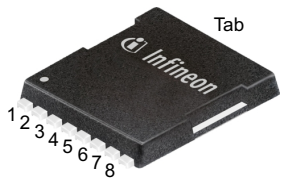
MOSFET

IR MOSFET - StrongIRFET™

HSOF



Benefits

- Improved Gate and Avalanche Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Improved I_D rating
- Pb-Free ; RoHS Compliant ; Halogen-Free

Potential applications

- Brushed Motor drive applications
- BLDC Motor drive applications
- Battery powered circuits
- Half-bridge and full-bridge topologies
- Synchronous rectifier applications
- Resonant mode power supplies
- OR-ing and redundant power switches
- DC/DC and AC/DC converters
- DC/AC Inverters

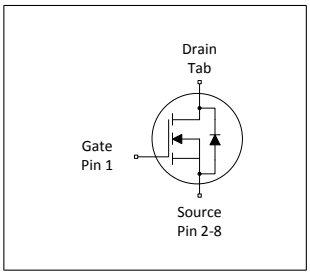


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),typ}$	0.59	mΩ
$R_{DS(on),max}$	0.72	mΩ
$I_{D\ (Silicon\ Limited)}$	586	A
$I_{D\ (Package\ Limited)}$	300	A

Type / Ordering Code	Package	Marking	Related Links
IRL40T209	PG-HSOF-8	RL40T209	-

Table of Contents

1 Maximum ratings

at T_C=25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	- - -	- - -	300 586 347	A	V_{GS}=10 V, T_C=25 °C V_{GS}=10 V, T_C=25 °C (silicon limited) V_{GS}=10 V, T_C=100 °C (silicon limited)[1]
Pulsed drain current[1]	$I_{D,pulse}$	-	-	1200	A	T_C=25 °C
Avalanche energy, single pulse[2]	E_{AS}	-	-	875	mJ	I_D=100 A, R_{GS}=50 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	500	W	T_C=25 °C
Operating and storage temperature	T_j, T_{stg}	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom[3]	R_{thJC}	-	-	0.3	°C/W	-
Thermal resistance, junction - case, top	R_{thJC}	-	-	20	°C/W	-
Device on PCB, 6 cm² cooling area[1]	R_{thJA}	-	-	30	°C/W	-
Device on PCB, RTHJA(<10s)	R_{thJA}	-	-	12	°C/W	-

[1] See Diagram 3 for more detailed information
[2] See Diagram 13 for more detailed information
[3] R_{thJC} is measured at T_J approximately 90°C.

3 Electrical characteristics

at T_j=25 °C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	V_{GS}=0 V, I_D=250 µA
Breakdown voltage temperature coefficient	$dV_{(BR)DSS}/dT_j$	-	31	-	mV/°C	I_D=5 mA, referenced to 25 °C
Gate threshold voltage	$V_{GS(th)}$	1	-	2.4	V	V_{DS}=V_{GS}, I_D=250 µA
Zero gate voltage drain current	I_{DSS}	- -	- -	1 150	µA	V_{DS}=40 V, V_{GS}=0 V, T_j=25 °C V_{DS}=40 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.59 0.75	0.72 1.10	mΩ	V_{GS}=10 V, I_D=100 A V_{GS}=4.5 V, I_D=50 A
Gate resistance[1)]	R_G	-	2.0	-	Ω	-
Transconductance	g_{fs}	-	380	-	S	$\|V_{DS}\|\geq 2\|I_D\|R_{DS(on)max}$, I_D=100 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1)]	C_{iss}	-	16000	-	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	2200	-	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	1600	-	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	60	-	ns	V_{DD}=20 V, V_{GS}=4.5 V, I_D=30 A, $R_{G,ext}$=2.7 Ω
Rise time	t_r	-	230	-	ns	V_{DD}=20 V, V_{GS}=4.5 V, I_D=30 A, $R_{G,ext}$=2.7 Ω
Turn-off delay time	$t_{d(off)}$	-	190	-	ns	V_{DD}=20 V, V_{GS}=4.5 V, I_D=30 A, $R_{G,ext}$=2.7 Ω
Fall time	t_f	-	160	-	ns	V_{DD}=20 V, V_{GS}=4.5 V, I_D=30 A, $R_{G,ext}$=2.7 Ω

[1)] Defined by design. Not subject to production test.

Table 6 Gate charge characteristics[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	43	-	nC	V_{DD}=20 V, I_D=100 A, V_{GS}=0 to 4.5 V
Gate charge at threshold	$Q_{g(th)}$	-	26	-	nC	V_{DD}=20 V, I_D=100 A, V_{GS}=0 to 4.5 V
Gate to drain charge[2)]	Q_{gd}	-	83	-	nC	V_{DD}=20 V, I_D=100 A, V_{GS}=0 to 4.5 V
Switching charge	Q_{sw}	-	100	-	nC	V_{DD}=20 V, I_D=100 A, V_{GS}=0 to 4.5 V
Gate charge total[2)]	Q_g	-	179	269	nC	V_{DD}=20 V, I_D=100 A, V_{GS}=0 to 4.5 V
Gate plateau voltage	$V_{plateau}$	-	2.6	-	V	V_{DD}=20 V, I_D=100 A, V_{GS}=0 to 4.5 V
Gate charge total, sync. FET	$Q_{g(sync)}$	-	96	-	nC	V_{DS}=0.1 V, V_{GS}=0 to 4.5 V
Output charge[1)]	Q_{oss}	-	84	-	nC	V_{DD}=20 V, V_{GS}=0 V

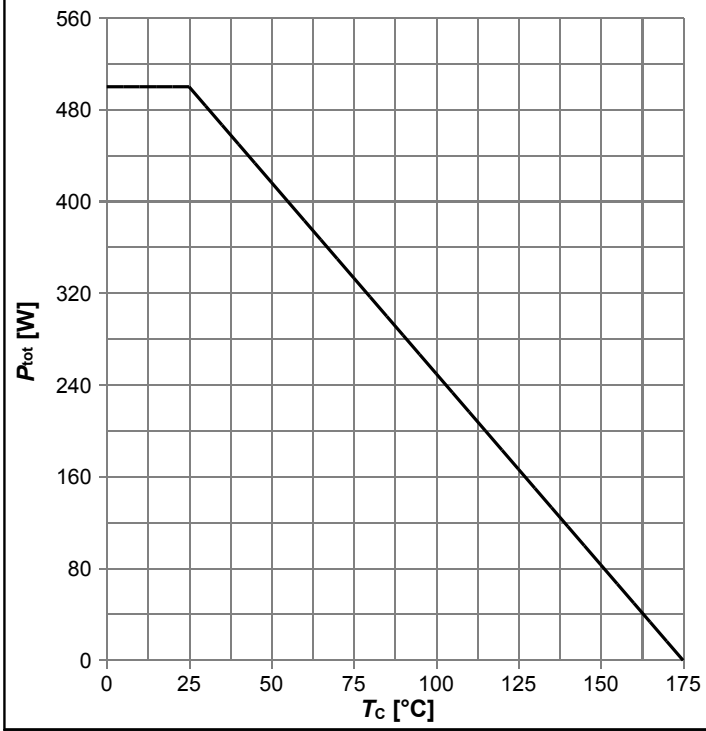
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current[3)]	I_S	-	-	300	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	1200	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	-	1.2	V	V_{GS}=0 V, I_F=100 A, T_j=25 °C
Reverse recovery time[2)]	t_{rr}	-	52	-	ns	V_R=34 V, I_F=100 A, di_F/dt=100 A/µs, Tj=25 °C
Reverse recovery charge[2)]	Q_{rr}	-	79	-	nC	V_R=34 V, I_F=100 A, di_F/dt=100 A/µs, Tj=25 °C

[1)] See "Gate charge waveforms" for parameter definition
[2)] Defined by design. Not subject to production test.
[3)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

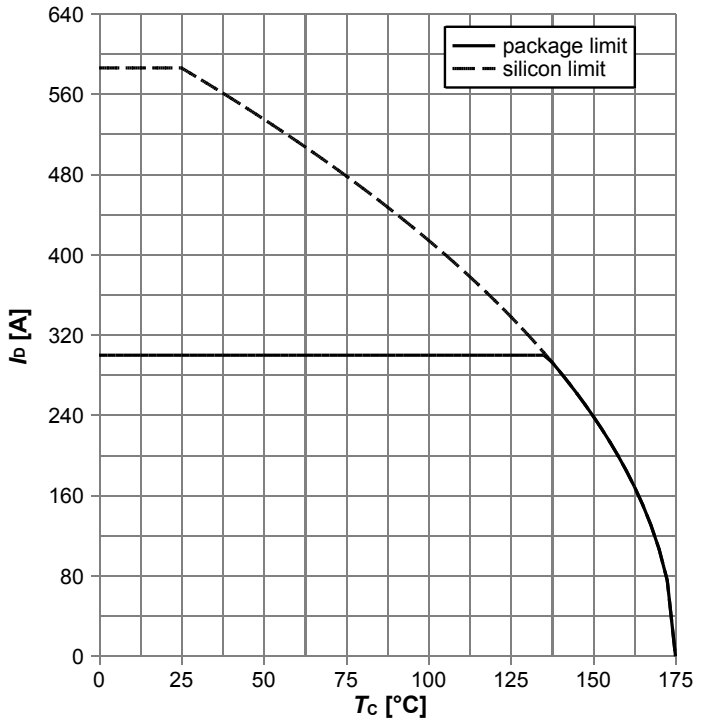
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



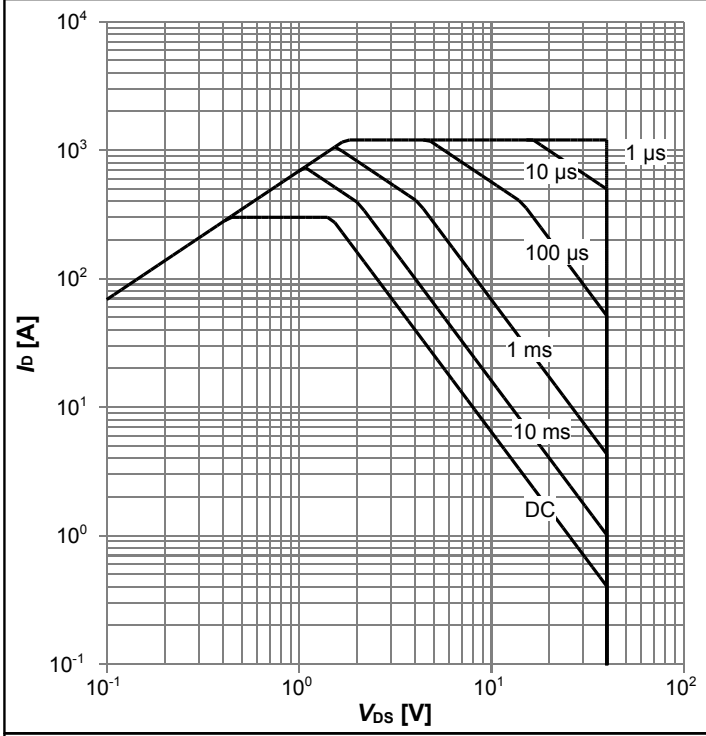
$P_{tot}=f(T_C)$

Diagram 2: Drain current



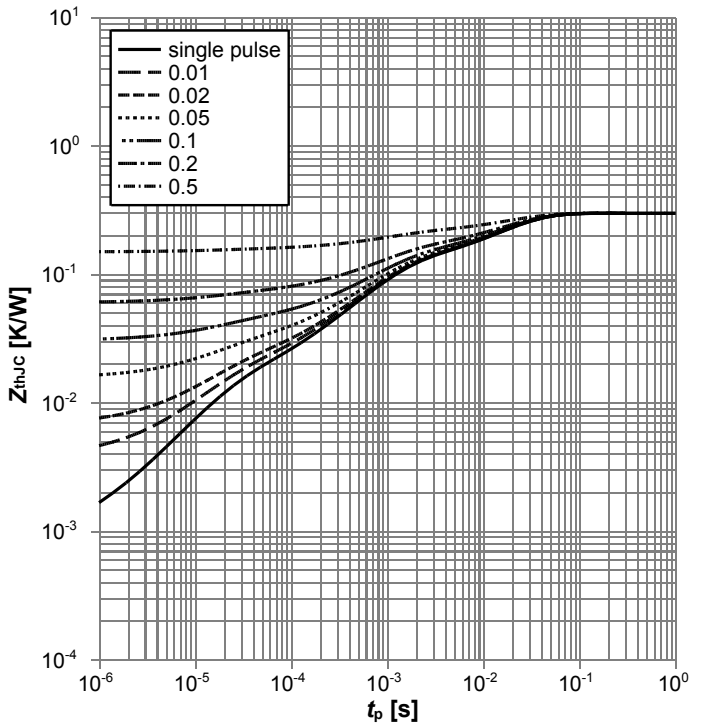
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



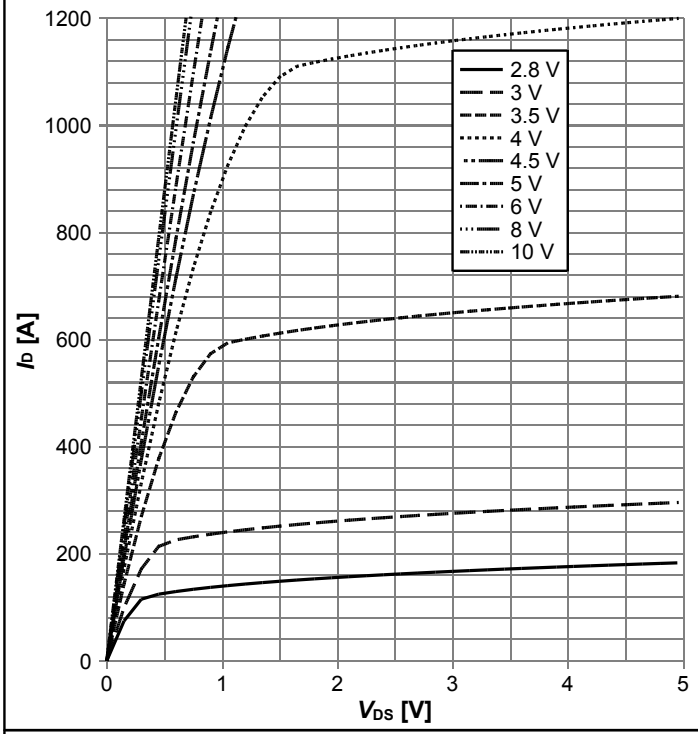
$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



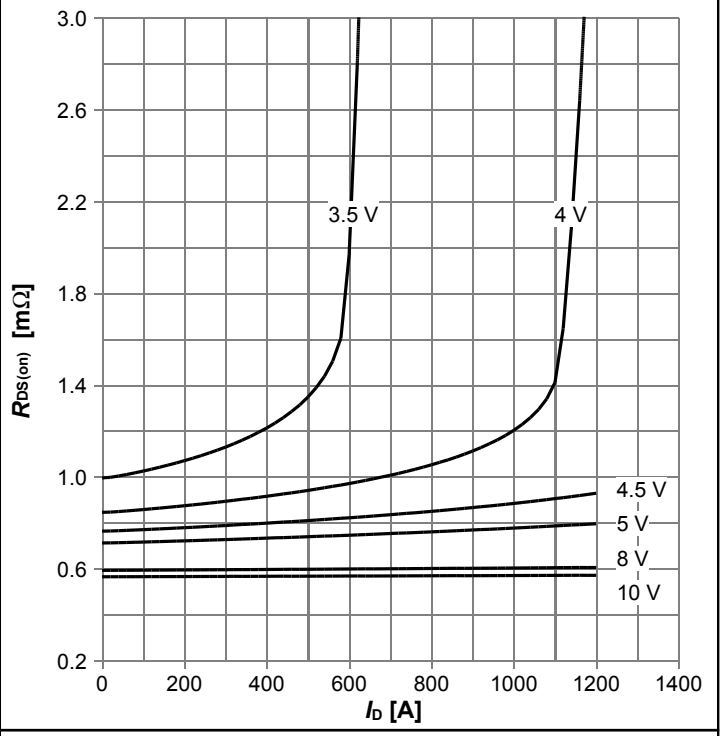
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



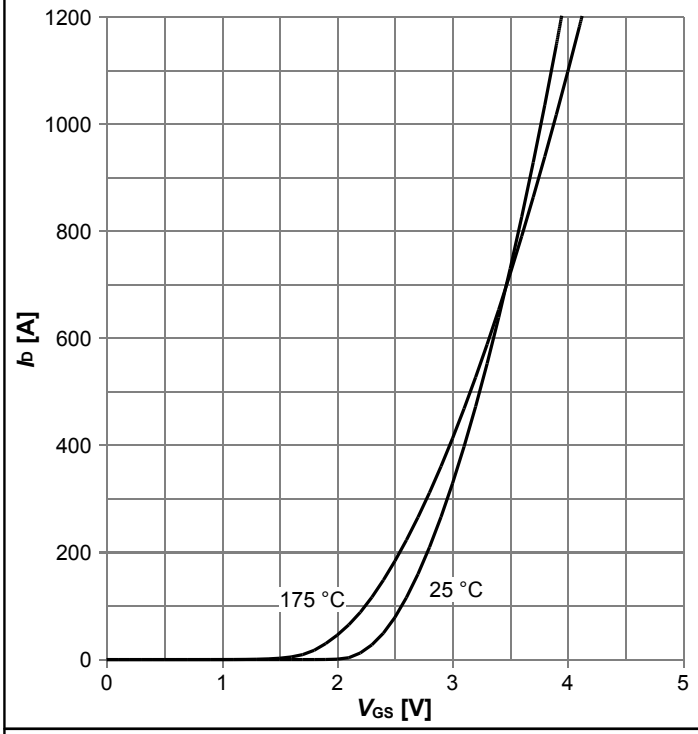
I_D=f(V_{DS}), T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



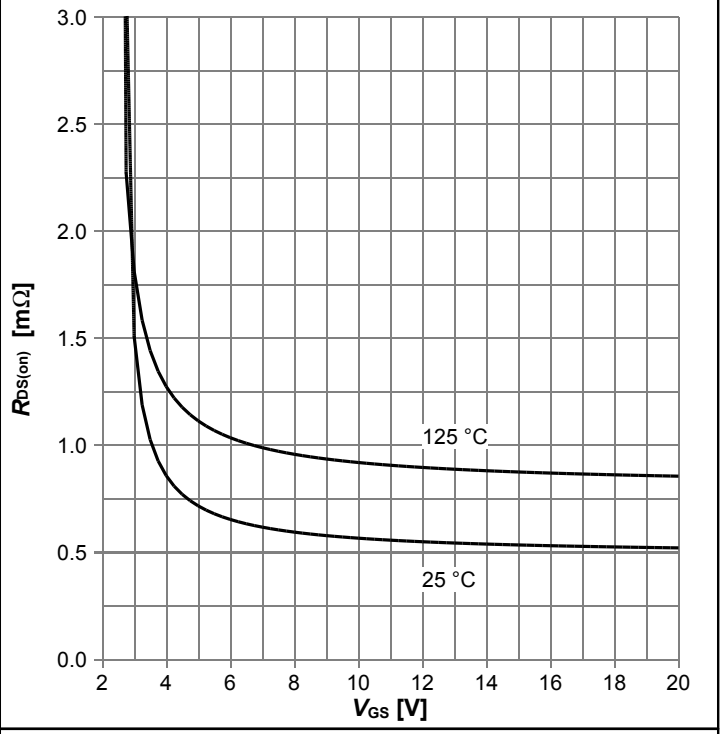
$R_{DS(on)}$=f(I_D), T_j=25 °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



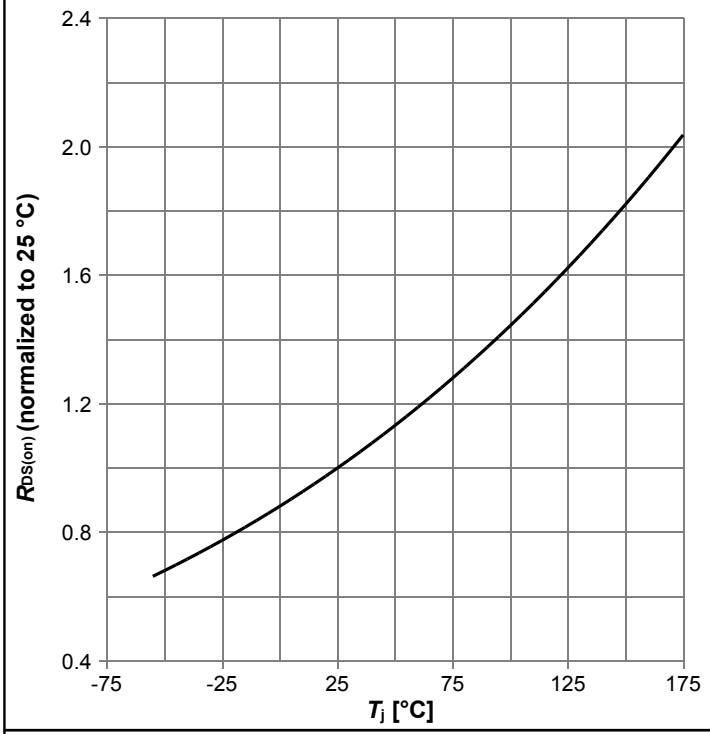
I_D=f(V_{GS}), |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



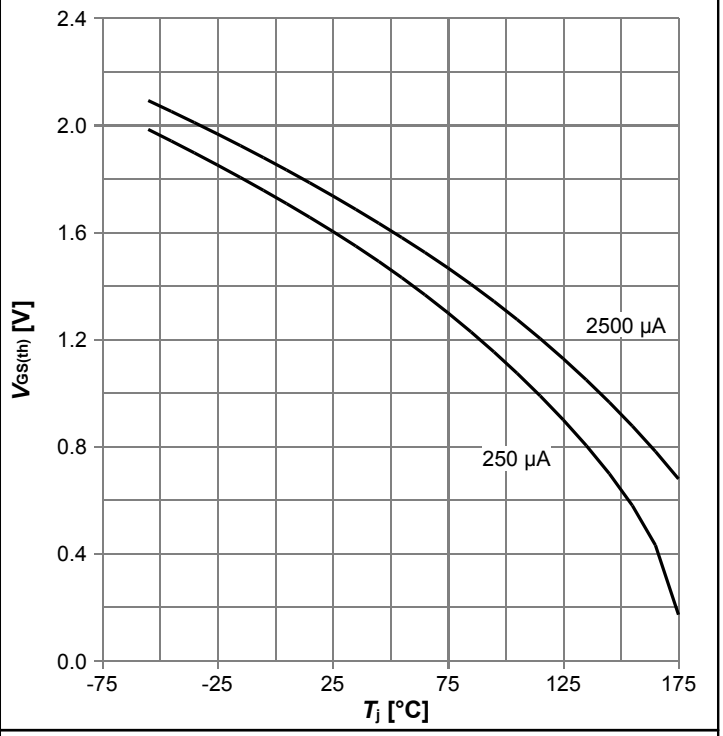
$R_{DS(on)}$=f(V_{GS}), I_D=100 A; parameter: T_j

Diagram 9: Normalized drain-source on resistance



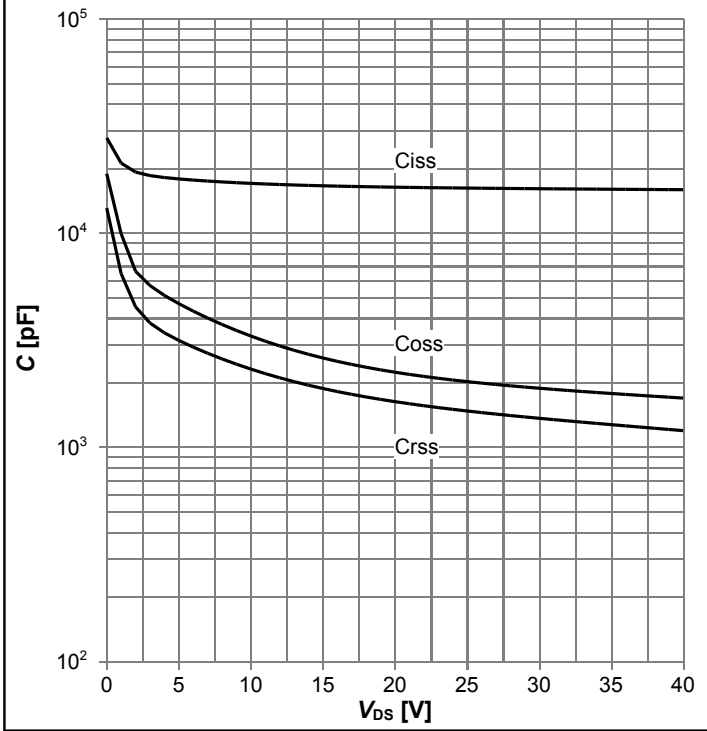
$R_{DS(on)}$=f(T_j), I_D=100 A, V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



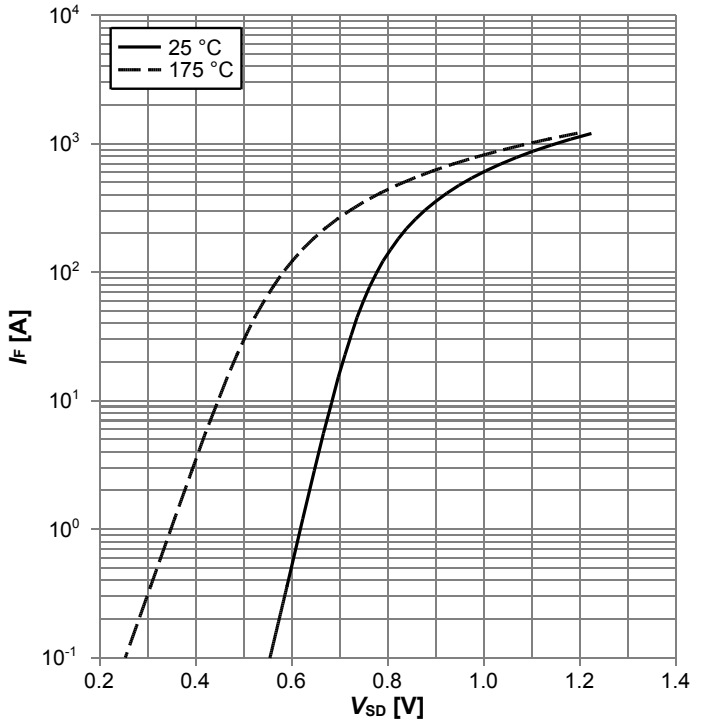
$V_{GS(th}$=f(T_j), V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



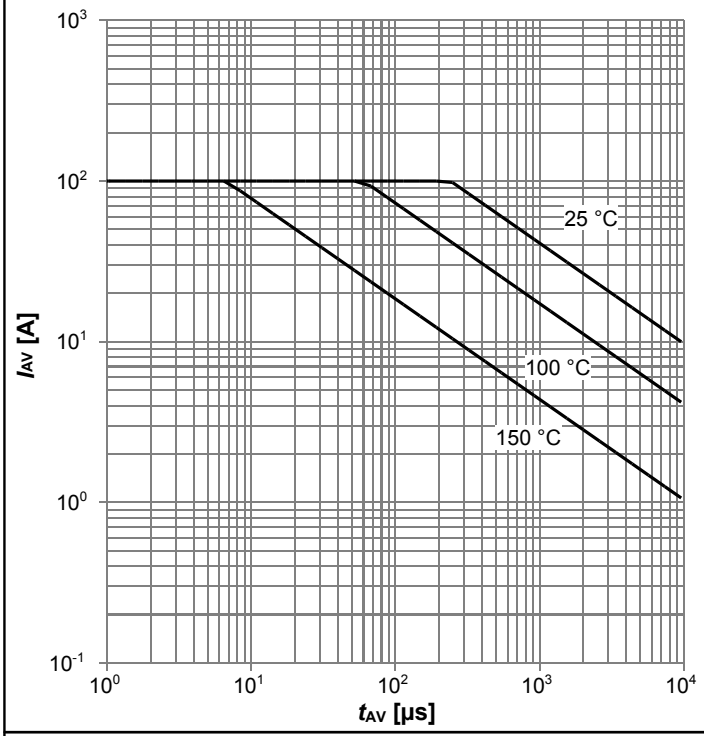
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



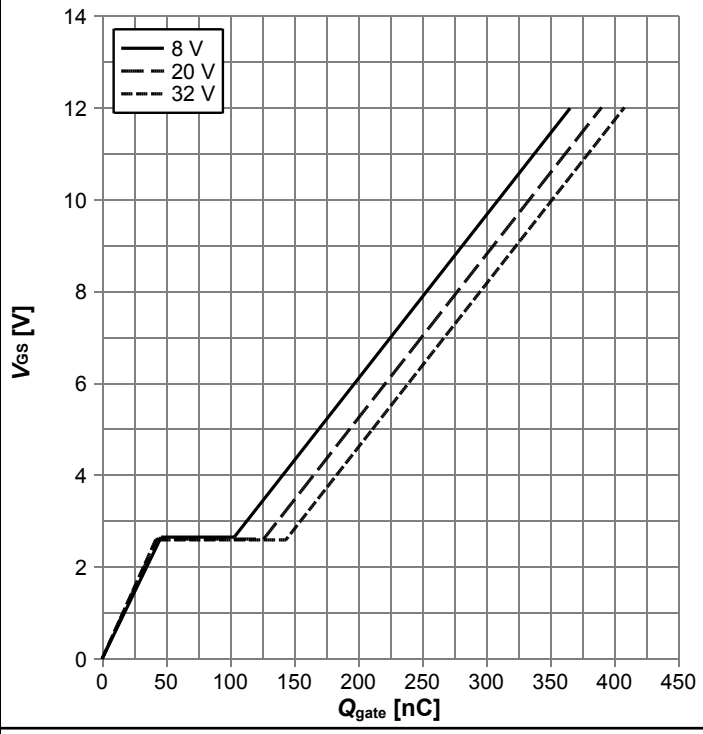
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



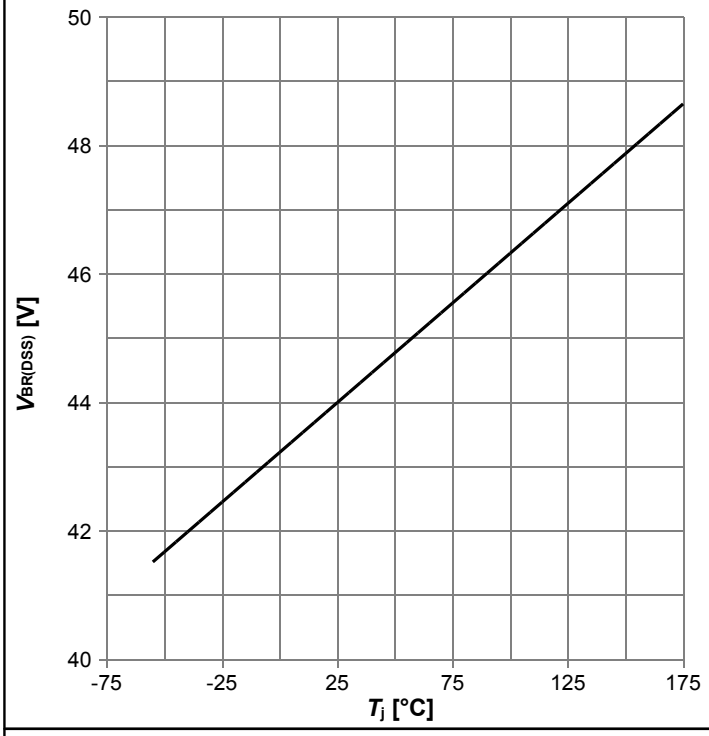
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



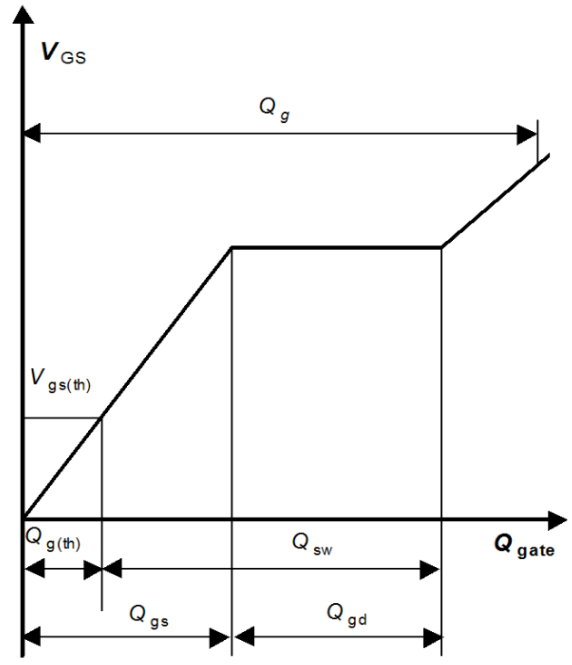
V_{GS}=f(Q_{gate}), I_D=100 A pulsed, T_j=25 °C; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

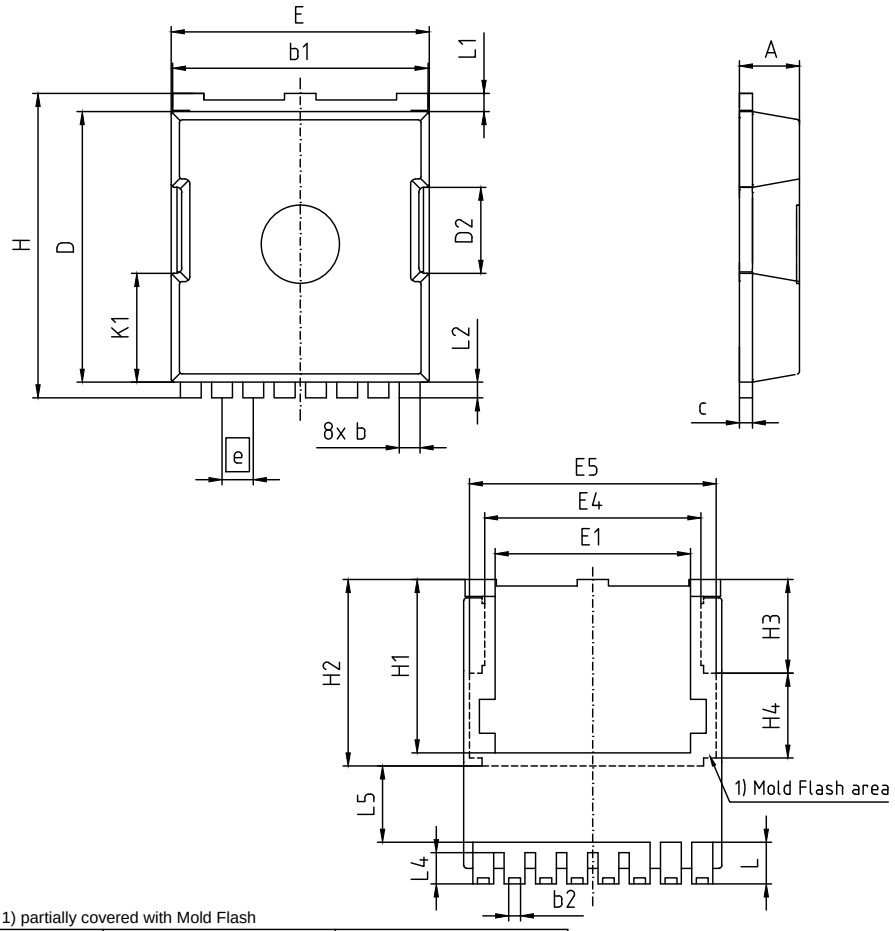


$V_{BR(DSS)}$=f(T_j); I_D=5 mA

Diagram Gate charge waveforms



5 Package Outlines



1) partially covered with Mold Flash

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.20	2.40	0.087	0.094
b	0.70	0.90	0.028	0.035
b1	9.70	9.90	0.382	0.390
b2	0.42	0.50	0.017	0.020
c	0.40	0.60	0.016	0.024
D	10.28	10.58	0.405	0.416
D2	3.30		0.130	
E	9.70	10.10	0.382	0.398
E1	7.50		0.295	
E4	8.50		0.335	
E5	9.46		0.372	
e	1.20 (BSC)		0.047 (BSC)	
H	11.48	11.88	0.452	0.468
H1	6.55	6.75	0.258	0.266
H2	7.15		0.281	
H3	3.59		0.141	
H4	3.26		0.128	
N	8		8	
K1	4.18		0.165	
L	1.40	1.80	0.055	0.071
L1	0.50	0.90	0.020	0.035
L2	0.50	0.70	0.020	0.028
L4	1.00	1.30	0.039	0.051
L5	2.62	2.81	0.103	0.111

DOCUMENT NO.	Z8B00176939
SCALE	0 2 0 2 4mm
EUROPEAN PROJECTION	
ISSUE DATE	28-04-2015
REVISION	01

Figure 1 Outline PG-HSOF-8, dimensions in mm/inches

Revision History

IRL40T209

Revision: 2018-05-05, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
1.0	2018-04-24	Release of preliminary version
2.0	2018-05-05	Release of final version

We Listen to Your Comments
Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:
erratum@infineon.com

Published by
Infineon Technologies AG
81726 München, Germany

Legal Disclaimer
The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”) .

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.
In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of Infineon Technologies in customer’s applications.
The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Information
For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (**www.infineon.com**).

Warnings
Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.
The Infineon Technologies component described in this Data Sheet may be used in life-support devices or systems and/or automotive, aviation and aerospace applications or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support, automotive, aviation and aerospace device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.