

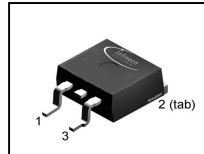
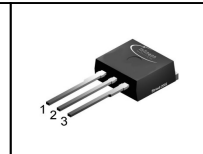
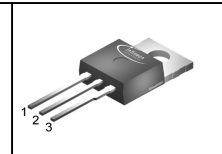
**OptiMOS<sup>®</sup> -P2 Power-Transistor**

**Features**

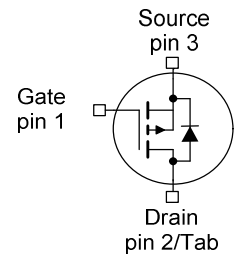
- P-channel - Normal Level - Enhancement mode
- AEC qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (RoHS compliant)
- 100% Avalanche tested

**Product Summary**

$V_{DS}$	-40	V
$R_{DS(on)}$ (SMD Version)	9.1	m $\Omega$
$I_D$	-70	A

**PG-TO263-3-2**

**PG-TO262-3-1**

**PG-TO220-3-1**


Type	Package	Marking
IPB70P04P4-09	PG-TO263-3-2	4P0409
IPI70P04P4-09	PG-TO262-3-1	4P0409
IPP70P04P4-09	PG-TO220-3-1	4P0409


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current <sup>1)</sup>	$I_D$	$T_C=25^\circ\text{C}$ , $V_{GS}=-10\text{V}$	-72	A
		$T_C=100^\circ\text{C}$ , $V_{GS}=-10\text{V}$	-50	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25^\circ\text{C}$	-288	
Avalanche energy, single pulse	$E_{AS}$	$I_D=-36\text{A}$	24	mJ
Avalanche current, single pulse	$I_{AS}$	-	-72	A
Gate source voltage	$V_{GS}$	-	$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ }^\circ\text{C}$	75	W
Operating and storage temperature	$T_j, T_{stg}$	-	-55 ... +175	$^\circ\text{C}$
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	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>2)</sup>	-	-	40	

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=-1mA$	-40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-120\mu A$	-2.0	-3.0	-4.0	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=-32V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-0.05	-1	$\mu A$
		$V_{DS}=-32V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-20	-200	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=-20V, V_{DS}=0V$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-70A$	-	6.9	9.4	m $\Omega$
		$V_{GS}=-10V, I_D=-70A, \text{SMD version}$	-	6.6	9.1	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=-25V,$ $f=1MHz$	-	3700	4810	pF
Output capacitance	$C_{oss}$		-	1400	1820	
Reverse transfer capacitance	$C_{rss}$		-	40	80	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=-20V,$ $V_{GS}=-10V, I_D=-70A,$ $R_G=3.5\Omega$	-	19	-	ns
Rise time	$t_r$		-	15	-	
Turn-off delay time	$t_{d(off)}$		-	24	-	
Fall time	$t_f$		-	31	-	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=-32V, I_D=-70A,$ $V_{GS}=0$ to $-10V$	-	20	26	nC
Gate to drain charge	$Q_{gd}$		-	10	20	
Gate charge total	$Q_g$		-	54	70	
Gate plateau voltage	$V_{plateau}$		-	-5.4	-	V

**Reverse Diode**

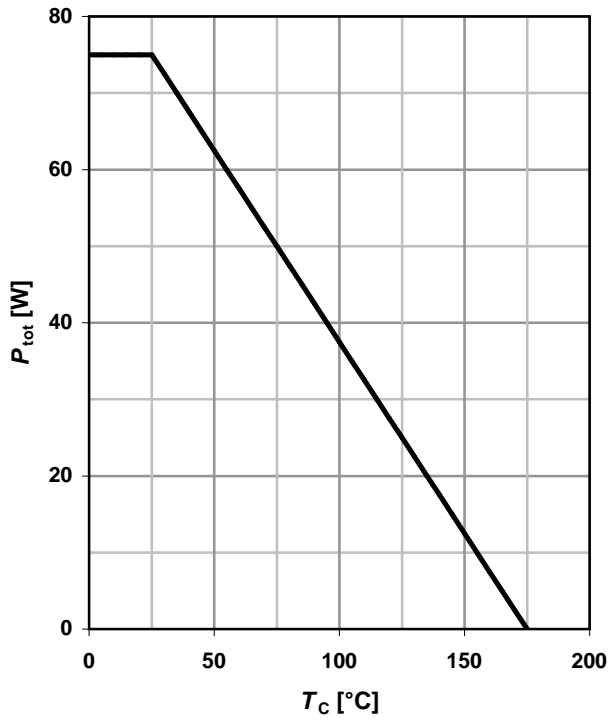
Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C=25^\circ C$	-	-	-72	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		-	-	-288	
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_F=-70A,$ $T_j=25^\circ C$	-	-1.0	-1.3	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=-20V, I_F=-50A,$ $di_F/dt=-100A/\mu s$	-	50	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	50	-	nC

<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</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.

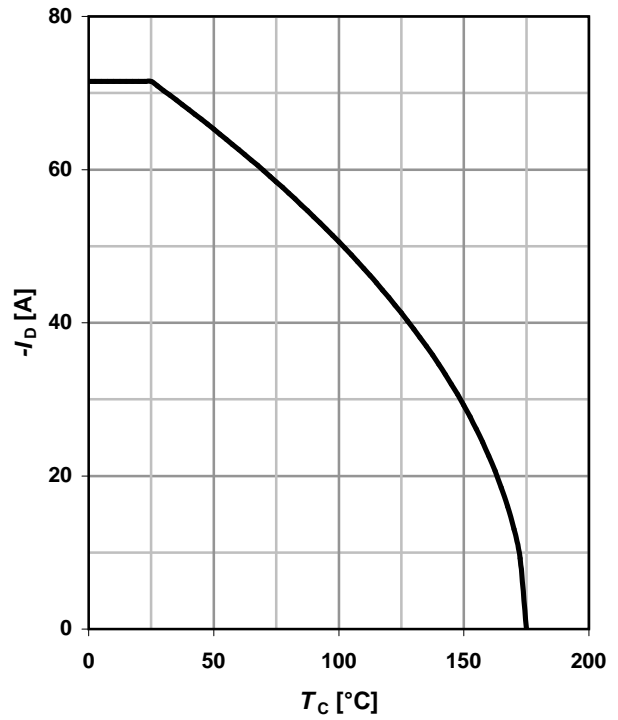
**1 Power dissipation**

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



**2 Drain current**

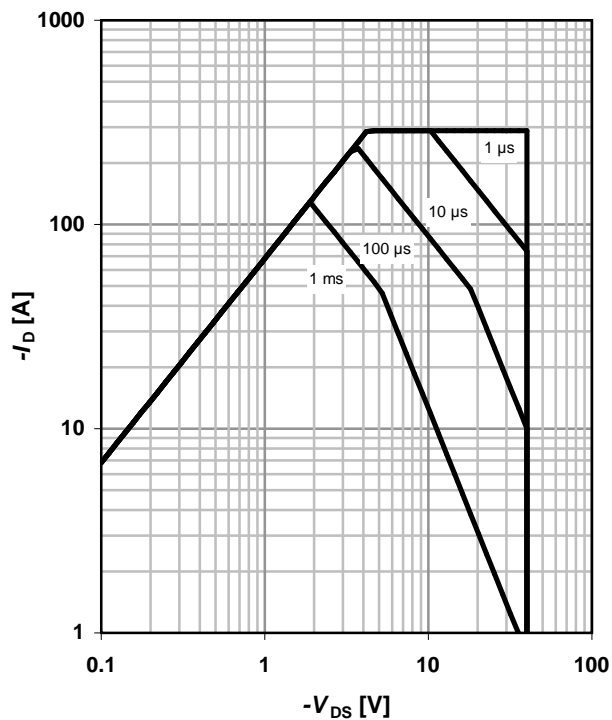
$I_D = f(T_C); V_{GS} \leq -6V; SMD$



**3 Safe operating area**

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

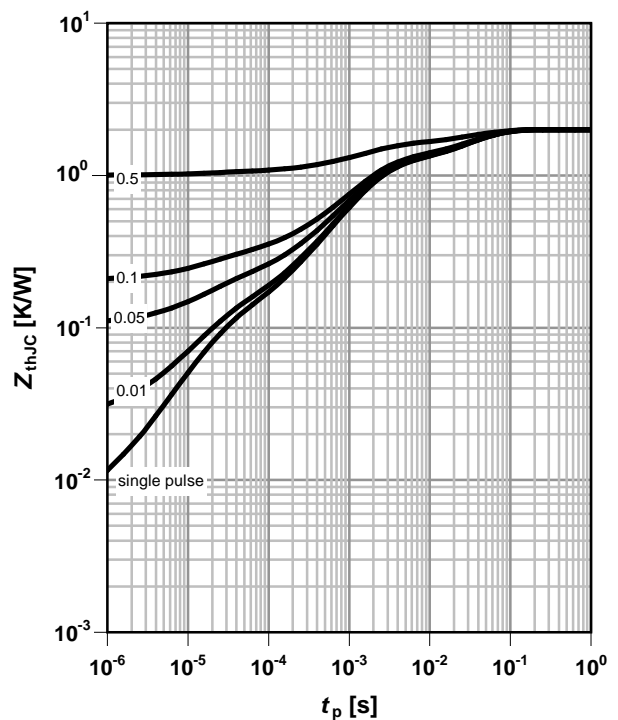
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

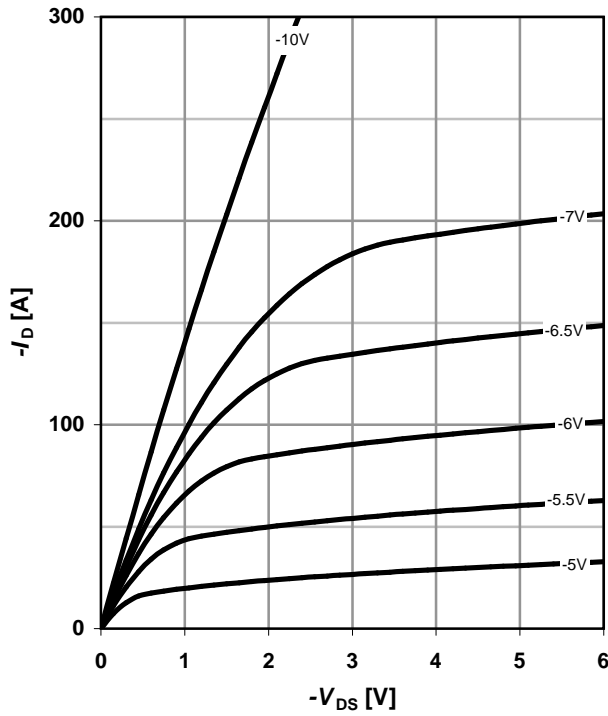
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

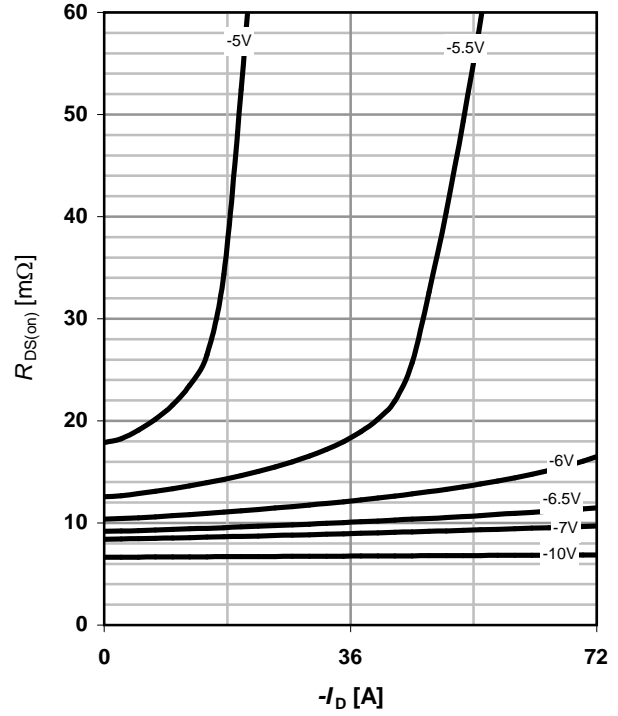
parameter:  $V_{GS}$



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

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

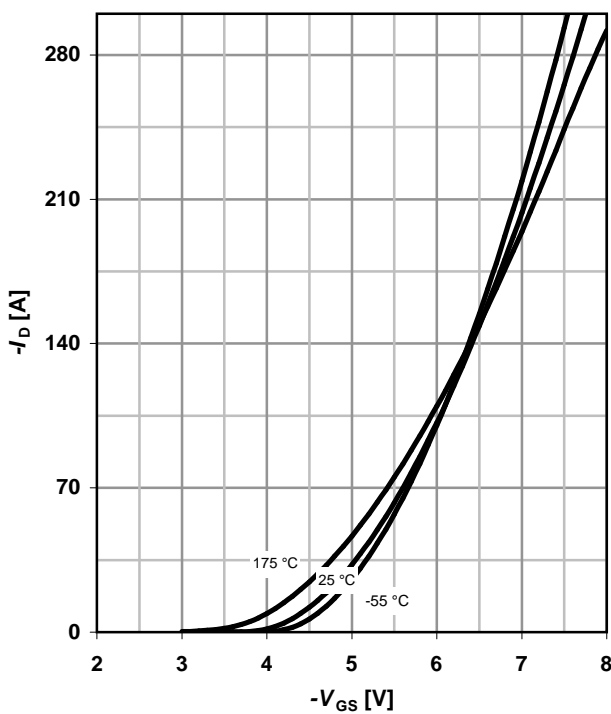
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

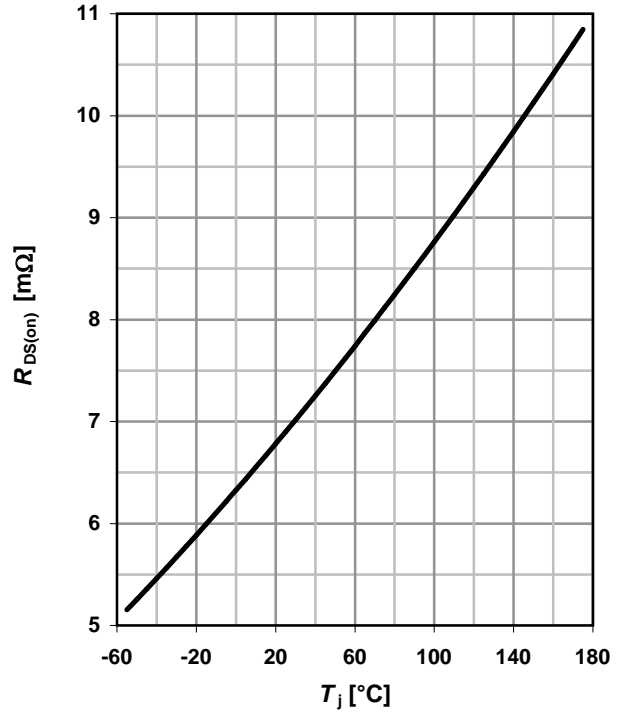
$I_D = f(V_{GS}); V_{DS} = -6V$

parameter:  $T_j$



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

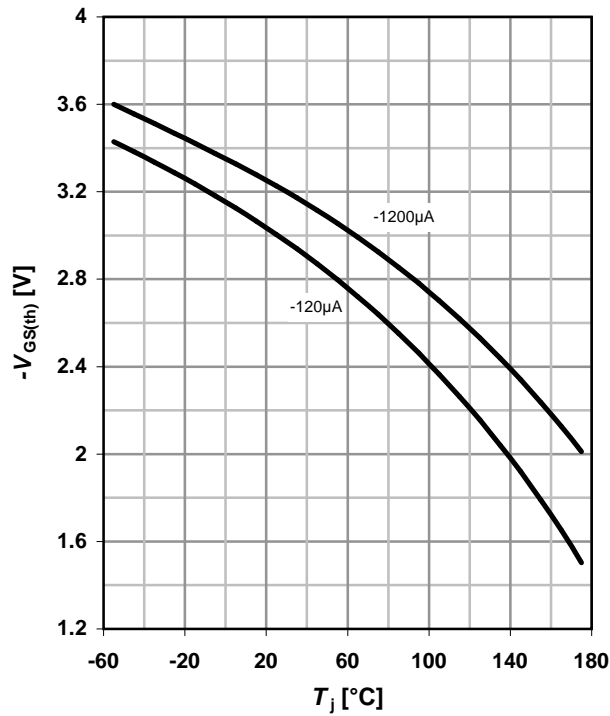
$R_{DS(on)} = f(T_j); I_D = -70\text{ A}; V_{GS} = -10\text{ V}; \text{SMD}$



**9 Typ. gate threshold voltage**

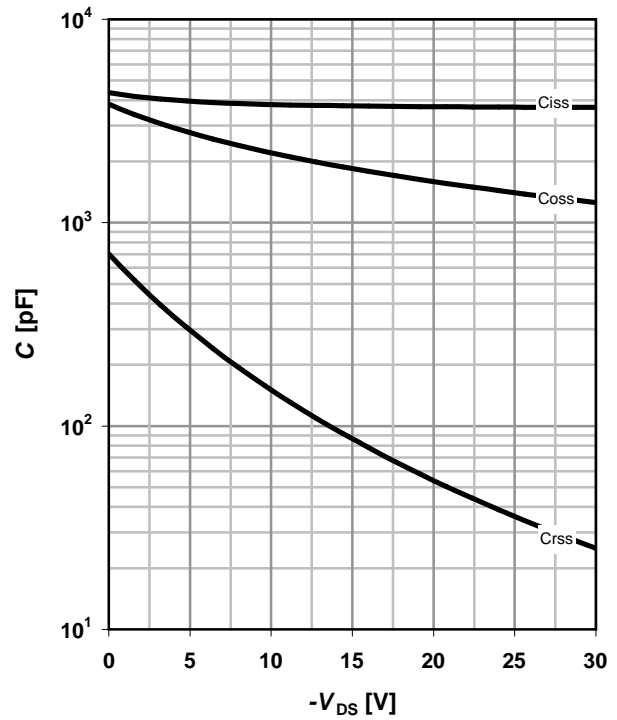
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

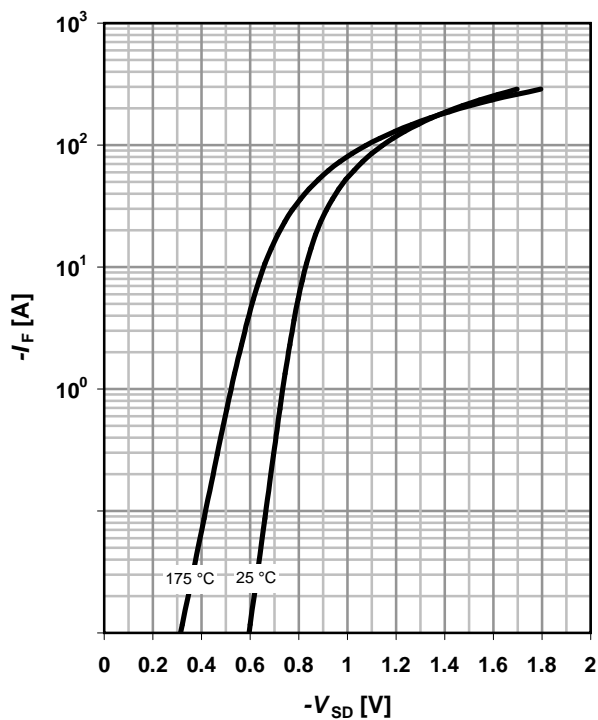
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



**11 Typical forward diode characteristics**

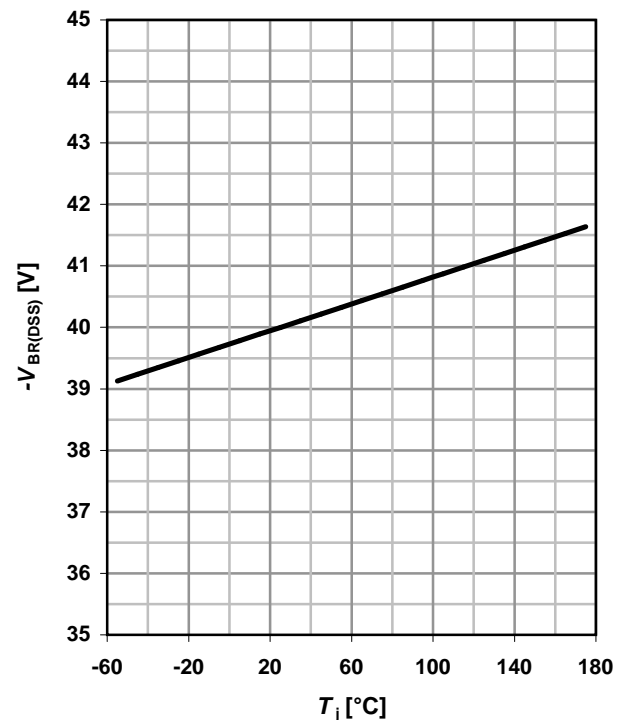
$I_F = f(V_{SD})$

parameter:  $T_j$



**12 Drain-source breakdown voltage**

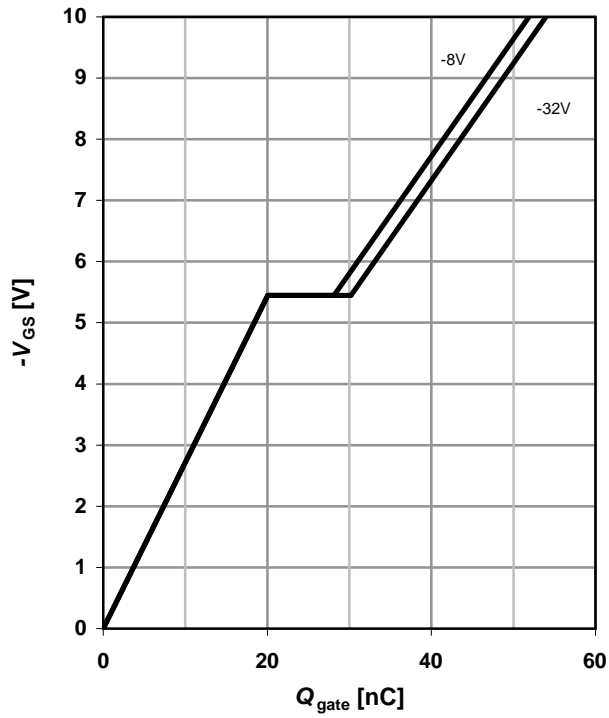
$V_{BR(DSS)} = f(T_j); I_D = -1 mA$



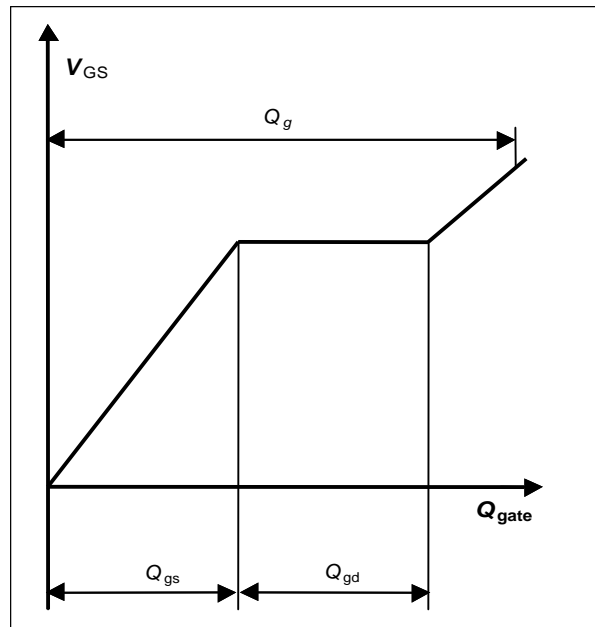
13 Typ. gate charge

$V_{GS} = f(Q_{gate}); I_D = -70$  A pulsed

parameter:  $V_{DD}$



14 Gate charge waveforms



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Revision History

Version	Date	Changes
1.1	02.09.2009	$V_{GS(th)}$ : $I_D$ changed to 116uA
1.2	07.10.2009	$V_{GS(th)}$ : $I_D$ changed to 120uA
1.2	07.10.2009	$R_{DS(on)}$ : $I_D$ changed to 70A
1.2	07.10.2009	$V_{SD}$ : $I_D$ changed to 70A
1.2	07.10.2009	$I_{GSS}$ : $V_{GS}$ changed to 20V
1.3	04.02.2011	Final Data Sheet