Wireless Charging

Witricity Electric Vehicle Charger

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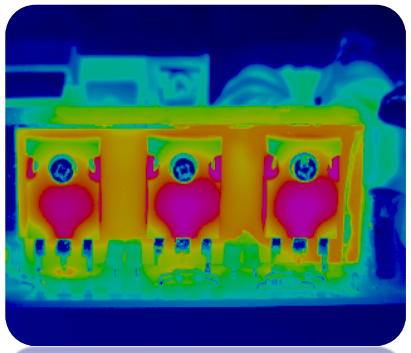
SiC EV Wireless Charging



SiC

High Efficiency

Better Thermal

High Frequency Switching

Advanced Topology for High Efficiency Power Transfer

Silicon Carbide MOSFET Technology

High Current Silicon Carbide and Ultrafast Rectifiers

Silicon Carbide Driving Methods

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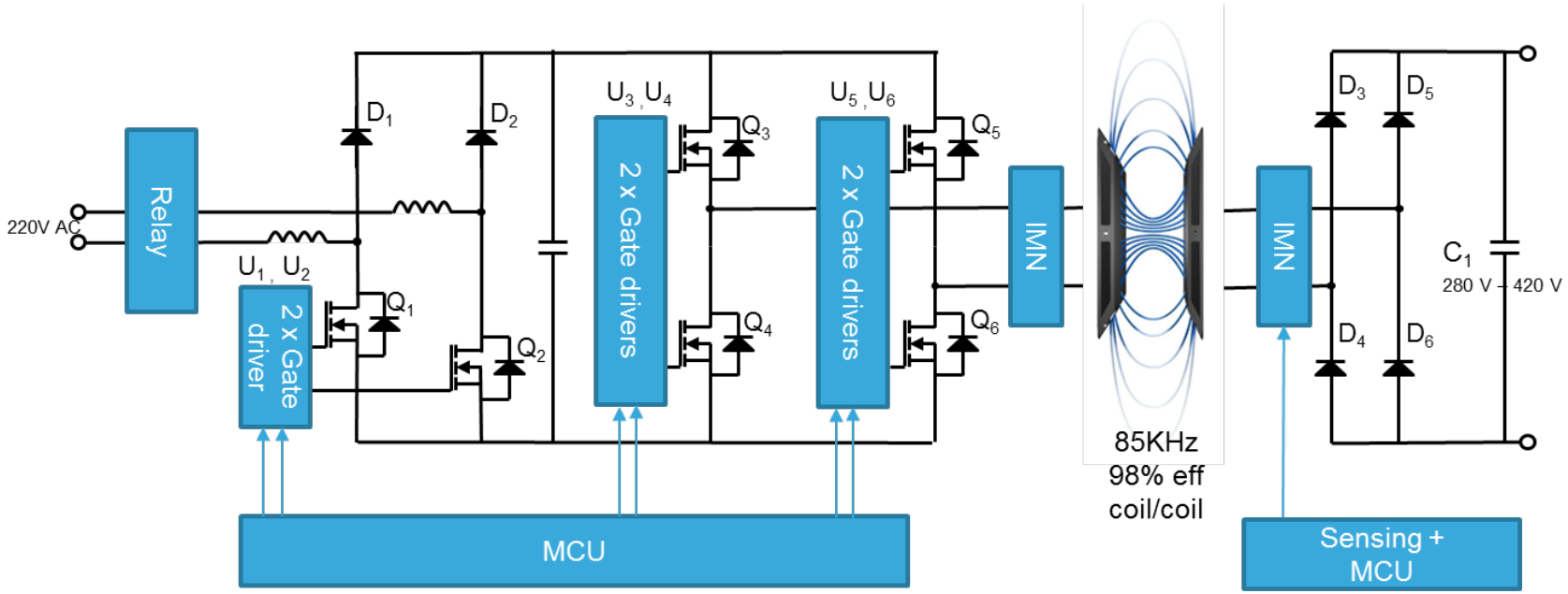
Advanced Topology for High Efficiency Power Transfer



11kW EV Charging System

Switch	Part Numbers
2x D1, D2	**STPSC20H065C** 650 V power Schottky silicon carbide diode
2x Q1, Q2	**SCTW90N65G2V** N-channel 650 V, 0.029 Ohm typ., 90 A SiC MOSFET
Q3, Q4, Q5, Q6	**SCTW90N65G2V** N-channel 650 V, 0.029 Ohm typ., 90 A SiC MOSFET
D3,D4,D5,D6	**STTH30L06WY** 30A 600V Fast Rectifiers
U1, U2, U3, U4, U5, U6	**TD350** 1.5A IGBT, MOSFET advanced gate driver 26V -10V
MCU	**STM32F405** Cortex M4

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Automotive Solution

Standards-Compliant

WiTricity wireless EV charging systems are “park-and-charge”

Highlights

- Delivers 3.3kW, 6.6kW, 11kW or more power wirelessly to compatible electric vehicle
- WiTricity is working on wireless charging standards with SAE and other organizations
- Spatial freedom for “park-and-charge” user experience with high efficiency (92%-94%)
- Foreign Object Detection (FOD)

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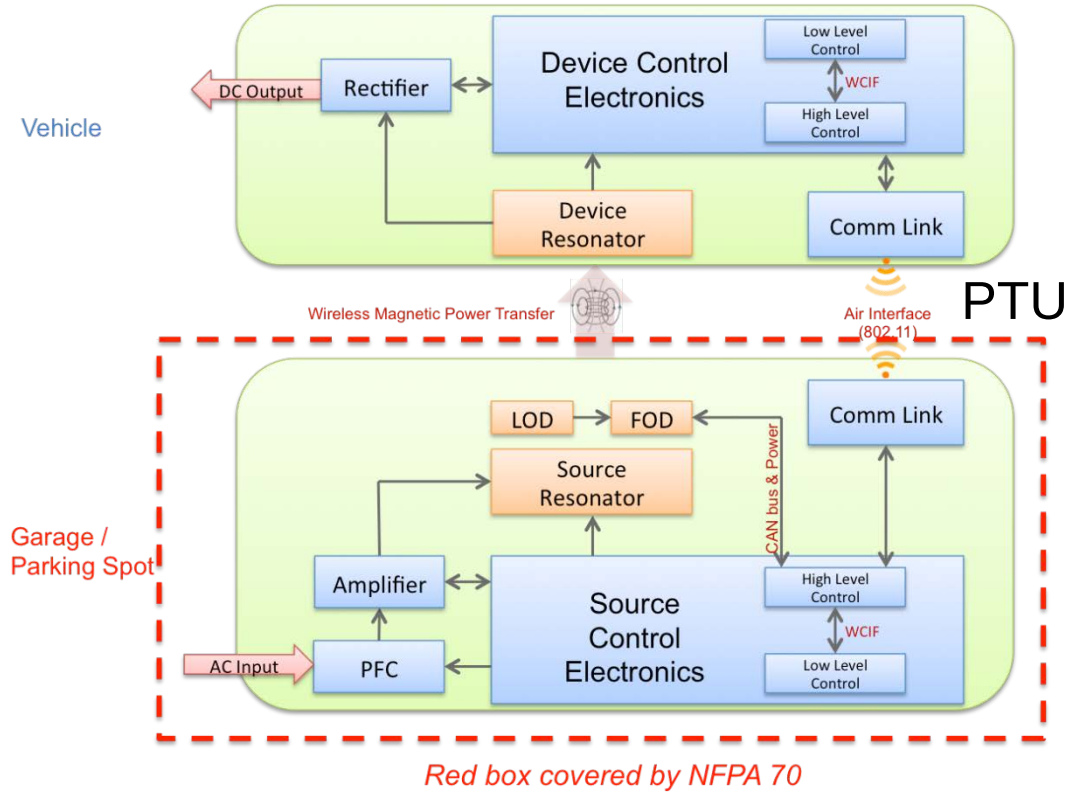
Automotive Solution



Specifications

- 3.3kW, 6.6kW and 11kW+ continuously variable ground assembly units (GA)
- Efficiency: Up to 98% coil-to-coil
- Operating Frequency: 85 kHz
- Operating Height: 9 - 28cm vehicle ground clearance
- Communications: WiFi
- Foreign Object Detection: Yes
- Standards: SAE, ISO, IEC pending
- Regulatory: meets FCC, CISPR, ICNIRP guidelines for Emissions and human safety

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Silicon Carbide MOSFET Technology

Benefits

Extremely low Power Loss and Low Ron especially at very high Tj

Higher operating frequency for Smaller and lighter systems

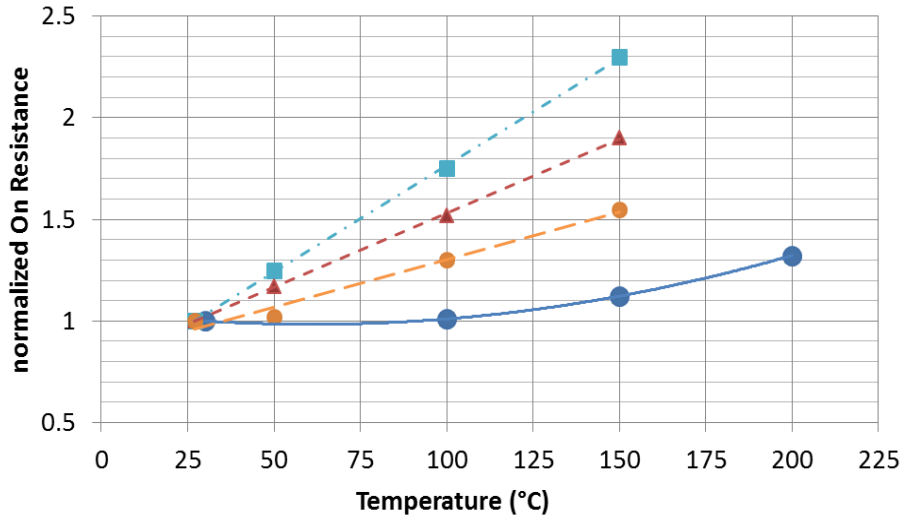
Thermal Performance

High operating temperature (T_{jmax} = 200°C)

➔ Reduced cooling requirements & heat-sink
Increased life time

Easy to Drive

➔ Fully compatible with standard Gate Drivers



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Silicon Carbide MOSFET Technology

SCTW90N65G2V

- **SCT3W90N65G2V** - SiC Power MOSFET, 90A, 650V, 25mΩ

- **Key parameters**:
  - V_{BR} > 650V
  - Ids = 90A
  - **$R_{on(typ.)}$ @ 150°C = 29mΩ**
  - $Q_{g(typ.)}$ < 190nC
  - Gate driving voltage = 20V
  - HiP247™ package → Tjmax = **200°C**

- **Key features:**
  - **Very tight variation of on-resistance vs. temperature**
  - Slight variation of switching losses vs. temperature
  - **Very high operating temperature capability (200°C)**
  - Very fast and robust intrinsic body diode
  - Low capacitance
  - Easy to drive
- **Schedule:**
  - **Full Production June 2016**

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SCTW90N65G2V

Silicon Carbide Power MOSFET

90A, 650V, 29mΩ (typ. @ Tj = 150°C)

Target datasheet

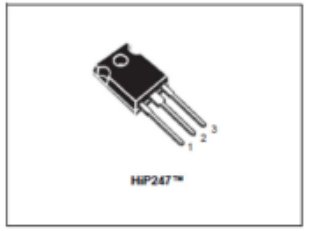
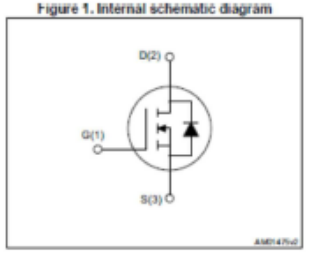


Figure 1. Internal schematic diagram



Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
SCTW90N65G2V	650 V	TBD	90A

Features

- Very tight variation of on-resistance vs. Temperature
- Extremely low gate charge and input capacitances
- Very fast and robust intrinsic body diode
- capacitance
- Very high operating temperature capability (Tj=200°C)

Applications

Switching applications
Server
High Frequency DC-DC Converters

Description

This silicon carbide Power MOSFET is produced exploiting the advanced, innovative properties of wide bandgap materials. This results in unsurpassed on-resistance per unit area and very good switching performance both almost independent of temperature.

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Silicon Carbide Diodes

Low switching losses

Best efficiency

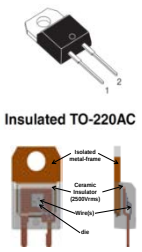
Full Series

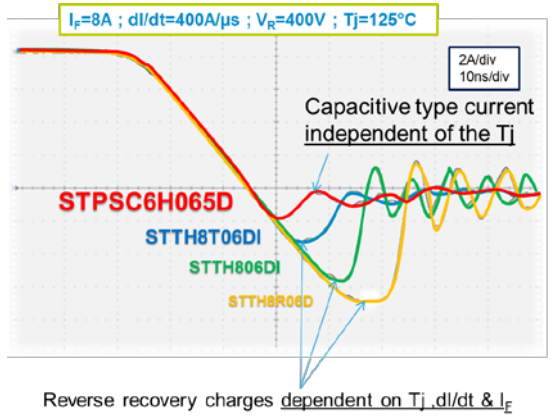
600-1200V & AG
High Peak Current – Low Vf

STPSC	bb	H	065	bb	bb
SiC diode	Current rating	blank H	Voltage: 06: 600V 065:650V 12: 1200V	• Blank: single diode • C: dual-diode with common cathode	Package

Insulated Packages

Better Thermal - Lower Cost





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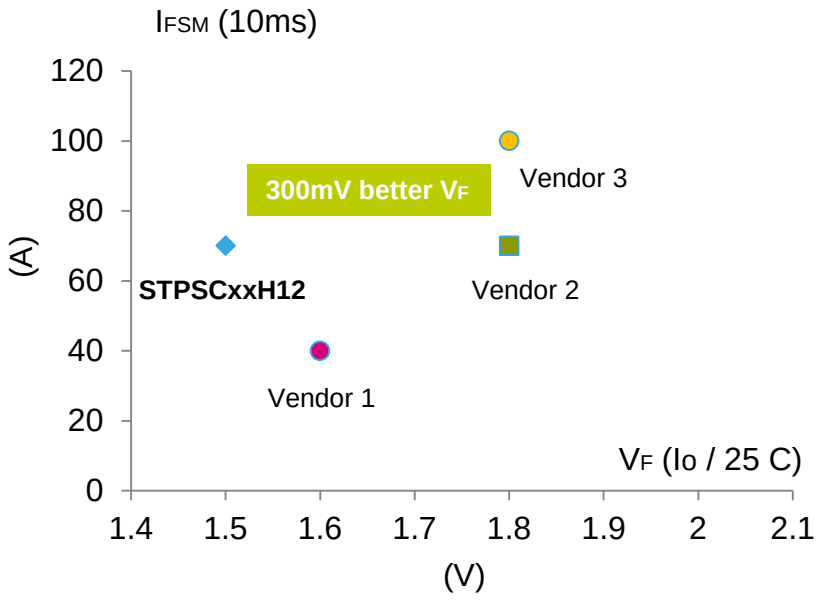
New 1200V Silicon Carbide Diodes



Best in class Forward voltage characteristics

Excellent Robustness with high I_{FSM} level

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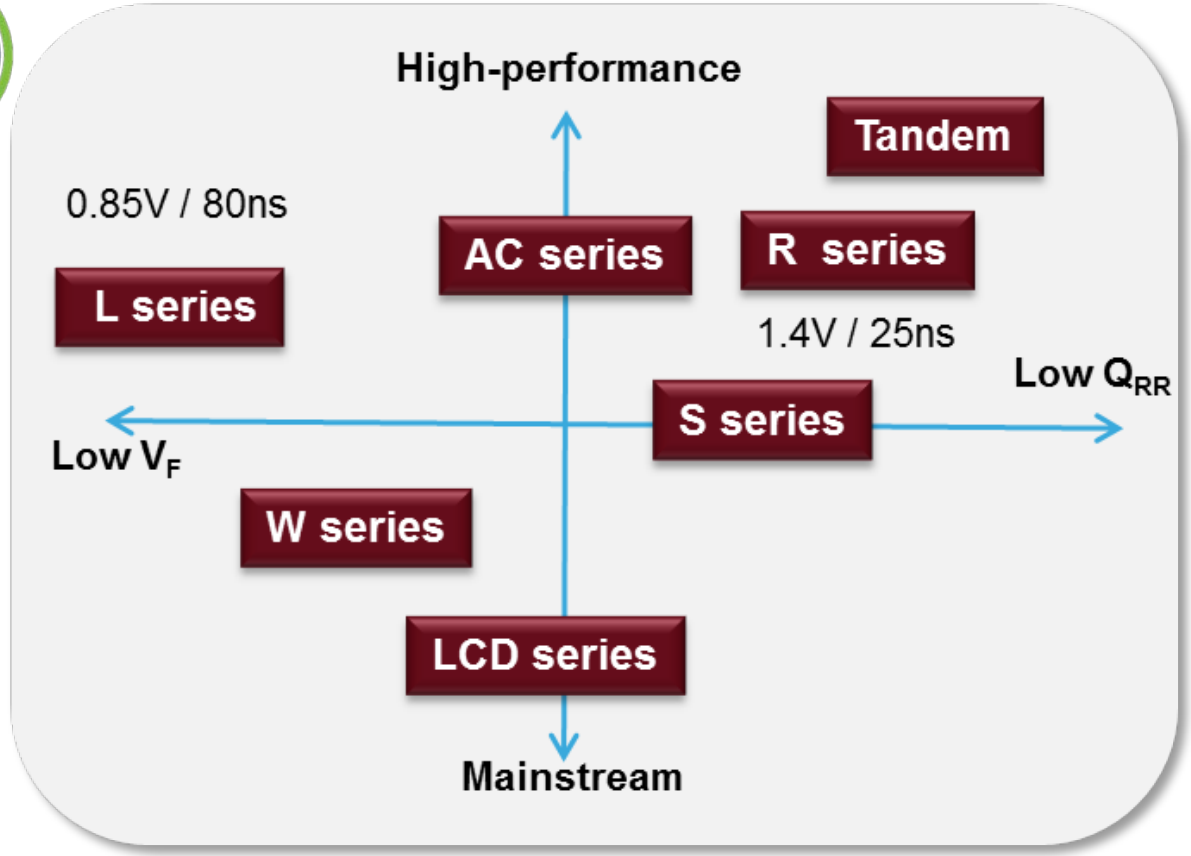
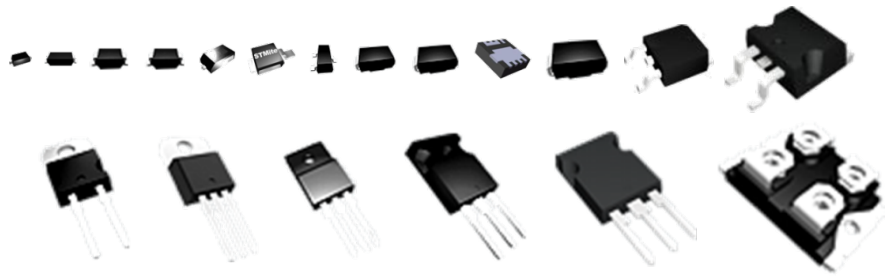
Ultrafast Rectifiers



Pt doped for low leakage (1/100)

STTHxxx 200-1200V, 1-200A, 175°C



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Silicon Carbide Driving Methods

- Driving a SiC MOSFET is almost easy as driving a silicon MOSFET:
  - Just need Vgs = 20V to get the right Ron
  - Adequate current capability to ensure high speed (2-3 A would be the best)
  - Recommended -4Vgs drive on turn off to minimize effects of high dv/dt on gate
- Very simple and very mature standard gate drivers can be used
  - ST TD350 + push-pull stage (to increase current capability) in production
  - The new ST isolated GAPdriver: STGAP1S
- An ***Application Note*** focused on “How to Drive a SiC MOSFET” has been published on st.com.

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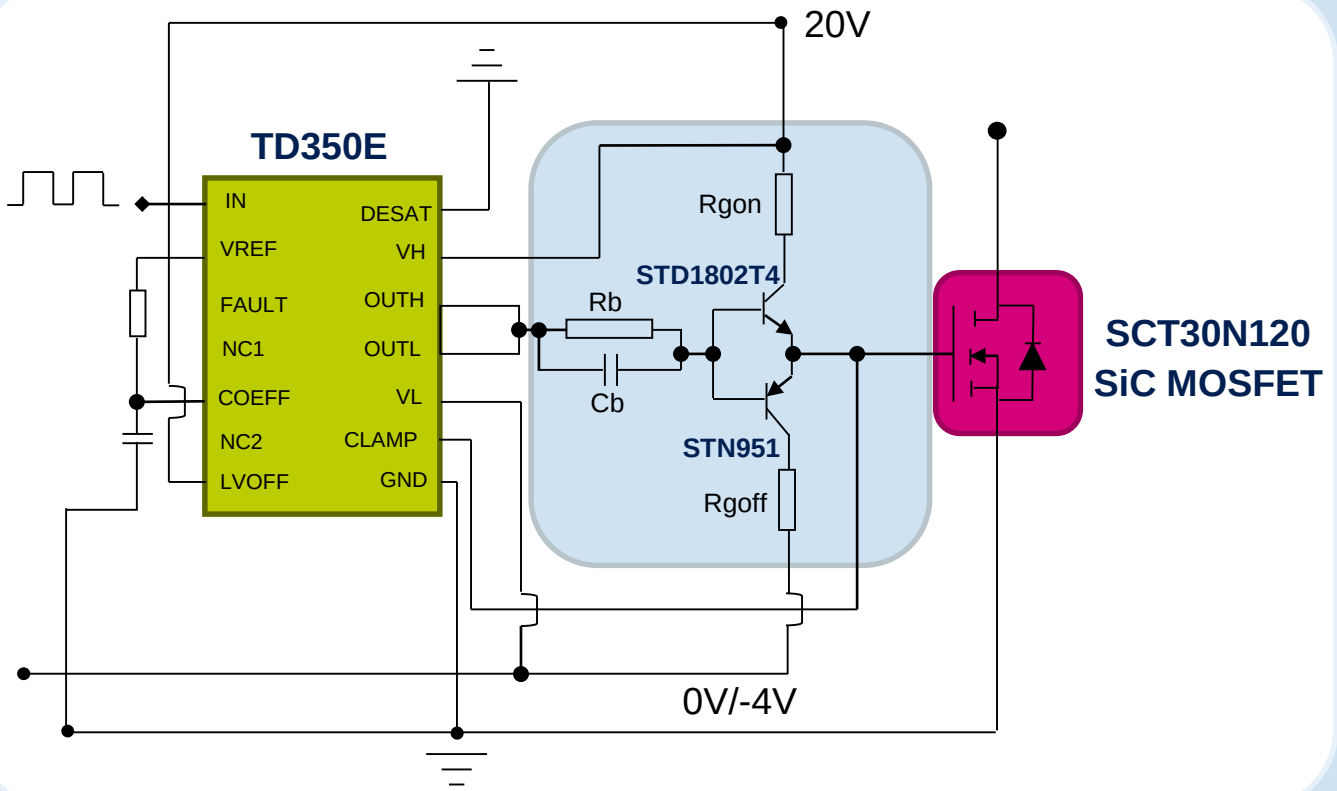
SiC MOSFET driving circuit

Driving SiC MOSFET with TD350E

The ST **TD350E** is an advanced gate driver for IGBTs and power MOSFETs.
To drive a SiC MOSFET, simply need to add an external push-pull network to increase the current capability.
The optimal value of the resistors of the push/pull stage ($R_{G\text{-}on}$ & $R_{G\text{-}off}$) are between 2.2Ω/6.8Ω according to dv/dt requirements.



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