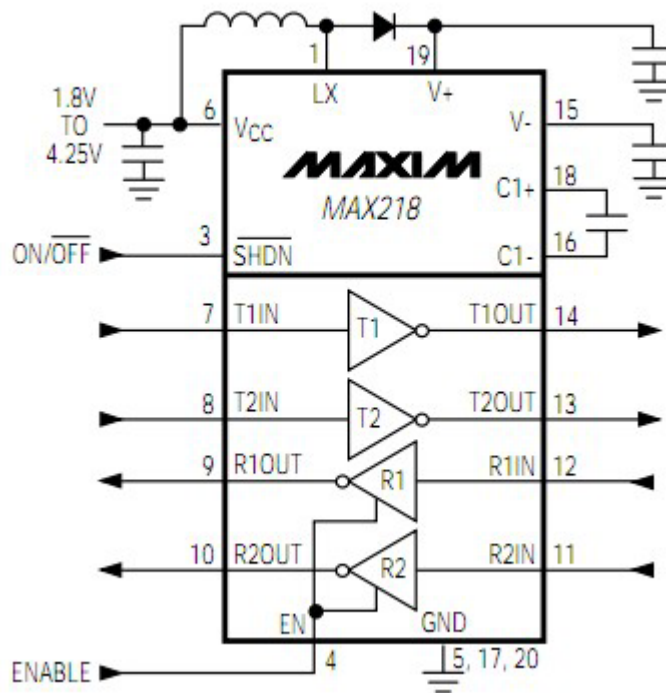
In order to translate the whole set of control lines of the UART you will need:

- 5 drivers
- 3 receivers



An example of RS232 level adaption circuitry could be accomplished using a MAXIM transceiver (MAX218).

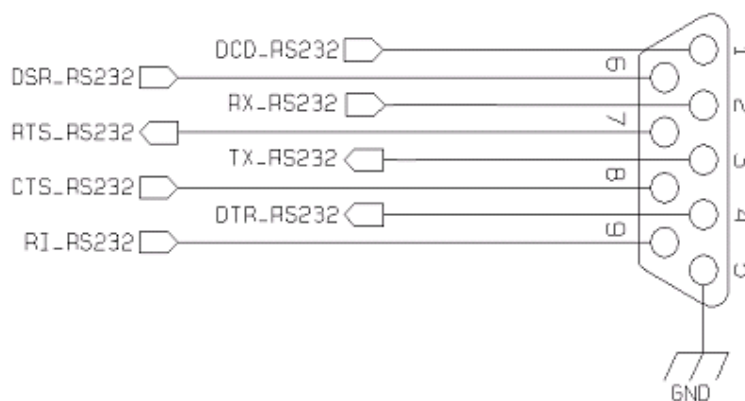
In this case the chipset is capable of translating directly from 1.8V to the RS232 levels (Example on 4 signals only).



NOTE:

In this case the length of the lines on the application has to be taken in account to avoid problems in case of High-speed rates on RS232.

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



10. Audio Section Overview

DE910-DUAL module doesn't support an analog audio interface and supports one Digital Audio bus.

In order to develop an application including an Analog Audio it is necessary to add a dedicated CODEC on the Application design.

For further information, please refer to the "Digital Voice Interface Application Note (TBD)".

10.1. Electrical Characteristics

The product is providing one Digital Audio Interface (DVI) on the following Pins:

PAD	Signal	I/O	Function	Type	COMMENT
B9	DVI_WA0	I/O	Digital Audio Interface (WA0)	B-PD 1.8V	
B6	DVI_RX	I	Digital Audio Interface (RX)	B-PD 1.8V	
B7	DVI_TX	O	Digital Audio Interface (TX)	B-PD 1.8V	
B8	DVI_CLK	I/O	Digital Audio Interface (CLK)	B-PD 1.8V	

10.1.1. CODEC Example

Please refer to the Digital Voice Interface Application note. (TBD)

11. General Purpose I/O

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

- Input
- Output
- Alternate function (internally controlled)

Input pads can only be read and report the digital value (high or low) present on the pad at the read time;

Output pads can only be written or queried and set the value of the pad output;

An alternate function pad is internally controlled by the DE9109-DUAL firmware and acts depending on the function implemented.

The following GPIOs are available on the DE910-DUAL.

PAD	Signal	I/O	Function	Type	Drive Strength
C8	GPIO_01	I/O	Configurable GPIO	B-PD 1.8V	2 mA
C9	GPIO_02	I/O	Configurable GPIO	B-PD 1.8V	2 mA
C10	GPIO_03	I/O	Configurable GPIO	B-PD 1.8V	2 mA
C11	GPIO_04	I/O	Configurable GPIO	B-PD 1.8V	2 mA
B14	GPIO_05	I/O	Configurable GPIO	B-PD 1.8V	2 mA
C12	GPIO_06	I/O	Configurable GPIO	B-PD 1.8V	2 mA
C13	GPIO_07	I/O	Configurable GPIO	B-PD 1.8V	2 mA
K15	GPIO_08	I/O	Configurable GPIO	B-PD 1.8V	2 mA
L15	GPIO_09	I/O	Configurable GPIO	B-PD 1.8V	2 mA
G15	GPIO_10	I/O	Configurable GPIO	B-PD 1.8V	2 mA

11.1. Logic Level Specification

Where not specifically stated, all the interface circuits work at 1.8V CMOS logic levels.

The following table shows the logic level specifications used in the DE910-DUAL interface circuits:

Operating Range - Interface levels (1.8V CMOS)

Level	DE910-DUAL	
	Min	Max
Input high level	1.17V	2.1V
Input low level	-0.3V	0.63V
Output high level	1.35V	1.8V
Output low level	0V	0.45V

11.2. Using a GPIO Pad as Input

The GPIO pads, when used as inputs, can be connected to a digital output of another device and report its status, provided this device has interface levels compatible with the 1.8V CMOS levels of the GPIO.

If the digital output of the device is connected with the GPIO input, the pad has interface levels different from the 1.8V CMOS. It can be buffered with an open collector transistor with a 47K Ω pull-up resistor to 1.8V.



NOTE:

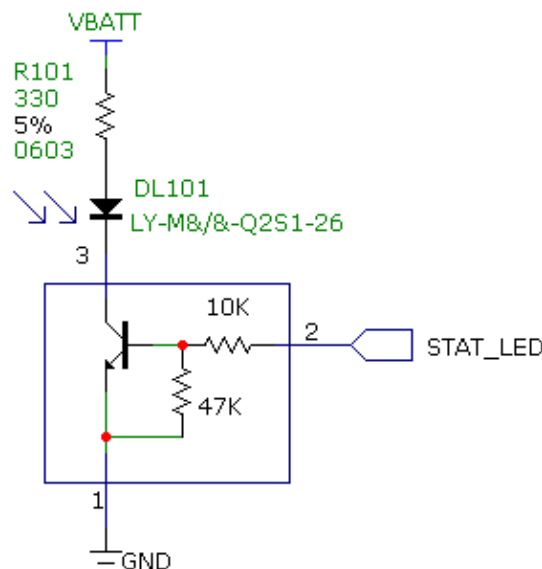
In order to avoid a back powering effect it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the module when is powered OFF or during an ON/OFF transition.



11.5. Indication of Network Service Availability

The STAT_LED pin status shows information on the network service availability and Call status. In the DE910-DUAL modules, the STAT_LED usually needs an external transistor to drive an external LED. Because of the above, 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



11.6. RTC Bypass output

The VRTC pin brings out the Real Time Clock supply, which is separate from the rest of the digital part, allowing only RTC to be active when all the other parts of the device are off. To this power output a backup capacitor can be added in order to increase the RTC autonomy during power off of the battery.



NOTE:

NO devices must be powered from this pin.



11.7. VAUX/PWRMON 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 – VAUX/PWRMON power supply

	Min	Typical	Max
Output voltage	V	1.8V	V
Output current			200mA
Output bypass capacitor (Inside the module)			1.0 μ F

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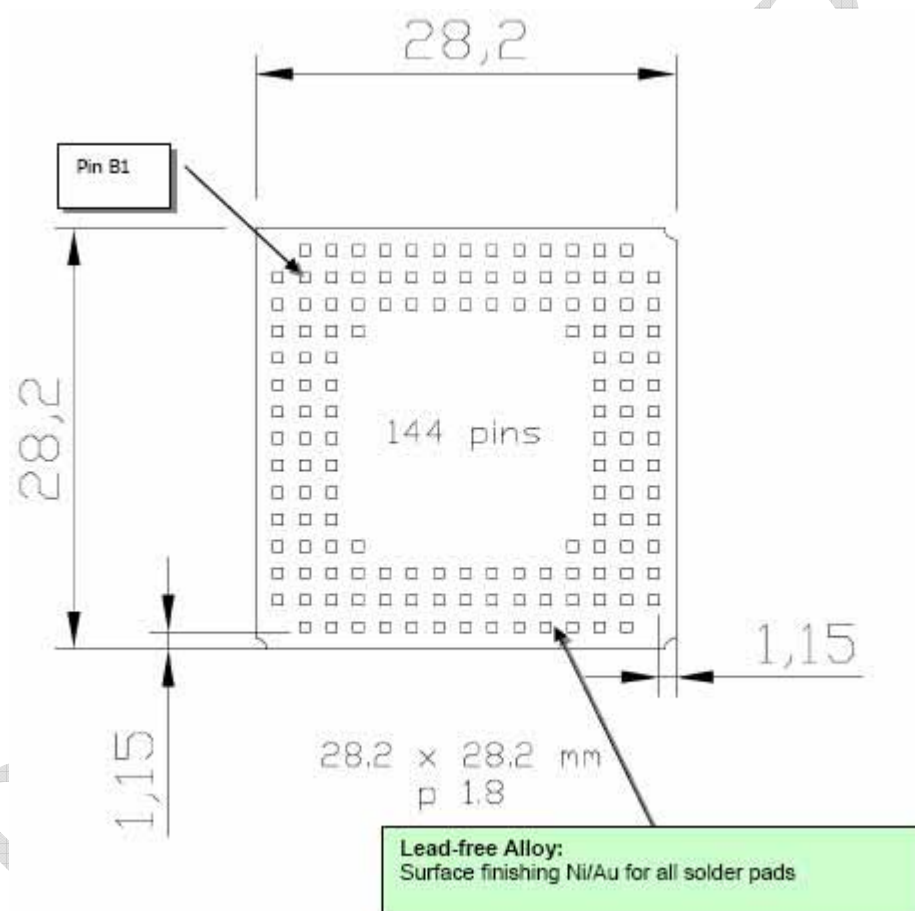


12. Mounting the Module on your Board

12.1. General

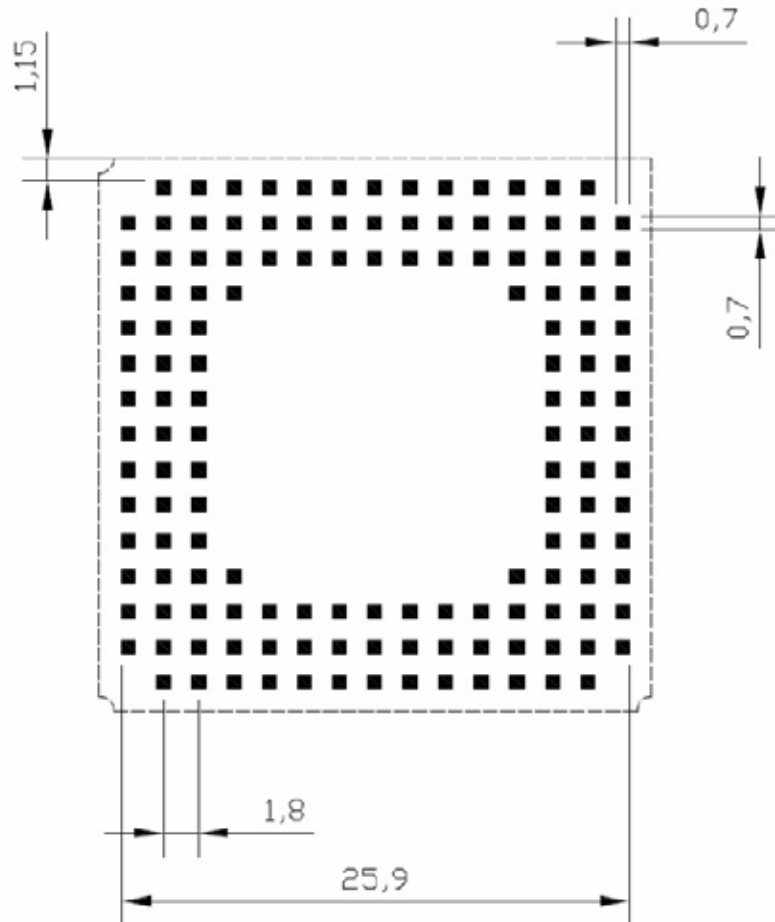
The DE910-DUAL modules have been designed in order to be compliant with a standard lead-free SMT process.

12.2. Module Finishing & Dimensions



Bottom View (Dimensions in mm)

12.4. Recommended foot print for the application



Top View

In order to easily rework the DE910-DUAL it is suggested to consider on the application having a 1.5 mm placement inhibit area around the module.

It is also suggested, as common rule for an SMT component, to avoid having a mechanical part of the application in direct contact with the module.



NOTE:

In the customer application, the region under WIRING INHIBIT (see figure) must be clear from signal or ground paths.

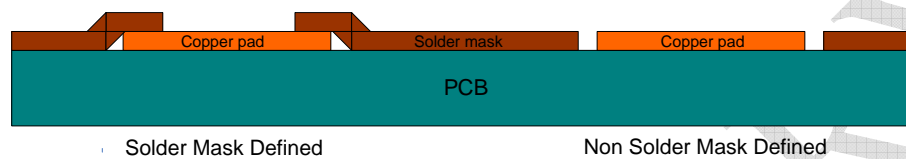


12.5. Stencil

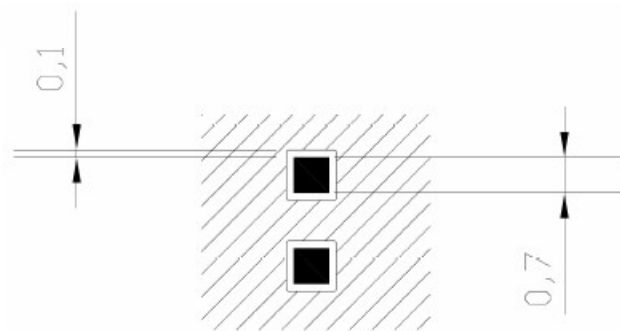
Stencil's apertures layout can be the same of the recommended footprint (1:1). A suggested thickness of stencil foil is less than 120 μm .

12.6. PCB Pad Design

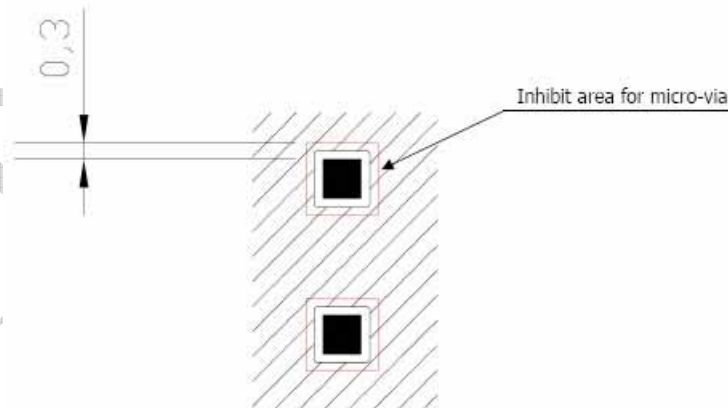
Non solder mask defined (NSMD) type is recommended for the solder pads on the PCB.



12.7. Recommendations for PCB Pad Dimensions (mm)



It is not recommended to place via or micro-via not covered by solder resist in an area of 0,3 mm around the pads unless it carries the same signal of the pad itself (see following figure).



Holes in pad are allowed only for blind holes and not for through holes.

12.8. Recommendations for PCB Pad Surfaces

Finish	Layer thickness (um)	Properties
Electro-less Ni / Immersion Au	3 – 7 / 0.05 – 0.15	good solder ability protection, high shear force values

The PCB must be able to resist the higher temperatures which are occurring at the lead-free process. This issue should be discussed with the PCB-supplier. Generally, the wettability of tin-lead solder paste on the described surface plating is better compared to lead-free solder paste.

12.9. Solder Paste

Solder Paste	Lead free
	Sn/Ag/Cu

We recommend using only “no clean” solder paste in order to avoid the cleaning of the modules after assembly.

12.10. Solder Reflow

The following is the recommended solder reflow profile:

Profile stage	Description	Lead-free(High-Temp) condition limits
Preheat	Initial ramp	3 /sec max
Soak	Dry out and flux activation	135 to 175 60 to 120 sec
Reflow	Time above solder paste melting point SMT peak package body temperature	40 to 90 sec 245
Cool down	Cool rate-ramp to ambient	6 /sec max



NOTE:

All temperatures refer to topside of the package, measured on the package body surface.



WARNIG:

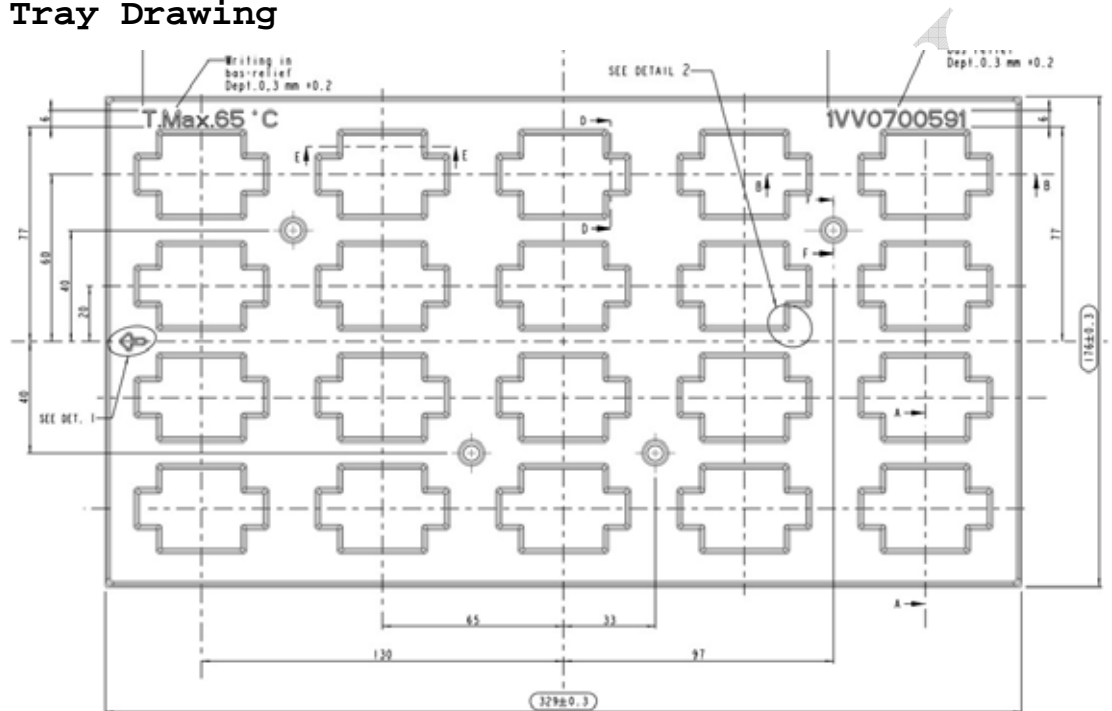
The DE910-DUAL module withstands one reflow process only.



12.11. Packing System

The DE910-DUAL modules are packaged on trays of 20 pieces each. These trays can be used in SMT processes for pick & place handling.

12.11.1. Tray Drawing



(1VV0700591-0A)



WARNIG:

These trays can withstand a maximum temperature of 65 .

12.12. Moisture Sensibility

The DE910-DUAL is a Moisture Sensitive Device level 3, in accordance with standard IPC/JEDEC J-STD-020. Observe all of the requirements for using this kind of components.

Calculated shelf life in sealed bag: 4 months at <40°C and <90% relative humidity (RH).



13. **Conformity Assessment Issues (Problèmes d'évaluation de conformité)**

The DE910-DUAL is FCC/IC Approved as module to be installed in other devices. This device should be used only for fixed and mobile applications and if the final product after integration is intended for portable use, a new application and FCC is required.

Le DE910-DUAL est approuvé FCC/IC comme module à installer dans d'autres dispositifs. Ce dispositif doit être utilisé uniquement pour des applications fixes et mobiles et si le produit fini est prévu après intégration pour un usage portatif, une nouvelle application et la FCC est requise

The user is cautioned that this device should be used only as specified within this manual to meet RF exposure requirements.

L'utilisateur est averti que ce dispositif doit être utilisé uniquement comme spécifié dans ce manuel pour répondre aux normes d'exposition aux ondes rf.

Use of this device in a manner inconsistent with this manual could lead to excessive RF exposure conditions.

L'utilisation de ce dispositif en quelque sorte contradictoire avec ce manuel a pu mener aux états excessifs d'exposition de rf.

The DE910-DUAL is conforming to the following US Directives:

- Use of RF Spectrum. Standards: FCC47 Part 22&24
- EMC Standards: FCC47 Part 15

Le DE910-DUAL est conforme aux directives suivantes des USA

- Utilisation de spectre de rf. Normes : FCC47 partie 22&24
- Normes d'EMC : FCC47 partie 15

This device complies with Part 15 of the FCC Rules.

Ce dispositif est conforme à la partie 15 des règles FCC.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le fonctionnement est sujet aux deux conditions suivantes :

- (1) ce dispositif peut ne pas causer l'interférence nocive, et
- (2) ce dispositif doit accepter aucune interférence, y compris un interférence qui pourrait causer le fonctionnement non désiré du dispositif.

The user must refer to below information to meet the FCC/IC's RF exposure rules and regulations when they design:

Lors de la conception, l'utilisateur doit se référer à l'information ci-dessous pour remplir les conditions et réglementations FCC/IC' d'exposition aux ondes RF:

- The system antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
Le système d'antenne utilisé pour cet émetteur doit être installé à une distance d'au moins de 20 cm de toute personne et ne doit pas être co-implanté ou opérer en même temps que n'importe quelle autre antenne ou émetteur.
- The system antenna(s) used for this module must not exceed 5.12dBi in CDMA BC0 and 6.12dBi in CDMA BC1 for mobile and fixed or mobile operating configurations.
Le système d'antenne utilisé pour ce module ne doit pas dépasser 5.12dBi en CDMA BC0 et 6.12dBi en CDMA BC1 pour des configurations mobiles et fixes ou des configurations opérant en mode mobile.
- Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.
Manufacturers of mobile, fixed or portable devices incorporating this module are advised to clarify any regulatory questions and to have their complete product tested and approved for FCC compliance.
Les instructions d'installation de l'antenne ainsi que les conditions de fonctionnement de l'émetteur doivent être remis aux utilisateurs et aux installateurs conformément à la réglementation sur l'exposition aux ondes rf. Des fabricants des dispositifs mobiles, fixes ou portables incorporant ce module sont invités à clarifier toutes les questions de normalisation et à avoir leur produit complètement testé pour la mise en conformité FCC.
- DE910-DUAL is intended for the OEM integrator only.
DE910-DUAL est prévu pour l'intégrateur OEM seulement.
- The user is required to see the Grant of Equipment document for other restrictions.
L'utilisateur doit se référer au document « Grant of equipment » pour d'autres restrictions.
- DE910-DUAL must be operated and used with a locally approved access point.
DE910-DUAL doit être actionné et utilisé avec un point d'accès localement approuvé.
- The radio transmitter(IC ID: 5131A-DE910DUAL) has been approved by Industry Canada to operate with the antenna type listed in this manual with the maximum permissible gain and required antenna impedance for each antenna type indicated.
Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.
L'émetteur radio (identification d'IC : 5131A-DE910DUAL) a été approuvé par Industry Canada pour fonctionner avec le type d'antenne énuméré dans ce manuel avec le gain autorisé maximum et l'impédance d'antenne exigée pour chaque type d'antenne indiqué. Les types d'antenne non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits pour un usage avec ce dispositif.

The following regulatory and safety notices must be published in documentation supplied to the end user of the product or system incorporating an adapter in compliance with local regulations.

- Host system including DE910-DUAL must be labeled with
“Contains transmitter module with
FCC ID: RI7DE910-DUAL and IC ID: 5131A-DE910DUAL”

Les notices de normalisation et de sécurité doivent se trouver dans la documentation fournie à l'utilisateur du produit ou du système incorporant un adaptateur conforme aux réglementations locales.

- Le système hôte comprenant DE910-DUAL doit être marqué avec « Contient un module émetteur avec IDENTIFICATION FCC : RI7DE910-DUAL et identification IC : 5131A-DE910DUAL »

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14. Safety Recommendations

READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country's regulations and the specific environment regulation.

Do not disassemble the product; any evidence of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself.

The system integrator is responsible for the functioning of the final product; therefore, care has to be taken with the external components of the module, as well as of any project or installation issue, because the risk of disturbing the CDMA network or external devices or having impact on security. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

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