Final datasheet

Features

- Electrical features
  - V_{DSS} = 1400 V
  - I_{DN} = 850 A / I_{DRM} = 1700 A
  - Silicon carbide MOSFET with .XT
  - Low $R_{DS,on}$
  - Low switching losses
  - Low inductive design
  - $T_{vj,op}$ = 175°C
- Mechanical features
  - High power cycling capability due to .XT
  - High creepage and clearance distances
  - High vibration resistance
  - Direct-cooled PinFin base plate
  - Integrated temperature sensor
  - Power terminals for laser welding
  - Aux terminals with PressFIT contact technology
  - RoHS compliant

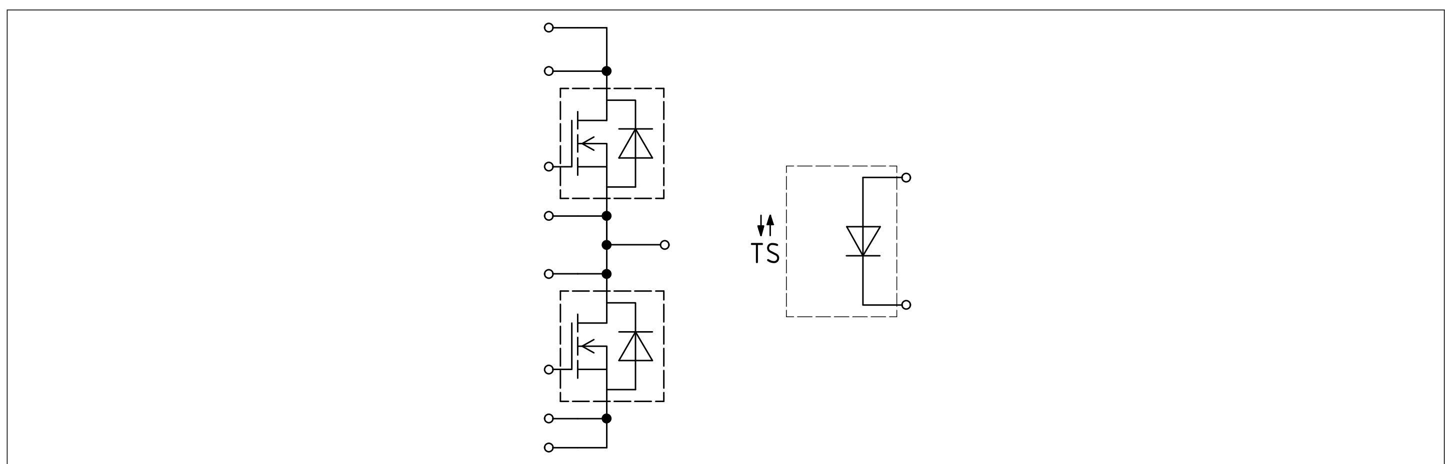
Potential applications

- CAV electric drive train on road

Product validation

- Qualified according to AQG 324, release no.: 03.1/2021
- Vibration resistance qualified according to ISO 16750-3
- Qualified according to IPC-9797

Description



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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, t = 1 min	3.4	kV
Material of module baseplate			Cu+Ni[1]	
Internal isolation		basic insulation (class 1, IEC 61140)	Si_3N_4	
Creepage distance	$d_{Creep\ min}$	terminal to baseplate, min., (PD2, IEC 60664-1, Ed. 3.0)	16.6	mm
Creepage distance	$d_{Creep\ min}$	terminal to terminal, min., (PD2, IEC 60664-1, Ed. 3.0)	17.6	mm
Clearance	$d_{Clear\ min}$	terminal to baseplate, min.	14.0	mm
Clearance	$d_{Clear\ min}$	terminal to terminal, min.	13.2	mm
Comparative tracking index	CTI		175	

1) Ni plated Cu baseplate

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Pressure drop in cooling circuit[1]	Δp	$\Delta V/\Delta t$ = 10.0 dm^3/min, 50% water / 50% ethylenglycol, T_F = 60 °C			102		mbar
Maximum pressure in cooling circuit	p					3	bar
Stray inductance module	L_{sDS}				6.5		nH
Module lead resistance, terminals - chip	$R_{DD'+SS'}$	T_F = 25 °C, per switch			0.4		mΩ
Storage temperature	T_{stg}			-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}					150	°C
Mounting torque for module mounting	M	- Mounting according to valid application note[2]	PCB to frame, EJOT Delta PT, Screw	0.45		0.55	Nm
			baseplate to heatsink, M4 8.8, Screw	1.8		2.3	
Weight	G				435		g

1) Design of the heat sink, flow rate and flow direction of the coolant according to application note AN-2026-04 "HybridPACK HD Application and Mounting Instructions"

2) AN-2026-04 "HybridPACK HD Application and Mounting Instructions"

2 MOSFET

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}		T_{vj} = -40...175 °C	1400	V
Implemented drain current	I_{DN}			850	A
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_F = 65 °C	785[1)]	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		1700	A
Gate-source voltage, max. transient voltage	V_{GS}			-10...23	V
Gate-source voltage, max. static voltage	V_{GS}			-7...20	V

1) calculated with typical $R_{th,JF}$ + 4.5 $\sigma_{Rth,JF}$

Table 4 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
On-state gate voltage	$V_{GS(on)}$		15...18	V
Off-state gate voltage	$V_{GS(off)}$		-5...-3	V

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{DS(on)}$	I_D = 850 A	V_{GS} = 15 V, T_{vj} = 25 °C		1.16	1.58	mΩ
			V_{GS} = 15 V, T_{vj} = 125 °C		1.77		
			V_{GS} = 15 V, T_{vj} = 175 °C		2.26		
			V_{GS} = 18 V, T_{vj} = 25 °C		1	1.36	
			V_{GS} = 18 V, T_{vj} = 125 °C		1.65		
			V_{GS} = 18 V, T_{vj} = 175 °C		2.15		
Gate threshold voltage	$V_{GS(th)}$	I_D = 310 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C, (tested after 1ms pulse at V_{GS} = +20 V)		3.05	3.95	4.75	V
Total gate charge	Q_G	V_{DD} = 750 V, V_{GS} = -3...18 V, T_{vj} = 25 °C			2.2		μC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.17		Ω

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 750 V, V_{GS} = 0 V	T_{vj} = 25 °C		74.1		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 750 V, V_{GS} = 0 V	T_{vj} = 25 °C		2.6		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 750 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.2		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 750 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			974		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 1400 V, V_{GS} = -3 V	T_{vj} = 25 °C			900	µA
Gate-source leakage current	I_{GSS}	V_{DS} = 0 V, T_{vj} = 25 °C	V_{GS} = 20 V			400	nA
Turn-on delay time (inductive load)	$t_{d\ on}$	I_D = 850 A, R_{Gon} = 4.7 Ω, V_{DD} = 750 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 V_{GS} to 0.1 I_D	T_{vj} = 25 °C		87		ns
			T_{vj} = 125 °C		73		
			T_{vj} = 175 °C		63		
Rise time (inductive load)	t_r	I_D = 850 A, R_{Gon} = 4.7 Ω, V_{DD} = 750 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 I_D to 0.9 I_D	T_{vj} = 25 °C		85		ns
			T_{vj} = 125 °C		79		
			T_{vj} = 175 °C		77		
Turn-off delay time (inductive load)	$t_{d\ off}$	I_D = 850 A, R_{Goff} = 1 Ω, V_{DD} = 750 V, V_{GS} = -3/18 V, 0.9 V_{GS} to 0.9 I_D	T_{vj} = 25 °C		188		ns
			T_{vj} = 125 °C		201		
			T_{vj} = 175 °C		201		
Fall time (inductive load)	t_f	I_D = 850 A, R_{Goff} = 1 Ω, V_{DD} = 750 V, V_{GS} = -3/18 V, 0.9 I_D to 0.1 I_D	T_{vj} = 25 °C		40		ns
			T_{vj} = 125 °C		40		
			T_{vj} = 175 °C		42		
Turn-on energy loss per pulse	E_{on}	I_D = 850 A, V_{DD} = 750 V, $L_σ$ = 8 nH, V_{GS} = -3/18 V, R_{Gon} = 4.7 Ω, di/dt = 12.4 kA/µs (T_{vj} = 175 °C), t_{dead} = 1000 ns	T_{vj} = 25 °C		57.1		mJ
			T_{vj} = 125 °C		59.7		
			T_{vj} = 175 °C		62.7		
Turn-on energy loss per pulse, optimized	$E_{on,o}$	I_D = 850 A, V_{DD} = 750 V, $L_σ$ = 8 nH, V_{GS} = -3/18 V, $R_{Gon,o}$ = 3.9 Ω, di/dt = 14.5 kA/µs (T_{vj} = 175 °C), t_{dead} = 100 ns	T_{vj} = 25 °C		44.4		mJ
			T_{vj} = 125 °C		42.4		
			T_{vj} = 175 °C		43.1		
Turn-off energy loss per pulse	E_{off}	I_D = 850 A, V_{DD} = 750 V, $L_σ$ = 8 nH, V_{GS} = -3/18 V, R_{Goff} = 1 Ω, dv/dt = 17.6 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		26.6		mJ
			T_{vj} = 125 °C		26.6		
			T_{vj} = 175 °C		26.1		

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
SC data	I_{SC}	V_{GS} = -3/18 V, V_{DD} = 750 V, $V_{DSmax} = V_{DSS}-L_{sDS}*di/dt$ [1]	$t_P \le 1.2$ µs, T_{vj} = 175 °C		10500		A
SC data	I_{SC}	V_{GS} = -3/15 V, V_{DD} = 750 V, $V_{DSmax} = V_{DSS}-L_{sDS}*di/dt$ [1]	$t_P \le 2$ µs, T_{vj} = 175 °C		8700		A
Thermal resistance, junction to cooling fluid	R_{thJF}	per MOSFET, ΔV/Δt = 10 dm^3/min, cooling fluid = 50% water / 50% ethylenglycol, T_F = 60 °C			58.5		K/kW
Standard deviation of thermal resistance, junction to cooling fluid	$\sigma_{Rth,JF}$	ΔV/Δt = 10 dm^3/min, cooling fluid = 50% water / 50% ethylenglycol, T_F = 60 °C			0.48		K/kW
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

1) Recommended short-circuit turn-off with $-di/dt_{90\%-10\%} \ge 19$ kA/µs

***Note**: The selection of positive and negative gate-source voltages impacts losses and the long-term behavior of the MOSFET and body diode. The design guidelines described in Application Note AN-2025-02 "CoolSiC™ MOSFET M2 in Easy modules" must be considered to ensure sound operation of the device over the planned lifetime.*

3 Body diode (MOSFET)

Table 6 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
DC body diode forward current	I_{SD}	T_{vj} = 175 °C, V_{GS} = -3 V	T_F = 65 °C	450	A
Pulsed body diode current	$I_{SD\,pulse}$			1700	A
I^2t - value	I^2t	V_{DS} = 0 V, V_{GS} = -3 V, t_P = 10 ms	T_{vj} = 175 °C	24.5	kA^2s

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 850 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.47	5.65	V
			T_{vj} = 125 °C		4.06		
			T_{vj} = 175 °C		3.93		

(table continues...)

Table 7 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current	I_{rrm}	I_{SD} = 850 A, di_s/dt = 13 kA/µs, V_{DD} = 750 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		235		A
			T_{vj} = 125 °C		417		
			T_{vj} = 175 °C		513		
Recovered charge	Q_{rr}	I_{SD} = 850 A, di_s/dt = 13 kA/µs, V_{DD} = 750 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		20.2		µC
			T_{vj} = 125 °C		32		
			T_{vj} = 175 °C		38.4		
Reverse recovery energy	E_{rec}	I_{SD} = 850 A, di_s/dt = 13 kA/µs (T_{vj} = 175 °C), V_{DD} = 750 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		1.6		mJ
			T_{vj} = 125 °C		5.4		
			T_{vj} = 175 °C		8.2		
Reverse recovery energy, optimized	$E_{rec,o}$	I_{SD} = 50 A, di_s/dt = 14.8 kA/µs (T_{vj} = 175 °C), V_{DD} = 750 V, V_{GS} = -3 V, t_{dead} = 100 ns	T_{vj} = 25 °C		1.6		mJ
			T_{vj} = 125 °C		3.3		
			T_{vj} = 175 °C		5.1		

4 Temperature Sensor

Table 8 Characteristic values

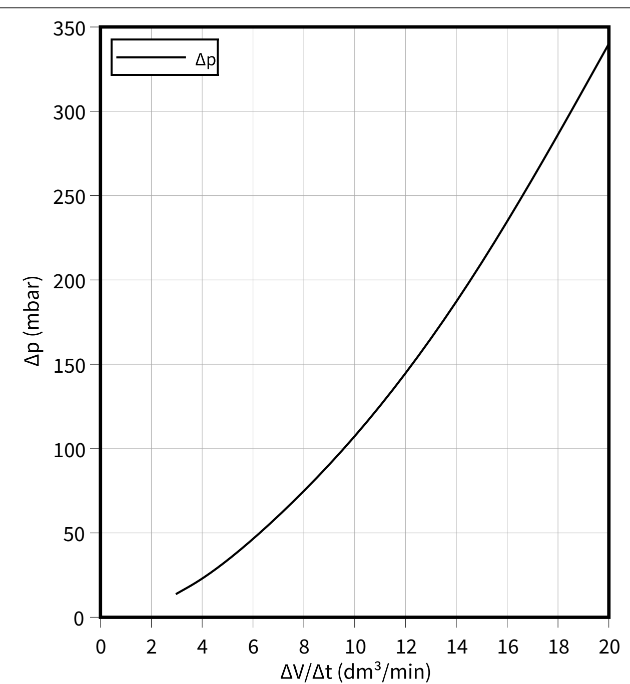
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Transient sense current	I_{TS}					10	mA
Forward voltage	V_{TS}		I_{TS} = 0.2 mA, T_{vj} = 25 °C	2.574	2.624	2.674	V
			I_{TS} = 0.2 mA, T_{vj} = 85 °C	2.169	2.234	2.299	

5 Characteristics diagrams

Pressure drop in cooling circuit, Package

$\Delta p = f(\Delta V/\Delta t)$

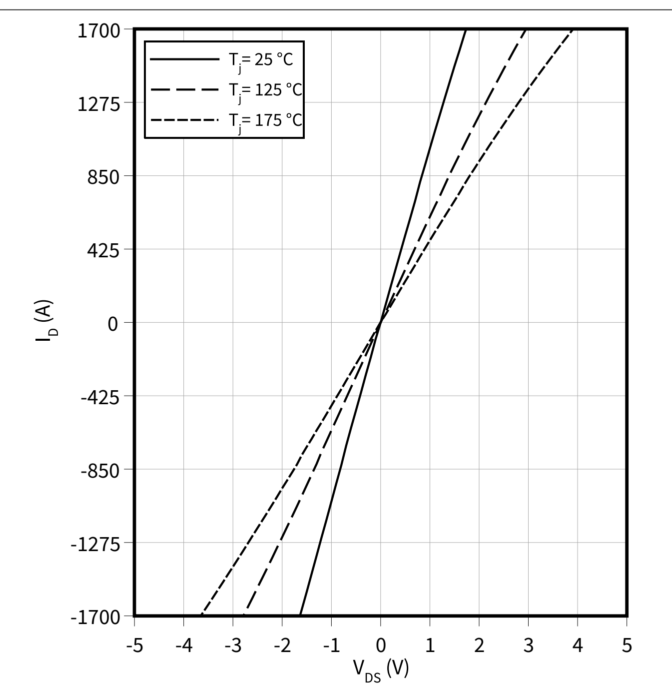
T_F = 60 °C, 50% water / 50% ethylenglycol



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

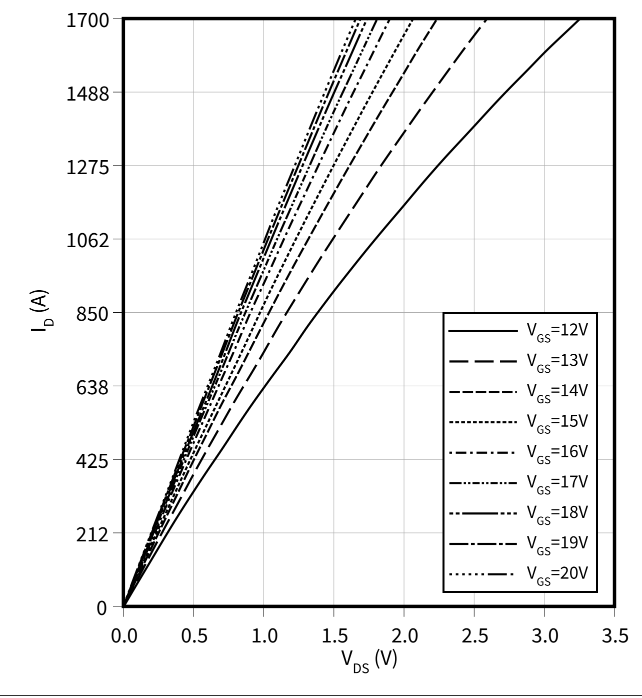
V_{GS} = 18 V



Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$

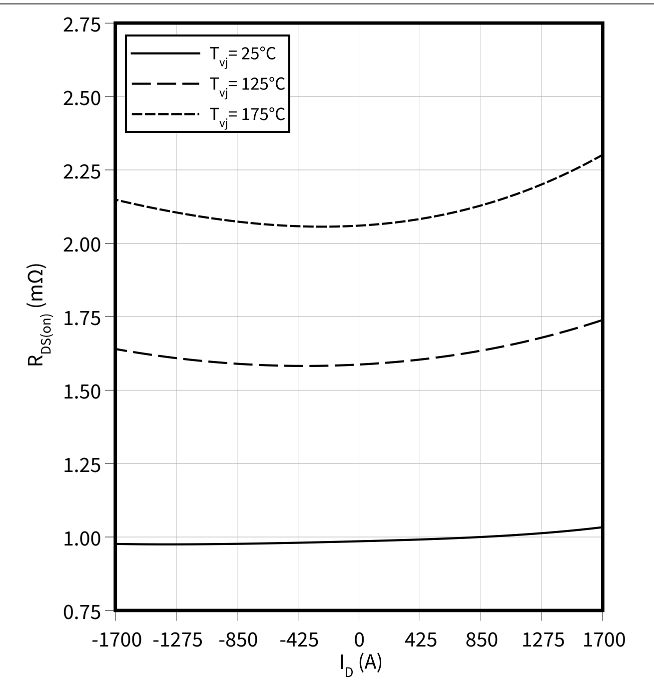
T_{vj} = 25 °C



Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(I_D)$

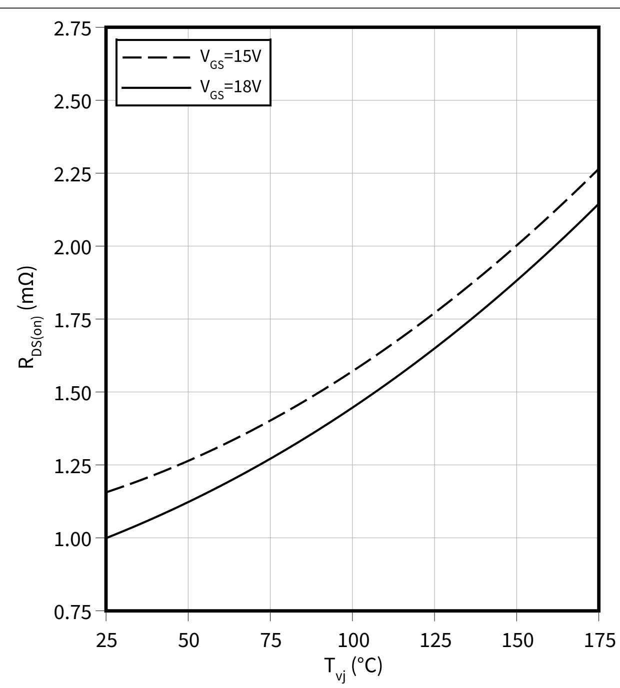
V_{GS} = 18 V



Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$

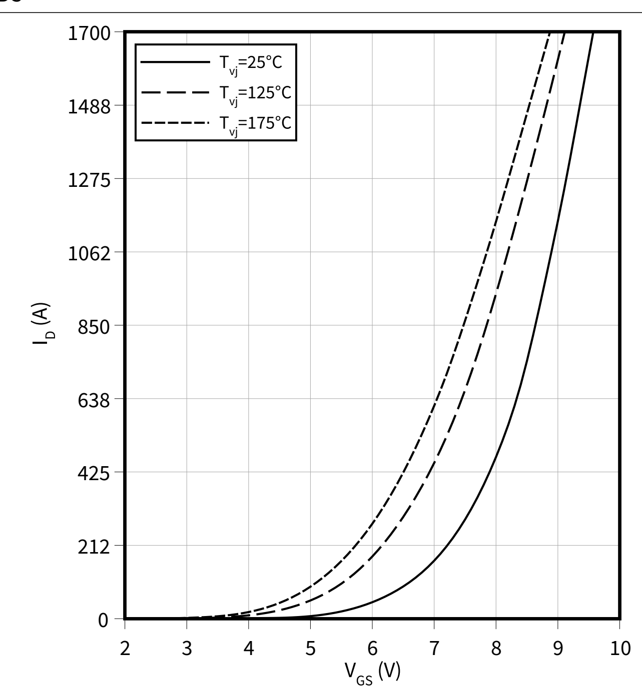
$I_D = 850$ A



Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$

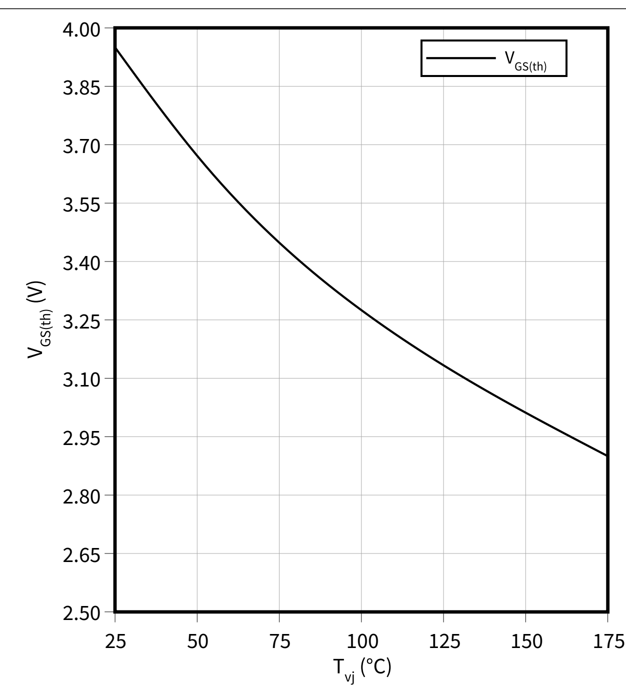
$V_{DS} = 20$ V



Gate-source threshold voltage (typical), MOSFET

$V_{GS(th)} = f(T_{vj})$

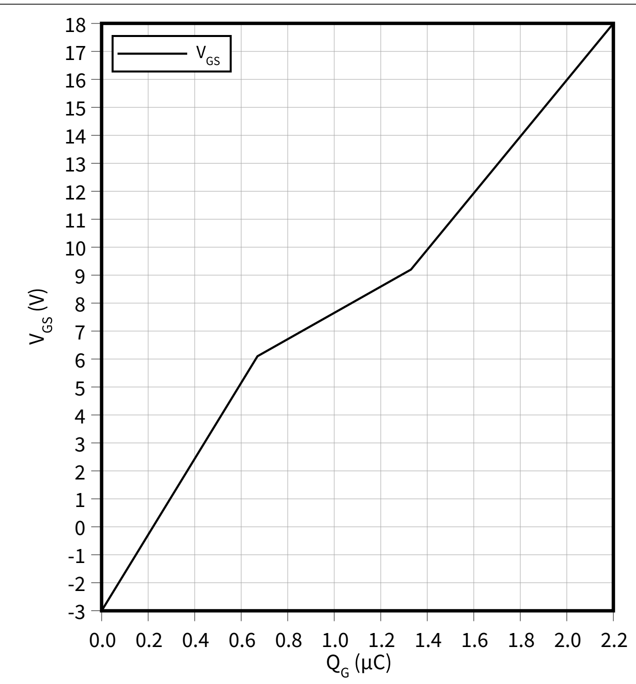
$I_D = 10$ mA, $V_{GS} = V_{DS}$



Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$

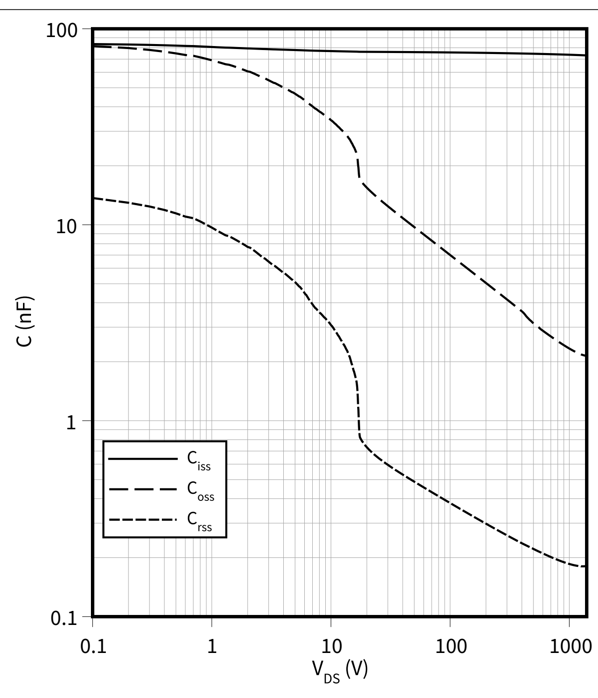
$I_D = 850$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

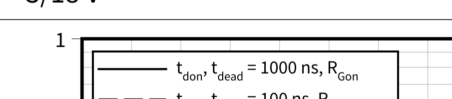
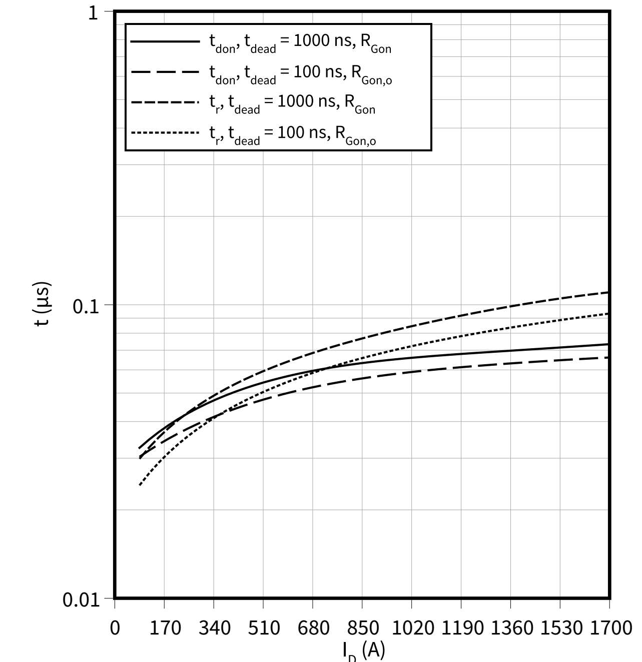
$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GS} = 0$ V



Switching times (typical), MOSFET

$t = f(I_D)$

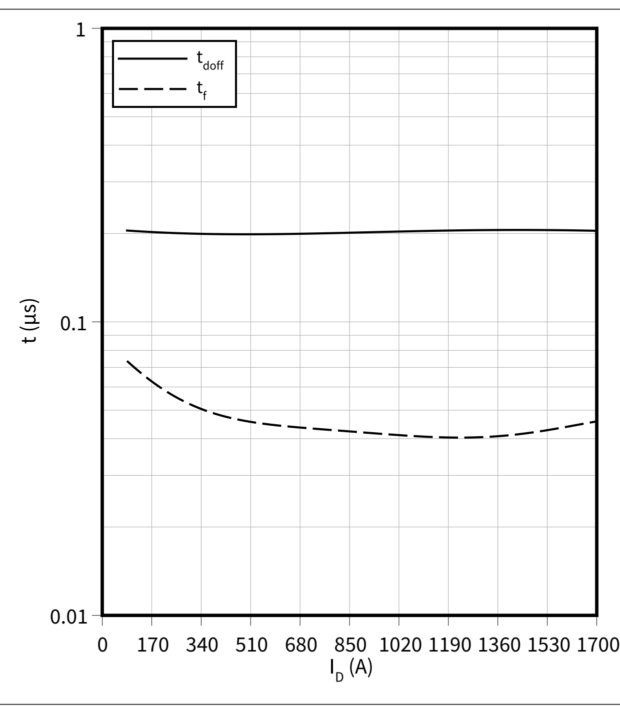
$V_{DD} = 750$ V, $R_{Gon} = 4.7$ Ω, $R_{Gon,o} = 3.9$ Ω, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V

Switching times (typical), MOSFET

$t = f(I_D)$

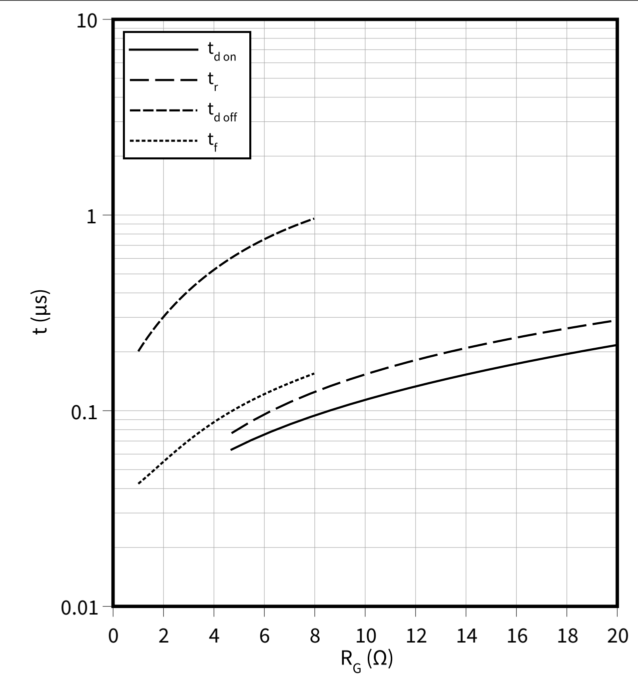
$R_{Goff} = 1$ Ω, $V_{DD} = 750$ V, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET

$t = f(R_G)$

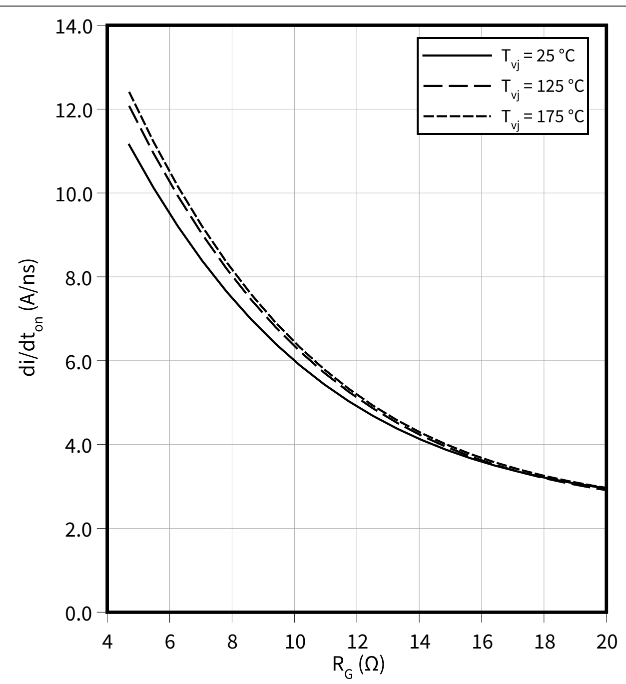
$V_{DD} = 750$ V, $t_{dead} = 1000$ ns, $I_D = 850$ A, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Current slope (typical), MOSFET

$di/dt_{on} = f(R_G)$

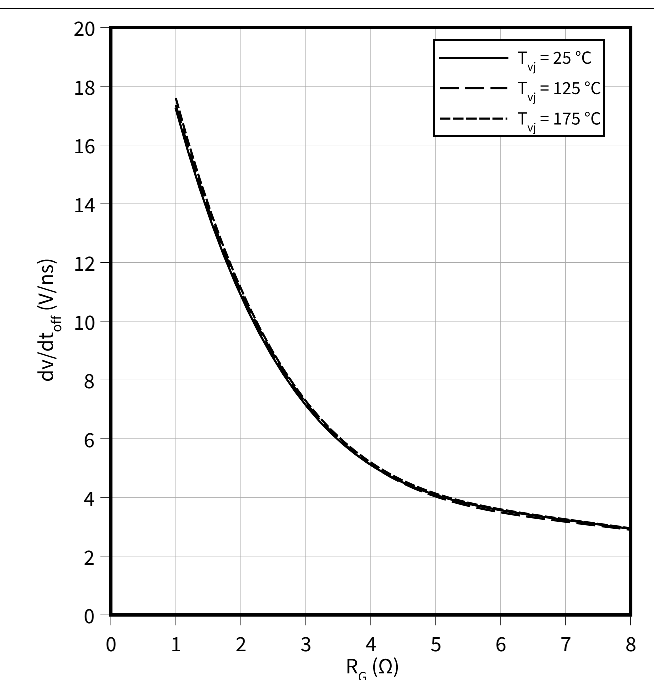
V_{DD} = 750 V, t_{dead} = 1000 ns, I_D = 850 A, V_{GS} = -3/18 V



Voltage slope (typical), MOSFET

$dv/dt_{off} = f(R_G)$

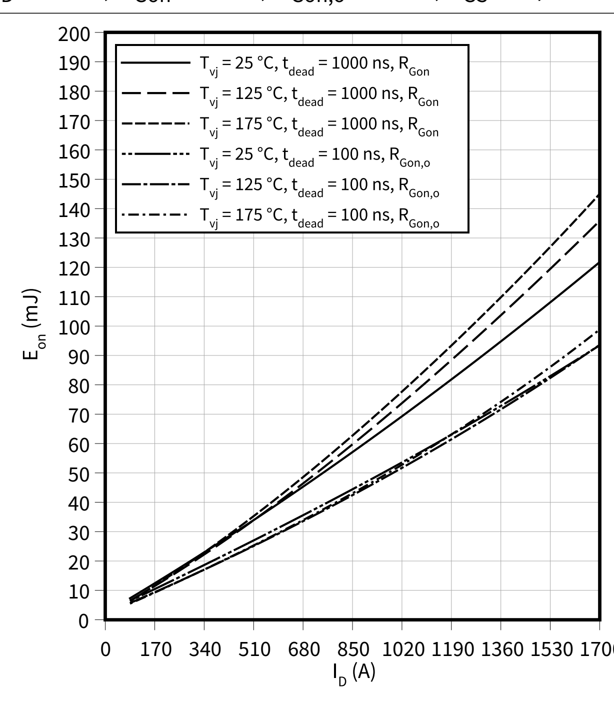
V_{DD} = 750 V, I_D = 850 A, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

$E_{on} = f(I_D)$

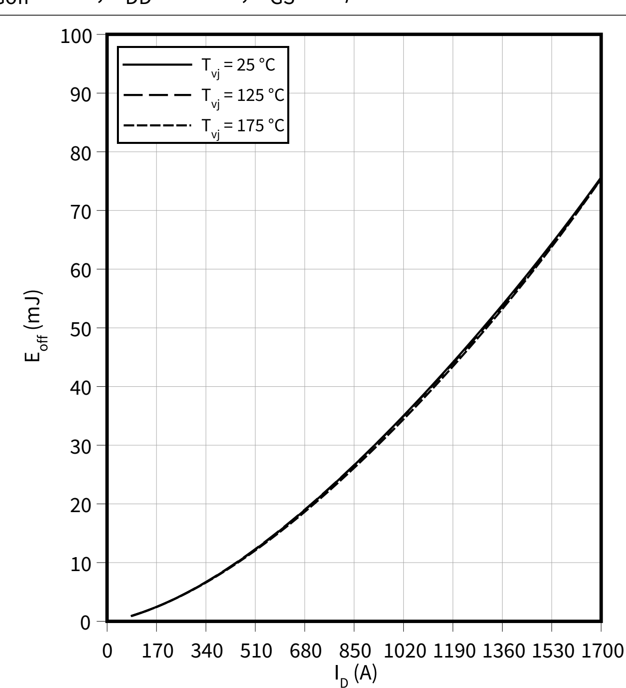
V_{DD} = 750 V, R_{Gon} = 4.7 Ω, $R_{Gon,o}$ = 3.9 Ω, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

$E_{off} = f(I_D)$

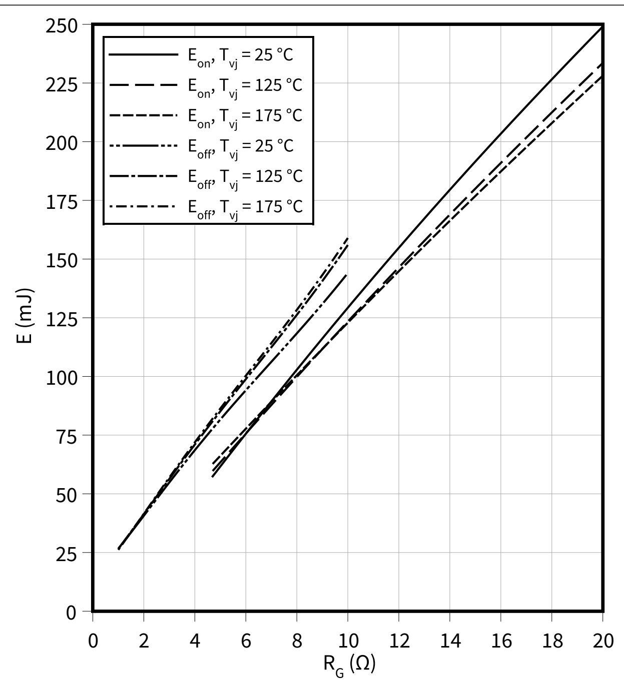
R_{Goff} = 1 Ω, V_{DD} = 750 V, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

$E = f(R_G)$

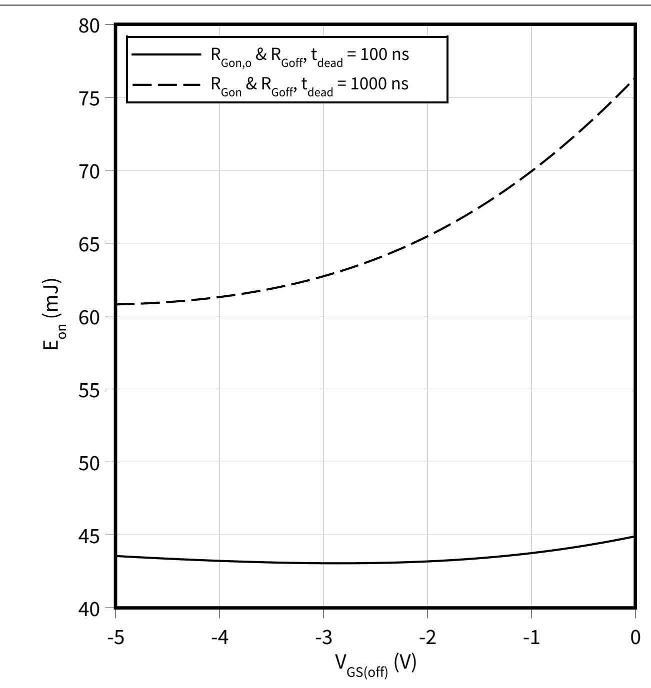
$V_{DD} = 750$ V, $t_{dead} = 1000$ ns, $I_D = 850$ A, $V_{GS} = -3/18$ V



Switching losses (typical), MOSFET

$E_{on} = f(V_{GS(off)})$

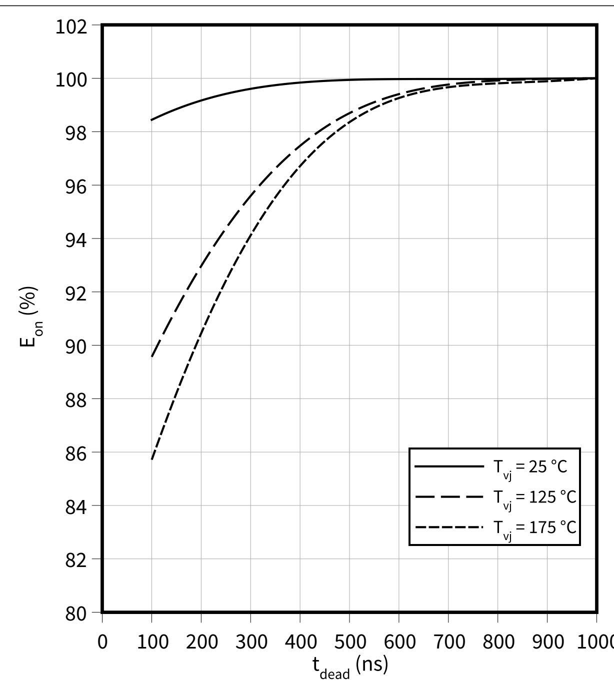
$R_{Goff} = 1\ \Omega$, $V_{DD} = 750$ V, $R_{Gon} = 4.7\ \Omega$, $V_{GS(on)} = 18$ V, $I_D = 850$ A, $R_{Gon,o} = 3.9\ \Omega$, $T_{vj} = 175$ °C



Switching losses (typical), MOSFET

$E_{on} = f(t_{dead})$

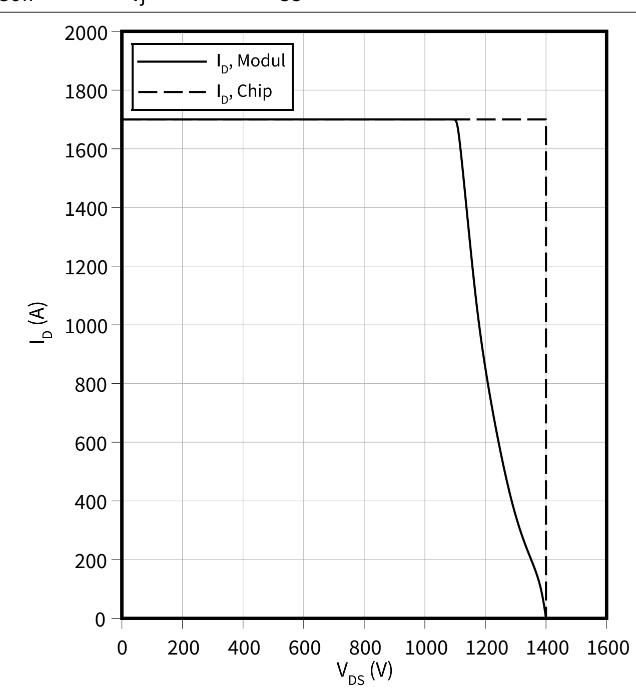
$R_{Gon} = 4.7\ \Omega$, $I_D = 850$ A, $V_{DD} = 750$ V, $V_{GS} = -3/18$ V



Reverse bias safe operating area (RBSOA), MOSFET

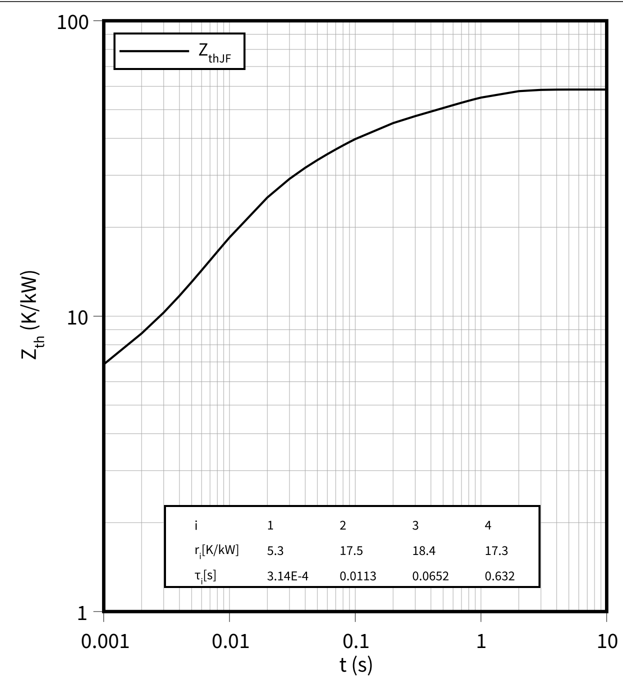
$I_D = f(V_{DS})$

$R_{Goff} = 1\ \Omega$, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Transient thermal impedance, MOSFET

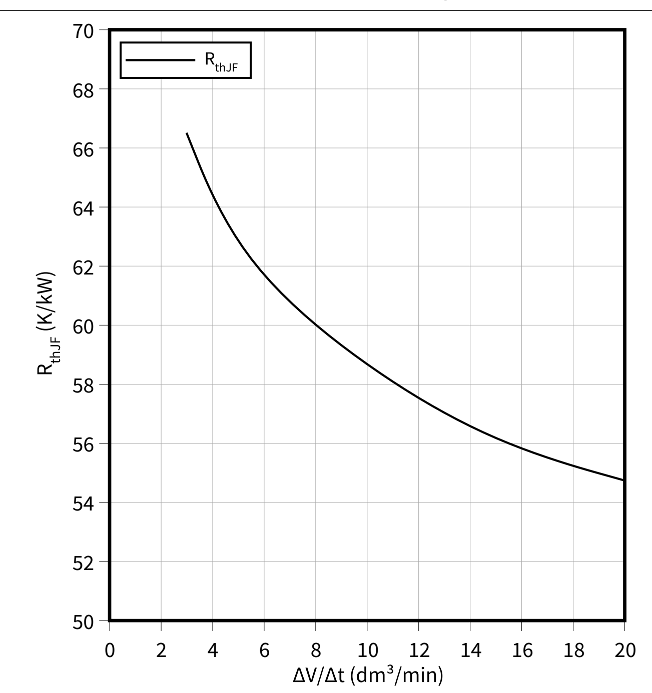
$Z_{th} = f(t)$



Thermal resistance, MOSFET

$R_{thJF} = f(\Delta V/\Delta t)$

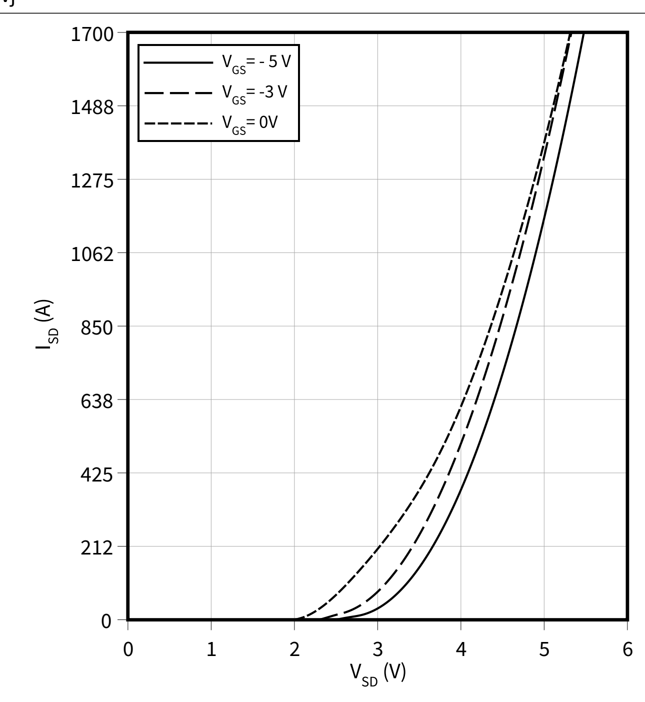
T_F = 60 °C, 50% water / 50% ethylene glycol



Forward characteristic body diode (typical), MOSFET

$I_{SD} = f(V_{SD})$

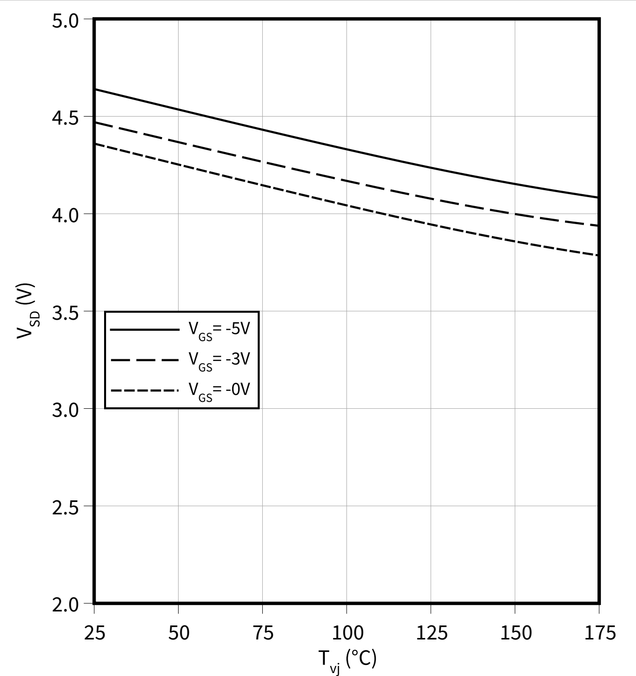
T_{vj} = 25 °C



Forward voltage of body diode (typical), MOSFET

$V_{SD} = f(T_{vj})$

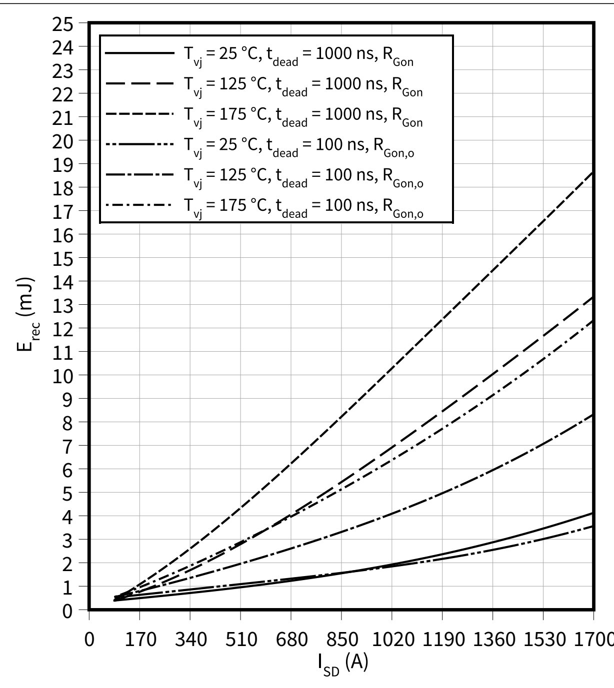
I_{SD} = 850 A



Switching losses body diode (typical), MOSFET

$E_{rec} = f(I_{SD})$

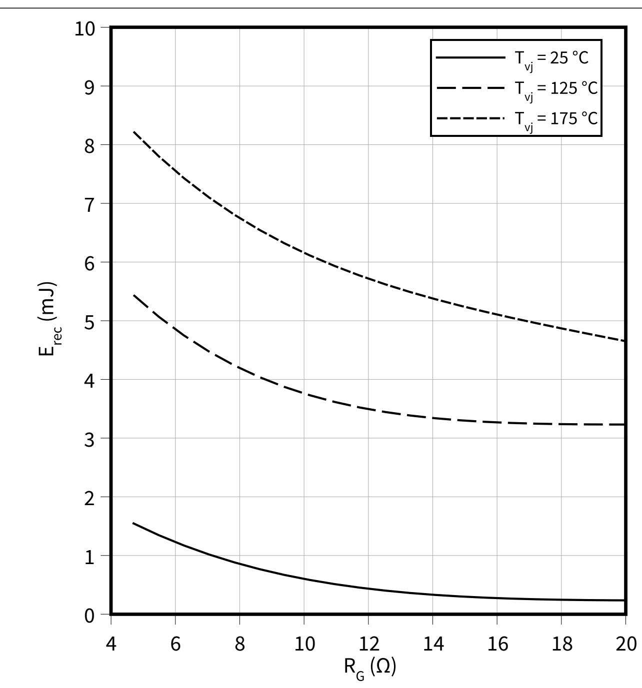
$R_{Gon} = 4.7\ \Omega$, $R_{Gon,o} = 3.9\ \Omega$, $V_{DD} = 750$ V



Switching losses body diode (typical), MOSFET

$E_{rec} = f(R_G)$

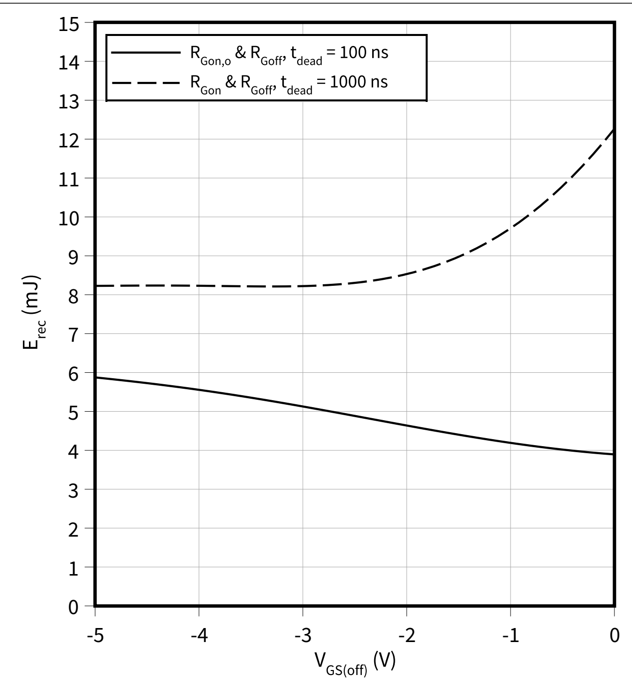
$t_{dead} = 1000$ ns, $I_{SD} = 850$ A, $V_{DD} = 750$ V



Switching losses body diode (typical), MOSFET

$E_{rec} = f(V_{GS(off)})$

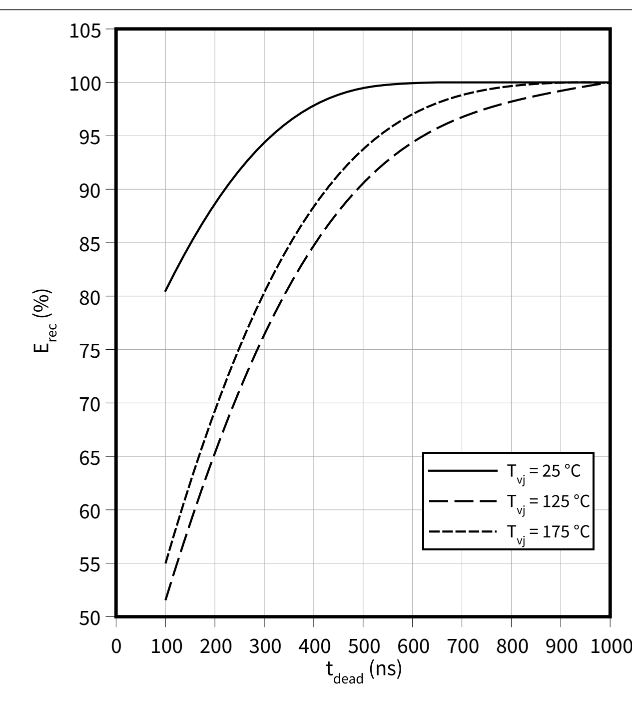
$R_{Goff} = 1\ \Omega$, $R_{Gon} = 4.7\ \Omega$, $V_{GS(on)} = 18$ V, $I_{SD} = 850$ A, $R_{Gon,o} = 3.9\ \Omega$, $V_{DD} = 750$ V, $T_{vj} = 175$ °C



Switching losses body diode (typical), MOSFET

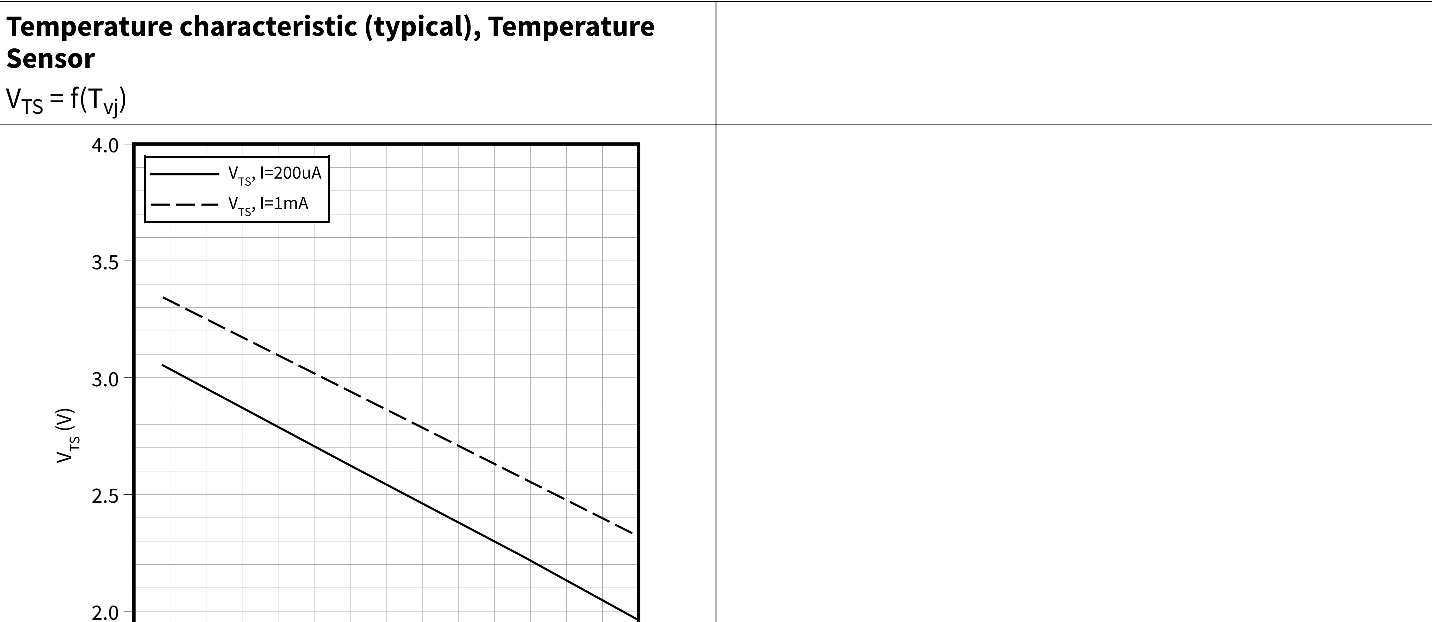
$E_{rec} = f(t_{dead})$

$R_{Gon} = 4.7\ \Omega$, $I_D = 850$ A, $V_{DD} = 750$ V, $V_{GS} = -3/18$ V



Temperature characteristic (typical), Temperature Sensor

$V_{TS} = f(T_{vj})$



6 Circuit diagram

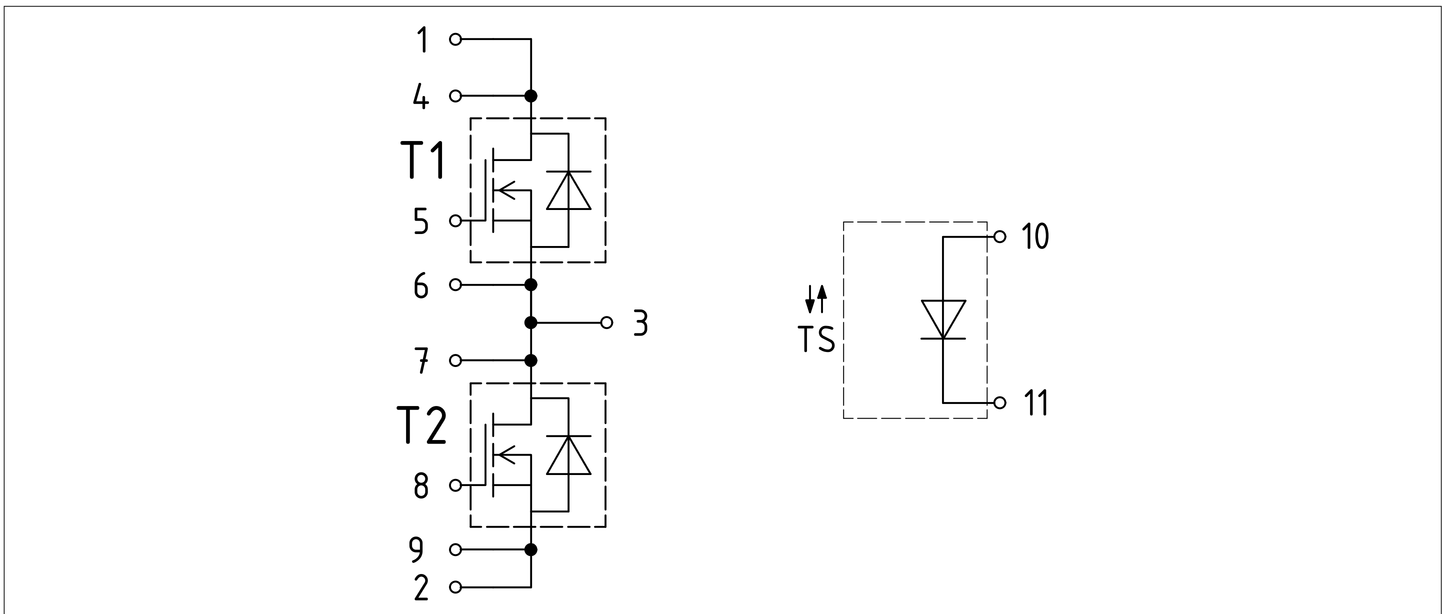


Figure 1

7 Package outlines

110 ± 0,1 (*Distance of threaded holes in heat sink*)

4x dimensioned for M4 screw

64,8 ± 0,5

50 ± 0,1 (*Distance of threaded holes in heat sink*)

(18) (3,8) (24) (34)

HybridPACK™ HD

(78,5) (65,82) (0) (51,21) (61,2) (73,55) (83,5)

162 ± 0,5

Center of press-fit zone
(solderable press-fit contact)

Module labeling ☐ 15x68

(23,03) 22,2 ± 0,3 14 ± 0,3 (6,5) 14 ± 0,3 16,4 ± 0,3

(5,9)

4x
Height of module mounting area
from heatsink

2. Reference hole for Module alignment (dowel pin Ø2 mm)
according to application note AN2026-04

82,7 ± 0,3

(111,5)

43,1 ± 0,3 (8,29)

Flow direction

1. Reference hole for Module alignment (dowel pin Ø2 mm)
according to application note AN2026-04

54,2

2. Reference hole for PCB alignment according to
application note AN2026-04

Hole pattern for optional current sensor

PCB hole pattern

6x self-tapping screws according to
application note AN2026-04

1. Reference hole for PCB alignment according to
application note AN2026-04

28,5 9,1 4,42 0,82 0 4,25 16,8 19,8 28,5

59,75 57,76 55,75 46 35,4 30,53 16,2 13,5 6,15 0 6,9 13,5 25,97 29,97 46

Recommended hole specification according to application note AN2026-04
Tolerance of PCB hole pattern ⌖ Ø0,1

W00243864.00

Figure 2

8 Module label code

Module label code				
Code format	Data Matrix		Barcode Code128	
Encoding	ASCII text		Code Set A	
Symbol size	16x16		23 digits	
Standard	IEC24720 and IEC16022		IEC8859-1	
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30	
Example	71549142846550549911530		71549142846550549911530	

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2024-07-12	Initial version
0.20	2025-09-05	Initial version
0.21	2026-01-20	added T_BPmax changed Viso definition from t=1s to t=1min
1.00	2026-06-03	Final datasheet

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