OptiMOS™-T Power-Transistor

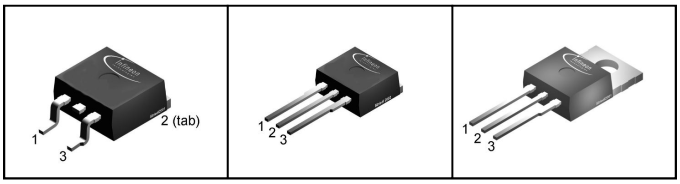
Product Summary

V_{DS}	120	V
$R_{DS(on),max}$ (SMD version)	11.3	mΩ
I_D	70	A

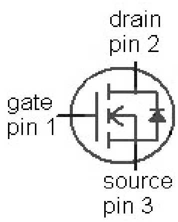
Features

- OptiMOS™ - power MOSFET for automotive applications
- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested

PG-TO263-3-2 PG-TO262-3-1 PG-TO220-3-1



Type	Package	Marking
IPB70N12S3-11	PG-TO263-3-2	3N1211
IPI70N12S3-11	PG-TO262-3-1	3N1211
IPP70N12S3-11	PG-TO220-3-1	3N1211



Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C, V_{GS}=10 V	70	A
		T_C=100 °C, V_{GS}=10 V[1)]	48	
Pulsed drain current[1)]	$I_{D,pulse}$	T_C=25 °C	280	
Avalanche energy, single pulse[1)]	E_{AS}	I_D=35A	410	mJ
Avalanche current, single pulse	I_{AS}	-	70	A
Gate source voltage	V_{GS}	-	±20	V
Power dissipation	P_{tot}	T_C=25 °C	125	W
Operating and storage temperature	T_j, T_{stg}	-	-55 ... +175	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics[1]						
Thermal resistance, junction - case	R_{thJC}	-	-	-	1.2	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[2]	-	-	40	

Electrical characteristics, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D= 1 mA	120	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=83µA	2.0	3.0	4.0	
Zero gate voltage drain current	I_{DSS}	V_{DS}=120V, V_{GS}=0V, T_j=25°C	-	0.01	0.1	µA
		V_{DS}=120V, V_{GS}=0V, T_j=125°C[1]	-	1	10	
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	-	9.7	11.6	mΩ
		V_{GS}=10V, I_D=70A, SMD version	-	9.4	11.3	

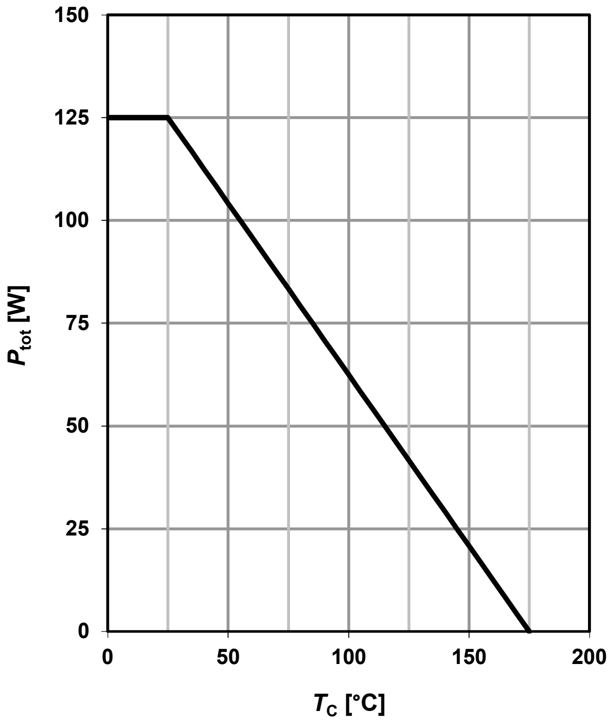
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics[1]						
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	3350	4355	pF
Output capacitance	C_{oss}		-	940	1222	
Reverse transfer capacitance	C_{rss}		-	105	158	
Turn-on delay time	$t_{d(on)}$	V_{DD}=20 V, V_{GS}=10 V, I_D=70 A, R_G=3.5 Ω	-	17	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	25	-	
Fall time	t_f		-	8	-	
Gate Charge Characteristics[1]						
Gate to source charge	Q_{gs}	V_{DD}=96 V, I_D=70 A, V_{GS}=0 to 10 V	-	18	23	nC
Gate to drain charge	Q_{gd}		-	16	24	
Gate charge total	Q_g		-	51	65	
Gate plateau voltage	$V_{plateau}$		-	5.5	-	V
Reverse Diode						
Diode continous forward current[1]	I_S	T_C=25°C	-	-	70	A
Diode pulse current[1]	$I_{S,pulse}$		-	-	280	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=70 A, T_j=25 °C	0.6	1	1.2	V
Reverse recovery time[1]	t_{rr}	V_R=60V, I_F=50A, di_F/dt=100A/µs	-	100	-	ns
Reverse recovery charge[1]	Q_{rr}		-	265	-	nC

[1] Defined by design. Not subject to production test.

[2] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

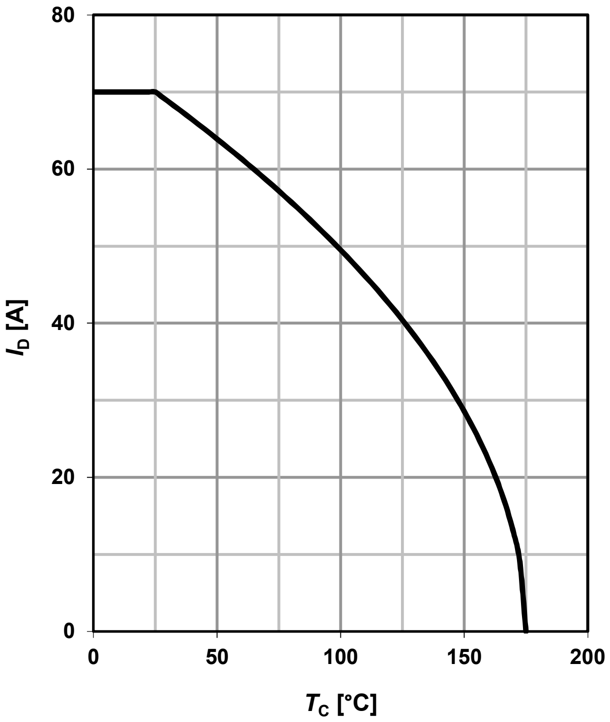
1 Power dissipation

$P_{tot} = f(T_C)$; $V_{GS} = 10$ V



2 Drain current

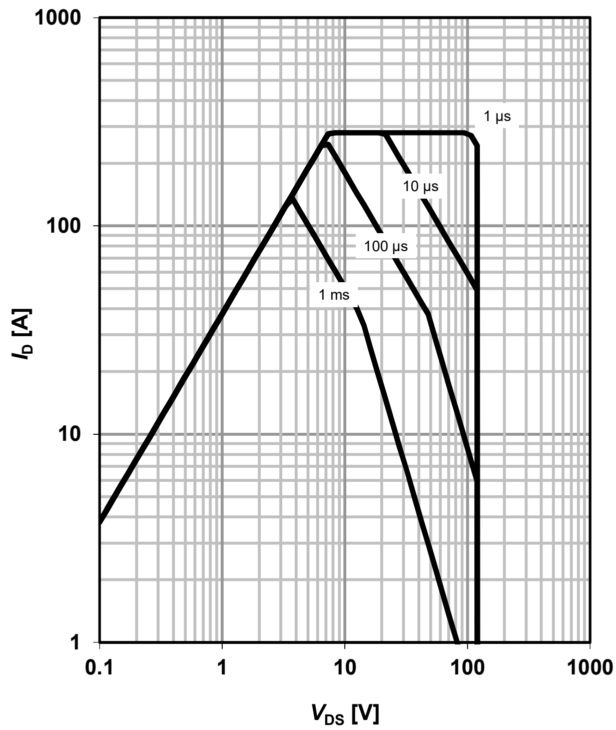
$I_D = f(T_C)$; $V_{GS} = 10$ V; SMD



3 Safe operating area

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

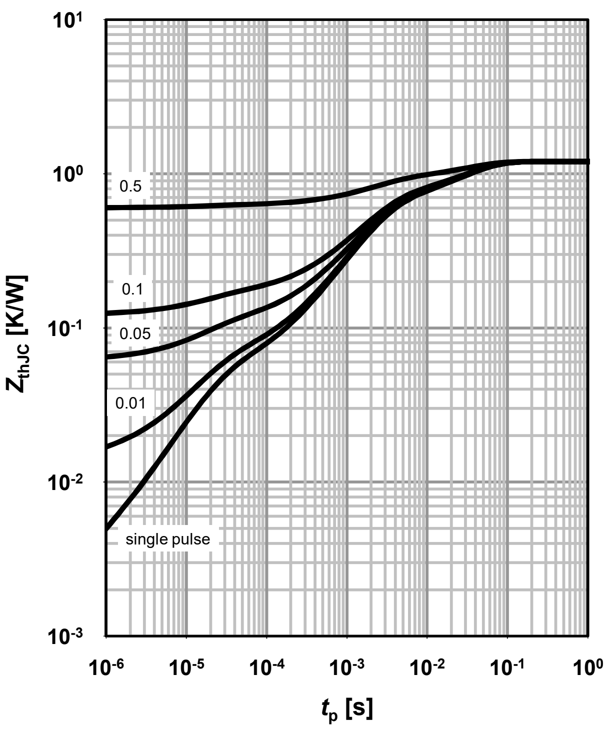
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

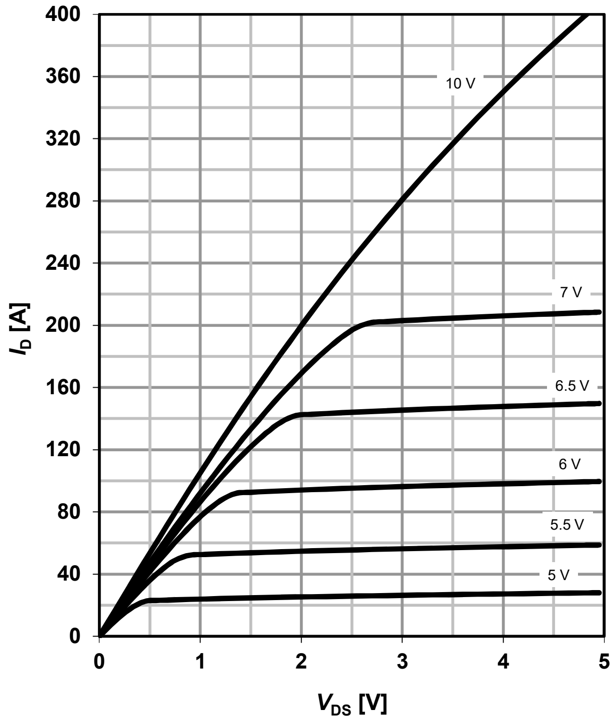
parameter: $D = t_p/T$



5 Typ. output characteristics

$I_D = f(V_{DS})$; $T_j = 25$ °C; SMD

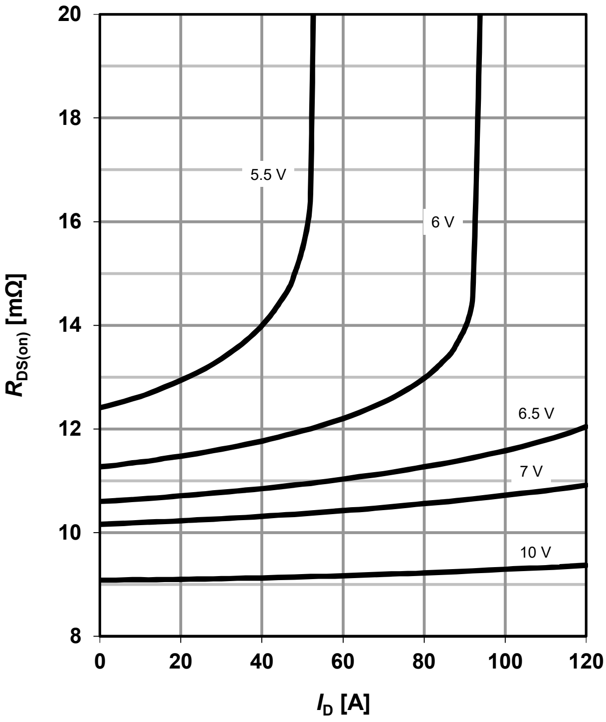
parameter: V_{GS}



6 Typ. drain-source on-state resistance

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

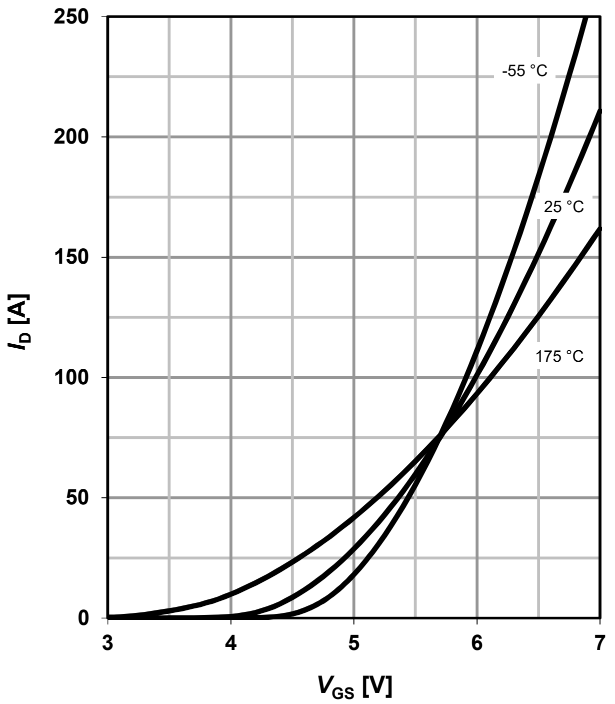
parameter: V_{GS}



7 Typ. transfer characteristics

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

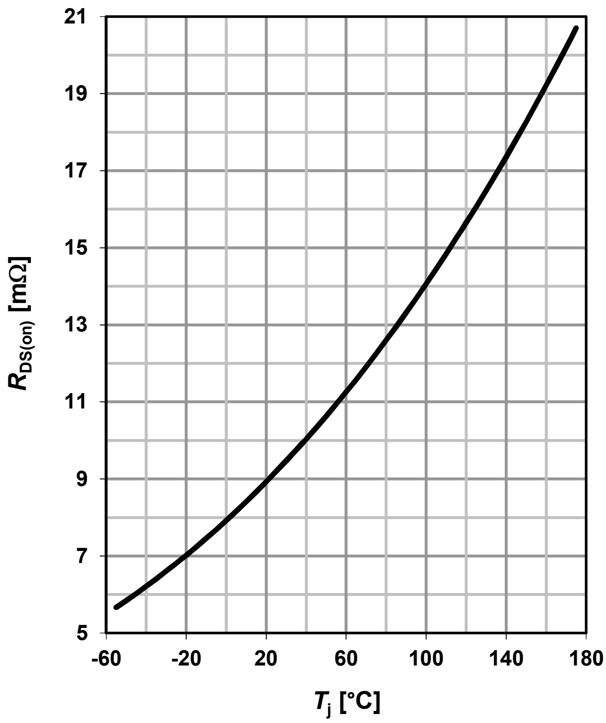
parameter: T_j



8 Typ. drain-source on-state resistance

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

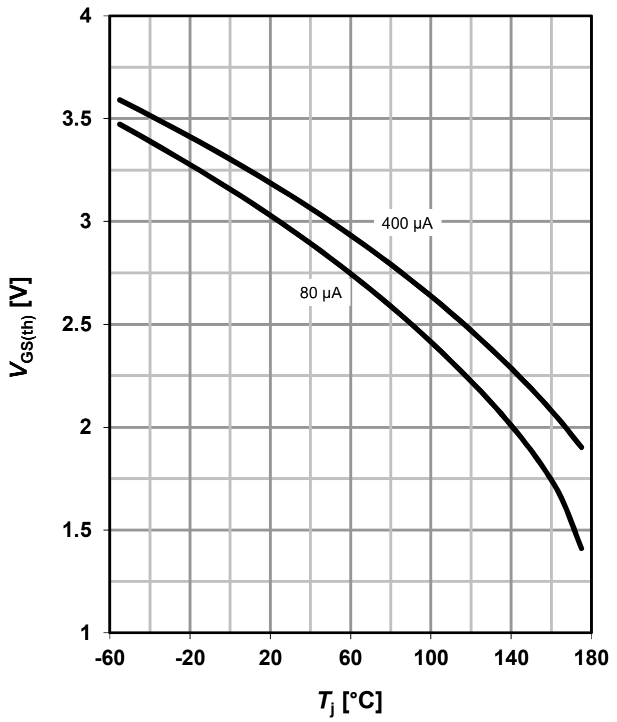
$\alpha = 0.4$



9 Typ. gate threshold voltage

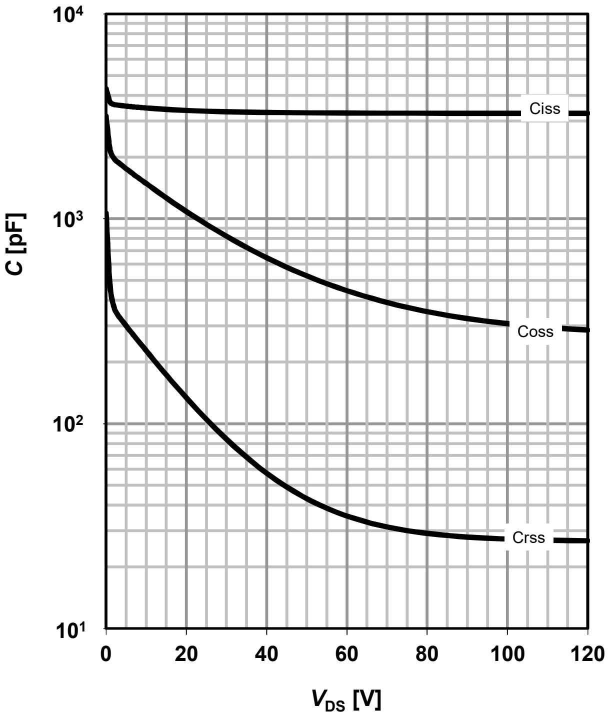
$V_{GS(th)} = f(T_j)$; $V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

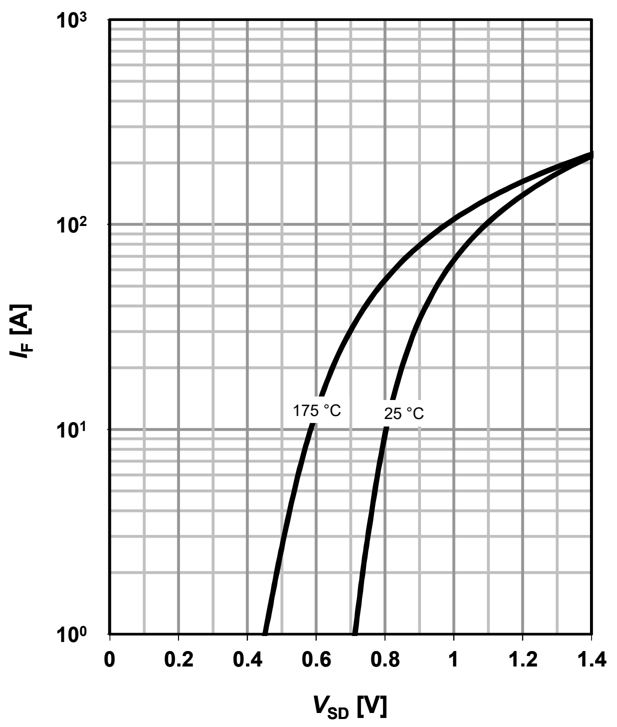
$C = f(V_{DS})$; $V_{GS} = 0$ V; $f = 1$ MHz



11 Typical forward diode characteristics

$I_F = f(V_{SD})$

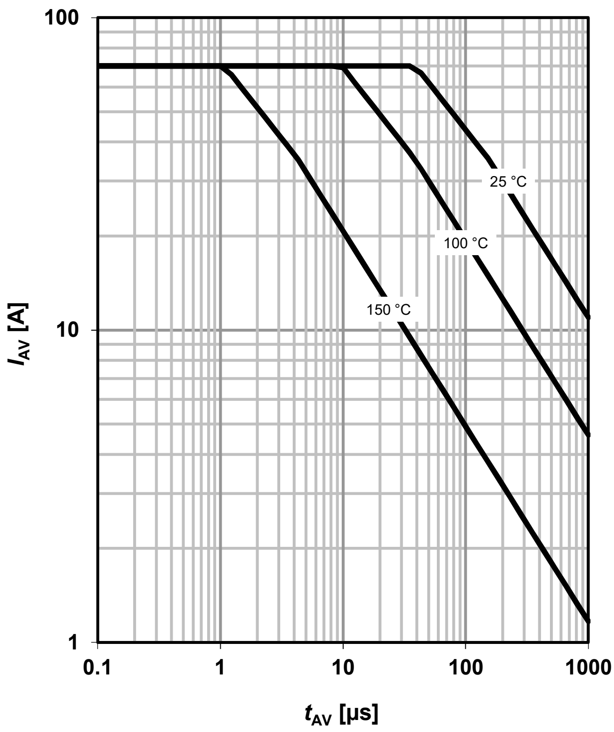
parameter: T_j



12 Typ. avalanche characteristics

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

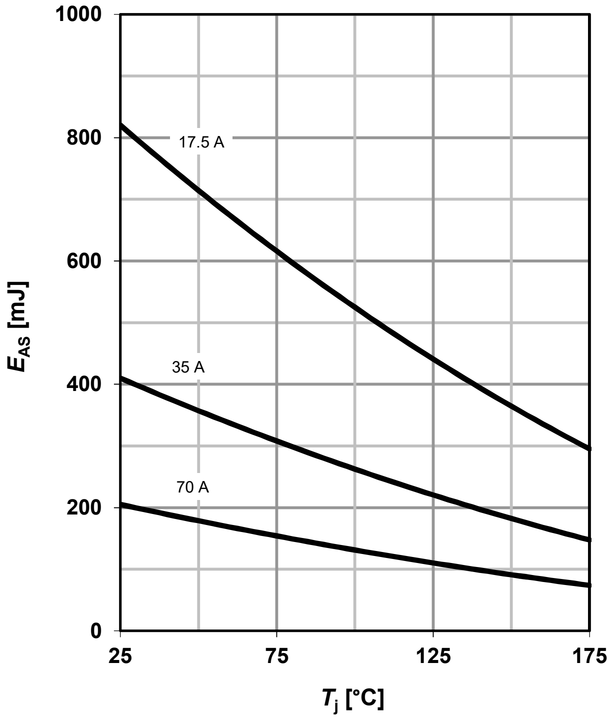
parameter: $T_{j(start)}$



13 Typical avalanche energy

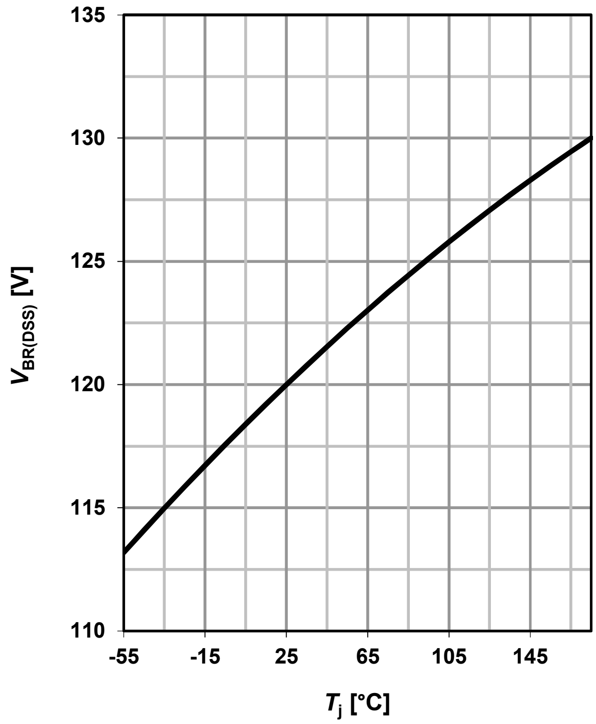
$E_{AS} = f(T_j)$

parameter: I_D



14 Typ. drain-source breakdown voltage

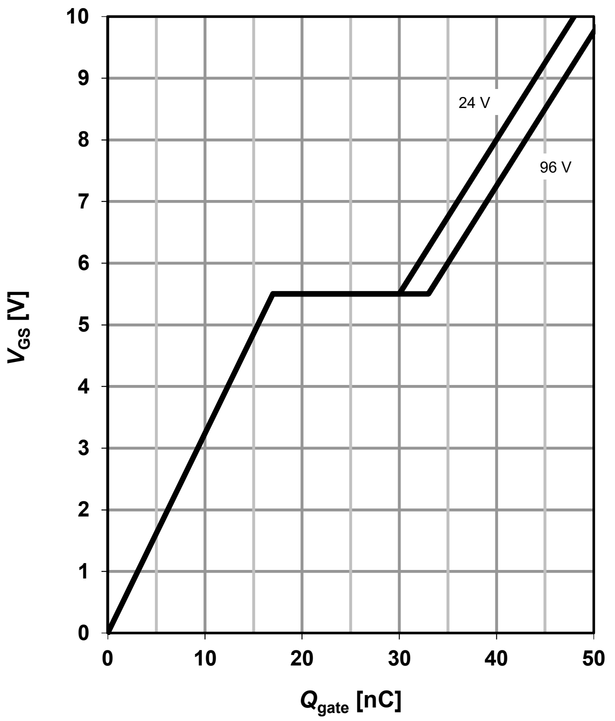
$V_{BR(DSS)} = f(T_j)$; $I_D = 1$ mA



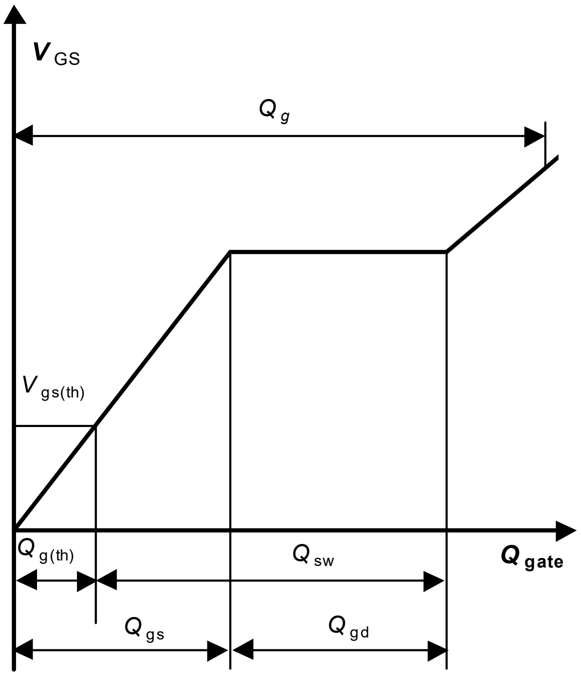
15 Typ. gate charge

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

parameter: V_{DD}



16 Gate charge waveforms



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Revision History

Version	Date	Changes
Revision 1.0	2016-06-20	Final Data Sheet
Revision 1.1	2023-06-15	Diagram 8 Typ. drain-source on-state resistance: used α value clarified
Revision 1.1	2023-06-15	Corrected diagram 10 typical capacitances