IRXPT60R022S7

PPD-98018

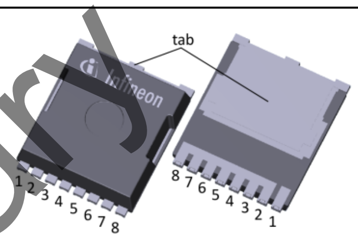
MOSFET
600V CoolMOS™ SJ S7 Technology

Features

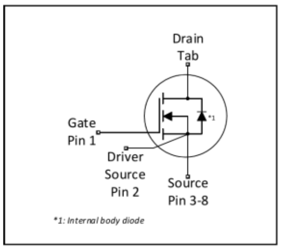
- CoolMOS™ S7 Technology enables 22mΩ $R_{DS(on)}$ in the smallest footprint
- Optimized price performance in low frequency switching applications
- High pulse current capability
- Kelvin Source pin improves switching performance at high current
- TOLL package is MSL1 compliant and has easy visual inspection leads
- Lead solder dipped

Product Summary

- **BV_{DSS}:** 600V
- **Pulsed I_{SD}, I_{DS}:** 375A
- **$R_{DS\ (on),\ max}$:** 22mΩ
- **Q_G:** 150nC
- **V_{SD}:** 0.82V



PG-HSOF-8



Potential Applications

- Solid state relays and circuit breakers
- Line rectification in high power/performance applications e.g. Computing, Telecom, UPS and Solar

Product Validation

JESD-22 Qualification

Description

IRXPT60R022S7 enables the best price performance for low frequency switching applications. CoolMOS™ S7 boasts the lowest Rdson values for a HV SJ MOSFET, with distinctive increase of energy efficiency. CoolMOS™ S7 is optimized for “static switching” and high current applications. It is an ideal fit for solid state relay and circuit breaker designs as well as for line rectification in SMPS and inverter topologies. The package is offered in lead solder dipped.

Ordering Information

Table 1 Ordering options

Part number	Package	Part Marking	Standard Pack	
			Form	Quantity
IRXPT60R022S7	PG-HSOF-8	60IR22S7	Tape and Reel	TBD

Table of contents

1 Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I_D	Drain current rating	—	—	23	A	T_C = 140°C Current is limited by T_{jmax} = 150°C Lower case temp does increase current capability
$I_{D, pulse}$	Pulsed drain current [1]	—	—	375	A	T_C = 25°C
E_{AS}	Avalanche energy, single pulse	—	—	289	mJ	I_D = 3.8A, V_{DD}= 50V, see Fig 19, 20
I_{AS}	Avalanche current, single pulse	—	—	3.8	A	—
dv/dt	MOSFET dv/dt ruggedness [2]	—	—	20	V/ns	V_{DS} = 0V to 300V
V_{GS}	Gate source voltage (static)	-20	—	20	V	Static
V_{GS}	Gate source voltage (dynamic)	-30	—	30	V	AC (f >1 Hz)
P_{tot}	Power dissipation	—	—	390	W	T_C = 25°C
T_{stg}	Storage temperature	-55	—	150	°C	—
T_j	Operating junction temperature	-55	—	150	°C	—
—	Mounting torque	—	—	n.a.	Ncm	—
I_S	Diode forward current rating	—	—	23	A	T_C = 140°C Current is limited by T_{jmax} = 150°C Lower case temp does increase current capability
$I_{S, pulse}$	Diode pulse current[1]	—	—	375	A	T_C = 25°C
dv/dt	Reverse diode dv/dt [3]	—	—	5	V/ns	V_{DS} = 0 to 300V, I_{SD}<=23A, Tj = 25°C see Fig 17, 18
d_{if}/dt	Maximum diode commutation speed	—	—	1000	A/µs	V_{DS} = 0 to 300V, I_{SD}<=23A, Tj = 25°C see Fig 17, 18
V_{ISO}	Insulation withstand voltage	—	—	n.a.	V	V_{rms},T_C=25°C, t = 1min

[1] Pulse width t_p limited by $T_{j,max}$
[2] The dv/dt has to be limited by appropriate gate resistor
[3] Identical low side and high side switch

2 Device Characteristics

2.1 Electrical Characteristics

For applications with applied blocking voltage >70% of the specified blocking voltage, it is required that the customer evaluates the impact of cosmic radiation effect in early design phase and contacts the Infineon sales office for the necessary technical support by IR Hirel

Table 3 Static and Dynamic Electrical Characteristics @ T_j = 25°C (Unless Otherwise Specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$V_{(BR)DSS}$	Drain-to-source breakdown voltage	600	—	—	V	V_{GS} = 0V, I_D = 1mA
$R_{DS(on)}$	Static drain-to-source on-state resistance	—	20	22	mΩ	V_{GS} = 12V, I_D = 23A, T_J =25°C
		—	46	—		V_{GS} = 12V, I_D = 23A, T_J =150°C
$V_{GS(th)}$	Gate threshold voltage	3.5	4.0	4.5	V	V_{DS} = V_{GS}, I_D = 1.44mA
I_{DSS}	Zero gate voltage drain current	—	—	5	µA	V_{DS} = 600V, V_{GS} = 0V, T_J =25°C
		—	50	—		V_{DS} = 600V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-source leakage current	—	—	100	nA	V_{GS} = 20V, V_{DS} = 0V
Q_G	Total gate charge	—	150	—	nC	I_D = 23A V_{DD} = 300V V_{GS} = 0 to 12V
Q_{GS}	Gate-to-source charge	—	31	—		
Q_{GD}	Gate-to-drain ('Miller') charge	—	49	—		
$V_{plateau}$	Gate plateau voltage	—	5.4	—	V	
$t_{d(on)}$	Turn-on delay time	—	30	—	ns	I_{D1} = 23A ** V_{DD} = 300V R_G = 5.3Ω V_{GS} = 13V, see Fig 21,22
t_r	Rise time	—	4.0	—		
$t_{d(off)}$	Turn-off delay time	—	150	—		
t_f	Fall time	—	9.0	—		
C_{iss}	Input capacitance	—	5639	—	pF	V_{GS} = 0V V_{DS} = 300V f = 250kHz
C_{oss}	Output capacitance	—	89	—		
$C_{O(er)}$	Effective output capacitance, energy related [1]	—	303	—		V_{GS} = 0V, V_{DS} = 0 to 300V
$C_{O(tr)}$	Effective output capacitance, time related [2]	—	2678	—		I_D = constant, V_{GS} = 0V, V_{DS} = 0 to 300V
Q_{OSS}	Output charge	—	803	—	nC	V_{GS} = 0V, V_{DS} = 0 to 300V
R_G	Gate resistance	—	0.80	—	Ω	f=1MHz, open drain

[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 300V

[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 300V

2.2 Source-Drain Diode Ratings and Characteristics

Table 4 Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
V_{SD}	Diode forward voltage	—	0.82	—	V	T_J = 25°C, I_S = 23A, V_{GS} = 0V
t_{rr}	Reverse recovery time	—	460	—	ns	T_J = 25°C, I_F = 23A, V_R =300V di/dt = 100A/µs see Fig 17, 18
Q_{rr}	Reverse recovery charge	—	9.0	—	µC	
I_{rrm}	Peak reverse recovery current	—	40	—	A	
t_{on}	Forward turn-on time	Intrinsic turn-on time is negligible				

2.3 Thermal Characteristics

Table 5 Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{\theta JC}$	Thermal resistance, junction - case	—	—	0.32	°C/W	-
$R_{\theta JA}$	Thermal resistance, junction - ambient	—	—	62		Device on PCB, minimal footprint
$R_{\theta JA}$	Thermal resistance, junction - ambient for SMD version	—	35	45		Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70µm thickness) copper area for drain connection and PCB is vertical without air stream cooling.
T_{sold}	Soldering temperature, wave- & reflow soldering allowed	—	—	260	°C	

3 Electrical Characteristics Curves

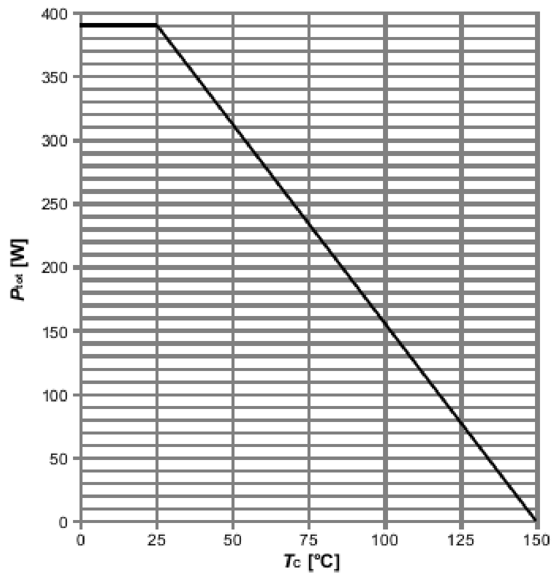


Figure 1 **Power dissipation** (Ptot=f(TC))

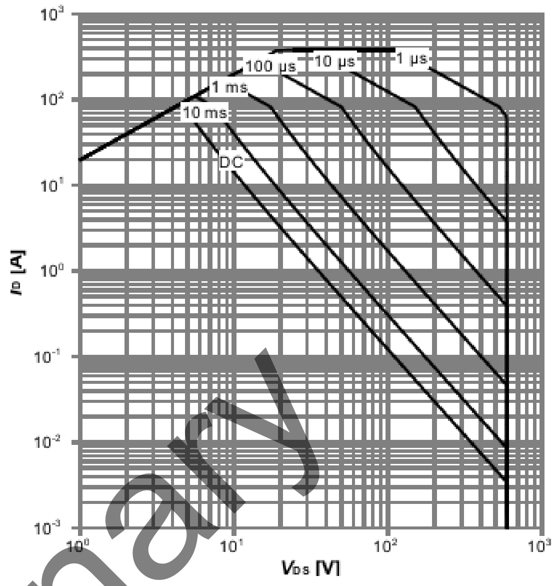


Figure 2 **Safe operating area**
(ID=f(VDS);T_C=25°C;D=0;parameter:tp)

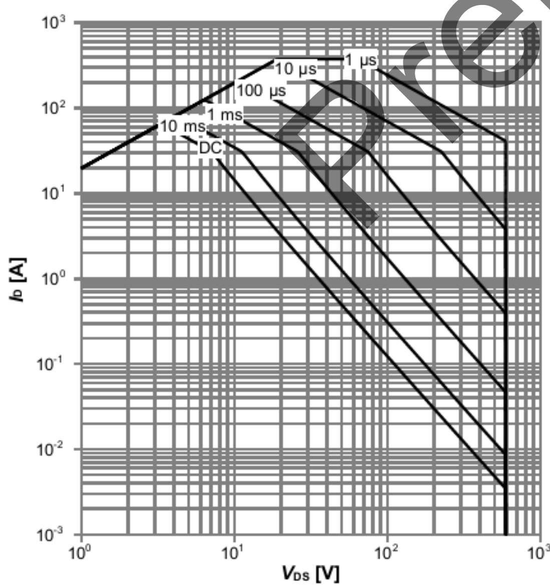


Figure 3 **Safe operating area**
(I_D=f(V_{DS});T_C=80°C;D=0;parameter:tp)

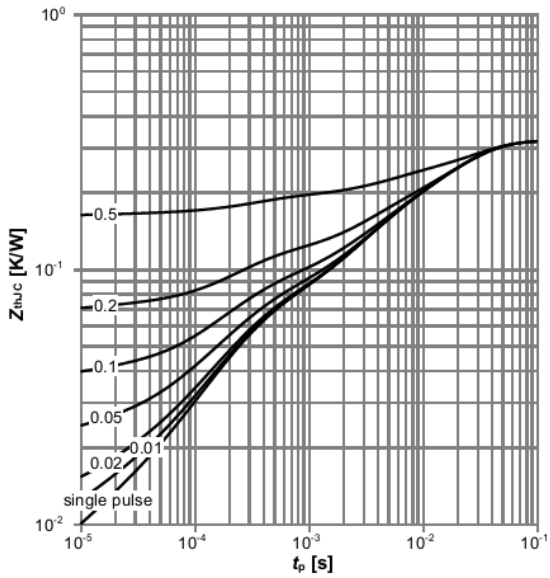


Figure 4 **Max. transient thermal impedance**
(Z_{thJC}=f(t_P); parameter:D=t_p/T)

Electrical Characteristics Curves

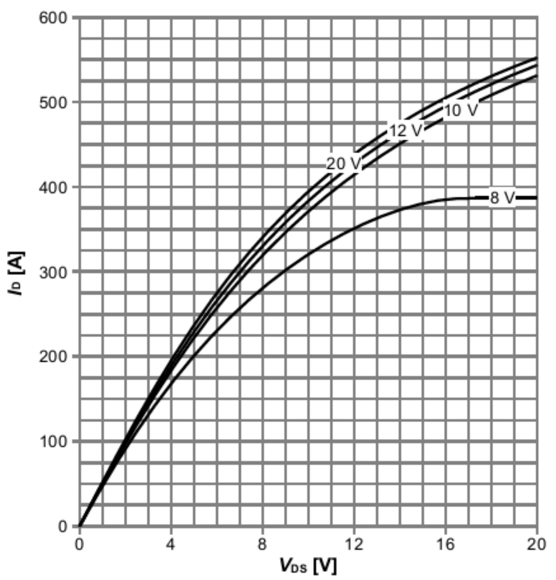


Figure 5 **Typical output characteristics**
(I_D=f(V_{DS}); Tj=25°C;parameter: V_{GS})

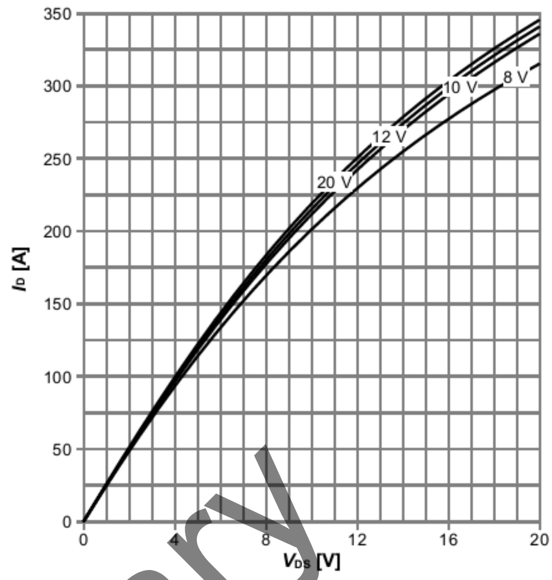


Figure 6 **Typical output characteristics**
(I_D=f(V_{DS}); T_j=125°C;parameter: V_{GS})

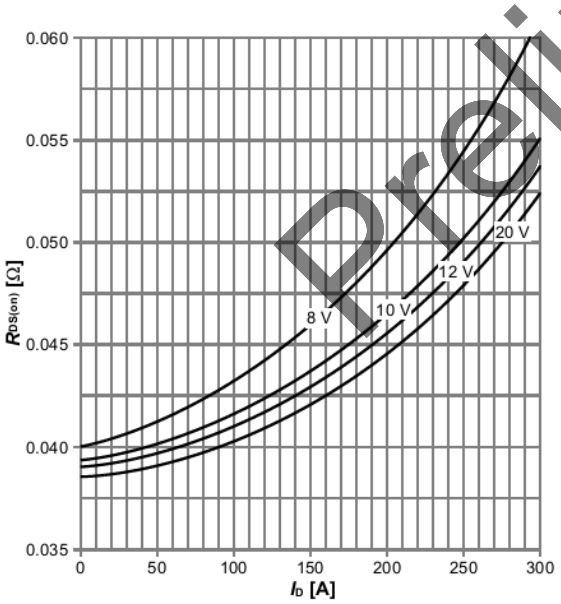


Figure 7 **Typical drain -source on state resistance**
($R_{DS(on)}$=f(I_D);T_j=125°C;parameter:V_{GS})

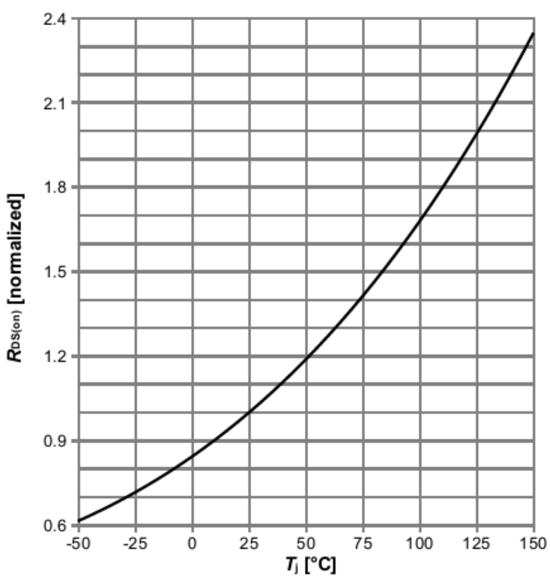


Figure 8 **Drain-source on -state resistance**
($R_{DS(on)}$=f(Tj);I_D23.0A ; V_{GS}=12V)

Electrical Characteristics Curves

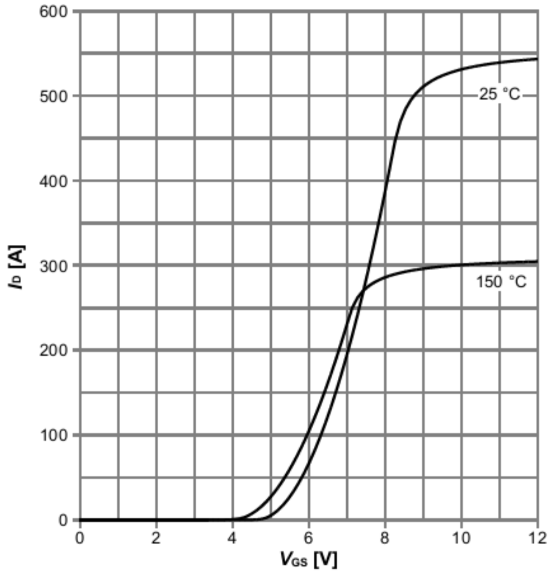


Figure 9 **Typical transfer characteristics**
(D=f(V_{GS});V_{DS}=20V;parameter:Tj)

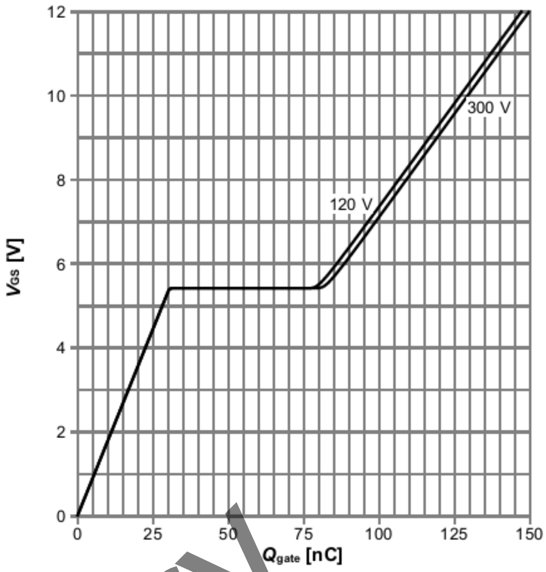


Figure 10 **Typical gate charge**
(V_{GS}=f(Qgate);I_D=23.0A pulsed; parameter: V_{DD})

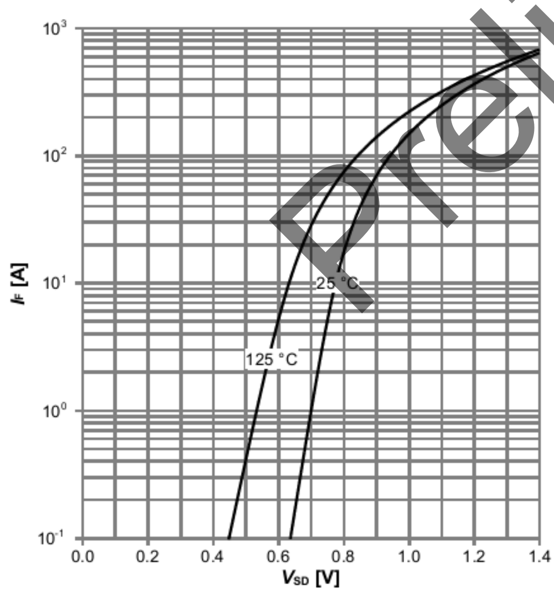


Figure 11 **Forward characteristics of reverse diode** (I_F=f(V_{SD});V_{GS}=0V;parameter:T_j)

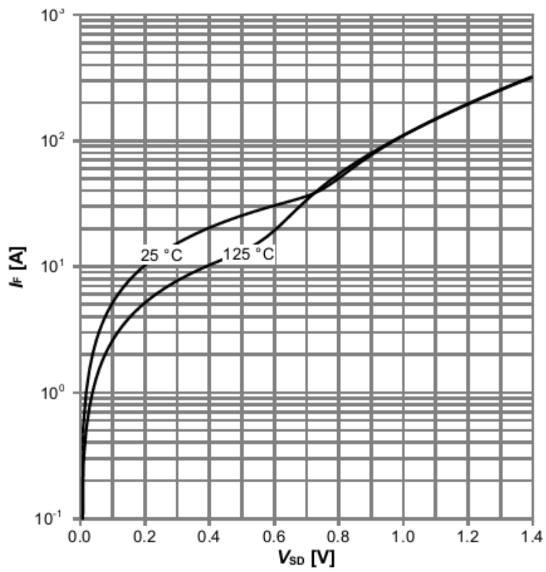


Figure 12 **Forward characteristics of reverse diode** (I_F=f(V_{SD});V_{GS}=12V;parameter:T_j)

PRELIMINARY

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Electrical Characteristics Curves

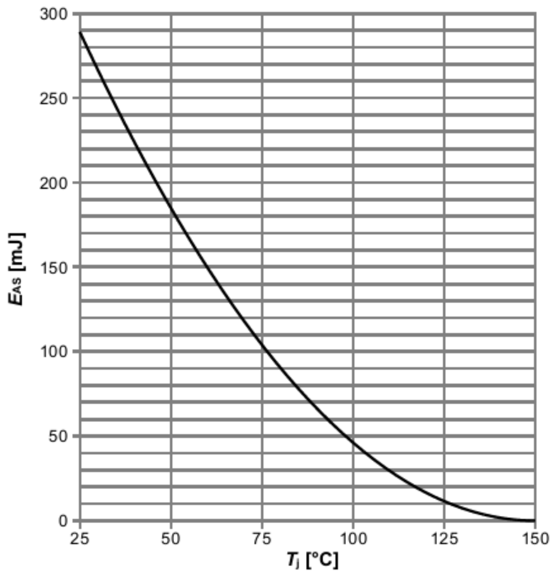


Figure 13 Avalanche energy
(E_{AS}=f(Tj); I_D=3.8A;V_{DD}=50V)

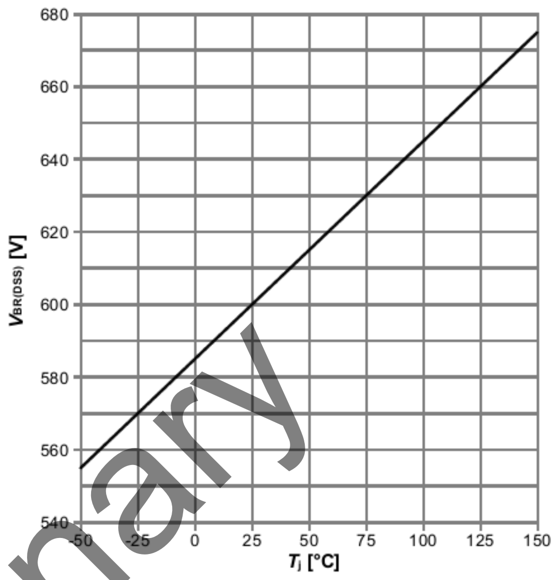


Figure 14 Drain-source breakdown voltage
($V_{BR(DSS)}$=f(Tj);I_D=1mA)

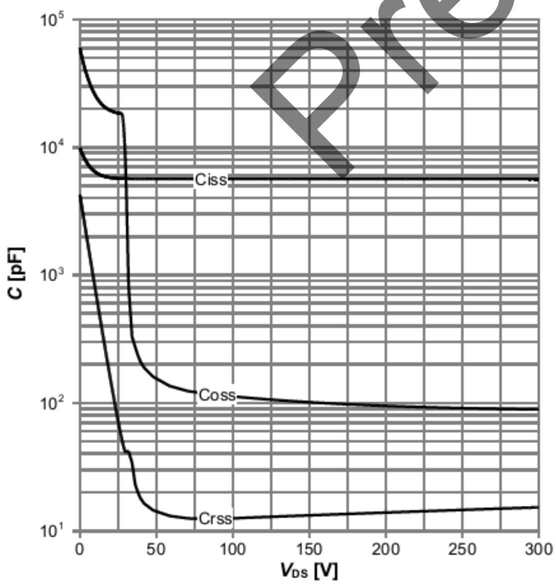


Figure 15 Typical capacitances
(C=f(V_{DS});V_{GS}=0V; f=250kHz)

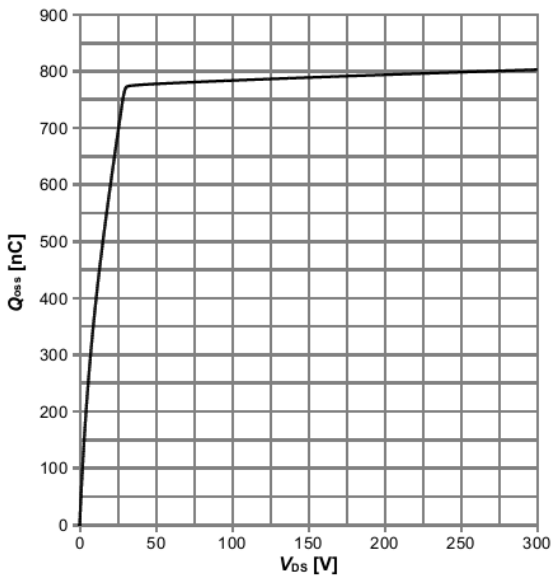


Figure 16 Typical Qoss output charge
(Q_{oss}=f(V_{DS}); V_{GS}=0V)

4 Test Circuits

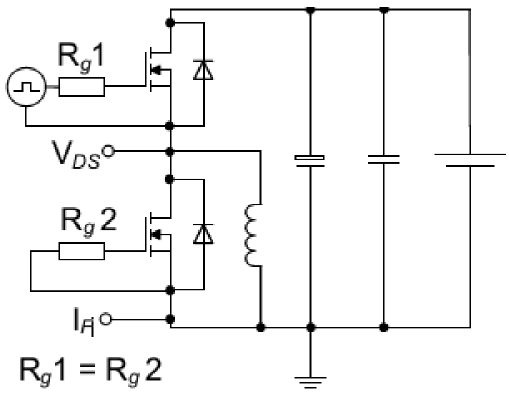


Figure 17 Test circuit for diode characteristics

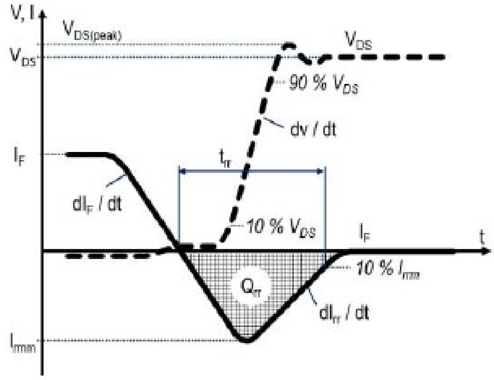


Figure 18 Diode recovery waveform

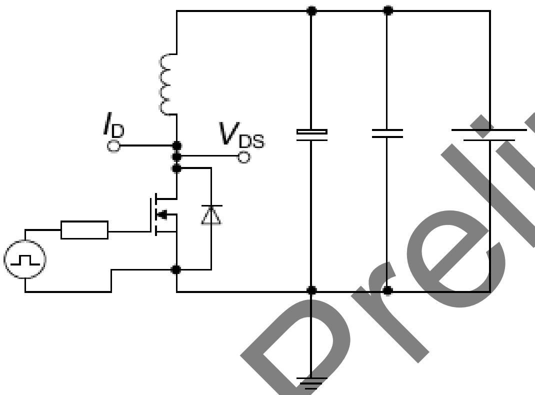


Figure 19 Unclamped inductive load test circuit

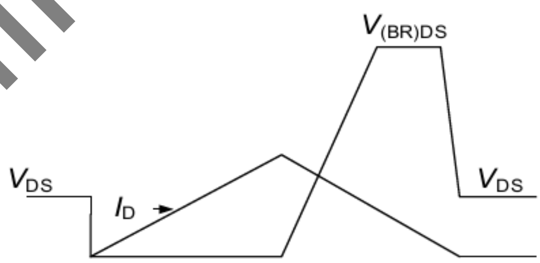


Figure 20 Unclamped inductive waveform

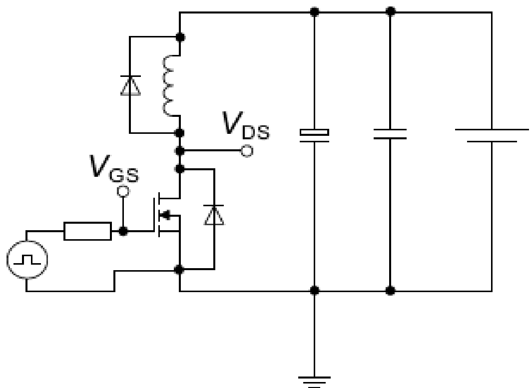


Figure 21 Switching time test circuit

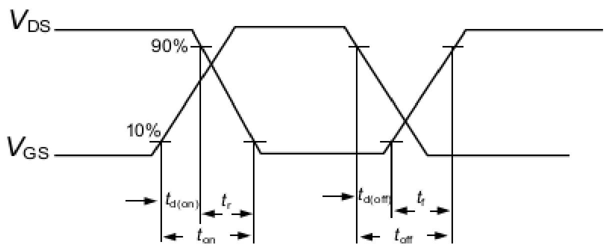
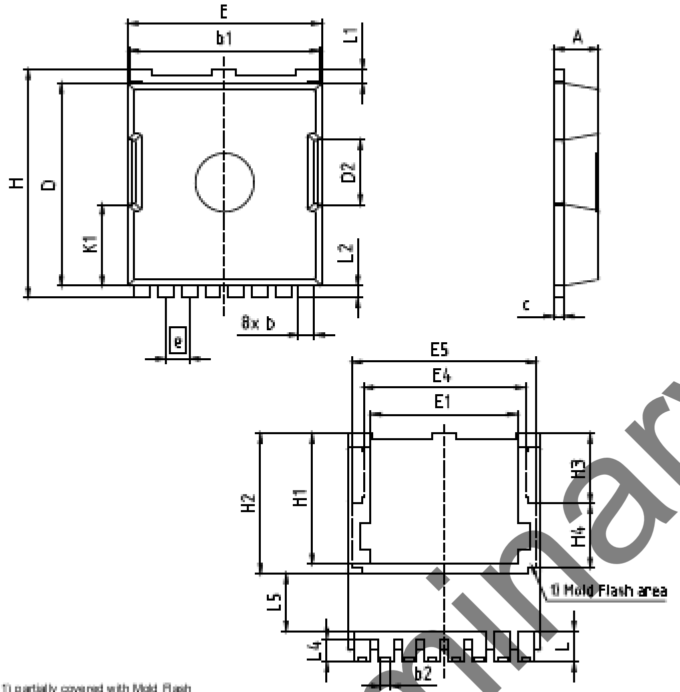


Figure 22 Switching time waveforms

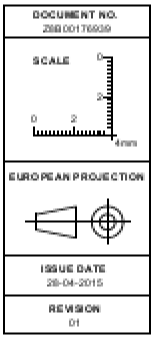
5 Package Outline

Note: For the most updated package outline, please see the website: PG-HSOF-8, dimensions in mm/inches



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



Revision history

Document version	Date of release	Description of changes
	06/03/2024	Preliminary datasheet with PPD number (PPD-98018)

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Document reference