



# CH232BGN

## Embedded WiFi Module

### User Manual



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# 1. PRODUCT OVERVIEW

## 1.1. General Specifications

Table 1: CH232BGN Technical Specifications

Class	Item	Parameters
<b>Wireless Parameters</b>	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	Frequency range	2.412GHz-2.484GHz
	Transmit Power	802.11b: +20 dBm (Max.)
		802.11g: +18 dBm (Max.)
		802.11n: +15 dBm (Max.)
		Configurable
	Receiver Sensitivity	802.11b: -89 dBm
		802.11g: -81dBm
802.11n: -71dBm		
Antenna Option	External:I-PEX Connector (Thru-hole)	
	Internal:On-board chip antenna	
<b>Hardware Parameters</b>	Data Interface	UART: 1200bps - 230400bps
		GPIOs
		Ethernet: 100Mbps
	Operating Voltage	3.3V (+/-5%)
	Operating Current	170mA~300mA
	Operating Temperature	-25° C - 85 ° C
Storage Temperature	-40 ° C - 100 ° C	
Dimensions and Size	25x40x8mm	
<b>Software Parameters</b>	Network Type	Station /Access Point mode/STA+AP
	Security Mechanisms	WEP/WAP-PSK/WAP2-PSK/WAPI
	Encryption	WEP64/WEP128/TKIP/AES
	Work Mode	Transparent Transmission
	Serial command	AT+ Command set
	Network Protocol	TCP/UDP/ARP/ICMP/DHCP/DNS/HTTP
	Max. TCP Connection	32
	User Configuration	Web Server or AT+ command configuration.

## 1.2. Hardware Introduction

### 1.2.1. CH232BGN Pin Definitions

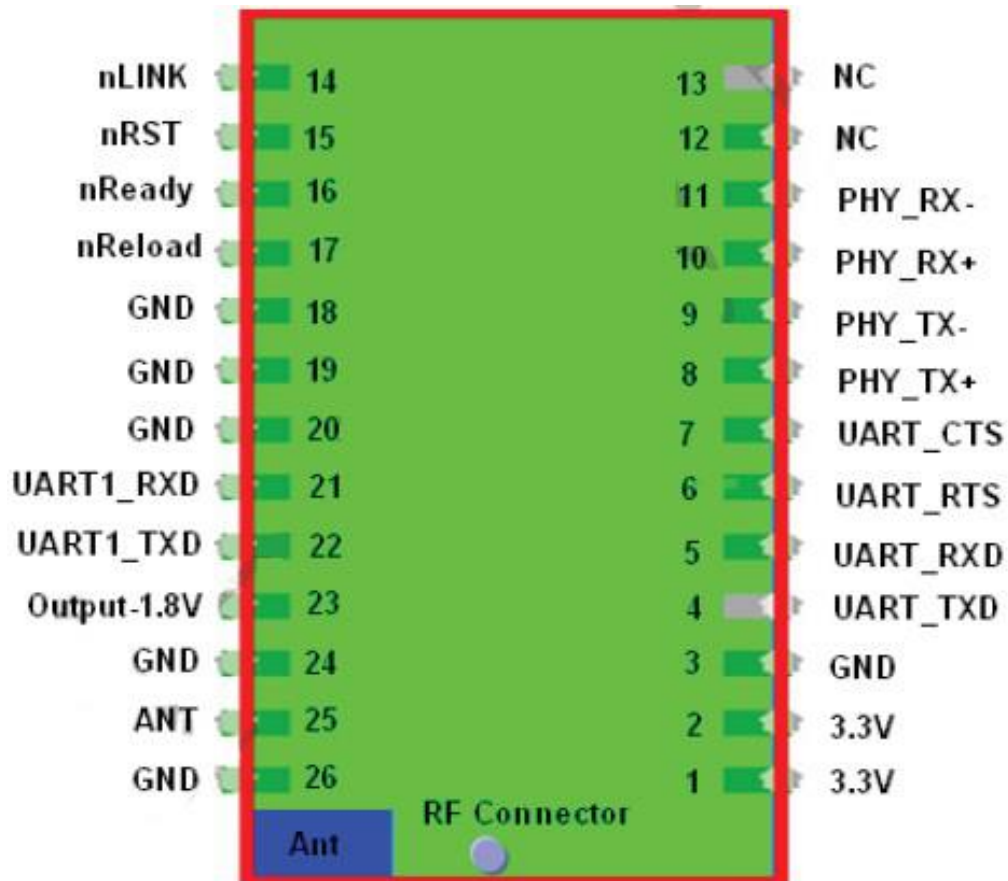
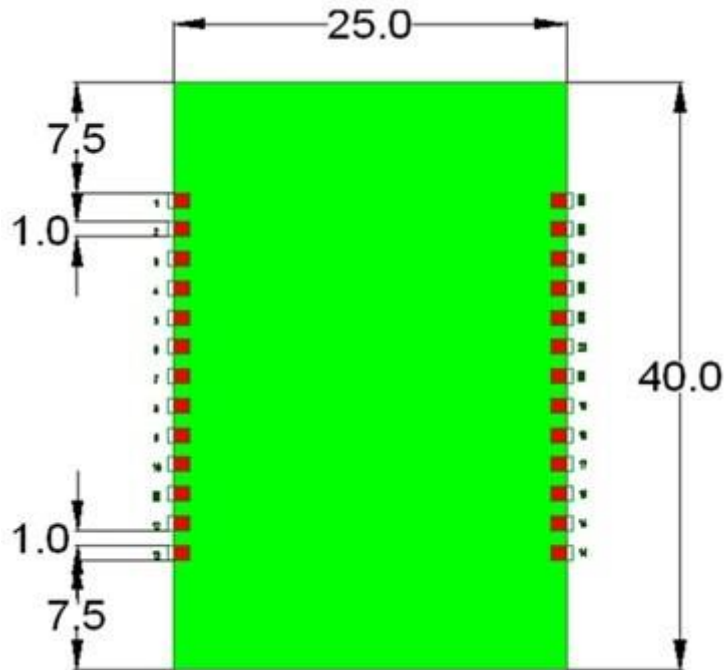


Figure 1: CH232BGN Pin Assignments

**Table 2: CH232BGN Pin Descriptions**

Pin	Description	Name	Direction	Notes
1,2	VCC	3.5V	Power	3.3V maximum 350 mA power input
3	Ground	GND	Power	Ground
4	UART Receive Data	UART_RXD	Output	If the UART is not used this pin can serve as a general purpose I/O
	General Purpose I/O	GPIO3	Input/Output	
5	UART Transmit Data	UART_TXD	Input	If the UART is not used this pin can serve as a general purpose I/O
	General Purpose I/O	GPIO4	Input/Output	
6	UART Clear to Send	UART_CTS	Output	If the UART is not used this pin can serve as a general purpose I/O
	General Purpose I/O	GPIO5	Input/Output	
7	UART Request to Send	UART_RTS	Input	If the UART is not used this pin can serve as a general purpose I/O
	General Purpose I/O	GPIO6	Input/Output	
8	Ethernet Transmit +	PHY_TX+	Output	1.8 Volt Ethernet Data I/F
9	Ethernet Transmit -	PHY_TX-	Output	1.8 Volt Ethernet Data I/F
10	Ethernet Receive +	PHY_RX+	Input	1.8 Volt Ethernet Data I/F
11	Ethernet Receive -	PHY_RX-	Input	1.8 Volt Ethernet Data I/F
12, 13	No Connection	NC	NC	Do not Connect
14	WiFi Status Indicator	Nlink	Output	High – WiFi Link available Low – No WiFi Link
15	Reset	nRST	Input	Active low; must be held for a minimum of 300 msec
16	Boot Status	nReady	Output	Active low boot sequence complete; a high indicates boot in progress
17	Restore Factory Defaults	nReload	Input	Holding this pin low for more than 1 second resets the configuration to the factory defaults
18,19,20	Ground	GND	Power	Ground
21, 22	No Connection	NC	NC	Do not Connect
23	1.8 Volt Output	1.8V	Output	1.8V 300 mA power for Ethernet connection
24	Ground	GND	Power	Ground
25	Antenna Connection	ANT	Output	50 ohm impedance for antenna connection
26	Ground	GND	Power	Ground

### 1.2.2. CH232BGN Mechanical Dimensions

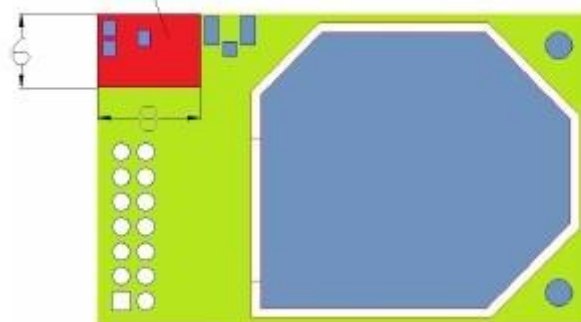


**Figure 2: CH232BGN Mechanical Dimensions**

### 1.2.3. On-board Chip Antenna

The CH232BGN supports a built-in antenna option. When the customer chooses to utilize a built-in antenna, the customer circuit board must comply with the following rules:

- The antenna may not be located in the (6X8MM) red region, see Figure 3 below.
- The antenna must be located away from any metal or any components taller than 10MM;
- The antenna cannot be shielded by any metal enclosure. Any cover or enclosure must be at least 10MM from the antenna.



**Figure 3: CH232BGN Circuit Board**

We recommend that the CH232BGN module be placed in a corner of the user's circuit board. This location provides optimal placement for antenna efficiency and helps to isolate the module from other circuits.

#### 1.2.4. External Antenna

CH232BGN modules support internal antenna and external antenna options. If user selects to use an external antenna, CH232BGN modules must be connected to the 2.4G antenna according to IEEE 802.11b/g/n standards. The antenna parameters required as follows:

**Table 3: CH232BGN External Antenna Parameters**

Item	Parameters
Frequency range	2.4~2.5GHz
Impedance	50 Ohm
VSWR	2 (Max)
Return Loss	-10dB (Max)
Connector Type	I-PEX or populate directly

#### 1.2.5. Evaluation Kit

An evaluation kit is available to assist users develop their applications. The evaluation kit, shown below, allows the user to connect the CH232BGN module directly to an RS-232 port, 100Base-T Ethernet port or Wireless port.



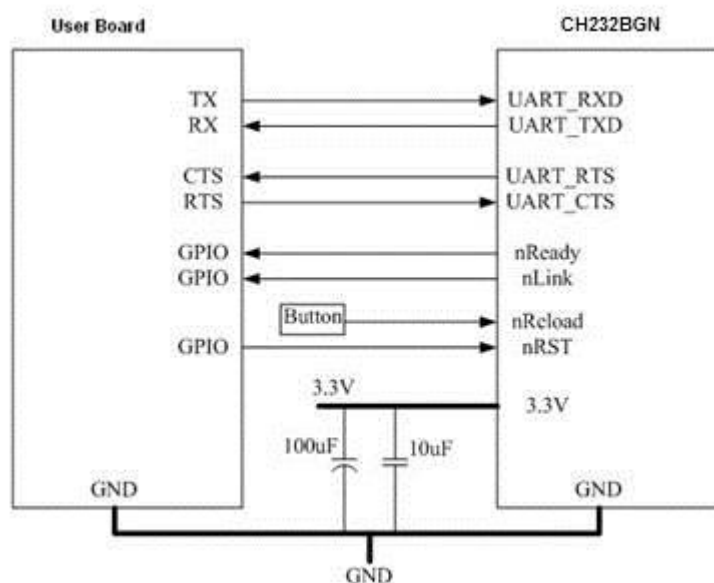
**Figure 4: CH232BGN Evaluation Kit**

**Table 4: Evaluation Kit Interface Description:**

Function	Name	Description
<b>External Interface</b>	DB9	Male 9pin serial jack
	RJ-45	100M Eth Interface
	Mini USB	B–type interface, AS 5v@1A power input port
	Module	2x7 2mm DIP connector
<b>LED</b>	Power (Red)	3.3V Power Indicator
	CTS (Green 1)	CTS/GPIO Indicator
	RTS (Green 2)	RTS/GPIO Indicator
	Reload (Green 3)	nReload/GPIO Indicator
	Ready (Green 4)	nReady/GPIO Indicator
	Link (Green 5)	NLink/GPIO Indicator
<b>Button</b>	Reset	Used to reset the module.
	Reload	Module restored to factory default configuration.

### 1.3. Hardware Reference Design

#### 1.3.1. Hardware Typical Application



**Figure 5: CH232BGN Hardware Typical Application**

Notes: **nRST** is an active low input serving as the CH232BGN hardware reset signal. The signal includes a 100K Ohm pull-up resistor. This signal must be asserted for at least 300 milliseconds when power is initially applied to the module.

**nReady** is an active low output that signals that the module has completed its initial boot sequence and is ready for use. This signal includes an internal 4.7K Ohm pull-up resistor. The module provides a low output or a square wave output after normal boot up.



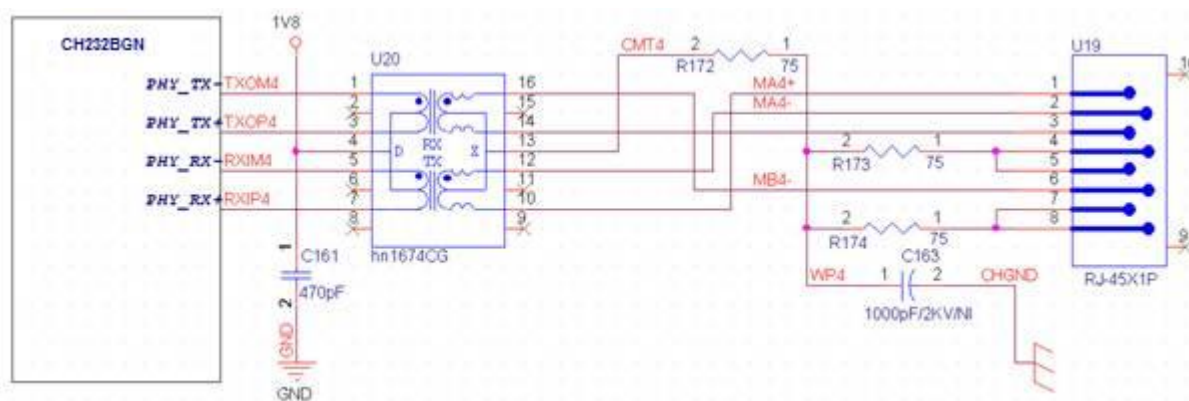
**nLink** is an active low output that indicates a WiFi link is established. There is an internal 4.7K Ohm pull-up resistor on this signal.

**nReload** is an active low input. When activated for more than three (3) seconds, it causes the module to reset the internal configuration to factory defaults. A 4.7K pull up resistor must be installed at the nReload pin.

**UART\_TXD/RXD** signals provide the pathway for serial data to and from the UART; transmit data (TXD) and received data (RXD). These signals include a 1L ohm pull-up resistor.

### 1.3.2. 10/100M Ethernet Interface

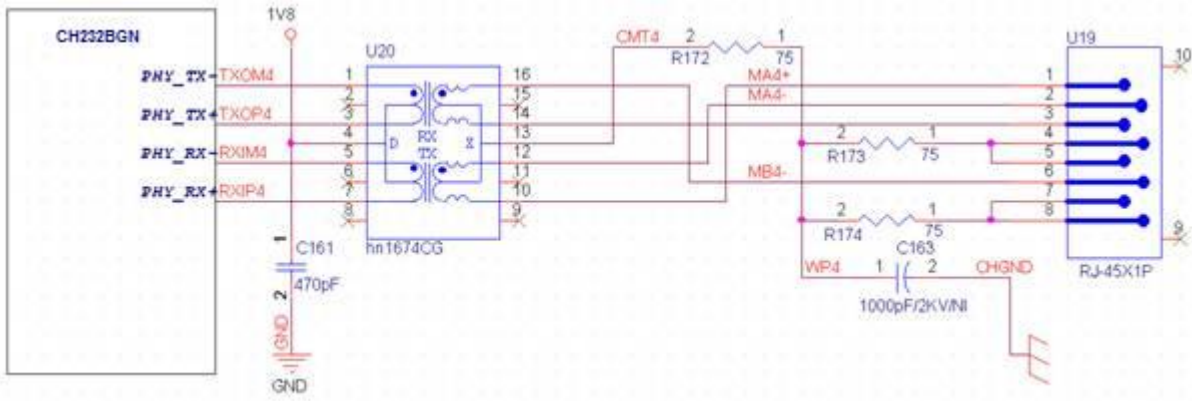
The CH232BGN provides one 10/100M Ethernet PHY layer interface for data transfer or user configuration. The User circuit board must include an Ethernet transformer and RJ-45 connector. This creates a standard 10/100M Ethernet physical layer connection. See the reference design below:



**Figure 6: Ethernet Reference Design with Transformer**

### 1.3.3. UART Interface

UART interface is the serial data transmission interface primarily used for the CH232BGN. The User can add RS-232 drivers on their board to convert the signals to RS-232 voltage levels for communications with outside equipment or sensors. CH232BGN modules UART interface include 4 signals: Transmit Data (TXD), Received Data (RXD), Request to Send (RTS), and Clear to Send (CTS). The hardware reference design with RS-232 chipset as following:



**Figure 7: UART Interface Reference Design**

Notes: CH232BGN modules incorporate an internal pull-down resistor on the serial interface signals;; therefore, the User cannot add pull-up or pull-down resistors to the serial interface signals.

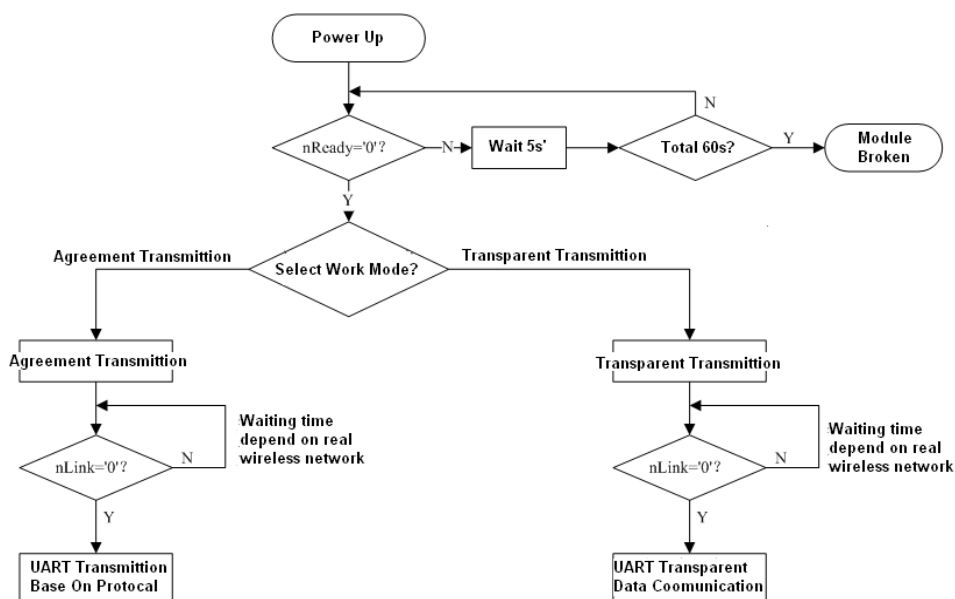
### 1.3.4. Power

CH232BGN module utilizes a single +3.3V power supply. The typical peak current is 350mA. During normal WiFi operation the module draws about 200mA. Current draw with WiFi OFF is 100mA.

Cermetek recommends decoupling be added at the power pin of the CH232BGN. At least one 100uF and one 10uF capacitor are recommended for maximum reliability and performance. The decoupling capacitors should be added as close to the CH232BGN power pin as possible.

## 1.4. Software Reference Design

The following flow chart illustrates the proper flow for user code should on CH232BGN boot-up:



**Figure 8: User Software Boot Flow Chart**

CH232BGN modules operate in either Transparent Transmission Mode or Configuration Mode. Configuration is accomplished through AT+ commands.

#### 1.4.1. Transparent Transmission Mode

The CH232BGN supports transparent data transmission through its serial interface. Once power is applied, the CH232BGN connects automatically to the wireless network with minimal configuration changes.

Notes: Transparent transmission requires flow control to be active to prevent data transfer errors. Enable hardware flow control (RTS/CTS) on the UART port to prevent buffer overflow.

#### 1.4.2. Configuration Mode

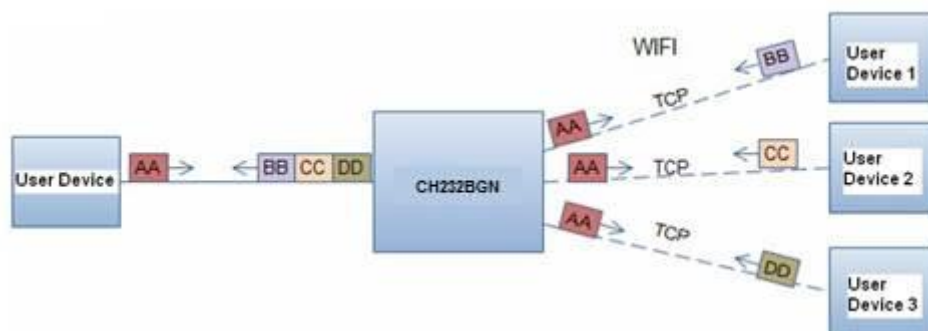
In configuration mode, the user can set CH232BGN configuration. The user can switch from transparent transmission to the configuration mode using the AT+ commands described in Chapter 4.

#### 1.4.3. Multi-TCP Link Connection

When the CH232BGN module is configured as TCP Server, it supports Multiple TCP connections. A maximum of 32 TCP clients can connect to one CH232BGN module. Figure 9 below illustrates Multiple TCP Connections

Upstream: Data from each TCP connection or client is transmitted to the serial port in sequence.

Downstream: The CH232BGN duplicates and broadcasts data from the serial port to every TCP connection or client.



**Figure 9: Data Flow for Multiple TCP Connections**

#### 1.4.4. TCPB Function

The CH232BGN supports 2 network connections. The second network connection, TCPB, works only as a TCP client and can be configured only through the AT commands as follows. For detailed AT command descriptions refer to Chapter 4.

- AT+TCPB=on, Enable TCPB function;
- AT+TCPPTB=<port>, Set TCPB port number;
- AT+TCPADDB=<IP or domain>, Set TCPB's server address;
- AT+TCPTOB=<time>, Set TCPB timeout;
- AT+TCPLKB, Query TCPB link status;

After TCPB is enabled the two network interfaces work as a multiple TCP link. All data from each TCP connection will be transmitted to the serial port in sequence and all data from user serial port will be duplicated and broadcast to both TCP connections.

#### 1.4.5. GPIO Function

The CH232BGN module supports two General Purpose Input-Output (GPIO) configurations, GPIO-1 and GPIO-2. In GPIO-1 the user defines TXD, RXD, CTS, and RTS as GPIO lines; the nReady, nLink, and nReload pins serve as functional pins. In GPIO-2, all seven I/O pins (TXD, RXD, RTS, CTS, nLink, nReady, and nReload) act as GPIO. With either of the GPIO modes selected the module does not support serial communications.

- GPIO IN: Sets GPIO as an input;
- GPIO OUT 0: Sets GPIO as output equal to a logic 0;
- GPIO OUT 1: Sets GPIO as output equal to a logic 1;
- GPIO PWM m1 m2: Sets GPIO output to a square wave where m1 is the duration 'high' and m2 is the duration 'low' in milliseconds. The minimum duration is 10 milliseconds;
- GPIO GET: commands the CH232BGN to read the status of GPIO, responds with I0 (input low), I1 (input high), O0 (output low), or O1 (output high).

Notes: Pins 3, 4, 5, 6, 8, 9, 10 can be used as GPIO. Pins 4 and 10 can only be defined as inputs, while Pin 3 can only be defined as an output.

The CH232BGN responds with GPIO OK if the I/O signal is active and GPIO NOK if the I/O signal is not active.

The command GPIO READ returns the current status of all current IO status.

#### 1.4.6 nReady Output

The nReady signal has two output modes:

- Mode One: The module activates nReady (active low) to signal success completion of the boot sequence.
- Mode Two: The module generates a square wave on nReady after a successful boot sequence. The frequency of the square wave is 0.5 Hz with a 50% duty cycle. The User software can check for the presence of this square wave to determine if a re-boot is required.

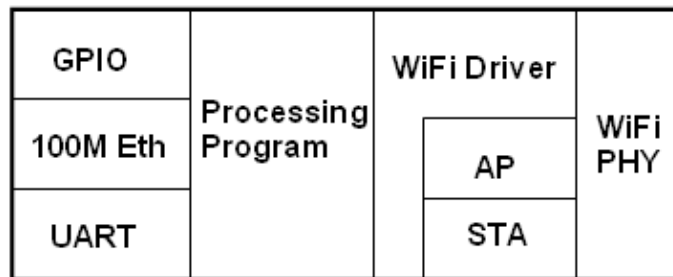
Notes: This nReady output function is user selected.

The AT+RELD command does not operate when this function is active. If user not requires RELD, the default factory setting is Status One.

# 2. FUNCTIONAL DESCRIPTION

## 2.1. Wireless Networking

The CH232BGN module can be configured to operate as either a WiFi Station (STA) or Access Point (AP). Internally the CH232BGN incorporates separate interfaces for a WiFi Station or Access Point. When the CH232BGN works as an Access Point, other Stations are able to connect to the wireless LAN via the CH232BGN module. Figure 10 below shows the functional architecture of the CH232BGN module:

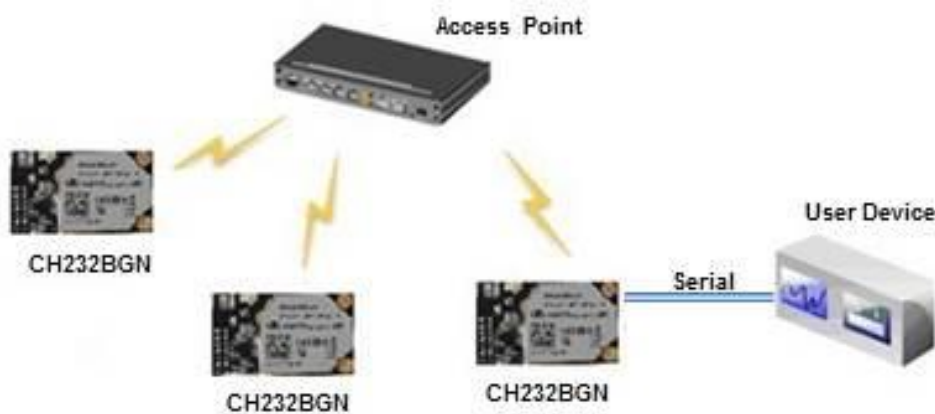


**Figure 10: CH232BGN Functional Architecture**

Notes: An Access Point serves as a router providing WiFi services to a network of wireless nodes. A Station serves as a wireless node to an established network.

### 2.1.1. Basic WiFi Network Architecture

A basic WiFi network features an Access Point at its hub supporting multiple Stations. All communications between Stations pass through the Access Point. Figure 11 below shows an example of a basic WiFi network



**Figure 11: Basic Wireless Network Structure**

### 2.1.2. Adhoc Wireless Network

An Adhoc WiFi network, also called an Independent Basic Service Set, uses multiple Stations without an Access Point. The Stations communicate directly with each other.

As shown in Figure 12 below, Nodes 1, 2 and 3 and the laptop serve as Stations in the Adhoc network with user devices connected via the serial interface. The CH232BGN modules can be operated and managed over the network from the laptop.

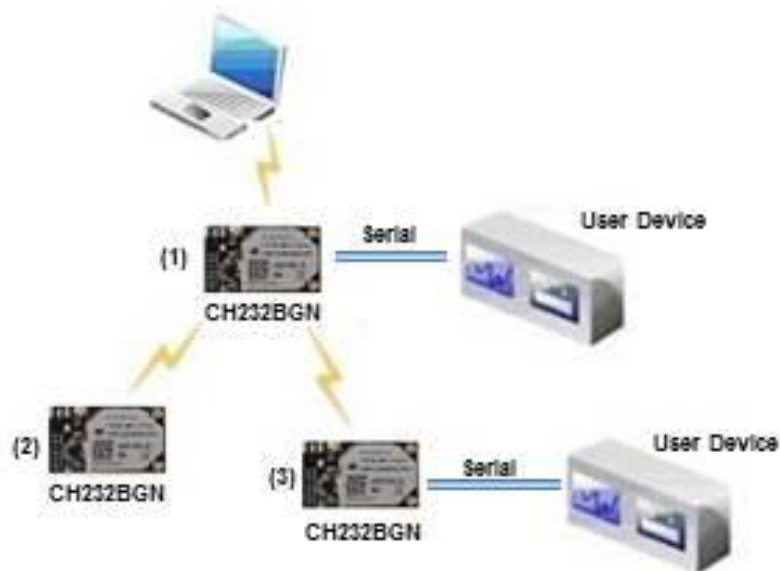


Figure 12: CH232BGN Adhoc Network Structure

### 2.1.3. Access Point Plus Station Wireless Network

The CH232BGN module can simultaneously serve as both an Access Point and a Station. Figure 13 below illustrates this type of network.,

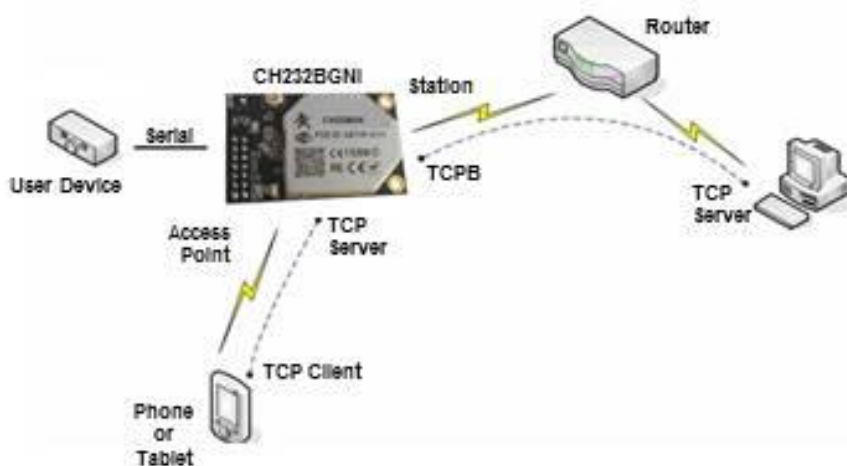


Figure 13 CH232BGN Access Point Plus Station Network

This dual network mode is activated by enabling both the Access Point and Station functions on the CH232BGN. The CH232BGN Station Interface connects to the router and then to the TCP server in the network. At the same time the CH232BGN Access Point interface is also active. This permits a mobile phone or tablet to connect to the module through a secondary TCP connection for remote access to module parameters.

The advantages of Access Point plus Station mode include:

- Users can easily control and track the user device through a mobile phone or tablet without affecting the network settings.
- Users can modify module parameters over the WiFi connection.

#### **Access Point plus Station Mode Setting:**

The serial command below enables Access Point plus Station Mode:

- AT+FAPSTA=on

**Notes:** When user enables Access Point and Station Modes, the Station port must maintain a connection with the other Access Point to prevent data loss. If the Station port cannot maintain the connection, disable the Station Scan with the commands below:

- **AT+STTC=on/off**, “on” selects Access Point scanning; “off” disables Access Point scanning: This command is not saved when the module is restarted.
- **AT+FSTTC=on/off**; “on” selects Access Point scanning; “off” disables Access Point scanning: This command is saved when the module is re-started.

## **2.2. Auto- Frequency Function**

When module works as a Station, CH232BGN adjusts the wireless communications channel to maintain the same channel as the associated Access Point. When the module works as an Access Point and the Auto-frequency function is enabled, the CH232BGN will select the optimal wireless channel based on the environment on boot-up, it will select the optimal wireless channel based on the surrounding environment.

## **2.3. Security**

CH232BGN module supports multiple wireless encryption protocols, and enables them to protect user data transmission, the protocols include:

- ◆ WEP
- ◆ WPA-PSK/TKIP
- ◆ WPA-PSK/AES
- ◆ WPA2-PSK/TKIP
- ◆ WPA2-PSK/AES



## 2.4. UART Frame Scheme

### 2.4.1. UART Free-Frame

CH232BGN supports the UART free-frame function. This function allows the module set frame breaks based on the intervals between any two data bytes received through the serial port. If this interval time exceeds the defined value (default 50ms), the CH232BGN interprets the interval as the end of a frame and immediately transfers this frame to the WiFi port. If there is no pause in the data, the CH232BGN buffers up to 4K Bytes of data before transferring the data as a frame to the WiFi port.

This Auto-Frame function is controlled by the commands AT+UARTF (Auto-Frame on/Off), AT+UARTFT (Auto-Frame interval), and AT+UARTFL (Trigger length in Bytes).

Notes: The default frame interval is 50 milliseconds. The user can select a fast interval of 10 milliseconds; however, this increases the risk of fragmented data.

## 2.5. Address Binding

The CH232BGN module supports binding the Basic Service Set identification (BSSID) address of the target network. According to the provisions of 802.11 protocol, different wireless networks can have a same network name (i.e. SSID / ESSID), but must correspond to a unique BSSID address (i.e. MAC address). Intruders could create a wireless network with the same SSID / ESSID and permit Stations in the network to unknowingly connect to a fraudulent Access Point. Binding the BSSID address prevents the Station from connecting to an intruder improving wireless network security.

## 2.6. Ethernet Interface Communication

CH232BGN module includes a 10/100M Ethernet interface. The Ethernet interface permits the user to easily realize three types of communications (WiFi, Serial, and Ethernet). This allows the CH232BGN to be configured as a Bridge or Router.

Notes: The CH232BGN consumes more power with Ethernet mode active. For that reason the default configuration disables Ethernet. The command “AT+FEPHY=on” activates Ethernet operation.

### 2.6.1. CH232BGN Ethernet Operation as Access Point



**Figure 14: CH232BGN As Access Point**

The CH232BGN module can serve as an access point to the Ethernet network. All devices in the network must use the same network segment within their IP address.

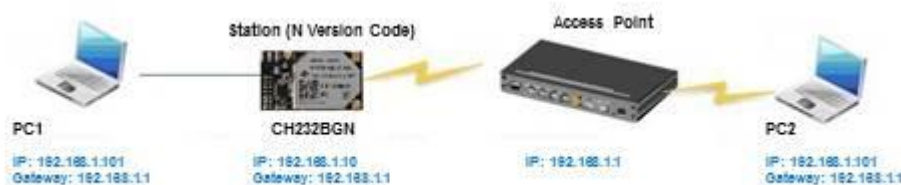
### 2.6.2. CH232BGN Ethernet Operation As Station (N-Version Code)



**Figure 15: CH232BGN Ethernet Interface Station with “N” Version Code**

The CH232BGN module operates as a Station (N-Version Software required) when the module is set as a router. When the module connects to an Access Point, it will receive the wireless port IP address from the Access Point. At the same time, the module also forms a sub-network (Default 10.10.100.254) and all devices connected to the modules Ethernet interface will receive an assigned IP address. Figure 15 shows, PC1 on the sub-network able to initiate a connection with PC2 (With CH232BGN serving as a router). PC2 cannot initiate a connection to PC1.

### 2.6.3. CH232BGN Ethernet Operation as Station (Z-Version)



**Figure 16 CH23 BGN Ethernet Interface Station with “Z” Version Code**

In Figure 16 above, the CH232BGN module operates as a Station (Firmware version Z required) with the module configured in bridge mode. When the module connects to an Access Point, all devices connected to the Ethernet interface have an IP address assigned from the Access Point. In bridge mode the module can be treated as a transparent device. PC1 and PC2 can communicate without limits.

Notes: This network configuration requires a static IP address be assigned to the CH232BGN in order to communicate with an Access Point or modify the configuration through a web page.

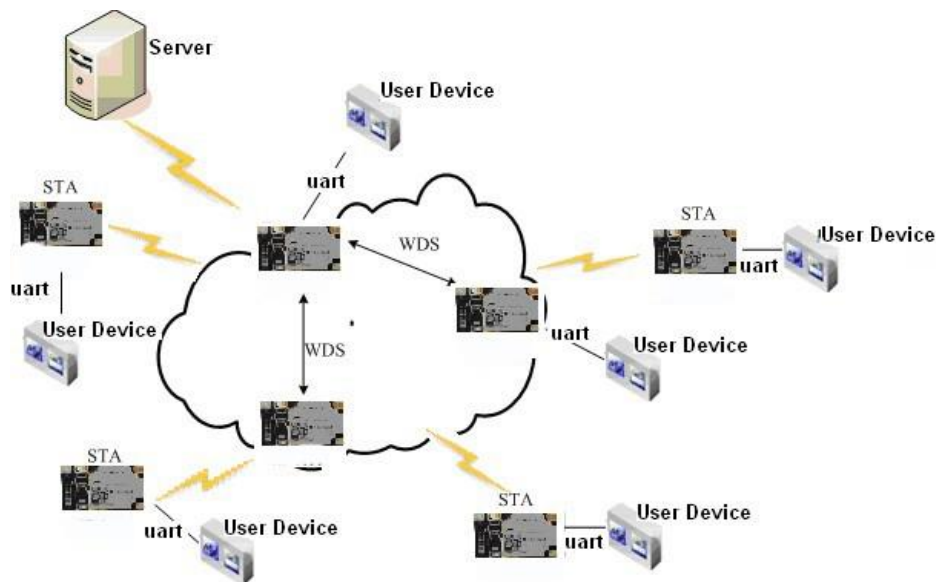
## 2.7. Wireless Distribution System (WDS)

The CH232BGN supports the Wireless Distribution System (WDS) function. Through WDS, several Access Points can connect to each other to build a WiFi network.

Figure 17 below illustrates the WDS network structure. Each of the three CH232BGN modules at the network core serves as an Access Point to the WDS network. The remaining CH232BGN models work as Stations and can connect with any Access Point in the network. All modules including the Access Points and Stations reside on the same local area network (LAN).

The server can connect with an Access Point over the WiFi or Ethernet link. Once the devices are connected, the server can connect with every user device and control them as if it were a seamless local area network.

The AT command `AT+FVER=w` enables the WDS function. WDS can also be enabled from the web page.



**Figure 17: WDS Networking Demo**

## 2.8. Search Function for Station

When using web configuration for the Station Interface, the user can push the “Search” button to find surrounding Access Points.

## 2.9. Work Mode

CH232BGN modules communicate only in “Transparent Transmission Mode.” Transparent transmission mode provides a plug and play serial data port reducing system complexity. On power up the module will attempt to connect with a compatible wireless network. The parameters which need to be configured include:

- **Wireless Network Parameters**
  - Wireless Network Name (AT+WSSSID)
  - Security Mode & Encryption Key (AT+WSKEY)
- **TCP/UDP Linking Parameters**
  - Protocol Type; Link Type (Server or Client) (AT+TCPB)
  - Target Port ID Number (AT+TCPPTB)
  - Target Port IP Address (AT+TCPADDB)

➤ **Serial Port Parameters (AT+UART)**

- Baud Rate
- Data Bit
- Parity (Check) Bit
- Stop Bit
- Hardware Flow Control

➤ **Work Mode Selection (AT+TMODE)**

- Transparent transmission

Transparent transmission mode is illustrated in Figure 18. The CH232BGN modules serve as a wireless serial link. Data is sent between user devices without modification.



**Figure 18: CH232BGN Transparent Transmission Operation**

## 2.10. Parameters Configuration

CH232BGN module supports two methods of configuring parameters; Over the web and through the serial port using AT+ commands. The user configures the CH232BGN on-line through an integrated web page. When the module is connected to a wireless network, parameters can be configured from a PC connected to the same wireless network. Configuration through the serial port is done with AT+ commands. See Section 4 for full descriptions of the AT+ commands.

# 3. ONLINE CONFIGURATION

The CH232BGN module may require configuration to establish a wireless connection. The default wireless configuration of the CH232BGN is shown in table 5 below. This information can be modified by entering AT+ commands to the CH232BGN through the serial port.

**Table 5 CH232BGN Web Access Default Setting**

Parameters	Default Setting
SSID	HF-A11_AP
IP Address	10.10.100.254
Subnet Mask	255.255.255.0
User Name	Admin
Password	Admin

## 3.1 Web Management Interface

Following is the procedure to configure the CH232BGN via its web interface.

Step 1: Connect a laptop to the CH232BGN, SSID “CH232BGN\_AP,” via the wireless LAN;

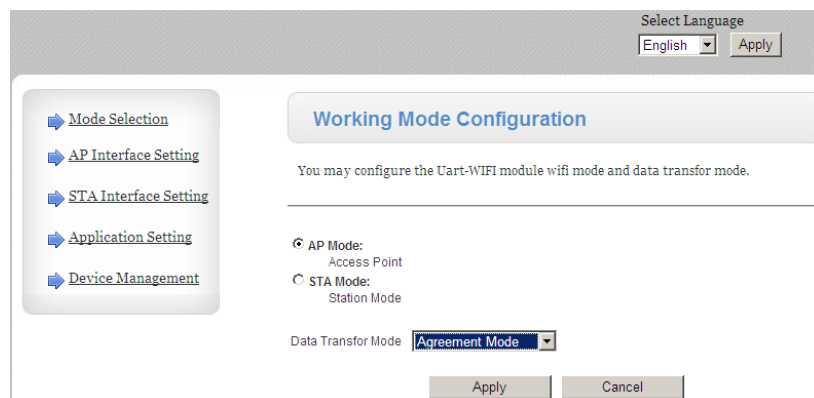
Step 2: After the wireless connection has been established. Open the web browser on the laptop and access “http://10.10.100.254”;

Step 3: Input the user name and password in the web page click “OK”.

The web configuration menu includes five pages: “Mode Selection,” “AP Interface Setting,” “STA Interface Setting,” “Application Setting”, and “Device Management”

## 3.2 Mode Selection Page

The mode selection page, see figure 19 below, allows the user to configure the CH232BNG to operate as an Access Point or in Station mode.



**Figure 19 Mode Selection Page**

### 3.3 Access Point Interface Configuration Page

Figure 20, below, allows the user to set the parameters to be used when the CH232BGN module works as an Access Point. Options include the WiFi networking mode (802.11 b, g, or n), network ID, Security Mode, and LAN setup.

**AP Interface Setting**

AP Interface Setting , such as : SSID, Security...

---

**Wireless Network**

Network Mode	11b/g/n mixed mode
Network Name(SSID)	HF-A11x_AP Hidden <input type="checkbox"/> Isolated <input type="checkbox"/>
Broadcast Network Name (SSID)	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
AP Isolation	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
BSSID	88:8B:5D:70:04:87
Frequency (Channel)	AutoSelect

Apply Cancel

---

**"HF-A11x\_AP"**

Security Mode	Disable
---------------	---------

Apply Cancel

---

**LAN Setup**

IP Address	10.10.100.254
Subnet Mask	255.255.255.0
MAC Address	88:8B:5D:70:04:87
DHCP Type	Server
Default DHCP Gateway	10.10.100.254

Apply Cancel

**Figure 20: Access Point Interface Configuration Page**

### 3.4 Station Interface Configuration Page

This page, Figure 21 below, sets the parameters for the CH232BGN module when configured as a Station. The parameters to be set include the SSID of the local Access Point and the type of network addressing: DHCP or static IP address.

**STA Interface Setting**

You could configure STA interface parameters here.

---

**STA Interface Parameters**

SSID	HF-A11x_AP
MAC Address (Optional)	
Security Mode	OPEN
Encryption Type	None

Apply Cancel

WAN Connection Type: DHCP (Auto config)

---

**DHCP Mode**

Hostname (optional)	
---------------------	--

Apply Cancel

**Figure 21: Station Interface Configuration Page**

### 3.5 UART Configuration

The UART configuration page sets the serial port communication parameters, including UART settings and high layer network protocols which support serial communication. See figure 22 below.

The screenshot shows a web interface for UART configuration. On the left is a vertical navigation menu with five items: Mode Selection, AP Interface Setting, STA Interface Setting, Application Setting (highlighted), and Device Management. The main content area is titled 'AP Interface Setting' and contains a sub-section 'Wireless Network' with a 'Wifi-Uart Setting' button. Below this is a descriptive text: 'You could configure the Uart parameters and network parameters of the wifi-uart application.' The 'Uart Setting' section contains a table with the following parameters:

Uart Setting	
Baudrate	57600
Data Bits	8
Parity	None
Stop	1
CTSRTS	Disable

Below the table are 'Apply' and 'Cancel' buttons. The 'Net Setting' section contains another table:

Net Setting	
Mode	Server
Protocol	TCP
Port	8899
IP Address	10.10.10.100
TCP Time out (MAX 600 s)	300

Below this table are also 'Apply' and 'Cancel' buttons.

**Figure 22: UART Configuration Page**

Notes: Network protocols typically support three modes: TCP Server, TCP Client, and UDP. UDP has no server or client requirement.

When used in a mode other than as a TCP Server, the user must set the IP address of the device. No IP Address is required when the CH322BGN is used as a TCP server.

The Port ID must be the same for the devices on each end of the communications link.

### 3.6 Account Administrator Configuration

This page manages the administrative settings of the CH232BGN module. These settings include the account identification, module re-start, reload factory defaults and on-line firmware upgrade.

**Device Management**

You may configure administrator account and password, load default setting or update firmware.

---

Administrator Settings	
Account	<input type="text" value="admin"/>
Password	<input type="password" value="••••"/>
<input type="button" value="Apply"/> <input type="button" value="Cancel"/>	

Restart Module	
Restart Module	<input type="button" value="Restart"/>

Load Factory Defaults	
Load Default Button	<input type="button" value="Load Default"/>

Update Firmware	
Location:	<input type="text"/> <input type="button" value="Browse..."/>
<input type="button" value="Apply"/>	

**Figure 23: Administrative Configuration Page**

Notes: When parameters are set on-line, the “Apply” button on the bottom of the page confirms the new settings; however, the settings only become active after the Restart Module button on this page is selected.



# 4 AT+ COMMANDS

## 4.1 Configuration Mode

When the CH232BGN is powered up, it defaults to transparent transmission mode. The user can change the configuration through the serial port using AT+ commands. The default UART settings are shown in Figure 24 below.

Uart Setting	
Baudrate	57600
Data Bits	8
Parity	None
Stop	1
CTSRTS	Disable

**Figure 3 CH232BGN Default UART Port Parameters**

There are two steps to switch from transparent transmission mode to configuration mode.

**Step 1:** Send the text string “+++” to the CH232BGN. The module responds with “a” to confirm receipt of the command.

**Step 2:** Send the character “a” to the CH232BGN. The CH232BGN responds with “+ok” and enters AT+ configuration mode.

Notes: The “+++” character string is not echoed back to the serial port.

If the CH232BGN receives any input other than the “+++”, the module continues to operate in transparent transmission mode.

## 4.2 AT+ Command Set Overview

All configuration of the CH232BGN can be accomplished by issuing AT+ commands through the module’s serial port. Descriptions of the AT+ commands follow.

### 4.2.1 Document Format

Below is a list of the conventions used in this document to describe the AT+ commands

- < >: Text shown between the less-than sign and greater-than sign is required.
- [ ]: Text shown within the brackets is optional.

#### 4.2.2 Command Format

Following is a description of the general format for the AT+ commands.

**AT+<CMD>[op][para-1,para-2,para-3,para-4...]<CR>**

AT+: Command Prefix of command message;

CMD: Command string;

[op]: Command operator

= equals sign indicates the command requires parameters to be inserted;

“NULL”: Requests the current parameter setting;

[para-n]: Parameter settings if required;

<CR> "Enter" Key, (0x0a or 0x0d in ASCII to execute the command)

Notes: When an AT+ command is entered, characters echoed back will always be capital letters even if the command is entered in lower case.

#### 4.2.3 CH232BGN Responses

Below is a description of the general format for responses to AT+ commands.

**+<RSP>[op] [para-1,para-2,para-3,para-4...]<CR><LF><CR><LF>**

+ - Prefix indicating a response;

RSP: - Response string sent by the CH232BGN;

“ok” : - Confirmation that the command was received successfully;

“ERR”: - Indication that the command was not successfully received;

“=” - Indicates the parameters of the requested command will follow;

[para-n]: - Lists the response Parameters for queries and error codes;

<CR>: - Carriage Return, ASCII 0x0d;

<LF>: - Line Feed, ASCII 0x0a;

#### 4.2.4 Error Codes

Table 6 below list the Error codes for the CH232BGN AT+ commands

**Table 6: Error Code Description (CH232BGN Web Access Default Settings)**

Error Code	Description
-1	Invalid Command Format
-2	Invalid Command
-3	Invalid Operation Symbol
-4	Invalid Parameter
-5	Operation Not Permitted

#### 4.2.5 AT+ Command Set

Table 7 below lists the AT+ Commands available in the CH232BGN module.

**Table 7: AT+ Command Set List**

INSTRUCTION	DESCRIPTION
<null>	NULL
E	Open/Close show back function
ENTM	Set module into transparent transmission mode
NETP	Set/Query network protocol parameters
UART	Set/Query serial port parameters
UARTF	Open/Close UART auto-frame function
UARTFT	Set/Query UART auto-frame trigger time
UARTFL	Set/Query UART auto-frame trigger length
TMODE	Set/Query data transmission mode
WMODE	Set/Query WIFI work mode (Access Point or Station)
WSKEY	Set/Query WIFI security parameters as Station
WSSSID	Set/Query WIFI target Access Point SSID parameters as Station
WSLK	Query WiFi link status as Station
WEBU	Set/Query WEB page login parameters
WAP	Set/Query WIFI parameters as Access Point
WAKEY	Set/Query WIFI security parameters as Access Point
MSLP	Set modules into power save mode
WSCAN	Seek Access Point when module works as Station
TCPLK	Query if TCP link already build-up
TCPDIS	Open/Close TCP
WANN	Set/Query WAN setting, only effective as Station
LANN	Set/Query LAN setting, only effective as Access Point
DHCPGW	Set/Query DHCP gateway address
TCPTO	Set/Query TCP timeout
MAXSK	Set/Query maxima TCP connection
TCPB	Open/Close TCPB function
TCPPTB	Set/Query TCPB port number
TCPADDB	Set/Query TCPB server address
TCPTOB	Set/Query TCPB time out time
TCPLKB	Query TCPB link status
EPHY	Open/Close ETH interface
RELD	Restore to factory default setting
Z	Re-start module
MID	Query module ID information
VER	Query module software version information
H	Help

Notes: CH232BGN module can operate as an Access Point or Station. Access Points and Stations require different AT+ command settings.

4.2.5.1 **AT+E**: This command controls the whether or not the module will echo commands back to the terminal equipment. Enter the “AT+E” command toggles the status of the echo function.

```
AT+E<CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Note: When the CH232BGN module first switches from transparent transmission to configuration mode, command echo is active. The “AT+E” command disables command echo. When echo is disabled “AT+E” command reactivates it.

4.2.5.2 **AT+ENTM**: This command places the CH232BGN into transparent transmission mode.

```
AT+ENTM<CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

4.2.5.3 **AT+NETP**: This command permits the user to Set or Read the network protocol parameters for the CH232BGN;

Read Protocol Parameters;

```
AT+NETP<CR>
```

```
+ok=<protocol,CS,port,IP><CR>< LF ><CR>< LF >
```

Set Protocol Parameters;

```
AT+NETP=<protocol,CS,port,IP><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Protocol = TCP or UDP

CS = SERVER or CLENT

Port = Protocol ID Number 0 to 65535

IP = Server IP Address (Only when the CH232BGN is configured as a Client)

Note: New settings for AT+NETP do not become active until the CH232BGN module reboots.

4.2.5.4 **AT+UART**: This command permits the user to Set or Read serial port parameters

Read Serial Port Parameters;

```
AT+UART<CR>
```

```
+ok=<baudrate,data_bits,stop_bit,parity,flowctrl><CR>< LF ><CR>< LF >
```

Set Serial Port Parameters

```
AT+UART=<baudrate,data_bits,stop_bit,parity><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Baudrate (bps) = 50, 75, 110, 134, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600,  
19200, 38400, 57600, 115200, 230400, 345600, or 460800

data\_bit (bits) = 5, 6, 7, or 8

stop\_bits (bits) = 1 or 2

parity = NONE, EVEN, ODD, MARK, SPACE

flowctrl (hardware flow control) = NFC (no flow control) or FC (Flow Control Active)

Note: New settings for the AT+UART command do not become active until the CH232BGN module reboots.

4.2.5.5 **AT+UARTF**: This command allows the user to read or control the auto-frame function of the serial port.

Read Auto-Frame Status

```
AT+ UARTF<CR>
```

```
+ok=<para><CR>< LF ><CR>< LF >
```

Set Auto-Frame Function

```
AT+ UARTF=<para ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Para = Disable – Auto-Frame Function Disabled

= Enable – Auto-Frame Function Active

4.2.5.6 **AT+UARTFT**: This command permits the user to read and control the UART auto-frame trigger time.

Read Auto-Frame Trigger time

```
AT+ UARTFT<CR>
```

```
+ok=<time><CR>< LF ><CR>< LF >
```

Set Auto-Frame Trigger Timer

```
AT+ UARTF=<time ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Time = Auto-Frame Trigger Time in milliseconds; Range 100 to 10000;

4.2.5.7 **AT+UARTFL**: This command allows the user to Read or control the auto frame trigger length.

Read Auto-Frame Trigger length

```
AT+UARTFL<CR>
```

```
+ok=<len><CR>< LF ><CR>< LF >
```

Set Auto-Frame Trigger Timer

```
AT+ UARTF=<len ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

len = Auto-Frame Trigger length in bytes; Range 64 to 4096;

4.2.5.8 **AT+TMODE**: this command allows the user to Set or Read the data transmission mode.

Read Data Transmission Mode

```
AT+TMODE<CR>
```

```
+ok=<tmode><CR>< LF ><CR>< LF >
```

Set Data Transmission Mode

```
AT+ TMODE=<tmode ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

tmode = through; Transparent transmission selected;

= Agreement; Agreement transmission selected

Note: New settings for AT+TMODE do not become active until the CH232BGN module reboots.

4.2.5.9 **AT+WMODE**: This command allows the user to read or set the WiFi Mode.

Read WiFi Mode

```
AT+WMODE<CR>
```

```
+ok=<mode><CR>< LF ><CR>< LF >
```

Set WiFi Mode

```
AT+WMODE=<mode ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

mode = AP; module set as Access Point;

= STA; module set as Station

Note: New settings for AT+WMODE do not become active until the CH232BGN module reboots.

4.2.5.10 **AT+WSKEY**: This command sets/reads the WiFi security parameters.

Read WiFi Security Parameters

```
AT+WSKEY<CR>
```

```
+ok=<auth,encrypt,key><CR>< LF ><CR>< LF >
```

Set WiFi Security Parameters

```
AT+WSKEY=<auth,encrypt,key><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

auth (Authentication Mode) = OPEN;

= Shared

= WPA2PSK

Encry (Encryption) = None (with authorization set to open)

= WEP (with authorization set to open or shared)

= TKIP (with WPA2PSK selected)

= AES (with WPA2PSK selected)

Key (Password) = ASCII code between 8 and 64 bits

Note: New settings AT+WSKEY do not become active until the CH232BGN module reboots.

This command is only active in Station mode.

4.2.5.11 **AT+WSSID**: This command allows the user to Read or Set WiFi Service Set Identifier in the CH232BGN.

Read WiFi SSID Parameters

```
AT+WSSID<CR>
```

```
+ok=<ap's ssid ><CR>< LF ><CR>< LF >
```

Set WiFi WSSID Parameters

```
AT+WSSID=<mode ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

ap's ssid = Service Set identifier of the local Access Point

Note: New settings for AT+WSSID do not become active until the CH232BGN module reboots.

This command is only active in Station mode.

4.2.5.12 **AT+WSLK**: This command allows the user to Read the WiFi Link Status.

Read WiFi Link Status

```
AT+WSLK<CR>
```

```
+ok=<ret ><CR>< LF ><CR>< LF >
```

Parameters:

- ret = Disconnected (no WiFi connection)
- = "AP" SSID (Access Points MAC address)
- = "RF Off (WiFi disabled)

Note: New settings for AT+WSLK do not become active until the CH232BGN module reboots.  
This command is only active in Station mode.

4.2.5.13 **AT+WEBU**: This command allows the user to Set or Read Web Page login parameters

Read Web Page Login Parameters

```
AT+WEBU<CR>
```

```
+ok=<usr,password><CR>< LF ><CR>< LF >
```

Set Web Page Login Parameters

```
AT+WSSID=<usr,password ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

- usr = User Name for web page access
- password = Web page password

4.2.5.14 **AT+WAP**: this command permits the user to Set or Read Access Point Parameters.

Read Access Point Parameters

```
AT+WAP<CR>
```

```
+ok=<wifi_mode,ssid,channel><CR>< LF ><CR>< LF >
```

Set Access Point Parameters

```
AT+WAP=< wifi_mode,ssid,channel ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Wifi\_mode = 11BG

= 11B

= 11G

= 11BGN

=11N

ssid = Service Set Identifier

channel = Auto (automatic channel selection)

= CH1 to CH11 (use designated channel)

Note: New settings for AT+WAP do not become active until the CH232BGN module reboots.  
This command is only active in Station mode.



4.2.5.15 **AT+WAKEY**: This command allows the user to Set or Read the WiFi security parameter.

Read Wifi Security Parameters

```
AT+WAKEY<CR>
```

```
+ok=<auth,encry,key><CR>< LF ><CR>< LF >
```

Set WiFi Security Parameters

```
AT+WAKEY=< auth,encry,key><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

auth (Authentication mode) = OPEN

= SHARED

= WPAPSK (WiFi Protected Access)

encry (Encryption algorithm) = NONE (Authentication Mode Open)

= OPEN (Authentication Mode Shared)

= TKIP (WiFi Protected Access selected)

= AES (WiFi Protected Access selected)

= TKIPAES (WiFi Protected Access selected)

key (password) = ASCII code between 8 and 64 bits;

Note: New settings for AT+WAKEY do not become active until the CH232BGN module reboots.

This command is only active in Station mode.

4.2.5.16 **AT+MSLP**: This command Sets the module into power saving mode and allows the user to read which mode is active.

Read Power Saving Status

```
AT+MSLP <CR>
```

```
+ok=<sta.><CR>< LF ><CR>< LF >
```

Set Power Saving Mode

```
AT+MSLP=<on/off><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Sta (status) = ON (WiFi Mode on, no sleep mode)

= Off (WiFi Off, module in sleep mode);

Note: When the module goes into sleep mode, the user can input "AT+MSLP=on" to re-start the module and put the module into transparent transmission mode.

4.2.5.17 **AT+WSCAN**: this command causes the module to seek an Access Point. This command only works when the CH232BGN is in Station mode.

Search for Access Point

```
AT+ WSCAN<CR>
```

```
+ok=<ap_site><CR>< LF ><CR>< LF >
```

Parameters:

ap\_site =Searched for Access Point

Note: This command is only active in Station mode.

4.2.5.18 **AT+ TCPLK**: This command checks the CH232BGN to see if a TCP link is established.

Confirm presence of a TCP Link

```
AT+TCPLK<CR>
```

```
+ok=<sta><CR>< LF ><CR>< LF >
```

Parameters:

sta.: ON = TCP Link established

OFF = No TCP Link Established

4.2.5.19 **AT+TCPDIS**: This command allows the user to control a TCP Link or read TCP Link status.

Read TCP Link Status

```
AT+TCPDIS<CR>
```

```
+ok=<sta><CR>< LF ><CR>< LF >
```

Set TCP Link

```
AT+ TCPDIS=<on/off><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

sta. (Set/Read TCP link status) = ON (Immediately make TCP connection)

= OFF (disconnect TCP connection)

Note: This command functions only when the CH232BGN is configured as a TCP Client

4.2.5.20 **AT+WANN:** This command allows the user to Set or Read the Wide Area Network (WAN) settings of the CH232BGN.

Read WAN Configuration

```
AT+WANN<CR>
```

```
+ok=<mode,address,mask,gateway><CR>< LF ><CR>< LF >
```

Set WAN Configuration

```
AT+WANN=< mode,address,mask,gateway ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

mode (IP setting) = static (Static IP)  
                    = DHCP (Dynamic IP)

address = WAN port IP address

mask = WAN port subnet mask

gateway = WAN port gateway address

Note: New settings for AT+WANN do not become active until the CH232BGN module reboots.  
This command functions only in Station mode.

4.2.5.21 **AT+ LANN:** This command Sets and Reads the Local Area network (LAN) parameters.

Read LAN Configuratioin

```
AT+LANN<CR>
```

```
+ok=<address,mask ><CR>< LF ><CR>< LF >
```

Set LAN Configuration

```
AT+LANN=<address,mask ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

address = IP Address

mask = subnet mask

Note: New settings for AT+LANN do not become active until the CH232BGN module reboots.  
This command functions only when the CH232BGN is configured as an Access Point.

4.2.5.22 **AT+DHCPGW**: This command allows the user to Read or Set the DHCP (Dynamic Host Configuration Protocol) gateway address

Read DHCP Gateway Address

```
AT+DHCPGW<CR>
```

```
+ok=<address><CR>< LF ><CR>< LF >
```

Set DHCP Gateway Address

```
AT+DHCPGW=<address ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

address = DHCP gateway address

4.2.5.23 **AT+TCPTO**: This command allows the user to Set or Read the time for the TCP timeout.

Read TCP Timeout

```
AT+TCPTO<CR>
```

```
+ok=<time><CR>< LF ><CR>< LF >
```

Set TCP Timeout

```
AT+TCPTO=<time ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Time (TCP timeout setting) = 600 (600 seconds)

= 0 (no timeout)

Default value is 300 seconds

4.2.5.24 **AT+MAXSK**: This command allows the user to Read or set the maximum number of TCP connections permitted.

Read the Maximum Number of TCP Connections

```
AT+MAXSK<CR>
```

```
+ok=<num><CR>< LF ><CR>< LF >
```

Set the Maximum Number of TCP Connections

```
AT+MAXSK =<num ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

num (Maximum Number of Connections) = 1-32

Note: When configured as a TCP/Server, the CH232BGN can support a maximum of 32 TCP connections. The user can reset this parameter if fewer connections are required.

4.2.5.25 **AT+TCPB**: This command permits the user to Set or Read the status of TCPB in the CH232BGN.

Read TCPB Status

```
AT+TCPB<CR>
```

```
+ok=<sta><CR>< LF ><CR>< LF >
```

Read TCPB Status

```
AT+TCPB=<on/off><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

sta = on (TCPB Enabled)

= off (TCPB Disabled)

Note: New settings for AT+TCPB do not become active until the CH232BGN module reboots.

4.2.5.26 **AT+TCPPTB**: This command permits the user to Set or Read the TCPB port number.

Read TCPB Port Number

```
AT+TCPPTB<CR>
```

```
+ok=<port><CR>< LF ><CR>< LF >
```

Set TCPB Port Number

```
AT+TCPPTB=<port><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

port: = decimal number < than 65535 (TCPB Port Number)

Note: New settings for AT+TCPPTB do not become active until the CH232BGN module reboots.

4.2.5.27 **AT+TCPADDB**: This command allows the user to Set or Read the TCPB server address.

Read TCPB Server Address

```
AT+TCPADDB<CR>
```

```
+ok=<add><CR>< LF ><CR>< LF >
```

Set TCPB Server Address

```
AT+TCPADDB=<add><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

add: = IP Server Address or url

Note: New settings for AT+TCPADDB do not become active until the CH232BGN module reboots.

4.2.5.28 **AT+TCPTOB**: This command allows the user to Set and Read the TCPB timeout.

Read TCP Timeout

```
AT+TCPTO<CR>
```

```
+ok=<time><CR>< LF ><CR>< LF >
```

Set TCP Timeout

```
AT+TCPTO=<time ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

Time (TCP timeout setting) = 600 (600 seconds)

= 0 (no timeout)

Default value is 300 seconds

Note: New settings for AT+TCPTOB do not become active until the CH232BGN module reboots.

4.2.5.29 **AT+TCPLKB**: This command allows the user to Read TCPB link status.

Read TCPB Link Status

```
AT+TCPCKB<CR>
```

```
+ok=<sta><CR>< LF ><CR>< LF >
```

Parameters:

sta = on (TCPB Link Active)

= off (TCPB Link not available)

4.2.5.30 **AT+EPHY**: This command allows the user to enable or disable the Ethernet physical interface.

Select Ethernet Availability

```
AT+ EPHY=<on/off><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

on/off = off (Ethernet Disabled)

= on (Ethernet Enabled)

Notes: If you want to keep the Ethernet port open, set AT+FEPHY=on.

Turning off the Ethernet port on the XE232BGN reduces power consumption. The default configuration is for Ethernet to be disabled, AT+FEPHY=off.

4.2.5.31 **AT+FUDLX**: This command permits the user to control the RS485 interface.

Select RS485 Availability

```
AT+FUDLX=<on/off><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

Parameters:

on/off = off (RS485 Disabled)

= on (RS485 Enabled)

4.2.5.32 **AT+RELD**: This command restores the module to factory default setting, and then re-starts the module.

Restore Factory Defaults

```
AT+RELD<CR>
```

```
+ok=rebooting...<CR>< LF ><CR>< LF >
```

4.2.5.33 **AT+Z**: This command restarts the CH232BGN.

Restart Module:

```
AT+Z<CR>
```

4.2.5.34 **AT+MID**: Request Module ID;

Request Module ID

```
AT+MID<CR>
```

```
+ok=<module_id><CR>< LF ><CR>< LF >
```

Parameters:

Module\_id = A11-yymmddnnnn (“yymmdd” is the date code; “nnnn” is the serial number)

4.2.5.35 **AT+VER**: Read the CH232BGN software version.

Read Software Version

```
AT+VER<CR>
```

```
+ok=<ver><CR>< LF ><CR>< LF >
```

Parameters:

ver = Module software version

4.2.5.36 **AT+H**: Read list of AT+ Commands

Read T Command List

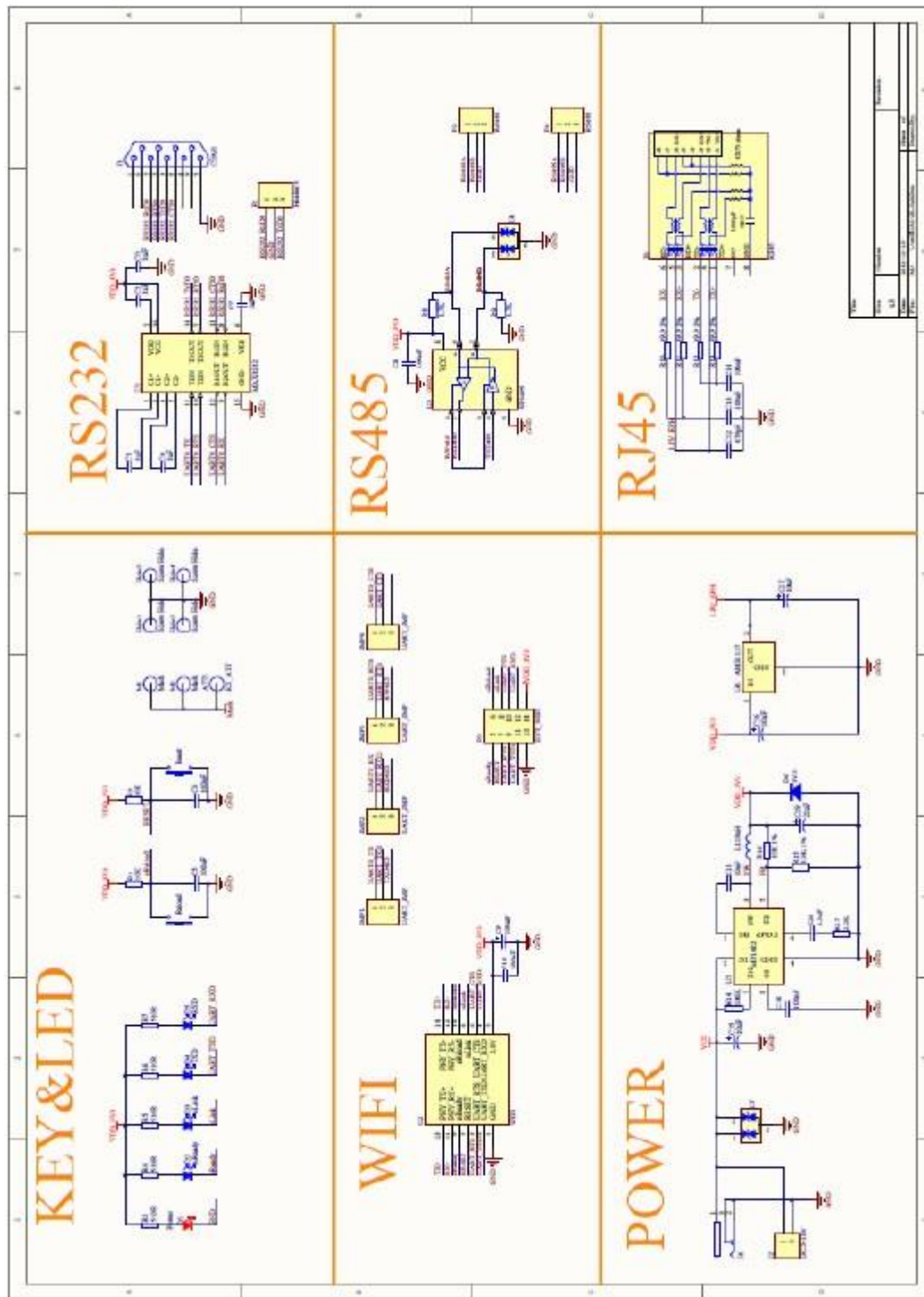
```
AT+H<CR>
```

```
+ok=<command help><CR>< LF ><CR>< LF >
```

Parameters:

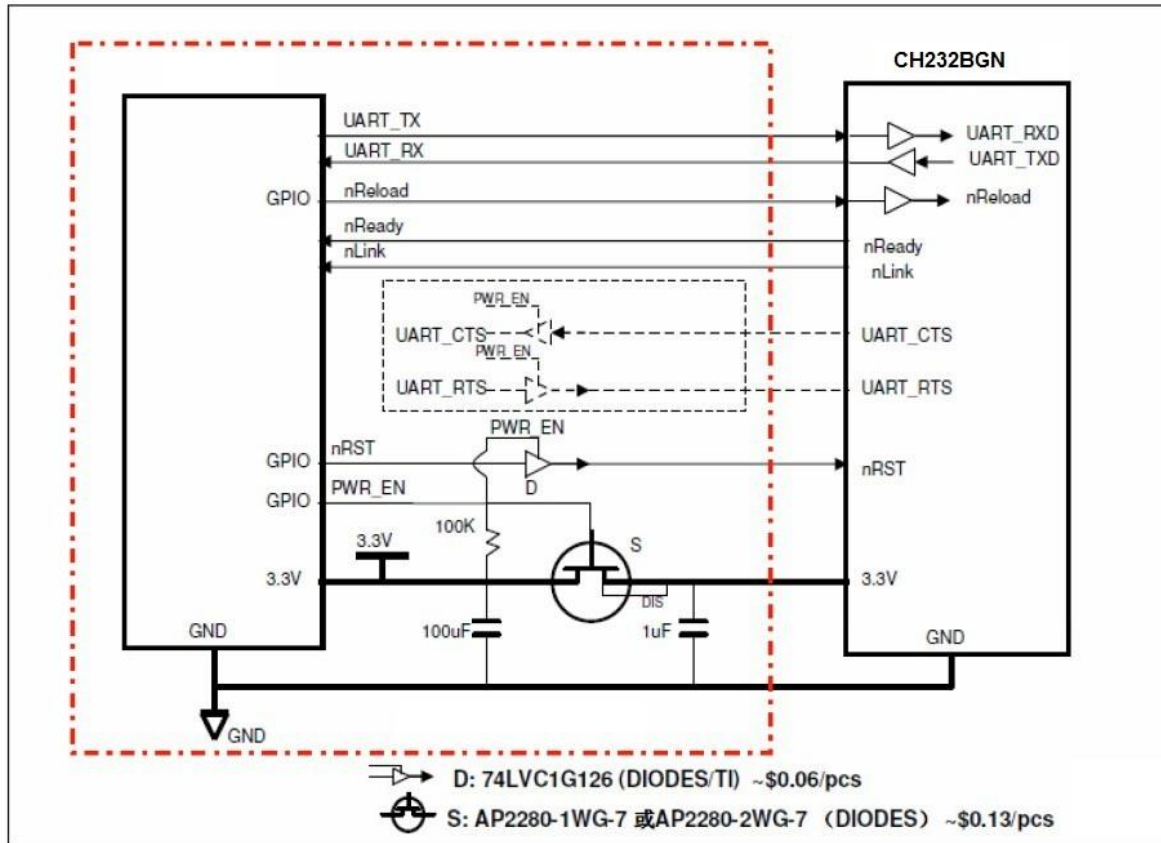
command help = AT+ Command Listing (see Figure 38)

# APPENDIX A: EVALUATION BOARD REFERENCE DESIGN





# APPENDIX B: EXTERNAL POWER SHUTDOWN MODE REFERENCE DESIGN



# CONTACT INFORMATION

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