

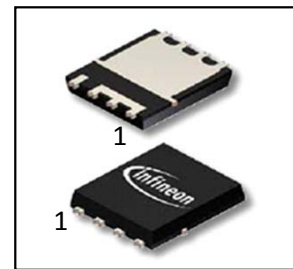
OptiMOS™-T2 Power-Transistor

Product Summary

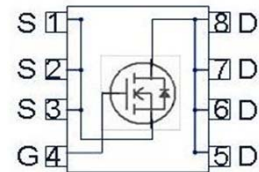
V_{DS}	40	V
$R_{DS(on)}$	5.6	mΩ
I_D	60	A

Features

- N-channel Logic Level - Enhancement mode
- AEC qualified
- MSL1 up to 260°C peak reflow
- Green product (RoHS compliant)
- 100% Avalanche tested
- Feasible for automatic optical inspection (AOI)

PG-TDSON-8-23


Type	Package	Marking
IPC60N04S4L-06	PG-TDSON-8-23	4N04L06


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}$, $T_J=175\text{ °C}$, $V_{GS}=10\text{ V}$	60 ¹⁾	A
		$T_C=100\text{ °C}$, $T_J=175\text{ °C}$, $V_{GS}=10\text{ V}$	58 ^{1, 2)}	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	240	
Avalanche energy, single pulse	E_{AS}	$I_D=30\text{ A}$	120	mJ
Avalanche current, single pulse	I_{AS}	-	60	A
Gate source voltage	V_{GS}	-	±16	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$, $T_J=175\text{ °C}$	63	W
Operating and storage temperature	T_j, T_{stg}	-	-55 ... +175 ³⁾	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}	-	-	-	2.4	K/W
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Electrical characteristics, at $T_j=25\text{ °C}$, unless otherwise specified
Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=30\mu\text{A}$	1.2	1.7	2.2	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.01	1	μA
		$V_{DS}=18\text{ V}, V_{GS}=0\text{ V}, T_j=85\text{ °C}^{2)}$	-	1	20	
Gate-source leakage current	I_{GSS}	$V_{GS}=16\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=30\text{ A}$	-	4.8	5.6	m Ω
		$V_{GS}=4.5\text{ V}, I_D=30\text{ A}$	-	6.5	7.9	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	2763	3600	pF
Output capacitance	C_{oss}		-	514	670	
Reverse transfer capacitance	C_{rss}		-	23	54	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{ V}, V_{GS}=10\text{ V},$ $I_D=60\text{ A}, R_G=3.5\ \Omega$	-	4	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	15	-	
Fall time	t_f		-	15	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=32\text{ V}, I_D=60\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	9	12	nC
Gate to drain charge	Q_{gd}		-	4	9	
Gate charge total	Q_g		-	35	46	
Gate plateau voltage	$V_{plateau}$		-	3.2	-	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C=25\text{ °C}$	-	-	60	A
Diode pulse current ²⁾	$I_{S,pulse}$		-	-	240	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=30\text{ A},$ $T_j=25\text{ °C}$	-	0.9	1.3	V
Reverse recovery time ²⁾	t_{rr}	$V_R=20\text{ V}, I_F=50\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	37	-	ns
Reverse recovery charge ²⁾	Q_{rr}		-	33	-	nC

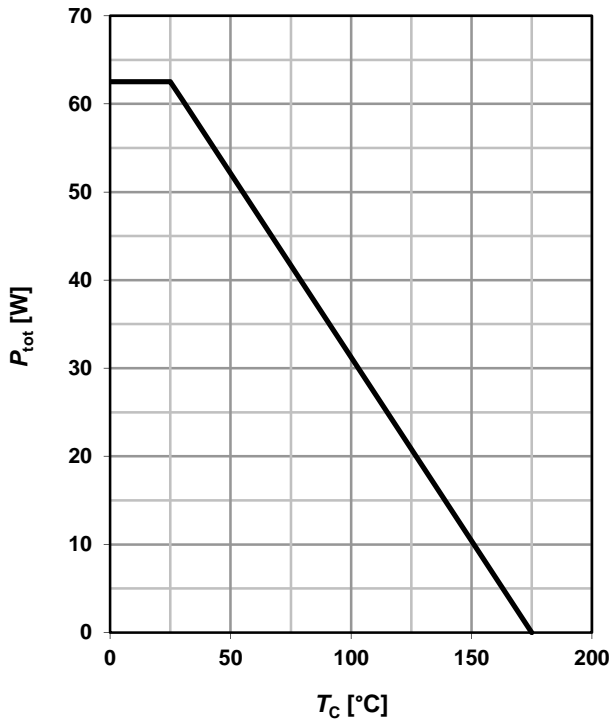
¹⁾ Current is limited by package; with an $R_{thJC} = 2.4\text{ K/W}$ the chip is able to carry 81 A at 25°C.

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

³⁾ $T_J > 150\text{ °C}$ is limited to 200h operation time over life time of the device

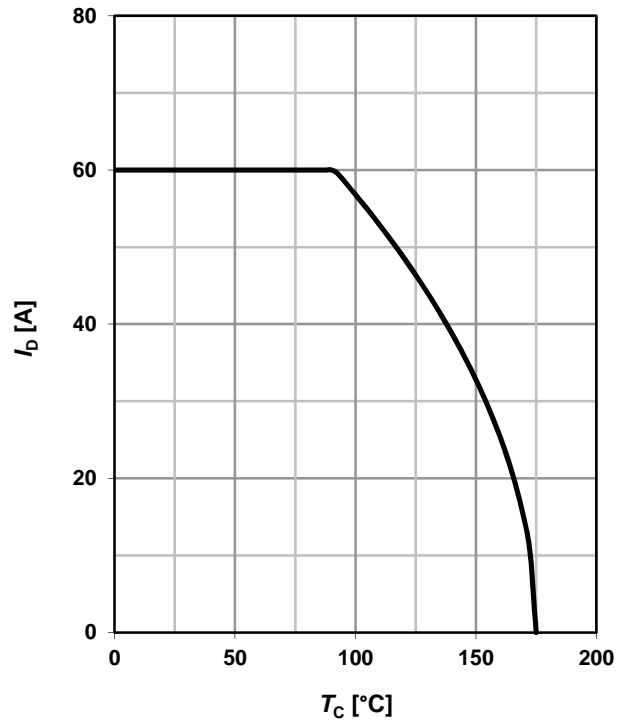
1 Power dissipation

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



2 Drain current

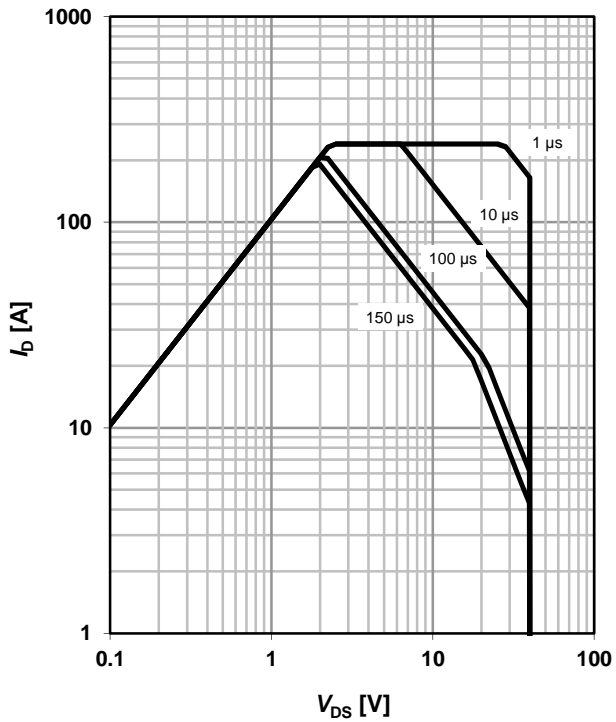
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



3 Safe operating area

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

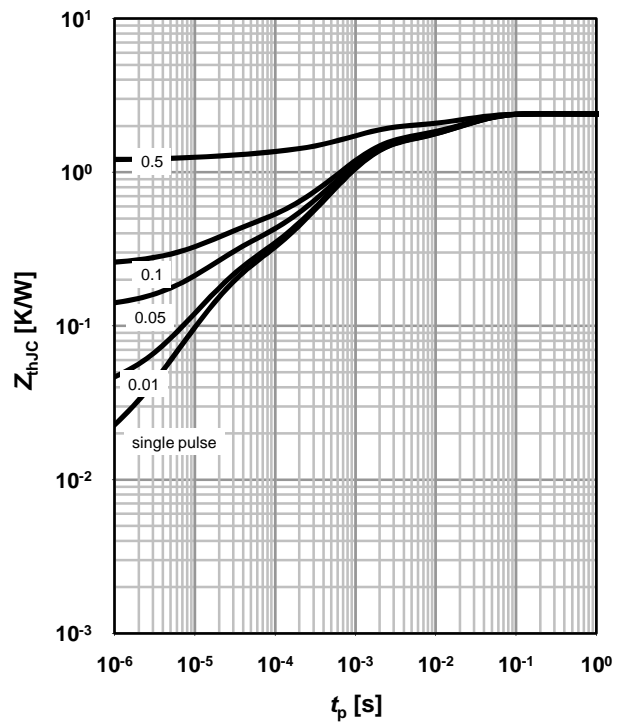
parameter: t_p



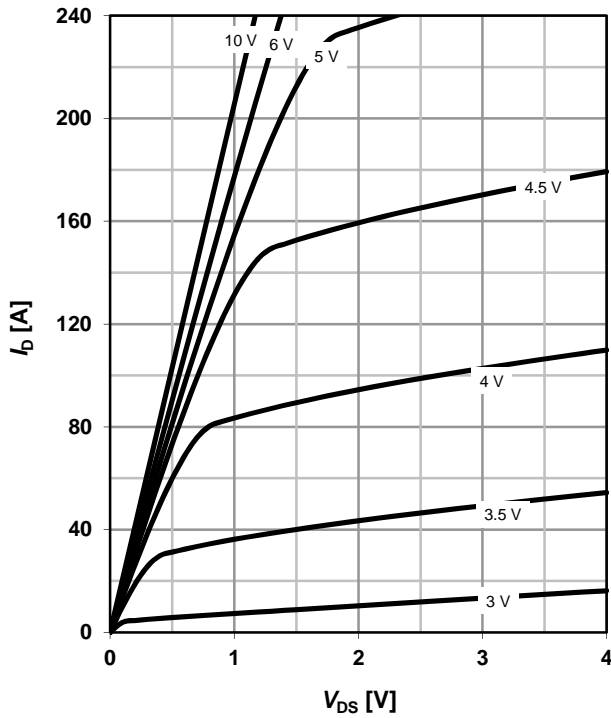
4 Max. transient thermal impedance

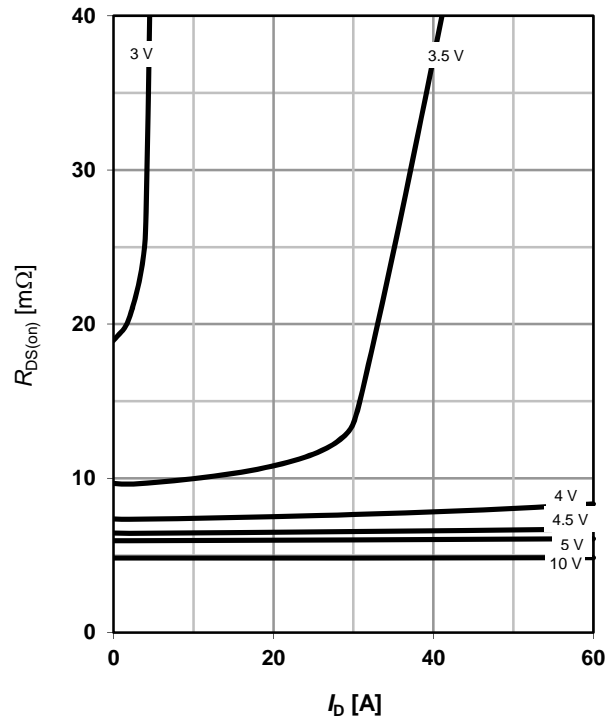
$$Z_{\text{thJC}} = f(t_p)$$

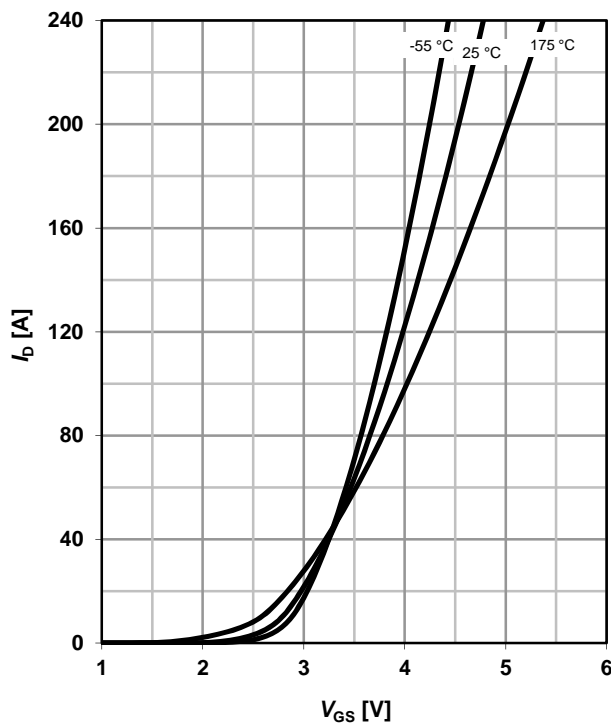
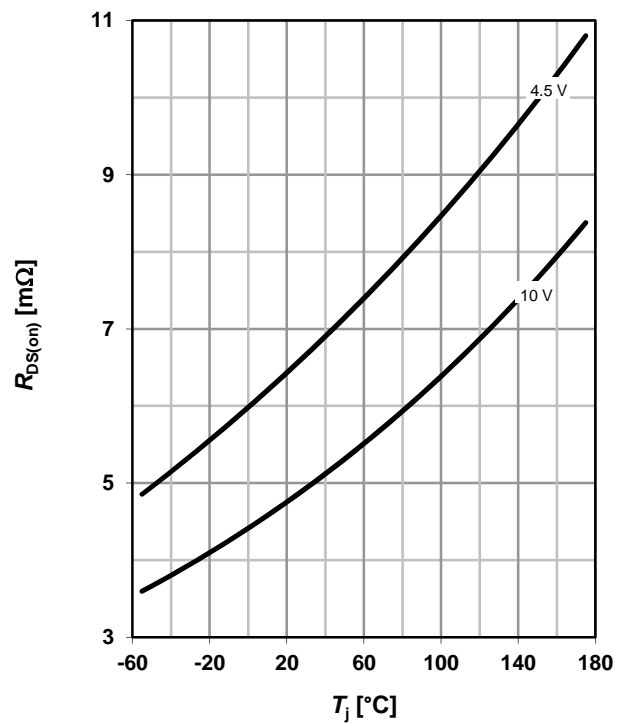
parameter: $D = t_p/T$



5 Typ. output characteristics
 $I_D = f(V_{DS}); T_j = 25\text{ °C}$

 parameter: V_{GS}

6 Typ. drain-source on-state resistance
 $R_{DS(on)} = f(I_D); T_j = 25\text{ °C}$

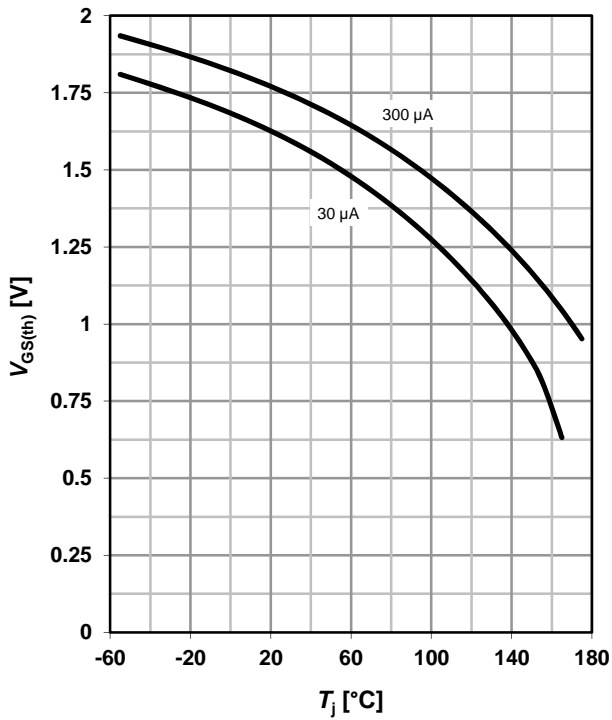
 parameter: V_{GS}

7 Typ. transfer characteristics
 $I_D = f(V_{GS}); V_{DS} = 6\text{ V}$

 parameter: T_j

8 Typ. drain-source on-state resistance
 $R_{DS(on)} = f(T_j); I_D = 100\text{ A}; V_{GS} = 10\text{ V}$


9 Typ. gate threshold voltage

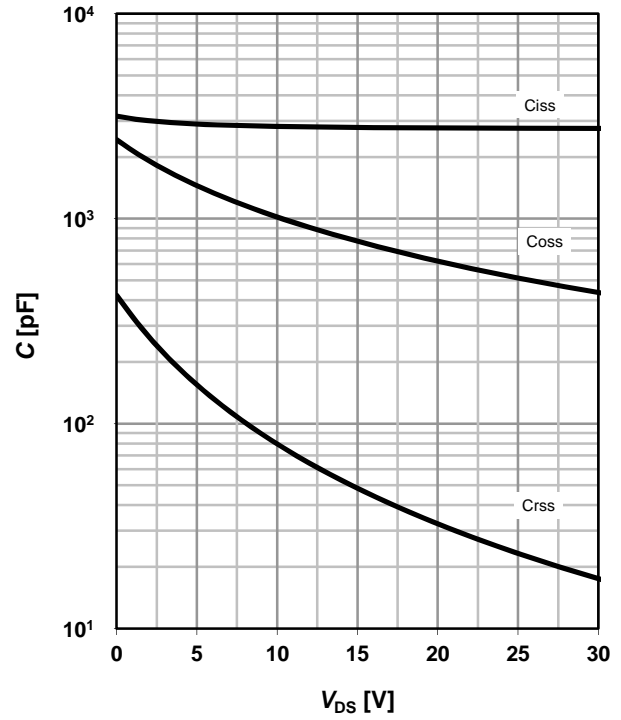
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

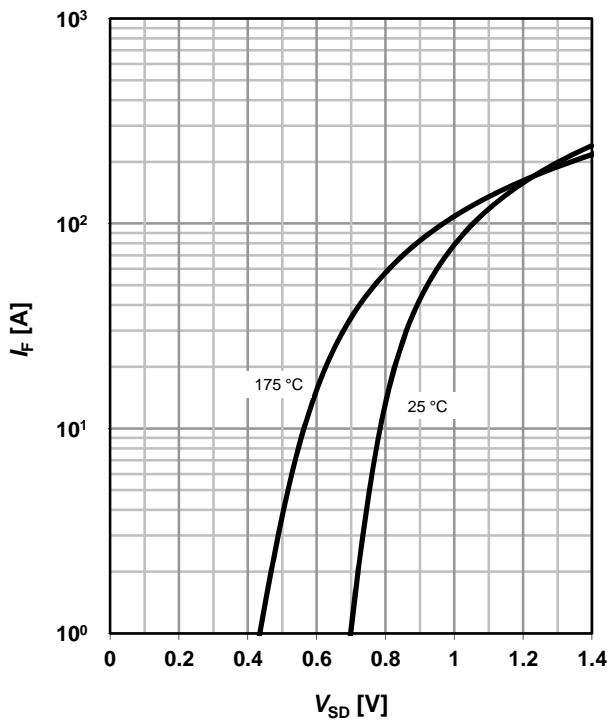
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



11 Typical forward diode characteristics

$I_F = f(V_{SD})$

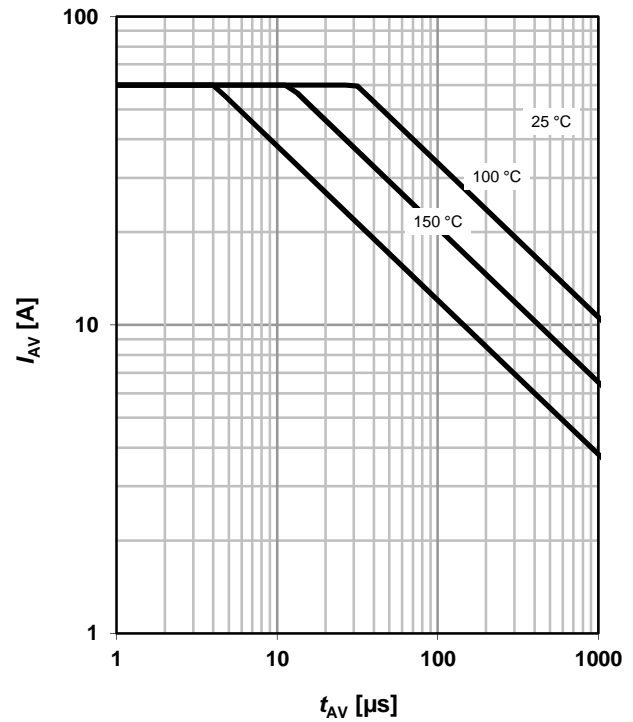
parameter: T_j



12 Typ. avalanche characteristics

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

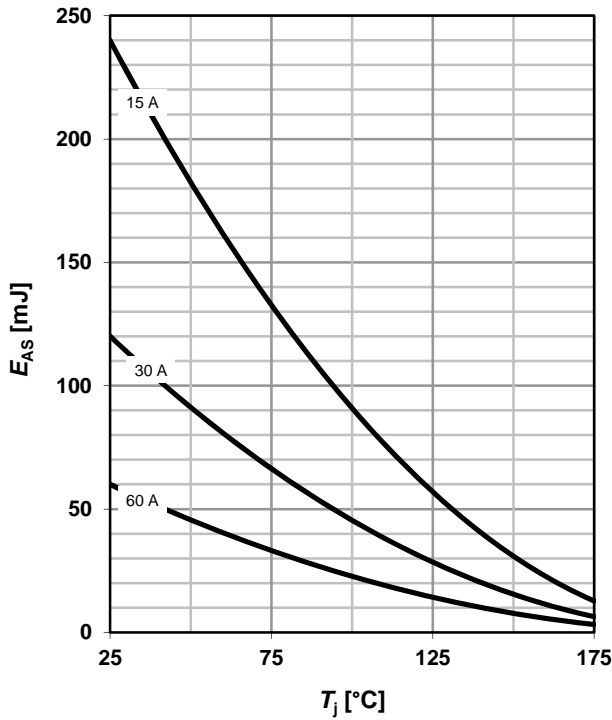
parameter: $T_{j(start)}$



13 Typical avalanche energy

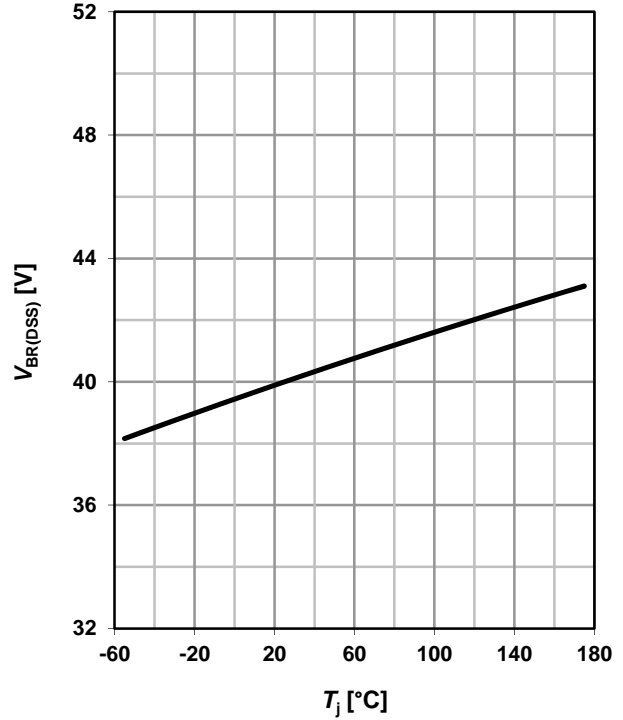
$$E_{AS} = f(T_j)$$

parameter: I_D



14 Drain-source breakdown voltage

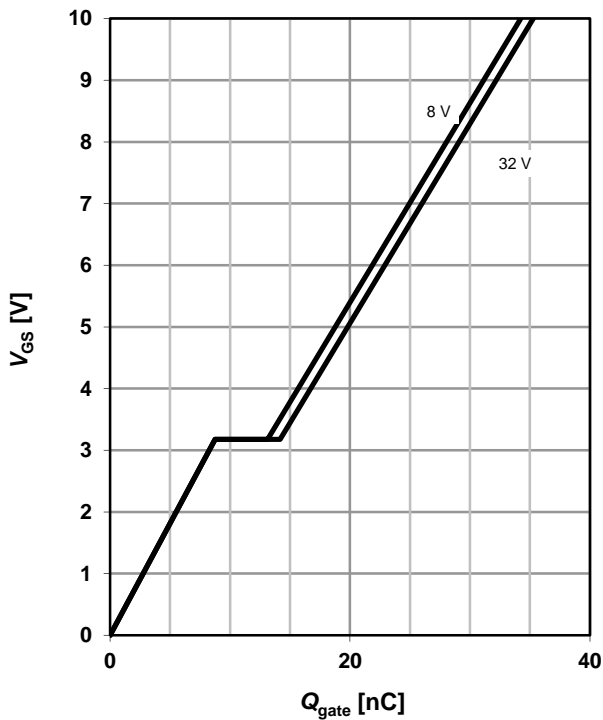
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



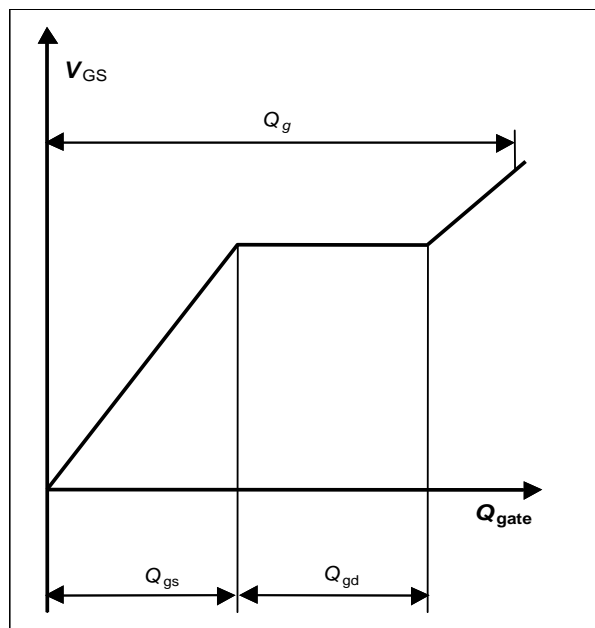
15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 60 \text{ A pulsed}$$

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	2015-05-22	Final Data Sheet