

3.0 kW Dual LLC Evaluation Board

EVAL_3kW_2LLC_C7

TO-220

TO-247

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Zechner Florian



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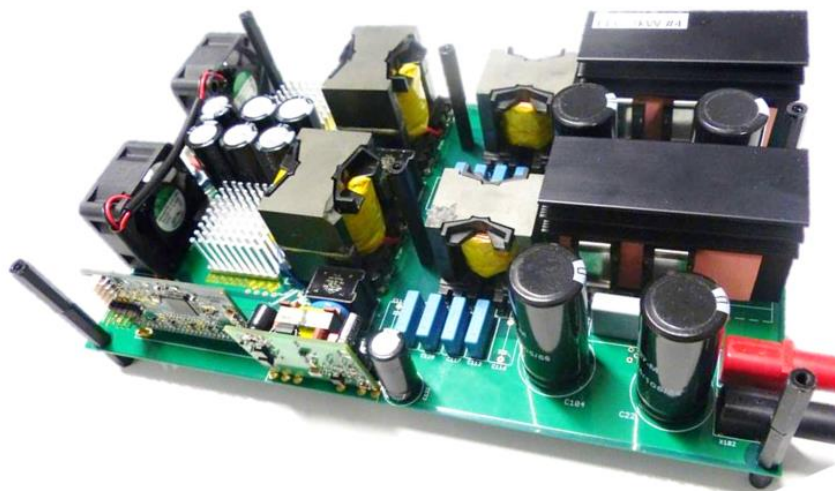
General

Description:

The "EVAL_3kW_2LLC_C7" - evaluation board shows how to design a dual phase LLC system solution of a telecom/industrial SMPS with the target to meet **highest efficiency** requirements. On this purpose there has been applied latest CoolMOS™ technology [IPP60R040C7](#) 600 V Power MOSFET on the primary side and OptiMOS™ low voltage Power MOSFET in SuperSO8 [BSC093N15NS5](#) in the synchronous rectification secondary stage, in combination with QR CoolSET™ [ICE2QR2280Z](#), [1EDI60N12AF](#) [EiceDRIVER™](#) high voltage, high speed driver ICs for [MOSFETs](#), low side gate driver [2EDN7524R](#) and digital LLC controller [XMC4400](#)

Summary of features:

- › Output voltage: 44 V_{DC} – 58 V_{DC}
- › Output current max: 55 A
- › Peak efficiency @ 50% load > 98.5%
- › Efficiency @ 10% load > 97%



The following variants are available:

- › EVAL_3kW_2LLC_C7 version with CoolMOS™ C7 **TO-220**, IPP60R040C7, EVAL_3kW_2LLC_C7_220
- › EVAL_3kW_2LLC_C7 version with CoolMOS™ C7 **TO-247**, IPW60R040C7, EVAL_3kW_2LLC_C7_247

Example of system understanding: Infineon demo solution for highest efficiency HV DC-DC stage

Half-bridge LLC with synchronous rectification in center tap configuration

V_{in}	$350 V_{DC} - 400 V_{DC}$
V_{in_nom}	$380 V_{DC}$
V_{out}	$44 V_{DC} - 58 V_{DC}$
I_{out}	55 A
P_o	3 kW
C_r	66 nF
L_r	12 μ H
L_m	62 μ H

Primary HV MOSFETs CoolMOS™ IPP60R040C7

Reduced gate charge (Q_g)

- > Reduced E_{off}
- > High body diode ruggedness

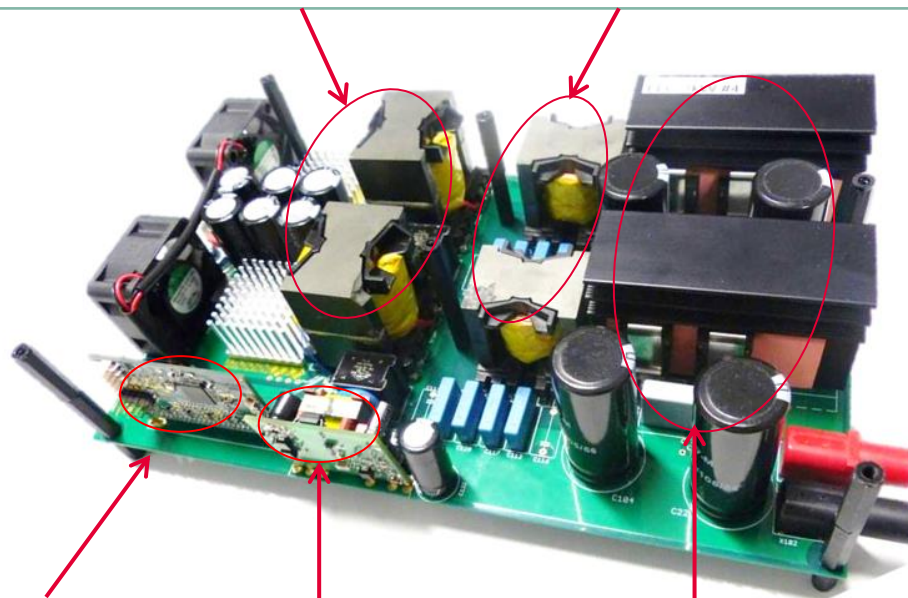
SR MOSFETs OptiMOS™ BSC093N15NS5

New generation

- > Best FOM $R_{DS(on)} \times Q_g$
- > Best FOM $R_{DS(on)} \times Q_{oss}$

Transformer
SP-PQ 40/40 core

Resonant inductor
SP-PQ 35/35 core



LLC controller
digital XMC4400

Bias QR Flyback controller
ICE2QR2280Z

HV MOSFETs
IPP60R040C7 TO-220
IPP60R040C7 TO-247

Digital control board

Infineon`s solution to control the 3 kW dual phase LLC evaluation board

Digital

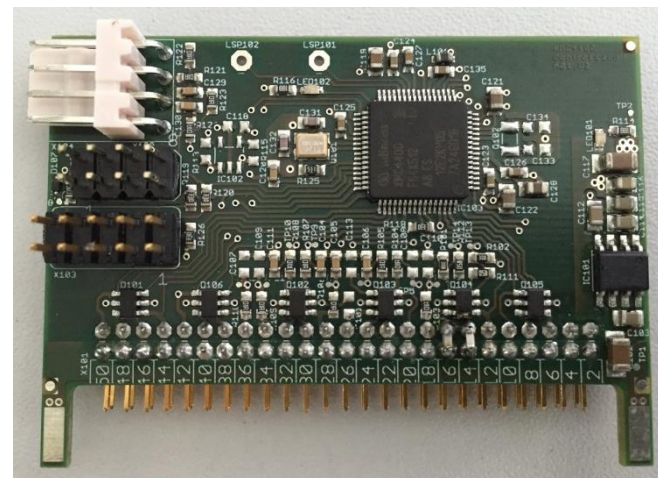
[XMC4400-F64K512 AB](#)

Summary of features:

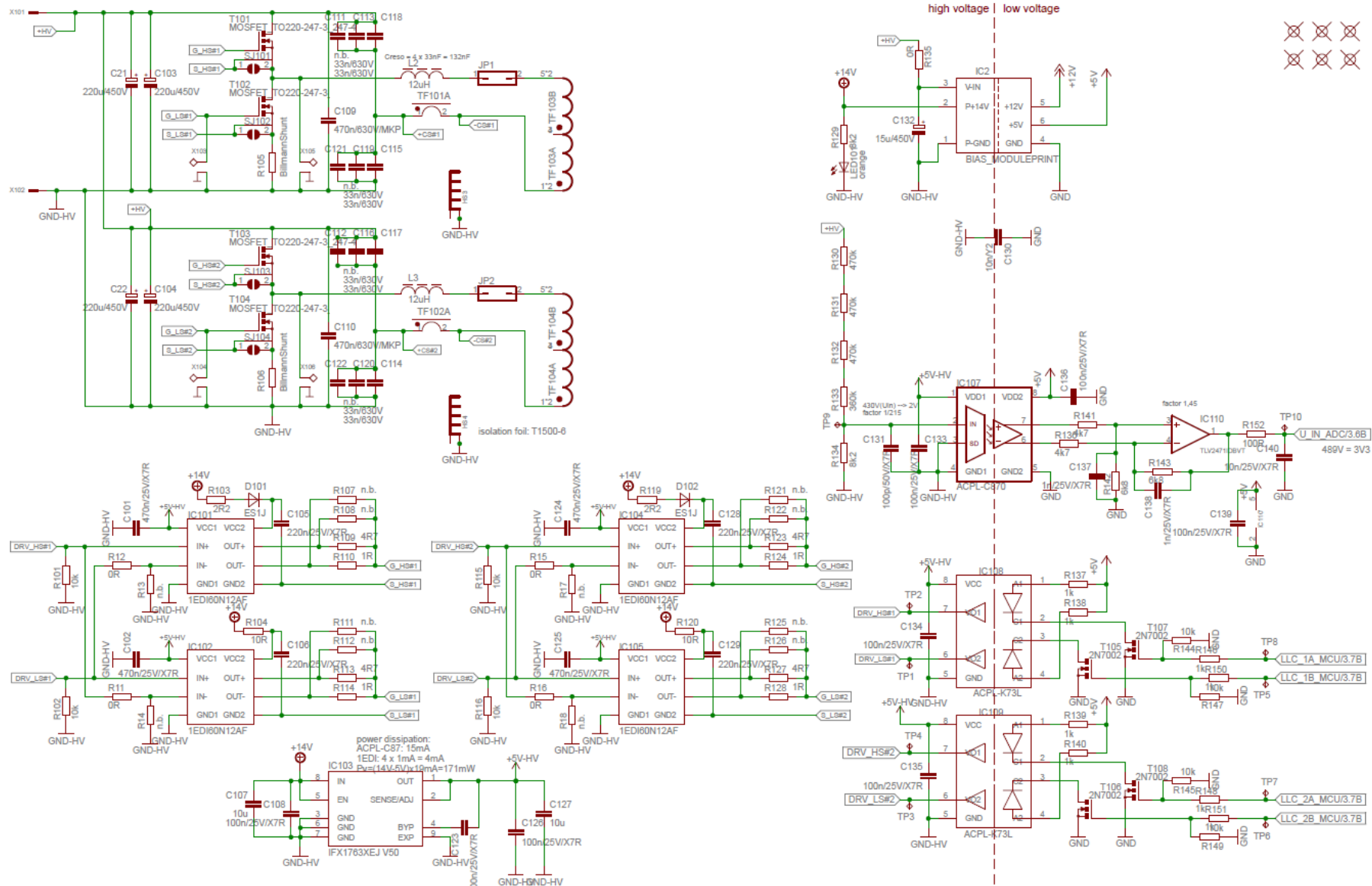
- > ARM® Cortex®-M4, 120 MHz, incl. single cycle DSP MAC and floating point unit (FPU)
- > 8-channel DMA + dedicated DMAs for USB and Ethernet
- > USB 2.0 full-speed on-the-go
- > CPU Frequency: 120 MHz
- > eFlash: 512 kB including hardware ECC
- > 80 kB SRAM
- > Package: PG-LQFP-64

Target applications:

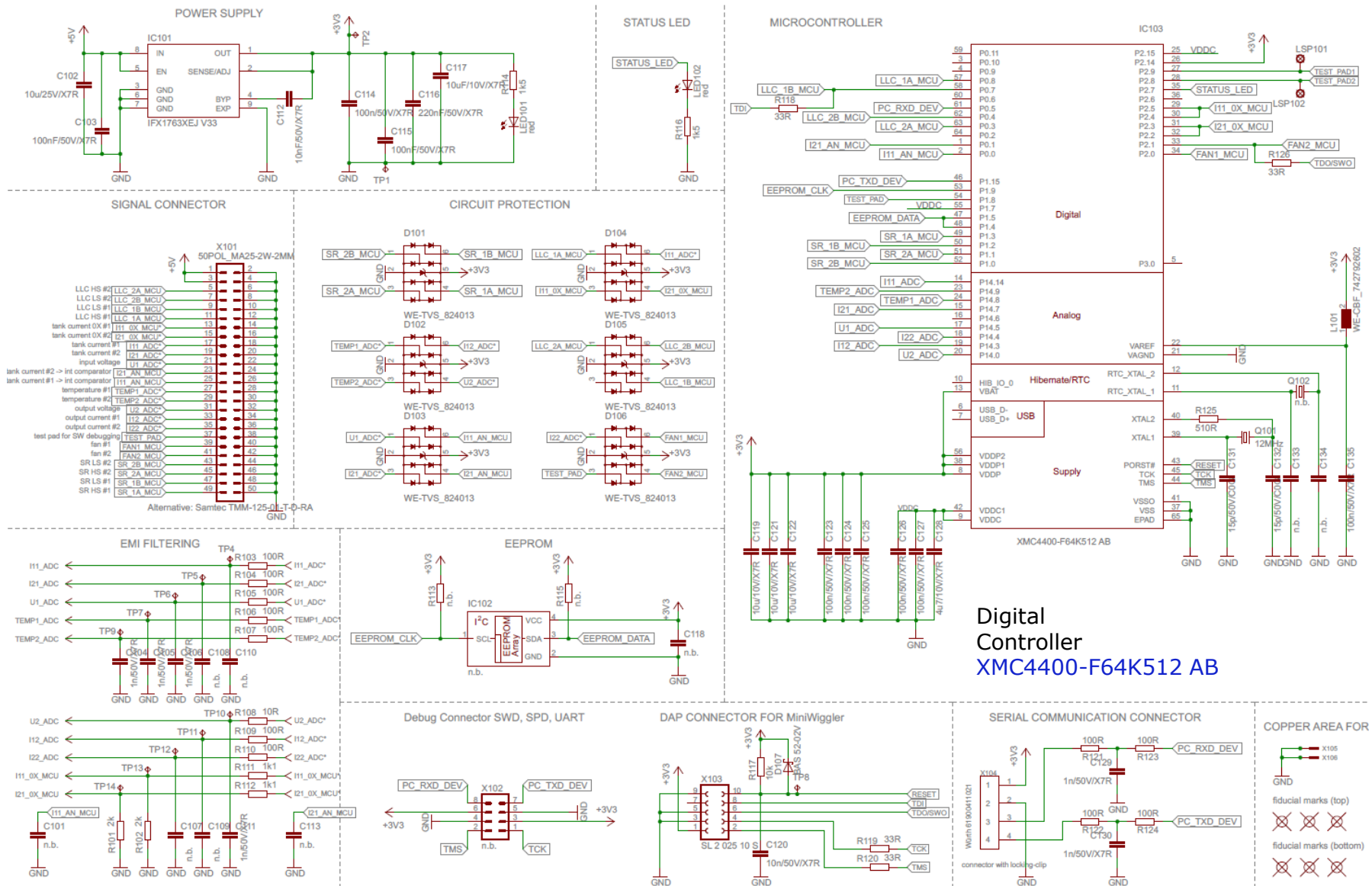
- > Motor control
- > Position detection
- > IO devices
- > HMI
- > Solar inverters
- > SMPS
- > Sense & control systems
- > PLC
- > UPS
- > Light networks



Main power board schematic

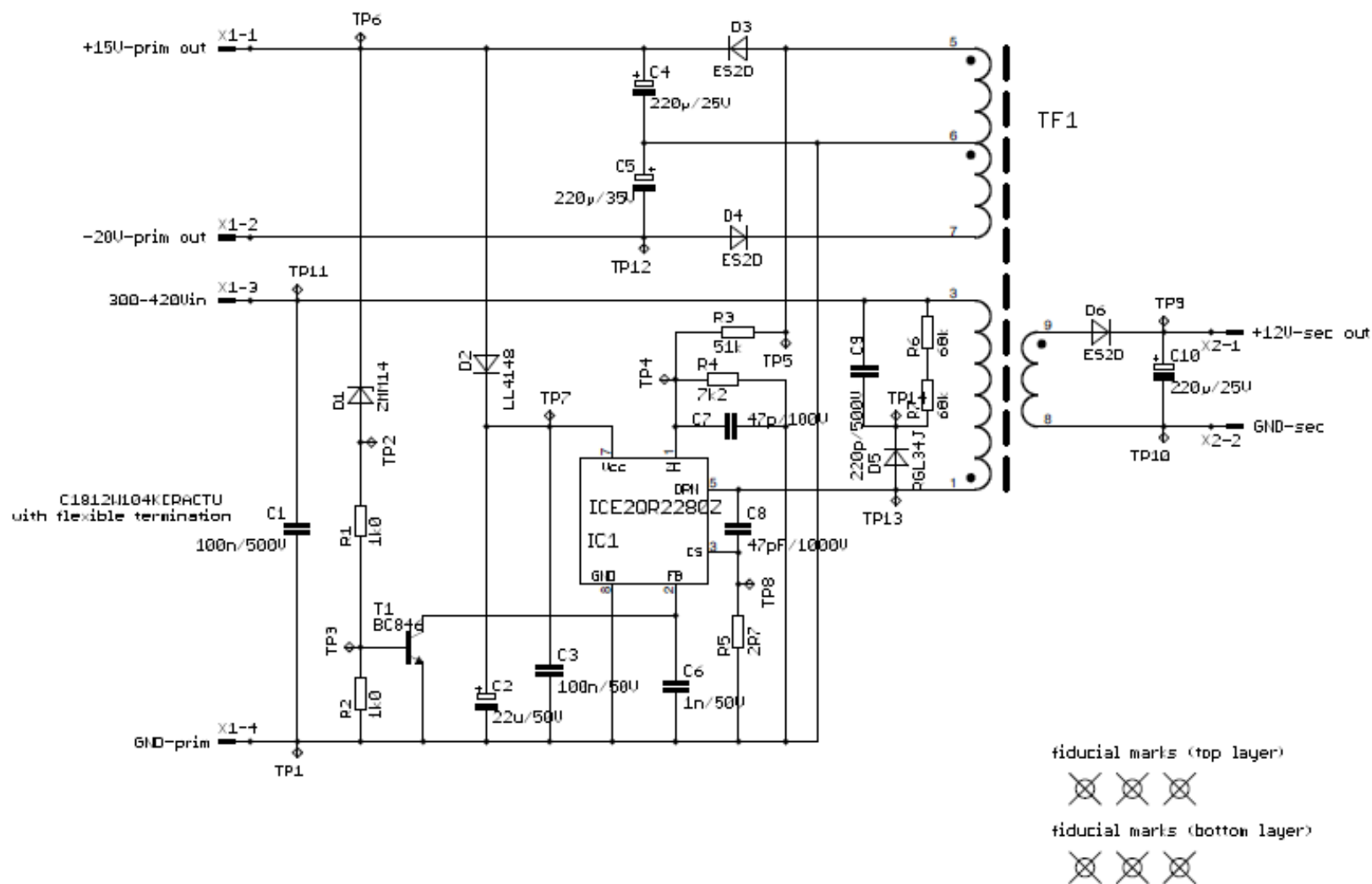


Digital control board schematic



Digital Controller
XMC4400-F64K512 AB

Bias board schematic



Connection instruction

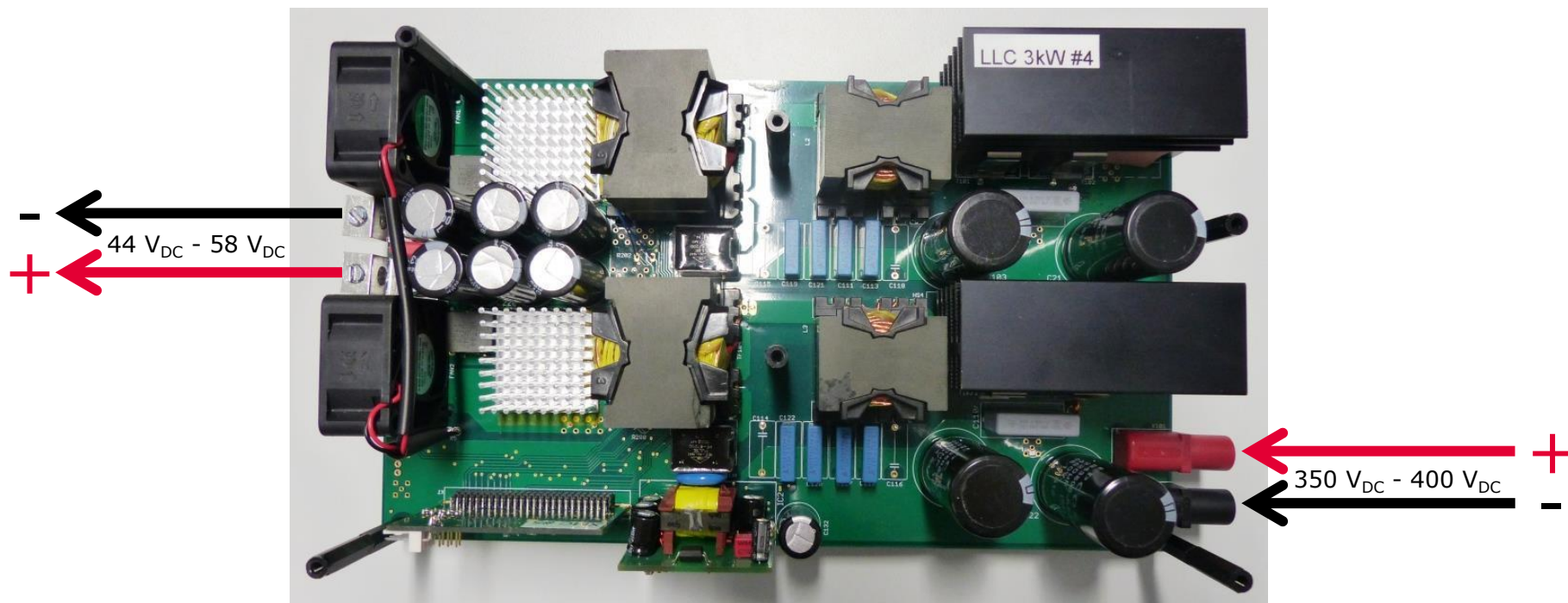


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Efficiency plot measured with IPP60R040C7/ IPW60R040C7

3 kW Dual Phase LLC efficiency

(without Bias & fans absorption)

Efficiency

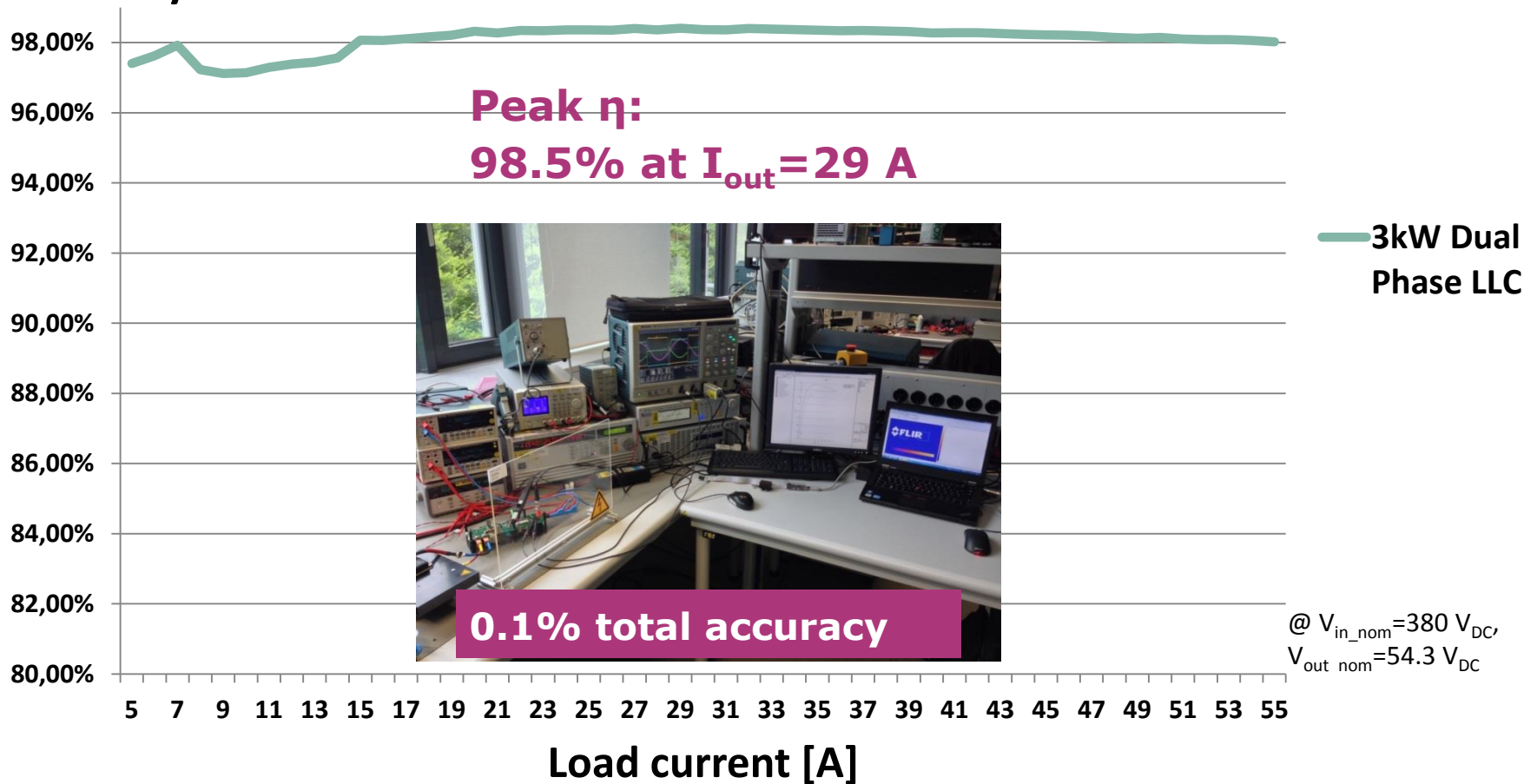


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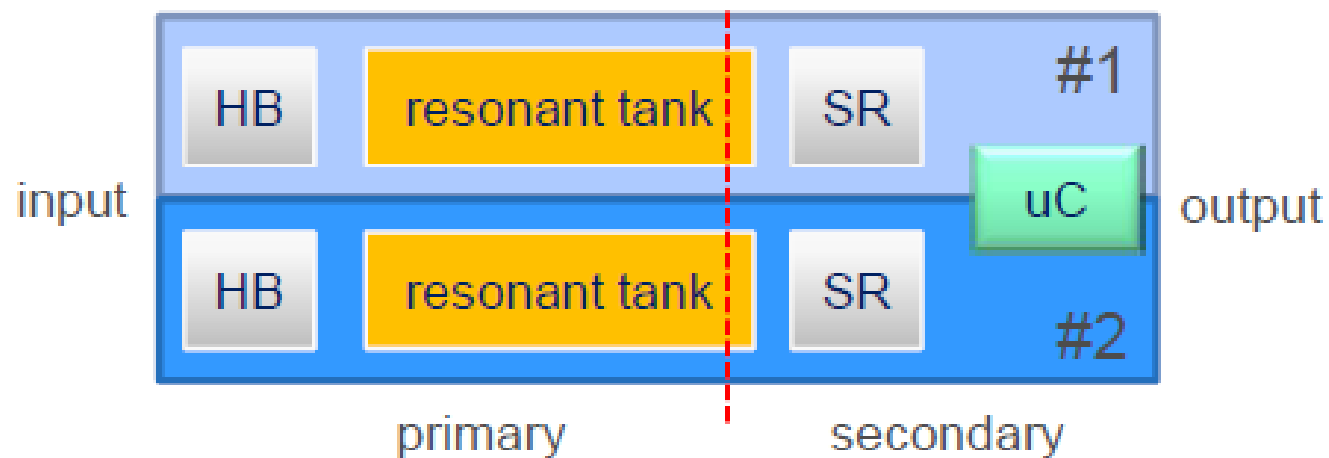
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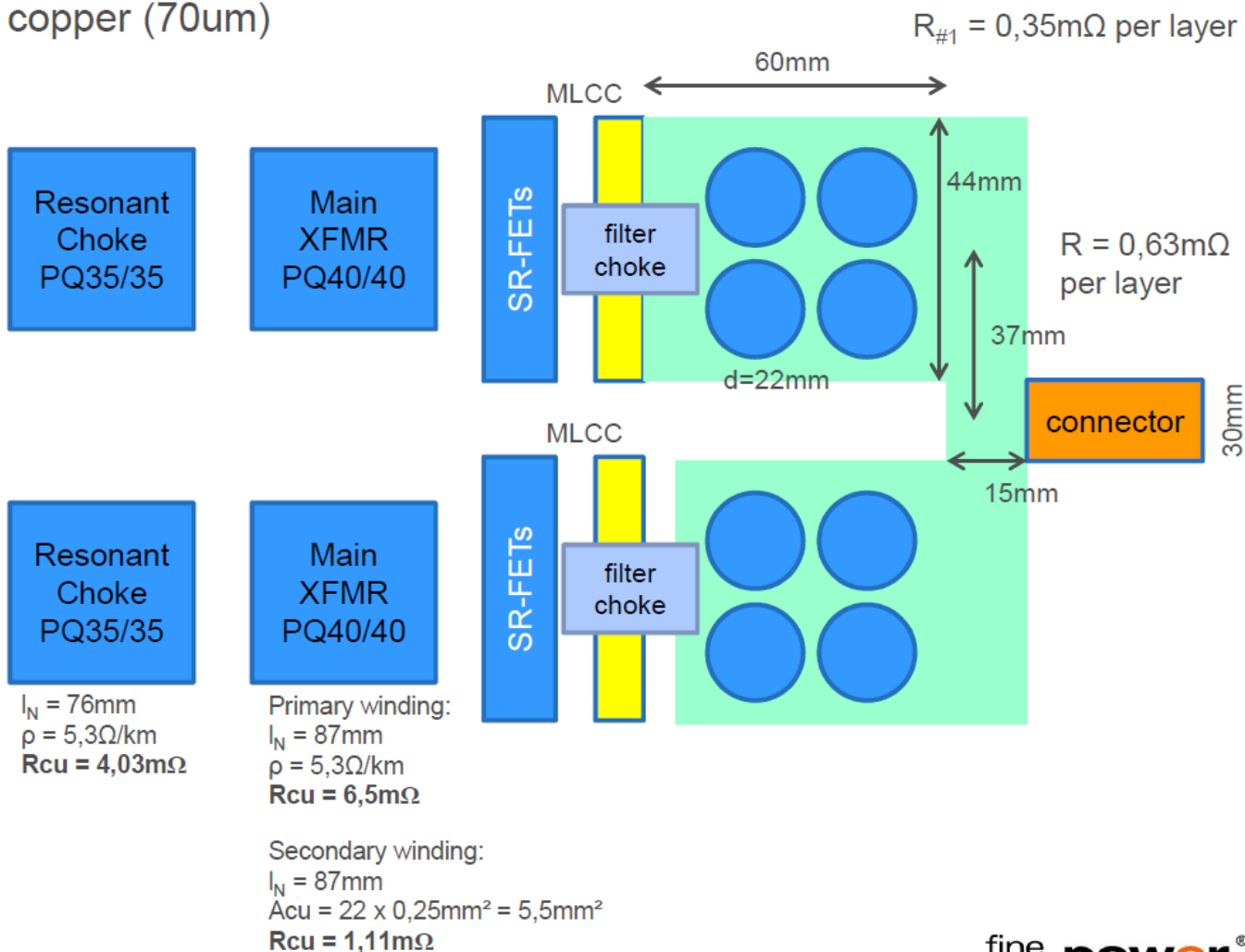
Design concept

Design concept

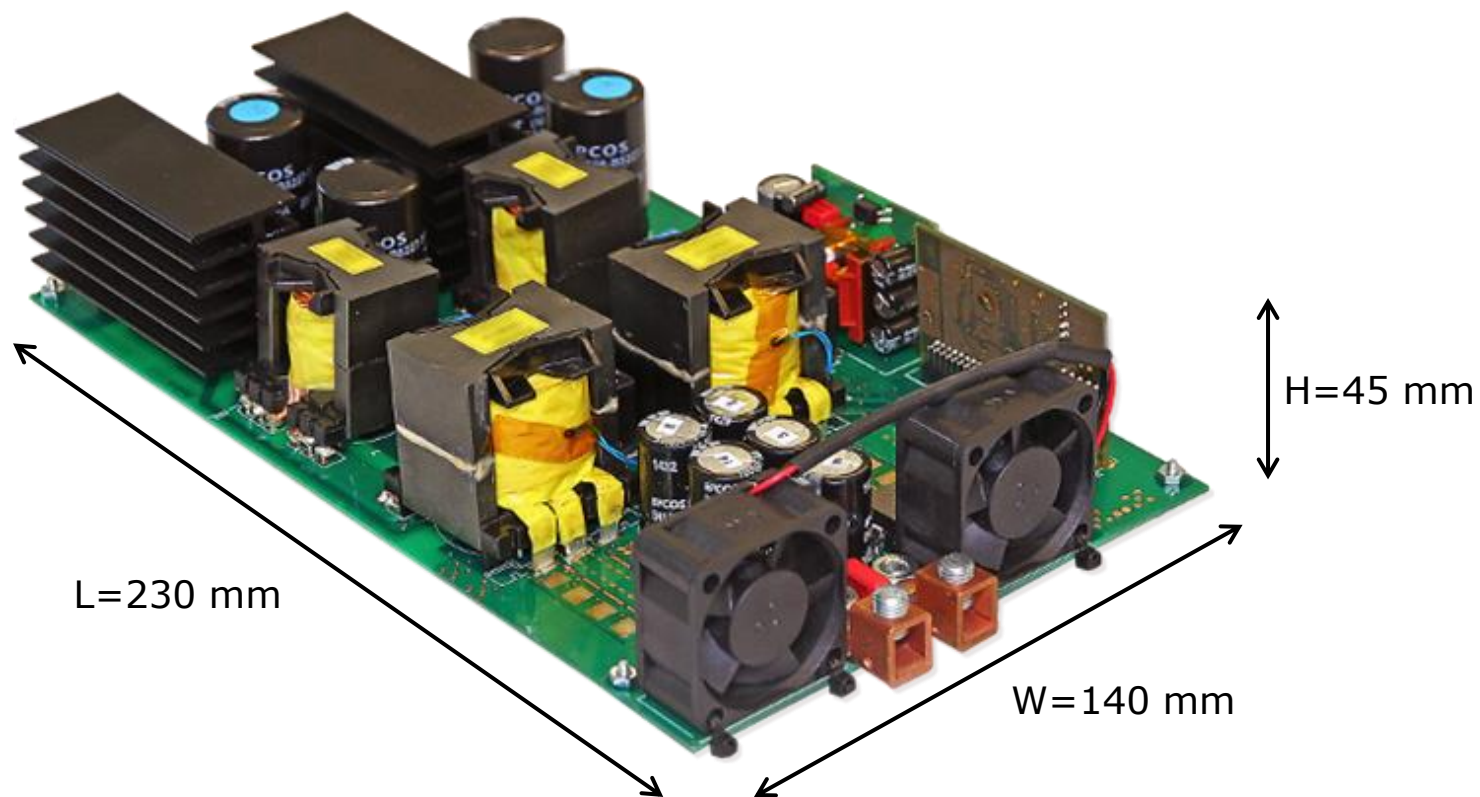


Basic components positioning in the PCB

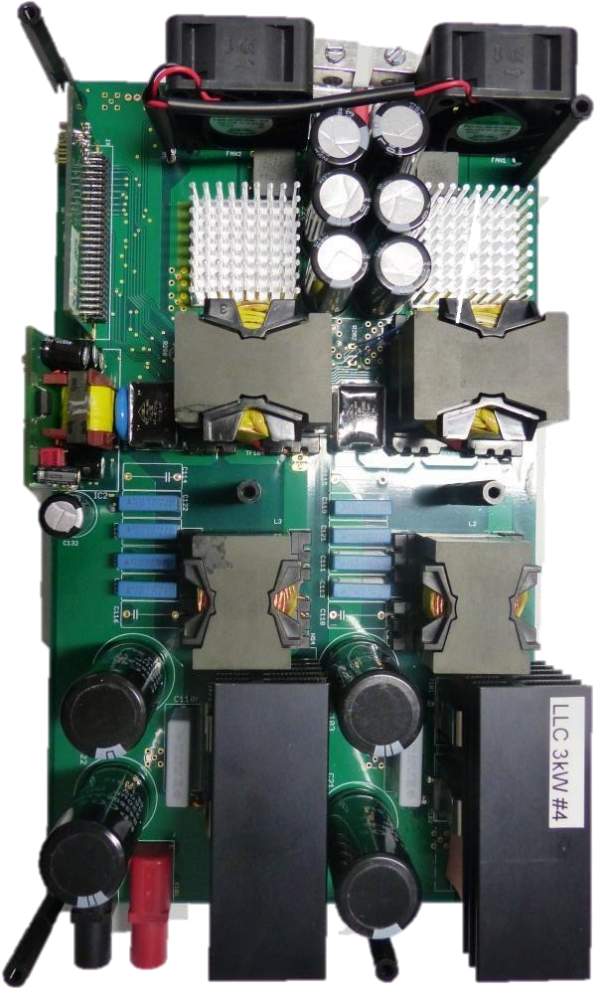
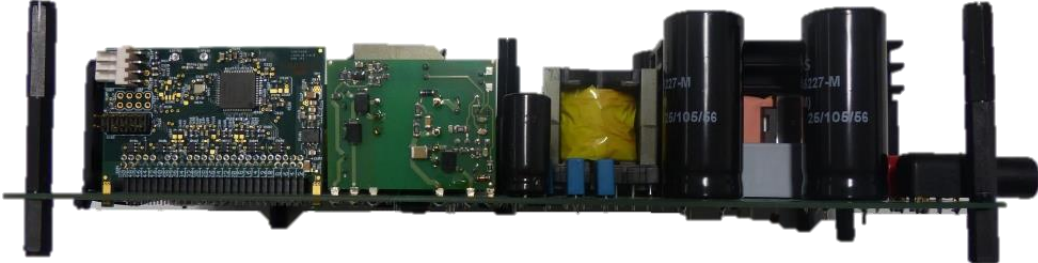
4 layer PCB, 2oz copper (70um)



Final shape and overall dimensions



Evaluation board EVAL_3kW_2LLC_C7



Support slides

3 KW Dual LLC evaluation board

Evaluation board page

- > Technical Description
- > Datasheets
- > Parameters
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Overview

Parameters

Diagrams

Documents

Order

Videos

Support

EVAL_3KW_2LLC_C7_47

Description:

The 3kW Dual Phase LLC demo board is an example of a complete Infineon solution for the HV DC-DC stage of telecom rectifiers and industrial SMPS, meeting the highest efficiency and reliability standard levels. The combination of state-of-the-art 600V CoolMOS™ C7 in TO-247 and OptiMOS™ 5 in SuperSO8 power device technologies with optimized driving and control techniques using Infineon components allows to achieve this result.

Summary of features:

- Dual Phase LLC topology with full digital control (including current sharing and phase shedding)
- Prevention of MOSFET body diode hard commutation and LLC capacitive mode operation
- Graphical User Interface (GUI) for parameters setting and monitoring

Benefits:

- Peak efficiency >98.4%
- Flat efficiency plot from 10% to 100% load
- Flexible design adjustment and fine tuning through the GUI

Target Applications:

- Telecom rectifiers
- Industrial SMPS
- High power battery chargers

Solution Finder

MOSFET	IGBT	Diode	MCU	Other
<input type="checkbox"/> ESD Protection	<input type="checkbox"/> Sim Models			
<input type="checkbox"/> Bipolar Transistor	<input type="checkbox"/> Eval Boards			
<input type="checkbox"/> Zener Diodes	<input type="checkbox"/> Infineon Tools			
<input type="checkbox"/> Smart Switch	<input type="checkbox"/> IP Design Tools			
<input type="checkbox"/> Transceivers				

Reset Find

> [EVAL_3kW_2LLC_C7](#)

Product family pages

- > Product Brief
- > Application Notes
- > Selection Guides
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- > Videos
- > Simulation Models

Infineon

Products Applications Tools About Infineon Careers

600V CoolMOS™ C7

A stepping stone to GaN in hard- and soft-switching topologies

Customer benefits:

- Higher efficiency at 80% load reduction
- In efficiency-critical applications the reduced switching losses boost efficiency and translate into lower thermal stress and lower power consumption. Ideally, the CoolMOS™ C7 efficiency is further boosted by using a package with a thermal source (TO-247, Super-IPack, etc.).
- 80% load of these applications can use the efficiency gains for increasing the switching frequency, which allows to reduce the cost of the magnetic components by up to 30%.

Key features:

- Reduced switching loss parameters such as E_{on} , resulting in higher switching frequency
- 50% E_{on} reduction compared to older CoolMOS™ C7 technology and lower E_{on}
- Boosting the switching frequency will reduce the size and cost of magnetic components (e.g. 30 kHz @ 100 kHz)
- Increased efficiency in hard switching topologies such as PFC and TFC

Go to product selection table

Power Management Selection Guide 2018

Download

Free Request Evaluation Board

Technical Information

Reliability Data

MOSFET Finder

- > [IPP60R040C7](#)
- > [BSC093N15NS5](#)
- > [XMC4400-F64K512 AB](#)
- > [2EDN7524R](#)
- > [ICE2QR2280Z](#)
- > [1EDI60N12AF](#)
- > [IFX1763XEJ V50](#)
- > [IFX1763XEJ V33](#)



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