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

Features

Typical appearance

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 50 A / I_{DRM} = 100 A
  - Low inductive design
  - High current density
- Mechanical features
  - Integrated NTC temperature sensor
  - PressFIT contact technology
  - Rugged mounting due to integrated mounting clamps

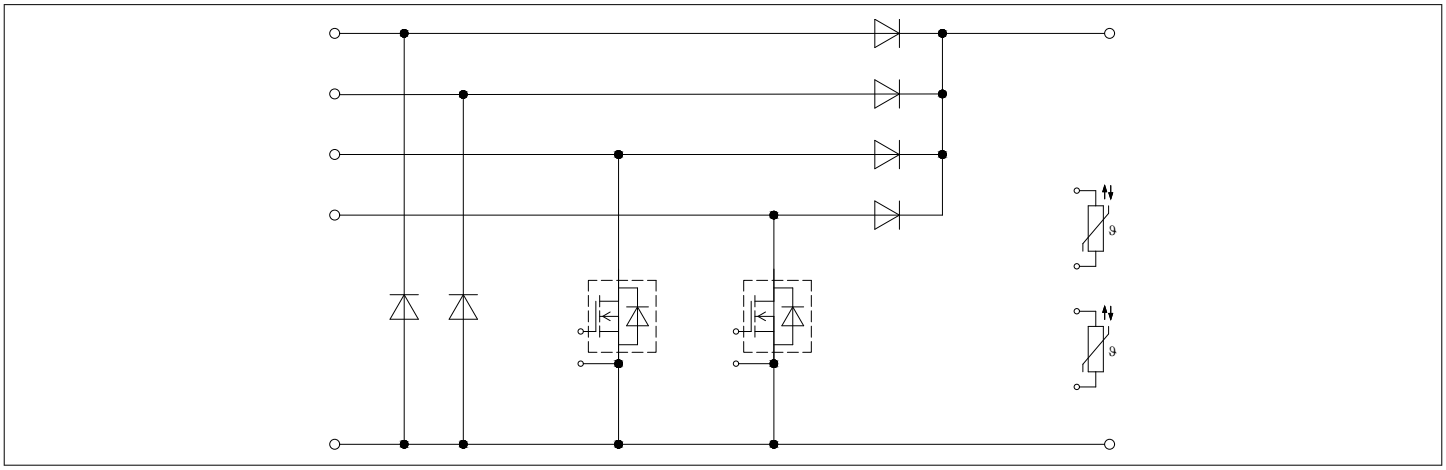
Potential applications

- Solar applications

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)	Al_2O_3	
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}			10		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_H = 25 °C, per switch		3		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		2		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting force per clamp	*F*		20		50	N
Weight	*G*			24		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
Implemented drain current	I_{DN}			50	A
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_H = 65 °C	45	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		100	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 = 50 A	V_{GS} = 18 V, T_{vj} = 25 °C		16.2		mΩ
			V_{GS} = 18 V, T_{vj} = 125 °C		26.1		
			V_{GS} = 18 V, T_{vj} = 175 °C		34.7		
			V_{GS} = 15 V, T_{vj} = 25 °C		19.4		
Gate threshold voltage	$V_{GS(th)}$	I_D = 20 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C, (tested after 1ms pulse at V_{GS} = +20 V)		3.45	4.3	5.15	V
Total gate charge	Q_G	V_{DD} = 800 V, V_{GS} = -3/18 V			0.149		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			4.1		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		4.4		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.21		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.014		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			86		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.03	210	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 = 50 A, R_{Gon} = 3.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		32		ns
			T_{vj} = 125 °C		32		
			T_{vj} = 175 °C		32		
Rise time (inductive load)	t_r	I_D = 50 A, R_{Gon} = 3.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		23.9		ns
			T_{vj} = 125 °C		23.9		
			T_{vj} = 175 °C		23.9		

(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 = 50 A, R_{Goff} = 2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		60.7		ns
			T_{vj} = 125 °C		60.7		
			T_{vj} = 175 °C		60.7		
Fall time (inductive load)	t_f	I_D = 50 A, R_{Goff} = 2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		10.5		ns
			T_{vj} = 125 °C		10.5		
			T_{vj} = 175 °C		10.5		
Turn-on energy loss per pulse	E_{on}	I_D = 50 A, V_{DD} = 600 V, L_σ = 35 nH, V_{GS} = -3/18 V, R_{Gon} = 3.3 Ω, di/dt = 4.29 kA/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.516		mJ
			T_{vj} = 125 °C		0.516		
			T_{vj} = 175 °C		0.516		
Turn-off energy loss per pulse	E_{off}	I_D = 50 A, V_{DD} = 600 V, L_σ = 35 nH, V_{GS} = -3/18 V, R_{Goff} = 2 Ω, dv/dt = 45.7 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.133		mJ
			T_{vj} = 125 °C		0.133		
			T_{vj} = 175 °C		0.133		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET			1.1		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 MOSFET and body diode. For detailed specifications, please refer to AN 2021-13.

3 Body diode

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	24	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 50 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.2	5.35	V
			T_{vj} = 125 °C		3.9		
			T_{vj} = 175 °C		3.8		

4 Diode, Boost

Table 8 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Continuous DC forward current	I_F			40	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		80	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	320	A^2s
			T_{vj} = 150 °C	295	

Table 9 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 40 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.40	1.85	V
			T_{vj} = 125 °C		1.70		
			T_{vj} = 150 °C		1.85		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 40 A, $-di_F/dt$ = 3900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		43		A
			T_{vj} = 125 °C		43		
			T_{vj} = 150 °C		43		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 40 A, $-di_F/dt$ = 3900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		4.03		µC
			T_{vj} = 125 °C		4.03		
			T_{vj} = 150 °C		4.03		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 40 A, $-di_F/dt$ = 3900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.063		mJ
			T_{vj} = 125 °C		0.063		
			T_{vj} = 150 °C		0.063		
Thermal resistance, junction to heat sink	R_{thJH}	per diode			1.11		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

5 Bypass-diode

Table 10 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V

(table continues...)

Table 10 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Maximum RMS forward current per chip	I_{FRMSM}	T_H = 80 °C		50	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 80 °C		50	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	450	A
			T_{vj} = 150 °C	360	
I²t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	1010	A²s
			T_{vj} = 150 °C	648	

Table 11 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 30 A	T_{vj} = 150 °C		0.95		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1200 V			0.1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode			1.29		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

6 Inverse-polarity protection diode

Table 12 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Maximum RMS forward current per chip	I_{FRMSM}	T_H = 80 °C		50	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 80 °C		50	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	450	A
			T_{vj} = 150 °C	360	
I²t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	1010	A²s
			T_{vj} = 150 °C	648	

Table 13 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 30 A	T_{vj} = 150 °C		0.95		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1200 V			0.1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode			1.16		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

7 NTC-Thermistor

Table 14 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

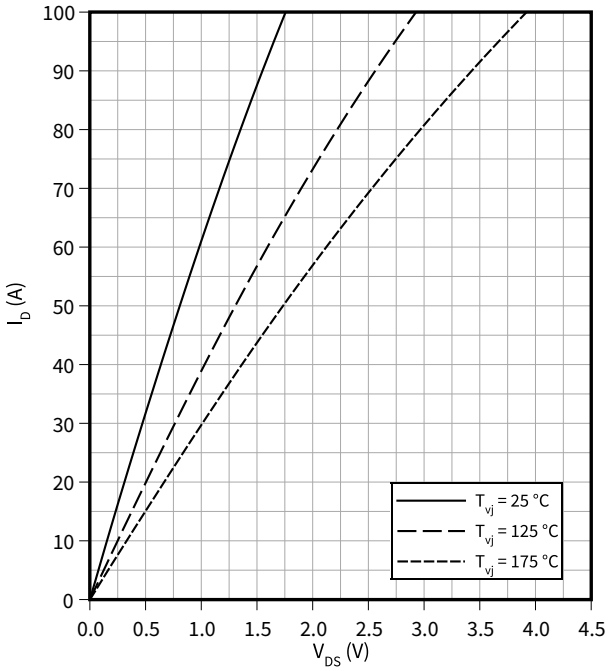
Note: Specification according to the valid application note.

8 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

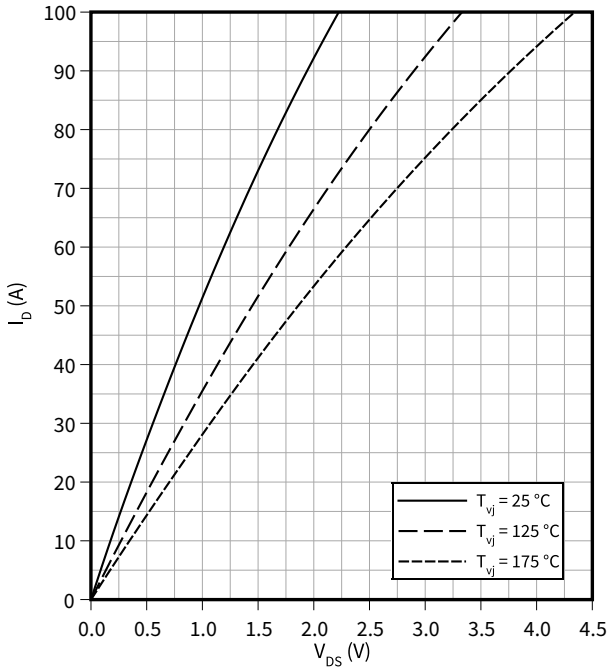
$V_{GS} = 18$ V



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

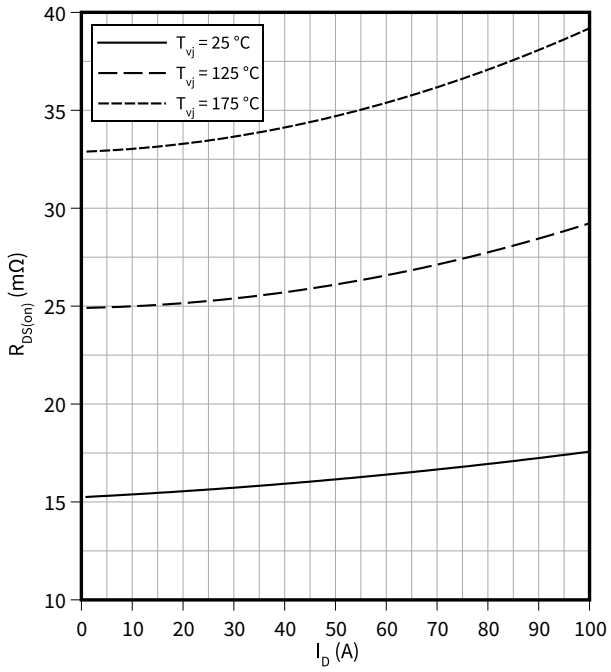
$V_{GS} = 15$ V



Drain source on-resistance (typical), MOSFET

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

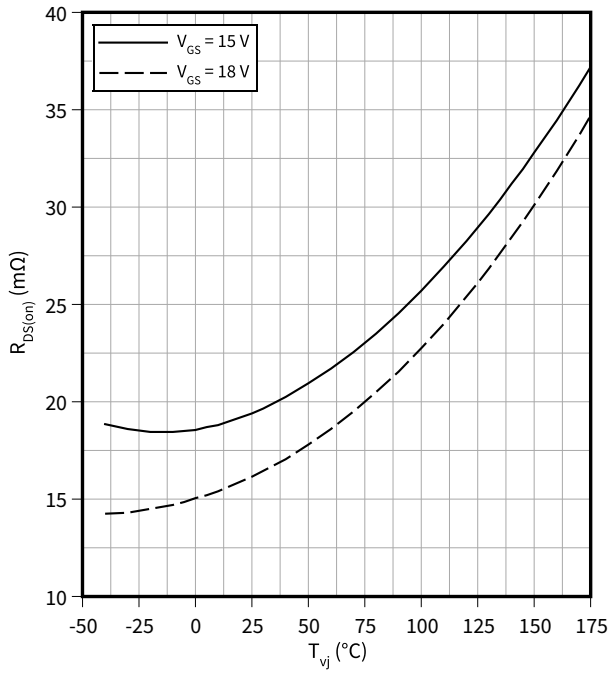
$V_{GS} = 18$ V



Drain source on-resistance (typical), MOSFET

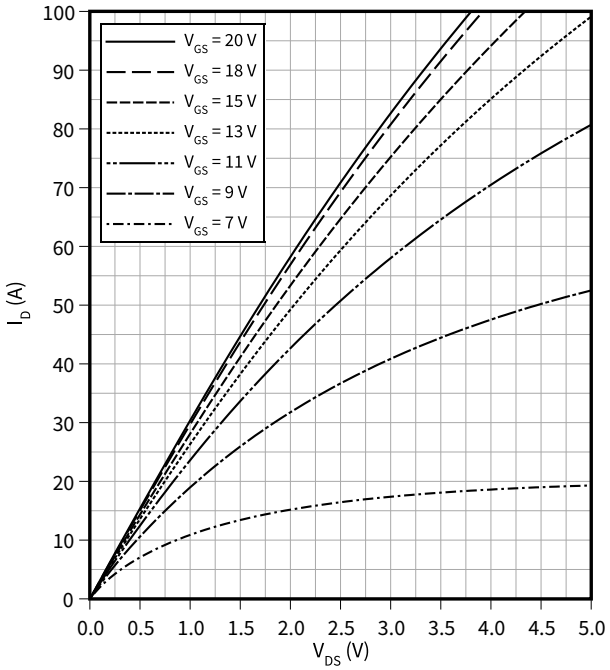
$R_{DS(on)} = f(T_{vj})$

$I_D = 50$ A



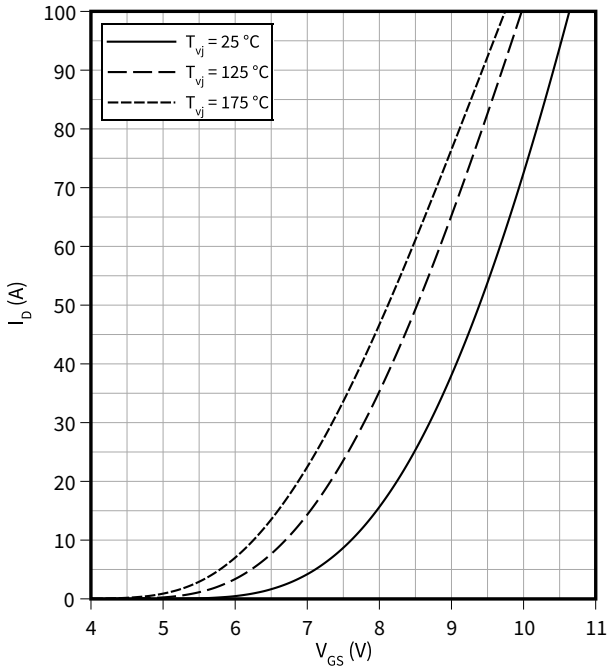
Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$
$T_{vj} = 175\ °C$



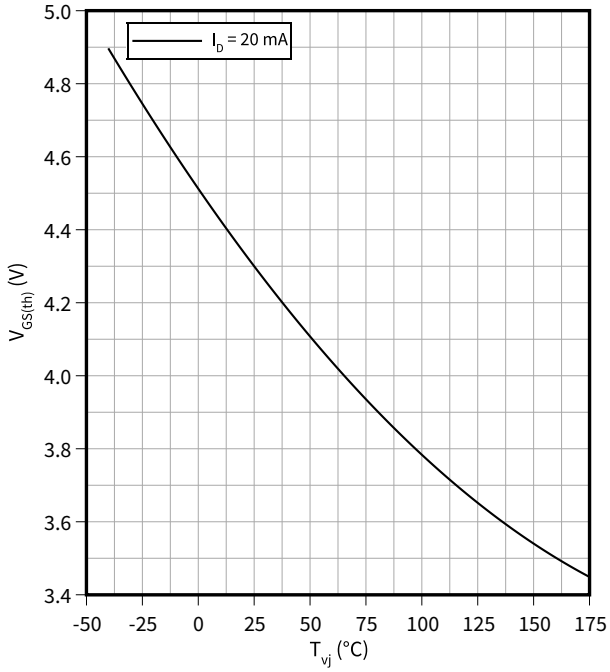
Transfer characteristic (typical), MOSFET

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



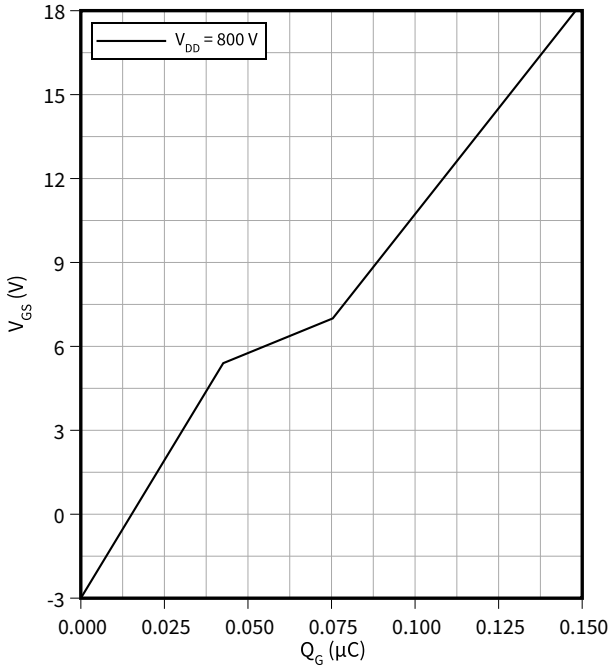
Gate-source threshold voltage (typical), MOSFET

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



Gate charge characteristic (typical), MOSFET

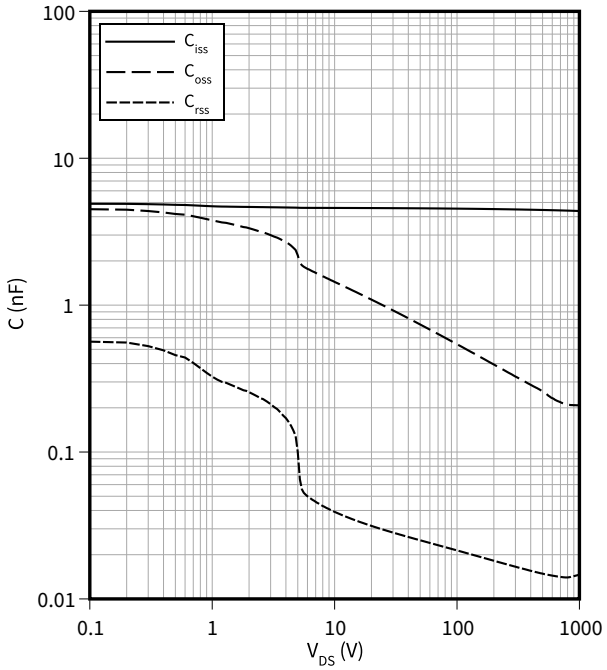
$V_{GS} = f(Q_G)$
$I_D = 50\ A,\ T_{vj} = 25\ °C$



Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

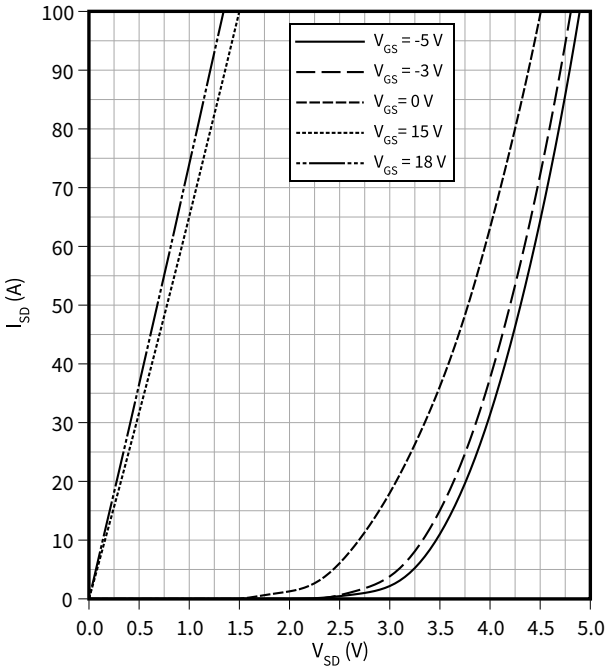
$f = 100\ kHz$, $T_{vj} = 25\ °C$, $V_{GS} = 0\ V$



Forward characteristic body diode (typical), MOSFET

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

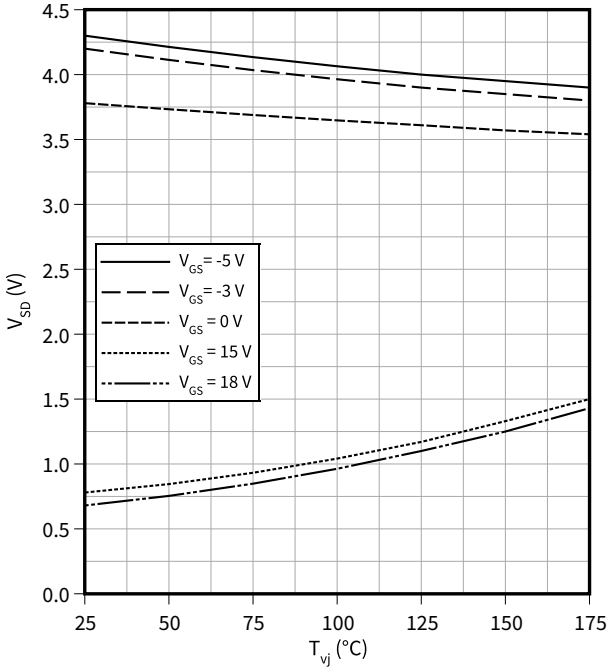
$T_{vj} = 25\ °C$



Forward characteristic body diode (typical), MOSFET

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

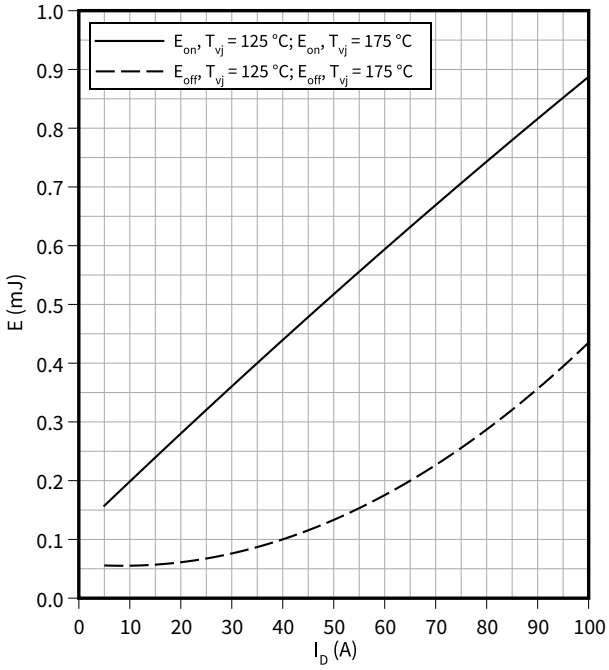
$I_{SD} = 50\ A$



Switching losses (typical), MOSFET

$E = f(I_D)$

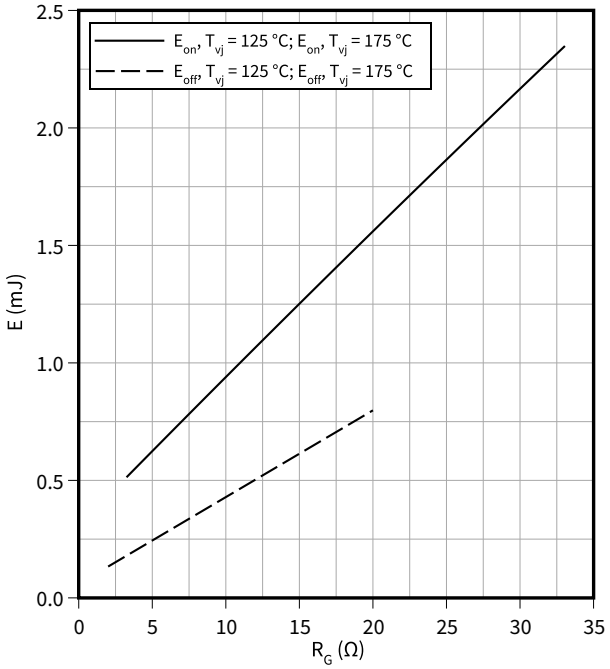
$R_{Goff} = 2\ \Omega$, $R_{Gon} = 3.3\ \Omega$, $V_{DD} = 600\ V$, $V_{GS} = -3/18\ V$



Switching losses (typical), MOSFET

$E = f(R_G)$

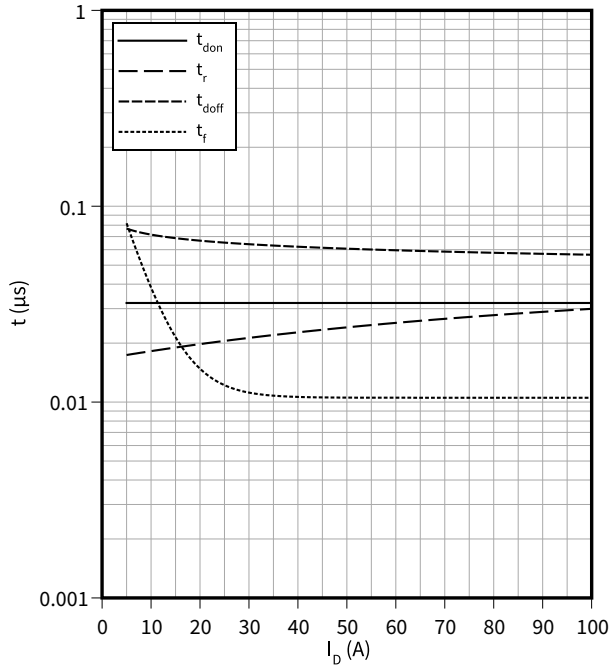
V_{DD} = 600 V, I_D = 50 A, V_{GS} = -3/18 V



Switching times (typical), MOSFET

$t = f(I_D)$

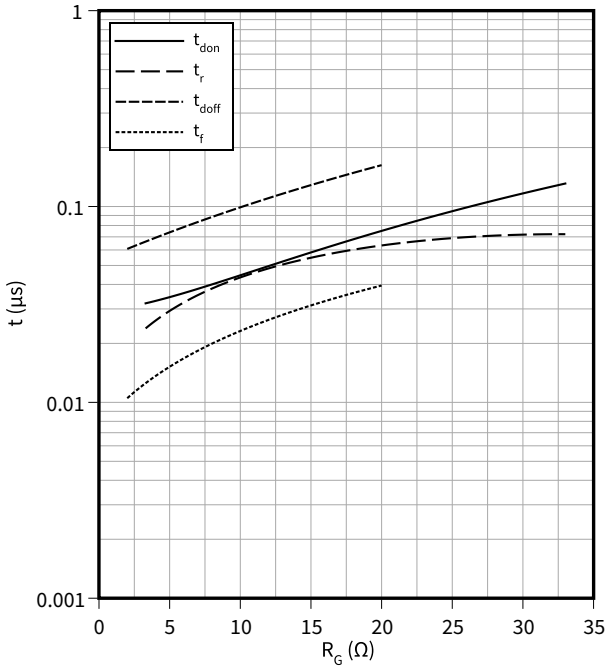
R_{Goff} = 2 Ω, R_{Gon} = 3.3 Ω, V_{DD} = 600 V, T_{vj} = 175 °C, V_{GS} = -3/18 V



Switching times (typical), MOSFET

$t = f(R_G)$

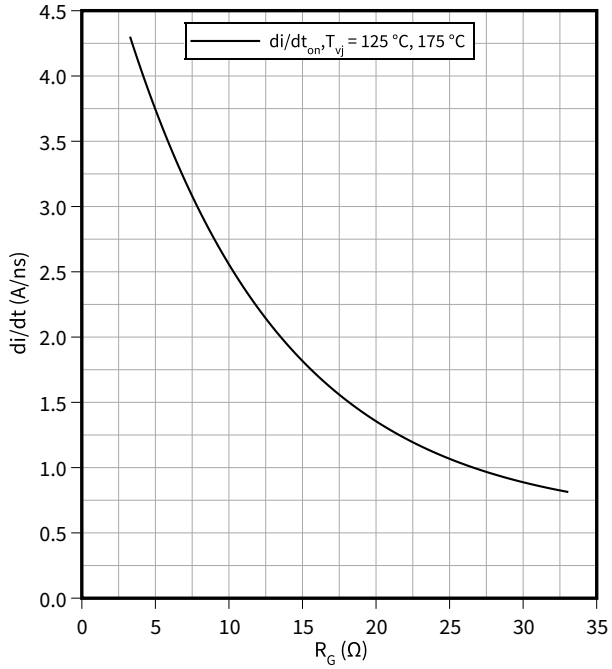
V_{DD} = 600 V, I_D = 50 A, T_{vj} = 175 °C, V_{GS} = -3/18 V



Current slope (typical), MOSFET

$di/dt = f(R_G)$

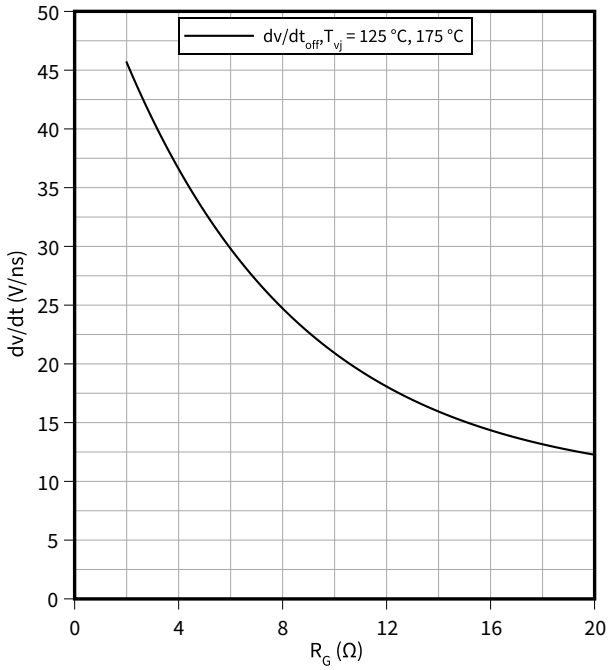
V_{DD} = 600 V, I_D = 50 A, V_{GS} = -3/18 V



Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

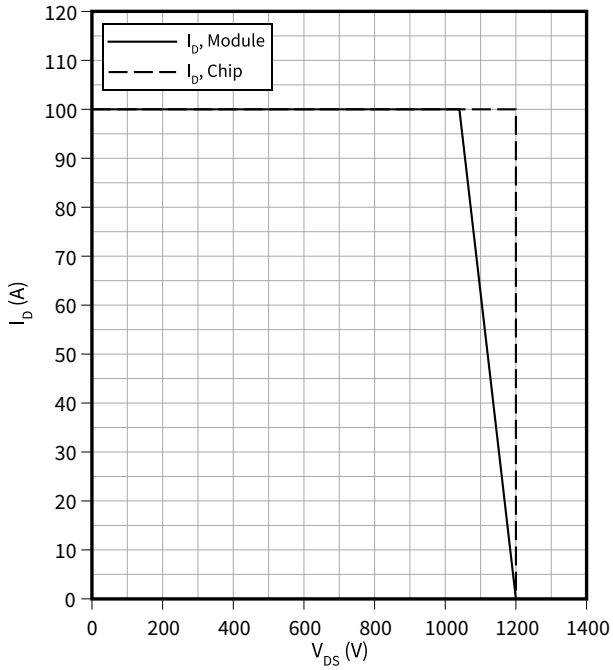
V_{DD} = 600 V, I_D = 50 A, V_{GS} = -3/18 V



Reverse bias safe operating area (RBSOA), MOSFET

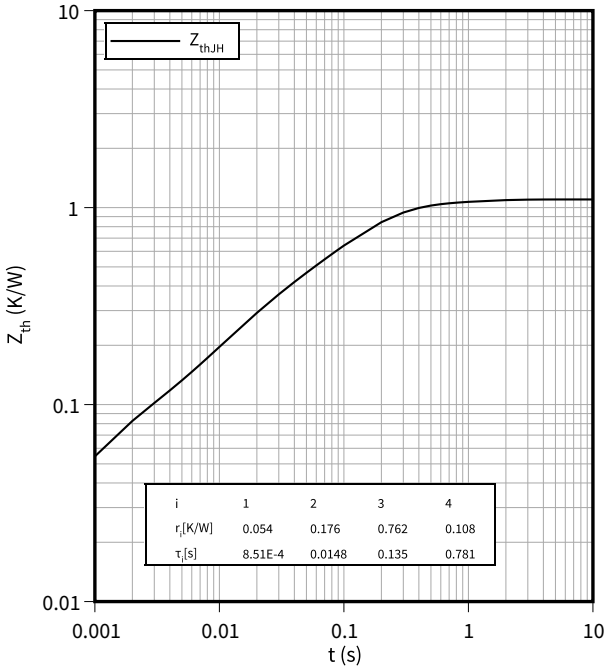
$I_D = f(V_{DS})$

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



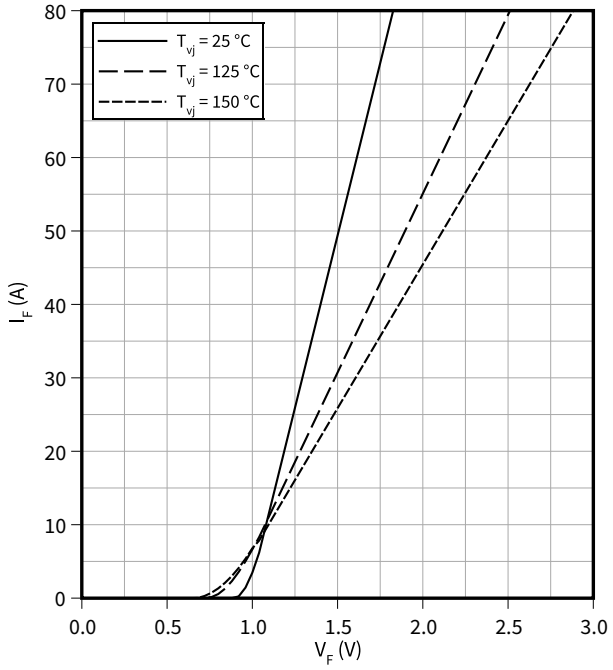
Transient thermal impedance , MOSFET

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Boost

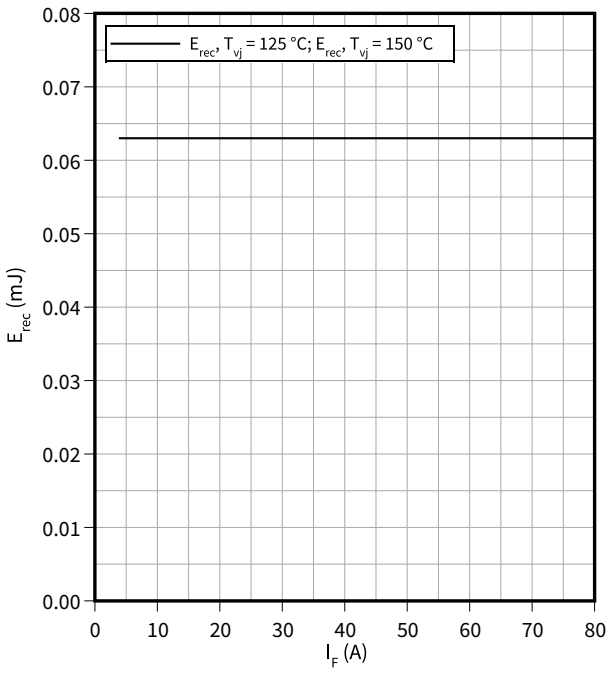
$I_F = f(V_F)$



Switching losses (typical), Diode, Boost

$E_{rec} = f(I_F)$

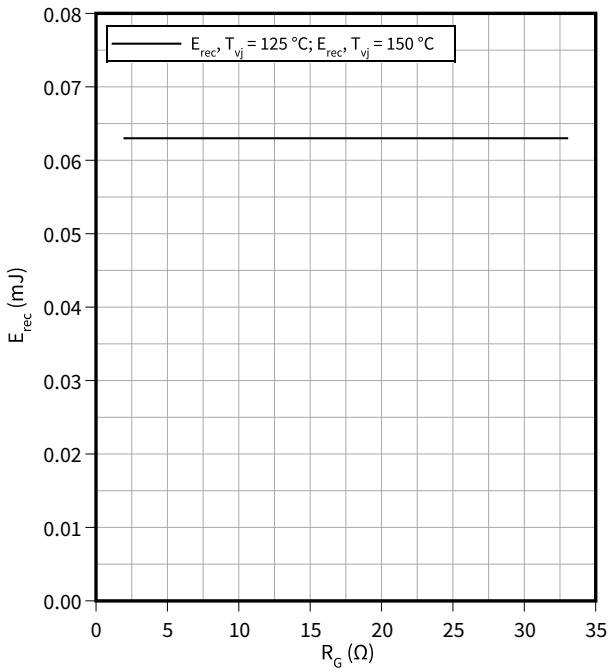
$R_{Gon} = 3.3\ \Omega$, $V_{CC} = 600$ V



Switching losses (typical), Diode, Boost

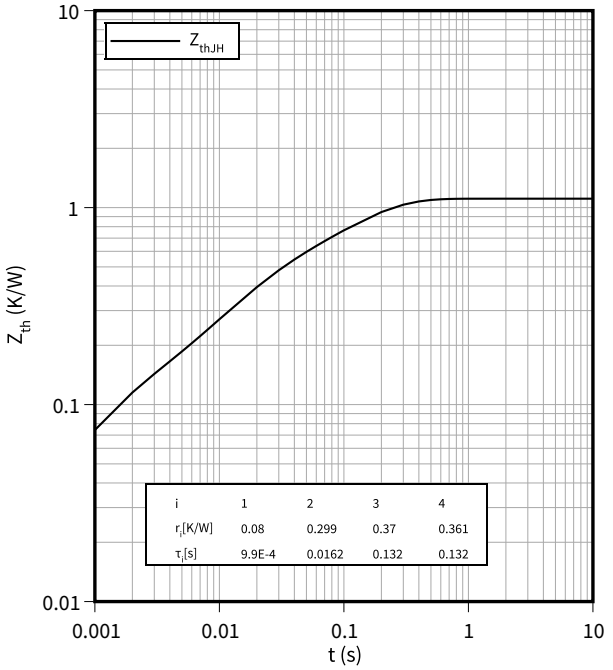
$E_{rec} = f(R_G)$

$I_F = 40$ A, $V_{CC} = 600$ V



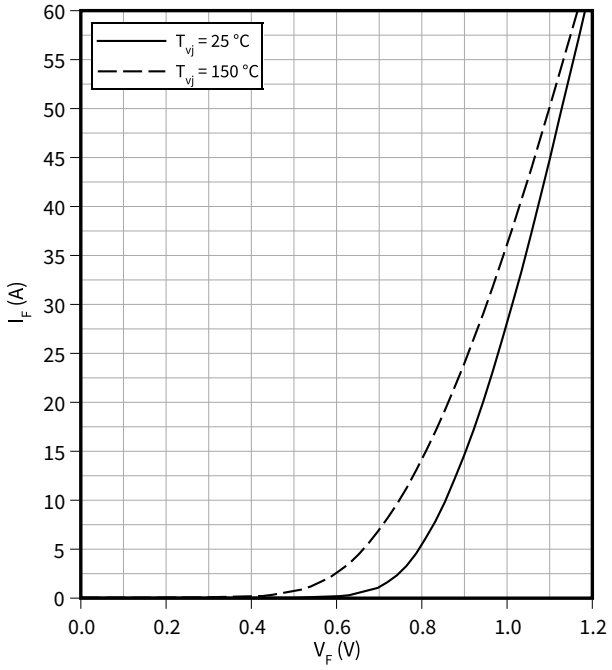
Transient thermal impedance, Diode, Boost

$Z_{th} = f(t)$



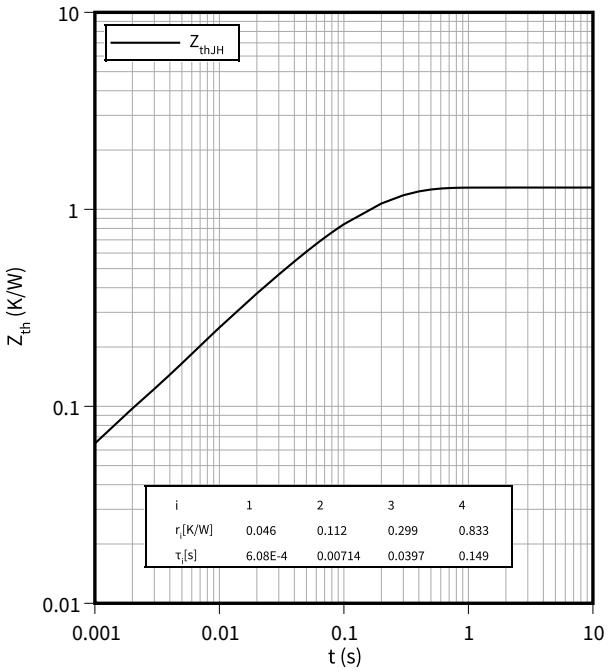
Forward characteristic (typical), Bypass-diode

$I_F = f(V_F)$



Transient thermal impedance, Bypass-diode

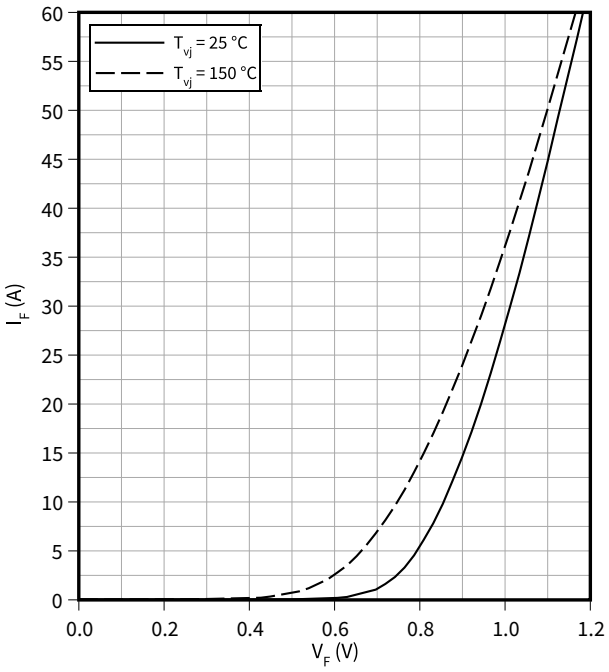
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.046	0.112	0.299	0.833
τ_i[s]	6.08E-4	0.00714	0.0397	0.149

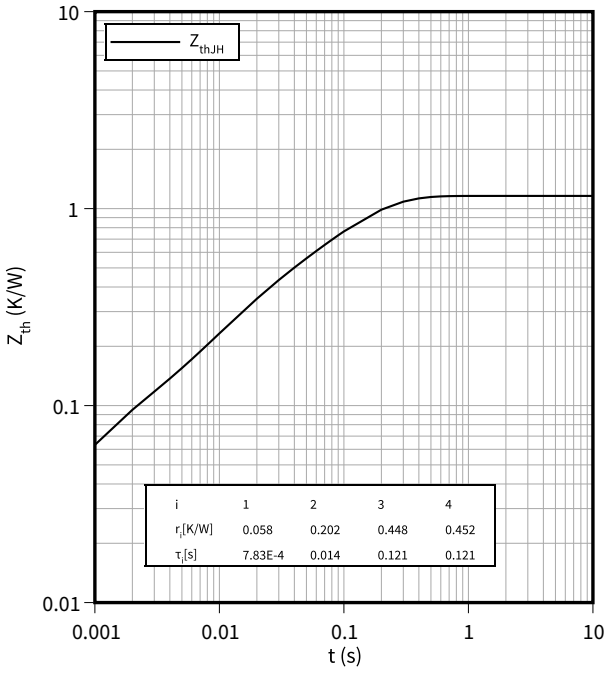
Forward characteristic (typical), Inverse-polarity protection diode

$I_F = f(V_F)$



Transient thermal impedance, Inverse-polarity protection diode

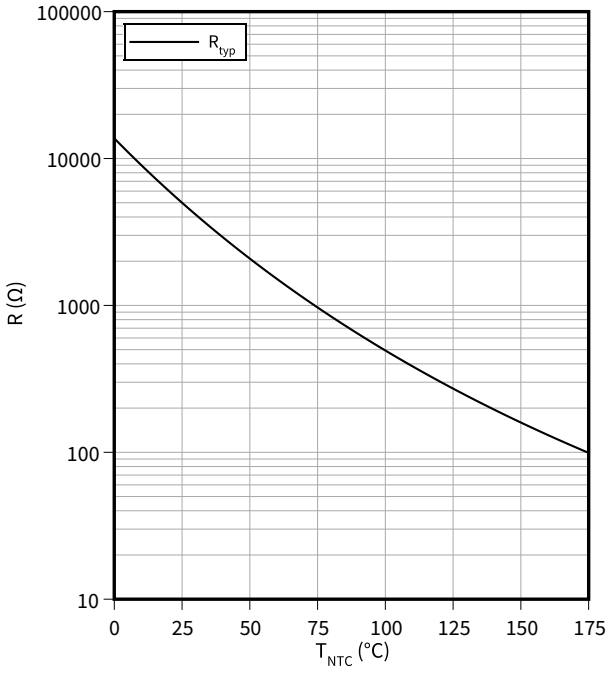
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.058	0.202	0.448	0.452
τ_i[s]	7.83E-4	0.014	0.121	0.121

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

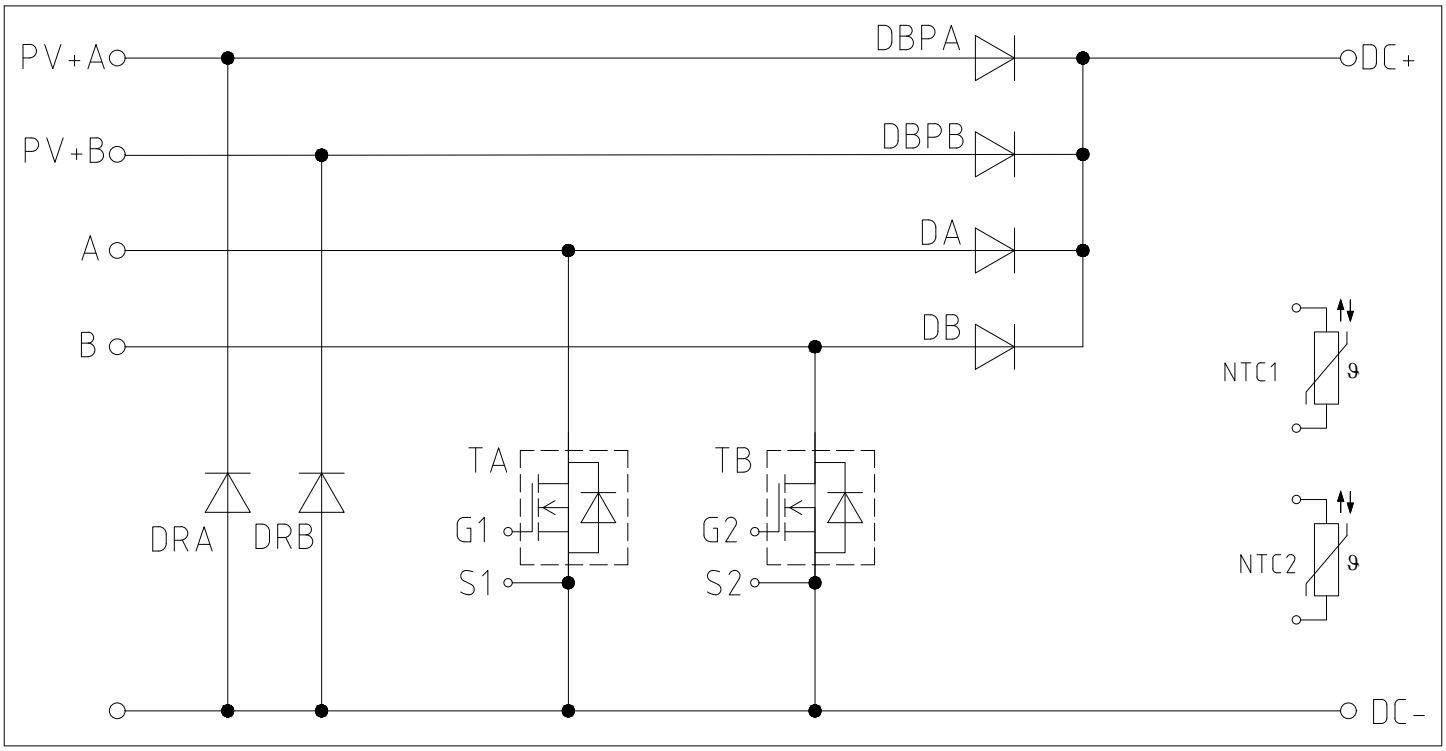


Figure 1

10 Package outlines

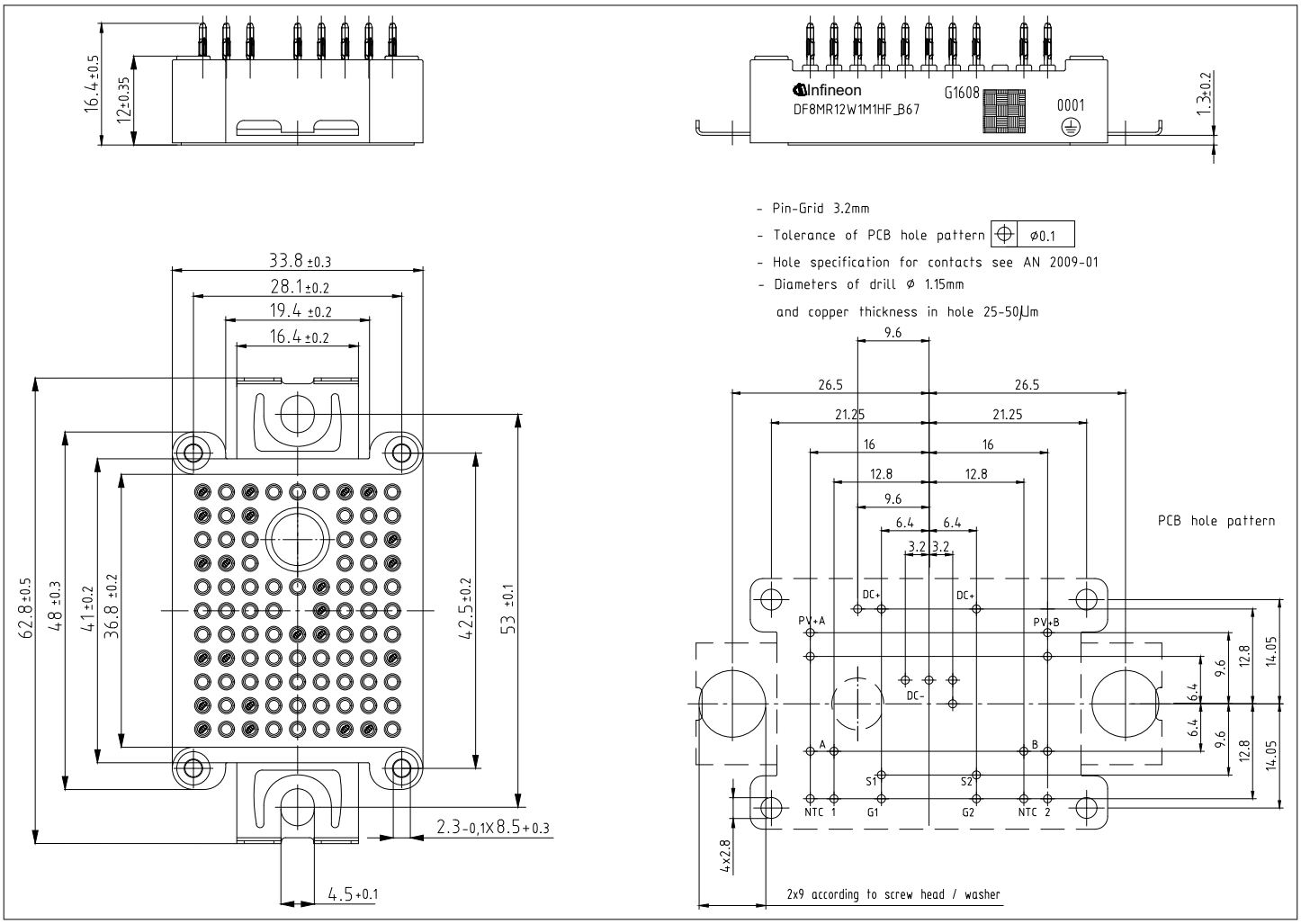


Figure 2

11 Module label code

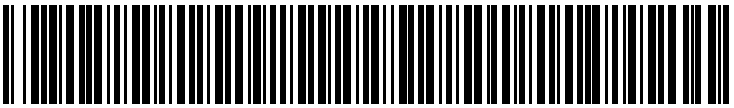
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	 715491428465505499115 30	 715491428465505499115 30	

Figure 3

Revision history

Document version	Date of release	Description of changes
0.10	2022-11-21	Initial version