

OptiMOS™ -5 Power-Transistor



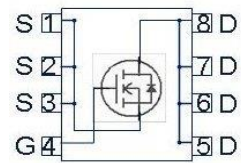
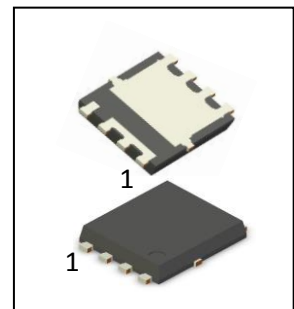
Features

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

Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	5.5	mΩ
I_D	50	A

PG-TDSON-8-33



Type	Package	Marking
IPC50N04S5L-5R5	PG-TDSON-8-33	5N04L5R5

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⁾	42	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	200	
Avalanche energy, single pulse ²⁾	E_{AS}	$I_D=25\text{ A}$	30	mJ
Avalanche current, single pulse	I_{AS}	-	50	A
Gate source voltage	V_{GS}	-	±16	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	42	W
Operating and storage temperature	T_j , T_{stg}	-	-55 ... +175	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics²⁾

Thermal resistance, junction - case	R_{thJC}	-	-	-	3.6	K/W
Thermal resistance, junction - ambient	R_{thJA}	6 cm ² cooling area ³⁾	-	-	50	

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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=13\mu A$	1.2	1.6	2.0	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=16V, V_{DS}=0V$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=25A$	-	5.7	7.9	m Ω
		$V_{GS}=10V, I_D=25A$	-	4.4	5.5	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$	-	930	1209	pF
Output capacitance	C_{oss}		-	210	279	
Reverse transfer capacitance	C_{rss}		-	14	21	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20V, V_{GS}=10V,$ $I_D=50A, R_G=3.5\Omega$	-	2	-	ns
Rise time	t_r		-	2	-	
Turn-off delay time	$t_{d(off)}$		-	8	-	
Fall time	t_f		-	6	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=32V, I_D=50A,$ $V_{GS}=0 \text{ to } 10V$	-	2.7	3.6	nC
Gate to drain charge	Q_{gd}		-	3.6	5.4	
Gate charge total	Q_g		-	17	23	
Gate plateau voltage	$V_{plateau}$		-	2.9	-	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C=25^\circ C$	-	-	50	A
Diode pulse current ²⁾	$I_{S,pulse}$		-	-	200	
Diode forward voltage	V_{SD}	$V_{GS}=0V, I_F=25A,$ $T_J=25^\circ C$	-	0.8	1.1	V
Reverse recovery time ²⁾	t_{rr}	$V_R=20V, I_F=50A,$ $di_F/dt=100A/\mu s$	-	30	-	ns
Reverse recovery charge ²⁾	Q_{rr}		-	22	-	nC

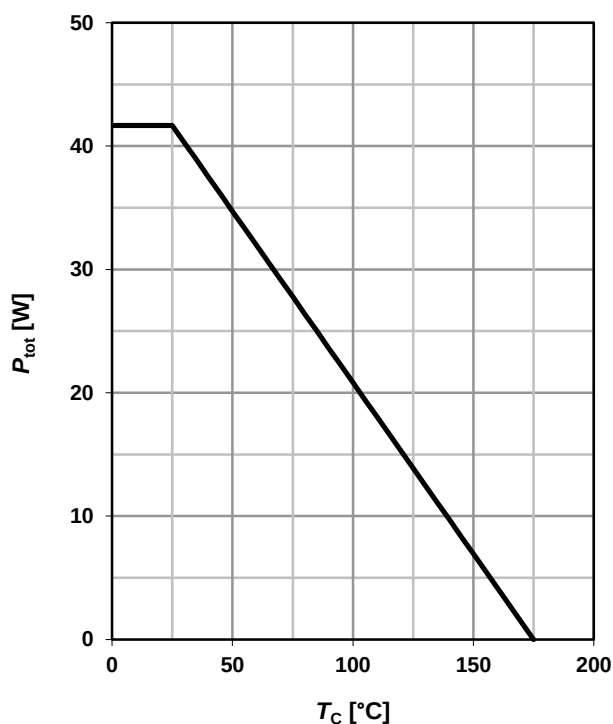
¹⁾ Current is limited by package; with an $R_{thJC} = 3.6K/W$ the chip is able to carry 60 A at 25°C.

²⁾ The parameter is not subject to production test- verified by design/characterization.

³⁾ 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.

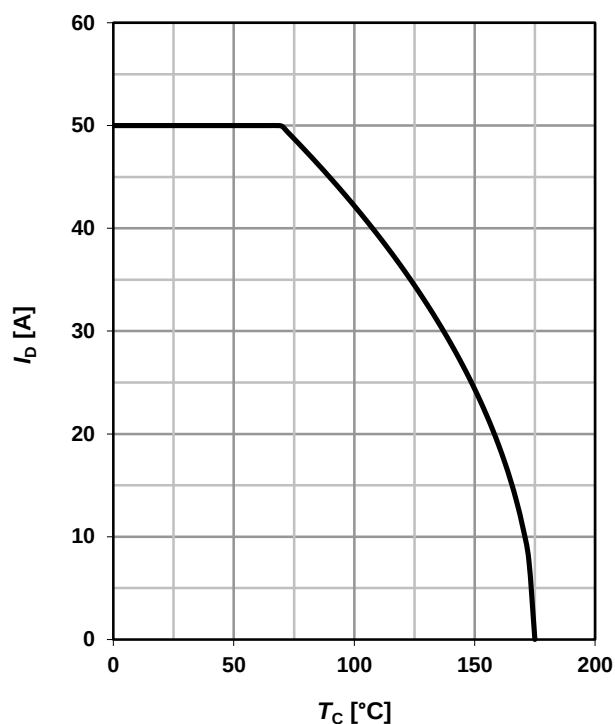
1 Power dissipation

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



2 Drain current

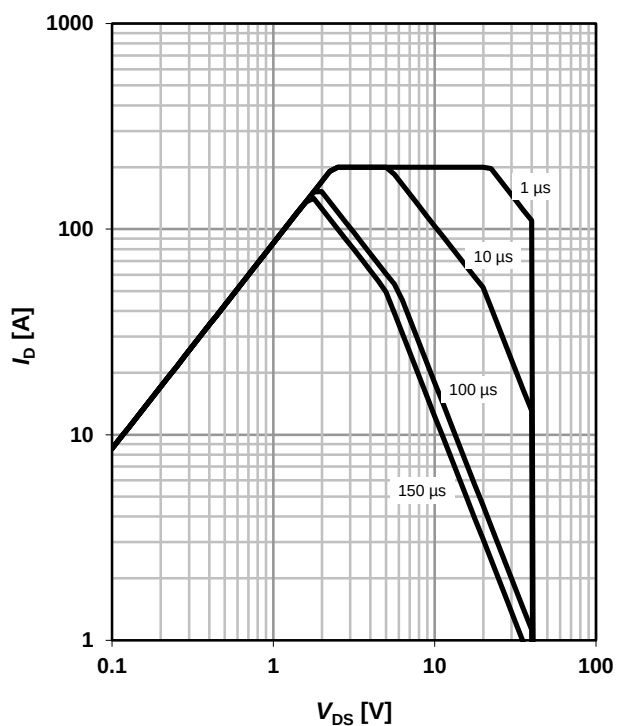
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



3 Safe operating area

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

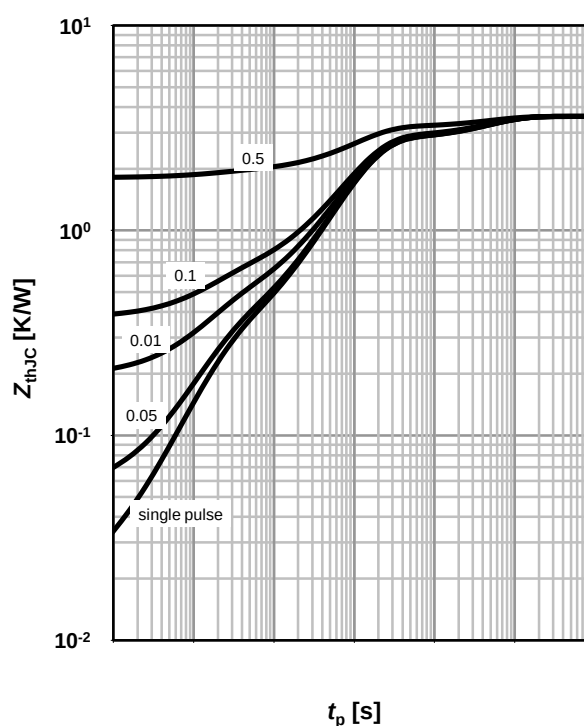
parameter: t_p



4 Max. transient thermal impedance

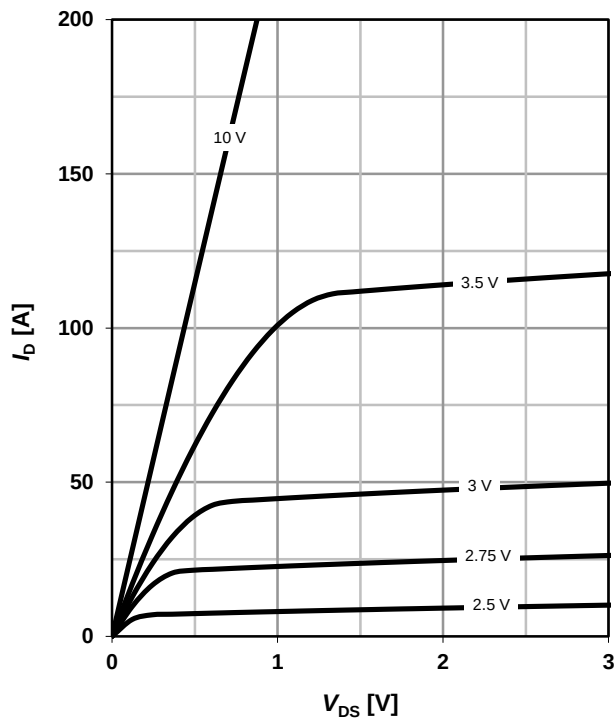
$$Z_{\text{thJC}} = f(t_p)$$

parameter: $D = t_p/T$



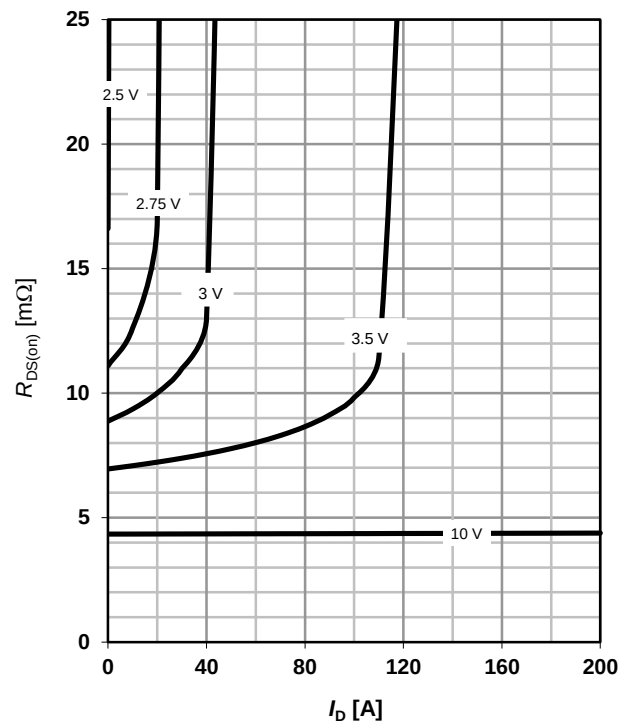
5 Typ. output characteristics

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

parameter: V_{GS}


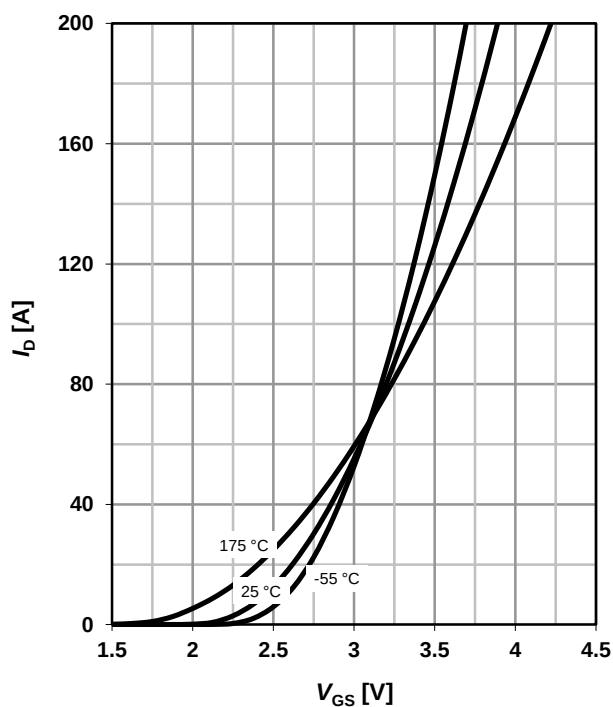
6 Typ. drain-source on-state resistance

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

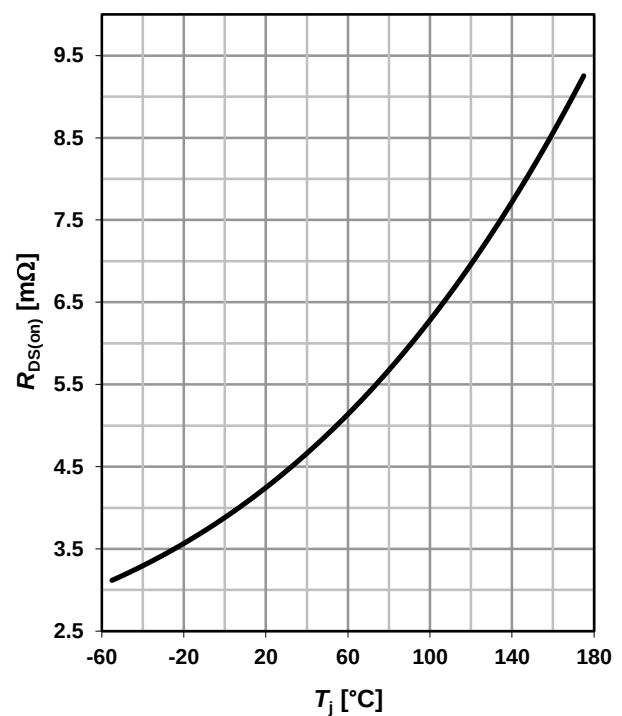
parameter: V_{GS}


7 Typ. transfer characteristics

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

parameter: T_j


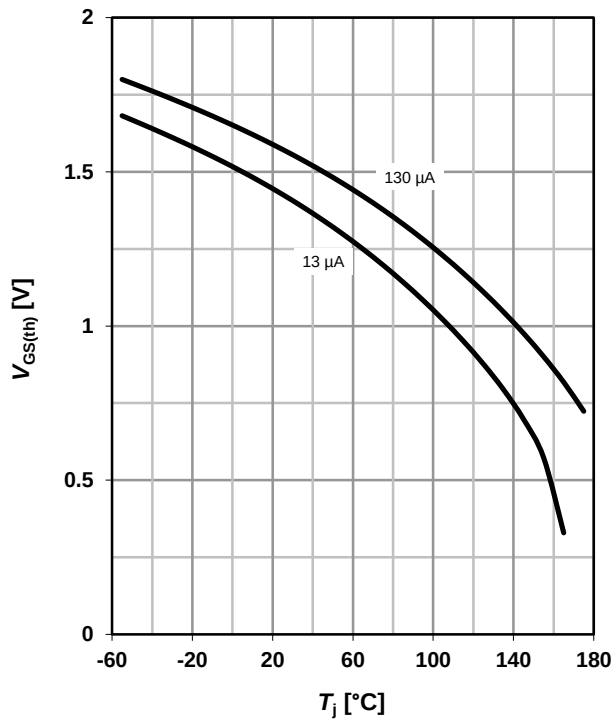
8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 25\text{ A}; V_{GS} = 10\text{ V}$


9 Typ. gate threshold voltage

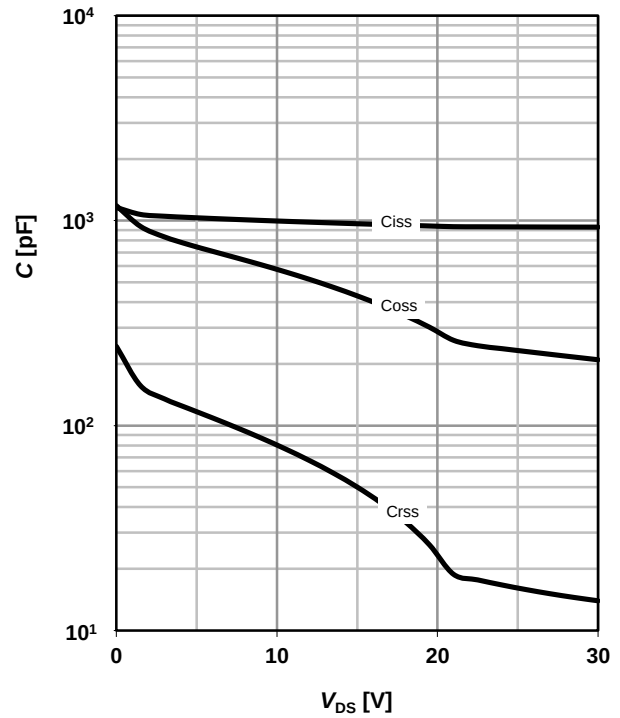
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter: I_D



10 Typ. capacitances

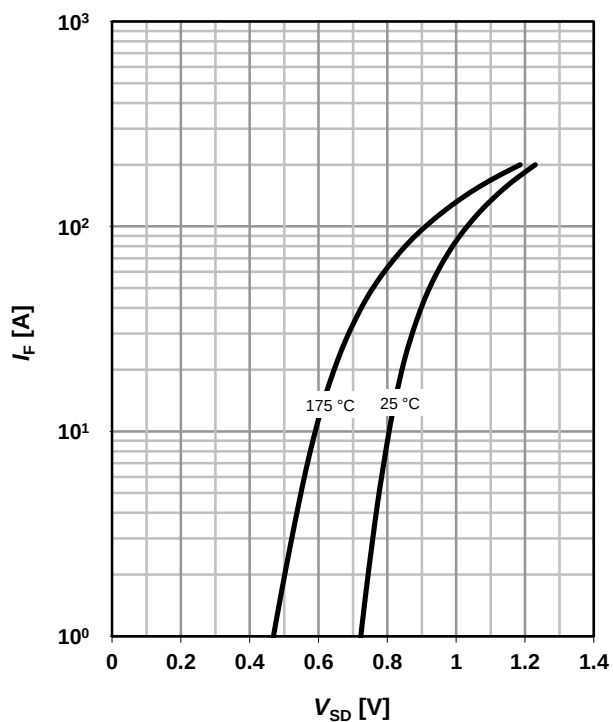
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



11 Typical forward diode characteristics

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

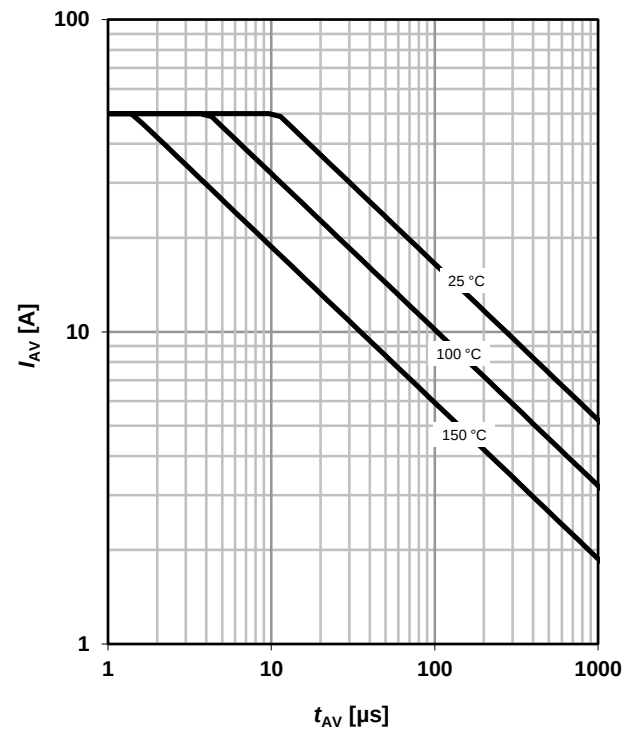
parameter: T_j



12 Avalanche characteristics

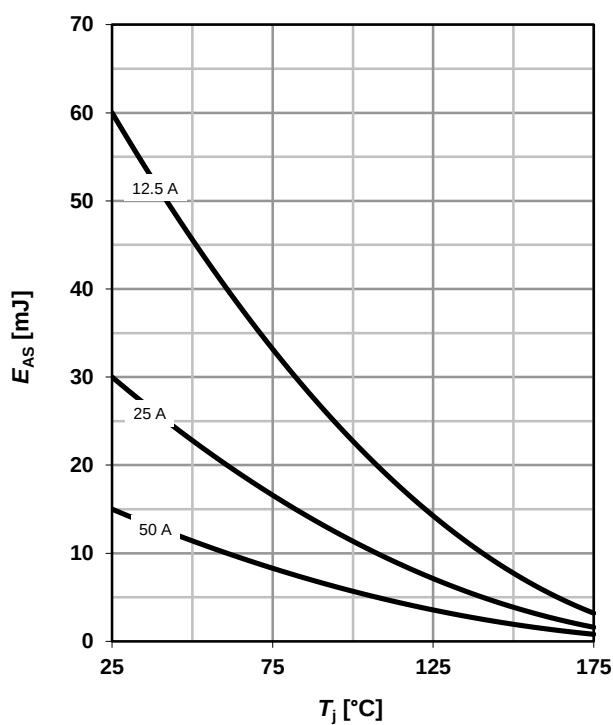
$$I_{AS} = f(t_{AV})$$

parameter: $T_{j(start)}$



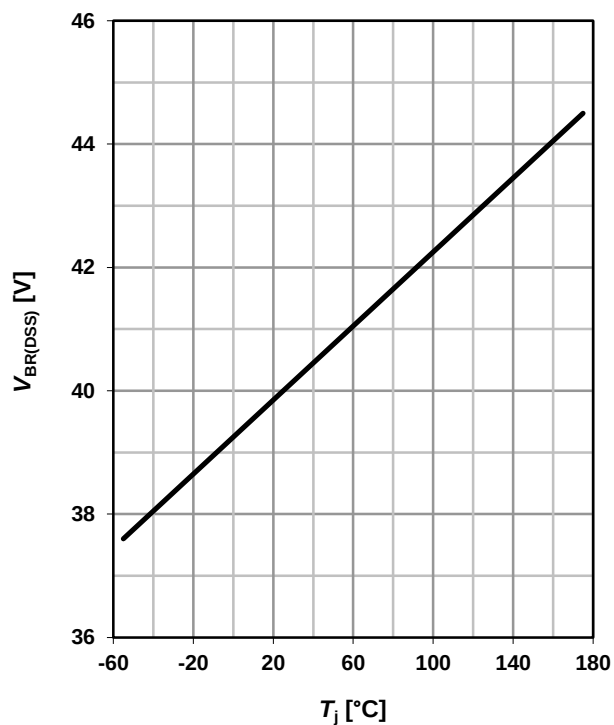
13 Avalanche energy

$$E_{AS} = f(T_j)$$



14 Drain-source breakdown voltage

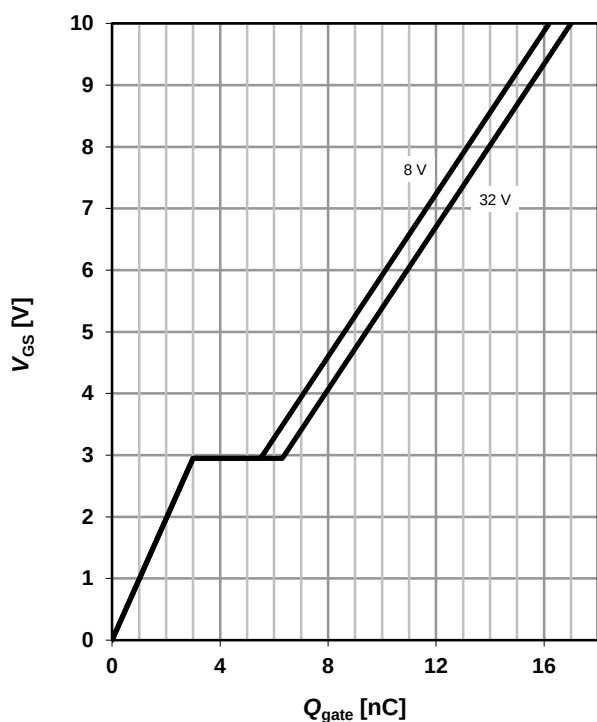
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



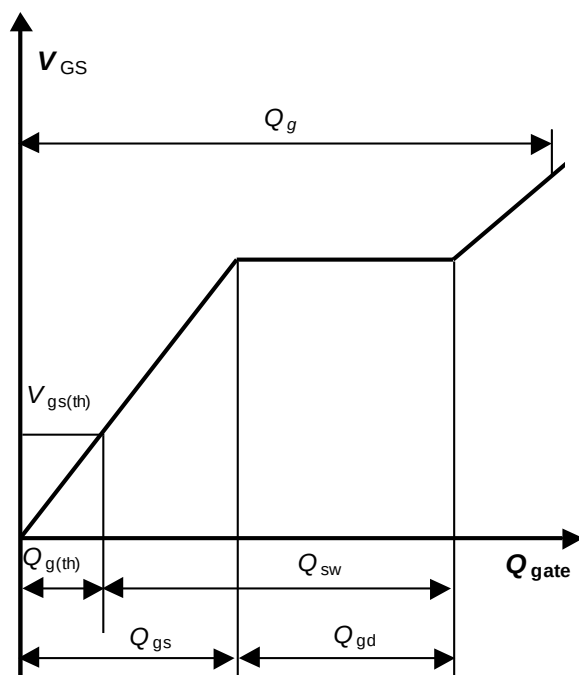
15 Typ. gate charge

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

parameter: V_{DD}



16 Gate charge waveforms



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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
Revision 1.0	14.03.2016	Final Data Sheet
Revision 1.1	07.09.2016	Detailed package name added
Revision 1.2	06.12.2016	Update the IDSS for Tj=25°C