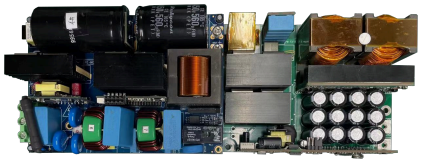
STDES-3KWTLCP

Data brief

3 kW telecom rectifier reference design based on the STM32G474RBT6 digital power MCU



Fully assembled board developed for performance evaluation only, not available for sale

Features

- Input voltage range: 90 to 264 V_{AC}
- Output voltage: 53.5 V
- Maximum output power: 3 kW at 230 V, 1.5 kW at 115 V_{AC}
- Peak efficiency: 96.3%
- Power density: 40 W/in^3
- Power factor >0.98 at 100% load
- Total harmonic distortion <5% at 100% load

Description

The STDES-3KWTLCP is a 3 kW AC-DC converter designed for telecom rectifier applications. This type of application requires a high efficiency over the entire load range of operation and across the universal mains input voltage range.

This reference design opens the path to a compact solution (up to 40 W/inch^3), offering a high peak efficiency (96.3%), low THD distortion (less than 5% THD at full load), and a reduced bill of materials.

The system consists of two power stages: a bridgeless totem-pole PFC controlled by an STM32G474RBT6 and an isolating regulation stage implemented with a full-bridge LLC with zero-voltage-switching (ZVS) PWM, and synchronous rectification (SR) controlled by a second STM32G474RBT6 microcontroller.

The STDES-3KWTLCP also helps you to design an innovative topology with the latest ST power kit devices: silicon carbide MOSFETs, high-voltage MDmesh MOSFETs, STripFET MOSFETs, isolated FET drivers, and a VIPer converter.

The STDES-3KWTLCP is a fully assembled kit developed for performance evaluation only, not available for sale.

Product summary	
3 kW Telecom rectifier reference design based on STM32G4 digital power MCU	STDES-3KWTLCP
Firmware for the STDES-3KWTLCP 3 kW telecom rectifier	STSW-3KWTLCP
Mainstream Arm® Cortex®-M4 MCU 170 MHz with 128 Kbytes of flash memory	STM32G474RBT6
Silicon carbide power MOSFET	SCTW35N65G2V
N-channel 650 V, 36 mOhm typ., 68 A MDmesh	STW70N65DM6-4
Galvanically isolated 4 A single gate driver	STGAP2HSCMTR
Applications	Server & Telecom Power/On Board Charger (OBC)/EV Charging

1 Electrical characteristics

Table 1. STDES-3KWTLCP electrical characteristics

Symbol	Description	Condition	Min.	Typ	Max.	Units
V_{AC}	Input AC voltage		90		264	V
f_{AC}	Input AC frequency		47		63	Hz
V_{out}	Output voltage	25%-50%-25% dynamic load	50.8	53.5	56.2	V
P_{out}	Output power	V_{AC} = 115 V			1500	W
		V_{AC} = 230 V			3000	W
I_{out}	Output current	V_{AC} = 115 V			28	A
		V_{AC} = 230 V			56	A
η	Peak efficiency	V_{AC} = 230 V_{AC}		96		%
iTHD	Total harmonic distortion	V_{AC} = 230 V_{AC}/ 3000 W		5		%
		V_{AC} = 115 V_{AC}/ 1500 W				
PF	Power factor	VAC=230Vac/ 3000W		0.98		
		V_{AC} = 115 V_{AC}/ 1500 W				
I_{inrush}	Inrush current				30	A
T_{holdup}	Holdup time	Full load	10			ms
V_{brown_out}	Input voltage protection		85			V
V_{brown_in}					87	V
PFC_OVP	PFC output voltage protection	V_{PFC_OVP}			450	V
PFC_OCP	PFC input current protection	I_{PFC_OCP}		20		A
LLC_OVP	LLC output voltage Protection	V_{LLC_OVP}			59	V
LLC_OCP	LLC output current protection	I_{LLC_OCP}			65	A

2 Block diagrams

Figure 1. **Bridgeless totem-pole PFC block diagram**

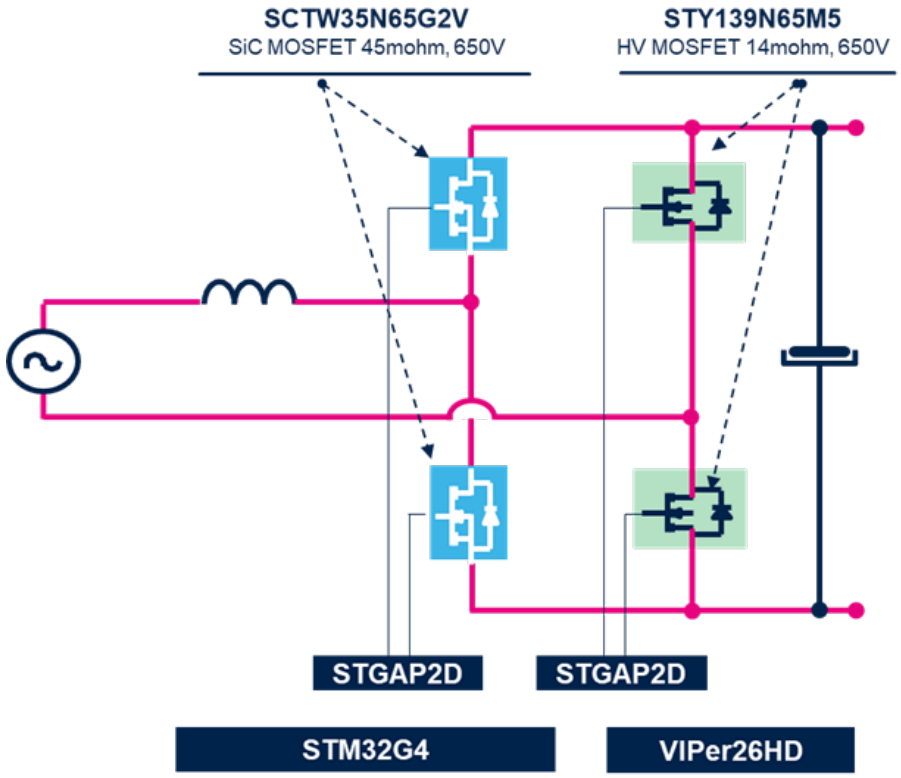


Figure 2. **Bridgeless totem-pole PFC firmware functional block diagram**

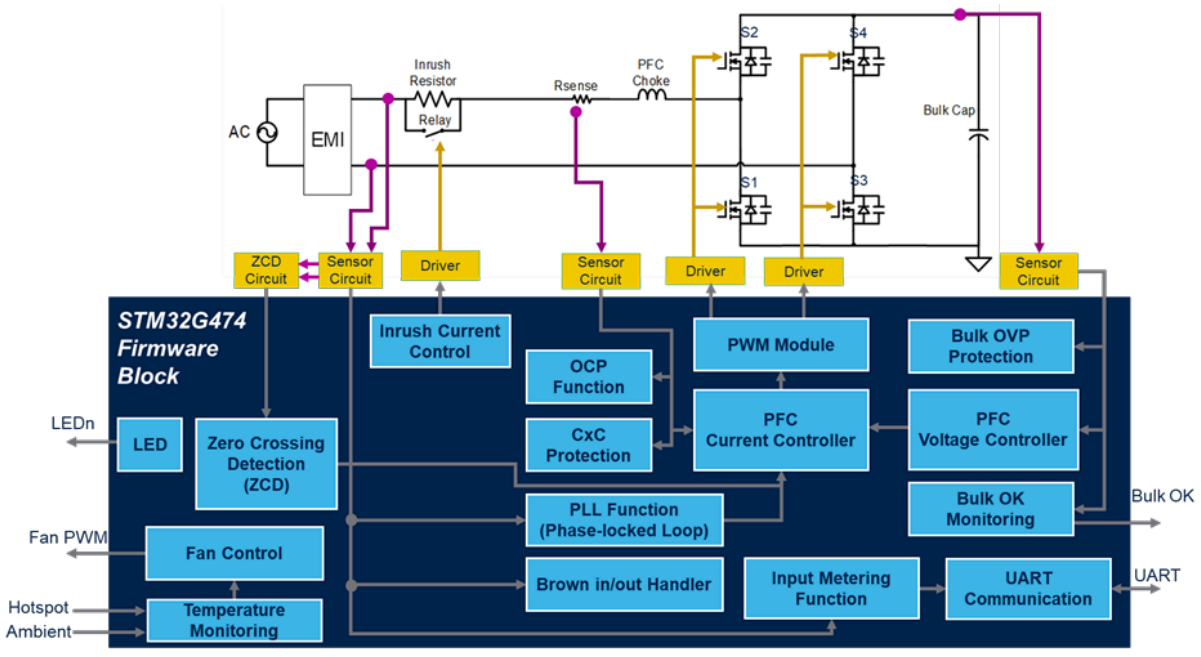


Figure 3. **Full-bridge LLC block diagram**

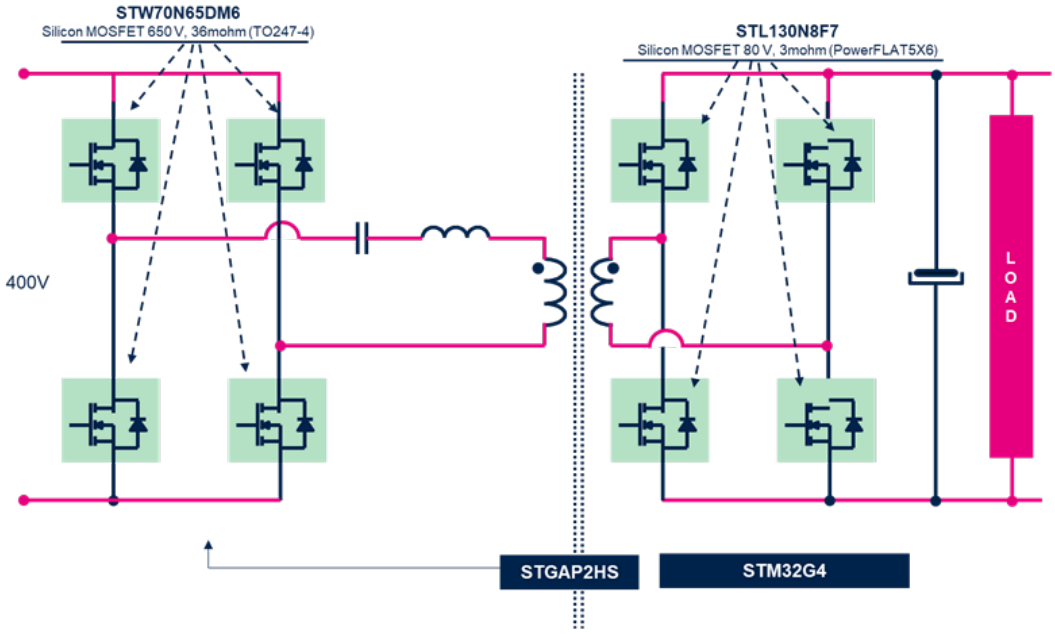
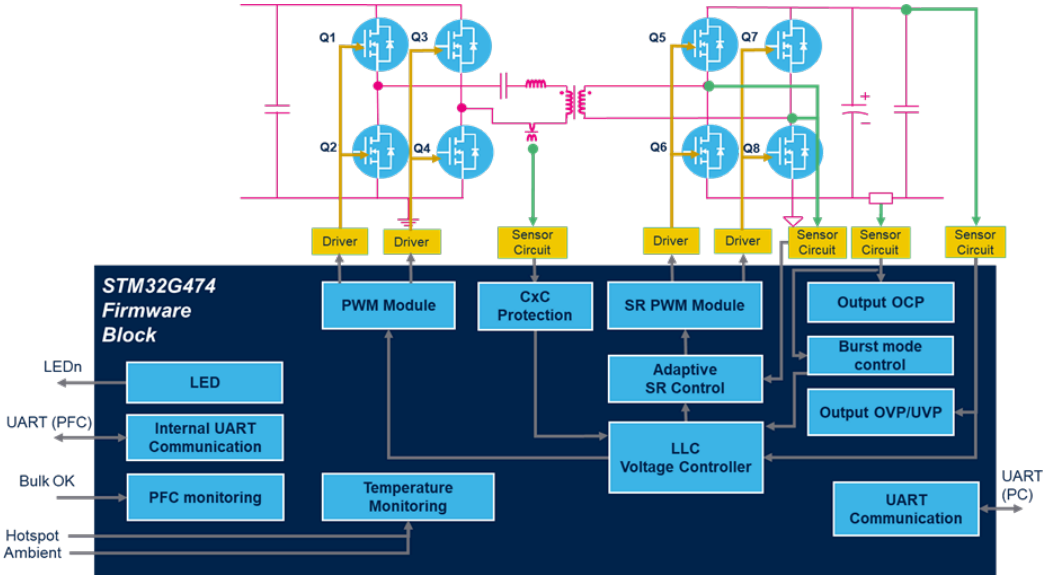


Figure 4. **Full-bridge LLC firmware functional block diagram**



3 Schematic diagrams

Figure 5. STDES-3KWTLCPT totem-pole PFC board circuit schematic (1 of 7)

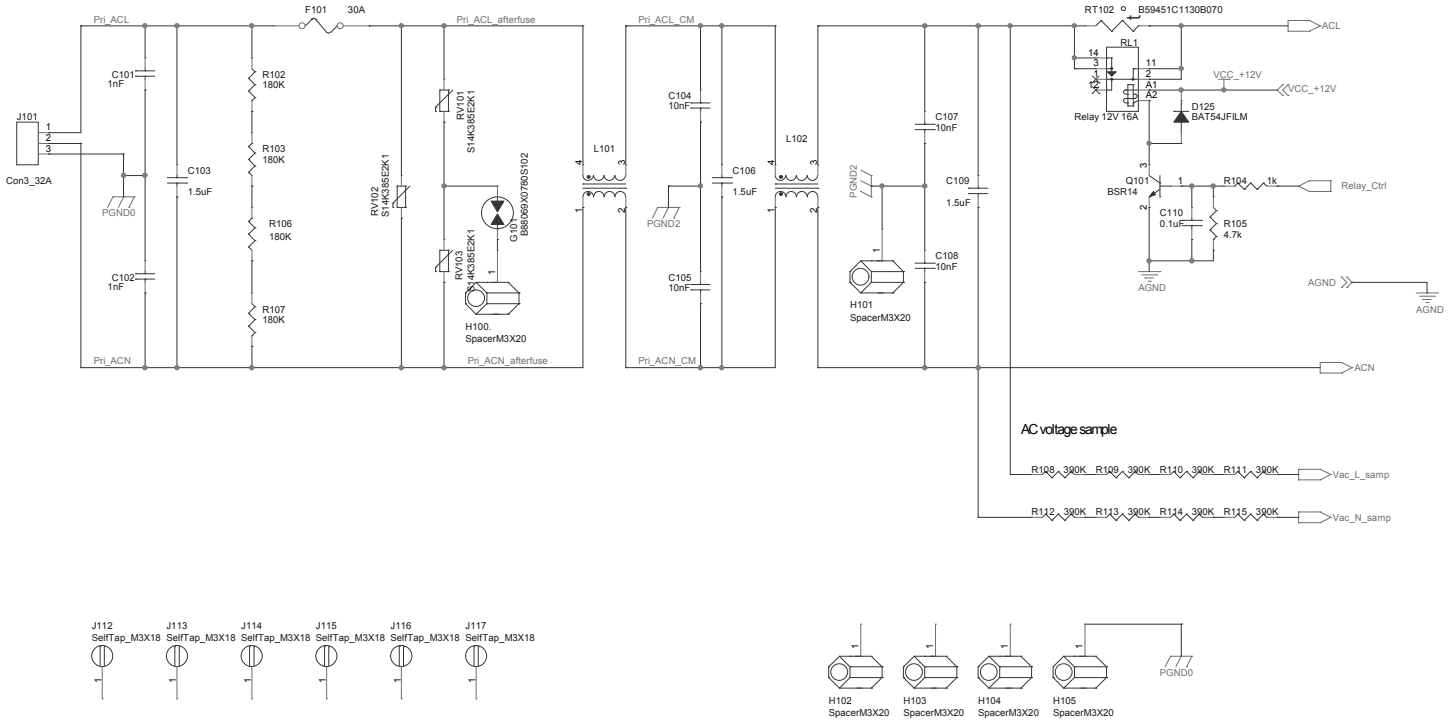


Figure 6. STDES-3KWTLCPT totem-pole PFC board circuit schematic (2 of 7)

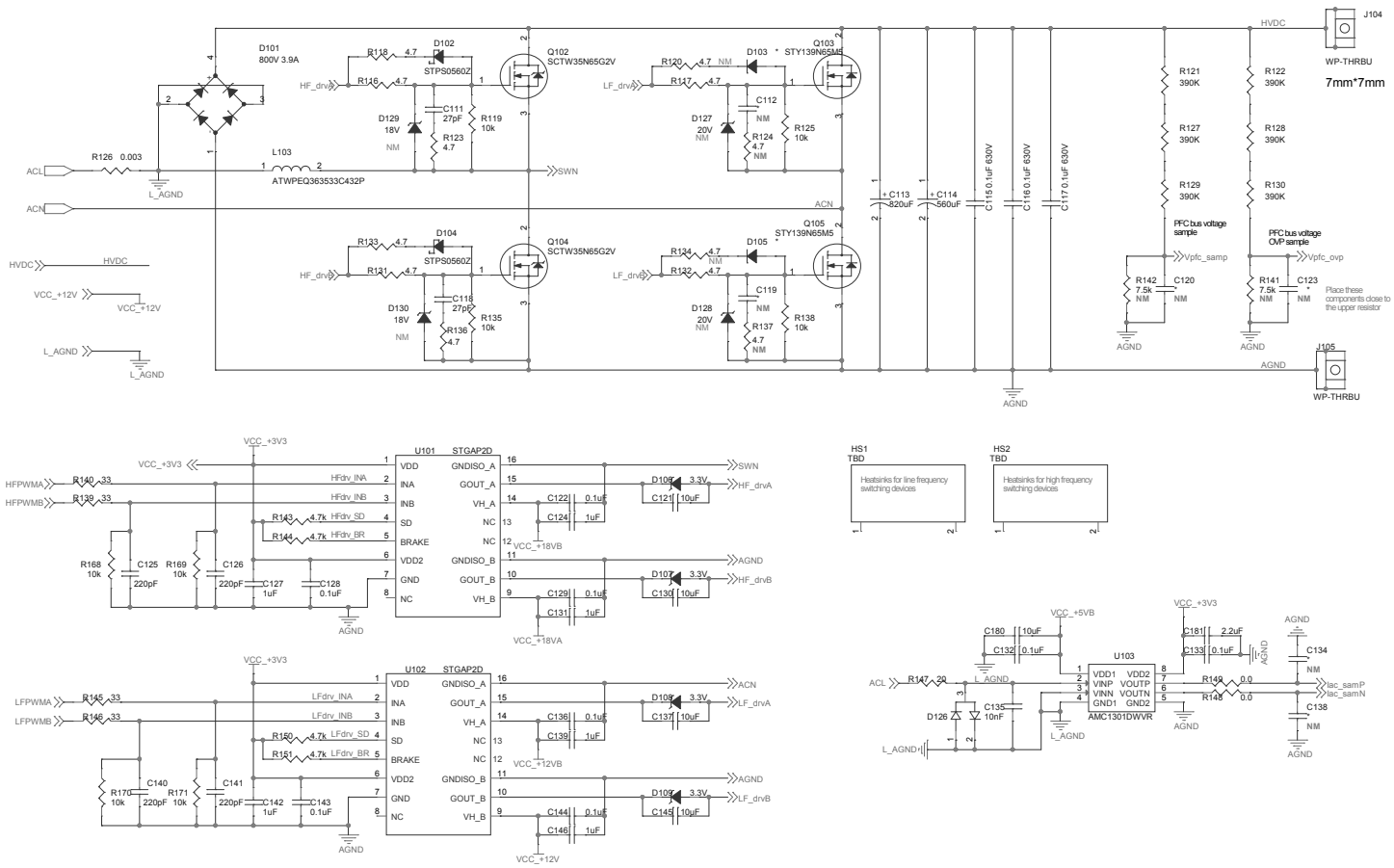


Figure 7. STDES-3KWTLCPT totem-pole PFC board circuit schematic (3 of 7)

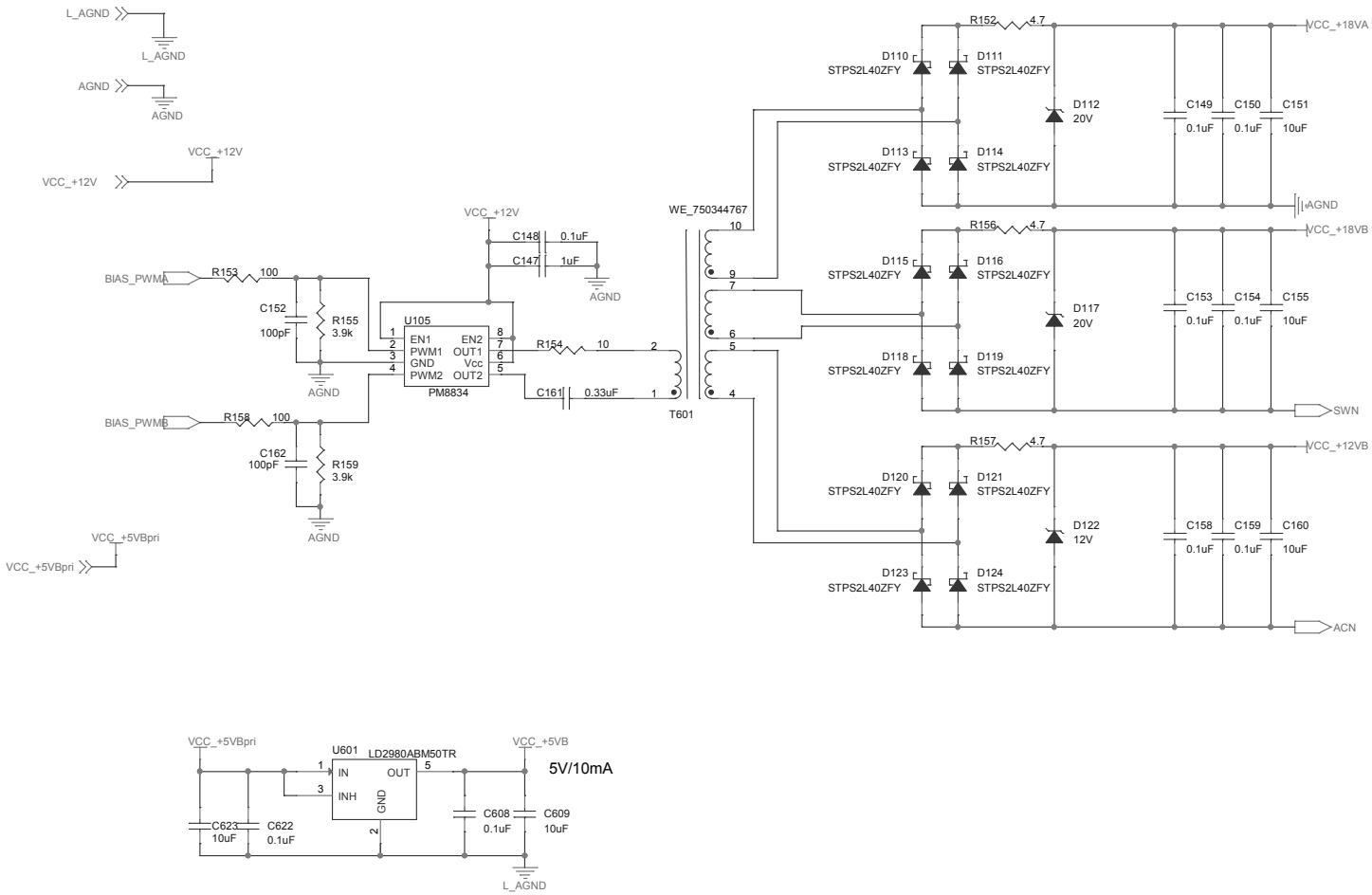


Figure 8. STDES-3KWTLCPT totem-pole PFC board circuit schematic (4 of 7)

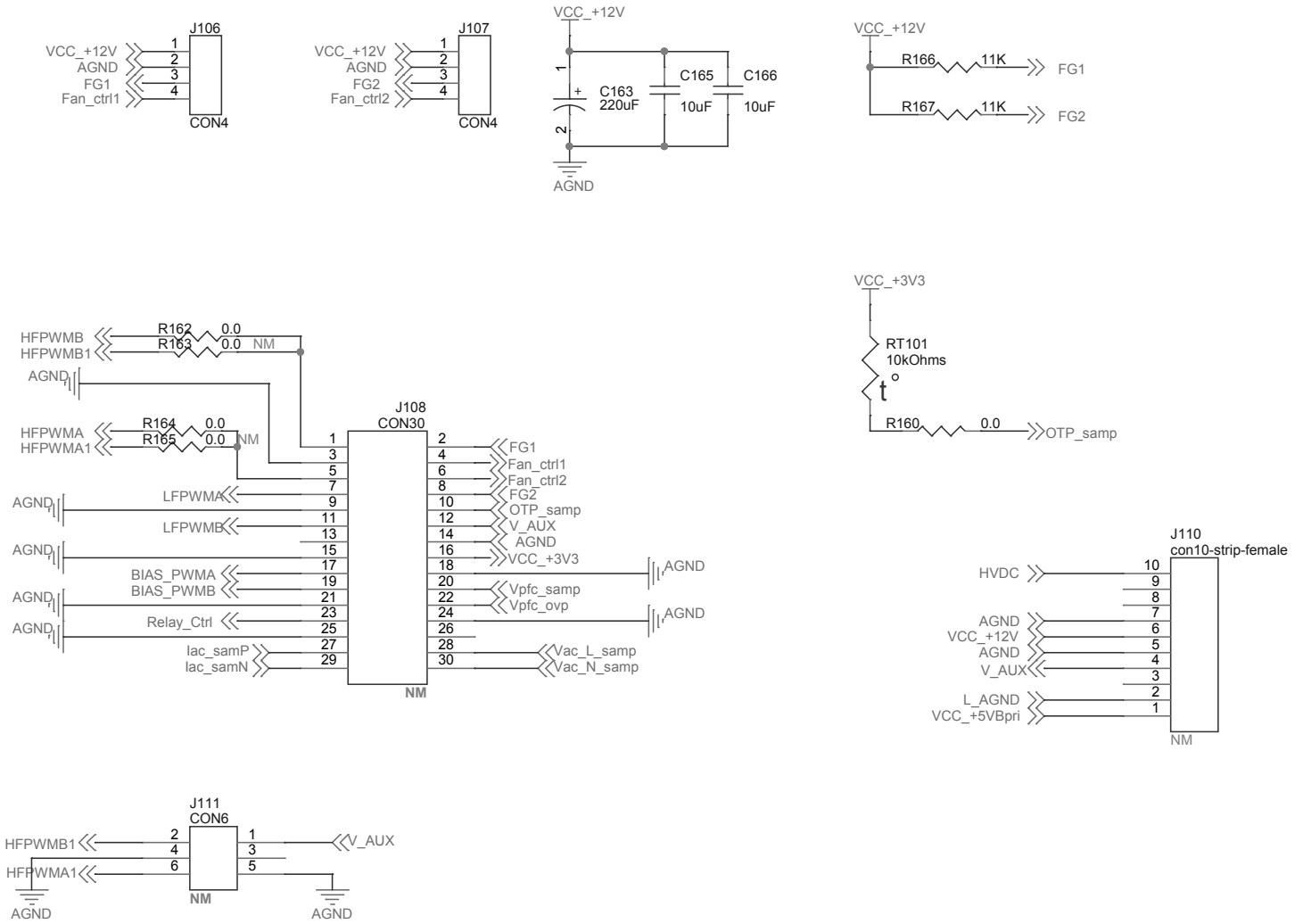


Figure 9. STDES-3KWTLCPT totem-pole PFC board circuit schematic (5 of 7)

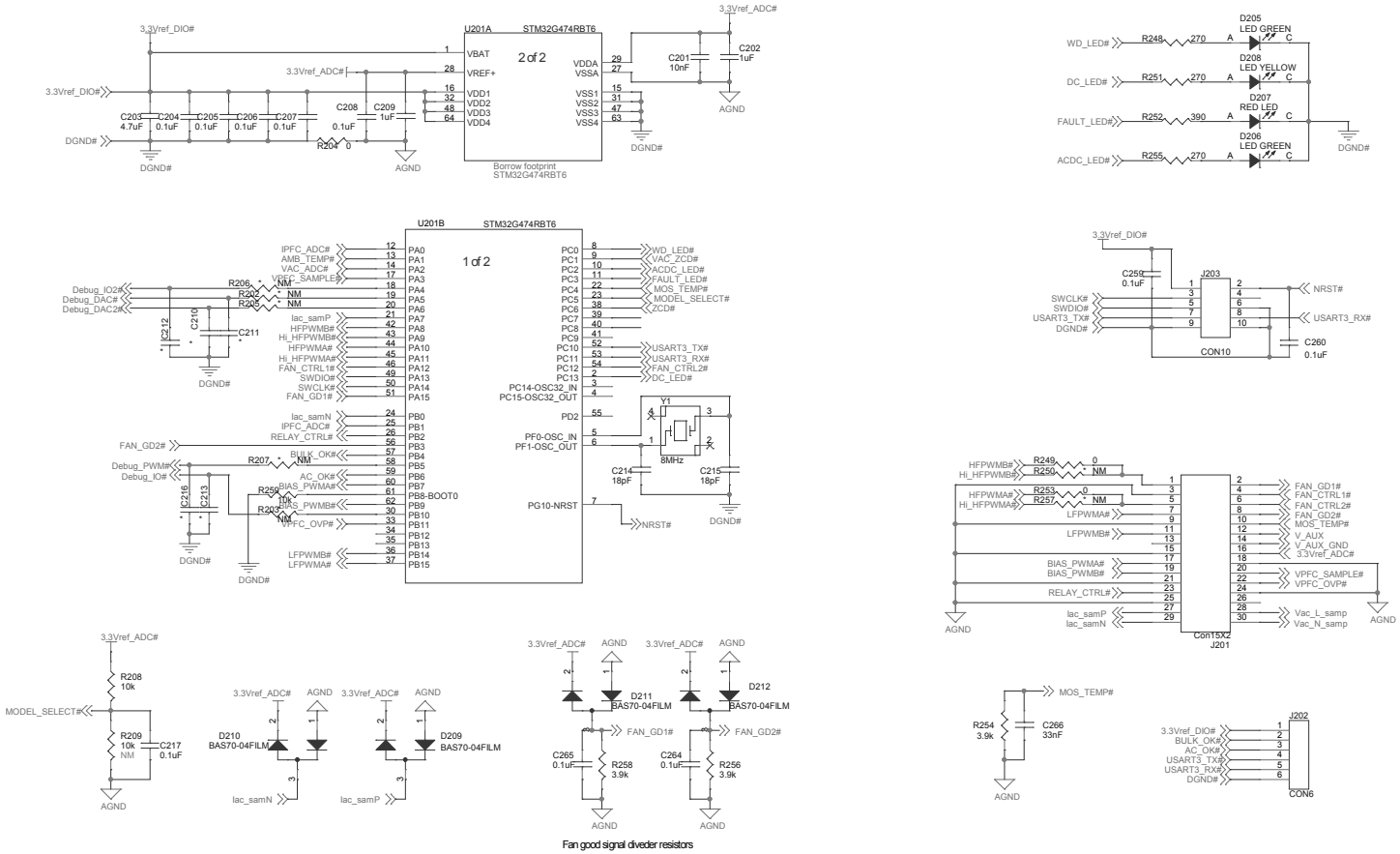


Figure 10. STDES-3KWTLCPT totem-pole PFC board circuit schematic (6 of 7)

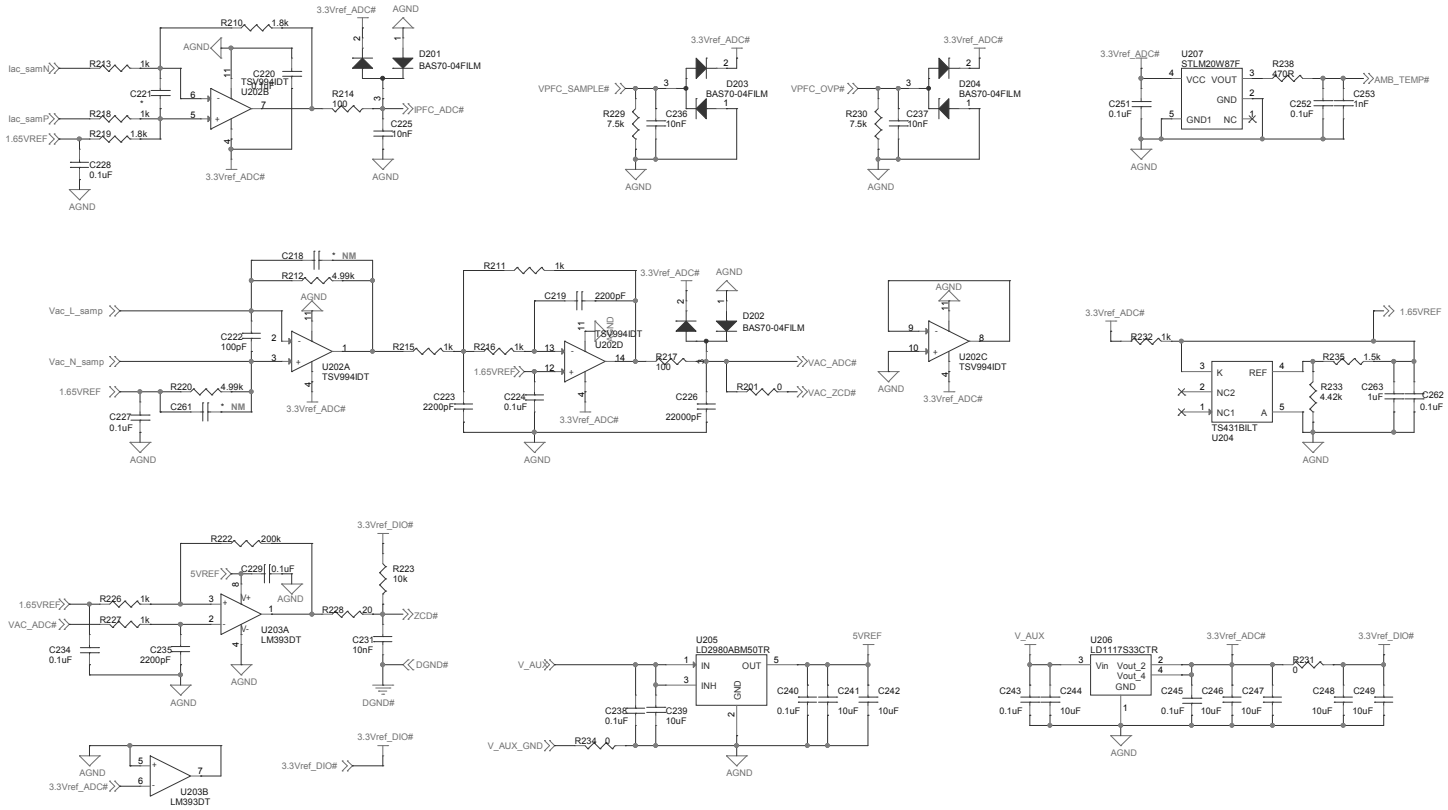


Figure 11. STDES-3KWTLCPT totem-pole PFC board circuit schematic (7 of 7)

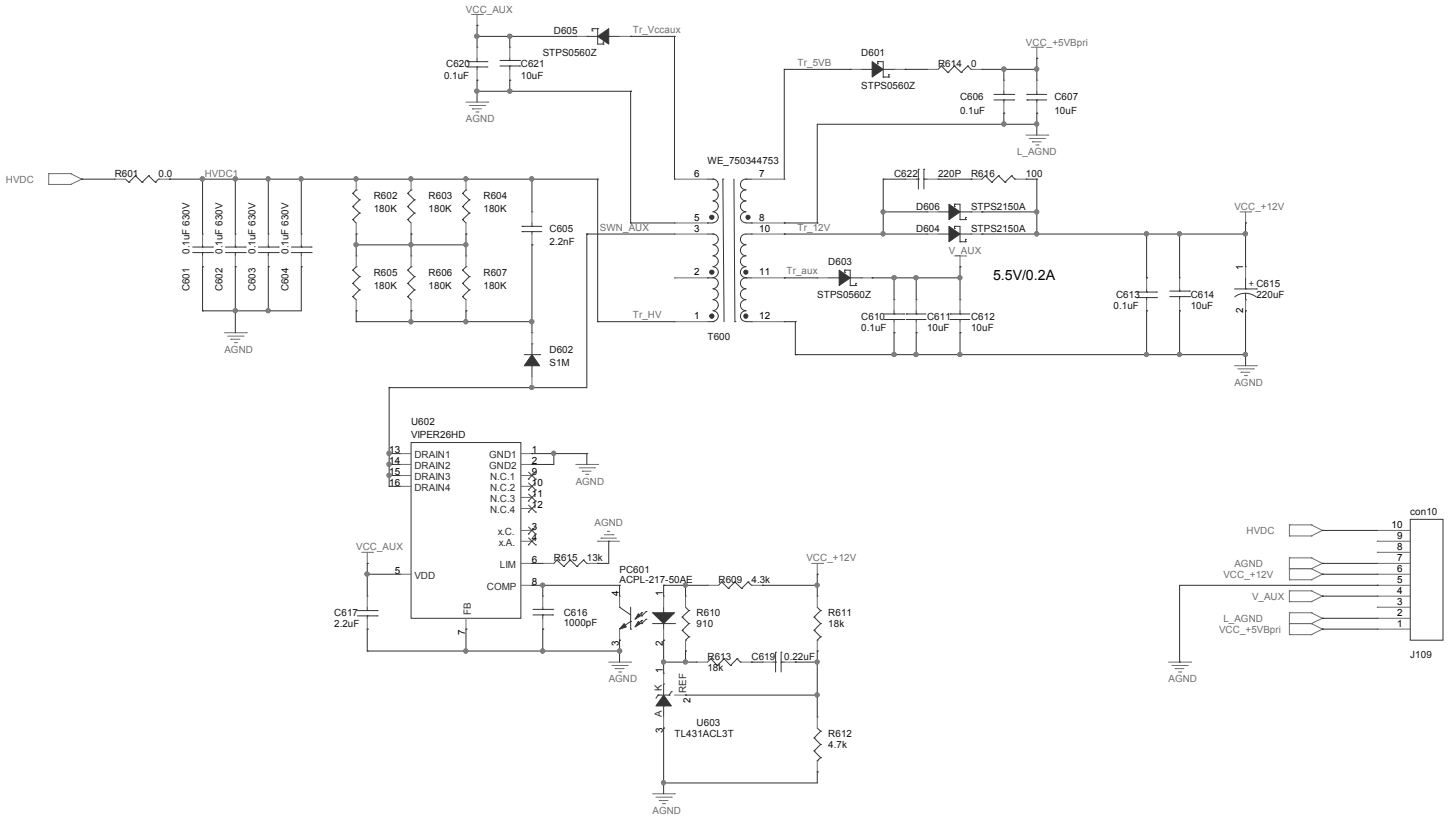


Figure 12. STDES-3KWTLCPL LLC resonant converter board circuit schematic (1 of 5)

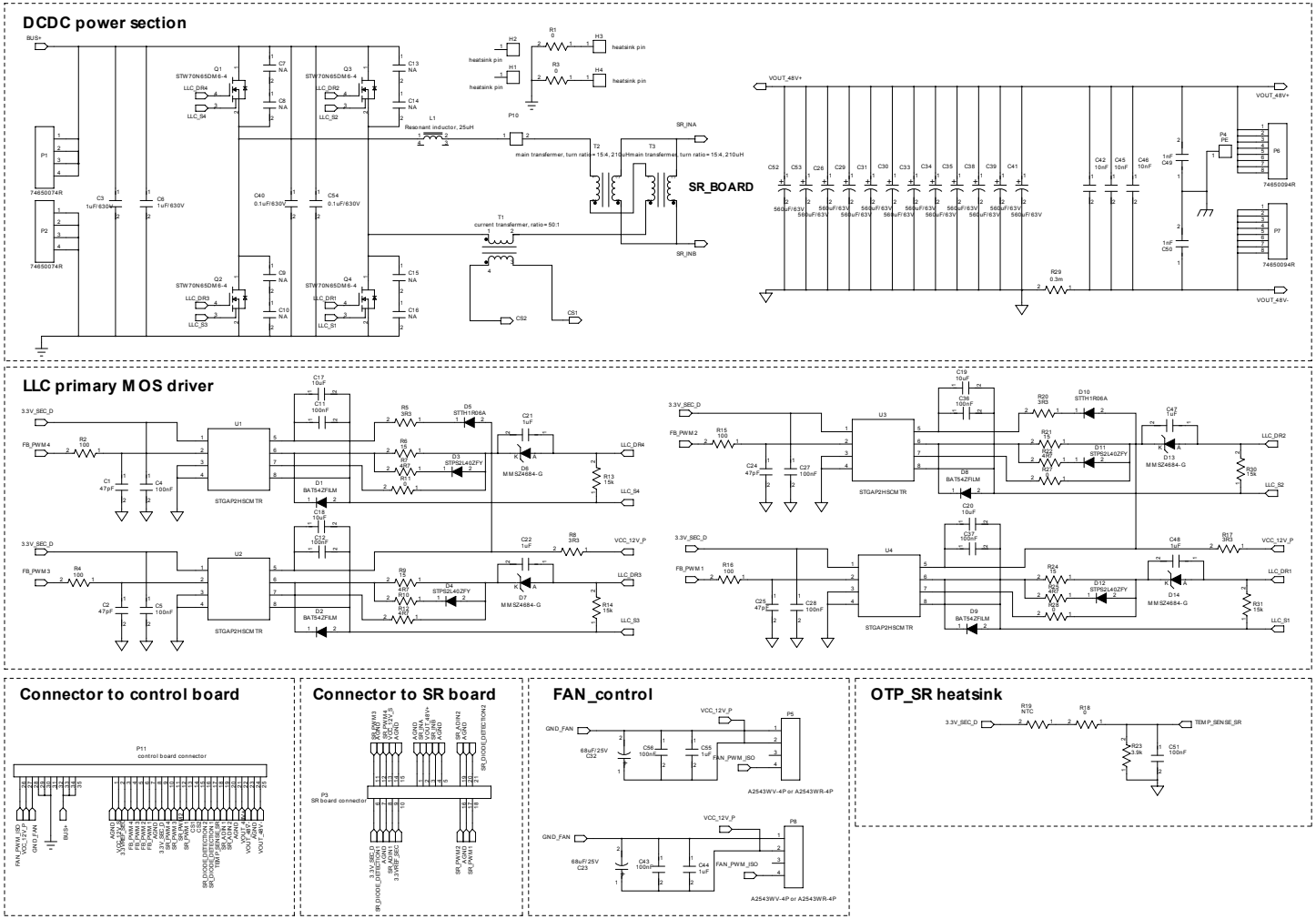


Figure 13. STDES-3KWTLCPL LLC resonant converter board circuit schematic (2 of 5)

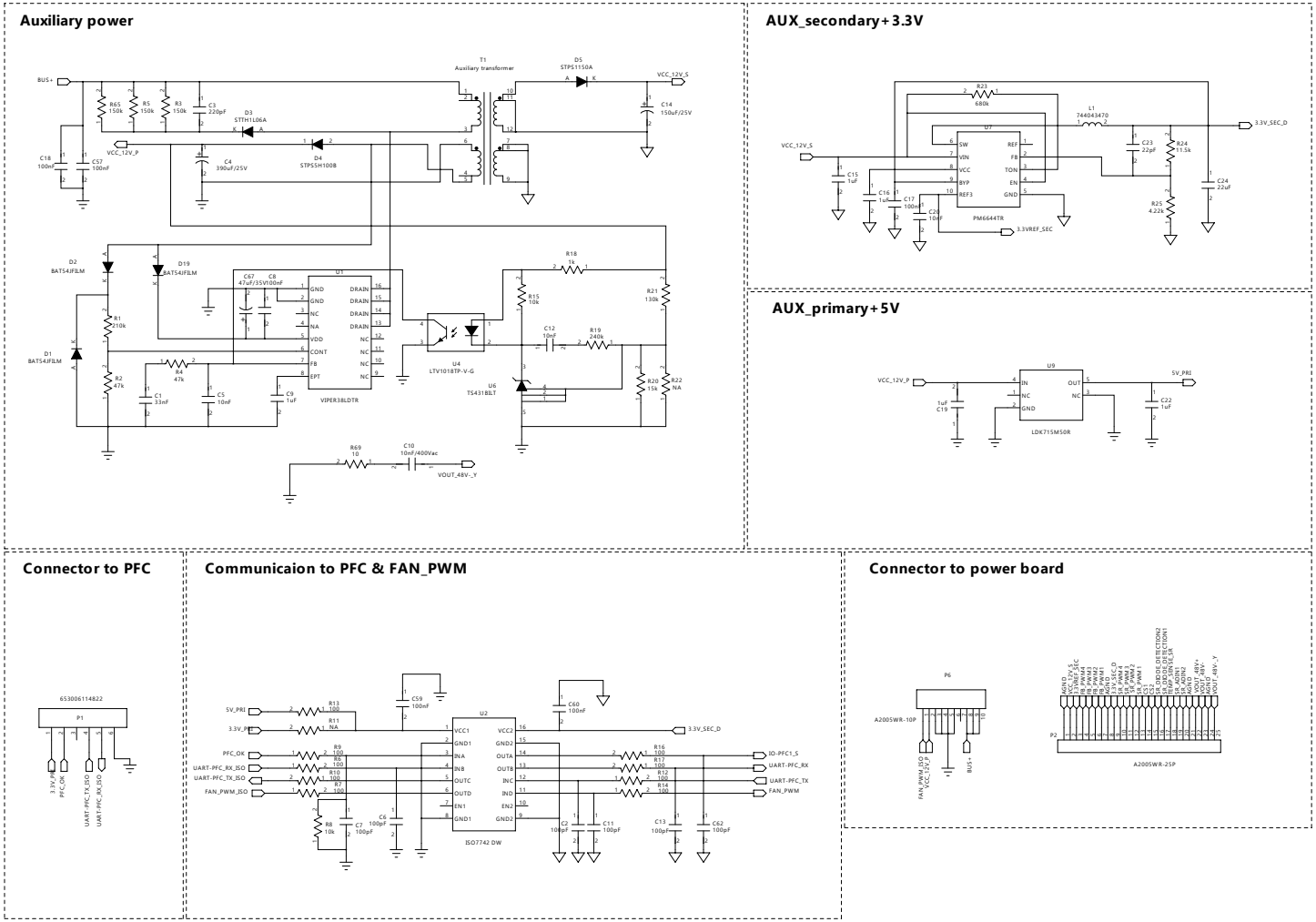


Figure 14. STDES-3KWTLCPL LLC resonant converter board circuit schematic (3 of 5)

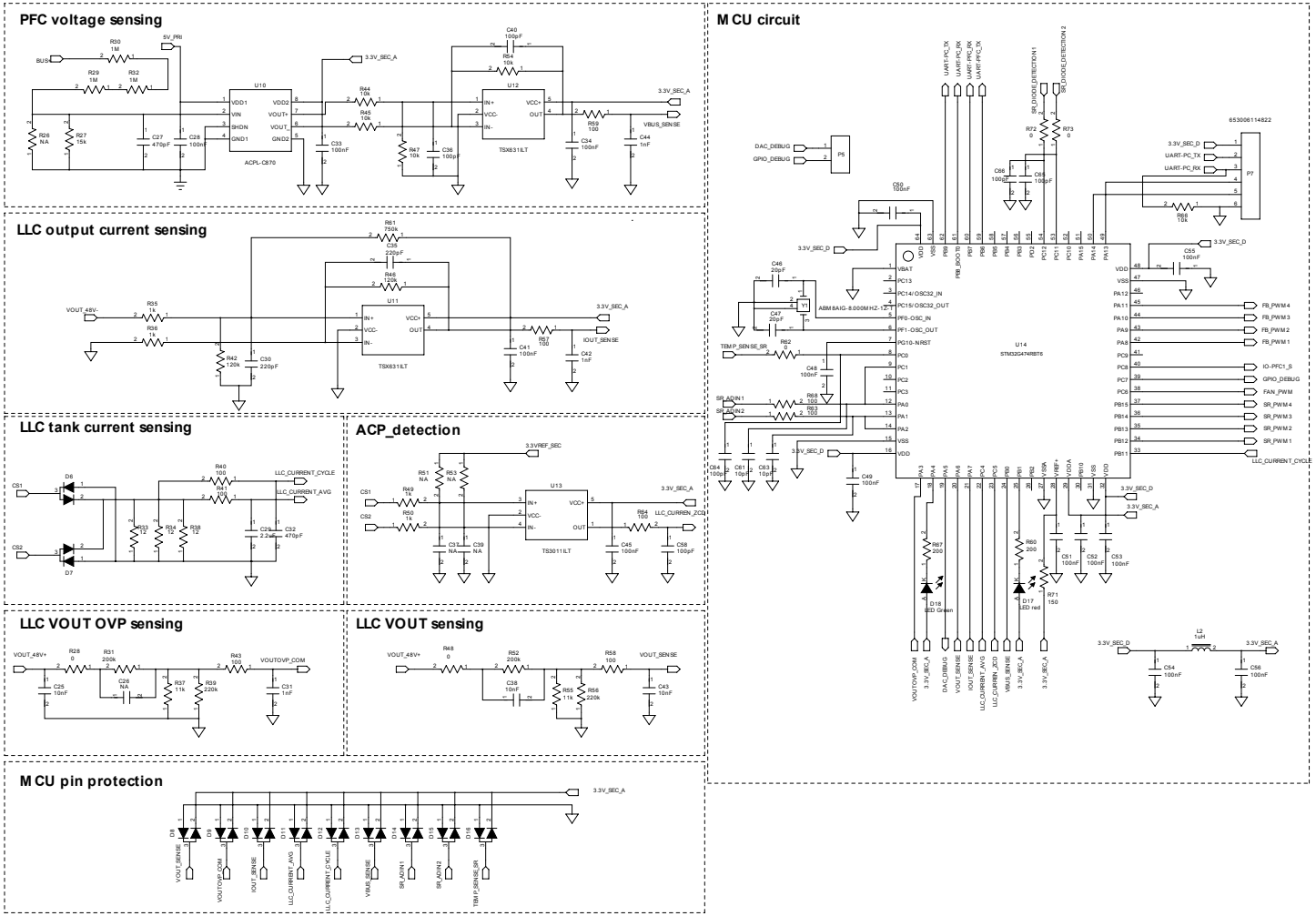


Figure 15. STDES-3KWTLCPL LLC resonant converter board circuit schematic (4 of 5)

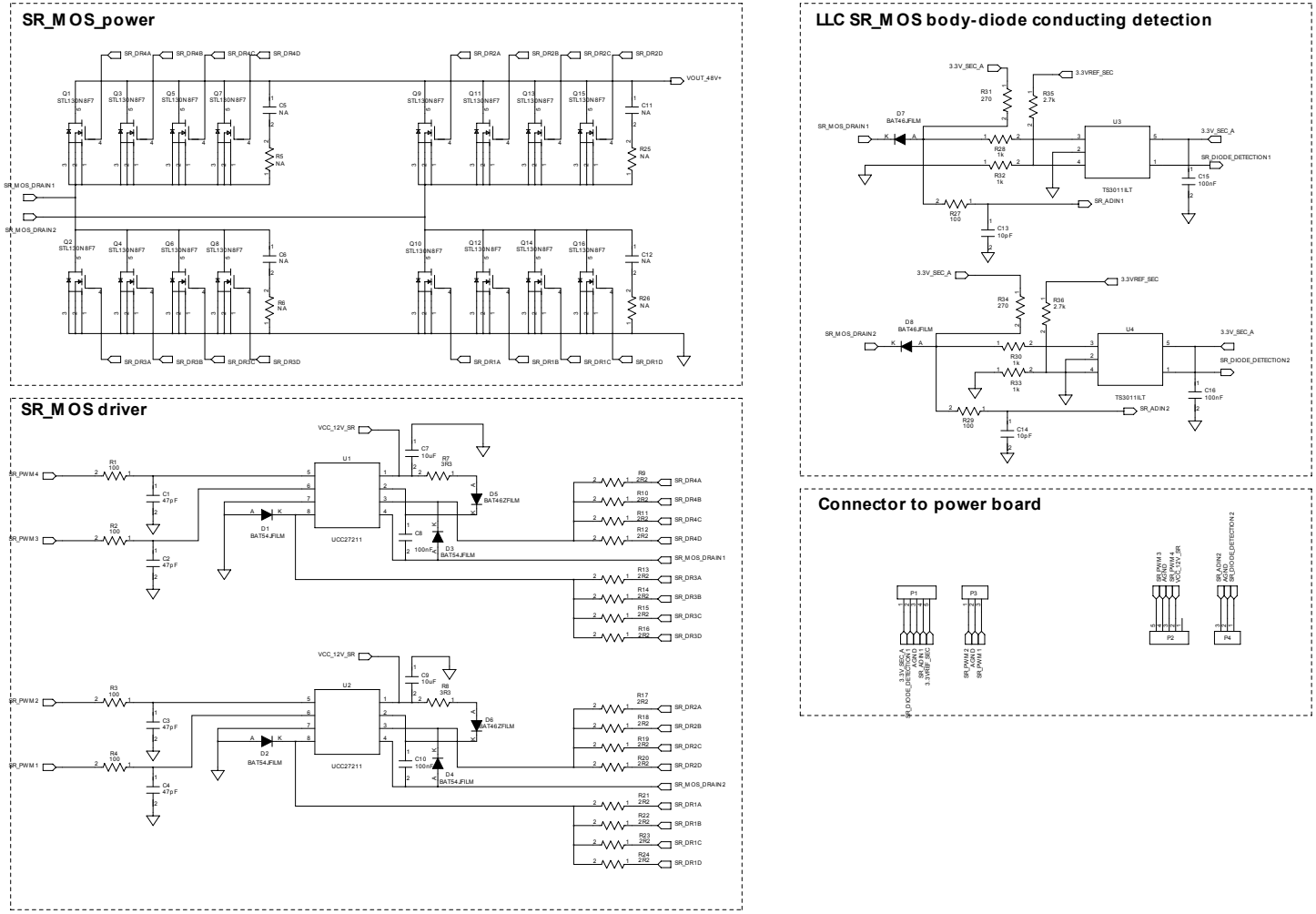
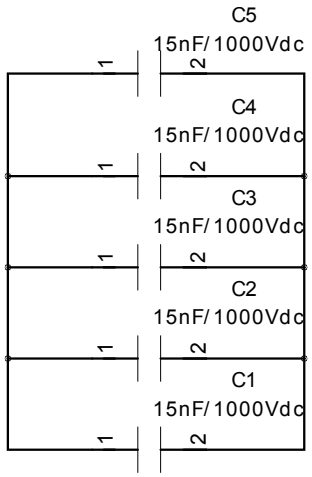


Figure 16. **STDES-3KWTLCPL LLC resonant converter board circuit schematic (5 of 5)**



Revision history

Table 2. **Document revision history**

Date	Revision	Changes
12-Jan-2022	1	Initial release.