

OptiMOS[®] -T Power-Transistor



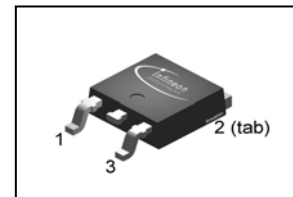
Features

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

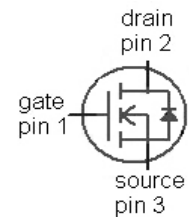
Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	6.0	mΩ
I_D	82	A

PG-TO252-3-11



Type	Package	Marking
IPD70N04S3-07	PG-TO252-3-11	QN0407



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}$, $V_{GS}=10\text{ V}$	82	A
		$T_C=100\text{ °C}$, $V_{GS}=10\text{ V}^{1)}$	58	
		$T_C=25\text{ °C}$	280	
Pulsed drain current ¹⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	280	
Avalanche energy, single pulse	E_{AS}	$I_D=50\text{ A}$	145	mJ
Gate source voltage	V_{GS}		±20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	79	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 characteristics¹⁾

Thermal resistance, junction - case	R_{thJC}		-	-	1.9	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm ² cooling area ²⁾	-	-	40	

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

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=50\text{ }\mu\text{A}$	2.1	3.0	4.0	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	-	1	μA
		$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$	-	-	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=70\text{ A}$	-	4.9	6.0	m Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics¹⁾

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	2050	2700	pF
Output capacitance	C_{oss}		-	610	800	
Reverse transfer capacitance	C_{rss}		-	90	130	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{ V}, V_{GS}=10\text{ V},$ $I_D=70\text{ A}, R_G=3.5\ \Omega$	-	13	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	17	-	
Fall time	t_f		-	7	-	

Gate Charge Characteristics¹⁾

Gate to source charge	Q_{gs}	$V_{DD}=32\text{ V}, I_D=70\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	12	16	nC
Gate to drain charge	Q_{gd}		-	8	14	
Gate charge total	Q_g		-	30	40	
Gate plateau voltage	$V_{plateau}$		-	6.0	-	V

Reverse Diode

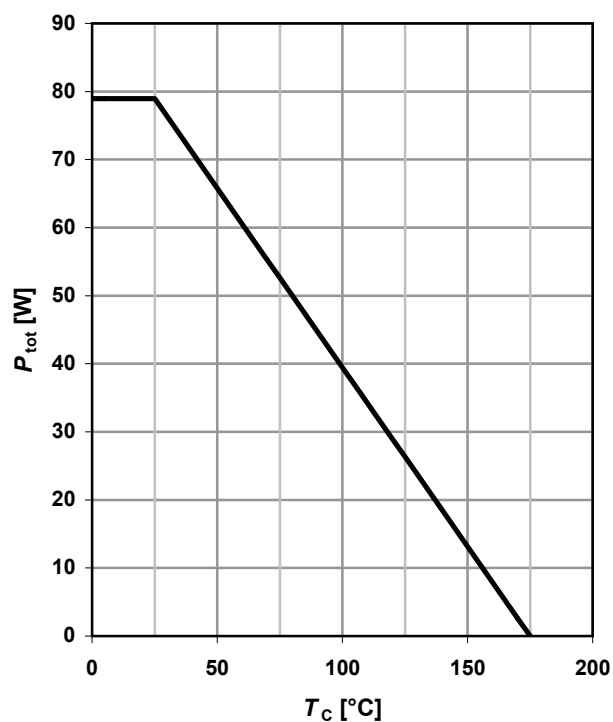
Diode continuous forward current ¹⁾	I_S	$T_C=25\text{ °C}$	-	-	70	A
Diode pulse current ¹⁾	$I_{S,pulse}$		-	-	280	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=70\text{ A},$ $T_j=25\text{ °C}$	-	1	1.3	V
Reverse recovery time ¹⁾	t_{rr}	$V_R=20\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	34	-	ns
Reverse recovery charge ¹⁾	Q_{rr}		-	36	-	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 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

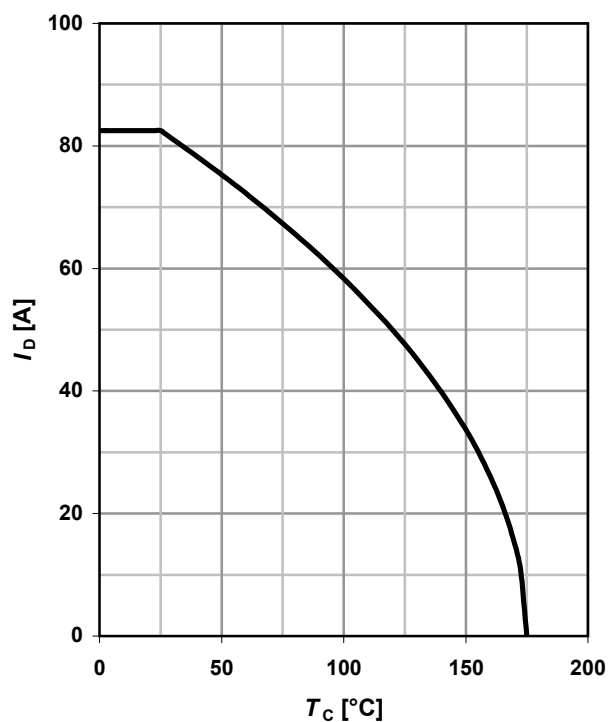
1 Power dissipation

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



2 Drain current

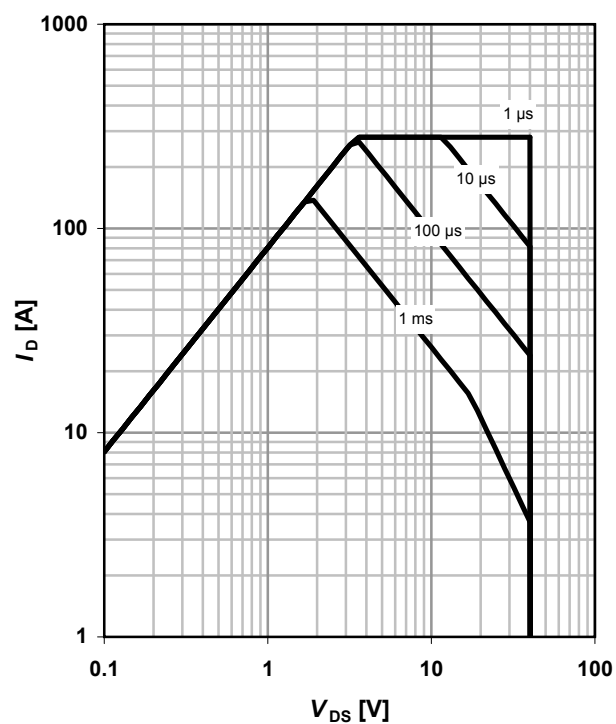
$$I_D = f(T_C); V_{\text{GS}} \geq 6 \text{ V}$$



3 Safe operating area

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

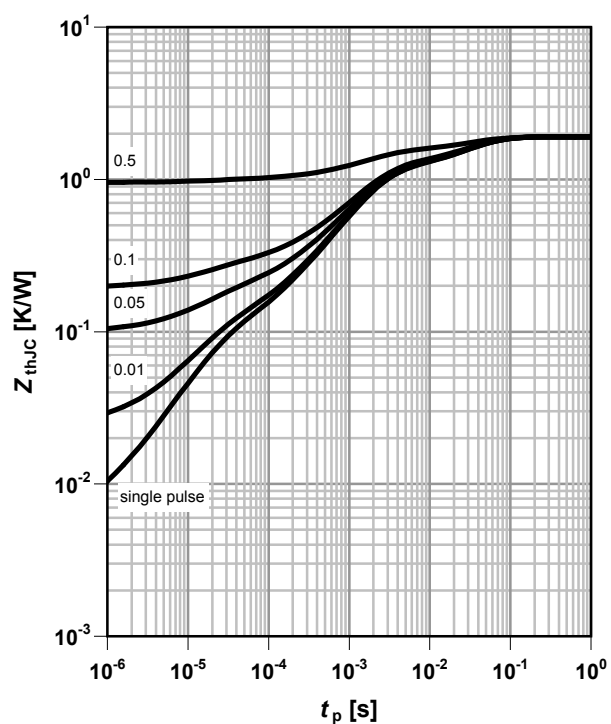
parameter: t_p



4 Max. transient thermal impedance

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

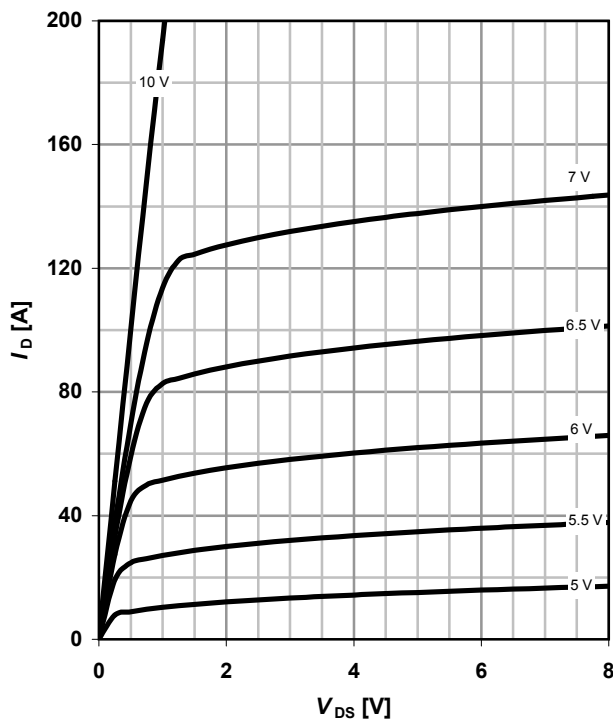
parameter: $D = t_p/T$



5 Typ. output characteristics

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

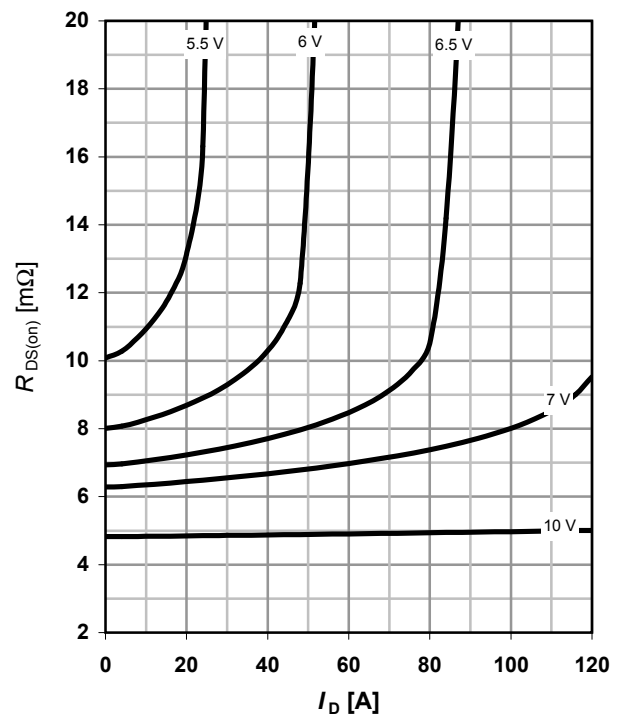
parameter: V_{GS}



6 Typ. drain-source on-state resistance

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

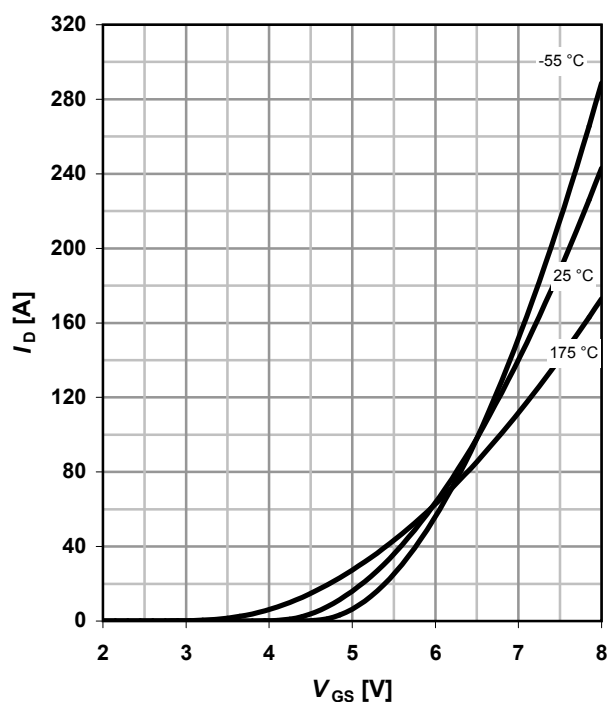
parameter: V_{GS}



7 Typ. transfer characteristics

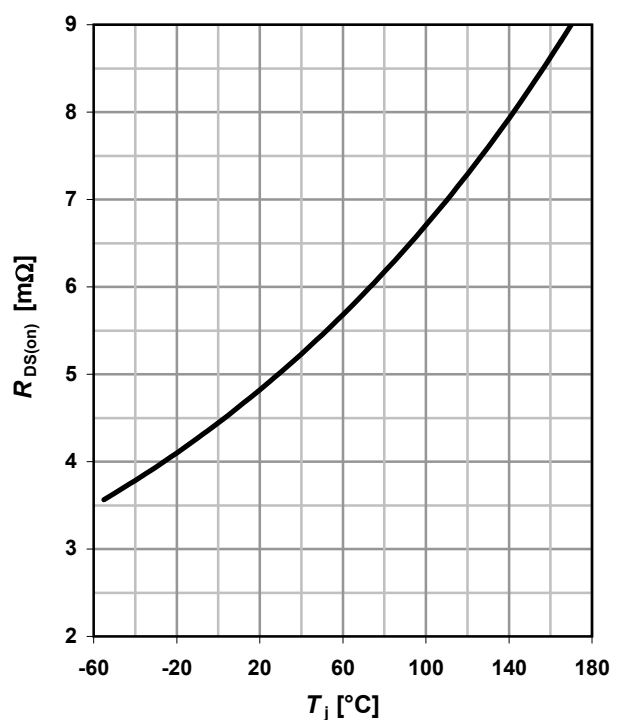
$$I_D = f(V_{GS}); V_{DS} = 6\text{ V}$$

parameter: T_j



8 Typ. drain-source on-state resistance

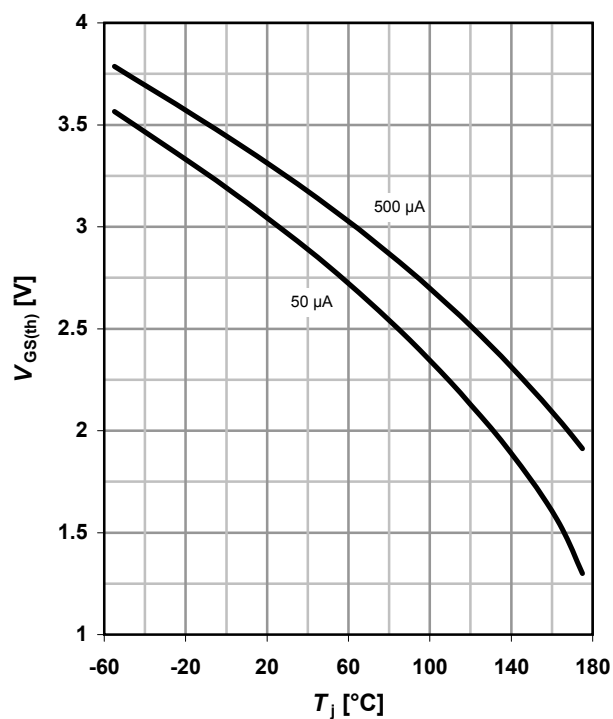
$$R_{DS(on)} = f(T_j); I_D = 70\text{ A}; V_{GS} = 10\text{ V}$$



9 Typ. gate threshold voltage

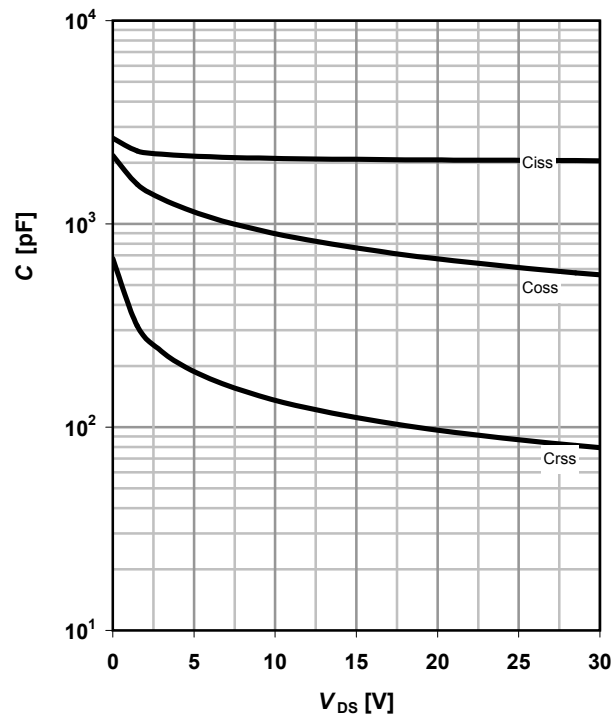
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter: I_D



10 Typ. capacitances

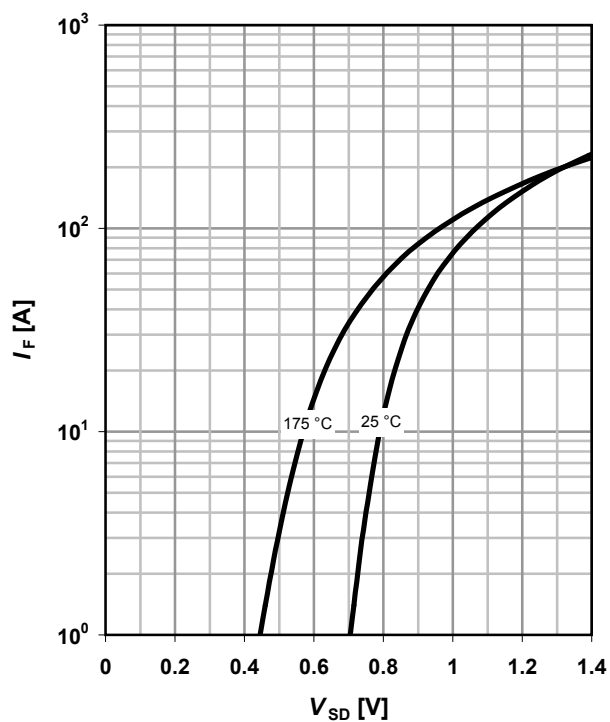
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



11 Typical forward diode characteristics

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

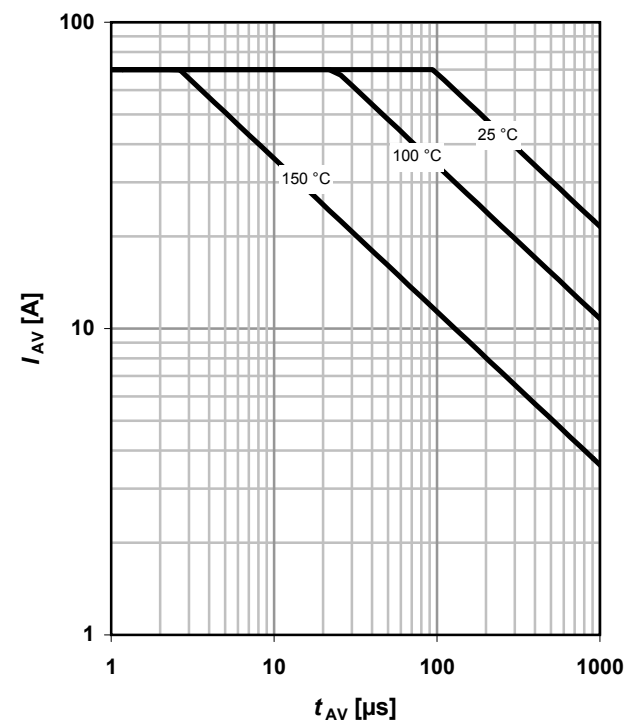
parameter: T_j



12 Typ. avalanche characteristics

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

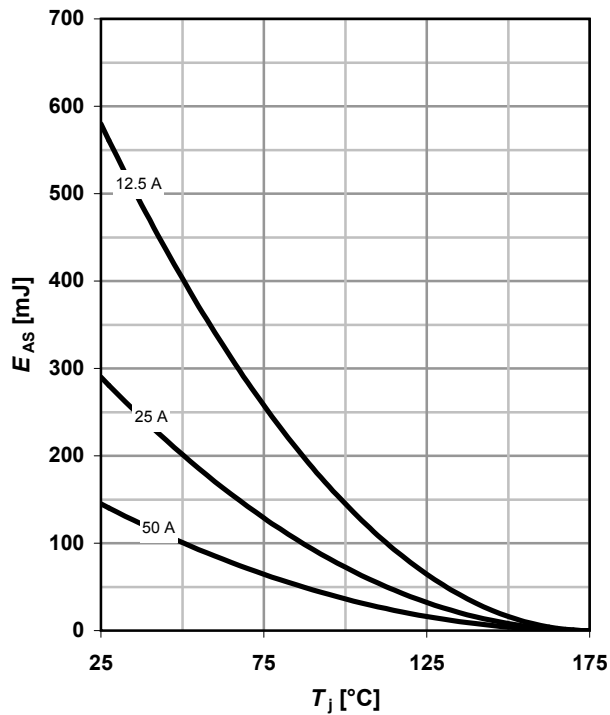
parameter: $T_{j(start)}$



13 Typical avalanche energy

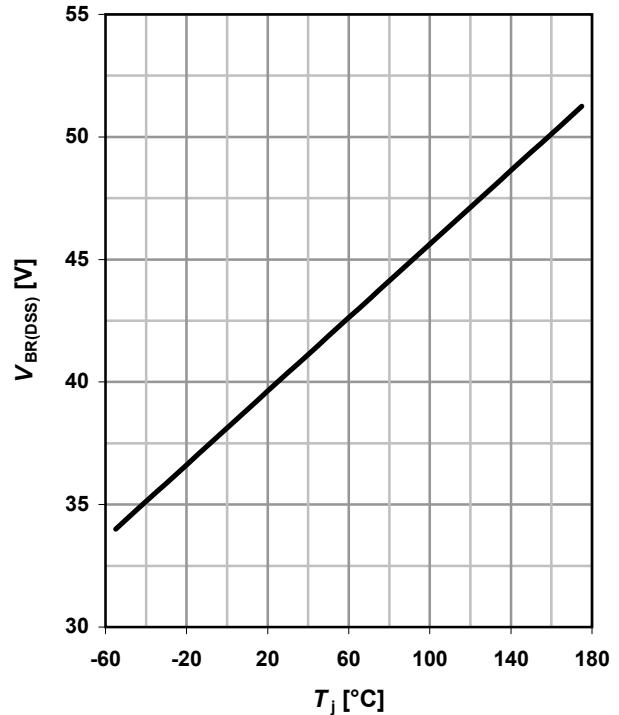
$$E_{AS} = f(T_j)$$

parameter: I_D



14 Typ. drain-source breakdown voltage

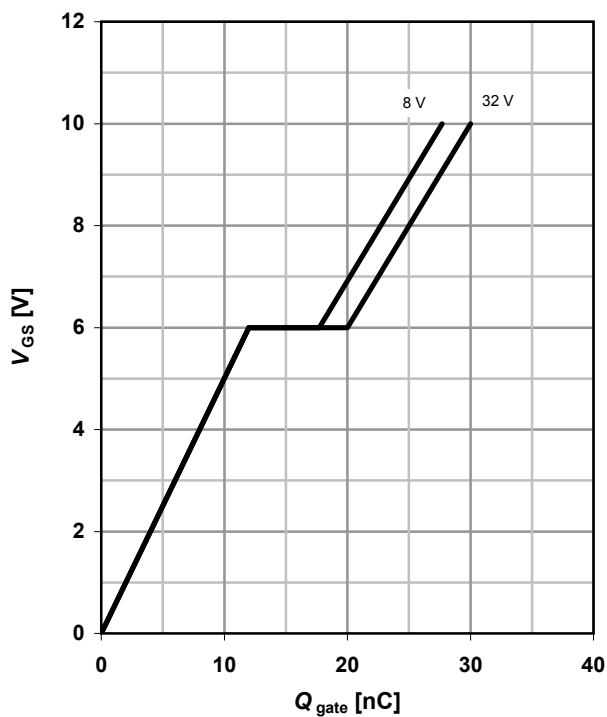
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



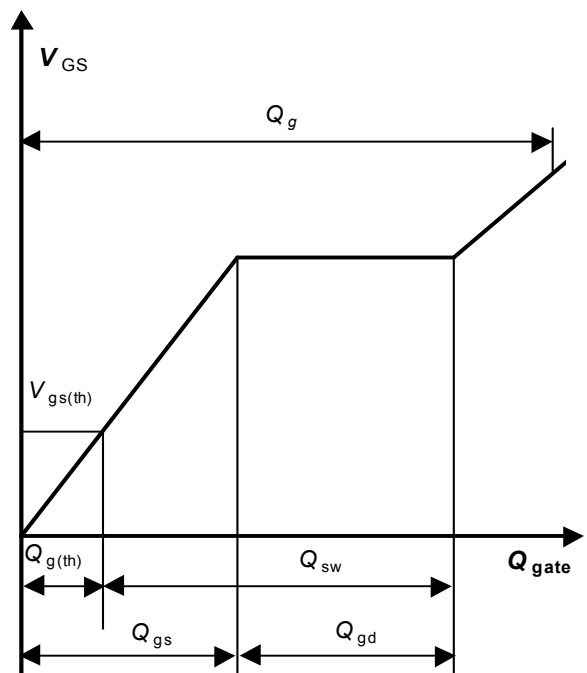
15 Typ. gate charge

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

parameter: V_{DD}



16 Gate charge waveforms



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Revision History

Version	Date	Changes