

Preliminary datasheet

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

Features

- Electrical features
 - $V_{DSS} = 1200\text{ V}$
 - $I_{DN} = 75\text{ A} / I_{DRM} = 150\text{ A}$
 - Low inductive design
 - Low switching losses
 - High current density
- Mechanical features
 - PressFIT contact technology
 - Integrated NTC temperature sensor
 - Rugged mounting due to integrated mounting clamps
 - AlN substrate with low thermal resistance



Typical appearance

Potential applications

- High-frequency switching application
- DC/DC converter
- UPS systems
- DC charger for EV

Product validation

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

Description

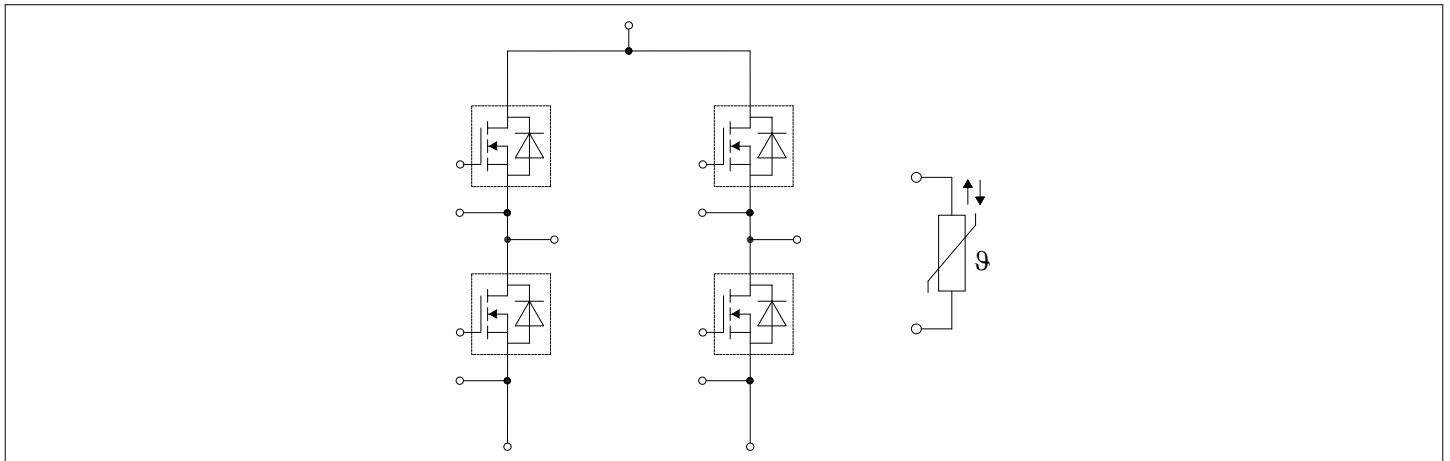


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50$ Hz, $t = 1$ min	3.0	kV
Internal isolation		basic insulation (class 1, IEC 61140)	AIN	
Comparative tracking index	CTI		> 200	
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}			9		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25$ °C, per switch		2.2		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting force per clamp	F		40		80	N
Weight	G			39		g

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

2 MOSFET

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} = 25$ °C	1200	V
Continuous DC drain current	I_{DDC}	$T_{vj} = 175$ °C, $V_{GS} = 18$ V $T_H = 100$ °C	75	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}	150	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	$R_{DS(on)}$	$I_D = 75\text{ A}$	$V_{GS}=18\text{ V}, T_{vj}=25\text{ °C}$		10.8		mΩ
			$V_{GS}=18\text{ V}, T_{vj}=125\text{ °C}$		17.4		
			$V_{GS}=18\text{ V}, T_{vj}=150\text{ °C}$		20.1		
			$V_{GS} = 15\text{ V}, T_{vj} = 25\text{ °C}$		12.9		
Gate threshold voltage	$V_{GS(th)}$	$I_D = 30\text{ mA}, V_{DS} = V_{GS}, T_{vj} = 25\text{ °C},$ (tested after 1ms pulse at $V_{GS} = +20\text{ V}$)	3.45	4.3	5.15	V	
Total gate charge	Q_G	$V_{DD}=800\text{ V}, V_{GS} = -3/18\text{ V}$		0.223		μC	
Internal gate resistor	R_{Gint}	$T_{vj}=25\text{ °C}$		2.7		Ω	
Input capacitance	C_{ISS}	$f = 100\text{ kHz}, V_{DS}=800\text{ V}, V_{GS}=0\text{ V}$	$T_{vj}=25\text{ °C}$		6.6	nF	
Output capacitance	C_{OSS}	$f = 100\text{ kHz}, V_{DS}=800\text{ V}, V_{GS}=0\text{ V}$	$T_{vj}=25\text{ °C}$		0.315	nF	
Reverse transfer capacitance	C_{rSS}	$f = 100\text{ kHz}, V_{DS}=800\text{ V}, V_{GS}=0\text{ V}$	$T_{vj}=25\text{ °C}$		0.021	nF	
C_{OSS} stored energy	E_{OSS}	$V_{DS}=800\text{ V}, V_{GS} = -3/18\text{ V}, T_{vj} = 25\text{ °C}$		129		μJ	
Drain-source leakage current	I_{DSS}	$V_{DS} = 1200\text{ V}, V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ °C}$	0.045	300	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)	$t_{d\ on}$	$I_D = 75\text{ A}, R_{Gon} = 6.2\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$	$T_{vj} = 25\text{ °C}$		43		ns
			$T_{vj} = 125\text{ °C}$		43		
			$T_{vj} = 150\text{ °C}$		43		
Rise time (inductive load)	t_r	$I_D = 75\text{ A}, R_{Gon} = 6.2\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$	$T_{vj} = 25\text{ °C}$		53		ns
			$T_{vj} = 125\text{ °C}$		53		
			$T_{vj} = 150\text{ °C}$		53		
Turn-off delay time (inductive load)	$t_{d\ off}$	$I_D = 75\text{ A}, R_{Goff} = 3.9\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$	$T_{vj} = 25\text{ °C}$		80		ns
			$T_{vj} = 125\text{ °C}$		87		
			$T_{vj} = 150\text{ °C}$		89		
Fall time (inductive load)	t_f	$I_D = 75\text{ A}, R_{Goff} = 3.9\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$	$T_{vj} = 25\text{ °C}$		23		ns
			$T_{vj} = 125\text{ °C}$		23		
			$T_{vj} = 150\text{ °C}$		23		

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-on energy loss per pulse	E_{on}	$I_D = 75\text{ A}$, $V_{DD} = 600\text{ V}$, $L_\sigma = 3\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Gon} = 6.2\ \Omega$, $di/dt = 3.98\text{ kA}/\mu\text{s}$ ($T_{vj} = 150\text{ }^\circ\text{C}$)	$T_{vj} = 25\text{ }^\circ\text{C}$	1.49		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	1.61		
			$T_{vj} = 150\text{ }^\circ\text{C}$	1.67		
Turn-off energy loss per pulse	E_{off}	$I_D = 75\text{ A}$, $V_{DD} = 600\text{ V}$, $L_\sigma = 3\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Goff} = 3.9\ \Omega$, $dv/dt = 20.9\text{ kV}/\mu\text{s}$ ($T_{vj} = 150\text{ }^\circ\text{C}$)	$T_{vj} = 25\text{ }^\circ\text{C}$	0.496		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.536		
			$T_{vj} = 150\text{ }^\circ\text{C}$	0.566		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		0.423		K/W
Temperature under switching conditions	$T_{vj\text{op}}$		-40		150	$^\circ\text{C}$

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 Note AN 2018-09 and AN 2021-13 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}	$T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GS} = -3\text{ V}$ $T_H = 100\text{ }^\circ\text{C}$	40	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_{SD}	$I_{SD} = 75\text{ A}$, $V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	4.2	5.35	V
			$T_{vj} = 125\text{ }^\circ\text{C}$	3.9		
			$T_{vj} = 150\text{ }^\circ\text{C}$	3.85		

4 NTC-Thermistor

Table 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25\text{ }^\circ\text{C}$		5		k Ω
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100\text{ }^\circ\text{C}$, $R_{100} = 493\ \Omega$	-5		5	%

(table continues...)

Table 8 (continued) **Characteristic values**

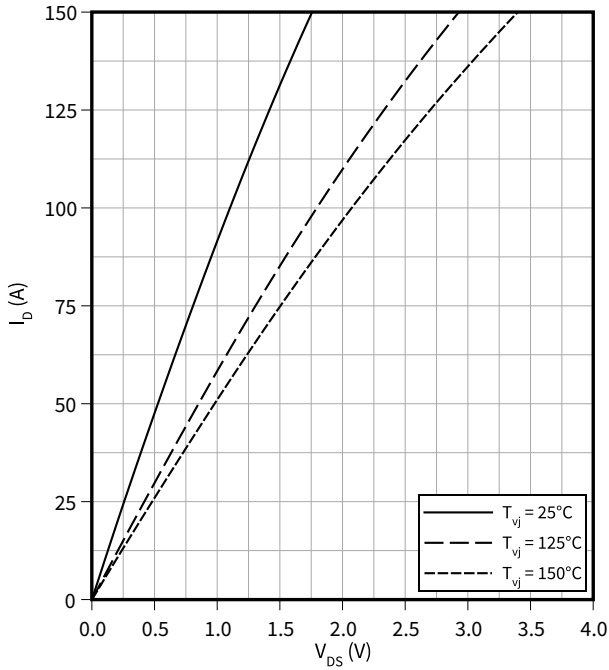
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Power dissipation	P_{25}	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		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

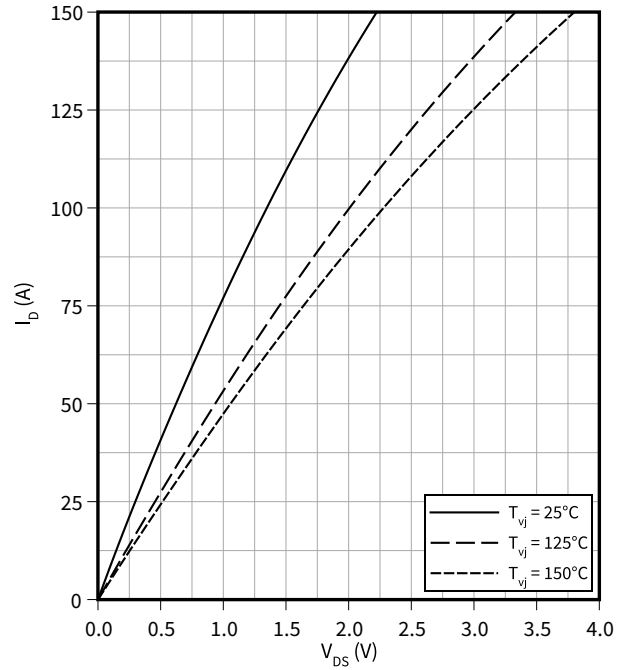
Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$
 $V_{GS} = 18\text{ V}$



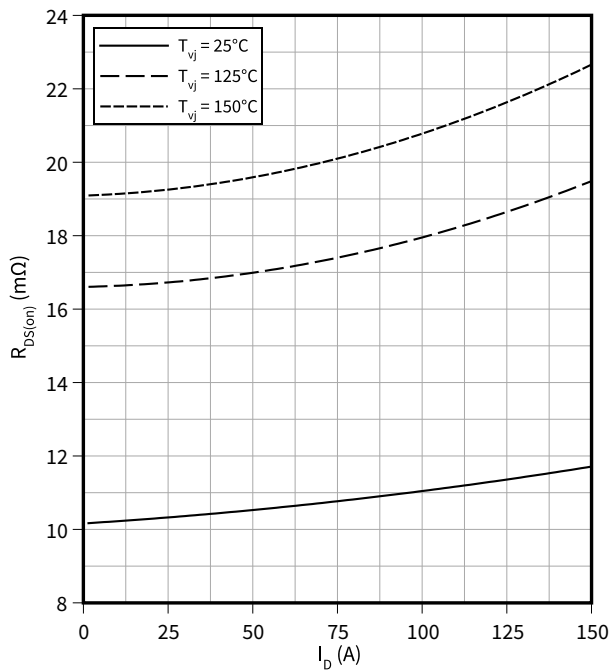
Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$
 $V_{GS} = 15\text{ V}$



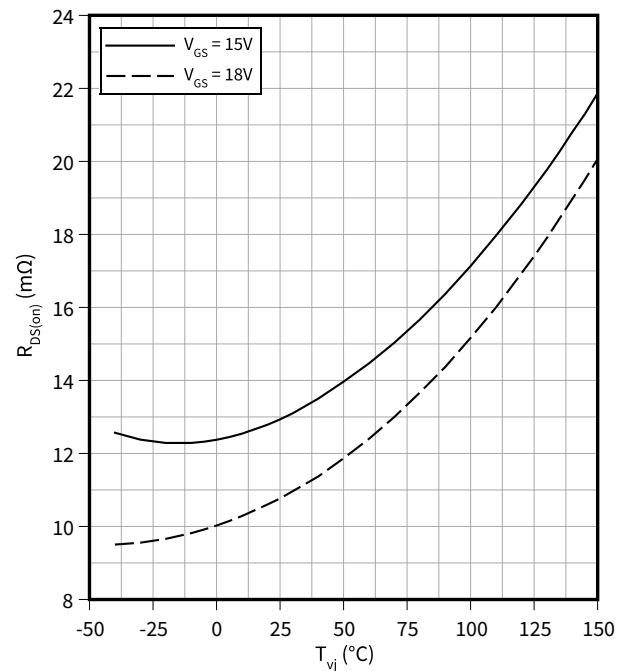
Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(I_D)$
 $V_{GS} = 18\text{ V}$



Drain source on-resistance (typical), MOSFET

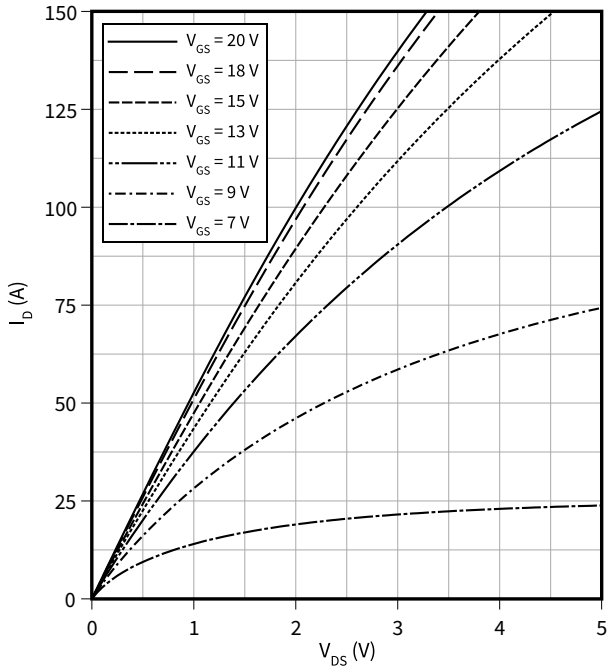
$R_{DS(on)} = f(T_{vj})$
 $I_D = 75\text{ A}$



5 Characteristics diagrams

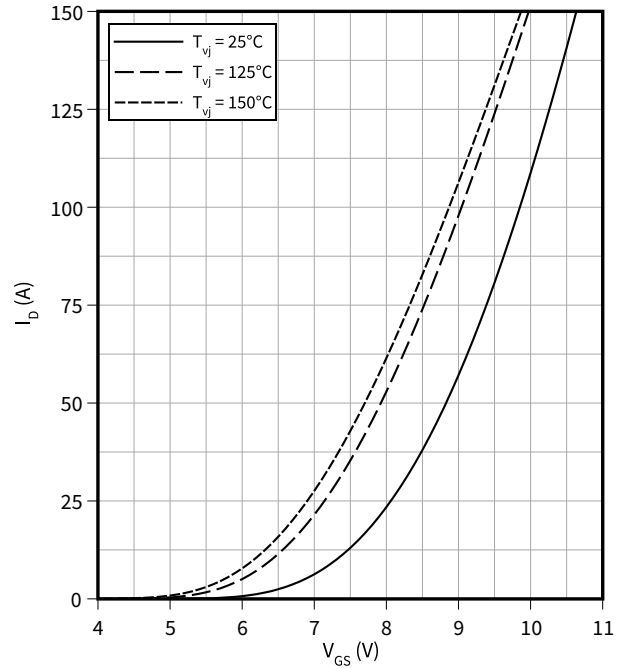
Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$
 $T_{vj} = 150\text{ °C}$



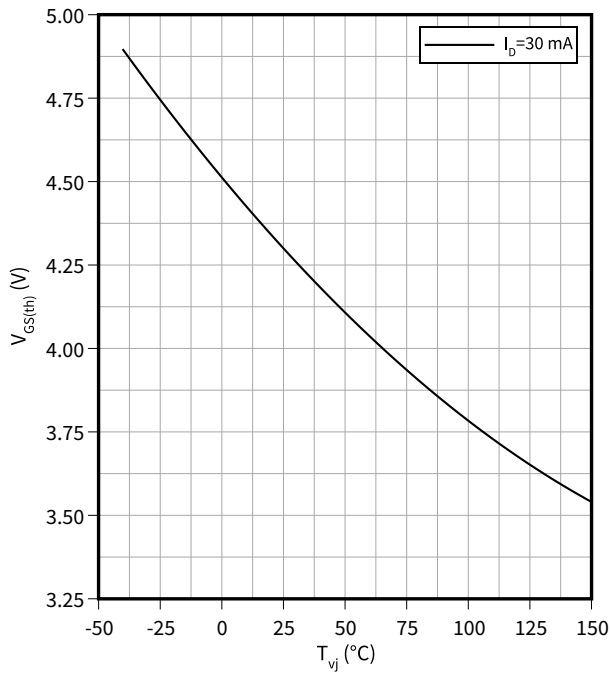
Transfer characteristic (typical), MOSFET

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



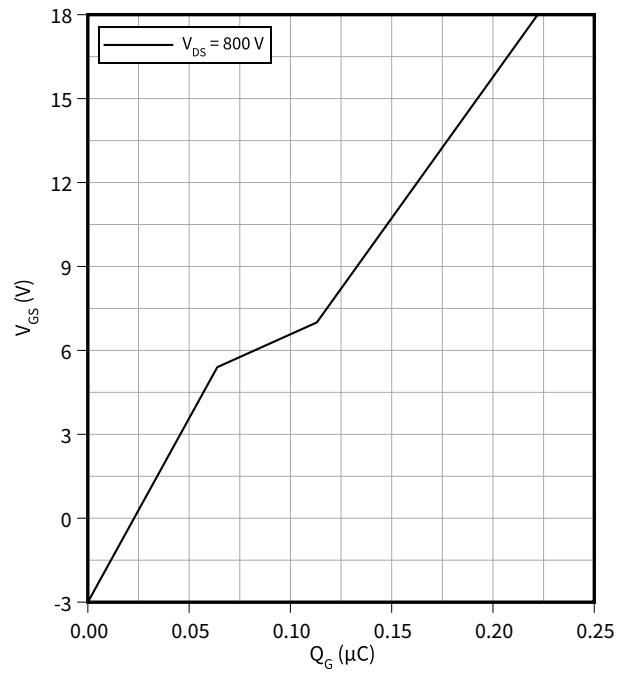
Gate-source threshold voltage (typical), MOSFET

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



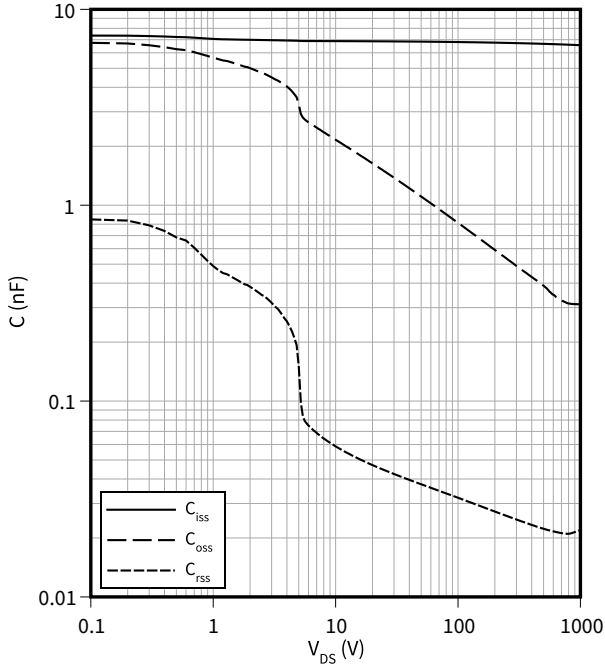
Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$
 $I_D = 75\text{ A}, T_{vj} = 25\text{ °C}$



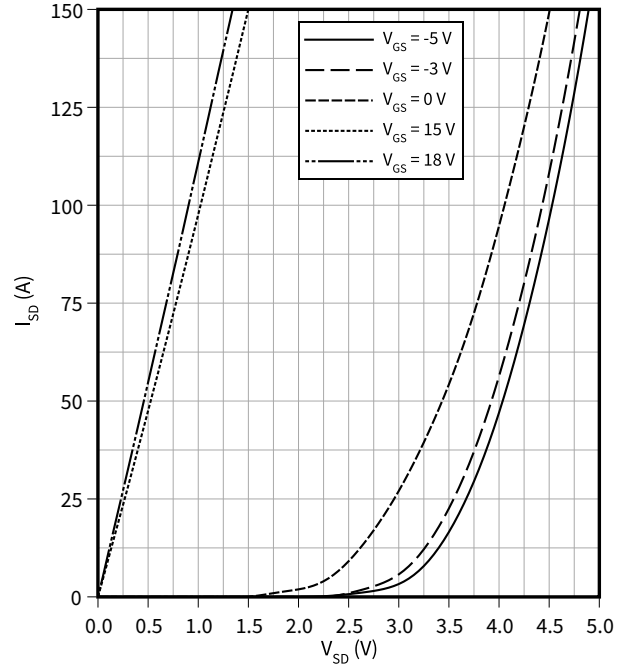
Capacity characteristic (typical), MOSFET

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



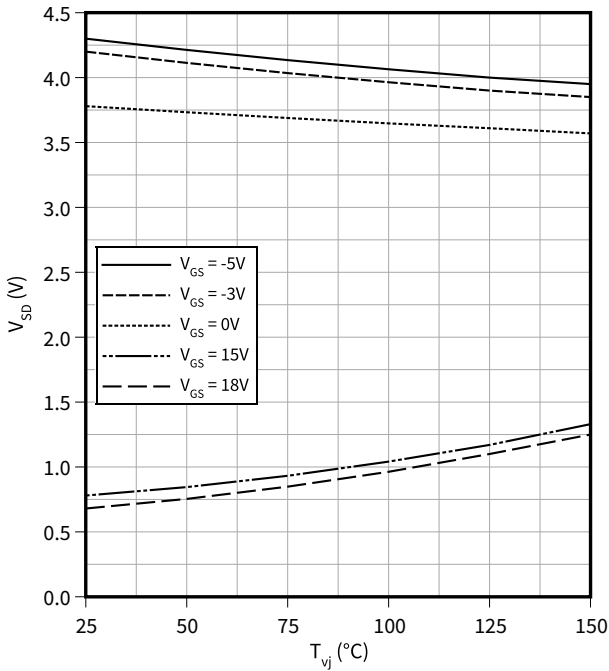
Forward characteristic body diode (typical), MOSFET

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



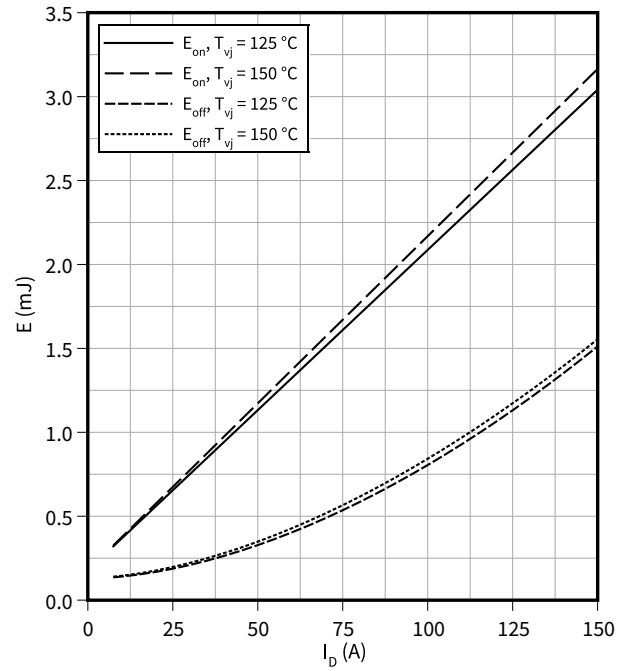
Forward voltage of body diode (typical), MOSFET

$V_{SD} = f(T_{vj})$
 $I_{SD} = 75 \text{ A}$



Switching losses (typical), MOSFET

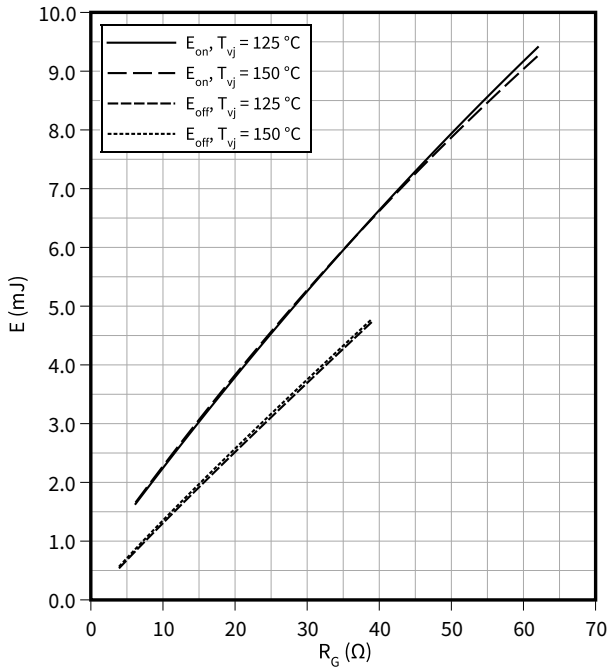
$E = f(I_D)$
 $R_{Goff} = 3.9 \text{ } \Omega, R_{Gon} = 6.2 \text{ } \Omega, V_{DD} = 600 \text{ V}, V_{GS} = -3/18 \text{ V}$



Switching losses (typical), MOSFET

$E = f(R_G)$

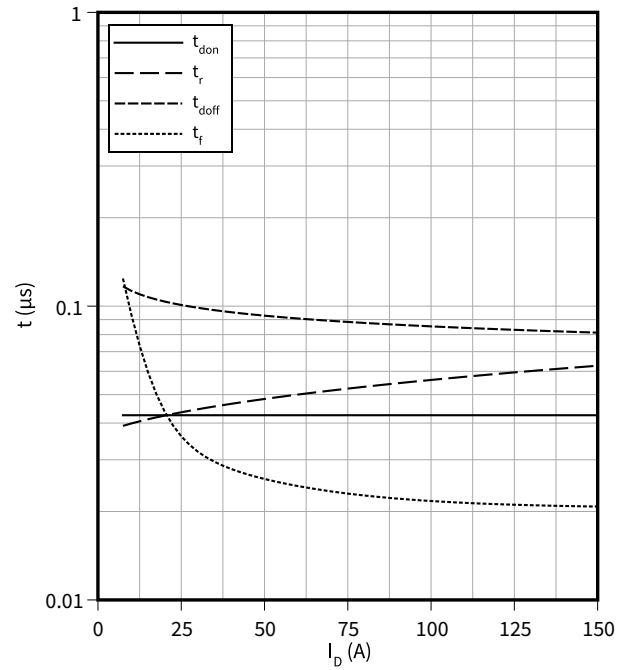
$V_{DD} = 600\text{ V}, I_D = 75\text{ A}, V_{GS} = -3/18\text{ V}$



Switching times (typical), MOSFET

$t = f(I_D)$

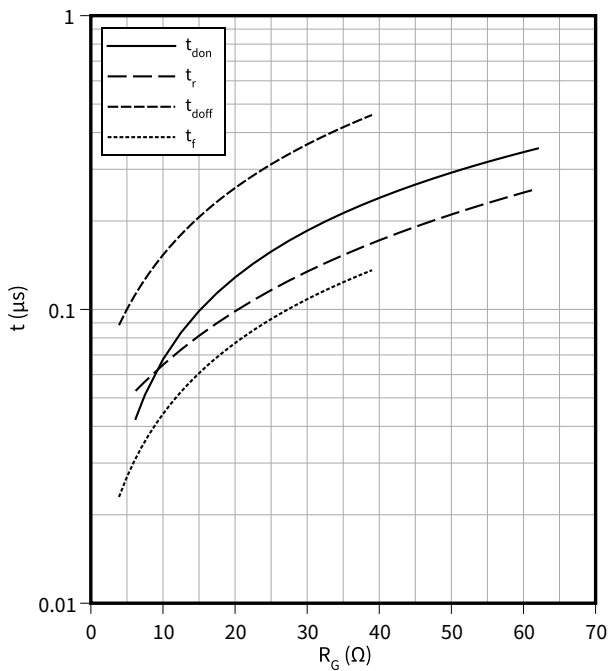
$R_{Goff} = 3.9\ \Omega, R_{Gon} = 6.2\ \Omega, V_{DD} = 600\text{ V}, T_{vj} = 150\text{ }^\circ\text{C}, V_{GS} = -3/18\text{ V}$



Switching times (typical), MOSFET

$t = f(R_G)$

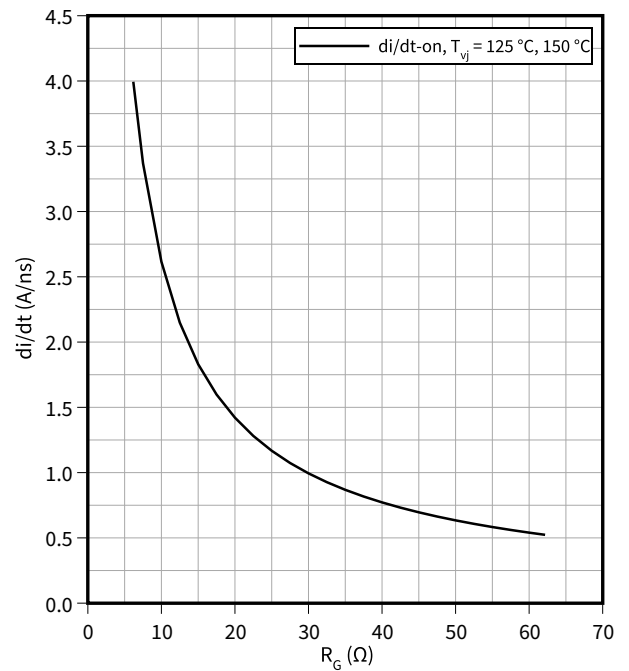
$V_{DD} = 600\text{ V}, I_D = 75\text{ A}, T_{vj} = 150\text{ }^\circ\text{C}, V_{GS} = -3/18\text{ V}$



Current slope (typical), MOSFET

$di/dt = f(R_G)$

$V_{DD} = 600\text{ V}, I_D = 75\text{ A}, V_{GS} = -3/18\text{ V}$

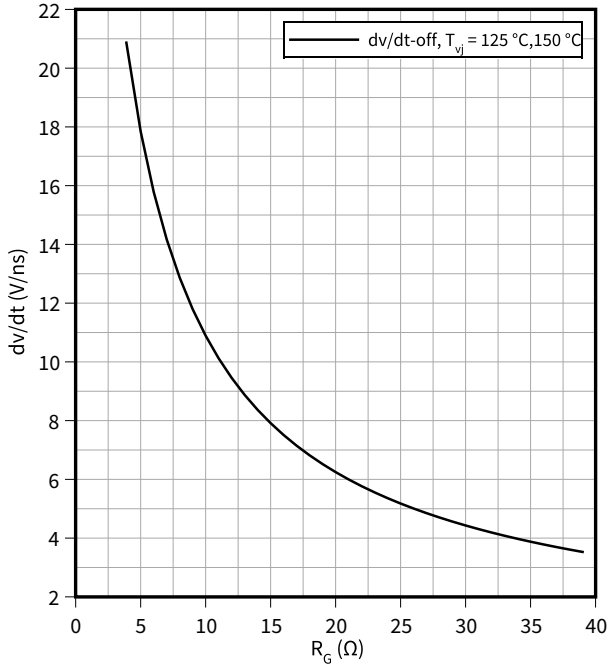


5 Characteristics diagrams

Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

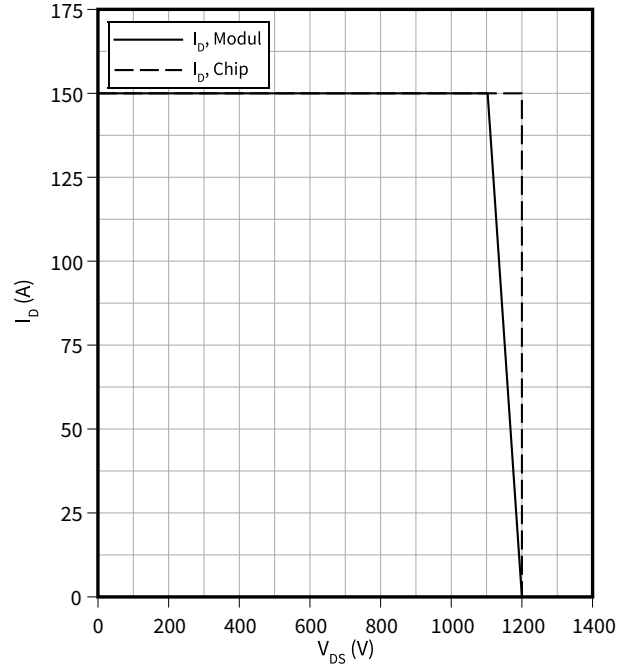
$V_{DD} = 600\text{ V}, I_D = 75\text{ A}, V_{GS} = -3/18\text{ V}$



Reverse bias safe operating area (RBSOA), MOSFET

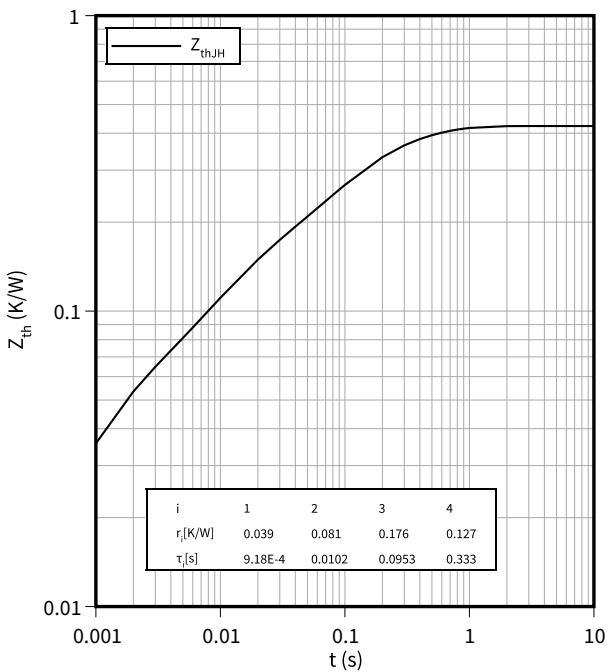
$I_D = f(V_{DS})$

$R_{Goff} = 3.9\ \Omega, T_{vj} = 150\ \text{°C}, V_{GS} = -3/18\ \text{V}$



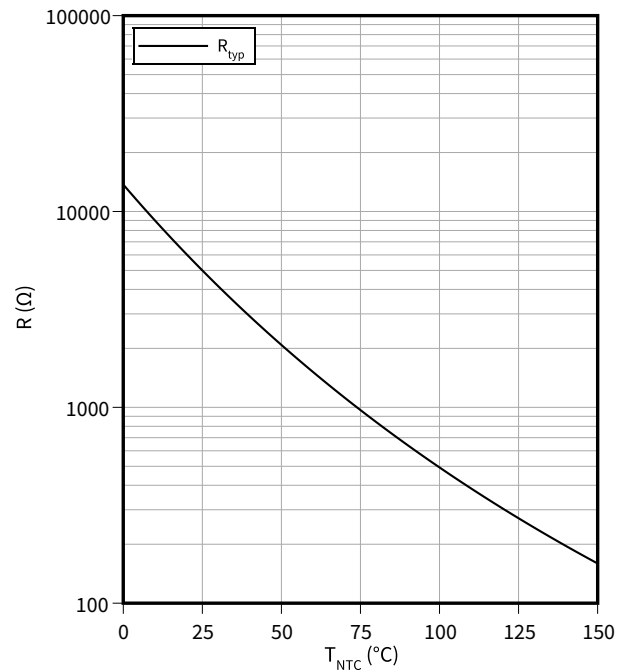
Transient thermal impedance, MOSFET

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

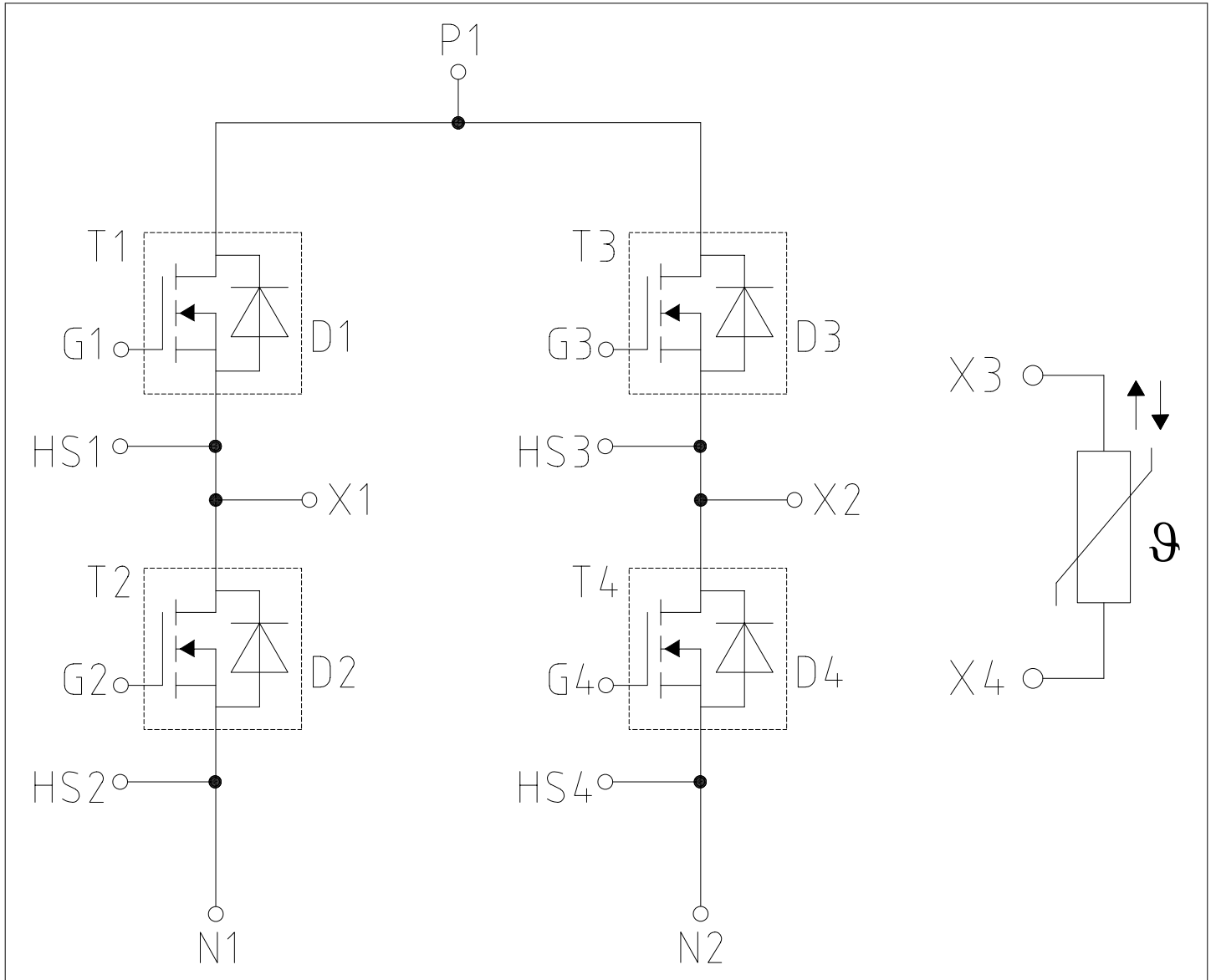


Figure 1

8 Module label code


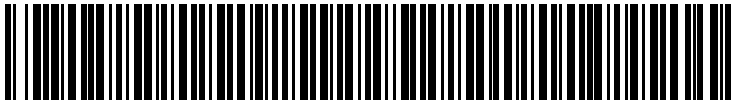
Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	<i>Content</i> Module serial number Module material number Production order number Date code (production year) Date code (production week)	<i>Digit</i> 1 - 5 6 - 11 12 - 19 20 - 21 22 - 23	<i>Example</i> 71549 142846 55054991 15 30
Example	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  71549142846550549911530 </div> <div style="text-align: center;">  71549142846550549911530 </div> </div>		

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2022-08-03	Initial version
0.20	2023-06-09	Preliminary datasheet

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