

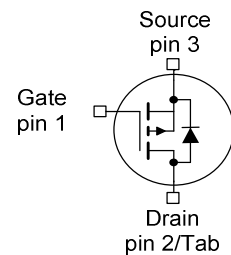
**OptiMOS®-P2 Power-Transistor**

**Product Summary**

$V_{DS}$	-40	V
$R_{DS(on),max}$	10.6	mΩ
$I_D$	-50	A

**Features**

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

**PG-TO252-3-313**


Type	Package	Marking
IPD50P04P4L-11	PG-TO252-3-313	4P04L11

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}$ , $V_{GS}=-10\text{V}^{(1)}$	-50	A
		$T_C=100\text{ °C}$ , $V_{GS}=-10\text{V}^{(2)}$	-40	
Pulsed drain current <sup>(2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	-200	
Avalanche energy, single pulse	$E_{AS}$	$I_D = -25\text{A}$	18	mJ
Avalanche current, single pulse	$I_{AS}$	-	-50	A
Gate source voltage	$V_{GS}$	-	$\pm 16^{(3)}$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	58	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	$R_{thJC}$	-	-	-	2.6	K/W
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>4)</sup>	-	-	40	

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

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D = -1mA$	-40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-85\mu A$	-1.2	-1.7	-2.2	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=-32V, V_{GS}=0V, T_j=25\text{ °C}$	-	-0.03	-1	$\mu A$
		$V_{DS}=-32V, V_{GS}=0V, T_j=125\text{ °C}^{2)}$	-	-7	-70	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=-16V, V_{DS}=0V$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=-4.5V, I_D=-30A$	-	12.3	17.2	m $\Omega$
		$V_{GS}=-10V, I_D=-50A$	-	8.2	10.6	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=-25V,$ $f=1MHz$	-	3000	3900	pF
Output capacitance	$C_{oss}$		-	1100	1400	
Reverse transfer capacitance	$C_{rss}$		-	37	74	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=-20V,$ $V_{GS}=-10V, I_D=-50A,$ $R_G=3.5\Omega$	-	12	-	ns
Rise time	$t_r$		-	9	-	
Turn-off delay time	$t_{d(off)}$		-	46	-	
Fall time	$t_f$		-	39	-	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=-32V, I_D=-50A,$ $V_{GS}=0$ to $-10V$	-	11	14	nC
Gate to drain charge	$Q_{gd}$		-	8	16	
Gate charge total	$Q_g$		-	45	59	
Gate plateau voltage	$V_{plateau}$		-	-3.6	-	V

**Reverse Diode**

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C=25^\circ C$	-	-	-50	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		-	-	-200	
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_F=-50A,$ $T_j=25^\circ C$	-	-1	-1.3	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=-20V, I_F=50A,$ $di_F/dt=-100A/\mu s$	-	40	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$	-	-	32	-	nC

<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 2.6K/W$  the chip is able to carry 60A at 25°C.

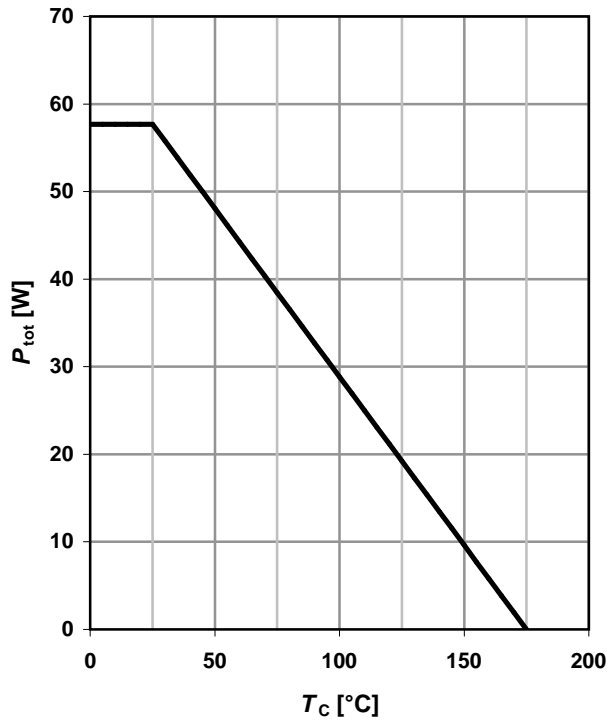
<sup>2)</sup> Specified by design. Not subject to production test.

<sup>3)</sup>  $V_{GS}=+5V/-16V$  according AEC;  $V_{GS}=+16V$  for max 168h at  $T_j=175^\circ C$

<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.

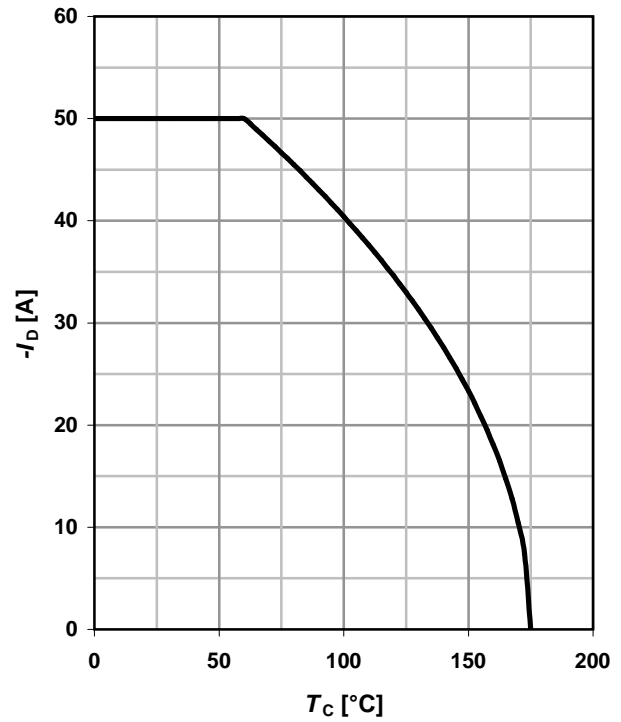
### 1 Power dissipation

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



### 2 Drain current

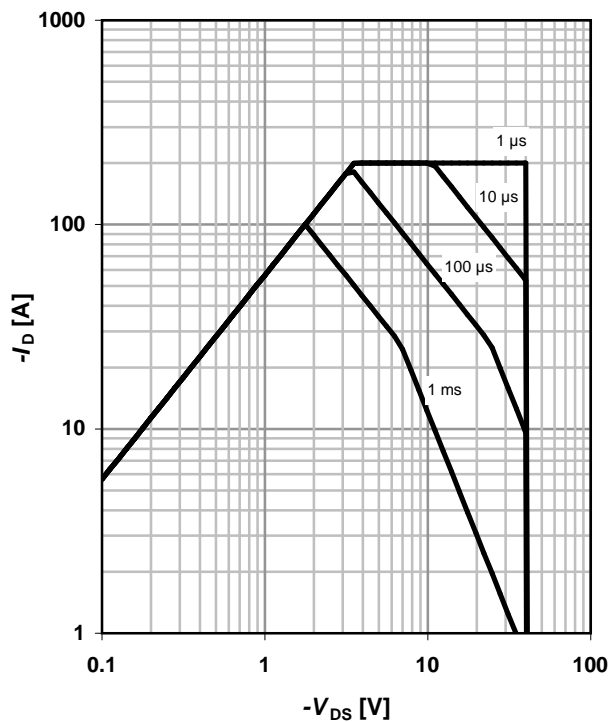
$$I_D = f(T_C); V_{\text{GS}} \leq -6\text{V}$$



### 3 Safe operating area

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

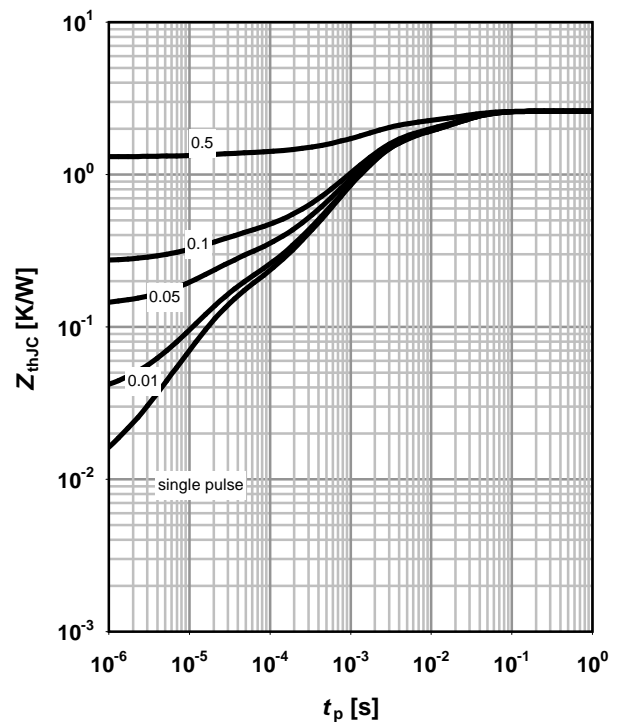
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

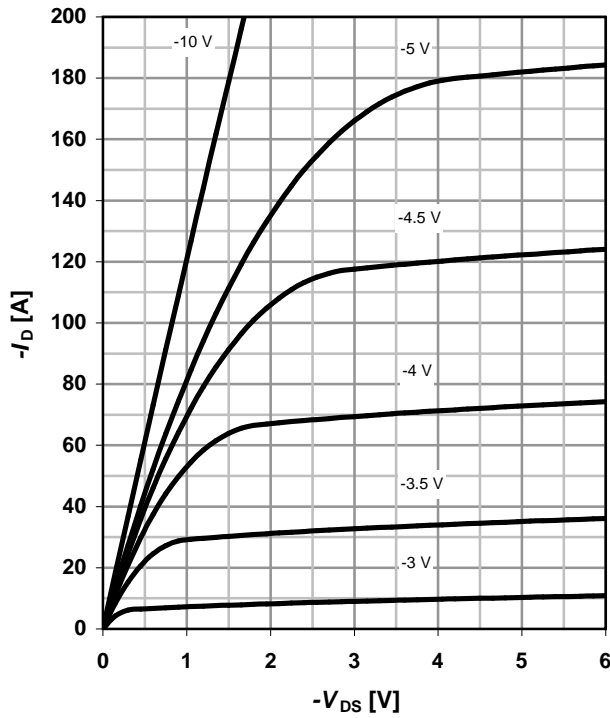
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

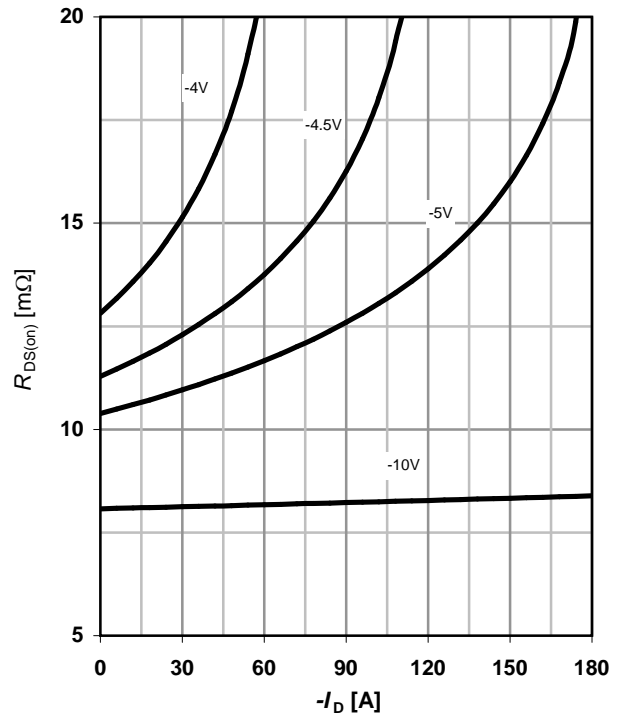
parameter:  $V_{GS}$



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

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

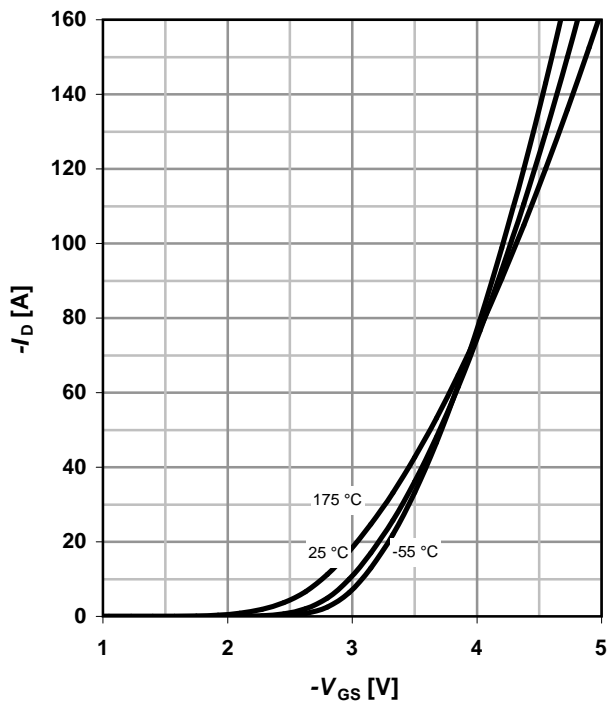
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

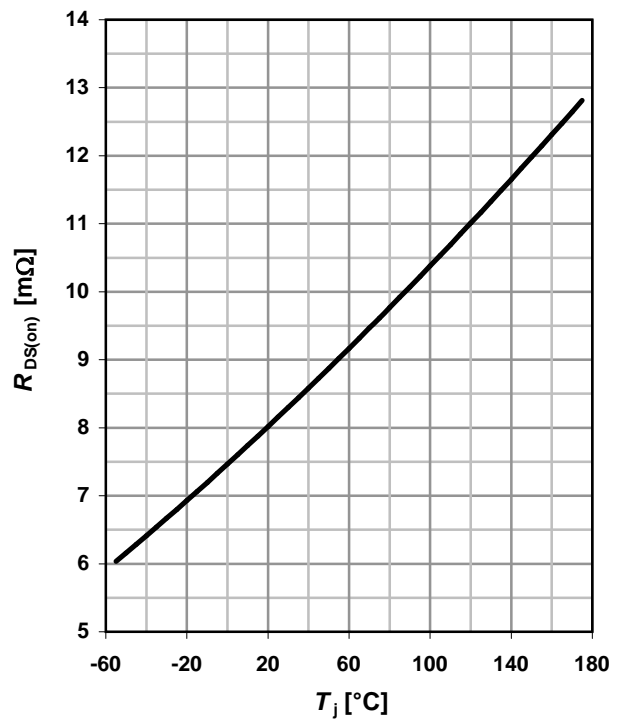
$I_D = f(V_{GS}); V_{DS} = -6V$

parameter:  $T_j$



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

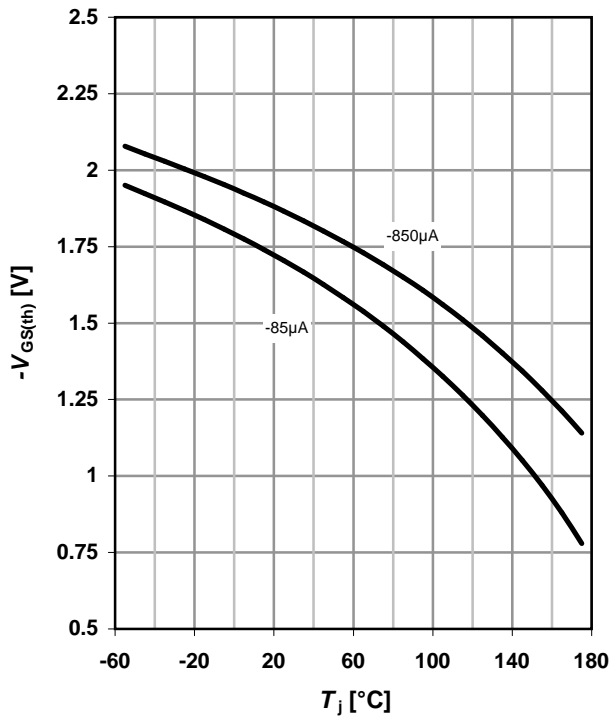
$R_{DS(on)} = f(T_j); I_D = -50A; V_{GS} = -10V$



**9 Typ. gate threshold voltage**

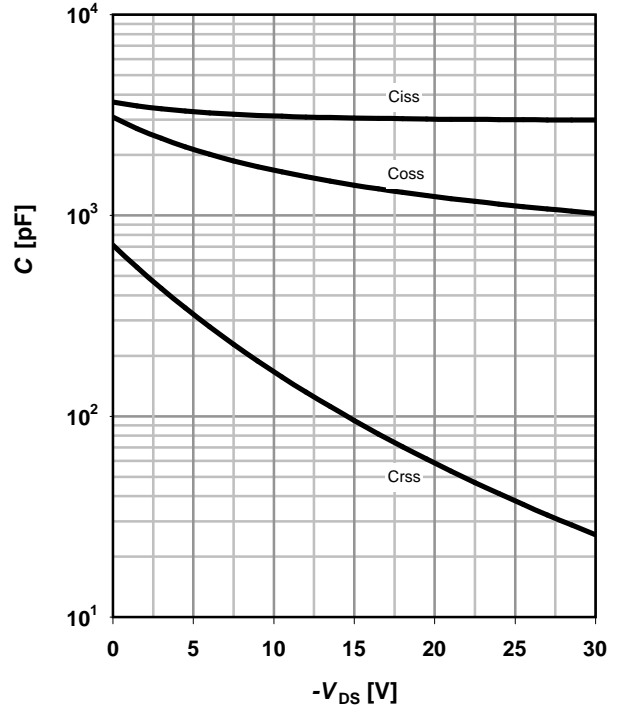
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

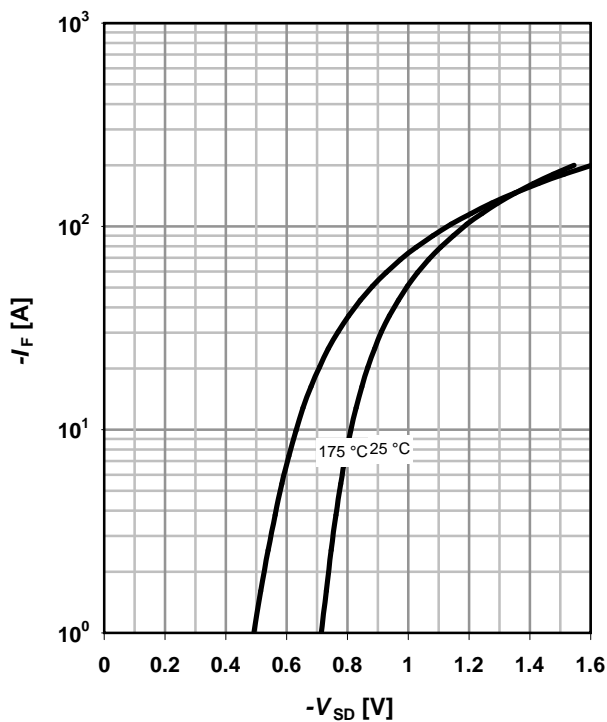
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



**11 Typical forward diode characteristics**

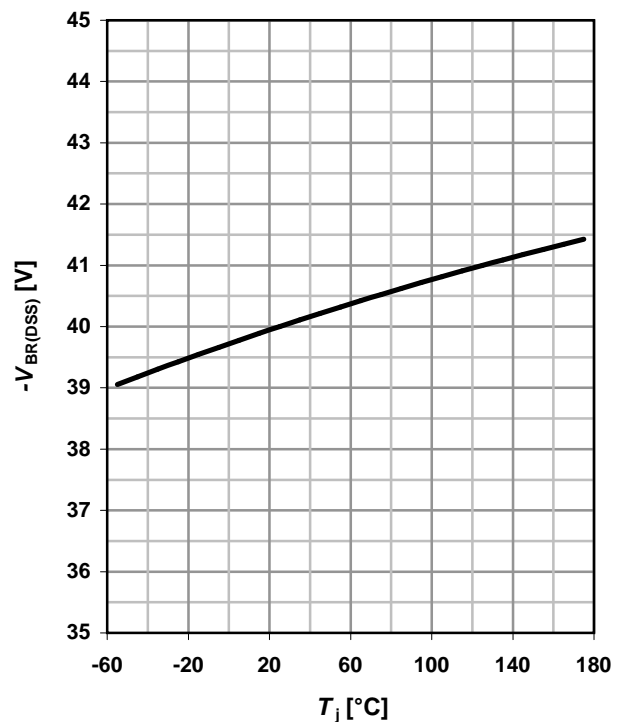
$I_F = f(V_{SD})$

parameter:  $T_j$



**12 Drain-source breakdown voltage**

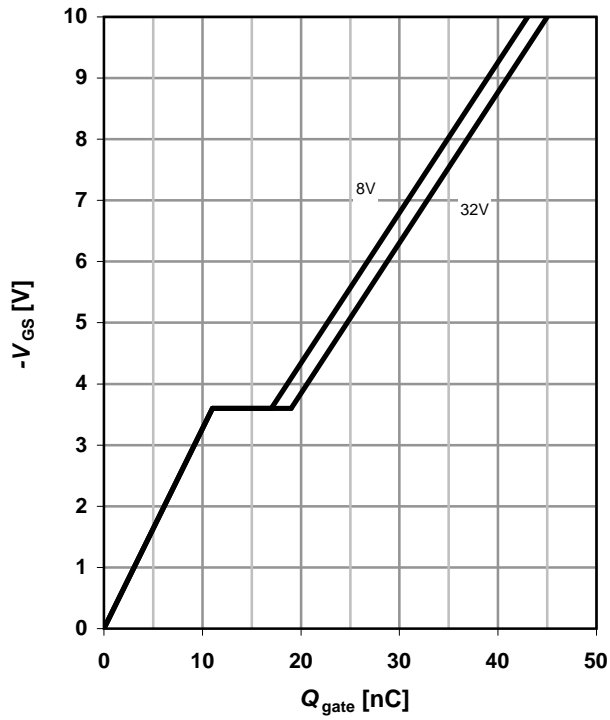
$V_{BR(DSS)} = f(T_j); I_D = -1mA$



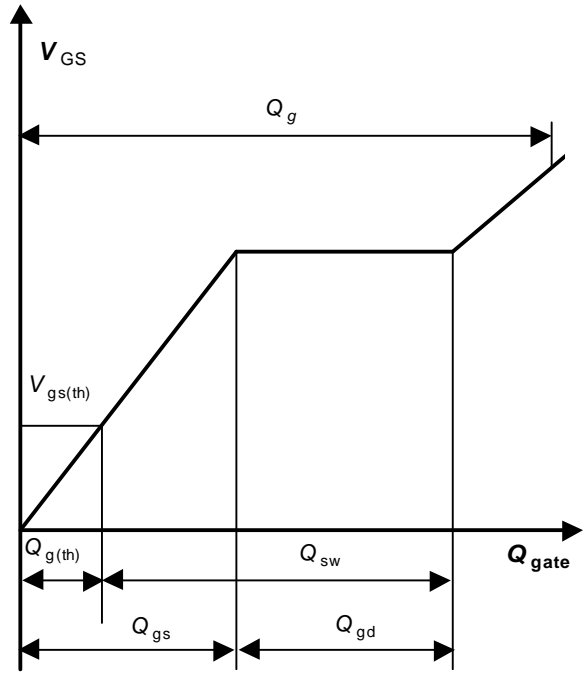
**13 Typ. gate charge**

$V_{GS} = f(Q_{gate}); I_D = -50A$  pulsed

parameter:  $V_{DD}$



**14 Gate charge waveforms**



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Revision History

Version	Date	Changes
Revision 1.0	6/8/2010	Final Data Sheet