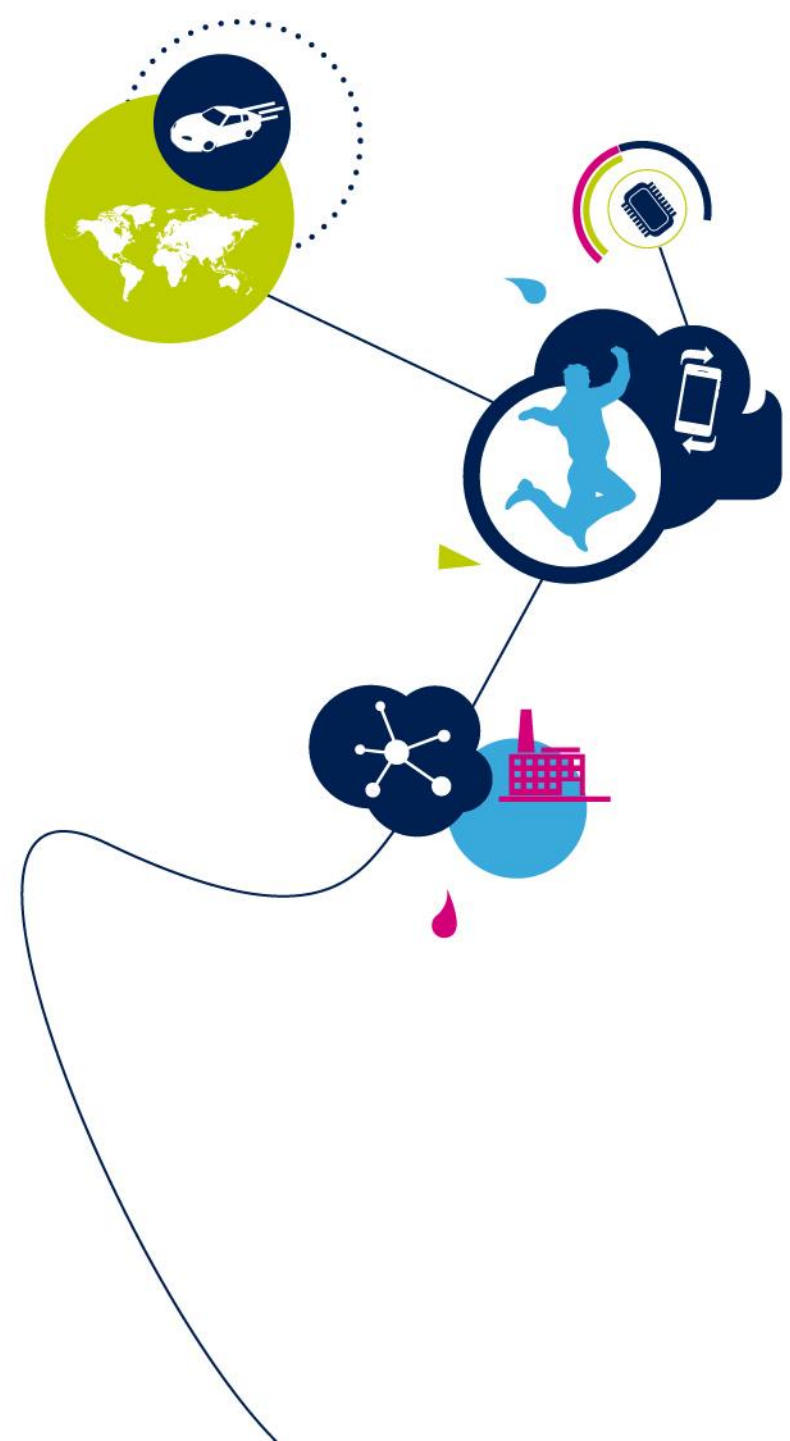


Traction Inverter

ST New Solutions



System Block diagram

2

- SPC58NN

- GTM V3 for fully programmable and flexible timer system designed to unload the CPU
- SAR ADC & Σ - Δ ADC support Software Resolver in evaluation

- SBC L9396

- Multiple Power Supply IC

- SIC/ IGBT

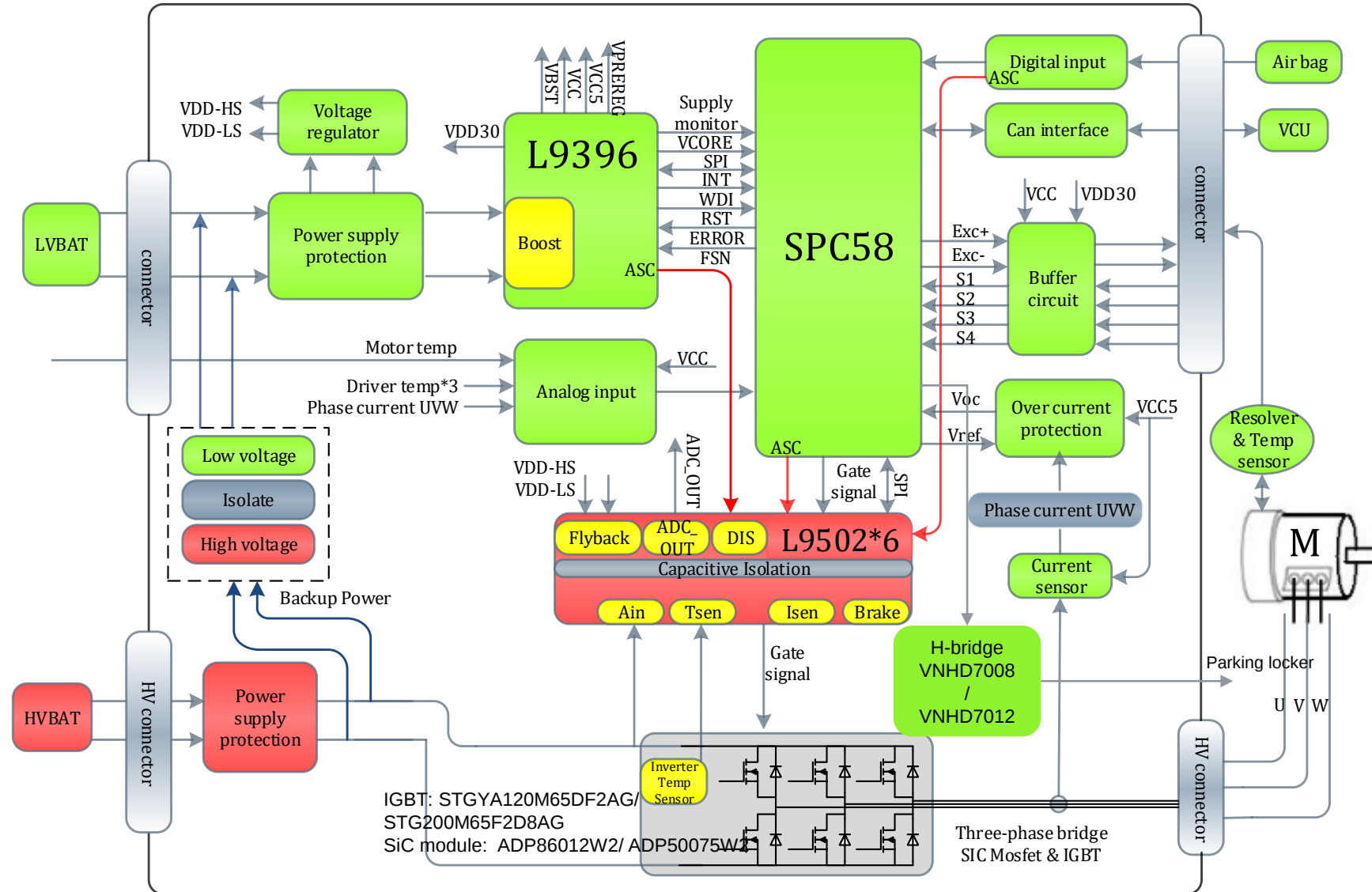
- 750V SiC MOSFETs
Gen 2 High Voltage Product Family
- 1200V SiC MOSFETs
Gen 2 High Voltage High Performance Product

- L9502

- Single isolated Gate Driver (6kV)for TRACTION
With protection, diagnostics and communication

- Designed for ISO26262 compliance

- Kit Solution approach





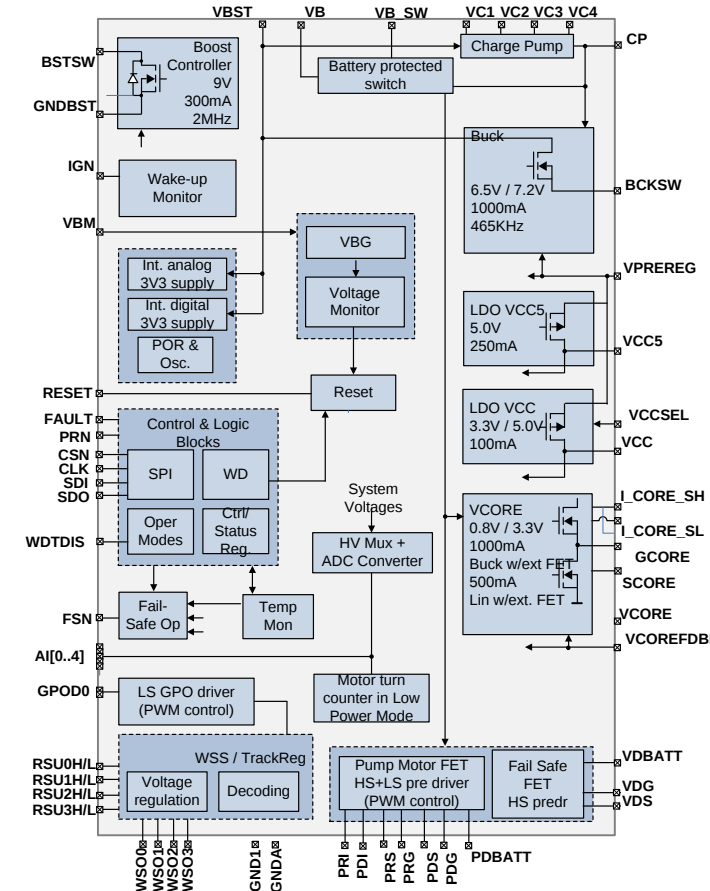
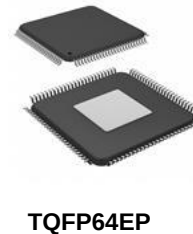
Automotive Multiple Power Supply IC

SBC L9396

4

Technical information

- Boost Converter, 9V, up to 0.3A - 2MHz with spread spectrum
- Buck Converter, 6.5V/7.2V, up to 1.0A – 465KHz with spread spectrum
- LDO VCC5 (5V +/-2%, 250mA), LDO VCC (3.3V / 5V +/-2%, 100mA), VCORE (0.8V / 5V +/-2% - μ C core supply, max 1000mA in switching mode, max 750mA in linear mode)
- 4 WSS regulated interface / 2 tracking regulators (120mA)
- Integrated 10-bit ADC
- HS pre-drivers for fail safe relay and for motor pump
- Configurable Watchdog (Time-out / Window / Periods) & configurable Fail-Safe Functionality
- Fail-Safe Output (FSN), Wake-up input
- Voltage monitoring UV/OV on all regulated rails
- Temp. monitoring and Thermal Shutdown



Timing information

- Commercial samples : available
- In production

Key Value

- Designed for **ISO26262 compliance**
- **Flexible solution** to 3 configurable voltage rails
- Boost - Buck topology for low battery functionality for **Start/Stop systems**
- **BOM selection optimized** on output current needs
- **Low emission** design

- ✓ Application Note
- ✓ Demo board w/ GUI
- ✓ Safety Manual
- ✓ FMEDA / DFA



L9502B / L9502

5

Isolated Gate Driver for Traction Inverter

Single channel isolated gate driver

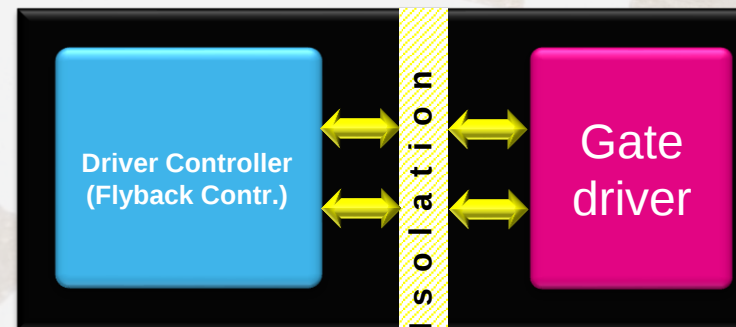
AEC-Q100 Grade 1

ASIL D systems ready

6kV galvanic isolation

Flyback controller on L9502

- 15A driver sink/source current capability
- Miller clamp
- Advanced Diagnostic and Protection
- 10-bit A/D Converter with 2 external inputs
- BRAKE pin with programmable safe state
- 5MHz SPI interface with enhanced safety
- Output flyback voltage 23V (-5V 18V; -8V 15V) on L9502



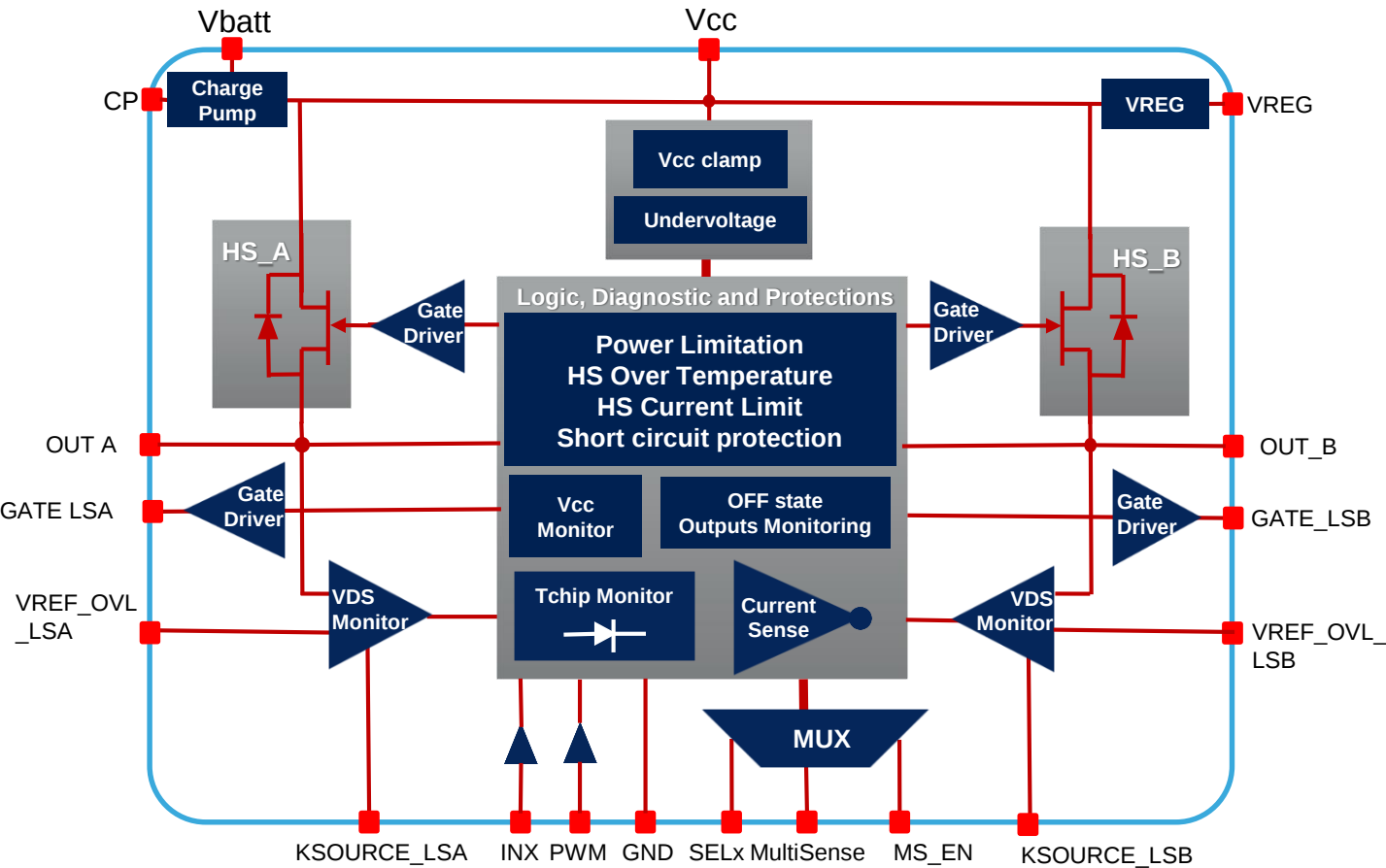
In development

VNHD7008AY / VNHD7012AY

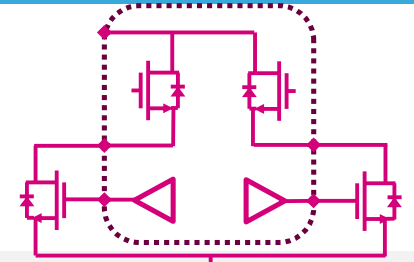
6



VIpower™ H-Bridges Solution for High Power



Part number	Ron per channel
VNHD7008AY	8mΩ
VNHD7012AY	12mΩ



Improved Performance

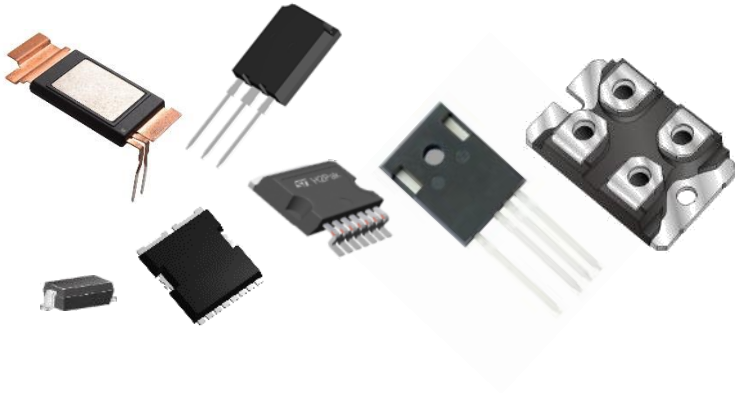
- Optimized **Standby** current
- **PWM** operations up to 20kHz
- Tailored and compact full bridges in combination with latest dual-channel F7 technology PowerMOS
 - STL64DN4F7AG 8mΩmax
 - STL76DN4LF7AG 6mΩmax
- **Charge Pump Out** for reverse polarity protection
- Drain and Source voltage Monitoring of external PMOSFETs
- **Gate Slope Control** thruout external Resistor To Optimize EMI
- PSSO36 Package

Power & Discrete Group (PDG)

Wide Power Product Portfolio

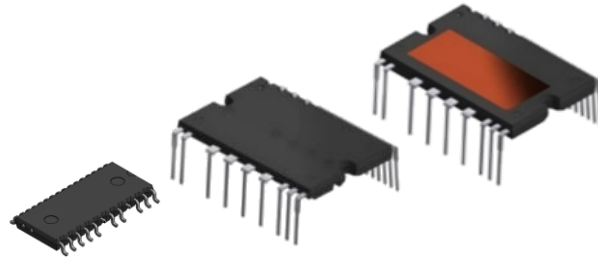
7

From Discrete to Power Modules, ST leads the innovation



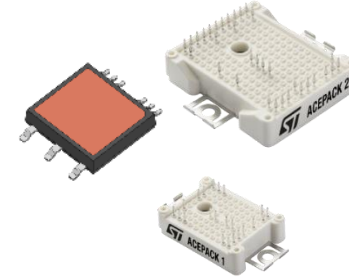
Discrete & Drivers & SIP

Typical Power: 10 W ÷ 10 kW



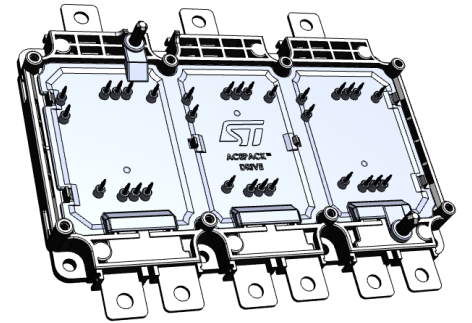
SLLIMM™ IPM

Typical Power: 20 W ÷ 3 kW



ACEPACK™ Power Modules

Typical Power: 3 kW ÷ > 30 kW



ACEPACK™ modules

Adaptable, Compact and Easier PACKAGE

8

ACEPACK

1 & 2

SMIT

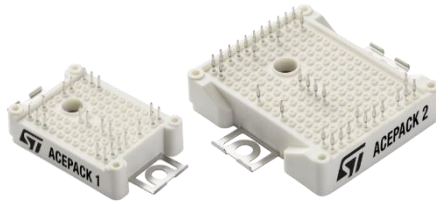
DRIVE

Outlook

Key features

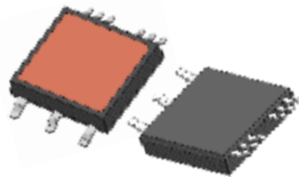
Configurations

Target Applications



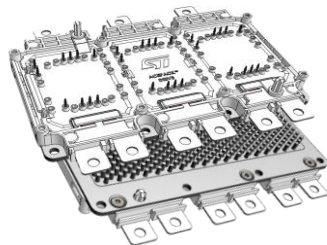
- 100% controlled by ST for silicon (SiC, MOSFET, IGBT and Diodes)
- Compact design and cost-effective system approach for a plug & play system solution
- Configuration flexibility
- 2500Vrms electrical isolation

- CIB
- Six-pack
- Three level Boost
-



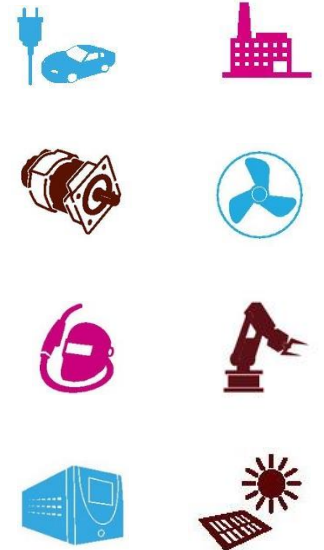
- 100% controlled by ST for silicon (SiC, MOSFET, IGBT and Diodes)
- 2500Vrms electrical isolation
- SMD assembly
- Top side cooling
- Low thermal resistance

- Bridge rectifier
- Half Bridge
- Boost
-



- 750 - 1200V SiC MOSFET based switch
- Improved light load power losses for extended EV driving ranges
- AMB frame for better thermal dissipation
- 3 different lead configuration options
- Extreme low conduction losses
- Direct Cooled Cu Base Plate with pin fins

- Six-pack



Direct liquid cooled high performance power module

Press FIT connections for high reliable and long lasting connection

SiC-MOSFET based, 750V and 1200V

Pin-fin for direct cooling

Dedicated NTC for each single substrate

Unequalled $R_{DS(on)}$



Internal layout optimized for minimized stray inductance

High reliability and robustness: Dice sintered to substrate

Different bus bar available to fit welding or screwing connection methods.

AMB substrates for better thermal management

Incredible high power density

Traction inverter for (H)EV, Trucks, Bus

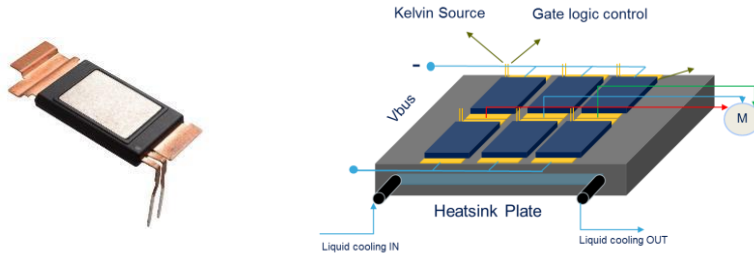
ST solutions for traction inverter

From scalable solutions to ACEPACK DRIVE

10

- Multi Sintering Package: **STPAK™**

- Very good thermal resistance, no TIM material needed
- Very high current capability



- Sintering needed to get best thermal performances

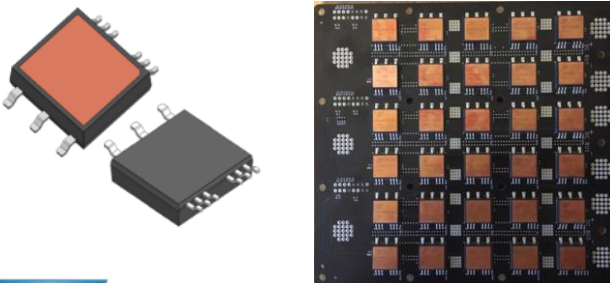


- In both cases several devices in parallel has to be connected to realize an high power system
 - connections introduces stray inductance which will limit speed
 - Inverter room occupation will increase accordingly

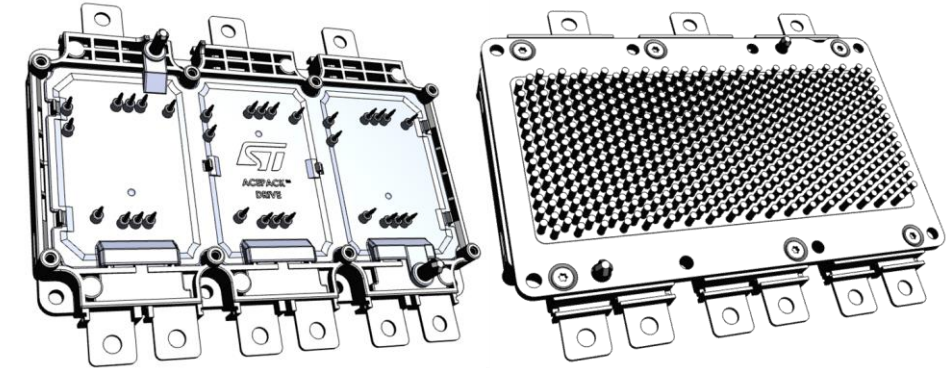


- Top Side Cooling Package: **ACEPACK™ SMIT**

- Customizable and versatile insulated power module



- PCB must be designed to deal with very high current level



- **ACEPACK DRIVE**

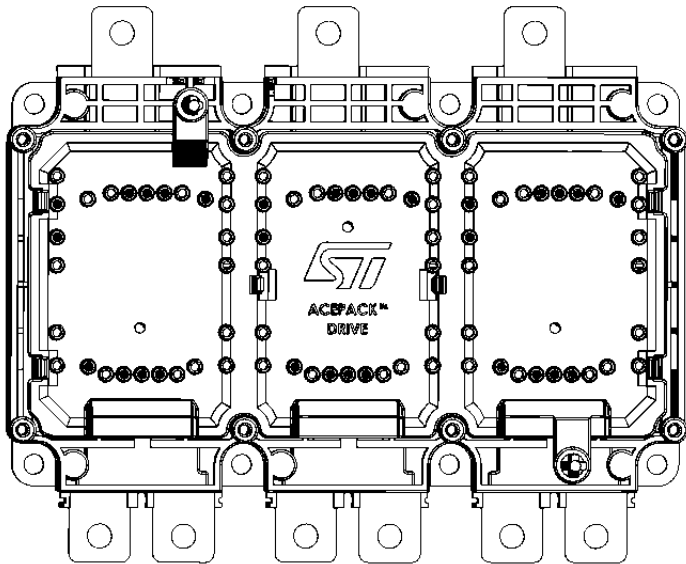
- Represents an easy-to-use solutions, with direct coolign thanks to pin-fin structure integrated in base plate
- Several device are connected in parallel in the same substrate, minimizing stray inductances and boosting speed capabilities
- Thanks to small footprint, power module can be easily integrated in motor chassis
- No soldering or sintering needed, improved manufacturability:
 - Press fit avoids soldering process
 - Need only to be screwed onto a waterjacked for liquid cooling
 - Differnt bus bar options for final used convenience, compatible wiht Hall-effect current



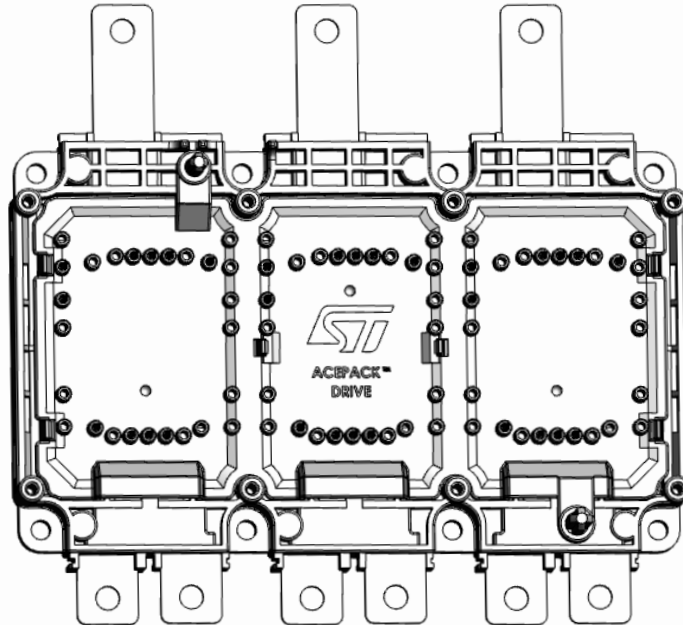
ACEPACK DRIVE case selection

11

Short tab option

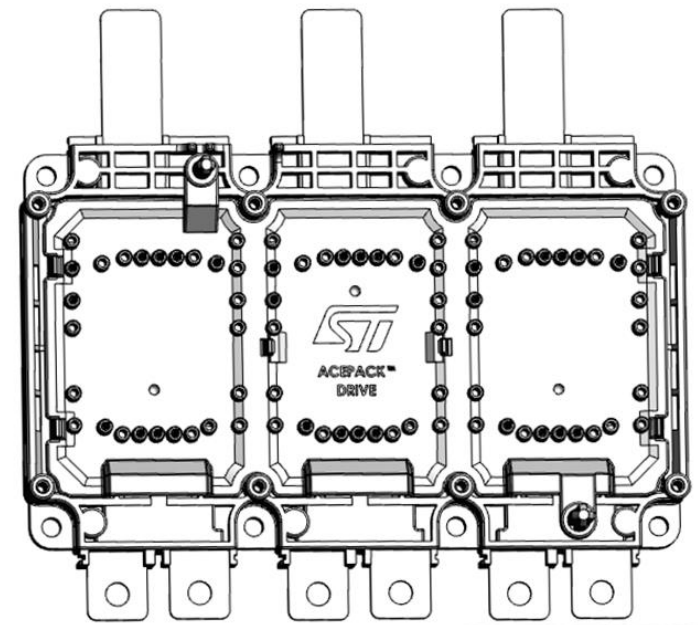


Long tab option



Possibility to use an Hall-current sensor thanks to longer tabs

Long tab w/o AC bar holes



AC bus bar to be welded to motor connections

Six-pack Module at 750V DC-link

1200V Si IGBT vs. SiC MOSFET

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