



Dual Gate MOSFET 48 V switch board

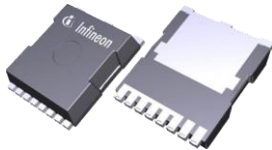
Quick introduction

IFAG ATV MOS
25.01.2024



SOA and R_{DS(on)} comparison

Dualgate trench vs. Standard trench vs. Planar



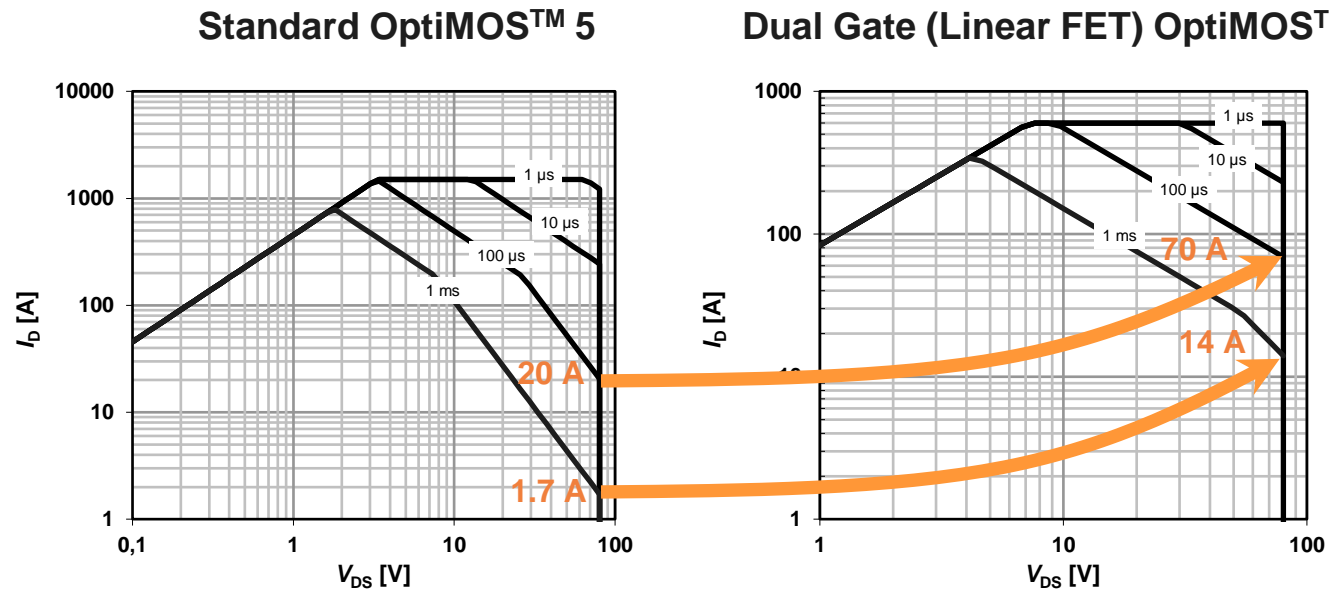
	IAUTN08S5N012L Dual Gate 80 V OptiMOS™ 5 Trench technology	IAUT300N08S5N011 Standard 80 V OptiMOS™ 5 Trench technology	IPB80N08S2-07 Standard 80 V OptiMOS™ Planar technology
SOA 1 ms at max V _{DS} , T _C = 25°C	14 A (Linear MOSFET)	1.7 A	14 A
R _{DS(on)} at V _{GS} = 10 V, T _J = 25°C	1.15 mΩ (Linear and On MOSFET)	1.10 mΩ	7.1 mΩ
Package footprint	TOLL (10x12x2.3 mm ³)	TOLL (10x12x2.3 mm ³)	D2PAK (15x11x4.4 mm ³)

Combining the best of 2 worlds with Dual Gate

Reaching levels of Planar MOSFET SOA, maintain low R_{DS(on)} and small solution size of trench technology

SOA comparison

Standard OptiMOS™ 5 vs. Dualgate Linear FET OptiMOS™ 5



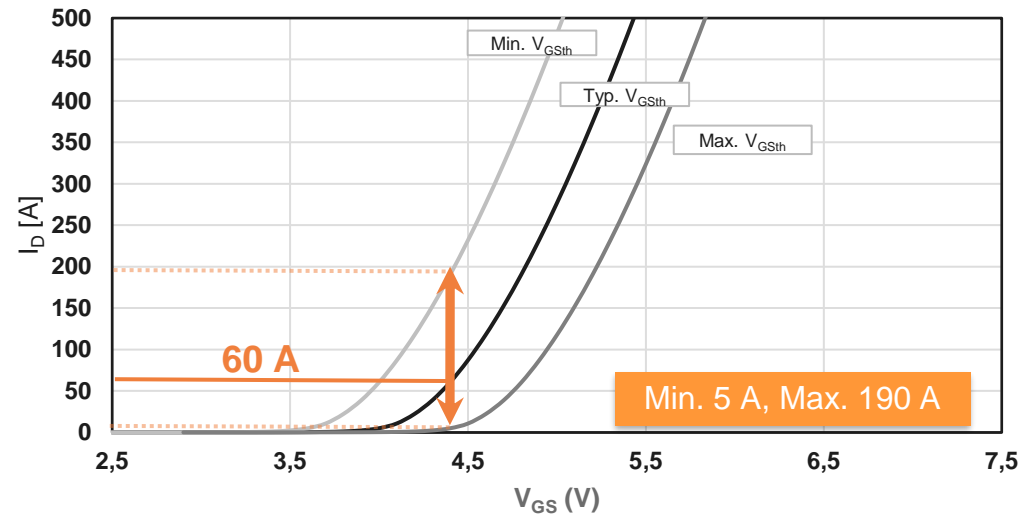
Dual Gate (Linear FET) SOA significantly larger at high V_{DS}

Enabling new applications as e.g. in-rush current limitation, short circuit clamping and slow switching

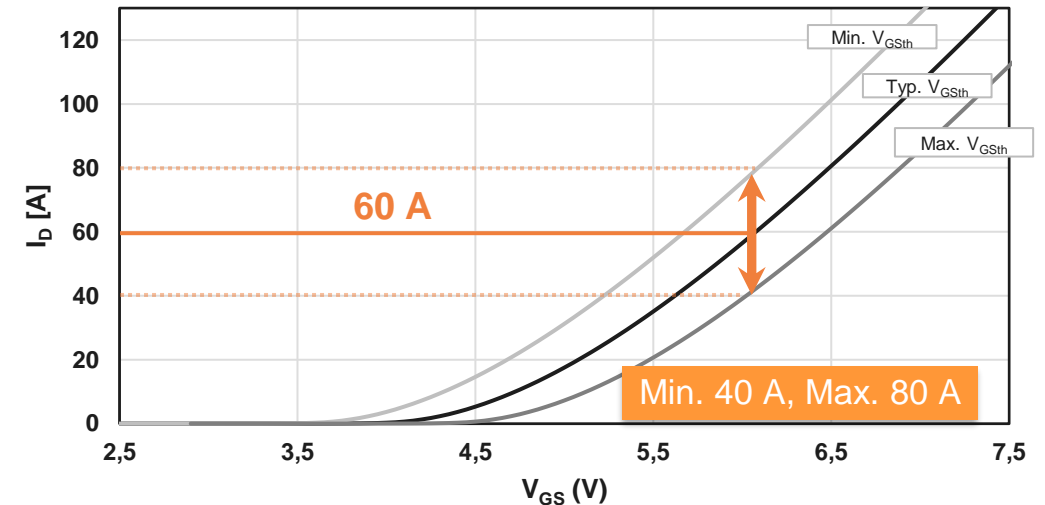
Transfer characteristics comparison

Standard OptiMOS™ 5 vs. Dualgate Linear FET OptiMOS™ 5

Standard OptiMOS™ 5



Dual Gate (Linear FET) OptiMOS™ 5



Dual Gate (Linear FET) improved current accuracy due to low transconductance and process variation

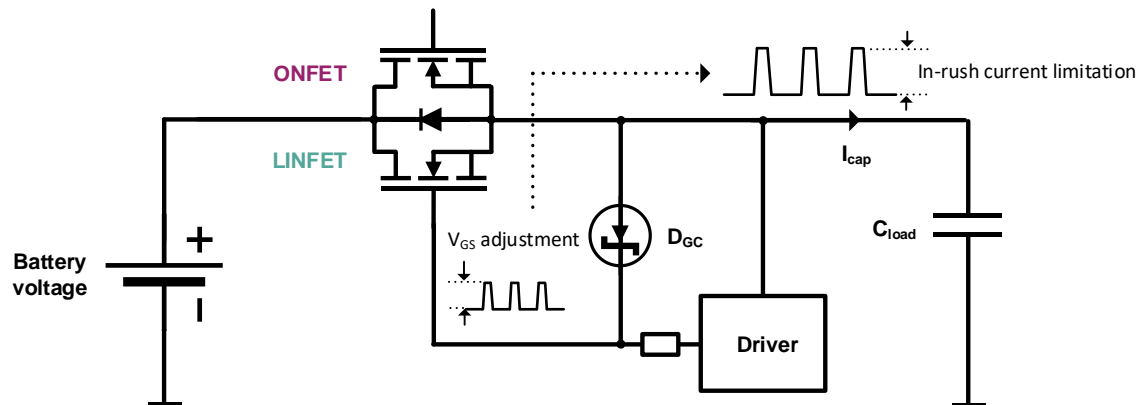
Enabling paralleling in linear mode operation

Dual Gate MOSFET 80 V

Application examples

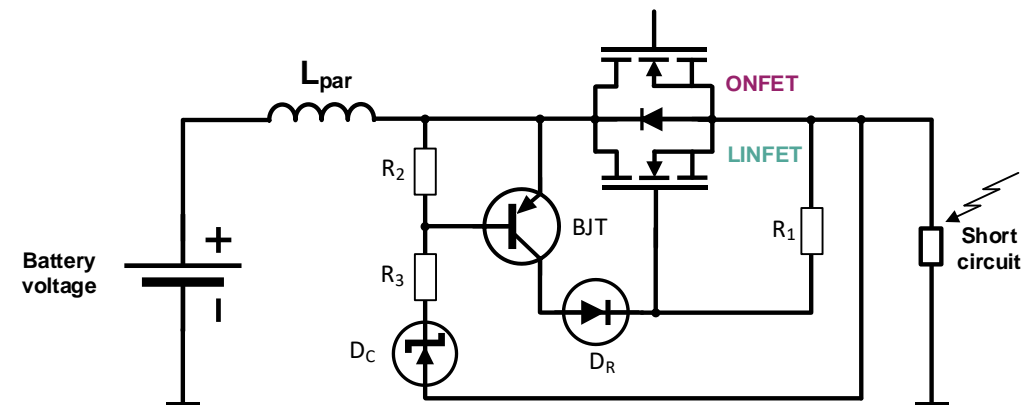
Capacitor charging

- LINFET current limited via V_{GS} adjustment according to transfer-characteristics.
- Pulsed capacitor charging to limit self-heating.
- Flexible control of PWM and switching speed.
- ONFET can be turned on to minimize steady state losses after capacitor is fully charged.



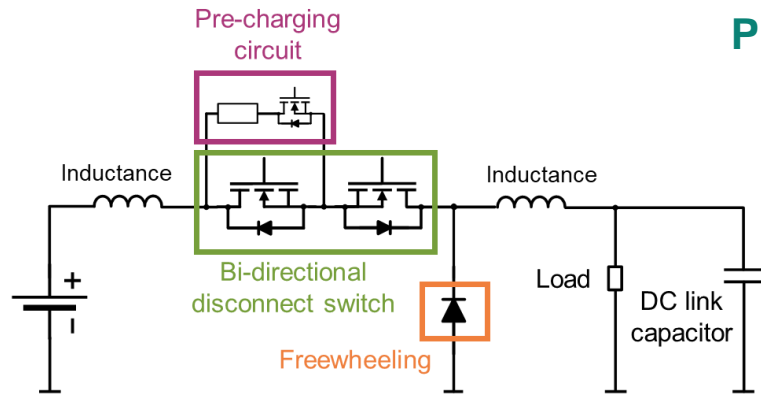
Short circuit clamping

- D_C limits the V_{DS} voltage to avoid avalanche (no hot carrier injection). Instead the MOSFET operates in linear mode to dissipate inductor energy.
- LINFET allows higher currents in linear mode and gives more flexibility for clamping circuit design.
- ONFET can be turned on to minimize steady state losses during normal operation.

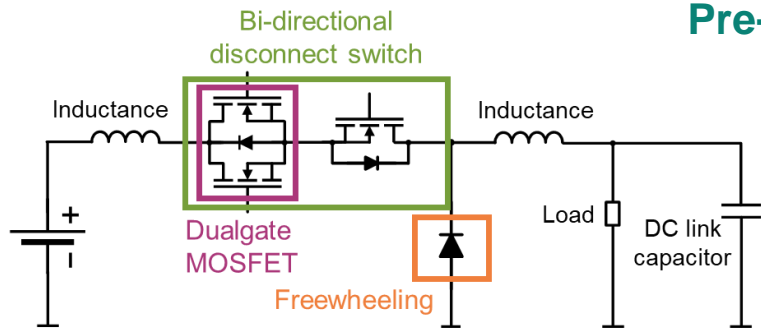
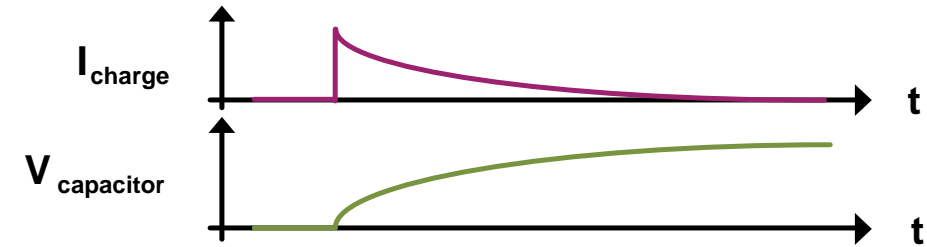


Capacitor pre-charging with power resistor vs. Dual Gate MOSFET

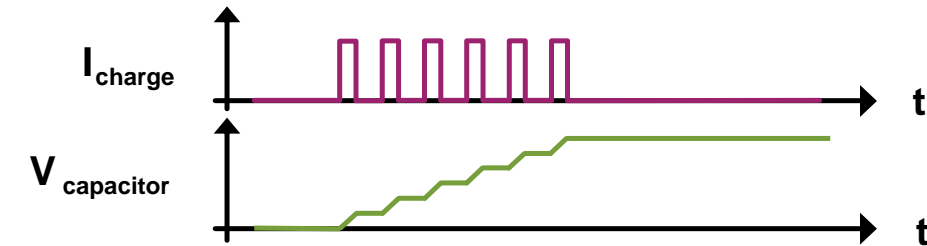
Reduction of system cost (no pre-charge circuit needed) and acceleration of capacitor charging



Pre-charging with power resistor



Pre-charging with Dual Gate MOSFET



Dual Gate MOSFET 80 V 48 V switch board (uni-directional)

Dual Gate 48 V switch board (uni-directional)

– Perfect fit for 48 V disconnect switch applications

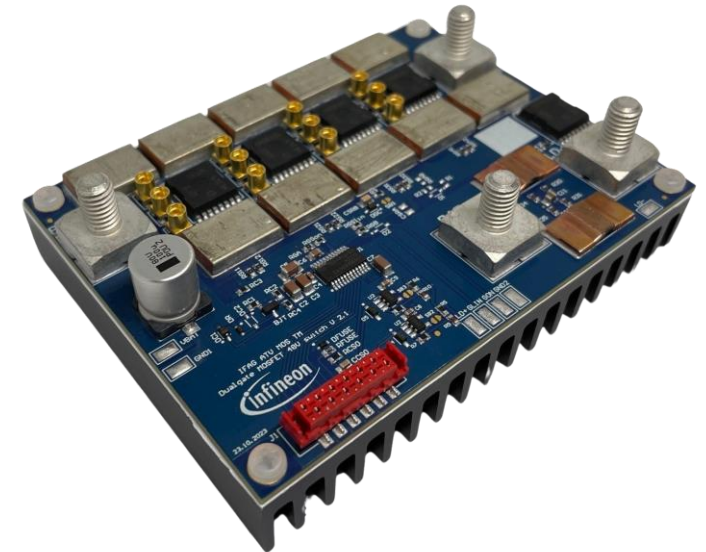
- Power distribution
- Battery management
- Electrically heated catalyst

– Used Infineon components

- Dual Gate MOSFETs IAUTN08S5N012L: 80 V, max. $R_{DS(on)}$ 1.15 m Ω
- Freewheeling MOSFET: IAUT300N08S5N012
- 48 V high-side driver: 2ED4820-EM

– System advantages

- Supports fast pulsed capacitor charging with Dual Gate MOSFET to minimize system costs (no separate pre-charging path needed).
- Active clamping capable to dissipate inductive energy from cable harness. Dual Gate MOSFET operates in linear mode instead of avalanche to increase short circuit robustness and increase drain-source voltage clamp accuracy.



Evaluation Board (available for purchase)

Part number: DG_48V_SWITCH_KIT

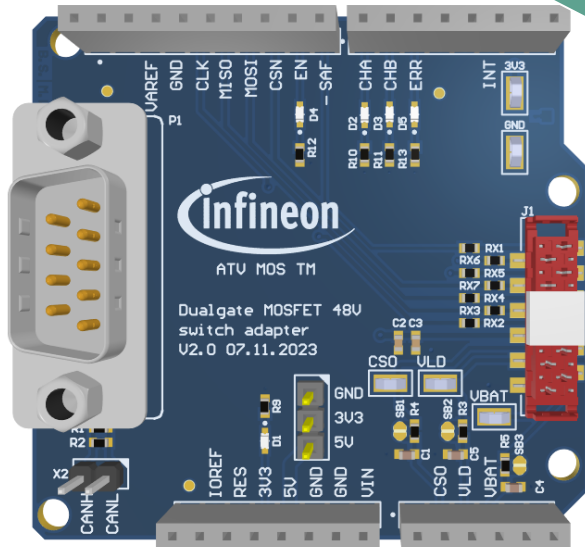
Contact your Infineon salesperson for support

Check out [infineon.com](https://www.infineon.com) for more information

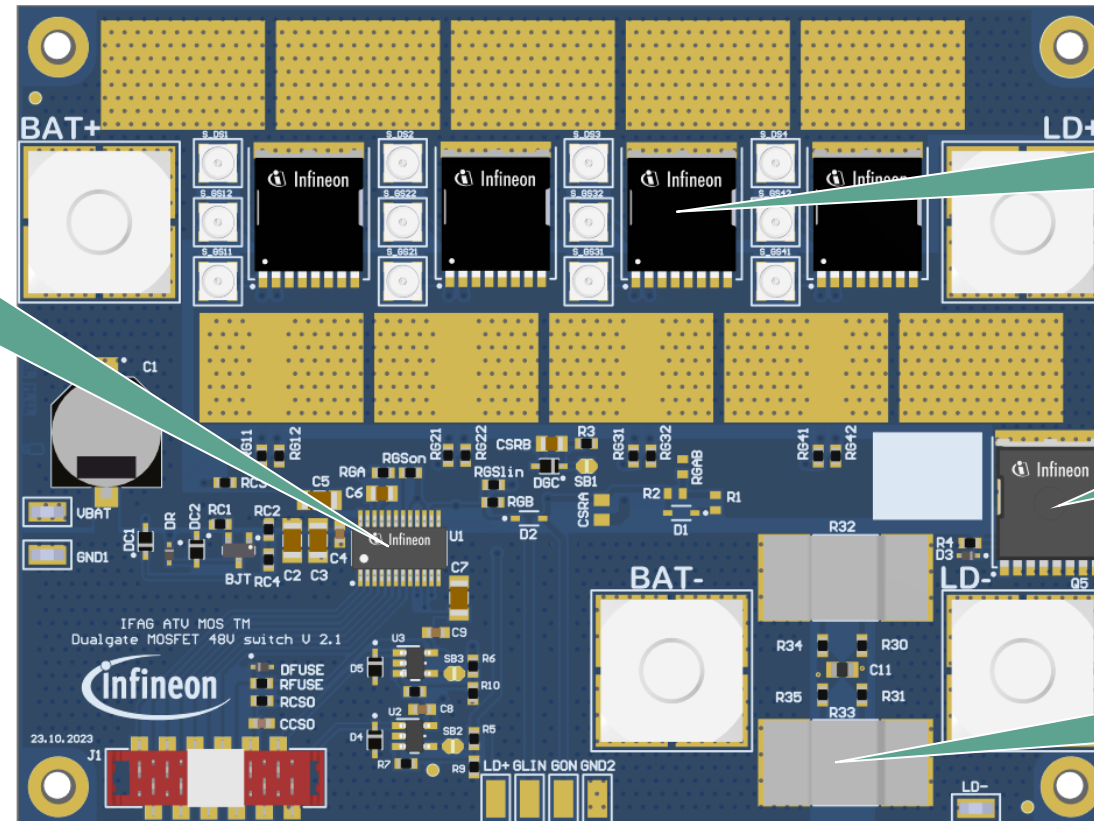
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Dual Gate MOSFET 80 V 48 V switch board (uni-directional) overview

2 channel 48V high-side
driver IC 2ED4820



Adapter Board



Main Board

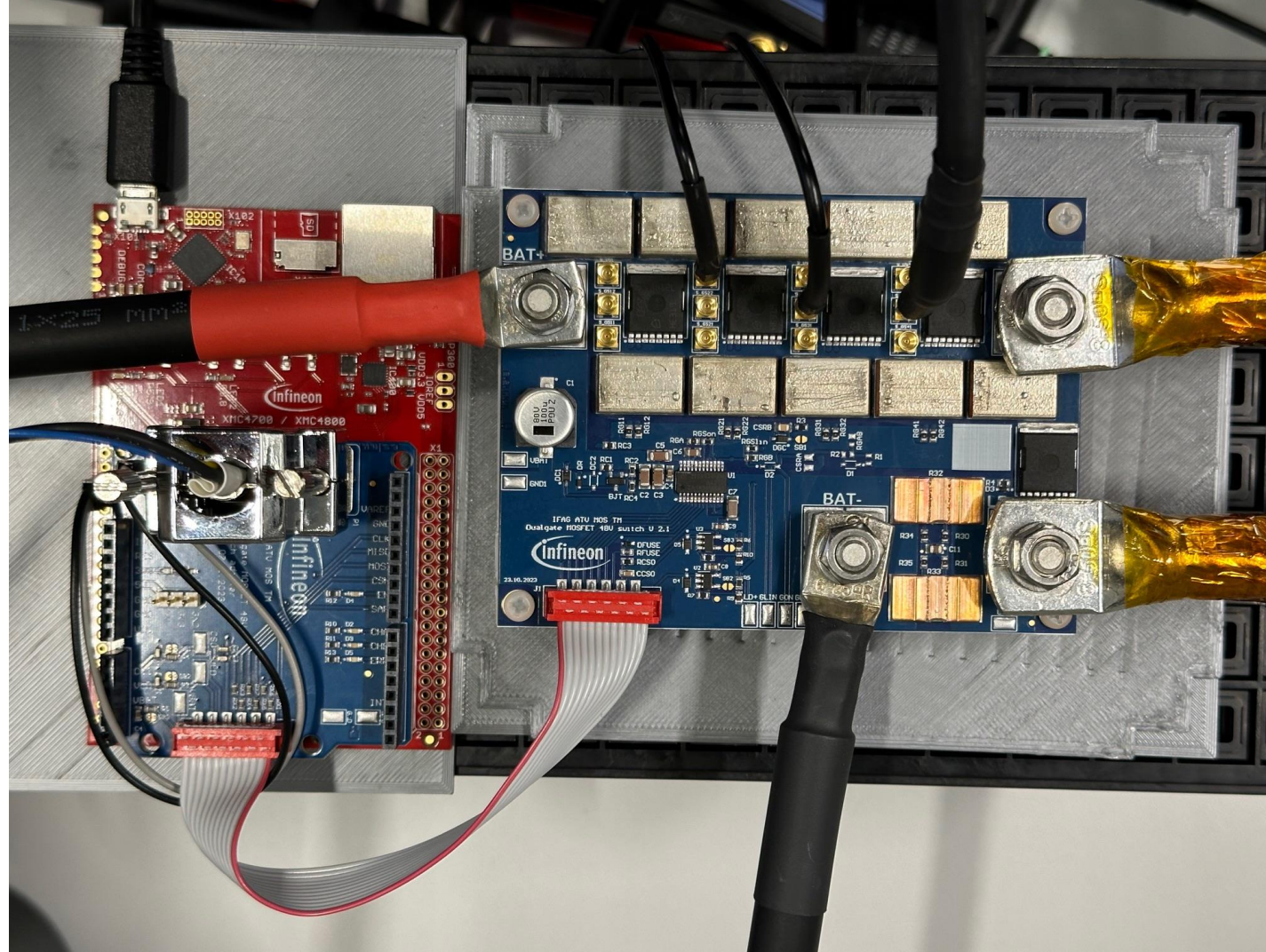
4 parallel IAUTN08S5N012L
max. 1.15 mΩ each

Freewheeling MOSFET
IAUT300N08S5N012

Shunts 100 μΩ (each)

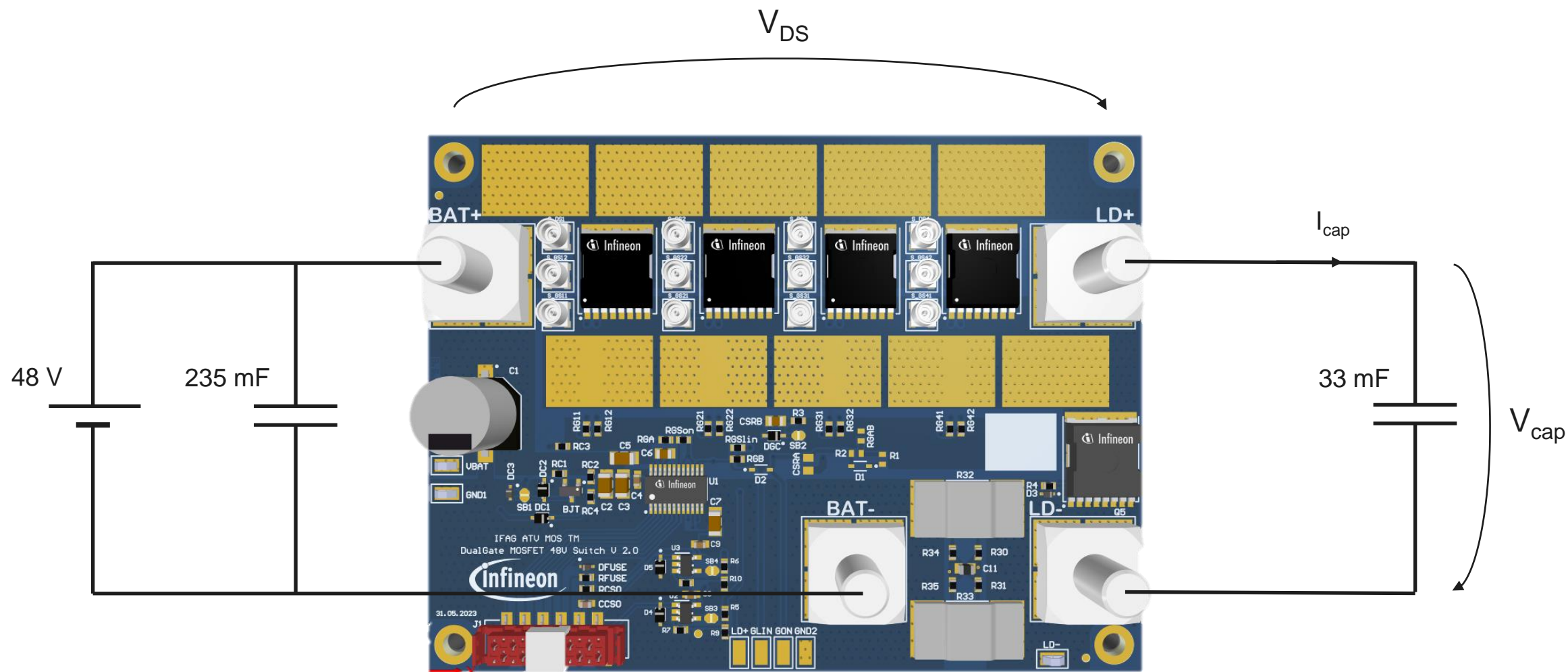
Board description

48 V Dual Gate MOSFET disconnect switch board with μ C control

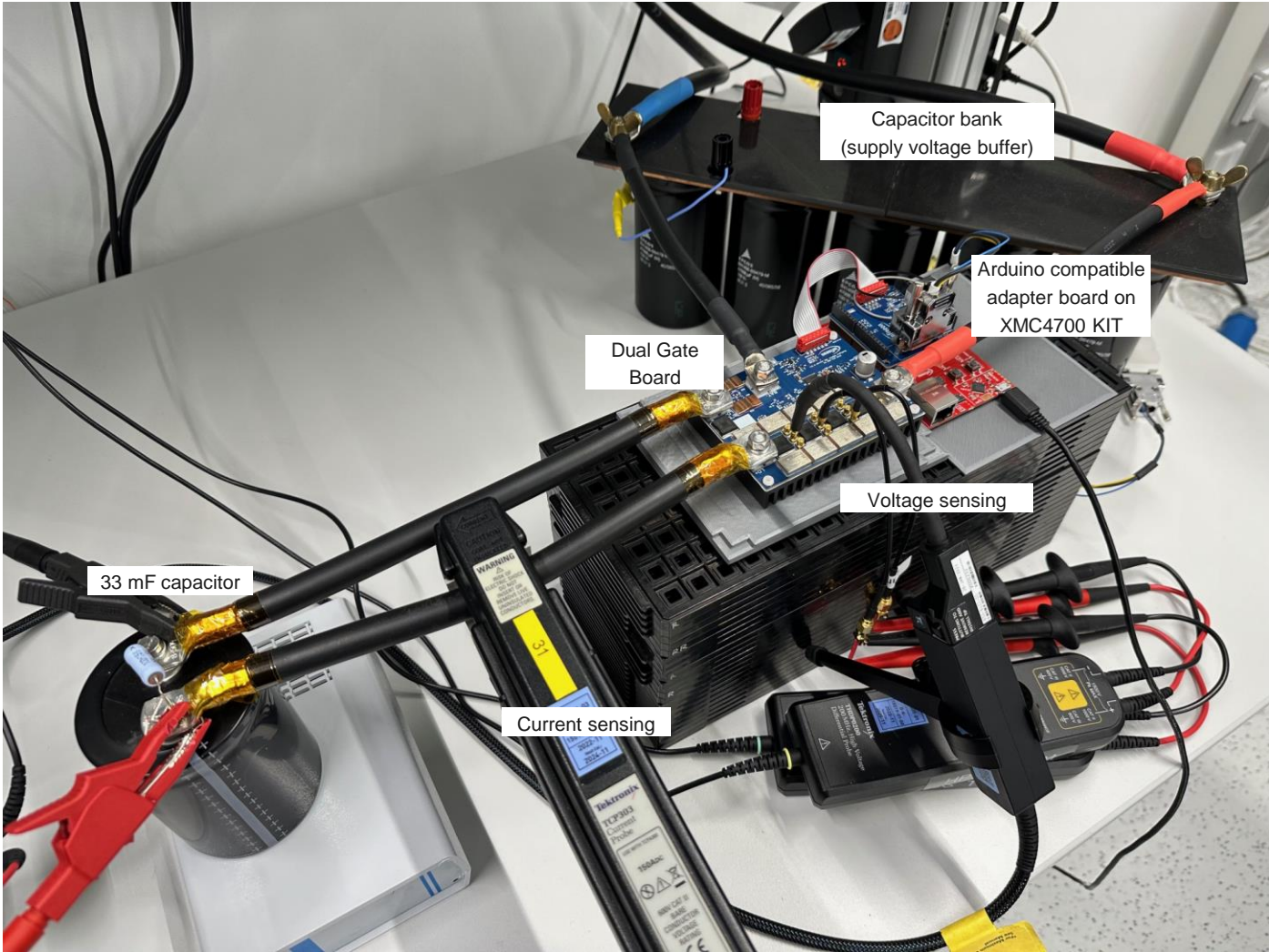


- Zener diode D_C to limit V_{DS} to 68 V
- BJT circuit for optimized clamping speed and high V_{DS} clamp accuracy:
 $V_{DS,clamp} \approx V_{DC}$
- Reverse diode D_R to avoid reverse currents

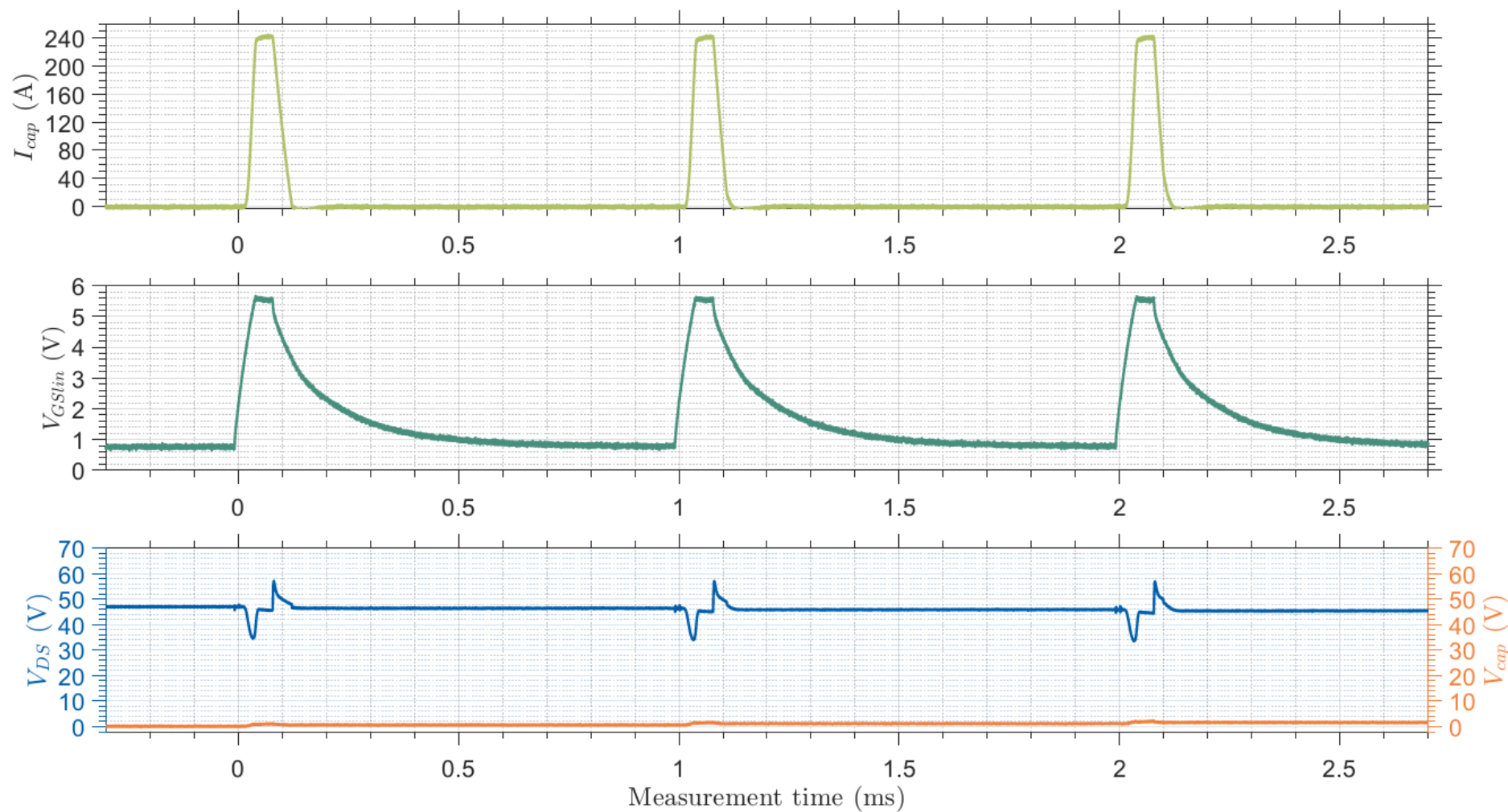
Capacitor charging setup – simplified schematic



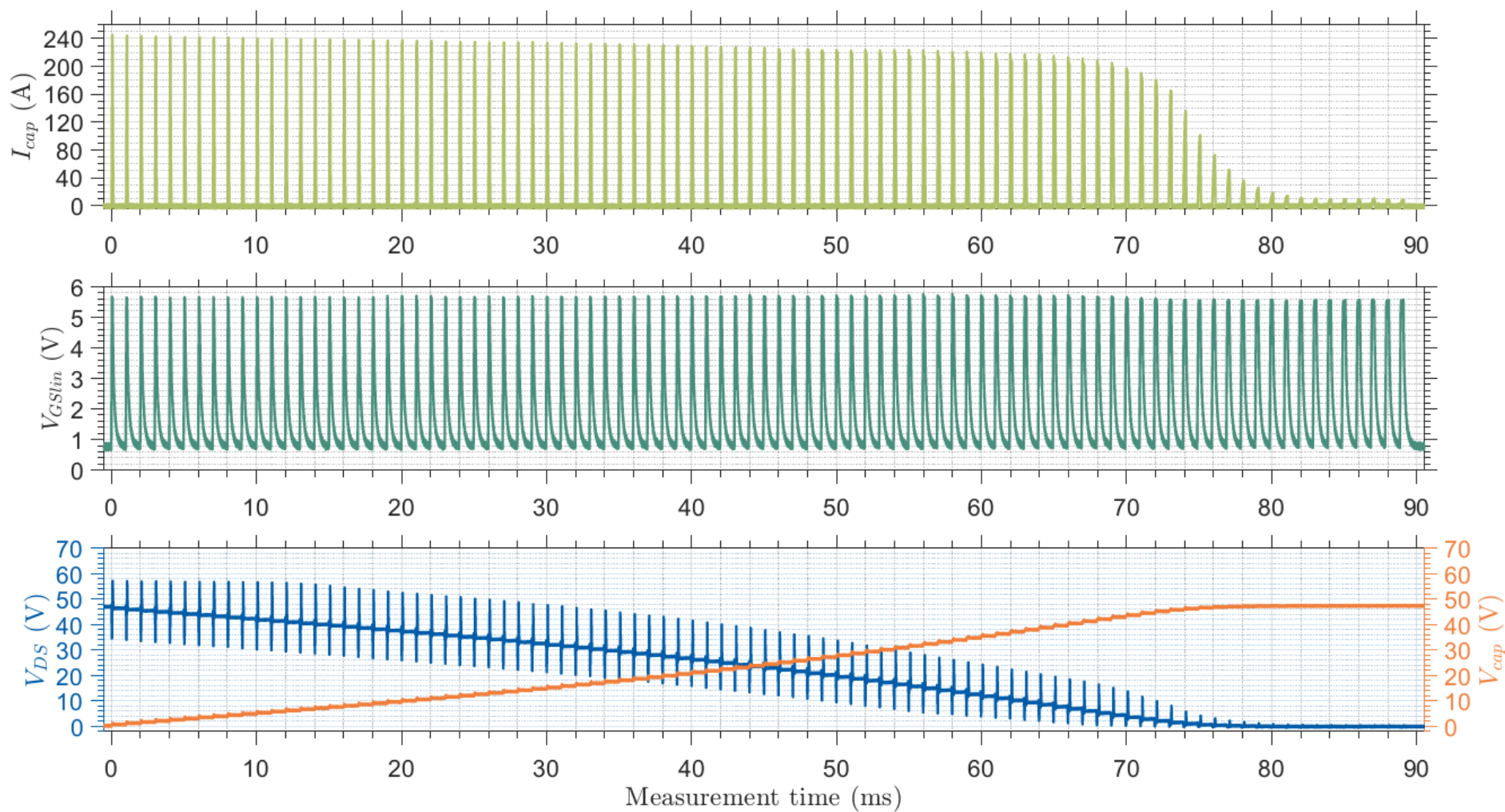
Capacitor charging setup



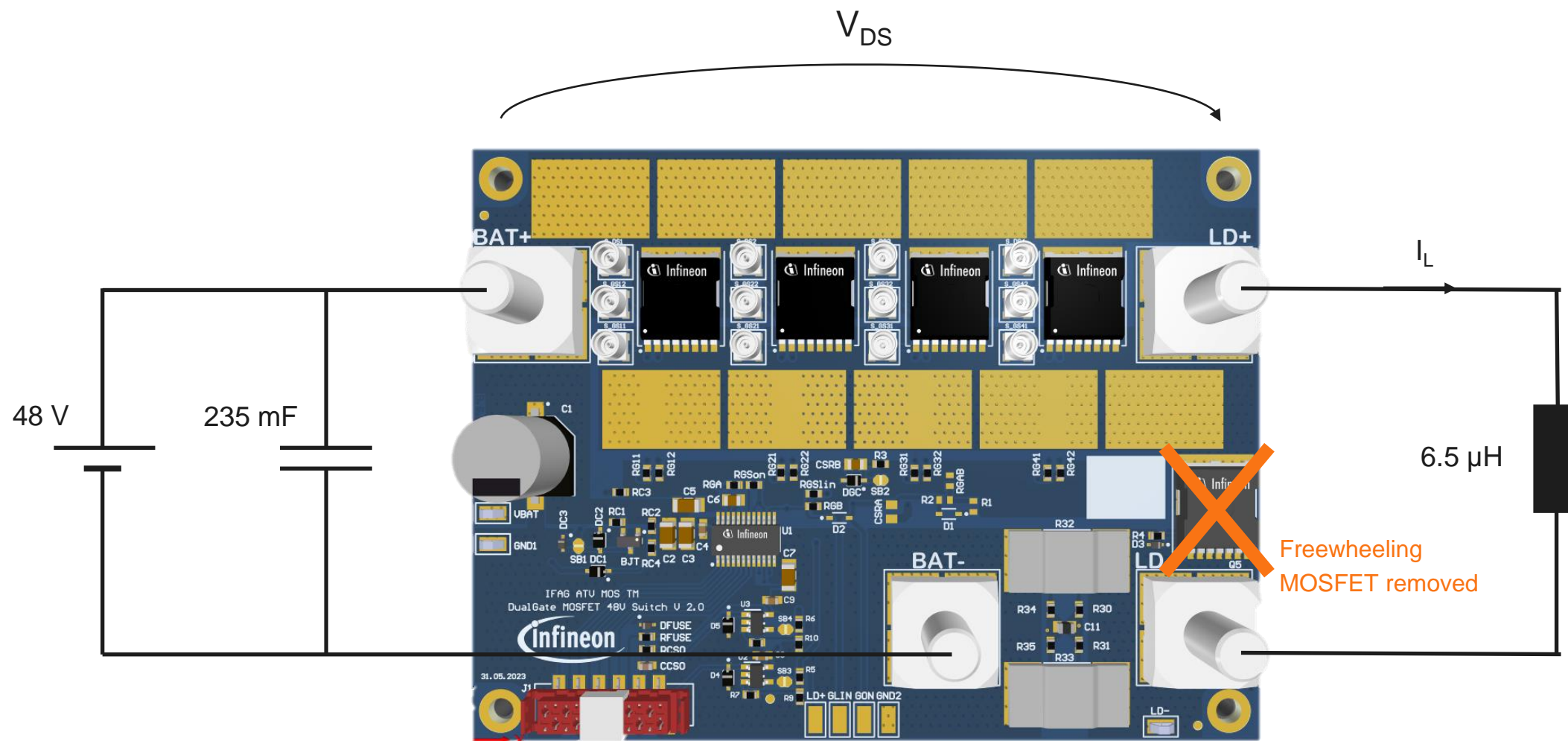
Capacitor charging – waveforms, first three pulses



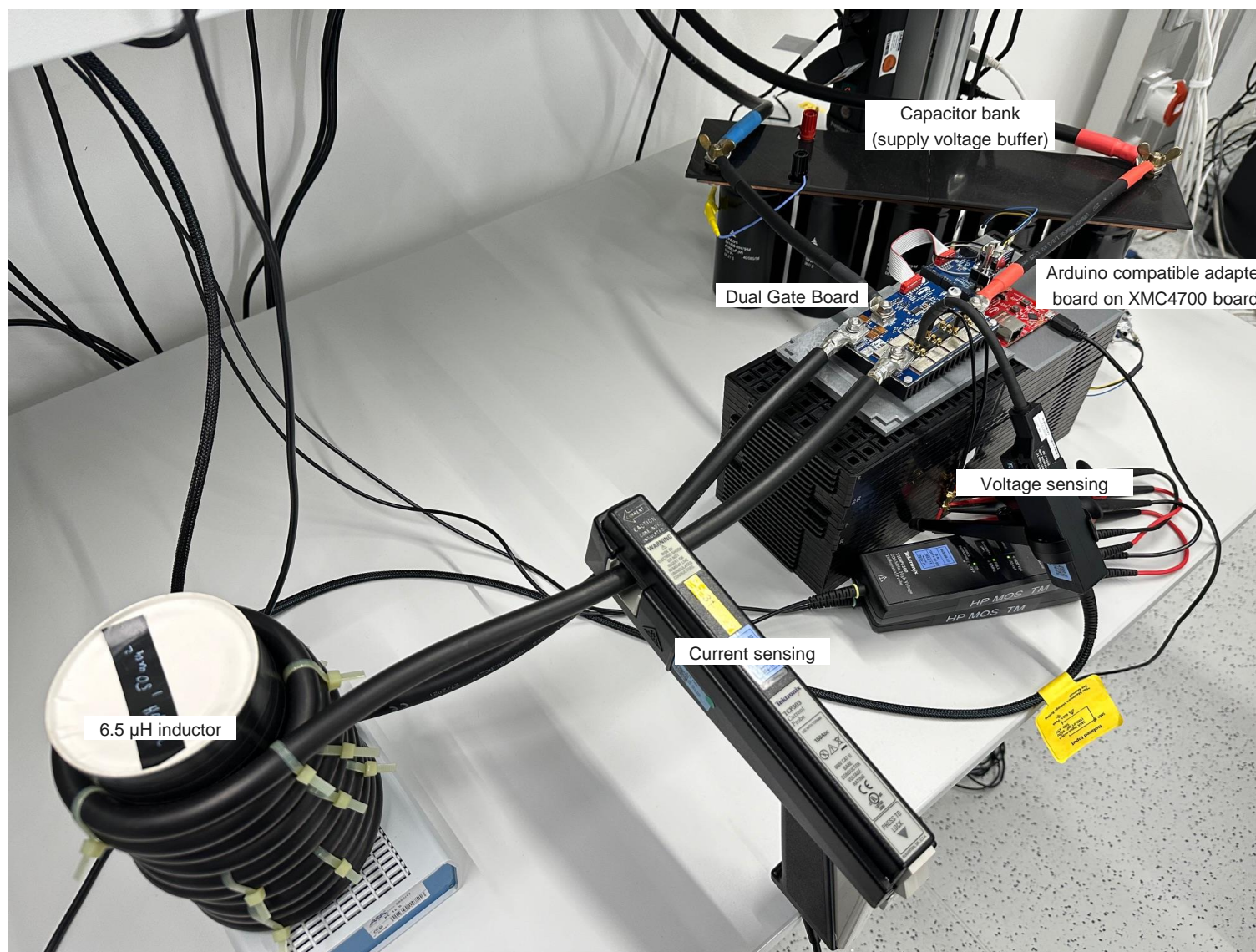
Capacitor charging – waveforms, all pulses



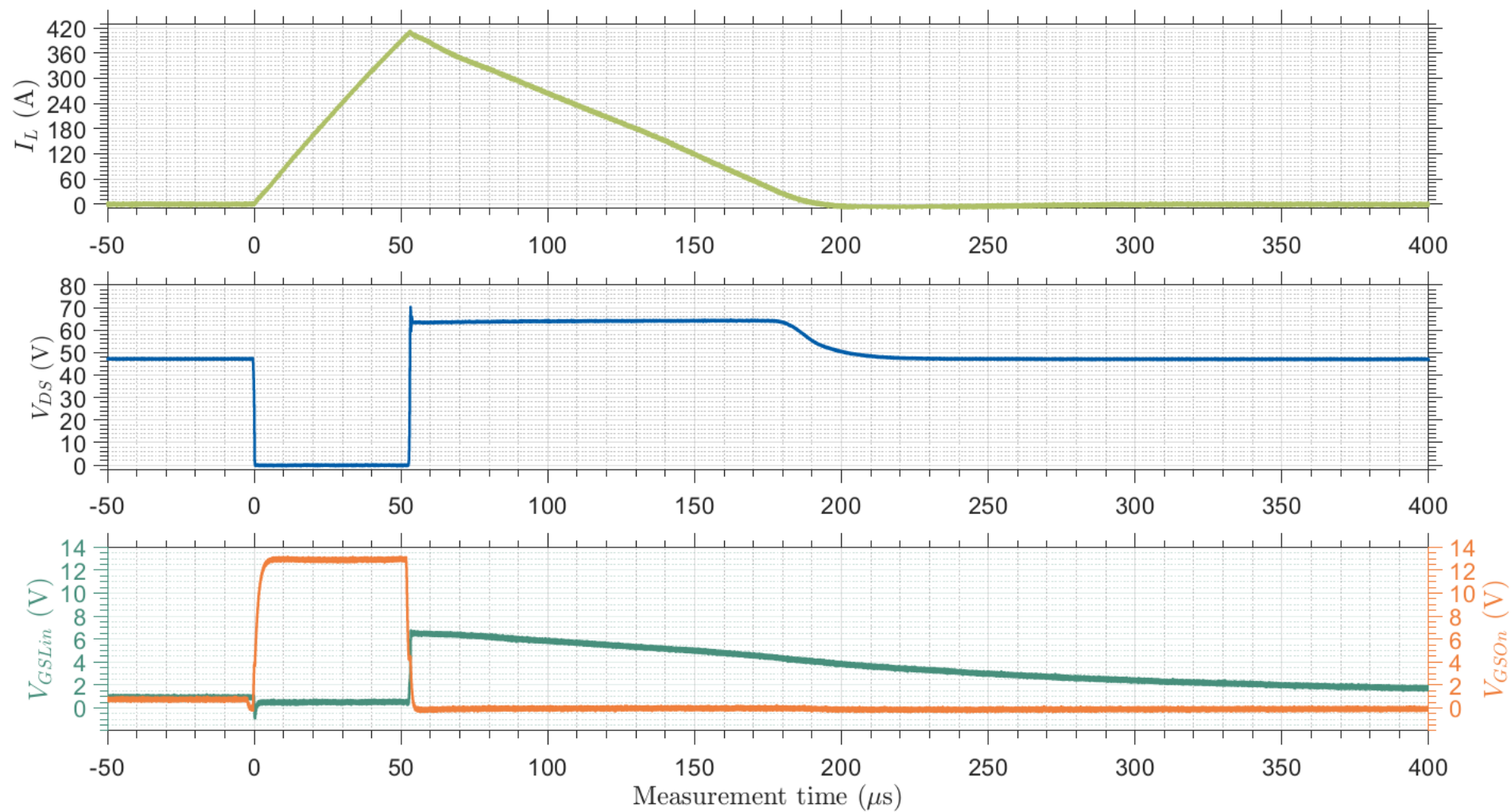
Short-circuit clamping setup – simplified schematic



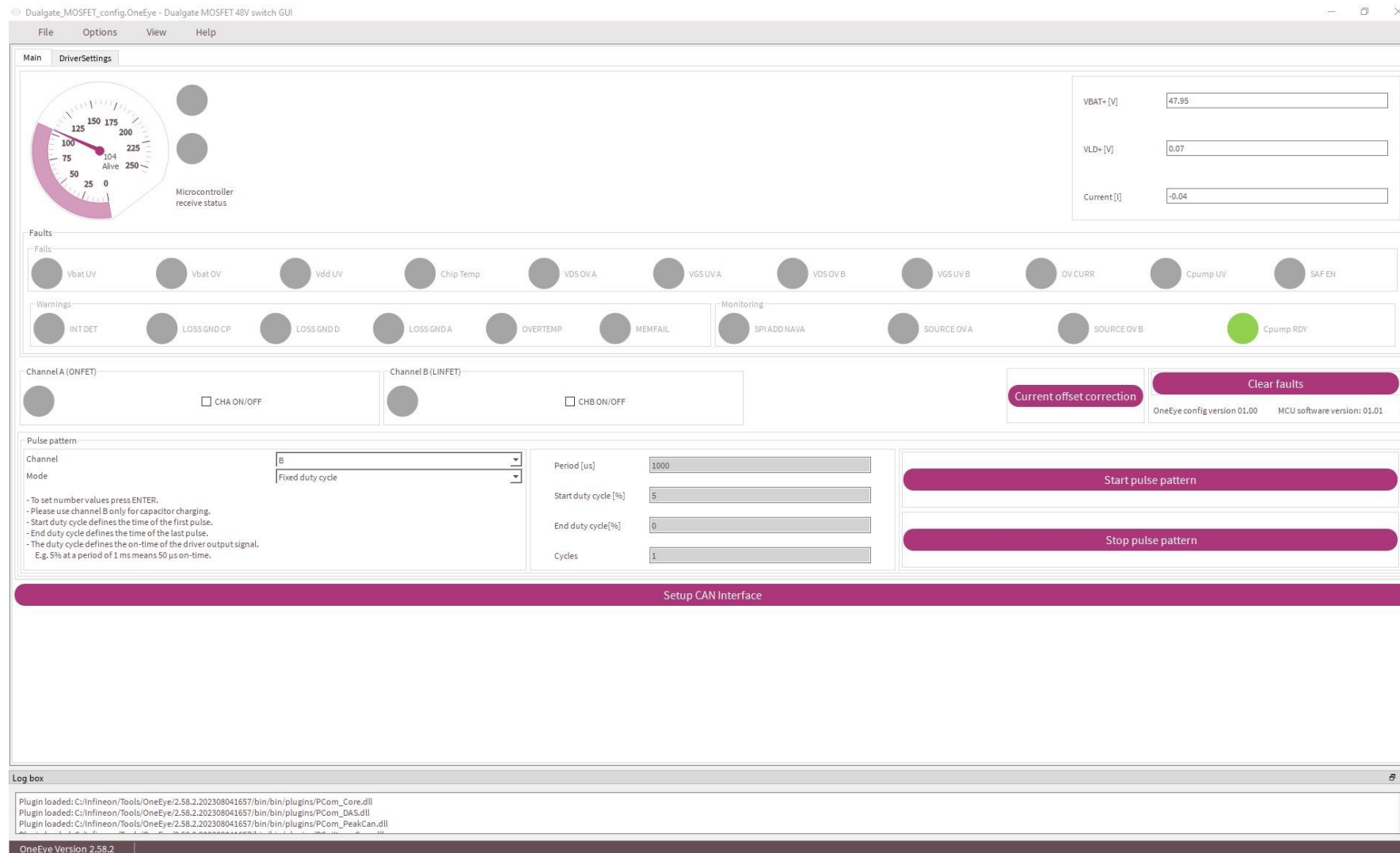
Short-circuit clamping setup



Short-circuit clamping setup – waveforms



OneEye control suite – Dual Gate MOSFET part 1



OneEye control suite – Dual Gate MOSFET part 2

Dualgate_MOSFET_config.OneEye - Dualgate MOSFET 48V switch GUI

File Options View Help

Main DriverSettings

General

Channel cross control OFF

VBAT undervoltage auto-restart time 1 ms

VBAT overvoltage auto-restart time 10 μ s

Current sense highside or lowside Low-Side

Current sense amplifier gain G_DIFF 35 V/V

Overcurrent detection thresholds $\pm 0.2 \cdot V_{DD}$

Current sense amplifier output capacitor Output load > 100 pF

Channel

Channel A

Drain-source overvoltage threshold 250 mV

VDS safe state Disabled

MOS voltage blank time 10 μ s

MOS voltage filter time 2 μ s

Channel B

Drain-source overvoltage threshold 250 mV

VDS safe state Disabled

MOS voltage blank time 10 μ s

MOS voltage filter time 2 μ s

Read driver register

Set driver register

Microcontroller receive status

Setup CAN Interface

Log box

Plugin loaded: C:\Infineon\Tools\OneEye\2.58.2.202308041657\bin\bin\plugins\PCom_Core.dll
 Plugin loaded: C:\Infineon\Tools\OneEye\2.58.2.202308041657\bin\bin\plugins\PCom_DAS.dll
 Plugin loaded: C:\Infineon\Tools\OneEye\2.58.2.202308041657\bin\bin\plugins\PCom_PeakCan.dll

OneEye Version 2.58.2

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