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CT6558

Document Version

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Edited by

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1. Abstract

This document gives brief technical specification & description of our product—CT6558.

2. Abbreviations

AMR Adaptive Multi Rate
CSFB Credit Suisse First Boston
EFR Enhanced Full Rate
EOTD Enhanced Observed Time Difference
FR Full Rate
LCD Liquid Crystal Display
OTA Over The Air
PDA Personal Digital Assistant
STN Super Twist Nematic
SMS Short Message Service
STK SIM Toolkit
TBD To Be Define
TBC To Be Confirmed
UART Universal Asynchronous Receiver/Transmitter
USB Universal Serial Bus
WAP Wireless Application Protocol
ANT Antenna
BB Base Band
BAI Baseband-Audio-Interface
DAI Digital-Audio-Interface
GPRS General Packet Radio Service
GSM Global system for mobile communications
IC Integrated circuit
IrDA Infra-red Data Adapter
IF Intermediate frequency
JTAG IEEE standardized test interface for IC's
LP Lowpass
MCP Multi Chip Package
NZIF Near Zero IF
PA Power amplifier
PCB Printed Circuit Board

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PCS Public cellular system

PMU Power Management Unit

RF Radio Frequency

RX Receiver

SIM Subscriber Identity Module

TC Transceiver

TX Transmitter

VCO Voltage controlled oscillator

VTCXO Voltage controlled temperature compensated x-tal oscillator

3. Product Features

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3.1 Main Features

Features	Specifications
Size	85mm X 45mm X 24 mm
Volume	77cc
Weight	85 g
Type	Clamshell
Battery	600mAh minimum guaranteed capacity
Talk time	Up to 250mm
Standby time	Up to 400h
Main Display	CSTN 65K Colors 128*160
Sub Display	B&W 80*48 (reversed screening) + EL backlighting
Polyphonic Melodies	64 channels MIDI formats
Camera	VGA camera
Back light	Blue back light for keypad
Band supported	E-GSM900/1800/1900
Vocoder	AMR/FR/EFR/HR
Antenna type	Integrated
Phone book	High capacity associated with icons/pictures/High-capacity SMS storage
WAP	1.2.1+ OTA provisioning
Multimedia Messaging Service	Yes
JAVA	2.0
Enhanced Messaging Service	EMS v 4.0
SIM Toolkit	Class 3 release '99
GPRS	10
Fototalk	Yes
Color screen savers & wall papers	JPEG/BMP/animated GIF formats
Personalization downloadable multimedia content	SMS, Email, MMS
Vibrator	Yes
Side key	Needed for volume control
Operation frequency in PCS 1900	Uplink 1850 to 1890 MHz Downlink 1930 to 1970 MHz
Game	Embedded and downloadable games
Calculator	Yes

3.2 Output power

Power Level	Output Power (Channel 661) ± 2 dBm
0	29
1	27.5
2	26
3	24
4	22
5	20
6	18
7	16
8	14
9	12
10	10.5
11	9
12	7.5
13	6
14	4.5
15	3.0

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4. Solution of the product

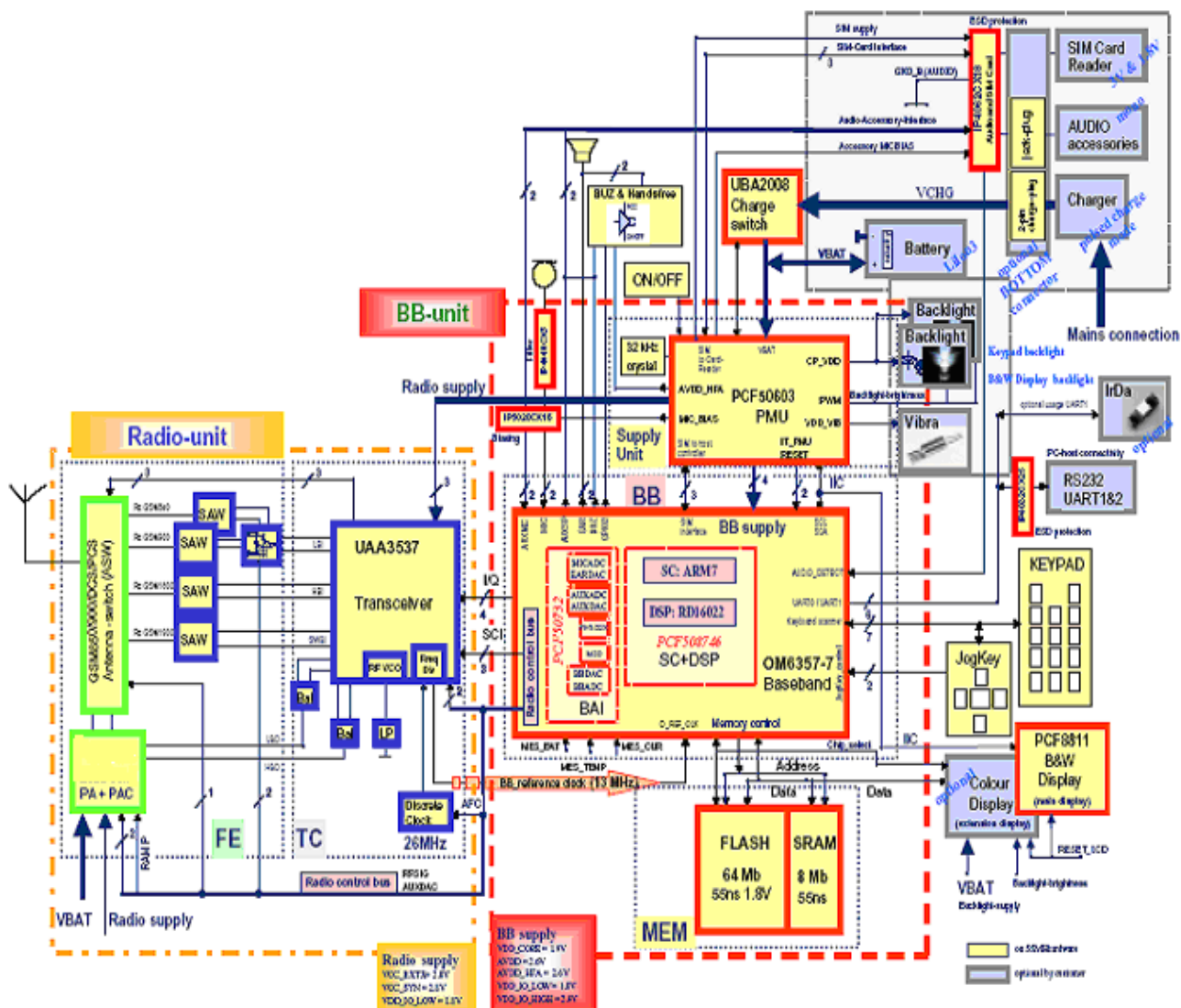
The CT6558 hardware consists of the GSM/GPRS Modem in addition of the peripherals and accessories to build a complete mobile terminal hardware. The GSM/GPRS Modem consists of the main or core building blocks, the subsystems:

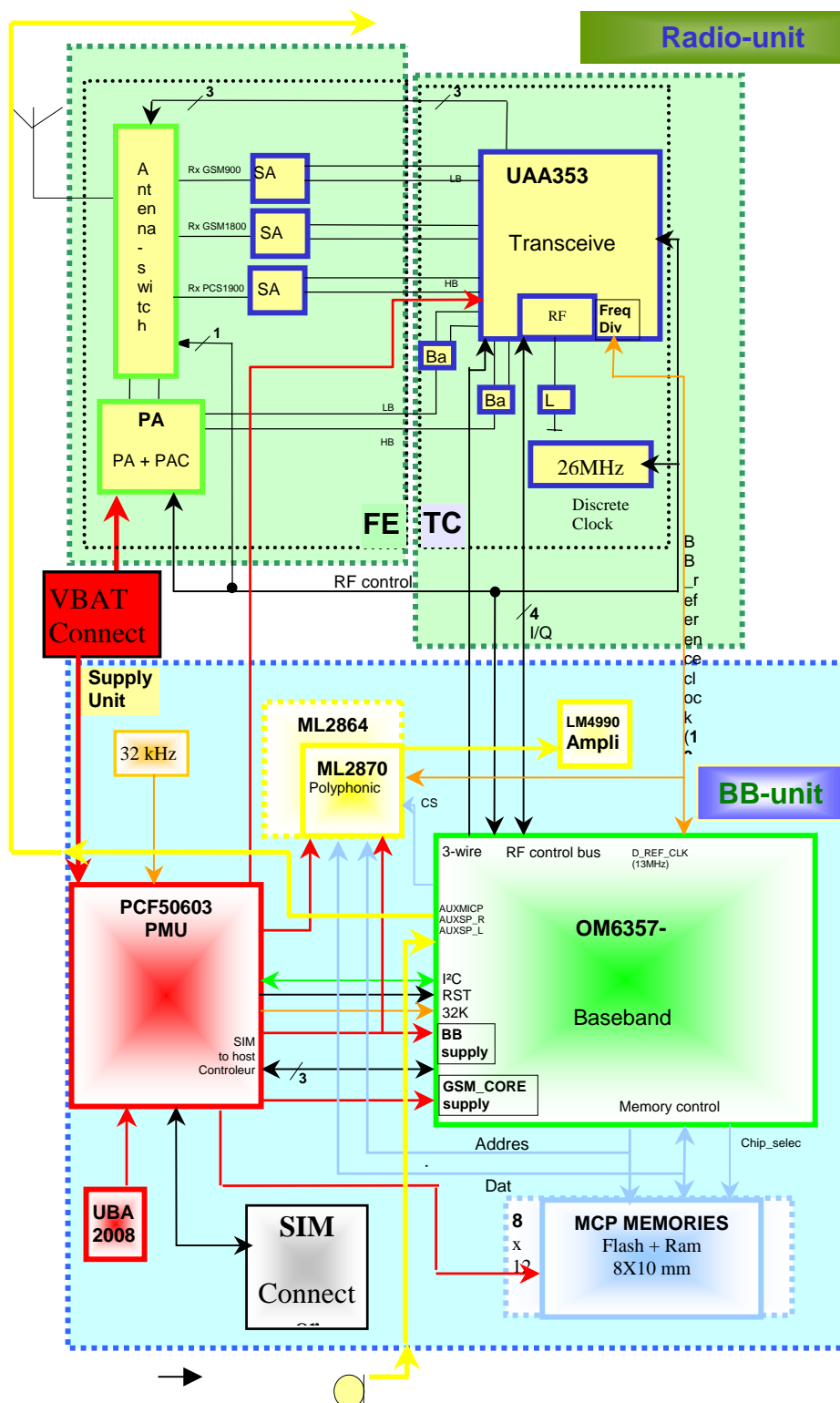
- **Radio-unit (RF)**
- **BaseBand-unit (BB)**

Subsystem	Function	IC
Radio-unit *)		
Transceiver: TC	GSM/DCS/PCS multi-band transceiver	UAA3537
	26MHz crystal, semi-integrated reference clock oscillator with external tuning components for reference clock AFC	
Front End: FE	Quad-Band GSM power amplifier with integrated control loop	SKY77324
	GSM850-EGSM900 switch. Switch two circuits in-lines for low band receiver	
	Quad-band antenna RX/TX switch module	
BB-unit		
Baseband	Baseband Audio Interface and Baseband processor (DSP and SC)	OM6357-7
Supply Unit	PMU: - ON/OFF, digital and analog I/O supply, reset generation and real time clock - SIM-card interface and supply (1.8V or 3V) - support battery charge	PCF50603
Memory	processor data memory: COMBO FLASH/SRAM (1.8V supply) reference board configuration: - 64Mb FLASH and 8Mbit SRAM Mobile terminal application it is requested: - FLASH (32Mb GPRS mode, 16Mb GSM only mode) - SRAM (4Mb GPRS mode, 2Mb GSM only mode)	
Peripherals		
Display	Main display: connectivity on IIC bus, placed on the CT6558 hardware. B&W LCD module: with 80x128 dots	
ESD	passive filter and ESD protection for audio microphone	
	passive filter and ESD protection for serial link connectivity (UART1 and UART2)	
	passive filter and ESD protection for external audio accessory and SIM-card interface	
	passive filter and ESD protection for microphone supply and AC coupling	
Battery charge	Pulsed_charge: charge switch, connection between charger input and battery needed to support pulsed charge mode for battery charge	

CT6558 GSM/GPRS Modem Block diagram

The block diagram shows the main building blocks inside the subsystems: Radio-unit (FE and TC) and BB-unit (BB, MEM, Supply-Unit). Following the main building and functional blocks of the block diagrams are described.





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5. RF Solution

The Radio-unit consist of all receiver, transmitter and high frequency generation and receive sections of the CT6558 hardware.

It represents the transition to the air-interface, the Radio-link between the GSM-network basestation and the mobile terminal.

5.1 Front End

This building block separate and switch the radio frequency signal from the receive/transmit antenna connector via an RF-PIN-diode switch into the receive and transmit part as well as a separation into the four receive bands and the transmit high and low band. For each of the four receive chains the corresponding SAW-filter prevents high level out-of band signals to the following receive low noise amplifiers (LNA). To realize a full quad-band application for the receive chain, with respect to the only 3-differential receive inputs of the UAA3537 transceiver, a circuitry combines the two low band receive chains for GSM850 and EGSM900 into one differential low-band receive signal input to the transceiver. For the transmit part, the complete power amplifier (Sky77324) for high and low band with integrated control loop generates the output power corresponding to the GMSK-GSM power class. The power amplifier is switched via the radio control signal DCS=RFSIG(1) from LB into HB frequency range. The PA is used as voltage controlled gain amplifier (typical 0...35dB) controlled by the RAMP voltage (AUXDAC3).

The RF input power coming from the transceiver is set on a constant level. The PA output power is controlled via the level of the analog control voltage RAMP. This control input voltage RAMP for controlling the output power as well as the GSM confirm up- and down-ramping is generated by the BB DAC voltage AUXDAC3 (10bit) coming from the BAI of the BB-unit. The integrated power detection and control loop compensate output power variations via supply voltage, RF input voltage and temperature, thus the transmitted output power is fully compliant to the ETSI specification regarding power time-template and power spectrum requirements.

5.2 Transceiver

This building block consists mainly out of the transceiver chip UAA3537. On the receive input chain the GSM-band separated signal from the FE is amplified by four available LNAs configured to allow 3-receive-chains for low, high and switched band. For the switched LNA, the PCS band is used as the roaming band, with respect to the 0.5dB lower noise performance. The amplified receive signal is converted down to a low IF of -100kHz (sideband select is set in supradyn mode) with high image suppression. The IF section of the receiver chain further provides integrated bandpass filter (polyphase-filter) for channel selectivity and gain control to adjust the differential IQ output level to the levels for the dynamic range of the BBADC of the BAI from the BB-unit. The integrated DC notch filter (BW: 6kHz) for easy DC compensation in the receiver chain offers active DC compensation.

The transmitter chain is using a direct up conversion architecture, the modulated differential IQ signals coming from the BB DAC of the BAI from the BB-unit. The mixer output stages are set to a fix TX-AGC step and an constant output level is send to the PA.

The RF local oscillator for the receive and transmit frequency generation is fully integrated and self calibrated except of the low pass filter from the PLL. The frequency of the RFVCO is set by an internal

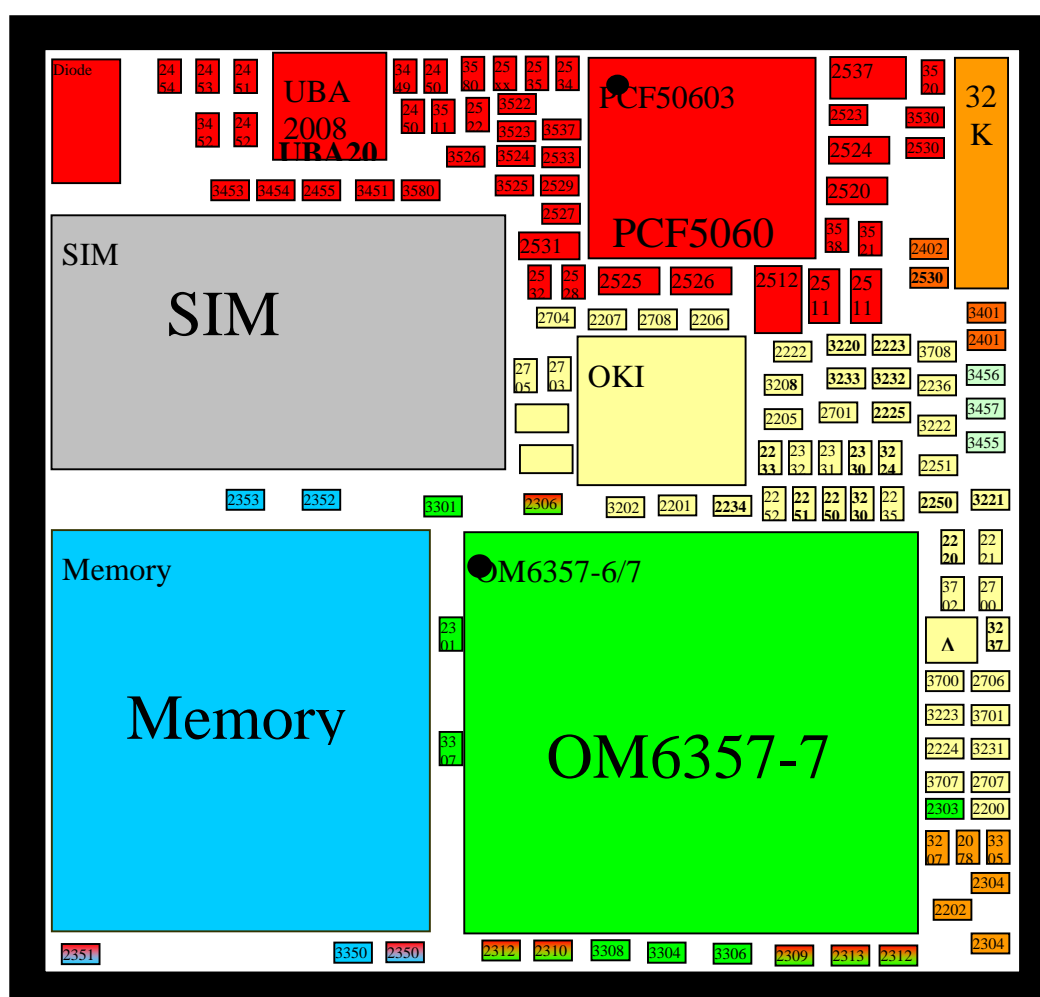
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fractional N synthesizer, programmable via serial 3-wire programming commands controlled by the BB-unit.

26MHz is the reference frequency for the synthesizer. On the CT6558 hardware for the reference frequency generation an semi-integrated reference clock oscillator is used. All the active parts from the oscillator are integrated on the transceiver chip, the 26MHz crystal, the tuning varactor diode and the coupling capacitors as well as the temperature compensation passives are placed as discrete components on the reference design board. Via the analog control voltage AFC controlled by AUXDAC2 of the BAI from the BB-unit, the reference clock is frequency adjusted to reach GSM network synchronization. The divided by 2 and buffered reference clock signal from the transceiver deliver the 13MHz reference frequency signal CLKOUT, the system reference clock for the whole mobile terminal and is clocking the BB-unit processors.

6. Baseband Solution

The BB-unit consists of all the baseband- and audio-signal generation sections as well as all the digital, power management and voltage supply sections of the CT6558 hardware. It represents mainly all the internal digital processing, the controlling of the Radio-unit and the power management of the mobile terminal.



The baseband building block consists out of the baseband chip OM6357-7 into one single IC package. It's

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mainly divided into the subsystems: system controller (SC: ARM7), digital signal processor (DSP: RD16022), their intercore subsystem and the base-band-audio system (BAI). The intercore subsystem provides all internal and external interfaces for Radio- and BB-control. The BAI provide the modulated baseband IQ-signal generation (TX: BBDAC) and demodulation (RX: BBADC) and the base-band-audio section. For the audio part of the mobile terminal, the microphone bias is supplied by the BAI of the BB-unit.

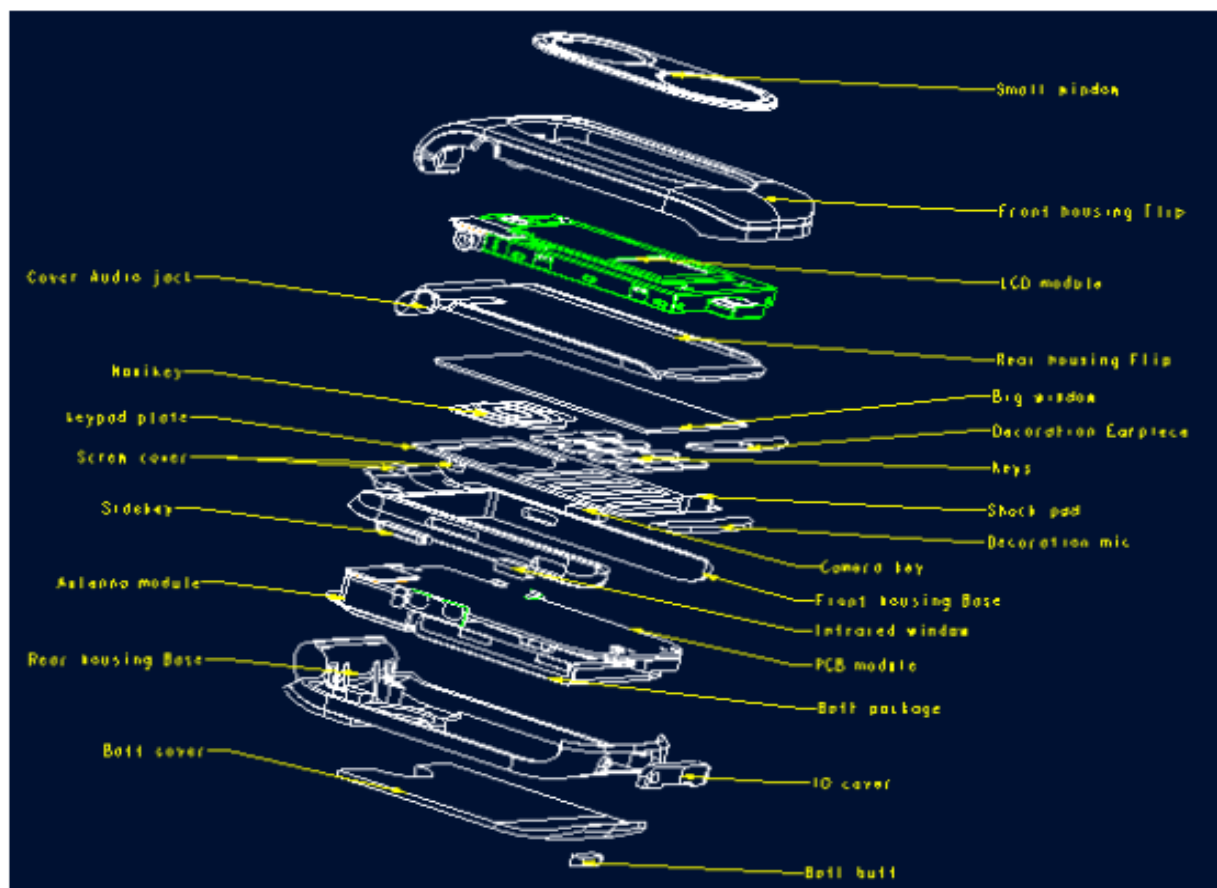
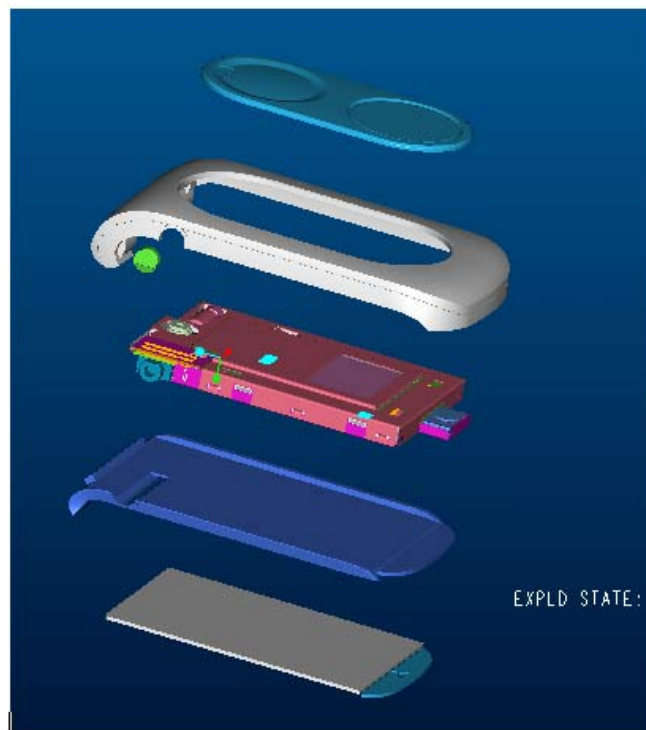
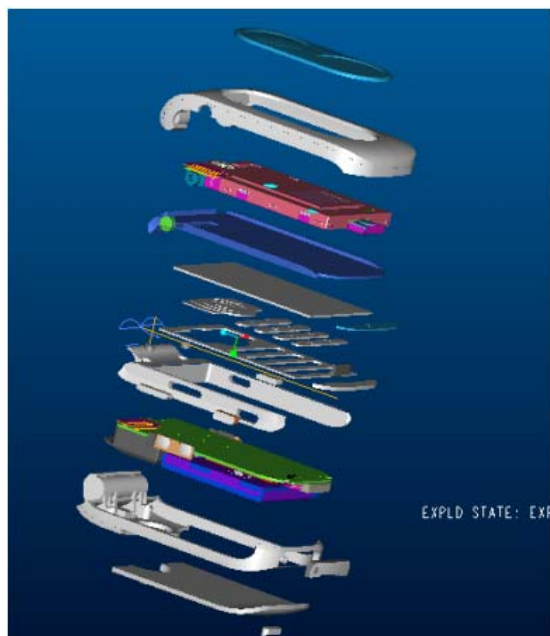
6.1 Memory

The memory building block consists mainly out of the combined memory chip, FLASH and SRAM into one single IC package. The CT6558 hardware provides 1.8V supply for the memory chip. The FLASH memory is a 64Mbit (4Mb x 16) multiple bank memory with burst mode operation possibility for processor synchronous FLASH read operation. The SRAM memory is 8Mbit (512k x 16).

6.2 Supply Unit

The supply unit on the CT6558 hardware consist out of the Philips PMU chip PCF50603. It integrates all the supply regulators for the complete hardware. For the CT6558 modem application no other external LDOs are needed.

7. Mechanical Architecture



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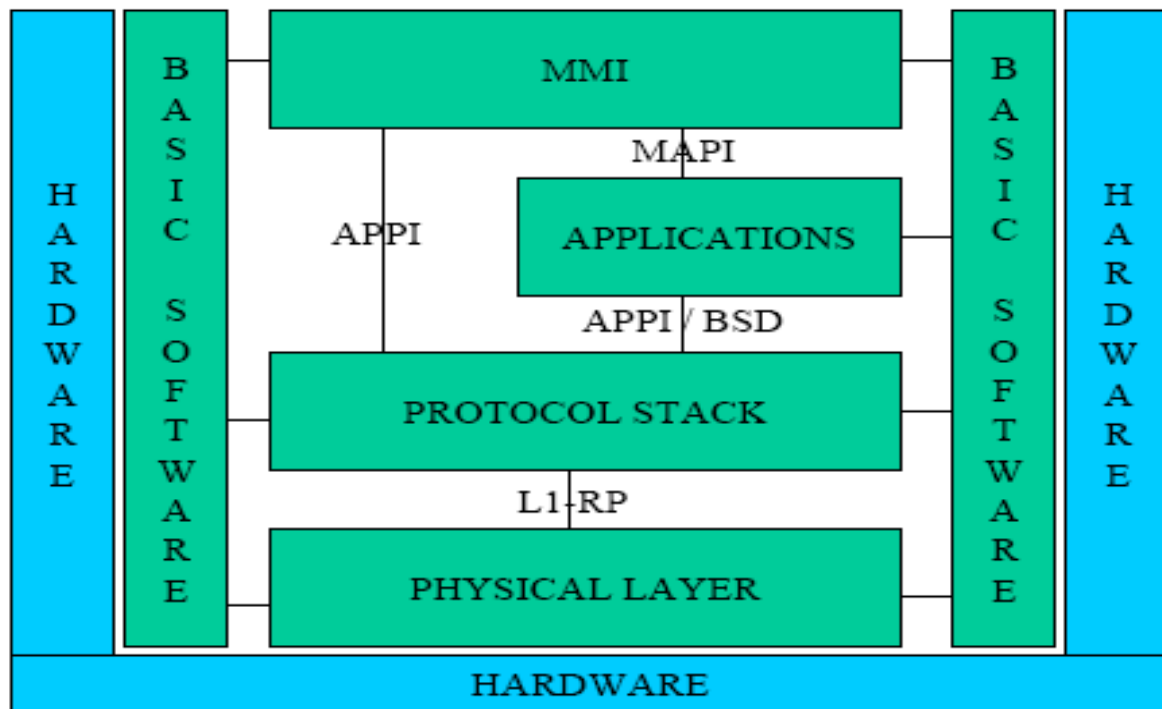
- Type & Size: CT6558 design is used for it is popular by women and men. The thickness of the product is 85mmx45mmx23.5mm
- Keypad: Layout and construction will give the feeling of comfortable pitch despite the product size. Navigation key, side key and camera key are needed.
- Antenna: Integrated antenna.
- FPC: 0.50mm thickness FPC, connect with main PCB via one 50 pin B-B connector, connects with Flip PCB by B-B connector.
- Display: 65K color
- Battery: 600mAh Li-Ion cell, dimension is 43mmX36mmX5.5mm (L x W x T). The battery and the cover are two separated parts. The battery must be integrated inside the phone, and the cover of the battery area must be in the same color and finishes than the other materials used for the front cover (no Al-alloy stamping).
- Housing material: All housing materials are plastic.
- SIM card operation: The insertion of the SIM card must be intuitive and easy for the user, the SIM card tank is built in down-rear housing, and below battery.
- Speaker :fixed in the antenna module.
- Hinge: Diameter is 5.80mm Hinge.
- Housing fixation: 8 screws, add hooks at correct position.
- Side key: 2 side keys for volume control ,it defined by SW.
- CT6558 key: camera keys for camera control, it defined by SW.
- Vibrator: Mounted in LCD module.
- MIC: Mounted in down-rear housing, touch main PCB solder pattern via MIC sleeve.
- I/O system connector: 18pin mini connector.
- Battery fixation and connector: Internal battery package with protection circuit, mounted in down-rear housing battery tank by 3 hooks. 4 pin battery connector is a very low profile connector.
- Flip and base connect: Flip FPC is connected with main PCB via 50 pin B-B connector.
- Accessories:

1. 600 mAh Li-ion battery as default.
2. Charger
3. Headset
4. Download cable

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8, Software Architecture

<i>Abbreviation</i>	<i>Description</i>
ADC	Analogue Digital Converter
APPI	Application Interface
BAI	Baseband and Audio Interface
BSD	Berkley Socket Datagram
CS	Circuit Switch
DRV	Driver
DSP	Digital Signal Processor
FMS	Frequency Modulation Synthesis
HDL	Handler
MAPI	Multi Application Interface
MMI	Man Machine Interface
MOBI	Mobile Interface
MS	Mobile Station
PCM	Pulse Code Modulation
PS	Packet Switch
SPV	Service Provider
TAT	Test and Auto-Test
TTY	TeleTYpe



Basic Software : Contains functionalities that allow other piece of software to run on top of the non-telecom hardware (For instance : drivers, handlers, operating system, TAT).

Physical Layer : Contains functionalities that allow access to DSP and BAI.

Protocol Stack : Contains functionalities that allow peer to peer exchange with GSM/GPRS networks (L2/L3/SPV REC)

Application : WAP, MMS.

MMI : Contains functionalities that allow interaction between user and the system.