

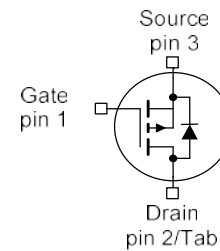
**OptiMOS<sup>®</sup>-P2 Power-Transistor**

**Features**

- P-channel - Logic Level - Enhancement mode
- AEC qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested
- Intended for reverse battery protection

**Product Summary**

$V_{DS}$	-30	V
$R_{DS(on)}$	4.1	mΩ
$I_D$	-90	A

**PG-TO252-3-11**


Type	Package	Marking
IPD90P03P4L-04	PG-TO252-3-11	4P03L04

**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	$E_{AS}$	$I_D=-45\text{A}$	370	mJ
Avalanche current, single pulse	$I_{AS}$	-	-90	A
Gate source voltage	$V_{GS}$	-	+5/-16	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	137	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	$R_{thJC}$	-	-	-	1.1	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  $T_j=25^\circ\text{C}$ , unless otherwise specified

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=-1mA$	-30	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-253\mu A$	-1.0	-1.5	-2.0	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=-24V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-0.05	-1	$\mu A$
		$V_{DS}=-24V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-20	-200	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=-16V, V_{DS}=0V$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=-4.5V, I_D=-90A$	-	5.1	6.8	m $\Omega$
		$V_{GS}=-10V, I_D=-90A$	-	3.3	4.1	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=-25V,$ $f=1MHz$	-	8670	11300	pF
Output capacitance	$C_{oss}$		-	2350	3050	
Reverse transfer capacitance	$C_{rss}$		-	93	186	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=-15V,$ $V_{GS}=-10V, I_D=-90A,$ $R_G=3.5\Omega$	-	17	-	ns
Rise time	$t_r$		-	11	-	
Turn-off delay time	$t_{d(off)}$		-	140	-	
Fall time	$t_f$		-	40	-	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=-24V, I_D=-90A,$ $V_{GS}=0 \text{ to } -10V$	-	29	38	nC
Gate to drain charge	$Q_{gd}$		-	15	30	
Gate charge total	$Q_g$		-	125	160	
Gate plateau voltage	$V_{plateau}$		-	-3.3	-	V

**Reverse Diode**

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C=25^\circ C$	-	-	-90	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		-	-	-360	
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_F=-90A,$ $T_j=25^\circ C$	-	-	-1.3	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=-15V, I_F=-50A,$ $di_F/dt=-100A/\mu s$	-	50	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	70	-	nC

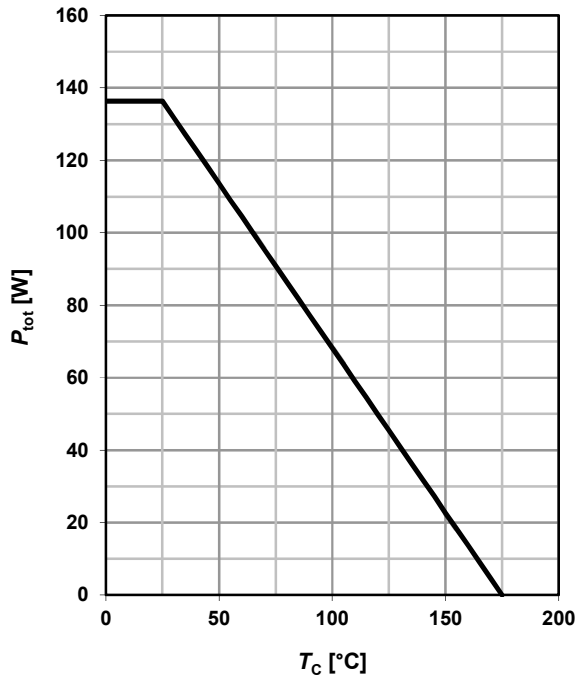
<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 1.1K/W$  the chip is able to carry -150A at 25°C.

<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.

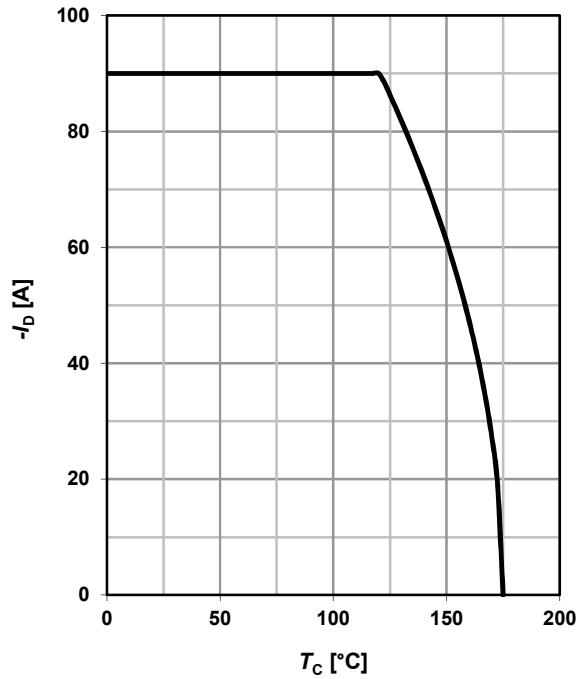
### 1 Power dissipation

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



### 2 Drain current

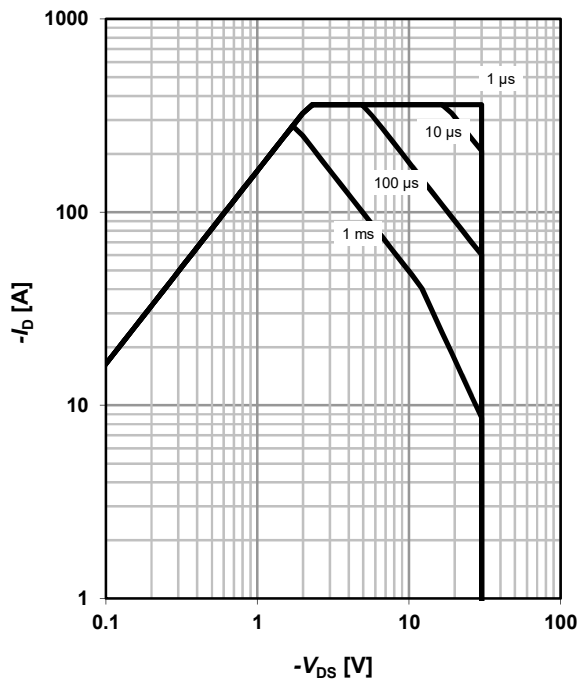
$$I_D = f(T_C); V_{\text{GS}} \leq -6\text{V}$$



### 3 Safe operating area

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

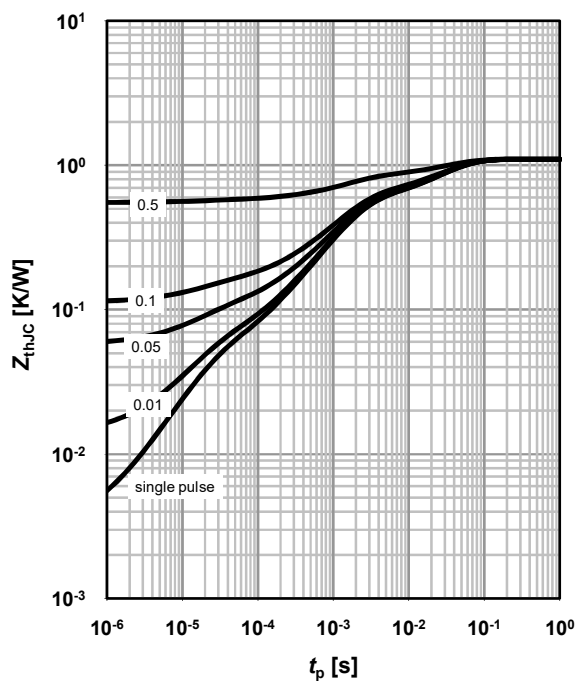
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

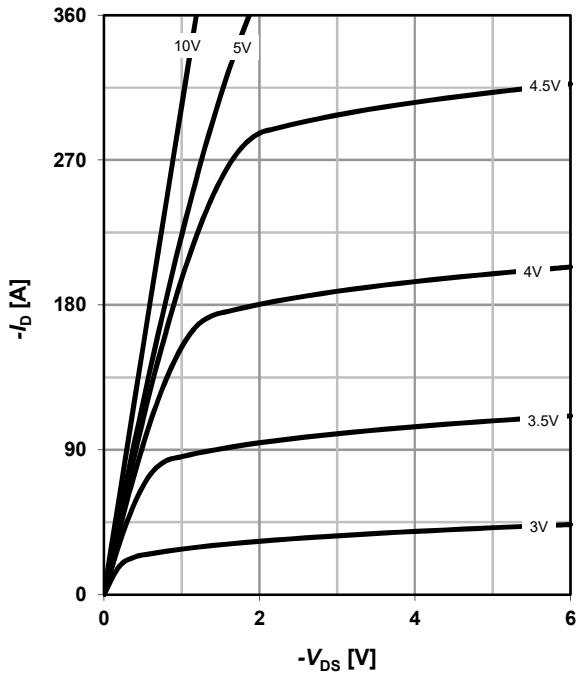
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

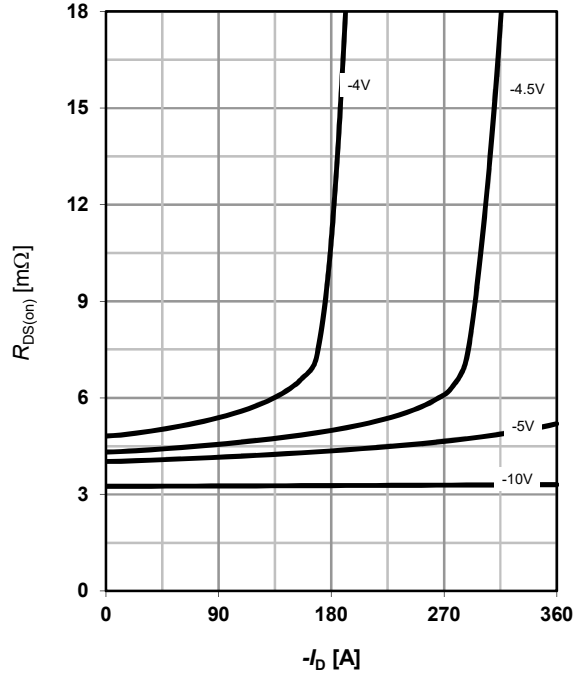
parameter:  $V_{GS}$



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

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

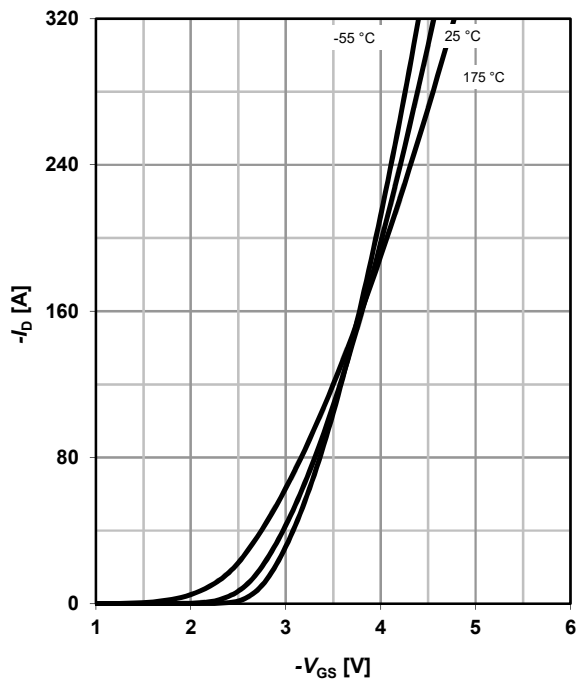
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

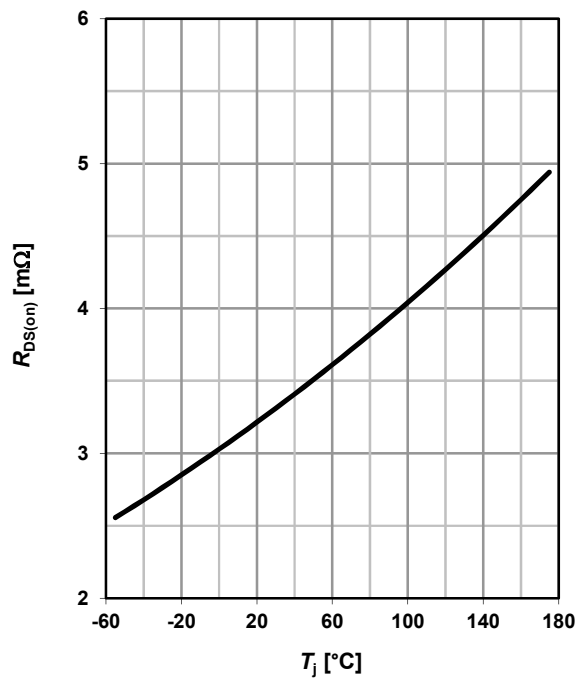
$I_D = f(V_{GS}); V_{DS} = -6V$

parameter:  $T_j$



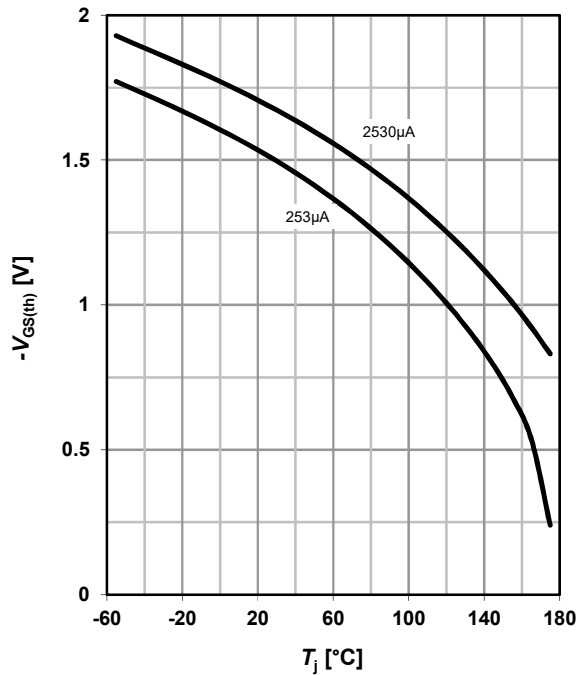
**8 Typ. drain-source on-state resistance**

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

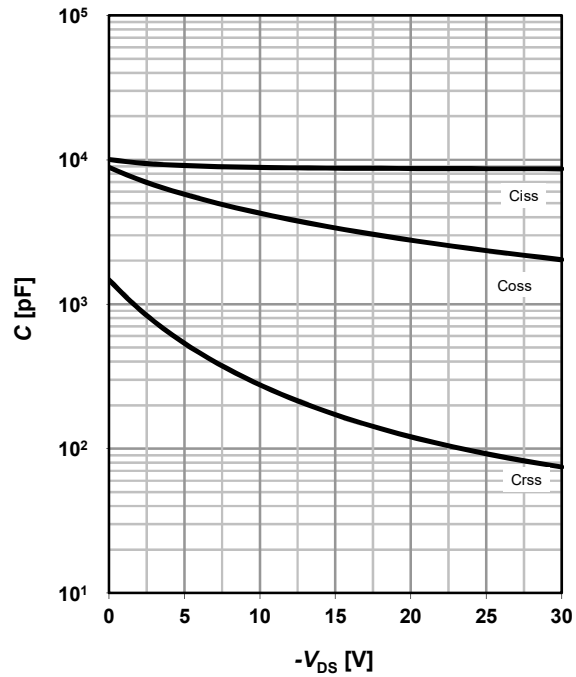


**9 Typ. gate threshold voltage**

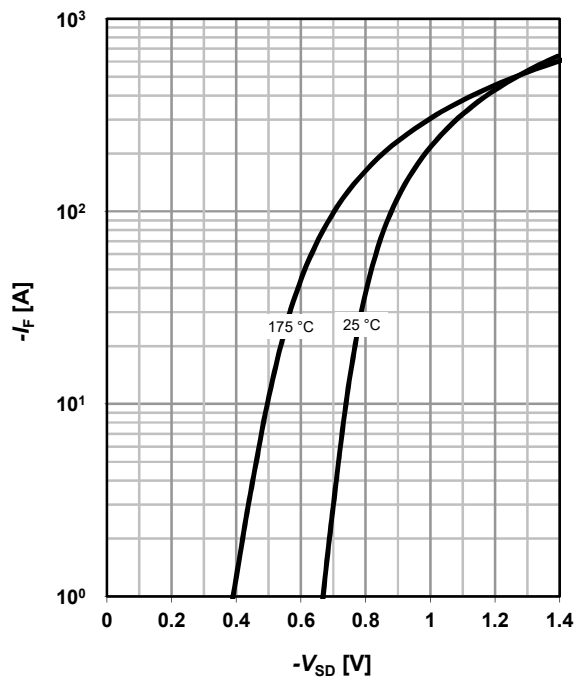
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

 parameter:  $-I_D$ 

**10 Typ. capacitances**

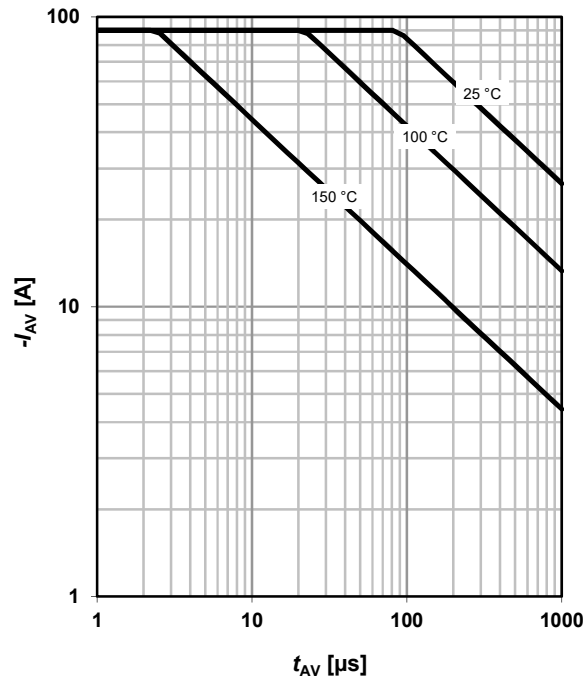
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$


**11 Typical forward diode characteristics**

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

 parameter:  $T_j$ 

**12 Avalanche characteristics**

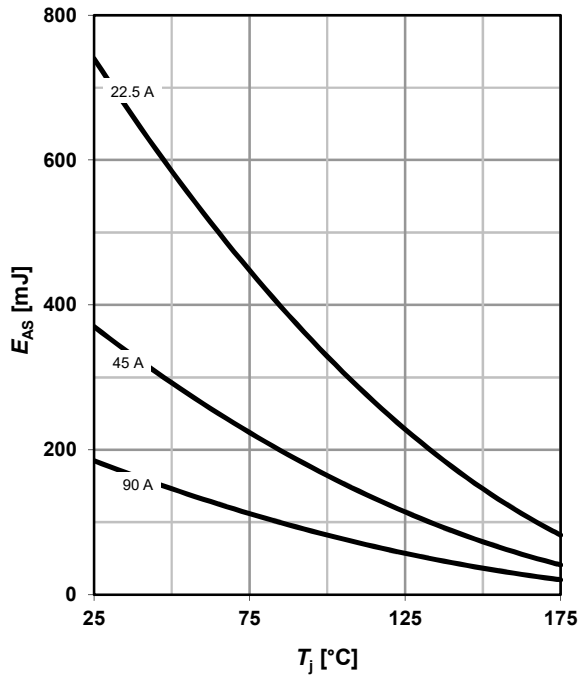
$$I_{AS} = f(t_{AV})$$

 parameter:  $T_{j(start)}$ 


**13 Avalanche energy**

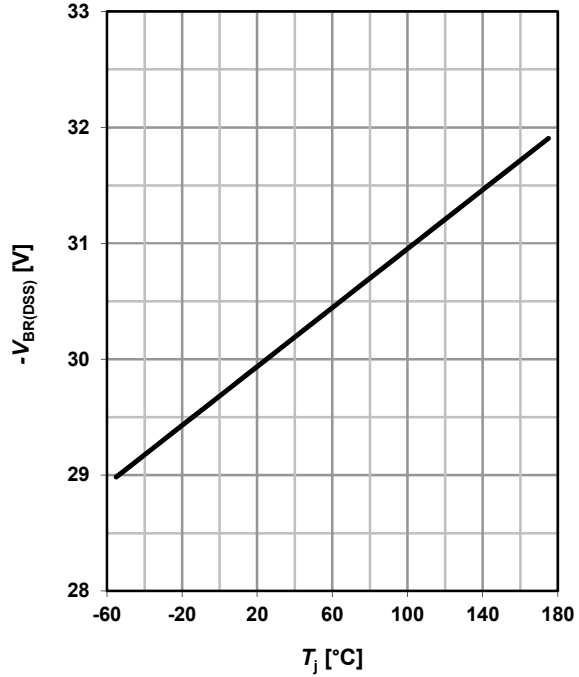
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



**14 Drain-source breakdown voltage**

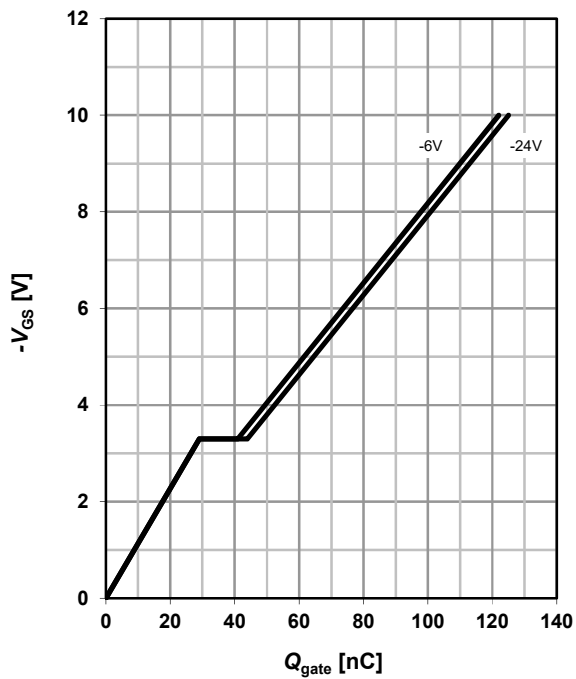
$$V_{BR(DSS)} = f(T_j); I_D = -1 \text{ mA}$$



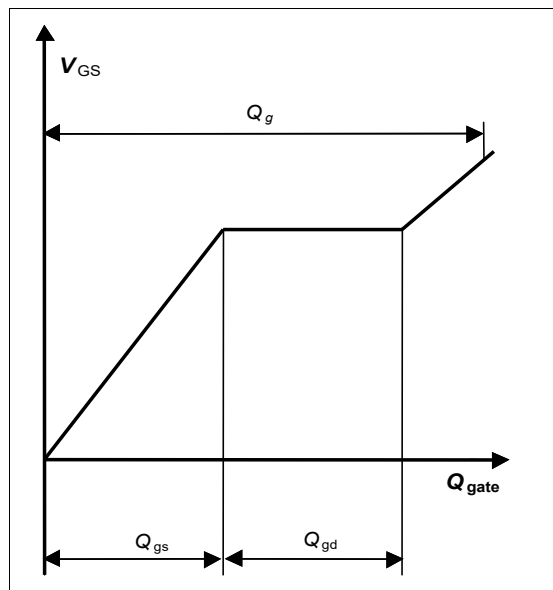
**15 Typ. gate charge**

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

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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## Revision History

Version	Date	Changes
Revision 1.0	2008-07-30	Final data sheet
Revision 1.1	2022-03-10	Corrected Crss