Kernel driver NCT6775¶

Note

This driver supersedes the NCT6775F and NCT6776F support in the W83627EHF driver.

Supported chips:

- Nuvoton NCT6102D/NCT6104D/NCT6106D

Prefix: ‘nct6106’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from the Nuvoton web site

- Nuvoton NCT5572D/NCT6771F/NCT6772F/NCT6775F/W83677HG-I

Prefix: ‘nct6775’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT5573D/NCT5577D/NCT6776D/NCT6776F

Prefix: ‘nct6776’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT5532D/NCT6779D

Prefix: ‘nct6779’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT6791D

Prefix: ‘nct6791’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT6792D

Prefix: ‘nct6792’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT6793D

Prefix: ‘nct6793’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT6795D

Prefix: ‘nct6795’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT6796D

Prefix: ‘nct6796’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

- Nuvoton NCT6796D-S/NCT6799D-R

Prefix: ‘nct6799’

Addresses scanned: ISA address retrieved from Super I/O registers

Datasheet: Available from Nuvoton upon request

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Description

This driver implements support for the Nuvoton NCT6775F, NCT6776F, and NCT6779D and compatible super I/O chips.

The chips support up to 25 temperature monitoring sources. Up to 6 of those are direct temperature sensor inputs, the others are special sources such as PECI, PCH, and SMBUS. Depending on the chip type, 2 to 6 of the temperature sources can be monitored and compared against minimum, maximum, and critical temperatures. The driver reports up to 10 of the temperatures to the user. There are 4 to 5 fan rotation speed sensors, 8 to 15 analog voltage sensors, one VID, alarms with beep warnings (control unimplemented), and some automatic fan regulation strategies (plus manual fan control mode).

The temperature sensor sources on all chips are configurable. The configured source for each of the temperature sensors is provided in tempX_label.

Temperatures are measured in degrees Celsius and measurement resolution is either 1 degC or 0.5 degC, depending on the temperature source and configuration. An alarm is triggered when the temperature gets higher than the high limit; it stays on until the temperature falls below the hysteresis value. Alarms are only supported for temp1 to temp6, depending on the chip type.

Fan rotation speeds are reported in RPM (rotations per minute). An alarm is triggered if the rotation speed has dropped below a programmable limit. On NCT6775F, fan readings can be divided by a programmable divider (1, 2, 4, 8, 16, 32, 64 or 128) to give the readings more range or accuracy; the other chips do not have a fan speed divider. The driver sets the most suitable fan divisor itself; specifically, it increases the divider value each time a fan speed reading returns an invalid value, and it reduces it if the fan speed reading is lower than optimal. Some fans might not be present because they share pins with other functions.

Voltage sensors (also known as IN sensors) report their values in millivolts. An alarm is triggered if the voltage has crossed a programmable minimum or maximum limit.

The driver supports automatic fan control mode known as Thermal Cruise. In this mode, the chip attempts to keep the measured temperature in a predefined temperature range. If the temperature goes out of range, fan is driven slower/faster to reach the predefined range again.

The mode works for fan1-fan5.

sysfs attributes

pwm[1-7]

- this file stores PWM duty cycle or DC value (fan speed) in range:

  0 (lowest speed) to 255 (full)

pwm[1-7]_enable

- this file controls mode of fan/temperature control:
  - 0 Fan control disabled (fans set to maximum speed)
  - 1 Manual mode, write to pwm[0-5] any value 0-255
  - 2 “Thermal Cruise” mode
  - 3 “Fan Speed Cruise” mode
  - 4 “Smart Fan III” mode (NCT6775F only)
  - 5 “Smart Fan IV” mode

pwm[1-7]_mode

- controls if output is PWM or DC level
  - 0 DC output
  - 1 PWM output

Common fan control attributes

pwm[1-7]_temp_sel

Temperature source. Value is temperature sensor index. For example, select ‘1’ for temp1_input.

pwm[1-7]_weight_temp_sel

Secondary temperature source. Value is temperature sensor index. For example, select ‘1’ for temp1_input. Set to 0 to disable secondary temperature control.

If secondary temperature functionality is enabled, it is controlled with the following attributes.

pwm[1-7]_weight_duty_step

Duty step size.

pwm[1-7]_weight_temp_step

Temperature step size. With each step over temp_step_base, the value of weight_duty_step is added to the current pwm value.

pwm[1-7]_weight_temp_step_base

Temperature at which secondary temperature control kicks in.

pwm[1-7]_weight_temp_step_tol

Temperature step tolerance.

Thermal Cruise mode (2)

If the temperature is in the range defined by:

pwm[1-7]_target_temp

Target temperature, unit millidegree Celsius (range 0 - 127000)

pwm[1-7]_temp_tolerance

Target temperature tolerance, unit millidegree Celsius

There are no changes to fan speed. Once the temperature leaves the interval, fan speed increases (if temperature is higher that desired) or decreases (if temperature is lower than desired), using the following limits and time intervals.

pwm[1-7]_start

fan pwm start value (range 1 - 255), to start fan when the temperature is above defined range.

pwm[1-7]_floor

lowest fan pwm (range 0 - 255) if temperature is below the defined range. If set to 0, the fan is expected to stop if the temperature is below the defined range.

pwm[1-7]_step_up_time

milliseconds before fan speed is increased

pwm[1-7]_step_down_time

milliseconds before fan speed is decreased

pwm[1-7]_stop_time

how many milliseconds must elapse to switch corresponding fan off (when the temperature was below defined range).

Speed Cruise mode (3)

This modes tries to keep the fan speed constant.

fan[1-7]_target

Target fan speed

fan[1-7]_tolerance

Target speed tolerance

Untested; use at your own risk.

Smart Fan IV mode (5)

This mode offers multiple slopes to control the fan speed. The slopes can be controlled by setting the pwm and temperature attributes. When the temperature rises, the chip will calculate the DC/PWM output based on the current slope. There are up to seven data points depending on the chip type. Subsequent data points should be set to higher temperatures and higher pwm values to achieve higher fan speeds with increasing temperature. The last data point reflects critical temperature mode, in which the fans should run at full speed.

pwm[1-7]_auto_point[1-7]_pwm

pwm value to be set if temperature reaches matching temperature range.

pwm[1-7]_auto_point[1-7]_temp

Temperature over which the matching pwm is enabled.

pwm[1-7]_temp_tolerance

Temperature tolerance, unit millidegree Celsius

pwm[1-7]_crit_temp_tolerance

Temperature tolerance for critical temperature, unit millidegree Celsius

pwm[1-7]_step_up_time

milliseconds before fan speed is increased

pwm[1-7]_step_down_time

milliseconds before fan speed is decreased

Usage Notes

On various ASUS boards with NCT6776F, it appears that CPUTIN is not really connected to anything and floats, or that it is connected to some non-standard temperature measurement device. As a result, the temperature reported on CPUTIN will not reflect a usable value. It often reports

unreasonably high temperatures, and in some cases the reported temperature declines if the actual temperature increases (similar to the raw PECI temperature value - see PECI specification for details). CPUTIN should therefore be ignored on ASUS boards. The CPU temperature on ASUS boards is reported from PECI 0 or TSI 0.

NCT6796D-S and NCT6799D-R chips are very similar and their chip_id indicates they are different versions. This driver treats them the same way.