Hexagon Application Kit

For XMC4000 Family

HMI_OLED-V1

Standard Human Machine Interface Card

Board User‘s Manual

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Microcontroller

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Revision History	
Page or Item	**Subjects (major changes since previous revision)**
Revision 1.0, 2012-02-28	**Initial release**

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Introduction

This document describes the features and hardware details of the Standard Human Machine Interface Card (HMI_OLED-V1) designed to work with Infineon's XMC4500 CPU board. This board is part of Infineon's Hexagon Application Kits.

1 Overview

The HMI_OLED-V1 board is an application expansion satellite card of Hexagon Application Kits. The satellite card along with a CPU board (e.g. CPU_45A-V2 board) demonstrates the Human Machine Interface (HMI) capabilities of XMC4500. The main use case for this satellite card is to demonstrate the HMI features of XMC4500 device including the toolchain. The focus is safe operation under evaluation conditions. The board is not cost optimized and cannot be seen as reference design.

1.1 Key Features

The HMI_OLED-V1 satellite card is equipped with following features

- Connection to CPU board (e.g. CPU_45A-V2) via HMI satellite connector
- Micro SD card connector – 4 bit mode
- Passive matrix OLED display (PMOLED), 1.54" screen size, 160x128 pixels
- Stereo audio codec TLV320AIC3204
- 2.5 mm stereo receptacle for audio headsets with microphone
- 2 touch buttons with LED's
- I2C based IO expander with 8 channels
- Power supply via satellite connector

1.2 Block Diagram

Figure 1 shows the block diagram of the HMI_OLED-V1 satetllite card. There are following building blocks:

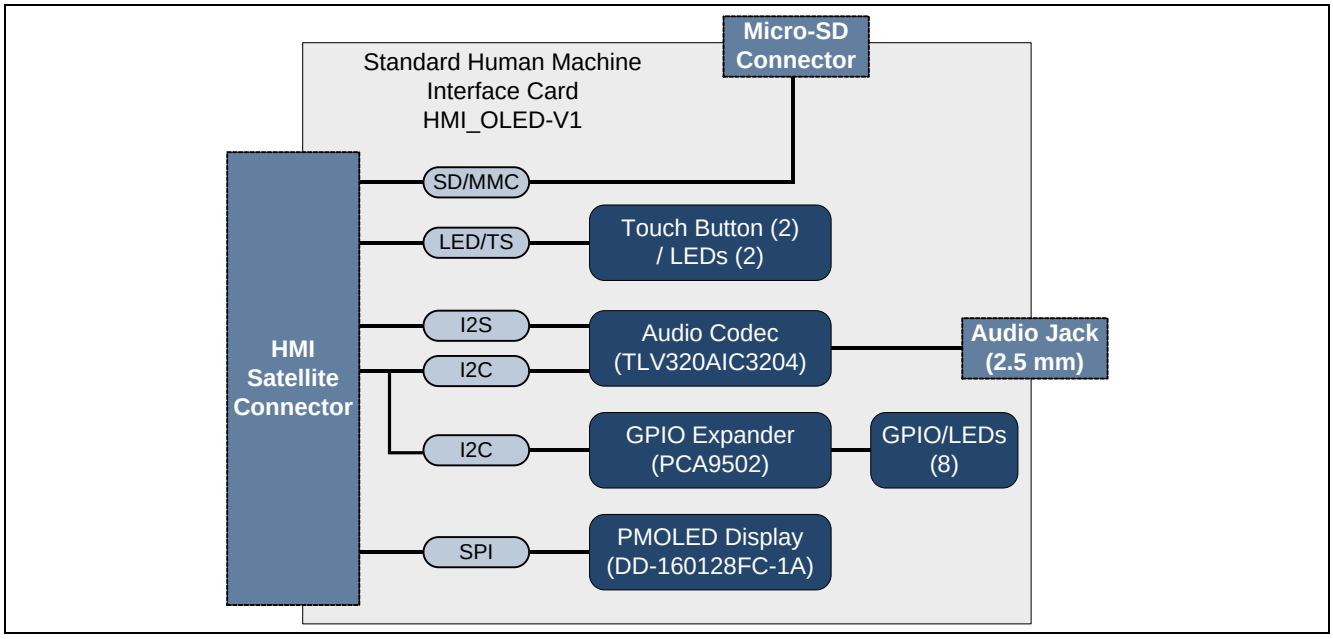

Figure 1 Block Diagram of Standard Human Machine Interface Card

2 Hardware Description

The following sections give a detailed description of the hardware and how it can be used.

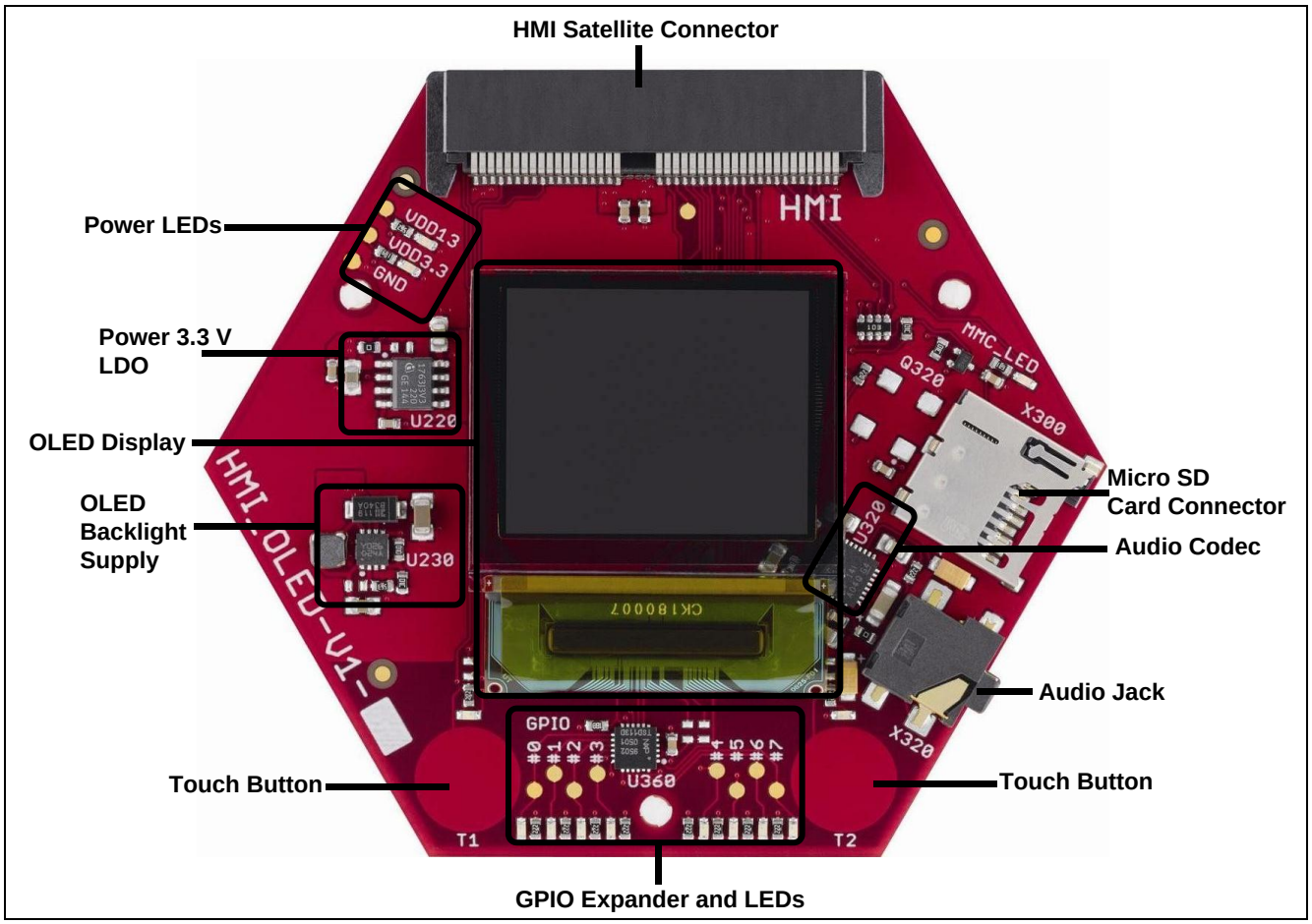

Figure 2 Standard HMI Card Interfaces

2.1 MicroSD Memory Slot

The HMI_OLED-V1 satetllite card supports a MicroSD card connector on board. The SD/MMC interface of XMC4500 can be used in different modes (SPI mode, 1-bit SD, 4-bit SD, 8-bit MMC). HMI_OLED-V1 satetllite card supports 4-bit SD mode implementation of SD card interface.

Note: Signals MMC_BUSPWR and MMC_LED from SD card are connected to ground in CPU board CPU_45A-V2, hence power a SD-Card will be always enabled and LED (V300) will be ON when satellite card is powered and interfaced to CPU_45A-V2 board .

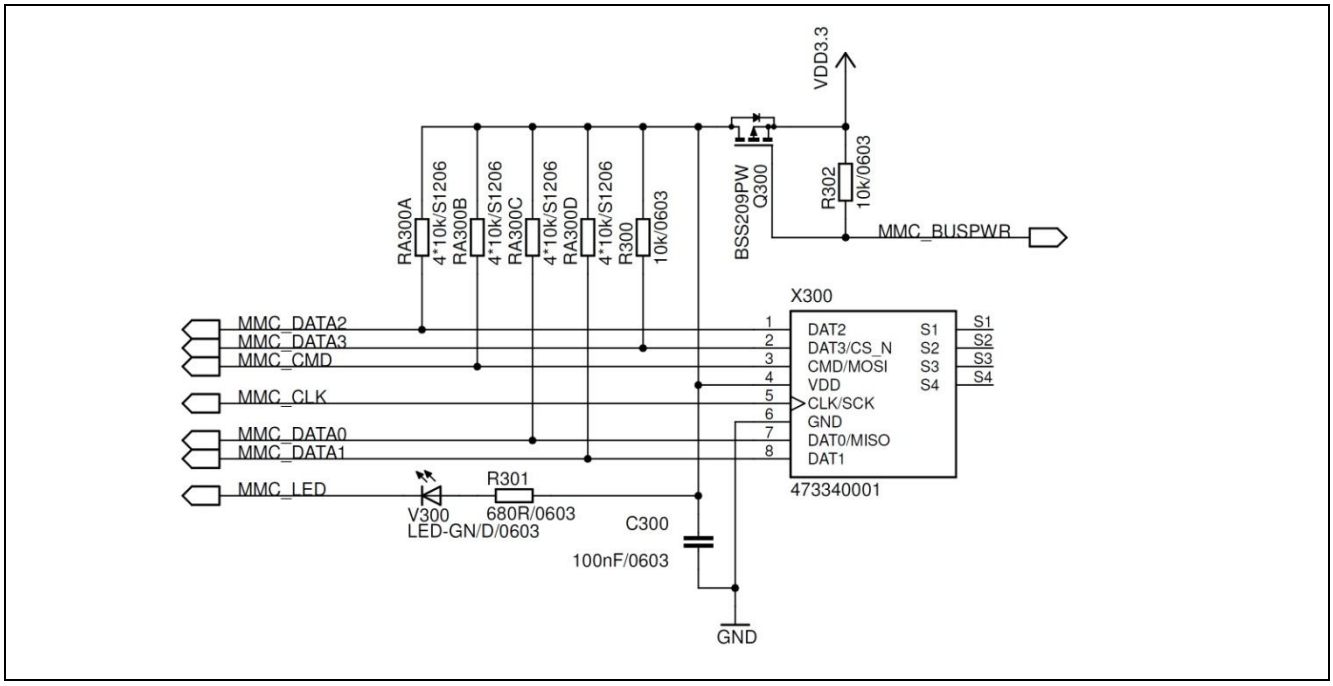

Figure 3 MicroSD card Connector Intertface

Table 1 below gives the signal details of SD card connector interface.

Table 1 MicroSD Connector

Pin No.	Signal Name	Description
1	DAT2	Data Bit 2
2	DAT3/CS_N	Data Bit 3
3	CMD/MOSI	Command
4	VDD	Power (+3.3 V)
5	CLK/SCK	Clock
6	GND	Ground
7	DAT0	Data Bit 0
8	DAT1	Data Bit 1

Table 2 shows the connection of the MicroSD card signals to the HMI satellite connector.

Table 2 MicroSD signal connection to the Satellite Connector

Pin No.	Signal Name	Description
3	MMC_CLK	Clock
6	MMC_DATA0	Data Bit 0
5	MMC_DATA1	Data Bit 1
8	MMC_DATA2	Data Bit 2
7	MMC_DATA3	Data Bit 3
13	MMC_BUSPWR	Power
14	MMC_CMD	Command
16	MMC_LED	LED

2.2 OLED Display

The HMI_OLED-V1 satellite card supports a passive matrix OLED display (PMOLED) from Densitron on board. The display DD-160128FC-1A has a resolution of 160x128 pixels on a 1.54” screen.

The card implements PMOLED display interface through SPI-Bus of XMC4500. This display module uses a Syncoam SEPS525F 160 RGB x 128 Dots, 262K Colors PMOLED Display Driver and Controller. Refer to the SEPS525F datasheet for details.

The card implements a backlight power supply STOD2540 to generate 13 Volt (VDD13). LED V241 indicates the presence of VDD13 (OLED Backlight Supply)

Table 3 gives the details of OLED display connector pin mapping.

Table 3 OLED display Connector Pinout

Pin No.	Signal Name	Description
1	NC	No Connect
2	VSDH	Data Driver Ground
3	VDDH	Data, Scan Driver Power Supply (8 ~ 18 V)
4	VSSH	Scan Driver Ground
5	IREF	Tie 70 kΩto VSS
6	OSCA2	Tie 10 kΩto OSCA1 between OSCA2
7	OSCA1	Tie 10 kΩto OSCA1 between OSCA2
8	VDDIO	MPU I/F PAD Power Supply (1.6 ~ 3.3 V)
9	VSYNCO	No Connect (used only in RGB mode)
10	VSYNC	No Connect (used only in RGB mode)
11	HSYNC	No Connect (used only in RGB mode)
12	DOTCLK	No Connect (used only in RGB mode)
13	ENABLE	No Connect (used only in RGB mode)
14	CPU	Selects the CPU type Low : 80 Series CPU, High : 68 Series CPU
15	PS	Selects Parallel/Serial Interface For SPI, connect Low
16	D17/SCL	SPI Clock
17	D16/SDI	SPI Data Input

Table 3 OLED display Connector Pinout

Pin No.	Signal Name	Description
18	D15/SDO	SPI Data Output (use 0 ohm)
19	D14	No Connect (used only in parallel mode)
20	D13	No Connect (used only in parallel mode)
21	D12	No Connect (used only in parallel mode)
22	D11	No Connect (used only in parallel mode)
23	D10	No Connect (used only in parallel mode)
24	D9	No Connect (used only in parallel mode)
25	RS	Data/Command Select
26	CSB	SPI Select
27	RDB	When using SPI, fix it to VDD or VSS level
28	WRB	When using SPI, fix it to VDD or VSS level
29	RESETB	Reset SEPS525(active low)
30	VSS	Logic Ground
31	VDD	Logic Power Supply(2.4 ~ 3.3 V)
32	VSSH	Scan Driver Ground
33	VDDH	Data, Scan Driver Power Supply(8 ~ 18 V)
34	VSDH	Data Driver Ground
35	NC	No connect

The PMOLED display module is interfaced to the connector through a 30-wire flatcable and glued to the satellite card.

Table 4 shows the connection of the OLED signals to the HMI satellite connector.

Table 4 OLED signal connection to the Satellite Connector

Pin No.	Signal Name	Description
31	SPI_CSH0	Chipselect
32	SPI_MTSR	Data In
34	SPI_MRST	Data Out
36	SPI_CLK	Clock
24	OLED_RS	Data/Command Select
42	RESET_N	Reset

2.3 Audio

The HMI_OLED-V1 satetllite card supports audio interface on board with stereo audio codec TLV320AIC3204 (U320). The control interface of audio codec is through I2C Bus and audio data is interfaced to I2S Bus of XMC4500 CPU extended though satellite connector.

A GPIO pin (P2.10) is used to reset the the audio codec (signal AUDIO_RST_N). The codec has a built-in headphone driver as well as a microphone input (analog and digital). The satellite card uses a 4-pin, 2.5 mm stereo receptacle (Nokia 6300 style) for audio headsets.

The board supports an external clock through an oscillator (Q320). Currently this oscillator is not mounted.

Table 5 2.5 mm Audio Jack Pinout

Pin No.	Signal Name	Description
1	GND	Ground
2	HPL	Head Phone Left
3	HPR	Head Phone Right
4	MICBIAS	Mic Input

Table 6 shows the connection of the audio signals to the HMI satellite connector.

Table 6 Audio signal connection to the Satellite Connector

Pin No.	Signal Name	Description
23	AUDIO_RST_N	Reset
25	I2S_WA	Address
27	I2S_MCLK	Master Clock
26	I2S_MTSR	Data In
28	I2S_MRST	Data Out
30	I2S_SCLK	Slave Clock

2.4 IO Expander

The HMI_OLED-V1 satellite card supports GPIO expansion though I2C IO-Expander on board (U360). The I2C address for the IO expander device is 0x1001101X. The satellite card supports 8 such GPIO's. All the GPIO's are connected to LEDs (V360-V367) and SMD-Pads (TP360 – TP367). The Table 7 shows the GPIO channel and corresponding LED/PAD mapping.

Table 7 GPIO channel LED/SMD pad mapping

GPIO	LED Reference	SMD pad Reference
GPIO0	V360	TP360
GPIO1	V361	TP361
GPIO2	V362	TP362
GPIO3	V363	TP363
GPIO4	V364	TP364
GPIO5	V365	TP365
GPIO6	V366	TP366
GPIO7	V367	TP367

Table 8 shows the connection of the IO Expander device to the HMI satellite connector.

Table 8 IO Expander I2C signal connection to the Satellite Connector

Pin No.	Signal Name	Description
38	I2C_SCL	Clock
37	I2C_SDA	Data

2.5 Touch Buttons

The HMI_OLED-V1 satellite card supports two touch buttons (TOUCH250 and TOUCH251) that are connected to the CPU board via the satellite connector. These two signals are connected to LED's V250 & V251.

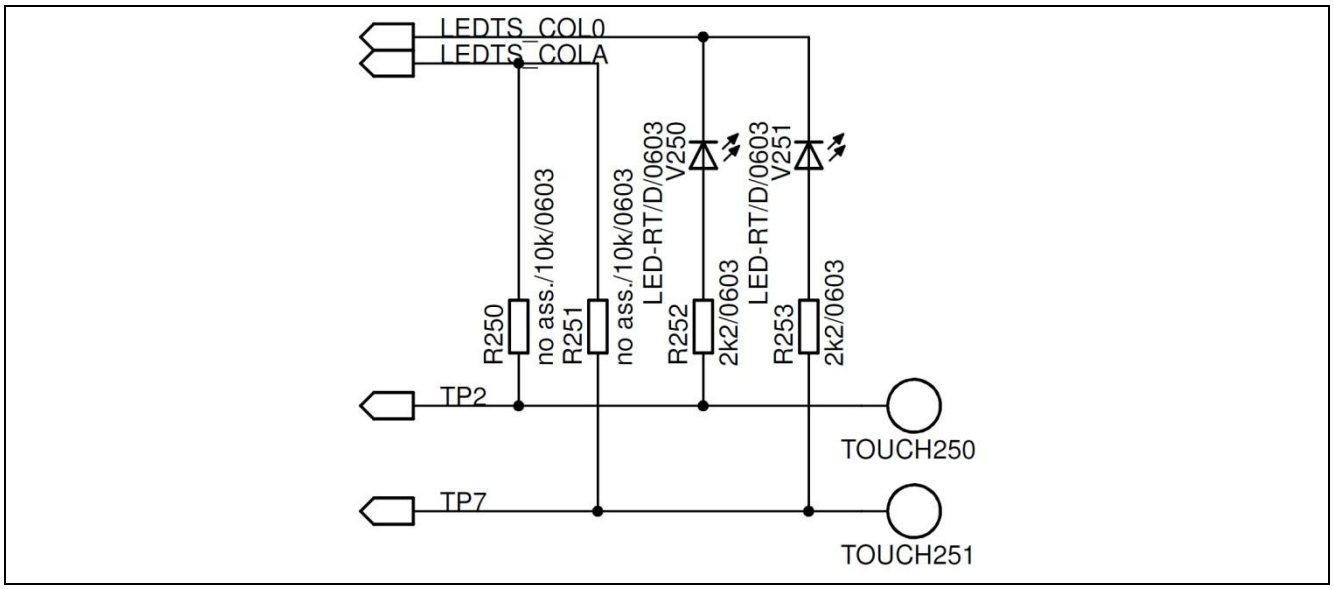

Figure 4 Touch Buttons

Table 9 shows the connection of the touch signals to the HMI satellite connector.

Table 9 Touch signal connection to the Satellite Connector

Pin No.	Signal Name	Description
75	LEDTS_COL0	Column 0
77	LEDTS_COLA	Column A
74	TP2	Touch 2
64	TP7	Touch 7

2.6 Power

Power input (5 V) to the satellite card is supported through satellite connector. 3.3 V is generated on board using on board regulator (U220).

LED V240 indicates the presence of 3.3 V power. The card implements a backlight power supply STOD2540 to generate 13 Volt (VDD13). LED V241 indicates the presence of VDD13 (OLED Backlight Supply)

Table 10 Power LED

LED	Power Rail	Voltage	Note
V240	VDD3.3	3.3 V	Must always be "ON"
V241	VDD13	13 V	Must always be "ON"

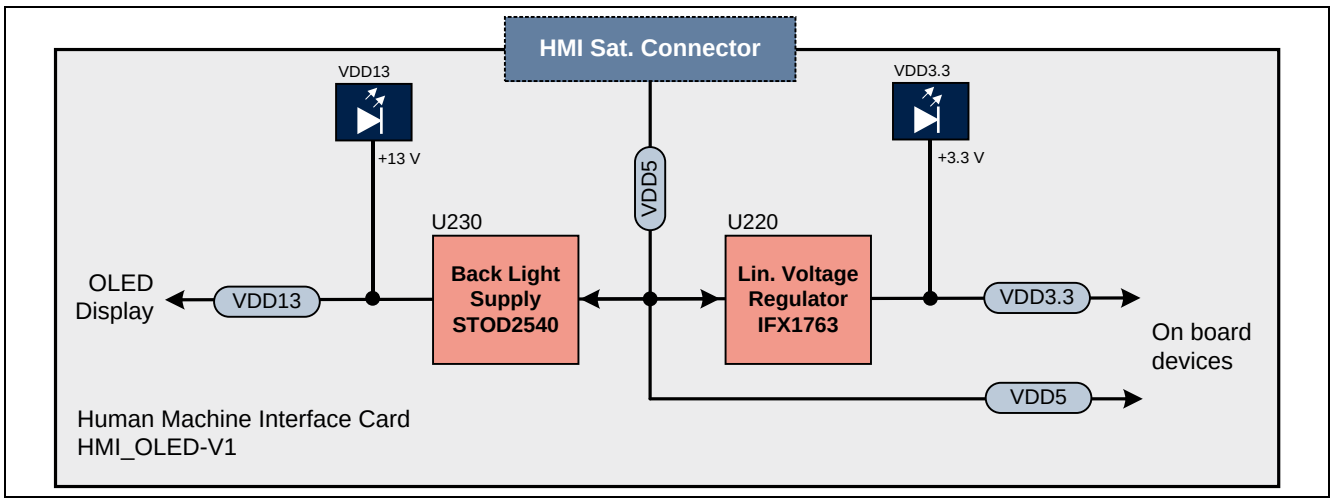

Figure 5 Power Circuit

Table 11 shows the connection of the power rails to the HMI satellite connector.

Table 11 Power rail connection to the Satellite Connector

Pin No.	Power rail	Description
43,44,45,46	VDD5	5 V
1,2,79,80	GND	Ground

2.7 Satellite Connector

The satellite connector of the HMI_OLED-V1 satellite card interfaces it's the signals to a CPU board e.g. CPU_45A-V2. Take care to connect the HMI satellite card always to the corresponding HMI satellite connector of the CPU board only.

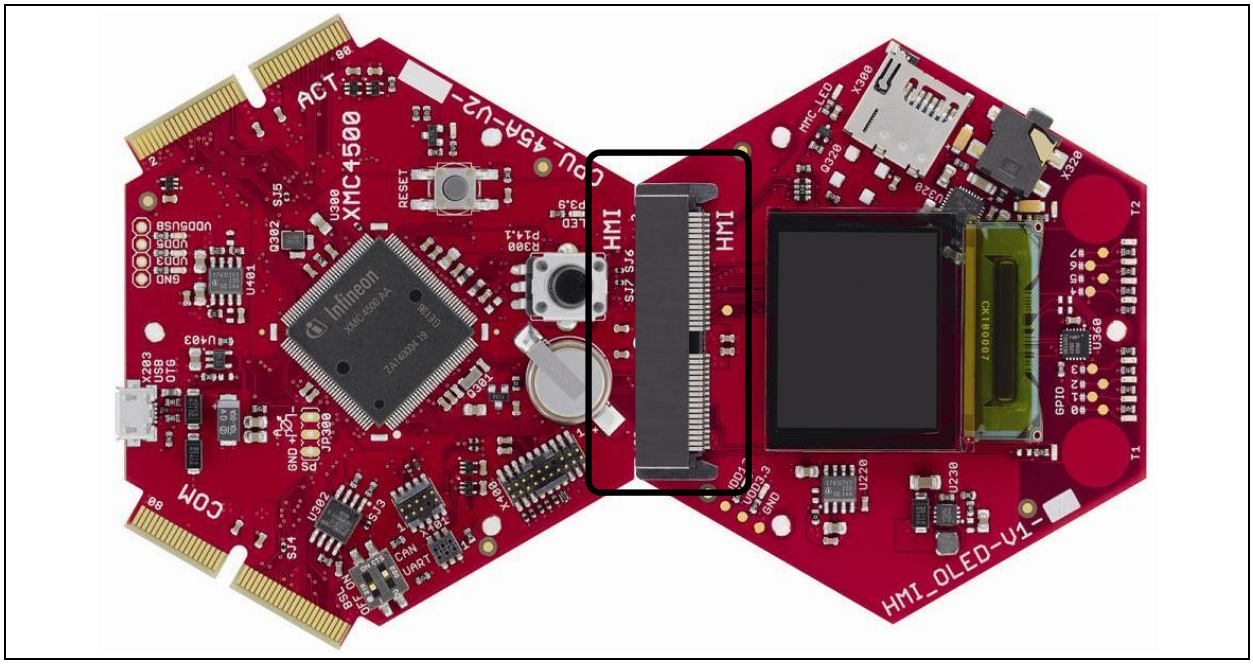

Figure 6 HMI Satellite Connector

The Signals mapping details of HMI satellite connector and correponding CPU function are provided in Figure 7.

Figure 7 Satellite Connector HMI

3 Production Data

3.1 Schematics

This chapter contains the schematics for the Standard Human Machine Interface Card:

- Satellite Connector, Power, Touch button
- Micro-SD, Audio, IO Expander, OLED

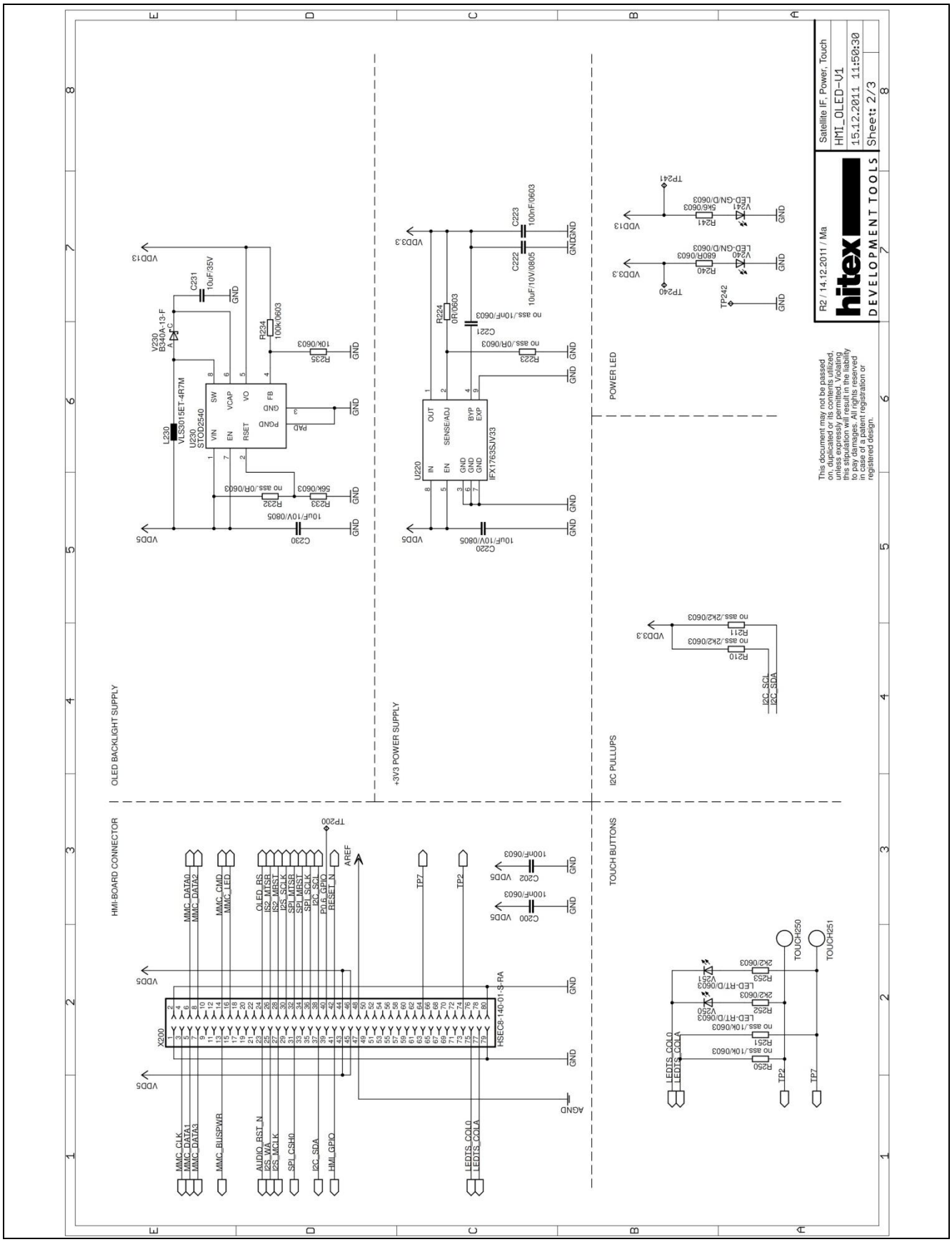

Figure 8 Satellite Connector, Power, Touch button

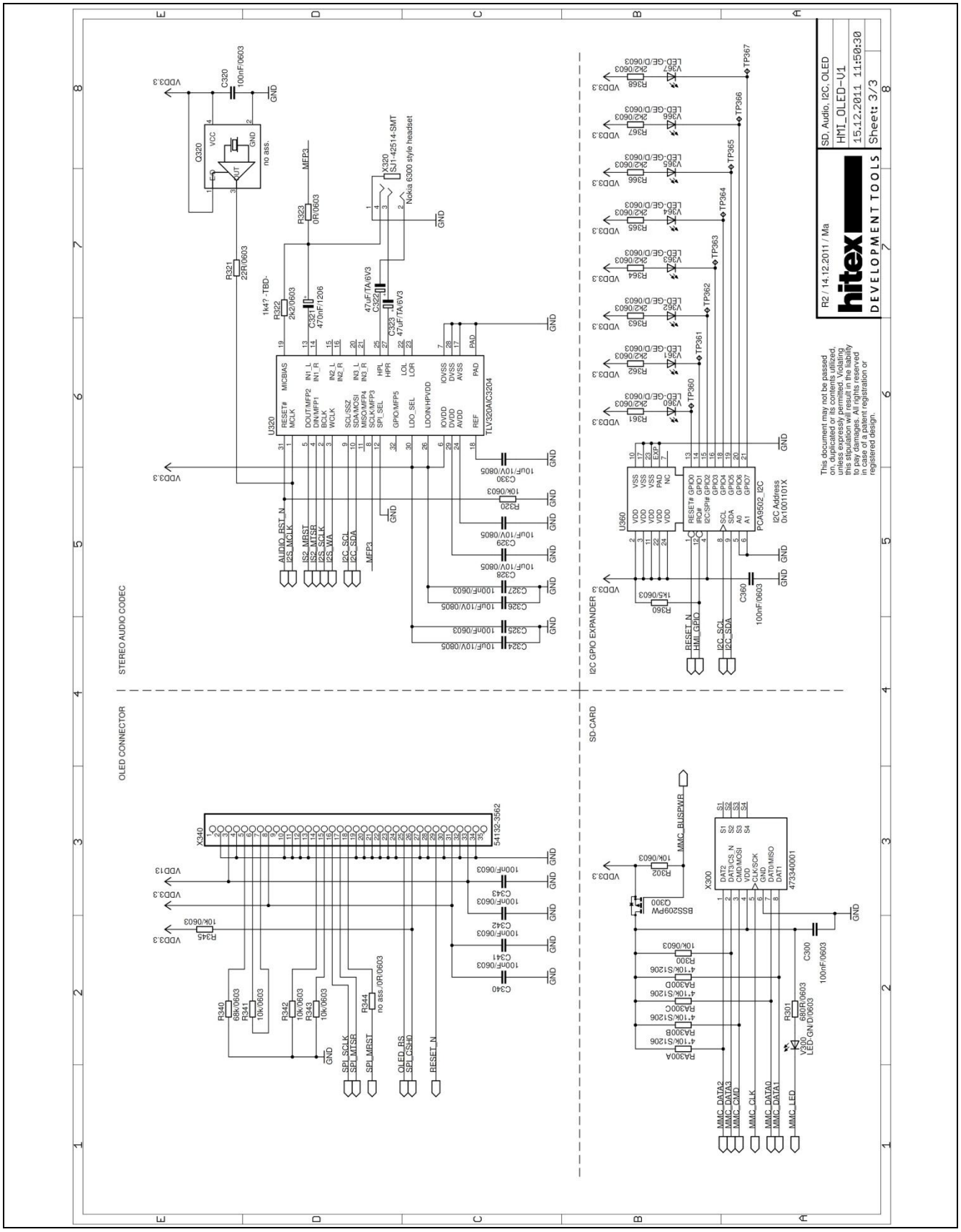

Figure 9 Micro-SD, Audio, IO Expander, OLED

3.2 Layout and Geometry

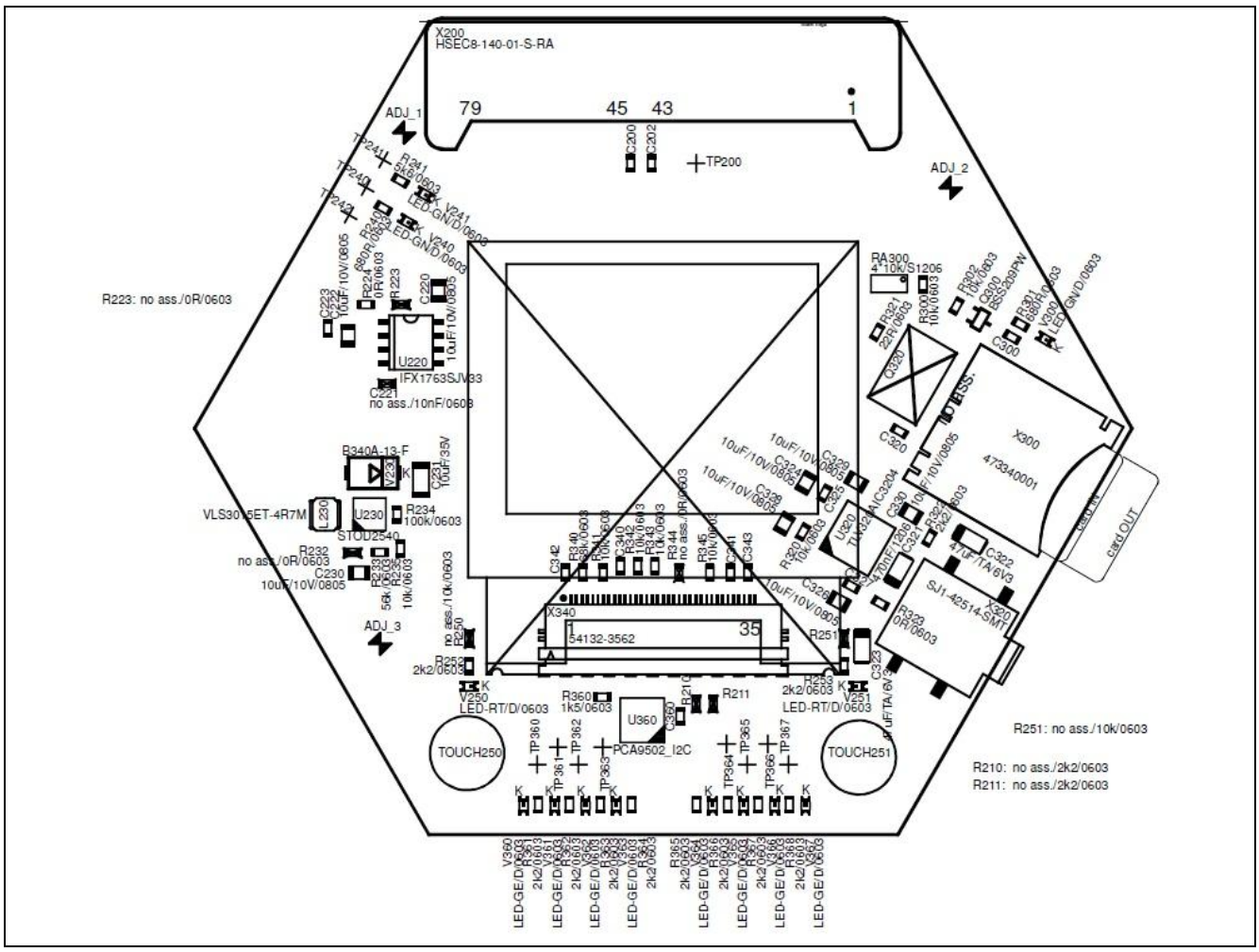

Figure 10 Standard Human Machine Interface Card Layout

3.3 Bill of Material

Table 12 Standard Human Machine Interface Card BOM

Sl. No.	Qty	Value	Device	Reference Designator
1	2	0R/0603	Resistor	R224, R323
2	1	1k5/0603	Resistor	R360
3	11	2k2/0603	Resistor	R252, R253, R322, R361, R362, R363, R364, R365, R366, R367, R368
4	1	4*10k/S1206	Resistor	RA300
5	1	5k6/0603	Resistor	R241
6	8	10k/0603	Resistor	R235, R300, R302, R320, R341, R342, R343, R345
7	8	10uF/10V/0805	Capacitor	C220, C222, C230, C324, C326, C328, C329, C330
8	1	10uF/35V/1206	Capacitor	C231
9	1	22R/0603	Resistor	R321
10	2	47uF/TA/6V3	Capacitor	C322, C323
11	1	56k/0603	Resistor	R233
12	1	68k/0603	Resistor	R340
13	1	100k/0603	Resistor	R234
14	12	100nF/0603	Capacitor	C200, C202, C223, C300, C320, C325, C327, C340, C341, C342, C343, C360
15	1	470nF/1206	Capacitor	C321
16	2	680R/0603	Resistor	R240, R301
17	1	54132-3562	Connector 54132-3562 Molex	X340
18	1	473340001	Connector 3M 2908-05WB-MG or Molex 047334001	X300
19	1	B340A-13-F	Diode B340A-13-F Diodes Inc.	V230
20	1	BSS209PW	IC BSS209PW Infineon technologies	Q300
21	1	HSEC8-140-01-S-RA	Connector HSEC8-140-01-S-RA Samtec	X200
22	1	IFX1763SJV33	IC IFX1763SJV33 Infineon Technologies	U220
23	8	LED-GE/D/0603	LED	V360, V361, V362, V363, V364, V365, V366, V367
24	3	LED-GN/D/0603	LED	V240, V241, V300
25	2	LED-RT/D/0603	LED	V250, V251
26	1	PCA9502	IC PCA9502BS NXP, HVQFN-24	U360
27	1	SJ1-42514-SMT	Connector SJ1-42514-SMT	X320
28	1	STOD2540	IC STOD2540PUR STMicro	U230

Table 12 Standard Human Machine Interface Card BOM

Sl. No.	Qty	Value	Device	Reference Designator
29	1	TLV320AIC3204	IC TLV320AIC3204 Texas Instruments	U320
30	1	VLS3015ET-4R7M	Inductor VLS3015ET-4R7M TDK	L230
31	1	no ass.	Crystal 3.3V 7x5mm SMD	Q320
32	3	no ass./0R/0603	Resistor	R223, R232, R344
33	2	no ass./2k2/0603	Resistor	R210, R211
34	2	no ass./10k/0603	Resistor	R250, R251
35	1	no ass./10nF/0603	Capacitor	C221
36	2	no ass.	Touchpad	TOUCH250, TOUCH251
37	12	no ass.	SMD-Pads	TP200, TP240, TP241, TP242, TP360, TP361, TP362, TP363, TP364, TP365, TP366, TP367

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