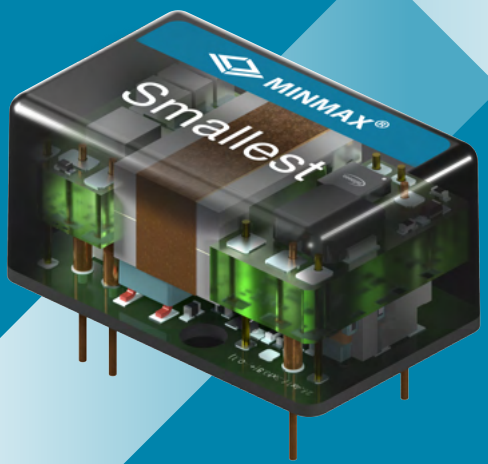
MINMAX®

Small in Size.
Big on Performance.

- Miniaturization
- High Efficiency
- Thermal Performance
- High Reliability



Power Design Advantages Overview

Higher Efficiency and Improved Thermal Performance in a Smaller Form Factor

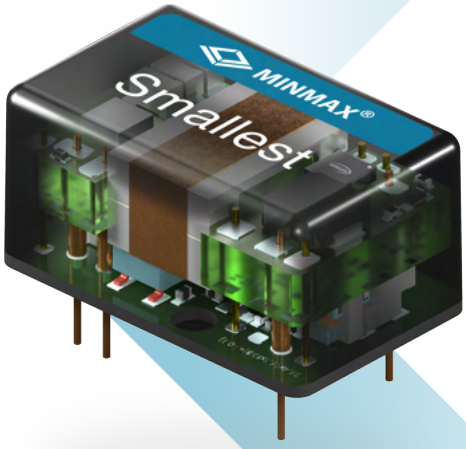
93% Higher Efficiency

81%↓ Smaller Product Size

85°C Wider Operating Temp. Range

5.2x Higher Power Density

1000+ TCT Cycles Higher Reliability



MINMAX is dedicated to the development of miniaturized power modules. While continuously reducing product size, we maintain a strong focus on performance, thermal management, and overall reliability, delivering power solutions with higher power density and greater efficiency.

In this new series, we have further achieved higher conversion efficiency, smaller package size, higher operating temperature, and increased power density—demonstrating technological advancements in both miniaturization and overall product performance.

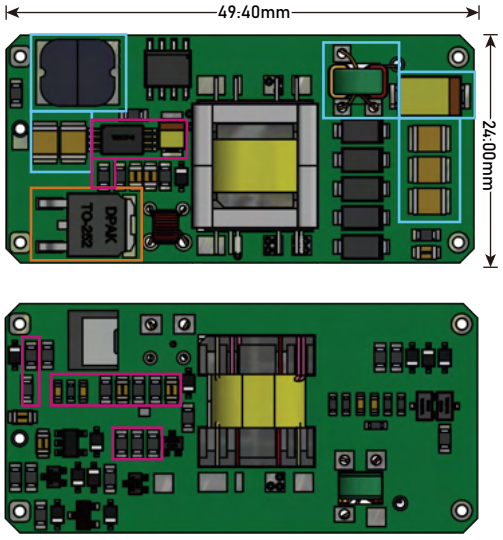
SMALLEST

By adopting a highly integrated PWM control IC, the overall component footprint can be reduced by more than 50%. The main switching MOSFET is downsized from a TO-252 package to a compact PQFN package, cutting the device size in half.

Through higher switching frequency operation, filter requirements and component area are further reduced, enabling a high-efficiency, low-profile, and highly miniaturized power solution.

The product weight is reduced from 36g to 15.68g (over 56%), supporting miniaturization, lowering material use and carbon emissions, and promoting sustainable design.

Previous Series



Miniaturized control IC
118.48 mm² → **63.15 mm²** **-47%**

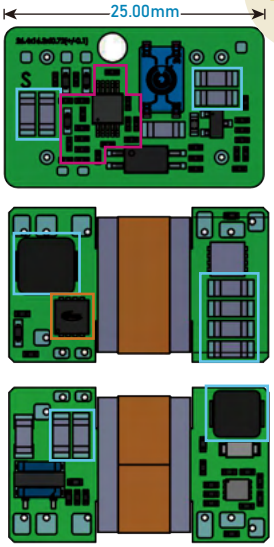
Compact main switching MOSFET
43.55 mm² → **10.89 mm²** **-75%**

Simplified filtering design
283.257 mm² → **125.17 mm²** **-56%**

Overall weight reduction
36g → **15.68g** **-56%**

NEW Series

Board space **-68%**



Previous Series vs. New Series Control IC

	Previous Series	NEW Series
Size	approx. 6.6 × 3.1 mm	approx. 4.0 × 3.0 mm
Features	Traditional leaded package; mature manufacturing process	Miniaturized package for improved thermal performance and grounding; integrates more functions including UVLO, LDO, SCP, OTP, OCP auto-compensation, and light-load green mode
Thermal Performance	Standard	Better (with exposed pad)

Smaller. Lighter. More Efficient. Driving ESG and Sustainability.

- Lower Carbon Footprint
- Material Reduction
- Energy Saving
- Longer Product Life

Previous Series vs. New Series Main Switching MOSFET

	Previous Series	NEW Series
Main Switching MOSFET	TO-252	PQFN
Package Type	Leaded power package with metal backplate	Leadless, low-profile package with bottom thermal pad
Thermal Performance	Metal backplate can be soldered to a copper area for effective heat dissipation, especially suitable for double-sided thermal design	Heat is conducted through a large exposed bottom pad, offering lower thermal resistance and superior thermal performance
Size	Larger (approx. 6.5 × 6.7 mm)	Smaller (approx. 3.3 × 3.3 mm)

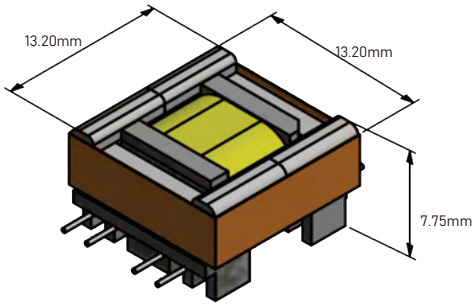
HIGH EFFICIENCY

To achieve miniaturization in power converter design, engineers must optimize both the size and performance of magnetic components. Among them, transformer optimization is one of the key approaches.

By adopting a planar PCB winding structure, transformer coupling is improved, leakage inductance and energy loss are reduced, and the need for snubber circuits is minimized. Combined with low-voltage, high-performance MOSFETs, system efficiency is increased without adding extra components.

Higher switching frequency enables a smaller core while maintaining reliable coupling. Improved efficiency reduces losses and thermal stress, extending product life and supporting ESG goals.

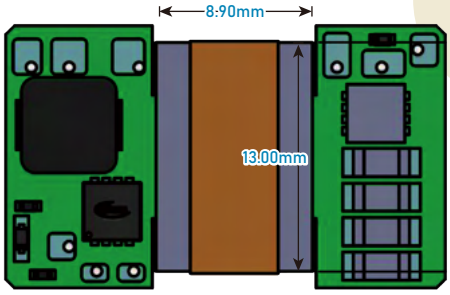
Previous Series



Conventional Wire-Wound Transformer

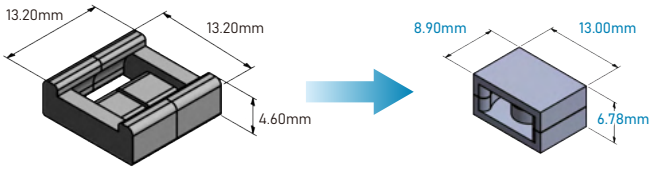
NEW Series

EFFICIENCY UP!



Planar Transformer

Core Volume Comparison: Previous vs. New Series

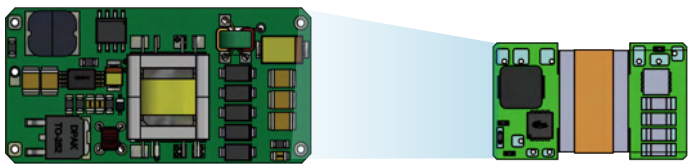


	Previous Series	NEW Series
Occupied Volume (mm^3)	801.504	784.446

Why Choose a Planar Transformer?

- **Lower Profile**
  Enables slimmer power modules and compact system design
- **Lower Current Density (Typically)**
  Wider copper paths reduce current crowding and hot spots
- **Higher Power Density**
  Optimized for high-frequency switching architectures
- **Better Thermal Performance**
  Large copper areas improve heat spreading
- **Consistent & Scalable Manufacturing**
  Ideal for high-volume, high-reliability applications

Previous Series vs. New Series Current Density



	Previous Series	NEW Series
Primary-Side Current Density (A/mm^2)	19.26	7.64
Secondary-Side Current Density (A/mm^2)	18.16	10.88

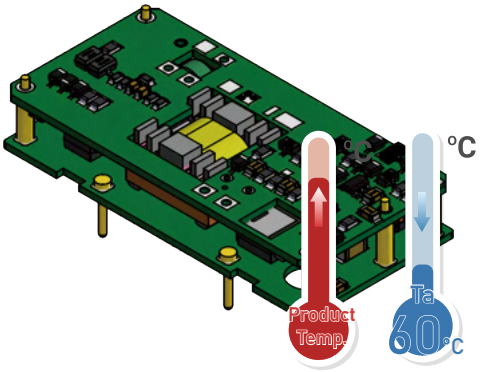
HIGHER OPERATING TEMP.

High operating temperature capability is critical for power modules deployed in hot, enclosed, and space-constrained systems, where limited airflow can easily lead to heat accumulation and affect system stability and long-term reliability.

The new series enhances thermal performance by placing key heat-generating components close to the metal case and adopting a distributed layout design to minimize localized hotspots. This optimized thermal path enables heat to transfer more efficiently to the enclosure, allowing faster heat dissipation, lower internal temperature rise, and more stable operation even under demanding thermal conditions.

Previous Series

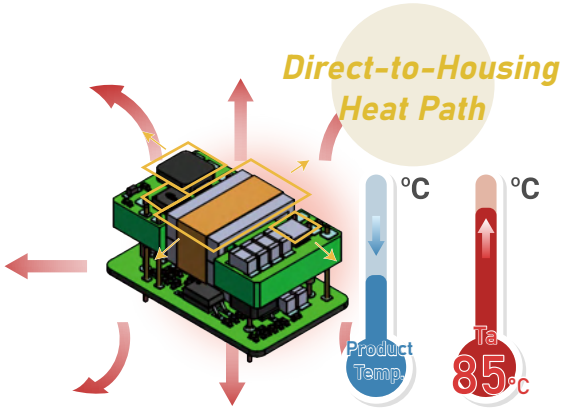
Operating Ambient Temp.(Ta): 60°C



Optimized
PCB Layout Design

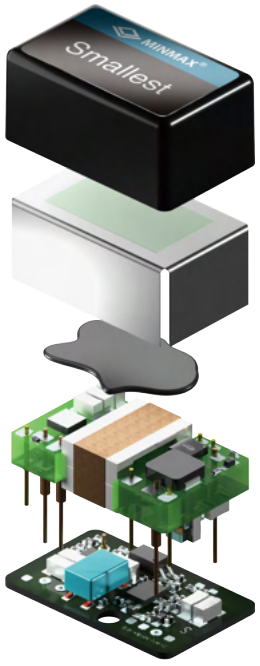
NEW Series

Operating Ambient Temp.(Ta): 85°C



In addition, optimized current density management on both the primary and secondary sides reduces thermal stress and supports long-term reliability.

Combined with a high thermal-conductivity potting compound (1.6 W/m·K), heat is transferred and dissipated more efficiently from critical components, improving heat spreading, increasing thermal margin, and ensuring stable operation in harsh industrial environments.



Previous Series vs. New Series Potting k

	Previous Series	NEW Series
Potting Compound Thermal Conductivity (W/m•K)	0.63	1.6

HIGH RELIABILITY

Reliability matters because power failures can lead to system downtime, costly maintenance, and operational risk—especially in high-temperature, continuously operating environments.

MINMAX products are qualified through rigorous TCT (Thermal Cycling Test), enabled in part by MINMAX's in-house potting formulation designed to improve mechanical support and resistance to thermal stress.
For example, MINMAX's railway product MRZI75 has successfully passed over 1,000 TCT cycles, demonstrating exceptional durability under extreme conditions.

This ensures MINMAX power solutions deliver reliable performance even in extreme conditions, supporting critical applications in industries like industrial automation, telecommunications, and medical equipment, while minimizing the risk of unexpected failures.

The actual number of TCT cycles passed depends on the series.

Exclusive Potting Formula!!

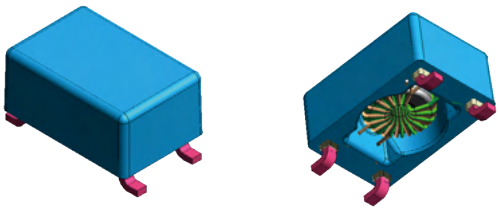
- Long-term reliability
- Reduced failure risk
- Stable in harsh conditions
- Built for 24/7 operation
- Thermal-stress resistant

From a design perspective, MINMAX applies reinforced mechanical protection—protective housings and structural support—even for compact, precision-critical components (such as inductors/transformers and other magnetic parts).

Because these parts are sensitive to thermal expansion mismatch and repeated temperature swings that can induce micro-movement and stress buildup, this protection helps minimize displacement and stress concentration during thermal cycling—ensuring long-term reliability.

In addition, thermal stress can cause fine solder cracks that may worsen at elevated temperatures and potentially affect contact between the pins and the aluminum substrate.

To address this, MINMAX incorporates a specialized pin design that provides thermal cushioning, improving robustness in high-temperature operation.



Protective casing prevents coil damage under thermal stress.