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

Features

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 25 A / I_{DRM} = 50 A
  - High current density
  - Low inductive design
- Mechanical features
  - PressFIT contact technology
  - Integrated NTC temperature sensor
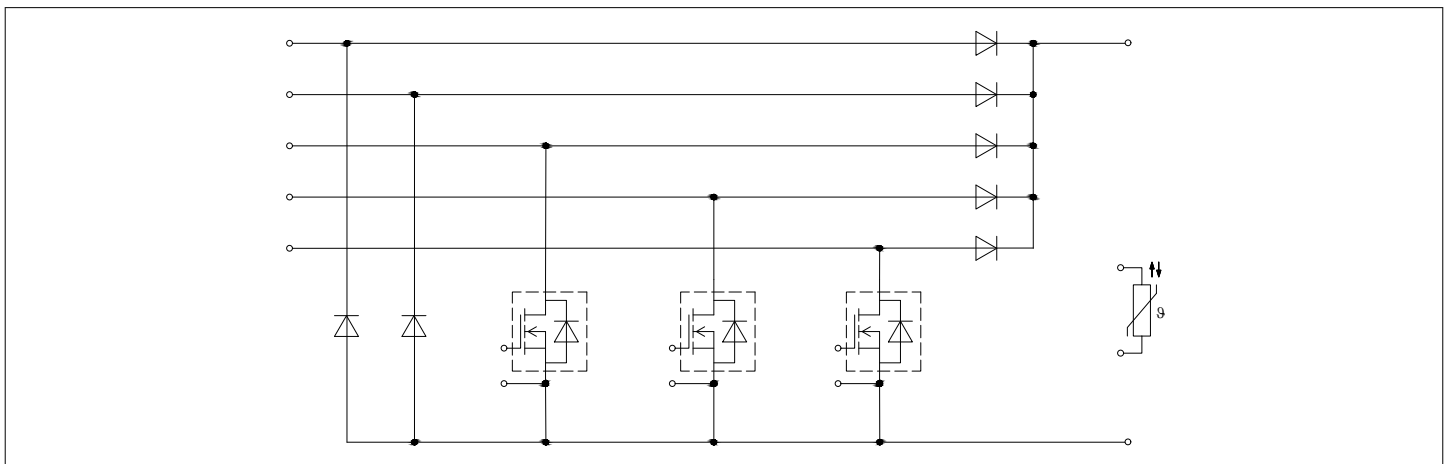 - Rugged mounting due to integrated mounting clamps

Potential applications

- Solar applications

Product validation

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

Description

Typical appearance

Please read the sections "Important notice" and "Warnings" at the end of this document

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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		3.2		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		3.2		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
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_H = 70 °C	25	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		50	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		Min.	Typ.	Max.	Unit
Drain-source on-resistance	$R_{DS(on)}$	$I_D = 25$ A	$V_{GS} = 18$ V, $T_{vj} = 25$ °C		32.3		mΩ
			$V_{GS} = 18$ V, $T_{vj} = 125$ °C		52.2		
			$V_{GS} = 18$ V, $T_{vj} = 175$ °C		69.4		
			$V_{GS} = 15$ V, $T_{vj} = 25$ °C		38.8		
Gate threshold voltage	$V_{GS(th)}$	$I_D = 10$ 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			0.074		µC
Internal gate resistor	R_{Gint}	$T_{vj} = 25$ °C			8.2		Ω
Input capacitance	C_{ISS}	$f = 100$ kHz, $V_{DS} = 800$ V, $V_{GS} = 0$ V	$T_{vj} = 25$ °C		2.2		nF
Output capacitance	C_{OSS}	$f = 100$ kHz, $V_{DS} = 800$ V, $V_{GS} = 0$ V	$T_{vj} = 25$ °C		0.105		nF
Reverse transfer capacitance	C_{rss}	$f = 100$ kHz, $V_{DS} = 800$ V, $V_{GS} = 0$ V	$T_{vj} = 25$ °C		0.007		nF
C$_{OSS}$ stored energy	E_{OSS}	$V_{DS} = 800$ V, $V_{GS} = -3/18$ V, $T_{vj} = 25$ °C			43		µJ
Drain-source leakage current	I_{DSS}	$V_{DS} = 1200$ V, $V_{GS} = -3$ V	$T_{vj} = 25$ °C		0.015	120	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)	$t_{d\ on}$	$I_D = 25$ A, $R_{Gon} = 5.6$ 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	$I_D = 25$ A, $R_{Gon} = 5.6$ Ω, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V	$T_{vj} = 25$ °C		26		ns
			$T_{vj} = 125$ °C		26		
			$T_{vj} = 175$ °C		26		

(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 = 25 A, R_{Goff} = 1.5 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		48		ns
			T_{vj} = 125 °C		53		
			T_{vj} = 175 °C		55		
Fall time (inductive load)	t_f	I_D = 25 A, R_{Goff} = 1.5 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		11		ns
			T_{vj} = 125 °C		11		
			T_{vj} = 175 °C		11		
Turn-on energy loss per pulse	E_{on}	I_D = 25 A, V_{DD} = 600 V, L_σ = 35 nH, V_{GS} = -3/18 V, R_{Gon} = 5.6 Ω, di/dt = 2.3 kA/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.297		mJ
			T_{vj} = 125 °C		0.297		
			T_{vj} = 175 °C		0.297		
Turn-off energy loss per pulse	E_{off}	I_D = 25 A, V_{DD} = 600 V, L_σ = 35 nH, V_{GS} = -3/18 V, R_{Goff} = 1.5 Ω, dv/dt = 43.6 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.057		mJ
			T_{vj} = 125 °C		0.057		
			T_{vj} = 175 °C		0.057		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET			1.85		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 AN2021-13 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 = 70 °C	13	A

Table 7 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 25 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
Implemented forward current	I_{FN}			20	A
Continuous DC forward current	I_F			25	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\ ms$		40	A
I^2t - value	I^2t	$t_P = 10\ ms$, $V_R = 0\ V$	$T_{vj} = 25\ °C$	193	A^2s
			$T_{vj} = 125\ °C$	169	
			$T_{vj} = 150\ °C$	165	

Table 9 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 25\ A$, $V_{GE} = 0\ V$	$T_{vj} = 25\ °C$		1.55	2.05	V
			$T_{vj} = 125\ °C$		1.95		
			$T_{vj} = 150\ °C$		2.10		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600\ V$, $I_F = 25\ A$, $-di_F/dt = 2300\ A/\mu s$ ($T_{vj} = 150\ °C$)	$T_{vj} = 25\ °C$		21		A
			$T_{vj} = 125\ °C$		21		
			$T_{vj} = 150\ °C$		21		
Recovered charge	Q_r	$V_{CC} = 600\ V$, $I_F = 25\ A$, $-di_F/dt = 2300\ A/\mu s$ ($T_{vj} = 150\ °C$)	$T_{vj} = 25\ °C$		0.21		µC
			$T_{vj} = 125\ °C$		0.21		
			$T_{vj} = 150\ °C$		0.21		
Reverse recovery energy	E_{rec}	$V_{CC} = 600\ V$, $I_F = 25\ A$, $-di_F/dt = 2300\ A/\mu s$ ($T_{vj} = 150\ °C$)	$T_{vj} = 25\ °C$		0.03		mJ
			$T_{vj} = 125\ °C$		0.03		
			$T_{vj} = 150\ °C$		0.03		
Thermal resistance, junction to heat sink	R_{thJH}	per diode			1.75		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	°C

5   Bypass-diode A

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
Maximum RMS forward current per chip	I_{FRMSM}	$T_H = 50\ °C$		50	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_H = 50\ °C$		50	A
Surge forward current	I_{FSM}	$t_P = 10\ ms$	$T_{vj} = 25\ °C$	450	A
			$T_{vj} = 150\ °C$	360	
I^2t - value	I^2t	$t_P = 10\ ms$	$T_{vj} = 25\ °C$	1010	A^2s
			$T_{vj} = 150\ °C$	648	

Table 11   **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 25\ A$	$T_{vj} = 150\ °C$		0.90		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			1.38		K/W
Temperature under switching conditions	$T_{vj,\ op}$			-40		150	°C

6   Bypass-diode B

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}	$T_H = 100\ °C$		25	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_H = 100\ °C$		25	A
Surge forward current	I_{FSM}	$t_P = 10\ ms$	$T_{vj} = 25\ °C$	450	A
			$T_{vj} = 150\ °C$	360	
I^2t - value	I^2t	$t_P = 10\ ms$	$T_{vj} = 25\ °C$	1010	A^2s
			$T_{vj} = 150\ °C$	648	

Table 13   Characteristic values

Parameter	Symbol	Note or test condition		Min.	Typ.	Max.	Unit
Forward voltage	V_F	$I_F = 25$ A	$T_{vj} = 150$ °C		0.90		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			1.38		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

7   Inverse-polarity protection diode A

Table 14   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}	$T_H = 50$ °C		50	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_H = 50$ °C		50	A
Surge forward current	I_{FSM}	$t_P = 10$ ms	$T_{vj} = 25$ °C	450	A
			$T_{vj} = 150$ °C	360	
I^2t - value	I^2t	$t_P = 10$ ms	$T_{vj} = 25$ °C	1010	A^2s
			$T_{vj} = 150$ °C	648	

Table 15   Characteristic values

Parameter	Symbol	Note or test condition		Min.	Typ.	Max.	Unit
Forward voltage	V_F	$I_F = 50$ A	$T_{vj} = 150$ °C		1.10		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			1.38		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

8 Inverse-polarity protection diode B

Table 16 **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}	$T_H = 100\ °C$		25	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_H = 100\ °C$		25	A
Surge forward current	I_{FSM}	$t_P = 10\ ms$	$T_{vj} = 25\ °C$	450	A
			$T_{vj} = 150\ °C$	360	
I^2t - value	I^2t	$t_P = 10\ ms$	$T_{vj} = 25\ °C$	1010	A^2s
			$T_{vj} = 150\ °C$	648	

Table 17 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 25\ A$	$T_{vj} = 150\ °C$		0.90		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			1.38		K/W
Temperature under switching conditions	$T_{vj,\ op}$			-40		150	°C

9 NTC-Thermistor

Table 18 **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}	$\Delta R/R$	$T_{NTC} = 100\ °C$, $R_{100} = 493\ \Omega$	-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.*

10 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

$V_{GS} = 18\ V$
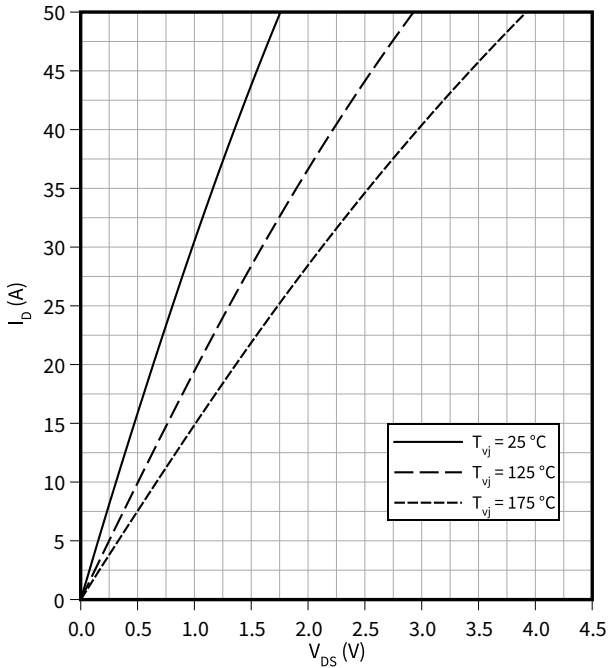
Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

$V_{GS} = 15\ V$
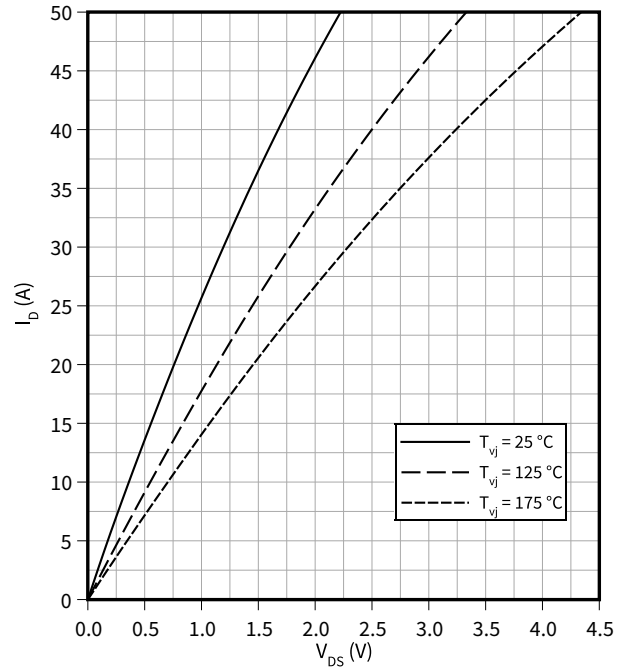
Drain source on-resistance (typical), MOSFET

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

$V_{GS} = 18\ V$
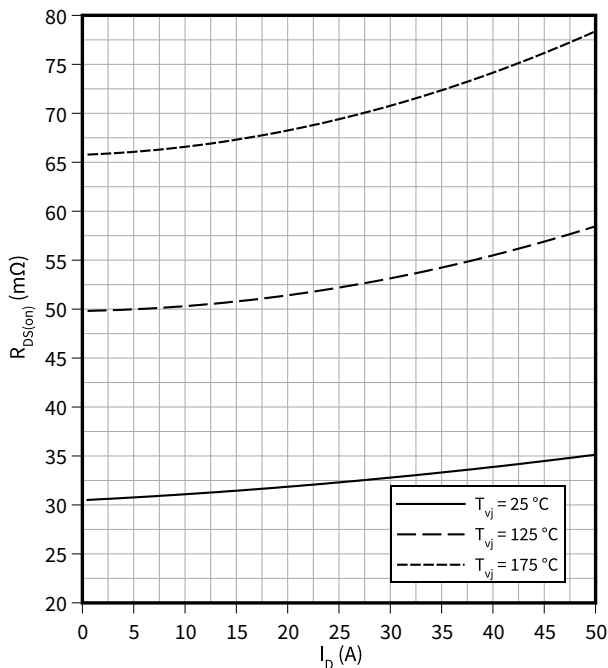
Drain source on-resistance (typical), MOSFET

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

$I_D = 25\ A$
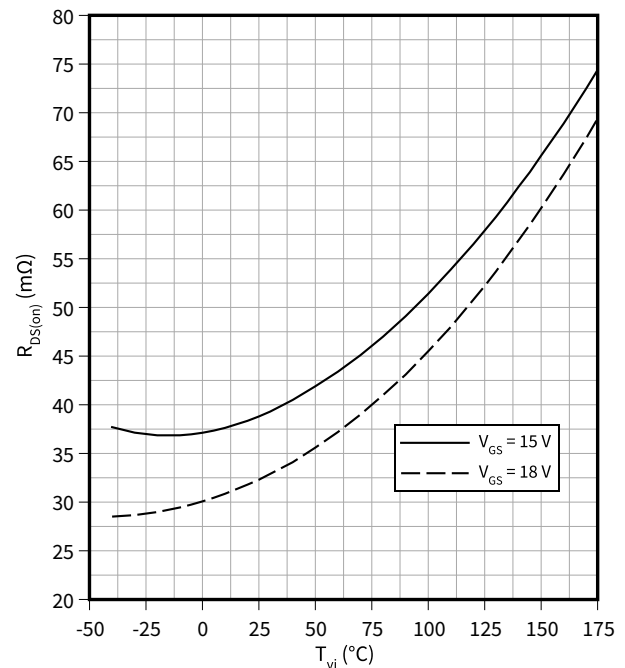
Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$

$T_{vj} = 175\ °C$
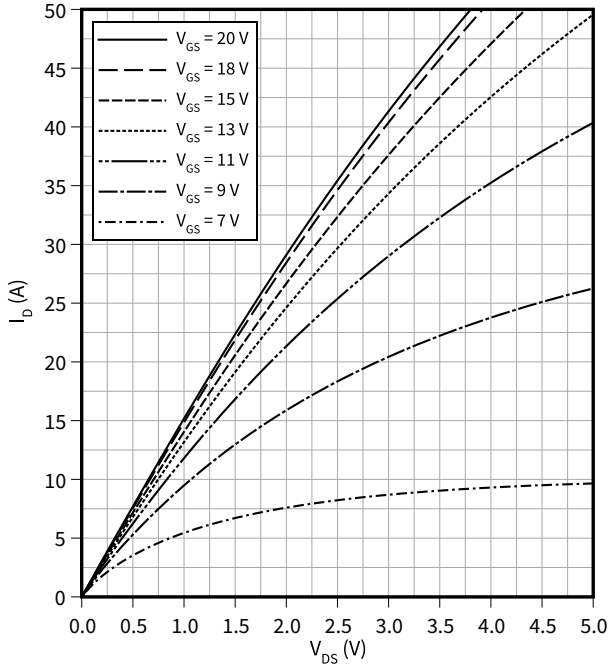
Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$

$V_{DS} = 20\ V$
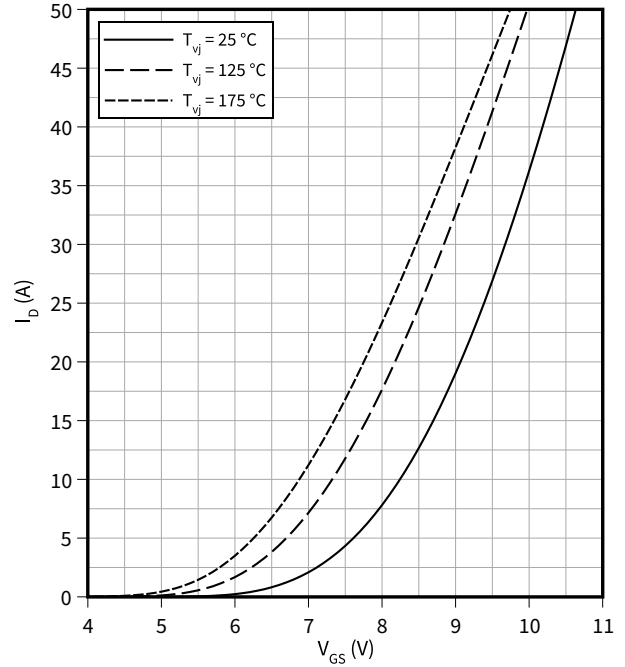
Gate-source threshold voltage (typical), MOSFET

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

$I_D = 10\ mA,\ V_{GS} = V_{DS}$
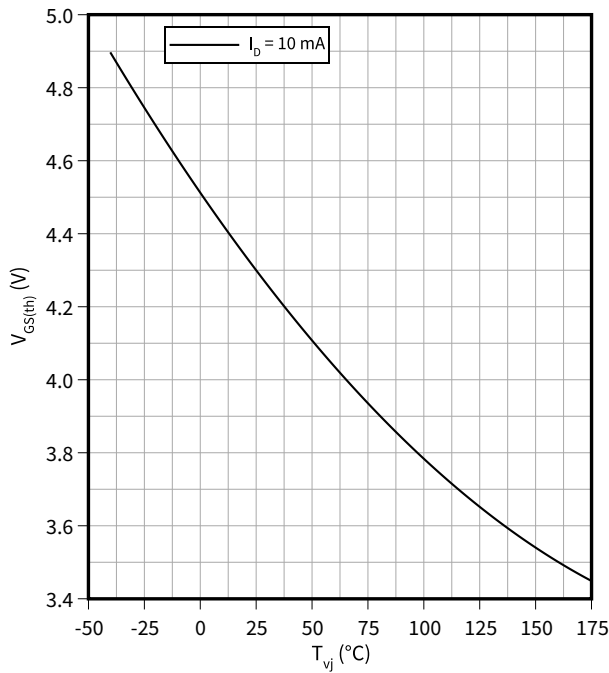
Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$

$I_D = 25\ A,\ T_{vj} = 25\ °C$
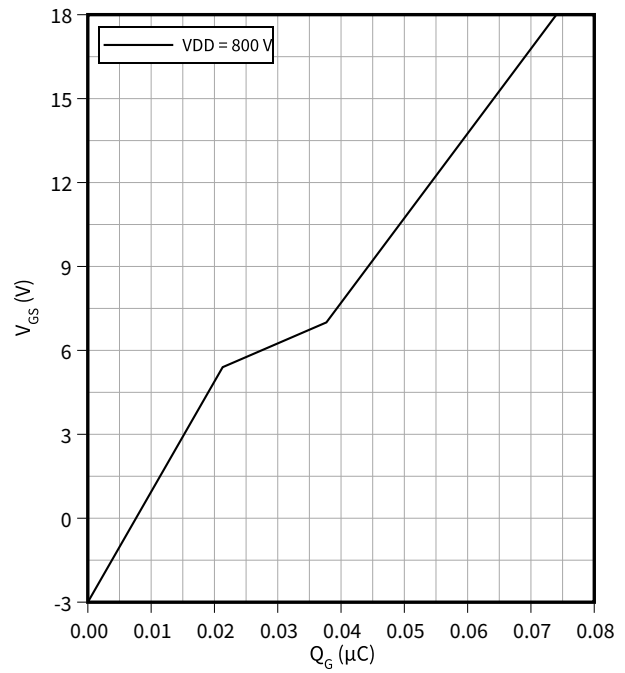
Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GS} = 0$ V
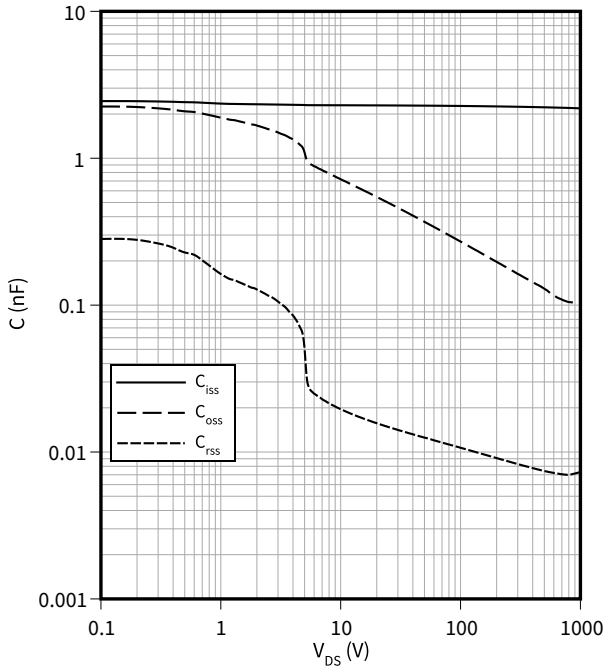
Forward characteristic body diode (typical), MOSFET

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

$T_{vj} = 25$ °C
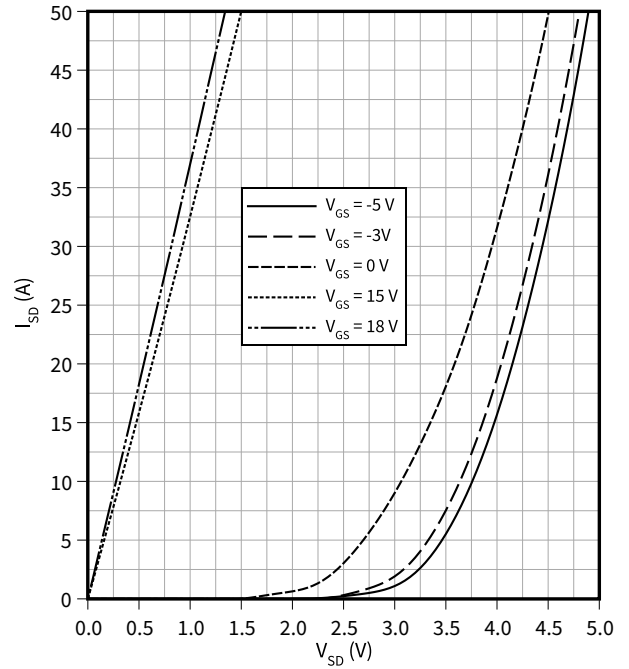
Forward voltage of body diode (typical), MOSFET

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

$I_{SD} = 25$ A
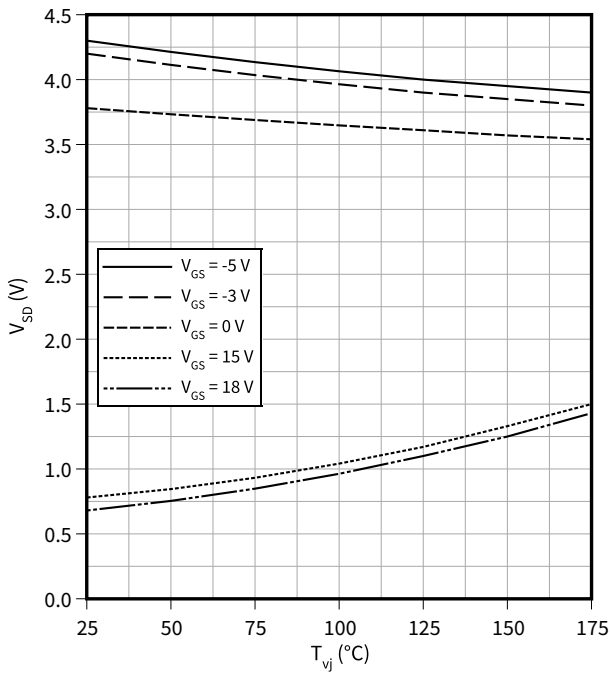
Switching losses (typical), MOSFET

$E = f(I_D)$

$R_{Goff} = 1.5$ Ω, $R_{Gon} = 5.6$ Ω, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V

Switching losses (typical), MOSFET

$E = f(R_G)$

$V_{DD} = 600$ V, $I_D = 25$ A, $V_{GS} = -3/18$ V
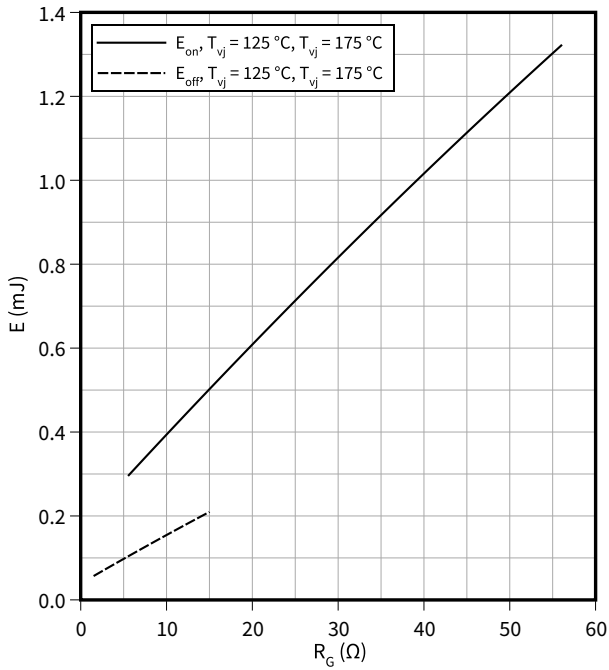
Switching times (typical), MOSFET

$t = f(I_D)$

$R_{Goff} = 1.5$ Ω, $R_{Gon} = 5.6$ Ω, $V_{DD} = 600$ V, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V
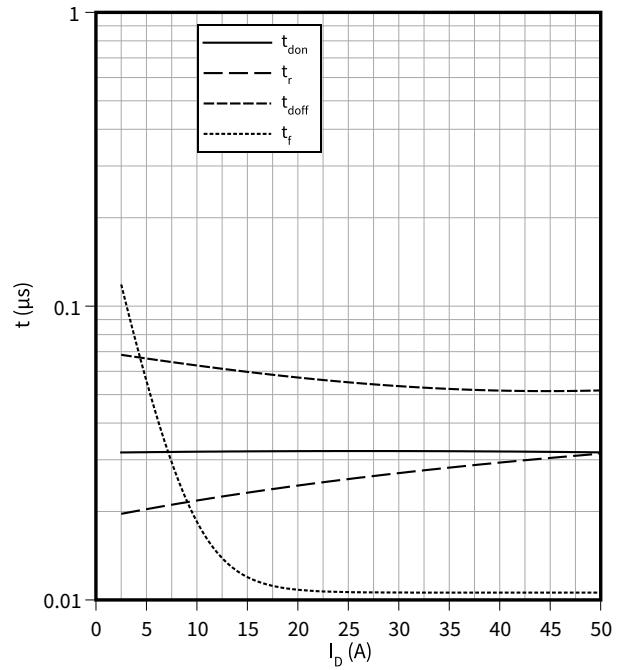
Switching times (typical), MOSFET

$t = f(R_G)$

$V_{DD} = 600$ V, $I_D = 25$ A, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V
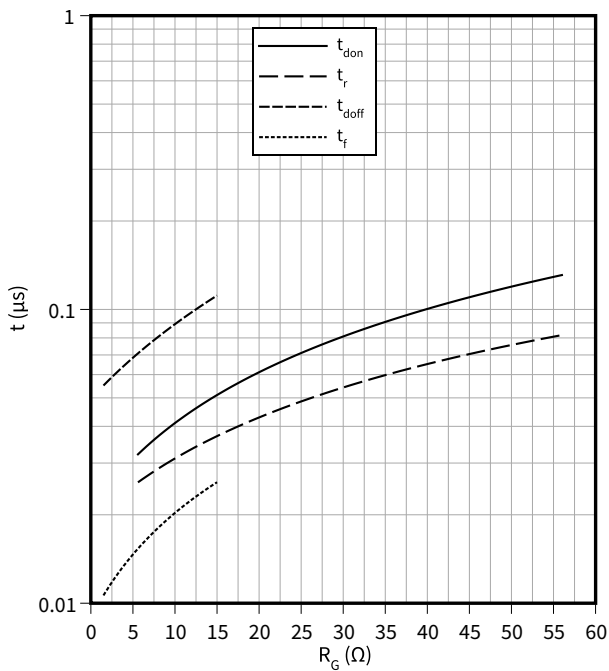
Current slope (typical), MOSFET

$di/dt = f(R_G)$

$V_{DD} = 600$ V, $I_D = 25$ A, $V_{GS} = -3/18$ V

Voltage slope (typical), MOSFET

dv/dt = f(R_G)

V_{DD} = 600 V, I_D = 25 A, V_{GS} = -3/18 V
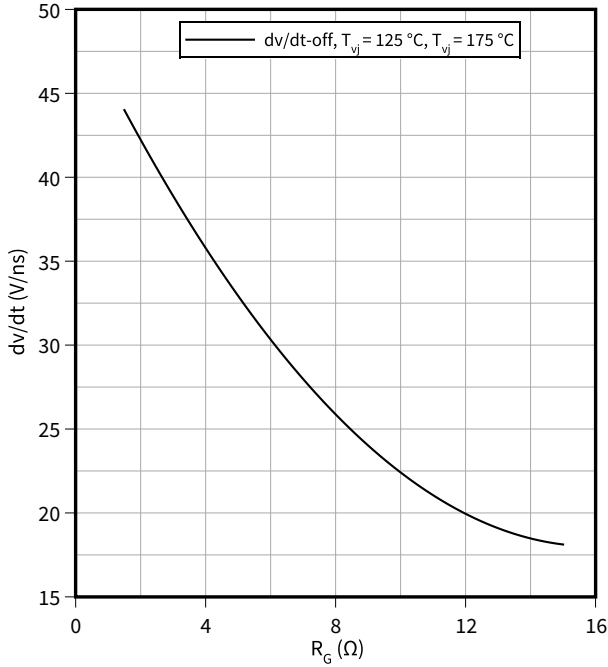
Reverse bias safe operating area (RBSOA), MOSFET

I_D = f(V_{DS})

R_{Goff} = 1.5 Ω, T_{vj} = 175 °C, V_{GS} = -3/18 V
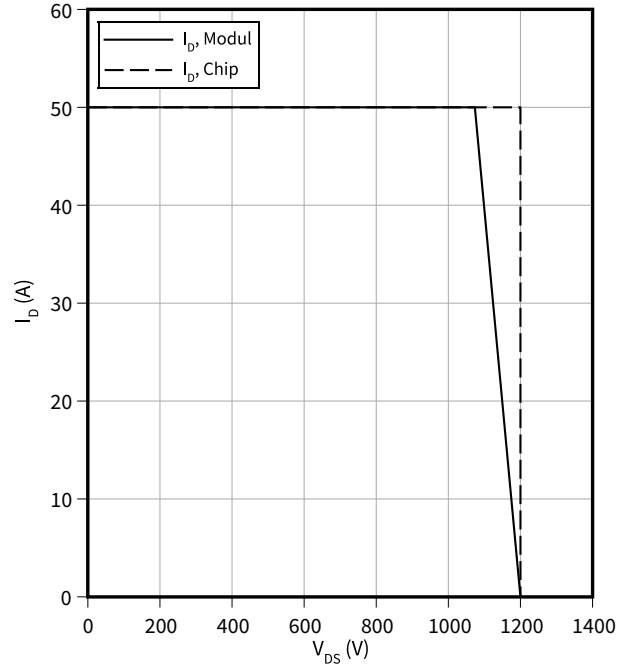
Transient thermal impedance , MOSFET

Z_{th} = f(t)

i	1	2	3	4
r_i[K/W]	0.084	0.283	0.75	0.733
τ_i[s]	7.63E-4	0.0089	0.0649	0.185
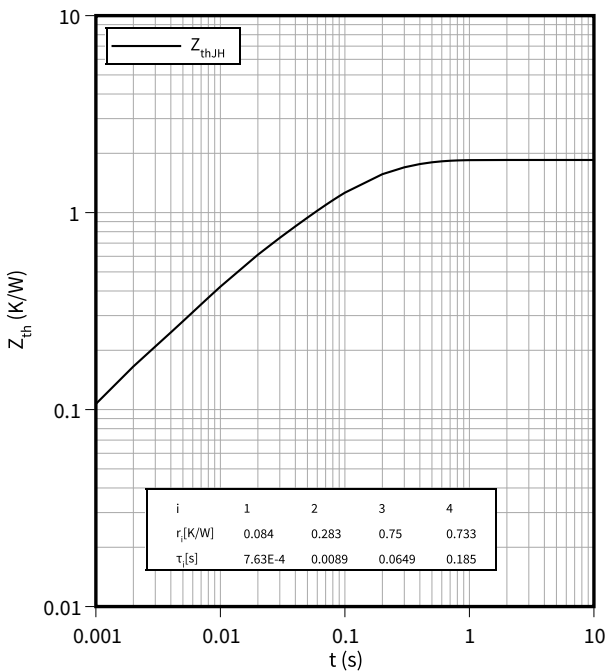
Forward characteristic (typical), Diode, Boost

I_F = f(V_F)
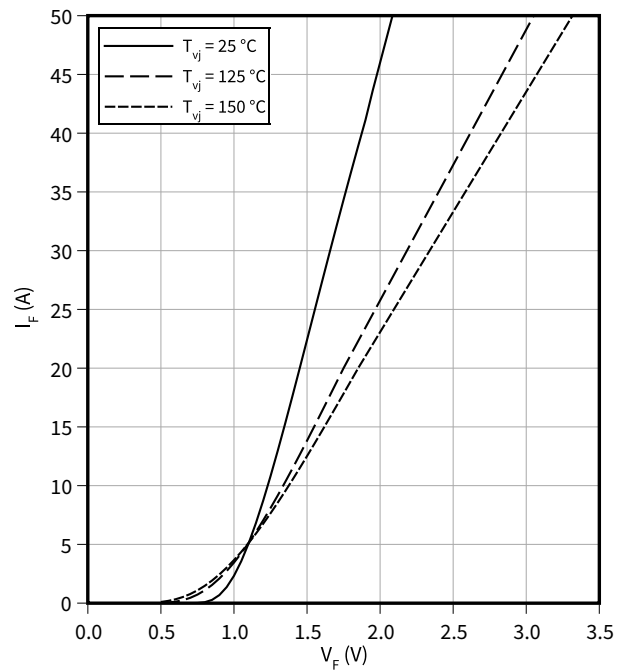
Switching losses (typical), Diode, Boost

$E_{rec} = f(I_F)$

$R_{Gon} = 5.6$, $V_{CC} = 600$ V
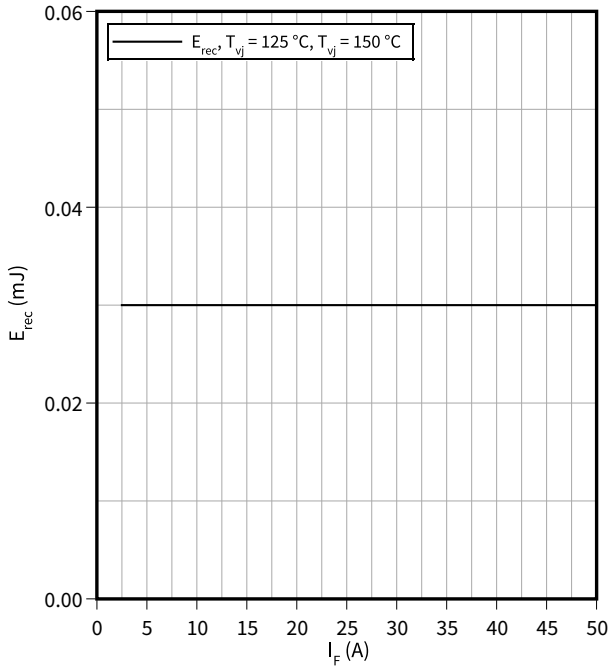
Switching losses (typical), Diode, Boost

$E_{rec} = f(R_G)$

$I_F = 25$ A, $V_{CC} = 600$ V
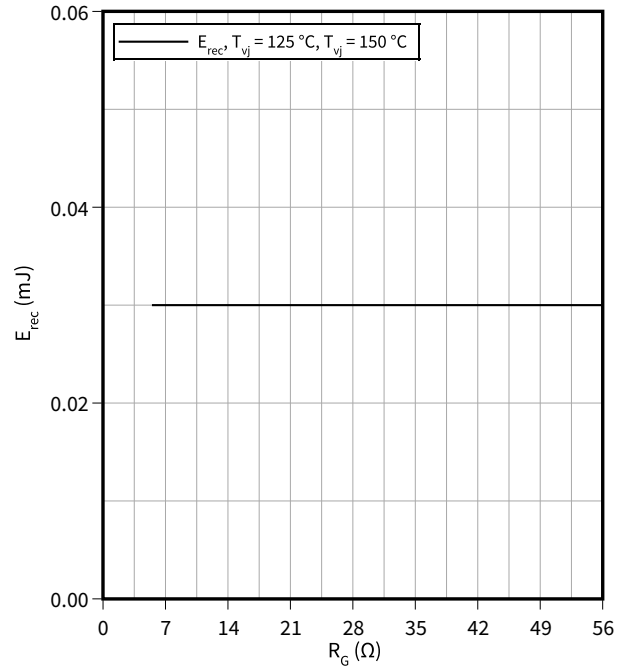
Transient thermal impedance, Diode, Boost

$Z_{th} = f(t)$

i	1	2	3	4
r_i[K/W]	0.103	0.342	0.679	0.626
τ_i[s]	6.0E-4	0.0075	0.0404	0.194
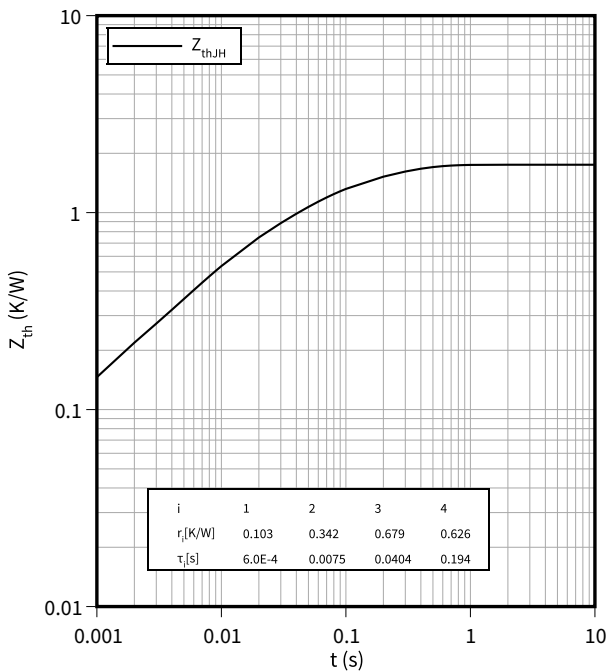
Forward characteristic (typical), Bypass-diode A

$I_F = f(V_F)$
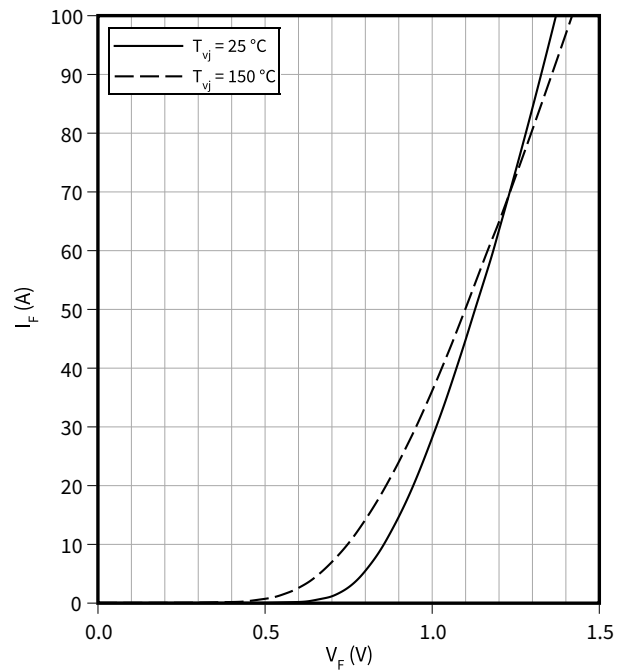
Forward characteristic (typical), Bypass-diode B

$I_F = f(V_F)$
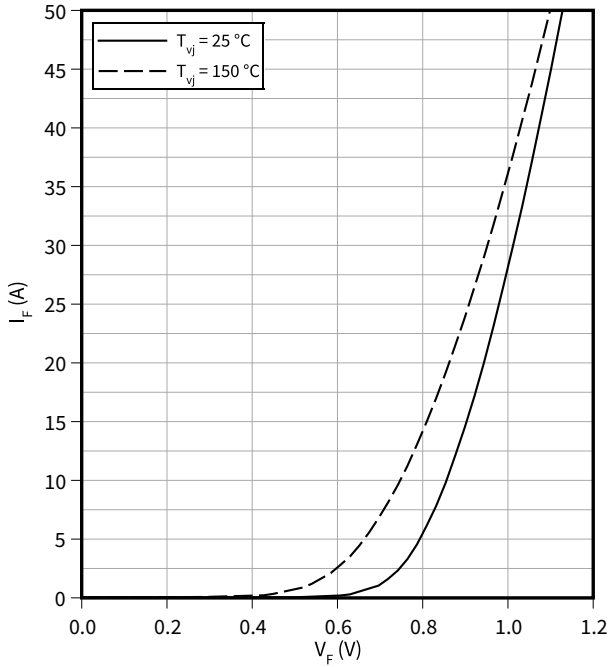
Forward characteristic (typical), Inverse-polarity protection diode A

$I_F = f(V_F)$
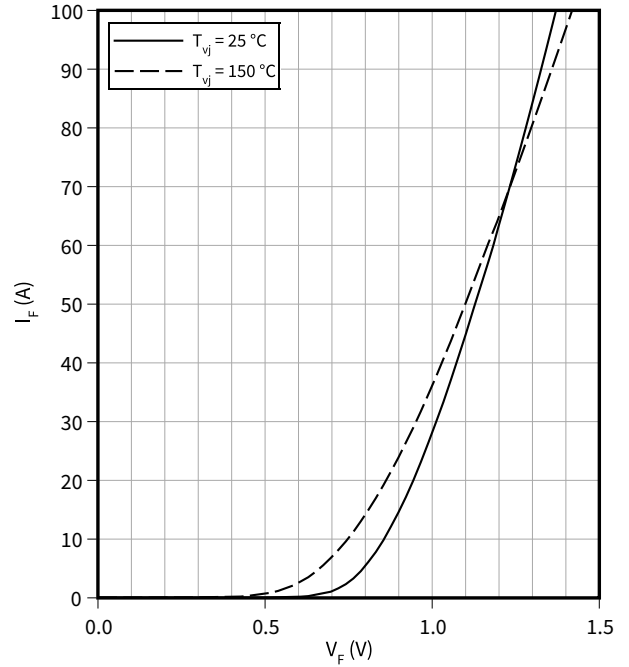
Forward characteristic (typical), Inverse-polarity protection diode B

$I_F = f(V_F)$
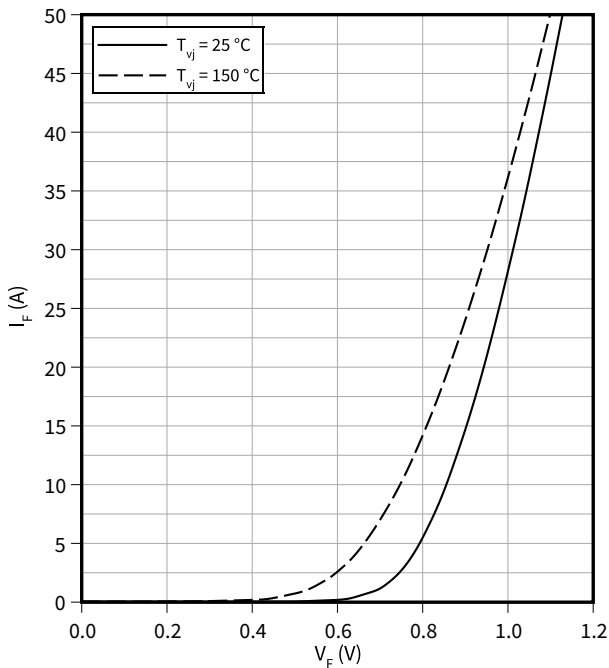
Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$
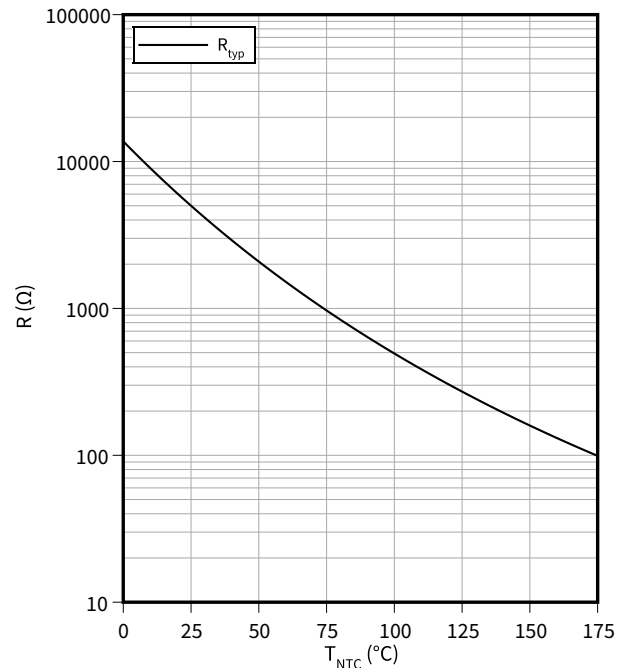
11 Circuit diagram
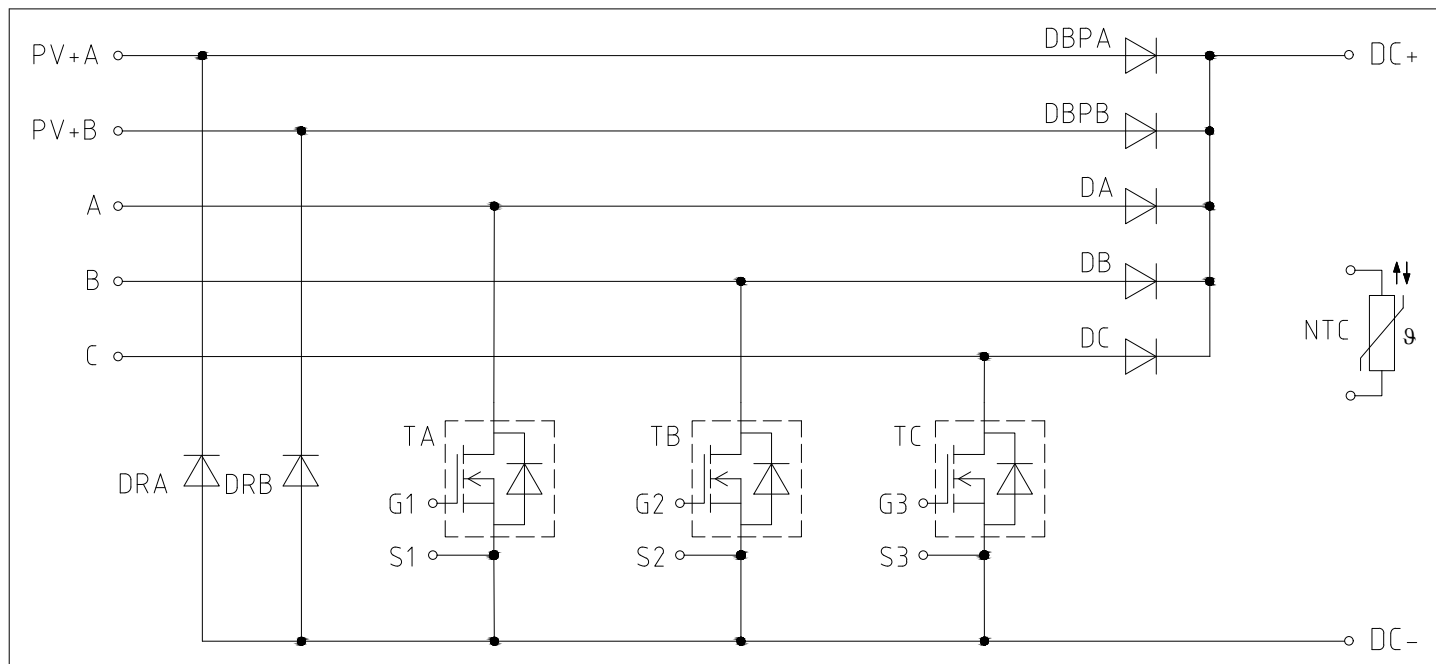
Figure 1

12 Package outlines
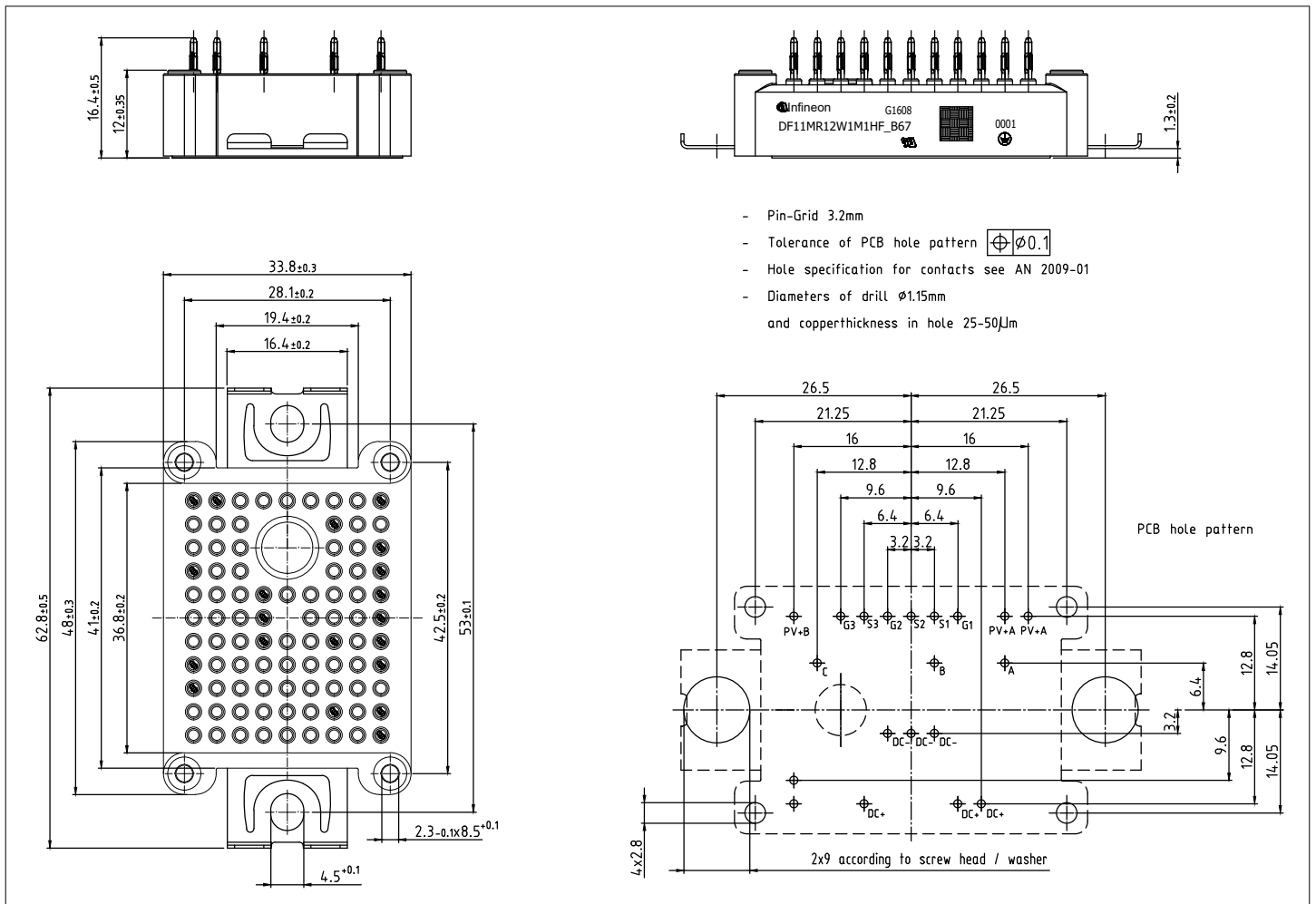
Figure 2

13 Module label code
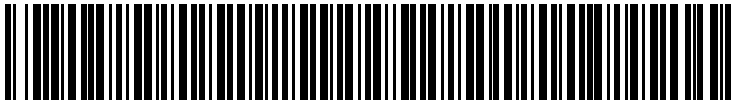
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production 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 version	Date of release	Description of changes
0.10	2022-11-24	Initial version

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