Digital Servo Motor Driver

SRVODRV-8012

Description

This digital servo drive is designed to drive brushed and brushless servomotors from a compact form factor ideal for embedded applications. This fully digital drive operates in torque, velocity, or position mode and employs Space Vector Modulation (SVM), which results in higher bus voltage utilization and reduced heat dissipation compared to traditional PWM. The command source can be generated internally or can be supplied externally. In addition to motor control, this drive features dedicated and programmable digital and analog inputs and outputs to enhance interfacing with external controllers and devices.

The drive features a RS-232 interface for drive configuration and setup as well as a RS-485 interface for drive networking.

All drive and motor parameters are stored in non-volatile memory.

Power Range

Peak Current	20 A (14.1 A_{RMS})
Continuous Current	12 A (8.5 A_{RMS})
Supply Voltage	10 - 80 VDC

Features

- Four Quadrant Regenerative Operation
- Space Vector Modulation (SVM) Technology
- Fully Digital State-of-the-art Design
- Programmable Gain Settings
- Fully Configurable Current, Voltage, Velocity and Position Limits
- PIDF Velocity Loop
- PID + FF Position Loop
- Compact Size, High Power Density
- 16-bit Analog to Digital Hardware

MODES OF OPERATION

- Current
- Hall Velocity
- Position
- Velocity

COMMAND SOURCE

- PWM and Direction
- Encoder Following
- Over the Network
- ±10 V Analog
- 5V Step and Direction

FEEDBACK SUPPORTED

- Halls
- Incremental Encoder
- ±10 VDC Position
- Auxiliary Incremental Encoder

INPUTS/OUTPUTS

- 2 High Speed Captures
- 1 Programmable Analog Input (12-bit Resolution)
- 2 Programmable Digital Inputs (Differential)
- 3 Programmable Digital Inputs (Single-Ended)
- 3 Programmable Digital Outputs (Single-Ended)

COMPLIANCES & AGENCY APPROVALS

- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS

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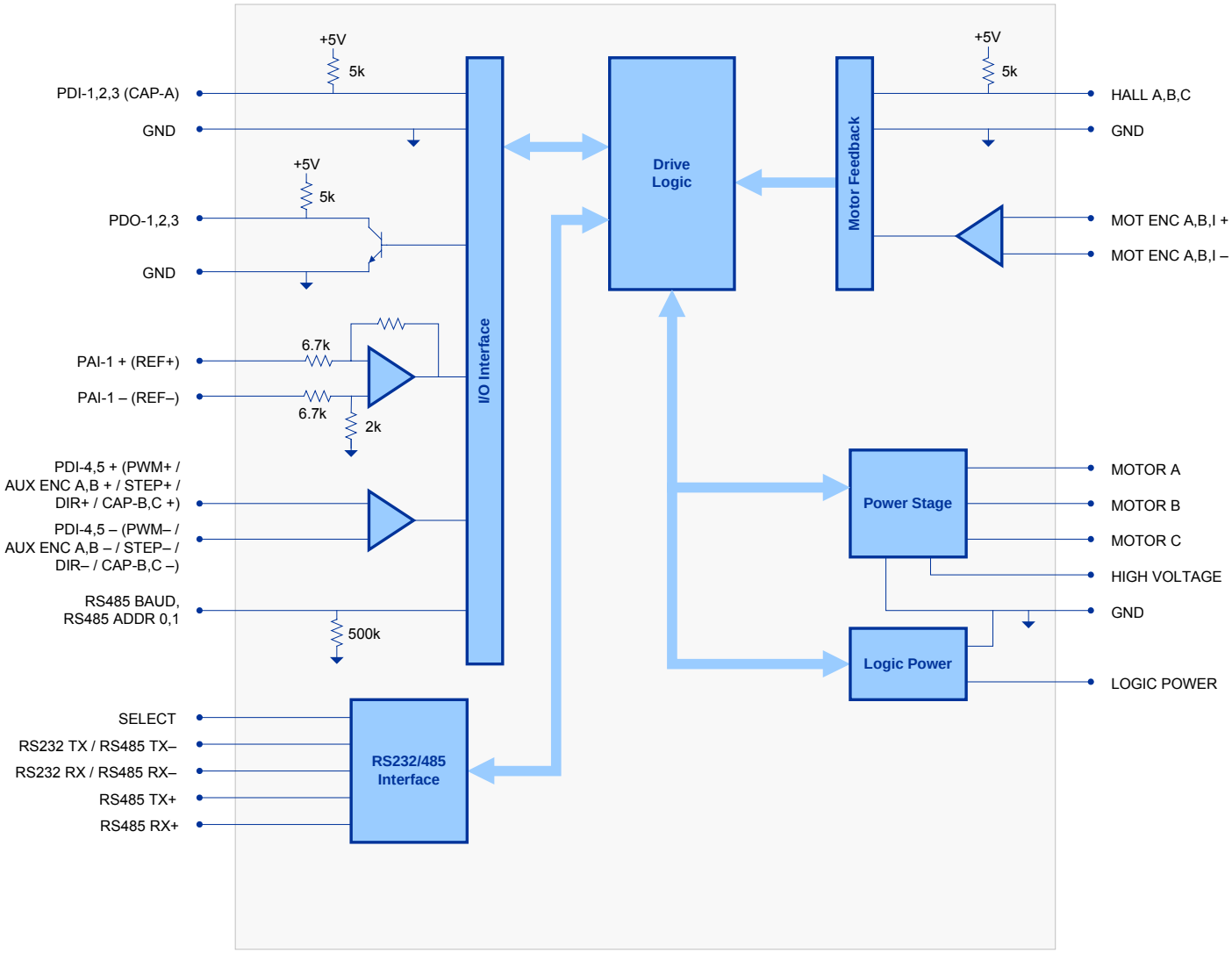
BLOCK DIAGRAM



Information on Approvals and Compliances	
RoHS COMPLIANCE	RoHS (Reduction of Hazardous Substances) is intended to prevent hazardous substances such as lead from being manufactured in electrical and electronic equipment.

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SPECIFICATIONS

Power Specifications		
Description	Units	Value
DC Bus Over Voltage Limit	VDC	86
DC Bus Under Voltage Limit	VDC	9
Logic Supply Voltage	VDC	5 (+/- 5%)
Maximum Peak Output Current	A (Arms)	20 (14.1)
Maximum Continuous Output Current	A (Arms)	12 (8.5)
Internal Bus Capacitance	µF	94
Minimum Load Inductance (Line-To-Line)[1]	µH	250
Switching Frequency	kHz	20
Maximum Output PWM Duty Cycle	%	85
Control Specifications		
Description	Units	Value
Communication Interfaces	-	RS-485/232
Command Sources	-	±10 V Analog, 5V Step and Direction, Encoder Following, Over the Network, PWM and Direction
Feedback Supported	-	±10 VDC Position, Auxiliary Incremental Encoder, Halls, Incremental Encoder
Commutation Methods	-	Sinusoidal, Trapezoidal
Modes of Operation	-	Current, Hall Velocity, Position, Velocity
Motors Supported	-	Closed Loop Vector, Single Phase (Brushed, Voice Coil, Inductive Load), Three Phase (Brushless)
Hardware Protection	-	40+ Configurable Functions, Over Current, Over Temperature (Drive & Motor), Over Voltage, Short Circuit (Phase-Phase & Phase-Ground), Under Voltage
Programmable Digital Inputs/Outputs (PDIs/PDOs)	-	5/3
Programmable Analog Inputs/Outputs (PAIs/PAOs)	-	1/0
Primary I/O Logic Level	-	5V TTL
Current Loop Sample Time	µs	50
Velocity Loop Sample Time	µs	100
Position Loop Sample Time	µs	100
Maximum Encoder Frequency	MHz	20 (5 pre-quadrature)
Mechanical Specifications		
Description	Units	Value
Agency Approvals	-	CE Class A (EMC), CE Class A (LVD), cUL, RoHS, UL
Size (H x W x D)	mm (in)	24.4 x 50.8 x 63.5 (1 x 2 x 2.5)
Weight	g (oz)	105 (3.7)
Heatsink (Base) Temperature Range[2]	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Cooling System	-	Natural Convection
Form Factor	-	PCB Mounted
P1 Connector	-	30-pin, 2.54 mm spaced, dual-row header
P2 Connector	-	24-pin, 2.54 mm spaced header

Notes

1. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
2. Additional cooling and/or heatsink may be required to achieve rated performance.

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PIN FUNCTIONS

P1 - Signal Connector			
Pin	Name	Description / Notes	I/O
1	RS485 ADDR 0	RS-485 Network Address Selector	I
2	RS485 ADDR 1		I
3	PAI-1 + (REF+)	Differential Programmable Analog Input or Reference Signal Input (12-bit Resolution)	I
4	PAI-1 - (REF-)		I
5	GND	Ground	GND
6	RS485 BAUD	RS-485 Baud Rate Selector	I
7	PDO-1	Programmable Digital Output	O
8	PDO-2	Programmable Digital Output	O
9	PDO-3	Programmable Digital Output	O
10	PDI-1	Programmable Digital Input	I
11	PDI-2	Programmable Digital Input	I
12	PDI-3 (CAP-A)	Programmable Digital Input or High Speed Capture	I
13	RS232 RX / RS485 RX-	Receive Line (RS-232 or RS-485)	I
14	RS485 RX+	Receive Line (RS-485)	I
15	RS232 TX / RS485 TX-	Transmit Line (RS-232 or RS-485)	O
16	RS485 TX+	Transmit Line (RS-485)	O
17	PDI-4 + (PWM+ / STEP+ / AUX ENC A+ / CAP-B+)	Programmable Digital Input or PWM or Step+ or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open)	I
18	PDI-4 - (PWM- / STEP- / AUX ENC A- / CAP-B-)		I
19	PDI-5 + (DIR+ / AUX ENC B+ / CAP-C+)	Programmable Digital Input or Direction or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open)	I
20	PDI-5 - (DIR- / AUX ENC B- / CAP-C-)		I
21	GND	Ground	GND
22	HALL A	Single-ended Commutation Sensor Input (For Differential Inputs See MC1XZDCR Datasheet For Recommended Signal Conditioning)	I
23	HALL B		I
24	HALL C		I
25	MOT ENC I+	Differential Encoder Index Input (See MC1XDZ Datasheet For Recommended Signal Conditioning)	I
26	MOT ENC I-		I
27	MOT ENC A+	Differential Encoder A Channel Input (See MC1XDZ Datasheet For Recommended Signal Conditioning)	I
28	MOT ENC A-		I
29	MOT ENC B+	Differential Encoder B Channel Input (See MC1XDZ Datasheet For Recommended Signal Conditioning)	I
30	MOT ENC B-		I

P2 - Power Connector				
Pin		Name	Description / Notes	I/O
1a		LOGIC PWR	Logic Supply Input	I
	1b	RESERVED	Reserved	-
2a	2b	GND	Ground	GND
3a	3b	GND		GND
4a	4b	HIGH VOLTAGE	DC Power Input. 3A Continuous Current Rating Per Pin.	I
5a	5b	HIGH VOLTAGE		I
6a	6b	RESERVED	Reserved	-
7a	7b	MOTOR C	Motor Phase C. 3A Continuous Current Rating Per Pin.	O
8a	8b	MOTOR C		O
9a	9b	MOTOR B	Motor Phase B. 3A Continuous Current Rating Per Pin.	O
10a	10b	MOTOR B		O
11a	11b	MOTOR A	Motor Phase A. 3A Continuous Current Rating Per Pin.	O
12a	12b	MOTOR A		O

Pin Details

RS485 ADDR 0 (P1-1)

This pin, RS485 ADDR 0, as well as RS485 ADDR 1, are used for RS-485 network addressing. To set the address of a drive, use the formula

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$$RS485Address = \frac{7 * Addr0}{3} + 8 * \frac{7 * Addr1}{3},$$

where *RS485Address* is the desired node address and *Addr0* and *Addr1* represent the voltage that should be applied to pins RS485 ADDR 0 and RS485 ADDR 1, respectively. The values for *Addr0* and *Addr1* are always integer multiples of 3/7 V within the range 0-3 V. Examples of the voltages required to set certain node addresses are given in the table below. Note that setting a drive address of 0 will utilize the address stored in non-volatile memory.

RS485 ADDR 0 Value (V)	RS485 ADDR 1 Value (V)	RS485 ADDR Tolerance (V)	RS485 Address (Address #)
0	0	±0.1	Address stored in non-volatile memory
3/7 (0.43)	0	±0.1	1
6/7 (0.86)	0	±0.1	2
9/7 (1.3)	0	±0.1	3
…	…	±0.1	…
18/7 (2.57)	21/7 (3.0)	±0.1	62
21/7 (3.0)	21/7 (3.0)	±0.1	63

RS485 BAUD (P1-6)

The RS-485 baud rate is set by applying the appropriate voltage to the RS485 BAUD pin as given in the table below.

RS485 BAUD Value (V)	RS485 BAUD Tolerance (V)	RS485 Baud Rate (bits/s)
0	±0.388	Bit rate stored in non-volatile memory
1	±0.388	9.6k
2	±0.388	38.4k
3	±0.388	115.2k

HARDWARE SETTINGS

Jumper Settings

Jumper	Description	Configuration		
	Header Jumper	Not Installed	Pins 1-2	Pins 2-3
J1	Reserved.	-	-	N/A
J2	Reserved.	-	-	N/A
J3	RS-485 selection. Install this jumper to select RS-485 communication. This jumper is located on a 6-pin header between the PCB and heatsink. It consists of the two pins closest to the corner of the PCB.	RS-232	RS-485	N/A

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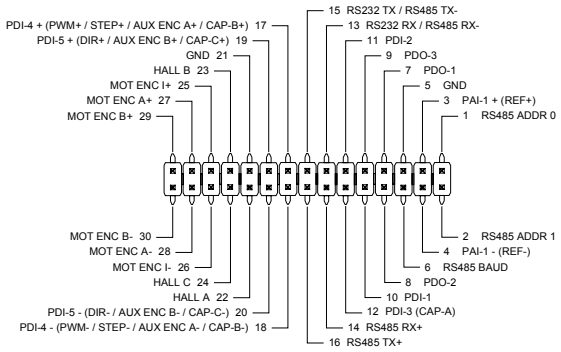
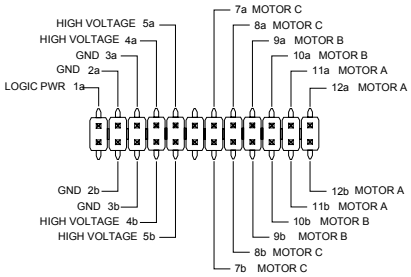
MECHANICAL INFORMATION

P1 - Signal Connector		
Connector Information		30-pin, 2.54 mm spaced, dual-row header
Mating Connector	Details	Samtec: SSM-115-L-DV
	Included with Drive	No



P2 - Power Connector		
Connector Information		24-pin, 2.54 mm spaced header
Mating Connector	Details	Samtec: BCS-112-L-D-PE
	Included with Drive	No



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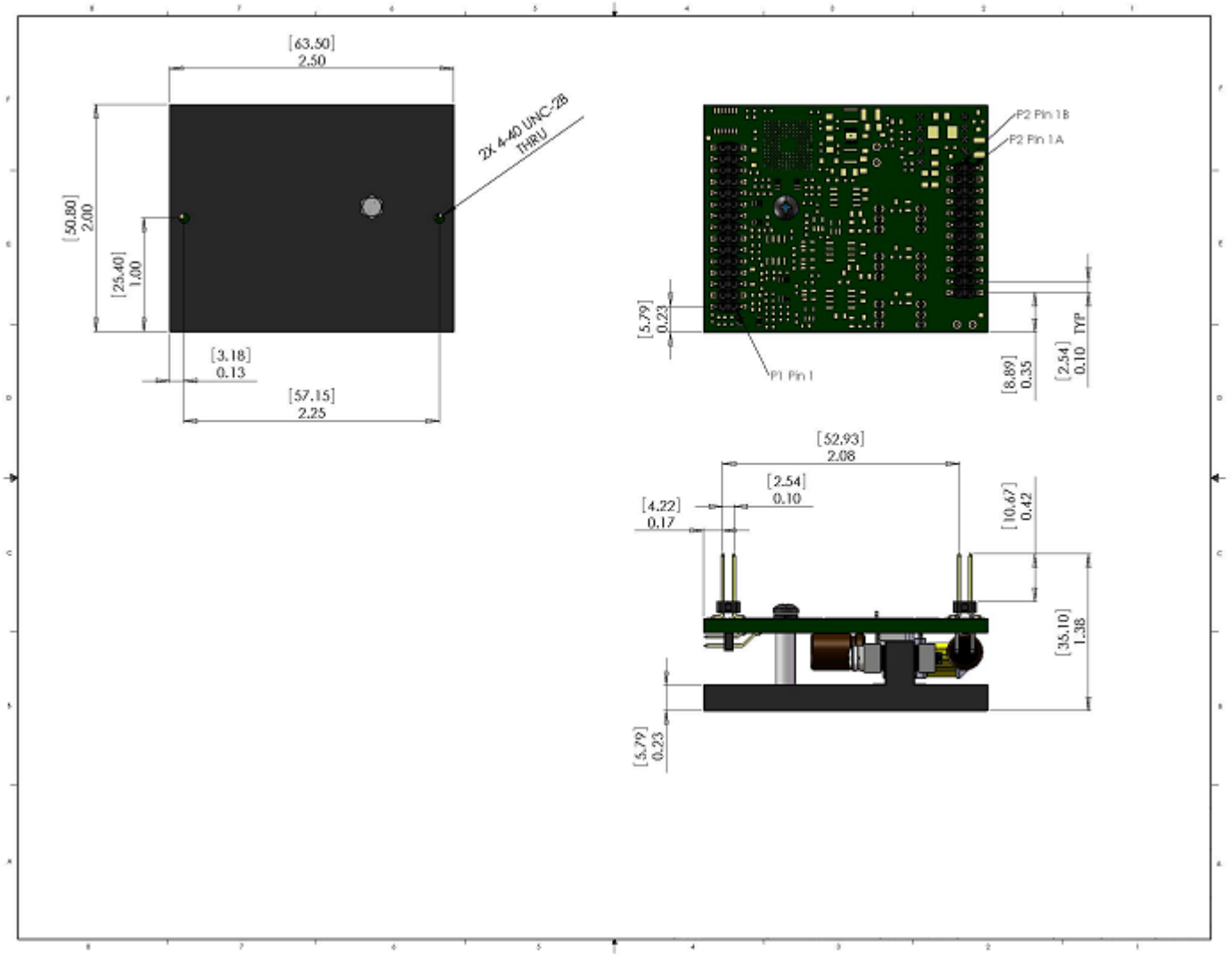
MOUNTING DIMENSIONS



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