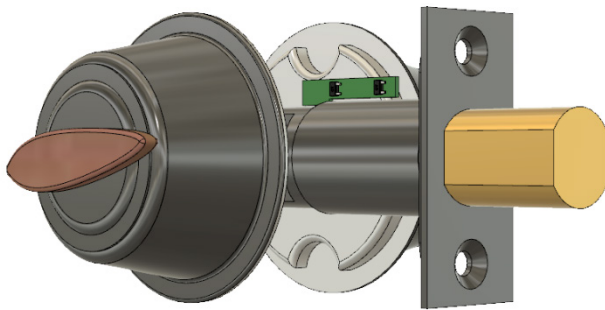


SMART LOCKS

By Allegro MicroSystems

INTRODUCTION



New keyless, smart locks are emerging and replacing the traditional key deadbolt locks. With this new technology, the key is no longer used, and the deadbolt position is now controlled by the smart lock itself and not the user with their key. Manufacturers of the new smart locks use various methods to determine the deadbolt position and travel. As with any security-based product, reliability and repeatability are a stringent requirement. The absolute position of the deadbolt needs to be known for the lock to accurately work with no issue. Hence, implementation of a sensor system to determine absolute position is the best solution. Allegro offers switches that, when used with a complementary magnet, provide absolute position feedback. This plug-and-play solution does not require the user to run through a complicated calibration procedure for some smart locks. As the smart locks are battery operated, the CT81xx series provides extended life drawing less than 110 nA of current.

Also of note, an additional switch can be integrated into the smart lock design to determine if the door is open or closed. This is an added feature that can alert the user to any security issues.

RELEVANT PRODUCTS

- CT81xx—Digital Switch Series

SMART LOCK SYSTEM DIAGRAM

A simplified smart lock system comprises a power source, microcontroller unit (MCU), communications, keypad, and sensors, as shown in Figure 1.

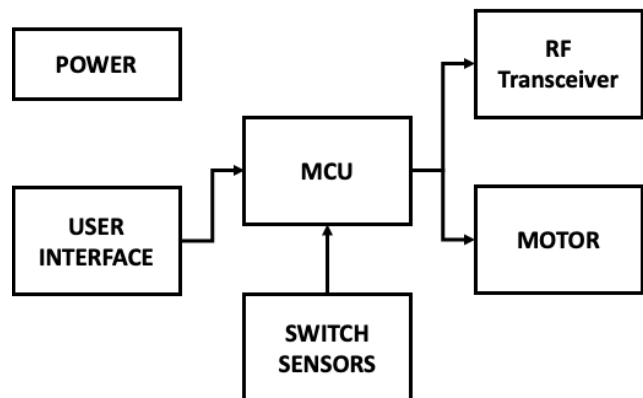


Figure 1: Simplified Smart Lock System

FEATURES AND BENEFITS

- Accurate deadbolt position detection
- Long battery life with less than 110 nA
- Plug and play implementation
- Digital output
- Cost Competitive

DEADBOLT IMPLEMENTATION

Deadbolt position sensing can be implemented by:

- Sensing cylinder rotation position, as shown in Figure 2; or
- Sensing actual travel of the deadbolt, as shown in Figure 3.

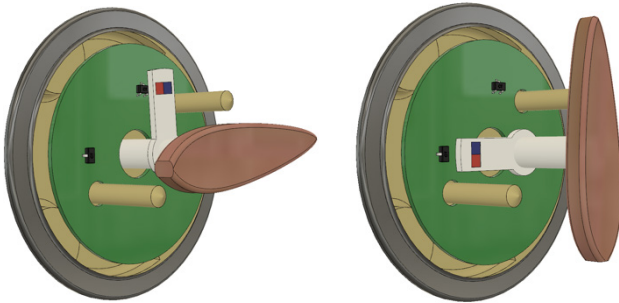


Figure 2: Cylinder Rotation Sensing Example

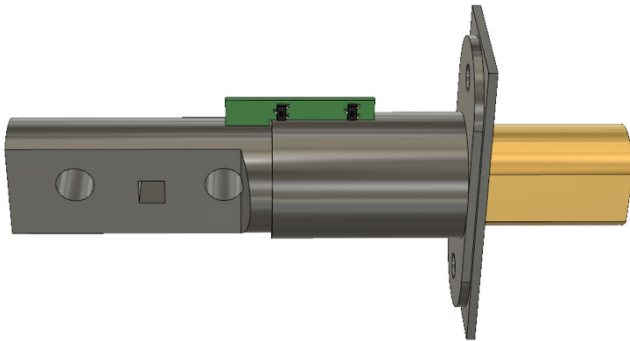
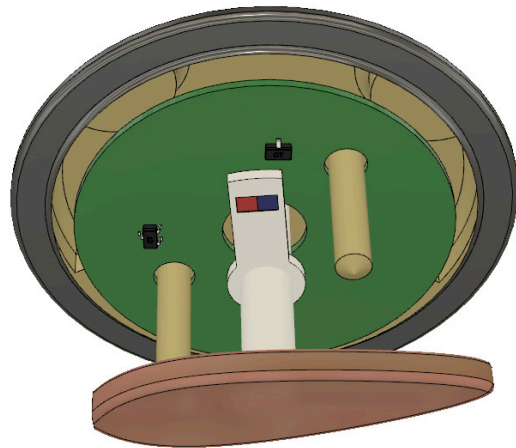


Figure 3: Deadbolt Travel Sensing Example

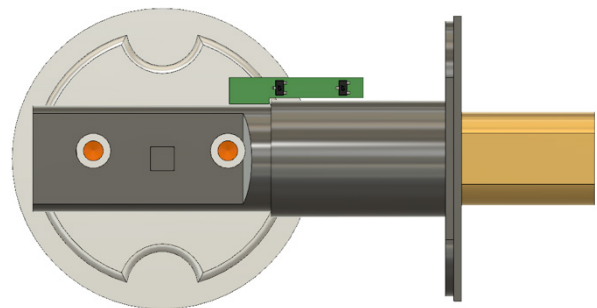
CYLINDER ROTATION SENSING

As the cylinder rotation is mechanically linked to the deadbolt position, knowing the cylinder location correlates directly to the deadbolt position. By using two magnets to identify full travel of the cylinder in both the clockwise (CW) and counter-clockwise (CCW) positions, the sensor provides accurate data that allows the position of the deadbolt—locked or unlocked—to be known.



DEADBOLT POSITION SENSING

The deadbolt position can be determined by mounting a magnet to the deadbolt itself. A sensor switch is located at both the locked and unlocked positions. When the magnet aligns with either switch, the switch turns on and communicates the position of the deadbolt.



DOOR SECURITY FEATURE

The smart lock can also incorporate the CT81xx series switch to signal an open-door or closed-door condition, as shown in Figure 4, by aligning the switch and complementary magnet to the strike of the door, the sensor output signals low for a closed-door condition or high for an open-door condition.

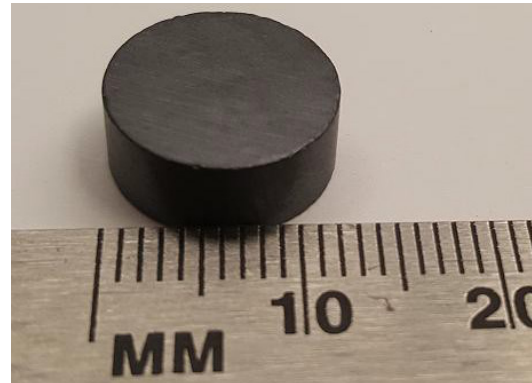


Figure 4: Door Position Detection Example

For example, by mating the CT81xx switch with a ceramic magnet with surface magnetic field strength $B = 220 \text{ G}$ (or 22 mT ; see Figure 5), the sensor performs as follows:

- In the closed-door condition, the switch output is in the low state.
- As the door opens, the switch remains low until the release point, B_{RP} , is reached. At the B_{RP} , the output switches to high, signaling an open-door condition.
- As the door is closed, the sensor is in the high state until the operating point, BOP , is reached. At the BOP , the output switches to low, signaling a closed-door condition.

The application circuit is very user friendly and can be easily integrated into the smart lock system design, as shown in Figure 6.



- Magnet Manufacturer: Ningo Magnetics Factory, Ltd.
- Magnet Model #: 07002
- Magnet Surface Field Strength: 220 G (22 mT)
- Disc Dimensions: Diameter = 12 mm , Height = 5 mm

Figure 5: Selected Magnet is the Complement of the Switch

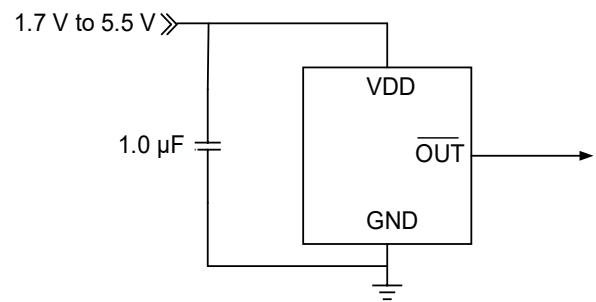


Figure 6: CT81xx Application Diagram

OTHER INFORMATION

For additional documentation, visit the Allegro website at www.allegromicro.com or contact Allegro at <https://www.allegromicro.com/en/about-allegro/contact-us>.

Revision History

Number	Date	Description	Responsibility
1	November 15, 2023	Document rebrand and minor editorial corrections	J. Henry

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