3128 Circuit Description

1. Introduction

The model 3128 is a 40 channel (2.40055-2.47740GHz) Caller ID cordless speaker telephone. The whole unit is divided into two main parts as follow :

a. A remote Handset.
b. A Base unit.

2. Functional Blocks of the Remote Handset

2.1 Keyboard matrix and function LED
2.2 LCD
2.3 MCU and MCU interface
2.4 Antenna and RF module
2.5 Compander
2.6 Data shaper
2.7 Charge detector
2.8 Low battery detector
2.9 Buzzer amplifier

3. Circuit Block Description

3.1 Keyboard matrix and function LED
Pin 66 to pin71 of the U2 form a keyboard.
The new call LED is controled by the pin 98 of U2.

3.2 LCD
LCD is controlled by the U1 pin 12 to 28 and pin 30 to 51 and pin 53 to 65 and pin75 to 82.

3.3 MCU and MCU interface
The handset and the base is link up by the pins(84 and 89 in HS and 77 and 81 in Base).
Besides, the PLL of the RF Module is controlled by the pins 86 to pin 88 of the U2.

3.4 Antenna and RF module
ANT is the common point for transmitting and receiving. Antenna is 1/4 wave length wire, it is permanently attached on RF module.
MD1 is a RF module which consists of Duplexer, Power amplifier, Mixer & IF, RXVCO, TXVCO, VCC & TXVCC control, Synthesizer and DEMO Audio Output circuits.
The block diagram of RF Module is as shown below. It is made up of the following parts:

3.4.1 Power Supply

3.4.2 PLL and MCU Interface

3.4.3 RF Transmitter

3.4.4 RF Receiver

3.5.5 Audio Detector

3.4.1 Power Supply
The RF transmitter receives power from TXVCC. TXVCC is enabled only during TALK mode.The RF receiver receives power from RXVCC. RXVCC is enabled only during TALK or stand-by mode when wake up.

3.4.2 PLL and MCU Interface

The frequencies of the RF transmitter and RF local oscillator are controlled by PLL IC U3. The MCU transmit PLL data through DATA, CLK and CE signal lines. The basic clock frequency of the PLL is derived from an 11.15MHz crystal inside the RF module. The local frequencies to TX and RX are generated and locked at 1237MHz and 1206MHz respectively.

3.4.3 RF Transmitter

The RF transmitter oscillator frequency 1237MHz is controlled by the PLL through Vt. The PLL samples the RF frequency through fin. The audio input signal AFIN is fed to this RF oscillator through the FM modulator.

Fundamental frequency 1237MHz is multiplied to 2474MHz and bypass through band pass filter formed by Q304. The filtered 2474MHz is then injected into TX power amplifier Q303 and related passive components. The enlarged 2474MHz rf signal is then input into the 2475MHz TX_FILTER DF1. The transmitted rf signal is then injected into the ANTENNA and radiated out into air.

3.4.4 RF Receiver

Received rf signal is collected from ANTENNA and passed through 2403MHz filter DF2. The filtered 2403MHz rf signal will then be injected into the LNA Q3 and be enlarged. The amplified 2403MHz signal is then input into the MIXER which is formed by Q307and related passive components.

Q2 and VD2 with related resistors and capacitors network form the RXVCO **which is fed and locked by the PLL U3. The fundamental 1206MHz frequency is multiplied to 2412MHz and bypass the BPF formed by C25,R329 to the receiver mixer.**

The receiver local oscillator frequency is controlled by the PLL through Vt. The PLL samples the local oscillator RF frequency through fin.

The mixer collects the input from LNA and 2412MHz signal from BPF and then output the IF 10.7MHz into Q5.

3.4.5 Audio Detector

Amplified IF from Q5 is passed into 10.7MHz filter CF1and then injected into the IF demodulated IC U2. Detected audio will then be recovered and output at the AFOUT pin of the RF module.

3.5 Compander

A compander U1 is used for improving the S/N of the transmit and receive audio signal.

3.6 Data shaper

The information which sending from base unit, is recovered by the amplifier Q9,Q8 and Q4.

3.7 Charge detector

R31,ZD1,D2, R51and R52 form a charge detector to direct the charging signal to the MCU pin 73.

3.8 Low battery detector

A battery low detector is built-in by the Q12 which detects the battery dropping and sends a signal to pin 72 of MU1.

3.9 Buzzer amplifier

Q7 is a buzzer amplifier driven directly by the U2 pin 93.

4. Functional Blocks of the Base unit

4.1 Power supply
4.2 MCU and MCU interface
4.3 Calling line identifier
4.4 Antenna and RF module
4.5 Compander
4.6 Data shaper
4.7 Charge detector
4.8 Line audio interface
4.9 Ring detector
4.10 LCD function board
4.11 Carrier detector
4.12 Speakerphone

5. Circuit Block Description

5.1 Power supply
BU4 7805 regulate the input DC 9V to 5V which provides power to every part of the circuit.

5.2 MCU and MCU interface
The heart of the base is MCU BMU1 that communicates with the PLL of BMD1 through pins 78,79 and 80. Transmitter is controlled by the signal TX_DC which output from MCU via pin 76. MCU pin 2 is for generating DTMF signal. The communication between Handset and Base is via the pin 77 and pin 81 through the RF link.

5.3 Calling line identifier
MCU pin 6 to pin 9, when receiving caller ID data, MCU controls the LCD to display the correct information.

5.4 Antenna and RF modulator
ANT is the common point for transmitting and receiving. Antenna is 1/4 wave length wire, it is permanently attached on RF module. BMD1 is a RF modulator which consist of Duplexer, Power amplifier, Mixer & IF, RXVCO, TXVCO, VCC & TXVCC control, Synthesizer and DEMO Audio Output circuits.
The block diagram of RF Module is as shown below. It is made up of the following parts:

5.4.1 Power Supply

5.4.2 PLL and MCU Interface

5.4.3 RF Transmitter

5.5.4 RF Receiver

5.5.5 Audio Detector

5.4.1 Power Supply
The RF transmitter receives power from TXVCC. TXVCC is enabled only during TALK mode

or Ring mode.The RF receiver receives power from RXVCC. RXVCC is enabled when BASE plug in DC adapter.

5.4.2 PLL and MCU Interface

The frequencies of the RF transmitter and RF local oscillator are controlled by PLL IC U3. The MCU transmit PLL data through DATA, CLK and CE signal lines. The basic clock frequency of the PLL is derived from an 11.15MHz crystal inside the RF module. The local frequencies to TX and RX are generated and locked at 1202MHz and 1237MHz respectively**.**

5.4.3 RF Transmitter

The RF transmitter oscillator frequency 1202MHz is controlled by the PLL through Vt. The PLL samples the RF frequency through fin. The audio input signal AFIN is fed to this RF oscillator through the FM modulator.

Fundamental frequency 1202MHz is multiplied to 2404MHz and bypass through band pass filter formed by Q304,R302,R303,C307,L307,C306. The filtered 2404MHz is then injected into TX power amplifier Q303 and related passive components. The enlarged 2404MHz rf signal is then input into the 2403MHz TX_FILTER, DF1. The transmitted rf signal is then injected into the ANTENNA and radiated out into air.

5.4.4 RF Receiver

Received rf signal is collected from ANTENNA and passed through 2475MHz filter DF2. The filtered 2475MHz rf signal will then be injected into the LNA Q3 and be enlarged. The amplified 2475MHz signal is then input into the MIXER which is formed by Q307 and related passive components. The mixer collects the input from LNA and 2464MHz signal from BPF and then output the IF 10.7MHz into Q5.

Q2 and VD2 with related resistors and capacitors network form the RXVCO **which is fed and locked by the PLL U3. The fundamental 1232MHz frequency is multiplied to 2464MHz and bypass the BPF formed by C25, R329 to the receiver mixer.**

The receiver local oscillator frequency is controlled by the PLL through Vt. The PLL samples the local oscillator RF frequency through fin.

5.4.**5 Audio Detector**

Amplified IF from Q5 is passed into 10.7MHz filter CF1 and then injected into the IF demodulated IC U2. Detected audio will then be recovered and output at the AFOUT pin of the RF module.

5.5 Compander

A compander BU2 is used for improving the S/N of the transmit and receive audio signal.

5.6 Data shaper

The information which sending from handset unit, is recovered by the amplifier BMQ4,BMQ5 and BMQ6.

5.7 Charge detector

BQ7 is a charge detector to direct the charging signal to the MCU pin 98.

5.8 Line audio interface

BL1,BL2,BF1,BRD1,BD1 to BD4, BQ3,BQ4, BQ8,BQ9 and BZD3 are the audio interface to the telephone line.

5.9 Ring detector

BC62,BR61,BR54,BD5,BC57 form a ring detector which feed the signal through pin 5 of MCU.

5.10 LCD function board

BMLCD1 is used for indicating information.

5.11 Carrier detector

The RF Module pin 10 is an output pin of the carrier detector signal to MCU pin82.

5.12 Speakerphone

Speakerphone is mainly formed by BU1 and Base Keyboard.

Speaker ringing which is controled by MPU pin 75.

When use speakerphone, BU1 amplify signal from BMIC1 also amplify singnal from line and drives speaker.

RF MODULE FREQUENCY TABLE PLL IC=S1T8825B

DATE:27FEB,04
REF DIVIDER=446
CRYSTAL=11.15MHz

CH	HANDSET		BASE	
	FREQ(TX)=(TX VCO)X2	(RX VCO)X2	FREQ(TX)=(TX VCO)X2	(RX VCO)X2
1	2,472,500,000	2,411,250,000	2,400,550,000	2,461,800,000
2	2,472,600,000	2,411,350,000	2,400,650,000	2,461,900,000
3	2,472,700,000	2,411,450,000	2,400,750,000	2,462,000,000
4	2,472,800,000	2,411,550,000	2,400,850,000	2,462,100,000
5	2,472,900,000	2,411,650,000	2,400,950,000	2,462,200,000
6	2,473,000,000	2,411,750,000	2,401,050,000	2,462,300,000
7	2,473,100,000	2,411,850,000	2,401,150,000	2,462,400,000
8	2,473,200,000	2,411,950,000	2,401,250,000	2,462,500,000
9	2,473,300,000	2,412,050,000	2,401,350,000	2,462,600,000
10	2,473,400,000	2,412,150,000	2,401,450,000	2,462,700,000
11	2,473,500,000	2,412,250,000	2,401,550,000	2,462,800,000
12	2,473,600,000	2,412,350,000	2,401,650,000	2,462,900,000
13	2,473,700,000	2,412,450,000	2,401,750,000	2,463,000,000
14	2,473,800,000	2,412,550,000	2,401,850,000	2,463,100,000
15	2,473,900,000	2,412,650,000	2,401,950,000	2,463,200,000
16	2,474,000,000	2,412,750,000	2,402,050,000	2,463,300,000
17	2,474,100,000	2,412,850,000	2,402,150,000	2,463,400,000
18	2,474,200,000	2,412,950,000	2,402,250,000	2,463,500,000
19	2,474,300,000	2,413,050,000	2,402,350,000	2,463,600,000
20	2,474,400,000	2,413,150,000	2,402,450,000	2,463,700,000

21	2,474,500,000	2,413,250,000	2,402,550,000	2,463,800,000
22	2,474,600,000	2,413,350,000	2,402,650,000	2,463,900,000
23	2,474,700,000	2,413,450,000	2,402,750,000	2,464,000,000
24	2,474,800,000	2,413,550,000	2,402,850,000	2,464,100,000
25	2,474,900,000	2,413,650,000	2,402,950,000	2,464,200,000
26	2,475,000,000	2,413,750,000	2,403,050,000	2,464,300,000
27	2,475,100,000	2,413,850,000	2,403,150,000	2,464,400,000
28	2,475,200,000	2,413,950,000	2,403,250,000	2,464,500,000
29	2,475,300,000	2,414,050,000	2,403,350,000	2,464,600,000
30	2,475,400,000	2,414,150,000	2,403,450,000	2,464,700,000
31	2,475,500,000	2,414,250,000	2,403,550,000	2,464,800,000
32	2,475,600,000	2,414,350,000	2,403,650,000	2,464,900,000
33	2,475,700,000	2,414,450,000	2,403,750,000	2,465,000,000
34	2,475,800,000	2,414,550,000	2,403,850,000	2,465,100,000
35	2,475,900,000	2,414,650,000	2,403,950,000	2,465,200,000
36	2,476,000,000	2,414,750,000	2,404,050,000	2,465,300,000
37	2,476,100,000	2,414,850,000	2,404,150,000	2,465,400,000
38	2,476,200,000	2,414,950,000	2,404,250,000	2,465,500,000
39	2,476,300,000	2,415,050,000	2,404,350,000	2,465,600,000
40	2,476,400,000	2,415,150,000	2,404,450,000	2,465,700,000

H/S TX FREQ.=(TX VCO) X2
H/S RX(1ST LO)=B/S TX(FREQ.) +10.7MHz=H/S(RX VCO) X 2

B/S TX FREQ.=(TX VCO) X2

B/S RX(1ST LO)=H/S TX(FREQ.) -10.7MHz=B/S(RX VCO) X 2

PLL Fin1=TX FREQ. ; PLL Fin2=RX FREQ.