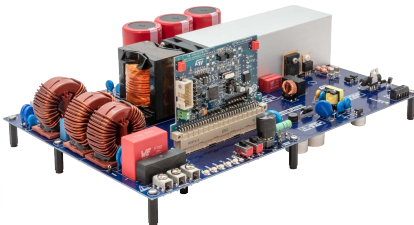


3.6 kW Totem Pole PFC with inrush current limiter reference design using TN3050H-12WY and SCTW35N65G2V



Features

- Peak efficiency: 97.5 % with 3.7% THD
- Compact PFC converter
- Higher switching lifetime
- Compliant with EMI normative at 4 kV
- RoHS and 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 72 kHz offering a high peak efficiency, low THD distortion (97.5 % with 3.7 % THD) and reduced bill of materials.

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 with 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
Energy saving 12 W high voltage converter with direct feedback	VIPER26LD
Mixed-signal MCU with DSP and FPU for digital power conversion applications	STM32F334
Applications	AC-DC Converters Industrial Power Supply Server and Telecom Power

1 Electrical characteristics

Table 1. Electrical characteristics (T_j=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	V _{AC} = 230 V RMS / 50 Hz			3.6	kW
		V _{AC} = 110 V RMS / 60 Hz			1.6	
f _{AC}	Input AC frequency		45		65	Hz
V _{DC}	Output DC voltage			400	450	V
I _{DC}	Output DC current	V _{AC} = 230 V RMS / 50 Hz			9	A
		V _{AC} = 110 V RMS / 60 Hz			4	
f _s	Switching frequency			72		kHz
η	Peak PFC efficiency	V _{AC} = 230 V RMS / 50 Hz Output power = 2 kW		97.5		%
		V _{AC} = 110 V RMS / 60 Hz Output power = 1 kW		94.8		
T _{AMB}	Ambient temperature		0		45	°C
THD	Min Total Harmonic Distortion	V _{AC} = 230 V RMS / 50 Hz Output power = 2.5 kW		3.3		%
		V _{AC} = 110 V RMS / 60 Hz Output power = 1.4 kW		3.5		
PF	Power factor			0.99		-

Figure 1. STEVAL-DPSTPFC1 power board electrical diagram

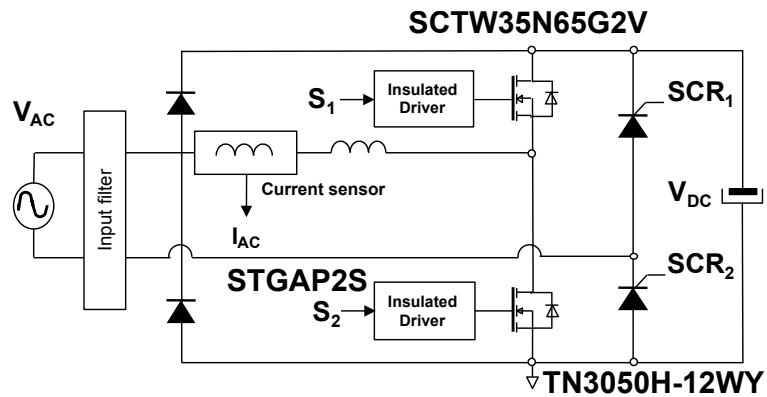
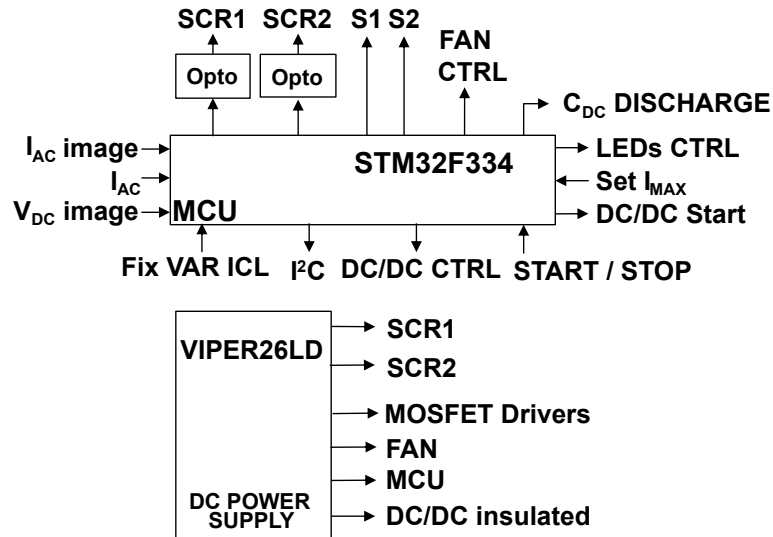


Figure 2. STEVAL-DPSTPFC1 control board electrical diagram and auxiliary power supply



2 Schematic diagrams

Figure 3. STEVAL-DPS334M1 circuit schematic (1 of 3)

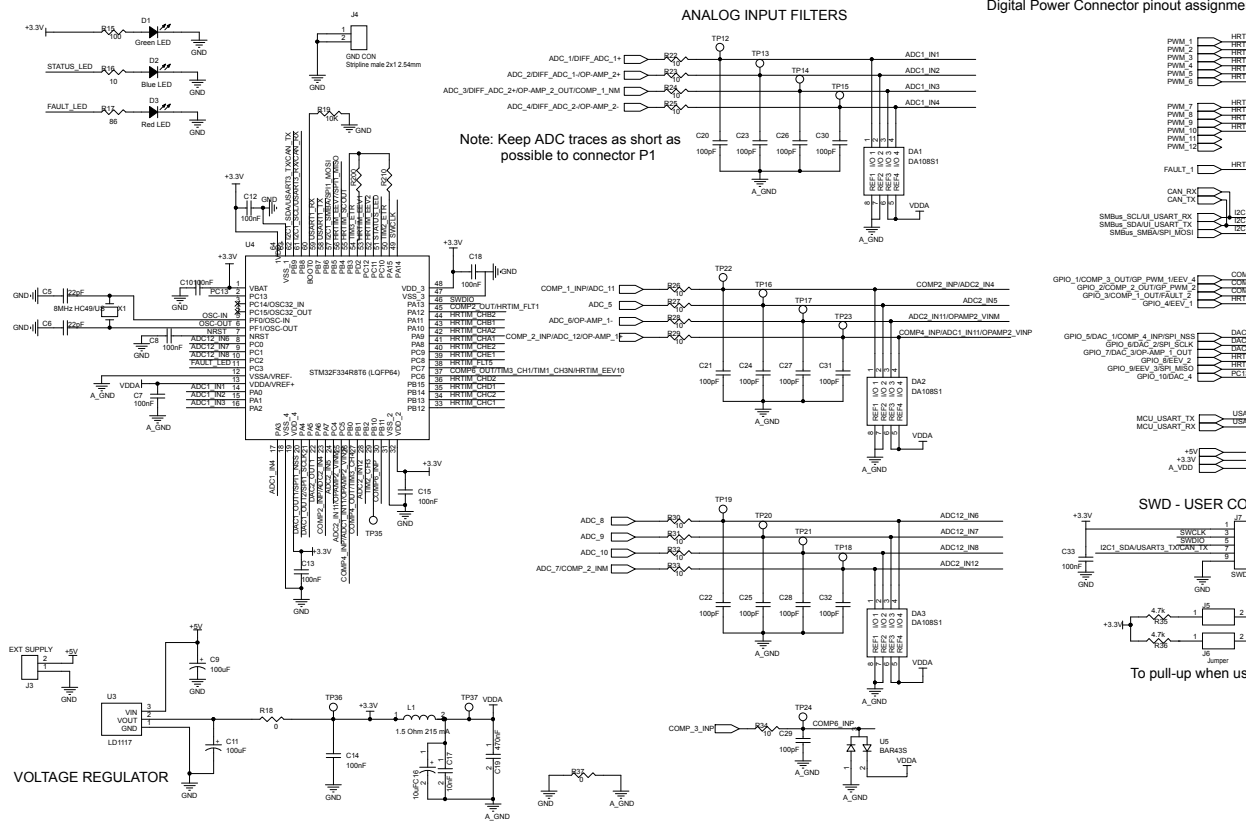


Figure 4. STEVAL-DPS334M1 circuit schematic (2 of 3)

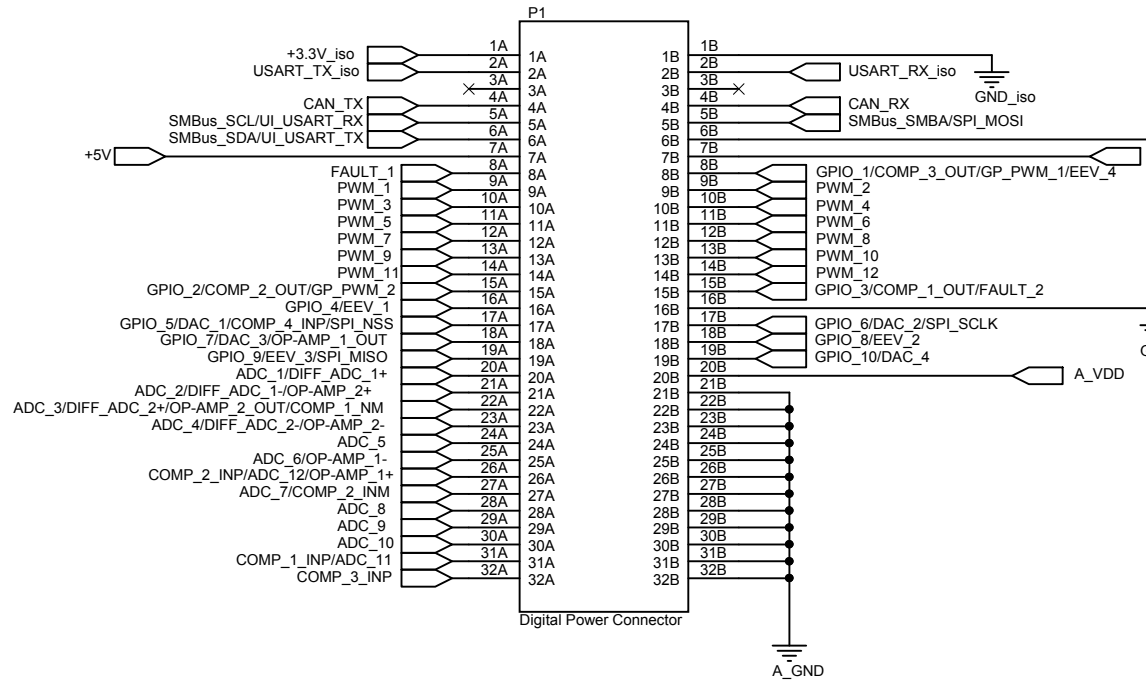


Figure 5. STEVAL-DPS334M1 circuit schematic (3 of 3)

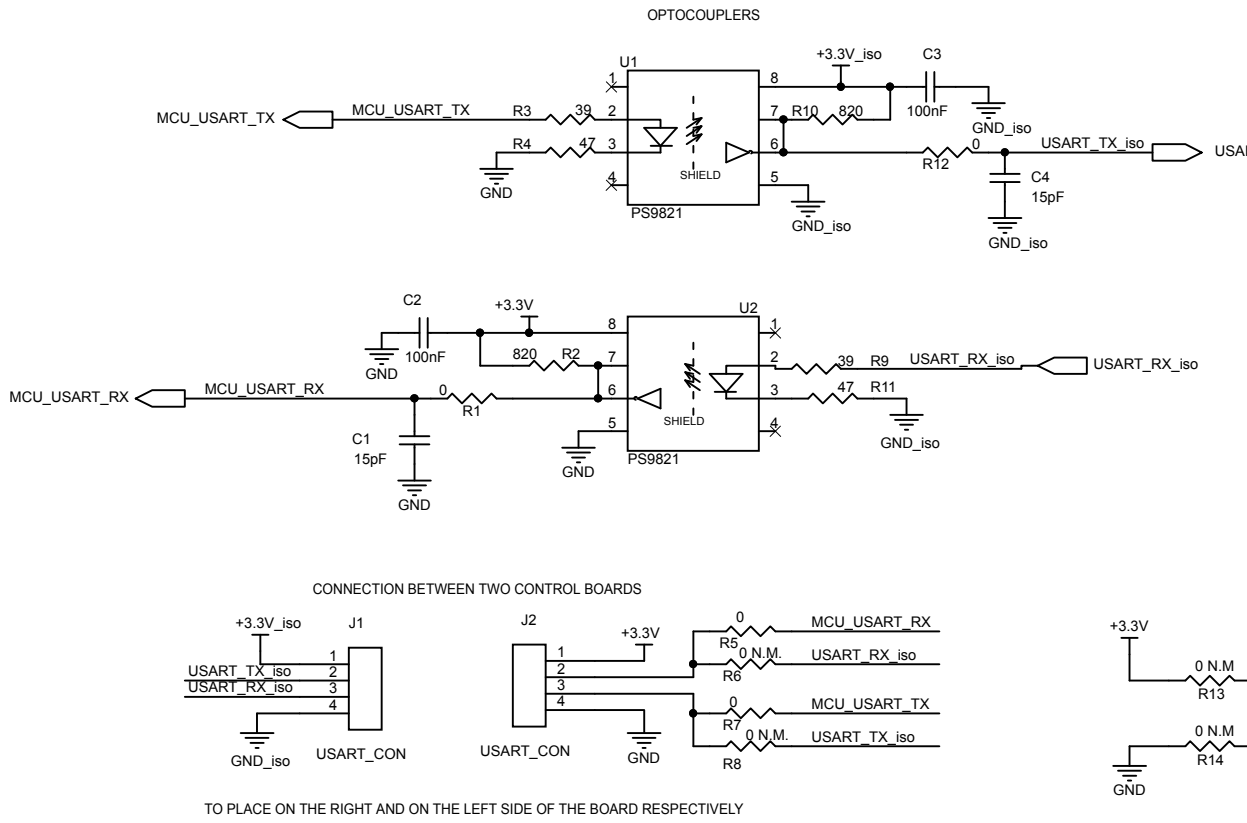


Figure 6. STEVAL-DPSADP01 circuit schematic

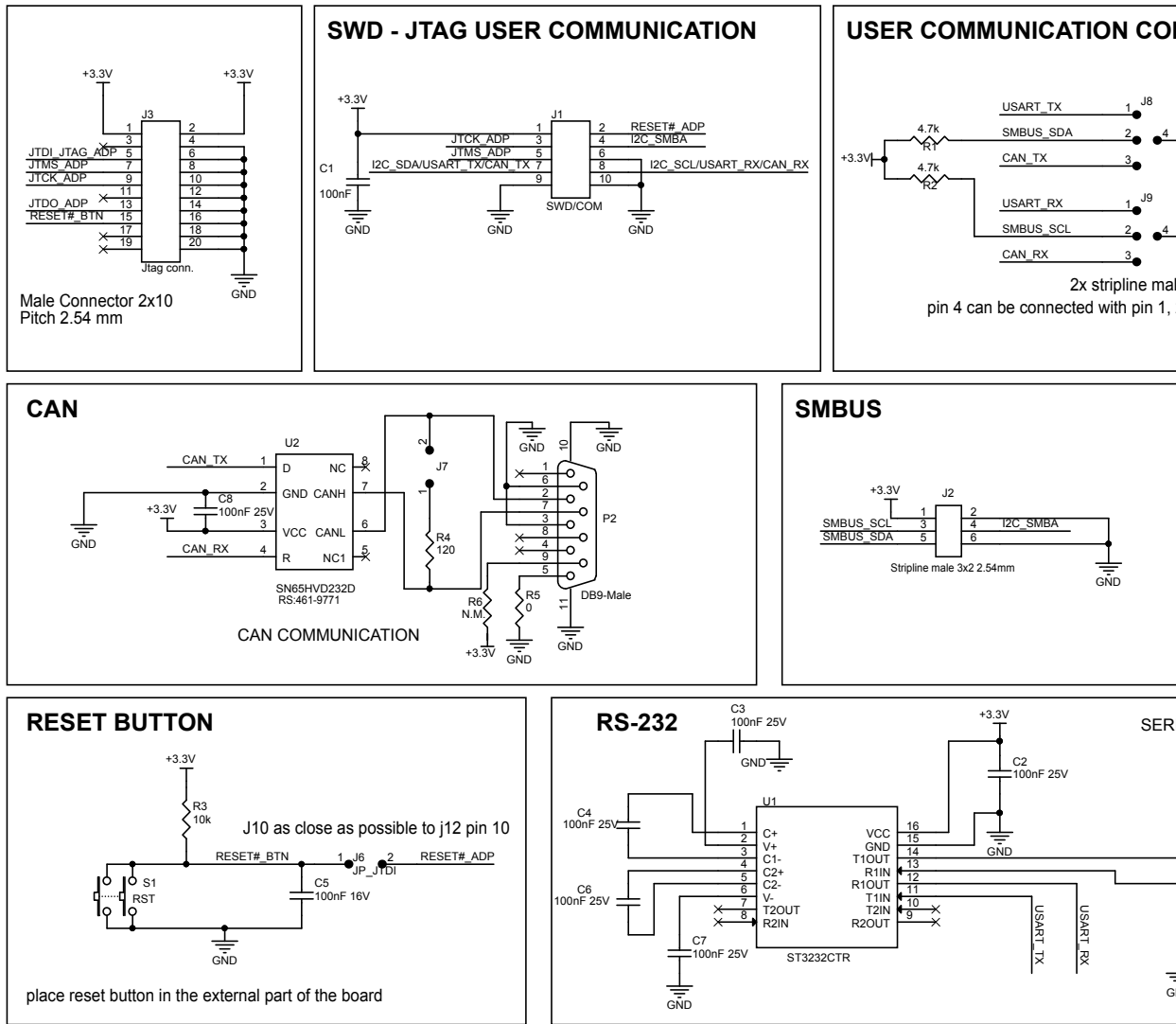
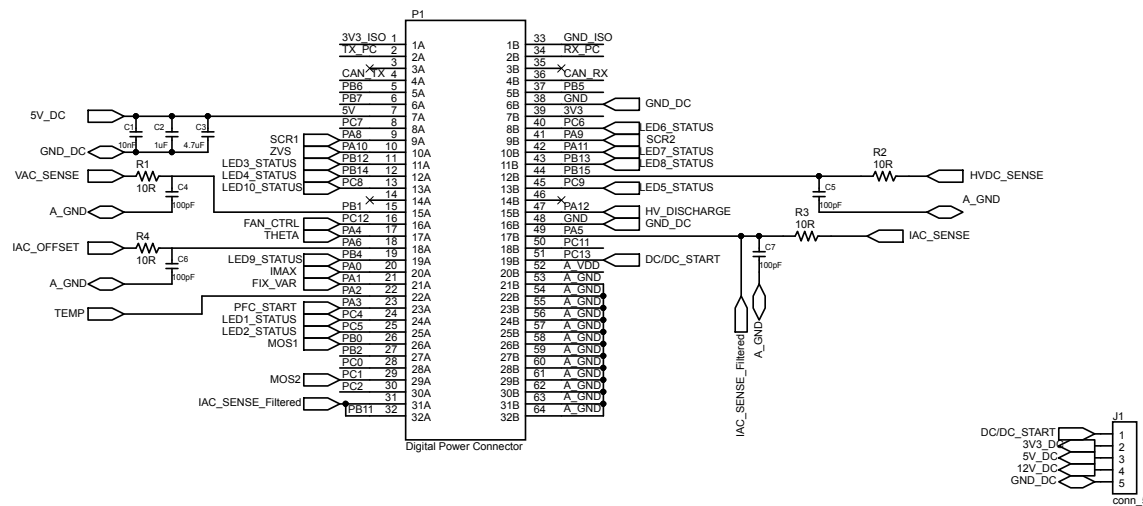


Figure 7. STEVAL-DPSTPFC0 circuit schematic (1 of 4)

EXTERNAL CONNECTORS



LED STATUS

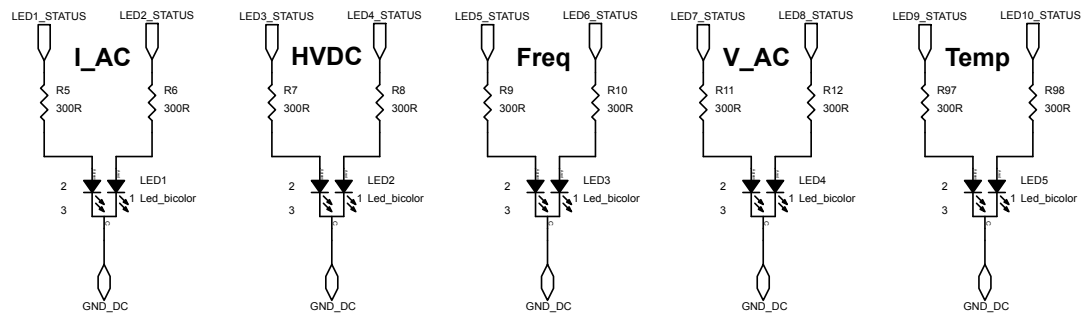


Figure 8. STEVAL-DPSTPFC0 circuit schematic (2 of 4)

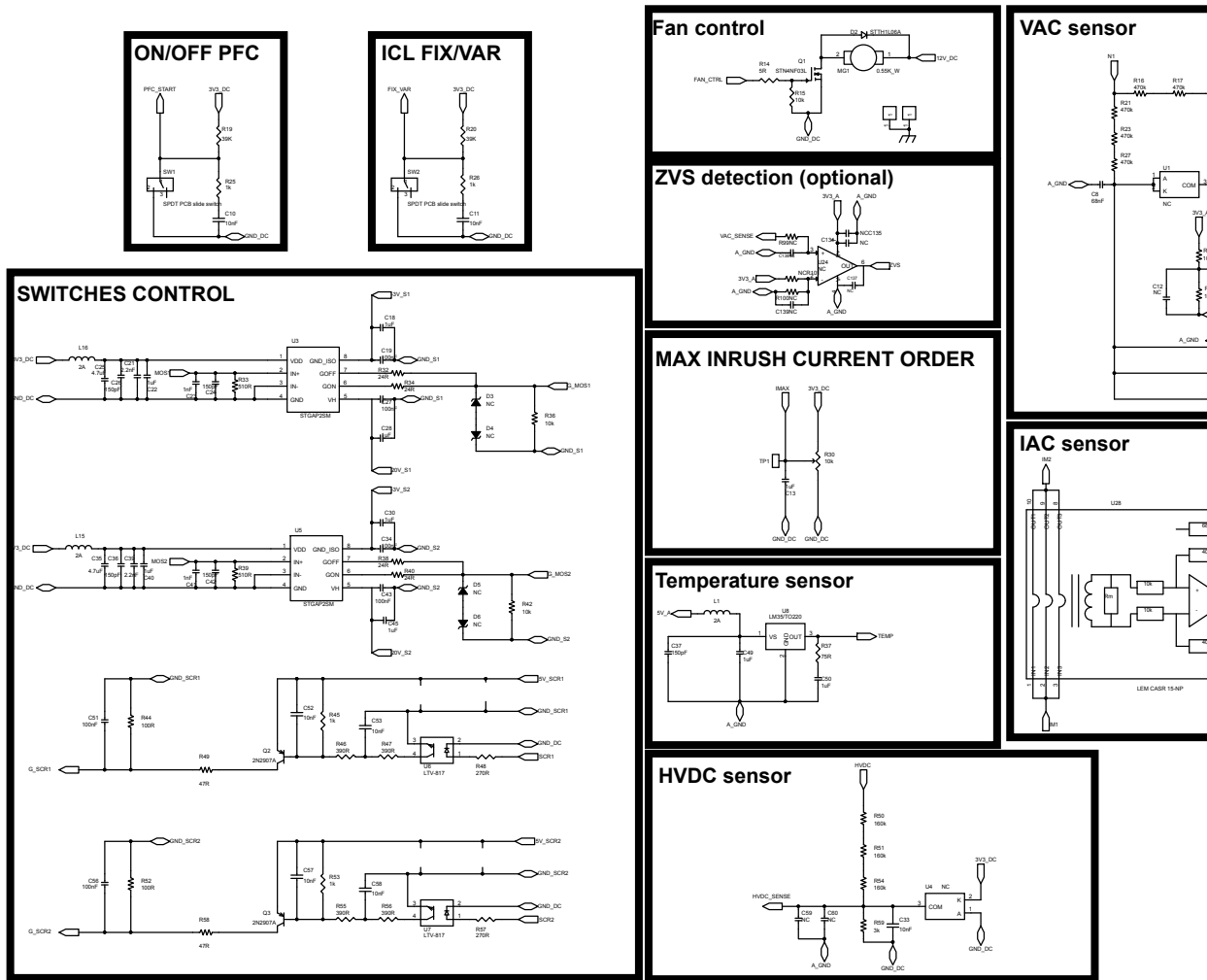
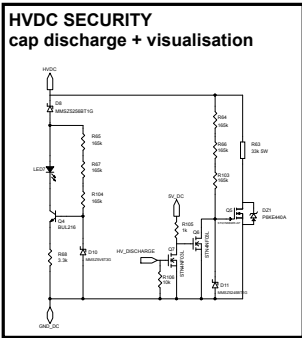
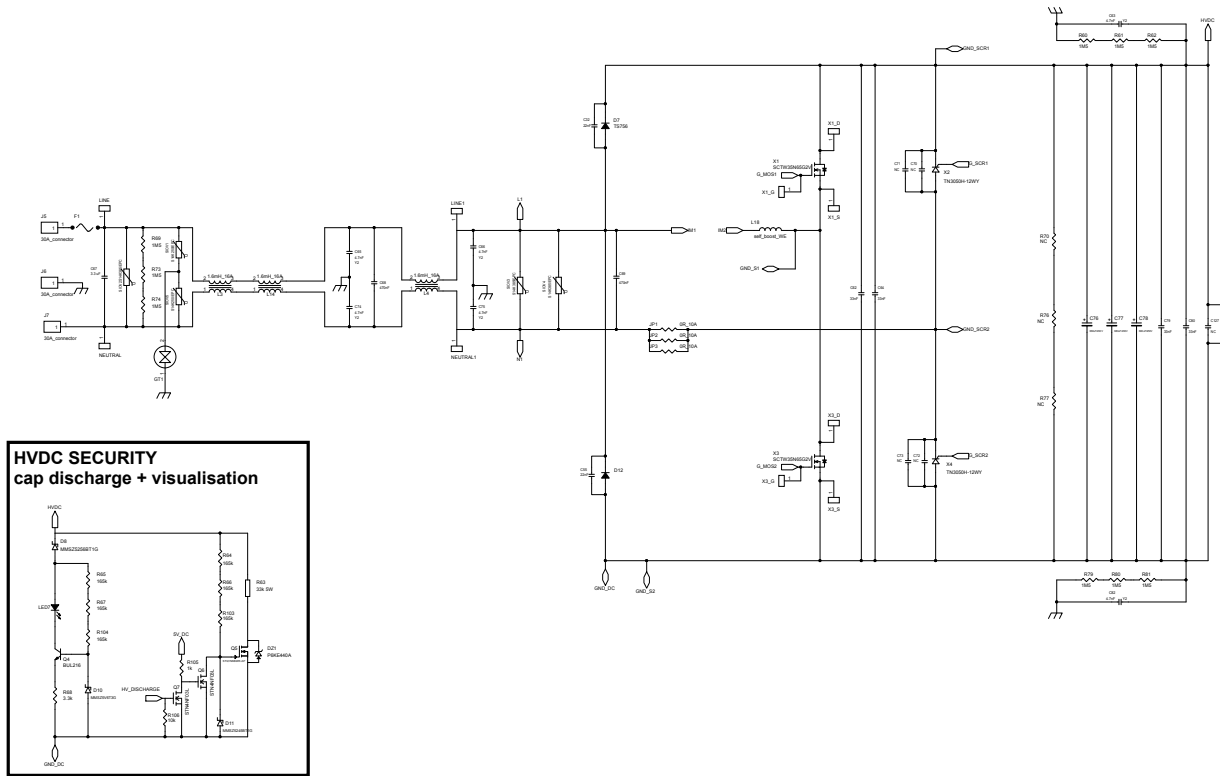


Figure 9. STEVAL-DPSTPFC0 circuit schematic (3 of 4)



Revision history

Table 2. Document revision history

Date	Version	Changes
03-May-2019	1	Initial release.
11-Dec-2020	2	Updated cover page image, features, description and product summary table. Updated Section 1 Electrical characteristics . Added Section 2 Schematic diagrams .

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2020 STMicroelectronics – All rights reserved

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [Power Management IC Development Tools](#) category:

Click to view products by [STMicroelectronics](#) manufacturer:

Other Similar products are found below :

[EVAL-ADM1168LQEBZ](#) [EVB-EP5348UI](#) [MIC23451-AAAYFL EV](#) [MIC5281YMME EV](#) [DA9063-EVAL](#) [ADP122-3.3-EVALZ](#) [ADP130-0.8-EVALZ](#) [ADP130-1.2-EVALZ](#) [ADP130-1.5-EVALZ](#) [ADP130-1.8-EVALZ](#) [ADP1712-3.3-EVALZ](#) [ADP1714-3.3-EVALZ](#) [ADP1715-3.3-EVALZ](#) [ADP1716-2.5-EVALZ](#) [ADP1740-1.5-EVALZ](#) [ADP1752-1.5-EVALZ](#) [ADP1828LC-EVALZ](#) [ADP1870-0.3-EVALZ](#) [ADP1871-0.6-EVALZ](#) [ADP1873-0.6-EVALZ](#) [ADP1874-0.3-EVALZ](#) [ADP1882-1.0-EVALZ](#) [ADP199CB-EVALZ](#) [ADP2102-1.25-EVALZ](#) [ADP2102-1.875EVALZ](#) [ADP2102-1.8-EVALZ](#) [ADP2102-2-EVALZ](#) [ADP2102-3-EVALZ](#) [ADP2102-4-EVALZ](#) [ADP2106-1.8-EVALZ](#) [ADP2147CB-110EVALZ](#) [AS3606-DB](#) [BQ24010EVM](#) [BQ24075TEVM](#) [BQ24155EVM](#) [BQ24157EVM-697](#) [BQ24160EVM-742](#) [BQ24296MEVM-655](#) [BQ25010EVM](#) [BQ3055EVM](#) [NCV891330PD50GEVB](#) [ISLUSBI2CKIT1Z](#) [LM2744EVAL](#) [LM2854EVAL](#) [LM3658SD-AEV/NOPB](#) [LM3658SDEV/NOPB](#) [LM3691TL-1.8EV/NOPB](#) [LM4510SDEV/NOPB](#) [LM5033SD-EVAL](#) [LP38512TS-1.8EV](#)