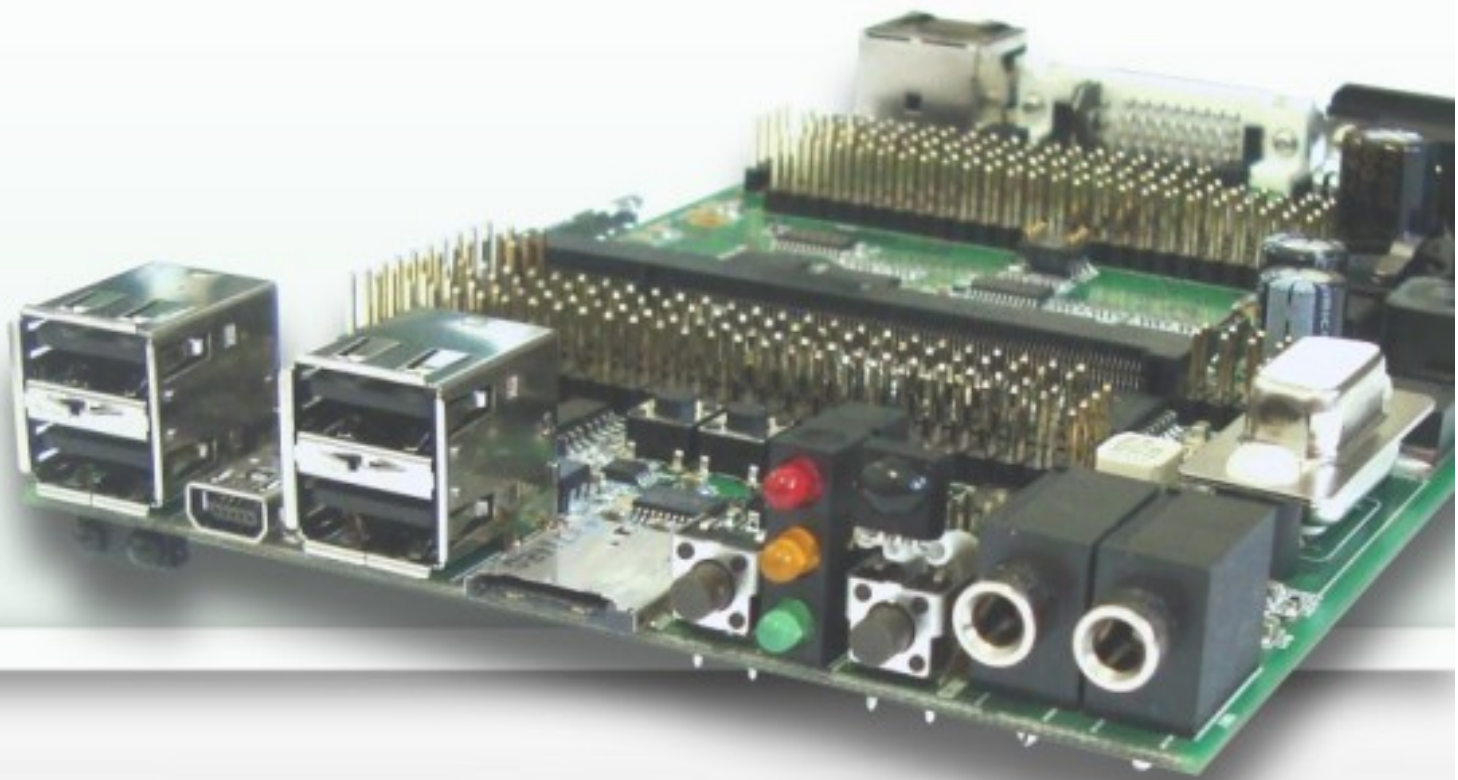


i.MX51 Development Kit **QUICK GUIDE**



voipac

About Voipac i.MX51 Development kit	4
<i>Packing List</i>	4
<i>Connector Locations</i>	5
<i>Connecting the components and cables</i>	5
First Step	6
<i>Conrolling the Development Kit over serial line</i>	6
<i>Using external monitor (or supplied TFT panel) and USB Keyboard</i>	7
<i>Conrolling the Development Kit over Ethernet (telnet, ssh, ftp, sftp)</i>	7
Open On-Chip Debugger 0.6.0 with Voipac`s JTAG Cable under WinXP	9
<i>JTAG Cable Installation</i>	9
<i>How to run Open On-Chip Debugger</i>	9
<i>How to connect to Open On-Chip Debugger using Telnet</i>	10
<i>How to connect to Open On-Chip Debugger using terminal (TeraTerm)</i>	11
<i>How to load bootloader into i.MX51 SODIMM Module (barebox.bin)</i>	12
<i>How to flash zImage and rootfs through the TeraTerm</i>	16
Important and Practical Information	19
<i>E-Fuses</i>	19
<i>BOOTMODE Jumper H902</i>	20
<i>Mounting Fasteners</i>	20
<i>Products` Life Cycle Phase</i>	21
<i>CE compliance of Voipac products</i>	21
TECHNICAL SUPPORT	22

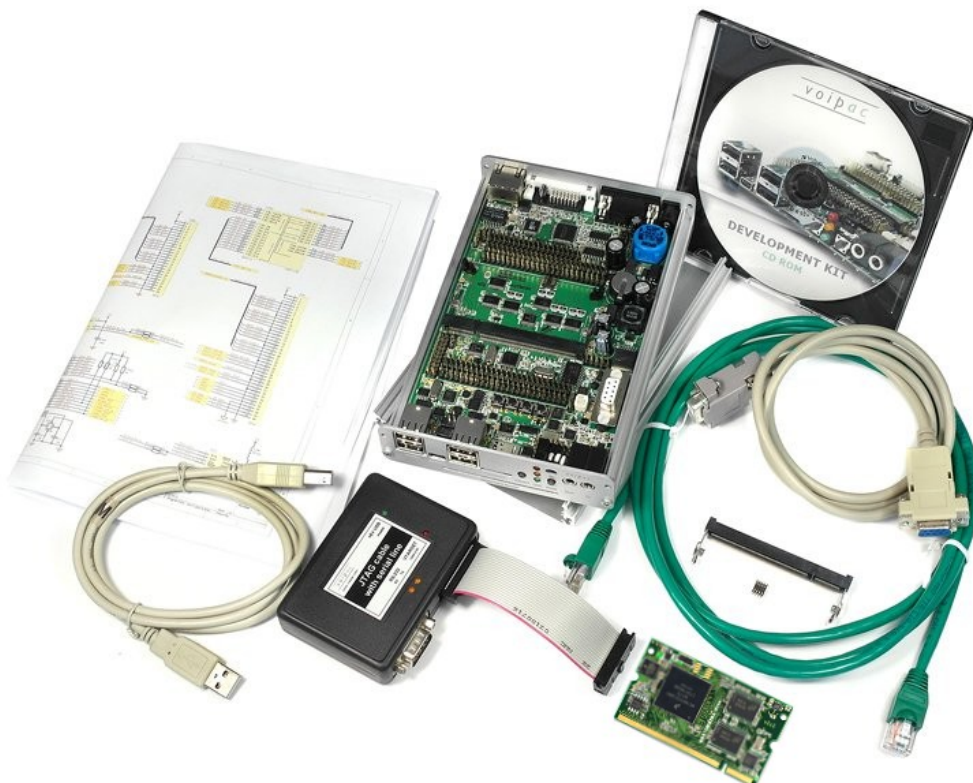
About Voipac i.MX51 Development kit

Voipac i.MX25 SODIMM Baseboard is designed to be used as development platform for the Voipac cross-compatible i.MX53/i.MX51/i.MX25 SODIMM Module. Together they create a low power system with excellent MIPS/mW performance allowing deployment in situation where power source is limited. Besides the standard PC peripheral interfaces, the system provides numerous communication channels as well as universal expansion slots and connectors.

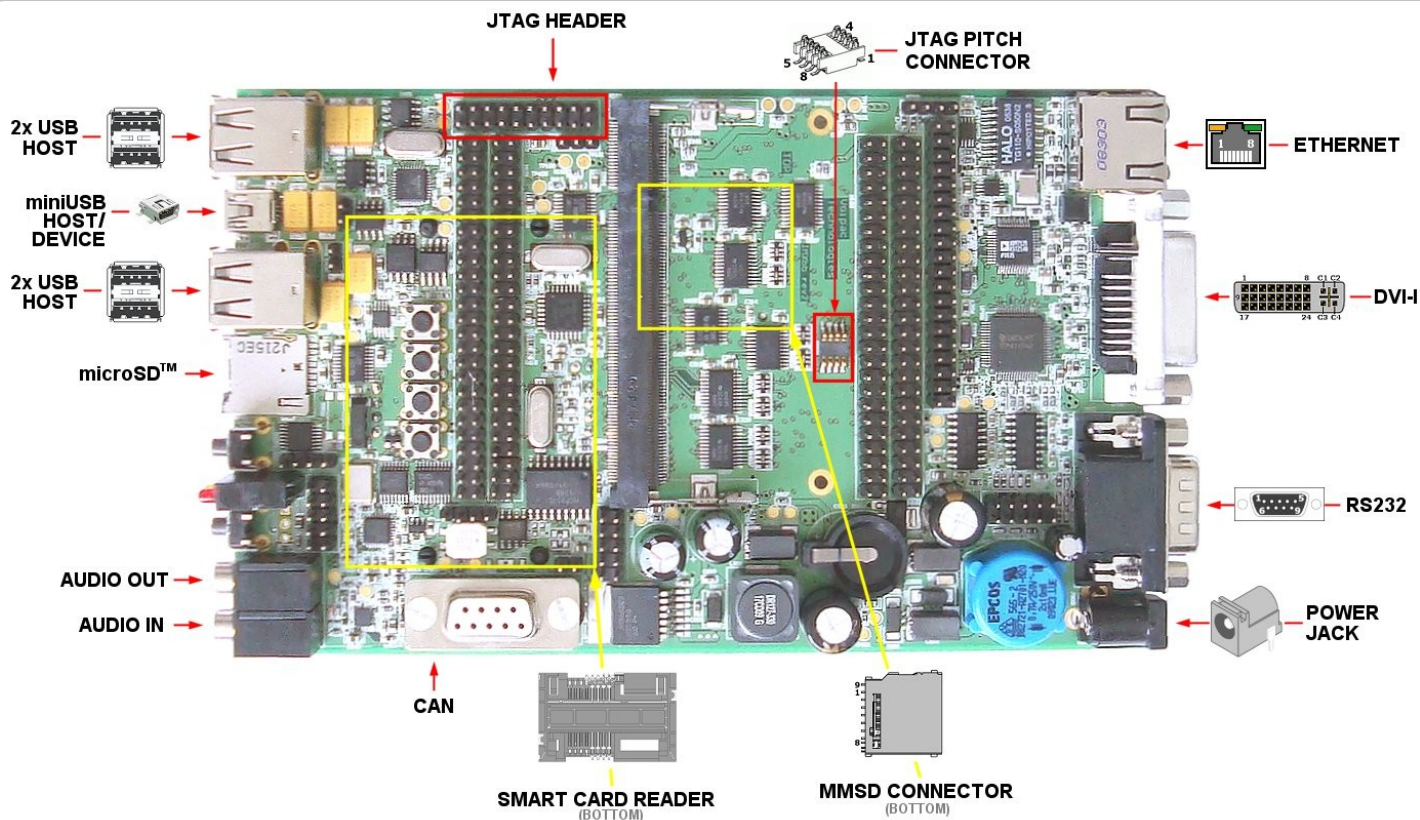
This QuickGuide shows, how to install JTAG Cable, load Linux using TeraTerm. Programs run under Windows XP.

Packing List

COMPONENTS	QUANTITY
SODIMM Base Board	1
SODIMM Module	1
JTAG cable with serial line	1
Support CD	1
Aluminium case set	1
Serial port cable	1
Crossover Ethernet cable	1
SODIMM socket	1
JTAG pitch compression connector	1
SODIMM Module Printed Schematics	1
Mounting Fastener	2
Quickguide Brochure	1
DATAIMAGE TFT Display with touchscreen set <i>(Optional)</i>	1
OPTREX TFT Display with touchscreen set <i>(Optional)</i>	1
EDT TFT multitouch capacitive display with mounting ears set <i>(Optional)</i>	1



Connector Locations

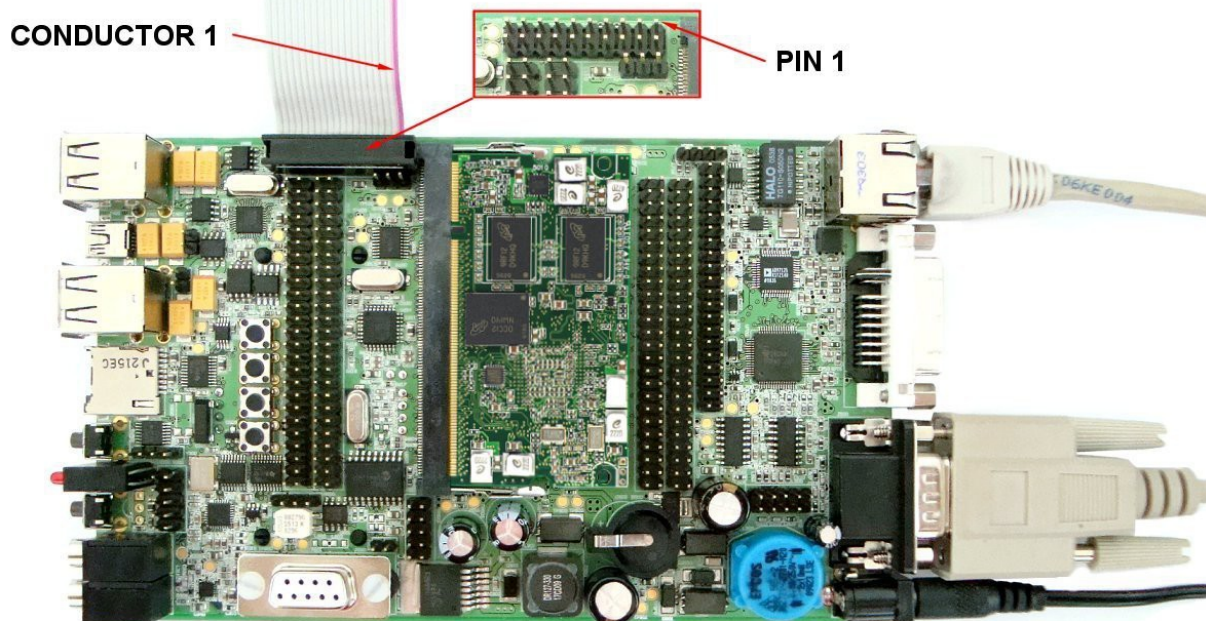


Connecting the components and cables

Prepare Baseboard and plug in JTAG Cable with Serial line, Ethernet cable and other devices or interfaces you need.



IMPORTANT! Be careful when connecting JTAG's 20 conductor flat cable to the board. Check if the conductor 1 is connected to Pin 1 (Header connector J901) on the board before you turn on the board.



First Step

The development kit is supplied with pre-installed bootloader, linux kernel and demo file system.
The development kit can be controlled over:

Controlling the Development Kit over serial line

Recommended HW:

- PC with serial port or USB to serial adapter
- Voipac i.MX51 development kit
- Voipac serial cable (<http://voipac.com/#X25-SPC-000>)

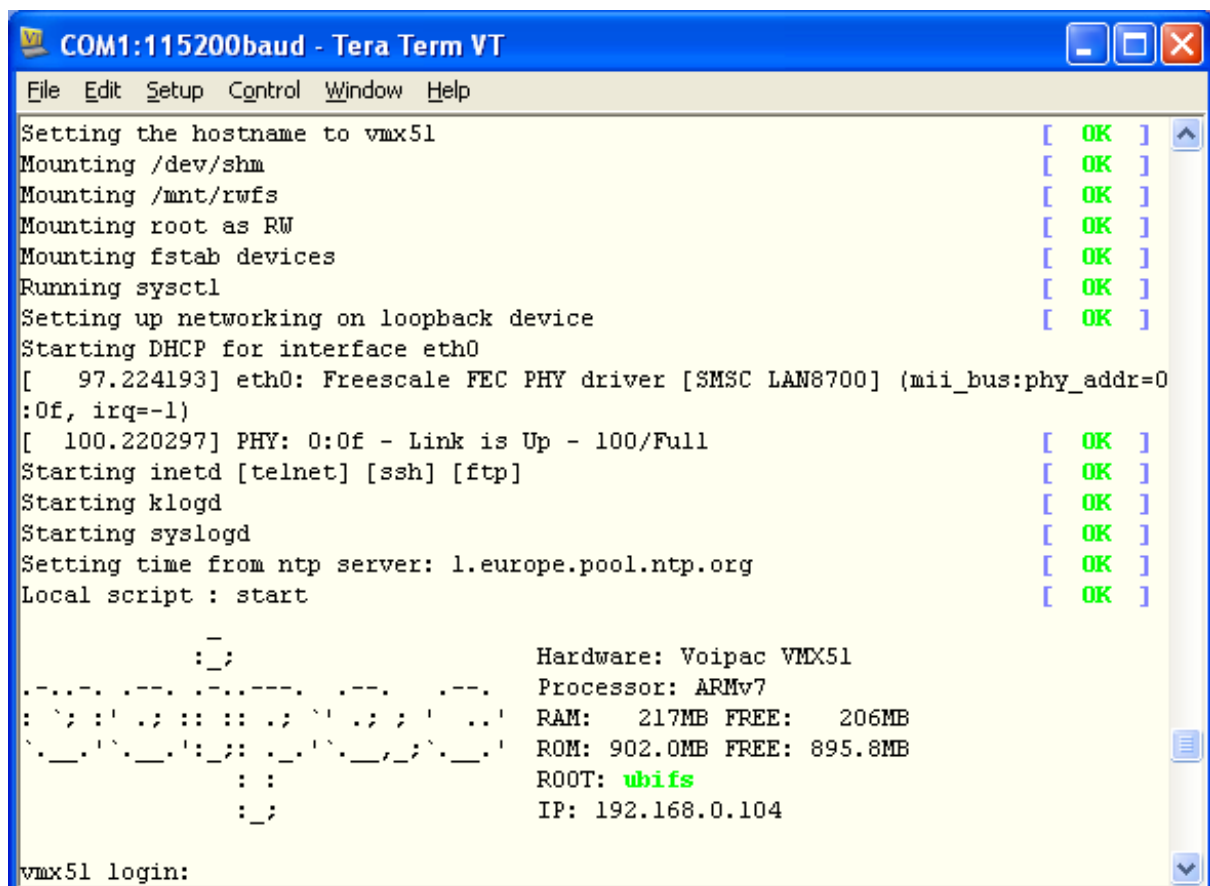
Recommended SW:

Serial line terminal (PUTTY, Minicom, Ckermit, Hyperterminal, TeraTerm, ...)

Default serial port settings:

Speed (baud):	115200
Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None

Controlling the development kit using TeraTerm



```
COM1:115200baud - Tera Term VT
File Edit Setup Control Window Help
Setting the hostname to vmx51 [ OK ]
Mounting /dev/shm [ OK ]
Mounting /mnt/rwfs [ OK ]
Mounting root as RW [ OK ]
Mounting fstab devices [ OK ]
Running sysctl [ OK ]
Setting up networking on loopback device [ OK ]
Starting DHCP for interface eth0
[ 97.224193] eth0: Freescale FEC PHY driver [SMSC LAN8700] (mii_bus:phy_addr=0
:0f, irq=-1)
[ 100.220297] PHY: 0:0f - Link is Up - 100/Full [ OK ]
Starting inetd [telnet] [ssh] [ftp] [ OK ]
Starting klogd [ OK ]
Starting syslogd [ OK ]
Setting time from ntp server: 1.europe.pool.ntp.org [ OK ]
Local script : start [ OK ]

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  \ \ \ \ \
   \ \ \ \
    \ \ \
     \ \
      \

Hardware: Voipac VMX51
Processor: ARMv7
RAM: 217MB FREE: 206MB
ROM: 902.0MB FREE: 895.8MB
ROOT: ubifs
IP: 192.168.0.104

vmx51 login:
```

Using external monitor (or supplied TFT panel) and USB Keyboard

Recommended HW:

- a) External monitor with DVI or VGA connector (for VGA monitor is required to use DVI to VGA adapter)
DATAIMAGE TFT Display (optional, <http://voipac.com/#27M-TFT-000>)
OPTREX TFT Display (optional, <http://www.voipac.com/#X51-TFT-000>)
EDT TFT Display (optional, <http://voipac.com/#X53-TFT-000>)
- b) Voipac i.MX51 development kit

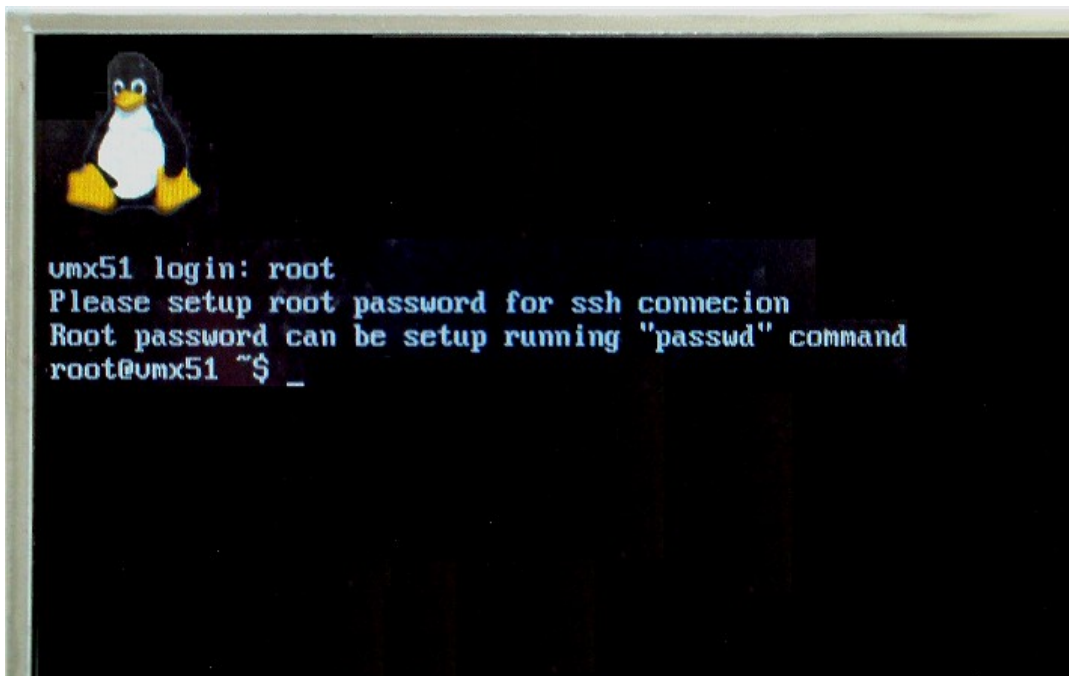
Recommended SW:



IMPORTANT!

External monitor must support at least one of following resolutions 640x480px, 800x480px, 800x600px, 1024x720px or 1280x800px.

Controlling the development kit using external monitor and USB Keyboard



Controlling the Development Kit over Ethernet (telnet, ssh, ftp, sftp)

Recommended HW:

- a) PC with Ethernet
- b) Voipac i.MX51 development kit
- c) Ethernet cable (<http://voipac.com/#X25-CEC-000>)

Recommended SW:

- Telnet client (Telnet, PUTTY, ...)
- SSH client (SSH, PUTTY, ...)
- FTP client (FTP, Filezilla, BareFTP, ...)
- SFTP client (Filezilla, PUTTY, WinSCP, ...)

IMPORTANT!



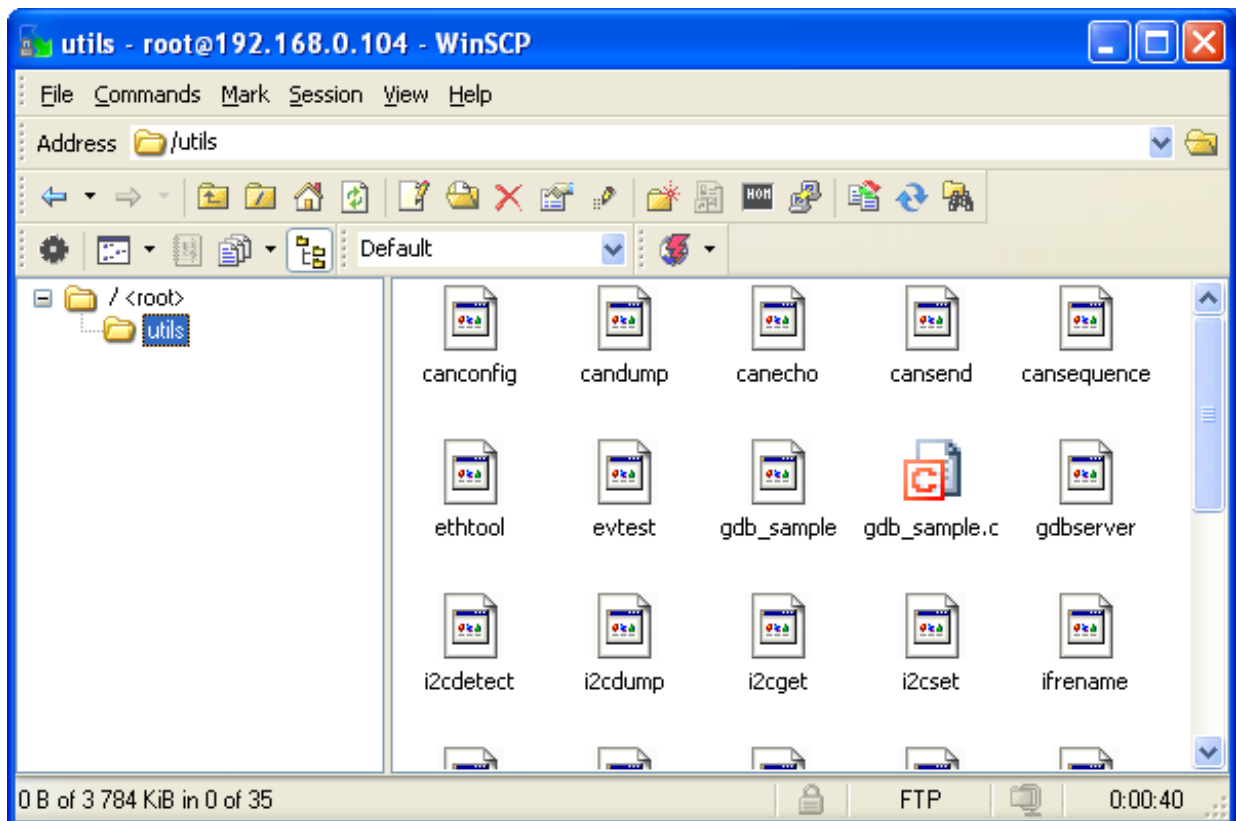
Demo modules are shipped with empty root password.
The default IP address is dynamic and setup by your dhcp server upon boot.

SSH, SFTP require root password to be set up. (“passwd” command)
FTP, SFTP are recommended only for data transfers. (binary mode is recommended)

Controlling the development kit using PUTTY



Controlling the development kit using WinSCP (Explorer Interface)



Open On-Chip Debugger 0.6.0 with Voipac`s JTAG Cable under WinXP

JTAG Cable Installation

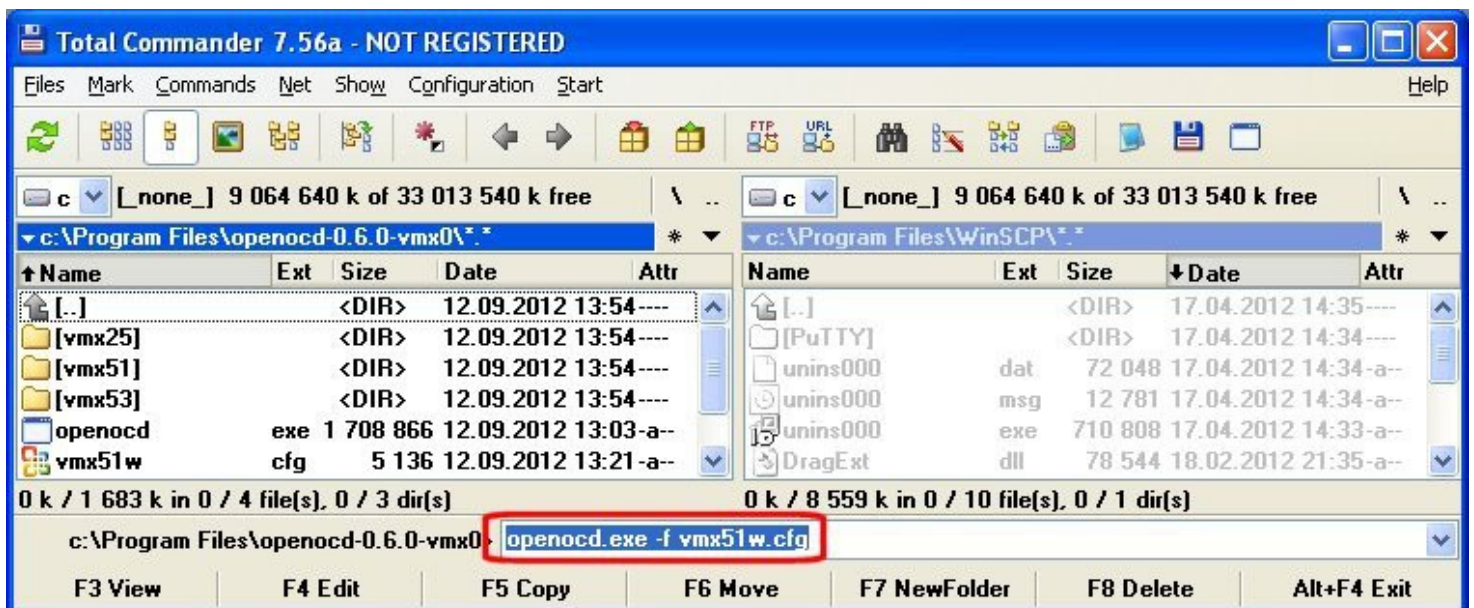
- 1** STEP Connect JTAG Cable to USB port on your computer. JTAG Cable will be installed automatically and prepared for usage.

- 2** STEP Download OpenOCD v 0.6.0 (<http://www.voipac.com/downloads/imx/jtag/bin/openocd-0.6.0-vmx0.zip>).

- 3** STEP Unzip the file and place to the folder you want to.

How to run Open On-Chip Debugger

- 4** STEP Run OpenOCD using, for examle, Total Commander. Open the folder where is placed the unzipped file. Type in command line: **openocd.exe -f vmx51w.cfg**. Press [Enter].

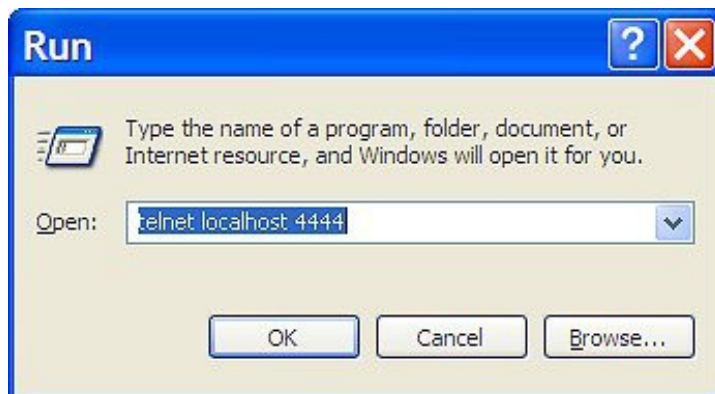


5 STEP Open On-Chip Debugger is running.

```
c:\Program Files\openocd-0.6.0-vmx0\openocd.exe
Open On-Chip Debugger 0.6.0 (2012-09-12-13:02)
Licensed under GNU GPL v2
For bug reports, read
  http://openocd.sourceforge.net/doc/doxygen/bugs.html
Info : only one transport option; autoselect 'jtag'
adapter speed: 100 kHz
trst_and_srst separate srst_gates_jtag trst_push_pull srst_open_drain
Warn : imx51.SDMA: nonstandard IR value
vmx51_init
Info : device: 4 "2232C"
Info : deviceID: 67330064
Info : SerialNumber: FTUGKFPUA
Info : Description: UPACLink A
Info : clock speed 100 kHz
Polling target failed, GDB will be halted. Polling again in 100ms
Polling target failed, GDB will be halted. Polling again in 300ms
Info : JTAG tap: imx51.DAP tap/device found: 0x1ba00477 (mfg: 0x23b, part: 0xba0
Info : TAP imx51.SDMA does not have IDCODE
Info : JTAG tap: imx51.SJC tap/device found: 0x1190c01d (mfg: 0x00e, part: 0x190
Info : imx51.cpu: hardware has 6 breakpoints, 2 watchpoints
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x60008140
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x60008140
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x60008140
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x60008140
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x60008150
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x60008150
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x600081c0
Error: JTAG-DP STICKY ERROR
Error: MEM_AP_CSW 0x80000042, MEM_AP_TAR 0x600081c0
Polling succeeded again
```

How to connect to Open On-Chip Debugger using Telnet

6 STEP Click on Start/Run, type **telnet localhost 4444** and click on OK button.

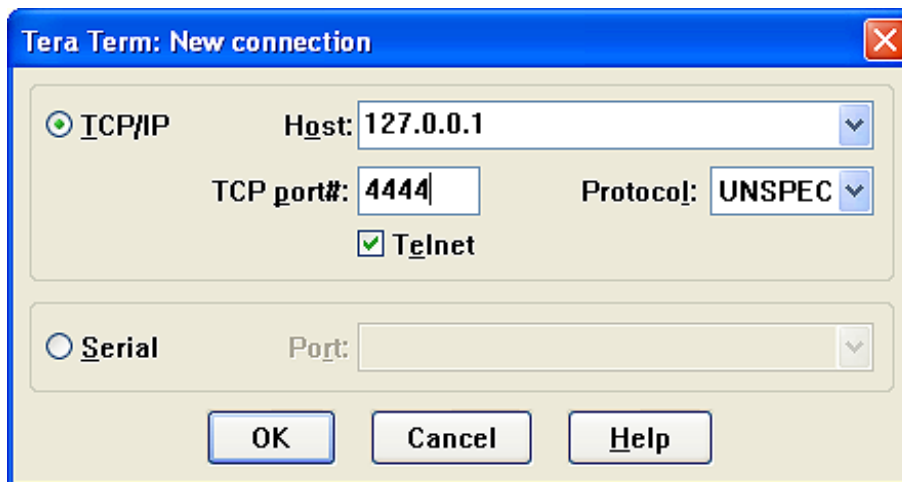


Open On-Chip Debugger is running.

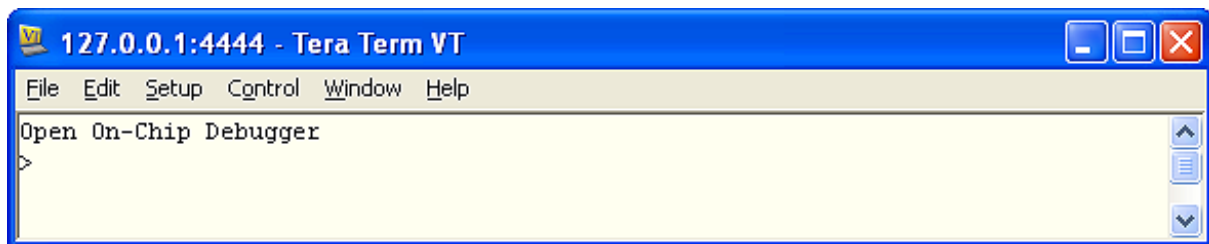
```
Telnet localhost
Open On-Chip Debugger
>
```

How to connect to Open On-Chip Debugger using terminal (TeraTerm)

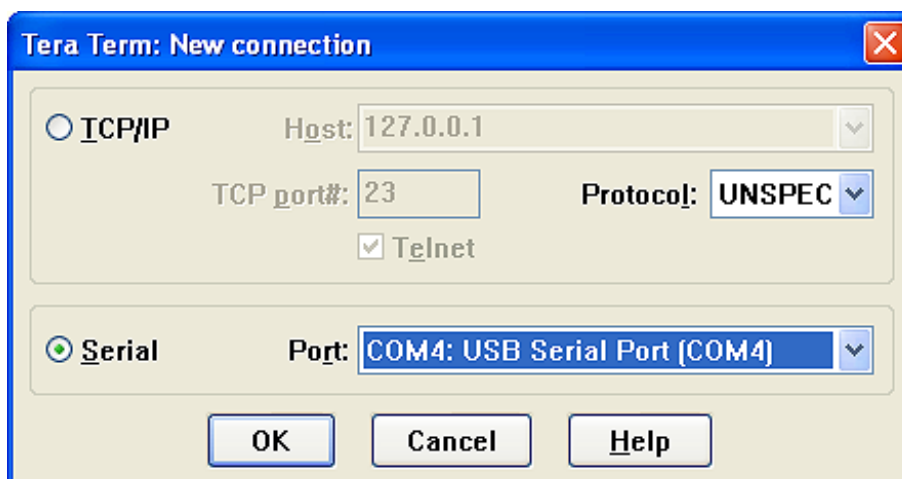
- 7** STEP Open TeraTerm program, click on File/New Connection, check TCP/IP and type **4444** into TCP port# field. Press OK.



Open On-Chip Debugger over TeraTerm program is running.

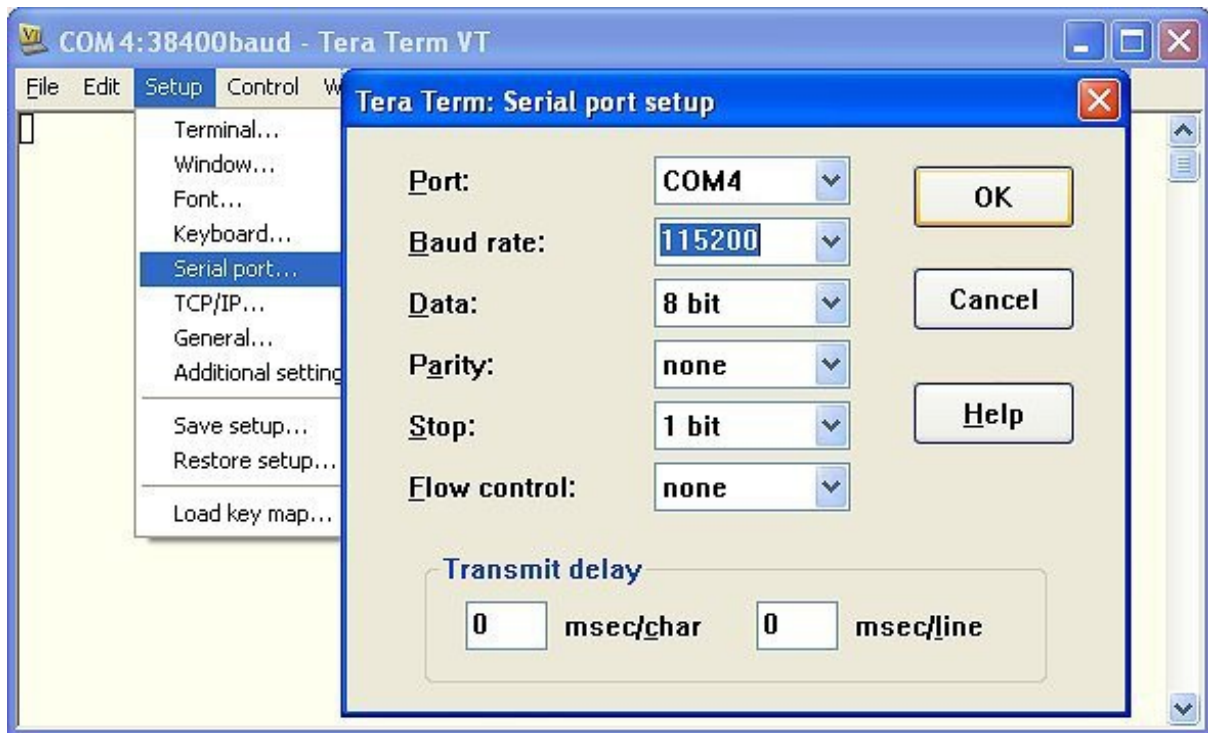


- 8** STEP Open TeraTerm program, click on File/New Connection, check Serial and choose the port where the JTAG cable is connected to a PC.



9
STEP

Click on Setup, choose Serial port and set Baud rate. (115200, 8n1)

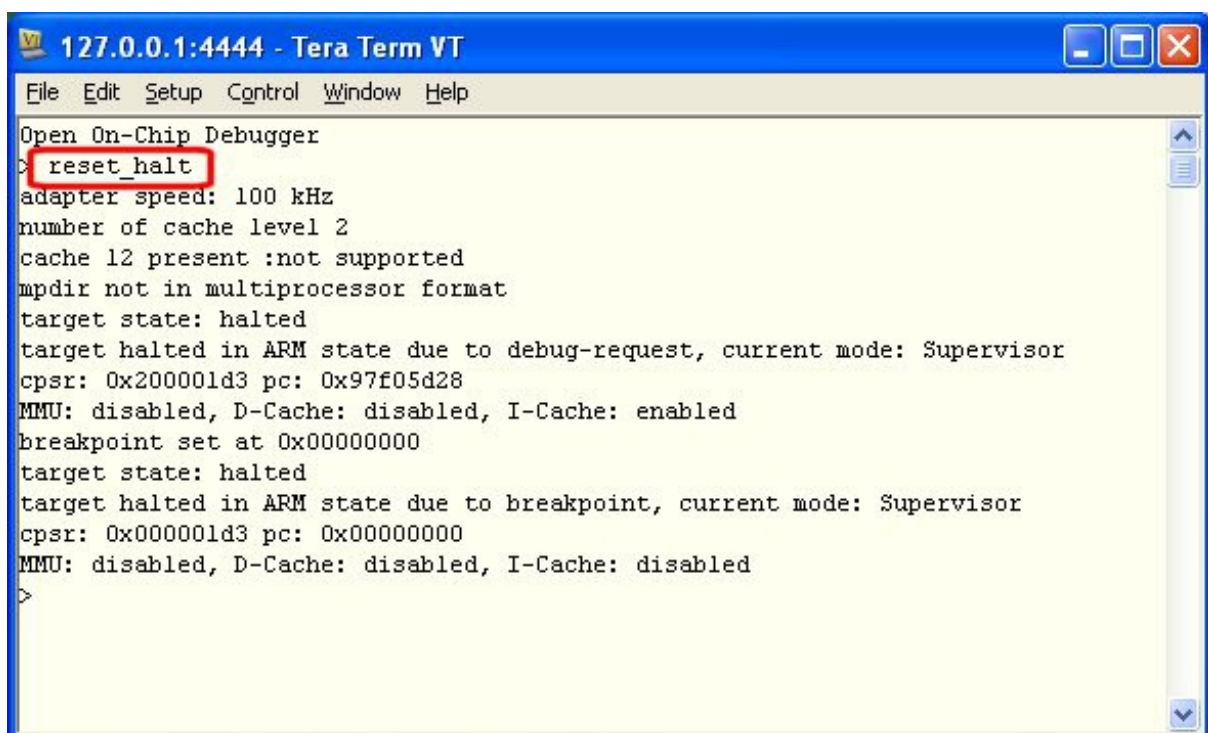


How to load bootloader into i.MX51 SODIMM Module (barebox.bin)

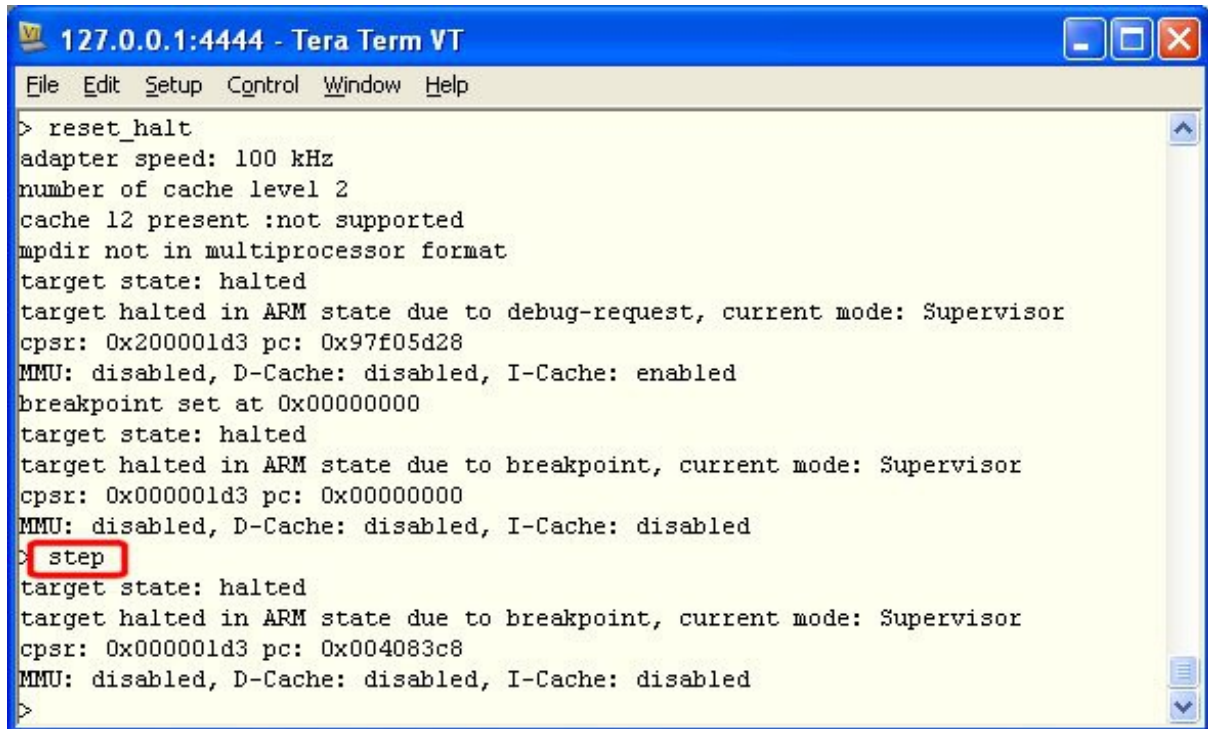
10
STEP

Type or paste commands into TCP/IP console (Open On-Chip Debugger connection):

Type: **reset_halt**

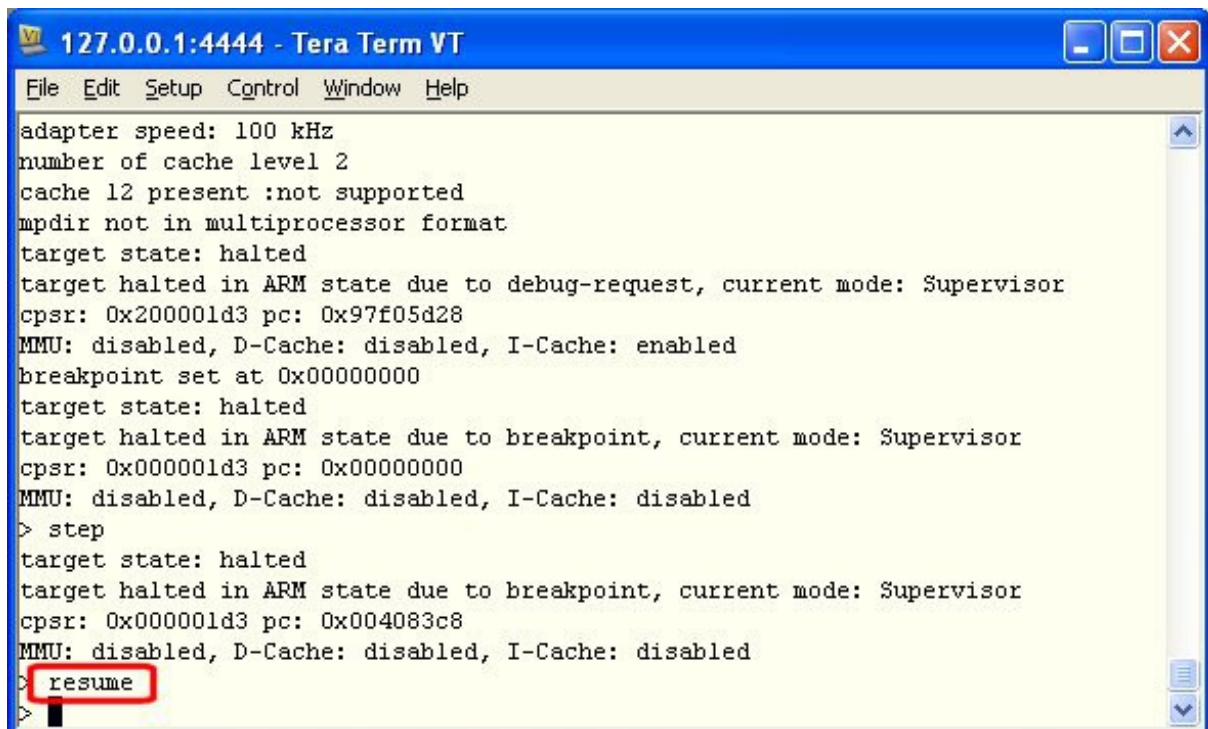


Type: **step**



```
127.0.0.1:4444 - Tera Term VT
File Edit Setup Control Window Help
> reset_halt
adapter speed: 100 kHz
number of cache level 2
cache l2 present :not supported
mpdir not in multiprocessor format
target state: halted
target halted in ARM state due to debug-request, current mode: Supervisor
cpsr: 0x200001d3 pc: 0x97f05d28
MMU: disabled, D-Cache: disabled, I-Cache: enabled
breakpoint set at 0x00000000
target state: halted
target halted in ARM state due to breakpoint, current mode: Supervisor
cpsr: 0x000001d3 pc: 0x00000000
MMU: disabled, D-Cache: disabled, I-Cache: disabled
> step
target state: halted
target halted in ARM state due to breakpoint, current mode: Supervisor
cpsr: 0x000001d3 pc: 0x004083c8
MMU: disabled, D-Cache: disabled, I-Cache: disabled
>
```

Type: **resume**



```
127.0.0.1:4444 - Tera Term VT
File Edit Setup Control Window Help
adapter speed: 100 kHz
number of cache level 2
cache l2 present :not supported
mpdir not in multiprocessor format
target state: halted
target halted in ARM state due to debug-request, current mode: Supervisor
cpsr: 0x200001d3 pc: 0x97f05d28
MMU: disabled, D-Cache: disabled, I-Cache: enabled
breakpoint set at 0x00000000
target state: halted
target halted in ARM state due to breakpoint, current mode: Supervisor
cpsr: 0x000001d3 pc: 0x00000000
MMU: disabled, D-Cache: disabled, I-Cache: disabled
> step
target state: halted
target halted in ARM state due to breakpoint, current mode: Supervisor
cpsr: 0x000001d3 pc: 0x004083c8
MMU: disabled, D-Cache: disabled, I-Cache: disabled
> resume
>
```

Type: `vmx51_init`

```
127.0.0.1:4444 - Tera Term VT
File Edit Setup Control Window Help
MMU: disabled, D-Cache: disabled, I-Cache: disabled
> step
target state: halted
target halted in ARM state due to breakpoint, current mode: Supervisor
cpsr: 0x000001d3 pc: 0x004083c8
MMU: disabled, D-Cache: disabled, I-Cache: disabled
> resume
> vmx51_init
Configuring VMX51...
target state: halted
target halted in Thumb state due to debug-request, current mode: Supervisor
cpsr: 0x600001f3 pc: 0x000015c6
MMU: disabled, D-Cache: disabled, I-Cache: disabled
core state: ARM
cpsr (/32): 0x000001D3
adapter speed: 1000 kHz
ap 1 selected, identification register 0x04770002
ap 0 selected, identification register 0x14770001
Initialisation completed...
>
```

Type: `boot`

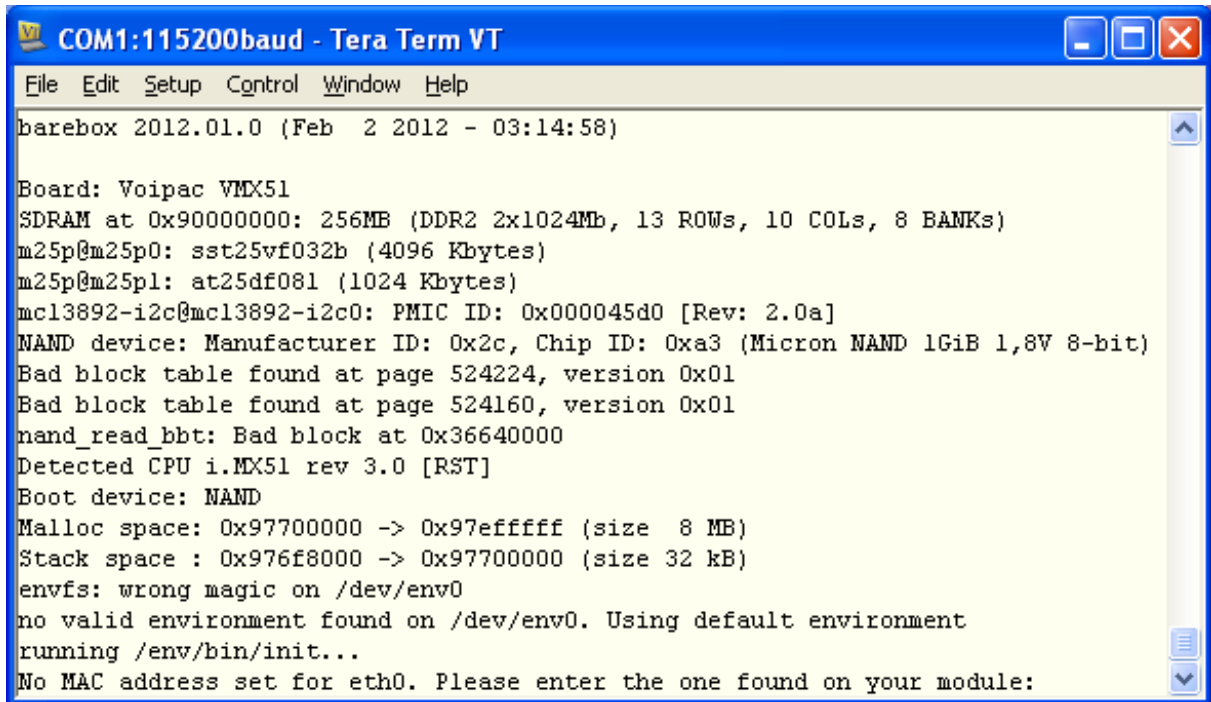
```
127.0.0.1:4444 - Tera Term VT
File Edit Setup Control Window Help
Configuring VMX51...
target state: halted
target halted in Thumb state due to debug-request, current mode: Supervisor
cpsr: 0x600001f3 pc: 0x000015c6
MMU: disabled, D-Cache: disabled, I-Cache: disabled
core state: ARM
cpsr (/32): 0x000001D3
adapter speed: 1000 kHz
ap 1 selected, identification register 0x04770002
ap 0 selected, identification register 0x14770001
Initialisation completed...
> boot
core state: ARM
245360 bytes written at address 0x90000000
downloaded 245360 bytes in 9.125000s (26.259 KiB/s)
target state: halted
target halted in ARM state due to breakpoint, current mode: Supervisor
cpsr: 0x000001d3 pc: 0x90002000
MMU: disabled, D-Cache: disabled, I-Cache: disabled
>
```

Barebox is loaded into the i.MX51 module SRAM.



(Note) After "boot" the barebox is being executed.

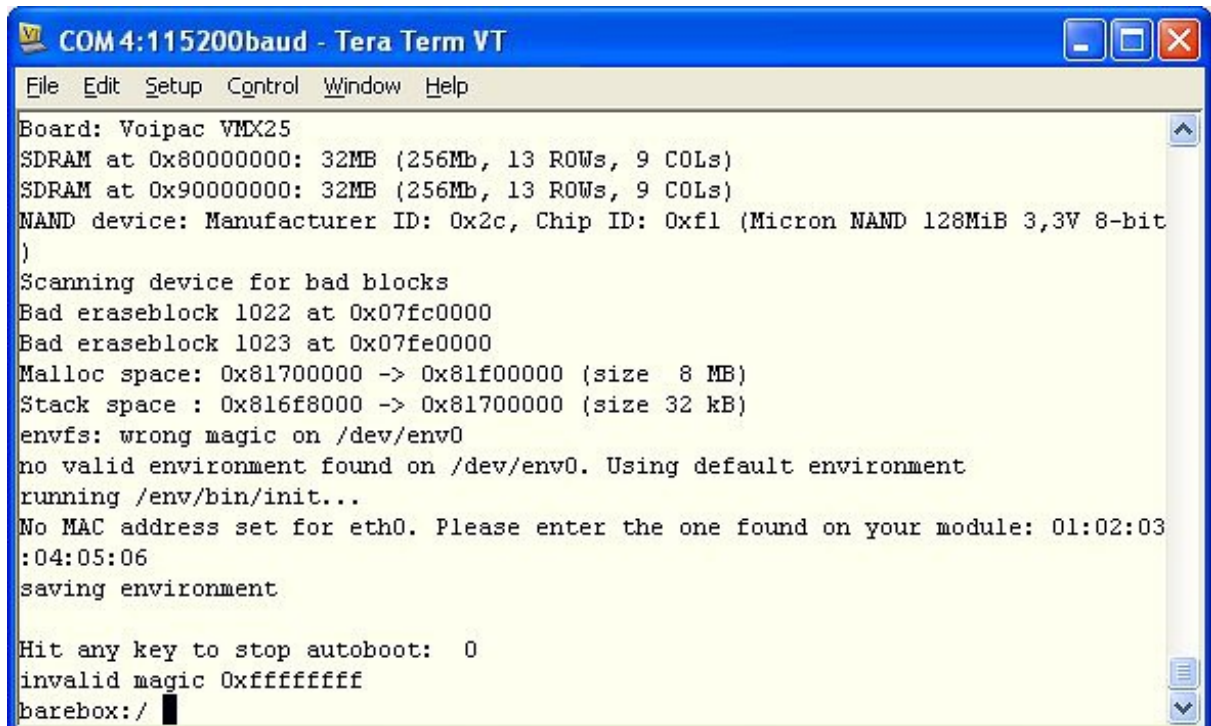
Loaded bootloader (barebox.bin) is running in Serial console.



```
COM1:115200baud - Tera Term VT
File Edit Setup Control Window Help
barebox 2012.01.0 (Feb  2 2012 - 03:14:58)

Board: Voipac VMX51
SDRAM at 0x90000000: 256MB (DDR2 2x1024Mb, 13 ROWs, 10 COLs, 8 BANKs)
m25p@m25p0: sst25vf032b (4096 Kbytes)
m25p@m25p1: at25df081 (1024 Kbytes)
mcl3892-i2c@mcl3892-i2c0: PMIC ID: 0x000045d0 [Rev: 2.0a]
NAND device: Manufacturer ID: 0x2c, Chip ID: 0xa3 (Micron NAND 1GiB 1,8V 8-bit)
Bad block table found at page 524224, version 0x01
Bad block table found at page 524160, version 0x01
nand_read_bbt: Bad block at 0x36640000
Detected CPU i.MX51 rev 3.0 [RST]
Boot device: NAND
Malloc space: 0x97700000 -> 0x97efffff (size 8 MB)
Stack space : 0x976f8000 -> 0x97700000 (size 32 kB)
envfs: wrong magic on /dev/env0
no valid environment found on /dev/env0. Using default environment
running /env/bin/init...
No MAC address set for eth0. Please enter the one found on your module:
```

11 STEP Type MAC address from the module in standard form (00:0d:15:00:XX:XX) and press [Enter].



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help
Board: Voipac VMX25
SDRAM at 0x80000000: 32MB (256Mb, 13 ROWs, 9 COLs)
SDRAM at 0x90000000: 32MB (256Mb, 13 ROWs, 9 COLs)
NAND device: Manufacturer ID: 0x2c, Chip ID: 0xf1 (Micron NAND 128MiB 3,3V 8-bit)
)
Scanning device for bad blocks
Bad eraseblock 1022 at 0x07fc0000
Bad eraseblock 1023 at 0x07fe0000
Malloc space: 0x81700000 -> 0x81f00000 (size 8 MB)
Stack space : 0x816f8000 -> 0x81700000 (size 32 kB)
envfs: wrong magic on /dev/env0
no valid environment found on /dev/env0. Using default environment
running /env/bin/init...
No MAC address set for eth0. Please enter the one found on your module: 01:02:03
:04:05:06
saving environment

Hit any key to stop autoboot:  0
invalid magic 0xffffffff
barebox:/
```



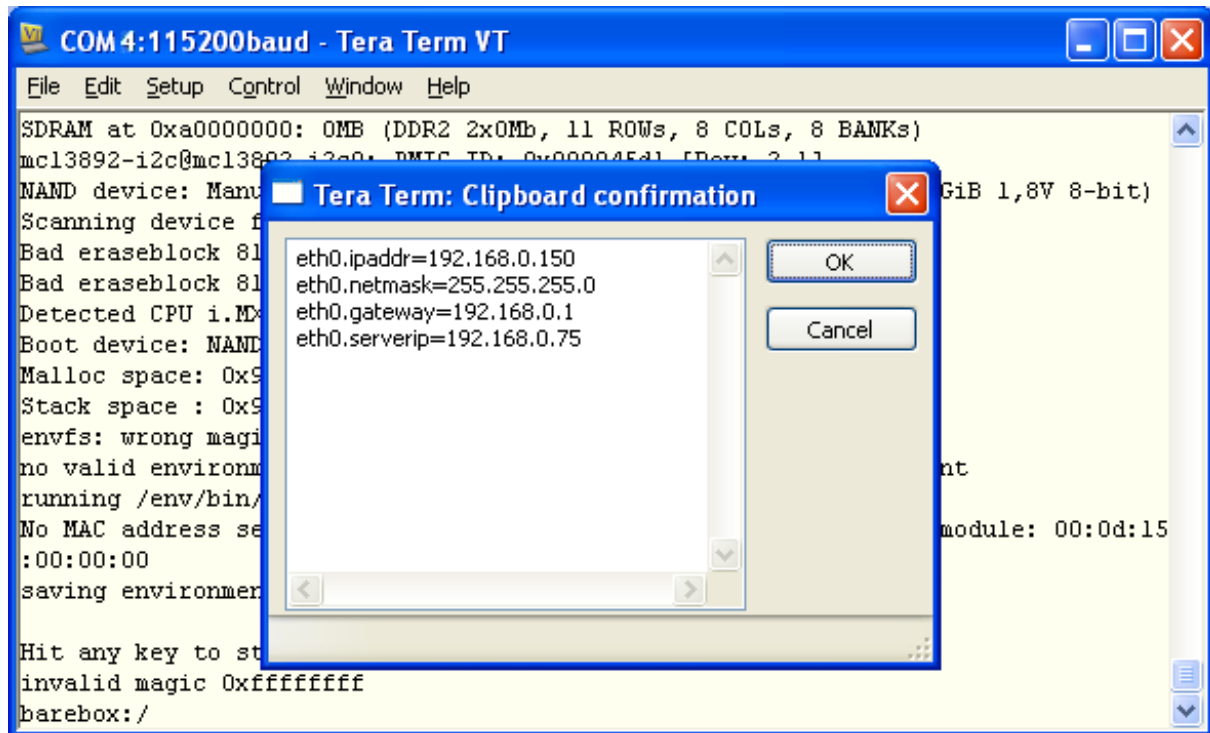
When the module is swithed off, barebox is erased. To flash barebox again, use the same procedure as shown in Step 10.

When the module is swithed off,the MAC address is not erased. It is not required to set MAC address again.

How to flash zImage and rootfs through the TeraTerm

12 Run TFTP server. Type or paste commands in Serial console to set Ethernet:
STEP

```
eth0.ipaddr=192.168.0.150
eth0.netmask=255.255.255.0
eth0.gateway=192.168.0.1
eth0.serverip=192.168.0.75
```



The screenshot shows a Tera Term VT window titled "COM 4:115200baud - Tera Term VT". The main window displays serial console output. A "Tera Term: Clipboard confirmation" dialog box is overlaid on top, containing the following text:

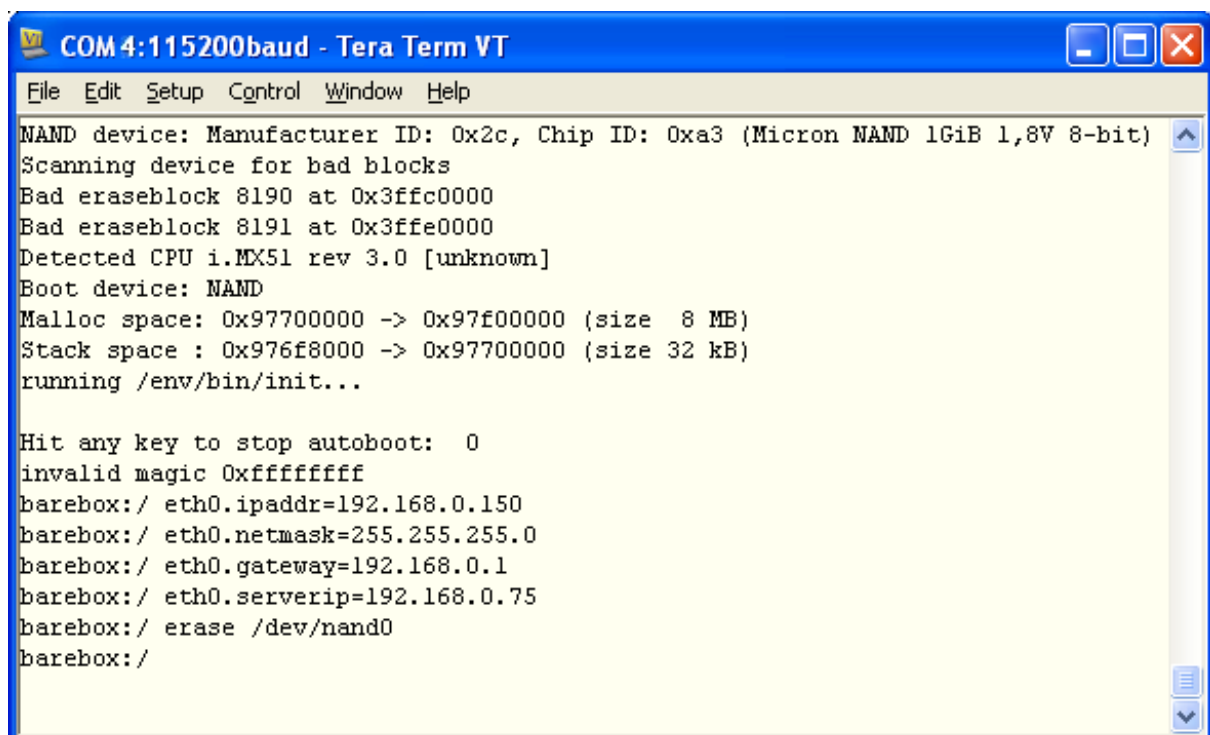
```
eth0.ipaddr=192.168.0.150
eth0.netmask=255.255.255.0
eth0.gateway=192.168.0.1
eth0.serverip=192.168.0.75
```

The dialog box has "OK" and "Cancel" buttons. The background serial console output includes:

```
SDRAM at 0xa0000000: OMB (DDR2 2x0Mb, 11 ROWs, 8 COLs, 8 BANKs)
mcl3892-i2c@mcl3892-i2c0: FWIC ID: 0x000045d1 (Rev: 2.11)
NAND device: Manufacturer ID: 0x2c, Chip ID: 0xa3 (Micron NAND 1GiB 1,8V 8-bit)
Scanning device for bad blocks
Bad eraseblock 8190 at 0x3ffc0000
Bad eraseblock 8191 at 0x3ffe0000
Detected CPU i.MX51 rev 3.0 [unknown]
Boot device: NAND
Malloc space: 0x97700000 -> 0x977f00000 (size 8 MB)
Stack space : 0x976f8000 -> 0x97700000 (size 32 kB)
running /env/bin/init...
No MAC address set
:00:00:00
saving environment
Hit any key to stop autoboot: 0
invalid magic 0xffffffff
barebox:/
```

Type or paste commands in Serial console to erase Flash:

```
erase /dev/nand0
```



The screenshot shows the same Tera Term VT window. The serial console output now includes the command and its execution:

```
Hit any key to stop autoboot: 0
invalid magic 0xffffffff
barebox:/ eth0.ipaddr=192.168.0.150
barebox:/ eth0.netmask=255.255.255.0
barebox:/ eth0.gateway=192.168.0.1
barebox:/ eth0.serverip=192.168.0.75
barebox:/ erase /dev/nand0
barebox:/
```


Type or paste commands separately in Serial console to load files:

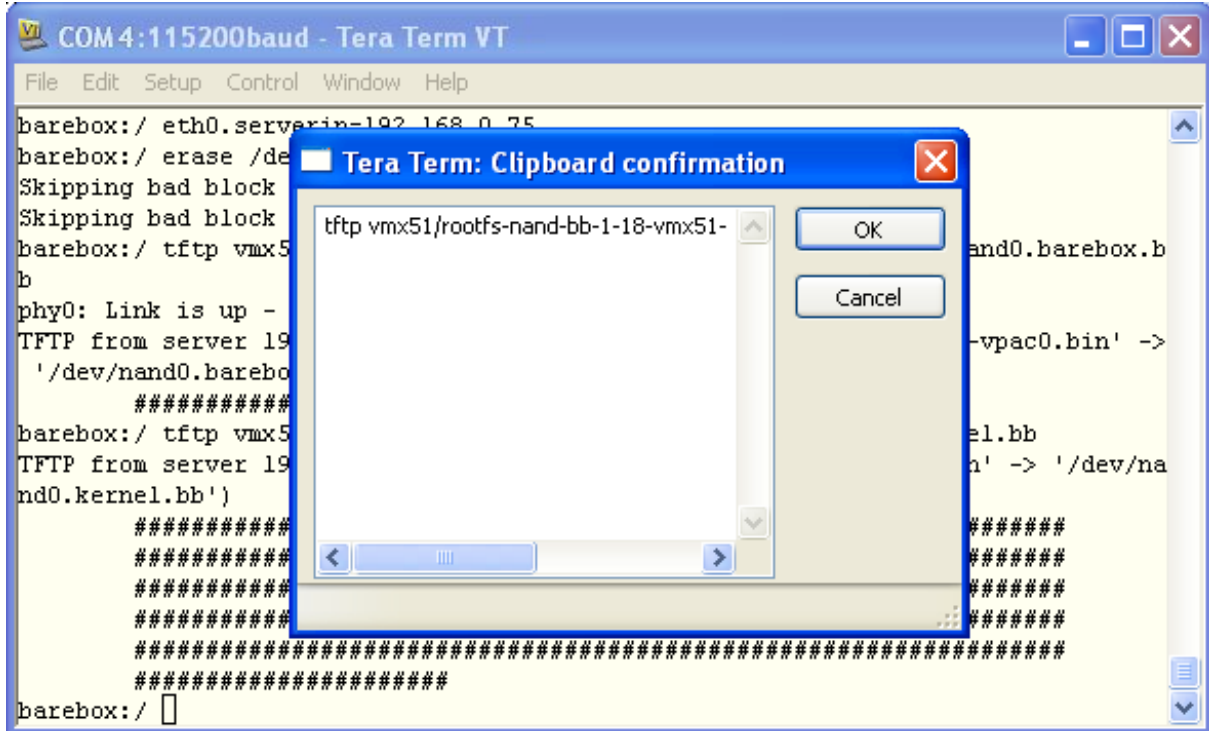
tftp **directory**/barebox-2011_06_0-vmx51-256M-vpac0.bin /dev/nand0.barebox.bb

tftp **directory**/zimage-2_6_35-vmx51-vpac0.bin /dev/nand0.kernel.bb

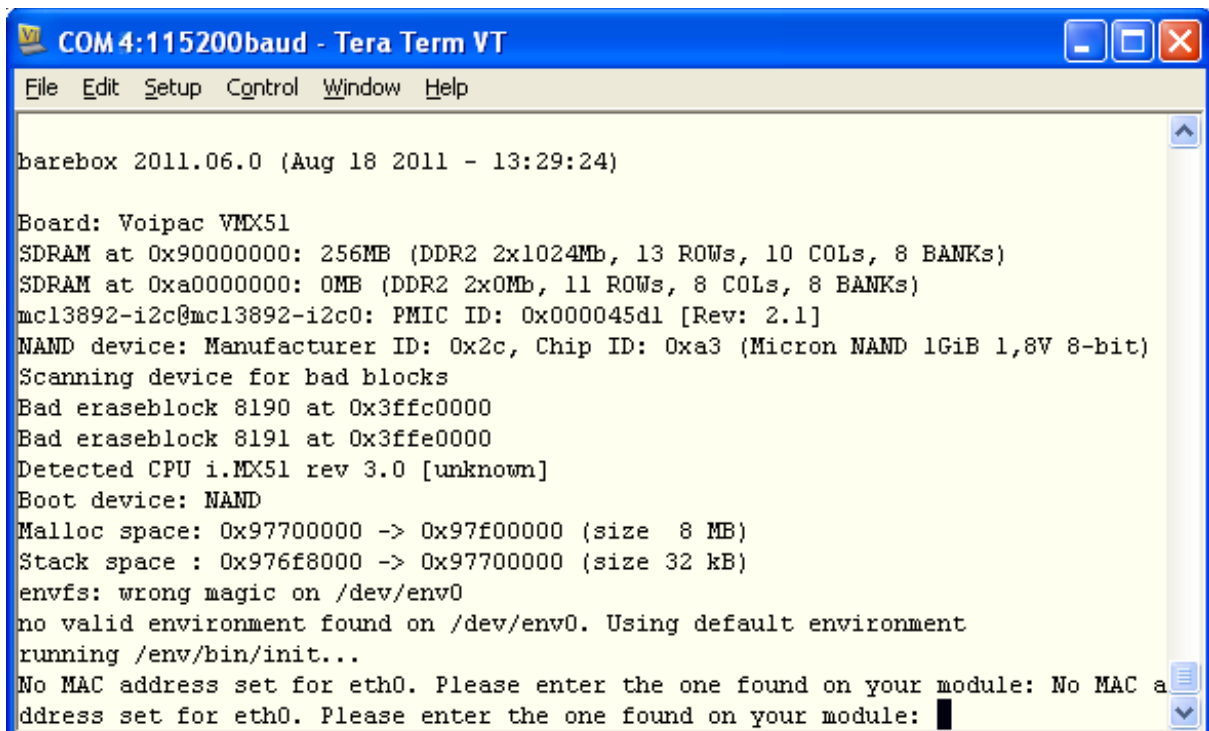
tftp **directory**/rootfs-nand-bb-1-18-vmx51-vpac0.ubi.bin /dev/nand0.rootfs.bb

For 512MB RAM configuration, enter this command:

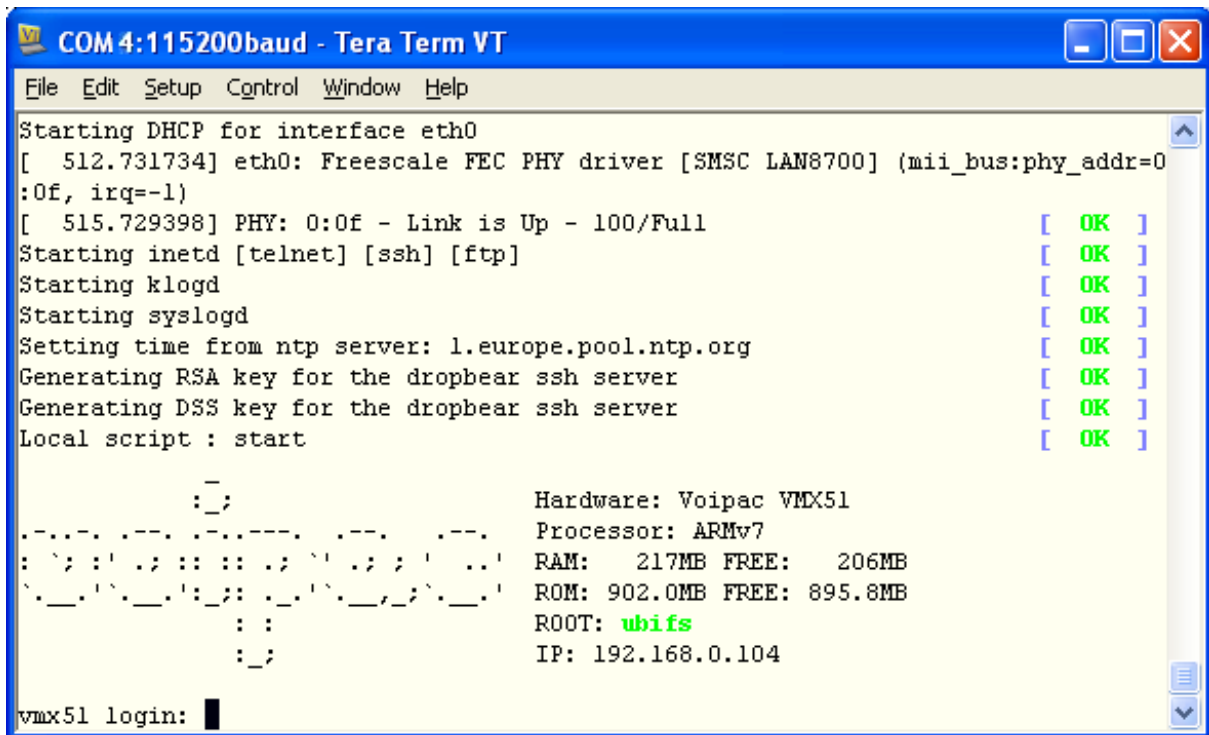
tftp **directory**/barebox-2011_06_0-vmx51-512M-vpac0.bin /dev/nand0.barebox.bb



Final step is to press reset button on baseboard



Type MAC address from the module in standard form (00:0d:15:00:XX:XX) and press [Enter].



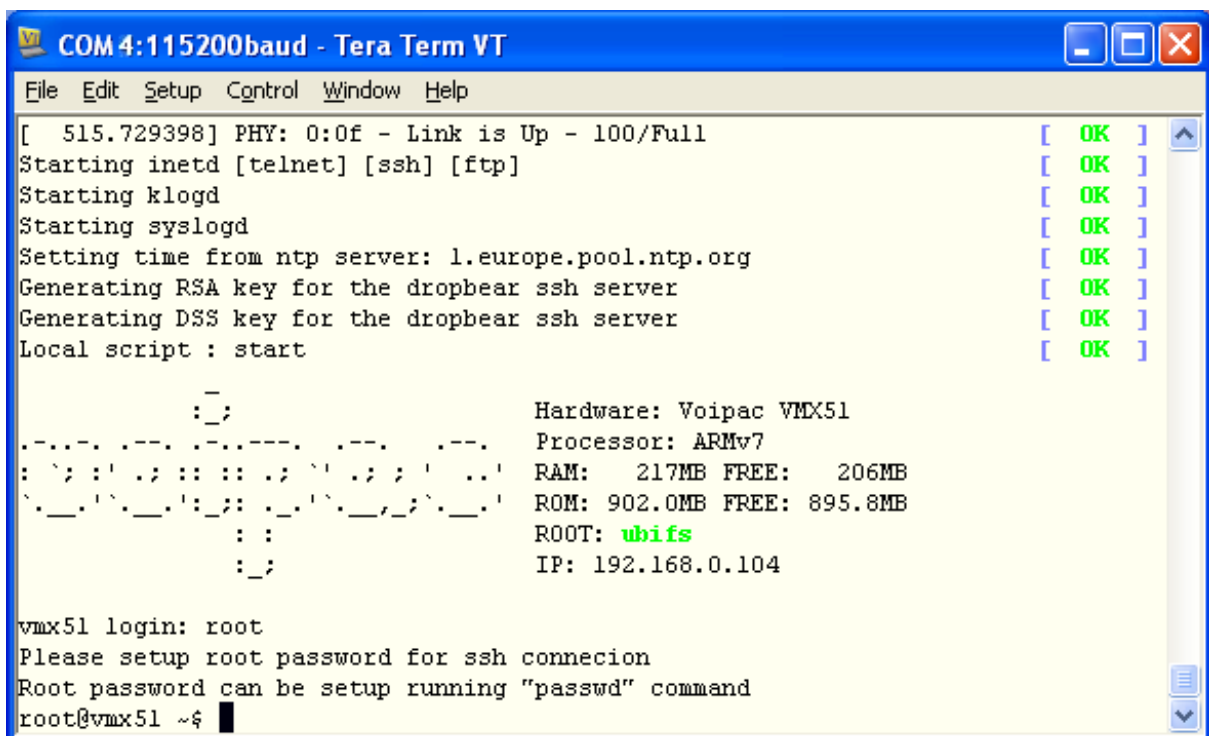
```
COM 4:115200baud - Tera Term VT
File Edit Setup Control Window Help
Starting DHCP for interface eth0
[ 512.731734] eth0: Freescale FEC PHY driver [SMSC LAN8700] (mii_bus:phy_addr=0:0f, irq=-1)
[ 515.729398] PHY: 0:0f - Link is Up - 100/Full [ OK ]
Starting inetd [telnet] [ssh] [ftp] [ OK ]
Starting klogd [ OK ]
Starting syslogd [ OK ]
Setting time from ntp server: 1.europe.pool.ntp.org [ OK ]
Generating RSA key for the dropbear ssh server [ OK ]
Generating DSS key for the dropbear ssh server [ OK ]
Local script : start [ OK ]

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Hardware: Voipac VMX51
Processor: ARMv7
RAM: 217MB FREE: 206MB
ROM: 902.0MB FREE: 895.8MB
ROOT: ubifs
IP: 192.168.0.104

vmx51 login: █
```

Type vmx51 login “root” and press [Enter].



```
COM 4:115200baud - Tera Term VT
File Edit Setup Control Window Help
[ 515.729398] PHY: 0:0f - Link is Up - 100/Full [ OK ]
Starting inetd [telnet] [ssh] [ftp] [ OK ]
Starting klogd [ OK ]
Starting syslogd [ OK ]
Setting time from ntp server: 1.europe.pool.ntp.org [ OK ]
Generating RSA key for the dropbear ssh server [ OK ]
Generating DSS key for the dropbear ssh server [ OK ]
Local script : start [ OK ]

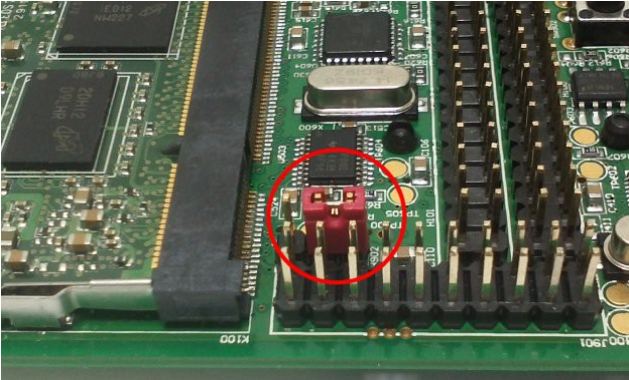
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Hardware: Voipac VMX51
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RAM: 217MB FREE: 206MB
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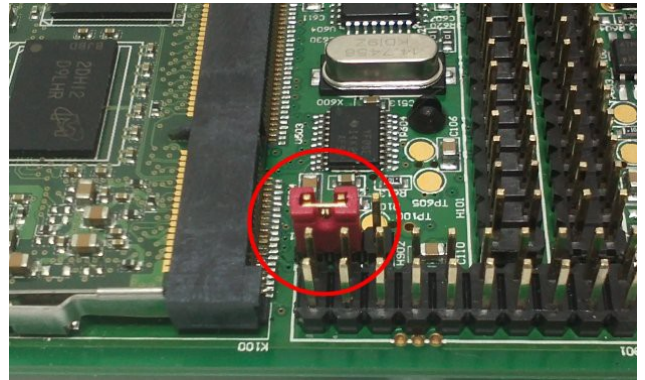
vmx51 login: root
Please setup root password for ssh connection
Root password can be setup running "passwd" command
root@vmx51 ~$ █
```


BOOTMODE Jumper H902

H902 jumper (BOOTMODE) on the baseboard has pins 1 and 2 connected together for Direct Boot. Serial Boot is selected as the bootmode by connecting pins 2 and 3 together. In the current configuration of the modules, there is the Serial(Internal) boot active in both positions.

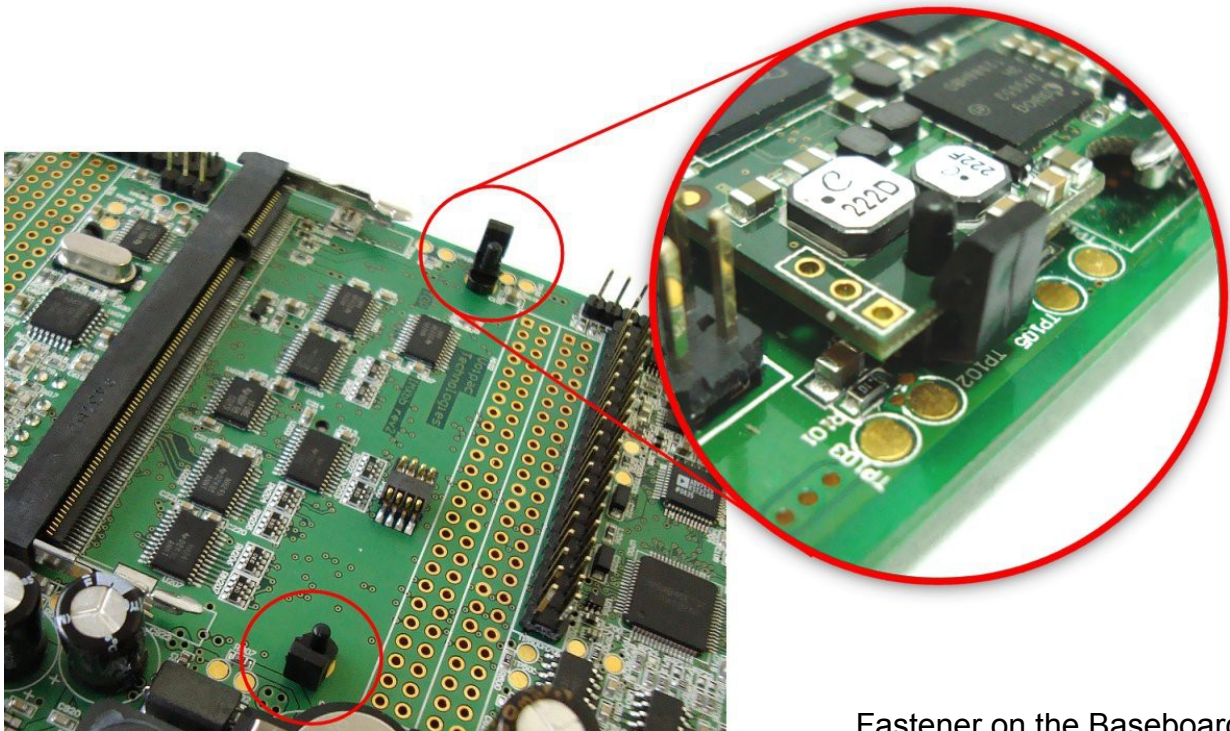


Direct Boot



Serial Boot (Internal Boot)

Mounting Fasteners



Fastener on the Baseboard.

Additional protection of the SODIMM Module fall out of the 200pin socket, ideal for mobile applications.

Products` Life Cycle Phase

Voipac products are divided into 4 phases:

- **INTRODUCTION PHASE**, approximately the first 6-12 months.
The last software issues are still being resolved.
Product in this stage is the most suitable for new designs.
- **ACTIVE PHASE**, the first 1-3 years following the product introduction.
Product software packages are stable, additional functions, OS and GUI are being released.
Product in this stage is suitable for new designs.
- **MATURITY PHASE**, approximately the first 4-6 years after the introduction.
Products are shipped in volumes, additional functions additions declines.
Product in this stage is no longer recommended for new designs.
- **EOL PHASE**, approximately 7-10 years after the introduction.
Used components availability decreases, although product may still be purchased under specific circumstances.
The Last Time Buy notification is send to all product users app. 6 months prior to product discontinuation.
Components stocking service for discontinued products and manufacturing of further production batches is available.

To find out the specific product life cycle phase, visit its [product](#) page and check the title color.

CE compliance of Voipac products

The CE label is a mandatory conformity mark for complex electronic devices placed on the market in the European Economic Area and each product sold within the EU needs a CE Certificate of Conformance that ensures that the product conforms to the essential requirements of the applicable EC directives.

However, if such complex electronic devices are produced for further processing by the industry, skilled development teams or system integrators, they do not need to observe the above mentioned CE requirements and consequently do not need any identification either. This applies to the Voipac SODIMM sized Computers On Module, because these are not used as stand-alone devices by the general public.

Anyway, to make sure that Voipac COMs can be used in CE marked devices, they are designed to obey the EC directives and the standard configuration SBCs manufactured by Voipac are tested for Electromagnetic Interference and operating temperature ranges plugged in corresponding Base Board and mounted in the standard Aluminium case provided to Voipac development kits.

Please visit [Downloads](#) for the testing reports.

TECHNICAL SUPPORT

HW & SW support: support@voipac.com

Warranty claims: warranty.claim@voipac.com

Voipac I.MX53/51/25 development kits come with prepaid 1 month support packages. All of the relevant communication between the customer and Voipac should be executed via e-mails preferably.

Response time is up to 48 hours, except state holidays and weekends.

Voipac working hours are: 8:00 - 17:00, Monday - Friday.

Before contacting support, please read the following for the basic information about how to work with a development kit:

www.voipac.com/#Downloads

<http://free-electrons.com/training>

Besides the free-of-charge support, we provide support for your new designs when it comes to the special drivers for the peripherals not included in the Voipac development kits, design of your own base boards, prototyping, or even new products development.

Please contact: support@voipac.com for more info.

Warranty:

VOIPAC TECHNOLOGIES s.r.o. Does Not Bear Responsibility for the Following:

- Failure of a product resulting from misuse, accident, modification, unsuitable operating environment, or improper maintenance by user
- Unless otherwise agreed in written, a product does not include technical support and the customer may be able to purchase technical support under separate agreement
- Any technical or other support provided under warranty by VOIPAC TECHNOLOGIES s.r.o. such as assistance, set-up and installation is provided WITHOUT WARRANTY OF ANY KIND.

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