

Porting OV5645 to Android4.2.2

2015-08-15

The document will introduce all steps for poring ov5645 camera module to freescale android4.2.2 BSP, it includes these contents:

- Environment
- Hardware Design Based on ov5645 module
- BSP configuration for audio
- ov5645 dirver for linux 3.0.35
- Android HAL

1. Environment

*Software Platform:

Kernel : Linux 3.0.35

Android: jb4.2.2

*Hardware Platform

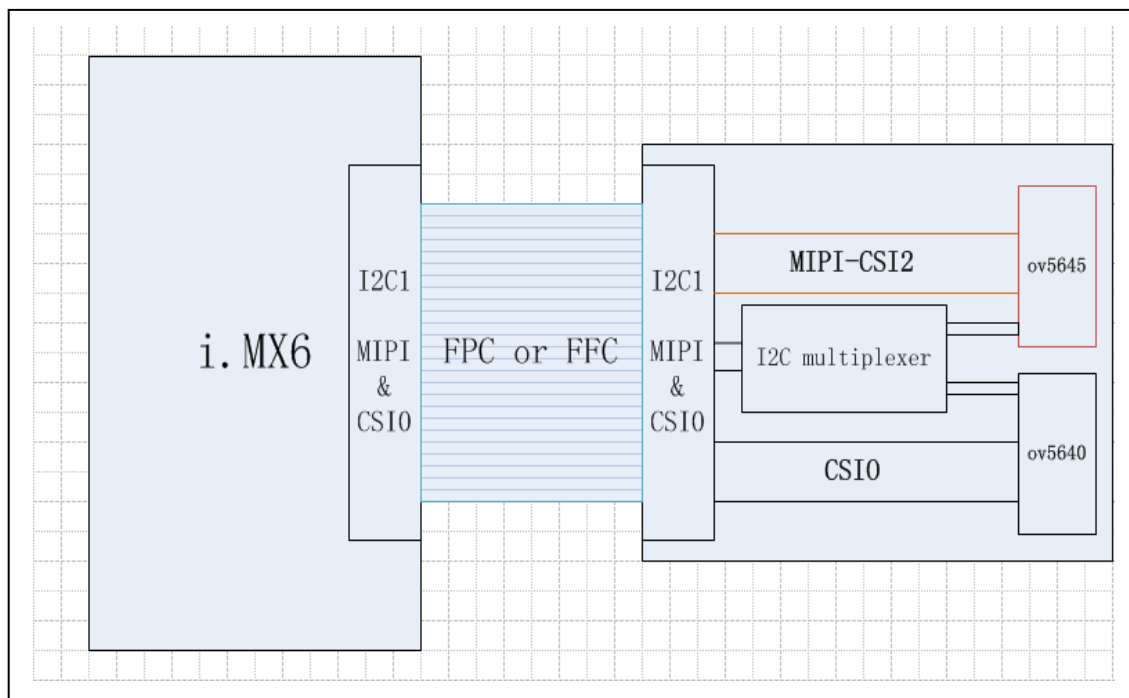
Processor: Freescale i.MX6Q/DL

Memory: DDR3 1GB

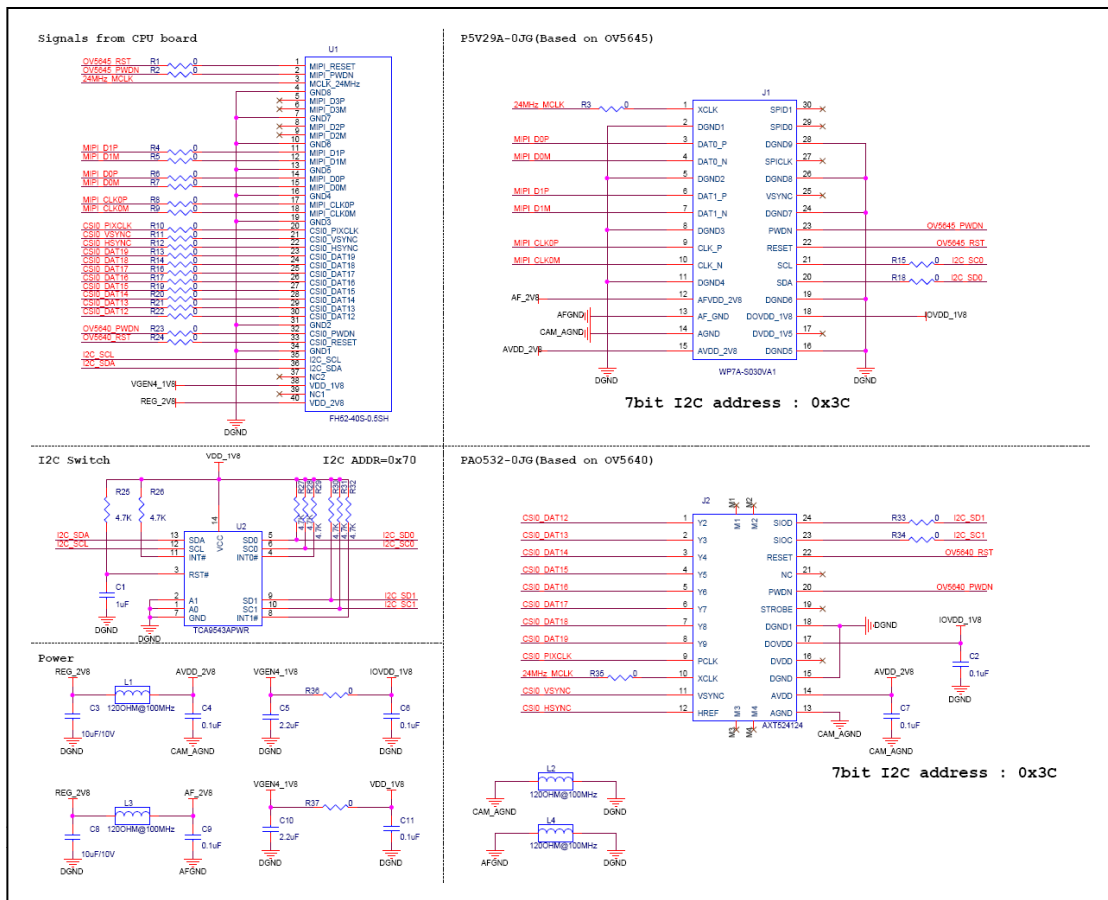
Flash: 8GB Managed Nand

2. Hardware Design Based on ov5645 module

The following diagram is how to connect camera board to CPU board, the board is an expansion one based on MIPI-CSI2 & CSI0 on i.MX6:



The following schematic is an expansion board for MIPI-CSI2 & CSI of i.MX6 :



[Note] Due to same I2C address, a I2C multiplexer had to be used.

3. BSP configuration for ov5645

BSP files are in path `myandroid/kernel_imx/arch/arm/mach-mx6/`, we will adjust source code based on board-`mx6q_sabresd.c` & board-`mx6q_sabresd.h`.

(1) I2C1 multiplexing

open board-`mx6q_sabresd.h`, check if I2C1 has been multiplexed, static `iomux_v3_cfg_t mx6q_sabresd_pads[] = {`

```

...
    MX6Q_PAD_CSI0_DAT8__I2C1_SDA,
    MX6Q_PAD_CSI0_DAT9__I2C1_SCL,
...
}

```

(2)GPIO multiplexing

On U1 connector, we used 2 GPIO pins for OV5645 reset & power down control: `OV5645_RST` & `OV5645_PWDN`. Here `SD1_DAT1` & `SD1_DAT2` pads were used.

We should also add multiplexing to board-mx6q_sabresd.h:

```
static iomux_v3_cfg_t mx6q_sabresd_pads[] = {
...
    MX6Q_PAD_SD1_DAT1__GPIO_1_17,          /* MIPI Power Control */
    MX6Q_PAD_SD1_DAT2__GPIO_1_19,          /* MIPI Reset Control */..
}
```

(3) source code for board--mx6q_sabresd.c

The following source code should be added:

--Power & Reset control

In GPIO definitions, add these 2 lines:

```
#define MX6Q_SABRESD_MIPI_PWDN          IMX_GPIO_NR(1, 17)
#define MX6Q_SABRESD_MIPI_RST          IMX_GPIO_NR(1, 19)
```

---ov5645 power control function

```
static void mx6q_mipi_powerdown(int powerdown)
{
    if (!powerdown)
        gpio_set_value(MX6Q_SABRESD_MIPI_PWDN, 1);
    else
        gpio_set_value(MX6Q_SABRESD_MIPI_PWDN, 0);
    msleep(5);
}

static void mx6q_mipi_sensor_io_init(void)
{
    /* Camera reset */
    gpio_request(MX6Q_SABRESD_MIPI_RST, "mipi-reset");
    gpio_direction_output(MX6Q_SABRESD_MIPI_RST, 1);

    /* Camera power down */
    gpio_request(MX6Q_SABRESD_MIPI_PWDN, "mipi-pwdn");
    gpio_direction_output(MX6Q_SABRESD_MIPI_PWDN, 1);
    msleep(5);
    gpio_set_value(MX6Q_SABRESD_MIPI_PWDN, 0);
    msleep(5);
    gpio_set_value(MX6Q_SABRESD_MIPI_RST, 0);
    msleep(20);
    gpio_set_value(MX6Q_SABRESD_MIPI_RST, 1);
    msleep(5);
    gpio_set_value(MX6Q_SABRESD_MIPI_PWDN, 1);
    msleep(5);
}
```

```

    /*for mx6dl, mipi virtual channel 1 connect to csi 1*/
    if (cpu_is_mx6dl())
        mxc_iomux_set_gpr_register(13, 3, 3, 1);
}

```

---MIPI-CSI2 data settings

```

static struct fsl_mxc_camera_platform_data mipi_csi2_data = {
    .mclk = 24000000,
    .mclk_source = 0,
    .csi = 1,
    .io_init = mx6q_mipi_sensor_io_init,
    .pwn = mx6q_mipi_powerdown,
};
static struct mipi_csi2_platform_data mipi_csi2_pdata = {
    .ipu_id = 0,
    .csi_id = 1,
    .v_channel = 1,
    .lanes = 2,
    .dphy_clk = "mipi_pllref_clk",
    .pixel_clk = "emi_clk",
};

```

---I2C BUS Settings

I2C1 was multiplexed 2 I2C channel, we defined them as I2C4 & I2C5, the following lines should be added to board-mx6q_sabresd.h:

```

#define PCA954x_I2C_BUS_BASE 4
#define PCA9543_I2C_BUS0 (PCA954x_I2C_BUS_BASE + 0)
#define PCA9543_I2C_BUS1 (PCA954x_I2C_BUS_BASE + 1)

```

Then in board-mx6q_sabresd.c, add these lines:

```

static struct i2c_board_info mux_i2c4_board_info[] __initdata = {
    {
        I2C_BOARD_INFO("ov5645_mipi", 0x3c),
        .platform_data = (void *)&mipi_csi2_data,
    },
};
/* I2C5 is only for OV5640*/
static struct i2c_board_info mux_i2c5_board_info[] __initdata = {
    {
        I2C_BOARD_INFO("ov5640", 0x3c),
        .platform_data = (void *)&camera_data,
    },
};

```

---Board specific initialization

In function static void __init mx6_sabresd_board_init(void), the following code should exist:

```
static void __init mx6_sabresd_board_init(void)
{
...
imx6q_add_v4l2_capture(0, &capture_data[0]);
imx6q_add_v4l2_capture(1, &capture_data[1]);
imx6q_add_mipi_csi2(&mipi_csi2_pdata);
...
imx6q_add_imx_i2c(0, &mx6q_sabresd_i2c_data);
i2c_register_board_info(0, mxc_i2c0_board_info,
        ARRAY_SIZE(mxc_i2c0_board_info));
i2c_register_board_info(PCA9543_I2C_BUS0,
        mux_i2c4_board_info,ARRAY_SIZE(mux_i2c4_board_info));
i2c_register_board_info(PCA9543_I2C_BUS1,
        mux_i2c5_board_info,ARRAY_SIZE(mux_i2c5_board_info));
...
}
```

4. ov5645 dirver for linux 3.0.35

--Copy ov5645.c to myandroid/kernel_imx/drivers/media/video/mxc/capture/

--Add it to Kconfig :

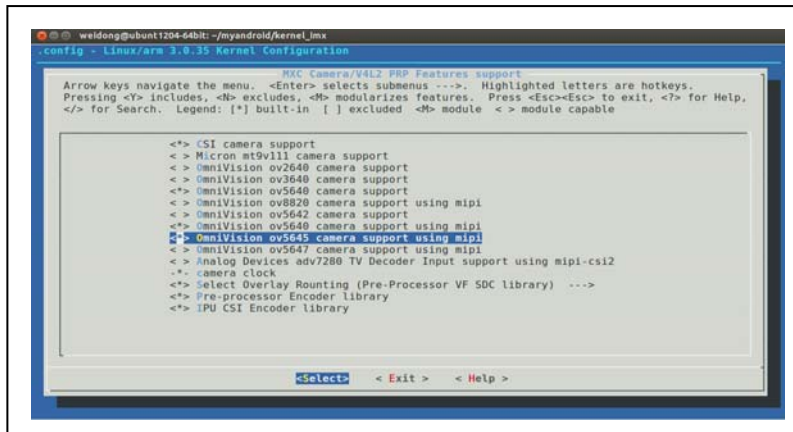
```
config MXC_CAMERA_OV5645_MIPI
    tristate "OmniVision ov5645 camera support using mipi"
    depends on !VIDEO_MXC_EMMA_CAMERA
    depends on ARCH_MX6Q
    select MXC_MIPI_CSI2 if ARCH_MX6Q
    select MXC_CAMERA_SENSOR_CLK
    ---help---
```

If you plan to use the ov5645 Camera with mipi interface in your MXC system, say Y here.

--Add it to Makefile:

```
...
ov5645_camera_mipi-objs := ov5645_mipi.o
obj-$(CONFIG_MXC_CAMERA_OV5645_MIPI) += ov5645_camera_mipi.o...
...
```

--Running make menuconfig and Selecting OV5645 :



After system running, ov5645 will be driven as /dev/video1(video0 is ov5640)

5. Android HAL

Source code for Android camera HAL is in ~/myandroid/hardware/imx/mx6/libcamera2, Copy Ov5645Mipi.cpp & Ov5645Mipi.h file to the directory, and continue to do following step:

(1)Add source code to DeviceAdapter.cpp

```
...
#include "Ov5645Mipi.h"
...
sp<DeviceAdapter>DeviceAdapter::Create(const CameraInfo& info)
{
...
    else if (strstr(info.name, OV5645MIPI_SENSOR_NAME)) {
        FLOGI("DeviceAdapter: Create ov5645 mipi device");
        devAdapter = new Ov5645Mipi();
    }
...
}
```

(2)Add source code to CameraUtil.h

```
#define OV5645MIPI_SENSOR_NAME "ov5645_mipi"
```

6. init.freescale.rc

```
setprop back_camera_name      ov5640_camera
setprop back_camera_orient    0
setprop front_camera_name     uvc,ov5645_mipi
setprop front_camera_orient   0
```