



life.augmented

E-mobility SiC Traction Inverter

March 2020

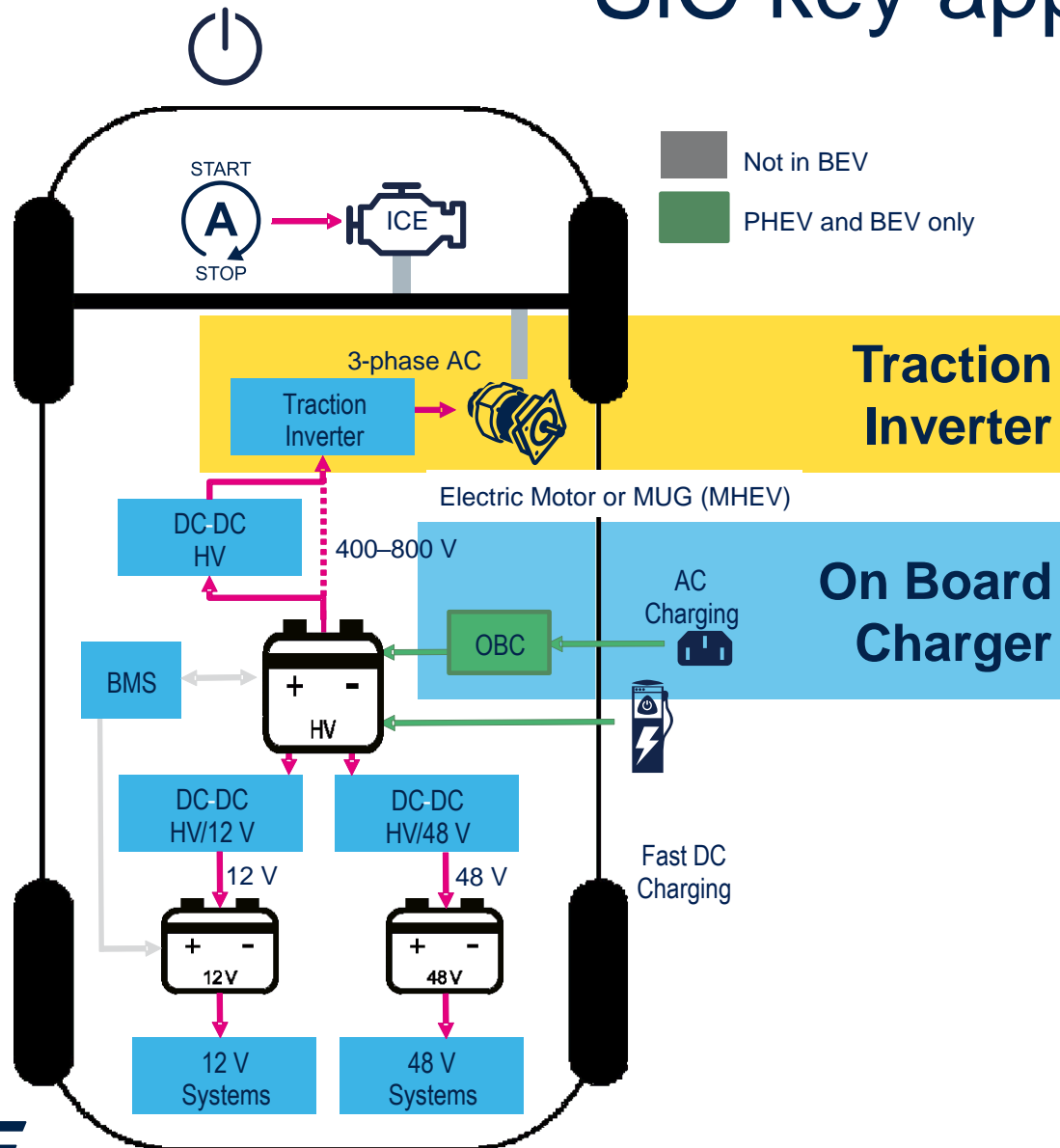
SiC Traction Inverter Overview

Highlights

- E-mobility Power Blocks
- SiC benefits in Traction Inverter
- Full System Power Board SiC for Traction



SiC key applications in electric vehicles



Traction Inverter

- High power inverter stage to drive the **traction motor** of the vehicle
- Replace Si IGBTs and Diodes by **SiC MOSFETs** results in:
 - Higher efficiency
 - Smaller form factor
 - Less cooling efforts

On Board Charger

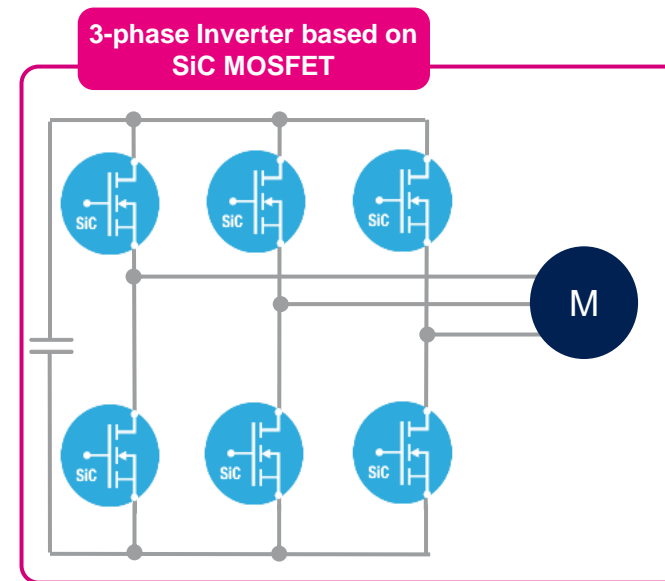
- **Charging the battery** of plug-in HEVs and EVs from the 1-phase or 3-phase power grid
- Different architectures and topologies in automotive require **supporting scalable solutions**
- Smaller form factor & weight

Main Inverter for HEV/EV

E-mobility: SiC Traction Inverter

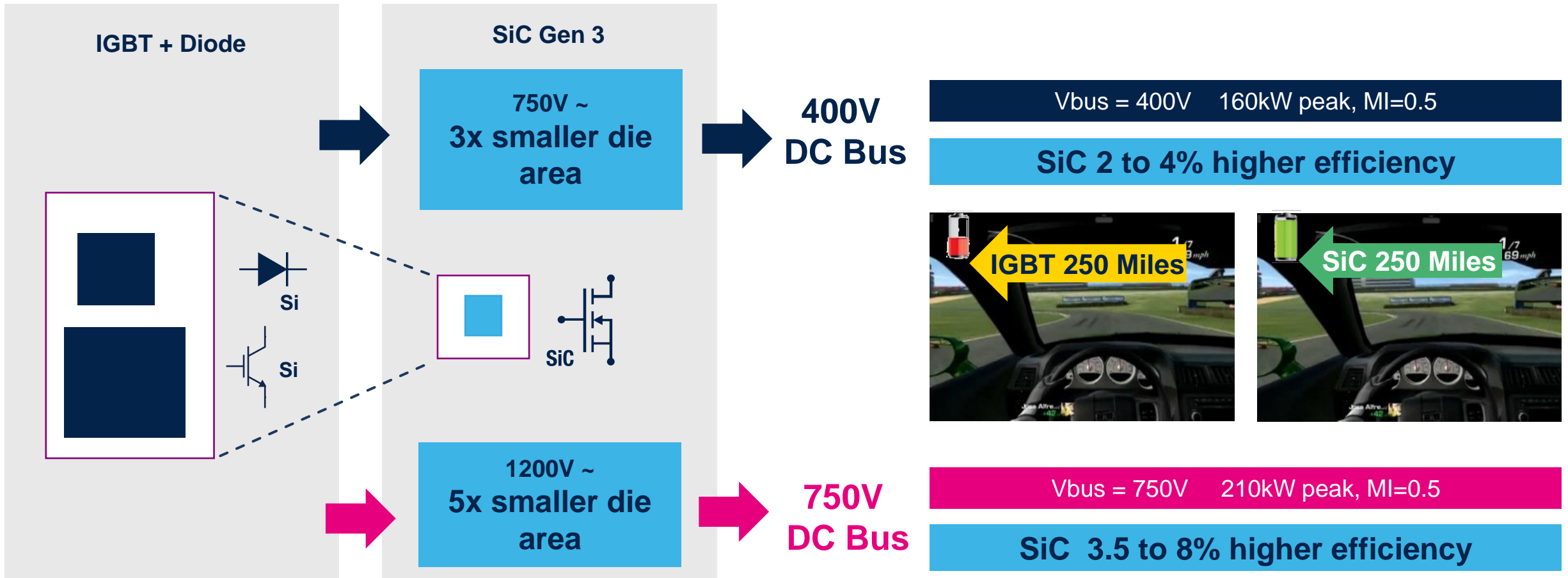


- Usually 3-phase permanent magnet motors are used for traction
- Operating voltage from 48V to 800V
- **Bi-directional**
 - Feed the electric motor when driving the wheels
 - Stream energy back on HV Bus when braking the vehicle
- **Nominal power ranging from 10 kW (ICE assistance) to 200 kW (pure EV)**



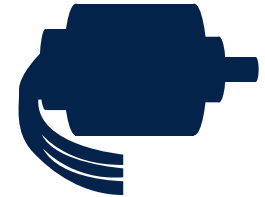
Vbus	400V	700-800V
SiC MOSFET	650V / 750V	1200V

Si IGBT vs SiC MOSFET–Traction Inverter

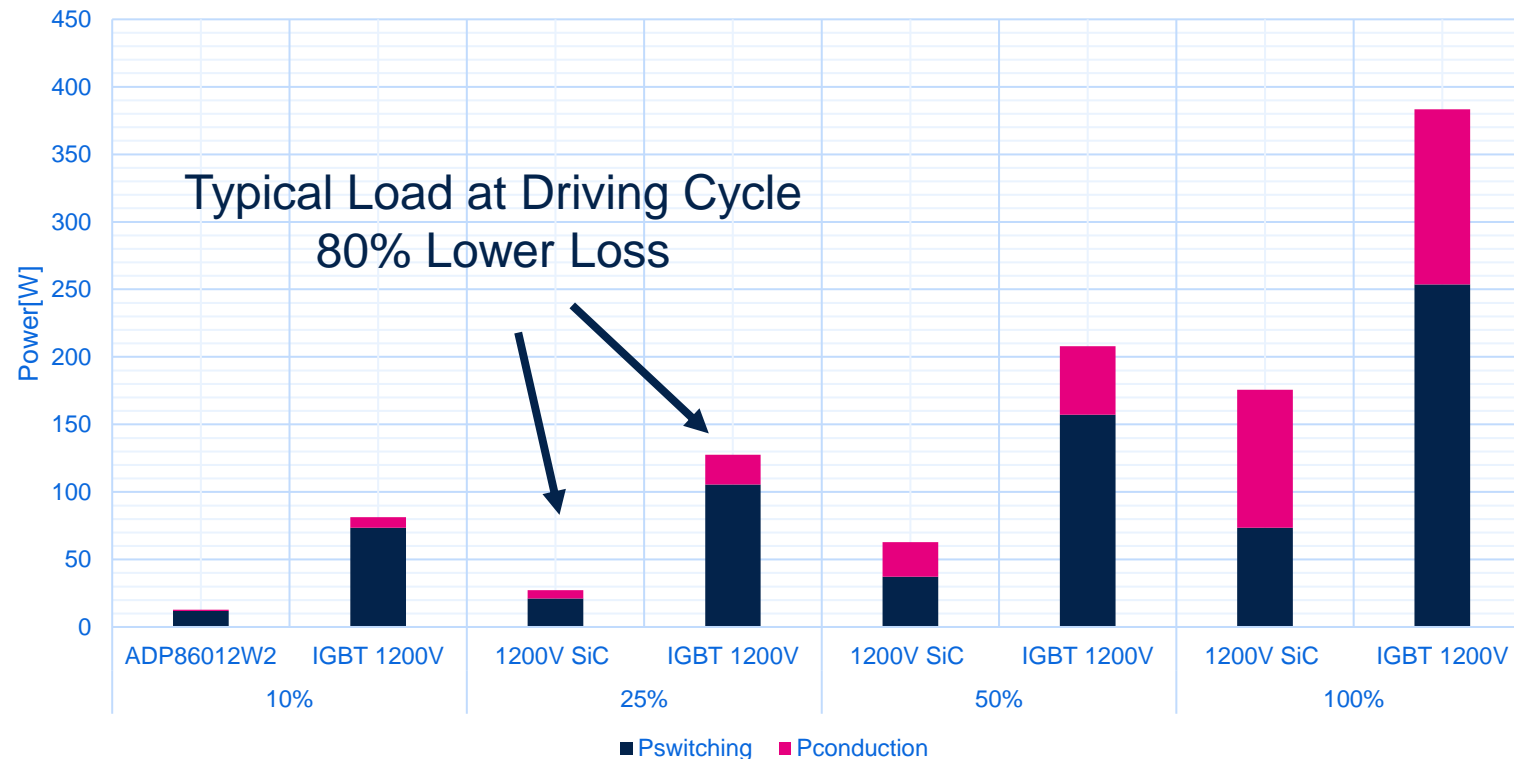


Power Loss Traction Inverter SiC vs IGBT

SiC Significant Lower Power Loss at all Loads

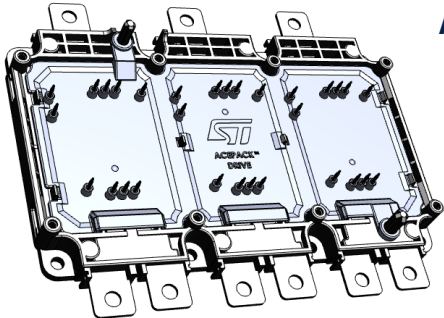


Overall energy losses comparison @ 10kHz vs working load

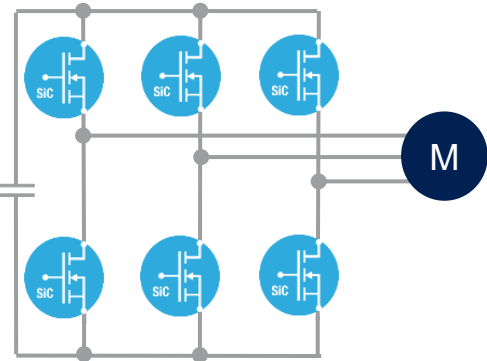


ACEPACK Drive Six-pack Module

Smaller Size & Lower Losses → More Power Achievable with SiC



ACEPACK™ DRIVE



- DC-link : $750V_{dc}$
- PWM Strategy: Bipolar
- 10kHz
- Peak Power 10 sec
- MI = 1, Cos(phi) = 0.8
- $T_{fluid} = 65^{\circ}C$

110kW
(220kW_{peak})

1200V IGBT+Diode based

140kW
(280kW_{peak})

ACEPACK DRIVE
ADP86012W2
1200V Gen2

180kW
(360kW_{peak})

ACEPACK DRIVE
ADP450120W3
1200V Gen3

SiC Traction Inverter Eval Board

Highlights

- Compact High Power Motor Drive
- 400V and 700-800V bus
- Driving Board and Motor Control included

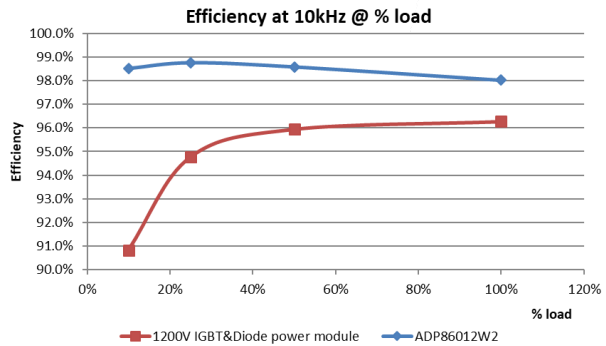
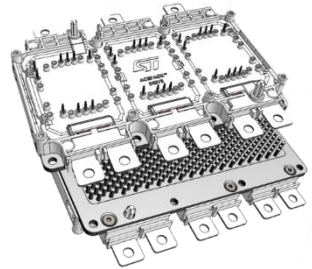


Power Inverter Traction Eval Board

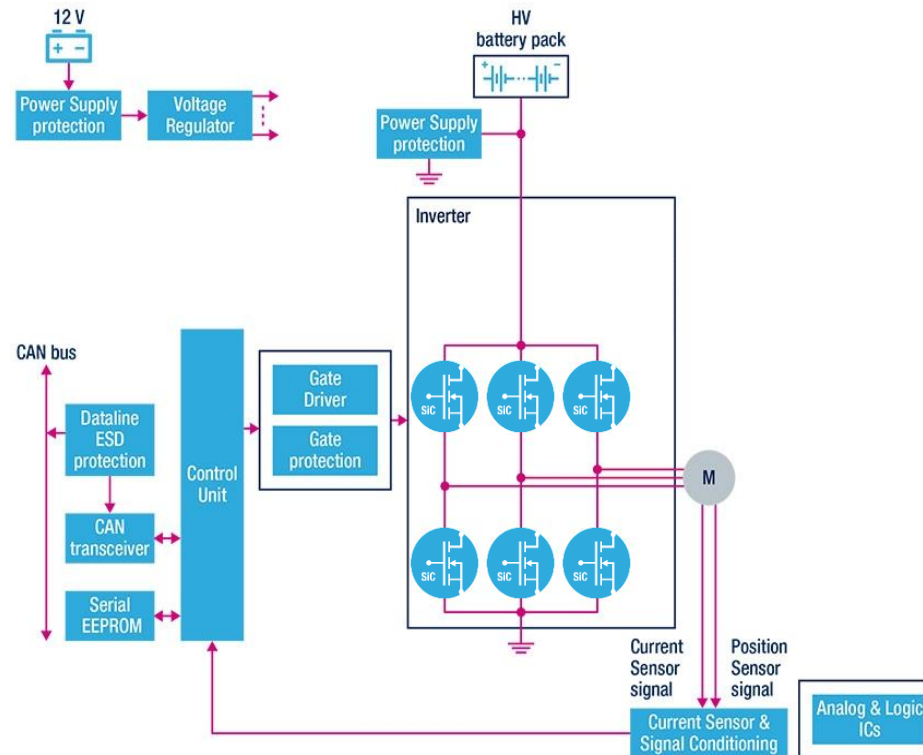
ADPxxxxW2 + STEVAL-APD001K1

Power Module

ADP86012W2 – 1200V
ADP50075W2 – 750V



Power Board Block Diagram



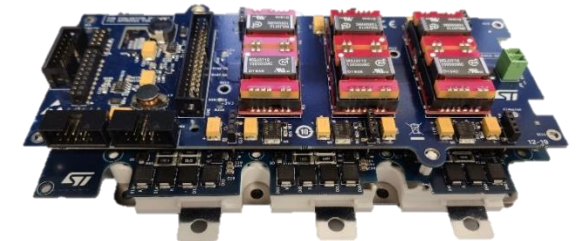
Control Board

SPC58NN4E7
Motor Control FW Included



Driving Board

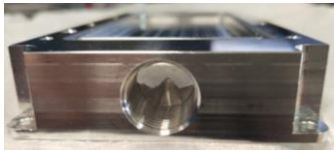
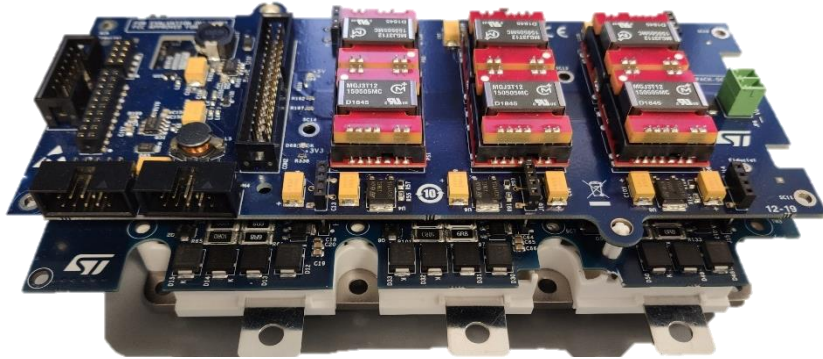
STGAP1AS / L95xx
Isolated Gate Drivers





Power Inverter Traction Eval Board

KEY PRODUCTS



Liquid Cooling Case Included

1. ADP86012W2 (1,200V 3.5 mOhm), ADP50075W2 (750V 2.0 mOhm): ACEPACK DRIVE SiC Modules
2. STGAP1AS or L95xx: isolated single gate drivers
3. A7986: Buck Boost switching regulator up to 3A
4. A6902: Buck switching regulator up to 1°
5. SPC58xx: 32 bit Automotive MCU
6. TVS and Diodes

Thank you

© STMicroelectronics - All rights reserved.

The STMicroelectronics corporate logo is a registered trademark of the STMicroelectronics group of companies. All other names are the property of their respective owners.



life.augmented