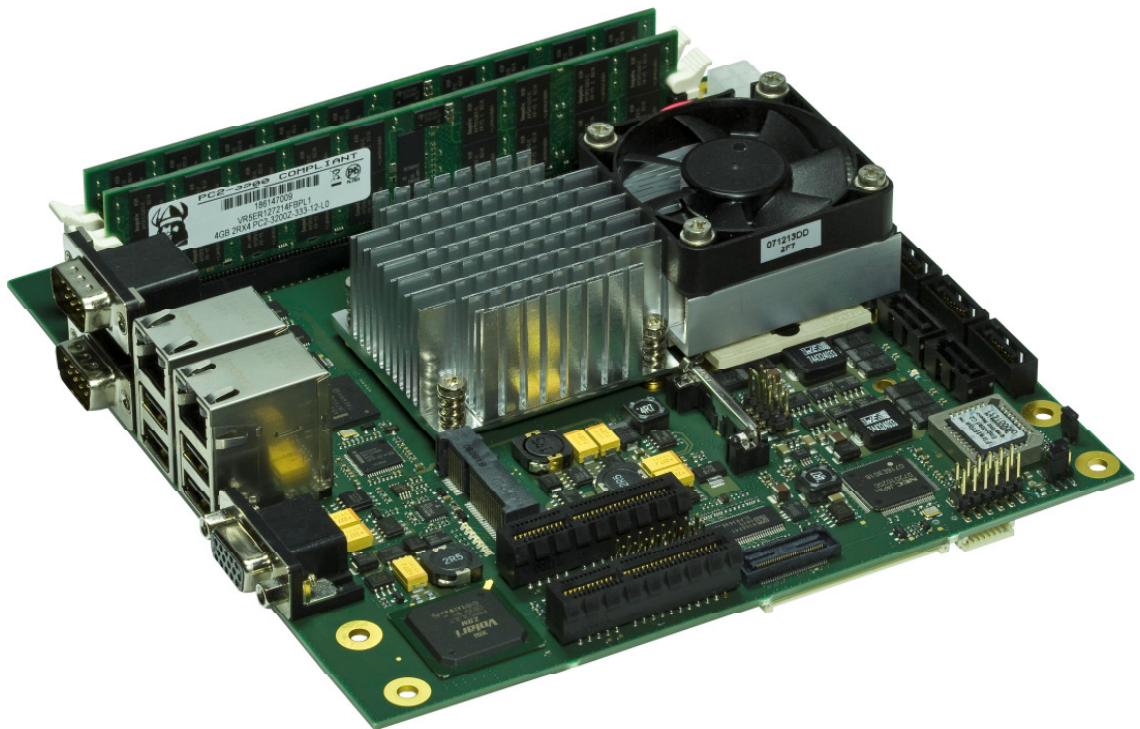


Thunderbird-E3100-SMC

LEMT Manual



Technical Manual Thunderbird-E3100-SMC

LiPPERT Document: TME-TB-E3100-SMC-0V1 Revision 0.1

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1 OVERVIEW

The onboard System Management Controller (SMC) on the Thunderbird-E3100 implements power sequencing and LEMT (**L**iPPERT **E**nhanced **M**anagement **T**echnology) functionality. The microcontroller communicates via the System Management Bus with the CPU/Chipset.

The following functions are implemented including permitting the user to: .

- Set/Clear the Watchdog-timer
- Read the uptime seconds since power on
- Read the total ontime minutes
- Read the power cycles
- Read the actual temperature of the CPU and Board
- Get power-up temperature of CPU and Board
- Min-/Max-Temperature Logger of CPU and Board
- Read Onboard-Voltages
- Get Fan-Speed
- Get access to 1kB Flash-ROM for User data
- Save Data in 128 Bytes of Write-Protectable Flash-ROM (fused)
- Read the version information of the SMC
- Get the status information of the SMC

The communication to the SMC-Controller is done through the SMBus 1.0-compliant host controller of the Chipset. This host controller provides a mechanism for the CPU to initiate communications with the SMC as slave device. Please look at the Chipset Datasheet for detailed information's about the SMBus host controller.

2 Addressing

The SMC is connected to the SMBus of the Chipset. It's slave address is 0101000X, where X is the Read(1)-/Write(0)-bit.

BITS							
A7	A6	A5	A4	A3	A2	A1	A0
0	1	0	1	0	0	0	Read/Wri te

2.1 SMC STANDARD RECEIVER FORMAT (WRITE CYCLE)

The SMC receiver format is shown in Table 2.1.1.

START	SMC_addr	ACK	command	ACK	length	ACK	data_byte	ACK	n- bytes	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	-----------	-----	-------------	-----	------

Table 2.1.1 SMC receiver format

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	0101000W (send by chipset)
W	logic 0, SM-bus write to SMC receiver
ACK	SM-bus acknowledge condition generated by slave receiver
command	Selected Command (send by chipset)
length	Number of Data-bytes (send by chipset)
Data_byte	data byte transmitted to SMC receiver (send by chipset)
n-bytes	more data bytes transmitted to SMC receiver (send by chipset)
STOP	SM-bus stop condition

Table 2.1.2 Explanation of Table 2.1.1

2.2 SMC STANDARD TRANSMITTER FORMAT (READ CYCLE)

The SMC transmitter format is shown in Table 2.2.1.

START	SMC_addr	ACK	command	ACK	length	ACK	data_byte	ACK	n-bytes	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	-----------	-----	---------	-----	------

Table 2.2.1 SMC transmitter format (direction of length and data-bytes changed)

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	0101000R (send by chipset)
R	logic 1, SM-bus read from SMC transmitter
ACK	SM-bus acknowledge condition generated by slave receiver
command	Selected Command (send by chipset)
length	Number of Data-bytes (send by SMC)
data_byte	data byte transmitted to SMC receiver (send by SMC)
n-bytes	more data bytes transmitted to SMC receiver (send by SMC)
STOP	SM-bus stop condition

Table 2.2.2 Explanation of Table 2.2.1

3 COMMANDS OF THE SMC

To start communication between the bus master (SMBus host controller of Chipset) and the slave device (SMC), the host controller must initiate a Start condition followed by the address of the SMC. The SMC recognizes his address and responds with ACK. Following this, the host controller sends the Command Code (shown in Table 3.1).

COMMAND	DESCRIPTION
0x20	Set/Clear Watchdog-timer
0x21	Clear BIOS Timeout Counter
0x2F	Get SMC Capability
0x30	Read Version-String 1
0x31	Read Version-String 2
0x32	Read Total Ontime Minutes
0x33	Read Ontime Seconds since Power-Up
0x34	Read Power Cycles
0x35	Read SMC Flags
0x36	Get last System Restart Event
0x37	Read actual CPU Temperature
0x38	Read actual Board Temperature
0x39	Get Min/Max-Temperatures (Temperature Logger)
0x3A	Get Startup-Temperatures of CPU and Board
0x3B	Get number of PROCHOT-Events
0x40	Set Address/Length for Flash Access
0x41	Write Data to User-Flash
0x42	Read Data from User-Flash
0x43	Clear all Data in User-Flash
0x44	Write-protect SECURE-Area
0x61-0x67	Get Voltages
0x68	Get Fan-Speed
0x70-0x77	Get Board Manufacturing Data
0x90	ASF CPU-Temp-Sensor
0x91	ASF Fan-Sensor
0x92	ASF Voltages-Sensor
0x95	ASF Remote Control Register

Table 3.1 SMC Command Codes

3.1 Set/Clear Watchdog-timer

This command sets the Timeout of the Watchdog-timer. After Start-Up the Watchdog is disabled. To enable the Watchdog a timeout value must be written. This timeout value is given in seconds and has a 16-bit (two byte wide) size. So the Timeout of the Watchdog can be set to 1-65535 seconds. 0 disables the Watchdog. The Most Significant Byte is sent first, followed by the Least Significant Byte (Table 3.1.1).

START	SMC_addr	ACK	command	ACK	length	ACK	MSB_byte	ACK	LSB_byte	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	----------	-----	----------	-----	------

Table 3.1.1 SMC receiver format of the Watchdog-timer Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b (Write access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x20 = "Set/Clear Watchdog-timer" Command code
length	0x02 = 2 Bytes data length
MSB_byte	High-byte of Timeout-value in seconds
LSB_byte	Low-byte of Timeout-value in seconds
STOP	SM-bus stop condition

Table 3.1.2 Explanation of Table 3.1.1

3.2 Clear BIOS Timeout Counter

This command clears Timeout Counter of the BIOS-timer. After the module is powered-on, an internal timer start. The BIOS or the boot loader clear this timer before it reaches 0 within t.b.d. seconds. In case of a corrupt BIOS a timeout occurs and the SMC generates a Power-Cycle.

START	SMC_addr	ACK	command	ACK	STOP
-------	----------	-----	---------	-----	------

Table 3.2.1 SMC receiver format of the Clear BIOS Timeout Counter Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b (Write access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x21 = "Clear BIOS Timeout Counter" Command code
STOP	SM-bus stop condition

Table 3.2.2 Explanation of Table 3.2.1

3.3 Get SMC Capability

This command reports the Capability of the SMC. Several features are controlled by the SMC on different hardware platforms. The Capability bytes gives the User the Information about the implemented features (explained in Table 3.3.2).

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1 (MSB)	ACK
Byte 2 (LSB)	ACK	STOP						

Table 3.3.1 SMC transmitter format of the Get SMC Capability Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x2F = "Get SMC Capability" Command code
length	0x02 = 2 Bytes data length
Byte 1,2	Data-Bytes containing the Capability Bits Bit 6-15: set to 0 for future functionality Bit 5: Voltage Monitor 0 = not provided, 1 = featured Bit 4: Temperatures 0 = not provided, 1 = featured Bit 3: Watchdog 0 = not provided, 1 = featured Bit 2: USER FLASH Size: 0 = 512 Bytes, 1 = 1024 Bytes Bit 1: System Restart Event 0 = not provided, 1 = featured Bit 0: Uptime & Power Cycles Counter 0 = not provided, 1 = featured
STOP	SM-bus stop condition

Table 3.3.2 Explanation of Table 3.3.1

3.4 Read Version-String 1/2

This command reads the Version Information of the SMC Firmware. Each command receives 1 length Byte and 32 Bytes of Data.

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1	ACK	...	ACK	Byte 32
ACK	STOP										

Table 3.4.1 SMC transmitter format of the Version String 1/2 Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x30 / 0x31 = "Read Version-String 1/2" Command code
length	0x20 = 32 Bytes data length
Byte 1-32	ASCII-Byte of Information String
STOP	SM-bus stop condition

Table 3.4.2 Explanation of Table 3.4.1

3.5 Read Total Ontime Minutes

This command reads the total Ontime Minutes of the Thunderbird-E3100 Board. The Ontime Minute-counter has a 32-bit (four byte wide) size and is count-up every minute in the Flash of the SMC. The Most Significant Byte is sent first, followed by the next highest Byte down to the Least Significant Byte (Table 3.5.1).

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1 (MSB)	ACK	...	ACK	
Byte 4 (LSB)	ACK	STOP									

Table 3.5.1 SMC transmitter format of the Total Ontime Minutes Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x32 = "Read Total Ontime Minutes" Command code
Length	0x04 = 4 Bytes data length
Byte 1-4	Value of Ontime Minute Counter
STOP	SM-bus stop condition

Table 3.5.2 Explanation of Table 3.5.1

3.6 Read Ontime Seconds

This command reads the Ontime Seconds of the Thunderbird-E3100 Board since the system is powered and runs in S0-State. The Ontime Seconds-counter has a 32-bit (four byte wide) size and is count-up every second in the SMC. The counter is cleared when the system is removed from power. The Most Significant Byte is sent first, followed by the next highest Byte down to the Least Significant Byte (Table 3.6.1).

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1 (MSB)	ACK	...	ACK
Byte 4 (LSB)	ACK	STOP								

Table 3.6.1 SMC transmitter format of the Ontime Seconds Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x33 = "Read Ontime Seconds" Command code
Length	0x04 = 4 Bytes data length
Byte 1-4	Value of Ontime Seconds Counter
STOP	SM-bus stop condition

Table 3.6.2 Explanation of Table 3.6.1

3.7 Read Power Cycles

This command reads the Power Cycles of the Thunderbird-E3100 Board. The Power-cycle-counter has a 32-bit (four byte wide) size and is updated every time when the Thunderbird-E3100 Board is Powered-ON in the Flash of the SMC. The Most Significant Byte is sent first, followed by the next highest Byte down to the Least Significant Byte (Table 3.7.1).

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1 (MSB)	ACK	...	ACK
Byte 4 (LSB)			ACK	STOP						

Table 3.7.1 SMC transmitter format of the Power Cycles Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x34 = "Read Power Cycles" Command code
length	0x04 = 4 Bytes data length
Byte 1-4	Value of Power Cycle Counter
STOP	SM-bus stop condition

Table 3.7.2 Explanation of Table 3.7.1

3.8 Read SMC Flags

This command reads the SMC Flags and gives an information of the internal status of the SMC.

START	SMC_addr	ACK	command	ACK	length	ACK	data	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	------	-----	------

Table 3.8.1 SMC transmitter format of the Read BIOS Flags Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x35 = "Read SMC Flags" Command code
length	0x01 = 1 Bytes data length
data	t.b.d.
STOP	SM-bus stop condition

Table 3.8.2 Explanation of Table 3.8.1

3.9 Get last System Restart Event

This command reads the cause of the last System Restart. The returned code is explained in Table 3.9.2.

START	SMC_addr	ACK	command	ACK	length	ACK	data	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	------	-----	------

Table 3.9.1 SMC transmitter format of the System Restart Event Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x36 = "System Restart Event" Command code
length	0x01 = 1 Bytes data length
Data	<p>Data-Byte containing the cause of the last restart</p> <p>0x10: UNKNOWN Unknown Reason of Restart (should never reported)</p> <p>0x20: SW_RESET A reset by Software caused the Restart of the system</p> <p>0x30: HW_RESET A reset by Hardware caused the Restart of the system (e.g. Reset-Button)</p> <p>0x40: WATCHDOG The Watchdog has restarted the system</p> <p>0x50: BIOS_FAULT Main-BIOS is corrupted -> boot from Recovery BIOS</p> <p>0x60: POWER_DOWN The system was Shutdown (e.g. Power-Button, ACPI Shutdown)</p> <p>0x70: POWER_LOSS The system is restarted after a Power-loss (e.g. external Power supply was switched off while the system was running)</p>
STOP	SM-bus stop condition

Table 3.9.2 Explanation of Table 3.9.1

3.10 Read actual CPU Temperature

This command reads the actual CPU Temperature of the Thunderbird-E3100 Board. The CPU temperature is transmitted in two Bytes. The first byte is the full degree value, the second byte the value after the comma (Table 3.10.1). Both values are signed chars.

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1 (MSB)	ACK
Byte 2 (LSB)		ACK	STOP					

Table 3.10.1 SMC transmitter format of the CPU Temperature Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x37 = "Read actual CPU Temperature" Command code
Length	0x02 = 2 Bytes data length
Byte 1	Full degree value of CPU temperature. The format of this byte is signed char.
Byte 2	Value after comma of CPU temperature
STOP	SM-bus stop condition

Table 3.10.2 Explanation of Table 3.10.1

3.11 Read actual Board Temperature

This command reads the actual Board Temperature of the Thunderbird-E3100 Board. The Board temperature is transmitted in a signed char Byte.

START	SMC_addr	ACK	command	ACK	length	ACK	data	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	------	-----	------

Table 3.11.1 SMC transmitter format of the Read actual Board Temperature Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x38 = "Read actual Board Temperature" Command code
length	0x01 = 1 Bytes data length
Data	Board temperature. The format of this byte is signed char.
STOP	SM-bus stop condition

Table 3.11.2 Explanation of Table 3.11.1

3.12 Get Min/Max-Temperatures (Temperature Logger)

This command reads the maximum and minimum reached CPU and Board Temperatures. The temperatures are transmitted in a signed char Bytes.

START	SMC_addr	ACK	command	ACK	length	ACK	MaxCPUtemp	ACK
MinCPUtemp	ACK	MaxBoardTemp	ACK	MinBoardTemp	ACK	STOP		

Table 3.12.1 SMC transmitter format of the Get Min/Max-Temperatures Command

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x39 = "Get Min/Max-Temperatures" Command code
length	0x04 = 4 Bytes data length
MaxCPUtemp	Maximum CPU temperature. The format of this byte is signed char.
MinCPUtemp	Minimum CPU temperature. The format of this byte is signed char.
MaxBoardTemp	Maximum Board temperature. The format of this byte is signed char.
MinBoardTemp	Minimum Board temperature. The format of this byte is signed char.
STOP	SM-bus stop condition

Table 3.12.2 Explanation of Table 3.12.1

3.13 Get Startup-Temperatures of CPU and Board

This command reads the CPU and Board Temperatures at power-on time. The temperatures are transmitted in a signed char Bytes.

START	SMC_addr	ACK	command	ACK	length	ACK	CPU_temp	ACK
Board_temp	ACK	STOP						

Table 3.13.1 SMC transmitter format of the Get Startup-Temperatures of CPU and Board Command

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x3A = "Get Startup-Temperatures of CPU and Board" Command code
Length	0x02 = 2 Bytes data length
CPU_temp	CPU temperature at Startup. The format of this byte is signed char.
Board_temp	Board temperature at Startup. The format of this byte is signed char.
STOP	SM-bus stop condition

Table 3.13.2 Explanation of Table 3.13.1

3.14 Get Number of PROCHOT-Events

This command reads the PROCHOT-Event-counter. PROCHOT (processor hot), is asserted by the CPU when the processor die temperature has reached its maximum operating temperature. Since Thermal Monitor 2 is enabled, the reduces it's clock speed and decreases it's Core Voltage when PROCHOT is asserted. This counter gives the User an information of Cooling problems. This counter is cleared when the system is removed from power.

START	SMC_addr	ACK	comman d	ACK	lengt h	ACK	Byte 1 (MSB)	ACK	...	ACK
Byte 4 (LSB)	ACK	STOP								

Table 3.14.1 SMC transmitter format of the Get Number of PROCHOT-Events Command

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x3B = "Get Number of PROCHOT-Events" Command code
length	0x04 = 4 Bytes data length
Byte 1-4	Value of PROCHOT-Counter
STOP	SM-bus stop condition

Table 3.14.2 Explanation of Table 3.14.1

3.15 Set Address/Length for Flash Access

This command prepares the read or write access to the SMC-Flash. For this, the address and the length information must be set in the first step. In the next step the Data can be read or write to the Flash. The address must have a 16-bit format and a length information about the number of bytes to write. For accesses to the USER-Area be sure that the address have 32-bit alignment and is within 1kB, so 0x0000, 0x0004, 0x0008, ..., 0x03f8, 0x03fc are valid addresses. To access the SECURE-Area the address must be 0x8000 or greater but not higher than 0x807c. The memory map is show in Table 3.13.1.

The number of bytes to write must be a multiple of 4 and not more than 32 Bytes.

No Memory	0xFFFF
SECURE-Data	0x8080
	0x807F
No Memory	0x8000
	0x7FFF
USER-Data	0x0400
	0x03FF
	0x0000

Table 3.13.1 Memory-Map of SMC-Flash

START	SMC_addr	ACK	command	ACK	length	ACK	MSB_Addr	ACK	LSB_Addr	ACK
Data_length	ACK	STOP								

Table 3.13.2 SMC receiver format of the Set Address/Length for Flash Access Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b (Write access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x40 = "Set Address/Length for Flash Access" Command code
length	0x03 = 3 Bytes data length
MSB_byte	High-byte of Flash-Address
LSB_byte	Low-byte of Flash-Address (32bit-alignment)
Data_length	Number of Data-Bytes to read or write (in steps of 4)
STOP	SM-bus stop condition

Table 3.13.3 Explanation of Table 3.13.2

3.16 Write Data to User-Flash

This command writes data to the selected address of the SMC-Flash. Up to 32 Bytes can be written in a single block access. The number of bytes to write must be a multiple of 4. This command takes up to 250ms of time (depends if the requested Flash-Area is clear or not). During this time the SMC is not accessible. To detect if the SMC is busy use a single read with 0xFF as command (like Read BIOS Flags, but use 0xFF instead of 0x35). If the SMC responds with 0xF0, the SMC is ready for next steps.

START	SMC_addr	ACK	command	ACK	length	ACK	Data0	ACK	...	ACK
Data_n	ACK	STOP								

Table 3.16.1 SMC receiver format of the Write Data to User-Flash Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b (Write access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x41 = "Write Data to User-Flash" Command code
Length	Number of Data_Bytes to write (=n)
Data0..n	4-32 Data-Bytes to write
STOP	SM-bus stop condition

Table 3.16.2 Explanation of Table 3.16.1

3.17 Read Data from User-Flash

This command reads data from the selected address of the SMC-Flash. Up to 32 Bytes can be written in a single block access. The number of bytes to write must be a multiple of 4.

START	SMC_addr	ACK	command	ACK	length	ACK	Data0	ACK	...	ACK
Data_n	ACK	STOP								

Table 3.17.1 SMC transmitter format of the Read Data from User-Flash Command

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b = 0x51 (Read access to SMC)
ACK	SM-bus acknowledge condition generated by receiver
command	0x42 = "Read Data from User-Flash" Command code
length	Number of Data_Bytes to write
Data0..n	4-32 Data-Bytes
STOP	SM-bus stop condition

Table 3.17.2 Explanation of Table 3.17.1

3.18 Clear all Data in User-Flash

This single command clears the total USER-Area of the SMC-Flash. To prevent unintentional erase of the User-Flash two Magic Bytes must be send with this command (see Table 3.18.2). This command takes up to 50ms of time. During this time the SMC is not accessible. To detect if the SMC is busy use a single read with 0xFF as command (like Read BIOS Flags, but use 0xFF instead of 0x35). If the SMC responds with 0xF0, the SMC is ready for next steps.

START	SMC_addr	ACK	comman d	ACK	length	ACK	Magic_1	ACK	Magic_2	ACK
STOP										

Table 3.18.1 SMC receiver format of the Clear all Data in User-Flash Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b = 0x50 (Write access to SMC)
ACK	SM-bus acknowledge condition generated by receiver
command	0x43 = "Clear all Data in USER-Area" Command code
length	0x02 = Length of this Command
Magic_1	0xAE = Magic Byte 1
Magic_2	0xCD = Magic Byte 2
STOP	SM-bus stop condition

Table 3.18.2 Explanation of Table 3.18.1

3.19 Write-protect SECURE-Area

This single command protect the total SECURE-Area against write accesses. To prevent unintentional protect of the SECURE-Area two Magic Bytes must be send with this command (see Table 3.16.2).

Caution: If this security setting has been applied, the SECURE-Area of that device will not be rewritten by anyone (protected by hardware-fuse).

START	SMC_addr	ACK	command	ACK	length	ACK	Magic_1	ACK	Magic_2	ACK
STOP										

Table 3.19.1 SMC receiver format of the Write-protect SECURE-Area Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b = 0x50 (Write access to SMC)
ACK	SM-bus acknowledge condition generated by receiver
command	0x44 = "Write-protect SECURE-Area" Command code
length	0x02 = Length of this Command
Magic_1	0xAE = Magic Byte 1
Magic_2	0xCE = Magic Byte 2
STOP	SM-bus stop condition

Table 3.19.2 Explanation of Table 3.19.1

3.20 Get Voltages

The 10-bit-ADC of the SMC is used to monitor the Voltages on the Thunderbird-E3100 board. SMC provides 7 Channels which are separately accessed by Command codes as described in Table 3.20.2.

START	SMC_addr	ACK	command	ACK	length	ACK	MSB_byte	ACK	LSB_byte	ACK	STOP
-------	----------	-----	---------	-----	--------	-----	----------	-----	----------	-----	------

Table 3.20.1 SMC transmitter format of the Get Voltages Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	"Get Voltages" Command code: 0x61: Get Voltage channel 1 (0.9V) 0x62: Get Voltage channel 2 (1.8V) 0x63: Get Voltage channel 3 (1.05V) 0x64: Get Voltage channel 4 (1.5V) 0x65: Get Voltage channel 5 (CPU-Vcore) 0x66: Get Voltage channel 6 (5V) 0x67: Get Voltage channel 7 (12V)
length	0x02 = 2 Bytes data length
MSB byte	16-Bit data value of Voltage
LSB byte	
STOP	SM-bus stop condition

Table 3.20.2 Explanation of Table 3.20.1

The system voltages can be expressed as following equation:

$$V_x = \text{ADC_CHANNEL_}[1..5] * 3.3 / 1024$$

The higher system voltages (5V and 12V) can be expressed as following equation:

$$V_5 = \text{ADC_CHANNEL_}[6] * 22 / 12 * 3.3 / 1024$$

$$V_{12} = \text{ADC_CHANNEL_}[7] * 62 / 15 * 3.3 / 1024$$

3.21 Get Fan Speed

This command reads the actual Speed of the CPU Cooler Fan. It delivers the Fan Speed in RPM.

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1 (MSB)	ACK
Byte 2 (LSB)	ACK	STOP						

Table 3.21.1 SMC transmitter format of the Get Fan Speed Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x68 = "Get Fan Speed" Command code
length	0x02 = 2 Bytes data length
MSB byte LSB byte	16-Bit data value of Fan Speed (RPM)
STOP	SM-bus stop condition

Table 3.21.2 Explanation of Table 3.21.1

3.22 Get Board Manufacturing Data

These commands reads the contents of the 8 Data-Fields. The Manufacturing Data gives Information about the Board-Serial-Number, BIOS-Version, Test-Date, etc. Each command receives 1 length Byte and 16 Bytes of Data.

START	SMC_addr	ACK	command	ACK	length	ACK	Byte 1	ACK	...	ACK	Byte 16
ACK	STOP										

Table 3.22.1 SMC transmitter format of the Get Board Manufacturing Data Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	"Get Board Manufacturing Data" Command code: 0x70: BOARD ARTICLE NUMBER 0x71: BOARD SERIAL NUMBER 0x72: BIOS VERSION 0x73: TEST DATE 0x74: For Future data 0x75: For Future data 0x76: For Future data 0x77: For Future data
length	0x10 = 16 Bytes data length
Byte 1-16	ASCII-Byte of Information String
STOP	SM-bus stop condition

Table 3.22.2 Explanation of Table 3.22.1

3.23 ASF CPU-Temp-Sensor

This command returns the state of the actual CPU Temperature. The returned data-value is explained in Table 3.23.2.

START	SMC_addr	ACK	command	ACK	data	ACK	STOP
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Table 3.23.1 SMC transmitter format of the ASF CPU-Temp-Sensor Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x90 = "ASF CPU-Temp-Sensor" Command code
Data	Data-Byte containing the status of the CPU-Temp-Sensor 0x00: NO_ERROR CPU-Temperature is normal. 0x01: WARNING CPU-Temperature is above 85°C 0x03: CRITICAL CPU-Temperature is above 95°C
STOP	SM-bus stop condition

Table 3.23.2 Explanation of Table 3.23.1

3.24 ASF Fan-Sensor

This command returns the state of the actual CPU Fan. The returned data-value is explained in Table 3.24.2.

START	SMC_addr	ACK	command	ACK	data	ACK	STOP
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Table 3.24.1 SMC transmitter format of the ASF Fan-Sensor Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x91 = "ASF Fan-Sensor" Command code
data	Data-Byte containing the status of the CPU-Temp-Sensor 0x00: NO_ERROR CPU-Fan is running. 0x03: CRITICAL CPU-Fan is stopped.
STOP	SM-bus stop condition

Table 3.24.2 Explanation of Table 3.24.1

3.25 ASF Voltages-Sensor

This command returns the state of the actual Voltages on the board. The returned data-value is explained in Table 3.25.2.

START	SMC_addr	ACK	command	ACK	data	ACK	STOP
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Table 3.25.1 SMC transmitter format of the ASF Voltages-Sensor Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010001b (Read access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x92 = "ASF Voltages-Sensor" Command code
data	Data-Byte containing the status of the Voltages on the board 0x00: NO_ERROR All voltages are good. 0x03: CRITICAL At least one board voltage is outside of the 5% Tolerance.
STOP	SM-bus stop condition

Table 3.25.2 Explanation of Table 3.25.1

3.26 ASF Remote Control Register

This command returns the state of the actual Voltages on the board. The returned data-value is explained in Table 3.26.2.

START	SMC_addr	ACK	command	ACK	data	ACK	STOP
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Table 3.26.2 SMC receiver format of the ASF Remote Control Register Command Code

ITEM	DESCRIPTION
START	SM-bus start condition
SMC_addr	01010000b (Write access)
ACK	SM-bus acknowledge condition generated by receiver
command	0x95 = "ASF Remote Control Register" Command code
Data	Data-Byte containing the action to do: 0x01: RESET Reboots the system. (Note: Users are not alerted and will lose unsaved work.) 0x02: POWER DOWN Powers down the system. (Note: Users are not alerted and will lose unsaved work) 0x03: POWER UP Powers up the system. 0x04: POWER CYCLE Powers the system down and then powers it up again. (Note: Users are not alerted and will lose unsaved work.)
STOP	SM-bus stop condition

Table 3.26.3 Explanation of Table 3.26.2

Appendix A, Contact Information

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Appendix B, Getting Help

Should you have technical questions that are not covered by the respective manuals, please contact our support department at **support@lippertembedded.com**.

Please allow one working day for an answer!

Technical manuals as well as other literature for all LiPPERT products can be found in the *Products* section of LiPPERT's website www.lippertembedded.com. Simply locate the product in question and follow the link to its manual.

Returning Products for Repair

To return a product to LiPPERT for repair, you need to get a Return Material Authorization (RMA) number first.

Please fill in the RMA Request Form at <http://www.lippertembedded.com/?id=rma> and send it to us. We'll return it to you with the RMA number.

Deliveries without a valid RMA number are returned to sender at his own cost!

LiPPERT has a written Warranty and Repair Policy, which can be retrieved from <http://www.lippertembedded.com/?id=rwp>

It describes how defective products are handled and what the related costs are. Please read this document carefully before returning a product.

Appendix C, Further Resources

<http://www.lippertembedded.com>

LiPPERT Embedded Computers' website with news and detailed information.

<http://www.intel.com>

Datasheet of the CPU, Chipset and Ethernet-Controller.

<http://www.smbus.org>

Information about the System Management Bus (SMBus)

<http://www.phoenix.com/en/customer+services/bios/awardbios>

Additional BIOS information.

Appendix D, Revision History

Filename	Date	Edited by	Change
TME-TB-E3100-SMC-0V0.doc	2008-12-23	JS	Prerelease
TME-TB-E3100-SMC-0V1.doc	2008-12-23	MF	Formatted