

# EVAL\_3KW\_2LLC\_CFD7

3 kW dual-phase LLC evaluation board  
with 600 V CoolMOS™ CFD7 SJ MOSFET

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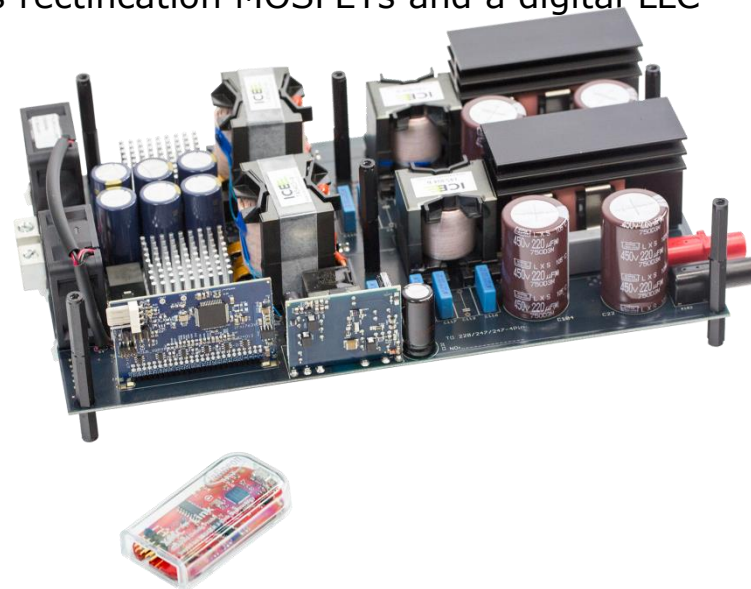
# General

## Description:

- › The "[EVAL\\_3kW\\_2LLC\\_CFD7](#)" evaluation board shows how to design a dual-phase LLC system solution of a server SMPS with the target to meet **80+ Titanium Standard** efficiency requirements. For this purpose the following technologies have been used: the latest 600 V CoolMOS™ CFD7 SJ MOSFET technology ([IPW60R031CFD7](#)) on the primary side and OptiMOS™ 5 150 V low voltage power MOSFET in SuperSO8 ([BSC093N15NS5](#)) in the synchronous rectification secondary stage, in combination with QR CoolSET™ ([ICE2QR2280Z](#)), high voltage gate driver EiceDRIVER™ 1EDI ([1EDI60N12AF](#)), high speed driver ICs for high voltage MOSFETs, low side gate driver EiceDRIVER™ 2EDN ([2EDN7524R](#)) for synchronous rectification MOSFETs and a digital LLC microcontroller ([XMC4400-F64K512 AB](#)).

## Summary of features:

- › Output voltage: 44 – 58 V<sub>DC</sub>
- › Output current max: 55 A
- › Peak efficiency @ 50% load > 98.4%
- › Efficiency @ 10% load > 97%



## The following variants are available:

- › EVAL\_3kW\_2LLC\_CFD7 version with 600 V CoolMOS™ CFD7 in **TO-247** ([IPW60R031CFD7](#))
  - › Order code: EVAL\_3kW\_2LLC\_CFD7 (SP001783688, SA001783696)

# Example of system understanding: Infineon demo solution for Titanium high voltage DC-DC stage

## Half-bridge LLC with synchronous rectification in center tap configuration

$V_{in}$	350 – 400 V <sub>DC</sub>
$V_{in\_nom}$	380 V <sub>DC</sub>
$V_{out}$	44 – 58 V <sub>DC</sub>
$I_{out}$	55 A
$P_o$	3 kW
$C_r$	66 nF
$L_r$	12 $\mu$ H
$L_m$	62 $\mu$ H

### Primary HV MOSFETs

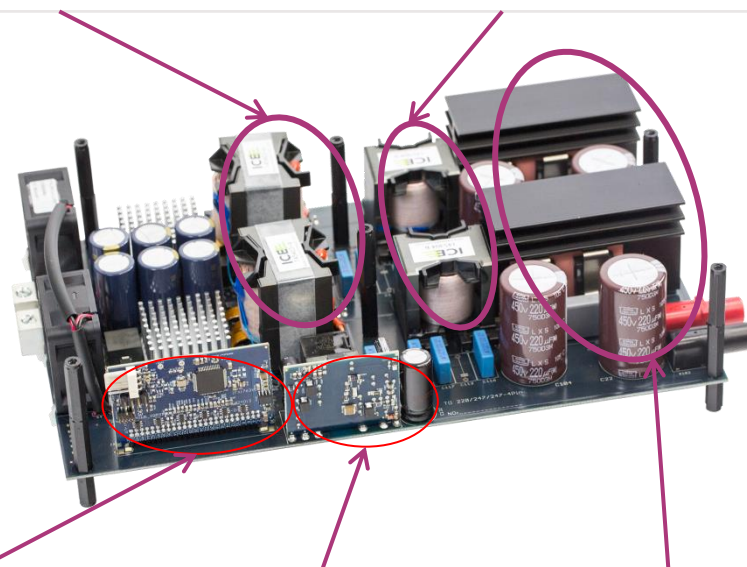
- > 600 V CoolMOS™ CFD7 (IPW60R031CFD7)
- > Reduced gate charge ( $Q_g$ )
- > Reduced  $E_{off}$
- > High body diode ruggedness

### 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-F64K512 AB

**Bias QR flyback controller**  
ICE2QR2280Z

**High voltage MOSFETs**  
IPW60R037P7 TO-247

# Digital control card – Infineon’s solution to control the 3 kW dual-phase LLC evaluation board



## [XMC4400-F64K512 AB](#)

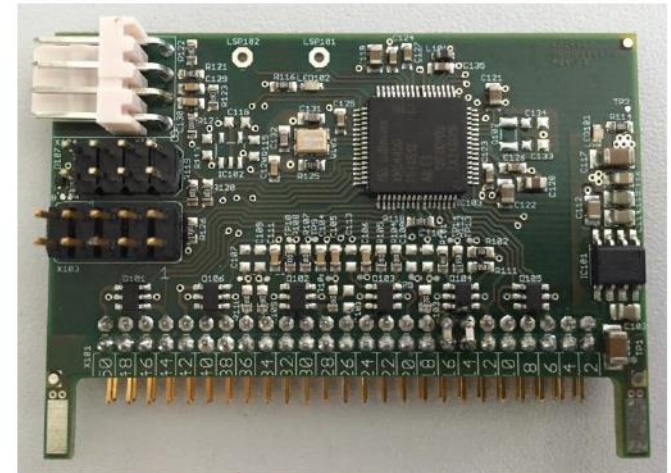
### Summary of features:

- › 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

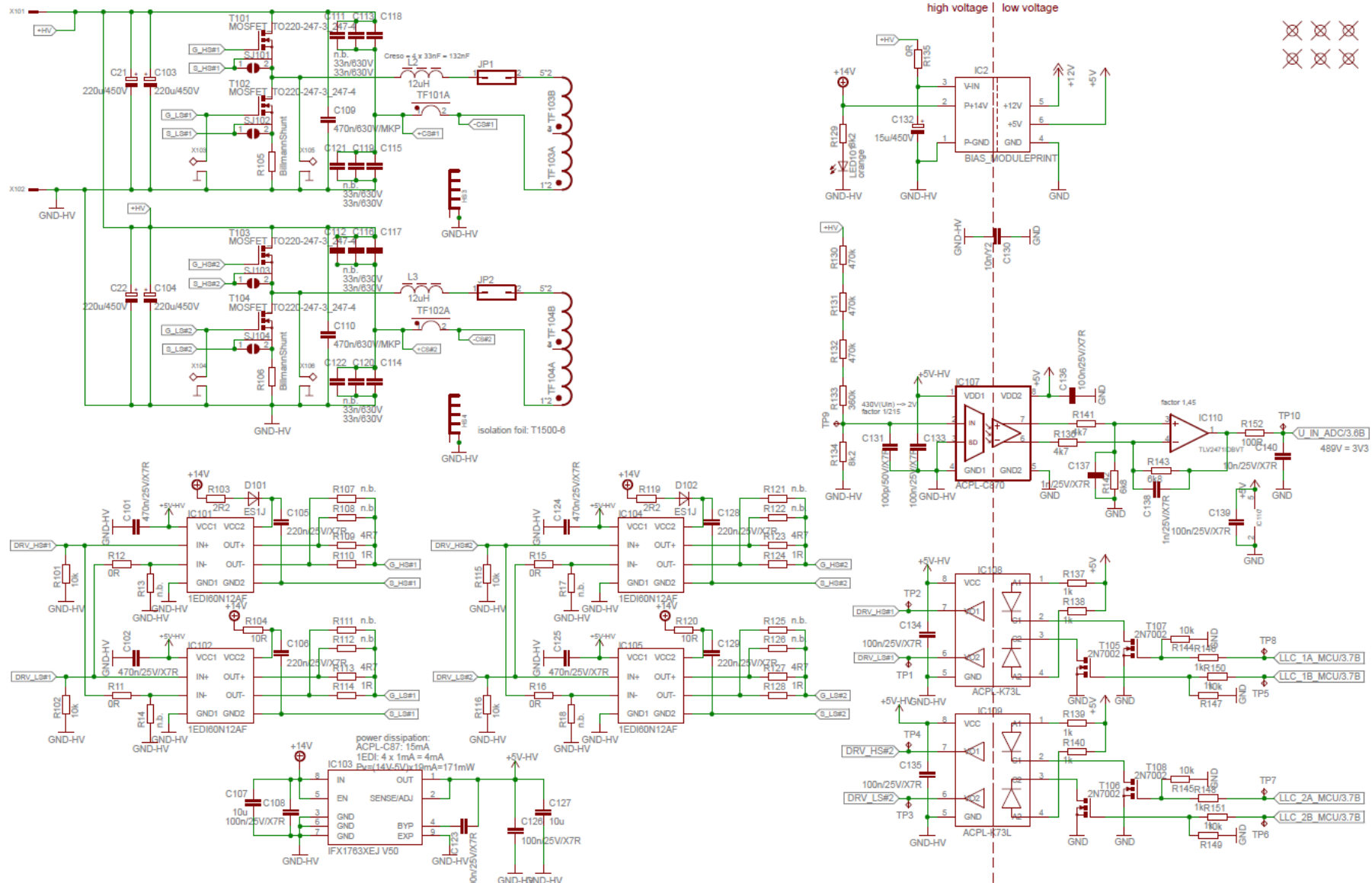
### Target applications:

#### Motor control

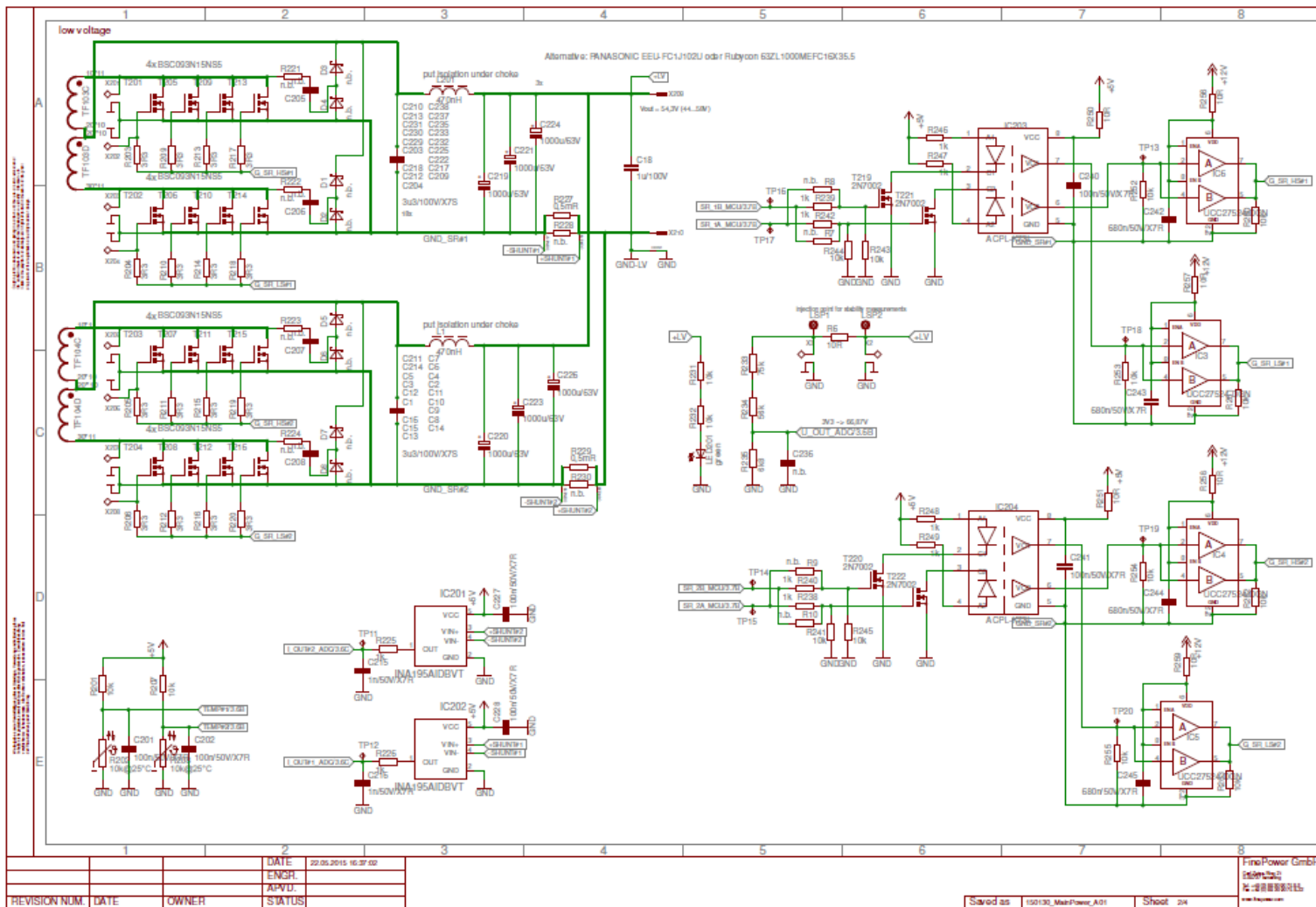
- › Position detection
- › IO devices
- › HMI
- › Solar inverters
- › SMPS
- › Sense and control systems
- › PLC
- › UPS
- › Light networks



# Main power board schematic\_1

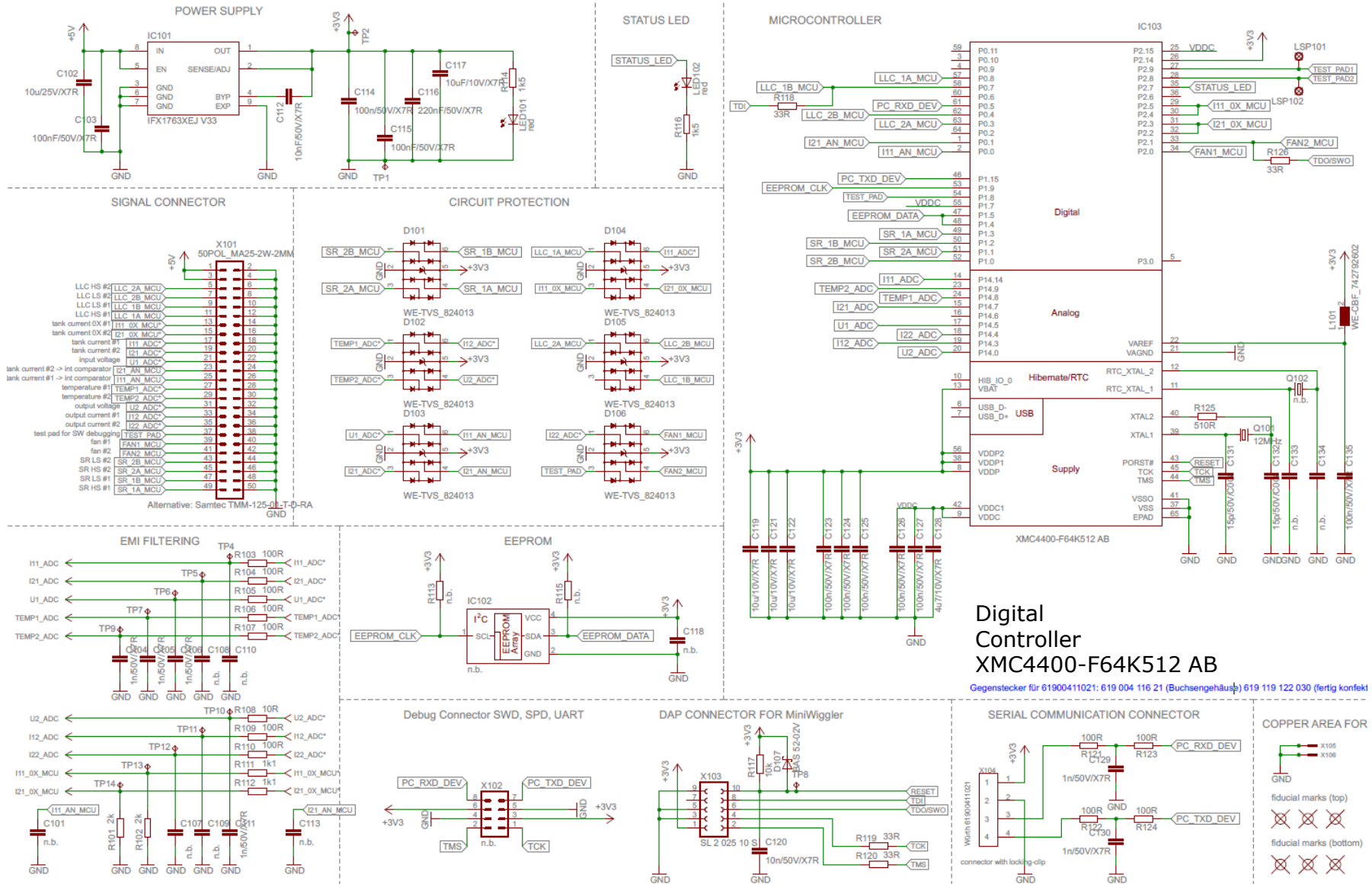


# Main power board schematic\_2





# Digital control board schematic



**Digital Controller**  
**XMC4400-F64K512 AB**

Gegenstecker für 61900411021: 619 004 116 21 (Buchsengehäuse) 619 119 122 030 (fertig konfekt)



# Connection instruction



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# Automated efficiency measurement

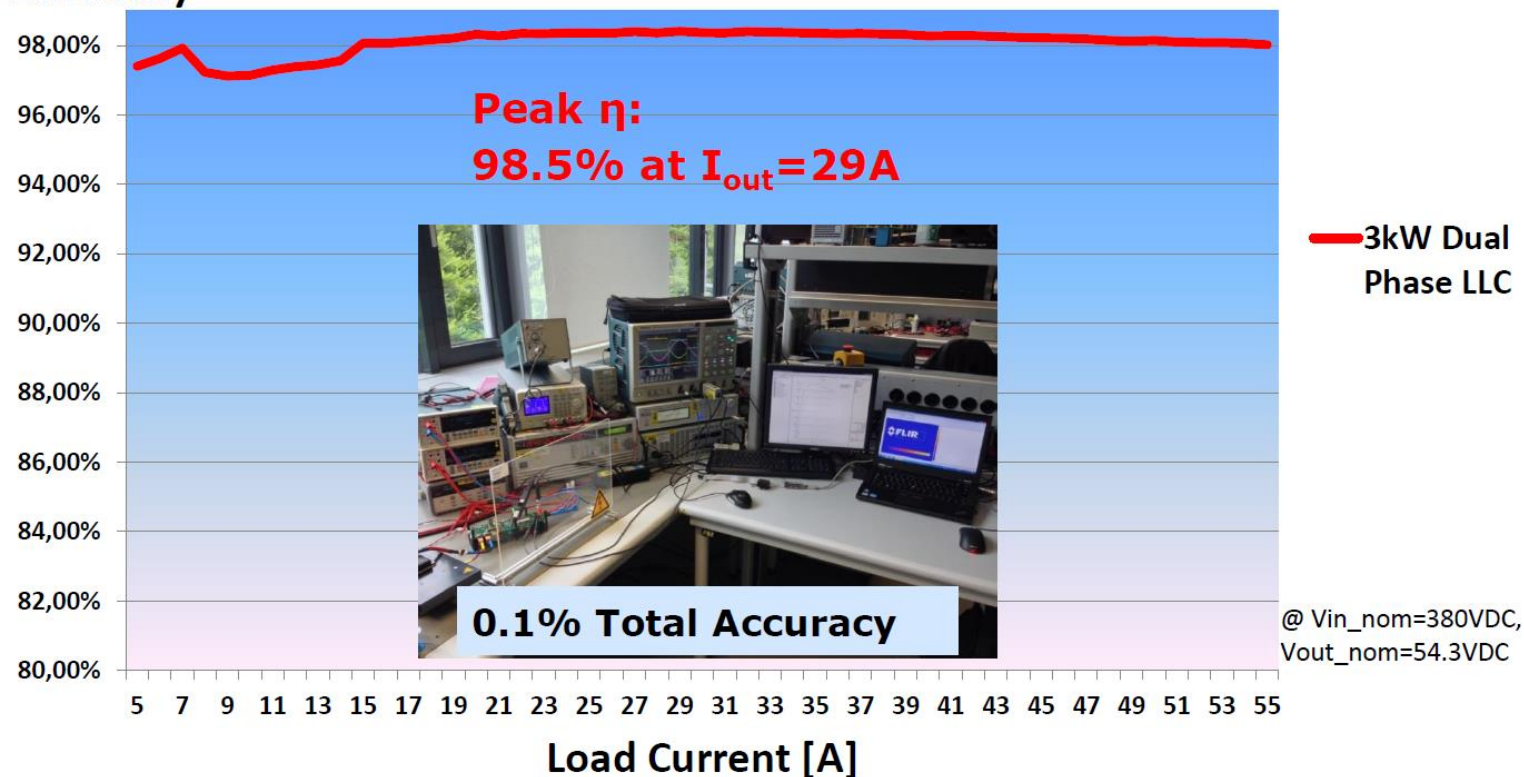
Combination of converter design (resonant tank, transformer) and proper high voltage device selection

Proper selection of SR low voltage device and secondary side design

## 3kW Dual Phase LLC Efficiency

(without Bias & fans absorption)

Efficiency



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General description

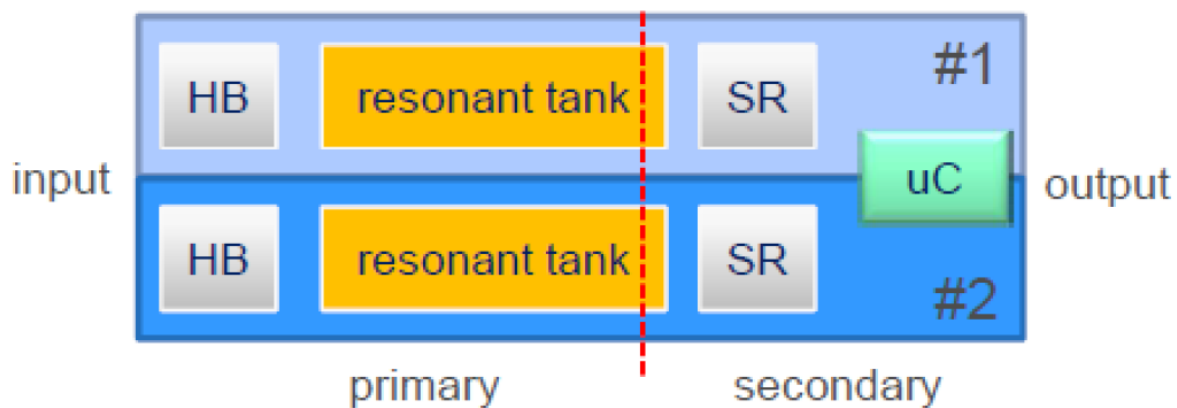
2

Efficiency results

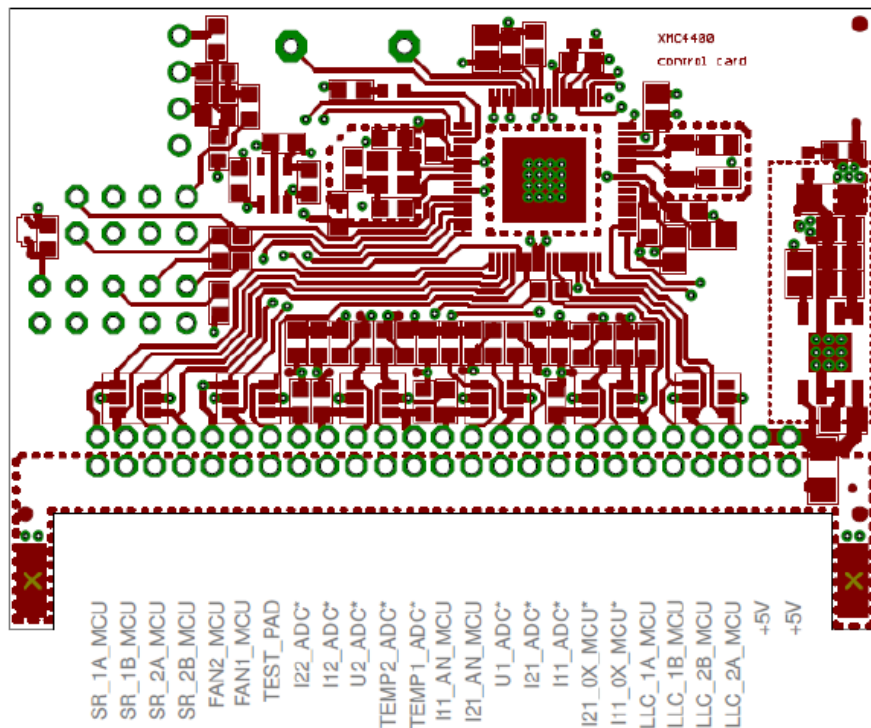
3

Design concept

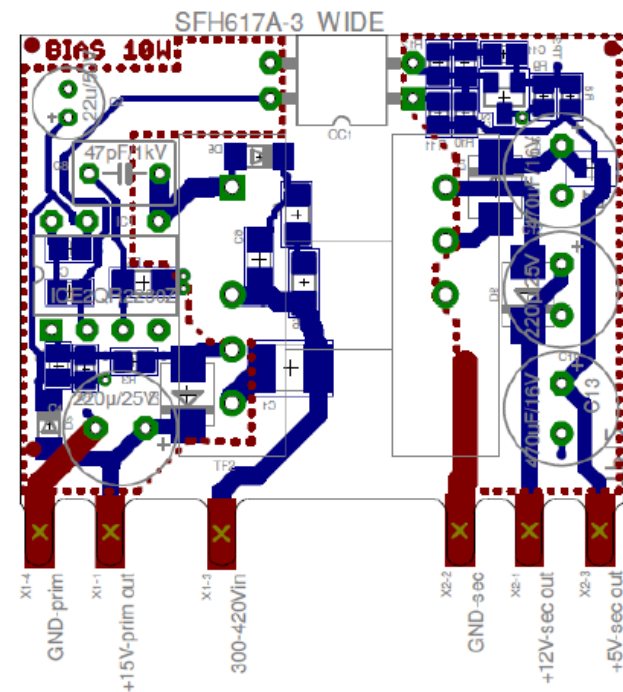
# Design concept



# Two daughter boards



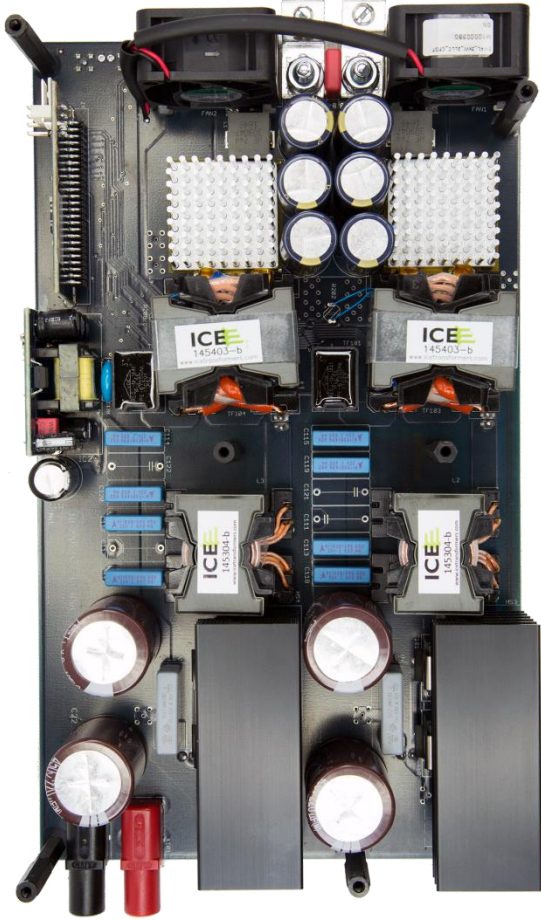
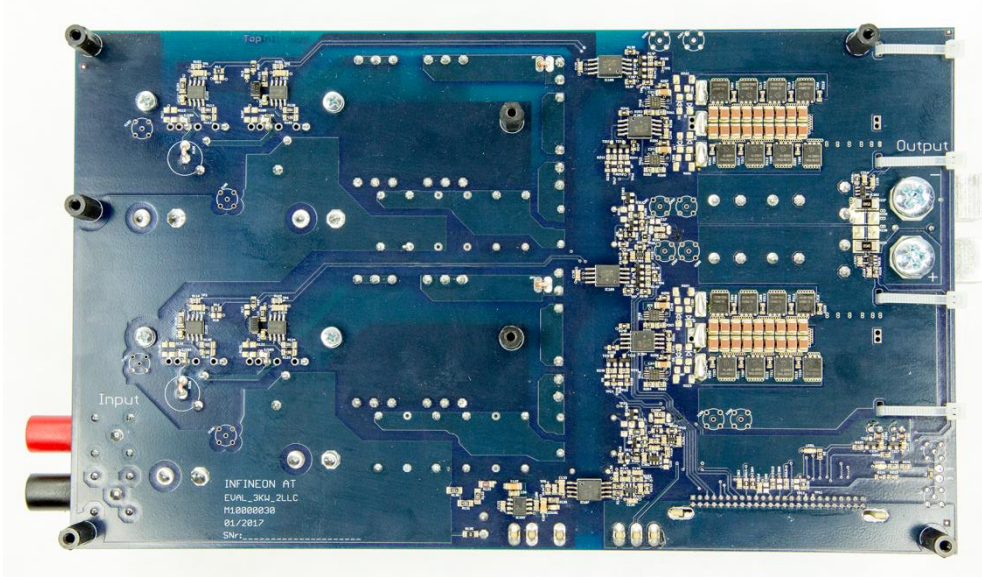
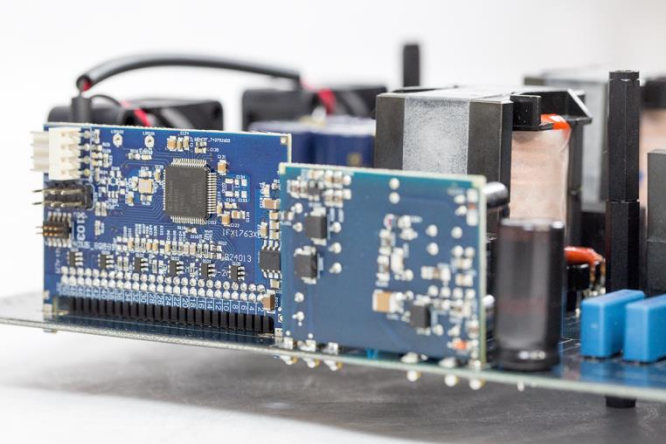
**Microcontroller Board**



**Auxiliary Converter Board**



# Evaluation board EVAL\_3KW\_2LLC\_CFD7





## Technical Material

- > Application Notes
- > Simulation Models
- > Datasheets
- > PCB Design Data

- > [www.infineon.com/3kw-llc-eval-cfd7](http://www.infineon.com/3kw-llc-eval-cfd7)
- > [www.infineon.com/cfd7](http://www.infineon.com/cfd7)

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  - Linear Voltage Regulator
  - DC-DC Converter
  - LED Driver | Lighting ICs
  - Silicon Carbide (SiC)
  - High Power Thyristors & Diodes
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  - AC-DC Supply

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