

## Data Sheet

# V850Netchip PSTN1 Module

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## Table of Contents

1. Introduction.....	3
1.1. Description .....	3
1.2. Applications .....	3
1.3. Features .....	3
2. Mechanical Specifications .....	4
2.1. Host Interface .....	5
2.2. Line Interface.....	5
3. Electrical Characteristics .....	6
4. Serial Interface Description .....	8
5. AT-Commands, S-Registers, and Result Codes.....	9
6. Command-line Mode .....	11
7. TCP/IP Features.....	13
7.1. Configuring ISP Parameters .....	13
7.2. Establishing an ISP Connection.....	13
7.3. Opening TCP Connections .....	13
7.4. Closing TCP Connections .....	14

## 1. Introduction

### 1.1. Description

The V850Netchip PSTN1 Module is a 2400 bps embedded modem module intended for applications that require a data communications link over the phone network. It is a complete module on a small printed circuit board that can be socketed onto the host system motherboard. 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. It is EN60950 certified and CTR21 approved for European markets.

### 1.2. Applications

It can be used in a variety of applications including

- credit card authorization terminals
- set-top box back channel communication
- vending machines
- remote utility metering
- remote diagnostics
- remote telemetry
- embedded applications

### 1.3. Features

- Supported protocols: V.21(300 bps), V.22 (1200 bps) and V.22 *bis* (2400 bps).
- Error correction: V.42 and MNP4
- Built-in Internet access support: PPP, IP, UDP, TCP protocols included
- AT command interface for modem control
- Command-line interface for TCP/IP control
- Interface:TTL level serial, with data rates of 300 bps – 9600bps
- Flow control: RTS/CTS (hardware)
- Single +5V power supply
- Dimensions: 74.93mm x 55.88mm

### 1.4. Revision

This Data Sheet describes revision 1.0.4 of the V850Netchip PSTN1 Module.

## 2. Mechanical Specifications

The V850Netchip PSTN1 is designed to be attached to a host system motherboard using two connectors – the host interface connector and the phone line interface connector. Pins are 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 – PSTN1.

Figure 1: Outline plan (component side) of V850Netchip – PSTN1

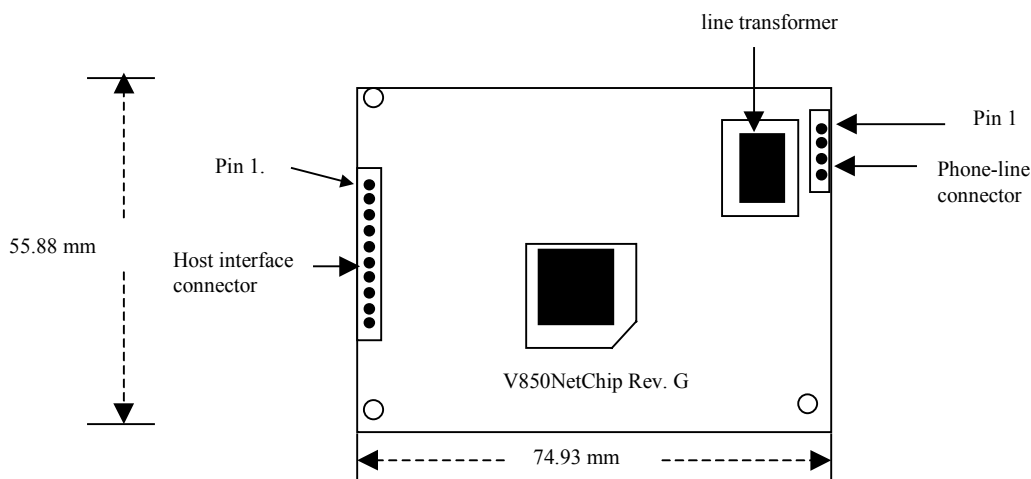
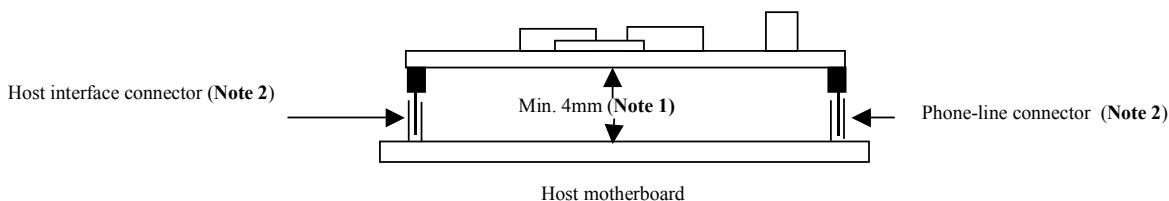


Figure 2: Elevation view of short-format V850Netchip – PSTN1



**Note 1:** At least 4mm clearance or equivalent insulation must be provided between the V850Netchip PSTN1 and the host motherboard.

**Note 2:** The pins for the host interface and phone line connectors are spaced 2.54mm apart

The V850Netchip PSTN1 must always be installed within unit which includes a fire enclosure that meets the safety requirements of EN60950:2000.

### Note

The RJ-11 connector for attaching to the phone network must be mounted on the host system. The V850Netchip PSTN1 includes a designed-in electrical insulation barrier of 4 mm creepage between the phone line interface circuit and the rest of the V850Netchip PSTN1 board. The host motherboard should have an equivalent barrier between the RJ-11 connector circuit and other components.

2.1. Host Interface

**Table 1.1: 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 modem if it should present data to the DTE on - RXD. -RTS OFF (high) indicates to the modem that it should not transfer data. -RTS ON (low) indicates to the modem that it is ready to accept data for transmission.
5	O	-CTS	Clear To Send. -CTS is used by the modem to indicate whether or not it is ready 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 modem status to the DTE.
7	I	-DTR	Data Terminal Ready. An active low on this pin indicates that the host system is ready to communicate with the modem.
8	O	-DCD	Data Carrier Detect. An active low on this pin indicates that the modem has detected a carrier signal.
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 1.2: Pin description for phone line interface**

Pin	I/O	Name	Function
1	I/O	a/b	Telco phone line connection from RJ11 or other connector on host system
2	I/O	a/b	Telco phone line connection from RJ11 or other connector on host system
3	-	N/C	Not connected
4	-	N/C	Not connected

### 3. Electrical and Line Characteristics

**Table 1.3: Power supply**

Parameter	Min	Typical	Max	Units
V <sub>CC</sub> supply voltage – noise less than 50mV	4.75	5.00	5.25	V
I <sub>CC</sub> Off Hook - nominal operating current when modem is active		50	75	mA
I <sub>CC</sub> On Hook - nominal operating current when modem is idle		25	50	mA
I <sub>CCPD</sub> – Power-down current			5	mA

**Table 1.4: Serial interface**

Parameter	Min	Typical	Max	Units
V <sub>H</sub> – High level input voltage	2			V
V <sub>L</sub> – low level input voltage	-0.3		0.8	V
V <sub>OH</sub> – high level output voltage	2.4			V
V <sub>OL</sub> – low level output voltage			0.6	V

**Table 1.5: Transmission characteristics**

Parameter	Condition	Min	Typical	Max	Units
Isolation protection between a and b interfaces		1500			VAC RMS
Surge protection between a and b interfaces		2000			V <sub>Peak</sub>
Transmission insertion loss	300Hz-4kHz	-0.8	0	+0.8	dB
Frequency response (ref=1000Hz transit)	200Hz-4KHz	-0.3		+0.3	dBm
Distortion noise - transmit	-10dBm transmit power (600Hz)			-72	dBm
Receive gain	300Hz-4kHz	-0.8	0	+0.8	dB
Receive frequency response (ref=1000Hz receive)	200Hz-4KHz	-0.3		+0.3	dBm
Receive 2 <sup>nd</sup> /3 <sup>rd</sup> /4 <sup>th</sup> harmonic distortion	-10dB at a/b			-72	dBm
Noise-receive	400Hz-4KHz		-80		dBm
PSTN line input impedance	At 1000Hz	550	600	650	Ohm
On-hook impedance		10	20		Mohm
Loop current	48VDC from a to b	20		60	mA
Longitudinal balance		66			dBm
Return loss (Zref=600ohm)	1000Hz	25			dBm
Trans-hybrid loss	Attenuation between the transmitter i/p and the receiver o/p at 1kHz with 600ohm complex impedance	20	25		dBm
Ring sensitivity	AC voltage between a and b	25	28	40	Vrms
Ringer equivalence	Type A		0.2A		REN

**Table 1.6: Signalling Specification**

<b>Parameter</b>	<b>Min</b>	<b>Typical</b>	<b>Max</b>	<b>Units</b>
Tone 2 <sup>nd</sup> harmonic Distortion (600Ohm)			-35	dB
DTMF Twist (balance)		3		dB
DTMF Tone duration (85 ms default)	50		200	ms
DTMF Interdigit interval (85 ms default)	50		300	ms
Call Progress Passband Frequency	120		620	Hz
Wait Time for dial tone	2		255	sec
Return loss @ 1000Hz (600ohm)		25		dB

## 4. Serial Interface Description

Data transferred to the V850Netchip PSTN1 has the following characteristics:

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

The serial interface operates in one of the following three modes:

- AT 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 modem (and optionally TCP/IP) connection

When operating in AT command mode the V850Netchip PSTN1 module automatically detects the serial-line speed of the connected device in the range 1200 bps to 9600 bps. It behaves as a standard modem, with the capability of making and receiving calls, using AT commands as described in section 5 below. The normal ATD, ATA for dialling and answering a call are supported, as is the +++ sequence used to escape from online to AT command mode.

By default, the V850Netchip PSTN1 starts in AT command mode from a power-on or soft reset. This behaviour may be modified using the **startup** command-line command: see section 6 for more details.



## 5. AT-Commands, S-Registers, and Result Codes

Each command line must start with the prefix “AT” and be terminated by a carriage return (ASCII code 16). Several commands may be included on one command line. A command line may contain up to 80 characters, excluding the AT prefix and terminating carriage return.

No separator is required between commands on the same line. See **Table 1.4** for result codes and messages. See **Table 1.5** for a summary of the command set.

**Table 1.4: Result codes and messages**

<b>Numeric Code</b>	<b>Text Code</b>	<b>Details</b>
0	OK	Command line executed without errors
1	CONNECT	Connection established
2	RING	Ringling signal detected
3	NO CARRIER	Carrier lost or never detected
4	ERROR	Invalid command line or other error
6	NO DIALTONE	No dial tone detected
7	BUSY	Busy signal detected

Table 1.5: AT Command Summary

Command	Function	Default	Parameters/Description
!	Enter command-mode	-	Enters command-line (as described in section 6)
A	Answer a call	-	-
Bn	Select bell or CCITT mode	n=0	n=0 selects CCITT operation
Cn	Carrier control	n=1	No effect - for compatibility only
Dn	Dial	-	Dial command. Causes the modem to go off-hook and dial the specified number or IP address. The command accepts an optional "T" as the first character of the dial string to indicate tone dialling. Digits can be separated by a comma (,) to indicate a pause
En	Echo	n=1	n=0 disables command echo n=1 enables command echo
Hn	Hook control	n=0	n=0 go on-hook (hang up the line) n=1 go off-hook (seize the line)
In	Information	n=0	n=0 display product name and revision n=1 display ROM checksum n=3 display product name and revision n=4 display revision
Ln	Speaker level	-	No effect - for compatibility only
Mn	Speaker control	n=1	No effect - for compatibility only
\Nn	Error control mode	n=0	n=0 no error control n=1 no error control n=2 attempt V.42, then MNP4. If both fail, disconnect the call n=3 attempt V.42, then MNP4. If both fail, use no error control n=4 attempt V.42. If this fails, disconnect the call n=5 attempt MNP4. If this fails, disconnect the call
O	Online mode		Return to online mode
Qn	Quiet result codes	n=0	n=0 enables result codes n=1 disables result codes
\Qn	Asynchronous mode	n=0	No effect - for compatibility only
Sn?	S-register read	-	Reads an S register. Sn? returns the contents of S register n, where n is a value between 0 and 27. See table??? for details (which table is that? There's no 5-3 in your tables)
Sn=v	S-register write	-	Writes value v to S register n, where v is between 0 and 255 and n is between 0 and 27. See table 5-3 for details
Vn	Result codes format	n=1	n=0 results code is displayed as a numeric digit n=1 result code is displayed as a text string
Xn	Result code format	n=0	No effect - for compatibility only
Z	Reset modem		Reset the modem (soft reset)

## 6. Command-line Mode

Command-line mode is used to configure the V850Netchip PSTN1 for TCP/IP operation. It is selected by using the **AT!** command (see above). Once selected, the V850Netchip PSTN remains in command-line mode until the **AT** command is selected.

Command-line mode is indicated by the `->` prompt. The syntax in command-line mode is

```
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

The IP address parameters have the normal “dotted decimal” syntax, for example, 192.168.16.20. Where an address is specified with an optional port, the port is separated from the address with a comma (,) or slash (/), for example 192.168.16.20,1200 for port number 1200 at address 192.168.16.

**Table 1.6: Commands**

Command	Details
<code>address</code>	Display local address information
<code>at</code>	Revert to AT-command mode
<code>close</code>	Close any active TCP connection
<code>dial [number]</code>	Dial and connect to the specified phone number. If no number is specified, dial the previously-configured ISP phone number
<code>hangup</code>	Hang up the modem call; this disconnects the V850Netchip PSTN from the ISP
<code>help [command]</code>	Provide a list of available commands or, with optional parameter, describe the use and syntax of the specified command
<code>isp &lt;number&gt;</code>	Set the phone number of the ISP; this number is dialed when an Internet connection is requested
<code>open &lt;ip_address&gt;[,port]</code>	Open a TCP connection to the specified IP address and port. If no port is specified, use the telnet port (23) at the specified address
<code>ping &lt;ip_address&gt;</code>	Send an ICMP echo request to the specified IP address
<code>reset</code>	Soft-reset the Modem-NetChip
<code>rev</code>	Display the V850Netchip PSTN revision number
<code>save</code>	Save all configuration information to non-volatile memory
<code>startup [at   command   none]</code>	Display or set default user interface
<code>status [-v]</code>	Display status of modem and optional TCP connection; response takes the form x:y:z x= TCP connection y= ISP connection z= modem connection See Table 1.7 below for details -v selects verbose mode display
<code>user &lt;username&gt; [password]</code>	Set the ISP username and optional password

**Table 1.7: Modem, ISP and TCP states as reported by the status command**

<b>State</b>	<b>Details</b>
<b>TCP State (x)</b>	
0	TCP is disconnected
1	TCP is establishing a connection
2	TCP connection is fully established
<b>ISP State (y)</b>	
0	<no connection required>
1	PPP is disconnected
2	PPP is establishing connection
3	PPP is fully connected and IP address assigned
<b>Modem State (z)</b>	
0	<no connection required>
1	Modem is on-hook and disconnected
2	Modem is off-hook and establishing a connection
3	Modem is off-hook and fully connected
4	Modem is ringing

## 7. TCP/IP Features

V850Netchip PSTN1 provides the facility of establishing a TCP/IP connection across an intranet or the global Internet. The three stages of configuring and establishing a TCP/IP connection are

- configuring the ISP parameters
- dialling the ISP
- opening a TCP connection

### 7.1. Configuring ISP Parameters

Configuring ISP parameters is usually done once only. When configured, the parameters can be saved to non-volatile memory using the **save** command-line modem command. Typically, all of the information in Table 1.8 is required.

The **save** command may be used to store all of the ISP configuration information to non-volatile memory if required, otherwise the information is lost when the V850Netchip PSTN is powered off or reset.

**Table 1.8: Information for configuring ISP parameters**

Parameter	Details
phone number	The ISP's phone number to dial. This is configured using the <i>ISP</i> command
username	ISPs provide a username for the account to use when dialling. This is configured using the <i>user</i> command
password	The password associated with the username. This is configured using the <i>user</i> command

### 7.2. Establishing an ISP Connection

The second stage of connecting to the Internet is to establish a modem and ISP connection between the V850Netchip PSTN1 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 PSTN1 will place a call and attempt to connect at the fastest data rate possible.

V850Netchip PSTN1 indicates the result of the connection attempt as follows:

- +OK** - indicates that the connection attempt was successful
- ERR** - indicates that the connection attempt was unsuccessful

#### Note

Successful connection means the V850Netchip PSTN1 has connected to the ISP, initialized PPP correctly and has been assigned an IP address. Unsuccessful connection can mean that any one of these stages did not complete successfully. In this case, V850Netchip PSTN1 automatically drops the modem 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 using the *open* command. For example, `open 192.168.16.20,1200` opens a TCP connection to port 1200 at address 192.168.16.20.

V850Netchip PSTN1 indicates the result of the connection attempt as follows:

- +OK** - indicates that the connection attempt was successful
- ERR** - indicates that the connection attempt was unsuccessful

Once established, V850Netchip PSTN1 is in online mode. Any information sent to the V850Netchip PSTN 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:

- sending the +++ escape sequence
- sending a **BREAK** signal

Both of these methods result in the V850Netchip PSTN reverting to command-line mode.

Once in command-line mode, the connection may be closed using the **close** command. New TCP connections may be opened using the **open** command. When all connections have been closed, the **hangup** command should be used to clear the modem call to the ISP.