

MOTION 2350 Pro

An Advanced Robotics Controller for Beginners



Datasheet

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1. BOARD LAYOUT & FUNCTION



Figure 1: MOTION 2350 Pro Board Functions

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Function	Description			
Power Input	Terminal for external 3.6V - 16V DC power input. Can be powered up with external LiPo or 4x AA batteries.			
On/Off Switch	Turn On/Off the power.			
Ext. On/Off Switch	Header for external On/Off switch. The onboard switch must be in Off position to use the external switch.			
	Power output for external servos. Controlled by an automatic voltage selector, the output of 5V supply depends on the input from the VIN.			
5V Supply	VIN	5V Supply output		
	VIN > 5.8V	It will step down the VIN voltage to 5V.		
	VIN < 5.5V	It will follow the VIN voltage.		

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USB-C	Used for upload programs from PC. Used to power up the board.							
GPIO/Servo Status LEDs	LED indicator for digital IO. Turn on when the IO state is high.							
	Arranged in color-coded GVS format. With 3.3V power output for each GPIO.							
	GPIO	PWM	SPI	I2C	UART	Analog		
	16	PWM0-A	SPI0 SDI	I2C0 SDA	UART0 TX	-		
	17	PWM0-B	SPI0 CSn	I2C0 SCL	UARTO RX	-		
GPIOs Breakout	18	PWM1-A	SPI0 SCK	I2C1 SDA	UART0 CTS	-		
	19	PWM1-B	SPI0 SDO	I2C1 SCL	UARTO RTS	-		
	26	PWM5-A	SPI1 SCK	I2C1 SDA	UART1 CTS	ADC0		
	27	PWM5-B	SPI1 SDO	I2C1 SCL	UART1 RTS	ADC1		
	28	PWM6-A	SPI1 SDI	I2C0 SDA	UART0 TX	ADC2		
	29	PWM6-B	SPI1 CSn	I2C0 SCL	UARTO RX	ADC3		
Servo Ports	Connectors for 8 x RC servo motors. Signal is connected to GP0, GP1, GP2, GP3, GP4, GP5, GP6, and GP7. For 5V, please refer to the 5V Supply section.							
Maker Ports	JST-SH 4-Ways Connector for external modules. Compatible with Qwiic, STEMMA QT and Grove (Via Conversion Cable).							
	These pins are available on Maker Ports: GP16, GP17, GP26, GP27, GP28 and GP29.							
Motor Test Buttons	Press to test the functionality of the motor driver. Motor will run at full speed.							
Motor Terminals	Connect to the motor terminal. Motor voltage at full speed is equal to power source voltage. Motor direction is dependent on the polarity.							
Motor Status LEDs	Turn on when the motor is running.							
IICR Host	USB type A port for USB Host. The connected pins to USB data transmission on this port are:							
	U	SB Pins	0	PIO				
		D+	(GP24				
		D-	0	GP25				

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RGB LEDs	User programmable WS2812B RGB LEDs, NeoPixel compatible. Connected to GP23.		
Piezo Buzzer	Can be used to play tone or melody. Connected to GP22.		
Buzzer Mute Switch	Used to mute the piezo buzzer.		
Measure VIN Jumper	Solder this jumper to measure VIN on the GP29(ADC3). * Please be aware that the GPIO LED on GP29 will always turn on due to the high input from the VIN measurement.		

Table 1: MOTION 2350 Pro Board Functions

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2. PINOUT DIAGRAM

	Cytron)	
ADC3 PWM6 B UART0 RX 12C0 SCL SPI1 CSn GP29	Technologies	2250 000
ADC2 PWM6 A UARTO TX I2CO SDA SPI1 SDI GP28 MAKER		
3V3 PORT		
GND		GP27 SPI1 SDO I2C1 SCL UART1 RTS PWM5 B ADC1
	MAKER	GP26 SPITSCK IZCTSDA UARTITCTS PWM5A ADCO
PWM0 B UARTO IX I2C0 SDA SPI0 SDI GP17		GND
3V3 PORT		
GND	USB	D+ GP24 I2C0 SDA UART1 TX
	HOST	D- GP25 I2C0 SCL UART1 RX
SWCLK	응왕왕 · · · · · · · · · · · · · · · · · ·	
PWM0 B UARTO RX 12C0 SCL SPI0 CSn GP17	SERVO	GP1 SPI0 CSn I2C0 SCL UART0 RX PWM0 B
PWM1 A UARTO CTS I2C1 SDA SPIO SCK GP18	GP24 GP25 GP1 GP1	GP2 SPI0 SCK I2C1 SDA UART0 CTS PWM1 A
PWM1 B UARTO RTS I2C1 SCL SPI0 SDO GP19		GP3 SPI0 SDO I2C1 SCL UART0 RTS PWM1 B
ADC0 PWM5 A UART1 CTS 12C1 SDA SPI1 SCK GP26		GP4 SPI0 SDI I2C0 SDA UART0 TX PWM2 A
ADC1 PWM5 B UART1 RTS I2C1 SCL SPI1 SDO GP27		GP5 SPI0 CSn I2C0 SCL UART0 RX PWM2 B
ADC2 PWM6 A UARTO TX I2CO SDA SPI1 SDI GP28		GP6 SPI0 SCK I2C1 SDA UART0 CTS PWM3 A
ADC3 PWM6 B UART0 RX 12C0 SCL SPI1 CSn GP29		GP7 SPI0 SDO I2C1 SCL UART0 RTS PWM3 B
Legend : GPIO & PIO SPI 12C UART PWM6 A M3A GP12 PWM6 B M3B GP13 PWM7 A M4A GP14 PWM7 A M4A GP14 PWM7 B M4B GP15 Control of the second seco		GP9M1BPWM4 BGP8M1APWM4 AGP11M2BPWM5 BGP10M2APWM5 A
Max DC Motor Current: • 3A Continuous • 5A Peak GP8 - GP15 GP20 GP2	TON PIEZO BUZZER	Image: RGB LED Image: VIN sense VIN sense VIN = VADC / 6.1 (Solder the jumper to measure VIN) GP23 ADC3

Figure 2: MOTION 2350 Pro Pinout Diagram

3. SPECIFICATIONS

No	o Parameters			Max	Unit
1	Power Input Voltage (USB or VIN) *			16	V
	Digital Input Valtage	Low Level	-0.3	0.8	V
2	Digital input voltage	High Level	2.0	3.6	V
3 Digit	Divital Output Valtage	Low Level	0	0.5	V
	Digital Output Voltage	High Level	2.6	3.3	V
4	Analog Input Voltage			3.3	V
5	5 Vmotor (Only USB is connected)			B - 0.4	V
6	Vmotor (Only VIN is connected)		VIN		V
		VIN < VUSB	VUSB - 0.4		V
7	Vmotor (USB and VIN are connected)	VIN > VUSB and VIN - VUSB < 0.6	VIN - 0.4		V
		VIN - VUSB > 0.6	VIN		V
0	EV Output Valta and (Carrow Danta)	VIN > 5.8V	5		V
ð	8 5V Output Voltage (Servo Ports)	VIN < 5.5V	VIN		V
9	USB Host Output Voltage		-	5	V
10	USB Host Output Current		-	100	mA
11 Ma Ch	Maximum DC Motor Current each	Continuous	-	3	А
	Channel	Peak (< 5 seconds)	-	5	А
12	DC Motor Driver PWM Frequency		-	20	kHz
13	3 Total +3V3 Output Current (GPIO Breakout & Grove Ports)			200	mA
14	Total (TV Output Current (Course Douts)	VIN < 5.8V	-	3	А
		VIN > 5.8V	-	2	Α
15	5 Operating Temperature			85	°C

Table 2: MOTION 2350 Pro Absolute Maximum Ratings

^{*} It's not recommended to connect both USB and VIN at the same time. Although it's perfectly safe to do so.



5V Port Automatic Voltage Selector

Figure 3: 5V Port Automatic Voltage Selector

The 5V port output is controlled by Schmitt Trigger to automatically control the output voltage on the 5V port output. It is to protect the servo and provide stable output voltage. When the VIN input voltage more than the high threshold voltage V_{TH} 5.8V, it will switch the output to an internal buck converter 5V. Will retain the 5V output until it reaches the low threshold voltage V_{TL} 5.5V.

4. DIMENSION



Figure 4: MOTION 2350 Pro Dimension

5. INTERFACE

Motor Driver



Figure 5: Connection Diagram for Brushed DC Motor

- * Actual motor direction is depending on the motor connection. Swapping the connection (MA & MB) will reverse the direction.
- * The motor driver do not have overcurrent protection, please be aware with the max current rating on the motor. Overdraw the current can damage the motor driver.

Input Voltage Measurement



Figure 6: Solder to measure the VIN

Calculate the VIN on the GP29(ADC3) using this formula:

$$V_{IN} = V_{ADC} / 6.1$$

Where:

 V_{IN} = VIN input terminal or VUSB input voltage (whichever is higher). V_{ADC} = The ADC input voltage after converted from raw input data.

6. IMPORTANT NOTES

RP2350 GPIO Pull-Down Issue (Errata E9)

The RP2350 IC has a known hardware issue (Errata E9) affecting its General-Purpose Input/Output (GPIO) pins. When a GPIO pin is configured as an input with the internal pull-down resistor enabled, it exhibits a bus-hold-like behavior. After receiving a high input, the pin fails to properly pull down to 0V and instead retains a voltage of approximately 2.15V. It also happens even if the internal pull-down is disabled and an external pull-down is used (if the resistor value is too high).

To mitigate this issue, implement external pull-down resistors with a value less than 8k Ohms for each used pin.

Caution: This equipment is not intended for use in residential environments and might not provide adequate protection to radio reception in such environments.

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