

XMC4500 Satellite-kit: Automation I/O Kit

Part Number: *KIT_XMC4X_AUT_ISO_001*



Features

- Connection to CPU board via ACT Satellite Connector
- ISOFACE OUT, up to 8 channels
- ISOFACE IN, up to 8 channels
- I2C based IO expander up to 8 channels
- Single side assembly of all parts
- 2 LEDs indicating power (3.3 Volt, 5 Volt)
- Power supply:
 - Power jack for external 24V supply
 - From CPU Board via ACT Satellite Connector

PLEASE SEE THE FOLLOWING PAGES FOR USERS MANUAL



Hexagon Application Kit

For XMC4000 Family

AUT_ISO-V1

Automation I/O Card

Board User's Manual

Revision 1.0, 2012-02-28

Microcontroller

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Revision History

| 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:

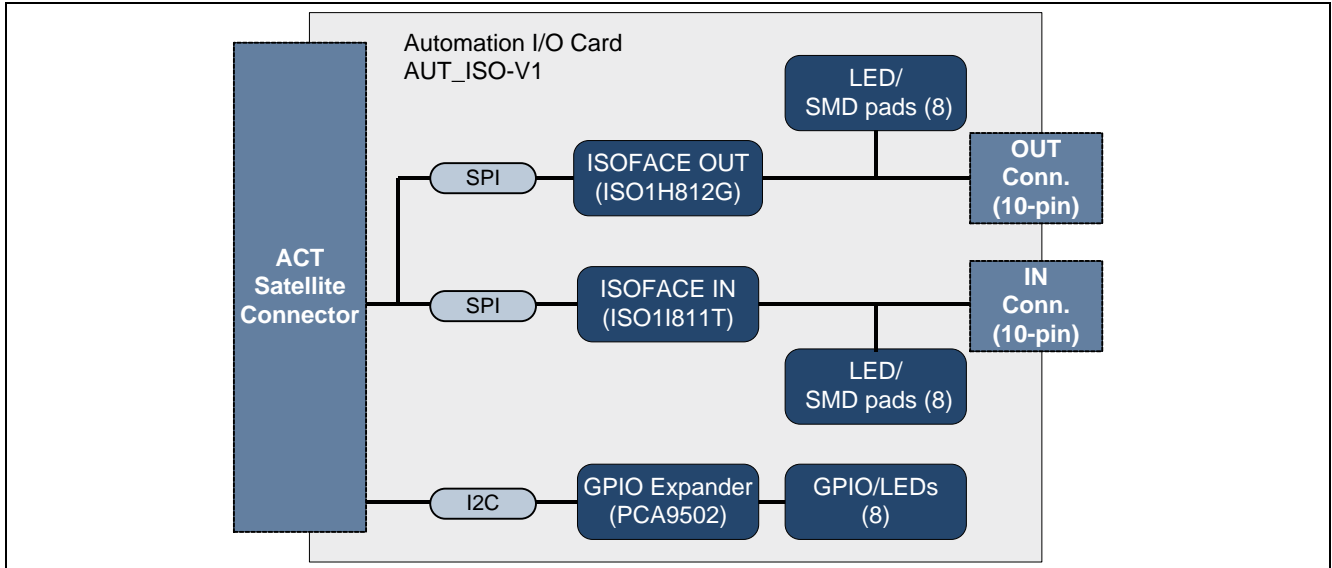


Figure 1 Automation I/O Card (AUT_ISO-V1)

2 Hardware Description

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

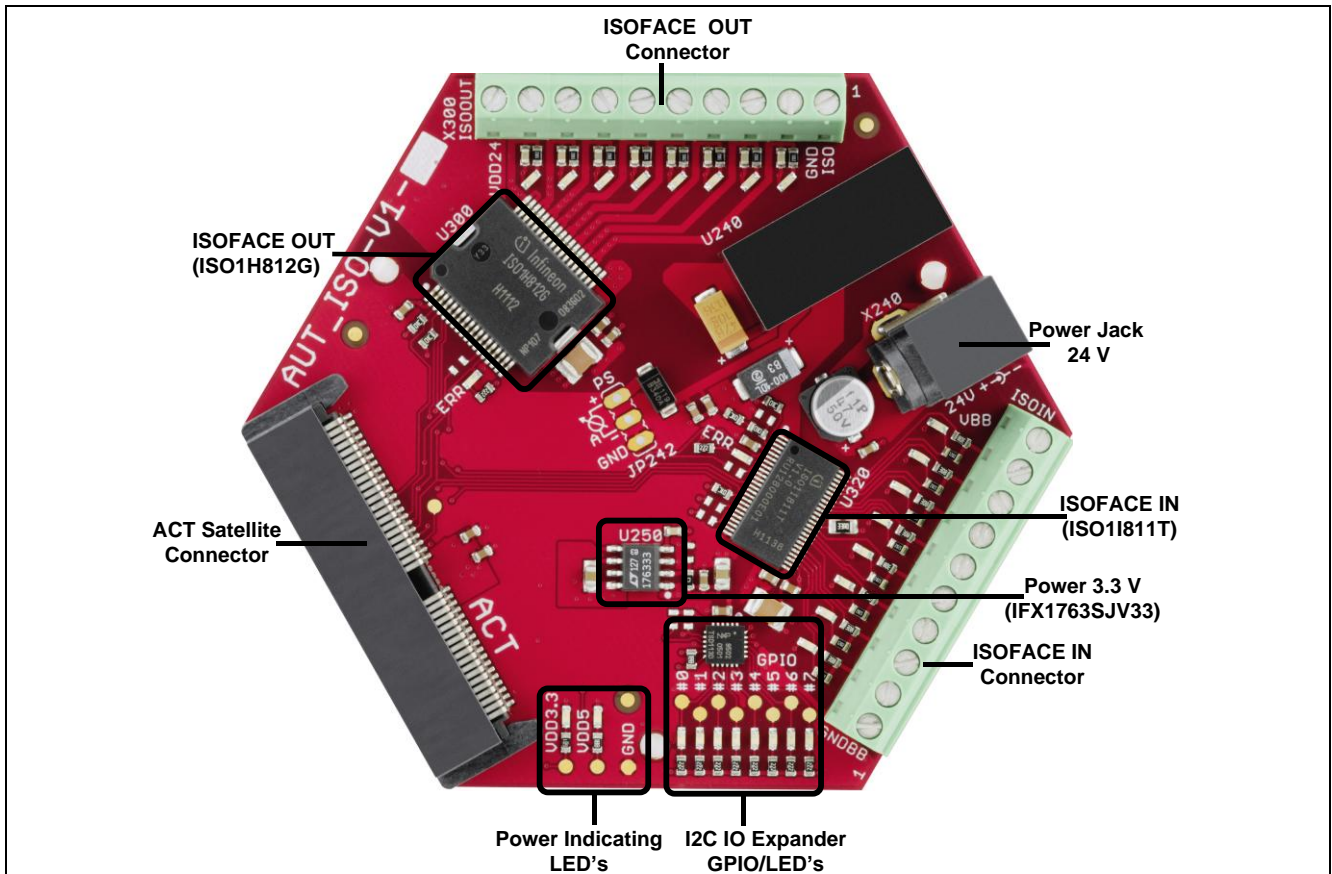


Figure 2 Automation I/O Card Interfaces

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 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 through 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.

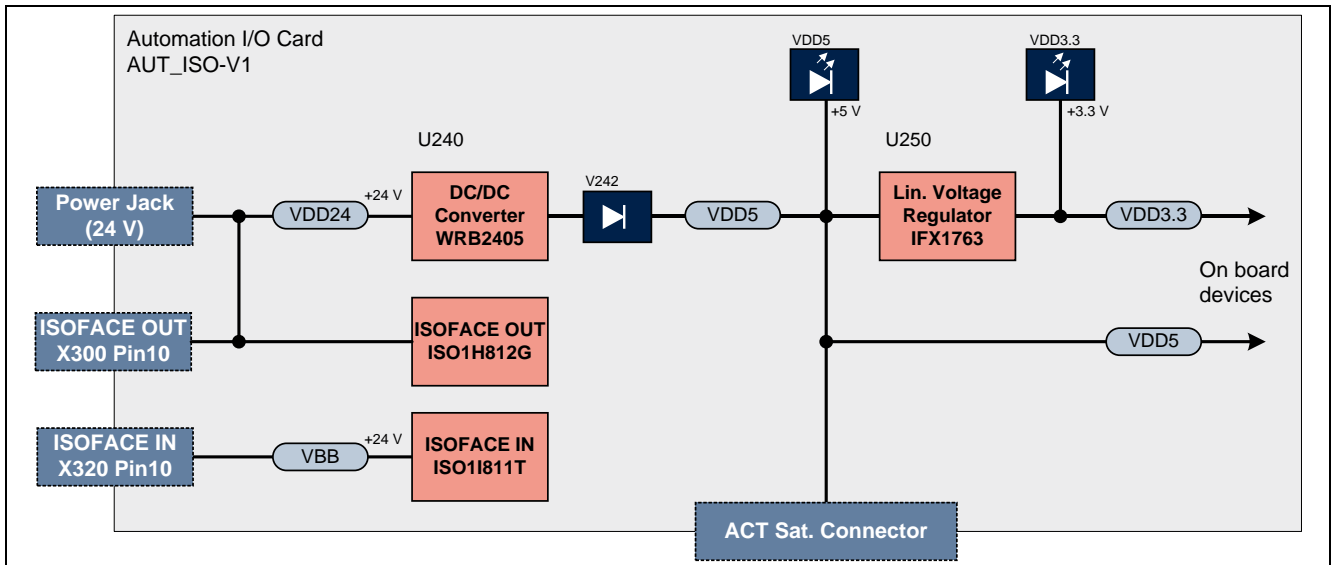


Figure 3 Power Circuit

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) <i>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</i> |

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.

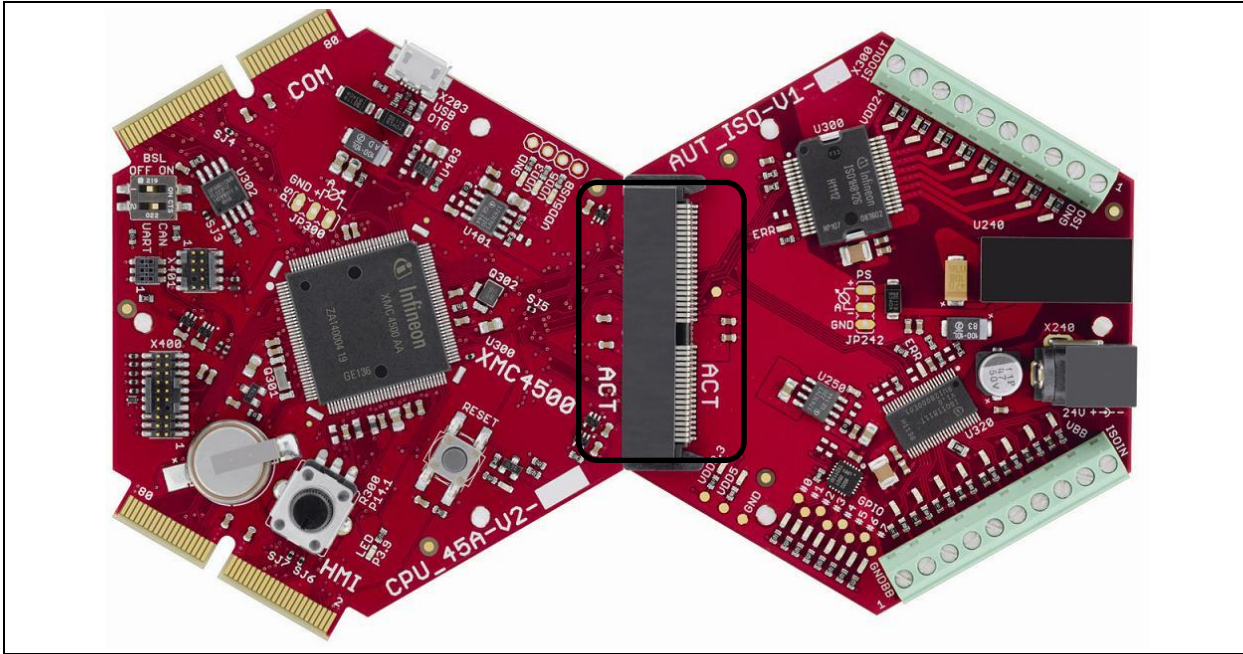


Figure 4 ACT Satellite Connector

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

| CPU_45A V2 function >> | CONpins >> | CONpins >> | CPU_45A V2 function >> |
|------------------------|------------|-------------|------------------------|
| GND | 2 | GND | GND |
| PIFO_IN0A | 3 | RSVD | nc |
| PIFO_IN1A | 4 | PIFOIN1 | nc |
| PIFO_IN2A | 5 | PIFOIN2 | nc |
| PIFO_IN3A | 6 | PIFOIN3 | nc |
| DSD_DIN0A | 7 | RSVD | DSD_PWMIN |
| DSD_DIN1B | 8 | DSDIN0 | DSD_PWMIP |
| DSD_DIN2A | 9 | DSDIN1 | DSD_MCLK2A |
| DSD_DIN3A | 10 | DSDIN2 | DSD_MCLK3B |
| nc | 11 | DSDIN3 | nc |
| CCU43_IN0A | 12 | RSVD | CCU43_IN3A |
| CCU43_IN1A | 13 | CC_IN0 | CCU81_IN1B |
| CCU43_IN2A | 14 | CC_IN1 | CCU81_IN3B |
| CCU43_IN3C | 15 | CC_IN2 | CCU80_IN0A |
| CCU43OUT1 | 16 | ENA_A | CCU81_IN0A |
| U1C1_DX00 | 17 | ENA_B | CCU43_IN0C |
| U1C1_DX00B | 18 | ENA_X | U1C1_SELO0 |
| U1C0_SCLKOUT | 19 | SPI_MTSR | U1C1_OUT12 |
| P0.6 | 20 | SPI_MRST | nc |
| PORST | 21 | SPI_SCLK | U1C0_DX0C/DOUT0 |
| 5V | 22 | SPI_SCLK | P15.4 |
| 5V | 23 | I2C_SCL | P4.2 |
| 5V | 24 | GPIO | 5V |
| 5V | 25 | RESET | 5V |
| 5V | 26 | 5V | 5V |
| VAREF | 27 | 5V | VAGND |
| VADC_G1CH0 | 28 | 5V | VADC_G1CH1 |
| VADC_G0CH4 | 29 | AREF | VADC_G0CH6 |
| VADC_G1CH6 | 30 | DAC1/ADCO | VADC_G0CH7 |
| VADC_G1CH7 | 31 | ADC2/DACREF | VADC_G0CH0 |
| VADC_G2CH2 | 32 | ADC4/ORC1 | VADC_G0CH5 |
| VADC_G2CH6 | 33 | ADC6/ORC3 | VADC_G3CH6 |
| VADC_G2CH7 | 34 | ADC8 | VADC_G3CH7 |
| CCU80_OUT00 | 35 | ADC10 | CCU81_OUT00 |
| CCU80_OUT01 | 36 | ADC12 | CCU81_OUT01 |
| CCU80_OUT10 | 37 | ADC13 | CCU81_OUT10 |
| CCU80_OUT11 | 38 | PWMA0_H | CCU81_OUT11 |
| CCU80_OUT20 | 39 | PWMA0_L | CCU81_OUT20 |
| CCU80_OUT21 | 40 | PWMA1_H | CCU81_OUT21 |
| CCU43OUT2 | 41 | PWMA1_L | CCU81_OUT31 |
| CCU43OUT3 | 42 | PWMA2_H | CCU81_OUT30 |
| GND | 43 | PWMA2_L | GND |
| GND | 44 | PWMA2_L | GND |
| GND | 45 | PWMA2_L | GND |
| GND | 46 | PWMA2_L | GND |
| GND | 47 | PWMA2_L | GND |
| GND | 48 | PWMA2_L | GND |
| GND | 49 | PWMA2_L | GND |
| GND | 50 | PWMA2_L | GND |
| GND | 51 | PWMA2_L | GND |
| GND | 52 | PWMA2_L | GND |
| GND | 53 | PWMA2_L | GND |
| GND | 54 | PWMA2_L | GND |
| GND | 55 | PWMA2_L | GND |
| GND | 56 | PWMA2_L | GND |
| GND | 57 | PWMA2_L | GND |
| GND | 58 | PWMA2_L | GND |
| GND | 59 | PWMA2_L | GND |
| GND | 60 | PWMA2_L | GND |
| GND | 61 | PWMA2_L | GND |
| GND | 62 | PWMA2_L | GND |
| GND | 63 | PWMA2_L | GND |
| GND | 64 | PWMA2_L | GND |
| GND | 65 | PWMA2_L | GND |
| GND | 66 | PWMA2_L | GND |
| GND | 67 | PWMA2_L | GND |
| GND | 68 | PWMA2_L | GND |
| GND | 69 | PWMA2_L | GND |
| GND | 70 | PWMA2_L | GND |
| GND | 71 | PWMA2_L | GND |
| GND | 72 | PWMA2_L | GND |
| GND | 73 | PWMA2_L | GND |
| GND | 74 | PWMA2_L | GND |
| GND | 75 | PWMA2_L | GND |
| GND | 76 | PWMA2_L | GND |
| GND | 77 | PWMA2_L | GND |
| GND | 78 | PWMA2_L | GND |
| GND | 79 | PWMA2_L | GND |
| GND | 80 | PWMA2_L | GND |

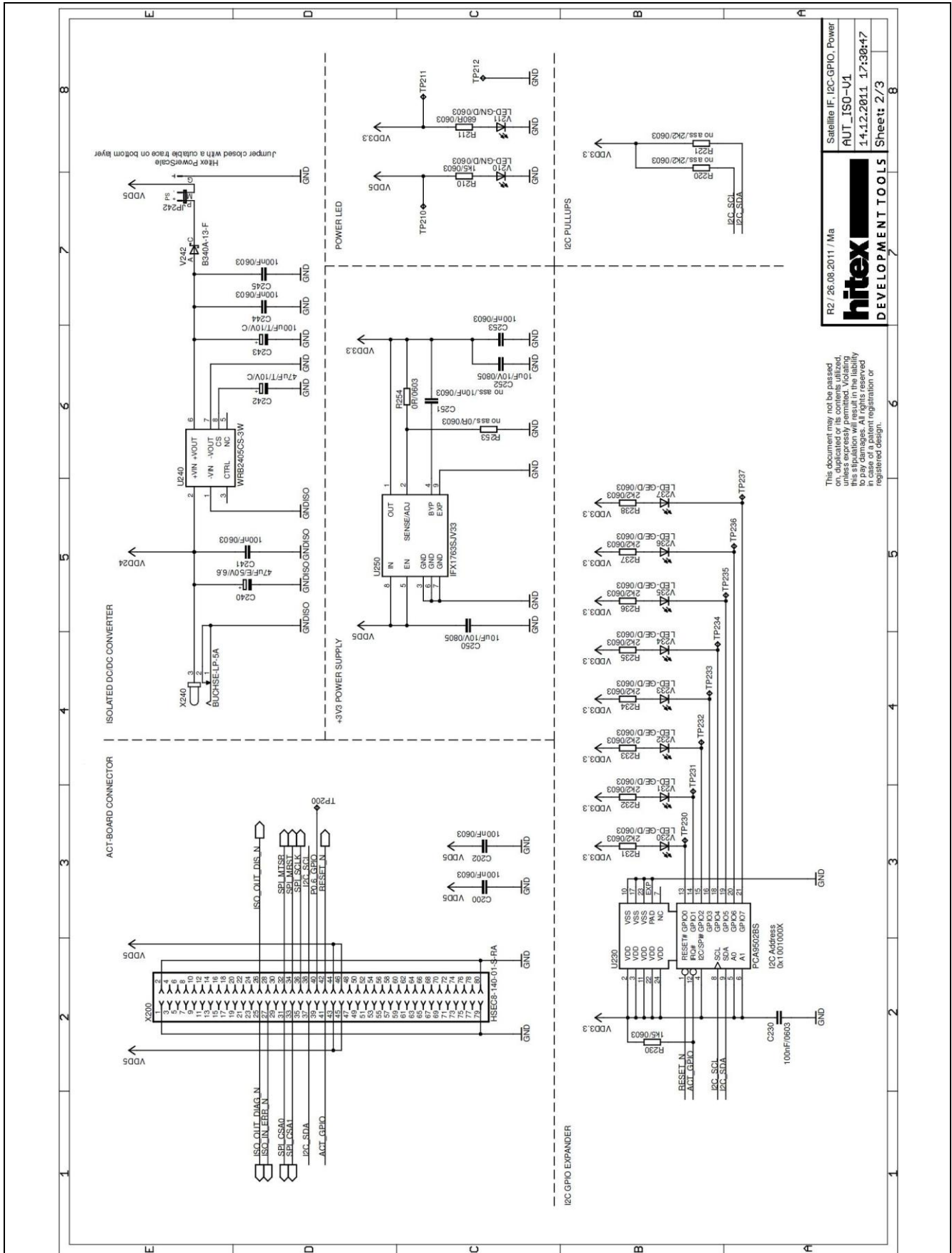
Figure 5 Satellite Connector Type ACT

3 Production Data

3.1 Schematics

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

- Satellite Connector, IO Expander, Power
- ISOFACE



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Figure 6 Satellite Connector, IO Expander, Power

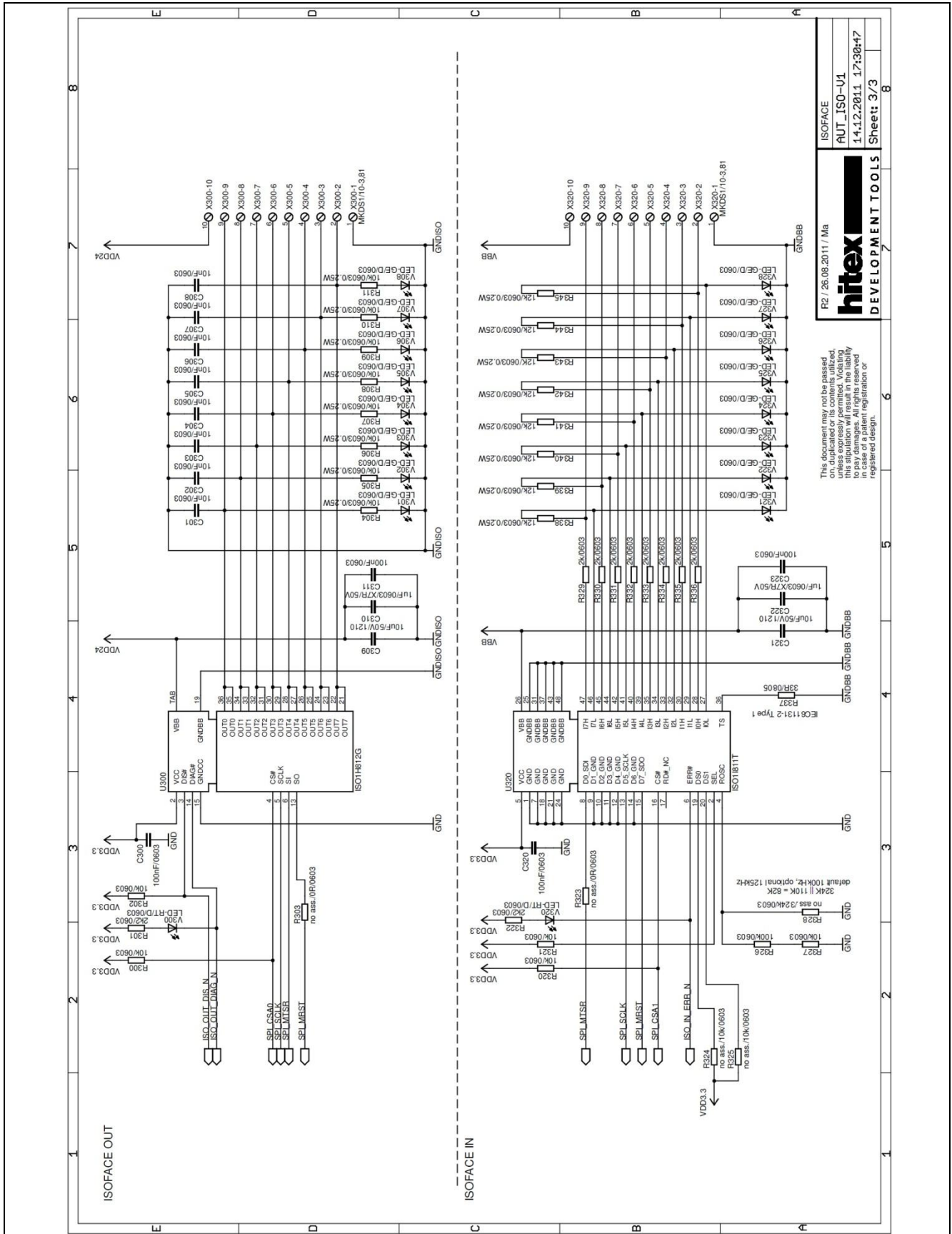


Figure 7 ISOFACE

3.2 Layout and Geometry

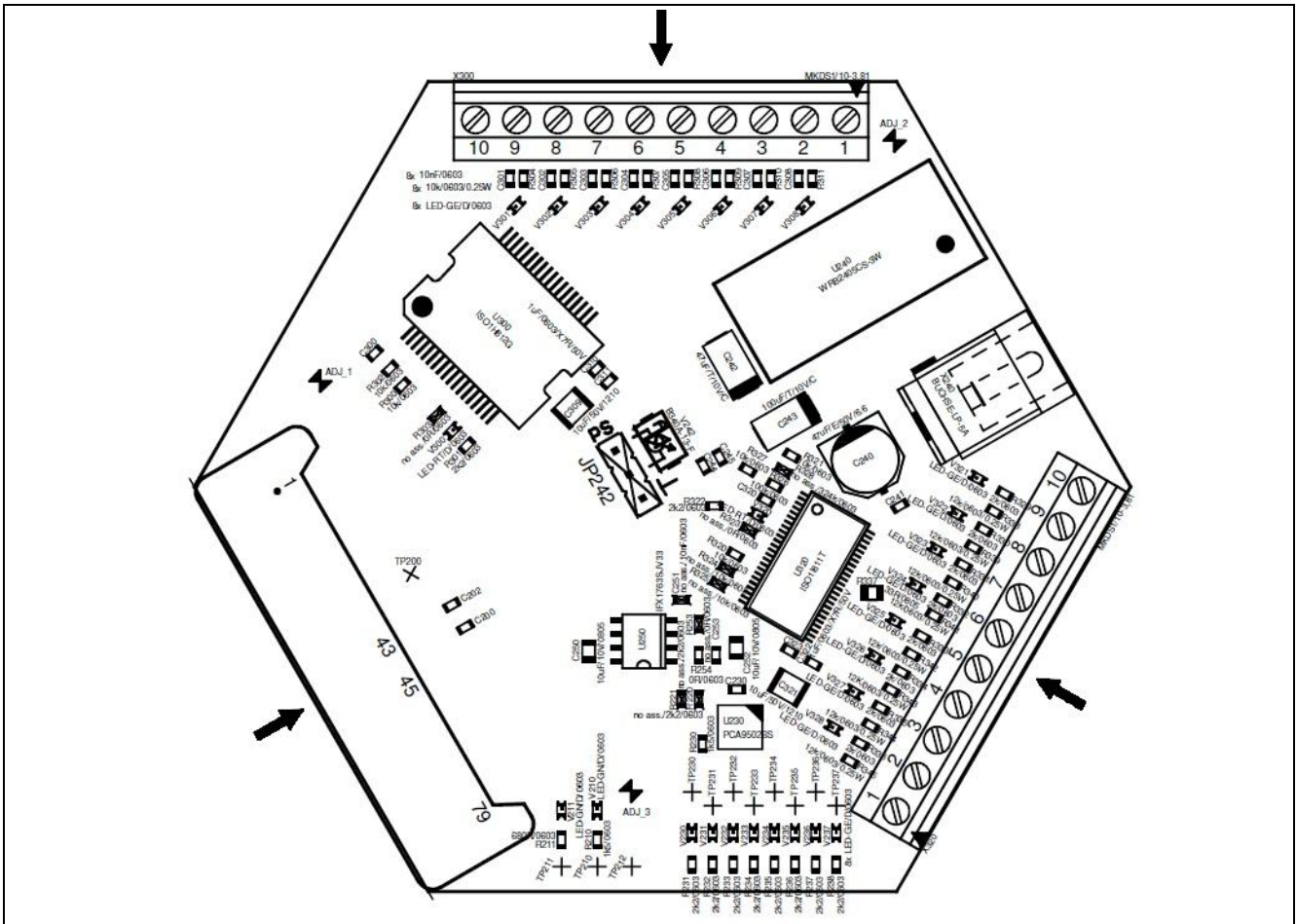


Figure 8 Automation I/O Card Layout

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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