

AMOD

ACM8068 Quad band GSM/GPRS Module

Hardware Application Note
<V1.0>

[AMOD Technology Co.,LTD](#)

Subject to changes in technology, design and availability

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Change History

Version	Effective Date	Description of Changes
V1.0	2010/02/04	Released

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1. ACM8068 Key Features

Table 1: ACM8068 key feature list

Product features	Descriptions
Frequency	GSM 850/ GSM900/GSM1800 /GSM1900 Quad Band
Maximum RF Power	GSM850/EGSM900 Class4 (2W)
	GSM1800 GSM 1900 Class1 (1W)
Receiving Sensitivity	850/900 <-109dBm
	1800/1900 <-105~106dBm
Working Temperature	-30°C ~ +85°C
Power Voltage	3.4V ~ 4.5V (4.0V is recommended)
Average STB current	<2mA (Standby mode)
Leaking current	<0.1mA
Protocol	Support GSM/GPRS Phase2/2+
AT COMMAND	GSM Standard AT COMMAND
	V.25 AT COMMAND
	AMOD defined AT COMMAND
48PIN SMD pad	UART Interface (Maximum I/O speed: 115200bit/s)
SIM interface	Standard SIM interface (3V/1.8V)
Audio interface	2 Analogue audio Input/Output interfaces
Power interface	Power interface
Voice Communication	Support FR, EFR, HR and AMR voice codec
	Support hands free operation and echo exhibition.
SMS	Support MO and MT
	Support Point-to-Point Short Message Cell Broadcast
	Support TEXT and PDU mode
GPRS Data transmission	GPRS CLASS 10
	Coding scheme CS 1, CS 2, CS 3, CS 4
	Maximum transmission speed: 85.6Kbit/s ¹
	Support PBCCH
	Built-in TCP/IP protocol. Support multi-slot, ACK response, support large memory buffer and domain name resolution
CSD Service	Support CSD data transmission up to 9600bit/s
	Fax support: Group3, Class1.0
	Support USSD
Supplemental service	Caller ID, Call transfer.
Group Service	Support group call, broadcast, Group call service & broadcast service
STK ²	Support STK through enhanced AMOD AT COMMAND

¹ Depending on network condition² Upon customer request

2. System Architecture

Figure 1 describes ACM8068 function diagram and main system interface.

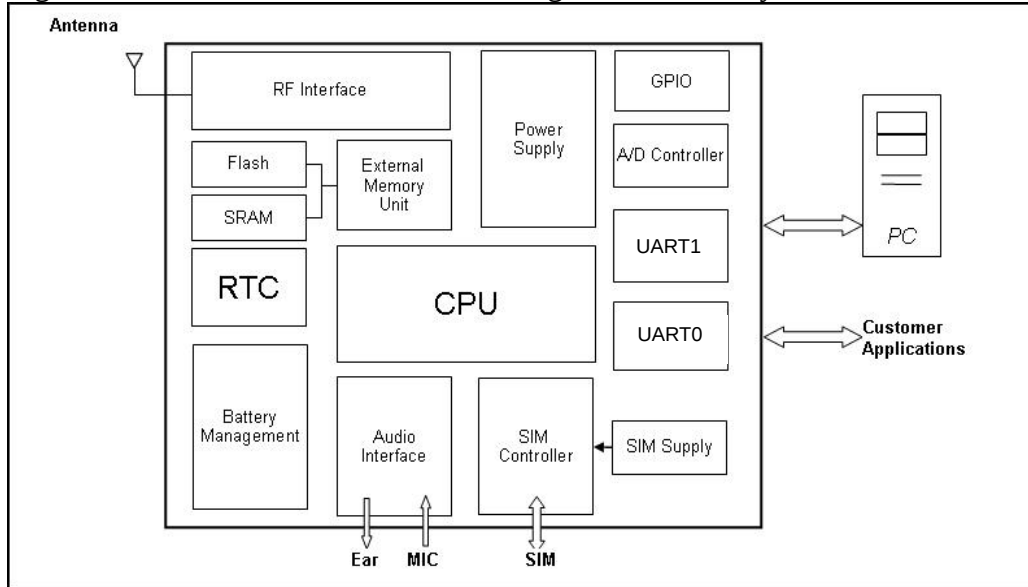


Figure 1: ACM8068 system function block diagram

3. Power Supply Recommendations

3.1 Power Supply Generalities

Power supply design is critical to GSM module applications. The design guides should be strictly followed to ensure the performance of the module. The VBAT voltage limits must be at any time: $3.4V < V_{BAT} < 4.5V$. The worst condition is during the burst period transmission, when current consumption is at its highest. During this period, the VBAT voltage is reduced to the lowest level:

- The output voltage of the power supply drops.
- Voltage drop is present between the power supply output and the GSM module supply pins (VBAT).

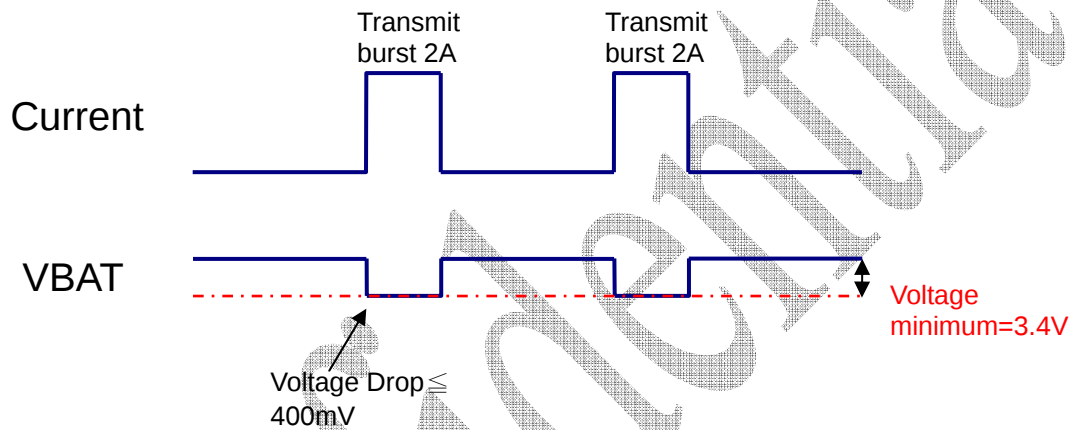


Figure 2: VBAT voltage drop

3.2 Voltage Versus Distance

Depending on the distance between the power supply and the GSM module, behavior is described as figure 3:

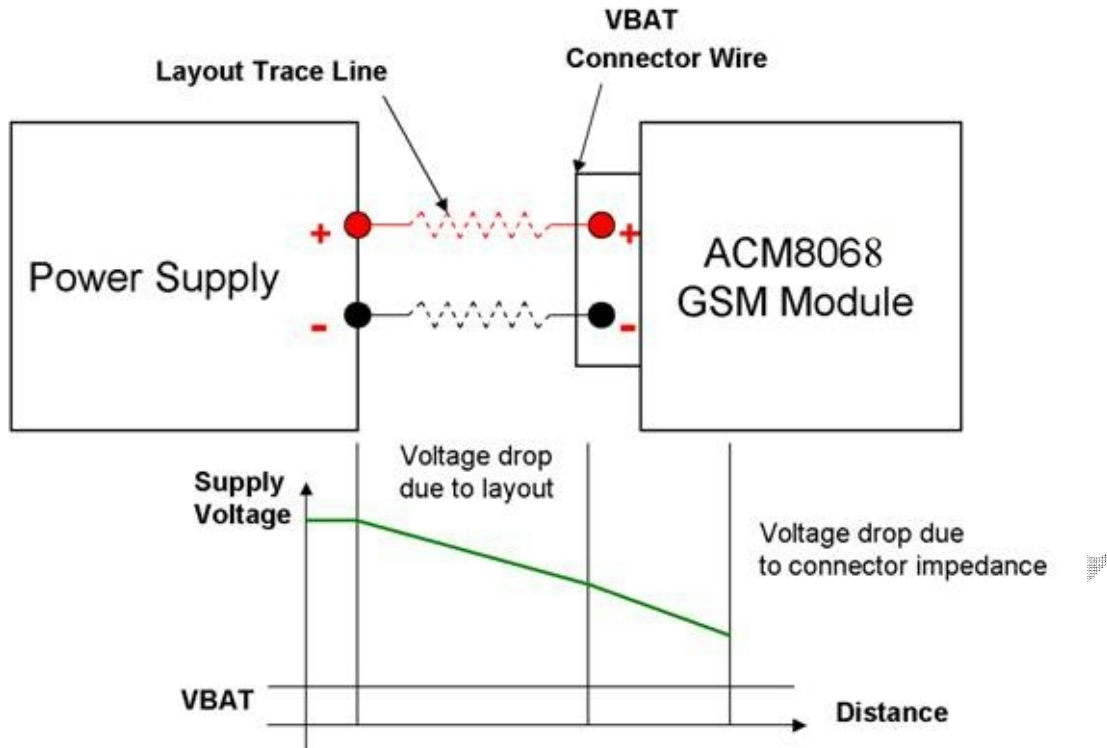


Figure 3: Voltage drop versus distance

3.3 Design Recommendation

Additional notes to the design of power supply circuit:

- Quality attention must be paid to the power supply circuit for their resistance value and burst current.
- The circuit line between power supply input to VBAT should try to avoid interference of other source of signals.
- Decoupling capacitors.

3.3.1 Power Supply Selection

Power supply selection must fulfill following conditions:

- By using large capacity and low ESR capacitors, the system can avoid influence of over burst current.
- The power sources must have good ripple rejection. In another word, the ripple value of current input to VBAT should be as low as possible.
- Low output resistance.

3.3.2 Power Supply Circuit Recommendation

Interferences of other signal sources to the power supply must be avoided.

VBAT connection pins: Pins 38, 39

- Track line width between the power supply and GSM VBAT input should be 3mm.
- The power circuit lines should be separated from other signal lines (e.g. Audio/SIM/UART... etc) by ground
- Make sure to avoid having any signal lines going under the power lines.

- D01 of the input side is used to avoid over voltage of burst current to damage internal circuit. It can also avoid wrong connection of positive and negative poles.
- R02/R03 of the output side is to adjust output voltage
- Value of C06/C07 is 330uF and needs to be Low ESR capacitors.

3.3.3 Power ON & reset circuit recommendation

User can use ON_KEY (PIN 12) for system reset. Pull low for 300ms to active to re-power on the system.

4. Interfaces

4.1 UART Interface

4.1.1 UART interface characteristic and pin out description

ACM8068 has two UARTs. UART0 is used to communicate with host systems, and to download the memory FLASH. The interface configuration is described as follow tables:

Table 2: UART Data configuration

Description	Configurations
Baud rate	115,200
Data bits	8 bits
Stop bit	1
Parity check	Non
HW flow control	Non

Table 3: UART0 pin out description

UART0	Connector Pin	Description
RXD0	3	Receive Data
TXD0	4	Transmit Data
DCD0	42	Data Carrier Detected
DSR0	43	Data Set Ready
RTS0	44	Clear to Send
CTS0	45	Request To Send
RI0	11	Ring Indication

Table 4: UART1 pin out connector

UART1	Connector Pin	Description
RXD1	1	Receive Data
TXD1	2	Transmit Data

Table 5: Electrical characteristics

ITEM	Description	UART0 interface (UART1 for system)	
		MIN	MAX
Vil	Low level voltage input		(0.3 x VDD_IO_HIGH) 0.87V
Vih	high level voltage input	(0.7 x VDD_IO_HIGH) 2.03V	
Vol	Low level voltage Output		0.4 V
Voh	High level voltage output	(VDD_IO_HIGH-0.4V) 2.5V	

Iil	Low level input current		1 μ A
Iih	High level input current		1 μ A
Iol	Low level output current		4 mA
Ioh	High level output current		-4 mA

The ESD/EMI IC has internal resistors in the range of 72 W to 88W.

4.1.2 UART0 interface reference circuit design

4.2 Audio Interface

Two different microphone inputs and two speaker outputs are supported on ACM8068.

4.2.1 Audio track and PCB Layout Recommendation

To avoid TDMA noise, it is recommended to surround the audio tracks by ground:

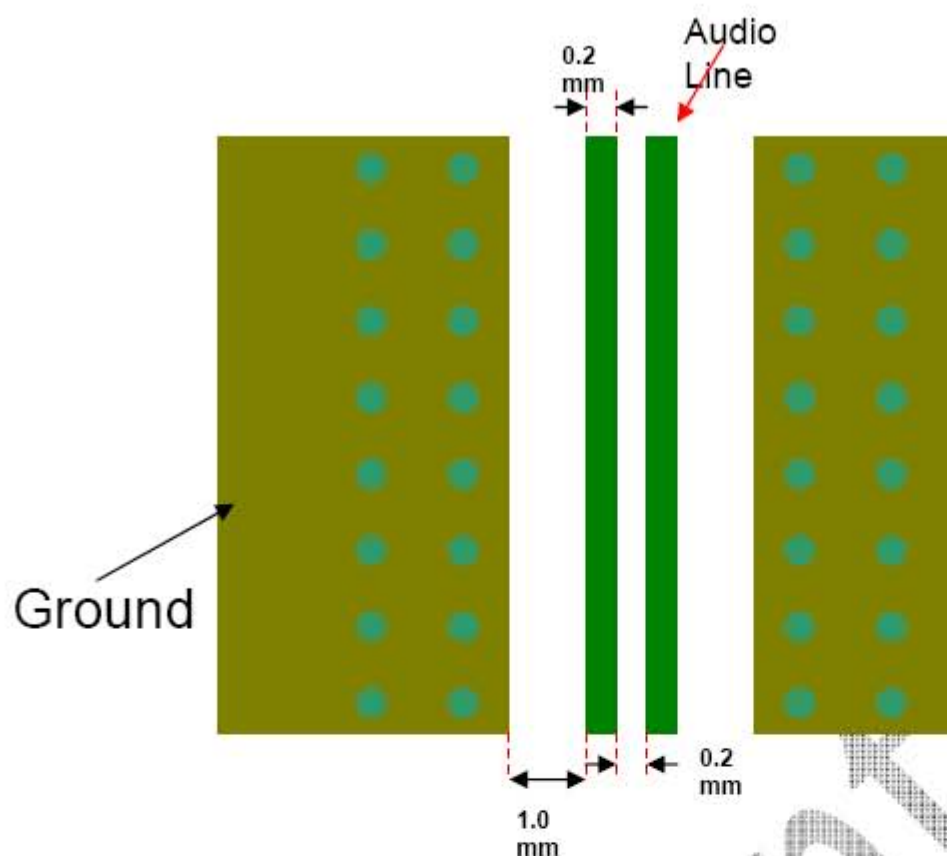


Figure 6: Audio track design

4.2.2 Microphone Inputs

The MIC1 and MIC2 inputs already include the biasing for an electric microphone, allowing easy connection to a headset. The circuit design is as below picture. Please note that Audio GND (Pin24) needs to be connected to Audio Jack GND.

4.2.3 Audio Mode

There are 3 modes for Audio input/output:

1. Normal Mode (for Earphone with Microphone):
MIC1(Pin20/Pin21) and EAR1(Pin22/Pin23)
2. Handfree Mode (for Speaker/Microphone):

- MIC1(Pin20/Pin21) and AUX(Pin29)
3. Car kit Mode (for Speaker/Microphone):
MIC2(Pin18/Pin19) and AUX(Pin29)

4.3SIM Interface

ACM8068 supports 1.8V and 3.3V SIM cards. SIM_VCC can be connected to 1.8V or 3.3V power source.

4.3.1 SIM interface circuit design

Please pay attention to place two capacitors in the circuit design described as follows:

1. 1 μ F: close to the GSM module;
2. 100nF: close to the SIM connector.

These two capacitors are to avoid EMC problems. In addition, PESDXL4UW/TVSX4 connected to SIM track is to avoid ESD problem.

4.3.2 SIM Layout

It's important to pay additional caution to the ESD component of SIM connector layout. Following are suggested guidelines for the layout of SIM holder.

1. The ESD component should be placed as close as possible to the SIM connector.
2. The ESD component should be connected to a clean ground to perform well.
3. Track between ESD to SIM connector should be 8mil wide.
4. Each signal track of SIM circuit needs to be surrounded by ground.
5. Tracks distance between SIM connector and GSM module connector should be below 10 cm.

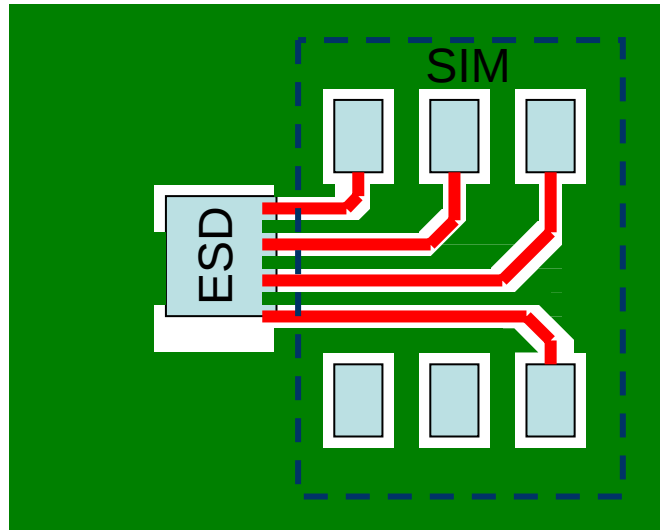


Figure 9: SIM connector layout reference

4.3.3 SIM Card Interface

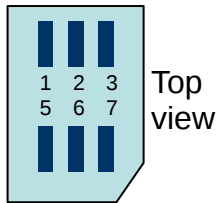


Table 6: SIM connector pin out

Pin number	Schematics name	Description
1	SIM_VCC	Supply voltage (1.8 or 3V)
2	SIMRSCDn_ESD	Reset for SIM card
3	SIMCKCDn_ESD	Clock for SIM card
5	GND	Ground
6	SIM_VCC	Supply voltage (1.8 or 3V)
7	SIMIOCD_ESD	I/O line to/from SIM card

4.4 RF Interface Design

When we design RF Trace on PCB, RF Trace can't be under ACM8068 module. It needs to be used according to the following instruction:

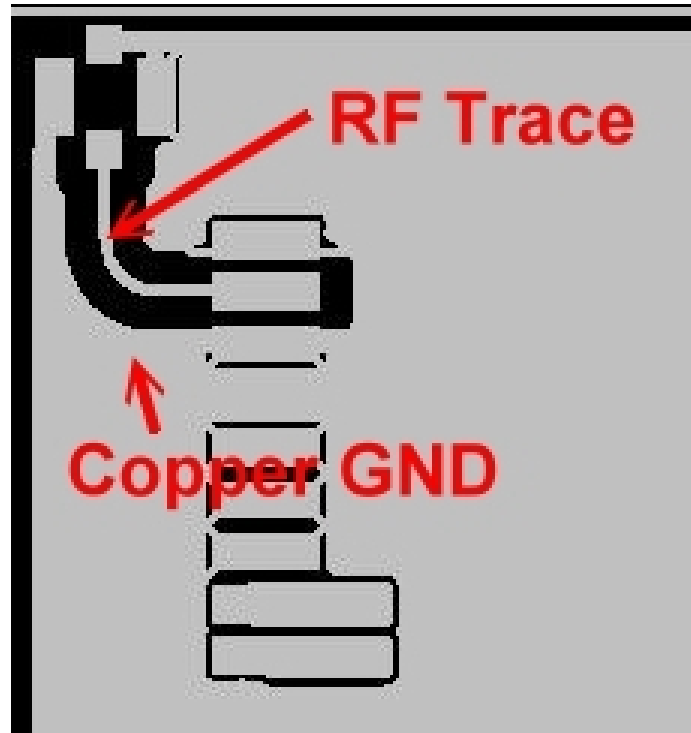


Figure 10: RF Interface Design

4.5 LED Indicators

PIN 5 and PIN 13 can be used as system indicators (refer to enhanced AT command for function switch):

PIN 5: When the output is at high level, the system is ready to accept AT command.

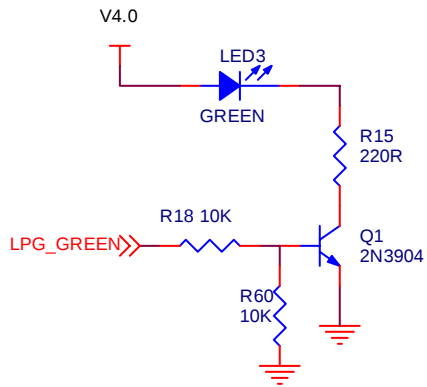


Figure 11: PIN 5 for system ready indication

PIN 13: When the output is at high level, the module had camped on the network.

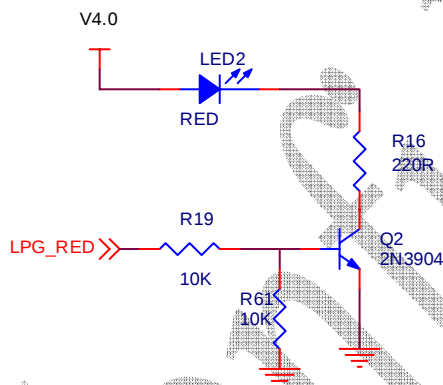


Figure 12: PIN 13 for network ready indication

5. Power ON/OFF Procedure

It is recommended to use following procedure to power on/off module. Follow below procedure as described as figure 1:

Figure 13: Before Power-In, ONKEY has been in the “Low” mode

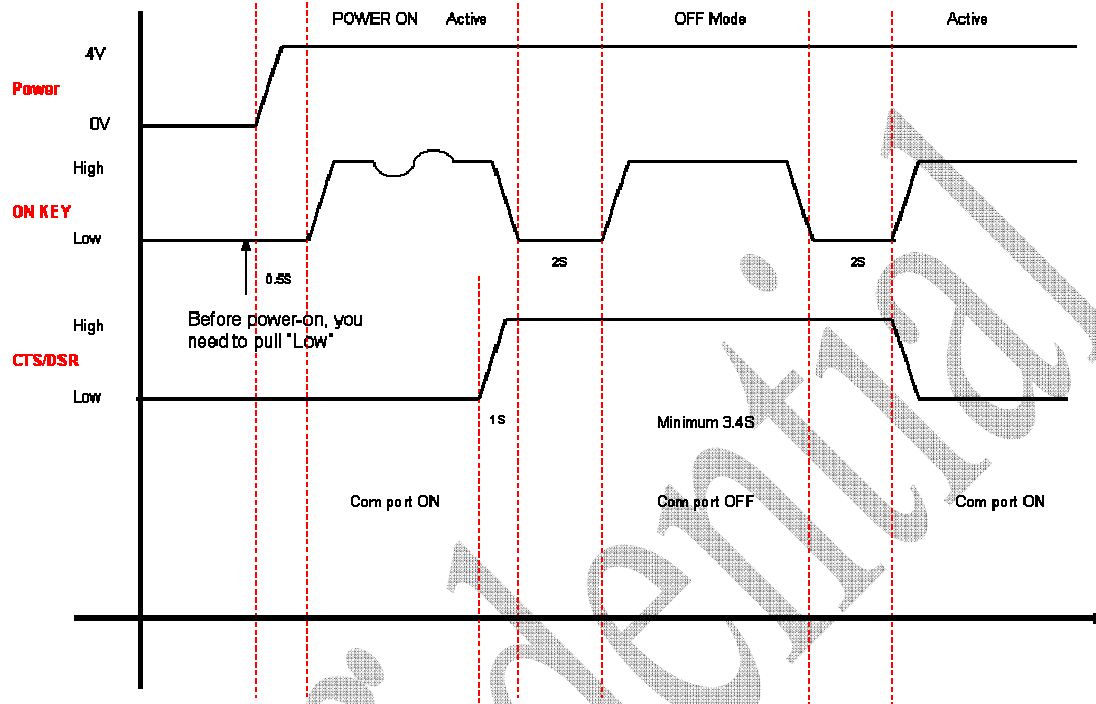


Figure 14: Before Power-In, ONKEY is not in “Low” mode

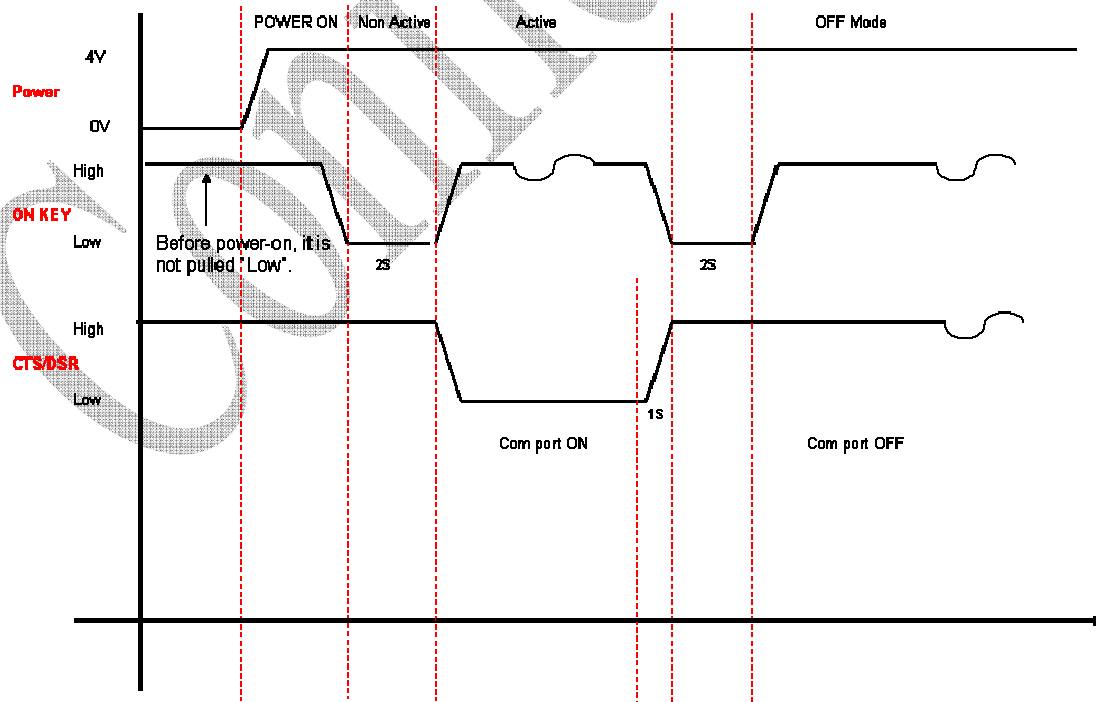
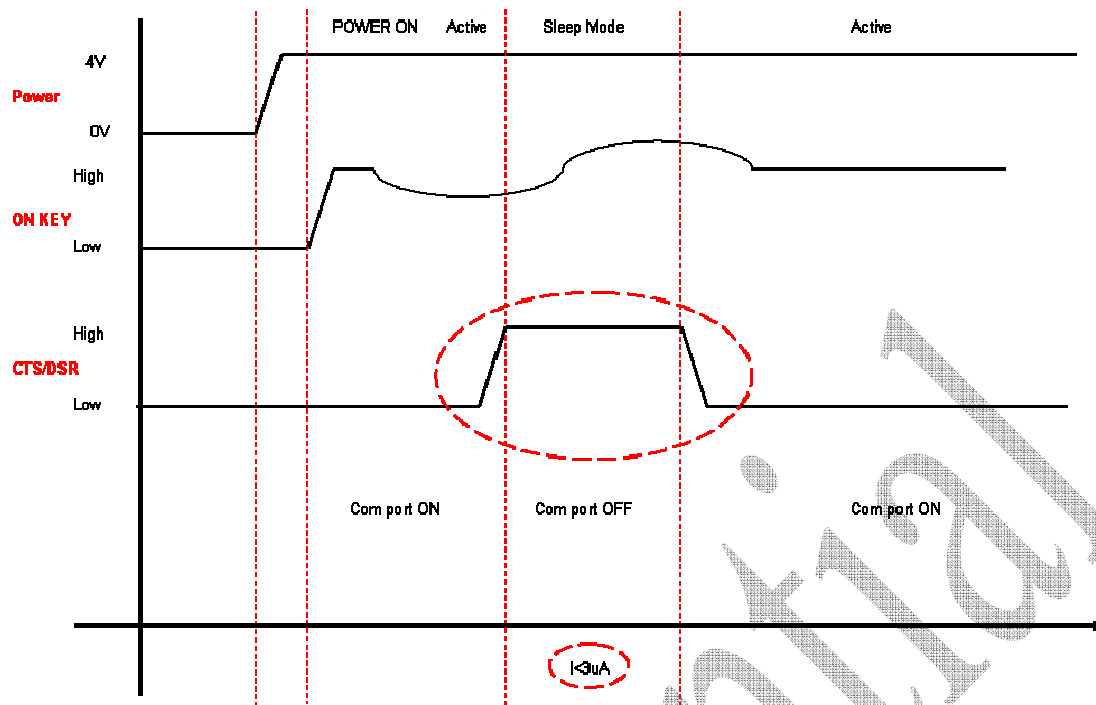


Figure 15: GSM Sleep Process



6. Electrical & Environmental Characteristics

Table 7: MIC 1 audio input electrical requirements

Parameter	Typical Value
Maximum input level (MIC+–MIC-)	32.5mVrms
Differential input resistance (MICI+–MICI-)	220 K Ω
MIC Skew voltage	1.9~2.1V
	2.0~2.2V

Table 8: MIC1 audio output electrical information

Parameter	Testing condition	MIN	TYP	MAX
Resistance (MIC+–MIC-)	4VPP Output	16 Ω	-	-
	3V 1KHz	<1 Ω	-	-

Table 9: EAR 1 audio output electrical information

Parameter	Testing condition	MIN	TYP	MAX
EAR+ or EAR- maximum capacitance	Differentiate	-	-	1%
EAR+ or EAR- maximum output	16 Ω 5%	3.1VPP	-	43.92VPP
	4 Ω 5%	1.2VPP	-	1.5VPP

Table 10: EAR2 audio output electrical information

Parameter	Testing condition	MIN	TYP	MAX
EAR+ or EAR- capacitance differential	Differential 4VPP	-	-	1%
EAR+ or EAR- maximum output	16 Ω 5%	3.1VPP	-	43.92VPP
	4 Ω 5%	1.2VPP	-	1.5VPP

Table 11: Input power requirement

Parameter	Min	Typ	Max	Unit
VBat+	3.4	4.0	4.5	V

Table 12: Operation current requirement

Operation mode	Min	TYP	Max	Unit
Standby mode	-	-	2	mA
Talking mode	-	250	-	mA
GPRS data transmission	-	350(GPRS4+1)	-	mA
Power off mode	-	-	100	μ A

7. Appendix 1. Summary of Pin Out

The board to board connection pin definitions of ACM8068 are described as below table:

1	Debug_RX	UART1
2	Debug_TX	UART1
3	RXD	UART0 RX
4	TXD	UART0 TX
5	Status	Status indicator
6	SIMDATA	SIM interface
7	SIMCLK	SIM interface
8	SIMREST	SIM interface
9	VSIM	SIM interface
10	KBROW0	
11	RI	Ring tone indicator output, can also be used as GPIO or interrupt.
12	ON_KEY	
13	GPIO	General purpose I/O
14	GPIO	General purpose I/O
15	BACKUP	
16	GPIO	General purpose I/O
17	GND	Ground
18	MIC2P	Mic2 in positive
19	MIC2N	Mic2 in negative
20	MIC1N	Mic1 in negative
21	MIC1P	Mic1 in positive
22	EAR+	Audio output 1 positive
23	EAR-	Audio output 1 negative
24	AGND	
25	AUDIOOUT-	AUX out negative
26	AUDIOOUT+	AUX out positive
27	TEMP_BAT	
28	VCHG	
29	AUXADC	
30	GND	Ground
31	GND	Ground
32	GND	Ground
33	ANTENNA	Antenna trace pad
34	GND	Ground
35	GND	Ground
36	GND	Ground
37	GND	Ground

38	VBAT	Power input positive, input voltage is limited to 3.5V ~ 4.5V
39	VBAT	Power input positive, input voltage is limited to 3.5V ~ 4.5V
40	GPO1	General purpose I/O
41	NETLIGHT	
42	DCD	UART0 DCD
43	DTR	UART0 DTR
44	RTS	UART0 RTS
45	CTS	UART0 CTS
46	GPIO	General purpose I/O
47	SIM_PRESENCE	SIM interface
48	GND	Ground

ACM8068 module is used as DCE (Data circuit-terminating equipment). However to let customer connect DCE-DTE, the signal naming is provided here as DTE (Data terminal equipment) signal definitions.

8. Appendix 2. PCB PAD Land Pattern

ACM8068 is a 48 Pin PCB PAD with 0.5mm pitch as pig 2-1 and the dimension is 33mm x 33mm x 3.3mm (high). The model number is Hirose's DF12C(3.0)-50DS-0.5V. The pad is as figure 16.

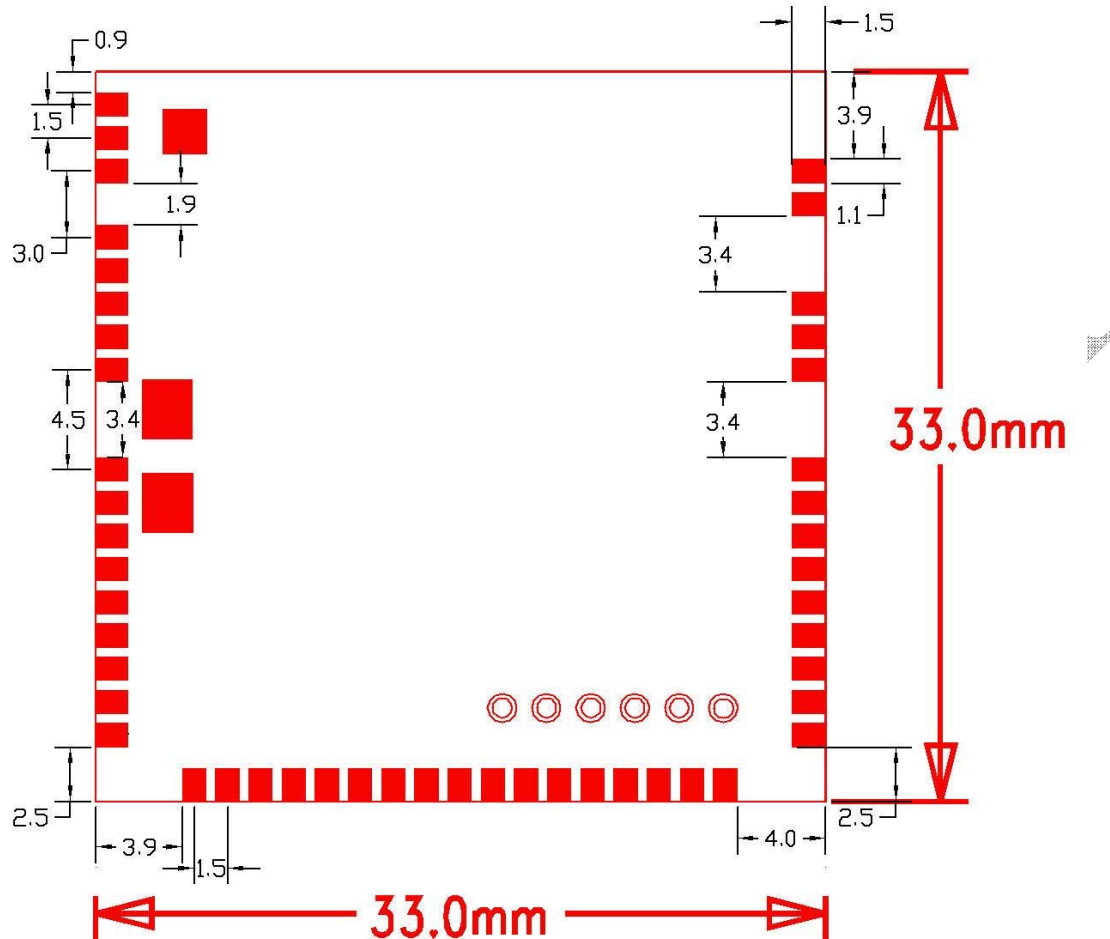


Figure 16: 48 pin SMD pad

FCC Regulations:

●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.

●This device 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.

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

●The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

► RF Exposure Information

This device meets the government's requirements for exposure to radio waves.

This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S. Government.

●This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

Maximum antenna gain allowed for use with this device is 1.57 dBi.

When the module is installed in the host device, 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 re-moved. If not, a second label must be placed on the outside of the final device that contains the following text:

“Contains FCC ID: TLTACM8068”