

## CoolSiC™

PG-TO247-3

### 400V CoolSiC™ G2 MOSFET

#### Features

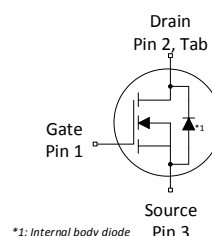
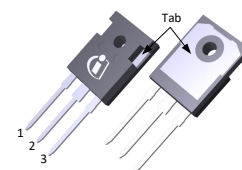
- Ideal for high frequency switching and synchronous rectification
- Commutation robust fast body diode with low  $Q_{fr}$
- Low  $R_{DS(on)}$  dependency on temperature
- Benchmark gate threshold voltage,  $V_{GS(th)} = 4.5\text{ V}$
- Recommended gate driving voltage 0 V to 18 V
- .XT interconnection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

#### Potential applications

- SMPS
- Solar PV inverters
- Energy storage, UPS and battery formation
- Class-D audio
- Motor drives

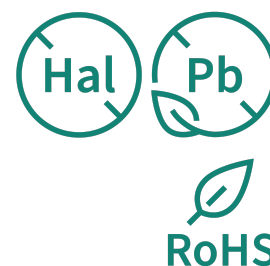
#### Product validation

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
$V_{DS}$	400	V
$R_{DS(on),typ}$	15.2	mΩ
$I_D$	94	A
$Q_{oss}$	101	nC
$E_{oss}$	7.3	μJ
$Q_G$	62	nC



Part number	Package	Marking	Related links
IMW40R015M2H	PG-TO247-3	40R015M2	-



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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>	$I_D$	-	-	94	A	$V_{GS}=18\text{ V}$ , $T_C=25\text{ °C}$
				70		$V_{GS}=18\text{ V}$ , $T_C=100\text{ °C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	282	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>3)</sup>	$E_{AS}$	-	-	162	mJ	$I_D=27.1\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Avalanche energy, repetitive	$E_{AR}$			0.81		
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	$P_{tot}$	-	-	273	W	$T_C=25\text{ °C}$
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> See Diagram 3 for more detailed information.

<sup>3)</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	$R_{thJC}$	-	-	0.55	°C/W	-

## 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  $T_j=25\text{ °C}$ , unless otherwise specified

**Table 5 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	400	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=0.97\text{ mA}$
Gate threshold voltage <sup>4)</sup>	$V_{GS(th)}$	3.5	4.5	5.6	V	$V_{DS}=V_{GS}$ , $I_D=9.7\text{ mA}$
Zero gate voltage drain current	$I_{DSS}$	-	1	75	$\mu\text{A}$	$V_{DS}=400\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$
			2	-		$V_{DS}=400\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=175\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	1	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	15.2	19.1	m $\Omega$	$V_{GS}=18\text{ V}$ , $I_D=27.1\text{ A}$ , $T_j=25\text{ °C}$
			21.9	-		$V_{GS}=18\text{ V}$ , $I_D=27.1\text{ A}$ , $T_j=175\text{ °C}$
			18.5	-		$V_{GS}=15\text{ V}$ , $I_D=27.1\text{ A}$ , $T_j=25\text{ °C}$
Gate resistance	$R_G$	-	2.8	-	$\Omega$	-

<sup>4)</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	$C_{iss}$	-	2100	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=200\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$		300			
Reverse transfer capacitance	$C_{rss}$		24			
Effective output capacitance, energy related <sup>5)</sup>	$C_{o(er)}$	-	363	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=0\ldots 200\text{ V}$
Effective output capacitance, time related <sup>6)</sup>	$C_{o(tr)}$	-	510	-	pF	$I_D=\text{constant}$ , $V_{GS}=0\text{ V}$ , $V_{DS}=0\ldots 200\text{ V}$
Turn-on delay time <sup>7)</sup>	$t_{d(on)}$	-	11.5	-	ns	$V_{DD}=200\text{ V}$ , $V_{GS}=0\ldots 18\text{ V}$ , $I_D=27.1\text{ A}$ , $R_{G,ext}=1.8\text{ }\Omega$
Rise time <sup>7)</sup>	$t_r$		17.6			
Turn-off delay time <sup>7)</sup>	$t_{d(off)}$	-	26.3	-	ns	$V_{DD}=200\text{ V}$ , $V_{GS}=18\ldots 0\text{ V}$ , $I_D=27.1\text{ A}$ , $R_{G,ext}=1.8\text{ }\Omega$
Fall time <sup>7)</sup>	$t_f$		6.1			

<sup>5)</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>6)</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.

<sup>7)</sup> Refer to Table 9 for test setup.

**Table 7 Gate Charge Characteristics** <sup>8)</sup>

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	16.9	-	nC	$V_{DD}=200\text{ V}$ , $I_D=27.1\text{ A}$ , $V_{GS}=0\text{ to }18\text{ V}$
Gate to drain charge	$Q_{gd}$		12.8			
Gate charge total	$Q_g$		62			
Gate charge total, sync. FET	$Q_{g(sync)}$	-	58	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }18\text{ V}$
Output charge	$Q_{oss}$	-	101	-	nC	$V_{DS}=200\text{ V}$ , $V_{GS}=0\text{ V}$
Output Energy	$E_{oss}$		7.3		μJ	

<sup>8)</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	$I_S$	-	-	44	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	282	A	$T_C=25\text{ °C}$ , $t_{pulse}\leq 250\text{ ns}$
Diode forward voltage	$V_{SD}$	-	3.5	4.3	V	$V_{GS}=0\text{ V}$ , $I_S=27.1\text{ A}$ , $T_J=25\text{ °C}$
MOSFET forward recovery time	$t_{fr}$	-	31.5	-	ns	$V_R=200\text{ V}$ , $I_S=27.1\text{ A}$ , $di_S/dt=1000\text{ A}/\mu\text{s}$
MOSFET forward recovery charge <sup>9)</sup>	$Q_{fr}$		136.8		nC	

<sup>9)</sup>  $Q_{fr}$  includes  $Q_{oss}$ . Refer to Table 10 for test setup.

## 5 Electrical characteristics diagrams

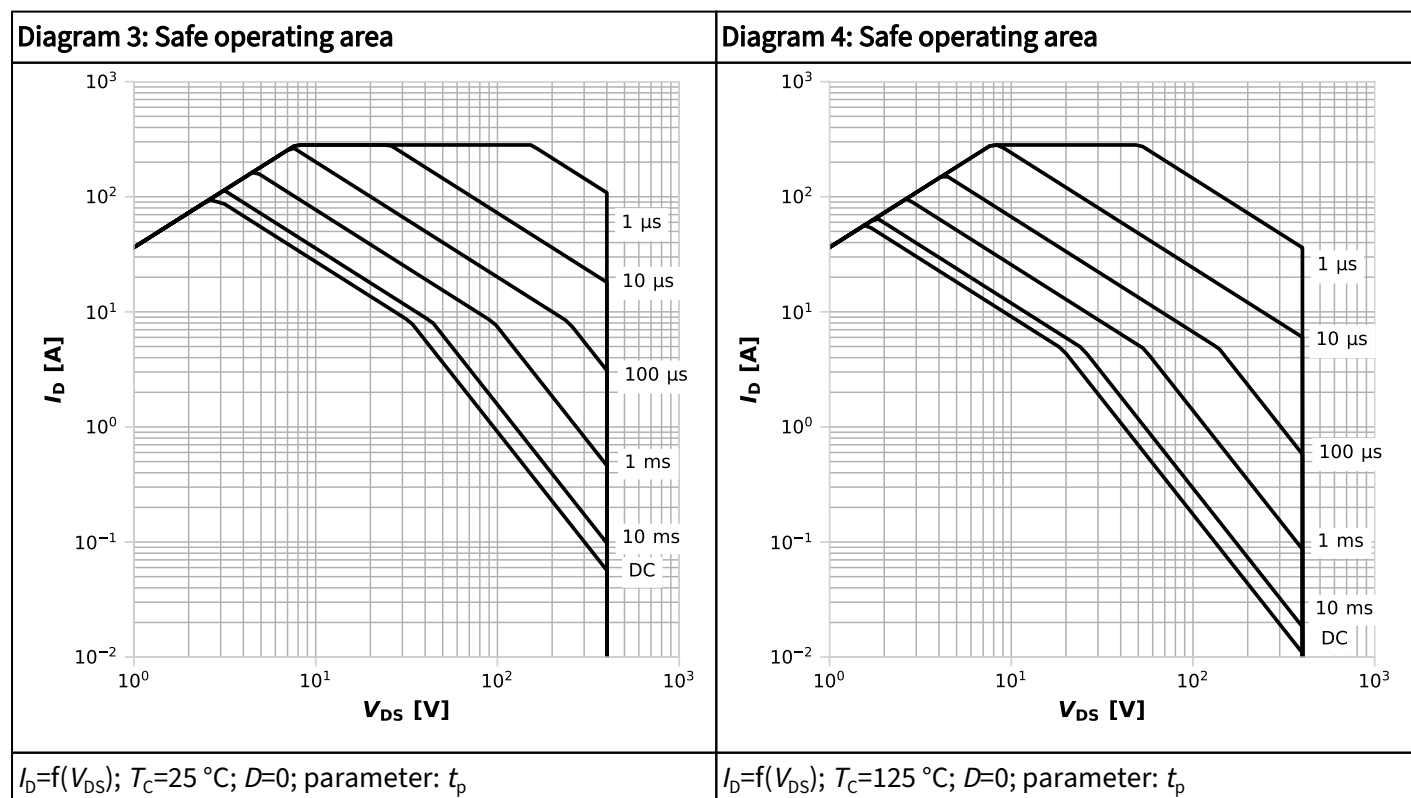
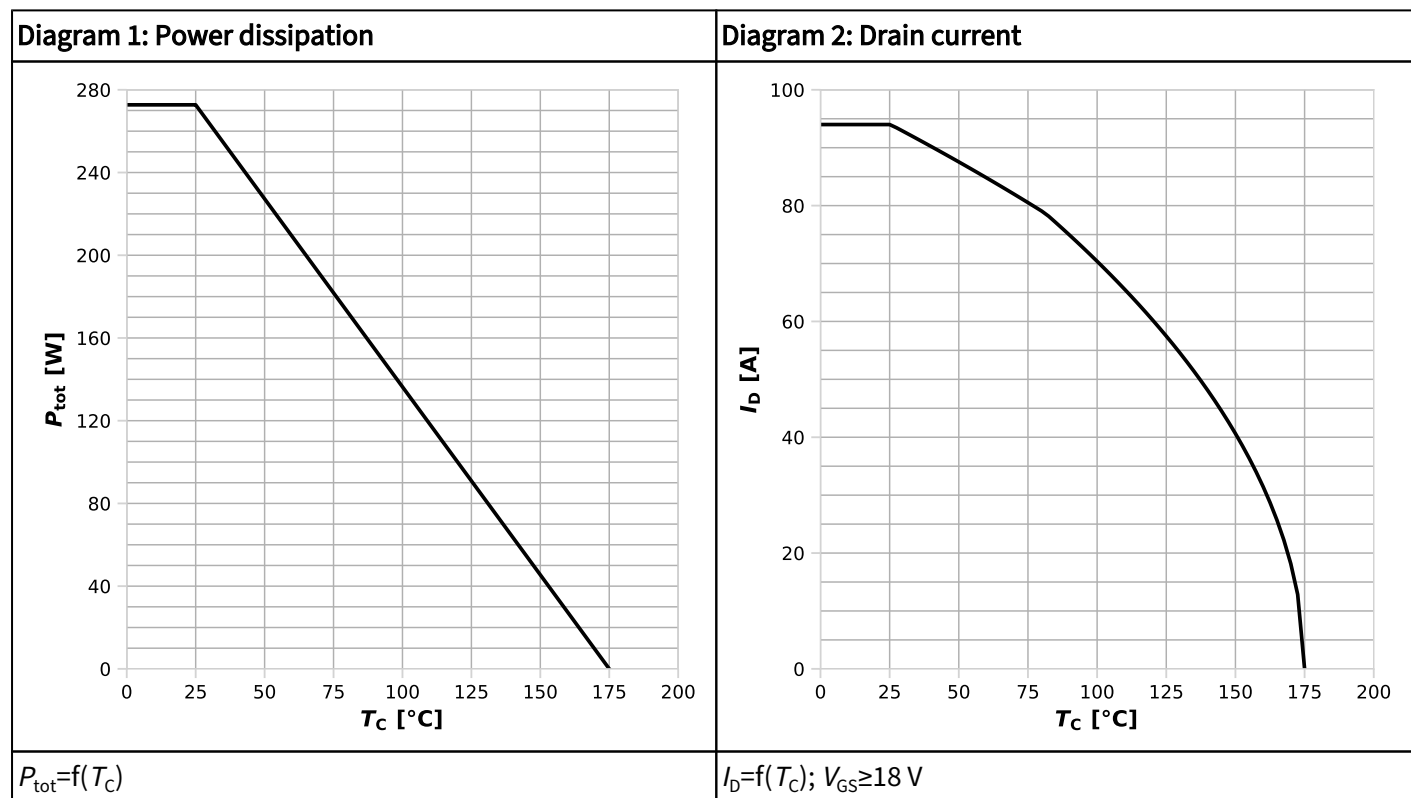
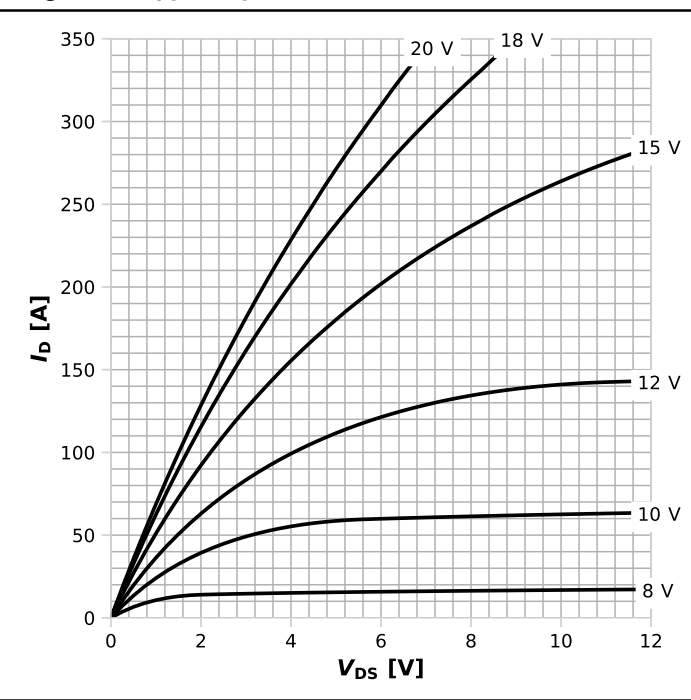
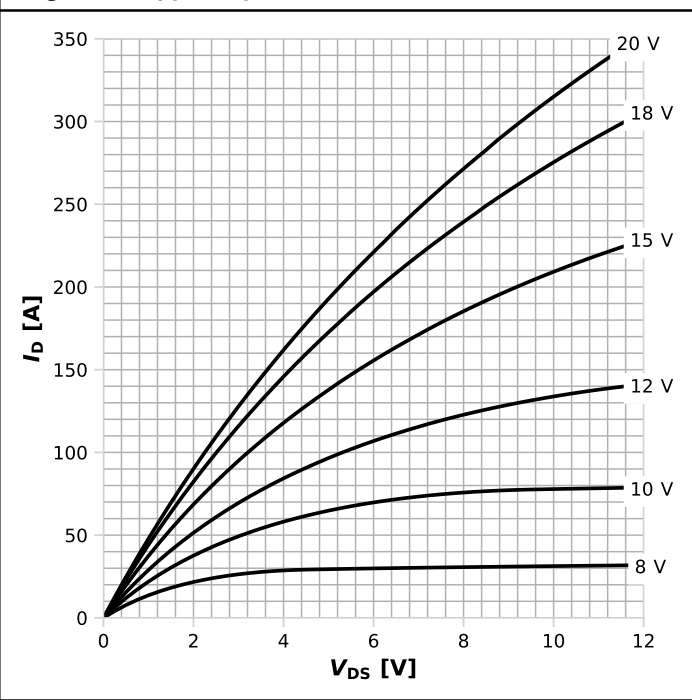


Diagram 5: Typ. output characteristics



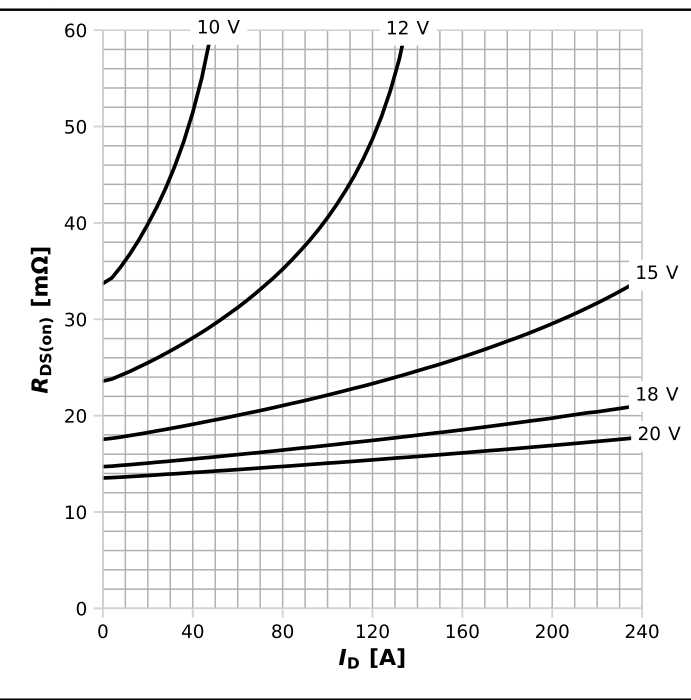
$I_D = f(V_{DS})$ ,  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. output characteristics



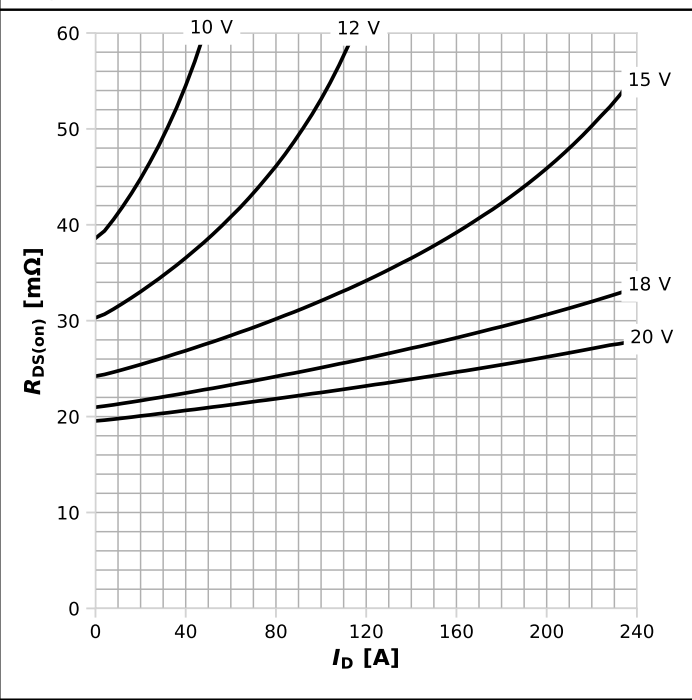
$I_D = f(V_{DS})$ ,  $T_j = 175\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. drain-source on resistance



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

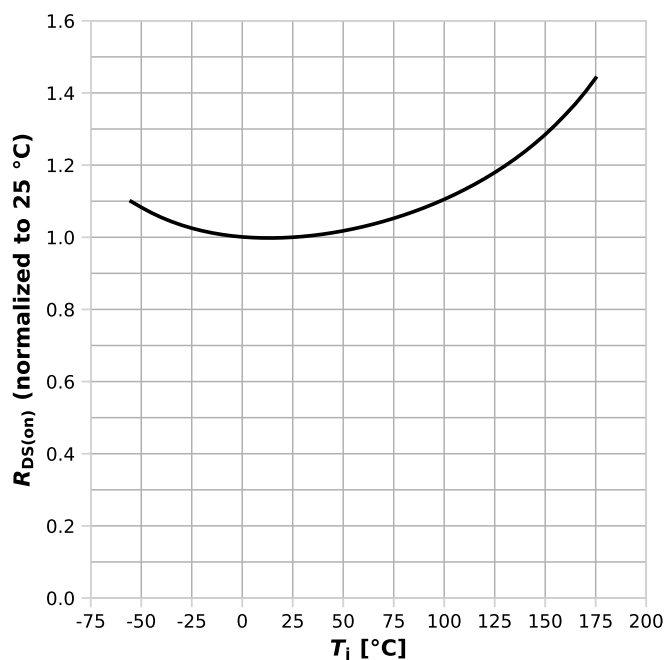
Diagram 8: Typ. drain-source on resistance



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

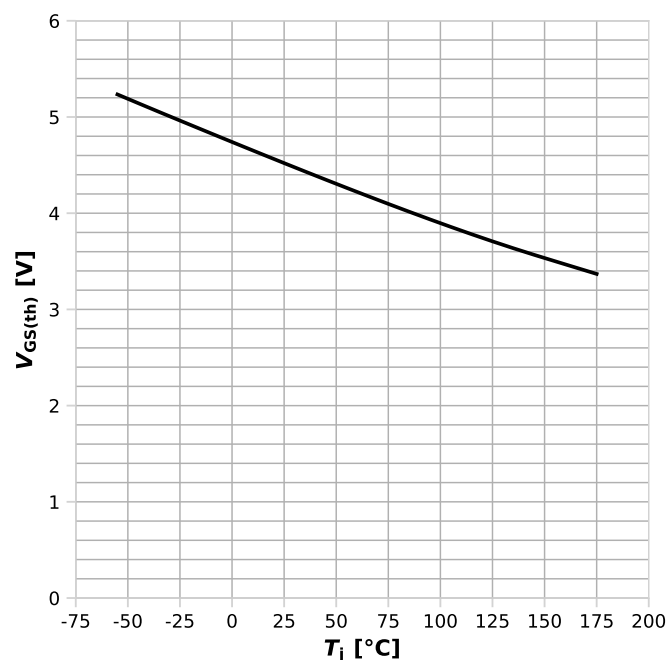


Diagram 9: Normalized drain-source on resistance



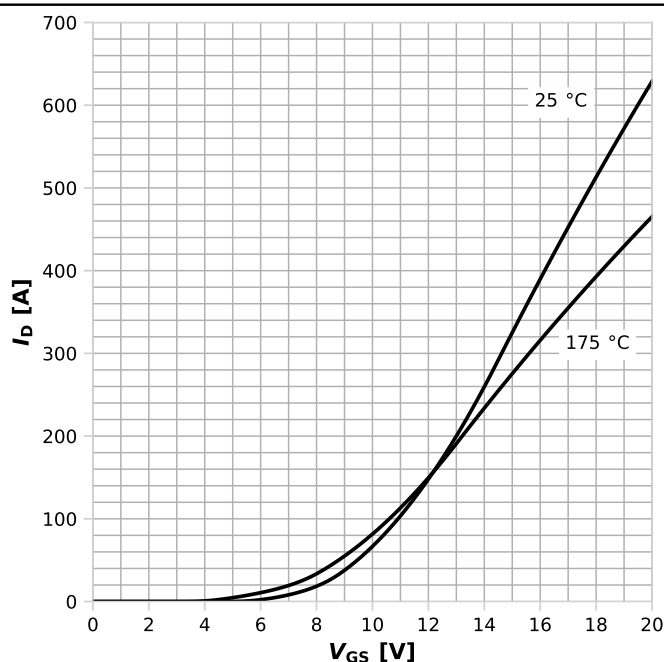
$$R_{DS(on)} = f(T_j), I_D = 27.1 \text{ A}, V_{GS} = 18 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



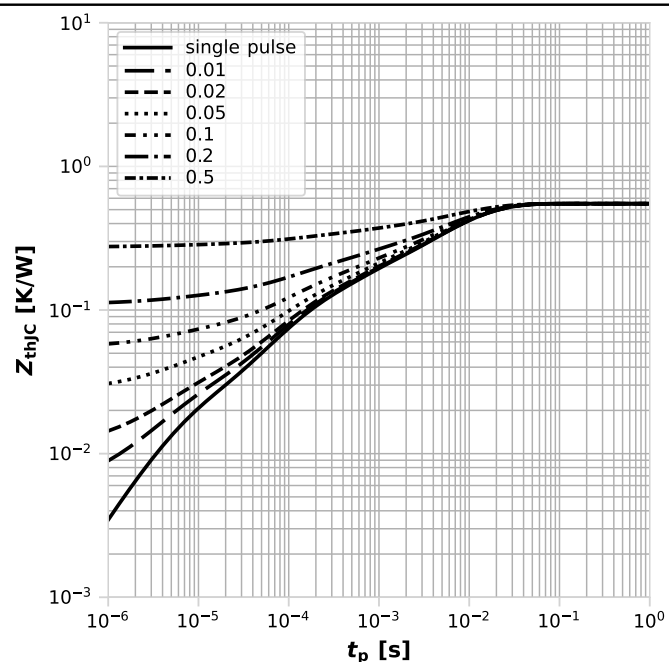
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}, I_D = 9.7 \text{ mA}$$

Diagram 11: Typ. transfer characteristics



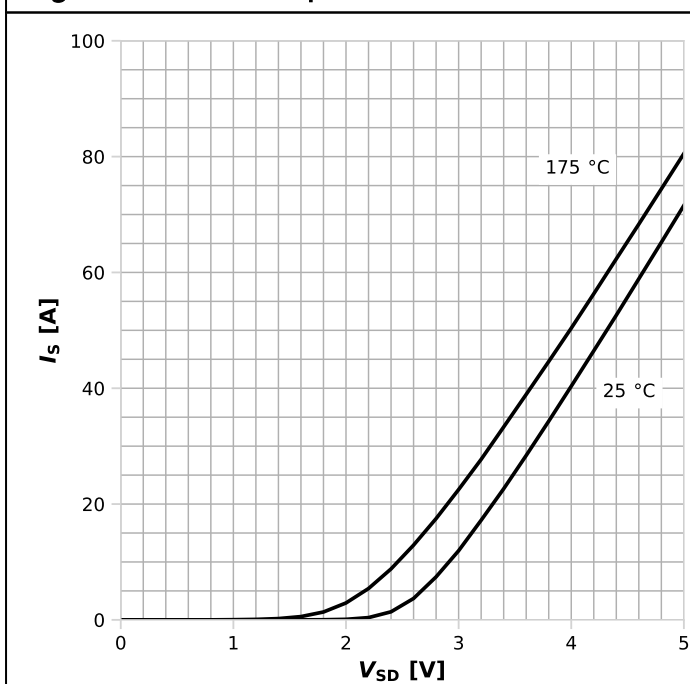
$$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max}, \text{ parameter: } T_j$$

Diagram 12: Max. transient thermal impedance



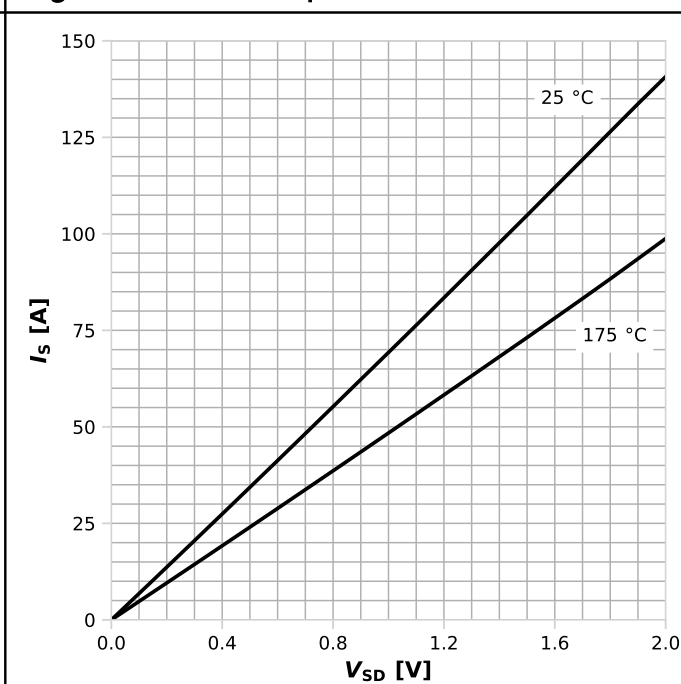
$$Z_{thJC} = f(t_p), \text{ parameter: } D = t_p / T$$

Diagram 13: Reverse output characteristics



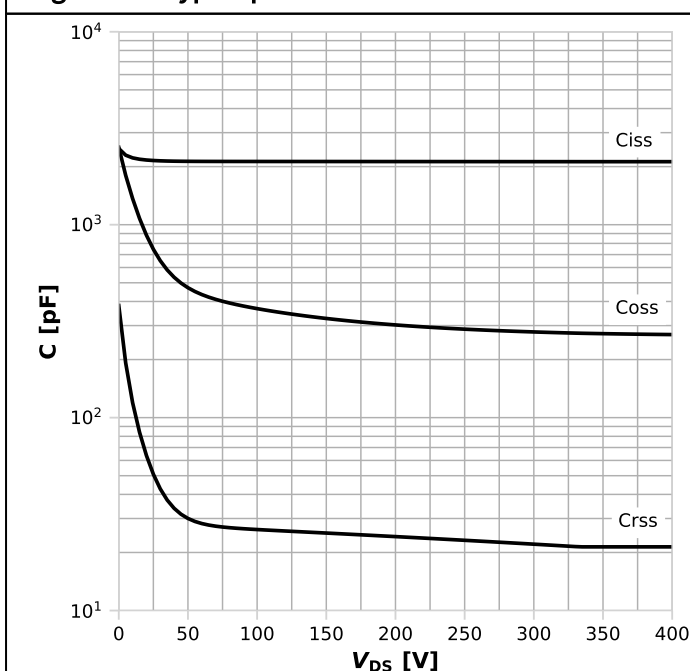
$I_F = f(V_{SD})$ ,  $V_{GS} = 0$  V; parameter:  $T_j$

Diagram 14: Reverse output characteristics



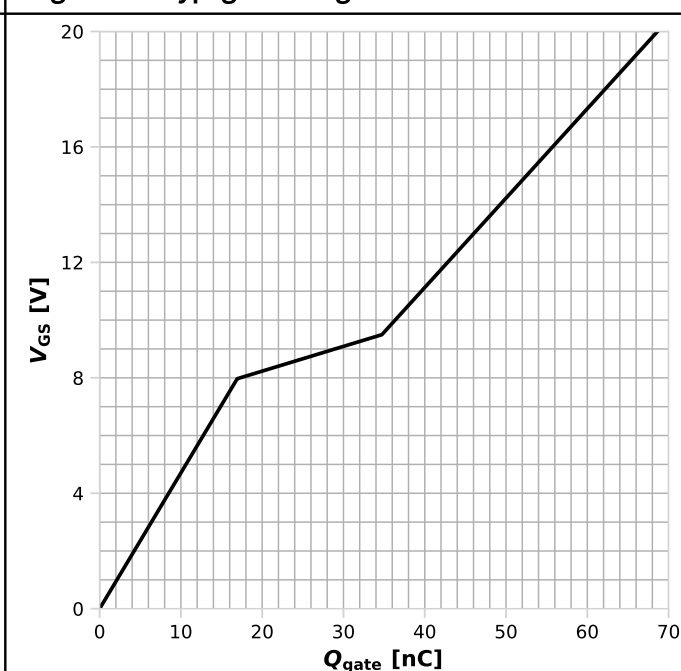
$I_F = f(V_{SD})$ ,  $V_{GS} = 18$  V; parameter:  $T_j$

Diagram 15: Typ. capacitances



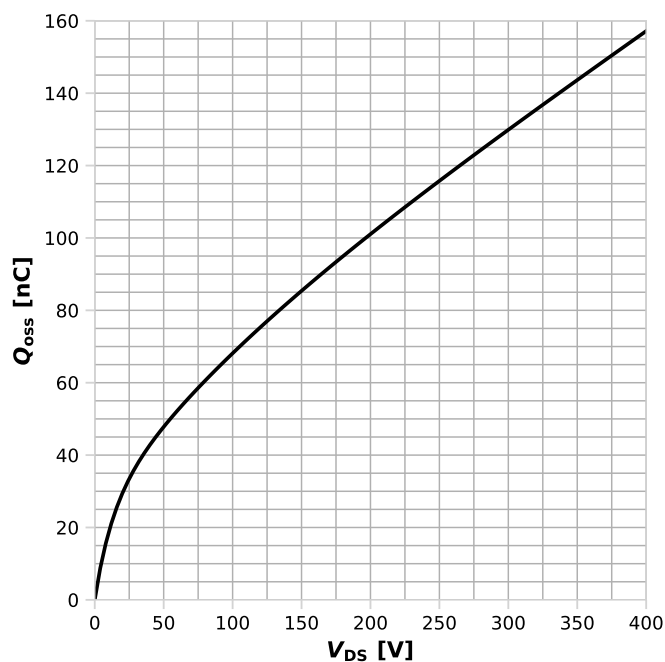
$C = f(V_{DS})$ ;  $V_{GS} = 0$  V;  $f = 1$  MHz

Diagram 16: Typ. gate charge



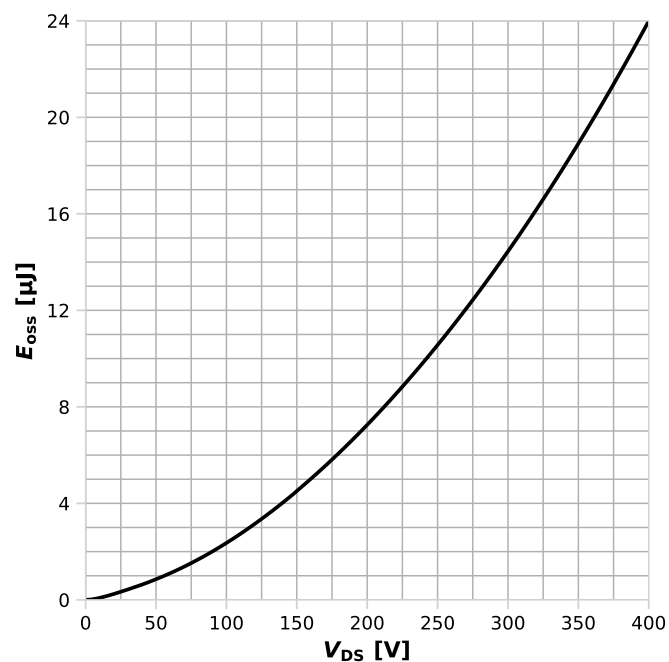
$V_{GS} = f(Q_{gate})$ ,  $V_{DD} = 200$  V,  $I_D = 27.1$  A pulsed,  $T_j = 25$  °C

Diagram 17: Typ. output charge



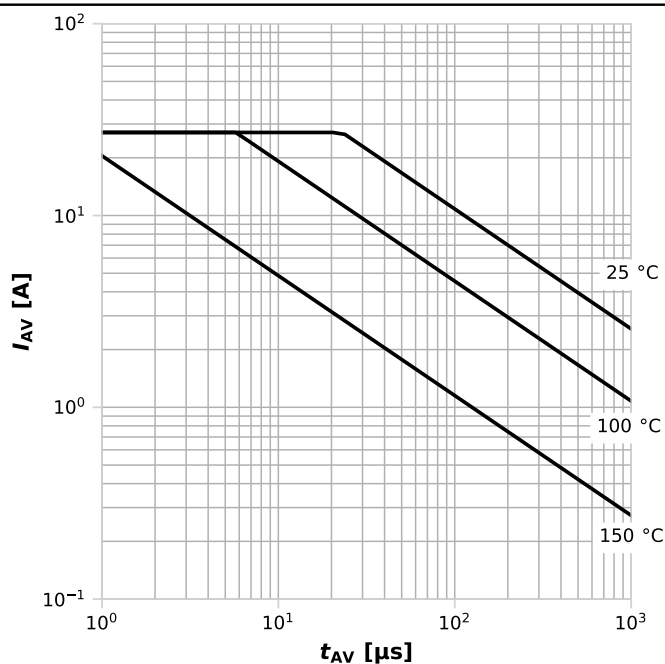
$$Q_{oss}=f(V_{DS}), V_{GS}=0\text{ V}$$

Diagram 18: Typ. output energy



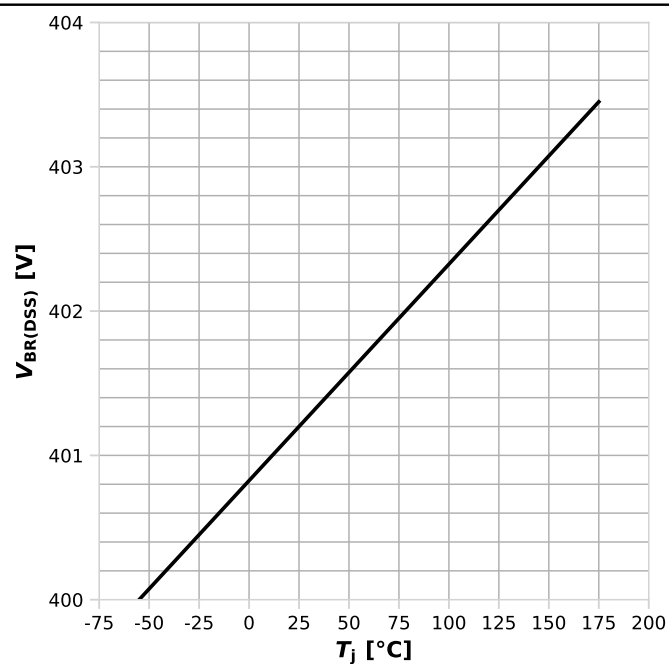
$$E_{oss}=f(V_{DS}), V_{GS}=0\text{ V}$$

Diagram 19: Avalanche characteristics



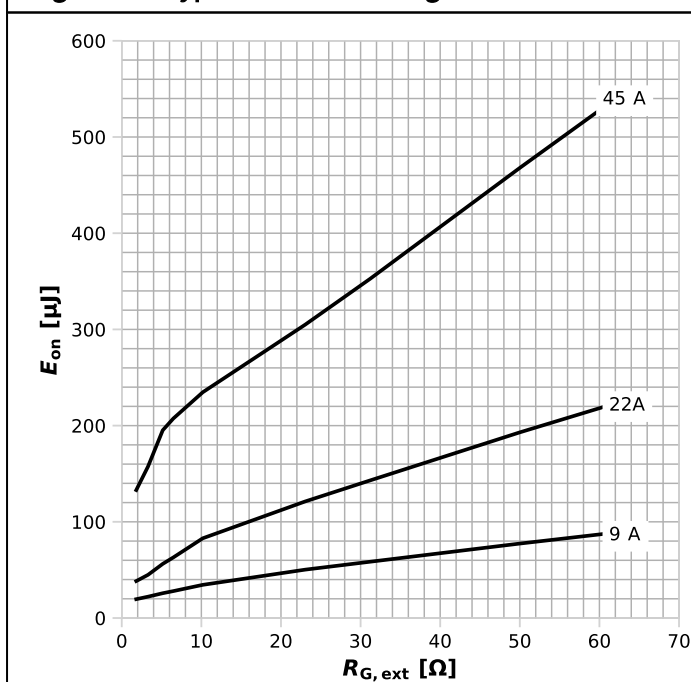
$$I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j,\text{start}}$$

Diagram 20: Min. drain-source breakdown voltage



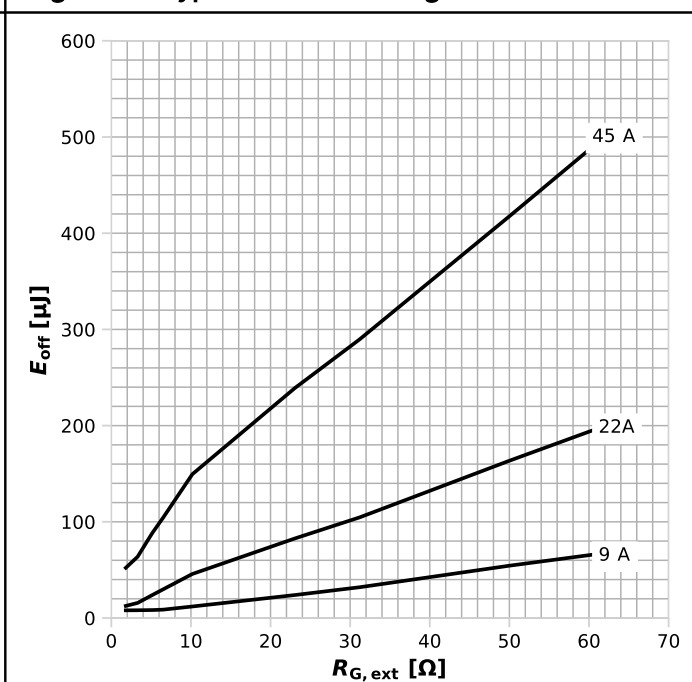
$$V_{BR(DSS)}=f(T_j); I_D=0.97\text{ mA}$$

**Diagram 21: Typ. turn-on switching losses**



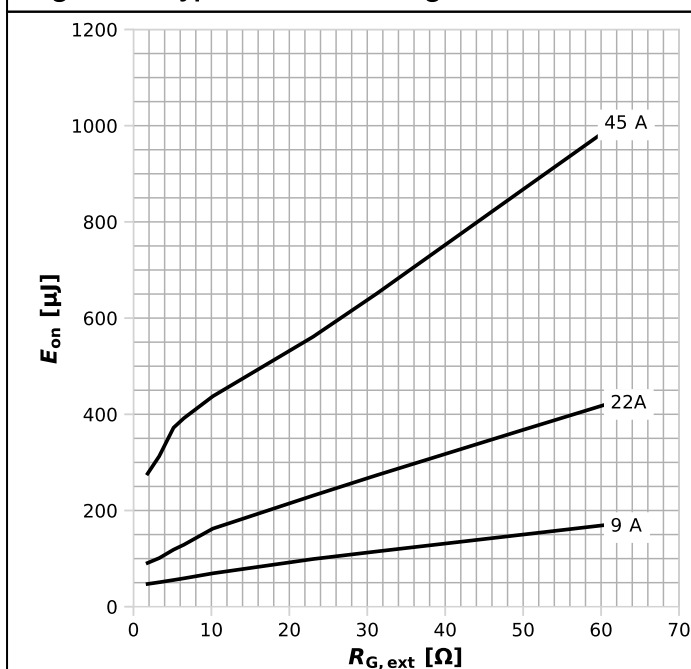
$E_{on}=f(R_{G,ext})$ ,  $V_{DD}=200$  V,  $V_G=0...18$  V; parameter:  $I_D$

**Diagram 22: Typ. turn-off switching losses**



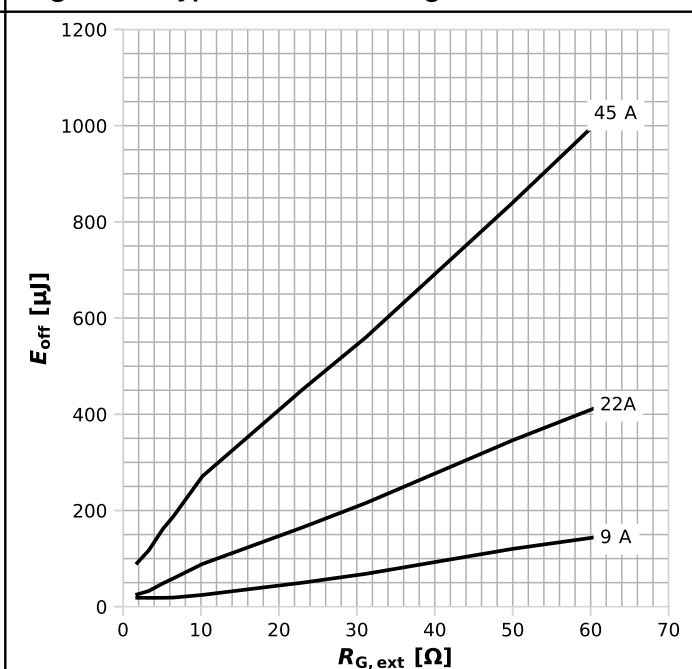
$E_{off}=f(R_{G,ext})$ ,  $V_{DD}=200$  V,  $V_G=18...0$  V; parameter:  $I_D$

**Diagram 23: Typ. turn-on switching losses**



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

**Diagram 24: Typ. turn-off switching losses**



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

6 Test circuits

Table 9 Switching times

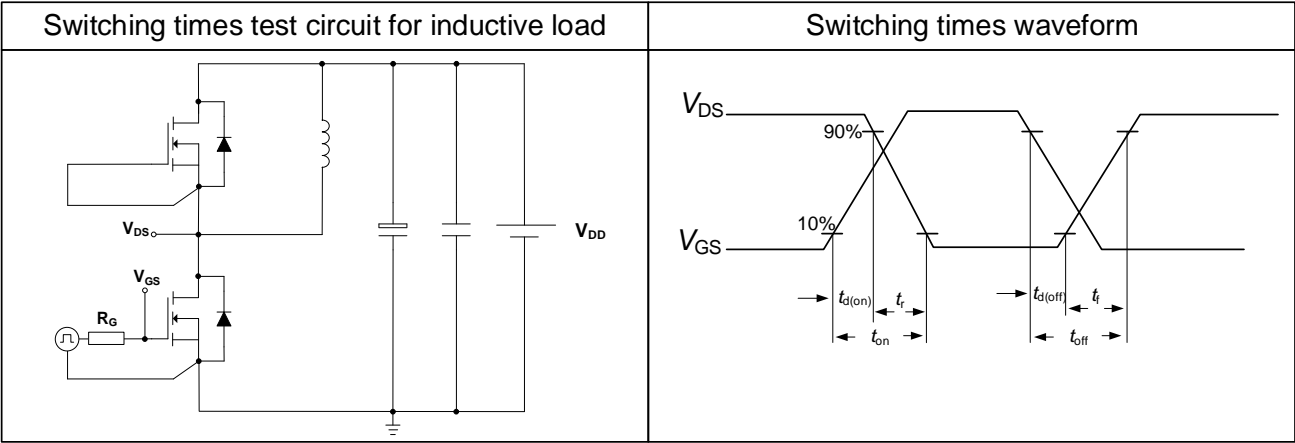
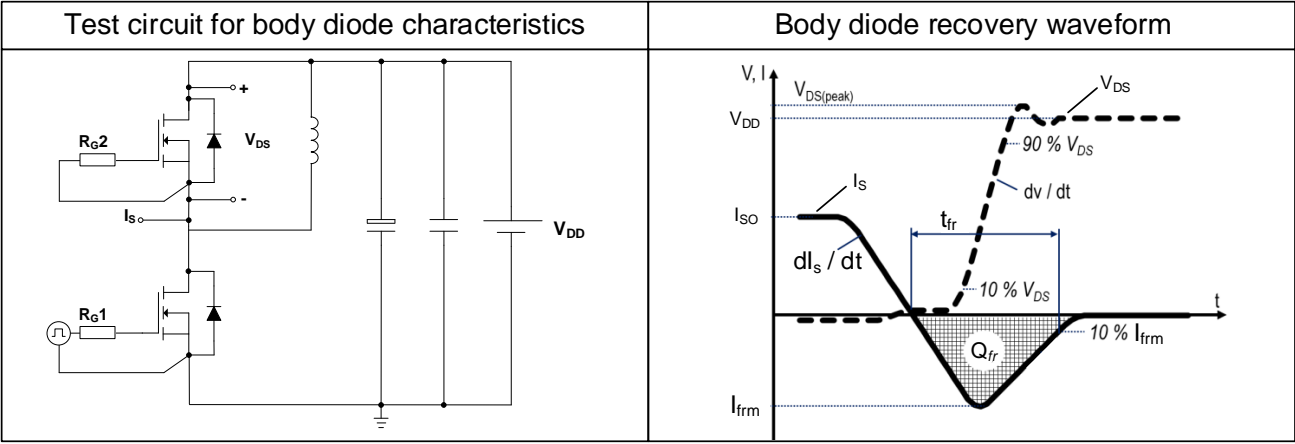
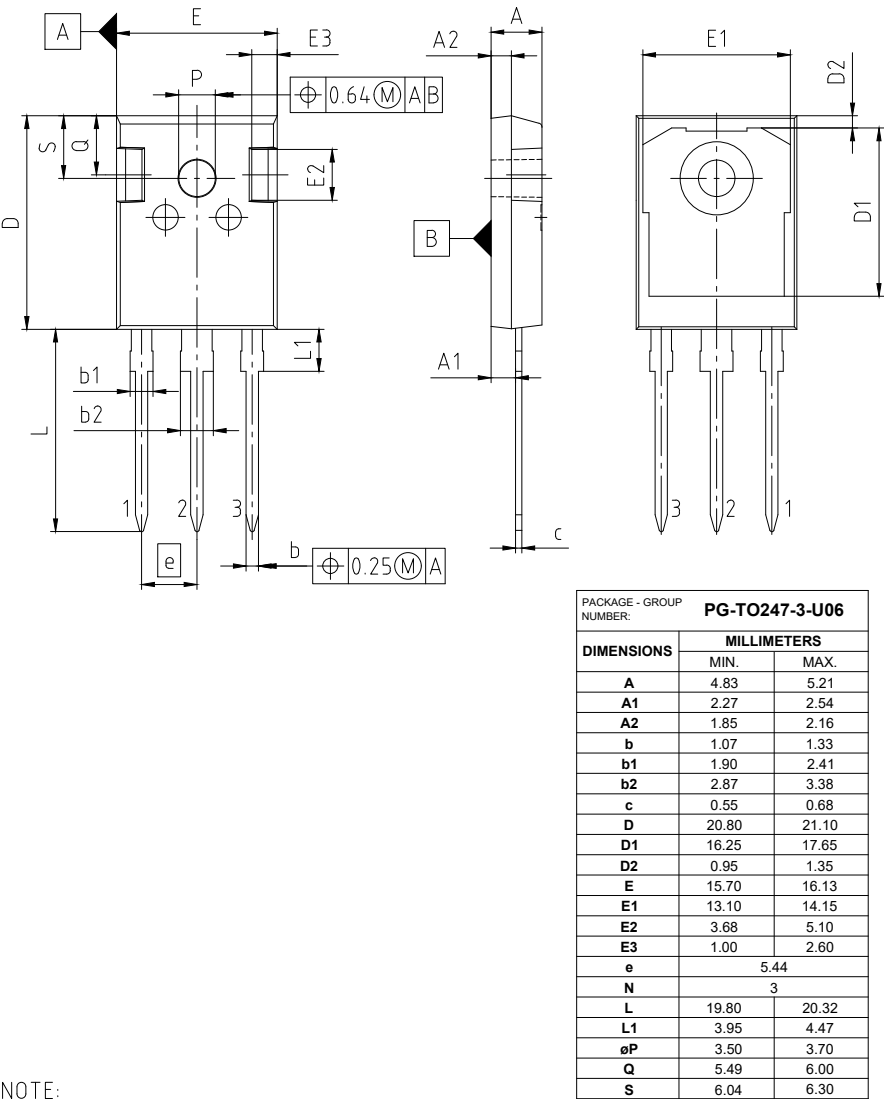


Table 10 Body diode characteristics

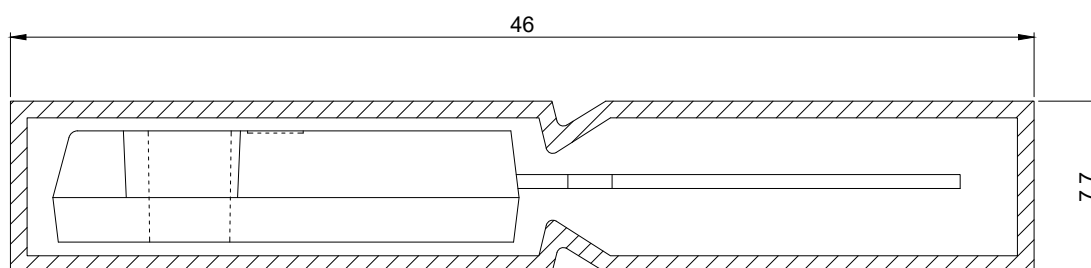


7 Package outlines



NOTE:  
DIMENSIONS DO NOT INCLUDE MOLDFLASH; PROTRUSION OR GATE BURRS

Figure 1 Outline PG-T0247-3, dimensions in mm



All dimensions are in units mm

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

**Figure 2** Packaging variant PG-T0247-3, dimensions in mm

**Revision history**

IMW40R015M2H

**Revision 2025-07-15, Rev. 1.0**

Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2025-07-15	Release of final datasheet



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