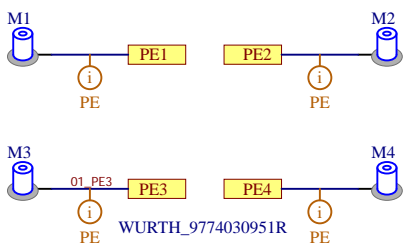
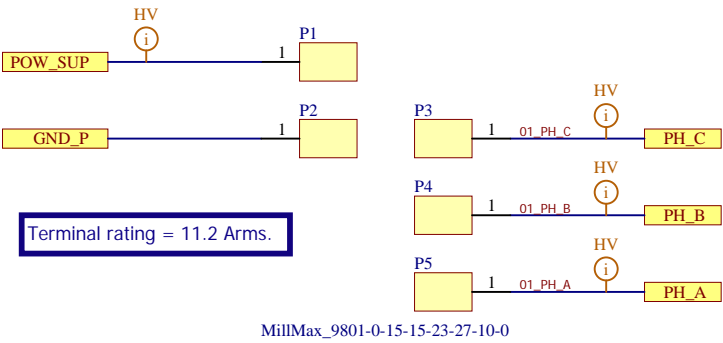


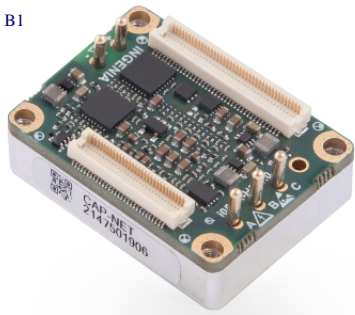
SM Standoffs



Power Pluggable Contacts



Capitan NET Servo Drive



Capitan_NET

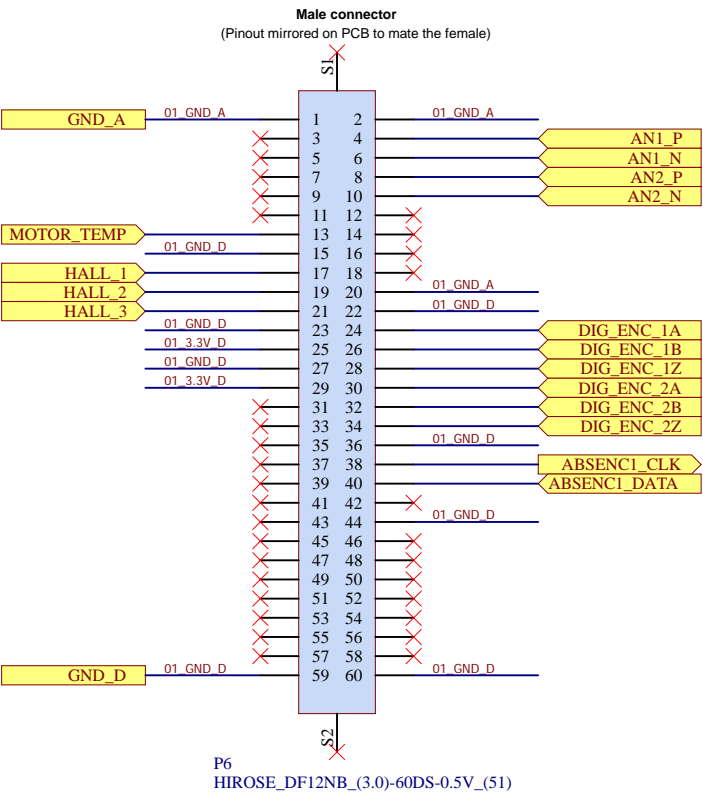
Recommendations PCB

Clearance & Creepage

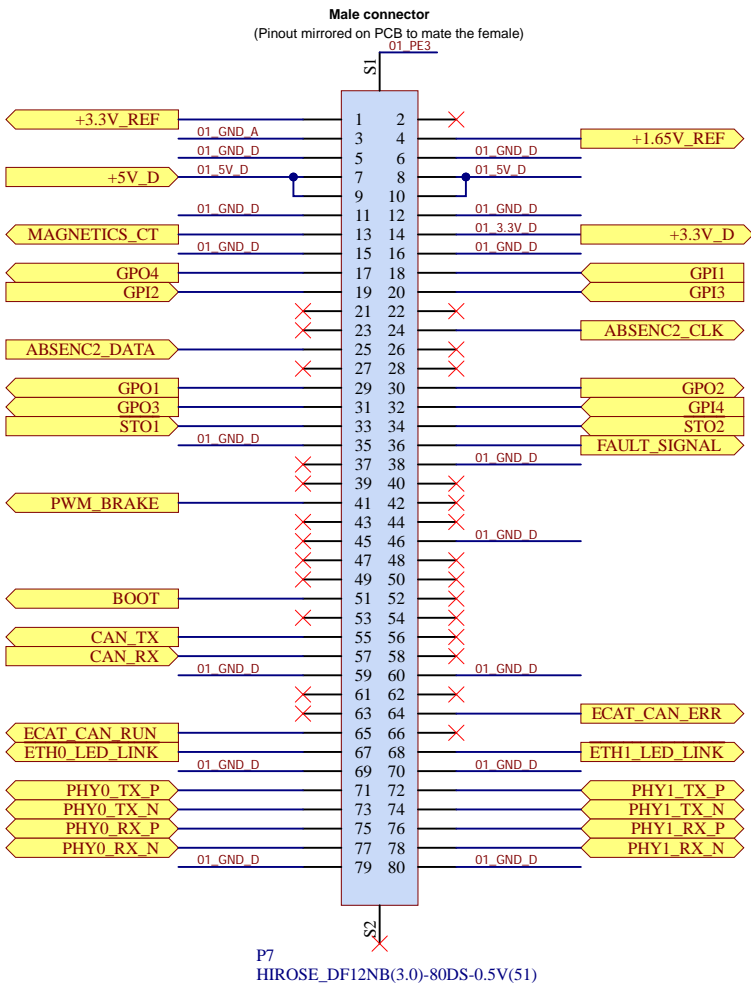
- Environmental conditions:
Pollution degree II
Overvoltage category II
- Nets non-related to safety:
Min. clearance: 0.125 mm
Min. creepage (Capitan): 0.1 mm
Min. creepage (Everest): 0.144 mm
- Protective Earth (PE) to non-accessible nets:
Min. clearance: 0.25 mm
Min. creepage (Capitan): 0.063 mm
Min. creepage (Everest): 0.1 mm
- Protective Earth (PE) to user-accessible nets:
Min. clearance: 0.625 mm
Min. creepage (Capitan): 0.126 mm
Min. creepage (Everest): 0.2 mm
- *Everest data indicated for compatibility between products.

Signal Connectors to Capitan NET

Feedback Connector



Interface Connector



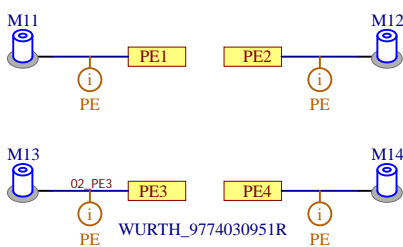
Layer Stack

- Layer Stack definition (6 layers):
TOP: components, tracks and GND_D.
MID1: GND_D.
MID2: signal tracks, GND_D.
MID3: power supplies.
MID4: signal tracks, GND_D.
BOT: components, tracks and GND_D.

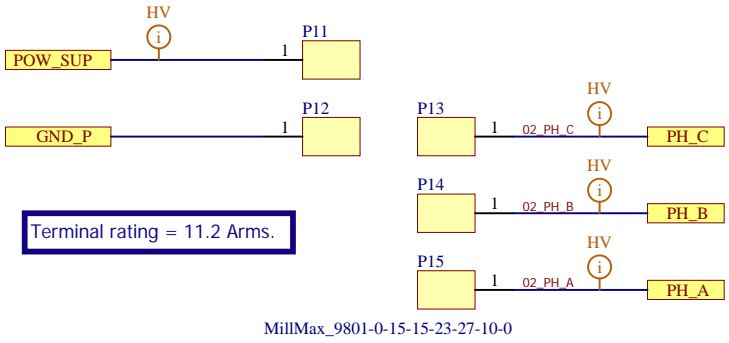
Height limits under the Capitan NET

- Board to board height is 3mm.
Do not place any component taller than 1 mm under the Capitan NET.
Do not place any circuit that could generate electrical noise or EMI under the PHY modules.
- Find instructions on layer MECHANICAL 5.

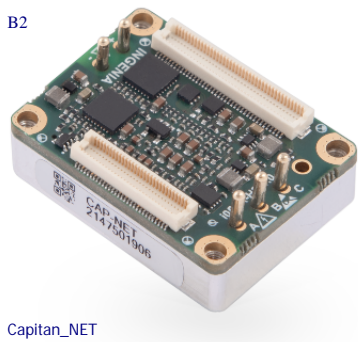
SM Standoffs



Power Pluggable Contacts



Capitan NET Servo Drive



Recommendations PCB

Clearance & Creepage

Environmental conditions:
Pollution degree II
Overvoltage category II

Nets non-related to safety:
Min. clearance: 0.125 mm
Min. creepage (Capitan): 0.1 mm
Min. creepage (Everest): 0.144 mm

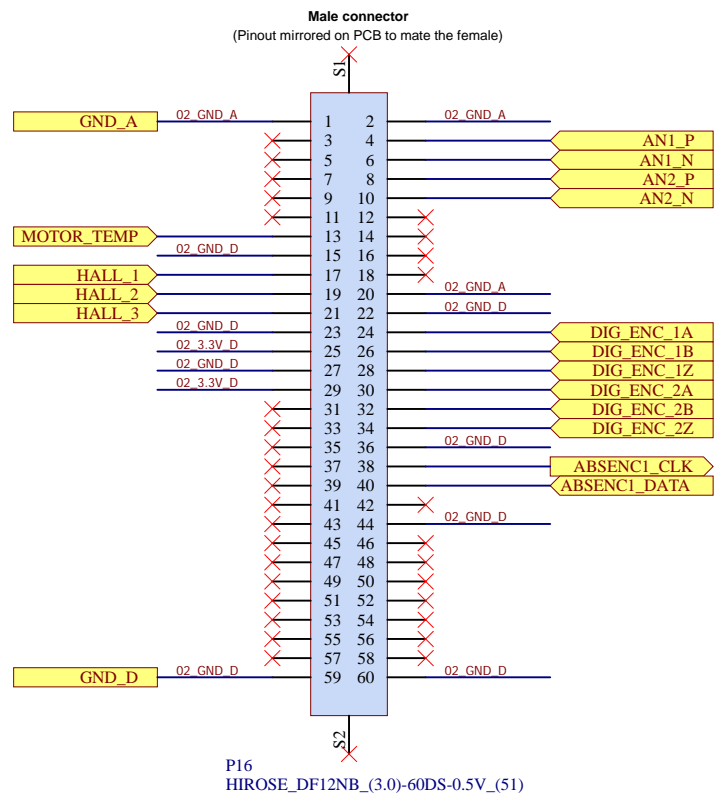
Protective Earth (PE) to non-accessible nets:
Min. clearance: 0.25 mm
Min. creepage (Capitan): 0.063 mm
Min. creepage (Everest): 0.1 mm

Protective Earth (PE) to user-accessible nets:
Min. clearance: 0.625 mm
Min. creepage (Capitan): 0.126 mm
Min. creepage (Everest): 0.2 mm

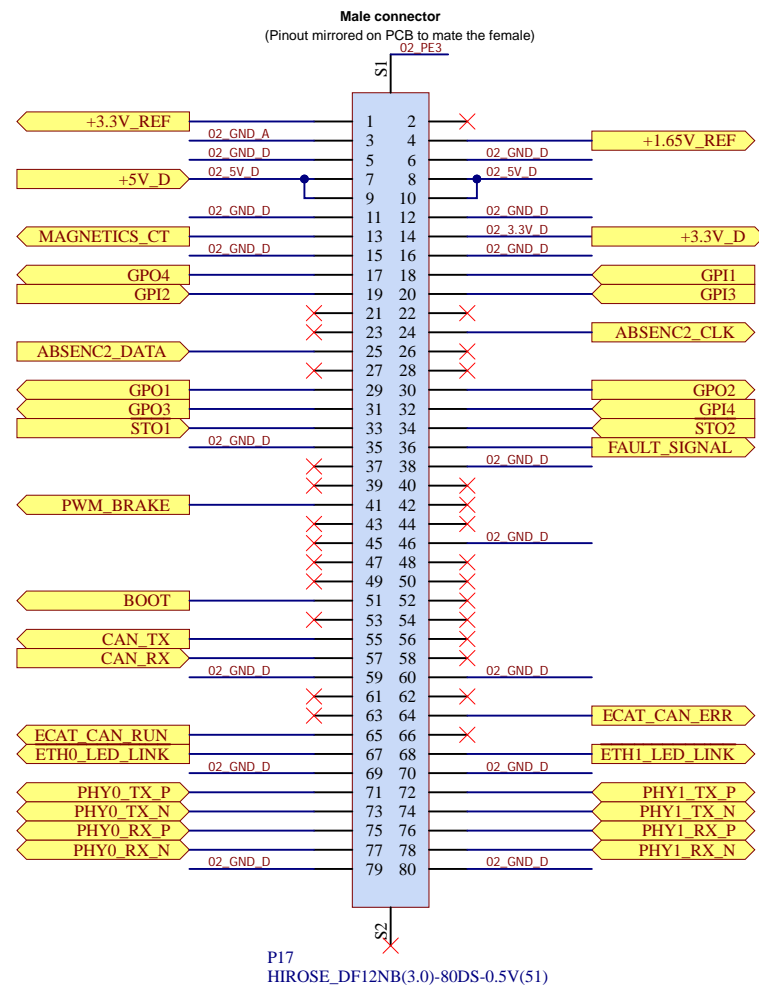
*Everest data indicated for compatibility between products.

Signal Connectors to Capitan NET

Feedback Connector



Interface Connector

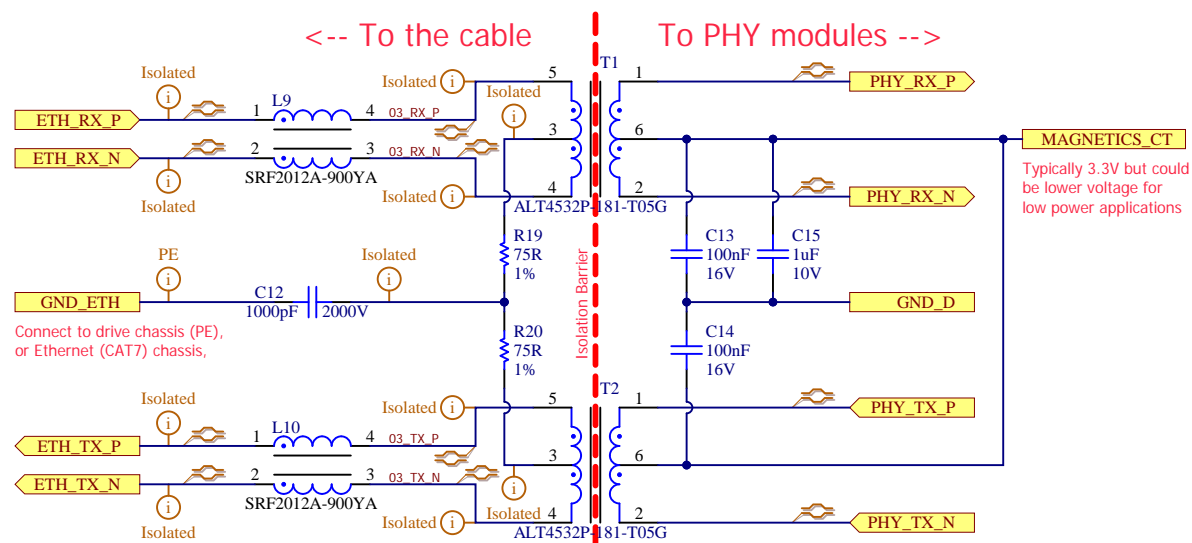


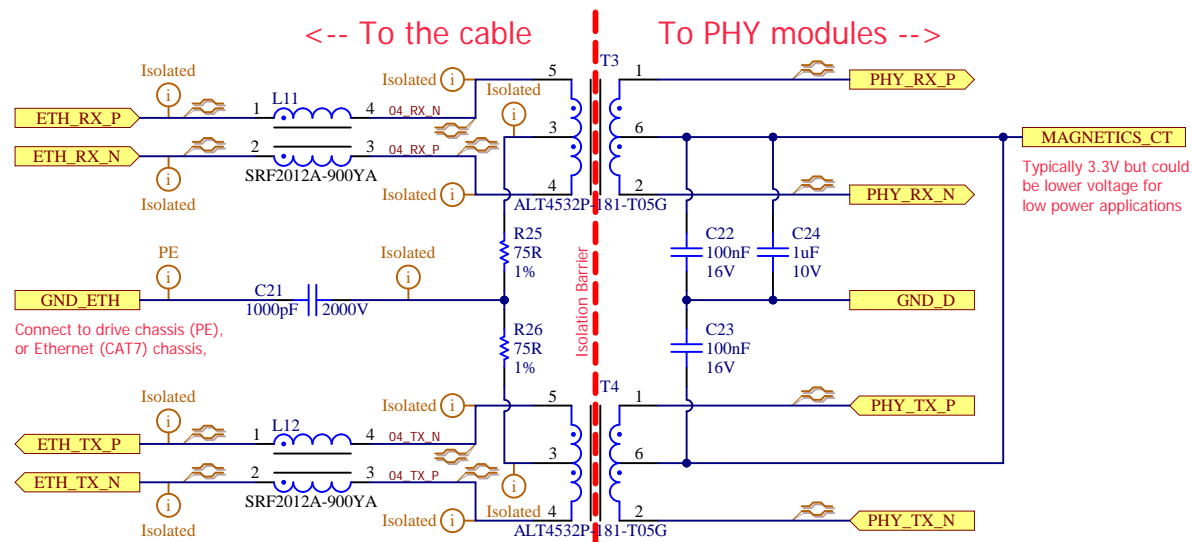
Layer Stack

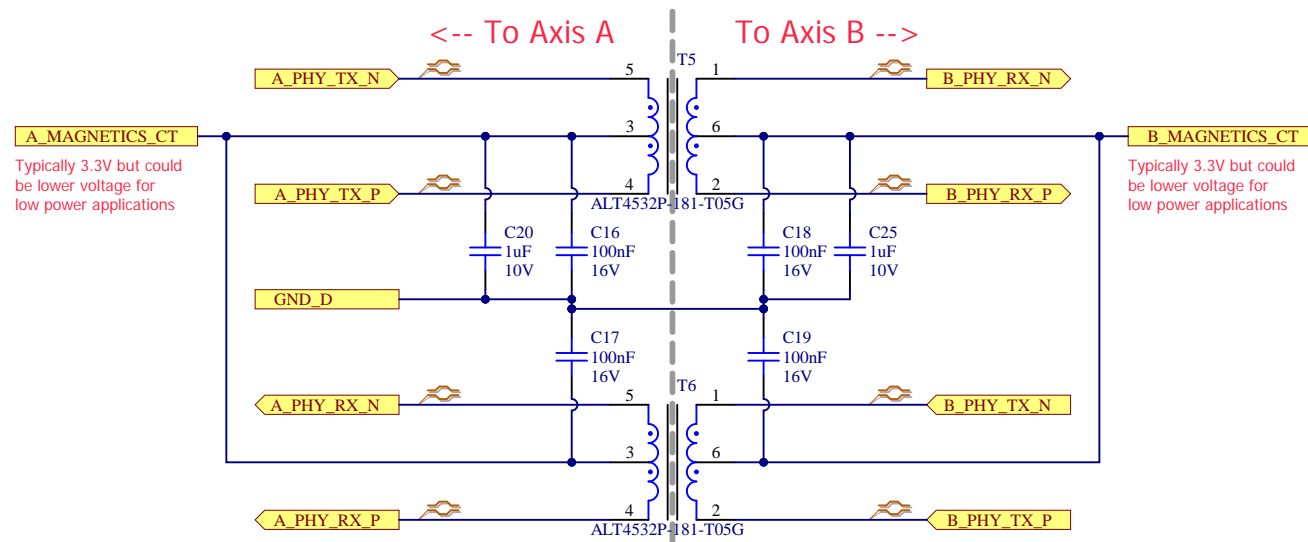
Layer Stack definition (6 layers):
TOP: components, tracks and GND_D.
MID1: GND_D.
MID2: signal tracks, GND_D.
MID3: power supplies.
MID4: signal tracks, GND_D.
BOT: components, tracks and GND_D.

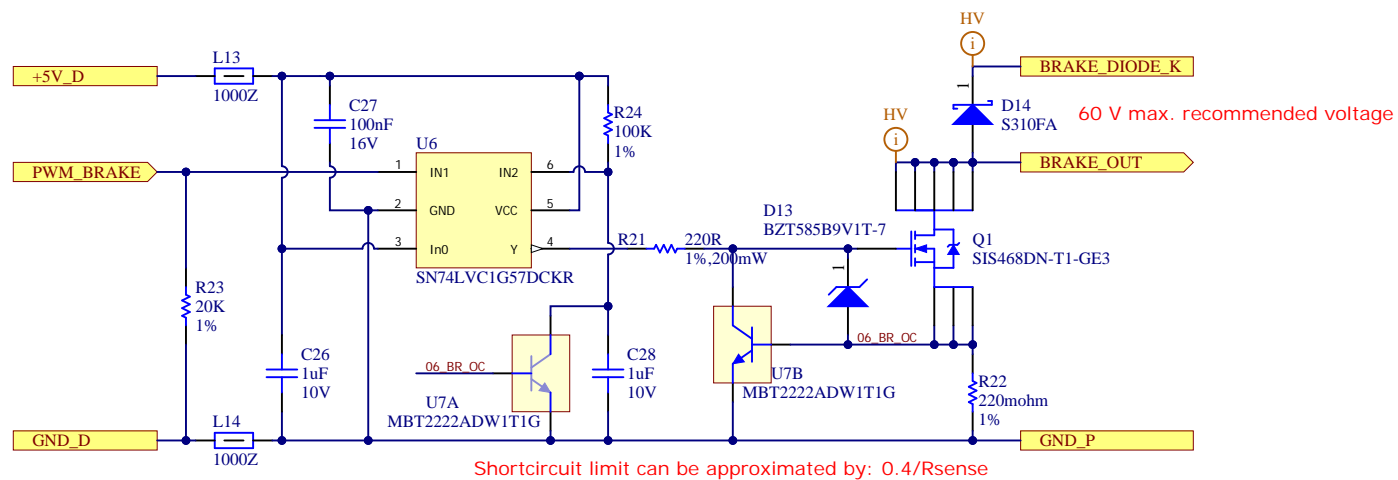
Height limits under the Capitan NET

Board to board height is 3mm.
Do not place any component taller than 1 mm under the Capitan NET.
Do not place any circuit that could generate electrical noise or EMI under the PHY modules.
Find instructions on layer MECHANICAL 5.









Title 06_Brake_OC_Protected.SchDoc

Project i058A-H1.PrjPCB

Documentation <http://doc.ingeniamc.com/x/NAfyB>

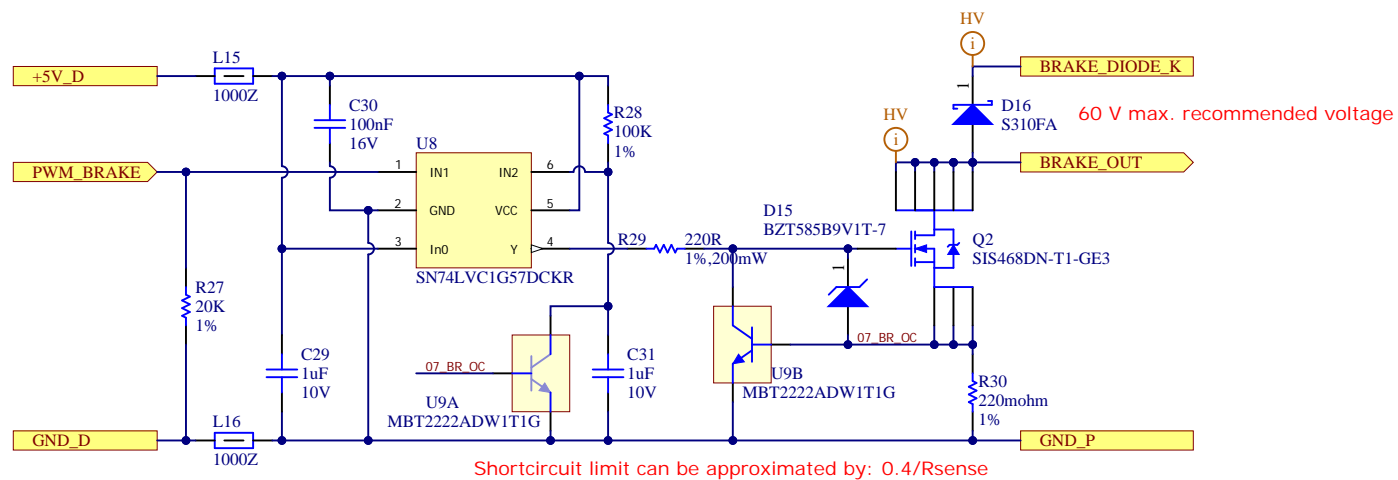
Variant BASIC

Revision i058A-H1-1.0.0

Version Not in version control Date: 16/04/2024

Ingenia Motion Control
Carrer Avila, 124, 2B
08018 Barcelona Spain

INGENIA
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Title 07_Brake_OC_Protected.SchDoc

Project i058A-H1.PrjPCB

Documentation <http://doc.ingeniamc.com/x/NAfyB>

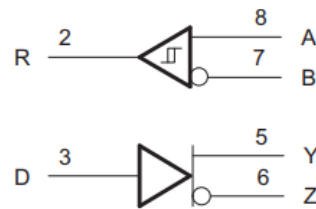
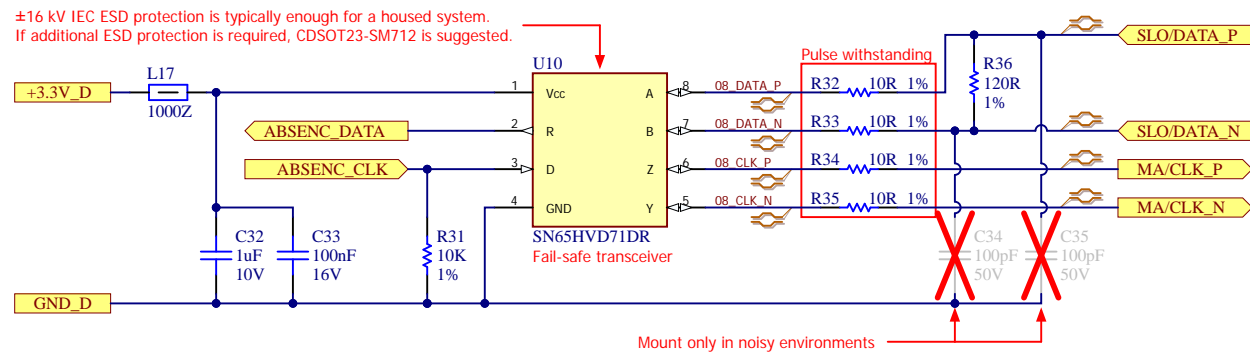
Variant BASIC

Revision i058A-H1-1.0.0

Version Not in version control Date: 16/04/2024

Ingenia Motion Control
Carrer Avila, 124, 2B
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Title 08_Absolute_Encoder_50Mbps.SchDoc

Project i058A-H1.PrjPCB

Documentation <http://doc.ingeniamc.com/x/NAfyB>

Variant BASIC

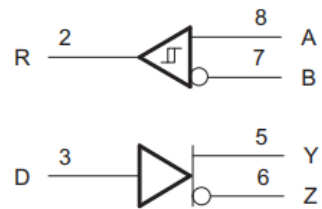
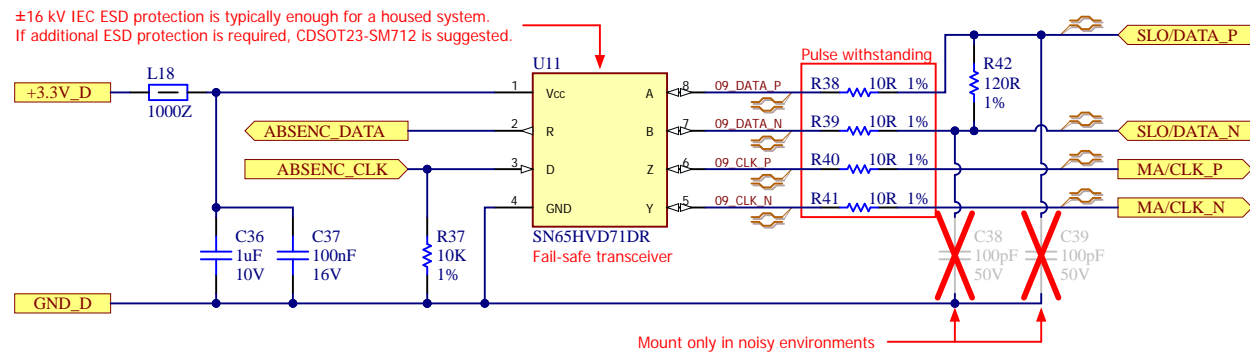
Revision i058A-H1-1.0.0

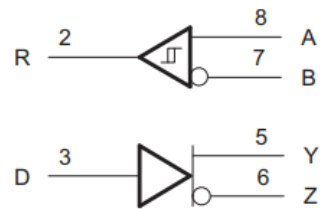
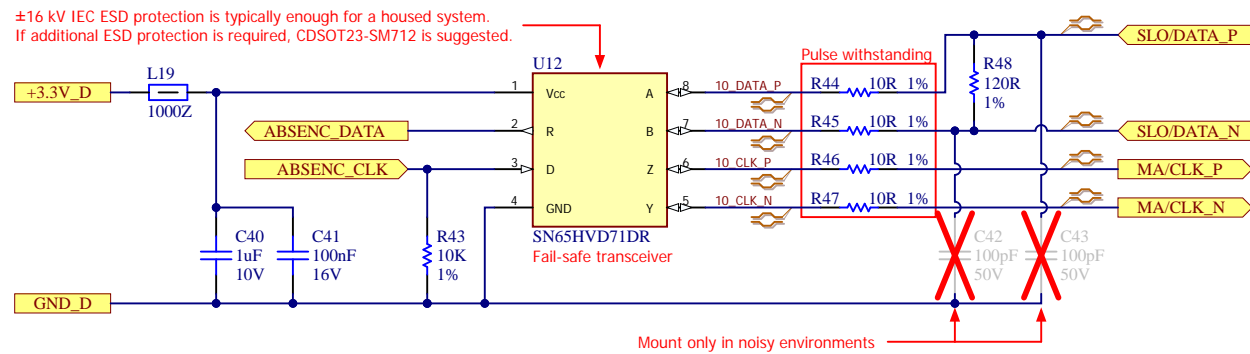
Version Not in version control Date: 16/04/2024

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Title 10_Absolute_Encoder_50Mbps.SchDoc

Project i058A-H1.PrjPCB

Documentation <http://doc.ingeniamc.com/x/NAfyB>

Variant BASIC

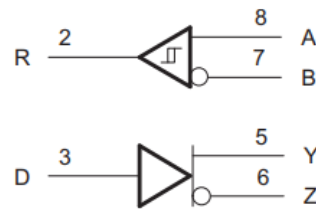
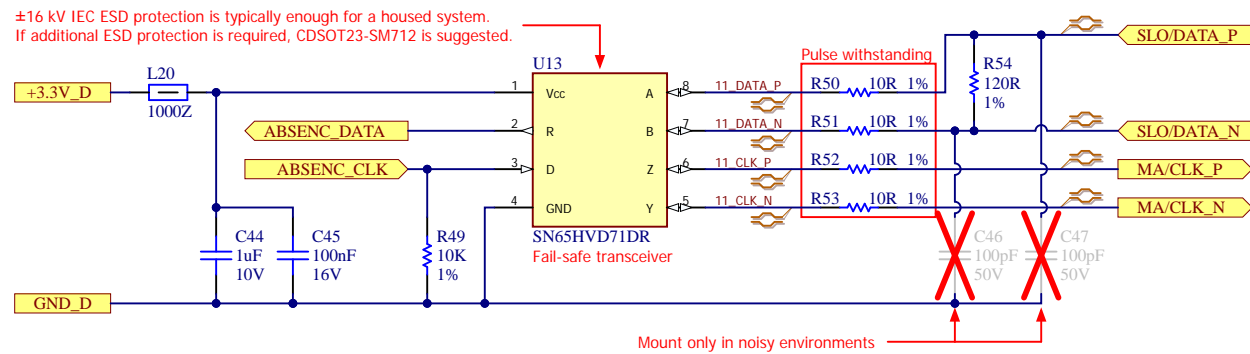
Revision i058A-H1-1.0.0

Version Not in version control Date: 16/04/2024

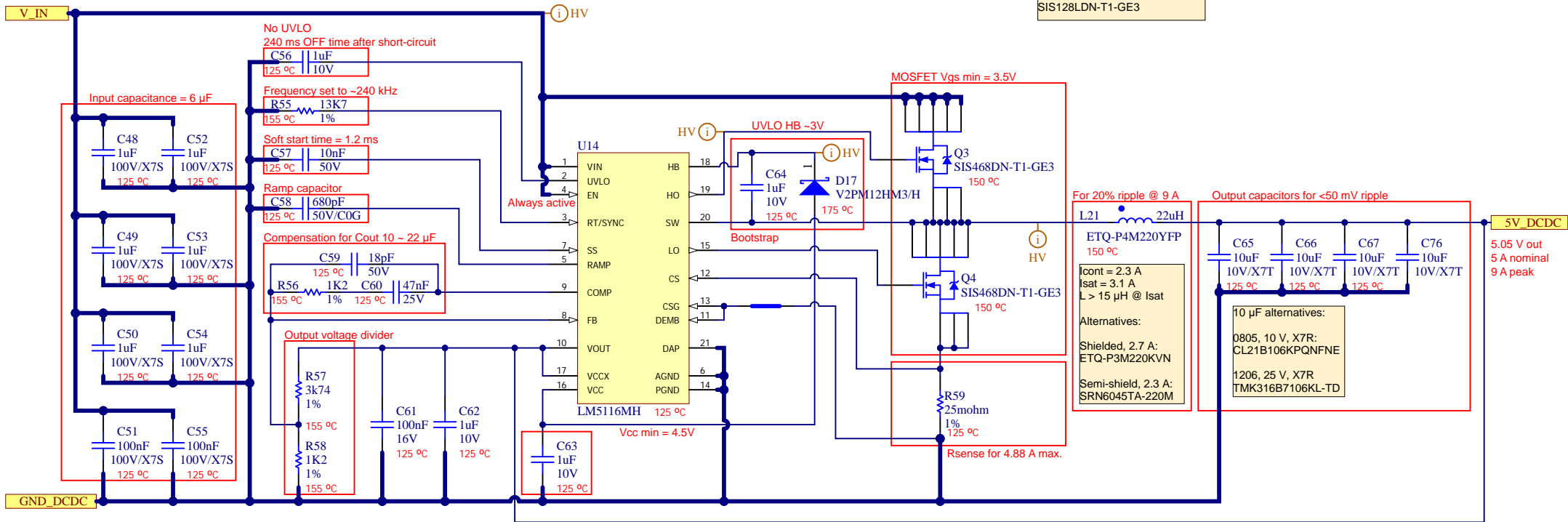
Ingenia Motion Control

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8 V to 60 V maximum input range



Title 12_DCDC_8V_to_60V_in_5V_out_1500mA.SchDoc

Project i058A-H1.PrjPCB

Documentation <http://doc.ingeniamc.com/x/NAfyB>

Variant BASIC

Revision i058A-H1-1.0.0

Version Not in version control Date: 16/04/2024

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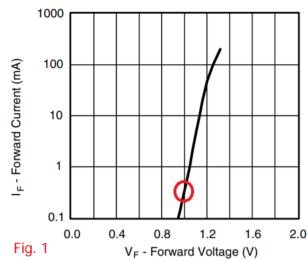


Fig. 1

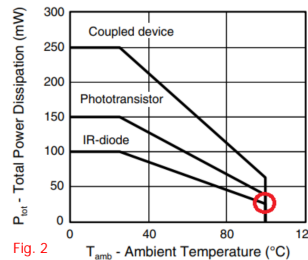


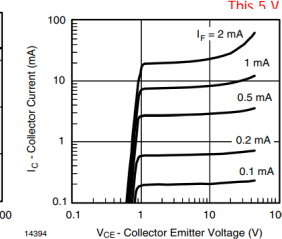
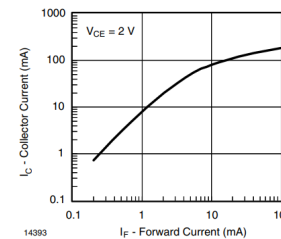
Fig. 2

Calculations:

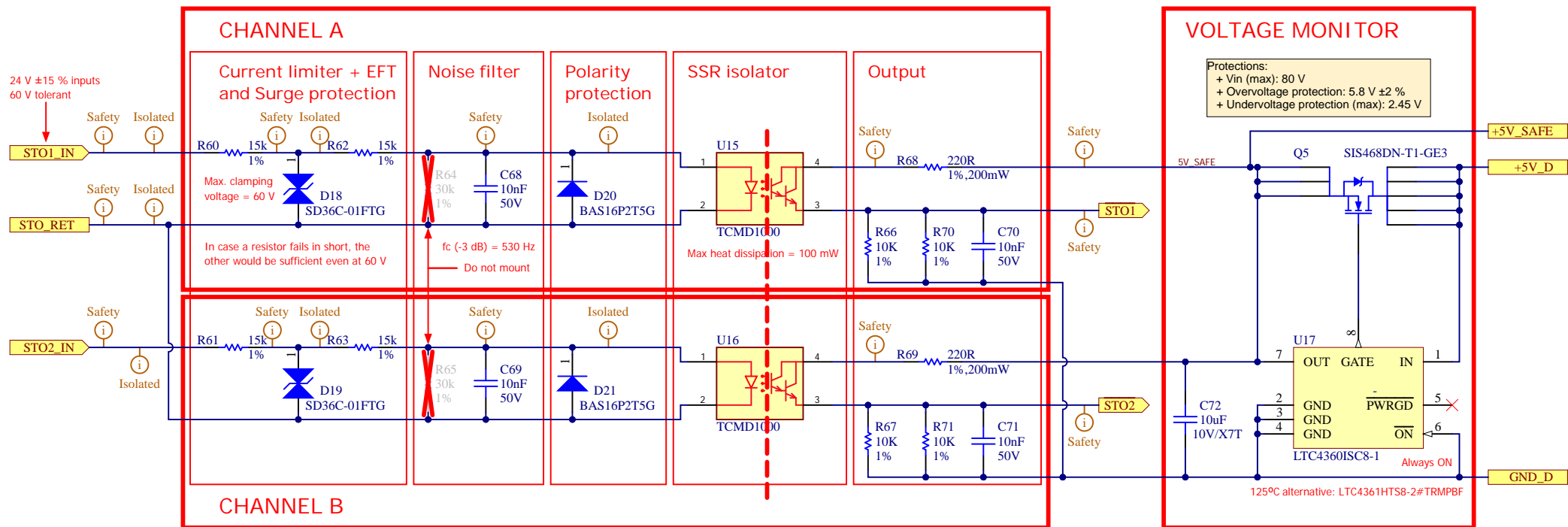
Min. input voltage = $24 \text{ V} \cdot 0.85 = 20.4 \text{ V}$
 Min. photodiode V_f @ 0.5 mA, with derating for $100^\circ\text{C} = 1 \text{ V} \cdot 0.9 = 0.9 \text{ V}$ (fig. 1)
 Max. photodiode V_f @ 0.5 mA, with overating for $0^\circ\text{C} = 1 \text{ V} \cdot 1.05 = 1.05 \text{ V}$ (fig. 1)
 Absolute max. photodiode forward current (I_f) = 60 mA
 Max. photodiode I_f (one resistor fails in short) = $(60 \text{ V} - 0.9 \text{ V}) / 15 \text{ k}\Omega = 3.94 \text{ mA}$
 Min. resistor power rating with 50 % derating factor = $((60 \text{ V} \wedge 2) / 15 \text{ k}\Omega) / 0.5 = 465 \text{ mW}$
 Absolute max. photodiode power dissipation with derating for $100^\circ\text{C} = 25 \text{ mW}$ (fig. 2)
 Max. photodiode power dissipation = $3.94 \text{ mA} \cdot 1.05 \text{ V} = 4.137 \text{ mW}$

Min. photodiode $I_f = (20.4 \text{ V} - 0.9 \text{ V}) / (2 \cdot 15 \text{ k}\Omega) = 650 \mu\text{A}$
 Typ. output collector current (I_c) for 2 Capitan = $5 \text{ V} / (220 \Omega + (1.2 \text{ k}\Omega \parallel 23.9 \text{ k}\Omega \parallel 23.9 \text{ k}\Omega)) = 3.82 \text{ mA}$

min. CTR (I_c/I_f) = 600



This 5 V input must be fully against overvoltage, it, and have the power < 100 mW.



Capitan input specs:
 - Max. VIL = 0.8 V
 - Min. VIH = 2.8 V
 - Max. input working voltage = 7 V
 - Max. input failure voltage = 26.4 V
 - Max input current = 50 mA
 - Typ. Input impedance = 23.9 k Ω

Overcurrent protection is missing, but current is already limited by resistor.

Thermal shutdown is also missing, but is not mandatory.

Title 13_Isolated_Dual_Channel_STO_Input.SchDoc

Project i058A-H1.PrjPCB

Documentation

Variant BASIC

Revision i058A-H1-1.0.0

Version Not in version control Date: 16/04/2024

Ingenia Motion Control

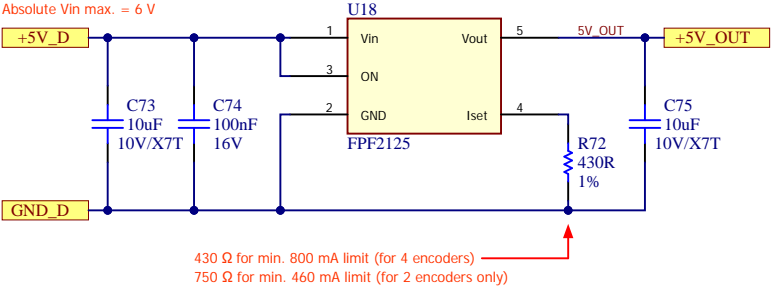
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08018 Barcelona Spain

Embedded protections:
+ Over-current
+ Reverse current
+ Under-voltage (UVLO)
+ Over-temperature

Target feedback is RLS AksIM-2:
+ Max current consumption (no load): 150 mA
+ Typ. 5V-based RS422 load: $5/120 = 40$ mA
+ Max. ~200 mA per sensor
+ Total max. 800 mA per 4 sensors

[AksIM-2 datasheet](#)



Title 14_Load_Switch_Protected_800mA.SchDoc

Project i058A-H1.PrjPCB

Documentation

Variant BASIC

Revision i058A-H1-1.0.0

Version Not in version control Date: 16/04/2024

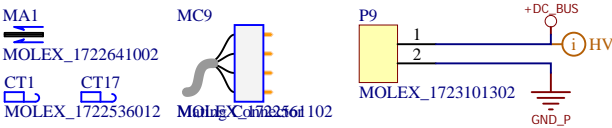
Ingenia Motion Control

Carrer Avila, 124, 2B

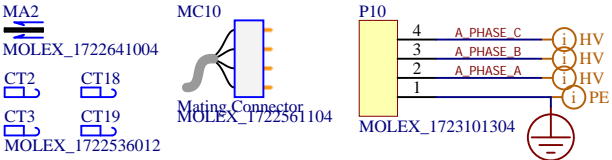
08018 Barcelona Spain

Connectors Axis A

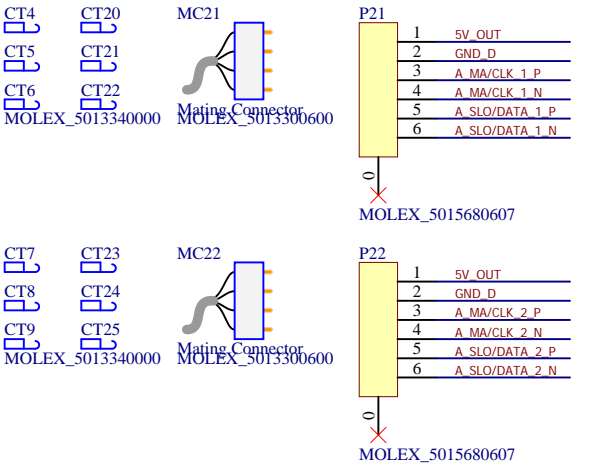
Supply IN



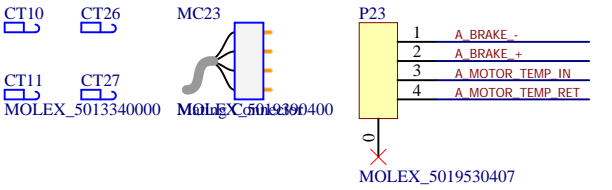
Motor A phases



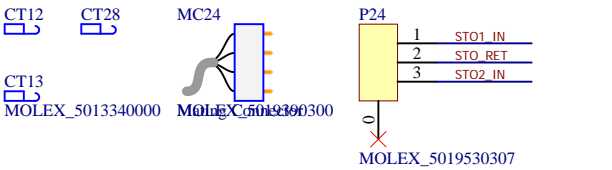
Motor A Absolute Encoders



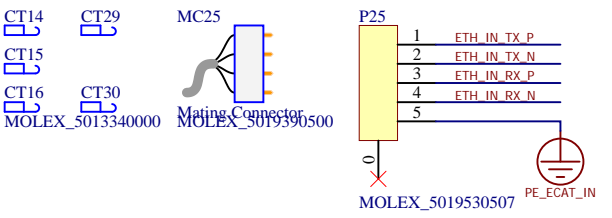
Motor A Brake & Temperature



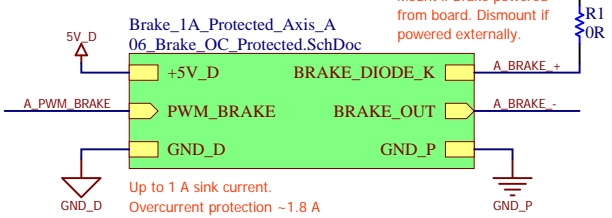
STO IN



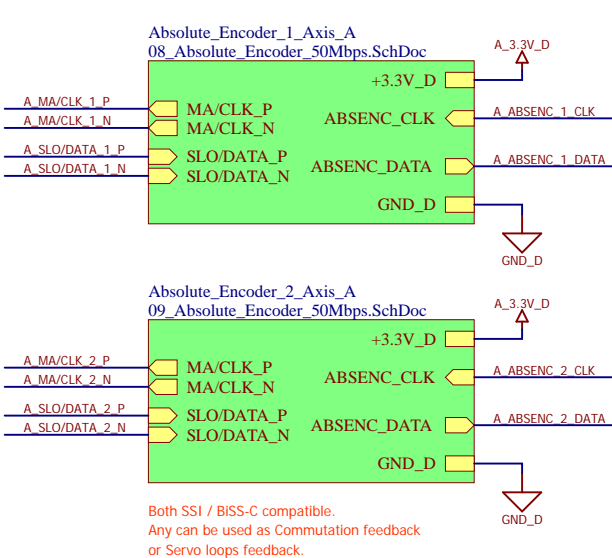
EtherCAT IN



Brake Axis A

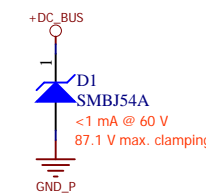


Absolute Encoders Axis A

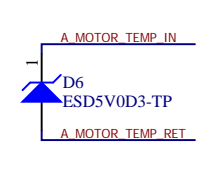


ESD Protections Axis A

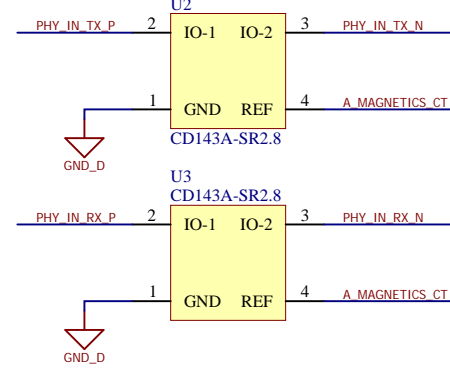
DC Bus



Motor A Temp.



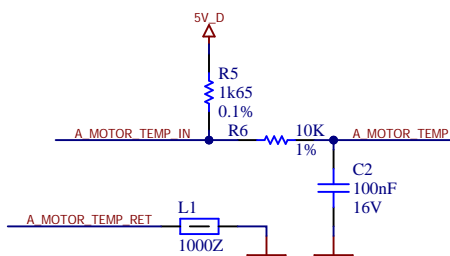
Ethernet



Other

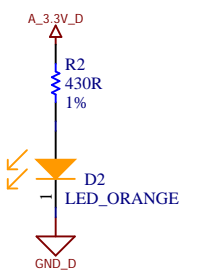
The ESD protection embedded in the RS485 transceiver is sufficient for the Feedback inputs. The ESD protection of the STO inputs is included in the module sheet. Due to the avalanche properties of the Silicon MOSFet, the ESD protection is typically not required in the Brake output, specially if the brake is supplied from the DC bus.

Motor Temp Axis A

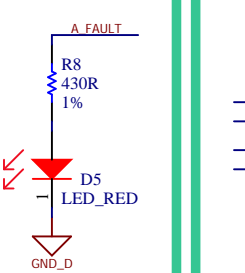


LEDs Axis A

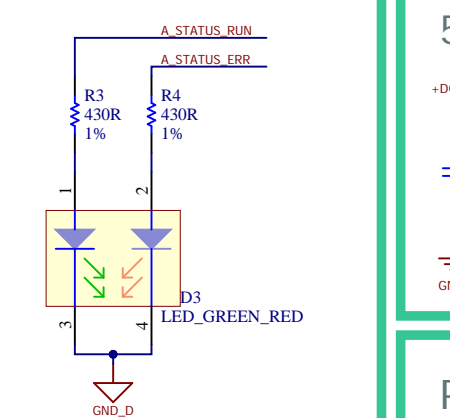
Supply



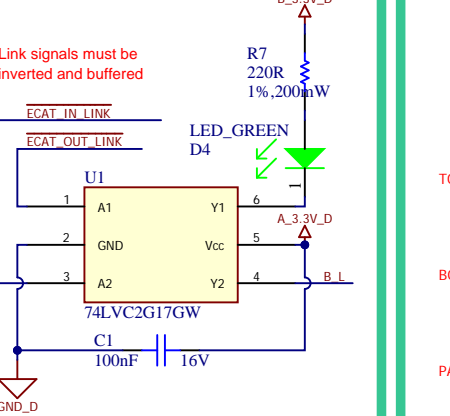
Fault



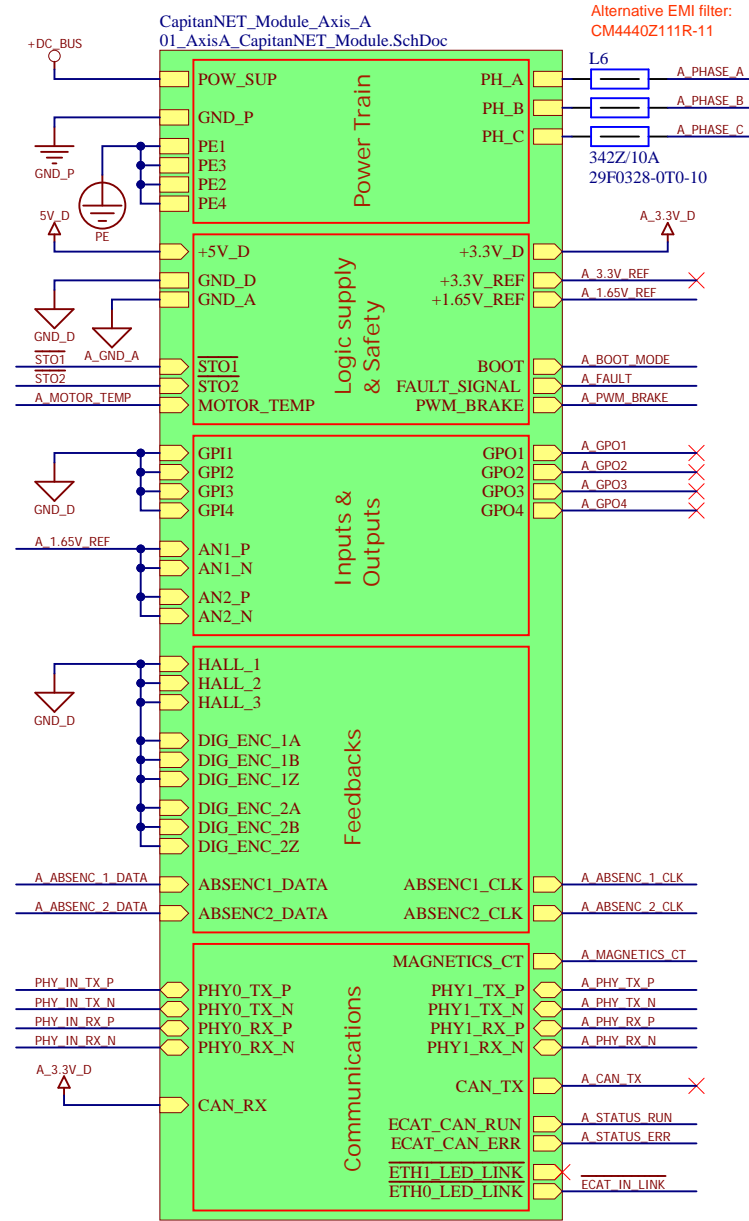
ECAT Status



ECAT Link LED



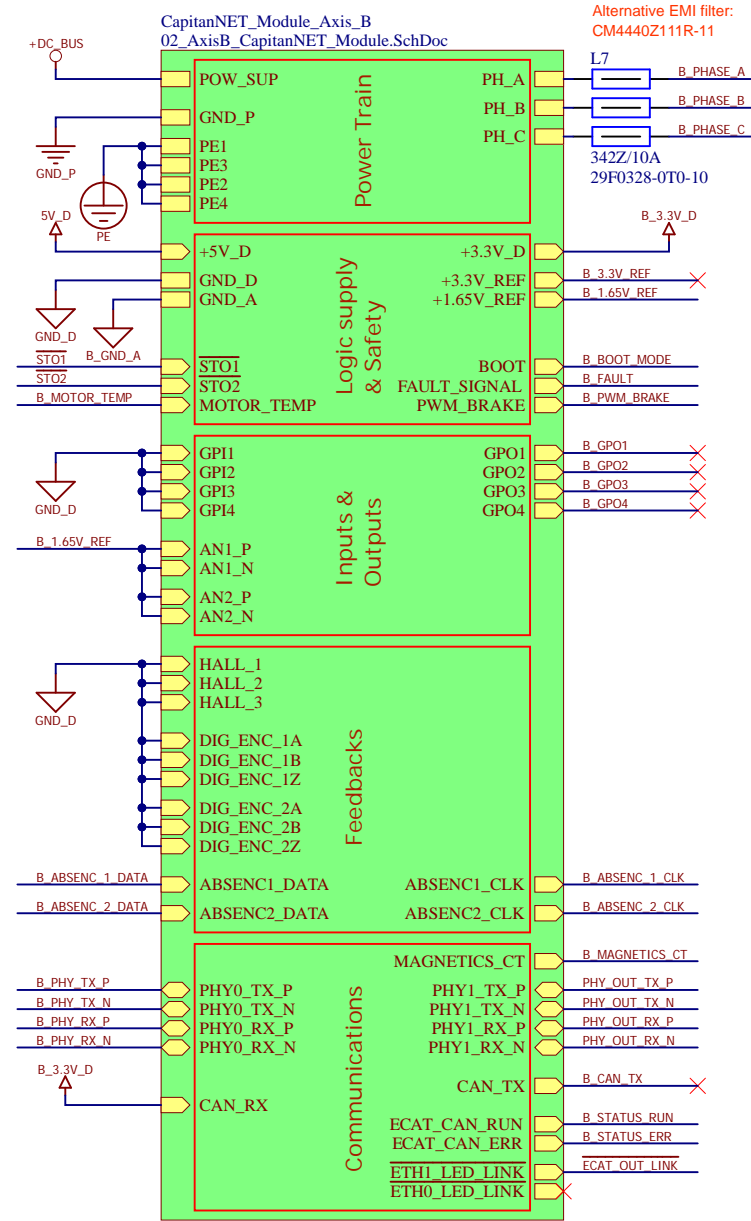
Capitan NET Axis A



Boot Mode



Capitan NET Axis B

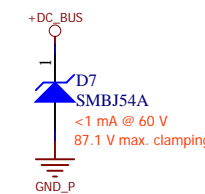


Boot Mode

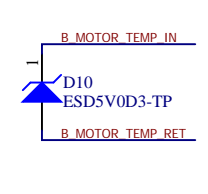


ESD Protections Axis B

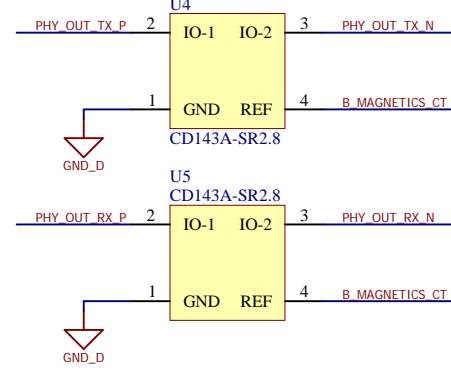
DC Bus



Motor B Temp.



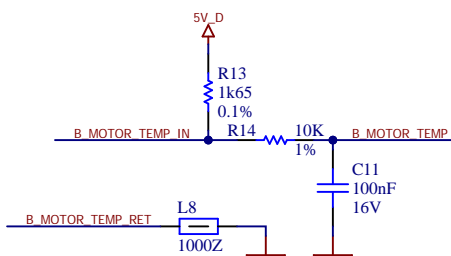
Ethernet



Other

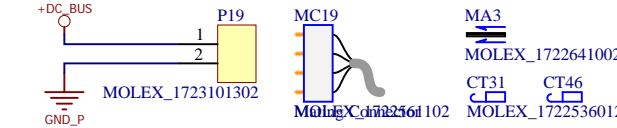
The ESD protection embedded in the RS485 transceiver is sufficient for the Feedback inputs. The ESD protection of the STO inputs is included in the module sheet. Due to the avalanche properties of the Silicon MOSFet, the ESD protection is typically not required in the Brake output, specially if the brake is supplied from the DC bus.

Motor Temp Axis B

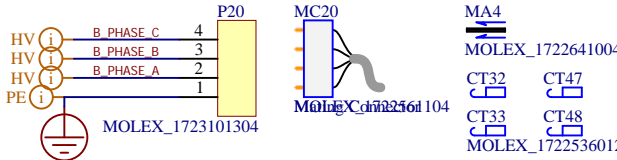


Connectors Axis B

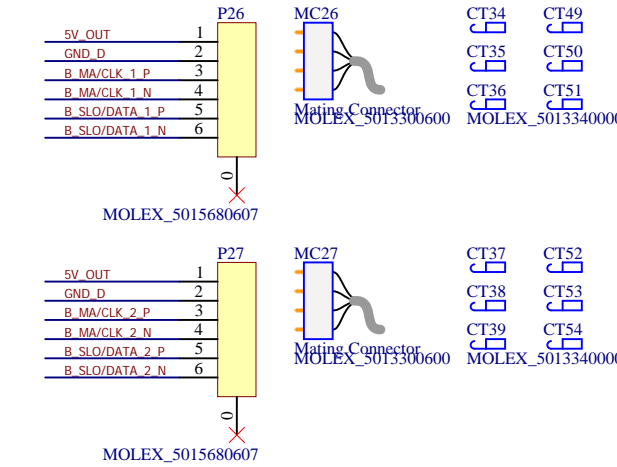
Supply OUT



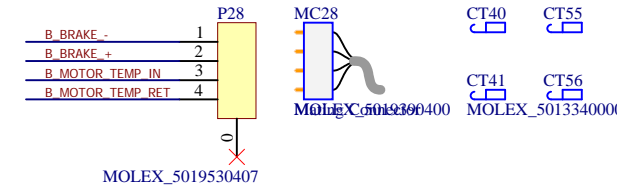
Motor B phases



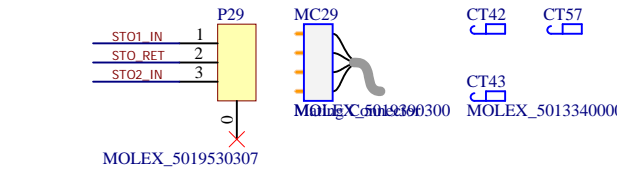
Motor B Absolute Encoders



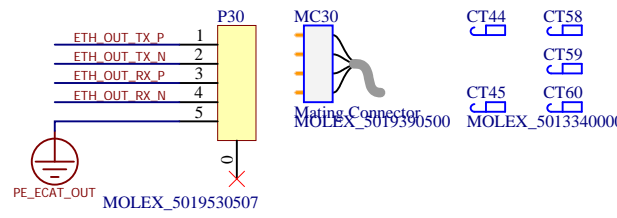
Motor B Brake & Temperature



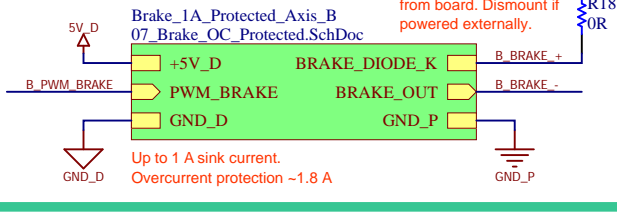
STO OUT



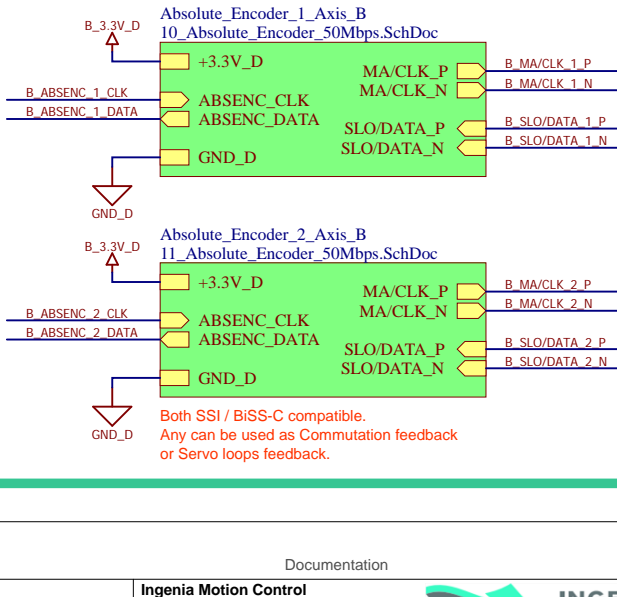
EtherCAT OUT



Brake Axis B



Absolute Encoders Axis A



Layers Legend

Ingenia Logo

ORIGIN

Title Top.SchDoc

Project i058A-H1.PrjPCB

Variant BASIC

Revision i058A-H1-1.0.0

Version Not in version control Date:16/04/2024

Documentation

Ingenia Motion Control

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08018 Barcelona Spain

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