

DESIGN FOR APPLICATION BASED ON Q2403

POWER SUPPLY 5V

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001	12/12/01	OFFICIAL VERSION	B LEBOT
002	05/03/02	STRUTURE MODIFICATION ONLY	B LEBOT
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	Name / Nom	Function / Fonction	Date/ Date	Signature/ Signature
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1 INTRODUCTION

1.1 Goal of the document

The goal of this document is to propose a design around the **Q2403** modules.

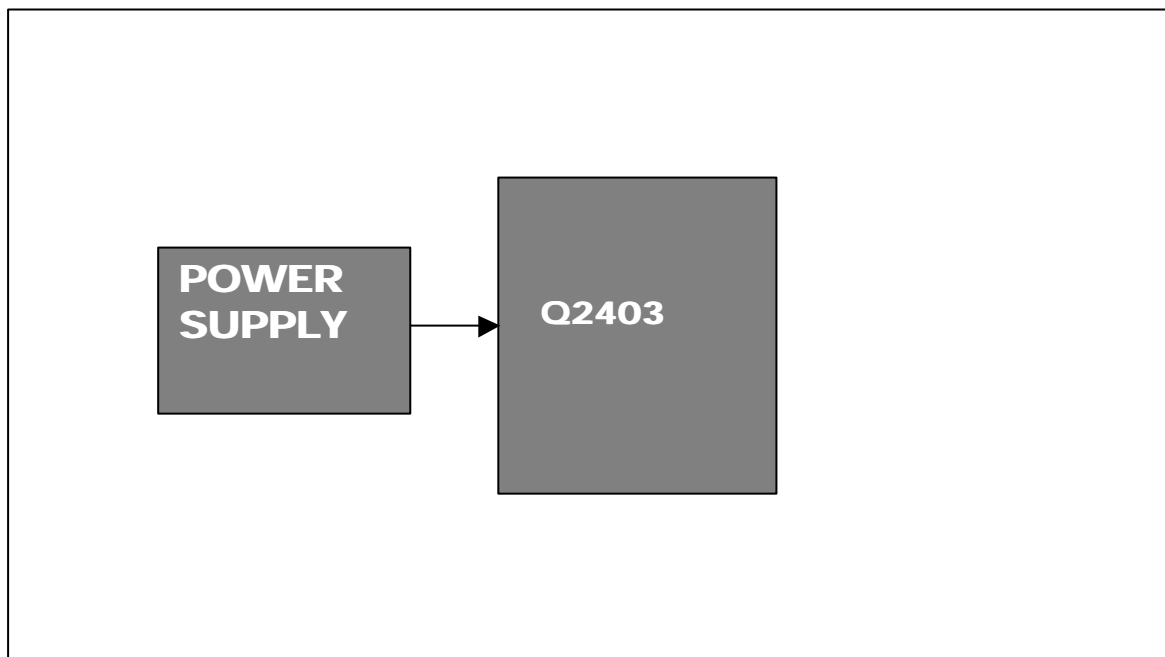
NOTES:

All schematics proposed in this document have been applied in a modem and have EMC test in accordance with the following standards :

ETSI EN 300 342-1 edition 1997
EN 55022 Class B (emission)
EN 61000-4-2(CEM)
EN 61000-4-3(ESD).
CLIMATIC TEST OPERATING -20°C;+55°C
CLIMATIC TEST STORAGE -30°C;+85°C

2 MODULE INTERFACES

2.1 Block diagram



2.2 Interface description

- POWER SUPPLY: A standard 5V +/-5%-1A power is strictly required to supply this design..

3 POWER SUPPLY

3.1 5V /1A Power supply

Power Supply is one of the key issue in the design of a GSM terminal.
The purpose is to characterise a reference 5 V power supply to feed Q2403 module .

Advantages of such kind of power supply:

- Small size(based on MIC 5158: LDO Regulator)
- Low POWER DISSIPATION
- Very Low consumption in OFF (SHUTDOWN)
- High autonomy
- Minimal radio perturbation (ripple)
- Limitation of current 1A

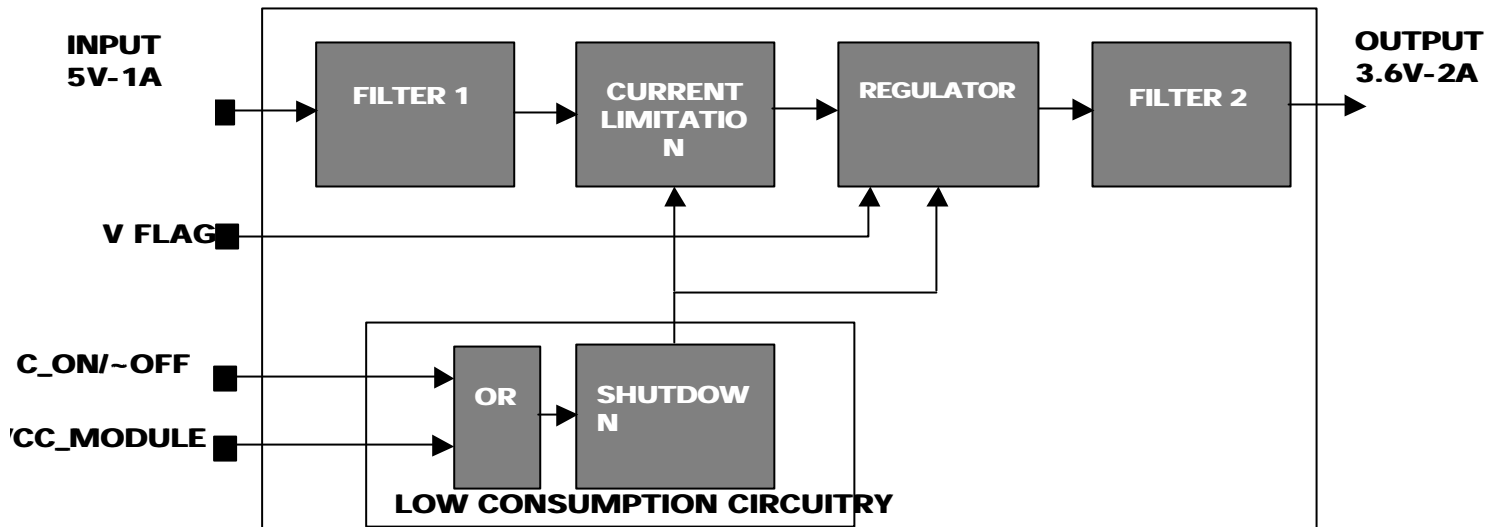
3.1.1 Input features

	MIN	NOM	MAX	UNITES
Input voltage DC	4.75	5	5.25	V
Input current	1			A
Ripple voltage :F<200Khz			60	mV
Ripple voltage :F>200Khz			15	mV

3.1.2 output features

	SPECIFICATION				
	MIN	NOM	MAX	RESULT	UNITES
Output current @ PCL5-TX			2	1.6	A
Consumption in OFF				56	µA
Current limit			0.80	0.80	A
Output voltage DC		3.7	3.8	3.68	V
Ripple voltage			300	85	mV

3.2 Block diagram



FILTER1 and FILTER 2 :

These filter are to minimise noise coming from outside and for needs for significant current in the burst we use large capacitor of 470µF of technology LOW ESR.
It's on this part that you can decrease the price.

REGULATOR:

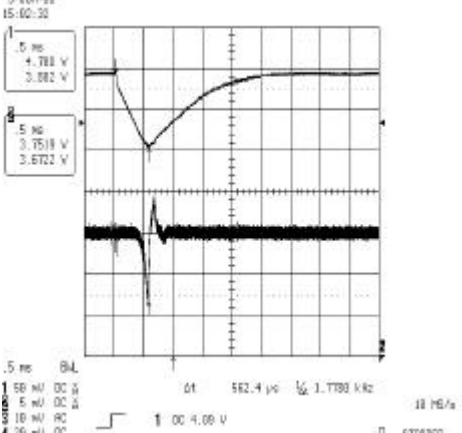
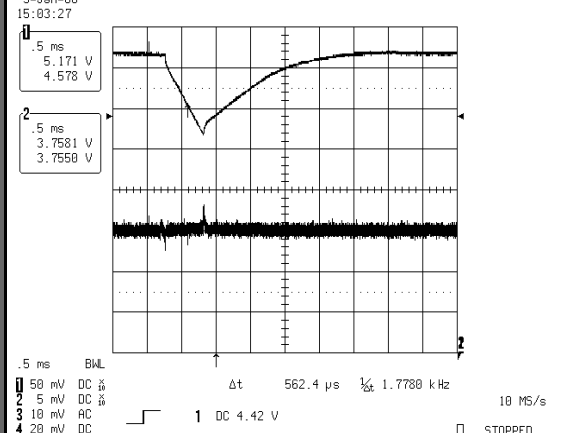
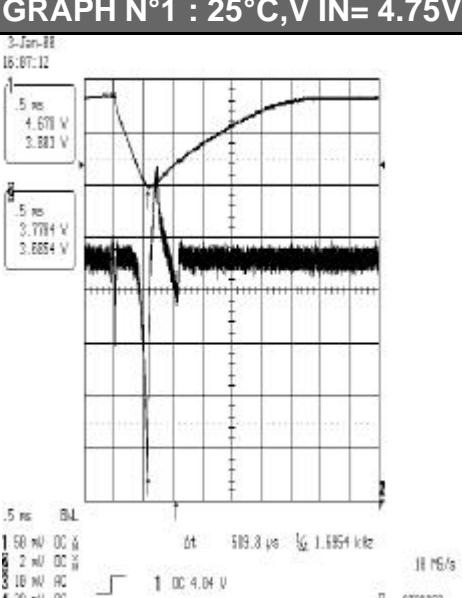
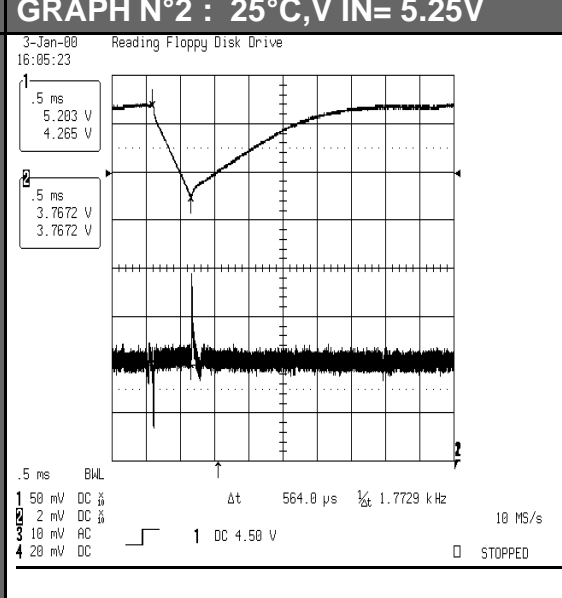
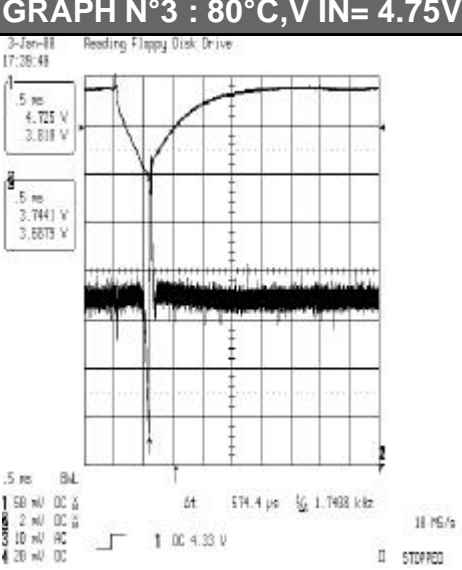
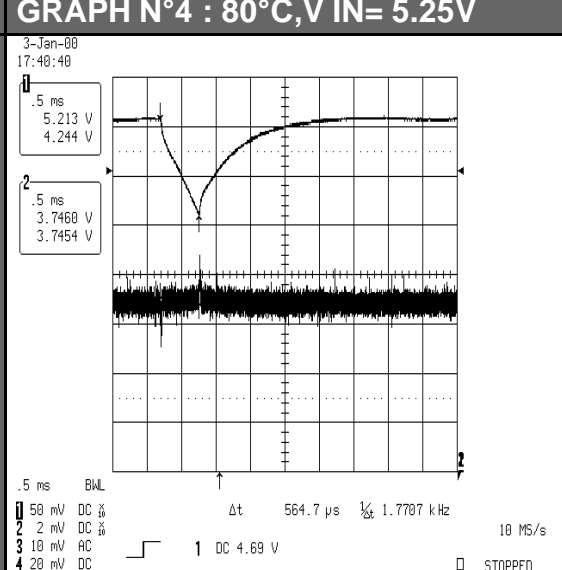
A LDO regulator is used.
LDO regulator added to a PMOS output minimise dissipation.

CURRENT LIMITATION : protection against over consumption .

LOW CONSUMPTION CIRCUITRY : shutdown current when the module is OFF thanks to OR circuitry (60µA) .

The schematic diagram illustrates the power supply circuitry for the TMS320C67 evaluation module. It shows the connection between the +5V and -5V pins of the VCC-MODULE connector and various components. The +5V line passes through resistor R12 (1K) and capacitor C5 (2.2µF) before reaching the VCC pin of the U1 IC. The -5V line is connected to the GND pin of the U1 IC. A network of resistors (R1-R8) and capacitors (C1-C4) provides decoupling and filtering throughout the circuit. Key components include the U1 IC (TMS320C67), U2 (LM7805), U3 (LM7905), and U4 (MAX485). The diagram also shows the connection to the VBAT pin of the U1 IC via a series of capacitors (C1-C4) and a resistor (R1).

3.4 Climatics Test with 5V +/- 5% power supply

<p>Voie1= VIN</p> <p>Voie2= VBATT</p> <p>Vdrop= 0.08V</p>	 <p>3-Jan-88 15:02:32</p> <p>1 50 mV DC 5</p> <p>2 5 mV DC 5</p> <p>3 10 mV AC 5</p> <p>4 20 mV DC 5</p> <p>Δt 562.4 μs 1/2 1.7780 kHz</p> <p>10 MS/s</p> <p>1 DC 4.06 V</p> <p>STOPPED</p>	<p>Voie1=V IN</p> <p>Voie2=V BATT</p> <p>Vdrop=0 .003V</p>	 <p>3-Jan-88 15:03:27</p> <p>1 50 mV DC 5</p> <p>2 5 mV DC 5</p> <p>3 10 mV AC 5</p> <p>4 20 mV DC 5</p> <p>Δt 562.4 μs 1/2 1.7780 kHz</p> <p>10 MS/s</p> <p>1 DC 4.42 V</p> <p>STOPPED</p>
<p>Voie1= VIN</p> <p>Voie2= VBATT</p> <p>Vdrop= 0.09V</p>	 <p>3-Jan-88 16:07:12</p> <p>1 50 mV DC 5</p> <p>2 5 mV DC 5</p> <p>3 10 mV AC 5</p> <p>4 20 mV DC 5</p> <p>Δt 589.0 μs 1/2 1.6954 kHz</p> <p>10 MS/s</p> <p>1 DC 4.04 V</p> <p>STOPPED</p>	<p>Voie1=V IN</p> <p>Voie2=V BATT</p> <p>Vdrop=0 .002V</p>	 <p>3-Jan-88 16:05:23</p> <p>1 50 mV DC 5</p> <p>2 5 mV DC 5</p> <p>3 10 mV AC 5</p> <p>4 20 mV DC 5</p> <p>Δt 564.0 μs 1/2 1.7729 kHz</p> <p>10 MS/s</p> <p>1 DC 4.50 V</p> <p>STOPPED</p>
<p>Voie1= VIN</p> <p>Voie2= VBATT</p> <p>Vdrop= 0.06V</p>	 <p>3-Jan-88 17:08:48</p> <p>1 50 mV DC 5</p> <p>2 5 mV DC 5</p> <p>3 10 mV AC 5</p> <p>4 20 mV DC 5</p> <p>Δt 574.4 μs 1/2 1.7498 kHz</p> <p>10 MS/s</p> <p>1 DC 4.33 V</p> <p>STOPPED</p>	<p>Voie1=V IN</p> <p>Voie2=V BATT</p> <p>Vdrop=0 .001V</p>	 <p>3-Jan-88 17:40:40</p> <p>1 50 mV DC 5</p> <p>2 5 mV DC 5</p> <p>3 10 mV AC 5</p> <p>4 20 mV DC 5</p> <p>Δt 564.7 μs 1/2 1.7707 kHz</p> <p>10 MS/s</p> <p>1 DC 4.69 V</p> <p>STOPPED</p>
<p>GRAPH N°5 : -35°C,V IN= 4.75V</p>			<p>GRAPH N°6 : -35°C,V IN= 5.25V</p>

3.5 Comments about climatics test

We note that it is for a minimal supply voltage, 4.75v (= VCC 5v -5%), that the variation of tension VBATT is most significant. the **DU max** =90mV and VBATTmini = 3.68V.

3.6 Components triple sourcing

filtrage 1

F20 : INDUCTOR FERRITE -742792023

F20	First source	Second source	Third source
SUPPLIER	WE	MURATA	WURTZ
DEVICE	WEEMI	BLM21300SN1	
PACK	742792023		74279206

Current limitation

R1 :RESISTOR-0.33ohm-5%- 1/4W

R1	First source
SUPPLIER	PHILIPS
DEVICE	
PACK	R1206

T6 :TRANSISTOR-PNP

T6	First source
SUPPLIER	PHILIPS
DEVICE	BC807
PACK	SOT23

D1 :DIODE SCHOTTKY

D1	First source	Second source	Third source
SUPPLIER	PHILIPS	MOTOROLA	GENERAL SEMICONDUCT
DEVICE	BAT54W		
PACK	SOT323		

T1 :TRANSISTOR-MOSFET-P CHANNEL

T1	First source	Second source
SUPPLIER	VISHAY	TBD
DEVICE	SI3441	TBD
PACK	SOT23-6	TBD

Regulation

C11,C12 :CAPACITOR-TANTALE-470µF LOW ESR -10V

C11 ,C12	First source	Second source
SUPPLIER	EPCOS	AVX
DEVICE	CTCE	
PACK	CTCE	

C11,C12 can be replaced by 1CAPACITOR-ELECTROLYTIQUE 6.3V 1500µF or 1000µF TANTALE 6.3V

C11 ,C12	First source	Second source
SUPPLIER	SANYO 1500µF	VISHAY 1000µF
DEVICE	6CV1500AX	594D108X06R3R2D
PACK	C103X103	RCASE
ADVANTAGE	PRICE CHEAPER	
DISADVANTAGE	CASE HIGHER	PRICE EXPENSIVE CASE HIGHER

C1:CAPACITOR-TANTALE-2.2µF-16V

C1	First source	Second source
SUPPLIER	AVX	MURATA
DEVICE	Y5V	
PACK	C0805	

T5 :TRANSISTOR-MOSFET- N CHANNEL

T5	First source	Second source	Third source
SUPPLIER	VISHAY	INTERNATI RECTIFIER	FAIRCHILD
DEVICE	SI3454DV	IRLMS1503	FDC655AN
PACK	SOT23-6		

U1 :LDO CONTROLEUR-ADJUSTABLE

U1	First source
SUPPLIER	MICREL
DEVICE	MI5158BN
PACK	SOIC14

Filtrage2

C13,C14 :CAPACITOR-TANTALE-470µF-6.3V

C13 ,C14	First source	Second source
SUPPLIER	EPCOS	KEMET
DEVICE	CTCE	
PACK	CTCE	

C13,C14 can be replaced by 1CAPACITOR-ELECTROLYTIQUE 6.3V 1500µF or 1000µF TANTALE 6.3V

C13 ,C14	First source	Second source
SUPPLIER	SANYO 1500µF	VISHAY 1000µF
DEVICE	6CV1500AX	594D108X06R3R2D
PACK	C103X103	RCASE
ADVANTAGE	PRICE CHEAPER	PRICE EXPENSIVE
DISADVANTAGE	CASE HIGHER	CASE THICKNESS

U2 :DOUBLE TRANSISTOR PNP+NPN

U2	First source	Second source
SUPPLIER	ROHM	TBD
DEVICE	UMC5N	TBD
PACK	UNT5	TBD

T7 :TRANSISTOR-MOSFET-N CHANNEL

T7	First source	Second source	Third source
SUPPLIER	VISHAY	INTERNATIONAL-RECTIFIER	VISHAY
DEVICE	SI2306DS	IRLML2402	TN0200T
PACK	SOT23	SOT23	SOT23

T8 :TRANSISTOR-PNP

T8	First source	Second source
SUPPLIER	PHILIPS	TBD
DEVICE	BC807	TBD
PACK	SOT23	TBD

D4 :DOUBLE SCHOTTKY DIODE

D4	First source	Second source	Third source
SUPPLIER	PHILLIPS	PHILLIPS	ROHM
DEVICE	BAT54W	BAT54CW	AT425D
PACK	SOT323		

3.7 Bill of material

INDEX	FUNCTION	TYPE	VALUE	TOL	INFO	PACK	PART NAME	SUPPLIER	DEVICE
C1	CAPACITOR	Y5V	2.2UF		16V	C0805			C0805
C11	CAPACITOR	TANTALUM	470UF		10V	CTCE	B45197-A2477-K509	EPCOS	CTCE
C12	CAPACITOR	TANTALUM	470UF		10V	CTCE	B45197-A2477-K509	EPCOS	CTCE
C13	CAPACITOR	TANTALUM	470UF		6.3V	CTCE	B45196-H1477-K509	EPCOS	CTCE
C14	CAPACITOR	TANTALUM	470UF		6.3V	CTCE	B45196-H1477-K509	EPCOS	CTCE
C15	CAPACITOR	COG	33PF		10V	C0603			C0603
C16	CAPACITOR	X7R	100NF		16V	C0603			C0603
C17	CAPACITOR	COG	33PF		50V	C0603			C0603
C18	CAPACITOR	X7R	100NF		16V	C0603			C0603
C19	CAPACITOR	X7R	100NF		16V	C0603			C0603
C2	CAPACITOR	X7R	100NF		16V	C0603			C0603
C20	CAPACITOR	X7R	1NF		50V	C0603			C0603
C21	CAPACITOR	COG	33PF		50V	C0603			C0603
C22	CAPACITOR	COG	33PF		50V	C0603			C0603
C23	CAPACITOR	X7R	1NF		50V	C0603			C0603
C3	CAPACITOR	X7R	100NF		16V	C0603			C0603
C4	CAPACITOR	COG	470PF		50V	C0603			C0603
C5	CAPACITOR	COG	47PF		25V	C0603			C0603
C6	CAPACITOR	COG	47PF		25V	C0603			C0603
C7	CAPACITOR	COG	47PF		25V	C0603			C0603
C8	CAPACITOR	COG	47PF		25V	C0603			C0603
C9	CAPACITOR	COG	47PF		25V	C0603			C0603
D1	DIODE	SCHOTTKY				SOT323		PHILIPS	BAT54W
D4	DIODE	SCHOTTKY				SOT323		PHILIPS	BAT54CW
F20	INDUCTOR	FERRITE				WE0805	742792023	WE	WEEMI
R1	RESISTOR		0.33	5%	1/4W	R1206	LRC01-96014	PHILIPS	R1206
R12	RESISTOR		NC	5%	1/4W	R1206			R1206
R2	RESISTOR		10K	1%	1/16W	R0603			R0603
R3	RESISTOR		20K	1%	1/16W	R0603			R0603
R4	RESISTOR		3.9K		1/16W	R0603			R0603
R5	RESISTOR		100K		1/16W	R0603			R0603
R8	RESISTOR		1M		1/16W	R0603			R0603
R9	RESISTOR		100K		1/16W	R0603			R0603
T1	MOSFET	P CHANNEL				SOT23-6		VISHAY	SI3441DV
T5	MOSFET	N CHANNEL				SOT23-6		VISHAY	SI3454DV
T6	TRANSISTOR	PNP				SOT23		PHILIPS	BC807
T7	MOSFET	N CHANNEL				SOT23		VISHAY	SI2306DS
T8	TRANSISTOR	PNP				SOT23		PHILIPS	BC807
U1	LDO CONTROLLER		ADJ			SOIC14	MIC5158BM	MICREL	MIC5158BM
U2	TRANSISTOR DIGITAL	PNP+NPN				UMT5	UMC5N	ROHM	UMC5N

3.8 Layout restriction

- See application notes of MIC 5158 MICREL :
 - dissipation under MOS
 - MOS near the MIC5158

- **VBATT** :
 - The track between battery and module connectors has to be 2mm large.
 - It is recommended to get the track not too close from the audio circuit.

4 MMI layout restrictions

To avoid any EMI/RFI problem, do not place any electrical function around the antenna connection on module or too close to the antenna.

Especially for Low frequency devices: DC/DC converter, microprocessors, memories..

RF lines or cables shall be as short as possible to minimize losses and must have a characteristic impedance of 50 Ohms until $F \geq 2$ GHz.

A micro strip line, as above, or a strip line can be used.

4.1 Power supply connection

Since the maximum peak current is around 2 A, to avoid voltage loss between the external power supply and the module power supply, WAVECOM strongly recommends a large width for the layout of this signal.

A total impedance line $\leq 10 \text{ m}\Omega$ @ 217 Hz shall be routed, including through holes.

4.2 Ground connection

The ground connection on module is assumed by mechanical fixing points, and not 60pts connector. All of these 4 points shall be connected together to assume the module ground. An extra ground plane is recommended on application board just behind module.