為下一代先進的測試和量測系統提供動力

Powering the next-generation of advanced test and measurement systems

Vicor Taiwan FAE

Jeff Chang 張仁程

為下一代先進的測試和量測系統提供動力

Powering the next-generation of advanced test and measurement systems

- Next generation ATE market trends and Power requirement
- Test and measurement system power solution
  - Discrete vs. modular comparison
- Vicor value proposition in next generation ATE
- ATE application with Vicor high-performance power modules
  - Semiconductor ATE
  - Burn-In tester
  - Battery formation/tester
  - Instrumentation
- Case study and success story

Next generation ATE market trends and power requirements

ATE market overview

- Global ATE market size is valued at $8.5B in 2022 grows to $20B by 2032 – 10% CAGR
- Global IC market CAGR is 7.5% to $650B by 2025
- Largest IC growth in automotive and industrial markets
- Advantest and Teradyne dominate the ATE business at 80% of market
- Processor products becoming more complex – large bottleneck of test time

ATE market trends

- Rapid growth of the automotive and semiconductor industries
- Increasing demand for consumer electronics products
- Government regulations promoting development of semiconductor industry
- Grading products more important to hit high performance price points
- Increased capacity to meet rising demands
- Maximize ATE floor space and reduce cost of testing
- HV DC networks

Test and measurement system power solution

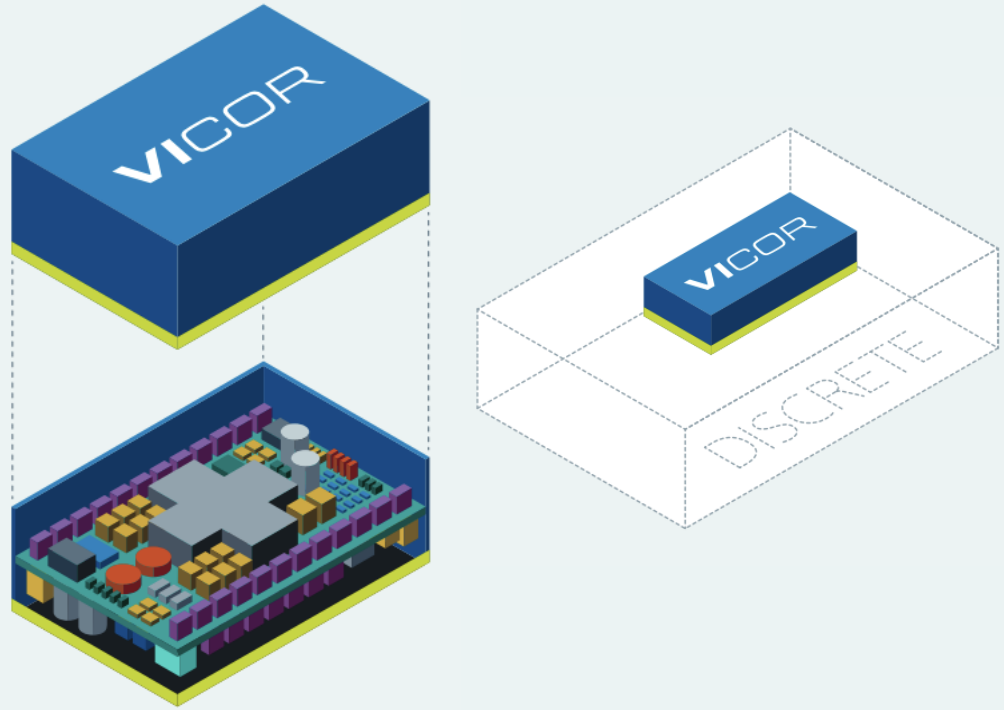
Discrete vs. modular comparison

Test and measurement system power solution – discrete vs. modular comparison

Feature	Discrete	Vicor power modules
In-house power design	Extensive engineering skill needed	Minimal engineering skill needed
Size	Larger BOM and PCB area	Small and compact
Weight	Bigger BOM/larger PCB make it heavier in most cases	Light
Power density	Low	High
Flexibility	Larger footprint makes it difficult to fit into existing application	Compact size allows for ease of implementation in any application
Scalability	Fixed circuitry makes it difficult to scale to a new design	Modular design makes it easy to scale up or down
Design cycle/time-to-market	Longer	Up to 50% shorter compared to discrete
Qualification	Need to be performed in house	Guaranteed from the vendor
Thermal management design	Inefficient and complex with non-uniform and spread-out devices	Simplified with uniform planar packaging profile and localized source
Ease of assembly	More complicated, slower and higher risk of damage	Simple, faster, lower risk of damage
Procurement / supply chain	More complex with greater risk of supply chain interruption	Simpler with lower risk

Test and measurement system power solution – discrete vs. modular comparison

- Modules have a higher power density and in most cases are more efficient
- Power delivery network that drives more power in less space
- Modules provide the flexibility and scalability needed to make design changes quickly
- Discrete solutions need to be significantly resized to account for the additional power requirements.



Vicor value proposition in next generation ATE

Market needs vs. Vicor value proposition

Market needs	Vicor value proposition
Faster/higher throughput	Small size allows ATE manufacturers to power more pins in same or smaller test head
Small as possible ATE floor space requirement	High power density to increase test capacity without increasing system size
Cycle time reduction	Highest power density to power more ATE test pins
Architecture expansion from generation to generation	PDN allows for similar architectures to continue over generations
Highest possible yield	Isolated DCDC conversion to not add to yield loss due to noise

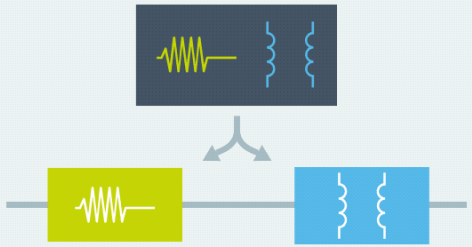
Positioning: Vicor value proposition in ATE

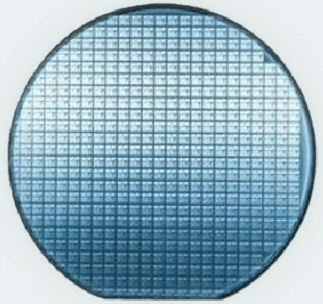
- Increase speed of testing, requires smaller, faster moving test head
- Minimize set-up time by broadening capabilities of tester
- System size constrained, even as number of pins to be tested increases
- IC performance and complexity have increased in all end markets

- Factorized Power Architecture allows separation of transformation and isolation from regulation, reducing size and weight of PoL supply
- Flexible topologies offering wide trim range
- Highest power density and low-profile products – no need to expand current footprint
- Higher throughput with more compact, modular power solutions allow for rapid development with reduced test and burn-in cost

The four pillars of Vicor power system innovation

Innovative architectures

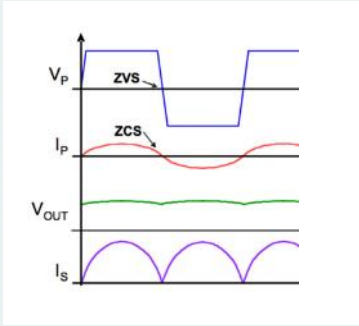


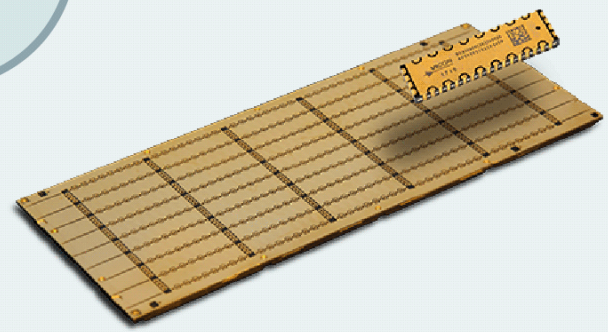


Unique control systems

VICOR

Advanced topologies



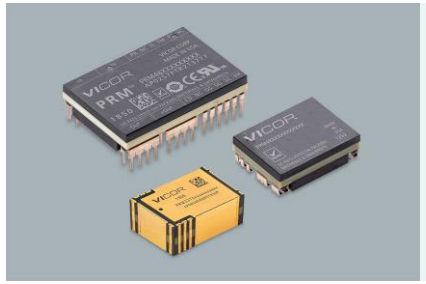


Proprietary components and packaging

Vicor power module families

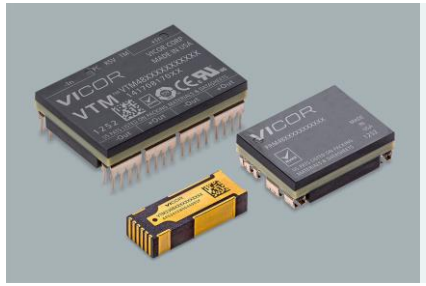
DCM DC-DC converters

BCM bus converter modules

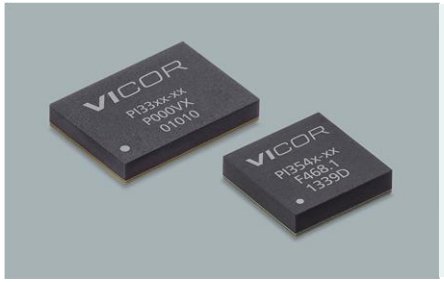


PRM pre- and post-transformation regulators

ZVS buck-boost regulators



VTM current multipliers



ZVS buck regulators

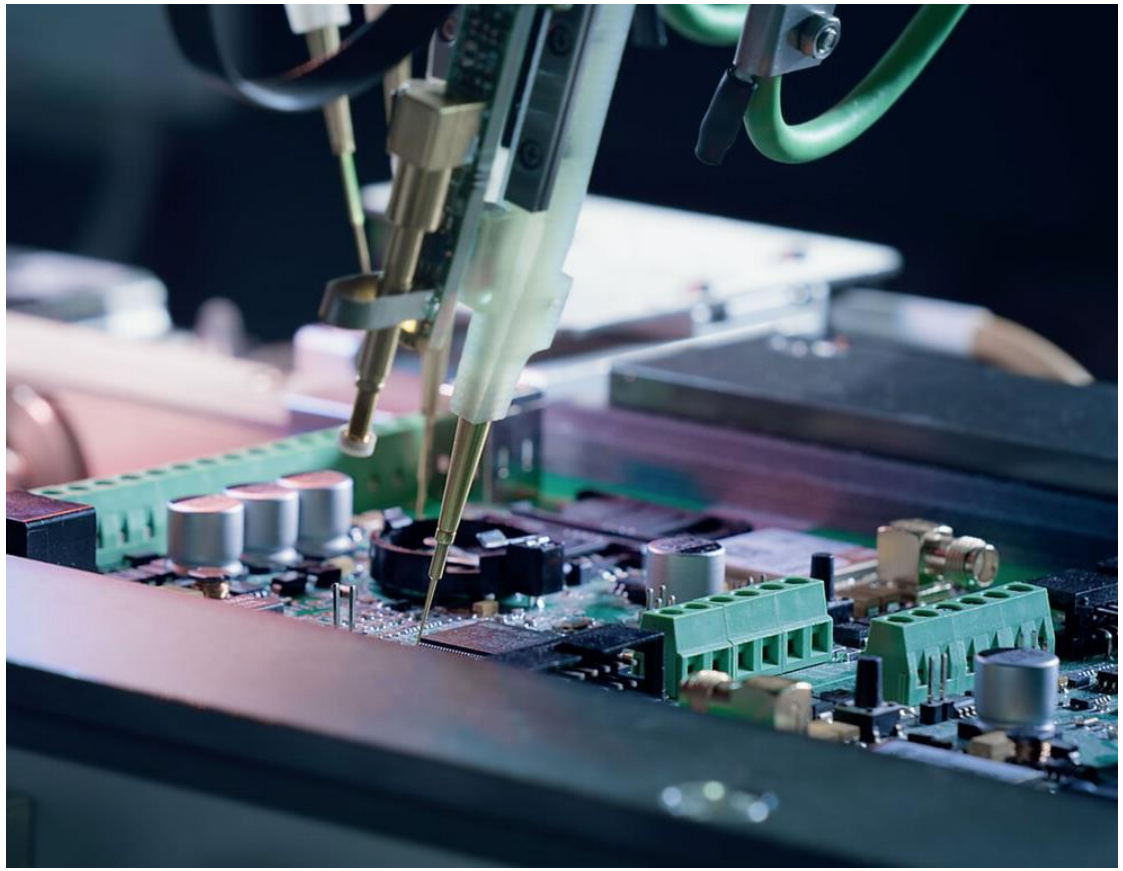
ATE application with Vicor high-performance power modules

Semiconductor ATE solution

Increase speed and throughput of automated test station

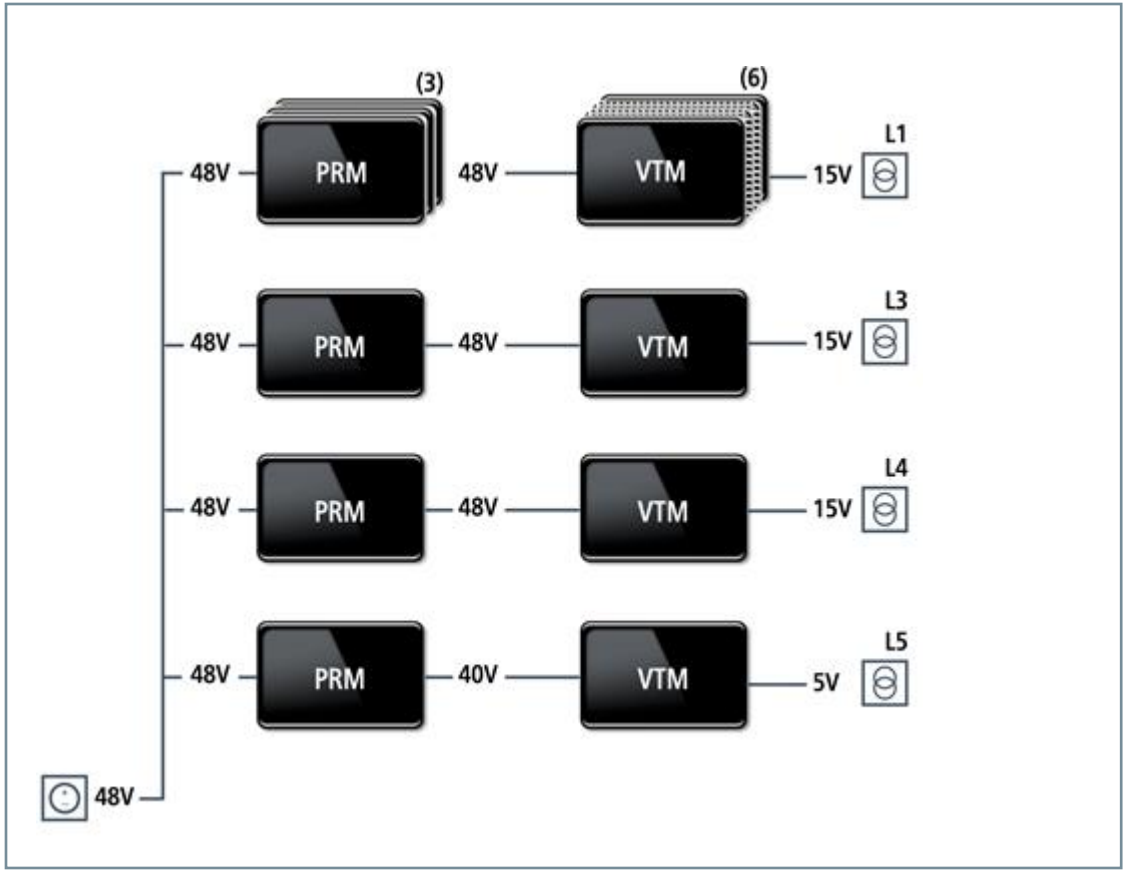
Customer challenges

- Achieving maximum power density with low MTBF and FIT metrics
- The number of IC pins to be tested is rapidly increasing
- Test equipment requires low noise and variable output



Semiconductor ATE solution

- Vicor Factorized Power Architecture (FPA) allows separation of regulation and transformation/isolation
- PRM regulator modules provides regulation away from the load
- VTM current multipliers at the point-of-load to minimize PCB real estate needed at the space-limited test head



Vicor Semiconductor ATE solution advantage

- High switching frequency of the VTM SAC topology minimizes output ripple
- Use of power components makes it easy to implement additional load voltages
- Adjustability of output removes need for equipment change, reducing set-up time significantly

Vicor Value in Semiconductor ATE

Minimize the cost-of-test for end customers

Automated test equipment customers are competing to provide the lowest possible cost-of-test to their customers

Powering size-constrained test head with maximum power density enables more components to be tested simultaneously, leading to faster test throughput and lower cost-of-test

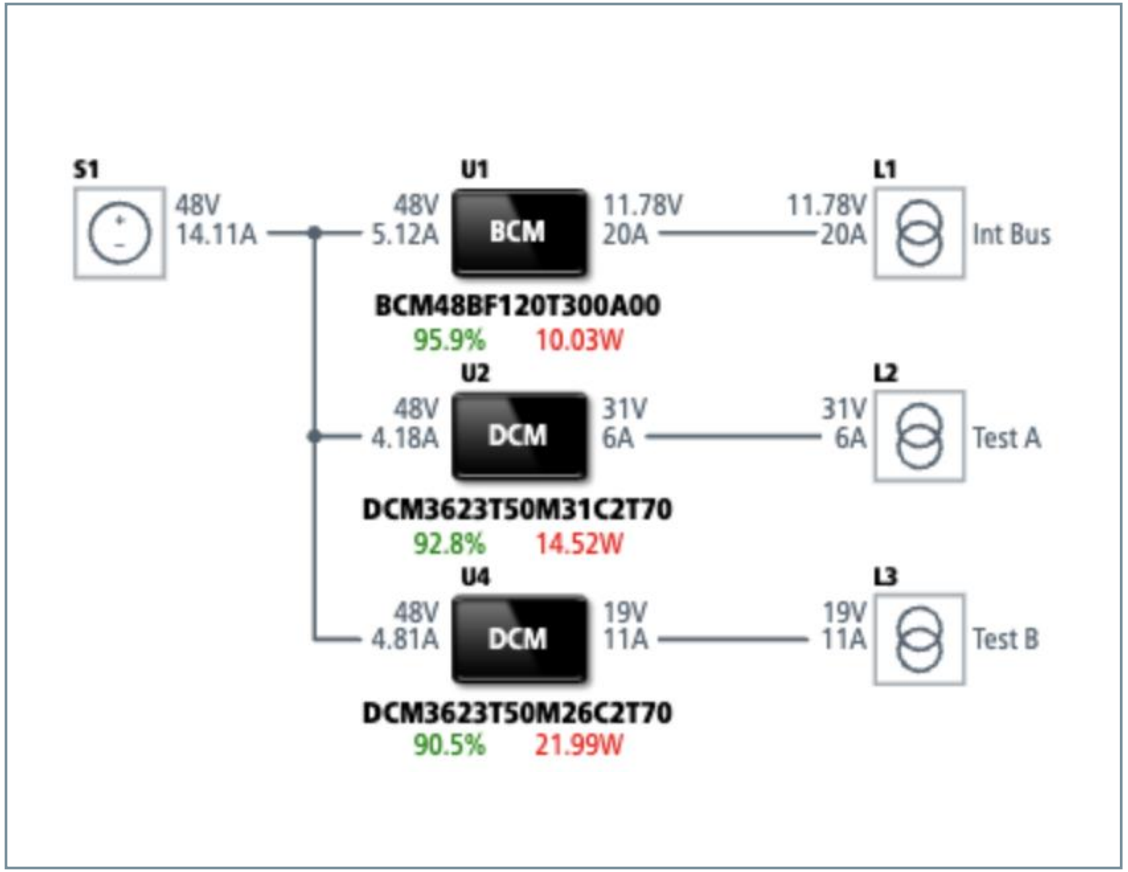
Burn-In tester

Customer challenges

- More space needed for processing electronics
- Power supply should support the increased load demands in the reduced footprint available
- Increased power means increased heat in the system, requiring improved cooling
- Minimizing operating costs
- Low noise and low ripple required

Memory Burn-In tester solution

- A move to a 48V bus architecture reduced system distribution losses
- A BCM Bus Converter Module converted the 48V bus to a non-regulated 12V rail
- DCM DC-DC converters provided the 31V and 19V rails



ASIC Burn-In tester solution

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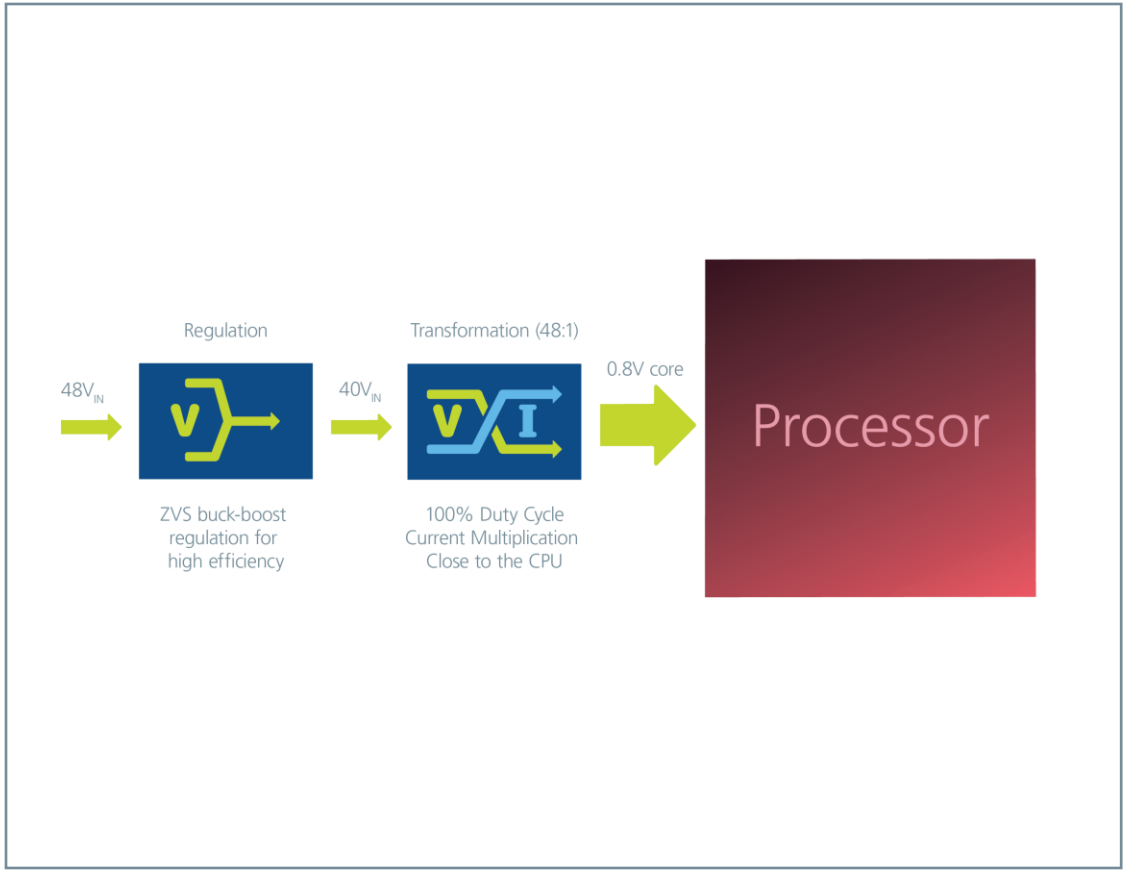


Vicor Burn-In tester solution advantage

- Small footprint of BCM and DCM provides space for other functionality
- Double-sided conduction cooling and low profile of BCM and DCM allows increased airflow and improved system cooling
- High efficiency switching topologies reduced waste heat and reduced power consumption

Vicor Value in Burn-In tester

Highest power density

Tested a greater number of devices in parallel without having to expand current footprint

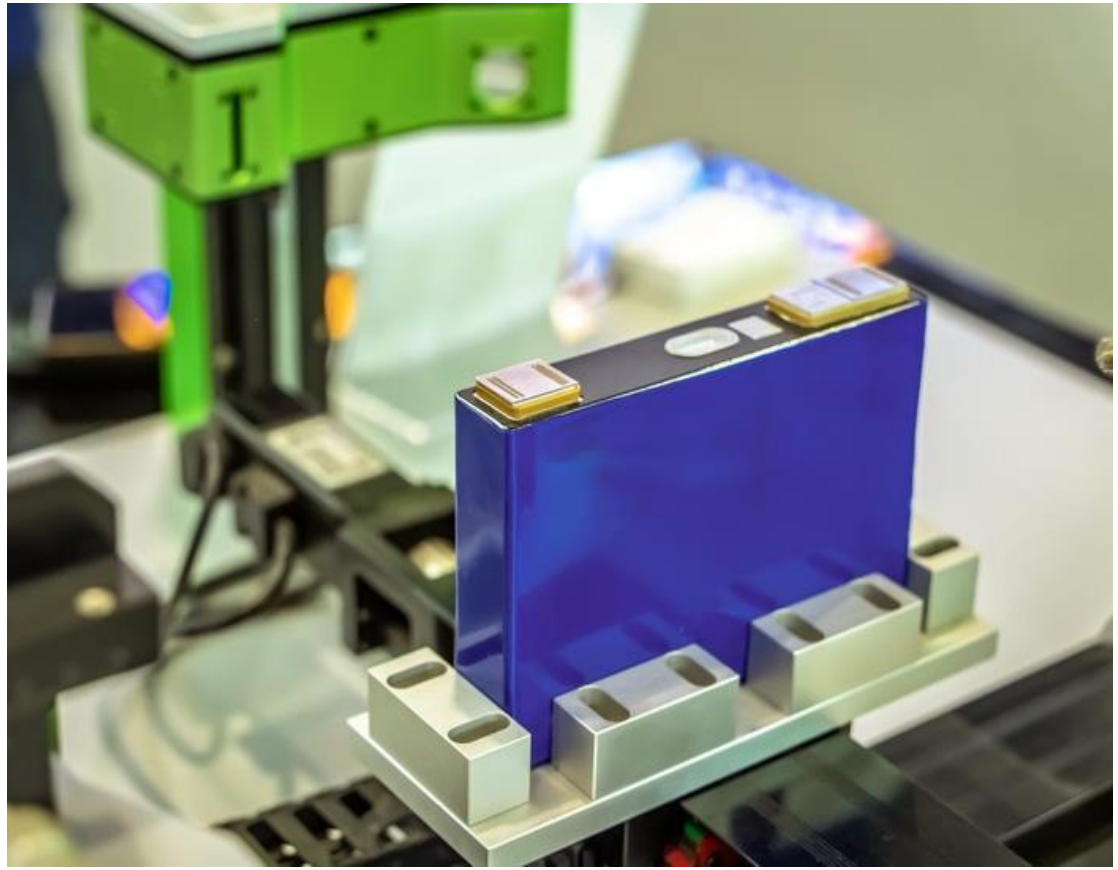
Reduced cost and time for testing

Low EMI and best-in-class thermal management

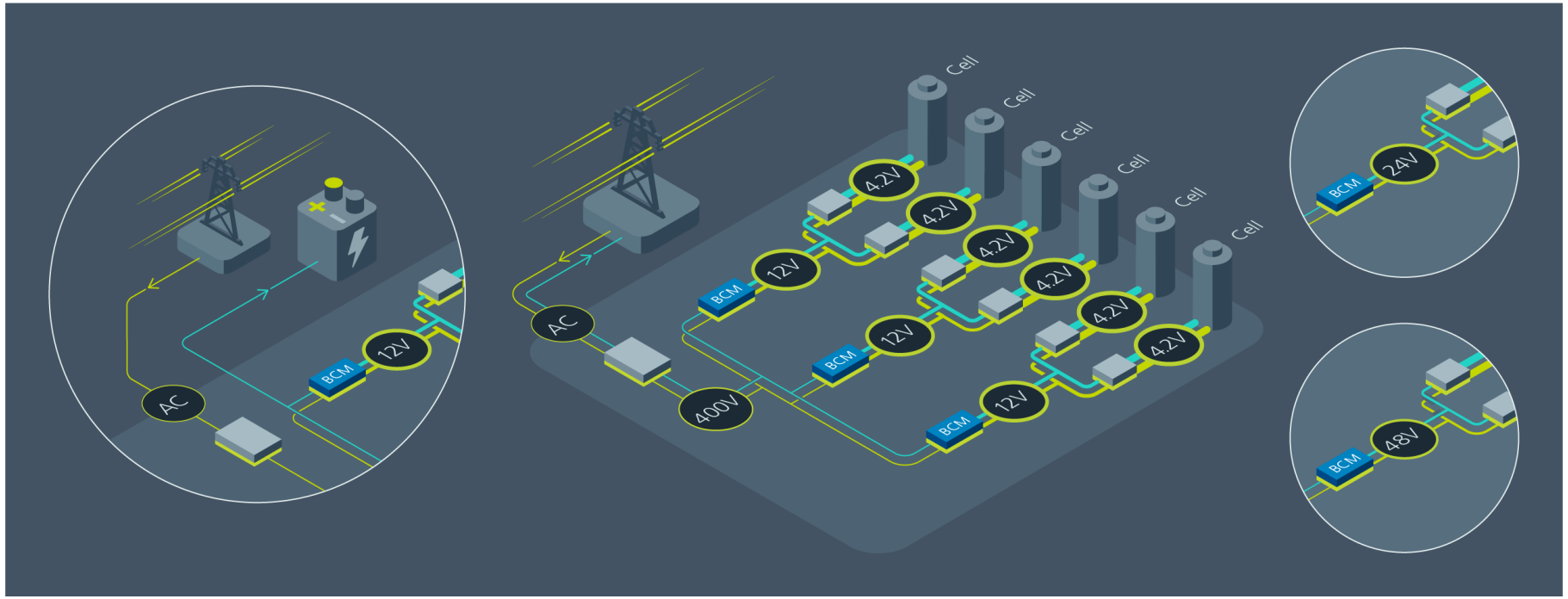
Battery formation/tester

Customer challenges

- More space needed for processing battery formation
- Increased battery testing throughput without increasing floor space.
- HV Bi-directional operation
- Versatile and reliable required
- Minimizing operating costs
- High efficiency/Power density required



Battery formation Power Delivery Network



BCM6123 bus converters

Input: 260 – 410V (384V nom)

Output: 8.1 – 12.8V (12V nom)

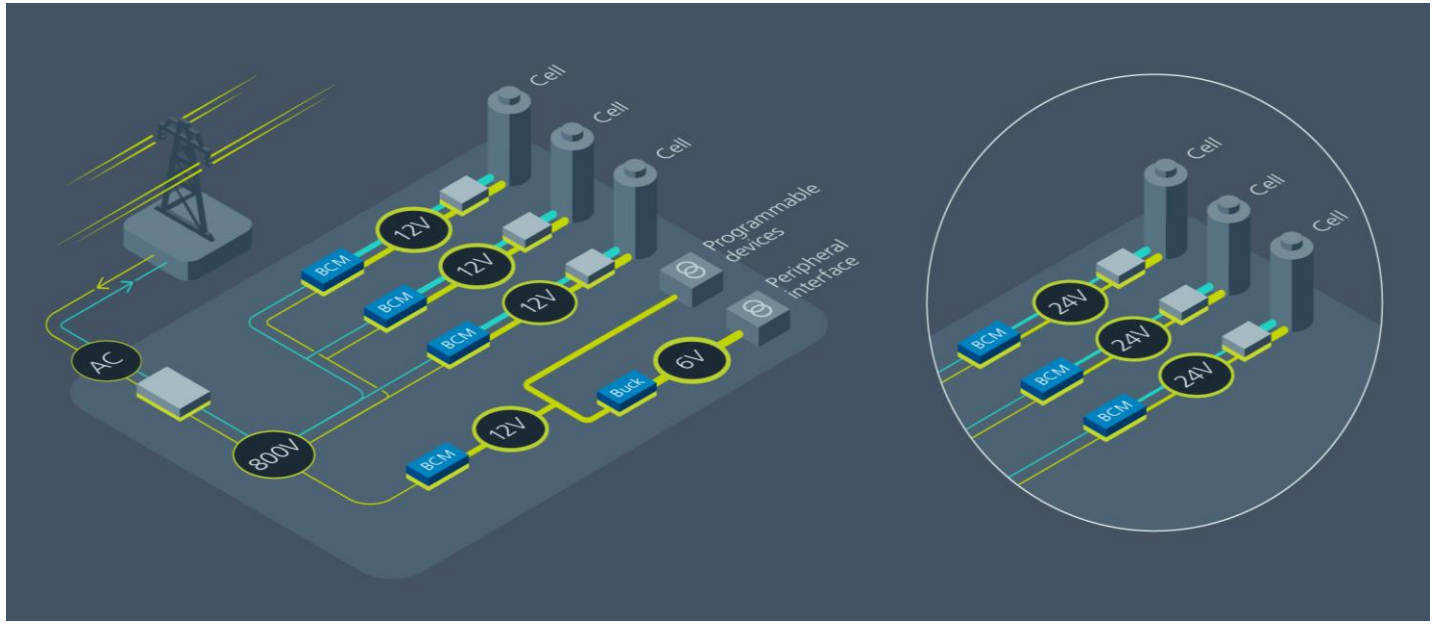
Power: Up to 320W

Efficiency: Up to 97.9%

63.3 x 22.8 x 7.2mm

vicorpower.com/bcm

Battery testing Power Delivery Network



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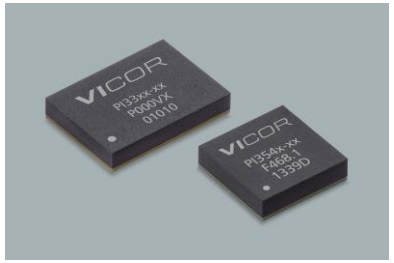


ZVS buck regulators

Input: 12V (8 – 18V), 24V (8 – 42V), 48V (30 – 60V)

Output: 2.2 – 16V

Current: Up to 22A

Efficiency: Up to 98%

As small as 10.0 x 10.0 x 2.56mm

vicorpower.com/zvs

Vicor Value in Battery formation/tester

Maximize throughput and adapt to change quickly and easily

High density and efficiency

High current capability

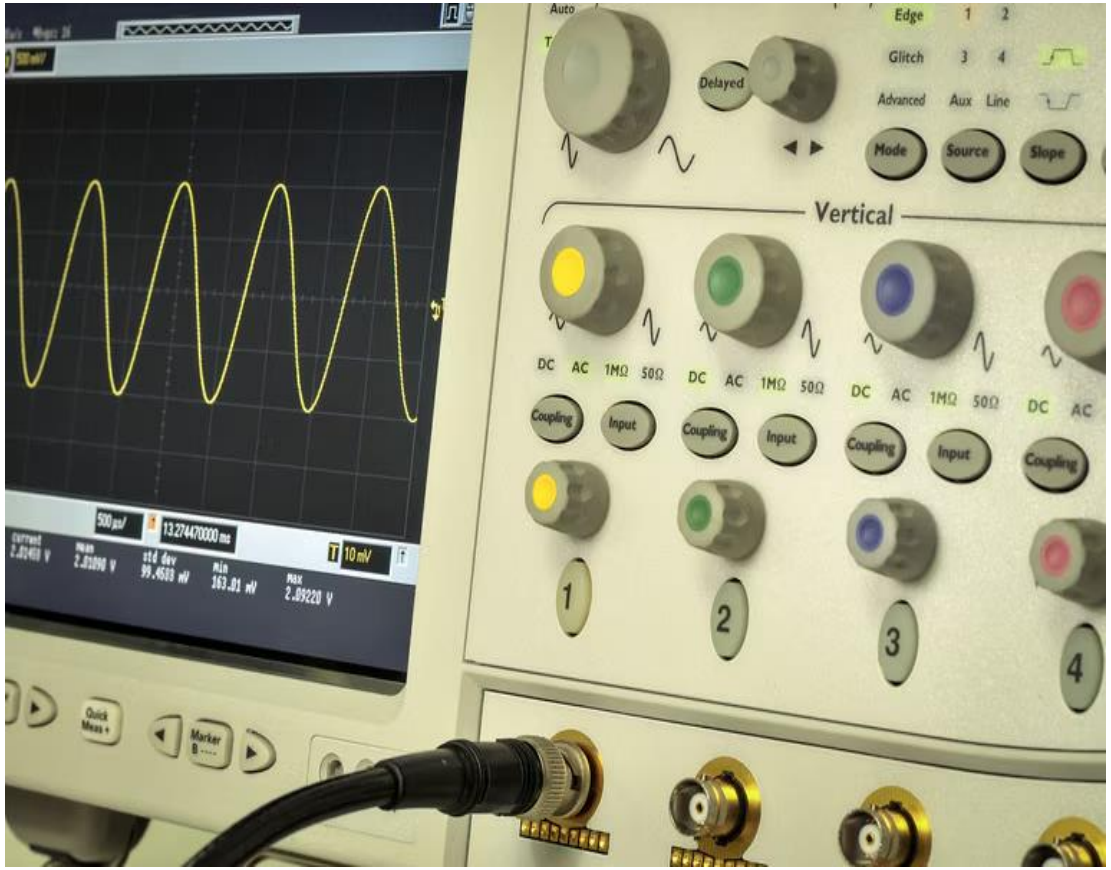
Low height

Scalable and flexible

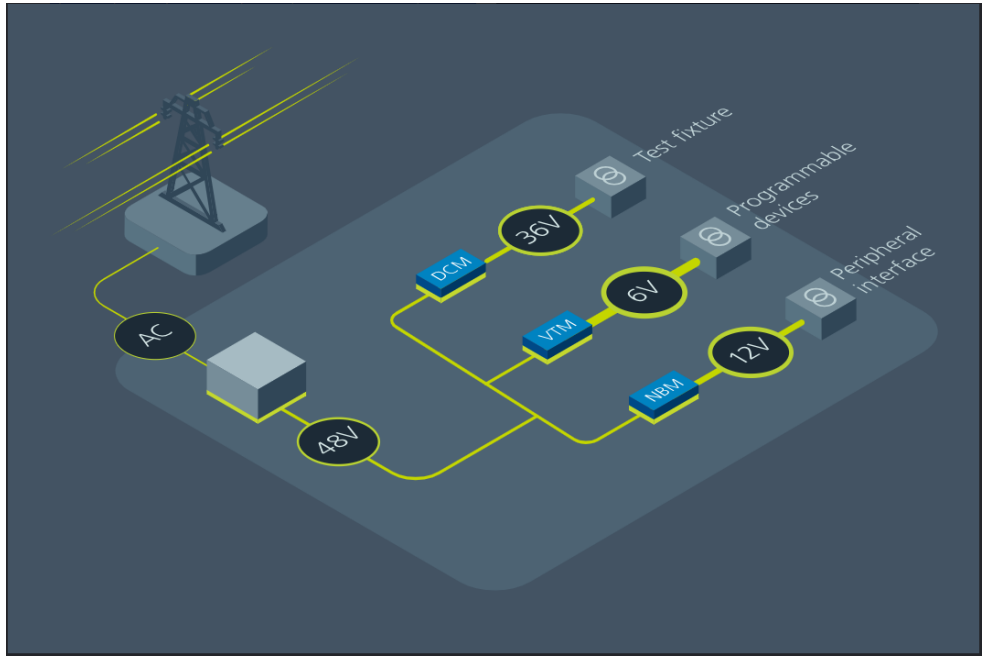
Instrumentation

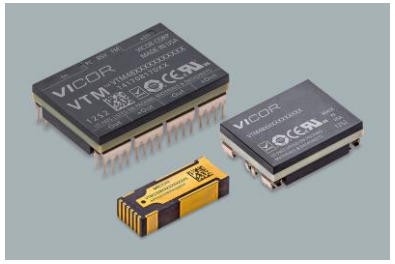
Customer challenges

- Space constraints limit performance
  - Maintaining signal integrity
  - Managing excessive heat
- High performance with low noise required
- Efficient thermal management required
- ASIC load tester less 1V design challenge



Instrumentation solution





VTM current multipliers

Input: 0 – 60V

Output: 0 – 55V

Current: Up to 115A

Efficiency: Up to 97%

As small as 22.83 x 8.52 x 4.9mm

vicorpower.com/vtm

NBM fixed-ratio DC-DC converters

Input: 36 – 60V

Output: 7.2 – 15.3V

Power: Up to 2400W

Efficiency: Over 98%

As small as: 23 x 17 x 5.2mm

vicorpower.com/nbm

DCM DC-DC converters

Input: 9 – 420V

Output: 3.3, 5, 12, 13.8, 15, 24, 28, 36, 48V

Power: Up to 1300W

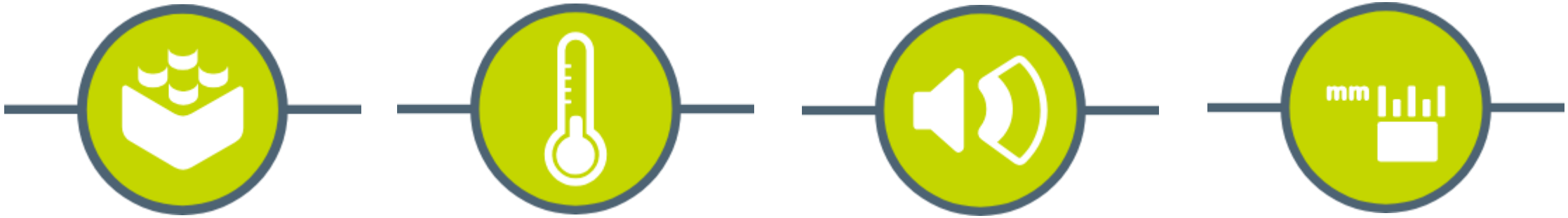
Efficiency: Up to 96%

As small as 24.8 x 22.8 x 7.21mm

vicorpower.com/dcm

Vicor Value in Instrumentation

The lowest noise and best thermal management for test and measurement



Modular, scalable power delivery

Improved thermal management

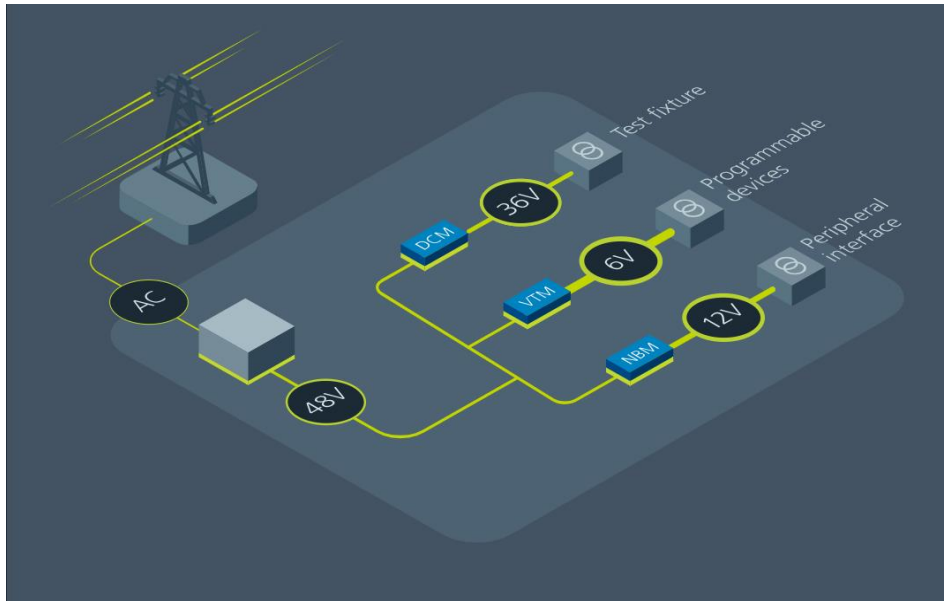
Low noise

High power density

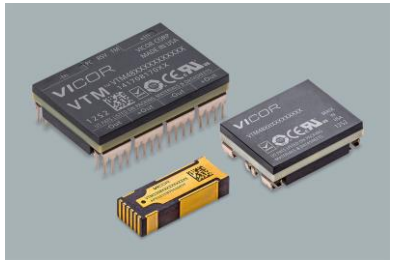
Case studies and success stories

High density, modular testing for CPUs, GPUs, and SoCs

Semiconductor manufacturers rely on high-density test systems to support their growing portfolios of increasingly complex products



The inherently low noise of Vicor SAC topology and advanced packaging technology, combined with planar magnetics and a low profile, greatly simplify and improve thermal management.



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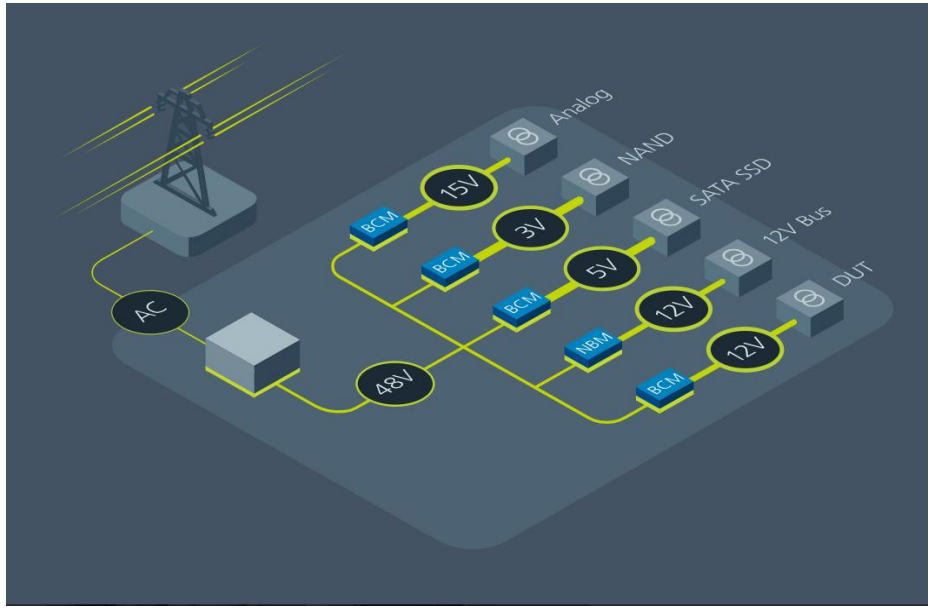
vicorpower.com/dcm

Increasing capacity of semiconductor burn-in thermal chambers

- Chambers increasingly more prevalent as high-reliability end markets require semiconductor ICs that achieve the highest levels of quality, reliability and stability.
- Vicor can help achieve higher burn-in throughput with more compact, modular power solutions to allow for rapid development with reduced test and burn-in cost



BCM bus converters

Input: 800 – 48V

Output: 2.4 – 55.0V

Current: Up to 150A

Efficiency: Up to 98%

As small as 22.0 x 16.5 x 6.7mm

vicorpower.com/bcm

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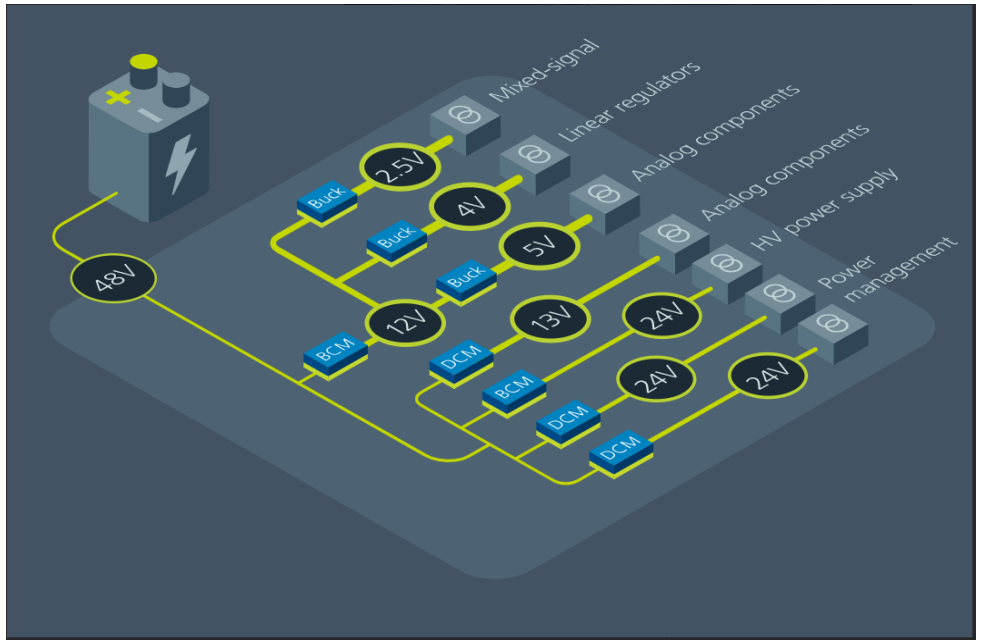
Precision inspection equipment

Wafer-level automated visual inspection systems ensure the highest quality and reliability of semiconductor ICs and enable manufacturers to continuously improve yields.



Vicor provide a new approach to power delivery is required to keep pace with advances in semiconductor wafer fabrication.

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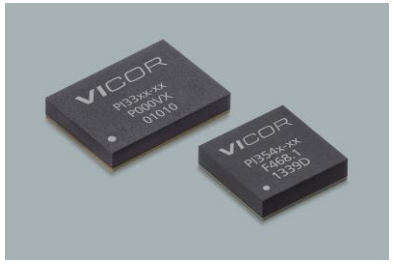

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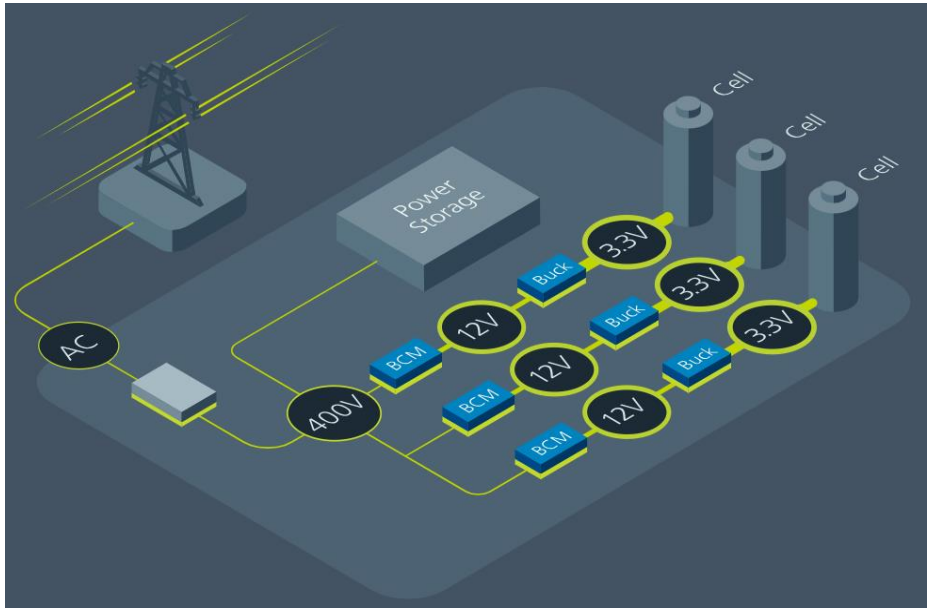
vicorpower.com/zvs

Battery formation/test equipment

- Battery formation/test equipment higher output power requirement for new gen. with the same system side, need HV to reduce total manufacture cost for >50A application
- BCM6123 products are critical in the battery formation and test PDNs due to the high-density, bidirectional, high-efficiency isolation features



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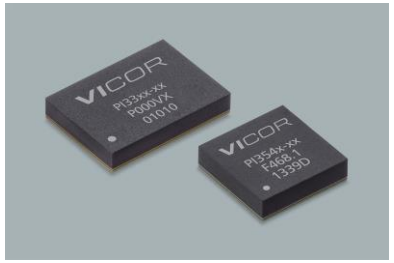

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Thank you