

Final datasheet

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

Features

- Electrical features
 - $V_{DS} = 2000\text{ V}$
 - $I_{DN} = 160\text{ A}$ / $I_{DRM} = 320\text{ A}$
 - 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

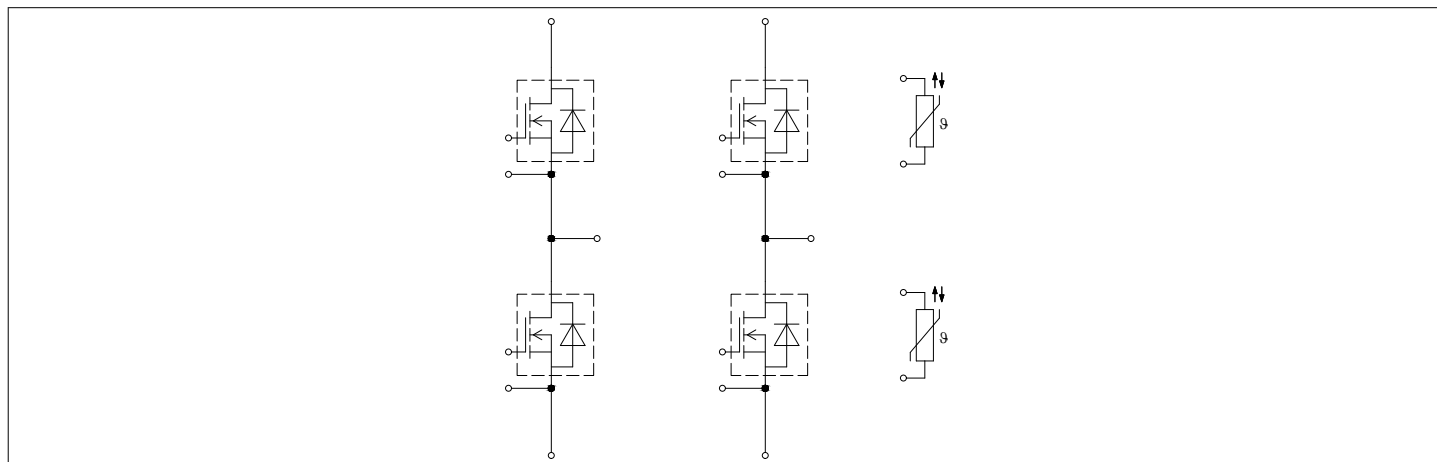




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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	3.2	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	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	$R_{CC'+EE'}$	$T_H = 25 \text{ °C}$, 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}	$T_{vj} = 25 \text{ °C}$	2000	V
Implemented drain current	I_{DN}		160	A
Continuous DC drain current	I_{DDC}	$T_{vj} = 175 \text{ °C}$, $V_{GS} = 18 \text{ V}$ $T_H = 65 \text{ °C}$	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	$R_{DS(on)}$	$I_D = 160\text{ A}$	$V_{GS} = 18\text{ V}, T_{vj} = 25\text{ °C}$		5.1	8.1	mΩ
			$V_{GS} = 18\text{ V}, T_{vj} = 125\text{ °C}$		10.9		
			$V_{GS} = 18\text{ V}, T_{vj} = 175\text{ °C}$		15.4		
			$V_{GS} = 15\text{ V}, T_{vj} = 25\text{ °C}$		5.6		
Gate threshold voltage	$V_{GS(th)}$	$I_D = 112\text{ mA}, V_{DS} = V_{GS}, (\text{tested after 1ms pulse at } V_{GS} = +20\text{ V}), T_{vj} = 25\text{ °C}$		3.45	4.3	5.15	V
Total gate charge	Q_G	$V_{DD} = 1200\text{ V}, V_{GS} = -3\text{ V}, T_{vj} = 25\text{ °C}$			0.78		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\text{ °C}$			1.8		Ω
Input capacitance	C_{ISS}	$f = 100\text{ kHz}, V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		24.1		nF
Output capacitance	C_{OSS}	$f = 100\text{ kHz}, V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		0.563		nF
Reverse transfer capacitance	C_{rSS}	$f = 100\text{ kHz}, V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		0.041		nF
C_{OSS} stored energy	E_{OSS}	$V_{DS} = 1200\text{ V}, V_{GS} = -3/18\text{ V}, T_{vj} = 25\text{ °C}$			508		μJ
Drain-source leakage current	I_{DSS}	$V_{DS} = 2000\text{ V}, V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ °C}$		0.04	378	μA
Gate-source leakage current	I_{GSS}	$V_{DS} = 0\text{ V}, T_{vj} = 25\text{ °C}$	$V_{GS} = 20\text{ V}$			400	nA
Turn-on delay time (inductive load)	$t_{d on}$	$I_D = 160\text{ A}, R_{Gon} = 4.3\text{ Ω}, V_{DD} = 1200\text{ V}, V_{GS} = -3/18\text{ V}, t_{dead} = 1000\text{ ns}, 0.1 V_{GS} \text{ to } 0.1 I_D$	$T_{vj} = 25\text{ °C}$		70		ns
			$T_{vj} = 125\text{ °C}$		69		
			$T_{vj} = 175\text{ °C}$		69		
Rise time (inductive load)	t_r	$I_D = 160\text{ A}, R_{Gon} = 4.3\text{ Ω}, V_{DD} = 1200\text{ V}, V_{GS} = -3/18\text{ V}, t_{dead} = 1000\text{ ns}, 0.1 I_D \text{ to } 0.9 I_D$	$T_{vj} = 25\text{ °C}$		29		ns
			$T_{vj} = 125\text{ °C}$		29		
			$T_{vj} = 175\text{ °C}$		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)	$t_{d\ off}$	$I_D = 160\text{ A}$, $R_{Goff} = 0.51\ \Omega$, $V_{DD} = 1200\text{ V}$, $V_{GS} = -3/18\text{ V}$, $0.9\ V_{GS}$ to $0.9\ I_D$	$T_{vj} = 25\text{ °C}$	107		ns
			$T_{vj} = 125\text{ °C}$	113		
			$T_{vj} = 175\text{ °C}$	119		
Fall time (inductive load)	t_f	$I_D = 160\text{ A}$, $R_{Goff} = 0.51\ \Omega$, $V_{DD} = 1200\text{ V}$, $V_{GS} = -3/18\text{ V}$, $0.9\ I_D$ to $0.1\ I_D$	$T_{vj} = 25\text{ °C}$	33		ns
			$T_{vj} = 125\text{ °C}$	36		
			$T_{vj} = 175\text{ °C}$	38		
Turn-on energy loss per pulse	E_{on}	$I_D = 160\text{ A}$, $V_{DD} = 1200\text{ V}$, $L_\sigma = 15\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Gon} = 4.3\ \Omega$, $di/dt = 4.5\text{ kA}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$), $t_{dead} = 1000\text{ ns}$	$T_{vj} = 25\text{ °C}$	10.8		mJ
			$T_{vj} = 125\text{ °C}$	12.5		
			$T_{vj} = 175\text{ °C}$	15.1		
Turn-on energy loss per pulse, optimized	$E_{on,o}$	$I_D = 160\text{ A}$, $V_{DD} = 1200\text{ V}$, $L_\sigma = 15\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Gon,o} = 2.4\ \Omega$, $di/dt = 6\text{ kA}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$), $t_{dead} = 100\text{ ns}$	$T_{vj} = 25\text{ °C}$	7.6		mJ
			$T_{vj} = 125\text{ °C}$	7.9		
			$T_{vj} = 175\text{ °C}$	8.7		
Turn-off energy loss per pulse	E_{off}	$I_D = 160\text{ A}$, $V_{DD} = 1200\text{ V}$, $L_\sigma = 15\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Goff} = 0.51\ \Omega$, $dv/dt = 38.5\text{ kV}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$)	$T_{vj} = 25\text{ °C}$	2.7		mJ
			$T_{vj} = 125\text{ °C}$	3		
			$T_{vj} = 175\text{ °C}$	3.1		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, $\lambda_{grease} = 3.3\text{ W}/(\text{m}\cdot\text{K})$		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.
 $T_{vj\ op} > 150\text{ °C}$ 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}	$T_{vj} = 175\text{ °C}$, $V_{GS} = -3\text{ V}$ $T_H = 65\text{ °C}$	100	A

Table 7 Characteristic values

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

4 NTC-Thermistor

Table 8 Characteristic values

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

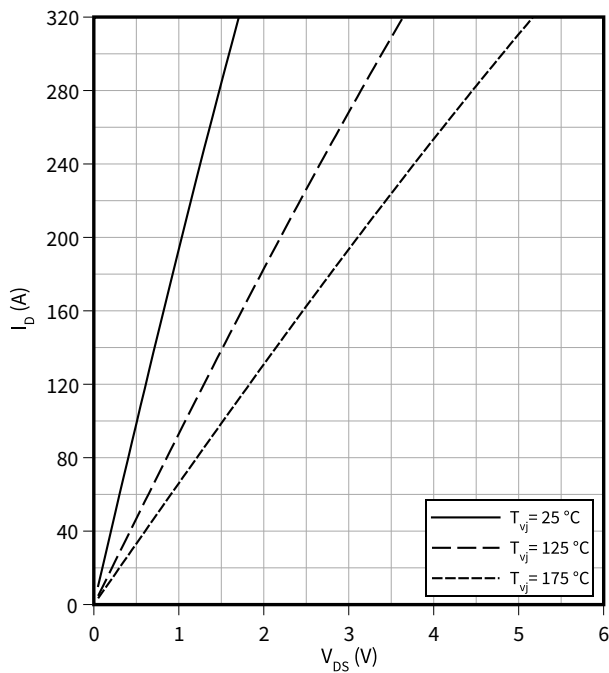
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

5 Characteristics diagrams

Output characteristic (typical), MOSFET, T1-T4

$I_D = f(V_{DS})$

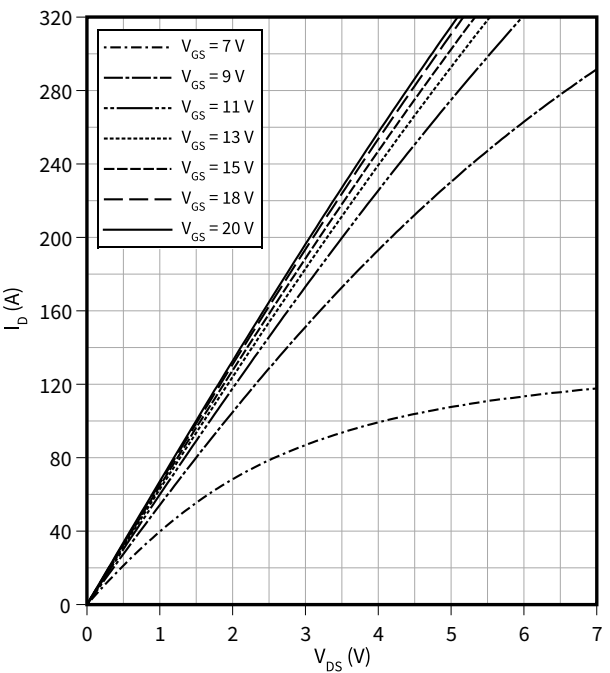
$V_{GS} = 18\text{ V}$



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

$I_D = f(V_{DS})$

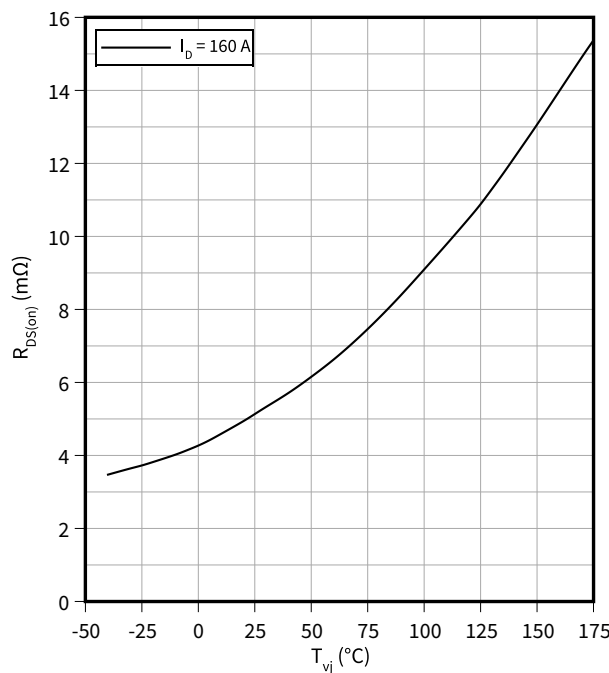
$T_{vj} = 175^\circ\text{C}$



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

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

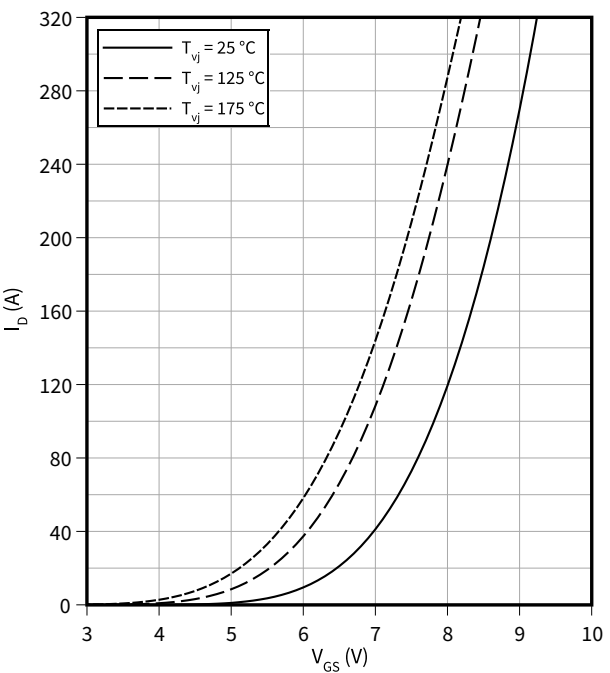
$V_{GS} = 18\text{ V}$



Transfer characteristic (typical), MOSFET, T1-T4

$I_D = f(V_{GS})$

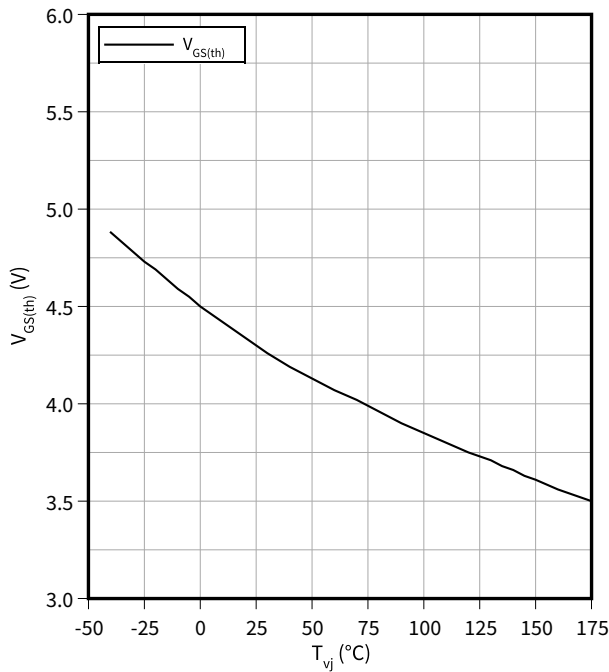
$V_{DS} = 20\text{ V}$



5 Characteristics diagrams

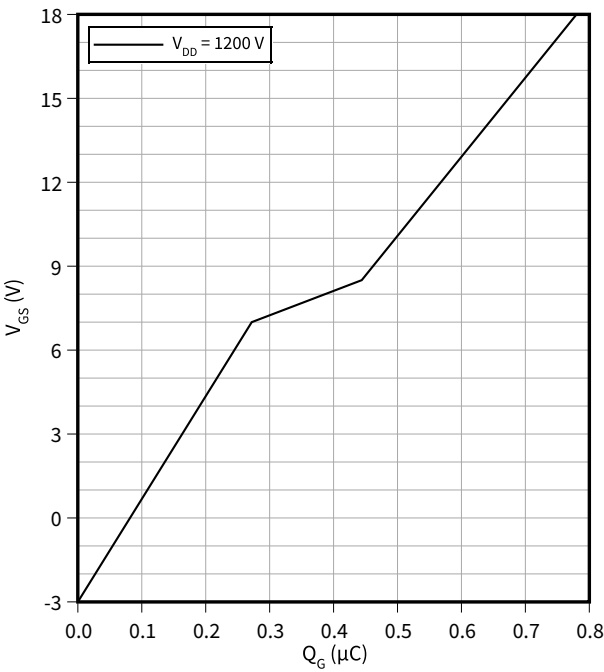
Gate-source threshold voltage (typical), MOSFET, T1-T4

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



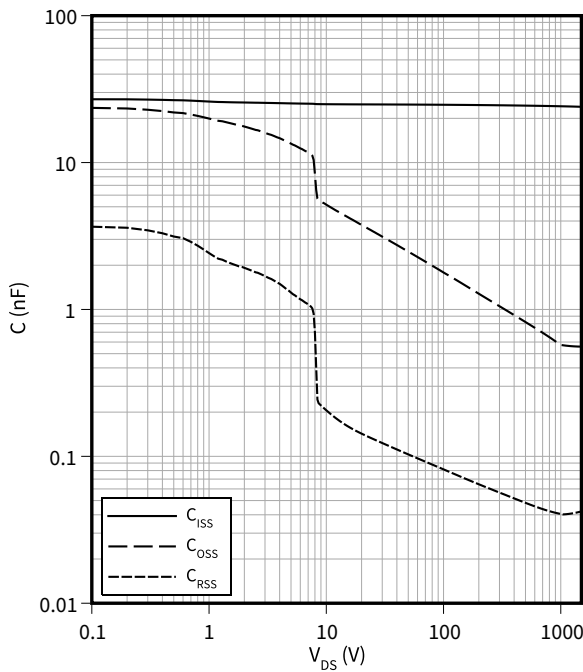
Gate charge characteristic (typical), MOSFET, T1-T4

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



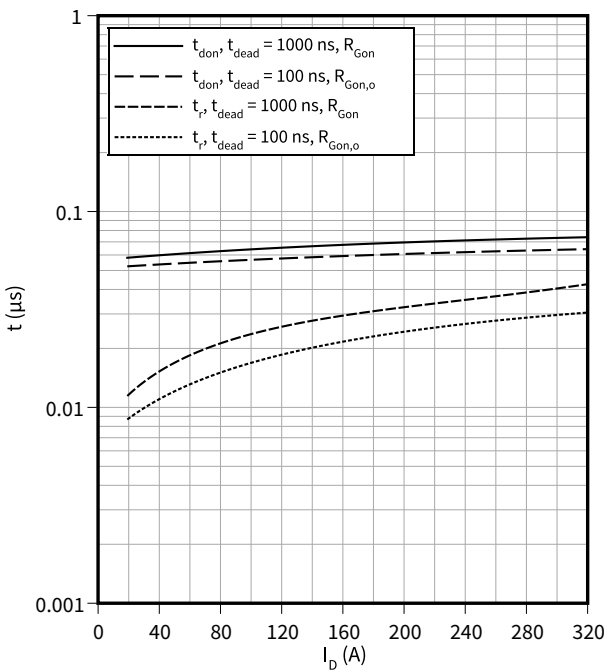
Capacity characteristic (typical), MOSFET, T1-T4

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



Switching times (typical), MOSFET, T1-T4

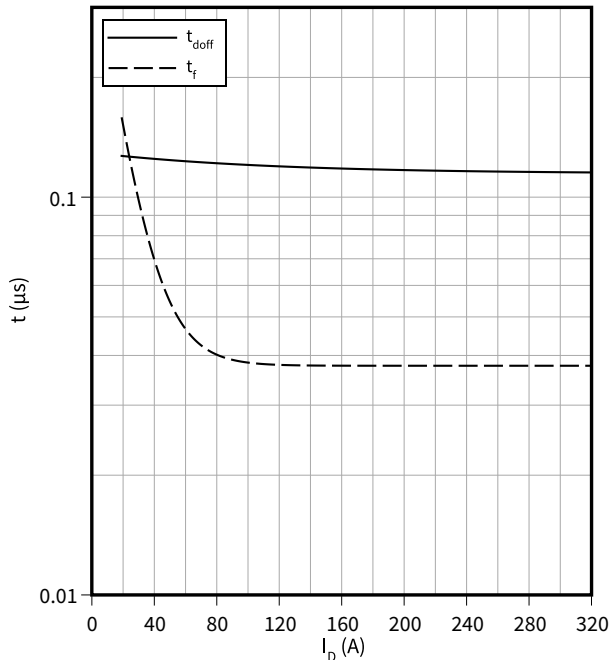
$t = f(I_D)$
 $V_{DD} = 1200\text{ V}, R_{Gon} = 4.3\text{ }\Omega, R_{Gon,o} = 2.4\text{ }\Omega, T_{vj} = 175\text{ °C}, V_{GS} = -3/18\text{ V}$



5 Characteristics diagrams

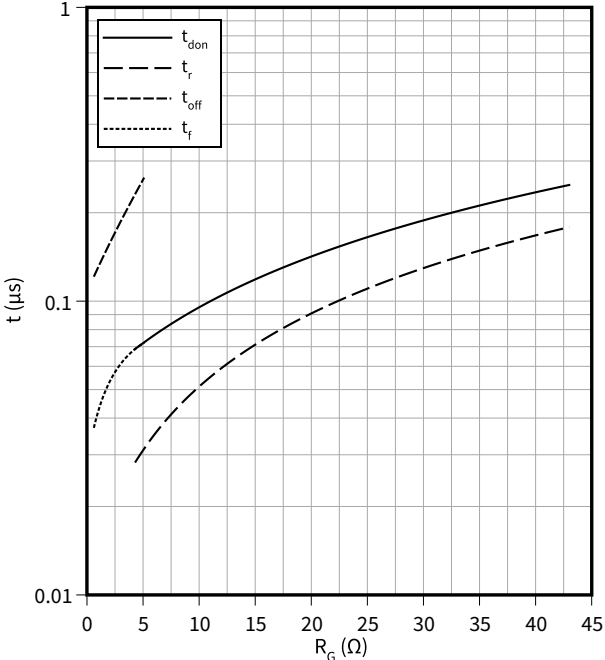
Switching times (typical), MOSFET, T1-T4

$t = f(I_D)$
 $R_{Goff} = 0.51 \Omega$, $V_{DD} = 1200 \text{ V}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GS} = -3/18 \text{ V}$



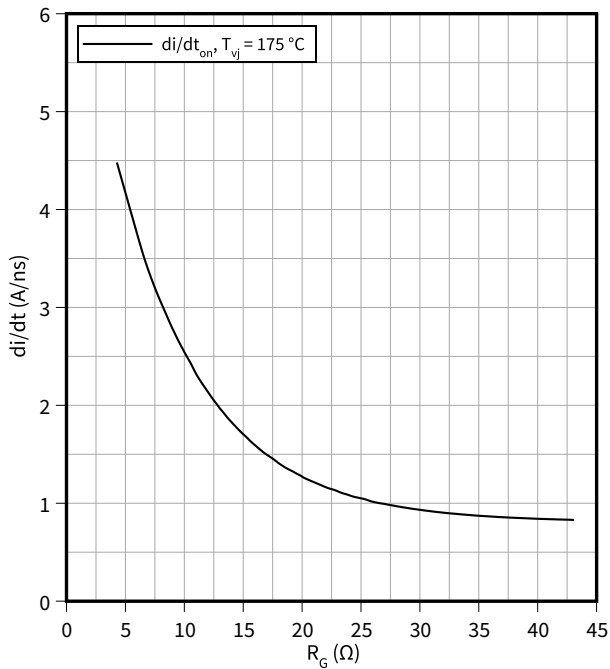
Switching times (typical), MOSFET, T1-T4

$t = f(R_G)$
 $V_{DD} = 1200 \text{ V}$, $t_{dead} = 1000 \text{ ns}$, $I_D = 160 \text{ A}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GS} = -3/18 \text{ V}$



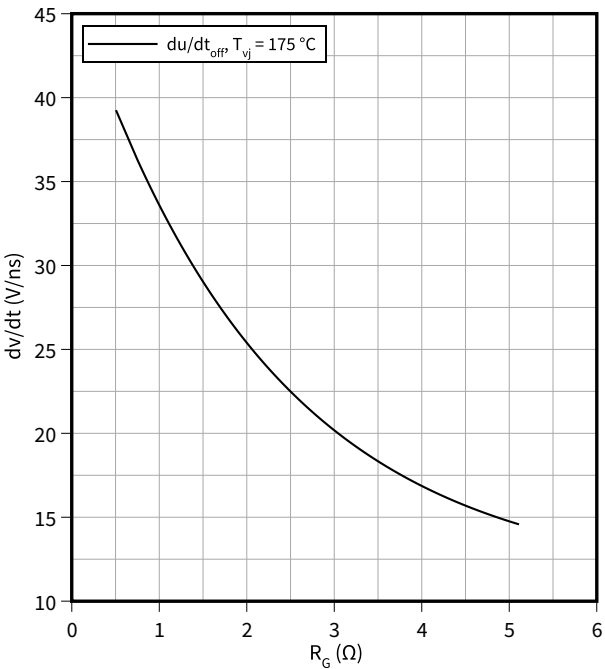
Current slope (typical), MOSFET, T1-T4

$di/dt = f(R_G)$
 $V_{DD} = 1200 \text{ V}$, $I_D = 160 \text{ A}$, $V_{GS} = -3/18 \text{ V}$



Voltage slope (typical), MOSFET, T1-T4

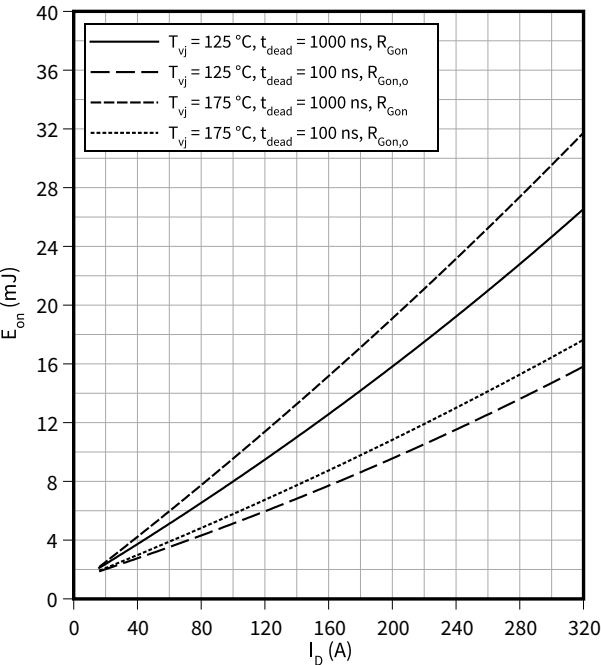
$dv/dt = f(R_G)$
 $V_{DD} = 1200 \text{ V}$, $I_D = 160 \text{ A}$, $V_{GS} = -3/18 \text{ V}$



5 Characteristics diagrams

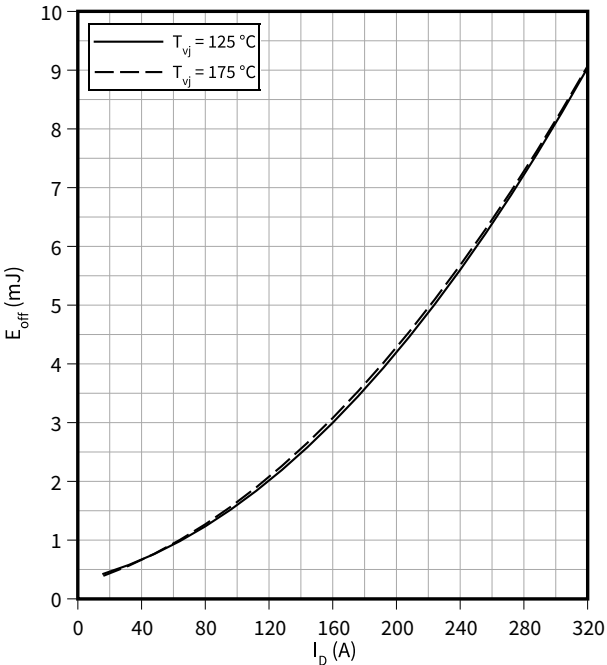
Switching losses (typical), MOSFET, T1-T4

$E_{on} = f(I_D)$
 $V_{DD} = 1200\text{ V}$, $R_{Gon} = 4.3\ \Omega$, $R_{Gon,o} = 2.4\ \Omega$, $V_{GS} = -3/18\text{ V}$



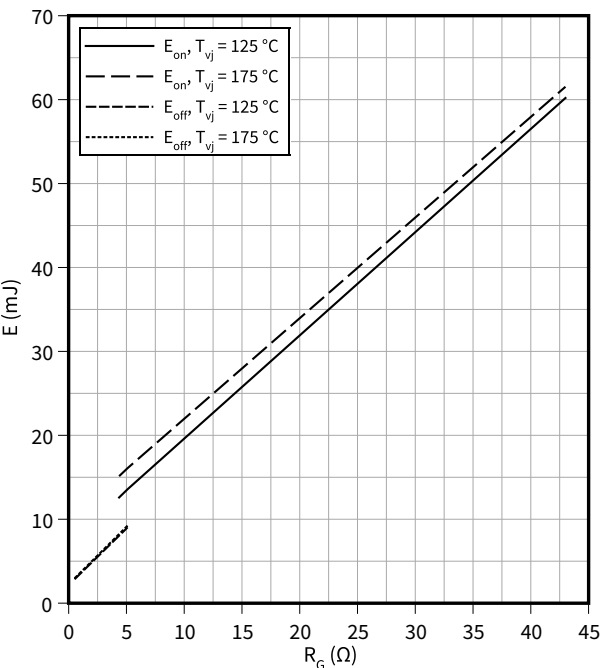
Switching losses (typical), MOSFET, T1-T4

$E_{off} = f(I_D)$
 $R_{Goff} = 0.51\ \Omega$, $V_{DD} = 1200\text{ V}$, $V_{GS} = -3/18\text{ V}$



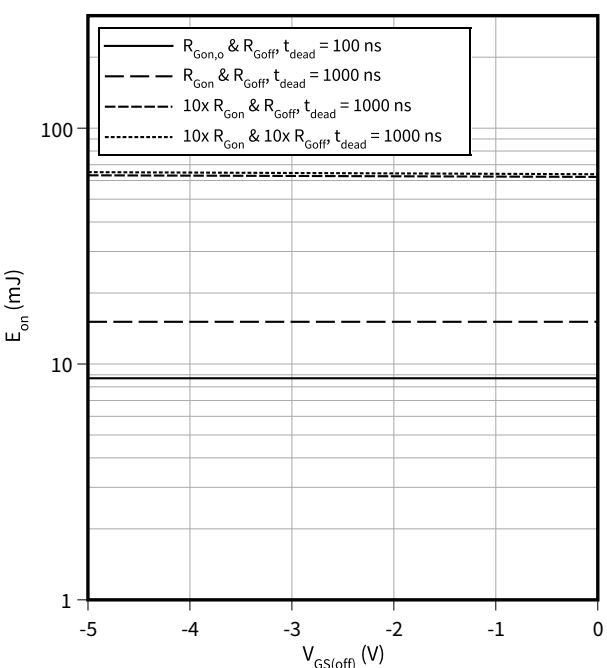
Switching losses (typical), MOSFET, T1-T4

$E = f(R_G)$
 $V_{DD} = 1200\text{ V}$, $t_{dead} = 1000\text{ ns}$, $I_D = 160\text{ A}$, $V_{GS} = -3/18\text{ V}$



Switching losses (typical), MOSFET, T1-T4

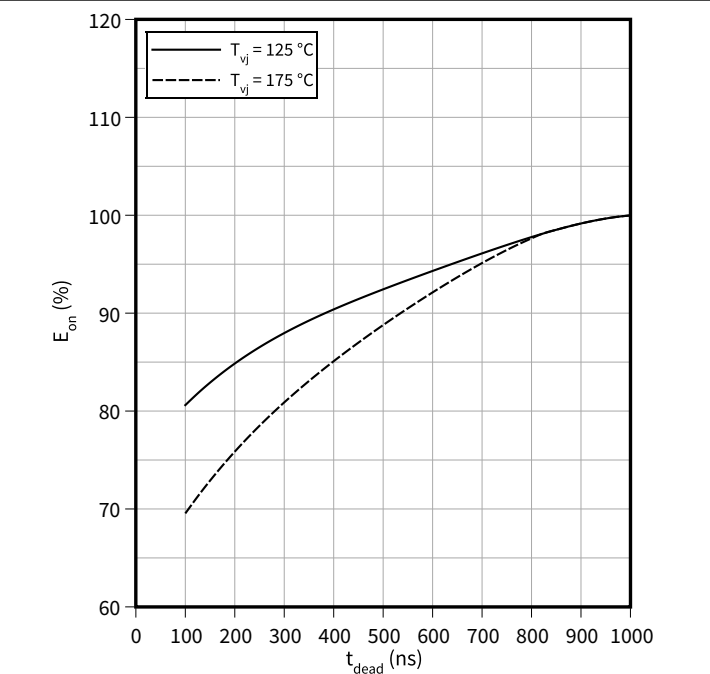
$E_{on} = f(V_{GS(off)})$
 $R_{Goff} = 0.51\ \Omega$, $V_{DD} = 1200\text{ V}$, $R_{Gon} = 4.3\ \Omega$, $V_{GS(on)} = 18\text{ V}$, $I_D = 160\text{ A}$, $R_{Gon,o} = 2.4\ \Omega$, $T_{vj} = 175\text{ °C}$



5 Characteristics diagrams

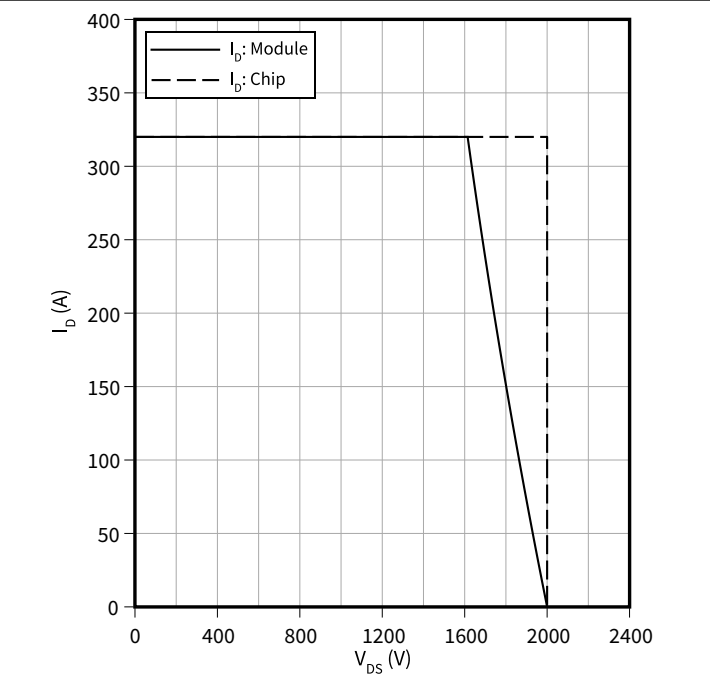
Switching losses (typical), MOSFET, T1-T4

$E_{on} = f(t_{dead})$
 $R_{Gon} = 4.3\ \Omega$, $I_D = 160\ A$, $V_{DD} = 1200\ V$, $V_{GS} = -3/18\ V$



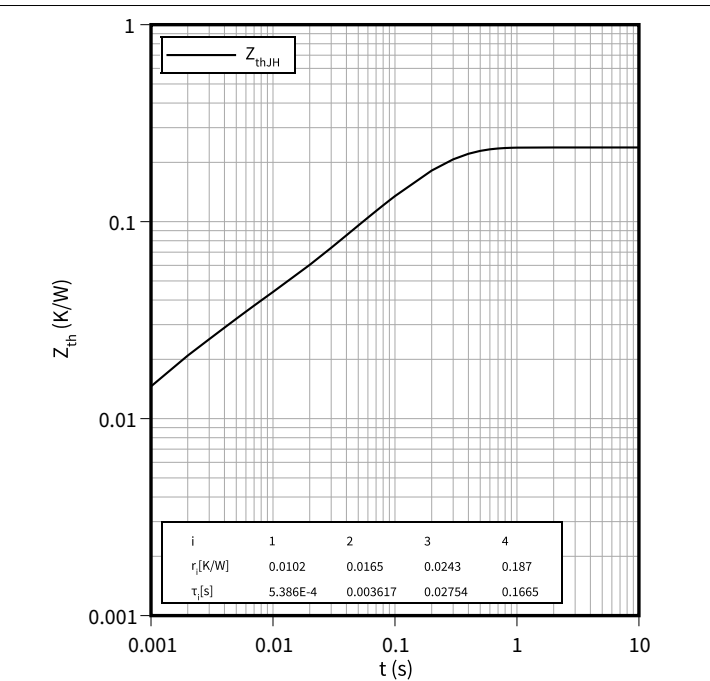
Reverse bias safe operating area (RBSOA), MOSFET, T1-T4

$I_D = f(V_{DS})$
 $R_{Goff} = 0.51\ \Omega$, $T_{vj} = 175\ ^\circ C$, $V_{GS} = -3/18\ V$



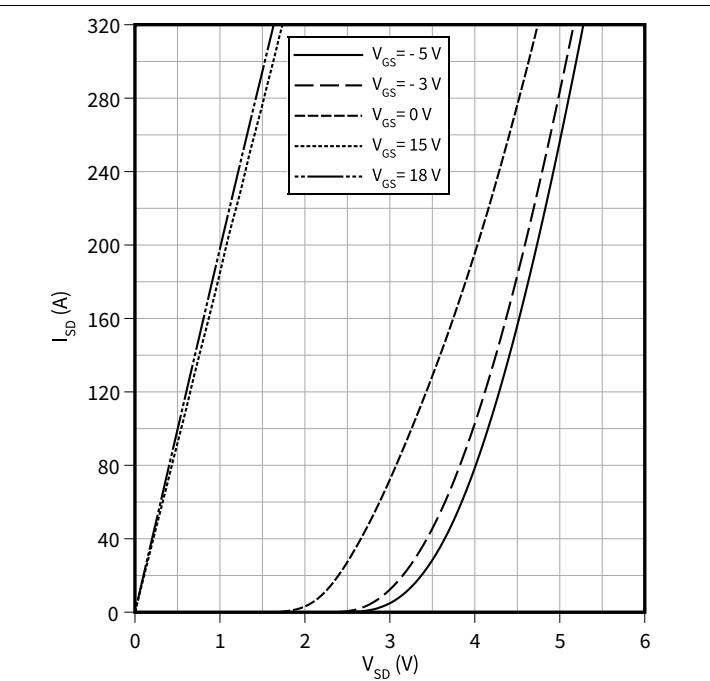
Transient thermal impedance, MOSFET, T1-T4

$Z_{th} = f(t)$



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

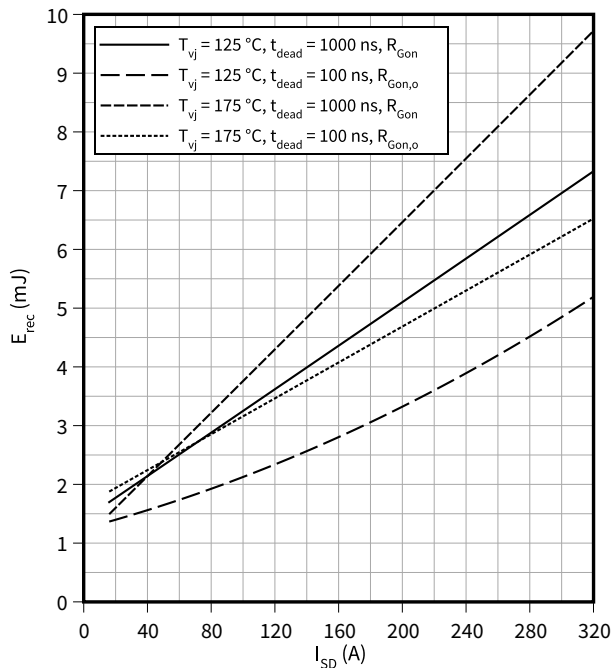
$I_{SD} = f(V_{SD})$
 $T_{vj} = 25\ ^\circ C$



5 Characteristics diagrams

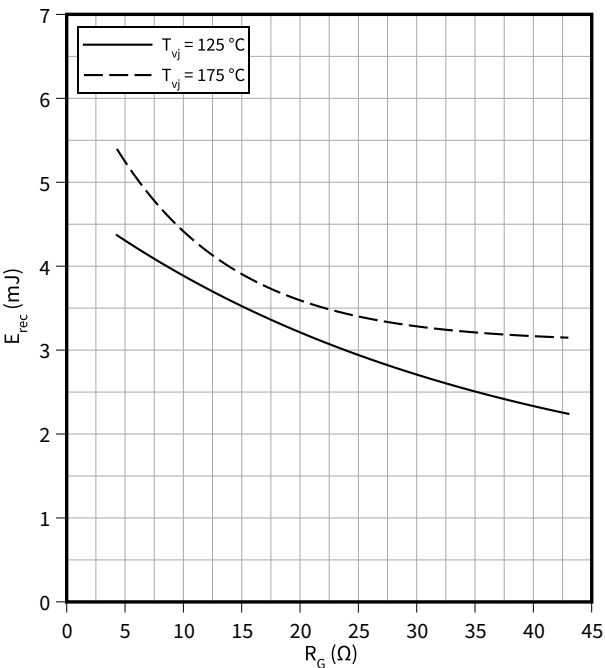
Switching losses body diode (typical), MOSFET, T1-T4

$E_{rec} = f(I_{SD})$
 $R_{Gon} = 4.3 \Omega$, $R_{Gon,o} = 2.4 \Omega$, $V_{DD} = 1200 V$



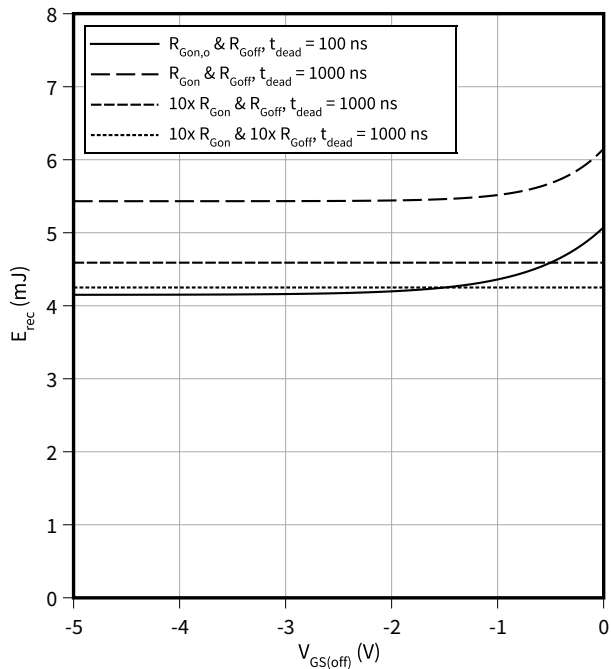
Switching losses body diode (typical), MOSFET, T1-T4

$E_{rec} = f(R_G)$
 $t_{dead} = 1000 ns$, $I_{SD} = 160 A$, $V_{DD} = 1200 V$



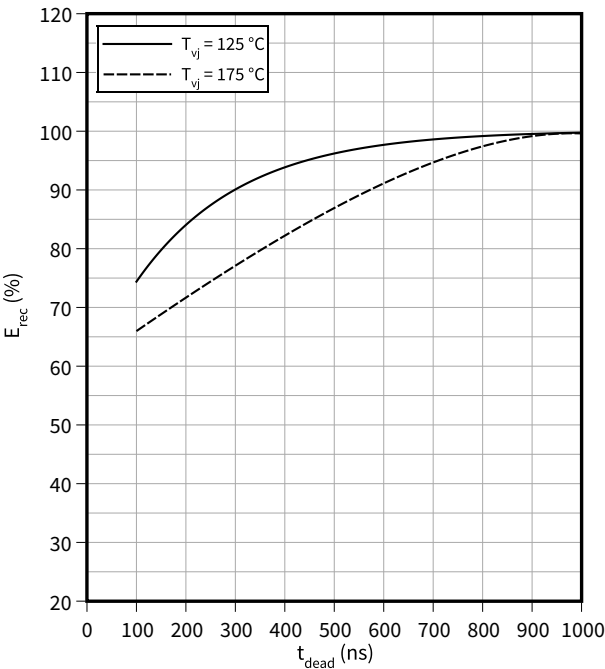
Switching losses body diode (typical), MOSFET, T1-T4

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



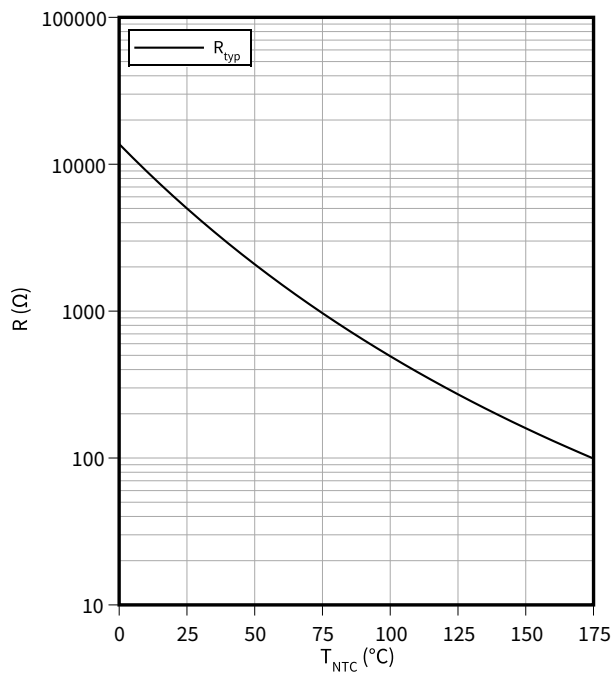
Switching losses body diode (typical), MOSFET, T1-T4

$E_{rec} = f(t_{dead})$
 $R_{Gon} = 4.3 \Omega$, $I_D = 160 A$, $V_{DD} = 1200 V$, $V_{GS} = -3/18 V$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

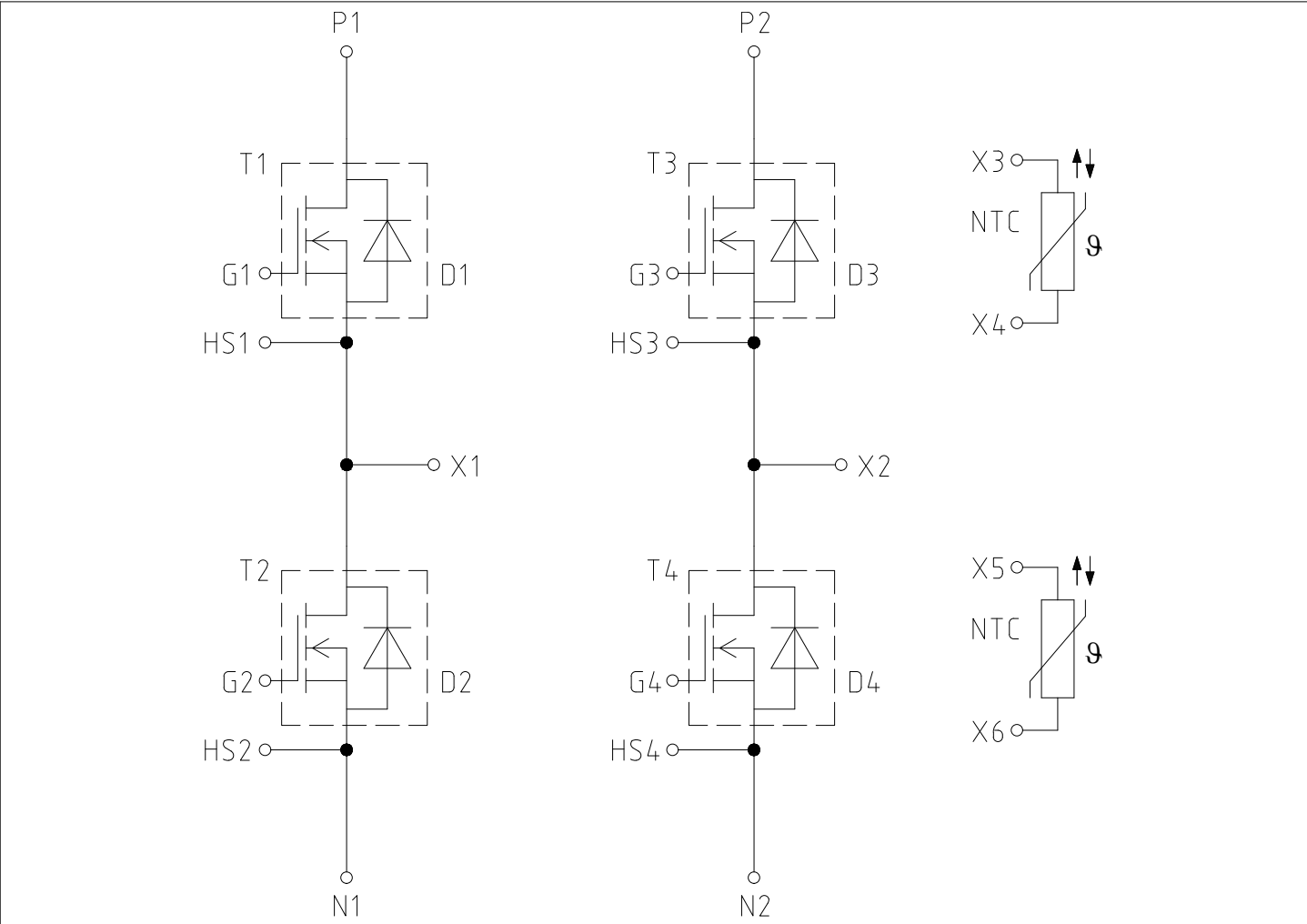


Figure 1

7 Package outlines

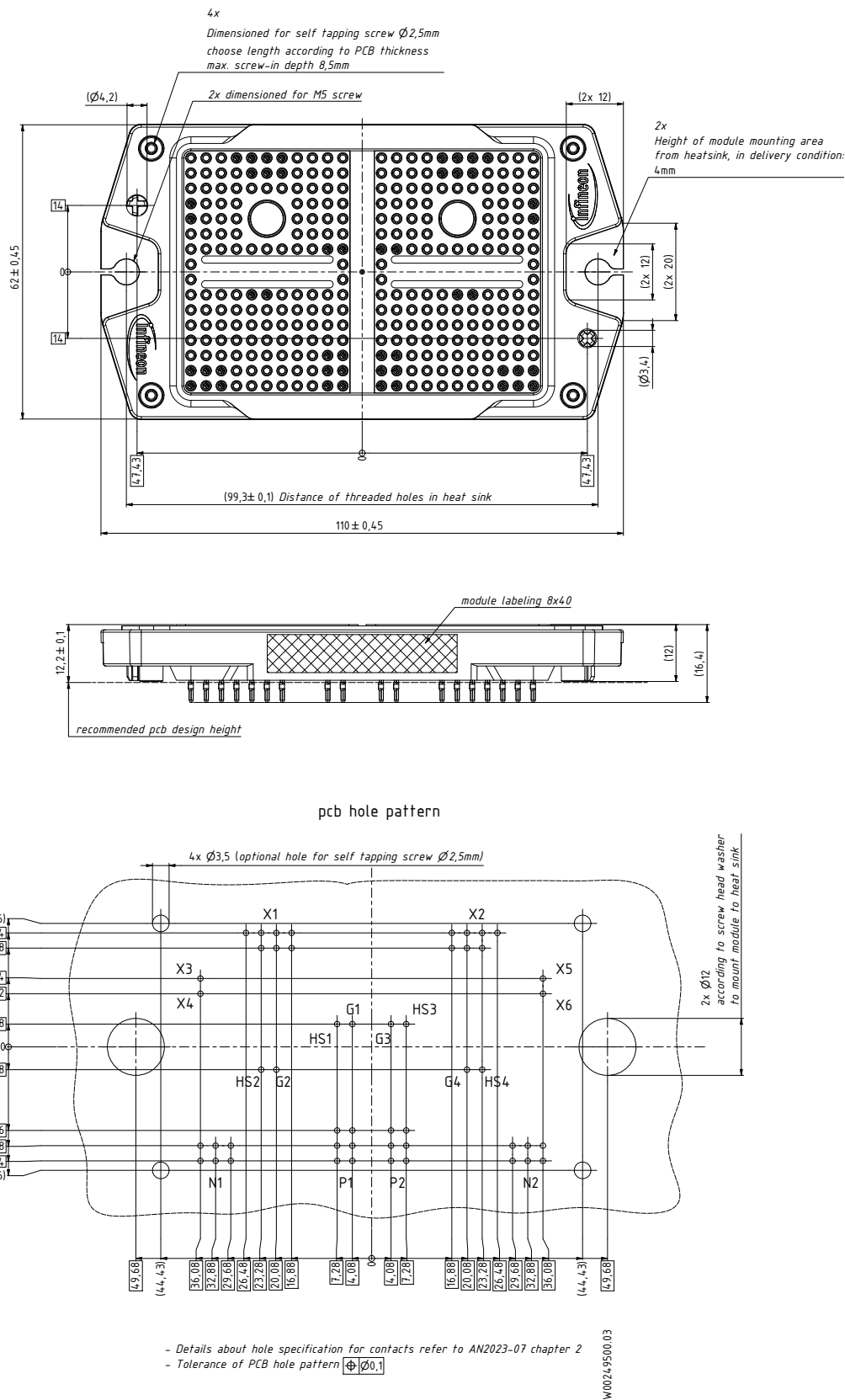


Figure 2

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	Digit	Example
	Module serial number	1 – 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 19	55054991
	Date code (production year)	20 – 21	15
	Date code (production week)	22 – 23	30
Example	 7154914284655054991153071549142846550549911530		

Figure 3



Revision history

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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