



# RW25 CUBESAT REACTION WHEEL

RW25 is a self-contained, highly integrated Attitude Determination and Control System (ADCS) solution for one axis. It includes a high-performance Brushless Direct Current Motor (BLDC), controlled by a built-in microcontroller with advanced control and diagnostic options, such as fully autonomous single-axis freeze mode and in-orbit motor monitoring with performance optimization.

Our Reaction Wheel combines attitude control system with elements of attitude determination system using its 6-axis inertial measurement unit for a truly integrated ADCS solution.

- ▶ Speed or torque control mode
- ▶ Motor control optimized for low power usage
- ▶ Fully automatic single-axis freeze mode
- ▶ Wide range of self-diagnostic tools, including:
  - ▶ current/voltage monitoring
  - ▶ configurable software overcurrent protection
  - ▶ automated motor performance evaluation
  - ▶ in-orbit power consumption optimization
- ▶ Improved radiation hardness features, including:
  - ▶ ECC non-volatile memory
  - ▶ radiation damage detection in all memory banks
- ▶ Several degrees of redundancy within motor sensors and the possibility to run completely sensorless
- ▶ Designed to reduce imbalance of the rotating parts
- ▶ Low noise generation
- ▶ Low-drift 3-axis gyroscope with built-in high-resolution temperature sensor
- ▶ Runtime configurable I2C or UART communication interface with CSP support
- ▶ 5 or 8 V variants

The capability of performing extremely fine pointing maneuvers, high position accuracy, advanced attitude control including freeze mode, low vibration design and high energy efficiency make these Reaction Wheels ideal for low-GSD Earth observation CubeSat missions on 1U - 3U sized platforms.

## HARDWARE

- ▶ BLDC motor with 3 integrated Hall sensors
- ▶ ARM Cortex-M0+ microcontroller (24 MHz)
- ▶ 6-axis Inertial Measurement Unit (3-axis accelerometer, 3-axis gyroscope)

## INTERFACES

- ▶ I2C or UART communication interface (runtime configurable)
- ▶ CubeSat Space Protocol support

## PROPERTIES

### ABSOLUTE MAXIMUM RATINGS

Stress above those listed as "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

Power rail	Min.	Max.	Unit
3.3V	-0.3	4.0	V
PWR	-0.3	11.0	V

### ELECTRICAL CHARACTERISTICS

Power consumption	Min.	Max.	Unit
Idle	75	100	mW
Active <sup>1</sup>	300	400	mW

### THERMAL CHARACTERISTICS

Temperature	Min.	Max.	Unit
Operating	-40	85	°C
Storage	-40	125	°C

### PHYSICAL CHARACTERISTICS

Characteristics	Value	Unit
Mass	40	g
Dimensions	25×25×25	mm
Radiation tolerance	36	krad
Static imbalance	< 0.003	g·cm
Dynamic imbalance	< 0.006	g·cm

The envelope dimensions were chosen so that the full three-axis reaction wheel actuator system can fit comfortably within a 1U CubeSat.

### PERFORMANCE CHARACTERISTICS

Characteristics	Value	Unit
Speed range	± 5600	RPM
Maximum torque	0.200	mN·m
Total momentum storage	0.600	mN·m·s

<sup>1</sup> BOL at maximum RPM, when using default amplitude model. Performance with customized and self-measured amplitude models may vary.

