NCT7904D
H/W Monitor

Date: 04/27/2010 Revision: 0.12

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1. GENERAL DESCRIPTION

NCT7904D is an evolving version of the Nuvoton popular Hardware Monitor IC family. NCT7904D provides several innovative features, SMBus 2.0 ARP compatible command, Intel PECI1.1/2.0/3.0 interface, PROCESSOR HOT. Conventionally, NCT7904D can be used to monitor several critical hardware parameters of the system, including power supply voltages, fan speeds, and temperatures, which are very important for a high-end computer system, such as server, workstation…etc, to work stably and efficiently.

A 10-bit analog-to-digital converter (ADC) is built inside NCT7904D. NCT7904D can simultaneously monitor 17 analog voltage inputs (including power 3VSB / VBAT / VTT monitoring), 12 fan tachometer inputs, 4 fan output control, 4 remote temperature sensor inputs, 2 of which support current mode (dual current source) temperature measurement method, caseopen detection, Watch Dog Timer function, and GPIO pins. The sense of remote temperature can be performed by thermistors, or directly from thermal diode. NCT7904D provides PWM (pulse width modulation) for each fan control output pin, and DC fan output mode is supported on PWM4 pin. NCT7904D provides SMART FAN™ control - **“** SMART FAN™ IV **”** mode, which equips with 6 sets of temperatures setting point each could control fan’s duty cycle, so fan could be operated at the lowest possible speed and the acoustic could be balanced. As for warning mechanism, NCT7904D provides SMI#, TEMP_ALM#, VOLT_ALM#, and FAN_ALM# to protect the system. has 1 specific pins to provide address selection so that 2 NCT7904D could be wired through I^2C interface at the same time.

Through the application software or BIOS, the users can read all the monitored parameters of the system from time to time. A pop-up warning can also be activated when the monitored item is out of the proper/preset range. The application software could be Nuvoton's application software --Health Manager, or other management application software. Besides, the users can set up the upper and lower limits (alarm thresholds) of these monitored parameters and activate corresponding maskable interrupts.

2. FEATURES

■ Monitoring Items

VOLTAGE

Up to 17 voltage sensing inputs.

- 14 general voltage inputs.
- 2 power pins. (3VDD and VTT)
- 1 power pin (VBAT)
- 4 multi-function with thermistor temperature inputs (on VSEN2, VSEN4, VSEN6, VSEN8)
- 2 multi-function with thermal diode pair. (on VSEN2, VSEN3, VSEN4 and VSEN5)

TEMPERATURE

Up to 3 temperature monitoring.

- 2 pairs thermal diode (current mode) / 4 thermistor mode temperature
- 1 on-chip temperature sensor
- Support Intel® PECI interfaces for reading CPU temperature.
- Support AMD SB-TSI interface for reading CPU temperature

PECI (PLATFORM ENVIRONMENT CONTROL INTERFACE)

- Support PECI 3.0 Specification
- Support 4 CPU sockets(ie. 4 PECI address) and 2 domains per CPU address
- Support Listen Mode to monitor the PECI activities

FAN

Up to 4 Fan Control output and Up to 8 fan tachometer input.

- 4 pure fan control output pins with PWM mode
- 12 pure fan tachometer input

SMART FAN™ CONTROL

- Support the SMART FAN™ control – "SMART FAN™ IV" mode.
- Multiple temperature sources could affect multiple fan control outputs
- Support Thermal Control for Intel Sandy Bridge-EP/EX DTS specification (Intel Doc#:433155)

CPU THERMAL EVENT (PROCHOT) MONITOR AND CPU THROTTLING CONTROL

MEMORY THERMAL EVENT MONITOR AND MEMORY THROTTLING CONTROL

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Alarm Output

- Issue SMI# signal to activate system protection.
- Issue voltage, temperature and fan alarm signals to activate system protection

Self-initialization

- Self-configuration by reading external Flash/EEPROM with SMBus interface

SMBus

- Support SMBus master function to read EEPROM configuration data and other SMBus devices
- Support SMBus bridge function to pass through PCH transaction
- **Support accessing PCH Thermal Reporting**

General

- Provide up to 20 GPIO pins (GPIO1~16, GPIOA~H, multi-function with other function pins)
- LED indication with programmable blinking frequency
- I^2C / SMBus2.0 serial bus interface (max. 400KHz Clock).
- Watch Dog Timer function with a output signal(WDT_RSTOUT#)
- 1 address selection pins provide 6 selectable SMBus addresses and pin-out combinations
- 3.3V operation.

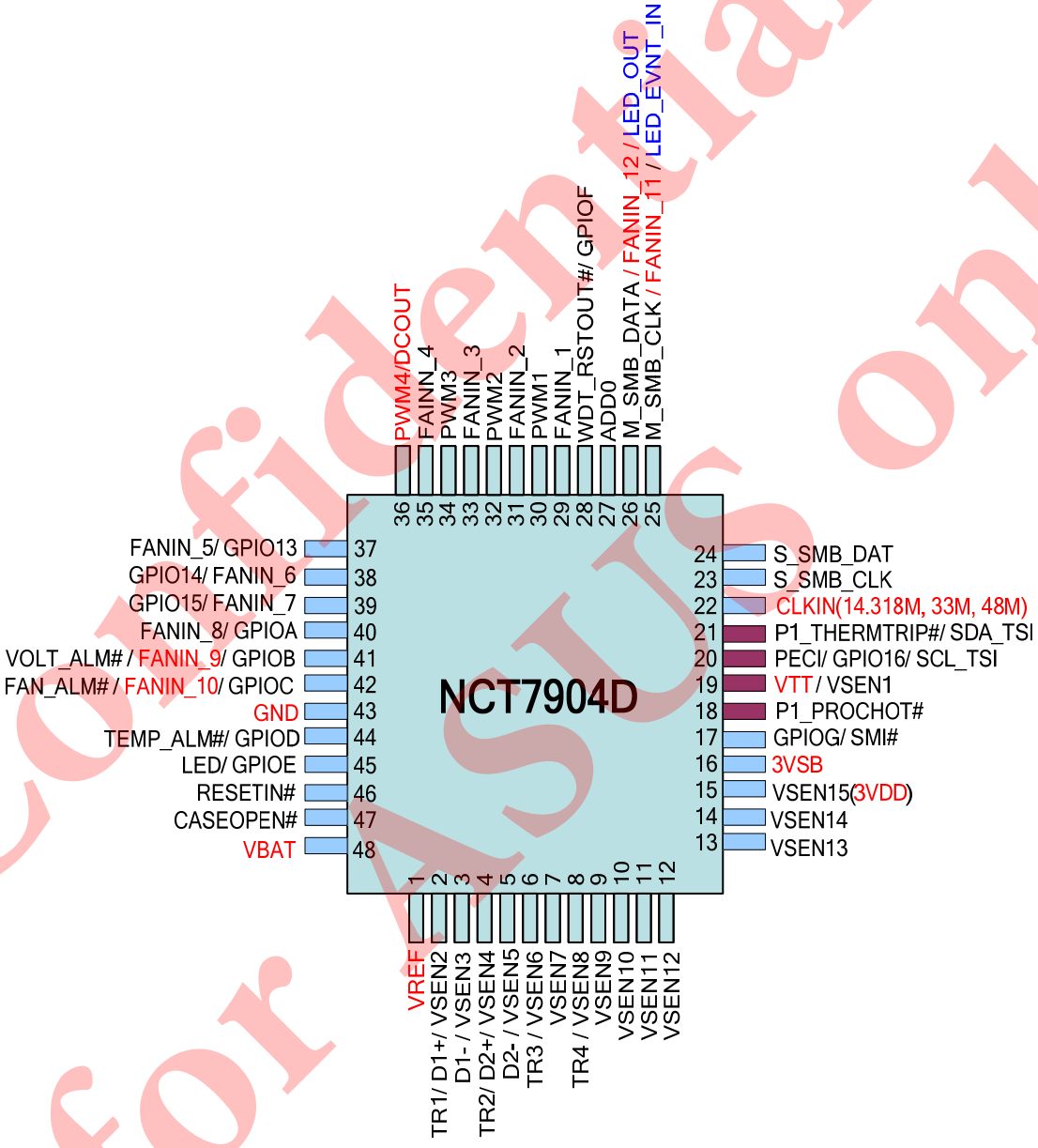
Package

- 48-LQFP Package type
- RoHS-Compliant

3. KEY SPECIFICATIONS

- Voltage monitoring accuracy ±10mV
- Temperature Sensor Accuracy
  - Remote Diode Sensor Accuracy (25~85°C) ± 1°C typ.
  - On-chip Temperature Sensor Accuracy (25~70°C) ± 1°C typ. (max +/-2°C)
  - Range -20°C ~ 100°C
  - Resolution 0.5 ℃
- Supply Voltage 3VCC 3.3V ± 5%
- Operating Supply Current 15 mA typ.

4. PIN CONFIGURATION



5. PIN DESCRIPTION

5.1 Pin Type Description

SYMBOL	DESCRIPTION
TTL	TTL level
GTL	VTT level
I	Input
O	Output (Push-pull)
OD	Open-drain output
AIN	Input pin(Analog)

1. Unless specified, all I/O(OD) pads are with 8mA drive and sink capability.

2. Unless specified, all GPIO defaults are GPI, and they could be programmed to be push-pull or open-drain.

3. TTL or GTL are specified in Type column.

5.2 NCT7904D Pin Description List

Pin Name	Pin No.	Power Plane	Type	Description
VREF	1	3VSB	AOUT	Reference voltage output. This pin is for thermistor application.
TR1	2	3VSB	AIN	Thermistor 1 sensing input
D1+				Thermal diode 1 D+.
VSEN2				Voltage sensing input. Detection range is 0~2.040V. (default)
D1-	3	3VSB	AIN	Thermal diode 1 D-
VSEN3				Voltage sensing input. Detection range is 0~2.040V.
TR2	4	3VSB	AIN	Thermistor 2 sensing input.
D2+				Thermal diode 2 D+
VSEN4				Voltage sensing input. Detection range is 0~2.040V.(default)

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Pin Name	Pin No.	Power Plane	Type	Description
D2-	5	3VSB	AIN	Thermal diode 2 D-
VSEN5				Voltage sensing input. Detection range is 0~2.040V
TR3	6	3VSB	AIN	Thermistor 3 sensing input.
VSEN6				Voltage sensing input. Detection range is 0~2.040V.
VSEN7	7	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
TR4	8	3VSB	AIN	Thermistor 4 sensing input.
VSEN8				Voltage sensing input. Detection range is 0~2.040V
VSEN9	9	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
VSEN10	10	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
VSEN11	11	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
VSEN12	12	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
VSEN13	13	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
VSEN14	14	3VSB	AIN	Voltage sensing input. Detection range is 0~2.040V
3VDD (VSEN15)	15		POWER	+3V VDD power. It is also a voltage monitor channel. Bypass with the parallel combination of 10µF (electrolytic or tantalum) and 0.1µF (ceramic) bypass capacitors.
3VSB	16	-	POWER	+3V VSB power. It is also a voltage monitor channel. Bypass with the parallel combination of 10µF (electrolytic or tantalum) and 0.1µF (ceramic) bypass capacitors.
GPIOG	17	3VSB	TTL I/O	General Purpose I/O G (default).
SMI#		3VSB	TTL OD	System Management Interrupt.

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Pin Name	Pin No.	Power Plane	Type	Description
P1_PROCHOT#	18	VTT	GTL I/O	CPU1 PROCHOT# signal
VTT (VSEN1)	19	--	POWER	VTT power pin. This power will be also monitored as VSEN1
PECI	20	VTT	GTL I/O	Intel® PECI interface signal. The power source is pin 28 (VTT)
GPIO16		3VSB	TTL I/O	General Purpose I/O 16
SCL_TSI		3VSB	TSI_O	Clock line of AMD® SB_TSI interface
P1_THERMTRIP#	21	VTT	GTL I	CPU1 THERMTRIP# signal
SDA_TSI		3VSB	TSI_I/O	Data line of AMD® SB_TSI interface
CLKIN(33M, 14.318M, 48M)	22	3VSB	TTL I	Clock input. 14.318MHz or 33MHz or 48MHz could be applied to this pin with corresponding register configuration. Default setting is for 33MHz. This clock is for PECI and fan speed monitor
S_SMB_CLK	23	3VSB	TTL OD	SMBus clock line for this device being slave device
S_SMB_DATA	24	3VSB	TTL I/O	SMBus data line for this device being slave device
M_SMB_CLK	25	3VSB	TTL OD	SMBus clock line for this device being master device
FANIN_11				Fan techometer input.
LED_EVNT_IN#			TTL I	An input event to trigger LED_OUT
M_SMB_DATA	26	3VSB	TTL I/O	SMBus data line for this device being master device
FANIN_12				Fan techometer input.
LED_OUT				When pin LED_EVNT_IN is asserted a low pulse, this pin will output a pulse to drive LED on or blinking.
ADDR	27	3VSB	TTL I	SMBus slave address strap selection pin. Strapped to low, the 7-bit address is 0101101. Strapped to high, the 7-bit address is 0101110.
WDT_RSTOUT#	28	3VSB	TTL OD	Watch dog timer reset output

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Pin Name	Pin No.	Power Plane	Type	Description
GPIOF			TTL I/O	General Purpose I/O F (default)
FANIN_1	29	3VSB	TTL I	Fan techometer input. (default)
PWM1	30	3VSB	TTL OD	Fan speed control PWM output. This is 5V tolerant.
FANIN_2	31	3VSB	TTL I	Fan techometer input. (default)
PWM2	32	3VSB	TTL OD	Fan speed control PWM output. This is 5V tolerant.
FANIN_3	33	3VSB	TTL I	Fan techometer input. (default)
PWM3	34	3VSB	TTL OD	Fan speed control PWM output. This is 5V tolerant.
FANIN_4	35	3VSB	TTL I	Fan techometer input.(default)
PWM4/DCOUT	36	3VSB	TTL OD AOUT	Fan speed control PWM or DC output. A register bit could be programmed to select PWM or DC mode. DC output is default mode.
FANIN_5	37	3VSB	TTL I	Fan techometer input.(default)
GPIO13		3VSB	TTL I/O	General Purpose I/O 13
FANIIN_6	38	3VSB	TTL I	Fan techometer input. (when pin37(ADD0) is strapped to high)
GPIO14		3VSB	TTL I/O	General Purpose I/O 14. (when pin37(ADD0) is strapped to low)
FANIN_7	39	3VSB	TTL I	Fan techometer input. (when pin37(ADD0) is strapped to high)
GPIO15		3VSB	TTL I/O	General Purpose I/O 15. (when pin37(ADD0) is strapped to low)
FANIN_8	40	3VSB	TTL I	Fan techometer input. (when pin37(ADD0) is strapped to high)
GPIOA		3VSB	TTL I/O	General Purpose I/O A (when pin37(ADD0) is strapped to low)
VOLT_ALM#	41	3VSB	TTL OD	Voltage abnormal alert output signal. (active low)
FANIN_9		3VSB	TTL I	Fan techometer input.(default)
GPIOB		3VSB	TTL I/O	General Purpose I/O B

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Pin Name	Pin No.	Power Plane	Type	Description
FAN_ALM#	42	3VSB	TTL OD	Fan speed abnormal alert output signal. (active low)
FANIN_10		3VSB	TTL I	Fan techometer input. (default)
GPIOC		3VSB	TTL I/O	General Purpose I/O C
GND	43		POWER	GROUND
TEMP_ALM#	44	3VSB	TTL OD	Temperature abnormal alert output signal. (active low)
GPIOD			TTL I/O	General Purpose I/O D (default)
LED	45	3VSB	TTL OD	Programmable frequency LED output signal
GPIOE			TTL I/O	General Purpose I/O E (default)
RESETIN#	46	3VSB	TTL I	System reset input
CASEOPEN	47	VBAT	TTL I (Schmitt Trigger required)	Case Open detection input signal. An active low input from an external device when case is opened. This event will be latched even when the case is closed.
VBAT	48		POWER	VBAT power for Case Open detection and status log.

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6. FUNCTIONAL DESCRIPTION

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7. ELECTRICAL CHARACTERISTICS

7.1 Absolute Maximum Ratings

PARAMETER	RATING	UNIT
Power Supply Voltage	-0.3 to +3.6	V
Input Voltage	-0.3 to +3.6	V
Operating Temperature	-40 to + 125	° C
Storage Temperature	-55 to +150	° C

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8. ORDER INFORMATION

PART NO.	PACKAGE	REMARKS
NCT7904D	48-pin LQFP	RoHS Package

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9. TOP MARKING SPECIFICATIONS

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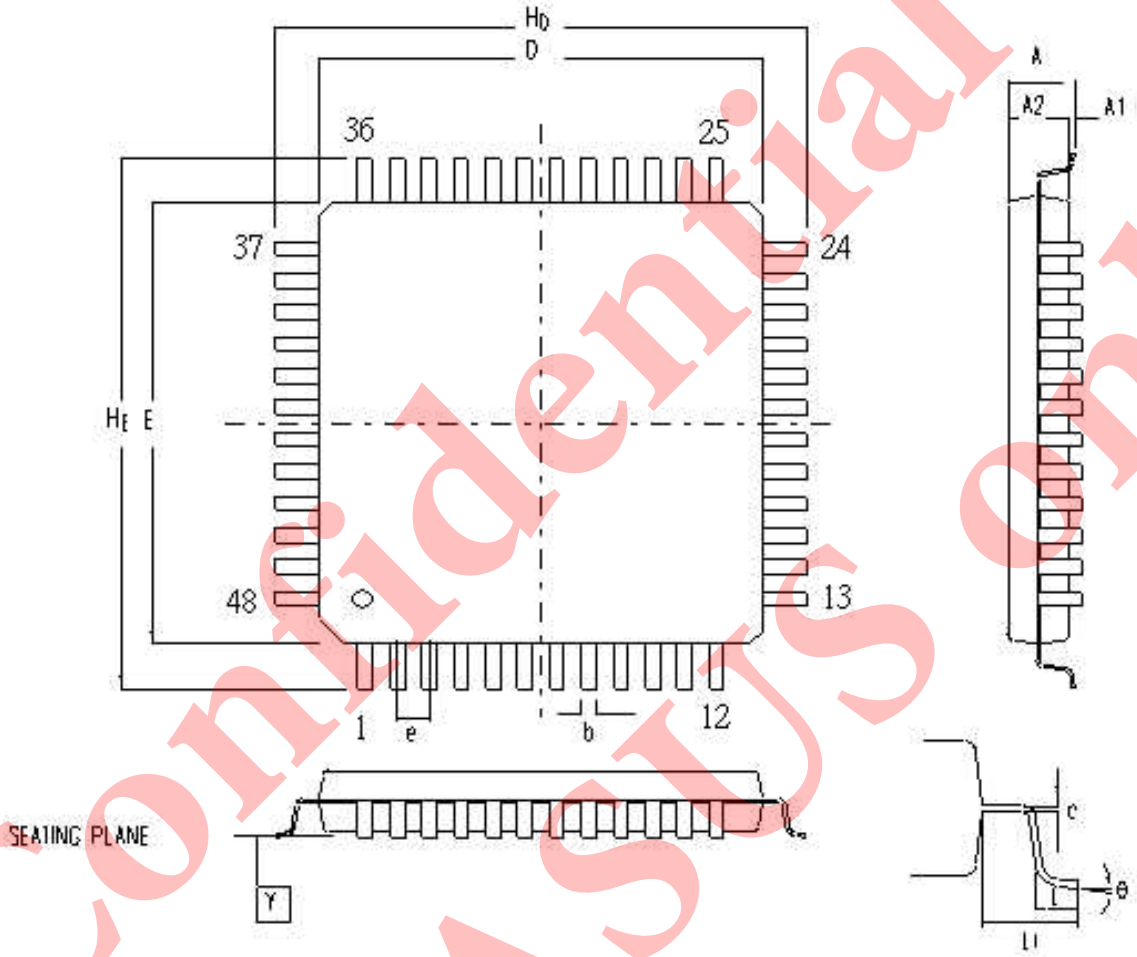
10. PACKAGE DRAWING AND DIMENSIONS

NCT7904D (48-pin LQFP 7X7X1.4mm)



Controlling dimension : Millimeters

Symbol	Dimension in inch			Dimension in mm		
	Min	Nom	Max	Min	Nom	Max
A	—	—	0.063	—	—	1.60
A1	0.002	0.004	0.006	0.05	0.10	0.15
A2	0.053	0.055	0.057	1.35	1.40	1.45
b	0.006	0.008	0.010	0.15	0.20	0.25
c	0.004	0.006	0.008	0.10	0.15	0.20
D	0.272	0.276	0.280	6.90	7.00	7.10
E	0.272	0.276	0.280	6.90	7.00	7.10
e	0.014	0.020	0.026	0.35	0.50	0.65
HD	0.350	0.354	0.358	8.90	9.00	9.10
HE	0.350	0.354	0.358	8.90	9.00	9.10
L	0.018	0.024	0.030	0.45	0.60	0.75
L1	—	0.039	—	—	1.00	—
Y	—	—	0.004	—	—	0.10
θ	0°	—	7°	0°	—	7°

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11. REVISION HISTORY

VERSION	DATE	PAGE	DESCRIPTION
0.1	N.A	N.A.	Nuvoton Internal Use
0.12	04/27/2010	N.A.	Draft for review

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Important Notice

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