System Solution Guide - Preview

Drone Power and Communication

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Full Guide Preview

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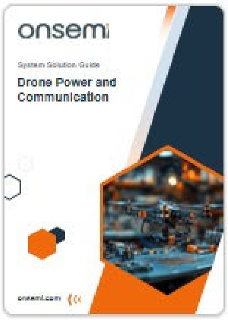

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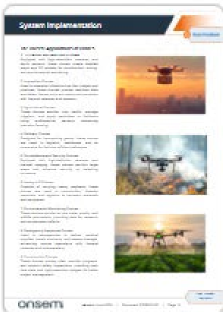

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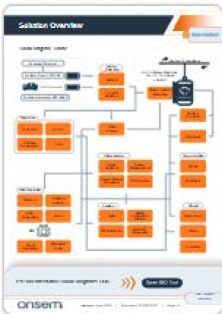

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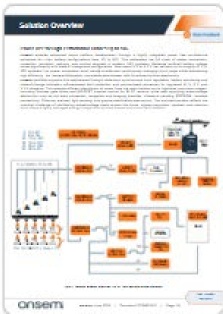

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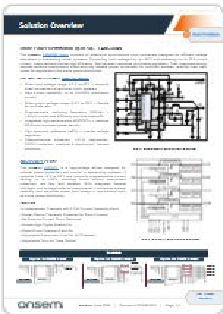

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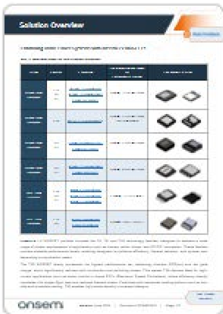

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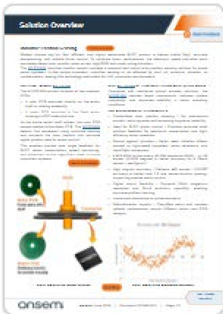

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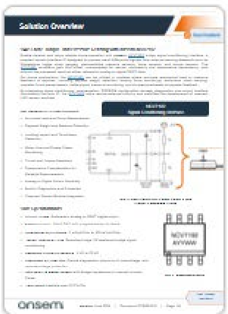

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Block Diagram

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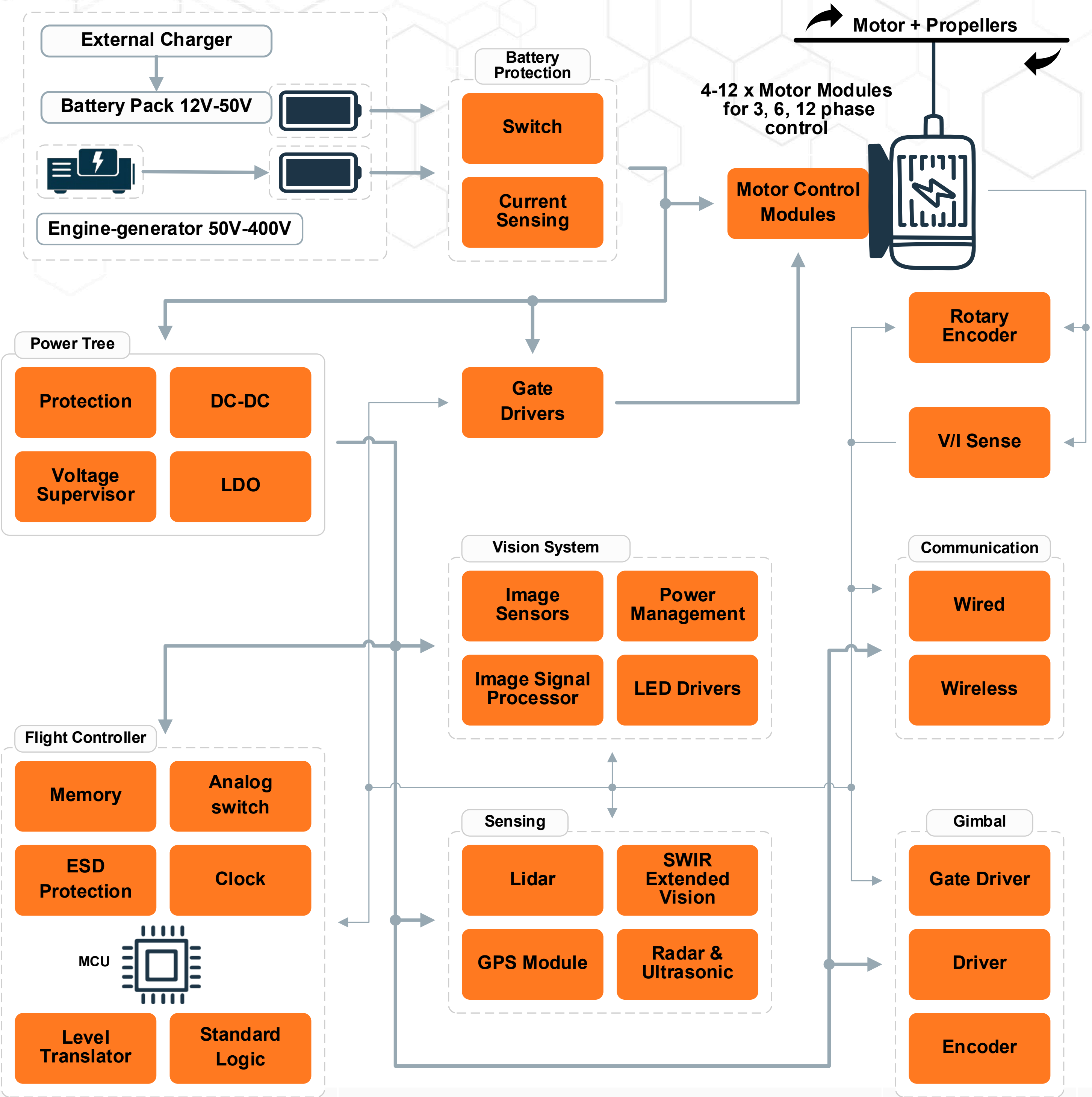
Block Diagram - Drone



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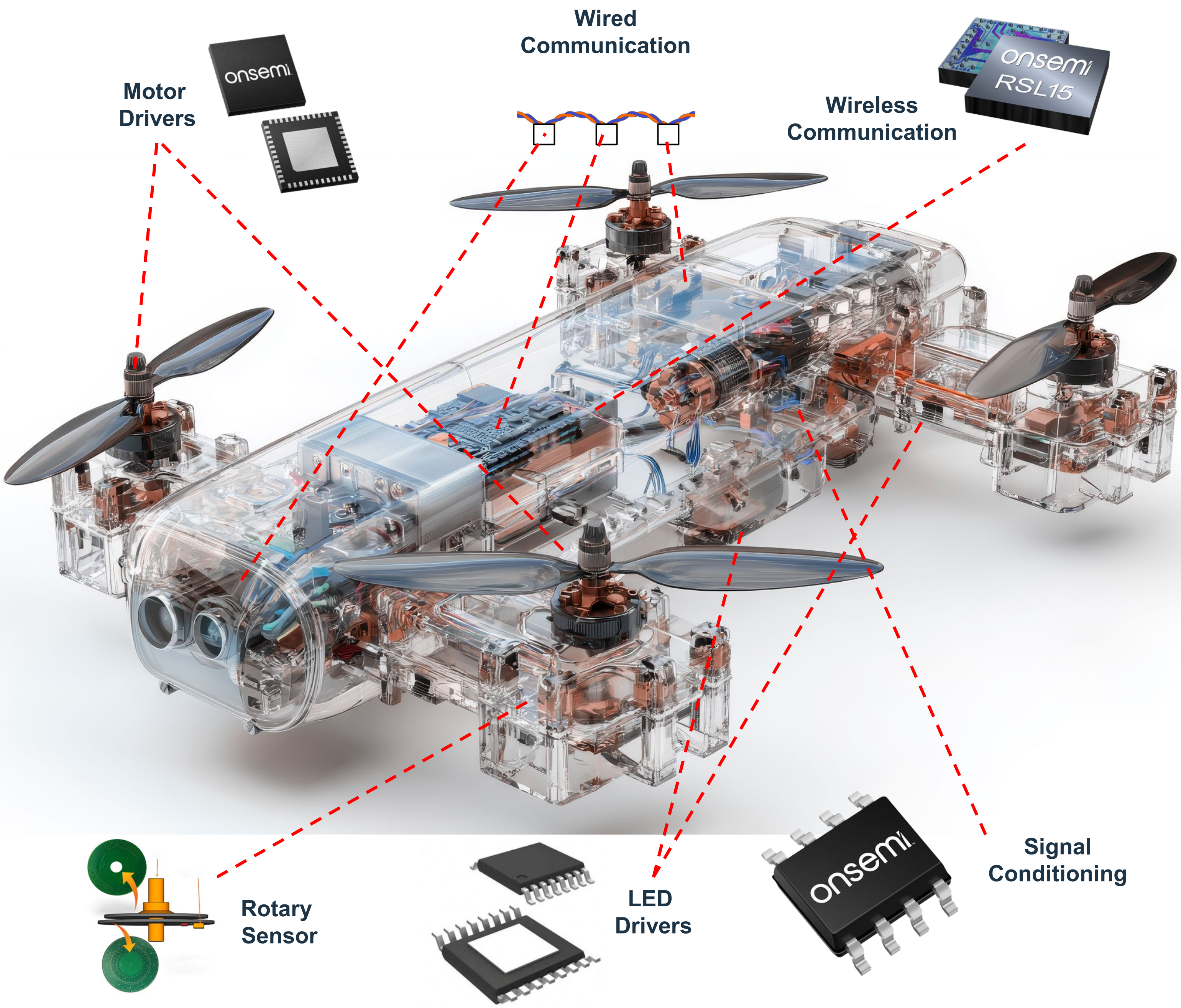
Drone Complementary Systems

Drone auxiliary subsystems combine supporting electronics for power management, communication, sensing, and control, where **onsemi** components address key requirements such as efficiency, compactness, and robustness: precision analog devices like the NCS32100 enable accurate, low-noise signal conditioning for battery monitoring, current sensing, and other critical measurements; reliable internal communication across distributed architectures is ensured by the NCV7192 CAN transceiver; actuation functions, including gimbals and positioning mechanisms, are supported by integrated drivers such as the NCV78514, while lighting is handled by the **onsemi** NCV LED drivers; the NCN26010 and NCN26000 further enhance system design by enabling both powerline communication and compact 10BASE-T1S single-pair Ethernet, providing 10 Mb/s multidrop connectivity over a single unshielded twisted pair with deterministic access via PLCA, while supporting flexible integration through MAC-PHY (NCN26010) or PHY (NCN26000) interfaces; in addition, the RSL15 ultra-low-power Bluetooth Low Energy MCU enables wireless telemetry, diagnostics, and firmware updates. Together, these devices help optimize energy usage, reduce system footprint, and improve communication reliability and control across modern drone auxiliary electronics.



Solution Overview

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LED Drivers for Drones

onsemi LED driver portfolio enables highly efficient, scalable, and reliable drone lighting systems designed for advanced aerial displays and swarm-based light shows. By combining high-efficiency power stages such as the NCV78964, a single-chip two-phase booster with synchronous dual-buck regulation capable of driving two LED strings up to 60 V at up to 1.6 A per channel, with the NCV78935, a synchronous three-channel buck LED driver for high-current strings up to 60 V, these components deliver precise current regulation, strong power efficiency, and seamless scalability across large fleets of drones.

Complementing these devices, the NCV7683 provides flexible multi-channel LED control through eight programmable 100 mA linear current sources with built-in sequencing support, programmable stop and tail brightness levels, optional external PWM control, and open-LED diagnostics. This combination supports both high-power illumination channels and lower-power segmented lighting functions, allowing designers to tailor system topology to drone swarm requirements with fine-grained control and dependable performance.

The architecture supports a wide battery input range, ensuring stable performance throughout the entire discharge cycle while maximizing energy efficiency to extend flight time. High-efficiency switched-mode regulation in the NCV78964 and NCV78935, together with average LED current control and programmable switching behavior, helps optimize power conversion while maintaining consistent brightness across dynamically changing operating conditions.

With the ability to drive multiple LED strings independently, designers can optimize both system weight and electrical complexity for airborne platforms. Multiple NCV78964 devices can be combined in multiphase operation when more channels are required, while NCV78935 devices can be added to expand the number of buck-controlled strings, creating a cost-effective and modular lighting platform for synchronized multi-drone systems.

Flexible system configurations support microcontroller-controlled operation through high-speed SPI interfaces on the NCV78964 and NCV78935, while the NCV7683 adds stand-alone brightness programming and pin-controlled sequencing for compact auxiliary lighting functions. This versatility simplifies system integration and accelerates development cycles, while compact implementation and low external component count contribute to lightweight, space-efficient drone designs.

Overall, **onsemi** LED driver solutions including the NCV78964, NCV78935, and NCV7683 empower developers to design next-generation drone lighting systems that combine high performance, energy efficiency, and reliability, enabling visually compelling aerial displays while optimizing power consumption, channel scalability, and control flexibility.

Solution Overview

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Inductive Position Sensing

Find More Details

Modern drones rely on fast, efficient, and highly responsive BLDC motors to deliver stable flight, accurate maneuvering, and reliable thrust control. To optimize motor performance, the electronic speed controller must accurately detect rotor position, even at very high RPM and under strong vibration.

The NCS32100 inductive position sensor provides a compact and robust rotor position sensing solution for drone motor systems. Unlike optical encoders, inductive sensing is not affected by dust, oil, moisture, vibration, or contamination, making this technology well suited for UAV propulsion environments.

Inductive Sensing NCS32100

The NCS32100 solution consists of two compact PCBs:

- A rotor PCB mounted directly on the motor shaft or rotating assembly
- A stator PCB mounted to the fixed motor housing or ESC-side structure

As the drone motor shaft rotates, the rotor PCB moves relative to the stator PCB. The NCS32100 detects this movement using inductive sensing and converts the rotor position into accurate digital position data for motor control.

This enables precise rotor angle feedback for BLDC motor commutation, speed monitoring, and advanced control algorithms used in drone propulsion systems.

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Why NCS32100 Is Suitable for Drone Motor Applications

Compared with traditional optical encoder solutions, the NCS32100 requires fewer components, reduces system complexity, and improves reliability in harsh operating conditions.

Key Advantages for Drone Motors:

- Contactless rotor position sensing - No mechanical contact, reducing wear and improving long-term reliability.
- Ideal for BLDC motor control - Provides accurate shaft position feedback for electronic commutation and high-efficiency motor operation.
- Robust against vibration - Helps reject vibration effects caused by high-speed propellers, motor imbalance, and rapid flight maneuvers.
- 6,000 RPM full accuracy (45,000 maximum RPM) +/- 50 arcsec (0.0138 degree) or better accuracy for a 38mm sensor - see figure 7.
- High angular accuracy - Delivers ±50 arcsec / 0.0138° accuracy or better from 3.8 mm sensor-to-rotor spacing, supporting precise motor control.
- Digital output flexibility - Supports 20-bit single-turn resolution and 24-bit multi-turn capability, enabling accurate position tracking.
- Lower-cost alternative to optical encoders
- Self-calibration support - Simplifies setup and enables reliable performance across different motor and PCB designs.

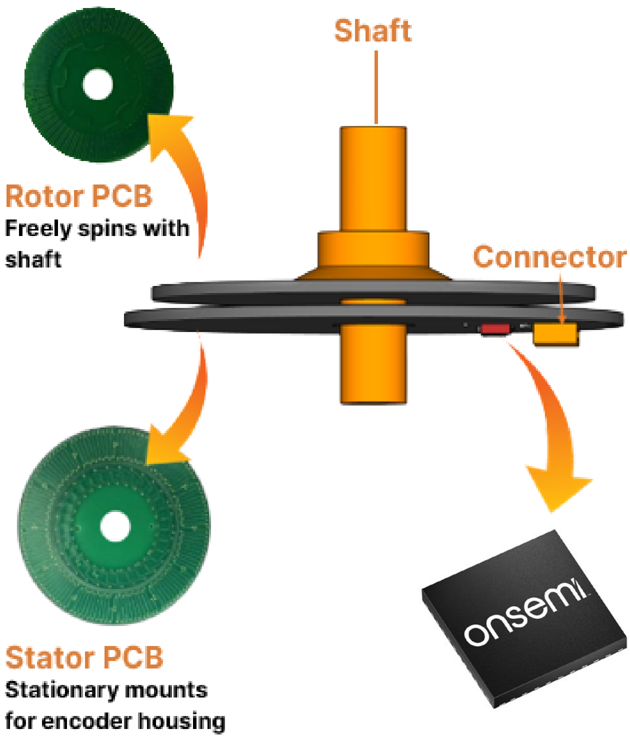

Fig.5: NCS32100 sensor solution

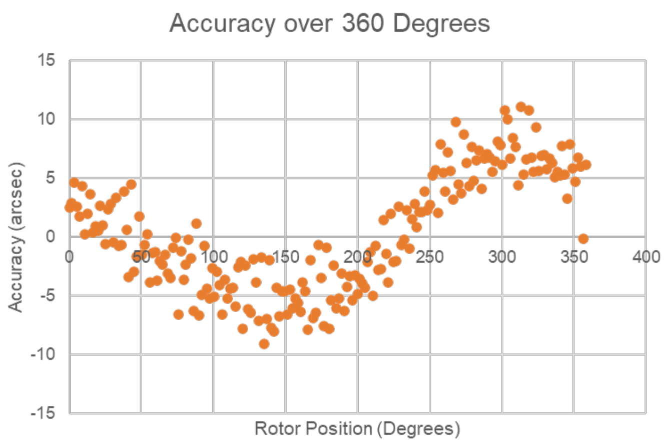

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Fig.6: NCS32100 measured accuracy

Solution Overview

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UAV Force, Torque, and Pressure Sensing with onsemi NCV7192

Enable smarter and more reliable drone operation with **onsemi** NCV7192 bridge signal conditioning interface, a compact sensor-interface IC designed to process small differential signals from external sensing elements such as Wheatstone bridge strain gauges, piezoresistive pressure sensors, force sensors, and torque sensors. The NCV7192 conditions gain and offset, compensates for sensor nonlinearity and temperature dependency, and outputs the processed result as either ratiometric analog or digital SENT data.

For drone applications, the NCV7192 can be utilized in systems where accurate mechanical load or pressure feedback is required, including payload weight detection, landing force monitoring, motor-arm strain sensing, propeller thrust measurement, battery-pack pressure monitoring, and air-pressure-based subsystem feedback.

By integrating signal conditioning, compensation, EEPROM configuration storage, diagnostics, and output interface functionality into one IC, the NCV7192 helps reduce external circuitry and simplifies the development of compact UAV sensor modules.

Key Benefits for Drone Utilization

- Accurate Load and Force Measurement
- Payload Weight and Balance Detection
- Landing Impact and Touchdown Detection
- Motor Arm and Frame Stress Monitoring
- Thrust and Torque Feedback
- Temperature Compensation for Reliable Measurements
- Analog or Digital Output Flexibility
- Built-In Diagnostics and Protection
- Compact Sensor-Module Integration

NCV7192
Signal Conditioning Interface

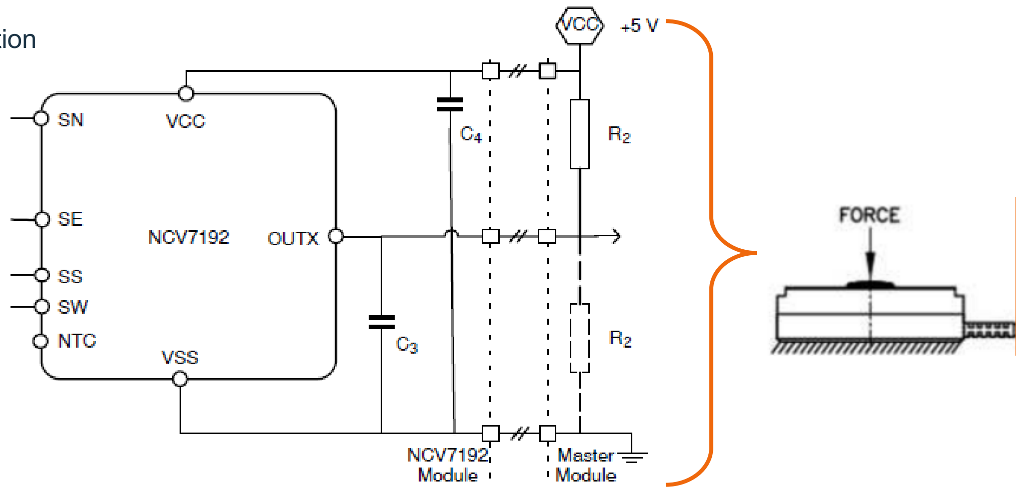

Fig. 7: LPF + Gain (2x) + ADC + DSP + LPF + DAC + EEPROM + NTC

Core Specifications

- **Output Types:** Ratiometric analog or SENT digital output
- **Analog Output:** 14-bit DAC with programmable clip levels
- **Differential Input Range:** 2 mVpk/Vbdr to 125 mVpk/Vbdr
- **Sensor Interface Type:** Resistive bridge / Wheatstone bridge signal conditioning
- **Resistive Bridge Impedance:** 1 kΩ to 25 kΩ
- **Diagnostics/Protection:** Failure diagnostics, short-circuit, overvoltage, and reverse-voltage protection
- **Temperature Measurement** with Bridge Impedance or Internal Junction Diode
- **Calibration** Interface over OUTX Pin

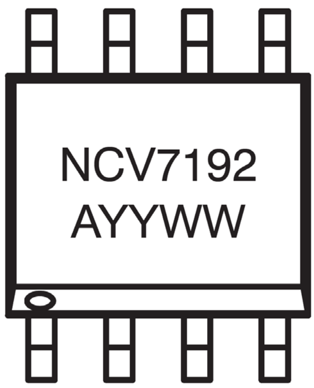

Fig. 8: Component Case

Frequently Asked Questions (FAQ)

1

What are the main power design challenges in modern drones?

Modern drones must distribute battery energy efficiently across propulsion, sensing, imaging, communication, and control electronics while minimizing weight and heat. A wide battery range from 1S to 10S creates changing input voltage conditions, so designers need efficient DC-DC conversion, protection, low-loss MOSFETs, and stable rails for 12 V, 5 V, and 3.3 V subsystems.

2

Why is an efficient power tree critical for drone flight time?

An efficient power tree reduces conversion losses and keeps more battery energy available for flight. In drone systems, propulsion consumes the largest share of power, while processors, sensors, wireless modules, lighting, and imaging still require stable low-voltage rails. Using synchronous buck regulators, eFuses, and optimized point-of-load conversion helps extend endurance and improve reliability.

3

Why use 10BASE-T1S Ethernet inside a drone?

10BASE-T1S enables 10 Mb/s Ethernet over a single unshielded twisted pair, supporting multidrop communication between distributed drone modules. Compared with fragmented fieldbus networks, it can reduce wiring, gateways, connector count, and software complexity. PLCA also helps provide predictable shared-bus access, which is useful for sensors, actuators, battery telemetry, and payload electronics.

4

Why are MOSFETs important in drone power systems?

MOSFETs are used for motor drives, battery switching, power distribution, and DC-DC conversion. Low-resistance and fast-switching MOSFETs reduce losses, improve efficiency, and lower heat generation. This helps drones achieve longer flight time, smaller electronics, and better performance under high-current operating conditions.

5

How do force and pressure sensors help UAV applications?

Force, torque, and pressure sensing can support payload weight detection, landing impact monitoring, motor-arm strain measurement, thrust feedback, and battery-pack pressure monitoring. The NCV7192 conditions small bridge-sensor signals and provides compensation, diagnostics, EEPROM configuration, and analog or SENT output. This enables compact and reliable sensor modules for smarter drone operation.

Drone Power and Communication

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