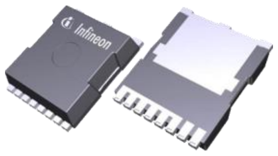
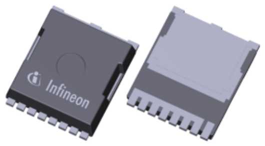
Dual Gate MOSFET 48 V switch board Quick introduction

IFAG ATV MOS
25.01.2024

SOA and RDSON comparison
Dualgate trench vs. Standard trench vs. Planar



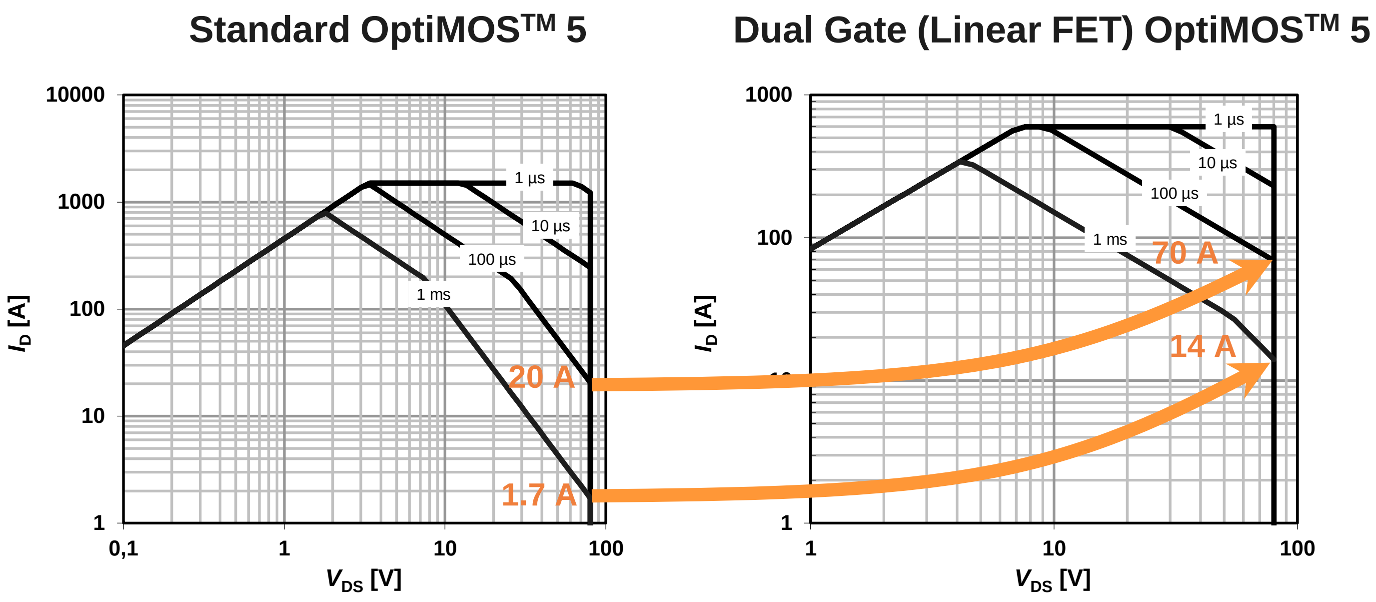


	IAUTN08S5N012L Dual Gate 80 V OptiMOS^{TM} 5 Trench technology	IAUT300N08S5N011 Standard 80 V OptiMOS^{TM} 5 Trench technology	IPB80N08S2-07 Standard 80 V OptiMOS^{TM} Planar technology
SOA 1 ms at max V_{DS}, T_C = 25°C	14 A (Linear MOSFET)	1.7 A	14 A
R_{DSON} at V_{GS} = 10 V, T_J = 25°C	1.15 mΩ (Linear 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_{DSON} and small solution size of trench technology

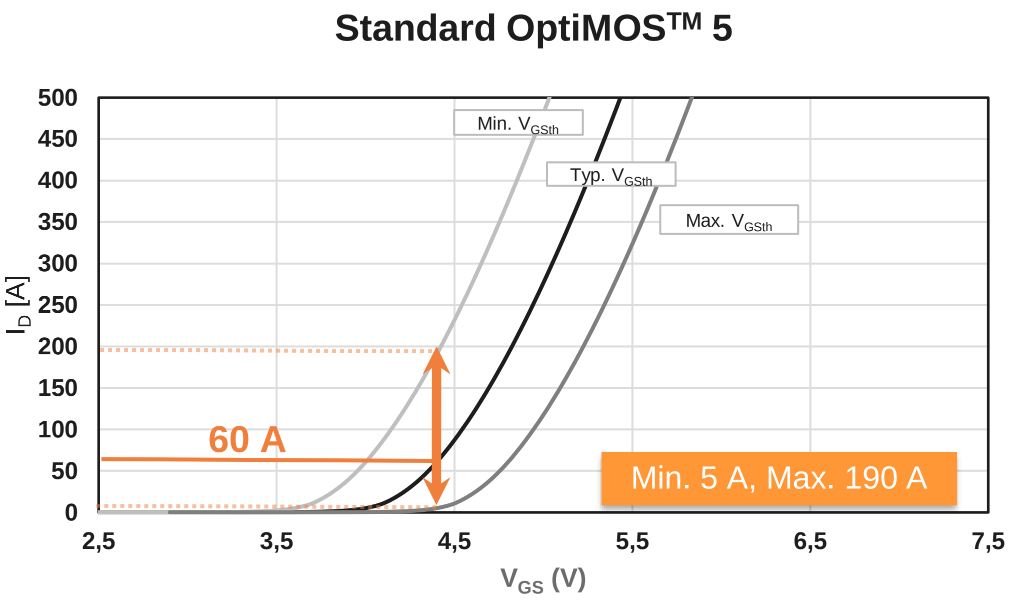
SOA comparison
Standard OptiMOS^{TM} 5 vs. Dualgate Linear FET OptiMOS^{TM} 5

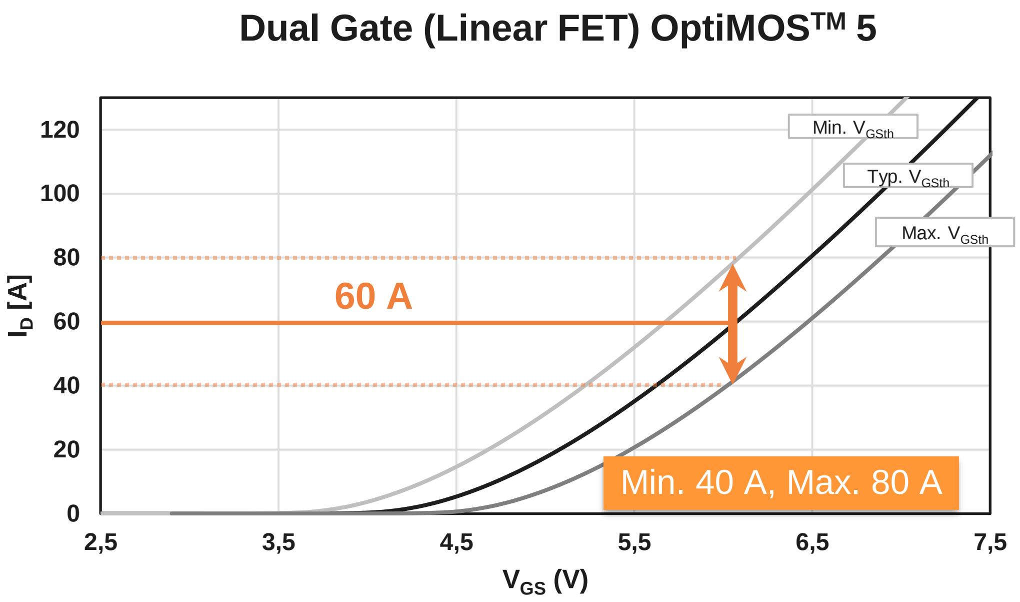


Dual Gate (Linear FET) SOA significantly larger at high V_{DS}

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

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





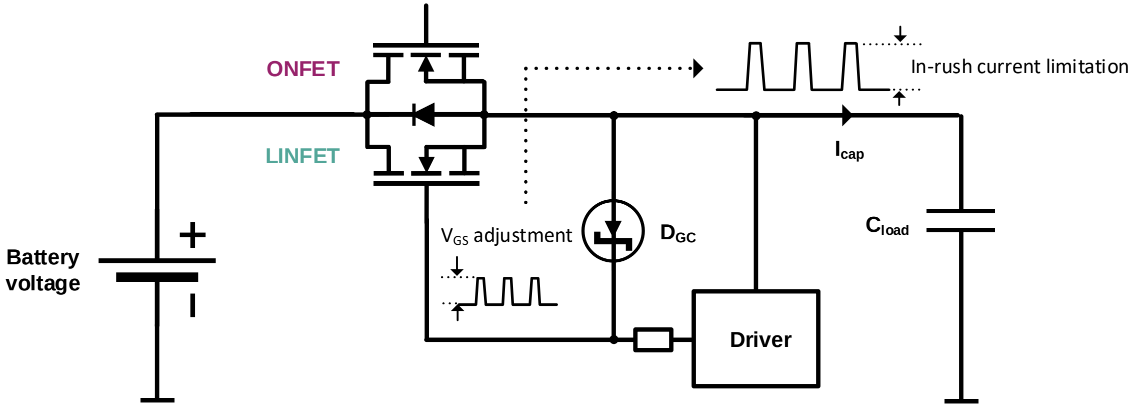
Dual Gate (Linear FET) improved current accuracy due to low transconductance and process variation

Enabling paralleling in linear mode operation

Dual Gate MOSFET 80 V
Application examples

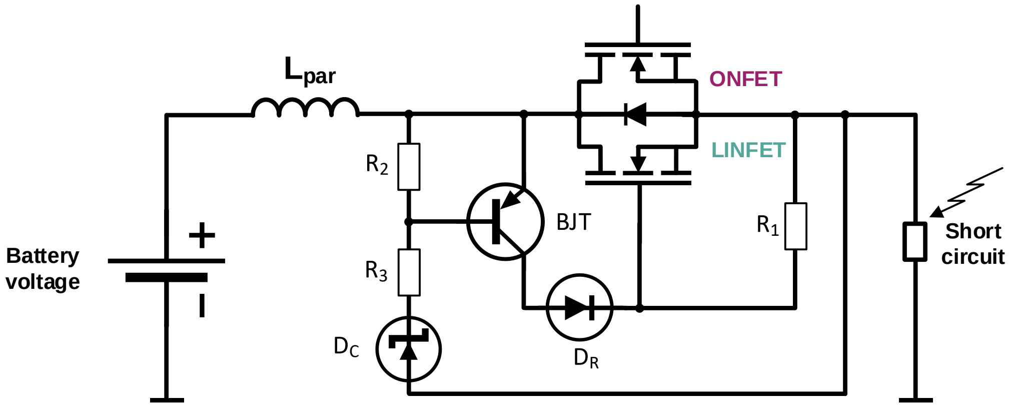
Capacitor charging

- 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

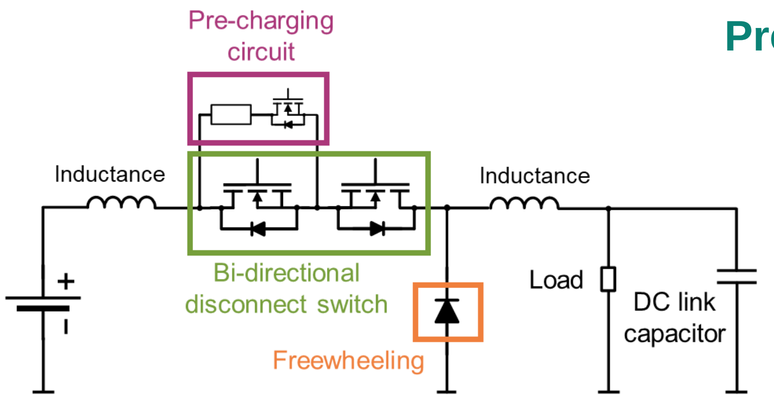
- D_C limits the V_{DS} voltage to avoid avalanche (no hot carrier injection). Instead the MOSFET operates in linear mode to dissipate inductor energy.
- LINFET allows higher currents in linear mode and gives more flexibility for clamping circuit design.
- ONFET can be turned on to minimize steady state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

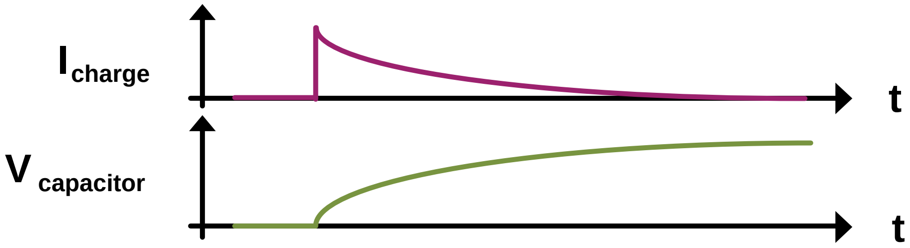


Dual Gate MOSFET 80 V
Capacitor pre-charging with power resistor vs. Dual Gate MOSFET

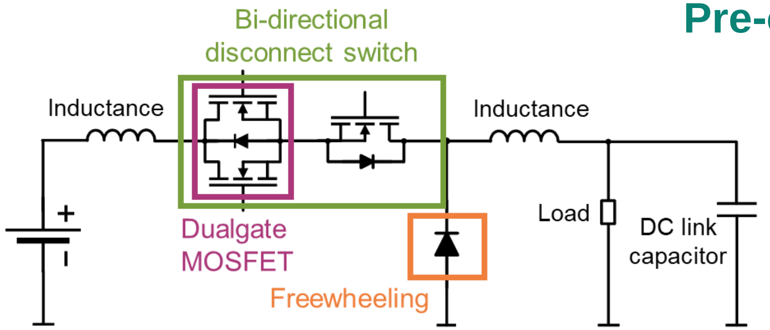
Reduction of system cost (no pre-charge circuit needed) and acceleration of capacitor charging

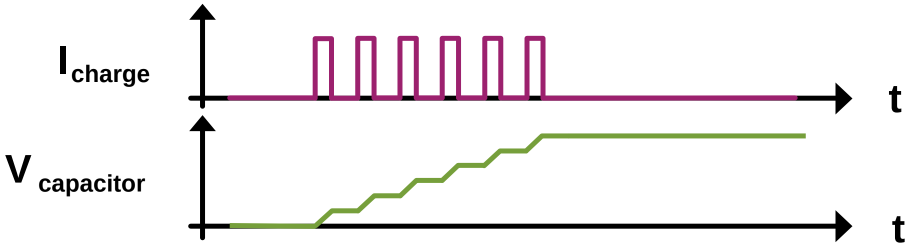
Pre-charging with power resistor





Pre-charging with Dual Gate MOSFET

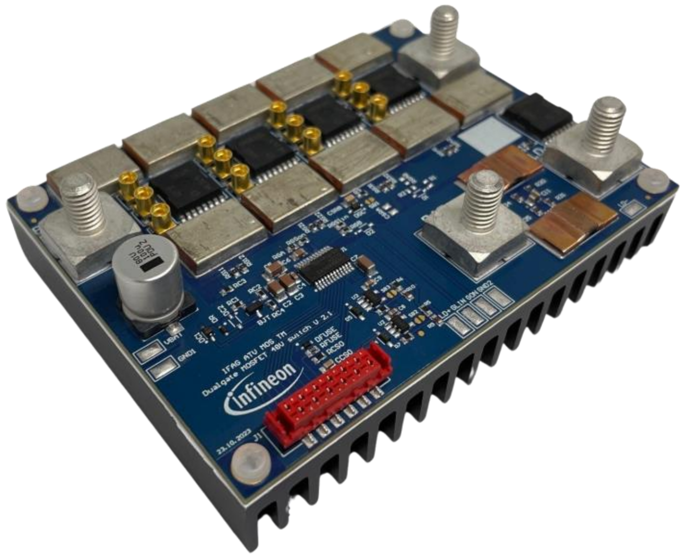




Dual Gate MOSFET 80 V
48 V switch board (uni-directional)

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 mΩ
  - 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 for more information
Click here

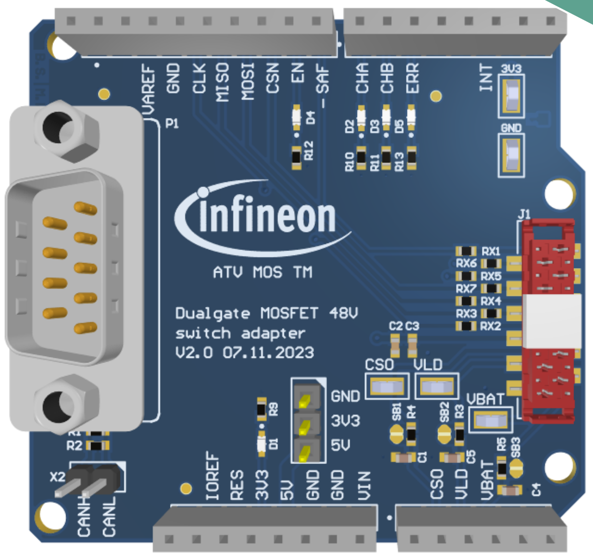
Dual Gate MOSFET 80 V
48 V switch board (uni-directional) overview

2 channel 48V high-side driver IC 2ED4820

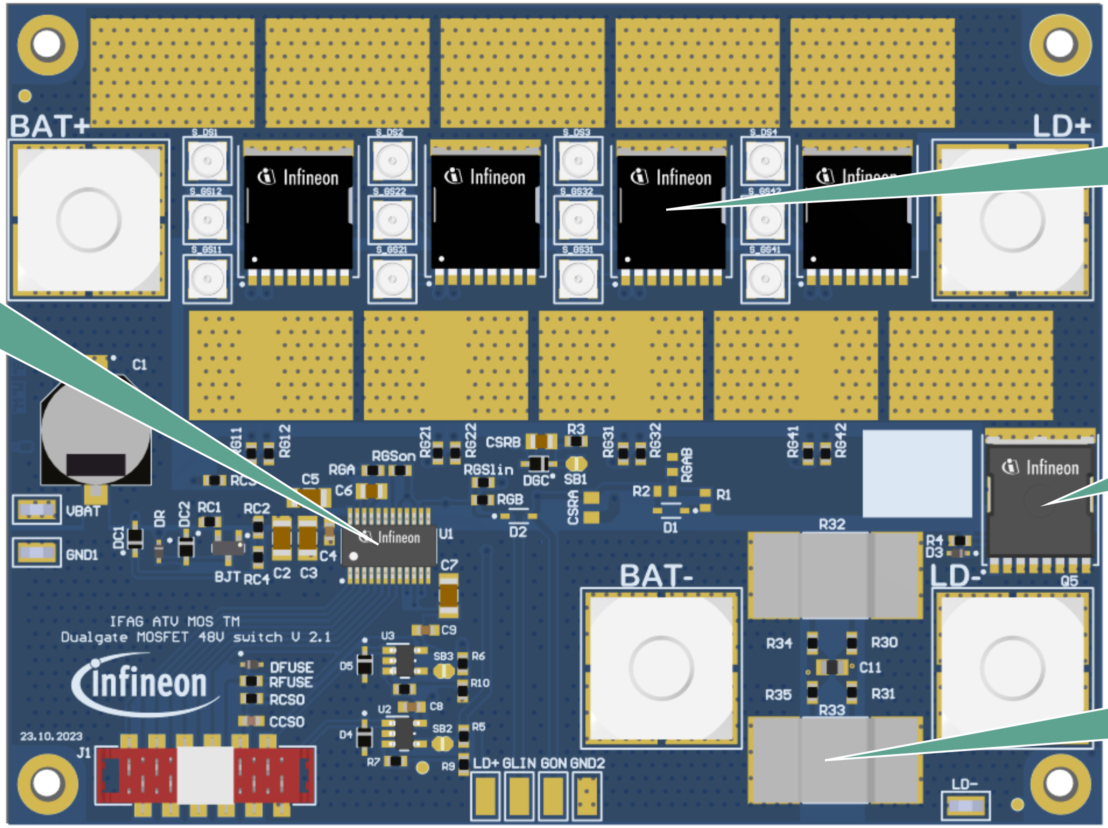
4 parallel IAUTN08S5N012L max. 1.15 mΩ each

Freewheeling MOSFET IAUT300N08S5N012

Shunts 100 µΩ (each)

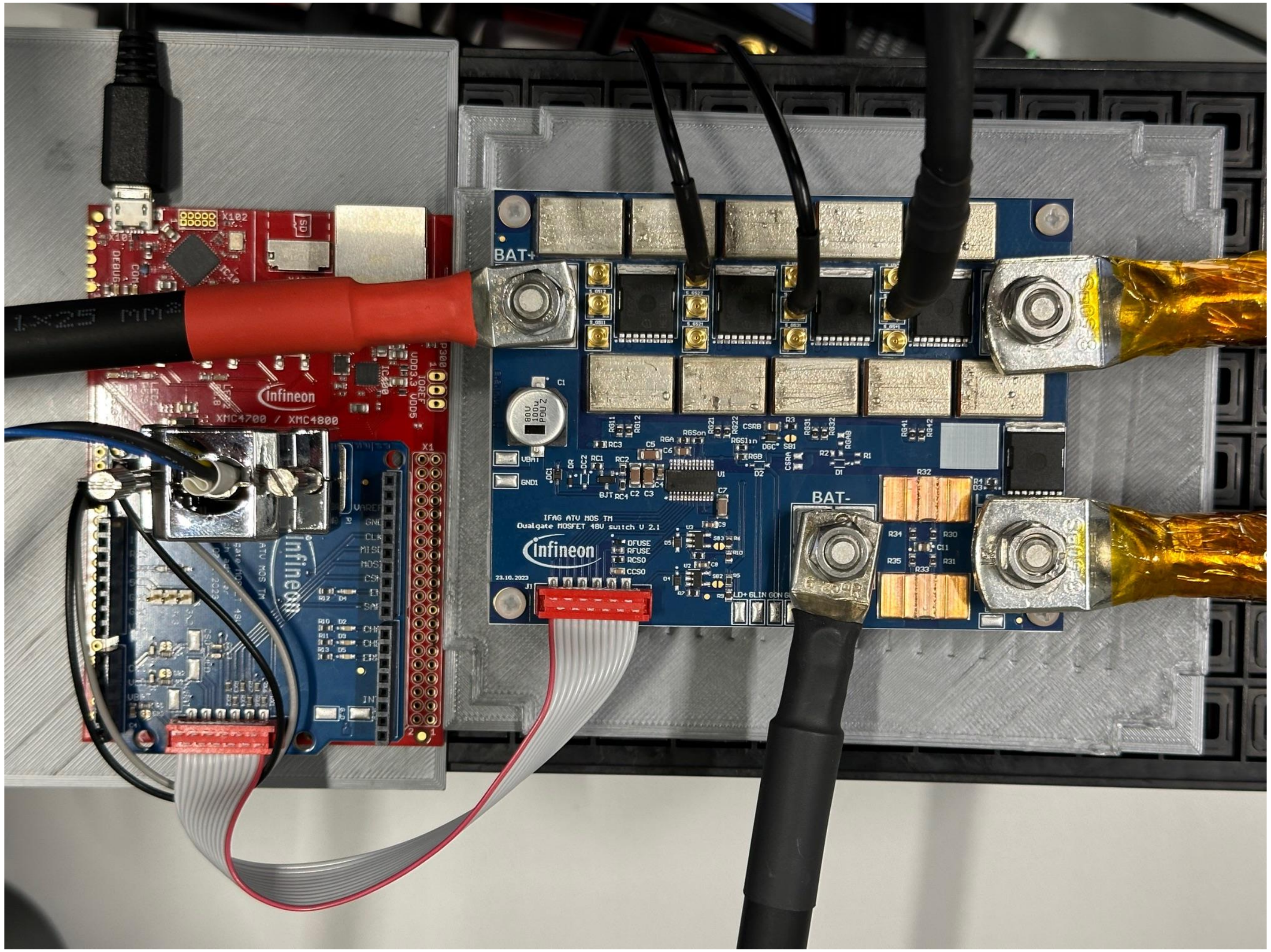


Adapter Board



Main Board

Board description
48 V Dual Gate MOSFET disconnect switch board with µC control



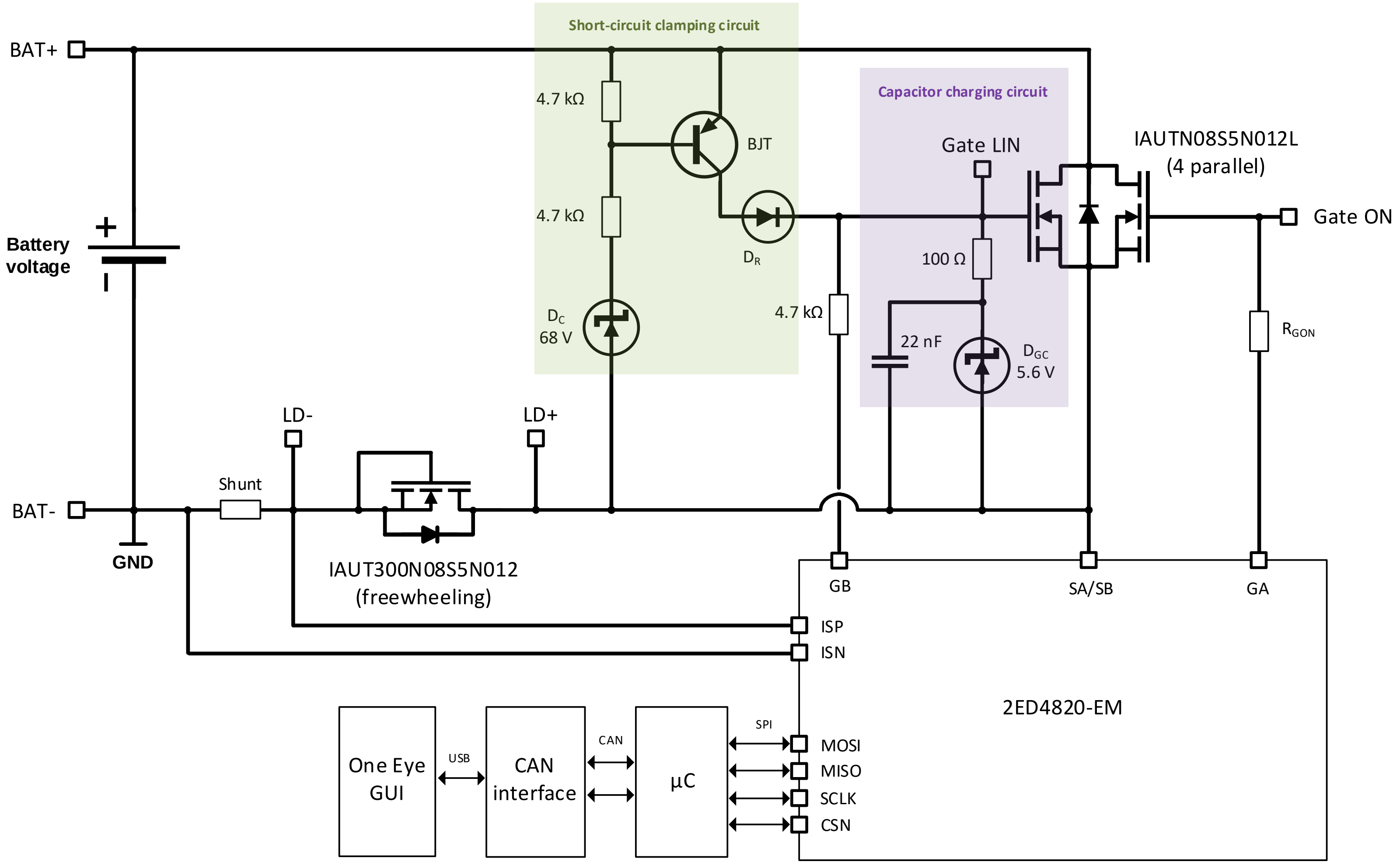
Simplified schematic Dual Gate 48V switch board

Clamping circuit

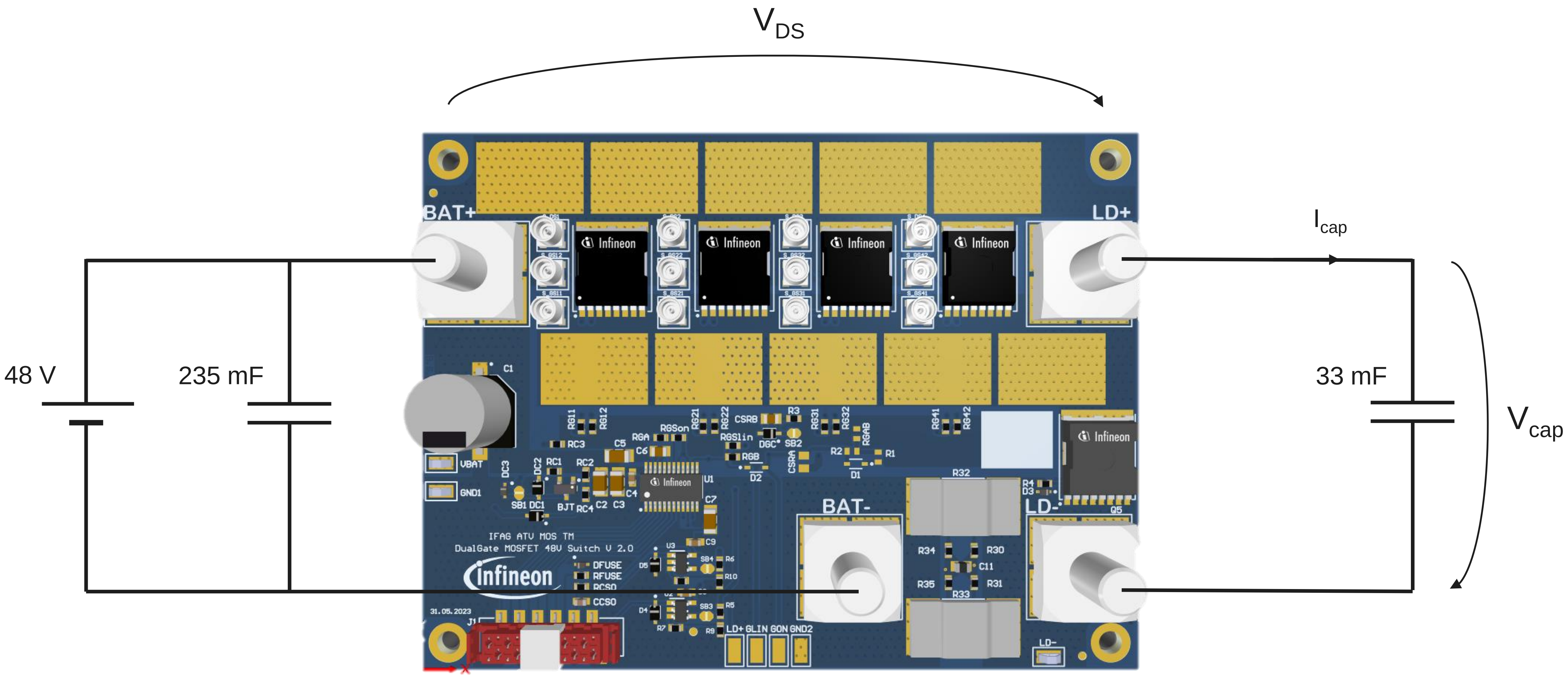
- Zener diode D_C to limit V_{DS} to 68 V
- BJT circuit for optimized clamping speed and high V_{DS} clamp accuracy: $V_{DS,clamp} \approx V_{DC}$
- Reverse diode D_R to avoid reverse currents

Capacitor charging circuit

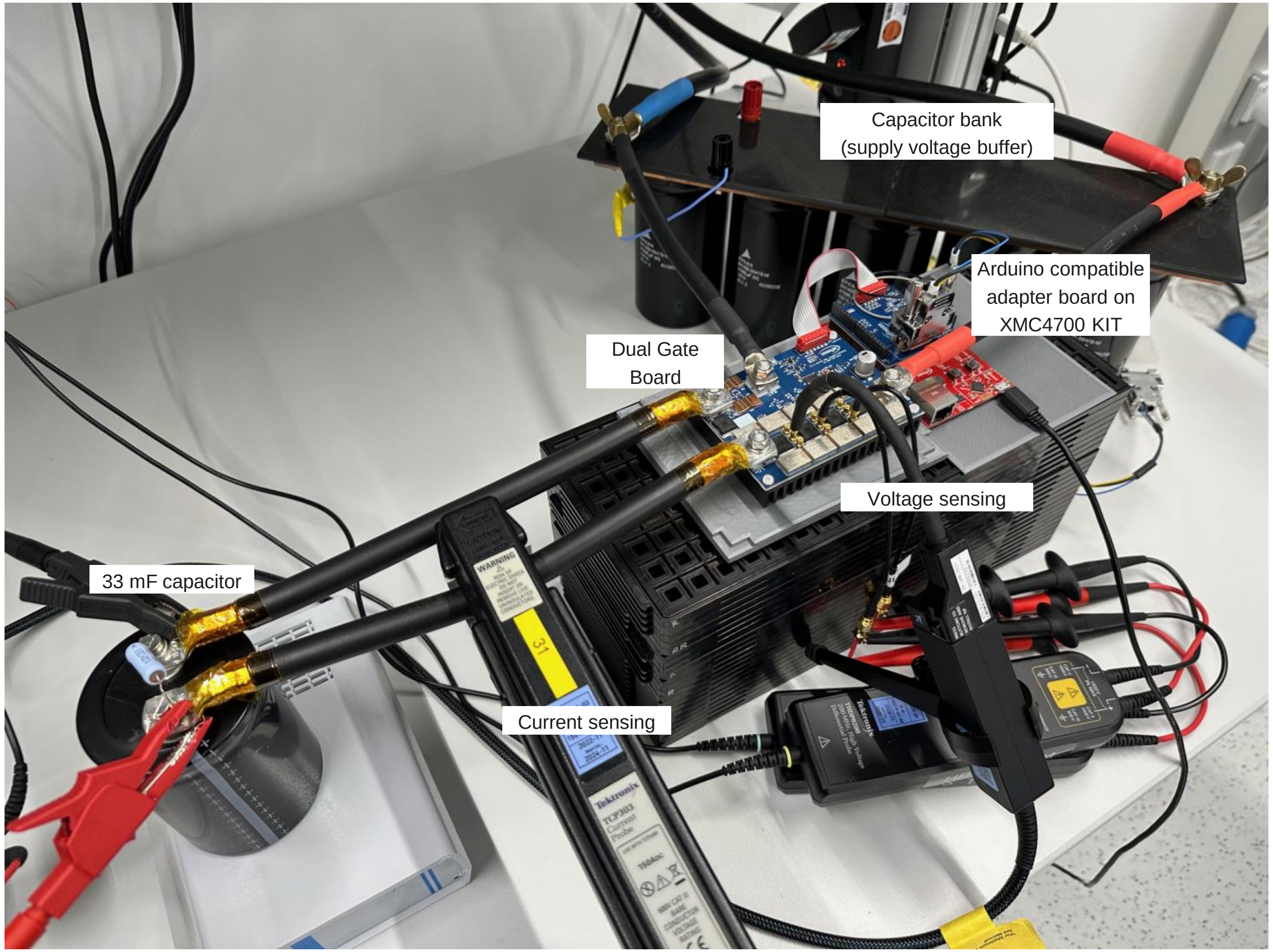
- Gate voltage limited by Zener diode D_{GC} 5.6 V to limit in-rush current
- 22 nF for slow switching
- 100 Ω resistance to decouple the capacitor charging circuit from the clamping circuit



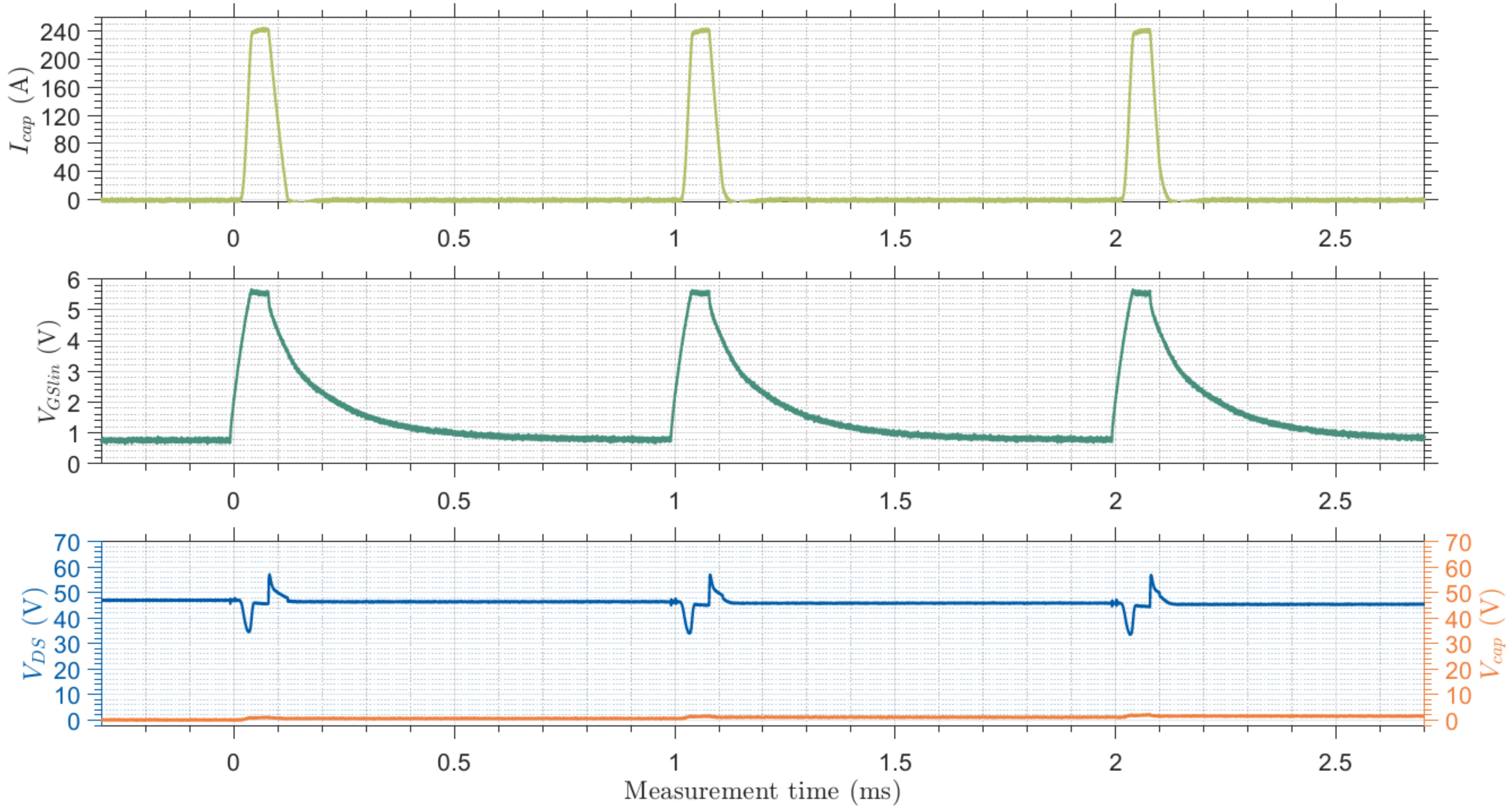
Capacitor charging setup – simplified schematic



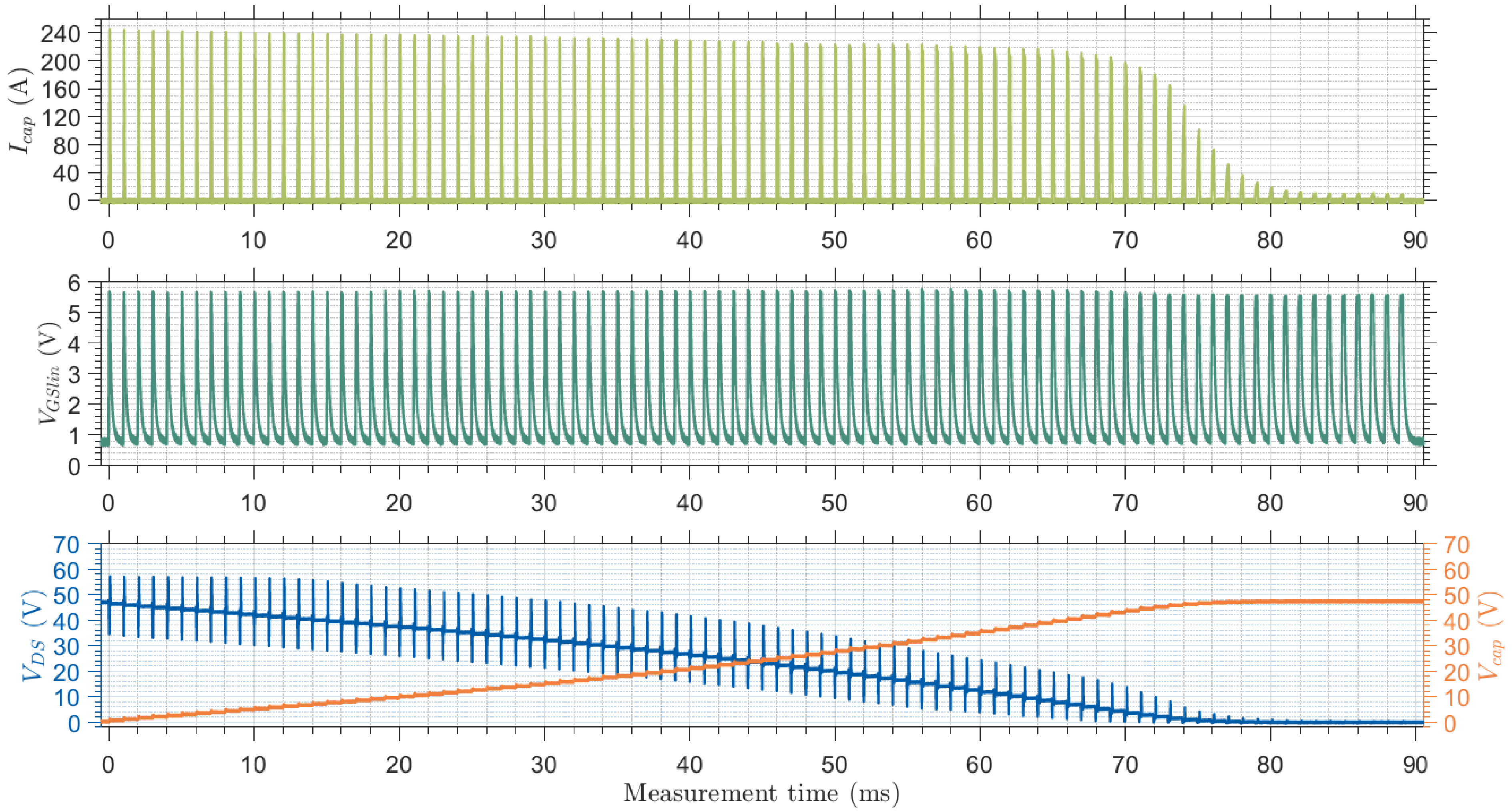
Capacitor charging setup



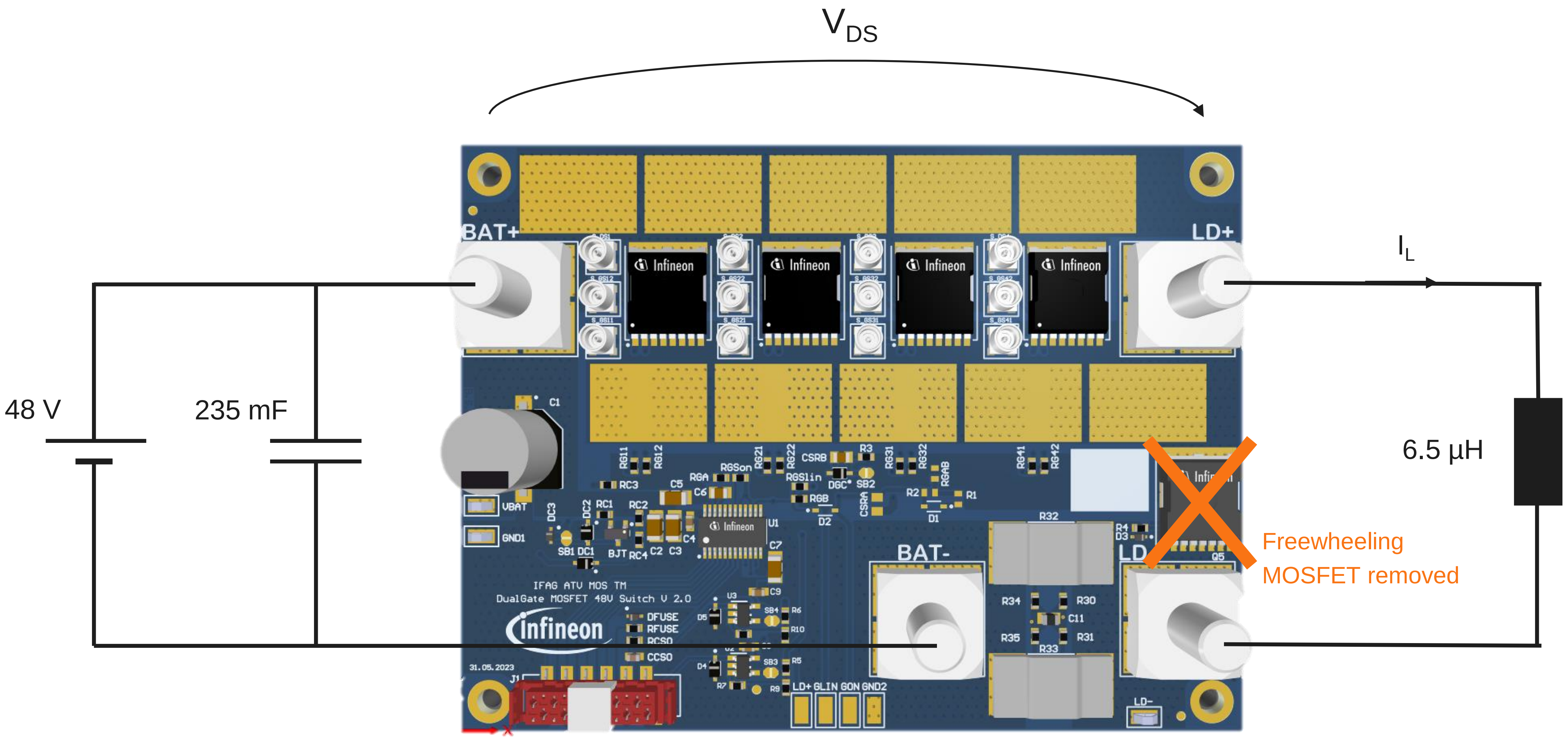
Capacitor charging – waveforms, first three pulses



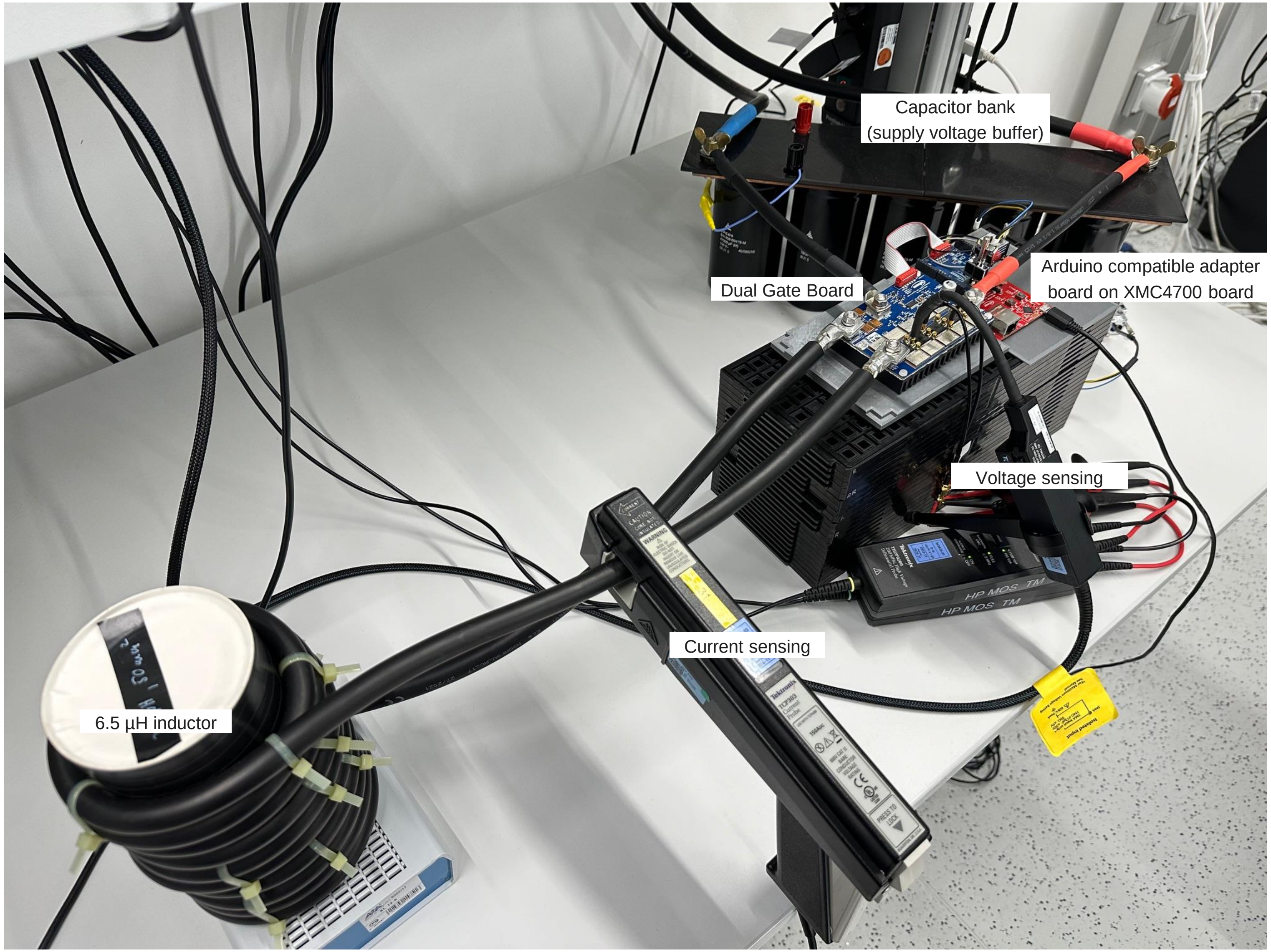
Capacitor charging – waveforms, all pulses



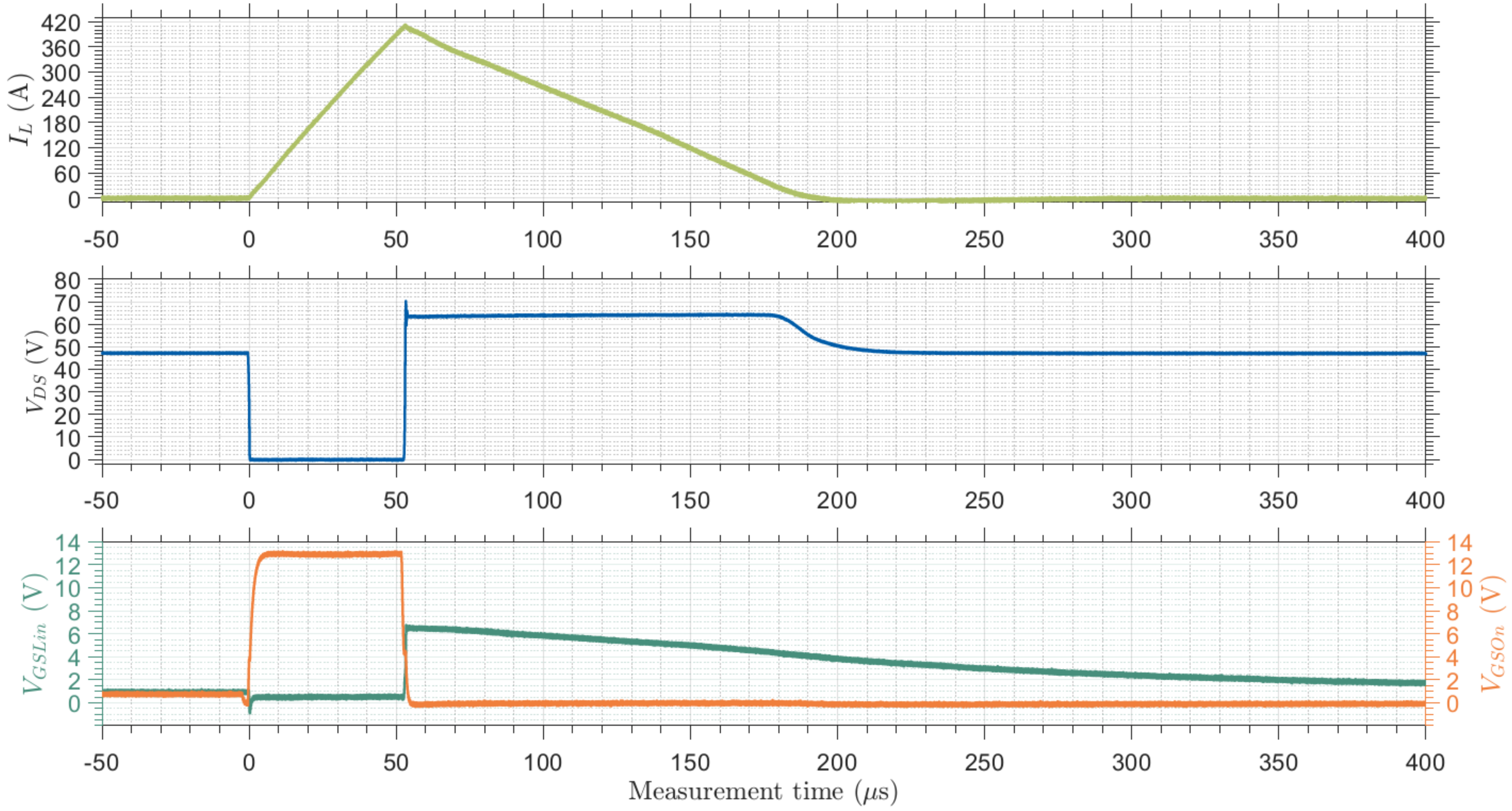
Short-circuit clamping setup – simplified schematic



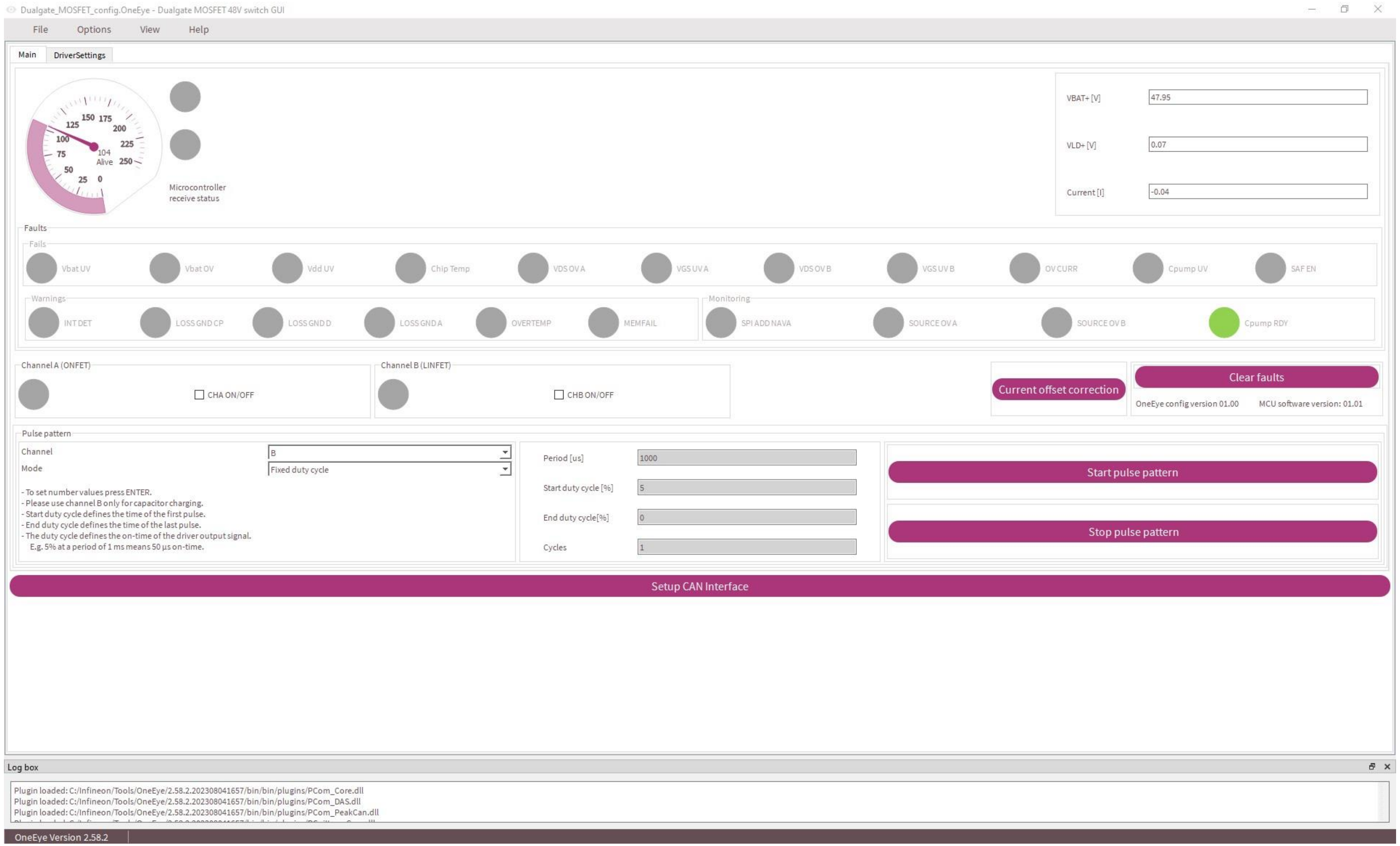
Short-circuit clamping setup



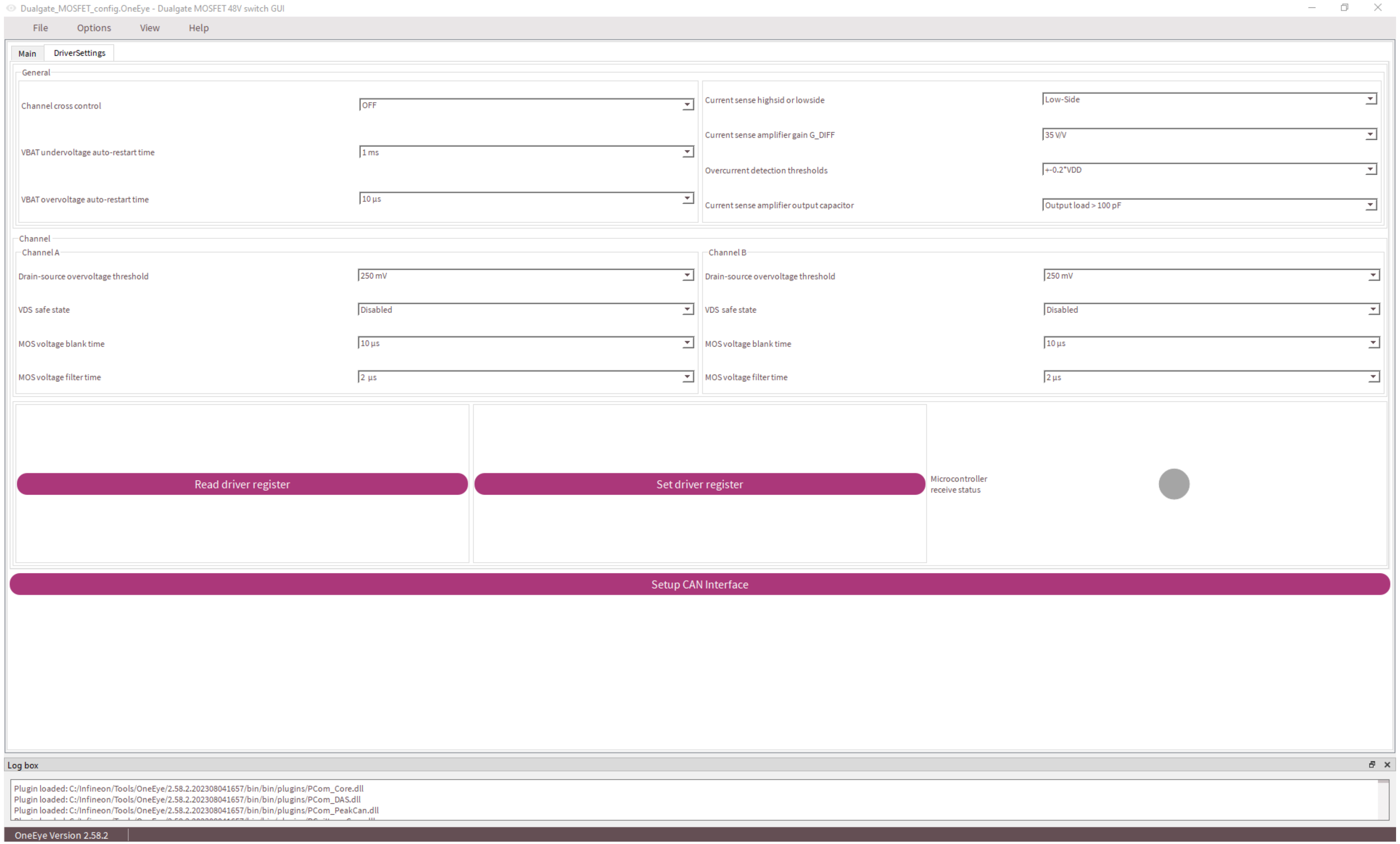
Short-circuit clamping setup – waveforms



OneEye control suite – Dual Gate MOSFET part 1



OneEye control suite – Dual Gate MOSFET part 2



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