C-007. DC-DC Buck Converter 2-Phase Vo=250V, Io=40A

ROHM Solution Simulator Schematic Information

2025. Nov.
64UG124E Rev.006

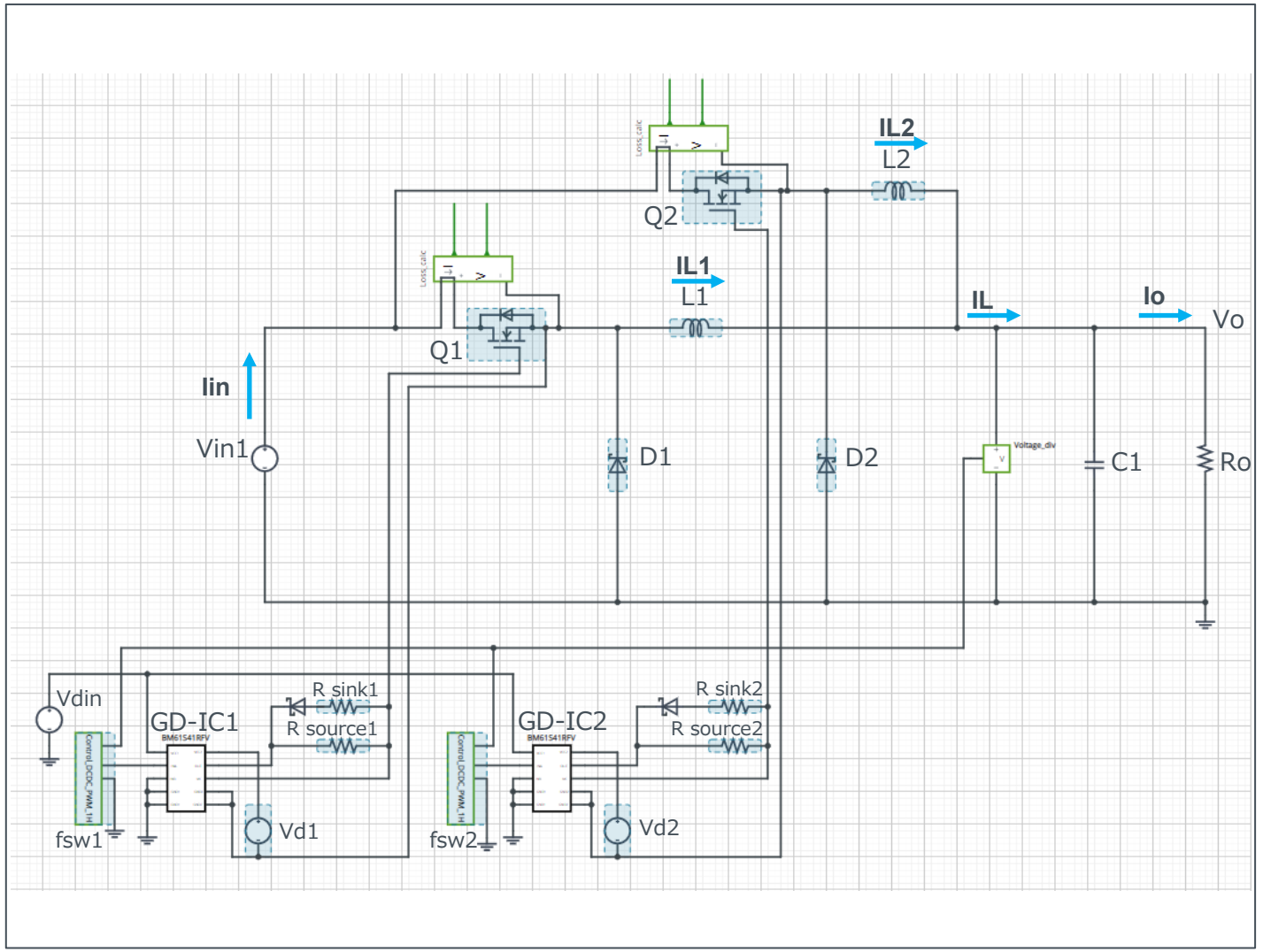
Simulation Parameters

Component name	Component	Default	Simulation Setting Range
Vin1	Input voltage	800Vdc	
Vo	Output voltage	250Vdc	
Io	Output current	40Adc	
fsw1,2	Switching frequency	50kHz	10k – 300kHz
Tj	Temperature	100°C	
Vd1,2	Gate Drive voltage H	18V	10 – 20V
Vdin	Signal voltage level	5V	

Devices

Component Name	Component	Default	Simulation Setting Range
Q1,2	SiC MOSFET SJ MOSFET	Selectable	
D1,2	SiC SBD	Selectable	
GD-IC1,2	Gate Driver	Selectable	
R sink1,2	Resistor for sink	ESR18 2Ω	0.1 -
R source1,2	Resistor for source	ESR18 5Ω	0.1 -
L1,2	Inductor	200µH	10µH - 2mH
C1	Capacitor	10µF	1µF - 1mF
Ro	Output Resistor	{Vo/Io}	

Simulation Circuit



Note: The Loss_calc component is a utility module to support power loss calculation and does not affect the simulation results of circuit operation or performance.

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C-007. DC-DC Buck Converter 2-Phase Vo=250V, Io=40A

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Selectable Devices

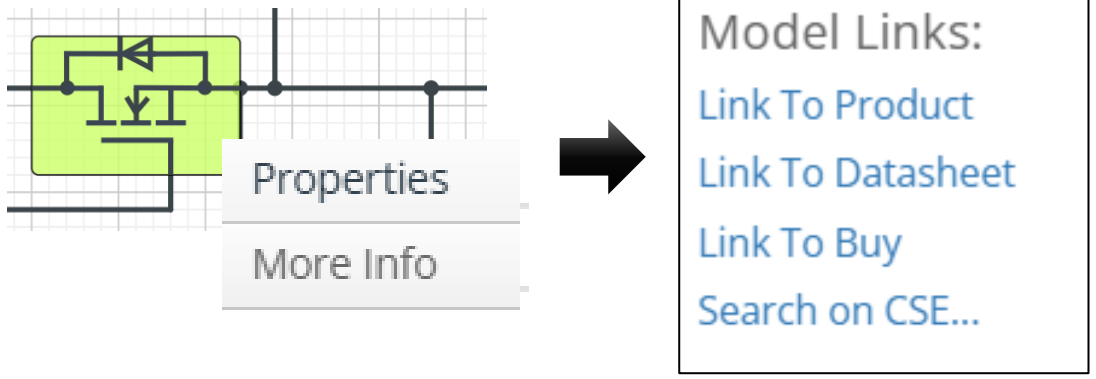
Component name	Component
Q1 , 2	SiC MOSFET

SiC MOSFET part number information

S C T 4 0 3 6 K R

- Part No.
- **Product category 1**
  - SC: SiC discrete device
- **Product category 2**
  - T: MOSFET
- **Product generations**
  - 2: 2nd Generation
  - 3: 3rd Generation
  - 4: 4th Generation
- **ON-resistance (Typ.)**
  - 013: 13 mΩ
  - 017: 17 mΩ
  - 018: 18 mΩ
  - 022: 22 mΩ
  - 026: 26 mΩ
  - 030: 30 mΩ
  - 036: 36 mΩ
  - 040: 40 mΩ
  - 045: 45 mΩ
  - 060: 60 mΩ
  - 062: 62 mΩ
  - 080: 80 mΩ
  - 105: 105 mΩ
  - 120: 120 mΩ
  - 160: 160 mΩ
  - 280: 280 mΩ
  - H12: 1150 mΩ
- **Rated voltage**
  - A: 650 V
  - D: 750 V
  - K: 1200 V
  - N: 1700 V
- **Package**
  - E: TO-247 (TO-247N) Other than 3rd generation
  - L: TO-247 (TO-247N) 3rd generation only
  - R: TO-247-4L
  - W7: TO-263-7L
  - WA: TO-263-7LA
  - Z: TO-3PFM
  - * JEDEC code. Parentheses indicate ROHM packages.

For more information, go to **“More Info”** and click on **“Link to Datasheet”**.



Product Lineup: SiC MOSFETs

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Note) We have not been able to confirm operation with all combinations. Please read the disclaimer carefully.

C-007. DC-DC Buck Converter 2-Phase Vo=250V, Io=40A

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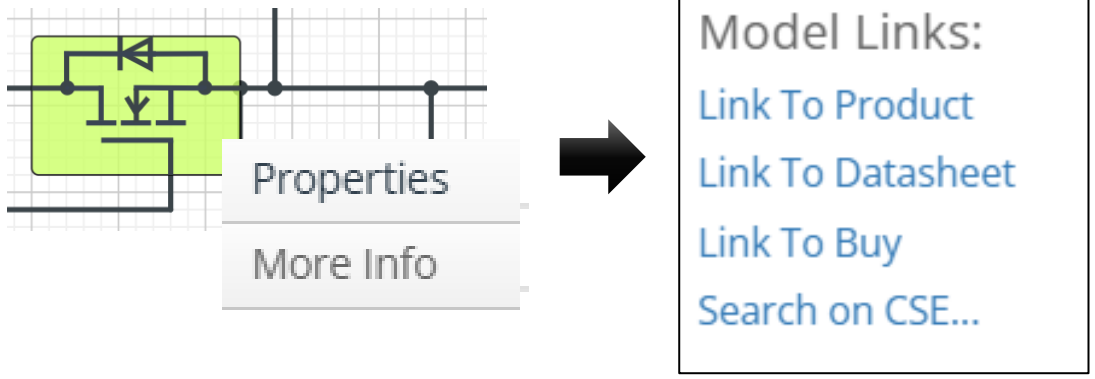
Selectable Devices

Component name	Component	Product
Q1 , 2	SJ MOSFET	RxxxxJN series RxxxxVN series

For more information, go to **“More Info”** and click on **“Link to Datasheet”**.



SJ MOSFET part number information

Single type

R 6 0 0 4 P N D 3 F R A

Part No.

ROHM

VDSS
52: 525V
60: 600V
65: 650V
80: 800V

ID
00: < 1A
01: 1A
02: 1A < ID ≤ 2A
03: 3A
04: 4A
: :
77: 77A
86: 86A

Polarity
N: Nch

Series
A: 1st Gen, For Automotive
C: 1st Gen, For Automotive, Built-in ESD Protection
E: 3rd Gen, Low Noise
J: 3rd Gen, Fast recovery
K: 3rd Gen, Fast switching
P: 1st Gen, For Automotive
R: 3rd Gen, Fast recovery, Low Noise
Y: 4th Gen, Fast switching
V: 4th Gen, Fast recovery

Grade
None: Standard
FRA: Automotive
FRG: Automotive

Package
D3: TO-252
D4: SOT-223-3
H: SOP8
J: TO-263 (LPTS)
X: TO-220FM
X3: TO-220AB
Z: TO-3PF
Z4: TO-247AD (TO-247)

➧ Product Lineup: Super Junction MOSFETs

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C-007. DC-DC Buck Converter 2-Phase Vo=250V, Io=40A

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Selectable Devices

Component name	Component	Product
Q1 , 2	IGBT	RGW series

IGBT part number information

R G S 6 0 T S 6 5 D H R

Part No.

Product category
RG: IGBT

Product series
C: For voltage resonant, Reverse Conducting IGBT (RC-IGBT)
CL: Low $V_{CE(sat)}$
S: For Automotive Inverter, Short circuit capability guaranteed 8 to 10µs
T: For inverter, Short circuit capability guaranteed 5µs
TV: For converter / inverter, High speed switching, Short circuit capability guaranteed 2µs
TH: For converter, High speed switching
W: For converter, Ultra high-speed switching
WS: For converter, Ultra high-speed switching, Popular edition

Rated collector current I_C (T_C=100°C)
8: 4 A
16: 8 A
20: 10 A
30: 15 A
40: 20 A
50: 25 A
60: 30 A
80: 40 A
00: 50 A
X2: 60 A
X5: 75 A
X6: 80 A
* See datasheet for current values that may differ in some cases.

Package
BM: TO-252, TO-252GE
NS: TO-263S, TO-262
NL: TO-263L
TM: TO-220NFM
TS: TO-247N, TO-247GE
TK: TO-3PFM

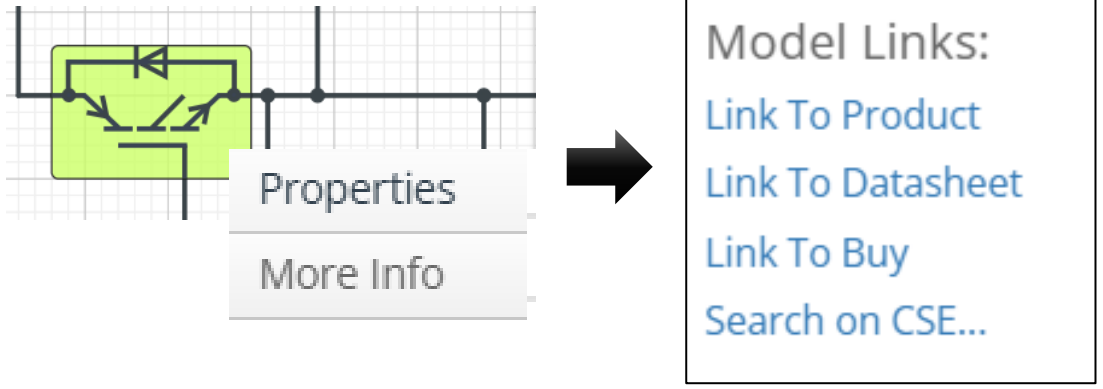
Rated voltage V_{CES}
60: 600 V
65: 650 V
X2: 1200 V
X8: 1800 V

Built-in diode configuration
None: Without diode
C: SiC Schottky barrier diode
D: Fast recovery diode
E: Larger size Fast recovery diode
R: Body diode with reverse conducting (RC) structure

Grade
G: Standard
GV: Standard
HR: Automotive (AEC-Q101)
HRB: Automotive (AEC-Q101)

➧ Product Lineup: Field Stop Trench IGBT

For more information, go to **“More Info”** and click on **“Link to Datasheet”**.



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Note) We have not been able to confirm operation with all combinations. Please read the disclaimer carefully.

C-007. DC-DC Buck Converter 2-Phase Vo=250V, Io=40A

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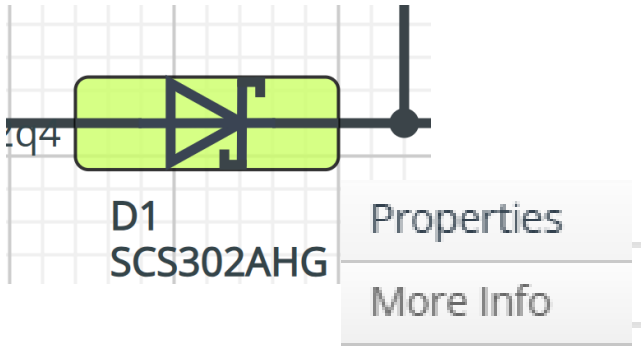
Selectable Devices

Component name	Component
D1,2	SiC Schottky Barrier Diode

For more information, go to **“More Info”** and click on **“Link to Datasheet”**.



Model Links:
Link To Product
Link To Datasheet
Link To Buy
Search on CSE...

SiC Schottky Barrier Diode part number information

S C S 2 2 0 A E 2

- Part No.
- **Product category 1**
  - SC: SiC discrete device
- **Product category 2**
  - S: SiC schottky barrier Diode
- **Product generations**
  - 2: 2nd Generation
  - 3: 3rd Generation
- **Rated current**
  - 04: 4 A
  - 05: 5 A
  - 06: 6 A
  - 08: 8 A
  - 10: 10 A
  - 12: 12 A
  - 15: 15 A
  - 20: 20 A
  - 30: 30 A
  - 40: 40 A
- **Reverse voltage (repetitive peak)**
  - A: 650 V
  - K: 1200 V
- **Package**
  - E: TO-247 (TO-247N)
  - E2: TO-247 (TO-247N) 2-chip configuration
  - G : TO-220AC (TO-220ACGE / TO-220ACG)
  - H: TO-220AC (TO-220ACP)
  - J: TO-263AB (LPTL)
  - M: TO-220FM (TO-220FM-2LGE)
  - N: TO-263 (TO-263-2L)
  - * JEDEC code. Parentheses indicate ROHM packages.

➧ Product Lineup: SiC Schottky Barrier Diodes

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Note) We have not been able to confirm operation with all combinations. Please read the disclaimer carefully.

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Selectable Devices

Component name	Component	Product No.	feature
GD-IC1,2	Gate Driver	BM61S41RFV-C (*)	**for SiC MOSFET** Isolation Voltage : 3750 Vrms I/O Delay Time (max) : 65ns Miller Clamp : Built-in UVLO : 14.5V
		BM61M41RFV-C	**for SJ-MOS / IGBT** Isolation Voltage : 3750 Vrms I/O Delay Time (max) : 65ns Miller Clamp : Built-in UVLO : 7.4V

* Default device

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Simulation Waveform 1

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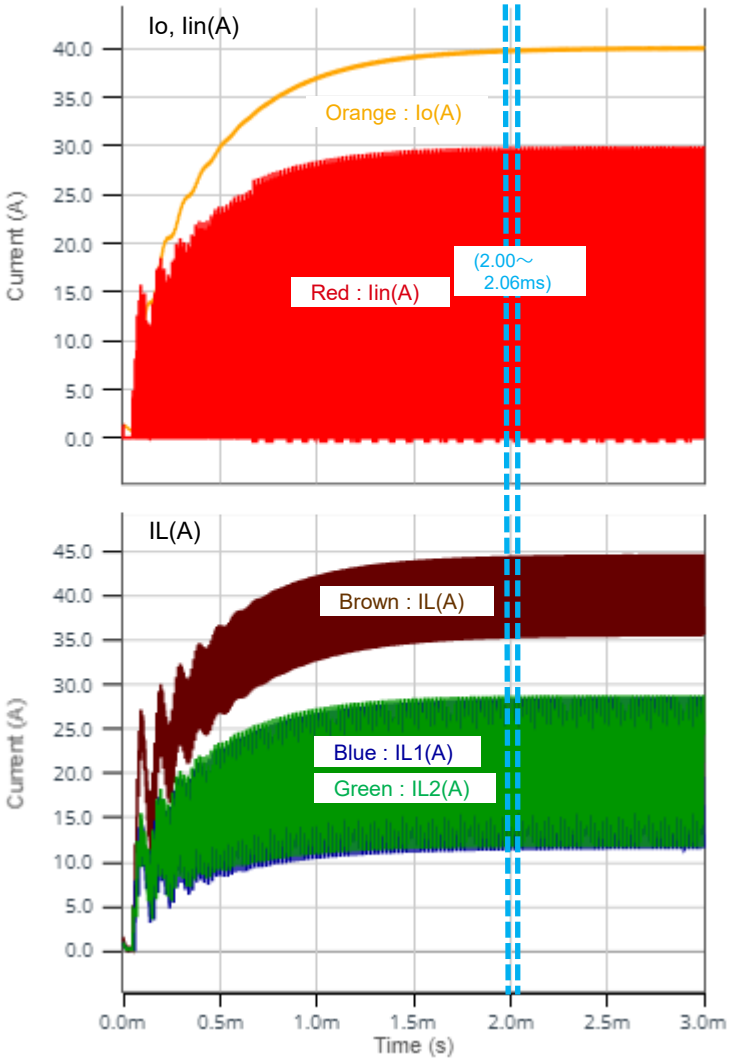
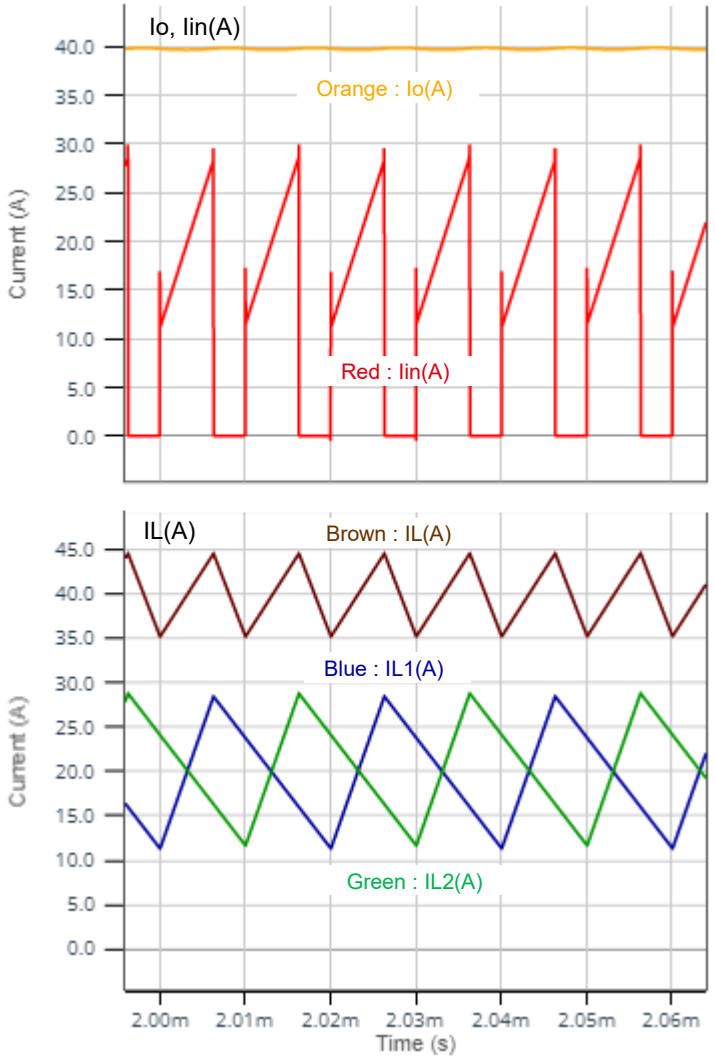
Q1,2 : SiC MOSFET
SCT3080KL
D1,2 : SiC SBD
SCS220KG

Io, Iin, IL (0～3.00ms)

Vin=800V Vo=250V
Io=20A Tj=100℃



Expansion （2.00ms～2.06ms）



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Simulation Waveform2

2025. Nov.
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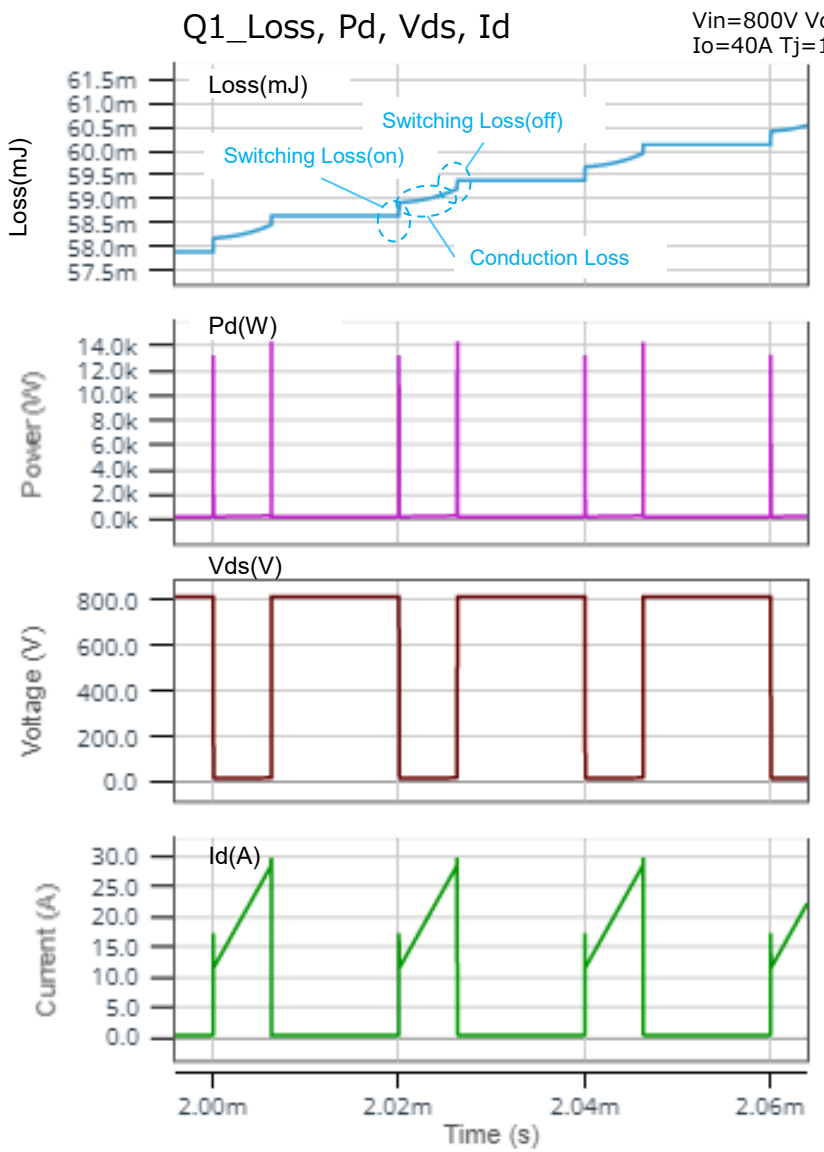
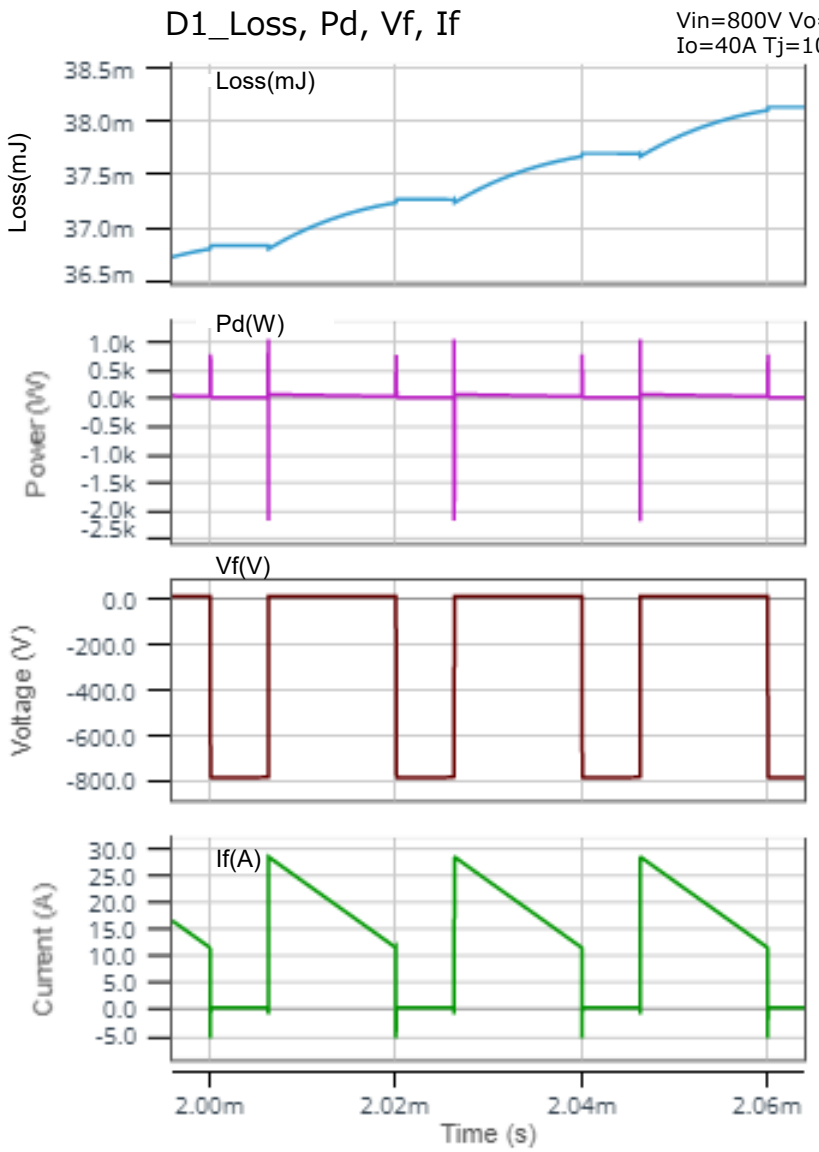
Q1,2 : SiC MOSFET
SCT3080KL
D1,2 : SiC SBD
SCS220KG





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Efficiency, Power Dissipation 1

2025. Nov.
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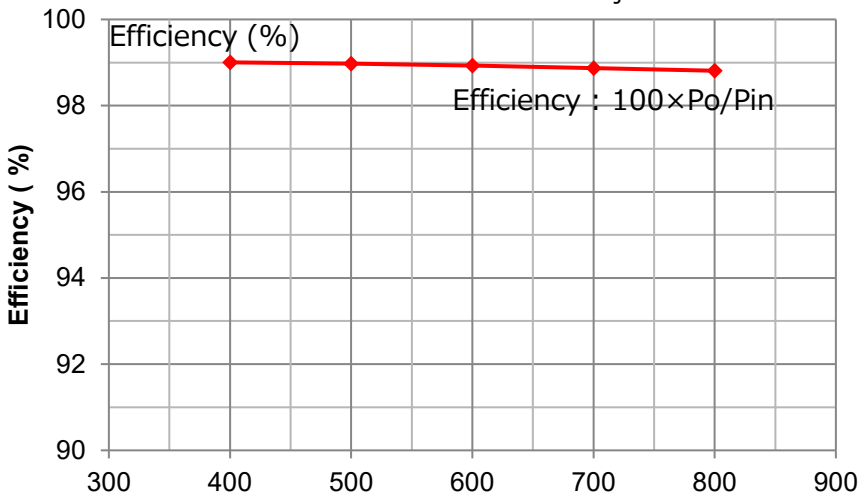
Q1,2 : SiC MOSFET
SCT3080KL
D1,2 : SiC SBD
SCS220KG

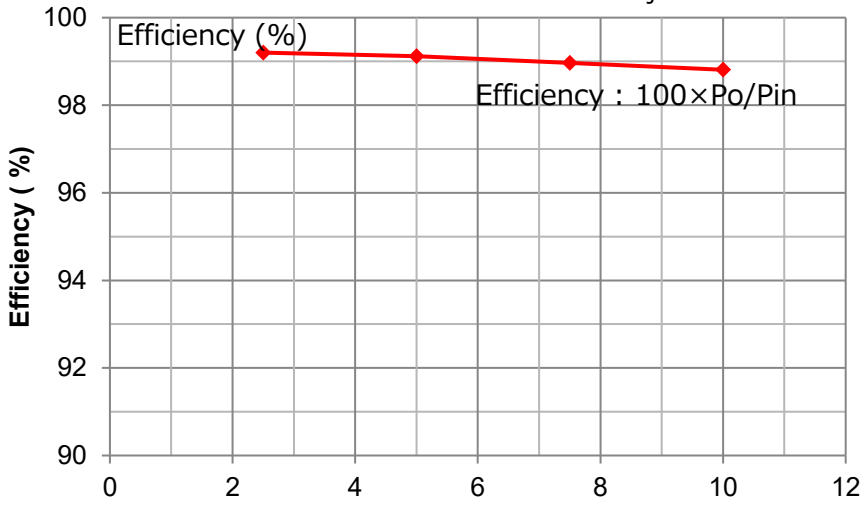
Vin : 400V～800V

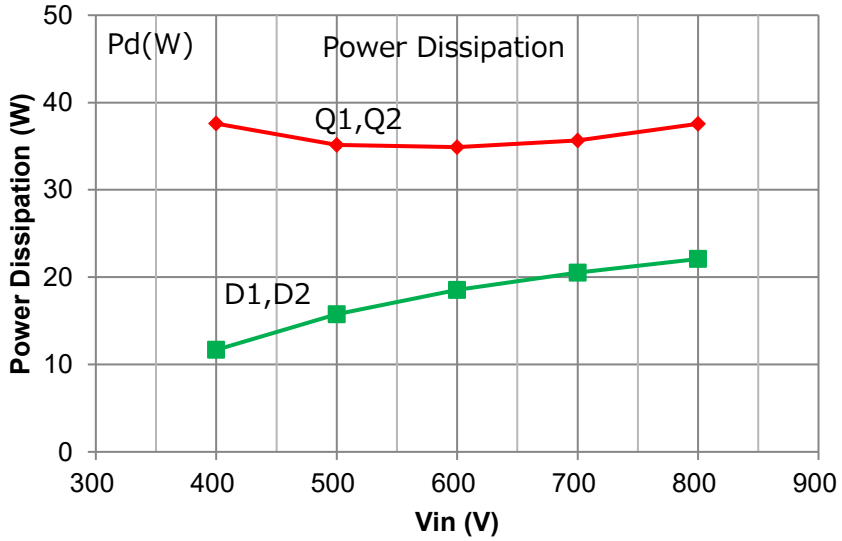
Vo=250V Io=40A
Tj=100℃

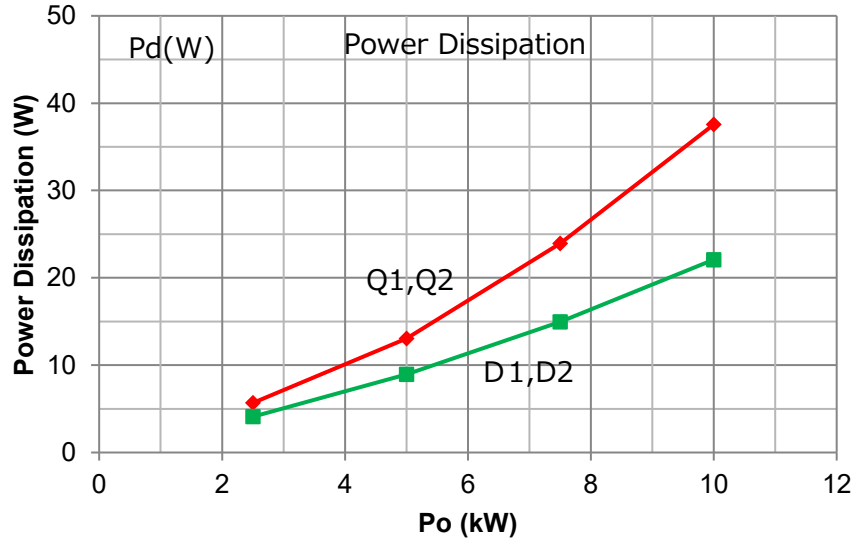


Po : 2.5kW～10kW

Vin=800V Vo=250V
Tj=100℃







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Efficiency, Power Dissipation 2

2025. Nov.
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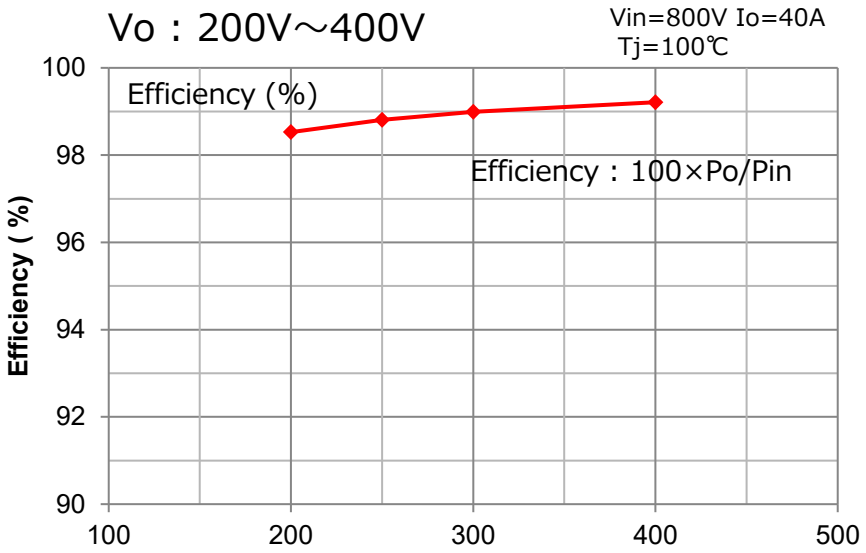
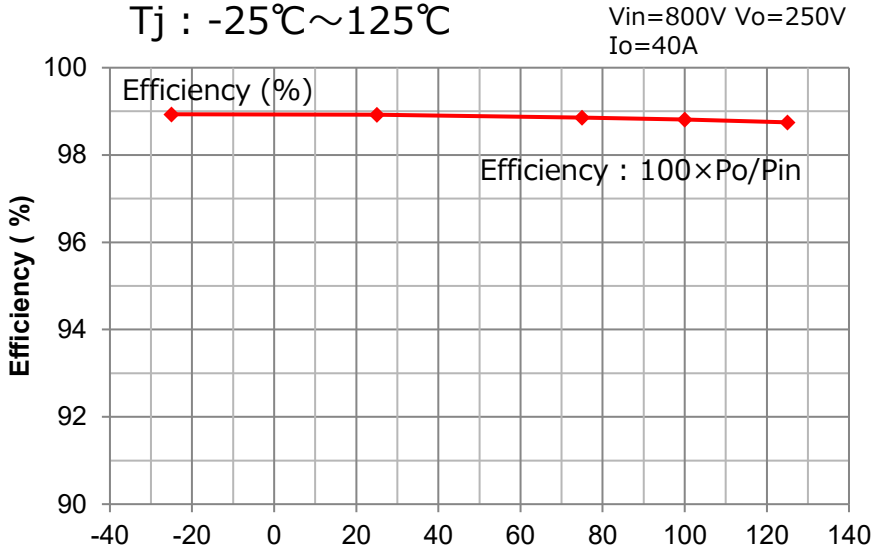
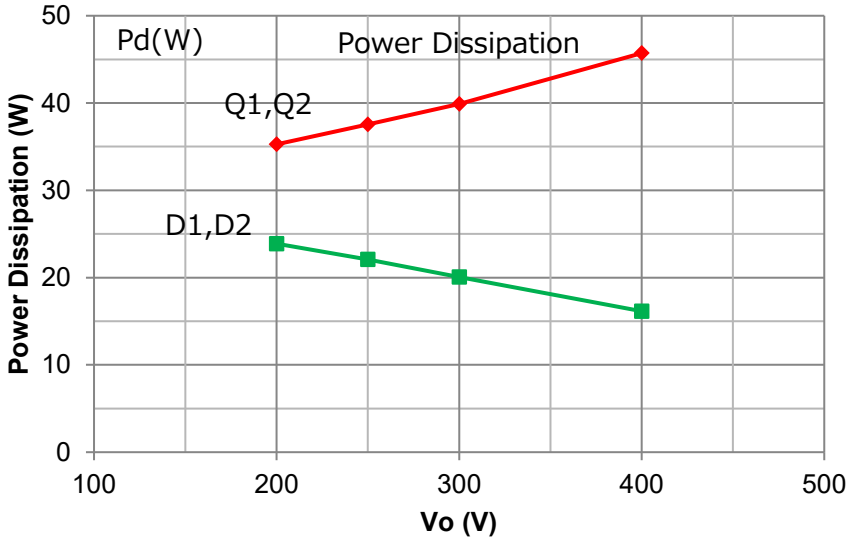
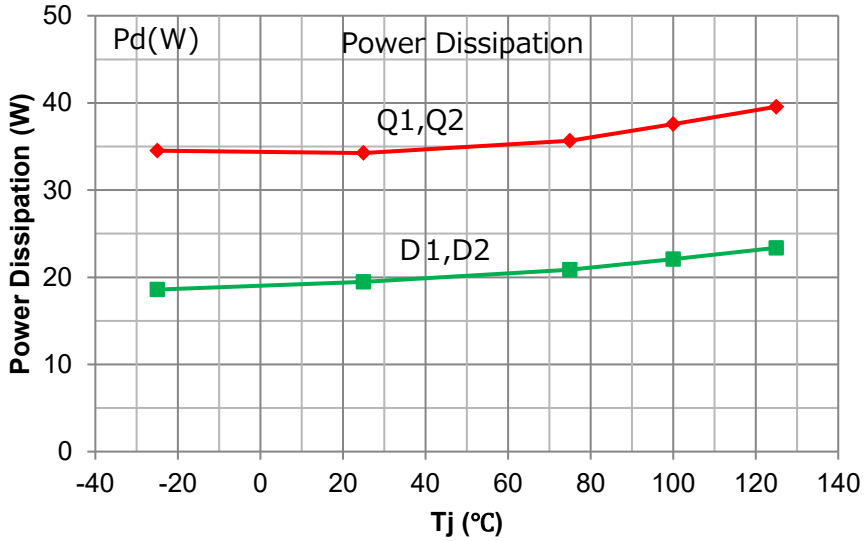
Q1,2 : SiC MOSFET
SCT3080KL
D1,2 : SiC SBD
SCS220KG









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How to change the devices

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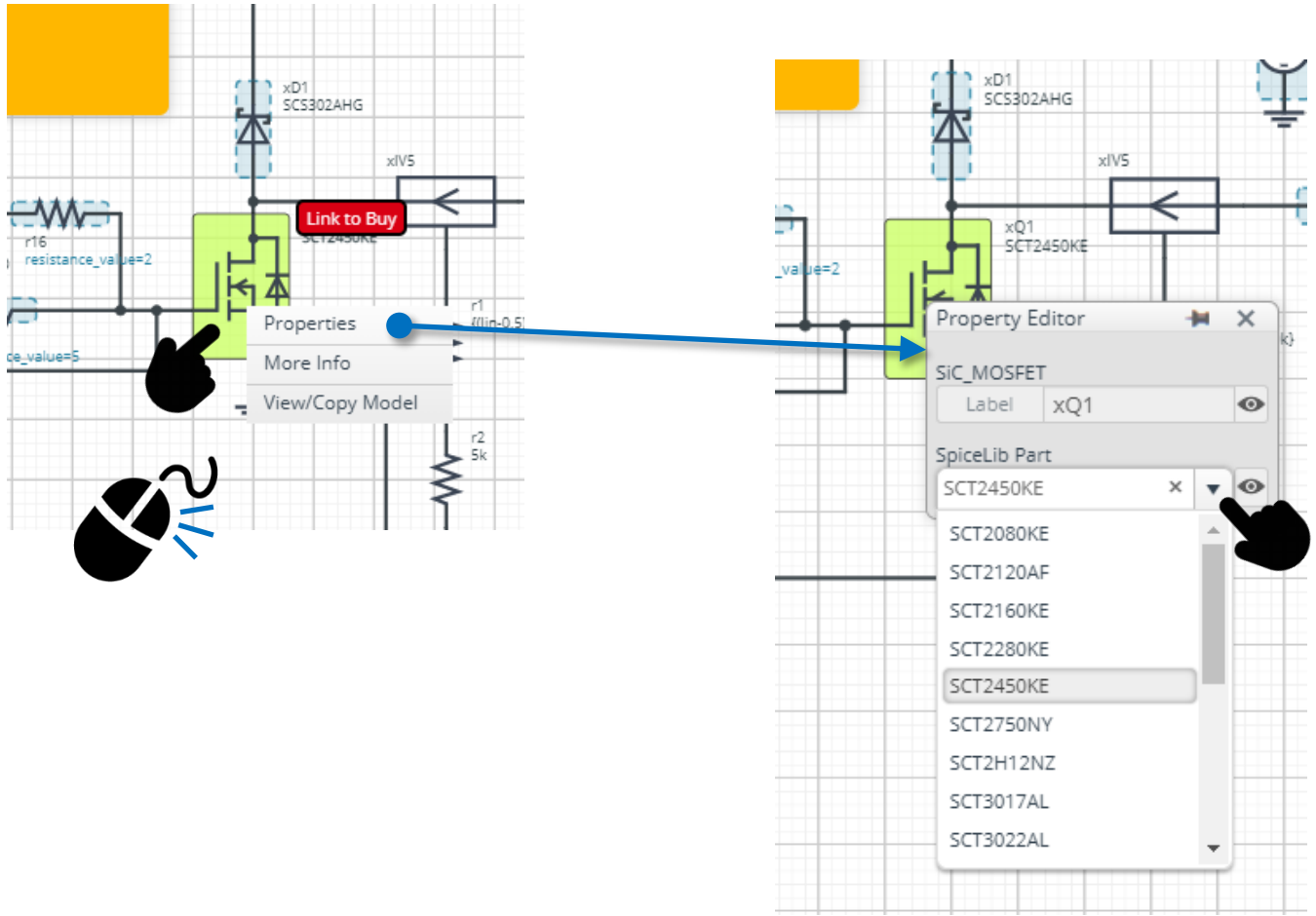
Right-click on the device ⇨ Select Properties ⇨ Pull down “SpiceLib Part” ⇨ Select the product



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Loss Calculation Model

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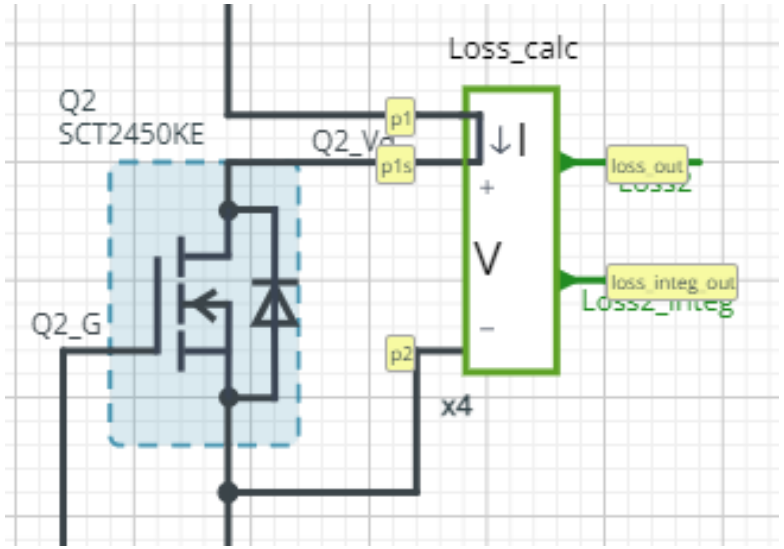
Loss Calculation Model outputs the instantaneous value of power loss and its integration.

Loss calculation model 'Loss_calc'



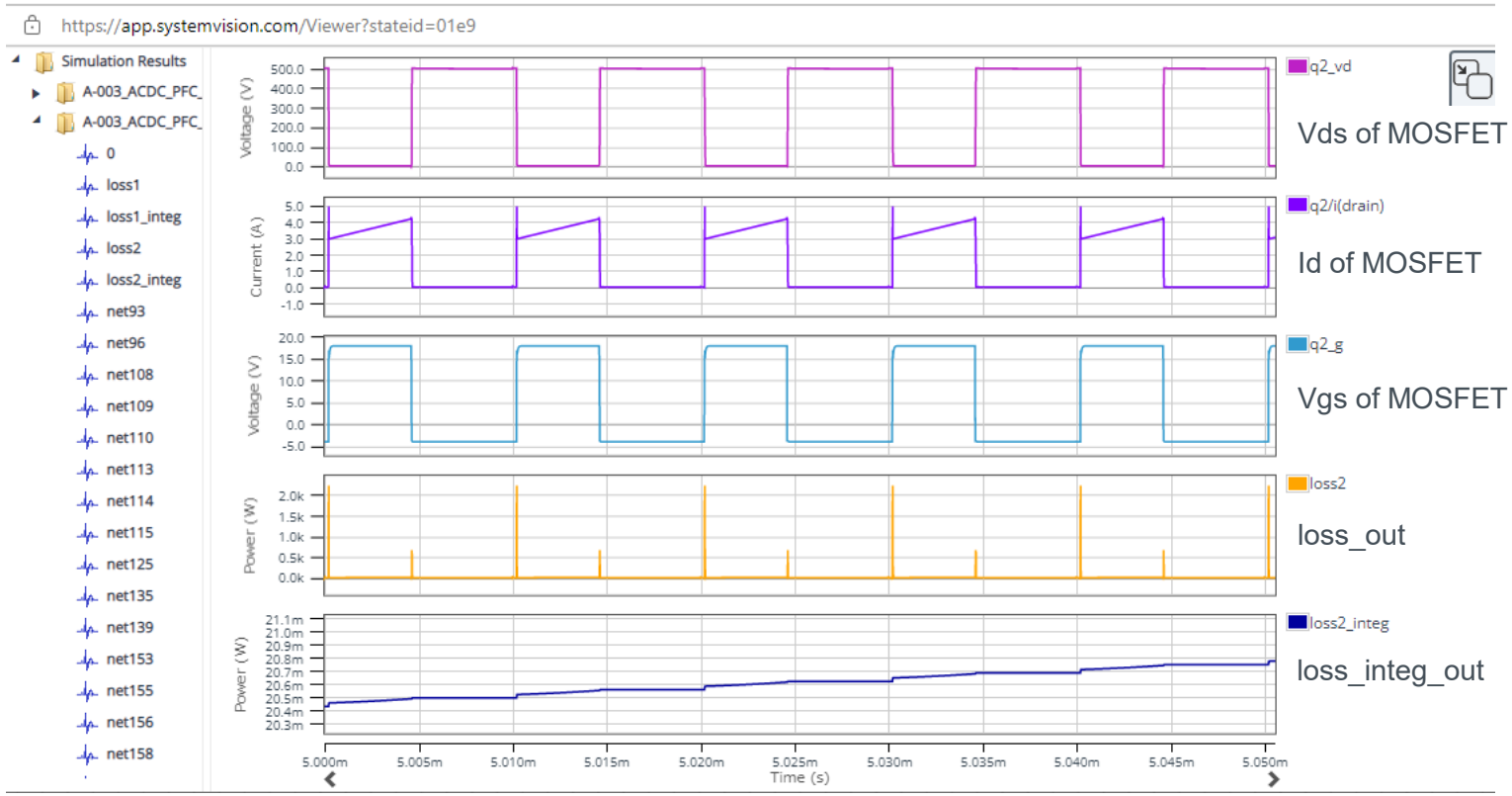
$$loss_out(t) = I(t) \times V(t)$$

$$loss_integ_out = \int_0^t loss_out(t)dt$$

I : Current through p1 to p1s

V : Voltage between p1s and p2

Waveform example



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ROHM SEMICONDUCTOR

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