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# SIM Design Application Note

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## Trademark



The trademark is registered and owned by Fibocom Wireless Inc.

## Versions

Version	Date	Remarks
V1.0.0	2013-08-01	Initial Version
V1.0.1	2014-02-10	According to the performance reduction of SIM card, we suggest customer to modify the circuit and components (capacitance and ESD) on SIM pin.
V1.0.2	2014-07-28	Change R1 setting description of G510
V1.0.3	2014-08-19	Update the description of G510 R1.
V1.0.4	2015-04-26	Update the description of copyright and attention.
V1.0.5	2015-08-24	Update the logo.

## Applicability Type

No.	Type	Note
1	Applicable to all the communication modules which include SIM interface	

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# 1 Introduction

Fibocom module integrated SIM card interface, here are the features:

- Supports 1.8V and 3.0V (adaptive voltage)
- Supports SIM card state detection (by some models)

SIM interface pin description:

Pin Name	Pin Description	Remarks
SIM_CLK	Serial clock, 3.25 MHz	
SIM_VCC	SIM card supply the power, adaptive voltage	For some models, it is called VSIM.
SIM_DATA	Serial input/output signals	For some models, it is called SIM_IO; the module internal is pulled up to SIM_VCC
SIM_RST	SIM card reset pin, low level	
SIM_CD	SIM card state detection	Supported by some models
SIM_GND	SIM card ground	Supported by Some models, for the models which doesn't support, direct grounding

Fibocom module support and can automatically identify SIM card with 1.8V and 3.0V. When the module is powered on, output 1.8V voltage in SIM\_VCC and communicates with SIM card, if failed, output 2.85V to communicate with SIM card again.

Fibocom module supports SIM card hot plug with the peripheral circuits.

**Note:** When the module is working normally, if you unplug the SIM card without enabling SIM card hot plug function, it may cause damage to the SIM card and module.

# 2 SIM Card Design

## 2.1 Recommended Model for SIM Connector

For M2M application, we recommend you use the following SIM card connector:

### 1. Drawer Type

	Part Number	Manufacturer
SIM CONNECTOR ASSY	912283001	MOLEX
SIM CARD HOLDER	912360001	MOLEX

SIM Connector Assy (PN: 912283001)

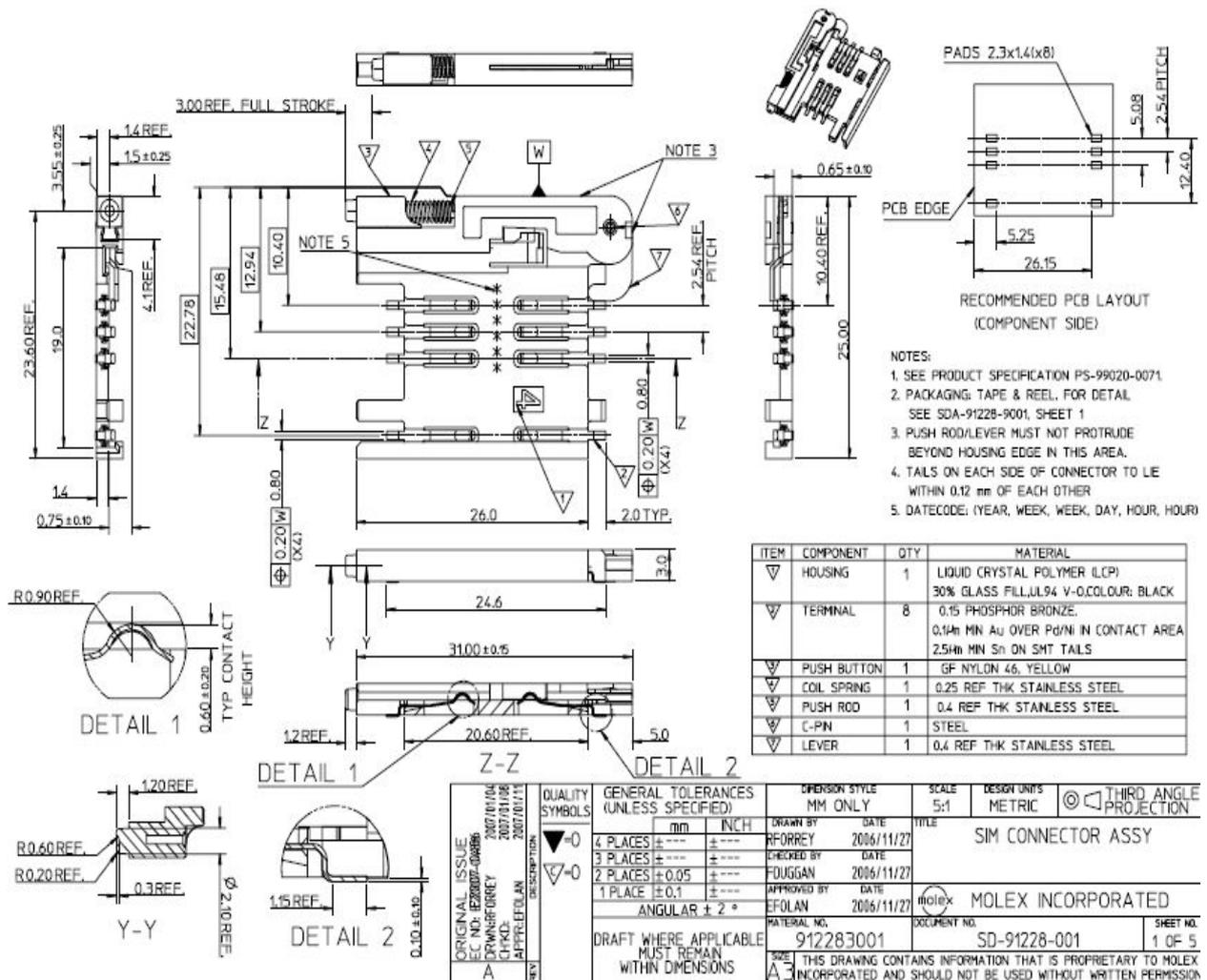


Figure 2- 1 SIM Connector Assy

## SIM Card Holder (PN: 912360001)

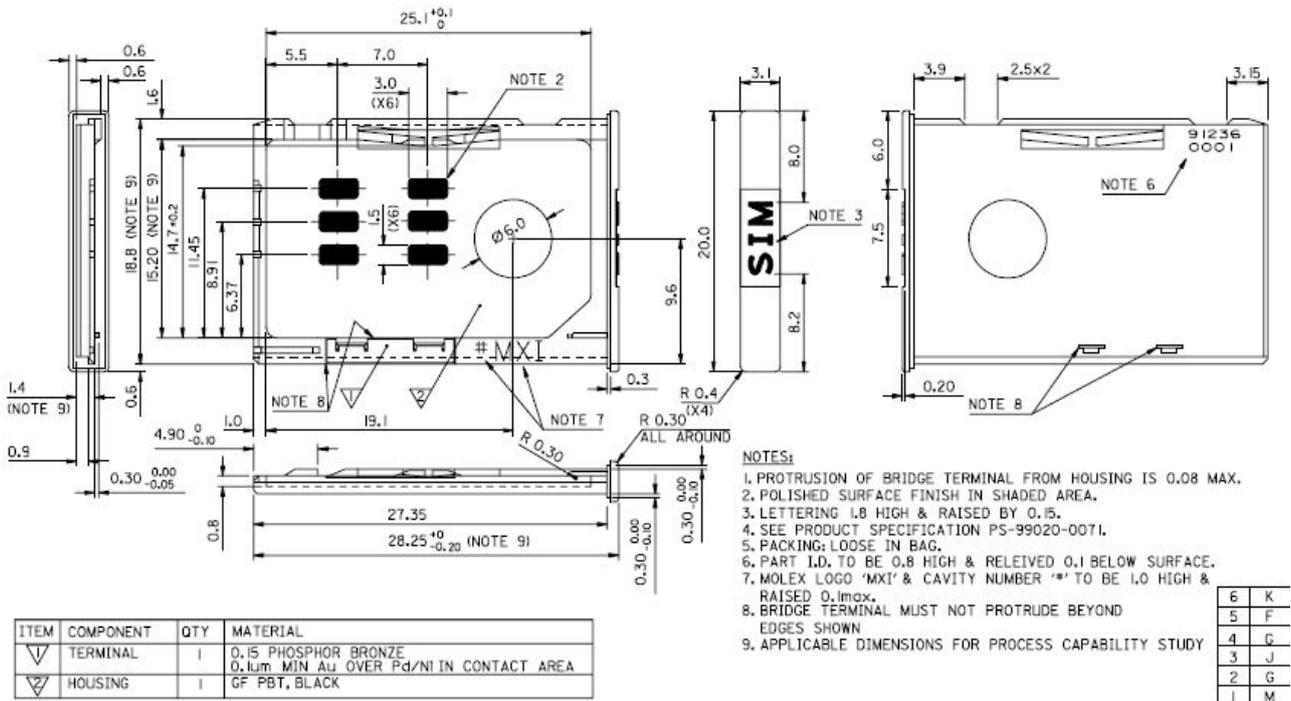


Figure 2- 2 SIM Card Holder

### 2. Flip Type

Flip type SIM card holder with metal shell can greatly enhance the anti-interference ability of EMI.

## 2.2 Schematic Diagram Design for SIM

The following figure is a typical SIM card circuit, J101 is a standard 8 pin SIM card connector.

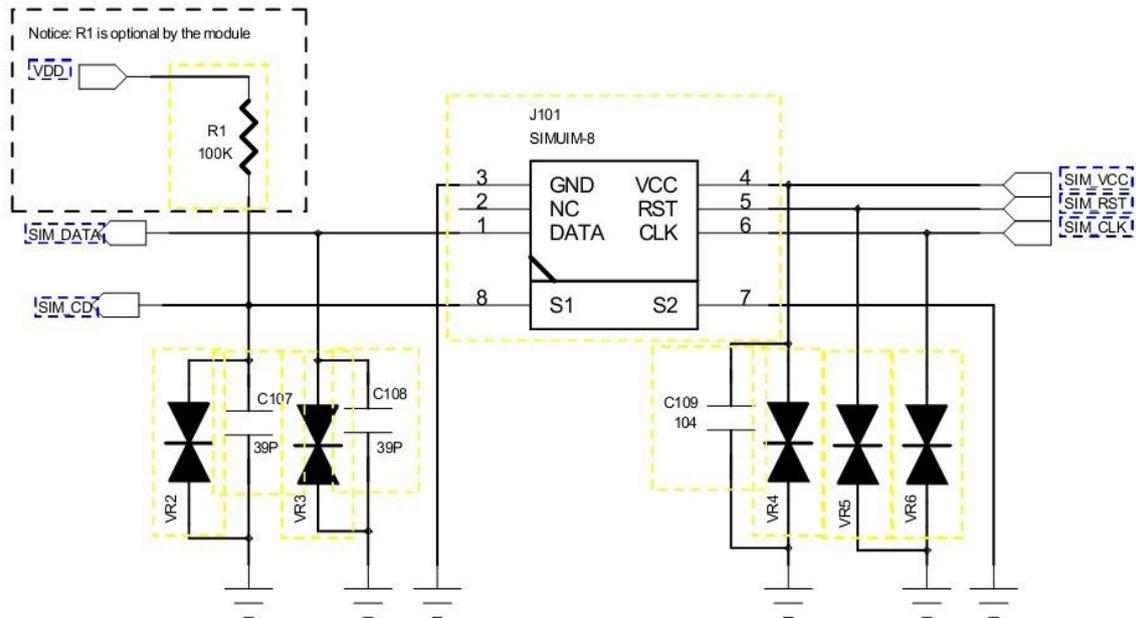


Figure 2-3 SIM Card Circuit

**Note:**

- SIM\_DATA signal is already pulled up to SIM\_VCC inside the module, no need to pull up the peripheral
- R1 configuration instruction

Model Number	R1 Configuration	Description
G600	NC	Pulled-up internally, don't need to pull up externally.
G610	NC	Pulled-up internally, don't need to pull up externally.
G510	100Kohm	SIM_CD need external circle to pull up 3V
G520	10Kohm	SIM_CD connects to Pin14(INT2); You can use a high resistance to reduce power consumption.
G530	NC	Pulled-up internally, don't need to pull up externally.
H330	NC	Pulled-up internally, don't need to pull up externally.

## 2.3 Key Design Points for SIM

The interface design of SIM card is important for module and SIM card.

Schematic design points:

- Please reserve capacitor filter for SIM signal line, to prevent interference from GSM high frequency signal.
- Add ESD protective device to SIM signal line. Please choose protective device which is low capacity (not exceed 39pF, like Zener diode. Normally, we recommend you use AVR-M1608C270MTAAB (TDK).

The SIM performance is lower than before, many times we found that many SIM cards couldn't be detected, and later, we tested and found that the capacitor and ESD components from pin SIM\_DATA and pin SIM\_CLK, SIM\_RST affected it.

Suggestions:

Please reserve the pad area for capacitor and ESD components when designing PCB, but don't mount components there when doing SMT.

For selecting the components of capacitor and ESD components, please select ones with small capacitive value (less than 10pF).

- When you design SIM\_CD, please note that the R1 pull-up methods are different for each model.

PCB layout points:

- SIM card and trace should be away from EMI interference source, such as power circuit, RF circuit, digital signal circuit and so on.
- Some ESD components of SIM should be close to SIM card holder.
- To ensure the integrity of signal, the trace length from the module to SIM card should not exceed 100mm.
- When routing antenna feeder line, please keep the line away from power device, and avoid to paralleling to antenna copper foil.

PCB trace points:

- To reduce EMC problem, SIM signal should away from RF cable, power line, clock line and high speed data line.

- Do not trace the adjacent layer of the SIM signal line; if you do, it brings you with EMI risk. Design the other trace and SIM signal line to be perpendicular which can reduce risk.
- Ensure the connectivity and integrity of PCB environment and SIM\_GND. The nearest path connects to a clean system ground.
- To avoid mutual interference, please separately ground SIM\_CLK and SIM\_DATA.
- The SIM signal line should trace along the inner layer.

# 3 Solutions for Radio Frequency Interference

The interference is closely related to SIM card itself, for M2M application; we recommend you use a dedicated SIM card. Inappropriate SIM card would cause SIM card abnormal.

In practice, radio frequency interference is quite normal, here are some solutions.

## 3.1 RF Interference Source

Antenna coupling interference:

- When antenna transmits with high power, it cause direct interference to the SIM signal
- When antenna transmits with high power, it coupled to the ground, reduce the stability of the whole system, it cause indirect interference to the SIM signal.

PCB crosstalk:

- Caused by other signal line on the main board
- Caused by signal interrupted by antenna
- Caused by fluctuations of power

## 3.2 Solutions

Antenna coupling interference:

- Adjust the filter capacitance value of the SIM signal
- Use a longer antenna; keep it far away from SIM card part
- Isolate the interference signal by shielding to protect SIM card
- Pay attention to the design of the ground, especially the connectivity of SIM card、 module and the system ground.
  - When the condition of the whole system ground is not good, connect SIM\_GND separately, then connect to the main ground of the module by beads, it can reduce the influence to SIM card
  - Each layer of PCB should be fully grounded, more holes would be better; it can enhance the EMC performance of the system.

- RF coupling will cause interference to GND, adjusting the value of capacitor and ESD components or even remove the capacitor (if it is necessary) can reduce the interference.

PCB crosstalk:

- Adjust the filter capacitance value of the SIM signal
- If it cannot be improved, then you need to find out the interference source, and change the board specifically

## 4 SIM Hot Plug Design

Some Fibocom modules support SIM card state detection; this can achieve the SIM card hot plug design.

### 4.1 Hardware Connection

SIM hot plug function needs the cooperation of SIM\_CD signal.

When SIM card is not available, SIM\_CD is high level, after you install the SIM card, SIM\_CD is low.

As shown in figure2-3, SIM\_CD connects to S1pin of J101, S2 connects to ground. When SIM card is not installed, S1 is high; after you install SIM card, S1 is connected with S2, SIM\_CD is be pulled down.

### 4.2 Software Configuration

“+MSMPD” is the AT command to set SIM card state detection function.

Set AT+MSMPD=0, SIM card state detection function is disabled, the module cannot detect the SIM\_CD signal.

Set AT+MSMPD=1, SIM card state detection function is enabled, the module can detect whether SIM card is installed by SIM\_CD pin.

SIM\_CD is low, SIM card is installed, the module registers the network automatically.

SIM\_CD is high or not connected, SIM card is not installed, the module does not register the network.

**Note:** The default value of command +MSMPD is 0.