

BE-25F Circuit Description

1. Introduction

The model BE-25F is a 25 channel (43/49MHz) cordless telephone with speaker phone in the base unit. The whole unit is divided into two main parts as follows:

One remote handset.

One base unit.

2. Function Blocks of the Remote Handset

- Keyboard matrix and function LED
- MCU and MCU interface
- Antenna and Duplexer
- Receiver amplifier
- Demodulator
- Audio amplifier
- compander
- Transmitter and receiver PLL frequency synthesizer
- Data shaper
- Transmitter amplifier
- Transmitter oscillator and modulator
- PLL loop filter
- Charge detector
- Buzzer amplifier

3. Circuit Block Description

3.1 Keyboard matrix and Function LED

Pin4 to Pin 6, Pin 8 to Pin11 and Pin 25 of the MCU form a keyboard and the talk LED, LED1 function is controlled by the Pin 7 of the MCU IC2.

3.2 MCU and MCU interface

The heart of the handset is the MCU 87C405-HM. It communicates with the PLL of the TB31224 via pin 16,17 and 18. These three pins also control the audio path of the incoming and outgoing audio signal.

Transmitter DC power is controlled by pin 14 of IC2.

Data communication between Handset and Base is via the pin 12 and pin24 by the RF link.

3.3 Antenna and Duplexer

ANT is the transmit and receive signal antenna.

DUP2 is a duplexer which rejects the transmitter signal to interfere the receiver.

3.4 Receiver amplifier

Q7 (9018H) and IFT3 is a tuned RF amplifier which amplifies the 43 to 46 MHz incoming RF signal and rejects the unwanted signal at the other frequencies.

3.5 Demodulator

U1 (TB31224F) is a combo chip includes a demodulator which performs double conversion in order to produce two IF signals and demodulate the FM signal into baseband audio. In addition, it has noise detector to monitor the receiving carrier for the changed condition of channels.

3.6 Transmitter amplifier

Q1, C22, L2, C24, L3 and Q2 form transmitter amplifier which amplifies the outgoing 48 to 49 MHz RF signal.

3.7 Transmitter oscillator and modulator

Q3, IFT4, C33, C32, D13 C28 form a PLL tuned oscillator which oscillates at the FCC assigned channel frequencies. D14, C27 C29, C30 performs as a FM modulator.

3.8 PLL loop filter

C19, C20, C73, R2, R1 and R37, C48, R38, C78, C79 are the receive and transmit PLL loop filters respectively.

3.9 Charge detector

ZD1, D5 R44, R43 and C50 form a charge detector to direct the charging signal to the MCU.

3.10 Buzzer amplifier

Q5 is a buzzer amplifier driven directly by the MCU pin 23. Pin 22 is used to lower the Buzzer volume when press the key.

3.11 Audio Amplifier

For U1 TB31224 - Pin 15, Pin 16, Pin 19, Pin 20 are the receive audio amplifier
For U1 TB31224 - Pin 13, Pin 14, Pin 9, Pin 10 are the transmit audio amplifier.

3.12 Compander and Low battery detector

U1 TB31224 also includes a compander IC which performs compression at transmitted signal via Pin 12 and expands the received signal via pin 17.

Low battery detector output is from U1's Pin 21.

3.12 Data shaper

U1's Pin 23 is a datashaper which send the information from BASE to the MCU Pin 24 (RXDAT).

4. Function Blocks of the Base unit

- Power supply
- MCU and MCU interface
- Antenna and Duplexer
- Receiver amplifier
- Demodulator
- Audio amplifier
- Compander
- Transmitter and receiver PLL frequency synthesizer
- PLL loop filter
- Data shaper and noise detector
- Transmitter amplifier
- Transmitter oscillator and modulator
- Charge detector
- Line audio interface
- Ring detector
- LED and Keyboard
- Power failure detector
- Analog Switches
- Speaker Phone

5. Circuit Block Description

5.1 Power supply

BU4 7805 regulate the input DC12V which provides 5VDC power to every part of the circuit.

5.2 MCU and MCU interface

The heart of the base is the MCU 87C807 , BU5 communicates with the PLL of Combo Chip TB31224 via pin 1, 43 and 44.

Transmitter DC is controlled by pin 35.

Pin 19 to Pin 24 consist of the DTMF generator. The communication between Handset and Base is via the Pin 31 and Pin 33 through the RF link.

Pin 27 controls the muting of the speaker phone

Pin 28 controls the muting of the line interface.

Pin 38 and BSW2 select the ringer on/off.

Pin 39 and BSW1 select tone or pulse dialing.

5.3 Antenna and Duplexer

ANT is the transmit and receive signal antenna. BDUP2 is a duplexer which rejects the transmitter signal to interfere the receiver.

5.4 Receiver amplifier

BQ1 and BIFT3 is RF amplifier which amplifies the 48 to 49 MHz incoming RF signal and rejects the unwanted signal at the other frequencies.

5.5 Demodulator

BU1 (TB31224F) includes a demodulator IC which performs double conversion to produce two IF signals and demodulate the FM signal into baseband audio. In addition, it has noise detector to monitor the receiving carrier for the changed condition of channels. BU5 pin 5 provide the logic signal to indicate the noisy condition to BU1 pin 26.

5.6 Transmitter

BQ3, BL2, BC22, BC20, BQ2, BL6, BC18, BC59 and BL4 form a RF transmitter amplifier which amplifies the outgoing 43 to 46 MHz RF signal. BQ5, BR116, BC54, BC61 and BR117 are band switch.

5.7 Transmitter oscillator and modulator

BQ4, BC28, BC29, BIFT4, BC24, BC25, BD8 form a PLL tuned oscillator which oscillates at the FCC assigned channel frequencies. FM modulation is achieved through BD9, BC62, BC3, BC64, BR120 and BR121. BQ6, BC26, BD2, BC23 BC3 are band switch.

Band switch is controlled by CPU BU5 pin 36.

5.8 PLL loop filter

BR32, BR33, BC43 BC104, BC105 and BR2, BR1, BC16, BC17, BC99 are the transmit and receive PLL loop filters respectively.

5.9 Charge detector

BQ14 is a charge detector to direct the charging signal to the MCU pin 30.

5.10 Audio amplifier and compander

For BU1 TB31224 - Pin15, Pin 16, Pin19, Pin 20 are the receive audio amplifier.
For BU1 TB31224 - Pin13, Pin 14, Pin 9, Pin 19 are the transmit audio amplifier
BU1 TB31224 also include a compander IC which performs compression at transmitted signal via Pin 12 and expands the received signal via pin 17.

5.11 Line audio interface

BQ11, BR129, BR133, BR134, BR131, BR130, BC122 and BT1 line transformer are the audio interface to the telephone line. The transformer is also for telephone line isolation.

5.12 Data shaper and noise detector

BU1's Pin 23 is a data shaper which send the information from Handset to the MCU pin 31 (RXDAT).

BU1 pin 25, 26 form a noise detector. It can detect the high frequency noise and the signal is given out from BU1's pin 5 and to BU5 pin 26.

5.13 Ring Detector

BR138, BC87, BZ1, BZ2, BU6 (TLP521), BR137 and BD5 form a ring detector to signal the pin 34 of MCU BU1.

5.14 Power fail detector

BZD3, BR145, BQ13, BR147 form a power failure detector. The power failure signal is sent to pin 37 of BU1.

5.15 LED and KeyBoard

KLED1 indicate the status of the speakerphone and is controlled by BU5 pin 11.

KLED3 indicate the unit is in used and is controlled by BU5 pin 9.

Key Board is connected to BU5 pin 2 to 8, pin 42 and pin29.

Keytone and ringing tone is generated by BU5 through pin 32 and send to the speaker phone amplifier via BC84.

5.16 Analog Switches

BU3A, BU3B and BU3C are switches for baseband analog signals.

BU3A, BR69, BR70, BR71 combine the line audio and RF received audio signal.

BU3B, BR74, BR75, BR76 combine the RF received audio, speaker phone transmit audio and DTMF signal to the telephone line. BQ17 gates the speaker phone transmit audio. Muting of RF received audio is done by BU1, TB31224.

BU3C, BR132, BR125 and BQ9 amplify and gate the line received audio.

5.17 Speaker Phone

BU2, MC34018 is a speaker phone IC which allows handfree conversation through the telephone line and the remote handset.

Mic picked up audio is amplified via BC74, BU2 pin 9 and pin 10. Then go through a switching circuit BC67, BU2 pin 3, pin 2 and pin 1, BR57, and BR58. The transmit audio signal at BU2 pin 4 is buffered by BQ16 and BR68 before sending out to telephone line or the RF transmitter.

BC72, BR62, BC113, BR66, BC115, BR65, BC114, BU2 pin 13, pin 12, pin 11 and pin 23 detect the background noise of the environment picked up by the microphone.

Received audio signal is amplified through BC68, BR59, BR60, BC70, BC116, BC111, BU2 pin 27, pin 28, pin 26, pin 19, pin 14, pin 15 and pin 17. Speaker volume is controlled by BVR2 and BR56.

BC71, BR61, BR64, BC110, BR63, BC73, BC107, BC108, BC109, BU2 pin 5, pin 6, pin 7, pin 8, and pin 25 compare the signal magnitude of received audio and mic picked up to determine whether the speaker phone is in transmit or receive mode.