Final datasheet
62 mm C-Series module with CoolSiC™ Trench MOSFET

Features

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 280 A / I_{DRM} = 560 A
  - High current density
  - Low switching losses
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - 2.5 kV AC 1 minute insulation

Potential applications

- UPS systems
- Solar applications
- DC/DC converter
- High-frequency switching application
- Energy storage systems
- DC charger for EV

Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

Description

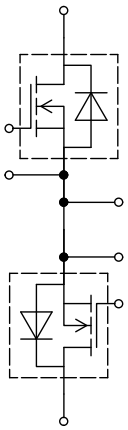

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Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, *t* = 60 s	2.5	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	$d_{Creep\ nom}$	terminal to baseplate, nom.	29.0	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom.	23.0	mm
Clearance	$d_{Clear\ nom}$	terminal to baseplate, nom.	23.0	mm
Clearance	$d_{Clear\ nom}$	terminal to terminal, nom.	11.0	mm
Comparative tracking index	*CTI*		> 400	
Relative thermal index (electrical)	*RTI*	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray inductance module	L_{sCE}				20		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C = 25 °C, per switch			0.465		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for module mounting	*M*	- Mounting according to valid application note	M6, Screw	3		6	Nm
Terminal connection torque	*M*	- Mounting according to valid application note	M6, Screw	2.5		5	Nm
Weight	*G*				340		g

***Note**: The electrical characterization was performed in NPC2 topology, which combines the modules FF3MR12KM1H and FF3MR12KM1H_S.*
It has to be considered, that the commutation in this configuration takes place between both modules

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Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}		T_{vj} = 25 °C	1200	V
Implemented drain current	I_{DN}			280	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_C = 115 °C	200	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		560	A
Gate-source voltage, max. transient voltage	V_{GS}	D < 0.01		-10/23	V
Gate-source voltage, max. static voltage	V_{GS}			-7/20	V

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...0	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 = 280 A	V_{GS} = 18 V, T_{vj} = 25 °C		2.9	4.4	mΩ
			V_{GS} = 18 V, T_{vj} = 125 °C		4.8		
			V_{GS} = 18 V, T_{vj} = 175 °C		6.3		
			V_{GS} = 15 V, T_{vj} = 25 °C		3.5		
Gate threshold voltage	$V_{GS(th)}$	I_D = 112 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C, (tested after 1ms pulse at V_{GS} = +20 V)		3.5	4.3	5.1	V
Total gate charge	Q_G	V_{DD} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			0.8		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1.9		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		24.2		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		1.2		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.079		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			473		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.16	378	µA

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
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 = 280 A, R_{Gon} = 5.6 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 V_{GS} to 0.1 I_D	T_{vj} = 25 °C		118		ns
			T_{vj} = 125 °C		113		
			T_{vj} = 175 °C		108		
Rise time (inductive load)	t_r	I_D = 280 A, R_{Gon} = 5.6 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 I_D to 0.9 I_D	T_{vj} = 25 °C		116		ns
			T_{vj} = 125 °C		126		
			T_{vj} = 175 °C		131		
Turn-off delay time (inductive load)	$t_{d\,off}$	I_D = 280 A, R_{Goff} = 2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, 0.9 V_{GS} to 0.9 I_D	T_{vj} = 25 °C		110		ns
			T_{vj} = 125 °C		121		
			T_{vj} = 175 °C		127		
Fall time (inductive load)	t_f	I_D = 280 A, R_{Goff} = 2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, 0.9 I_D to 0.1 I_D	T_{vj} = 25 °C		30		ns
			T_{vj} = 125 °C		32		
			T_{vj} = 175 °C		34		
Turn-on energy loss per pulse	E_{on}	I_D = 280 A, V_{DD} = 600 V, L_σ = 31 nH, V_{GS} = -3/18 V, R_{Gon} = 5.6 Ω, di/dt = 3.4 kA/µs (T_{vj} = 175 °C), t_{dead} = 1000 ns	T_{vj} = 25 °C		8		mJ
			T_{vj} = 125 °C		9.1		
			T_{vj} = 175 °C		9.7		
Turn-on energy loss per pulse, optimized	$E_{on,o}$	I_D = 280 A, V_{DD} = 600 V, L_σ = 31 nH, V_{GS} = -3/18 V, $R_{Gon,o}$ = 0.68 Ω, di/dt = 6.9 kA/µs (T_{vj} = 175 °C), t_{dead} = 100 ns	T_{vj} = 25 °C		2.3		mJ
			T_{vj} = 125 °C		2.3		
			T_{vj} = 175 °C		2.4		
Turn-off energy loss per pulse	E_{off}	I_D = 280 A, V_{DD} = 600 V, L_σ = 31 nH, V_{GS} = -3/18 V, R_{Goff} = 2 Ω, dv/dt = 15.7 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		7		mJ
			T_{vj} = 125 °C		7.1		
			T_{vj} = 175 °C		7.5		
Thermal resistance, junction to case	R_{thJC}	per MOSFET				0.176	K/W
Thermal resistance, case to heat sink	R_{thCH}	per MOSFET			0.049		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

***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 Notes AN 2018-09 and AN 2021-13 must be considered to ensure sound operation of the device over the planned lifetime.*

Tvj,op > 150°C is allowed for operation at overload conditions for MOSFET and body diode. For detailed specifications, please refer to AN 2021-13.

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_C = 115 °C	90	A

Table 7 Characteristic values

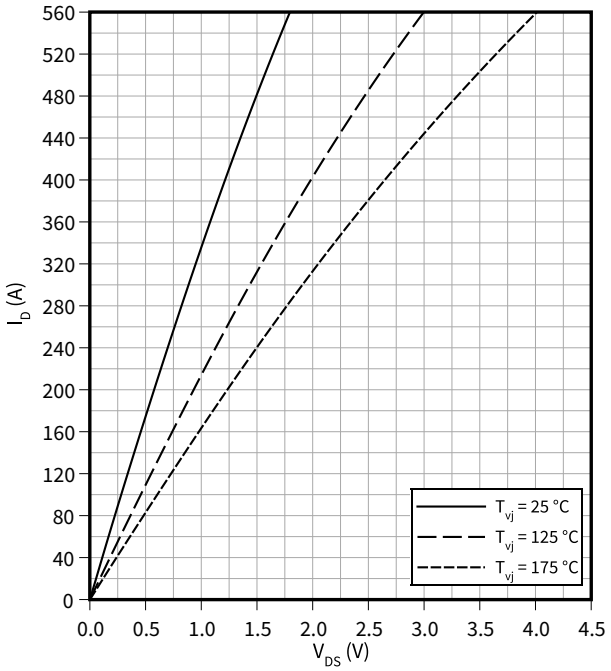
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 280 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.22	5.59	V
			T_{vj} = 125 °C		3.95		
			T_{vj} = 175 °C		3.85		
Peak reverse recovery current	I_{rrm}	I_{SD} = 280 A, di_s/dt = 3.4 kA/µs, V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		111		A
			T_{vj} = 125 °C		155		
			T_{vj} = 175 °C		184		
Recovered charge	Q_{rr}	I_{SD} = 280 A, di_s/dt = 3.4 kA/µs, V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		5.3		µC
			T_{vj} = 125 °C		6.9		
			T_{vj} = 175 °C		9.1		
Reverse recovery energy	E_{rec}	I_{SD} = 280 A, di_s/dt = 3.4 kA/µs (T_{vj} = 175 °C), V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		1		mJ
			T_{vj} = 125 °C		1.8		
			T_{vj} = 175 °C		2.6		
Reverse recovery energy, optimized	$E_{rec,o}$	I_{SD} = 280 A, di_s/dt = 6.9 kA/µs (T_{vj} = 175 °C), V_{DD} = 600 V, V_{GS}=-3 V, t_{dead} = 100 ns	T_{vj} = 25 °C		3.1		mJ
			T_{vj} = 125 °C		3.1		
			T_{vj} = 175 °C		4.6		

4 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

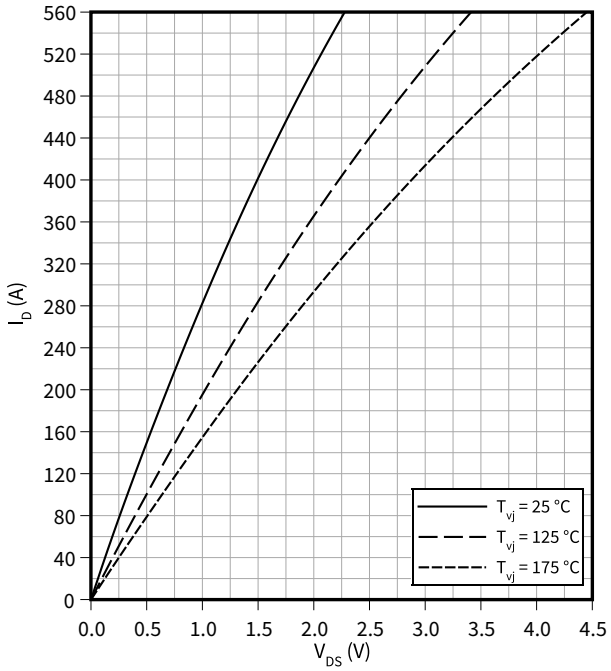
V_{GS} = 18 V



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

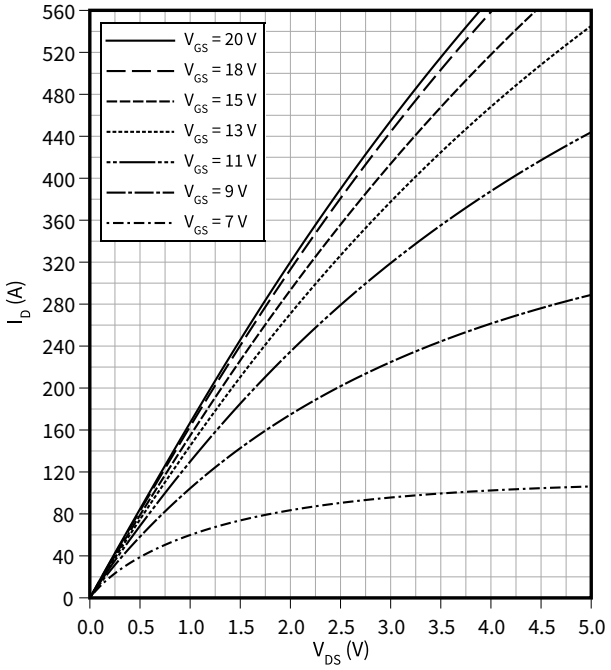
V_{GS} = 15 V



Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$

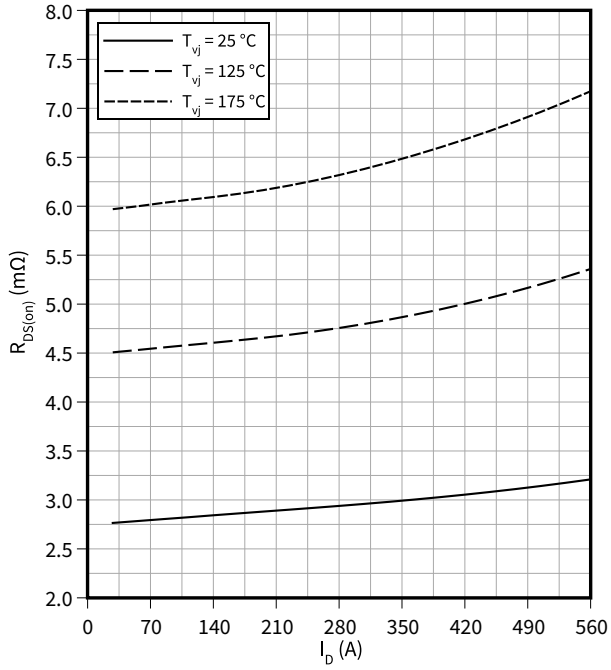
T_{vj} = 175 °C



Drain source on-resistance (typical), MOSFET

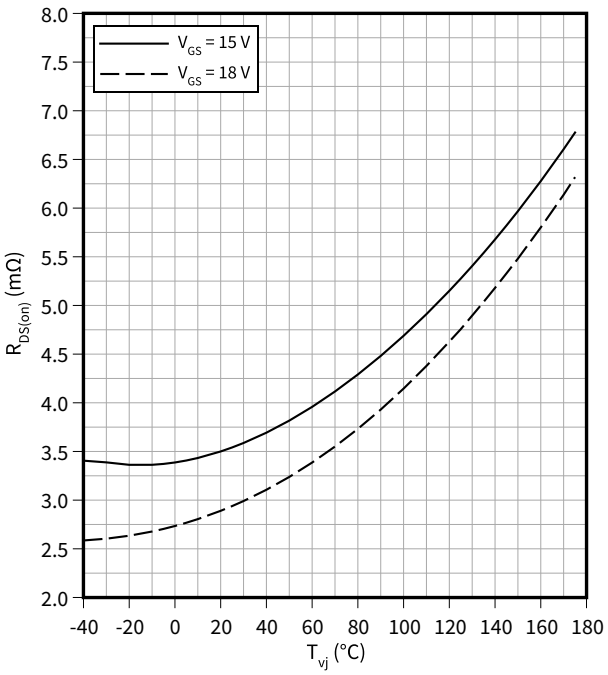
$R_{DS(on)} = f(I_D)$

V_{GS} = 18 V



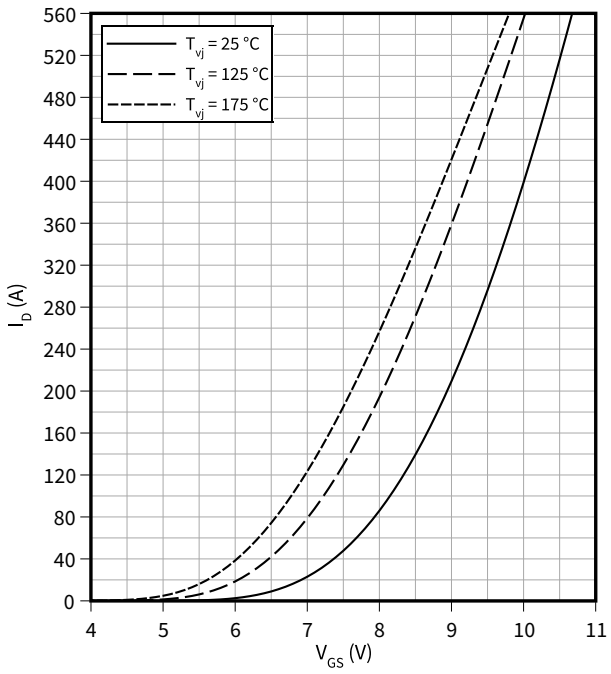
Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$
$I_D = 280$ A



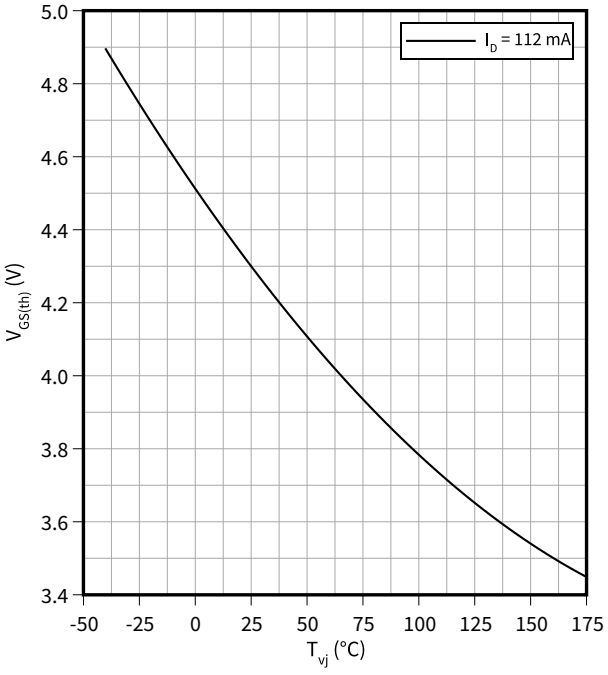
Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$
$V_{DS} = 20$ V



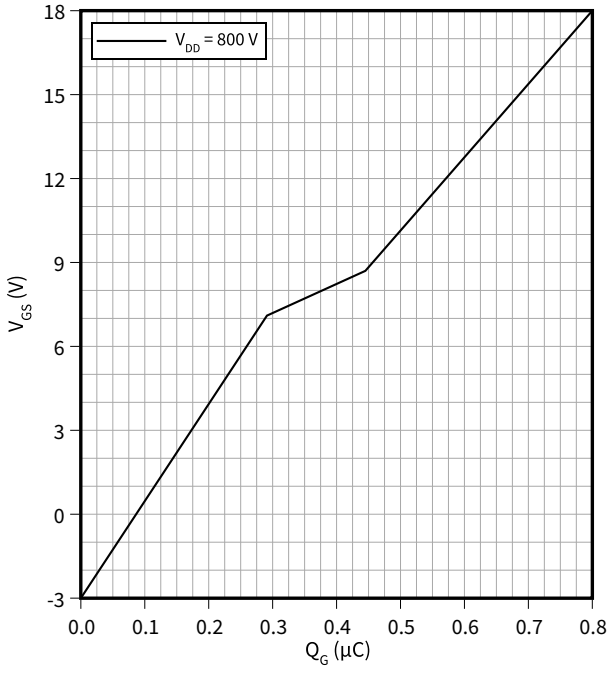
Gate-source threshold voltage (typical), MOSFET

$V_{GS(th)} = f(T_{vj})$
$I_D = 112$ mA, $V_{DS} = V_{GS}$



Gate charge characteristic (typical), MOSFET

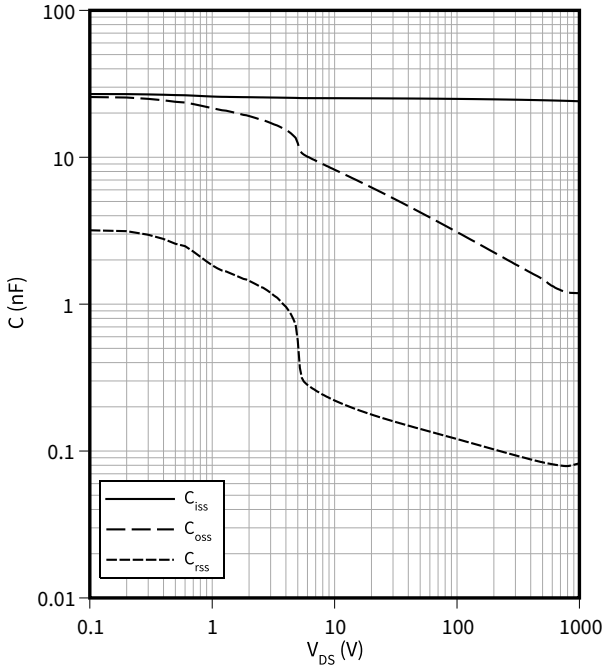
$V_{GS} = f(Q_G)$
$I_D = 280$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

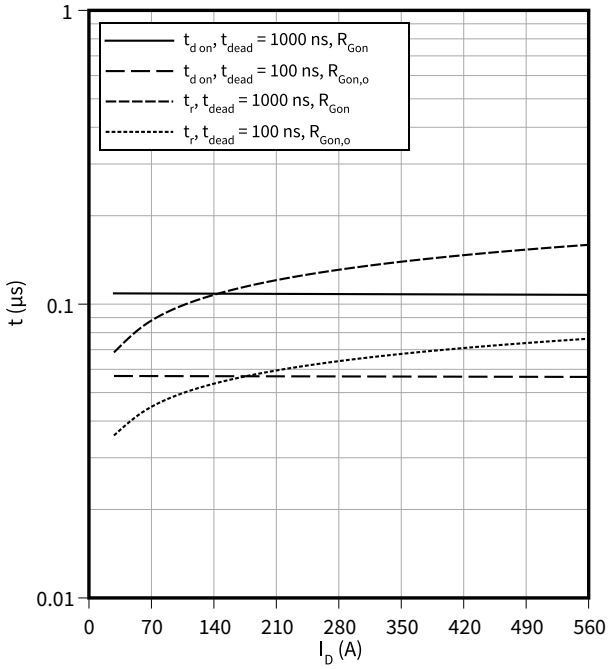
$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GS} = 0$ V



Switching times (typical), MOSFET

$t = f(I_D)$

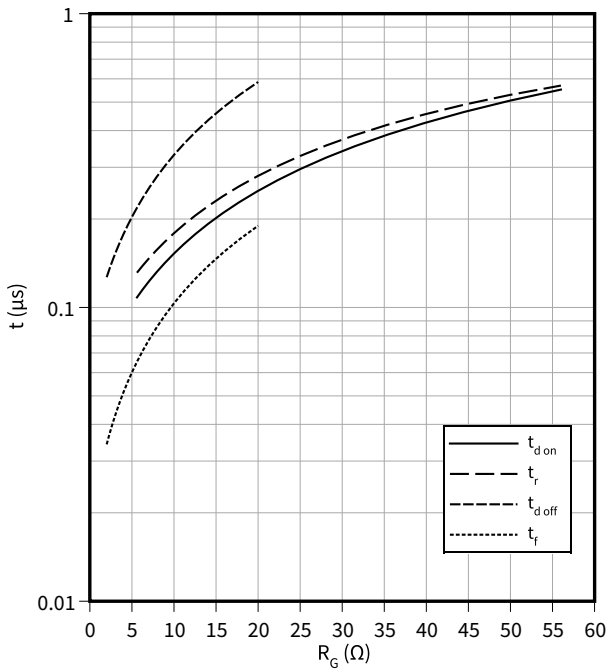
$R_{Gon} = 5.6\ \Omega$, $V_{DD} = 600$ V, $R_{Gon,o} = 0.68\ \Omega$, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET

$t = f(R_G)$

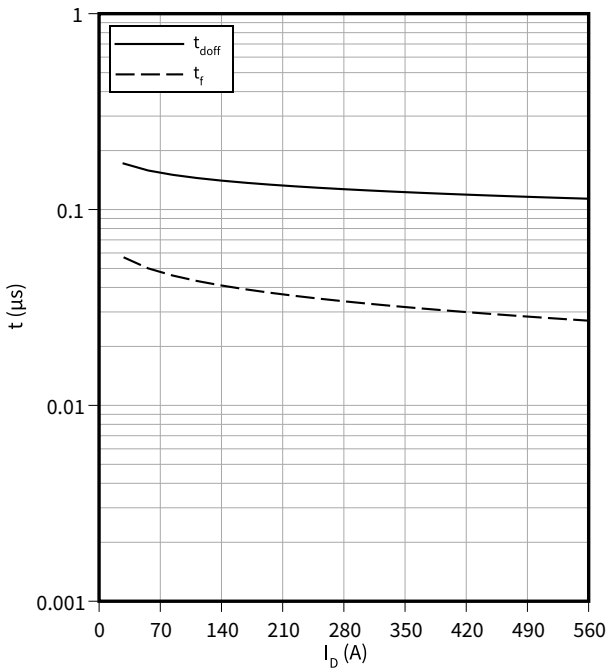
$V_{DD} = 600$ V, $t_{dead} = 1000$ ns, $I_D = 280$ A, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET

$t = f(I_D)$

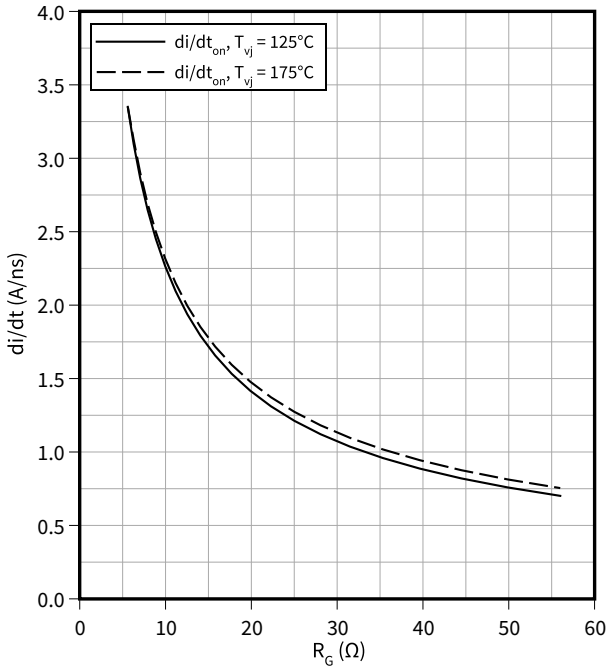
$R_{Goff} = 2\ \Omega$, $V_{DD} = 600$ V, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Current slope (typical), MOSFET

$di/dt = f(R_G)$

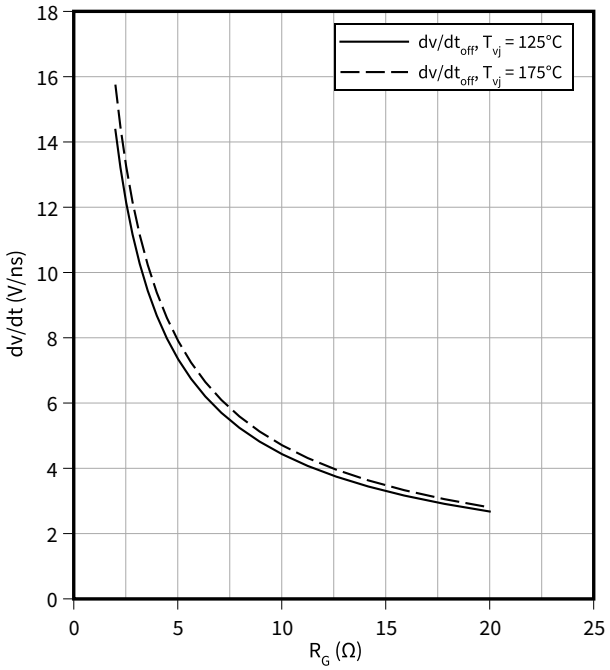
V_{DD} = 600 V, t_{dead} = 1000 ns, I_D = 280 A, V_{GS} = -3/18 V



Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

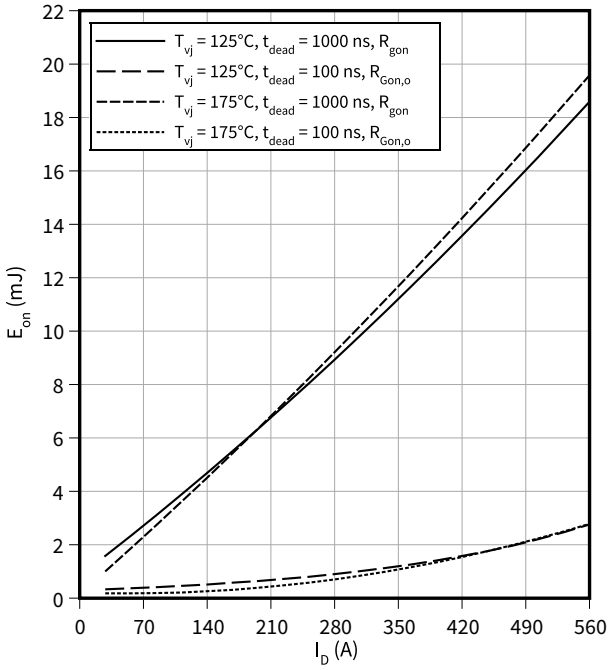
V_{DD} = 600 V, I_D = 280 A, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

$E_{on} = f(I_D)$

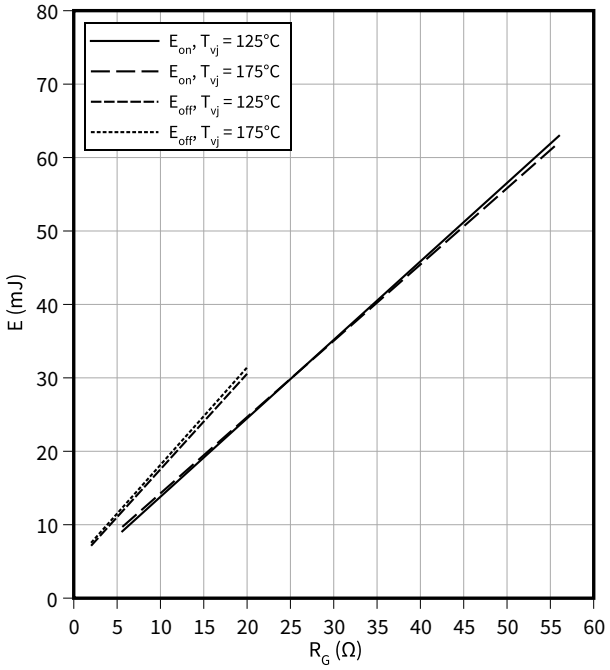
R_{Gon} = 5.6 Ω, V_{DD} = 600 V, $R_{Gon,o}$ = 0.68 Ω, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

$E = f(R_G)$

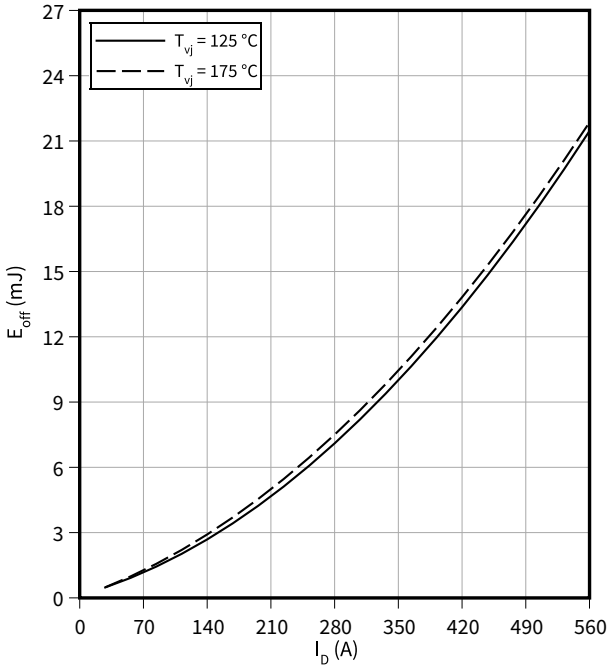
t_{dead} = 1000 ns, V_{DD} = 600 V, I_D = 280 A, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

$E_{off} = f(I_D)$

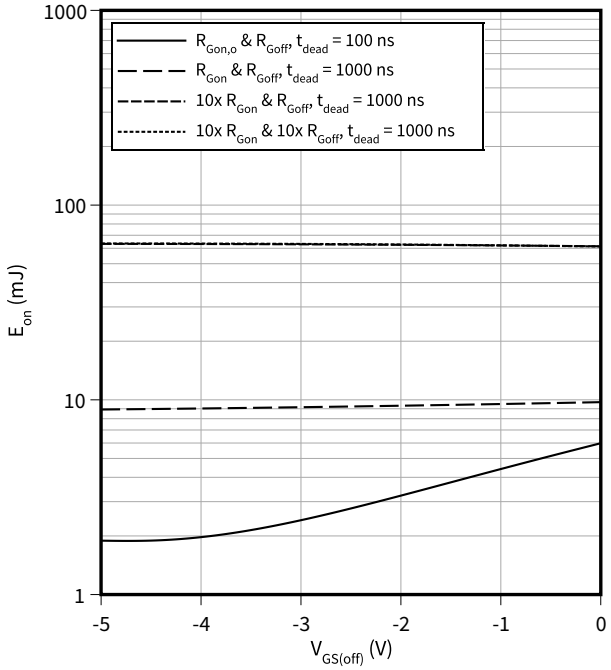
R_{Goff} = 2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

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

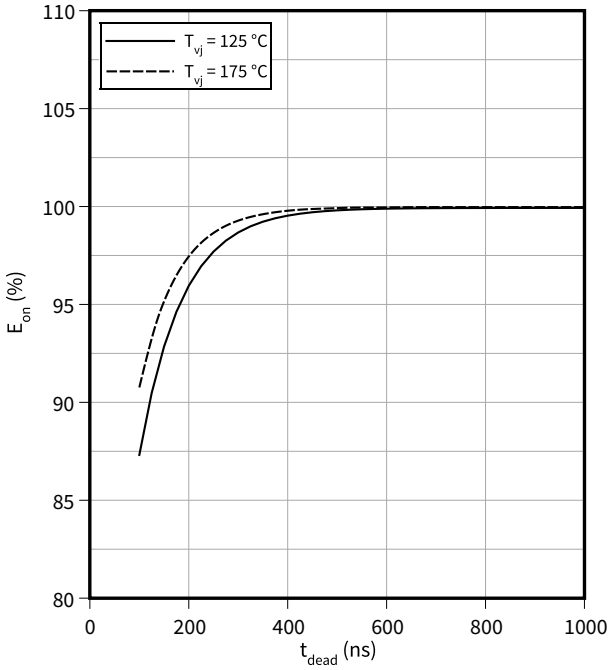
R_{Goff} = 2 Ω, V_{DD} = 600 V, R_{Gon} = 5.6 Ω, $V_{GS(on)}$ = 18 V, I_D = 280 A, $R_{Gon,o}$ = 0.68 Ω, T_{vj} = 175 °C



Switching losses (typical), MOSFET

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

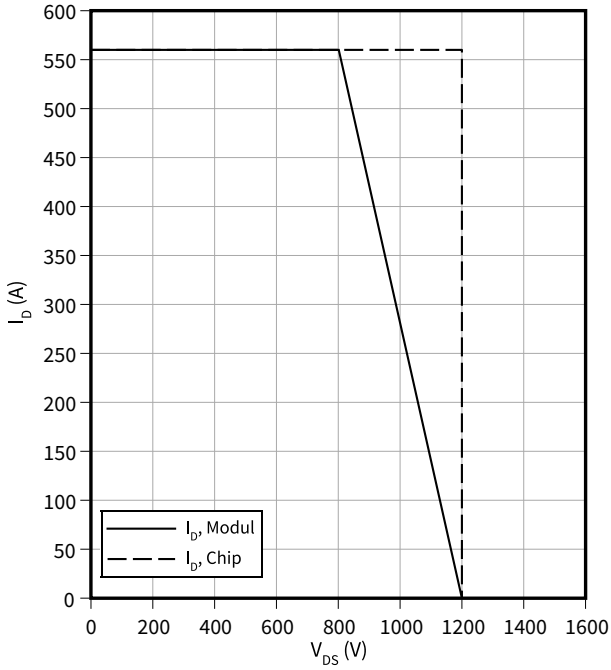
R_{Gon} = 5.6 Ω, I_D = 280 A, V_{DD} = 600 V, V_{GS} = -3/18 V



Reverse bias safe operating area (RBSOA), MOSFET

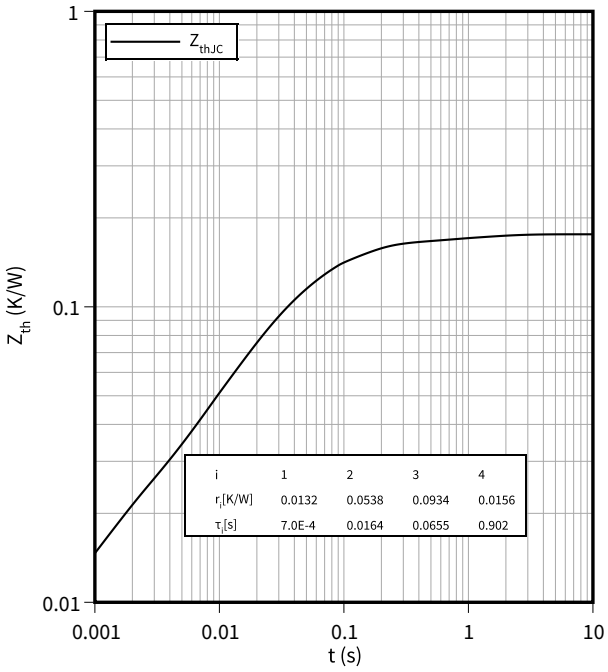
$I_D = f(V_{DS})$

R_{Goff} = 2 Ω, T_{vj} = 175 °C, V_{GS} = -3/18 V



Transient thermal impedance, MOSFET

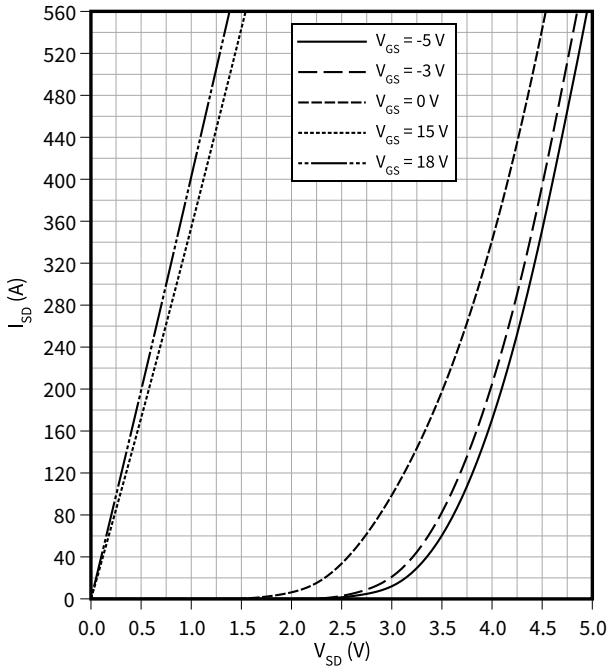
$Z_{th} = f(t)$



Forward characteristic body diode (typical), MOSFET

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

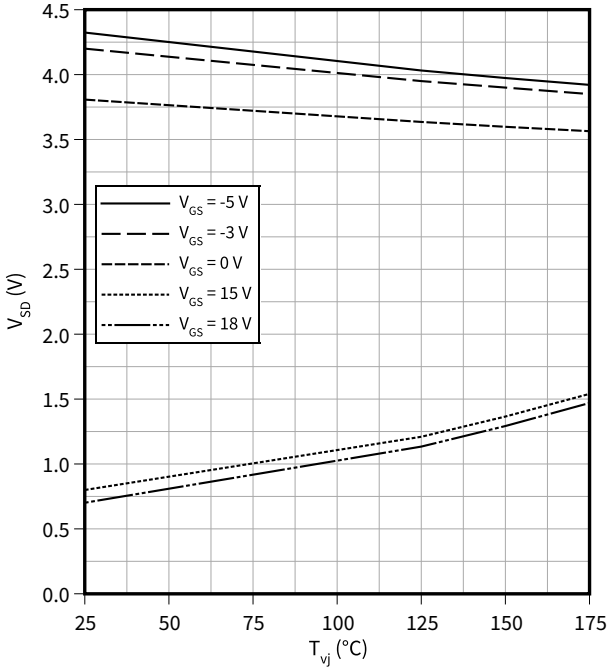
$T_{vj} = 25\ °C$



Forward voltage of body diode (typical), MOSFET

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

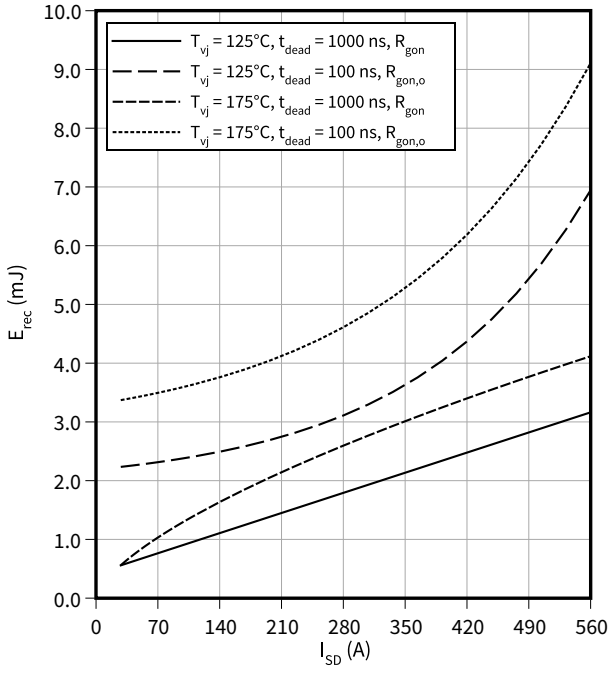
$I_{SD} = 280\ A$



Switching losses body diode (typical), MOSFET

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

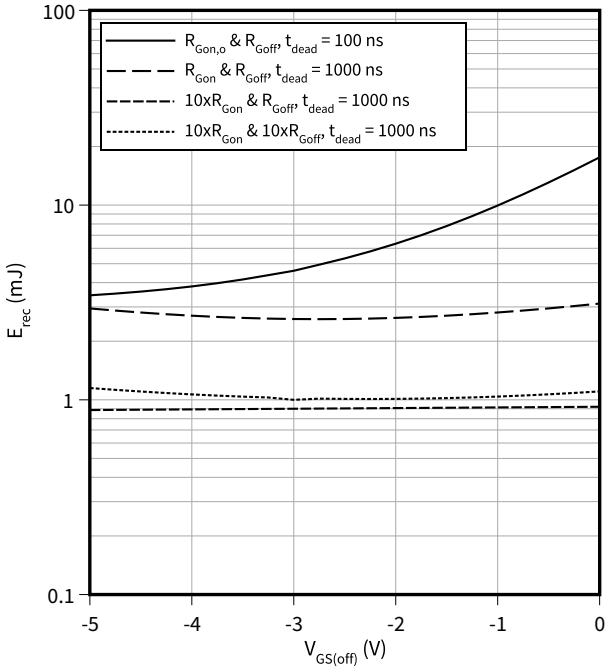
$R_{Gon} = 5.6\ \Omega$, $R_{Gon,o} = 0.68\ \Omega$, $V_{DD} = 600\ V$



Switching losses body diode (typical), MOSFET

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

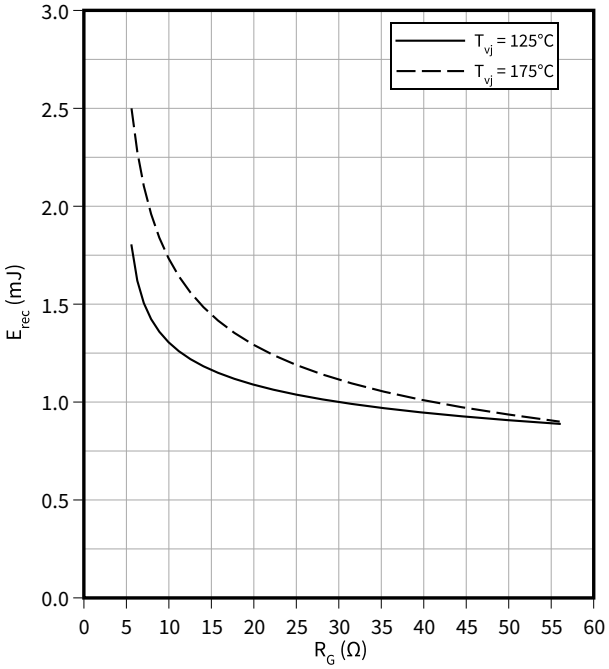
R_{Goff} = 2 Ω, R_{Gon} = 5.6 Ω, T_{vj} = 175 °C, $V_{GS(on)}$ = 18 V, $R_{Gon,o}$ = 0.68 Ω, V_{DD} = 600 V, I_{SD} = 280 A



Switching losses body diode (typical), MOSFET

$E_{rec} = f(R_G)$

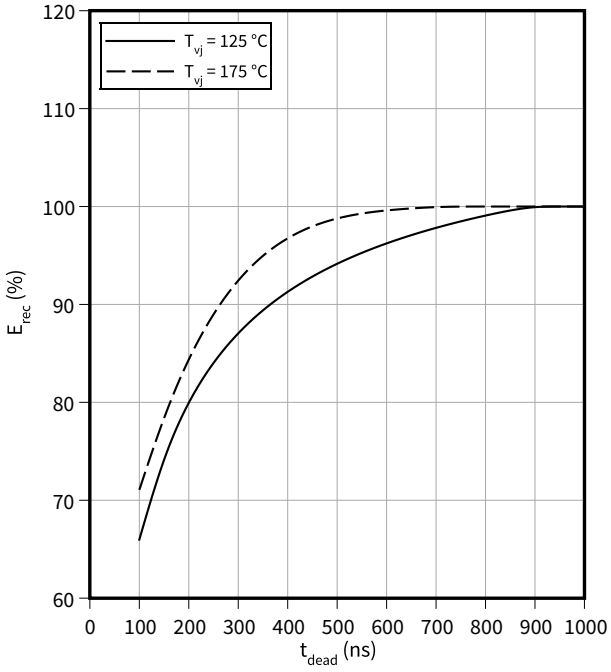
t_{dead} = 1000 ns, V_{DD} = 600 V, I_{SD} = 280 A



Switching losses body diode (typical), MOSFET

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

R_{Gon} = 5.6 Ω, I_{SD} = 280 A, V_{DD} = 600 V, V_{GS} = -3/18 V



5 Circuit diagram

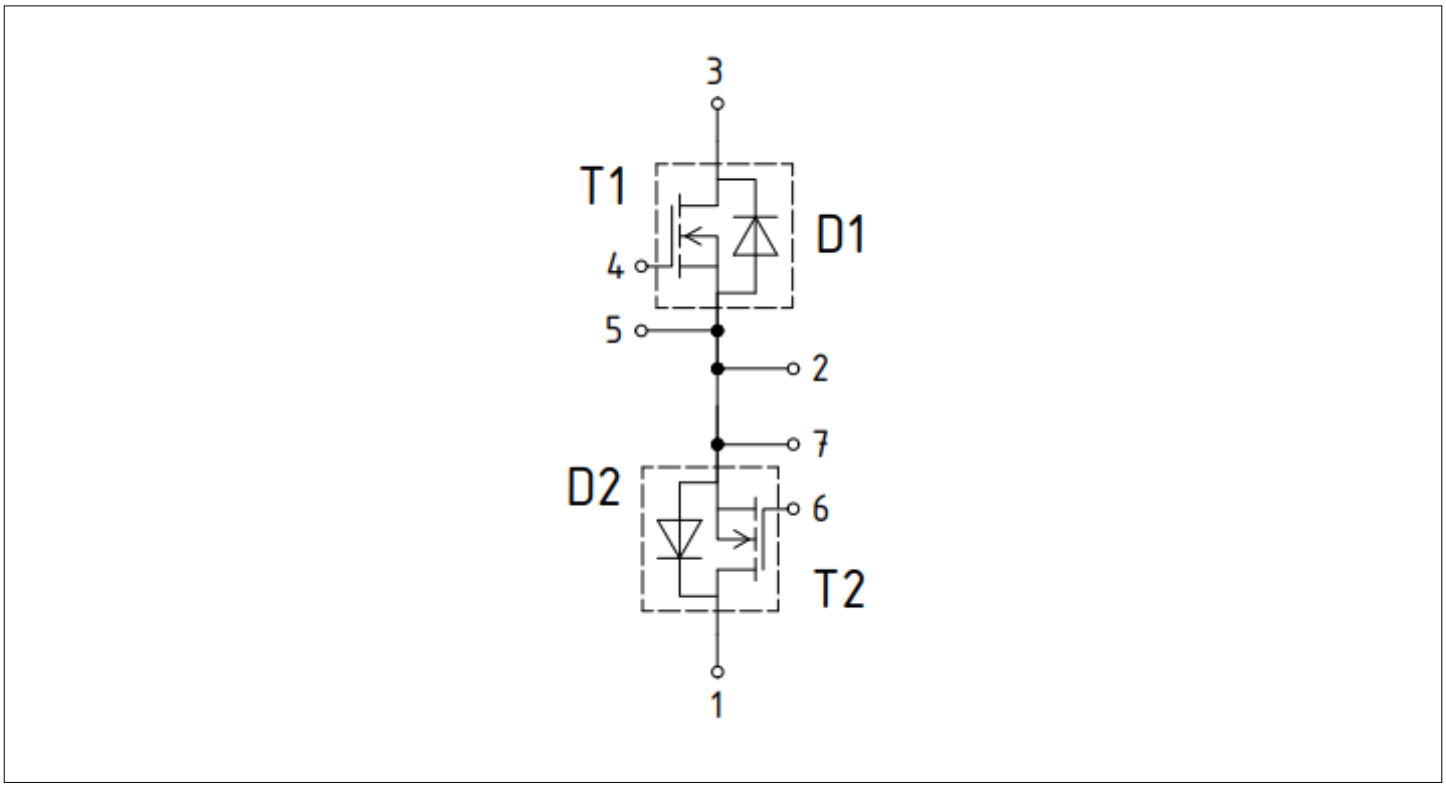


Figure 1

6 Package outlines

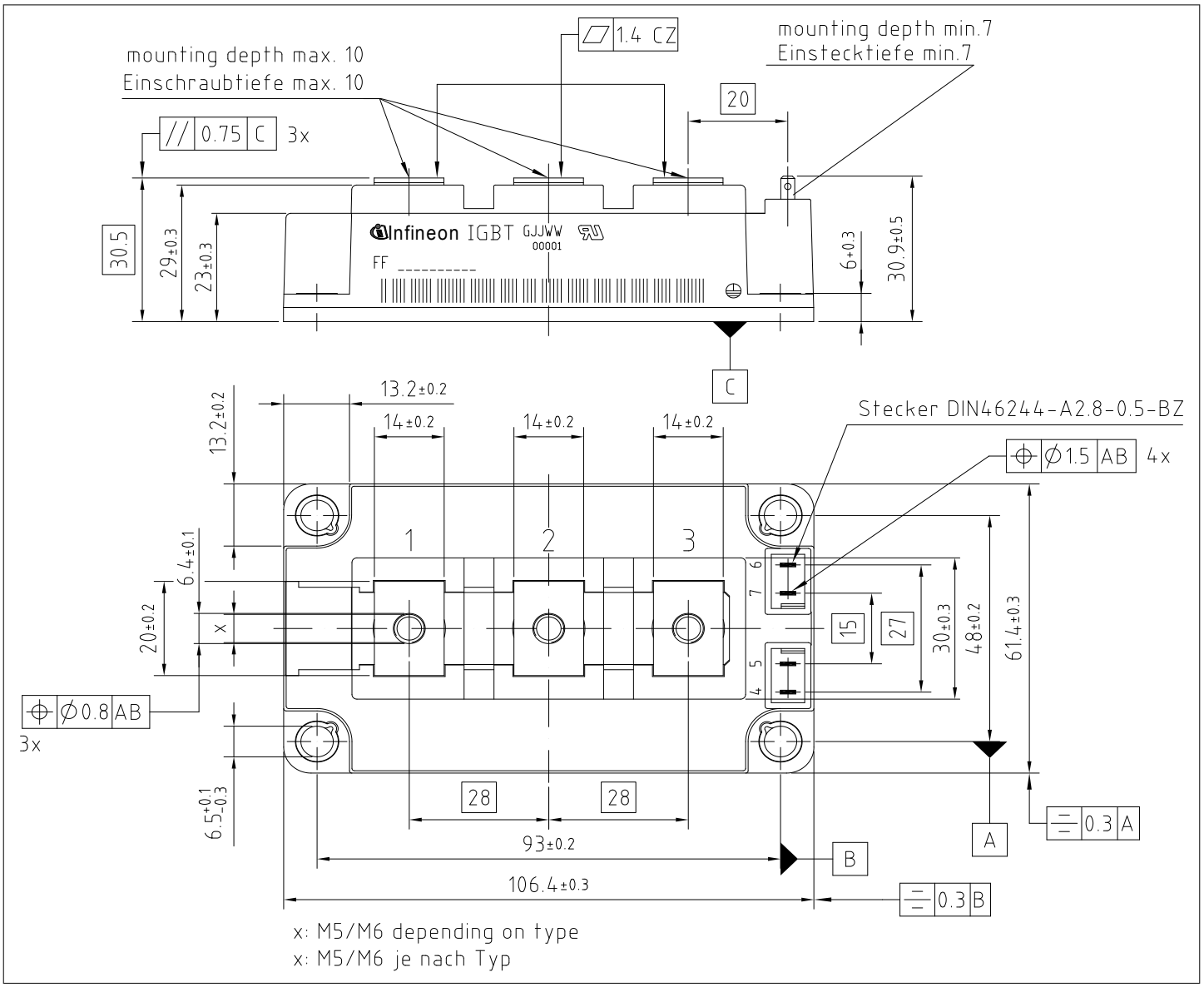


Figure 2

7 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
1.00	2025-07-30	Final datasheet

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