

S726

Battery Curve Configuration Guide

Issue 1.0



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Notice

This document provides guide for users to use S726.

This document is intended for system engineers (SEs), development engineers, and test engineers.

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Support@neoway.com

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About This Document

Scope

This document is applicable to the S726 series.




Audience

This document is intended for [system engineers \(SEs\)](#), [development engineers](#), and [test engineers](#).

Change History

Issue	Change	Changed By
1.0	Initial draft	Jian Hou

Conventions

Symbol	Indication
	Indicates danger or warning. This information must be followed. Otherwise, a catastrophic module or user device failure or bodily injury may occur.
	Indicates caution. This symbol alerts the user to important points about using the module. If these points are not followed, the module or user device may fail.
	Indicates instructions or tips. This symbol provides advices or suggestions that may be useful when using the module.

1 Overview

The battery is an important power supply component in the smart module. Its charge control and power display during discharge rely on the charge-discharge curve of the battery.

This document takes the battery model JBT-D009 added to the S726 project as an example to describe how to add a custom battery curve file to the Linux kernel in Android.

2 Device Tree Configuration

The configuration of the charging chip and fuel gauge is available in [S726 uis8581e5h10](#). The **charger-manager** driver is an intermediate driver for battery metering and charging, and has functions such as battery parameter acquisition, charging parameter acquisition, and communication with the user layer.

```
charger-manager {
    compatible = "charger-manager";
    cm-name = "battery";
    cm-poll-mode = <2>;
    cm-poll-interval = <15000>;
    cm-battery-stat = <2>;

    cm-fullbatt-vchkdirp-ms = <30000>;
    cm-fullbatt-vchkdirp-volt = <60000>;
    cm-fullbatt-voltage = <4300000>;
    cm-fullbatt-current = <120000>;
    cm-fullbatt-capacity = <100>;

    cm-num-chargers = <1>;
    cm-chargers = "sc2721_charger";
    cm-fuel-gauge = "sc27xx-fgu";

    /* in deci centigrade */
    cm-battery-cold = <200>;
    cm-battery-cold-in-minus;
    cm-battery-hot = <800>;
    cm-battery-temp-diff = <100>;
    .....
};
```

Wherein,

cm-chargers = "sc2721_charger" is the configuration of the charging chip, for example, sc2721_charger in this example.

cm-fuel-gauge = "sc27xx-fgu" is the configuration of the fuel gauge, for example, sc27xx-fgu in this example.

The corresponding name configuration is located in the corresponding charger chip. Search for the keyword **sc27xx_fgu_desc**:

```
2:
3: static const struct power_supply_desc sc27xx_fgu_desc = {
4:     .name           = "sc27xx-fgu",
5:     .type           = POWER_SUPPLY_TYPE_UNKNOWN,
6:     .properties     = sc27xx_fgu_props,
7:     .num_properties = ARRAY_SIZE(sc27xx_fgu_props),
8:     .get_property   = sc27xx_fgu_get_property,
9:     .set_property   = sc27xx_fgu_set_property,
0:     .external_power_changed = sc27xx_fgu_external_power_changed,
1:     .property_is_writeable = sc27xx_fgu_property_is_writeable,
2: };
3:
```

Both measurement of the fuel gauge and charging rely on the configuration of the battery parameters. The configurations of the fuel gauge and the charged battery in the S726 are both **monitored-battery = <&bat>**, and modification is not recommended.

```
&pmic_fgu {
    monitored-battery = <&bat>;
    sprd,calib-resistance-real = <20000>;
    sprd,calib-resistance-spec = <20000>;
};

&pmic_charger {
    status = "okay";
    phys = <&hsphy>;
    monitored-battery = <&bat>;
};
```

This document mainly describes the battery configuration.

3 Battery Curve Configuration Method

Before configuring the battery parameters, obtain a set of battery curves and battery specification from the battery manufacturer. The following takes **A.11.002.008.004 JBT-D009 Battery Specification Version B.pdf** as an example.

3.1 Basic Parameters of Battery Pack

The battery specification generally provides basic parameters of the battery pack, including the nominal capacity, charge cut-off voltage, maximum charge current, and operating temperature. The following figure shows the basic parameters of JBT-D009:

Figure 3-1 S726 Battery Related Configuration

2. Battery Pack Specification 电池组参数

NO	Items	Criteria	Remarks
2.1	Nominal Capacity 标称容量	5500mAh	0.2C discharge 0.2C 放电 cut-off voltage 3.0V 截止电压 3.0V
	Minimum Capacity 最小容量	5500mAh	
2.2	Nominal Voltage 标称电压	3.80V	
2.3	Shipment voltage 出货电压	≥3.75V	Within 10 days from Factory 在出厂 10 天内
2.4	Internal Impedance 内阻	≤180mΩ	
2.5	Charge cut-off voltage 充电截止电压	4.35V	
2.6	Standard charging Method 标准充电方式	0.2C CC to 4.35V, CV to 0.02C	
2.7	Max. Charge Current 最大充电电流	4A	@15-45℃
		0.2C	@0-15℃
2.8	Standard discharge Method 标准放电方式	0.2C CC to 3.0V	
2.9	Max. discharge current 最大放电电流	4.0A	@10~60℃
		0.2C	@-20~10℃
2.10	Discharge cut-off voltage 放电截止电压	3.0V	
2.11	Operating Temperature 工作温度	0~+45℃	Charging 充电
		-20~+60℃	Discharging 放电
2.12	Storage Temperature 贮存温度 (30%SOC)	-20℃~+50℃	Less than 1 month 小于一个月 Recovery

```
bat: battery {
  compatible = "simple-battery";
  charge-full-design-microamp-hours = <2780000>;
  charge-term-current-microamp = <120000>;
  constant_charge_voltage_max_microvolt = <4350000>;
  factory-internal-resistance-micro-ohms = <320000>;
  voltage-min-design-microvolt = <3450000>;
```



```

ocv-capacity-celsius = <20>;
ocv-capacity-table-0 = <4330000 100>, <4249000 95>, <4189000 90>,
    <4133000 85>, <4081000 80>, <4034000 75>,
    <3991000 70>, <3953000 65>, <3910000 60>,
    <3866000 55>, <3836000 50>, <3813000 45>,
    <3795000 40>, <3782000 35>, <3774000 30>,
    <3765000 25>, <3750000 20>, <3726000 15>,
    <3687000 10>, <3658000 5>, <3400000 0>;
voltage-temp-table = <1095000 800>, <986000 850>, <878000 900>,
    <775000 950>, <678000 1000>, <590000 1050>,
    <510000 1100>, <440000 1150>, <378000 1200>,
    <324000 1250>, <278000 1300>, <238000 1350>,
    <204000 1400>, <175000 1450>, <150000 1500>,
    <129000 1550>, <111000 1600>, <96000 1650>;
charge-sdp-current-microamp = <500000 500000>;
charge-dcp-current-microamp = <1150000 3000000>;
charge-cdp-current-microamp = <1150000 1150000>;
charge-unknown-current-microamp = <500000 500000>;
};

```

Parameters are described as follows:

- **charge-full-design-microamp-hours**: Nominal capacity in μAH
- **charge-term-current-microamp**: Cut-off current in μa (can be configured based on the actual situation)
- **constant_charge_voltage_max_microvolt**: Maximum voltage
- **factory-internal-resistance-micro-ohms**: Battery internal resistance
- **voltage-min-design-microvolt**: minimum voltage. Modification of this parameter is not recommended.
- **charge-sdp-current-microamp**: charging current when the charging type is SDP. Its value shown in the preceding figure is 500 mA.
- **charge-dcp-current-microamp**: charging current when the charging type is DCP. Its value shown in the preceding figure is 1150 mA - 3000 mA.
- **charge-cdp-current-microamp**: charging current when the charging type is CDP. Its value shown in the preceding figure is 1150 mA.
- **charge-unknown-current-microamp**: charging current when the charging type is unknown. Its value shown in the preceding figure is 500 mA.

3.2 Configuring the Battery Charging Curve

Before configuration, collect four groups of basic battery data corresponding to the temperature 0°C , -10°C , 25°C , and 50°C from the battery factory.

- **ocv-capacity-celsius** and **ocv-capacity-table-0** are the configuration files of the battery charging curve.

- **ocv-capacity-celsius** is the configuration of 20 sets of parameters that the driver requires. Modification of these parameters is not recommended.
- **ocv-capacity-table-0** is the battery curve configuration. The parameters include the battery voltage and battery power. For example, <3953000 65> indicates that the battery power is 65% when the battery voltage is 3.95 V. In the configuration, there are 20 levels in total. In the S726, these parameters can be configured based on the battery curve table provided by the battery manufacturer, and the corresponding temperature is 25°C.

```
ocv-capacity-table-0 = <4330000 100>, <4249000 95>, <4189000 90>,  
                        <4133000 85>, <4081000 80>, <4034000 75>,  
                        <3991000 70>, <3953000 65>, <3910000 60>,  
                        <3866000 55>, <3836000 50>, <3813000 45>,  
                        <3795000 40>, <3782000 35>, <3774000 30>,  
                        <3765000 25>, <3750000 20>, <3726000 15>,  
                        <3687000 10>, <3658000 5>, <3400000 0>;
```

- **voltage-temp-table** is a temperature-voltage comparison table, which is used to read the battery temperature changes according to the NTC. It does not need to be modified on the battery curve.