Get More From Your System With a Cutting-Edge Supervisory IC

Introduction

Supervisory integrated circuits are ubiquitous in electronic systems. They monitor critical electronic loads, enabling them only after the supply rails have settled within specified values. This simple task often becomes challenging as the supervisory IC may be required to operate in a noisy environment or in an application starved for space or powered by a limited energy supply. This article reviews some typical applications and the challenges they pose to the supervisory IC and introduces a new family of highly integrated devices that overcome them.

Better Noise Immunity in the Automotive Environment

The automotive environment is subject to electromagnetic interference due to both external and internal sources. The "arc and spark" noise that comes from ignition components (Figure 1), motors, and similar pulse-type systems affects the electronics supply rails by producing disruptive undervoltages or overvoltages. Noise tolerance or immunity is an important factor when selecting the car's electronic components.

Figure 1. Spark Plug Firing

In Figure 2, a microprocessor supervisory IC controls the car's remote camera modules, controller area network (CAN), serializer, and deserializer. Each electronic load correctly operates within its specified input voltage range. The operating range of each load is limited by the accuracies of the power supply and the supervisory IC, along with the input-voltage noise amplitude. An accurate supervisory IC will provide more margin against noise. For example, a ±0.5% accuracy advantage on a 3V supervisory threshold will provide an extra noise immunity of 15mV.

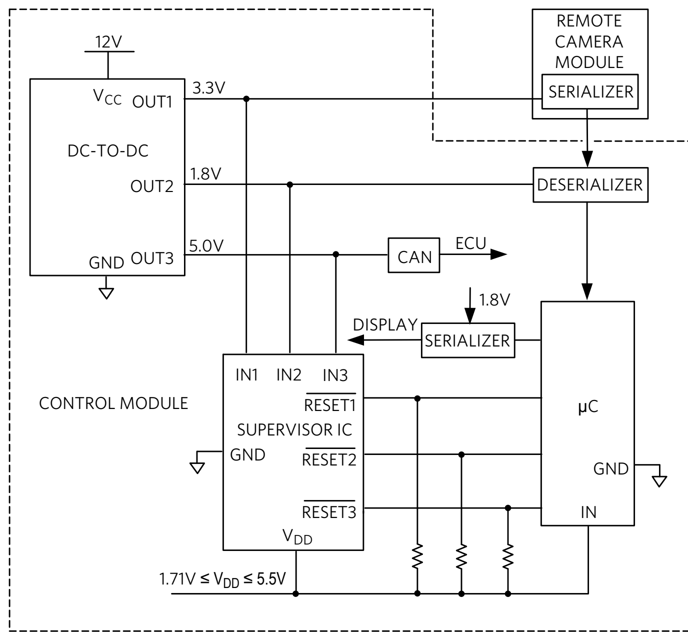

Figure 2. A Supervisory IC Controls a Remote Camera Module, CAN, Serializer and Deserializer

A wide V_{DD} input voltage for the supervisory IC range like the one indicated in Figure 2 offers flexibility and more margins against noise

Accuracy Saves Power in Portables

In portable applications, an accurate supervisory IC can be leveraged to set the electronic load voltage lower, therefore saving power. A supervisory IC with an accuracy advantage of ±ε% will enable an extra range of operation of ε%. Consider an electronic load that operates at a minimum voltage, V_{IN}. The same electronic load monitored by a supervisory IC with a ±0.5% accuracy disadvantage will have to operate at a higher minimum voltage 1.005V_{IN}. Its associated power loss (proportional to the square of V_{IN}) will be 1% worse in the latter case. This is the same as lowering the electronic load's power-supply efficiency by 1% point, not something to be taken lightly.

Low Supply Current Saves Power in Portables

Due to the supply current required for its operation, a supervisory IC may become a significant current drain to a system in sleep mode. However, a supervisory IC designed in a modern CMOS process should reduce the current drawn down to the order of 10µA, minimizing the burden on the battery.

Small Size for Rotary and Linear Encoders

In another example, motion encoders—electromechanical devices that convert the linear or angular position or motion of a shaft or axle to an analog or digital signal—squeeze a lot of electronics into a small space. Figure 3 shows an example of a rotary encoder.

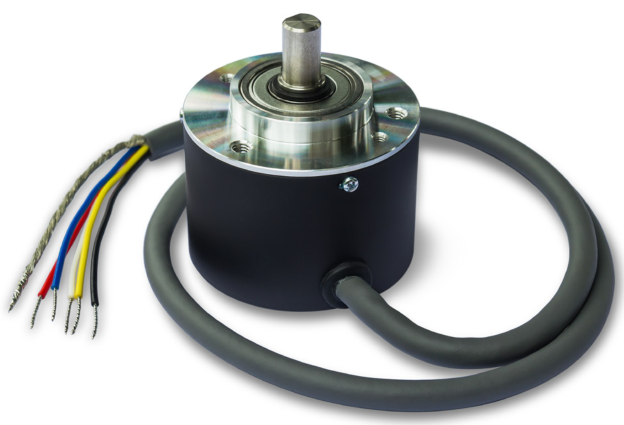

Figure 3. Rotary Encoder

Figure 4 shows the application-specific standard product (ASSP), power supply, supervisory/POR/OTP and RS-485 interface subsystem embedded in the encoder.

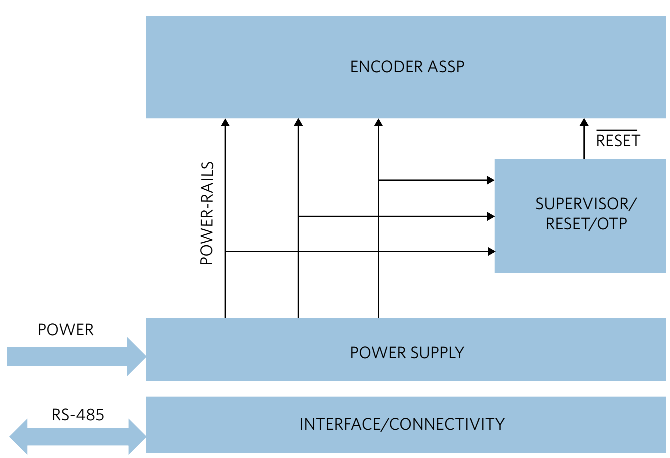

Figure 4. Encoder ASSP Power Rails Control

In this application, space is at a premium, and the integration of supervisory and protection functions in a small IC package make a difference. As shown in Figure 5, the MAX16132/MAX16133/MAX16134/MAX16135 µP supervisors are housed in a small SOT23-8 package, in comparison to a similar device housed in a bulky MSOP10. The larger package takes up about twice as much PCB space.

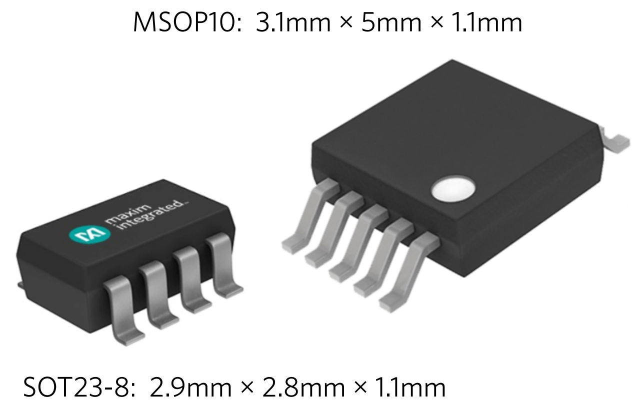

Figure 5. The SOT23-8's Size Advantage

Low-Voltage, Precision µP Supervisors

TThe MAX16132–MAX16135 µP supervisors are excellent examples of monitoring ICs that address these challenges. They are low-voltage, low-supply-current, ±1% accurate, OTP-protected, single/dual/triple/quad-voltage µP supervisors that monitor up to four system-supply voltages for undervoltage and overvoltage faults. Figure 6 shows the single-channel device (MAX16132).

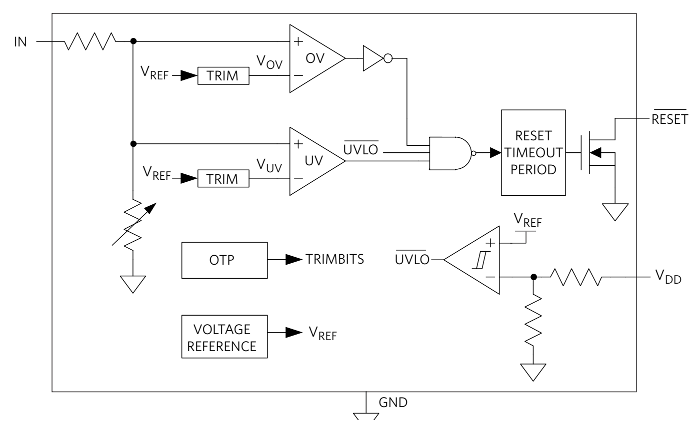

Figure 6. MAX16132 µP Supervisor Block Diagram

The reset is maintained for a minimum timeout period after the voltage at the input falls within the factory-set window threshold. These integrated supervisory and OTP circuits significantly improve system reliability and reduce solution size compared to separate ICs or discrete components. The MAX16132–MAX16135 are fixed-threshold devices.

The nominal input voltage for any input is factory programmable from 0.5V to 5.0V, providing a wide range of threshold selections. The reset outputs are active-low, open-drain, and are guaranteed to be in the correct reset output logic state when V_{DD} remains greater than 1.0V. All devices are offered with 23 reset timeout periods ranging from 20µs (min) to 1200ms (min). All reset outputs share the same factory-set reset timeout period. The MAX16132–MAX16135 are specified over the automotive temperature range of -40°C to +125°C.

Conclusion

We reviewed the challenges of a supervisory IC that is powered by a limited energy supply, operates in a noisy environment or in an application starved for space. The MAX16132–MAX16135 are low-voltage, low-supply-current, ±1% accurate, OTP-protected, single/dual/triple/quad-voltage µP supervisors in a small SOT23-8 package. They overcome all of these challenges by enabling solutions that consume less power, have better noise immunity, and occupy less PCB space.

Glossary

ASSP: Application-specific standard product

CAN: Controller area network. A robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other in applications without a host computer

ECU: Electronic control unit. An embedded system that controls one or more of the electrical systems or subsystems in a transport vehicle

OTP: Overtemperature protection

POR: Power-on reset

Learn more:

MAX16132 Low-Voltage, Precision, Single-Voltage µP Supervisor

MAX16133 Low-Voltage, Precision, Dual-Voltage µP Supervisor

MAX16134 Low-Voltage, Precision, Triple-Voltage µP Supervisor

MAX16135 Low-Voltage, Precision, Quad-Voltage µP Supervisor

Application Note 3227: Power-On Reset and Related Supervisory Functions

Tutorial 279: Supervisory Circuits Keep Your Microprocessor Under Control

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