

## Preliminary datasheet

### 62 mm C-Series module with CoolSiC™ Trench MOSFET and pre-applied thermal interface material

#### Features

- Electrical features
  - $V_{DS} = 1200\text{ V}$
  - $I_{DN} = 560\text{ A} / I_{DRM} = 1120\text{ A}$
  - High current density
  - Low switching losses
- Mechanical features
  - 4 kV AC 1 min insulation
  - Pre-applied thermal interface material



#### Potential applications

- UPS systems
- Solar applications
- DC/DC converter
- High-frequency switching application
- Energy storage systems
- DC charger for EV

#### Product validation

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

#### Description

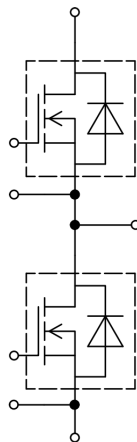


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## 1 Package

**Table 1** Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	$V_{ISOL}$	RMS, $f = 50 \text{ Hz}$ , $t = 60 \text{ s}$	4.0	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	$Al_2O_3$	
Creepage distance	$d_{Creep}$	terminal to heatsink	29.0	mm
Creepage distance	$d_{Creep}$	terminal to terminal	23.0	mm
Clearance	$d_{Clear}$	terminal to heatsink	23.0	mm
Clearance	$d_{Clear}$	terminal to terminal	11.0	mm
Comparative tracking index	$CTI$		> 400	
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	$L_{sCE}$				20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25\text{ }^{\circ}\text{C}$ , per switch			0.465		mΩ
Storage temperature	$T_{stg}$			-40		125	°C
Maximum baseplate operation temperature	$T_{BPmax}$					125	°C
Mounting torque for module mounting	$M$	- Mounting according to valid application note	M6, Screw	3		6	Nm
Terminal connection torque	$M$	- Mounting according to valid application note	M6, Screw	2.5		5	Nm
Weight	$G$				340		g

Note: Storage and shipment of modules with TIM => see AN2012-07.

## 2 MOSFET

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	$V_{DSS}$	$T_{vj} = 25 \text{ °C}$	1200	V
Implemented drain current	$I_{DN}$		560	A

(table continues...)

**Table 3** (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Continuous DC drain current	$I_{\text{DDC}}$	$T_{\text{vj}} = 175\text{ °C}$ , $V_{\text{GS}} = 18\text{ V}$	$T_{\text{H}} = 65\text{ °C}$	475	A
Repetitive peak drain current	$I_{\text{DRM}}$	verified by design, $t_{\text{p}}$ limited by $T_{\text{vjmax}}$		1120	A
Gate-source voltage, max. transient voltage	$V_{\text{GS}}$	$D < 0.01$		-10/23	V
Gate-source voltage, max. static voltage	$V_{\text{GS}}$			-7/20	V

**Table 4** Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
On-state gate voltage	$V_{\text{GS(on)}}$		15...18	V
Off-state gate voltage	$V_{\text{GS(off)}}$		-5...0	V

**Table 5** Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{\text{DS(on)}}$	$I_{\text{D}} = 560\text{ A}$	$V_{\text{GS}} = 18\text{ V}$ , $T_{\text{vj}} = 25\text{ °C}$		1.47		mΩ
			$V_{\text{GS}} = 18\text{ V}$ , $T_{\text{vj}} = 125\text{ °C}$		2.38		
			$V_{\text{GS}} = 18\text{ V}$ , $T_{\text{vj}} = 175\text{ °C}$		3.16		
			$V_{\text{GS}} = 15\text{ V}$ , $T_{\text{vj}} = 25\text{ °C}$		1.77		
Gate threshold voltage	$V_{\text{GS(th)}}$	$I_{\text{D}} = 224\text{ mA}$ , $V_{\text{DS}} = V_{\text{GS}}$ , $T_{\text{vj}} = 25\text{ °C}$ , (tested after 1ms pulse at $V_{\text{GS}} = +20\text{ V}$ )		3.45	4.3	5.15	V
Total gate charge	$Q_{\text{G}}$	$V_{\text{DD}} = 800\text{ V}$ , $V_{\text{GS}} = -3/18\text{ V}$			1.6		μC
Internal gate resistor	$R_{\text{Gint}}$	$T_{\text{vj}} = 25\text{ °C}$			0.9		Ω
Input capacitance	$C_{\text{ISS}}$	$f = 100\text{ kHz}$ , $V_{\text{DS}} = 800\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$	$T_{\text{vj}} = 25\text{ °C}$		48.4		nF
Output capacitance	$C_{\text{OSS}}$	$f = 100\text{ kHz}$ , $V_{\text{DS}} = 800\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$	$T_{\text{vj}} = 25\text{ °C}$		2.4		nF
Reverse transfer capacitance	$C_{\text{rss}}$	$f = 100\text{ kHz}$ , $V_{\text{DS}} = 800\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$	$T_{\text{vj}} = 25\text{ °C}$		0.158		nF
$C_{\text{OSS}}$ stored energy	$E_{\text{OSS}}$	$V_{\text{DS}} = 800\text{ V}$ , $V_{\text{GS}} = -3/18\text{ V}$ , $T_{\text{vj}} = 25\text{ °C}$			945		μJ
Drain-source leakage current	$I_{\text{DSS}}$	$V_{\text{DS}} = 1200\text{ V}$ , $V_{\text{GS}} = -3\text{ V}$	$T_{\text{vj}} = 25\text{ °C}$		0.32	660	μA

(table continues...)

**Table 5** (continued) **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Gate-source leakage current	$I_{GSS}$	$V_{DS} = 0 \text{ V}$ , $T_{vj} = 25 \text{ }^{\circ}\text{C}$	$V_{GS} = 20 \text{ V}$			400	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_D = 560 \text{ A}$ , $R_{Gon} = 4.3 \text{ } \Omega$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		166		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		155		
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$		150		
Rise time (inductive load)	$t_r$	$I_D = 560 \text{ A}$ , $R_{Gon} = 4.3 \text{ } \Omega$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		172		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		152		
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$		155		
Turn-off delay time (inductive load)	$t_{doff}$	$I_D = 560 \text{ A}$ , $R_{Goff} = 1.8 \text{ } \Omega$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		180		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		196		
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$		204		
Fall time (inductive load)	$t_f$	$I_D = 560 \text{ A}$ , $R_{Goff} = 1.8 \text{ } \Omega$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		43		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		44		
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$		45		
Turn-on energy loss per pulse	$E_{on}$	$I_D = 560 \text{ A}$ , $V_{DD} = 600 \text{ V}$ , $L_{\sigma} = 10 \text{ nH}$ , $V_{GS} = -3/18 \text{ V}$ , $R_{Gon} = 4.3 \text{ } \Omega$ , $di/dt = 5.9 \text{ kA}/\mu\text{s}$ ( $T_{vj} = 175 \text{ }^{\circ}\text{C}$ )	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		23.9		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		23.1		
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$		23.3		
Turn-off energy loss per pulse	$E_{off}$	$I_D = 560 \text{ A}$ , $V_{DD} = 600 \text{ V}$ , $L_{\sigma} = 10 \text{ nH}$ , $V_{GS} = -3/18 \text{ V}$ , $R_{Goff} = 1.8 \text{ } \Omega$ , $dv/dt = 10.7 \text{ kV}/\mu\text{s}$ ( $T_{vj} = 175 \text{ }^{\circ}\text{C}$ )	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		15		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		16.2		
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$		16.7		
Thermal resistance, junction to heat sink	$R_{thJH}$	per MOSFET, Valid with IFX pre-applied Thermal Interface Material				0.104	K/W
Temperature under switching conditions	$T_{vj\text{ op}}$			-40		175	$^{\circ}\text{C}$

**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.

$T_{vj,op} > 150^{\circ}\text{C}$  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	$I_{SD}$	$T_{vj} = 175\text{ °C}$ , $V_{GS} = -3\text{ V}$	$T_H = 65\text{ °C}$	255	A

**Table 7** Characteristic values

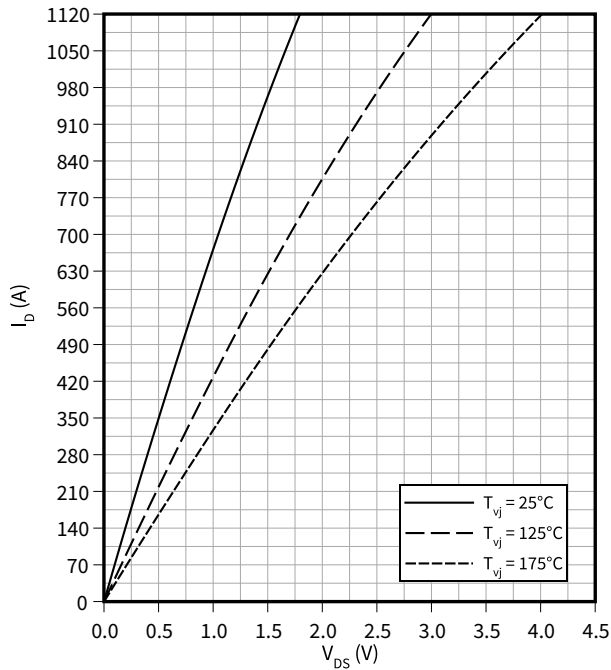
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	$V_{SD}$	$I_{SD} = 560\text{ A}$ , $V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ °C}$		4.22	5.59	V
			$T_{vj} = 125\text{ °C}$		3.95		
			$T_{vj} = 175\text{ °C}$		3.85		

4 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

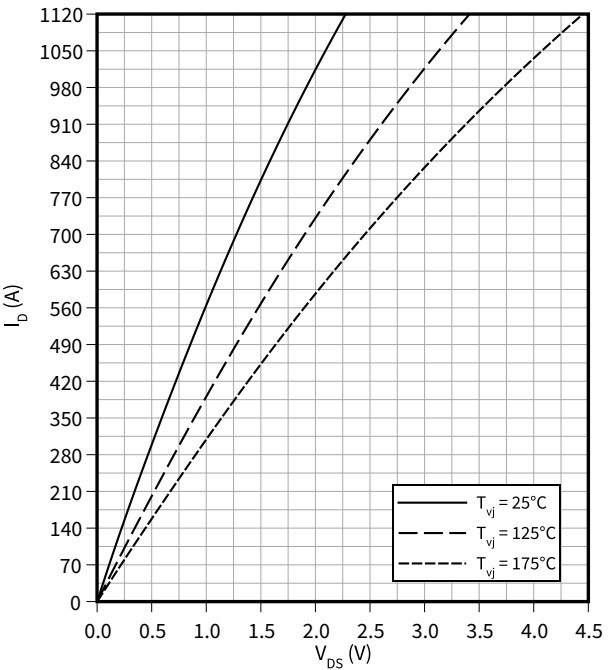
$V_{GS} = 18\text{ V}$



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

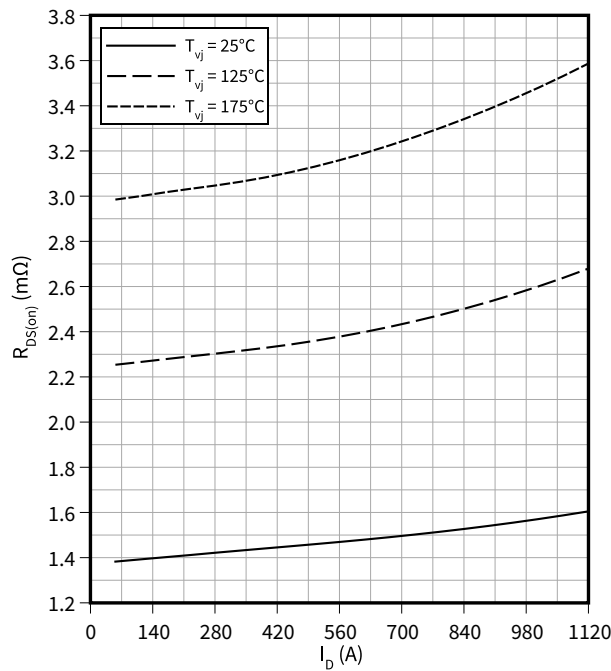
$V_{GS} = 15\text{ V}$



Drain source on-resistance (typical), MOSFET

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

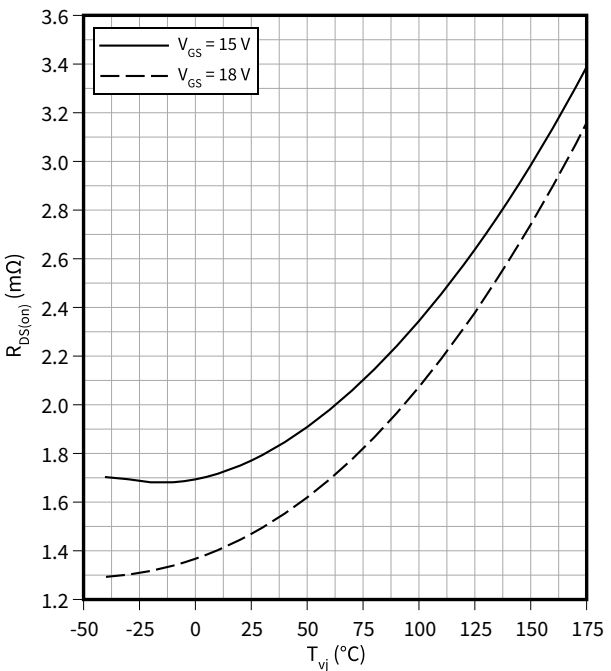
$V_{GS} = 18\text{ V}$



Drain source on-resistance (typical), MOSFET

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

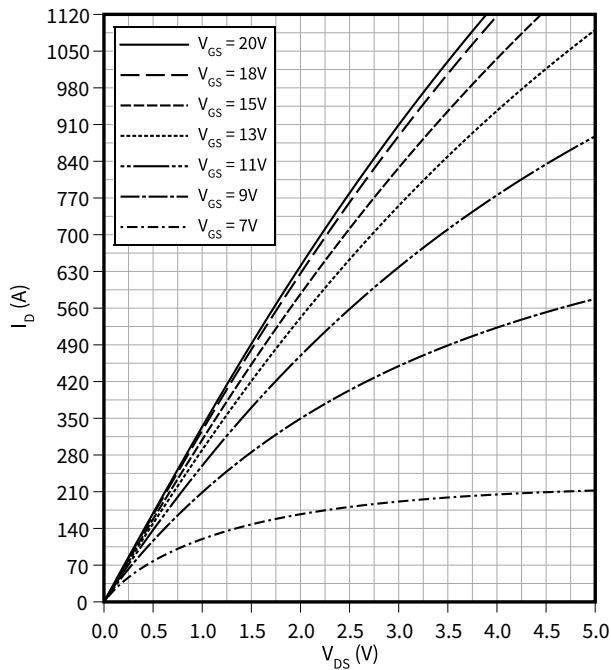
$I_D = 560\text{ A}$



4 Characteristics diagrams

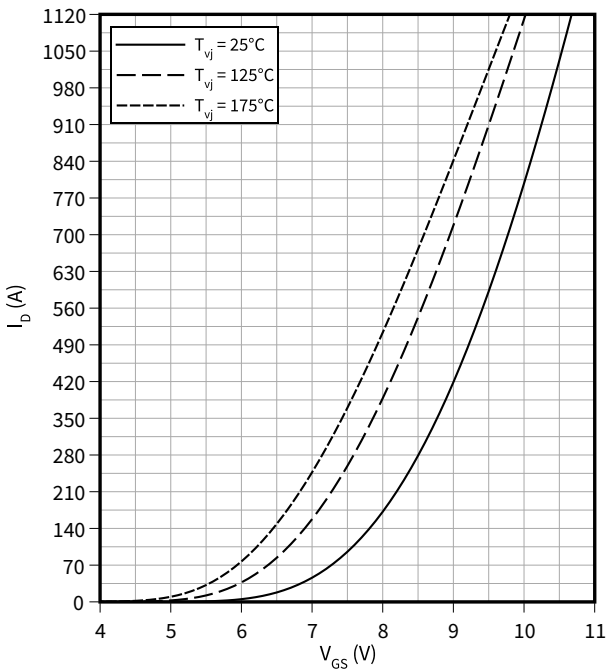
Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$   
 $T_{vj} = 175\text{ °C}$



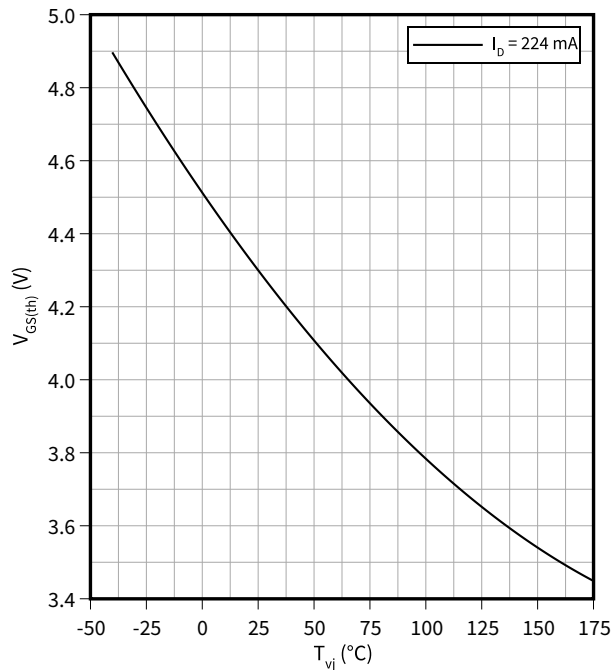
Transfer characteristic (typical), MOSFET

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



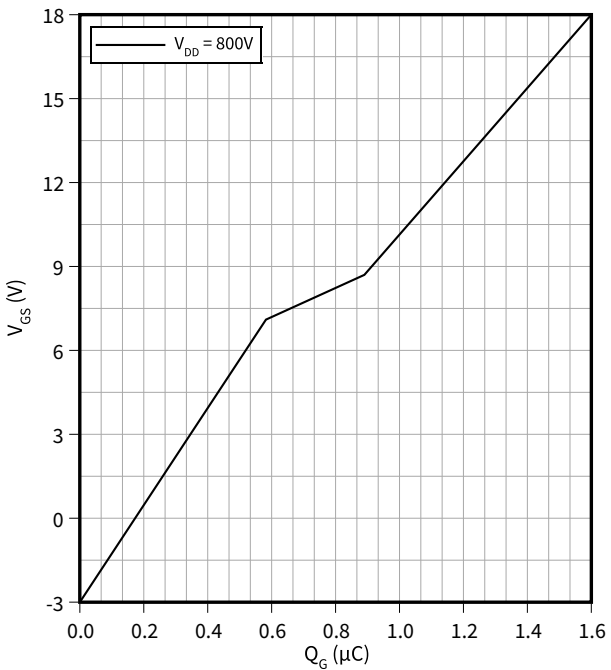
Gate-source threshold voltage (typical), MOSFET

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



Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$   
 $I_D = 560\text{ A}, T_{vj} = 25\text{ °C}$

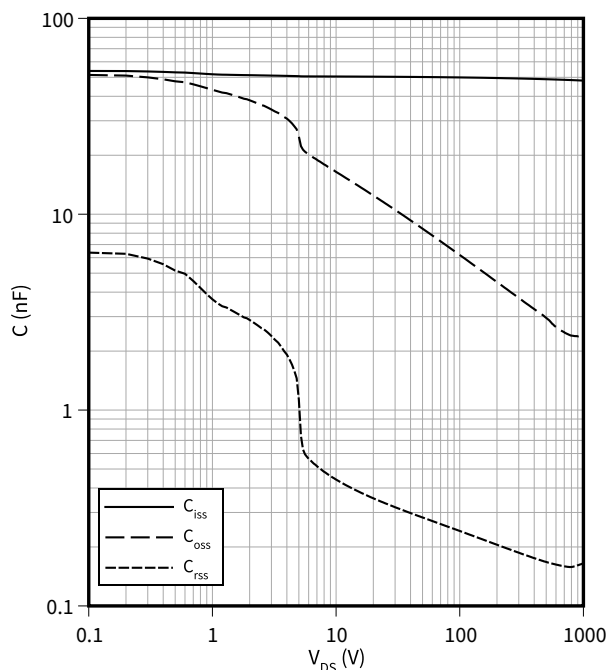




**Capacity characteristic (typical), MOSFET**

$$C = f(V_{DS})$$

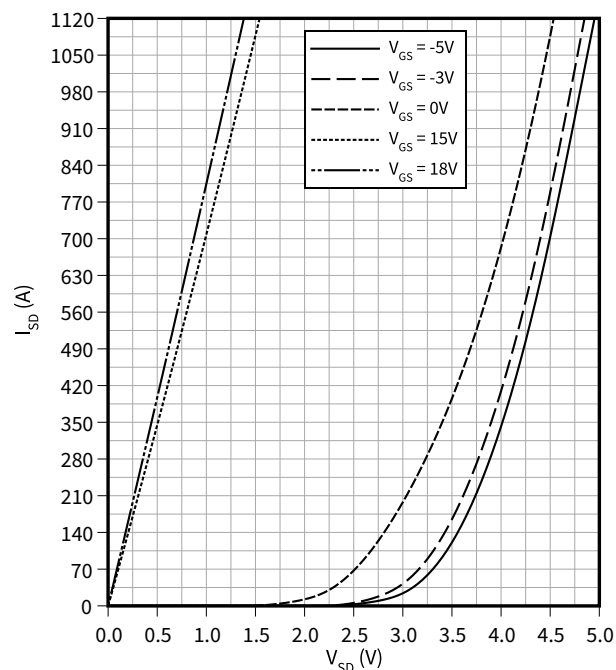
$T_{vj} = 25\text{ °C}$ ,  $V_{GS} = 0\text{ V}$ ,  $f = 100\text{ kHz}$



**Forward characteristic body diode (typical), MOSFET**

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

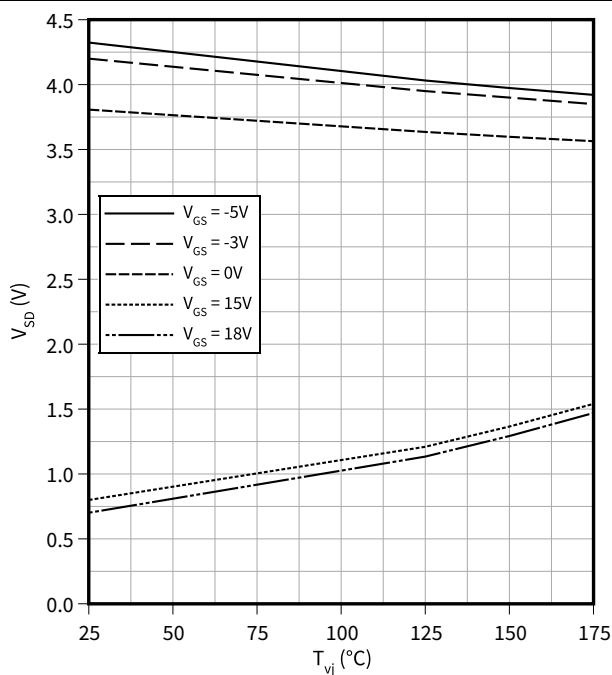
$T_{vj} = 25\text{ °C}$



**Forward voltage of body diode (typical), MOSFET**

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

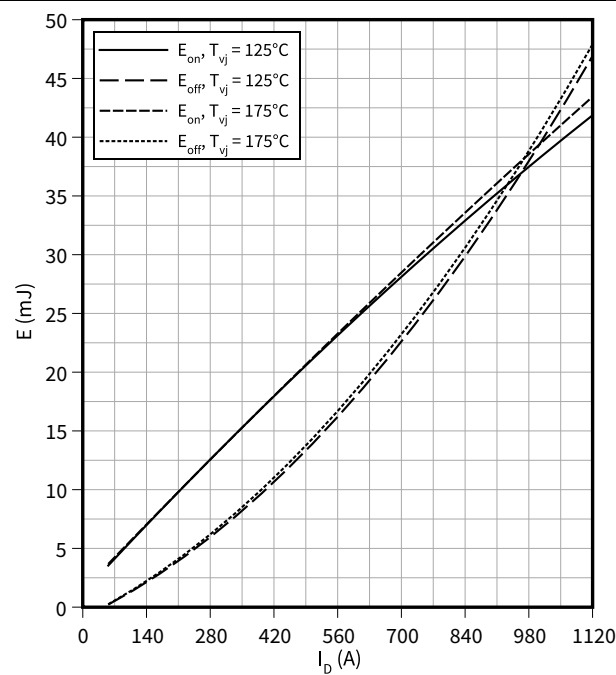
$I_{SD} = 560\text{ A}$



**Switching losses (typical), MOSFET**

$$E = f(I_D)$$

$R_{Goff} = 1.8\text{ }\Omega$ ,  $R_{Gon} = 4.3\text{ }\Omega$ ,  $V_{DD} = 600\text{ V}$ ,  $V_{GS} = -3/18\text{ V}$

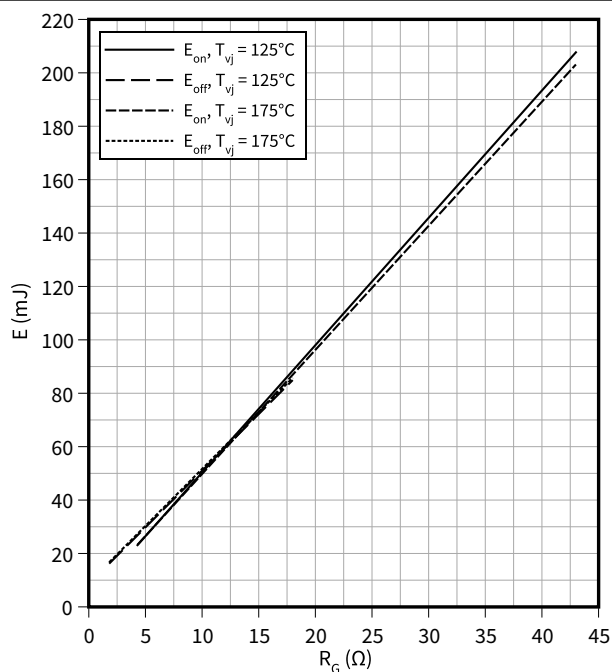


4 Characteristics diagrams

**Switching losses (typical), MOSFET**

$$E = f(R_G)$$

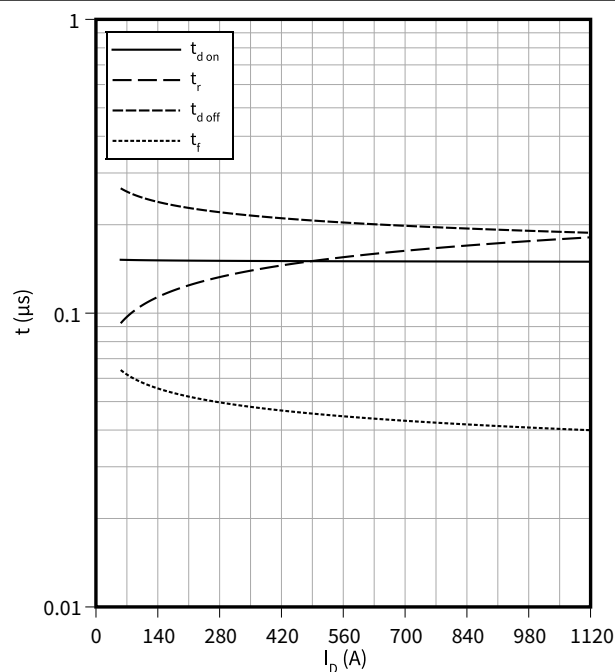
$V_{DD} = 600 \text{ V}$ ,  $I_D = 560 \text{ A}$ ,  $V_{GS} = -3/18 \text{ V}$



**Switching times (typical), MOSFET**

$$t = f(I_D)$$

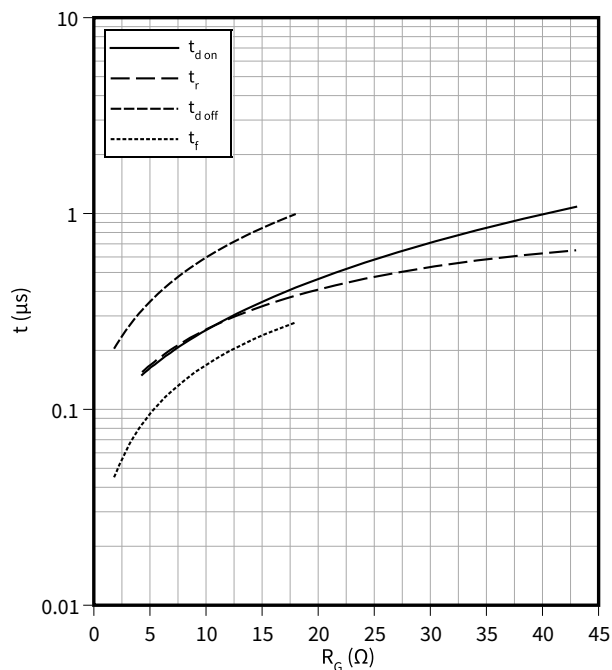
$R_{Goff} = 1.8 \text{ } \Omega$ ,  $R_{Gon} = 4.3 \text{ } \Omega$ ,  $V_{DD} = 600 \text{ V}$ ,  $T_{vj} = 175 \text{ } ^\circ\text{C}$ ,  $V_{GS} = -3/18 \text{ V}$



**Switching times (typical), MOSFET**

$$t = f(R_G)$$

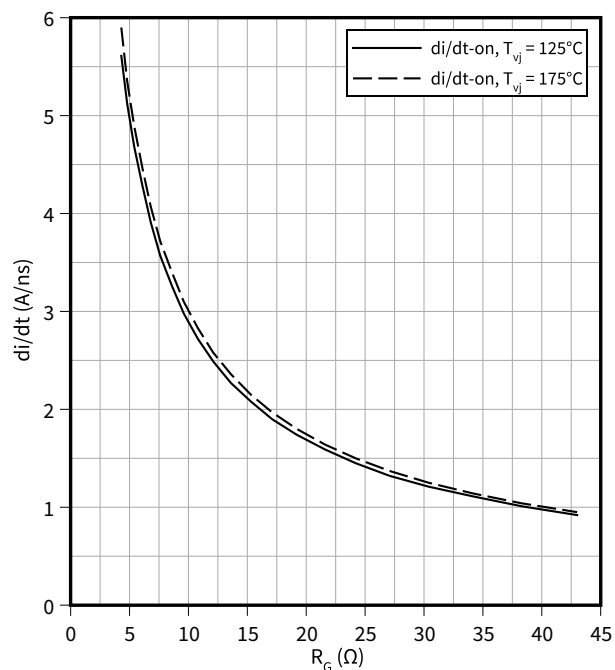
$V_{DD} = 600 \text{ V}$ ,  $I_D = 560 \text{ A}$ ,  $T_{vj} = 175 \text{ } ^\circ\text{C}$ ,  $V_{GS} = -3/18 \text{ V}$



**Current slope (typical), MOSFET**

$$di/dt = f(R_G)$$

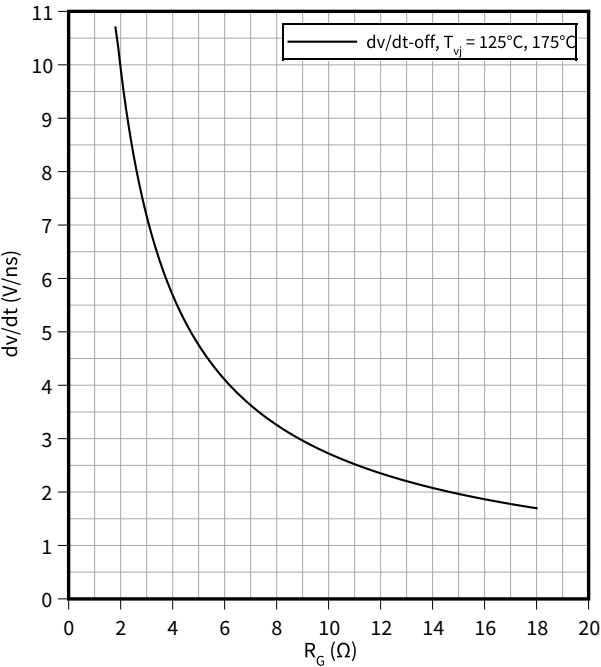
$V_{DD} = 600 \text{ V}$ ,  $I_D = 560 \text{ A}$ ,  $V_{GS} = -3/18 \text{ V}$



4 Characteristics diagrams

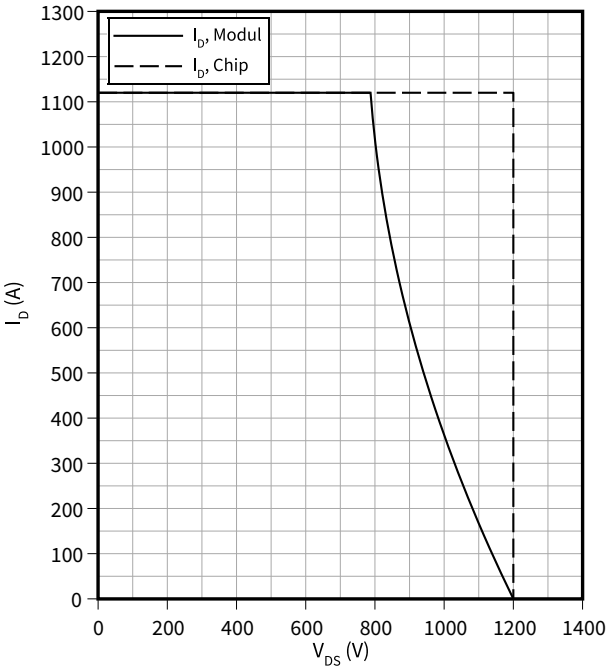
Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$   
 $V_{DD} = 600\text{ V}$ ,  $I_D = 560\text{ A}$ ,  $V_{GS} = -3/18\text{ V}$



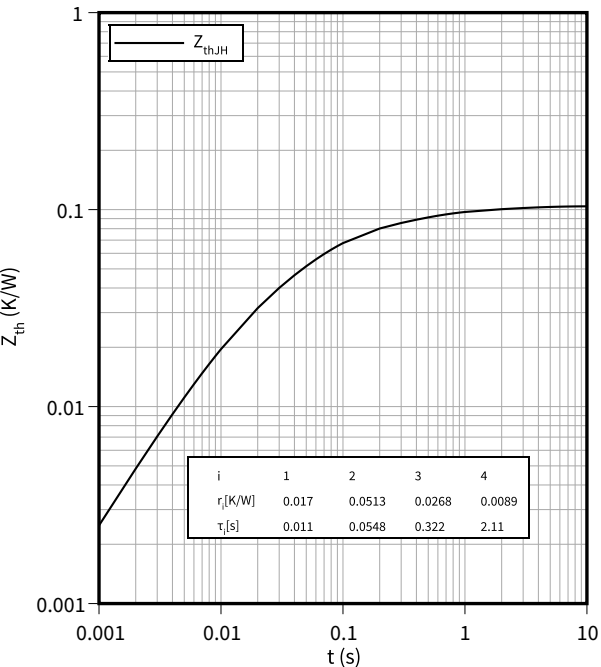
Reverse bias safe operating area (RBSOA), MOSFET

$I_D = f(V_{DS})$   
 $R_{Goff} = 1.8\text{ }\Omega$ ,  $T_{vj} = 175\text{ }^\circ\text{C}$ ,  $V_{GS} = -3/18\text{ V}$

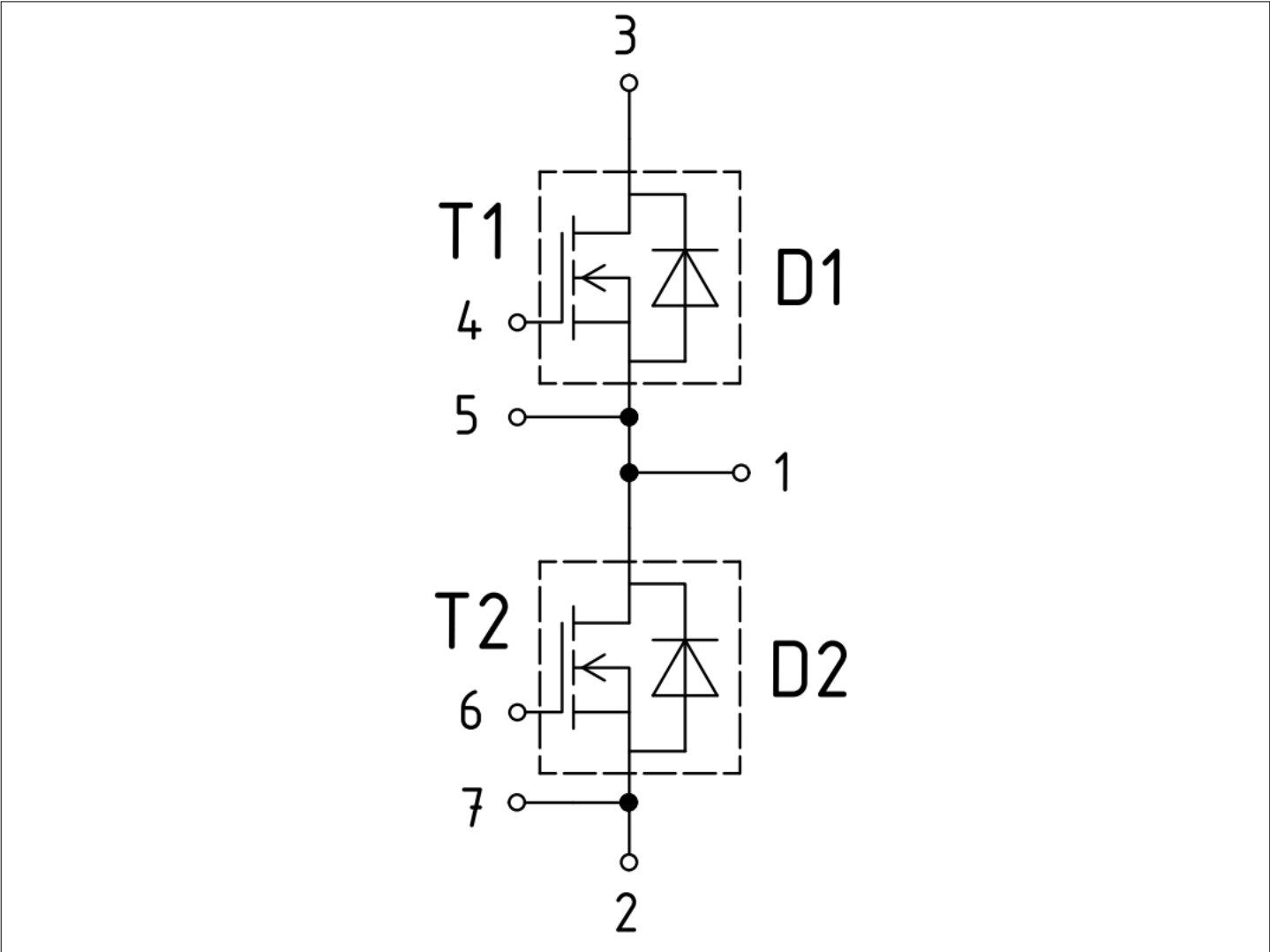


Transient thermal impedance, MOSFET

$Z_{th} = f(t)$

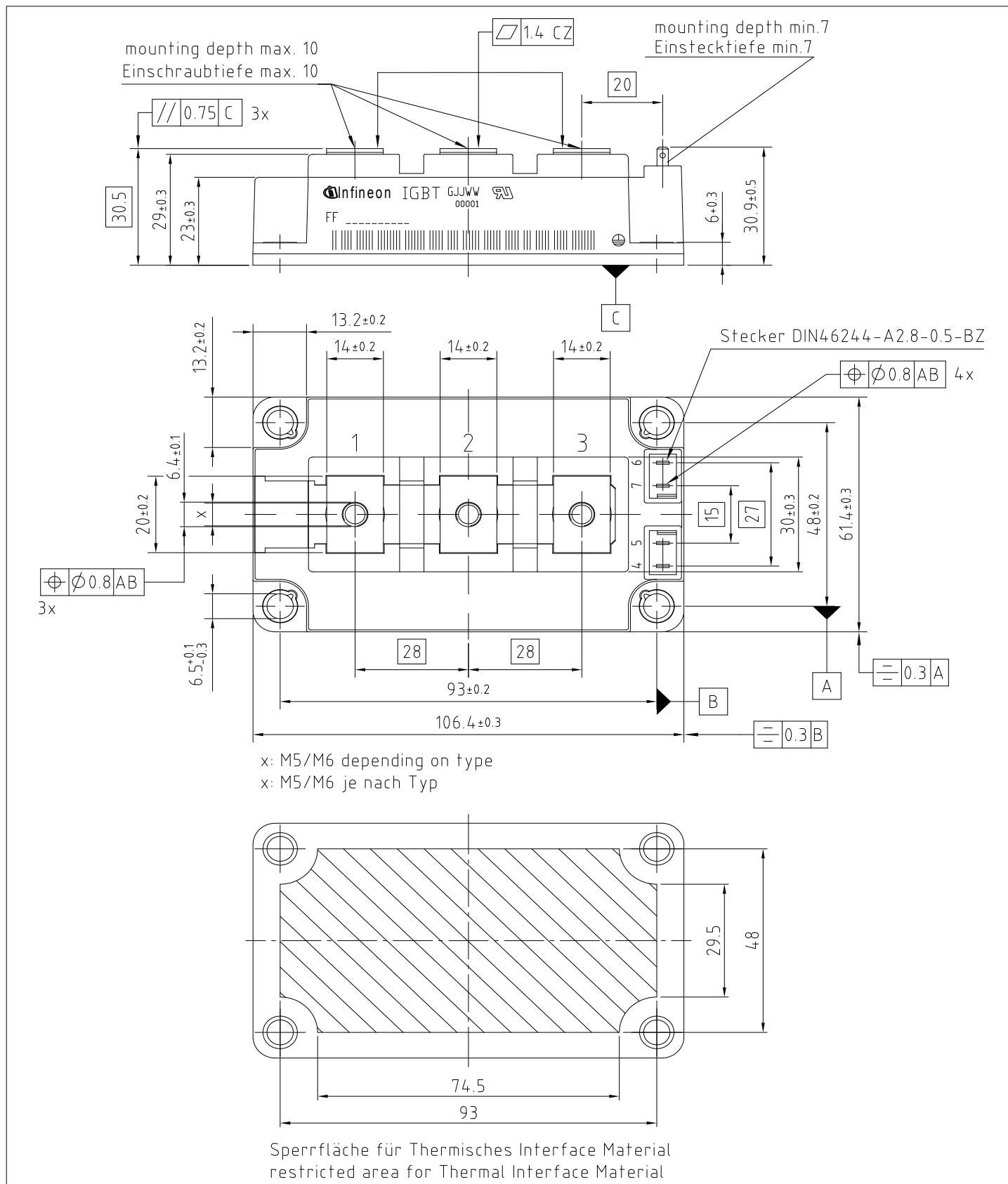


5      **Circuit diagram**



**Figure 1**

## 6 Package outlines



**Figure 2**

7 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	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	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	2023-01-18	Initial version
0.20	2023-02-21	Preliminary datasheet
0.30	2023-02-27	Preliminary datasheet

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