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Z02215

Single Chip Modem with Integrated Controller, Data Pump, and Analog Front End

Product Specification

PS001907-0904

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Document Disclaimer

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Features

- Complete modem integrated circuit with integrated controller, data pump and Analog Front End (AFE) with active hybrid
- Includes an AT command set interpreter in the on-chip ROM with no external memory required
- Programmable country parameters through AT commands or EEPROM interface
- Automatic determination of AT command speed and parity
- Includes V.14 asynchronous to synchronous conversion
- Accepts asynchronous or synchronous terminal data
- Speed matching and RTS/CTS flow control between the modem and the terminal
- Voice answer detection
  - Line-In-Use detection before connection
  - Pick-up detection during connections
- Supports Tone or Pulse dialing
- Call progress monitoring controls
- Guard tone controls
- Line quality monitoring and auto-retrain
- Auto-Dial and Auto-Answer
- Supports telephone dial blacklisting
- Data modem throughput to 2400 bps
  - ITU V.22bis, V.23, V.22, V.21
  - Bell 212A, Bell 103, Bell 202, Bell 202T
- FSK (V.23 1200/75 bps, Bell 202/Bell 202T 1200/150 bps, V.21/Bell 103 300 bps), DPSK (V.22/Bell 212A 1200 bps), or QAM Encoding (V.22bis 2400 bps)
- V.23 with Minitel line reversal
- Programmable bi-quad call progress tone detectors
- Adaptive equalization to compensate for a wide variety of line conditions
- Programmable transmit attenuation and selectable receive threshold
- Fully-programmable call progress detectors for precise call program monitoring, including signal quality detectors, tone detectors, tone generators, and transmit signal levels that aid in rapid country qualifications
- On-chip peripheral, a full-duplex voice band AFE with 12-bit resolution

- Dynamic power management: power-saving SLEEP modes
- North American Type-I Caller ID
- 44-Pin PLCC, 44-Pin LQFP footprint
- Single +5 VDC power supply
- Minimal external logic
- 0°C to +70°C standard temperature range and –40°C to +85°C extended temperature range

Note: International Telecommunications Union (ITU, formerly known as CCITT)

General Description

The Z02215 is a synchronous single-chip V.22bis modem capable of 2400 bps full-duplex over dial-up lines. It is a full-featured, self-controlled modem that includes a modem controller, DSP, and Analog Front End (AFE) functions. This device is specifically designed for use in embedded modem applications where space, performance, and low-power consumption are key requirements.

Operating over the Public Switched Telephone Network (PSTN), the Z02215 meets the modem standards for V.22bis, V.22, V.23 (Minitel), V.21, Bell 212A, Bell 202, Bell 202T, and Bell 103.

A typical modem can be created by simply adding a phone- line interface (DAA), and DTE interface.

All modulation, demodulation, filtering, Analog to Digital (A/D), and Digital to Analog (D/A) conversion functions for transmission and reception are provided on-chip. Automatic compromise equalizers are included to optimize performance over a wide range of line types.

The Z02215 device compensates for a wide variety of adverse line conditions by using adaptive equalizers.

The Z02215 provides comprehensive selectable and programmable tone generation and detection.

Transmit drivers and receive amplifiers can be connected directly to a Data Access Arrangement (DAA) by adding a transformer, or a silicon DAA, reducing the external circuits to a minimum.

In addition, the Z02215 provides further system-level savings by providing built-in filters for both the transmitter analog output and the receiver analog Input. This configuration eliminates the need for external filtering components.

The analog front end of the Z02215 includes an active hybrid circuit that improves modem performance and reduces system-level costs by reducing the requirement for external components.

The Z02215 device operates on a single +5 VDC power supply. During periods of no traffic, the modem can be placed into SLEEP mode, reducing power consumption through Dynamic Power Management.

Note: All signals with an $\overline{\text{overline}}$, are active Low. For example, B/$\overline{\text{W}}$, in which WORD is active Low; and $\overline{\text{B}}$/W, in which BYTE is active Low.

Power connections follow these conventional descriptions:

Connection	Circuit	Device
Power	V_{CC}	V_{DD}
Ground	GND	V_{SS}

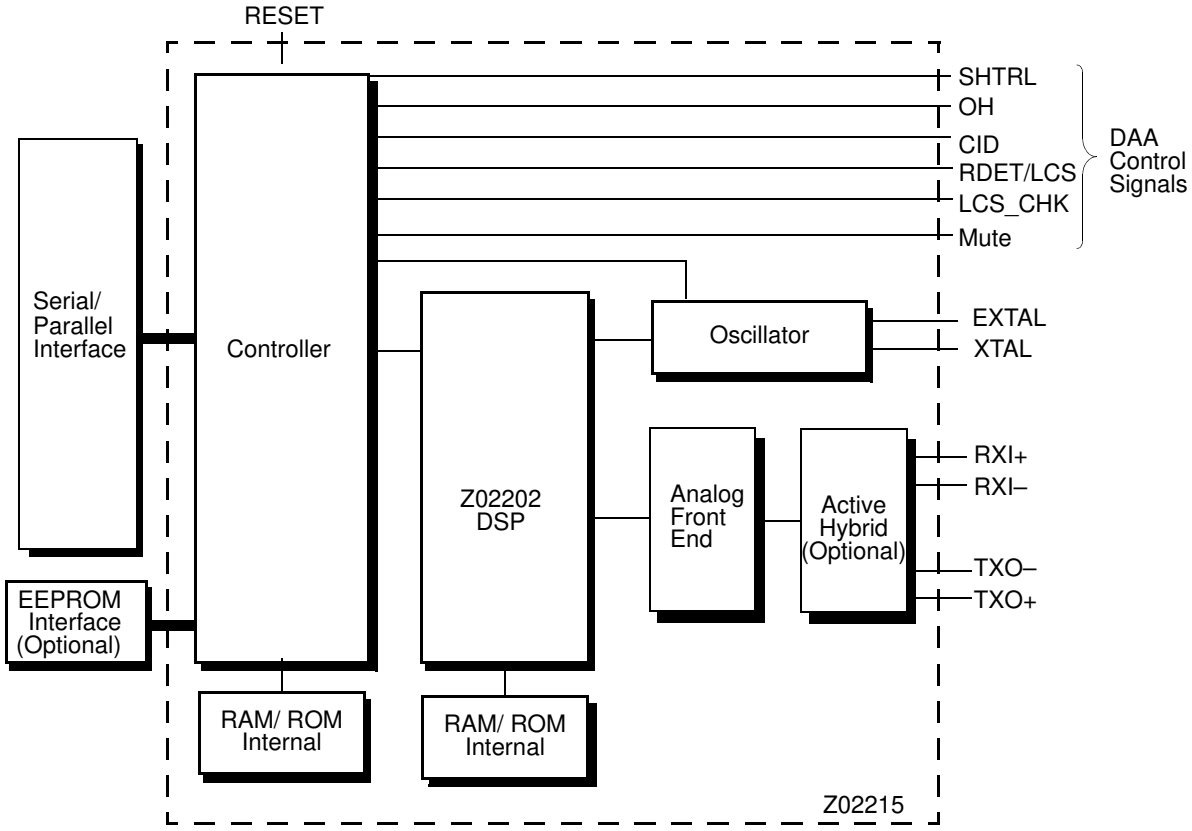

Figure 1. Z02215 Block Diagram

Pin Descriptions

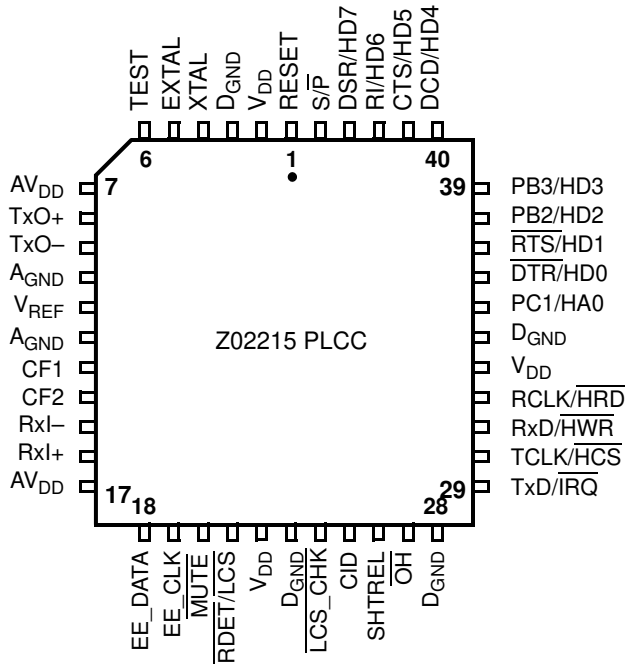

Figure 2. Z02215 44-Lead PLCC Pin Identification (for Prototype Only)

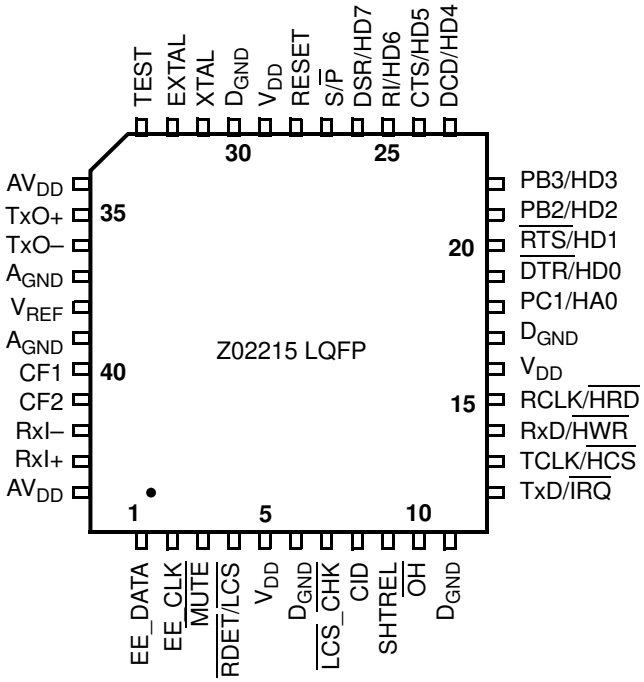

Figure 3. Z02215 44-Lead LQFP Pin Identification

Table 1. Pin Descriptions

Symbol	PLCC Pin #	LQFP Pin #	Function	Direction	Description
RESET	1	28	Reset (Active low)	Input, Output	The RESET signal sets the modem to a RESET state.
V_{DD}	2	29	Digital Power		
D_{GND}	3	30	Digital Ground		
XTAL	4	31	Crystal (Time-based Output)	Output	This pin connects a parallel-resonant crystal. This pin is left open if an external clock is used instead of a crystal.
EXTAL	5	32	Crystal (Time-based Output)	Input	This pin connects a parallel-resonant crystal. An external clock can be input to the device on this pin when a crystal is not used.
TEST	6	33		Input	This pin is a test pin that must be tied to digital ground.
AV_{DD}	7	34	Analog Power		
TXO+	8	35	Transmit Differential Analog Output Positive	Analog Output	The TXO+ is capable of driving a 600W resistive load over a leased line or public switched telephone network via a Data Access Arrangement (DAA).
TXO–	9	36	Transmit Differential Analog Output Negative	Analog Output	The TXO+ is capable of driving a 600W resistive load over a leased line or public switched telephone network via a Data Access Arrangement (DAA).
A_{GND}	10	37	Analog Ground		
V_{REF}	11	38	Reference Voltage active High	Analog Output	An internally generated DC voltage.
A_{GND}	12	39	Analog Ground		
CF1	13	40	Integration Capacitor PIN 1	Analog Input	Connect an 82pF capacitor between CF2 and CF1 to complete the internal feedback integration filter for improved analog A/D performance.
CF2	14	41	Integration Capacitor PIN 2	Analog Input	Connect an 82pF capacitor between CF2 and CF1 to complete the internal feedback integration filter for improved analog A/D performance.
RXI–	15	42	Receive Differential Analog Output Negative	Analog Input	These are the analog inputs from the DAA.

Table 1. Pin Descriptions (Continued)

Symbol	PLCC Pin #	LQFP Pin #	Function	Direction	Description
RXI+	16	43	Receive Differential Analog Output Positive	Analog Input	These are the analog inputs from the DAA.
AV_{DD}	17	44	Analog Power		
EE_DATA	18	1		Input/ Output	I^2C EEPROM Data.
EE_CLK	19	2		Output	I^2C EEPROM Clock.
$\overline{MUTE}$	20	3	Speaker Mute Control	Output	Controls speaker muting.
$\overline{RDET}$/ LCS	21	4	Ring Detect Input Line Current Sense	Input	Signals the presence of a ring signal on the line.The LCS_CHK input is used to detect when a parallel phone is off-hook before dialing or when a parallel phone has been picked up while connected. In either case when LCS goes Low, the connection attempt is dropped with a NO CARRIER message.
V_{DD}	22	5	Digital Power	Output	
D_{GND}	23	6	Digital Ground		
LCS_CHK	24	7	Line Current Sense	Output	This signal is used to enable the Line Current Sense circuits in the DAA when checking for parallel phone off-hook condition prior to taking the phone line off-hook.
CID	25	8	Caller ID Relay	Output	This signal is used to turn on the Caller ID relay in the DAA.
SHTREL	26	9	Pulse Dial Shunt Relay Output	Output	SHTREL works in conjunction with pulse dial *make/break*. It offers extra-low resistance across the tip and ring. When all relays are closed, SHRTEL provides 100 Ohms (Low) instead of 600 Ohms.
OH	27	10	Off-Hook Relay Output	Output	This signal is used to turn on the off-hook relay in the DAA.
D_{GND}	28	11	Digital Ground		

Table 1. Pin Descriptions (Continued)

Symbol	PLCC Pin #	LQFP Pin #	Function	Direction	Description
TXD/$\overline{IRQ}$	29	12	Transmit Data	Input	Active Low, **Serial mode only**. Serial transmit data to the DSP is presented on this pin.
			Interrupt Request	Open Drain Output	Active Low, **Parallel mode only**. This pin goes Low in response to an interrupt from the Parallel Interface which is enabled. $\overline{IRQ}$ returns High when the source of the interrupt is serviced, or by disabling the interrupt.
TCLK/ $\overline{HCS}$	30	13	Transmit Serial Data Clock	Output	**Serial mode only.** This pin is a synchronous data clock used to transfer serial data via TXD to the DTE. The clock frequencies are 2400,1200, and 300 Hz.
			Host Chip Select	Input	Active Low, **Parallel mode only.** When this pin goes Low, data transfer between the Z02215 Parallel Interface and the Host are enabled. Data transfers are 8 bits wide.
RXD/$\overline{HWR}$	31	14	Receive Data	Output	Active Low, **Serial mode only**. The serial receive data from the DSP is presented on this pin.
			Host Write	Input	Active Low, **Parallel mode only**. On the rising edge of $\overline{HWR}$ the data on HD7–HD0 is written to register PIDR or PISR depending on the state of HA0 and provided $\overline{HCS}$ is Low.
RCLK/ $\overline{HRD}$	32	15	Receive Serial Data Clock	Output	**Serial mode only**. This pin is a synchronous data clock used to transfer serial data via RXD to the DTE. The clock frequencies are 2400 Hz, 1200 Hz, and 300 Hz.
			Host Read	Input	Active Low, **Parallel mode only**. When this pin and $\overline{HCS}$ is Low, the contents of register PIDR or PISR, (depending on the state of HA0), is placed on HD7–HD0. See Table 2, “Status Register,” on page 11
V_{DD}	33	16	Digital Power		
D_{GND}	34	17	Digital Ground		

Table 1. Pin Descriptions (Continued)

Symbol	PLCC Pin #	LQFP Pin #	Function	Direction	Description
PC1/HA0	35	18	Port C	Input/ Output	**Serial mode only**. This line can be configured as an input or output on a bit-by-bit basis.
			Host Address	Input	**Parallel mode only**. Address bit 0 for the Parallel interface. High level selects the PICR register; Low selects the PIDT register.

Table 1. Pin Descriptions (Continued)

Symbol	PLCC Pin #	LQFP Pin #	Function	Direction	Description
Note: This comment applies to pins HD0–HD7, respectively. HD0–HD7 are the Host Parallel Interface Data bus. Bi-directional, Active High, **Parallel mode only**. These pins constitute an 8-bit bi-directional data bus used for the transfer of control and status information. HD0–HD7 are 3-stated except for a PIDT or PICR read.					
$\overline{DTR}$/HD0	36	19	Data Terminal Ready	Input	**Serial mode only.** This signal is asserted by the DTE when it is ready to receive data.
$\overline{RTS}$/HD1	37	20	Request To Send	Input	**Serial mode only.** This signal indicates that the DTE is ready to send data to the modem. When the modem is ready, it asserts $\overline{CTS}$ (see $\overline{CTS}$, below).
PB2/HD2	38	21	General Purpose Output	Output	**Serial mode only.** Programmable using Diplomat™.
PB3/HD3	39	22	General Purpose Output	Output	**Serial mode only.** Programmable using Diplomat™.
$\overline{DCD}$/HD4	40	23	Data Carrier Detect	Output	**Serial mode only.** This signal indicates that a modem carrier signal has been detected on the line.
$\overline{CTS}$/HD5	41	24	Clear To Send	Output	**Serial mode only.** This signal indicates that the modem is ready for the DTE to send data to it.
$\overline{RI}$/HD6	42	25	Ring Indicator	Output	**Serial mode only.** When active, this signal indicates that a ring signal on the phone line is detected by the modem.
$\overline{DSR}$/HD7	43	26	Data Set Ready	Output	**Serial mode only.** This pin is the Data Set Ready pin and indicates when the modem is ready to transmit data. Refer to the &S command for details.
S/$\overline{P}$	44	27	Serial or Parallel Mode Select	Input	This pin configures the Z02215 Host interface to Serial or Parallel mode. When High (V_{CC}), the Serial mode is selected and when this pin is tied Low (GND), the Parallel mode is selected.

Parallel Host Interface

With the Parallel Host Interface, a host controller can put the Z02215 on its processor bus and access it as a peripheral.The Parallel Interface consists of two host registers:

- Register 0–Parallel Interface Data Register (PIDR)
- Register 1–Parallel Interface Status Register (PISR)

PIDR is the data register for transmitting and receiving data, including the AT commands.

In RECEIVE DATA mode (when $\overline{HRD}$, $\overline{HCS}$, HA0, S/$\overline{P}$ are Low), Z02215 reads the data on the Host Parallel Data bus (HD0–HD7) for the external host to read the contents.

In TRANSMIT DATA mode (when $\overline{HWR}$, $\overline{HCS}$, HA0, S/$\overline{P}$ are Low), Z02215 reads the contents placed on the Host Parallel Data bus (HD0–HD7) by the external host processor.

PISR is the Status register. Bits 0, 1, 6 and 7 of this register are defined in hardware, and bits 2, 3, 4, and 5 are defined in software as follows:

Table 2. Status Register

7	6	5	4	3	2	1	0
RRIE	TRIE	DCD	RBRK	DTR	SBRK	RRF	TRE
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
0	0	1	0	0	0	0	1

Bit No.	Mnemonic	R/W	Default Value	Description
Bit 7	RRIE	R/W	0	Receive Register Interrupt Enable. When this bit is 1, the Z02215 drives the $\overline{HIRQ}$ pin Low when RRF is 1.
Bit 6	TRIE	R/W	0	Transmit Register Interrupt Enable. When this bit is 1, the Z02215 drives the $\overline{HIRQ}$ pin Low when TRE is 1
Bit 5	DCD	R/W	1	DCD signal sent from the Z02215. 1–Active 0–Inactive
Bit 4	RBRK	R/W	0	Break signal sent to the host. The Z02215 sets this bit to 1 to indicate that a line break is transmitted to the host. The Z02215 resets this bit to 0 when the line break condition is ended.
Bit 3	DTR	R/W	0	DTR signal sent to the Z02215. 1: Active 0: Inactive
Bit 2	SBRK	R/W	0	Send Line Break to the Z02215. The host sets this bit to 1 to transmit a line break to the Z02215. The host sets this bit to 0 to stop transmitting a line break. The host performs the timing of the transmitted line break.
Bit 1	RRF	R/W	0	Receive Register Full. The host can receive a byte from the Z02215 when this bit is 1.
Bit 0	TRE	R/W	1	Transmit Register Empty. The host can transmit a byte to the Z02215 when this bit is 1.

Operating Modes

The modem controller software features several different states of operation.

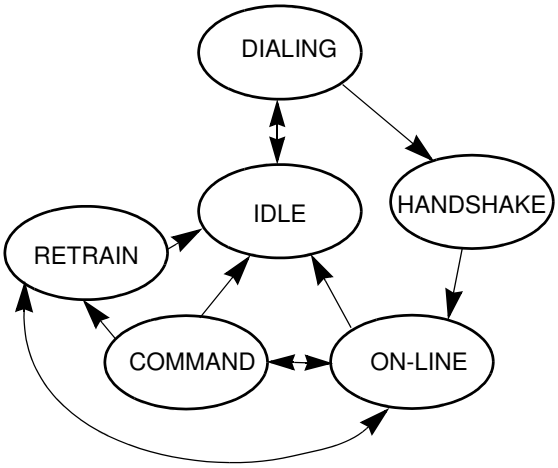

Figure 4. Modem State Diagram

IDLE

When the modem is in the IDLE state it is not communicating with another modem. The modem accepts AT commands from the terminal while IDLE.

DIALING

When the modem dials it performs the same tasks a person uses to dial a telephone. The modem does not accept AT commands or data from the terminal while dialing.

HANDSHAKE

When the modem handshakes it communicates with another modem to determine the data rate the two modems use to communicate. Handshaking takes place at the beginning of each connection between two modems. The originator and answerer of a connection perform different actions while handshaking. The modem does not accept AT commands or pass data from the terminal while handshaking.

ON-LINE

After successfully completing Handshaking the modems enter the ON-LINE state. When a modem is in the ON-LINE state, data received from its terminal is sent over the telephone line to the other modem. Data received from the other modem is sent to the terminal.

COMMAND

If the terminal sends a special escape sequence to a modem in the ON-LINE state, the modem enters the COMMAND state. During COMMAND state the modem maintains the connection with the other modem but does not pass data between the terminal and the other modem. Instead, data received from the terminal is treated as AT commands in the same way as if the modem was in the Idle state. The modem can be returned to the ON-LINE state by the O command. Data received from the other modem while a modem is in COMMAND state is discarded unless the modem can buffer it for display on the terminal when the modem re-enters the ON-LINE state.

Retrain

During a telephone line connection, the modem tries to remain synchronized with the remote modem by adapting to changes in telephone line connection and bridging transient noises such as call waiting, analog switching and cross talk. In V.22bis and higher speed data modes, if the modem loses synchronization with the remote modem data can not be received until synchronization is restored by a process called Retraining. During Retraining the modem accepts data and commands from the terminal but does not transmit data to, or receive data from, the other modem.

AT Command Set

Command lines are typed to the modem from the terminal when the modem is in the IDLE or COMMAND state. The modem does not execute any of the commands in a command line until after the command line is ended by the end-of-line character <CR>. A command line is a string of characters starting with the A and T characters and ending with a special end-of-line character, <CR>. Characters typed before the AT are ignored. Command lines contain, at most, 40 characters after the AT. The modem does not execute any of the commands in a command line that is too long.

To echo command line characters, use the E1 command.

Typing mistakes can be aborted by using a special BackSpace character, <BS>, after the initial A and T characters are entered.

A partial command line can be aborted by typing a Ctrl-X character. The modem returns an OK result code and ignores the partial AT command line.

Command lines may contain several commands one after another. The Answer (A), Dial (D), and Go ON-LINE (O) commands usually cause the following commands in the command line to be ignored.

Command Line Execution

The characters in a command line are executed one at a time. Any unexpected characters (except control characters) stop command line execution and return an ERROR result code. Unexpected characters include numbers outside the range of values accepted by the command. All control characters in a command line except Ctrl-X (and the special characters such as <CR> and <BS>) are ignored.

The numerical argument of a command is assumed to be 0 if it is not provided. For example, the commands ATH<CR> and ATH0<CR> both hang up the telephone line.

When the modem has executed a command line, the result code of the most recent command executed is returned to the terminal.

If the value written to a modem S-register is outside the range of values accepted by the S-register, then its value is set to the nearest allowed value.

Leading 0s in numeric arguments, including S-register numbers, are ignored. For example, both set S-register S1 to 2:

```
ATS1=2
ATS01=2
```

All numeric arguments, including S-register numbers, are decimal (base 10).

AT Command Prefix

Each modem command line begins with the letters A and T. The modem uses these characters to determine the data rate and parity from the terminal.

A/ Repeat Last Command

To repeat the commands in the most recent command line, type the letters A and / instead of A and T.

<CR> End-of-Line Character

This character is typed to end a command line. The value of the <CR> character is stored in S-register S3. The default value is 13 (the ASCII carriage return character).

When the <CR> character is entered, the modem executes the commands in the command line.

Table 3. AT Command Set

Command		Function and Description
A	Answer	The A command causes the modem to go off-hook and respond to an incoming call. This command is issued after the modem has returned the RING result code. If the modems successfully complete the answering process, each returns a CONNECT result code and enters the ON-LINE state. If no transmit carrier signal is received from the calling modem within the time specified in S-register S7, the modem hangs up, returns the NO CARRIER result code, and enters the IDLE state. If the modem is in the COMMAND state or &Q2 or &Q3 is selected then the ERROR result code is returned. Any commands following the A command on the command line are ignored. This command is aborted if a character is received from the terminal before the answer process is completed, or when DTR drops if certain options in the &Q or &D commands have been used.
Note: North American default values are designated by **bold type**. The operation of these commands, and the default values of option commands, are configurable for operation in different countries.		
B	Communication Standard Option	The B command specifies special telephone line modulation standards required for the connection. The modem can be configured to use: 1 – Bell 212A instead of ITU-T V.22 at 1200 bps 2 – Bell 103 instead of ITU-T V.21 at 300 bps 3 – ITU-T V.23 or Bell 202 in data modes with receive and transmit speeds that differ whether the caller or answerer transmits data at a higher data rate. 4 – In ITU-T V.23 data mode, Minitel line reversals. 5 – ITU-T V.23 or Bell 202T in data modes when the receive and transmit speeds are different, and with a 4-wire telephone interface instead of a 2-wire telephone interface When ON-LINE in data modes with differing receive and transmit speeds (V.23, Bell 202), the modem recognizes only the Escape Sequence (+++) and modem commands at the higher of the speeds. S-register S37 also contributes to the selection of the modulation standard. This register sets the telephone line data rate, and the split rate data mode (Bell 202/ Bell 202T or V.23). Both modems must be configured identically to prevent communication failures caused by incompatible telephone line modulation standards.

Table 3. AT Command Set (Continued)

Command	Function and Description	
	B0	This option specifies the ITU-T modulation standards for all telephone line data rates unless S-register S37 is 2. These rates include V.22 for the 1200 bps telephone line data rate, and V.21 for the 300-bps telephone line data rate. When the value of S-register S37 is 1and the originating modem is transmitting at 75 bps and receiving at 1200 bps, V.23 is utilized. The answering modem transmits data at 1200 bps and receives data at 75 bps. When the value of S-register S37 is 2 and the originating modem is transmitting at 150 bps and receiving at 1200 bps, Bell 202 is utilized. The answering modem transmits data at 1200 bps and receives data at 150 bps.
	B1	This option specifies the Bell modulation standards for 1200 bps and 300 bps telephone line data rates, unless S-register S37 is 1. Bell 212A at 1200 bps is utilized instead of V.22. Bell 212A, V.22 is the default value for North America. Bell 103 is utilized when a 300 bps telephone line data rate is required. If neither the 1200 bps nor 300 bps telephone line data rate are required, then a setting of B1 is ignored and the modem operates as if B0 was set.
	B2	When the value of S-register S37 is 1 and when the originating modem is transmitting at 1200 bps and receiving at 75 bps V.23 B1 is selected. The answering modem transmits data at 75 bps and receives data at 1200 bps. When the value of S register S37 is 2 and when the originating modem is transmitting at 1200 bps and receiving at 150 bps, Bell 202 is utilized. The answering modem transmits data at 150 bps and receives data at 1200 bps. When S-register S37 is set to any value other than 1 or 2, then a setting of B2 operates as if B0 is set.
	B3	This option is the same as B0.

Table 3. AT Command Set (Continued)

Command		Function and Description	
		B4	The Minitel compatibility mode is activated by this command. It defaults to master mode (Tx75/Rx1200) if the modem is the originator. If S-register S37 is 1, Minitel line reversals are supported. Minitel allows a modem using V.23 and transmitting at 75 bps to simultaneously switch its transmitter to 1200 bps and receiver to 75 bps. The other V.23 Minitel modem detects the rate change and switches its transmitter to 75 bps and receiver to 1200 bps. The \R and R commands describe methods of causing a Minitel line reversal during a V.23 connection. When S-register S37 is set to any value other than 1, then a setting of B4 operates as if B0 was set.
		B5	When S-register S37 is 1 (V.23) or 2 (Bell 202T), the modem assumes that a 4-wire telephone connection exists. Both the transmitter and receiver use the 1200 bps telephone line data rate. This mode does not operate properly unless a 4-wire telephone connection exists. When S-register S37 is set to any value other than 1 or 2, the B5 option operates as if B0 is set.
&C	Data Carrier Detect Options	This command determines how the modem's DCD signal relates to the carrier signal (RLSD) from the other modem. This option takes effect only at the beginning of a telephone line connection. If &C is issued from the COMMAND state, no immediate effect results.	
		&C0	During asynchronous operation (&Q0 in effect), DCD is on at all times. During synchronous operation (&Q1, &Q2 or &Q3), DCD reflects the state of the carrier signal from the other modem using S-registers S9 and S10. This command is the default value in North America.
		&C1	This command reflects the state of the carrier signal from the other modem using S-registers S9 and S10.

Table 3. AT Command Set (Continued)

Command		Function and Description	
#CID=	Caller ID Options	This command controls how the modem displays North American caller identification information. If Caller ID has been disabled in the country configuration, the modem responds with an ERROR result code to a #CID= command. Caller ID information is displayed only when it is provided by the telephone company, and only when the terminal data rate is 2400 bps or higher. Lower data rates are too slow to display Caller ID information. The modem receives Caller ID information between telephone rings. The country configuration contains a parameter controlling whether the modem uses Bell 202 or V.23 to receive Caller ID information.	
		#CID=0	This command does not display Caller ID information. This option is the default value.
		#CID=1	This command returns the information as formatted data.
		#CID=2	This command returns the information as unformatted data.
		#CID=?	This command returns the current setting of the #CID=command.
D	Dial	The D command initiates a telephone call using the digits and dial modifiers in the dial string following the command. Any commands following the dial string on a command line are ignored, unless a semicolon is the last character in the dial string. If the modem was already off-hook when the `Dial` command is issued, the modem dials immediately without trying to detect a dial tone. Characters other than digits and dial modifiers in a dial string are ignored; however, ignored characters are counted in the command line buffer. If line-current sensing is enabled and line current is detected before the modem is taken off-hook when the modem must dial, a NO CARRIER result code is displayed and the modem enters the IDLE state. If the modem is not required to perform a dial function (for example, ATD with no dial string), the modem assumes the call was manually established and attempts to make a connection. The X1 command may be used to disable the modem's need to detect dial tone or busy tone before handshaking. The D command is not valid when the modem is in the ON-LINE state or when &Q2 or &Q3 is in effect. See “Dial Modifiers” on page 34 for more information.	