

OptiMOS®-P2 Power-Transistor



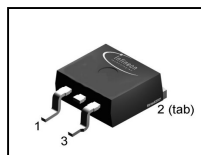
Features

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

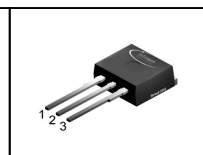
Product Summary

V_{DS}	-40	V
$R_{DS(on)}$ (SMD Version)	3.1	mΩ
I_D	-120	A

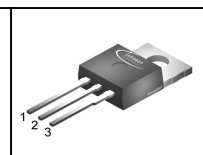
PG-TO263-3-2



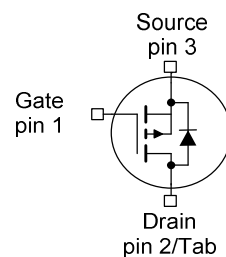
PG-TO262-3-1



PG-TO220-3-1



Type	Package	Marking
IPB120P04P4L-03	PG-TO263-3-2	4P04L03
IPI120P04P4L-03	PG-TO262-3-1	4P04L03
IPP120P04P4L-03	PG-TO220-3-1	4P04L03



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current ¹⁾	I_D	$T_C=25\text{ °C}$, $V_{GS}=-10\text{V}$	-120	A
		$T_C=100\text{ °C}$, $V_{GS}=-10\text{V}^{2)}$	-114	
		$T_C=25\text{ °C}$	-480	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	-480	
Avalanche energy, single pulse	E_{AS}	$I_D=-60\text{A}$	78	mJ
Avalanche current, single pulse	I_{AS}	-	-120	A
Gate source voltage	V_{GS}	-	$\pm 16^{3)}$	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	136	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 characteristics²⁾

Thermal resistance, junction - case	R_{thJC}	-	-	-	1.1	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	-	62	
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm ² cooling area ⁴⁾	-	-	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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-340\mu A$	-1.2	-1.7	-2.2	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=-32V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-0.05	-1	μA
		$V_{DS}=-32V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-20	-200	
Gate-source leakage current	I_{GSS}	$V_{GS}=-16V, V_{DS}=0V$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=-4.5V, I_D=-100A$	-	4.0	5.2	m Ω
		$V_{GS}=-4.5V, I_D=-100A, \text{SMD version}$	-	3.7	4.9	
		$V_{GS}=-10V, I_D=-100A$	-	2.9	3.4	
		$V_{GS}=-10V, I_D=-100A, \text{SMD version}$	-	2.6	3.1	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=-25V,$ $f=1MHz$	-	11380	15000	pF
Output capacitance	C_{oss}		-	3410	5000	
Reverse transfer capacitance	C_{rss}		-	135	270	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=-20V,$ $V_{GS}=-10V, I_D=-120A,$ $R_G=3.5\Omega$	-	21	-	ns
Rise time	t_r		-	16	-	
Turn-off delay time	$t_{d(off)}$		-	85	-	
Fall time	t_f		-	57	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=-32V,$ $I_D=-120A,$ $V_{GS}=0 \text{ to } -10V$	-	40	52	nC
Gate to drain charge	Q_{gd}		-	32	64	
Gate charge total	Q_g		-	180	234	
Gate plateau voltage	$V_{plateau}$		-	3.5	-	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C=25^\circ C$	-	-	-120	A
Diode pulse current ²⁾	$I_{S,pulse}$		-	-	-480	
Diode forward voltage	V_{SD}	$V_{GS}=0V, I_F=-100A,$ $T_j=25^\circ C$	-	-1	-1.3	V
Reverse recovery time ²⁾	t_{rr}	$V_R=-20V, I_F=-50A,$ $di_F/dt=-100A/\mu s$	-	54		ns
Reverse recovery charge ²⁾	Q_{rr}		-	60		nC

¹⁾ Current is limited by bondwire; with an $R_{thJC} = 1.1K/W$ the chip is able to carry -171A at 25°C.

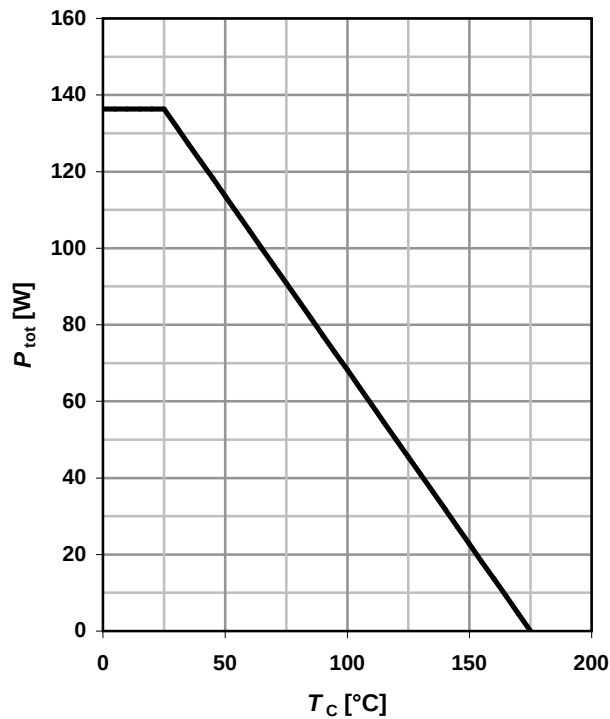
²⁾ Defined by design. Not subject to production test.

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

⁴⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

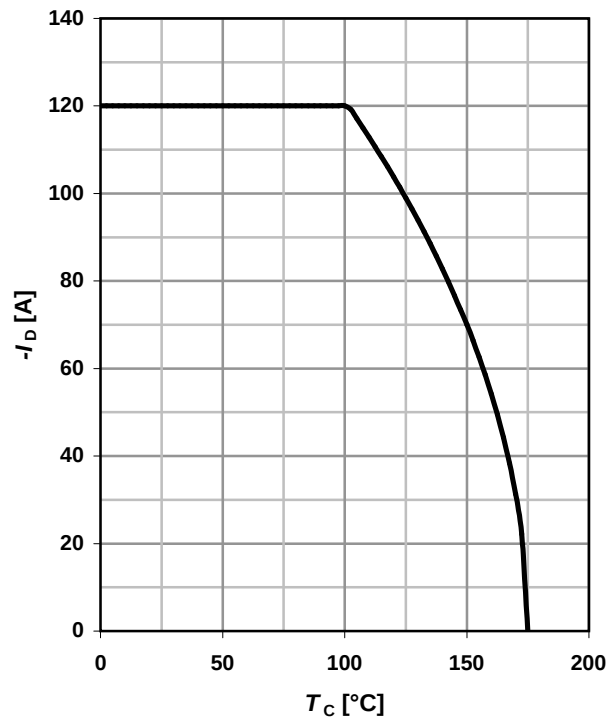
1 Power dissipation

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



2 Drain current

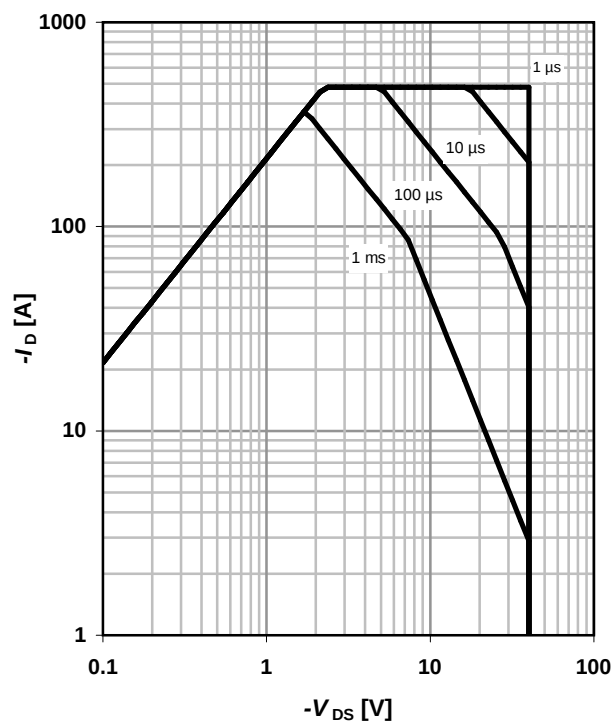
$$I_D = f(T_C); V_{\text{GS}} \leq -6\text{V}; \text{SMD}$$



3 Safe operating area

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

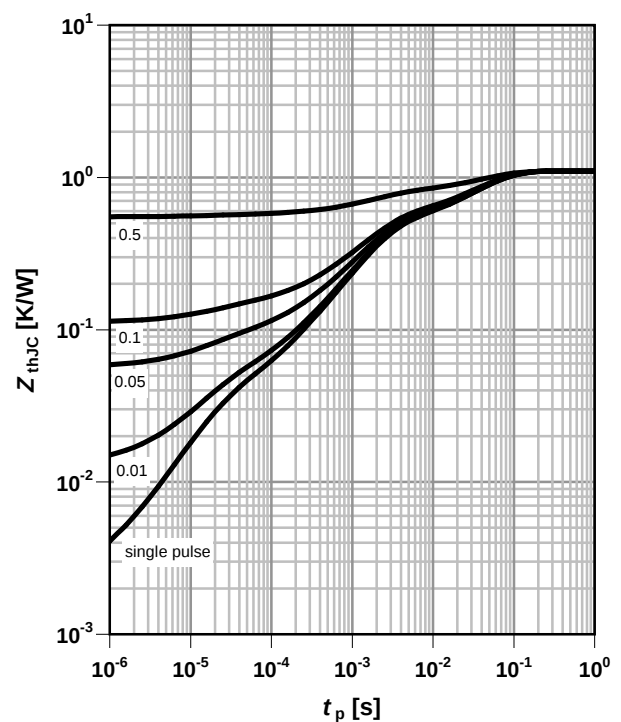
parameter: t_p



4 Max. transient thermal impedance

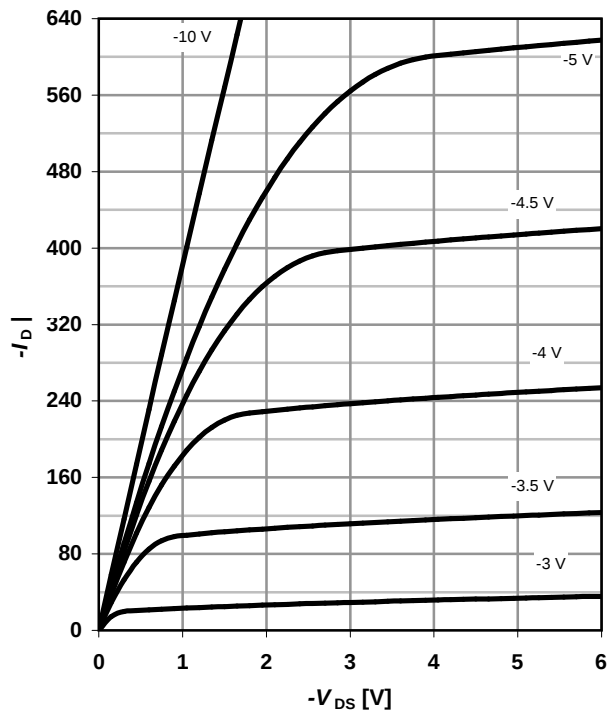
$$Z_{\text{thJC}} = f(t_p)$$

parameter: $D = t_p/T$



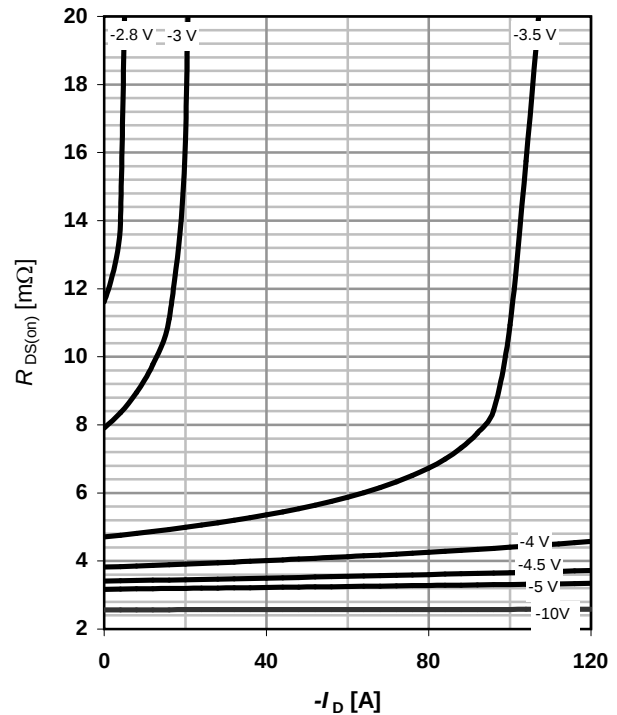
5 Typ. output characteristics

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

parameter: V_{GS}


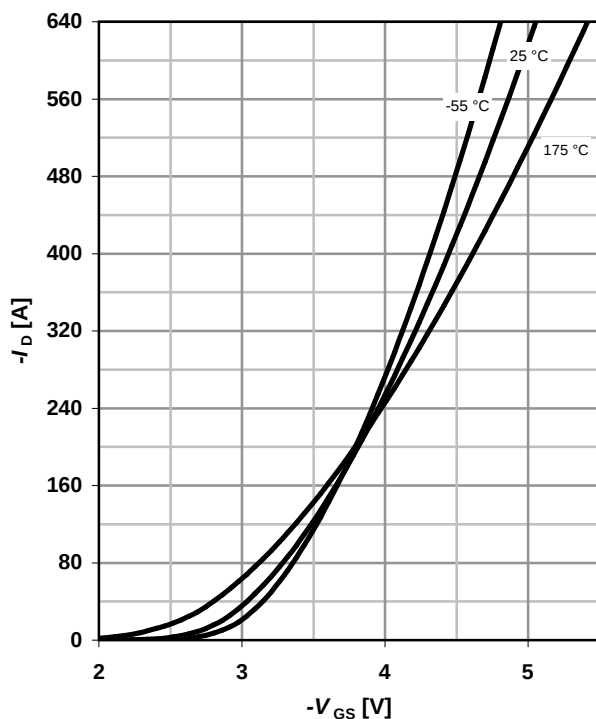
6 Typ. drain-source on-state resistance

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

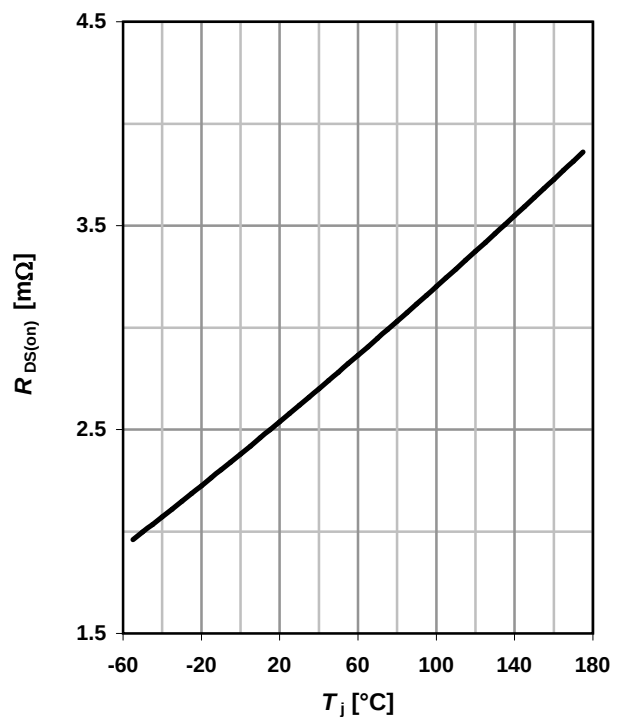
parameter: V_{GS}


7 Typ. transfer characteristics

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

parameter: T_j


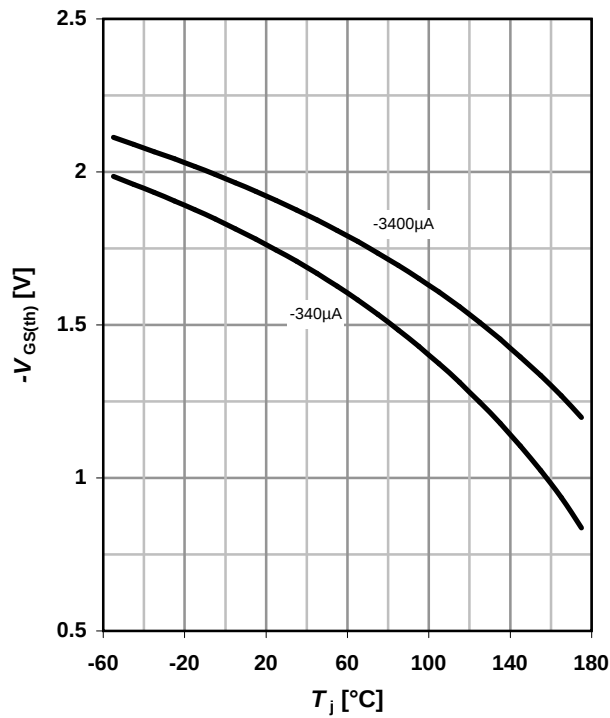
8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = -100\text{ A}; V_{GS} = -10\text{ V}; \text{SMD}$


9 Typ. gate threshold voltage

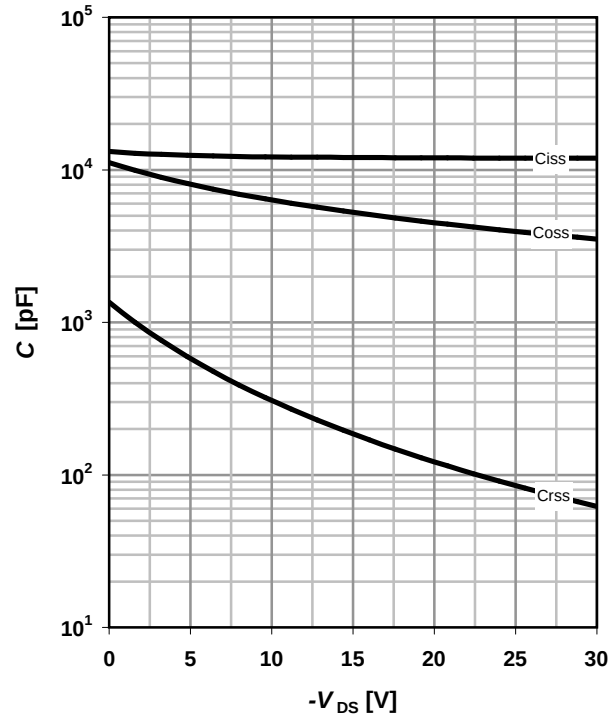
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter: I_D



10 Typ. capacitances

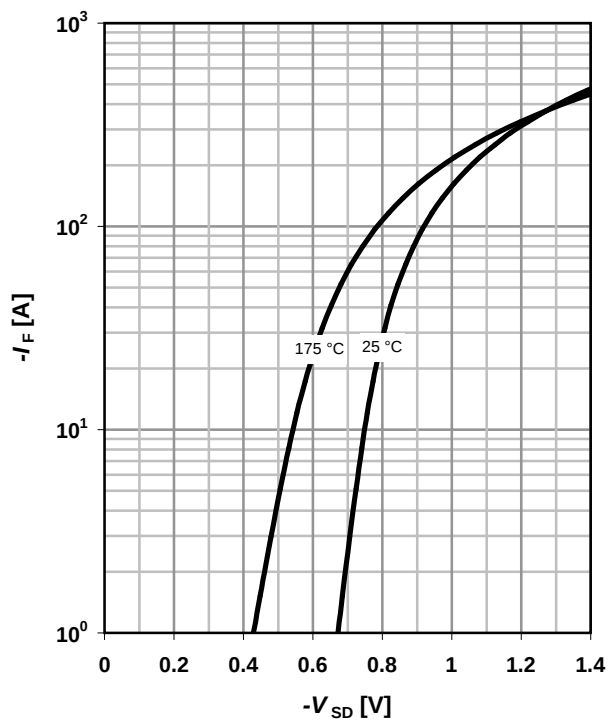
$$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$$



11 Typical forward diode characteristics

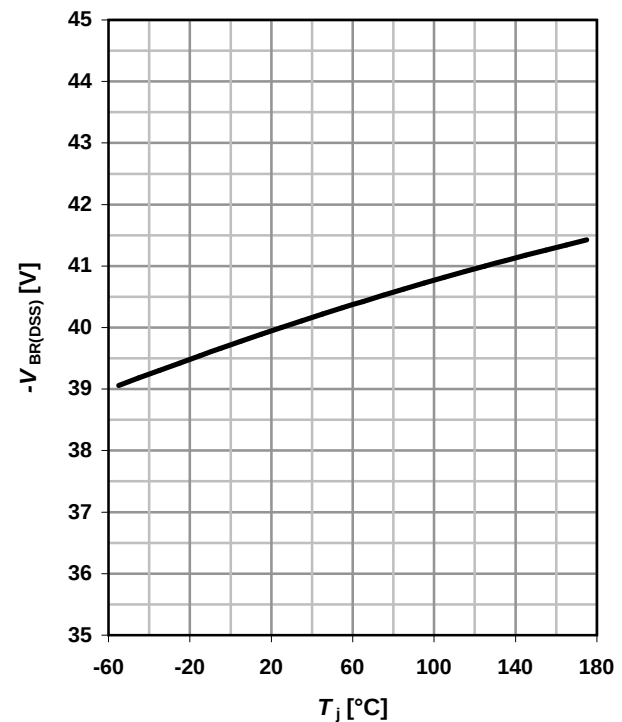
$$I_F = f(V_{SD})$$

parameter: T_j



12 Drain-source breakdown voltage

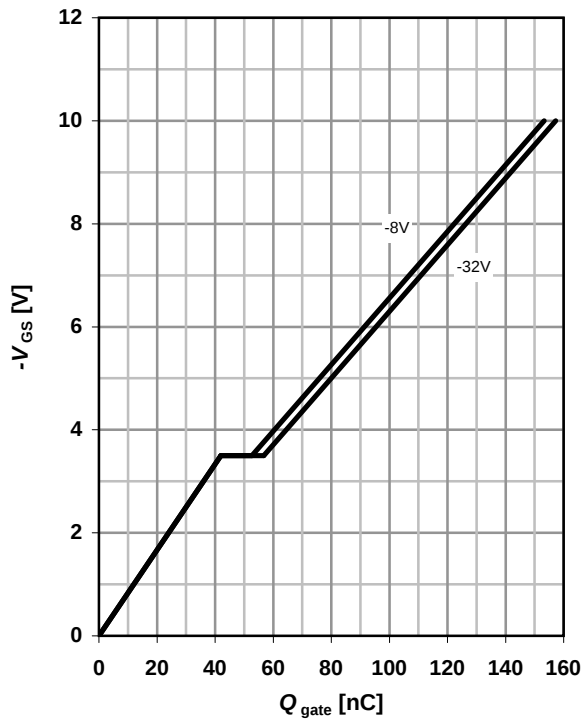
$$V_{BR(DSS)} = f(T_j); I_D = -1 mA$$



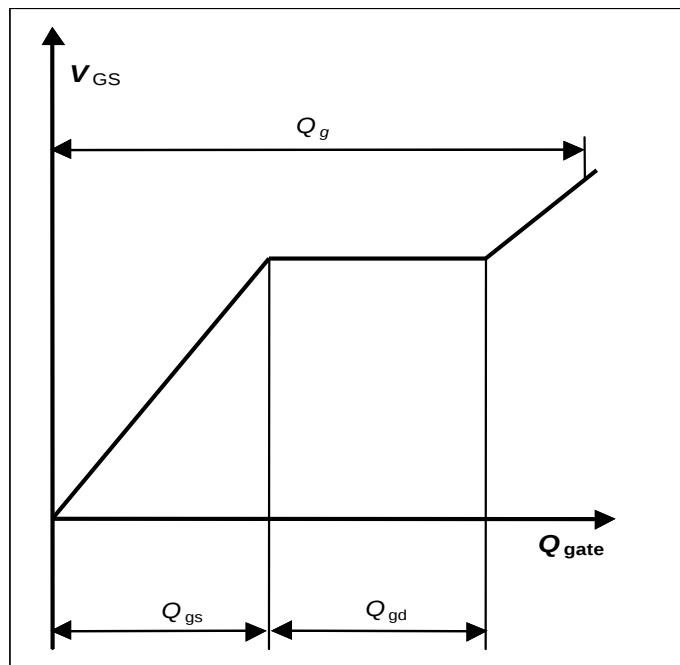
13 Typ. gate charge

$V_{GS} = f(Q_{gate}); I_D = -120 \text{ A pulsed}$

parameter: V_{DD}



14 Gate charge waveforms



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If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

Revision History

Version	Date	Changes
0.1	08.03.2010	Initial Target Data Sheet
1.0	24.01.2011	Final Data Sheet