DAQ-2543-LOOP-8
Analog Peripheral Board
Technical Manual

Document Revision: 1.02

Date: 11 October, 2017

 BiPOM Electronics

Warranty

1. Overview

DAQ-2543-LOOP-8 is a high-perfomance multifunction board which offers the most desired measurement function: 12-bit Analog-To-Digital Conversion. When combined with a low-cost microcontroller board, the DAQ-2543-LOOP-8 board is a very cost-effective solution for industrial measurement and monitoring applications.

DAQ-2543-LOOP-8 has a TLC2543, 11-channel, 12-bit Analog-To-Digital Converter from Texas Instruments with the addition of 8 channel, jumper configurable either 4-20mA current loop input or up to 4.096V voltage input.

The board directly interfaces via expansion connector to Single Board Computer (SBC) systems from Bipom Electronics such as 8051 boards, AVR boards, MSP430 boards, ARM boards.

2. Specifications

DAQ-2543-LOOP-8 board has the following configuration:

- TLC-2543, 12-bit ADC, 11 channels, 0 to 4.096 Volt input range, 10 microsecond conversion time

- Voltage reference, 4.096V

- Expansion connector

- Analog input/output terminal blocks

- 8 channel jumper configurable either 4-20mA current loop input or up to 4.096V analog voltage input.

- 6.7 uA resolution

- 40 mA internal current limit on each loop.

Dimensions are 2.35 X 2.40 inches (5.97 X 6.10 centimeters).

Mounting holes of 0.138 inches (3.5 millimeters) on four corners.

0° - 70° C operating, -40° - +85° C storage temperature range.

3. Functional Blocks

Figure 1 shows the block diagram of the DAQ-2543-LOOP-8 board.
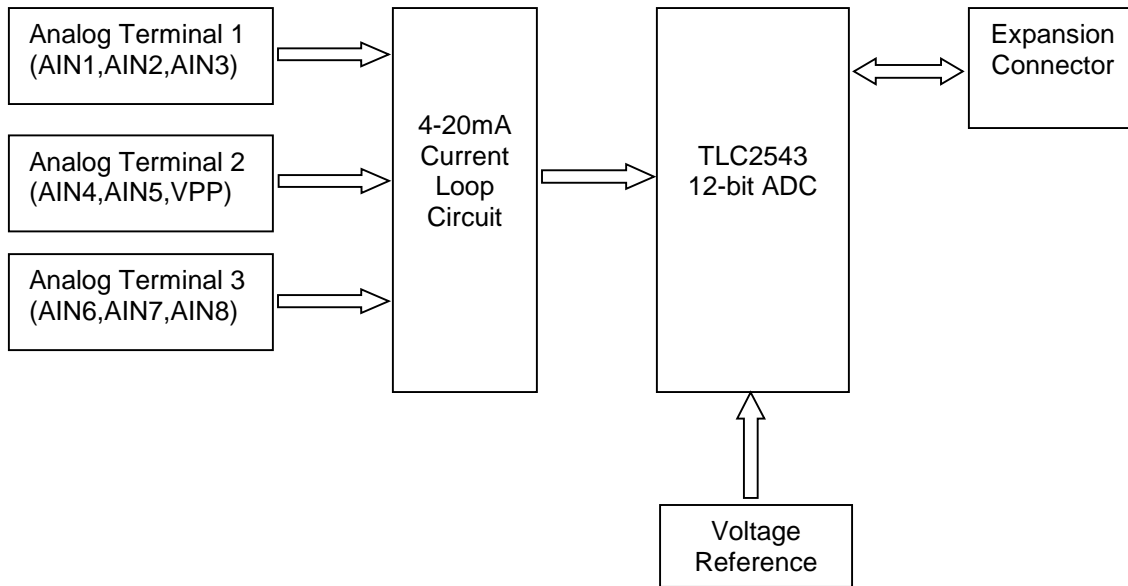

Figure 1

Analog-To-Digital Converter

The TLC-2543 (IC2) is a 12-bit data acquisition system (DAS) that requires only a single +5V supply and an external 4.096V reference for operation.TLC2543 has 11 single-ended, analog input channels that have 0 to 4.096 Volt range. 8 channels are available through X1, X2 and X3 terminal blocks. The TLC-2543 has a 3-wire, SPI-compatible serial interface that allows communication with microcontroller boards. Maximum conversion time is 10 microseconds. Input channels can withstand voltages between 0 to 5 Volts although the measurement range is 0 to 4.096 Volts.

4-20mA Current Loop Circuits

The board contains 8 channel jumper configurable 4-20mA or 0-20mA Current Loop circuit. It has current limiting and current sensing circuits. Depending on jumper settings, it can serve either as 4-20mA or 0-20mA current loop or as regular up to 5V analog voltage inputs. Figure 2 shows jumper setting for up to +5V analog voltage inputs. Figure 3 shows jumper setting for 4-20mA or 0-20mA current loop.
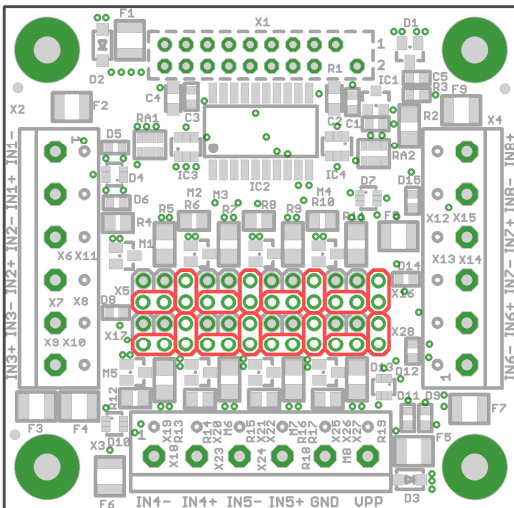

Figure 2   Figure 3
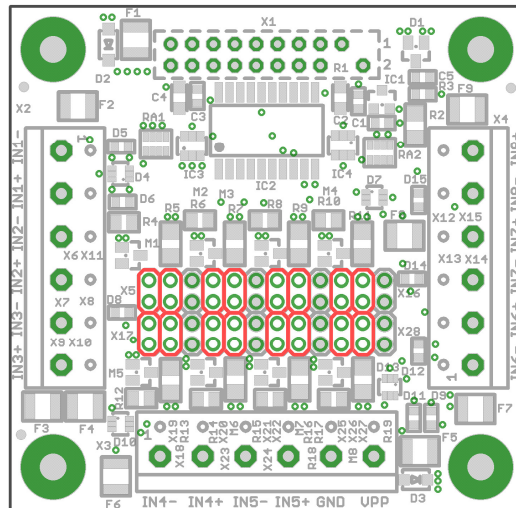
The power supply for 4-20mA or 0-20mA current loop should be applied externally. It could be any 10V-30VDC (up to 300mA) power supply.

4-20mA or 0-20mA current loop circuits are internally current limited to 40mA so the loops are short circuit tolerant.

12-bit ADC with 4.096V reference and 150 Ohms shunt resistor results in 6.7uA resolution, and maximal current measurement up to 25 mA.

Figure 5 shows how to connect a 4-20mA Current Loop sensor to Input 4. It also shows how to connect a 12-30V power supply to VPP input:
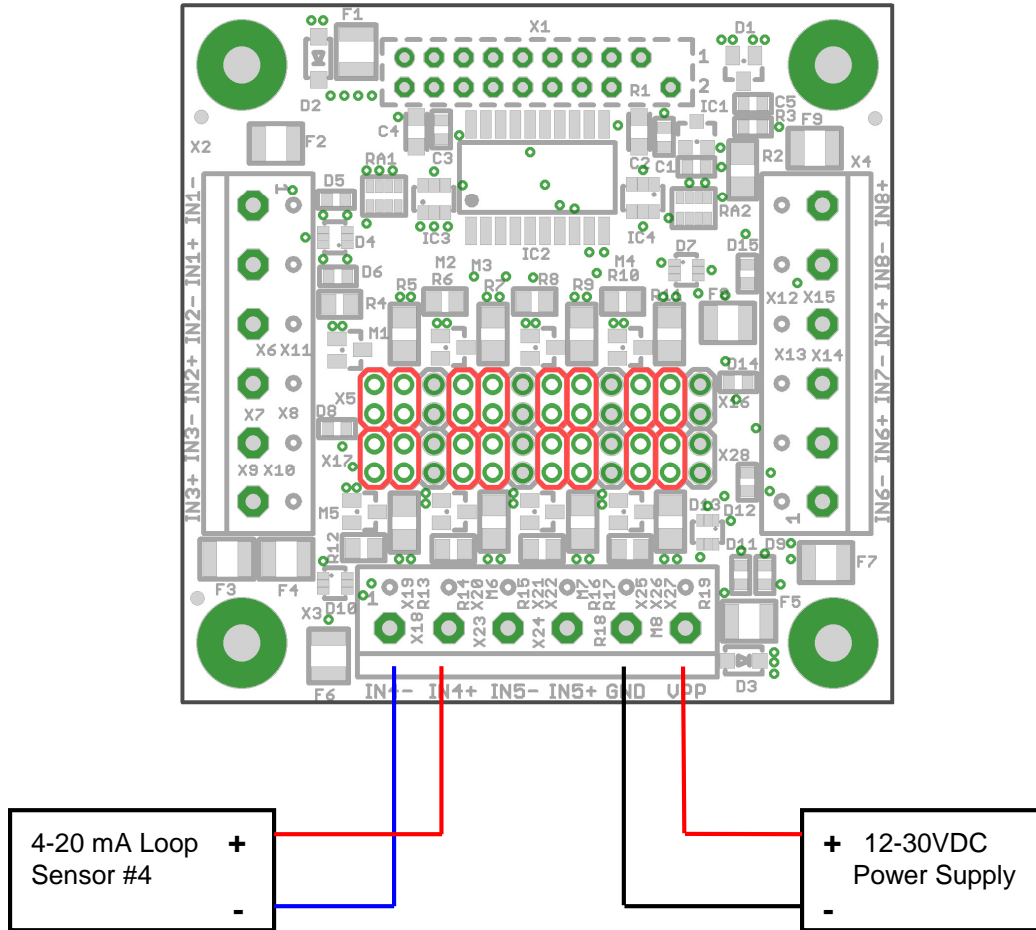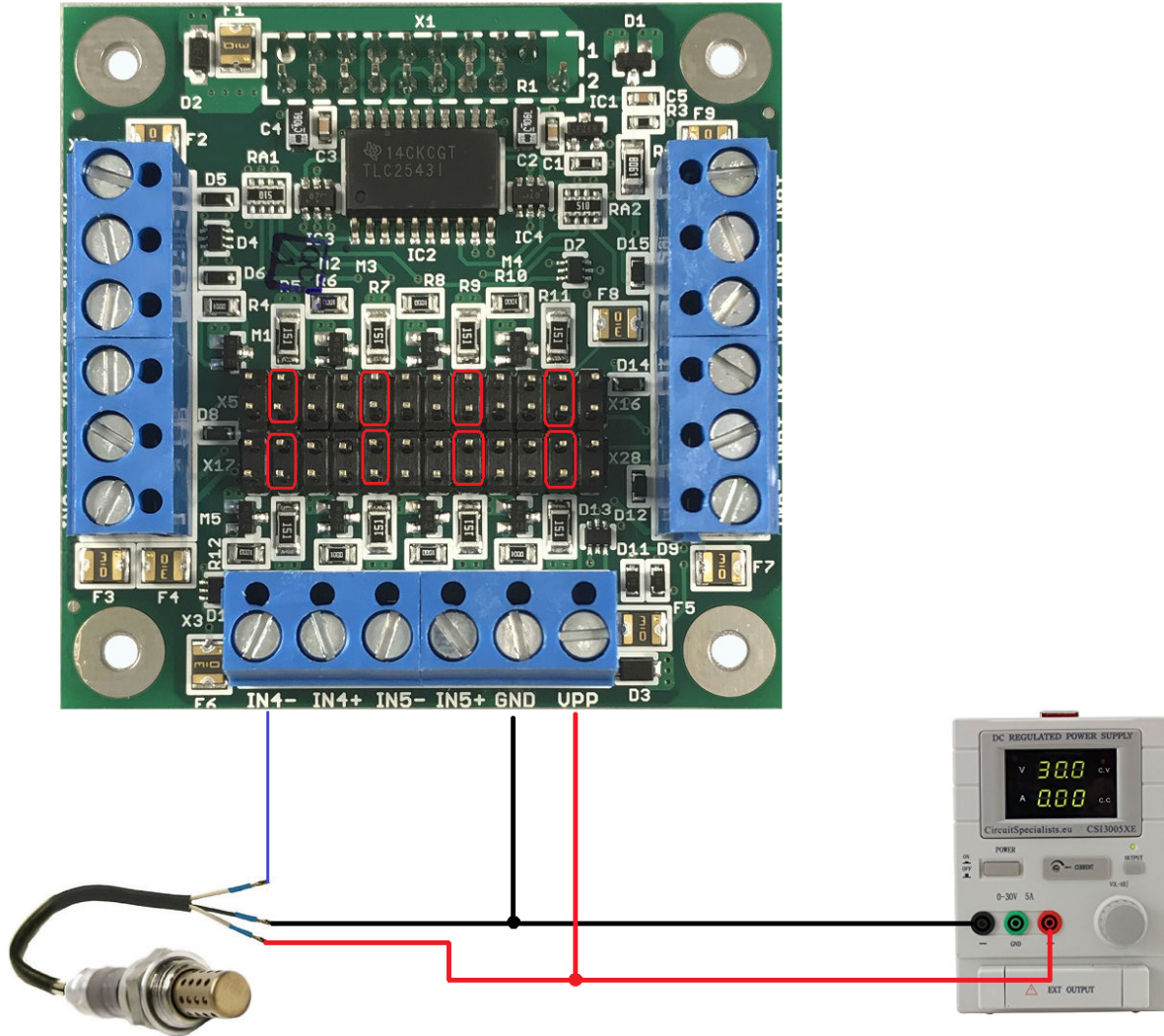

Figure 4

Externally powered 4-20mA devices

Jumpers are installed as shown in Figure 4 for externally powered (typically 3-wire or 4-wire) devices. The output of the device is applied to NEGATIVE (-) input of the corresponding channel. In the example below, the output of the 4-20mA device is connected to negative input of channel 4. Positive input of channel 4 is not used. Ground and loop power are shared by the 4-20mA device and the DAQ2543-LOOP8 through the external power supply.

Externally powered, 3-wire 4-20mA sensor

Figure 5

Note 1: DAQ2543-LOOP8 still needs to be powered through the 5 Volts from its host microcontroller system.

Note 2: It is OK to mix and match channel types. For example, channel 1 can be a voltage input type, channel 2 can be loop-powered 4-20mA and channel 4 can be externally powered 3-wire 4-20mA.

Voltage Reference

The LM4040-4.1 is a precision micropower shunt 4.096V reference. The LM4040 utilizes fuse and zener-zap reverse breakdown voltage trim during wafer sort to ensure that the prime parts have an accuracy of better than ±0.1% (A grade) at 25°C. Bandgap reference temperature drift curvature correction and low dynamic impedance ensure stable reverse break-down voltage accuracy over a wide range of operating temperatures and currents.

Expansion

All the control/data lines and the 5-Volt power supply connections are available on a 20-pin Expansion connector (X1) for interfacing to existing microcontroller boards. DAQ-2543-LOOP-8 peripheral board can be connected either as a piggyback daughter-board on a microcontroller board using standoffs or can be placed up away from the microcontroller board using a 20-wire ribbon cable (Cable length should be limited to few inches for best performance). Table 1 shows the pin assignments for Expansion connector.

Expansion connector (X1)

Signal	Pin	Pin	Signal
P3.0	20	19	P3.1
P3.2	18	17	P3.3
P3.4	16	15	P3.5
P3.6	14	13	P3.7
P1.0	12	11	P1.1
P1.2	10	9	P1.3
P1.4	8	7	P1.5
P1.6	6	5	P1.7
VCC	4	3	GND
VCC	2	1	GND

Table 1

Analog Input/Output Terminals

8 analog inputs, GND and VPP power supply for 4-20mA current loop are available on the Analog Input terminals (X2, X3, X4) for interfacing to external circuitry and prototyping boards. Tables 2, 3, 4 show the pin assignments for Analog Input Terminals.

Analog Input Terminal (X2)

Signal	Pin
AIN1+	1
AIN1-	2
AIN2+	3
AIN2-	4
AIN3+	5
AIN3-	6

Table 2

Analog Input Terminal (X3)

Signal	Pin
AIN4+	1
AIN4-	2
AIN5+	3
AIN5-	4
ANALOG GROUND	5
Power Supply for 4-20mA Loop	6

Table 3

Analog Input Terminal (X4)

Signal	Pin
AIN6+	1
AIN6-	2
AIN7+	3
AIN7-	4
AIN8+	5
AIN8-	6

Table 4

4. Software

Software project examples for interfacing with DAQ-2543-LOOP-8 board are available with our program development packages:

Micro C 8051 Development System   http://www.bipom.com/products/us/202.html

SDCC 8051 Development System   http://www.bipom.com/products/us/319513.html

BASCOM51   http://www.bipom.com/products/us/729.html

AVR Development System   http://www.bipom.com/products/us/4289037.html

MSP Development System   http://www.bipom.com/products/us/3180265.html

ARM Development System   http://www.bipom.com/products/us/319589.html

5. Board Layout

Figure 4 shows positions of major components, connectors and terminals on the DAQ-2543-LOOP-8 board.
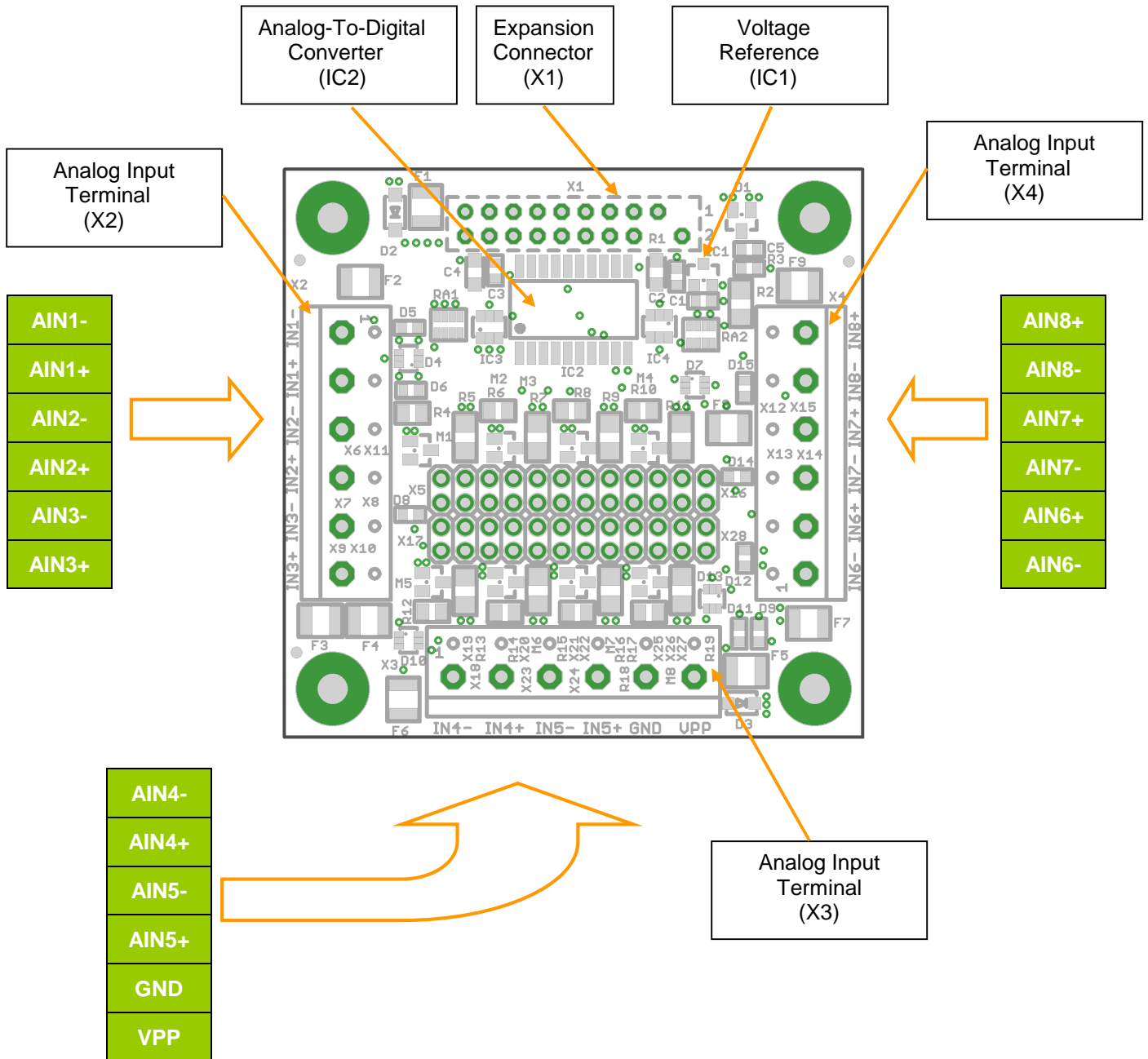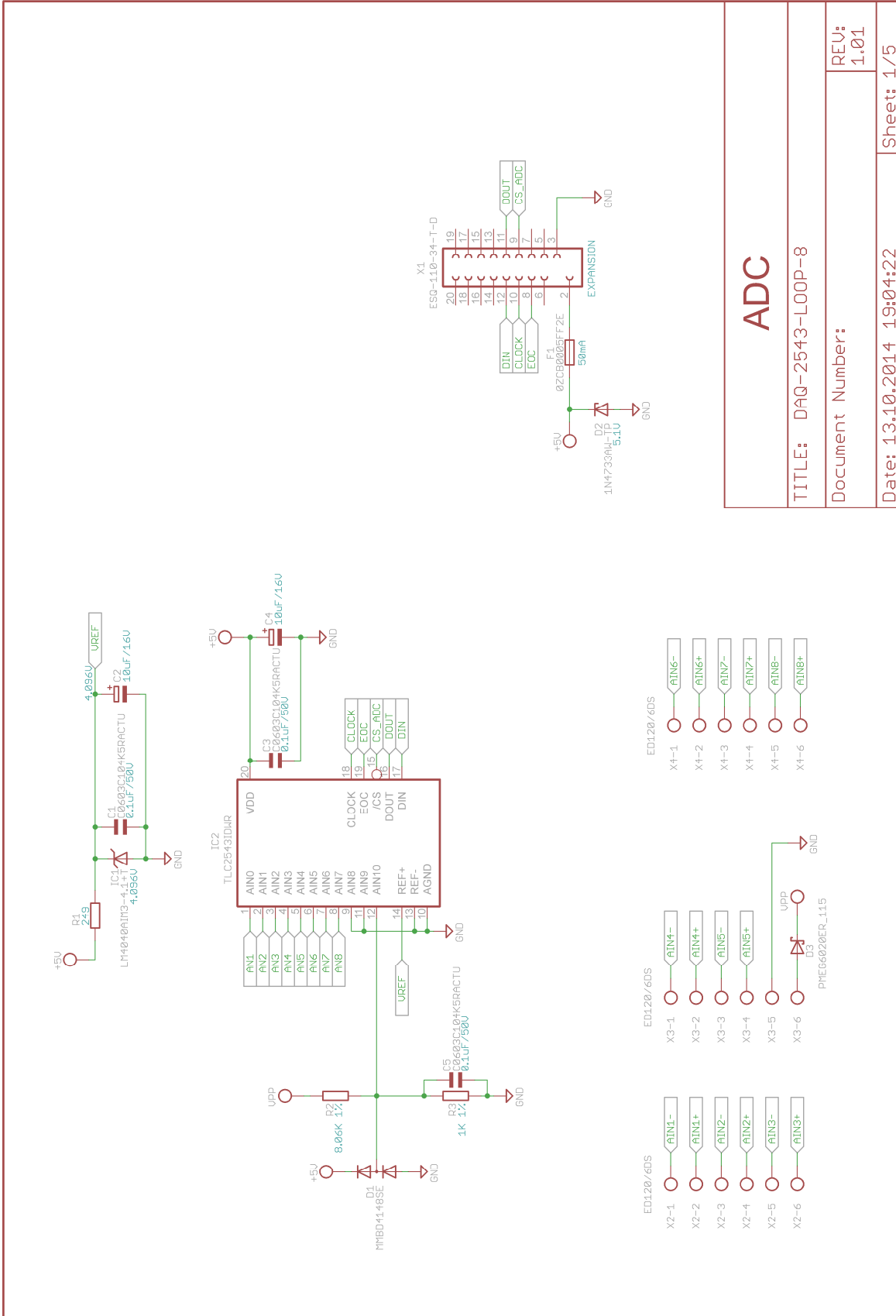

Figure 6

5. Schematics
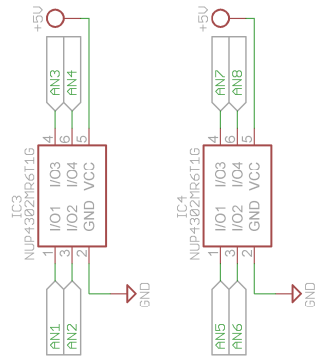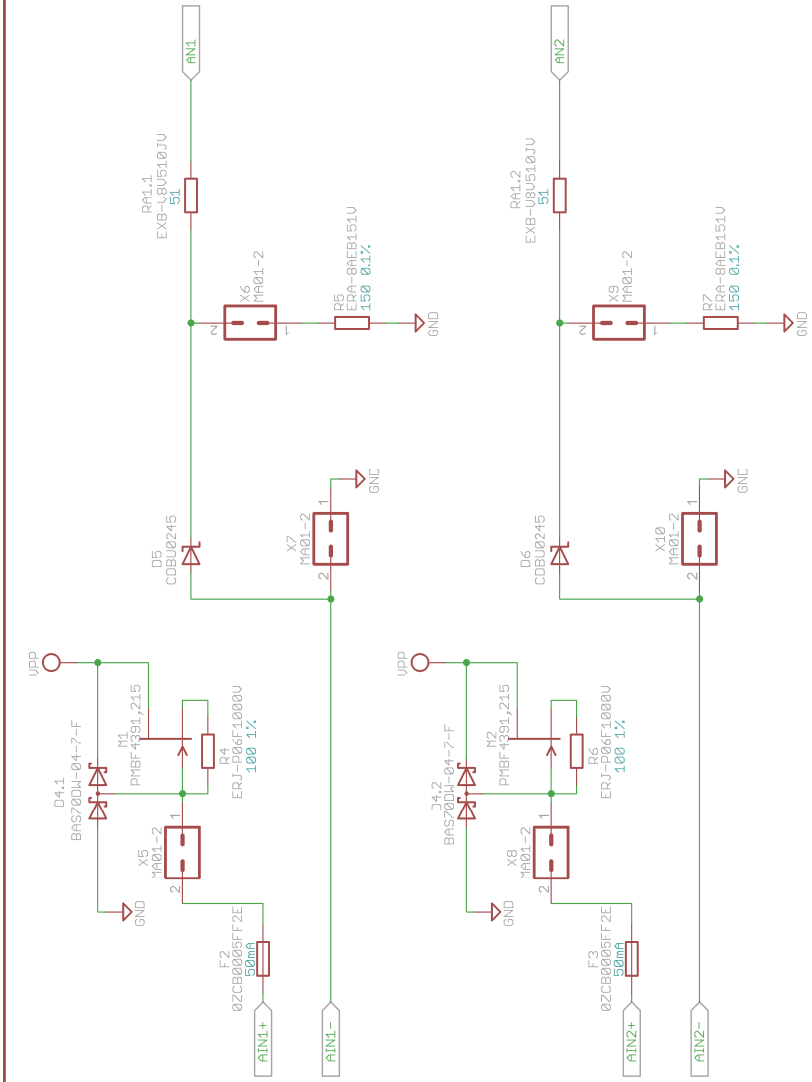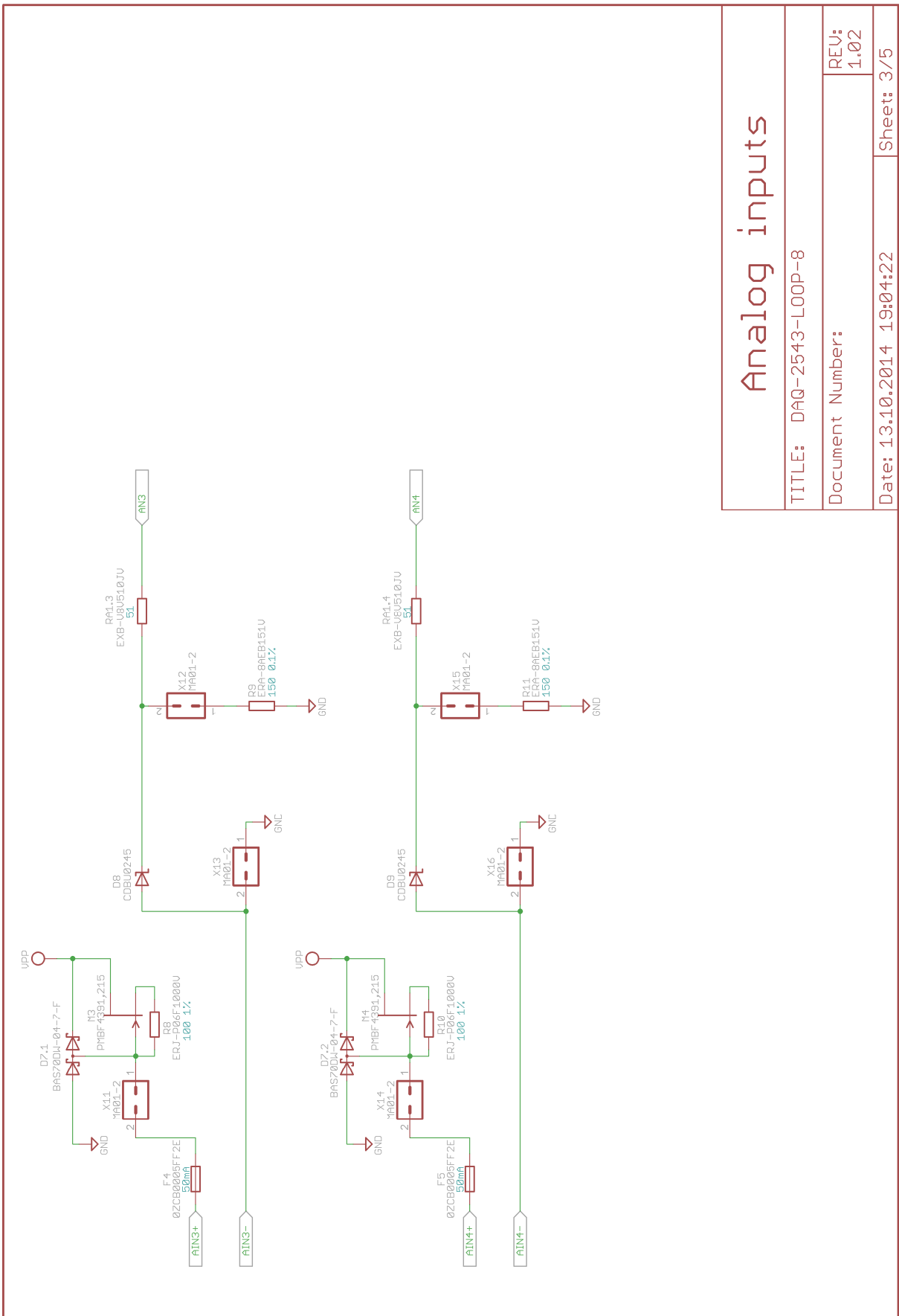
Analog inputs

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Document Number:

REV:
1.02

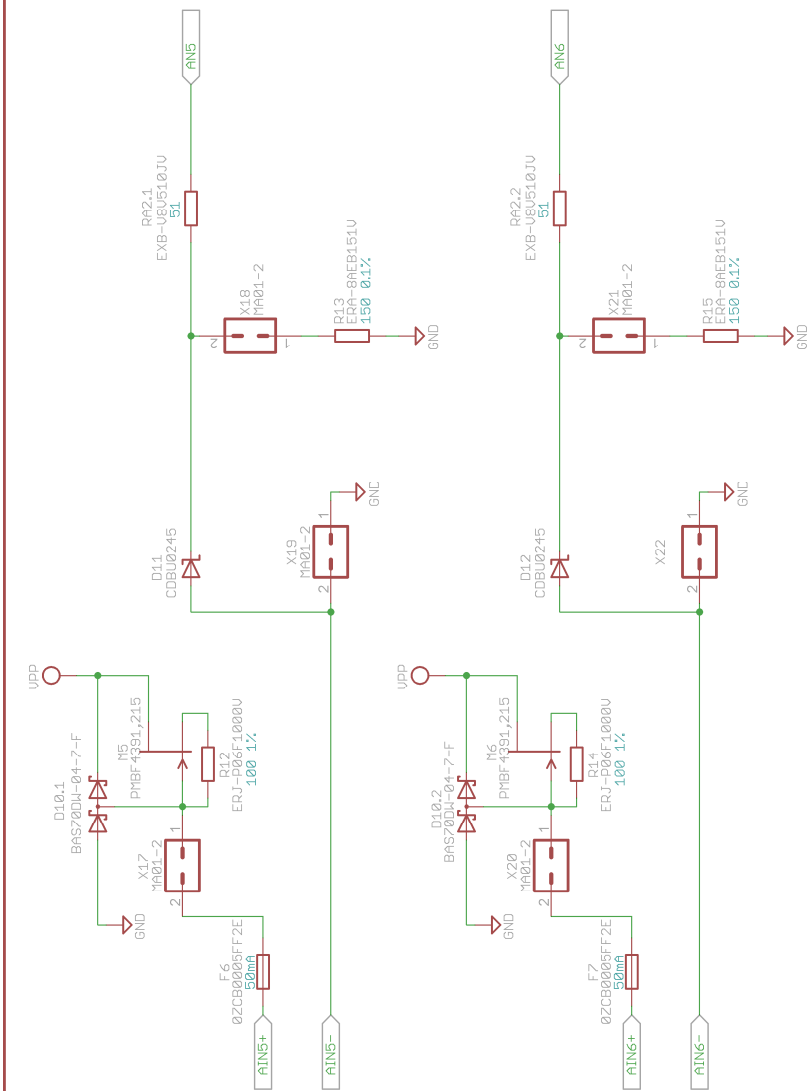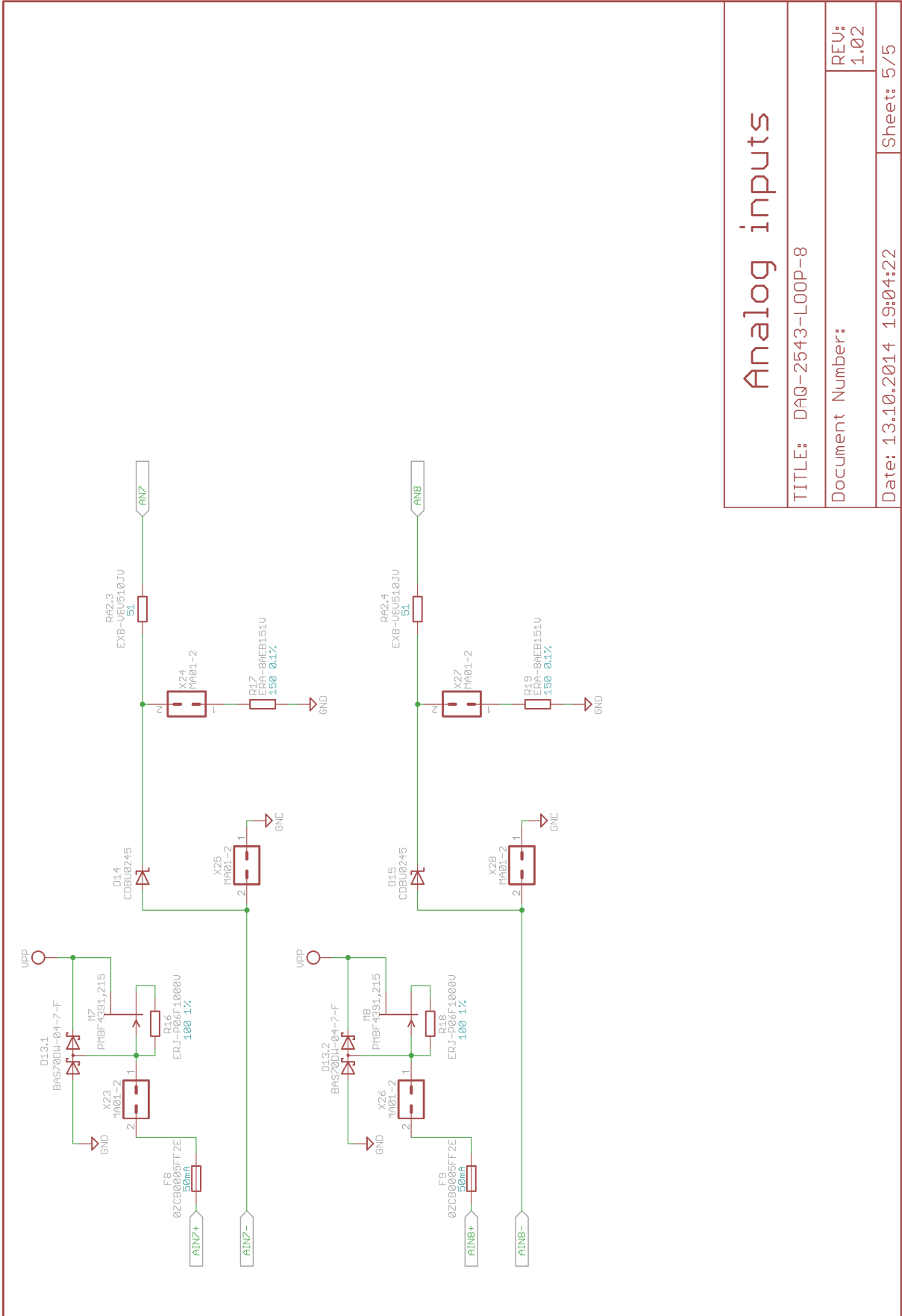Date: 13.10.2014 19:04:22

Sheet: 2/5

Analog inputs

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Document Number:

REV: 1.02

Date: 13.10.2014 19:04:22   Sheet: 3/5

Analog inputs

TITLE: DAQ-2543-LOOP-8

Document Number:

REV: 1.02

Date: 13.10.2014 19:04:22   Sheet: 4/5

Analog inputs

AN7

AN8

RA2.3
EXB-V8V510JV
51

RA2.4
EXB-V8V510JV
51

X24
MA01-2

X27
MA01-2

R17
ERA-8AEB151V
150 0.1%

R19
ERA-8AEB151V
150 0.1%

GND

GND

D14
CDBU0245

D15
CDBU0245

X25
MA01-2

X28
MA01-2

GND

GND

VPP

VPP

D13.1
BAS70DW-04-7-F

D13.2
BAS70DW-04-7-F

M7
PMBF4391,215

M9
PMBF4391,215

R16
ERJ-P06F1000V
100 1%

R18
ERJ-P06F1000V
100 1%

X23
MA01-2

X26
MA01-2

GND

GND

F8
0ZCB0005FF2E
50mA

F9
0ZCB0005FF2E
50mA

AIN7+

AIN7-

AIN8+

AIN8-