INTEGRATED TECHNOLOGY EXPRESS, INC.

IT8705F

Preliminary Environment Controller (EC)

Programming Guide V0.3

INTEGRATED TECHNOLOGY EXPRESS, INC.

IT8705F EC
Programming Guide

Revision History

Version	Date	Changes from Last Version
0.1	8/30/99	• Initial version
0.2	9/6/99	• Added Analog to Digital Table for Monitoring Voltage
0.3	03/01/01	• Revised the bit 5 of section 3.4.1 Configuration Register to "Reserved".

Contents

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1. Overview

The Environment Controller (EC), built in the IT8705F, includes eight voltage inputs, three temperature sensor inputs, three FANs' tachometer inputs, and three sets of advanced FAN Controllers. The EC monitors the hardware environment and implements environmental control for personal computer systems.

The IT8705F contains an 8-bit ADC (Analog-to-Digital Converter) responsible for monitoring the voltages and temperatures. The ADC converts the analog inputs, ranging from 0V to 4.096V, to 8-bit digital bytes. Thanks to the additional external components, the analog inputs are able to monitor different voltage ranges, in addition to monitoring the fixed input range of 0V to 4.096V. Through the external thermistors, the temperature sensor inputs can be converted to 8-bit digital bytes, enabling the sensor inputs, and monitoring the temperature around the thermistors or thermal diode. A built-in ROM is also provided to adjust the non-linear characteristics of thermistors.

FAN Tachometer inputs are digital inputs with an acceptable input range of 0V to 5V, and are responsible for measuring the FAN's Tachometer pulse periods. FAN_TAC1 and FAN_TAC2 are included with programmable divisors, and can be used to measure different fan speed ranges. FAN_TAC3 is included in the fixed divisor, and can only be used in the default range.

The EC of the IT8705F provides multiple internal registers and an interrupt generator for programmers to monitor the environment and control the FANs. Both the LPC Bus and Serial Bus interfaces are supported to accommodate the various applications' needs.

2. Flow Charts

The coding flow chart of the voltage monitor of the EC is illustrated in Figure 2-1. The coding flow chart of the Temperature monitor of the EC flow charts is illustrated in Figure 2-2. The flow chart of the Fan monitor and control of the EC is illustrated in Figure 2-3.

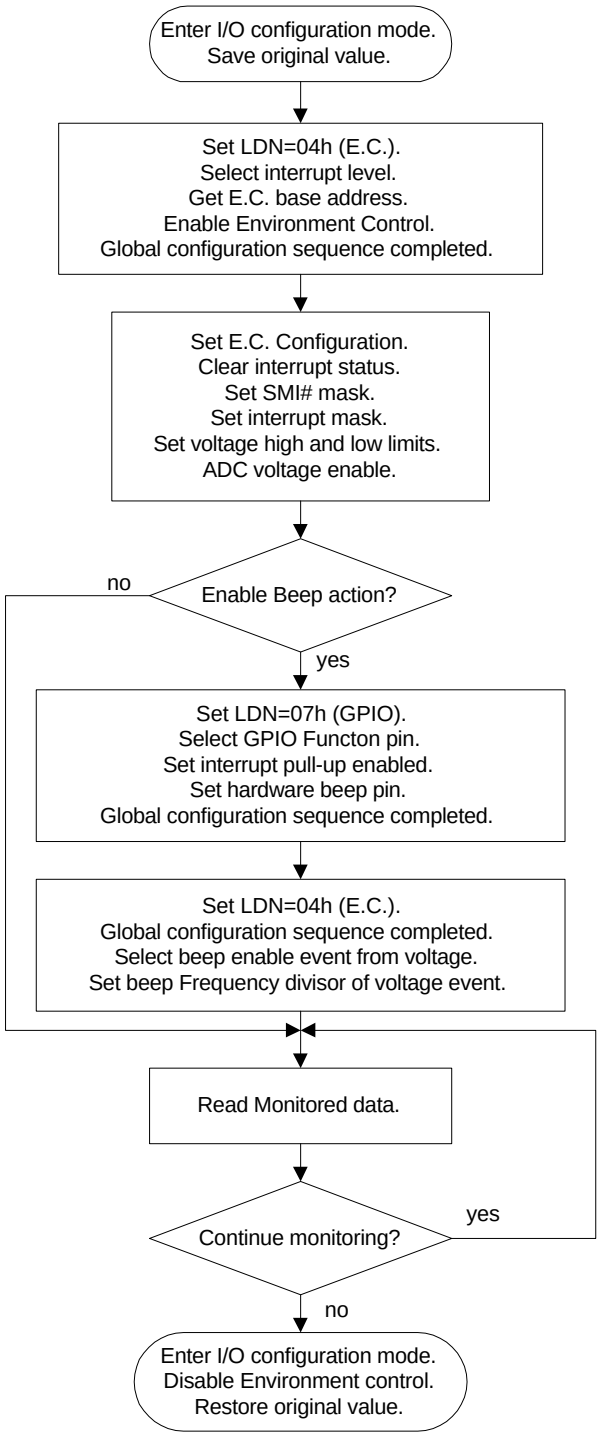

Figure 2-1. EC Voltage Monitor Control Flow Chart

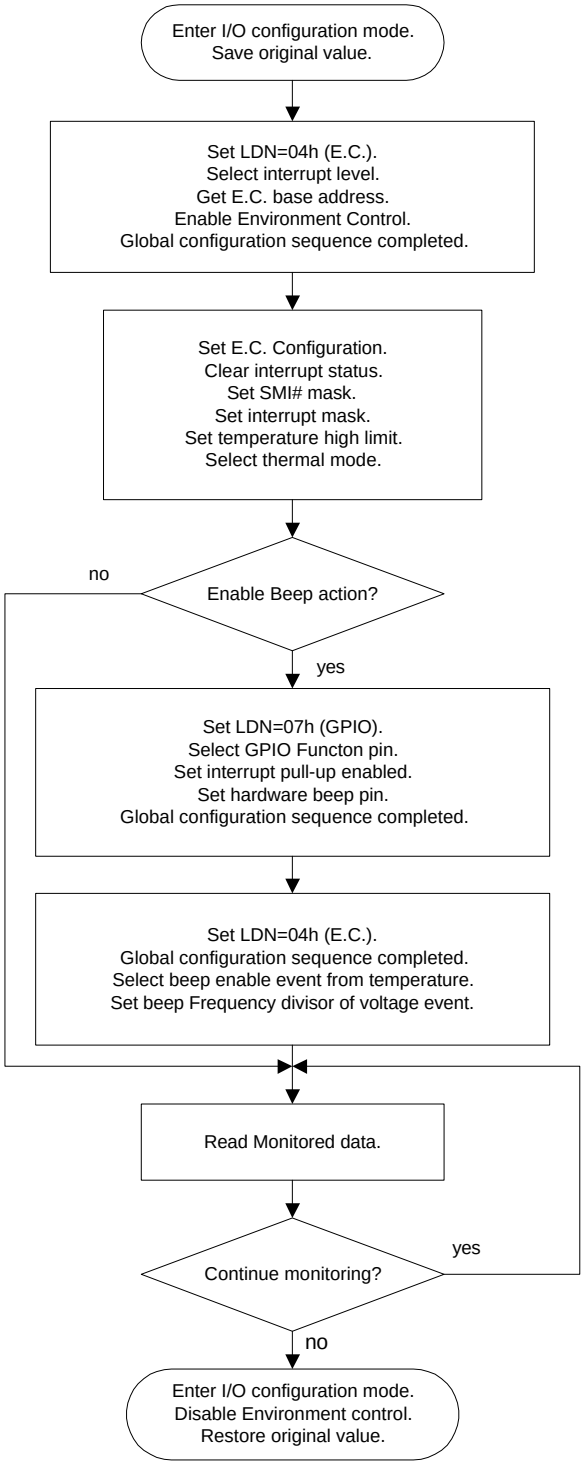

Figure 2-2. EC Temperature Monitor Control Flow Chart

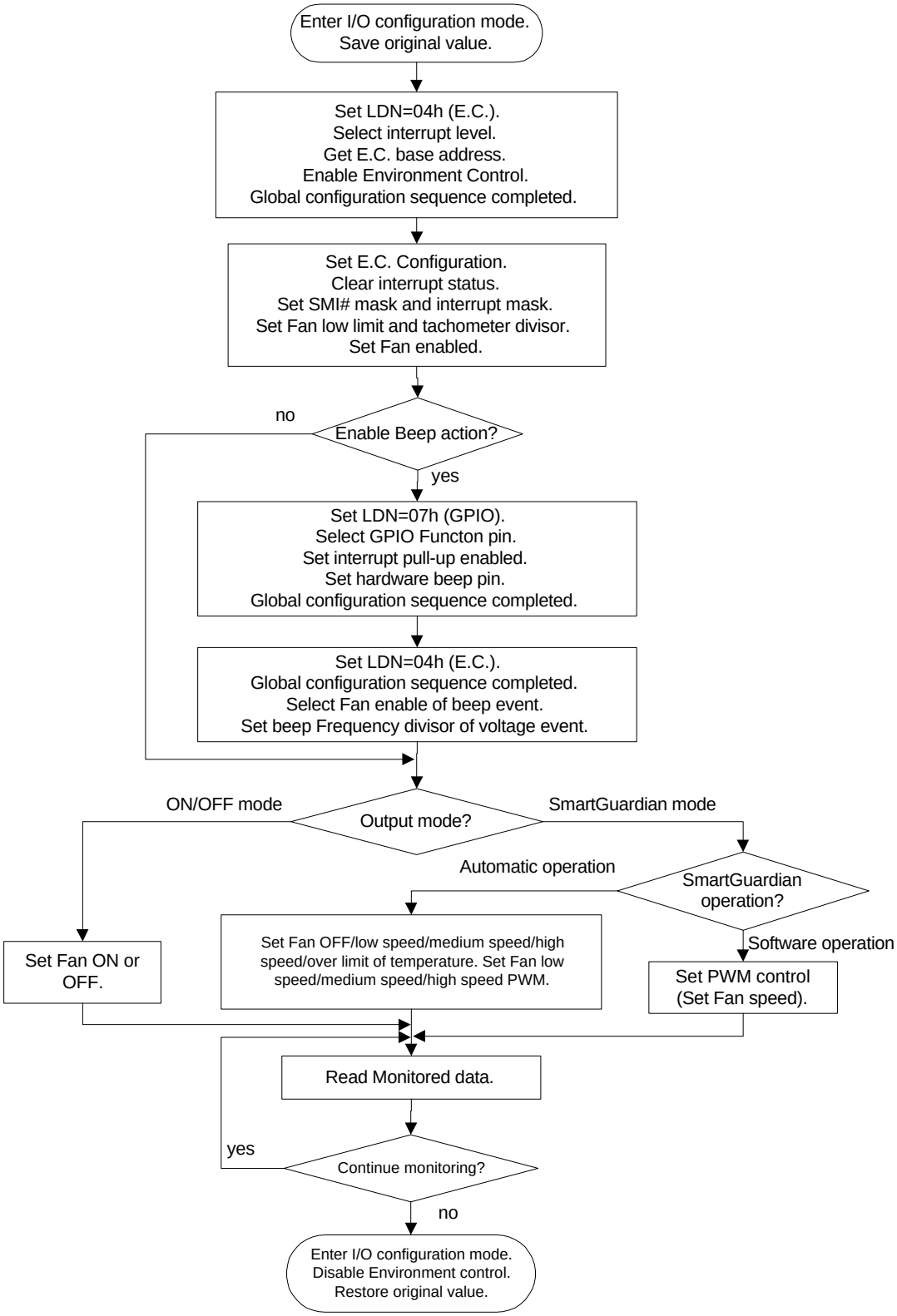

Figure 2-3. Fan Monitor and EC Control Flow Chart

3. Programming Guide

3.1 Interfaces

The Environment Controller of the IT8705F decodes two addresses.

Table 3-1. Address Map on the LPC Bus

Register or Port	Address
Address register of the EC	Base+05h
Data register of the EC	Base+06h

Note 1. The Base Address is determined by the Logical Device configuration registers of the Environment Controller (LDN=04h, registers index= 60h, 61h).

To access an EC register, the address of the register is written to the address port (Base+05h). Read or write data from or to that register via data port (Base+06h).

3.2 Set Configuration Registers

The configuration registers must be set first: set LDN=04h for IT8705F. Activate the Environment Controller. Select the base address from Environment Controller Base Address MSB register (Index=60h) and Base Address LSB register (Index=61h). Select the Environment Controller interrupt level from the register of Environment Controller Interrupt Level Select (Index=70h). Make sure to hook the operation system interrupt and create the interrupt service routine, too.

Table 3-2. Environment Controller Configuration Registers

LDN	Index	R/W	Reset	Configuration Register or Action
04h	30h	R/W	00h	Environment Controller Activate
04h	60h	R/W	03h	Environment Controller Base Address MSB Register
04h	61h	R/W	10h	Environment Controller Base Address LSB Register
04h	70h	R/W	0Bh	Environment Controller Interrupt Level Select
04h	F3h	R/W	00h	Environment Controller Special Configuration Register

3.3 Pre-settings for EC Monitoring Process

The monitoring function in the EC is activated when the bit 3 of Configuration Register is cleared (low) and bit 0 of Configuration Register is set (high). Otherwise, several enable bits should be set to enable the monitoring function. Those enable bits are categorized into three groups: positive voltages, temperatures and FAN Tachometer inputs. Before the EC monitoring function can be used, the steps below should be followed:

1. Set the Limits
2. Set the interrupt Masks
3. Set the Enable bits

The EC monitoring process can be then started.

Note 1. Please refer to Figure 2-1 (EC Voltage Monitor Control flow chart) to set the Voltage monitor of the hardware monitor controller.
Note 2. Please refer to Figure 2-2 (EC Temperature Monitor Control flow chart) to set the Temperature Controller/Monitor of the hardware monitor controller.
Note 3. Please refer to Figure 2-3 (Fan Monitor and EC Control flow chart) to set the Fan Controller/Monitor of the hardware monitor controller.
Note 4. Please refer to Table 4-2 Global Configuration Registers and Table 4-3 GPIO Configuration Registers for GPIO setting.

3.4 Register Description

3.4.1 Configuration Register (Index=00h, Default=18h)

Bit	R/W	Description
7	R/W	Initialization. A "1" restores all registers to their individual default values, except the Serial Bus Address register. This bit clears itself when the default value is "0".
6	R/W	Update VBAT Voltage Reading.
5	R/W	Reserved
4	R	Read Only, Always "1".
3	R/W	INT_Clear. A "1" disables the SMI# and IRQ outputs with the contents of interrupt status bits remain unchanged.
2	R/W	IRQ enables the IRQ Interrupt output.
1	R/W	SMI# Enable. A "1" enables the SMI# Interrupt output.
0	R/W	Start. A "1" enables the startup of monitoring operations while a "0" sends the monitoring operation in the STANDBY mode.

3.4.2 Interrupt Status Register 1 (Index=01h, Default=00h)

Reading this register will clear itself following a read access.

Bit	R/W	Description
7-6	R	Reserved
5	R	A "1" indicates a WTI# signal has been activated.
4	R	A "1" indicates a Case Open event has occurred.
3	R	Reserved
2-0	R	A "1" indicates the FAN_TAC3-1 Count limit has been reached.

3.4.3 Interrupt Status Register 2 (Index=02h, Default=00h)

Reading this register will clear itself after the read operation is completed.

Bit	R/W	Description
7-0	R	A "1" indicates a High or Low limit of VIN7-0 has been reached.

3.4.4 Interrupt Status Register 3 (Index=03h, Ddfault=00h)

Reading this register will clear itself following a read access.

Bit	R/W	Description
7-3	R	Reserved
2-0	R	A "1" indicates a High or Low limit of Temperature 3-1 has been reached.

3.4.5 SMI# Mask Register 1 (Index=04h, Default=00h)

Bit	R/W	Description
7-6	R/W	Reserved
5	R/W	A "1" disables the WTI# Intrusion interrupt status bit for SMI#.
4	R/W	A "1" disables the Case Open Intrusion interrupt status bit for SMI#.
3	R/W	Reserved
2-0	R/W	A "1" disables the FAN_TAC3-1 interrupt status bit for SMI#.

3.4.6 SMI# Mask Register 2 (Index=05h, Default=00h)

Bit	R/W	Description
7-0	R/W	A "1" disables the VIN7-0 interrupt status bit for SMI#.

3.4.7 SMI# Mask Register 3 (Index=06h, Default=00h)

Bit	R/W	Description
7-3	R/W	Reserved
2-0	R/W	A "1" disables the Temperature 3-1 interrupt status bit for SMI#.

3.4.8 Interrupt Mask Register 1 (Index=07h, Default=00h)

Bit	R/W	Description
7-6	R/W	Reserved
5	R/W	A "1" disables the WTI# Intrusion interrupt status bit for IRQ.
4	R/W	A "1" disables the Case Open Intrusion interrupt status bit for IRQ.
3	R/W	Reserved
2-0	R/W	A "1" disables the FAN_TAC3-1 interrupt status bit for IRQ.

3.4.9 Interrupt Mask Register 2 (Index=08h, Default=00h)

Bit	R/W	Description
7-0	R/W	A "1" disables the VIN7-0 interrupt status bit for IRQ.

3.4.10 Interrupt Mask Register 3 (Index=09h, Default=00h)

Bit	R/W	Description
7-3	R/W	Reserved
2-0	R/W	A "1" disables the Temperature 3-1 interrupt status bit for IRQ.

3.4.11 VID Register (Index=0Ah)

Bit	R/W	Description
7-5	-	Reserved
4-0	R	VID4-0 inputs.

3.4.12 Fan Tachometer Divisor Register (Index=0Bh, Default=09h)

Bit	R/W	Description
7-6	-	Reserved
5-3	R/W	FAN_TAC2 Counter Divisor. 000 – divided by 1; 100 – divided by 16; 001 – divided by 2; 101 – divided by 32; 010 – divided by 4; 110 – divided by 64; 011 – divided by 8; 111 – divided by 128.
2-0	R/W	FAN_TAC1 Counter Divisor. 000 – divided by 1; 100 – divided by 16; 001 – divided by 2; 101 – divided by 32; 010 – divided by 4; 110 – divided by 64; 011 – divided by 8; 111 – divided by 128.

3.4.13 Fan Tachometer 1-3 Reading Registers (Index=0Dh-0Fh)

Bit	R/W	Description
7-0	R	The number of counts of the internal clock per revolution.

3.4.14 Fan Tachometer 1-3 Limit Registers (Index=10h-12h)

Bit	R/W	Description
7-0	R	Limit value.

3.4.15 Fan Controller Main Control Register (Index=13h, Default=00h)

Bit	R/W	Description
7	R	Reserved
6-4	R/W	FAN_TAC3-1 enable.
3	R/W	Reserved
2-0	R/W	FAN_CTL3-1 output mode selection. 0: ON/OFF mode. 1: SmartGuardian mode.

3.4.16 FAN_CTL Control Register (Index=14h, Default=00h)

Bit	R/W	Description
7	R	FAN_CTL Parity.
6-3	R/W	Reserved
2-0	R/W	FAN_CTL3-1 ON/OFF mode control. These bits are only available when the relative output modes are selected in ON/OFF mode. 0: OFF. 1: ON.

3.4.17 FAN_CTL1 PWM Control Register (Index=15h, Default=00h)

Bit	R/W	Description
7	R/W	FAN_CTL1 PWM mode Automatic/Software operation selection. 0: Software operation. 1: Automatic operation.
6-0	R/W	128 steps of PWM control when in Software operation (bit 7=0), or Temperature input selection when in Automatic operation (bit 7=1). Bits[1:0]: 00: TMPIN1 01: TMPIN2 10: TMPIN3 11: Reserved

3.4.18 FAN_CTL2 PWM Control Register (Index=16h, Default=00h)

Bit	R/W	Description
7	R/W	FAN_CTL2 PWM mode Automatic/Software operation selection. 0: Software operation. 1: Automatic operation.
6-0	R/W	128 steps of PWM control when in Software operation (bit 7=0), or Temperature input selection when in Automatic operation (bit 7=1). Bits[1:0]: 00: TMPIN1 01: TMPIN2 10: TMPIN3 11: Reserved

3.4.19 FAN_CTL3 PWM Control Register (Index=17h, Default=00h)

Bit	R/W	Description
7	R/W	FAN_CTL3 PWM mode Automatic/Software operation selection. 0: Software operation. 1: Automatic operation.
6-0	R/W	128 steps of PWM control when in Software operation (bit 7=0), or Temperature input selection when in Automatic operation (bit 7=1). Bits[1:0]: 00: TMPIN1 01: TMPIN2 10: TMPIN3 11: Reserved

3.4.20 VIN7-VIN0 Voltage Reading Registers (Index=27h-20h)

Bit	R/W	Description
7-0	R/W	Voltage Reading value.

3.4.21 VBAT Voltage Reading Register (Index=28h)

Bit	R/W	Description
7-0	R/W	VBAT Voltage Reading value.

3.4.22 TMPIN3-1 Temperature Reading Registers (Index=2Bh-29h)

Bit	R/W	Description
7-0	R/W	Temperature Reading value.

3.4.23 VIN7-0 High Limit Registers (Index=3Eh, 3Ch, 3Ah, 38h, 36h, 34h, 32h, 30h)

Bit	R/W	Description
7-0	R/W	High Limit value.

3.4.24 VIN7-0 Low Limit Registers (Index=3Fh, 3Dh, 3Bh, 39h, 37h, 35h, 33h, 31h)

Bit	R/W	Description
7-0	R/W	Low Limit value.

3.4.25 TMPIN3-1 High Limit Registers (Index=44h, 42h, 40h)

Bit	R/W	Description
7-0	R/W	High Limit value.

3.4.26 TMPIN3-1 Low Limit Registers (Index=45h, 43h, 41h)

Bit	R/W	Description
7-0	R/W	Low Limit value.

3.4.27 Serial Bus Interface Address Register (Index=48h, Default=2Dh)

Bit	R/W	Description
7	R/W	Reserved
6-0	R/W	Serial Bus Interface Address.

3.4.28 ADC Voltage Channel Enable Register (Index=50h, Default=00h)

Bit	R/W	Description
7-0	R/W	ADC VIN7-VIN0 scan enable.

3.4.29 ADC Temperature Channel Enable Register (Index=51h, Default=00h)

TMPIN3-1 cannot be enabled in both Thermal Resistor mode and Thermal Diode (Diode connected Transistor) mode.

Bit	R/W	Description
7-6	R/W	Reserved
5-3	R/W	TMPIN3-1 are enabled in Thermal Resistor mode.
2-0	R/W	TMPIN3-1 are enabled in Thermal Diode (or Diode connected Transistor) mode.

3.4.30 TMPIN3-1 Thermal Output Limit Registers (Index=54h-52h, Default=7Fh)

Bit	R/W	Description
7-0	R/W	Thermal Output Limit value.

3.4.31 Vendor ID Register (Index=58h, Default=90h)

Bit	R/W	Description
7-0	R	ITE Vendor ID. Read Only.

3.4.32 Thermal Diode Zero Degree Adjust Register (Index=59h, Default=56h)

This register is **read only** unless the bit 7 of 5Ah is set.

Bit	R/W	Description
7-0	R/W	Thermal Diode Zero Degree voltage value (default: 0.664V 156h).

3.4.33 Beep Event Enable Register (Index=5Ch, Default=00h)

Bit	R/W	Description
7	R/W	Thermal Diode Zero Degree Adjust register write enable.
6-3	R/W	Reserved
2	R/W	Enables Beep action when TMPINs exceed limit.
1	R/W	Enables Beep action when VINs exceed limit.
0	R/W	Enables Beep action when FAN_TACs exceed limit.

3.4.34 Beep Frequency Divisor of Fan Event Register (Index=5Dh, Default=00h)

Bit	R/W	Description
7-4	R/W	Tone divisor. Tone=500/(bits[7:4]+1).
3-0	R/W	Frequency divisor. Frequency=10K/(bits[3:0]+1).

3.4.35 Beep Frequency Divisor of Voltage Event Register (Index=5Eh, Default=00h)

Bit	R/W	Description
7-4	R/W	Tone divisor. Tone=500/(bits[7:4]+1).
3-0	R/W	Frequency divisor. Frequency=10K/(bits[3:0]+1).

3.4.36 Beep Frequency Divisor of Temperature Event Register (Index=5Fh, Default=00h)

Bit	R/W	Description
7-4	R/W	Tone divisor. Tone=500/(bits[7:4]+1).
3-0	R/W	Frequency divisor. Frequency=10K/(bits[3:0]+1).

3.4.37 FAN_CTL3-1 SmartGuardian Automatic Mode Temperature Limit of OFF Registers (Index=70h, 68h, 60h, Default=7Fh)

Bit	R/W	Description
7-0	R/W	Temperature Limit value of Fan OFF.

3.4.38 FAN_CTL3-1 SmartGuardian Automatic Mode Temperature Limit of Low Speed Registers (Index=71h, 69h, 61h, Default=7Fh)

Bit	R/W	Description
7-0	R/W	Temperature Limit value of Fan Low speed.

3.4.39 FAN_CTL3-1 SmartGuardian Automatic Mode Temperature Limit of Medium Speed Registers (Index=72h, 6Ah, 62h, Default=7Fh)

Bit	R/W	Description
7-0	R/W	Temperature Limit value of Fan Medium speed.

3.4.40 FAN_CTL3-1 SmartGuardian Automatic Mode Temperature Limit of High Speed Registers (Index=73h, 6Bh, 63h, Default=7Fh)

Bit	R/W	Description
7-0	R/W	Temperature Limit value of Fan High speed.

3.4.41 FAN_CTL3-1 SmartGuardian Automatic Mode Over Temperature Limit Registers (Index=74h, 6Ch, 64h, Default=7Fh)

Bit	R/W	Description
7-0	R/W	Over Temperature Limit value.

3.4.42 FAN_CTL3-1 SmartGuardian Automatic Mode Low Speed PWM Registers (Index=75h, 6Dh, 65h, Default=00h)

Bit	R/W	Description
7	R/W	Reserved
6-0	R/W	PWM value of Low speed.

3.4.43 FAN_CTL3-1 SmartGuardian Automatic Mode Medium Speed PWM Registers (Index=76h, 6Eh, 66h, Default=00h)

Bit	R/W	Description
7	R/W	Reserved
6-0	R/W	PWM value of Medium speed.

3.4.44 FAN_CTL3-1 SmartGuardian Automatic Mode High Speed PWM Registers (Index=77h, 6Fh, 67h, Default=00h)

Bit	R/W	Description
7	R/W	Reserved
6-0	R/W	PWM value of High speed.

4. Operation

4.1 Power On RESET and Software RESET

When the system power is first applied, the EC performs a "power on reset" on the registers with default values (due to system hardware reset), and the EC will acquire a monitored value before it goes inactive. The ADC is active to monitor the VBAT pin and then goes inactive. Except the function of the Serial Bus Interface Address register, a software reset (bit 7 of Configuration register) is able to accomplish all the functions as the hardware reset does.

4.2 Voltage and Temperature Inputs

The 8-bit ADC has a 16mV LSB, with a 0V to 4.096V input range. The 2.5V and 3.3V supplies of PC applications can be directly connected to the inputs. The 5V and 12V inputs should be divided to the acceptable range. When the dividing circuit is used to measure the positive voltage, the recommended range for Ra and Rb is from 10KΩ to 100KΩ. The negative voltage can be measured by the same divider unless the divider is connected to VREF (constant voltage, 4.096V), not ground. The temperature measurement system of the EC converts the voltage of the TMPINs to 8-bit two's-complement. The system also includes an OP amp providing a constant voltage. It also additionally includes an external thermistor, a constant resistance, the ADC and a conversion table ROM.

Temperature	Digital Output Format	
	Binary	Hex
+ 125°C	01111101	7Dh
+ 25°C	00011001	19h
+ 1°C	00000001	01h
+ 0°C	00000000	00h
- 1°C	11111111	FFh
- 25°C	11100111	E7h
- 55°C	11001001	C9h

With the addition of the external application circuit, the actual voltages are calculated as below:

Positive Voltage: Vs = Vin X (Ra+Rb) / Rb
Negative Voltage: Vs = (1+Rin/Rf)XVin – (Rin/Rf)XVREF

All the analog inputs are equipped with the internal diodes that clamps the input voltage exceeding the power supply and ground. But, the current limiting input resistor is recommended when no dividing circuit is available.

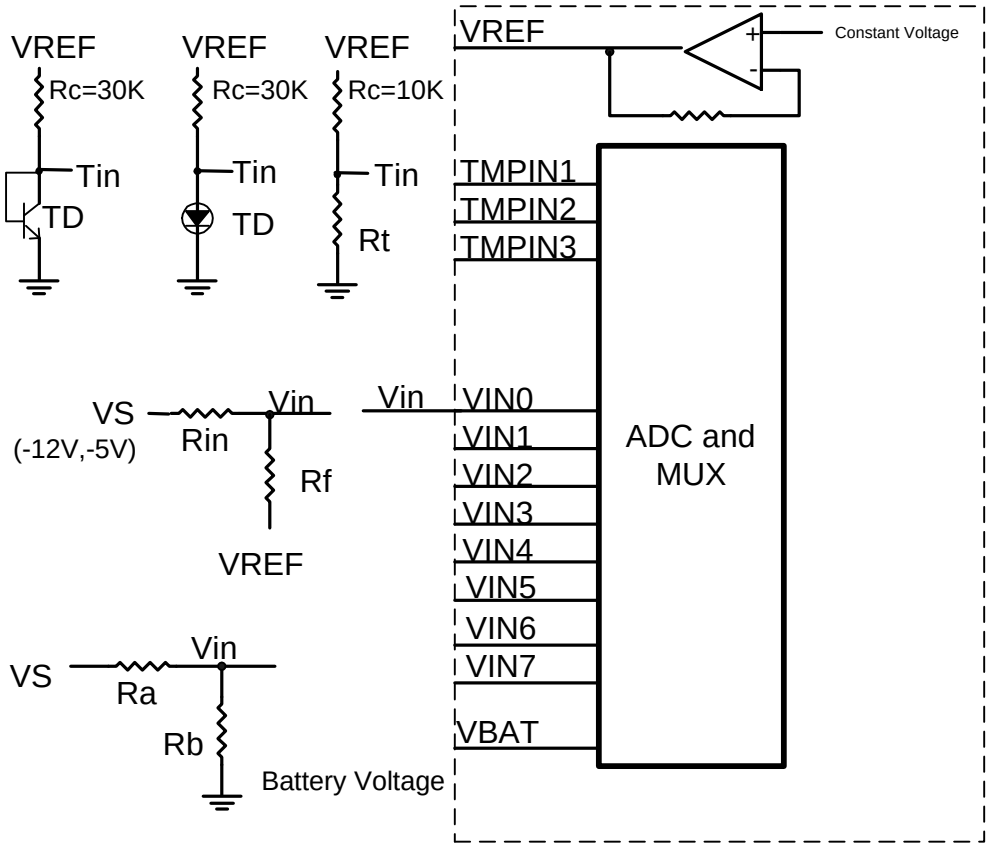

Figure 4-1. Application Example. Resistor should provide approximately 2V at the Analog Inputs

4.3 Analog to Digital Table for Monitoring Voltage

Table 4-1. Analog to Digital Table for Monitoring Voltage

(Sheet1 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
0	0	0	mV	0	V	0	V	-16.9691	V	-8.7771	V
1	1	16	mV	0.02688	V	0.064	V	-16.8869	V	-8.7269	V
2	2	32	mV	0.05376	V	0.128	V	-16.8046	V	-8.6766	V
3	3	48	mV	0.08064	V	0.192	V	-16.7223	V	-8.6263	V
4	4	64	mV	0.10752	V	0.256	V	-16.64	V	-8.576	V
5	5	80	mV	0.1344	V	0.32	V	-16.5577	V	-8.5257	V
6	6	96	mV	0.16128	V	0.384	V	-16.4754	V	-8.4754	V
7	7	112	mV	0.18816	V	0.448	V	-16.3931	V	-8.4251	V
8	8	128	mV	0.21504	V	0.512	V	-16.3109	V	-8.3749	V
9	9	144	mV	0.24192	V	0.576	V	-16.2286	V	-8.3246	V
A	10	160	mV	0.2688	V	0.64	V	-16.1463	V	-8.2743	V
B	11	176	mV	0.29568	V	0.704	V	-16.064	V	-8.224	V
C	12	192	mV	0.32256	V	0.768	V	-15.9817	V	-8.1737	V
D	13	208	mV	0.34944	V	0.832	V	-15.8994	V	-8.1234	V
E	14	224	mV	0.37632	V	0.896	V	-15.8171	V	-8.0731	V
F	15	240	mV	0.4032	V	0.96	V	-15.7349	V	-8.0229	V
10	16	256	mV	0.43008	V	1.024	V	-15.6526	V	-7.9726	V
11	17	272	mV	0.45696	V	1.088	V	-15.5703	V	-7.9223	V
12	18	288	mV	0.48384	V	1.152	V	-15.488	V	-7.872	V
13	19	304	mV	0.51072	V	1.216	V	-15.4057	V	-7.8217	V
14	20	320	mV	0.5376	V	1.28	V	-15.3234	V	-7.7714	V
15	21	336	mV	0.56448	V	1.344	V	-15.2411	V	-7.7211	V
16	22	352	mV	0.59136	V	1.408	V	-15.1589	V	-7.6709	V
17	23	368	mV	0.61824	V	1.472	V	-15.0766	V	-7.6206	V
18	24	384	mV	0.64512	V	1.536	V	-14.9943	V	-7.5703	V
19	25	400	mV	0.672	V	1.6	V	-14.912	V	-7.52	V
1A	26	416	mV	0.69888	V	1.664	V	-14.8297	V	-7.4697	V
1B	27	432	mV	0.72576	V	1.728	V	-14.7474	V	-7.4194	V
1C	28	448	mV	0.75264	V	1.792	V	-14.6651	V	-7.3691	V
1D	29	464	mV	0.77952	V	1.856	V	-14.5829	V	-7.3189	V
1E	30	480	mV	0.8064	V	1.92	V	-14.5006	V	-7.2686	V
1F	31	496	mV	0.83328	V	1.984	V	-14.4183	V	-7.2183	V
20	32	512	mV	0.86016	V	2.048	V	-14.336	V	-7.168	V
21	33	528	mV	0.88704	V	2.112	V	-14.2537	V	-7.1177	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 2 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
22	34	544	mV	0.91392	V	2.176	V	-14.1714	V	-7.0674	V
23	35	560	mV	0.9408	V	2.24	V	-14.0891	V	-7.0171	V
24	36	576	mV	0.96768	V	2.304	V	-14.0069	V	-6.9669	V
25	37	592	mV	0.99456	V	2.368	V	-13.9246	V	-6.9166	V
26	38	608	mV	1.02144	V	2.432	V	-13.8423	V	-6.8663	V
27	39	624	mV	1.04832	V	2.496	V	-13.76	V	-6.816	V
28	40	640	mV	1.0752	V	2.56	V	-13.6777	V	-6.7657	V
29	41	656	mV	1.10208	V	2.624	V	-13.5954	V	-6.7154	V
2A	42	672	mV	1.12896	V	2.688	V	-13.5131	V	-6.6651	V
2B	43	688	mV	1.15584	V	2.752	V	-13.4309	V	-6.6149	V
2C	44	704	mV	1.18272	V	2.816	V	-13.3486	V	-6.5646	V
2D	45	720	mV	1.2096	V	2.88	V	-13.2663	V	-6.5143	V
2E	46	736	mV	1.23648	V	2.944	V	-13.184	V	-6.464	V
2F	47	752	mV	1.26336	V	3.008	V	-13.1017	V	-6.4137	V
30	48	768	mV	1.29024	V	3.072	V	-13.0194	V	-6.3634	V
31	49	784	mV	1.31712	V	3.136	V	-12.9371	V	-6.3131	V
32	50	800	mV	1.344	V	3.2	V	-12.8549	V	-6.2629	V
33	51	816	mV	1.37088	V	3.264	V	-12.7726	V	-6.2126	V
34	52	832	mV	1.39776	V	3.328	V	-12.6903	V	-6.1623	V
35	53	848	mV	1.42464	V	3.392	V	-12.608	V	-6.112	V
36	54	864	mV	1.45152	V	3.456	V	-12.5257	V	-6.0617	V
37	55	880	mV	1.4784	V	3.52	V	-12.4434	V	-6.0114	V
38	56	896	mV	1.50528	V	3.584	V	-12.3611	V	-5.9611	V
39	57	912	mV	1.53216	V	3.648	V	-12.2789	V	-5.9109	V
3A	58	928	mV	1.55904	V	3.712	V	-12.1966	V	-5.8606	V
3B	59	944	mV	1.58592	V	3.776	V	-12.1143	V	-5.8103	V
3C	60	960	mV	1.6128	V	3.84	V	-12.032	V	-5.76	V
3D	61	976	mV	1.63968	V	3.904	V	-11.9497	V	-5.7097	V
3E	62	992	mV	1.66656	V	3.968	V	-11.8674	V	-5.6594	V
3F	63	1008	mV	1.69344	V	4.032	V	-11.7851	V	-5.6091	V
40	64	1024	mV	1.72032	V	4.096	V	-11.7029	V	-5.5589	V
41	65	1040	mV	1.7472	V	4.16	V	-11.6206	V	-5.5086	V
42	66	1056	mV	1.77408	V	4.224	V	-11.5383	V	-5.4583	V
43	67	1072	mV	1.80096	V	4.288	V	-11.456	V	-5.408	V
44	68	1088	mV	1.82784	V	4.352	V	-11.3737	V	-5.3577	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 3 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
45	69	1104	mV	1.85472	V	4.416	V	-11.2914	V	-5.3074	V
46	70	1120	mV	1.8816	V	4.48	V	-11.2091	V	-5.2571	V
47	71	1136	mV	1.90848	V	4.544	V	-11.1269	V	-5.2069	V
48	72	1152	mV	1.93536	V	4.608	V	-11.0446	V	-5.1566	V
49	73	1168	mV	1.96224	V	4.672	V	-10.9623	V	-5.1063	V
4A	74	1184	mV	1.98912	V	4.736	V	-10.88	V	-5.056	V
4B	75	1200	mV	2.016	V	4.8	V	-10.7977	V	-5.0057	V
4C	76	1216	mV	2.04288	V	4.864	V	-10.7154	V	-4.9554	V
4D	77	1232	mV	2.06976	V	4.928	V	-10.6331	V	-4.9051	V
4E	78	1248	mV	2.09664	V	4.992	V	-10.5509	V	-4.8549	V
4F	79	1264	mV	2.12352	V	5.056	V	-10.4686	V	-4.8046	V
50	80	1280	mV	2.1504	V	5.12	V	-10.3863	V	-4.7543	V
51	81	1296	mV	2.17728	V	5.184	V	-10.304	V	-4.704	V
52	82	1312	mV	2.20416	V	5.248	V	-10.2217	V	-4.6537	V
53	83	1328	mV	2.23104	V	5.312	V	-10.1394	V	-4.6034	V
54	84	1344	mV	2.25792	V	5.376	V	-10.0571	V	-4.5531	V
55	85	1360	mV	2.2848	V	5.44	V	-9.97486	V	-4.5029	V
56	86	1376	mV	2.31168	V	5.504	V	-9.89257	V	-4.4526	V
57	87	1392	mV	2.33856	V	5.568	V	-9.81029	V	-4.4023	V
58	88	1408	mV	2.36544	V	5.632	V	-9.728	V	-4.352	V
59	89	1424	mV	2.39232	V	5.696	V	-9.64571	V	-4.3017	V
5A	90	1440	mV	2.4192	V	5.76	V	-9.56343	V	-4.2514	V
5B	91	1456	mV	2.44608	V	5.824	V	-9.48114	V	-4.2011	V
5C	92	1472	mV	2.47296	V	5.888	V	-9.39886	V	-4.1509	V
5D	93	1488	mV	2.49984	V	5.952	V	-9.31657	V	-4.1006	V
5E	94	1504	mV	2.52672	V	6.016	V	-9.23429	V	-4.0503	V
5F	95	1520	mV	2.5536	V	6.08	V	-9.152	V	-4	V
60	96	1536	mV	2.58048	V	6.144	V	-9.06971	V	-3.9497	V
61	97	1552	mV	2.60736	V	6.208	V	-8.98743	V	-3.8994	V
62	98	1568	mV	2.63424	V	6.272	V	-8.90514	V	-3.8491	V
63	99	1584	mV	2.66112	V	6.336	V	-8.82286	V	-3.7989	V
64	100	1600	mV	2.688	V	6.4	V	-8.74057	V	-3.7486	V
65	101	1616	mV	2.71488	V	6.464	V	-8.65829	V	-3.6983	V
66	102	1632	mV	2.74176	V	6.528	V	-8.576	V	-3.648	V
67	103	1648	mV	2.76864	V	6.592	V	-8.49371	V	-3.5977	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 4 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
68	104	1664	mV	2.79552	V	6.656	V	-8.41143	V	-3.5474	V
69	105	1680	mV	2.8224	V	6.72	V	-8.32914	V	-3.4971	V
6A	106	1696	mV	2.84928	V	6.784	V	-8.24686	V	-3.4469	V
6B	107	1712	mV	2.87616	V	6.848	V	-8.16457	V	-3.3966	V
6C	108	1728	mV	2.90304	V	6.912	V	-8.08229	V	-3.3463	V
6D	109	1744	mV	2.92992	V	6.976	V	-8	V	-3.296	V
6E	110	1760	mV	2.9568	V	7.04	V	-7.91771	V	-3.2457	V
6F	111	1776	mV	2.98368	V	7.104	V	-7.83543	V	-3.1954	V
70	112	1792	mV	3.01056	V	7.168	V	-7.75314	V	-3.1451	V
71	113	1808	mV	3.03744	V	7.232	V	-7.67086	V	-3.0949	V
72	114	1824	mV	3.06432	V	7.296	V	-7.58857	V	-3.0446	V
73	115	1840	mV	3.0912	V	7.36	V	-7.50629	V	-2.9943	V
74	116	1856	mV	3.11808	V	7.424	V	-7.424	V	-2.944	V
75	117	1872	mV	3.14496	V	7.488	V	-7.34171	V	-2.8937	V
76	118	1888	mV	3.17184	V	7.552	V	-7.25943	V	-2.8434	V
77	119	1904	mV	3.19872	V	7.616	V	-7.17714	V	-2.7931	V
78	120	1920	mV	3.2256	V	7.68	V	-7.09486	V	-2.7429	V
79	121	1936	mV	3.25248	V	7.744	V	-7.01257	V	-2.6926	V
7A	122	1952	mV	3.27936	V	7.808	V	-6.93029	V	-2.6423	V
7B	123	1968	mV	3.30624	V	7.872	V	-6.848	V	-2.592	V
7C	124	1984	mV	3.33312	V	7.936	V	-6.76571	V	-2.5417	V
7D	125	2000	mV	3.36	V	8	V	-6.68343	V	-2.4914	V
7E	126	2016	mV	3.38688	V	8.064	V	-6.60114	V	-2.4411	V
7F	127	2032	mV	3.41376	V	8.128	V	-6.51886	V	-2.3909	V
80	128	2048	mV	3.44064	V	8.192	V	-6.43657	V	-2.3406	V
81	129	2064	mV	3.46752	V	8.256	V	-6.35429	V	-2.2903	V
82	130	2080	mV	3.4944	V	8.32	V	-6.272	V	-2.24	V
83	131	2096	mV	3.52128	V	8.384	V	-6.18971	V	-2.1897	V
84	132	2112	mV	3.54816	V	8.448	V	-6.10743	V	-2.1394	V
85	133	2128	mV	3.57504	V	8.512	V	-6.02514	V	-2.0891	V
86	134	2144	mV	3.60192	V	8.576	V	-5.94286	V	-2.0389	V
87	135	2160	mV	3.6288	V	8.64	V	-5.86057	V	-1.9886	V
88	136	2176	mV	3.65568	V	8.704	V	-5.77829	V	-1.9383	V
89	137	2192	mV	3.68256	V	8.768	V	-5.696	V	-1.888	V
8A	138	2208	mV	3.70944	V	8.832	V	-5.61371	V	-1.8377	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 5 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
8B	139	2224	mV	3.73632	V	8.896	V	-5.53143	V	-1.7874	V
8C	140	2240	mV	3.7632	V	8.96	V	-5.44914	V	-1.7371	V
8D	141	2256	mV	3.79008	V	9.024	V	-5.36686	V	-1.6869	V
8E	142	2272	mV	3.81696	V	9.088	V	-5.28457	V	-1.6366	V
8F	143	2288	mV	3.84384	V	9.152	V	-5.20229	V	-1.5863	V
90	144	2304	mV	3.87072	V	9.216	V	-5.12	V	-1.536	V
91	145	2320	mV	3.8976	V	9.28	V	-5.03771	V	-1.4857	V
92	146	2336	mV	3.92448	V	9.344	V	-4.95543	V	-1.4354	V
93	147	2352	mV	3.95136	V	9.408	V	-4.87314	V	-1.3851	V
94	148	2368	mV	3.97824	V	9.472	V	-4.79086	V	-1.3349	V
95	149	2384	mV	4.00512	V	9.536	V	-4.70857	V	-1.2846	V
96	150	2400	mV	4.032	V	9.6	V	-4.62629	V	-1.2343	V
97	151	2416	mV	4.05888	V	9.664	V	-4.544	V	-1.184	V
98	152	2432	mV	4.08576	V	9.728	V	-4.46171	V	-1.1337	V
99	153	2448	mV	4.11264	V	9.792	V	-4.37943	V	-1.0834	V
9A	154	2464	mV	4.13952	V	9.856	V	-4.29714	V	-1.0331	V
9B	155	2480	mV	4.1664	V	9.92	V	-4.21486	V	-0.9829	V
9C	156	2496	mV	4.19328	V	9.984	V	-4.13257	V	-0.9326	V
9D	157	2512	mV	4.22016	V	10.048	V	-4.05029	V	-0.8823	V
9E	158	2528	mV	4.24704	V	10.112	V	-3.968	V	-0.832	V
9F	159	2544	mV	4.27392	V	10.176	V	-3.88571	V	-0.7817	V
A0	160	2560	mV	4.3008	V	10.24	V	-3.80343	V	-0.7314	V
A1	161	2576	mV	4.32768	V	10.304	V	-3.72114	V	-0.6811	V
A2	162	2592	mV	4.35456	V	10.368	V	-3.63886	V	-0.6309	V
A3	163	2608	mV	4.38144	V	10.432	V	-3.55657	V	-0.5806	V
A4	164	2624	mV	4.40832	V	10.496	V	-3.47429	V	-0.5303	V
A5	165	2640	mV	4.4352	V	10.56	V	-3.392	V	-0.48	V
A6	166	2656	mV	4.46208	V	10.624	V	-3.30971	V	-0.4297	V
A7	167	2672	mV	4.48896	V	10.688	V	-3.22743	V	-0.3794	V
A8	168	2688	mV	4.51584	V	10.752	V	-3.14514	V	-0.3291	V
A9	169	2704	mV	4.54272	V	10.816	V	-3.06286	V	-0.2789	V
AA	170	2720	mV	4.5696	V	10.88	V	-2.98057	V	-0.2286	V
AB	171	2736	mV	4.59648	V	10.944	V	-2.89829	V	-0.1783	V
AC	172	2752	mV	4.62336	V	11.008	V	-2.816	V	-0.128	V
AD	173	2768	mV	4.65024	V	11.072	V	-2.73371	V	-0.0777	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 6 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
AE	174	2784	mV	4.67712	V	11.136	V	-2.65143	V	-0.0274	V
AF	175	2800	mV	4.704	V	11.2	V	-2.56914	V	0.02286	V
B0	176	2816	mV	4.73088	V	11.264	V	-2.48686	V	0.07314	V
B1	177	2832	mV	4.75776	V	11.328	V	-2.40457	V	0.12343	V
B2	178	2848	mV	4.78464	V	11.392	V	-2.32229	V	0.17371	V
B3	179	2864	mV	4.81152	V	11.456	V	-2.24	V	0.224	V
B4	180	2880	mV	4.8384	V	11.52	V	-2.15771	V	0.27429	V
B5	181	2896	mV	4.86528	V	11.584	V	-2.07543	V	0.32457	V
B6	182	2912	mV	4.89216	V	11.648	V	-1.99314	V	0.37486	V
B7	183	2928	mV	4.91904	V	11.712	V	-1.91086	V	0.42514	V
B8	184	2944	mV	4.94592	V	11.776	V	-1.82857	V	0.47543	V
B9	185	2960	mV	4.9728	V	11.84	V	-1.74629	V	0.52571	V
BA	186	2976	mV	4.99968	V	11.904	V	-1.664	V	0.576	V
BB	187	2992	mV	5.02656	V	11.968	V	-1.58171	V	0.62629	V
BC	188	3008	mV	5.05344	V	12.032	V	-1.49943	V	0.67657	V
BD	189	3024	mV	5.08032	V	12.096	V	-1.41714	V	0.72686	V
BE	190	3040	mV	5.1072	V	12.16	V	-1.33486	V	0.77714	V
BF	191	3056	mV	5.13408	V	12.224	V	-1.25257	V	0.82743	V
C0	192	3072	mV	5.16096	V	12.288	V	-1.17029	V	0.87771	V
C1	193	3088	mV	5.18784	V	12.352	V	-1.088	V	0.928	V
C2	194	3104	mV	5.21472	V	12.416	V	-1.00571	V	0.97829	V
C3	195	3120	mV	5.2416	V	12.48	V	-0.92343	V	1.02857	V
C4	196	3136	mV	5.26848	V	12.544	V	-0.84114	V	1.07886	V
C5	197	3152	mV	5.29536	V	12.608	V	-0.75886	V	1.12914	V
C6	198	3168	mV	5.32224	V	12.672	V	-0.67657	V	1.17943	V
C7	199	3184	mV	5.34912	V	12.736	V	-0.59429	V	1.22971	V
C8	200	3200	mV	5.376	V	12.8	V	-0.512	V	1.28	V
C9	201	3216	mV	5.40288	V	12.864	V	-0.42971	V	1.33029	V
CA	202	3232	mV	5.42976	V	12.928	V	-0.34743	V	1.38057	V
CB	203	3248	mV	5.45664	V	12.992	V	-0.26514	V	1.43086	V
CC	204	3264	mV	5.48352	V	13.056	V	-0.18286	V	1.48114	V
CD	205	3280	mV	5.5104	V	13.12	V	-0.10057	V	1.53143	V
CE	206	3296	mV	5.53728	V	13.184	V	-0.01829	V	1.58171	V
CF	207	3312	mV	5.56416	V	13.248	V	0.064	V	1.632	V
D0	208	3328	mV	5.59104	V	13.312	V	0.14629	V	1.68229	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 7 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
D1	209	3344	mV	5.61792	V	13.376	V	0.22857	V	1.73257	V
D2	210	3360	mV	5.6448	V	13.44	V	0.31086	V	1.78286	V
D3	211	3376	mV	5.67168	V	13.504	V	0.39314	V	1.83314	V
D4	212	3392	mV	5.69856	V	13.568	V	0.47543	V	1.88343	V
D5	213	3408	mV	5.72544	V	13.632	V	0.55771	V	1.93371	V
D6	214	3424	mV	5.75232	V	13.696	V	0.64	V	1.984	V
D7	215	3440	mV	5.7792	V	13.76	V	0.72229	V	2.03429	V
D8	216	3456	mV	5.80608	V	13.824	V	0.80457	V	2.08457	V
D9	217	3472	mV	5.83296	V	13.888	V	0.88686	V	2.13486	V
DA	218	3488	mV	5.85984	V	13.952	V	0.96914	V	2.18514	V
DB	219	3504	mV	5.88672	V	14.016	V	1.05143	V	2.23543	V
DC	220	3520	mV	5.9136	V	14.08	V	1.13371	V	2.28571	V
DD	221	3536	mV	5.94048	V	14.144	V	1.216	V	2.336	V
DE	222	3552	mV	5.96736	V	14.208	V	1.29829	V	2.38629	V
DF	223	3568	mV	5.99424	V	14.272	V	1.38057	V	2.43657	V
E0	224	3584	mV	6.02112	V	14.336	V	1.46286	V	2.48686	V
E1	225	3600	mV	6.048	V	14.4	V	1.54514	V	2.53714	V
E2	226	3616	mV	6.07488	V	14.464	V	1.62743	V	2.58743	V
E3	227	3632	mV	6.10176	V	14.528	V	1.70971	V	2.63771	V
E4	228	3648	mV	6.12864	V	14.592	V	1.792	V	2.688	V
E5	229	3664	mV	6.15552	V	14.656	V	1.87429	V	2.73829	V
E6	230	3680	mV	6.1824	V	14.72	V	1.95657	V	2.78857	V
E7	231	3696	mV	6.20928	V	14.784	V	2.03886	V	2.83886	V
E8	232	3712	mV	6.23616	V	14.848	V	2.12114	V	2.88914	V
E9	233	3728	mV	6.26304	V	14.912	V	2.20343	V	2.93943	V
EA	234	3744	mV	6.28992	V	14.976	V	2.28571	V	2.98971	V
EB	235	3760	mV	6.3168	V	15.04	V	2.368	V	3.04	V
EC	236	3776	mV	6.34368	V	15.104	V	2.45029	V	3.09029	V
ED	237	3792	mV	6.37056	V	15.168	V	2.53257	V	3.14057	V
EE	238	3808	mV	6.39744	V	15.232	V	2.61486	V	3.19086	V
EF	239	3824	mV	6.42432	V	15.296	V	2.69714	V	3.24114	V
F0	240	3840	mV	6.4512	V	15.36	V	2.77943	V	3.29143	V
F1	241	3856	mV	6.47808	V	15.424	V	2.86171	V	3.34171	V
F2	242	3872	mV	6.50496	V	15.488	V	2.944	V	3.392	V
F3	243	3888	mV	6.53184	V	15.552	V	3.02629	V	3.44229	V

Table 4-1. Analog to Digital Table for Monitoring Voltage (cont'd)

(Sheet 8 of 8)

Hex	Dec	Vref		Monitoring 5	V	Monitoring 12	V	Monitoring -5	V	Monitoring -12	V
F4	244	3904	mV	6.55872	V	15.616	V	3.10857	V	3.49257	V
F5	245	3920	mV	6.5856	V	15.68	V	3.19086	V	3.54286	V
F6	246	3936	mV	6.61248	V	15.744	V	3.27314	V	3.59314	V
F7	247	3952	mV	6.63936	V	15.808	V	3.35543	V	3.64343	V
F8	248	3968	mV	6.66624	V	15.872	V	3.43771	V	3.69371	V
F9	249	3984	mV	6.69312	V	15.936	V	3.52	V	3.744	V
FA	250	4000	mV	6.72	V	16	V	3.60229	V	3.79429	V
FB	251	4016	mV	6.74688	V	16.064	V	3.68457	V	3.84457	V
FC	252	4032	mV	6.77376	V	16.128	V	3.76686	V	3.89486	V
FD	253	4048	mV	6.80064	V	16.192	V	3.84914	V	3.94514	V
FE	254	4064	mV	6.82752	V	16.256	V	3.93143	V	3.99543	V
FF	255	4080	mV	6.8544	V	16.32	V	4.01371	V	4.04571	V
100	256	4096	mV	6.88128	V	16.384	V	4.096	V	4.096	V

4.4 Layout and Grounding

A separate and low-impedance ground plane for analog ground is needed in achieving accurate measurement. The analog ground also provides a ground point for the voltage dividers including the temperature loops and analog components. Analog components such as voltage dividers, feedback resistors and the constant resistors of the temperature loops should be located as close as possible to the IT8705F. However, the thermistors of the temperature loops should be positioned at the measuring area. In addition, the power supply bypass, and the parallel combination of 10µF and 0.1µF bypass capacitors connected between VCC and analog ground, should also be located as close as possible to the IT8705F.

Due to the small differential voltage of thermal diode (diode connected transistor), there are many PCB layout's recommendations:
- Position the sensor as close as possible
- Ground of the sensor should be directly short to GNDA with excellent noise immunity
- Keep trace away from the noise source. (High voltage, fast data bus, fast clock, CRTs ..)
- Wider trace width (10mil at least) and guard ground (flanking and under) are recommended
- Position the noise filter and 0.1µF bypass capacitors as close to IT8705F as possible

4.5 Fan Tachometer

The Fan Tachometer inputs gate a 22.5kHz clock into an 8-bit counter (maximum count=255) for one period of the input signals. Several divisors, located in VID/FAN Divisor Register, are provided for FAN_TAC1 and FAN_TAC2, and are used to modify the monitoring range. FAN_TAC3 is not adjustable, and its divisor value is always set to 2. Counts are based on 2 pulses per revolution tachometer output.

RPM = 1.35 X 10^6 / (Count X Divisor)

The maximum input signal range is 0 to VCC. The additional application is needed to clamp the input voltage and current.

4.6 Interrupt of the EC

The EC generates interrupts as a result of each of its Limit registers on the analog voltage, temperature, and FAN monitor. All the interrupts are indicated in two Interrupt Status Registers. The IRQ and SMI# outputs have individual mask registers. These two Interrupts can also be enabled/disabled in the Configuration Register. The Interrupt Status Registers will be reset after being read. When the Interrupt Status Registers are cleared, the Interrupt lines will also be cleared. When a read operation is completed before the completion of the monitoring loop sequence, it indicates an Interrupt Status Register has been cleared. Due to slow monitoring sequence, the EC needs 1.5 seconds to allow all the EC Registers to be safely updated between completed read operations. When the bit 3 of the Configuration Register is set to high, the Interrupt lines are cleared and the monitoring loop will be stopped. The loop will resume when this bit is cleared.

All the analog voltage inputs have high and low Limit Registers that generate Interrupts, except that the FAN monitoring inputs only have low Limit Register to warn the host. The IT8705F provides two modes dedicated to temperature interrupts in the EC: "Interrupt" mode and "Comparator" mode.

In "Interrupt" mode, an interrupt will be generated whenever the temperature exceeds Th limit, and the corresponding Interrupt status bits will be set to high until being reset by reading Interrupt Status Register. Once an interrupt event has occurred by crossing Th limit, then after being reset, an interrupt will only occur again when the temperature goes below TL limit. Again, it will set the status bit to high until being reset by reading the Interrupt Status Register.

When the TL limit register is set to 127°C, the temperature interrupts enter the **"Comparator" mode**. In this mode, an interrupt will be generated whenever the temperature exceeds the Th limit. The interrupt will also be cleared by reading the Interrupt Status Register, but the interrupt will be set again following the completion of another measurement cycle. It will remain set until the temperature goes below the Th limit.

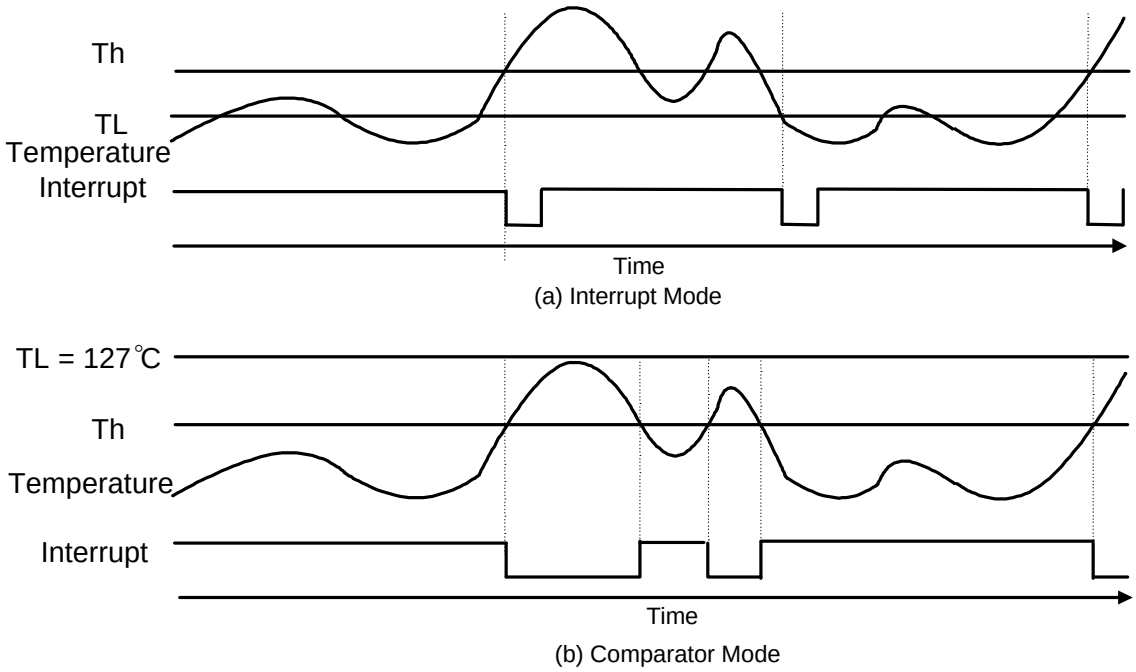

Figure 4-2. Temperature Interrupt Response Diagram

4.7 FAN Controller FAN_CTL's ON-OFF and SmartGuardian Modes

The IT8705F provides advanced FAN Controllers. Two modes are provided for each controller: ON_OFF and SmartGuardian modes. The former is a logical ON or OFF, and the latter is a PWM output. With the addition of external application circuits, the FAN's voltage values can be varied easily. There are also two mode options in the SmartGuardian mode: software and automatic modes. In the software mode, the PWM value is subject to the changes in the values of bits 6-0 of FAN_CTL PWM Control Register (Index=15h, 16h, 17h). With the application circuits, FAN_CTL can generate 128 steps of voltage. So, the FAN_CTL1-3 PWM Control Registers can vary the voltage by changing the PWM value. Fan speeds or other voltage control cooling device can be varied in 128 steps.

In the automatic mode, the PWM value is subject to the specific temperature inputs by five stages (OFF, Low Level, Medium Level, High Level and Full ON). The PWM values of the Low, Medium and High Levels are pre-loaded. Each of FAN's control sources (temperature inputs) can be any of the three temperature inputs, and are determined by bits 1-0 of FAN_CTL PWM Control Register (Index=15h, 16h, 17h). When the source temperature is below the Low Temperature (Index=71h, 69h, 61h), the FAN_CTL output will enter OFF state. When the temperature is between Low and Medium Temperature (Index=72h, 6Ah, 62h), the output will perform Low Level PWM; Medium Level PWM when between Medium and High Temperatures (Index=73h, 6Bh, 63h); High Level PWM when between the High and Over Temperatures (Index=74h, 6Ch, 64h). When any of the Over Temperature is exceeded, all the FAN_CTL outputs will be full ON. The FAN_CTL output will not return to the OFF state until the source temperature goes below the OFF Temperature limit (Index=70h, 68h, 60h).

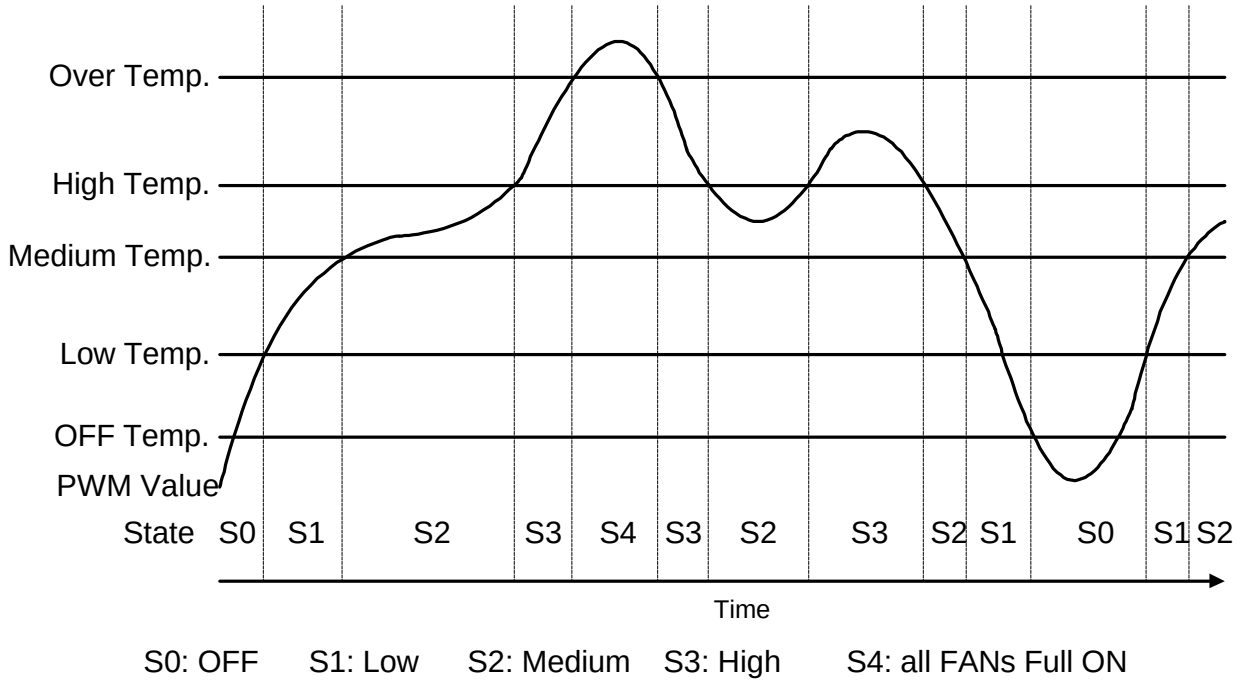

Figure 4-3. SmartGuardian Automatic Mode

Table 4-2. Global Configuration Registers

LDN	Index	R/W	Reset	Configuration Registers or Action
All	02h	W	NA	Configure Control
All	07h	R/W	NA	Logical Device Number (LDN)
All	20h	R	87h	Chip ID Byte 1
All	21h	R	12h	Chip ID Byte 2
All	22h	R	00h	Chip Version
All	23h	R/W	00h	Clock Selection Register
All	24h	R/W	00h	Software Suspend
05h*	25h	R/W	00h	GPIO Set 1 Multi-Function Pin Selection Register
05h*	26h	R/W	00h	GPIO Set 2 Multi-Function Pin Selection Register
05h*	27h	R/W	00h	GPIO Set 3 Multi-Function Pin Selection Register
05h*	28h	R/W	00h	GPIO Set 4 Multi-Function Pin Selection Register
05h*	29h	R/W	00h	GPIO Set 5 Multi-Function Pin Selection Register
05h*	2Ah	R/W	00h	GPIO Set 6 Multi-Function Pin Selection Register
F4h*	2Eh	R/W	00h	Test 1 Register
F4h*	2Fh	R/W	00h	Test 2 Register

Note: *: All these registers can be read from all LDNs.

Table 4-3. GPIO Configuration Registers

LDN	Index	R/W	Reset	Configuration Registers or Action
05h	60h	R/W	00h	Simple I/O Base Address MSB Register
05h	61h	R/W	00h	Simple I/O Base Address LSB Register
05h	62h	R/W	00h	Panel Button De-bounce Base Address MSB Register
05h	63h	R/W	00h	Panel Button De-bounce Base Address LSB Register
05h	64h	R/W	00h	SMI# Normal Run Access Base Address MSB Register
05h	65h	R/W	00h	SMI# Normal Run Access Base Address LSB Register
05h	70h	R/W	00h	Panel Button De-bounce Interrupt Level Select Register
05h	B0h	R/W	00h	GPIO Set 1 Pin Polarity Register
05h	B1h	R/W	00h	GPIO Set 2 Pin Polarity Register
05h	B2h	R/W	00h	GPIO Set 3 Pin Polarity Register
05h	B3h	R/W	00h	GPIO Set 4 Pin Polarity Register
05h	B4h	R/W	00h	GPIO Set 5 Pin Polarity Register
05h	B5h	R/W	00h	GPIO Set 6 Pin Polarity Register
05h	B8h	R/W	00h	GPIO Set 1 Pin Internal Pull-up Enable Register
05h	B9h	R/W	00h	GPIO Set 2 Pin Internal Pull-up Enable Register
05h	BAh	R/W	00h	GPIO Set 3 Pin Internal Pull-up Enable Register
05h	BBh	R/W	00h	GPIO Set 4 Pin Internal Pull-up Enable Register
05h	BCh	R/W	00h	GPIO Set 5 Pin Internal Pull-up Enable Register
05h	BDh	R/W	00h	GPIO Set 6 Pin Internal Pull-up Enable Register
05h	C0h	R/W	00h	Simple I/O Set 1 Enable Register
05h	C1h	R/W	00h	Simple I/O Set 2 Enable Register
05h	C2h	R/W	00h	Simple I/O Set 3 Enable Register
05h	C3h	R/W	00h	Simple I/O Set 4 Enable Register
05h	C4h	R/W	00h	Simple I/O Set 5 Enable Register
05h	C5h	R/W	00h	Simple I/O Set 6 Enable Register
05h	C8h	R/W	00h	Simple I/O Set 1 Output Enable Register
05h	C9h	R/W	00h	Simple I/O Set 2 Output Enable Register
05h	CAh	R/W	00h	Simple I/O Set 3 Output Enable Register
05h	CBh	R/W	00h	Simple I/O Set 4 Output Enable Register
05h	CCh	R/W	00h	Simple I/O Set 5 Output Enable Register
05h	CDh	R/W	00h	Simple I/O Set 6 Output Enable Register
05h	D0h	R/W	00h	Panel Button De-bounce Control Register
05h	D1h	R/W	00h	Panel Button De-bounce Set 1 Enable Register
05h	D2h	R/W	00h	Panel Button De-bounce Set 2 Enable Register
05h	D3h	R/W	00h	Panel Button De-bounce Set 3 Enable Register
05h	D4h	R/W	00h	Panel Button De-bounce Set 4 Enable Register
05h	D5h	R/W	00h	Panel Button De-bounce Set 5 Enable Register
05h	D6h	R/W	00h	Panel Button De-bounce Set 6 Enable Register
05h	F0h	R/W	00h	SMI# Control Register
05h	F1h	R/W	00h	Reserved
05h	F2h	R/W	00h	SMI# Status Register
05h	F5h	R/W	00h	SMI# Pin Mapping Register

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