

MOSFET

OptiMOS™ 3 Power-Transistor, 30 V

Features

- Fast switching MOSFET for SMPS
- Optimized technology for DC/DC converters
- Qualified according to JEDEC¹⁾ for target applications
- N-channel, logic level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Avalanche rated
- Pb-free plating

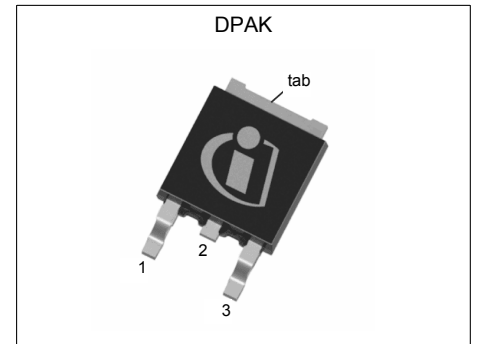
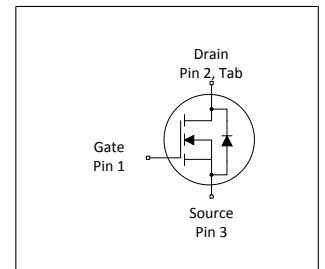


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	30	V
$R_{DS(on),max}$	9	mΩ
I_D	40	A



RoHS

Type / Ordering Code	Package	Marking	Related Links
IPD090N03L G E8177	PG-TO252-3	090N03L	-

¹⁾ J-STD20 and JESD22

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1 Maximum ratings

at $T_A=25\text{ °C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	40	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$
		-	-	37		
		-	-	40		
		-	-	30		
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	280	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ²⁾	I_{AS}	-	-	40	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	40	mJ	$I_D=12\text{ A}$, $R_{GS}=25\text{ }\Omega$
Reverse diode dv/dt	dv/dt	-	-	6	kV/ μ s	$I_D=40\text{ A}$, $V_{DS}=24\text{ V}$, $di/dt=200\text{ A}/\mu$ s, $T_{j,max}=175\text{ °C}$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	42	W	$T_C=25\text{ °C}$
Operating and storage temperature	T_j , T_{stg}	-55	-	175	$^{\circ}\text{C}$	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	R_{thJC}	-	-	3.6	K/W	-
SMD version, device on PCB, minimal footprint	R_{thJA}	-	-	75	K/W	-
SMD version, device on PCB, 6 cm ² cooling area ³⁾	R_{thJA}	-	-	50	K/W	-

¹⁾ See figure 3 for more detailed information

²⁾ See figure 13 for more detailed information

³⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μ m thick) copper area for drain connection. PCB is vertical in still air.

3 Electrical characteristics

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

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	30	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1	-	2.2	V	$V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=30\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=30\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance ¹⁾	$R_{DS(on)}$	-	10.8 7.5	13.5 9	$\text{m}\Omega$	$V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$
Gate resistance	R_G	-	1.1	-	Ω	-
Transconductance	g_{fs}	26	53	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=30\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance ²⁾	C_{iss}	-	1200	1600	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Output capacitance ²⁾	C_{oss}	-	460	610	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	24	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	4.0	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	3	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	15	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	2.6	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

Table 6 Gate charge characteristics³⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	4.0	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	1.8	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	Q_{gd}	-	1.8	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	Q_{sw}	-	3.8	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total ²⁾	Q_g	-	7.2	9.6	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	3.4	-	V	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total	Q_g	-	15	-	-	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET ²⁾	$Q_{g(sync)}$	-	6.3	8.3	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge	Q_{oss}	-	12	-	-	$V_{DD}=15\text{ V}$, $V_{GS}=0\text{ V}$

¹⁾ Measured from drain tab to source pin

²⁾ Defined by design. Not subject to production test

³⁾ See "Gate charge waveforms" for parameter definition

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	37	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	280	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.93	1.1	V	$V_{GS}=0\text{ V}, I_F=30\text{ A}, T_j=25\text{ °C}$
Reverse recovery charge ¹⁾	Q_{rr}	-	-	10	nC	$V_R=15\text{ V}, I_F=I_S, di_F/dt=400\text{ A}/\mu\text{s}$

¹⁾ Defined by design. Not subject to production test

4 Electrical characteristics diagrams

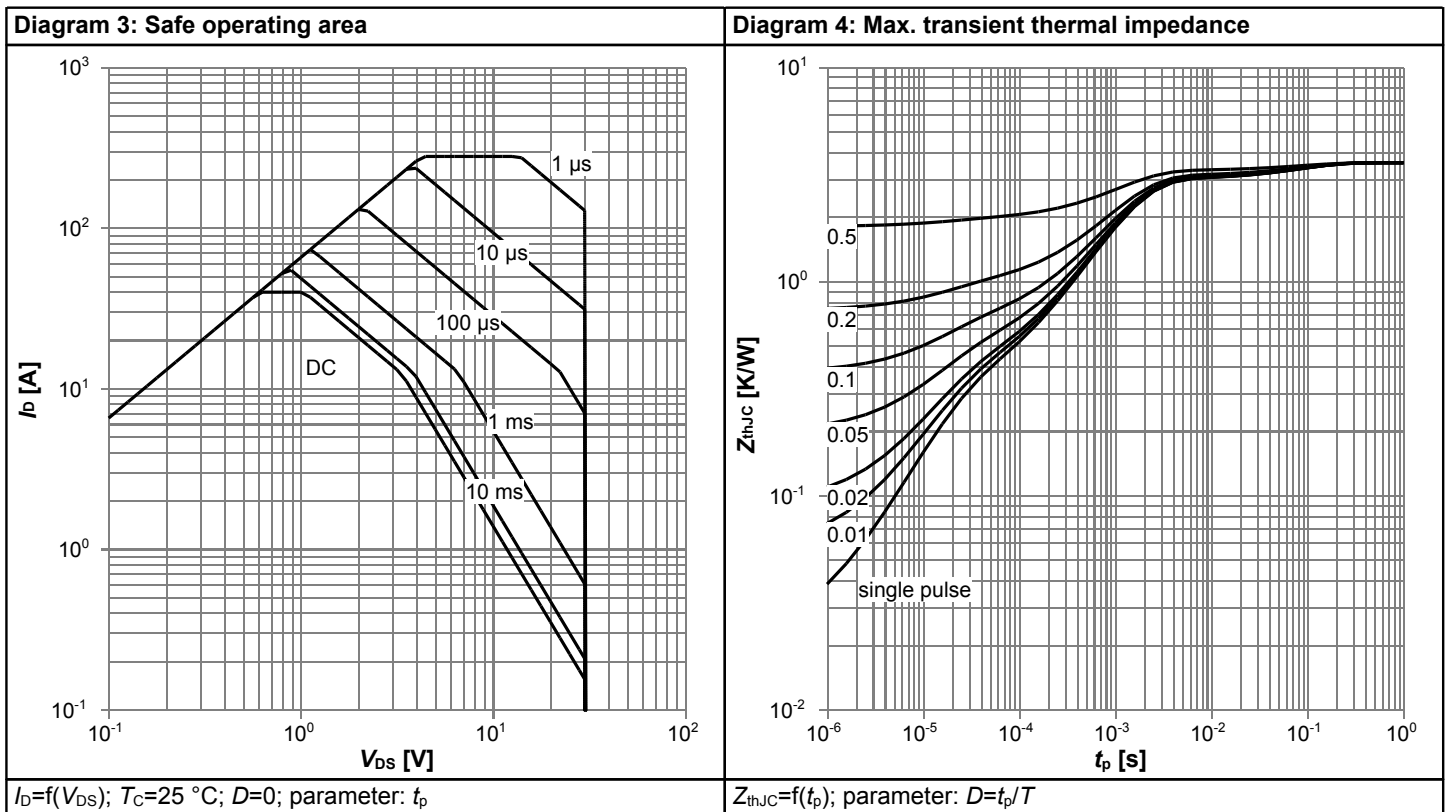
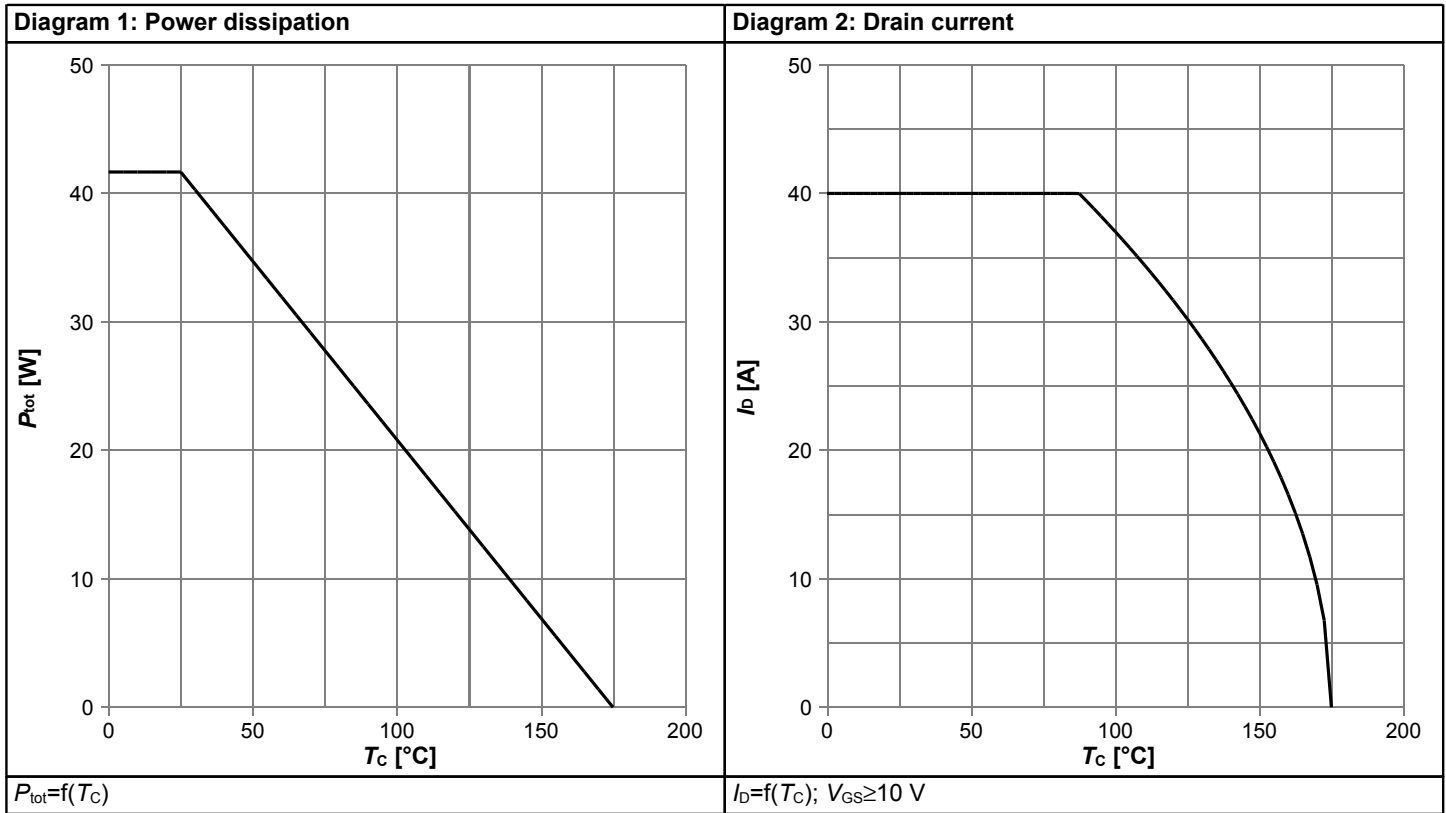
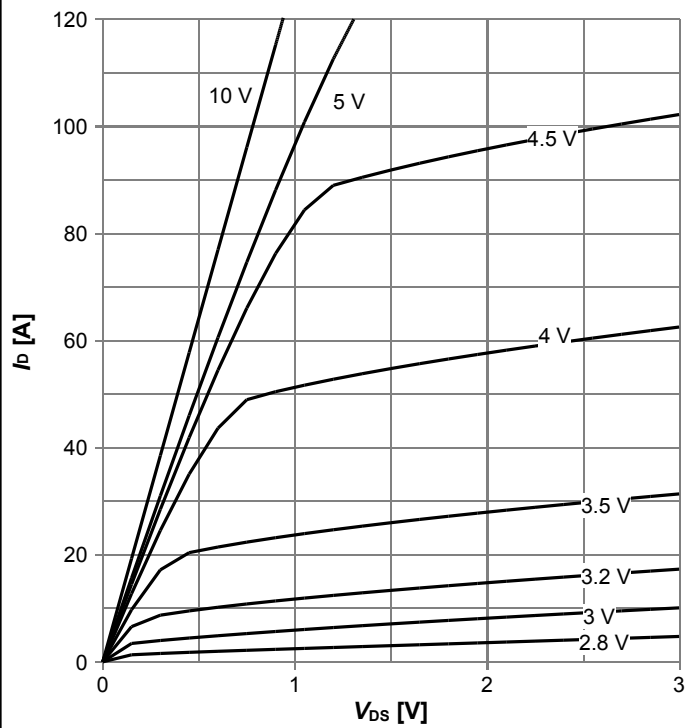
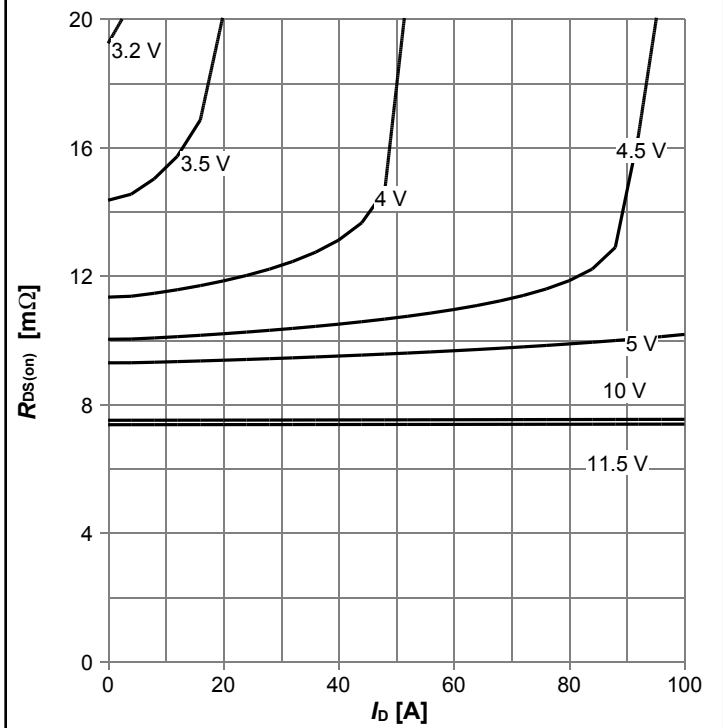


Diagram 5: Typ. output characteristics



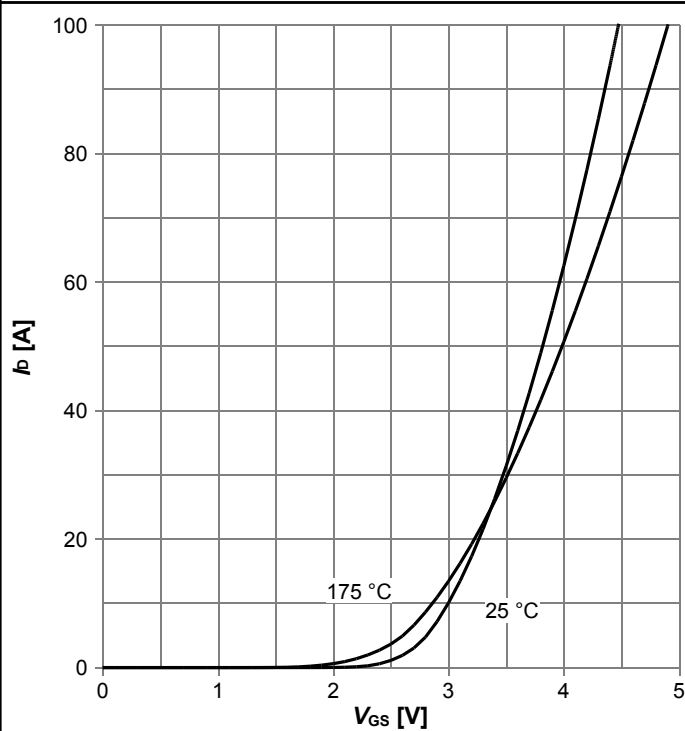
$I_D = f(V_{DS}); T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



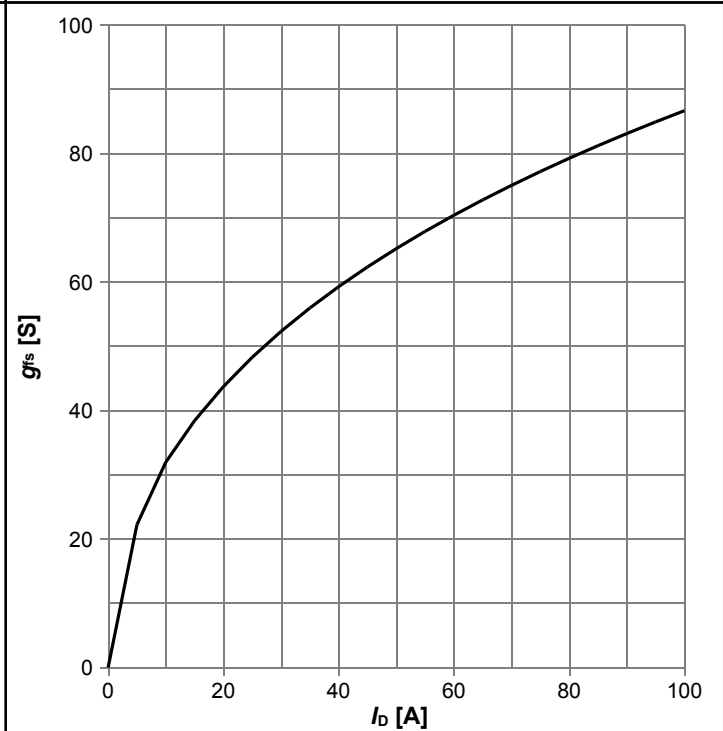
$R_{DS(on)} = f(I_D); T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



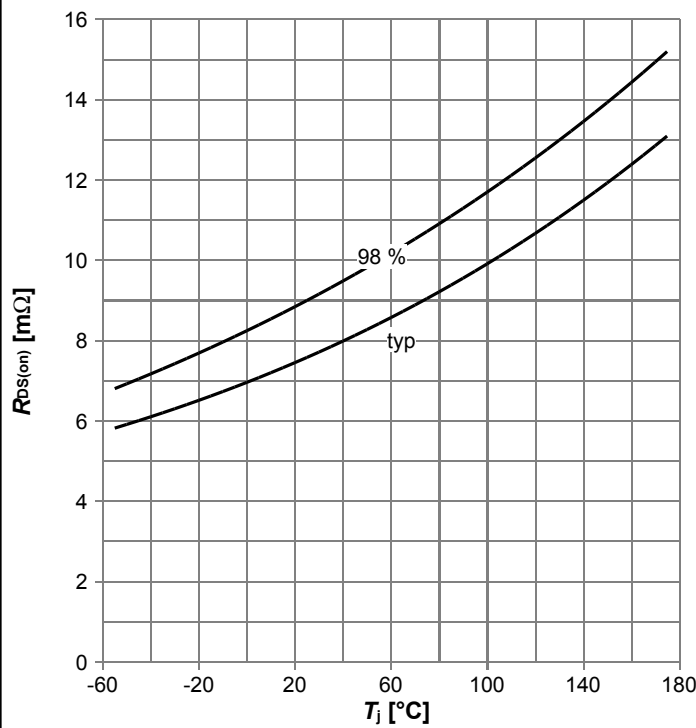
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. forward transconductance



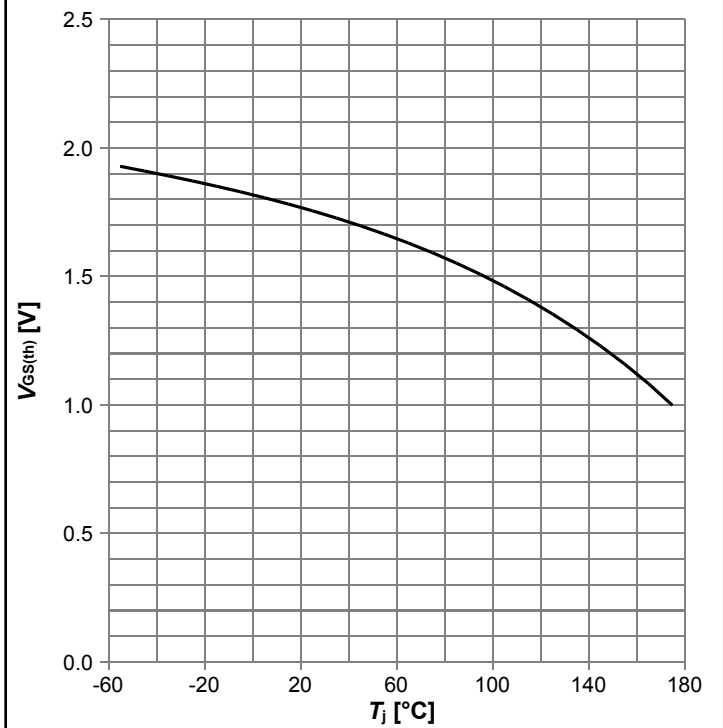
$g_{fs} = f(I_D); T_j = 25\text{ °C}$

Diagram 9: Drain-source on-state resistance



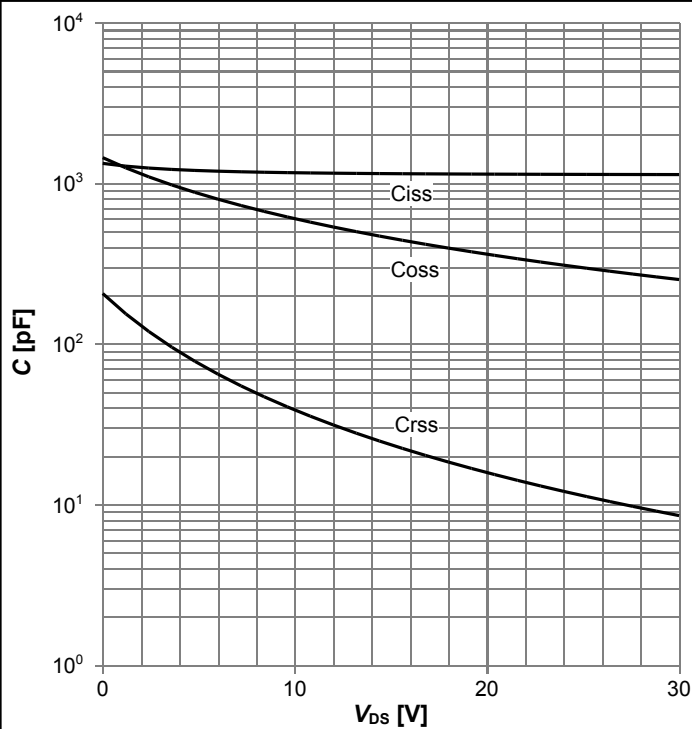
$R_{DS(on)}=f(T_j)$; $I_D=30\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



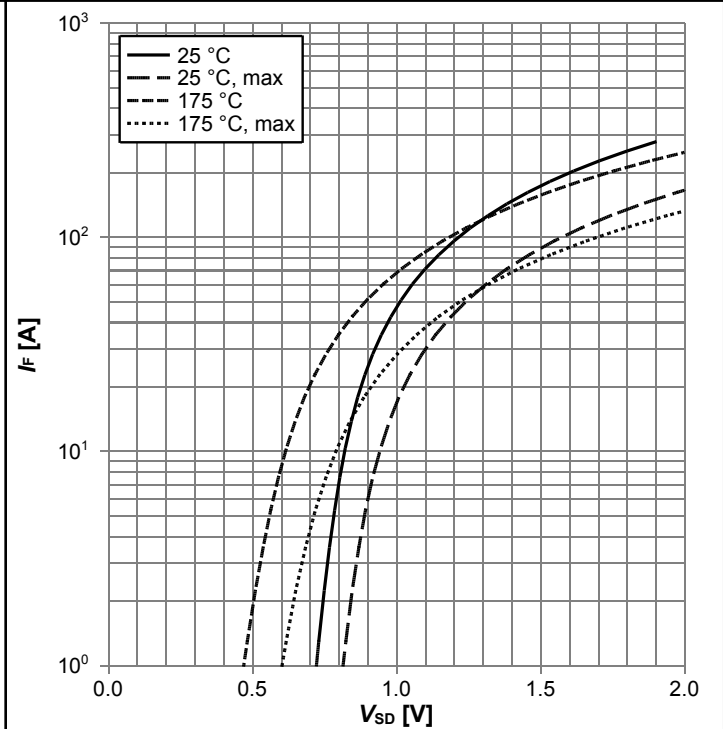
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=250\text{ }\mu\text{A}$

Diagram 11: Typ. capacitances



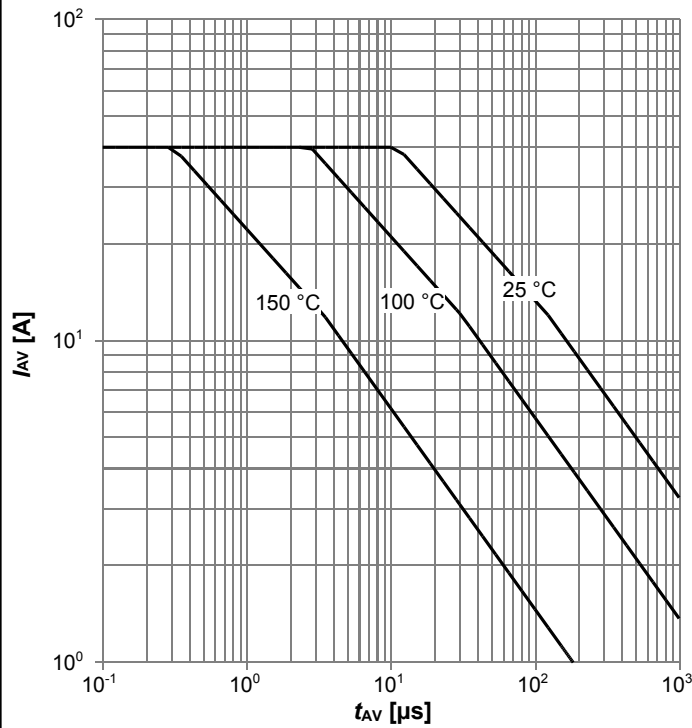
$C=f(V_{DS})$; $V_{GS}=0\text{ V}$; $f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



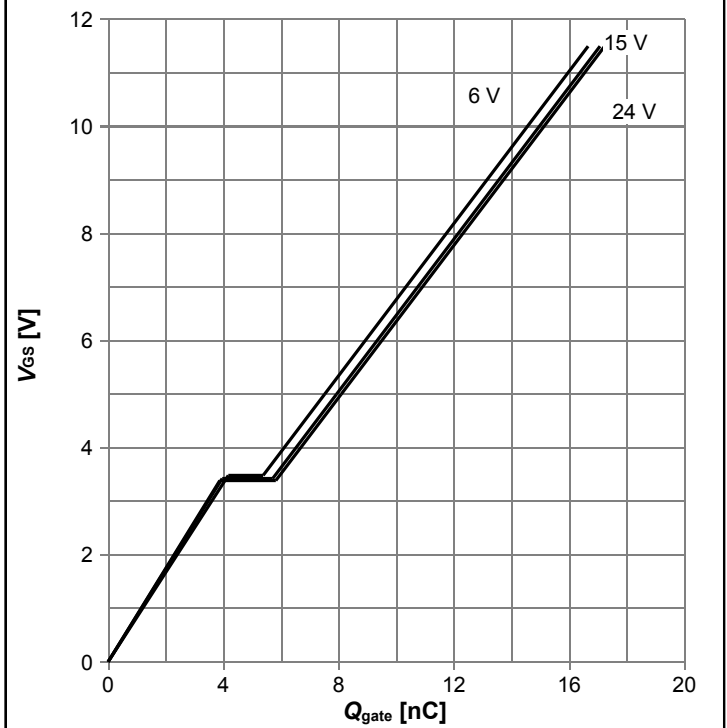
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



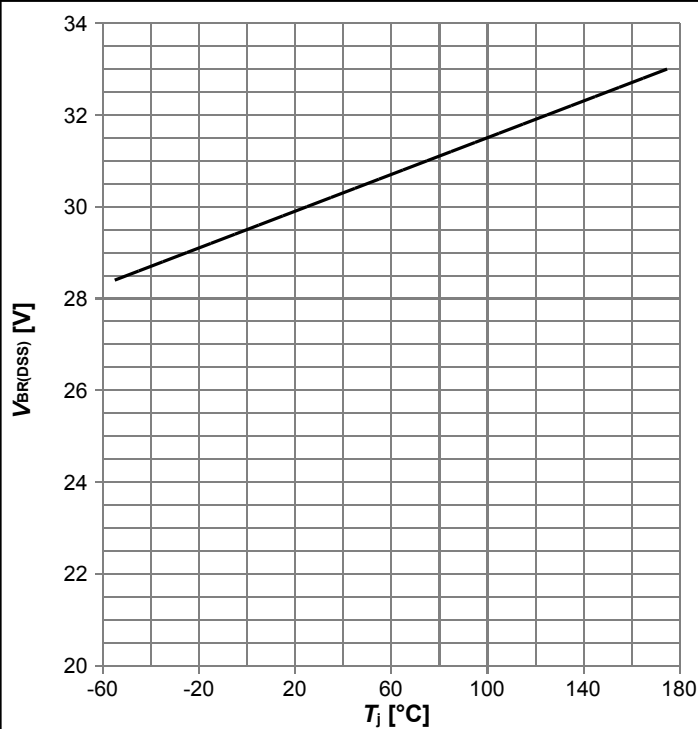
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



$V_{GS}=f(Q_{gate}); I_D=30 \text{ A pulsed}$; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

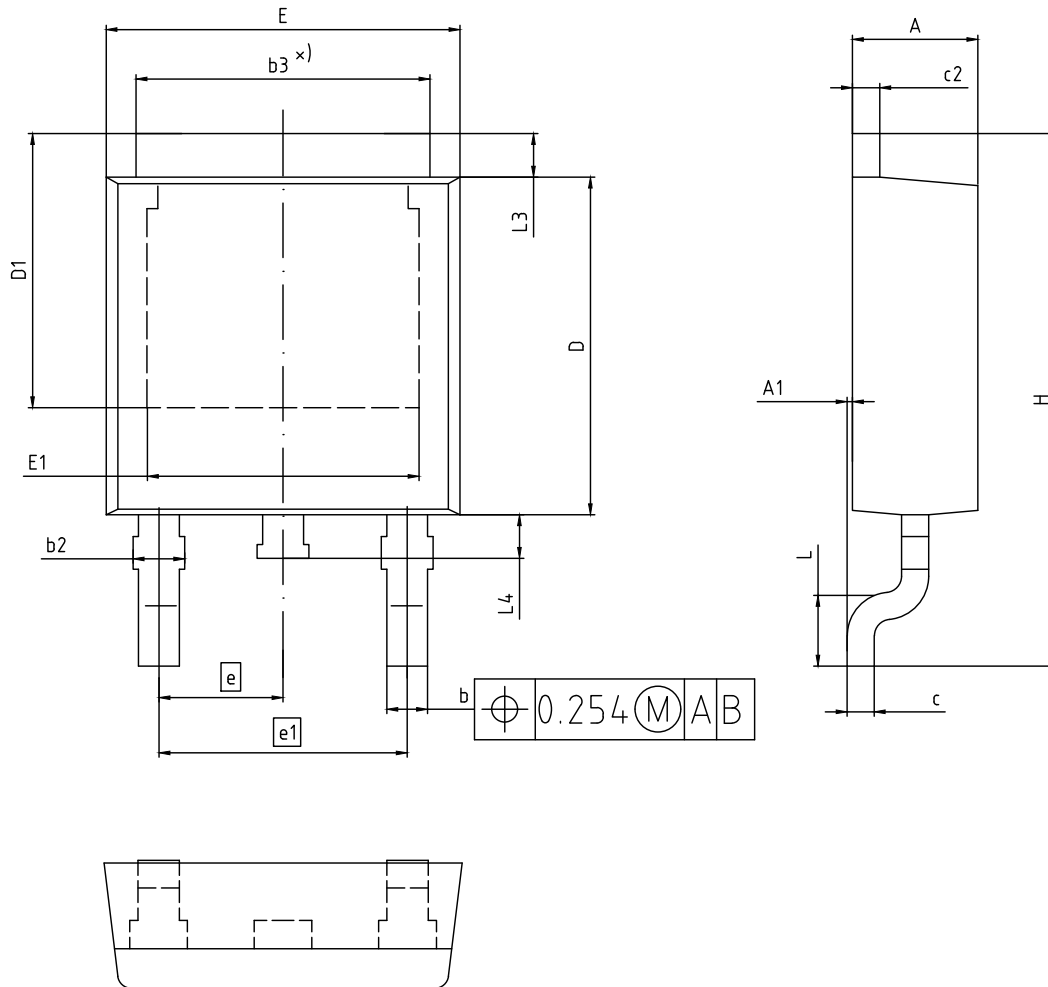


$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

Diagram Gate charge waveforms



5 Package Outlines



ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

DIMENSION	MILLIMETERS	
	MIN.	MAX.
A	2.16	2.41
A1	0.00	0.15
b	0.64	0.89
b2	0.65	1.15
b3	4.95	5.50
c	0.46	0.61
c2	0.40	0.98
D	5.97	6.22
D1	5.02	5.84
E	6.35	6.73
E1	4.32	5.50
e	2.29	
e1	4.57	
N	3	
H	9.40	10.48
L	1.18	1.78
L3	0.89	1.27
L4	0.51	1.02

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Figure 1 Outline PG-TO252-3, dimensions in mm

Revision History

IPD090N03L G E8177

Revision: 2020-09-14, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2020-09-14	Update POD

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