48V High Power Technologies
TT Electronics / AB Mikroelektronik GmbH
## Overview: CO₂ Savings

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Average CO₂ Reduction*</th>
<th>Additional System Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Hybrid 12V</td>
<td>~5%</td>
<td>&lt; 1000€</td>
</tr>
<tr>
<td>Mild Hybrid 48V</td>
<td>~17%</td>
<td>1000€ - 3000€</td>
</tr>
<tr>
<td>Full Hybrid HV</td>
<td>~25%</td>
<td>3000€ - 4000€</td>
</tr>
<tr>
<td>Plug-In Hybrid HV</td>
<td>~65%</td>
<td>&gt; 4000€</td>
</tr>
<tr>
<td>EV</td>
<td>100%</td>
<td>&gt; 9000€</td>
</tr>
</tbody>
</table>

- ~10% Passive Engine-Off Coasting
- ~3% Active Engine-Off Coasting
- ~4% Start-Stop

* Values averaged from: Schlegel & Partner, Schaeffler, Continental, Valeo, Infineon, Hella, ZVEI

Variations due to NEDC (New European Drive Cycle, WLTC (World Light Duty Cycle), real world driving conditions, vehicle segments
High Power Active Engine-Off Coasting

Worldwide Speed Limits, w/o Germany

- SUV
- Compact

E-Motor Power $P$ (kW)

Velocity $v$ (km/h)

- High power active engine-off coasting!
- Current BN48 Limit

- 12kW
Extended 2 Battery BN Architecture: 48V

- BN48: max. 250A
- BN12: max. 250A
- DC/DC converter
- 48V Battery
- 12V Battery
- EPS
- Roll Stabilizer
- Waterpump
- SG
- E-Motor
- 300A – 500A
- Lighting, Motorcontrol, ...
- Safety, Entertainment, ...

Ralph Stömmer / ralph.stoemmer@ttelelectronics.com
E-Motor Controller

DC+

EMC Supply

Reverse polarity protection

µC

Supply

Signal conditioning

MOSFET driver

Amplifier

Shunt

CAN/LIN/PWM driver

B6 MOSFET Bridge

E-Motor

DC-
GND

EMC Signal

Signal

DC+ to E-Motor

DC- to E-Motor

Signal to E-Motor
Enabling Technologies: 48V, 20kW SBS Controller*

SBS Controller Basics:
- 48V, 15kW-20kW (25kW peak)
- Power Density: 6kW/L

Current Status:
- in product development

* patent pending

Ralph Stömmer / ralph.stoemmer@ttelectronics.com
Enabling Technologies: 48V, 20kW Power Stack*

Power Stack Basics:
- 48V, 15kW - 20kW
- Current range 300A-400A (500A max)
- Double sided cooling
- Stack structure: improved power density compared to standard modules
- Enhanced pulse stability and improved reliability with current transients / shorts
- Improved thermal homogeneity, no hot spots
- Reduced inductive parasitics (6nH measured)
- Reduced voltage overshoot
- Reduced power losses

Current Status:
- Under qualification according to LV324

* technology patented

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