SH-2A

TCP/IP for Embedded system M3S-T4-Tiny: Introduction Guide

Introduction

This document explains TCP/IP for Embedded system M3S-T4-Tiny for the SH-2A V.1.06 Release 00 (hereafter referred to as "T4") that depends on MCUs.

T4 is the TCP/IP protocol stack for embedded system. T4 is provided as library format and user can develop own system with this library to use TCP/IP function. The peripherals of the MCU used for communication are two types. Type 1 Ethernet. The peripherals are internal Ethernet controller or external bus. The external bus connects to external Ethernet controller chip.

T4 has sample programs for each CPU board included in the Renesas Starter Kit. This material explains how to setup CPU board, PC settings, Network connections to confirm correct sample program behavior.

And we prepared "easy T4 application" (Web server, FTP server, DHCP client, DNS client, etc..). Please refer to the URL below.

http://www.renesas.com/mw/t4

T4 is assumed for easy application implementation. T4 does not have the function that "Socket interface" like Linux TCP/IP, next generation IP technology like IPSec and IPv6, router function like ICMP error notifying and routing protocol.

T4 can be used for mass-product developing by any users. T4 does not need any payment and royalty. If user needs some supports in time that user implements T4 for own product or after mass-product will be released, we prepared T4 versioned for a fee.

Target Device

SH-2A

Contents

1. Structure of Product

Package Name(*):   TCP/IP for Embedded system M3S-T4-Tiny for the SH-2A V.1.06 Release 00E
Part Number: R0M02APT0020RRC
 (*)V.x.xx Release yy is package version. Vx.xx is T4 Library version.
Package version indicates all data (document, sample program, library) package's version.
T4 Library version is the Version that indicates Software Library for TCP/IP function provided as binary file.

File/Directory name	Description
installer (setup.exe)	Windows installer. Installer will show the T4 product agreement. If user admits this agreement, installer will copy the T4 file to the path below. [Free version] C:\Renesas\an_r20an0050ej_sh2a_t4_v106r00 [Version for a fee] C:\Renesas\an_r20an0050ej_sh2a_t4_v106r00p * There is no difference of the data included in these.
T4 Library (lib)	
T4_Library_sh2a_ether.lib	T4 Library (SH-2A, for Ethernet)
T4_Library_sh2a_fpu_ether.lib	T4 Library (SH-2A, fpu, for Ethernet)
r_t4_itcpip.h	T4 header file
r_stdint.h	Data type header file
r_mw_version.h	Version data header file
Sample program (sample)	
ether.hws	Sample program for Ethernet (High-performance Embedded Workshop Project file)
Sample driver (drv)	

ether
   common
   inc
	Ethernet sample driver for SH7216
	Excerpt from R01AN0289EJ0211
	http://am.renesas.com/products/mpumcu/superh/sh7216/sh7216/Application_Notes.jsp

Document (doc)	
r20uw0031ej0105_t4tiny.pdf	User's Manual
r20uw0032ej0104_t4tiny.pdf	Ethernet Driver Interface Specification
r20an0051ej0104_sh2a_t4.pdf	Introduction Guide

When user installs T4 to Windows 7 PC, Please select "Run as administration"
Or please install T4 to Windows XP PC and copy install directory to Windows 7 PC.

2.   Library Specification

Library specification can be seen in user's manual included in T4 installer. T4 installer can be downloaded in Renesas Electronics Web site.

User's manual explains how to use this library, and APIs. And Ethernet driver interface specification explain how to make the user defined functions called from library.

3.   Corresponding MCU

This product corresponds to SH-2A.

Library file is built with default compile option.

-cpu=sh2a   T4_Library_sh2a_ether.lib

-cpu=sh2afpu   T4_Library_sh2a_fpu_ether.lib

4.   Development Environment

-Requirement items
  When user develops, please choose newer version than below.

[Software]
  -Integrated Development Environment
    High Performance Embedded Workshop Version 4.09.01.007

  -C compiler
  SuperH RISC engine Standard Toolchain (V.9.4.0.1)

[Debug tools]
  Emulator debugger
    E10A-USB emulator

  Emulator Software
  E10A-USB emulator software V.3.03 Release 00

[board]
Ethernet :

    RSK+SH7216   (Type : R0K572167C001BR)

5. T4 Ethernet Sample Application ROM / RAM / Stack Size

Sample application is made with settings below. Required memory1 - 3 are needed for this sample program.

        * 3 Reception buffer for application
                -> Required RAM1500 byte.by 1 reception buffer.
        * 3 Communication endpoints with 1460bytes reception window.
                -> Required RAM 1460byte by 1 communication endpoint.
         *1 Reception/1 Transmit buffer for Ethernet driver.
                -> Required RAM 1536byte by 1 Reception/Transmit buffer.

[Required memory1 : ROM/RAM size for Application :: main.c, echo_srv.c (tcp non blocking call)]
        ROM   :   about   396   byte
        RAM   :   about   10040   byte

[Required memory2 : ROM/RAM size for T4 :: T4_Library_ether_sh2a_little.lib]
        ROM   :   about   16564   byte
        RAM   :   about   144   byte

[Required memory3 : ROM/RAM size for Ethernet driver :: t4_driver.c, phy.c, r_ether.c]
        ROM   :   about   1340   byte
        RAM   :   about   4726   byte

API	stack size (includes sample driver)	Function called from T4 Library
tcp_acp_cep	68	tcp_api_slp
tcp_con_cep	68	tcp_api_slp
tcp_rcv_dat	104	tcp_api_slp
tcp_snd_dat	72	tcp_api_slp
tcp_sht_cep	52	tcp_api_slp
tcp_cls_cep	60	tcp_api_slp
tcp_can_cep	24	tcp_api_slp
udp_rcv_dat	80	udp_api_slp
udp_snd_dat	44	udp_api_slp
udp_can_cep	20	dis_int ena_int
tcpudp_get_ramsize	28	
tcpudp_open	84	tcpudp_act_cyc
_process_tcpip	396	tcp_api_wup udp_api_wup tcp_api_slp udp_api_slp rcv_buff_release lan_write lan_read lan_reset tcpudp_get_time
tcpudp_close	4	tcpudp_act_cyc

        This stack size table is for sample program of T4.

Use the "CallWalker" to check your system stack size. Because the stack size is changed in case "Changed compile option" and "Changed sample driver code", etc.

6.   Version information

User can access T4 Library information with valuable below.
```
extern const mw_version_t R_t4_version;

SH-2A Library file (For the Ethernet) :
  Library = " M3S-T4-Tiny(Ethernet) version 1.06 for SH-2A.(Jun 13 2013,
14:36:38)"

SH-2A(fpu) Library file (For the Ethernet) :
  library = " M3S-T4-Tiny(Ethernet) version 1.06 for SH2A-FPU.(Jun 13 2013,
14:39:41)"
```

7. Ethernet sample driver

In case update sample Ethernet driver shown in Renesas web site, user overwrite directories "ether" and "common" from sample Ethernet driver to T4 sample program's HEW.

And correct 4 files after this.

1. resetprg.c line95   comment out
```
//    COPYSCT();
```

2. resetprg.c line98   add a compilation condition
```
#if defined (_SH2AFPU)
   set_fpscr(FPSCR_Init);
#endif
```

3. intprg.c line47   comment out
```
//#include "clock-arch.h"
```

4. intprg.c line 324   comment out existing processing, add timer interrupt function "timer_interrupt();" and CMF clear.
```
CMT0.CMCSR.BIT.CMF = 0;
CMT0.CMCSR.BIT.CMF;      /* Dummy Read */
timer_interrupt();
//int_cmt0_isr();
```

5. intprg.c line 350   add Ethernet interrupt function "lan_recv_handler();"
```
lan_recv_handler();
```

6. intprg.c   add extern
```
extern void lan_recv_handler(void);
extern void timer_interrupt(void);
```

7. Changing eth.h line37, line38
<Before changing>
```
#define   BUFSIZE   256
#define   ENTRY       8
```

<After changing>
```
#define   BUFSIZE   1536
#define   ENTRY       1
```

8. Changing eth.h line196
<Before changing>
```
EDMAC.TRSCER.LONG = 0x00000000;         /* copy-back status is RFE & TFE
only */
```

<After changing>
```
EDMAC.TRSCER.LONG = 0x00000080;         /* copy-back status is RFE & TFE
only */
```

9. add 10ms timer program into hwsetup.c

add extern	:	extern void io_init_cmt0(void);
add call this function	:	in function HardwareSetup();
implement io_init_cmt0()	:	in HardwareSetup.c

```
/*""FUNC COMMENT""*******************************************************
 * ID          :
 * Outline     : CMT0 setting
 *-----------------------------------------------------------------------
 * Include     : #include "iodefine.h"
 *-----------------------------------------------------------------------
 * Declaration : void io_init_cmt0(void);
 *-----------------------------------------------------------------------
 * Description : Sets CMT0 as the fixed-cycle timer for 10 msec
 *-----------------------------------------------------------------------
 * Argument    : void
 *-----------------------------------------------------------------------
 * Return Value : void
 *-----------------------------------------------------------------------
 * Note        : None
 *""FUNC COMMENT END""***************************************************/
void io_init_cmt0(void)
{
  /* ==== CMT0 setting ==== */
  /* ---- CMSTR setting ---- */
  CMT.CMSTR.BIT.STR0 = 0x0;        /* Count stop */
  /* ---- CMCSR0 setting ---- */
  CMT0.CMCSR.WORD = 0x0043;        /* Pclock/512 */
  /* ---- CMCNT0 setting ---- */
  CMT0.CMCNT = 0x0000;             /* Timer counter clear */
  /* ---- CMCOR0 setting ---- */
  CMT0.CMCOR = 976;                /* Set time = 10msec. */
  /* ---- CMSTR setting ---- */
  CMT.CMSTR.BIT.STR0 = 0x1;        /* Count start */
}
```

8. Confirm sample program

8.1 How to confirm Ethernet sample program

(1)Setup Hardware connections

Ethernet sample program environment 1

Ethernet sample program environment 2
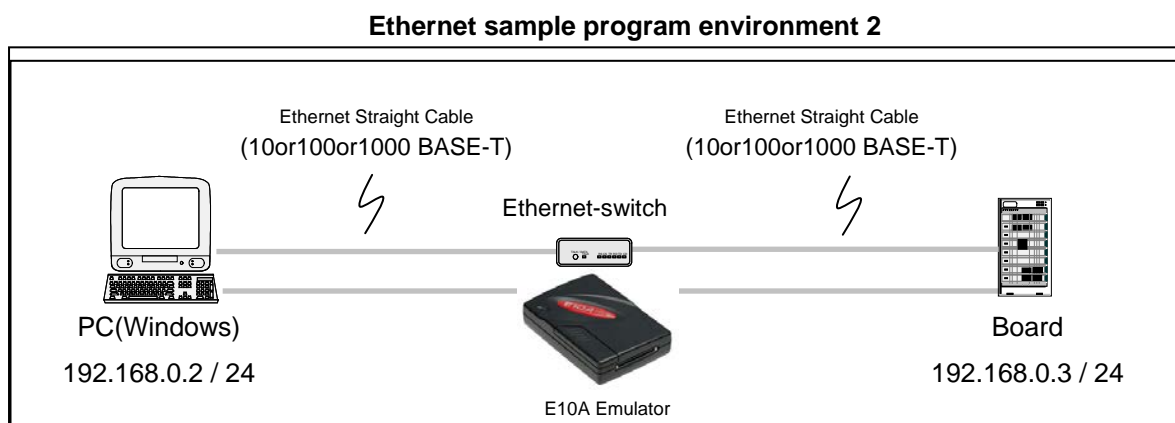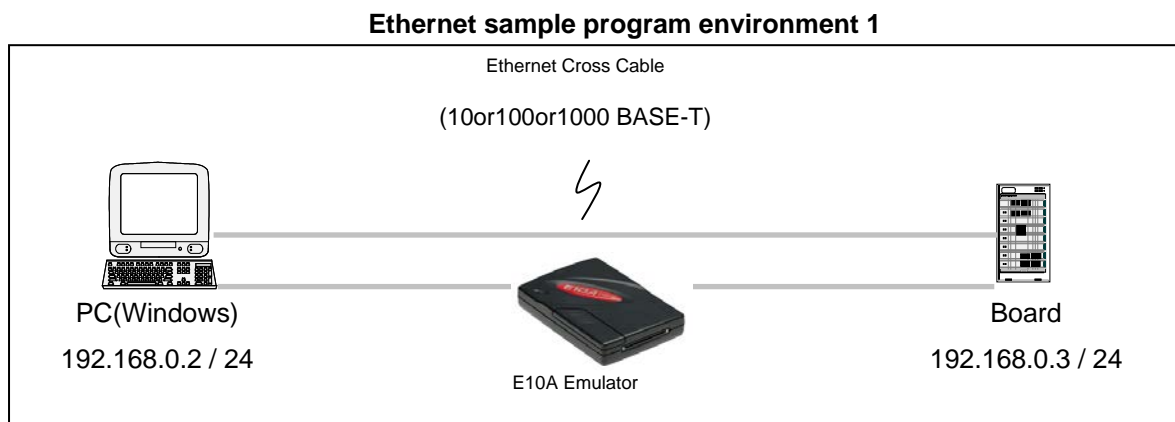
We have confirmed using the Ethernet-switch product introduced in below.

- NETGEAR: GS108E

This Ethernet-switch has the function called "port mirroring function", this function provides monitoring function for Ethernet. This Ethernet-switch can realize packet monitoring environment if user uses normally Ethernet-switch.

For example, please refer to the figure below, the board A transfers data to board B, normally Ethernet-switch filters packet and only outputs to the port connected to board B. If "port mirroring function" exists on Ethernet-switch, it copies data board B port and port mirroring port.

This function provides to monitor for peer-to-peer communication.

We recommend "Wireshark" for packet monitor. Please use "promiscuous mode" for peer-to-peer communication.
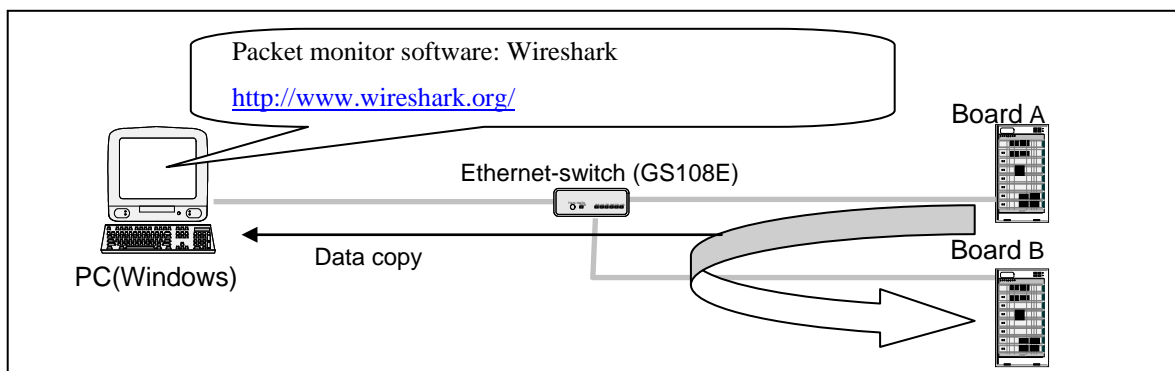
(2) PC setting.

Windows 7:

Control Panel -> Network -> Adaptor setting -> Local Network Connection

Network Tab -> Internet Protocol Version 4 (TCP/IPv4) -> Property

Display current settings for IP address. Please save the current settings.

After this, please set like below.
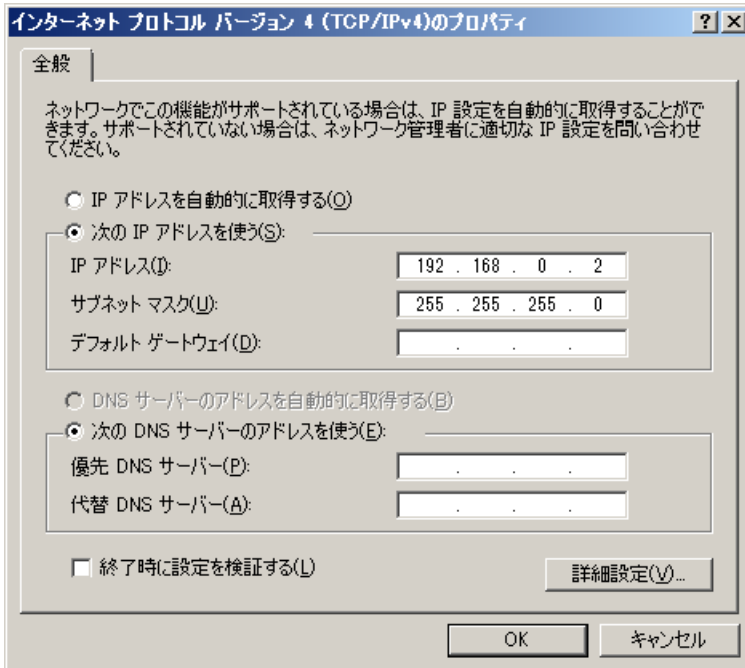
After setting, please push OK button.

(3) Double click *.hws file in Sample program (sample folder)

(4) Connect E10A Emulator and program download and execute.
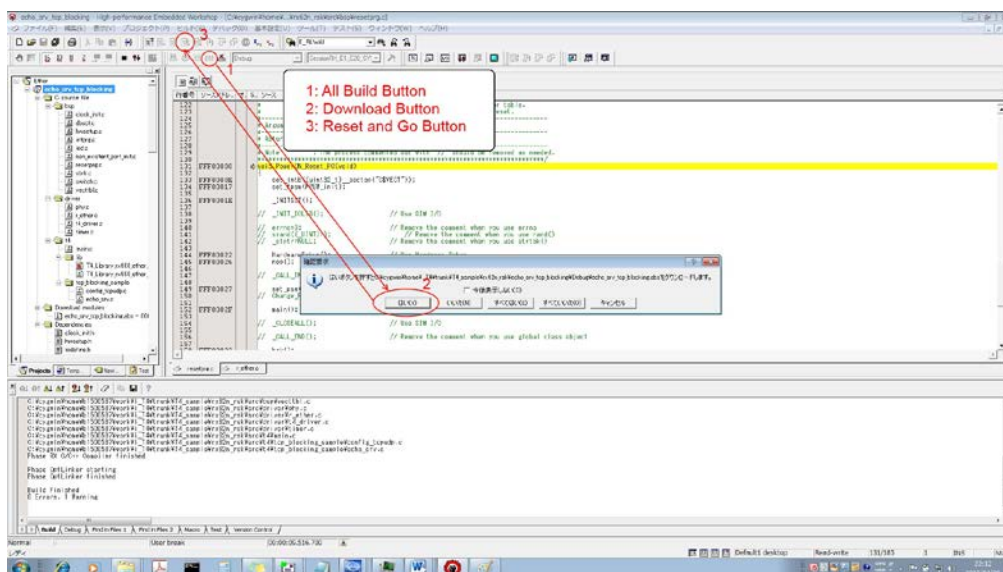
(5) Confirm IP Address for MCU (find MY_IP_ADDR in config_tcpudp.c)

(6) Execute ping command to MCU in command prompt.

(7) Execute telnet in command prompt

Windows 7 needs availability to use telnet command.

Start -> Control Panel -> Program and Function
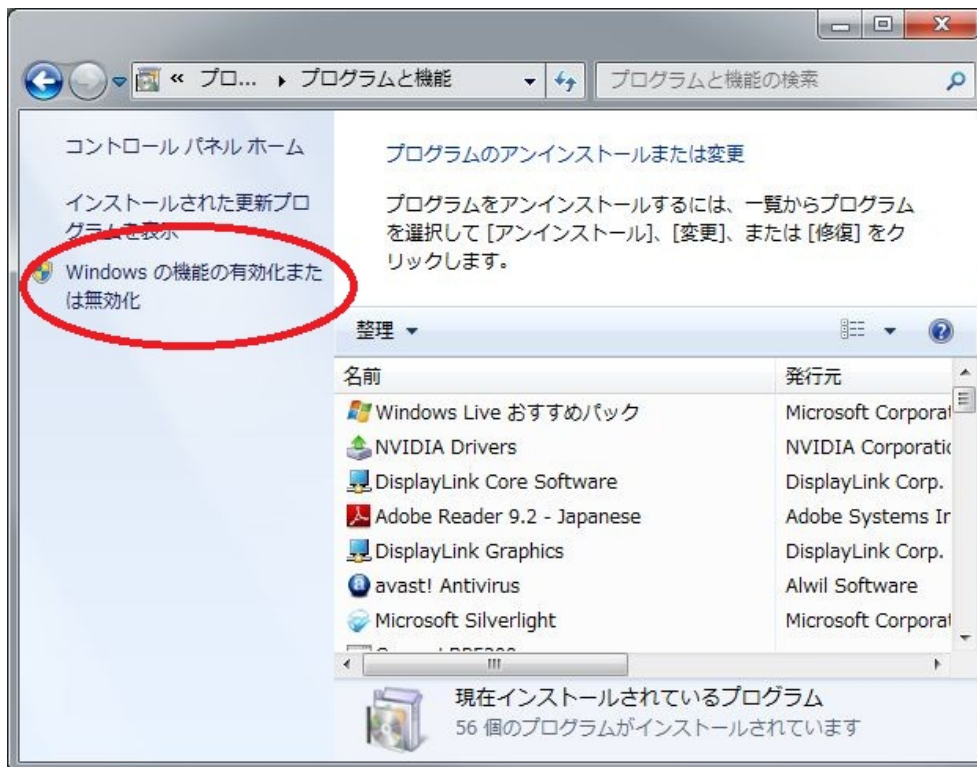
Please check Telnet client
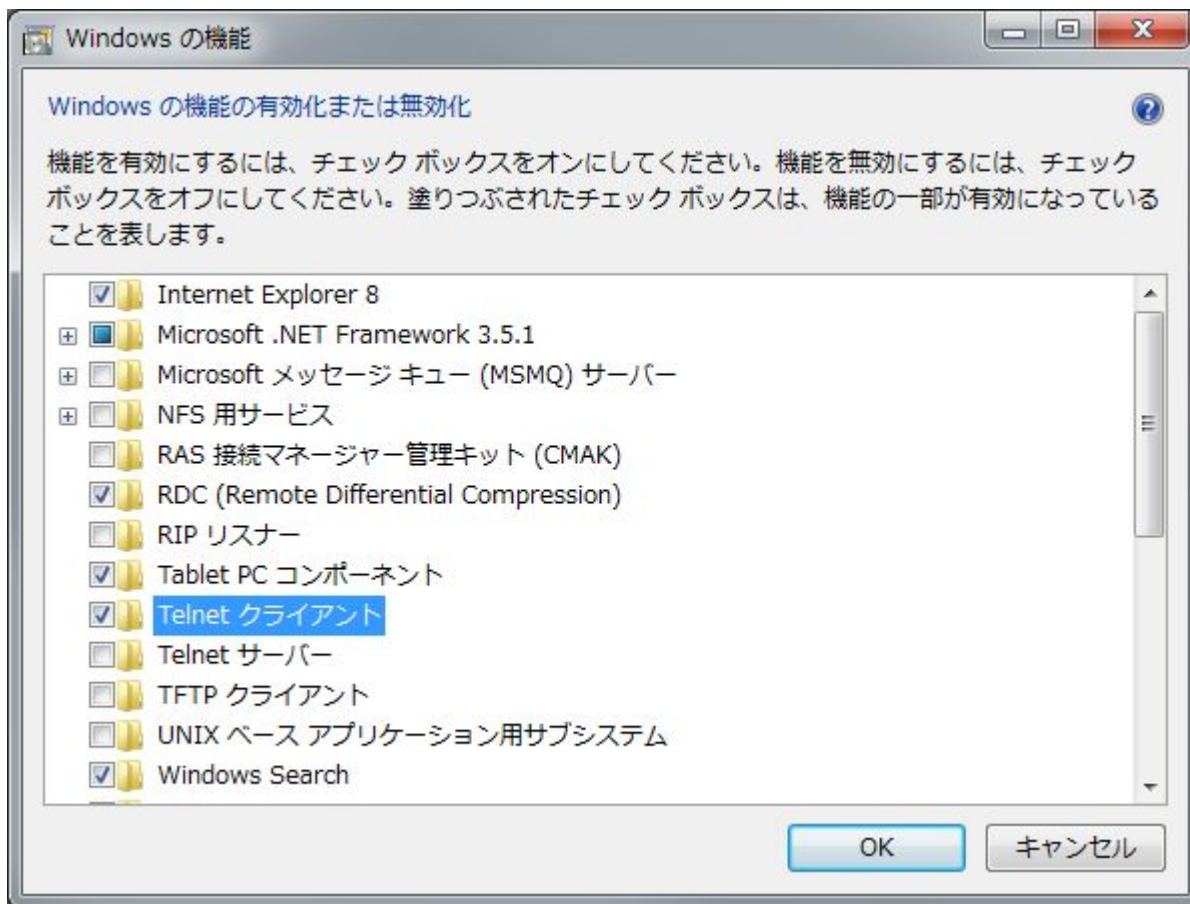
Please input "telnet 192.168.0.3 1024" in command prompt.

Please input any keyboard input.

It is OK to confirm the data echo-back.

Please input Ctrl + "]" and next, input "quit[enter key]" makes disconnection.
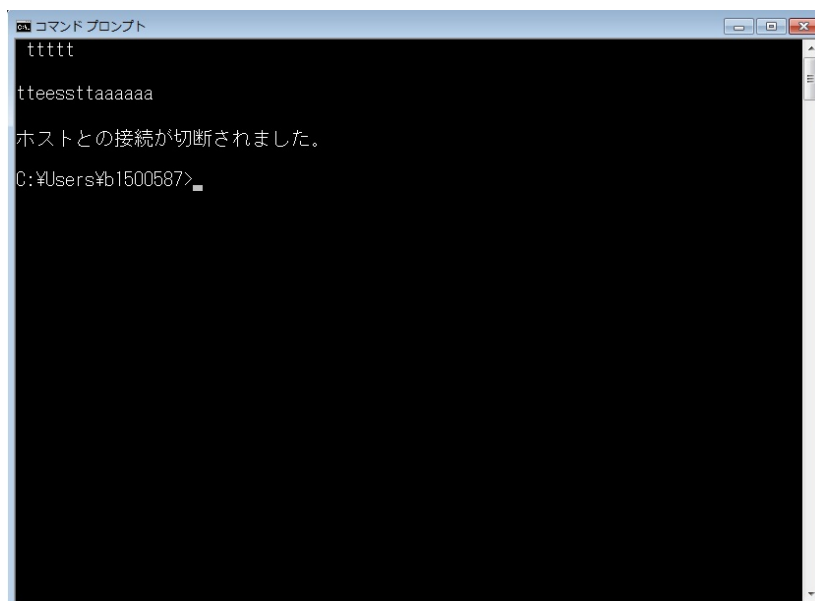
9. Notes

(1)Specify the size of 15bit or less for the third argument "INT len" of tcp_rcv_dat() and tcp_snd_dat().

(2)Specify the size of 15bit or less for the fourth argument "TMO tmout" of tcp_rcv_dat() and tcp_snd_dat().

(3)The MAC address of the sample program is stored in _ myethaddr variable of config_tcpudp.c.

　　Change an initial value of the myethaddr (MAC address) variable if necessary according to the system.

10. Software update information

Package version	change	release date
V.1.06 Release 00	Add Function: - UDP broadcast receive function (destination IP address 255.255.255.255) - UDP directed-broadcast receive function (destination IP address example: network address = 192.168.0.0/24 -> broadcast address 192.168.0.255) - UDP broadcast send function (destination IP address 255.255.255.255) - UDP directed-broadcast send function (destination IP address example: network address = 192.168.0.0/24 -> broadcast address 192.168.0.255) - UDP multicast receive function Improve Performance: - Optimize checksum calculation. - Enable Ethernet transmit interrupt Bug Fix: - When user use RI600/4(Renesas uITRON) with T4, conflict r_t4_itcpip.h and itron.h. - Receiving TCP window size is 0 packet, incorrect ACK would be sent from T4 - Incorrect return value from tcp_acp_cep() that is in state of accepting. - There is incorrect combination about IP address and subnet mask. This combination makes the packets not to transmit. - In case, result of calculating UDP checksum is ZERO, T4 stores temporary value to received UDP checksum area. In case, receiving broadcast packet before sending ARP response, T4 sends illegal packet.	Aug,30,13
1.04	Add Function: - Add Etherent driver function "report_error". - Add variable "_udp_enable_zerochecksum" for behavior of UDP sum check. Bug Fix: - Correct "t4_driver.c" to fix FR flag clear timing. - This fixes wrong operation that EDMAC stops incorrectly.	Aug.30.11
1.03	Bug Fix: - When user use RI600/4(Renesas uITRON) with T4, User definition function "api_wup()" has no way to know which communication endpoint is ended. - Change "api_wup()" argument. To know which communication endpoint is ended.	Feb.02.11
1.02	Bug Fix: - When user use RI600/4(Renesas uITRON) with T4, conflict r_t4_itcpip and itron.h. - Fixed r_t4_itcpip.h	internal use
1.01	Bug Fix: - When T4 uses API "tcp_snd_dat" with condition that other endpoint becomes zerowindow, and other endpoint returns ACK with enough window size. T4 (sender) continues zerowindow probe, and other endpoint returns ACK with enough window size. - This condition makes T4 not to be able to update remote window size and hung-up. - When T4 judges "other endpoint is zerowindow", and other endpoint returns ACK with enough window size, T4 retransfers previous data. (not zerowindow probe)	Nov.10.10

1.00	first release	Oct.09.10

Website and Support

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http://www.renesas.com/

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Revision Record

		Description	
Rev.	**Date**	**Page**	**Summary**
1.04	Aug.30.13	-	Release with TCP/IP for Embedded system M3S-T4-Tiny for the SH-2A V.1.06 Release 00E
			- Changed form "Library version information" to "Software update information".
			->Changed from "Ver" to "Package version"
		p6	- Changed stack size table.
			- Changed ROM/RAM size.
		p15	- Added How to confirm sample program sections
1.03	Sep.12.11	all	Release with M3S-T4-Tiny for the SH-2A V.1.04 Release01E
		p2	Add description for word that "HEW".
1.02	Aug.30.11	all	Release with T4 library ver 1.04
1.01	Feb.02.11	all	Release with T4 library ver 1.03
1.00	Nov.10.10	-	First edition issued

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins

   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.
   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.
   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.
   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.
   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to one with a different type number, confirm that the change will not lead to problems.
   — The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

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