

CH1724 Low-cost Modem Module

DESCRIPTION

The Cermetek CH1724 is a complete, low-speed modem in a compact module format. The CH1724 is a leadless surface mount, SMD, module. The CH1724 requires less than half the board space of the leading competitor and is less than half as tall as well.

Despite being a low cost module, the CH1724 includes many advanced features such as; error correction, non-volatile memory for configuration storage and stored number dialing, and shared line features thereby permitting the CH1724 to unobtrusively share the telephone line with standard telephones and other equipment.

Every CH1724 includes conveyed FCC Part 68 registration and Global Telecom compatibility. This eases the compliance burden on the designer adding of security, process control, medical monitoring, point-of-sale, or remote diagnostic systems.

MODELS

CH1724 - 2400 bps; 0°C to 70°C

CH1724S - 2400 bps; Security Protocols, 0°C to 70°C

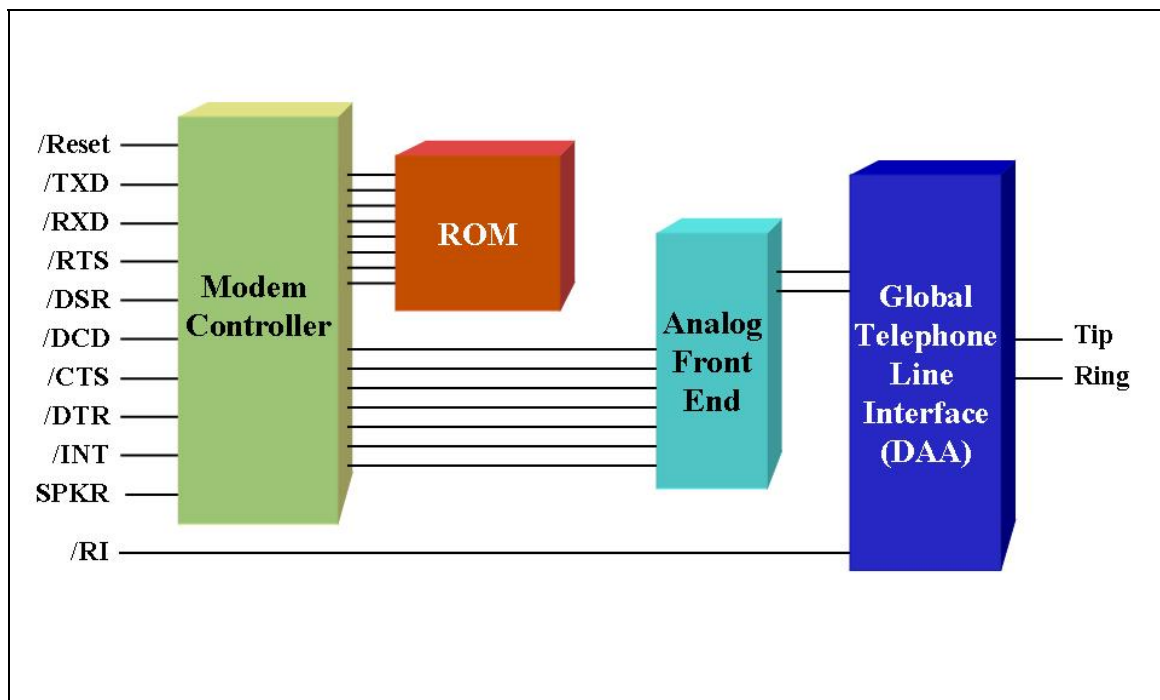
CH1724 ET - 2400 bps; -40°C to 85°C

CH1724S ET - 2400 bps; SIA Protocols, -40°C to 85°C

FEATURES

- Small Size: 1.6" x 0.8" x 0.220"
- Data transfer rates; 300 bps to 2400 bps
- Control & configuration via AT commands.
- 3.3 and 5 volt compatible serial interface
- MNP Error control
- Shared line features prevent modem operation from interfering with voice communications.
- Complete integrated, Global DAA.
- Nonvolatile configuration storage
- Contact ID and SIA Format Security protocols
- SDLC Data Format
- User transferable FCC Part 68 registration
- Industry Canada CS-03 Registration
- World-wide telephone network compliance.
- UL60950 Compliance
- Low Power operation; 3.3 Volts, 130 mW
- RoHS compliant

Figure 1: Functional Block Diagram of CH1724



CH1724 DESIGN NOTES

The following design notes are intended to assist the developer in achieving maximum utility from the CH1724 modem module.

Power Supply: The CH1724 modem module involves a complex set of sub-systems. During the course of normal operation the CH1724 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 CH1724 to malfunction or to function erratically.

The CH1724 requires a single $+3.3V \pm 0.3$ 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 μ F Tantalum capacitor in parallel with a 0.01 μ F ceramic capacitor.

Error Correction: The CH1724 employs MNP error correction to preserve data integrity. MNP 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 CH1724. 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.

Shared Line Features: The CH1724 includes a line monitor function to prevent the modem from interfering with other devices connected to the same telephone line. Both loop current and voltage are monitored to prevent the modem from interrupting an ongoing call or blocking an emergency call from being made. The shared line features are controls with the **ATLS** command

Non-Volatile RAM (NVRAM): The CH1724 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 CH1724 is delivered with factory default setup parameter values pre-stored in NVRAM.

The **AT&Yn** command selects the modem configurations to be automatically recalled and made active upon a reset or power up. The **ATZn** command immediately recalls and activates a stored profile configuration. Refer to Tables 4, 5 and 6 for storable S-Registers and available commands.

The NVRAM can save two telephone numbers with up to 60 digits or modifiers in each telephone number. The **AT&Zn=s** command will store s, the telephone number dial string. The individual NVRAM telephone number storage locations are selected by specifying an n of 0 or 1. The **ATDTS=n** command will cause the modem to dial the stored telephone number in location n.

World-wide Telecom Compliance: The CH1724 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 CH1724 connects to the system host through a 5 volt tolerant 3 volt 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 used 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&K3** allows the modem to deactivate /CTS if the modem's input buffers approach capacity.

CH1724 AT COMMANDS

Control of the CH1724 relies on "AT" commands. This section describes the AT command format and lists the commands, registers and result codes.

Command Mode: The CH1724 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 60 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.

SECURITY STANDARDS

The CH1724S supports a pair of Security industry Association standard protocols; Contact ID (SIA DC-05-1999.09) and SIA Format (SIA DC-03-1990.01). the CH1724S selects both of these protocols with variations on the standard modem AT commands.

Contact ID: Contact ID is selected with the command AT-A1<CR>. With Contact ID selected a modified dialing command is used to transfer the Contact ID message see command below.

ATDT!xxx!1yyyy<CR>

In the above command xxx represents the number to be dialed. The 1 identifies the digits that follow as Contact ID formatted data. The characters YYYY represent the Contact ID message including the CRC. A maximum of 63 characters may be included in the Contact ID message. Additional data can be sent using the AT!1zzz or !zzz commands.

Other commands and registers are also used in the Contact ID messaging. The AT-B command causes the modem to resend the previous Contact ID message. S10, S61, and S90 control the Kissoff tone timing at end the transaction. S42 and S43 control the timing of the handshake tones.

Contact ID mode also uses a unique set of responses as shown below.

```

b Busy Tone Detected
c Connect
K Valid Kissoff Tone Detected
k Kissoff Tone Exceeds the Time Limit Set by S10
N No Carrier Detected
n No Dial Tone Detected
O OK, Valid Command Received
R Ringing
r Ringback Tone Detected
t Dial Tone Detected
^ Kissoff Tone Detection Required
, Dialing Complete

```

SIA Format: The SIA Format is selected with the command AT-A2<CR>. With SIA Format selected a modified dialing command is used to transfer the SIA formatted message see command below.

ATDxx!2YYYY<CR> or ATD!xxx!2yyyy<CR>

In the above command xxx represents the number to be dialed. The d identifies the digits that follow as SIA formatted data. The characters YYYY represent the SIA formatted message. A maximum of 63 characters may be included in the Contact ID message. Additional data can be sent using AT!2zzz.

Other commands and registers are also used in the Contact ID messaging. The AT-E and AT-Q commands determine how an Acknowledgement tone will be handled. AT-R selects the SIA Format Column Parity calculation. S42, S61, S62, S7, S90, S92, S96, S99 and S102 control handshaking in SIA mode.

Contact ID mode also uses a unique set of responses as shown below.

b	Busy Tone Detected
c	Connect
E	Negative Acknowledgement Detected
N	No Carrier Detected
n	No Dial Tone Detected
O	OK, Valid Command Received
P	Positive Acknowledgement Detected
R	Ringing
r	Ringback Tone Detected
t	Dial Tone Detected
T	Acknowledgement Time Out
,	Dialing Complete

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=3	Driver Version Number
n=4	Data Pump Firmware Version
n=9	Country ID
n=11	Connection Data (see page ?)

Ln - Speaker Volume - Selects speaker output level.

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

LSn – Shared Line Features – Controls modem operation on a shared telephone line.

- n=0 Shared Line Features Disabled *
- n=1 Display Line Voltage Value
- n=2 Display Line Availability
- n=3 Disconnect on Extension Pickup
- n=4 Report Extension Pickup; remain off-hook
- n=5 Display Loop Current Value
- n=6 Display Line Sense Thresholds
- n=7 Do not go off-hook; if line unavailable, disconnect on extension pickup

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 OK, RING, ERROR, NO CARRIER and NO DIALTONE responses *

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

\Fn - Fast Connect – Controls the V.22 Fast connect and V.23 turn around functions.

- n=0 V.22 Fast Connect and V.23 Turnaround modes disabled.
- n=1 V.22 Fast Connect Enabled
- n=5 V.23 turnaround using RTS
- n=6 V.23 Turnaround using DTR

\Jn - Data Buffer – Determines if data buffers will be used on non-error controlled connections.

- n=0 Data Buffer Enabled *
- n=1 Modem will not connect at a rate faster than the serial interface speed.

\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=6 Ignore the break signal

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

- n=0,1 Buffer Data, No Error Control
- n=2 MNP Error Correction required
- n=3 Auto Error Correction *
- n=6 SDLC Formatted Data

-An – Security Mode – Selects the Security mode used by the modem

- n=0 Normal Operation
- n=1 Contact ID Format
- n=2 SIA DC-03-1990.01 Format

-B – Retransmit Contact ID message – Causes the modem to immediately resend the most recent Contact ID message

-En – Detect SIA Format Acknowledgement Tone – Determines if the modem will detect the SIA Format Acknowledgement Tone.

- n=0 Do not detect Acknowledgement Tone
- n=1 Detect Acknowledgement Tone

-Kn – Response to Invalid SDLC Frame format – Determines how the modem will respond in SDLC mode if the data frame from the host to not conform to the SDLC standard.

- n=0 send "bad crc" message
- n=1 send abort character

-Qn – Hang-up on Receipt of Acknowledgment Tone – This command selects how the modem will disconnect in response to receipt of the Acknowledgement Tone.

- n=0 Do not Disconnect
- n=1 Disconnect upon Timeout
- n=2 Disconnect upon negative acknowledgement
- n=3 Disconnect on positive acknowledgement

-Rn - SIA Format Column Parity Calculation – This command selects whether or not the modem will calculate the Column parity.

- n=0 Do not Calculate Column Parity
- n=1 Calculate column parity

+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

+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	=	Jordan
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	=	110 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

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)

+VCID=n - Caller ID Selection - Controls the use of Caller ID in the CH1724

n=0	Caller ID Disabled
n=1	Caller ID message presented as formatted data.
n=2	Caller ID message presented as raw data.

CH1724 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 50
- 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 Kissoff Tone Window:** This register determines how long the modem will look for the Kissoff Tone during Contact ID operations.
Range: 0 to 255
Units 16 ms
Default 78 (1.248 second window)
- 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
- S29 Hook Flash Duration:** S29 determines the duration of the hook flash generated by the "!" dial modifier.
Range: 0 to 255
Units 0.01 Seconds
Default 70
- 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
- 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
 - 7 = 2400 bps
- S42 Data Delay Timer** – S42 sets the time during which the received data will be ignored after handshaking is initiated.
- Range: 0 to 255
Units 2 milliseconds
Default 125
- S43 Contact ID Handshake Tone Validation Timer** – S43 sets the time allotted for the CH1724 to complete handshaking in the Contact ID mode.
- Range: 0 to 255
Units 1 milliseconds
Default 50
- S61 Acknowledgement Tone Validation Timer** – S61 sets the time allotted for the CH1724 to detect the acknowledgement or Kissoff tones in Security modes.
- Range: 0 to 255
Units 8 milliseconds
Default 35 (280 milliseconds)
- S62 SIA Handshake Tone Validation Timer** – S62 sets the time allotted for the CH1724 to detect the handshake tones in SIA mode.
- Range: 0 to 255
Units 8 milliseconds
Default 113 (904 milliseconds)
- S71 Delay Before Looking for Acknowledgement** – S71 determines how long after transmitting a message before the modem looks for the Acknowledgement Tone on SIA mode.
- Range: 0 to 255
Units 8 milliseconds
Default 130 (1.04 seconds)
- S90 Acknowledgement Timeout** – S90 sets the time allotted for the CH1724 to receive an acknowledgement or Kissoff tone in Security modes before disconnecting.
- Range: 0 to 255
Units 16 milliseconds
Default 156 (2.496 seconds)
- S92 Sync Delay** – S92 sets the time between the Handshake Tone and the Synchronization signal in SIA mode.
- Range: 0 to 255
Units 4 milliseconds
Default 120 (480 milliseconds)
- S96 Mute Delay** – S96 determines how long the modem will transmit null characters after the message is sent in SIA mode.
- Range: 0 to 255
Units 1 millisecond
Default 54
- S102 Speed Synchronizatoin Signals:** S102 sets the number of Speed Synchronization Signals to be sent in SIA Format. Each sync signal is 26.67 milliseconds.
- Range: 0 to 255
Units Sync signals
Default 10

Table 1: CH1724 Modem Responses

Verbose Result Code	Numeric Result Code	Description
<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 CARRRIER<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 established. When extended result codes are enabled "MNP4" is added for an error controlled connection and "NoEC" for a normal 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 established. When extended result codes are enabled "MNP4" is added for an error controlled connection and "NoEC" for a normal connection
CR><LF>CONNECT 38400<CR><LF>	28<CR>	A connection was established at the DTE rate of 38,400 bps. When extended result codes are enabled "MNP4" is added for an error controlled connection and "NoEC" for a normal connection
CR><LF>CONNECT 57600<CR><LF>	18<CR>	A connection was established at the DTE rate of 57,600 bps. When extended result codes are enabled "MNP4" is added for an error controlled connection and "NoEC" for a normal connection
CR><LF>CONNECT 115200<CR><LF>	87<CR>	A connection was established at the DTE rate of 115,200 bps. When extended result codes are enabled "MNP4" is added for an error controlled connection and "NoEC" for a normal connection

Figure 2: CH1724 Mechanical Specifications

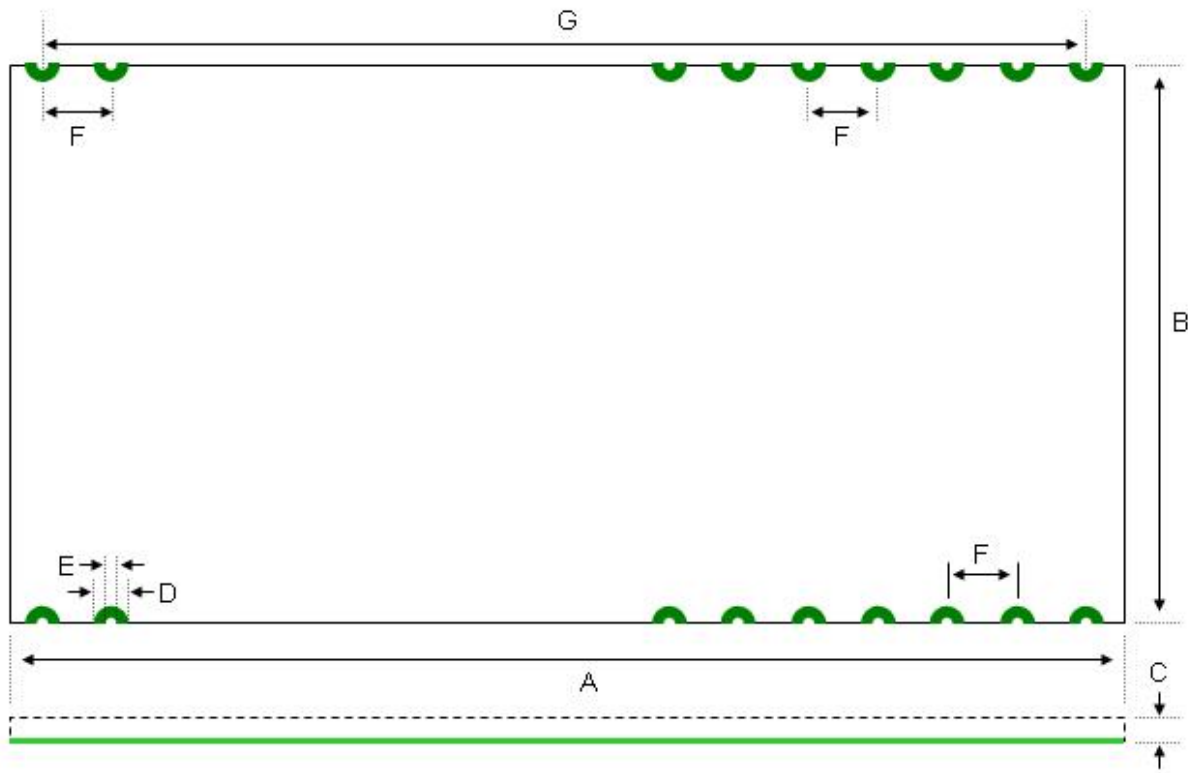
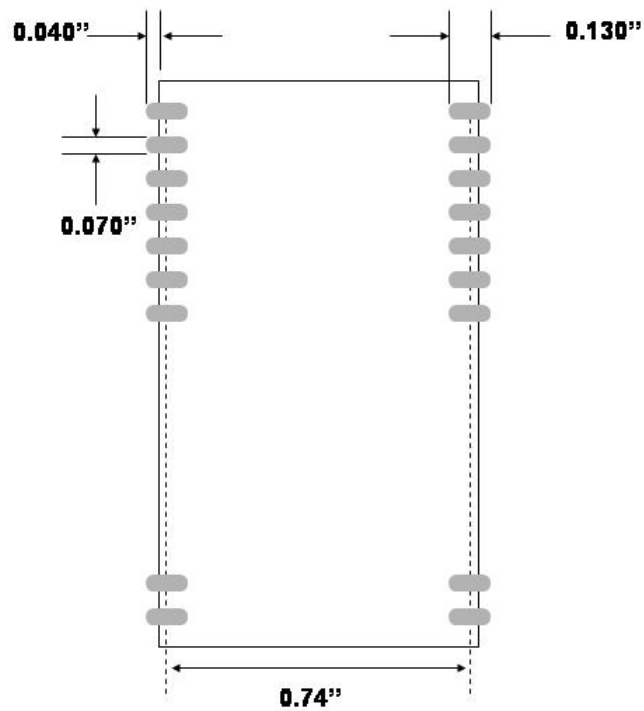


Table 2: CH1724 Mechanical Specifications

DIMENSION	MIN	TYP	MAX	DESCRIPTION
A		1.60		Module Length in inches
B		0.80		Module Width in inches
C		0.220		Module Height in inches
D		0.050		Solder Pad Diameter in inches
E		0.039		Solder Pad Castellation Diameter in inches
F		0.100		Center to center space between Pads in inches
G		1.500		Pin row Length in inches

FIGURE 3: CH1724 RECOMMENDED LANDING PATTERN



Pad Dimensions: Oval 0.130 inches by 0.070 inches

Pad Extension beyond CH1724 PCB: 0.040 inches

Row Center to Row Center: 0.74 inches

Warning: No Vias, Traces or other Copper should be placed under the CH1724C module

CH1724 SURFACE MOUNT SOLDERING INSTRUCTIONS

The CH1724 is subject to damage if over-exposed to heat during solder reflow operations. Following the soldering instructions below will ensure that the process of soldering the module to the board does not damage the modem.

- Absolute Maximum Temperature: 250° C
- Maximum Time at 235° C: 15 Seconds
- Maximum Time in reflow zone (217° C): 90 Seconds
- Maximum Preheat Dwell Time: 180 Seconds

Figure 4: Maximum Recommended Solder Temperature Profile

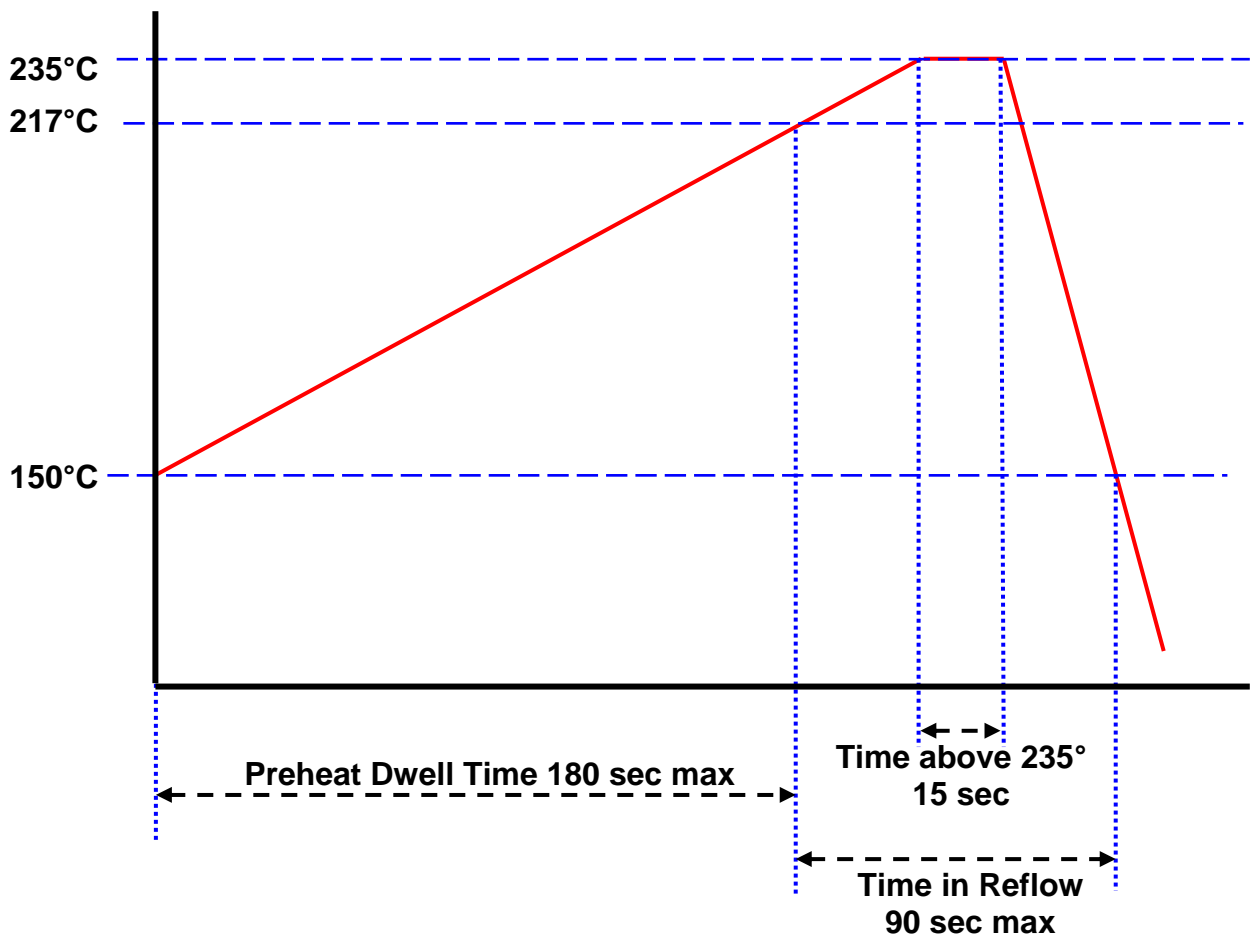
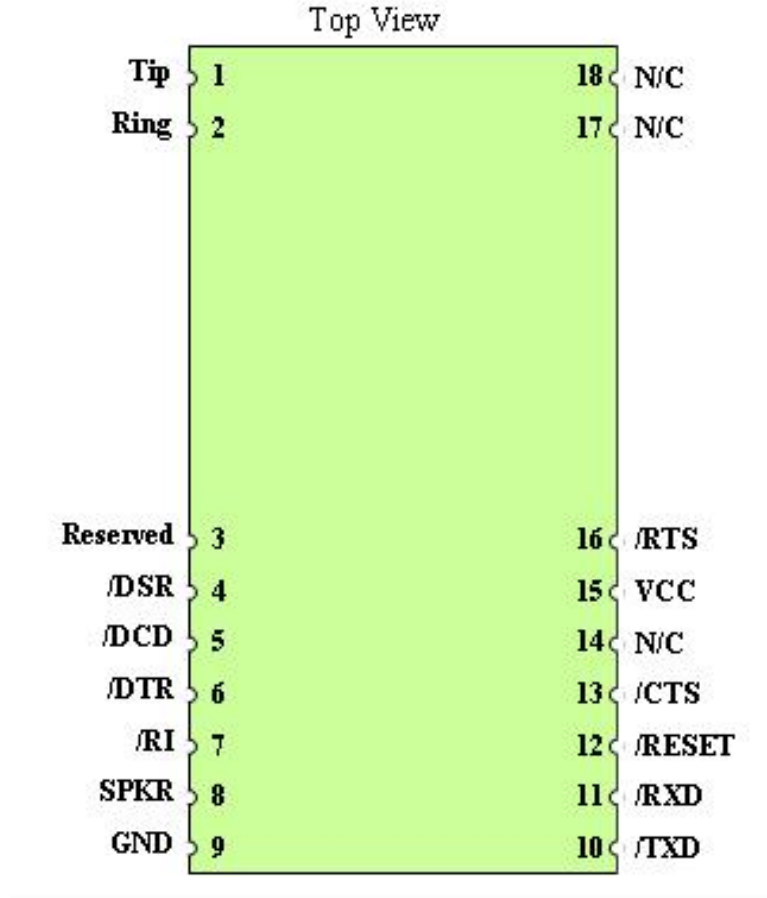


Figure 5: CH1724 Solder Pad Configuration



CH1724 PAD DESCRIPTIONS

PAD	SIGNAL	DESCRIPTION
1	TIP	The Ring and Tip signals connect the modem to the telephone line. FCC Part 68 Rules require 1500 volt isolation barrier between the telephone line and all other circuits. This isolation must be preserved throughout the system. The telephone company places a DC “Battery” voltage across Tip and Ring on public switched telephone lines. The CH1724 operates regardless of the polarity of this voltage. The “Battery” voltage drives up to 100 milliampere of DC loop current. UL60950 requires minimum creepage and clearances distances between the Tip and Ring and all other circuits. Clearance is the shortest distance between conductive circuits; creepage is the distance between conductive points along the surface.
2	RING	The Ring and Tip signals connect the modem to the telephone line. FCC Part 68 Rules require a 1500 volt isolation barrier between the telephone line and all other circuits. This isolation must be preserved throughout the system.
3	Reserved	This pin is reserved for future use. This pin should remain unconnected.
4	/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.

PAD	SIGNAL	DESCRIPTION
5	/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 CH1724 asserts /DCD.
6	/DTR	/DTR is an active low input to the modem. An active /DTR signals traditionally indicates that the terminal is available for communications. The AT&D command determines how the modem interprets activity on /DTR.
7	/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.
8	SPKR	SPKR provides a Pulse Width Modulated version of the signal on Tip and Ring allowing connection of a speaker to the modem to monitor modem operations. The signal on SPKR is controlled by the ATL and ATM commands.
9	Ground	Ground provides the reference voltage for all host interface signals
10	TXD	TXD provides the path for transmitted data and modem commands to be passed from the host controller to the modem. Data starts with a high to low transition. Mark or binary 1 condition is indicated by HIGH
11	RXD	RXD provides the path for received data and modem responses to be sent from the modem to the host controller. Data starts with a high to low transition. Mark or binary 1 condition is indicated by HIGH
12	/RESET	/RESET is an active low 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
13	/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.
14	N/C	No Connection; this pad should remain unconnected.
15	VCC	VCC provides 3.3 volt power to the modem.
16	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.
17	N/C	This pad is provided only for mechanical stability. No electrical connection should be made.
18	N/C	This pad is provided only for mechanical stability. No electrical connection should be made.

Table 3: CH1724 Electrical Specifications

Parameter	Minimum	Typical	Maximum	Units	Notes
VCC	3.0	3.3	3.6	Volts	
ICC		40		mA	During Data Transfer
Ring Voltage Detected	26		150	V _{RMS}	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 _{OH}			2.6	Volts	VCC = 3.3 Volts; I _{OH} = -1.8 mA
V _{OL}			0.4	Volts	I _{OL} = 1.8 mA
V _{IH}	2.31		5.5	Volts	VCC = 3.3 Volts
V _{IL}	-0.3		0.99	Volts	VCC = 3.3 Volts
EXT CLK		27.0		MHz	± 50 PPM

Table 4: CH1724 Absolute Maximum Ratings

Parameter	Minimum	Typical	Maximum	Units	Notes
Storage Temperature	-40°		85°	Celsius	
VCC			4.2	Volts	
V _{IH}			5.7	Volts	5 Volt tolerant Interface
Operating Temperature	0°		70°	Celsius	CH1724
	-40°		85°	Celsius	CH1724 ET

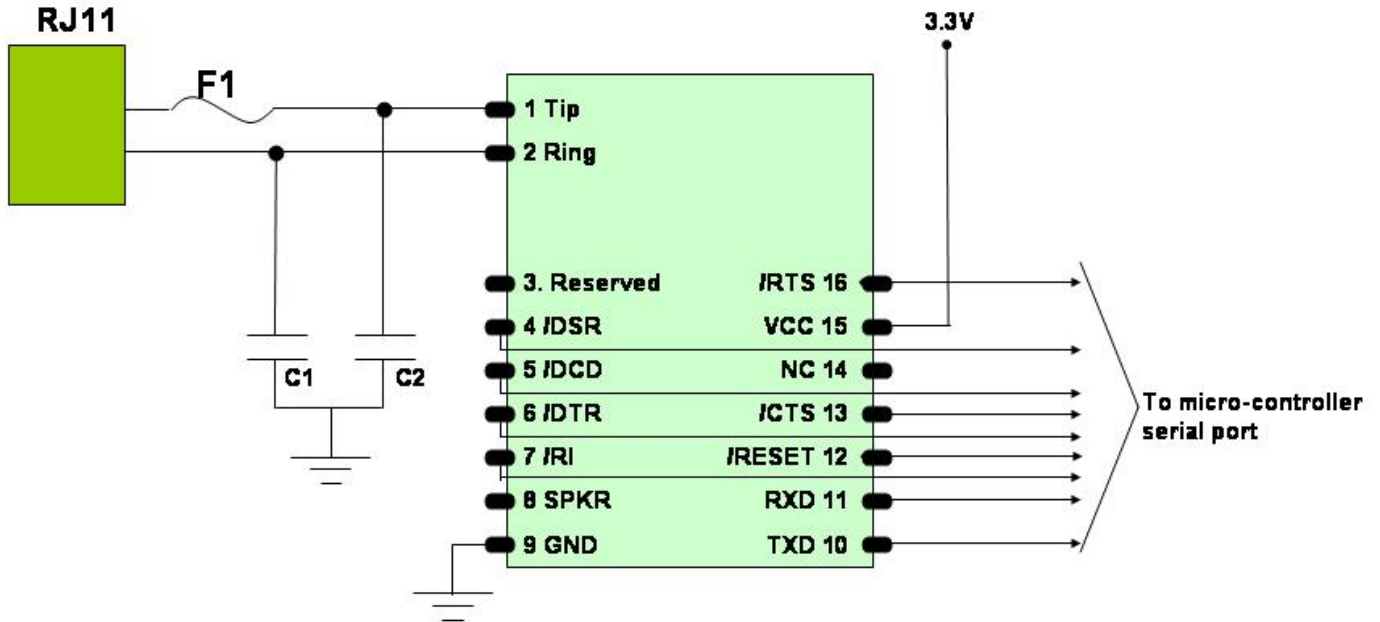
Model Numbers

Cermetek offers a couple of variations of the CH1724. Variants include modems utilizing and external system clock and those supporting an extended operating temperature range. Table 5 below lists the available CH1724 models.

Table 5: CH1724 Model Numbers

Model	Summary of Features
CH1724	2400 bps modem; Error Correction; NVRAM; 0°C to 70°C
CH1724S	2400 bps modem; Error Correction; NVRAM; SIA and Contact ID Security; 0°C to 70°C
CH1724 ET	2400 bps modem; Error Correction; NVRAM; -40°C to 85°C
CH1724S ET	2400 bps modem; Error Correction; NVRAM; SIA and Contact ID Security; -40°C to 85°C

FIGURE 6: CH1724 TYPICAL CONNECTION DIAGRAM



Parts List for CH1724 Typical Connection Diagram

Reference Designation	Qty	Description
C1, C2	2	Cap 680 pFd, Y2
F1	1	PTC, TR600-150

Notes:

1. Capacitors C1 and C2 may be required for EMI filtering in your system. Without these components you may experience unintended radiation when the telephone cable is attached. C1 and C2 are high-voltage capacitors. We recommend the Novocap ES2211N681K502NXTM. This 680 pFd, 5000 volt capacitor will direct high frequency harmonics to the system ground.
2. F1 is a positive thermal coefficient (PTC) device which protects the modem from excessive current flow. This device is required for your system to pass UL60950. Fuses may be used in place of the PTC.

FCC INSTRUCTIONS

ACTA Product Registration Number: US: B46MM01BCH1724

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.

CS-03 Registration # 176A-CH1724

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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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