



Dual Gate MOSFET 48 V switch board

Quick introduction

IFAG ATV MOS
25.01.2024



SOA and RDS_{ON} comparison

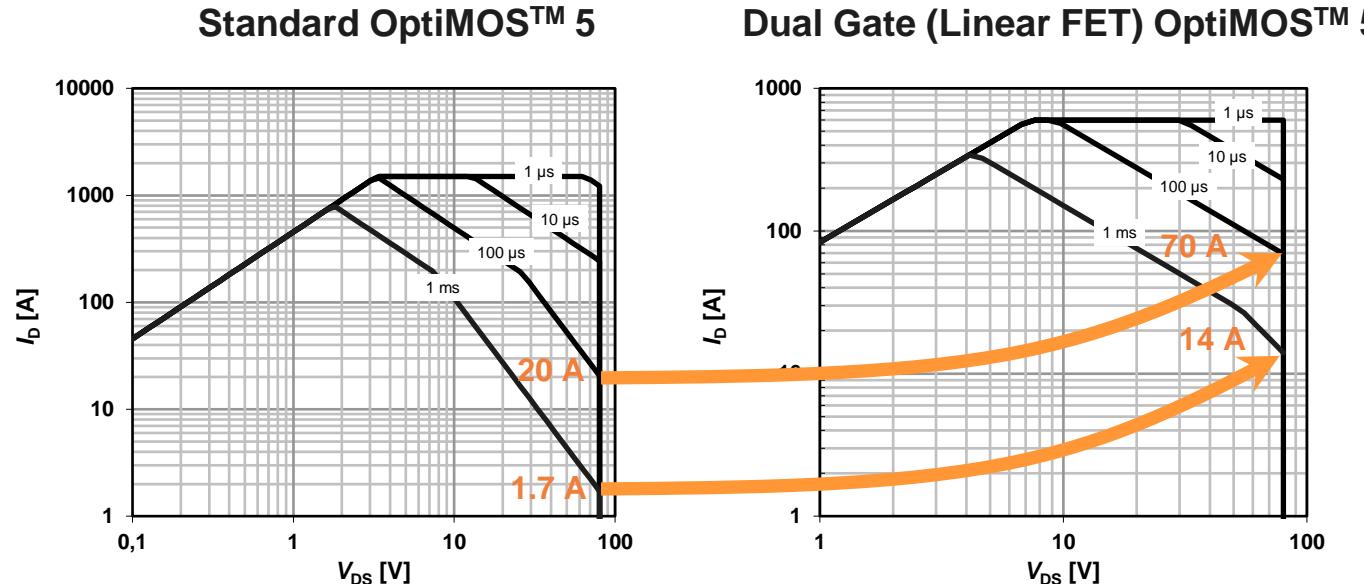
Dualgate trench vs. Standard trench vs. Planar



	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} , $T_C = 25^\circ\text{C}$	14 A (Linear MOSFET)	1.7 A	14 A
R_{DSON} at $V_{GS} = 10 \text{ V}$, $T_J = 25^\circ\text{C}$	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



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

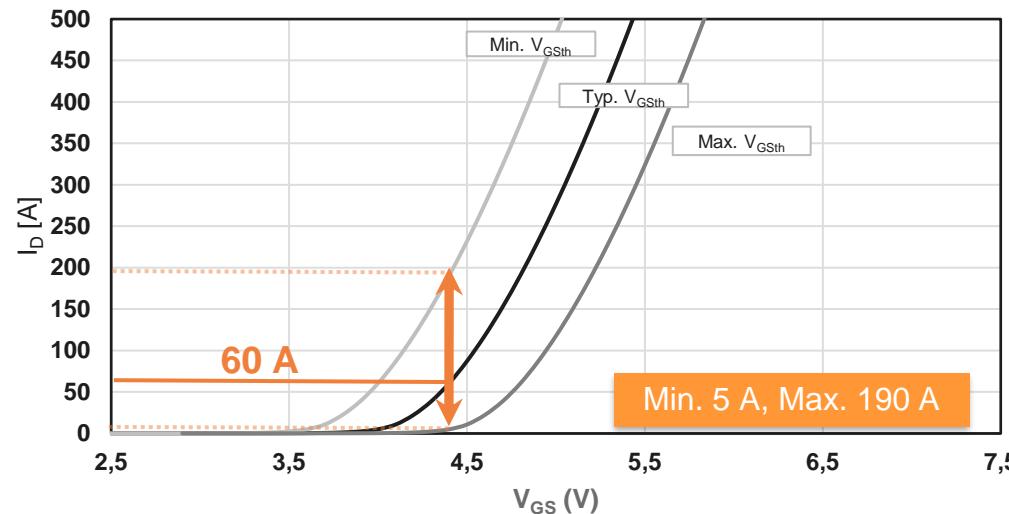
Enabling new applications as e.g. in-rush current limitation, short circuit clamping and slow switching

Transfercharacteristics comparison

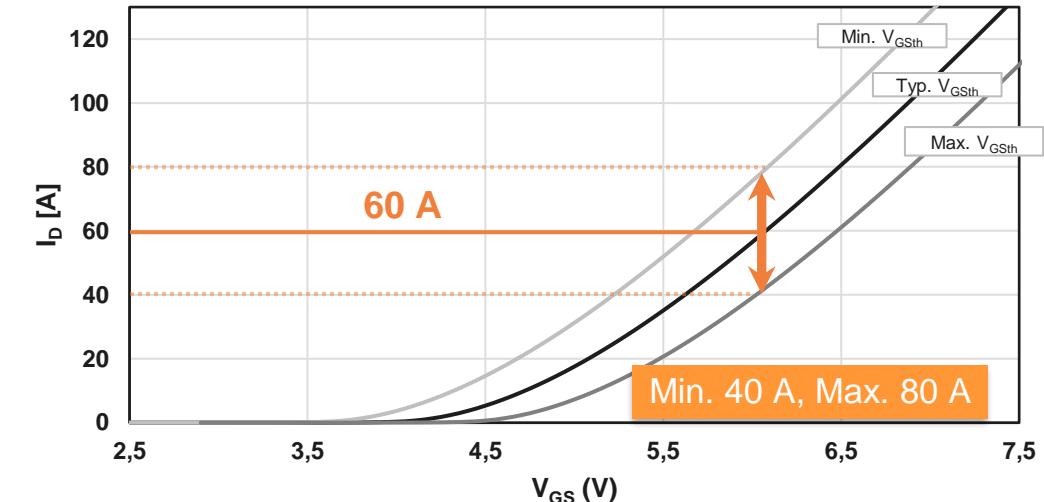
Standard OptiMOS™ 5 vs. Dualgate Linear FET OptiMOS™ 5



Standard OptiMOS™ 5



Dual Gate (Linear FET) OptiMOS™ 5



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

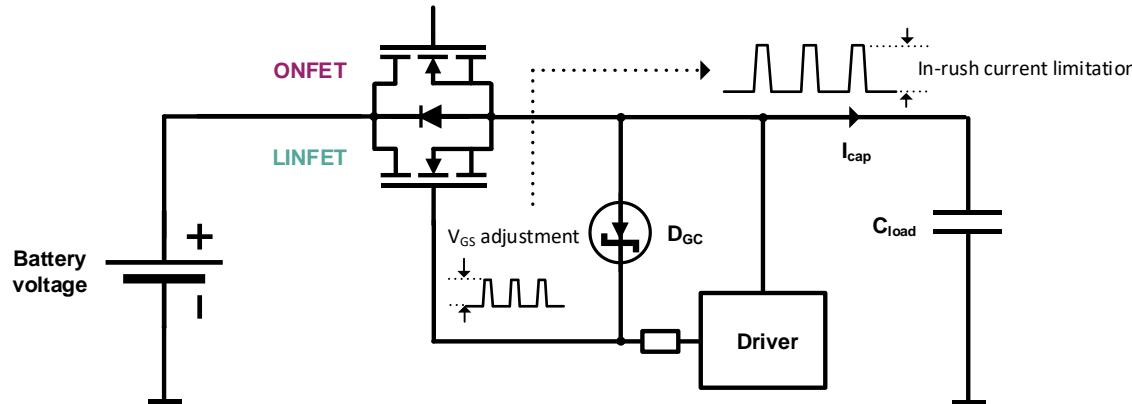
Enabling paralleling in linear mode operation

Dual Gate MOSFET 80 V

Application examples

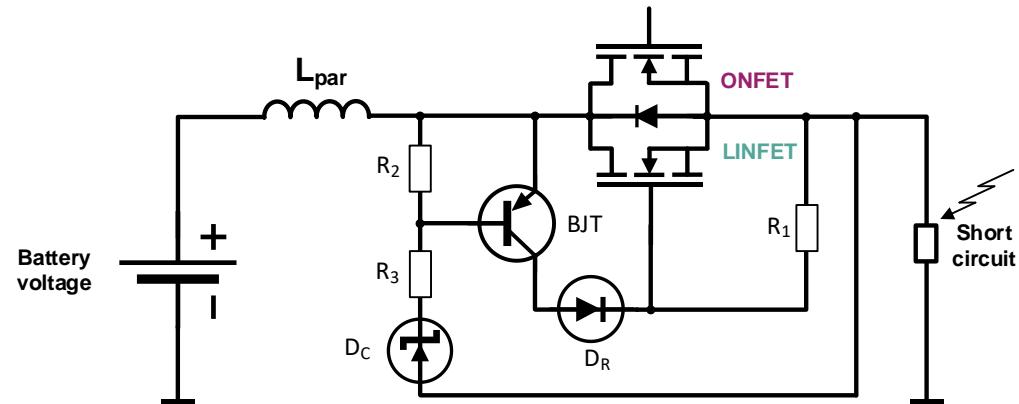
Capacitor charging

- 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.

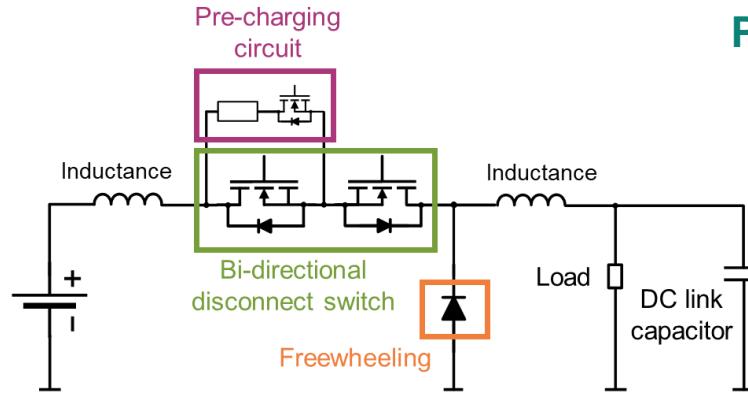


Short circuit clamping

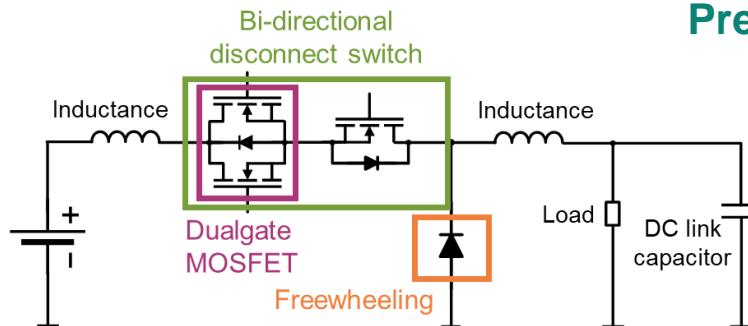
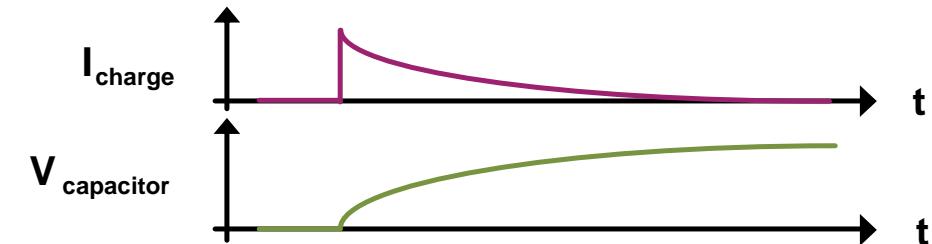
- D_C limits the V_{DS} voltage to avoid avalanche (no hot carrier injection). Instead the MOSFET operates in linear mode to dissipate inductor energy.
- LINFET allows higher currents in linear mode and gives more flexibility for clamping circuit design.
- ONFET can be turned on to minimize steady state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



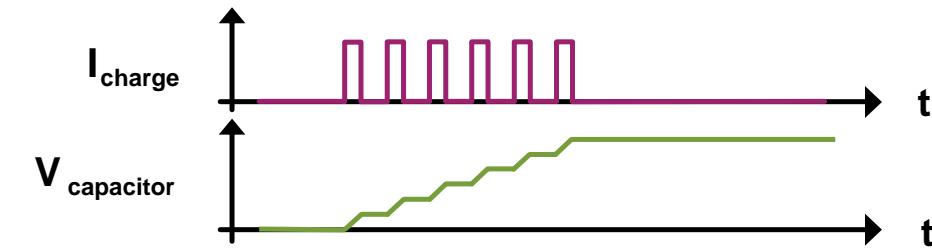
Reduction of system cost (no pre-charge circuit needed) and acceleration of capacitor charging



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)

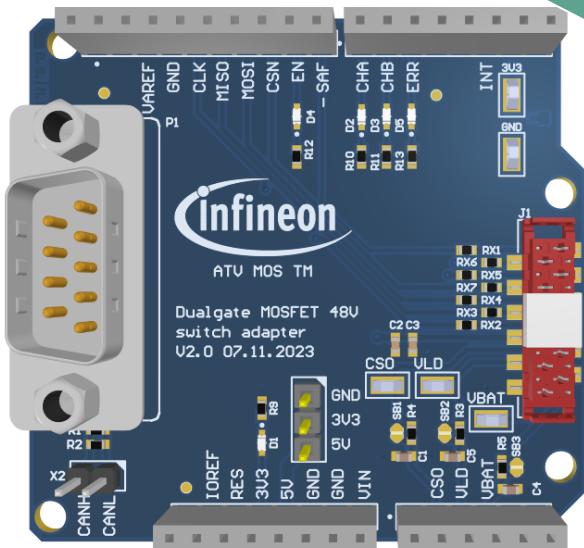
Part number: DG_48V_SWITCH_KIT

Contact your Infineon salesperson for support

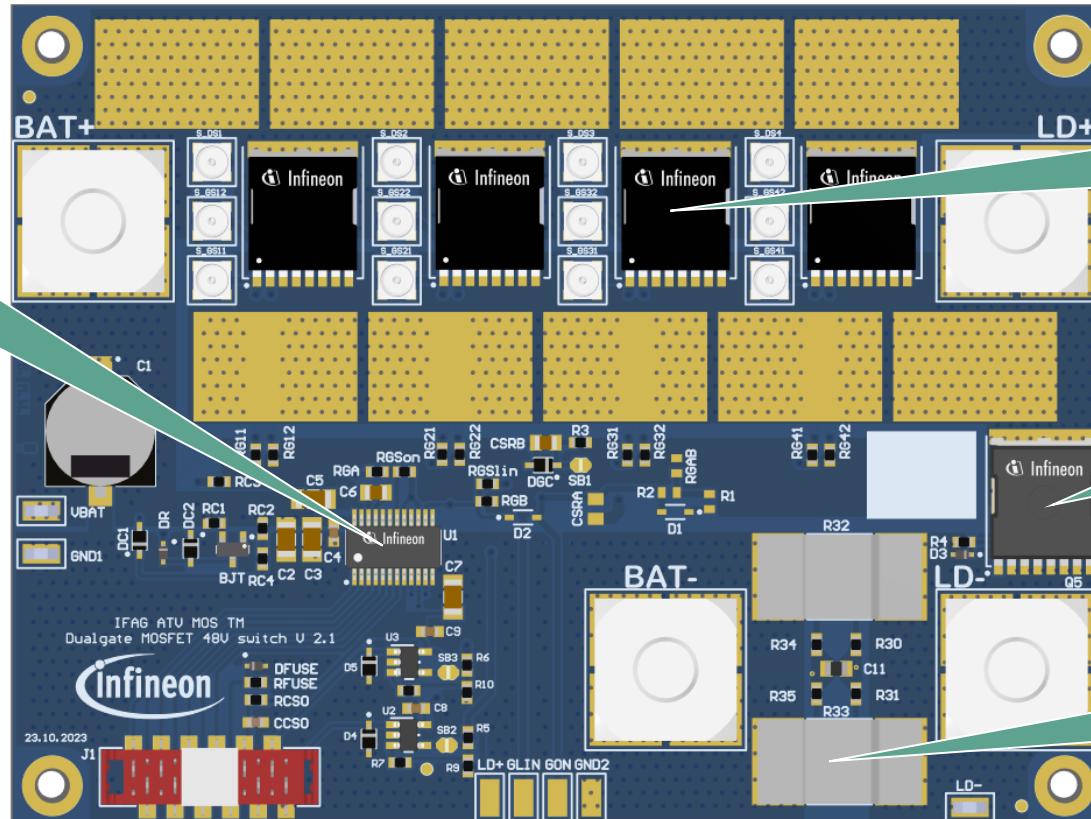
Check out infineon.com for more information

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



Adapter Board



Main Board

2 channel 48V high-side
driver IC 2ED4820

4 parallel IAUTN08S5N012L
max. 1.15 mΩ each

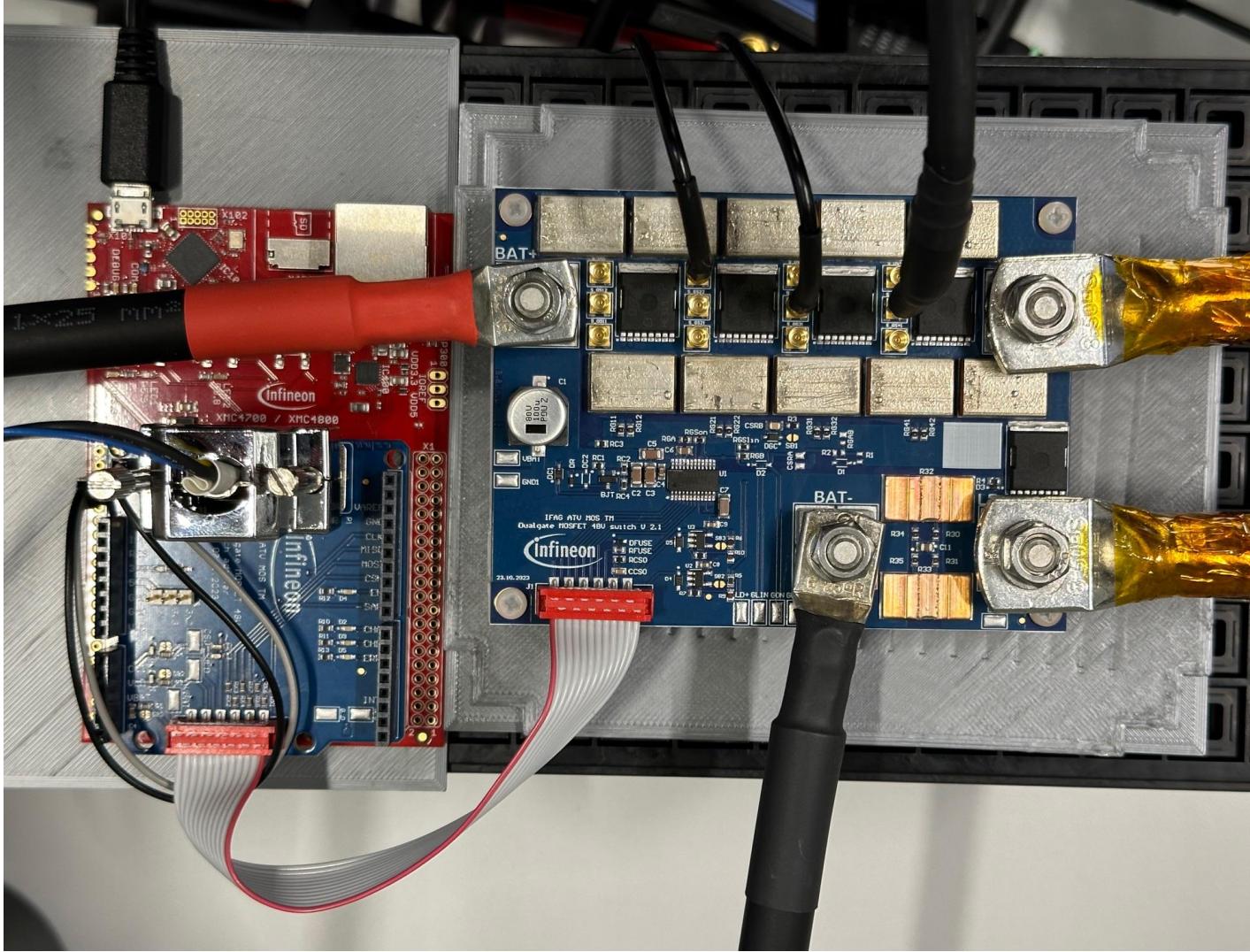
Freewheeling MOSFET

IAUT300N08S5N012

Shunts 100 $\mu\Omega$ (each)

Board description

48 V Dual Gate MOSFET disconnect switch board with µC control



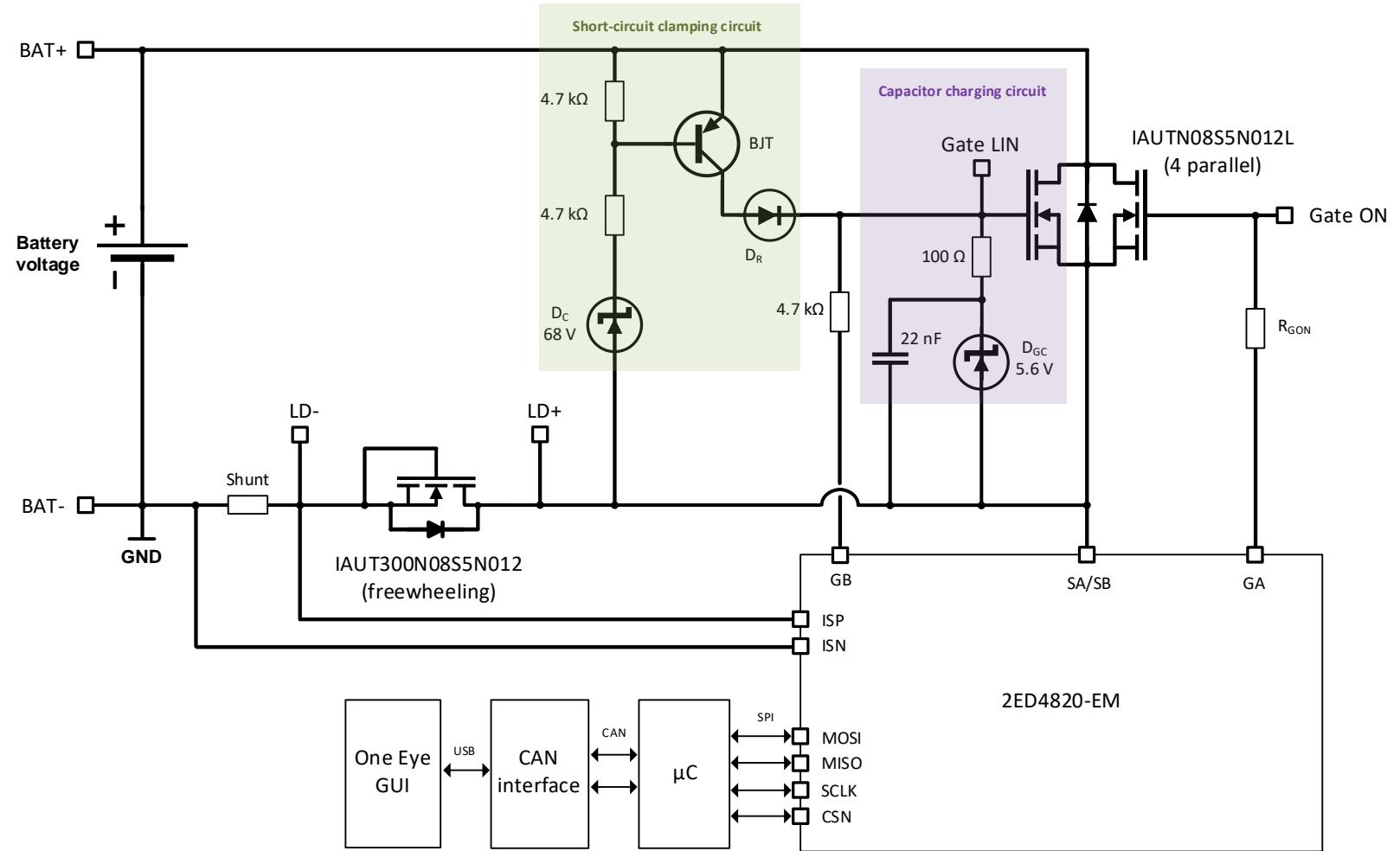
Simplified schematic Dual Gate 48V switch board

Clamping circuit

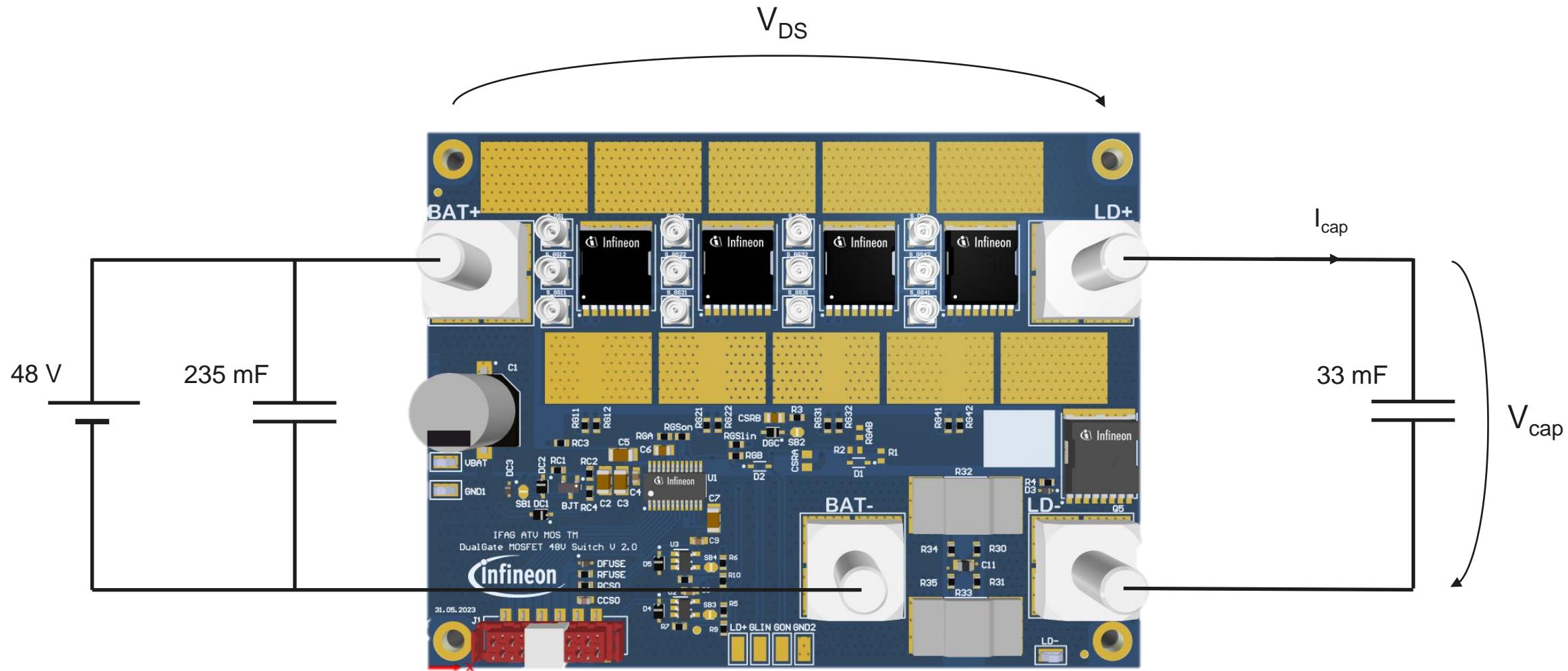
- Zener diode D_C to limit V_{DS} to 68 V
- BJT circuit for optimized clamping speed and high V_{DS} clamp accuracy:
 $V_{DS,clamp} \approx V_{DC}$
- Reverse diode D_R to avoid reverse currents

Capacitor charging circuit

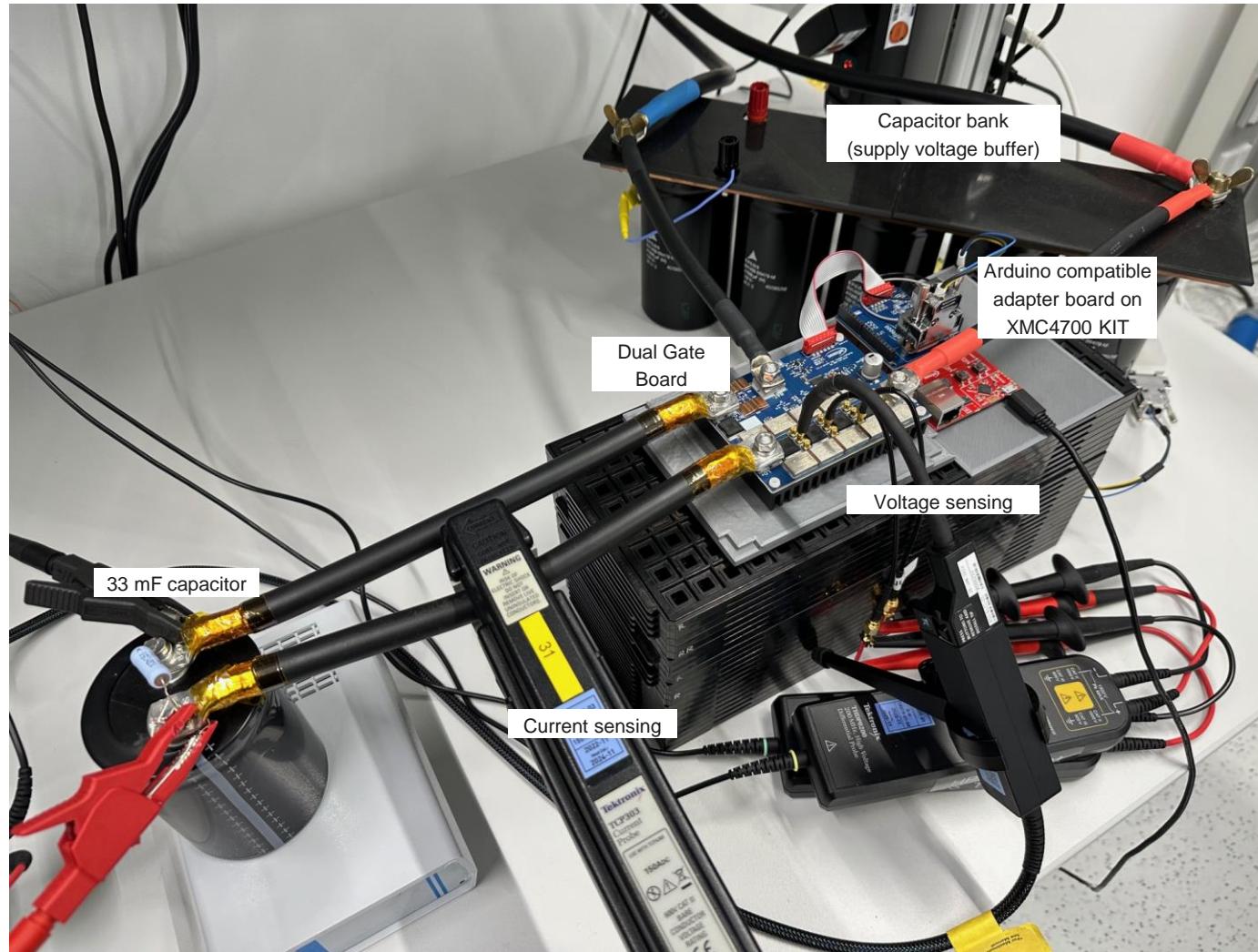
- Gate voltage limited by Zener diode D_{GC} 5.6 V to limit in-rush current
- 22 nF for slow switching
- 100 Ω resistance to decouple the capacitor charging circuit from the clamping circuit



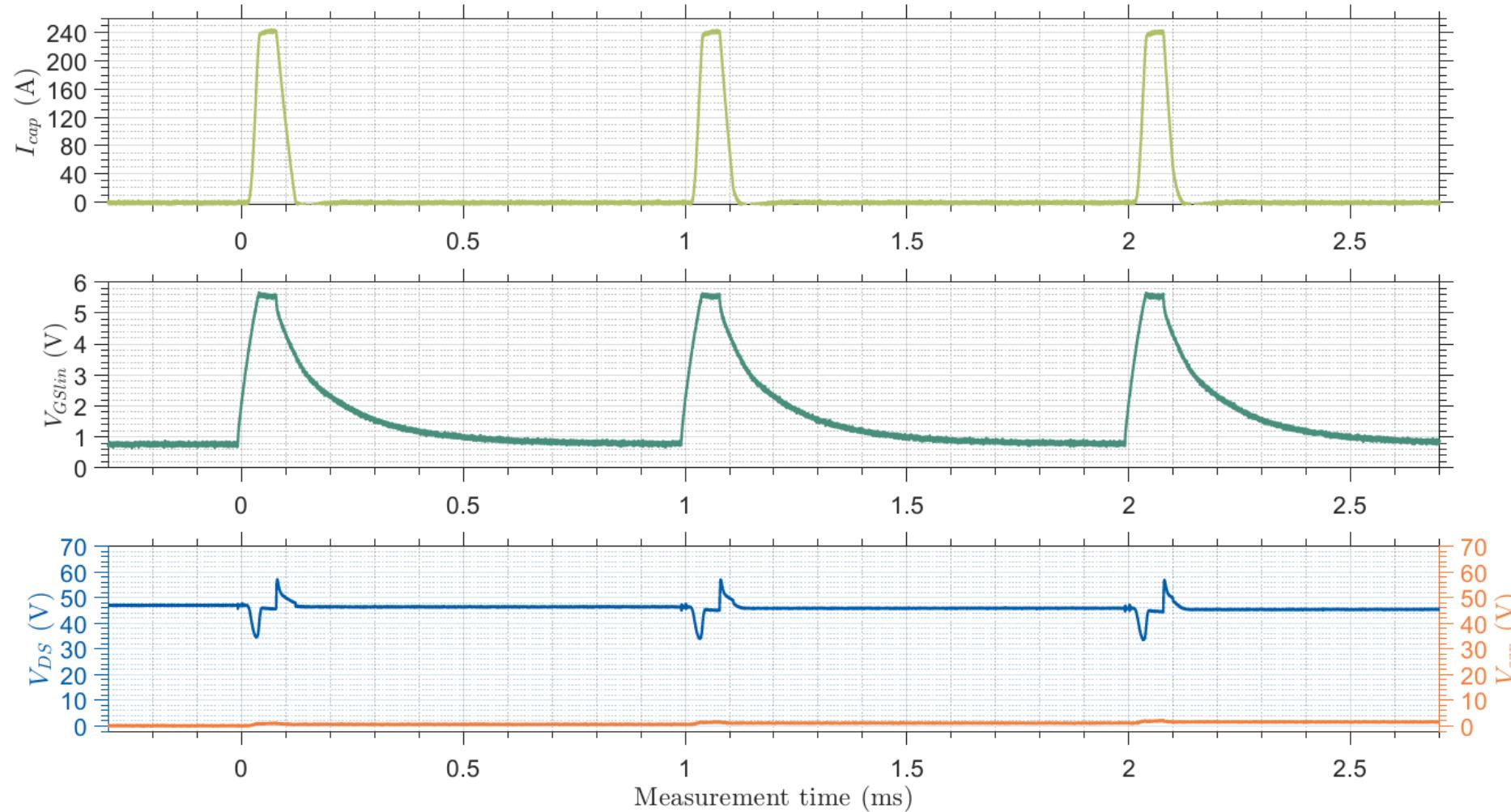
Capacitor charging setup – simplified schematic



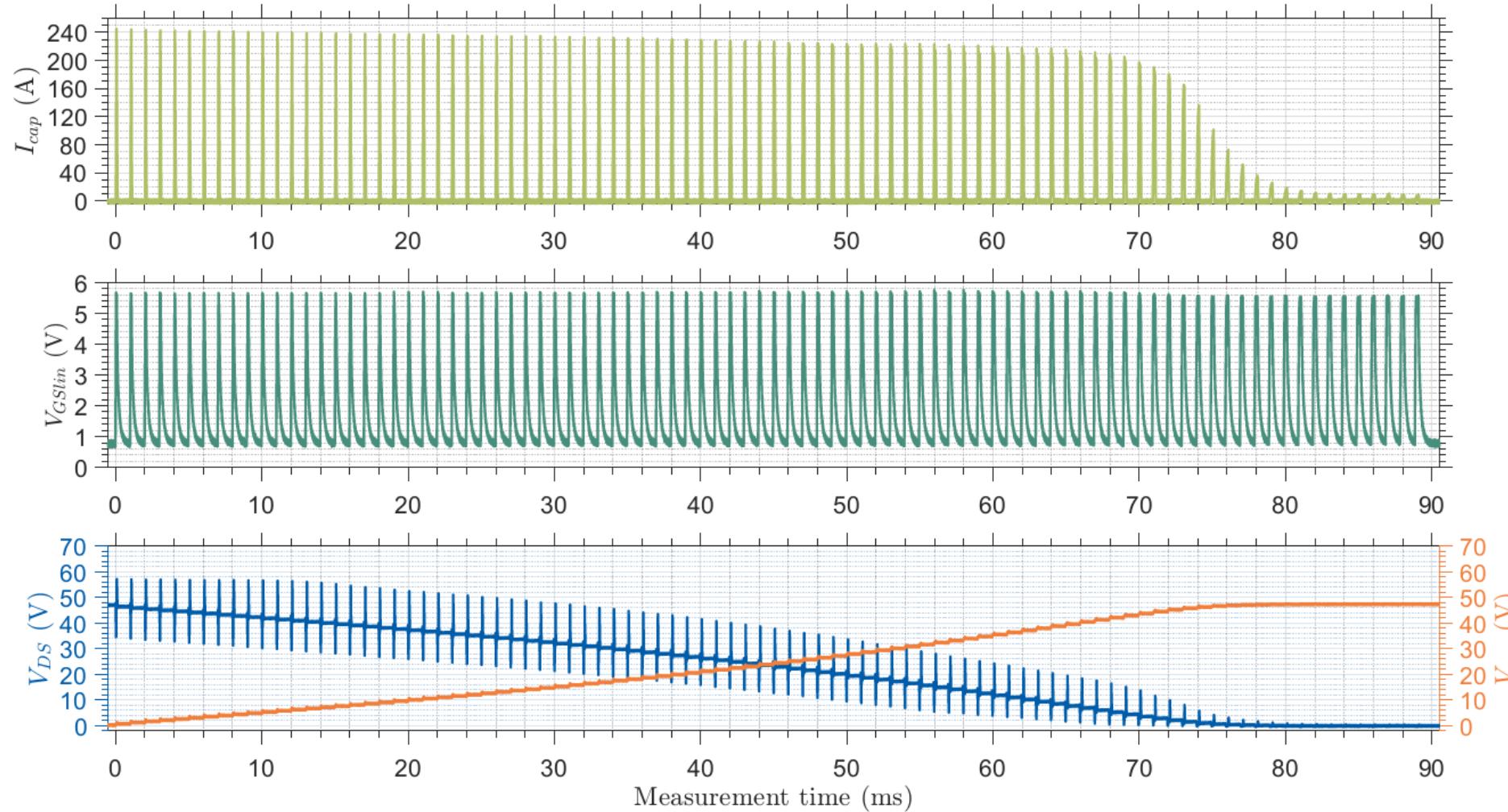
Capacitor charging setup



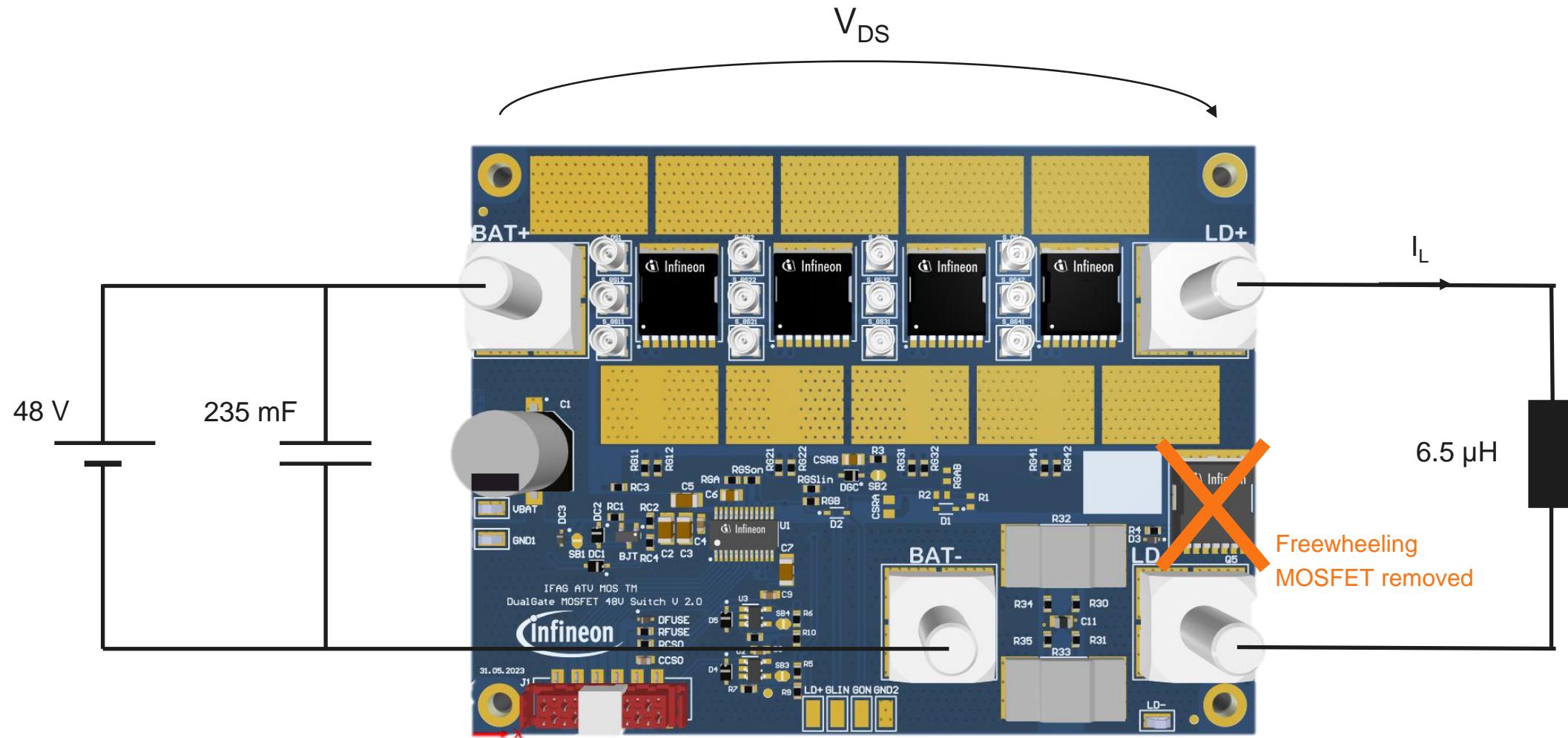
Capacitor charging – waveforms, first three pulses



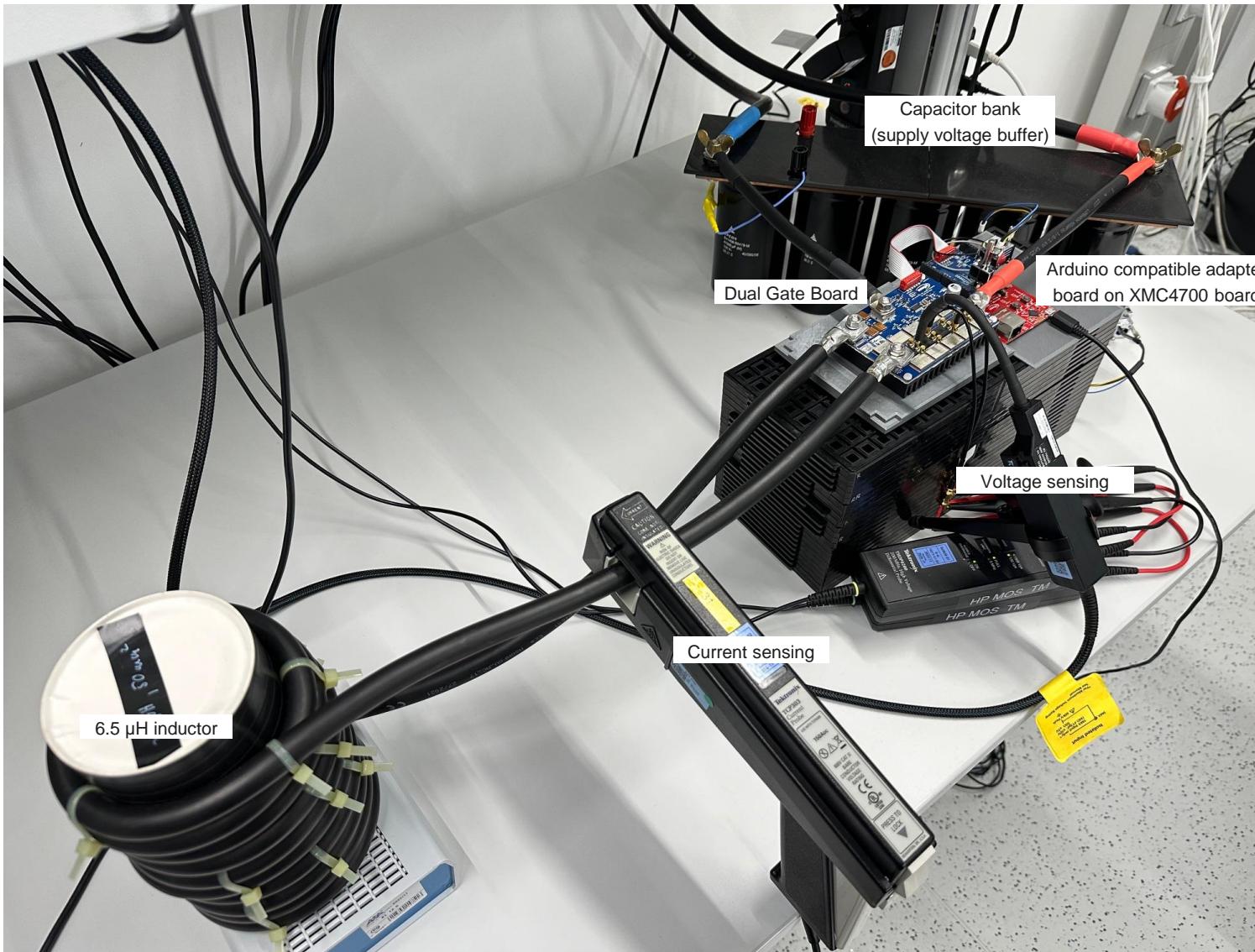
Capacitor charging – waveforms, all pulses



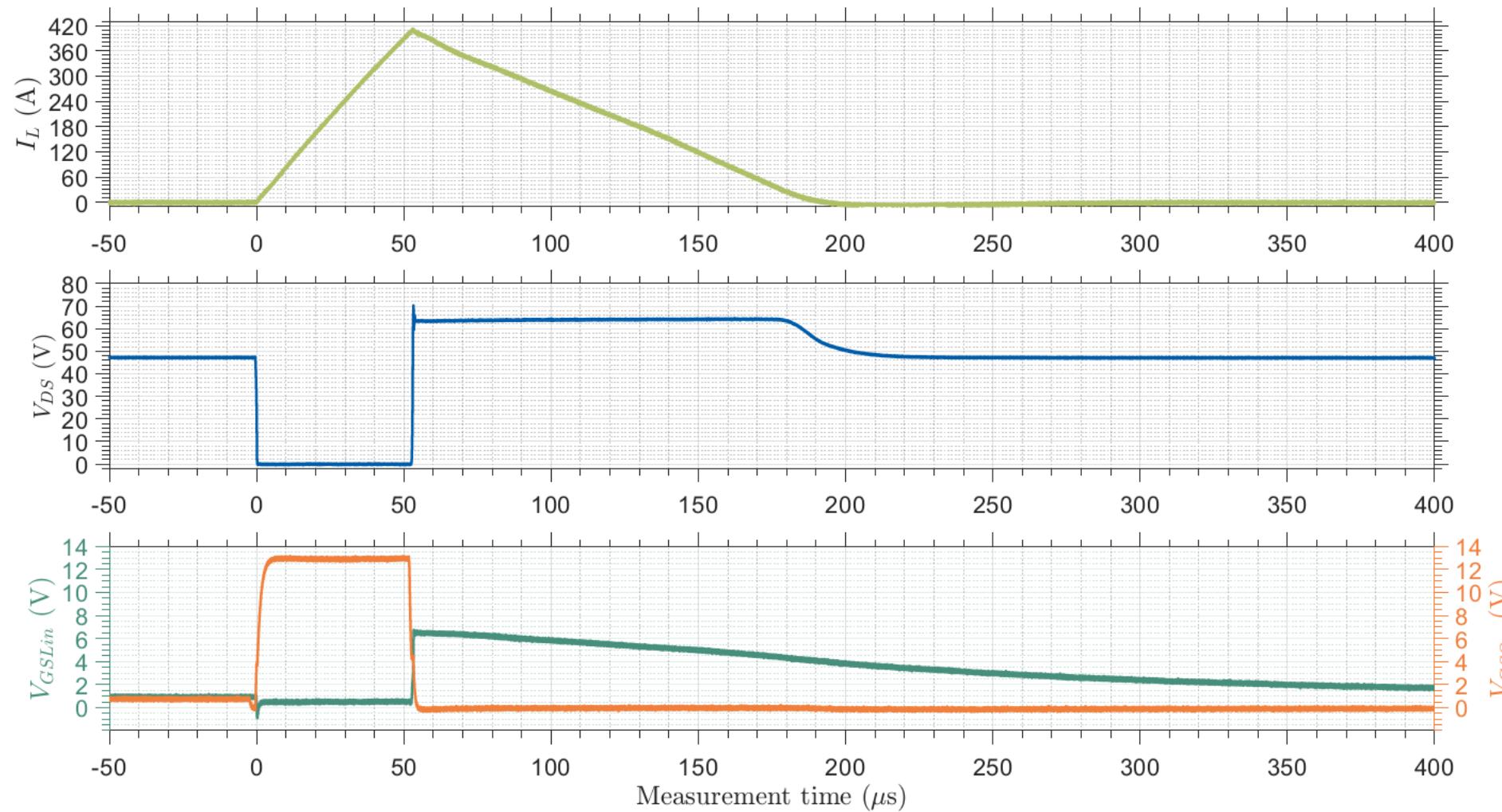
Short-circuit clamping setup – simplified schematic



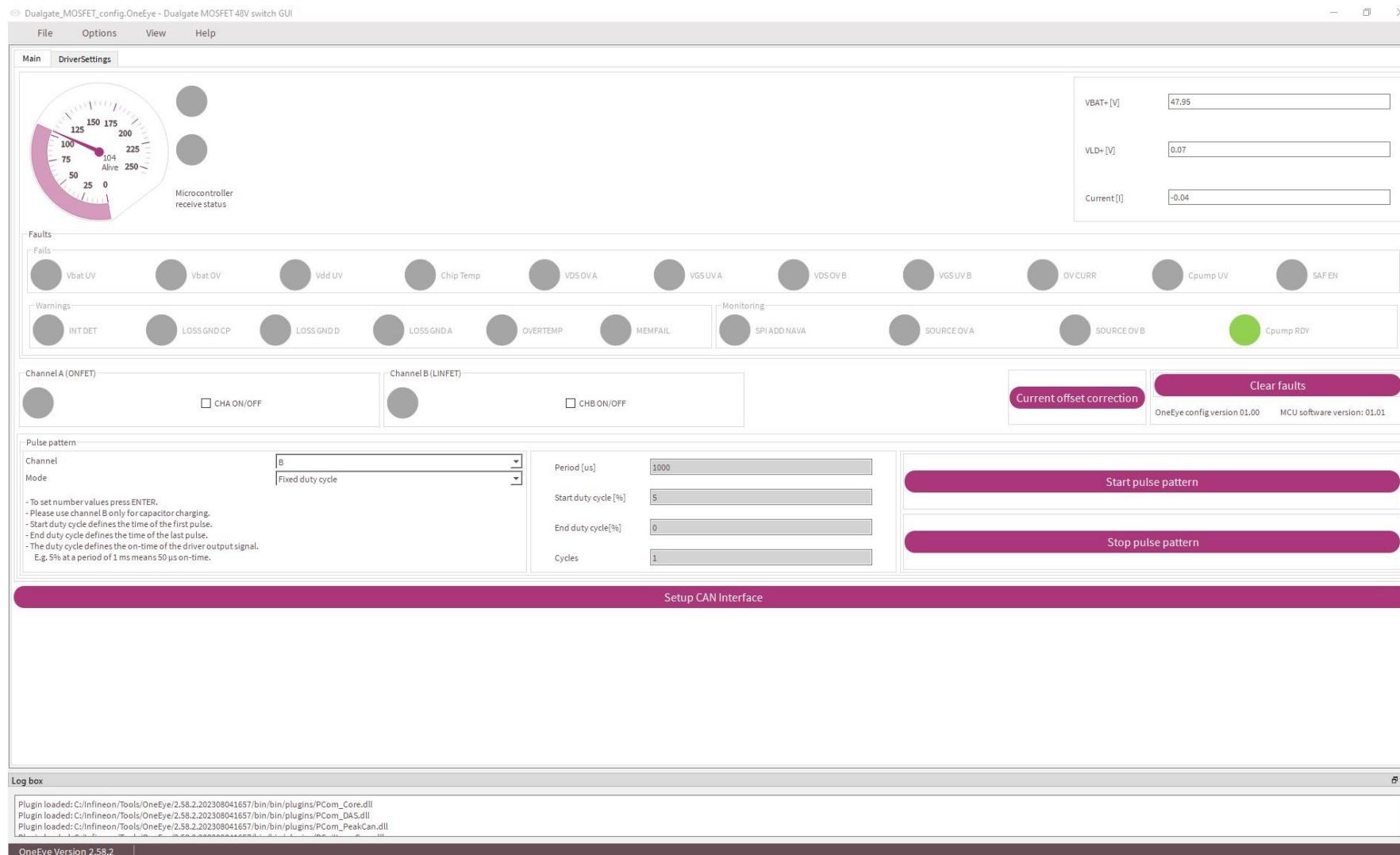
Short-circuit clamping setup



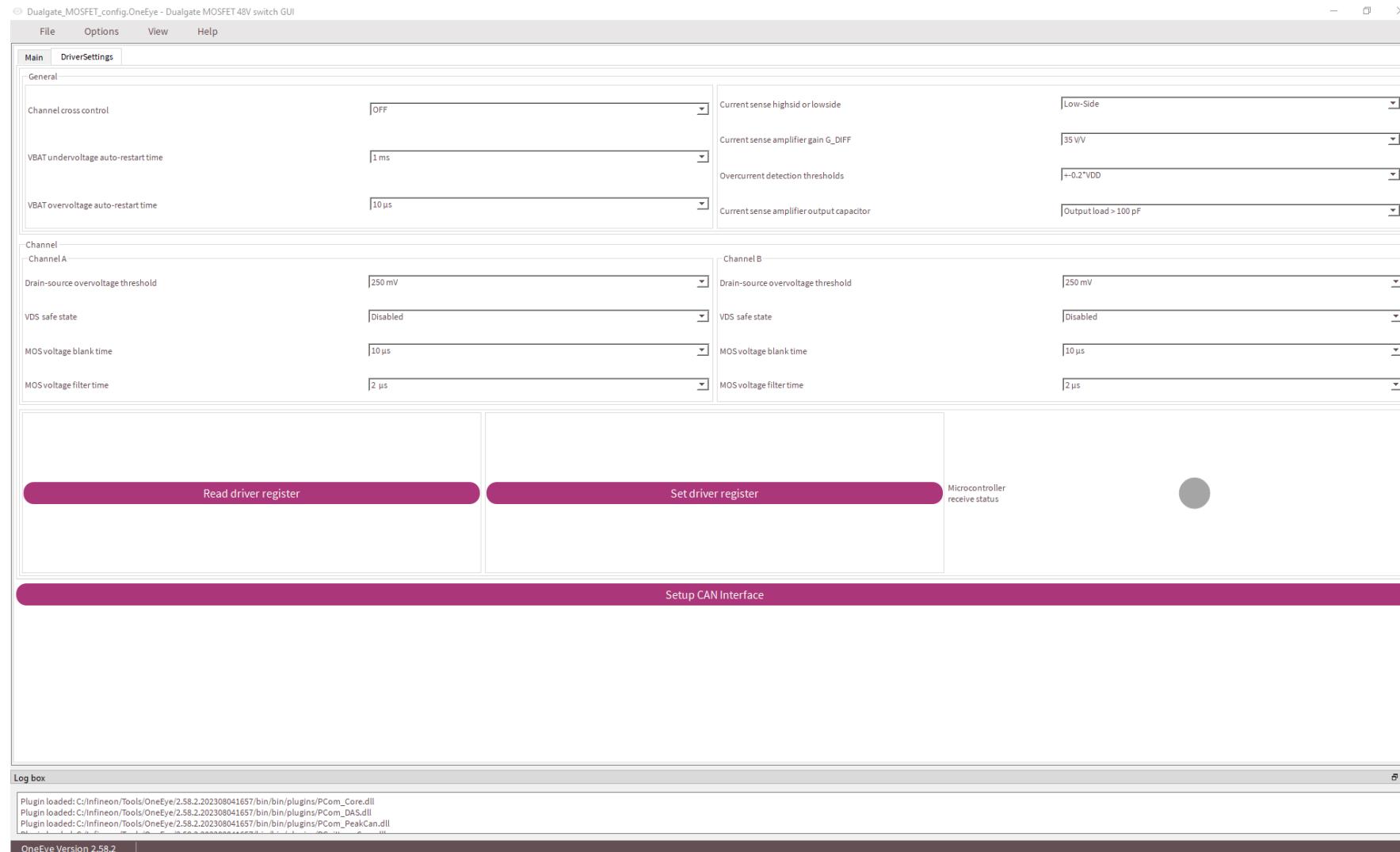
Short-circuit clamping setup – waveforms



OneEye control suite – Dual Gate MOSFET part 1



OneEye control suite – Dual Gate MOSFET part 2



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