Hexagon Application Kit

For XMC4000 Family

AUT_ISO-V1

Automation I/O Card

Board User's Manual

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Page or Item	**Subjects (major changes since previous revision)**
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Introduction

This document describes the features and hardware details of the Automation I/O Card (AUT_ISO-V1) designed to work with Infineon's XMC4500 CPU board. This board is part of Infineon's Hexagon Application Kits.

1 Overview

The AUT_ISO-V1 board is an application expansion satellite card of the Hexagon Application Kits. The satellite card along with a CPU board (e.g. CPU_45A-V2 board) demonstrates ISOFACE capabilities together with XMC4500. The focus is safe operation under evaluation conditions. The satellite card is not cost optimized and cannot be seen as reference design.

1.1 Key Features

The AUT_ISO-V1 satellite card is equipped with following features

- Connection to CPU board (e.g. CPU_45A-V2) via satellite connector ACT
- ISOFACE OUT, up to 8 channels
- ISOFACE IN, up to 8 channels
- I2C based IO expander up to 8 channels
- Power supply
    - Powerjack for external 24 V supply
    - From CPU board via ACT satellite connector

1.2 Block Diagram

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

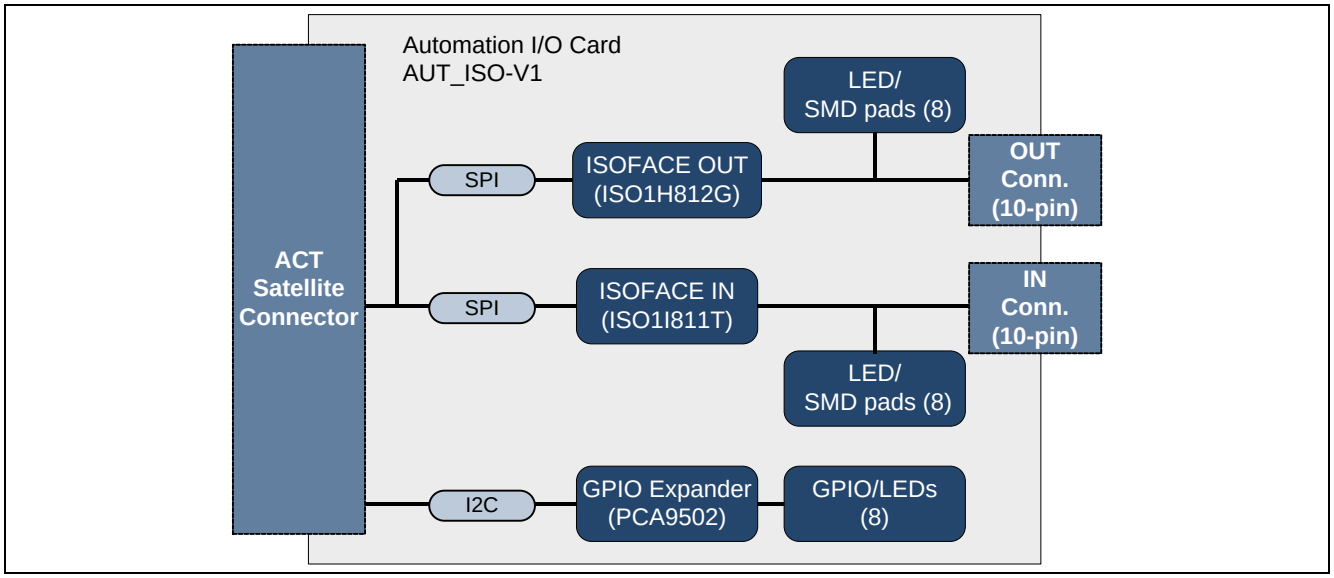

Figure 1 Automation I/O Card (AUT_ISO-V1)

2 Hardware Description

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

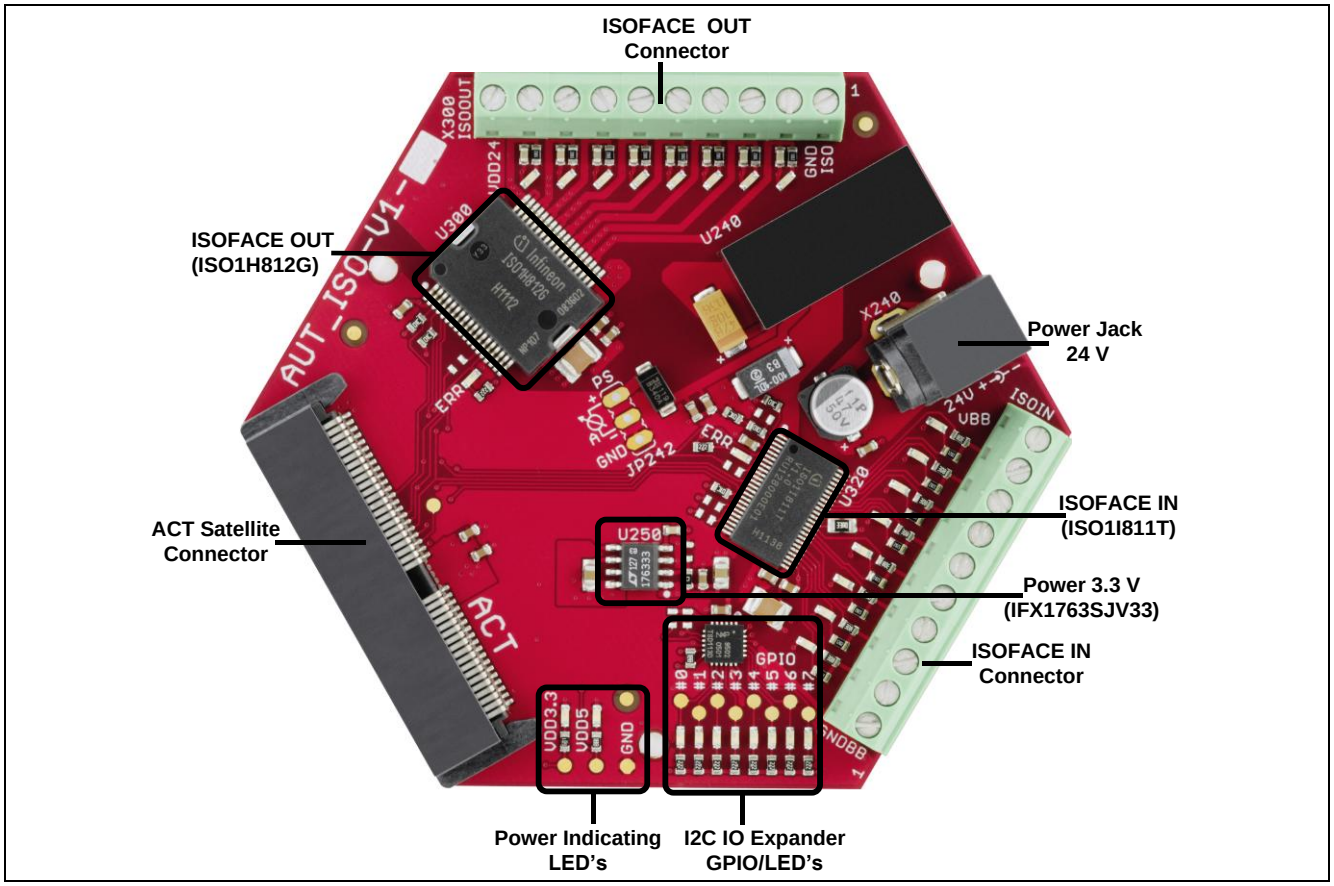

Figure 2 Automation I/O Card Interfaces

2.1 ISOFACE OUT

ISOFACE output device used in AUT_ISO-V1 satellite card is ISO1H812G. It is supplied by VDD3.3 on the CPU side and VDD24 for the ISOFACE OUT side. VDD24 and GNDISO can to be connected either by X300 or by X240(24 V external power jack). This is the same net that supplies the DC/DC converter. VDD24 is +24 Vdc (referred to GNDISO)

Table 1 below gives the signal details of ISOFACE OUT connector.

Table 1 ISOFACE OUT Connector Pinout

Pin No.	Signal Name	Description
1	GND	Ground
2	OUT7	Output 7
3	OUT6	Output 6
4	OUT5	Output 5
5	OUT4	Output 4
6	OUT3	Output 3
7	OUT2	Output 2
8	OUT1	Output 1
9	OUT0	Output 0
10	VDD24	24 V

Table 12 below gives the details of SPI signal connection to the satellite connector.

Table 2 ISOFACE OUT signal connection to the Satellite Connector

Pin No.	Signal Name	Description
31	SPI_CSA0	SPI Chip Select
32	SPI_MTSR	SPI ISOFACE Data In
34	SPI_MRST	SPI ISOFACE Data Out
36	SPI_SCLK	SPI Clock
3	ISO_OUT_DIS_N	Output Disable
14	ISO_OUT_DIAG_N	Common Diagnostic Output for Overtemperature

2.2 ISOFACE IN

ISOFACE input device used in AUT_ISO-V1 satellite card is ISO1I811T. It is supplied by 3.3 V on the CPU side and VBB (24V) for the ISOFACE IN side. VBB and GNDBB need a separate connection to 24 V external power source through connector X320.

Resistor R337 is used on board for setting input type to IEC61131-2 Type 1.
Resistors R326 and R327 sets the frequency of ISOFACE IN to 100 kHz (default).

Table 3 gives the details of ISOFACE IN connector pin mapping.

Table 3 ISOFACE IN Connector Pinout

Pin No.	Signal Name	Description
1	GNDBB	Ground reference for Supply VBB
2	IN0	Input 0

Table 3 ISOFACE IN Connector Pinout

Pin No.	Signal Name	Description
3	IN1	Input 1
4	IN2	Input 2
5	IN3	Input 3
6	IN4	Input 4
7	IN5	Input 5
8	IN6	Input 6
9	IN7	Input 7
10	VBB	+24 V (Separate external power source required)

ISOFACE IN shares the same SPI lines with ISOFACE OUT except the chip select as shown in Table 4.

Table 4 ISOFACE IN signal connection to the Satellite Connector

Pin No.	Signal Name	Description
33	SPI_CSA1	SPI Chip Select
32	SPI_MTSR	SPI ISOFACE Data In
34	SPI_MRST	SPI ISOFACE Data Out
36	SPI_SCLK	SPI Clock
6	ISO_IN_ERR_N	Error Output

2.3 IO Expander

The AUT_ISO-V1 satellite card supports GPIO expansion though I2C IO-Expander on board (U230). The I2C Address for IO expander device is 0x1001000X. The satellite card supports 8 such GPIO's. All the GPIO's are connected to LEDs (V230-V237) and SMD-Pads (TP230 – TP237). The Table 5 gives the GPIO channel and corresponding LED/PAD mapping.

Table 5 GPIO channel LED/SMD pad mapping

GPIO	LED reference	SMD pad Reference
GPIO0	V230	TP230
GPIO1	V231	TP231
GPIO2	V232	TP232
GPIO3	V233	TP233
GPIO4	V234	TP234
GPIO5	V235	TP235
GPIO6	V236	TP236
GPIO7	V237	TP237

Table 6 shows the connection of the IO Expander device to the ACT satellite connector.

Table 6 IO Expander I2C signal connection to the Satellite Connector

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

2.4 Power

The AUT_ISO-V1 satellite card can be supplied by an external power supply (24 V / 1 A) to be connected to the power jack X240 or by a 5 V supply via the 80-pin ACT satellite connector. An external power supply is necessary only in case the current coming via the ACT satellite connector is not sufficient.

A DC-DC converter on board (U240) steps down the input voltage from the power jack X240 to 5 V (VDD5). The input voltage can be in the range from 12 V to 24 V. An on board linear voltage regulator is generating a 3.3 V (VDD3.3) power supply out of the VDD5.

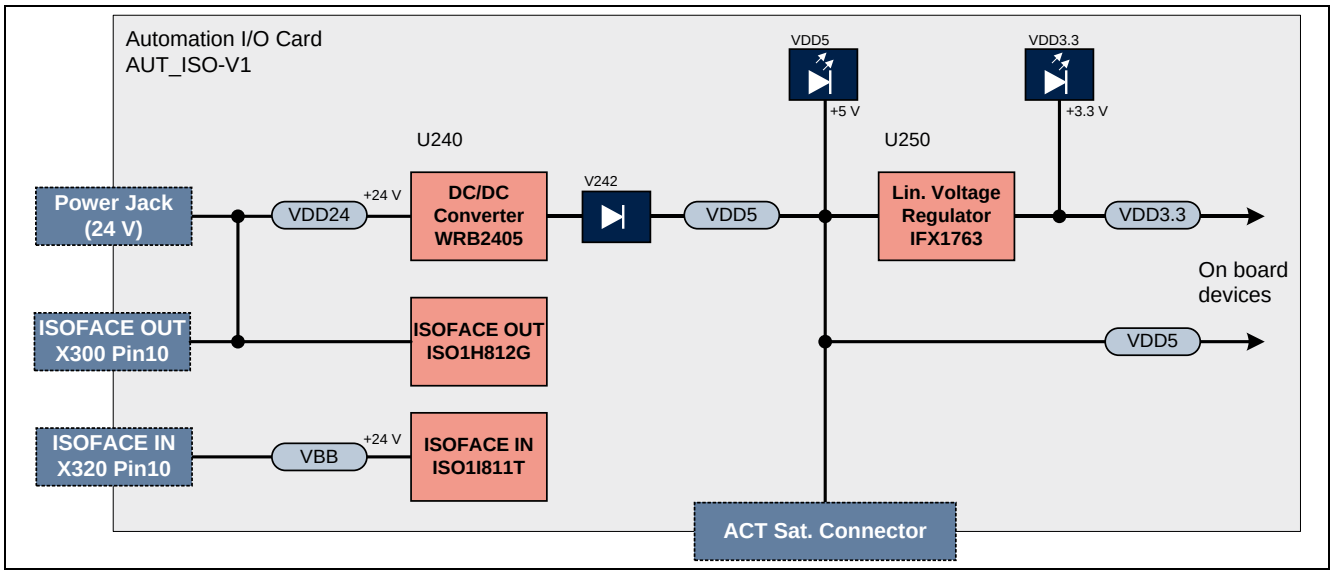

Figure 3 Power Circuit

A Diode V242 protects the reverse flow of current to an external source. Therefore a simultaneous power supply of the satellite boards via both the power jack and the satellite connector with not harm.

LED V210 indicates the presence of 5 V power and LED V211 indicates the presence of 3.3 V power.

Table 7 Power LED's

LED	Power Rail	Voltage	Note
V210	VDD5	5 V	Must always be "ON"
V211	VDD3.3	3 V	Must always be "ON"

The AUT_ISO-V1 satellite card supports a PowerScale probe for power measurement purpose.

Table 8 PowerScale Jumper

Jumper	Function	Description
JP242	PowerScale	At this point a Hitex PowerScale probe can be connected for current sensing VDD5 (complete power) Default: pos. 1-2 (closed) *Note: On the PCB bottom side there will be a shorting trace between pin 1-2. This trace has to be cut first, before using PowerScale*

2.5 Satellite Connector

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

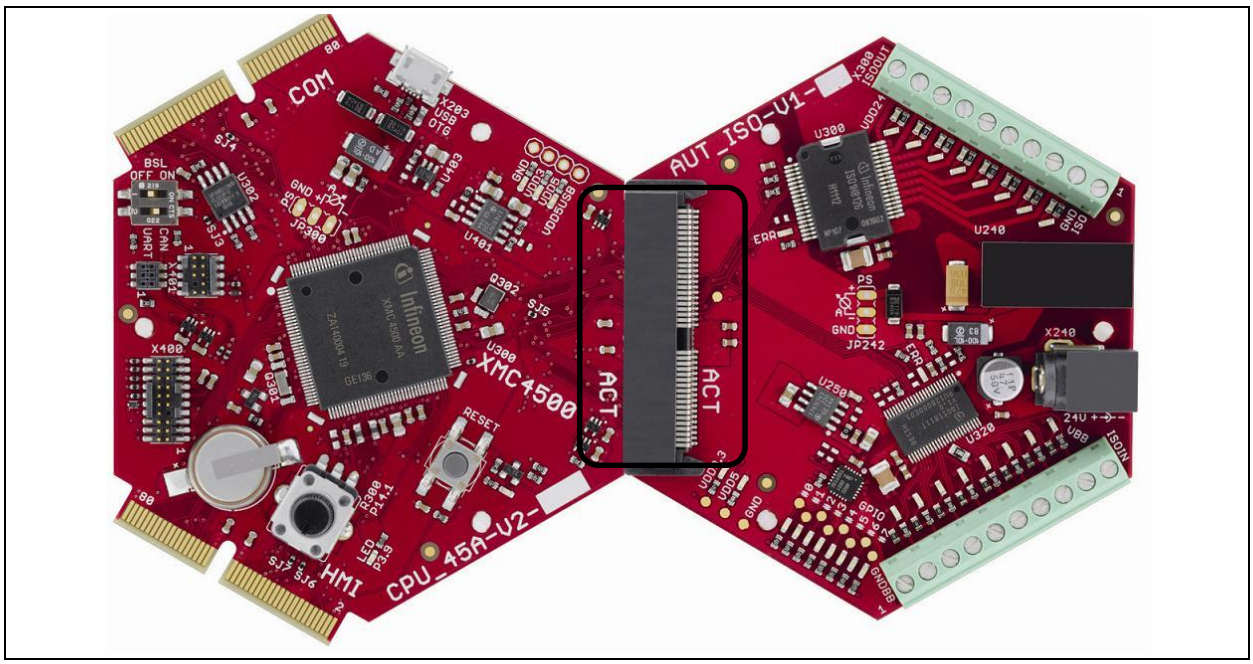

Figure 4 ACT Satellite Connector

The signal mapping of the ACT satellite connector and correponding CPU function are provided in figure 6

CPU_45A V2 function >>		GND	PIFO_IN0A	PIFO_IN1A	PIFO_IN2A	DSD_DIN0A	DSD_DIN1B	DSD_DIN2A	DSD_DIN3A	nc	CCU43_IN0A	CCU43_IN1A	CCU43_IN2A	CCU43_IN2C	CCU43_IN3C	CCU43OUT1	U1C1_DOUT0	U1C1_DX0B	U1C1_SCLKOUT	U1C0_SCLKOUT	P0.6	PORST	5V		5V	VAREF	VADC_G1CH0	VADC_G0CH4	VADC_G1CH6	VADC_G1CH7	VADC_G0CH2	VADC_G2CH6	VADC_G2CH7	CCU80_OUT00	CCU80_OUT01	CCU80_OUT10	CCU80_OUT11	CCU80_OUT20	CCU80_OUT21	CCU43OUT2	CCU43OUT3	GND	
CONpins >>		GND	PIFOIN1	PIFOIN2	PIFOIN3	DSDIN0	DSDIN1	DSDIN2	DSDIN3	RSVD	CC_IN0	CC_IN1	CC_IN2	ENA_A	ENA_B	ENA_X	SPI_MTSR	SPI_MRST	SPI_SCLK	I2C_SCL	GPIO	RESET	5V		5V	AREF	DAC1/ADC0	ADC2/DACREF	ADC4/ORC1	ADC6/ORC3	ADC8	ADC10	ADC12	PWMA0_H	PWMA0_L	PWMA1_H	PWMA1_L	PWMA2_H	PWMA2_L	PWMX0	PWMX1	GND	
	ACT	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44		46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	
		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43		45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	
CONpins >>		GND	RSVD	RSVD	RSVD	PWMN	PWMP	DSDCLK0	DSDCLK1	RSVD	CC_IN3	CC_IN4	CC_IN5	TRAP_A	TRAP_B	TRAP_X	SPI_CSA0	SPI_CSA1	RSVD	I2C_SDA	ACTERR	ACT_GPIO	5V		5V	AGND	DAC0/ADC1	ADC3/ORC0	ADC5/ORC2	ADC7	ADC9	ADC11	ADC13	PWMB0_H	PWMB0_L	PWMB1_H	PWMB1_L	PWMB2_H	PWMB2_L	PWMX2	PWMX3	GND	
CPU_45A V2 function >>		GND	nc	nc	nc	DSD_PWMN	DSD_PWMP	DSD_MCLK2A	DSD_MCLK3B	nc	CCU43_IN3A	CCU81_IN1B	CCU81_IN3B	CCU80_IN0A	CCU81_IN0A	CCU43_IN0C	U1C1_SELO0	CCU81_OUT12	nc	U1C0_DX0C/DOUT0	P15.4	P4.2	5V		5V	VAGND	VADC_G1CH1	VADC_G0CH6	VADC_G0CH7	VADC_G0CH0	VADC_G0CH5	VADC_G3CH6	VADC_G3CH7	CCU81_OUT00	CCU81_OUT01	CCU81_OUT10	CCU81_OUT11	CCU81_OUT20	CCU81_OUT21	CCU81_OUT31	CCU81_OUT30	GND	

Figure 5 Satellite Connector Type ACT

3 Production Data

3.1 Schematics

This chapter contains the schematics for the Automation I/O Card:

- Satellite Connector, IO Expander, Power
- ISOFACE

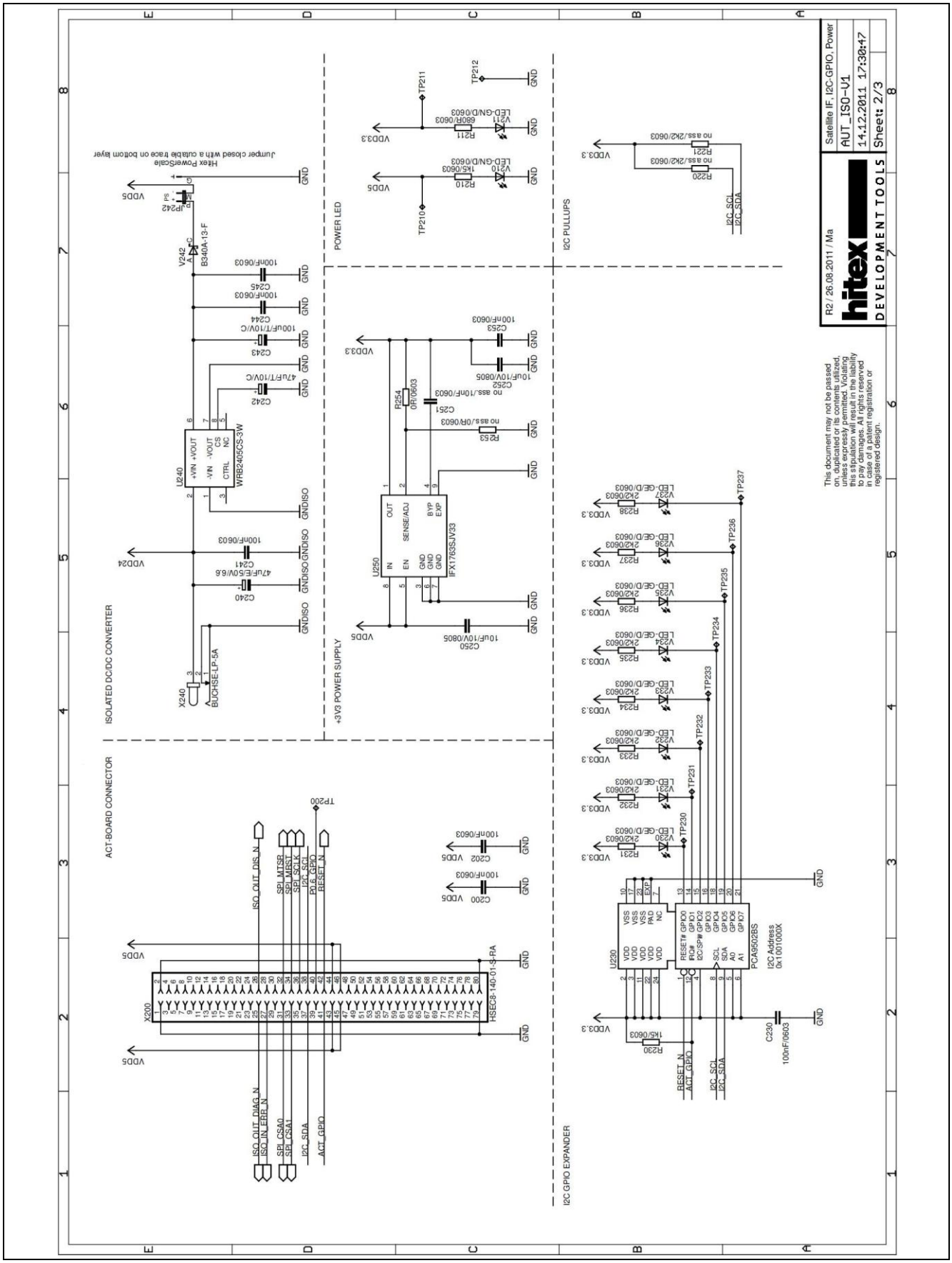

Figure 6 Satellite Connector, IO Expander, Power

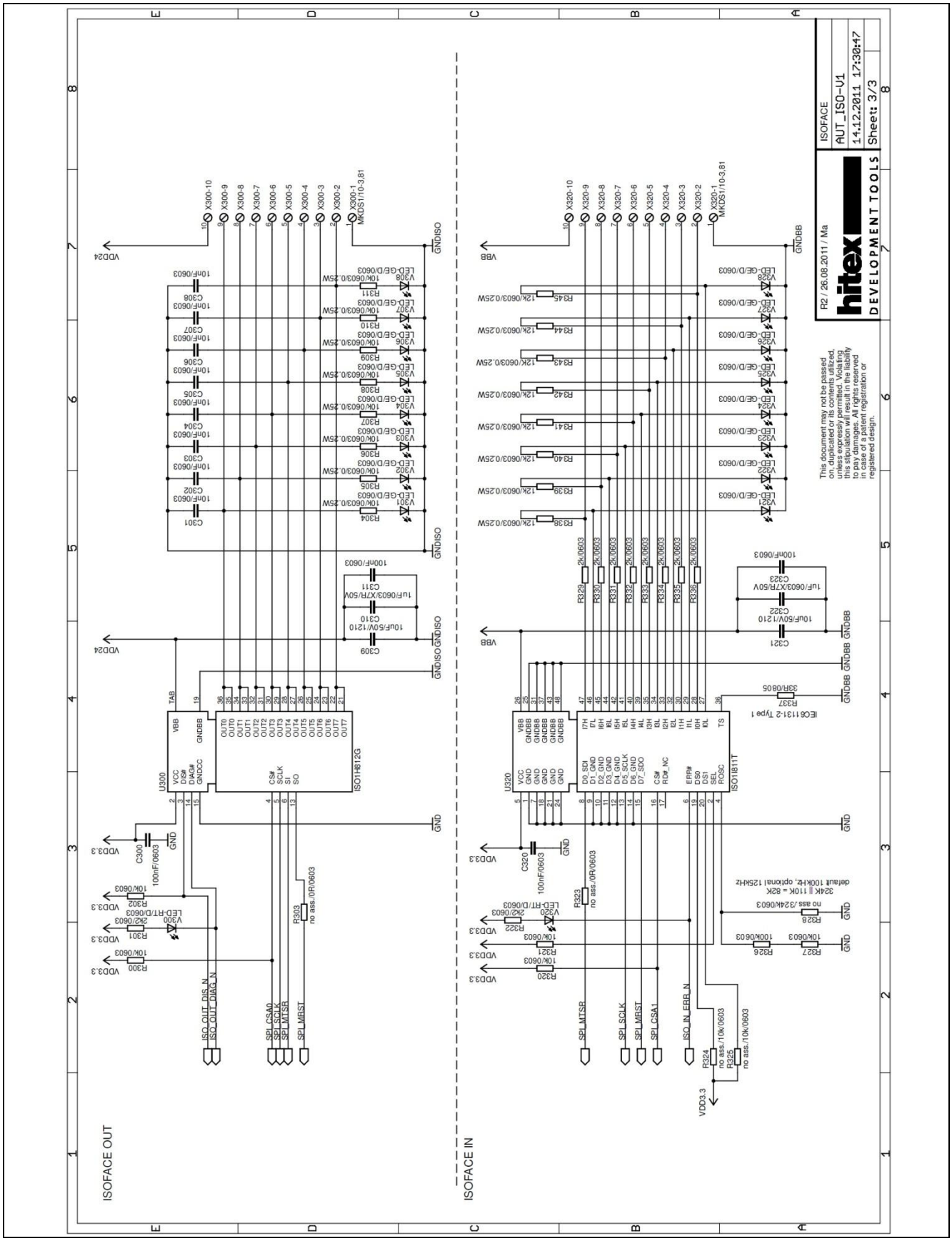

Figure 7 ISOFACE

3.2 Layout and Geometry

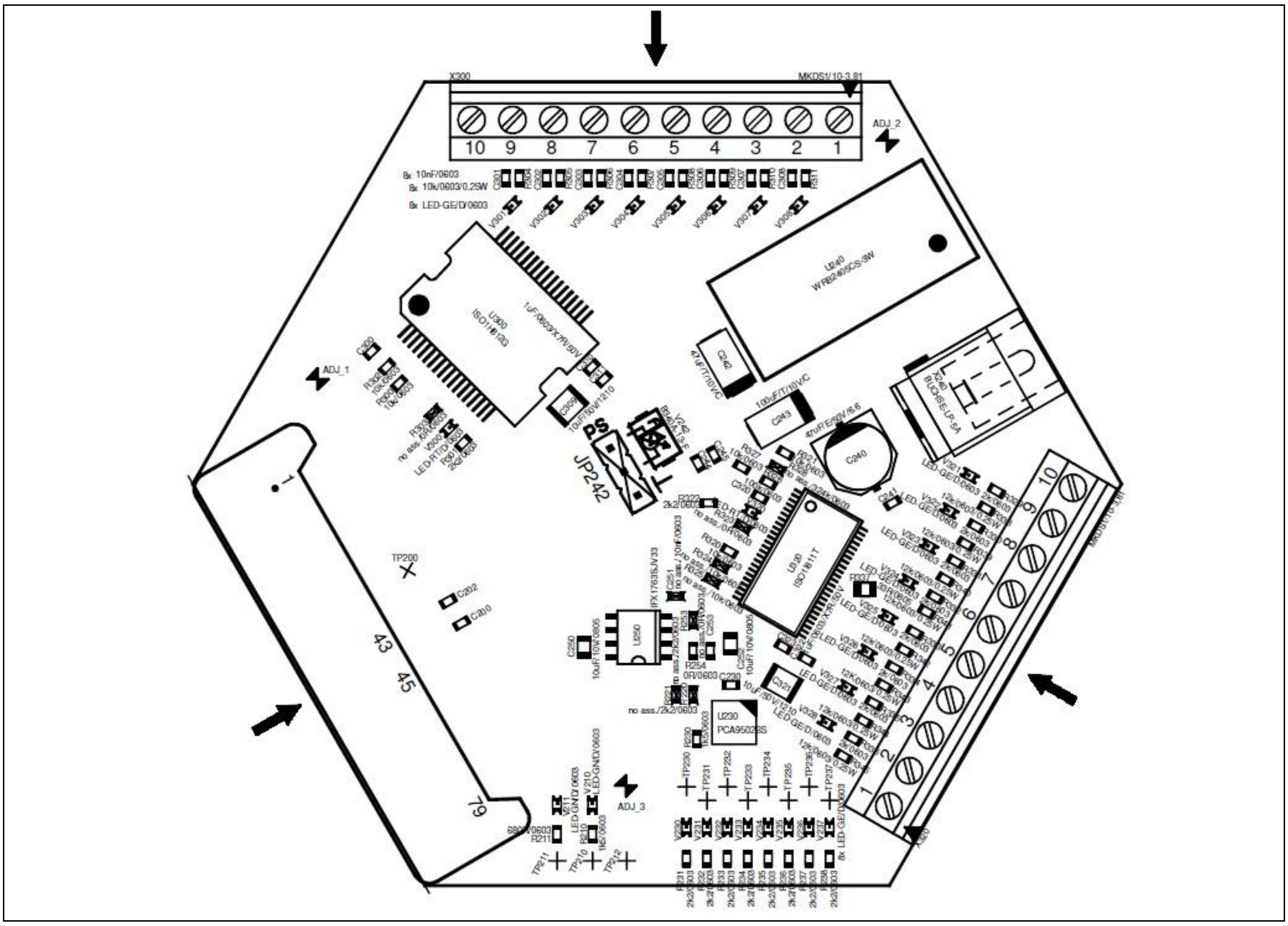

Figure 8 Automation I/O Card Layout

3.3 Bill of Material

Table 9 Automation I/O Card BOM

Pos. No.	Qty	Value	Device	Reference Designator
1	1	0R/0603	Resistor	R254
2	2	1k5/0603	Resistor	R210, R230
3	2	1uF/0603/X7R/50V	Capacitor	C310, C322
4	8	2k/0603	Resistor	R329, R330, R331, R332, R333, R334, R335, R336
5	10	2k2/0603	Resistor	R231, R232, R233, R234, R235, R236, R237, R238, R301, R322
6	5	10k/0603	Resistor	R300, R302, R320, R321, R327
7	8	10k/0603/0.25W	Resistor	R304, R305, R306, R307, R308, R309, R310, R311
8	8	10nF/0603	Capacitor	C301, C302, C303, C304, C305, C306, C307, C308
9	2	10uF/10V/0805	Capacitor	C250, C252
10	2	10uF/50V/1210	Capacitor	C309, C321
11	8	12k/0603/0.25W	Resistor	R338, R339, R340, R341, R342, R343, R344, R345
12	1	33R/0805	Resistor	R337
13	1	47uF/E/50V/6.6	Capacitor UWT1H470MCL1GS Nichicon	C240
14	1	47uF/T/10V/C	Capacitor	C242
15	1	100k/0603	Resistor	R326
16	11	100nF/0603	Capacitor	C200, C202, C230, C241, C244, C245, C253, C300, C311, C320, C323
17	1	100uF/T/10V/C	Capacitor	C243
18	1	680R/0603	Resistor	R211
19	1	B340A-13-F	Diode B340A-13-F Diodes Inc.	V242
20	1	BUCHSE-LP-5A	Connector RAPC722X	X240
21	1	HSEC8-140-01-S-RA	Connector HSEC8-140-01-S-RA Samtec	X200
22	1	IFX1763SJV33	IC IFX1763SJV33 Infineon Technologies	U250
23	1	ISO1H812G	IC ISO1H812G Infineon Technologies	U300
24	1	ISO1I811T	IC ISO1I811T Infineon Technologies	U320
25	24	LED-GE/D/0603	LED	V230, V231, V232, V233, V234, V235, V236, V237, V301, V302, V303, V304, V305, V306, V307, V308, V321, V322, V323, V324, V325, V326, V327, V328
26	2	LED-GN/D/0603	LED	V210, V211

Table 9 Automation I/O Card BOM

Pos. No.	Qty	Value	Device	Reference Designator
27	2	LED-RT/D/0603	LED	V300, V320
28	2	MKDS1/10-3,81	Connector MKDS 1/10-3,81 Phoenix 1727094	X300, X320
29	1	PCA9502BS	IC PCA9502BS NXP, HVQFN-24	U230
30	1	WRB2405CS-3W	IC Isolated DC/DC 24V/5V 3W	U240
31	3	no ass./0R/0603	Resistor	R253, R303, R323
32	2	no ass./2k2/0603	Resistor	R220, R221
33	2	no ass./10k/0603	Resistor	R324, R325
34	1	no ass./10nF/0603	Capacitor	C251
35	1	no ass./324k/0603	Resistor	R328
36	12	no ass.	SMD Pads	TP200, TP210, TP211, TP212, TP230, TP231, TP232, TP233, TP234, TP235, TP236, TP237
37	1	no ass.	Pinheader 0.1" TH, Hitex PowerScale	JP242

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