

# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™

OptiMOS™ Power-Transistor, 60 V  
IPD025N06N

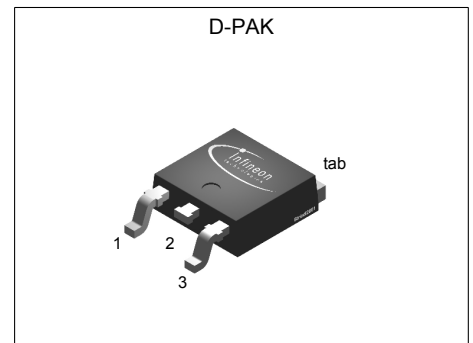
## Data Sheet

Rev. 2.5  
Final

## 1 Description

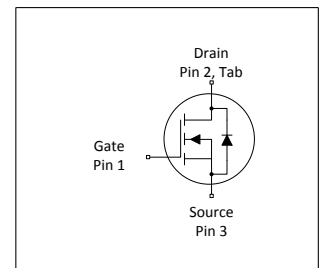
### Features

- Optimized for synchronous rectification
- 100% avalanche tested
- Superior thermal resistance
- N-channel, normal level
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(on),max}$	2.5	mΩ
$I_D$	90	A
$Q_{OSS}$	81	nC
$Q_G(0V..10V)$	71	nC



Type / Ordering Code	Package	Marking	Related Links
IPD025N06N	PG-TO252-3	025N06N	-

<sup>1)</sup> J-STD20 and JESD22

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## 2 Maximum ratings

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

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	$I_D$	-	-	90	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ , $R_{thJA}=50\text{K/W}$
Pulsed drain current <sup>1)</sup>	$I_{D,pulse}$	-	-	360	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	-	-	210	mJ	$I_D=90\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	167 3.0	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

## 3 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	0.5	0.9	K/W	-
Device on PCB, minimal footprint	$R_{thJA}$	-	-	62	K/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area <sup>3)</sup>	$R_{thJA}$	-	-	40	K/W	-
Soldering temperature, wave and reflow soldering are allowed	$T_{sold}$	-	-	260	°C	Reflow MSL1

<sup>1)</sup> See figure 3 for more detailed information

<sup>2)</sup> See figure 13 for more detailed information

<sup>3)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

## 4 Electrical characteristics

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2.1	2.8	3.3	V	$V_{DS}=V_{GS}$ , $I_D=95\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.5 10	1 100	$\mu\text{A}$	$V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	2.1 2.7	2.5 3.8	$\text{m}\Omega$	$V_{GS}=10\text{ V}$ , $I_D=90\text{ A}$ $V_{GS}=6\text{ V}$ , $I_D=22.5\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	-	1.7	2.6	$\Omega$	-
Transconductance	$g_{fs}$	80	160	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=90\text{ A}$

**Table 5 Dynamic characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	5200	6500	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	1200	1500	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	48	96	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	16	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=90\text{ A}$ , $R_{G,ext,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	20	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=90\text{ A}$ , $R_{G,ext,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	34	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=90\text{ A}$ , $R_{G,ext,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	12	-	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=90\text{ A}$ , $R_{G,ext,ext}=1.6\text{ }\Omega$

<sup>1)</sup> Defined by design. Not subject to production test

**Table 6 Gate charge characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	24	-	nC	$V_{DD}=30\text{ V}$ , $I_D=90\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	14	-	nC	$V_{DD}=30\text{ V}$ , $I_D=90\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge <sup>2)</sup>	$Q_{gd}$	-	13	17	nC	$V_{DD}=30\text{ V}$ , $I_D=90\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	-	23	-	nC	$V_{DD}=30\text{ V}$ , $I_D=90\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	$Q_g$	-	71	83	nC	$V_{DD}=30\text{ V}$ , $I_D=90\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.7	-	V	$V_{DD}=30\text{ V}$ , $I_D=90\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	62	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge <sup>2)</sup>	$Q_{oss}$	-	81	102	nC	$V_{DD}=30\text{ V}$ , $V_{GS}=0\text{ V}$

**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	90	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	360	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	1.0	1.2	V	$V_{GS}=0\text{ V}$ , $I_F=90\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time <sup>2)</sup>	$t_{rr}$	-	83	133	ns	$V_R=30\text{ V}$ , $I_F=I_S$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	105	-	nC	$V_R=30\text{ V}$ , $I_F=I_S$ , $di_F/dt=100\text{ A}/\mu\text{s}$

<sup>1)</sup> See "Gate charge waveforms" for parameter definition

<sup>2)</sup> Defined by design. Not subject to production test

## 5 Electrical characteristics diagrams

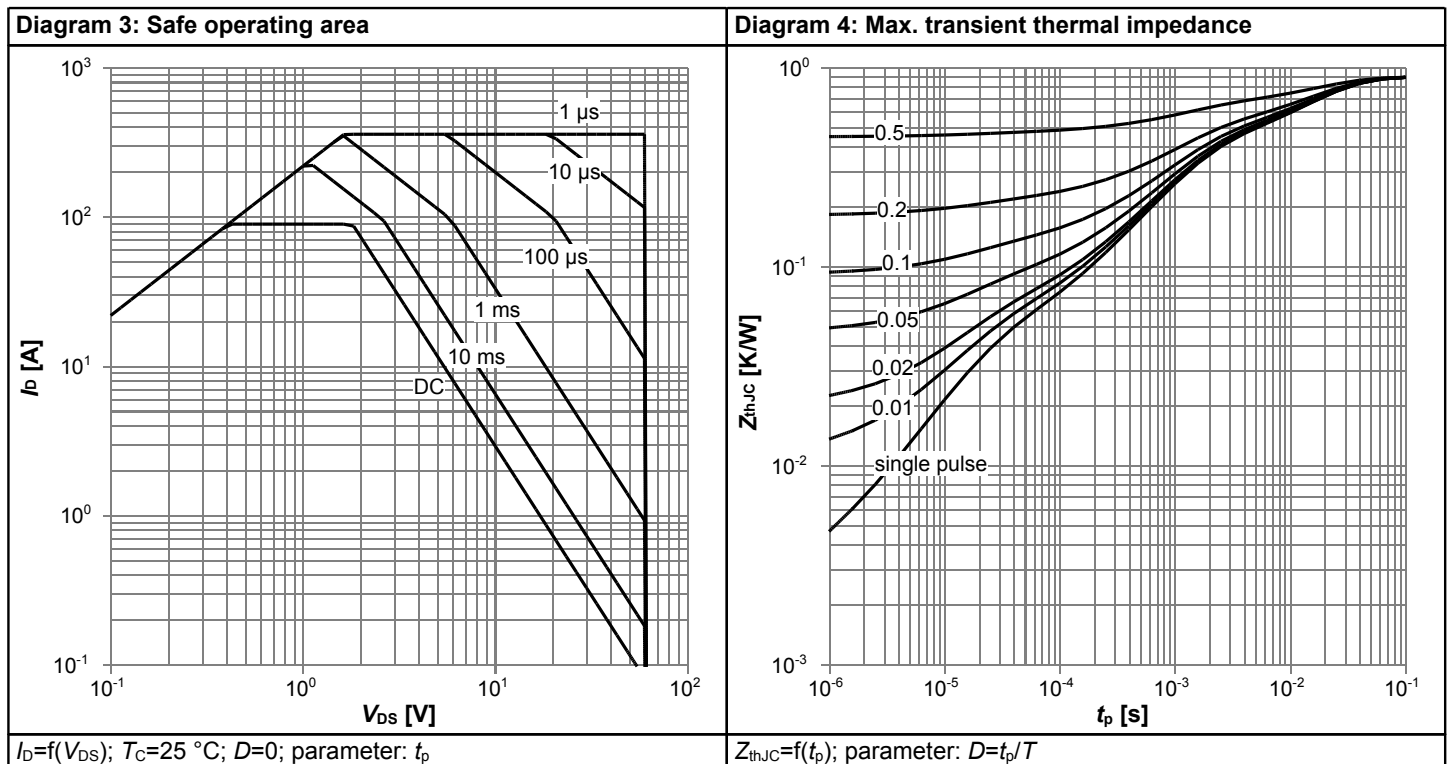
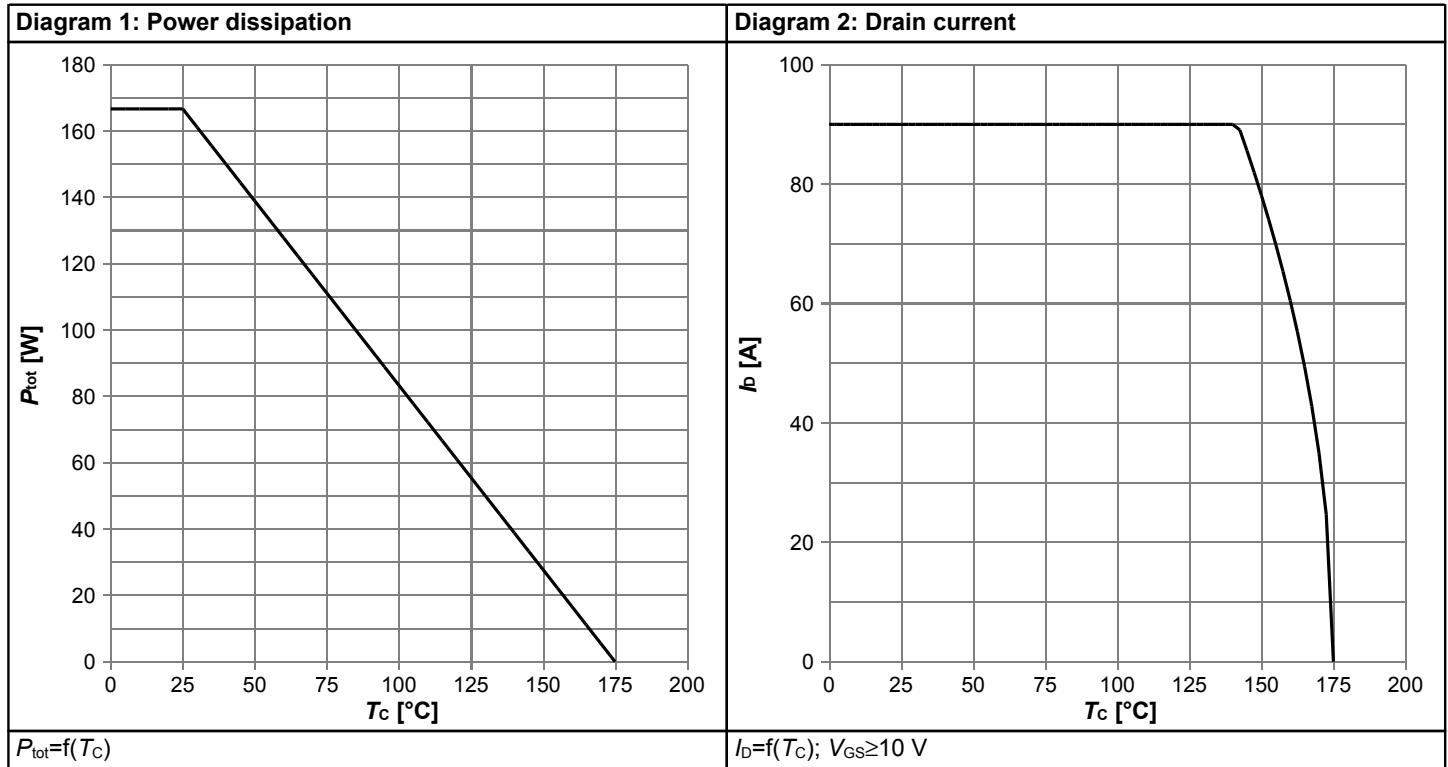
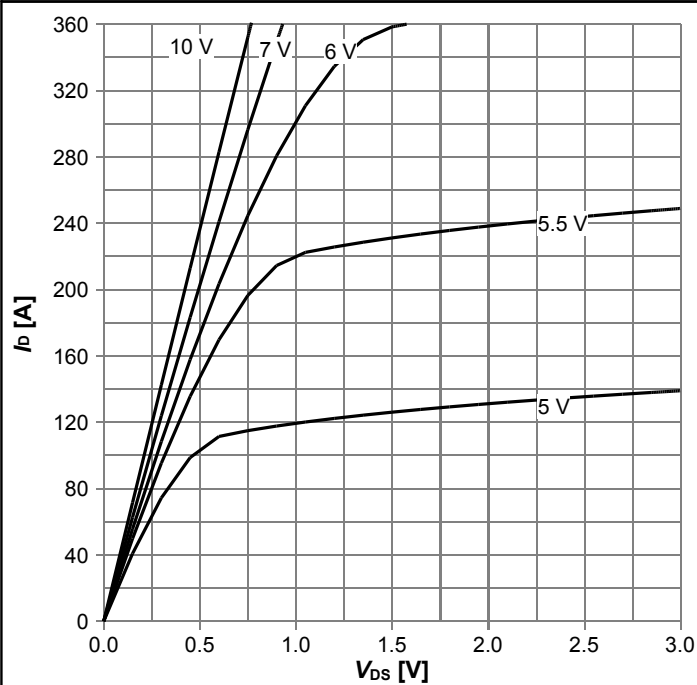
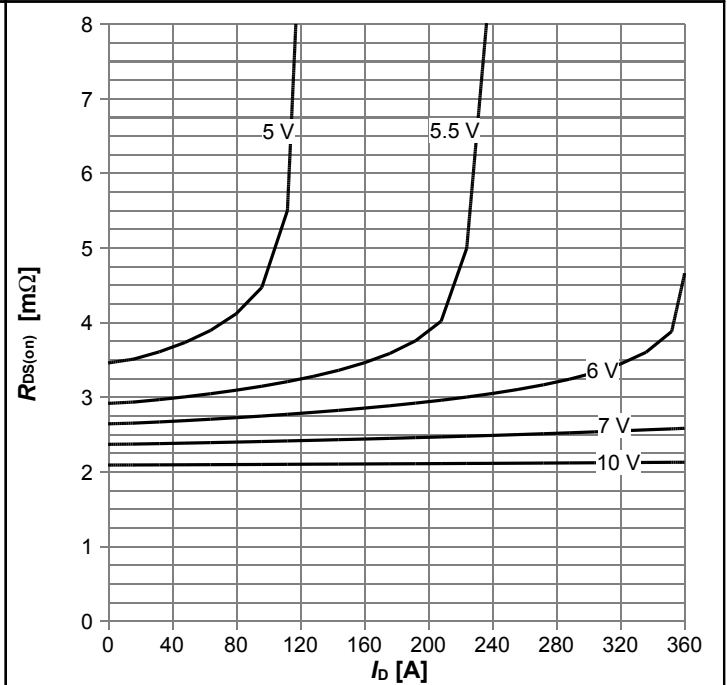


Diagram 5: Typ. output characteristics



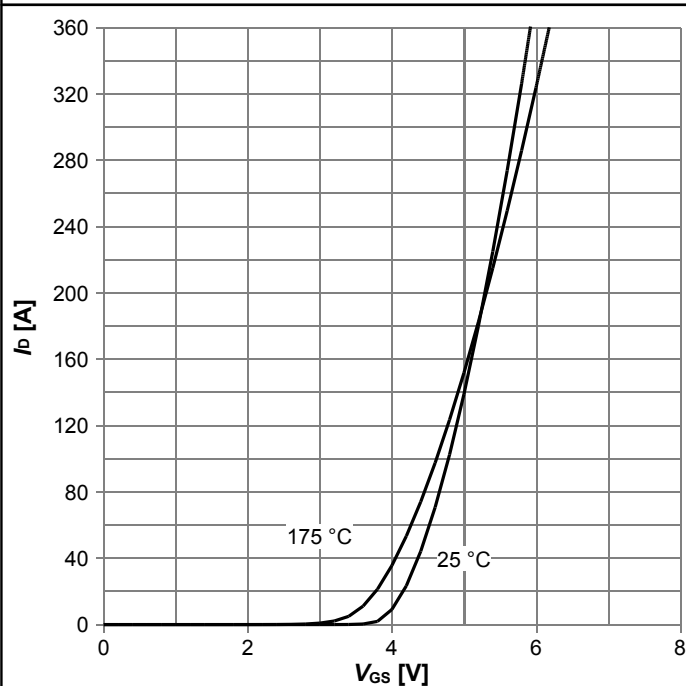
$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



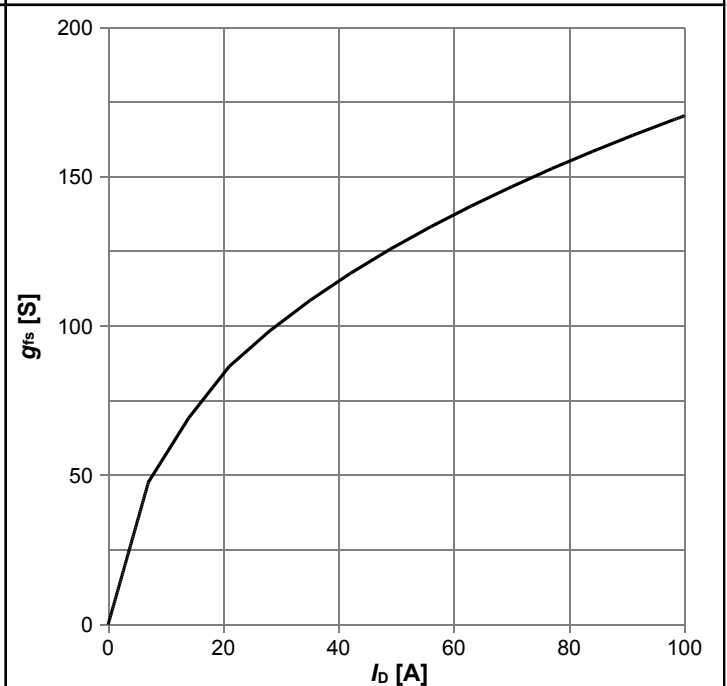
$R_{DS(on)}=f(I_D); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



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

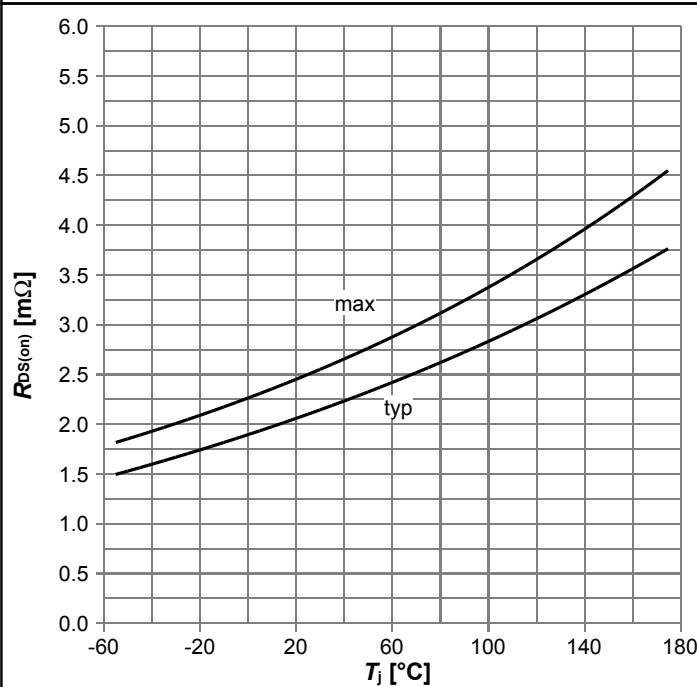
Diagram 8: Typ. forward transconductance



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

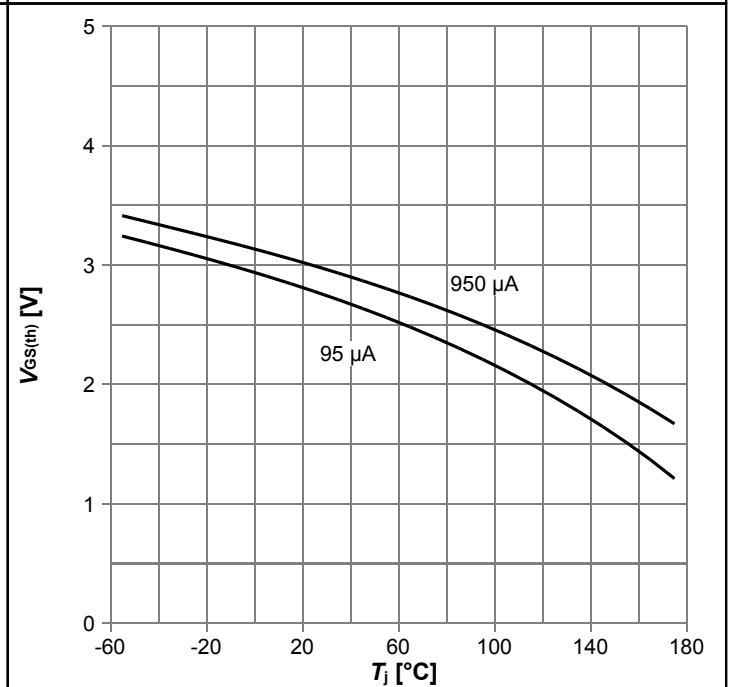


Diagram 9: Drain-source on-state resistance



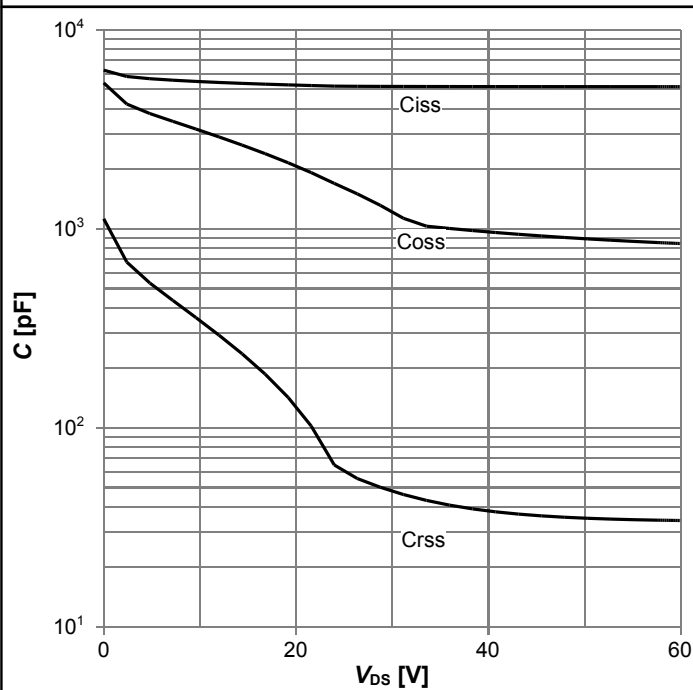
$R_{DS(on)}=f(T_j)$ ;  $I_D=90$  A;  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



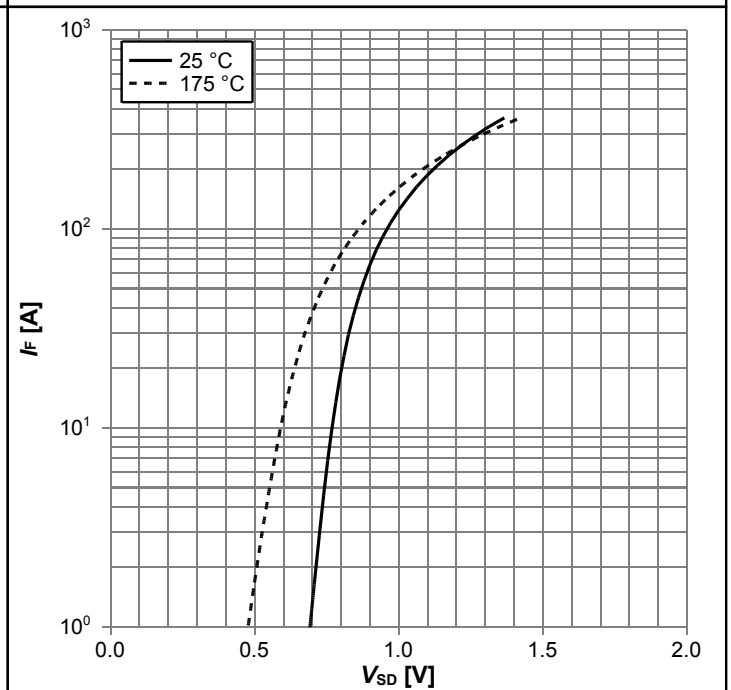
$V_{GS(th)}=f(T_j)$ ;  $V_{GS}=V_{DS}$

Diagram 11: Typ. capacitances



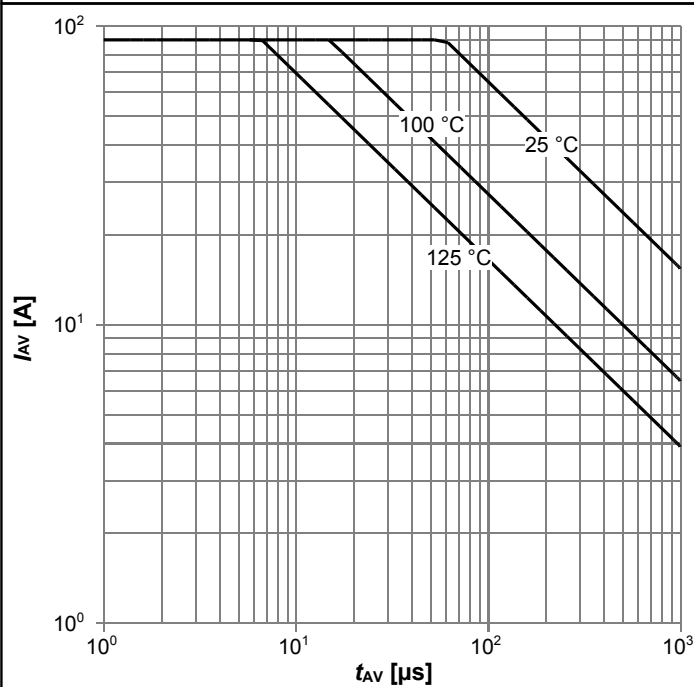
$C=f(V_{DS})$ ;  $V_{GS}=0$  V;  $f=1$  MHz

Diagram 12: Forward characteristics of reverse diode



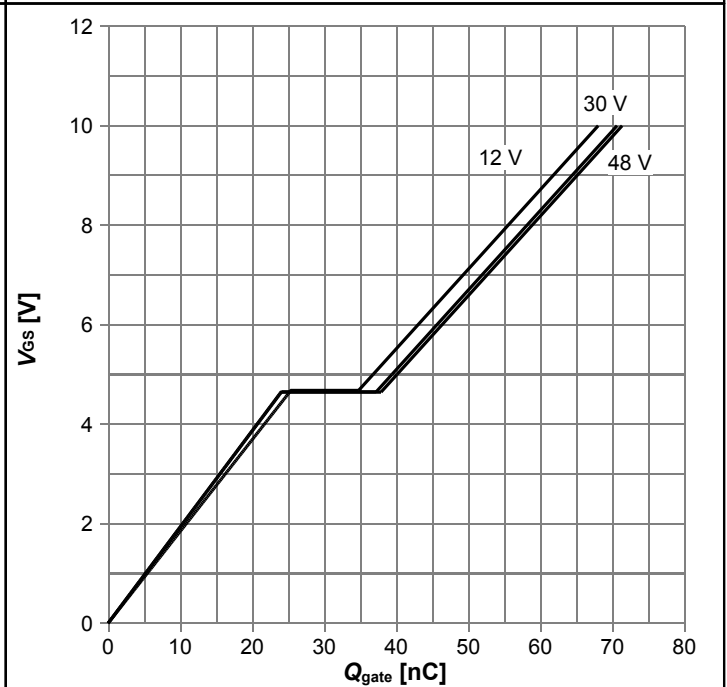
$I_F=f(V_{SD})$ ; parameter:  $T_j$

Diagram 13: Avalanche characteristics



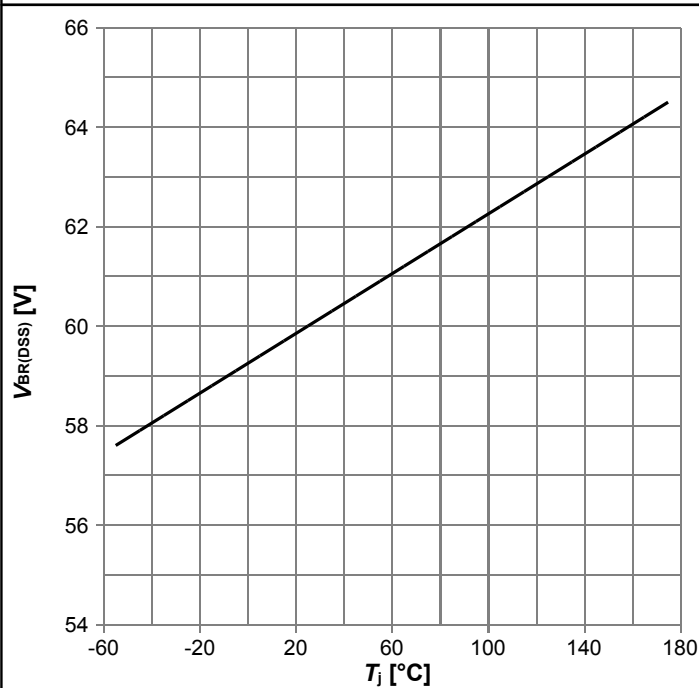
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j(start)}$

Diagram 14: Typ. gate charge



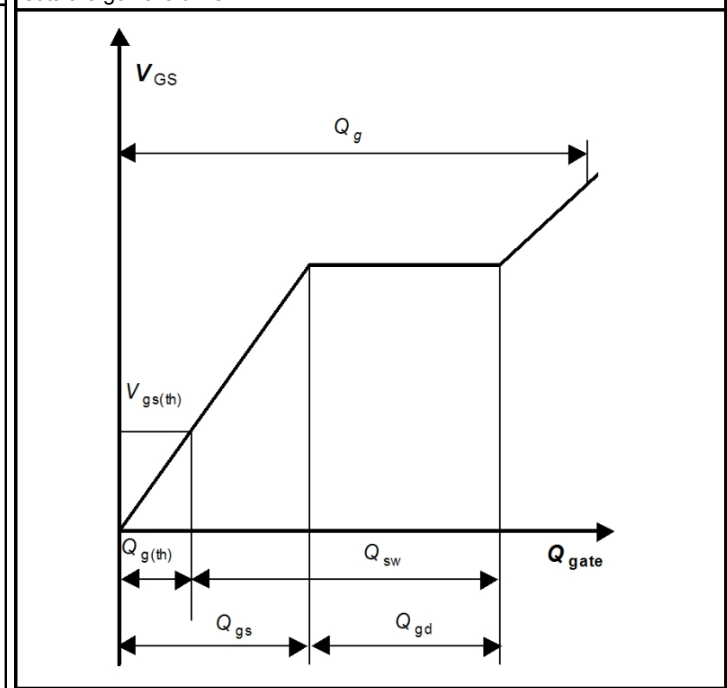
$V_{GS}=f(Q_{gate}); I_D=90A$  pulsed; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

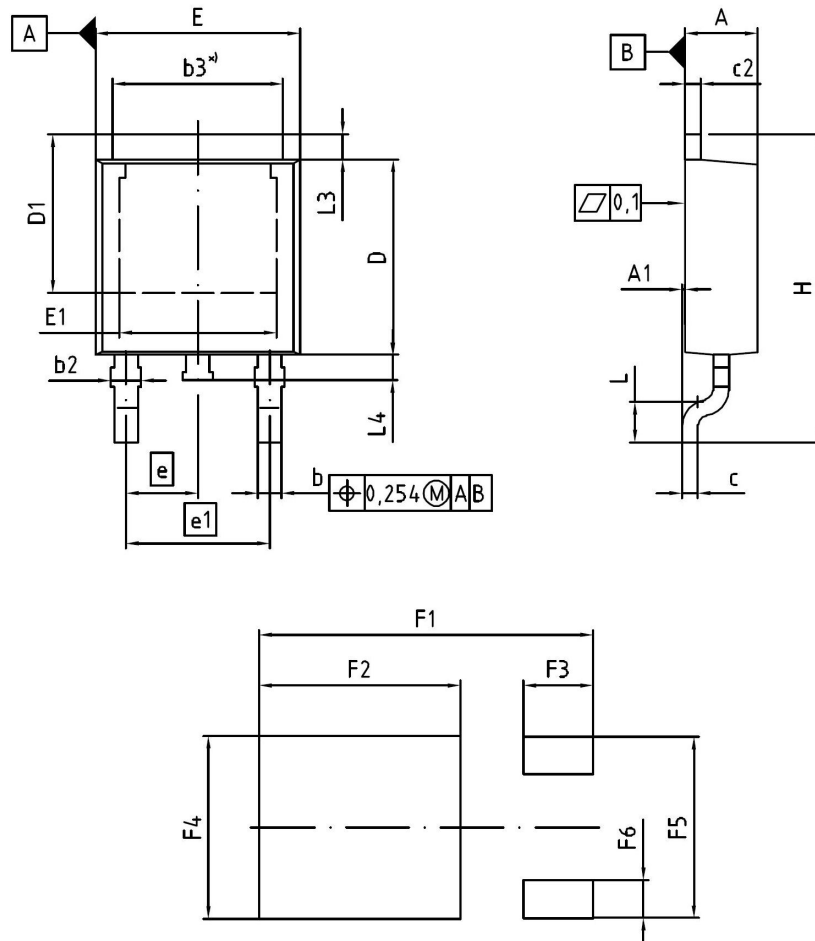


$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

Gate charge waveforms



## 6 Package Outlines



\*) mold flash not included

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.21	0.185	0.205
e	2.29 (BSC)		0.090 (BSC)	
e1	4.57		0.180	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.60		0.417	
F2	6.40		0.252	
F3	2.20		0.087	
F4	5.80		0.228	
F5	5.76		0.227	
F6	1.20		0.047	

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REVISION 04

Figure 1 Outline PG-T0252-3, dimensions in mm/inches

## Revision History

IPD025N06N

**Revision: 2014-07-23, Rev. 2.5**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.5	2014-07-23	Rev.2.5

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