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

Features

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 100 A / I_{DRM} = 200 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
  - Pre-applied thermal interface material

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
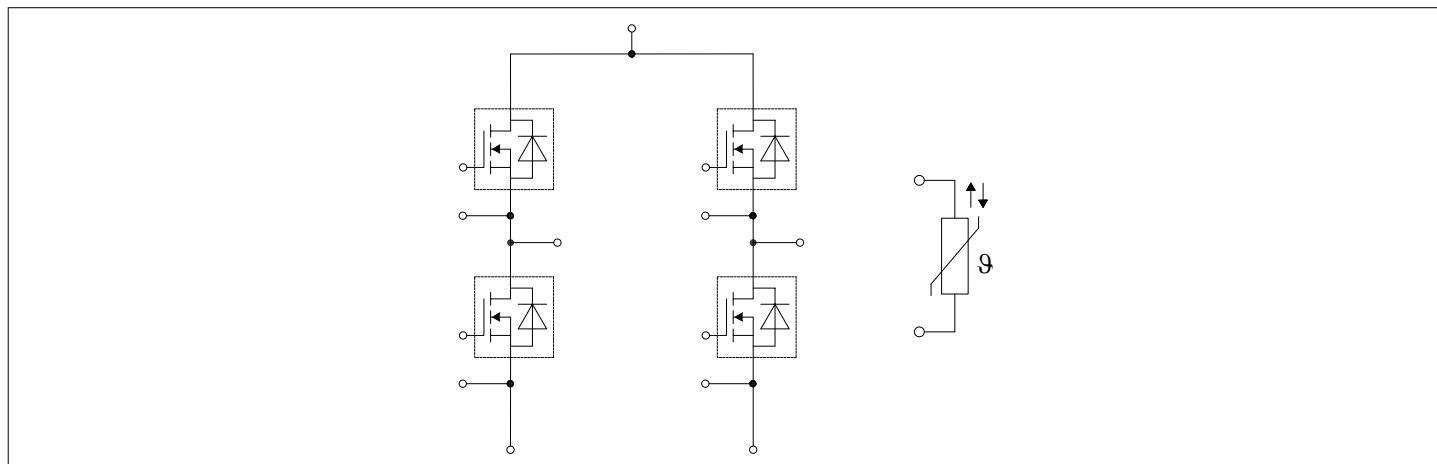
Description

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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)	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		2.1		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				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.*

Storage and shipment of modules with TIM => see AN 2012-07.

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	75	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
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 = 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		42		ns
			T_{vj} = 125 °C		42		
			T_{vj} = 175 °C		42		
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		63		ns
			T_{vj} = 125 °C		63		
			T_{vj} = 175 °C		63		
Turn-off delay time (inductive load)	$t_{d off}$	I_D = 100 A, R_{Goff} = 5.6 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		72		ns
			T_{vj} = 125 °C		80		
			T_{vj} = 175 °C		84		

(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, $R_{Goff} = 5.6$ Ω, $V_{DD} = 600$ V, $V_{GS} = $ -3/18 V	$T_{vj} = 25$ °C		24		ns
			$T_{vj} = 125$ °C		24		
			$T_{vj} = 175$ °C		24		
Turn-on energy loss per pulse	E_{on}	$I_D = 100$ A, $V_{DD} = 600$ V, $L_\sigma = 3$ nH, $V_{GS} = $ -3/18 V, $R_{Gon} = 8.2$ Ω, di/dt = 3.83 kA/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		2.23		mJ
			$T_{vj} = 125$ °C		2.44		
			$T_{vj} = 175$ °C		2.59		
Turn-off energy loss per pulse	E_{off}	$I_D = 100$ A, $V_{DD} = 600$ V, $L_\sigma = 3$ nH, $V_{GS} = $ -3/18 V, $R_{Goff} = 5.6$ Ω, dv/dt = 20 kV/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		0.949		mJ
			$T_{vj} = 125$ °C		1.01		
			$T_{vj} = 175$ °C		1.05		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, Valid with IFX pre-applied Thermal Interface Material				0.788	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.*

Tvj,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	35	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$_{100}$	$\Delta R/R$	$T_{NTC} = 100\,°C$, $R_{100} = 493\,\Omega$	-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: *For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

5   Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

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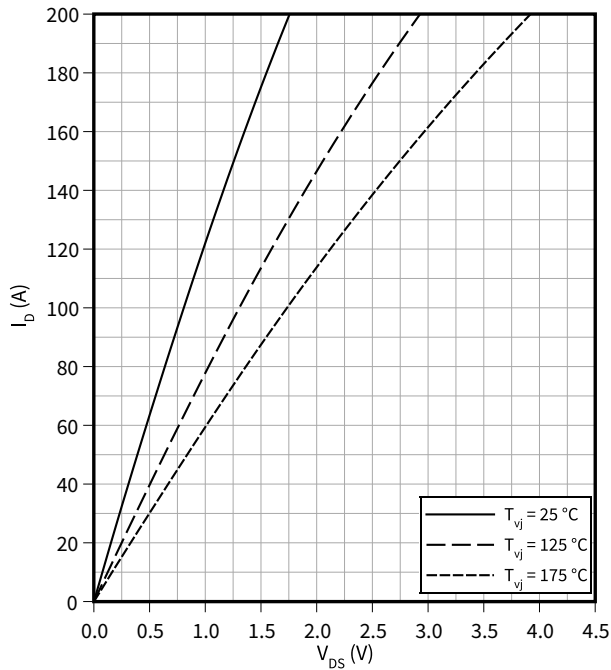
Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

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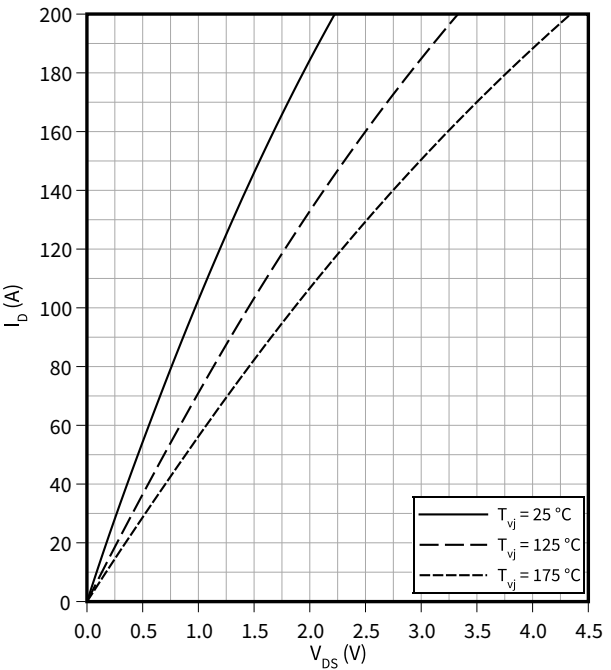
Drain source on-resistance (typical), MOSFET

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

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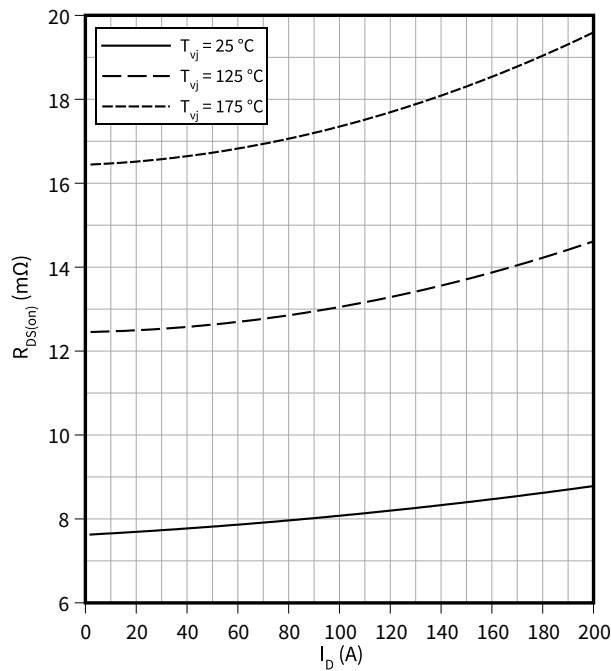
Drain source on-resistance (typical), MOSFET

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

$I_D = 100$ A

Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$

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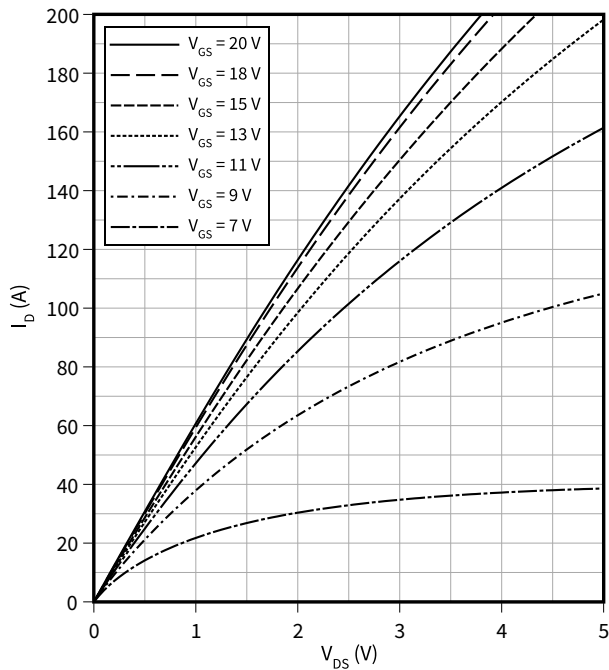
Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$

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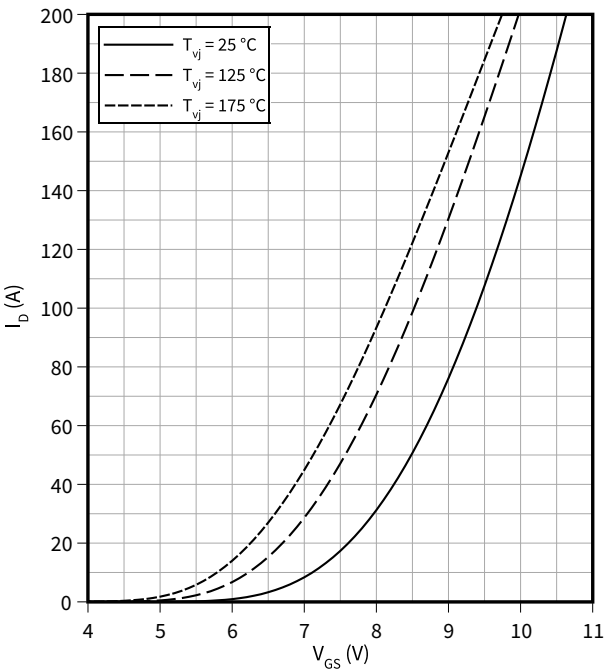
Gate-source threshold voltage (typical), MOSFET

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

$V_{GS} = V_{DS}$
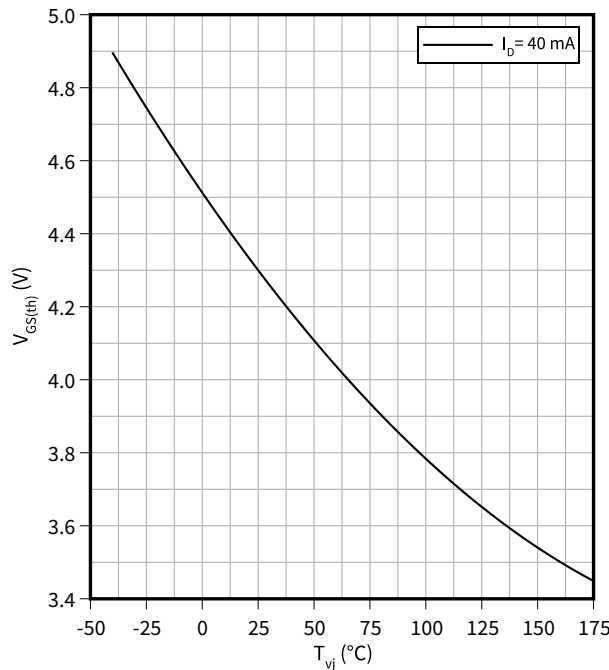
Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$

$I_D = 100 \ A, \ T_{vj} = 25 \ °C$
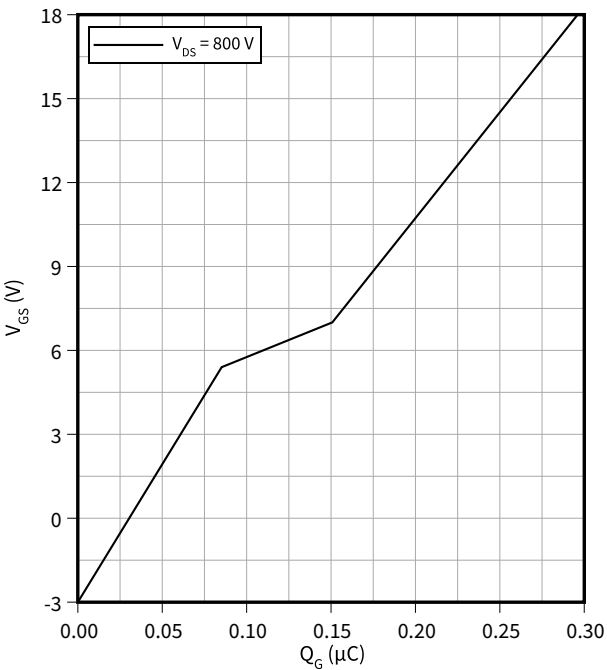
Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

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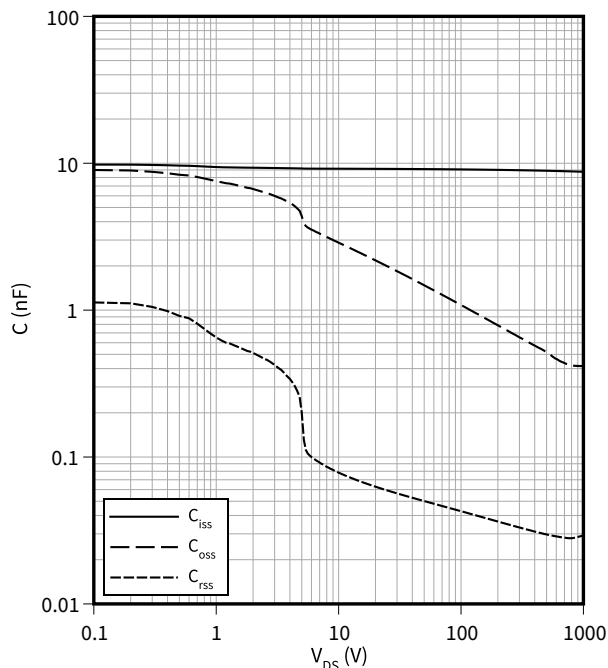
Forward characteristic body diode (typical), MOSFET

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

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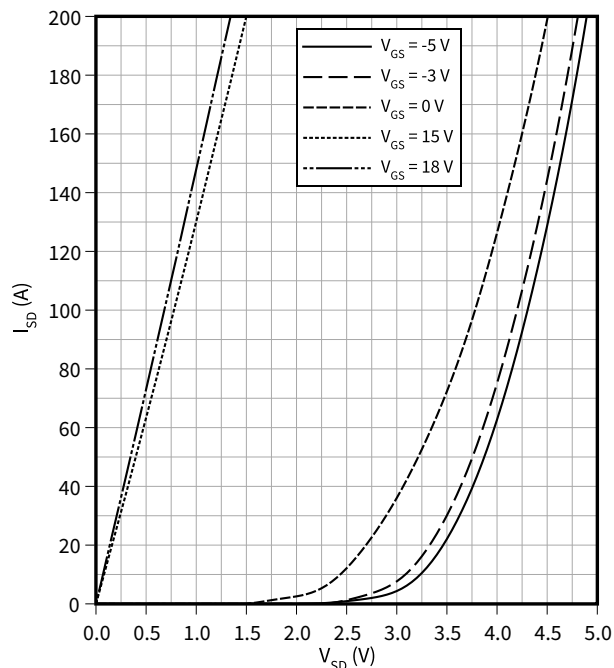
Forward voltage of body diode (typical), MOSFET

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

$I_{SD} = 100$ A
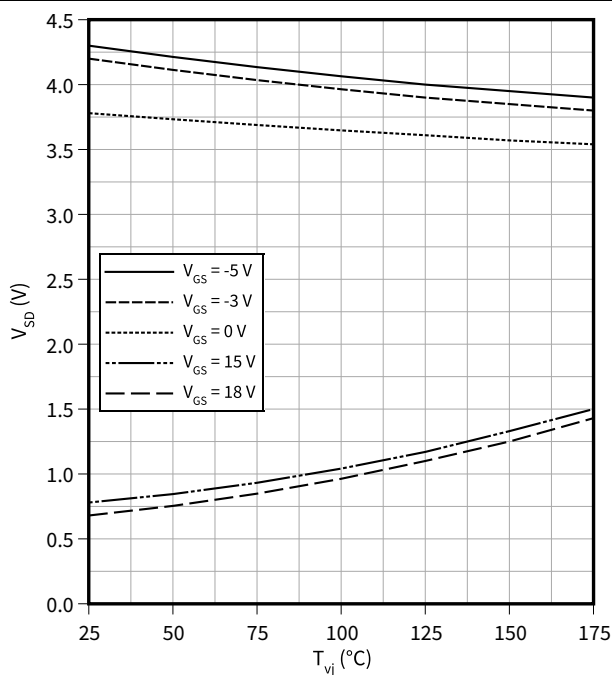
Switching losses (typical), MOSFET

$E = f(I_D)$

$R_{Goff} = 5.6$ Ω, $R_{Gon} = 8.2$ Ω, $V_{DD} = 600$ 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
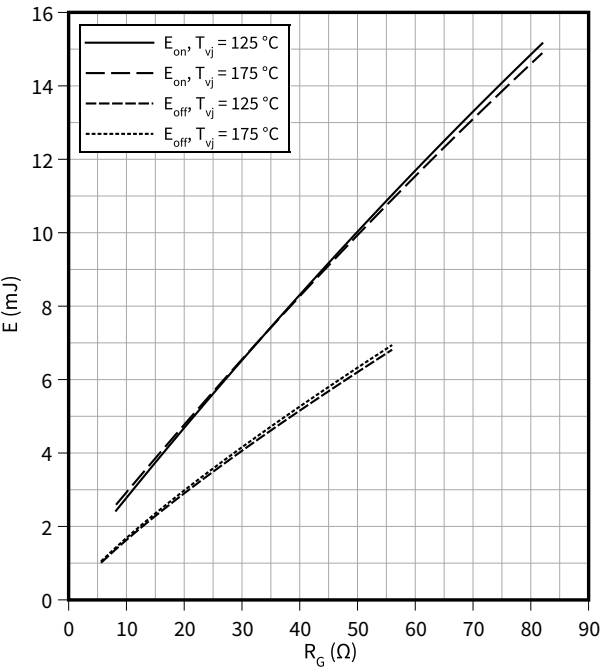
Switching times (typical), MOSFET

$t = f(I_D)$

$R_{Goff} = 5.6\ \Omega$, $R_{Gon} = 8.2\ \Omega$, $V_{DD} = 600$ V, $T_{vj} = 175\ °C$, $V_{GS} = -3/18$ V
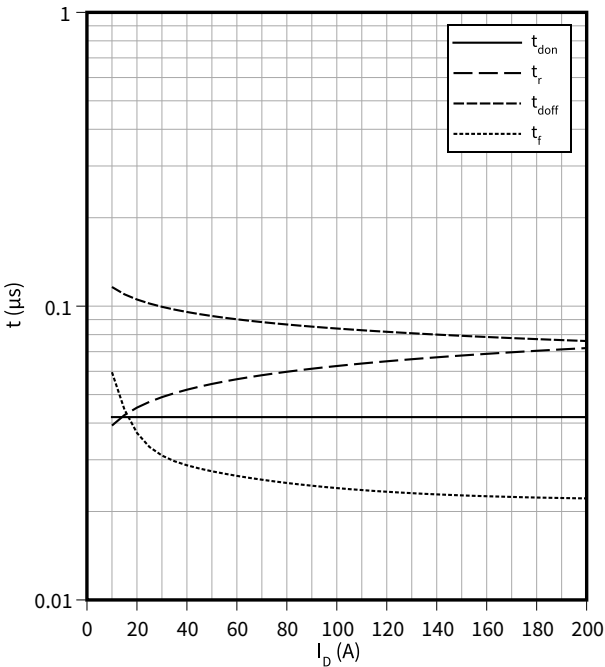
Switching times (typical), MOSFET

$t = f(R_G)$

$V_{DD} = 600$ V, $I_D = 100$ A, $T_{vj} = 175\ °C$, $V_{GS} = -3/18$ V
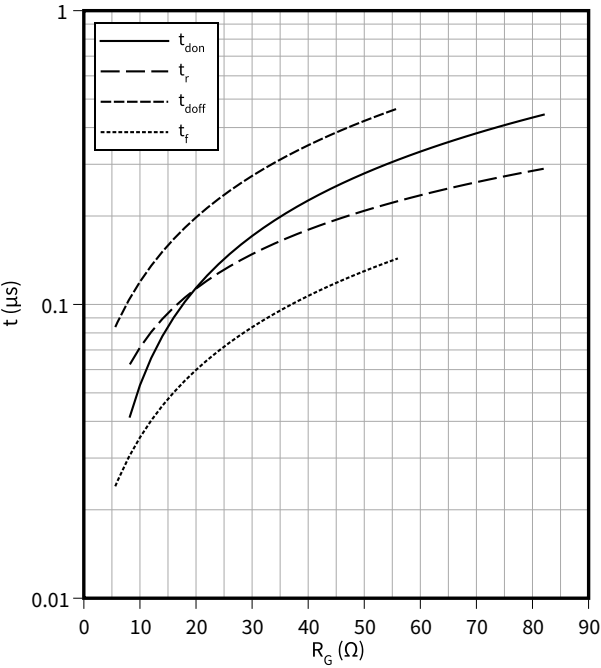
Current slope (typical), MOSFET

$di/dt = f(R_G)$

$V_{DD} = 600$ 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
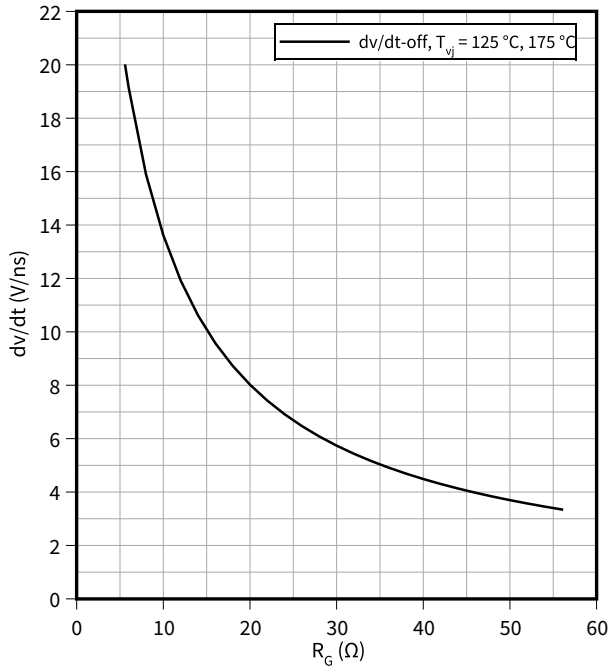
Reverse bias safe operating area (RBSOA), MOSFET

$I_D = f(V_{DS})$

$R_{Goff} = 5.6$ Ω, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V
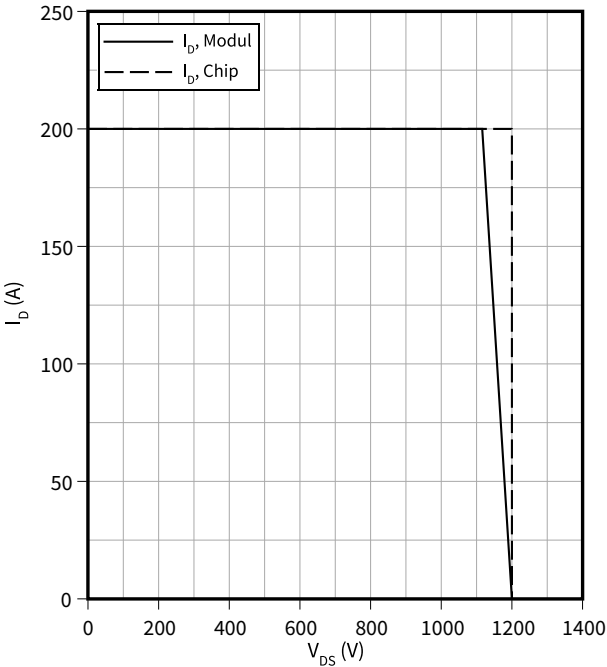
Transient thermal impedance, MOSFET

$Z_{th} = f(t)$

i	1	2	3	4
r_i[K/W]	0.025	0.098	0.244	0.421
τ_i[s]	7.71E-4	0.0102	0.103	0.346
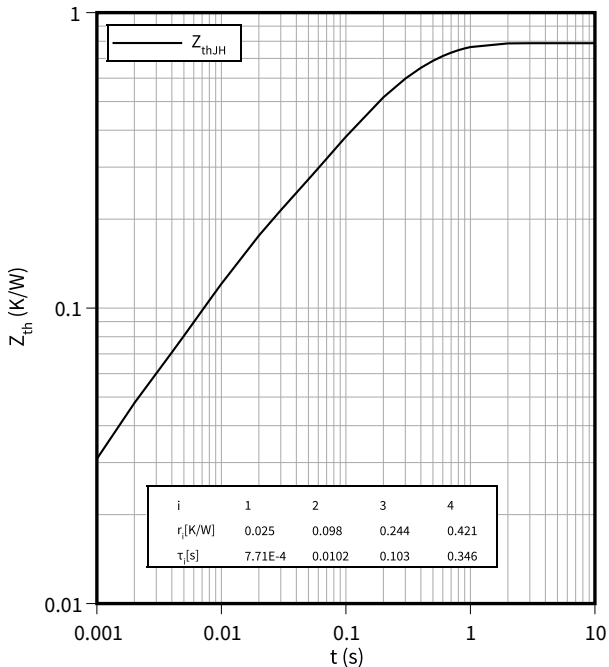
Temperature characteristic (typical), NTC-Thermistor

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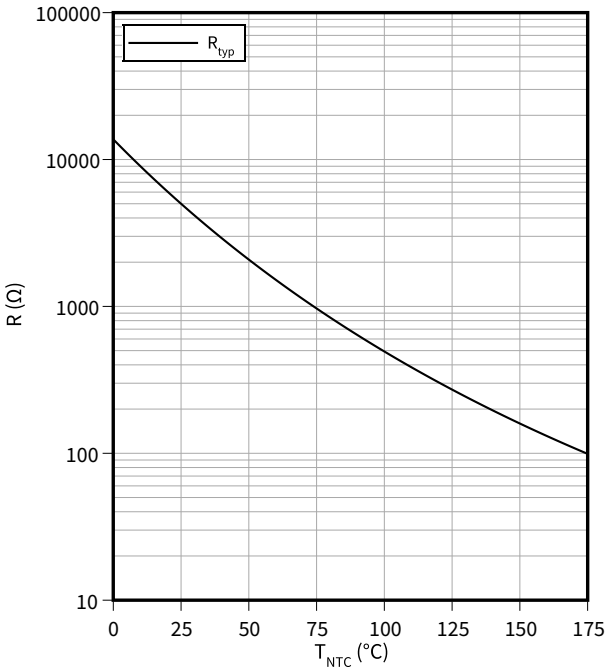
6 Circuit diagram
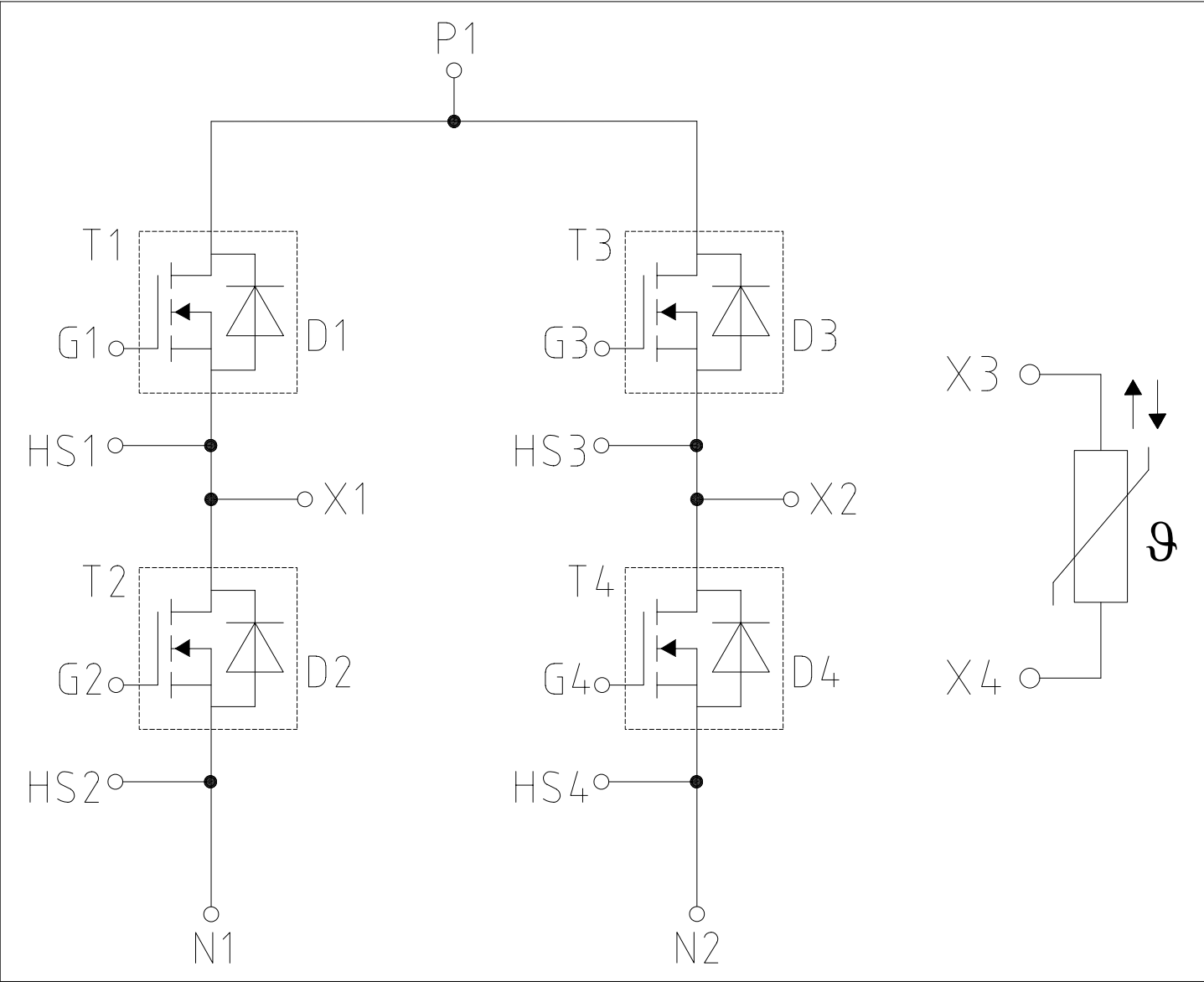
Figure 1

7   Package outlines

- Pin-Grid 3.2mm
- Tolerance of PCB hole pattern ⊕ ⌀0.1
- Hole specification for contacts see AN 2009-01:
  Diameters of drill ⌀ 1.15mm
  and copper thickness in hole 25-50μm

PCB hole pattern

2x9 according to screw head / washer

restricted area for Thermal Interface Material
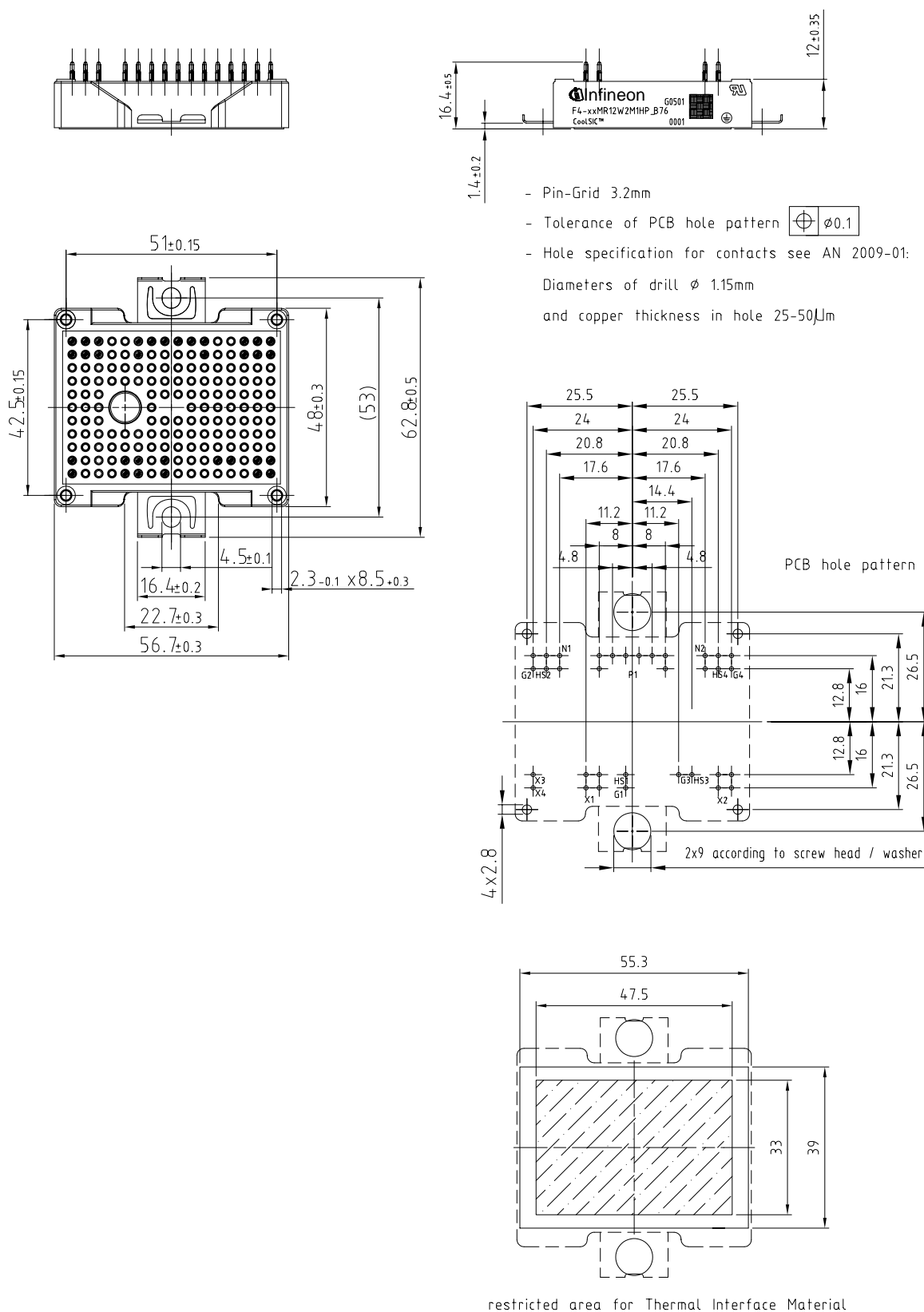
Figure 2

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* 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 revision	Date of release	Description of changes
0.10	2023-06-06	Initial version

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