Final datasheet
62 mm C-Series module with CoolSiC™ Trench MOSFET

Features

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 560 A / I_{DRM} = 1120 A
  - Low switching losses
  - High current density
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - 4 kV AC 1 min insulation

Typical appearance

Potential applications

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

Product validation

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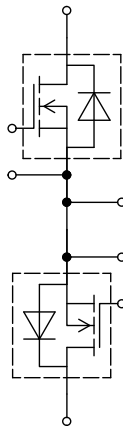
Description

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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	4.0	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	$d_{Creep\ nom}$	terminal to baseplate, nom.	29.0	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom.	23.0	mm
Clearance	$d_{Clear\ nom}$	terminal to baseplate, nom.	23.0	mm
Clearance	$d_{Clear\ nom}$	terminal to terminal, nom.	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 °C, per switch			0.465		mΩ
Storage temperature	T_{stg}			-40		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: *The electrical characterization was performed in NPC2 topology, which combines the modules FF1MR12KM1H and FF1MR12KM1H_S.*

It has to be considered, that the commutation in this configuration takes place between both modules

2 MOSFET, T1 / T2

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}			560	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_C = 115 °C	395	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		1120	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 = 560 A	V_{GS} = 18 V, T_{vj} = 25 °C		1.5	2.2	mΩ
			V_{GS} = 18 V, T_{vj} = 125 °C		2.4		
			V_{GS} = 18 V, T_{vj} = 175 °C		3.2		
			V_{GS} = 15 V, T_{vj} = 25 °C		1.8		
Gate threshold voltage	$V_{GS(th)}$	I_D = 224 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, T_{vj} = 25 °C			1.6		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.9		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		48.4		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		2.4		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.158		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			945		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °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}	$V_{DS} = 0$ V, $T_{vj} = 25$ °C	$V_{GS} = 20$ V			400	nA
Turn-on delay time (inductive load)	$t_{d\,on}$	$I_D = 560$ A, $R_{Gon} = 6.2$ Ω, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V, $t_{dead} = 2000$ ns, 0.1 V_{GS} to 0.1 I_D	$T_{vj} = 25$ °C		244		ns
			$T_{vj} = 125$ °C		218		
			$T_{vj} = 175$ °C		206		
Rise time (inductive load)	t_r	$I_D = 560$ A, $R_{Gon} = 6.2$ Ω, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V, $t_{dead} = 2000$ ns, 0.1 I_D to 0.9 I_D	$T_{vj} = 25$ °C		268		ns
			$T_{vj} = 125$ °C		202		
			$T_{vj} = 175$ °C		207		
Turn-off delay time (inductive load)	$t_{d\,off}$	$I_D = 560$ A, $R_{Goff} = 4.3$ Ω, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V, 0.9 V_{GS} to 0.9 I_D	$T_{vj} = 25$ °C		239		ns
			$T_{vj} = 125$ °C		273		
			$T_{vj} = 175$ °C		288		
Fall time (inductive load)	t_f	$I_D = 560$ A, $R_{Goff} = 4.3$ Ω, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V, 0.9 I_D to 0.1 I_D	$T_{vj} = 25$ °C		75		ns
			$T_{vj} = 125$ °C		76		
			$T_{vj} = 175$ °C		78		
Turn-on energy loss per pulse	E_{on}	$I_D = 560$ A, $V_{DD} = 600$ V, $L_\sigma = 31$ nH, $V_{GS} = -3/18$ V, $R_{Gon} = 6.2$ Ω, di/dt = 3.6 kA/µs ($T_{vj} = 175$ °C), $t_{dead} = 2000$ ns	$T_{vj} = 25$ °C		36.8		mJ
			$T_{vj} = 125$ °C		34		
			$T_{vj} = 175$ °C		34		
Turn-on energy loss per pulse, optimized	$E_{on,o}$	$I_D = 560$ A, $V_{DD} = 1200$ V, $L_\sigma = 31$ nH, $V_{GS} = -3/18$ V, $R_{Gon,o} = 1$ Ω, di/dt = 7.9 kA/µs ($T_{vj} = 175$ °C), $t_{dead} = 500$ ns	$T_{vj} = 25$ °C		6.1		mJ
			$T_{vj} = 125$ °C		5.9		
			$T_{vj} = 175$ °C		5.9		
Turn-off energy loss per pulse	E_{off}	$I_D = 560$ A, $V_{DD} = 600$ V, $L_\sigma = 31$ nH, $V_{GS} = -3/18$ V, $R_{Goff} = 4.3$ Ω, dv/dt = 6.4 kV/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		30.8		mJ
			$T_{vj} = 125$ °C		33		
			$T_{vj} = 175$ °C		33.7		
Thermal resistance, junction to case	R_{thJC}	per MOSFET				0.092	K/W
Thermal resistance, case to heat sink	R_{thCH}	per MOSFET, $\lambda_{grease} = 1$ W/(m*K)			0.039		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 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, T1 / T2)

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_C = 115 °C	180	A

Table 7   **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 560 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.22	5.59	V
			T_{vj} = 125 °C		3.95		
			T_{vj} = 175 °C		3.85		
Peak reverse recovery current	I_{rrm}	I_{SD} = 560 A, di_s/dt = 3.6 kA/μs, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 2000 ns	T_{vj} = 25 °C		126		A
			T_{vj} = 125 °C		191		
			T_{vj} = 175 °C		231		
Recovered charge	Q_{rr}	I_{SD} = 560 A, di_s/dt = 3.6 kA/μs, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 2000 ns	T_{vj} = 25 °C		10.2		μC
			T_{vj} = 125 °C		13.9		
			T_{vj} = 175 °C		15.9		
Reverse recovery energy	E_{rec}	I_{SD} = 560 A, di_s/dt = 3.6 kA/μs (T_{vj} = 175 °C), V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 2000 ns	T_{vj} = 25 °C		0.7		mJ
			T_{vj} = 125 °C		1.8		
			T_{vj} = 175 °C		2.7		
Reverse recovery energy, optimized	$E_{rec,o}$	I_{SD} = 560 A, di_s/dt = 7.9 kA/μs (T_{vj} = 175 °C), V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 500 ns	T_{vj} = 25 °C		3.5		mJ
			T_{vj} = 125 °C		5.8		
			T_{vj} = 175 °C		8.3		

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4　　Characteristics diagrams

Output characteristic (typical), MOSFET, T1 / T2
$I_D = f(V_{DS})$
$V_{GS} = 18\ V$
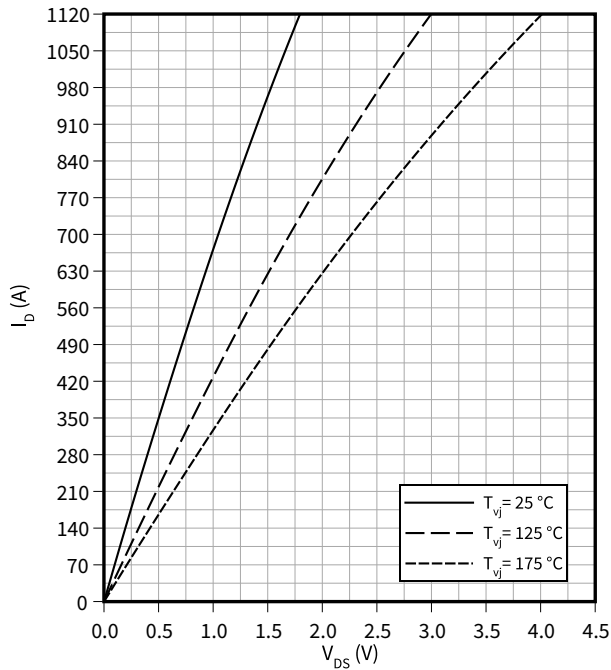
Output characteristic (typical), MOSFET, T1 / T2
$I_D = f(V_{DS})$
$V_{GS} = 15\ V$
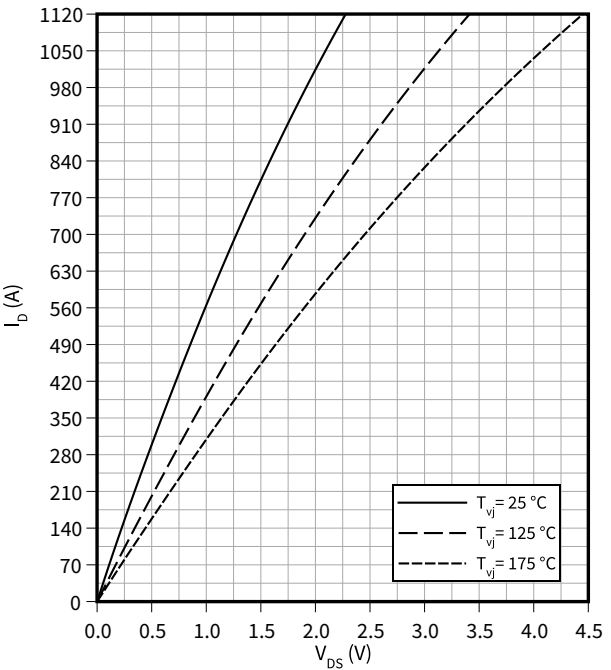
Output characteristic field (typical), MOSFET, T1 / T2
$I_D = f(V_{DS})$
$T_{vj} = 175\ °C$
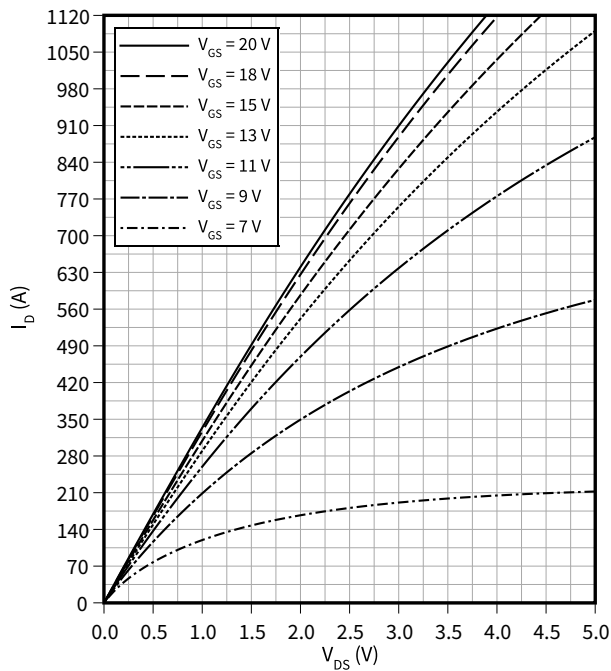
Drain source on-resistance (typical), MOSFET, T1 / T2
$R_{DS(on)} = f(I_D)$
$V_{GS} = 18\ V$

Drain source on-resistance (typical), MOSFET, T1 / T2

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

$I_D = 560$ A
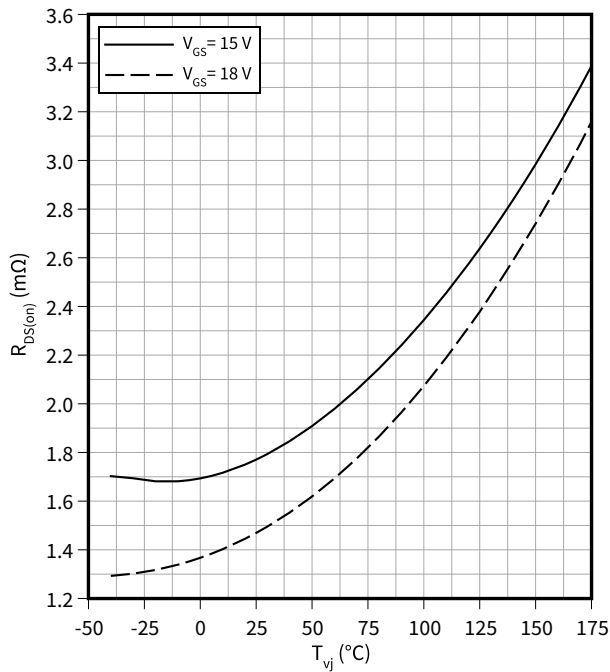
Transfer characteristic (typical), MOSFET, T1 / T2

$I_D = f(V_{GS})$

$V_{DS} = 20$ V
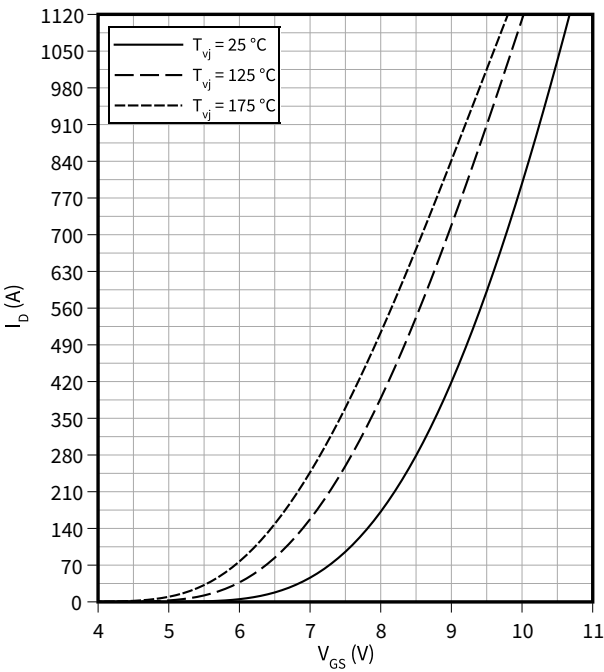
Gate-source threshold voltage (typical), MOSFET, T1 / T2

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

$V_{GS} = V_{DS}$
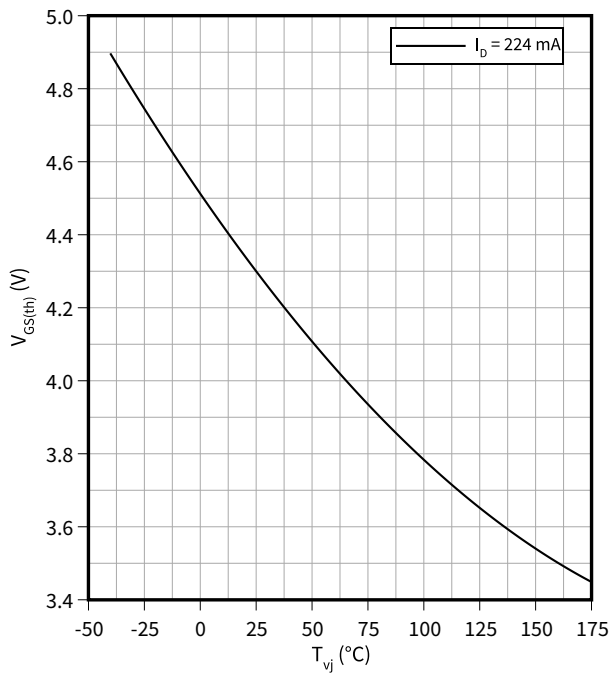
Gate charge characteristic (typical), MOSFET, T1 / T2

$V_{GS} = f(Q_G)$

$I_D = 560$ A, $T_{vj} = 25$ °C

Capacity characteristic (typical), MOSFET, T1 / T2

$C = f(V_{DS})$

$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GS} = 0$ V
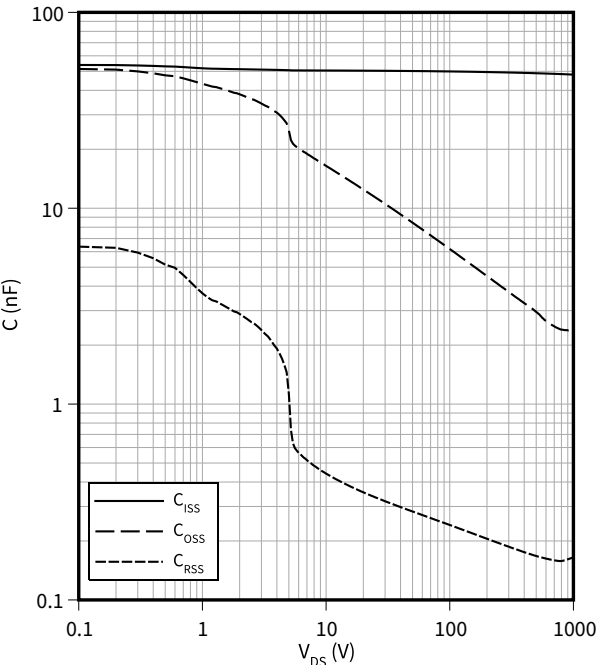
Switching times (typical), MOSFET, T1 / T2

$t = f(I_D)$

$R_{Gon} = 6.2$ Ω, $V_{DD} = 600$ V, $R_{Gon,o} = 1$ Ω, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V
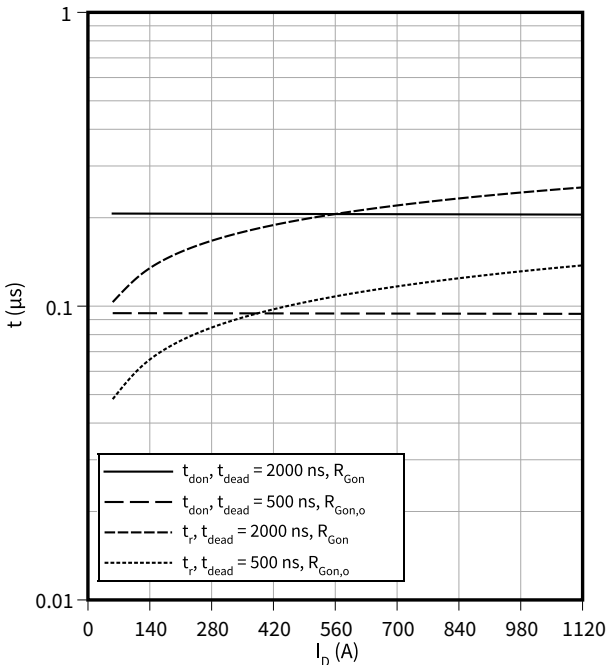
Switching times (typical), MOSFET, T1 / T2

$t = f(R_G)$

$V_{DD} = 600$ V, $t_{dead} = 2000$ ns, $I_D = 560$ A, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V
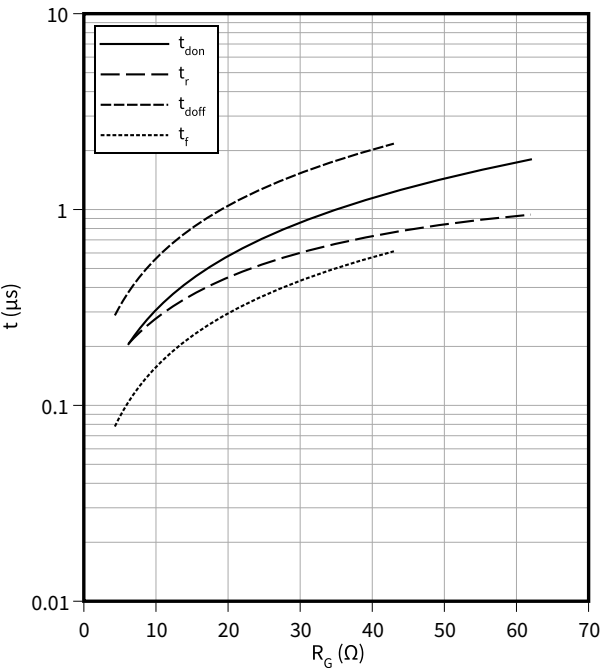
Switching times (typical), MOSFET, T1 / T2

$t = f(I_D)$

$R_{Goff} = 4.3$ Ω, $V_{DD} = 600$ V, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V

Current slope (typical), MOSFET, T1 / T2

$di/dt = f(R_G)$

$V_{DD} = 600$ V, $t_{dead} = 2000$ ns, $I_D = 560$ A, $V_{GS} = -3/18$ V
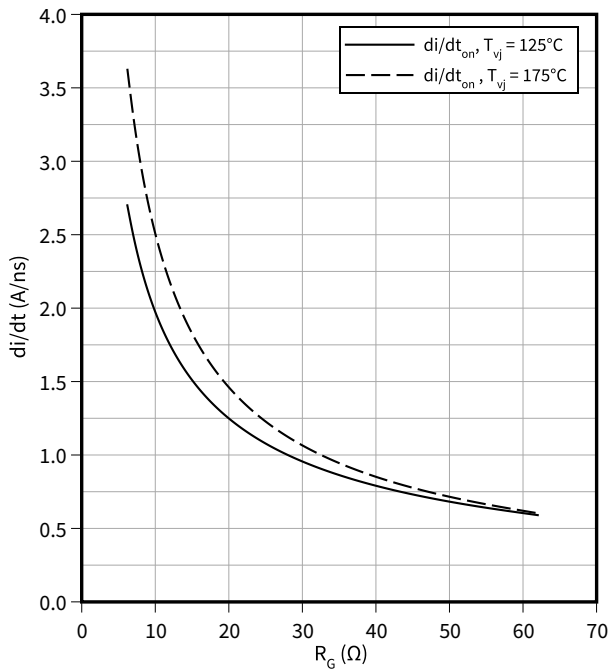
Voltage slope (typical), MOSFET, T1 / T2

$dv/dt = f(R_G)$

$V_{DD} = 600$ V, $I_D = 560$ A, $V_{GS} = -3/18$ V
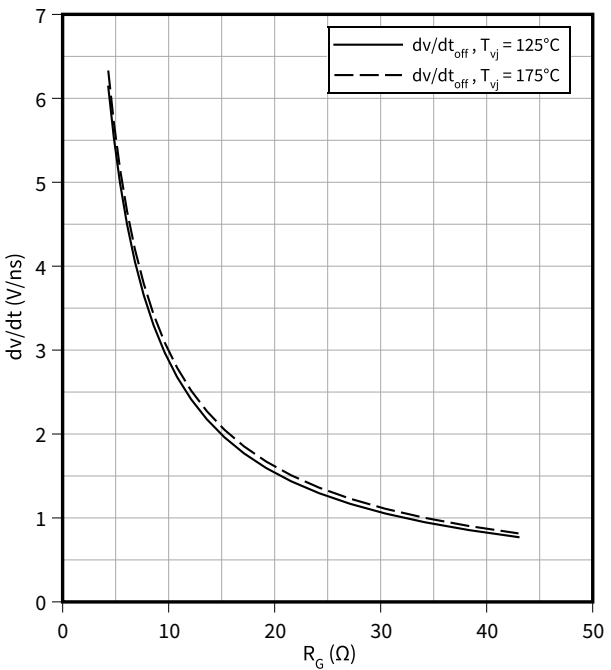
Switching losses (typical), MOSFET, T1 / T2

$E_{on} = f(I_D)$

$R_{Goff} = 4.3$ Ω, $R_{Gon} = 6.2$ Ω, $V_{DD} = 600$ V, $R_{Gon,o} = 1$ Ω, $V_{GS} = -3/18$ V
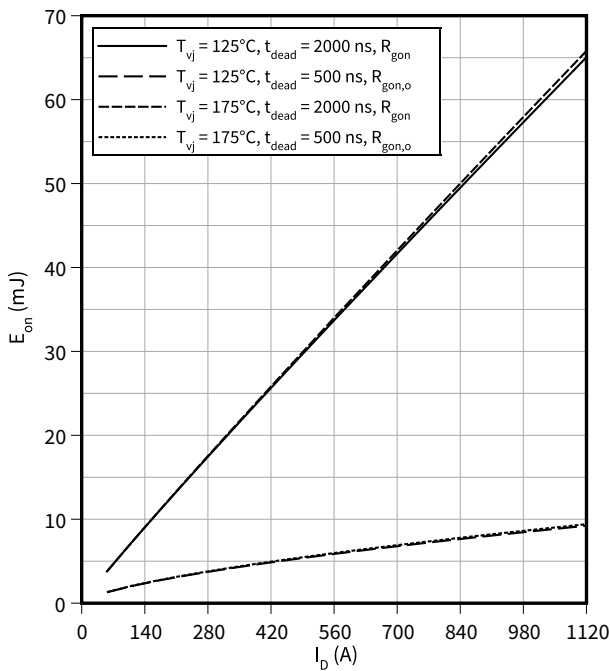
Switching losses (typical), MOSFET, T1 / T2

$E = f(R_G)$

$V_{DD} = 600$ V, $t_{dead} = 2000$ ns, $I_D = 560$ A, $V_{GS} = -3/18$ V

Switching losses (typical), MOSFET, T1 / T2

$E_{off} = f(I_D)$

R_{Goff} = 4.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V
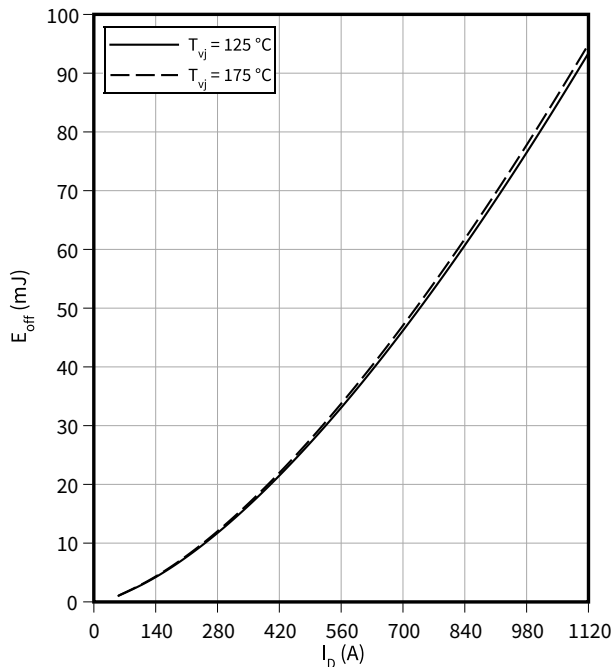
Switching losses (typical), MOSFET, T1 / T2

$E_{on} = f(V_{GS(off)})$

R_{Goff} = 4.3 Ω, V_{DD} = 600 V, R_{Gon} = 6.2 Ω, $V_{GS(on)}$ = 18 V, I_D = 560 A, $R_{Gon,o}$ = 1 Ω, T_{vj} = 175 °C
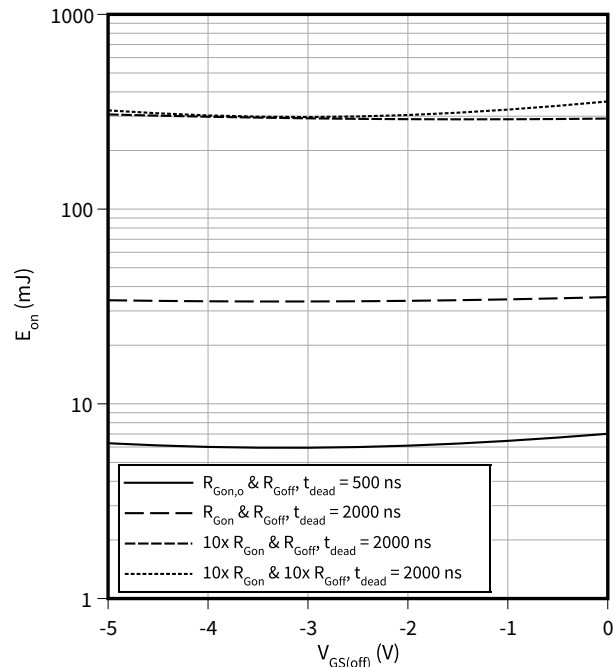
Switching losses (typical), MOSFET, T1 / T2

$E_{on} = f(t_{dead})$

R_{Gon} = 6.2 Ω, I_D = 560 A, V_{DD} = 600 V, V_{GS} = -3/18 V

**Reverse bias safe operating area (RBSOA), MOSFET, T1 / T2**

$I_D = f(V_{DS})$

R_{Goff} = 4.3 Ω, T_{vj} = 175 °C, V_{GS} = -3/18 V

Transient thermal impedance, MOSFET, T1 / T2

$Z_{th} = f(t)$

i	1	2	3	4
r_i[K/W]	0.0069	0.0268	0.0482	0.0101
τ_i[s]	7.0E-4	0.0168	0.07	1.09
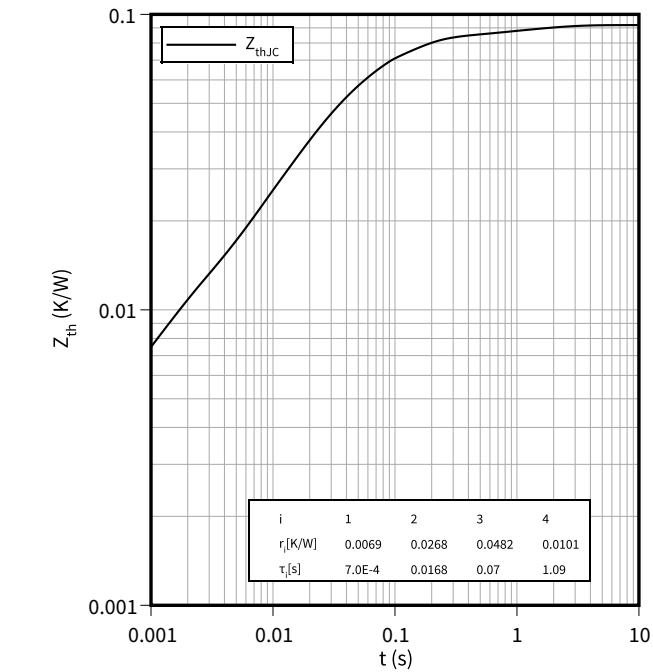
Forward characteristic body diode (typical), MOSFET, T1 / T2

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

$T_{vj} = 25\ °C$
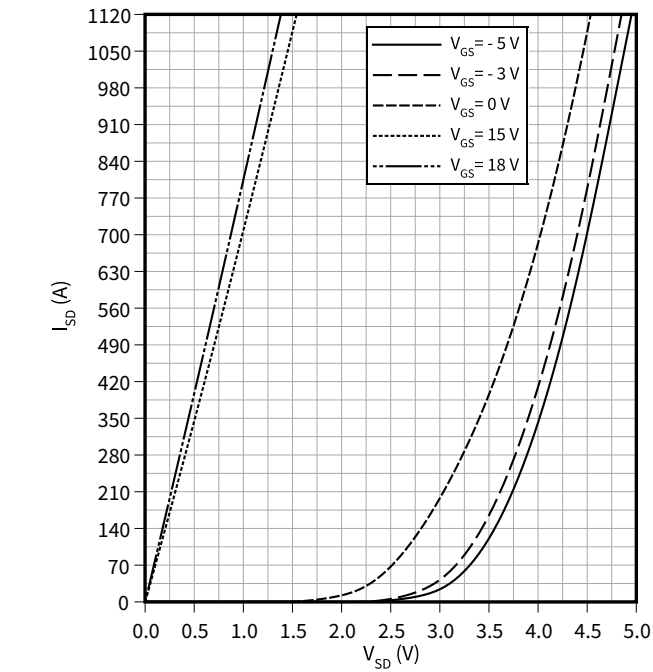
Forward voltage of body diode (typical), MOSFET, T1 / T2

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

$I_{SD} = 560\ A$
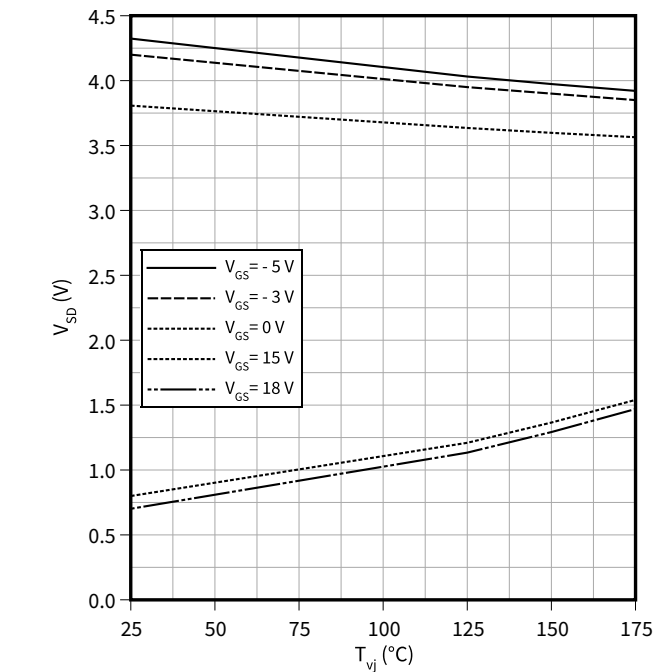
Switching losses body diode (typical), MOSFET, T1 / T2

$E_{rec} = f(R_G)$

$t_{dead} = 2000\ ns,\ V_{DD} = 600\ V,\ I_{SD} = 560\ A$
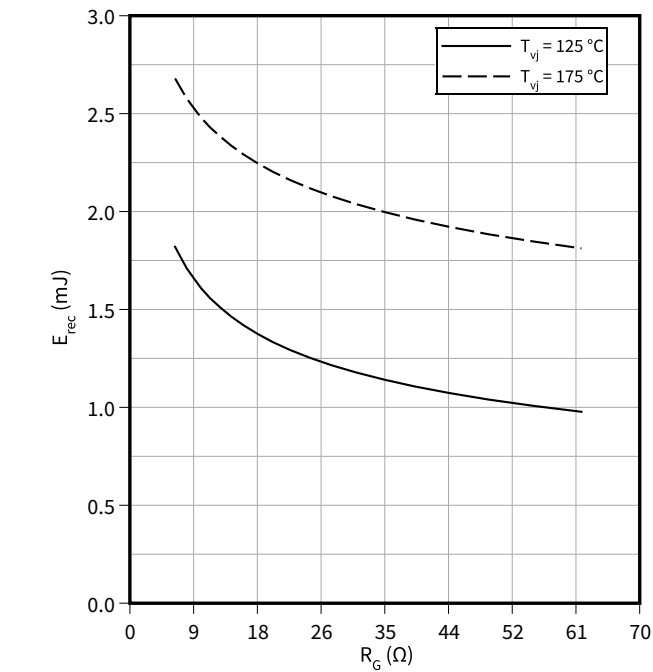
Switching losses body diode (typical), MOSFET, T1 / T2

$E_{rec} = f(I_{SD})$

$R_{Gon} = 6.2\ \Omega$, $R_{Gon,o} = 1\ \Omega$, $V_{DD} = 600\ V$
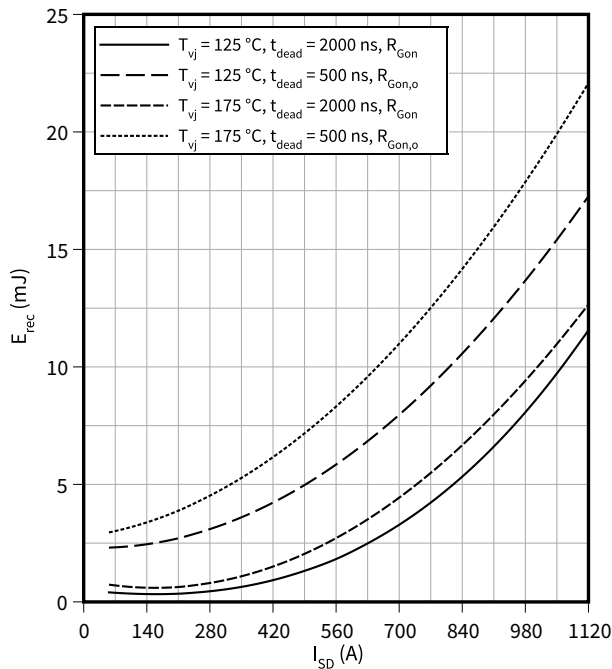
Switching losses body diode (typical), MOSFET, T1 / T2

$E_{rec} = f(V_{GS(off)})$

$R_{Goff} = 4.3\ \Omega$, $R_{Gon} = 6.2\ \Omega$, $V_{GS(on)} = 18\ V$, $I_{SD} = 560\ A$, $R_{Gon,o} = 1\ \Omega$, $V_{DD} = 600\ V$, $T_{vj} = 175\ °C$
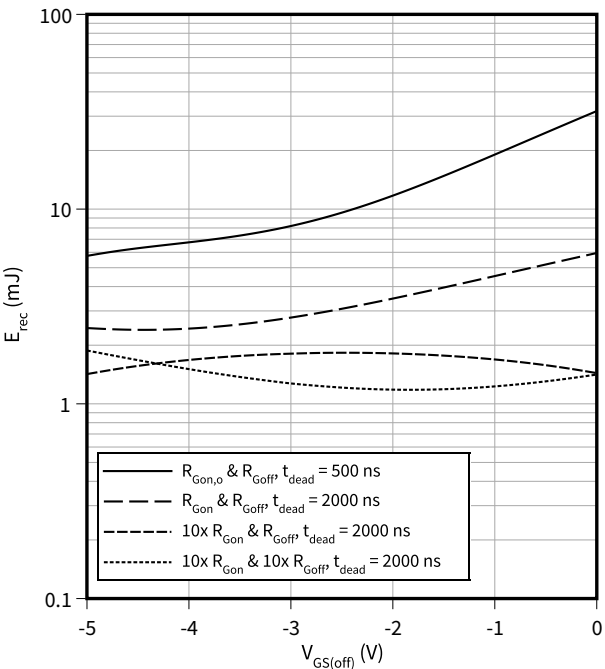
Switching losses body diode (typical), MOSFET, T1 / T2

$E_{rec} = f(t_{dead})$

$R_{Gon} = 6.2\ \Omega$, $I_D = 560\ A$, $V_{DD} = 600\ V$, $V_{GS} = -3/18\ V$
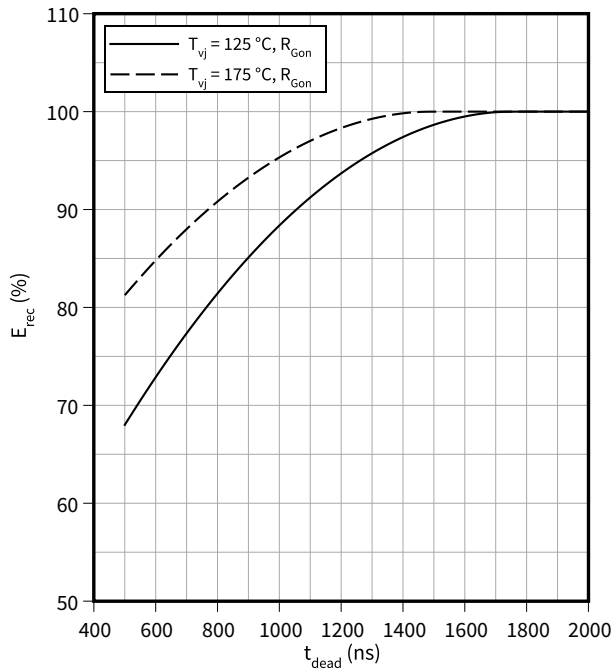
5 Circuit diagram
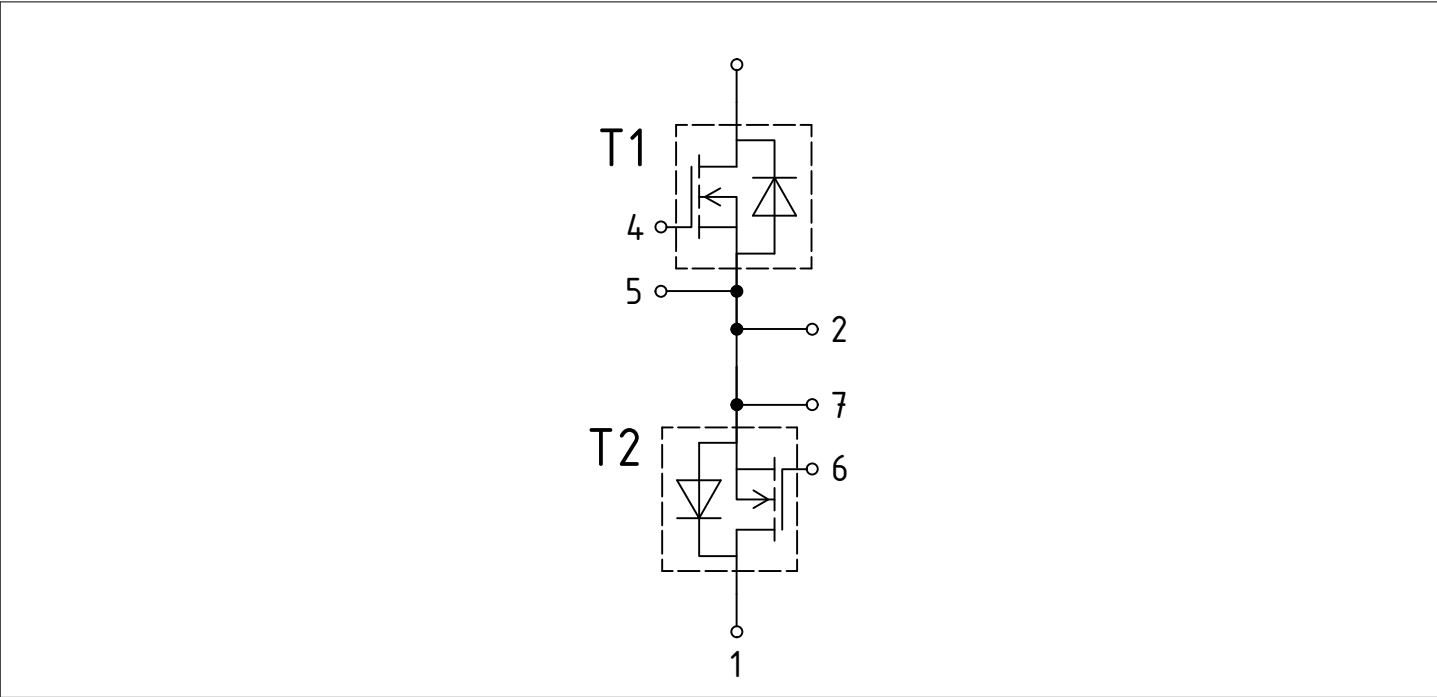
Figure 1

6 Package outlines
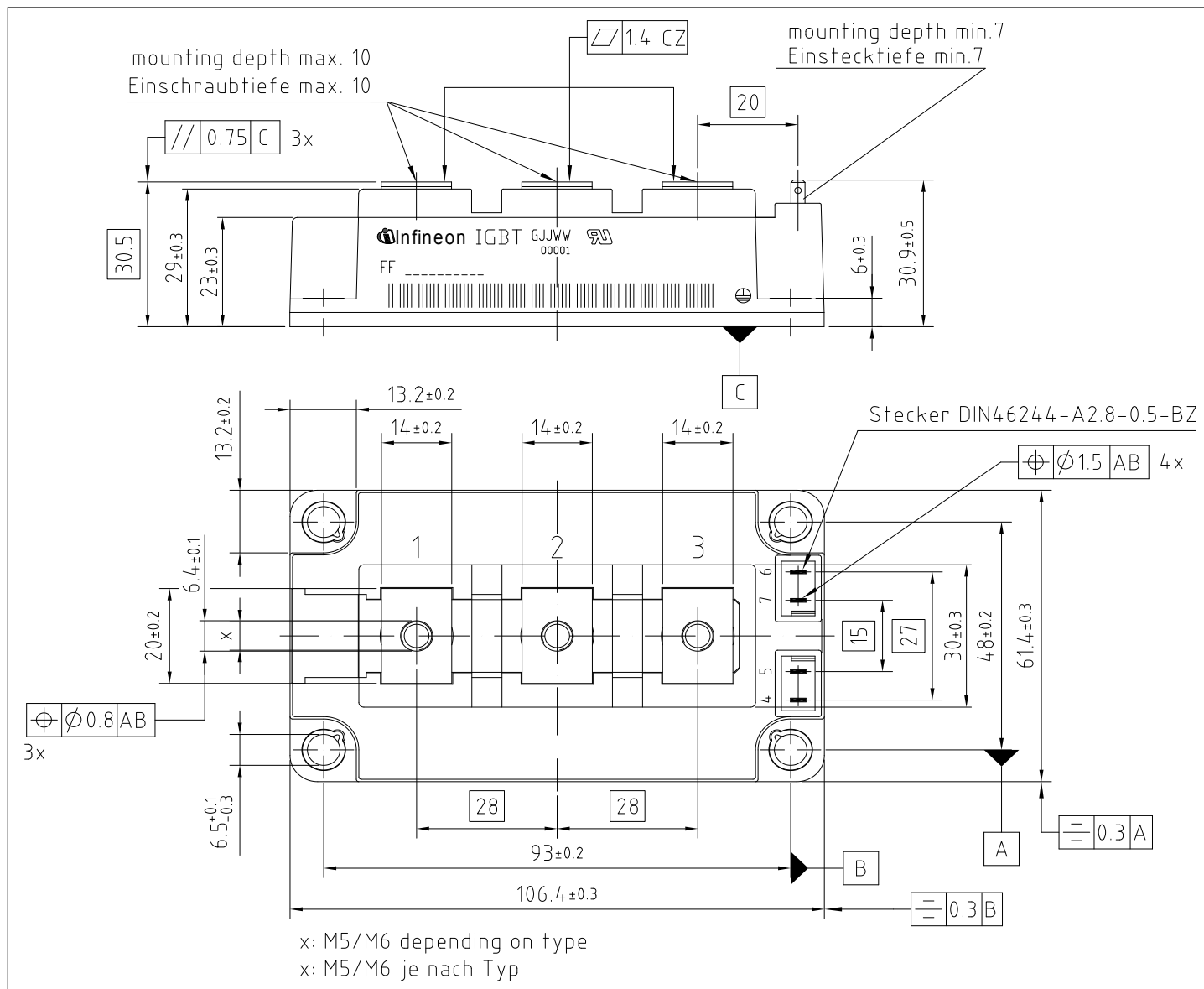
Figure 2

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* 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	2025-01-22	Target datasheet
1.00	2025-06-30	Final datasheet

Trademarks

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