



**THE DATASHEET OF  
IPP45N06S3-16**



**OptiMOS<sup>®</sup> -T2 Power-Transistor**

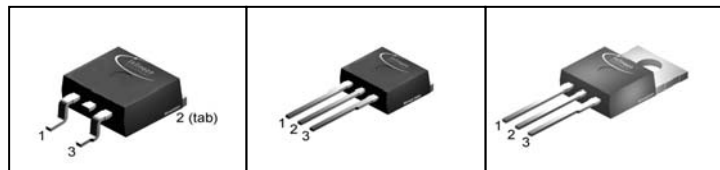
**Product Summary**

$V_{DS}$	55	V
$R_{DS(on),max}$ (SMD version)	15.4	m $\Omega$
$I_D$	45	A

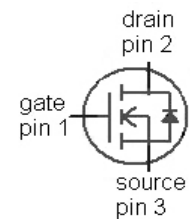
**Features**

- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green product (RoHS compliant)
- 100% Avalanche tested

PG-TO263-3-2      PG-TO262-3-1      PG-TO220-3-1



Type	Package	Marking
IPB45N06S3-16	PG-TO263-3-2	3N0616
IPI45N06S3-16	PG-TO262-3-1	3N0616
IPP45N06S3-16	PG-TO220-3-1	3N0616


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current <sup>1)</sup>	$I_D$	$T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$	45	A
		$T_C=100\text{ °C}$ , $V_{GS}=10\text{ V}^{2)}$	33	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	90	
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	$I_D=22.5\text{ A}$	145	mJ
Avalanche current, single pulse	$I_{AS}$		45	A
Gate source voltage <sup>3)</sup>	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	65	W
Operating and storage temperature	$T_j, T_{stg}$		-55 ... +175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
<b>Thermal characteristics<sup>2)</sup></b>						
Thermal resistance, junction - case	$R_{thJC}$		-	-	2.3	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$		-	-	62	
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>5)</sup>	-	-	40	

**Electrical characteristics, at  $T_j=25\text{ °C}$ , unless otherwise specified**
**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$	55	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=30\text{ }\mu\text{A}$	2.1	3	4	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{1)}$	-	1	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=23\text{ A}$	-	13.5	15.7	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=23\text{ A},$ SMD version	-	13.2	15.4	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics<sup>2)</sup>**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	2980	-	pF
Output capacitance	$C_{oss}$		-	450	-	
Reverse transfer capacitance	$C_{rss}$		-	430	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=27.5\text{ V},$ $V_{GS}=10\text{ V}, I_D=45\text{ A},$ $R_G=22\ \Omega$	-	28	-	ns
Rise time	$t_r$		-	61	-	
Turn-off delay time	$t_{d(off)}$		-	26	-	
Fall time	$t_f$		-	68	-	

**Gate Charge Characteristics<sup>2)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=11\text{ V}, I_D=45\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	23	-	nC
Gate to drain charge	$Q_{gd}$		-	10	-	
Gate charge total	$Q_g$		-	43	57	
Gate plateau voltage	$V_{plateau}$		-	7.2	-	V

**Reverse Diode**

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	45	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		-	-	90	
Diode forward voltage <sup>2)</sup>	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=45\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	1.1	1.3	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=27.5\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	20	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	25	-	nC

<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 2.3\text{ K/W}$  the chip is able to carry 46A at 25°C. For detailed information see Application Note ANPS071E

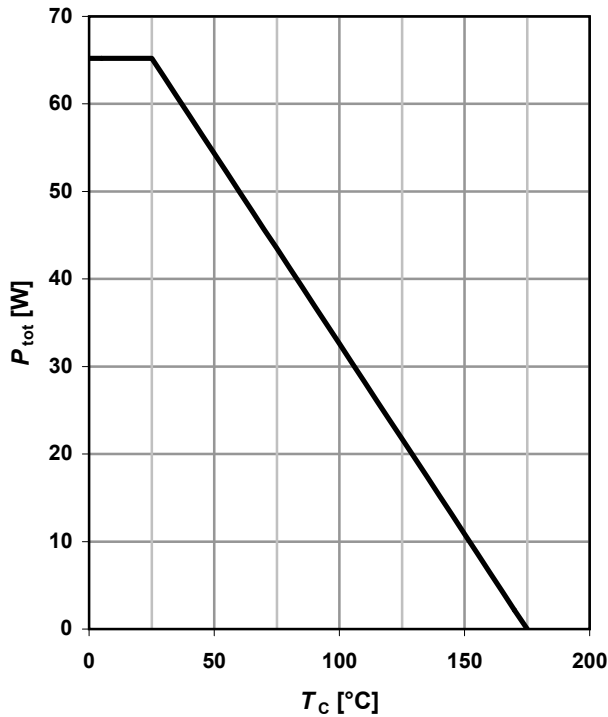
<sup>2)</sup> Defined by design. Not subject to production test.

<sup>3)</sup> Qualified at -5V and +20V.

<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.

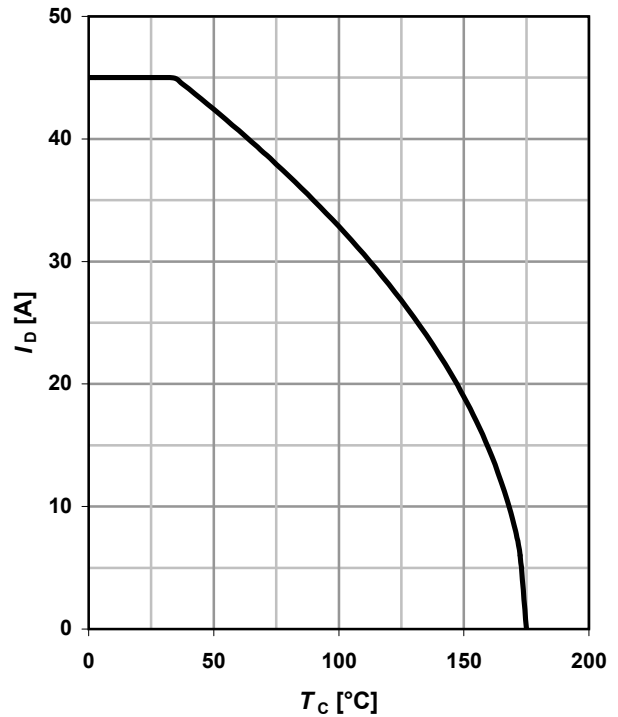
**1 Power dissipation**

$P_{tot}=f(T_C); V_{GS} \geq 6 \text{ V}$



**2 Drain current**

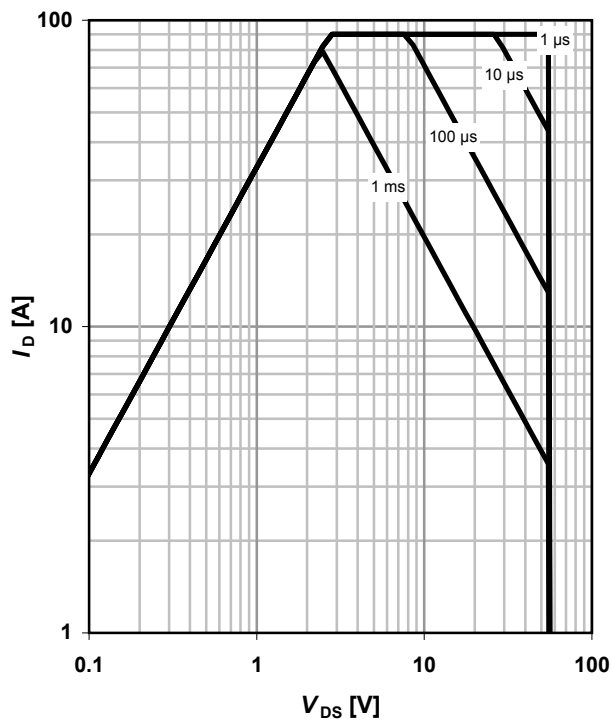
$I_D=f(T_C); V_{GS} \geq 10 \text{ V}$



**3 Safe operating area**

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

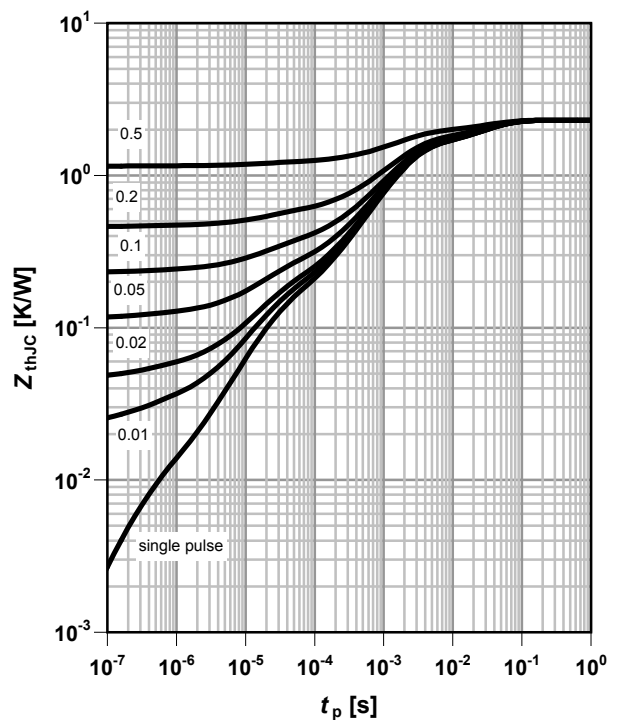
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC}=f(t_p)$

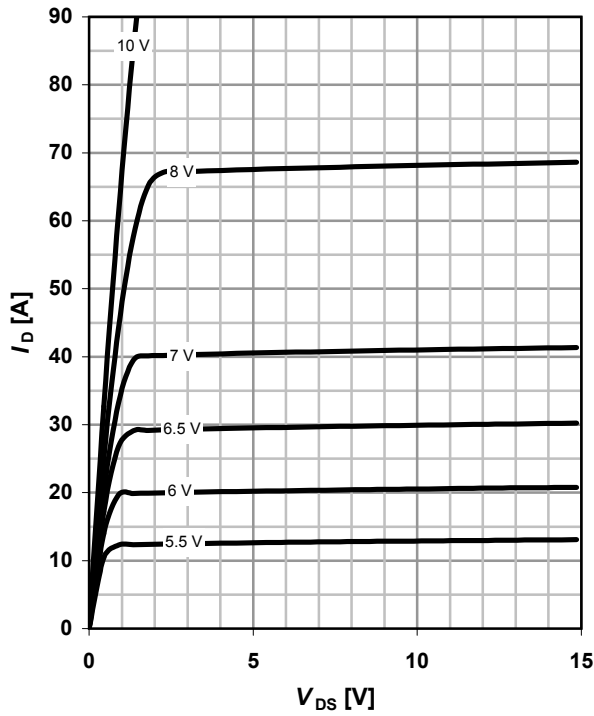
parameter:  $D=t_p/T$



**5 Typ. output characteristics**

$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C}$

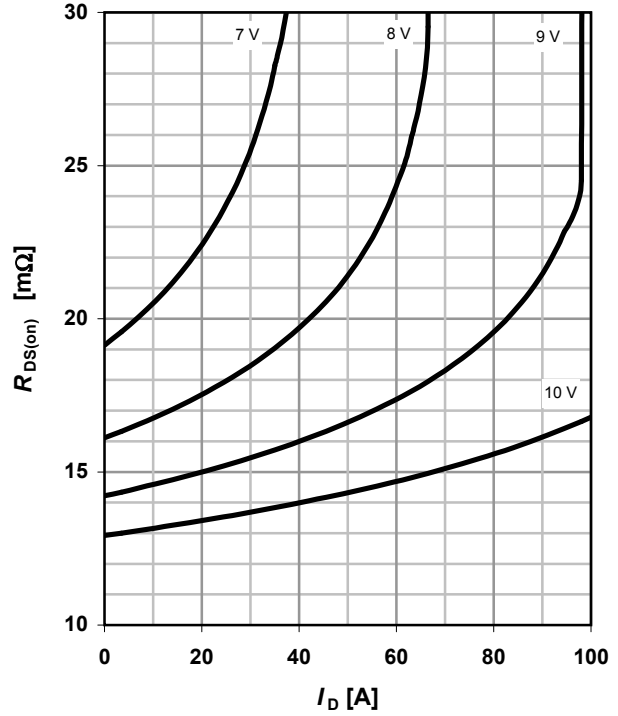
parameter:  $V_{GS}$ , pulsed



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

$R_{DS(on)}=f(I_D); T_j=25\text{ }^\circ\text{C}$

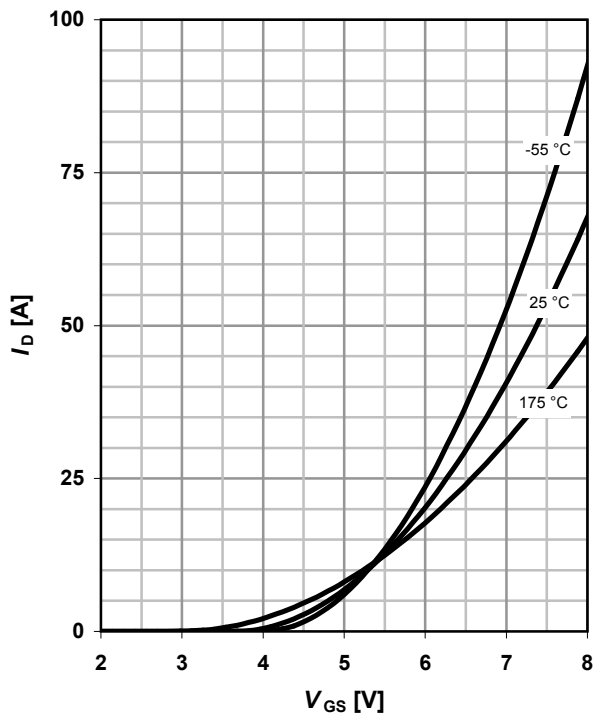
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

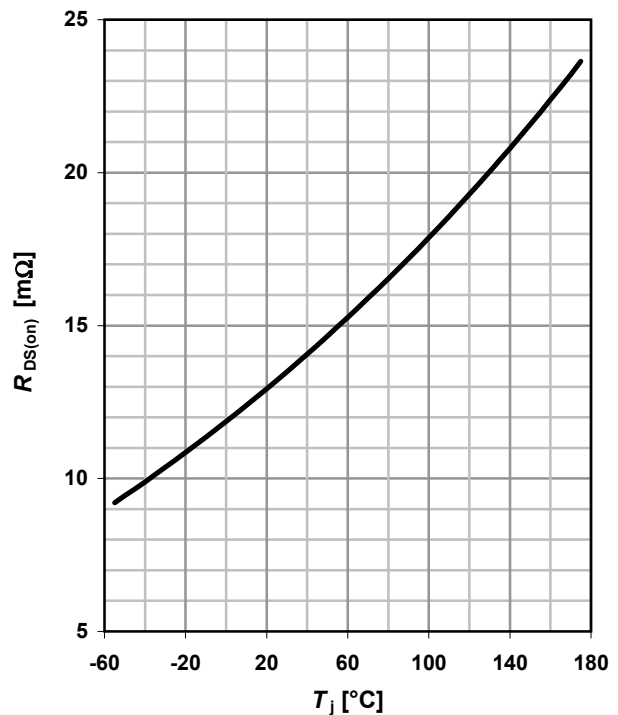
$I_D=f(V_{GS}); V_{DS}=10\text{ V}$

parameter:  $T_j$



**8 Drain-source on-state resistance**

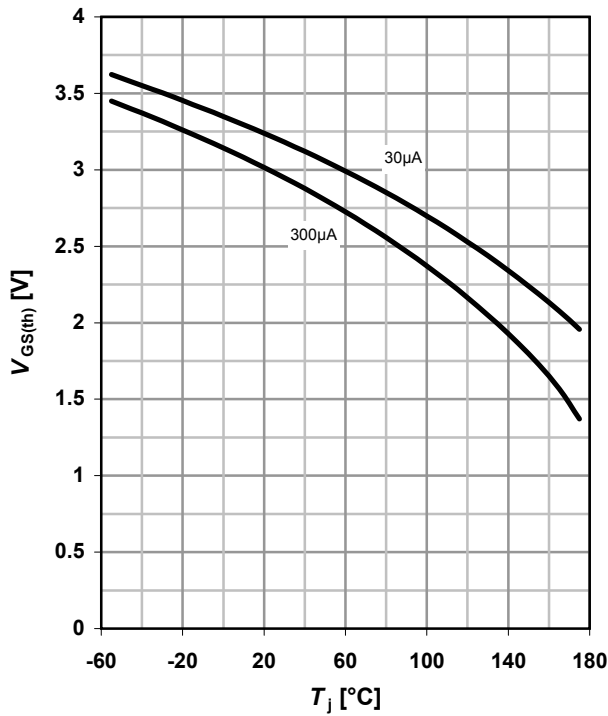
$R_{DS(on)}=f(T_j); I_D=20\text{ A}; V_{GS}=10\text{ V}$



**9 Typ. gate threshold voltage**

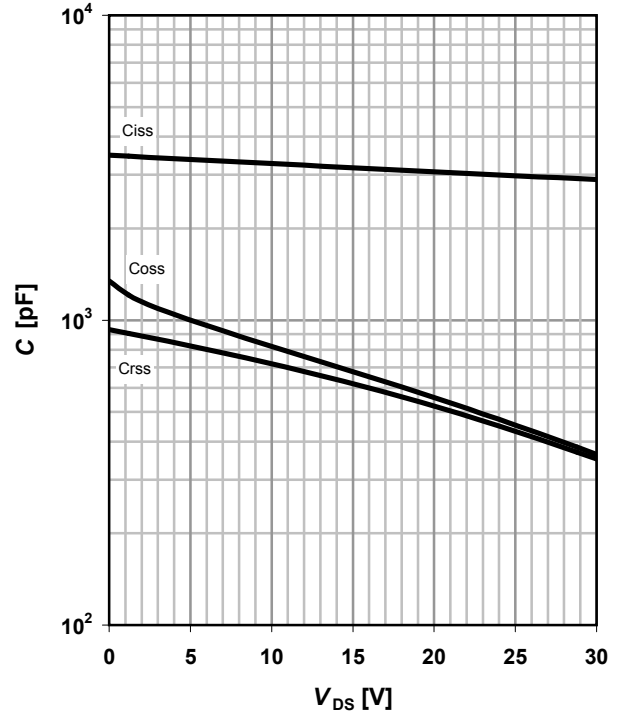
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

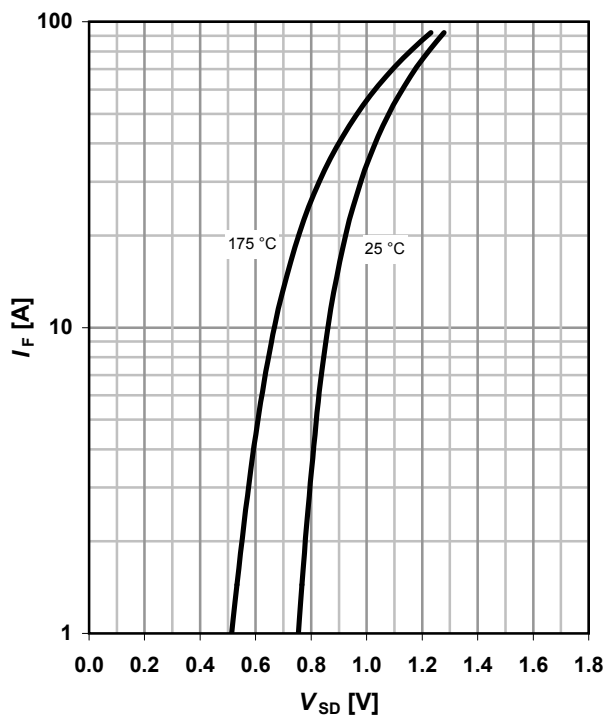
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**11 Forward characteristics of reverse diode**

$I_F = f(V_{SD}), \text{ pulsed}$

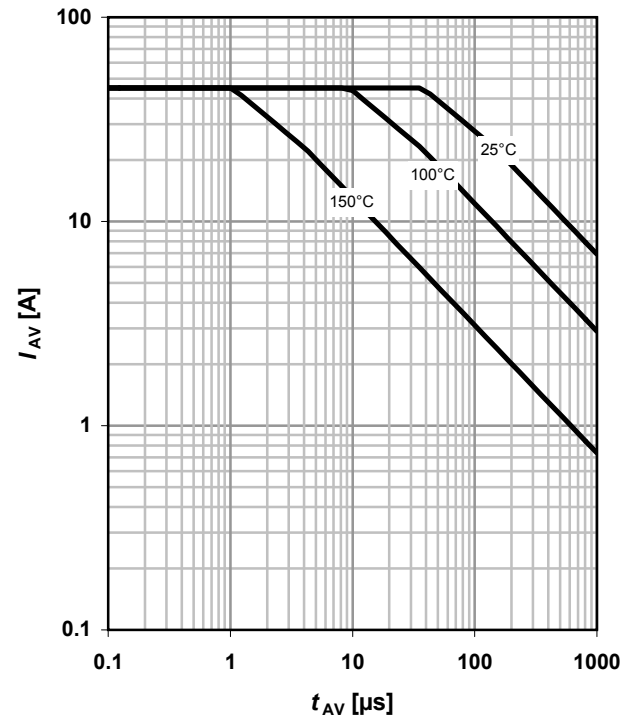
parameter:  $T_j$



**12 Typ. avalanche characteristics**

$I_{AS} = f(t_{AV})$

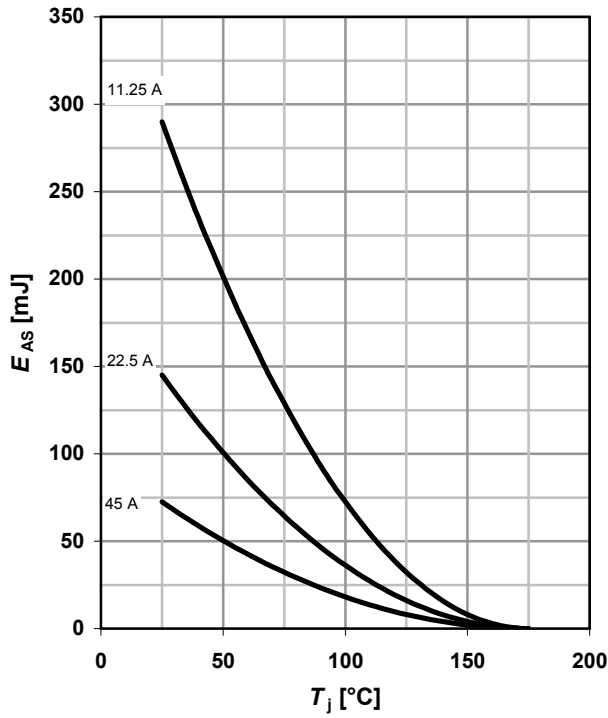
parameter:  $T_{j(start)}$



**13 Typ. avalanche energy**

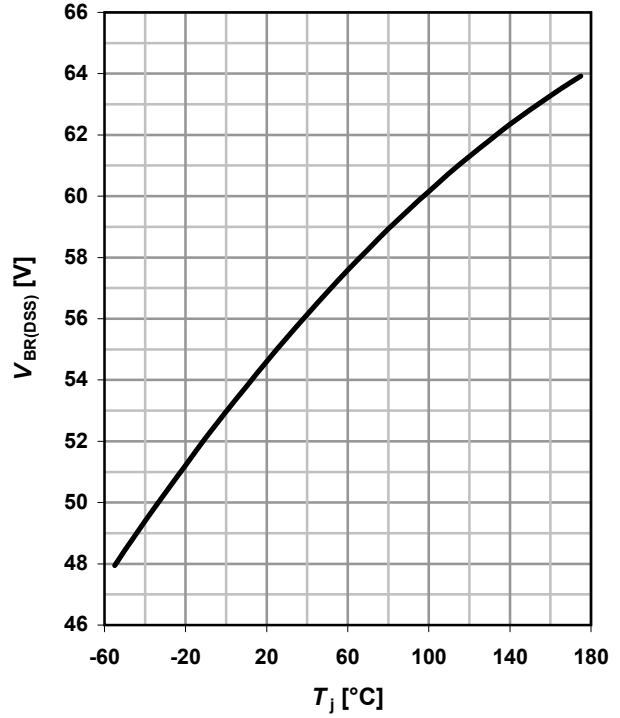
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



**15 Drain-source breakdown voltage**

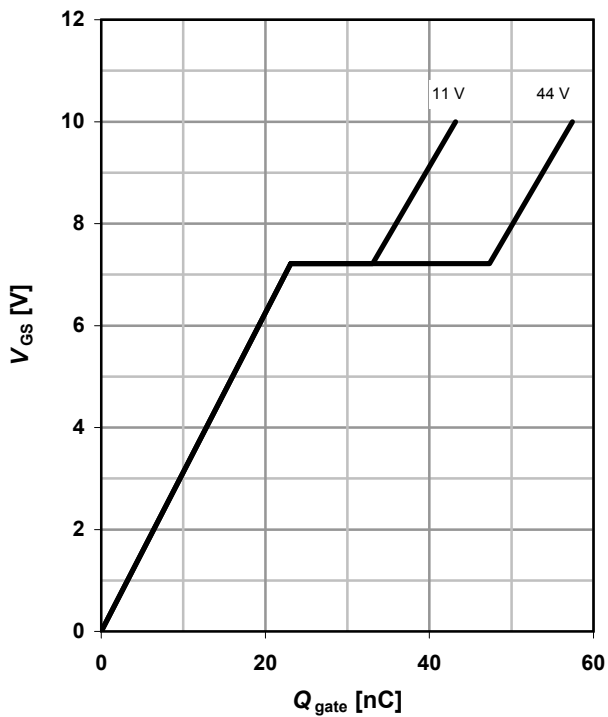
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



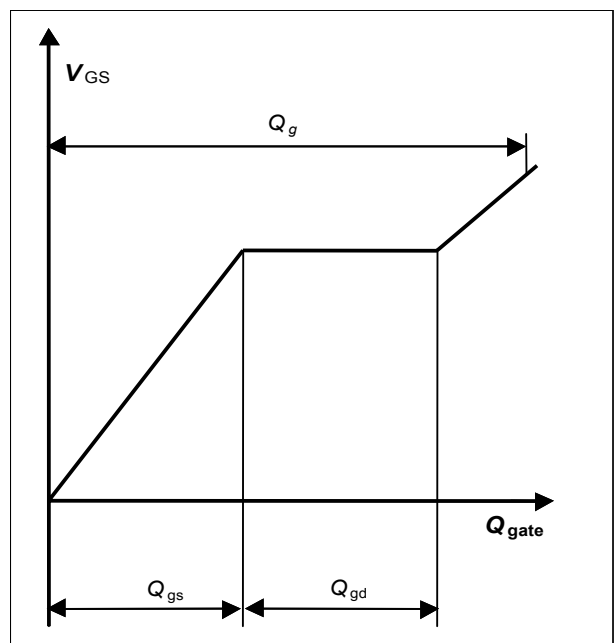
**14 Typ. gate charge**

$$V_{GS} = f(Q_{gate}); I_D = 45 \text{ A pulsed}$$

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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Revision History

Version	Date	Changes
Data Sheet 2.1	15.12.2006	Removal of ordering code
Data Sheet 2.1	15.12.2006	Implementation of avalanche current single pulse
Data Sheet 2.1	15.12.2006	Update of Infineon address
Data Sheet 2.1	15.12.2006	Removal of foot note 3, avalanche diagrams
Data Sheet 2.1	15.12.2006	Implementation of Qrr and trr typ
Data Sheet 2.1	15.12.2006	Pulse current rating from 180A to 90A
Data Sheet 2.1	15.12.2006	Update of disclaimer
Data Sheet 2.1	15.12.2006	Implementation of RoHS and AEC logo, update of feature list
Data Sheet 1.1	07.11.2007	Update of data sheet layout
Data Sheet 1.1	07.11.2007	Adaptation of Ias
Data Sheet 1.1	07.11.2007	implementation of footnote 2 for Eas specification
Data Sheet 1.1	07.11.2007	removal of Vdg specification from data sheet

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