

## OptiMOS®-T2 Power-Transistor



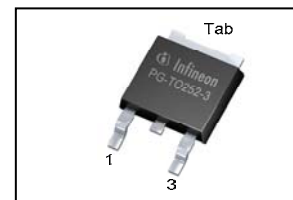
### Features

- 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

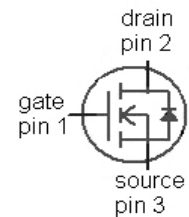
### Product Summary

$V_{DS}$	30	V
$R_{DS(on),max}$	3.3	mΩ
$I_D$	90	A

PG-TO252-3-11



Type	Package	Marking
IPD90N03S4L-03	PG-TO252-3-11	4N03L03



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current <sup>1)</sup>	$I_D$	$T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$	90	A
		$T_C=100\text{ °C}$ , $V_{GS}=10\text{ V}^{2)}$	90	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	360	
Avalanche energy, single pulse	$E_{AS}$	$I_D=90\text{ A}$	85	mJ
Avalanche current, single pulse	$I_{AS}$	$T_C=25\text{ °C}$	90	A
Gate source voltage	$V_{GS}$	-	±16	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	94	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.	

### Thermal characteristics<sup>2)</sup>

Thermal resistance, junction - case	$R_{thJC}$		-	-	1.6	K/W
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>3)</sup>	-	-	40	

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

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	30	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=45\text{ }\mu\text{A}$	1.0	1.6	2.2	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.01	1	$\mu\text{A}$
		$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$	-	10	1000	
		$V_{DS}=18\text{ V}, V_{GS}=0\text{ V}, T_j=85\text{ °C}^{2)}$	-	5	60	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=16\text{ V}, V_{DS}=0\text{ V}$	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=45\text{ A}$	-	3.4	4.4	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=90\text{ A}$	-	2.5	3.3	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	4000	5100	pF
Output capacitance	$C_{oss}$		-	1000	1300	
Reverse transfer capacitance	$C_{rss}$		-	53	100	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$ $I_D=90\text{ A}, R_G=3.5\ \Omega$	-	9	-	ns
Rise time	$t_r$		-	6	-	
Turn-off delay time	$t_{d(off)}$		-	37	-	
Fall time	$t_f$		-	7	-	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=24\text{ V}, I_D=90\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	12	15	nC
Gate to drain charge	$Q_{gd}$		-	8	16	
Gate charge total	$Q_g$		-	60	75	
Gate plateau voltage	$V_{plateau}$		-	3.1	-	V

### Reverse Diode

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C=25\text{ °C}$	-	-	90	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		-	-	360	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=90\text{ A},$ $T_j=25\text{ °C}$	0.6	0.9	1.3	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	60	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	50	-	

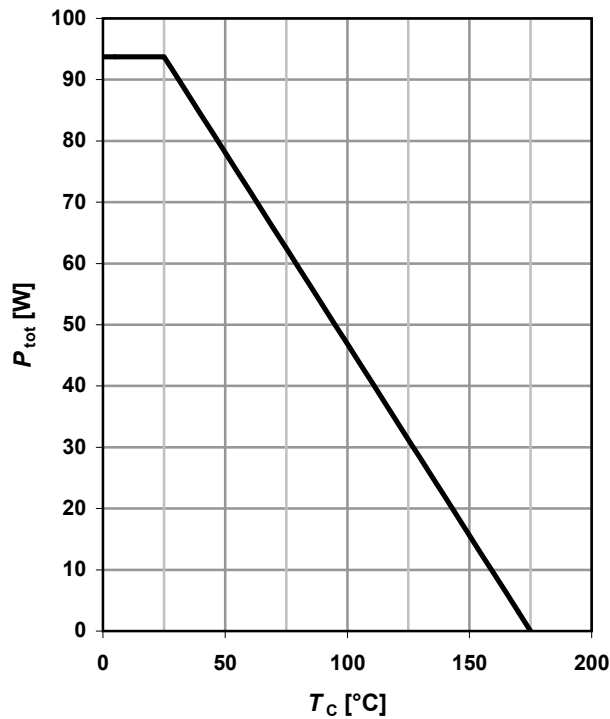
<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 1.6\text{K/W}$  the chip is able to carry 129A at 25°C.

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

<sup>3)</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.

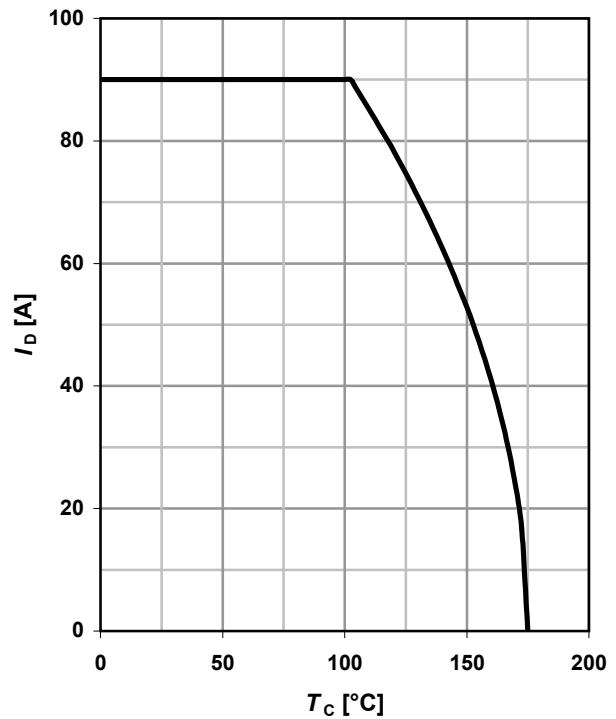
### 1 Power dissipation

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



### 2 Drain current

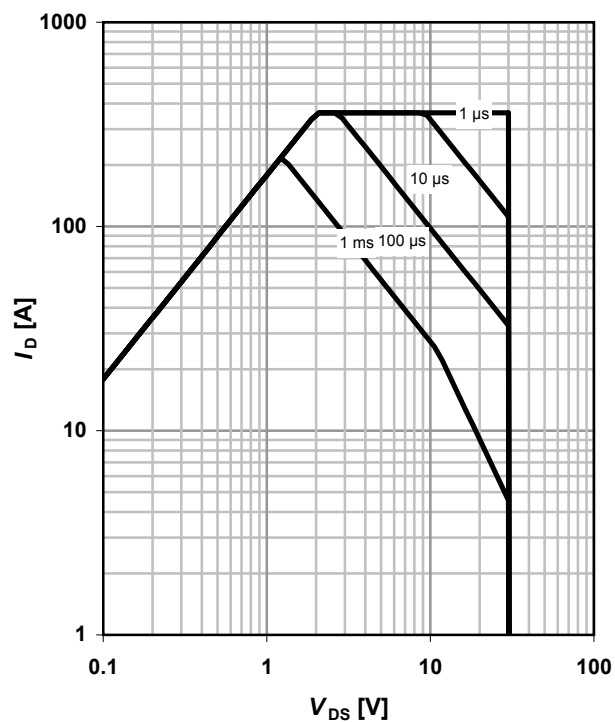
$$I_D = f(T_C); V_{\text{GS}} \geq 6 \text{ V}$$



### 3 Safe operating area

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

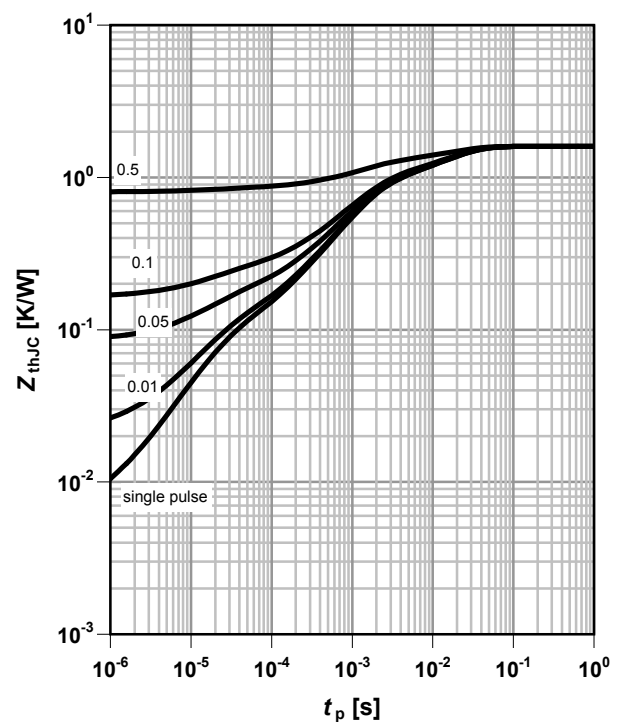
parameter:  $t_p$



### 4 Max. transient thermal impedance

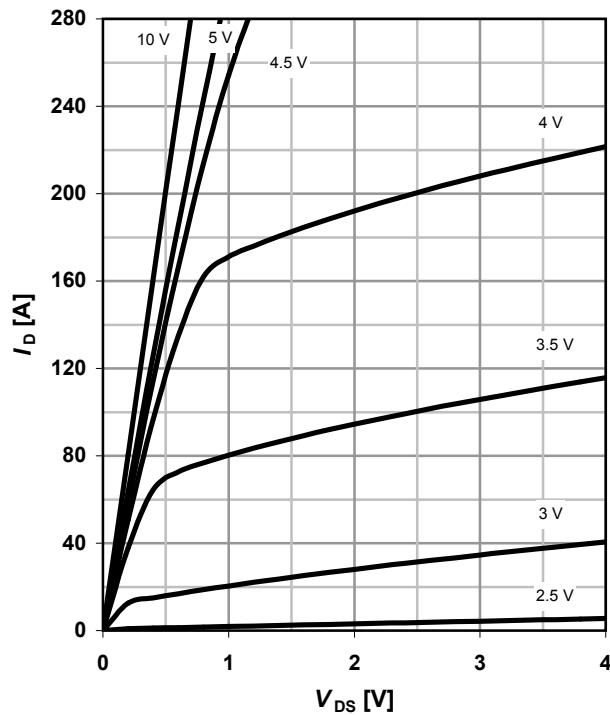
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p/T$



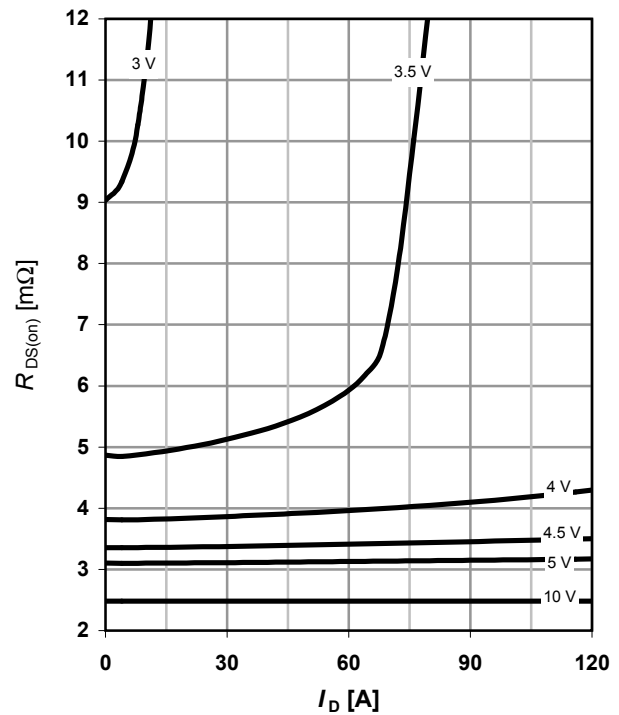
### 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


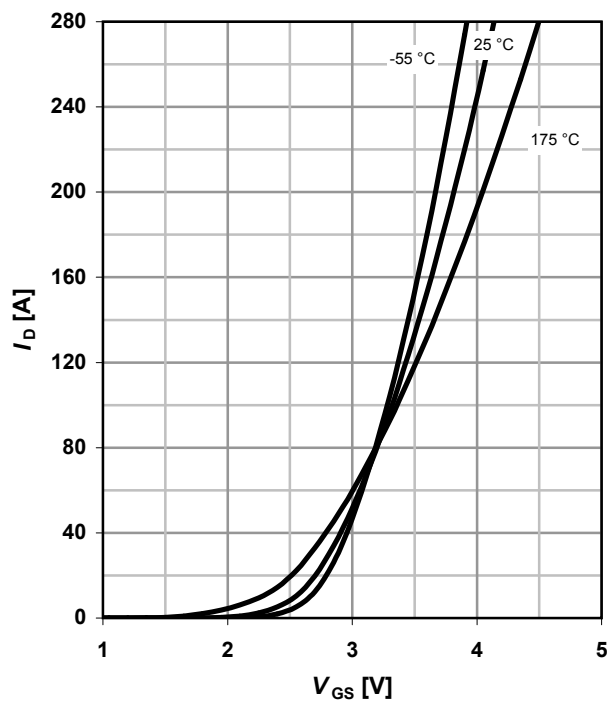
### 6 Typ. drain-source on-state resistance

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

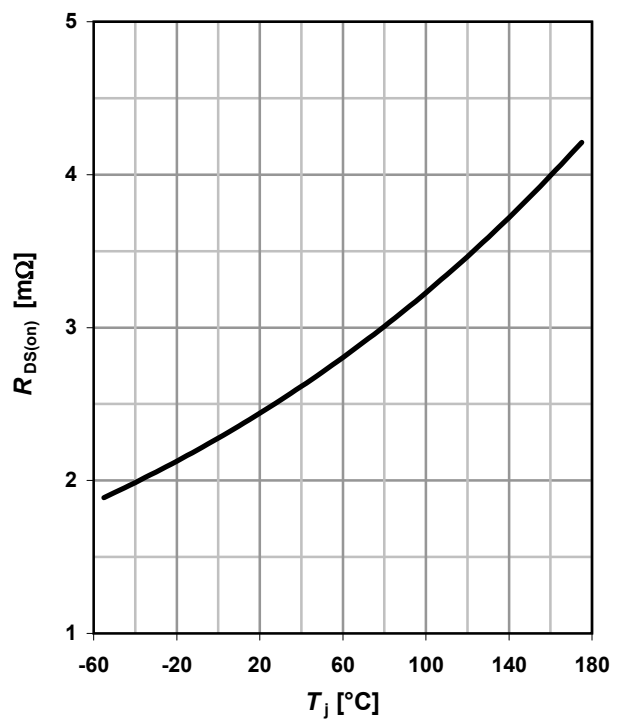
parameter:  $V_{GS}$ 


### 7 Typ. transfer characteristics

 $I_D = f(V_{GS}); V_{DS} = 6\text{ V}$ 

parameter:  $T_j$ 


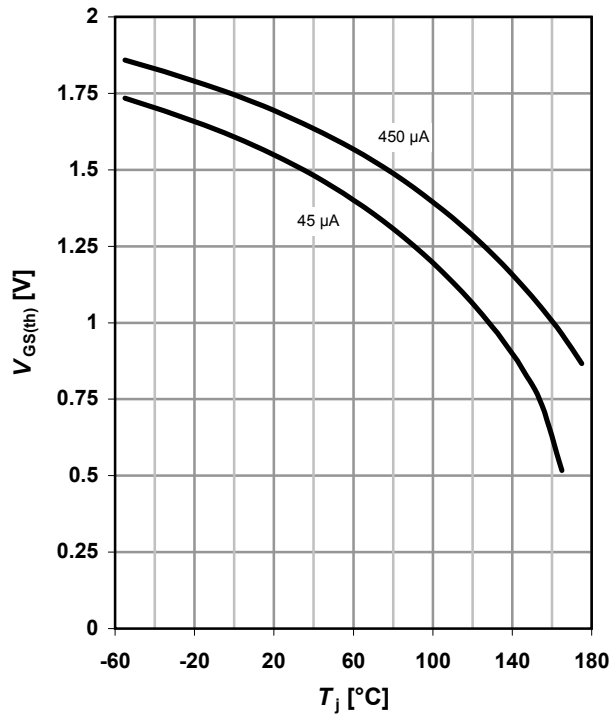
### 8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 90\text{ A}; V_{GS} = 10\text{ V}$ 


### 9 Typ. gate threshold voltage

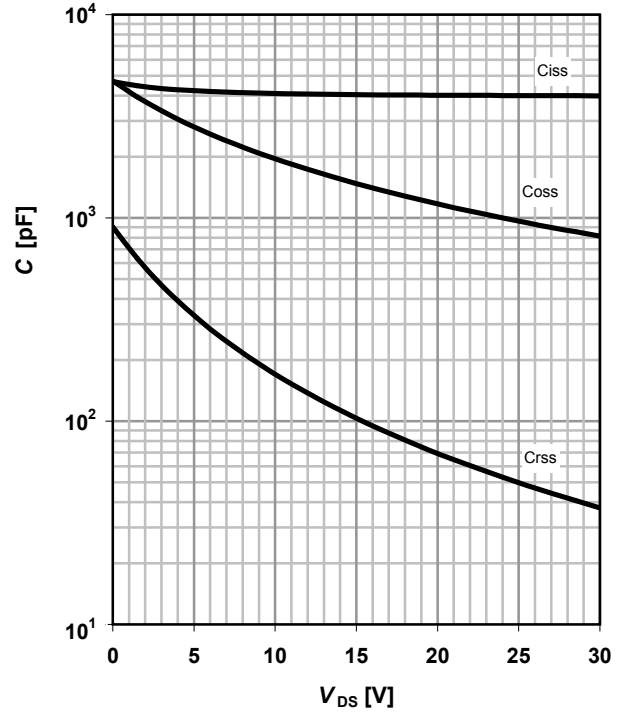
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



### 10 Typ. capacitances

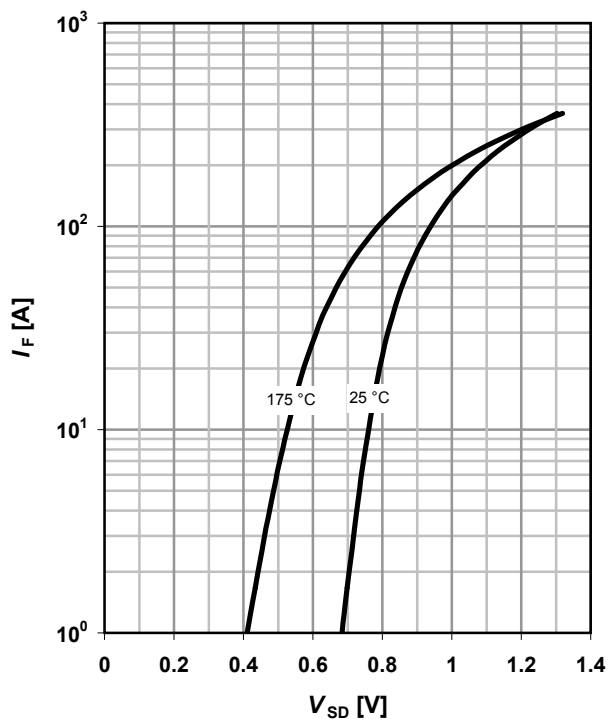
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 11 Typical forward diode characteristics

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

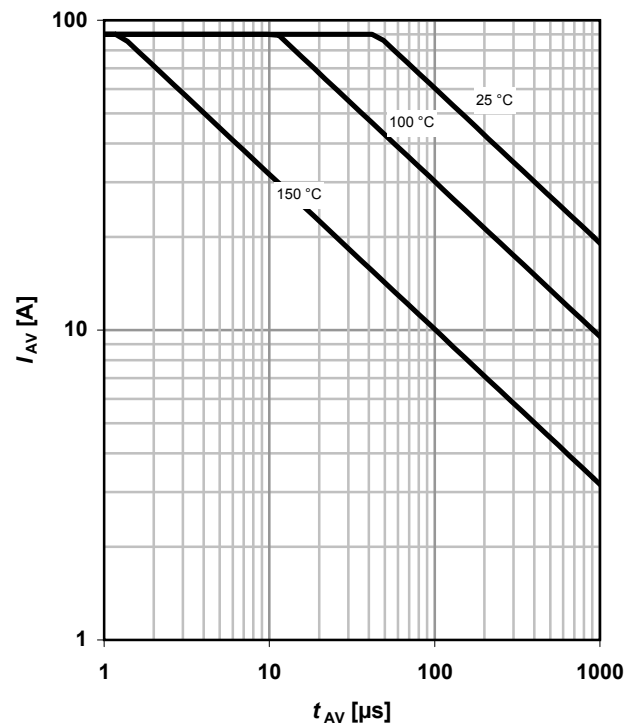
parameter:  $T_j$



### 12 Typ. avalanche characteristics

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

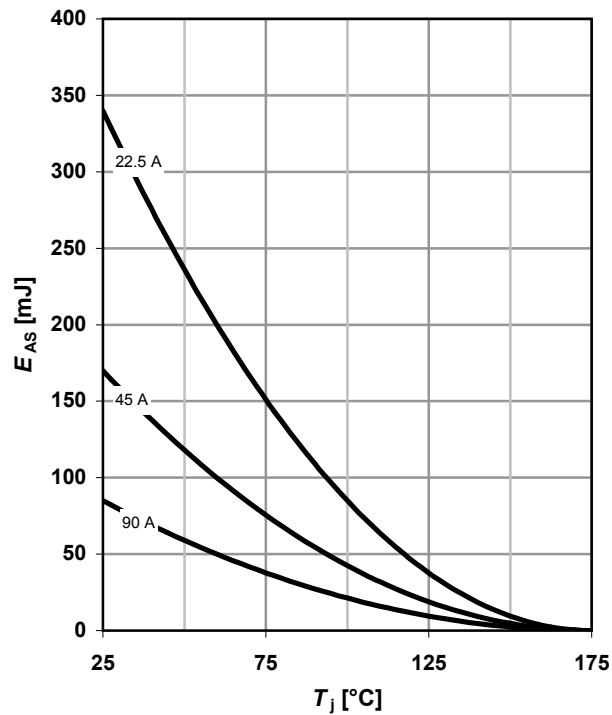
parameter:  $T_{j(start)}$



### 13 Typical avalanche energy

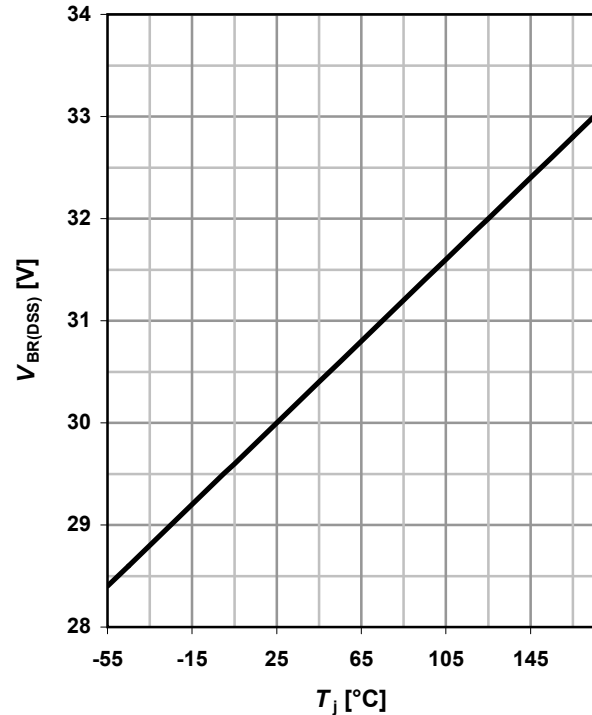
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



### 14 Typ. drain-source breakdown voltage

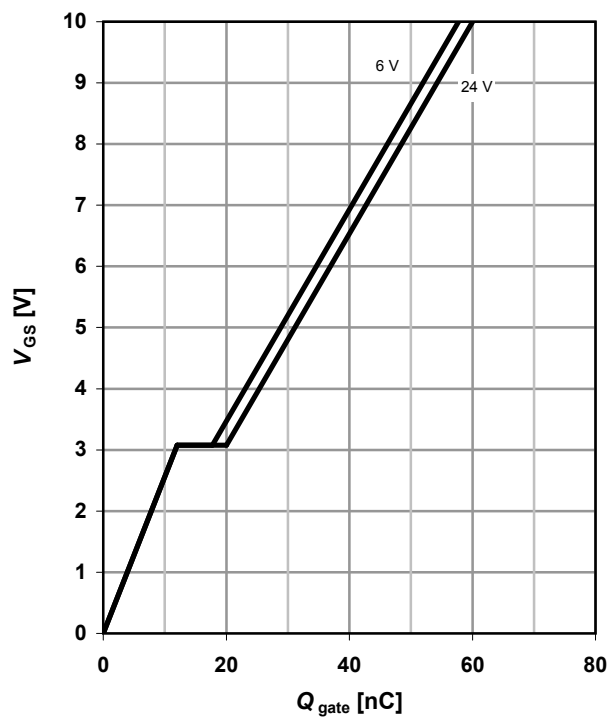
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



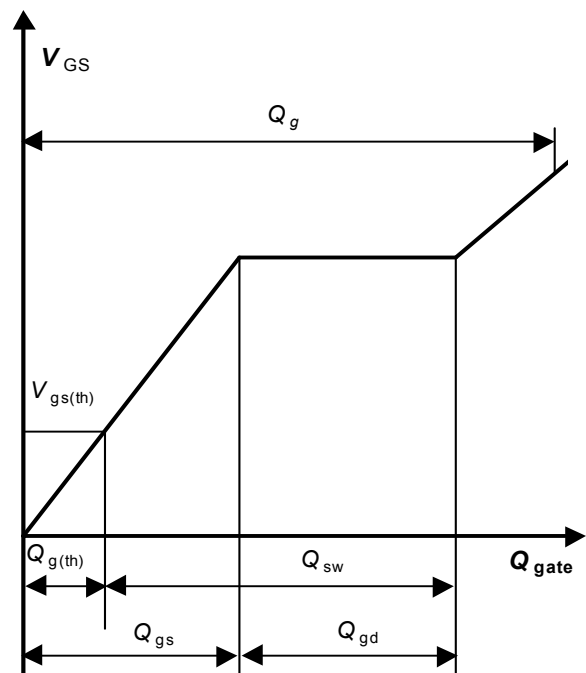
### 15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 90 \text{ A pulsed}$$

parameter:  $V_{DD}$



### 16 Gate charge waveforms



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Revision History

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Version	Date	Changes
Rev 2.0	09.03.2007	Final data sheet
Rev 2.1	08.03.2010	Update of RDSon