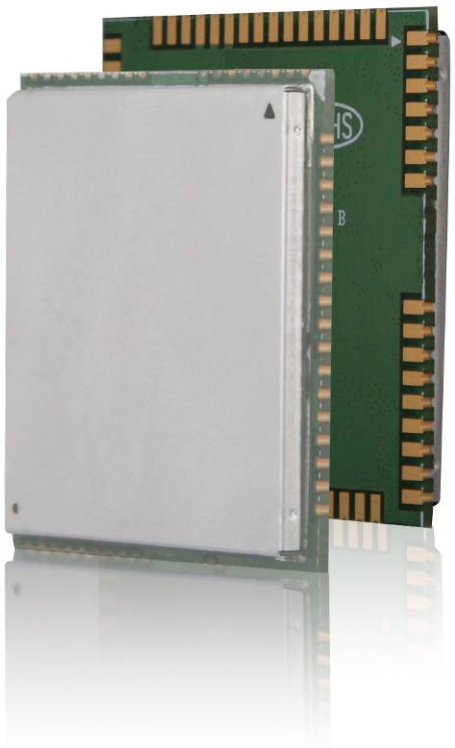
M10

Quectel Cellular Engine



M10 User Guide

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General Notes

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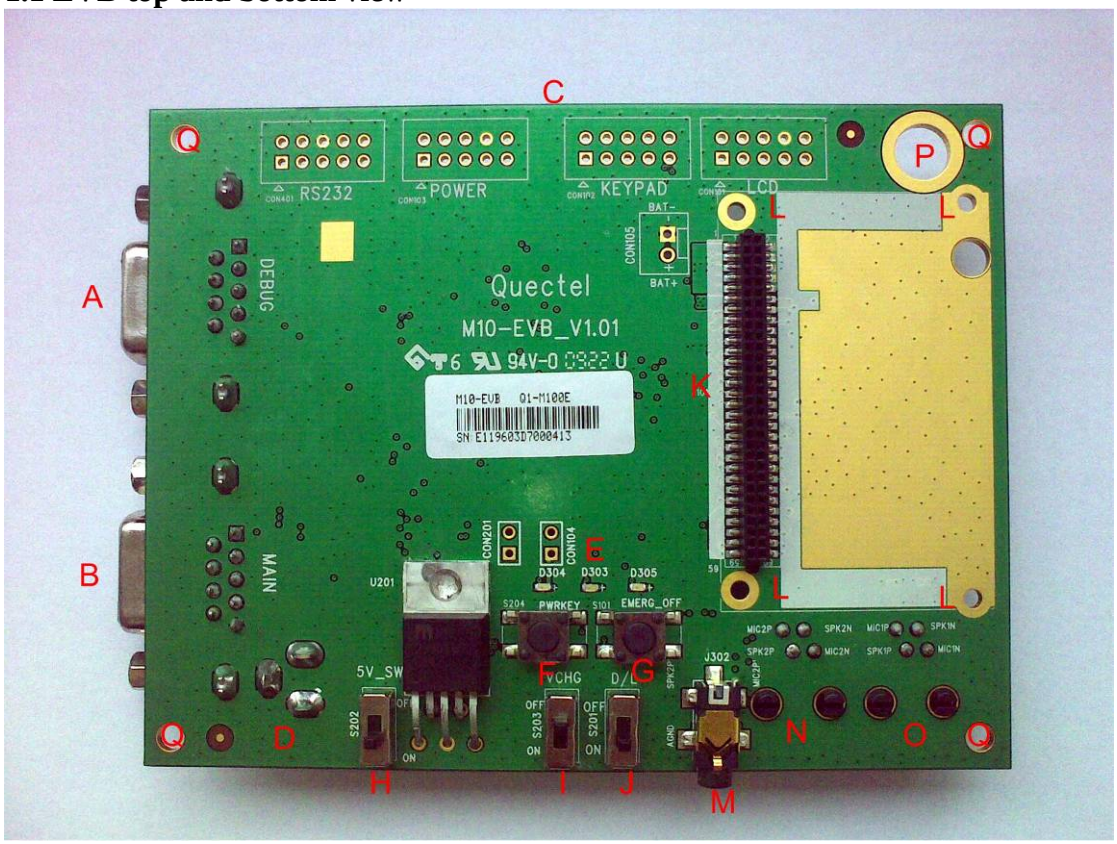
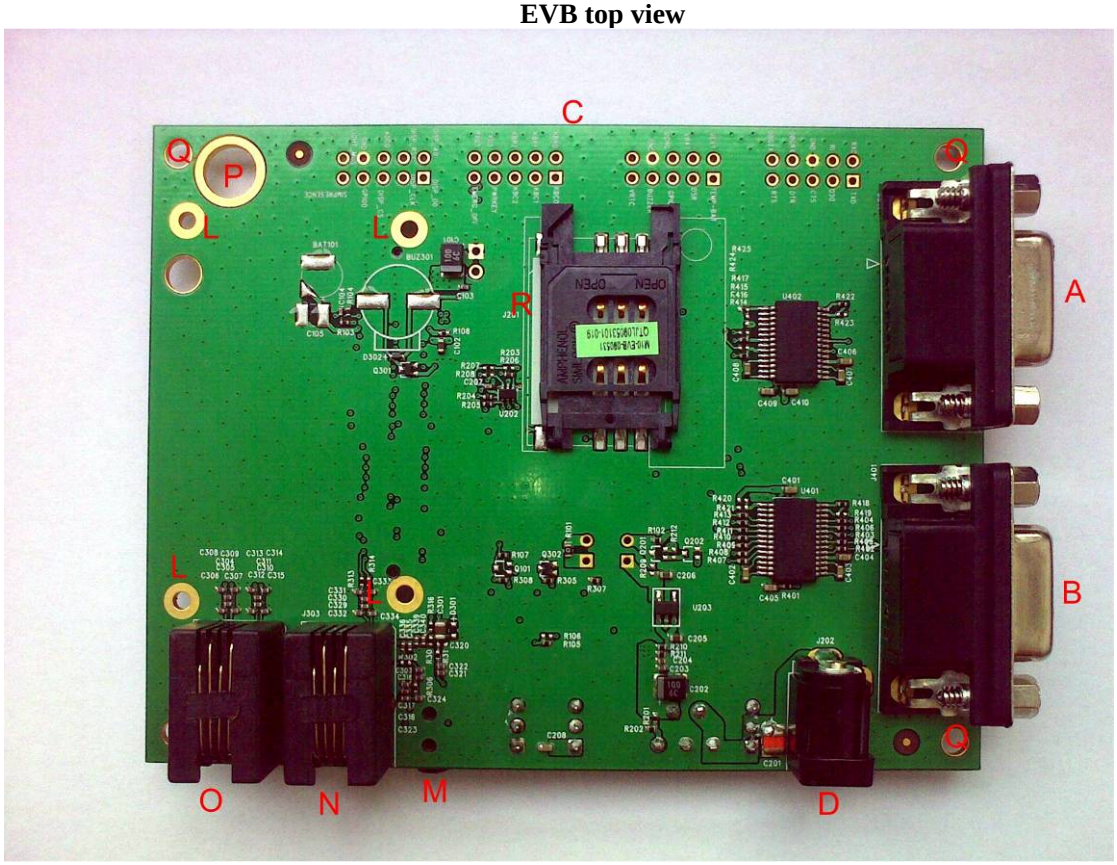
1 .EVB kit introduction

1.1 EVB top and bottom view



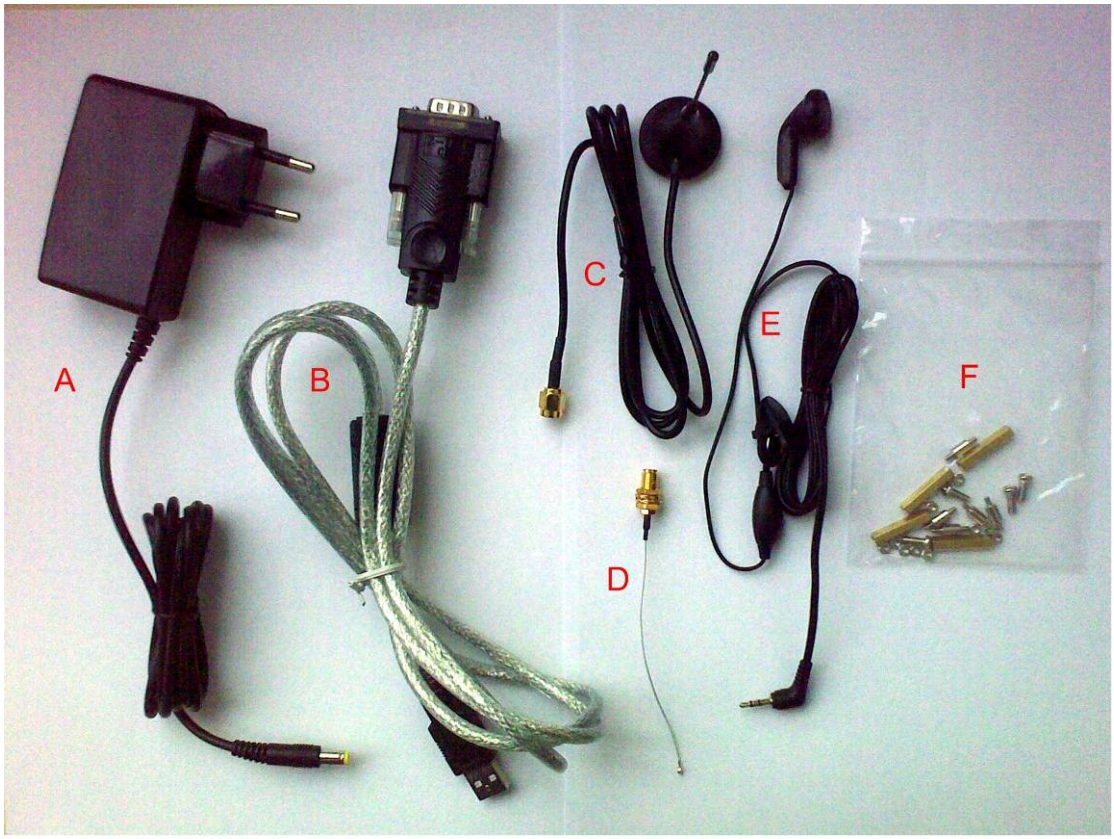
EVB top view



EVB bottom view

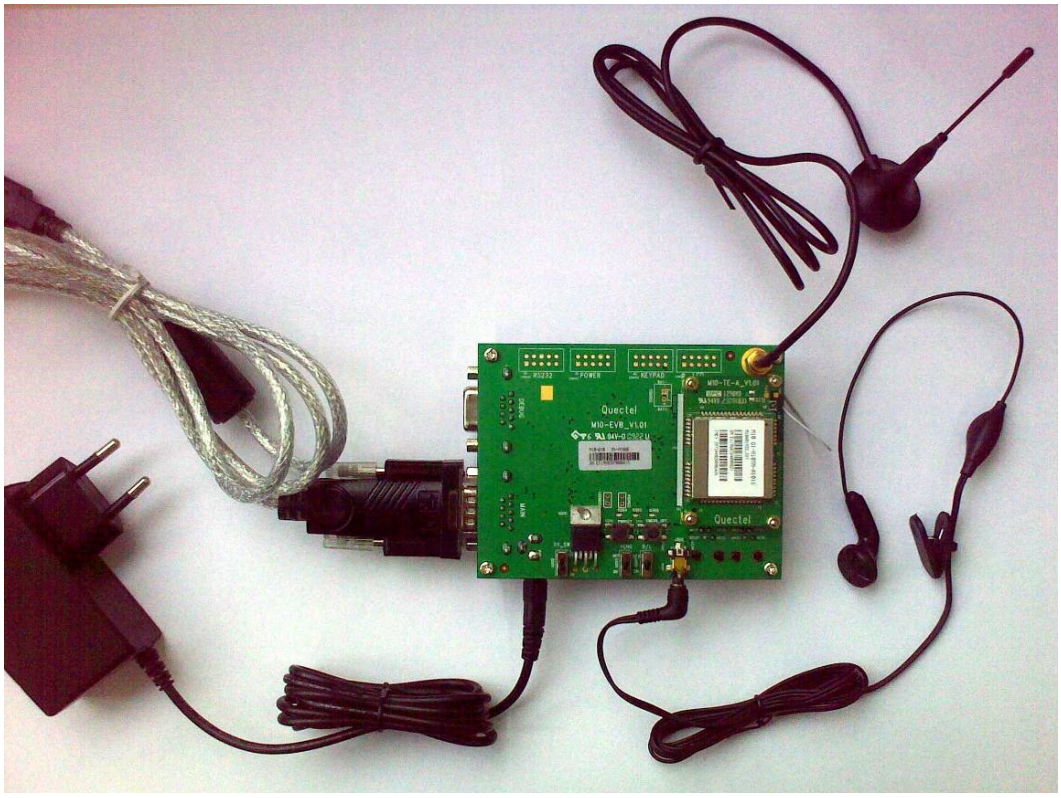
A: Debug port
B: Main UART port
C: Test points
D: Adapter interface
E: Module operating status indication LEDs
F: PWRKEY button
G: EMERG_OFF button
H: VBAT switch
I: VCHG switch (charge function)
J: Download switch
K: Connector for M10-TE-A board
L: Screw holes for fixing the M10-TE-A
M: Headset socket
N: Handset socket of audio channel 2
O: Handset socket of audio channel 1
P: Antenna connector fixing hole
Q: Screw holes for EVB placement
R: SIM card socket

1.2 EVB accessory



Accessory introduction

A: 5V DC switching adapter
B: USB to UART converter cable
C: Antenna
D: RF cable
E: Headset
F: Bolts and nuts for fixing module and EVB

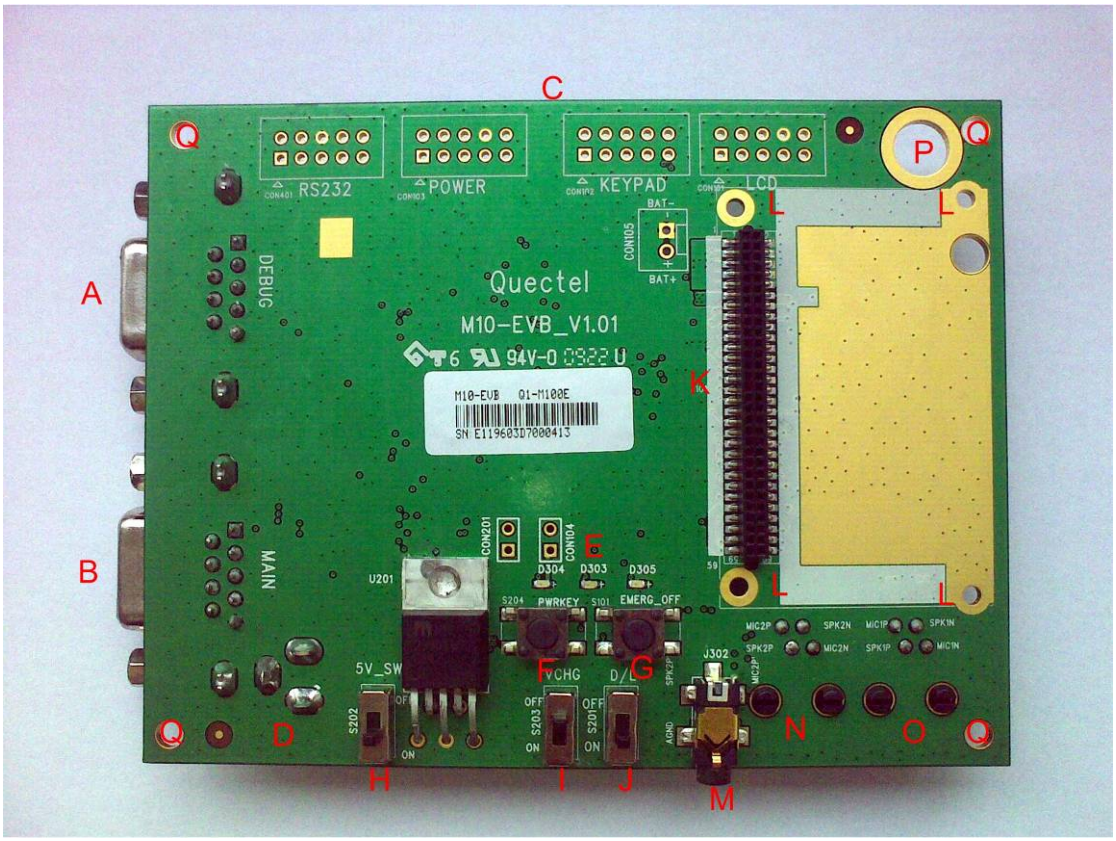


EVB and accessories

2. Operational description

2.1 Tune up procedure

Firstly，please equip the module and accessories as the figure 4.



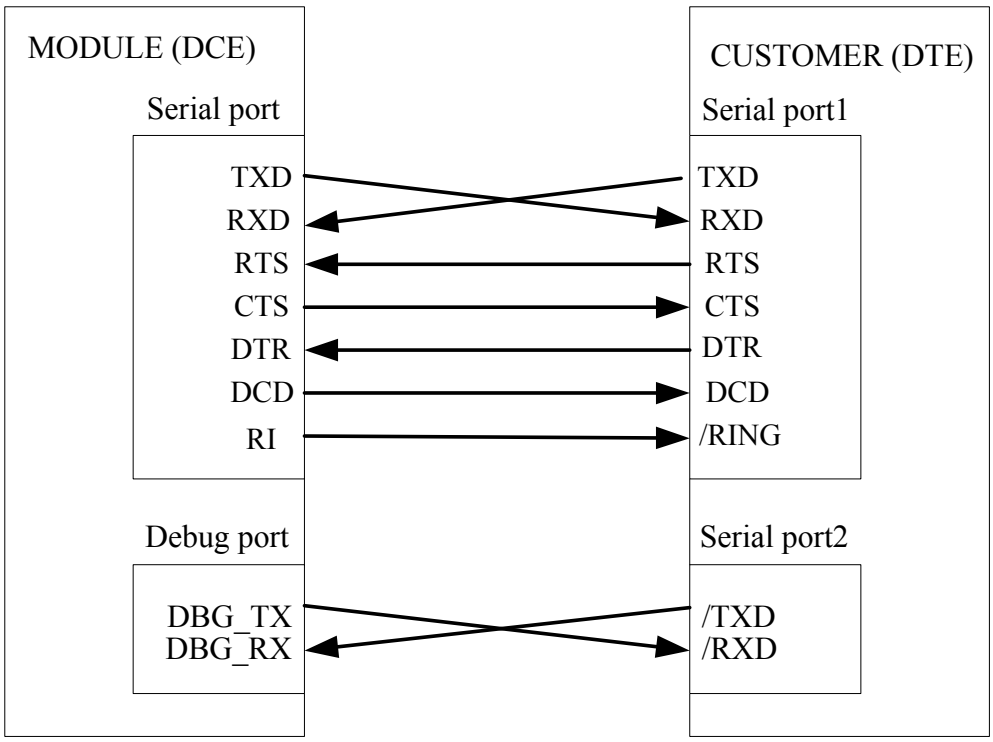
Then ,switching the **H** switch to **ON** state, **J** switch to **ON** state； Press the **F** button **PWRKEY** for about 2 second, then the LED glint，and the module is tuningup successfully；(the location of All Switches and buttons please see the Figure 1)

2.2 Serial interfaces

The module provides two unbalanced asynchronous serial ports. One is the serial port ,the other is the debug port. The module is designed as a DCE (Data Communication Equipment), following the traditional DCE-DTE (Data Terminal Equipment) connection. The module and the client (DTE) are connected through the following signal (as following figure shows). Autobauding supports baud rate from 4800bps to 115200bps.

Serial port

- TXD: Send data to the RXD signal line of the DTE
- RXD: Receive data from the TXD signal line of the DTE



Connection of serial interfaces

Note: The RTS PIN must be connected to the GND in the customer circuit when only the TXD and RXD are used in the Serial Port communication.

2.3 Antenna interface

The Pin 43 is the RF antenna pad. The RF interface has an impedance of 50Ω.

2.3.1 Antenna installation

M10 provides an RF antenna PAD for customer's antenna installation. The customer's antenna should be located in the customer's main board and connect to module's antenna pad through microstrip line or other type RF trace which the impendence must be controlled in 50Ω. To help the customer to ground the antenna, M10 comes with 2 grounding pads located close to the antenna pad.

Pin definition of the RF_ANT

Name	Pin	Function
RF_ANT	43	RF antenna pad
GND	42	
GND	44	

If the customer installs the antenna via a soldered microwave coaxial cable, we would suggest the customer to choose RF cable carefully so as to minimize the loss on the RF cable. And the recommended insertion loss should try to meet the following requirements:

- GSM850/EGSM900<0.5dB
- DCS1800/PCS1900<1dB

2.3.2 RF output power

The module conducted RF output power

Frequency	Max	Min
GSM850	33dBm ±2dB	5dBm±5dB
EGSM900	33dBm ±2dB	5dBm±5dB
DCS1800	30dBm ±2dB	0dBm±5dB
PCS1900	30dBm ±2dB	0dBm±5dB

2.3.3 RF receiving sensitivity

The module conducted RF receiving sensitivity

Frequency	Receive sensitivity
GSM850	< -107dBm
EGSM900	< -107dBm
DCS1800	< -107dBm
PCS1900	< -107dBm

2.3.4 Operating frequencies

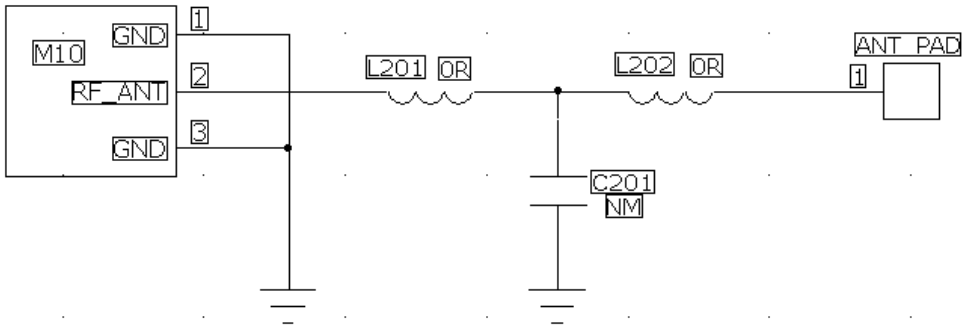
The module operating frequencies

Frequency	Receive	Transmitting	channel
GSM850	869 ～ 894MHz	824 ～ 849MHz	128 ～ 251
EGSM900	925 ～ 960MHz	880 ～ 915MHz	0～124, 975～1023
DCS1800	1805 ～ 1880MHz	1710 ～ 1785MHz	512 ～ 885
PCS1900	1930 ～ 1990MHz	1850 ～ 1910MHz	512 ～ 810

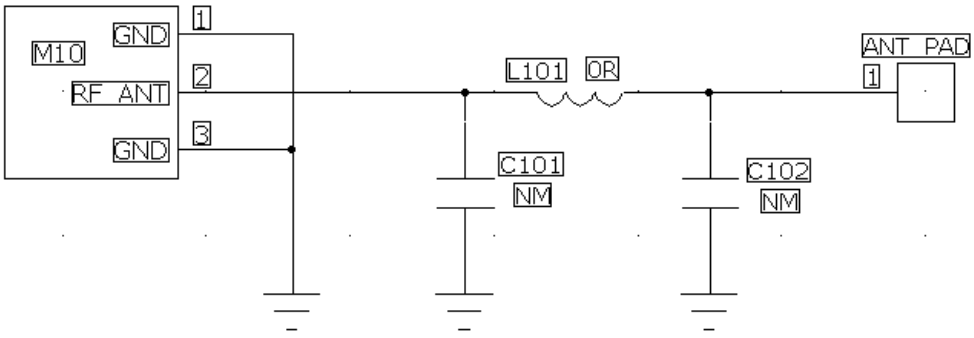
2.3.5 Recommended impedance matching circuit

The impedance of M10's RF_ANT port is 50Ω. If the impedance of antenna is close to 50Ω in all working frequency bands, the antenna could be connected to the RF_ANT port directly via 50Ω transmission line. But if the impedance of antenna is not close to 50Ω, a T-type or π-type matching circuit should be inserted between transmission line and antenna. The matching components should be placed as close as possible to the antenna's feed point.

The following 2 figures show the reference designs of T-type and π-type matching circuits.



T-type matching circuit



π-type matching circuit

NOTE: The impedance of traces in Bold type must be 50Ω.

3. M10 features

3.2.1 General specification

M10 is a Quad-band GSM/GPRS module delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. M10 can be used for WLL applications/M2M application and much more.
Quad- band GSM/GPRS module with a size of 29x29x3.6mm
● Customized MMI and keypad/LCD support
● An embedded Powerful TCP/IP protocol stack
● Supply voltage range 3.4 ... 4.5 V
● Normal Operation Temperature: -35°C ~80°C
● GPRS multi-slot Class 12
● GSM R99

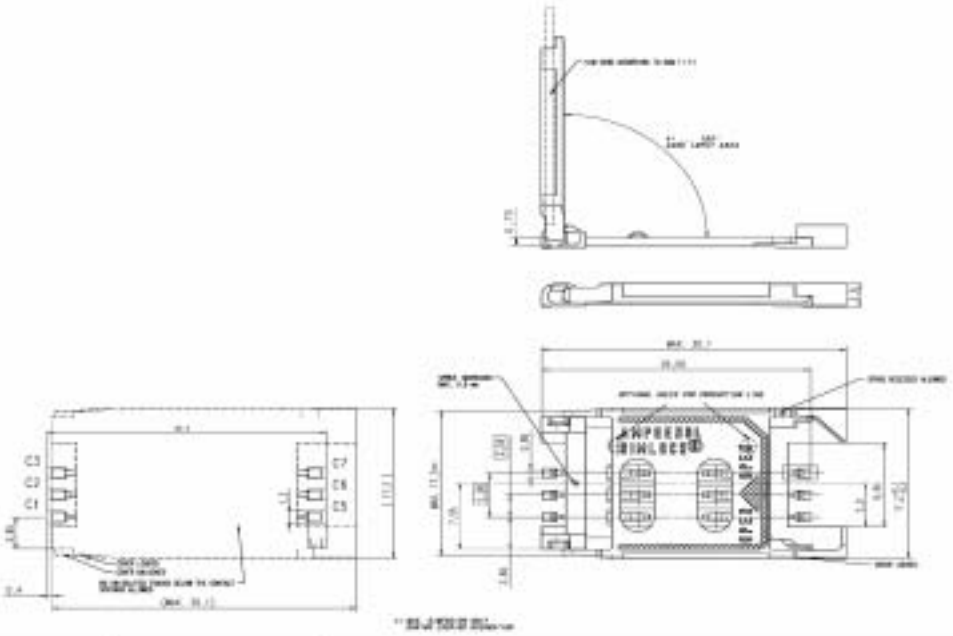
3.2.2 Hardware Specification

The following figure shows a block diagram of the M10 module and illustrates the major functional part:

- The GSM baseband engine
- Flash and SRAM
- The GSM radio frequency part
- The SMT pads interface
  - —LCD interface
  - —SIM card interface
  - —Audio interface
  - —Key board interface
  - —UART interface
  - —Power supply
  - —RF interface

The PCB for M10 is 6 layers.

The mechanical architecture of SIM card holder and the definition of SIM card are shown below:



Pin	Signal	Description
C1	SIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode, one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
C2	SIM_RST	SIM Card Reset.
C3	SIM_CLK	SIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	Not connect.
C7	SIM_DATA	SIM Card data I/O.

3.2.3 Software Specification

Feature	Implementation
Power supply	Single supply voltage 3.4V – 4.5V
Power saving	Typical power consumption in SLEEP mode to 1.1 mA@ DRX=5 0.7 mA@ DRX=9
Frequency bands	Quad-band: GSM850, EGSM 900, DCS1800, PCS1900. The module can search these frequency bands automatically. The frequency bands also can be set by AT command. Compliant to GSM Phase 2/2+
GSM class	Small MS
Transmitting power	Class 4 (2W) at GSM 850 and EGSM 900 Class 1 (1W) at DCS 1800 and PCS 1900
GPRS connectivity	GPRS multi-slot class 12 （default） GPRS multi-slot class 10 (option) GPRS multi-slot class 8 (option) GPRS mobile station class B
Temperature range	Normal operation: -35°C ~ +80°C Restricted operation: -45°C ~ -35°C and +80°C ~ +85°C ① Storage temperature: -45°C ~ +90°C
DATA *GPRS:* *CSD:*	GPRS data downlink transfer: max. 85.6 kbps GPRS data uplink transfer: max. 85.6 kbps Coding scheme: CS-1, CS-2, CS-3 and CS-4 Supports the protocols PAP (Password Authentication Protocol) usually used for PPP connections. Integrates the TCP/IP protocol. Support Packet Switched Broadcast Control Channel (PBCCH) CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent Unstructured Supplementary Services Data (USSD) support
SMS	MT, MO, CB, Text and PDU mode SMS storage: SIM card
FAX	Group 3 Class 1
SIM interface	Support SIM card: 1.8V, 3V
Antenna interface	Connected via 50 Ohm antenna pad
Audio features	Speech codec modes: Half Rate (ETS 06.20) Full Rate (ETS 06.10) Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) Adaptive multi rate (AMR) Echo Cancellation Echo Suppression Noise Reduction
Serial port and Debug port	Serial Port: Seven lines on Serial Port Interface Serial Port can be used for CSD FAX, GPRS service and send AT command of controlling module. Serial Port can use multiplexing function. Autobauding supports baud rate from 4800 bps to 115200bps. Debug Port: Two lines on Serial Port Interface /TXD and /RXD Debug Port only used for debugging
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.

SIM Application Toolkit	Support SAT class 3, GSM 11.14 Release 99
Real time clock	Implemented
Alarm function	Programmable via AT command
Physical characteristics	Size: 29±0.15 x 29±0.15 x 3.6±0.3mm Weight: 8g
Firmware upgrade	Firmware upgrade over serial port

3.2.4 Solution of M10

The hardware solution is MT6223D+AD6548+PF08155B+HWR874-2+SST34HF3284; The software solution is MTK Release 0836.

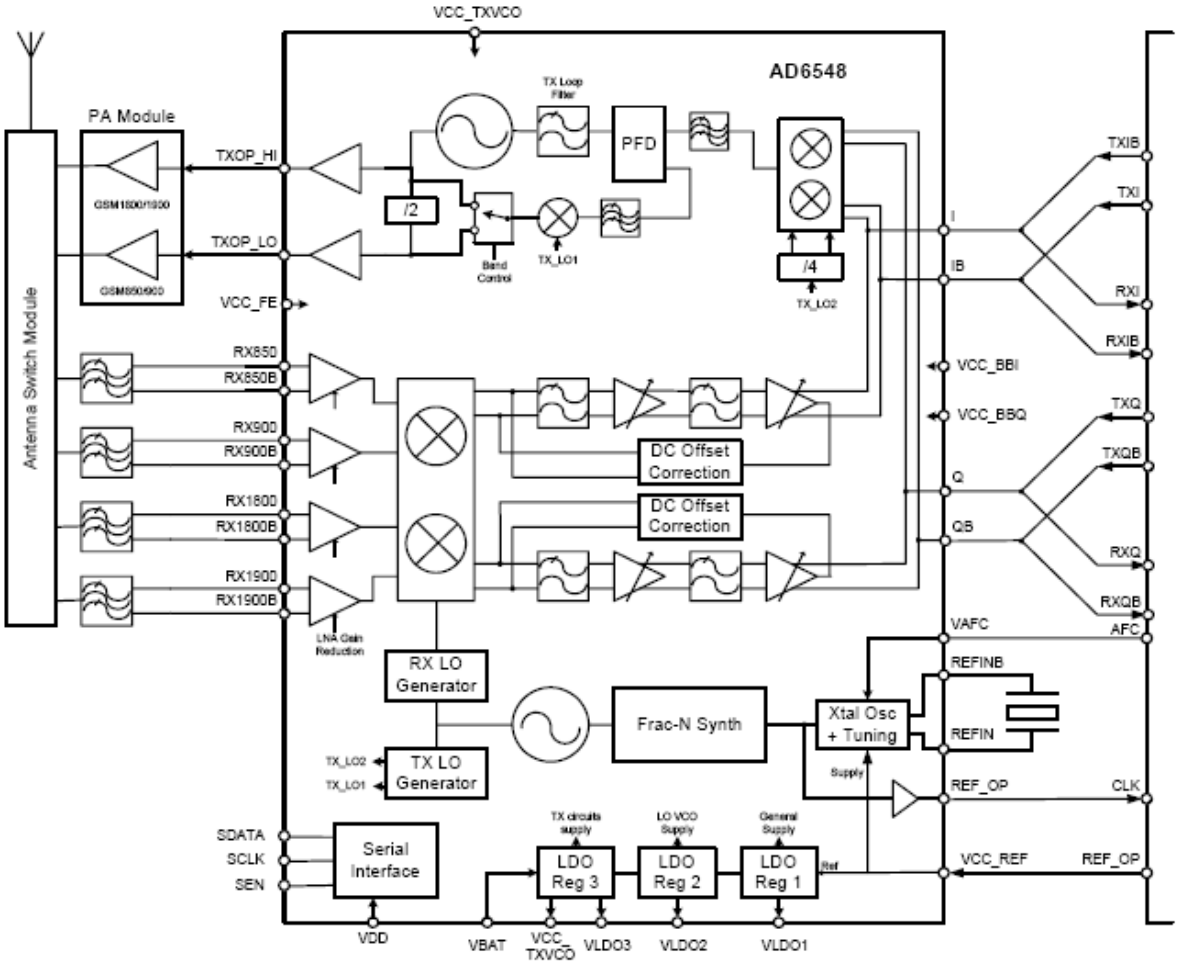
3.2.5 Radio frequency units

The RF units for M10 include AD6548 (transceiver), PF08155(PA), HWX874-2(FEM).

1) AD6548

Key Features:

- Complete Quad-band GSM/GPRS Transceiver
- Direct-conversion (Zero-IF) Receiver
- Integrated VCOs, PLL loop filter
- Integrated Power Management
- Smallest quad-band GSM/GPRS Radio Solution



2) PF08155

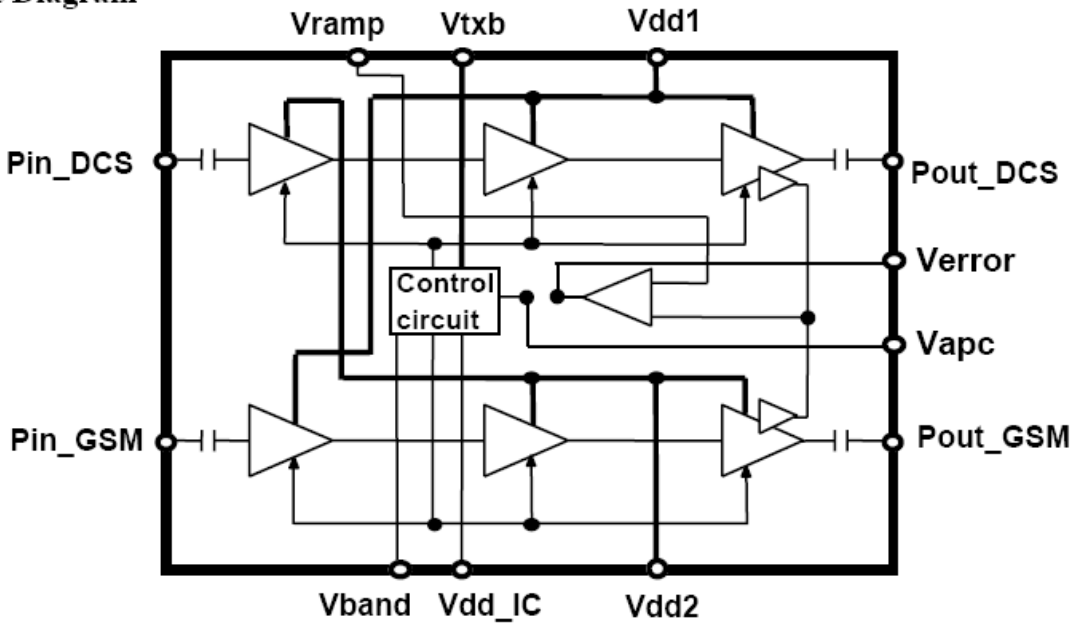
Application

- Quad band amplifier for
  US/E-GSM (824 to 849MHz, 880 to 915 MHz),
  DCS1800/1900 (1710 to 1785 MHz, 1850 to 1910 MHz).
- For 3.5 V nominal operation

Features

- Built-in closed loop APC circuit with power detector performs stable power control accuracy under varied supply voltage and temperature.
- Easy power control design
- The smallest size : 6.0 × 6.0 × 1.2mm typ. (1.3 mm t Max.) as APC integrated PA module.
- High Gain 3-stage amplifier: 3 dBm typical Input power.
- Superb forward isolation level: -45dBm Typical at 6dBm input power.
- Lead free soldering process available
- GPRS Class 12 compatible

Circuit Diagram



3) HWX874

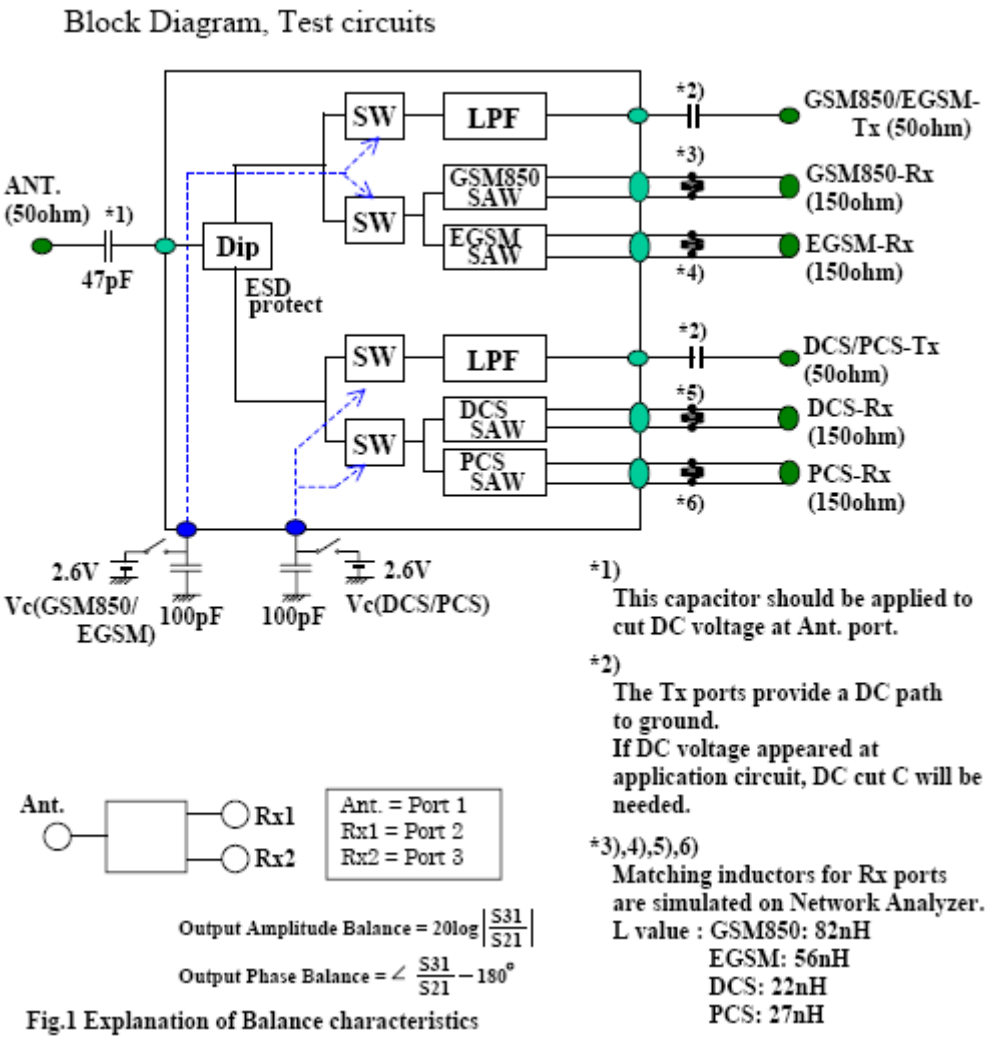


Fig.1 Explanation of Balance characteristics

3.2.6 Baseband units

The baseband units for M10 include MT6223D and SST34HF.

1) MT6223D (MT6223D is integrated Digital baseband and analog baseband).

Baseband architecture comprises mainly two chips: MT6223D and Combo Flash.

MT6223D is an entry level chipset solution with class 12GPRS/GSM modem. It integrates not only analog baseband but also power management blocks into one chip and cangreatly reduce the component count and make smaller PCB size. Besides, MT6223D is capable of SAIC (Single Antenna Interference Cancellation) and AMR speech. Based on 32 bit ARM7EJ-STM RISC processor, MT6223Dprovides an unprecedented platform for high quality modem performance.

Microcontroller Unit (MCU) Subsystem - includes an ARM7EJ-S RISC processor and its accompanying memorymanagement and interrupt handling logics.

 Digital Signal Processor (DSP) Subsystem - includes 2 DSP cores and their accompanying memory, memorycontroller, and interrupt controller.

 MCU/DSP Interface - where the MCU and the DSPs exchange hardware and software information.

 Microcontroller Peripherals - includes all user interface modules and RF control interface modules.

 Microcontroller Coprocessors - runs computing-intensive processes in place of Microcontroller.

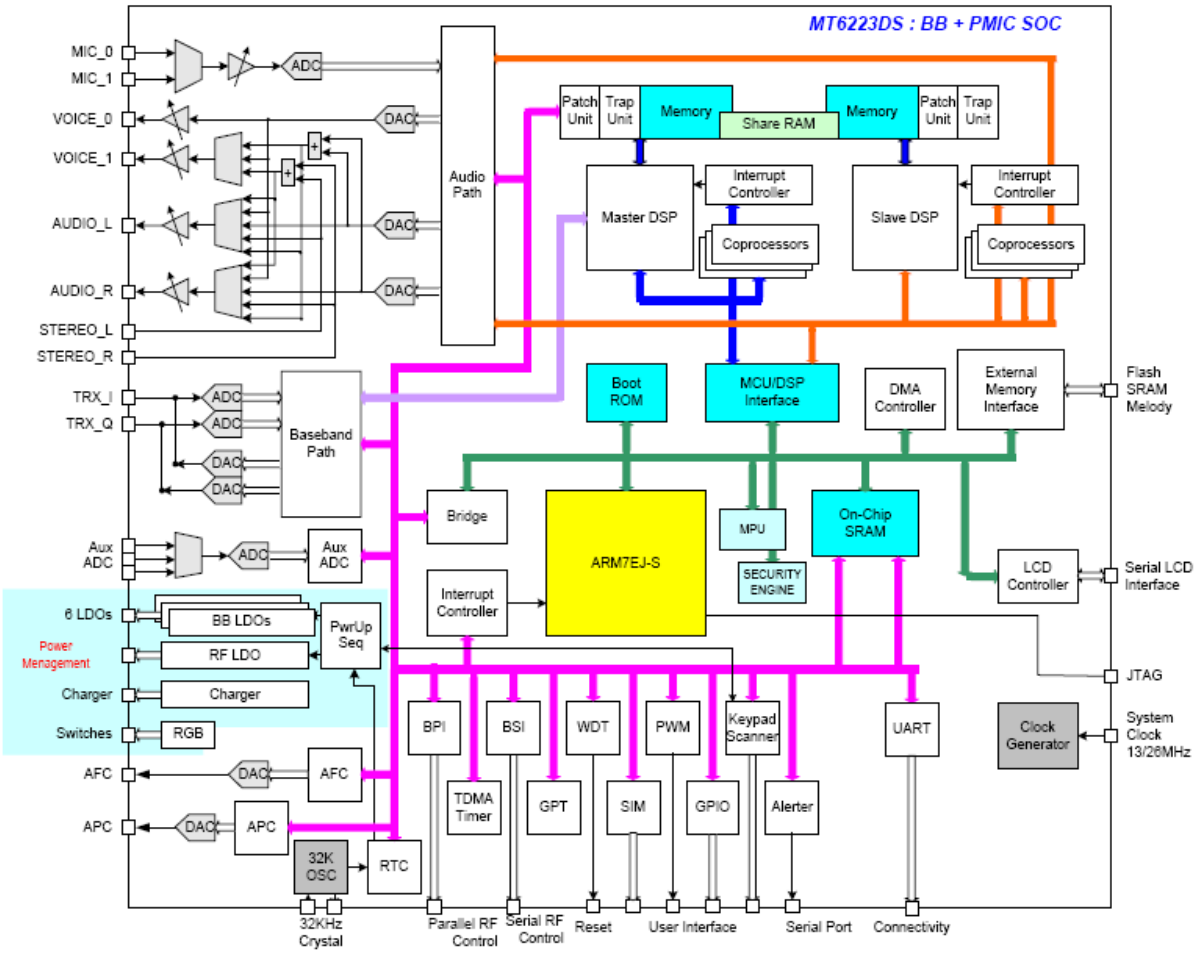
 DSP Peripherals - hardware accelerators for GSM/GPRS channel codec.

 Voice Front End - the data path for converting analog speech from and to digital speech.

 Audio Front End - the data path for converting stereo audio from stereo audio source

 Baseband Front End - the data path for converting digital signal from and to analog signal of RF

modules.
- Timing Generator - generates the control signals related to the TDMA frame timing.
- Power, Reset and Clock subsystem - manages the power, reset, and clock distribution inside MT6223D
- LDOs, Power-on sequences, swicthes and SIM level shifters.



2) SST34HF

Features：

32-Mbit Flash and 8-Mbit PSRAM 2.7V~3.0V Operating voltage

Flash：32-megabit（2M*16）2.7V to 3.0V Read/Write Access Time-70ns Sector Erase Architecture

-Sixty-three 32K WordSectors With Individual Write Lockout

-Eight 4K Word Sectors with Individual Write Lockout Fast Word Program Time-15us Suspend/Resume Feature for Erase and Program

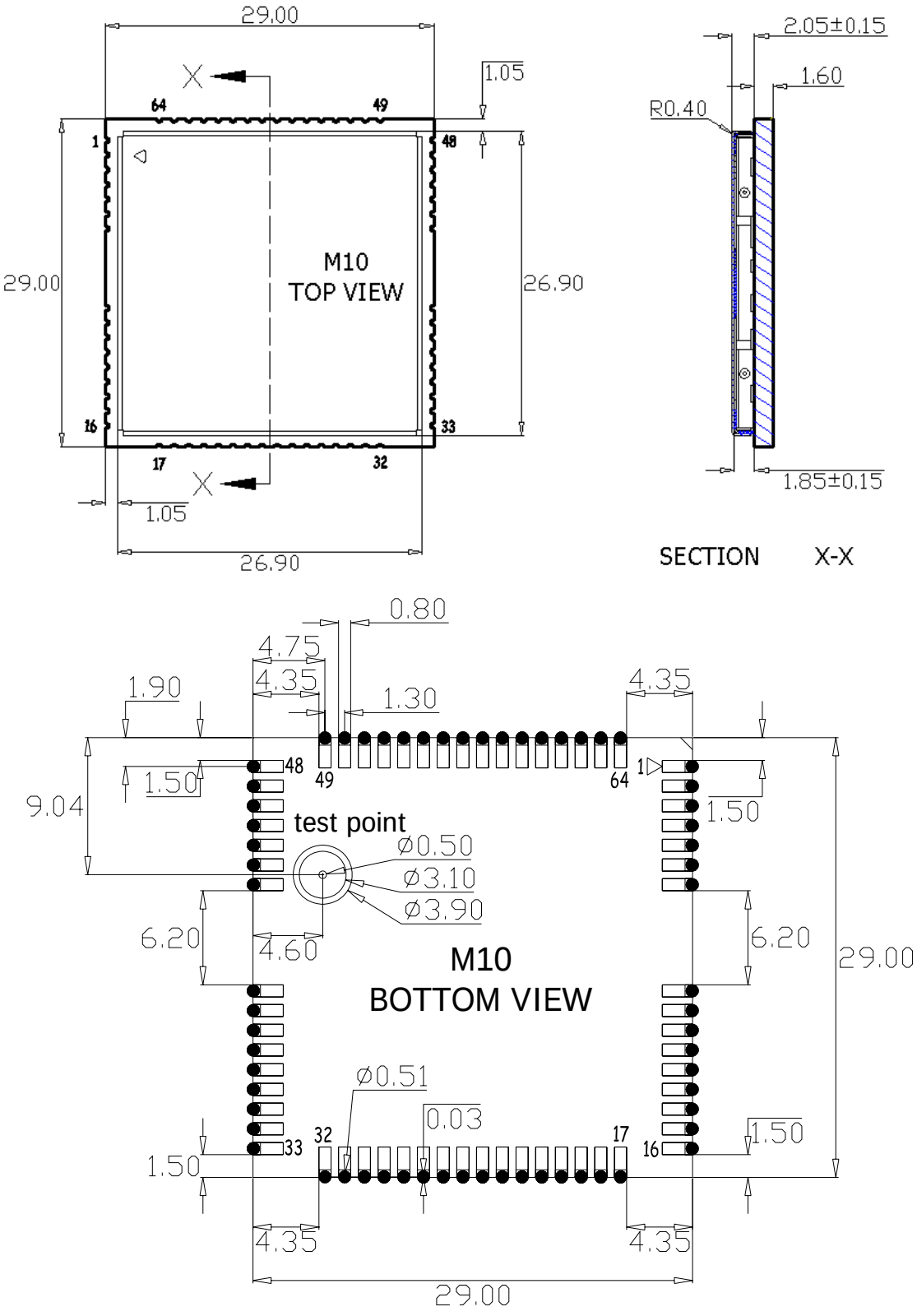
-Supports Reading and Programming from Any Sectors by Suspending Erase of a

Different Sector -Supports Reading Any Word by Suspending Programming of Any Other Word

Low-power Operation -12mAActive -13uA Standby

PSRAM：4-megabit（256K*16）/8-megabit(512K*16) 2.7V to 3.3V Vcc 70ns Access Time

3.2.7 Mechanical architecture


29.00
1.05
64
49
1
48
M10
TOP VIEW
29.00
26.90
16
33
17
32
1.05
26.90
2.05±0.15
1.60
R0.40
1.85±0.15
SECTION X-X
0.80
4.75
4.35
1.90
1.30
4.35
48
49
64
1
1.50
9.04
test point
Ø0.50
Ø3.10
Ø3.90
6.20
4.60
M10
BOTTOM VIEW
6.20
29.00
Ø0.51
0.03
32
17
33
16
1.50
1.50
4.35
4.35
29.00

4. AT command

（please see the AT command document）

5. Compliance with FCC Regulations

Manufacturers of mobile or fixed devices incorporating this RF module are authorized to use the FCC Grant of this RF module for their own final products according to the conditions referenced in these documents. In this case, the FCC label of the module shall be visible from the outside, or the host device shall bear a second label stating "**Contains TX FCC ID XMR-16182009002**".
Manufacturers of portable applications incorporating this RF module are required to have their final product certified and apply for their own FCC Grant related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles.

FCC Section 15.105 (b)
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

FCC Section 15.21 Information to the user
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

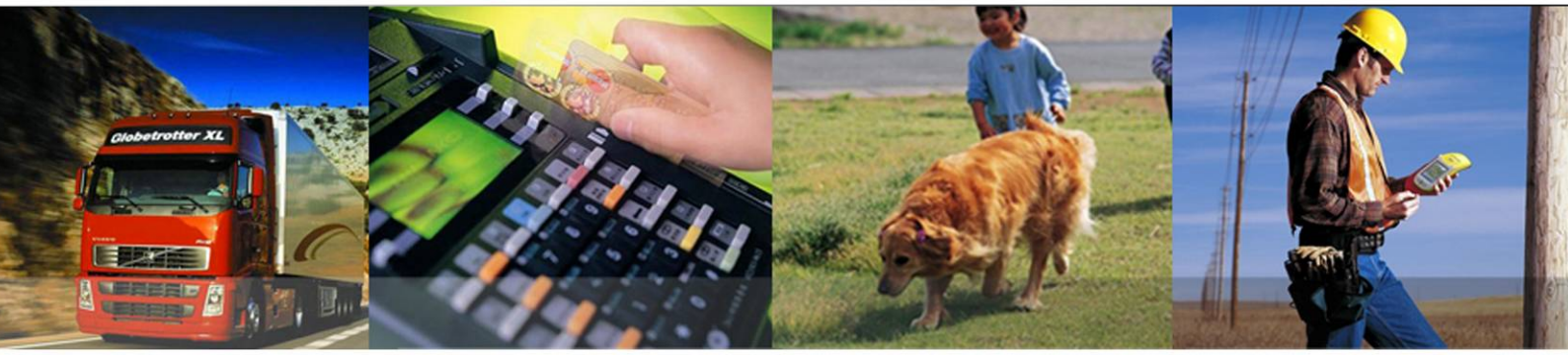
FCC Section 15.19 Labelling requirements
This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:

1.This device may not cause harmful interference, and
2.This device must accept any interference received,
including interference that may cause undesired operation.

When the M10 is integrated into a final product, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel，door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text：
"Contains FCC ID：**XMR-16182009002** "M10 FCC label is shown as：

FCC RF Radiation Exposure Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna 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.



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