

## CH1756 Global Modem Module

### DESCRIPTION

The Cermetek CH1756 provides a complete, high-speed modem in a compact module. The CH1756 is pin-compatible with the Cermetek CH1794A, CH1799A and CH2056A product lines. The CH1756 provides current users of other Cermetek products with a lower cost, lower power alternative.

The CH1756 supports all of the advanced features expected in the latest embedded modems. These include error correction, non-volatile memory for configuration storage, and stored number dialing. The CH1756 supports both data and fax applications

Every CH1756 includes conveyed FCC Part 68 registration and Global Telecom compatibility. This eases the compliance burden on the system designer adding a modem to a process control, medical monitoring, point-of-sale, or remote diagnostic system.

### MODELS

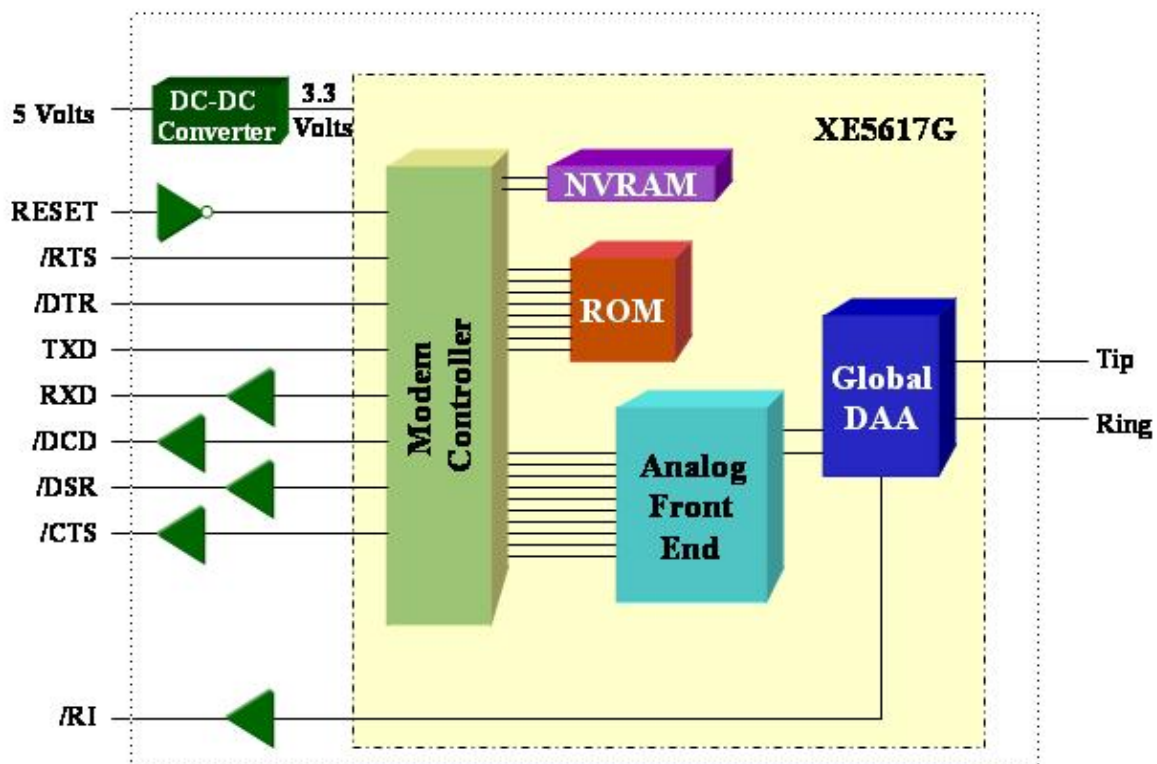
**CH1756** 56K bps; Operating Temp 0°C to 70°C

**CH1756 ET** 56K bps; Operating Temp -40°C to 85°C

### FEATURES

- Small Size: 1.22 inches by 1.02 inches by 0.525 inches
- Data transfer rates; 300 bps to 56,000 bps
- Fax transfer to 14,400 bps
- Control & configuration via AT commands.
- TTL compatible serial interface
- V.42 Error Control and V.42 bis Data Compression
- Complete integrated, Global DAA.
- Nonvolatile configuration storage
- User transferable FCC Part 68 registration
- World-wide telephone network compliance.
- UL60950 Compliant
- Low Power operation; 5 Volts, 100 mA
- RoHS compliant

**Figure 1: Functional Block Diagram of CH1756**



## CH1756 DESIGN NOTES

The following design notes are intended to assist the developer in achieving maximum utility from the CH1756 modem module.

**Power Supply:** The CH1756 modem module involves a complex set of sub-systems. During the course of normal operation the CH1756 decodes analog signals from the telephone line that are in the millivolt range. Steps must be taken by the user to guarantee that power supply noise on all supply lines, including ground, does not exceed 50 mV peak to peak. Any frequency between 20 kHz and 150 kHz must be less than 500 micro volts peak. If necessary, use dedicated power and ground planes. Failure to provide such operating conditions could cause the CH1756 to malfunction or to function erratically.

The CH1756 requires a single +5V  $\pm$  0.5 volt supply. It is recommended that by-pass capacitors be placed on the power supply as close to the modem's supply input as practical. Cermetek recommends a 10  $\mu$ F Tantalum capacitor in parallel with a 0.01  $\mu$ F ceramic capacitor.

**Error Correction:** The CH1756 employs V.42 error correction to preserve data integrity. V.42 error correction monitors blocks of data for errors and executes a retransmission of any data blocks containing errors. The **ATN** command selects the use of error correction in the CH1756. Two modems negotiate error correction on completion of the modem handshake. Both modems must have error correction available for error correction to be successfully negotiated. The **ATW** command causes the modem to report the status of the error correction negotiations as part of the CONNECT response.

**Flow Control:** When error correction or data buffering is employed, flow control is needed to prevent the loss of data due to a buffer overflow. With flow control activated, **AT&K** command, the modem signals the host when its transmit data buffer nears capacity. Likewise the host signals the modem if its input buffer fills. Two methods of signaling can be used: hardware flow control uses the **RTS** and **CTS** control lines for signaling; software flow control employs **XON** and **XOFF** characters in the data stream to signal a buffer full condition.

**Non-Volatile RAM (NVRAM):** The CH1756 incorporates NVRAM to store a user customized modem profile and phone numbers for automated dialing. The **AT&W** command will store the active modem configuration in the NVRAM. The CH1756 is delivered with factory default setup parameter values pre-stored in NVRAM. Refer to Tables 4, 5 and 6 for storable S-Registers and available commands.

The NVRAM can save three telephone numbers with up to 40 digits or modifiers in each telephone number. The **AT&Zn=s** command stores the telephone number dialing string. The individual NVRAM telephone number storage locations are selected by specifying an n of 0, 1, or 2. The **ATDTS=n** command will cause the modem to dial the stored telephone number in location n.

**World-wide Telecom Compliance:** The CH1756 is configurable to meet telecom requirements from around the world. The **AT+GCI** command includes settings for more than 75 countries. Additional countries can be added on request.

**Serial Interface:** The CH1756 connects to the system host through a TTL level serial interface. At a minimum TXD, RXD and Ground must be used. Use of the remaining signals, inputs /RTS, /DTR, and /Reset and outputs /CTS, /DCD, /DSR, and /RI is optional. If you elect to not use the /RTS and /DTR inputs, a 1K pull-down resistor should be installed to force those signals to the active state. If not used the /Reset line should be left open. Any of the outputs which are unused can be left open.

The operation of several interface pins is under AT command control. The **AT&C** command can be used to force /DCD to the active state; The **AT&D** command controls how the modem interprets the status of /DTR; the **AT&S** command allows /DSR to be forced to the active condition. **AT&Q3** allows the modem to deactivate /CTS if the modem's input buffers approach capacity.

## CH1756 AT COMMANDS

Control of the CH1756 relies on "AT" commands. This section describes the AT command format and lists the commands, registers and result codes.

**Command Mode:** The CH1756 enters command mode on power-up, reset, a lost connection, or receipt of the escape code. In command mode the modem accepts commands from the host on transmit data. Appropriate result codes are returned on received data.

**Note:** For backward compatibility some functions are controlled by more than one command. In these instances the last command issued determines the function setting.

**Command Line Format:** AT commands follow a strict format. Each command line, except A/, begins with the prefix AT. The "A" and "T" may be either upper case or both lower case but cannot be of different cases. The modem determines data rate of the host equipment by measuring the width of the incoming bits of the "A" and "T."

Multiple commands may be combined into a single command line of up to 40 characters. Commands are executed in the sequence they appear upon receipt of a carriage return. Spaces inserted into the command line are not placed in the buffer.

The command line can be edited with a backspace before it is executed. The backspace erases the previous character in the command line. Register S5 allows the user to select a character other than backspace to edit the command line.

If the command buffer overflows, the modem issues an "ERROR" result code, and the command line is not executed. Register S3 allows the user to select a character other than a carriage return to terminate the command line.

**Re-Execute Last Command** - The A/ command causes the modem to re-execute the last command line. This is the only command which does not require the "AT" prefix.

**Omitted Parameters** - Most commands include a parameter which determines how the functions will be set. When the command parameter is omitted from the command string, it is assumed to be a 0.

**Escape Characters** - A 3 character escape sequence may be entered to switch the modem into command mode while on line. The escape character, set by Register S2, must be entered 3 times in succession to execute the escape. A command must then be entered within the period defined by S12 to enter command mode. The default escape sequence is "+++."

**Result Codes** - The modem issues a result code after each action. Result codes may be sent as full words, one or two digit numeric codes, or may be disabled all together. Each result code ends with a carriage return when numeric result codes are chosen. When full word result codes are chosen, a Line Feed and Carriage Return precede and follow each result code.

**AT COMMANDS****An asterisk indicates the factory default**

**A - Answer Command** - Causes the modem to immediately go off-hook and attempt link negotiations.

**D - Dial Command** - Causes the modem to go off-hook and dial. Below is a list of the characters accepted in the dialing string.

0-9, A-D, #, \* = Dialing Digits

- L = Redial Last Number Dialed
- P = Pulse dial
- S=n = Dial number stored in location n
- T = Tone dial
- W = Wait for dial tone
- , = Pause for the duration of S8
- ! = Switch hook flash
- ; = Return to the command state
- @ = Wait for 5 seconds of silence

**En - Command Echo** - Determines if the modem returns the commands received from the host.

- n=0 Do not echo commands
- n=1 Enable command echo \*

**Hn - Switch Hook Control** - Controls the connection to the telephone line.

- n=0 Switch hook relay opens; modem on-hook
- n=1 Switch hook relay closes; modem off-hook

**In - Modem Identification** - Provides product data..

- n=0 Modem identity
- n=1 ROM Checksum
- n=2 Verify Checksum,
- n=3 Modem identity
- n=4 Data Pump Firmware Version
- n=5 Code Version
- n=9 Country ID
- n=11 Connection Data

**Ln - Speaker Volume** - Selects speaker output level.

- n=0 Low Volume
- n=1 Low Volume
- n=2 Moderate Volume \*
- n=3 High Volume

**Mn - Speaker Activity** - Selects speaker activity

- n=0 Speaker off
- n=1 Speaker on until carrier received \*
- n=2 Speaker remains on with modem off-hook
- n=3 Speaker on until carrier except during dialing

**Nn - Link Negotiations** - Selects how Register S37 will be used to set the link negotiations

- n=0 Connect only using the speed selected by S37
- n=1 Begin negotiations at the selected speed but allow fallback \*

**On - On Line** - Puts the modem back into data mode from the on-line command mode.

- n=0 Return On Line with no retrain \*
- n=1 Initiate retrain while returning On line.
- n=3 Initiate rate renegotiation on return On line.

**Qn - Responses** - Determines if the modem will send responses to the host.

- n=0 Send responses \*
- n=1 No Responses

**Sr? - Interrogate Register** – Read register value.

**Sr=n - Set Register Value** - Set register value.

**Vn - Result Codes** - Determines what the type of result codes to be issued.

- n=0 Numeric Result Codes
- n=1 English Word Result Codes \*

**Wn - Expanded Result Codes** – Allows inclusion of protocol messages with the Connect responses.

- n=0 Report DTE Receive Speed
- n=1 Report DTE Receive Speed and protocol type
- n=2 Report DCE Receive Speed and protocol \*

**Xn - Result Code Set** - Sets modem responses (see Table 3 on Page 13 for full response set)

- n=0 Allows OK, RING, ERROR, CONNECT and NO CARRIER responses
- n=1 Allows OK, RING, ERROR, CONNECT (with connect speed) and NO CARRIER responses
- n=2 Allows OK, RING, ERROR, CONNECT (with connect speed), NO CARRIER and NO DIALTONE responses
- n=3 Allows OK, RING, ERROR, CONNECT (with connect speed), BUSY, NO CARRIER, and BLACKLISTED responses
- n=4 Allows OK, RING, ERROR, and NO CARRIER responses
- n=5 Allows All responses \*
- n=6 Allows all responses
- n=7 Allows all responses except extended result codes

**Z - Reset** - Causes an immediate modem soft reset and reconfigures the modem to the stored values

**&Cn - Data Carrier Detect Operation** - Determines how the modem will present /DCD.

- n=0 /DCD forced active at all times
- n=1 /DCD indicates modem carrier signal state \*

**&Dn - Data Terminal Ready** - Selects how the modem will react to the removal of /DTR from the host

- n=0 Modem ignores status of /DTR
- n=1 If /DTR is removed with the modem on line, the modem enters on-line command mode
- n=2 /DTR must be active to maintain link \*
- n=3 Reset modem with on to off transition of /DTR.

**&F - Restore Factory Configuration** - Returns modem configuration to its factory settings

**&Kn - Local Flow Control** - Determines the operation of flow control between the modem and local host.

- n=0 No Flow Control
- n=3 RTS/CTS (hardware) Flow Control \*
- n=4 XON/XOFF (software) Flow Control

**&Sn - Data Set Ready** - Determines how the modem will present /DSR to the host.

- n=0 Force /DSR active \*
- n=1 /DSR Indicates the modem's readiness to communicate

**&Tn - Modem Test Modes** - Control diagnostics

- n=0 Terminate Test in Progress
- n=1 Local Analog Loopback test

**&V - View Active Configuration** - Presents current modem configuration information

**&W - Store Active Configuration** - Places the current configuration into the selected memory location where it can be recalled on a soft reset.

**&Zx=n - Store Number n in Location "x"** - Permits placement of a telephone number in the selected memory location. Dialing the stored number is accomplished with the s=n dial modifier where n is the memory location of the stored number.

- x=0 Location 0
- x=1 Location 1

**\Gn - In Band Flow Control** - Determines how the modem handles received XON and XOFF flow control characters.

- n=0 Act on received XON and XOFF characters
- n=1 Pass XON/XOFF characters in data stream

**\Kn - Response to receipt of Break Signal (Data Mode)** Determines how the modem will handle a received break signal

- n=0 Enter on-line command mode, do not transmit break
- n=1 Clear data buffers, transmit break
- n=2 same as n=0
- n=3 Immediately transmit break
- n=4 same as n=0
- n=5 Transmit nondestructive break in sequence with data

**\N - Error Control Mode** - Selects which protocols will be used during data connections.

- n=0 Buffer Data, No Error Control
- n=1 Direct mode, No Error Control, No buffered data
- n=2 MNP Error Correction required
- n=3 Auto Error Correction \*
- n=4 V.42 Required
- n=5 same as n=3
- n=7 same as n=3

**+ER=n - Error Control Reporting** - Determines if the Error Control status of the connection will be reported.

- 0 = Error Control Report enabled \*
- 1 = Error Control Report Disabled

**-V90=r - Select V.90 downstream data rate** - selects the downstream data rate during a V.90 connection.

- r=0 V.90 disabled
- r=1 Auto negotiate data rate
- r=2 28,000 bps
- r=3 29,333 bps
- r=4 30,666 bps
- r=5 32,000 bps
- r=6 33,333 bps
- r=7 34,666 bps
- r=8 36,000 bps
- r=9 37,333 bps
- r=10 38,666 bps
- r=11 40,000 bps
- r=12 41,333 bps
- r=13 42,666 bps
- r=14 44,000 bps
- r=15 45,333 bps
- r=16 45,666 bps
- r=17 48,000 bps
- r=18 49,333 bps
- r=19 50,666 bps
- r=20 52,000 bps
- r=21 53,333 bps

**+FCLASS = a Select Service Class - Selects modem operating mode.**

- 0 = Data Mode
- 1 = Class 1 Fax Mode
- 8 = Select Voice Mode

**+GCI = a Country Selection (Hex code) - Chooses the modem's country configuration. The country configuration is always stored in nonvolatile memory.****a - Country Code**

- 00 = Japan
- 04 = Germany
- 07 = Argentina
- 09 = Australia
- 0A = Austria
- 0D = Bangladesh
- 0E = Barbados
- 0F = Belgium
- 14 = Bolivia
- 16 = Brazil
- 19 = Bulgaria
- 1E = Belarus
- 20 = Canada
- 25 = Chile
- 26 = People's Republic of China
- 27 = Columbia
- 2B = Costa Rica
- 2D = Cyprus
- 2E = Czech Republic
- 31 = Denmark
- 35 = Ecuador
- 36 = Egypt
- 3C = Finland
- 3D = France
- 46 = Greece
- 49 = Guatemala
- 50 = Hong Kong
- 51 = Hungary
- 52 = Iceland
- 53 = India
- 54 = Indonesia
- 57 = Ireland
- 58 = Israel
- 59 = Italy
- 5E = Jordon
- 61 = Korea
- 62 = Kuwait
- 64 = Lebanon
- 69 = Luxembourg
- 6C = Malaysia
- 70 = Malta
- 73 = Mexico
- 77 = Morocco
- 7B = Netherlands

- 7E = New Zealand
- 7F = Nicaragua
- 82 = Norway
- 83 = Oman
- 84 = Pakistan
- 85 = Panama
- 87 = Paraguay
- 88 = Peru
- 89 = Philippines
- 8A = Poland
- 8B = Portugal
- 8C = Puerto Rico
- 8E = Romania
- 98 = Saudi Arabia
- 9C = Singapore
- 9F = South Africa
- A0 = Spain
- A1 = Sri Lanka
- A5 = Sweden
- A6 = Switzerland
- A9 = Thailand
- AE = Turkey
- B2 = Ukraine
- B3 = United Arab Emirates
- B4 = United Kingdom
- B5 = United States
- B7 = Uruguay
- BB = Venezuela
- BC = Vietnam
- C1 = Serbia and Montenegro
- F8 = Latvia
- F9 = Lithuania
- FC = Slovakia
- FD = Slovenia
- FE = Taiwan

**+IFC = a,b Local Flow Control - Selects the flow control settings for the modem.****a - DTE control of data from DCE**

- 0 = No Flow Control
- 1 = XON/XOFF (Software Flow Control)
- 2 = RTS/CTS (Hardware Flow Control) \*

**b - DCE control of data from DTE**

- 0 = No Flow Control
- 1 = XON/XOFF (Software Flow Control)
- 2 = RTS/CTS (Hardware Flow Control) \*

**+ILR=a - Report Serial Data Rate - Determines if the local serial data rate will be reported as part of the Connect message.**

- 0 = Do not transmit local serial data rate with the Connect response
- 1 = Transmit the local serial data rate as part of the Connect message.

**+IPR=a - Fix Serial Data Rate** - Sets the speed of the serial interface to a predetermined rate.

a - Data Rate Setting

0	=	Automatic rate detection
110	=	100 bps
300	=	300 bps
600	=	600 bps
1200	=	1200 bps
2400	=	2400 bps
4800	=	4800 bps
9600	=	9600 bps
14400	=	14,400 bps
19200	=	19,200 bps
38400	=	38,400 bps
57600	=	57,600 bps
115200	=	115,200 bps

**+MS=a,b,c,d,e,f - Select Modulation** - Selects the starting modulation for link negotiations/

a - Carrier

V.92	=	V.92 connection *
V.90	=	V.90 connection
V34	=	V.34 connection
V32B	=	V.32bis connection
V32	=	V.32 connection
V22B	=	V.22bis connection
V22	=	V.22 connection
Bell212A	=	Bell 212A connection
V23C	=	V.23 connection
V21	=	V.21 connection
Bell103	=	Bell 103 connection

b - Automatic Modulation negotiations

0	-	Disabled
1	-	Enabled *

c - Minimum receive data rate (300 to 2400 bps)

d - Maximum receive data rate (300 to 2400 bps)

e - Minimum transmit data rate (300 to 2400 bps)

f - Maximum transmit data rate (300 to 2400 bps)

## Voice Commands

**+FClass=8 - Enter Voice Mode**

**+VCID=n Caller ID Options**

n=1	Disable Caller ID
n=2	Enable formatted Caller ID
n=3	Enable unformatted Caller ID

**+VDR=a,b Distinctive Ring**

a=0	Disable Distinctive Ring
a=1	Enable Distinctive Ring
b=0-255	delay in Ring Result code (b x 0.1 seconds)

**+VEM=<mask> Event Reporting and masking**  
nask=bits 0-33 (FFFFFFFFC)

**+VGM=n Microphone Gain**

n=0-255	Microphone Gain (128 nominal value)
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**+VGR=n Receive Gain**

n=0-255	Receive Gain (128 nominal value)
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**+VGS=n Speaker Gain**

n=0-255	Speaker Gain (128 nominal value)
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**+VGT=n Speaker Volume Control**

n=0-255	Speaker Volume (128 nominal value)
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**+VIP Initialize Voice Parameters**

**+VIT=t DTE/DCE Inactivity Timer**

t=0-255	seconds
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**+VNH=n Automatic DCE Disconnect**

n=0	DCE Disconnect enabled
n=2	DCE Disconnect disabled

**+VLS=n Speakerphone Selection**

n=0	Speakerphone off
n=5	Speakerphone Mute Operation
n=7	Normal Speakerphone Operation

**+VRA=n Wait After Ringback Tone**

n=0-255	Required wait after Ringing (0.1 seconds)
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**+VRN=n No Ringback Tone Delay**

n=0-255	Required delay before off-hook (seconds)
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**+VRX Enter Voice Receive State**

**+VSD=s,i Silence Detection**

s=0-255	sensitivity in -dBm
i=0-255	duration of silence (0.1 seconds)

**+VSM=c,s Voice Compression, sampling rate**

c=128	8-bit Linear Compression, s=7200, 8000, 11025
c=129	16-bit linear Compression, s=7200, 8000, 11025 *
c=130	8-bit A-law Compression, s=8000
c=131	8-bit u-law Compression, s=8000
c=132	IMA ADPCM Compression, s=8000
c=133	G.729 Compression, s=8000

**+VSP=n Speaker Phone**

n=0	Speakerphone Off
n=1	Speakerphone On

**+VTD=t Beep tone Duration**

t=0-400	Beep duration in .01 seconds
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**+VTR Start Full-Duplex Voice Communications**

**+VTS=(string) DTMF string**

string = 0-9, #, *, !	(hook flash), A, B, C, D
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**+VTX Enter Voice Transmit State**

**+FCLASS = a Select Service Class**

- a - Service Class
  - 0 = Data Mode \*
  - 1 = Class 1 Fax Mode
  - 8= Voice Mode

**+FLO = a Flow Control**

- a - Flow Control Type
  - 0 = Flow Control Disabled
  - 1 = XON/XOFF (software flow control)
  - 2 = RTS/CTS (hardware flow control) \*

**+FPR = a Serial Data Rate**

- a - Select Serial Data Rate
  - 0 = Automatic Rate Detection
  - 1 = 2400 bps
  - 2 = 4800 bps
  - 4 = 9600 bps
  - 8 = 19,200 bps
  - 10 = 38,400 bps
  - 18 = 57,600 bps \*

**+FRH = a Receive HDLC Data**

- a - Select Modulation
  - 3 = V.21 Channel 2; 300 bps
  - 24 = V.27ter; 2400 bps
  - 48 = V.27ter; 4800 bps
  - 72 = V.29; 7200 bps
  - 73 = V.17; 7200 bps
  - 74 = V.17 short train; 7200 bps
  - 96 = V.29; 9600 bps
  - 97 = V.17; 9600 bps
  - 98 = V.17 short train; 9600 bps
  - 121= V.17; 12,000 bps
  - 122= V.17 short train; 12,000 bps
  - 145= V.17; 14,400 bps
  - 146= V.17 short train; 14,400 bps

**+FRM = a Receive Data**

- a - Select Modulation
  - 3 = V.21 Channel 2; 300 bps
  - 24 = V.27ter; 2400 bps
  - 48 = V.27ter; 4800 bps
  - 72 = V.29; 7200 bps
  - 73 = V.17; 7200 bps
  - 74 = V.17 short train; 7200 bps
  - 96 = V.29; 9600 bps
  - 97 = V.17; 9600 bps
  - 98 = V.17 short train; 9600 bps
  - 121= V.17; 12,000 bps
  - 122= V.17 short train; 12,000 bps
  - 145= V.17; 14,400 bps
  - 146= V.17 short train; 14,400 bps

**+FRS = a Receive Silence**

- a - Required Silence in 10 msec increments  
values 0 to 255

**+FTH = a Transmit HDLC Data**

- a - Select Modulation see +FRH for selections

**+FTM = a Transmit Data**

- a - Select Modulation see +FRM for selections

**+FTS = a Transmit Silence**

- a - Requires the modem to end transmission and wait before issuing OK response. The wait set by "a" is in 10 millisecond increments. Values of "a" range from 0 to 255.

**CH1756 REGISTER SETTINGS**

- S0 Answer on nth Ring:** S0 sets the modem to automatically answer on the nth ring. Setting S0 to 0 disables automatic answer.  
Range: 0 to 255  
Units Rings  
Default 0
- S1 Ring Count:** S1 is a read-only register showing the number of rings detected. If no ring is detected within 8 seconds, S1 is reset.  
Range: 0 to 255  
Units Rings  
Default 0
- S2 Escape Character:** S2 sets the ASCII escape character. Values 0-127 select valid characters; values 128 to 255 disable the escape sequence.  
Range: 0 to 255  
Units ASCII Character  
Default 43 (+)
- S3 Line Termination Character:** S3 determines the ASCII character which will terminate commands and modem responses.  
Range: 0 to 127  
Units ASCII Character  
Default 13 (Carriage Return)
- S4 Line Feed Character:** S4 sets the ASCII character to act as a line feed in modem responses.  
Range: 0 to 127  
Units ASCII Character  
Default 10 (Line Feed)
- S5 Backspace Character:** S5 defines the ASCII character used as a backspace to edit the command line.  
Range: 0 to 127  
Units ASCII Character  
Default 8 (Back Space)
- S6 Dial Tone Wait Time:** S6 determines how long the modem waits for dial tone before dialing. The Dial Tone Wait Time cannot be set to less than two seconds.  
Range: 0 to 255  
Units Seconds  
Default 3
- S7 Wait for Carrier after Dialing:** S7 determines how long the modem waits for a valid carrier signal after dialing.  
Range: 0 to 255  
Units Seconds  
Default 60
- S8 Comma Pause Time:** S8 defines the duration of the pause initiated by a comma in the dialing string when waiting for a second dial tone.  
Range: 0 to 255  
Units Seconds  
Default 2
- S10 Carrier Off Disconnect Delay:** S10 selects how long carrier must be lost to initiate a modem disconnect.  
.. Range: ... 1 to 255  
.. Units..... 0.1 Seconds  
Default 20
- S11 DTMF Dialing Speed:** S11 determines the DTMF tone duration and spacing.  
Range: 50 to 150  
Units: milliseconds  
Default 55
- S12 Escape Code Guard Timer:** S12 sets the modem guard timer. Anything received before or after the escape sequence, within the guard timer causes the modem to abort the escape.  
Range: 10 to 255  
Units 0.02 Seconds  
Default 50
- S28 V.34 Modulation:** S29 determines if V.34 modulation can be used.  
S28 = 0 V.34 Modulation Disabled  
S28 = 1 V.34 modulation Enabled  
Default 1
- S30 Disconnect Inactivity Timer:** S30 sets how long the modem remains on line with no data flowing. A zero prevents the modem from disconnecting due to inactivity.  
Range: 0-255  
Units: 10 Minutes  
Default: 0
- S35 Calling Tone:** S35 determines if Calling Tone will be present on a data call.  
.. S35 = 0 .. Disabled  
.. S35 = 1 .. Enabled  
Default: 1

**S36 Response to LAPM Negotiation failure:** S36 determines the action taken by the modem if the selected error correction negotiations are unsuccessful.

- 0 = Disconnect
- 1 = Maintain link with no error correction
- 3 = Maintain link with no error correction
- 4 = A MNP negotiation is attempted, disconnect if unsuccessful
- 5 = MNP negotiation attempted, establish normal connection if unsuccessful
- 7 = MNP negotiation attempted, establish normal connection if unsuccessful \*

**S37 Line Data Rate:** S37 sets the maximum line data rate that can be negotiated

- 0 = Automatic rate negotiation \*
- 2 = 1200/75 bps (V.23)
- 3 = 300 bps
- 5 = 1200 bps
- ... 6 = 2400 bps
- ... 7 = 4800 bps
- ... 8 = 7200 bps
- ... 9 = 9600 bps
- ... 10 = 12,000 bps
- ... 11 = 14,400 bps
- ... 12 = 16,800 bps
- ... 13 = 19,200 bps
- ... 14 = 21,600 bps
- ... 15 = 24,000 bps
- ... 16 = 26,400 bps
- ... 17 = 28,800 bps
- ... 18 = 31,200 bps
- ... 19 = 33,600 bps \*

**S38 Downstream Data Rate:** S38 forces a maximum line data rate in V.90 mode

- 0 = V.90 disabled
- 1 = Automatic rate selection \*
- 2 = 28,000 bps
- 3 = 29,333 bps
- 4 = 30,666 bps
- 5 = 32,000 bps
- 6 = 33,333 bps
- 7 = 34,666 bps
- 8 = 36,000 bps
- 9 = 37,333 bps
- 10 = 38,666 bps
- 11 = 40,000 bps
- 12 = 41,333 bps
- 13 = 42,666 bps
- 14 = 44,000 bps
- 15 = 45,333 bps
- 16 = 46,666 bps
- 17 = 48,000 bps
- 18 = 49,333 bps
- 19 = 50,666 bps
- 20 = 52,000 bps
- 21 = 53,333 bps
- 22 = 54,666 bps
- 23 = 56,000 bps

**S48 LAPM Error Control** - S48 allows LAPM Error Control to be enabled or disabled.

- S48 = 128 LAPM Disabled
- S48 = 7 LAPM Enabled
- Default: 7

**Table 1: CH1756 Modem Responses**

<b>Verbose Result Code</b>	<b>Numeric Result Code</b>	<b>Description</b>
<CR><LF>OK<CR><LF>	0<CR>	Command line executed successfully
<CR><LF>CONNECT<CR><LF>	1<CR>	Modem connected to line
<CR><LF>RING<CR><LF>	2<CR>	An incoming Ring has been detected
<CR><LF>NO CARRIER<CR><LF>	3<CR>	Modem lost carrier, does not detect answer tone, or does not detect a carrier signal
<CR><LF>ERROR<CR><LF>	4<CR>	Invalid command received
<CR><LF>CONNECT 1200<CR><LF>	5<CR>	1200 bps connection
<CR><LF>NO DIALTONE<CR><LF>	6<CR>	No Dialtone was detected
<CR><LF>BUSY<CR><LF>	7<CR>	A Busy Tone was detected
<CR><LF>NO ANSWER<CR><LF>	8<CR>	Remote modem did not answer
<CR><LF>CONNECT 2400<CR><LF>	10<CR>	2400 bps connection
<CR><LF>CONNECT 4800<CR><LF>	11<CR>	4800 bps connection
<CR><LF>CONNECT 9600<CR><LF>	12<CR>	9600 bps connection
<CR><LF>CONNECT 14400<CR><LF>	13<CR>	14,400 bps connection
<CR><LF>CONNECT 19200<CR><LF>	14<CR>	19,200 bps connection
<CR><LF>CONNECT 57600<CR><LF>	18<CR>	A connection was established with the DTE rate at 57,600 bps.
<CR><LF>CONNECT 7200<CR><LF>	24<CR>	7200 bps connection
<CR><LF>CONNECT 12000<CR><LF>	25<CR>	12,000 bps connection
<CR><LF>CONNECT 300<CR><LF>	40<CR>	300 bps connection
<CR><LF>CONNECT 21600<CR><LF>	55<CR>	21,600 bps connection
<CR><LF>CONNECT 24000<CR><LF>	56<CR>	24,000 bps connection
<CR><LF>CONNECT 26400<CR><LF>	57<CR>	26,400 bps connection
<CR><LF>CONNECT 28800<CR><LF>	58<CR>	28,800 bps connection
<CR><LF>CONNECT 31200<CR><LF>	59<CR>	31,200 bps connection
<CR><LF>CONNECT 33600<CR><LF>	60<CR>	33,600 bps connection
<CR><LF>CONNECT 32000<CR><LF>	70<CR>	32,000 bps connection
<CR><LF>CONNECT 34000<CR><LF>	71<CR>	34,000 bps connection
<CR><LF>CONNECT 36000<CR><LF>	72<CR>	36,000 bps connection
<CR><LF>CONNECT 38000<CR><LF>	73<CR>	38,000 bps connection
<CR><LF>CONNECT 40000<CR><LF>	74<CR>	40,000 bps connection
<CR><LF>CONNECT 42000<CR><LF>	75<CR>	42,000 bps connection
<CR><LF>CONNECT 44000<CR><LF>	76<CR>	44,000 bps connection
<CR><LF>CONNECT 46000<CR><LF>	77<CR>	46,000 bps connection
<CR><LF>CONNECT 48000<CR><LF>	78<CR>	48,000 bps connection

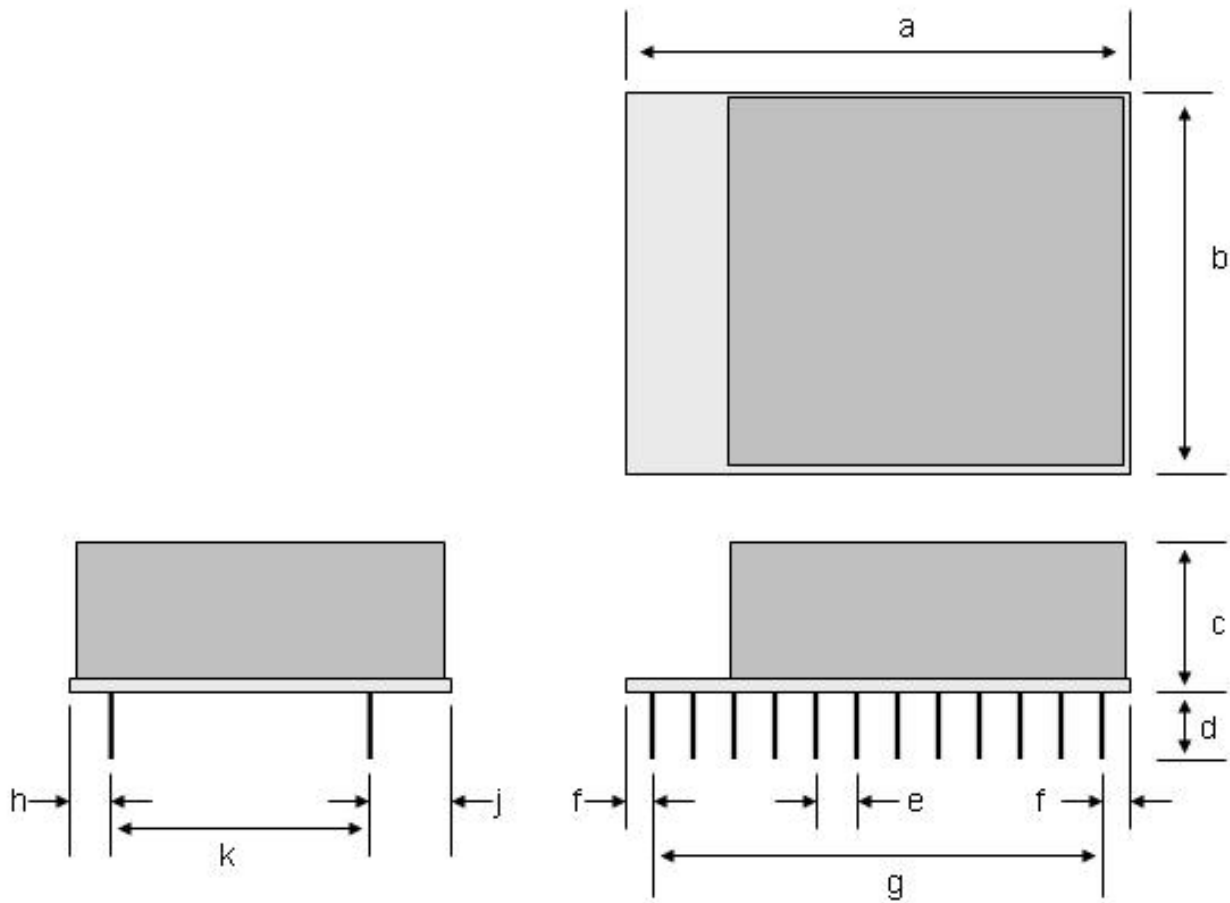
**Table 1: CH1756 Modem Responses (continued)**

<b>Verbose Result Code</b>	<b>Numeric Result Code</b>	<b>Description</b>
<CR><LF>CONNECT 50000<CR><LF>	79<CR>	50,000 bps connection
CR><LF>CONNECT 52000<CR><LF>	80<CR>	52,000 bps connection
CR><LF>CONNECT 54000<CR><LF>	81<CR>	54,000 bps connection
CR><LF>CONNECT 56000<CR><LF>	82<CR>	56,000 bps connection
CR><LF>CONNECT 16800<CR><LF>	86<CR>	16,800 bps connection
CR><LF>CONNECT 115200<CR><LF>	87<CR>	A connection was established with the DTE rate at 115,200 bps.
CR><LF>DELAYED<CR><LF>	88<CR>	Dialing of the current number is delayed because of successive failed attempts
CR><LF>BLACKLISTED<CR><LF>	89<CR>	Dialing failed because the number is blacklisted
CR><LF>BLACKLIST FULL<CR><LF>	90<CR>	The buffer for storing blacklisted numbers is full
CR><LF>CONNECT 28000<CR><LF>	100<CR>	28,000 bps connection
CR><LF>CONNECT 29333<CR><LF>	101<CR>	29,333 bps connection
CR><LF>CONNECT 30666<CR><LF>	102<CR>	30,666 bps connection
CR><LF>CONNECT 30333<CR><LF>	103<CR>	30,333 bps connection
CR><LF>CONNECT 34666<CR><LF>	104<CR>	34,666 bps connection
CR><LF>CONNECT 37333<CR><LF>	105<CR>	37,333 bps connection
CR><LF>CONNECT 38666<CR><LF>	106<CR>	38,666 bps connection
CR><LF>CONNECT 41333<CR><LF>	107<CR>	41,333 bps connection
CR><LF>CONNECT 42666<CR><LF>	108<CR>	42,666 bps connection
CR><LF>CONNECT 45333<CR><LF>	109<CR>	45,333 bps connection
CR><LF>CONNECT 46666<CR><LF>	110<CR>	46,666 bps connection
CR><LF>CONNECT 49333<CR><LF>	111<CR>	49,333 bps connection
CR><LF>CONNECT 50666<CR><LF>	112<CR>	50,666 bps connection
CR><LF>CONNECT 53333<CR><LF>	113<CR>	53,333 bps connection
CR><LF>CONNECT 54666<CR><LF>	114<CR>	54,666 bps connection

The following responses are appended to Connect responses when extended result codes are selected, ATW.

<b>Response</b>	<b>Description</b>
V.44	V.44 Data Compression
V.42	V.42 error correction protocol negotiated
V.42bis	V.42bis data compression protocol negotiated
MNP4	MNP4 error correction negotiated
MNP5	MNP5 error correction negotiated
NoEC	No Error Control active on this link

**Figure 2: CH1756 Mechanical Specifications**



**Table 2: CH1756 Mechanical Specifications**

DIMENSION	TYP	DESCRIPTION
a	1.22	Module Length in inches
b	1.02	Module Width in inches
c	0.52	Module Height in inches
d	0.050	Lead Length in inches
e	0.10	Centerline to centerline distance between adjacent pins in inches
f	0.05	Center of last pin to edge of module in inches
g	1.10	Pin row Length in inches
H	0.05	Center of pin row to module edge in inches
j	0.18	Center of pin row to module edge in inches
k	0.80	Centerline to centerline distance between pin rows in inches



**CH1756 PIN DESCRIPTIONS (continued)**

<b><u>PIN</u></b>	<b><u>SIGNAL</u></b>	<b><u>DESCRIPTION</u></b>
14	/DSR	/DSR is an active low output from the modem. The /DSR signal typically indicates that the modem has established a communications link. The AT&S command determines the operation of the /DSR signal.
15	/RI	The /RI signal reports on the presence of an incoming ring signal. When a ring occurs across Tip and Ring, the /RI output goes low and toggles with the cadence of the ring signal.
16	/CTS	/CTS is an active low output from the modem. When hardware flow control is set, the modem asserts /CTS to indicate that it can accept data from the terminal equipment on /TXD.
17	/DCD	/DCD is an active low output from the modem. /DCD normally indicates that the modem has detected a valid carrier signal from the remote modem. The AT&C command controls when the CH1756 asserts /DCD.
18	N/C	No Connection should be made to this pin.
19	VCC	VCC provides 5 volt power to the modem.
20	Ground	Ground provides the reference voltage for all host interface signals.
21	RESET	RESET is an active high input which initiates a modem hardware reset. RESET must be active for a minimum of 100 milliseconds for a proper modem reset sequence. No external reset is required; if none is used the RESET signal should be left open.
22	/RTS	/RTS is an active low input to the modem. When hardware flow control is set, an active /RTS indicates to the modem that the host has data to send.

**Table 3: CH1756 Electrical Specifications**

Parameter	Minimum	Typical	Maximum	Units	Notes
VCC		5.0		Volts	
ICC		100		mA	During Data Transfer
Ring Voltage Detected	26		150	V <sub>RMS</sub>	Type B Ringer
Ring Frequencies Detected	15.3		68	Hz	Type B Ringer
Telephone Line Loop Current	10	20	100	mA	Off-Hook
Line Impedance		600		Ohms	
Transmit Level			-9.0	dBm	Data Transfer
			0.0	dBm	DTMF Signaling
V <sub>OH</sub>			2.6	Volts	
V <sub>OL</sub>			0.4	Volts	
V <sub>IH</sub>	2.31		5.5	Volts	
V <sub>IL</sub>	-0.3		0.99	Volts	
EXT CLK		27.0		MHz	± 50 PPM

**Table 4: CH1756 Absolute Maximum Ratings**

Parameter	Minimum	Typical	Maximum	Units	Notes
Storage Temperature	-40°		85°	Celsius	
VCC			4.2	Volts	
V <sub>IH</sub>			5.7	Volts	5 Volt tolerant Interface
Operating Temperature	0°		70°	Celsius	CH1756
	-40°		85°	Celsius	CH1756 ET

**Model Numbers**

Cermetek offers a couple of variations of the CH1756. Variants include modems utilizing an external system clock and those supporting an extended operating temperature range. Table 5 below lists the available CH1756 models.

**Table 5: CH1756 Model Numbers**

Model	Summary of Features
<b>CH1756</b>	2400 bps modem; Error Correction; NVRAM; Operating Temp 0°C to 70°C
<b>CH1756 ET</b>	2400 bps modem; Error Correction; NVRAM; Operating Temp -40°C to 85°C

## FCC INSTRUCTIONS

### ACTA Product Registration Number: US: DWEMM01BXE5617G

This equipment complies with TIA/EIA/IS-968 rules. Located on the equipment is a label that displays the FCC registration number. The FCC registration number includes information on the manufacturer, model number and ringer equivalence of the connection to the telephone network. If requested this information must be provided to the telephone company.

The ringer equivalence is used to determine the quantity of devices which may be connected to a telephone line. An excessive number of devices on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the Ringer Equivalence Numbers should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total Ringer Equivalence Numbers, contact the local telephone company for the maximum Ringer Equivalence for the calling area.

This equipment cannot be used on the telephone company-provided coin service. Connection to party Line Service is subject to State Tariffs.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe this is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advanced notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

If trouble is experienced with this equipment, please contact;

Company Name: Cermetek Microelectronics, Inc.  
Address: 374 Turquoise Street, Milpitas, CA 95035  
Telephone: 408-942-2200  
Fax: 408-942-1346

If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved.

This equipment uses the following USOC jacks: RJ11C

It is recommended that the customer install an AC surge arrester in the AC outlet to which this device is connected. This is to avoid damaging the equipment caused by local lightning strikes and other electrical surges.

Cermetek reserves the right to make changes in specifications at any time and without notice. The information furnished by Cermetek in this publication is believed to be accurate and reliable. However, Cermetek assumes no responsibility for its use, or for any infringements of patents or other rights of third parties resulting from its use. No license is granted under any patents or patent rights of Cermetek.

Cermetek provides the user with a FCC (USA) Approved module. However, Cermetek does not have influence over nor knowledge of the specific user application environment. Therefore, for FCC Approved or Approvable devices, the user assumes all risk for maintaining compliance to registration.

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