STEVAL-DPSTPFC1

Data brief

3.6 kW PFC totem pole with inrush current limiter reference design using TN3050H-12WY and SCTW35N65G2V

Features

- 97.5 % efficiency at full load
- Max. 5 % THD at 10 % of full load
- Compact PFC converter
- Higher switching lifetime
- Compliant with EMI norms at 4 kV
- RoHS compliant
- WEEE compliant

Applications

- EV/HEV on-board chargers
- Charging stations
- Motor drive, motion control
- UPS, industrial battery charger
- Server/Telecom SMPS

Description

The STEVAL-DPSTPFC1 3.6 kW bridgeless totem pole boost circuit achieves a digital power factor correction (PFC) with inrush current limiter (ICL). It helps you to design an innovative topology with the latest ST power kit devices: a silicon carbide MOSFET (SCTW35N65G2V), a thyristor SCR (TN3050H-12WY), an isolated FET driver (STGAP2S) and a 32-bit MCU (STM32F334).

This reference design also opens the path to a compact converter running at 75 kHz offering a high efficiency at full load (97.5%) and a low THD distortion (5 % max. at 10 % of maximum load).

It achieves a robust circuit that meets EMC standards up to 4 kV delivering high switching lifetime with reduced EMI emissions.

The thyristor SCR used as AC line polarity switcher allows achieving an active current limitation at power up or line drop recovery: the PFC efficiency is optimal and no EMI bouncing effect occurs.

The reference design includes a power board bridgeless totem pole boost (with an inrush limiter circuit, switch drivers and an auxiliary power supply), a control board with its MCU, a PFC/ICL control firmware and an adapter board for software debug.

Product summary	
3.6 kW power factor corrector totem pole with inrush current limiter using TN3050H-12WY and SCTW35N65G2V	STEVAL-DPSTPFC1
30 A 1200 V automotive grade SCR thyristor	TN3050H-12WY
Galvanically isolated 4 A single gate driver	STGAP2S
Silicon carbide power MOSFET	SCTW35N65G2V
VIPerPlus family: energy saving 12W high voltage converter with direct feedback	VIPER26LD
Mixed-signal MCU with DSP and FPU for digital power conversion applications	STM32F334

1 Electrical characteristics

Table 1. Electrical characteristics (Tj=25 °C where not specified)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V_{AC}	AC line RMS voltage		85		264	V
I_{AC}	AC line RMS current				16	A
P_{IN}	Input power				3.7	kW
f_{AC}	Input AC frequency		45		65	Hz
V_{DC}	Output DC voltage			400	450	V
I_{DC}	Output DC current				9	A
f_s	Switching frequency			75		kHz
η	PFC efficiency	V_{AC} = 230 V; full load		97.5		%
T_{AMB}	Ambient temperature		0		60	°C
THD	Distortion	>10% rated load			5	%
PF	Power factor			0.99		-

Figure 1. STEVAL-DPSTPFC1 power board electrical diagram

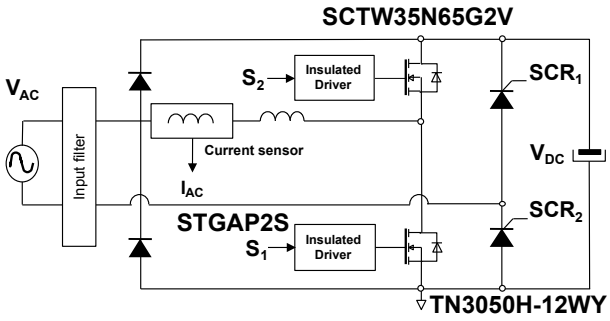
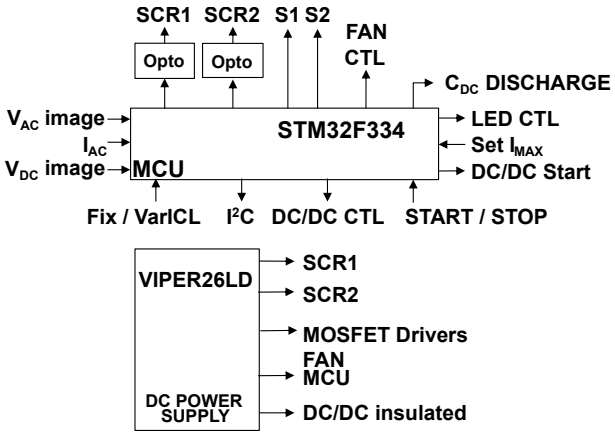


Figure 2. STEVAL-DPSTPFC1 control board electrical diagram and auxiliary power supply



Revision history

Table 2. **Document revision history**

Date	Version	Changes
03-May-2019	1	Initial release.