Kernel driver bt1-pvt

Supported chips:

- Baikal-T1 PVT sensor (in SoC)

  Prefix: 'bt1-pvt'

  Addresses scanned: -

  Datasheet: Provided by BAIKAL ELECTRONICS upon request and under NDA

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Description

This driver implements support for the hardware monitoring capabilities of the embedded into Baikal-T1 process, voltage and temperature sensors. PVT IP-core consists of one temperature and four voltage sensors, which can be used to monitor the chip internal environment like heating, supply voltage and transistors performance. The driver can optionally provide the hwmon alarms for each sensor the PVT controller supports. The alarms functionality is made compile-time configurable due to the hardware interface implementation peculiarity, which is connected with an ability to convert data from only one sensor at a time. Additional limitation is that the controller performs the thresholds checking synchronously with the data conversion procedure. Due to these in order to have the hwmon alarms automatically detected the driver code must switch from one sensor to another, read converted data and manually check the threshold status bits. Depending on the measurements timeout settings (update_interval sysfs node value) this design may cause additional burden on the system performance. So in case if alarms are unnecessary in your system design it's recommended to have them disabled to prevent the PVT IRQs being periodically raised to get the data cache/alarms status up to date. By default in alarm-less configuration the data conversion is performed by the driver on demand when read operation is requested via corresponding _input-file.

Temperature Monitoring

Temperature is measured with 10-bit resolution and reported in millidegree Celsius. The driver performs all the scaling by itself therefore reports true temperatures that don't need any user-space adjustments. While the data translation formulae isn't linear, which gives us non-linear discreteness, it's close to one, but giving a bit better accuracy for higher temperatures. The temperature input is mapped as follows (the last column indicates the input ranges):

```
temp1: CPU embedded diode       -48.38C - +147.438C
```

In case if the alarms kernel config is enabled in the driver the temperature input has associated min and max limits which trigger an alarm when crossed.

Voltage Monitoring

The voltage inputs are also sampled with 10-bit resolution and reported in millivolts. But in this case the data translation formulae is linear, which provides a constant measurements discreteness. The data scaling is also performed by the driver, so returning true millivolts. The voltage inputs are mapped as follows (the last column indicates the input ranges):

```
in0: VDD                (processor core)                0.62V - 1.168V
in1: Low-Vt             (low voltage threshold)         0.62V - 1.168V
in2: High-Vt            (high voltage threshold)        0.62V - 1.168V
in3: Standard-Vt        (standard voltage threshold)    0.62V - 1.168V
```

In case if the alarms config is enabled in the driver the voltage inputs have associated min and max limits which trigger an alarm when crossed.

Sysfs Attributes

Following is a list of all sysfs attributes that the driver provides, their permissions and a short description:

Name	Perm	Description
update_interval	RW	Measurements update interval per sensor.
temp1_type	RO	Sensor type (always 1 as CPU embedded diode).
temp1_label	RO	CPU Core Temperature sensor.
temp1_input	RO	Measured temperature in millidegree Celsius.
temp1_min	RW	Low limit for temp input.
temp1_max	RW	High limit for temp input.

Name	Perm	Description
temp1_min_alarm	RO	Temperature input alarm. Returns 1 if temperature input went below min limit, 0 otherwise.
temp1_max_alarm	RO	Temperature input alarm. Returns 1 if temperature input went above max limit, 0 otherwise.
temp1_offset	RW	Temperature offset in millidegree Celsius which is added to the temperature reading by the chip. It can be used to manually adjust the temperature measurements within 7.130 degrees Celsius.
in[0-3]_label	RO	CPU Voltage sensor (either core or low/high/standard thresholds).
in[0-3]_input	RO	Measured voltage in millivolts.
in[0-3]_min	RW	Low limit for voltage input.
in[0-3]_max	RW	High limit for voltage input.
in[0-3]_min_alarm	RO	Voltage input alarm. Returns 1 if voltage input went below min limit, 0 otherwise.
in[0-3]_max_alarm	RO	Voltage input alarm. Returns 1 if voltage input went above max limit, 0 otherwise.