

CoolSiC™  
440V CoolSiC™ G2 MOSFET with extended  $V_{DS}$

Features

- Ideal for high frequency switching and synchronous rectification
- Commutation robust fast body diode with low  $Q_{fr}$
- Low  $R_{DS(on)}$  dependency on temperature
- Benchmark gate threshold voltage,  $V_{GS(th)} = 4.5\text{ V}$
- Recommended gate driving voltage 0 V to 18 V
- .XT interconnection technology for best-in-class thermal performance
- 100% avalanche tested
- Fully tested in production to guarantee extended  $V_{(BR)DSS}$

Potential applications

- Application specific MOSFET designed to power AI
- High Power SMPS for server, datacenter and telecom rectifiers

Product validation

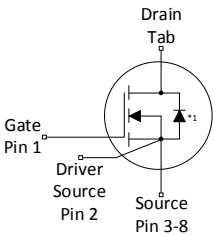
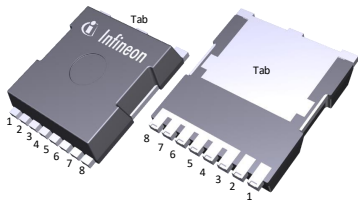
Qualified for industrial applications according to the relevant tests of JEDEC JESD47, JESD22 and J-STD-020.

Table 1 Key performance parameters

Parameter	Value	Unit
$V_{DS}$	440	V
$V_{DS,tr}$	455	V
$R_{DS(on),typ}$	11.3	mΩ
$I_D$	144	A
$Q_{oss}$	138	nC
$E_{oss}$	9.9	μJ
$Q_G$	85	nC

Part number	Package	Marking	Related links
IMT44R011M2H	PG-HSOF-8	44R011M2	-

TOLL



\*1: Internal body diode

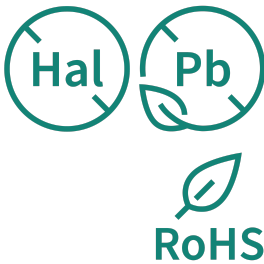




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## 1 Maximum ratings

at  $T_A=25\text{ °C}$ , unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$	-	-	144	A	$V_{GS}=18\text{ V}$ , $T_C=25\text{ °C}$
				102		$V_{GS}=18\text{ V}$ , $T_C=100\text{ °C}$
				13.4		$V_{GS}=18\text{ V}$ , $T_A=25\text{ °C}$ , $R_{THJA}=40\text{ °C/W}$ <sup>2)</sup>
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	432	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	220	mJ	$I_D=37.1\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Avalanche energy, repetitive	$E_{AR}$			1.1		
Gate source voltage (static)	$V_{GS,DC}$	-7	-	23	V	-
Gate source voltage (transient)	$V_{GS,AC}$	-10	-	25	V	$t_{pulse}\leq 500\text{ ns}$ , duty cycle $\leq 1\%$
Power dissipation	$P_{tot}$	-	-	429	W	$T_C=25\text{ °C}$
				3.8		$T_A=25\text{ °C}$ , $R_{THJA}=40\text{ °C/W}$ <sup>2)</sup>
Storage temperature	$T_{stg}$	-55	-	150	°C	-
Operating junction temperature	$T_j$			175		

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

<sup>3)</sup> See Diagram 3 for more detailed information.

<sup>4)</sup> See Diagram 19 for more detailed information.

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	0.35	°C/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>5)</sup>	$R_{thJA}$			40		

<sup>5)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

## 3 Operating range

**Table 4 Operating range**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Recommended turn-on voltage	$V_{GS(on)}$	-	18	-	V	-
Recommended turn-off voltage	$V_{GS(off)}$		0			

## 4 Electrical characteristics

at  $T_j=25\text{ }^{\circ}\text{C}$ , unless otherwise specified

**Table 5 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	440	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1.33\text{ mA}$
Transient drain-source breakdown voltage <sup>6)</sup>	$V_{(BR)DSS,tr}$	455	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=13.3\text{ mA}$ , $t_{pulse}\leq 10\text{ ms}$ , duty cycle $\leq 50\%$
Gate threshold voltage <sup>7)</sup>	$V_{GS(th)}$	3.5	4.5	5.6	V	$V_{DS}=V_{GS}$ , $I_D=13.3\text{ mA}$
Zero gate voltage drain current	$I_{DSS}$	-	1	75	$\mu\text{A}$	$V_{DS}=400\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ }^{\circ}\text{C}$
			2	-		$V_{DS}=400\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=175\text{ }^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$	-	1	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	11.3	14.4	m $\Omega$	$V_{GS}=18\text{ V}$ , $I_D=37.1\text{ A}$ , $T_j=25\text{ }^{\circ}\text{C}$
			16.3	-		$V_{GS}=18\text{ V}$ , $I_D=37.1\text{ A}$ , $T_j=175\text{ }^{\circ}\text{C}$
			13.7	-		$V_{GS}=15\text{ V}$ , $I_D=37.1\text{ A}$ , $T_j=25\text{ }^{\circ}\text{C}$
Gate resistance	$R_G$	-	2.3	3.5	$\Omega$	-

<sup>6)</sup> Guaranteed by design, rated for transient startup overvoltages to comply with IPC-9592B derating guidelines.

<sup>7)</sup> Tested after 1ms pulse at  $V_{GS} = +20\text{ V}$ .

**Table 6 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	2900	3770	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=200\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$		410	-		
Reverse transfer capacitance	$C_{rss}$		33	-		
Effective output capacitance, energy related <sup>8)</sup>	$C_{o(er)}$	-	494	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=0\ldots 200\text{ V}$
Effective output capacitance, time related <sup>9)</sup>	$C_{o(tr)}$	-	690	-	pF	$I_D=\text{constant}$ , $V_{GS}=0\text{ V}$ , $V_{DS}=0\ldots 200\text{ V}$
Turn-on delay time	$t_{d(on)}$	-	15.8	-	ns	$V_{DD}=200\text{ V}$ , $V_{GS}=0\ldots 18\text{ V}$ , $I_D=37.1\text{ A}$ , $R_{G,ext}=1.8\text{ }\Omega$
Rise time	$t_r$		18.3			
Turn-off delay time	$t_{d(off)}$	-	29.8	-	ns	$V_{DD}=200\text{ V}$ , $V_{GS}=18\ldots 0\text{ V}$ , $I_D=37.1\text{ A}$ , $R_{G,ext}=1.8\text{ }\Omega$
Fall time	$t_f$		9.3			

<sup>8)</sup>  $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 200 V.

<sup>9)</sup>  $C_{o(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 200 V.

**Table 7 Gate Charge Characteristics** <sup>10)</sup>

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	23	-	nC	$V_{DD}=200\text{ V}$ , $I_D=37.1\text{ A}$ , $V_{GS}=0\text{ to }18\text{ V}$
Gate to drain charge	$Q_{gd}$		17.5			
Gate charge total	$Q_g$		85			
Gate charge total, sync. FET	$Q_{g(sync)}$	-	79	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }18\text{ V}$
Output charge	$Q_{oss}$	-	138	-	nC	$V_{DS}=200\text{ V}$ , $V_{GS}=0\text{ V}$
Output Energy	$E_{oss}$		9.9		μJ	

<sup>10)</sup> As per JEP192, Guidelines for Gate Charge ( $Q_g$ ) Test Method for SiC MOSFET.

**Table 8 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	67	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	432	A	$T_C=25\text{ °C}$ , $t_{pulse} \leq 250\text{ ns}$
Diode forward voltage	$V_{SD}$	-	3.5	4.3	V	$V_{GS}=0\text{ V}$ , $I_S=37.1\text{ A}$ , $T_j=25\text{ °C}$
MOSFET forward recovery time	$t_{fr}$	-	18.2	-	ns	$V_R=200\text{ V}$ , $I_S=37.1\text{ A}$ , $di_S/dt=1000\text{ A}/\mu\text{s}$
			12.8			$V_R=200\text{ V}$ , $I_S=37.1\text{ A}$ , $di_S/dt=4000\text{ A}/\mu\text{s}$
MOSFET forward recovery charge <sup>11)</sup>	$Q_{fr}$	-	86	-	nC	$V_R=200\text{ V}$ , $I_S=37.1\text{ A}$ , $di_S/dt=1000\text{ A}/\mu\text{s}$
			220			$V_R=200\text{ V}$ , $I_S=37.1\text{ A}$ , $di_S/dt=4000\text{ A}/\mu\text{s}$

<sup>11)</sup>  $Q_{fr}$  includes  $Q_{oss}$ . Refer to Table 10 for test setup.

## 5 Electrical characteristics diagrams

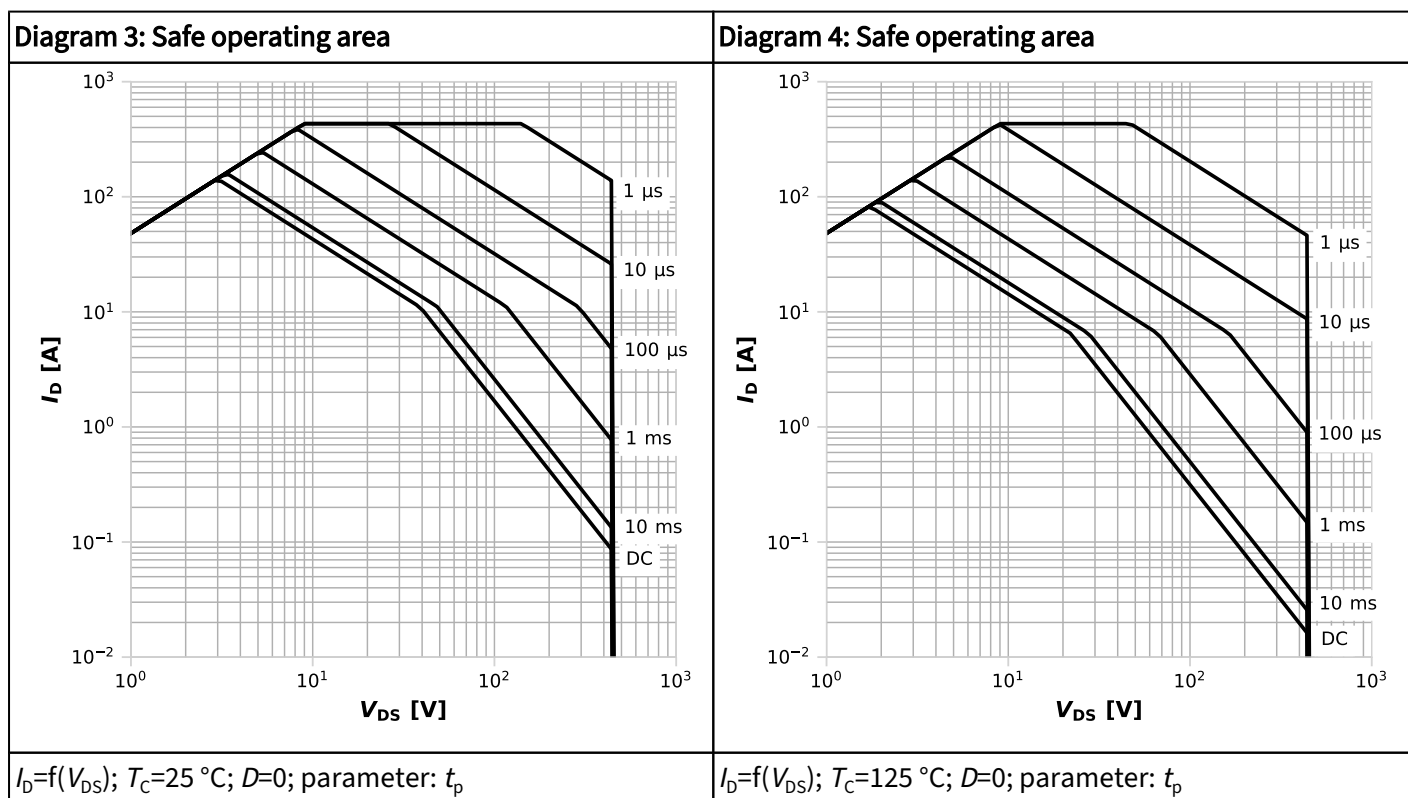
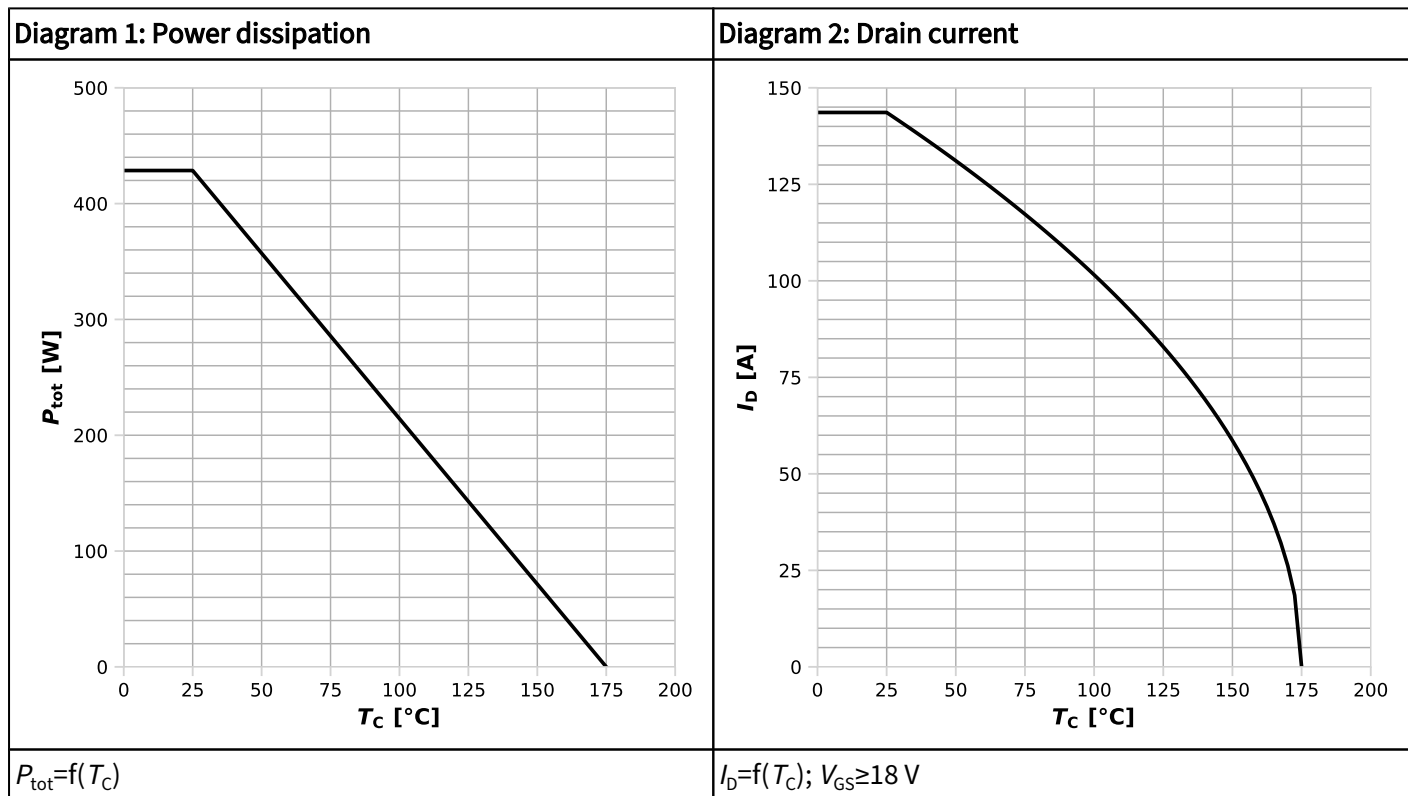
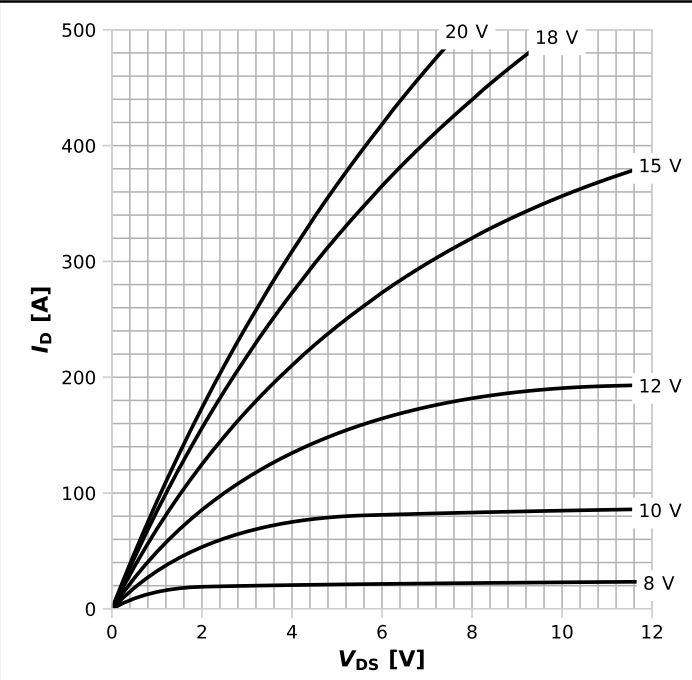
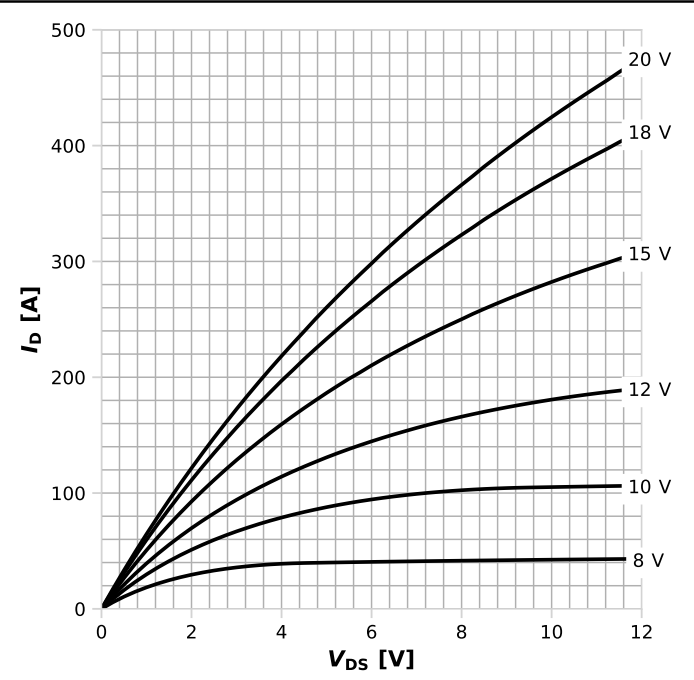


Diagram 5: Typ. output characteristics



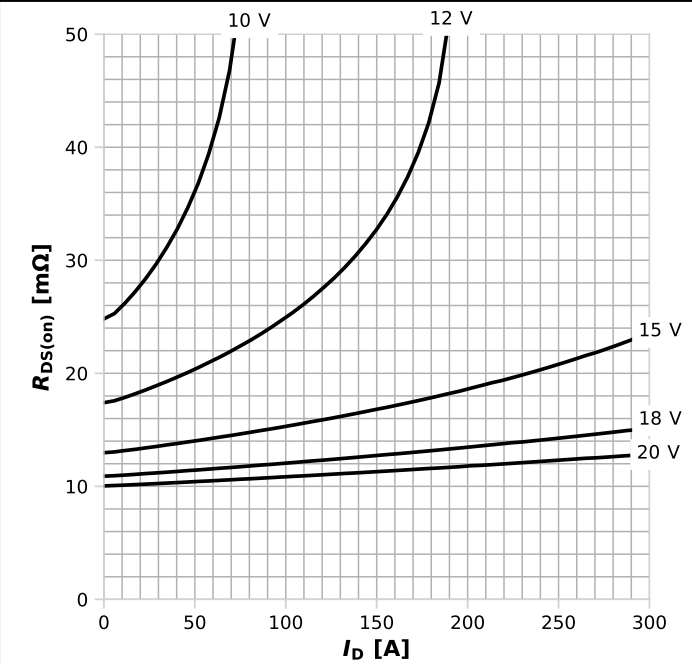
$I_D = f(V_{DS})$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. output characteristics



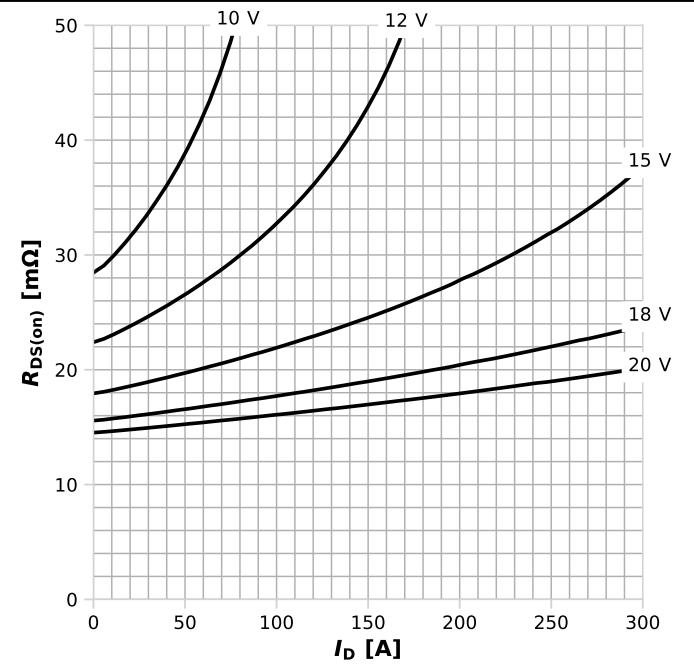
$I_D = f(V_{DS})$ ,  $T_j = 175\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. drain-source on resistance



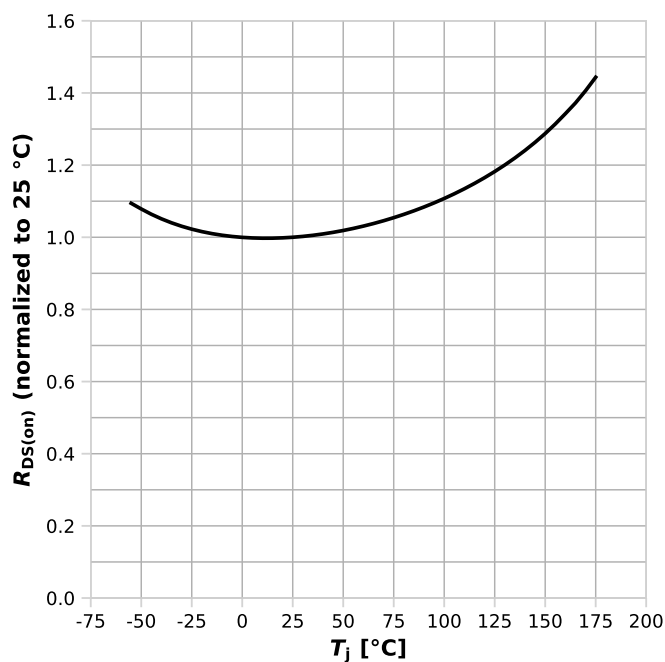
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 8: Typ. drain-source on resistance

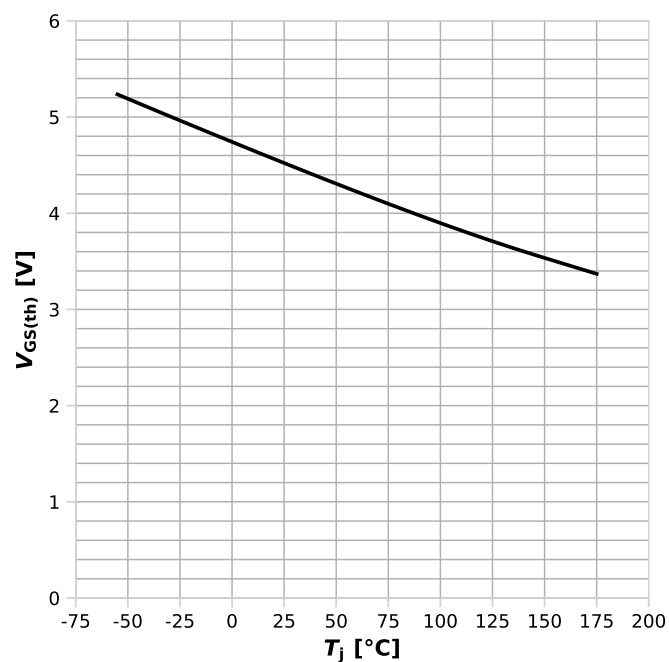


$R_{DS(on)} = f(I_D)$ ,  $T_j = 175\text{ °C}$ ; parameter:  $V_{GS}$

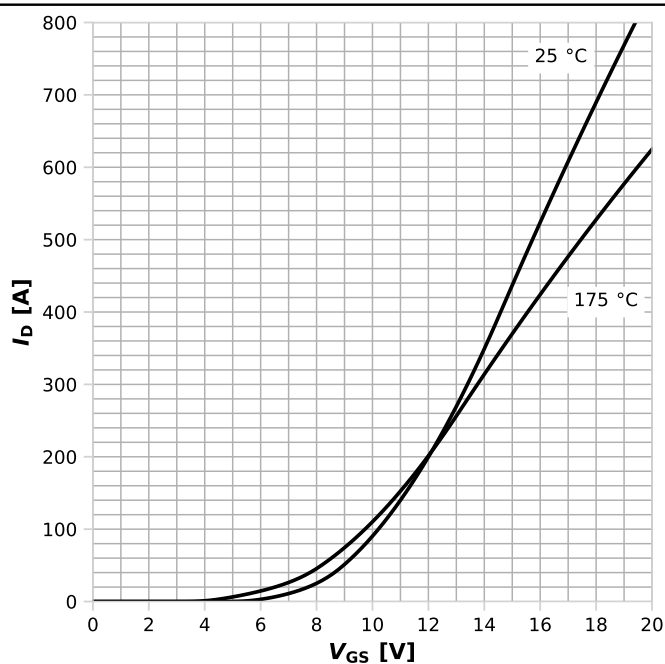


**Diagram 9: Normalized drain-source on resistance**


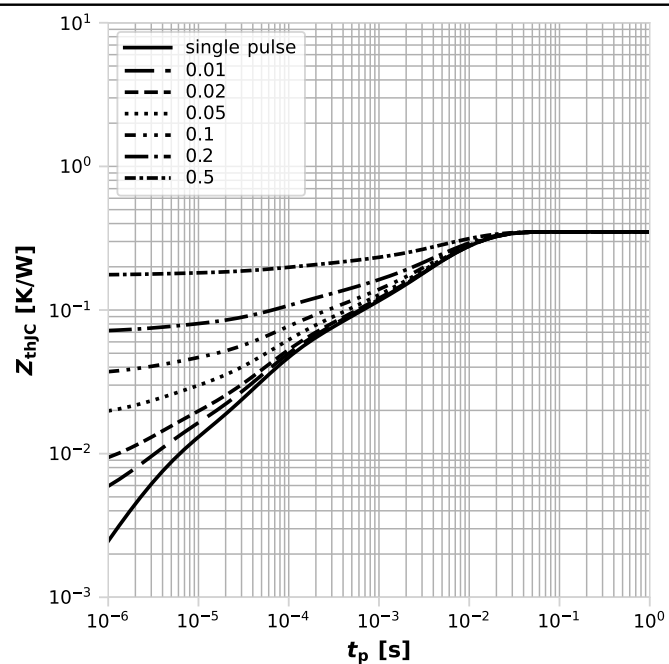
$$R_{DS(on)} = f(T_j), I_D = 37.1 \text{ A}, V_{GS} = 18 \text{ V}$$

**Diagram 10: Typ. gate threshold voltage**


$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}, I_D = 13.3 \text{ mA}$$

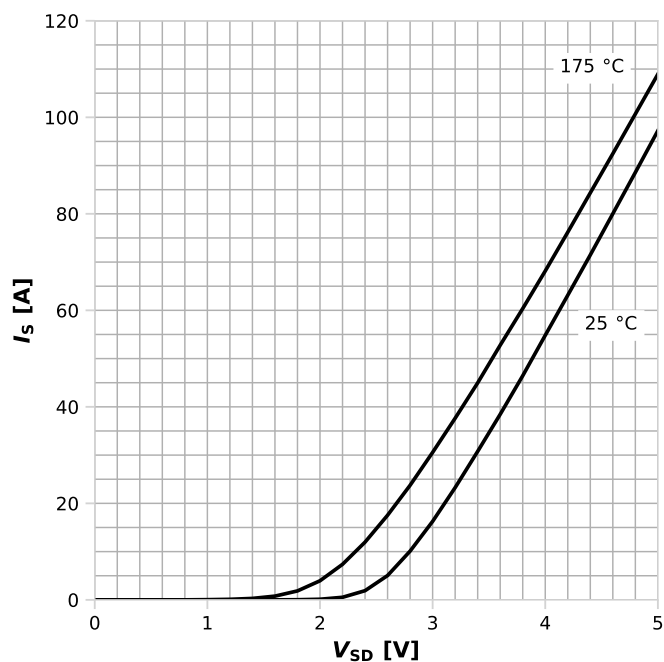
**Diagram 11: Typ. transfer characteristics**


$$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{ parameter: } T_j$$

**Diagram 12: Max. transient thermal impedance**


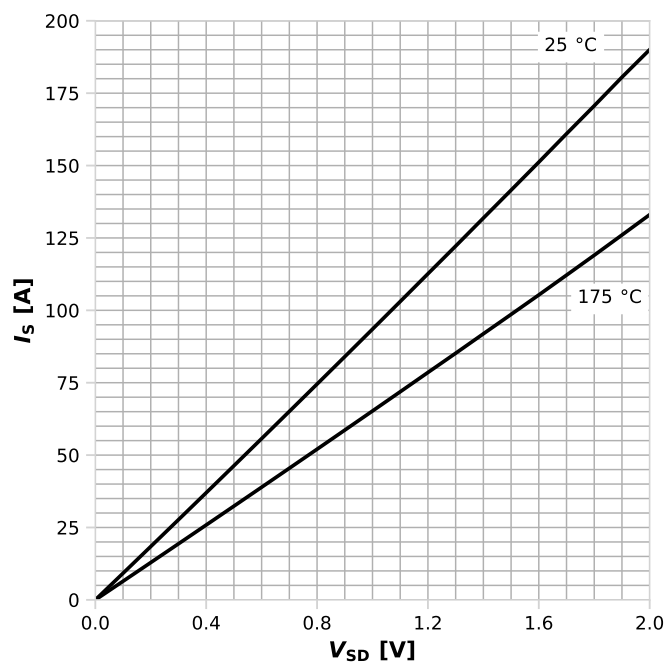
$$Z_{thJC} = f(t_p); \text{ parameter: } D = t_p / T$$

**Diagram 13: Reverse output characteristics**



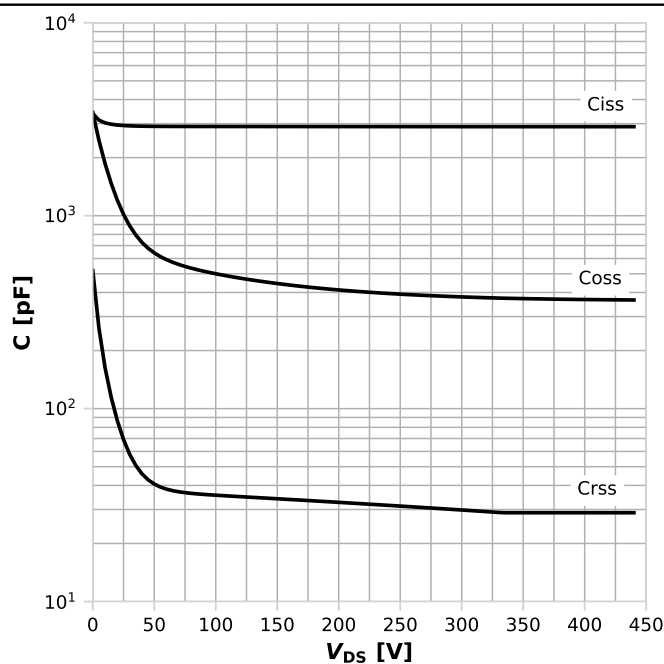
$I_F = f(V_{DS})$ ,  $V_{GS} = 0$  V; parameter:  $T_j$

**Diagram 14: Reverse output characteristics**



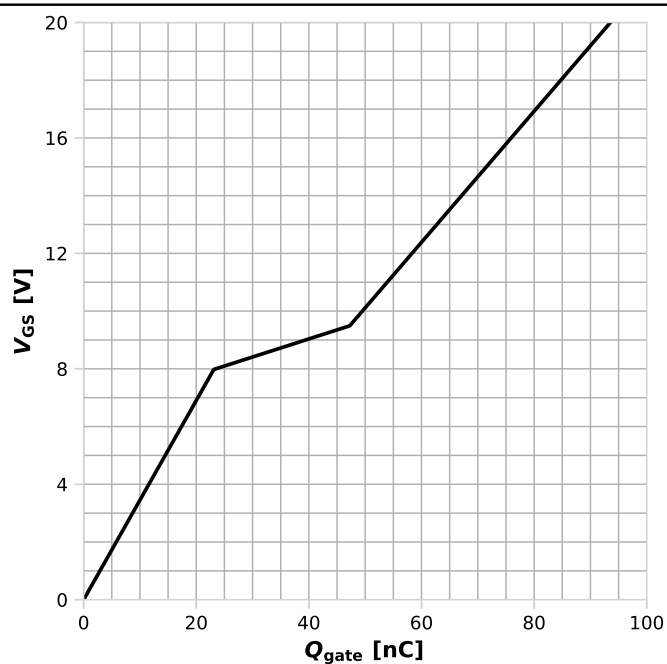
$I_F = f(V_{DS})$ ,  $V_{GS} = 18$  V; parameter:  $T_j$

**Diagram 15: Typ. capacitances**



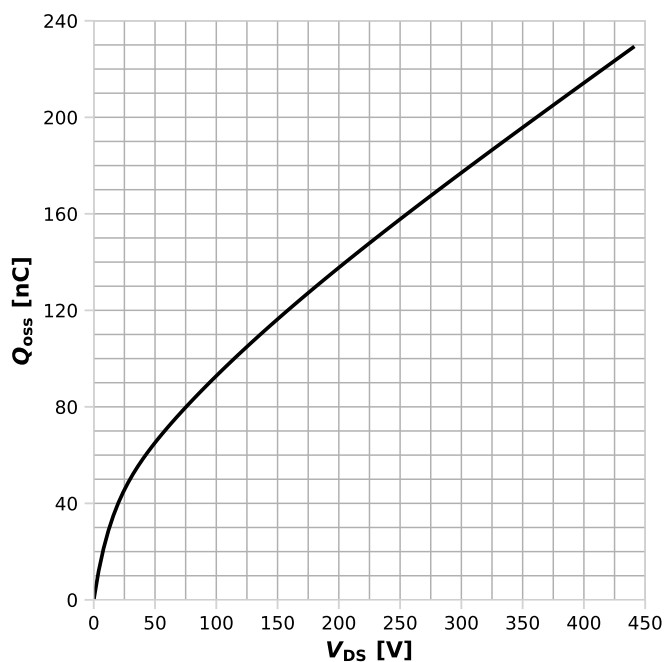
$C = f(V_{DS})$ ;  $V_{GS} = 0$  V;  $f = 1$  MHz

**Diagram 16: Typ. gate charge**



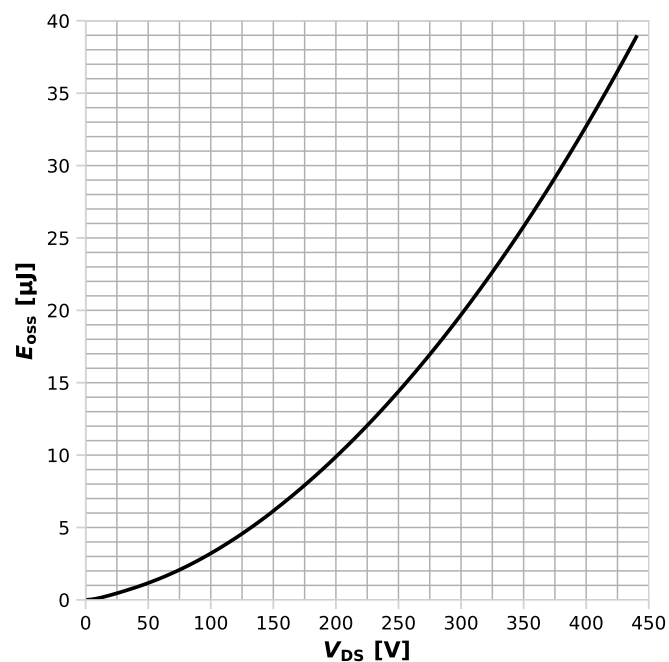
$V_{GS} = f(Q_{gate})$ ,  $V_{DD} = 200$  V,  $I_D = 37.1$  A pulsed,  $T_j = 25$  °C

Diagram 17: Typ. output charge



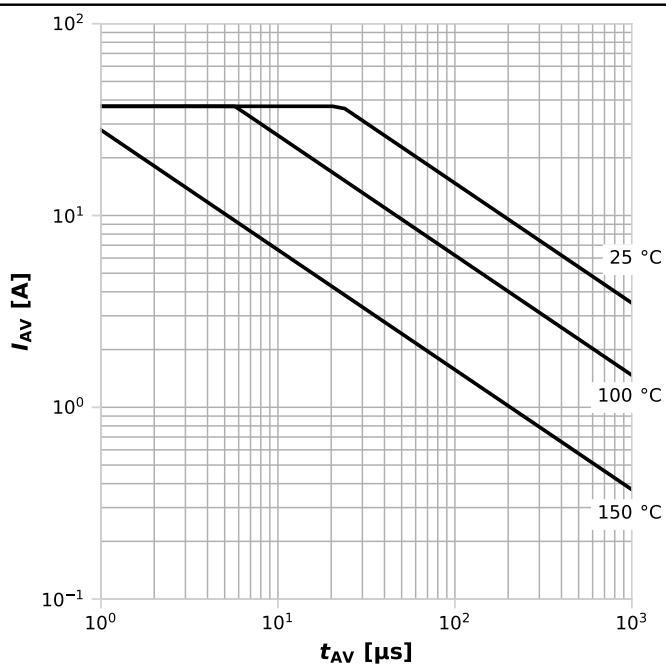
$$Q_{oss}=f(V_{DS}), V_{GS}=0\text{ V}$$

Diagram 18: Typ. output energy



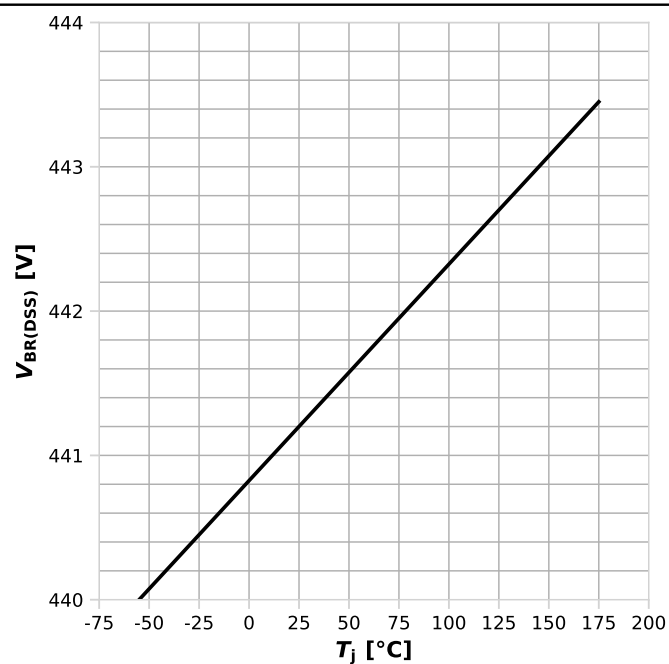
$$E_{oss}=f(V_{DS}), V_{GS}=0\text{ V}$$

Diagram 19: Avalanche characteristics



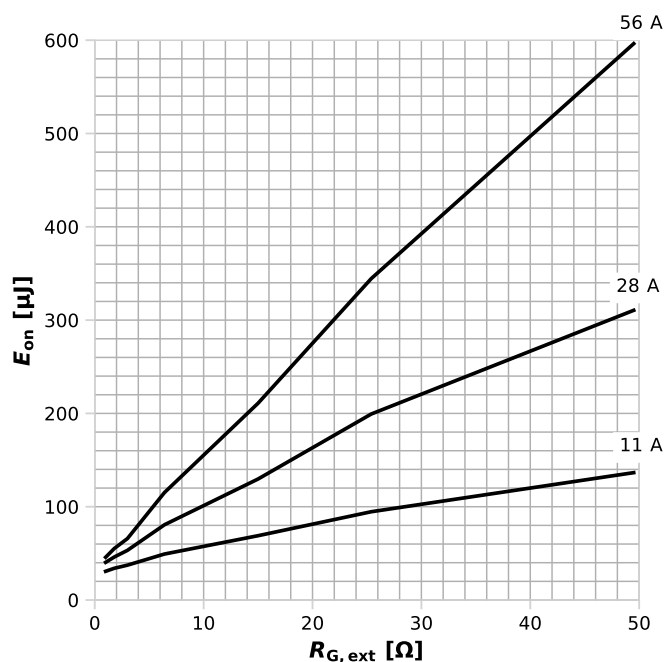
$$I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j,\text{start}}$$

Diagram 20: Min. drain-source breakdown voltage



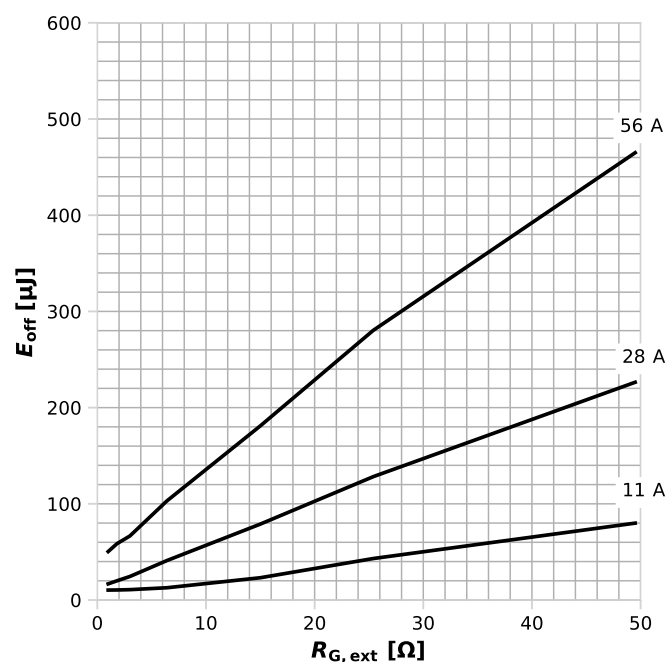
$$V_{BR(DSS)}=f(T_j); I_D=1.33\text{ mA}$$

Diagram 21: Typ. turn-on switching losses



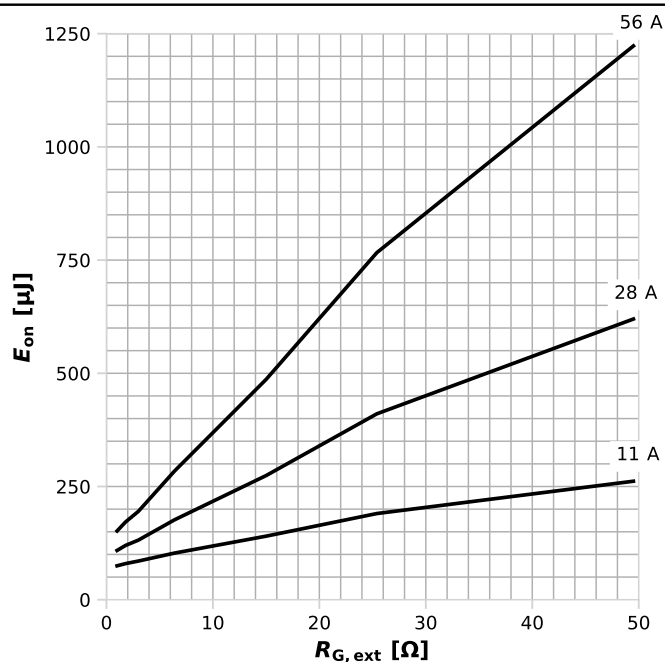
$$E_{on}=f(R_{G,ext}), V_{DD}=200\text{ V}, V_G=0\ldots 18\text{ V}; \text{ parameter: } I_D$$

Diagram 22: Typ. turn-off switching losses



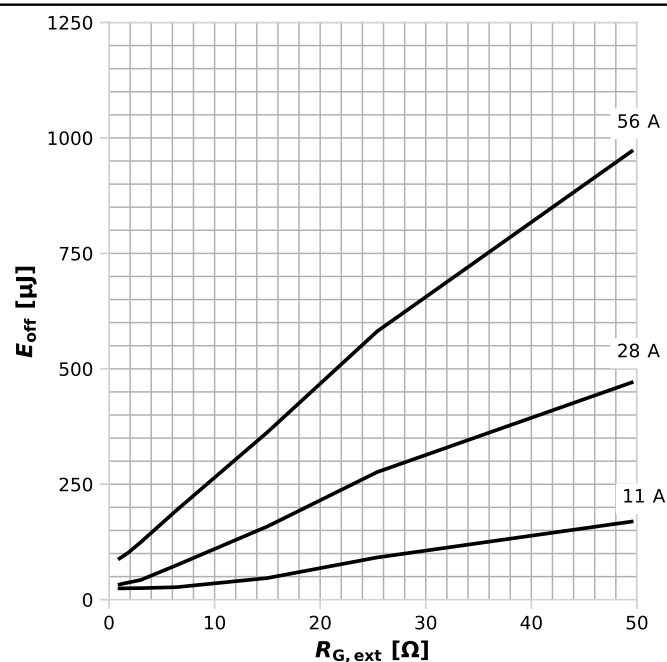
$$E_{off}=f(R_{G,ext}), V_{DD}=200\text{ V}, V_G=18\ldots 0\text{ V}; \text{ parameter: } I_D$$

Diagram 23: Typ. turn-on switching losses



$$E_{on}=f(R_{G,ext}), V_{DD}=320\text{ V}, V_G=0\ldots 18\text{ V}; \text{ parameter: } I_D$$

Diagram 24: Typ. turn-off switching losses



$$E_{off}=f(R_{G,ext}), V_{DD}=320\text{ V}, V_G=18\ldots 0\text{ V}; \text{ parameter: } I_D$$

## 6 Test circuits

Table 9 Switching times

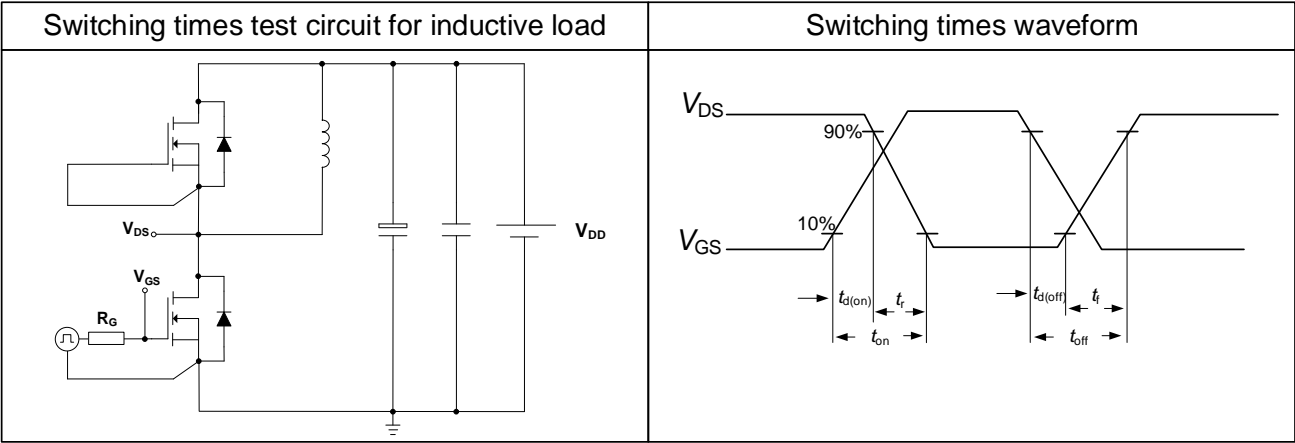
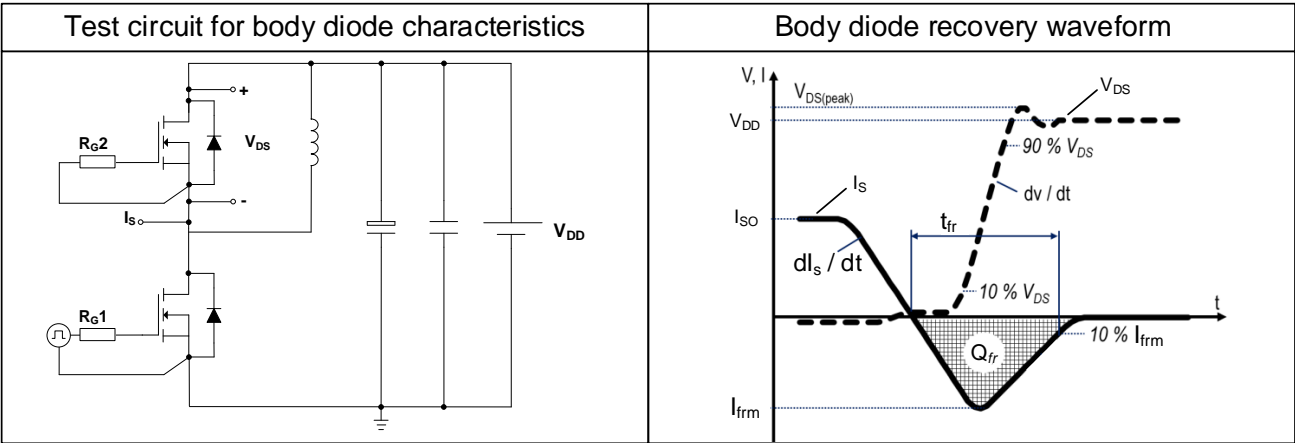
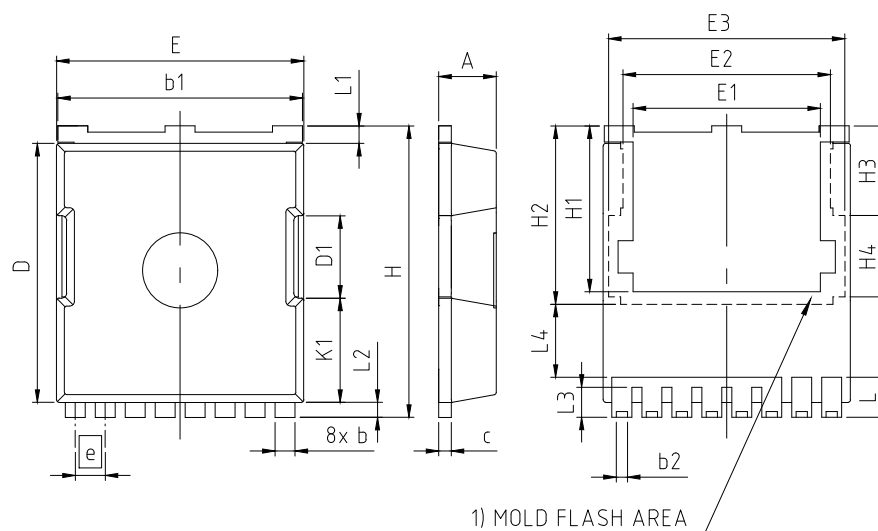


Table 10 Body diode characteristics



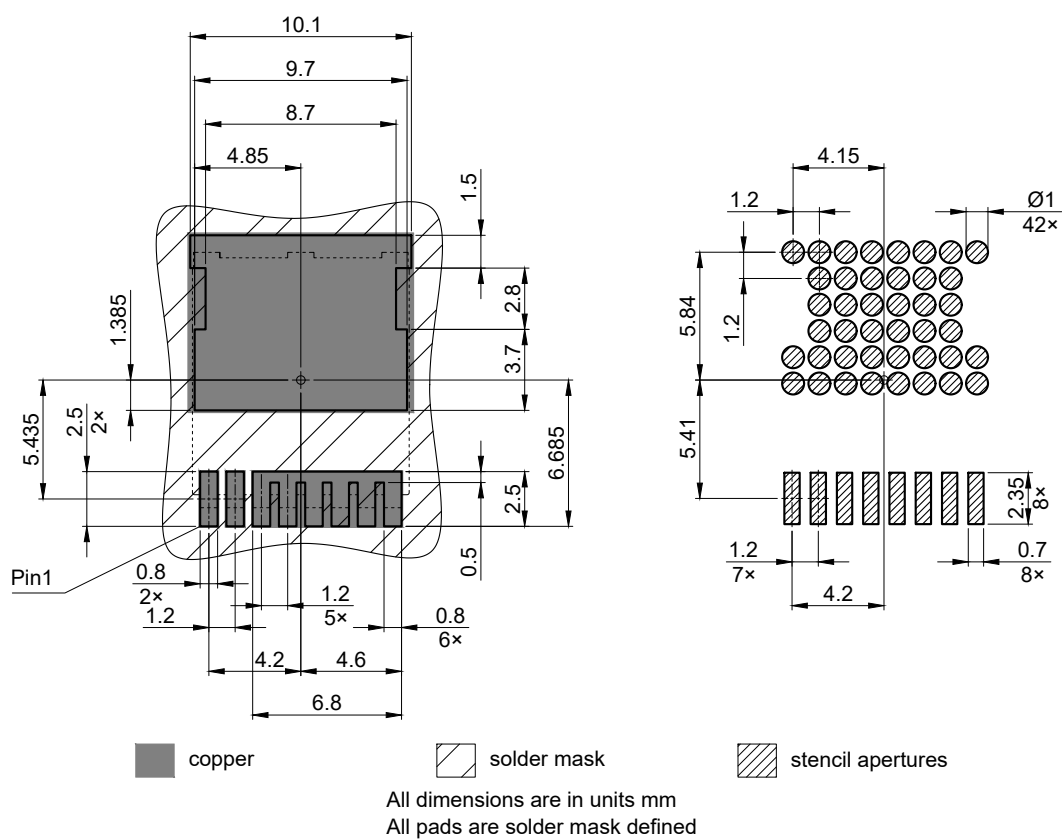
## 7 Package outlines



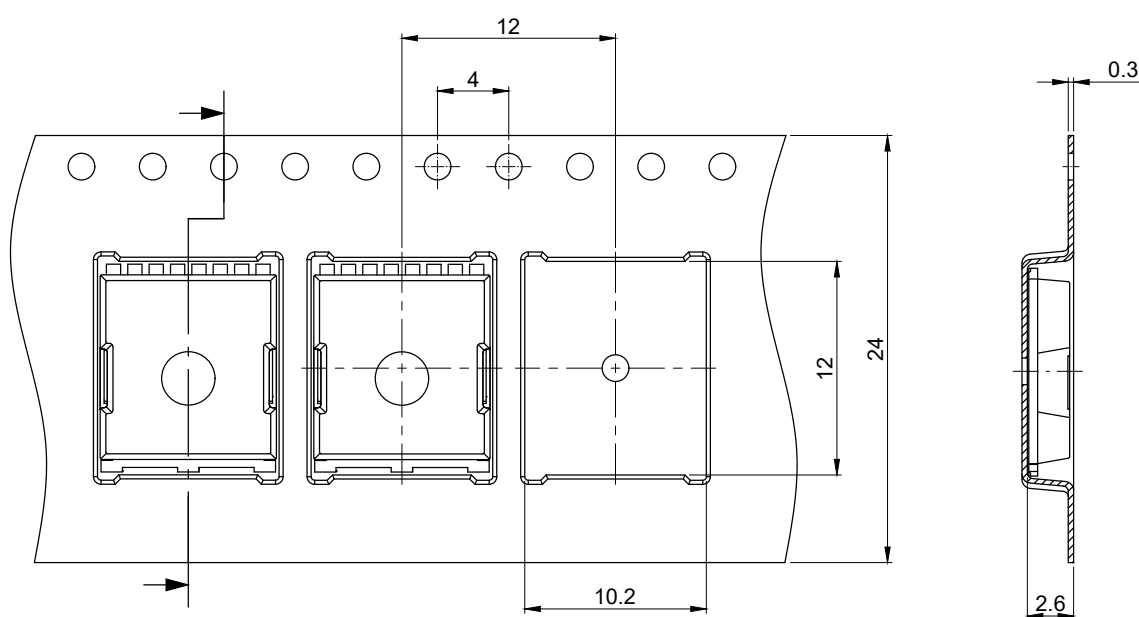
PACKAGE - GROUP NUMBER: PG-HSOF-8-U02		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	2.20	2.40
b	0.70	0.90
b1	9.70	9.90
b2	0.42	0.50
c	0.40	0.60
D	10.28	10.58
D1	3.30	
E	9.70	10.10
E1	7.50	
E2	8.50	
E3	9.46	
e	1.20 (BSC)	
H	11.48	11.88
H1	6.55	6.95
H2	7.15	
H3	3.59	
H4	3.26	
N	8	
K1	4.18	
L	1.40	1.80
L1	0.50	0.90
L2	0.50	0.70
L3	1.00	1.30
L4	2.62	2.81

1) PARTIALLY COVERED WITH MOLD FLASH


**Figure 1** Outline PG-HSOF-8, dimensions in mm



**Figure 2 Footprint drawing PG-HSOF-8, dimensions in mm**



All dimensions are in units mm

The drawing is in compliance with ISO 128-30, Projection Method 1 [  ]

**Figure 3** Packaging variant PG-HSOF-8, dimensions in mm



## Revision history

IMT44R011M2H

### Revision 2025-05-27, Rev. 1.0

Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2025-05-27	Release of final datasheet

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Infineon Technologies AG

81726 München, Germany

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