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TD230 Technical Datasheet

Navigil Ltd

This document describes the electrical connectivity and hardware functionality of the TD230 board.

Hardware revision D.

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DOCUMENT HISTORY

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1.0	Initial release	28.6.2012
1.09	Corrected DIO interrupt information	18.9.2012
1.10	Corrected VSAUT and GPS values	19.9.2012
1.11	Added image of extension connector	19.10.2012

Complementary reading

The following Navigil reference documents are complementary reading for this document. All operating and firmware related documentation is also available at ***extranet.navigil.com***

Ref. #	Document Name
1	TD230 Evaluation Kit User Guide
2	Navigil Application Protocol Version 1, Revision 8

1 General Overview

The Navigil TD230 is a compact tracking device that includes highly accurate GPS tracking, on-board complex data processing and GSM/GPRS reporting in one unit. A general block diagram of the TD230 Full version is presented below.

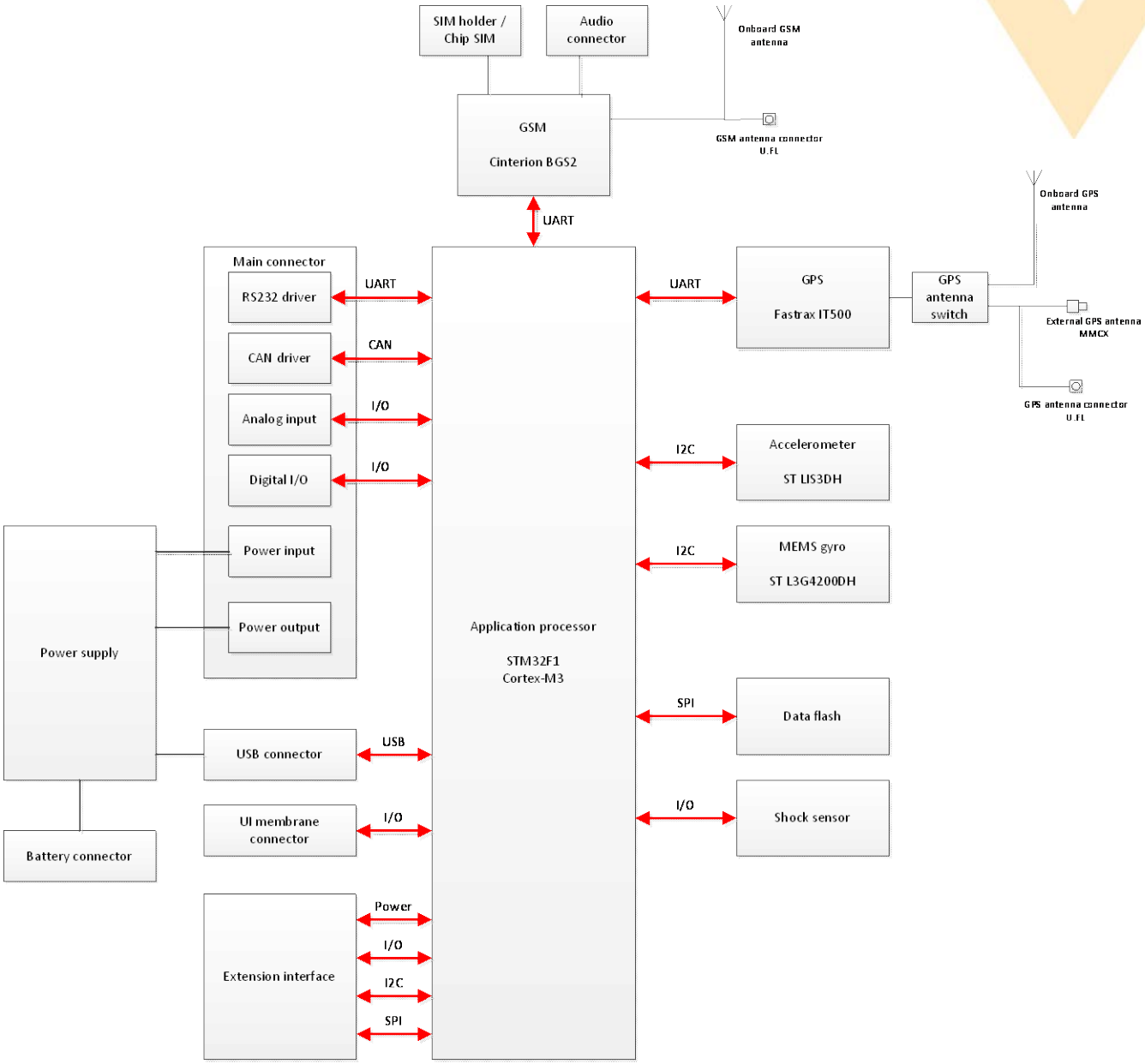


Figure 1. TD230 Block Diagram.

1.1 Key Features

The key features of the TD230 are:

- Compact unit: 92 mm x 58 mm x 24 mm (enclosed)
- Low power sleep mode: 200µA @ 3.8V (typ.)
- Wide power supply range (8-36 V and USB 5V)
- Internal lithium battery with battery heating option
- Integrated shock sensor
- Integrated 3D accelerometer
- Customizable local user interface (membrane)
- Optional integrated 3-axis gyro
- TD230 is available either as an enclosed unit or as a bare PCB
- TD230 is available in three variants: Full, Vehicle and Portable

2 Functional blocks

2.1 Application processor

The application processor of TD230 is an STM32F1 family MCU with Cortex-M3 core. The MCU has 256 kbytes of embedded flash and 48 kbytes of SRAM.

2.2 GPS

The TD230 uses Mediatek MT3329 chipset based Fastrax IT500 GPS receiver module. The GPS feature supports predicted ephemerides of up to 14 days, providing fast Time-To-First-Fix without the need to download new orbit information from the satellites.

GPS information is received from the module as standard NMEA 0183 sentences. The TD230 processes the NMEA sentences in order to minimize jumps and other undesirable artifacts in the raw NMEA stream.

2.2.1 GPS Antennas

The TD230 has multiple options of connecting a GPS antenna. In addition to an integrated chip antenna, there is a MMCX connector for external GPS antenna. TD230 has automatic switching logic to detect and use an external antenna whenever available. A fallback option to internal antenna is available for situation where the external antenna is broken. Optionally the TD230 can be equipped with a U.FL connector enabling free positioning of a GPS antenna inside a custom enclosure.

If a GPS antenna has been connected to the U.FL connector the MMCX antenna connector must be left unconnected and vice versa. Only one off board antenna can be connected at any time.

2.3 GSM

The TD230 utilizes Cinterion BGS2-W modem. This is a quad-band GSM/GPRS modem which is capable of communicating via SMS or GPRS with a backend server. Navigil offers an evaluation account on the Navigil Track&Trace server (see Ref. 1 [TD230 Evaluation Kit User Guide]) for customer testing purposes. TD230 supports voice calls by using a hands-free set.

2.3.1 GSM Antennas

TD230 has an on-board quad-band GSM antenna to cover world-wide GSM frequency plan. Optionally TD230 can be equipped with a U.FL connector for installations where the onboard antenna performance is not optimal. Using an external GSM antenna requires the use of a custom enclosure (not provided by Navigil).

2.3.2 SIM Card

TD230 has a holder for the standard SIM card (mini-SIM). The SIM card slot detects the insertion and removal of the SIM card. The TD230 SIM interface automatically detects and supports 3V and 1.8V SIM cards.

There is also a factory assembly option to use SMD SIM chip (in a 5 x 6 mm DFN-8 package). This requires a contract with a GSM operator that can provide SMD SIM chips. Navigil will handle the SIM assembly once the customer has made the operator agreement and SMD SIM chips are delivered to Navigil assembly line. Please contact Navigil sales for more information on the SMD SIM order procedure and for further information (sales@navigil.com).

2.4 Power supply

TD230 power supply has been organized into multiple stages, each stage being independent of other stages. TD230 can operate either directly from external power supply or using its internal battery. Battery heating is possible while the unit is powered from either VSAUT1 or VSAUT2 power source.

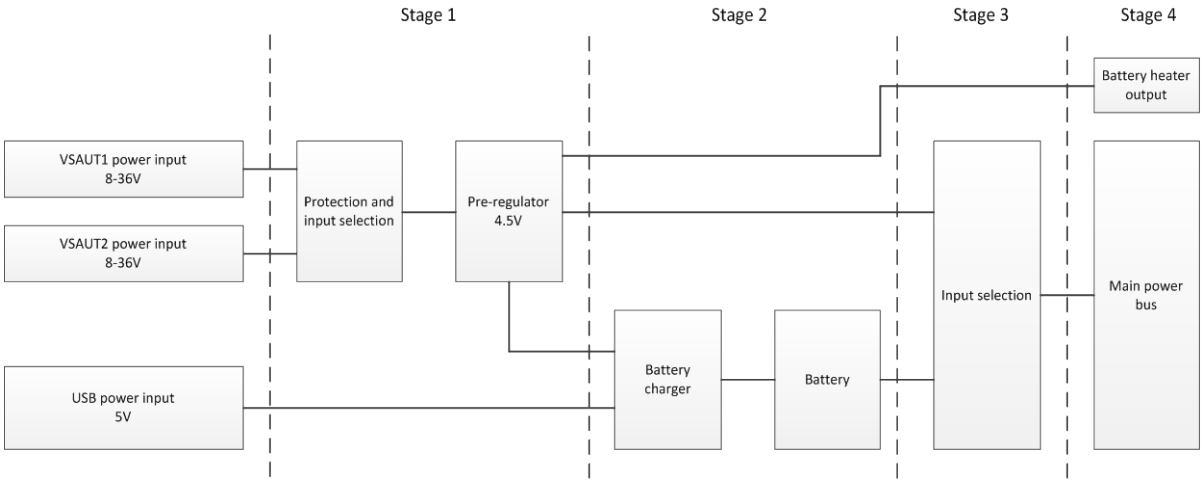


Figure 2. TD230 power supply

The first stage of the power supply is formed by two independent automotive power inputs VSAUT1 and VSAUT2. Both of them are compatible with 12V and 24V vehicle power systems. Voltage in each input can be measured separately. VSAUT inputs are protected against overvoltage spikes and the one with higher voltage is selected as a power supply of the pre-regulator. Power supplied to VSAUT inputs is regulated to 4.5V using a switching regulator. This regulated voltage is distributed to main PCB power, battery charger and battery heater output.

Battery charger is powered from both the pre-regulator output and USB power input. If both sources are available, the pre-regulator output is used and no power is drawn from the USB bus. The maximum charging current of the battery is 500mA regardless of the power source.

Battery voltage and pre-regulated voltage are combined in stage 3, providing power to the stage 4, where the main power bus voltage is further distributed to linear regulators and power switches. If VSAUT power supply is available, the pre-regulated voltage is used as input to the main power bus. While VSAUT power is available the battery will be charged, unless it is already full or battery temperature prevents charging.

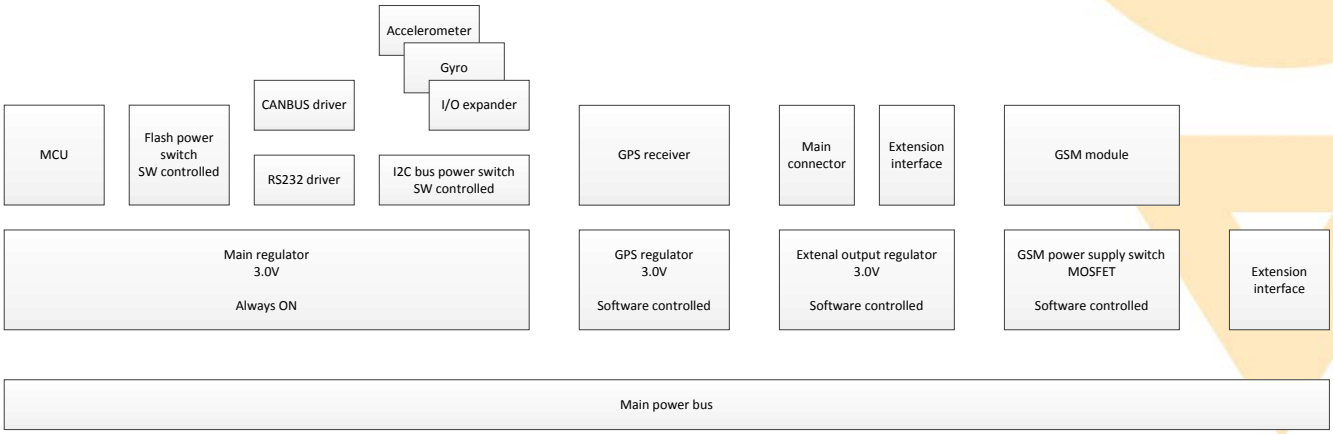


Figure 3. TD230 power regulation and distribution

As described above, voltage in the main power bus can either be the pre-regulated voltage or the battery voltage, depending on availability of VSAUT power supply. There are three 3.0V linear regulators from the main power bus: main regulator, GPS regulator and external output regulator. In addition to the linear regulators, there is a dedicated MOSFET switch to provide power to the GSM module. Main power bus voltage is also directly connected to the extension interface.

The main regulator supplies continuous power to the MCU, RS232 driver and CANBUS drivers. The CANBUS driver has a separate enable pin to put it to low power state when not needed. RS232 is automatically powered down when valid RS232 voltage is not present in its Rx input. There are separate software controlled switches for flash power and I2C bus.

GPS regulator is controlled by software and can be turned off, when GPS is not needed. Backup voltage from the main regulator output is provided to the GPS receiver to enable hot start when powered up again.

The third 3.0V regulator is not used internally by TD230, but is only used for providing supply voltage to external devices. The regulator output is connected to both the main connector and the extension interface.

2.4.1 Battery charging

TD230 has an onboard Li-battery charger with temperature monitoring to prevent damaging the battery by charging it outside the specified charging temperature range (0-45 °C). Battery charging may be possible in colder ambient temperatures if a battery heater is used as described in 2.4.2. The charger is powered from both the VSAUT supply and USB. If both power supplies are available, charging current is drawn from the VSAUT supply.

2.4.2 Battery heating

For operation in cold environments, where the ambient temperature remains below 0 °C for long times, TD230 provides power for a battery heater to raise the battery temperature above the minimum charging temperature and thus enabling the charging of the internal battery.

Battery heater output is powered from the pre-regulated 4.5 V voltage. Therefore battery heating is only possible when TD230 is powered from VSAUT. The maximum output current to the battery heater output is 500 mA @ 4.5 VDC.

Please see section 4 for details on battery heater soldering point locations and dimensions.

2.5 On-board Sensors

TD230 is equipped with a number of onboard sensors in order to minimize power consumption, detect trip starts and ends and to pin GPS location in order to remove jumps while stationary in difficult GPS signal conditions.

2.5.1 Shock sensor

TD230 has a simple mechanical shock switch connected directly to the MCU digital input. The shock sensor can be used by the software to wake up from sleep mode, pin GPS location and to sense trip start and end.

2.5.2 Accelerometer

A 3-axis MEMS accelerometer is connected to the MCU using I2C bus with dedicated I/O for interrupts and wakeups. The accelerometer type is ST LIS3DH. Accelerometer output can be used to wake up the unit from sleep mode. The data from accelerometer can be sent to a server using the MEASUREMENT_DATA message, please see Ref. 2 [Navigil Application Protocol Version 1, Release 8] for further details.

2.5.3 Gyroscope

A 3-axis MEMS gyroscope is available as an assembly option. The gyro is connected to the MCU using I2C with dedicated I/O for interrupts and wakeups. The gyroscope type is ST L3G4200DH. When TD230 is equipped with a gyroscope the heading information is derived from the gyroscope rather than from the GPS receiver. This improves the accuracy triggering of reports based on heading. Gyroscope is featured in the TD230 Full version only.

2.6 Temperature information

TD230 does not have a dedicated temperature sensor, but temperature information is available from two different sources:

- GSM module temperature
- Accelerometer temperature sensor.

Please note that the measured temperature is significantly affected by the charging current, whenever the battery is being charged.

2.7 Main connector

The main connector has 18 pins, its type is Molex 43045-1809. It contains the most commonly needed signals for fixed vehicle assemblies. If additional signals are required, further signals are available on extension interface (see section 2.8.3). The main connector is not present in the portable version.

The recommended mating connector is Molex 43025-1800. The recommended terminal types used in the mating connector are Molex 43030-0005 (AWG 26-30) and Molex 43030-0002 (AWG 20-24).

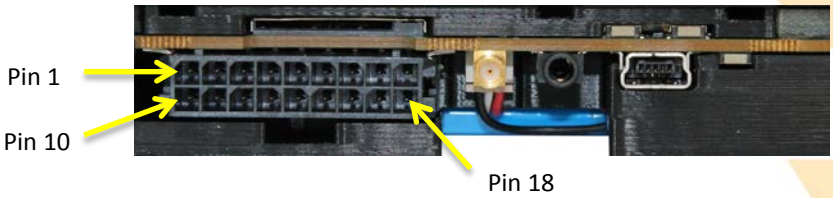


Figure 4. TD230 main connector

The main connector pins are defined in the table below:

Main connector pinout			
Pin	**Name**	**Description**	**Comment**
1	GND	PCB ground	
2	VSAUT1	Automotive power input 1	
3	ADC0	Analog input	
4	ADC1	Analog input	
5	RS232_TX	RS232 Tx line (RS232 level)	Same MCU UART as extension interface EXT_UART_TX
6	GND	PCB ground	
7	DIO1	Digital I/O	Same as extension interface EIO_DIO1
8	DIO3	Digital I/O	
9	GND	PCB ground	
10	NC	Not connected, must be left floating	
11	VSAUT2	Automotive power input 2	
12	CAN_HI	CANBUS HI line	
13	CAN_LO	CANBUS LO line	
14	RS232_RX	RS232 Rx line (RS232 level)	Same MCU UART as extension interface EXT_UART_RX
15	HCURR	High current load switch	
16	VEXTOUT	Regulated 3.0V output	Same as extension interface VEXTOUT
17	DIO2	Digital I/O	Same as extension interface EIO_DIO2
18	DIO4	Digital I/O	

2.7.1.1 Power supply inputs

There are two main power supply inputs VSAUT1 and VSAUT2, both compatible with 12V and 24V vehicle systems. Both lines can supply power to TD230 independently. In case of both supplies being available, the one with the higher voltage is used.

Voltage from the VSAUT power supply is regulated to 4.5V and then used for battery charging, battery heating and direct powering of the TD230 PCB.

2.7.1.2 RS232

One UART port from the MCU is connected to the main connector via an RS232 transceiver. In the standard software the port is used as the TD230 maintenance console. Custom protocols can be implemented with the TG2 SDK.

2.7.1.3 CANBUS

CANBUS 2.0 is available in the main connector. Higher level protocols must be implemented with the TG2 SDK. CANBUS IO is available in the TD230 Full version.

2.7.1.4 Digital I/O

There are 4 digital I/O lines (DIO1-DIO4) in the main connector. Each line can independently be configured either as an input or an output. DIO1-2 lines can be configured to generate interrupts.

2.7.1.5 Analog I/O

There are two analog inputs (ADC0-ADC1), each capable of measuring voltages in the range of 0-36V.

2.7.1.6 High-current load switch

The TD230 has an open drain load switch that can be used for switching an external high current load on and off. A typical application is to drive a standard automotive relay as described in Figure 5.

Note that TD230 does not provide the operating current for any device controlled by the high current load switch. High current load switch is a low side load switch that can only sink current.

The high current load switch pin must be connected to the negative power supply terminal of the external device, while the positive terminal is connected to an external power supply.

When an inductive load is connected to high current load switch, a flyback diode with sufficient current rating should be connected in parallel with the external load. A relay coil, a heater coil and an electric motor are examples of such inductive loads.

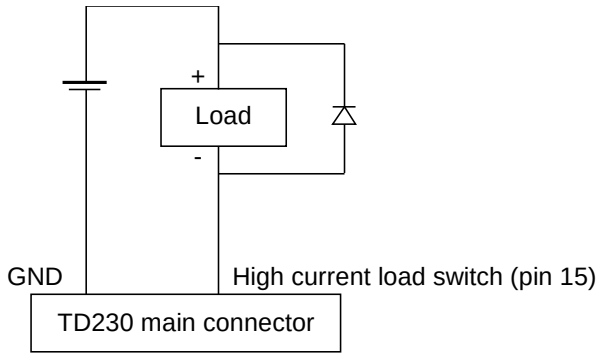


Figure 5. Relay driver output connectivity and protection

2.7.2 External GNSS antenna

When the TD230 is installed so that there is limited or no visibility to sky (i.e. covert installation), it is highly recommended that an external GPS antenna is used in order to get good GPS performance. The external antenna has to be an active antenna that can operate from 3.0V bias voltage at <20 mA bias current. Total power gain of the antenna and antenna cable must be in range 5dB…30dB. The external antenna should include internal SAW filter for improved out of band signal rejection. The antenna connector of the TD230 is MMCX female. Optionally the TD230 can be equipped with a U.FL connector for an off-board GPS antenna inside a custom enclosure.

Contact Navigil sales for recommendations of suitable antennas (sales@navigil.com).

2.7.3 Audio interface

The TD230 has a connector jack for a 2.5mm hands free plug. The interface supports a microphone and an earpiece. The button (for answering incoming call) sometimes featured in a hands free kits is not supported. The electrical connection for microphone and earpiece is differential. The connector type used is Technik industrial TG-2864D. The connections of a mating jack are described in Figure 6 below.

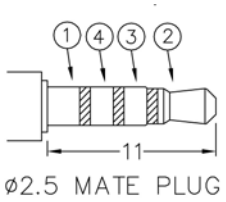


Figure 6. Audio jack pinout

The pinout of the audio jack is described in the table below.

Audio jack pinout		
Pin	**Name**	**Description**
1	GSM_MICP	Microphone positive
2	GSM_EARP	Earpiece positive
3	GSM_MICN	Microphone negative
4	GSM_EARN	Earpiece negative

Contact Navigil sales for references for suitable hand-free kits to be used with TD230.

2.7.4 USB

The current version of TD230 supports power supply from USB. The 5V supply provided by the USB connector is used for powering the battery charger. The connector type used is Molex 67503-1020. The typical mating connector has features similar to the Molex 47014-0000.

Future versions of TD230 software may include support for USB data connections.

2.8 Internal interfaces

2.8.1 Battery connectors

Standard TD230 enclosure has a place for a 1.150 mAh 3.7V Li-ion battery. See section 3 for requirements for the battery. Battery connects with wires to an onboard connector (Hirose DF13-3P-1.25DSA). The recommended mating connector is the Hirose DF13-3S-1.25C or equivalent.

Both battery connector types contain three contacts: battery positive and ground terminals as well as an NTC line for battery temperature monitoring. The NTC connection is mandatory for battery charging. See Figure 12 for battery connector placement.

Battery connector pinout			
Pin	**Name**	**Description**	**Comment**
1	BATT_POS	Battery positive	
2	BATT_NTC	Negative temperature coefficient	Must be connected for proper charging
3	BATT_GND	Battery ground	

2.8.2 User interface membrane

The TD230 standard enclosure features a user interface membrane with 3 LEDs and 3 buttons for quick and low-cost hardware rebranding and customization. The print layer of the membrane can easily be redesigned to include custom colors, logos and texts. Contact Navigil sales for details on print layer redesign.

The dimensions of the membrane used with the standard TD230 enclosure are defined in Figure 7 below. Please note that there is a small taper on the sides of the membrane (not shown on the drawing below), please contact Navigil sales for digital templates for design. Stated outside dimensions are maximum dimensions that fit into the top cover cavity on the standard TD230 enclosure. Buttons and LEDs may be placed anywhere on the left hand side of the membrane. Printing can be done in customer colours including logo, button symbols and LED legends.

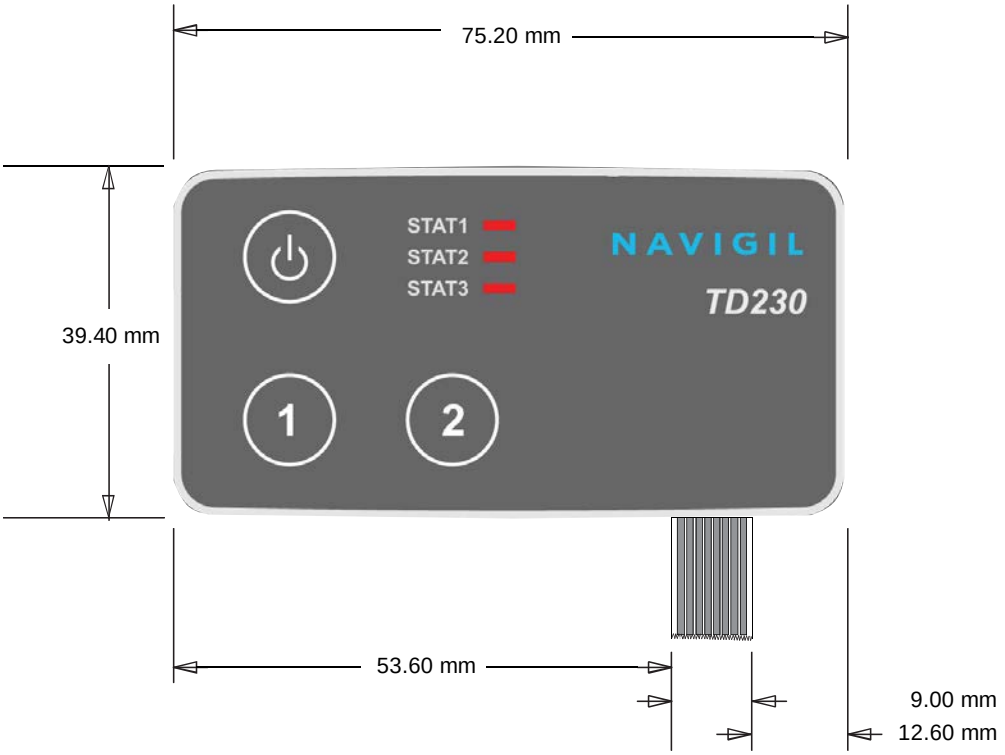


Figure 7: Membrane dimensions

The UI membrane connects to the TD230 PCB with a flex cable, using an 8-pin ZIF connector. The connector used is Molex 52207-0885. The recommended dimensions of the membrane flex cable are described in Figure 8 below.

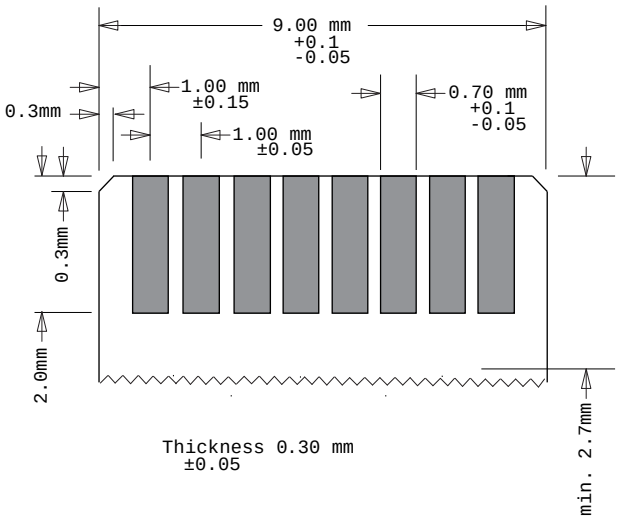


Figure 8: Membrane flex cable dimensions

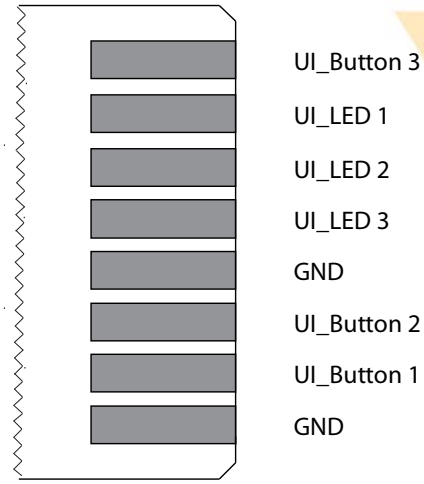


Figure 9: Membrane flex cable pinout

The UI flex cable pinout is defined in Figure 9 above. Please note that on the TD230 PCB each UI_LED line has a 1 kΩ serial resistor. UI_Button lines are connected to the MCU for wake up and interrupt purposes.

The electrical parameters of the membrane connector are described in detail in section 3.2.

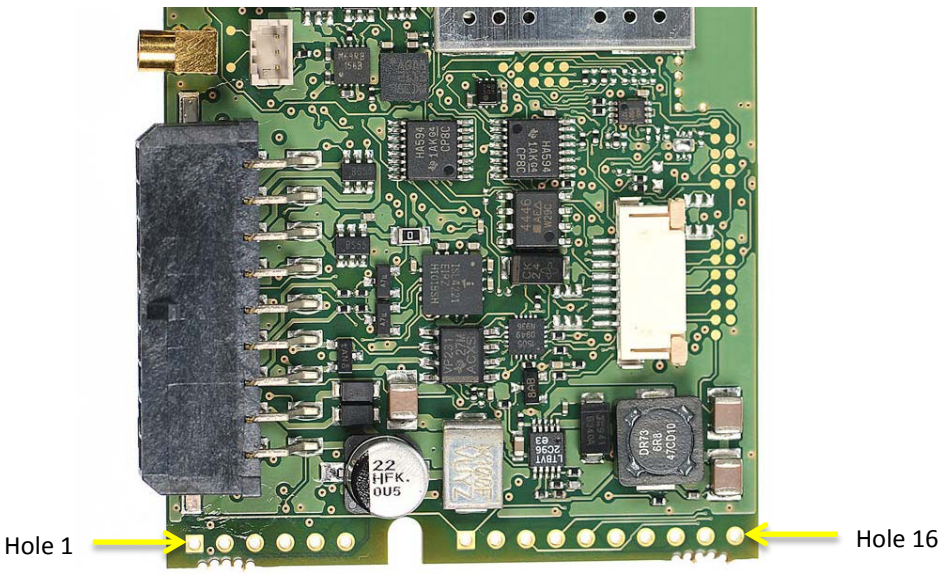
Please contact Navigil sales for further information on custom printed membranes (sales@navigil.com).

2.8.3 Extension interface

For interfacing with custom hardware, TD230 contains a 16-hole extension interface at the bottom edge of the PCB. The interface contains power supply, SPI and I2C serial buses and digital GPIO lines.

The physical interface has two rows of 0.88 mm holes on the PCB with 2.54 mm pitch. See section 4 for detailed placement of the holes.

The standard TD230 enclosure does not support any extension hardware to be connected because of space restrictions. When using the extension interface, a custom enclosure must be designed.



The extension interface pinout is described in the table below.

Extension interface hole assignment			
Hole	**Name**	**Description**	**Comment**
1	GND	PCB ground	
2	PWR_VMAIN	Main power supply line	See section 3.2 for details
3	VEXTOUT	Regulated 3.0V output	Same as main connector VEXTOUT, software controlled enable line
4	NC	Not connected	Must be left floating
5	EXT_UART_RX	UART Rx (TTL level)	Same MCU UART as main connector RS232_RX
6	EXT_UART_TX	UART Tx (TTL level)	Same MCU UART as main connector RS232_TX
7	SPI_CLK	SPI bus clock	
8	SPI_MISO	SPI bus MISO	
9	SPI_MOSI	SPI bus MOSI	
10	I2C_SCK	I2C bus clock	
11	I2C_SDA	I2C bus data	
12	NC	Not connected	Must be left floating
13	EIO_DIO1	Digital I/O	Same as main connector DIO1
14	EIO_DIO2	Digital I/O	Same as main connector DIO2
15	NC	Not connected	Must be left floating
16	NC	Not connected	Must be left floating

2.9 Reset and boot mode selection buttons

There are three miniature push buttons located on the rear edge of the PCB. Device reset can be triggered with the reset button. Additionally a special boot mode can be selected using the boot select buttons.

The reset button is located right next to the USB connector. The reset button is also accessible in the standard TD230 enclosure through the small hole in the back panel. Accessing boot select buttons (if assembled) requires removing the back panel.

Boot mode is defined by the states of the boot select buttons on the moment the reset button is released.

TD230 boot modes		
BOOT0	**BOOT1**	**Boot mode**
Not pressed	Not pressed	Normal application boot mode
Pressed	Not pressed	MCU ROM bootloader, for Navigil internal use only
Not pressed	Pressed	TD230 bootloader
Pressed	Pressed	Boot from MCU SRAM, not supported by TD230

NOTE: BOOT0 mode is reserved for Navigil internal use only and the corresponding boot select button may be omitted from the assembly.

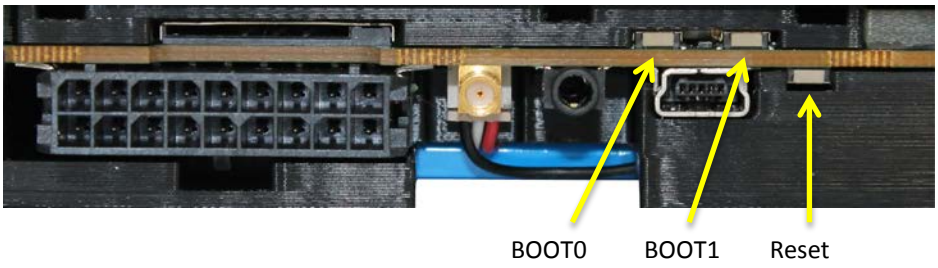


Figure 9: Placement of reset and boot select buttons

2.10 Battery

TD230 can be used with a chargeable lithium battery. The battery charger supports maximum of 500 mA charging power. The key characteristics of an approved battery are nominal voltage of 3.7V, minimum capacity of 500 mAh, maximum capacity of 2.000 mAh and low internal resistance. The TD230 draws up to 1.7A of current from the battery when the GSM module is registering to the network. The battery used with TD230 must be able to supply this current.

3 Operational specification

3.1 Environmental parameters

Following tables describe the environmental conditions under which the TD230 can be used.

Temperature range, PCB only					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Storage temperature	-40		+85	°C	
Operating temperature, limited functionality	-40		+85	°C	GSM not operational, degradation in GNSS accuracy
Operating temperature, full functionality	-30		+70	°C	

Temperature range, battery					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Storage temperature	-20		+60	°C	
Discharging temperature	-20		+60	°C	
Charging temperature	0		+45	°C	Refers to battery temperature
Charging temperature, with battery heating	-10		+45	°C	

3.2 Electrical parameters

Following tables describe the minimum, typical and maximum electrical parameters for TD230.

Power supply					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
VSAUT1/VSAUT2 supply voltage	8		32	V	
VSAUT1/VSAUT2 current drain	0	70	2000	mA	Typical value measured with battery full, heating disabled and no external load.
USB supply voltage	+4.8	+5.0	+5.2	V	
USB current drain	0		500	mA	
Battery capacity	500		2000	mAh	
Battery internal resistance			160	mΩ	
Battery voltage	3.5		4.2	V	
Battery current drain, active mode	30	70	150	mA	Average
Battery current drain, peak			1700	mA	During GSM transmit bursts
Battery current drain, sleep mode	200		300	uA	Assumes no external load during sleep

Main connector (18 pin connector)					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Digital IO voltage, high state	2.7	3.0	3.2	V	Output mode
Digital IO voltage, low state	0	0	0.3	V	Output mode
Digital IO source current			1	mA	Output mode
Digital IO voltage, high state	2.7		3.2	V	Input mode
Digital IO voltage, low state	0		0.3	V	Input mode
Digital IO sink current			1	uA	Input mode
Analog input measurement range	0		36	V	
High current load switch voltage	0		30	V	
High current load switch current			1000	mA	Sinking only

Extension interface (16 holes)					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
PWR_VMAIN voltage, battery/USB powered	3.5		4.2	V	
PWR_VMAIN voltage, powered from VSAUT1 / VSAUT2	4.4	4.5	4.6	V	
PWR_VMAIN current			300	mA	
VEXTOUT voltage	2.8	3.0	3.2	V	
VEXTOUT current			150	mA	

Membrane connector (8 pin connector)					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
LED voltage, high state	2.7	3.0	3.2	V	1Kohm serial resistor on PCB
LED voltage, low state	0	0	0.3	V	1Kohm serial resistor on PCB
Button IO voltage, high state	2.7		3.2	V	Input mode
Button IO voltage, low state	0		0.3	V	Input mode

GPS Parameters					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Navigation sensitivity		-165		dBm	Conductive measurement
Acquisition sensitivity		-148		dBm	Conductive measurement
Re-acquisition sensitivity		-160		dBm	Conductive measurement
Cold start TTFF		34		s	
Warm start TTFF		33		s	
Hot start TTFF		1		s	
Position accuracy		1.8		m	CEP95 criteria
Velocity accuracy		0.1		m/s	
External antenna bias voltage	2.7	3.0		V	
External antenna bias current			20	mA	Internal limiter: 40mA
External antenna gain	5		30	dB	Including cable loss.

GSM/GPRS Parameters					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
TX Frequency, 850MHz Band	824		849	MHz	
TX Frequency, 900MHz Band	880		915	MHz	
TX Frequency, 1800MHz Band	1710		1785	MHz	
TX Frequency, 1900MHz Band	1850		1910	MHz	
RX Frequency, 850MHz Band	869		894	MHz	
RX Frequency, 900MHz Band	925		960	MHz	
RX Frequency, 1800MHz Band	1805		1880	MHz	
RX Frequency, 1900MHz Band	1930		1990	MHz	

Audio Interface Parameters					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Speaker impedance	27	32		Ω	
Frequency band	300		3350	Hz	
Pass band flatness	-0.2		0.1	dB	
SNRD, speaker output	47			dB	
SNRD, microphone input	70	77		dB	

On-board battery charger					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Charge current, powered from VSAUT	45	530	600	mA	
Charge current, powered from USB	45	370	500	mA	
Trickle charge current		45		mA	
End of charge voltage		4.2		V	
Re-charge threshold		4.0		V	
Trickle charge threshold		2.8		V	
Charging temperature	0		+45	°C	

3.3 ESD Specification

The following table describes the ESD specification of various TD230 connections.

ESD Parameters					
Device IO-pin	**Min**	**Typ**	**Max**	**Unit**	**Note**
SIM Interface (1)	-4		+4	kV	ETSI EN 301 489-1/7
SIM Interface (2)	-8		+8	kV	ETSI EN 301 489-1/7
GPS Ant. Connector (1)	-8		+8	kV	IEC61000-4-2
GPS Ant. Connector (2)	-15		+15	kV	IEC61000-4-2
Audio connector (1)	-8		+8	kV	IEC61000-4-2
Audio connector (2)	-15		+15	kV	IEC61000-4-2
USB Data and Vdd (1)	-8		+8	kV	IEC61000-4-2
USB Data and Vdd (2)	-15		+15	kV	IEC61000-4-2
GPIO Interface (1)	-1		+1	kV	ETSI EN 301 489-1/7

Note (1): Contact Discharge
Note (2): Air Discharge

4 Mechanical Specification

The mechanical dimensions of the TD230 enclosed unit and PCB are defined in the tables and figures below. Please note that generic mechanical accuracy is ± 0.5 mm unless otherwise stated.

TD230 PCB dimensions					
Dimension	**Min**	**Typ**	**Max**	**Unit**	**Note**
Length		84.0		mm	± 0.5 mm
Width		50.0		mm	± 0.5 mm
Height		14.0		mm	± 1.0 mm
Weight	30	34	40	gr	± 4 gr (depending on configuration)

TD230 enclosure dimensions					
Dimension	**Min**	**Typ**	**Max**	**Unit**	**Note**
Length		92.0		mm	± 0.5 mm
Width		58.0		mm	± 0.5 mm
Height		24.0		mm	± 1.0 mm
Weight	90	94	100	gr	± 4 gr (depending on configuration)

The TD230 PCB overview [Figure 10.] describes the dimensions of PCB holes and slots in addition to battery heater soldering point dimensions.

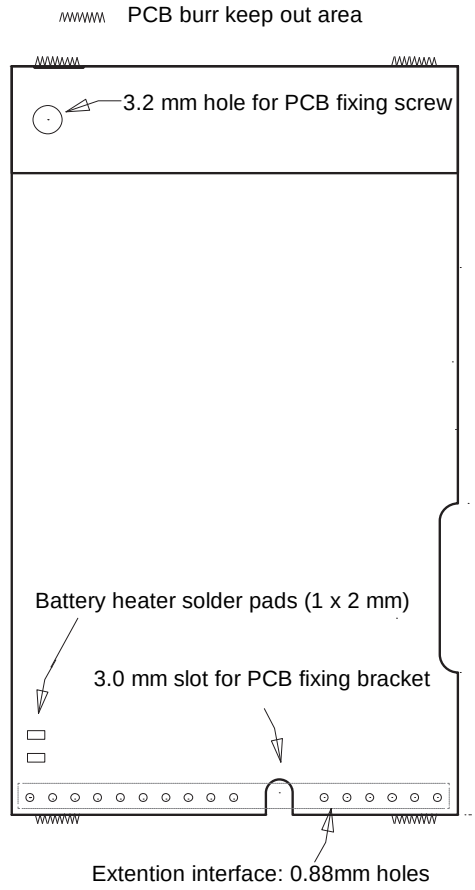


Figure 10. TD230 PCB Overview

TD230 PCB top side dimensions can be found in Figure 11 below. SIM card opening dimensions tolerances are ±0.7 mm.

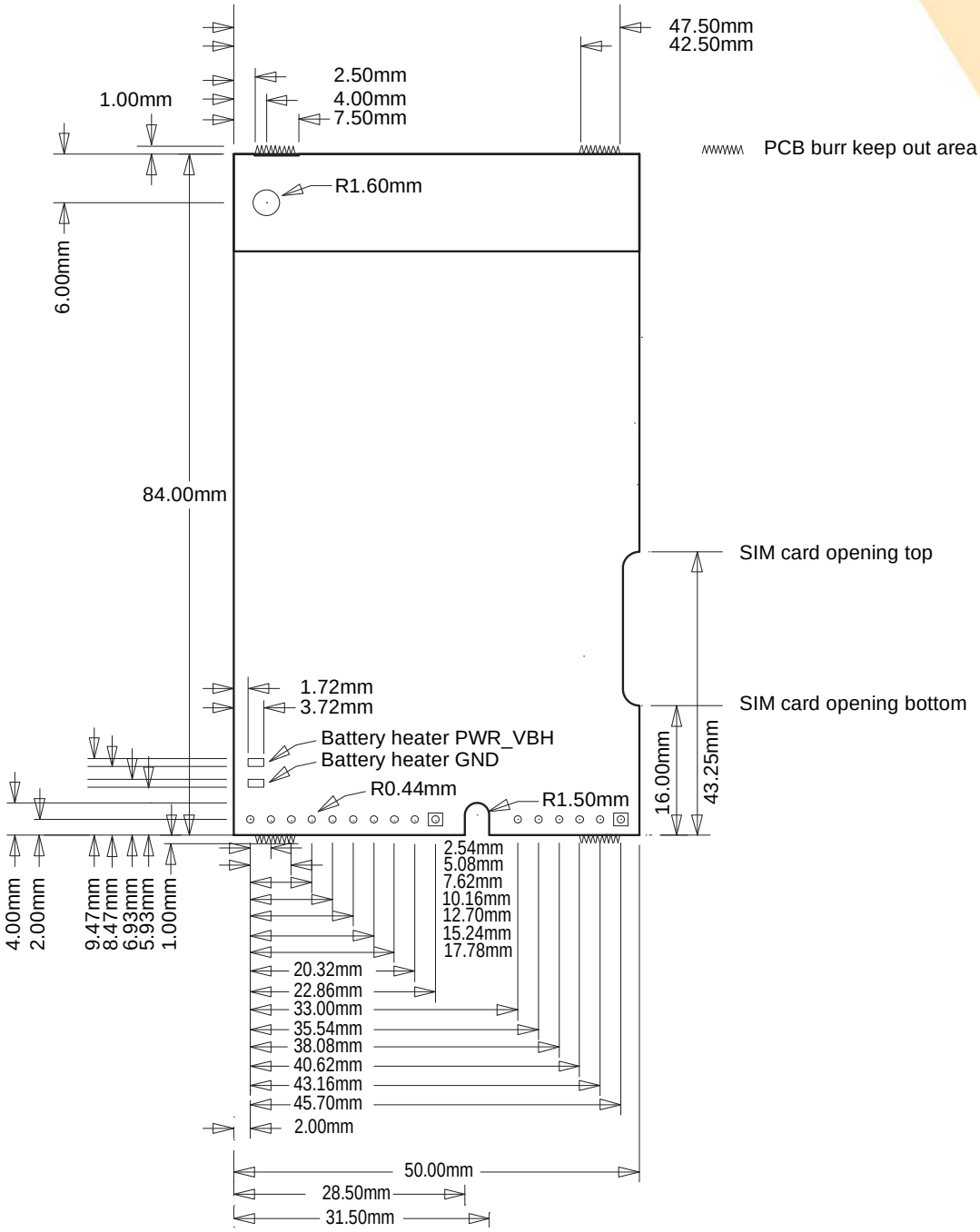


Figure 11. TD230 PCB Top side dimensions

TD230 PCB bottom side dimensions can be found in Figure 12 below. Connector placement dimension tolerances are ±1.0 mm

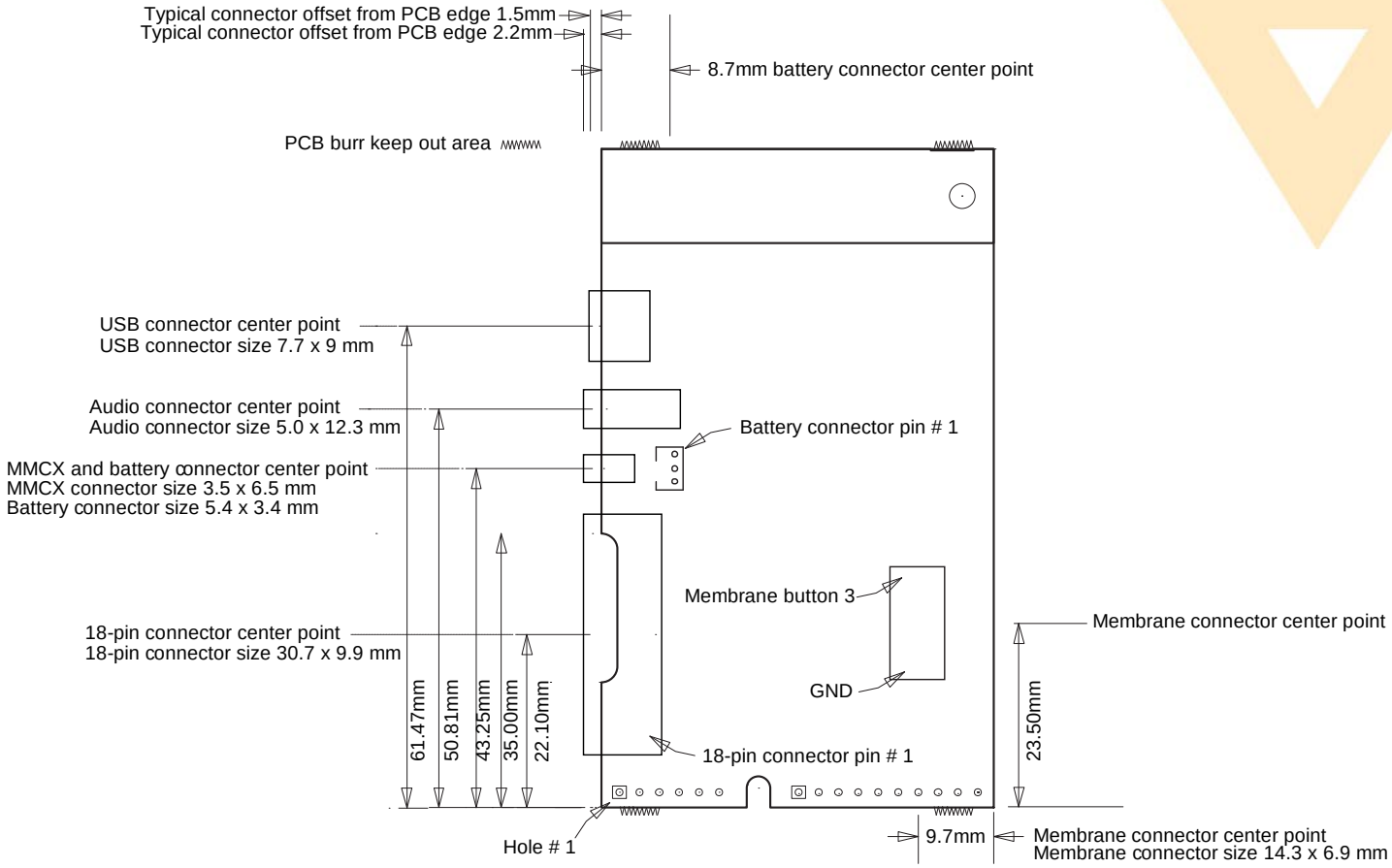


Figure 12. TD230 PCB bottom side dimensions