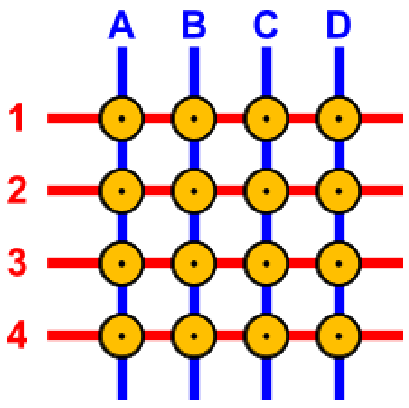
MTK keypad流程

keypad基本原理

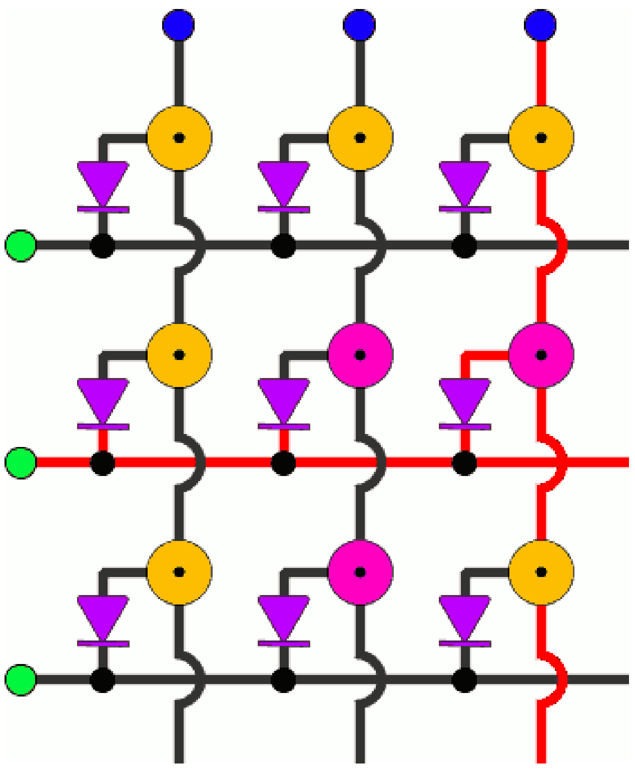


- col作为输出，row作为输入检测，低电平有效
- col A~D轮流输出低电平，通过rol 1~4上的低电平可以检测是哪个按键按下了

存在的问题：

A1，A2，B1同时按下，会造成B2按下的假象，称为鬼影（这3个键导通，colB打开，row2处也会检测到低电平）

解决办法：

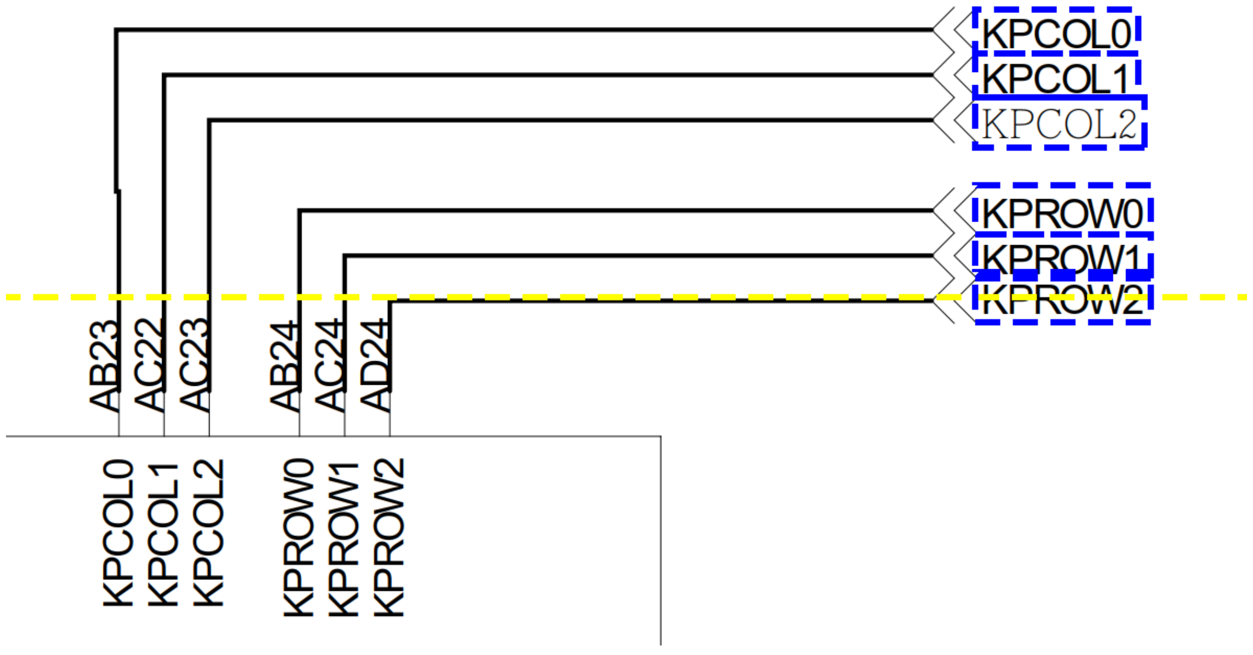


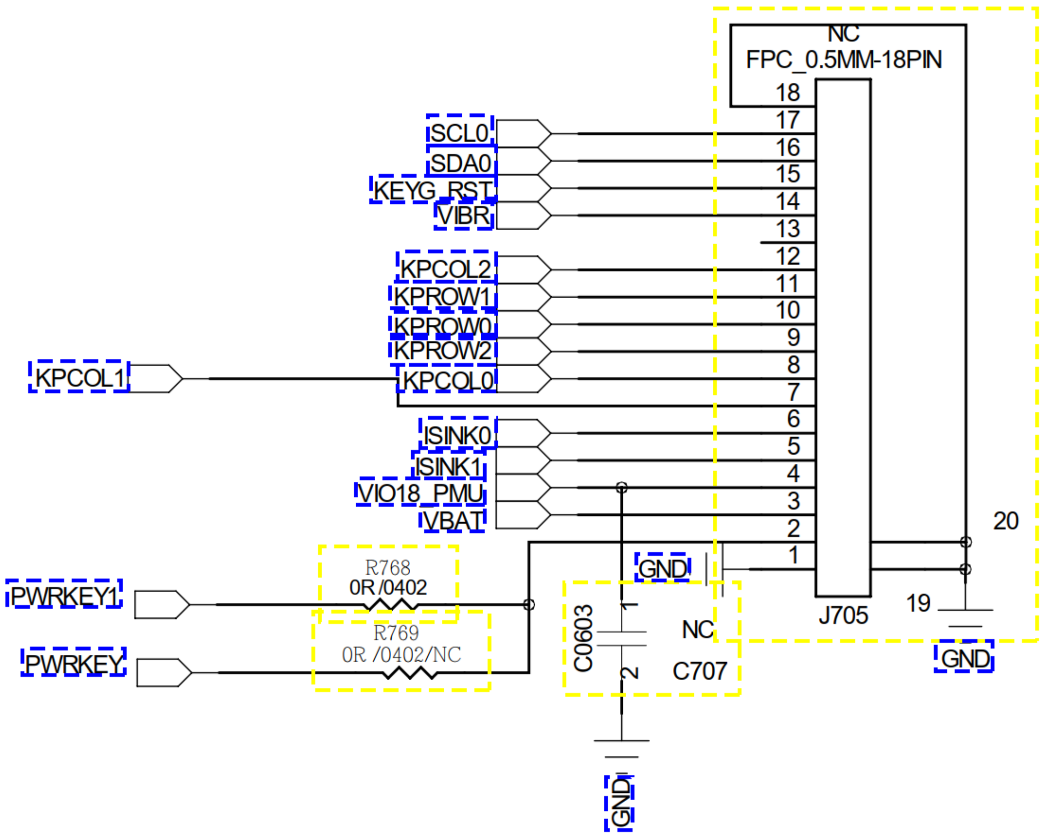
可以通过增加二极管的方式防止鬼影问题

keypad IO口的配置

- dws中GPIO设置，mtk将ROW作为输出，COL作为输入检测，preloader的keypad.c文件中对keypad进行了设置

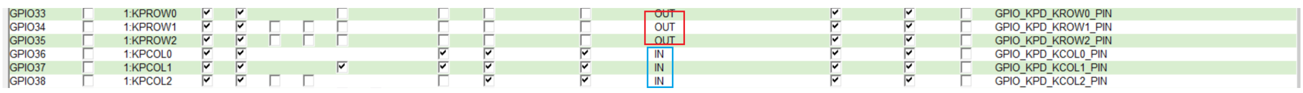
- CPU的三行三列io口,以及按键这边的接口。



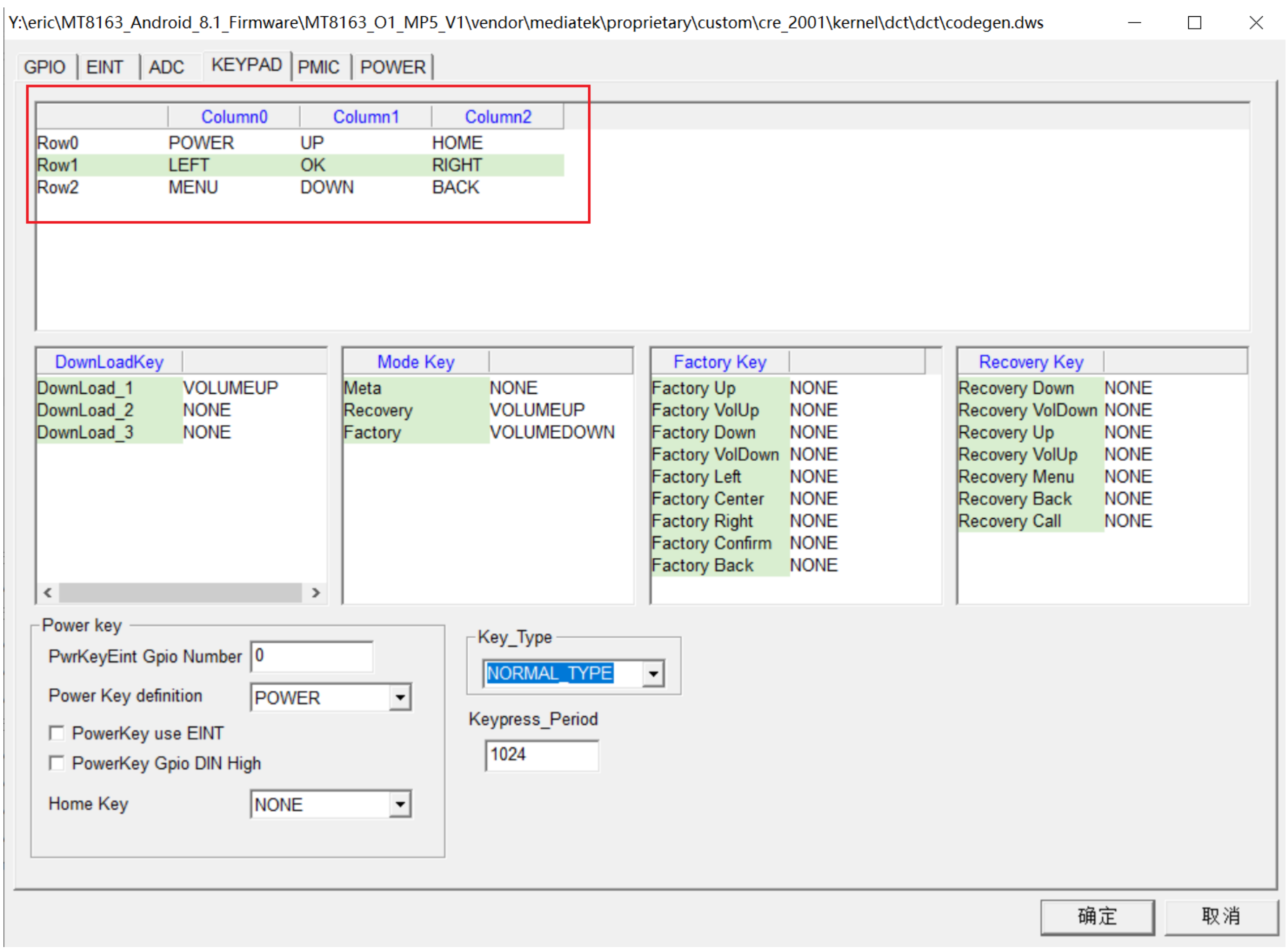


- dws中IO的配置要求,以及keypad按键功能的配置，按键里面的功能是在Keypad_YuSu.cmp中定义的。

```
KCOL  : input + pull enable + pull up
KROW  : output + pull disable + pulldown
```



GPIO33	☐	1:KPROW0	✓	✓			☐	☐	☐	☐	OUT	✓	✓	☐	GPIO_KPD_KROW0_PIN
GPIO34	☐	1:KPROW1	✓	✓	☐	☐	☐	☐	☐	☐	OUT	✓	✓	☐	GPIO_KPD_KROW1_PIN
GPIO35	☐	1:KPROW2	✓	✓	☐	☐	☐	☐	☐	☐	OUT	✓	✓	☐	GPIO_KPD_KROW2_PIN
GPIO36	☐	1:KPCOL0	✓	✓				✓	✓	✓	IN	✓	✓	☐	GPIO_KPD_KCOL0_PIN
GPIO37	☐	1:KPCOL1	✓	✓			✓	✓	✓	✓	IN	✓	✓	☐	GPIO_KPD_KCOL1_PIN
GPIO38	☐	1:KPCOL2	✓	✓	☐	☐		☐	✓	✓	IN	✓	✓	☐	GPIO_KPD_KCOL2_PIN



Y:\eric\MT8163_Android_8.1_Firmware\MT8163_O1_MP5_V1\vendor\mediatek\proprietary\custom\cre_2001\kernel\dct\dct\codegen.dws

	Column0	Column1	Column2
Row0	POWER	UP	HOME
Row1	LEFT	OK	RIGHT
Row2	MENU	DOWN	BACK

DownLoadKey	
DownLoad_1	VOLUMEUP
DownLoad_2	NONE
DownLoad_3	NONE

Mode Key	
Meta	NONE
Recovery	VOLUMEUP
Factory	VOLUMEDOWN

Factory Key	
Factory Up	NONE
Factory VolUp	NONE
Factory Down	NONE
Factory VolDown	NONE
Factory Left	NONE
Factory Center	NONE
Factory Right	NONE
Factory Confirm	NONE
Factory Back	NONE

Recovery Key	
Recovery Down	NONE
Recovery VolDown	NONE
Recovery Up	NONE
Recovery VolUp	NONE
Recovery Menu	NONE
Recovery Back	NONE
Recovery Call	NONE

Power key

PwrKeyEint Gpio Number: 0

Power Key definition: POWER

☐ PowerKey use EINT

☐ PowerKey Gpio DIN High

Home Key: NONE

Key_Type: NORMAL_TYPE

Keypress_Period: 1024

- keypad.c中对按键进行的初始化

```
for(i = 0; i < 3; i++)
  {
    if (COL_REG[i] != 0)
    {
      /* KCOL: GPIO INPUT + PULL ENABLE + PULL UP */
      mt_set_gpio_mode(COL_REG[i], ((GPIO_MODE[i] >> 4) & 0x0f));
      mt_set_gpio_dir(COL_REG[i], 0);
      mt_set_gpio_pull_enable(COL_REG[i], 1);
      mt_set_gpio_pull_select(COL_REG[i], 1);
    }

    if (ROW_REG[i] != 0)
    {
      /* KROW: GPIO output + pull disable + pull down */
      mt_set_gpio_mode(ROW_REG[i], (GPIO_MODE[i] & 0x0f));
      mt_set_gpio_dir(ROW_REG[i], 1);
      mt_set_gpio_pull_enable(ROW_REG[i], 0);
      mt_set_gpio_pull_select(ROW_REG[i], 0);
    }
  }
```

keypad代码分析

- dts的配置分析

```
&keypad {
  mediatek,kpd-key-debounce = <1024>;
  mediatek,kpd-sw-pwrkey = <116>;//电源键
  mediatek,kpd-hw-pwrkey = <8>;
  mediatek,kpd-sw-rstkey  = <114>;
  mediatek,kpd-hw-rstkey = <17>;
  mediatek,kpd-use-extend-type = <0>;
  /*HW Keycode [0~71] -> Linux Keycode*/
  mediatek,kpd-hw-map-num = <72>;
  /*按键的映射 从第0位开始，对应不同的功能，可以从kpd_keymap_handler中读取hw keycode,sw的配置则
可以查看mtk-kpd.kl*/
  mediatek,kpd-hw-init-map = <139 105 102 0 0 0 0 0 0 108 28 103 0 0 0 0 0 0 158 106 0 0 0
0
      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 >;
  mediatek,kpd-pwrkey-eint-gpio = <0>;
  mediatek,kpd-pwkey-gpio-din  = <0>;
  mediatek,kpd-hw-dl-key0 = <0>;
  mediatek,kpd-hw-dl-key1 = <17>;
  mediatek,kpd-hw-dl-key2 = <8>;
  mediatek,kpd-hw-recovery-key = <17>;
  mediatek,kpd-hw-factory-key  = <0>;
};
```

- 在kpd.c中按键的初始化probe()

```
static int kpd_pdrv_probe(struct platform_device *pdev)
{

    int i, r;
    int err = 0;
    struct clk *kpd_clk = NULL;
//获取clk，这里kpd-clk是通过ccf设置的
    kpd_clk = devm_clk_get(&pdev->dev, "kpd-clk");
    if (!IS_ERR(kpd_clk)) {
        int ret_prepare, ret_enable;

        ret_prepare = clk_prepare(kpd_clk);
        if (ret_prepare)
            kpd_print("clk_prepare returned %d\n", ret_prepare);
        ret_enable = clk_enable(kpd_clk);
        if (ret_enable)
            kpd_print("clk_enable returned %d\n", ret_prepare);
    } else {
        kpd_print("get kpd-clk fail, but not return, maybe kpd-clk is set by ccf.\n");
    }
//reg重映射
    kp_base = of_iomap(pdev->dev.of_node, 0);
    if (!kp_base) {
        kpd_info("KP iomap failed\n");
        return -ENODEV;
    };
//irq映射
    kp_irqnr = irq_of_parse_and_map(pdev->dev.of_node, 0);
    if (!kp_irqnr) {
        kpd_info("KP get irqnr failed\n");
        return -ENODEV;
    }
```

```
//申请input设备
    kpd_input_dev = input_allocate_device();
    if (!kpd_input_dev) {
        kpd_print("input allocate device fail.\n");
        return -ENOMEM;
    }
//input设备初始化
    kpd_input_dev->name = KPD_NAME;
    kpd_input_dev->id.bustype = BUS_HOST;
    kpd_input_dev->id.vendor = 0x2454;
    kpd_input_dev->id.product = 0x6500;
    kpd_input_dev->id.version = 0x0010;
    kpd_input_dev->open = kpd_open;
//解析dts中keypad节点的信息，赋值给kpd_dts_data结构体
    kpd_get_dts_info(pdev->dev.of_node);
//分配内存空间，用于存放键值和按键状态寄存器
    kpd_memory_setting();
//input设备支持EV_KEY事件
    __set_bit(EV_KEY, kpd_input_dev->evbit);
//powerkey连接PMIC，kpd_keymap[8]设置为空
#if defined(CONFIG_KPD_PWRKEY_USE_EINT) || defined(CONFIG_KPD_PWRKEY_USE_PMIC)
    __set_bit(kpd_dts_data.kpd_sw_pwrkey, kpd_input_dev->keybit);
    kpd_keymap[8] = 0;
#endif
    //powerkey列除[8]外，其余都清空
    if (!kpd_dts_data.kpd_use_extend_type) {
        for (i = 17; i < KPD_NUM_KEYS; i += 9)
        /* only [8] works for Power key */
            kpd_keymap[i] = 0;
    }
    //设置设备支持的键值
    for (i = 0; i < KPD_NUM_KEYS; i++) {
        if (kpd_keymap[i] != 0)
            __set_bit(kpd_keymap[i], kpd_input_dev->keybit);
    }
    //reset按键
    if (kpd_dts_data.kpd_sw_rstkey)
        __set_bit(kpd_dts_data.kpd_sw_rstkey, kpd_input_dev->keybit);

    kpd_input_dev->dev.parent = &pdev->dev;//注册input设备
    r = input_register_device(kpd_input_dev);
    if (r) {
        kpd_info("register input device failed (%d)\n", r);
        input_free_device(kpd_input_dev);
        return r;
    }

    /* register device (/dev/mt6575-kpd) */
    kpd_dev.parent = &pdev->dev;
    r = misc_register(&kpd_dev);
    if (r) {
        kpd_info("register device failed (%d)\n", r);
        input_unregister_device(kpd_input_dev);
        return r;
    }
    //初始化wake_lock
    wake_lock_init(&kpd_suspend_lock, WAKE_LOCK_SUSPEND, "kpd wakelock");

    //设置按键消抖并申请中断处理
    kpd_set_debounce(kpd_dts_data.kpd_key_debounce);
    r = request_irq(kp_irqnr, kpd_irq_handler, IRQF_TRIGGER_NONE, KPD_NAME, NULL);
    if (r) {
        kpd_info("register IRQ failed (%d)\n", r);
        misc_deregister(&kpd_dev);
        input_unregister_device(kpd_input_dev);
        return r;
    }

#ifndef KPD_EARLY_PORTING
 /*add for avoid early porting build err the macro is defined in custom file */
    long_press_reboot_function_setting();
    /* /API 4 for kpd long press reboot function setting */
#endif
    hrtimer_init(&aee_timer, CLOCK_MONOTONIC, HRTIMER_MODE_REL);
    aee_timer.function = aee_timer_func;
    //添加文件属性
    err = kpd_create_attr(&kpd_pdrv.driver);
    if (err) {
        kpd_info("create attr file fail\n");
        kpd_delete_attr(&kpd_pdrv.driver);
        return err;
    }
    kpd_info("%s Done\n", __func__);
    return 0;
}
```

- 中断按键的代码

```
static irqreturn_t kpd_irq_handler(int irq, void *dev_id)
{
    //禁止中断，无需进行同步，防止死锁
    disable_irq_nosync(kp_irqnr);
    //调度tasklet
    tasklet_schedule(&kpd_keymap_tasklet);
    return IRQ_HANDLED;
}
//定义tasklet，执行kpd_keymap_handler函数
static DECLARE_TASKLET(kpd_keymap_tasklet, kpd_keymap_handler, 0);

static void kpd_keymap_handler(unsigned long data)
{
    int i, j;
    bool pressed;
    u16 new_state[KPD_NUM_MEMS], change, mask;
    u16 hw_keycode, linux_keycode;
//mtk通过5组寄存器来保存按键的状态，这里回读寄存器并保存为new_state
    kpd_get_keymap_state(new_state);
//激活锁唤醒系统，500ms后就释放掉
    wake_lock_timeout(&kpd_suspend_lock, HZ / 2);

    for (i = 0; i < KPD_NUM_MEMS; i++) {
      //每组中按键状态未改变则对比下一组，按位处理
        change = new_state[i] ^ kpd_keymap_state[i];
        if (!change)
            continue;

        for (j = 0; j < 16; j++) {
          //每组（16位）中对比按位查看是否状态发生改变
            mask = 1U << j;
            if (!(change & mask))
                continue;

            hw_keycode = (i << 4) + j;
            /* bit is 1: not pressed, 0: pressed */
            //按键是否按下，寄存器中0表示按键处于按下状态
            pressed = !(new_state[i] & mask);
            if (kpd_show_hw_keycode)
                kpd_print("(%s) HW keycode = %u\n", pressed ? "pressed" : "released",
hw_keycode);
            BUG_ON(hw_keycode >= KPD_NUM_KEYS);
            linux_keycode = kpd_keymap[hw_keycode];
            if (unlikely(linux_keycode == 0)) {
                kpd_print("Linux keycode = 0\n");
                continue;
            }
            kpd_aee_handler(linux_keycode, pressed);
            //上报键值
            input_report_key(kpd_input_dev, linux_keycode, pressed);
            input_sync(kpd_input_dev);
            kpd_print("report Linux keycode = %u\n", linux_keycode);
        }
    }
    //kpd_keymap_state保存new_state，用于下轮对比
    memcpy(kpd_keymap_state, new_state, sizeof(new_state));
    kpd_print("save new keymap state\n");//按键处理完毕，打开中断
    enable_irq(kp_irqnr);
}
```