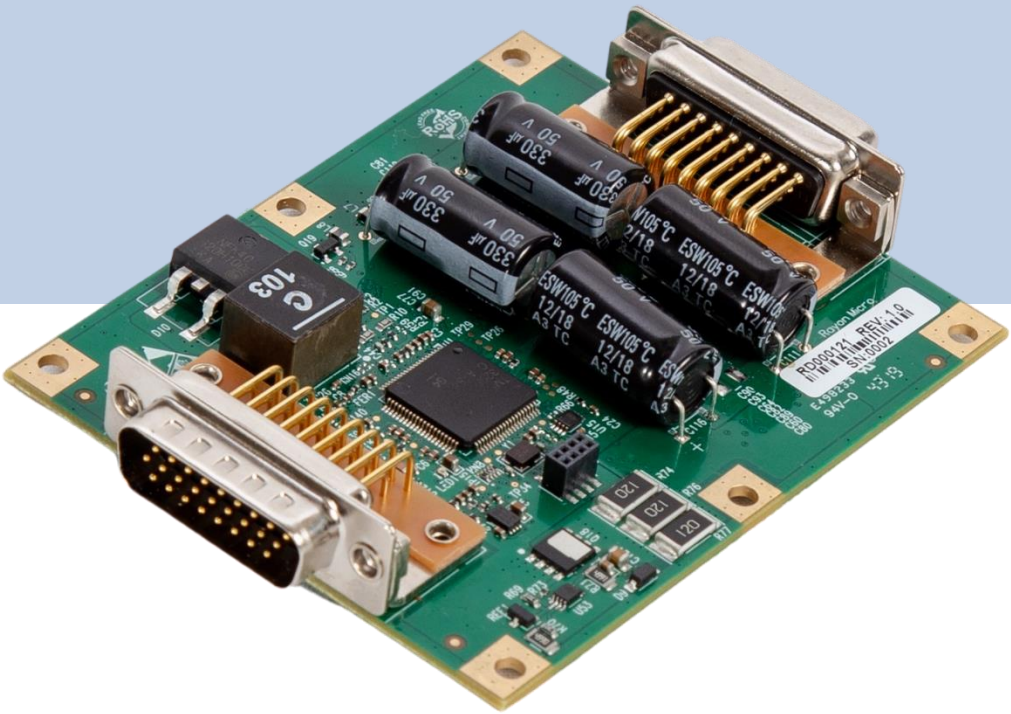
REDLER Technologies	Document Title:	DSH - Datasheet
	Document PN & Revision:	RRDSH000012 Rev: 1.3
	Project Name	Rayon Single Board
	Catalog number	RD000121, RD000181



RAYON Single Board

Board Level, High power
20A motor controller driver

DATASHEET

REDLER Technologies

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Disclaimer
This documentation was accurate and reliable at the time of its release. The manufacturer may revise product specifications and/or this document at any time without specifications of the product described in this manual without notification.

Product warranty
The Single Board warranty is valid for 12 months from the date of shipment, unless otherwise specified. The warranty will be invalidated if the customer fails to install, operate or maintain the product in accordance with the manufacturer's instructions.

Safety

To safely operate the Single Board, the manufacturer's safety guidelines must be strictly followed. These guidelines serve to keep your work area safe when operating the Rayon 70A and accompanying equipment.

WARNING
Before assembling and commissioning the drive, read all product documentation.
Be sure to comply with all installation instructions and requirements. Improper handling of products can cause personal injury and equipment damage.
The manufacturer takes no responsibility for any injury or damage caused by incorrect handling or use.

- Only qualified personnel are permitted to install, commission, and maintain this drive. A qualified person has the knowledge and permission to perform tasks such as transport, assembly, installation, and maintenance.
- Be sure all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth ground connection.
- During operation the drive has electrically charged components and hot surfaces. Power cables can carry a high voltage even when the motor is not moving. To avoid the risk of personal injury or equipment damage, keep covers (of encased drives) closed during and after operation according to safety guidelines. After disconnecting the power source from the drive, wait at least 30 seconds before touching the drive.
- To avoid electric arcing and hazards to personnel and electric contacts, never disconnect or connect the product while the power source is energized.
- To prevent electrostatic damage, avoid contact with highly insulating materials, such as plastic and synthetic materials. Place the drive on a conductive surface and ground yourself to discharge any potential build-up of static electricity.

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Document Control

Revision #	Release Date	Change Description	Author	Approved by
1.0	26/04/2020	Release	Ofer Keren	Michal Munster
1.1	18/07/2021	Update	Ofer Keren	Michal Munster

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Drive Features

The Rayon Single Board is a motor controller driver who is capable of powering up to 960 watts motors,
And support applications such as position, speed, and torque.
Full digital control enables fast response and high bandwidth of current and position control loops and enables easy implementation in servo applications.
A dedicated GUI provides automatic control loop parameters for fast application setup, load/read parameters, and a high-speed, Realtime graph monitor.

Key features

- Miniature module, high power density
- Powers motors up to 960W.
- 12–48 VDC recommended operating voltage
- 20A RMS continuous current – with appropriate heat sink plate
- Sinusoidal, flux-oriented current IQ ID vector control
- Motor calibration wizard
- Motor feedback: Hall, incremental, SSI, sin/cos absolute/incremental encoder
- PID closed loop modes: position, speed, current, stepper.
- Autotuning and manual tuning for PID
- Dedicated GUI, load/save parameters with real-time signal scope.
- Communication: CAN bus and RS232 (RD000121), RS422(RD000181)
- Firmware upgrade via serial communication
- 4 digital inputs, 2 digital outputs
- Regeneration protection – 10 Joule/10msec
- Additional digital input or analog ±10V command
- High current, low Rds(on), 100V power MOSFET transistors
- Protection: over-temperature, over-voltage, over-current, encoder fault, motor stall, Etc.
- Operating temperature -40°C to +85°C, can be extended upon request to -55°c.

Motors

- Brushed motors
- Brushless motors with Hall – six step commutation
- Brushless motors with Hall and incremental encoder – sinusoidal commutation
- Brushless motors with absolute SSI encoder – sinusoidal commutation

Current control

- Fully digital, closed loop PI at 20 kHz
- 20kHz PWM

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- Sinusoidal commutation with vector control (PID) or trapezoidal commutation with encoder and/or digital Hall sensors
- 20 kHz sample rate, 12-bit current loop resolution
- DC bus power supply compensation
- Autotuning

Speed control

- Closed loop PID at 4 kHz.
- Programmable PID
- Feed forward
- Control filters
- Gain scheduling
- Autotuning

Position control

- Closed loop PID at 2 kHz.
- Programmable notch and low-pass filters
- External position feedback loop

Communication

Two communication options:

- RS232 serial communication with CAN, for fast communication in a multi-axis distributed environment.
- RS422 serial communication

Feedback

- Incremental encoder – up to 1 MHz counts per second (250 kHz channel input), differential or single-ended encoder inputs.
- Digital Hall sensors – up to 12 kHz counts per second (2 kHz channel inputs)
- Absolute analog (sine/cosine) – up to 12 bits.
- Interpolated analog (sine/cosine) encoder – up to 250 kHz (analog signal)
  - Internal interpolation – up to 12 bits

Signals offset calibration

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Specifications

Absolute Max

Parameter	Description	Units	Min	Typ	Max
Motor voltage		V	12	24-48	53
Motor current	Sinusoidal	A	1	30	35
Motor current RMS		A	1	20	25
5V output	Current for encoder and Hall sensors	mA	0		220
Logic voltage	Must be connected to Motor voltage	V	15	24	53
Digital input		V	-0.5		5.5
Analog input	1 channel	V	-10		10
Operating temperature		°C	-40		85
Storage temperature		°C	-65		150

Electrical

Parameter	Description	Units	Min	Typ	Max
Motor voltage	Recommended working range	V	12	24	48
Input capacitance		µF		10	
External capacitance	Additional capacitance required per motor ampere	µF/A	2.0	5	
Quiescent current	Logic consumption @12V	mA			
	Logic consumption @24V	mA			
	Logic consumption @48V	mA			
Motor current	No cooling @50°C ambient	A	0		25
	With heat sink @50°C ambient	A	0		35
5V output	Current for encoder and Hall sensors	mA			200
Serial communication	Baud rate	Kbit/sec	9.6	230.4	921.6
	Packet rate	mSec	0.5		
CAN	Baud rate	kHz	50		1000
	Packet rate	mSec	1		
Analog input	Input voltage range	V	-10		10
Inputs	4 Inputs	V	0		3.3

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Parameter	Description	Units	Min	Typ	Max
Outputs	2 Outputs	mA			50
Digital inputs VIH	High-level input voltage	V	2.4		3.3
Digital inputs VIL	Low-level input voltage	V	0		1.5
PWM frequency		kHz	10	20	60
Current loop	Closed loop frequency	kHz		20	
Speed loop	Closed loop frequency	kHz		4	
Position loop	Closed loop frequency	kHz		2	
Current sensors	Sample frequency	kHz		20	
Motion feedback	Sample frequency	kHz		20	
I/Os	Sample frequency	kHz		0.1	
Power up	Power to communication	sec			0.75
DSP clock		MHz		60	
Crystal	20 MHz accuracy	ppm	-50		+50
	Power to motor command	sec			1
	Packet response	µsec		25	100
	Packet period from master	msec	0.5		

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Motor feedback

Parameter	Description	Units	Min	Typ	Max
Incremental	Resolution	bit	2		30
	Max input frequency	kHz		250	
Sin/cos incremental	Resolution	bit	2		30
	Input frequency	kHz		250	
Hall	Resolution in electrical turn, 60 degrees and 120 degrees	steps		6	
	Max input frequency	kHz		20	
Hall LPF	RC filter and debounce	kHz		72	
SSI	Resolution	bit	4		30
	Baud rate	Mbit	0.5	2	4
	Packet period	µsec	50		500
Encoder input V_{IH}	High-differential level input voltage	V		0.2	
Encoder input V_{IL}	Low-differential level input voltage	V		-0.2	
Encoder termination	Between positive and negative terminals	Ω		150	
Hall input H	High-level input voltage	V	2		
Hall input L	Low-level input voltage	V	0		0.8

Mechanical

Parameter	Description	Units	Min	Typ	Max
Dimensions	97 X 70 X 17 ±0.3mm	mm			
Weight		gram		330	
Connector type	NorComp 181-M26-213R141 NorComp 181-M26-113R141				
Mating connector	Ask on purchase				
Thermal pads	Pads between MOSFET and heatsink	mm		0.5	

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Environment

Parameter	Description	Units	Min	Typ	Max
Operating temperature	For derating table, contact Redler	°C	-40		85
Storage temperature		°C	-65		150
Vibration	Contact Redler				
EMC	Contact Redler				
ESS	Contact Redler				
Altitude	Contact Redler				

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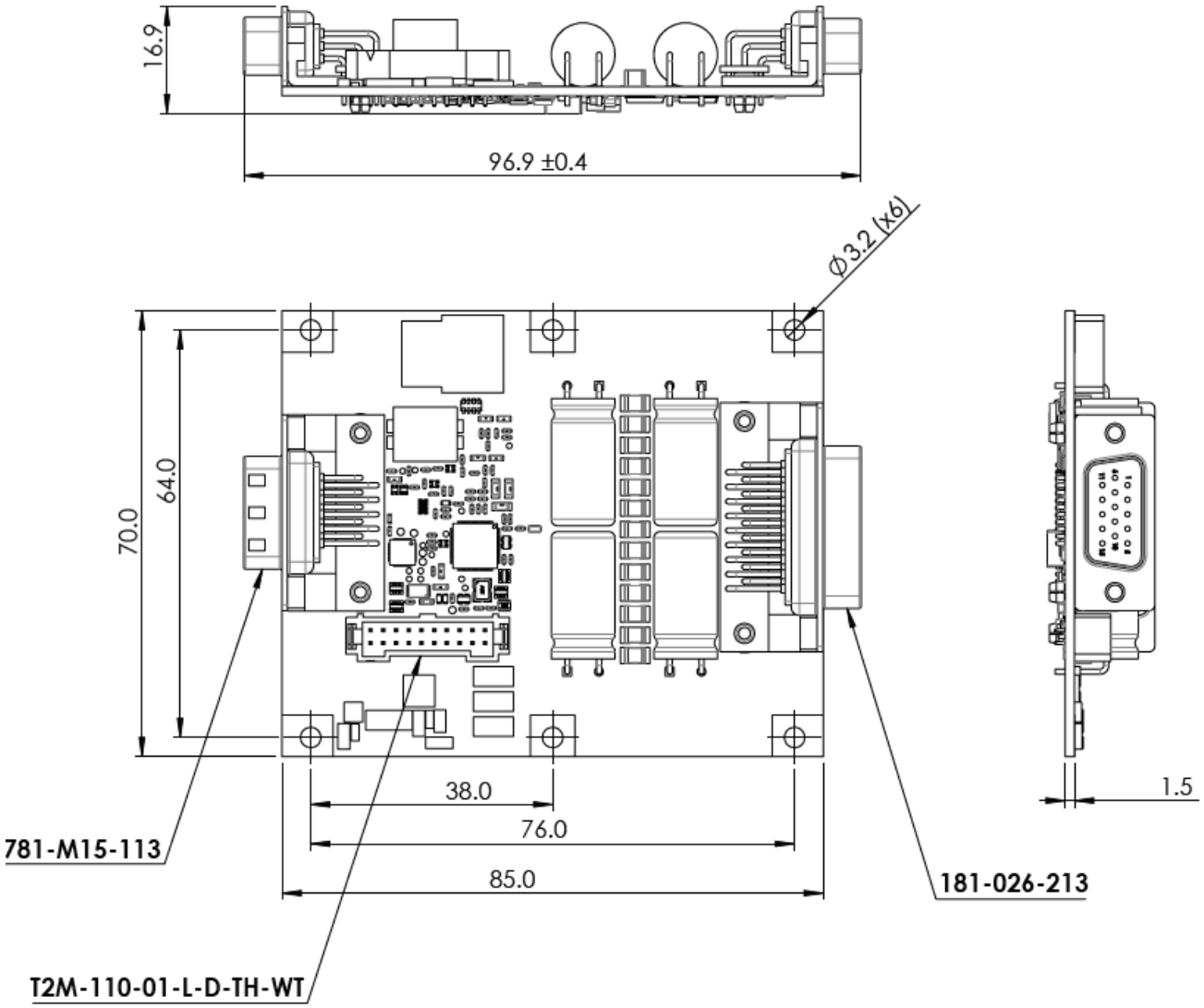
Dimension



Dimensions - RD000121/RD000181

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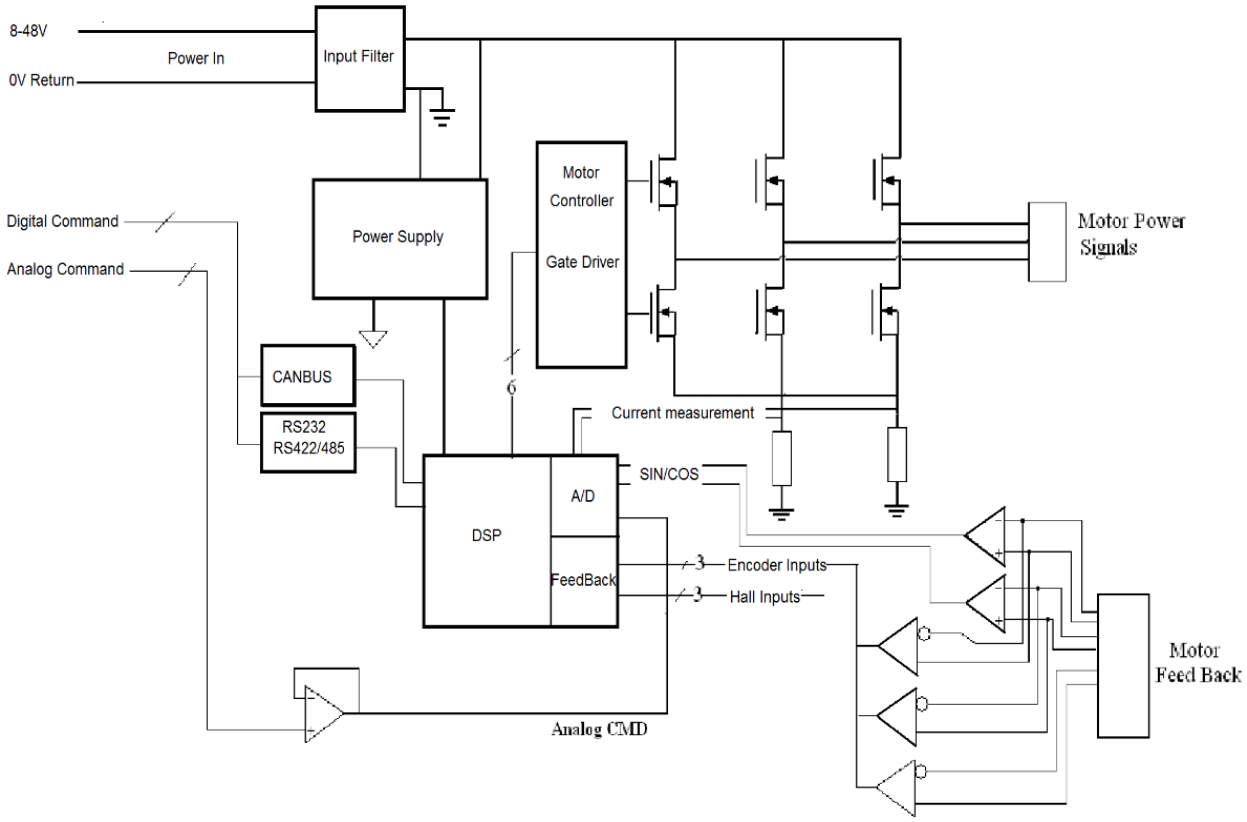
Wiring

System architecture



System architecture

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Communication

- J1 Connector type: NorComp 181-M26-113R141, 26 Position D-Sub, 5A Per pin, Male Pins

J1 Pin #	Signal Name	Signal Description
1	CAN_L /RS422 TXn	Communication
2	BiSS_CLK	SSI Encoder - Clock
3	BiSS_Datan	SSI Encoder - Datan
4	Ai_P	Analog input -positive
5	IN1	Digital input - num 1
6	STO1n	
7	VCC	
8	GND	
9	GND	
10	CAN_H/RS422_TX	Communication
11	RS232_TX / RS422_RXn	Communication
12	BiSS_Data	SSI Encoder-data
13	Ai_N	Analog input -negative
14	OC2	Open collector -num 2
15	IN3	Digital input -num 3
16	VCC	
17	VCC	
18	GND	
19	RS232_RX/RS422_RX	Communication
20	BiSS_CLKn	SSI Encoder-clock n
21	VCC_OUT_5V	5V
22	OC1	Open collector -num 1
23	IN2	Digital input
24	Control_Voltage	Do not connect Internally connected to Motor Voltage
25	VCC	
26	GND	

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Power

- J2 Connector type: NorComp 181-M26-113R141, 26 Position D-Sub, 5A Per pin, Female Pins

J2 Pin #	Signal Name	Signal Description
1	Motor Phase A	
2	Motor Phase B	
3	Motor Phase B	
4	ENC1_CLK_An	Incremental Encoder A-
5	Hall_GND	
6	H3	Hall 3
7	ENC1_CLK_B	Incremental Encoder B+
8	Motor Phase C	
9	Motor Phase C	
10	Motor Phase A	
11	Motor Phase A	
12	Motor Phase B	
13	ENC1_CLK_A	Incremental Encoder A+
14	H1	Hall 1 (Open collector)
15	Encoder_GND	
16	ENC1_IDXn	Incremental Encoder Index-
17	VCC_OUT_5V	Supply voltage for Hall and encoder
18	Motor Phase C	
19	Motor Phase A	
20	Motor Phase B	
21	VCC_OUT_5V	Supply voltage for Hall and encoder
22	STO2	Emergency cut motor power (short to GND if not required)
23	ENC1_CLK_Bn	Incremental Encoder B-
24	ENC1_IDX	Incremental Encoder Index+
25	H2	Hall 2
26	Motor Phase C	

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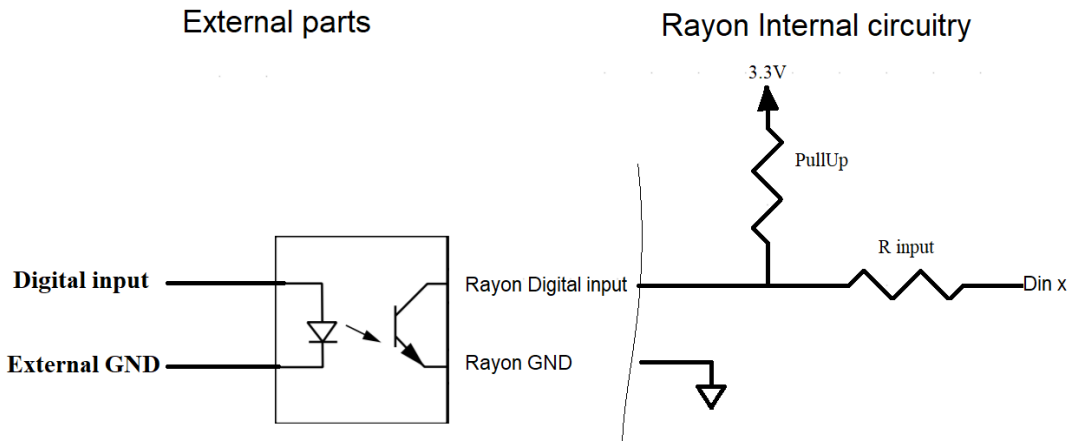
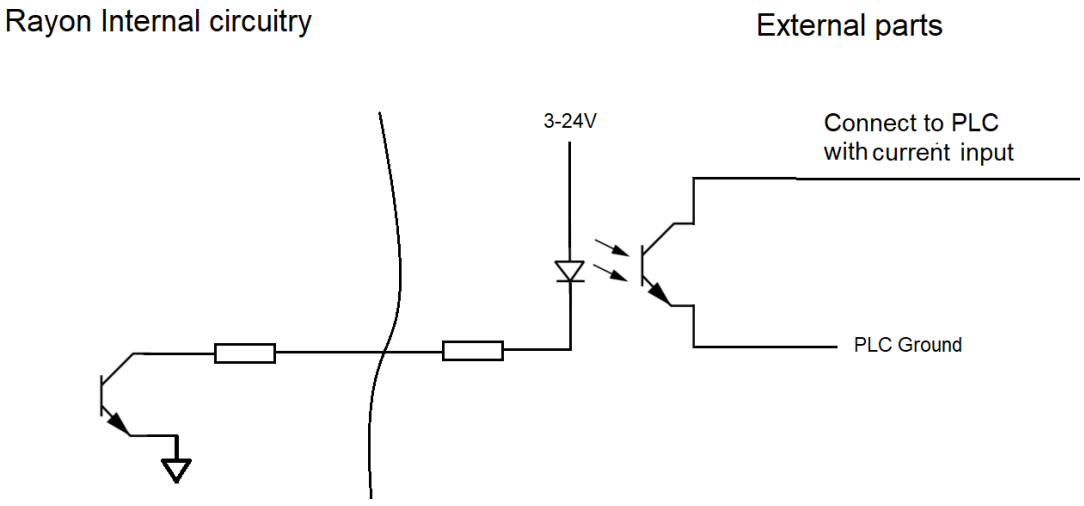
I/O Wiring



Digital input



Digital output

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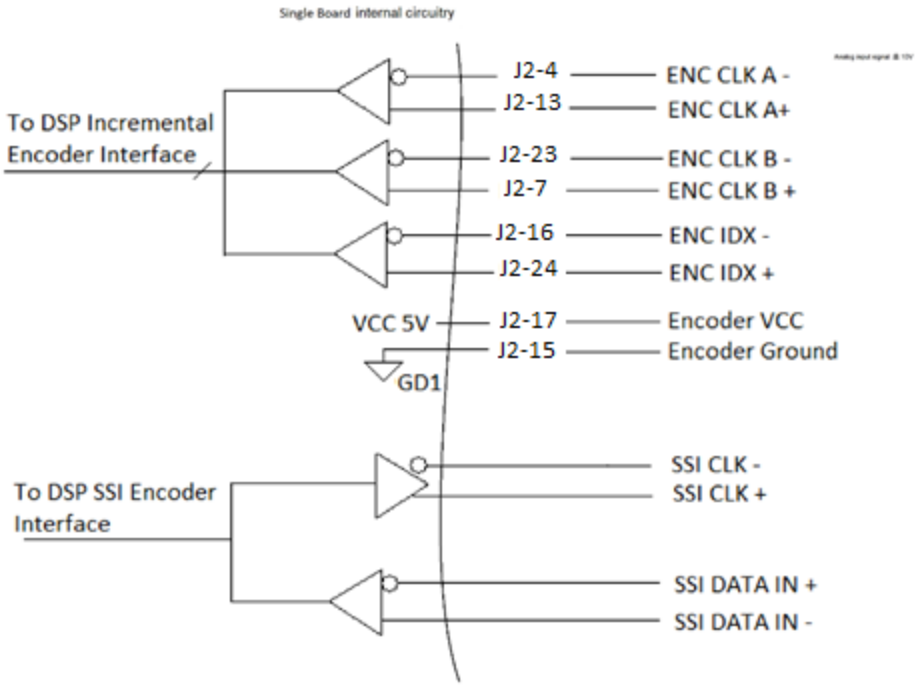
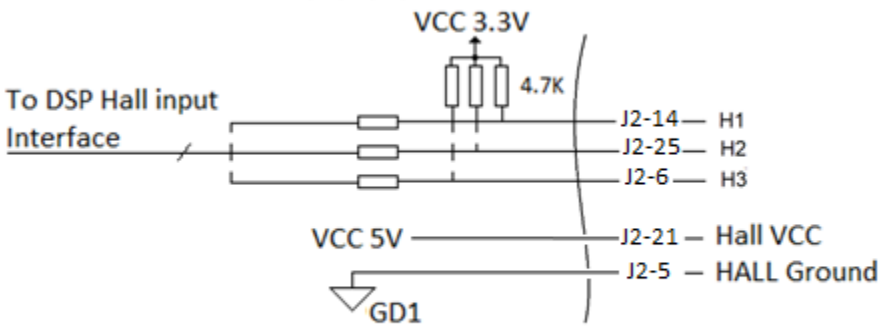


Use Incremental encoder or Digital encoder SSI interface



Hall effect device interface

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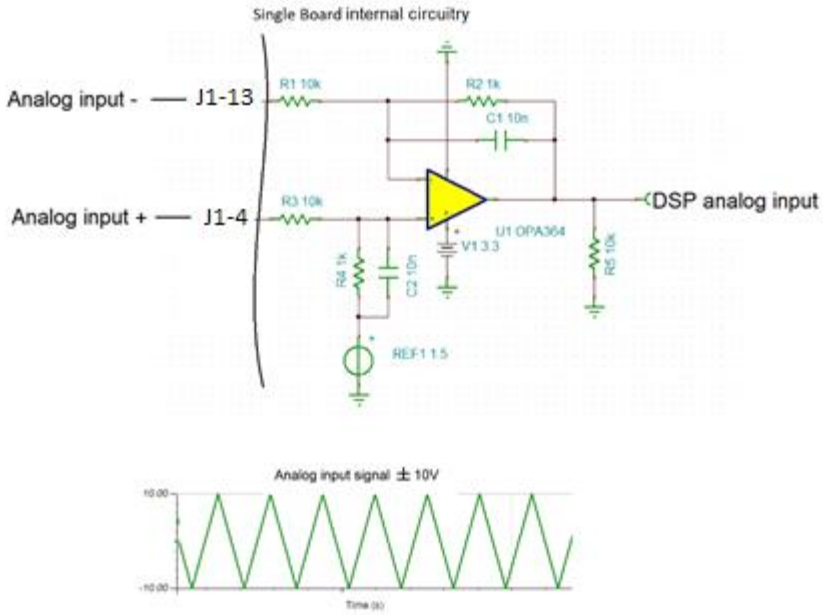
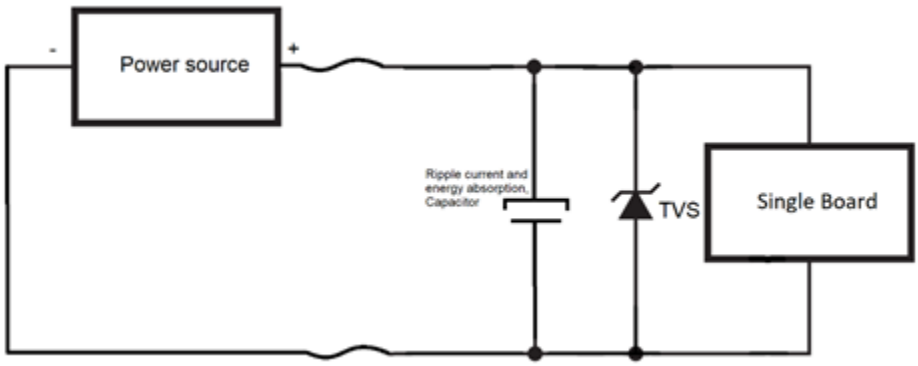


Analog command interface & wave form

For automotive ISO7637-2 protection, read Automotive Circuit Protection using Littelfuse Automotive TVS Diodes.

Place the TVS diode between the V Motor+ (J1-7,16,17,25) and V motor return (J1-8,9,18,26)



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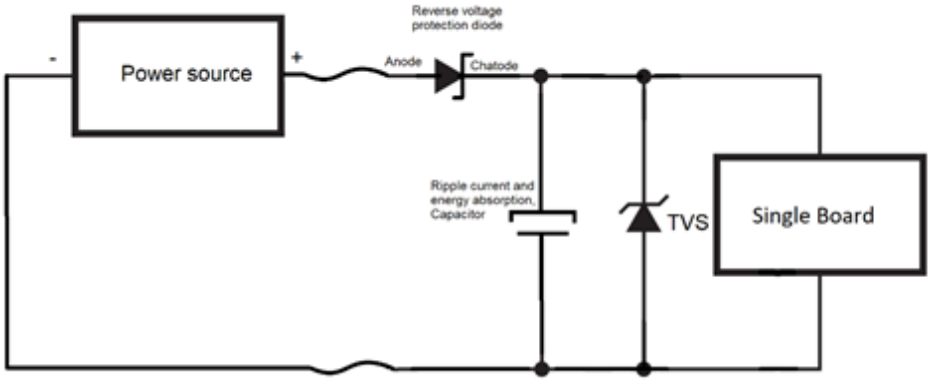
Reverse voltage - should be protected against negative voltage. The simplest protection is by connecting a diode with low Vf in series to the supply V Motor+. If the motor current drown by the driver is less than 5A, the diode is the best solution.
If the current is above 5A than a MOSFET transistor as ideal diode is needed.



- Example Vishay Schottky diode V8P8HM3_A/H display 0.5V drop @ 5ampere the power loss is:2.5Watt.

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