EM-T3530 and CB-T3

Reference Guide

CompuLab

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Table 1 Document Revision Notes

Date	Description
June 2011	First release

Please check for a newer revision of this manual at CompuLab's web site – http://www.compulab.co.il/. Compare the revision notes of the updated manual from the web site with those of the printed or electronic version you have.

Table 2 Board Revision Notes

Date	Description
June 2011	CB-T3 Board revision 1v0. First release

1 INTRODUCTION

1.1 About This Document

This document is part of a set of reference documents providing information necessary to operate and program CompuLab's CB-T3 baseboard.

1.2 Related Documents

For additional information not covered in this manual, refer to the documents listed in Table 3.

Table 3 Related Documents

Document	Location
CM-T3530 Developer Resources	http://www.compulab.co.il/
EM-T3530 datasheet	http://www.compulab.co.il/

2 OVERVIEW

2.1 Highlights

- Full-featured handheld computer for embedded applications
- Cortex-A8 OMAP3503 or OMAP3530 CPU, up to 720 MHz.
- Up to 256 Mbyte mobile DDR
- Up to 512 Mbyte Flash Disk, including file-system protection
- Integrated 3.5" 480 x 640 VGA display with touchscreen (optional)
- Graphics controller supporting STN and TFT panels with 1400 x 1050 max resolution
- H.264, H.263, MPEG-4, MPEG-2, JPEG, WMV9 and additional video codecs implemented by the TMS320C64x+ DSP core @ 520 MHz
- PowerVR SGX GPU providing 2D / 3D graphics acceleration with OpenGL-ES and OpenVG support
- WiFi 802.11b/g interface with on-board ceramic antenna
- Micro SD socket
- Keypad interface
- Audio codec with integrated speaker and microphone
- High-speed USB OTG and host ports
- Programmable general purpose buttons and indicator LED's
- Integrated Lithium-ion battery (optional) and on-board back-up battery
- Advanced power management sub-system with Lithium-ion battery charger
- Very low standby and active power consumption
- Standard size: 111 x 67 mm . Custom sizes and form factors are available on demand.

The EM-T3530 is a small handheld computer based on the Texas Instruments OMAP3530 processor. It is implemented by combination of CM-T3530 module providing most of the functions, and CB-T3 carrier board providing connectors and several additional features. The rich feature set of the EM-T3530 is customizable according to the price / performance targets of the user's application. Board form factor is also customizable.

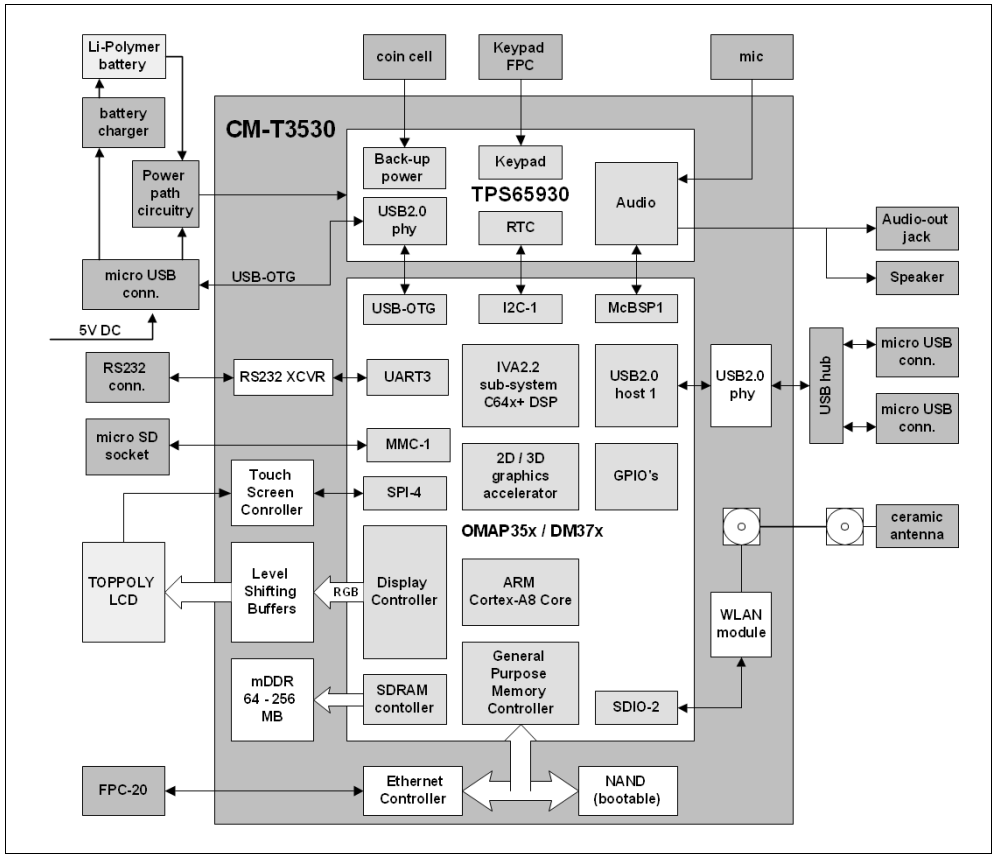
OMAP3530 processor of EM-T3530 combines two CPU cores in single package - an advanced Cortex-A8 ARM CPU for running operating system and application code, and TMS32064x DSP for dedicated video processing. Mobile DDR enables very low power consumption in regular operation and in standby.

Power supply options of the EM-T3530 enable its integration in mobile applications powered by a rechargeable battery. Charger and battery management support is provided on-board.

Thanks to modular design of EM-T3530, board's form factor and functional content could be easily customized according to specific application requirements. Customization service is offered by partnership of CompuLab and Bauer TKP.

2.2 Block Diagram

Figure 1 CB-T3 Block Diagram



2.3 Features

The features of EM-T3530 are derived from a combination of features provided by the attached CM-T3530 embedded CoM and the features implemented onboard the CB-T3 carrier board.

Table 4 summarizes the features available with EM-T3530.
The "CM Option" column specifies the P/N code of CM-T3530 required to have the particular feature. CB-T3 is always provided in full configuration, it has not options.
"+" means that the feature is always available, regardless of P/N code..

Table 4 CB-T3 Features

Feature	Specifications	CM Option
CPU SDRAM Flash Disk	See Feature List of the relevant CM-T3x module	
COM-C	Rx/TX only, RS-232, ultra mini serial conn.	+
Ethernet	CM-T3x 100 Mbps Ethernet port, FPC connector	E
USB 2.0 OTG	USB 2.0 OTG port, USB micro-AB connector (5V should be supplied externally)	+
USB 2.0 host	Two USB 2.0 host ports, 480 Mbps. Implemented by USB 2.0 high-speed hub. micro-AB connectors	U
Touch Panel	TSC2046 touchscreen controller for resistive panels. Interface to LCD panel	I
Sound I/O	I2S compliant audio codec, microphone, speaker and a stereo output jack	+
RTC Battery	Real time clock component on CM-T3x, supplied by lithium battery on CB-T3	+
Wi-Fi	Wi-Fi interface, provided by CM-T3x, The CB-T3 provides a ceramic Wi-Fi antenna onboard, an external antenna can be used.	W
SDIO / MMC	MMC / SD / SDIO support including SDHC up to 32GB. Standard micro-SD socket	+
Battery management	USB Charging and supervision support for Lithium-ion polymer batteries	+

Table 5 Electrical, Mechanical and Environmental Specifications

Supply Voltage	High efficiency switched power supply. Sleep mode support. Unregulated 3.3 to 4.2 volt input from battery or regulated 5V from wall adaptor
Power consumption	1W to 3W in full activity, depending on CPU speed and selected features Below 50mW in sleep mode
Dimensions	111 mm (L) x 67 mm (W) 15 mm (H)
Weight	37 grams (Only CB-T3)
Operation temperature (case)	Commercial: 0o to 70o C Extended: -20o to 70o C Industrial: -40o to 85o C
Storage temperature	-40o to 85o C
Relative humidity	10% to 90% (operation) 05% to 95% (storage)
Shock	50G / 20 ms
Vibration	20G / 0 - 600 Hz
MTBF	> 100,000 hours

3 SYSTEM COMPONENTS

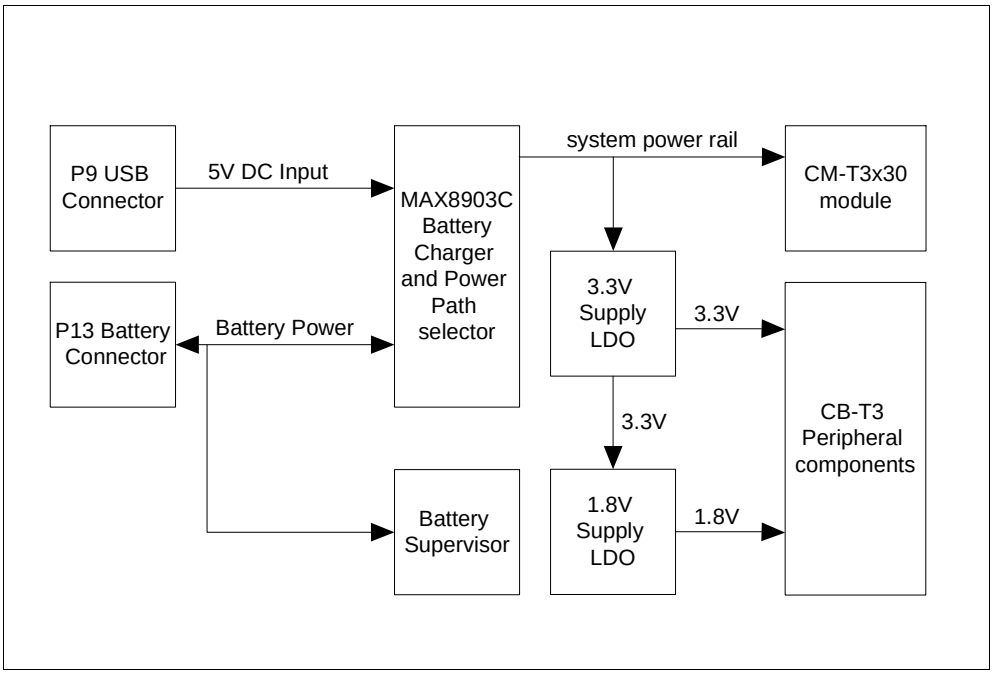
3.1 Power Supply

The power supply and battery charging capabilities of EM-T3530 are based on the MAX8903C battery charger and power path selector from MAXIM available onboard CB-T3.

EM-T3530 can draw its power from either a 5V DC input through the USB-OTG port (P9), or a single cell lithium battery connected to EM-T3530 through P13. In case both power supplies are connected, EM-T3530 charges the main battery and draws system power from P9. If one of the inputs is disconnected, power is drawn from the remaining source.

CB-T3 derives 3.3V and 1.8V from the EM-T3530 system power rail in order to supply the carrier board peripheral components, as described in the diagram below.

Figure 2 Power Scheme



3.2 Battery Supervision

The EM-T3530 battery management system incorporates a battery supervisor.

The battery supervisor is based on the DS2786 supervisor, it is available onboard CB-T3 carrier board and interfaces with the system through an I^2C port (I^2C-3 on CM-T3x). Battery information is available from DS2786 upon request.

3.3 USB2.0 Subsystem

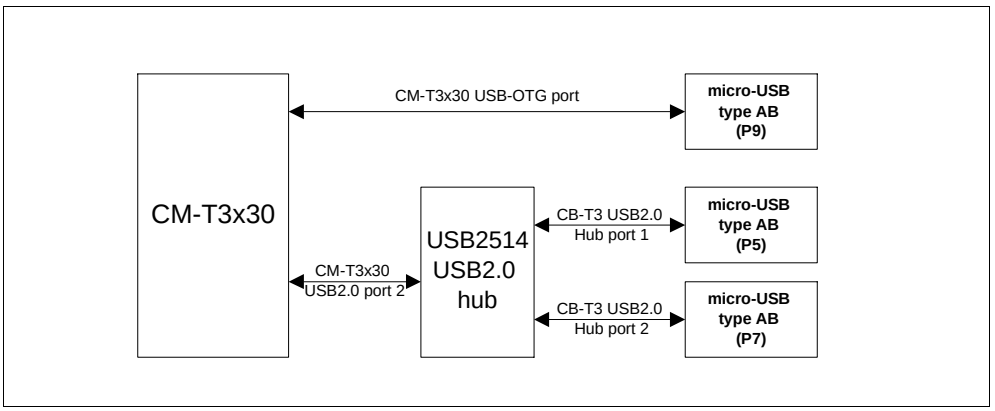
EM-T3530 USB2.0 subsystem is based on the USB2514 USB2.0 hub component from SMSC. The upstream port of USB2514 is interfaced with CM-T3530 USB port 2. CB-T3 derives two USB2.0 host ports (connectors P5 and P7) from the onboard hub.

In addition to the host port interfaces, EM-T3530 is equipped with a USB-OTG port (P9). USB-OTG functionality of EM-T3530 is based on the USB-OTG port provided by CM-T3530.

NOTE: USB-OTG port does not provide VBUS at connector P9. VBUS should be applied externally.

The diagram below summarizes the USB2.0 subsystem of EM-T3530.

Figure 3 USB Subsystem



3.4 Audio Amplifiers

EM-T3530 is equipped with two stereo amplifiers built around TPA102DGN ICs onboard CB-T3. Amplifier inputs are driven by the AUDIO_OUT_R/L signals of the CM-T3530. The first amplifier output is routed directly to the onboard headphone jack (P8). The second amplifier drives a speaker connected to P12.

The TPA102DGN is a 150mW Stereo Power Amplifier from Texas Instruments. The audio amplifier is capable of delivering 150mW of continuous RMS power per channel into 8Ω loads.

Both amplifiers are configured for a gain of 1V/V. Each amplifier can also be enabled/shut-down by software (GPIO61, GPIO54).

3.5 Back-Up Battery

An on-board 18mAh rechargeable coin cell lithium battery is the back-up power supply for RTC timekeeping. This battery is in charge of powering the CM-T3530 RTC whenever the main power supply is not present.

4 INTERFACES AND CONNECTORS

4.1 CM-T3530 Interface Connectors (P1, P2)

The CM-T3530 CoM is interfaced through two 0.6mm pitch, 140pin connectors - P1 and P2.

For signal descriptions, please refer to the CM-T3530 Reference Guide.

Table 6 P1 and P2 connector data

Manufacturer	P/N of CB-T3 Connector	P/N of CM-T3x Connector (Mating)
AMP	1-5353183-0	1-5353190-0 or CON140

4.2 Battery Connector (P13)

Table 7 P13 connector pinout

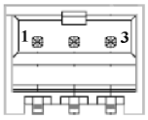
Pin	Signal Name	
1	VCC_BAT	
2	BT_NTC	
3	BAT_GND	

Table 8 P13 connector data

Manufacturer	Mfg. P/N	Mating connector
Molex	87438-0343	Molex, P/N: 87439-0300

The connector is compatible with the battery adaptor available from CompuLab.

4.3 RS232 connector (P4)

The RS232 port of CM-T3530 is available with EM-T3530 by means of the CB-T3 on-board RS232 ultra-mini connector (P4). All signals are at RS232 levels.

Table 9 P4 connector pinout

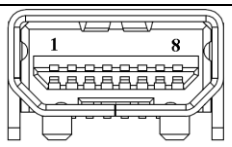
Pin	Signal Name	Pin	Signal Name	
1	RS232_TXD	5	NC	
2	NC	6	NC	
3	RS232_RXD	7	NC	
4	NC	8	GND	

Table 10 P4 connector data

Manufacturer	Mfg. P/N	Mating connector
Wieson	G3169-500001	Wieson, P/N: 4306-5000

The connector is compatible with the CABDB9UMP cable supplied by CompuLab.

4.4 USB Connectors (P5, P7, P9)

All USB ports of EM-T3530 are routed to micro-USB type AB connectors onboard Cb-T3 (P9, P5, and P7). The P9 connector serves as the USB-OTG port and the DC power input port of EM-T3530. P5 and P7 are routed to the USB2.0 host port connectors of EM-T3530.

Table 11 P9 (USB OTG) connector pinout

Pin	Signal Name
1	USB0_5V_OUT
2	USB0_DN
3	USB0_DP
4	USB0_ID
5	GND

Table 12 P5 (USB host port 1) connector pinout

Pin	Signal Name
1	USBP1_VBUS
2	SB_USBHUBP1_DM
3	SB_USBHUBP1_DP
4	NC
5	GND

Table 13 P7 (USB host port 2) connector pinout

Pin	Signal Name
1	USBP2_VBUS
2	SB_USBHUBP2_DM
3	SB_USBHUBP2_DP
4	NC
5	GND

Table 14 USB connector data

Manufacturer	Mfg. P/N	Mating connector
Hirose	ZX62-AB-5PA	Standard micro-USB type-B plug Standard micro-USB type-A plug

4.5 CORE Ethernet FPC Connector (P10)

EM-T3530 ethernet support is derived from CM-T3530 ethernet controller. CM-T3530 ethernet controller is interfaces with an FPC connector (P10) onboard CB-T3. When P10 is used with the CONFRJ45X2 adaptor available from Compulab, EM-T3530 provides a standard RJ-45 interface.

Table 15 P10 connector pinout

Pin	Signal Name	Pin	Signal Name
1	CM_ETH_LED1	11	GND
2	CM_ETH_RXP	12	GND
3	CM_ETH_RXN	13	GND
4	NC	14	GND
5	CM_ETH_LED2	15	GND
6	VCC3_3	16	GND
7	ETH_VDDA	17	GND
8	CM_ETH_TXN	18	GND
9	CM_ETH_TXP	19	GND
10	ETH_VDDA	20	GND

Table 16 P10 connector data

Manufacturer	Mfg. P/N	Mating connector
CVILux	CF20-201D0R0	FFC, 20 cont, 0.5mm

4.6 Micro-SD Socket (P11)

The EM-T3530 micro-SD socket is interfaced with MMC-1 port of CM-T3530. For additional details, please refer to the CM-T3530 reference guide.

Table 17 P11 connector pinout

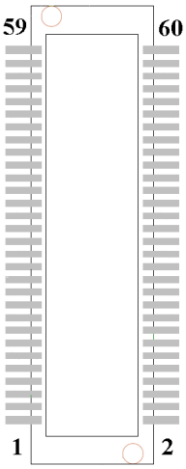
Pin	Signal Name	Pin	Signal Name
1	MMC1_DAT2	7	MMC1_DAT0
2	MMC1_DAT3	8	MMC1_DAT1
3	MMC1_CMD	9	GND
4	VCC_MMC	10	GND
5	MMC1_CLK	11	GND
6	GND	12	GND

4.7 TOPPOLY LCD Connector (P3)

The TOPPOLY LCD connector (P3) allows seamless integration with the TD035STEE1 LCD module. LCD interface, control and power signals and touch-screen interface signals are routed to this connector.

Table 18 P3 connector pinout

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	GND	21	GND	41	LCD_D17_T
2	TS_Y+	22	LCD_D0_T	42	GND
3	TS_X+	23	LCD_D1_T	43	VCC3_3
4	TS_Y-	24	LCD_D2_T	44	NC
5	TS_X-	25	LCD_D3_T	45	GND
6	GND	26	LCD_D4_T	46	LCD_PCLK_T2
7	NC	27	LCD_D5_T	47	GND
8	NC	28	GND	48	LCD_ACBIAS_T
9	GND	29	LCD_D6_T	49	SPI4_SOMI
10	NC	30	LCD_D7_T	50	SPI4_CS0
11	NC	31	LCD_D8_T	51	SPI4_SIMO
12	NC	32	LCD_D9_T	52	NC
13	NC	33	LCD_D10_T	53	SPI4_CLK
14	NC	34	LCD_D11_T	54	LCD_VSYNC_T
15	GND	35	GND	55	LCD_HSYNC_T
16	NC	36	LCD_D12_T	56	NC
17	LCD_RST	37	LCD_D13_T	57	NC
18	NC	38	LCD_D14_T	58	WLD_CAT
19	NC	39	LCD_D15_T	59	WLD_OUT
20	VCC3_3	40	LCD_D16_T	60	GND



- SPI4_SOMI, SPI4_SIMO, SPI4_CS0, SPI4_CLK signals are SPI interface lines (SPI-4) used for LCD setup.
- TS_[X+/Y-/X+/Y-] signals are input lines of the CM-T3x touch screen controller.
- WLD_OUT and WLD_CAT are positive and negative terminals of the 20V / 20mA white LED driver supplying the LCD backlight.

Table 19 P3 connector data

Manufacturer	Mfg. P/N	Mating connector
Matsushita	AXK5F60547YG	Matsushita, P/N: AXK6F60547YG

The connector is compatible with the TD035STEE1 LCD panel available from CompuLab.

4.8 Audio Jack (P8)

EM-T3530 features a 3.5mm jack for stereo headphone output.

Table 20 P8 connector pinout

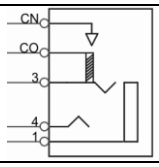
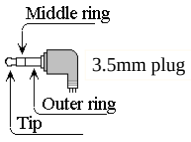
Pin	Signal Name	Mating plug pin	Jack pin-out	Mating plug
1	GND	Outer ring		
3	AUDIO_OUT_R_F	Middle ring		
4	AUDIO_OUT_L_F	Tip		
CN	GPIO143 (plug detect)	NC		
CO	GND	NC		

Table 21 P8 connector data

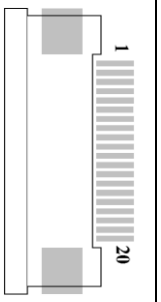
Manufacturer	Mfg. P/N	Mating connector
SC_Precision	SCJ305P00DG0BP9G	Standard 3.5mm stereo plug

4.9 Keypad FPC (P6)

The CM-T3530 keypad interface is routed to the keypad FPC connector (P6) onboard CB-T3 in order to provide an accessible KEYPAD connection with EM-T3530.

Table 22 P6 connector pinout

Pin	Signal Name	Pin	Signal Name
1	KPD_R0	11	KPD_C0
2	KPD_R1	12	KPD_C1
3	KPD_R2	13	KPD_C2
4	KPD_R3	14	KPD_C3
5	NC	15	GND
6	KPD_R4	16	KPD_C4
7	KPD_R5	17	KPD_C5
8	NC	18	NC
9	NC	19	NC
10	NC	20	GND



The connector is compatible with the KEYPAD available from CompuLab.

Table 23 P6 connector data

Manufacturer	Mfg. P/N	Mating connector
CVILux	CF20-201D0R0	FFC, 20 cont, 0.5mm

4.10 WLAN antenna connector (J1)

EM-T3530 Wireless connectivity is derived from CM-T3530 WLAN interface. The CB-T3 WLAN antenna connector (J1) allows interfacing the CB-T3 onboard ceramic WLAN antenna with the CM-T3530 on-board WLAN interface. An appropriate coax cable for such a connection is available from CompuLab.

Table 24 J1 connector data

Manufacturer	Mfg. P/N	Mating Connector
Hirose	U.FL-R-MT(10)	Hirose U.FL-LP-040

4.11 Power Button (SW1)

The power button (SW1) controls the basic EM-T3530 power functions.

When power is first applied to EM-T3530 the system remains in power-down mode, only SW1 circuitry and battery charger active and awaiting power-on event. SW1 must be pressed for 3 seconds in order to power-on CB-T3.

When the system is in active mode, pressing SW1 for 3 seconds cuts off power to EM-T3530 and puts the system into power-down mode.

EM-T3530 ignores accidental short ‘taps’ on SW1.

4.12 Reset Button (SW2)

EM-T3530 features a user-accessible reset button (SW2). Pressing the reset button issues a cold reset to CM-T3530 module and CB-T3 carrier board.

4.13 General Purpose Buttons (SW3, SW4, SW6)

SW3, SW4 and SW6 are general-purpose buttons. Software response to activity on the general-purpose buttons is user-defined. Please refer to CB-T3 schematics for additional information on general-purpose buttons.

4.14 LED's (DS1, DS2, DS3)

The table below describes EM-T3530 LEDS onboard CB-T3.

Table 25 LED Description

LED	Color	System	LED activity
DS3	Green	Power	Indicates that CB-T3 is powered by DC 5V input (on USB OTG port)
DS4	Red	Charger	Indicates that the battery charger is active
DS5	Green	General-purpose	DS5 LED is connected to GPIO162 and is active when GPIO162 is low. DS5 activity is software configured.

5 MECHANICAL DRAWINGS

Figure 4 CB-T3 top

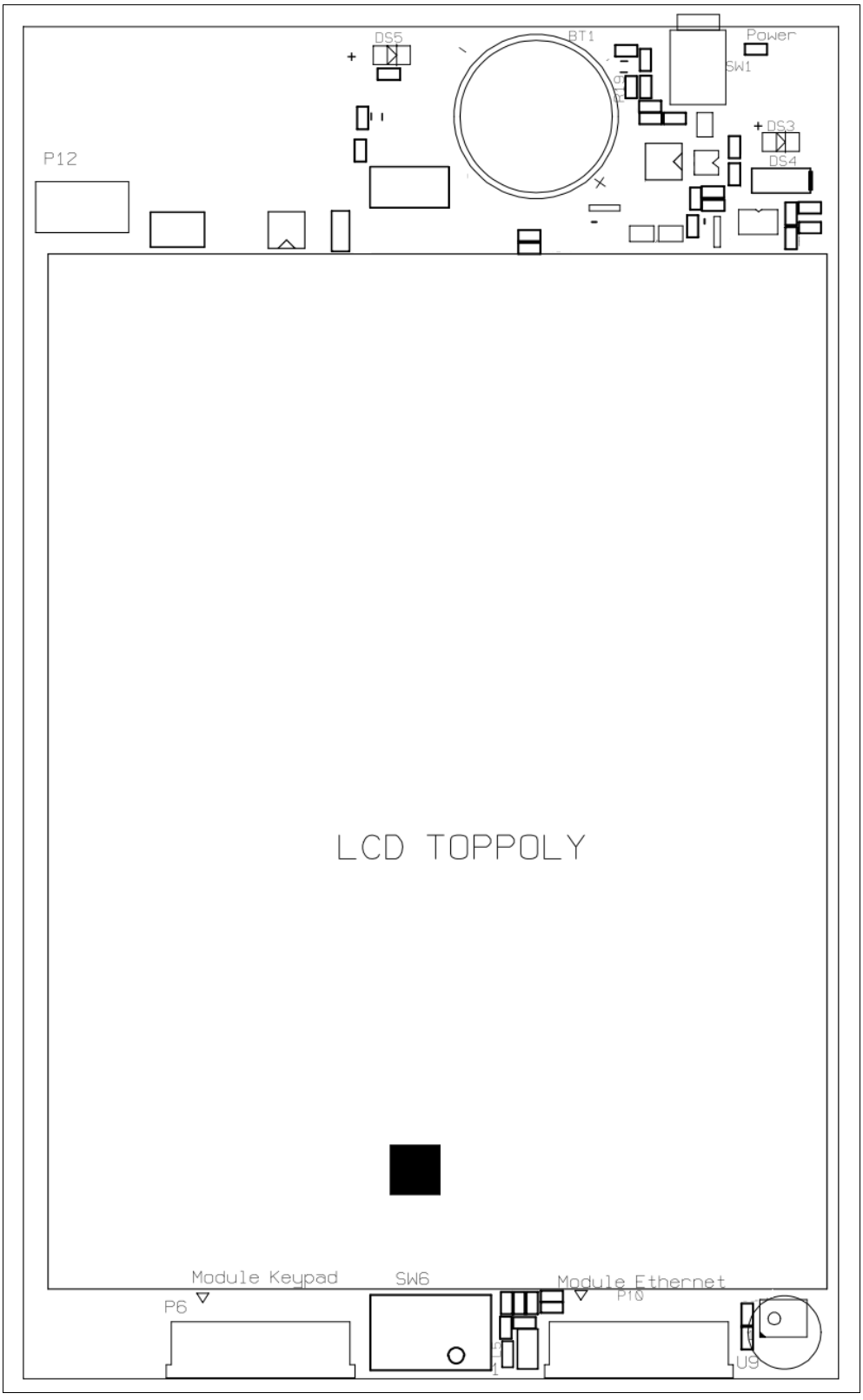
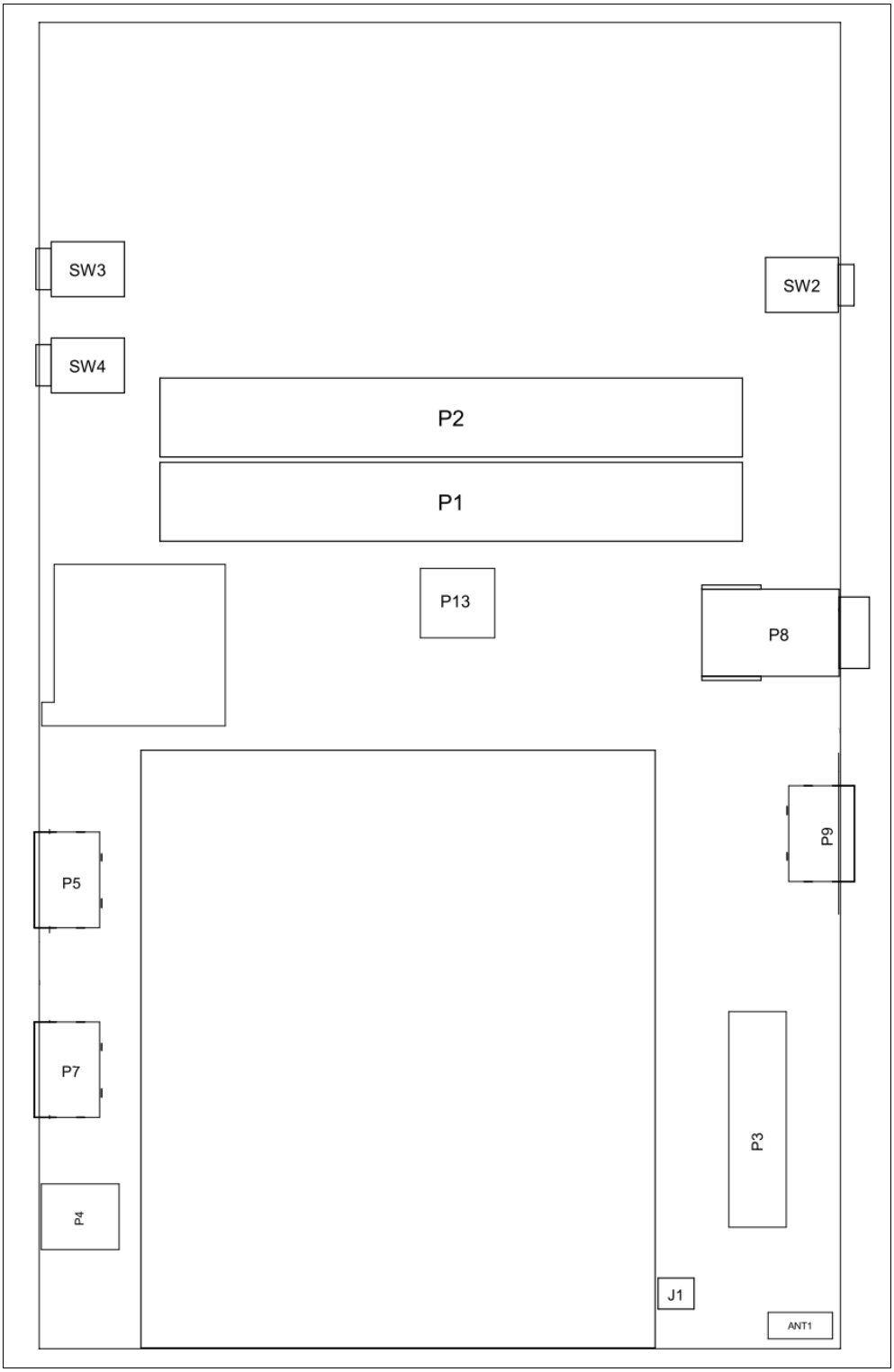


Figure 5 CB-T3 bottom



Mechanical drawings are available in DXF format from CompuLab's website, following [Developer] >> [CB-T3] >> [CB-T3 - Dimensions and Connectors Location] links.

6 OPERATIONAL CHARACTERISTICS

6.1 Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit
Power supply voltage (on P9 VBUS pin)	4.8	5	5.2	V
Battery input voltage	3.5	3.7	4.2	V

6.2 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Main power supply voltage (on P9 VBUS pin)	4.8	5	5.2	V
Battery input voltage	3.5	3.7	4.2	V

6.3 Charger and Recommended Battery Characteristics

CB-T3 onboard battery charger supports single-cell Li+ batteries. It operates autonomously and uses constant-current, constant-voltage charging profile.

NOTE: An under/over voltage protection circuit and an NTC thermistor (10KΩ @ 25°C) should be built into your battery pack for proper battery operation.

Parameter	Min	Typ	Max	Unit
Battery regulation voltage	4.179	4.2	4.221	V
Charger restart threshold	-150	-100	-60	mV
Precharge current	90	100	110	mA
Fast-Charge current	900	1000	1100	mA
Thermistor threshold HOT (Charger voltage is 5V)	0.35	1.4	1.45	V
Thermistor threshold Cold (Charger voltage is 5V)	3.65	3.7	3.75	V

6.4 DC Electrical Characteristics

Parameter	Operating Conditions	Min	Typ	Max	Unit
SD / MMC / SDIO					
V_{IH}	VCC_MMC = 1.8V	1.17		2.1	V
	VCC_MMC = 3.0V	1.875		3.3	
V_{IL}	VCC_MMC = 1.8V	-0.3		0.63	V
	VCC_MMC = 3.0V	-0.3		0.75	
V_{OH}	VCC_MMC = 1.8V	1.6			V
	VCC_MMC = 3.0V	2.25			
V_{OL}	VCC_MMC = 1.8V			0.2	V
	VCC_MMC = 3.0V			0.375	
1.8V Digital I/O					
V_{IH}		1.17		2.1	V
V_{IL}		-0.3		0.63	V
V_{OH}		1.4			V
V_{OL}				0.4	V

3.3V Digital I/O					
V_{IH}		2.145		3.3	V
V_{IL}		0		1.155	V
V_{OH}		2.9			V
V_{OL}				0.4	V
Display Interface					
V_{OH}		2.3			V
V_{OL}				0.7	V
I^2C (open drain with internal pull up to 1.8V)					
V_{IH}		1.26		2.3	V
V_{IL}		-0.5		0.54	V
V_{OH} (open drain with 3mA sink current)		0		0.36	V
RS232					
TX Voltage Swing		±5	±5.4		V
RX Voltage Swing			±25		V

6.5 Power Consumption

To be added in a future revision of this document.

6.6 Operating Temperature Ranges

The information in this section refers to the CB-T3 board only. For temperature ranges of off-board components such as the LCD panel, battery pack or CM-T3530 please refer to the relevant datasheet or reference guide.

The CB-T3 is available with three options of operating temperature range:

Table 26 Operating Temperature Ranges

Range	Temp.	Description
Commercial	0° to 70° C	Sample boards from each batch are tested for the lower and upper temperature limits. Individual cards are not tested.
Extended	-20° to 70° C	Every board undergoes a short test for the lower limit (-20° C) qualification.
Industrial	-40° to 85° C	Every board is extensively tested for both lower and upper limits and at several midpoints.

7 ACCESSORIES

Table 27 Accessories

Compulab P/N	Part Name	Description
199D10290	USB-A Rec to Micro-USB A Male adaptor	Cable, Adaptor , USB-A Rec to Micro-USB A Male, L=10cm Connects to P5, P7 and P9 on CB-T3.
199D10280	USB A Plug to Micro-USB B Plug	Cable, USB A Plug to Micro-USB B Plug, L=1m or 0.5m Connects to P9 on CB-T3.
199D10260	Cable, U.FL / I-Pex	Cable, U.FL / I-Pex, 6Ghz, L=150mm, double ended, 1.37mm coax cable. Can be connected directly to J1 on CB-T3
209C10040	adaptor, Generic to micro-USB	Power supp. adaptor, Generic to micro-USB (Type B), 1A Connects directly to P9 on the CB-T3.
605T10020	Stylus Pen	Stylus Pen, 97.2mm length, 4mm Dia
199A10020	AC power cord	Cord, AC power, 3 wire, US outlet to Notebook (IEC320-C5), 110V, 7A, 1.5m
139D3V000	LCD35	LCD panel, 3.5", TFT, 640x480x18bpp, 3.0V
209A10090	Power Supply 5V	Power supp. AC Univ w GND, 5V/3.6A, with generic adaptor plug, can be used for battery charging.
410X60200	CABFPC20	Cable, FFC, 20 cont, 0.5mm pitch, L=15cm
199D10170	CABDB9UMP	Cable, DB9-F to Ultra Mini Plug (USB like), L=2m (RS-232)
503M100100	KEYPAD	Assembled PCB, Demo Keypad for EM-X270
503R010090	CONFRJ45X2	Assembled PCB, CONFRJ45X2 adaptor
208B10030	Speaker 8ohm.	Speaker, Oval 13x18x3.75mm, 8ohm, with 40mm cable, 1.25mm conn
504B010020	EM-T3 Battery adaptor	Can be used for connecting a custom Li-Poly battery to EM-T3 as a main power source. Connects to P13 of CB-T3.