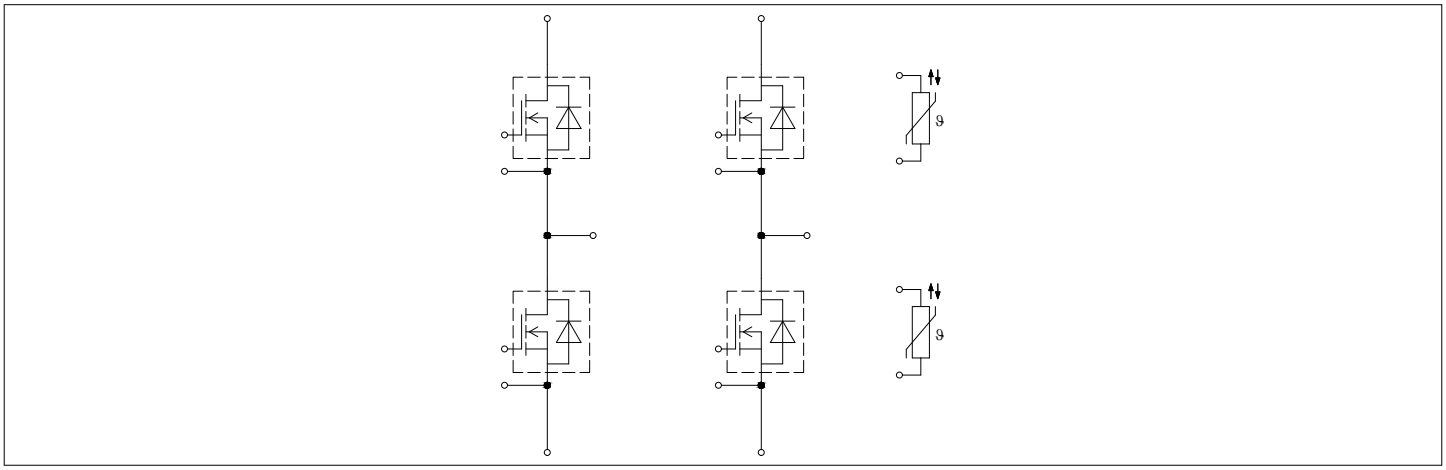
Final datasheet
EasyPACK™ module with CoolSiC™ Trench MOSFET and PressFIT / NTC

Features
- Electrical features
  - V_{DSS} = 2000 V
  - I_{DN} = 160 A / I_{DRM} = 320 A
  - Overload operation up to 175°C
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - Integrated NTC temperature sensor
  - PressFIT contact technology

Potential applications
- EV charging
- Energy storage systems (ESS)
- Solar applications
- DC/DC converter

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

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	3.2	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, *t* = 1 min	3.2	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
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}			22		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		1.4		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	*M*	- Mounting according to valid application note; M5, Screw	1.3		1.5	Nm
Weight	*G*			78		g

***Note**: The current under continuous operation is limited to 25A rms per connector pin.*

2 MOSFET, T1-T4

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}		T_{vj} = 25 °C	2000	V
Implemented drain current	I_{DN}			160	A
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_H = 65 °C	135	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		320	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...-2	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 = 160 A	V_{GS} = 18 V, T_{vj} = 25 °C		5.1	8.1	mΩ
			V_{GS} = 18 V, T_{vj} = 125 °C		10.9		
			V_{GS} = 18 V, T_{vj} = 175 °C		15.4		
			V_{GS} = 15 V, T_{vj} = 25 °C		5.6		
Gate threshold voltage	$V_{GS(th)}$	I_D = 112 mA, V_{DS} = V_{GS}, (tested after 1ms pulse at V_{GS} = +20 V), T_{vj} = 25 °C		3.45	4.3	5.15	V
Total gate charge	Q_G	V_{DD} = 1200 V, V_{GS} = -3 V, T_{vj} = 25 °C			0.78		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1.8		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C		24.1		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.563		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.041		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 1200 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			508		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 2000 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.04	378	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 = 160 A, R_{Gon} = 4.3 Ω, V_{DD} = 1200 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 V_{GS} to 0.1 I_D	T_{vj} = 25 °C		70		ns
			T_{vj} = 125 °C		69		
			T_{vj} = 175 °C		69		
Rise time (inductive load)	t_r	I_D = 160 A, R_{Gon} = 4.3 Ω, V_{DD} = 1200 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 I_D to 0.9 I_D	T_{vj} = 25 °C		29		ns
			T_{vj} = 125 °C		29		
			T_{vj} = 175 °C		29		

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time (inductive load)	$t_{d\,off}$	I_D = 160 A, R_{Goff} = 0.51 Ω, V_{DD} = 1200 V, V_{GS} = -3/18 V, 0.9 V_{GS} to 0.9 I_D	T_{vj} = 25 °C		107		ns
			T_{vj} = 125 °C		113		
			T_{vj} = 175 °C		119		
Fall time (inductive load)	t_f	I_D = 160 A, R_{Goff} = 0.51 Ω, V_{DD} = 1200 V, V_{GS} = -3/18 V, 0.9 I_D to 0.1 I_D	T_{vj} = 25 °C		33		ns
			T_{vj} = 125 °C		36		
			T_{vj} = 175 °C		38		
Turn-on energy loss per pulse	E_{on}	I_D = 160 A, V_{DD} = 1200 V, L_σ = 15 nH, V_{GS} = -3/18 V, R_{Gon} = 4.3 Ω, di/dt = 4.5 kA/µs (T_{vj} = 175 °C), t_{dead} = 1000 ns	T_{vj} = 25 °C		10.8		mJ
			T_{vj} = 125 °C		12.5		
			T_{vj} = 175 °C		15.1		
Turn-on energy loss per pulse, optimized	$E_{on,o}$	I_D = 160 A, V_{DD} = 1200 V, L_σ = 15 nH, V_{GS} = -3/18 V, $R_{Gon,o}$ = 2.4 Ω, di/dt = 6 kA/µs (T_{vj} = 175 °C), t_{dead} = 100 ns	T_{vj} = 25 °C		7.6		mJ
			T_{vj} = 125 °C		7.9		
			T_{vj} = 175 °C		8.7		
Turn-off energy loss per pulse	E_{off}	I_D = 160 A, V_{DD} = 1200 V, L_σ = 15 nH, V_{GS} = -3/18 V, R_{Goff} = 0.51 Ω, dv/dt = 38.5 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.7		mJ
			T_{vj} = 125 °C		3		
			T_{vj} = 175 °C		3.1		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, λ_{grease} = 3.3 W/(m·K)			0.238		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.*
$T_{vj\,op}$ > 150 °C is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

3 Body diode (MOSFET, T1-T4)

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_H = 65 °C	100	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 160 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.4	5.95	V
			T_{vj} = 125 °C		4		
			T_{vj} = 175 °C		3.85		
Peak reverse recovery current	I_{rrm}	I_{SD} = 160 A, di_s/dt = 4.5 kA/µs, V_{DD} = 1200 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		88		A
			T_{vj} = 125 °C		118		
			T_{vj} = 175 °C		162		
Recovered charge	Q_{rr}	I_{SD} = 160 A, di_s/dt = 4.5 kA/µs, V_{DD} = 1200 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		4.3		µC
			T_{vj} = 125 °C		5.9		
			T_{vj} = 175 °C		8.8		
Reverse recovery energy	E_{rec}	I_{SD} = 160 A, di_s/dt = 4.5 kA/µs (T_{vj} = 175 °C), V_{DD} = 1200 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		3.5		mJ
			T_{vj} = 125 °C		4.3		
			T_{vj} = 175 °C		5.4		
Reverse recovery energy, optimized	$E_{rec,o}$	I_{SD} = 160 A, di_s/dt = 6 kA/µs (T_{vj} = 175 °C), V_{DD} = 1200 V, V_{GS} = -3 V, t_{dead} = 100 ns	T_{vj} = 25 °C		2.5		mJ
			T_{vj} = 125 °C		2.8		
			T_{vj} = 175 °C		4.1		

4 NTC-Thermistor

Table 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2-1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2-1/(298{,}15\ K))]$		3433		K

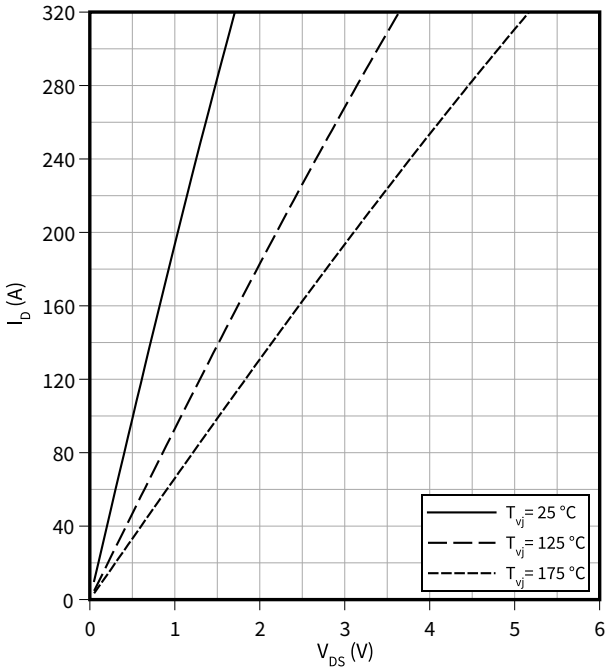
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4*

5 Characteristics diagrams

Output characteristic (typical), MOSFET, T1-T4

$I_D = f(V_{DS})$

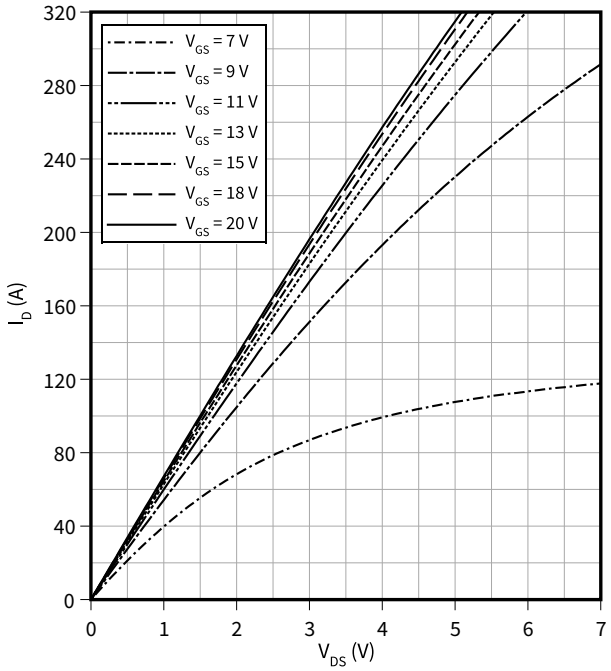
$V_{GS} = 18$ V



Output characteristic field (typical), MOSFET, T1-T4

$I_D = f(V_{DS})$

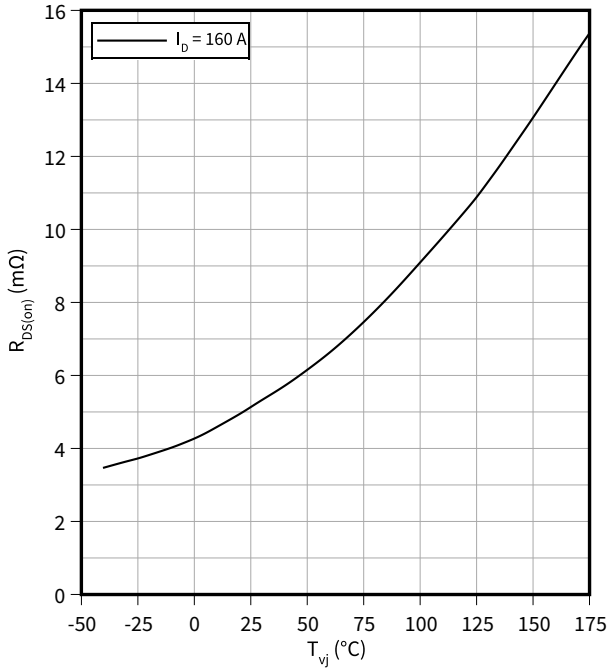
$T_{vj} = 175$ °C



Drain source on-resistance (typical), MOSFET, T1-T4

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

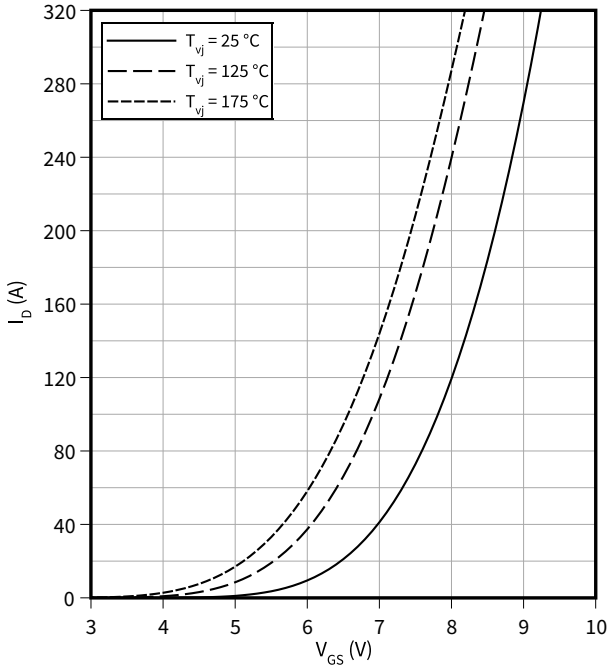
$V_{GS} = 18$ V



Transfer characteristic (typical), MOSFET, T1-T4

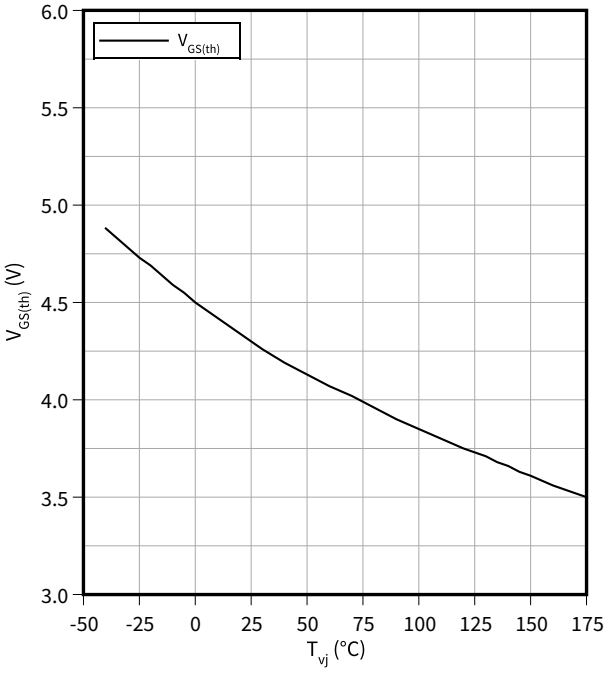
$I_D = f(V_{GS})$

$V_{DS} = 20$ V



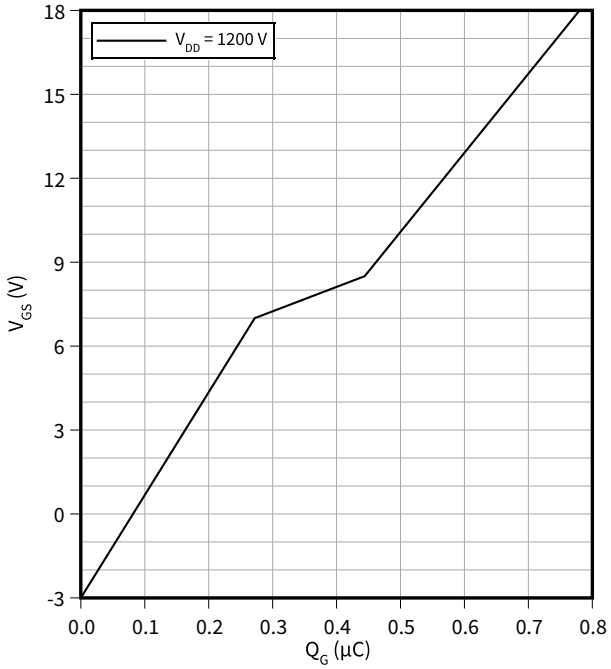
Gate-source threshold voltage (typical), MOSFET, T1-T4

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



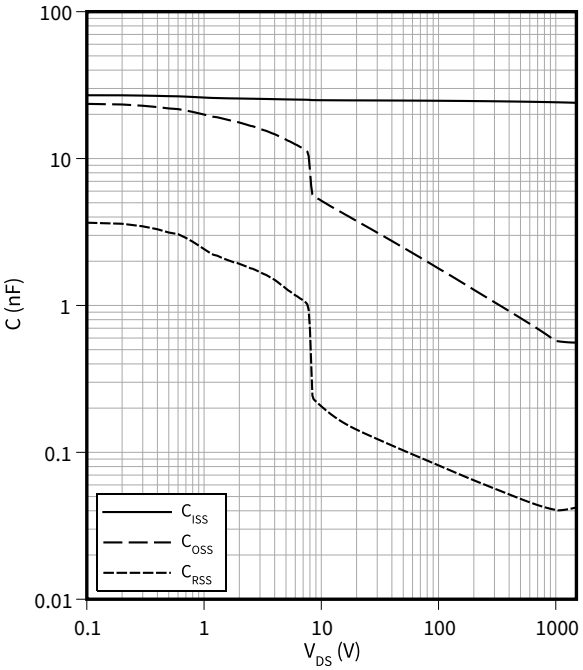
Gate charge characteristic (typical), MOSFET, T1-T4

$V_{GS} = f(Q_G)$
$I_D = 160$ A, $T_{vj} = 25$ °C



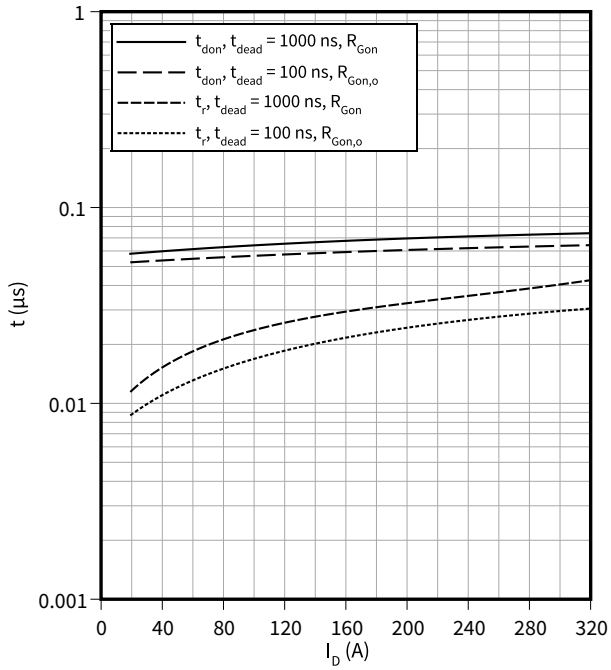
Capacity characteristic (typical), MOSFET, T1-T4

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



Switching times (typical), MOSFET, T1-T4

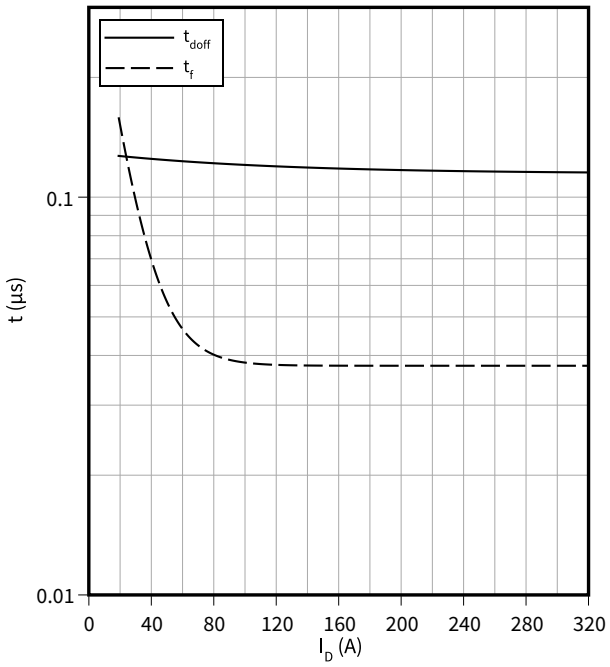
$t = f(I_D)$
$V_{DD} = 1200$ V, $R_{Gon} = 4.3\ \Omega$, $R_{Gon,o} = 2.4\ \Omega$, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET, T1-T4

$t = f(I_D)$

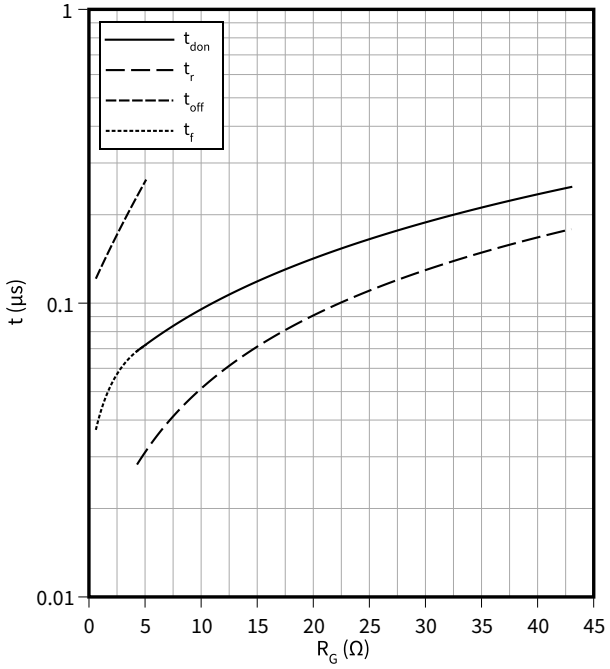
R_{Goff} = 0.51 Ω, V_{DD} = 1200 V, T_{vj} = 175 °C, V_{GS} = -3/18 V



Switching times (typical), MOSFET, T1-T4

$t = f(R_G)$

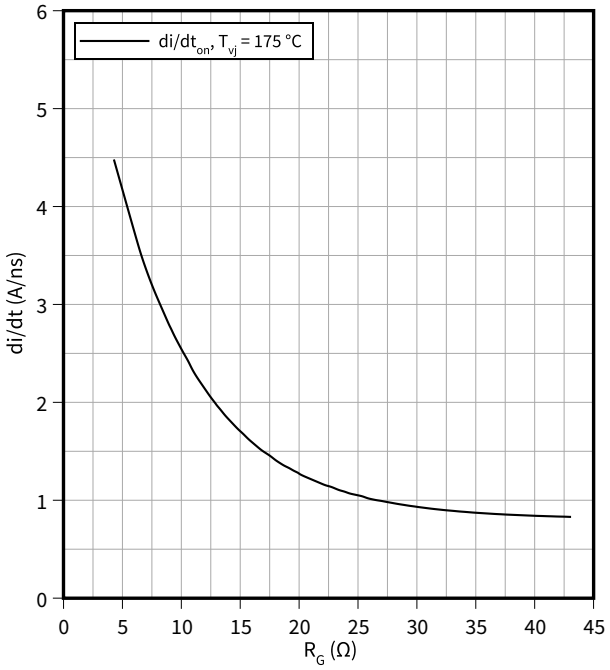
V_{DD} = 1200 V, t_{dead} = 1000 ns, I_D = 160 A, T_{vj} = 175 °C, V_{GS} = -3/18 V



Current slope (typical), MOSFET, T1-T4

$di/dt = f(R_G)$

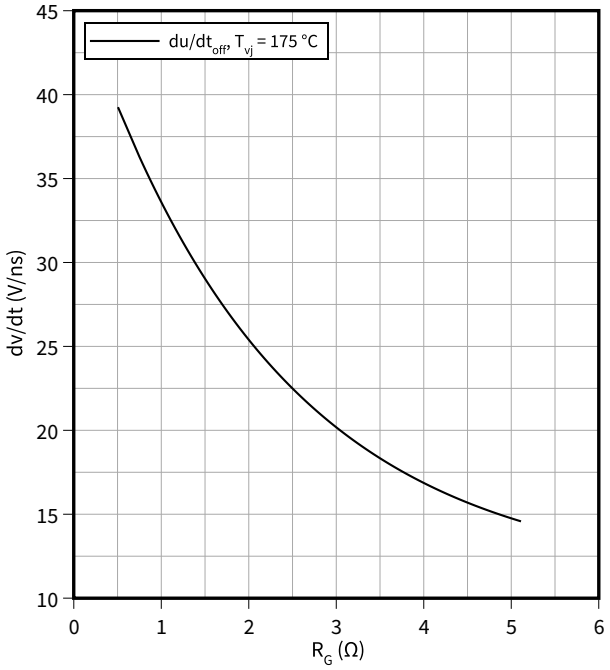
V_{DD} = 1200 V, I_D = 160 A, V_{GS} = -3/18 V



Voltage slope (typical), MOSFET, T1-T4

$dv/dt = f(R_G)$

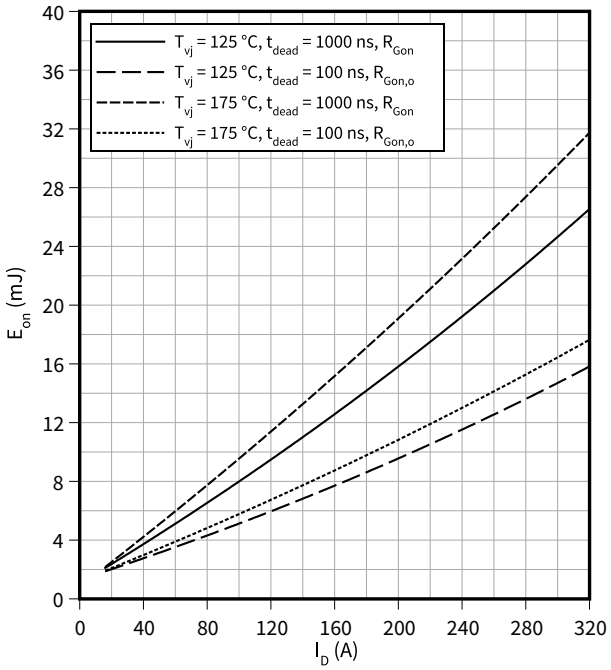
V_{DD} = 1200 V, I_D = 160 A, V_{GS} = -3/18 V



Switching losses (typical), MOSFET, T1-T4

$E_{on} = f(I_D)$

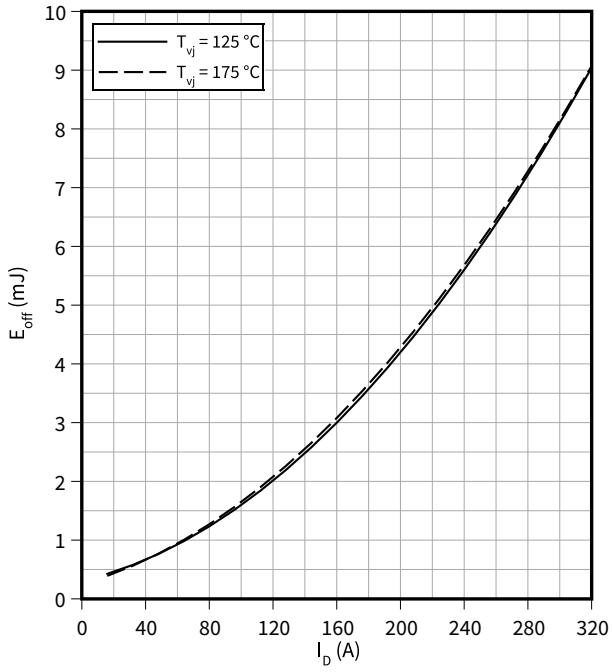
V_{DD} = 1200 V, R_{Gon} = 4.3 Ω, $R_{Gon,o}$ = 2.4 Ω, V_{GS} = -3/18 V



Switching losses (typical), MOSFET, T1-T4

$E_{off} = f(I_D)$

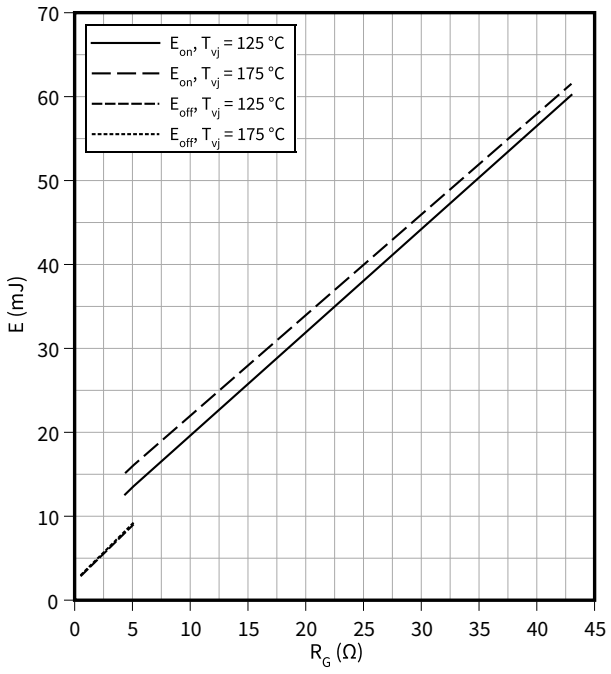
R_{Goff} = 0.51 Ω, V_{DD} = 1200 V, V_{GS} = -3/18 V



Switching losses (typical), MOSFET, T1-T4

$E = f(R_G)$

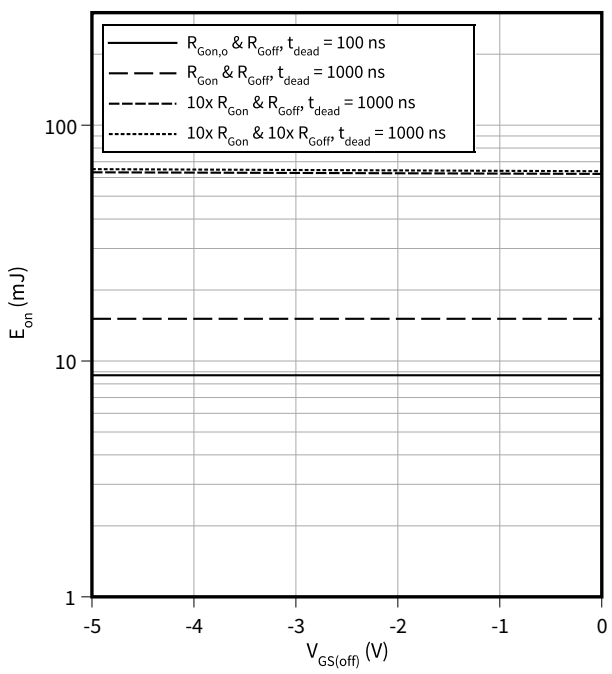
V_{DD} = 1200 V, t_{dead} = 1000 ns, I_D = 160 A, V_{GS} = -3/18 V



Switching losses (typical), MOSFET, T1-T4

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

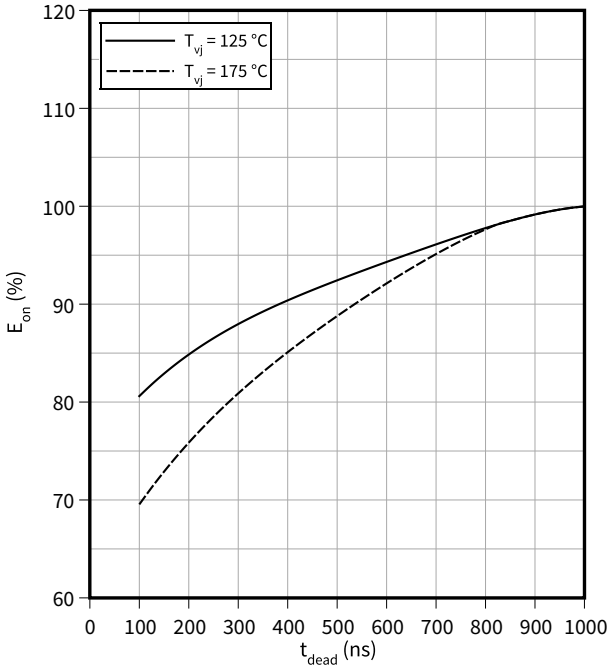
R_{Goff} = 0.51 Ω, V_{DD} = 1200 V, R_{Gon} = 4.3 Ω, $V_{GS(on)}$ = 18 V, I_D = 160 A, $R_{Gon,o}$ = 2.4 Ω, T_{vj} = 175 °C



Switching losses (typical), MOSFET, T1-T4

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

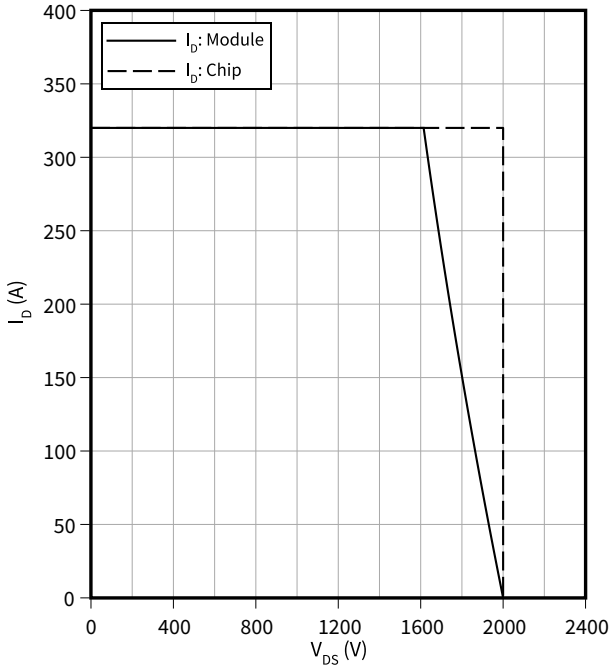
$R_{Gon} = 4.3\ \Omega$, $I_D = 160$ A, $V_{DD} = 1200$ V, $V_{GS} = -3/18$ V



Reverse bias safe operating area (RBSOA), MOSFET, T1-T4

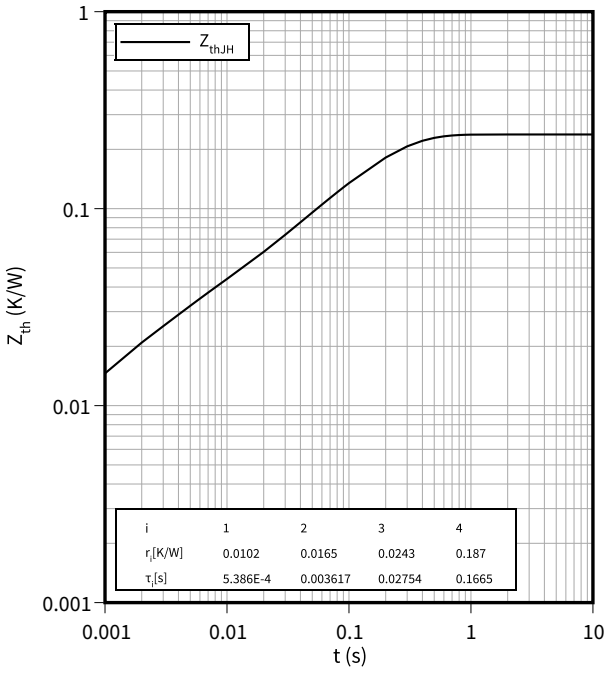
$I_D = f(V_{DS})$

$R_{Goff} = 0.51\ \Omega$, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Transient thermal impedance, MOSFET, T1-T4

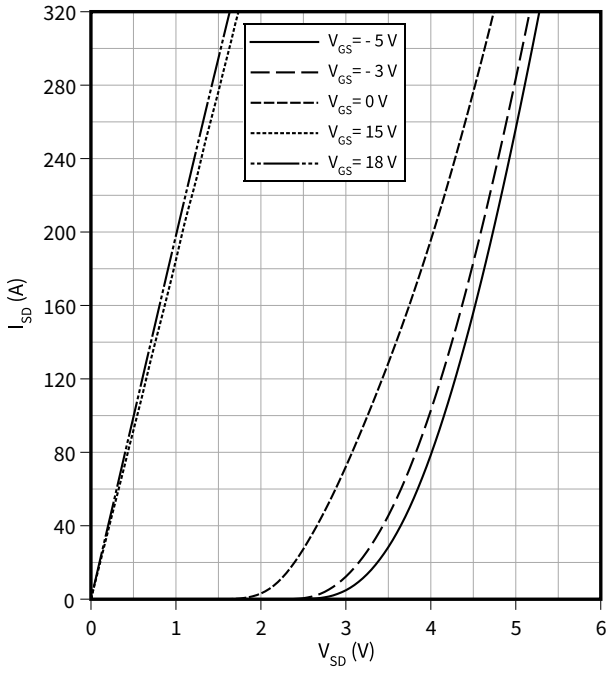
$Z_{th} = f(t)$



Forward characteristic body diode (typical), MOSFET, T1-T4

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

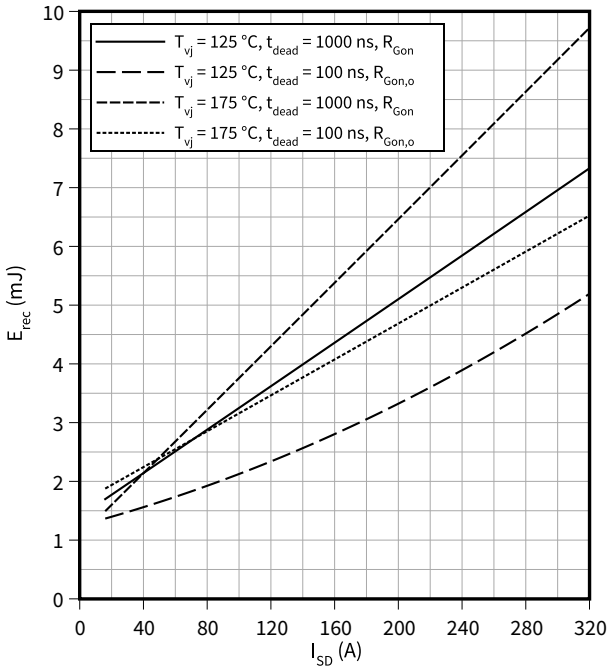
$T_{vj} = 25$ °C



Switching losses body diode (typical), MOSFET, T1-T4

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

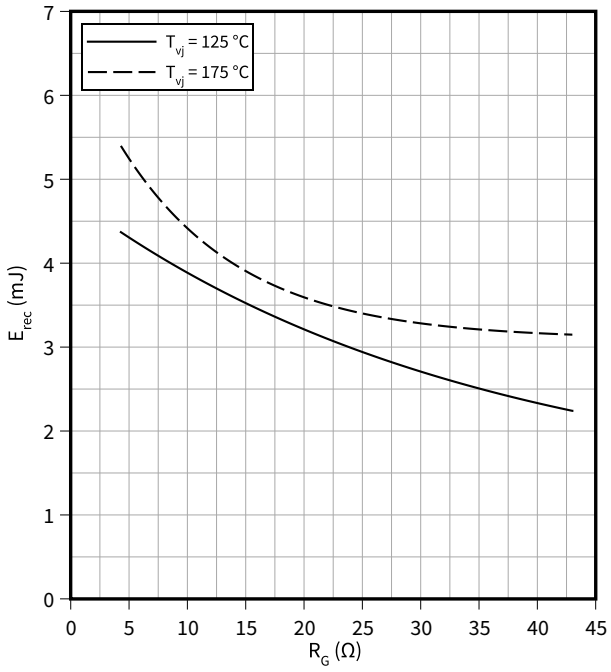
$R_{Gon} = 4.3\ \Omega$, $R_{Gon,o} = 2.4\ \Omega$, $V_{DD} = 1200$ V



Switching losses body diode (typical), MOSFET, T1-T4

$E_{rec} = f(R_G)$

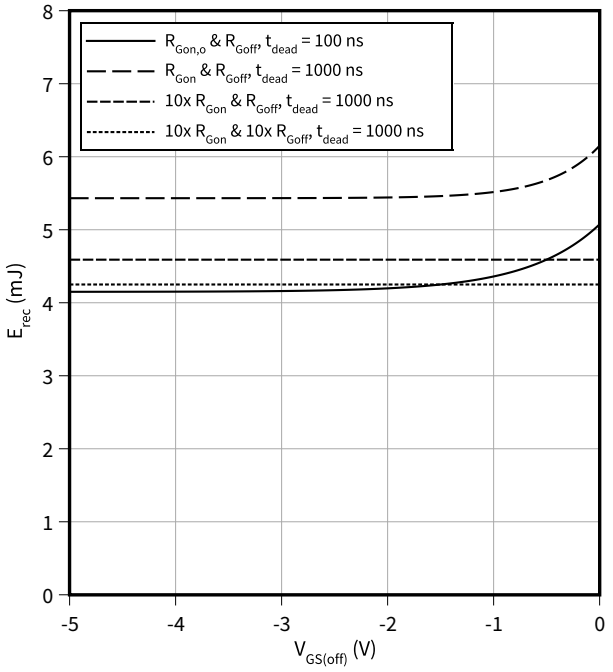
$t_{dead} = 1000$ ns, $I_{SD} = 160$ A, $V_{DD} = 1200$ V



Switching losses body diode (typical), MOSFET, T1-T4

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

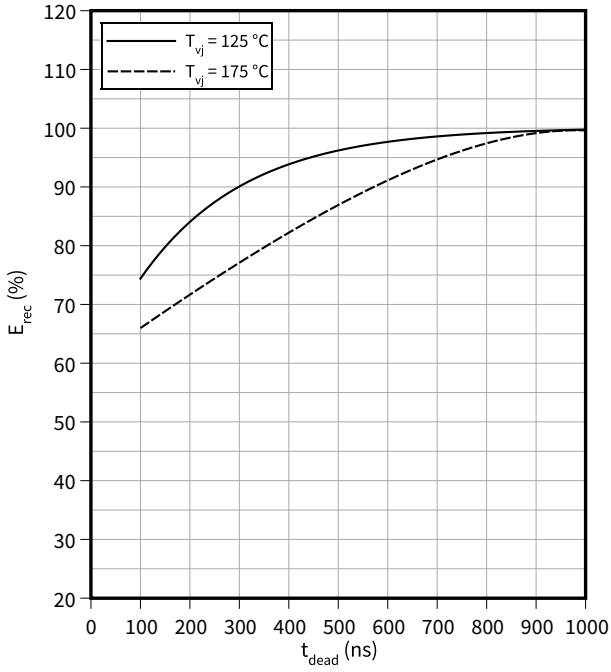
$R_{Goff} = 0.51\ \Omega$, $R_{Gon} = 4.3\ \Omega$, $V_{GS(on)} = 18$ V, $I_{SD} = 160$ A, $R_{Gon,o} = 2.4\ \Omega$, $V_{DD} = 1200$ V, $T_{vj} = 175$ °C



Switching losses body diode (typical), MOSFET, T1-T4

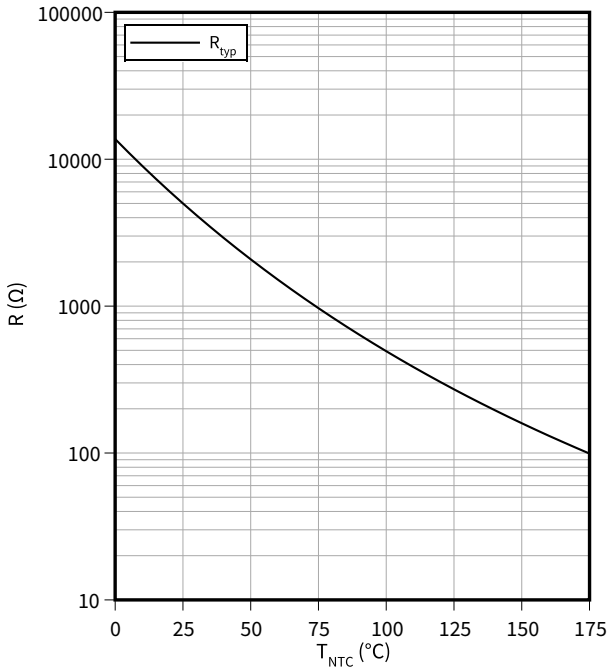
$E_{rec} = f(t_{dead})$

$R_{Gon} = 4.3\ \Omega$, $I_D = 160$ A, $V_{DD} = 1200$ V, $V_{GS} = -3/18$ V



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

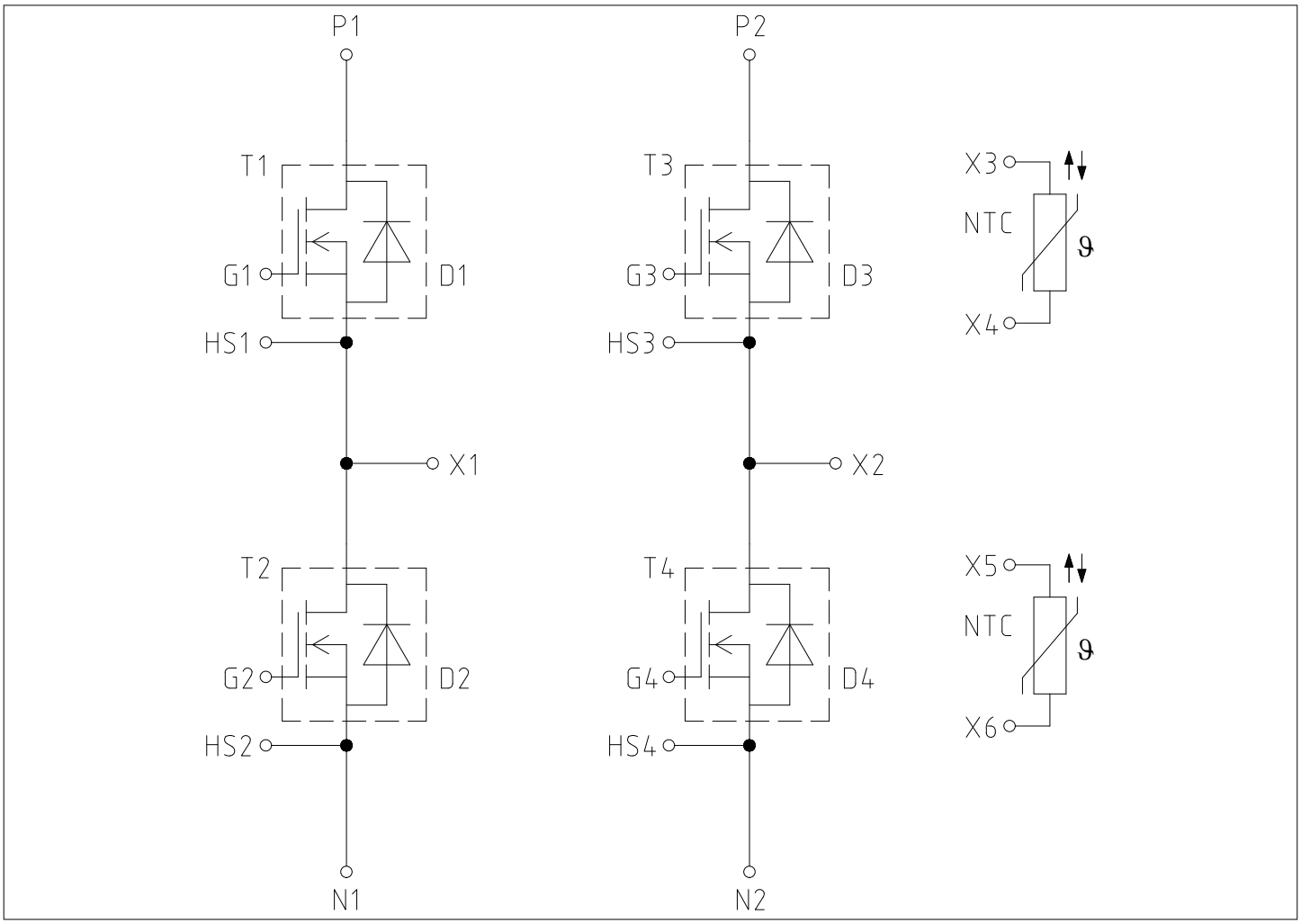


Figure 1

7 Package outlines

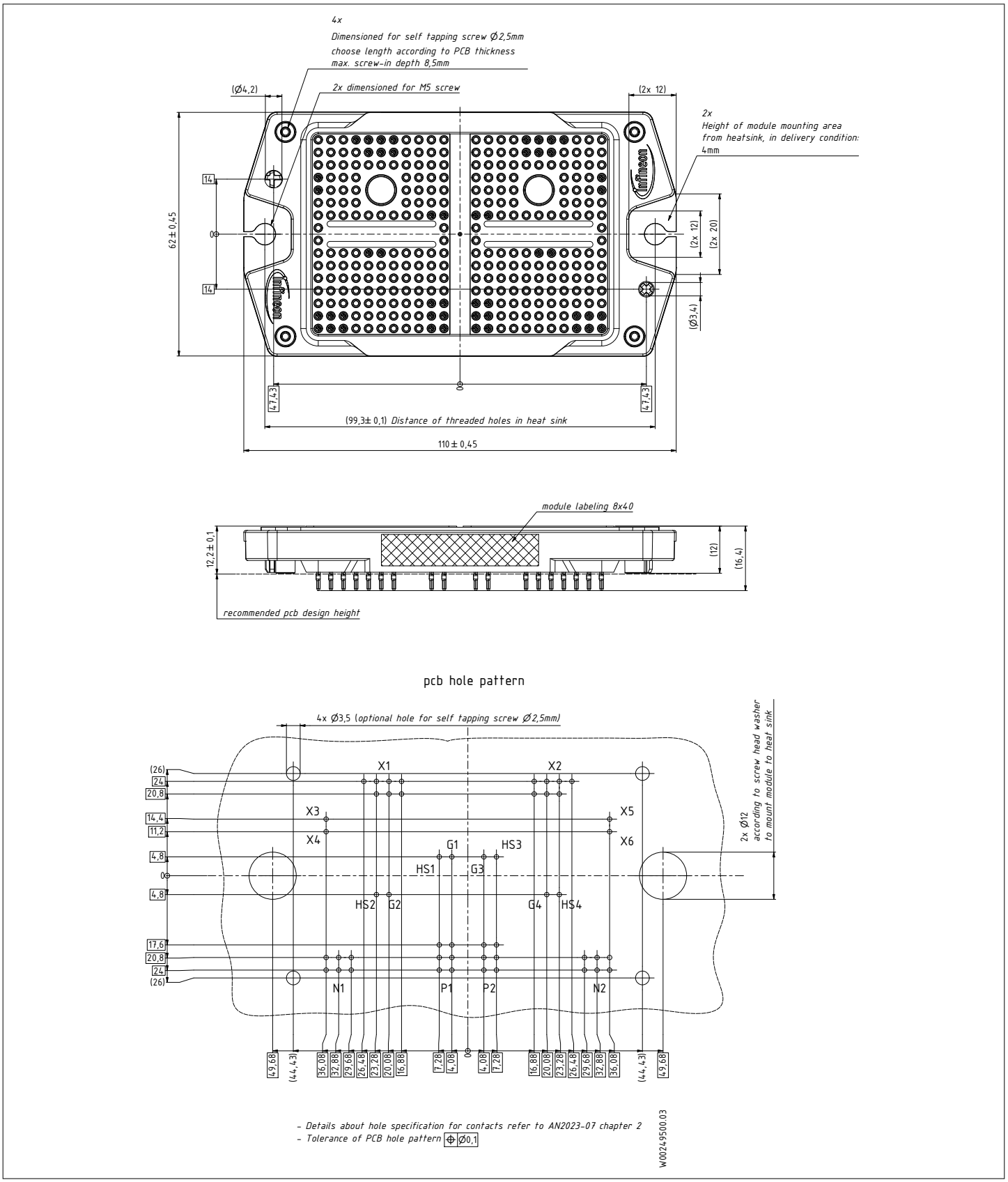


Figure 2

8 Module label code

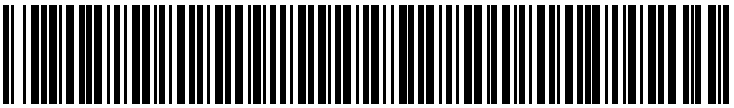
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	 7154914284655054991530	 7154914284655054991530	

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2024-08-12	Initial version
1.00	2024-11-11	Final datasheet

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