MOTOROLA

Personal Communications Sector

GSM
Service Support
Level 3 Authorized

GSM Service Support
Training - Documentation - Engineering

MPX220

Level 3
Circuit Description
08 / 14 / 04
V1.0

Circuit Description

Generally, the circuit is divided into 1 parts: Baseband(BB) circuits .

1.1 Baseband circuit

The Base-band circuits mainly consist of 5 chips: OMAP330 , PMIC (TPS65011), NAND Flash memory add SDRAM SAMSUNG KAG00J007M   Audio Codec TSC2101 , and Amp TPA2010   Bluetooth CSR BC213143A .
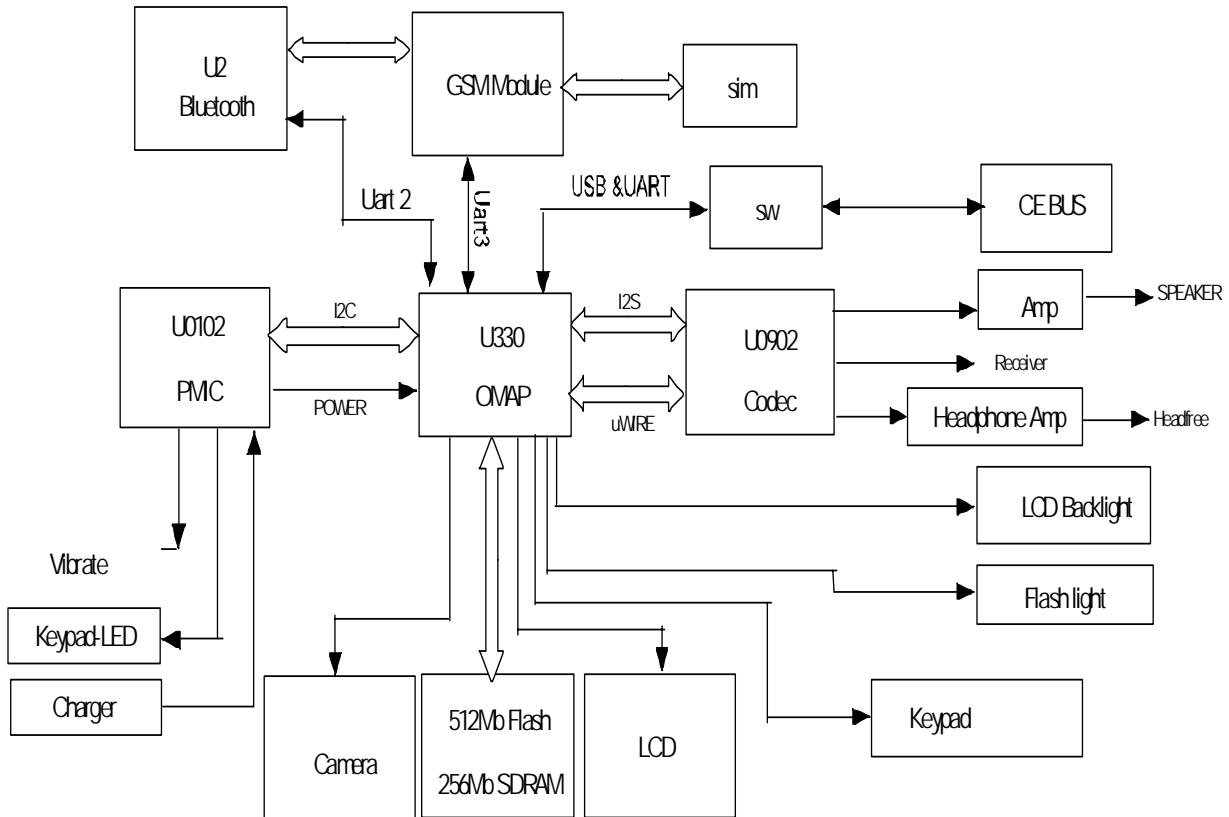
1.1.1   Digital Processor Chip – OMAP

   OMAP330 (U330) is a version of the baseband TI Wireless Platform Application Processor OMAP1611.It can be programmed to perform all personal communication system tasks, including call manager, Internet access, personal digital assistant (PDA).   .

   The OMAP330 chip is composed of several subsystems:

- MPU subsystem:

   The MPU subsystem is based on an ARM926EJ Megacell able to perform most Current operations on the chip.

- Internal memory subsystem:

   This subsystem is composed of a single port SRAM

- System DMA :

   This component is mainly used to help the MPU perform data memory transfer specific tasks.

- Memory interfaces

- Peripheral subsystem

- USB & modem interface

1.1.2   Audio codec-TSC2101   U0902

The TSC2101 (U0902) is a low-power highly integrated high performance codec , which supports stereo audio DAC, mono-aural Voice ADC and Battery measurement.

The power supply for TSC2101 (U0902) is listed below:

1.8V digital core supply
3.3V analog core supply
2.8V digital interface supply
3.3V speaker driver supply

The Control / Communication signals are summarized as follows:

CODEC-powerdown   hardware powerdown
nRESET-OUT   hardware reset
BUL_SS_2101   SPI Slave select input
BUL_SSPRXD3_2101   SPI Serial Data Input
BUL_SSPTXD3_2101   SPI Serial Data Output
BUL_SSPSCLK3_2101   SPI Serial Clock
I2S_SYSYCLK_2101   MASTER Clock
I2S_DATA_OUT_2101   Data Output
I2S_DATA_IN_2101   Data Input

1.1.2.1   Class D Audio Power Amplifier   TPA2010D1   U0904

The TPA2010D1 is a 2.5W high efficiency filter-free class-D audio power amplifier and it can through OP-EN signal to shutdown driver . it can through external resistance to change its amplification

1.1.2.2 Headset

The 1001 is the Headset Jack. The Headset MIC is biased by MIC-bias and goes back to U0416 through Headset_MICP_IN signal . The U0906 is a Stereo Headphone Amplifter, it can amplify HL2101 and HR2101 signal and output Headset Jack.(1001)

The U1010 is a voltage detector whose output signal , Hook_sw will indicate if the button in Headset is pressed and help mobile to connect or disconnect a call.

1.1.2.3 Receiver

The receive signal come form GSM Module(CN1301) and the go through L1604 in Upper PCB for noise reducing.

1.1.2.4   MIC

The MIC signals source come from GSM Module   CN1301   and it need through U0902 to transform signal output , it also are biased by HANDSET_MIC_BIAS from U0902.

1.1.2.5 Speaker

The Speaker signal come form U0902 and go through U0904 to amplify its signal . U0904 can amplify 1.2 times signal

1.1.3 Main LCD

The LCD module is a 176 (RGB) x 220 dots LCD module with LCD driver while TFT (262K colors) display mode.

The interface is listed in the following:

VLED – LED backlight power supply: anode
VLED-4 LED backlight power supply: cathode
LCD-B   LCD-R   LCD-D0~15 data bus
Reset-LCD Reset LCD
LCD-Dout –serial data Input
LCD-Din – serial data output
LCD-SCLK – serial clock
LCD-CS chip select
LCD-HSYNC – LCD horizontal sync
LCD-VSYNC – LCD vertical sync.
LCD_VCC – power supply for driver 2.8V

1.1.4 LCD Backlight Driver

The U1601 in Upper PCB , EL7513, is low noise , constant frequency charge pump DC/DC converters that use automatic conversion to increase efficiency in White LED applications. It can be used to produce current levels up to 20mA for each output from a 2.8V input. The outputs are connected to VLEDA of LCD module and VLED-4 can sense Current so that the LCD backlight can be turned on.

A serial digital input , PWL from U330 (OMAP 330), is provided to enable, disable and set the LED drive current for LED brightness control.

1.1.5 Sub LCD

The LCD module is a 96(RGB) x 64 dots LCD module with LCD driver while STN (56K colors) display mode.

The interface is listed in the following:
VDD   power supply for driver 2.8V
Reset_sublcd Reset LCD
LCD-Dout –serial data Input
LCD-SCLK – serial clock
SUBLCD-CS chip select

1.1.6 Camera

This is a color VGA CMOS sensor (640 X 480) camera module with 2.8V digital power supply.

The Control / Communication signals are summarized as follows:

CAM-D[0..7] – digital video output data
CAM-VSYNC – vertical synchronization signal
CAM-HSYNC – horizontal effective pixel synchronization signal
CAM-EXCLK – clock output pin to Camera
CAM-CLK – clock input pin
CAM-RST – device reset signal
CAM-ON – power down signal
SDA – I2C data
SCL – I2C clock
Vcmos-IO   power supply for I/O interface 2.8V
**Vamos-core**   power supply for core 2.5V

1.1.7 Keypad
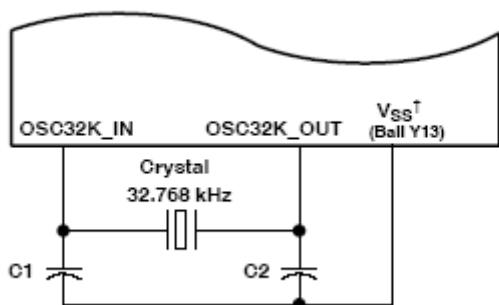
The keypad keyboard is connected to the U330 OMAP using:
- **KBR (4:0)** input pins for row lines
- **KBC (5:0)** output pins for column lines

If a key button of the keybord matrix is pressed, the corresponding row and column lines are shorted together. To allow key press detection, all input pins (KBR) are pulled up to VCC and all output pins (KBC) are driving a low level . Any action on a button will generate an interrupt to the micro-controller which will scan the column lines with sequence.
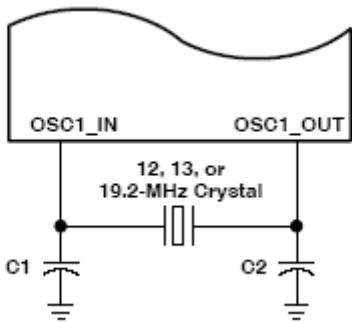
1.1.8   XTAL 32.768KHz

The oscillator is based on a CMOS inverter (in U330 OMAP), crystal U0202 and phasing capacitors (C0203 and C0204) are connected between input and output of the oscillator to provide the additional phase lag necessary to satisfy the oscillation criteria.

1.1.9   12MHz

The internal base system oscillator is enabled following a device reset. The oscillator requires an external crystal U0201   to be connected across pins OSC1_IN and OSC1_OUT

1.1.10 Light Sensor

The U0605 is a photo IC which detects the illuminance and output a voltage signal light_Sensor. Accordingly, the mobile will decide whether keypad backlight should be turned on or not by detecting the GSM Module output voltage.

1.1.11 Power Manage IC   U0102

1. Charger manage circuit (USB & Adaptor).
2. Two DC to DC converter . Vcore supply for the power of OMAP core. Vmain(VCC-3V3) supply for LDO1(2.8V) LDO2(1.8V) Bluetooth(U2) Analog Swith(U1107).
3. Two LDO, LDO1 supply for system I/O and Flash, LDO2(1.8V) supply for SDRAM interface of OMAP   SDRAM. Core of Codec(U0902).
4. Four GPIOs   Vibrator driver LED driver.circuits.

1.1.11.1 Vibrator

The Vibrator Motor is activated via Vibrator-EN   U0102   control signal

1.1.11.2 Keypad light

The Vibrator Motor is activated via KeypadLED-EN   U0102   control signal .R1 is limit current resistance

1.1.11.3 Charger

The U0405 is an over-voltage protection IC (it can avoid hight voltage adapter to insert) whose OUT pin controls the first stage of T0401 dual P-channel MOSFET ON/OFF
When adapter inser ,PM IC   U0102   can issue a /PG signal to U0407(P-channel MOSFET) ON/OFF and U0402 can detect Battery voltage
The U0402 is an Battery Overvoltage Protection IC whose OUT pin controls the second stage of T0401 dual P-channel MOSFET ON/OFF.

1.1.12 Light Sensor

The U401 is a photo IC which detects the illuminance and output a voltage signal, Light_Sensor. Accordingly, the mobile will decide whether keypad backlight should be turned on or not by detecting the U401 output voltage.

1.1.13 Hall Sensor

The U602 is an Omnipolar Hall Switch. The output Hall_Sensor_DET signal will go back to U330 and help mobile to know the Flip status (open or close).

1.1.14 Memory

The NAND Flash memory and Internal SDRAM (U03) is used to store code and other parameters. It contains 512M-bit Flash memory and 128M-bit SDRAM

The Flash memory uses 2.8V I/O and 2.8V core voltages.
The Control / Communication signals are listed below:

/WP – NAND Flash write protect
/WE – NAND Flash write enable
/CE – NAND Flash memory select
/RE – NAND Flash read enable
RDY/nBUSY –NAND Flash ready signal/busy signal
IO 0-7 –NAND Flash Data/address lines
ALE – NAND Flash address latch enable
CLE- NAND Flash common latch enable

The SDRAM uses 1.8V I/O and 1.8V core voltages.
The Control / Communication signals are listed below

SDATA 0~15 SDRAM data bus
SADD 0~12 SDRAM Address bus
SBANK 0~1 SDRAM bamk address bus
nSDQMU SDRAM upper data mask
nSDQML SDRAM lower data mask
SDCLK SDRAM clock
SDCLK_EN SDRAM clock enable
nSRAS SDRAM row address strobe
nSWE SDRAM write enable
CS_SDRAM SDRAM chip-select/power-down control signal
nSCAS SDRAM column address strobe

1.1.15 SIM card

The SIM Card digital interface in CN1301   GSM module   .
 The SIM card inerface can be programmed to drive a 1.8V or 3V SIM card.
The Control / Communication signals are listed below

GSM_SIMCLK – SIM card reference clock
GSM_SIMRST – SIM card reset
GSM_SIMIO – SIM card bidirectional data line
GSM_SIMVCC – power supply for SIM card

1.1.16 CE BUS

The CE Bus is P2K standard for Motorola. The bus incorporates serial communication and USB into one connector. The CE Bus is intended to support connection to accessories, personal

computers, and test systems. The bus connector has a total of 17 pins, 8 of which have multiple functions.

1.1.16.1 Modes of operation

The bus has six basic modes of operation:
1. Normal (also No Accessory Connected)
2. USB Mode
3. Analog Audio Mode (Dumb)
4. Phone powered USB mode
5. RS-232 Mode (8 Wire)

Mode	Option 1	Option 2	USB PWR	Audio_In
Normal (No Accessory)	1	1	0	X
USB Accessory (PC)	1	1	>4.0V	1
USB Accessory (6 Wire) Data logging	1	1	>4.0V	0
Dumb Accessory	1	0	X	1
Phone Powered USB Accessory	1	0	X	0
RS232 (8 Wire)	0	1	X	1

(Option Lines and AUDIO_IN lines will float at Logic '1')

Eight of the 17 pins will have different functions depending on which mode is selected. The other 9 pins always have the same function regardless of mode. The mode is selected by applying appropriate logic levels to the Option Select pins, named **OPTION1** and **OPTION2**. CN1103 Pins **13** and **14**. Some of the modes listed above are selected by the additional application of a level on the **USB POWER** and **AUDIO-IN** pins as well.

1.1.16.2 Pin Function

(Items highlighted in Blue remain constant regardless of Mode)

PIN No.	Signal Name (Short Form)	Power / Default States	USB	Bluetooth (RS-232 / SSI)	RS-232 (8wire)	USB / RS-232 86 wire	JTAG
1 (1)	Power Ground (GND)	GND	GND	N/A	GND	GND	N/A
2 (1)	Battery Feedback (BATT_FDBK)	BATT_FDBK	BATT_FDBK	N/A	BATT_FDBK	RTS	N/A
3 (1)	External Power (EXTB+)	EXTB+	EXTB+	N/A	EXTB+	EXTB+	N/A
4	USB+ / TXD (D+)		D+	N/A	TXD	D+	N/A
5	USB- / TXD (D-)		D-	N/A	RXD	D-	N/A
6	USB Power/Ignition/ Send/End/RTS (USB_PWR)		USB_PWR	N/A	RTS	USB_PWR	N/A
7	Switched Battery (SWB+)	SWB+	SWB+	N/A	SWB+	SWB+	N/A
8	Hook Switch / FM_DATA / CTS (HKSW)		HKSW	N/A	CTS	CTS	N/A
9	MUTE* /FS /DCD (MUTE*)			N/A	DCD	DCD	N/A
10	DUMB_SEL2 /SCK /RI (DSEL2)	DSCEN	DSCEN	N/A	RI	TXD	N/A
11	DUMB_SEL1/ FM_CLOCK/ SRDA/ DTR (DSEL0)			N/A	DTR	DTR	N/A
12	DUMB_SEL0 /FM_EN/ STDA/ DSR (DSEL0)			N/A	DSR	RXD	N/A
13 (1)	Option 1 (OPT1)	UPLINK	UPLINK	N/A	OPT1	OPT1	N/A
14 (1)	Option2 (OPT2)	DNLINK	DNLINK	N/A	OPT2	OPT2	N/A
15 (1)	Audio Out On/Off (AUDIO_OUT)	AUDIO_OUT	AUDIO_OUT	N/A	AUDIO_OUT	AUDIO_OUT	N/A
16 (1)	Audio In (AUDIO_IN)	AUDIO_IN	AUDIO_IN	N/A	AUDIO_IN	AUDIO_IN	N/A
17 (1)	Audio Ground (AUDIO_GND)	AUDIO_GND	AUDIO_GND	N/A	AUDIO_GND	AUDIO_GND	N/A

PIN No.	Signal Name (Short Form)	Power / Default States	USB	Bluetooth (RS-232 / SSI	RS-232 (8wire)	USB / RS-232 86 wire)
1 (1)	Power Ground (GND)	GND	GND	N/A	GND	GND
2 (1)	Battery Feedback (BATT_FDBK)	BATT_FDBK	BATT_FDBK	N/A	BATT_FDBK	
3 (1)	External Power (EXTB+)	EXTB+	EXTB+	N/A	EXTB+	
4	USB+ / TXD (D+)	TXD	TXD	N/A	TXD	TXD
5	USB- / TXD (D-)	RXD	RXD	N/A	RXD	RXD
6	USB Power/Ignition/ Send/End/RTS (USB_PWR)	RTS	RTS	N/A	RTS	RTS/_ Send/End
7	Switched Battery (SWB+)	SWB+	SWB+	N/A	SWB+	SWB+
8	Hook Switch / FM_DATA / CTS (HKSW)	CTS	CTS	N/A	CTS	CTS
9	MUTE* /FS /DCD (MUTE*)		MUTE*	N/A	FS	MUTE*
10	DUMB_SEL2 /SCK /RI (DSEL2)	DSEL2	DSEL2	N/A	DSEL2/ SCK	DSEL2
11	DUMB_SEL1/ FM_CLOCK/ SRDA/ DTR (DSEL0)	DSEL1	DSEL1	N/A	DSEL1/ SRDA	DSEL1
12	DUMB_SEL0 /FM_EN/ STDA/ DSR (DSEL0)	DSEL0	DSEL0	N/A	DSEL0/ STDA	DSEL0
13 (1)	Option 1 (OPT1)	OPT1	OPT1	N/A	OPT1	OPT1
14 (1)	Option2 (OPT2)	OPT2	OPT2	N/A	OPT2	OPT2
15 (1)	Audio Out On/Off (AUDIO_OUT)	AUDIO_OUT	AUDIO_OUT	N/A	AUDIO_OUT	AUDIO_OUT
16 (1)	Audio In (AUDIO_IN)	AUDIO_IN	AUDIO_IN	N/A	AUDIO_IN	AUDIO_IN
17 (1)	Audio Ground (AUDIO_GND)	AUDIO_GND	AUDIO_GND	N/A	AUDIO_GND	AUDIO_GND

1.1.17   Bluetooth(U2)

Its audio data convey to use Multi channels serial Interface and GSM Module communicate Data transfer to use U330 UART2

The Control / Communication signals are listed below:

MCSI_TXD   Transmit serial data
MCSI_RXD   Receive serial data
MCSI_CLK T   Bit synchronization clock
MCSI_FSYNCH   Frame synchronization

BT-RX   receive data
BT-TX   transmit data