

OptiMOS™ - 6 Power-Transistor



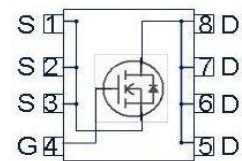
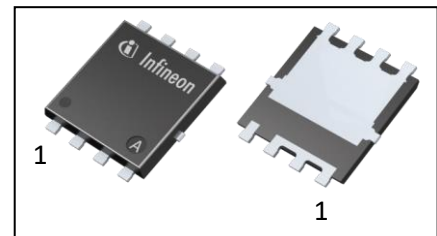
Features

- OptiMOS™ - power MOSFET for automotive applications
- N-channel - Enhancement mode - Normal 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
$R_{DS(on),max}$	0.6	mΩ
I_D	120	A

PG-TDSON-8-53



Type	Package	Marking
IAUC120N04S6N006	PG-TDSON-8-53	6N04N006

Maximum ratings, at $T_J=25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Drain current	I_D	$V_{GS}=10\text{V}$, Chip Limitation ^{1,2)}	405	A
		$V_{GS}=10\text{V}$, DC current ³⁾	120	
		$T_a=85^\circ\text{C}$, $V_{GS}=10\text{V}$, R_{thJA} on 2s2p ^{4,5)}	55	
Pulsed drain current ⁵⁾	$I_{D,pulse}$	$T_C=25^\circ\text{C}$, $t_p=100\mu\text{s}$	1500	
Avalanche energy, single pulse ²⁾	E_{AS}	$I_D=60\text{A}$, $R_G=25\Omega$	750	mJ
Avalanche current, single pulse	I_{AS}	$R_G=25\Omega$	120	A
Gate source voltage	V_{GS}	-	± 20	V
Power dissipation	P_{tot}	$T_C=25^\circ\text{C}$	187	W
Operating and storage temperature	T_J , T_{stg}	-	-55 ... +175	$^\circ\text{C}$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics⁵⁾

Thermal resistance, junction - case	R_{thJC}	-	-	-	0.8	K/W
Thermal resistance, junction - ambient ⁴⁾	R_{thJA}	-	-	26	-	

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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=130\mu A$	2.2	2.6	3.0	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-	33	
Gate-source leakage current	I_{GSS}	$V_{GS}=20V, V_{DS}=0V$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=7V, I_D=60A$	-	0.54	0.85	m Ω
		$V_{GS}=10V, I_D=60A$	-	0.46	0.60	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics²⁾

Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=25V, f=1MHz$	-	7607	10117	pF
Output capacitance	C_{oss}		-	2249	2991	
Reverse transfer capacitance	C_{rss}		-	100	150	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20V, V_{GS}=10V, I_D=120A, R_G=3.5\Omega$	-	13	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	33	-	
Fall time	t_f		-	16	-	

Gate Charge Characteristics²⁾

Gate to source charge	Q_{gs}	$V_{DD}=32V, I_D=120A, V_{GS}=0 \text{ to } 10V$	-	31	40	nC
Gate to drain charge	Q_{gd}		-	22	32	
Gate charge total	Q_g		-	116	151	
Gate plateau voltage	$V_{plateau}$		-	4.0	-	V

Reverse Diode

Diode continuous forward current ⁵⁾	I_S	$T_C=25^\circ C$	-	-	256	A
Diode pulse current ⁵⁾	$I_{S,pulse}$		-	-	1780	
Diode forward voltage	V_{SD}	$V_{GS}=0V, I_F=60A, T_J=25^\circ C$	-	0.8	1.1	V
Reverse recovery time ²⁾	t_{rr}	$V_R=20V, I_F=50A, di_F/dt=100A/\mu s$	-	66	-	ns
Reverse recovery charge ²⁾	Q_{rr}		-	83	-	nC

¹⁾ Practically the current is limited by overall system design including customer specific PCB.

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

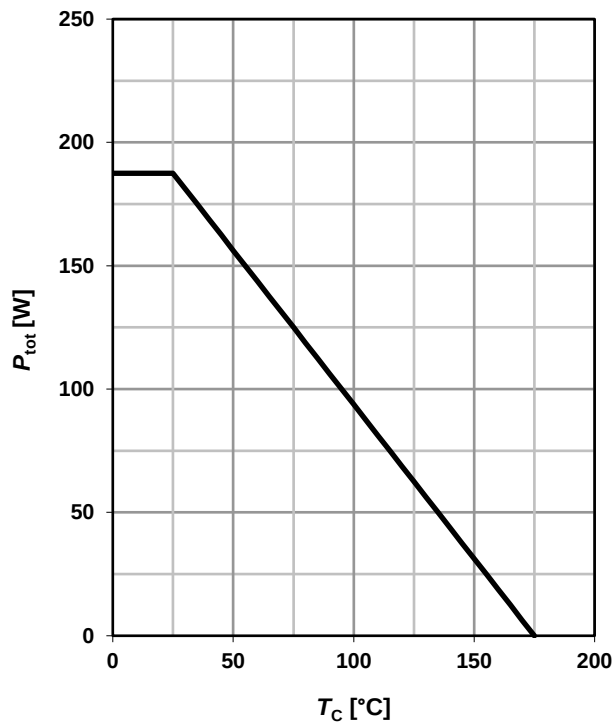
³⁾ The product can operate at specified current based on best practice to minimize electromigration at the solder joint. For rare events and inrush currents the value may be exceeded.

⁴⁾ Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

⁵⁾ The parameter is not subject to production test - verified by design.

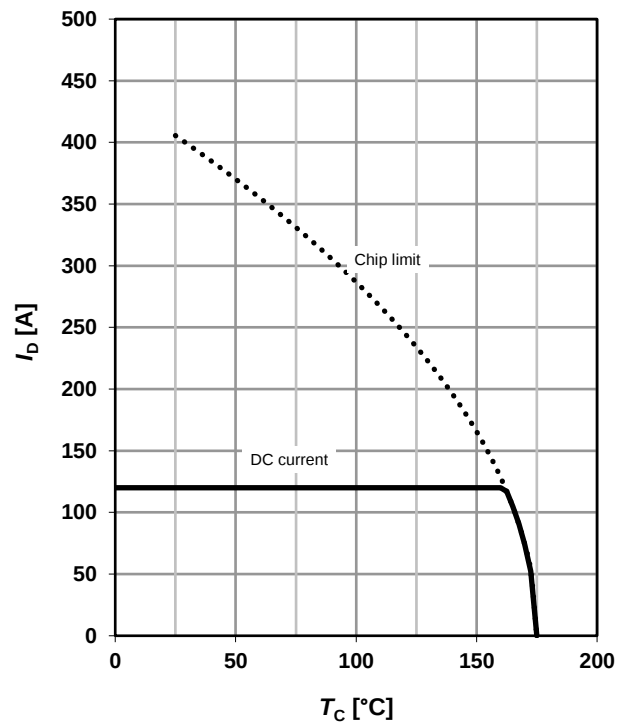
1 Power dissipation

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



2 Drain current

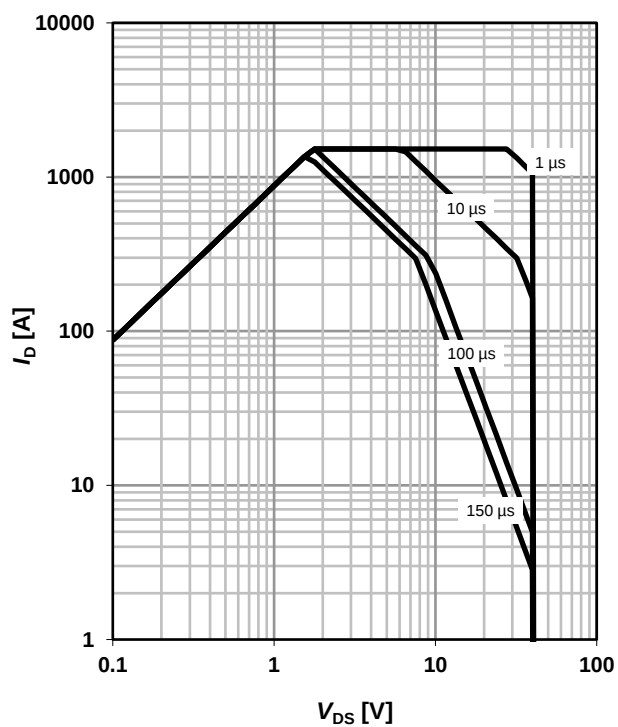
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



3 Safe operating area

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

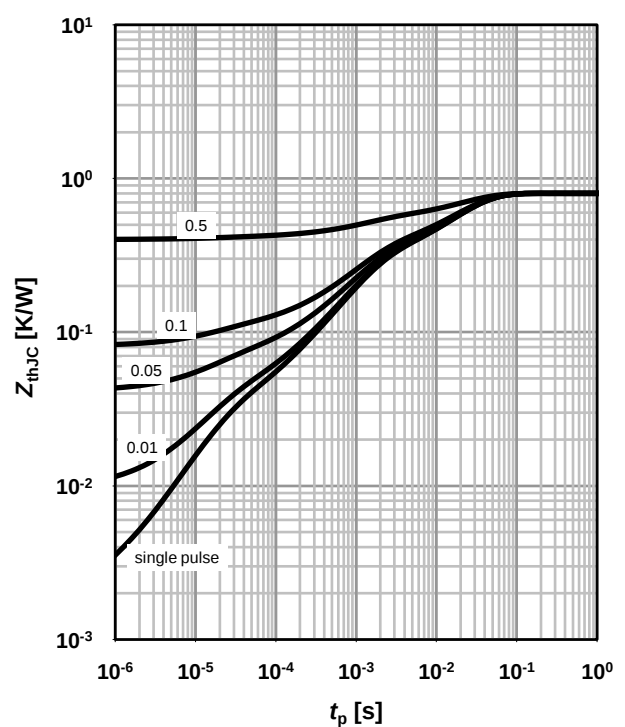
parameter: t_p



4 Max. transient thermal impedance

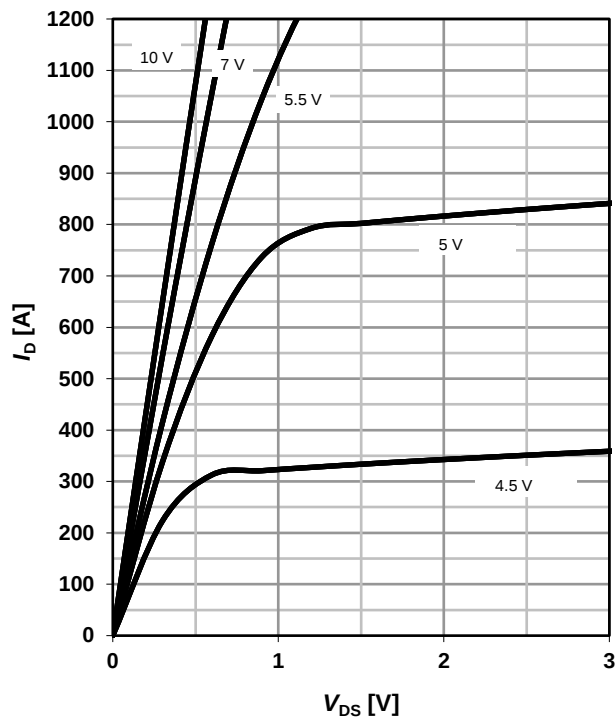
$$Z_{\text{thJC}} = f(t_p)$$

parameter: $D = t_p/T$



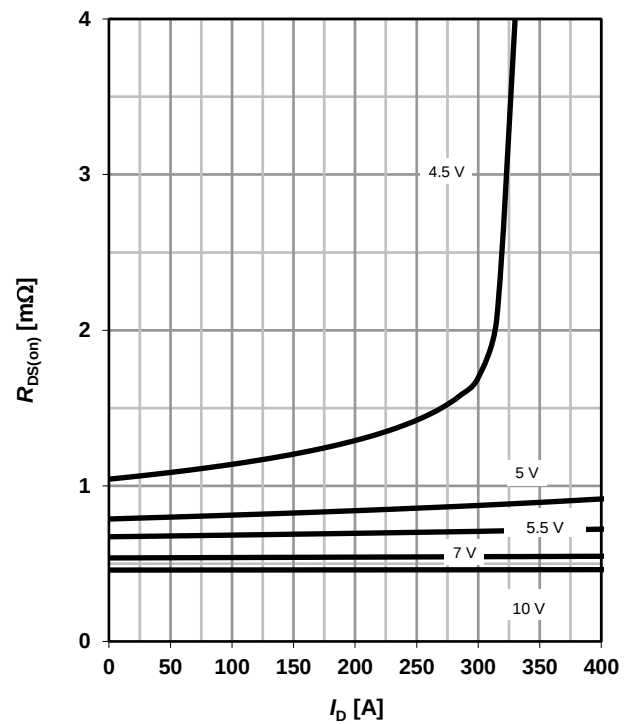
5 Typ. output characteristics

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

parameter: V_{GS}


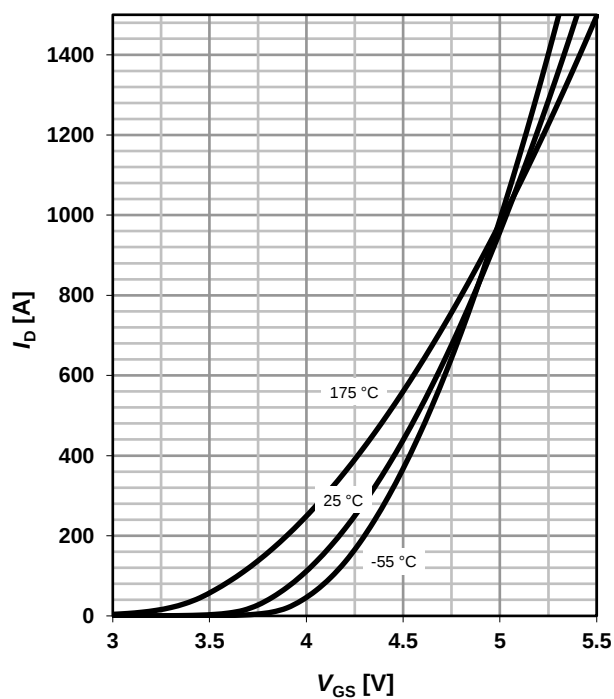
6 Typ. drain-source on-state resistance

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

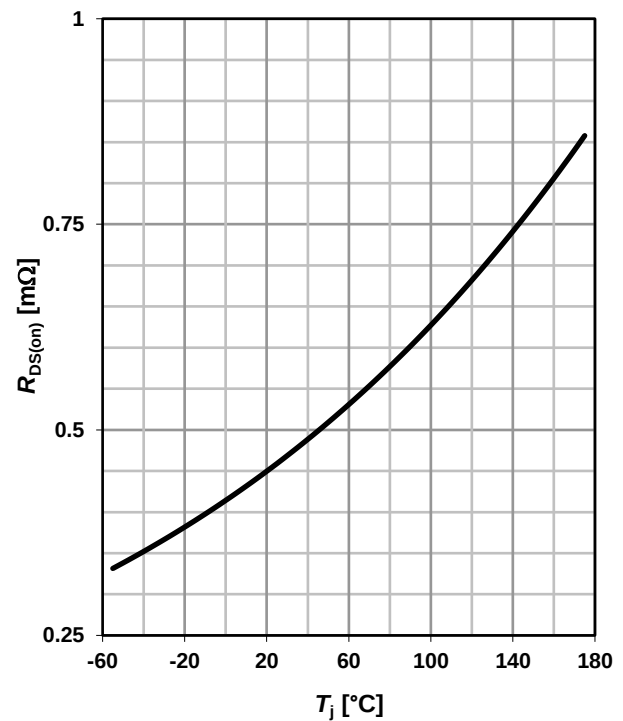
parameter: V_{GS}


7 Typ. transfer characteristics

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

parameter: T_j


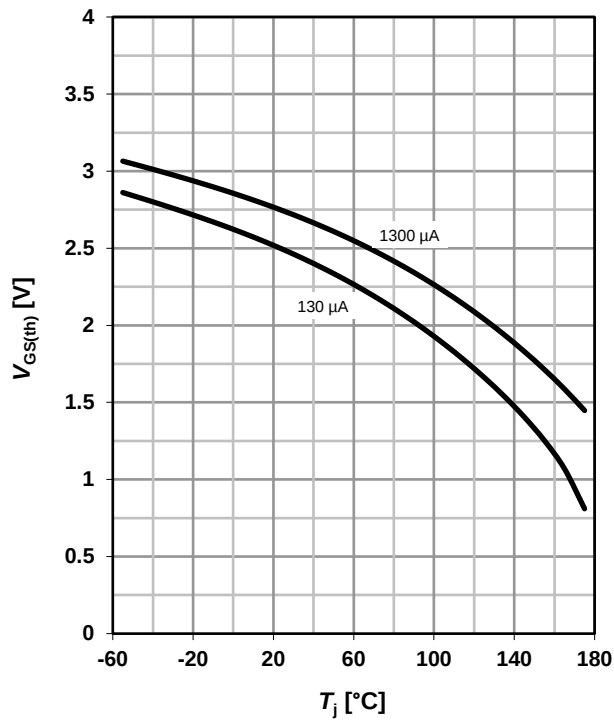
8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 60\text{ A}; V_{GS} = 10\text{ V}$


9 Typ. gate threshold voltage

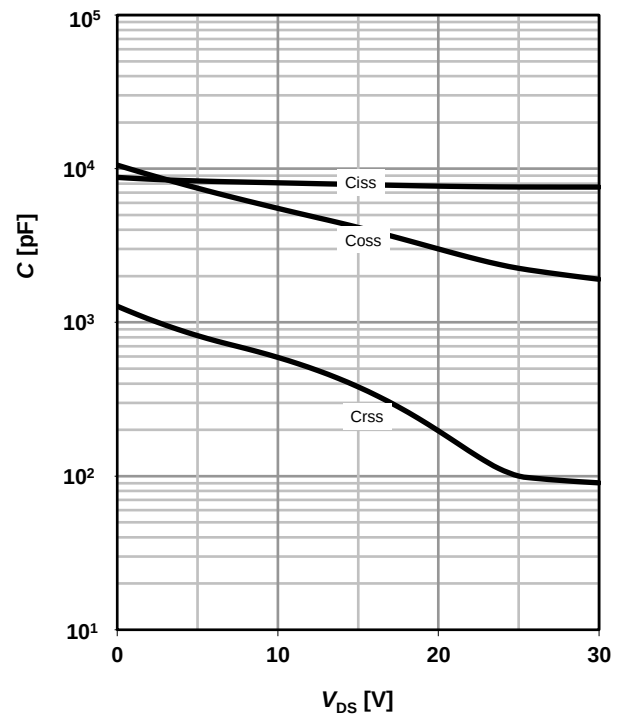
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter: I_D



10 Typ. capacitances

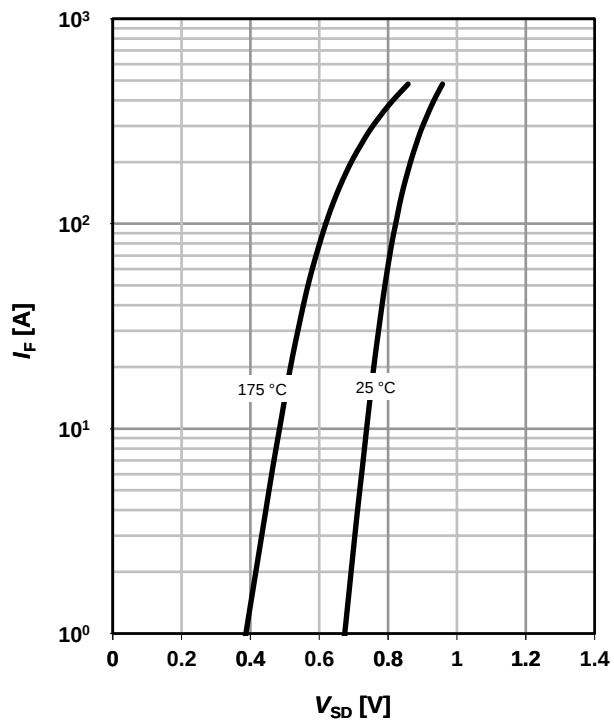
$$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$$



11 Typical forward diode characteristics

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

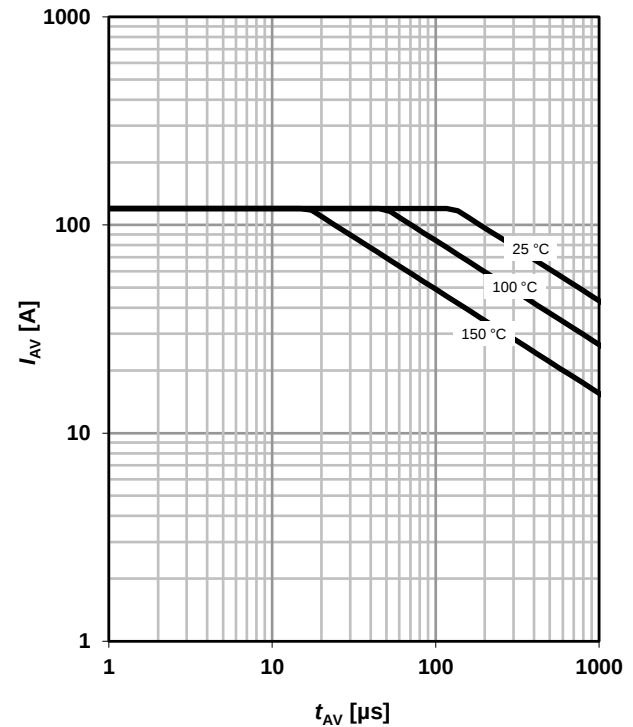
parameter: T_j



12 Avalanche characteristics

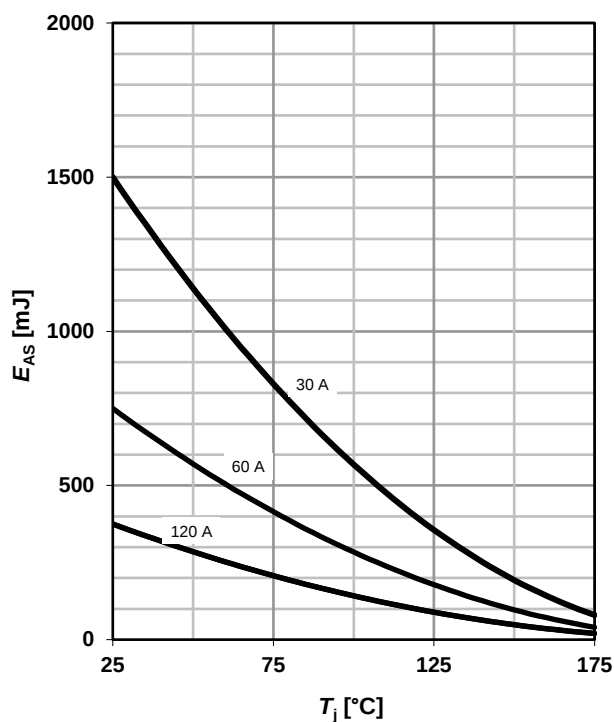
$$I_{AS} = f(t_{AV})$$

parameter: $T_{j(start)} > 25^\circ C$



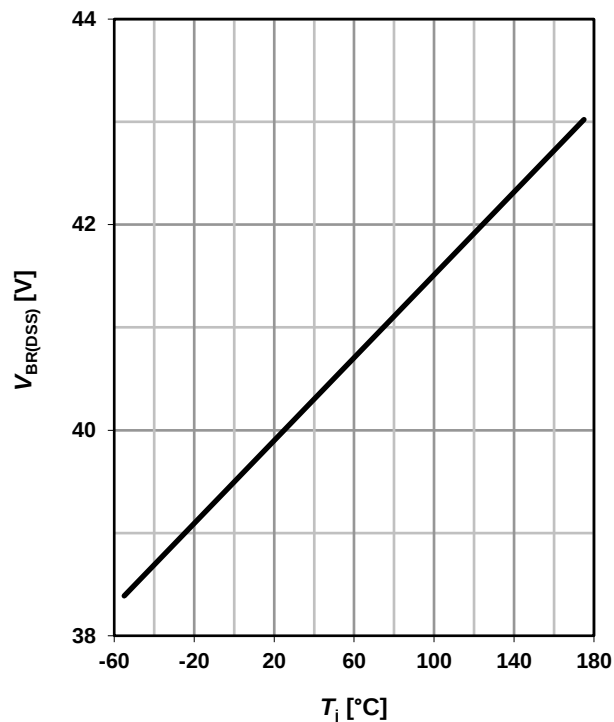
13 Avalanche energy

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



14 Drain-source breakdown voltage

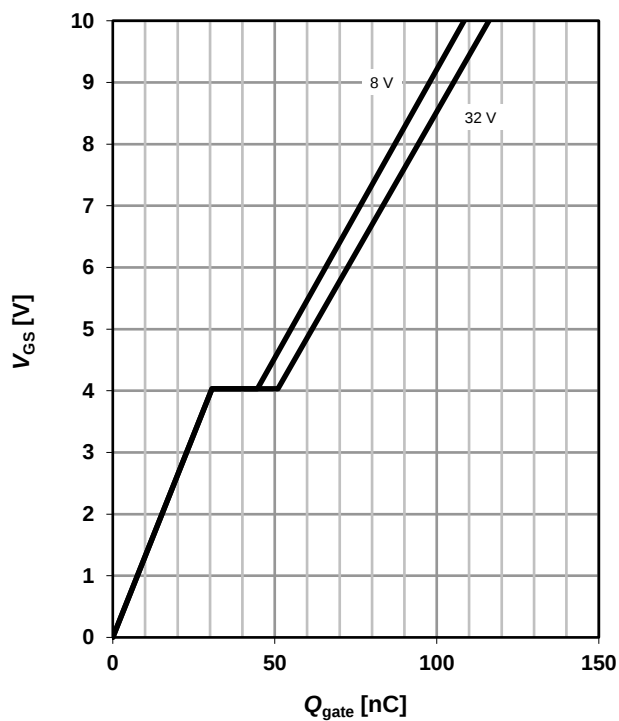
$$V_{BR(DSS)} = f(T_j); I_D = 1\text{ mA}$$



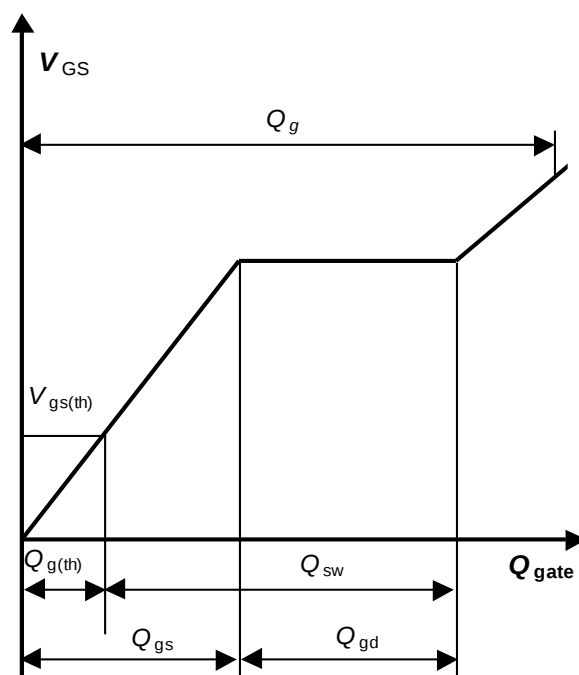
15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 120\text{ A pulsed}$$

parameter: V_{DD}



16 Gate charge waveforms



Technical drawing of a rectangular metal part with dimensions and tolerances. The drawing includes a top view, a side view, and a cross-sectional view.

Top View Dimensions:

- Overall width: 5.15 ± 0.1
- Overall height: 6.44 ± 0.1
- Distance from top edge to first hole: 0.48 ± 0.1
- Distance between holes: 1.27
- Distance from bottom edge to first hole: 0.44 ± 0.1
- Distance from right edge to first hole: 0.13 ± 0.1
- Distance from right edge to last hole: 0.13 ± 0.1
- Distance from left edge to first hole: 0.13 ± 0.1
- Distance from left edge to last hole: 0.13 ± 0.1
- Distance from bottom edge to last hole: 0.13 ± 0.1
- Distance from top edge to last hole: 0.13 ± 0.1

Side View Dimensions:

- Overall height: 5.48 ± 0.1
- Distance from top edge to first hole: 1 ± 0.1
- Distance from bottom edge to first hole: 0.03

Cross-sectional View Dimensions:

- Overall width: 4.3 ± 0.1
- Overall height: 3.8 ± 0.1
- Distance from top edge to first hole: 0.8 ± 0.1
- Distance from bottom edge to first hole: 0.4 ± 0.1
- Distance from left edge to first hole: 0.12 ± 0.1
- Distance from right edge to first hole: 0.12 ± 0.1

Surface Finish and Marking:

- Surface finish: $0.25 \mu m$
- Marking: INDEX MARKING

-

Technical drawing of the 1000 Series PCB showing top and side views with dimensions.

Top View Dimensions:

- Overall width: 6.9
- Overall height: 1.2
- Distance between center of first and third component: 0.8
- Distance between center of second and third component: 0.4
- Distance from left edge to center of first component: 0.3
- Distance from right edge to center of last component: 0.3
- Distance from bottom edge to center of components: 0.55

Side View Dimensions:

- Overall thickness: 0.3

Labels:

- PIN 1
- INDEX MARKING

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Revision History

Version	Date	Changes
Revision 1.0	05.06.2020	Final Data Sheet

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