



Space and Weight Saving Power Conversion for Active Suspension Systems

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Vicor 公司

BGM6135 DC-DC 双向电源转换器模块

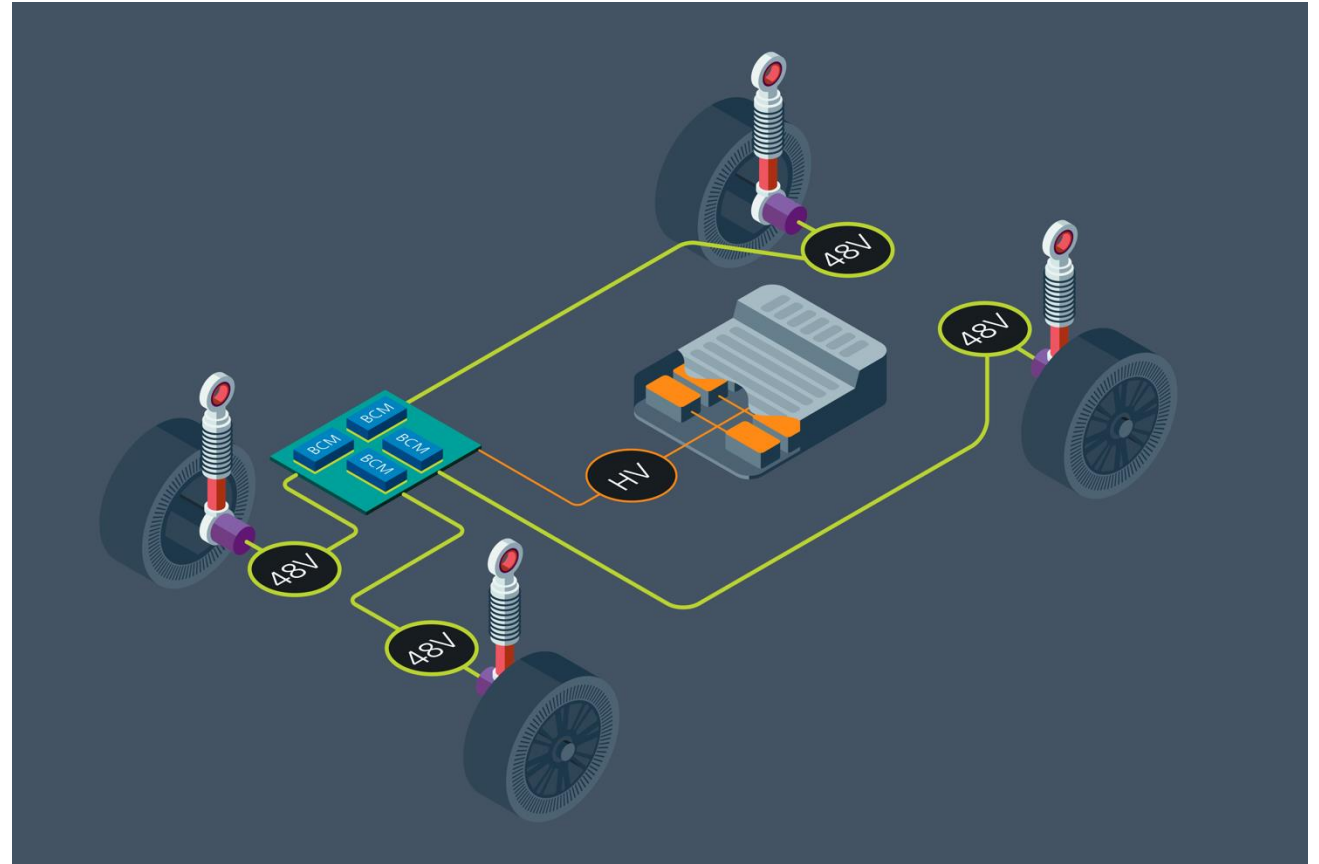
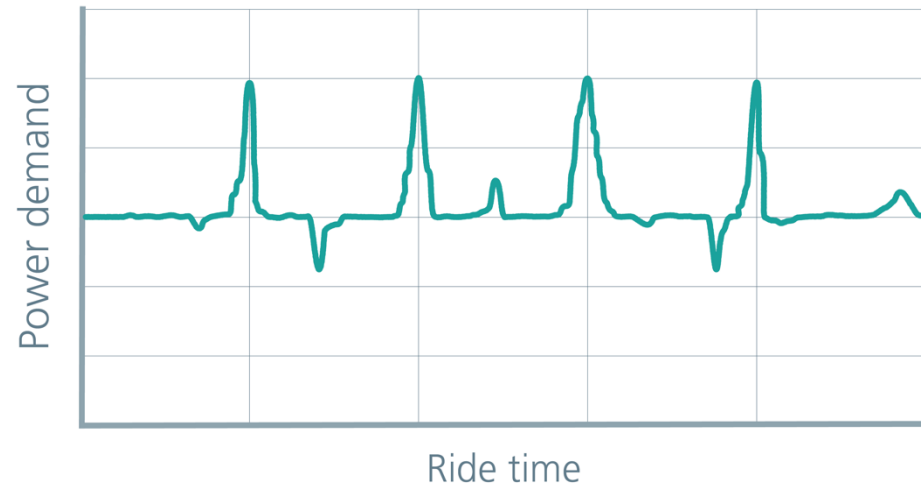
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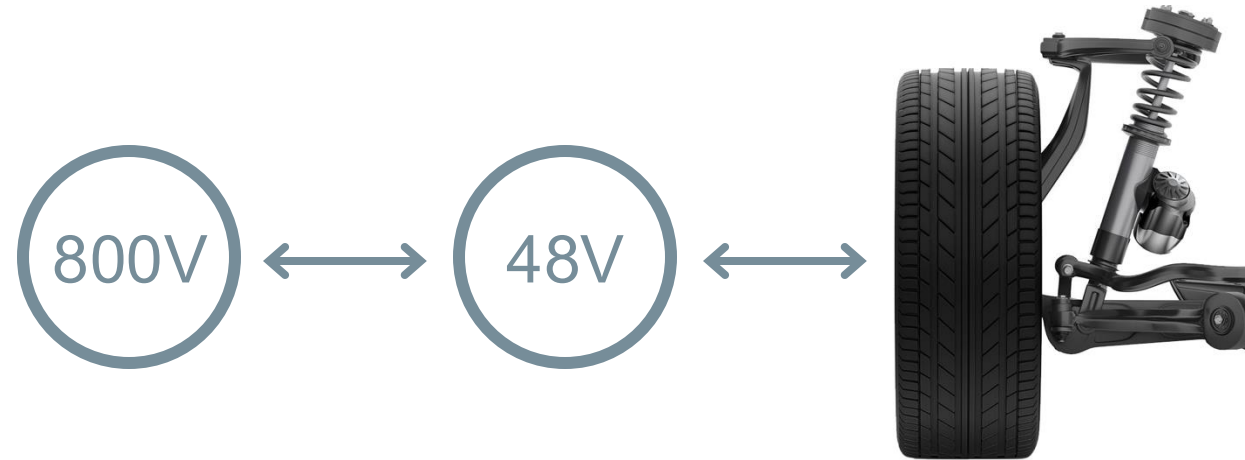
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Active suspension systems have demanding power requirements

- Highly dynamic profiles
- Extreme peak currents
- Energy recuperation



Active suspension system power requirements



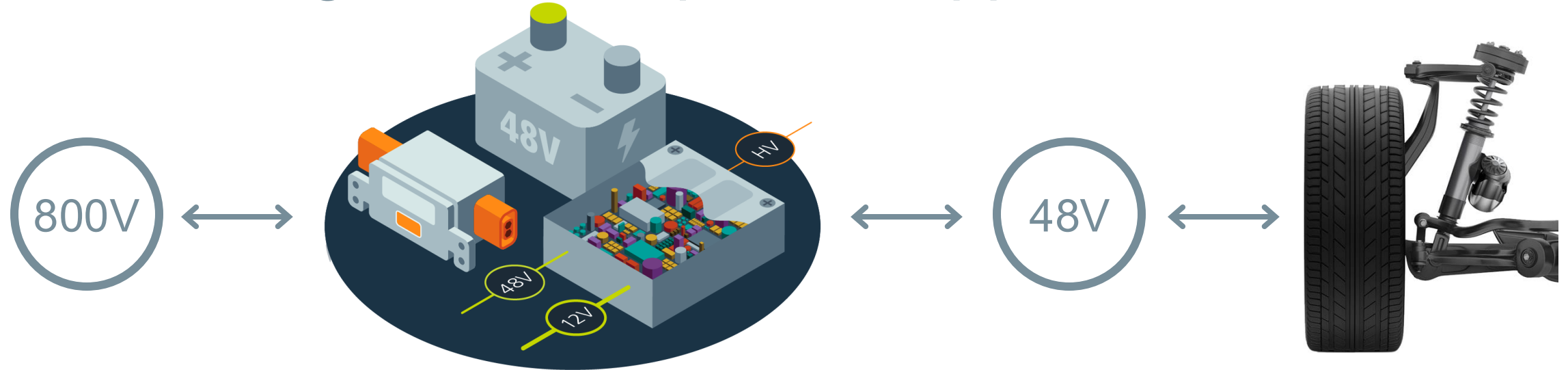
800V to 48V
Isolation for user safety

48V power for supporting
smaller actuators

Symmetrical buck/boost
capability to supply
regenerated power back
to the HV battery

Power switching speeds
that will match or exceed
the control system
processing times

Meeting the power curve requires multiple devices when using traditional power supplies



800V to 48V

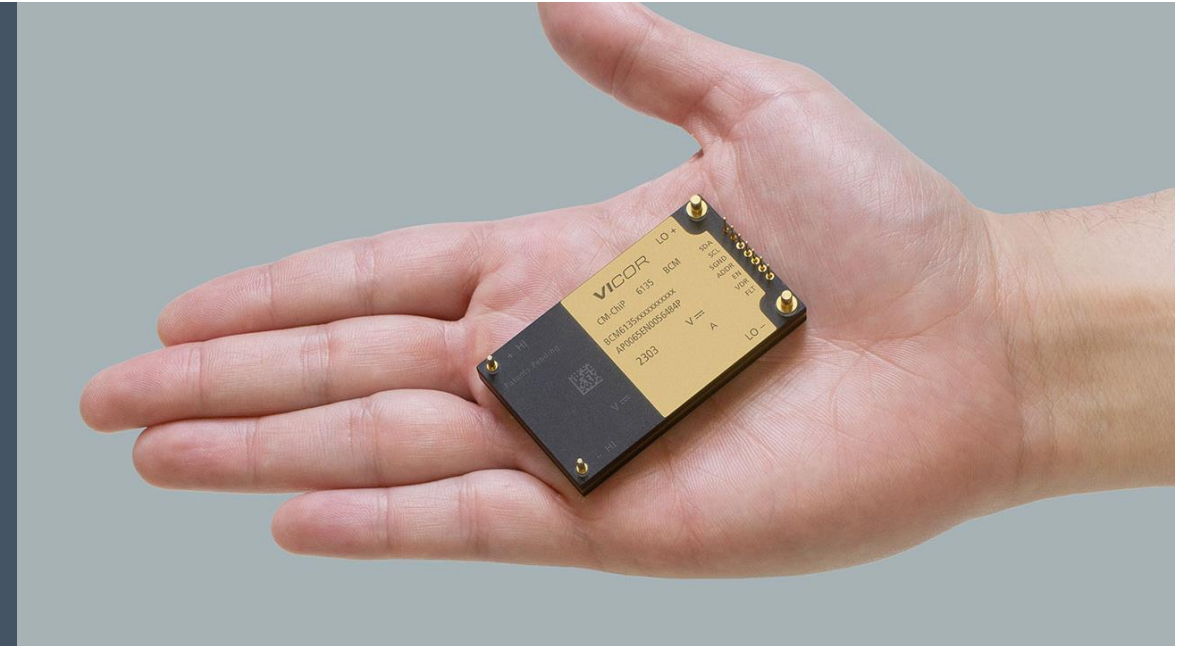
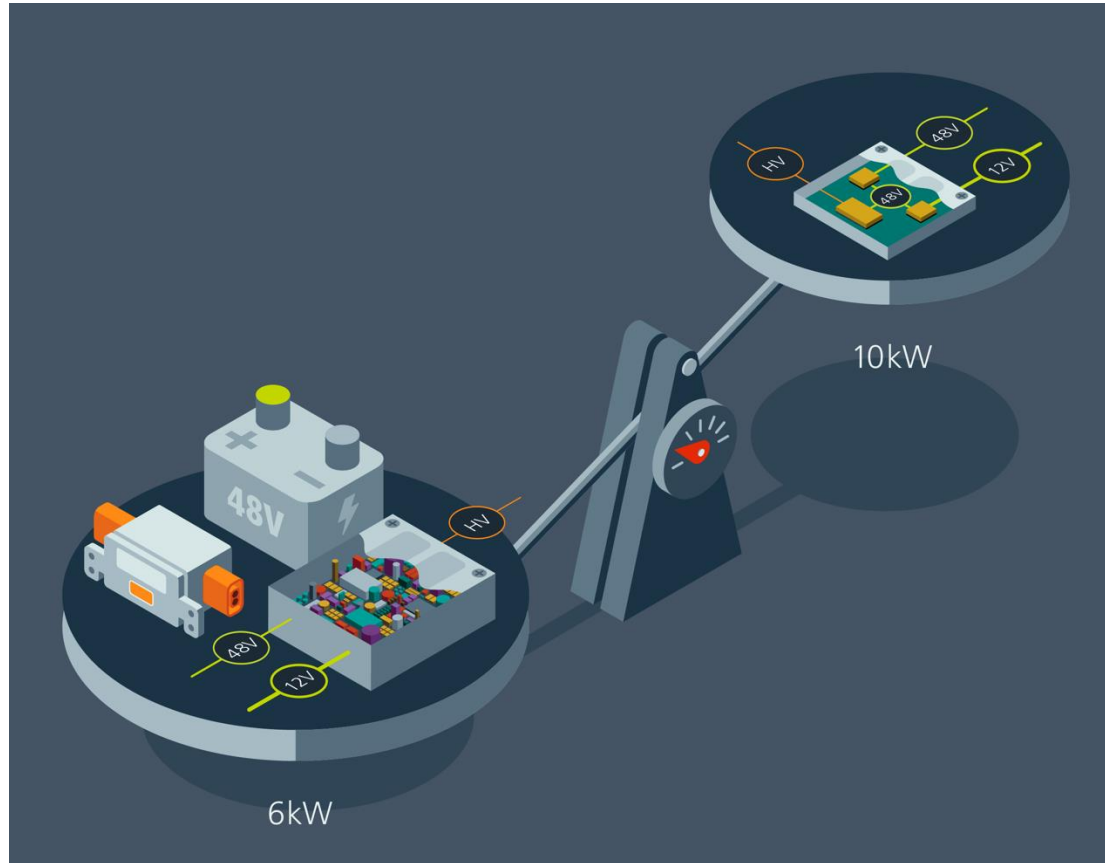
Requires large footprint and potting for creepage and clearance

48V sized for maximum power draw, up to 10x more than nominal power

Non-symmetrical buck/boost capability requires an added 48V battery or super capacitor with fuse box

Power switching speeds that will match the control system processing times

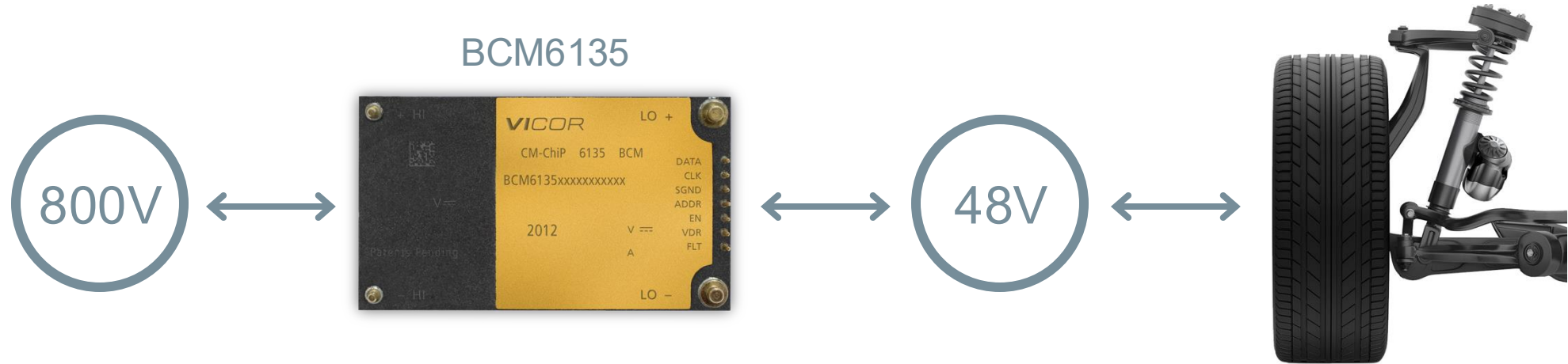
Sine Amplitude Converter systems provide more power from less space and weigh less



218 kW/L for 800V to 48V

500 kW/L for 48V to 12V

SAC based BCM6135 meets and exceeds active suspension power requirements



800V to 48V

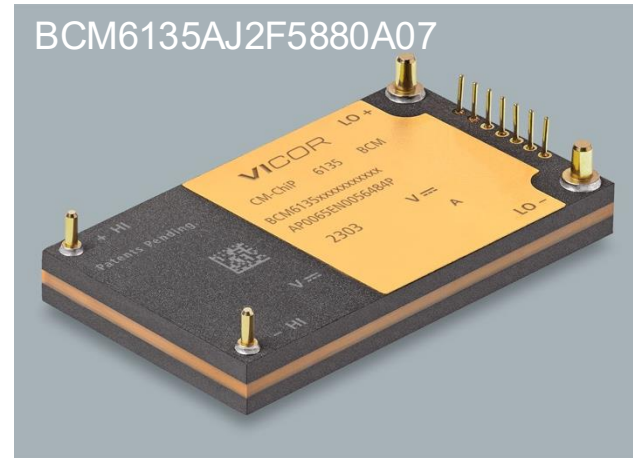
Isolation for user safety contained inside the module's 61 x 35 mm footprint

Can surge up to 30% for power events < 30 ms

Symmetrical buck/boost capability to directly supply regenerated power back to the HV battery

Power switching speeds that will exceed the control system processing times by over 100x

BCM6135 power performance capability overview



Peak Power	3.5 kW
V_{IN} Range	270 – 920V
V_{OUT} Range	16.9 – 57.5V
Peak Current	80 A
Bidirectional	Yes
Start-Up Bias	Internal

Creates 4242V input to output isolation internally

Provides 7kW of power when built in an array of 2 modules

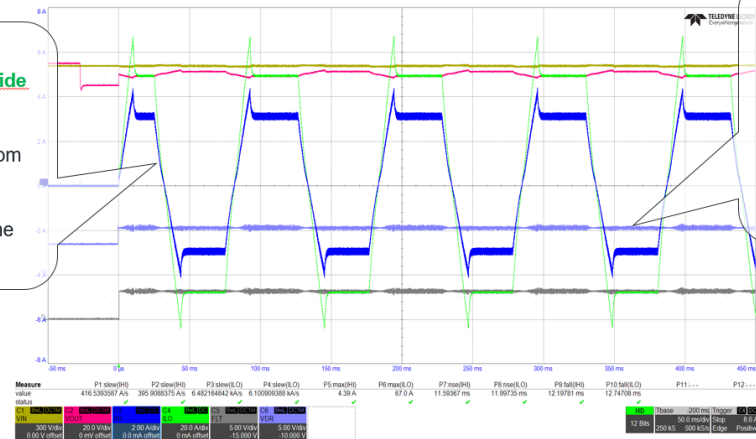
Symmetrical performance in buck or boost

Highest current change (slew) rate of 8 M A/s

System Load Transient

800VHI, 50VLO, 0 to 50A ILO, 0A to 3.125A IHI

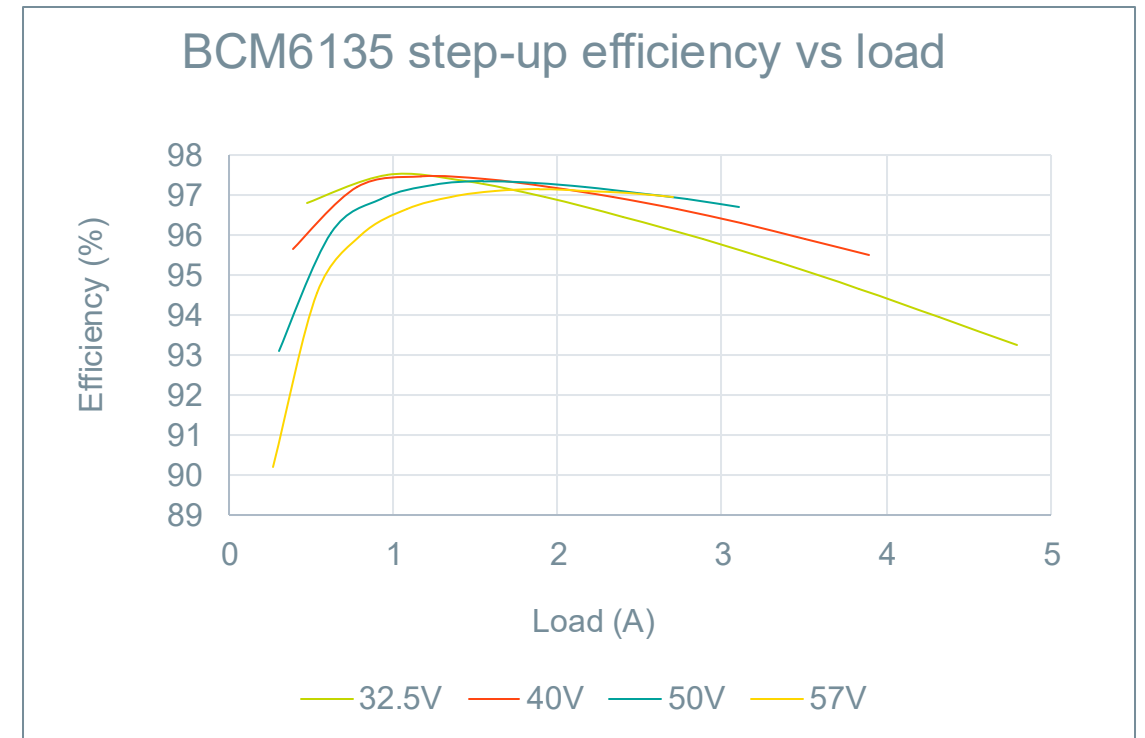
- **Hiside LoSide** Currents
- Linear transition from forward to reverse
- No dead time



- VDR Power is constant highlighting how the powertrain behaves no different forward or reverse

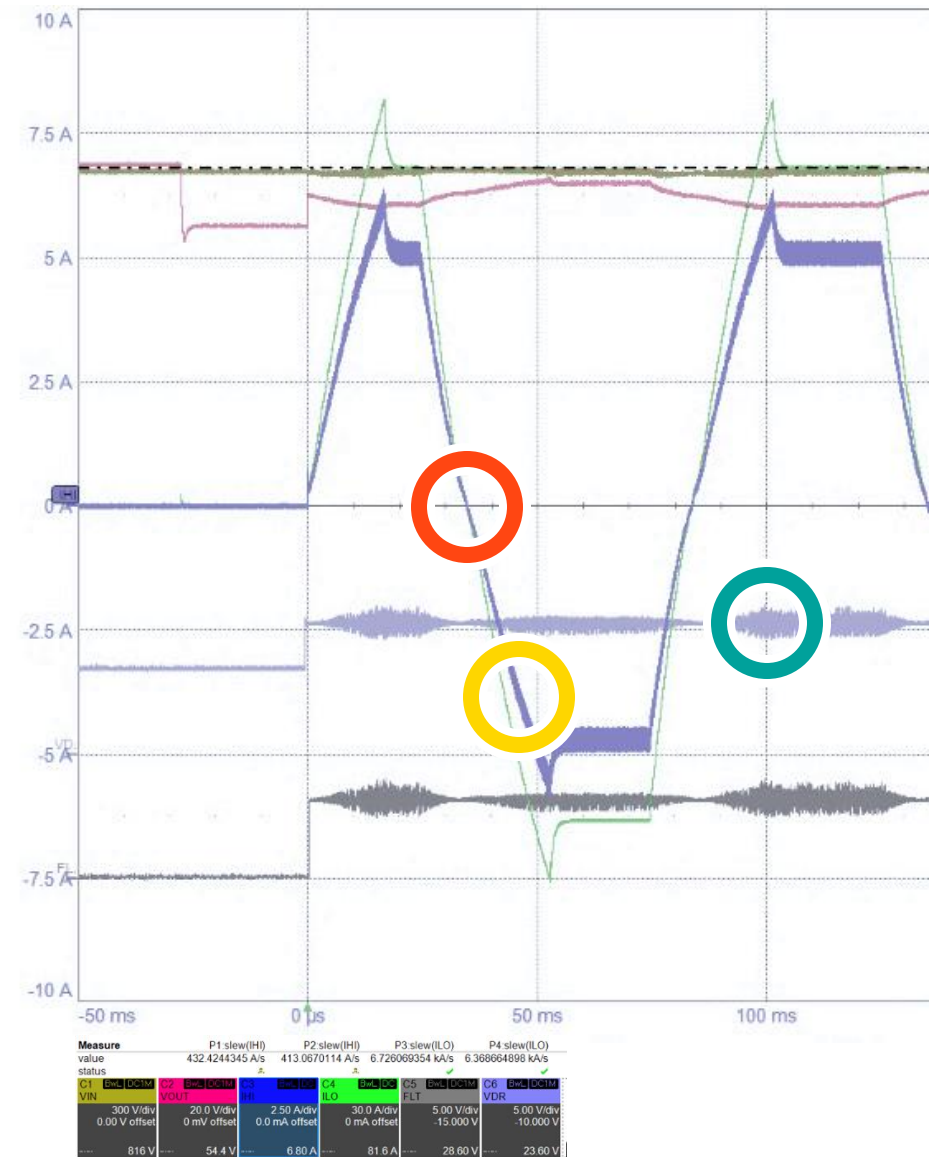
BCM6135 symmetrical power processing allows direct recharging of the HV battery

Equal power capability in either direction: 3.5 kW at 97.5% peak efficiency

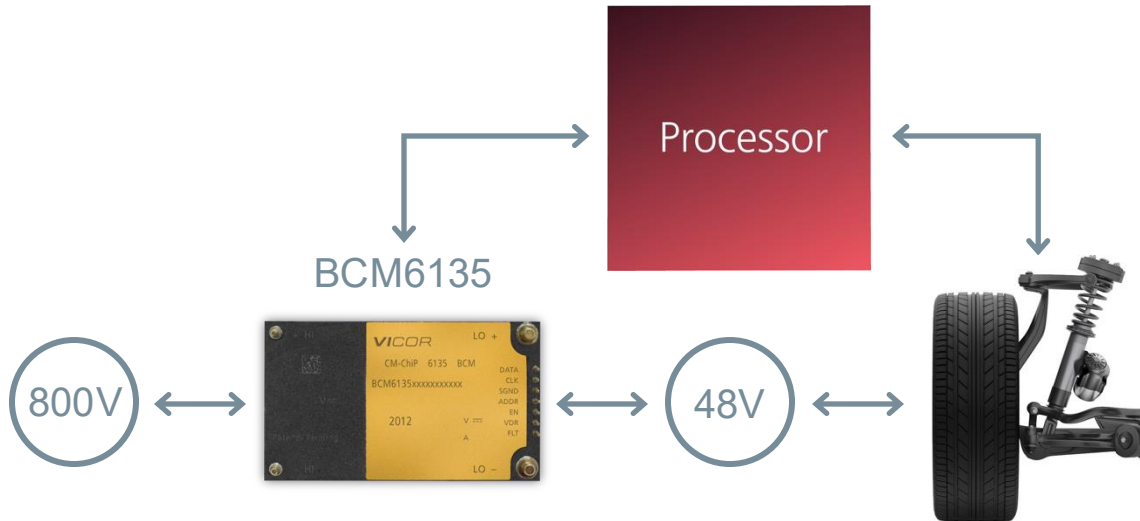


BCM bidirectional current flow and bandwidth for are well matched to active suspension

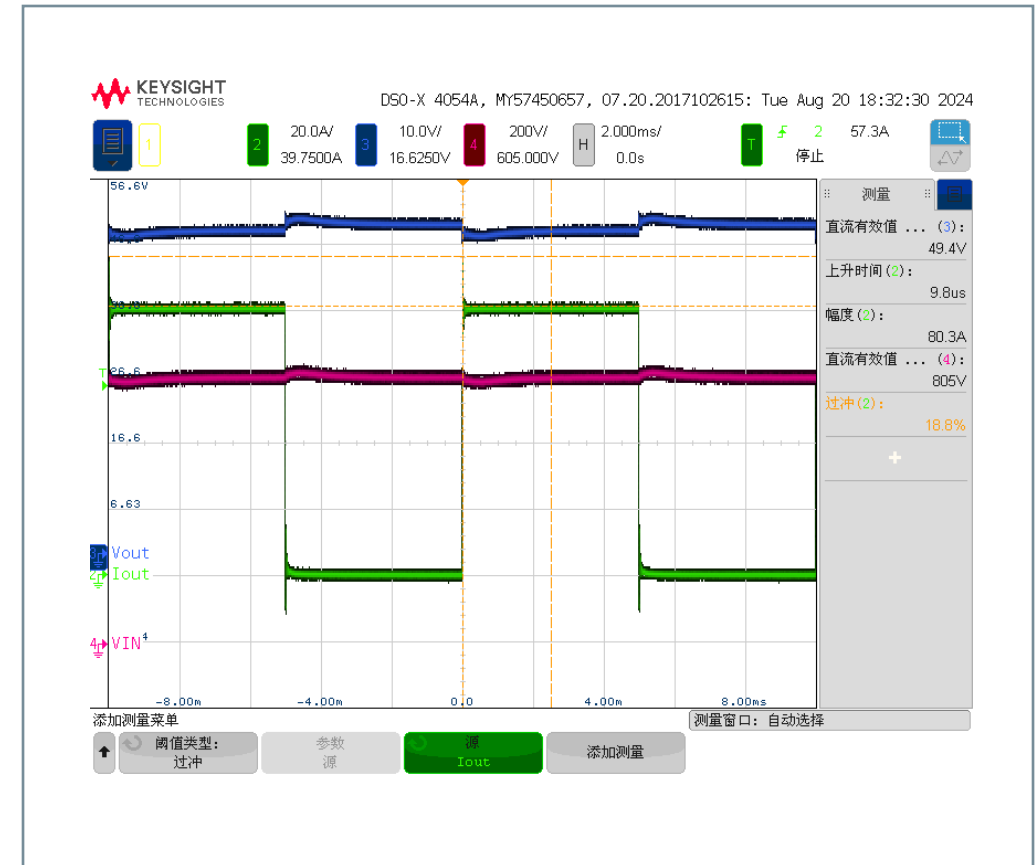
- No dead zone in transition
- VDR is constant over change in current direction
- Linear transition between forward and reverse



DC-DC conversion happens faster than ECU cycles with the BCM6135



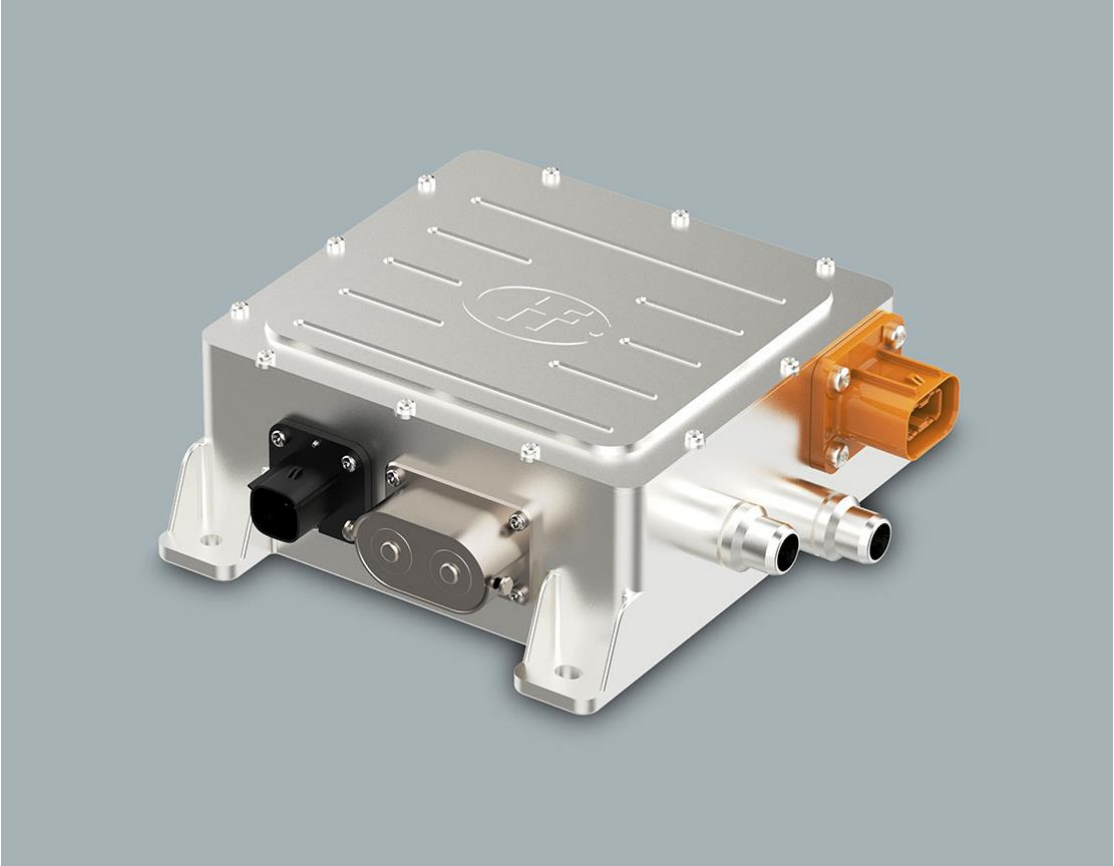
- ECU cycles average around 10 ms
- The BCM6135 reacts in under 10 μ s
- No lag in power conversion from 800V to 48V



The BCM6135 allows for the creation of a DC-DC converter with **best-in-class power density**

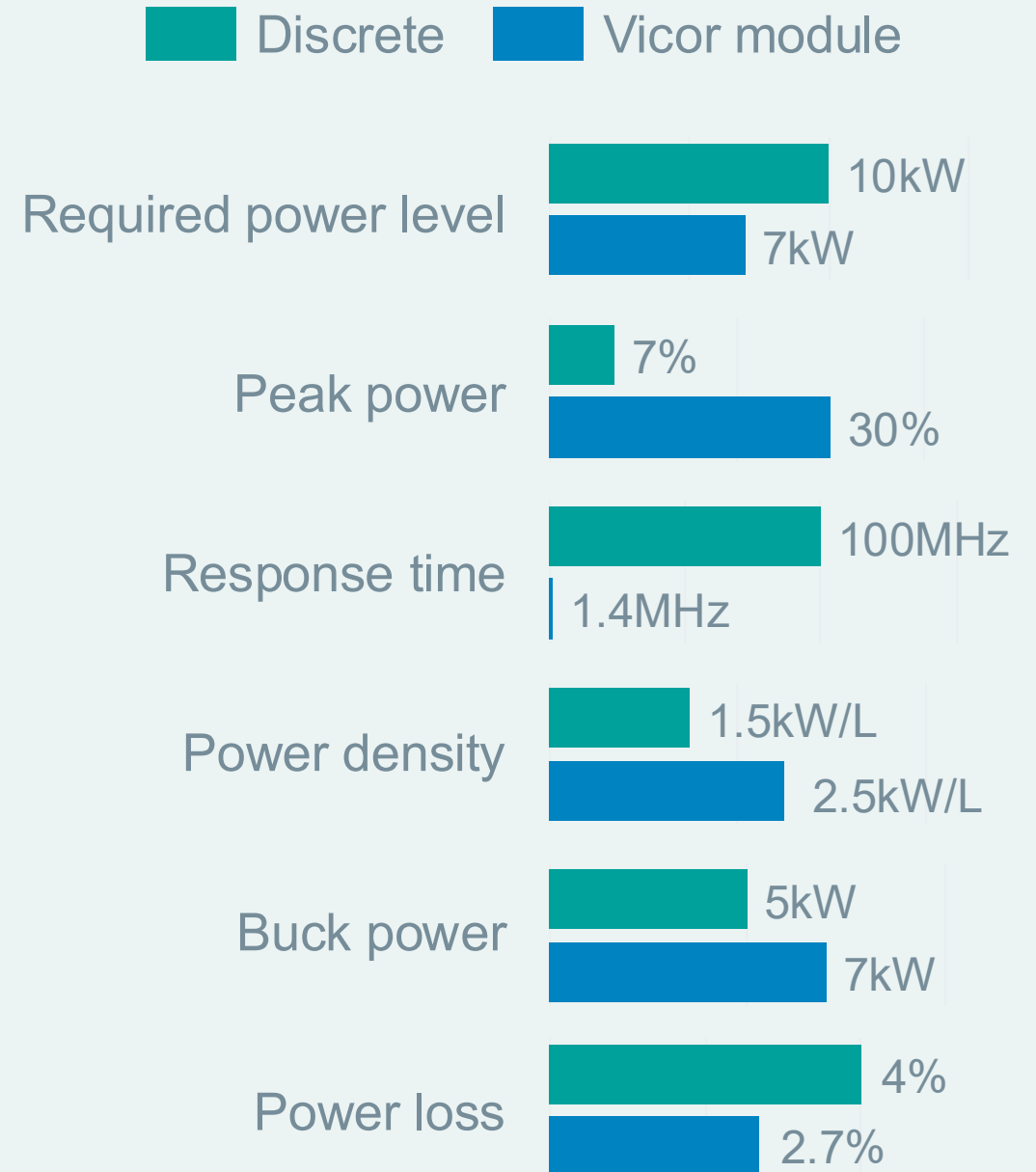
- Hongfa has used the BCM6135 in its compact 7kW DC-DC to be used with active suspension
- Power density of 2.5 kW/L and 2.7 kW/L
- Peak efficiency of 97.3%
- Up to 94% of the power drawn can be sent back to the HV Battery

HF3661 800V to 48V DC-DC active suspension power system	
Vin range	800V: 600 – 900V (DC)
Vout range	48V: 37.5 – 56V (DC)
Peak Efficiency	97.3%
Dimensions	197 x 201 x 71mm = 2.8L
Weight	2.6kg



Conclusion

- Symmetric performance of BCM6135 reduces the required power level for the DC-DC
- Transient performance eliminates latency in power delivery for suspension events
- The DC-DC converter will be reduced in size and weight, while eliminating super-capacitors or 48V batteries





Thank you

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