

M32

GSM / GPRS Wireless Module

DATASHEET

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BenQ

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DOCUMENT AMENDMENTS

VERSION	DATE	COMMENTS	PAGE
Rev 0.3	1/02/2003	I2C was replaced by Buzzer output and IO 12 / DCD pin. Pin 9 - I2C_SDA was changed to BU(buzzer output pin) Pin 10 - I2C_SCL was changed to IO 12 / DCD .	Page 14, 16,17,21
		Pin 24 – GND was changed to IO 13 . (For SW / non flow control Pin)	Page 14 16,19,21
		GPIO was increase to 7 Pins (IO 12 and IO 13)	Page14 , 16,17,21
		Pin 4 – IO 2 was renamed to IO 10 . (For module wake up external device , Low enable)	Page 16 , 17,21
		Pin 29 – IO 0 was renamed to IO 6 . (This pin was dedicated by Accessory_In , Low enable)	Page 16 , 17,21
		Pin 30 – IO 3 was renamed to IO 11 . (For re-down load function / audio Switch)	Page 16, 17,21
		Patten size was changed from 1.1 mm to 0.9 mm	Page 26

1. INTRODUCTION

1.1 DESCRIPTION

Overview

The document describes all the functions , features ,and interfaces of GSM / GPRS Tri band Module M32 from BenQ. M32 can provide wireless communication solution for any product that has requirement of voice communication and data transmission through state of art cellular technology.

Traditionally mobile technology is used as voice-centric application, and mobile phone form factor, but with the wide acceptance of mobile phone and popularity of internet access, the demand of data-centric application or nor mobile phone form-factor using cellular technology are surfacing gradually.

With embedded BENQ M32 GSM/GPRS module, devices could enhance its functionality and usability with state of art wireless technology

1.2 APPLICATION DEVICE

This module could be satisfied by manufactures which have dimension concern of embedded GSM / GPRS features into their products.

The application devices of this module with Tri-band GSM / GPRS features could be as the following :

- PDA Phone / Wireless PDA
- SMART PHONE
- Notebook
- Wireless PSTN
- Mobile Trunk
- Car Phone / Telematics
- Wireless Terminal
- Alarm / Securities System
- Remote control
- Data collection

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2. Features

2.1 General Characteristics

- BAND : EGSM 900 / DCS 1800 / PCS 1900 MHZ

	TX	RX
EGSM	880~915 MHz	925~960MHz
DCS	1710~1785MHz	1805~1880MHz
PCS	1850~1910MHz	1930~1990MHz

- GSM / GPRS : Phase 2+ Compliance
 - GPRS Class 10 : Max 4 downlink , 2 uplink , max 5 slot
 - GPRS Class B :
 - Simultaneous
 - attach
 - activation
 - monitor
 - no simultaneous traffic.
 - Coding Scheme :
 - CS1 - 9.05 kbps
 - CS2 - 13.4 kbps
 - CS3 - 15.6 kbps
 - CS4 - 21.4 kbps
- Support SIM Interface : 3V
- Form factor
 - Dimension : 33.8 x 36.8 x 2.85 mm
 - Weight : 7.5 g
- Power :
 - Operation Voltage : 3.2 V – 4.2 V
- Power Consumption:
 - Speech Mode : 230 mA (min) , 260 mA (max)
 - Standby Mode : 6 mA (paging rate 2)
 - 3 mA (paging rate 9)
- Hardware Output :
 - 48 Pins LCC Package . (Leadless Chip Carrier)

➤	UART / RS232	RS232 transmit interface
➤	UART 2	Software Debug
➤	BU	Buzzer Output
➤	GPIO	General Purpose I/O
➤	Power On	Power On Pin
➤	LED Driver	LED Driver , Paging
➤	SIM	SIM Function
➤	VBAT	Battery Voltage Input
➤	Audio	Earphone/MIC/Handfree
➤	JTAG	Download / Debug interface
➤	Keypad Interrupt	Keypad Interrupt
➤	BGND	GND
➤	ANT	Antenna

- **Software Interface :**

- **GSM Rec. 27.07**

- General
- Call Control
- Network Service
- ME Control and Status
- ME Errors
- TIA IS-101

- **GSM Rec. 27.05**

- SMS related services
- General Configuration
- Message Configuration
- Message Receiving and Reading
- Message Sending and Writing

- **ITU-T Rec. V25ter**

- General TA Control
- Call Control and Command Response
- Data Compression

- ITU-T Rec. T.32
- Action Command
- DCE Response
- Service Command

Note : AT commands , please refer to M32 AT Command List .

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2.2 Voice / Data Service

Tele Service

- Speech Service With EFR (Enhance Full Rate) / FR (Full Rate) / HR (Half Rate) Codec.
- Emergency Call
- DTMF Tone Generation

Short Message Service

- SMS with MT (Mobile Terminate) / PP , MO (Mobile Originated) / PP
- Delivery Report
- Cell Broadcast

FAX Service

- Direction: MOC (Mobile originated call) & MTC (Mobile terminated call)
- Fax GSM TS 3.45 fax transparent mode
- TS 61,62
- TIA/EIA 578 ,Fax class 1 ,Interface to PC for GSM & PSTN
- TIA/EIA 592 ,Fax class 2 ,Interface to PC for PSTN
- ITU-T V.17(14400 bps),V29(9600bps), V27ter(2400/4800 bps)
- Transmission speed rate: 2400, 4800, 7200, 9600bps

Circuit Switch

- Data GSM TS 4.21 transparent mode
- Data GSM TS4.22 Transparent mode
- Data transmission mode: asynchronous (normal)
- Radio channel: full rate
- Transmission speed rate: 2400, 4800, 9600 bps with data compression max 14400bps
- Modem type: V.34 (28800bps) / V.32 bis(14400bps) / 56k

Packet Switch

- GPRS Class B device
- Multi-Slot Transmission up to Class 10 , 2 uplink slot , 4

- downlink slot
- Coding Scheme CS1 – CS4 Supported

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2.3 Supplementary Service

Number identification

- Calling line identification presentation(CLIP)
- Calling line identification restriction (CLIR)
- Connected line identification presentation(CoLP)
- Connected line identification restriction (CoLR)

Call Offering

- Call forwarding unconditional (CFU)
- Call forwarding on mobile subscriber busy (CFB)
- Call forwarding on no reply (CFNRy)
- Call forwarding on mobile subscriber not reachable (CFNRc)

Call Completion

- Call waiting (CW)
- Call hold (HOLD)

Multi Party

- MPTY Supported

Call barring

- Barring of all outgoing calls (BAOC)
- Barring of outgoing international calls (BOIC)
- Barring of outgoing international calls (BOIC- xHC)
- Barring of all incoming calls (BAIC)
- Barring of incoming calls when roaming (BIC-Roam)

2.4 RF Functionalities

■ Maximum TX Power

The performance of transmitter meet the test requirement of GSM 11.10 chapter 13

Band	Max	Min
EGSM	33 dBm \pm 2dBm	5 dBm \pm 5dBm
DCS	30 dBm \pm 2dBm	0 dBm \pm 5dBm
PCS	30 dBm \pm 2dBm	0 dBm \pm 5dBm

■ Parametric Performance

Test at -20°C, 25°C and 60°C at each of voltage 3.6V, 3.8V and 4.0V. Measure Peak Phase, RMS Phase, frequency error, power level, static sensitivity per GSM 11.10 specifications

Band	Peak Phase Error	RMS Phase Error
EGSM	<20°	<5°
DCS	<20°	<5°
PCS	<20°	<5°

■ Sensitivity

The performance of receiver meets the test requirement of GSM 11.10 chapter 14.

Band	Typical	Min
EGSM	-106 dBm	-104 dBm
DCS	-105 dBm	-103 dBm
PCS	-106 dBm	-104 dBm

■ Radio Frequency

Radio Frequency (900 MHz EGSM)	
Frequency Range	TX 880-915 MHz; RX 925-960 MHz
Channel Spacing	200 KHz
Number of Channels	124 Carriers x 8 (TDMA)
Modulation	GMSK
Duplex Spacing	45 MHz
Frequency Stability	+/- 0.1 ppm (Uplink TX)
Power Output	33 dBm Class 4 (2 W peak)
Output Impedance	50 Ohm
Spurious Emission	-36 dBm up to 1 GHz (< -30 dBm > 1 GHz)
Radio Frequency (1800 MHz)	
Frequency Range	TX 1710-1785 MHz; RX 1805-1880 MHz
Channel Spacing	200 KHz
Number of Channels	374 Carriers x 8 (TDMA)
Modulation	GMSK
Duplex Spacing	95 MHz
Frequency Stability	+/- 0.1 ppm (Uplink TX)
Power Output	30 dBm – 0 dBm
Output Impedance	50 Ohm
Spurious Emission	-36 dBm up to 1 GHz (< -30 dBm > 1 GHz) Compatible with phase 2 feature
Radio Frequency (1900 MHz)	
Frequency Range	TX: 1850~1910MHz; RX: 1930~1990MHz
Channel Spacing	200KHz
Number of Channels	299 Carriers x 8 (TDMA)
Modulation	GMSK
Duplex Spacing	80 MHz
Frequency Stability	+/- 0.1 ppm (Uplink TX)
Power Output	30 dBm – 0 dBm
Output Impedance	50 Ohm
Spurious Emission	-36 dBm up to 1 GHz (< -30 dBm > 1 GHz) Compatible with phase 2 feature

3 Hardware Description

3.1 INTERFACE

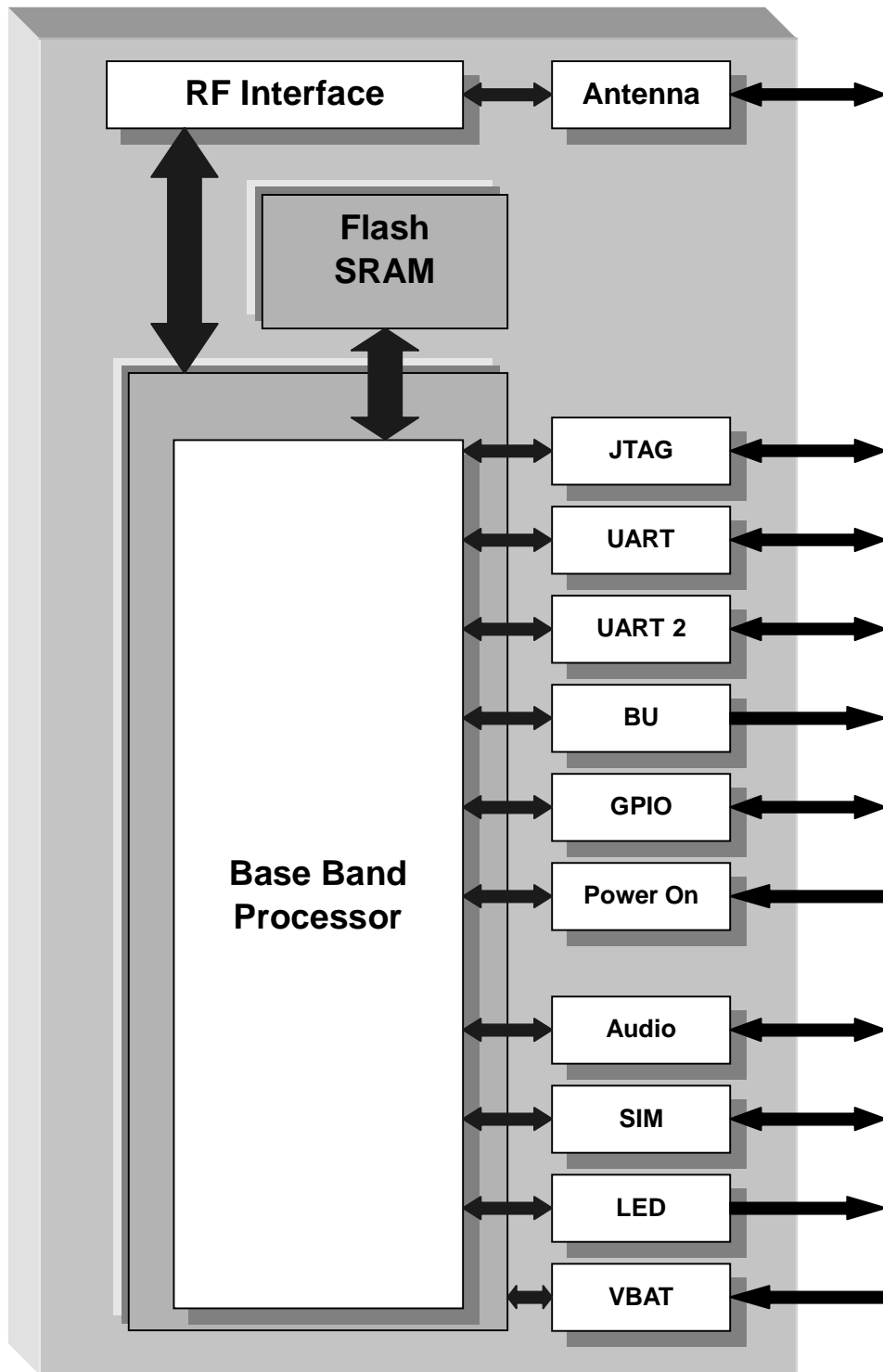
The following descriptions were all feature pins no. on M32 / LCC module .UART , GPIO , AUDIO , SIM ... etc features that could meet customer design for PDA / Smart phone / Notebook.

Group	Pin no.	Description
UART / RS232	5	RS232 transmit Interface
UART2	2	Software Debug
BU	1	Buzzer Output
GPIO	7	General Purpose I/O
Power On	1	Power On Pin
LED Driver	1	LED Driver , Paging
SIM	4	SIM Function
VBAT	4	Battery Voltage Input
Audio	8	Earphone / MIC / Hand Free
JTAG	4	Download / Debug Interface
Keypad Interrupt	1	Keypad Interrupt
ANT	1	Antenna
BGND	9	GND

Total 48 Pins

Detail Pin descriptions and electrical characteristics will introduce in the following contents .

3.2 Functional Diagram



3.3 Pin Description

■ Description Table

No.	Pin	Description	No.	Pin	Description
1	BGND	Ground	25	TMS	Test Mode Select
2	ANT	Antenna	26	TDO	Data Output
3	BGND	Ground	27	TCK	JTAG Clock
4	IO 10	M32 wake up External device	28	IO1	Loud Speaker shutdown
5	ROW4	Keypad Interrupt	29	IO 6	Accessory_In
6	PWON	Power On	30	IO 11	Re-download function / audio switch
7	TXD2	Transmit Data	31	BGND	Ground
8	RXD2	Receive Data	32	AUXI	Auxiliary hands free amplifier iutput(-)
9	BU	Buzzer Output	33	MICIN	Microphone amplifier input(-)
10	IO 12 / DCD	Data Carrier Detect	34	MICIP	Microphone amplifier input(+)
11	BGND	Ground	35	MICBIAS	Microphone bias supply
12	BGND	Ground	36	HSMICB	Headset Microphone bias supply
13	VBAT	Voltage Input	37	EARP	Earphone amplifier output(+)
14	VBAT	Voltage Input	38	EARN	Earphone amplifier output(-)
15	VBAT	Voltage Input	39	BGND	Ground
16	BGND	Ground	40	AUXOP	Auxiliary hands free amplifier Output(+)
17	TXD	Transmit Data	41	BGND	Ground
18	RXD	Receive Data	42	SIM_RST	SIM Reset
19	RTS	Request To Send	43	SIM_IO	SIM Input / Output
20	CTS	Clear To Send	44	SIM_CLK	SIM Clock
21	DSR	Data Set Ready	45	VRSIM	Regulator SIM Output
22	IO8 / DTR	GPIO 8 / Data Terminal Ready	46	LEDA	LED Driver , Paging
23	TDI	Data Input	47	VBAT	Voltage Input
24	IO 13	GPIO 13 / HW / Non flow control	48	BGND	Ground

■ UART / RS232

The UART includes the following additional features

- Hardware flow control (DCD , RTS/CTS)
- Auto-bauding rate with the possibility to match to baud-rate from 1200 to 115.2K bits.

Pin Name	Pin Out	Pull	Reset	Description
TXD	17		1	Transmit Data
RXD	18		Input	Receive Data
RTS	19		1	Request to Send
CTS	20		Input	Clear to Send
DSR	21		input	Data Set Ready
IO 12 / DCD	10		Output	Data Carrier Detect
IO 8 / DTR	22		Output	Data Terminal Ready
IO 1 / RI	28		Output	Ring Indicate

■ UART 2

Used for software debug .

Pin Name	Pin Out	Pull	Reset	Description
TXD2	7		1	Transmit Data
RXD2	8		input	Receive Data

■ BU

When Incoming call that Buzzer will generate pulse .

Pin Name	Pin Out	Pull	Reset	Description
BU	9			Buzzer Output Pin

■ GPIO

The module provides 7 GPIOs pins configurable in read or write mode .

IO 1 / IO 8 / IO 12 was dedicate for UART functions .

Pin Name	Pin Out	Pull	Reset	Description
IO 10	4		Output	Module wake up external device
IO 13	24		Input	HW / SW flow control switch
IO 6	29		Input	Accessory_In
IO 11	30		Output	Re-download function / Audio Switch
IO 1 / RI	28		Output	Ring Indicate
IO 8 / DTR	22		Output	Data Terminal Ready

IO 12 / DCD	10		Output	Data Carrier Detect
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Note : 1) IO 6 initial value = L

2) IO 11 default value = audio switch

3) IO 10 timing sequence was defined in design guide.

■ LED Driver

LEDA is dedicated for paging identification .

The initial status was list as following :

1. In initial mode (no voltage input) that this pin will in high status .
2. In standby mode that will pull low 1sec and pull high 1 sec alternately.
3. In communication mode that will pull low .

Pin Name	Pin Out	Pull	Reset	Description
LEDA	46			LED DRIVER , paging

Note : 1) The max current is 10 mA .

2) The LEDA voltage range was 0.4 V ~ VBAT

■ SIM Function

The SIM Card digital interface in ABB insures the translation of logic levels between DBB and SIM Card , for the transmission of 3 different signals ; a clock derived from a clock elaborated in DBB , to SIM Card (SIM_CLK) , a reset signal from DBB to the SIM Card (SIM_RST) , and serial data from DBB to SIM Card (SIM_IO) and vice-versa.

Pin Name	Pin Out	Pull	Reset	Description
SIM_CLK	44		0	SIM Clock
SIM_RST	42		0	SIN Reset
SIM_IO	43		0	SIM Input / Output
VRSIM (3V)	45			Regulator SIM Output

■ VBAT

The maximum and minimum voltage limited was defined in Electrical Character table .

Note : The Pin 13,14,15 were dedicated for Power Amplifier .

Pin Name	Pin Out	Pull	Reset	Description
VBAT	13			Voltage input
VBAT	14			Voltage input
VBAT	15			Voltage input
VBAT	47			Voltage input

■ Audio Function

There have differential EAR Phone output and differential Microphone input for customer use . Include Auxiliary pins that could be used for hand-free .

Pin Name	Pin Out	Pull	Reset	Description
EARP	37			Earphone amplifier output(+)
EARN	38			Earphone amplifier output(-)
MICP	34			Microphone amplifier input(+)
MICN	33			Microphone amplifier input(-)
AUXOP	40			Auxiliary hands free amplifier output(+)
AUXI	32			Auxiliary hands free amplifier iutput(-)
MICBIAS	35			Microphone bias supply
HSMICB	36			Headset Microphone bias supply

■ JTAG

Joined Test Action Group / for debug .

Pin Name	Pin Out	Pull	Reset	Description
TDO	26		Z	Data Output
TDI	23		Input	Data Input
TCK	27		Input	JTAG Clock
TMS	25		Input	Test Mode Select

■ BGND

Pin Name	Pin Out	Pull	Reset	Description
BGND	1			GND
BGND	3			GND
BGND	11			GND
BGND	12			GND
BGND	16			GND
BGND	31			GND
BGND	39			GND
BGND	41			GND
BGND	48			GND

■ Antenna

Pin Name	Pin Out	Pull	Reset	Description
Ant	2			Antenna Pin

■ Interrupt

For dual processor use that can send interrupt signal from external processor to module when there have any interrupt .

Pin Name	Pin Out	Pull	Reset	Description
ROW 4	5			External Device interrupt M32

Note : The interrupt pin of external device need to pull down 50ms that wake up M32 , detail timing sequence was defined in design guide.

■ Power ON

Power On Pin need pull low at least 100 ms for operation .

Pin Name	Pin Out	Pull	Reset	Description
PWON	6			Power On

3.4 Pin Assignment Diagram

BGND	1	48	BGND
ANT	2	47	VBAT
BGND	3	46	LEDA
IO 10	4	45	VRSIM
ROW4	5	44	SIM_CLK
PWON	6	43	SIM_IO
TXD2	7	42	SIM_RST
RXD2	8	41	BGND
BU	9	40	AUXOP
IO12/ DCD	10	39	BGND
BGND	11	38	EARN
BGND	12	37	EARP
VBAT	13	36	HSMICB
VBAT	14	35	MICBIAS
VBAT	15	34	MICIP
BGND	16	33	MICIN
TXD	17	32	AUXI
RXD	18	31	BGND
RTS	19	30	IO 11
CTS	20	29	IO 6
DSR	21	28	IO1 / RI
I/O8 DTR	22	27	TCK
TDI	23	26	TDO
IO 13	24	25	TMS

3.4 Electrical Characteristics

■ Operating Voltage / Current Characteristics

Parameter	Description	Min	Typ	Max	Unit
Supply Voltage range VBAT		3.0	3.6	5.5	V
Peak VBAT Current			1.8		A
Average VBAT Current		230		260	mA
Average Standby mode VBAT current	Paging Rate 9		3		mA
V _{ih}	High-level input voltage	2.5		4.1	V
V _{il}	Low-level input voltage	-0.5		0.8	V
V _{oh}	High-level output voltage	2.9			V
V _{ol}	Low-level output voltage			0.6	V
SIM_CLK	Output frequency	1.625		3.25	MHz
VRSIM	SIMSEL=1	2.7	2.85	3.0	V

■ Audio Uplink Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Maximum Input Range (MICIP-MICIN)	Inputs 3 dBm0 (Maximum digital sample amplitude with PGA gain set to 0 dB)		32.5		mVrms
Nominal Ref. Level (MICIP-MICIN)			-10		dBm0
Differential Input Resistance			36		K Ω
Micro amplifier gain (MIC)			25.6		dB
Parameter	Conditions	Min	Typ	Max	Unit
Maximum Input Range (AUXI)	Input 3 dBm0 (Maximum digital sample amplitude with PGA gain set to 0dB)		365		mVrms
Nominal Ref. Level (AUXI)			-10		dBm0
Micro amplifier gain (AUXI)	VBDFauxG=0		4.6		dB
	VBDFauxG=1		28.2		dB
Input Resistance at AUXI	VBDFauxG=0	100	170	24.5	K Ω
Parameter	Conditions	Min	Typ	Max	Unit
DC Level at MICBIAS	MICBIAS=0		2.0		Volt
DC Level at HSMICBIAS	MICBIAS=0		2.0		Volt
Current Capability at MICBIAS		0		2	mA
Current Capability at HSMICBIAS		0		2	mA

Note:

- (1)The MICBIAS and HSMICBIAS outputs are multiplexed , only one is available at the same time
- (2)The AUXI and HSMIC inputs are multiplexed.
- (3) MICIP / MICIN and HSMIC input are multiplexed , only one is available at the same time .

■ Audio Downlink Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Differential	Output swing 3.9 Vpp		120		Ω
Minimum Resistive load at EARP-EARN	Output swing 1.5 Vpp		33		Ω
Differential				100	pF
Maximum Resistive load at EARP-EARN					
Common Mode			200		K Ω
Minimum Resistive load at EARP-EARN					
Common Mode				10	pF
Maximum Resistive load at EARP-EARN					
Parameter	Conditions	Min	Typ	Max	Unit
Differential		1	1.2		K Ω
Minimum output resistive load at AUXOP					
Differential				100	pF
Minimum capacitor load at AUXOP					
Common Mode			200		K Ω
Minimum resistive load at AUXOP					
Common Mode				10	pF
Maximum Capacitor load at AUXOP					

■ Global Characteristics

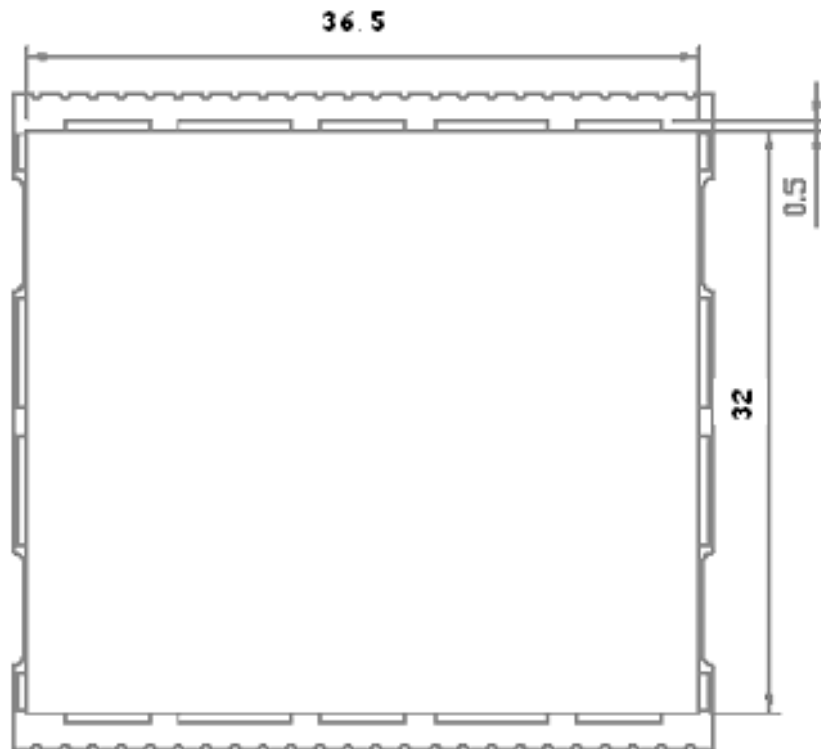
Parameter	Conditions	Min	Typ	Max	Unit
Maximum Output Swing	5% distortion and 120Ω	3.1	3.92		Vpp
EARP – EARN	5% distortion and 33Ω	1.2	1.5		Vpp
Earphone amplifier gain			1		dB
Earphone amplifier state in power down			Hi-Z		
Parameter	Conditions	Min	Typ	Max	Unit
Maximum Output swing at AUXOP	5% distortion maximum , load = 1k Ω	1.6	1.96		Vpp
Auxiliary amplifier gain (AUXO)			-5		dB
AUXO amplifier state in power down			Hi-Z		
Parameter	Conditions	Min	Typ	Max	Unit
Power Supply Rejection			40		dB

■ Digital I/O of SIMIO , SIMRST , SIMCK

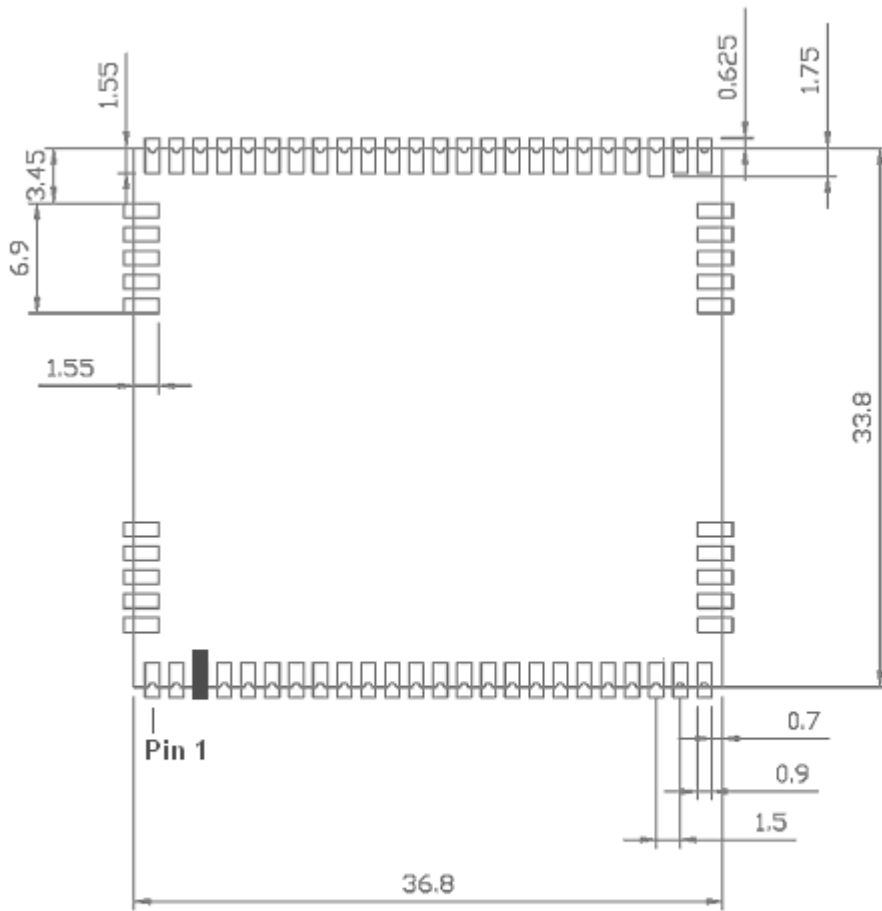
Parameters	Conditions	Min	Typ	Max	Unit
SIM_CK / VOH		0.7*VRSIM			V
SIM_CK / VOL				0.2*VRSIM	V
SIM_RST / VOH		0.8*VRSIM			V
SIM_RST / VOL				0.2*VRSIM	V
SIM_IO / VOH		0.7*VRSIM			V

3.5 Physical Package

■ Top View



■ Bottom View



Recommend Land
Pattern(Unit:mm)

4. Software Characteristics

4.1 Introduction

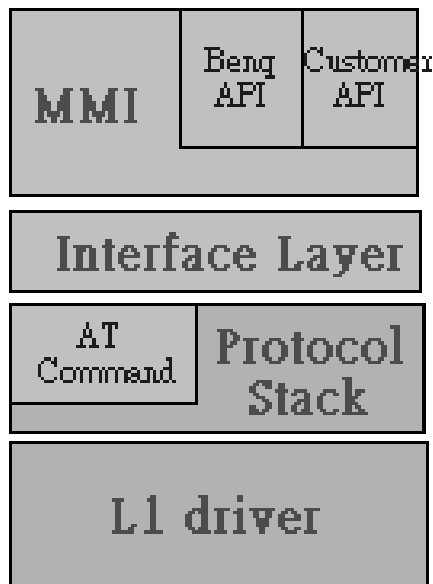
The following descriptions that define the BenQ M32 LCC software architecture . For PDA customers, BenQ provides them the AT Command ; For telematics/ Notebook application: Voice command, Address book, Voice memo, PC sync, Melody, Grouping by Ring Tones, FAX are needed.

4.2 Software Architecture

BenQ provide the Layer 1 driver , AT command , Interface Layer driver and basic MMI interface .Basic on different customer that will have different software architecture . It will be define in the next section.

Architecture :

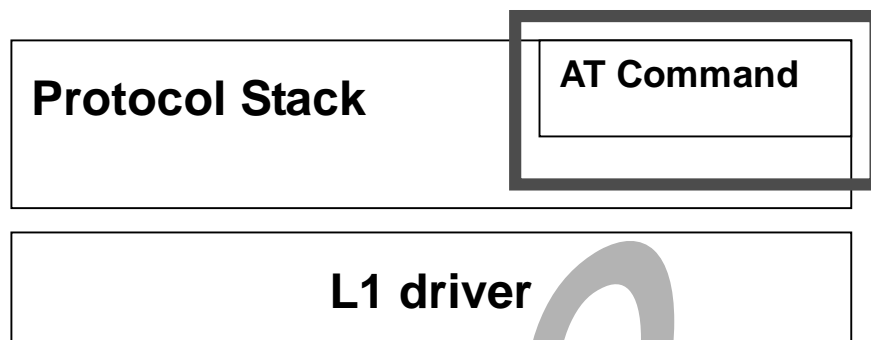
- Layer 1 Driver
- Protocol Stack / AT Command
- Interface Layer
- Basic interface



4.3 Software Architecture of PDA / Wireless PSTN

Owing to there will have processor in BenQ's Module and PDA that the common interface between module and PDA was AT Command so the software architecture was showed as the following diagram.

Customer can use BenQ provide AT Command to access GSM / GPRS network on their platform .



4.4 Software Architecture of Notebook

The software architecture of notebook application is as the following diagram . The common interface between notebook and module were AT Command and AP software . Customer could use BenQ provide AP software / AT commands to access the GSM / GPRS network in their own Windows OS.

