
PROTEUS HARDWARE

This document aims to provide information on Proteus device hardware, wiring and development process.

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PROTEUS PROJECT DOCUMENTATION SERIES:

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#1201	Proteus hardware internal	V0.5 (2018)
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PROTEUS

Proteus is project name for *Privecall TX* device, designed and manufactured by XXLSEC Ltd, Helsinki Finland. Internal project name *Proteus* was chosen to ease communication within teams building hardware & designing software for the device.

This document is first *public release* to github for developers.

CLEAN HARDWARE

Proteus design cycle, chosen components and restricted set of features realizes as *Clean Hardware* for secure computing purposes. It aims not to be feature rich, but reasonable secure reference design for high security purposes. From this perspective *Clean Hardware* means that there should be no *Known Unknowns* in design and every software component should have full visibility to source code level. From hardware design, selected components and their system interfacing should present isolated and access restricted methods to interact with kernel and user space applications.

PROTEUS HARDWARE

Proteus hardware is *mobile secure computing unit*. It's a computing device, not a mobile phone. This is difference which dictates security fundamentals in design and makes it possible to achieve secure platform more multiple mobile applications and use scenarios. Key features of hardware are internal battery, 5" touch screen, audio and wired Ethernet connectivity. Additionally design includes wifi module and buttons for power, volume and user application button.

System is designed around iMX6 ARM core and has 1GB RAM with 8GB of eMMC.

MICRO USB

Micro USB has +5V, GND and D+/D- signals connected to charger chip and charger chip has i2c connectivity to host. *There is no USB level access to host from provided micro USB connector.* You can use any compatible USB charging device to charge internal battery. Please note that charger chip requires valid configuration for optimal functionality and may behave out of specs with factory defaults.

CONSOLE ACCESS

Console access for uboot and system console is available through testpads on main PCB. Configure console serial access for 115200 bps with 8N1.

Test pad on PCB	Host signal	FTDI adapter signal
164	TXD1	Pin 5: red
165	RXD1	Pin 4: orange
197	GND	Pin 1: black

BUTTONS

Buttons on right side of device are (from top to down): Power, Volume+, Volume- and Lock:



Power button is only fixed functionality button for power up and down sequence. Other three buttons can be reassigned to any functionality required.

INDICATION LEDS

Bottom of device screen is located six leds as activity indicators. They are SPARE, WIFI, ACT, LNK, PFO and CHG signals. Spare led can be programmed by user via GPIO 3/5 (189) – active high. CHARGE led is controlled by charger chip and PFO is output from power button controller.

SPARE	User led
WIFI	Wifi module activity
ACT	Ethernet activity
LNK	Ethernet link status
PFO	Power Fail Output
CHARGE	Charging indication



BATTERY

Unit has internal 3500 mAh battery which is charged over micro USB or system connector.

Cell	FT606483P
Typical Capacity	3500 mAh
Nominal Voltage	3.7V
Watt-hour rating	12.95Wh
Charging Voltage:	4.2 +0.03/-0.02 V
Standard Charging Current:	700 mA
Charge Cut-off Current:	700 mA
Max. Discharging Current:	3500 mA
Discharge cut-off Voltage:	3.0V
Operation Temperature:	Charge: 10~45°C Discharge: -20~60°C

BATTERY LABEL

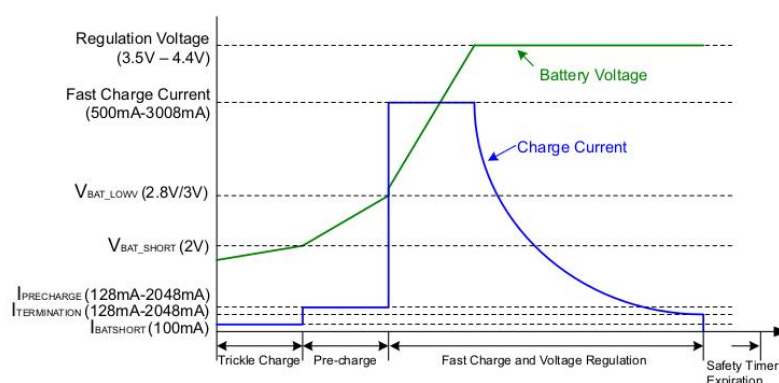


NOTE:

Battery label is under battery (between PCB and battery) in assembled product and type label is presented here for reference.

BATTERY CHARGING PROFILE

NOTE: User must configure charger before use. See BQ24295 data sheet for more details how to configure charger.



DEFAULT MODE	bq24295
Charging voltage	4.208 V
Charging current	1.024 A
Pre-charge current	256 mA
Termination current	256 mA
Temperature profile	Hot/Cold
Safety timer	12 hours ⁽¹⁾

I2C DEVICES

Device has range of I2C interfaced devices, which do provide functionality for power management, audio and touch screen.

Device	Functionality	I2C address	Reference
Touch controller	Touch controller for display	0xBA/0xBB	GT928
Battery gauge	The LTC ® 2942 measures battery charge state, battery voltage and chip temperature. Main line Linux driver.	1100100	LTC2942
Battery charger	I2C Controlled 3A Single Cell USB Charger With Narrow VDC 4.5-5.5V Adjustable Voltage at 1.5A Synchronous Boost Operation.	6BH	BQ24295
Audio Codec	Audio Codec mixer interface	0n01010(R/W) 0001010(R/W)	SGTL5000
MIPI Bridge	MIPI driver for display	7'b0001_110X	TC358778XBG
EEPROM	EEPROM 4K x 8 (32K bit)	1010nnnn	24LC32

ON/OFF CONTROLLER

System has on/off controller for power button functionality and system shutdown function.

On/Off controller	Push Button On/Off Controller with Voltage Monitoring	No i2c	LTC2953
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AUDIO CONFIGURATION

System has SGTL500 audio codec, internal speaker and microphone. For detailed information, see schematic sheet 8. Following GPIO's are used to control audio path addition to SGTL5000 mixer settings:

GPIO	Signal name	Functionality
3/9, output, active high	AUDIOPA	Activates audio amplifier for internal speaker
3/7, input, active high	HEADSET PLUGGED	Headset plugged in status, can be driven as well

Main audio path is internal speaker and internal microphone. Optionally internal speaker can be driven through amplifier for increased volume. User can connect external headset via system connector.

DEVICE SPECIFICATIONS

Variant: Privecall TX

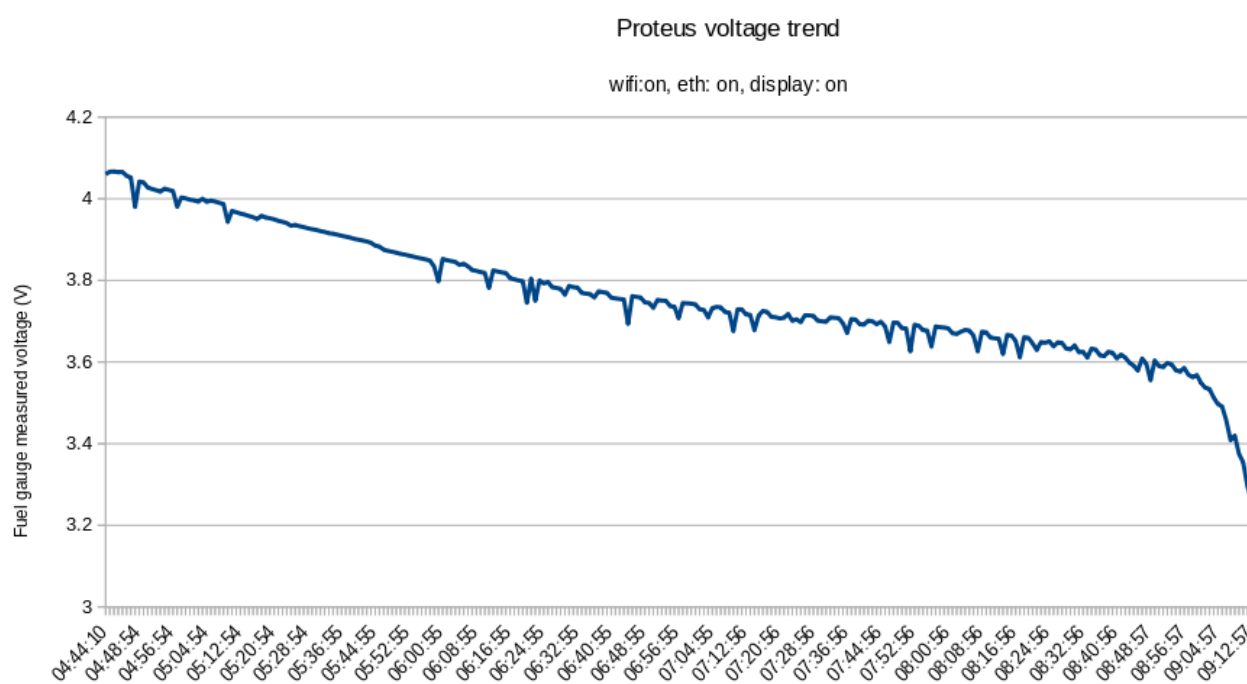
Device Type	Mobile Secure Computing Unit	
Host	IMX6 with 1 GB RAM and 8GB eMCC storage	
Dimensions	160 * 78 * 15 mm	
Weight	276 g	
Body	Aluminum, anodized black	
Connectors	Micro USB (charging only) System Connector (Charge, Ethernet, Audio, Switch) External wifi antenna connector, SMA (option)	
Buttons	1 x Power button 2 x Volume buttons 1 x Home button 1 x PTT button on System Connector → All buttons are user programmable	
Display	5" IPS TFT with PWM controlled LED backlight Touch controller (GT928)	
Connectivity	Wired Ethernet, 100 Mbit/s With internal magnetic transformer	
Wireless (option)	SDIO interfaced WL1801 (with regulatory firmware required)	
Audio	Internal audio codec (SGTL5000) Internal microphone Internal speaker (with controllable amplifier) External HF with Mic in System Connector	
Charger	MicroUSB charging input +5 V DC charging input on System Connectors Charger controlled over i2c from host	
Fuel gauge	Internal fuel gauge with i2c connectivity to host Battery voltage and temperature Indicates Accumulated Battery Charge and Discharge	
Auxiliary memory	32Kbit i2c EEPROM On board MicroSD, not user accessible	
Indicators	On display LED's: user action, wifi, ETH ACT, ETH LNK, PFO and charger status	
Battery	3500 mAh	
Operating System	Linux kernel PriveOS for commercial developers with Linux 5.4.0	

APPENDIX 1 – BATTERY DISCHARGE PROFILE(S)

Here is presented some initial discharging profiles for optimization reference.

Test type	Full consumption
Blocks	Wifi: On (not connected) Ethernet: Connected USERLED: Off Display: On Backlight: 50%
Software	7.7.2019 – Privecall internal beta
Battery	Start voltage: 4.01 V End voltage: 3.17 V (hw cutoff: 3.2 V)
Time	4 hours 31 minutes

Trend graphics (full consumption):



Test type	Partly consumption	
Blocks	Wifi:	On (connected)
	Ethernet:	Off
	USERLED:	Off
	Display:	On
	Backlight:	0 %
Software	24.7.2019	internal beta
Battery	Start voltage:	4.19 V
	End voltage:	3.18 V (hw cutoff: 3.2 V)
Time	7 hours 25 minutes	

