

Target datasheet

62 mm C-Series module with CoolSiC™ Trench MOSFET

Features

- Electrical features
 - $V_{DS} = 1200\text{ V}$
 - $I_{DN} = 280\text{ A} / I_{DRM} = 560\text{ A}$
 - High current density
 - Low switching losses
- Mechanical features
 - 4 kV AC 1 min insulation



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

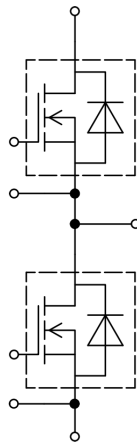


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1 Package

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	$R_{CC'+EE'}$	$T_C = 25 \text{ °C}$, per switch		0.475		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	3		6	Nm
Terminal connection torque	M	- Mounting according to valid application note	2.5		5	Nm
Weight	G			340		g

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}		280	A
Continuous DC drain current	I_{DDC}	$T_{vj} = 175 \text{ °C}$, $V_{GS} = 18 \text{ V}$ $T_C = 115 \text{ °C}$	190	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}	560	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
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	$R_{DS(on)}$	$I_D = 280\text{ A}$	$V_{GS} = 18\text{ V}, T_{vj} = 25\text{ }^{\circ}\text{C}$		2.94	4.44	mΩ
			$V_{GS} = 18\text{ V}, T_{vj} = 125\text{ }^{\circ}\text{C}$		4.76		
			$V_{GS} = 18\text{ V}, T_{vj} = 175\text{ }^{\circ}\text{C}$		6.32		
			$V_{GS} = 15\text{ V}, T_{vj} = 25\text{ }^{\circ}\text{C}$		3.54		
Gate threshold voltage	$V_{GS(th)}$	$I_D = 112\text{ mA}, V_{DS} = V_{GS}, T_{vj} = 25\text{ }^{\circ}\text{C}$, (tested after 1ms pulse at $V_{GS} = +20\text{ V}$)		3.5	4.3	5.1	V
Total gate charge	Q_G	$V_{DD} = 800\text{ V}, V_{GS} = -3/18\text{ V}$			0.8		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\text{ }^{\circ}\text{C}$			1.9		Ω
Input capacitance	C_{ISS}	$f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		24.2		nF
Output capacitance	C_{OSS}	$f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1.2		nF
Reverse transfer capacitance	C_{rss}	$f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		0.079		nF
C_{OSS} stored energy	E_{OSS}	$V_{DS} = 800\text{ V}, V_{GS} = -3/18\text{ V}, T_{vj} = 25\text{ }^{\circ}\text{C}$			473		μJ
Drain-source leakage current	I_{DSS}	$V_{DS} = 1200\text{ V}, V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		0.16	378	μA
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
Thermal resistance, junction to case	R_{thJC}	per MOSFET				0.168	K/W

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heat sink	R_{thCH}	per MOSFET, $\lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$		0.0680		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-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 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)

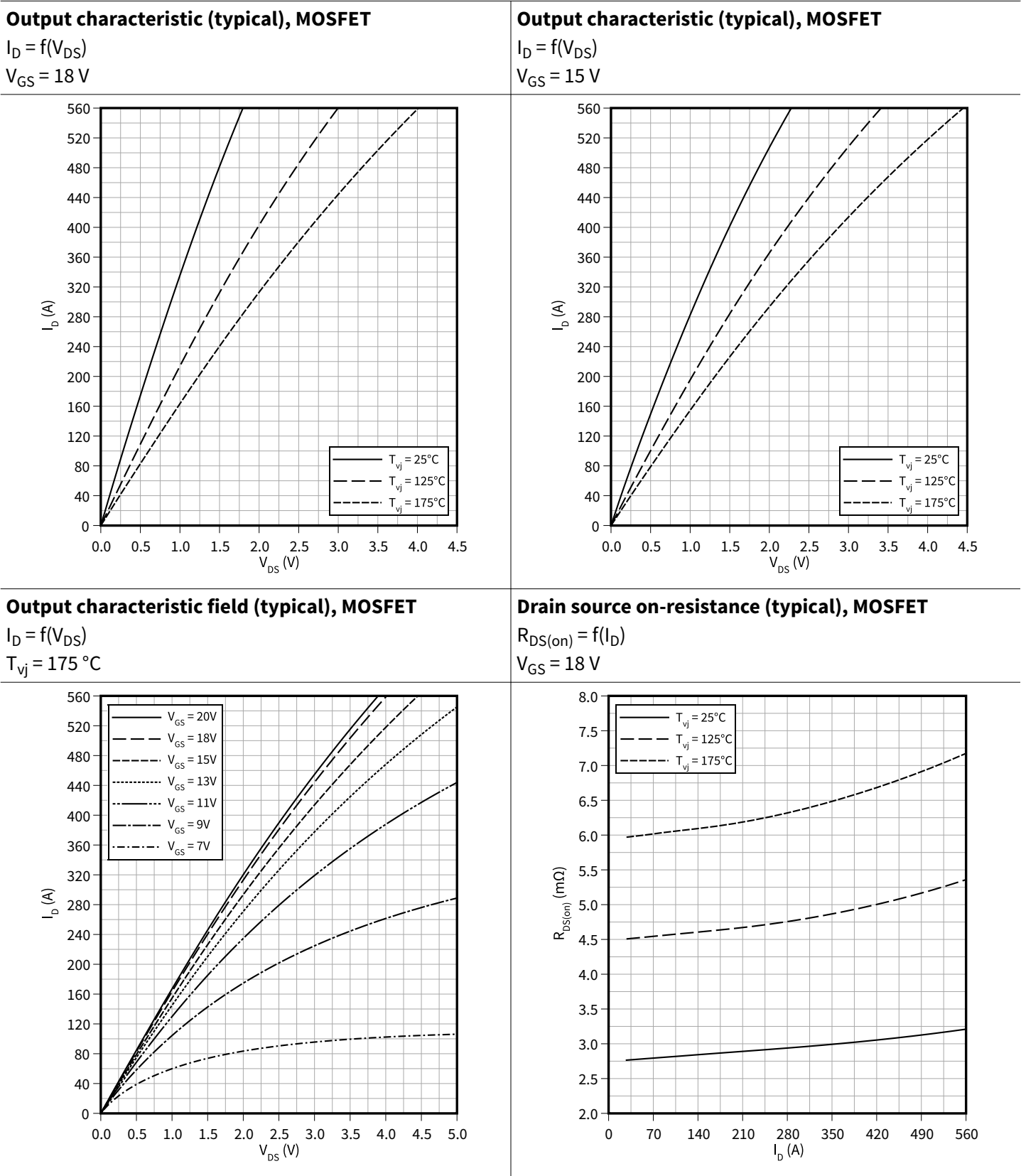
Table 6 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
DC body diode forward current	I_{SD}	$T_{vj} = 175^\circ\text{C}$, $V_{GS} = -3 \text{ V}$	$T_C = 115^\circ\text{C}$	90	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	$I_{SD} = 280 \text{ A}$, $V_{GS} = -3 \text{ V}$	$T_{vj} = 25^\circ\text{C}$		4.22	5.59	V
			$T_{vj} = 125^\circ\text{C}$		3.95		
			$T_{vj} = 175^\circ\text{C}$		3.85		

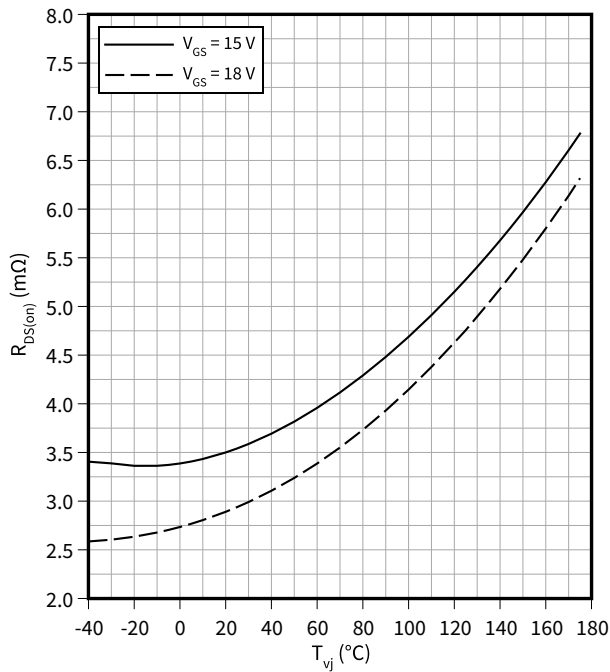
4 Characteristics diagrams



4 Characteristics diagrams

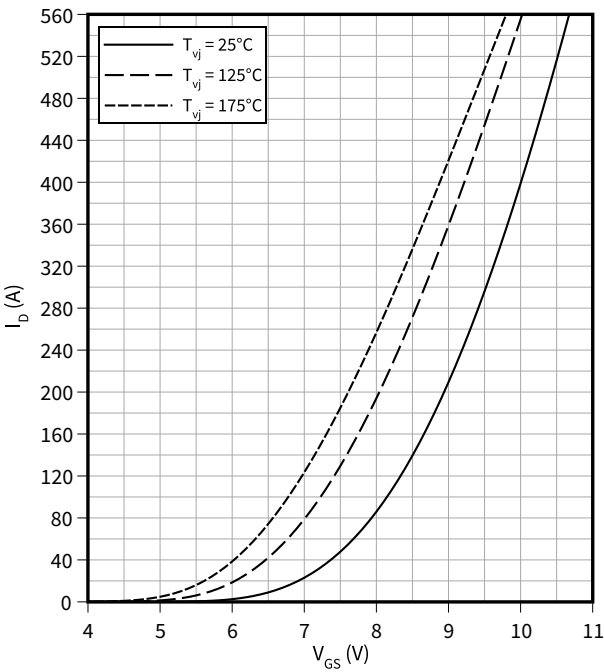
Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$
 $I_D = 280\text{ A}$



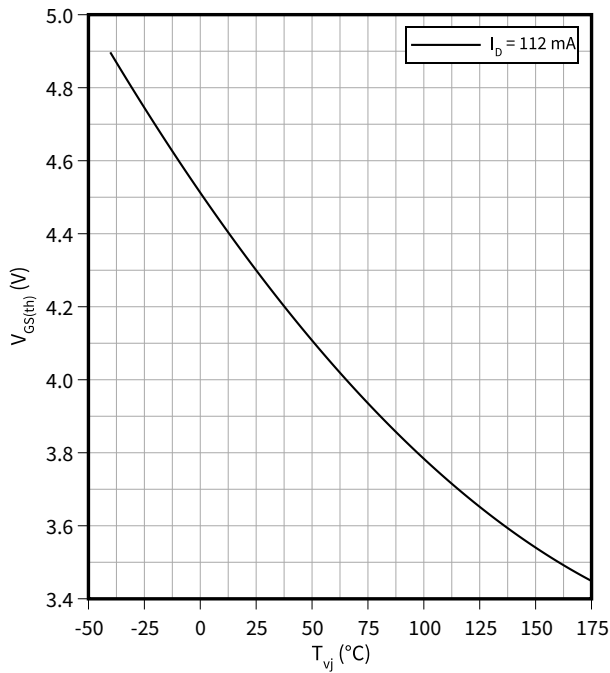
Transfer characteristic (typical), MOSFET

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



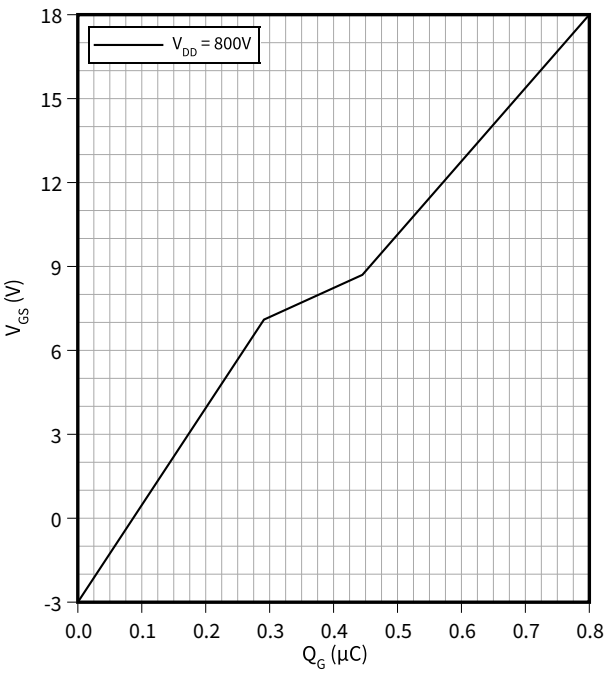
Gate-source threshold voltage (typical), MOSFET

$V_{GS(th)} = f(T_{vj})$
 $I_D = 112\text{ mA}$, $V_{GS} = V_{DS}$



Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$
 $I_D = 280\text{ A}$, $T_{vj} = 25^\circ\text{C}$

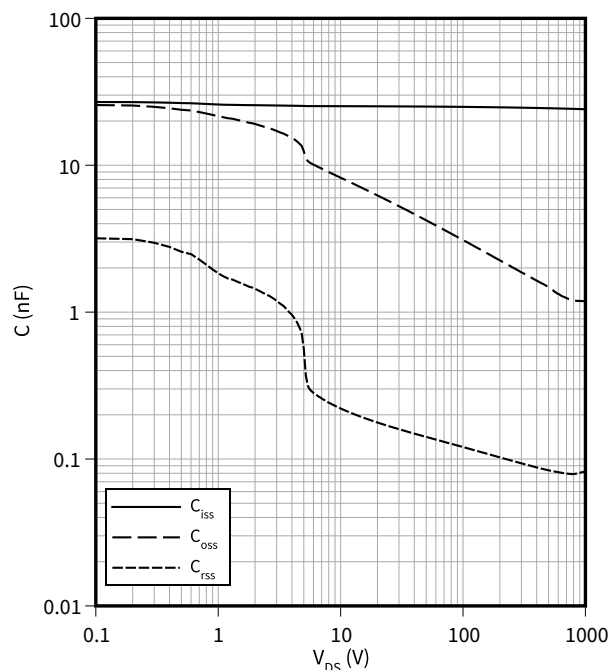


4 Characteristics diagrams

Capacity characteristic (typical), MOSFET

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

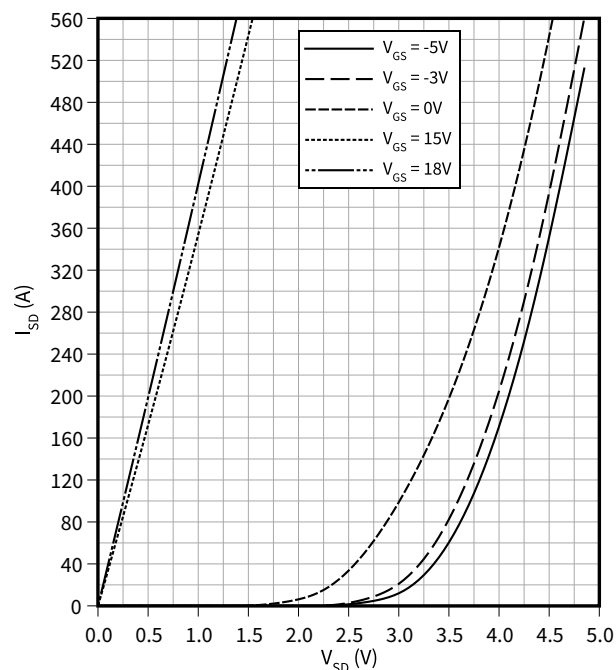
$f = 100 \text{ kHz}$, $T_{vj} = 25^\circ\text{C}$, $V_{GS} = 0 \text{ V}$



Forward characteristic body diode (typical), MOSFET

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

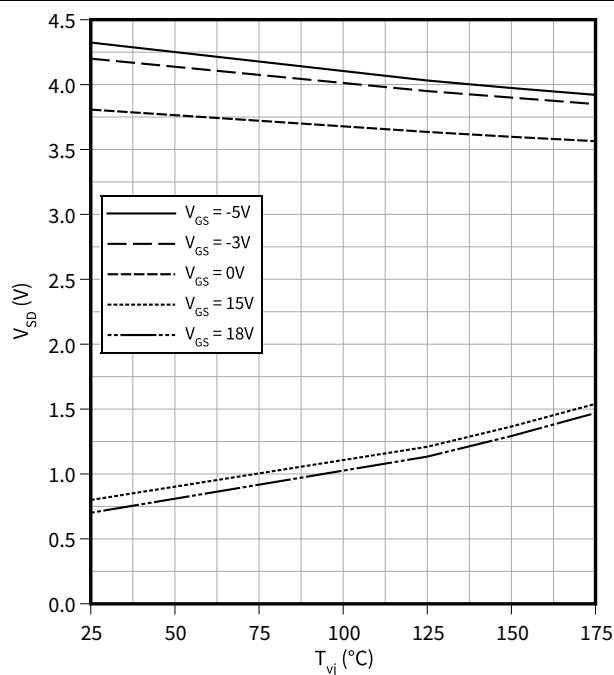
$T_{vj} = 25^\circ\text{C}$



Forward voltage of body diode (typical), MOSFET

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

$I_{SD} = 280 \text{ A}$



5 **Circuit diagram**

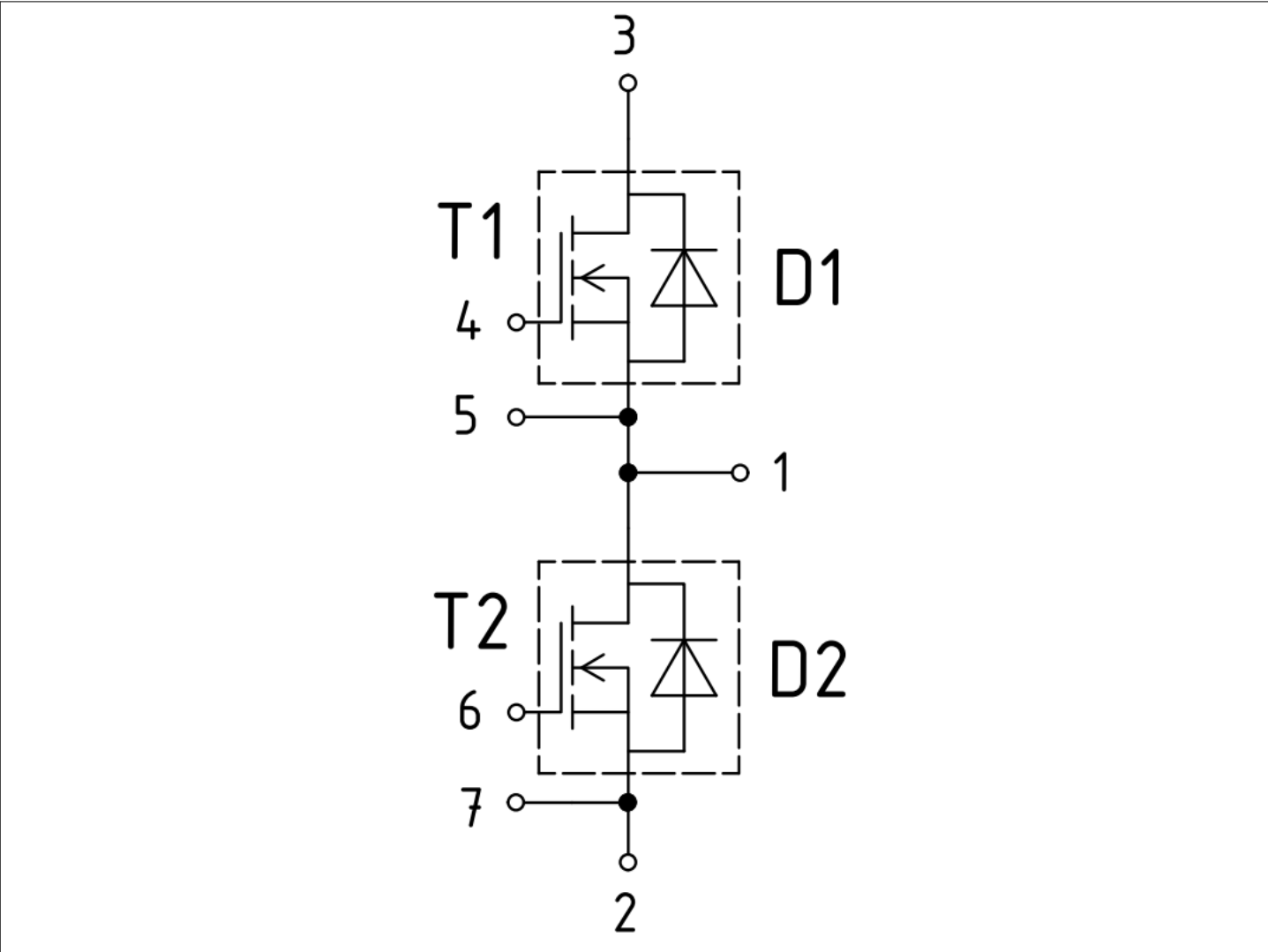


Figure 1

6 Package outlines

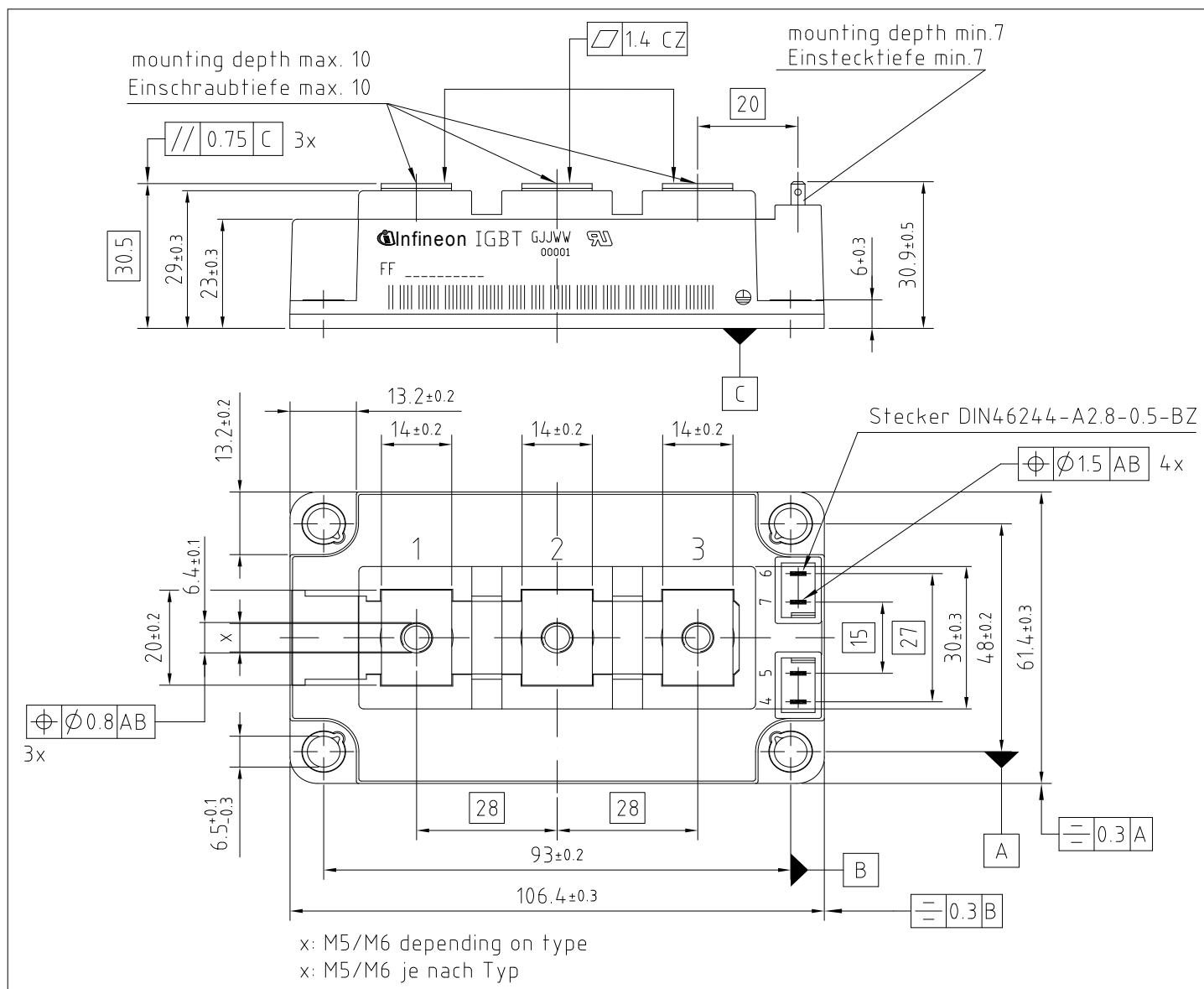


Figure 2

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	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	 7154914284655054991153071549142846550549911530		

Figure 3



Revision history

Revision history

Document revision	Date of release	Description of changes
0.10	2023-10-05	Initial version

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Edition 2023-10-05

Published by

Infineon Technologies AG
81726 Munich, Germany

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Document reference
IFX-ABI217-001

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