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RK817_RK809_Codec 开发指南

(技术部，第二系统产品部)

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1 概述

RK817/RK809 内置 codec 是高性能音频编解码器:

High performance Audio CODEC

- One internal PLL
- Support microphone input
- Support I2S as the digital signal interface for both DAC and ADC
- Support Automatic Level Control(ALC),limiter and noise gating
- Support programmable digital and analog gains
- Audio resolution from 16bits to 32bits
- Sample rate up to 192KHz
- Provides master and slave work mode, software configurable
- Support 3 I2S formats (normal, left-justified, right-justified)
- Support PDM mode(external input PCLK)

实地输出的耳机驱动输出

不需要外部滤波电感的 1.3W class-D 音频功放

2 代码路径

```
sound/soc/codecs/rk817_codec.c
```

```
sound/soc/codecs/rk817_codec.h
```

3 dts 配置

3.1 dts 解析

Documentation/devicetree/bindings/sound/rockchip,rk817-codec.txt

这个文件里的内容会介绍 rk817-codec 的 dts 各 property 的定义, 请认真看。

- compatible: "rockchip,rk817-codec"

- clocks: a list of phandle + clock-specifier pairs, one for each entry in

clock-names.

- clock-names: should be "mclk".

- spk-ctl-gpios: spk mute enable/disable

用于外置功放使能脚，如果产品上有使用外置功放，请配置对应的使能脚

- hp-ctl-gpios: hp mute enable/disable

- spk-mute-delay-ms: spk mute delay time

- hp-mute-delay-ms: hp mute delay time

- spk-volume: DAC L/R volume digital setting for Speaker

配置喇叭输出音量，0 最大，255 最小

- hp-volume: DAC L/R volume digital setting for Headphone

配置耳机输出音量，0 最大，255 最小

*

* DDAC L/R volume setting

* 0db~-95db,0.375db/step,for example:

* 0: 0dB

* 10: -3.75dB

* 125: -46dB

* 255: -95dB

*

* DADC L/R volume setting

* 0db~-95db,0.375db/step,for example:

* 0: 0dB

* 10: -3.75dB

* 125: -46dB

* 255: -95dB

*

- mic-in-differential:

Boolean. Indicate MIC input is differential, rather than single-ended.

指定使用差分 MIC，否则为单端 MIC，所以使用差分 MIC 时加上此 property。

- pdmdata-out-enable:

Boolean. Indicate pdmdata output is enabled or disabled.

录音数据使用 PDM 数字接口输出，如果使用 I2S 请不要配置此项。

- use-ext-amplifier:

Boolean. Indicate use external amplifier or not. 指定是否使用外部功放。

- adc-for-loopback:

Boolean. Indicate adc use for loopback or not.

指定 ADC 用于回采，一般音箱类产品使用。

3.2 rk817-codec 参考

arch/arm64/boot/dts/rockchip/rk3326-863-lp3-v10.dts

声卡的 dai_link 使用 simple-card framework，其 dts 配置：

```
rk817-sound {
    compatible = "simple-audio-card";
    simple-audio-card,format = "i2s";
    simple-audio-card,name = "rockchip,rk817-codec";
    simple-audio-card,mclk-fs = <256>;
    simple-audio-card,widgets =
        "Microphone", "Mic Jack",
        "Headphone", "Headphone Jack";
    simple-audio-card,routing =
        "Mic Jack", "MICBIAS1",
        "IN1P", "Mic Jack",
        "Headphone Jack", "HPOL",
        "Headphone Jack", "HPOR";
    simple-audio-card,cpu {
        sound-dai = <&i2s1_2ch>;
    };
    simple-audio-card,codec {
        sound-dai = <&rk817_codec>;
    };
};
```

声卡的 cpu_dai 部分，如使用的是 i2s1，则将其 okay:

```
&i2s1_2ch {
    status = "okay";
    #sound-dai-cells = <0>;
};
```

声卡的 codec_dai 部分即 codec driver，使用内置 class-D 音频功放，其 dts 配置：

```
rk817_codec: rk817-codec {
    #sound-dai-cells = <0>;
    compatible = "rockchip,rk817-codec";
    clocks = <&cru SCLK_I2S1_OUT>;
    clock-names = "mclk";
    pinctrl-names = "default";
    pinctrl-0 = <&i2s1_2ch_mclk>;
    spk-volume = <3>;
    hp-volume = <3>;
    mic-in-differential;
    status = "okay";
};
```

3.3 rk809-codec 参考

arch/arm64/boot/dts/rockchip/px30-evb-ddr3-v10.dts

声卡的 dai_link 使用 simple-card framework，其 dts 配置：

```
rk809-sound {
    compatible = "simple-audio-card";
    simple-audio-card,format = "i2s";
    simple-audio-card,name = "rockchip,rk809-codec";
    simple-audio-card,mclk-fs = <256>;
    simple-audio-card,widgets =
        "Microphone", "Mic Jack",
        "Headphone", "Headphone Jack";
    simple-audio-card,routing =
        "Mic Jack", "MICBIAS1",
        "IN1P", "Mic Jack",
        "Headphone Jack", "HPOL",
        "Headphone Jack", "HPOR";
    simple-audio-card,cpu {
        sound-dai = <&i2s1_2ch>;
    };
    simple-audio-card,codec {
        sound-dai = <&rk809_codec>;
    };
};
```

声卡的 cpu_dai 部分，如使用的是 i2s1，则将其 okay:

```
&i2s1_2ch {
    status = "okay";
    #sound-dai-cells = <0>;
};
```

声卡的 codec_dai 部分即 codec driver，其 dts 配置：

```
rk809_codec: codec {
    #sound-dai-cells = <0>;
    compatible = "rockchip,rk809-codec", "rockchip,rk817-codec";
    clocks = <&cru SCLK_I2S1_OUT>;
    clock-names = "mclk";
    pinctrl-names = "default";
    pinctrl-0 = <&i2s1_2ch_mclk>;
    hp-volume = <20>;
    spk-volume = <3>;
    status = "okay";
};
```

3.4 音箱类等多 MIC 产品，如使用了外部功放、PDM 输入、回采，参考

arch/arm64/boot/dts/rockchip/rk3326-evb-ai-va-v11.dts

声卡的 dai_link 使用 simple-card framework，其 dts 配置：

```
rk809-sound {
    compatible = "simple-audio-card";
    simple-audio-card,name = "rockchip,rk809-codec";
    simple-audio-card,mclk-fs = <256>;
    simple-audio-card,widgets =
        "Microphone", "Mic Jack",
        "Headphone", "Headphone Jack";
    simple-audio-card,routing =
        "Mic Jack", "MICBIAS1",
        "IN1P", "Mic Jack",
        "Headphone Jack", "HPOL",
        "Headphone Jack", "HPOR";
    simple-audio-card,dai-link@0 {
        format = "i2s";
        cpu {
            sound-dai = <&i2s1_2ch>;
        };
        codec {
            sound-dai = <&rk809_codec 0>;
        };
    };
    simple-audio-card,dai-link@1 {
        format = "pdm";
        cpu {
            sound-dai = <&pdm>;
        };
        codec {
            sound-dai = <&rk809_codec 1>;
        };
    };
};
```

声卡的 cpu_dai 部分，如使用的是 i2s1 用于播放，则将其 okay:

```
&i2s1_2ch {
    status = "okay";
    #sound-dai-cells = <0>;
    pinctrl-0 = <&i2s1_2ch_sclk
        &i2s1_2ch_lrck
        &i2s1_2ch_sdo>;
};
```

录音使用 PDM 接口，将其 okay:

```
&pdm {
    status = "okay";
    #sound-dai-cells = <0>;
    pinctrl-names = "default";
    pinctrl-0 = <&pdm_clk0m1
        &pdm_clk1
        &pdm_sdi0m1
        &pdm_sdi1
        &pdm_sdi2
        &pdm_sdi3>;
};
```

声卡的 codec_dai 部分即 codec driver，其 dts 配置：


```
rk809_codec: codec {
    #sound-dai-cells = <1>;
    compatible = "rockchip,rk809-codec", "rockchip,rk817-codec";
    clocks = <&cru SCLK_I2S1_OUT>;
    clock-names = "mclk";
    pinctrl-names = "default";
    pinctrl-0 = <&i2s1_2ch_mclk>;
    pdmdata-out-enable;
    use-ext-amplifier;
    adc-for-loopback;
    spk-ctl-gpios = <&gpio3 RK_PB2 GPIO_ACTIVE_HIGH>;
    hp-volume = <20>;
    spk-volume = <20>;
};
```

4 调试 log 开关

```
cd /sys/module/snd_soc_rk817/parameters/
```

```
echo 1 > dbg_level
```

或者将对应驱动 sound/soc/codecs/rk817_codec.c 中调试变量初始化为 1:

```
static int dbg_enable = 1;
```

5 查看 codec 寄存器

```
rk3326_evb:/ # cd /d/regmap/0-0020-rk817-codec/
```

```
rk3326_evb:/d/regmap/0-0020-rk817-codec # cat registers
```

6 声卡调试通过命令行播放录制调试声卡

6.1 tinymix 配置通路:

```
rk3326_evb:/ # tinymix
```

```
Mixer name: 'rockchip,rk809-codec'
```

```
Number of controls: 2
```

ctl	type	num	name	value
0	ENUM	1	Playback Path	OFF
1	ENUM	1	Capture MIC Path	MIC OFF

```
rk3326_evb:/ # tinymix 0 2 //打开 SPK 通路
```

```
rk3326_evb:/ # tinymix 1 1 //打开 Main MIC 通路
```

```
rk3326_evb:/ # tinymix
```

```
Mixer name: 'rockchip,rk809-codec'
```

```
Number of controls: 2
```

ctl	type	num	name	value
-----	------	-----	------	-------

0	ENUM	1	Playback Path	SPK
1	ENUM	1	Capture MIC Path	Main Mic

6.2 tinypplay 放音

```
rk3326_evb:/ # tinypplay
Usage: tinypplay file.wav [-D card] [-d device] [-p period_size] [-n n_periods]
rk3326_evb:/ # tinypplay /sdcard/test.wav -D 0 -d 0 -p 1024 -n 3
Playing sample: 2 ch, 44100 hz, 32 bit
```

6.3 tinycap 录音:

```
rk3326_evb:/ # tinycap
Usage: tinycap file.wav [-D card] [-d device] [-c channels] [-r rate] [-b bits] [-p
period_size] [-n n_periods] [-T capture time]
1|rk3326_evb:/ # tinycap /sdcard/rec.wav -D 0 -d 0 -c 2 -r 16000 -b 16 -p 1024
-n 3
```

7 常见问题分析

7.1 播放无声音

(1) 通过如下命令确认声卡是否注册成功:

```
rk3326_evb:/ # cat /proc/asound/cards
0 [rockchiprk809co]: rockchip_rk809- - rockchip,rk809-codec
rockchip,rk809-codec
```

(2) 查对应声卡是否在running状态

```
rk3326_evb:/ # cat /proc/asound/card0/pcm0p/sub0/status
```

(3) 示波器量测MCLK、BCLK、LRCK、SDO是否正常。

(4) 如果有外置功放, 请检查dts 中codec节点是否正确配置了use-ext-amplifier、spk-ctl-gpios; 如无外置功放, 直接使用codec的classD输出, 请不要配置use-ext-amplifier。

7.2 录音无声音

(1) 通过如下命令确认声卡是否注册成功:

```
rk3326_evb:/ # cat /proc/asound/cards
0 [rockchiprk809co]: rockchip_rk809- - rockchip,rk809-codec
rockchip,rk809-codec
```

(2) 平板录音在声卡0 device 0 , 查对应声卡是否在running状态:

```
rk3326_evb:/ # cat /proc/asound/card0/pcm0c/sub0/status
```

音箱类产品如用pdm接口, 录音在声卡0 device 1 , 查对应声卡是否在running状态:

```
rk3326_evb:/ # cat /proc/asound/card0/pcm1c/sub0/status
```

(3) I2S输出的，示波器量测I2S的MCLK、BCLK、LRCK、SDI是否正常；PDM输出的，量测PDM的PDM_CLK、PDM_SDI0是否正常。

(4) 检查codec的 dts节点内 pdmdata-out-enable属性，录音数据通过PDM数字接口输出时需要加上，如果使用I2S输出时请不要配置此项。

7.3 录音声音太小

(1) 单 MIC 产品系统录音机录音声音太小，external/tinyalsa 目录下可以加补丁：0001-add-channel_fixed-when-channels-2.patch。（注意：多 mic 产品不能加该补丁）

(2) 调整 sound/soc/codecs/rk817_codec.c 中如下代码 RK817_CODEC_DMIC_PGA_GAIN 值

```
static struct rk817_reg_val_t capture_power_up_list[] = {
    {RK817_CODEC_AREF_RT_CFG1, 0x40},
    {RK817_CODEC_DADC_SR_ACL0, 0x02},
    /* {RK817_CODEC_DTOP_DIGEN_CLKE, 0xff}, */
    {RK817_CODEC_APLL_CFG0, 0x04},
    {RK817_CODEC_APLL_CFG1, 0x58},
    {RK817_CODEC_APLL_CFG2, 0x2d},
    {RK817_CODEC_APLL_CFG4, 0xa5},
    {RK817_CODEC_APLL_CFG5, 0x00},

    /* {RK817_CODEC_DI2S_RXCMD_TSD, 0x00}, */
    {RK817_CODEC_DI2S_RSD, 0x00},
    /* {RK817_CODEC_DI2S_CKM, 0x00}, */
    {RK817_CODEC_DI2S_RXCR1, 0x00},
    {RK817_CODEC_DI2S_RXCMD_TSD, 0x20},
    {RK817_CODEC_DTOP_VUETIME, 0xf4},

    {RK817_CODEC_DDAC_MUTE_MIXCTL, 0x00},
    {RK817_CODEC_AADC_CFG0, 0x00},
    {RK817_CODEC_AMIC_CFG0, 0x0a},
    {RK817_CODEC_AMIC_CFG1, 0x30},
    {RK817_CODEC_DI2S_TXCR3_TXCMD, 0x88},
    {RK817_CODEC_DDAC_POPD_DACST, 0x02},
    /* 0x29: -18db to 27db */
    {RK817_CODEC_DMIC_PGA_GAIN, 0xaa},
};
```

CODEC_DMIC_PGA_GAIN

Address: Operational Base + offset (0x0029)

Bit	Attr	Reset Value	Description
7:4	RW	0x6	PGA_L_GAIN Change the gain of PGA block, the value changed from -18dB to 27dB. 0000:-18db; 1111:27db, 3db/step
3:0	RW	0x6	PGA_R_GAIN Change the gain of PGA block, the value changed from -18dB to 27dB. 0000: -18db; 1111:27db, 3db/step

7.4 喇叭放音声音太小

(1) 检查 codec 的 dts 节点内 spk-volume = <20>;属性，配置喇叭输出音量，0 最大，255 最小，但要注意不要超过喇叭的额定功率，以免批量时出现烧喇叭的情况。

(2) 如果有外置功放，请检查dts 中codec节点是否正确配置了use-ext-amplifier、spk-ctl-gpios；如无外置功放，直接使用codec的classD输出，请不要配置use-ext-amplifier。

7.5 MICP\MICN 单端输入立体声双 MIC 配置

- (1) kernel 对应的 dts 中 codec 节点不要配置 mic-in-differential 和 adc-for-loopback
- (2) 如下文件，kernel/sound/soc/codecs/rk817_codec.c 屏蔽红色框起部分

```
case MAIN_MIC:
    if (pre_path == MIC_OFF)
        rk817_codec_power_up(codec, RK817_CODEC_CAPTURE);

    if (rk817->adc_for_loopback) {
        /* don't need to gain when adc use for loopback */
        snd_soc_update_bits(codec, RK817_CODEC_AMIC_CFG0, 0xf, 0x0);
        snd_soc_write(codec, RK817_CODEC_DMIC_PGA_GAIN, 0x66);
        snd_soc_write(codec, RK817_CODEC_DADC_VOLL, 0x00);
        snd_soc_write(codec, RK817_CODEC_DADC_VOLR, 0x00);
        break;
    }
    /*if (!rk817->mic_in_differential) {
        snd_soc_write(codec, RK817_CODEC_DADC_VOLR, 0xff);
        snd_soc_update_bits(codec, RK817_CODEC_AADC_CFG0,
            ADC_R_PWD_MASK, ADC_R_PWD_EN);
        snd_soc_update_bits(codec, RK817_CODEC_AMIC_CFG0,
            PWD_PGA_R_MASK, PWD_PGA_R_EN);
    }*/
    break;
```

- (3) 如下文件，屏蔽#define SPEEX_DENOISE_ENABLE

```
hardware/rockchip/audio/tinyalsa_hal$ git diff ./
diff --git a/tinyalsa_hal/audio_hw.h b/tinyalsa_hal/audio_hw.h
index a46d3fa..f02e0a6 100755
--- a/tinyalsa_hal/audio_hw.h
+++ b/tinyalsa_hal/audio_hw.h
@ -106,7 +106,7 @ int PCM_BT = 3;
#define MAX_SUPPORTED_CHANNEL_MASKS 2 #ifndef RK3368
-#define SPEEX_DENOISE_ENABLE
+// #define SPEEX_DENOISE_ENABLE
#endif
```

7.6 MICP\MICN 差分输入单声道配置

dts 中 codec 节点需要配置 mic-in-differential;

7.7 使用外部功放和内部功放的配置方法

产品中RK817/RK809的HPL_OUT/HPR_OUT接外部功放，请检查dts 中codec节点是否正确配置了use-ext-amplifier、spk-ctl-gpios；参考如下：

use-ext-amplifier;

spk-ctl-gpios = <&gpio3 RK_PB2 GPIO_ACTIVE_HIGH>;

```
rk809_codec: codec {
    #sound-dai-cells = <1>;
    compatible = "rockchip,rk809-codec", "rockchip,rk817-codec";
    clocks = <&cru SCLK_I2S1_OUT>;
    clock-names = "mclk";
    pinctrl-names = "default";
    pinctrl-0 = <&i2s1_2ch_mclk>;
    pdmdata-out-enable;
    use-ext-amplifier;
    adc-for-loopback;
    spk-ctl-gpios = <&gpio3 RK_PB2 GPIO_ACTIVE_HIGH>;
    hp-volume = <20>;
    spk-volume = <20>;
};
```

如无外置功放，直接使用RK817/RK809的classD内部功放输出，请不要配置
use-ext-amplifier。