teknoCEA

F28M35 general purpose control board

CDA01-CU3 Technical Reference

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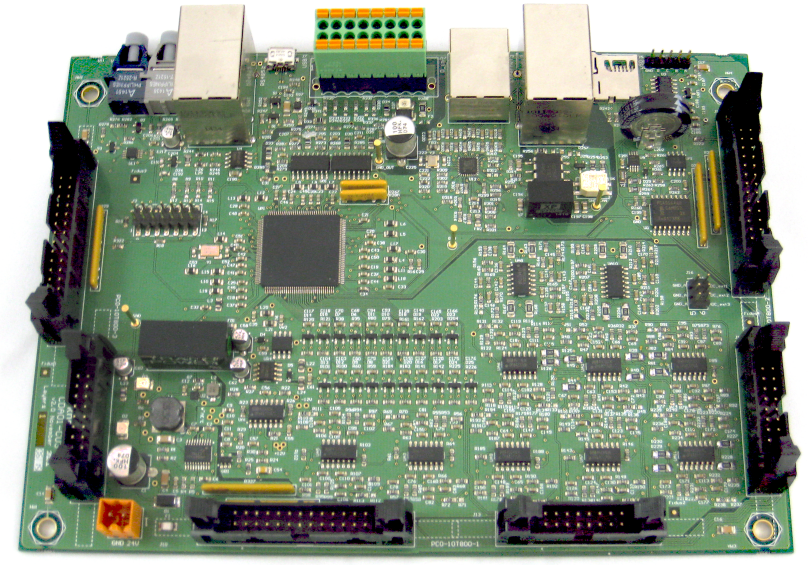

2019 COMPONENTS

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Contents

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About This Manual

This document describes board level operations of the CDA01-CU3 based on the Texas Instrumentents F28M35H52C Concerto. The TI microcontroller family that is a multicore system-on-chip microcontroller unit (MCU) with independent communication and real-time control subsystems.

The CDA01-CU3 is stand-alone module allowing engineers and software developer evaluation of certain characteristics of the F28M35H52C Concerto to determine processor applicability to design requirements. Evaluators can create software to execute on board or expand the system in a variety of ways.

Information About Cautions

This book may contain cautions.

> **IMPORTANT NOTICE**
> **This is an example of caution**

A caution statement describes a situation that could potentially damage your hardware, or other equipment. The information in a caution is provided for your protection. Please read each caution carefully.

Related Documents

Texas Instruments F28M35x Technical Reference Manual, literature #spruh22f.

teknoCEA PCO-10T800 Technical Reference

1 Introduction to CDA01-CU3

This chapter provides a description of the CDA01-CU3 control board based on F28M35H52C Concerto, key features, and block diagram of the circuit board.

1.1 Overview of the CDA01-CU3

The CDA01-CU3 is a stand-alone control card based on the Texas Instruments F28M35H52C Concerto micro-controller. The control board includes all the needed peripherals and circuits for a complete power electronics product or project that includes communications capabilities. Figure 1 shows a picture of the fully populated board. Furthermore, the control board has been designed as the control board of PCO-10T800, 10 kVA three phase poser converter from teknoCEA. It can control up 3 power converters simultaneously, allowing back-to-back converter topology, among others. Figure 2 shows such complete assembly. For more information about the assembly, see Chapter 2.4.

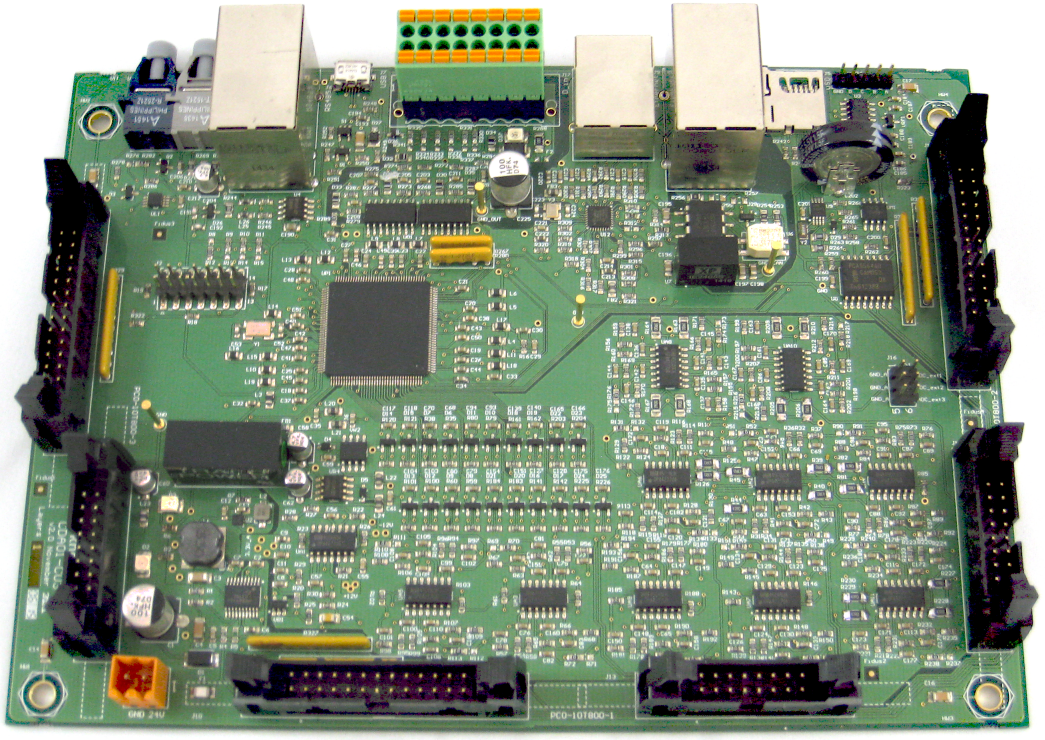

Figure 1: Picture of a fully populated CDA01-CU3.

The CDA01-CU3 is based on the F28M35H52C Concerto TI micro-controller. The CDA01-CU3 allows full speed implementation of F28M35H52C Concerto code. The platform also implements several circuits and connectors to use peripherals of Concerto.

On-board JTAG connector provides interface to emulators and C2000 Code Composer Studio™ programming and debugging tool from Texas Instruments. It can be downloaded from TI web page.

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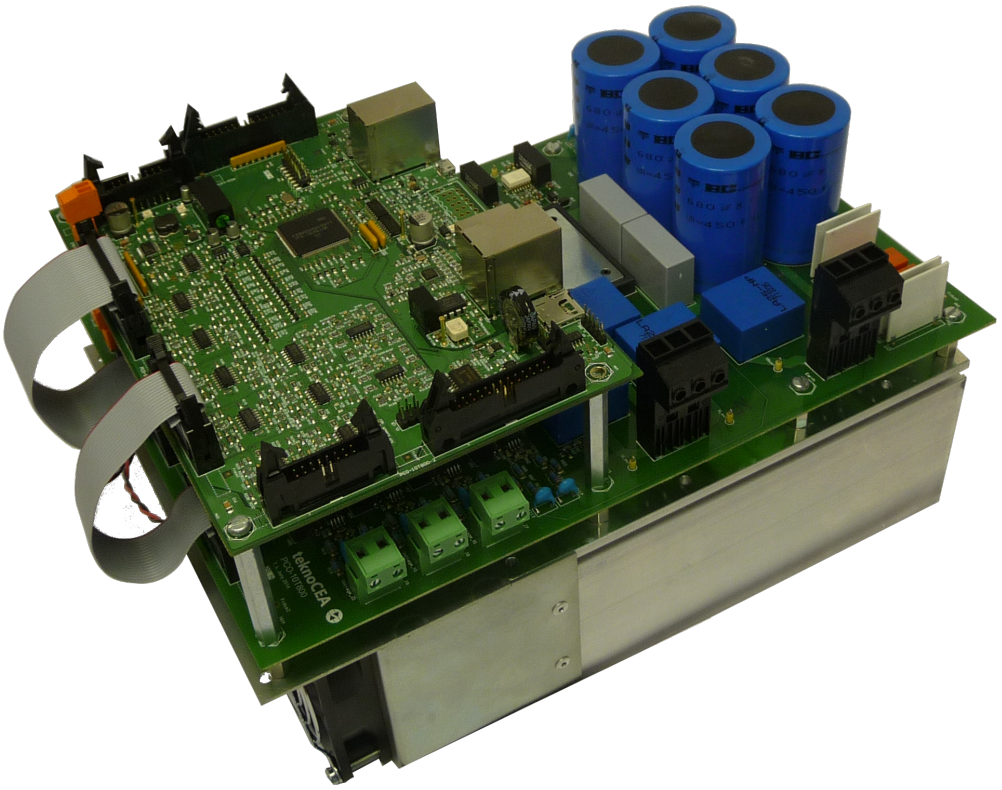

Figure 2: CDA01-CU3 and PCO-10T800 assembly.

1.2 Key features of the CDA01-CU3

1.2.1 Hardware features

The CDA01-CU3 has the following features:

- F28M35H52C Concerto
  - Master Subsystem – ARM Cortex – M3
    - Up to 100 MHz
    - 512 kB of Flash (ECC)
    - 64 kB of RAM (ECC or Parity)
    - 64 kB of Shared RAM
    - 2 kB of IPC Message RAM
  - Control Subsystem TMS320C28x 32-Bit CPU
    - Up to 150 Mhz
    - C28x Core Hardware Build-in Self-Test

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Embedded Memory

- 512 kB of Flash (ECC)
- 20 kB of RAM (ECC)
- 64 kB of Shared RAM
- 2 kB of IPC Message RAM

  - 20 MHz input clock

- 12 bit Analog to Digital converter (ADC) with 20 input channels
  - 9 inputs in J10 flat connector
  - 7 inputs in J11 flat connector
  - 1 input in J15 flat connector
  - 3 inputs in J16 pin strip connector
- 18 digital outputs
  - 8 outputs in J10 flat connector
  - 8 outputs in J11 flat connector
  - 2 outputs shared in J10, J11 and J12 flat connector
- 14 PWM signals
  - 6 outputs in J10 flat connector
  - 6 outputs in J11 flat connector
  - 2 outputs in J12 flat connector
- Transmitter and receiver fiber optic connectors for PWM synchronization
- On board isolated CAN 2.0 interface with line driver and duplicated RJ45 connector for daisy chain
- On board RS-485 with line driver and duplicated RJ45 connector for daisy chain
- On board Ethernet connector 10/100 ENET 1588 MII with line driver
- On board Universal Serial Bus On-the-Go (USB-OTG) with driver line and micro USB connector
- On board microSD Push-Push Card Connector
- 6 inputs configurable isolated or non-isolated in Expansion Connector
- Multiple Digital Outputs in flat cable expansion connectors
- Digital to Analog converter (DAC) with 4 output channels in pin strip connector
- On board 256 kB external EEPROM memory with I2C interface
- On board Real Time Clock (RTC) with I2C interface
- On board IEEE 1149.1 JTAG emulation connector

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- Unique 24 VDC power supply input

1.2.2 Software and programming tools

- TI F28xx Code Composer Studio™ Integrated Development Environment, Version 6.0.0
- Texas Instruments User's Guide F28M35x Peripheral Driver Library with API functions and examples.
- Texas Instruments User's Guide F28M35x Firmware Development Package
- Texas Instruments User's Guides F28M35x USB Library
- Texas Instruments Control Suite library
- teknoCEA JTAG-USB isolated emulator

1.3 Functional overview of the CDA01-CU3

Figure 3 shows a block diagram of the basic configuration for the CDA01-CU3. This figure shows the micro-controller and all the peripheral devices connected to it.

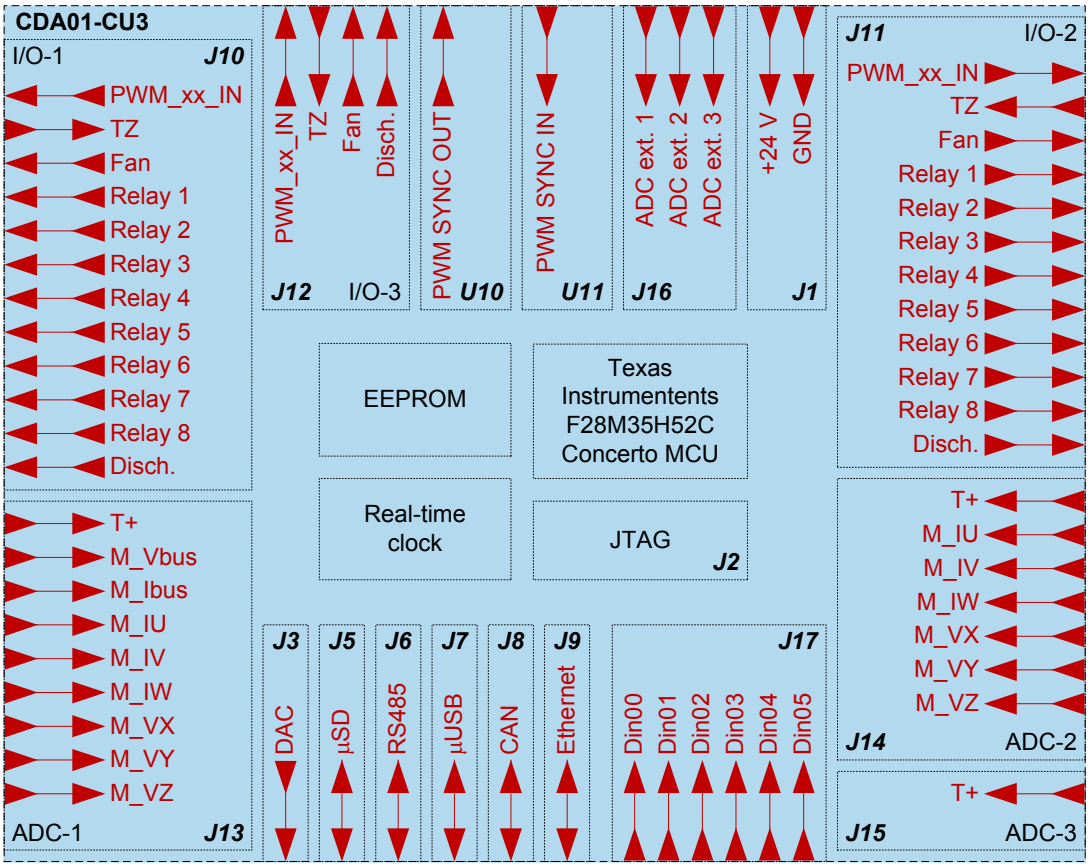

Figure 3: CDA01-CU3 block diagram.

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2 Operation of the CDA01-CU3

2.1 General description

The CDA01-CU3 is a 140 mm x 190 mm, 4 layered printed circuit board, powered by a unique external 24 VDC power supply. Figure 4 shows the layout of the top side of CDA01-CU3.

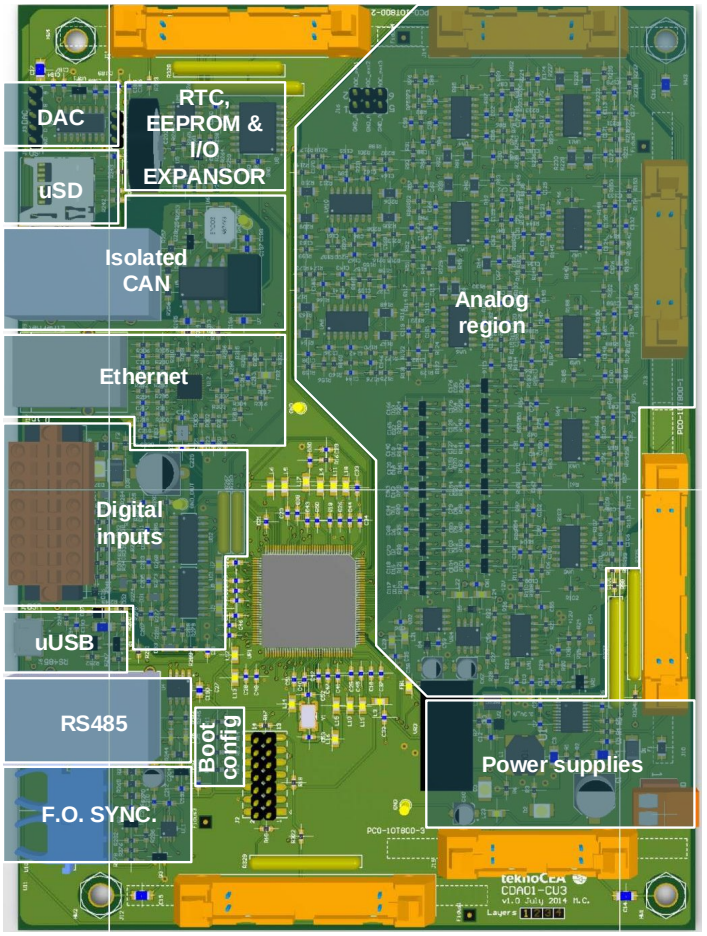

Figure 4: CDA01-CU3 block diagram.

2.1.1 Parts of the system

1. Boot sequence

   Boot sequence is used to configure the Master Subsystem and the Control Subsystem for execution of application code.

   Figure 5 shows the configuration resistors matrix and Table 1 describes the main configurations. More options can be found in Texas Instruments F28M35x Technical Reference Manual.

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Boot Mode	GPIO34	GPIO35	GPIO47	GPIO43
Boot from Parallel GPIO	0 R12	0 R13	0 R14	0 R15
Boot to Master Subsystem RAM	0 R12	0 R13	0 R14	1 R11
Boot to Serial Peripherals	0 R12	0 R13	1 R10	0 R15
Boot from Master Subsystem CAN interface	0 R12	1 R9	1 R10	1 R11
Boot from Master Subsystem Ethernet interface	1 R8	1 R9	0 R14	0 R15
Boot to Master Subsystem Flash memory	1 R8	1 R9	1 R10	1 R11

Table 1: Boot configurations.

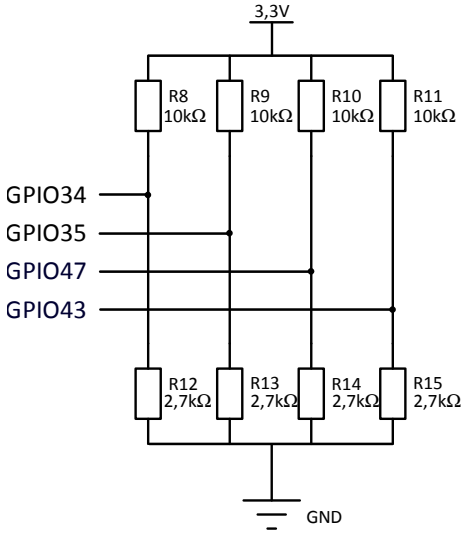

Figure 5: Boot configuration resistors.

IMPORTANT NOTICE
Only one of two resistor, 3,3 V 10 kΩ or GND 2,7 kΩ of each GPIO must be soldered.

2. Power supplies

The CDA1-CU3 must be powered by a unique external 24 V - 3 A power supply. The additional needed voltages of ±12 V, 5 V, 3,3 V and 1,65 V are generated internally and all of them are referenced to the same ground (GND). 5 V and 3 V are generated by LM3100 and TPS62291 step down converters respectively from Texas Instruments. However, ±12 V are generated by TMR 3-2423 step down converter from Traco Power plus TPS79L12 and TPS79L12 from Taiwan Semiconductors. Finally, 1,65 V are generated by TS431 low voltage adjustable shunt reference from STMicroelectronics plus a OPA4277 operational amplifier from TI as buffer and filter.

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Two LEDs (D2 for 5 V and D3 for 3,3 V) indicate the state of these power supplies. Furthermore, LED D37 for 24 V indicates if digital inputs are non-isolated and are used the internals 24 V from the board. The total power consumption from the 24 V external power supply is about 10 W.

IMPORTANT NOTICE
10 W does not consider the consumption from digital inputs, which can be internally connected. Furthermore, neither it is not included the consumption from any of three possible PCO-10T800 that can be supplied from CDA01-CU3. For more information about PCO-10T800 supply see Chapter 2.4

3. ADC

Each ADC channel consists of 2 analog input stages. The input of the analog input stage consist of a pull down (in order not to saturate ADC input when no voltage is connected) resistor for voltage input signal or a shunt resistor for current input signal. A voltage follower is used to decouple.

The second stage is a second order filter with offset and gain. Changing the resistors and capacitors values, user can configure the input voltage range (10 V or 5 V), unipolar o bipolar ADC (±5 V or ±10 V) and if the sum stage is a second or a first order filter. Figure 6 shows the schematic of ADC channel and Table 2 and Table 3 how to configure all possible options.

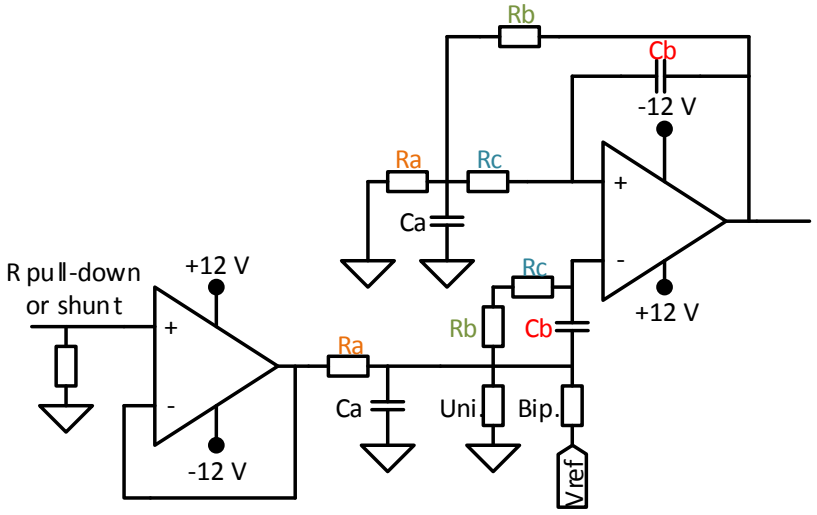

Figure 6: ADC's circuit.

Numbering of each ADC resistors and capacitors can be found in Table 2.

IMPORTANT NOTICE
Only one of the bipolar or unipolar resistors can be soldered!
Be aware of power shunt resistor dissipation. The default configuration is specified in Chapter 2.5.2.
Cut-off frequency is 5 kHz!

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ADC	Type	Polarity	Ra	Rb	Rc	Ca	Cb
ADC1.A0	Current → Shunt R44 R45	Unip. Bip. R51 R52	R37 R47	R32 R48	R36 R46	C69 C74	C66 C73
ADC1.A2	Current → Shunt R39 R40	Unip. Bip. R49 R50	R33 R42	R31 R43	R34 R41	C67 C72	C63 C71
ADC1.A3	Voltage → Pull-down R64	Unip. Bip. R71 R72	R57 R66	R54 R68	R58 R65	C78 C83	C76 C82
ADC1.A4	Voltage → Pull-down R61	Unip. Bip. R69 R70	R56 R63	R53 R67	R55 R62	C77 C84	C75 C81
ADC1.A6	Voltage → Pull-down R85	Unip. Bip. R92 R93	R77 R87	R74 R89	R78 R86	C90 C97	C88 C96
ADC1.A7	Current → Shunt R81 R82	Unip. Bip. R90 R91	R76 R84	R73 R88	R75 R83	C89 C98	C87 C95
ADC1.B0	Voltage → Pull-down R103	Unip. Bip. R112 R113	R98 R107	R95 R109	R99 R105	C101 C107	C100 C106
ADC1.B3	Voltage → Pull-down R102	Unip. Bip. R110 R111	R97 R106	R94 R108	R96 R104	C102 C108	C99 C105
ADC1.B4	Current → Shunt R125 R126	Unip. Bip. R133 R134	R118 R128	R115 R130	R119 R127	C116 C121	C114 C120
ADC1.B7	Voltage → Pull-down R122	Unip. Bip. R131 R132	R117 R124	R114 R129	R116 R123	C115 C122	C111 C119
ADC2.A0	Voltage → Pull-down R146	Unip. Bip. R153 R154	R139 R148	R136 R150	R140 R147	C126 C133	C124 C132
ADC2.A2	Voltage → Pull-down R143	Unip. Bip. R151 R152	R138 R145	R135 R149	R137 R144	C125 C134	C123 C131
ADC2.A3	Current → Shunt R167 R168	Unip. Bip. R175 R176	R159 R170	R156 R172	R160 R169	C138 C146	C136 C144
ADC2.A4	Current → Shunt R163 R164	Unip. Bip. R173 R174	R158 R166	R155 R171	R157 R165	C137 C145	C135 C143
ADC2.A6	Voltage → Pull-down R185	Unip. Bip. R193 R194	R180 R187	R177 R191	R179 R186	C149 C156	C147 C155
ADC2.A7	Voltage → Pull-down R188	Unip. Bip. R195 R196	R181 R190	R178 R192	R182 R189	C150 C158	C148 C157
ADC2.B0	Current → Shunt R205 R206	Unip. Bip. R215 R216	R199 R208	R197 R213	R200 R207	C163 C168	C161 C167
ADC2.B3	Current → Shunt R209 R210	Unip. Bip. R217 R218	R202 R212	R198 R214	R201 R211	C164 C170	C162 C169
ADC2.B4	Current → Shunt R227 R228	Unip. Bip. R237 R238	R221 R232	R219 R235	R222 R231	C173 C179	C171 C177
ADC2.B7	Current → Shunt R229 R230	Unip. Bip. R239 R240	R224 R234	R220 R236	R223 R233	C174 C180	C172 C178

Table 2: ADC's location on CDA01-CU3.

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Range	Order	Ra [$k\Omega$]	Rb [$k\Omega$]	Rc [$k\Omega$]	Ca [nF]	Cb [nF]
0V/+5V Unipolar	1st	3,3	2,2	0	NC	10
	2nd	33	22	13	3,3	1
0V/+10V Unipolar	1st	10	3,3	0	NC	10
	2nd	100	33	10	3,3	1
-5V/+10V Bipolar	1st	10	3,3	0	NC	10
	2nd	100	33	10	3,3	1
-10V/+10V Bipolar	1st	20	3,3	0	NC	10
	2nd	200	33	10	3,3	1

Table 3: ADC's configurations.

4. DAC and μSD

   DAC is implemented by TLV5614 that is a quadruple 12-bit voltage output digital-to-analog converter from Texas Instruments. There are 4 channels with 0 V – 4,095 V range. Both, DAC and µSD are programmed by SSI1 of Cortex M3. Jumper J4 is used to select DAC or μSD, by powering the selected device only. Only one of them can be active. Figure 7 shows this jumper.

uSD active DAC active

Figure 7: DAC/μSD J4 jumper.

5. Expansor I/O, RTC & EEPROM

   The three modules are communicated with the micro-controller by I2C serial communication bus (I2C0 of Cortex M3) up to 400 kHz clock. Expansor I/O is implemented by PCA9554, which provide 8 bit general purpose, from NXP and its address is 0111000.

   Real Time Clock is implemented by ISL1208 RTC from Intersil with an external 32,768 kHz quartz oscillator. Its address is 1101111. The back-up battery is a 1,5 F capacitor. EEPROM is implemented by 24AA256UID of 256 kbits from Microchip and its address is 1010001. These addresses are fixed by hardware.

6. Isolated CAN

   Isolated CAN is available on board. ISO1050 CAN transceiver from Texas Instruments and IE2405S DC/DC converter from XP Power are used. Furthermore, there is an end of line resistor of 120 Ω (R253) that has to be soldered or not depending on the position of the device on the communication bus. Moreover, there are two RJ45 connectors for the same isolated channel. It makes possible chaining many devices on the bus CAN communication.

   IMPORTANT NOTICE
   Close to each connector is a 0 Ω resistor to choose if 8th pin of the RJ45 CAN connectors has to be connect to 5 VCAN. For more information, see Chapter 2.3.7.

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7. Ethernet

   Ethernet on board is available. LAN8710A Ethernet transceiver from Microchip is used. Hardware design allows 10BASE-T/100BASE-TX of IEEE 802.3 support with speed up to 100 Mbps.

8. Digital inputs

   This module consists of 6 isolated digital inputs. The isolation is provided by ACPL-247 optoisolator from Avago allowing different configurations. Regarding power supply of the digital inputs, two configurations are possible. As shown in Figure 8, to energize this isolated inputs, the internal 24 V power supply, or an external 24 V ext power supply can be used. D36 and R289 must be removed when isolation is needed and a 24 V ext power supply must be used.

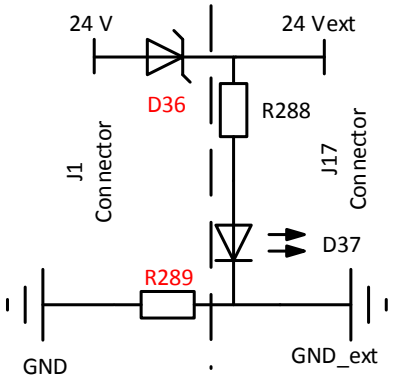

Figure 8: Digital inputs power supply configuration.

0 Ω resistors are used to allow free contacts as digital inputs (in blue in Figure 9) powered by 24 V ext power supply, or energized inputs (in orange in Figure 9). A or B resistors must be selected properly depending on the input type.

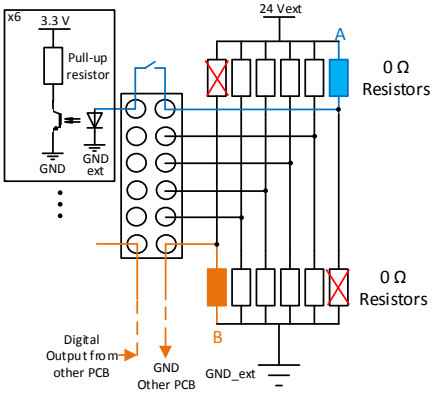

Figure 9: Digital inputs power supply configuration.

IMPORTANT NOTICE
Only one of two resistor, 24 V 0 Ω or GND_ext 0 Ω of each digital input must be soldered. Be aware that digital inputs have negative logic.

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9. μUSB

   USB On-The-Go (OTG) on board is available and that makes possible work as a host or a device.

10. RS485

    RS485 non-isolated on board is available. ST3485 transceiver from ST is used. Moreover, there are two RJ45 connectors for the same channel. It makes possible chaining many devices on the RS485 communication bus.

11. Fiber optic synchronization (F. O. SYNC.)

    PWM synchronization can be helpful when connecting several converters on the same DC bus, but also is a requirement when implementing multilevel or interleaved topologies. PWM synchronization needs one input signal SYNC IN and one output signal SYNC OUT. In this control board, and in order to avoid electromagnetic noise, fiber optic is used for this feature.

    Concerto can work in two different modes, sending the PWM synchronization signal or receiving the PWM synchronization signal from another device.

    Figure 10 shows how to select the two possible configurations:

    - Sending mode A: R276 is soldered and R282 is not soldered. In this mode, is the Concerto micro-controller who generates and outputs the PWM synchronization signal (SYNC OUT).
    - Receiving mode B: R276 is not soldered and R282 is soldered. In this mode, the control board has as an input a PWM synchronization signal (SYNC OUT) sent by other device. Furthermore, the signal is resend for other device to be synchronized and also working in this same mode.

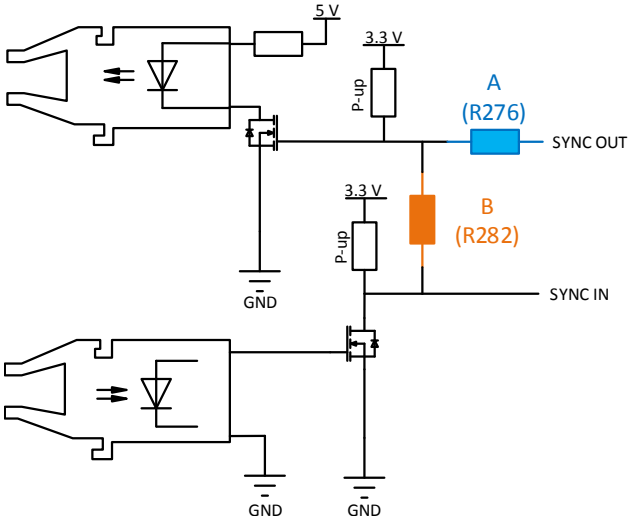

Figure 10: Fiber optic configuration.

IMPORTANT NOTICE
Only one of the A or B 0 Ω resistors can be soldered at the same time!

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Due to safety reasons, a flip-flop is used to latch the high input state as shown in Figure 11. A watch dog can be implemented by resetting this flip-flop by software. When resetting and a low level signal is obtained from the flip-flop, the synchronization signal is lost. Table 4 shows the logic table of such a feature.

RST	SYNCIN	OUT
L	L	L
H	H	H
L	H	H (unstable)
H	L	OUT_0

Table 4: Flip flop logic table.

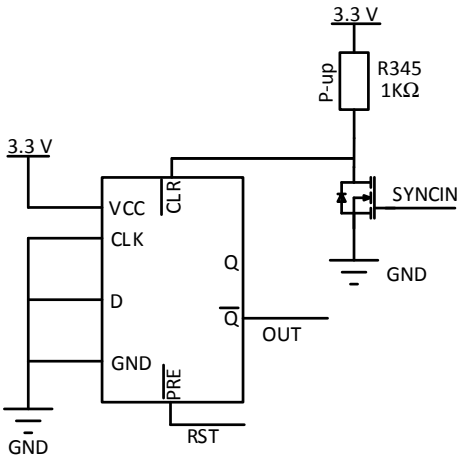

Figure 11: Flip-flop schematic diagram.

2.2 Memory Map

The CDA01-CU3 includes the following on-chip memory:

- Master Subsystem – ARM Cortex – M3
  - 512 kB of Flash (ECC)
  - 64 kB of RAM (ECC or Parity)
  - 64 kB of Shared RAM
  - 2 kB of IPC Message RAM
- C28x Core memory
  - 512 kB of Flash (ECC)
  - 20 kB of RAM (ECC)
  - 64 kB of Shared RAM
  - 2 kB of IPC Message RAM

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In addition 4 kB x 64 off-concerto EEPROM is provided on board. The external memory is programmed by I2C bus communication.

Please, refer to F28M35x literature for further information on memory map.

2.3 CDA01-CU3 connectors

The CDA01-CU3 has eighteen connectors that are shown in Figure 12. The function of each connector is shown in the Table 5.

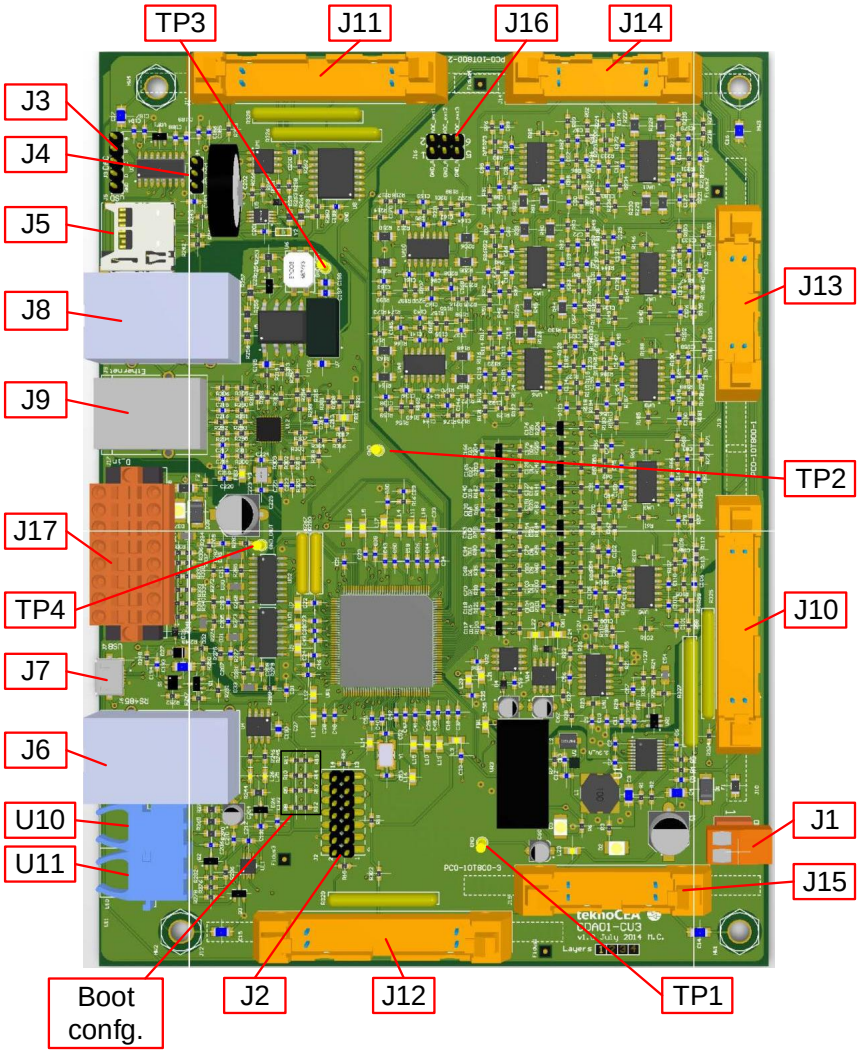

Figure 12: CDA01-CU3 connectors.

2.3.1 J1 connector, 24 V power supply

The J1 connector has a 2x1 pin arrangement and is used to supply the system. The J1 connector is from Weidmuller, reference manufacturer SL 3.5/2/180G. The female connector that matches the J1 is also

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Connector	Function
J1	24 V power supply
J2	JTAG interface
J3	DAC outputs
J5	micro-SD
J6	RS485
J7	micro-USB-OTG
J8	CAN
J9	Ethernet
J10, J11, J12	I/O interface
J13, J14, J15, J16	ADC inputs
J17	Digital inputs
U10	PWM SYNC OUT fiber optic
U11	PWM SYNC IN fiber optic

Table 5: Function of connectors.

from Weidmuller, reference BL 3.5/2. Pin arrangement and function of connector J1 is summarized in Table 6.

Pin	Pin name	Function	Description
1	+24 V	Power	Power supply +24 V_{DC}
2	GND	Power	Ground for power supply

Table 6: J1 connector, 24 V power supply, pin function and arrangement.

2.3.2 J2 connector, JTAG interface

The CDA01-CU3 is supplied with a 7x2 pin arrangement header interface, J2. This is the standard interface used by JTAG emulators to interface to Texas Instruments DSPs.

The position of the 14 pins on the J2 connector are shown in Figure 13 as viewed from the top of the CDA01-CU3.

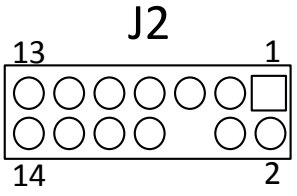

Figure 13: J2 connector JTAG interface.

The definition of J2, which has the JTAG signals, is shown in Table 7.

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Pin	Pin name	Pin	Pin name
1	TMS	2	TRST
3	TDI	4	GND
5	TPD (3,3 V)	6	No pin
7	TDO	8	GND
9	TCK	10	GND
11	TCK	12	GND
13	EMU0	14	EMU1

Table 7: J2 connector, JTAG interface, pin function and arrangement.

IMPORTANT NOTICE
The F28M35H52C Concerto supports 3,3 V Input/Output levels which are NOT 5 V tolerant. Connecting the CDA01-CU3 to a system with 5 V Input/Output levels will damage the F28M35H52C.

2.3.3 J3 connector, DAC

The J3 connector has a 5x1 pin arrangement. In this connector DAC output channels, when this module is programmed, are available. The J3 is a single row pin-strip connector from Multicomp, reference manufacturer 2211S-03G.

The position of the 5 pins on the J3 connector are shown in Figure 14 as viewed from the top of the CDA01-CU3.

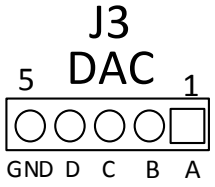

Figure 14: J3 connector DAC.

The definition of J3, which has the DAC signals, is shown in Table 8.

Pin	Pin name	Function	Description
1	DAC A	Analog Output	DAC A channel
2	DAC B	Analog Output	DAC B channel
3	DAC C	Analog Output	DAC C channel
4	DAC D	Analog Output	DAC D channel
5	GND	Power	Ground

Table 8: J3 connector, DAC, pin function and arrangement.

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2.3.4 J5 connector, micro-SD

The J5 is a standard polarization, push-push, surface mount, micro-SD connector. The J5 connector is from 3M, reference manufacture 2908-05WB-MG. The definition of J5 is shown in Table 9.

Pin	Pin name	Function	Description
1	NC	-	Not connected
2	FSS	Communication	Serial Frame
3	TX	Communication	Write
4	3,3 V μSD	Power	Power for μSD
5	CLK	Communication	Clock for communication
6,8	GND	Power	Ground
9,10,11,12	EARTH	Case	EARTH

Table 9: J5 connector, micro-SD, pin function and arrangement.

2.3.5 J6 connector, RS485

This J6 connector is a double port standard RJ45. The J6 connector is from FCI, reference manufacture 10118069-500A010LF. The definition of J6 is shown in Table 10.

Pin	Pin name	Function	Description
U1,U2,U6,U7,U8,L1,L2,L6,L7,L8	NC	-	Not connected
U3,L3	Data B	Communication	Data B
U4,L4	Data A	Communication	Data A
U5,L5	GND	Power	Ground
9	EARTH	Case	EARTH

Table 10: J6 connector, RS485, pin function and arrangement.

2.3.6 J7 connector, micro-USB-OTG

J7 is a micro USB receptacle type AB connector from Tyco Electronics, reference manufacture 1981584-1. The definition of J5 is shown in Table 11.

Pin	Pin name	Function	Description
1	VBUS	Power	5 V supply or supplied
2	D_N	Communication	Negative communication
3	D_P	Communication	Positive communication
4	PFLT	Communication	PFLT
5	GND	Power	Ground
6,7,8,9	EARTH	Case	EARTH

Table 11: J7 connector pin function and arrangement.

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2.3.7 J8 connector, CAN

This J8 connector is a double port standard RJ45. The J8 connector is from FCI, reference manufacture 10118069-500A010LF.

The definition of J8 is shown in Table 12.

Pin	Pin name	Function	Description
U1,L1	CAN H	Communication	CAN High
U2,L2	CAN L	Communication	CAN Low
U3,L3,U6*,L6*,U7,L7	GND	Power	Ground
U8*,L8*	5 V_CAN	Power	Earth
9	EARTH	Case	Earth

Table 12: J8 connector, CAN, pin function and arrangement.

*This pins can be disable by desoldering the 0 Ω resistors that are close to pins. Look schematics to check for the components.

2.3.8 J9 connector, Ethernet

This J9 connector is a 100 Base-TX (Fast Ethernet) RJ45 1x1 Tab-DOWN with LEDs 8-pin (J0 series) integrated magnetics connector (ICM). The J9 connector is from Pulse Electronics, reference manufacture J0011D01BNL.

The definition of J9 is shown Table13.

Pin	Pin name	Function	Description
1	TX_P	Communication	Transmit positive
2	TX_N	Communication	Transmit negative
3	RX_P	Communication	Receive positive
4	TXCT	Communication	Transmit
5	RXCT	Communication	Receive
6	RX_N	Communication	Receive positive
7	NC	-	Not connected
8,13,14	EARTH	Case	Earth
9	A_GREEN	Signalling	Anode green led
10	C_GREEN	Signalling	Cathode green led
11	C_YELLOW	Signalling	Cathode yellow led
12	A_YELLOW	Signalling	Anode yellow led

Table 13: J9 connector, Ethernet, pin function and arrangement.

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2.3.9 J10 connector, digital I/O interface

The J10 connector has a 13x2 pin arrangement. The J10 connector is from Amphenol, reference manufacturer T816126A1R101CEU. The female connector that matches the J10 is also from Amphenol, reference T812126A101CEU.

Pin arrangement and function of connector J10 is summarized in Table 14.

Pin	Pin name	Function	Description
1	GND*	Power	Ground for power supply
2	+24V*	Power	Power supply +24 VDC
3	GND*	Power	Ground for power supply
4	+24V*	Power	Power supply +24 VDC
5	PWM_3A	Digital I/O	PA4_GPIO4
6	PWM_3B	Digital I/O	PA5_GPIO5
7	PWM_2A	Digital I/O	PA2_GPIO2
8	PWM_2B	Digital I/O	PA3_GPIO3
9	PWM_1A	Digital I/O	PA0_GPIO0
10	PWM_1B	Digital I/O	PA1_GPIO1
11	TZ.VSC1	Digital I/O	PE6_GPIO30
12	D_out.VSC1.Fan	Digital I/O	GPIO131_COMP2OUT
13	D_out.VSC1.Rel1	Digital I/O	PH2_GPIO50
14	D_out.VSC1.Rel2	Digital I/O	PH5_GPIO53
15	D_out.VSC1.Rel3	Digital I/O	PJ5_GPIO61
16	D_out.VSC1.Rel4	Digital I/O	PJ6_GPIO62
17	D_out.VSC1.Rel5	Digital I/O	PC4_GPIO68
18	Expansor.VSC1.Rel6	Digital I/O	I/O PO0 from I2C expansor
19	Expansor.VSC1.Rel7	Digital I/O	I/O PO1 from I2C expansor
20	Expansor.VSC1.Rel8	Digital I/O	I/O PO2 from I2C expansor
21	D_out.VSC1.Disch	Digital I/O	PC7_GPIO71
22	-	-	Not connected
23	-	-	Not connected
24	-	-	Not connected
25	-	-	Not connected
26	-	-	Not connected

Table 14: J10 connector, digital I/O interface, pin function and arrangement.

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2.3.10 J11 connector, digital I/O interface

The J11 connector has a 13x2 pin arrangement. The J11 connector is from Amphenol, reference manufacturer T816126A1R101CEU. The female connector that matches the J11 is also from Amphenol, reference T812126A101CEU.

Pin arrangement and function of connector J11 is summarized in Table 15.

Pin	Pin name	Function	Description
1	GND*	Power	Ground for power supply
2	+24V*	Power	Power supply +24 VDC
3	GND*	Power	Ground for power supply
4	+24V*	Power	Power supply +24 VDC
5	PWM_6A	Digital I/O	PB2_GPIO10
6	PWM_6B	Digital I/O	PB3_GPIO11
7	PWM_5A	Digital I/O	PB0_GPIO8
8	PWM_5B	Digital I/O	PB0_GPIO9
9	PWM_4A	Digital I/O	PA6_GPIO6
10	PWM_4B	Digital I/O	PA7_GPIO7
11	TZ.VSC2	Digital I/O	PE7_GPIO31
12	D_out.VSC1.Fan	Digital I/O	GPIO131_COMP2OUT
13	D_out.VSC2.Rel1	Digital I/O	PC5_GPIO69
14	D_out.VSC2.Rel2	Digital I/O	PC6_GPIO70
15	D_out.VSC2.Rel3	Digital I/O	GPIO128
16	D_out.VSC2.Rel4	Digital I/O	GPIO129_COMP1OUT
17	D_out.VSC2.Rel5	Digital I/O	GPIO130_COMP6OUT
18	Expansor.VSC2.Rel6	Digital I/O	I/O PO3 from I2C expansor
19	Expansor.VSC2.Rel7	Digital I/O	I/O PO4 from I2C expansor
20	Expansor.VSC2.Rel8	Digital I/O	I/O PO5 from I2C expansor
21	D_out.VSC1.Disch	Digital I/O	PC7_GPIO71
22	-	-	Not connected
23	-	-	Not connected
24	-	-	Not connected
25	-	-	Not connected
26	-	-	Not connected

Table 15: J11 connector, digital I/O interface, pin function and arrangement.

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2.3.11 J12 connector, digital I/O interface

The J12 connector has a 13x2 pin arrangement. The J12 connector is from Amphenol, reference manufacturer T816126A1R101CEU. The female connector that matches the J12 is also from Amphenol, reference T812126A101CEU.

Pin arrangement and function of connector J12 is summarized in Table 16.

Pin	Pin name	Function	Description
1	GND*	Power	Ground for power supply
2	+24V*	Power	Power supply +24 VDC
3	GND*	Power	Ground for power supply
4	+24V*	Power	Power supply +24 VDC
5	PWM_7A	Digital I/O	PJ2_GPIO58
6	PWM_7B	Digital I/O	PJ3_GPIO59
7	PWM_7A	Digital I/O	PJ2_GPIO58
8	PWM_7B	Digital I/O	PJ3_GPIO59
9	PWM_7A	Digital I/O	PJ2_GPIO58
10	PWM_7B	Digital I/O	PJ3_GPIO59
11	TZ.VSC3	Digital I/O	PJ4_GPIO60
12	D_out.VSC1.Fan	Digital I/O	GPIO131_COMP2OUT
13	-	-	Not connected
14	-	-	Not connected
15	-	-	Not connected
16	-	-	Not connected
17	-	-	Not connected
18	-	-	Not connected
19	-	-	Not connected
20	-	-	Not connected
21	D_out.VSC1.Disch	Digital I/O	PC7_GPIO71
22	-	-	Not connected
23	-	-	Not connected
24	-	-	Not connected
25	-	-	Not connected
26	-	-	Not connected

Table 16: J12 connector, digital I/O interface, pin function and arrangement.

2.3.12 J13 connector, ADC measurements

The J13 connector has an 8x2 pin arrangement. It is used for voltage and current sensing signals. The J13 connector is from Multicomp, reference manufacturer MC9B132-1634. The female connector that matches the J13 is also from Multicomp, reference MC6FD016-30P1.

Pin arrangement and function of connector J13 is summarized in Table 17.

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Pin	Pin name	Function	Description (ADC channel)
1	M_VSC1.T+	Analog input	ADC1.B3
2	M_VSC1.VZ	Analog input	ADC1.B0
3	GND	Power	Ground
4	M_VSC1.VY	Analog input	ADC1.A4
5	GND	Power	Ground
6	M_VSC1.VX	Analog input	ADC1.A3
7	GND	Power	Ground
8	M_VSC1.Vbus	Analog input	ADC1.B7
9	GND	Power	Ground
10	M_VSC1.IW	Analog input	ADC1.B4
11	GND	Power	Ground
12	M_VSC1.IV	Analog input	ADC1.A0
13	GND	Power	Ground
14	M_VSC1.IU	Analog input	ADC1.A2
15	GND	Power	Ground
16	M_VSC1.Ibus	Analog input	ADC1.A7

Table 17: J13 connector, ADC measurements, pin function and arrangement.

2.3.13 J14 connector, ADC measurements

The J14 connector has an 8x2 pin arrangement. It is used for voltage and current sensing signals. The J14 connector is from Multicomp, reference manufacturer MC9B132-1634. The female connector that matches the J14 is also from Multicomp, reference MC6FD016-30P1.

Pin arrangement and function of connector J14 is summarized in Table 18.

Pin	Pin name	Function	Description (ADC channel)
1	M_VSC2.T+	Analog input	ADC2.A6
2	M_VSC2.VZ	Analog input	ADC2.A7
3	GND	Power	Ground
4	M_VSC2.VY	Analog input	ADC2.A2
5	GND	Power	Ground
6	M_VSC2.VX	Analog input	ADC2.A0
7	GND	Power	Ground
8	-	-	Not connected
9	GND	Power	Ground
10	M_VSC2.IW	Analog input	ADC2.B7
11	GND	Power	Ground
12	M_VSC2.IV	Analog input	ADC2.B4
13	GND	Power	Ground
14	M_VSC2.IU	Analog input	ADC2.B0
15	GND	Power	Ground
16	-	-	Not connected

Table 18: J14 connector, ADC measurements, pin function and arrangement.

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2.3.14 J15 connector, ADC measurements

The J15 connector has an 8x2 pin arrangement. It is used for voltage and current sensing signals. The J15 connector is from Multicomp, reference manufacturer MC9B132-1634. The female connector that matches the J15 is also from Multicomp, reference MC6FD016-30P1.

Pin arrangement and function of connector J15 is summarized in Table 19.

Pin	Pin name	Function	Description (ADC channel)
1	M_VSC3.T+	Analog input	ADC1.A6
2	-	-	Not connected
3	GND	Power	Ground
4	-	-	Not connected
5	GND	Power	Ground
6	-	-	Not connected
7	GND	Power	Ground
8	-	-	Not connected
9	GND	Power	Ground
10	-	-	Not connected
11	GND	Power	Ground
12	-	-	Not connected
13	GND	Power	Ground
14	-	-	Not connected
15	GND	Power	Ground
16	-	-	Not connected

Table 19: J15 connector, ADC measurements, pin function and arrangement.

2.3.15 J16 connector, ADC measurements

The J16 connector has a 3x2 pin arrangement. In this connector three ADC channels, when this module is programmed, are available. The J16 is a double row straight 6 way connector from Multicomp, reference manufacturer 2213S-06G. This connector is suitable for measuring with oscilloscope or passing ADC signals to other PCB with a pins-strip socket.

The position of the 6 pins on the J16 connector is shown in Figure 15. J16 external ADCs connector as vied from the top of the CDA01-CU3.

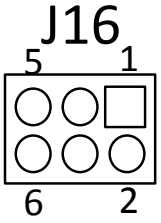

Figure 15: J16 connector external ADCs connector.

The definition of J16, which has the ADC signals, is shown in Table 20.

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Pin	Pin name	Function	Description (ADC channel)
1	GND	Analog output	Ground
2	ADC_ext.1	Analog output	ADC2.B3
3	GND	Analog output	Ground
4	ADC_ext.2	Analog output	ADC2.A4
5	GND	Analog output	Ground
6	ADC_ext.3	Analog output	ADC2.A3

Table 20: J16 connector, external ADCs, pin function and arrangement.

2.3.16 J17 connector isolated digital inputs

The J17 connector has 8x2 pin arrangement. In this connector 6 digital inputs and extern 24V power supply, if is desired, are available. The J17 is from Phoenix Contact, reference manufacturer DMCV 1,5/8-G1-3,5 P20THR. The female connector that matches the J17 is also from Phoenix Contact, reference DFMC 1,5/8-ST-3,5. This female connector is suitable to wire up the wires independently to be able the most versatile applications. Pin arrangement and function of connector J17 is summarized in Table 21.

Pin	Pin name	Function	Description
1	Din00	Digital input	Ground for power supply
2	+24V or 0 V*	Power	Power supply +24 V or 0V
3	Din01	Digital Input	Ground for power supply
4	+24V or 0 V*	Power	Power supply +24 V or 0V
5	Din02	Digital Input	PJ2_GPIO58
6	+24V or 0 V*	Power	Power supply +24 V or 0V
7	Din03	Digital Input	PJ2_GPIO58
8	+24V or 0 V*	Power	Power supply +24 V or 0V
9	Din04	Digital Input	PJ2_GPIO58
10	+24V or 0 V*	Power	Power supply +24 V or 0V
11	Din05	Digital Input	PJ4_GPIO60
12	+24V or 0 V*	Power	Power supply +24 V or 0V
13	-	-	Not connected
14	GND_out*	Power	Ground isolated or not
15	-	-	Not connected
16	24V_ext*	Power	24 V externals supply

Table 21: J17 connector, digital inputs, pin function and arrangement.

IMPORTANT NOTICE
If digital Input module is not isolated, do not supply by pins 16 (24V_ext) and 14 (GND_out).

2.3.17 U10 connector PWM SYNC OUT fiber optic

The U10 connector is optic fiber emitter from Avago, reference manufacturer HFBR-1521Z. The connector that matches the U10 is also from Avago, reference HFBR-4503Z.

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2.3.18 U11 connector PWM SYNC IN fiber optic

The U10 connector is optic fiber receiver from Avago, reference manufacturer HFBR-2521Z. The connector that matches the U10 is also from Avago, reference HFBR-4503Z.

2.4 Assembly CDA01-CU3 and PCO-10T800

CDA01-CU3 has been designed as the control board of PCO-10T800. It is possible control three PCO-10T800 with one CDA01-CU3.

The PCO-10T800 can be powered through the connector J1 or through the pins 1 to 4 of the J5 connector. If the PCO-10T800 is used in combination with the control board CDA01-CU3 it is recommendable to do the power supply through the J10, 11 or J12 connector directly from the control board.

IMPORTANT NOTICE
Be aware that connectors for 2nd and 3rd PCO-10T800 have no available all of digital signals or analogic measurements. Please, refer to Tables 22,23,24,25,?? and ??.

Both boards are mechanical assembled by 4 metal spacers (50 mm length recommended) where CDA01-CU3 is above the PCO-10T800, as can be seen in Figure 16.

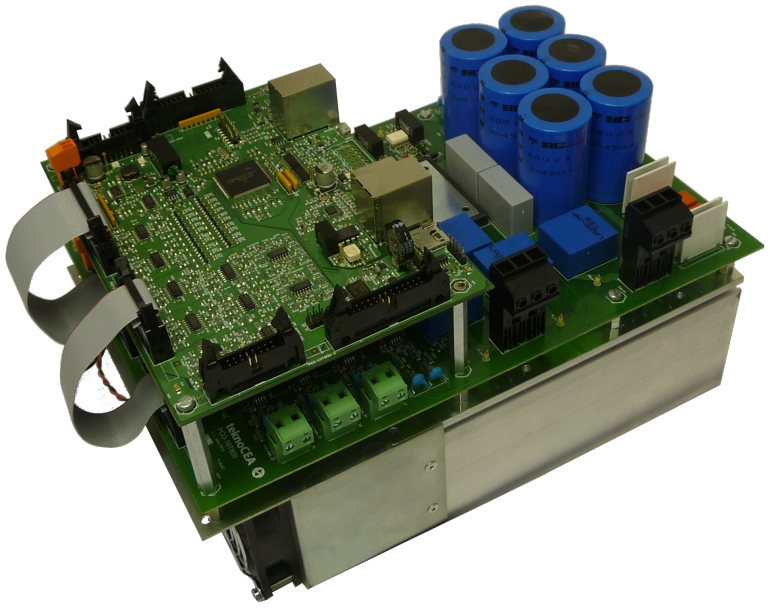

Figure 16: PCO-10T800 and CDA01-CU3 assembly.

Both boards are connected by 2 flat cables. A 26 wires flat cable for digital signals is connected between J10, J11 or J12 of CDA01-CU3 and J5 of PCO-10T800. And a 16 wires flat cable for analog measurements is connected between J13, J14 or J15 of CDA01-CU3 and J6 of PCO-10T800.

Once the assembly is done, functionality of I/O interface and analogic measurement pins connectors is fixed. Tables 22,23,24,25,**??** and **??** show the function of each pin.

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Pin	Pin name	Function	Description	1st PCO-10T800 func.
1	GND*	Power	Ground for power supply	Ground for power supply
2	+24V*	Power	Power supply +24 VDC	Power supply +24 VDC
3	GND*	Power	Ground for power supply	Ground for power supply
4	+24V*	Power	Power supply +24 VDC	Power supply +24 VDC
5	PWM_3A	Digital I/O	PA4_GPIO4	PWM WH signal
6	PWM_3B	Digital I/O	PA5_GPIO5	PWM WL signal
7	PWM_2A	Digital I/O	PA2_GPIO2	PWM VH signal
8	PWM_2B	Digital I/O	PA3_GPIO3	PWM VL signal
9	PWM_1A	Digital I/O	PA0_GPIO0	PWM UH signal
10	PWM_1B	Digital I/O	PA4_GPIO4	PWM UL signal
11	TZ.VSC1	Digital I/O	PE6_GPIO30	Driver error. Active low
12	D_out.VSC1.Fan	Digital I/O	GPIO131_COMP2OUT	Fan control
13	D_out.VSC1.Rel1	Digital I/O	PH2_GPIO50	Relay 1 control
14	D_out.VSC1.Rel2	Digital I/O	PH5_GPIO53	Relay 2 control
15	D_out.VSC1.Rel3	Digital I/O	PJ5_GPIO61	Relay 3 control
16	D_out.VSC1.Rel4	Digital I/O	PJ6_GPIO62	Relay 4 control
17	D_out.VSC1.Rel5	Digital I/O	PC4_GPIO68	Relay 5 control
18	Expansor.VSC1.Rel6	Digital I/O	PO0 from I2C expansor	Relay 6 control
19	Expansor.VSC1.Rel7	Digital I/O	PO1 from I2C expansor	Relay 7 control
20	Expansor.VSC1.Rel8	Digital I/O	PO2 from I2C expansor	Relay 8 control
21	D_out.VSC1.Disch	Digital I/O	PC7_GPIO71	Discharge relay control
22-26	-	-	Not connected	Not connected

Table 22: J10 CDA01-CU3 connector for J5 1st PCO-10T800 connector.

2.5 Configuration by default of CDA01-CU3

2.5.1 Boot sequence

Boot from Flash is the CDA01-CU3 boot configuration by default. Figure 17 shows the soldered resistors.

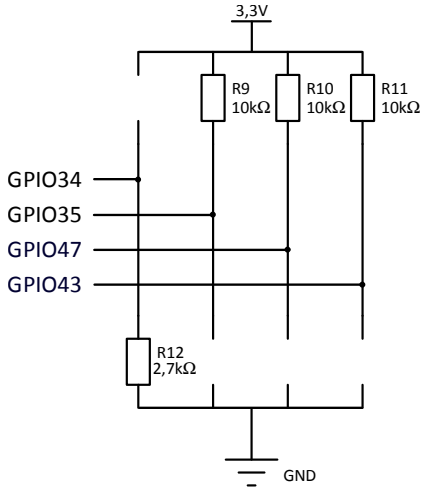

Figure 17: Boot configuration resistors by default.

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Pin	Pin name	Function	Description	2nd PCO-10T800 func.
1	GND*	Power	Ground for power supply	Ground for power supply
2	+24V*	Power	Power supply +24 VDC	Power supply +24 VDC
3	GND*	Power	Ground for power supply	Ground for power supply
4	+24V*	Power	Power supply +24 VDC	Power supply +24 VDC
5	PWM_6A	Digital I/O	PB2_GPIO10	PWM WH signal
6	PWM_6B	Digital I/O	PB3_GPIO11	PWM WL signal
7	PWM_5A	Digital I/O	PB0_GPIO8	PWM VH signal
8	PWM_5B	Digital I/O	PB1_GPIO9	PWM VL signal
9	PWM_4A	Digital I/O	PA6_GPIO6	PWM UH signal
10	PWM_4B	Digital I/O	PA7_GPIO7	PWM UL signal
11	TZ.VSC2	Digital I/O	PE7_GPIO31	Driver error. Active low
12	D_out.VSC1.Fan	Digital I/O	GPIO131_COMP2OUT	Fan control
13	D_out.VSC2.Rel1	Digital I/O	PC5_GPIO69	Relay 1 control
14	D_out.VSC2.Rel2	Digital I/O	PC6_GPIO70	Relay 2 control
15	D_out.VSC2.Rel3	Digital I/O	GPIO128	Relay 3 control
16	D_out.VSC2.Rel4	Digital I/O	GPIO129_COMP1OUT	Relay 4 control
17	D_out.VSC2.Rel5	Digital I/O	GPIO130_COMP6OUT	Relay 5 control
18	Expansor.VSC2.Rel6	Digital I/O	PO3 from I2C expansor	Relay 6 control
19	Expansor.VSC2.Rel7	Digital I/O	PO4 from I2C expansor	Relay 7 control
20	Expansor.VSC2.Rel8	Digital I/O	PO5 from I2C expansor	Relay 8 control
21	D_out.VSC1.Disch	Digital I/O	PC7_GPIO71	Discharge relay control
22-26	-	-	Not connected	Not connected

Table 23: J11 CDA01-CU3 connector for J5 2nd PCO-10T800 connector.

Pin	Pin name	Function	Description	3rd PCO-10T800 func.
1	GND*	Power	Ground for power supply	Ground for power supply
2	+24V*	Power	Power supply +24 VDC	Power supply +24 VDC
3	GND*	Power	Ground for power supply	Ground for power supply
4	+24V*	Power	Power supply +24 VDC	Power supply +24 VDC
5	PWM_7A	Digital I/O	PJ2_GPIO58	PWM WH signal
6	PWM_7B	Digital I/O	PJ3_GPIO59	PWM WL signal
7	PWM_7A	Digital I/O	PJ2_GPIO58	PWM VH signal
8	PWM_7B	Digital I/O	PJ3_GPIO59	PWM VL signal
9	PWM_7A	Digital I/O	PJ2_GPIO58	PWM UH signal
10	PWM_7B	Digital I/O	PJ3_GPIO59	PWM UL signal
11	TZ.VSC3	Digital I/O	PE7_GPIO31	Driver error. Active low
12	D_out.VSC1.Fan	Digital I/O	GPIO131_COMP2OUT	Fan control
13-20	-	-	Not connected	Not connected
21	D_out.VSC1.Disch	Digital I/O	PC7_GPIO71	Discharge relay control
22-26	-	-	Not connected	Not connected

Table 24: J12 CDA01-CU3 connector for J5 3rd PCO-10T800 connector.

2.5.2 ADC

Table 28 indicates configuration by default of ADCs. Unipolar or Bipolar, measurement range, and Pull-down resistor for voltage signals or Shunt resistors for current signals.

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Pin	Pin name	Function	Description (ADC channel)	1st PCO-10T800 func.
1	M_VSC1.T+	Analog input	ADC1.B3	Semicond. mod. temperature
2	M_VSC1.VZ	Analog input	ADC1.B0	Z1-Z2 voltage
3	GND	Power	Ground	Ground
4	M_VSC1.VY	Analog input	ADC1.A4	Y1-Y2 voltage
5	GND	Power	Ground	Ground
6	M_VSC1.VX	Analog input	ADC1.A3	X1-X2 voltage
7	GND	Power	Ground	Ground
8	M_VSC1.Vbus	Analog input	ADC1.B7	DC bus voltage
9	GND	Power	Ground	Ground
10	M_VSC1.IW	Analog input	ADC1.B4	W phase current
11	GND	Power	Ground	Ground
12	M_VSC1.IV	Analog input	ADC1.A0	V phase current
13	GND	Power	Ground	Ground
14	M_VSC1.IU	Analog input	ADC1.A2	U phase current
15	GND	Power	Ground	Not connected
16	M_VSC1.Ibus	Analog input	ADC1.A7	DC bus current

Table 25: J13 CDA01-CU3 connector for J6 1st PCO-10T800 connector.

Pin	Pin name	Function	Description (ADC channel)	2nd PCO-10T800 func.
1	M_VSC2.T+	Analog input	ADC2.A6	Semicond. mod. temperature
2	M_VSC2.VZ	Analog input	ADC2.A7	Z1-Z2 voltage
3	GND	Power	Ground	Ground
4	M_VSC2.VY	Analog input	ADC2.A2	Y1-Y2 voltage
5	GND	Power	Ground	Ground
6	M_VSC2.VX	Analog input	ADC2.A0	X1-X2 voltage
7	GND	Power	Ground	Ground
8	-	-	Not connected	Not connected
9	GND	Power	Ground	Ground
10	M_VSC2.IW	Analog input	ADC2.B7	W phase current
11	GND	Power	Ground	Ground
12	M_VSC2.IV	Analog input	ADC2.B4	V phase current
13	GND	Power	Ground	Ground
14	M_VSC2.IU	Analog input	ADC2.B0	U phase current
15	GND	Power	Ground	Not connected
16	-	-	Not connected	Not connected

Table 26: J14 CDA01-CU3 connector for J6 2nd PCO-10T800 connector.

2.5.3 CAN isolated

R255 and R257 0 Ω resistors that connect 5 V_{CAN} with U8 and L8 pins of J8 connector are not soldered by default.

2.5.4 Digital input

Digital inputs are no isolated by default. Therefore D36 and R289 0 Ω resistors are soldered.

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Pin	Pin name	Function	Description (ADC channel)	3rd PCO-10T800 func.
1	M_VSC3.T+	Analog input	ADC1.A6	Semicond. mod. temperature
3	GND	Power	Ground	Ground
5	GND	Power	Ground	Ground
7	GND	Power	Ground	Ground
9	GND	Power	Ground	Ground
11	GND	Power	Ground	Ground
13	GND	Power	Ground	Ground
15	GND	Power	Ground	Ground
even	-	-	Not connected	Not connected

Table 27: J15 CDA01-CU3 connector for J6 3rd PCO-10T800 connector.

Pin name	Description (ADC channel)	Unipolar/Bipolar	Range	Pull-down/Shunt
M_VSC1.T+	ADC1.B3	Unipolar	0 V/+10V	Pull-down
M_VSC1.VZ	ADC1.B0	Bipolar	-10V/+10V	Pull-down
M_VSC1.VY	ADC1.A4	Bipolar	-10V/+10V	Pull-down
M_VSC1.VX	ADC1.A3	Bipolar	-10V/+10V	Pull-down
M_VSC1.Vbus	ADC1.B7	Unipolar	0 V/+10V	Pull-down
M_VSC1.IW	ADC1.B4	Bipolar	-5V/+5V	Shunt
M_VSC1.IV	ADC1.A0	Bipolar	-5V/+5V	Shunt
M_VSC1.IU	ADC1.A2	Bipolar	-5V/+5V	Shunt
M_VSC1.Ibus	ADC1.A7	Bipolar	-5V/+5V	Shunt
M_VSC2.T+	ADC2.A6	Unipolar	0 V/+10V	Pull-down
M_VSC2.VZ	ADC2.A7	Bipolar	-10V/+10V	Pull-down
M_VSC2.VY	ADC2.A2	Bipolar	-10V/+10V	Pull-down
M_VSC2.VX	ADC2.A0	Bipolar	-10V/+10V	Pull-down
M_VSC2.IW	ADC2.B7	Bipolar	-5V/+5V	Shunt
M_VSC2.IV	ADC2.B4	Bipolar	-5V/+5V	Shunt
M_VSC2.IU	ADC2.B0	Bipolar	-5V/+5V	Shunt
M_VSC3.T+	ADC1.A6	Unipolar	0 V/+10V	Pull-down
ADC_ext.1	ADC2.B3	Bipolar	-10V/+10V	Shunt
ADC_ext.2	ADC2.A4	Bipolar	-10V/+10V	Shunt
ADC_ext.3	ADC2.A3	Bipolar	-10V/+10V	Shunt

Table 28: ADC's configuration by default.

Moreover, all digital inputs are configured as case A[1] (connected to 24 V) by default.

2.5.5 Fiber optic synchronization

This module is configured as case B[2] (it reads and sends simultaneously) by default.

[1]Look Point 8 of Chapter 2.1.1
[2]Look Point 11 of Chapter 2.1.1

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2.6 Security Precautions

2.6.1 General precautions

Do not disconnect any cable under load.

Do not pull any cable, which may cause their breaking or unplugging.

Before any intervention, ensure no voltage is still present on board and shut down any power supply connected to the CDA01-CU3.

2.6.2 Earthing

According to standard IEC 60439-1, the exposed conductive parts must be connected to the protective circuit using the appropriate connections.

All accessible metal parts (chassis connectors) should be grounded. CDA01-CU3 metal parts are designed to ensure earthing continuity. All of metal chassis are connected to the spacers.

After mounting, the electrical resistance between earth and any accessible metal surface should be checked and measured to less than 3 mΩ.

For a correct earthing connection all of four spacers[3] have to been connected to the earth cable.

Finally, four 100 pF 1000 V_{DC} capacitors (C14, C15, C16 and C17) have been implemented close to each spacer. These capacitors connect GND and EARTH because is desired providing a good path for electromagnetic noise generated. These capacitors are from Multicomp, reference manufacture MC1206B102K102CT.

[3] When CDA01-CU3 is assembled with PCO-10T800, metal spacers are already connected with earth of PCO-10T800.

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3 Layout

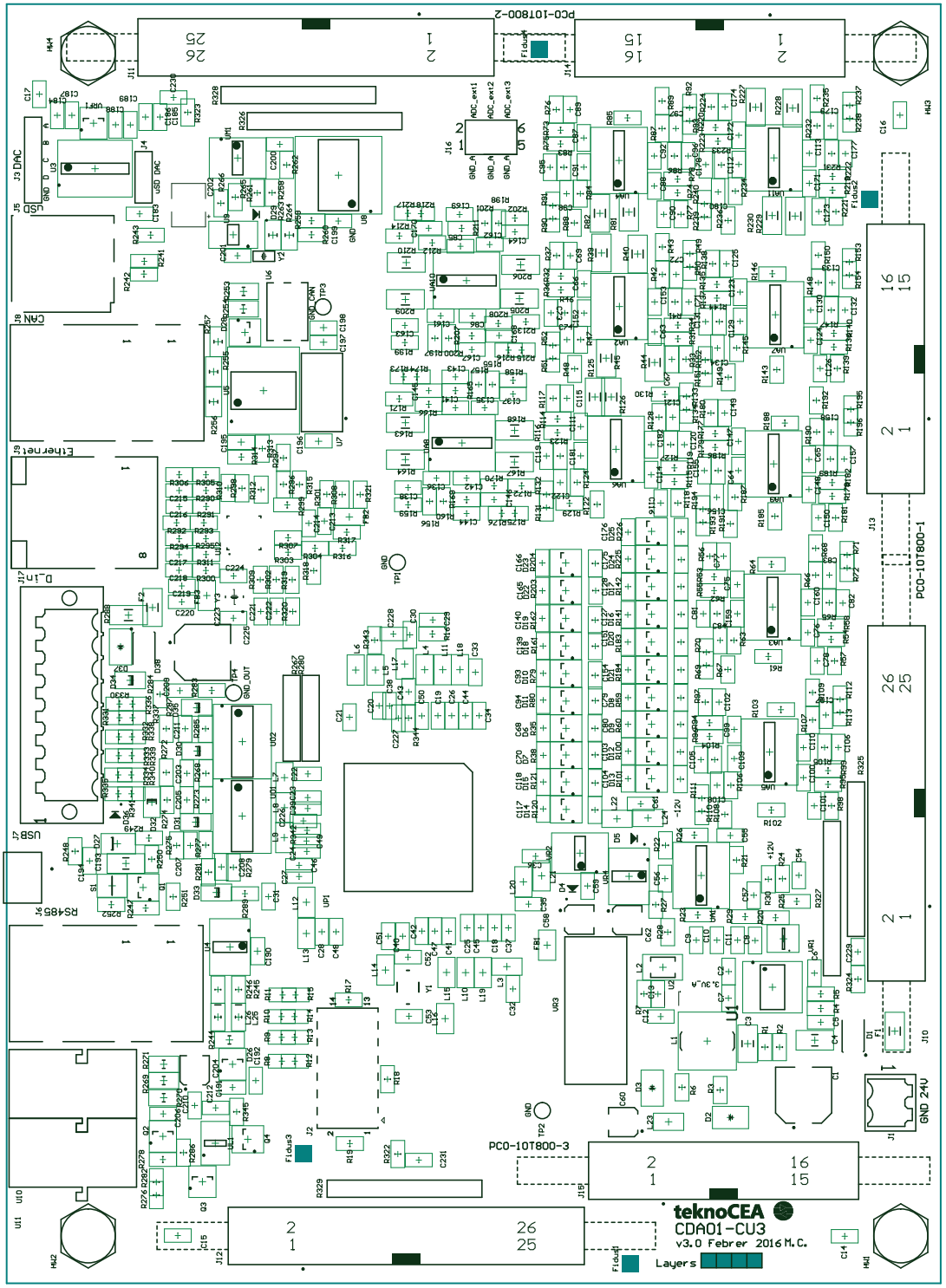

Figure 18: CDA01-CU3 Layout.

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4 Mechanical drawings

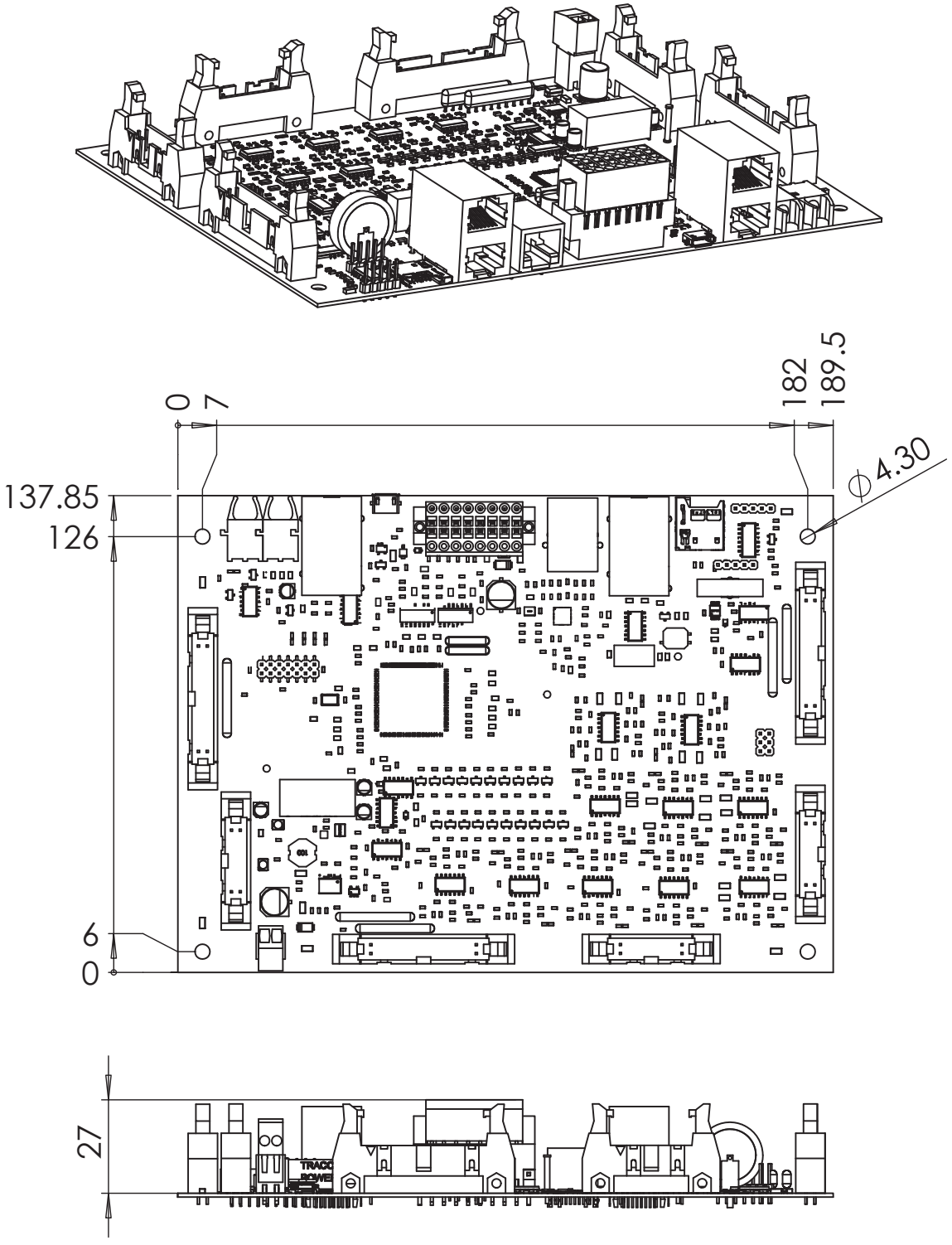

Figure 19: CDA01-CU3 Mechanical drawings.

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5 Schematics

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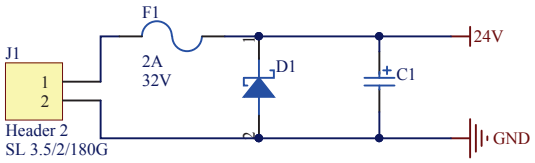
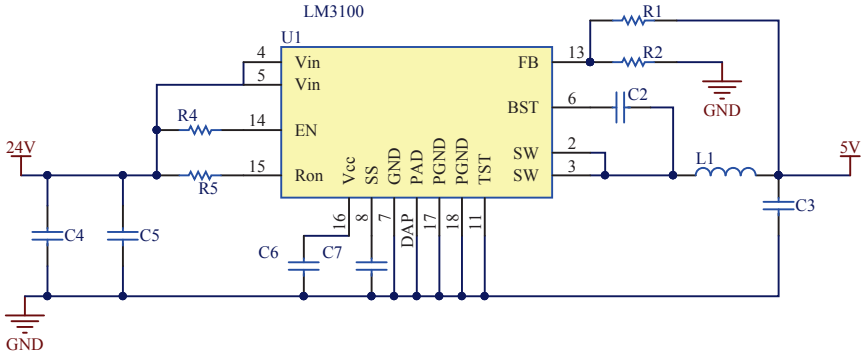
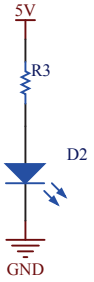
Power supply connector

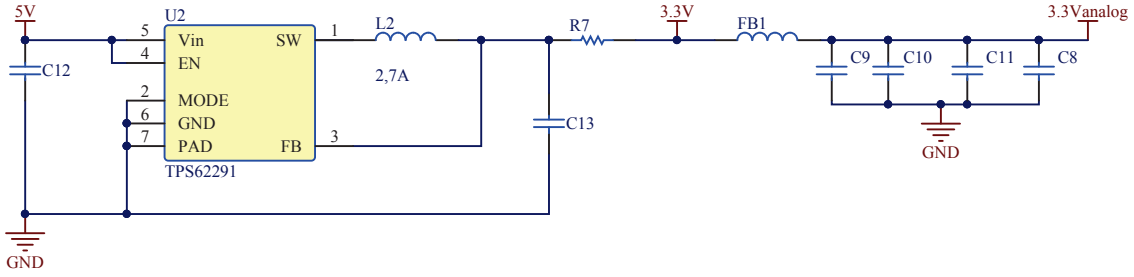


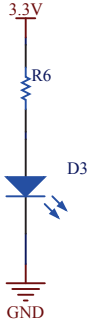
5V Power supply





3.3V Power supply





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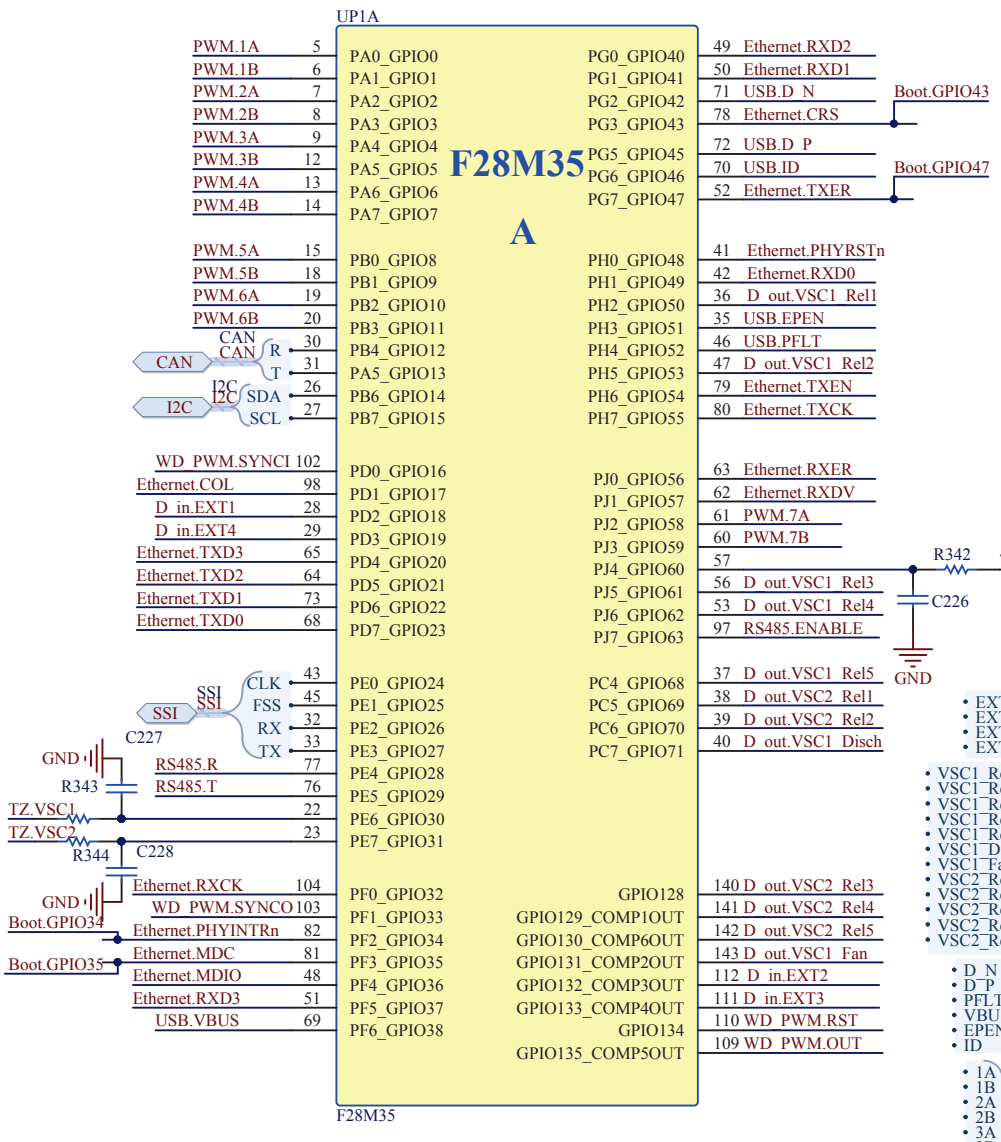
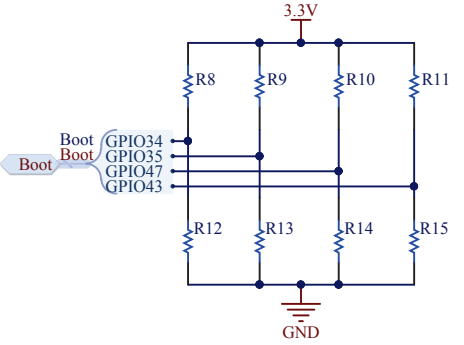
C2000 F28M35x - Part A

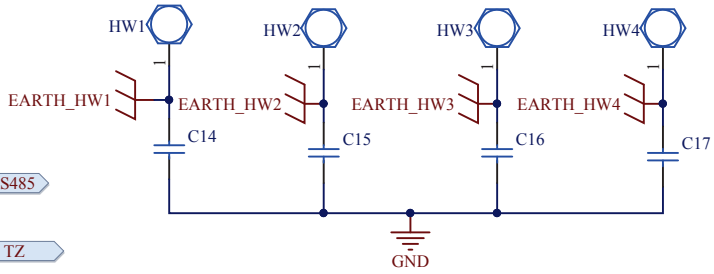


BOOT CONFIG



Mode#	GPIO34	GPIO35	GPIO47	GPIO43	Boot mode
0	0	0	0	0	Boot from Parallel GPIO
1	0	0	0	1	Boot to Master Subsystem RAM
2	0	0	1	0	Boot from Master Subsystem Serial Peripherials
3	0	0	1	1	Boot from Master Subsystem CAN interface
4	0	1	0	0	Boot from Master Subsystem Ethernet interface
7	0	1	1	1	Boot to Master Subsystem Flash memory

Mechanicals and logos



Layers 4
HW6

LOGO teknoCEA
HW5

Fidus2 Fidus3 Fidus4 Fidus1

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Projecte
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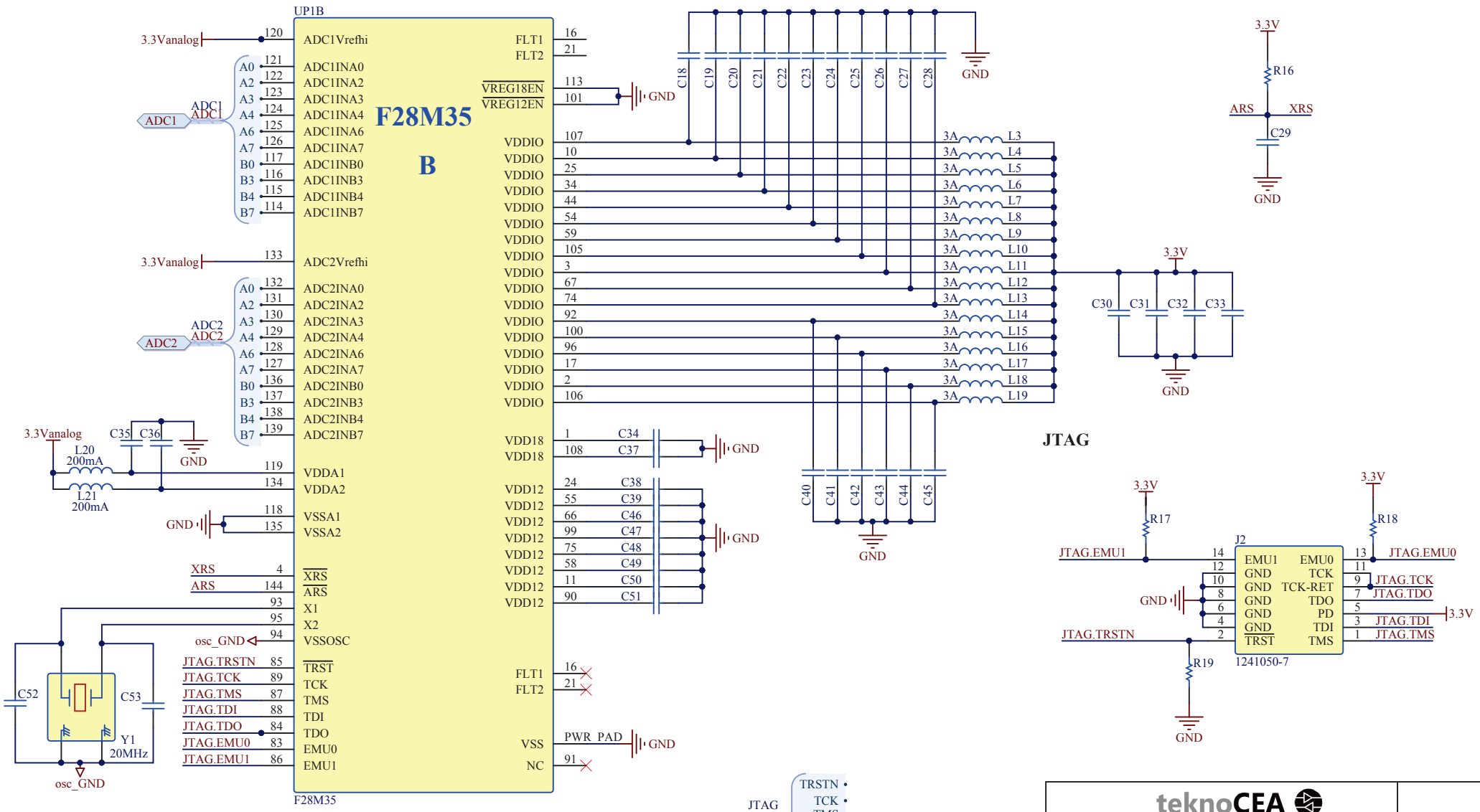
C2000 F28M35x - Part B



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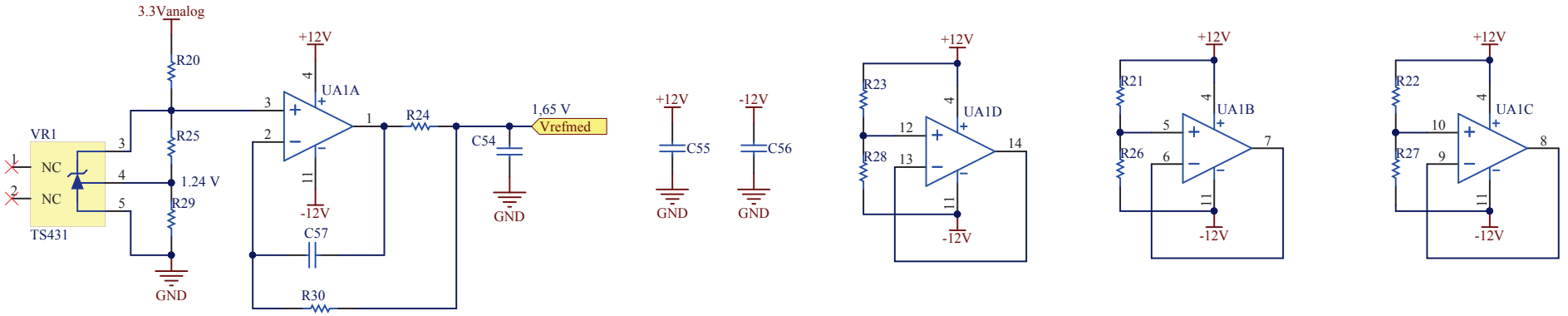
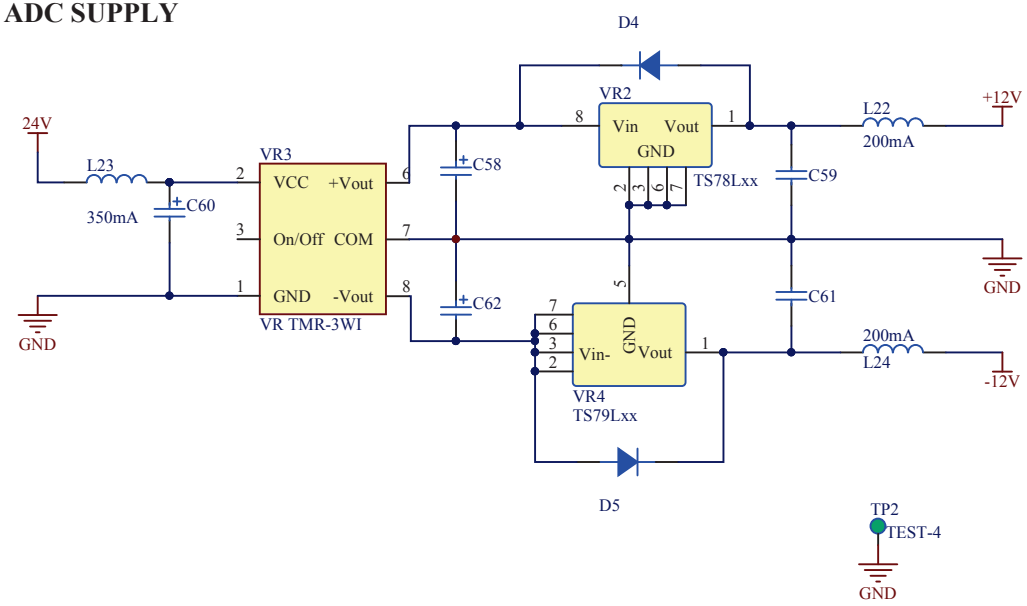
ADC REFERENCE



fc=1,59 kHz

ADC SUPPLY



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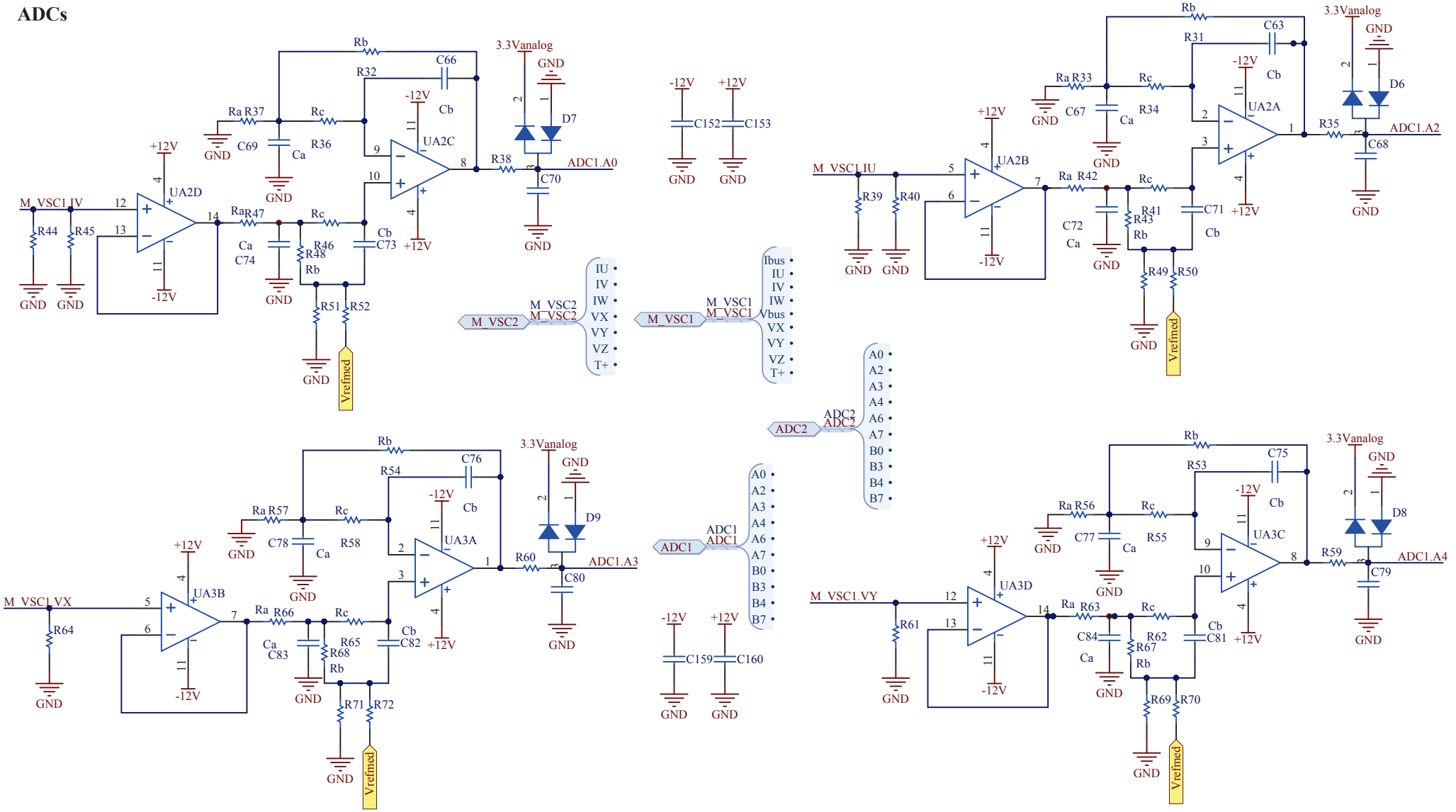
ADCs



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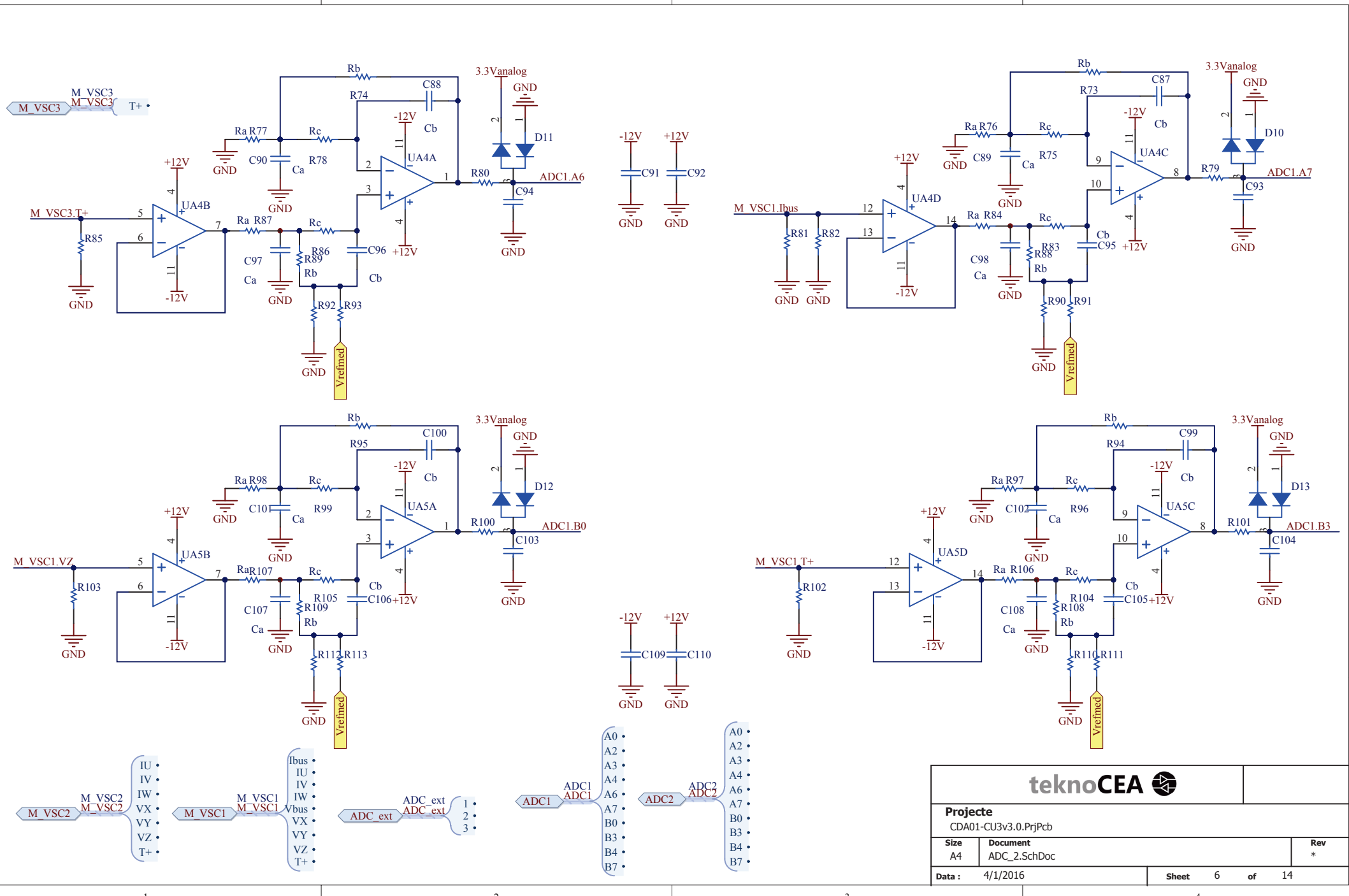
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T+
Rb
C88
3.3Vanalog
GND
R74
-12V
Cb
Ra R77
Rc
D11
C90
R78
Ca
UA4A
+12V
GND
R80
ADC1.A6
C94
M_VSC3.T+
UA4B
R85
Ra R87
Rc
C97
R86
R89
C96
Rb
Cb
R92
R93
Vrefmed
C91
C92
M_VSC1.Ibus
UA4D
R81
R82
Ra R84
C98
R83
R88
C95
R90
R91
R73
C87
R76
C89
R75
UA4C
R79
ADC1.A7
C93
D10
M_VSC1.VZ
UA5B
R103
Ra R107
C107
R105
R109
C106
R112
R113
R95
C100
Ra R98
C101
R99
UA5A
R100
ADC1.B0
C103
D12
M_VSC1.T+
UA5D
R102
Ra R106
C108
R104
R108
C105
R110
R111
R94
C99
Ra R97
C102
R96
UA5C
R101
ADC1.B3
C104
D13
C109
C110
M_VSC2
IU
IV
IW
VX
VY
VZ
T+
Ibus
Vbus
ADC_ext
ADC1
ADC2
A0
A2
A3
A4
A6
A7
B0
B3
B4
B7
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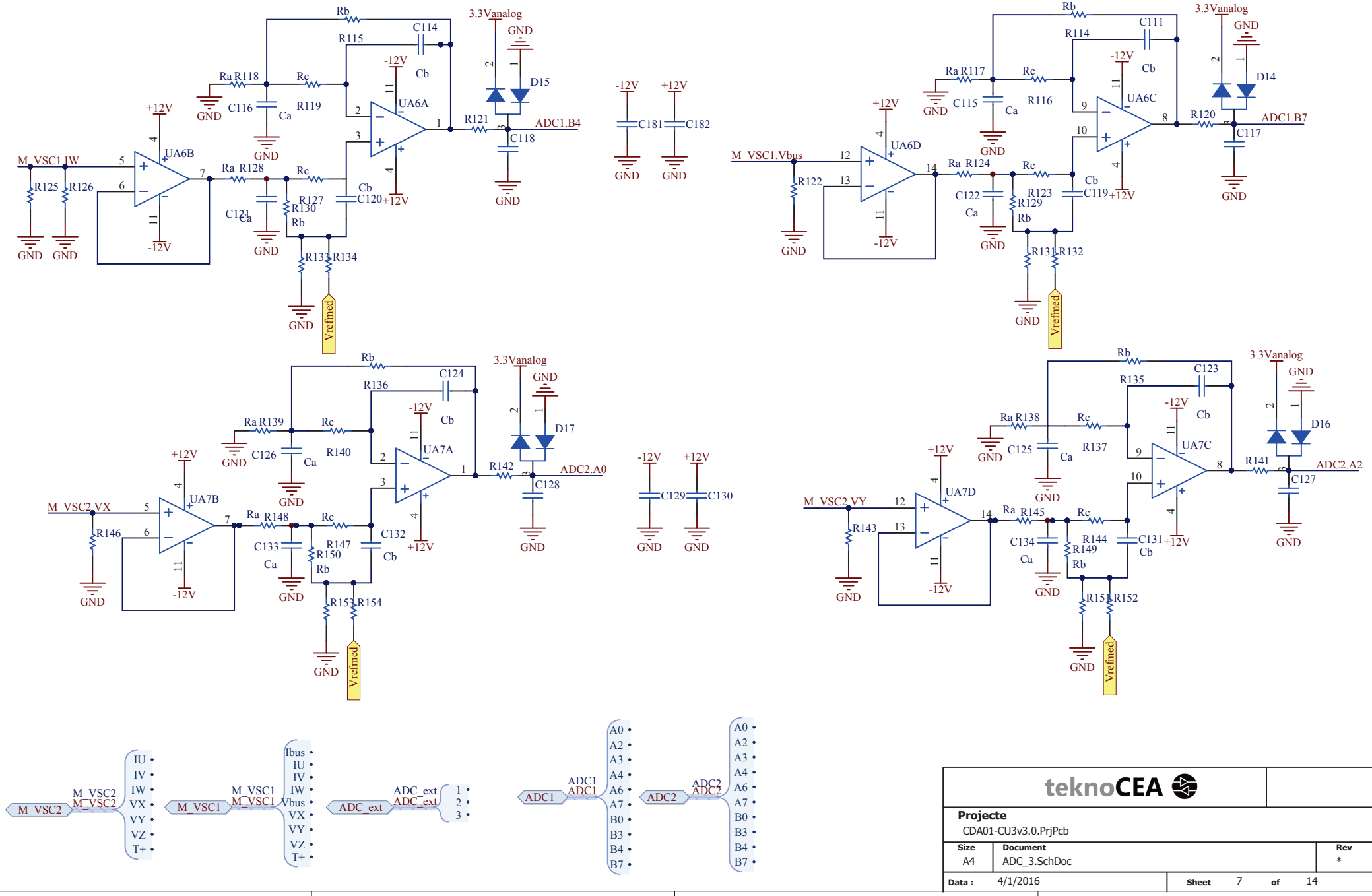

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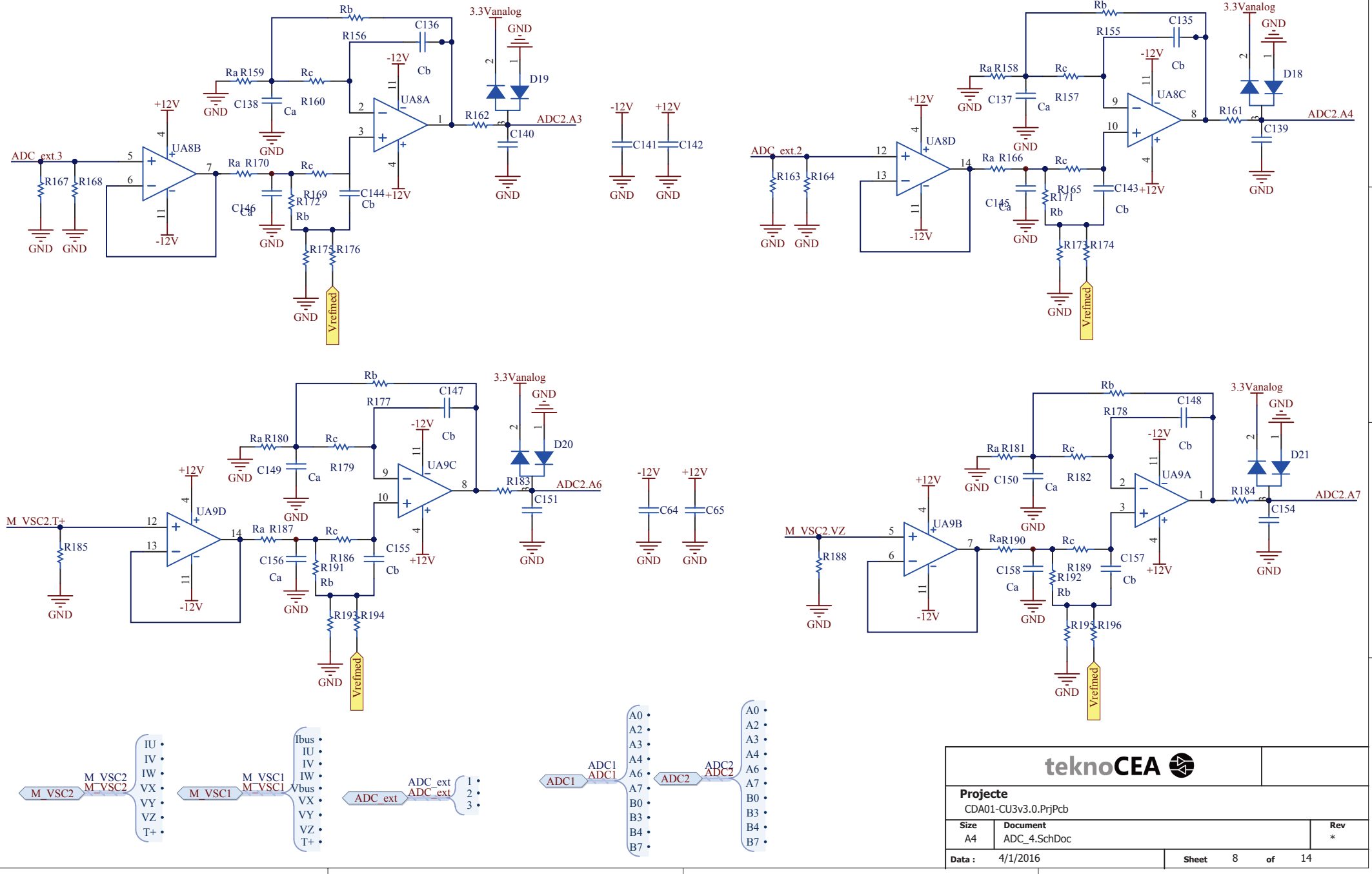

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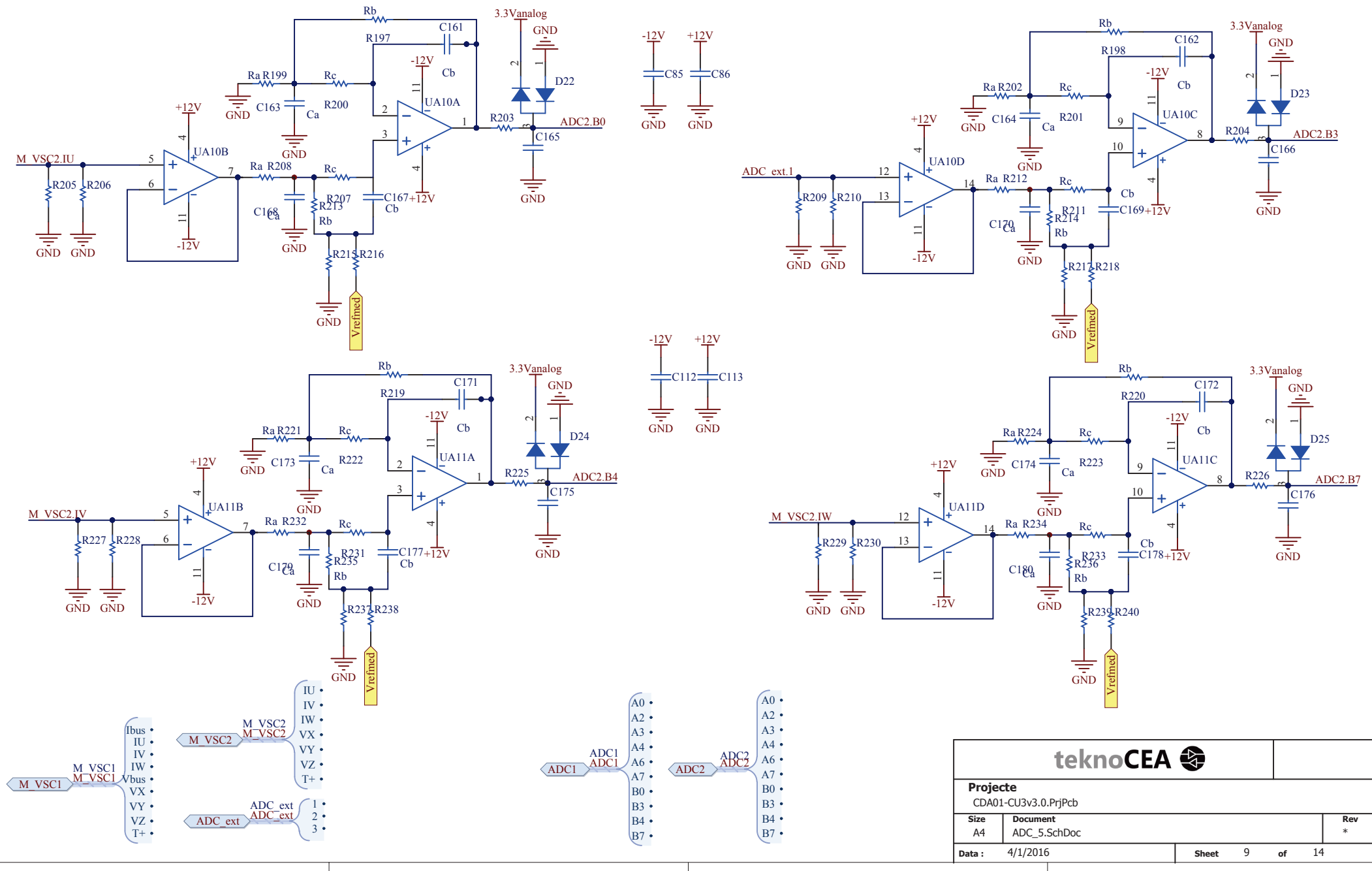

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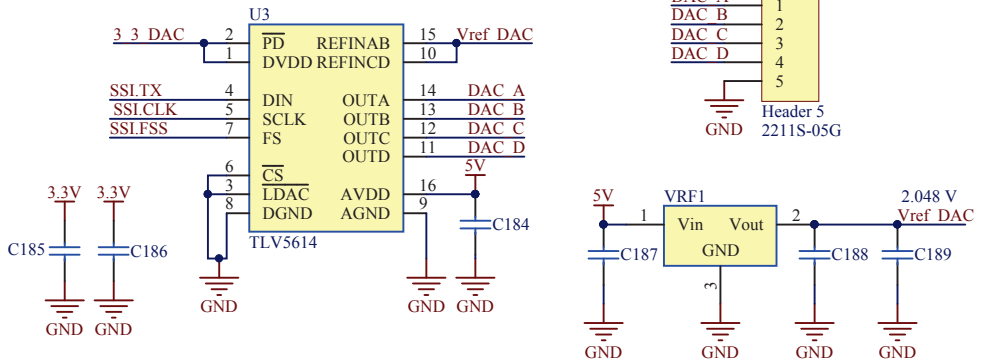
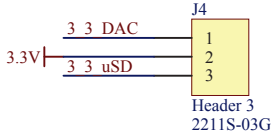
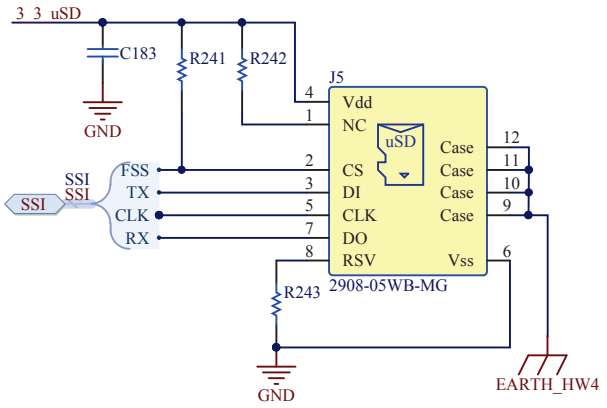
DAC



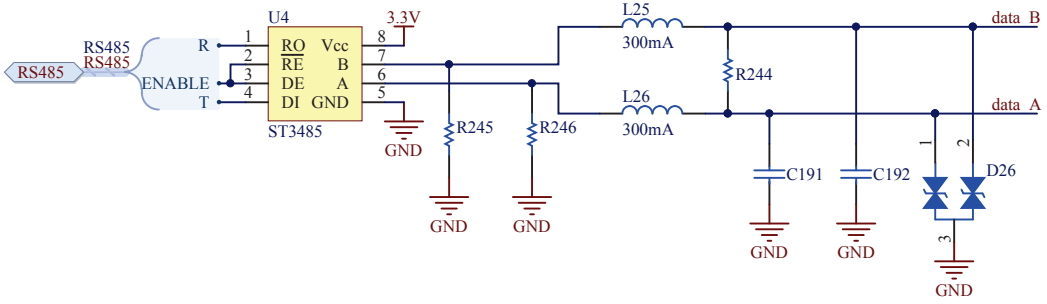
Jumper uSD or DAC

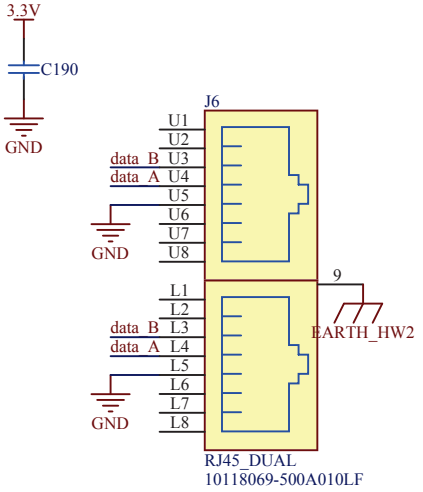


MICRO SD CARD

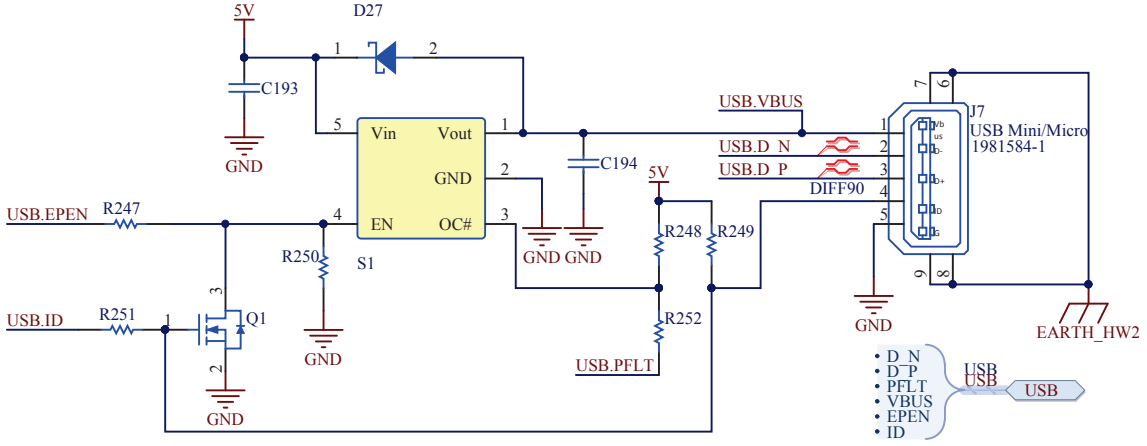


RS485





MICRO USB-OTG



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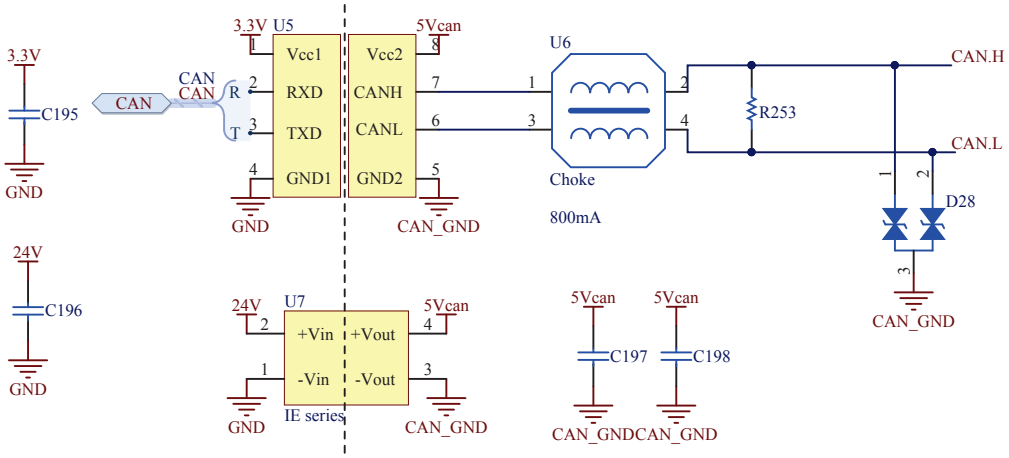
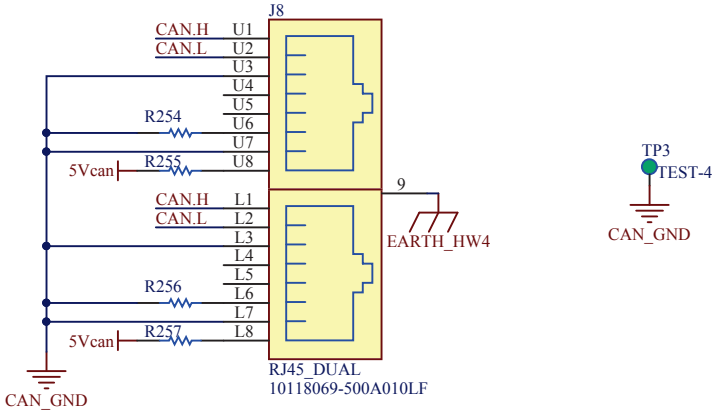
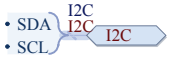
ISOLATED CAN

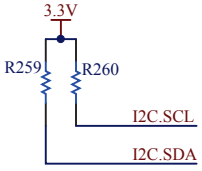




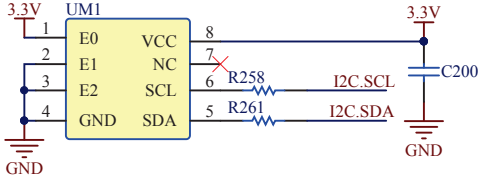
I2C



Pull-up I2C



EEPROM



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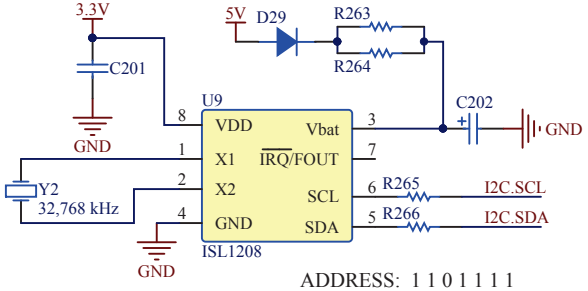
Real time clock



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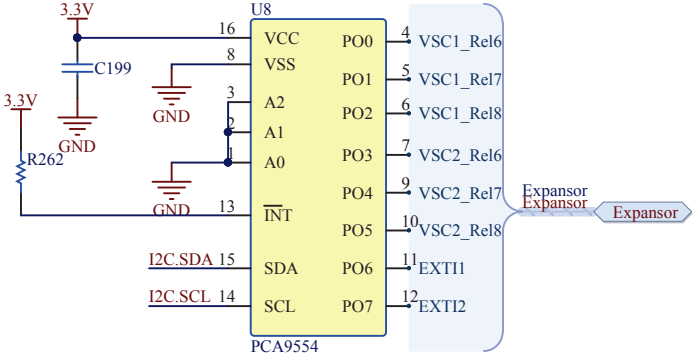

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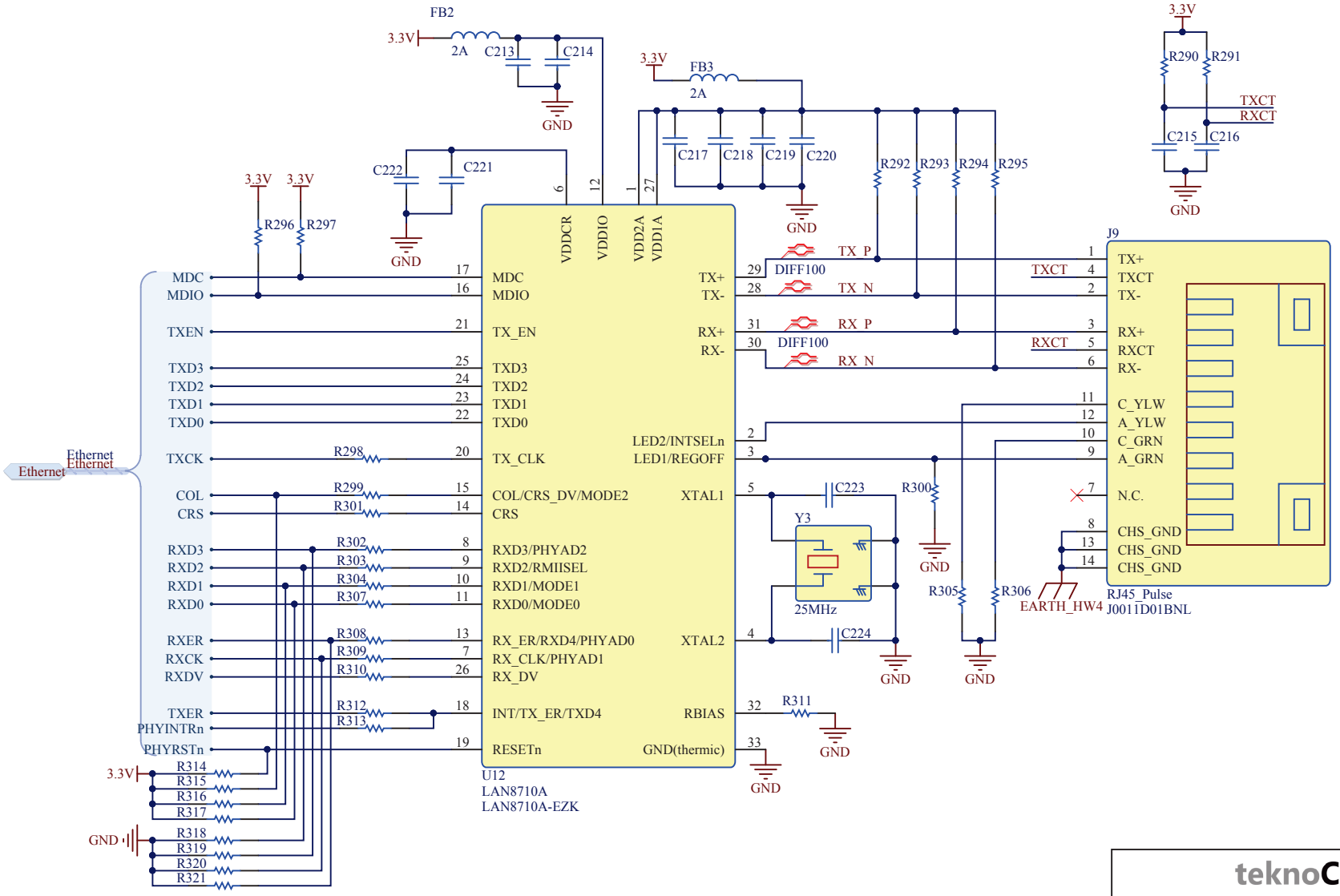
Ethernet



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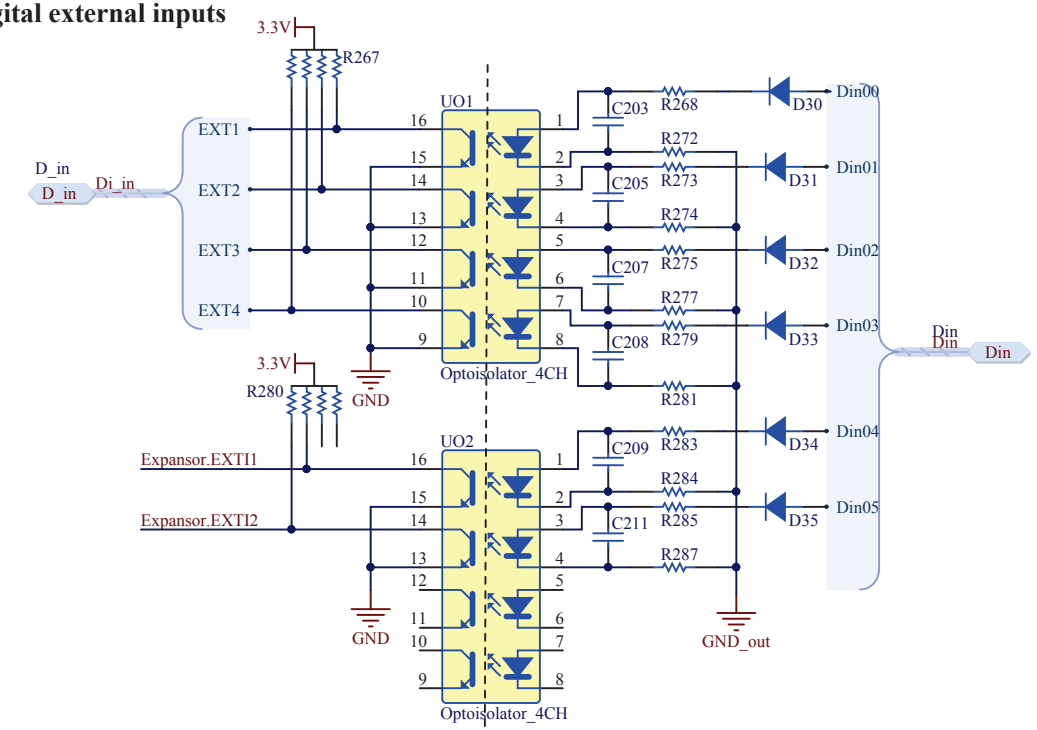
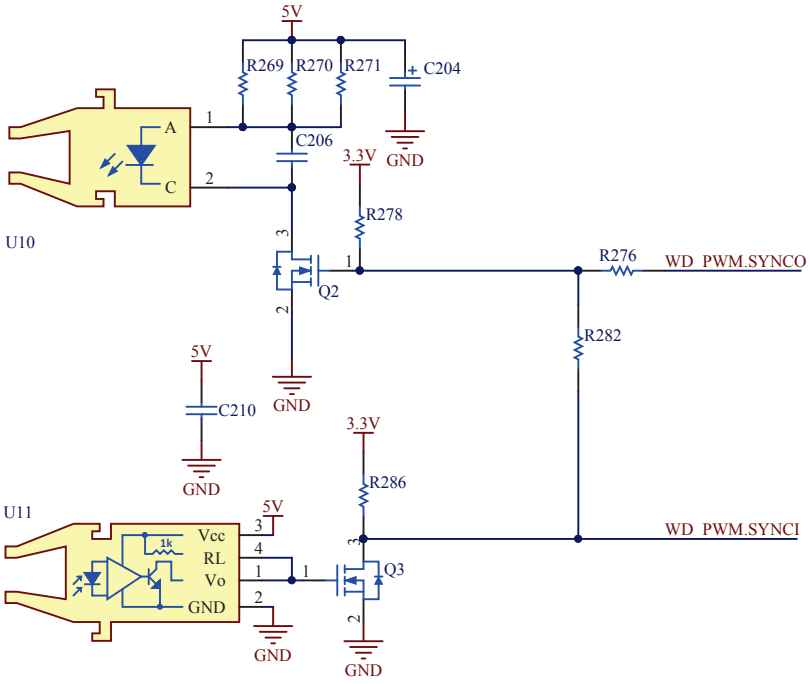
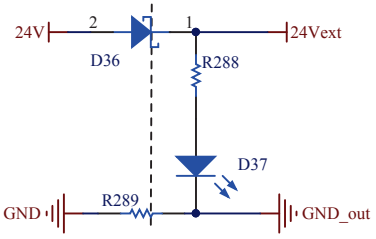
Isolated digital external inputs

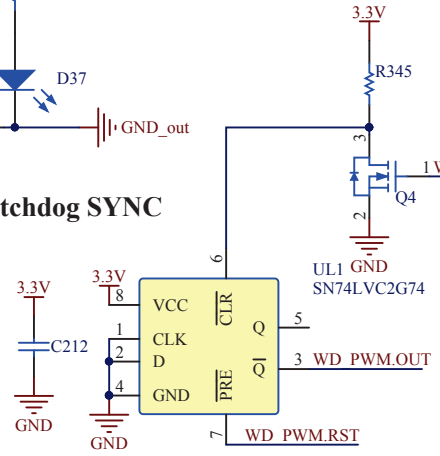


PWM SYNCI/SYNCO

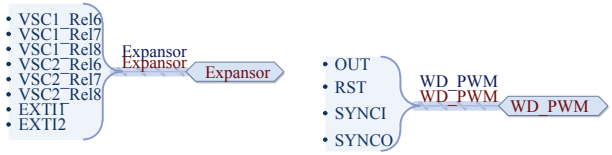




Watchdog SYNC



PRE	CLR	Q
L	H	L
H	L	H
L	L	H(inestable)
H	H	Q0



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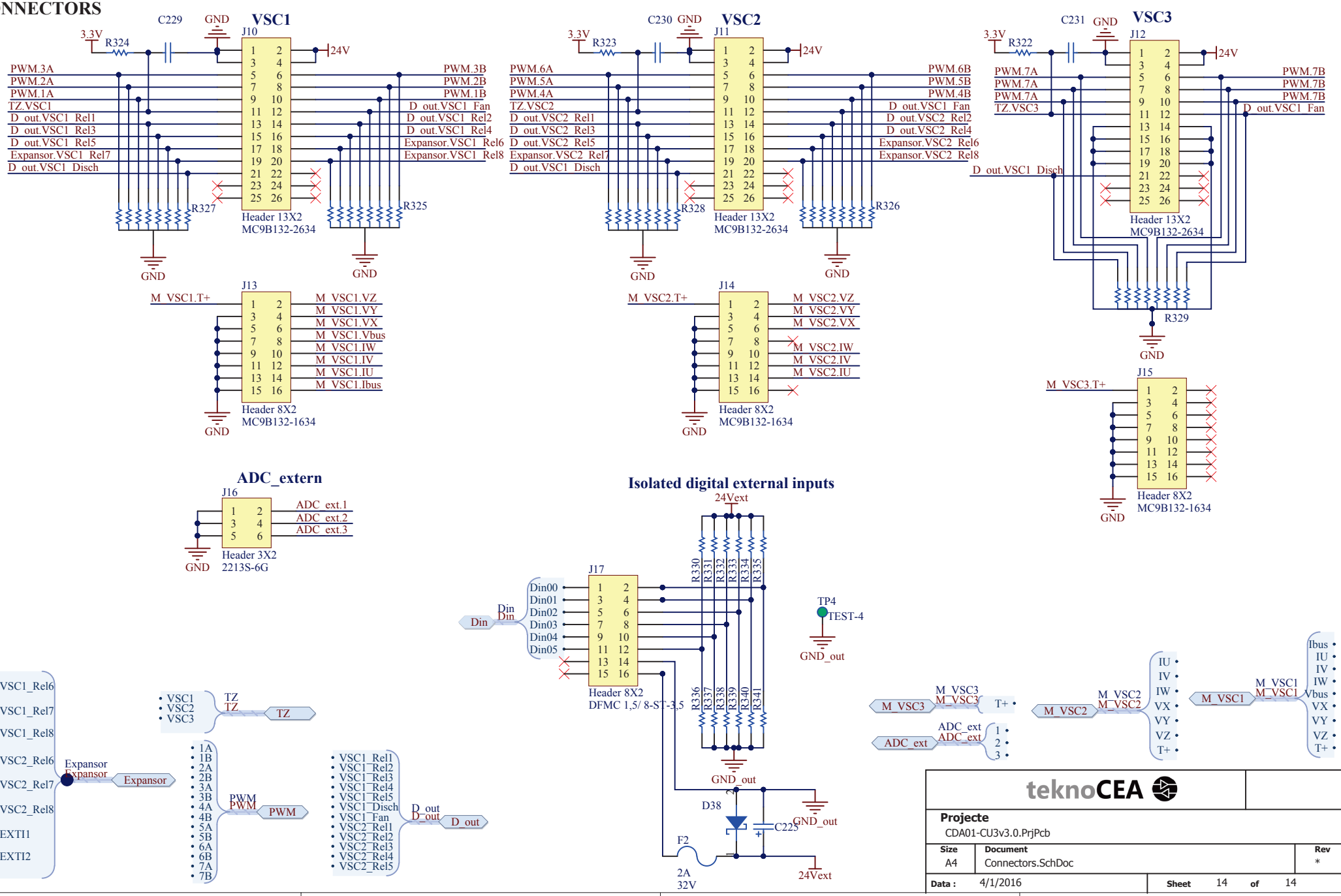
CONNECTORS



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