Datasheet

FS5908

Digital Temperature Sensor and Thermal Watchdog with I2C® Interface and SMBusTM Format

Fortune SEMICONDUCTOR CORPORATION

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1. General Description

FS5908 is a precise environmental temperature sensor chip to digitize and format the technology of environmental temperature. It is also one of SOC (**S**ystem **O**n **C**hip) chips of FSC Company that combined with sensor. The chip includes:
Digital Silicon Temperature Sensor (Resolution: 0.125℃)
Calibration Algorithm
PROM Coefficients
I²C Interface and SMBus Format
Open Drain ALARM ("Interrupt" and "Comparator" mode)
The internal control register status, calibration coefficient, I²C address lines and so on can be generated through PROM to meet the application requirement at production. When the chip is power on, all internal status will be at programmed default status so that FS5908 is flexible for variety applications.
A variable input voltage between 2.5V~5.5V of FS5908 will not influence the output of the temperature sensor.

2. Applications

Personal Computers.
Measuring Instruments.
Industry Control.
Household Appliance.
Automobile Temperature Detection.
Sports and Health Equipment.
System Temperature Management and Environmental Temperature Measurement.
All related products that need to measure temperature by digital format.

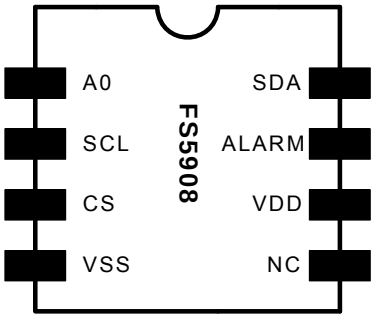
3. Features

Chip can measure temperature by itself without any other external component.
8 pin SOP package.
I²C digital interface (SMBus Format).
Temperature value can be read at any time via I²C interface.
Provide open drain over/under temperature warning pin (ALARM) in Comparator Mode or Interrupt Mode. Power on default is in Comparator Mode.
Readable upper and lower bound register (TUpLim and TLowLim) via I²C interface.
Upper and lower bound register can be one time programmed according to the application at production. TUpLim and TLowLim will be the programmed default at 80℃ and 75℃ when power on.
Different temperature accuracy requirement for variety applications can be met by calibration under different temperature.
When micro-controller is not connected, FS5908 can be an independent temperature sensor (Watch Dog) or thermostat.
Reducing the current consumption to minimum in Stand-by Mode.
The I²C interface of the chip can connect up to 128 FS5908 chips.
Low voltage detection.
The I²C address line of FS5908 is composed by an external address select line (A0) and the address select line (A6-A1), which can be programmed by PROM. When A0 is 0, A6 ~ A1 is forced to setup to 100100; when A0 is 1, A6 ~ A1 ← PROM9<7:2>.

4. Ordering Information

FS5908
FS5908-P: Lead Free

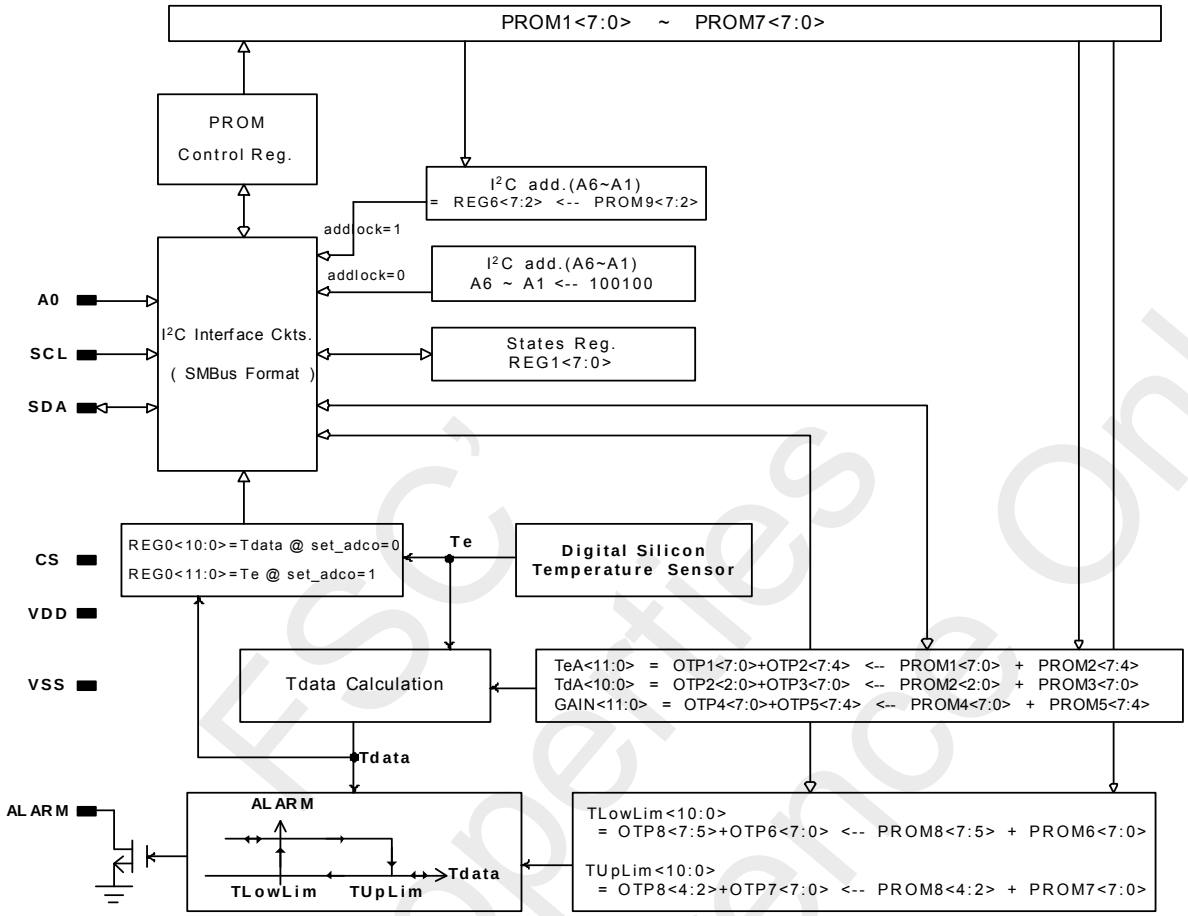
5. Pin Configurations



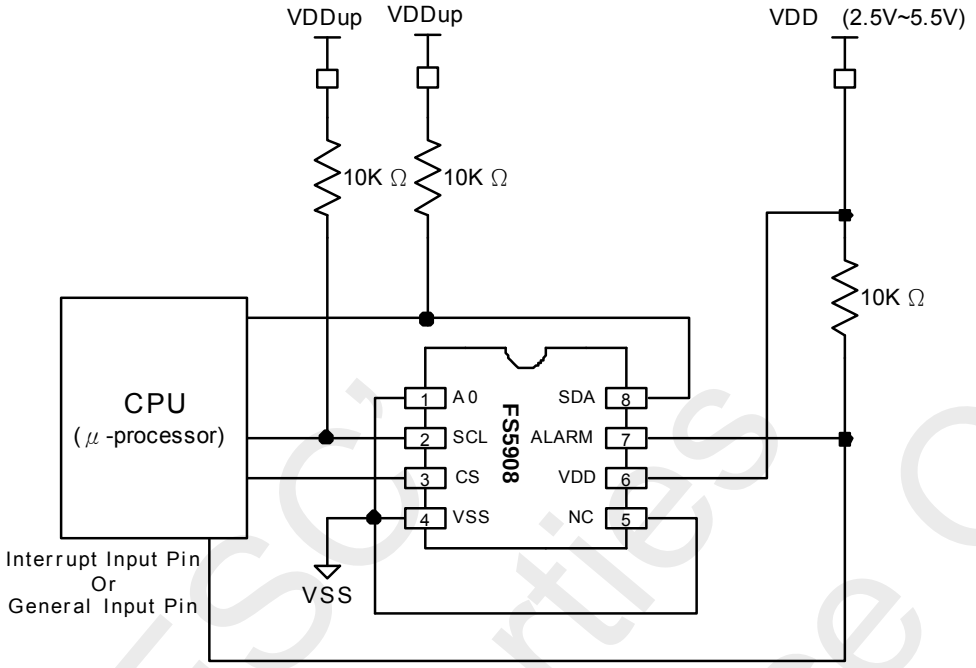
6. Pin Description

Pin	Name	Function
1	A0	The address lines of the chip controlled via I2C interface are A6, A5, A4, A3, A2, A1 and A0. A0 is controlled by external pins. A6 ~ A1 can be setup by programming the PROM in the chip. When A0 is 0, A6 ~ A1 is 100100. When A0 is 1, A6 ~ A1 ← PROM9<7:2>
2	SCL	Signal Clock Line of I2C Serial Transmission
3	CS	Chip Select (the chip is enabled when set to high)
4	VSS	Chip Negative Power Source Input Pin (0V)
5	NC	When in the normal operation, it connects to ground.
6	VDD	Chip Positive Power Source Input Pin (2.5V~5.5V)
7	ALARM	Overheat (Overcool) Warning Output Pin; Open-drain Output
8	SDA	Double Directions Data Transmission Line of I2C Serial Transmission

7. Functional Block Diagram

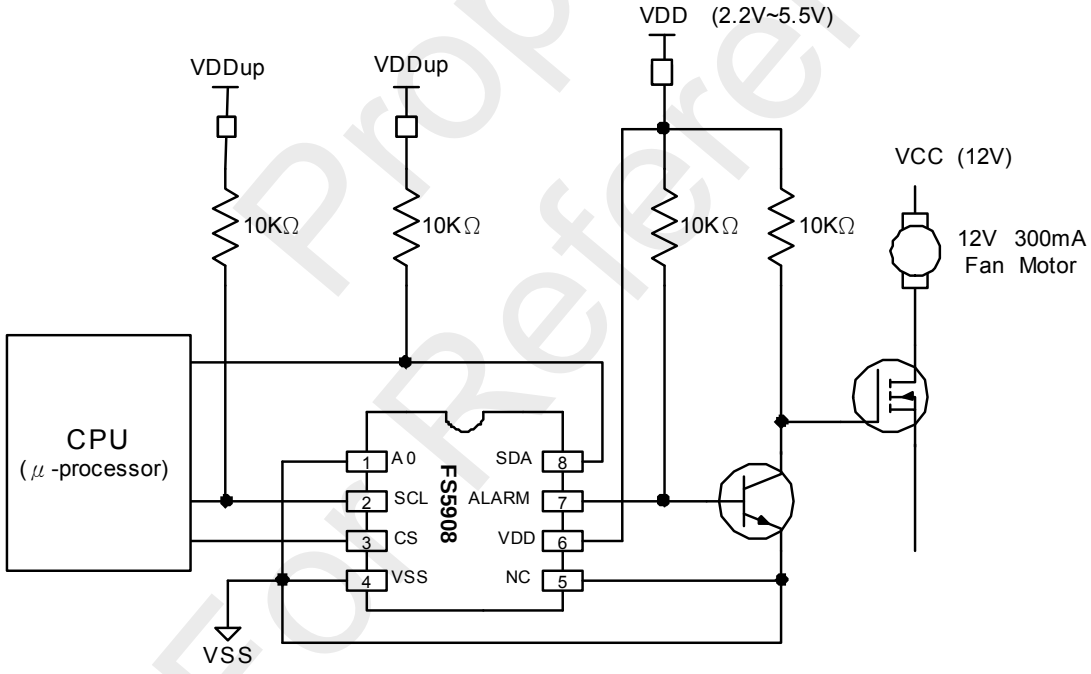


8. Typical Application Circuit



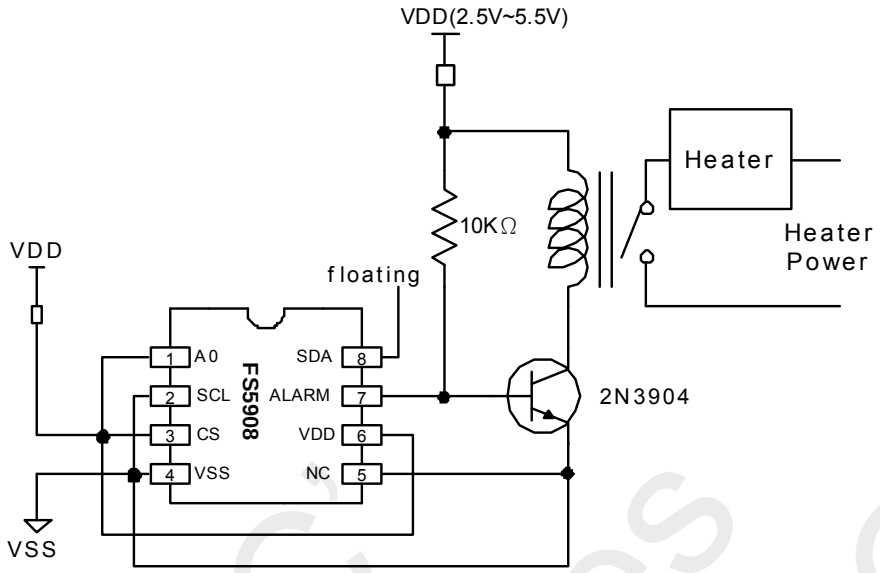
Application Ⅰ: Microprocessor controls Circuit

When control FS5908 by microprocessor, the SDA terminal of the microprocessor must be open drain double-way I/O pin.



Application Ⅱ: Control Fan Motor via Microprocessor

Digital Temperature Sensor: Able to combine with any CPU and Microprocessor.



Application Ⅲ: Setup the heater to heat in 75°C (T_{LowLim} = 75℃), and close if the temperature is higher than 80℃ (T_{UpLim} = 80℃).

Thermal Watchdog: Such as heater, refrigerator and various environment monitor.

9. Absolute Maximum Ratings

Supply Voltage ----------0.3V to 5.5V
Voltage at any Pin ----------0.3V to (VDD+0.3)V
Input Current at any Pin (Note 2) ---------- 5mA
Package Input Current (Note 2) ----------20mA
ALARM Output Sink Current ---------- 10mA
ALARM Output Voltage ---------- 5.5V
Storage Temperature ----------65℃ to 150℃
Soldering Information, Lead Temperature
Vapor Phase (60 seconds)----------215℃
Infrared (15 seconds) ----------220℃
ESD Susceptibility (Note 3)
Human Body Mode---------- 2000V
Machine Mode ----------200V

10. Operating Ratings

Specified Temperature Range (Note 4) ----------55℃ to 125℃
Supply Voltage Range (VDD) ----------2.5V to 5.5V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its rated operating conditions.

Note 2: When the input voltage (Vi) at any pin exceeds the power supply (Vi<GND or Vi>+Vs) the current at that pin should be limited to 5mA. The 20mA maximum package input current rating limits the number of pins that can safely exceed the power supplies with an input current of 5mA to four.

Note 3: Human body model, 100pF discharged through a 1.5KΩ resistor. Machine model, 200pF discharged directly into each pin.

Note 4: FS5908 θ_{JA} (thermal resistance, junction-to-ambient) is 0.125℃/mW.

11. Electrical Characteristics

(Unless otherwise noted, these specifications apply for VDD = 3.0V (Note 5). Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = +25°C, unless otherwise noted.)

Parameter	Test Conditions	Min (Note6)	Typ (Note10)	Max (Note6)	Unit
Supply Voltage		2.5	3.0	5.5	V
Quiescent Current	I^2C Inactive		300	450	μA
	I^2C Active		330	500	μA
	Shutdown Mode		3	4	μA
Temperature Accuracy	T_A = 0℃ to +50℃			±1.0	℃
	T_A = -25℃ to +100℃			±2.0	℃
	T_A = -55℃ to +125℃			±3.0	℃
Temperature Resolution			0.125		℃
Temperature Conversion Time	(Note 7)		105		ms
ALARM Output Saturation Voltage	I_{OUT}=10mA (Note 8)			0.5	V
ALARM Delay	(Note9)	1		8	Conversions

12. Logic Electrical Characteristics

12.1 Digital DC Characteristics

(Unless otherwise noted, these specifications apply for VDD = 3.0V (Note 5). Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = +25°C, unless otherwise noted.)

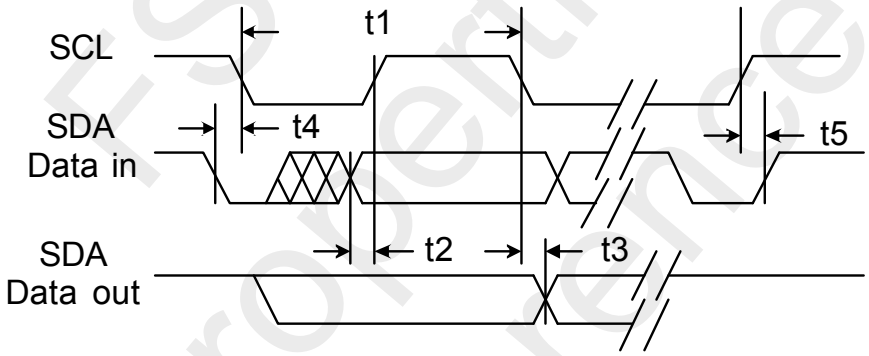
Symbol	Parameter	Test Conditions	Min (Note6)	Typ (Note10)	Max (Note6)	Unit
$V_{IN(1)}$	Logical 1 Input Voltage		VDD×0.7		VDD+0.5	V
$V_{IN(0)}$	Logical 0 Input Voltage		-0.3		VDD×0.3	V
$I_{IN(1)}$	Logical 1 Input Current	V_{IN}=5V		0.005	1.0	μA
$I_{IN(0)}$	Logical 0 Input Current	V_{IN}=0V		-0.005	-1.0	μA
C_{IN}	All Digital Inputs		20			pF
I_{OH}	High Level Output Current	V_{OH}=5V			100	μA
V_{OL}	Low Level Output Voltage	I_{OL}=3mA			0.4	V
T_{OF}	Output Fall Time	C_L=400pF, I_0=3mA			250	ns

12.2 I^2C Digital Switching Characteristics

(Unless otherwise noted, these specifications apply for VDD = 3.0V (Note 5). Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = +25°C, unless otherwise noted.)

The switching characteristics of the FS5908 fully meet or exceed the published specifications of the I^2C Bus. The following parameters are the timing relationships between SCL and SDA signals related to the FS5908. They are not the I^2C bus specifications.

Symbol	Parameter	Test Conditions	Min (Note6)	Typ (Note10)	Max (Note6)	Unit
t1	SCL (Clock) Period		10		100	μs
t2	Data In Set-up Time to SCL High		120			ns
t3	Data Out Stable after SCL Low		40			ns
t4	SDA Low Set-Up Time to SCL Low (Start Condition)		120			ns
t5	SDA High Hold Time after SCL High (Stop Condition)		0			ns



Note 5: FS5908 will operate properly over the +Vs supply voltage range from 2.5V to 5.5V. The devices are tested and specified for rated accuracy at their normal supply voltage, Accuracy will typically degrade 0.15℃/V of variation in VDD.

Note 6: Limits are guaranteed to Fortune AOQL (Average Outgoing Quality Level)

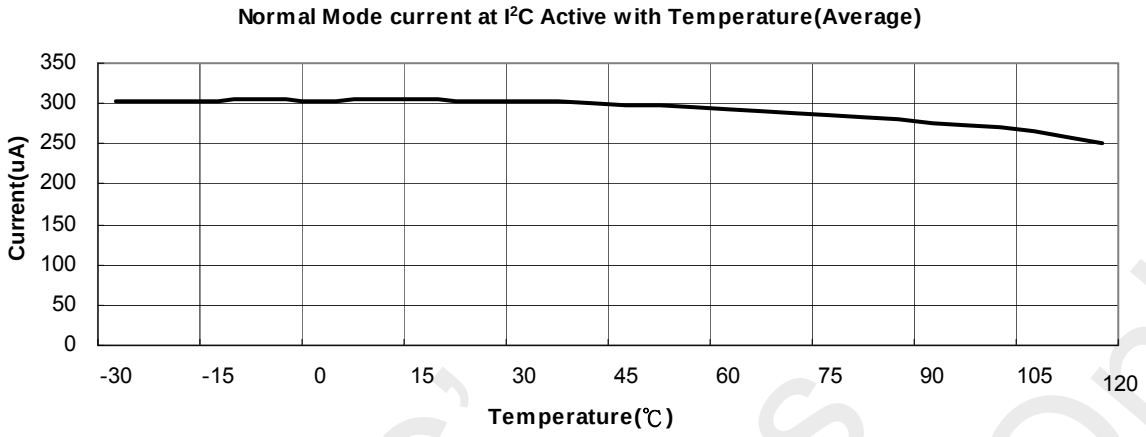
Note 7: This specification is provided only to indicate how often temperature data is updated. The FS5908 can be read at any time without regard to conversion state (and will yield last conversion result). If a conversion is in process it will be stopped and restarted after the end of the read.

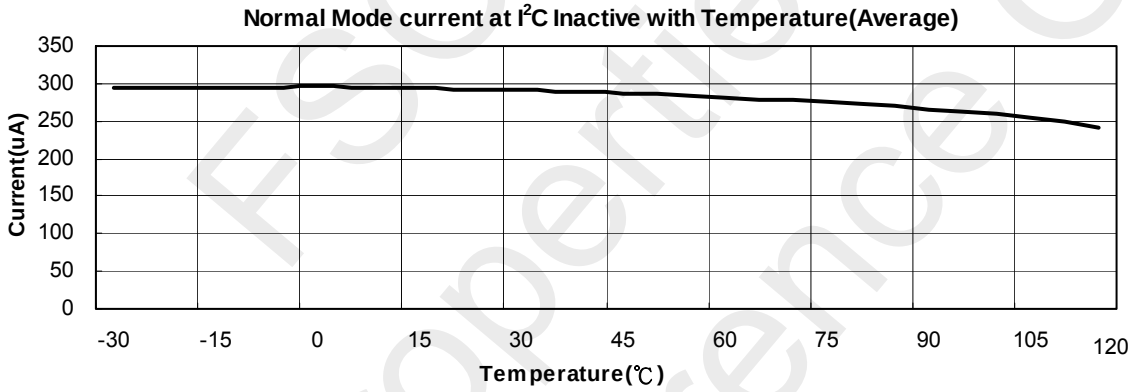
Note 8: For best accuracy, minimize output loading. Higher sink currents can affect sensor accuracy with internal heating. This can cause an error of 0.25℃ at full rated sink current and saturation voltage based on junction-to-ambient thermal resistance.

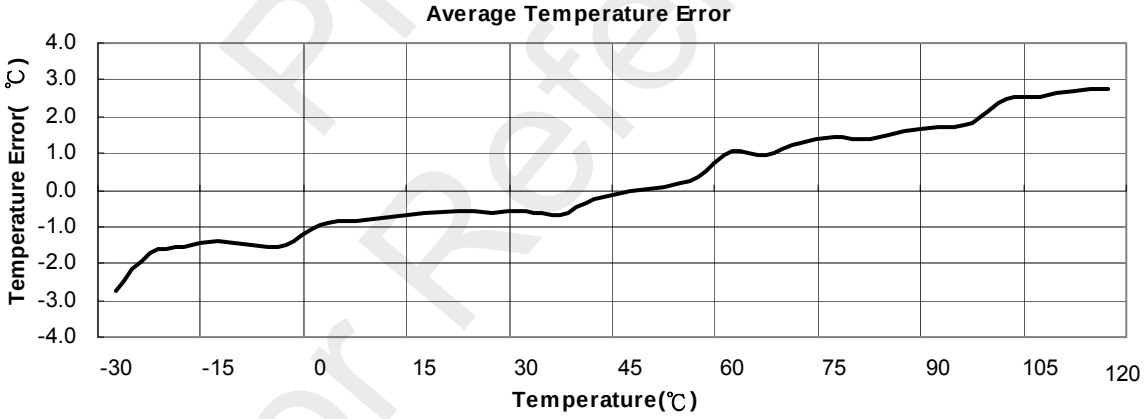
Note 9: ALARM Delay is user programmable up to 8 over limit conversions before O.S. is set to minimize false tripping in noisy environments.

Note 10: Typical are at TA=25℃ and represent most likely parametric norm.

12.3 Typical Performance Characteristics







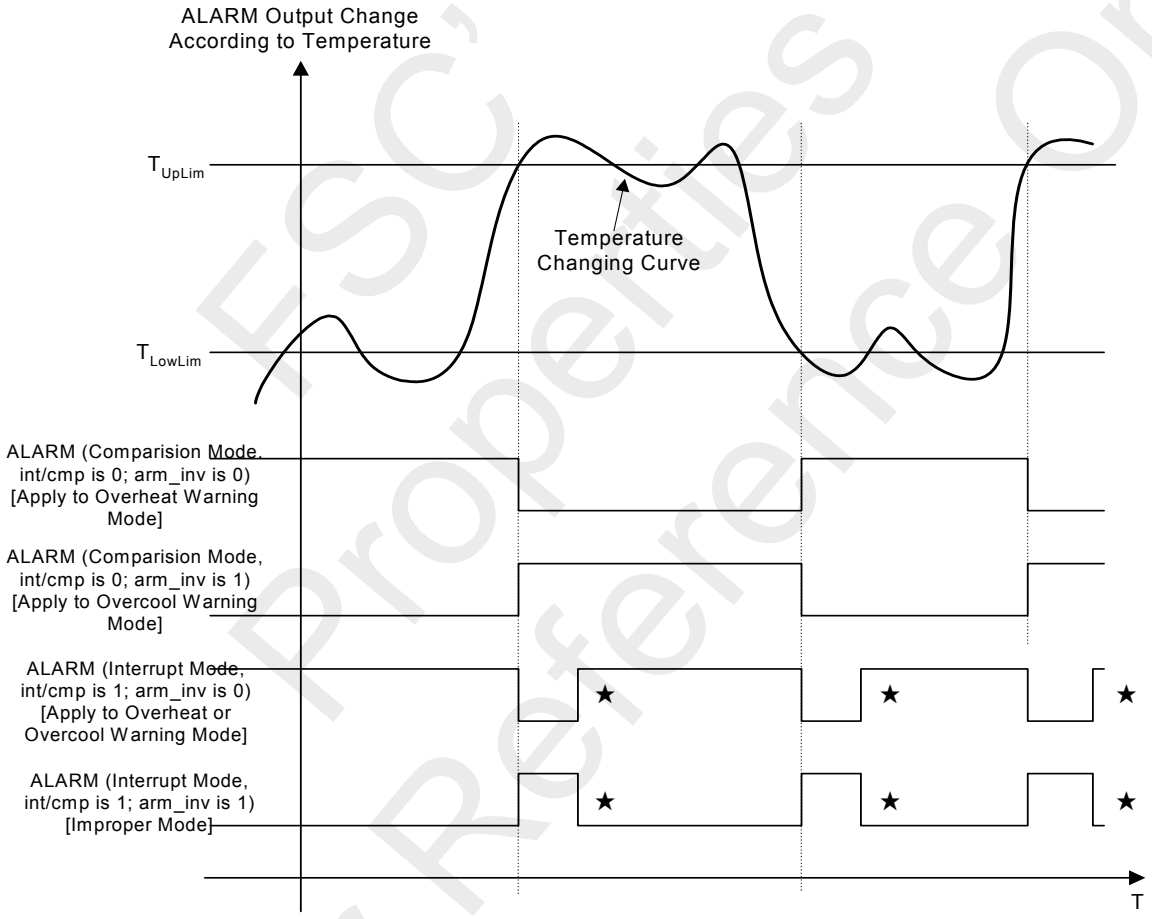
13. Function Description

13.1 Temperature Measurement

FS5908 measures the environmental temperature around the chip, and updates the temperature value in digital format via the register. Users can read these updated temperature values at any time through I2C interface.

13.2 Overheat/Overcool Warning

FS5908 can set up one set of the warning temperatures TUpLim and TLowLim (See below diagram). When the measured temperature reaches the warning temperature, the ALARM signal will notify microprocessor or enable directly the cooler fan, heater and so on. The related warning temperature of ALARM is decided by upper bound register (TUpLim) and lower bound register (TLowLim) that can be changed at any time as request.



★: In interrupt mode, after ALARM pin generates an interrupt signal, ALARM will be reset only when any one register of FS5908 is read or the system enters the stand-by mode.

13.2.1 ALARM Pin and arm_inv Setup

arm_inv bit in the control register decides the ALARM pin output mode (please refer to the diagram on previous page), the relationship between arm_inv and ALARM is as follow:

arm_inv is 0: In comparison operation mode, if the temperature is lower than the lower bound setup, ALARM is logic standard 1; if the temperature is higher than the upper bound setup, ALARM is logic standard 0.
In interrupt operation mode, ALARM in general situation is logic standard 1; if sending out the interrupt signal, ALARM is logic standard 0.

arm_inv is 1: In comparison operation mode, if the temperature is lower than the lower bound setup, ALARM is logic standard 0; if the temperature is higher than the upper bound setup, ALARM is logic standard 1.
In interrupt operation mode, ALARM in general situation is logic standard 0; if send out the interrupt signal, ALARM is logic standard 1.

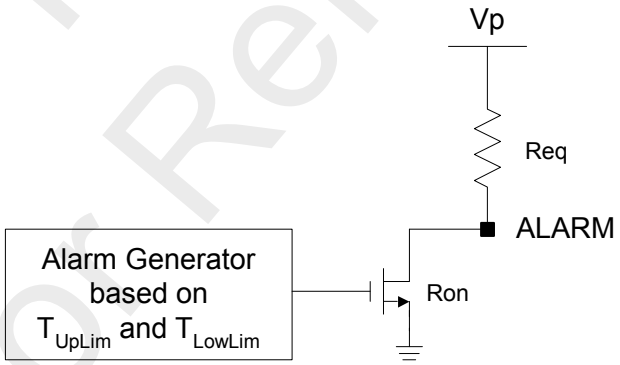
In comparison mode, ALARM output can be used to enable cool fan or emergency system, close or reduce system clock. FS5908 in comparison mode w ill not reset ALARM status when entering stand-by mode.

In interrupt mode, the arm_inv should be set to 0 no matter that it is applied to overcool warning or overheat warning.

Once detected the temperature exceeded the upper bound value, ALARM will send out the interrupt signal immediately. In the mean time, to read any FS5908 register via I2C interface will clear ALARM interrupt signal. ALARM will send out the interrupt signal again until detected the temperature being lower than the lower bound value. It is the same to clear the interrupt signal via reading the register. FS5908 in interrupt mode will reset ALARM output when entering stand-by mode.

13.2.2 ALARM Output

ALARM output pin outputs by open-drain (see below diagram), which without inner circuit promotion design. It will not generate logic high standard unless offering the additional current promotion from external (promotive resistor generally). The select of promotive resistor depends on the system.



In above diagram, when current I flows, MOS power consumption is:

$Pav = I^2 \cdot Ron$〔$I = V_P / (Req+Ron)$〕

And the temperature accuracy of the chip that influenced by the power is shown as below table:

Pav	Influenced Temp. (Δ℃)
1mW	0.125
5mW	0.625
10mW	1.125
20mW	1.750

13.3 Standby Mode (shutdown=Reg1<0>)

To setup Shutdown bit of control register will enter the Stand-by Mode. In stand-by mode, the standard current consumption of FS5908 will be lower than 100uA. In interrupt mode, if ALARM enters stand-by mode in action status, then the action status of ALARM will be clear, but if it enters stand-by mode when in comparison mode, ALARM will keep the status of before entering. In stand-by mode, all circuits are close except I2C circuit.

13.4 Power Off (CS)

When set CS to 0, then the chip is close, and the current consumption is lower than 5μA.

When set CS to 1 (voltage is VDD), then the chip is enabled, and all status will be default operations. Please see below diagram for the description of default status.

Take the chip as Watchdog (independent temperature sensor).
SCL: connect to ground
SDA: floating
CS: connect to VDD
A0: connect to ground or VDD

Please see the diagram on page 3: Application I

13.5 set_arm_cnt (Reg 1<4:3>)

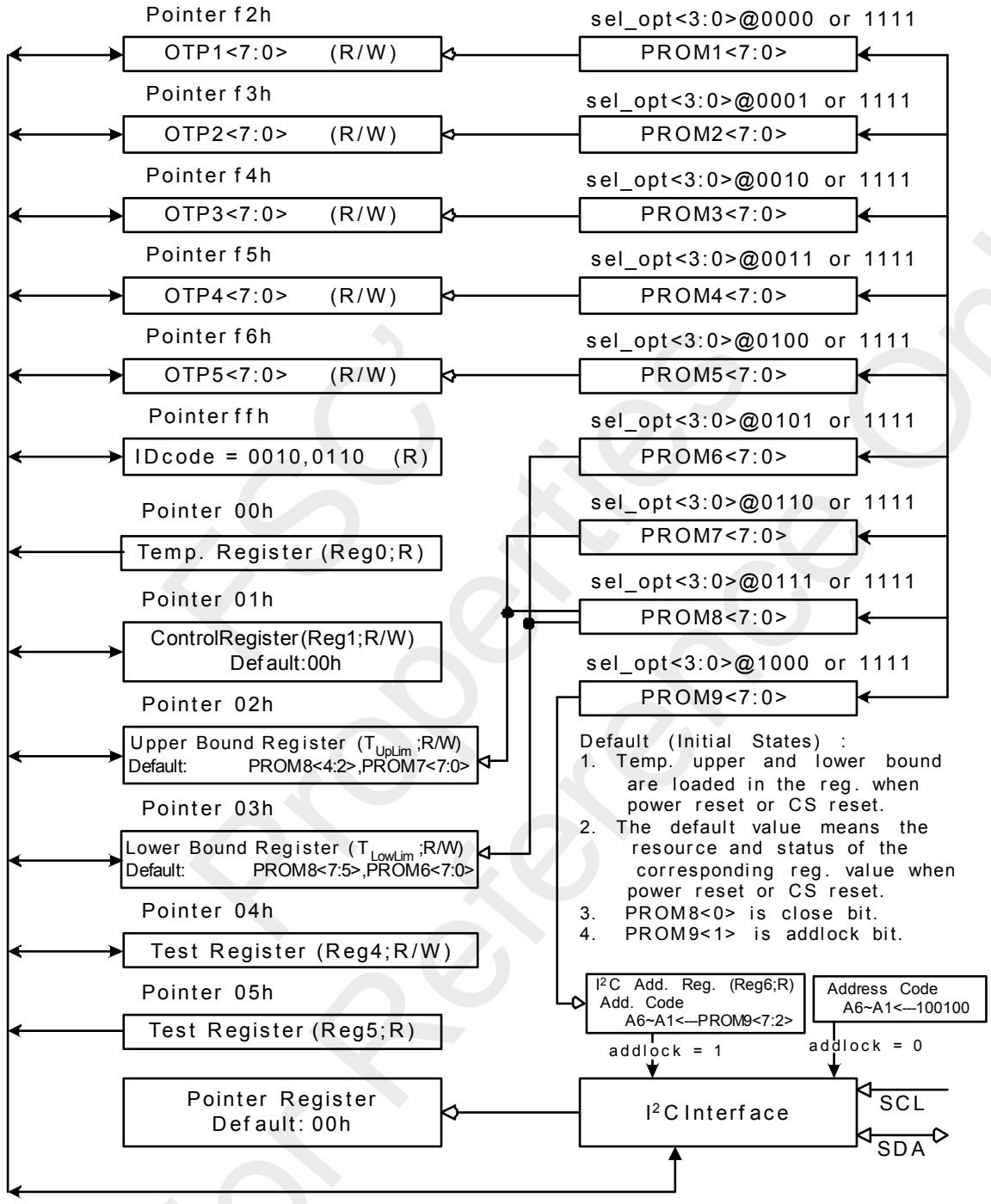
Inside the chip, every record of measuring temperature will be updated per 1/4 second. When the measuring temperature reaches the warning temperature, the inner warning counter will increase counting, and only when the value of the warning counter is equal to the setup times in set_arm_cnt, ALARM pin will send out the warning signal. During the process, any record of measuring temperature that not reach the warning temperature will make the system clear the warning counter to be 0 so that the proper setup for set_arm_cnt can avoid noise or interfere making ALARM to act error.

set_arm_cnt<1:0>	Necessary compare output times to make ALARM output change
00	1 (Default)
01	2
10	4
11	8

13.6 Low Battery Detection (setlowbat=Reg1<7>)

setlowbat	0	1
Rog0<14>=lowbat	=1	=1
	@VDDP2.4V	@VDDP2.2V

14. Internal Register Structure and Data Format



14.1 Temperature Register (Pointer=00h, Read Only)

Pointer	Name	Type	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
h'00	Reg0	R	adc_trans	lowbat	alarm	high	low	Tdata<10:0>											Set_adc0=0
				0	0	1	Te<11:0>												Set_adc0=1

When set_adco = 0:

Reg0<15> (adc_trans): When the temperature output value is updated, the bit becomes 1; when the register is read, the bit is cleared to 0.

Reg0<14> (lowbat): Low battery warning. When the bit is 1, it means the operating voltage of the chip is lower than the setting voltage. For the setting method, please refer to "2.2 Control Register Reg1<7> (setlowbat)".

Reg0<13> (alarm): The bit is always comparison mode output. When the temperature value is higher than (or equal to) the upper bound value, the bit becomes 1, and until the temperature value is lower than (or equal to) the lower bound value, the bit becomes 0.

Reg0<12> (high): When the temperature value is higher than (or equal to) the upper bound value, the bit is 1, on the contrary, the bit is 0.

Reg0<11> (low): When the temperature value is lower than (or equal to) the lower bound value, the bit is 1, on the contrary, the bit is 0.

Reg0<10:0>: Temperature data. The following table is the meaning that every bit stands for:

10	9	8	7	6	5	4	3	2	1	0
+/-	64	32	16	8	4	2	1	0.5	0.25	0.125

Ex: Temperature	Digit Output Value	
	Digit	Hexadecimal
+125℃	011-1110-1000	3E8
+25℃	000-1100-1000	0C8
+0.5℃	000-0000-0100	004
0℃	111-1111-1111	7FF
-0.5℃	111-1111-1100	7FC
-25℃	111-0011-1000	738
-125℃	100-0001-1000	418

Note: When the temperature is equal or lower than 0℃, the temperature is expressed by 2's complement.

When set-adco = 1:
Output is the direct output of digital silicon temperature sensor Te<11:0>.

14.2 Control Register (Pointer=01h, Readable and Writable)

Pointer	Name	Type	7	6	5	4	3	2	1	0
h'01	Reg1	R/W	setlowbat	rst_alarm	set_adco	set_arm_cnt<1:0>		arm_inv	int/cmp	shutdown

Reg1<7>=setlowbat: Low battery warning setup. 0 is 2.4V; 1 is 2.2V.

Reg1<6> (rst_alarm): When set to 1, alarm, high, low and so on bits and the warning signal of ALARM pin can be directly cleared; when set to 0, the above signals would be recalculated, and they can be used after reset the upper and lower bound.

Reg1<5> (set_adco): When set to 0, the bit is T_{data}<10:0> output; when set to 1, it is Te<11:0> output. Please see 2.1.

Reg1<4:3> (set_arm_cnt<1:0>):
If the temperature exceeds T_{UpLim} or lower than T_{LowLim}, ALARM output standard will be changed. The two bits decide the necessary continuing trigger times to changes ALARM output standard. (Please see 1.5)

Reg1<2> (arm_inv): Setup ALARM pin output mode. Please see 1.2.1.

Reg1<1> (int/cmp): 0 is comparison mode; 1 is interrupt mode. Please see 1.2.1.

Reg1<0> (shutdown): Stand-by mode. 0 is normal operation; 1 is stand-by mode. Please see 1.3.

14.3 Upper Bound Register (TUpLim, Pointer=02h) and Lower Bound Register (TLowLim, Pointer=03h) (Readable and Writable)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(NC)					T_{UpLim}<10:0>										
					+/-	64℃	32℃	16℃	8℃	4℃	2℃	1℃	0.5℃	0.25℃	0.125℃

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(NC)					T_{LowLim}<10:0>										
					+/-	64℃	32℃	16℃	8℃	4℃	2℃	1℃	0.5℃	0.25℃	0.125℃

The default values can be programmed in PROM (PROM6, PROM7, and PROM8) before out of factory. When power on or produce CS, they will be put in default related registers from PROM. The meanings of bits are the same as the temperature register (For detail, please see “2.1 Temperature Data Format”). When bit<10>=0, it means the positive (+), and when bit<10>=1, it means the negative (-).

For the upper bound register (T_{UpLim}) and lower bound register (T_{LowLim}), please see the diagram on Page11.
T_{LowLim} <10:0> ← {PROM8 <7:5>, PROM6<7:0>}
T_{UpLim} <10:0> ← {PROM8 <4:2>, PROM7<7:0>}
OTP6 <7:0> ← PROM6 <7:0>
OTP7 <7:0> ← PROM7 <7:0>
OTP8 <7:0> ← PROM8 <7:0>

14.4 Default Status

When power on or CS is produced, FS5908 will enter default operation mode. For its status, please refer to the diagram on Page11.

Initial States:

1. Pointer default: 00h
2. Control register default: 00h
3. The corresponding location of OTPX<7:0> and PROM1~PROM9:
   OTP1<7:0> ← PROM1<7:0>
   OTP2<7:0> ← PROM2<7:0>
   OTP3<7:0> ← PROM3<7:0>
   OTP4<7:0> ← PROM4<7:0>
   OTP5<7:0> ← PROM5<7:0>
4. TLowLim<10:0> ← {PROM8<7:5>, PROM6<7:0>}
5. TUpLim<10:0> ← {PROM8<4:2>, PROM7<7:0>}
6. OTP9<7:0> ← PROM9<7:0>
7. The upper and lower bound setup will load in the upper and lower bound register when power reset or CS reset.
8. Default value means the values resource and status of the corresponding register during power reset or CS reset.
9. PROM8<0> is close bit. When it is programmed as High (logic 1), no any programming action can be done to PROM again.
10. PROM9<1> is addlock bit. When it is programmed as High (logic1), I2C address is {PROM9<7:2>, A0}, or I2C address is {100100,A0}

FS5908 can be connected to independent thermoregulator without via I2C interface control so that all of the registers of FS5908 will enter the default status.

14.5 Test Register (Pointer=04h, Pointer=05h, Readable and Writable)

Reg4<7:0> and Reg5<7:0> are the test register for mass production, please ignore them in general use, lest influence IC normal operation.

14.6 I^2C Address Register (Pointer=06h, Read-Only)

Pointer	Name	Type	7	6	5	4	3	2	1	0
h'06	Reg6	R	I^2C addr<6:1>						addlock	(rv)

Reg6<7:2>: I^2C Address Lines A6 ~ A1.

Reg6<1>: A6 ~ A1 can be setup via programming PROM in the chip. When A0 is 0, it is 100100; when A0 is 1, A6 ~ A1 ← PROM9<7:2>.

Reg6<7:2>: register stores I^2C address A6 ~ A1 which programmed by PROM9<7:2>, but when A0 is 0, I^2C address A6 ~ A1 is default 100100 and will not be stored in Reg6<7:2>. This should be noticed in use.

15. Digital Interface

FS5908 takes I^2C as digital data transmission interface. It has SCL and SDA two signal lines: SCL is a clock signal that is the input pin in FS5908, and SDA is two-way serial data I/O pin. For the I/O format, please refer to SMBus specification.

15.1 Address

Base on I2C interface rules, FS5908 has 7 bits address plus 1 bit read and write control signal (R/W). When R/W is 0 means writing; 1 means reading. The complete address bytes are as follow:

7	6	5	4	3	2	1	0
A6	A5	A4	A3	A2	A1	A0	R/W
A6 ~ A1 can be setup via programming PROM in the chip. When A0 is 0, it is 100100. When A0 is 1, A6 ~ A1 ← PROM9<7:2>						External Pin	Read and Write Control

15.2 Pointer

Pointer is to select the register to read and write. Its corresponding relationship with register is as follow.

Pointer	Name	Length	Status
h'00	REG0	16 bits (2 bytes)	R
h'01	REG1	8 bits (1 byte)	R/W
h'02	T_{UpLim}	16 bits (2 bytes)	R/W
h'03	T_{LowLim}	16 bits (2 bytes)	R/W
h'04	REG4	8 bits (1 byte)	R/W
h'05	REG5	8 bits (1 byte)	R
h'06	REG6	8 bits (1 byte)	R
h'f2	PROM1	8 bits (1 byte)	R/W
h'f3	PROM2	8 bits (1 byte)	R/W
h'f4	PROM3	8 bits (1 byte)	R/W
h'f5	PROM4	8 bits (1 byte)	R/W
h'f6	PROM5	8 bits (1 byte)	R/W
h'f7	PROM6	8 bits (1 byte)	R
h'f8	PROM7	8 bits (1 byte)	R
h'f9	PROM8	8 bits (1 byte)	R
h'fa	PROM9	8 bits (1 byte)	R
h'ff	IDcode	8 bits (1 byte)	R

15.3 Register Writing Process

The process to write FS5908 register via I2C includes:

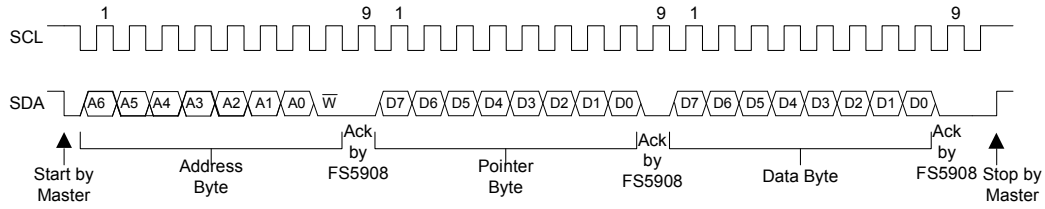
(1) Write address

(2) Write pointer

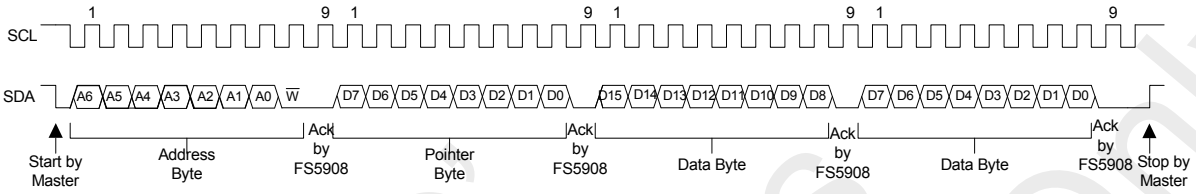
(3) Write data

The first byte of writing data is the highest byte of the record, and the first bit of every byte is the highest bit of the byte.

15.3.1 The control register with writing data length 1 byte



15.3.2 The register with writing data length 2 byte



The process to read FS5908 register via I2C includes complete reading process (3.4) and repeat reading process (3.5).

15.4 Register Complete Reading Process

15.4.1 Complete Reading Process and Repeat Reading Process. Complete reading process includes the following steps

(1) Write address

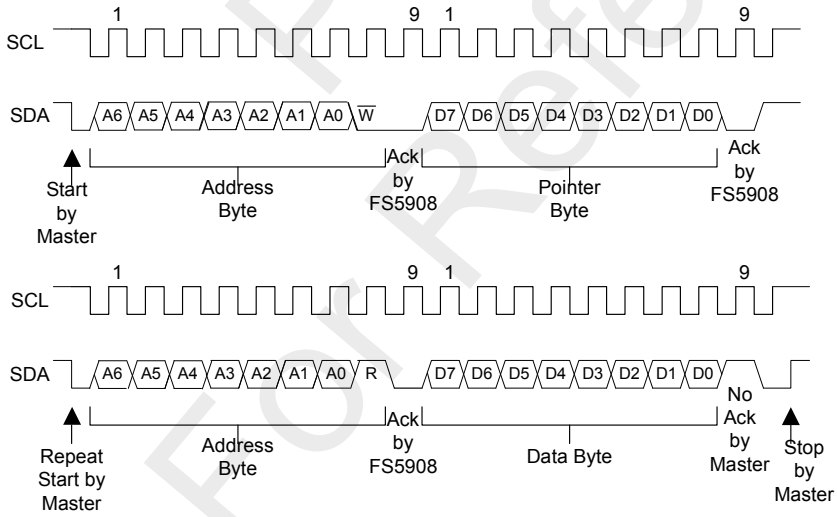
(2) Then write pointer

(3) Write address again

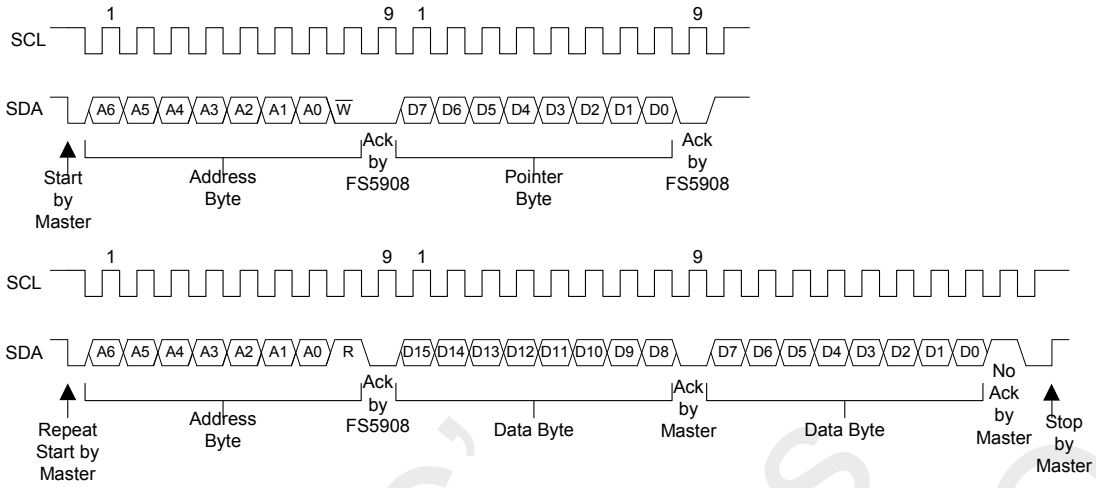
(4) Read data

The first byte of reading data is the highest byte of the record, and the first bit of every byte is the highest bit of the byte.

15.4.2 The controlled register with complete reading data length 1 byte



15.4.3 The register with complete reading data length 2 byte



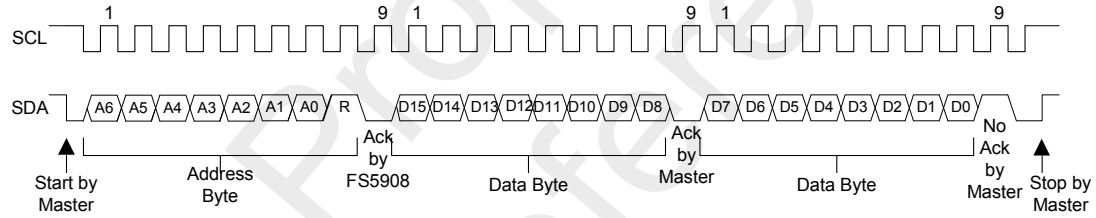
15.5 Register Repeat Reading Process

15.5.1 Repeat reading process includes the following steps

(1) Write address
(2) Read data

When read by repeat reading process, the read register is the previous register that appointed by complete reading, that is, the register that the pointer is setup.

15.5.2 The controlled register with repeat reading data length 1 byte

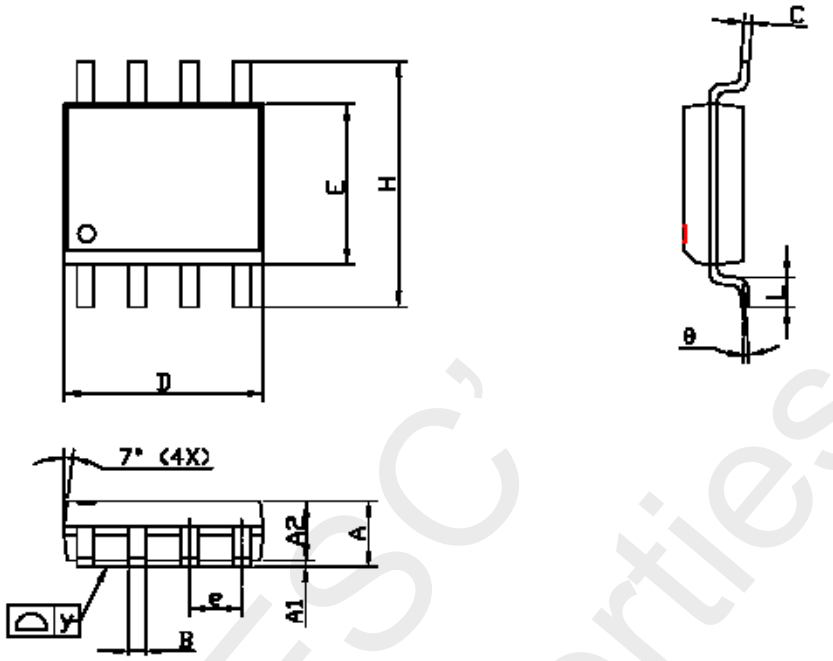


When read or write in I2C interface, if SDA signal is forced by FS5908 to logic low standard, it has to only re-execute reading or writing process to release. (This situation won't happen in normal timing. It happens only when the data length read by the user is smaller than the actual length of the register.)

After writing to the register of the chip, it should take reading confirmation to make sure the written commands not error.

16. Package Outline

16.1 SOP8



1. Note

2. Package body size exclude mold flash and gate burrs;
3. Dimension L is measure in gate plane;
4. Tolerance 0.10mm unless otherwise specified;
5. Controlling dimension is millimeter converted inch dimensions are not necessarily exact;
6. Followed from JEDEC MS-012.

Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min	Typ	Max	Min	Typ	Max
A	1.45	1.50	1.55	0.057	0.059	0.061
A1	0.10	—	0.25	0.004	—	0.010
A2	—	1.45	—	—	0.057	—
B	0.33	—	0.51	0.013	—	0.020
C	0.19	—	0.25	0.007	—	0.010
D	4.80	—	5.00	0.189	—	0.197
E	3.80	—	4.00	0.150	—	0.157
E	—	1.27	—	—	0.050	—
H	5.80	—	6.20	0.228	—	0.244
L	0.40	—	1.27	0.016	—	0.050
Y	—	—	0.10	—	—	0.004
θ	0^0	—	8^0	0^0	—	8^0

17. Revision History

Ver.	Date	Page	Description
0.1	2002/4/24	All	Initial Release (Preliminary, Chinese Version)
0.2	2002/10/29	All	Change to English Version
1.0	2004/3/25	All	Change to official 1.0 release
		1	Delete SOP8 ordering information
		4	ESD Susceptibility: Human Body Model 2000V/Machine Model: 200V
		5	Temperature Conversion Time: Typ 105 ms
		25	Add SOP8 Package Outline
1.1	2005/10/27	All	Change datasheet format
		1	Add Lead Free ordering information
		1	Revise Pin5 name from VDDPROM to NC
		2	Revise Pin5 Name and Function Description to NC/No Connect
		18~24	Delete Chap4/5 Program and Read PROM/Temperature Calibration and Production
1.2	2006/11/23	All	Change datasheet format (CIS logo)
		3	Feature: Delete MSOP package description
		3	Delete No connect under Pin Configurations
		4	Add Pin5 Function Description: When in the normal operation, it connects to ground.