

CH24606 Telemedicine Modem Module

DESCRIPTION

The Cermetek CH24606 is a complete, low-speed modem compliant with EN60601-1 for medical equipment applications. The CH24606 supports Basic Insulation from the voltages of the telephone network in a compact module. The CH24606 is available as either a leadless surface mount or leaded through-hole module.

In addition to compliance to medical safety requirements, the CH24606 includes many advanced features such as error correction, non-volatile memory for configuration storage and stored number dialing, and shared line features which permit the CH24606 to unobtrusively share the telephone line with standard telephones and other equipment.

In addition to EN60601-1 safety compliance, every CH24606 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

CH24606 2400 bps; Operating Temp 0°C - 70°C

CH24606T Through-hole version of CH24606

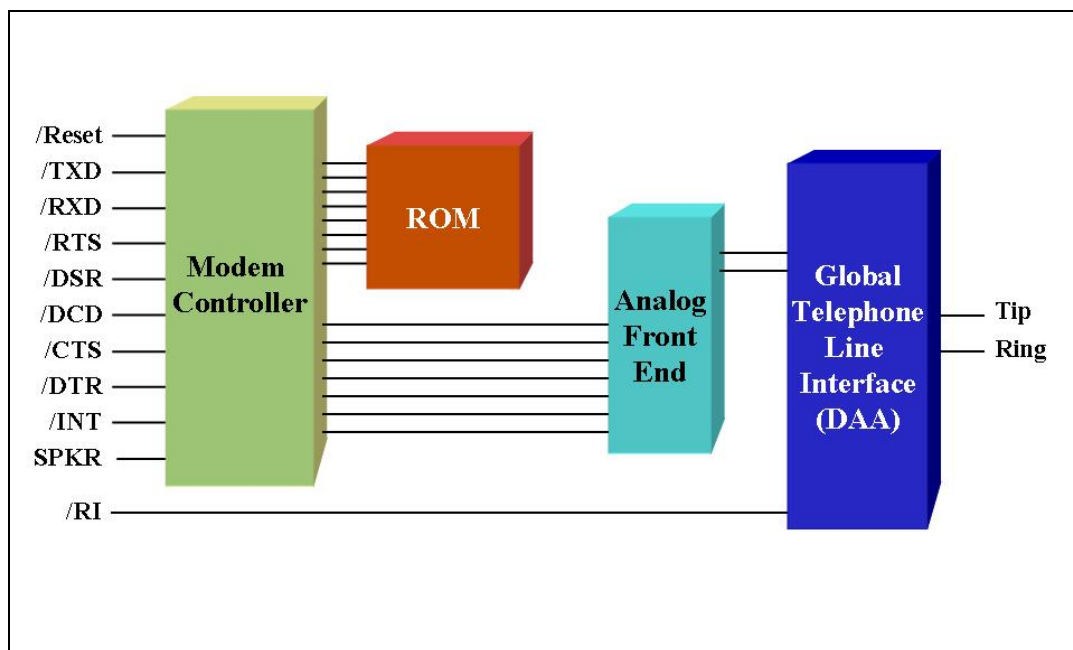
CH24606 ET 2400 bps; Operating Temp -40°C - 85°C

CH24606T-ET Through-hole version of CH24606T

FEATURES

- Small Footprint: 1.2" x 1.0" 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
- Conveyed FCC Part 68 registration
- World-wide telephone network compliance.
- UL60950 Compliance
- EN60601-1 approved
- Low Power operation, 3.3 Volts, 130 mW;
- RoHS compliant

Figure 1: Functional Block Diagram of CH24606



CH24606 DESIGN NOTES

The following design notes are intended to assist the developer in achieving maximum utility from the CH24606 modem module.

Power Supply: The CH24606 modem module involves a complex set of sub-systems. During the course of normal operation the CH24606 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 CH24606 to malfunction or to function erratically.

The CH24606 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 CH24606 employs MNP error correction to preserve data integrity. MNP error correction monitors blocks of data for errors and executes a retransmission of any data block containing errors. The **ATN** command selects the use of error correction in the CH24606. 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 CH24606 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 CH24606 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 CH24606 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 CH24606 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.

EN60601-1 Compliance: EN60601 defines proper system design to insure safety of medical devices. Among the critical requirements of the standard is that there be a substantial isolation barrier between high voltage circuits and the human interface. A Basic Insulation barrier must protect from a 1500 Volt source.

To insure that the 1500 volt barrier is not breached, EN60601-1 requires minimum distances to be maintained between high voltage and low voltage circuits. The telephone line connected to the modem qualifies as a high voltage circuit. A ring signal from the telephone central office can reach up to $150 V_{RMS}$. The clearance distance (the distance through air between any conductor in the high voltage circuit and the nearest conductor in the low voltage circuit) must be at least 2.5 millimeters. In addition the distance between high voltage and low voltage circuits along any surface (creepage distance) must be at least 4 millimeters.

Cermetek has designed the CH24606 with the necessary isolation and creepage and clearance distances to meet the EN60601-1 requirements. To maintain system compliance with that isolation barrier, the user must insure that those creepage and

clearance distances are maintained in the final product.

Serial Interface: The CH24606 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.

CH24606 AT COMMANDS

Control of the CH24606 relies on "AT" commands. This section describes the AT command format and lists the commands, registers and result codes.

Command Mode: The CH24606 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 the transmit data pin (/TXD). Appropriate result codes are returned on the received data pin (/RXD).

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.

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

\N - 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 *

+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 = 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

- 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)

CH24606 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
- 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

Table 1: CH24606 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: CH24606 Mechanical Specifications

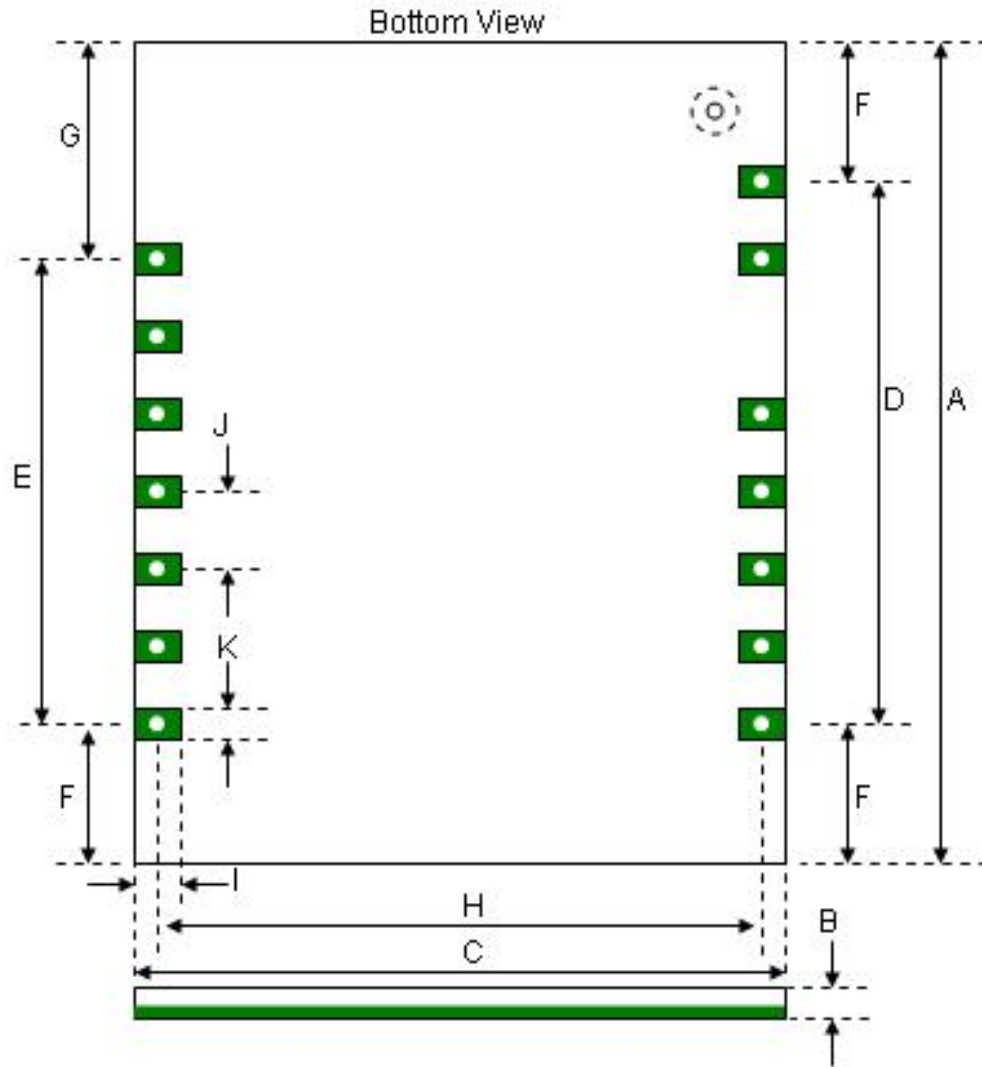


Table 2: CH24606 Mechanical Specifications

DIMENSION	MIN	TYP	MAX	DESCRIPTION
A		1.20		Module Length in inches
B		0.22		Module Height in inches
C		1.00		Module Width in inches
D		0.70		Pad Row Length in inches (Pads 1 to 8)
E		0.60		Pad Row Length in inches (Pads 9 to 15)
F		0.25		Pad 1, Pin 8, or Pin 9 to Module Edge in inches
G		0.35		Pad 15 to Module Edge in inches
H		0.90		Distance between pad rows in inches (center to center)
I		0.10		Pad length in inches
J		0.10		Distance between adjacent pads in inches
K		0.06		Pad width in inches

CH24606 SURFACE MOUNT SOLDERING INSTRUCTIONS

The CH24606 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 3: Maximum Recommended Solder Temperature Profile

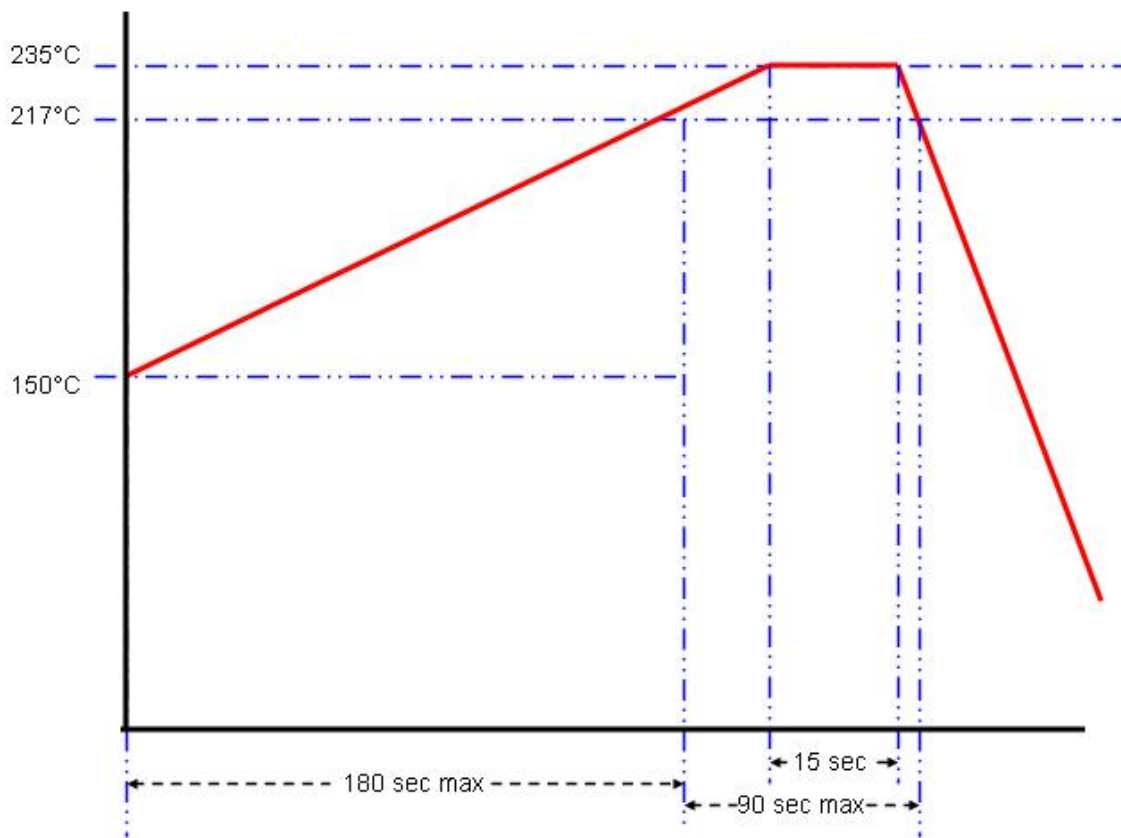
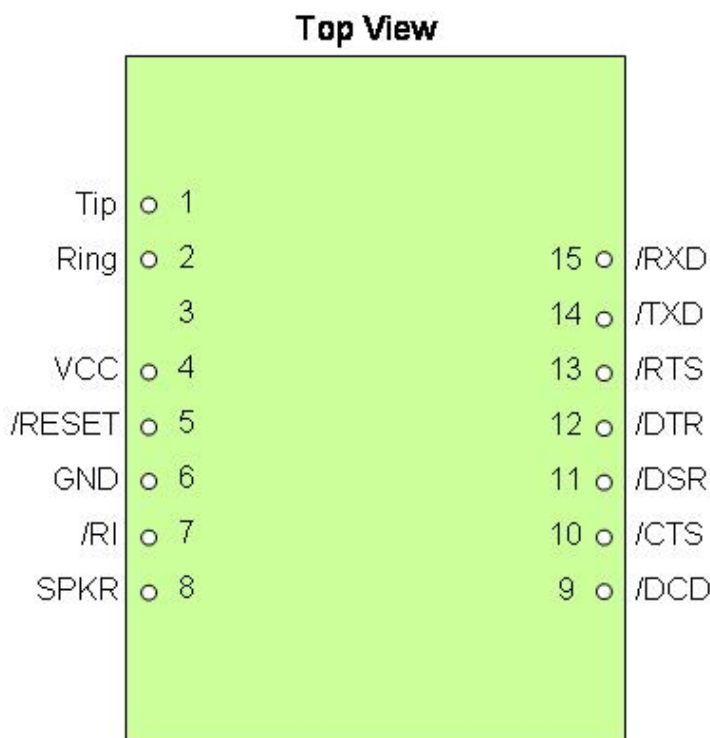


Figure 4: CH24606 Solder Pad Configuration



CH24606 PAD DESCRIPTIONS

Pad Signal Description

1	Tip	<p>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.</p> <p>The telephone company places a DC “Battery” voltage across Tip and Ring on public switched telephone lines. The CH24606 operates regardless of the polarity of this voltage. The “Battery” voltage drives up to 100 milliamps of DC loop current.</p> <p>UL60950 and UL 60601-1 require 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. The minimum clearance distance for a system with basic isolation is 2.5 MM; the minimum creepage distance is 4.0 MM.</p>
2	Ring	<p>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.</p>
3	No Pad	
4	VCC	VCC provides 3.3 volt power to the modem.
5	/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.
6	Ground	Ground provides the reference voltage for all host interface signals.
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 /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 CH24606 asserts /DCD.
- 10 /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.
- 11 /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.
- 12 /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.
- 13 /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.
- 14 /TXD The /TXD input 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.
- 15 /RXD The /RXD output 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.

Table 3: CH24606 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

Table 4: CH24606 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	CH24606
	-40°		85°	Celsius	CH24606 ET

Model Numbers

Cermetek offers a couple of variations of the CH24606. Variants include surface-mount and through-hole models and extended operating temperature range. Table 5 below lists the available CH24606 models.

Table 5: CH24606 Model Numbers

Model	Summary of Features
CH24606	2400 bps modem; SMT, Error Correction; NVRAM; Operating Temp 0°C to 70°C
CH24606T	2400 bps modem; Through-hole, Error Correction; NVRAM; Operating Temp 0°C to 70°C
CH24606 ET	2400 bps modem; SMT, Error Correction; NVRAM; Operating Temp -40°C to 85°C
CH24606T ET	2400 bps modem; Through-hole, Error Correction; NVRAM; Operating Temp -40°C to 85°C

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