



## PMIC hardware components



# PMIC hardware components

Stable: 11.06.2020 - 12:48 / Revision: 11.06.2020 - 12:24

Template:ArticleMainWriter Template:ArticleApprovedVersion

## Contents

1 Article purpose .....	2
2 Software frameworks .....	2
3 STPMIC1 .....	3
<b>3.1 Description .....</b>	<b>3</b>
<b>3.2 Support in Linux Kernel .....</b>	<b>3</b>
3.2.1 Core driver .....	3
3.2.2 Regulator driver .....	4
3.2.3 Watchdog driver .....	4
3.2.4 Input driver .....	4
3.2.5 Kernel Configuration .....	5
<b>3.3 Support in U-BOOT .....</b>	<b>5</b>
<b>3.4 Support in Cortex-A7 Secure .....</b>	<b>5</b>
3.4.1 TF-A .....	5
3.4.2 OP-TEE .....	6

## 1 Article purpose

The purpose of this article is to:

- list the PMIC hardware components that might be integrated in the different boards
- link these components to the corresponding software framework(s)
- point to the datasheet(s) of these components
- explain, when necessary, how to configure these components.

## 2 Software frameworks

Do	Peri	Software frameworks	Comment
mai Cor tex -A7	Cor tex -A7 no		



Do	Peri	Software frameworks			Comment
Main Secure (OP-TEE)	n-secure (Linux)	Cortex-M4  (STM32Cube)			
		OP-TEE overview	Regulator overview Watchdog overview		
PMIC	STPMIC1				

## 3 STPMIC1

### 3.1 Description

The STPMIC1 is a device that handles the power supplies for some STM32MP boards. The STPMIC1 main features are:

- configuration via I<sup>2</sup>C bus,
- 10 regulators of different kinds with over-current protection,
- 3 power switches for USB supplies,
- a power-on key input,
- a watchdog,
- a thermal protection,
- a NORMAL mode and an ALTERNATE mode that is used for system suspend.

The user manual is available here: NOT YET AVAILABLE

### 3.2 Support in Linux Kernel

The STPMIC1 driver is used to handle STPMIC1 Power Management Integrated Circuit (PMIC). The driver is composed of several parts:

- The core driver
- The regulator driver
- The watchdog driver
- The input driver

The thermal feature is not supported.

#### 3.2.1 Core driver

The core implements the Multi-Function Devices Framework API.

- It is probed by the I<sup>2</sup>C framework.
- It handles communication with the PMIC via I<sup>2</sup>C.



## PMIC hardware components

- It probes the others STPMIC1 drivers (input, watchdog...).
- It acts as an interrupt controller for the other drivers.

Source code:

```
include/linux/mfd/stpmic1.h  
drivers/mfd/stpmic1.c
```

Bindings are described in:

```
Documentation/devicetree/bindings/mfd/stpmic1.txt
```

### 3.2.2 Regulator driver

The driver implements the [Regulator framework API](#)

- Each BUCK, LDO or POWER SWITCH inside the STPMIC1 device is presented as a voltage regulator.
- Power switches are presented as fixed voltage sources. Voltage can not be set.
- The driver does not handle the suspend configuration. This is done by the Secure Monitor.

Source code:

```
drivers/regulator/stpmic1_regulator.c
```

Bindings are described in:

```
Documentation/devicetree/bindings/regulator/stpmic1-regulator.txt
```

### 3.2.3 Watchdog driver

The driver implements the [Watchdog framework API](#)

When enabled, a watchdog device is available for the user-land. As soon as a user has started to write in the watchdog it is armed in the PMIC. When the watchdog timer expires, the PMIC shuts down.

Source code:

```
drivers/watchdog/stpmic1_wdt.c
```

Bindings are described in:

```
Documentation/devicetree/bindings/watchdog/stpmic1-wdt.txt
```

### 3.2.4 Input driver

The driver implements the [Input framework API](#).

The driver exposes a single key (KEY\_POWER) that can be used as any standard input device in /dev/input/eventX

Source code:



```
drivers/input/misc/stpmic1_onkey.c
```

Bindings are described in:

```
Documentation/devicetree/bindings/input/stpmic1-onkey.txt
```

### 3.2.5 Kernel Configuration

With kernel menuconfig, enable following configurations:

- core part: MFD\_STPMIC1
- regulator: REGULATOR\_STPMIC1
- watchdog: STPMIC1\_WATCHDOG
- input: INPUT\_STPMIC1\_ONKEY

## 3.3 Support in U-BOOT

STPMIC1 is used by U-Boot to:

- Control regulators used by other drivers (mmc-supply for SDCard for example, usb vbus)
- Trace pmic startup reason

STPMIC1 is supported with existing uclass of the 'Driver Model' described in [doc/driver-model/pmic-framework.txt](#).

- pmic :
  - uclass: [drivers/power/regulator/regulator-uclass.c](#) , CONFIG\_DM\_PMIC
  - driver: [drivers/power/pmic/stpmic1.c](#) , CONFIG\_PMIC\_STPMIC1
- regulator:
  - uclass: [drivers/power/pmic/pmic-uclass.c](#) , CONFIG\_DM\_REGULATOR
  - driver: [drivers/power/regulator/stpmic1.c](#) , CONFIG\_DM\_REGULATOR\_STPMIC1
- sysreset:
  - uclass: [drivers/sysreset/sysreset-uclass.c](#) , CONFIG\_SYSRESET
  - code in pmic driver

The STPMIC1 is available with the existing commands:

- pmic (CONFIG\_CMD\_PMIC)
- regulator (CONFIG\_CMD\_REGULATOR)
- poweroff (CONFIG\_CMD\_POWEROFF)

STPMIC1 driver supports configuration via device-tree; the bindings, same as kernel, are described in:

```
doc/device-tree-bindings/mfd/stpmic1.txt
```

## 3.4 Support in Cortex-A7 Secure

### 3.4.1 TF-A

STPMIC1 is used by TF-A firmware to:

- Configure DDR power supplies.
- Configure the regulators for system suspend and system shutdown.



Driver source code:

```
include/drivers/st/stpmic1.h  
drivers/st/pmic/stpmic1.c
```

SPTMIC1 driver supports configuration via device-tree, bindings are described in:

```
docs/fdts/stm32mp/st, stpmic1.txt
```

### 3.4.2 OP-TEE

STPMIC1 is used by OP-TEE OS to configure the regulators for system suspend and system shutdown.

Driver source code:

```
core/include/drivers/stpmic1.h  
core/drivers/stpmic1.c
```

Power Management Integrated Circuit

Open Portable Trusted Execution Environment

Application programming interface

Low-dropout regulator

Multifunction device

Trusted Firmware for Arm Cortex-A

Doubledata rate (memory domain)

Operating System