VTECH ENGINEERING CANADA LTD.

TITLE	**Theory of Operation**
MODEL	**VTECH PDLci MK3 - 900MHz Single-Line Digital Cordless Telephone with Caller ID, Base Speakerphone & TAD**

Theory of Operation for the
VTECH PDLci MK3 (VTECH 1964)
900 MHz Single-Line Digital Cordless Telephone with Caller ID, Base Speakerphone & TAD

Revision History:

Revision	Description	Page	Effective Date
0	Initial release	All	Jul 20/99

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1 System Description

1.1 Introduction

This theory of operation covers the VTECH PDLci MK3 model of 900 MHz single-line digital cordless telephone with caller-ID. The PDLci MK3 is part of the VTECH's third generation of 900 MHz digital cordless telephones. The new digital products will be designed using the AM79C493A ASIC which is the third generation of the '49x series from AMD. This ASIC has been optimised for functionality and cost and provides the platform for developing an integrated ADPCM telephone answering device (TAD).

1.2 Feature List

DESCRIPTION	STANDARD FEATURE	OPTIONAL FEATURE
System General		
900 MHz digital (ADPCM)	Y	
# channels	30	
Channel selection	auto	
DTMF dialing	Y	
# security codes	16.8M	
Digital scramble voice	Y	
# lines	1	
Battery specification	3.6V, 600mAh	
Handset		
Mechanical /Cosmetic		
Retractable antenna	Y	
Fixed antenna	N	
Backlit keypad	Y	
Backlit LCD	Y	
Reversible handset charging at desktop	Y	
Reversible handset charging at wall mount	Y	
Volume switch	N	
2.5mm headset jack	Y	
Handset speakerphone	N	Y
Belt clip	Y	
Features		
Any key answer (except OFF)	Y	
# ringer types	4	
Ringer off	Y	
# speed dial entries	50	
# digits in speed dial entry	32	
Auto hang-up when handset returned to cradle	Y	
Extension-in -use indication	Y	
# ringer volume controls	3	
# ear-piece volume controls	4	
Out-of-range indicator (LCD display/LED)	LCD	

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DESCRIPTION	STANDARD FEATURE	OPTIONAL FEATURE
Memory match ringing	Y	
Telephone cord connection check	Y	
Base AC power check	Y	
Multi-handset	N	
Message waiting indication(LCD display/LED)	LCD	
Battery low indication(LCD display/LED)	LCD	
# redial	1	
Battery standby time	>7 days	
Battery talking time	>7 hours	
Line hold	Y	
Mic muting	Y	
Line flash (ms)	650 ms	
Caller ID (type)	Type II	Type 2.5
Handset intercom with base	Y	
Pause dialing	Y	
Handset privacy from interruption	N	
Handset conference mode	N	
Area code preset	Y	
Speakerphone	N	Y
CID voice announce	N	Y
Pay-per-use	N	Y
One-touch memory dialling	N	Y
Keys		
Numerical keys	12	
CHANNEL	N	
HOLD	N	/MUTE
MUTE	Y	/HOLD
PHONE ON	/FLASH	
OFF	Y	
FLASH	/PHONE	
PROGRAM	Y	
MEMORY	N	
CID	N	
REDIAL	/PAUSE	
CANCEL/DELETE	N	
INTERCOM	Y	
PAUSE	/REDIAL	
LINE 1	N	
LINE 2	N	
PRV	N	
CONF	N	
PPU keys	N	3
QUICKMEM keys	N	2
Receiver Volume (up & down)	Y	
SPEAKERPHONE	N	Y

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DESCRIPTION	STANDARD FEATURE	OPTIONAL FEATURE
SELECT	Y	
BACK (<)	Y	
FORWARD (>)	Y	
LEDs		
Speakerphone	N	backlit
Line 1		
Line 2		
Base Unit		
Mechanical /Cosmetic		
Backlit keypad	N	
Backlit LCD	N	
Allow reversible handset charging at desktop	Y	
Allow reversible handset charging at wall mount	Y	
Spare battery charger	Y	
Tone/pause switch	Y	
Ringer volume switch	Y	
Features		
Any key answer(except OFF)	N	
# ringer types	1	
# speed dial entries	10	
Extension-in-use indication	N	
# ringer volume controls	3	
# speaker volume control	8	
Ringer on/off	Y	
Memory match ringing	Y	
Speakerphone	Y	
Wall mountable	Y	
Page/handset locator	Y	
Intercom	Y	
Messaging waiting indication (LCD display/LED)	LED	
Conferencing	N	
Privacy from interruption	N	
AC power failure back-up with spare battery	Y	
Standby time with spare battery		
Talking Time with spare battery		
# redial	0	
Tone/pulse dialing	Y	
Line hold	Y	
Mic muting	Y	
Line Flash (ms)	650 ms	
CID (type) – incoming call only	N	
Handset intercom with base	Y	
Pause dialing	N	
CID voice announce	N	Y
Pay-per-use	N	

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DESCRIPTION	STANDARD FEATURE	OPTIONAL FEATURE
Keys		
Numerical keys	0	
HOLD	with LED	
MUTE	with LED	
FLASH	Y	
PROGRAM	N	
MEMORY	N	
CID	N	
REDIAL	N	
CANCEL/DELETE	N	
INTERCOM	with LED	
PAUSE	Y	
LINE 1	N	
LINE 2	N	
OFF	N	
PAGE	N	
SPK PHONE (on/off)	with LED	
CONF	N	
PRV	N	
Speaker Volume (up & down)	Y	
PPU keys	0	
LEDs		
Spare battery	red	
Charge	red	
In use	red	
New call	N	red
Message	red	
CID		
Features		
CID type	II	2.5
# CID storage	50	
Repeat indication/counter	counter	
LCD display matrix	2*16	
# characters	15	
# digits for call-back	11	
Private CID display	Y	
Transmission CID display	Y	
Unavailable CID display	Y	
New call display	Y	
Display CID tel #	Y	
Display CID name	Y	
Display CID time	Y	
Delete CID data	Y	
Save CID to speed dial entry	Y	
Keys		

DESCRIPTION	STANDARD FEATURE	OPTIONAL FEATURE
ADDITION DISPLAY	N	
ERASE/DELETE	N	
FORWARD	N	
BACKWARD	N	
TIME/DATE	N	
ITAD		
Features		
Recording time	17	
# incoming messages	99	
# mail boxes	3	4
Private mail box	N	
OGM recording	Y	
Line selection for OGM	N	
Voice menu & operating guide	Y	
Day and time setting	Y	
Ringer setting	2,4,6, toll saver	
Call screening	Y	
Factory pre-set security code	Y	
Programmable	Y	
Audio messaging alert	Y	
2-way conferencing recording	Y	
Announce-only	Y	
Remote ITAD operation	Y	
New message display	Y	
Privacy screening	N	Y
Keys		
ANSWERING MACHINE ON/OFF	with LED	
MAILBOX 1	with LED	
MAILBOX 2	with LED	
MAILBOX 3	with LED	
MAILBOX 4	N	with LED
PLAY/STOP	N	
PAUSE	N	
SKIP	/FAST	
REPEAT	/SLOW	
FAST	/SKIP	
SLOW	/REPEAT	
RECORD	/MEMO	
ERASE	Y	
MEMO	/RECORD	
TIME	/SET	
MENU	Y	
SELECT	Y	
SET	/TIME	
Message Waiting (VMWI**)**		

DESCRIPTION	STANDARD FEATURE	OPTIONAL FEATURE
FSK detection	Y	
Stutter dial detection	N	Y

1.3 System Block Diagram

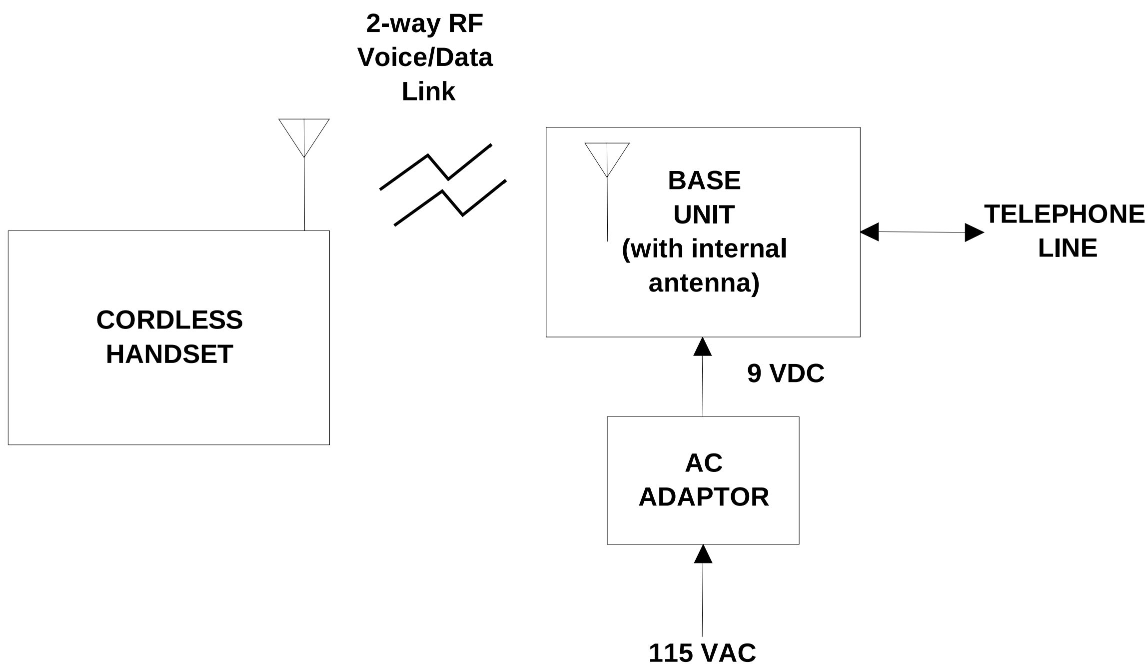

Figure 1.2 System Block Diagram

1.4 Handset Block Diagram

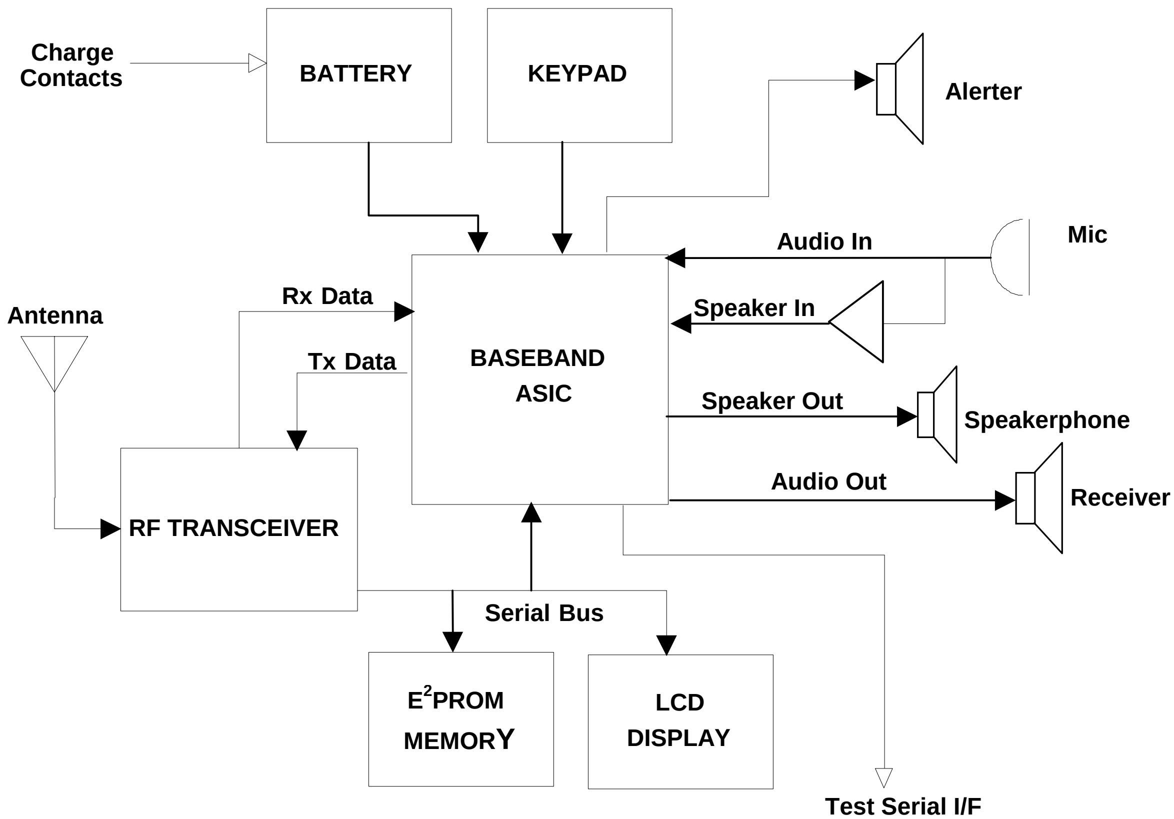

Figure 1.3 Handset Block Diagram

1.5 Base Block Diagram

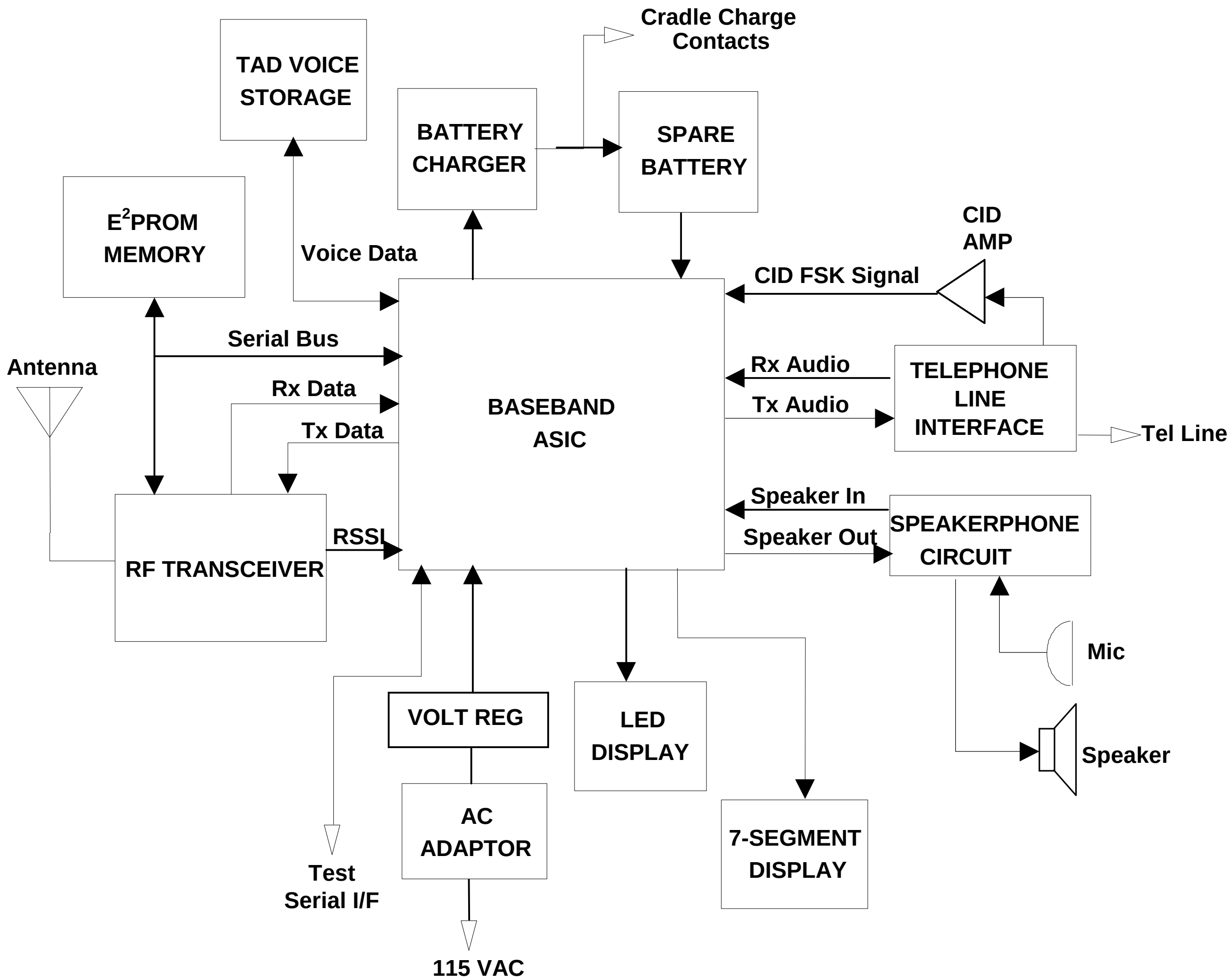

Figure 1.4 Base Block Diagram

2 RF Section Overview

2.1 Introduction

The basic function of the base and handset RF sections is to provide a full duplex wireless link between the handset and base sections of the telephone. This is accomplished by setting up two simultaneous communications links between the handset and base RF boards. The RF receiver and transmitter circuitry essentially provide a link between the microphone and receiver in the handset to the telephone line in the base set. In this way the phone performs exactly as a corded phone, except without the cord.

The frequency at which the handset transmits to the base is centered around 926.55 MHz, and the frequency at which the base transmits to the handset is centered around 903.8 MHz. The data rate which is modulated onto the RF carrier is 48 kbps. On the receiver side, the data is extracted and then converted back into the original audio signal.

It is important to note that the synthesizer / pre-scaler IC only operates up to 500 MHz. The VCO's therefore oscillate at roughly 450 MHz. The 900 MHz signals needed for the transmit and receive sections are generated from the second harmonic of the VCO frequencies.

The following section will outline the transmit frequencies used as well as the corresponding LO frequency which is used for the receiver. This is followed by the block diagram and a block-by-block functional description of the modules.

2.2 Frequency Tables

This section outlines the RF frequencies and corresponding channel numbers. The handset uses a high side LO while the base uses a low side LO to down-convert the incoming signal.

2.2.1 Base Unit Frequencies

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
1	902.30 MHz	925.05 MHz	914.35 MHz
2	902.60 MHz	925.35 MHz	914.65 MHz
3	902.90 MHz	925.65 MHz	914.95 MHz
4	903.20 MHz	925.95 MHz	915.25 MHz
5	903.50 MHz	926.25 MHz	915.55 MHz
6	903.80 MHz	926.55 MHz	915.85 MHz
7	904.10 MHz	926.85 MHz	916.15 MHz
8	904.40 MHz	927.15 MHz	916.45 MHz
9	904.70 MHz	927.45 MHz	916.75 MHz
10	905.00 MHz	927.75 MHz	917.05 MHz
11	902.45 MHz	925.20 MHz	914.50 MHz
12	902.75 MHz	925.50 MHz	914.80 MHz
13	903.05 MHz	925.80 MHz	915.10 MHz
14	903.35 MHz	926.10 MHz	915.40 MHz

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
15	903.65 MHz	926.40 MHz	915.70 MHz
16	903.95 MHz	926.70 MHz	916.00 MHz
17	904.25 MHz	927.00 MHz	916.30 MHz
18	904.55 MHz	927.30 MHz	916.60 MHz
19	904.85 MHz	927.60 MHz	916.90 MHz
20	905.15 MHz	923.10 MHz	912.40 MHz
21	905.45 MHz	923.40 MHz	912.70 MHz
22	905.75 MHz	923.70 MHz	913.00 MHz
23	906.05 MHz	924.00 MHz	913.30 MHz
24	906.35 MHz	924.30 MHz	913.60 MHz
25	906.65 MHz	924.60 MHz	913.90 MHz
26	905.30 MHz	923.25 MHz	912.55 MHz
27	905.60 MHz	923.55 MHz	912.85 MHz
28	905.90 MHz	923.85 MHz	913.15 MHz
29	906.20 MHz	924.15 MHz	913.45 MHz
30	906.50 MHz	924.45 MHz	913.75 MHz

2.2.2 Handset Frequencies

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
1	925.05 MHz	902.30 MHz	913.00 MHz
2	925.35 MHz	902.60 MHz	913.30 MHz
3	925.65 MHz	902.90 MHz	913.60 MHz
4	925.95 MHz	903.20 MHz	913.90 MHz
5	926.25 MHz	903.50 MHz	914.20 MHz
6	926.55 MHz	903.80 MHz	914.50 MHz
7	926.85 MHz	904.10 MHz	914.80 MHz
8	927.15 MHz	904.40 MHz	915.10 MHz
9	927.45 MHz	904.70 MHz	915.40 MHz
10	927.75 MHz	905.00 MHz	915.70 MHz
11	925.20 MHz	902.45 MHz	913.15 MHz
12	925.50 MHz	902.75 MHz	913.45 MHz
13	925.80 MHz	903.05 MHz	913.75 MHz
14	926.10 MHz	903.35 MHz	914.05 MHz
15	926.40 MHz	903.65 MHz	914.35 MHz

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
16	926.70 MHz	903.95 MHz	914.65 MHz
17	927.00 MHz	904.25 MHz	914.95 MHz
18	927.30 MHz	904.55 MHz	915.25 MHz
19	927.60 MHz	904.85 MHz	915.55 MHz
20	923.10 MHz	905.15 MHz	915.85 MHz
21	923.40 MHz	905.45 MHz	916.15 MHz
22	923.70 MHz	905.75 MHz	916.45 MHz
23	924.00 MHz	906.05 MHz	916.75 MHz
24	924.30 MHz	906.35 MHz	917.05 MHz
25	924.60 MHz	906.65 MHz	917.35 MHz
26	923.25 MHz	905.30 MHz	916.00 MHz
27	923.55 MHz	905.60 MHz	916.30 MHz
28	923.85 MHz	905.90 MHz	916.60 MHz
29	924.15 MHz	906.20 MHz	916.90 MHz
30	924.45 MHz	906.50 MHz	917.20 MHz

2.3 Block Diagram

Both the handset and base RF sections follow the same block diagram shown below with only minor changes to incorporate the different transmit and receive frequencies.

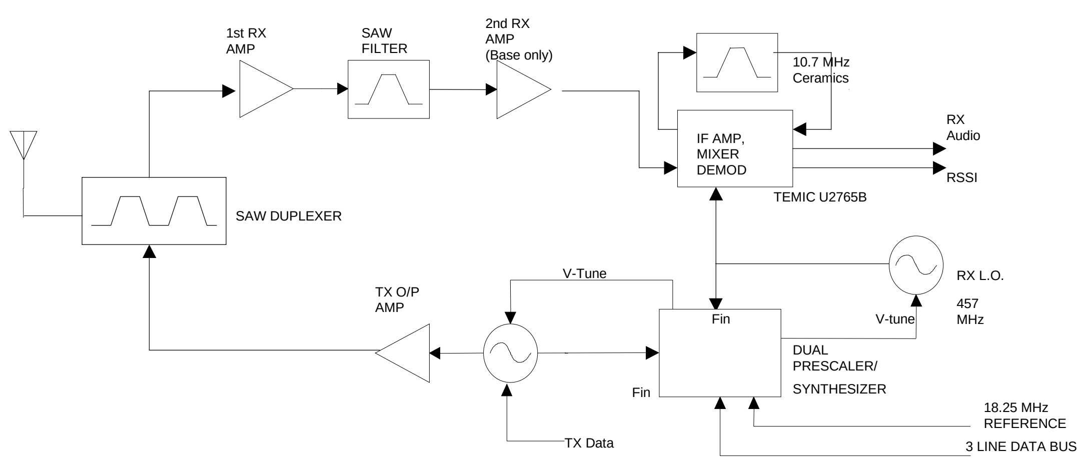

Figure 2.3 RF Section Block Diagram

As can be seen by the block diagram, there are several important input/output signals which are necessary for operation of the RF section (this does not include the separate supply lines for both TX and RX sections). An 18.25 MHz reference is present for use in the frequency synthesizers. The accuracy of this 18.25 MHz input will affect the transmit and receive frequencies. In order to ensure proper operation of the RF sections, the 18.25 MHz reference signal must be at least 500 mV in amplitude. Also present is the 3-line serial synchronous data bus on which data is transferred to the synthesizers to set both the transmit and receive frequencies.

In the transmit direction, modulation input allows digital data to be modulated directly onto the TX carrier.

In the receive direction, the RF section performs a single down-conversion of the incoming RF signal to 10.7 MHz where it is demodulated and sent to the AMD ASIC. The Data output is the demodulated signal which is sent to the ASIC to be filtered and shaped by an internal data slicer. The reconstructed data represents the original voice which is can then be processed by the DSP in the ASIC..

The following section explains the individual blocks in the RF section in detail. All reference to part numbers correspond to the handset schematic.

3 RF Section Detailed Operation

3.1 Antenna Section

3.1.1 Antenna

The antenna is a device which allows effective conversion of energy from air to the RF circuitry. The antennas used are a retractable 1/2 wave with 2.5 dB gain relative to an isotropic radiator and a fixed 1/4 wave antenna with roughly 0 dB gain relative to an isotropic radiator. The duplexer and filters which follow the antenna, require a 50 Ω match to operate properly. The antenna is roughly matched to 50 Ω and requires a simple microstrip matching network to achieve this. If a network analyzer is attached to the BFA connector after disconnecting the duplexer, the antenna match may be measured. In order to achieve a good 50 Ω match, one must be careful not to obstruct the antenna as any object near the antenna will affect its impedance.

3.1.2 SAW Duplexer

The SAW Duplexer consists of two bandpass filters to provide the necessary isolation between transmit and receive sections and to pass the correct frequencies to transmit and receive sections. To ensure that the Duplexer is operating correctly, the match looking into the filters from the BFA connector may be measured. To do this it is necessary to remove the 0 Ω resistor which connects the antenna to the Duplexer. A return loss of approximately 15 dB should be measured for both the TX and RX bands.

3.2 Receive Section

3.2.1 RX Amps and SAW Filter

The purpose of the first RX amp is to provide enough gain that the noise figure of the RX section is fixed to as low a value as possible. It must provide a good 50 Ω match to both the RX bandpass filter and the SAW filter. This amplifier must also have good power handling capability due to the limited filtering that precedes it. The design employs a collector inductor to improve the output power capability of the transistor. This form of matching also ensures that the gain of this stage is not too wide band, further improving its performance by allowing it to effectively reject signals that are far out of its passband.

Directly following the first RX amp is the SAW filter. This filter is responsible for the bulk of the filtering in the receive section. It provides more than 40dB of image rejection and TX carrier suppression. The insertion loss of this filter is relatively high due to its SAW implementation. It has an insertion loss of less than 5 dB, typically 4 dB. An amplifier is required before this SAW filter to keep the noise figure low. If it were not present, the noise figure of the phone would increase by the 4-dB loss associated with the SAW filter.

The second RX amp provides a limited amount of gain. Its main function is to ensure that the mixer sees a good wideband match. Measuring the RX gain from the BFA connector to the output of this amplifier will produce results as shown in Figure 4 below.

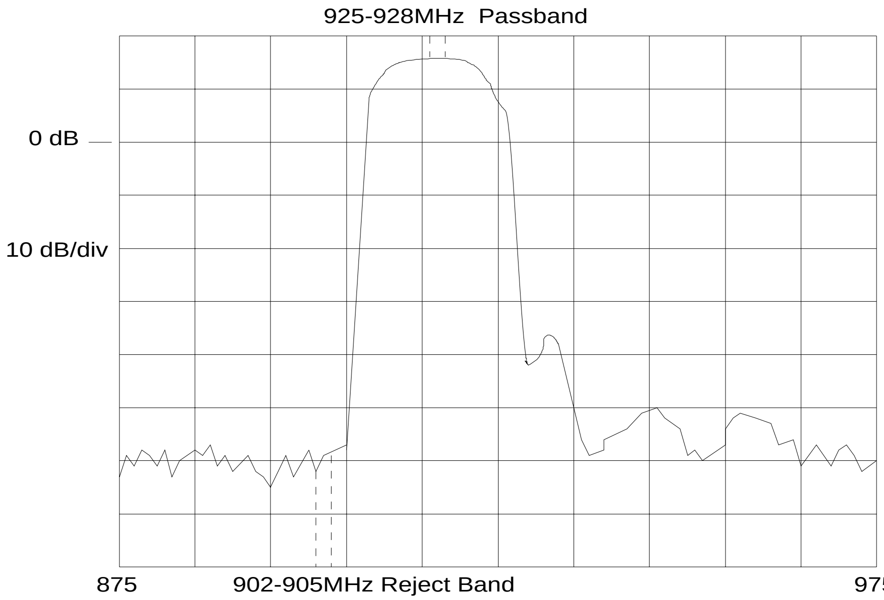

Figure 3.2.1 RX Front End Response

3.2.2 RX Mixer

The function of the mixer is to combine the incoming signal with a LO signal in order to convert the desired signal to the 10.7 MHz IF frequency. The mixer used for this task is a dual gate FET (NEC 25139). The LO and RF signals are placed on the gates of the FET and the IF signal is coupled off of the drain. The FET provides conversion gain along with adequate power handling characteristics. Both the RF and LO ports are shorted to ground by spiral microstrip inductors on base unit and, spiral microstrip and SMT inductors on the handset. These inductors provide a high impedance at both the RF and LO frequencies while presenting a very low impedance at the IF frequency. The mixer is followed by an emitter follower which converts the high impedance output of the mixer to a 330 Ω output suitable for directly driving the IF ceramic filters. The gain for the pair (mixer and follower) is about 4 dB (50 Ω in, 330 Ω out).

3.2.3 RX VCO and LO Buffer

The RX VCO is a Colpitt's type oscillator operating at about 450 MHz with a frequency selective network tuned to about 900 MHz on the collector. The frequency of oscillation is controlled by a varactor diode in the tank circuit connected to the base of the transistor. This diode is connected to the loop voltage from the RX synthesizer. Rough tuning is achieved with a variable chip cap. This capacitor is used to center the tuning voltage to ensure reliable operation over a wide temperature range and also to compensate for variances in component values.

The 450 MHz LO for the PLL is coupled off of the emitter of the VCO transistor. This is lightly coupled to ensure that the VCO is not loaded by the PLL. The 900 MHz RX LO signal for the Mixer is coupled off the collector of the VCO transistor.

3.2.4 RX Synthesizer

The PLL and prescaler for both the TX and RX sides are now combined into one IC. The Synthesizer receives channel information from the embedded microprocessor in the AMD ASIC via the serial buss. It also requires a stable 18.25 MHz reference that is also supplied from the AMD ASIC.

A passive loop filter is employed to connect the synthesizer to the VCO. This tuning voltage may be observed from test point RX_LOOP_V on the bottom side of the PCB. The loop filter cutoff frequency is set to about 1 kHz to allow relatively fast power-up times.

3.2.5 IF Amplifier Stage

There is only one stage of discrete IF amplification. Transistor Q8 on the base (Q5 on handset) is used as an amplifier with 330 Ω input and output impedance. The rest of the IF gain is provided by the FM demod IC discussed below.

3.2.6 IF Filtering

The choice of 10.7 MHz as an IF frequency, allows the use of relatively inexpensive filters. Two ceramic filters are used to achieve the desired adjacent channel suppression. Two different bandwidth filters are used, 230 kHz and 150 kHz, so that any shifting in the passband does not narrow the bandwidth excessively.

3.2.7 Mixer, IF Amplifier, FM Demodulator (Temic IC)

The RF design uses an integrated solution that provides a number of different receiver functions on a single silicon chip. The Temic U2765B IC combines a, mixer down-converter, IF amplifier and FM demodulator onto one device.

3.2.7.1 Rx Mixer

The function of the mixer is to combine the incoming signal with a LO signal in order to convert the desired signal to the 10.7 MHz intermediate frequency (IF). The LO and RF signals are coupled onto pins 26 and 3 respectively on the Temic IC. The mixer output is coupled off of the Temic IC by a 10.7 MHz transformer to a 10.7 MHz ceramic IF filter before it is injected into limiter 1 within the Temic IC. The output of limiter 1 is coupled off of the Temic IC into another 10.7 MHz ceramic IF filter.

3.2.7.2 IF Amplifier Stage

There is a two-stage limiting amplifier integrated with the Temic IC. Both of the limiters require external 10.7 MHz ceramic IF filters.

3.2.7.3 Demodulator

The quadrature circuit is made up one inductor, one resistor, and two capacitors. One of the two capacitors is a variable capacitor that allows tuning of the circuit. The quadrature voltage may be observed at the ATE test point connector. This voltage should nominally be 1.2 V for both the base and handset when a signal is centre tuned.

The recovered audio signal from the demodulator has a peak-to-peak amplitude of approximately 0.31 V (for 50 kHz peak-to-peak modulation). One path from the recovered audio port is filtered through a low-pass data filter and passed back into the baseband module.

3.2.7.4 RSSI Comparator

The U2765B provides an RSSI voltage that is proportional to the input signal level that is then sent to the ASIC A/D pin.

3.3 Transmit Section

3.3.1 TX Amp

There is one transistor which provide the necessary gain for the transmit section. Transistor Q1 amplifies the signal from the TX VCO. The output power is set such that we guarantee less then 50mV/meter radiated field strength measured at 3 meters.

3.3.2 TX VCO

The basic operation of the TX VCO is the same as the RX VCO, except for one detail. The TX VCO is also FSK modulated by the transmit data through a second varactor in the tank (25 kHz peak-to-peak). The data is first filtered and then the amplitude is set via a precision resistor divider (R119/R120 on handset and R27/R179 on base) to set the deviation of the data modulation.

3.3.3 TX Synthesizer/PLL

The TX PLL is combined into one IC with the RX PLL. See above. The loop filter cutoff frequency is about 100 Hz. This allows the data modulation to include frequencies down to about 100 Hz. The power-up time of the TX PLL is not critical.

4 Baseband Section

4.1 General Description

The AMD 79C493 ASIC is a custom designed IC, which consists of a VTech proprietary FDD protocol block plus a unique baseband architecture

The AMD ASIC performs virtually all the non-RF functions. The base and handset ASICs are identical with the exception of the ROM code that will be masked into the ASIC prior to mass production.

79C493 Block Diagram

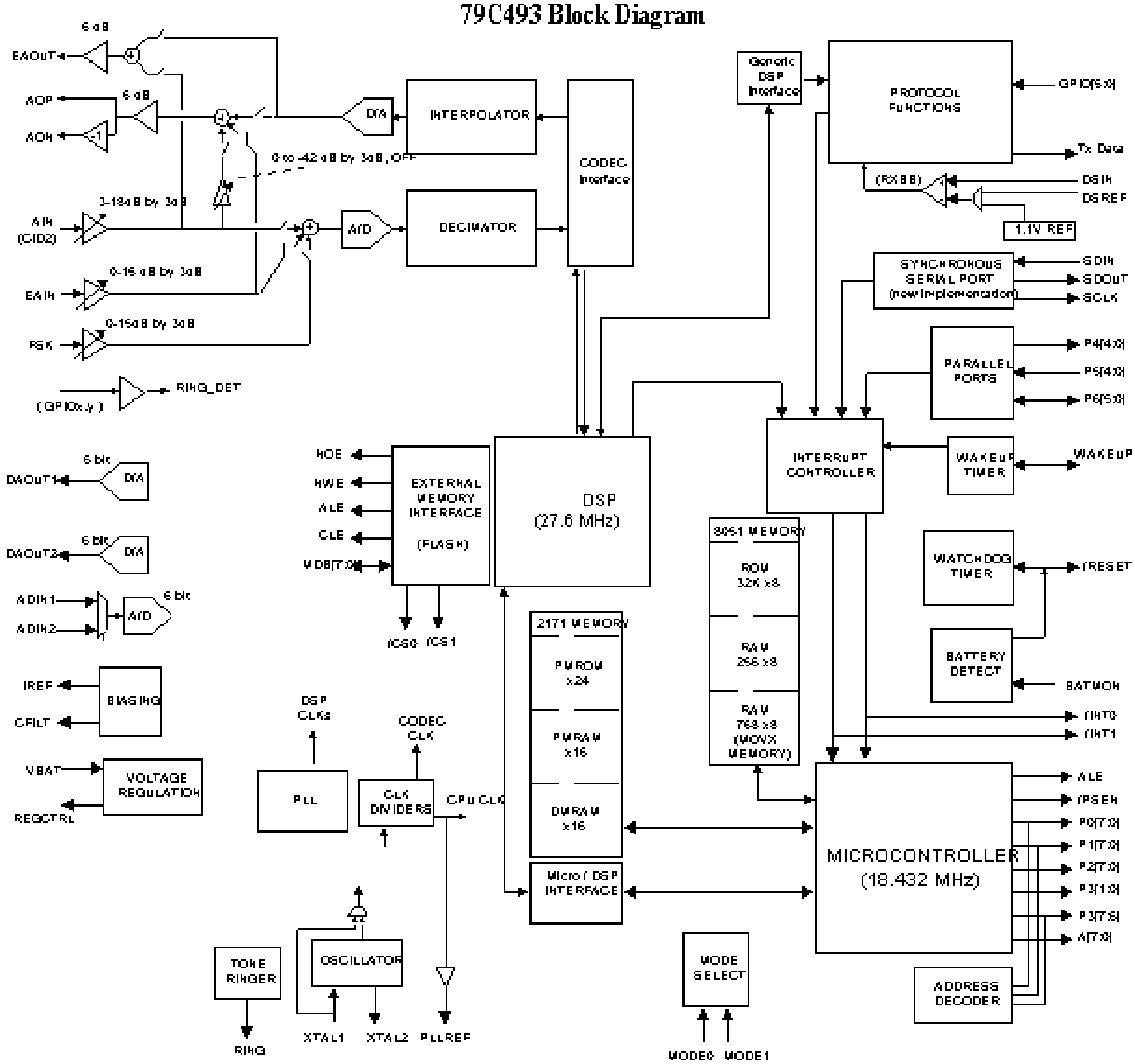

Figure 4.1 ASIC - Internal Structure Diagram

4.2 Detailed Functional Description

4.2.1 Protocol Functions

The protocol block conducts a signaling and a voice channel in the transmit and receive directions. All data I/O are CMOS levels.

4.2.2 Audio Functions

CODEC. The CODEC transcodes analog voice signals and digital voice data.

Audio Front End. The audio front end connects the analog voice I/O pins to the CODEC.

Tone Ringer. The tone ringer produces amplitude controllable square-wave ringing tone signals for output on the RING pin.

Biasing. The biasing circuits establish precision currents and voltage references to support audio and battery detection analog operations.

DTMF Generator. The DTMF generator produces digitally-generated tones for DTMF dialing and call progress tones.

4.2.3 DSP Functions

CODEC: The codec transcodes digital voice data and 32 kbps ADPCM data.

Audio Front End: The audio front end connects the analog voice I/O pins to the codec.

Tone Ringer: The tone ringer produces digital square-wave ringing tone signals for output on the RING pin.

Biasing: The biasing circuits establish precision currents and voltage references to support audio and battery detection analog operations.

DTMF Generator: The DTMF generator produces digitally-generated tones for DTMF dialling and call progress tones.

CID FSK: The DSP can execute an algorithm that does the FSK demodulation for Caller ID data and presents the microcontroller with the demodulated data.

CAS Tone Detection: The DSP can execute an algorithm that does the CAS tone detection for Caller ID Type II.

TAD: A TAD function is implemented including a memory management algorithm for a serial flash memory, which can have bad sectors.

4.2.4 System Control Functions

Microcontroller: An 8-bit 80C32T2 microcontroller executes the program and controls the protocol logic and other hardware configuration. It includes 32 Kbytes of mask-programmable ROM and a total of 1K bytes of RAM. It also includes an asynchronous serial port.

Synchronous Serial Port: The serial port provides a synchronous serial link to devices such as RF synthesizers, serial EEPROMs, etc. This is a different serial port function from that in the Am79C490 and Am79C491.

Peripheral Ports: The peripheral ports are for general purpose I/O functions. One port is designed such that any change of state generates an interrupt for the key scanning function.

Regulator Control: The regulator control function controls an external bipolar transistor to implement a regulating function to provide a steady voltage to the rest of the system.

Battery Level Detector: The battery level detector reports the low battery condition to prevent misoperation when batteries are low. It also emits a dead battery control signal which can be used to hold the device in a disabled, low power state and a high level detection for battery charging control.

Watchdog Timer: The watchdog timer protects the system from errant software by periodically issuing a reset unless serviced by software.

Wakeup Timer: The wakeup timer is a multivibrator controlled by external passive components to effect a low power periodic wakeup for call detection.

Interrupt Controller: The interrupt controller structures the various interrupts for manageable service by the microcontroller.

Clock Generator: The clock generator creates required internal timing signals from the crystal operating at 18.25 MHz. It also generates a PLL reference at the crystal frequency.

Address decoder: The address decoder generates strobes accessing selected address spaces in the device.

4.3 Port Pin Assignment and Functions

4.3.1 Handset Port Pin Assignment

Port #	Functional Description	Direction	Logic
P0.0-7	ADDRESS/DATA BUS		TRI-STATE
P1.0	\On Cradle	OUTPUT	ACTIVE LOW
P1.1	\Backlighting	OUTPUT	ACTIVE LOW
P1.2	\Speaker Enable	OUTPUT	ACTIVE LOW
P1.3	EEPROM2 Select	OUTPUT	ACTIVE LOW
P1.4	Keypad Output	OUTPUT	ACTIVE LOW
P1.5	LCD_E	OUTPUT	ACTIVE HIGH
P1.6	LCD_R/W	OUTPUT	
P1.7	LCD_RS	INPUT	ACTIVE HIGH
P2.0	ADDRESS BUS		TRI-STATE
P3.0	ATE DATA RX	INPUT	
P3.1	ATE DATA TX	OUTPUT	
P4.0	Keypad Output	OUTPUT	ACTIVE LOW
P4.1	Keypad Output	OUTPUT	ACTIVE LOW
P4.2	Keypad Output	OUTPUT	ACTIVE LOW
P4.3	Keypad Output	OUTPUT	ACTIVE LOW
P4.4	Keypad Output	OUTPUT	ACTIVE LOW
P5.0	Keypad Input	INPUT	
P5.1	Keypad Input	INPUT	

Port #	Functional Description	Direction	Logic
P5.2	Keypad Input	INPUT	
P5.3	Keypad Input	INPUT	
P5.4	Keypad Input	INPUT	
P6.0	LCD_DB4	OUTPUT	
P6.1	LCD_DB5	OUTPUT	
P6.2	LCD_DB6	OUTPUT	
P6.3	LCD_DB7	OUTPUT	
P6.4			
P6.5			
GPIO.0			
GPIO.1			
GPIO.2	PLL Enable	OUTPUT	ACTIVE HIGH
GPIO.3	\TX Enable	OUTPUT	ACTIVE LOW
GPIO.4	\RX Enable	OUTPUT	ACTIVE LOW
GPIO.5	EEPROM1 Select	OUTPUT	ACTIVE HIGH

4.3.2 Base Port Pin Assignment

Port #	Functional Description	Direction	Logic
P0.0-7	ADDR/DATA BUS		
P1.0	\Ring Detect	INPUT	ACTIVE LOW
P1.1	\Hook Sw	OUTPUT	ACTIVE LOW
P1.2	\Pots Mode	INPUT	ACTIVE LOW
P1.3	\On Cradle	INPUT	ACTIVE LOW
P1.4	Fast Charge	OUTPUT	ACTIVE HIGH
P1.5	ISD RAC	INPUT	ACTIVE HIGH
P1.6	ISD Interrupt	INPUT	ACTIVE LOW
P1.7	ISD Select	OUTPUT	ACTIVE LOW
P2.0	ADDRESS BUS		
P3.0	ATE DATA RX	INPUT	
P3.1	ATE DATA TX	OUTPUT	
P4.0	Keypad Output	OUTPUT	ACTIVE LOW
P4.1	Keypad Output	OUTPUT	ACTIVE LOW
P4.2	Keypad Output	OUTPUT	ACTIVE LOW
P4.3	Keypad Output	OUTPUT	ACTIVE LOW
P4.4	Keypad Output	OUTPUT	ACTIVE LOW

TITLE	Theory of Operation
MODEL	VTECH PDLci MK3 - 900MHz Single-Line Digital Cordless Telephone with Caller ID, Base Speakerphone & TAD

Port #	Functional Description	Direction	Logic
P5.0	Keypad Input	INPUT	
P5.1	Keypad Input	INPUT	
P5.2	Keypad Input	INPUT	
P5.3	Keypad Input	INPUT	
P5.4	Keypad Input	INPUT	
P6.0			
P6.1			
P6.2			
P6.3			
P6.4			
P6.5			
GPIO.0	\Ringer Lo	INPUT	ACTIVE LOW
GPIO.1	\Ringer Hi	INPUT	ACTIVE LOW
GPIO.2	PLL Enable	OUTPUT	ACTIVE HIGH
GPIO.3	\TX Enable	OUTPUT	ACTIVE LOW
GPIO.4	Tone/Pulse	INPUT	
GPIO.5	EEPROM Select	OUTPUT	ACTIVE HIGH