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 comunication 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 demodualtor 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 oscillaotr 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 ampifier 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 detemine whether the speaker phone is in transmit or receive mode.

MODEL : BE-25F

USER MANUAL

IMPORTANT SAFETY INSTRUCTIONS

When using your telephone equipment , basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following :

1. Read and understand all instructions.

2. Follow all warnings and instructions marked on the product.

3. Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

4. Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.

5. Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.

6. Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating, these openings must not be blocked or covered. The openings should never be blocked by placing the product on the bed, sofa, rug, or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.

7. This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home, consult your dealer or local power company.

8. (If provided with a grounded type attachment plug) -- This product is equipped with a three wire grounding type plug, a plug having a third (grounding) pin . This plug will only fit into a grounding type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the grounding type plug.

    (If provided with a polarized attachment plug) – This product is equipped with a polarized line plug (a plug having one blade wider than the other). This plug will fit into the power outlet only one way. This is a safety feature. If you are unable to insert the plug fully into the outlet try reversing the plug. If the plug should still not fit, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the polarized plug.

9. Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.

10. Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.

11. Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.

12. To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified serviceman when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.

13. Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions :

a) When the power supply cord or plug is damaged or frayed.

b) If liquid has been spilled into the product.

c) If the product has been exposed to rain or water.

d) If the product does not operate normally by following the operating instructions. Adjust only those controls, that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.

e) If the product has been dropped or the cabinet has been damaged.

f) If the product exhibits a distinct change in performance.

14. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.

15. Do not use the telephone to report a gas leak in the vicinity of the leak.

<p style="text-align:center">**SAVE THESE INSTRUCTIONS**</p>

Operation of 25 Channel Cordless Headset Phone with Baseset Speaker Phone (Rev 1)

OPERATION

25-Channel Operation

The cordless headset automatically searches and selects the clearest of 25 channels when TALK is pressed. There may be a 1-2 second delay while the headset scans for the clearest channel. The TALK LED will flash during scan. While on a call, if noise or static is experienced:

1. Press CHANNEL on headset until a clear channel is found, the call will not be interrupted.
OR
2. Move closer to base

Note: You must be in usable range to change channels. Base antenna should be in a fully upright position.

Security Code

The security code prevents your cordless headset conversation from being accessed by a phone on a different line. Once the headset battery is fully charged, the headset will automatically select the code from over 65,000 combinations. The code is changed every time the headset is placed in the cradle.

If you experience difficulty with placing or receiving calls, you may have lost the security code. The headset can no longer communicate with the base. Reset by placing headset on base for 2 seconds. If that does not work, unplug the AC adapter from the wall outlet. Disconnect the headset battery for 2 seconds, then reconnect. Place headset back on base and then replug the AC adapter.

Place a Call

1. Press TALK button.
2. Talk LED on headset will light.
3. When you hear a dial tone, place your call.

Note: There may be a 1-2 second delay while the headset scans for the clearest channel. The TALK LED will flash during scan.

Receiving a Call

1. If the headset is out of the base unit, press TALK.
2. If the headset is in the base unit, lift the headset. *Do not* press TALK. You will automatically be connected.

Note: If you pick up headset before the first ring is complete, you may need to press TALK.

Ending a Call

Place the headset in the base or press TALK to be disconnected from the line.

Flash

Use the FLASH button to activate custom calling services such as Call Waiting or Three-Way Calling (*Special subscription from your local telephone company required).

Temporary Tone (*)

PULSE (rotary) service users may access touch-tone features needed to operate answering machines or use electronic banking, calling cards, etc., by pressing the TONE (*) button. Phone will reset automatically after call ends.

Out of Range

Placing a call too far away from the base may result in static and a noise will hear form the ear piece .

1.	Move back closer to base or phone will turn off automatically after 16 seconds.
2.	If baseset turns off because it is out of range, you must reset by placing it back on the base to re establish the security code.

Moving out of range during a call may result in static. For better reception, move closer to base.

Memory Feature

Store up to 10 numbers in memory for quick dialing.

To Program Frequently Called Numbers

1.	Pick up headset, with TALK off.
2.	Press MEMO (MEMORY) button.
3.	Dial phone number (up to 16 digits).

Note: Each TONE (*) or PAUSE (REDIAL) entered uses one of the available digits. If a 17th digit is accidentally pressed during programming, an error tone will sound and leave the programming mode. Try again.

4.	Press MEMO button again.
5.	Press a number key (0-9) for the memory location where the number is to be stored.
6.	Two beep tones will confirm the number has been successfully stored.
7.	Record numbers to be speed dialed on memory index located on base of unit.

Change a Stored Number

Replace a stored number by programming a new number in its place.

Dialing a Number Stored in Memory

1.	Lift headset. Press TALK.
2.	With TALK button lit, press MEMO.
3.	Press memory location (0-9) assigned to number being called.

Pause

A 4-second PAUSE may be inserted into the speed dialing of long distance custom numbers.
Press PAUSE(REDIAL) button at required point during storage of a number in memory.

Redial
Last number dialed (up to 32 digits) is stored in redial memory until another number is dialed.
1.   Press TALK on headset.
2.   When you hear a dial tone, press REDIAL.

Page
Send a signal from the base to headset. Press PAGE button on base and 4 page tones will sound from headset.

Using Speakerphone
To make or answer a call without using the headset, press the SPEAKER button on the base. You will be connected to line. The base SPEAKER LED will light. To disconnect press SPEAKER button again. The line will disconnect and SPEAKER LED will turn off.

Speaker Volume Control
If necessary, you may adjust the volume of the base SPEAKER. Slide the VOLUME CONTROL on the base to the preferred setting.

Three Way Conference
You may use either the base or the headset as an extension phone.
To join a call already in progress on the headset, press the SPEAKER button on the base. SPEAKER LED in base will light.
To join a call already in progress on the base, press the TALK button on the headset. TALK LED in headset will light.

Call Transfer
Transfer a call from the base to the headset.
1.   Baseset user press the INTERCOM button to page headset, (SPEAKER LED with flash), headset press TALK button to pickup the call and complete transfer progress.
(If baseset user want to join a three way conference just press SPEAKER button again.)

Transfer a call from the headset to the base.
Press INTERCOM button in the headset to page base, baseset press SPEAKER button to complete the transfer progress.
(If headset user want to join a three way conference just press TALK button again.)

Intercom

Intercom allows you to communicate between the HEADSET and BASESET unit.

To communicate with the headset:

1. Press INTCOM button on base, (SPEAKER LED flash). The headset will ring.
2. When headset rings, press TALK button. You may then communicate with baseunit.
3. To end, press the Speaker button on base.

To communicate with baseset:

1. Press INTCOM button on headset, (SPEAKER LED flash). The baseset will ring.
2. When base rings, press Speaker button. You may then communicate with headset.
3. To end, press the Talk button on headset .

Note: The rings will last for between 4 to 10 seconds. If no answer, the base/headset will exit the intercom paging mode.

	LED	STATUS	INDICATIONS
BASE	INUSE/CHG	OFF	Standby
		ON	Line is in use by Headset
			Battery begin chargered (Headset on Cradle)
		SLOW FLASHING	Programming
		FAST FLASHING	Incoming Ring
	SPEAKER	OFF	Line is not use by Baseset
		ON	Line is in used by Baseset
			Unit is in Intercom mode
		FLASHING	Headset paging base
			Baseset paging headset
HEADSET	TALK	OFF	Line is not use by Headset
		ON	Line is used by Headset
			Unit is in Intercom mode
		FLASHING	Headset paging base
			Baseset paging headset
			Battery is low
			Ringing
			Searching for clearest channel
			Memory storage

INSTALLATION

! CAUTION

1.   Never install telephone jacks during a lightning storm.
2.   Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3.   Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4.   Use caution when installing or modifying telephone lines.

Modular Outlet Telephone Jacks

1.   This phone requires a modular phone jack (RJ11) and a standard 110 volt outlet.
2.   Plug phone directly into outlet, not an extension cord.
3.   Do not plug other appliances into outlet or have outlet controlled by a wall switch.

Antennas

Fully extend base antenna to upright position

Set Tone/Pulse Switch.

Set switch (Back of base) to correct dialing mode - (touch) TONE or PULSE (rotary).
Please check with local phone company if uncertain of type of service.

Ringer Off/LOW/HIGH

Set switch to OFF/LOW/HIGH. Ringer switch must be LOW or HIGH for headset to ring during incoming calls.

Receiver Volume Control

Adjust loudness of headset to either normal (NORM) or high (HI).

Handset Battery Charging

The battery pack in the handset must be fully charged 10-14 hours before using the telephone for the first time.

1. Place handset in base, the **CHARGE** LED on base will light.
2. After batteries are fully charged, check for dial tone by pressing **TALK** on handset.
3. Establish security code by recradling handset for 2 seconds. Handset is now ready to use.
4. When handset battery gets low, there will be two beeps every 30 seconds. The **TALK** LED will flash. Return to cradle for charging.
5. If battery becomes low while you are on a call, you will be disconnected after about 5 minutes. Terminate the call quickly and recharge battery.

To recharge battery pack, place handset in base and:
1. Make sure contact points are touching and **CHARGE** LED is lit.
2. Be careful not to short battery with conducting materials such as rings, bracelets and keys.

Replace battery every 2 years. Use only a NiMH battery in your cordless phone.

BATTERY CAUTION INSTRUCTION

CAUTION : To reduces the risk of fire of injury to persons, read and follow these instructions :

1. Use only the following type and size battery(ies) :   GP28AAAM3BMX   GP BRAND, 280mAH, 3.6V, 2/3AAA SIZE, NIMH RECHARGEABLE BATTERY.

2. Do not dispose of the battery(ies) in a fire. The cell may explode. Check with local codes for possible special disposal instructions.

3. Do not open or mutilate the battery (ies). Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.

4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.

5. Charge the battery(ies) provied with or identified for use with this product only in accordance with the instructions and limitations specified in this manual.

6. Observe proper polarity orientation between the battery(ies) and battery charger.

7. Do not mix old and new batteries in this product (applies to products employing more than one user replaceable secondary battery).

8. Do not mix batteries of different sizes or from different manufacturers in this product (applies to products employing more than one user replaceable secondary battery).

USER MANUAL INFORMATION

I.FCC REQUIREMENTS :

1. The Federal Communication Commission (FCC) has established Rules which permit this device to be directly connected to the telephone network. Standardized jacks are used for these connections. This equipment should not be used on party lines or coin lines.

2. If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the telephone company may temporarily disconnect service.

3. The telephone company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes. You will be advised of your right to file a complaint with the FCC.

4. If the telephone company requests information on what equipment is connected to their lines, inform them of :

a)   The telephone number this unit is connected to
b)   The ringer equivalence number
c)   The USOC jack required.
d)   The FCC Registration number

Item 'b' and 'd' are indicated on the label.

The ringer equivalence (REN) is used to determine how many device can be connected to your telephone line. In most areas, the sum of the RENs of all devices on any one line should not exceed five (5.0). If too many devices are attacted, they may not ring properly.

5. This equipment if it uses a telephone receiver is hearing aid compatible.

II.   SERVICE REQUIREMENTS

1. In the event of equipment malfunction, all repairs should be performed by our Company or an authorized agent. It is the responsibility of users requiring service to report the need for service to our Company or to one of our authorized agents. Service can obtained at :

    TT SYSTEM CORPORATION
    7 ODELL PLAZA
    YONKERS NY 10701
    Phone : (914) 968-2100
    Fax : (914) 968-2155

Warning : Changes or modification to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE : This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio interference to radio communications.

However, these is no guarantee that interference will not occur in a particular installation. If this equipment does harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures :

☐ Reorient or relocate the receiving antenna.
☐ Increase the separation between the equipment and receiver.
☐ Connect the equipment into an outlet on a circuit different from that to which the receiver is needed.
☐ Consult the dealer or an experienced radio / TV technician for help.

Some cordless telephones operate at frequencies that may cause interference to nearby TVs and VCRs; to minimize or prevent such interference, the base of the cordless telephone should be placed near or on top of a TV of VCR; and, if interference is experienced, moving the cordless telephone farther away from the TV or eliminate the interference.