**AC/DC input stage for onboard chargers with built-in inrush-current limitation**

**ABSTRACT**

Thyristor-based topologies offer many advantages for the AC/DC input stage of onboard chargers (OBCs) used in electric vehicles. In addition to controlling the inrush-current and allowing full OBC disconnection in standby to suppress undesired losses, these full-silicon solutions do not require any inrush-current limiting resistors or mechanical relays.

**FEATURES AND BENEFITS**

- **Smart inrush current limitation:**
  - Peak current controlled by software
  - Increased system power-up speed
- **High reliability:**
  - No moving mechanical parts
  - No EMI noise
  - No contact aging issues
  - Zero Current Switching thanks to SCRs
- **High power density:**
  - SMD packages available
  - Power density increased
  - Industrial production costs optimized
- **Embedded disconnection function:**
  - DC bus is disconnected from the line thanks to the SCRs
  - Stable and predictable efficiency
- **Automotive grade**

**MIXED SCR / RECTIFIER BRIDGE**

**BRIDGELESS TOTEM POLE**

**INRUSH CURRENT LIMITATION OPERATION**

- Bulk capacitor is smoothly charged thanks to the SCR's phase angle control
- T1 and T2 are synchronized according to the zero crossing (ZVS) of the AC line

→ At system start-up or after line drops, the peak line current is controlled by choosing the most adapted SCR gate driving strategy

→ Thin designs possible through SMD packages

→ Both line and neutral functional disconnection ensured by the SCRs (valid for both mixed bridge and bridgeless totem poles)

→ Mechanical relay contact aging makes the solid state solution more stable and predictable