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

Features


Typical appearance

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 100 A / I_{DRM} = 200 A
  - Low inductive design
  - Low switching losses
- Mechanical features
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - Rugged mounting due to integrated mounting clamps

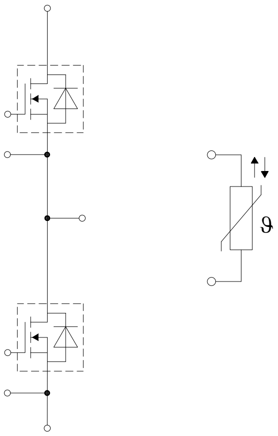
Potential applications

- 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)	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}			9		nH
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}			100	A
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_H = 65 °C	90	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		200	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

(table continues...)

Table 4 **(continued) Recommended values**

Parameter	Symbol	Note or test condition	Values	Unit
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 = 100 A	V_{GS} = 18 V, T_{vj}=25 °C		8.1		mΩ
			V_{GS}=18 V, T_{vj}=125 °C		13.1		
			V_{GS}=18 V, T_{vj}=175 °C		17.4		
			V_{GS} = 15 V, T_{vj} = 25 °C		9.7		
Gate threshold voltage	$V_{GS(th)}$	I_D = 40 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			0.297		µC
Internal gate resistor	R_{Gint}	T_{vj}=25 °C			2.1		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS}=800 V, V_{GS}=0 V	T_{vj}=25 °C		8.8		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS}=800 V, V_{GS}=0 V	T_{vj}=25 °C		0.42		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS}=800 V, V_{GS}=0 V	T_{vj}=25 °C		0.028		nF
C_{OSS} stored energy	E_{OSS}	V_{DS}=800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			172		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.06	380	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 = 100 A, R_{Gon} = 8.2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		53		ns
			T_{vj} = 125 °C		53		
			T_{vj} = 175 °C		53		
Rise time (inductive load)	t_r	I_D = 100 A, R_{Gon} = 8.2 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		70		ns
			T_{vj} = 125 °C		70		
			T_{vj} = 175 °C		70		
Turn-off delay time (inductive load)	$t_{d\,off}$	I_D = 100 A, R_{Goff} = 2.7 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		73		ns
			T_{vj} = 125 °C		79		
			T_{vj} = 175 °C		83		

(table continues...)

Table 5 **(continued) Characteristic values**

Parameter	**Symbol**	**Note or test condition**		**Values**			**Unit**
				Min.	**Typ.**	**Max.**	
Fall time (inductive load)	t_f	I_D = 100 A, R_{Goff} = 2.7 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		20		ns
			T_{vj} = 125 °C		20		
			T_{vj} = 175 °C		20		
Turn-on energy loss per pulse	E_{on}	I_D = 100 A, V_{DD} = 600 V, L_σ = 35 nH, V_{GS} = -3/18 V, R_{Gon} = 8.2 Ω, di/dt = 3.88 kA/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.87		mJ
			T_{vj} = 125 °C		3.05		
			T_{vj} = 175 °C		3.21		
Turn-off energy loss per pulse	E_{off}	I_D = 100 A, V_{DD} = 600 V, L_σ = 35 nH, V_{GS} = -3/18 V, R_{Goff} = 2.7 Ω, dv/dt = 24 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.75		mJ
			T_{vj} = 125 °C		0.81		
			T_{vj} = 175 °C		0.83		
SC data	I_{SC}	V_{GS} = -5/15 V, V_{DD} = 800 V, $V_{DSmax} = V_{DSS} - L_{sDS} * di/dt$, R_G = 10 Ω	t_P = 2 µs, T_{vj} = 25 °C		840		A
			t_P = 2 µs, T_{vj} = 150 °C		820		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, λ_{grease} = 1 W/(m·K)			0.553		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 Note 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 (MOSFET)

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	45	A

Table 7 **Characteristic values**

Parameter	**Symbol**	**Note or test condition**		**Values**			**Unit**
				Min.	**Typ.**	**Max.**	
Forward voltage	V_{SD}	I_{SD} = 100 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 NTC-Thermistor

Table 8 **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

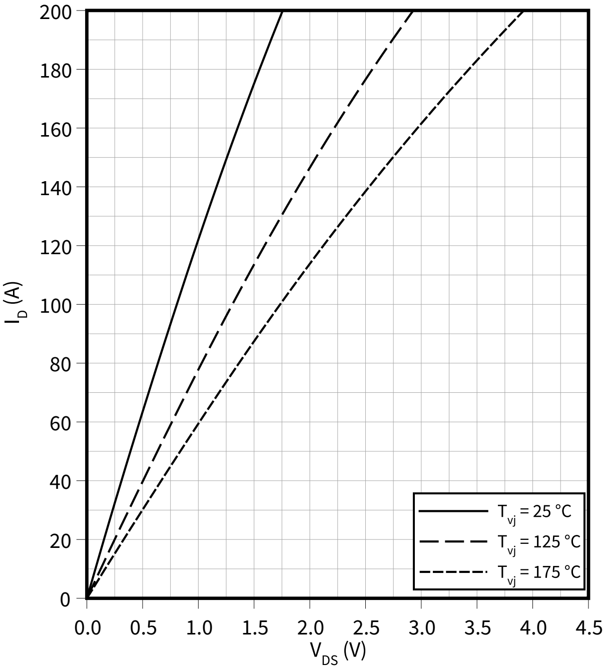
Note: *Specification according to the valid application note.*

5 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

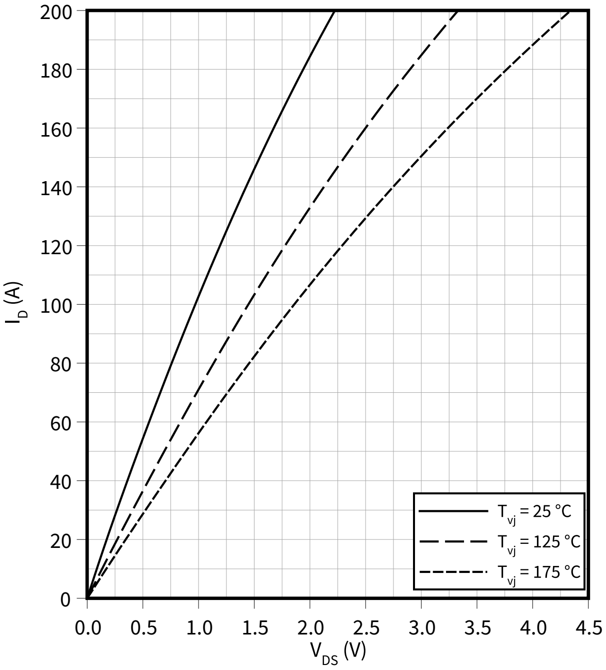
$V_{GS} = 18$ V



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

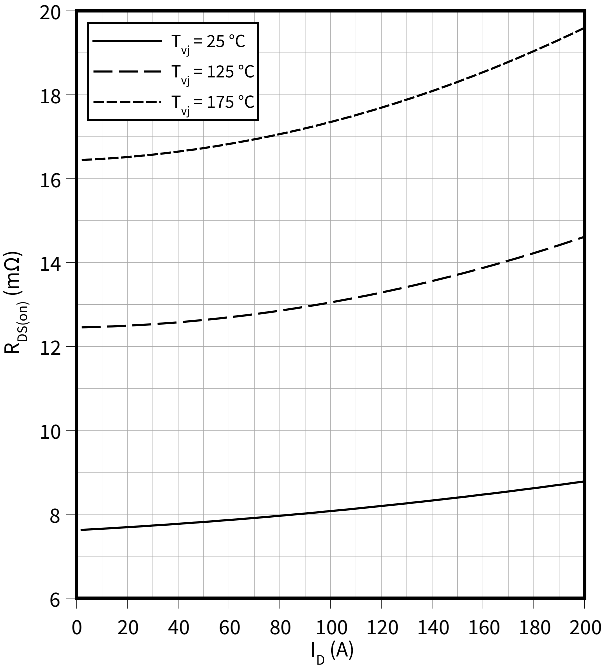
$V_{GS} = 15$ V



Drain source on-resistance (typical), MOSFET

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

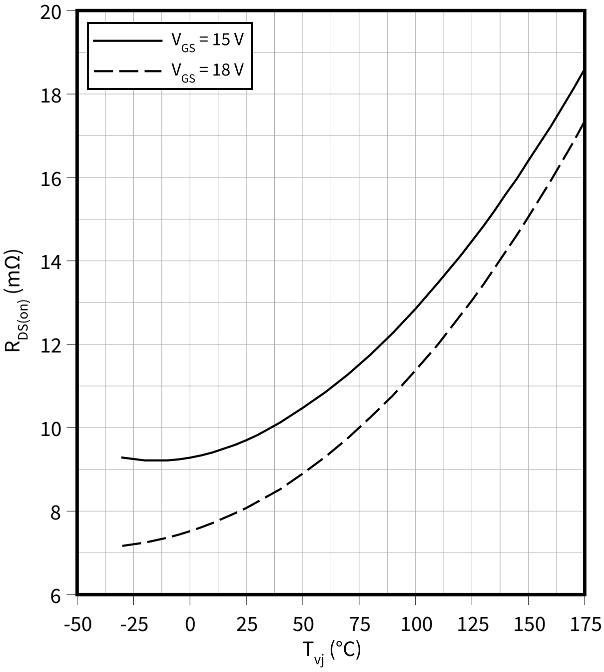
$V_{GS} = 18$ V



Drain source on-resistance (typical), MOSFET

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

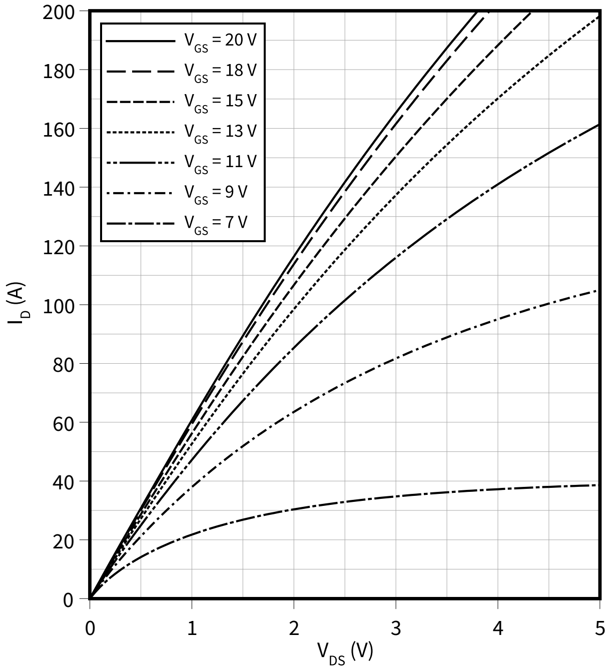
$I_D = 100$ A



Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$

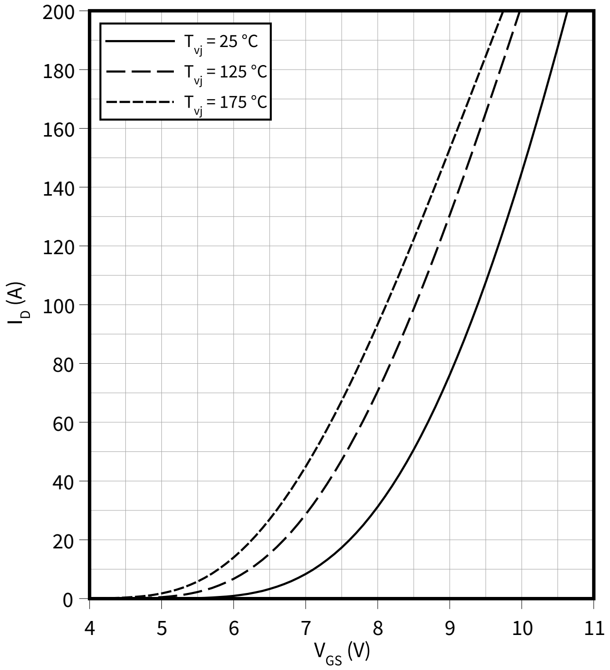
$T_{vj} = 175\ °C$



Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$

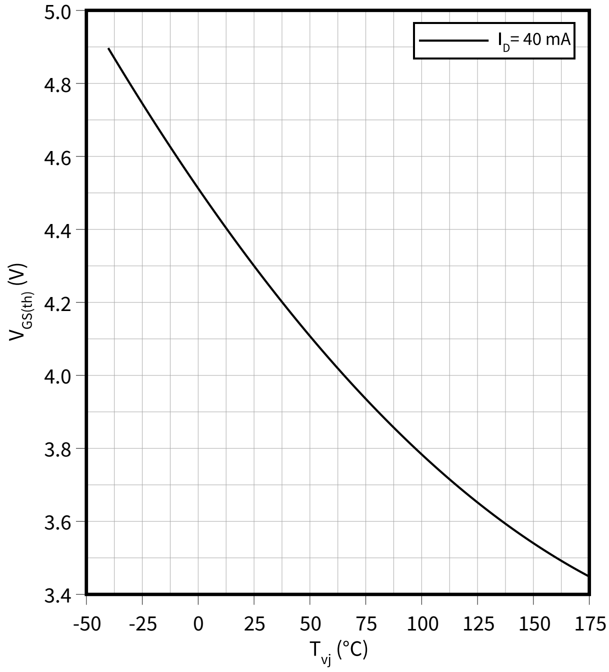
$V_{DS} = 20\ V$



Gate-source threshold voltage (typical), MOSFET

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

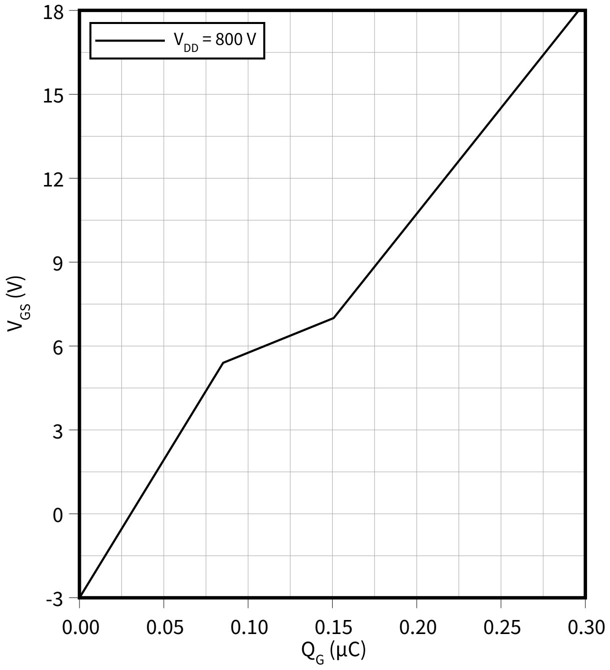
$V_{GS} = V_{DS}$



Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$

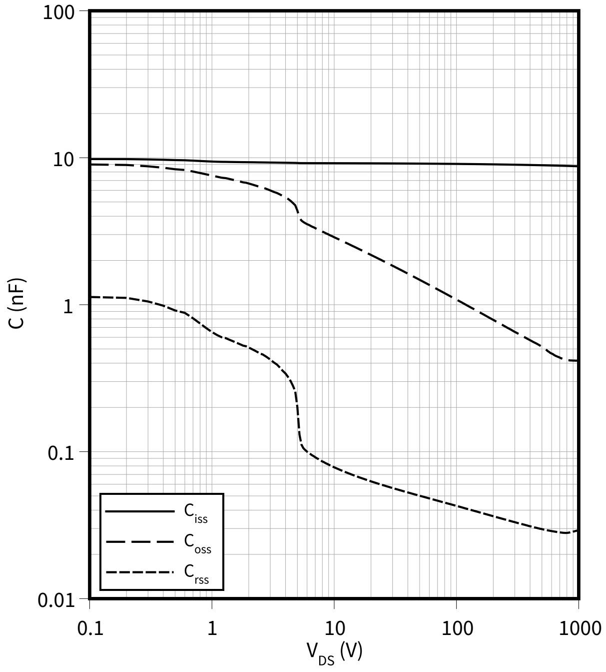
$I_D = 100\ A$, $T_{vj} = 25\ °C$



Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

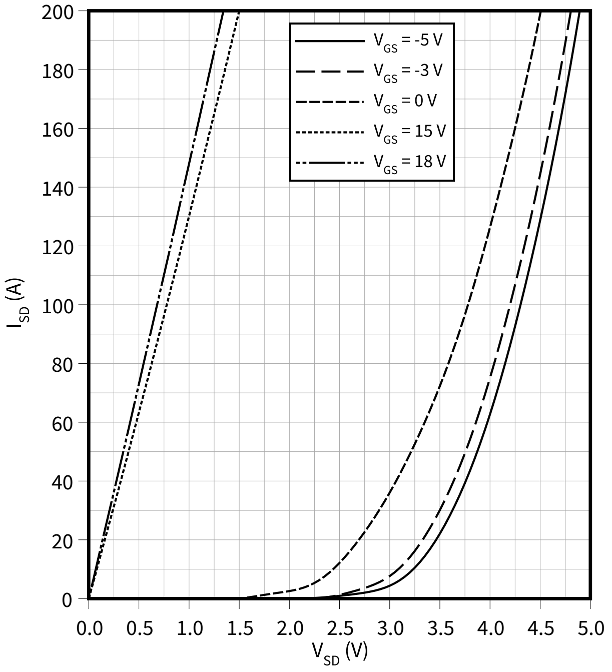
$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GS} = 0$ V



Forward characteristic body diode (typical), MOSFET

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

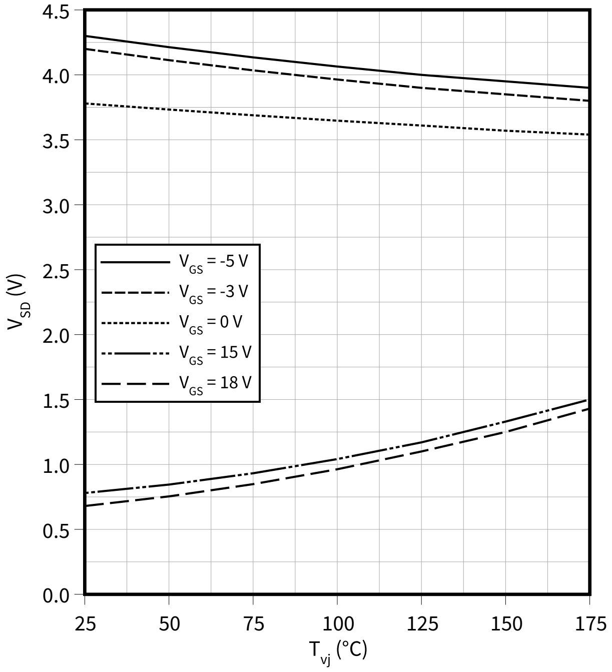
$T_{vj} = 25$ °C



Forward voltage of body diode (typical), MOSFET

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

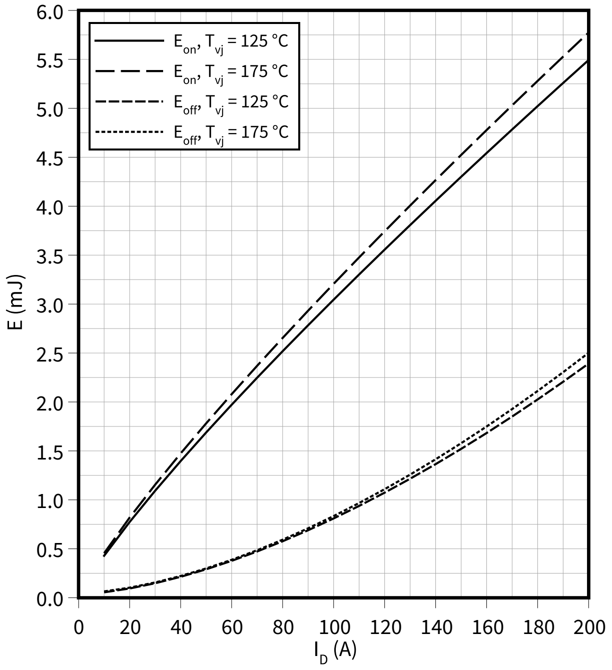
$I_{SD} = 100$ A



Switching losses (typical), MOSFET

$E = f(I_D)$

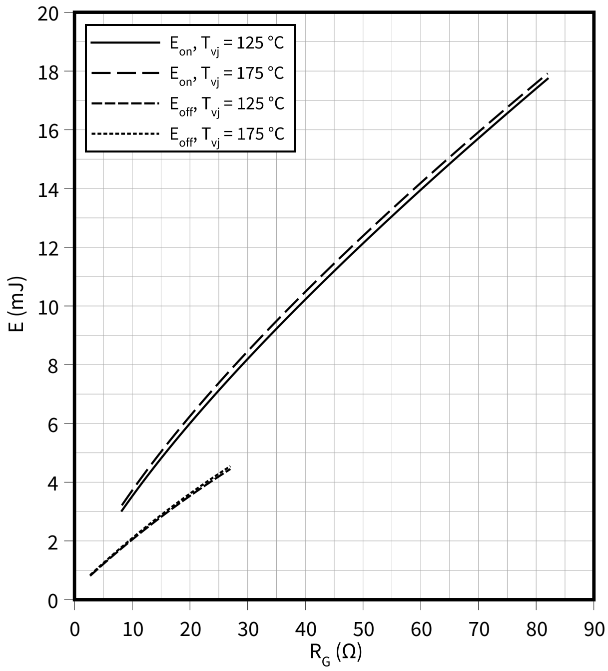
$R_{Goff} = 2.7\ \Omega$, $R_{Gon} = 8.2\ \Omega$, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V



Switching losses (typical), MOSFET

$E = f(R_G)$

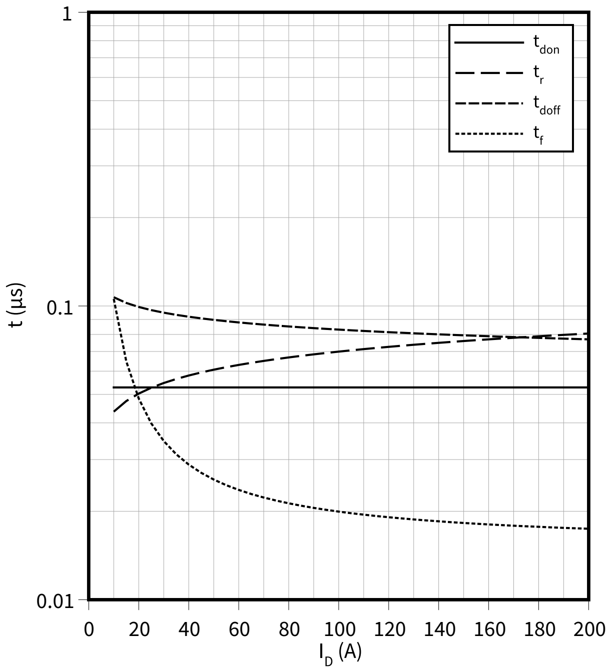
$V_{DD} = 600$ V, $I_D = 100$ A, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET

$t = f(I_D)$

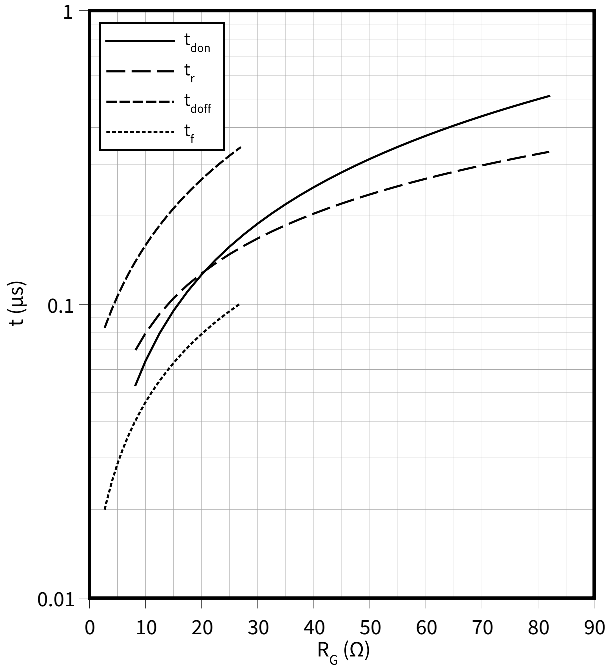
$R_{Goff} = 2.7$ Ω, $R_{Gon} = 8.2$ Ω, $V_{DD} = 600$ V, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET

$t = f(R_G)$

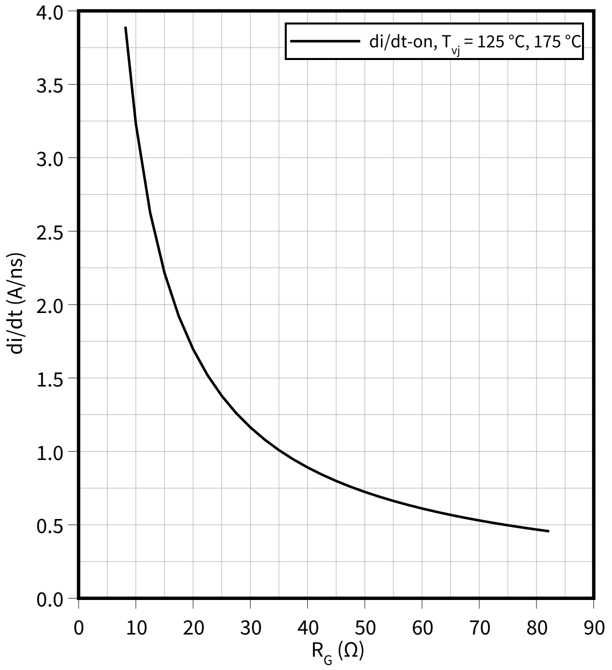
$V_{DD} = 600$ V, $I_D = 100$ A, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



Current slope (typical), MOSFET

$di/dt = f(R_G)$

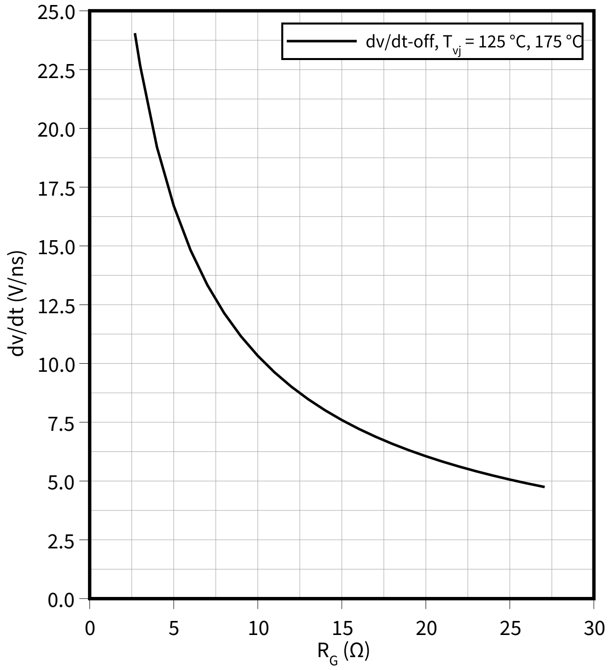
$V_{DD} = 600$ V, $I_D = 100$ A, $V_{GS} = -3/18$ V



Voltage slope (typical), MOSFET

dv/dt = f(R_G)

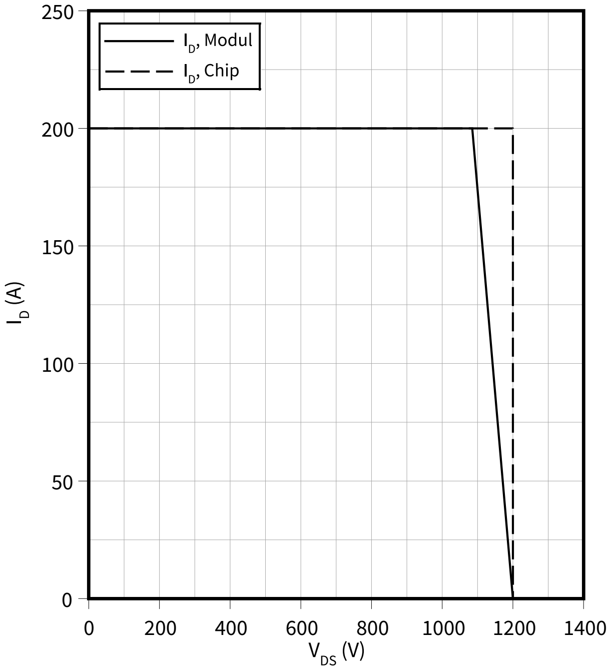
V_{DD} = 600 V, I_D = 100 A, V_{GS} = -3/18 V



Reverse bias safe operating area (RBSOA), MOSFET

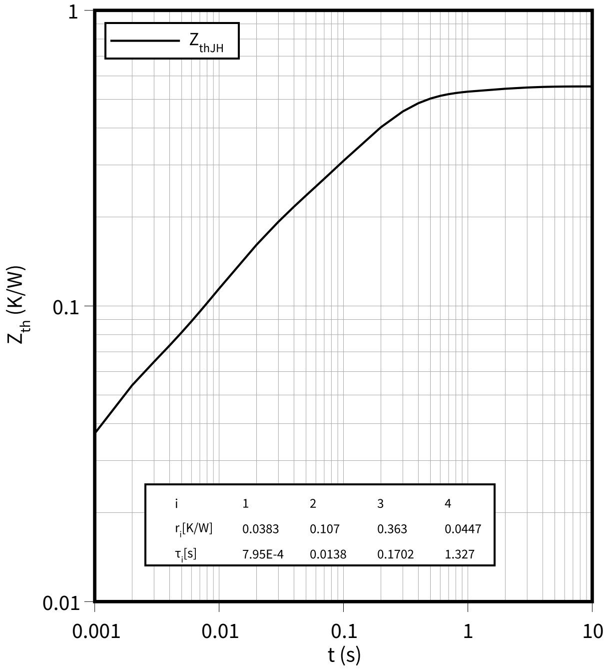
I_D = f(V_{DS})

R_{Goff} = 2.7 Ω, T_{vj} = 175 °C, V_{GS} = -3/18 V



Transient thermal impedance , MOSFET

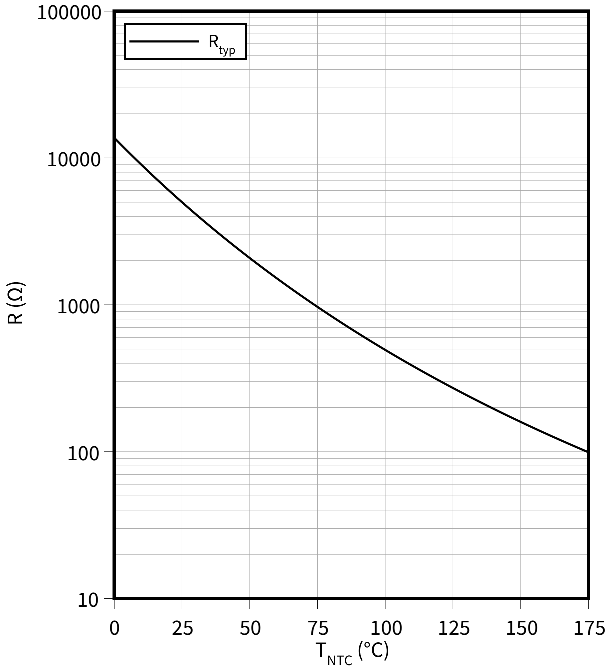
Z_{th} = f(t)



i	1	2	3	4
r_i[K/W]	0.0383	0.107	0.363	0.0447
τ_i[s]	7.95E-4	0.0138	0.1702	1.327

Temperature characteristic (typical), NTC-Thermistor

R = f(T_{NTC})



6 Circuit diagram

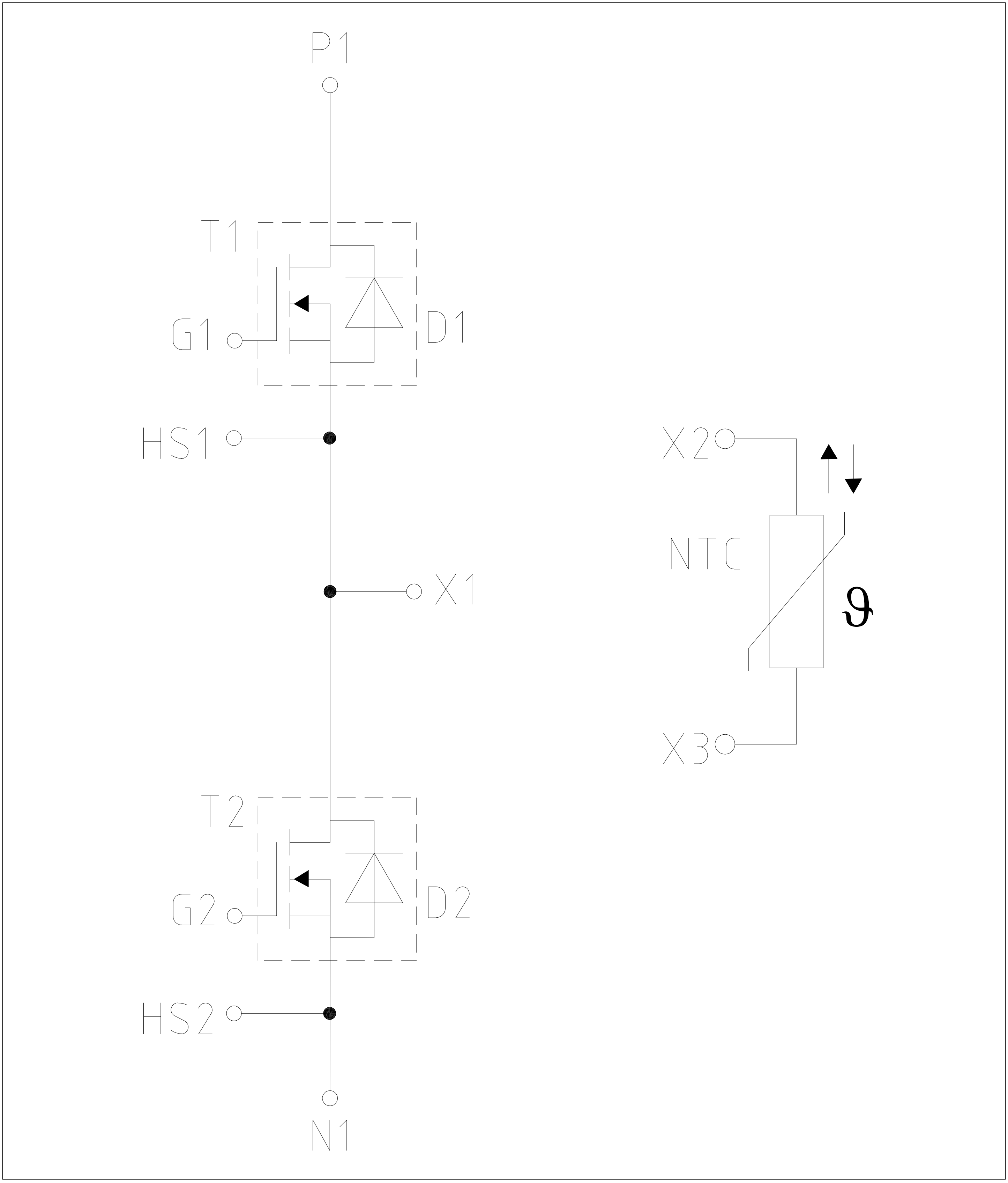


Figure 1

7 Package outlines

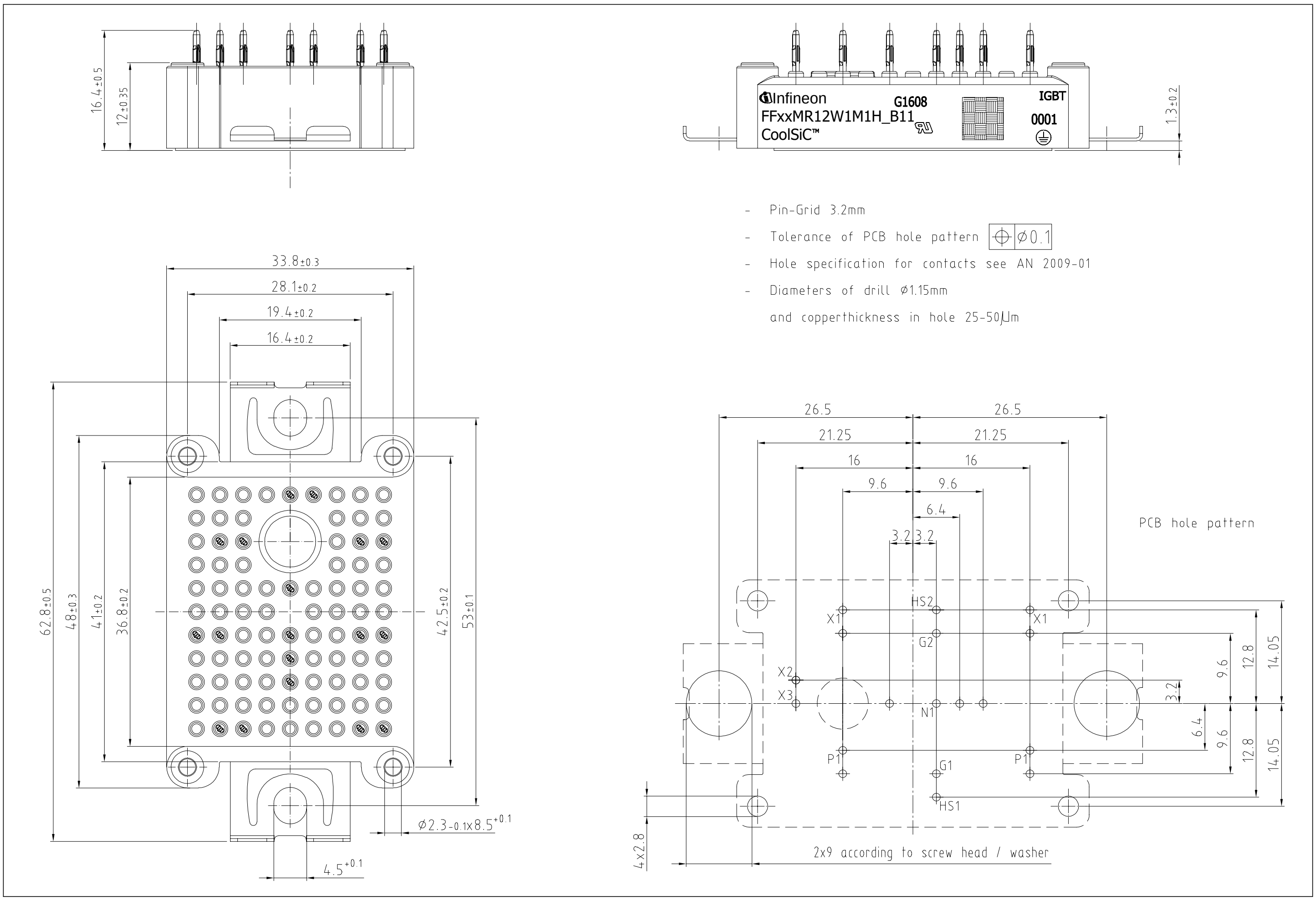


Figure 2

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	71549142846550549911530		71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2022-10-19	Initial version
0.20	2023-01-24	Preliminary datasheet
0.30	2023-02-07	Preliminary datasheet

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