

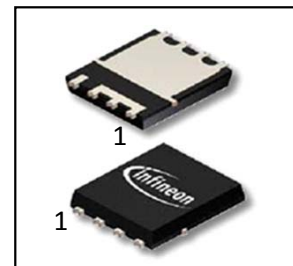
OptiMOS™-T2 Power-Transistor

Product Summary

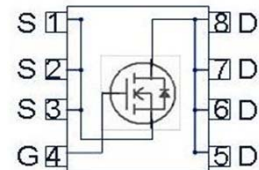
V_{DS}	40	V
$R_{DS(on)}$	6.0	m Ω
I_D	60	A

Features

- N-channel - 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
IPC60N04S4-06	PG-TDSON-8-23	4N0406


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}	-	+/-20	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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=30\mu\text{A}$	2.0	3.0	4.0	
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}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=30\text{ A}$	-	5.4	6.0	$\text{m}\Omega$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V}, f=1\text{ MHz}$	-	2040	2650	pF
Output capacitance	C_{oss}		-	510	660	
Reverse transfer capacitance	C_{rss}		-	16	37	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{ V}, V_{GS}=10\text{ V}, I_D=60\text{ A}, R_G=3.5\ \Omega$	-	6	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	6	-	
Fall time	t_f		-	6	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=32\text{ V}, I_D=60\text{ A}, V_{GS}=0\text{ to }10\text{ V}$	-	12	15	nC
Gate to drain charge	Q_{gd}		-	4	8	
Gate charge total	Q_g		-	25	33	
Gate plateau voltage	$V_{plateau}$		-	5.8	-	V

Reverse Diode

Diode continuous forward current ²⁾	I_S	$T_C=25\text{ }^\circ\text{C}$	-	-	60	A
Diode pulse current ²⁾	$I_{S,pulse}$		-	-	240	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=30\text{ A}, T_j=25\text{ }^\circ\text{C}$	-	0.9	1.3	V
Reverse recovery time ²⁾	t_{rr}	$V_R=20\text{ V}, I_F=50\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$	-	45	-	ns
Reverse recovery charge ²⁾	Q_{rr}		-	45	-	nC

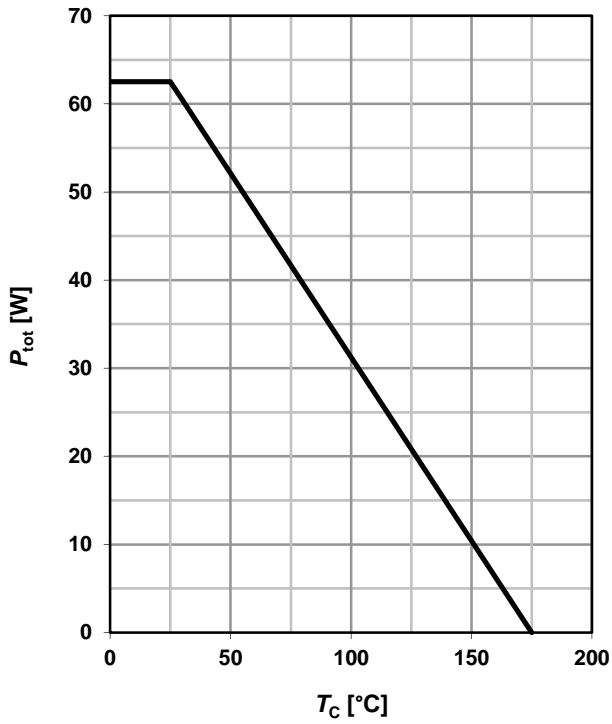
¹⁾ Current is limited by package; with an $R_{thJC} = 2.4\text{ K/W}$ the chip is able to carry 78 A at 25°C.

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

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

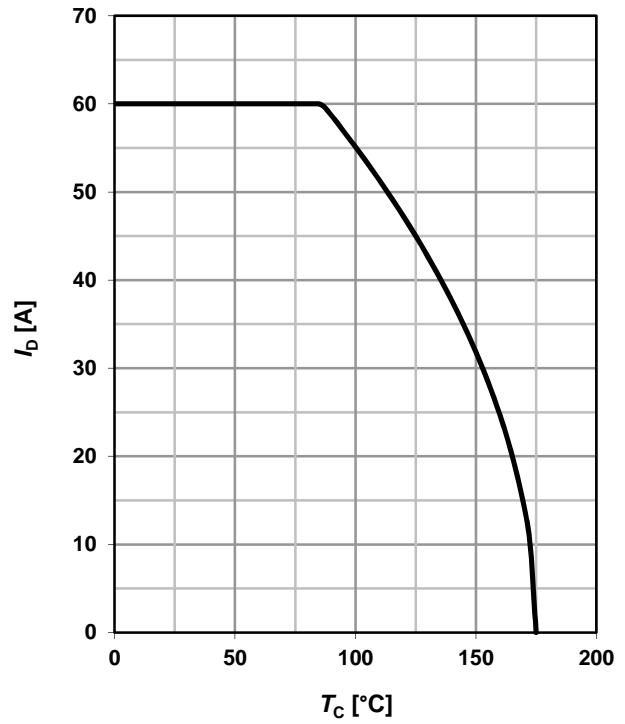
1 Power dissipation

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



2 Drain current

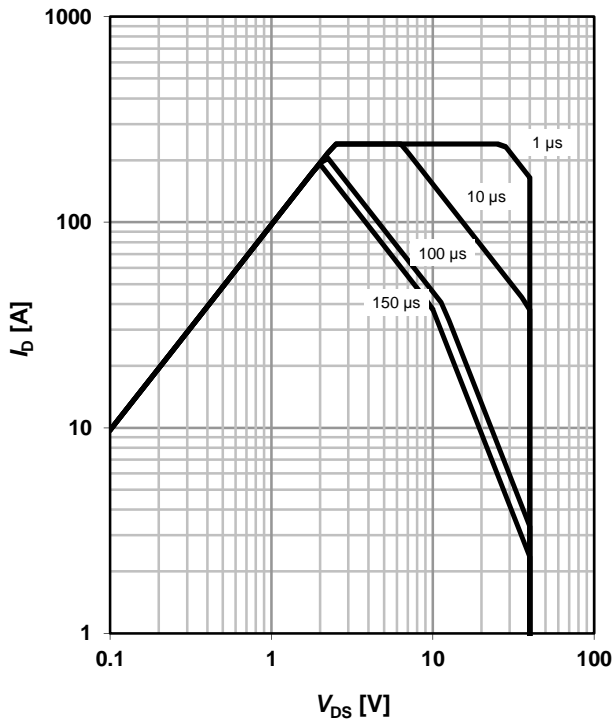
$I_D = f(T_C); V_{GS} = 10\text{ V}$



3 Safe operating area

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

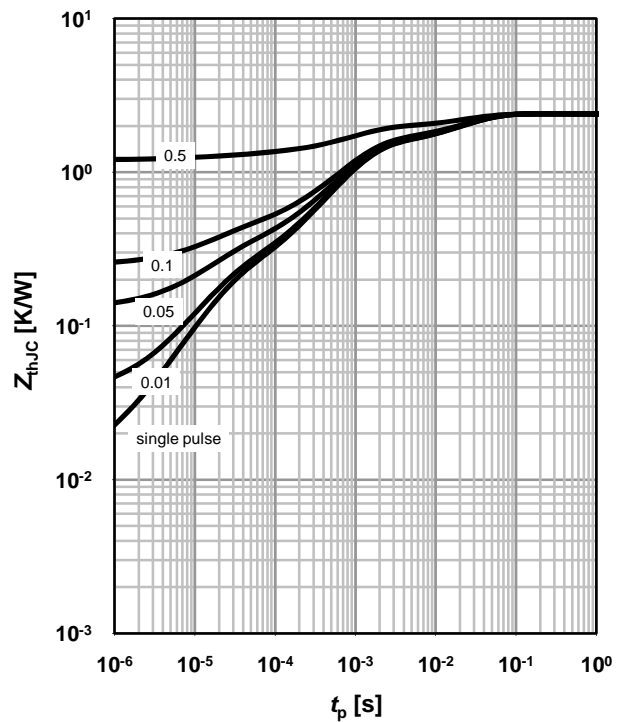
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

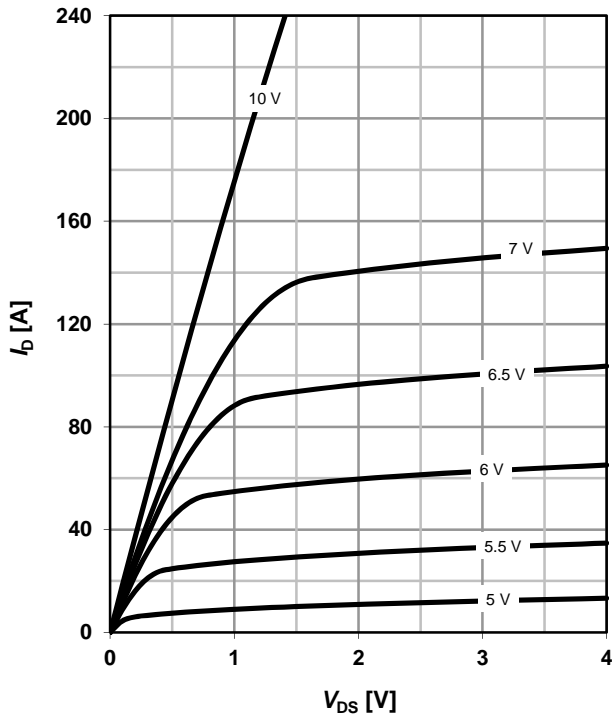
parameter: $D = t_p/T$



5 Typ. output characteristics

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

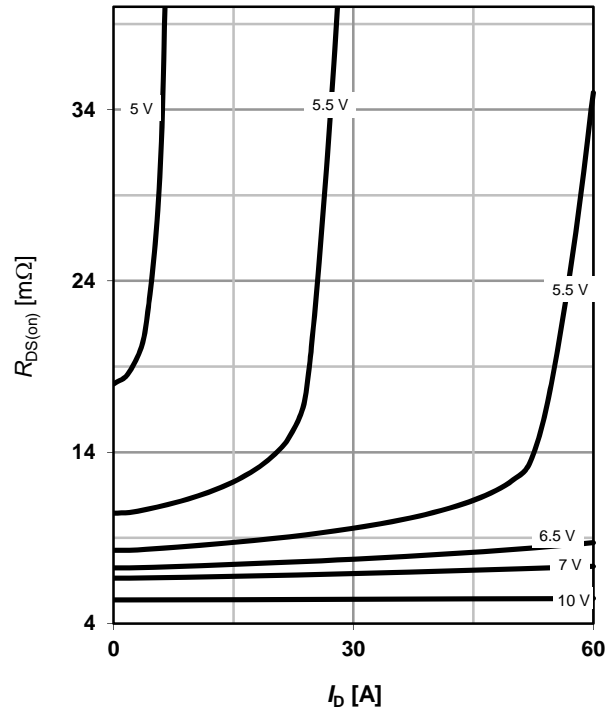
parameter: V_{GS}



6 Typ. drain-source on-state resistance

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

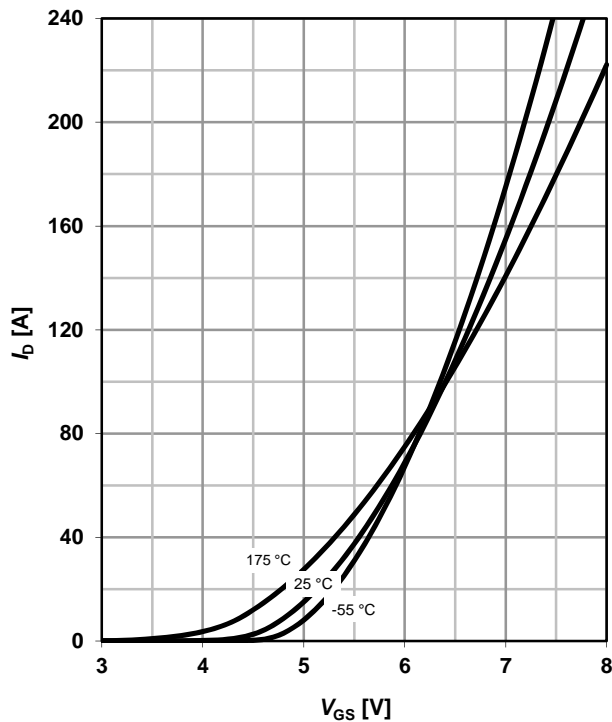
parameter: V_{GS}



7 Typ. transfer characteristics

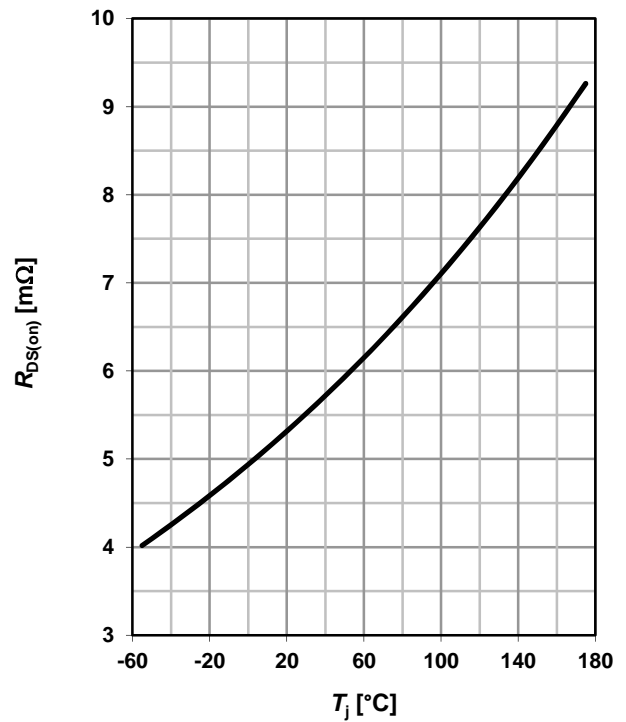
$I_D = f(V_{GS}); V_{DS} = 6\text{ V}$

parameter: T_j



8 Typ. drain-source on-state resistance

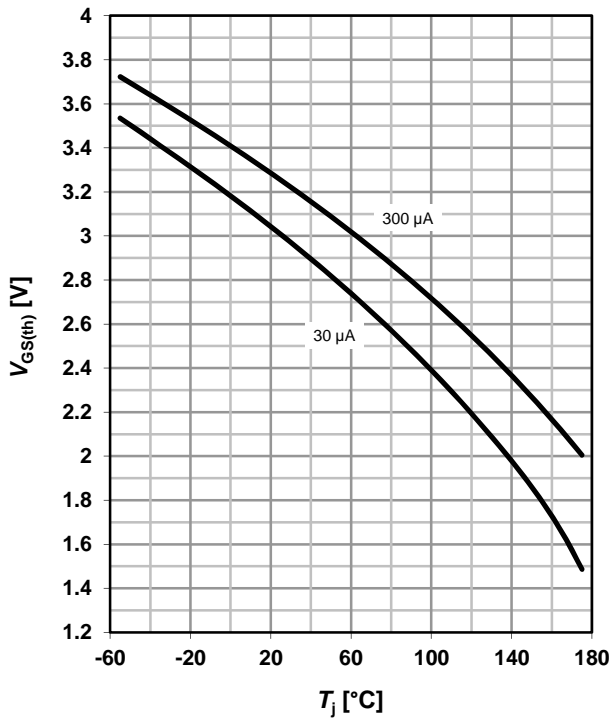
$R_{DS(on)} = f(T_j); I_D = 30\text{ A}; V_{GS} = 10\text{ V}$



9 Typ. gate threshold voltage

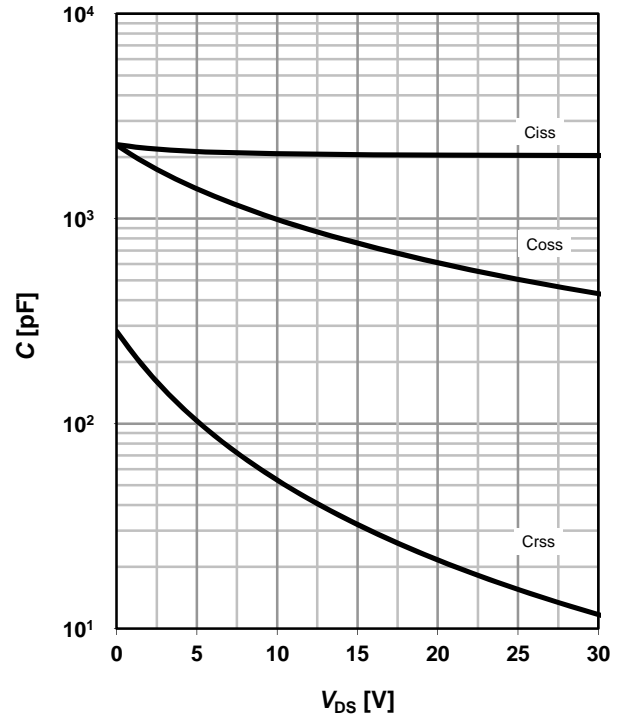
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

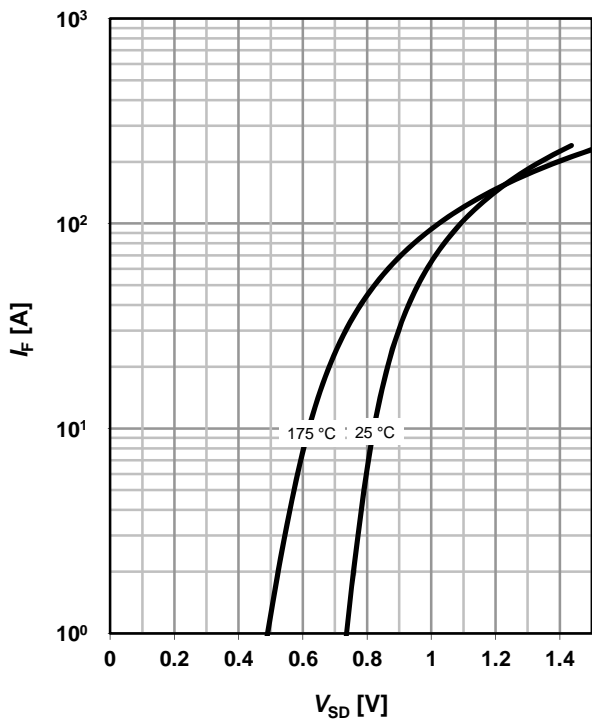
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



11 Typical forward diode characteristics

$I_F = f(V_{SD})$

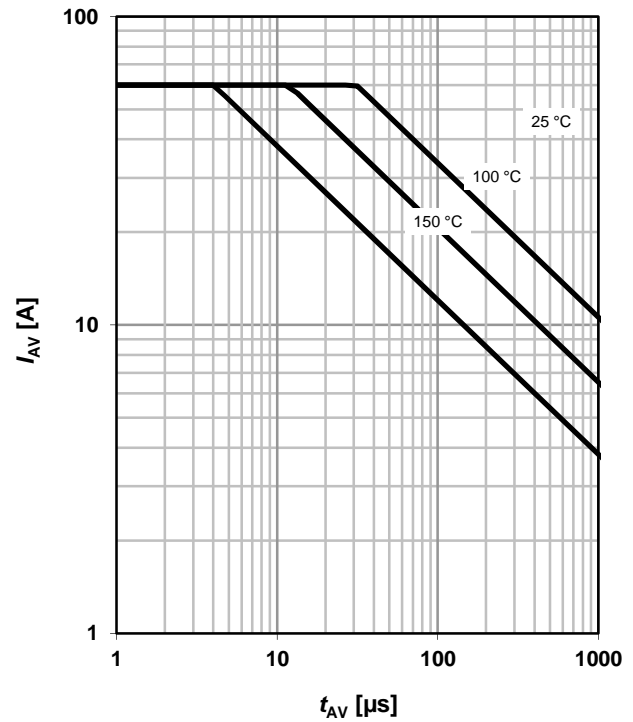
parameter: T_j



12 Typ. avalanche characteristics

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

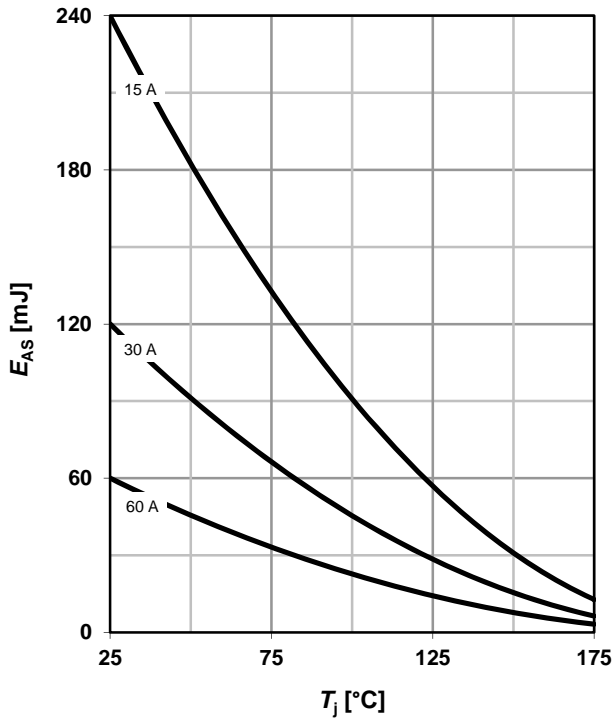
parameter: $T_{j(start)}$



13 Typical avalanche energy

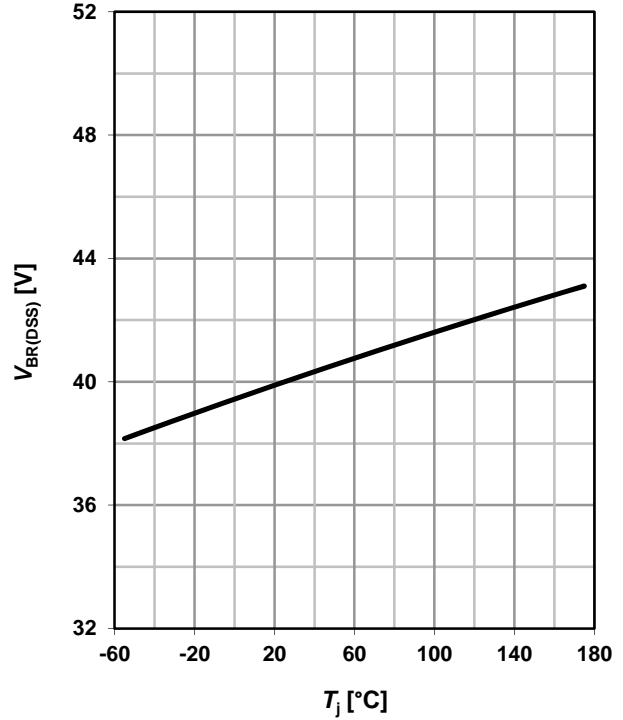
$$E_{AS} = f(T_j)$$

parameter: I_D



14 Drain-source breakdown voltage

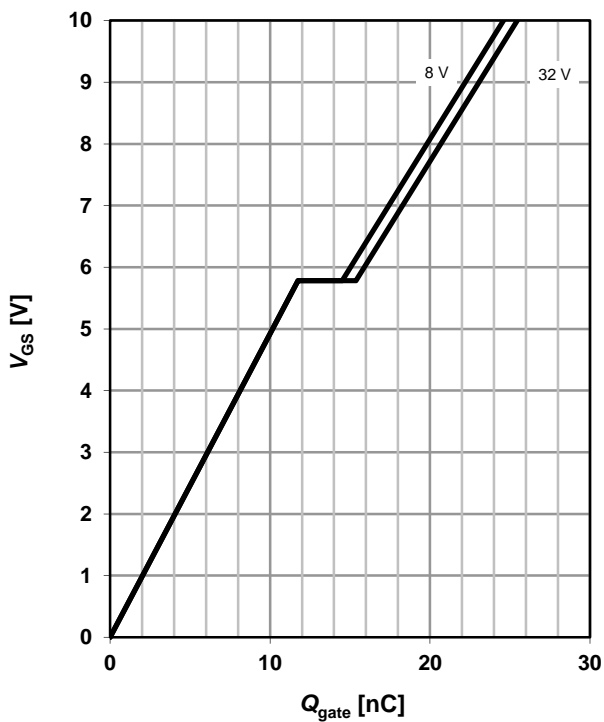
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



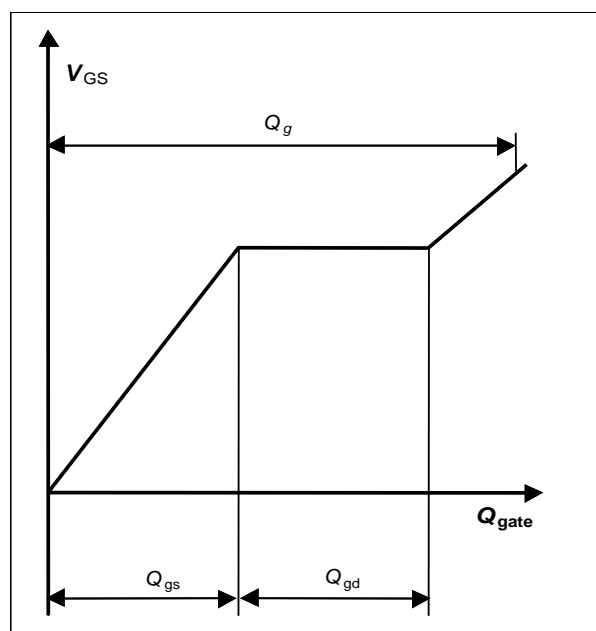
15 Typ. gate charge

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

parameter: V_{DD}



16 Gate charge waveforms



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Infineon Technologies AG
81726 Munich, Germany

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Revision History

Version	Date	Changes
Revision 1.0	2015-05-22	Final Data Sheet