NEC INNOVADA

Data Sheet

V850NetChip ISDN Module

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1. Introduction

1.1. Description

The V850NetChip-ISDN module is an ISDN terminal adapter embedded module intended for applications that require a data communications link over the ISDN network. It is a complete module on a small printed circuit board that can be socketed onto the host system mother board. It includes full TCP/IP protocol support, enabling host systems to send and receive e-mails, transfer files and serve Web pages to remote systems. The module is EN60950 certified, and has CTR3 approved for European markets.
It can be used in a variety of applications including credit card authorisation terminals, set top box back channel communication, vending machines, remote utility metering, remote data acquisition and many other applications. It meets those application needs for today's communication requirements, as well as future proofing with the unique in-built zero-cost Internet access feature.

1.2. Features

- Call control protocols: Q.921 (LAPD) and Q.931 D-channel Euro-ISDN (ETSI ETS-300)
- Data protocols: PPP, X.25 on B- and D-channel
- Built-in Internet access support: IP, UDP, TCP protocols included
- X.3/X.28/X.29 PAD command interface
- Command-line interface for TCP/IP control
- Interface: TTL level serial, with data rates of 300 bps to 115 kbps
- Flow control: XON/XOFF (software) or RTS/CTS (hardware)
- Single +5 V power supply
- Dimensions:

1.3. Applications

- Credit card authorization terminals
- Remote utility meters
- Vending machines
- Remote diagnostics
- Remote telemetry
- Remote monitoring
- Embedded applications

2. Mechanical Specifications

The V850NetChip-ISDN is designed to be attached to a host system motherboard using two connectors: the host interface connector and the phone line interface connector.
The V850NetChip-ISDN has pins mounted under each connector for inserting into sockets on the host motherboard. Figures 1 and 2 show outline plan and elevation views of the V850NetChip-ISDN.

Figure 1: Outline plan (component side) of V850NetChip-ISDN

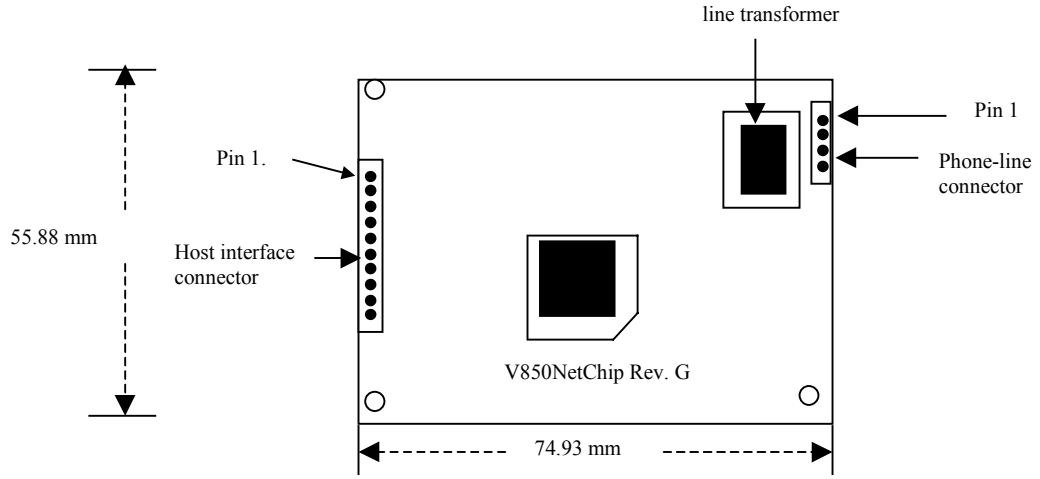
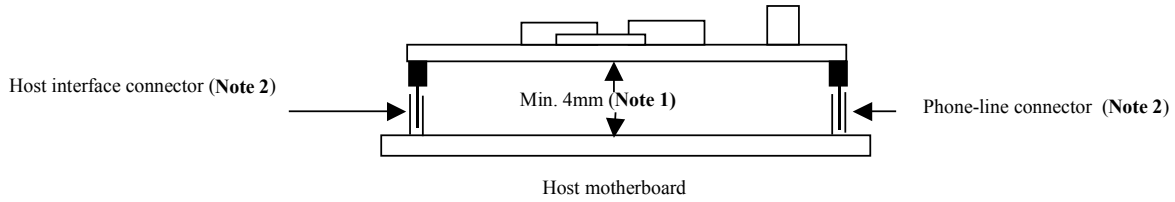


Figure 2: Elevation view of short-format V850NetChip-ISDN



Notes on Figure 2:

1. At least 4 mm clearance or equivalent insulation must be provided between the V850NetChip-ISDN and the host motherboard.
2. The pins for the host interface and phone-line connectors are spaced at 2.54 mm apart.

The V850NetChip-ISDN must always be installed within a unit which includes a fire enclosure that meets the safety requirements of EN60950:2000.
NOTE that the RJ-45 connector for attaching to the phone network must be mounted on the host system. The V850NetChip-ISDN includes a designed-in electrical insulation barrier of 4 mm creepage between the phone line interface circuit and the rest of the V850NetChip-ISDN board. The host motherboard must have an equivalent barrier between the RJ-45 connector circuit and other components.

2.1. Host interface

Table 2.1: Pin description for host serial interface

Pin	I/O	Name	Function
1	I	VCC	Connects to external host power of +5V +/- 5%
2	I	-TXD	Serial data output from host DTE
3	O	-RXD	Serial data input to host DTE
4	I	-RTS	Request To Send. –RTS is used to indicate to the V850NetChip-ISDN if it should present data to the DTE on –RXD. –RTS OFF (high) indicates to the V850NetChip-ISDN that it should not transfer data. –RTS ON (low) indicates to the V850NetChip-ISDN that it is ready to accept data for transmission.
5	O	-CTS	Clear To Send. –CTS is used by the V850NetChip-ISDN to indicate if it is ready or not to transmit data on -TXD. –CTS OFF (high) indicates to the DTE that it should not transfer data. –CTS ON (low) indicates to the DTE that it is ready to accept data for transmission.
6	O	-DSR	Data Set Ready. –DSR indicates the V850NetChip-ISDN status to the DTE.
7	I	-DTR	Data Terminal Ready. An active low on this pin indicates that the host system (DTE) is ready to communicate with the V850NetChip-ISDN
8	O	-DCD	Data carrier detect. An active low on this pin indicates that the V850NetChip-ISDN has detected a carrier signal. For further information, see AT command reference section [more info required]
9	I	-RESET	Device reset. Held high for normal operation, or low for at least 500 ns to reset the device
10	I	GND	Power supply ground

2.2. Line interface

Table 2.2: Pin description for phone-line interface

Pin	I/O	Name	Function
1	I	RX+	S-bus receive (positive)
2	O	TX+	S-bus transmit (negative)
3	I	RX-	S-bus receive (negative)
4	O	TX+	S-bus transmit (positive)

3. Electrical Characteristics

Table 3.1: DC electrical characteristics at 25°C

Parameter	Conditions	Min	Typ	Max	Units
Vcc supply voltage		4.75	5.0	5.25	V
Vcc supply current – Idle	Vcc = 5V	TBA	TBA	TBA	mA
Vcc supply current – Active	Vcc = 5V	TBA	TBA	TBA	mA

4. Serial Interface Description

All data transferred to the V850NetChip-ISDN has the following characteristics:

- 8-bit data, with no parity and two stop bits
- speed of between 300 bps and 115 kbps, defaulting to 9600 bps
- hardware flow control using RTS/CTS handshaking

The serial interface is in one of three modes:

- PAD command mode, as described in section 5 below
- command-line mode, as described in section 6 below
- online mode, where data is transferred using an established ISDN (and optionally TCP/IP) connection

The V850NetChip-ISDN always starts operating in PAD command mode from a power-on or soft reset.

5. PAD Command Mode

Where X.25 is being used as the data protocol, the V850NetChip-ISDN supports an X.25 PAD interface, as defined by X.3, X.28 and X.29. Commands are provided to configure the device, control its behaviour and set up and clear X.25 calls. Table 5-1 summarises the PAD commands.

Table 5.1. PAD Command Summary

Command	Function	Parameters/Description
<dial-string>	Establish an X.25 call	See below for format of dial-string
clr	Clear X.25 call	clears X.25 call, and after a timeout associated ISDN call (if any)
stat	Show the PAD connection status	Status is either **free** (no call present) or **engaged** (call present)
set x:n	Set PAD parameter	Set the PAD parameter number **x** to the value **n**. See table 5.2 for a full list of supported PAD parameters
par <x><,x>	Show PAD parameter	Show the PAD parameter number **x** or if **x** is not specified, the value of all PAD parameters
rev	Display software revision	Show the software revision of the V850NetChip-ISDN
exec [cmd]	Execute command	Execute one of the configuration commands: for a full list of commands, see table 5.3

The dial-string used to establish a call has the following format:

X25number[I<ISDNnumber][D<CallUserData]

where X.25 number of the X.25 called number, <ISDNnumber> is the ISDN called number and <CallUserData> is the X.25 call user data field. For example, the command:

45I5551234D12

first of all calls the ISDN number 5551234, when the call is established it sends an X.25 call request to destination address 45, filling in “12” as call user data.

Note: the V850NetChip-ISDN always automatically fills in the standard protocol identifier of “01000000” into the call user data field of X.25 call requests. Any (optional) call user data field specified in the dial-string is appended to this.

Table 5.2. PAD Parameter Summary

Parameter	Function	Value and description
1	Control switch to command mode	**0** switch to command mode disabled **1** switch to command mode enabled using <CTRL>P (hex 10, decimal 16) **n** switch to command mode enabled using ASCII character corresponding to **n**, where **n** is a decimal integer between 32 and 126
2	Echo – turns on or off echoing of characters received on serial port	**0** echo off **1** echo on
3	Data forwarding character(s)	Define character used to force transmission of buffered data over X.25 connection **0** no forwarding character: only send full data packets **2** <space> or <CR> are both forwarding charecters **6** <ESC>, <BEL>, <ENQ>, <ACK>, <CR> **18** <ETX>, <EOT>, <CR> **128** all ASCII control codes **See also notes below**

4	Timer for data forwarding	Define a timeout interval, the expiry of which forces the transmission of buffered data over X.25 connection **0** no timeout **1** immediate transfer: each character transmitted imediately **n** timeout value is **n**, where **n** is measured in units of 50 msec, and is a value between 2 and 255 (i.e. 100ms to 12.75 sec.)
5	Control of additional devices	not supported
6	Display PAD messages	**0** no PAD messages displayed **17** display extended PAD messages without prompt **21** display extended PAD messages with prompt
7	Handling of BREAK signal	**0** no reaction **2** send RESET X.25 packet **8** change to command mode
8	Display received data	Controls display of received data **0** display all received data **1** do not display received data
9	Fill characters after <CR>	not supported
10	Screen line width	not supported
11	Local line speed	Controls the bit rate of the serial port **1** 1200 bps **2** 2400 bps **3** 4800 bps **4** 9600 bps **5** 19.2 kbps **6** 38.4 kbps **7** 57.6 kbps **8** 115.2 kbps
12	Local flow-control	Controls the type of flow control used on the serial port **0** none (not recommended) **1** hardware (RTS/CTS) **2** software (XON/XOFF)

Note: As well as being controlled by PAD parameter 3, data is fowarded under the following circumstances:

- when a full data packet (normally 128 bytes) has been buffered
- following a BREAK signal
- after the timeout specified in parameter 4 has expired.

In addition to the standard PAD commands shown above, a number of commands are supprted to provide extended control and configuration of the V850NetChip-ISDN. These all follow the following general syntax:
exec cmd <optional_parameter>

Table 5.3. Exec Command Summary

Command	Function	Parameter and description
bsize <size>	Maximum data packet size	If no parameter is specified, display the maximum data packet size (default value is 128) If parameter is specified, set the maximum data packet size to the value specified (must be a value between 32 and 2048)
cato <time>	Call abort time out	If no parameter is specified, display the call abort timeout value (default value is 15 seconds) If parameter is specified, set the the call abort timeout value to the specifed number of seconds (must be a value between 3 and 255)
defa	Selects default settings	Reset configuration to default settings
lcgr	Logical channel group number	If no parameter is specified, display the X.25 logical channel group number (default value is 0) If parameter is specified, set the X.25 logical channel group number (must be a value between 0 and 15)
msn	Set own MSN (multiple subscriber number)	Display or set MSN **<no parameter>** display current MSN (if any) ***** all incomming (data) calls will be accepted **-** no incomming calls will be accepted **nnn** set own MSN to **nnn**, where **nnn** is a string of numeric digits Limits: TBA
prot	Set protocol	Set the data protocol **20** X.25 on B-channel (default) **21** X.25 on D-channel
reset	Reset V850NetChip-ISDN	Reset the V850NetChip-ISDN (software equiavalent of removing and restoring the power)
rev	Revision string	Display the V850NetChip-ISDN product revision string
save	Save V850NetChip-ISDN configuration	Saves the V850NetChip-ISDN's current configuration to non-volatile storage
tei <value>	TEI value	Display or set the TEI value to use for X.25 on the D-channel
xnr	Set own X.25 address	Display or set X.25 address **<no parameter>** display current X.25 address (if any) **nnn** set own X.25 address to **nnn**, where **nnn** is a string of numeric digits

6. Command-line Mode

Command-line mode is used to configure the V850NetChip-ISDN for TCP/IP operation. Command-line mode is selected by using the ***exec cmd*** command (see above). Once selected the V850NetChip-ISDN remains in command-line mode unless the ***PAD*** command is selected.
Command-line mode is indicated by the following prompt: **->**
Commands are described below, using the following syntax:

command <parameter> [parameter]
where,
command name of the command
<parameter> mandatory command parameter
[parameter] optional command parameter

All commands and parameters are case sensitive.
Note that IP address parameters have the normal “dotted decimal” syntax (e.g. 192.168.16.20). Where an address is specified with an optional port, the port is separated from the address with a “,” or “/” character, as in: 192.168.16.20,1200 for port number 1200 at address 192.168.16.20.

Command	Details
pad	revert to PAD-command mode
help [command]	provide list of available commands or, with optional parameter, describe the use and syntax of the specified command
isp <number>	set the phone number of the ISP: this number is dialled when an Internet connection is requested
user <username> [password]	set the ISP username, and optional password
save	save all configuration information to non-volatile memory
reset	soft-reset the V850NetChip-ISDN
ping <ip_address>	send an ICMP echo request to the specified IP address
status	display status of ISDN and optional TCP connection; response has syntax ***x:y:z*** where x, y and z are the states of the TCP, ISP and ISDN connections respectively: see table below for details.
dial [number]	dial and connect to the specified phone number, or if no number is specified, the previously configured ISP phone number
open <ip_address>[,port]	open a TCP to the specified IP address and port, or if no port is specified, to the telnet port (23) at the specified address
close	close any currently open TCP connection
hangup	hangup the ISDN call, disconnecting the V850NetChip-ISDN from the ISP
rev	display the V850NetChip-ISDN revision number
address	display local address information

The following table describes the ISDN, ISP and TCP states as reported by the ***status*** command:

ISDN State	Details
0	ISDN is idle with no call present
1	ISDN is establishing a connection
2	ISDN is “ringing” (i.e. an incomming call has been signalled)
3	ISDN is fully connected
ISP State	
0	ISP is disconnected
1	PPP is establishing a connection
2	PPP connection establishmenet has failed
3	PPP connection to ISP is fully established
TCP State	
0	TCP is disconnected
1	TCP is establishing a connection
2	TCP connection establishmenet has failed
3	TCP connection is fully established

7. TCP/IP Features

V850NetChip-ISDN provides the facility of establishing a TCP/IP connection across an Intranet or the global Internet. It also provides There are three stages to configuring and establishing a TCP/IP connection:

- configuration of ISP (Internet Service Provider) parameters
- dialling the ISP
- opening a TCP connection

7.1. Configuration of ISP parameters

Configuration of ISP parameters is normally done once only: the parameters can be saved to non-volatile memory using the ***save*** command-line ISDN command. Typically, all of the following information is required:

Parameter	Details
phone number	The ISP's phone number to dial. This is configured using the ***isp*** command
user name	ISP's provide a user name for the account to use when dialling. This is configured using the ***user*** command.
password	The password associated with the user name. This is also configured using the ***user*** command.

The ***save*** command may be used to store all of this configuration information to non-volatile memory if required: otherwise the information is lost when the V850NetChip-ISDN is powered-off or reset.

7.2. Establishing a connection

The second stage of connecting to the Internet is to establish a ISDN and ISP connection between the V850NetChip-ISDN and the ISP. This is done using the ***dial*** command. If the ISP number has been previously set using the ***isp*** command, there is no need to specify the number to dial.
V850NetChip-ISDN will place a call and attempt to connect at the fastest data rate possible. Successful connection is indicated by the V850NetChip-ISDN displaying the following:
+OK
An unsuccessful connection attempt is indicated by the V850NetChip-ISDN displaying the following:
-ERR
Note that successful connection means that the V850NetChip-ISDN has connected to the ISP, initialised PPP correctly and been assigned an IP address information. Successful connection is when any of these stages to not complete successfully. In this case, V850NetChip-ISDN automatically drops the ISDN call.

7.3. Opening TCP connections

The final stage in connecting to the Internet is to establish a TCP connection to a remote address. This is done with the open command as follows, and example of which is as follows:
open 192.168.16.20,1200
This opens a TCP connection to port 1200 at address 192.168.16.20. A successful connection is indicated by the V850NetChip-ISDN displaying the following:
+OK
An unsuccessful connection attempt is indicated by the V850NetChip-ISDN displaying the following:
-ERR
Once established, V850NetChip-ISDN is in online mode: any information sent to the V850NetChip-ISDN is then forwarded to the remote system over a TCP connection.

7.4. Closing TCP connections

Closing TCP connections is done by reverting to command-line mode using one of the following methods:

- by sending on the +++ escape sequence
- by sending in a BREAK signal

Both of these methods result in the V850NetChip-ISDN reverting to command-line mode.
Once in command-line mode, the connection may be closed using the ***close*** command. New TCP connections may be established using the ***open*** command. When all connections have been closed, the ***hangup*** command should be used to clear the ISDN call to the ISP.