



**THE DATASHEET OF  
IPB020N10N5ATMA1**

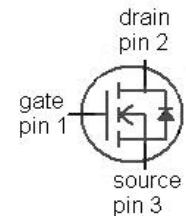


**OptiMOS™ 5 Power-Transistor**
**Features**

- N-channel, normal level
- Optimized for FOM<sub>OSS</sub>
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target application
- Ideal for high-frequency switching and synchronous rectification

**Product Summary**

$V_{DS}$	100	V
$R_{DS(on).max}$	2.0	mΩ
$I_D$	176	A



<b>Type</b>	IPB020N10N5
<b>Package</b>	PG-TO263-3
<b>Marking</b>	020N10N5

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}$	176	A
		$T_C=100\text{ °C}$	135	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	704	
Avalanche energy, single pulse	$E_{AS}$	$I_D=50\text{ A}$ , $R_{GS}=25\text{ Ω}$	1166	mJ
Gate source voltage	$V_{GS}$		±20	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	375	W
Operating and storage temperature	$T_j$ , $T_{stg}$		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

<sup>1)</sup>J-STD20 and JESD22

<sup>2)</sup> see Diagram 3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	0.3	0.4	K/W
Thermal resistance, junction - ambient	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>4)</sup>	-	-	40	
Soldering temperature, wave and reflow soldering are allowed	$T_{sold}$	reflow MSL1			260	°C

**Electrical characteristics, at  $T_j=25$  °C, unless otherwise specified**
**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0$ V, $I_D=1$ mA	100	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ , $I_D=270$ μA	2.2	3	3.8	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=100$ V, $V_{GS}=0$ V, $T_j=25$ °C	-	0.1	7	μA
		$V_{DS}=100$ V, $V_{GS}=0$ V, $T_j=125$ °C	-	10	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20$ V, $V_{DS}=0$ V	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10$ V, $I_D=100$ A	-	1.7	2.0	mΩ
		$V_{GS}=6$ V, $I_D=50$ A	-	2.0	2.5	
Gate resistance <sup>5)</sup>	$R_G$		-	1.3	2	Ω
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=100$ A	124	248	-	S

<sup>4)</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.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics<sup>5)</sup>**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=50\text{ V},$ $f=1\text{ MHz}$	-	12000	15600	pF
Output capacitance	$C_{oss}$		-	1810	2353	
Reverse transfer capacitance	$C_{rss}$		-	80	140	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$ $I_D=100\text{ A},$ $R_{G,ext}=1.6\ \Omega$	-	33	-	ns
Rise time	$t_r$		-	26	-	
Turn-off delay time	$t_{d(off)}$		-	77	-	
Fall time	$t_f$		-	29	-	

**Gate Charge Characteristics<sup>6)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=50\text{ V}, I_D=100\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	54	-	nC
Gate to drain charge <sup>5)</sup>	$Q_{gd}$		-	34	51	
Switching charge	$Q_{sw}$		-	52	-	
Gate charge total <sup>5)</sup>	$Q_g$		-	168	210	
Gate plateau voltage	$V_{plateau}$		-	4.5	-	V
Output charge <sup>5)</sup>	$Q_{oss}$	$V_{DD}=50\text{ V}, V_{GS}=0\text{ V}$	-	213	283	nC

**Reverse Diode**

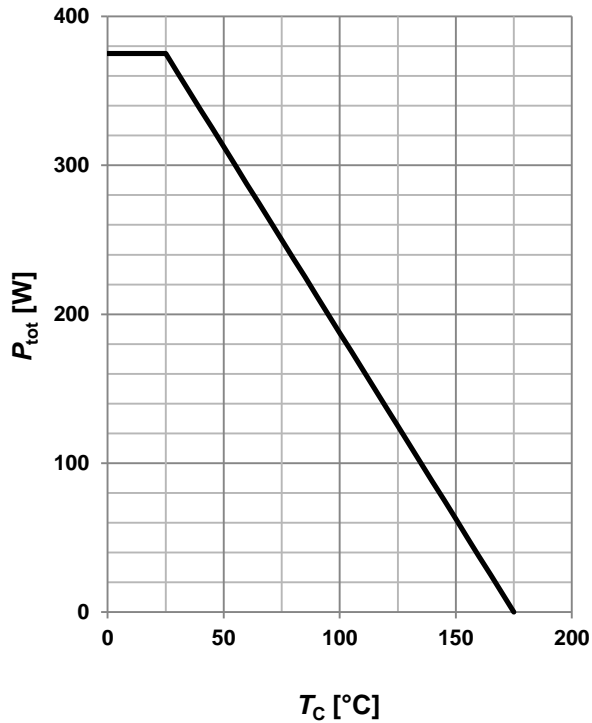
Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	176	A
Diode pulse current	$I_{S,pulse}$		-	-	480	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=100\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.9	1.2	V
Reverse recovery time <sup>5)</sup>	$t_{rr}$	$V_R=50\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	99	198	ns
Reverse recovery charge <sup>5)</sup>	$Q_{rr}$		-	287	574	nC

<sup>5)</sup> Defined by design. Not subject to production test

<sup>6)</sup> See figure 16 for gate charge parameter definition

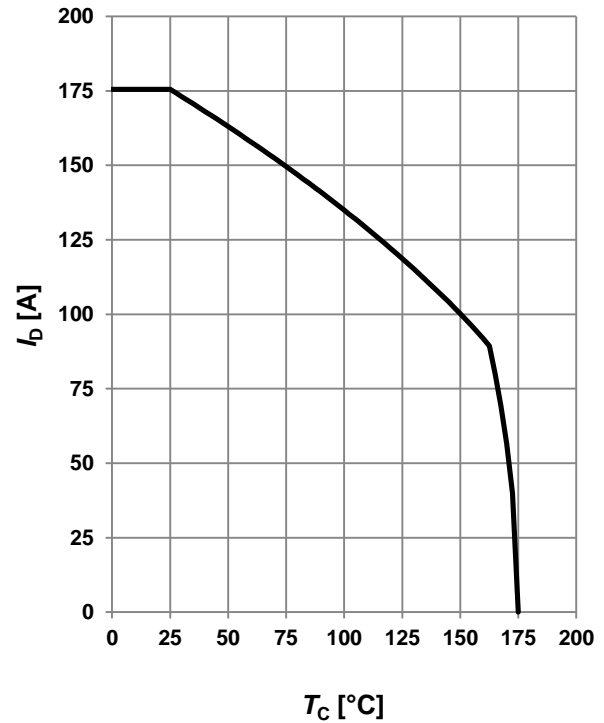
**1 Power dissipation**

$P_{tot}=f(T_C)$



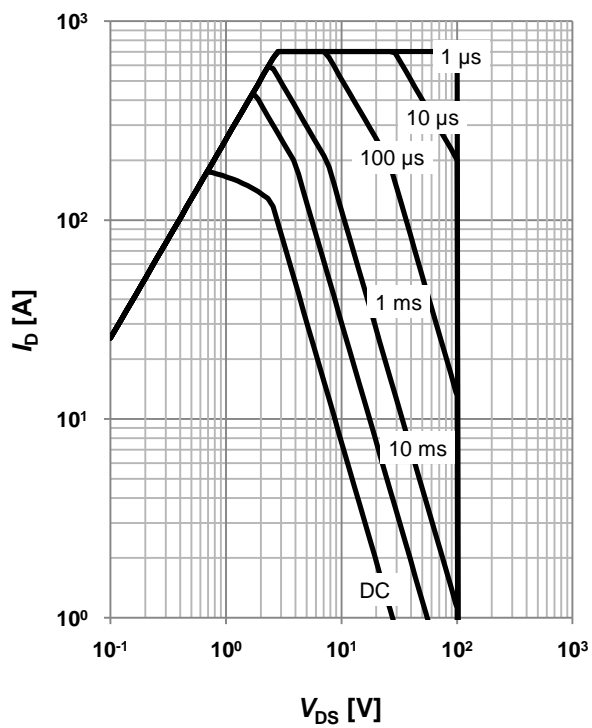
**2 Drain current**

$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



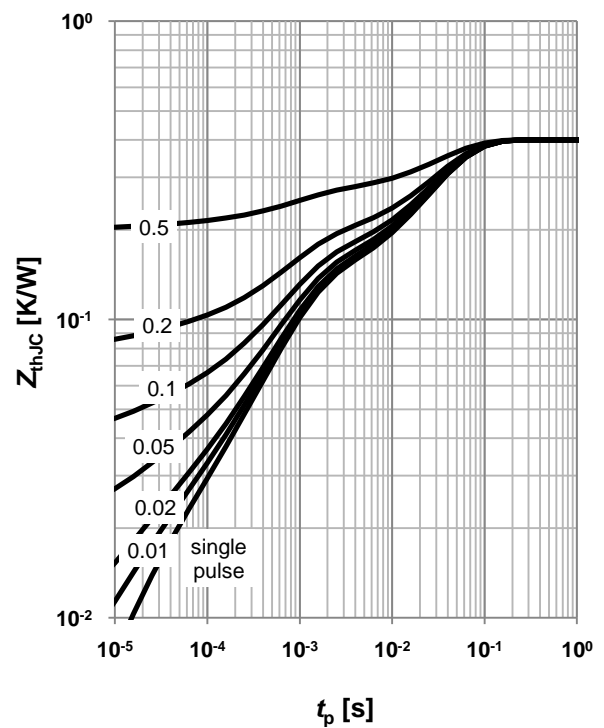
**3 Safe operating area**

$I_D=f(V_{DS}); T_C=25\text{ °C}; D=0$   
parameter:  $t_p$



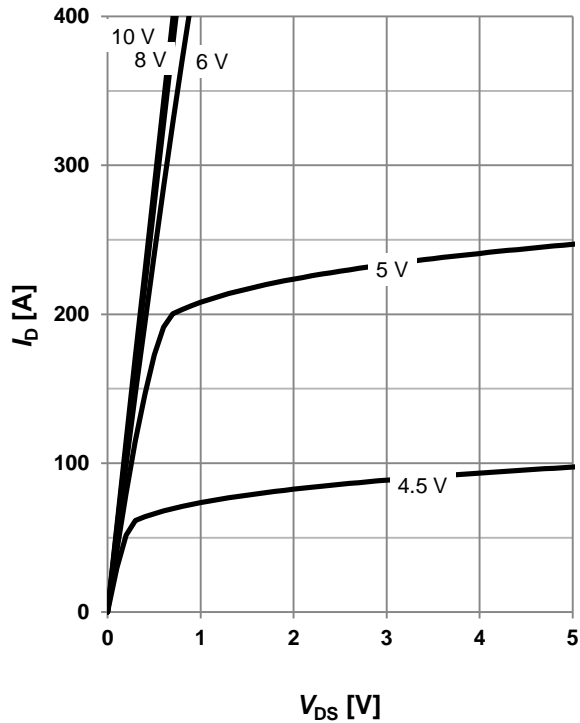
**4 Max. transient thermal impedance**

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



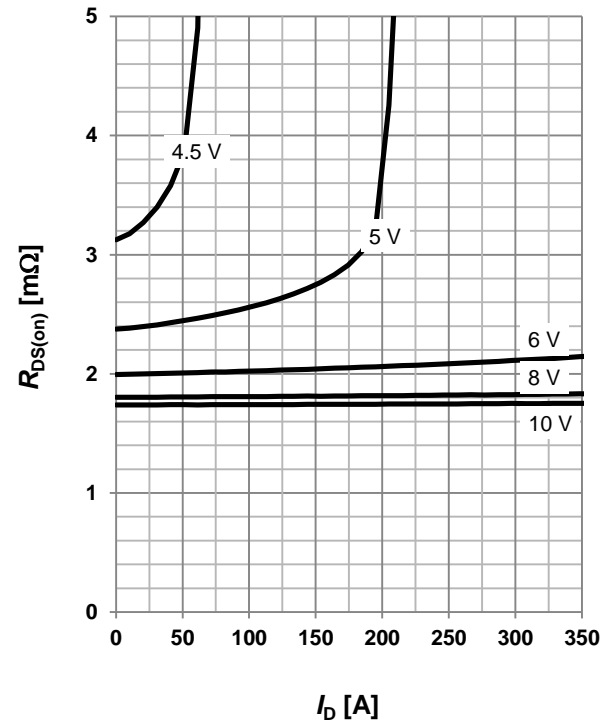
**5 Typ. output characteristics**

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



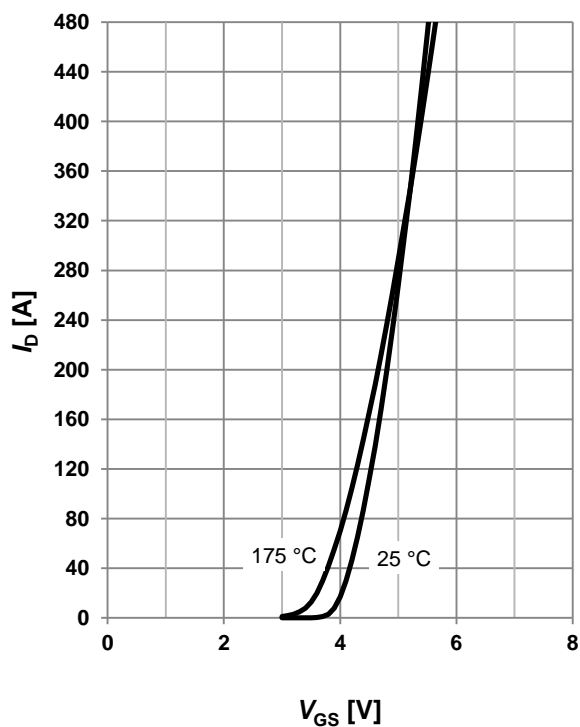
**6 Typ. drain-source on resistance**

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



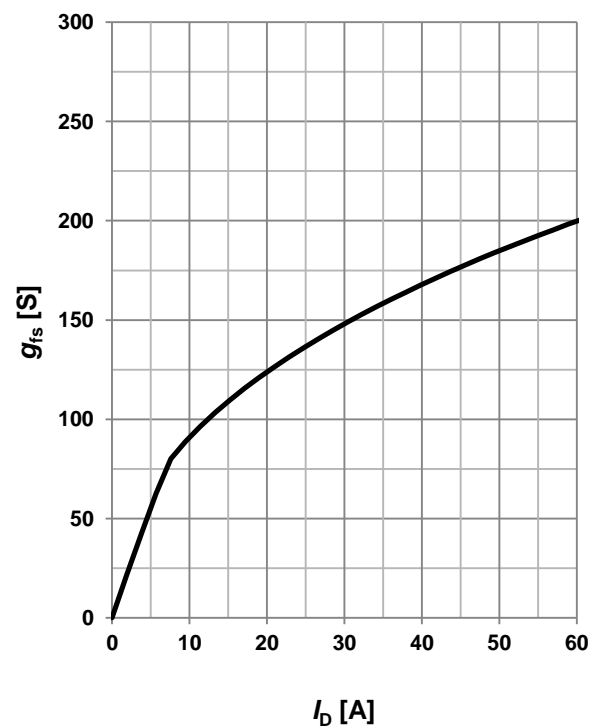
**7 Typ. transfer characteristics**

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



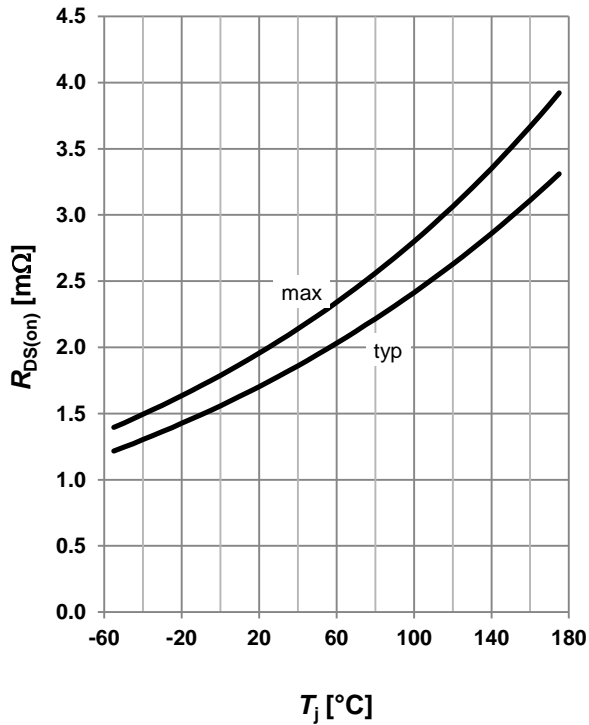
**8 Typ. forward transconductance**

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



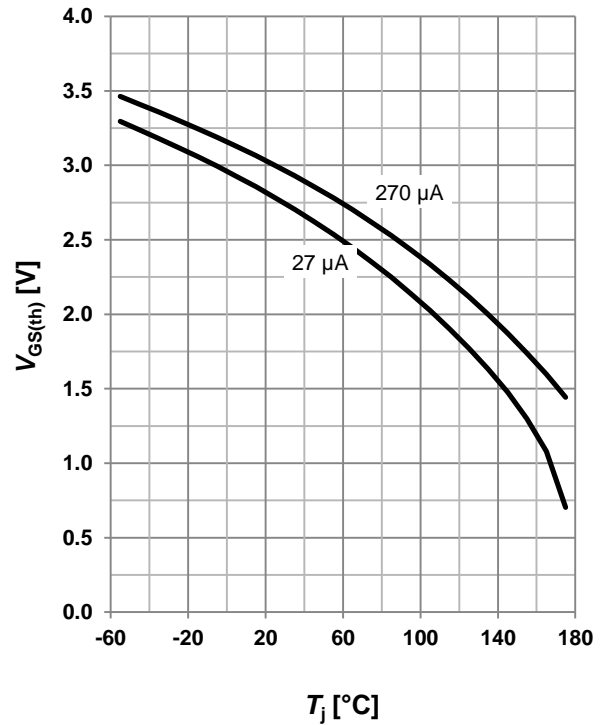
**9 Drain-source on-state resistance**

$R_{DS(on)}=f(T_j)$ ;  $I_D=100\text{ A}$ ;  $V_{GS}=10\text{ V}$



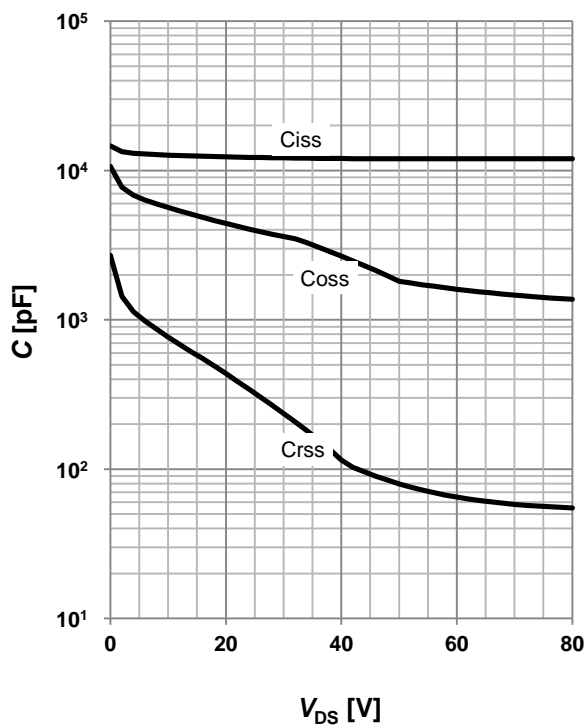
**10 Typ. gate threshold voltage**

$V_{GS(th)}=f(T_j)$ ;  $V_{GS}=V_{DS}$   
parameter:  $I_D$



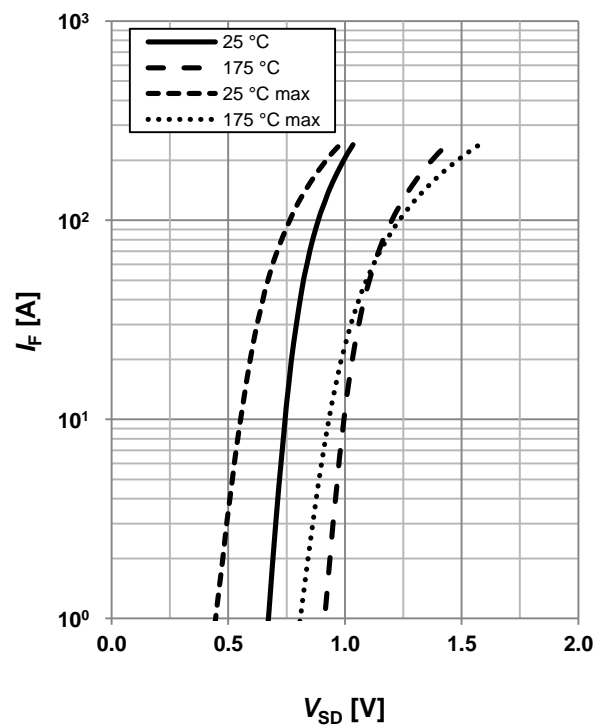
**11 Typ. capacitances**

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



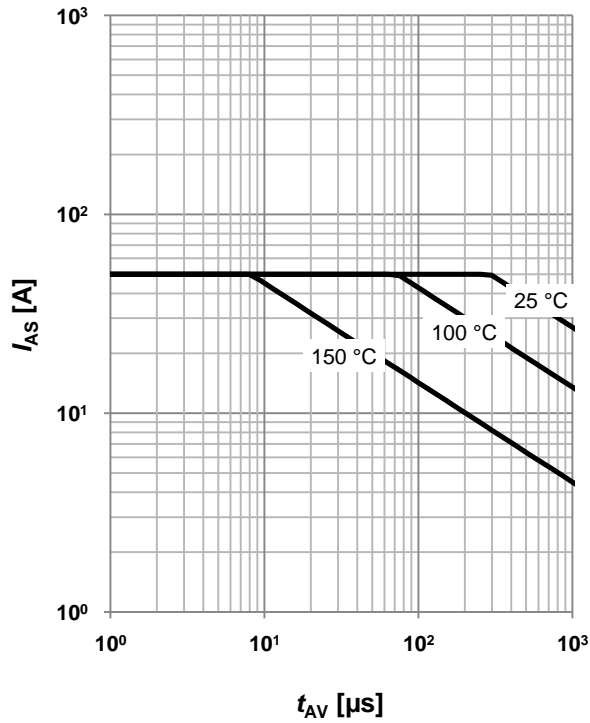
**12 Forward characteristics of reverse diode**

$I_F=f(V_{SD})$   
parameter:  $T_j$



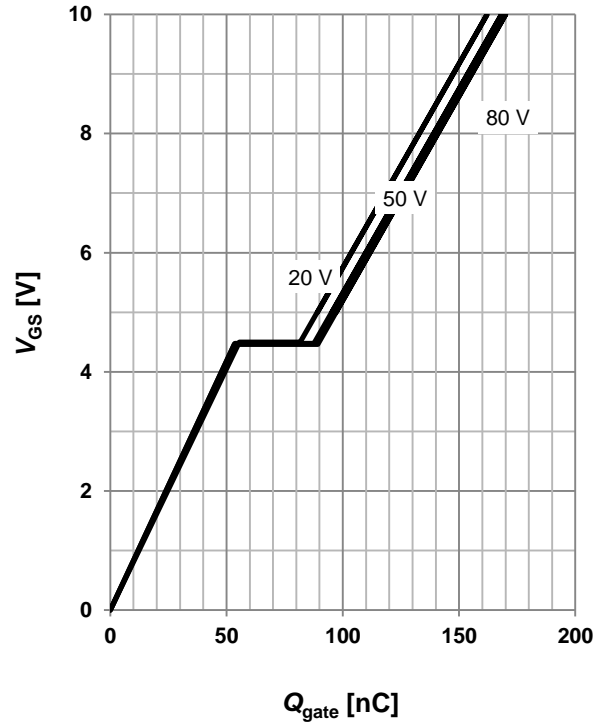
**13 Avalanche characteristics**

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



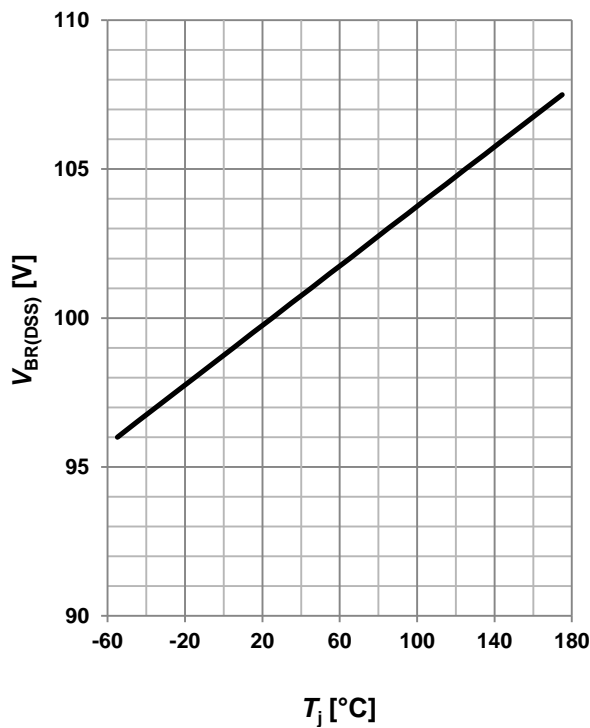
**14 Typ. gate charge**

$V_{GS}=f(Q_{\text{gate}}); I_D=100 \text{ A pulsed}$   
parameter:  $V_{DD}$



**15 Drain-source breakdown voltage**

$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$





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