MPOS-STD2 EV KIT User Guide

Ref: UG25H10

Revision A

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Revision History

Rev A	2014-Nov-17	1st release

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Glossary

I2C	Inter Integrated Circuit Protocol
JTAG	Joint Test Action Group - IEEE 1149.1 Standard Test Access Port
I/O	Input / Output
SPI	Serial Peripheral Interface
TFT	Thin Film Transistor
UART	Universal Asynchronous Receiver/Transmitter for serial communications
PCBA	Printed Circuit Board Assembled
EV KIT	Evaluation Kit
LiPo	Lithium-Ion Polymer
TP	Test Point
PCLK	Pixel Clock
HSYNC	Horizontal Synchronization
VSYNC	Vertical Synchronization

1 Introduction

MPOS-STD2 EVKIT is dedicated to software development for MPOS-STD2 platform. This document provides useful information for users.

2 Notations

2.1 Symbols

Hereafter is the meaning of symbols used in this document.

Symbol	Description
	Header pin 1 location
	Jumper
	Tips or warning

Figure 1 : Symbols

2.2 Header Numbering

Single and double row headers are numbered as follow:

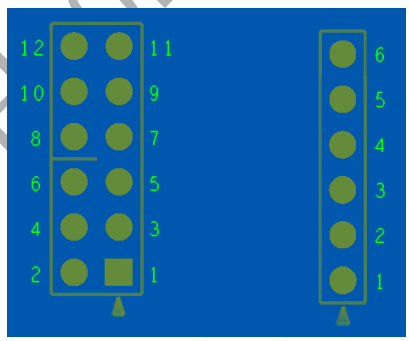

Figure 2 : Header Numbering

2.3 Net Name Prefix

Prefix	Description
V_SBAT_	'S' stands for "Secondary" term. Voltages with this prefix are powered by rechargeable battery, sorted on "Secondary" keyword at battery manufacturers.
V_PBAT_	'P' stands for "Primary" term. Voltages with this prefix are powered by non-rechargeable battery, sorted on "Primary" keyword at battery manufacturers.

Table 1 : Prefix

3 Deliverable

MPOS-STD2 EVKIT contents:

- MPOS-STD2 EV-KIT revision A
- J-Link Lite JTAG probe
- USB cable
- Wall power supply with micro-USB termination
- CR1632 battery
- 3.7V 400mAh Li-Polymer battery

4 Overview

MPOS-STD2 EVKIT is based on MPOS-STD2 reference design revision B. It provides additional features for testing and debugging:

- Additional test points
- Headers for probing and analysis
- JTAG connector.

Busses and useful tests points are available on the top side of the EVKIT. The smartcard connector, the rechargeable battery and some additional test points are placed on bottom side.

Note that the tamper mechanisms installed in MPOS-STD2 reference design are not designed in the same way on the EVKIT. They are installed for test purposes.

The pictures below provide locations of test points and connectors:

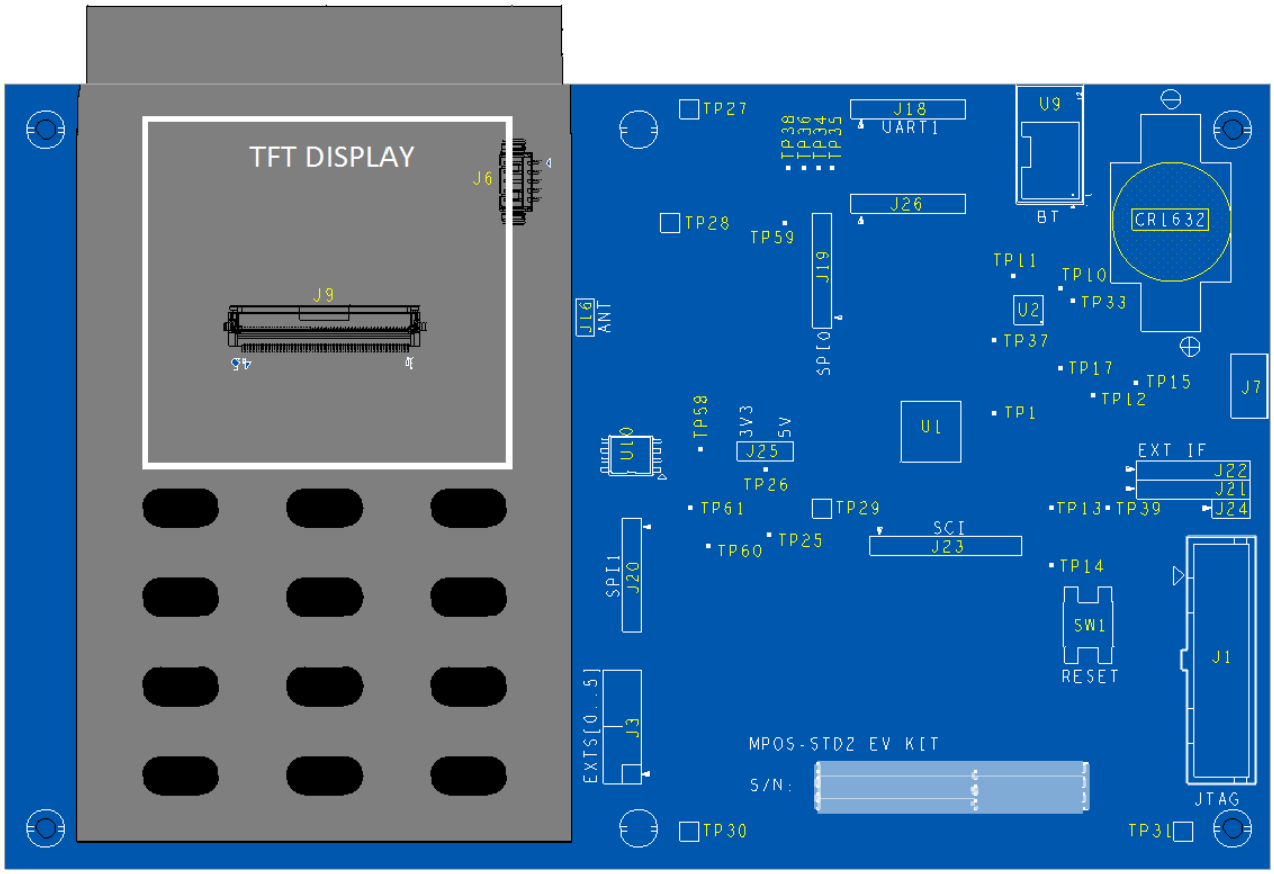

Figure 3: Top View

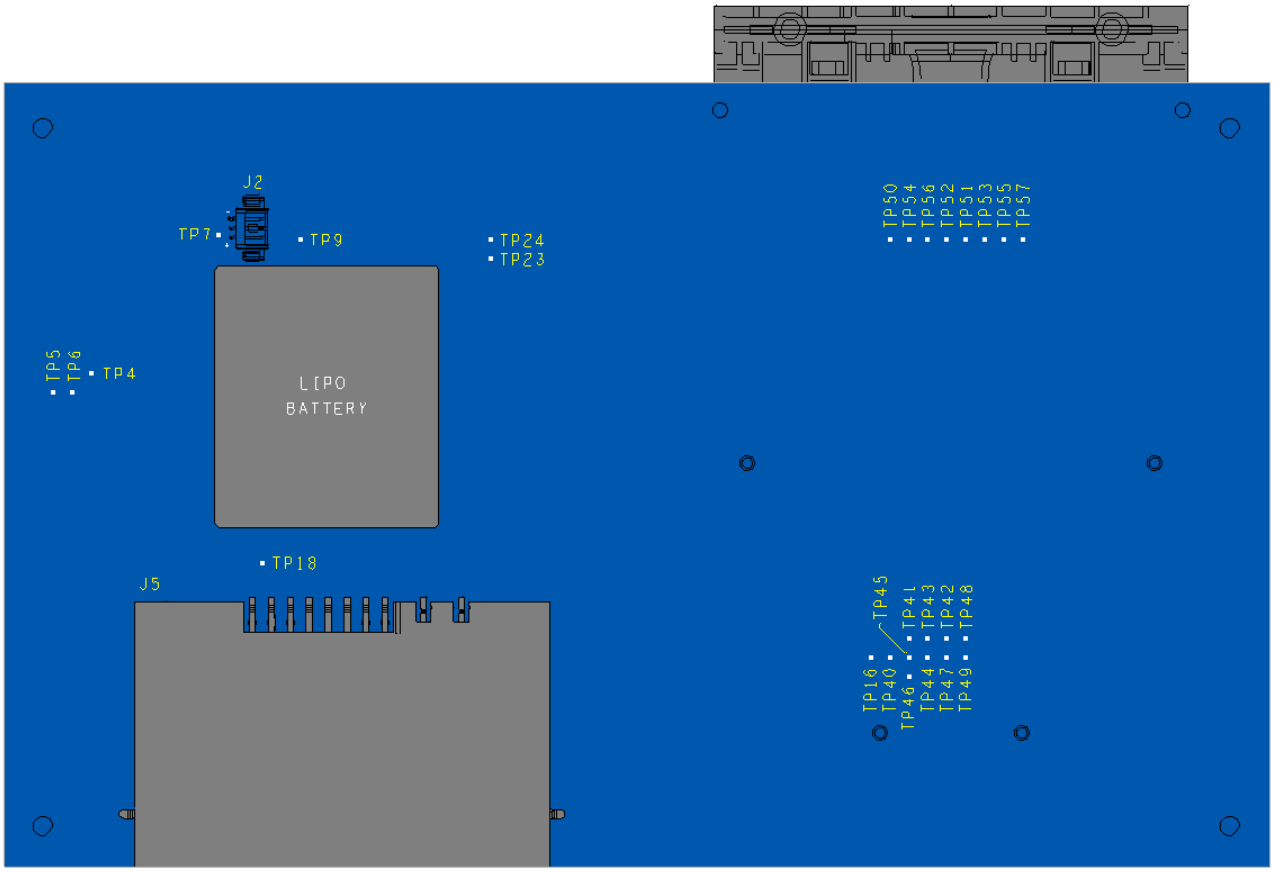

Figure 4: Bottom View

5 Board Usage

5.1 Power Supply

The table below provides a list of the power supplies with theirs characteristics and the associated test point.

Power Supply Net Name	Test Point	Voltage	Max Current	Notes
V_VBUS	**TP4**	5V	500mA	Battery charge current is limited at 300mA by hardware
V_LDO_USB_CHRG	**TP9**	3.3V	30mA	Permanent voltage. Present if a working battery is connected
V_PBAT	**TP15**	3V	-	Non-rechargeable battery
V_SBAT	**TP7**	2.4 to 3.7V	400mA	Rechargeable battery
V_VSYSTEM	**TP12**	2.4 to 4.2V	500mA	4.2V when VBUS is present V_SBAT otherwise
V_SBAT_VDD	**TP13**	3.3V	570mA	Regulated by U3 (step-up-down)
V_SBAT_SC_VDDA	**TP14**	5.25V	150mA	Active only if **SC_PWR_EN** is set.

Table 2 : Power Supplies

5.1.1 Control

The two batteries (backup battery + rechargeable battery) are must be connected. To switch-on the EVKIT, there are two ways:

- Connect the USB port to a power source (a USB host or a wall power adaptor)
- Push and maintain "**VALID**" key

In the second case, the software will have to Set **PWR_SUS_CMD** signal to '1' and the batteries must have a sufficient charging level

For smartcard readers operation the software must enable **V_SBAT VDDA** power rail (Smartcard and Contactless analog power supply) by setting **SC_PWR_EN** signal.

5.1.2 0R Resistors

Some 0R resistors are placed on the design allowing performing power supply current consumption measurement:

Voltage Name	Resistor Descriptor	Type	Description
V_SBAT	**R92**	PWR	Rechargeable Battery
V_SBAT_VDD	**R84**	PWR	Main 3.3V Power
V_SBAT_VDDA	**R85**	PWR	5.25V Power
V_PBAT	**R86**	PWR	Backup Battery
CLRC663_TVDD	**R87**	PWR	Contactless Analog Power

Table 3 : 0R Resistors

5.2 Reset

It is possible to reset platform from three sources:

- **JTAG**
- **RESET** Button
- Combination of "**Abort**" and "**Valid**" key during 4 seconds

5.3 Jumper Default Configuration

An EVKIT is provided with a default jumper configuration:

- External sensors are closed
- Smartcard readers power supply is set to 5V

The Picture below shows how they are installed and located on the board.

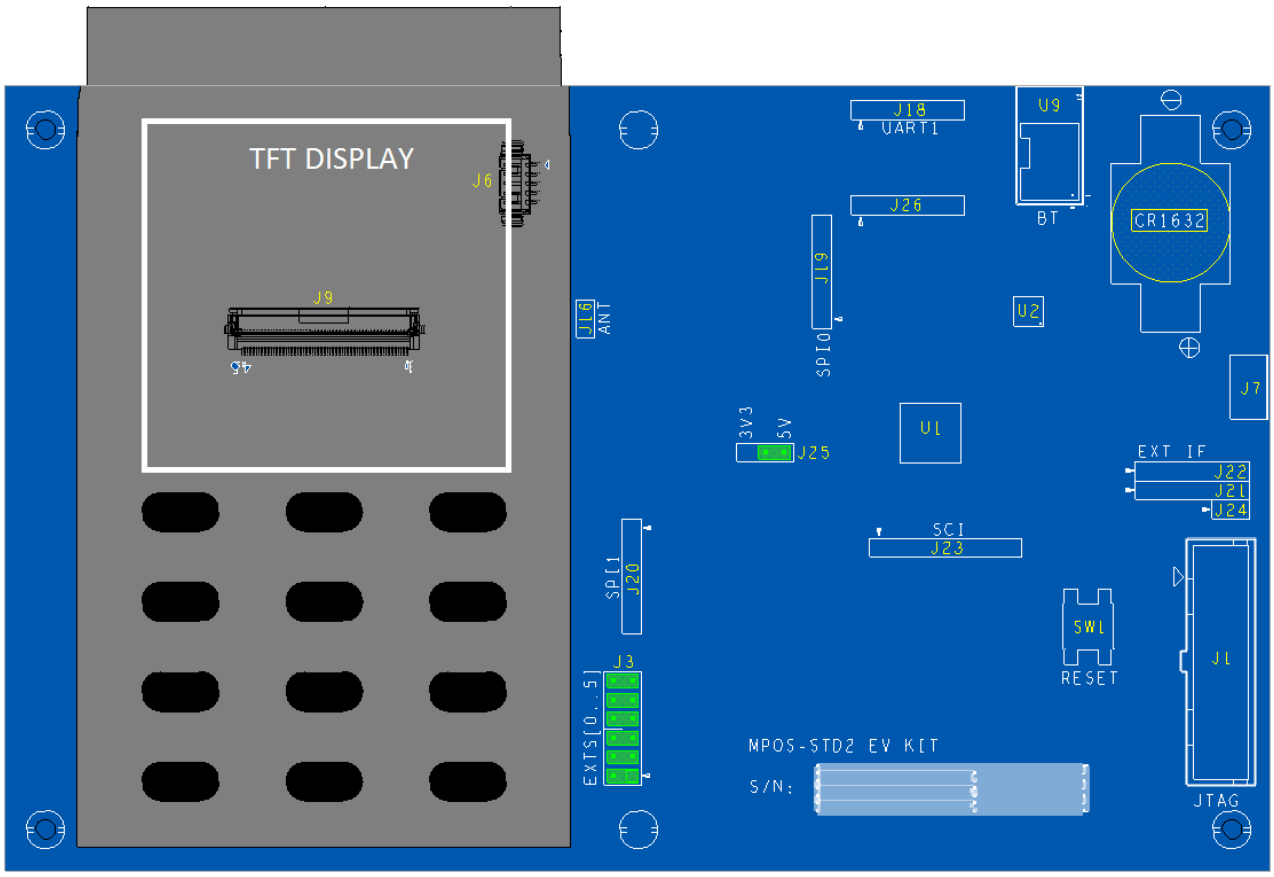

Figure 5 : Jumper Configuration

5.4 Peripherals

5.4.1 ADC Inputs

Two tests points provide an access to ADC inputs:

Signal Name	Pin Number	Enable Signal	Description
SBAT_FB	U1.ADC0	SBAT_ADC_EN	V_VSYSTEM image
PBAT_FB	U1.ADC1	PBAT_ADC_EN	V_PBAT Image

Table 4 : ADC Description

Insulation circuitries are placed in between the ADC inputs and the power supply rails. They prevent from short-circuiting a power supply rail through the ESD protection when the device is switched off. To perform battery voltage measurement, the software has to control the insulation circuit first. The schematic below shows one those circuitries.

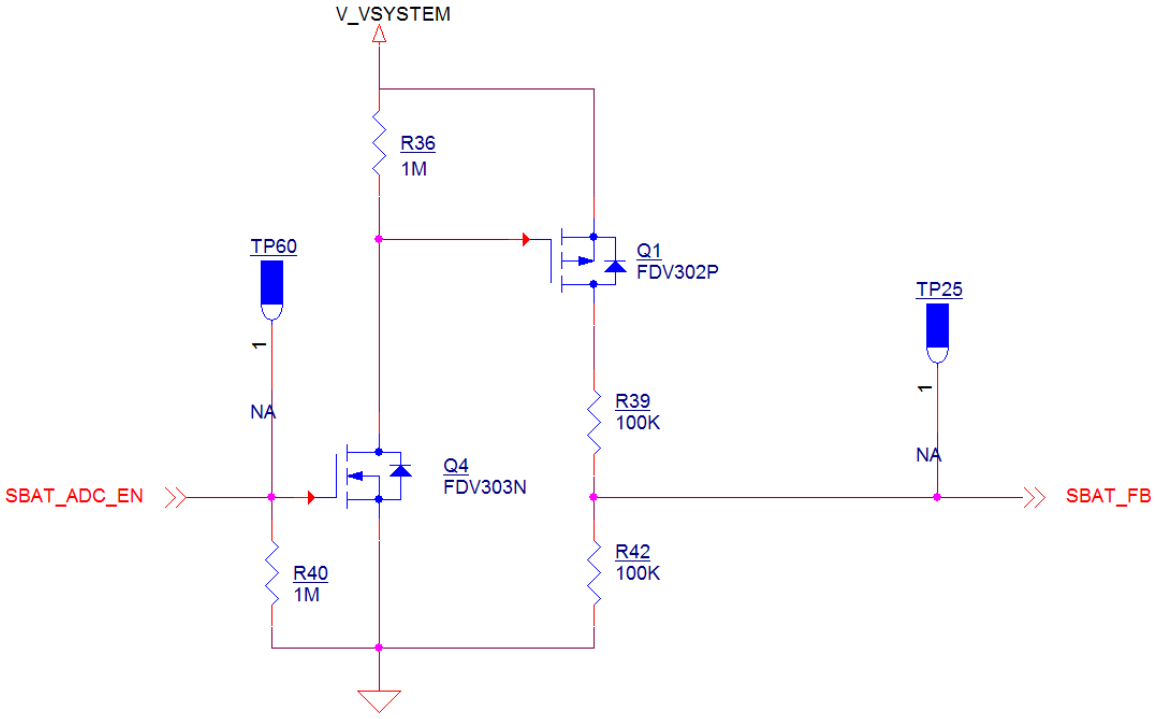

Table 5 : ADC schematics

- **To measure V_VSYSTEM, SBAT_ADC_EN must be set first.**
- **To measure V_PBAT, PBAT_ADC_EN must be set first.**

5.4.2 DAC Output

A DAC output is also available even if it is not implemented in the MPOS-STD2 reference design.

Signal Name	Pin Number	Type	Description
DAC0	U1.DAC0	Dedicated IO	DAC0 Output
GROUND	NA	PWR	Analog Ground

Table 6 : DAC Description

5.4.3 PWM/Timers Output

The two PWM/Timers I/Os are accessible.

Signal Name	Pin Number	Type	Description
BT_ACT	U1.TCLK0	Multiplexed IO	Designed for providing Bluetooth status
TFT_PWM_ BL_CTRL	U1.TCLK1	Multiplexed IO	TFT backlight intensity control.

Table 7 : Timers description

The application is responsible to control the PWM for enabling those functionalities.

5.4.4 MSR

MPOS-STD2 design provides a 2-tracks magnetic stripe reader and the EVKIT as well. Even if the MAX32550 can drive 3 tracks the third interface is not accessible.

There is no dedicated test point on the magnetic stripe reader interface. Anyway it is possible to install probing if needed. Please refer to schematics.

5.4.5 TFT Interface

The TFT display used is an EVERTRON ET023C1-TP. It is connected to work in **RGB 16-bits** mode with **HSYNC/VSYNC/PCLK** controls.

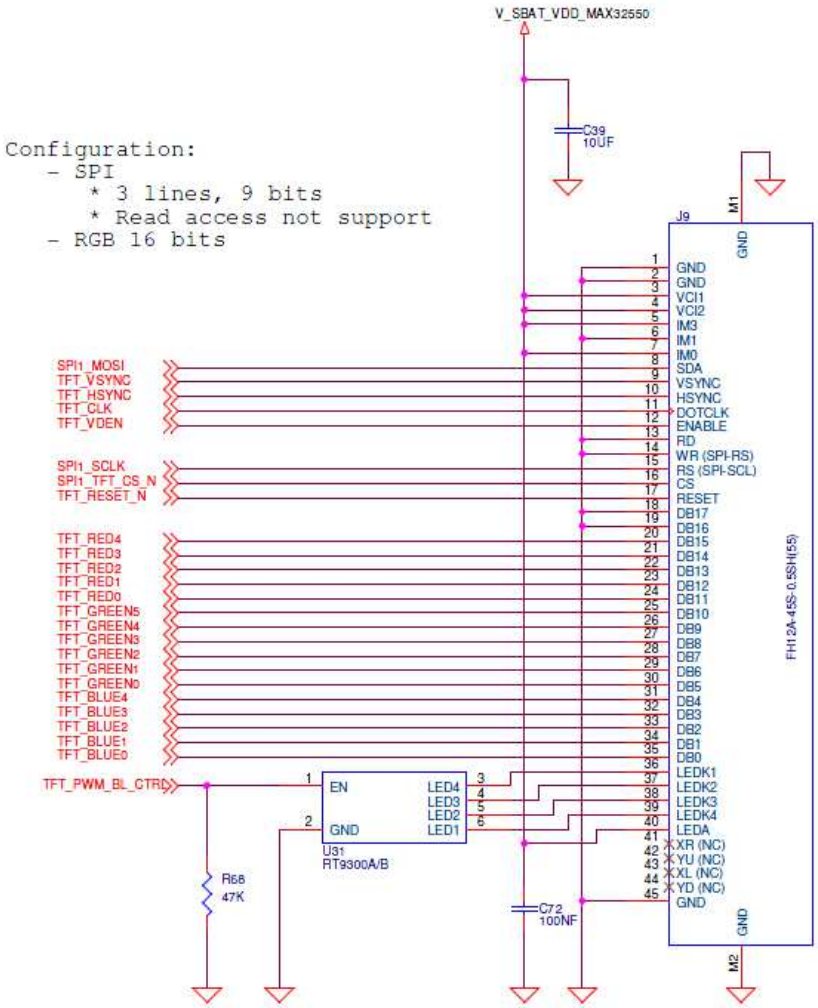

Figure 6 : TFT Display schematics

EVERTRON ET023C1-TP can be interfacing in several ways thanks to its embedded controller: **ILITEK IL9342C**. To select the 16-bit RGB access using HSYNC/VSYNC/PCLK synchronization signals, the display must be configured by sending an appropriate configuration through SPI bus.

A SPI 3-wire 9-bits protocol is used for accessing to the controller registers. Further details can be found in the **ILITEK IL9342C** controller datasheet and MPOS-STD2 software resources (i.e. BSP).

- ## *SPI 4-wire to 3-wire adaptation*

For debug purposes, it could useful to read back the display controller configuration.

The SPI bus interface available on the **ILITEK IL9342C** controller is a 3-wire meaning that the MISO and MOSI are the same line. Thanks the MAX32550 features it is possible to configure the SPI bus I/Os as open drain then to connect MISO and MOSI line together.

The adaptation must be installed by adding pull-up resistors and by modifying the SPI interface setting:

- On the software side, user must specify:
  - Open-drain type on SPI bus configuration.
- On the hardware side, user must add some resistors:
  - **1K** resistor between **V_SBAT_VDD** and **SPI1_SCLK**
  - **10K** resistor between **V_SBAT_VDD** and **SPI1_MOSI**
  - **10K** resistor between **V_SBAT_VDD** and **SPI1_TFT_CS_N**
  - **0R** resistor between **SPI1_MOSI** and **SPI1_MISO**

➢ *To do this modification, user could use **J20** header.*

For more details about data received format, please refer to ILITEK IL9342C datasheet.

- ## *SPI2 bus (Not available if TFT is running)*

The I/Os associated to SPI2 bus are configured as TFT color bus. In case the TFT display is not used (and not connected) it is possible to get access to the SPI2 bus.

The SPI2 bus is available on the bottom side of the board:

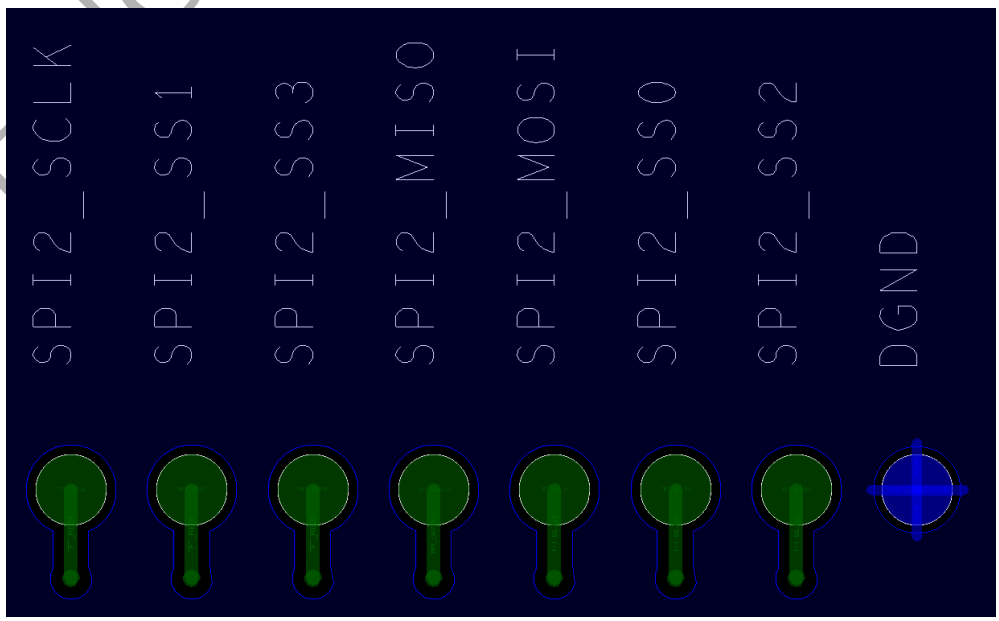

Figure 7 : SPI2 Signal Accessibility

5.4.6 Battery Charger

The battery charger is the MAX8934EETI+. The charger's status is provided by I/Os and they are accessible on test points:

Signal Name	Pin Number	Pin Name	Test Point	Description
USB_CHG_DONE_N	U2.1	DONE_N	D9 Led	Led if OFF when charge is finished
USB_CHG_DOK_N	U2.26	DOK_N	TP38	'0' : DC Input voltage detected '1' : No DC input
USB_CHG_UOK_N	U2.27	UOK_N	TP34	Normally '1' on this implementation
USB_CHG_FLT_N	U2.28	FLT_N	TP35	Goes low if fault detected. (*)
USB_CHG_OT_N	U2.25	OT_N	TP36	Over Temperature flag active Low
USB_CHG_CHG_N	U2.22	CHG_N	TP37	'0' : battery on fast-charge or prequal state
USB_CHG_PWREN_N	U2.6	PEN2	TP10	Select maximum Current Charge. **(*)**
USB_CHG_SUSPEND_N	U2.12	USUS	TP11	Select maximum Current Charge. Refer to datasheet for more details.
CEN_N	U2.4	CEN_N	TP33	Chip select : active low by default; can be used to go out from FAULT state

Table 8 : Battery charger status

***(*):** Refer to datasheet for more details.*

5.5 IOs Ports

- **Communication Interfaces**

J18: UART1 : Used for Bluetooth module

Signal Name	Pin Number	Type	Description
UART1_RX	J18.1	Multiplexed IO	UART1 RX or GPIO0.12
UART1_TX	J18.2	Multiplexed IO	UART1 TX or GPIO0.13
UART1_CTS	J18.3	Multiplexed IO	UART1 CTS or GPIO0.15
UART1_RTS	J18.4	Multiplexed IO	UART1 RTS or GPIO0.14
BT_SHUT _DOWN	J18.5	Multiplexed IO	GPIO1.23
NC	J18.6	Multiplexed IO	-

Table 9 : uart1 : bluetooth module

J19: SPI0 : Used for TFT display

Signal Name	Pin Number	Type	Description
SPI0_SCLK	J19.1	Multiplexed IO	SPI0 Clock or GPIO0.18
SPI0_MOSI	J19.2	Multiplexed IO	SPI0 MOSI or GPIO0.17
SPI0_MISO	J19.3	Multiplexed IO	SPI0 MISO or GPIO0.16
SPI0_NFC_CS_N	J19.4	Multiplexed IO	SPI SSEL0 or GPIO0.19
NFC_IRQ	J19.5	Multiplexed IO	GPIO1.6
GROUND	J19.6	Multiplexed IO	Digital Ground

Table 10 : SPI0

J20: SPI1 : Used for Contactless CLRC663 Chipset

Signal Name	Pin Number	Type	Description
TFT_RESET_N	J20.1	Multiplexed IO	GPIO1.16
SPI1_FL_CS_N	J20.2	Multiplexed IO	SPI1 SSEL0 or GPIO1.28
SPI1_MOSI	J20.3	Multiplexed IO	SPI1 MOSI or GPIO0.26
SPI1_SCLK	J20.4	Multiplexed IO	SPI SCLK or GPIO0.27
SPI_TFT_CS_N	J20.5	Multiplexed IO	SPI1 SSEL1 or GPIO1.29
SPI1_MISO	J20.6	Multiplexed IO	SPI1 MISO or GPIO0.25

Table 11 : spi1

J21: I2C & UART0

Signal Name	Pin Number	Type	Description
V_SBAT_VDD	J21.1	PWR	3.3V
I2C_SCL	J21.2	Multiplexed IO	I2C Clock
I2C_SDA	J21.3	Multiplexed IO	I2C Data
UART0 TX	J21.4	Multiplexed IO	UART0 TX or GPIO0.9
UART0 RX	J21.5	Multiplexed IO	UART0 RX or GPIO0.8
GROUND	J21.6	Multiplexed IO	Digital Ground

Table 12 : uart0 and I²C

For debugging purpose it could be useful to connect the UART0 to a TTL (3.3V) RS232 transceiver.

J23: Smartcard IOs

Signal Name	Pin Number	Type	Description
CARD_DET	J23.1	Dedicated IO	Card Detection
CARD_IO	J23.2	Dedicated IO	Card IO
CORD_CLK	J23.3	Dedicated IO	Card Clock
CARD_RST	J23.4	Dedicated IO	Card Reset
SPARE_IO3	J23.5	Dedicated IO	Card C4 (Not Used)
SPARE_IO4	J23.6	Dedicated IO	Card C8 (Not Used)
CARD_VCC	J23.7	Dedicated IO	Digital Ground
GROUND	J23.8	Dedicated IO	Card VCC

Table 13 : smartcard

J24: Available

Signal Name	Pin Number	Type	Description
U1.DAC0	J24.1	Dedicated IO	DAC0 Output
GROUND	J24.2	PWR	Analog Ground

Table 14 : DAC Header

- **Power Supplies Header**

J26: Power

Signal Name	Pin Number	Type	Description
V_SBAT_VDD	J26.1	PWR	3.3V Power
V_SBAT_SC_VDDA	J26.2	PWR	5.25V Power
V_PBAT	J26.3	PWR	3V Power (non-rechargeable battery)
V_SYSTEM	J26.4	PWR	2.4 to 4.2V Power (USB Charger Output)
GROUND	J26.5	PWR	Digital Ground
GROUND	J26.6	PWR	Digital Ground

Table 15 : power supplies header

J25: Contactless Analog Power

The CLRC663 Contactless controller analog part can be powered at 3.3V or 5V. Anyway it is recommended to power it at 5V.

Signal Name	Pin Number	Type	Description
V_SBAT_VDD	J25.1	PWR	3.3V Power supply
CLRC663_TVDD	J25.2	PWR	CLRC663 Analog Power Supply
V_SBAT_SC _VDDA	J25.3	PWR	5.25V Power Supply

Table 16 : contactless analog power supply selection

- ## Spare IOs

J22: Spare IOs

Signal Name	Pin Number	Type	Description
NC	J22.1	NA	-
SPARE_IO3	J22.2	SCI IO	Smartcard C4
SPARE_IO4	J22.3	SCI IO	Smartcard C8
NC	J22.4	NA	-
NC	J22.5	NA	-
GROUND	J22.6	PWR	Digital Ground

Table 17 : spare ios

- ## External Sensors

J3: External Sensors

Signal Name	Pin Number	Type	Description
EXTS0_OUT	J3.1	Dedicated IO	External Sensor 0 output
EXTS0_IN	J3.2	Dedicated IO	External Sensor 0 input
EXTS1_OUT	J3.3	Dedicated IO	External Sensor 1 output
EXTS1_IN	J3.4	Dedicated IO	External Sensor 1 input
EXTS2_OUT	J3.5	Dedicated IO	External Sensor 2 output
EXTS2_IN	J3.6	Dedicated IO	External Sensor 2 input
EXTS3_OUT	J3.7	Dedicated IO	External Sensor 3 output
EXTS3_IN	J3.8	Dedicated IO	External Sensor 3 input
EXTS4_OUT	J3.9	Dedicated IO	External Sensor 4 output
EXTS4_IN	J3.10	Dedicated IO	External Sensor 4 input
EXTS5_OUT	J3.11	Dedicated IO	External Sensor 5 output
EXTS5_IN	J3.12	Dedicated IO	External Sensor 5 input

Table 18 : external sensors

5.6 Test Points Description

Test Point Reference	Signal / Description	Type	Description
TP1	RST_OUT	Signal	Reset Status
TP4	USB VBUS	Power	USB VBUS voltage
TP5	USB DP	Signal	USB+
TP6	USB DM	Signal	USB-
TP7	VSBAT	Power	Rechargeable battery voltage level
TP9	VLDO_USB_CHG	Voltage	3.3V permanent power source
TP10	CHG_PWREN_N	Signal	USB Charger IO control
TP11	CHG_SUSPEND_N	Signal	USB Charger IO control
TP33	CEN_N	Signal	USB Charger IO control
TP34	UOK_N	Signal	USB Charger IO control
TP35	USB_CHG_FLT_N	Signal	Charger USB fault indicator
TP36	OT_N	Signal	USB Charger IO control
TP37	CHG_N	Signal	USB Charger IO control
TP38	DOK_N	Signal	USB Charger IO control
TP12	V_SSYSTEM	Voltage	USB Charger Output voltage
TP13	V_SBAT_VDD	Voltage	3.3V regulated voltage
TP14	V_SBAT_VDDA	Voltage	5.25V regulated voltage
TP15	VPBAT	Voltage	No-rechargeable battery voltage level
TP16	PWR_ON_CMD	Signal	System Power-On Command
TP17	SYS_EN	Signal	VDD power-on signal
TP18	JTAG_RESET	Signal	RESET signal from JTAG
TP23	CLRC663 SIGOUT	Signal	CLRC663 Auxiliary output
TP24	CLRC663 SIGIN	Signal	CLRC663 Auxiliary input

Test Point Reference	Signal / Description	Type	Description
TP59	NFC_PDOWN	Signal	CLRC663 IO Control
TP25	ADC IN VSBAT	Analog	ADC input voltage
TP26	ADC IN VPBAT	Analog	ADC input voltage
TP60	SBAT_ADC_EN	Analog	ADC input voltage activation
TP61	PBAT_ADC_EN	Analog	ADC input voltage activation
TP27	GROUND	Power	Digital Ground
TP28	GROUND	Power	Digital Ground
TP29	GROUND	Power	Digital Ground
TP30	GROUND	Power	Digital Ground
TP31	GROUND	Power	Digital Ground
TP39	SC_PWR_EN	Signal	V_SBAT_VDDA power-on signal
TP40	KEY_ABORT	Signal	“ABORT” key management
TP41	KEY_VALID	Signal	“VALID” key management
TP42	KEY_ROW0	Signal	Keypad IO
TP43	KEY_ROW1	Signal	Keypad IO
TP44	KEY_ROW2	Signal	Keypad IO
TP45	KEY_ROW3	Signal	Keypad IO
TP46	KEY_COL2	Signal	Keypad IO
TP47	KEY_COL1	Signal	Keypad IO
TP48	KEY_COL0	Signal	Keypad IO
TP49	GROUND	Power	Digital Ground
TP50	SPI2_SCLK	Signal	SPI2 auxiliary port (use TFT lines)
TP51	SPI2_MOSI	Signal	SPI2 auxiliary port (use TFT lines)
TP52	SPI2_MISO	Signal	SPI2 auxiliary port (use TFT lines)
TP53	SPI2_SS0	Signal	SPI2 auxiliary port (use TFT lines)

Test Point Reference	Signal / Description	Type	Description
TP54	SPI2_SS1	Signal	SPI2 auxiliary port (use TFT lines)
TP55	SPI2_SS2	Signal	SPI2 auxiliary port (use TFT lines)
TP56	SPI2_SS3	Signal	SPI2 auxiliary port (use TFT lines)
TP57	GROUND	Power	Digital Ground
TP58	FL_WP_N	Signal	SPI Flash Write Protect

Table 19 : test points list

The test points from TP1 to TP32 are common with MPOS-STD2 product version.
The test points from TP33 to TP61 are specific to MPOS-STD2 EV KIT Board.

Appendix

- **Power Supply Checkup**

Test Description	Test Point Reference	Expected result
Check if backup battery (non-rechargeable) is connected	NA	Connected
Check if main battery (rechargeable) is connected	NA	Connected
Check backup battery voltage : Battery is on place : if VPBAT = 0V, replace battery by a new one.	TP15	2.5 to 3.3V
Disconnect USB cable. Check main battery voltage: If voltage is 0V, connect USB cable for recharge during 1 hour. Check voltage after recharge: If voltage is around 0V, battery is **DEAD** and must be replaced by a new one.	TP7	2.4 to 3.8V
Connect USB Cable. Check SYS_EN signal	TP17	2.4V
Keep USB cable connected. Check **V_VBUS** voltage Check **V_VSYSTEM** voltage Check **V_SBAT_VDD** voltage Check **RST_OUT** voltage	 TP4 TP12 TP13 TP1	 V_VBUS = 5V V_VSYSTEM = [3.8..4.2]V V_SBAT_VDD = 3.3V RST_OUT = 3.3V
Keep USB cable connected. Check *USB charger status :* *Measure USB_CHG_FLT_N* *Measure VLDO_USB_CHG* *Measure CHG_PWREN* *Measure CHG_SUSPEND*	 TP35 TP9 TP10 TP11	 V(USB_CHG_FLT_N) = 3.3V V(VLDO_USB_CHG) = 3.3V V(CHG_PWREN) = 0V V(CHG_SUSPEND) = 0V

- **Issues and solutions**

Issue Description	Solutions
JTAG Not responding	• Check right connection of JTAG probe • Check board power supplies : Use Power Supply Checkup
VDDA voltage is not 5.25V	• Check if SC_PWR_EN signal is set
TFT Display backlight cutoff without particular reason	• Rechargeable battery needs to be recharging • Setup lower duty cycle for backlight PWM control
ADC measurement result is null	• Check enable signal : it must be set before ADC conversion
Smartcard inserted is not detected	• Check presence of 100K pull-down on CARD_DET net
Platform reset during external sensors activation	• Check presence of all EXTS[0..5] jumpers

More Information

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