Application

SIM7020 Series_TCPIP_Application Note

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Simplify Communication.

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About Document

Document Information

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Revision	Date	Owner	Status / Comments
1.00	April 10, 2018	Xiaolun Wang	First Release.
1.01	April 18, 2018	Albert Meng	Revised layout
1.02	Dec 27, 2018	Jiaxiang Wang Jimmy Zhang	Modify and add chapter 4 about TCPIP Application which compatible with SIM800 serial modules. Add transparent mode

Related Documents

[1] SIM7020 Series AT Command Manual V1.02.pdf

This document applies to the following products:

Name	Type	Size (mm)	Comments
SIM7020E	NB1	17.6*15.7	Band 1/3/5/8/20/28
SIM7020G	NB2	17.6*15.7	Band 1/2/3/4/5/8/12/13/17/18/19/20/25/26/28/66/70/71
SIM7060G	NB2+GNSS	24*24	Band 1/2/3/4/5/8/12/13/17/18/19/20/25/26/28/66/70/71

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Contents

1 Purpose of this document

Based on module AT command manual, this document will give an entire and complete concept and TCPIP architecture introduction.
Developers could understand and develop application quickly and efficiently based on this Document.

2 PDP Context Activation and Deactivation

2.1 Auto-Activation

AT Command	Response	Description
AT+CPIN?	+CPIN:READY OK	Check SIM card status
AT+CSQ	+CSQ: 20,0 OK	Check RF signal
AT+CGREG?	+CGREG: 0,1 OK	Check PS service
AT+CGACT?	+CGACT: 1,1 OK	Activated automatically
AT+COPS?	+COPS: 0,0,"CHN-UNICOM",9 OK	Check operator info CHN-UNICOM is operator's name9 is NB-IOT network
AT+CGCONTRDP	+CGCONTRDP: 1,5,"shnbiot","10.250.0.213.255.255.255.0" OK	Get APN and IP address from network

2.2 APN Manual Configuration

AT Command	Response	Description
AT+CFUN=0	+CPIN: NOT READY OK	Disable RF
AT*MCGDEFCONT="IP","3GNET	OK	Configure new APN

"		
AT+CFUN=1	OK +CPIN: READY	Enable RF
AT+CGREG?	+CGREG: 0,1 OK	Inquiry PS service
AT+CGCONTRDP	+CGCONTRDP: 1,5,"3GNET","10.250.0.253.255.255.255.0" OK	Attached PS domain and got IP address automatically

2.3 DNS Parser and Ping

AT Command	Response	Description
AT+CDNSGIP="www.baidu.com"	OK +CDNSGIP: 1,"www.baidu.com","111.13.100.92"	Got Baidu host name's IP address using DNS parser
AT+CIPPING="61.135.169.121"	OK +CIPPING: 1,61.135.169.121,11,52 +CIPPING: 2,61.135.169.121,2,52 +CIPPING: 3,61.135.169.121,3,52 +CIPPING: 4,61.135.169.121,2,52	Ping this IP address

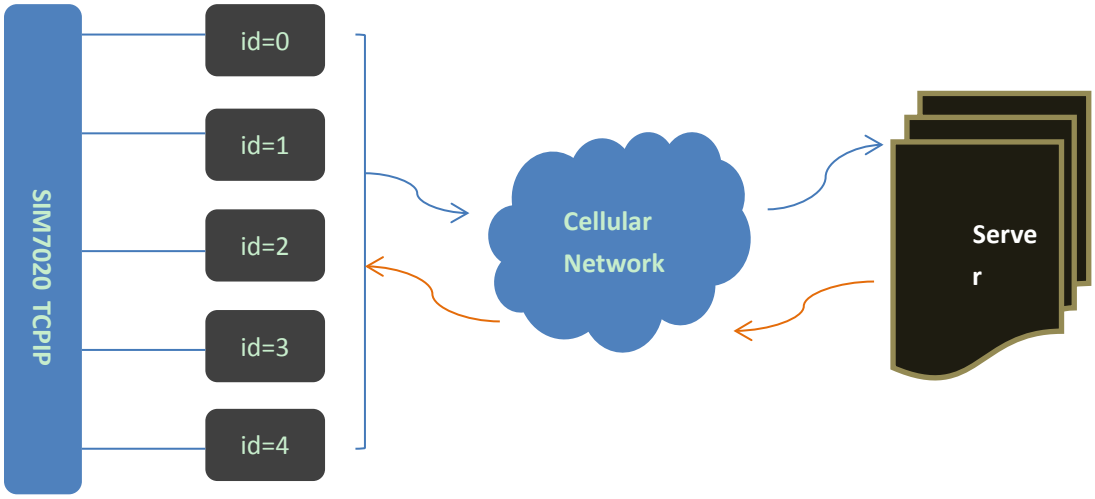
2.4 Deactivation

AT Command	Response	Description
AT+CGACT=0,1	OK	Deactivate <cid> #1
AT+CGACT?	+CGACT: 1,0 OK	Inquiry <cid> #1 status, it's deactivated already
AT+CGCONTRDP	OK	IP address is released

3 TCPIP Connection

3.1 TCPIP Architecture

SIM7020 series modules support TCP client only. And the default socket interface is designed for multiple sockets with total different 5 <socket_id>s, which could be TCP or UDP socket.



(Figure1 TCPIP Architecture)

3.2 TCP Client

AT Command	Response	Description
AT+CSOC=1,1,1	+CSOC: 0 OK	Created one TCP socket, <socket_id>=0
AT+CSOCON=0,5245,"116.247.119.165"	OK	Connected remote TCP server
AT+CSOSEND=0,0,"Hello World"	OK	Send TCP data out
AT+CSOCL=0	OK	Close socket

3.3 UDP Connection

AT Command	Response	Description
AT+CSOC=1,2,1	+CSOC: 0 OK	Created one UDP socket, <socket_id>=0
AT+CSOCON=0,5246,"116.247.119.165"	OK	Connected remote UDP peer
AT+CSOSEND=0,0,"Hello World"	OK	Send UDP data out

AT+CSOCL=0	OK	Close socket

3.4 Multiple Sockets

AT Command	Response	Description
AT+CSOC=1,1,1	+CSOC: 0 OK	Created one TCP socket, <socket_id>=0
AT+CSOC=1,2,1	+CSOC: 1 OK	Created one UDP socket, <socket_id>=1
AT+CSOCON=0,5245,"116.247.119.165"	OK	Connected remote TCP server
AT+CSOCON=1,5246,"116.247.119.165"	OK	Connected remote UDP peer
AT+CSOSEND=0,0,”Hello World”	OK	Send TCP data out
AT+CSOSEND=1,10,”3132333435”	OK	Send UDP data
AT+CSOCL=0	OK	Close socket 0
AT+CSOCL=1	OK	Close socket 1

3.5 Hex and ASCII Message

Command AT+CSOSEND=<socket_id>,<len>,<data> supports both Hex and Ascii code message. If <data> is pure hex, the <len> parameter must be configured correct bytes and must be even number.

Also Incoming message from remote socket are printed in Hex code.

3.6 TCP ACK

AT Command	Response	Description
AT+CSOC=1,1,1	+CSOC:0 OK	Created one TCP socket, <socket_id>=0
AT+CSOSENDFLAG=1	OK	Configure TCP ACK report
AT+CSOCON=0,5245,"116.247.119.165"	OK	Connected remote TCP server
AT+CSOSEND=0,0,”Hello World”	OK SEND: 0,11	Send TCP data out, 11 bytes had been sent out successfully.
AT+CSOCL=0	OK	Close socket

3.7 Incoming Message Indication

AT Command	Response	Description
	+CSONMI: 0,6,313233	Incoming data “123” from remote side

3.8 Retention Scene when Module is Waked from PSM Mode

After UDP connection is established,if user want to continue to use this connection when module is waked from PSM mode, the command AT+RETENTION should be set to 1.

AT Command	Response	Description
AT+RETENTION?	+RETENTION: 0	
AT+RETENTION=1	OK	Enable retention scene
AT+CSOC=1,2,1	+CSOC:0 OK	Created one UDP socket, <socket_id>=0
AT+CSOCON=0,5004,"117.131.85.139"	OK	Connected remote UDP server
AT+CPSMS=1	OK	Enable PSM mode
	+CPSMSTATUS: "ENTER PSM"	Enter into PSM mode
	+CPSMSTATUS: "EXIT PSM"	Wake module from PSM mode
AT+CSOSEND=0,0,"Hello World!!!	OK	Send data to UDP server
	+CSONMI: 0,12,313233343536	Receive data from UDP server

All command response is controlled by **ATE0** in this application note.

3.9 Summary of Socket Error codes

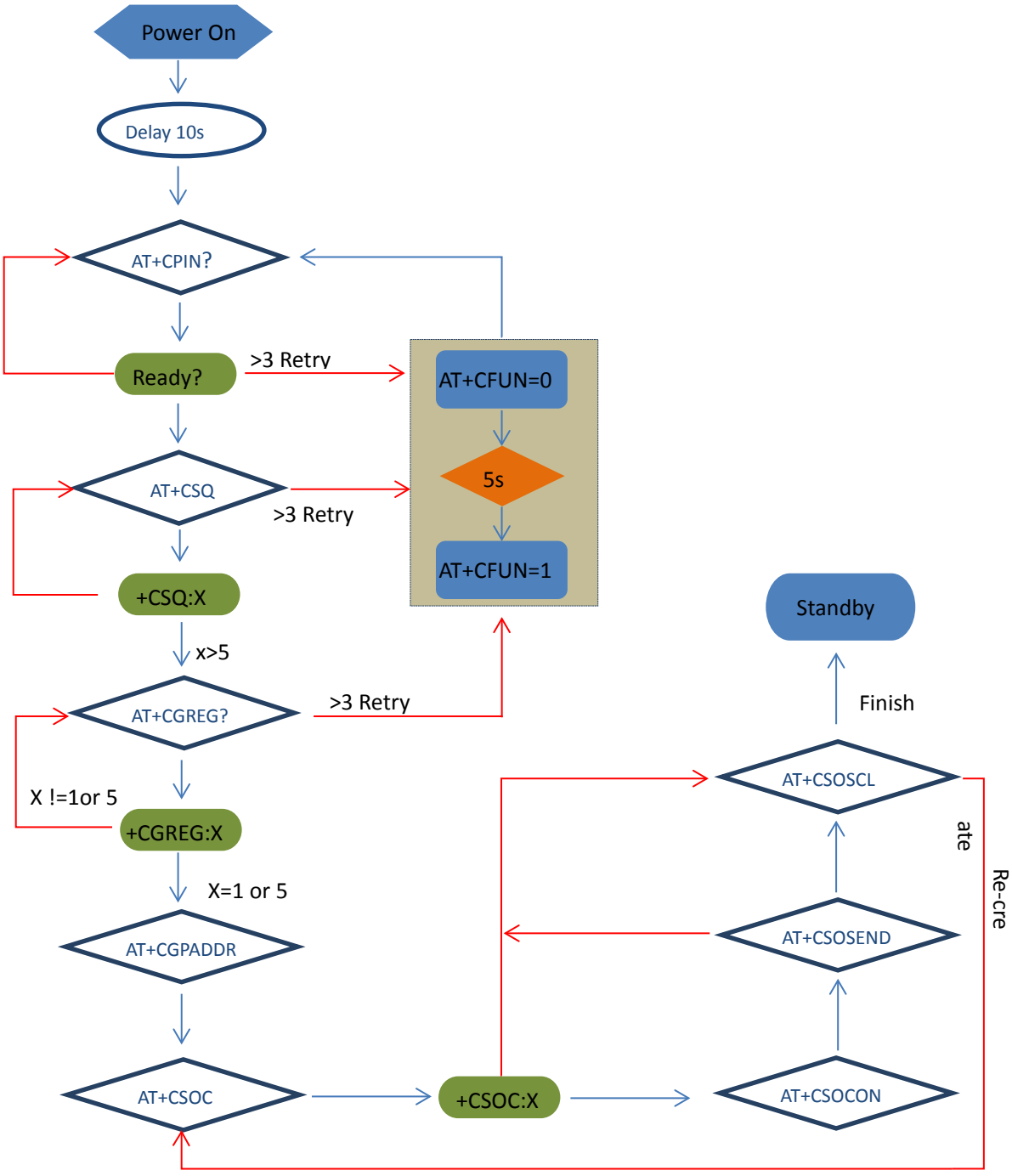
AT Command	Response	Description
	+CSOERR: 0,2	<socket id>, <error code>

Below is error code explanation list.

Code	Description
-1	Common error
1	Route error (host unreachable)
2	Connection abort error
3	Connection Reset error
4	Connected error
5	Illegal error

6	Buffer error
7	Block error
8	Address in use error
9	Already connecting error
10	Already connected error
11	Bearer error

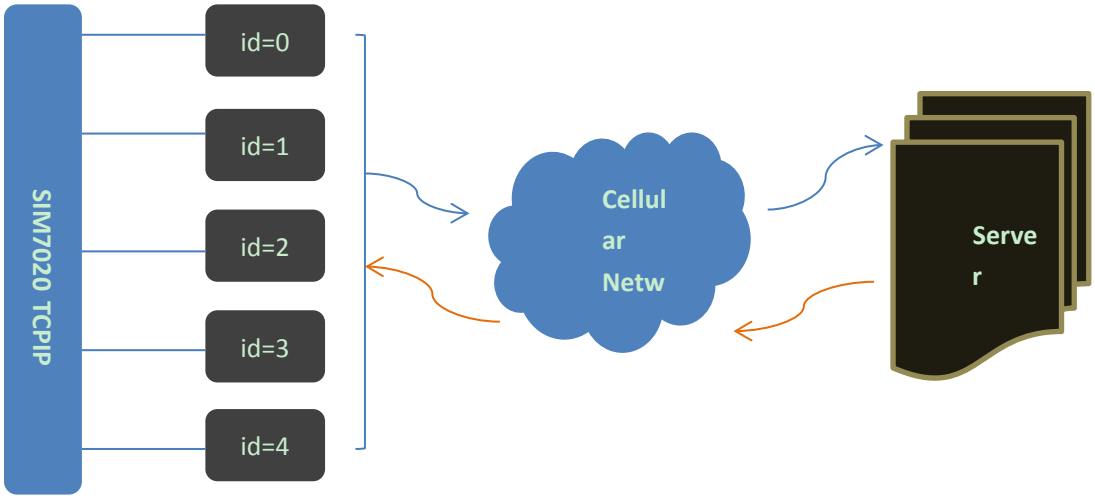
3.10 TCPIP Connection flow chart



4 TCPIP Application compatible with SIM800 serial module

4.1 TCPIP Architecture

SIM7020 series modules support TCP client only. And the default socket interface is designed for multiple sockets with total different 6 <socket_id>s, which could be TCP or UDP socket.



(Figure2 TCPIP Architecture)

4.2 TCP Client Connection

AT Command	Response	Description
AT+CSTT	OK	Start task and set APN.
AT+CIICR	OK	Bring up wireless connection(GPRS or CSD)
AT+CIFSR	10.78.245.128	Get local IP address
AT+CIPSTART="TCP","116.228.221.51","8500"	OK CONNECT OK	Start up the connection The TCP connection has been established successfully
AT+CIPSEND > hello TCP serve	SEND OK	Send data to remote server, CTRL+Z (0x1a) to send. Remote server receives data. For TCP, "SEND OK" means data has been sent out and received successfully by the remote server
	hello SIM7020	Received data from remote server
	CLOSED	Remote server closed the connection

4.3 UDP Client Connection

AT Command	Response	Description
AT+CSTT	OK	Start task and set APN.
AT+CIICR	OK	Bring up wireless connection(GPRS or CSD)
AT+CIFSR	10.78.245.128	Get local IP address
AT+CIPSTART=”UDP”,”116.228.221.51”,“9600”	OK CONNECT OK	Start up the connection The UDP connection has been established successfully
AT+CIPSEND >SIM7020 UDP test	SEND OK	Send data to remote server, CTRL+Z (0x1a) to send. Data has been sent out from the serial port, but it is unknown if the data reaches the UDP server.
	UDP test	Received data from remote server
	CLOSED OK	Remote server closed the connection

4.4 UDP Extended Mode

In UDP extended mode, SIM7020 series can receive UDP data from any IP address and port, meanwhile it can send UDP data to any IP address and port.

AT Command	Response	Description
AT+CSTT	OK	Start task and set APN.
AT+CIICR	OK	Bring up wireless connection(GPRS or CSD)
AT+CIFSR	10.78.245.128	Get local IP address
AT+CLPORT="UDP",8888	OK	Set local UDP port
AT+CIPSRIP=1	Ok	Display IP address and Port of sender
AT+CIPHEAD=1	OK	Add IP head in receiving data
AT+CIPUDPMODE=1	OK	Enable the UDP Extended Mode
AT+CIPSTART=”UDP”,”116.228.221.51”,”9600”	OK CONNECT OK	Start up UDP connection to remote server UDP connection has been established successfully.
AT+CIPUDPMODE?	+CIPUDPMODE: 1,"116.228.221.51",9600 OK	Check UDP mode’s status
AT+CIPSEND > Hello 9600	SEND OK	Send data to 116.228.221.51: 9600
	RECVFROM: 116.228.221.51:9600 +IPD,5:test1	Receiving data from 116.228.221.51:9600
AT+CIPUDPMODE=2,"116.2	OK	Re-set UDP port to be sent data to.

28.221.51",1234		
AT+CIPSEND > Hello 1234	SEND OK	Send data to 116.228.221.51: 1234
	RECV FROM: 116.228.221.51:1234 +IPD,5:test2	Receiving data from 116.228.221.51: 1234
AT+CIPUDPMODE=2,"10.78.103.220",5678	OK	Re-set UDP address and port to be sent data to.
AT+CIPSEND > Hello 5678	SEND OK	Send data to 10.78.103.220:5678
	RECV FROM: 10.78.103.220: 5678 +IPD,5:test3	Receiving data from 10.78.103.220: 5678
AT+CIPUDPMODE=2,"211.136.131.65",4500	OK	Re-set UDP address to be sent data to.
AT+CIPUDPMODE?	+CIPUDPMODE: 1,"211.136.131.65",4500 OK	The destination UDP address has been Updated, and UDP extended mode is still on.
AT+CIPSEND *>Hello 4500*	SEND OK	Send data to 211.136.131.65:4500

4.5 Multi Connection

AT Command	Response	Description
AT+CIPMUX=1	OK	Enable multi-connection
AT+CSTT	OK	Start task and set APN.
AT+CIICR	OK	Bring up wireless connection (GPRS or CSD)
AT+CIFSR	10.78.245.128	Get local IP address
AT+CIPSTART=0,"TCP","116.228.221.51","8500"	OK 0,CONNECT OK	Establish a TCP connection, connection number 0
AT+CIPSTART=1,"UDP","116.228.221.51","9600"	OK 1,CONNECT OK	Establish a UDP connection, connection number 1
AT+CIPSEND=0 >TCP test	0,SEND OK	Send data to connection 0
AT+CIPSEND=1 >UDP test	1,SEND OK	Send data to connection 1
	+RECEIVE,0,16: SIM7020 TCP test	Received data from connection 0, data length 16

	+RECEIVE,1,16: SIM7020UDP test	Received data from connection 1, data length 16
AT+CIPSTATUS	OK STATE: IP PROCESSING C: 0,0,"TCP","116.228.221.51","8500","CLOSED" C:1,0,"UDP","116.228.221.51","9600","CONNECTED" C: 2,,"","","","INITIAL" C: 3,,"","","","INITIAL" C: 4,,"","","","INITIAL" C: 5,,"","","","INITIAL"	Query the current connection status

4.6 DNS Function

AT Command	Response	Description
AT+CSTT	OK	Start up task and set APN
AT+CIICR	OK	Bring up wireless connection (GPRS or CSD)
AT+CIFSR	10.78.245.128	Get local IP address
AT+CDNSGIP=”www.baidu.com”	OK +CDNSGIP: 1,"www.baidu.com","119.75.218.77","119.75.217.56"	Query IP address of www.baidu.com Parsing succeed, the IP address has two results.
AT+CDNSGIP="abctest"	OK +CDNSGIP: 0,8	Query "abctest" Parsing error.
AT+CIPSTART="TCP","WWW.SIM.COM",80	OK CONNECT OK	Establish TCP connection.
AT+CIPSNED > DNS test	SEND OK	Send data

4.7 Data Sending Related

SIM7020 series provides 3 ways to send data: changeable data length sending, fixed data length sending and timed sending. SIM7020 series also provides a method to let user know how much data is sent out from the module and received by remote server on an active TCP connection.

4.7.1 Fixed Length Sending

User can send the fixed length of data with “AT+CIPSEND=<LENGTH>”, then input data after getting promoting mark “>”. Data will be sent automatically when the length of the input data

equals to the value “LENGTH”. User does not need the terminal symbol CTRL+Z (0x1a) in this case. For multi connection mode, the command is “AT+CIPSEND=<n>,<LENGTH>”.

4.7.2 Timed Sending

There is another way to send data automatically. First, set the timer of sending data automatically by the command “AT+CIPATS=<mode>,<time>”, then issue “AT+CIPSEND” (“AT+CIPSEND=<n>” for multi connection) and lastly input the data after getting promoting mark “>”. Data will be sent automatically when the set timer expires.

4.7.3 Select Data Transmitting Mode

SIM7020 series supports quick sending mode.
When command “AT+CIPQSEND=0”, it is in normal sending mode. In this mode, after user sends data by “AT+CIPSEND”, if the server receives TCP data, it will give ACK message to module, and the module will respond “SEND OK”.
When command “AT+CIPQSEND=1”, it is in quick sending mode. When the data is input to the serial port of module by “AT+CIPSEND”, it will respond “DATA ACCEPT:”, while not respond “SEND OK”. In such case, user can continuously use “AT+CIPSEND” to send data to the server.

Single connection:

AT Command	Response	Description
AT+CIPQSEND=1	OK	Enable quick sending mode
AT+CIPSEND >hello	DATA ACCEPT: 5	Data has been sent, not sure whether to be accepted

Multi connection:

AT Command	Response	Description
AT+CIPSTART=0,"TCP","116.236.221.75",5107	OK 0, CONNECT OK	Establish TCP connection
AT+CIPQSEND=1	OK	Enable quick sending mode
AT+CIPSEND=0 > 1234567890	DATA ACCEPT: 0,10	Data has been sent, not sure whether to be accepted

4.7.4 Query Data Transmitting Amount

The command “AT+CIPACK” is used to query previous connection data transmitting state. In single connection, the execution command “AT+CIPACK” will return “+CIPACK: <txlen>,<acklen>, <nacklen>”.
---- The 1st parameter <txlen> is the data amount which has been sent;
---- The 2nd parameter <acklen> is the data amount confirmed successfully by the server;
---- The 3rd parameter <nacklen> is the data amount without confirmed by the server.
As long as the connection is still active, user can know how much TCP data user sent to server

and how much is received successfully by the server in total. By this means, user can get the total data transmitting amount.

AT Command	Response	Description
AT+CIPQSEND=1	OK	Enable quick sending mode
AT+CIPSTART="TCP","116.236.221.75",5107	OK CONNECT OK	Establish TCP connection
AT+CIPSTATUS	OK STATE: CONNECT OK	Query connection's status
AT+CIPSEND > 012345678912	DATA ACCEPT:12	
AT+CIPACK	+CIPACK: 12,12,0 OK	12 be Send , 12 be confirmed

For multi connection, the correct command type is "AT+CIPACK=<n>".
<n> is the connection number.

AT Command	Response	Description
AT+CIPQSEND=1	OK	Enable quick sending mode
AT+CIPSTATUS	OK STATE: IP PROCESSING C: 0,,"","","","INITIAL" C: 1,0,"TCP","116.228.221.51","8500","CONNECTED" C: 2,0,"UDP","116.228.221.51","9600","CONNECTED" C: 3,,"","","","INITIAL" C: 4,,"","","","INITIAL" C: 5,,"","","","INITIAL"	Query connection's status
AT+CIPSEND=1 >TCP	DATA ACCEPT:1,3	Send data at 1 channel
AT+CIPACK=1	+CIPACK: 3,3,0 OK	3 be send, 3 be confirm
AT+CIPSEND=2 >UDP	DATA ACCEPT:2,3	Send data at 2 channel
AT+CIPACK=2	+CIPACK: 3,0,3 OK	3 be send, 3 be unconfirmed.

4.8 Data Receiving Related

4.8.1 Receive Data Automatically

The module will receive data automatically if there is data coming from remote server. Several commands can help to get the information header.

- "AT+CIPHEAD=1" helps to add IP header in the format "+IPD (data length): payload".
- "AT+CIPSRIP=1" helps to show the data source information in the format "RECV FROM: <IP ADDRESS>:<PORT >".
- "AT+CIPSHOWTP" helps to show the protocol (TCP/UDP) in the IP header. It takes effect only if "CIPHEAD" is enabled.

With this information, user can easily know the source of the data frame, the amount of the payload and the protocol. It can also help user to distinguish the received data from AT command responses.

4.8.2 Receive Data Manually

The module provides user a way to get data from the network manually instead of pushing data to the TE automatically.

"AT+CIPRXGET=1" is used to enable getting data from network manually, which should be set before connection. If it is set to "0" (default value), data will be pushed to TE directly.

"AT+CIPRXGET=<mode>[,<len>]" is used to get data with a given length. If it is multi IP connection, the connection ID should be given. E.g.: "AT+CIPRXGET=<mode>,<id>[,<len>]"

AT Command	Response	Description
AT+CIPRXGET=1	OK	Enable getting data from network manually
AT+CIPSTART="TCP","116.228.221.51",5555	OK CONNECT OK	Establish TCP connection
	+CIPRXGET:1	Data incoming from server
AT+CIPRXGET=2,1460	+CIPRXGET:2,11,0 HELLO WORLD OK	The mode is set to 2, the output data will be in normal mode, with the length not exceeding1460 bytes at a time.
	+CIPRXGET:1	Data incoming from server
AT+CIPRXGET=3,730	+CIPRXGET:3,11,0 48454C4C4F20574F524C44 OK	The mode is set to 3, user can get data in HEX mode with the length not exceeding 730 bytes at a time.

4.9 GPRS States Exchange Related

For single connection, there are 10 GPRS states in total; for multi connection, there are 7 GPRS

states. After some AT commands are executed, the corresponding state will be changed. User can get a general idea from the following diagrams:

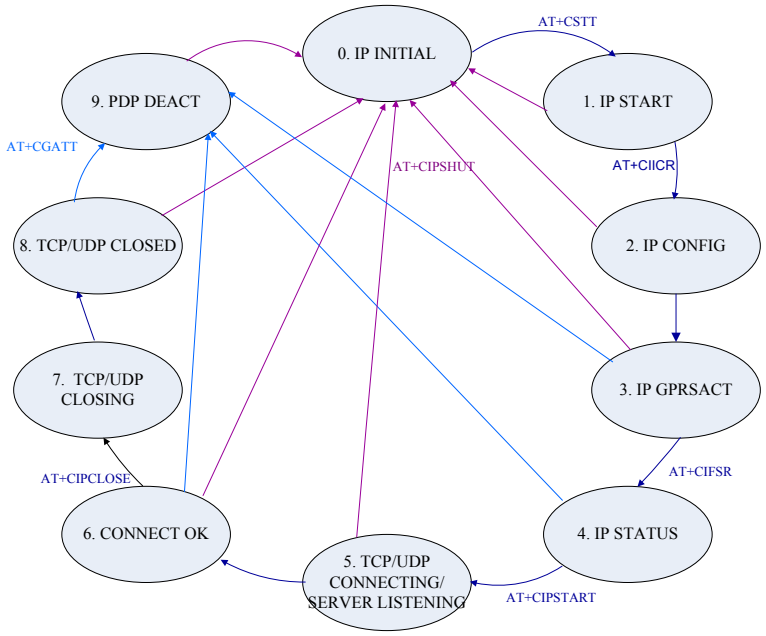


Figure3: GPRS States Diagram for single connection

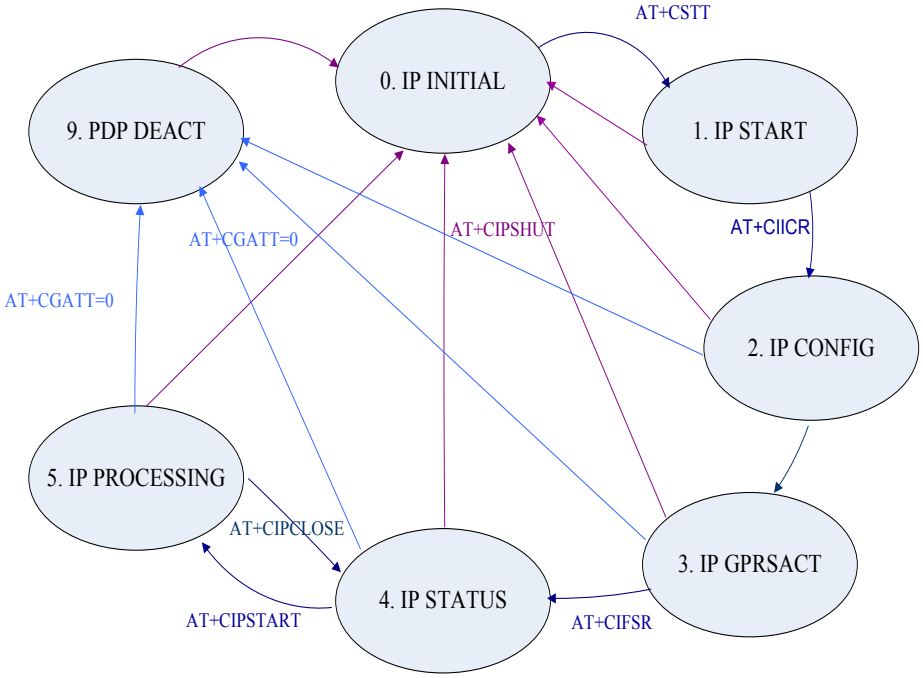


Figure4: GPRS States Diagram for multi connection

- IP INTIAL: GPRS initial status
- IP START: Start a TCP/UDP task
- IP CONFIG: Configure PDP context
- IP GPRSACT: Context active already
- IP STATUS: Get local IP address
- TCP/UDP CONNECTING: Connecting to server now
- SERVER LISTENING: Listening to server port now
- IP PROCESSING: Processing the existing connection now
- CONNECT OK: Connection to the server is successful
- TCP/UDP CLOSING: Closing connection now
- TCP/UDP CLOSED: Connection closed (local IP/PDP context still there)
- PDP DEACT: Context deactivated

4.10 Connection Closing Related

User can use the command "AT+CIPCLOSE=<mode>" to close the TCP or UDP connection.

If <mode> is "0", it is slow closing;

If <mode> is "1", it is quick closing.

In slow closing, the module will interactive with the server when it closes the TCP connection. Thus, the time of returning "CLOSE OK" will be a bit long. This method is suitable for steady network.

In quick closing, the module will disconnect the connection compulsorily and return "CLOSE OK" immediately, without interaction with the server.

The default setting is slow closing, so the "<mode>=0" can be omitted. And in multi connection, the connection number <n> should be added in front of <mode>.

Be noted that command "AT+CIPCLOSE" only closes current TCP/UDP connection, but PDP context is still active. Also user can close connection by AT+CIPSHUT, with current PDP context being deactivated.

4.11 Error Handling

If an error occurs in TCP/UDP connection, for example TCP sending data error or TCP connection dropping, it is suggested to close the connection by command "AT+CIPCLOSE" and then restart the connection by "AT+CIPSTART".

If the error still occurs, command "AT+CIPSHUT" is recommended to shut off the PDP context and then restart the connection.

If these two methods above can't help to solve it, SIMCom recommends user to reset the module.

4.12 Transparent Mode

4.12.1 What is Transparent Mode

SIM7020 series supports transparent mode which provides a special data mode for data receiving and sending by TCP/IP application task. Once the connection is established under

transparent mode, the module will be in data mode. All received data from serial port will be treated as data packet to be transferred later, similarly all data received from remote side will be sent to serial port directly. In transparent mode, all AT commands are not available. Methods are provided to switch back and forth between data mode and command mode. Once it is switched to command mode, all AT commands can be used again.

4.12.2 How to enable Transparent Mode

To enable transparent mode, the command AT+CIPMODE should be set to 1. The transparent mode is only supported under single connection.

AT Command	Response	Description
AT+CIPMUX=0	OK	Enable single-connection
AT+CIPMODE=1	OK	Enable transparent mode

4.12.3 How to Establish Connection and Enter into Transparent Mode after Enable Transparent Mode

After enable transparent mode, SIM7020 series can work as two modes too: TCP client, UDP client. Once the connection is established, “CONNECT OK” will be returned in the serial port.After establish connection,executing “AT+CIPCHAN” to enter into transparent mode.

AT Command	Response	Description
AT+CIPSTART=”TCP”,”116.228.221.51”,“8500”	OK CONNECT OK	Start up the connection The TCP connection has been established successfully
AT+CIPCHAN	CONNECT	Enter into transparent mode successfully
	1234567890	Receive data from server
123456		Send data to server

4.12.4 How to Switch Between Data Mode and Command Mode

To switch from data mode to command mode, following methods are available:

(1) The default escape sequence is +++, and to use this sequence, there should be 1000ms idle period before this sequence and 1000ms idle period after this sequence. Besides, the interval between each + should not exceed 1000ms, otherwise it will be treated as TCP/IP data.

(2) If the remote server closes the connection, the module will be switched back to command mode automatically.

(3) If the module is deactivated from PDP context (+PDP DEACT) during data transferring, module will be switched back to command mode automatically.

ATO command can be used to switch the module from command mode to data mode again if the

connection is activ.

AT Command	Response	Description
+++	OK	switch from data mode to command mode
AT+CSQ	+CSQ: 25,0 OK	At command work normally
ATO		switch the module to data mode
123456		Send data to server
	1234567890	Receive data from server

Contact

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