1. Register map outline

The RBCP memory space from 0xFFFFFF_0000 to 0xFFFFFF_FFFF is reserved for SiTCP internal use. There is currently defined EEPROM space, Ethernet PHY MIF interface space and SiTCP register space. This area controls the basic operation of the SiTCP and must be changed after understanding the contents of this document. The areas without explanation are not recommended for reading as well as writing. Do not change the undefined bits in the registers either, as they may be extended in the future.

1.1. EEPROM space(0xFFFF_FC00～0xFFFF_FCFF)

The EEPROM space can be read at any time, but the EEPROM write-protection must be released for writing. Write-protection can be released by writing 0x00 to 0xFFFFFFFCFF. The value to be written when the write-protect is released is arbitrary at present but should be set to 0x00 to ensure compatibility when expanding in the future. It is recommended to read/write 16 Bytes or less at a time.

Table.1-1. EEPROM memory map

address	explanation
0xFFFFFC10～0xFFFFFC4F	Initial value of 0xFFFFFFFF10 to 0xFFFFFFFF4F
0xFFFFFCFF	Write 0x00 to release write-protection.

1.2. Ethernet PHY MIF interface space(0xFFFF_FE00～0xFFFF_FEFF)

Write and read access to the PHY registers is possible from this space. For access, MDIO and MDC must be connected to SiTCP and the PHY address must be set (refer to the SiTCP Input/Output Port Manual). If the PHY register is R, it corresponds to the RBCP addresses 0xFFFF_FE00+2*R and 0xFFFF_FE00+2*R+1. For both read and write operations, access the registers starting with 0xFFFF_FE00+2*R in sequence. Refer to the data sheet of the PHY used for the contents of the PHY registers.

1.3. SiTCP register space(0xFFFF_FF00～0xFFFF_FFFF)

This is the area referred to as internal registers and SiTCP control registers in the 'SiTCP Manual'. “Details of the SiTCP register space” in the next section.

2. Details of the SiTCP register space

Table 2-1 shows the register map of the SiTCP. Normally these registers are set to standard values, either by default or by values saved in the EEPROM. Changes should only be made with full understanding.

Table 2-1. SiTCP register map

Address (Difference from 0xFFFF_FF00)		Byte	Explanation
Start	End		
+0x00	+0x03	4	SiTCP Library Synthesis Date Register
+0x04	+0x07	4	SiTCP Library FPGA ID Register
+0x08	+0x0F	4	SiTCP ID/Version Register
+0x10	+0x10	1	SiTCP and TCP Control Register
+0x11	+0x11	1	Reservation area
+0x12	+0x17	6	MAC Address Register
+0x18	+0x1B	4	IP Address Register
+0x1C	+0x1D	2	TCP Port Number Register (main port)
+0x1E	+0x1F	2	TCP Port Number Register (sub port)
+0x20	+0x21	2	TCP Maximum Segment Size Register
+0x22	+0x23	2	RBCP Port Number Register
+0x24	+0x25	2	TCP Keepalive Time (buffer not empty) Register
+0x26	+0x27	2	TCP Keepalive Time (buffer empty) Register
+0x28	+0x29	2	TCP Timeout (Connecting) Register
+0x2A	+0x2B	2	TCP Timeout (Disconnect) Register
+0x2C	+0x2D	2	TCP Maximum Segment Lifetime (MSL) Register
+0x2E	+0x2F	2	TCP Retransmission time Register
+0x30	+0x35	6	TCP Server MAC Address Register
+0x36	+0x39	4	TCP Server IP Address Register
+0x3A	+0x3B	2	TCP Server Port Number Register
+0x3C	+0x3F	4	User Area
+0x40	+0xFF	192	Access prohibited area

2.1. SiTCP and TCP Control Register

Sets or resets the SiTCP operating mode (Table 2-2). The initial value of this register is 0x01. Details are explained in 3.4.1 - 0.

Table 2-2. Bit map of control register

Bit address	Symbol	Explanation
bit7	SiTCP reset	Reset SiTCP by writing 1.
bit6	Client ARP	Client ARP function 1:Enabling 0:Disenabling
bit5	Dup Ack	Dup Ack transmission 1:Enabling 0:Disenabling
bit4	MIF Initializer	MIF initialization function 1:Enabling 0:Disenabling
bit3	MAC flow control	Corresponding PAUSE frame 1:Enabling 0:Disenabling
bit2	Keep alive packet	Keep alive packet transmission function 1:Enabling 0:Disenabling
bit1	Fast retrains.	Fast retransmission 1:Enabling 0:Disenabling
bit0	Nagle buffering	Nagle's algorithm 1:Enabling 0:Disenabling

2.1.1. SiTCP reset (bit7)

Setting this bit to 1 resets and initializes SiTCP and the registers in the same way as when 1 is input to the RST port of SiTCP. In addition, SiTCP-RST is temporarily held at 1 after initialization (Refer to the I/O port manual).

2.1.2. Client ARP (bit6)

This bit is used in client mode. Setting it to 1 allows an ARP request to be made to the server to be connected to and the MAC address is obtained from the ARP replies returned. In this case, it is not necessary to set the MAC address of the server to be connected to in 3.17.TCP Server MAC Address Register.

2.1.3. Dup Ack (bit5)

If this bit is set to 1, SiTCP sends ACK packets in approximately 2 msec cycles after receiving data from the connection partner until the next packet of some kind is received. If this bit is set to 0, only one ACK is sent for each data transmission from the destination.

2.1.4. MIF Initializer (bit4)

Setting this bit to 1 enables the PHY's (excluding the vendor-dependent part) MIF initialization using SiTCP to be performed. During auto-negotiation, the link partner's PHY can be advertised about the enablement of the PAUSE function (bit 3 below) and

the disablement of half-duplex communication. When this bit is set to 0, these settings are defaults on the PHY side.

When using the SiTCP register area, the EEPROM area corresponding to this SiTCP register area (bit 4 of 0xFFFF_FC10) must be set to 1 in advance.

The settings made by SiTCP to the PHY register of the connection destination when this bit is set to 1 are shown in Table 2-3 to Table 2-5. SiTCP makes settings in the Auto-Negotiation advertisement register (Register 4), MASTER-SLAVE control register (Register 9) and Control register (Register 0) in that order.

Table 2-3. Content of settings to Auto-Negotiation advertisement register (Register 4)

Bit address	Content	SiTCP set value
bit15	Next Page	0
bit14	Reserved	0
bit13	Remote Fault	0
bit12	Extended Next Page	0
bit11	Asymmetric PAUSE operation for full duplex Links	bit3 set value
bit10	PAUSE operation for full duplex links	bit3 set value
bit9	100BASE-T4	0
bit8	100BASE-TX full duplex	1
bit7	100BASE-TX	0
bit6	10BASE-T full duplex	1
bit5	10BASE-T	0
bit4-0	Selector Field	00001

Table 2-4. Content of settings to MASTER-SLAVE control register (Register 9)

Bit address	Content	SiTCP set value
bit15-13	Test mode bits	000
bit12	MASTER-SLAVE Manual Config Enable	0
bit11	MASTER-SLAVE Config Value	0
bit10	Port type	0
bit9	1000BASE-T Full Duplex	MODE_GMII set value (*)
bit8	1000BASE-T Half Duplex	0
bit7-0	Reserved	00000000

* Value of SiTCP input port MODE_GMII (Refer to input/output port manual).

Table 2-5. Content of settings to Control register (Register 0)

Bit address	Content	SiTCP set value
bit15	Reset	0
bit14	Loopback	0
bit13	Speed Selection (LSB)	1
bit12	Auto-Negotiation Enable	1
bit11	Power Down	0
bit10	Isolate	0
bit9	Restart Auto-Negotiation	1
bit8	Duplex Mode	1
bit7	Collision Test	0
bit6	Speed Selection (MSB)	0
bit5-0	Reserved	000000

2.1.5. MAC flow control (bit3)

This bit enables the PAUSE frame support function of IEEE802.3X, an Ethernet flow control method. When SiTCP receives a PAUSE frame from a switching hub during data transmission, it stops data transmission according to the interruption time set in the frame. In addition, data transmission is resumed when a frame with an interruption time of 0 is received. There is no function to send out PAUSE frames.

Regardless of the result of the negotiation, the setting to this register enables the PAUSE function of SiTCP, but the link partner must be advertised by auto-negotiation that the PAUSE function is enabled. To use SiTCP for advertising, the MIF initialization and PAUSE functions must be enabled beforehand (bit 4 and bit 3 of 0xFFFF_FC10, the EEPROM area corresponding to the SiTCP register area, must be set to 1).

By setting this bit to 1, SiTCP sets bit 11 (ASY_PAUSE) and bit 10 (PAUSE) of the PHY's Auto-Negotiation Advertisement Register to 1 when initializing the MIF. Therefore, the SiTCP will set these two bits to either 11 or 00. For reference, Table 2-6 shows whether PAUSE frames can be sent and received by the local device (SiTCP) and the link partner (connection partner) for the PAUSE settings.

Table 2-6. PAUSE settings and enabling/ disabling PAUSE frame transmission/reception

Local device settings		Link partner settings		Enabling/ disabling PAUSE frame transmission/reception	
ASY_PAUSE	PAUSE	ASY_PAUSE	PAUSE	Local device	Link partner
0	0	Don't Care	Don't Care	Sending and receiving is not possible	Sending and receiving is not possible
Don't Care	1	Don't Care	1	Sending and receiving is possible	Sending and receiving is possible
1	1	0	0	Sending and receiving is not possible	Sending and receiving is not possible
1	1	1	0	Sending is not possible. Receiving is possible	Sending is possible. Receiving it not possible.

2.1.6. Keep alive packet (bit2)

This bit enables the TCP Keep alive packet transmission function. If set to 1, Keep alive packets are sent in the timer cycle set in '3.11.TCP Keep alive Time (buffer not empty) Register' if there is data in the transmission buffer, or in the timer cycle set in '3.12 TCP Keepalive Time (buffer empty) Register'.

2.1.7. Fast retrains. (bit1)

If set to 1, Fast retrains mode is switched on. When Fast retrains mode is enabled, SiTCP retransmits data when it receives a count of four packets with the same ACK number from the destination even if the TCP retransmission timer (time set in "3.16. TCP Retransmission time Register") has not expired.

2.1.8. Nagle buffering (bit0)

Setting this bit to 1 enables the Nagle algorithm of TCP. When set to 1, SiTCP sends out packets when the size of the data to be sent is greater than MSS or after approximately 4 msec from the start of the write operation. If the data size is small (~ a few dozen Bytes) and the response time needs to be reduced, setting this to 0 may improve the response time. Usually set to 1.

2.2. TCP Server MAC Address Register

Register for setting the MAC address of the server to connect to, used only in client mode. The value shown here is output to the TCP_SERVER_MAC_DEFAULT port of the SiTCP library. If the value in the register is to be used as the MAC address of the server to be connected to, input the value of the TCP_SERVER_MAC_DEFAULT port into the TCP_SERVER_MAC_IN port.

If the Client ARP (bit 6) in “3.4. SiTCP and TCP Control Register” is set to 1, the value entered in TCP_SERVER_MAC_IN is not applied, because the MAC address is obtained from the result of an ARP request to the server to be connected.

2.3. TCP Server IP Address Register

Register for setting the IP address of the server to connect to, used only in client mode. The value shown here is output to the TCP_SERVER_ADDR_DEFAULT port of the SiTCP library. If you want to use the value in the register as the MAC address of the server to connect to, enter the value of the TCP_SERVER_ADDR_DEFAULT port into the TCP_SERVER_ADDR_IN port.

2.4. TCP Server Port Number Register

Register for setting the TCP port number of the server to connect to, used only in client mode. The value shown here is output to the TCP_SERVER_PORT_DEFAULT port in the SiTCP library. If you want to use the value in the register as the MAC address of the server to connect to, enter the value of the TCP_SERVER_PORT_DEFAULT port into the TCP_SERVER_PORT_IN port.