

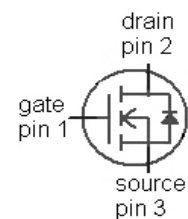
OptiMOS[®] -T Power-Transistor

Product Summary

V_{DS}	55	V
$R_{DS(on),max}$	9.0	m Ω
I_D	50	A

Features

- N-channel - Normal Level - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (RoHS compliant)
- Ultra low Rds(on)
- 100% Avalanche tested

PG-TO252-3-11


Type	Package	Marking
IPD50N06S3-09	PG-TO252-3-11	QN0609

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current ¹⁾	I_D	$T_C=25\text{ °C}, V_{GS}=10\text{ V}$	50	A
		$T_C=100\text{ °C}, V_{GS}=10\text{ V}^{2)}$	50	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	200	
Avalanche energy, single pulse ²⁾	E_{AS}	$I_D=25\text{ A}$	370	mJ
Avalanche current, single pulse	I_{AS}		50	A
Gate source voltage ³⁾	V_{GS}		± 20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	107	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}		-	-	1.4	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm ² cooling area ⁴⁾	-	-	40	

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

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	55	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=55\text{ }\mu\text{A}$	2.1	3.0	4	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=55\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.01	1	μA
		$V_{DS}=55\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$	-	1	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=39\text{ A}$	-	8.0	9	m Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	5340	6140	pF
Output capacitance	C_{oss}		-	810	1220	
Reverse transfer capacitance	C_{rss}		-	780	1170	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=27.5\text{ V},$ $V_{GS}=10\text{ V}, I_D=50\text{ A},$ $R_G=5.1\ \Omega$	-	23	-	ns
Rise time	t_r		-	42	-	
Turn-off delay time	$t_{d(off)}$		-	26	-	
Fall time	t_f		-	37	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=11\text{ V}, I_D=50\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	34	45	nC
Gate to drain charge	Q_{gd}		-	20	30	
Gate charge total	Q_g		-	77	90	
Gate plateau voltage	$V_{plateau}$		-	6.3	-	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C=25\text{ }^\circ\text{C}$	-	-	50	A
Diode pulse current ²⁾	$I_{S,pulse}$		-	-	200	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=50\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	0.6	0.9	1.3	V
Reverse recovery time ²⁾	t_{rr}	$V_R=27.5\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	43	-	ns
Reverse recovery charge ²⁾	Q_{rr}		-	58	-	nC

¹⁾ Current is limited by bondwire; with an $R_{thJC} = 1.4\text{ K/W}$ the chip is able to carry 81 A at 25°C. For detailed information see Application Note ANPS071E.

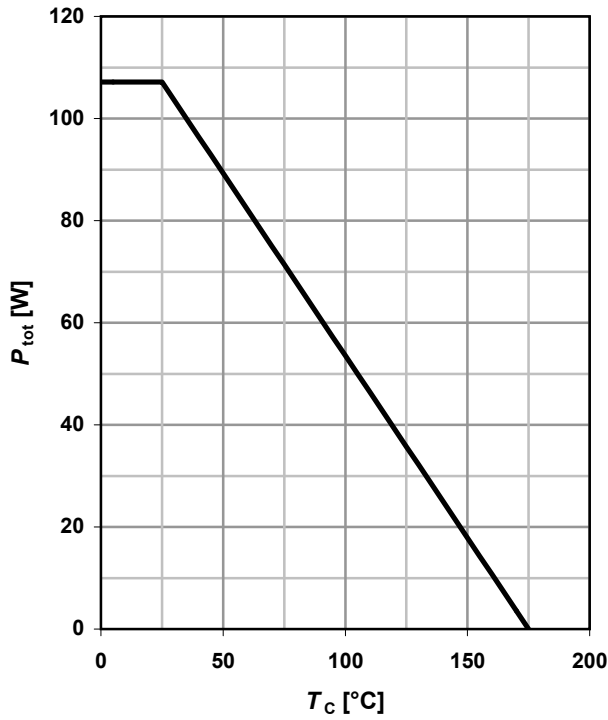
²⁾ Defined by design. Not subject to production test.

³⁾ Qualified at -5V and +20V.

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.

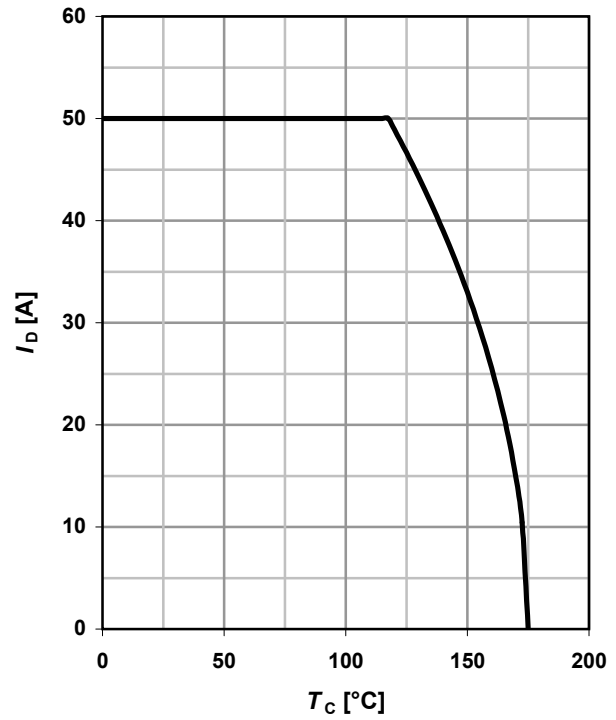
1 Power dissipation

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



2 Drain current

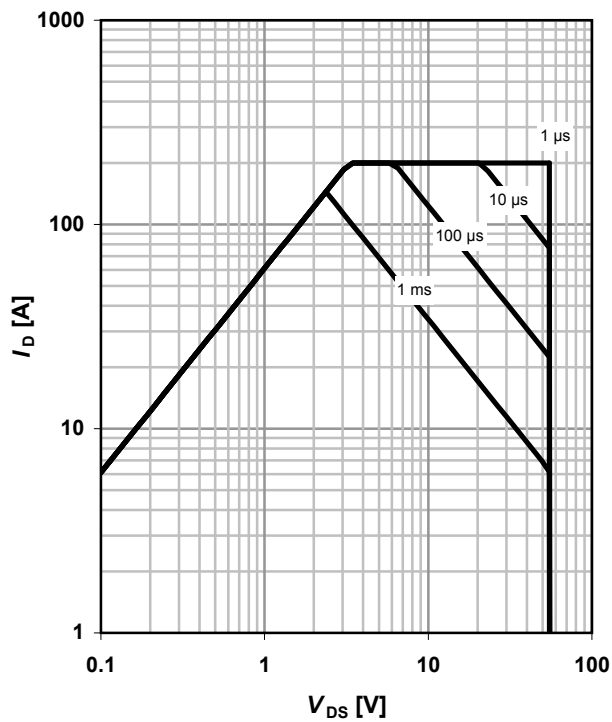
$I_D = f(T_C); V_{GS} \geq 6\text{ V}$



3 Safe operating area

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

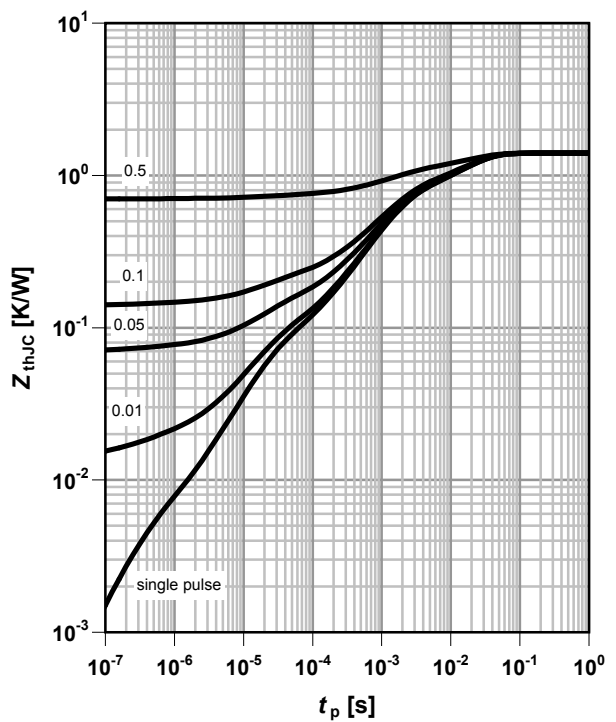
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

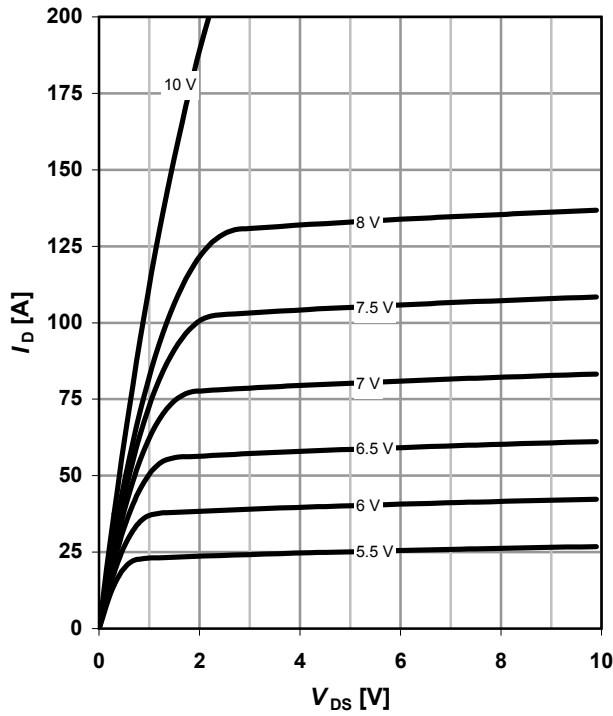
parameter: $D = t_p/T$



5 Typ. output characteristics

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

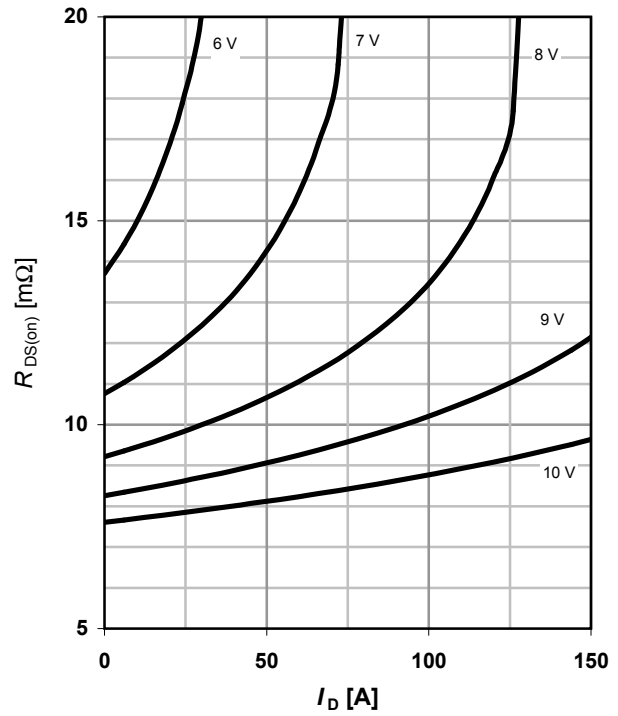
parameter: V_{GS}



6 Typ. drain-source on-state resistance

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

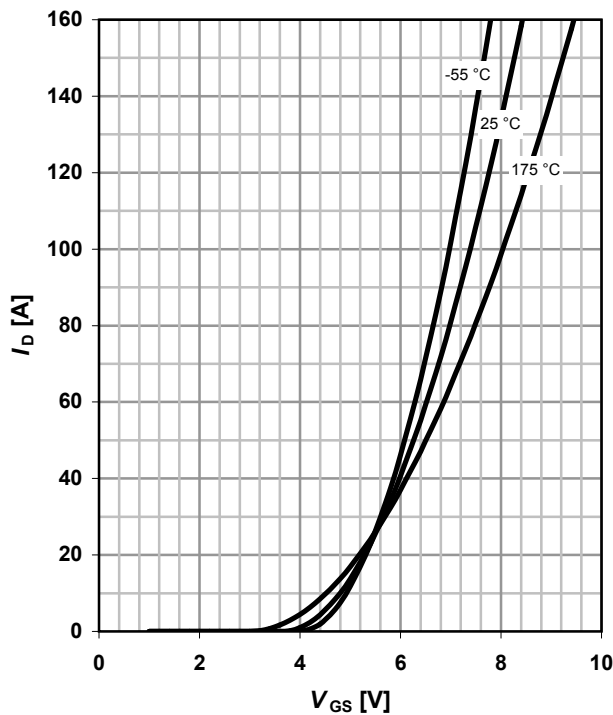
parameter: V_{GS}



7 Typ. transfer characteristics

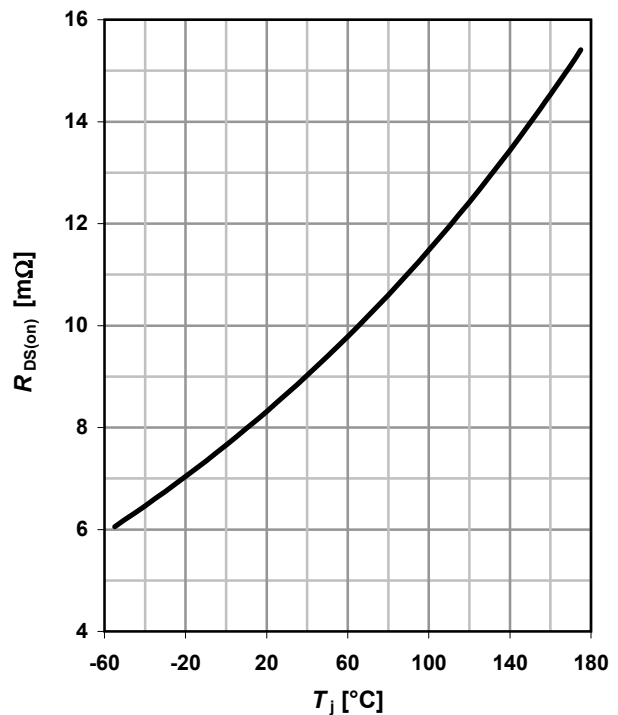
$I_D = f(V_{GS}); V_{DS} = 6\text{ V}$

parameter: T_j



8 Typ. drain-source on-state resistance

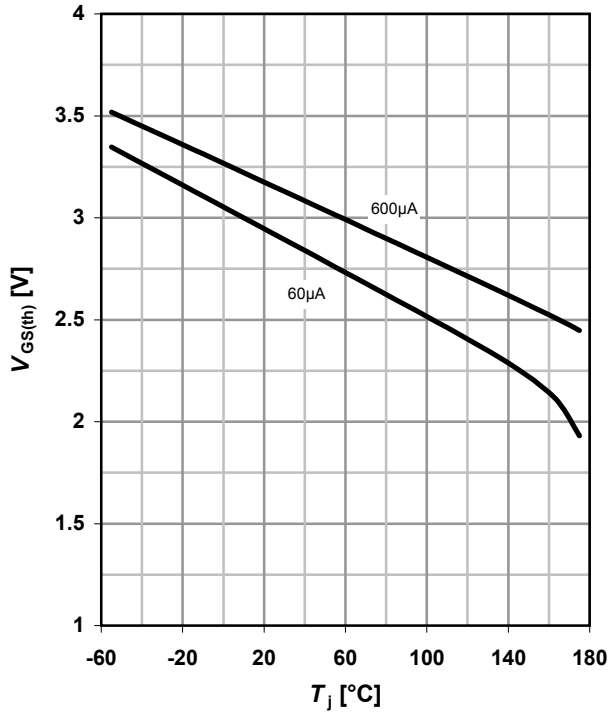
$R_{DS(on)} = f(T_j); I_D = 50\text{ A}; V_{GS} = 10\text{ V}$



9 Typ. gate threshold voltage

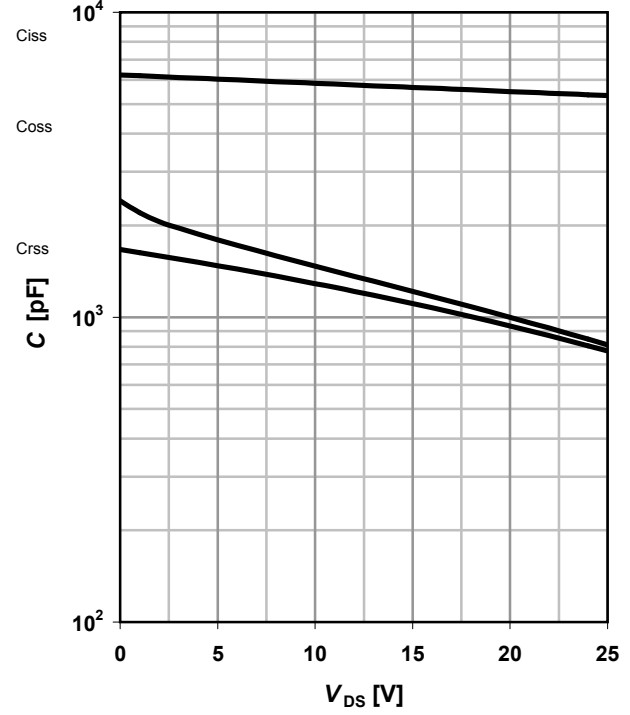
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

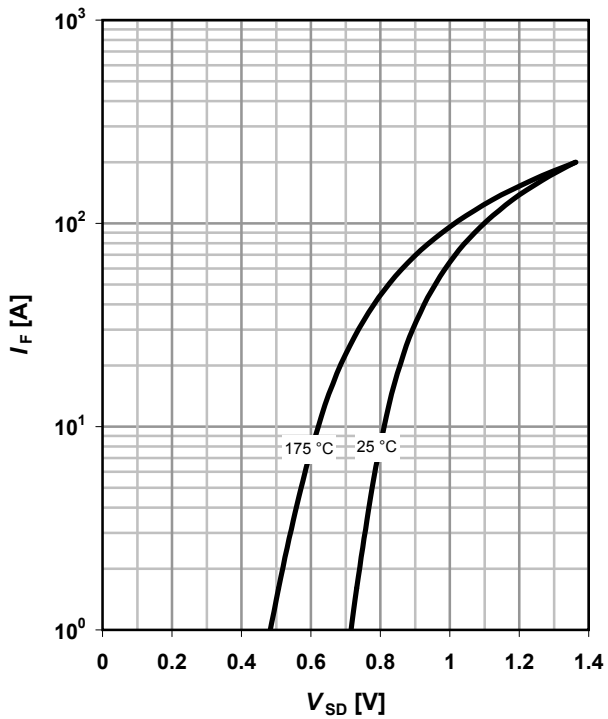
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



11 Typical forward diode characteristics

$I_F = f(V_{SD})$

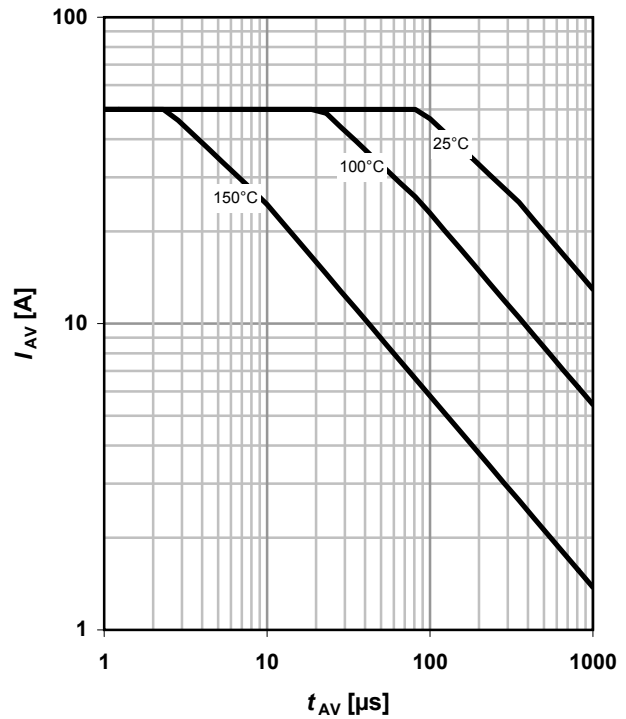
parameter: T_j



12 Typ. avalanche characteristics

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

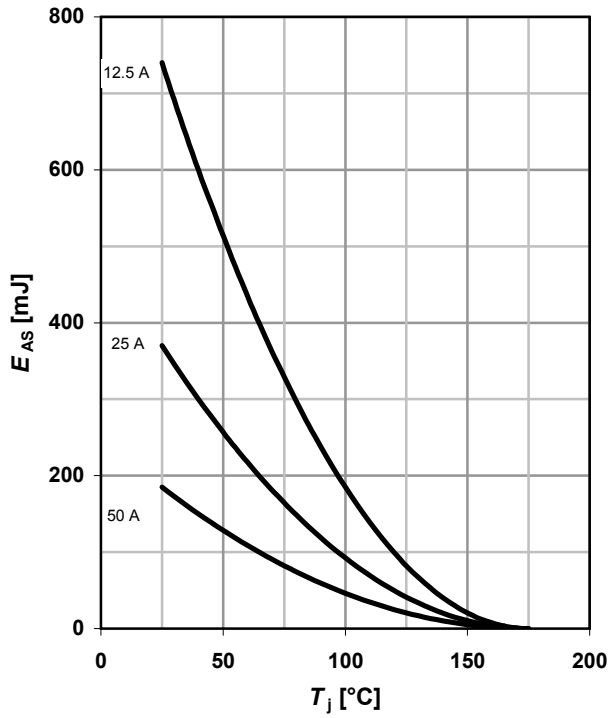
parameter: $T_{j(start)}$



13 Typical avalanche Energy

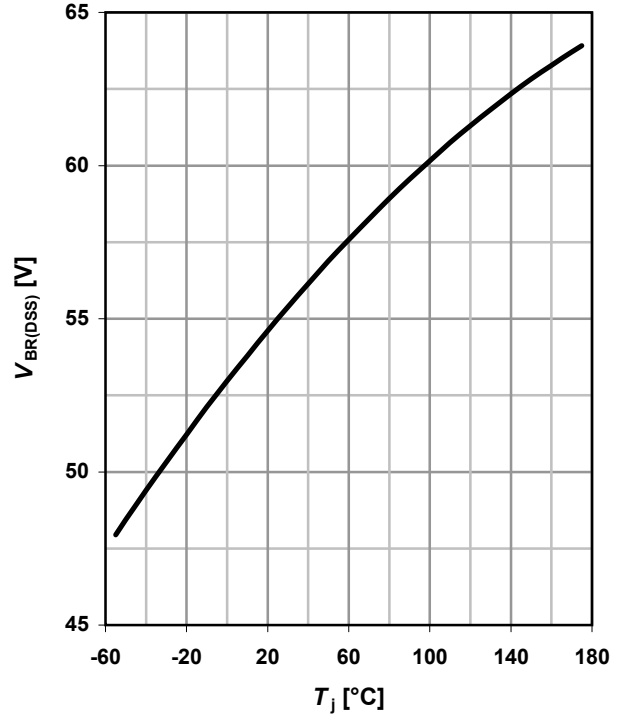
$E_{AS} = f(T_j)$

parameter: I_D



14 Drain-source breakdown voltage

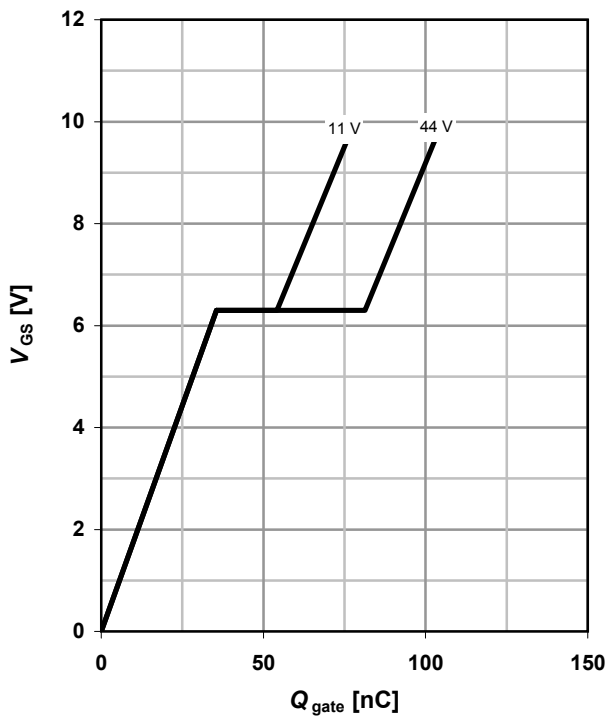
$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$



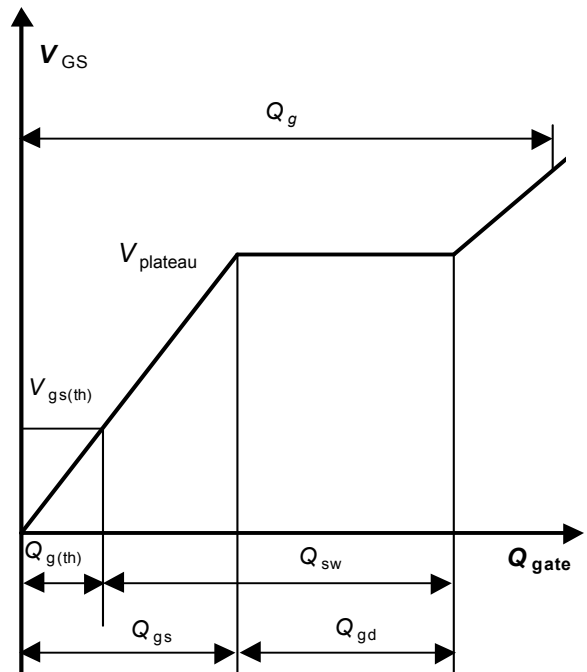
15 Typ. gate charge

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

parameter: V_{DD}



16 Gate charge waveforms



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Revision History

Version	Date	Changes
Revision 2.1	23.07.2007	Eas @ Id = 38A instead of 50A, according to D ² PAK product
Revision 2.1	23.07.2007	Update of diagram 12 and 13 according to Eas @ Id = 38A
Data Sheet version 1.1	07.11.2007	Implementation of avalanche current single pulse
Data Sheet version 1.1	07.11.2007	Update of package drawing
Data Sheet version 1.1	07.11.2007	Update of avalanche diagram 12 and 13
Data Sheet version 1.1	07.11.2007	implementation of footnote 2 for Eas specification
Data Sheet version 1.1	07.11.2007	Vgsth measured at 55μA