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

Features

Typical appearance

- 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

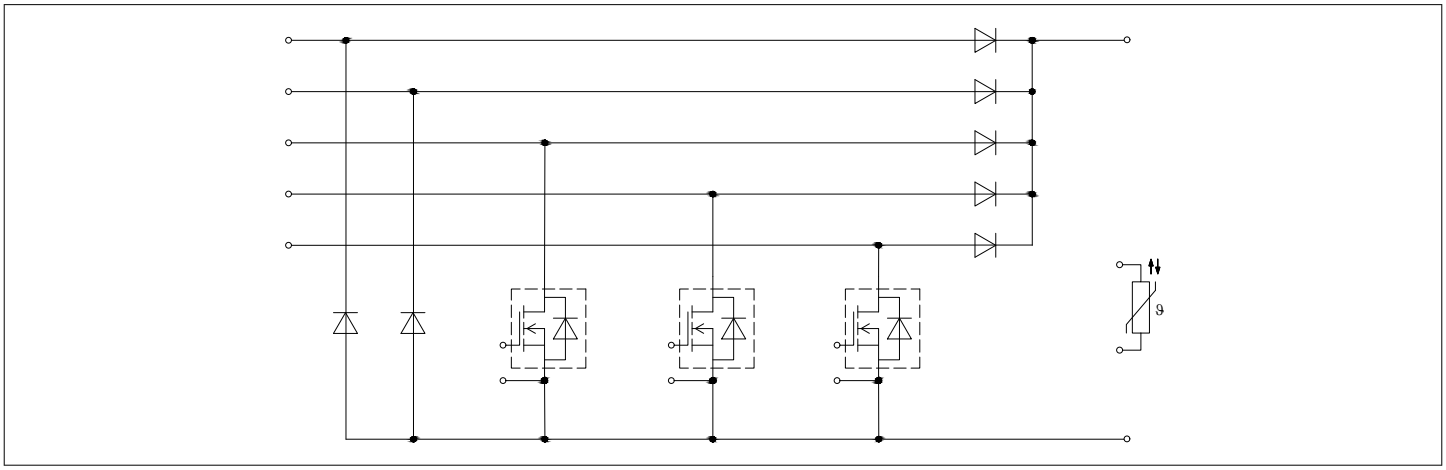


Table of contents

Description . . . 1
Features . . . 1
Potential applications . . . 1
Product validation . . . 1
Table of contents . . . 2
1 Package . . . 3
2 MOSFET . . . 3
3 Body diode . . . 5
4 Diode, Boost . . . 6
5 Bypass-diode A . . . 7
6 Bypass-diode B . . . 7
7 Inverse-polarity protection diode A . . . 8
8 Inverse-polarity protection diode B . . . 9
9 NTC-Thermistor . . . 9
10 Characteristics diagrams . . . 10
11 Circuit diagram . . . 17
12 Package outlines . . . 18
13 Module label code . . . 19
Revision history . . . 20
Disclaimer . . . 21

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		Values			Unit
				Min.	Typ.	Max.	
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/µs (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/µs (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/µs (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		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

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		Values			Unit
				Min.	Typ.	Max.	
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

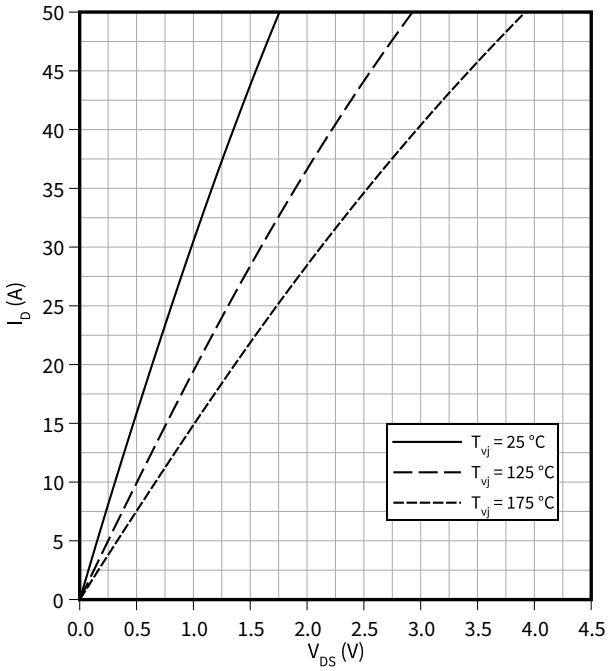
Table 18 Characteristic values

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 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$		3433		K

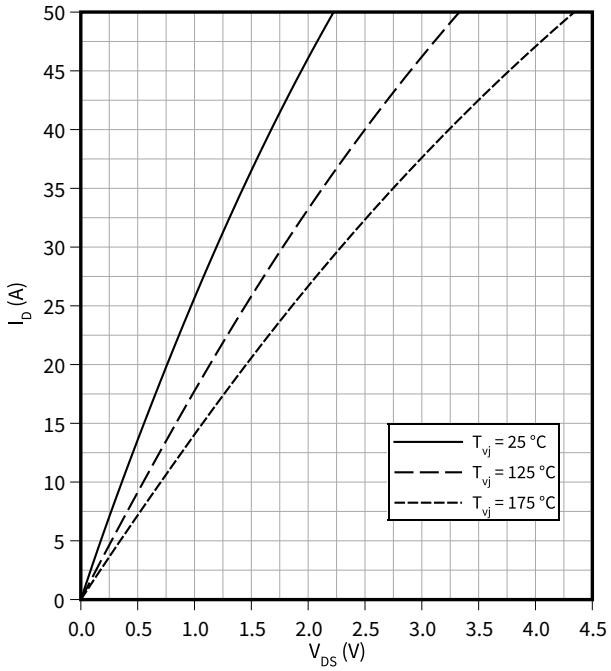
Note: Specification according to the valid application note.

10 Characteristics diagrams

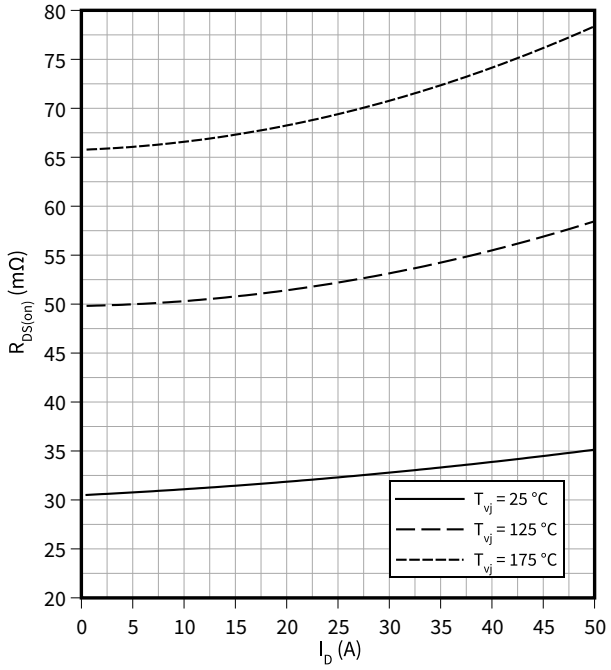
Output characteristic (typical), MOSFET
$I_D = f(V_{DS})$
V_{GS} = 18 V



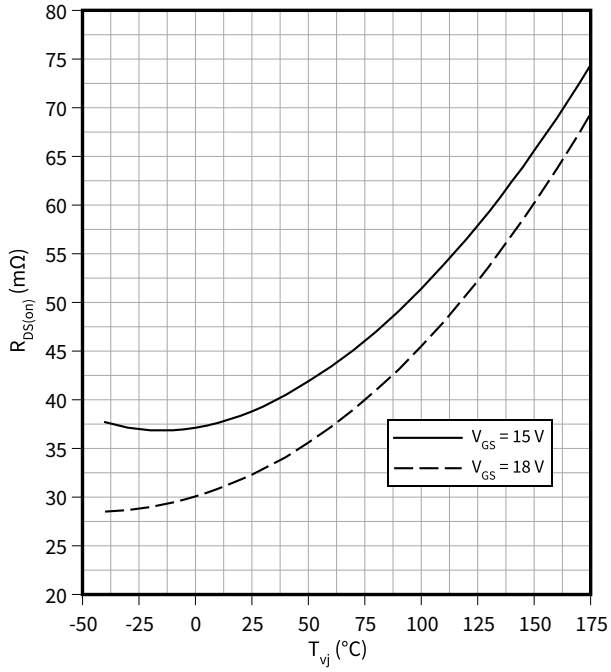
Output characteristic (typical), MOSFET
$I_D = f(V_{DS})$
V_{GS} = 15 V



Drain source on-resistance (typical), MOSFET
$R_{DS(on)} = f(I_D)$
V_{GS} = 18 V

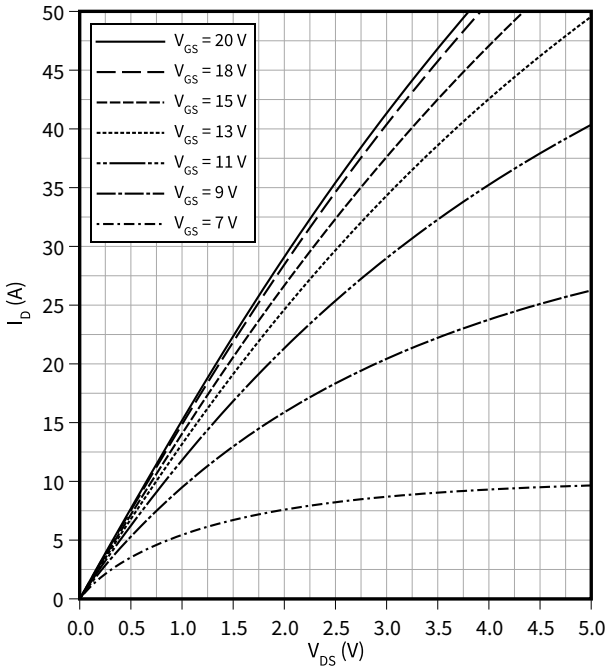


Drain source on-resistance (typical), MOSFET
$R_{DS(on)} = f(T_{vj})$
I_D = 25 A



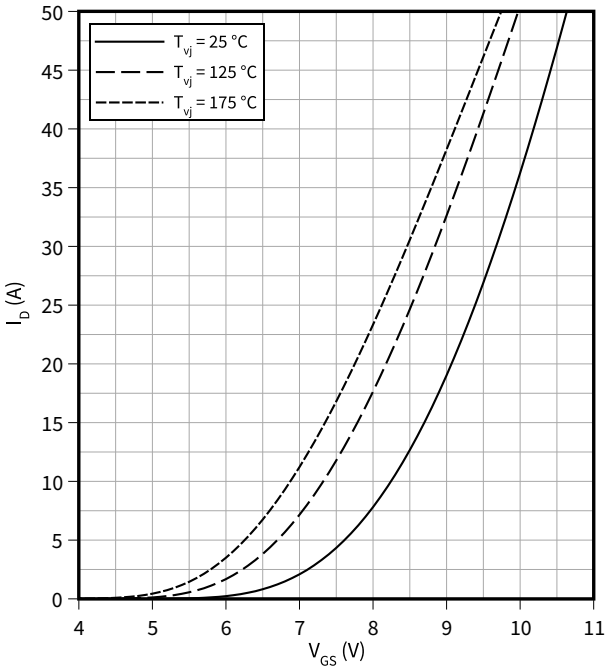
Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$
$T_{vj} = 175\ °C$



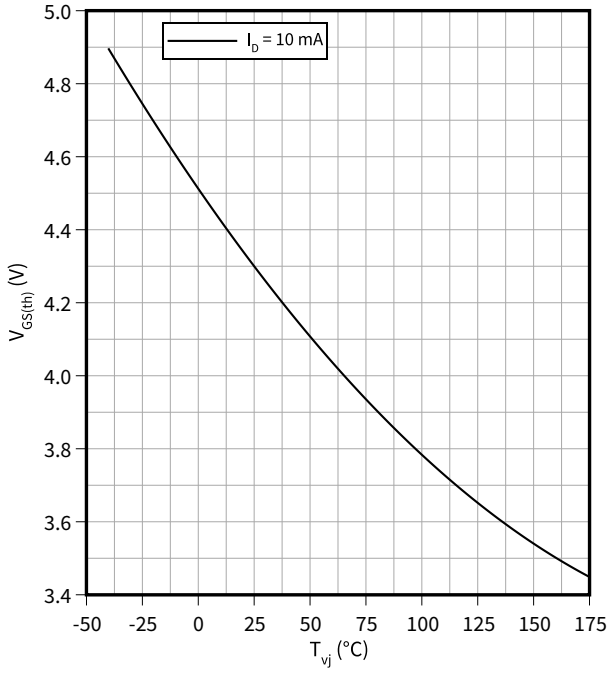
Transfer characteristic (typical), MOSFET

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



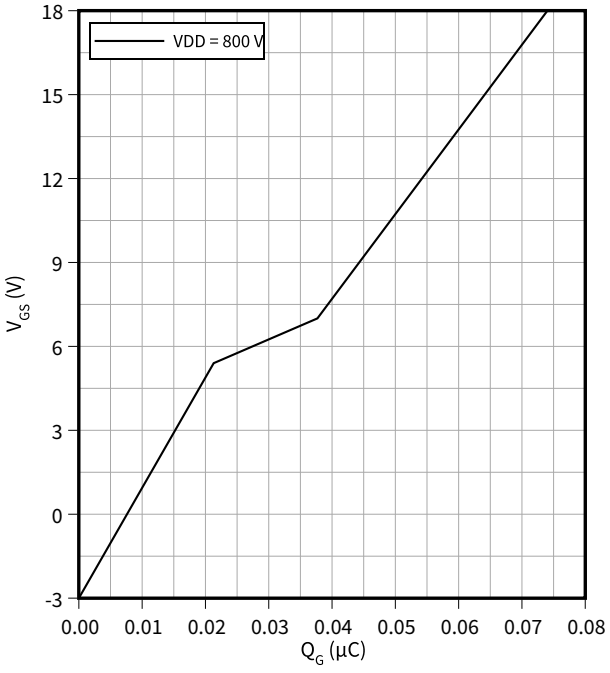
Gate-source threshold voltage (typical), MOSFET

$V_{GS(th)} = f(T_{vj})$
$I_D = 10\ mA, V_{GS} = V_{DS}$



Gate charge characteristic (typical), MOSFET

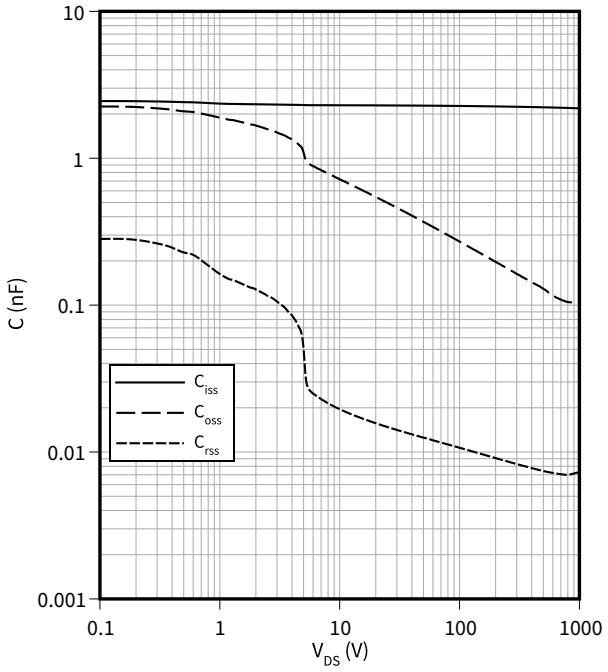
$V_{GS} = f(Q_G)$
$I_D = 25\ A, T_{vj} = 25\ °C$



Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

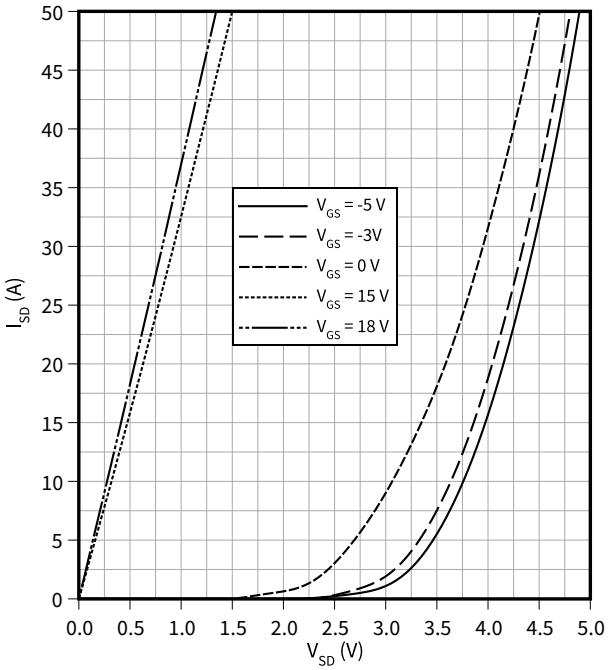
$f = 100\ kHz$, $T_{vj} = 25\ °C$, $V_{GS} = 0\ V$



Forward characteristic body diode (typical), MOSFET

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

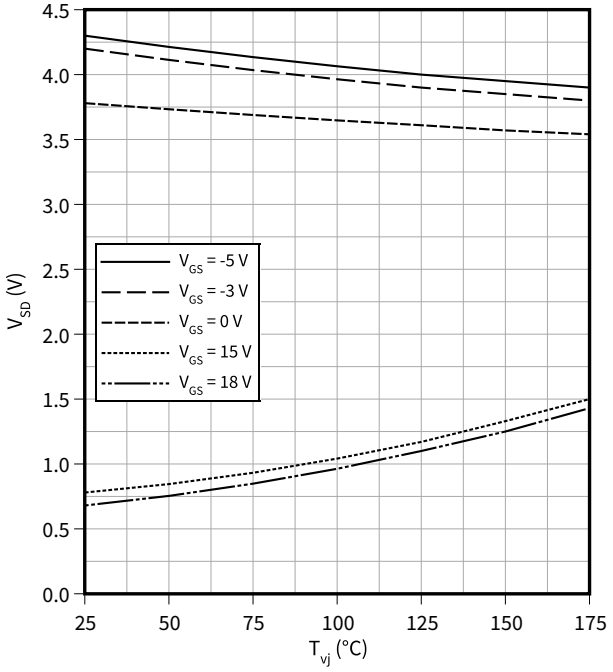
$T_{vj} = 25\ °C$



Forward voltage of body diode (typical), MOSFET

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

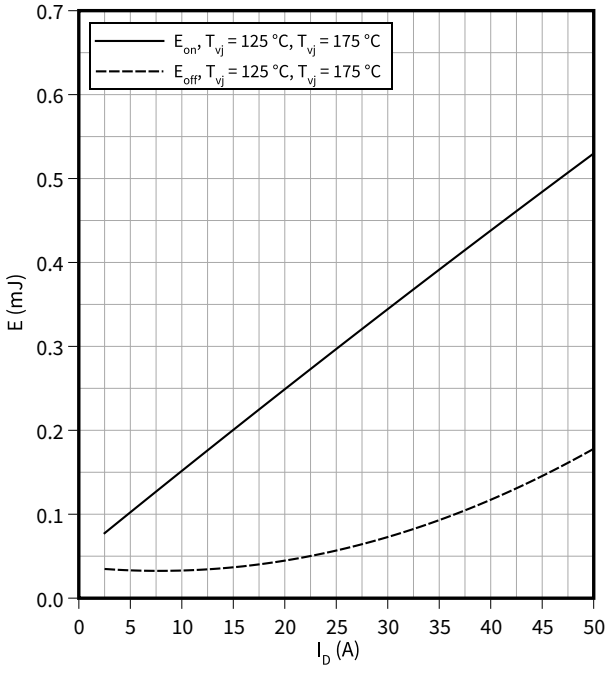
$I_{SD} = 25\ A$



Switching losses (typical), MOSFET

$E = f(I_D)$

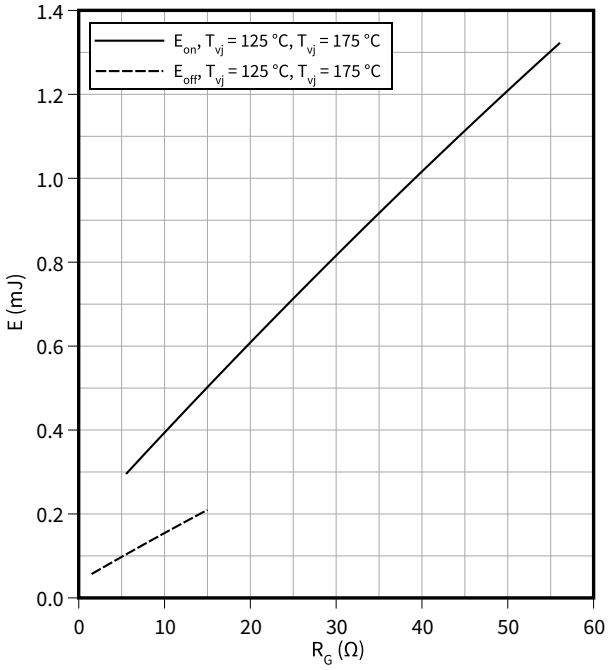
$R_{Goff} = 1.5\ \Omega$, $R_{Gon} = 5.6\ \Omega$, $V_{DD} = 600\ V$, $V_{GS} = -3/18\ V$



Switching losses (typical), MOSFET

$E = f(R_G)$

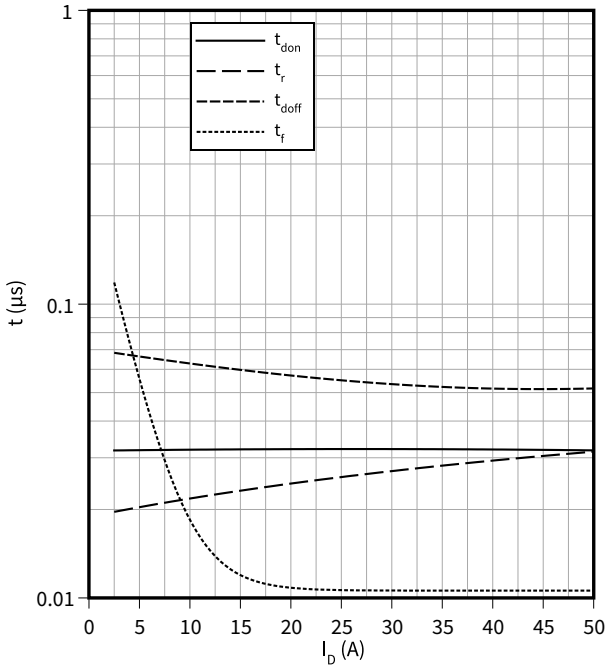
V_{DD} = 600 V, I_D = 25 A, V_{GS} = -3/18 V



Switching times (typical), MOSFET

$t = f(I_D)$

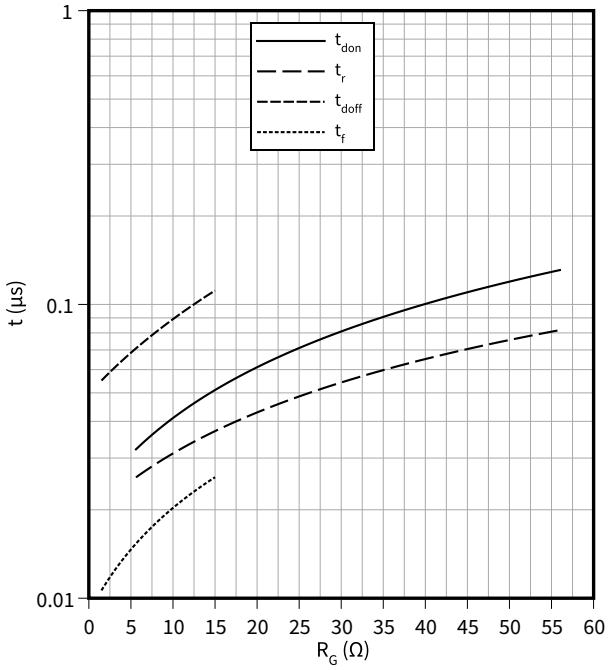
R_{Goff} = 1.5 Ω, R_{Gon} = 5.6 Ω, V_{DD} = 600 V, T_{vj} = 175 °C, V_{GS} = -3/18 V



Switching times (typical), MOSFET

$t = f(R_G)$

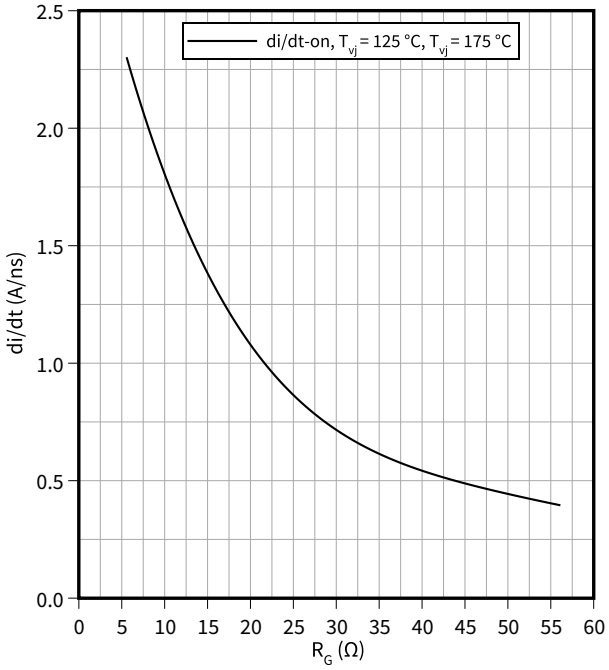
V_{DD} = 600 V, I_D = 25 A, T_{vj} = 175 °C, V_{GS} = -3/18 V



Current slope (typical), MOSFET

$di/dt = f(R_G)$

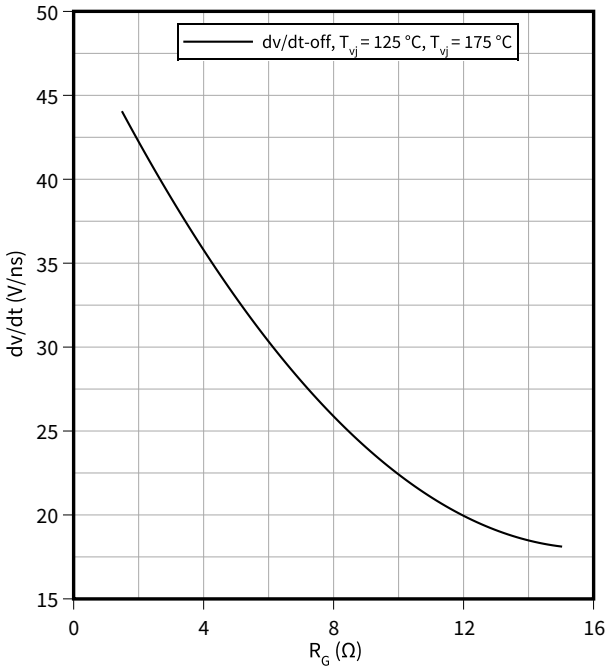
V_{DD} = 600 V, I_D = 25 A, V_{GS} = -3/18 V



Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

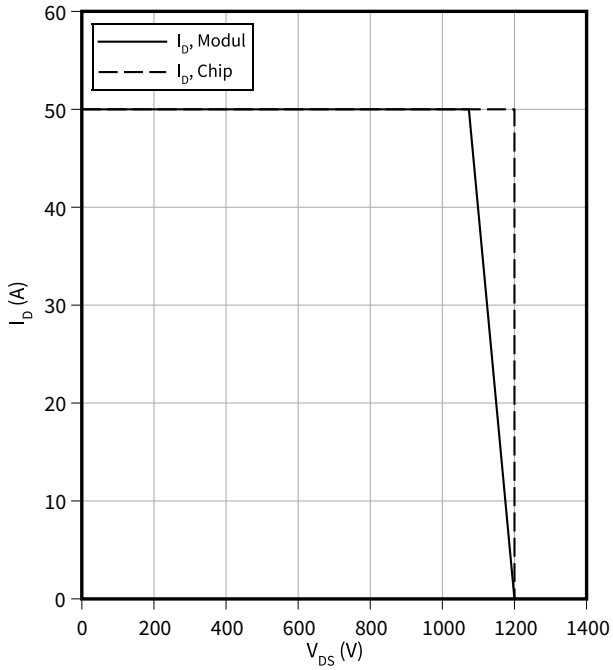
V_{DD} = 600 V, I_D = 25 A, V_{GS} = -3/18 V



Reverse bias safe operating area (RBSOA), MOSFET

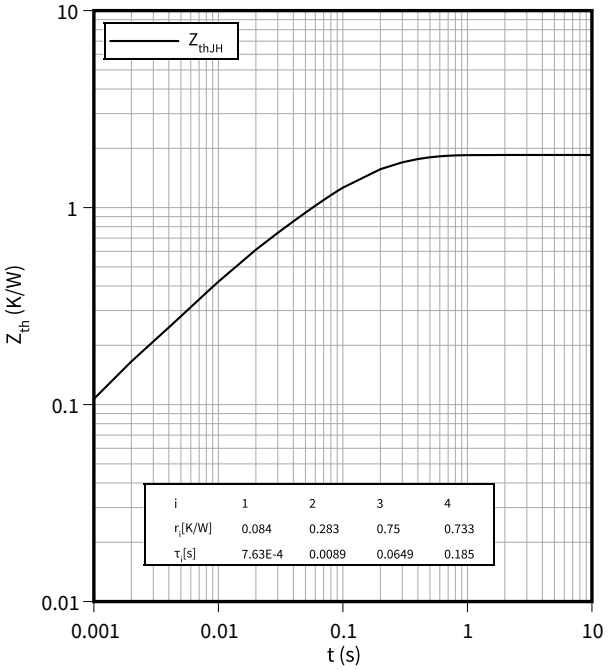
$I_D = f(V_{DS})$

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



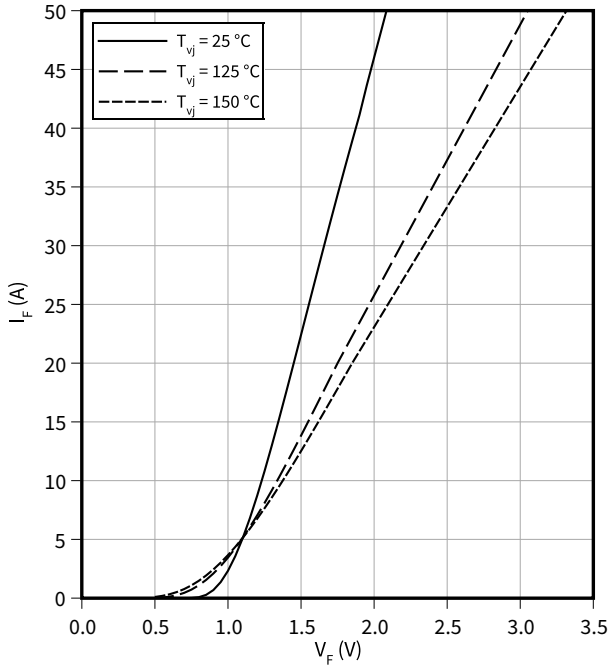
Transient thermal impedance , MOSFET

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Boost

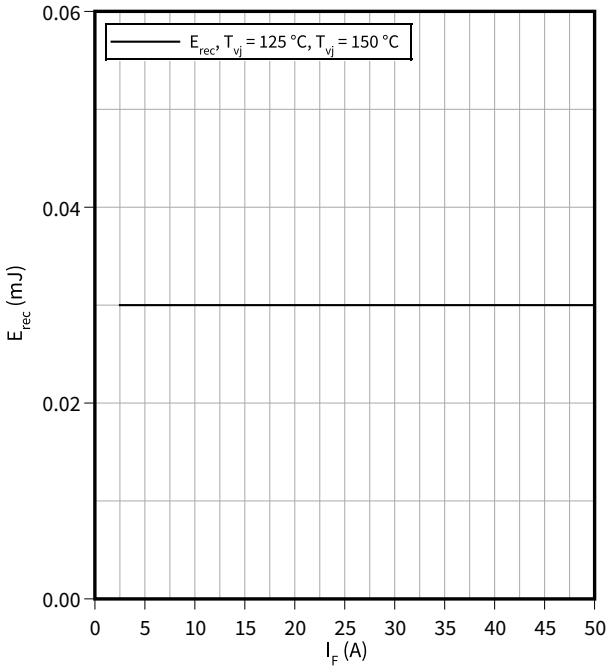
$I_F = f(V_F)$



Switching losses (typical), Diode, Boost

$E_{rec} = f(I_F)$

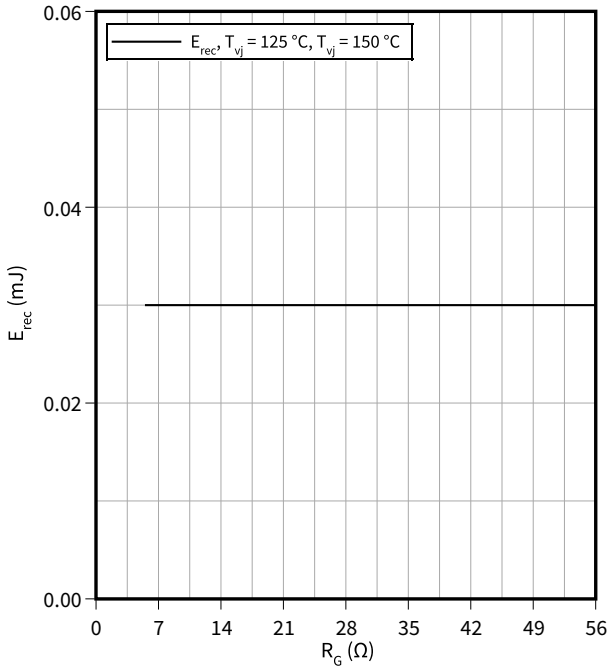
$R_{Gon} = 5.6\ \Omega$, $V_{CC} = 600$ V



Switching losses (typical), Diode, Boost

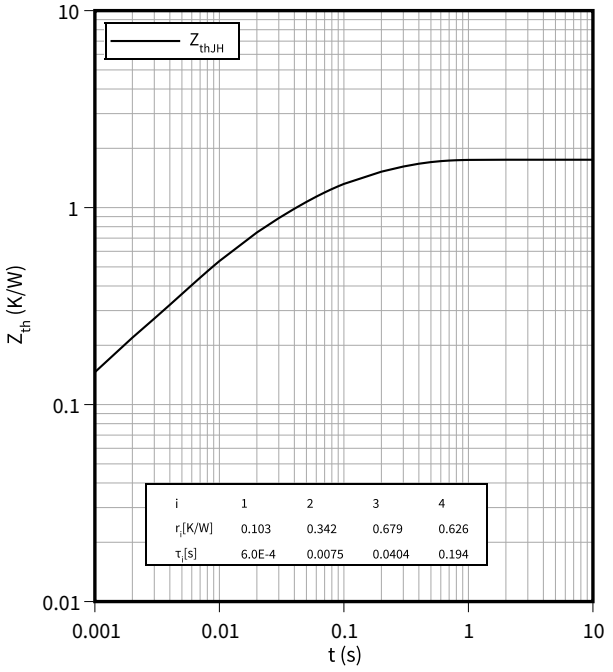
$E_{rec} = f(R_G)$

$I_F = 25$ A, $V_{CC} = 600$ V



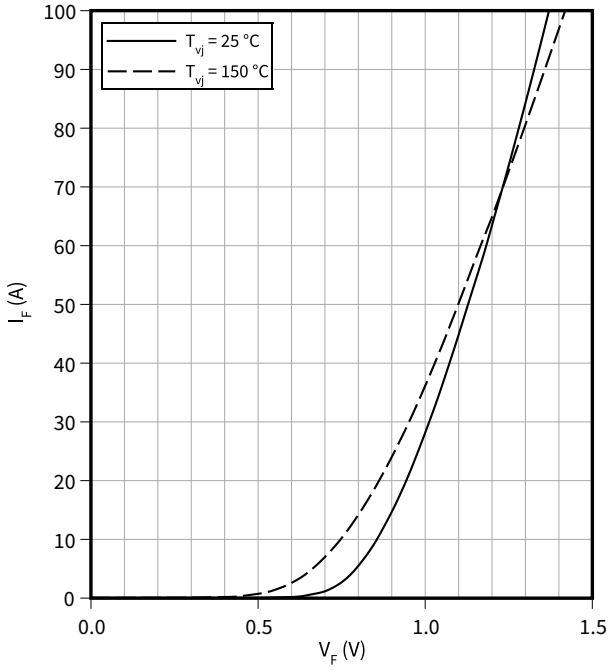
Transient thermal impedance, Diode, Boost

$Z_{th} = f(t)$



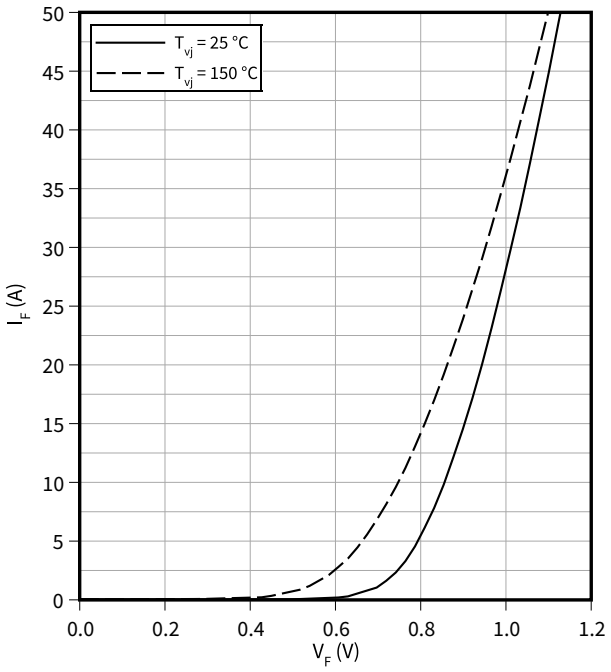
Forward characteristic (typical), Bypass-diode A

$I_F = f(V_F)$



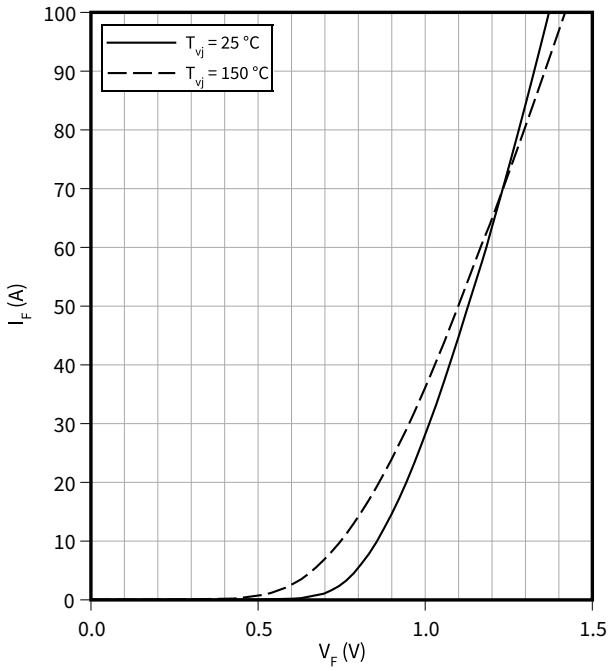
Forward characteristic (typical), Bypass-diode B

$I_F = f(V_F)$



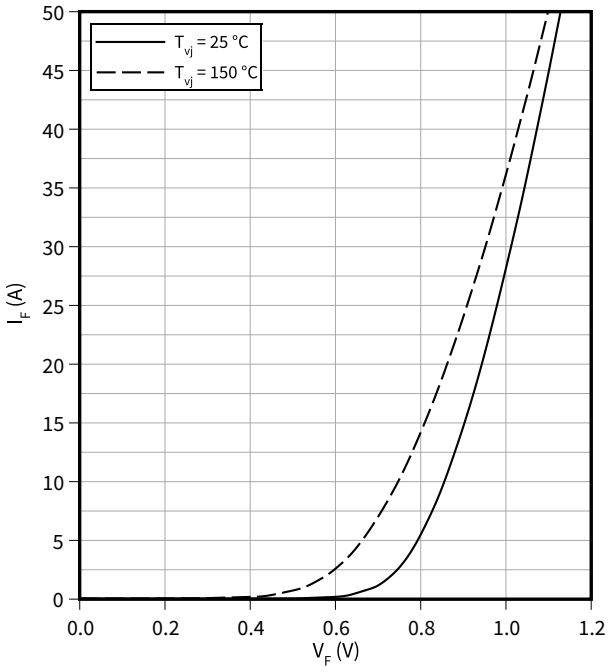
Forward characteristic (typical), Inverse-polarity protection diode A

$I_F = f(V_F)$



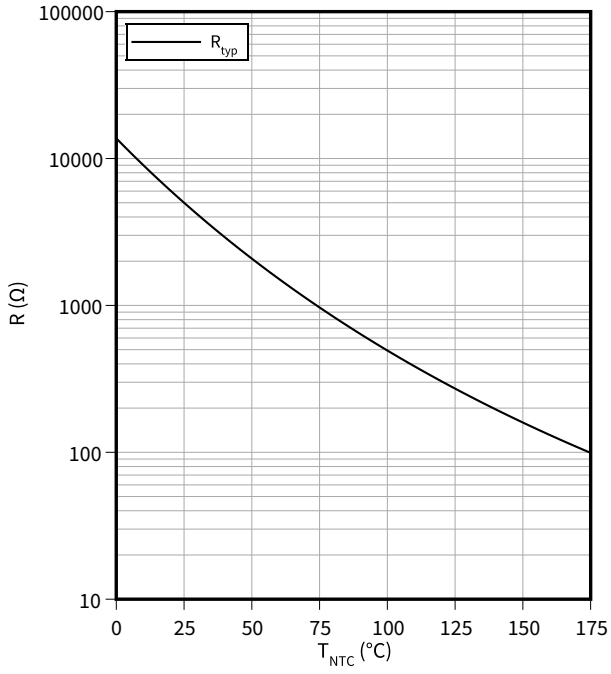
Forward characteristic (typical), Inverse-polarity protection diode B

$I_F = f(V_F)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



11 Circuit diagram

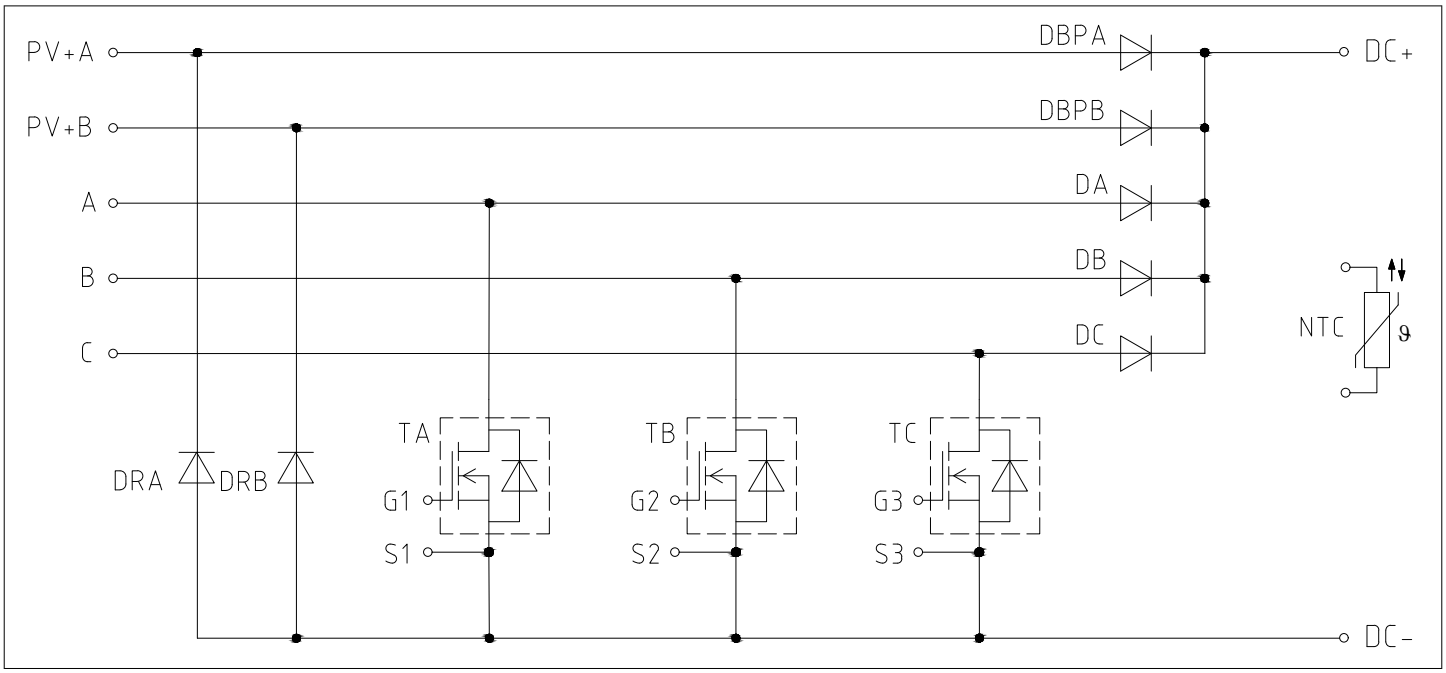


Figure 1

12 Package outlines

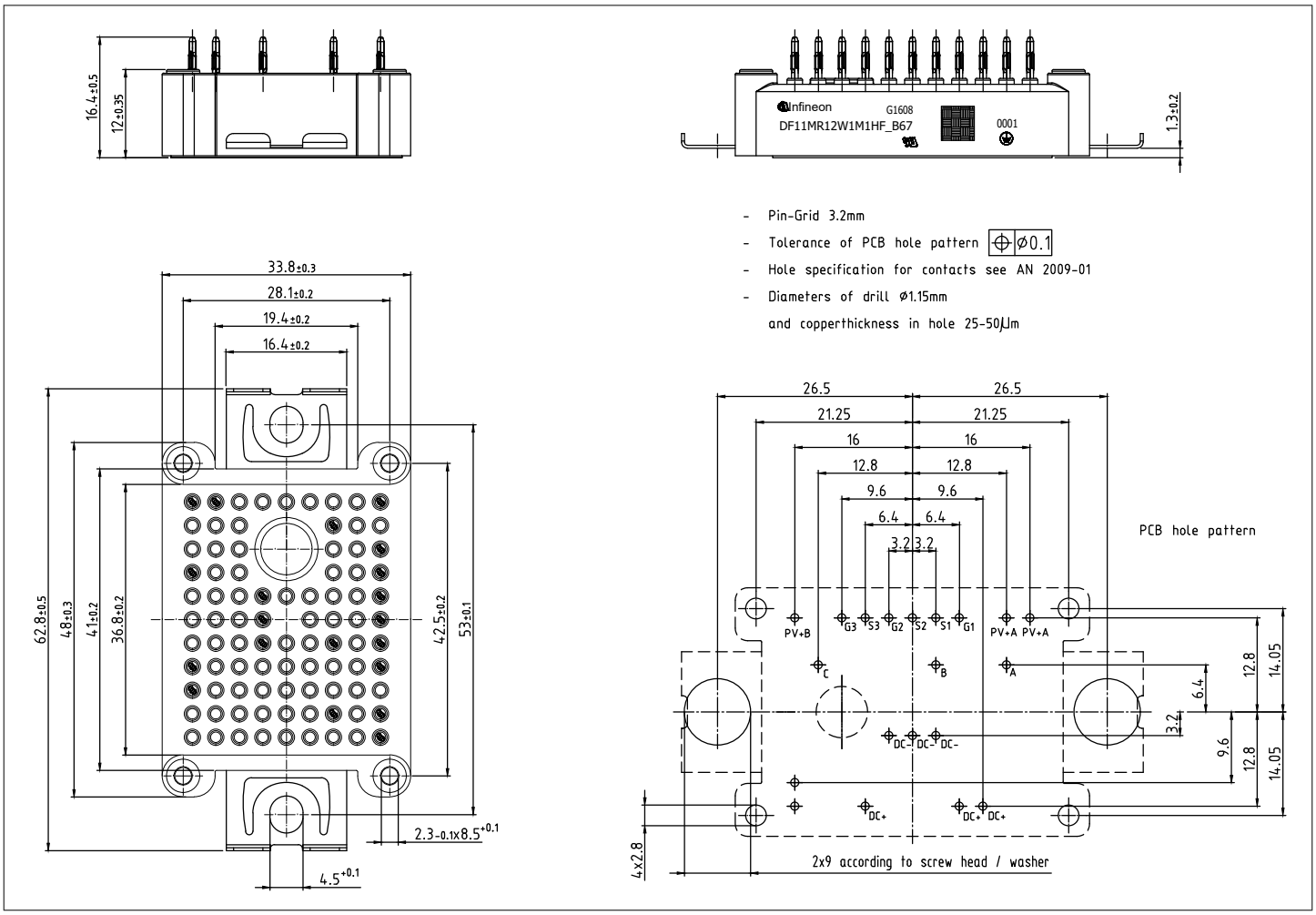


Figure 2

13 Module label code

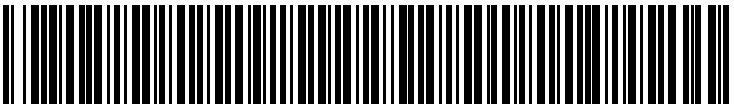
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production 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

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2022-11-24

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-ABD310-001

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.