

BRIDGELESS TOTEM POLE PFC



with SCR Inrush Current Limiter



Innovative boost topology based on SiC MOSFETs and SCR thyristors for a compact converter with high efficiency and low THD distortion

A 3.6 kW bridgeless totem pole boost circuit, the STEVAL-DPSTPFC1 reference design is a digital power factor correction (PFC) solution with inrush current limiter (ICL). It helps engineers to design innovative topologies using the latest ST power kit devices: silicon-carbide MOSFETs, SCR thyristors, isolated FET drivers and a STM32F3 microcontroller. It's an excellent way to develop compact converters running at 72 kHz with a high peak efficiency and low THD distortion (97.5% with 3.7% THD). A robust circuit design, this solid-state board meets EMC standards up to 4 kV and ensures a high switching lifetime and lower EMI.

KEY FEATURES

- AC line voltage: 85 up to 264 V
- AC line frequency: 45 up to 65 Hz
- Maximum RMS AC line current: 16 A
- DC output voltage: 400 VDC
- Ambient temperature: 0° up to 45 °C

KEY BENEFITS

- Peak efficiency : 97.5% with 3.7% THD
- Compact PFC converter
- Higher switching lifetime
- EMI standard compliant at 4 kV

KEY APPLICATIONS

- EV / HEV on-board chargers
- Charging stations
- Motor drives
- UPS
- Server / Telecom SMPS

Solid-state inrush current limiter

Using a thyristor SCR in place of a diode or a MOSFET for AC line polarity switching provides active current limitation at power-up or line-drop recovery. The AC section performs without compromising the global PFC efficiency, offering a non-bouncing, EMI-free solution versus the traditional bulky NTC thermistors with relay designs.

Complete ST power device kit

The STEVAL-DPSTPFC1 board includes a power board featuring bridgeless totem-pole boost, inrush limiter circuit, switch drivers and auxiliary power supply, a control board with a STM32F3 MCU, PFC / ICL control firmware and an adapter board for software debugging. It uses the following ST power devices:

- 1200 V, 30 A, automotive-grade thyristor (TN3050H-12WY)
- 650 V, 35 A, SiC power MOSFET (SCTW35N65G2V)
- 1700 V, 4 A, galvanically isolated single gate driver (STGAP2S)
- STM32F3 mixed-signal MCU with DSP and FPU instructions (STM32F334)
- Energy-saving, off-line, high-voltage, switching regulator (VIPER26LD)

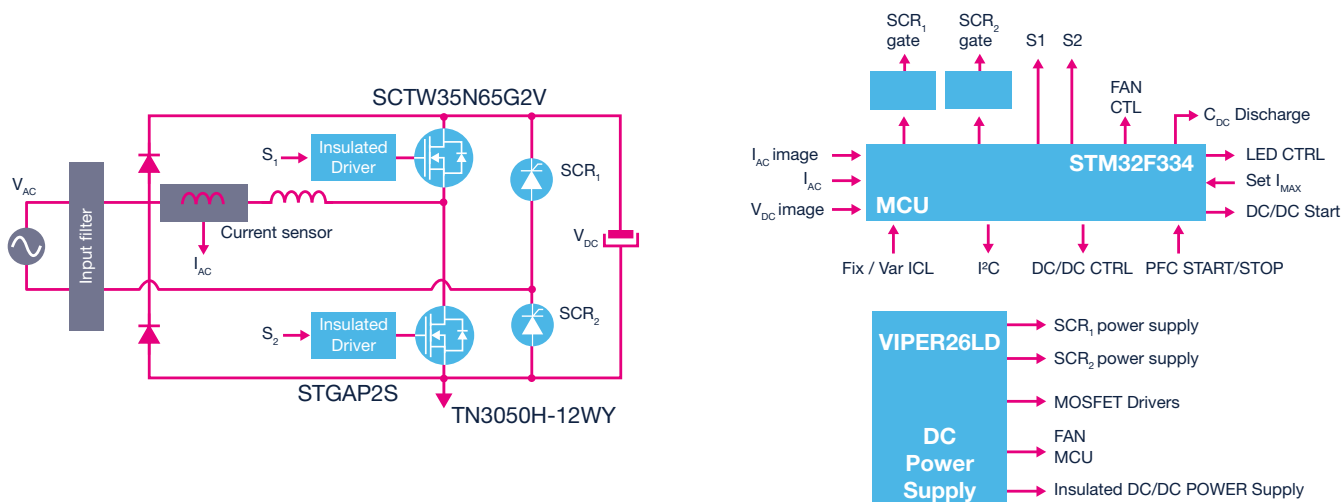
Bridgeless totem pole applications

Applications requiring a compact layout and high-quality power factor correction can benefit from our design: battery chargers, EV on-board chargers, charging stations, UPS and industrial chargers, SMPS in industrial, data center and telecom environments; even motor drives can take advantage of its efficiency and low distortion performance.

STEVAL-DPSTPFC1 reference design

The board is available with all the resources, to help you start building a straightforward and compact PFC design based on the innovative bridgeless boost topology, using a best-in-class ST power device kit.

STEVAL-DPSTPFC1 power and control block diagrams



STEVAL-DPSTPFC1 reference design content

Reference (*)	Name	Description
STEVAL-DPSTPFC0	AC-DC power board	Bridgeless Totem Pole circuit with AC filter and auxiliary supply
STEVAL-DPS334M1	PFC control board	32-bit MCU control board
STEVAL-DPSADP01	Adapter board	Interface for MCU debugging and USART communication

Note: (*) the boards that comprise the kit will not be available separately



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