TECHNICAL ARTICLE

Advancing Auxiliary Power Performance with CoolSET™ PWM Gen5 Pro Controllers by Infineon

Discover how CoolSET™ PWM Gen5 Pro controllers enhance auxiliary power supply performance with faster startup, flexible gate drive, robust protection, and high efficiency in high-voltage systems.

Designers of auxiliary power supplies face mounting pressure on multiple fronts. The industry now expects higher efficiency and stronger system reliability. At the same time, DC-link voltages continue to rise. For example, many three-phase solar inverter platforms now operate on electrically stressful 200-1000 VDC links.

These conditions change what engineers need from their controllers. Fast and predictable startups now matter because long bias delays can disrupt system sequencing. Protection against high-energy fault events is more important as DC-link energy increases. Stable operation should extend across wide load and line ranges because modern systems rarely operate at a single steady point.

Infineon's new CoolSET™ PWM Fixed Frequency Gen5 Pro family is the solution the industry needs. With upgraded control features, wider operating margins, and stronger compatibility with CoolSET™ and CoolSiC™ MOSFETs, the new family gives engineers a powerful new tool to face today's real-world problems.

Why Auxiliary Power Supplies Need a New Approach?



Auxiliary power supplies now sit in the direct path of many of the stresses impacting modern power-conversion platforms. Engineers need supplies that operate reliably even when DC-link voltages and load conditions swing instantaneously. In three-phase systems, auxiliary rails should remain stable even as the main converter transitions among startup, idle, partial-load, and fault states. Unfortunately, most legacy controllers simply can't keep up with these growing expectations.

Earlier controller generations were not designed for the startup speeds, standby efficiency targets, and protection depth needed today. As DC-link voltages climbed, startup circuits became slower and more fragile. At the same time, gate-drive structures often lacked the flexibility needed to support newer power devices, especially as wide-bandgap devices like silicon carbide (SiC) gained traction. Ultimately, these limitations forced engineers to add external circuitry, accept narrower operating margins, or compromise on long-term reliability.

Design requirements have also changed on the control side. Modern auxiliary supplies should regulate cleanly as operating modes transition between discontinuous and continuous conduction. They must tolerate high-voltage stress without nuisance tripping while still responding immediately to real fault events. In many cases, the controller now influences the overall level of system protection.

Infineon developed the CoolSET™ PWM Fixed Frequency Gen5 Pro family to directly address these realities. The controllers provide a more robust control solution that delivers the operating headroom and fault-handling behavior needed in modern three-phase designs.

The Gen5 Pro Family and Its Generational Improvements

Infineon deliberately designed the Gen5 Pro architecture around the conditions auxiliary supplies now face in high-voltage systems.

Design Flexibility



CoolSET™ PWM FF G5 Pro

First, Infineon structured the Gen5 Pro family to offer engineers flexibility without fragmenting the design approach. For example, the portfolio comes in ICE501 and ICE502 variants, each available with fixed switching frequencies of 65 or 100 kHz. With these options, designers can choose their power capability and magnetics size while staying within a known, consistent control architecture. In that way, engineers can scale their designs from lower-power auxiliary rails to higher-output ones without changing controllers.

Similarly, Gen5 Pro also introduces configurable gate-drive levels. Designers can select 10, 15, or 18 V gate voltage by adjusting a single resistor at the FB pin. That means the same controller can drive CoolMOS™ devices as well as 1200 and 1700 V CoolSiC™ MOSFETs. Gate-drive flexibility removes the need to redesign surrounding circuitry when changing power devices and helps engineers tune switching behavior to balance efficiency, switching loss, and robustness.

Better Performance

With respect to performance, Infineon deliberately redesigned Gen5 Pro's architecture around today's real-world, high-voltage conditions.

For example, Infineon reworked the startup path to deliver faster and more controlled bias formation. In that way, the controller stabilizes earlier during energization and reduces electrical stress when DC-link voltages rise quickly. In high-voltage flyback designs, predictable startup directly improves sequencing reliability and lowers component stress.

Meanwhile, Infineon also improved frequency behavior with Gen5 Pro. The new family supports frequency reduction at light loads to lower switching losses and improve standby efficiency. At the same time, controlled frequency jitter spreads spectral energy to reduce EMI peaks. Together, these features improve compliance margins without relying on external filtering or complex compensation networks.

Finally, Infineon included improved protection features in Gen5 Pro to manage the varied electrical stresses found in 200-1000 VDC systems. Specifically, Gen5 Pro offers dedicated line-overvoltage detection, overload and open-loop handling, bias-rail over- and undervoltage protection, and thermal shutdown. These mechanisms help the controller respond decisively to real faults and avoid unnecessary interruptions during normal operation, all without relying on additional external circuitry.

Evaluation Boards and Lab Testing

Infineon Technologies built 100 and 65 W evaluation boards to assess how the Gen5 Pro family performs under real-world electrical and thermal conditions.

To match the real-world DC-link voltages used in modern three-phase systems, the laboratory testing covered a full 200-1000 VDC input range. Across that range, testing showed the boards to provide a clean startup and stable regulation as the load changed. Results also showed the control loop holds steady throughout the entire operation range.

To evaluate frequency behavior in real hardware, the engineering team also captured steady-state switching waveforms and light-load data. Measurements confirmed that frequency reduction and controlled jitter operate as designed, leading to efficiency improvements at light load and EMI shaping without introducing instability.

Finally, Infineon performed thermal characterization that focused on the full-load operation that causes auxiliary supplies the greatest stress. Measurements showed predictable device temperatures at full load. On the 65 W platform, multi-output testing demonstrated that the controller could maintain stable regulation across multiple rails simultaneously, even in more complex secondary configurations.

Application Examples and System-Level Fit

But where do these results matter most?

Auxiliary power supplies are now indispensable in a myriad of systems, including solar inverters, EV chargers, energy-storage converters, UPS units, and industrial drives. Though different in function, each of these platforms shares the characteristics of operating from wide DC-link ranges and experiencing frequent load and line transients. Regardless of application, the underlying controller must respond quickly and predictably to keep bias rails stable as the main power stage ramps up, idles, or faults.

The Gen5 Pro family fits cleanly into these environments because it supports both isolated and non-isolated flyback topologies. Engineers can apply controllers within existing power architecture rather than redesigning auxiliary stages from scratch. Flexibility matters even more in mature platforms, where layout, magnetics, and protection concepts are already well-established.

These applications also stand to benefit from the family's gate-drive configurability. As power requirements change, designers may begin to move toward new SiC-based architectures. With the Gen5 Pro family, designers can simply adjust the drive voltage to match CoolMOS™ or high-voltage CoolSiC™ devices, making upgrades easily attainable. And, combined with expanded protection behavior, the controllers help mitigate the electrical stress that comes with these high-power transitions.

All things considered, the Gen5 Pro family offers a practical, non-disruptive path for designers to upgrade their power-conversion systems.

Conclusion

The CoolMOS™ PWM Fixed Frequency Gen5 Pro family is a powerful new solution for high-voltage auxiliary supplies. Through faster startup behavior, flexible gate-drive options, refined frequency control, and expanded protection coverage, the family helps engineers meet real-world needs. As system voltages rise and reliability expectations grow, the Gen5 Pro line provides designers with the resilience and control they need for next-generation designs.

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