# OptiMOS^{TM}3 Power-Transistor

Features

• N-channel, normal level

• Excellent gate charge x $R_{DS(on)}$ product (FOM)

• Very low on-resistance $R_{DS(on)}$

• 175 °C operating temperature

• Pb-free lead plating; RoHS compliant

• Qualified according to JEDEC[1] for target application

• Ideal for high-frequency switching and synchronous rectification

Product Summary

V_{DS}	200	V
$R_{DS(on),max}$	32	mΩ
I_D	34	A

Type	IPD320N20N3 G
Package	PG-TO252-3
Marking	320N20N
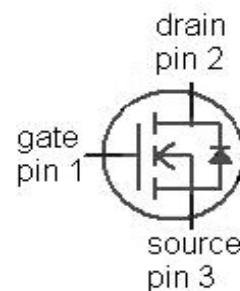
Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	34	A
		T_C=100 °C	24	
Pulsed drain current[2]	$I_{D,pulse}$	T_C=25 °C	136	
Avalanche energy, single pulse	E_{AS}	I_D=34 A, R_{GS}=25 Ω	190	mJ
Reverse diode dv/dt	dv/dt		10	kV/µs
Gate source voltage	V_{GS}		±20	V
Power dissipation	P_{tot}	T_C=25 °C	136	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

[1]J-STD20 and JESD22

[2] See figure 3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	-	1.1	K/W
Thermal resistance, junction - ambient	R_{thJA}	minimal footprint	-	-	75	
		6 cm2 cooling area[3]	-	-	50	

Electrical characteristics, at T_j=25 °C, unless otherwise specified

Static characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=1 mA	200	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=90 µA	2	3	4	
Zero gate voltage drain current	I_{DSS}	V_{DS}=160 V, V_{GS}=0 V, T_j=25 °C	-	0.1	1	µA
		V_{DS}=160 V, V_{GS}=0 V, T_j=125 °C	-	10	100	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	1	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=34 A	-	27	32	mΩ
Gate resistance	R_G		-	2.5	-	Ω
Transconductance	g_{fs}	$|V_{DS}|$>2$|I_D|R_{DS(on)max}$, I_D=34 A	28	55	-	S

[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.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz	-	1770	2350	pF
Output capacitance	C_{oss}		-	135	180	
Reverse transfer capacitance	C_{rss}		-	4	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=100 V, V_{GS}=10 V, I_{D}=17 A, $R_{G,ext}$=1.6 Ω	-	11	-	ns
Rise time	t_{r}		-	9	-	
Turn-off delay time	$t_{d(off)}$		-	21	-	
Fall time	t_{f}		-	4	-	

Gate Charge Characteristics[4]

Parameter	Symbol	Conditions	Values			Unit
Gate to source charge	Q_{gs}	V_{DD}=100 V, I_{D}=17 A, V_{GS}=0 to 10 V	-	8	-	nC
Gate to drain charge	Q_{gd}		-	3	-	
Switching charge	Q_{sw}		-	5	-	
Gate charge total	Q_{g}		-	22	29	
Gate plateau voltage	$V_{plateau}$		-	4.4	-	V
Output charge	Q_{oss}	V_{DD}=100 V, V_{GS}=0 V	-	54	72	nC

Reverse Diode

Parameter	Symbol	Conditions	Values			Unit
Diode continous forward current	I_{S}	T_{C}=25 °C	-	-	34	A
Diode pulse current	$I_{S,pulse}$		-	-	136	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_{F}=34 A, T_{j}=25 °C	-	0.9	1.2	V
Reverse recovery time	t_{rr}	V_{R}=100 V, I_{F}=$17A$, di_{F}/dt=100 A/μs	-	110	-	ns
Reverse recovery charge	Q_{rr}		-	500	-	nC

[4] See figure 16 for gate charge parameter definition

1 Power dissipation

P_{tot}=f(T_C)
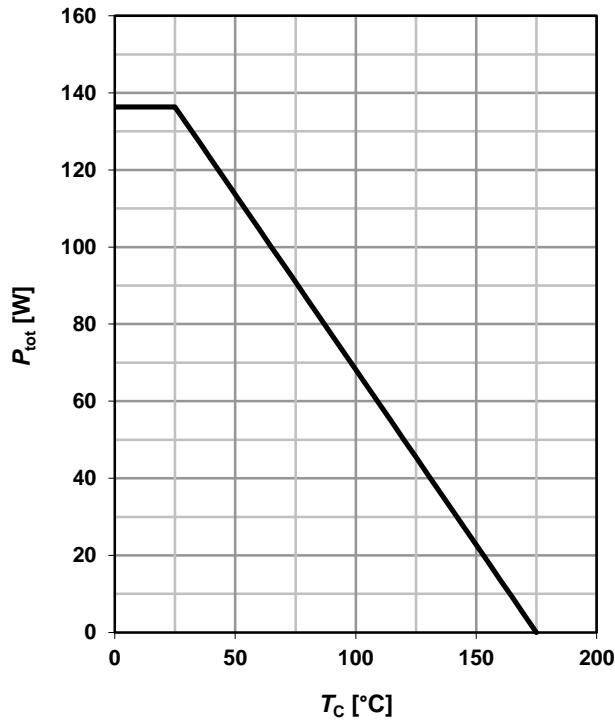
2 Drain current

I_D=f(T_C); V_{GS}≥10 V
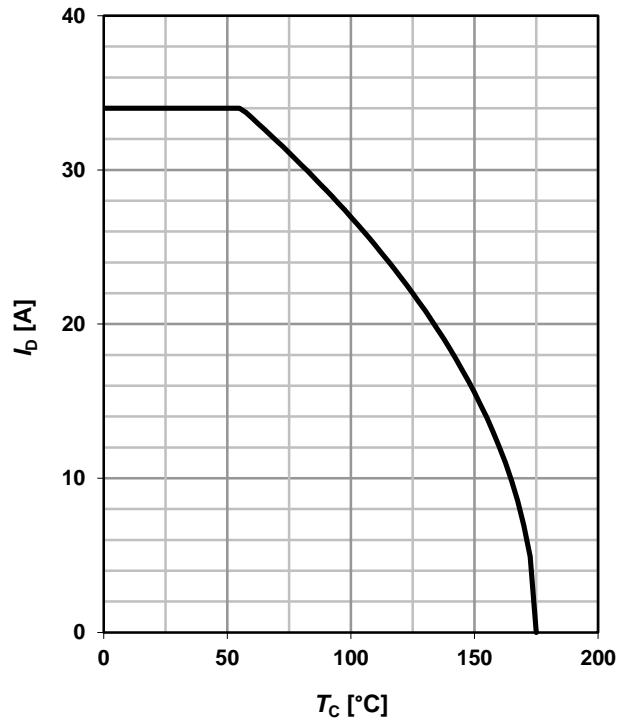
3 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

parameter: t_p
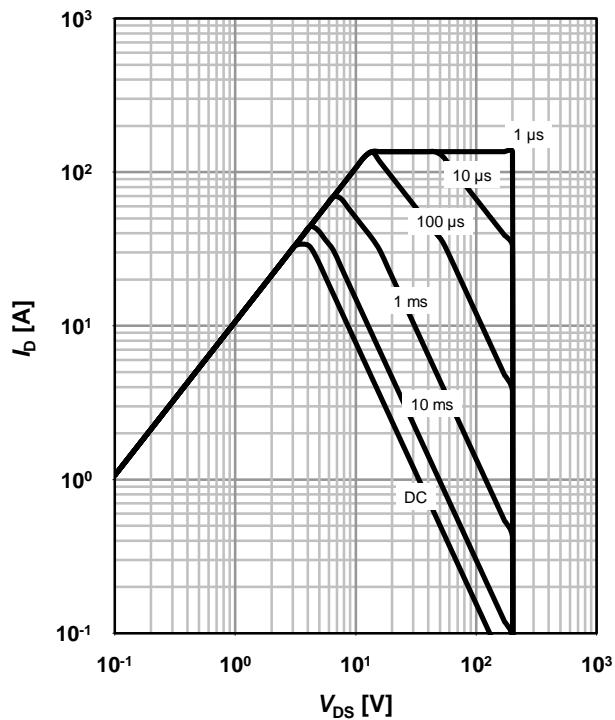
## 4 Max. transient thermal impedance

Z_{thJC}=f(t_p)

parameter: D=t_p/T
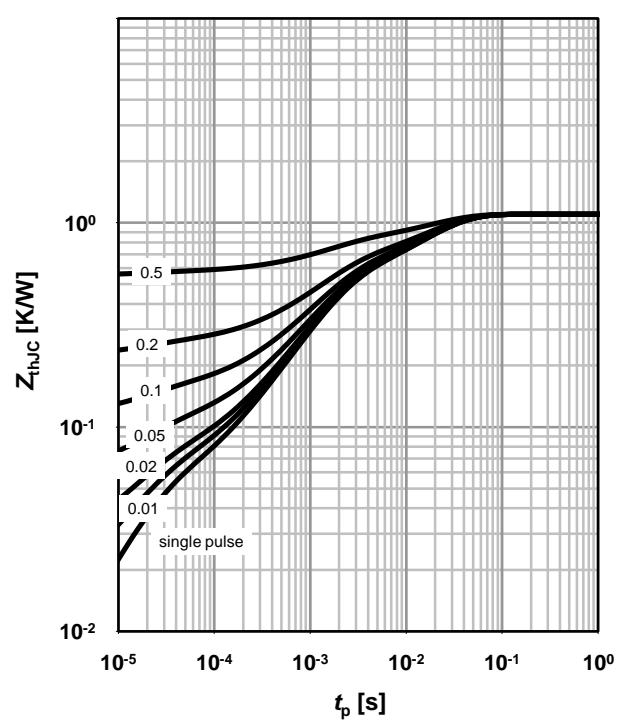
## 5 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

parameter: V_{GS}
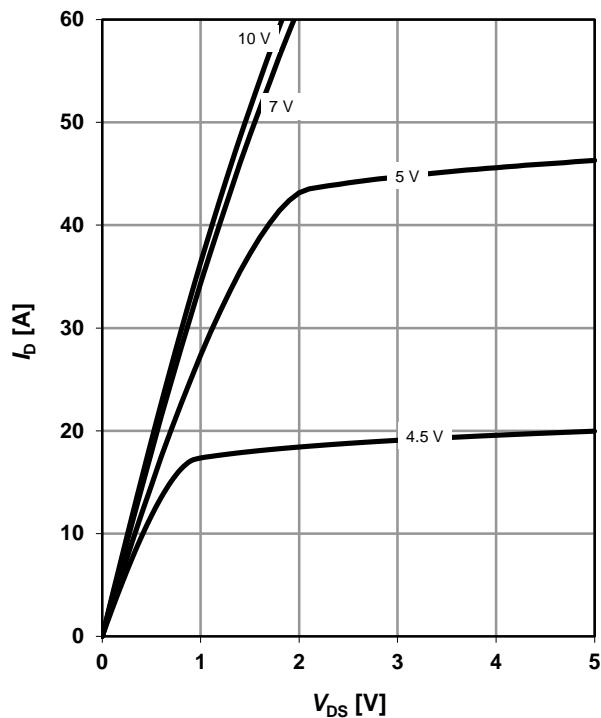
## 6 Typ. drain-source on resistance

$R_{DS(on)}$=f(I_D); T_j=25 °C

parameter: V_{GS}
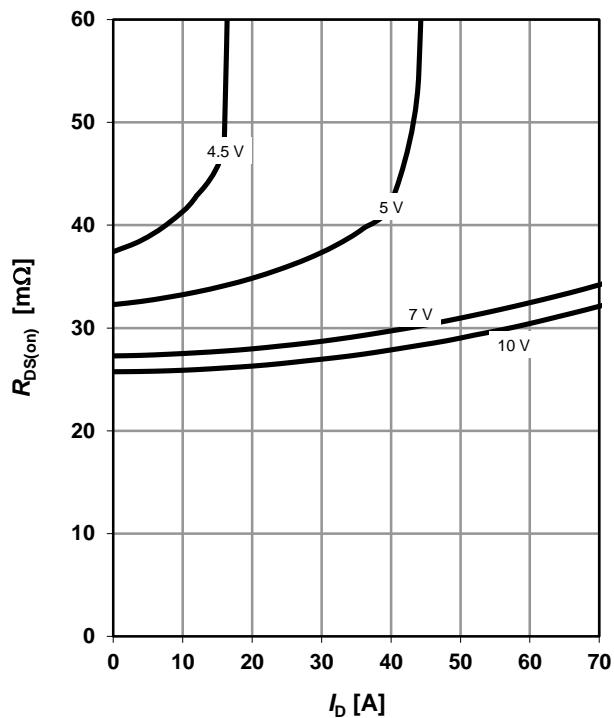
7 Typ. transfer characteristics

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

parameter: T_j
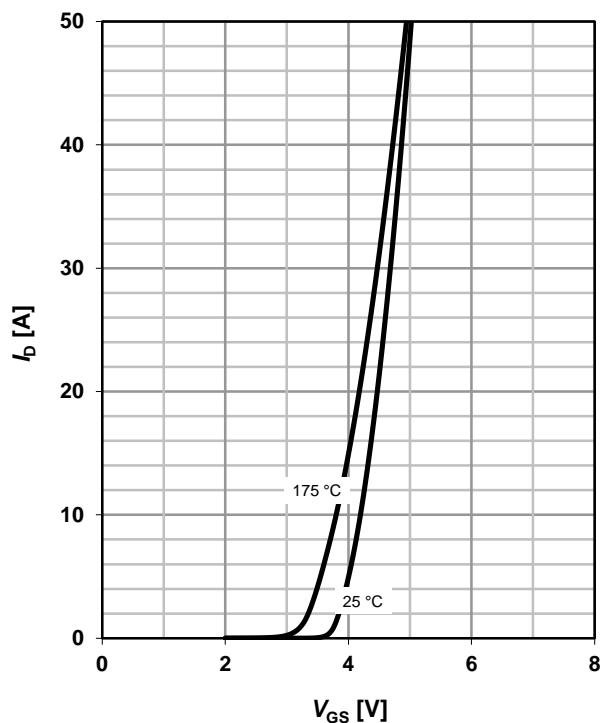
8 Typ. forward transconductance

g_{fs}=f(I_D); T_j=25 °C
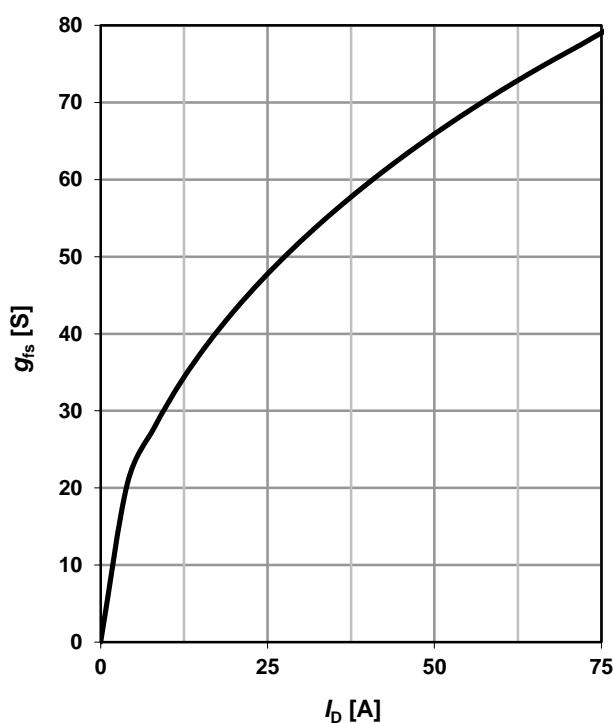
9 Drain-source on-state resistance

$R_{DS(on)}$=f(T_j); I_D=34 A; V_{GS}=10 V
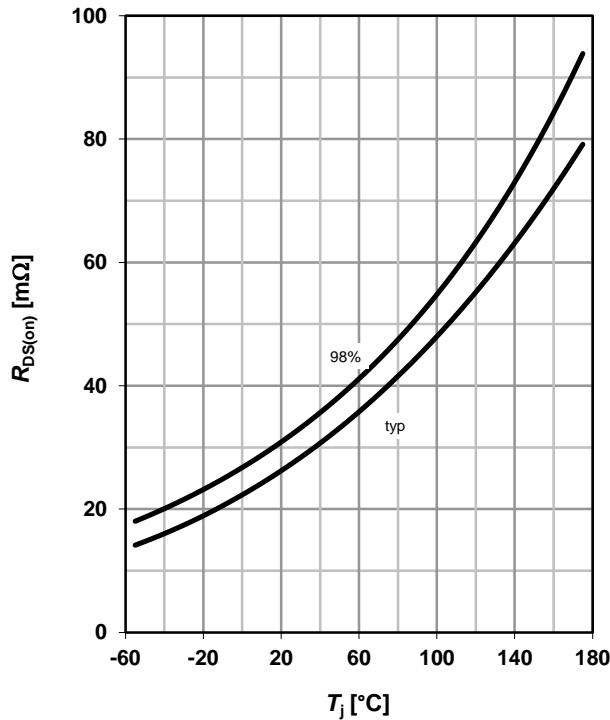

10 Typ. gate threshold voltage

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

parameter: I_D
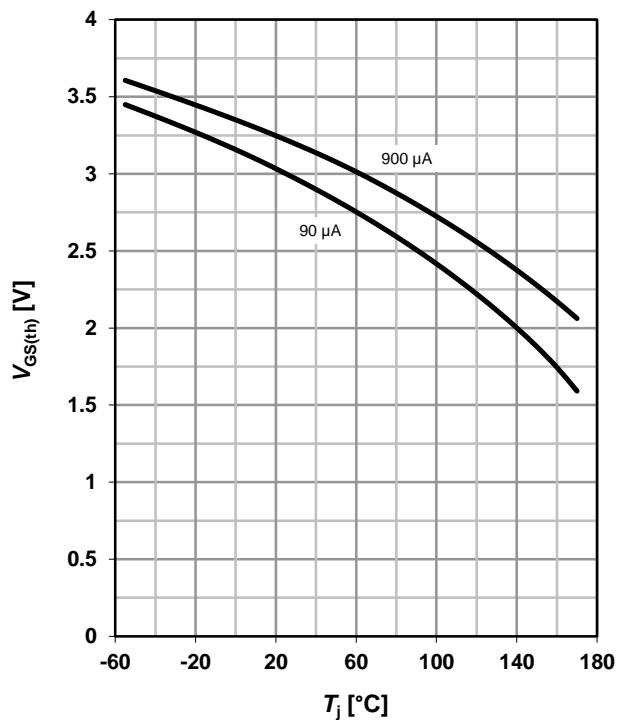
11 Typ. capacitances

C=f(V_{DS}); V_{GS}=0 V; f=1 MHz
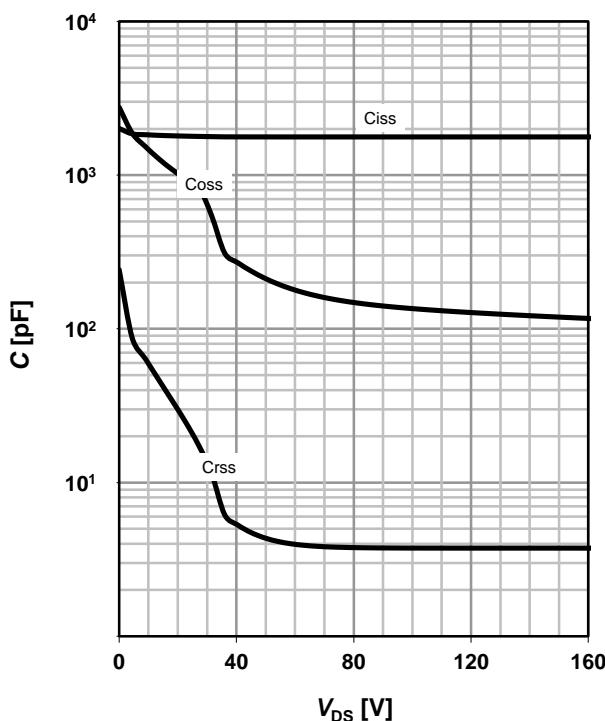
12 Forward characteristics of reverse diode

I_F=f(V_{SD})

parameter: T_j
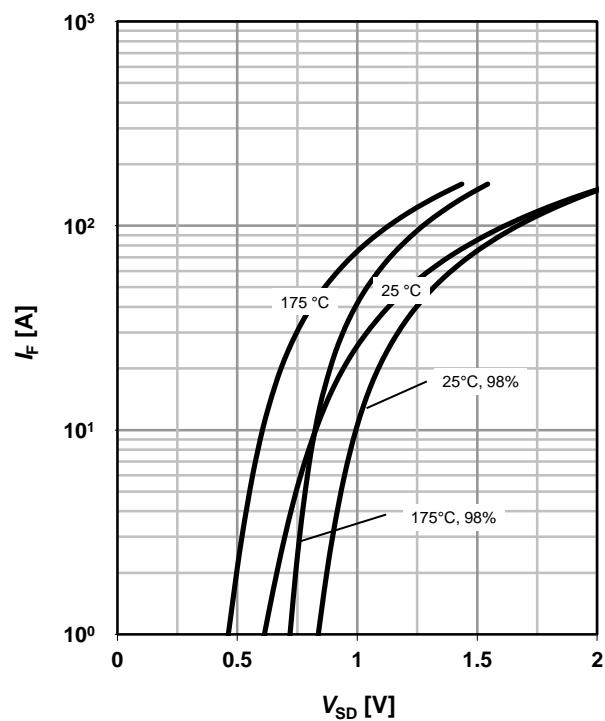
13 Avalanche characteristics

I_{AS}=f(t_{AV}); R_{GS}=25 Ω

parameter: $T_{j(start)}$
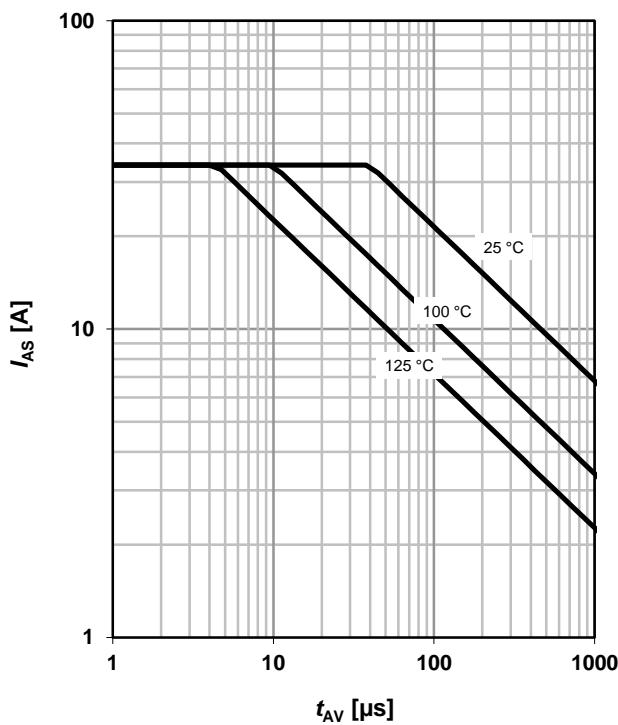
14 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=17 A pulsed

parameter: V_{DD}
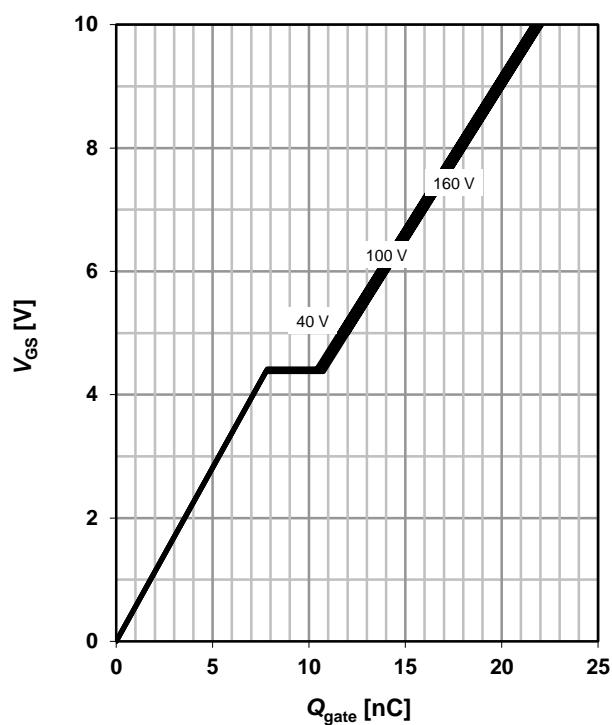
15 Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j); I_D=1 mA
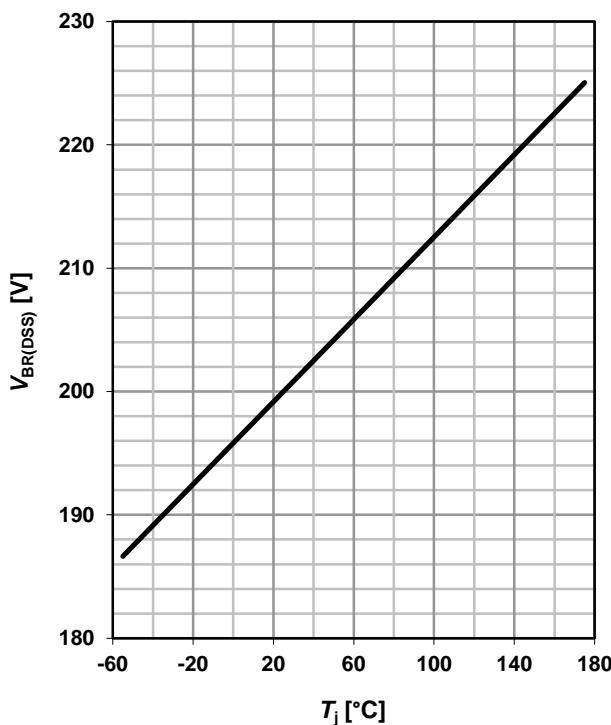
16 Gate charge waveforms
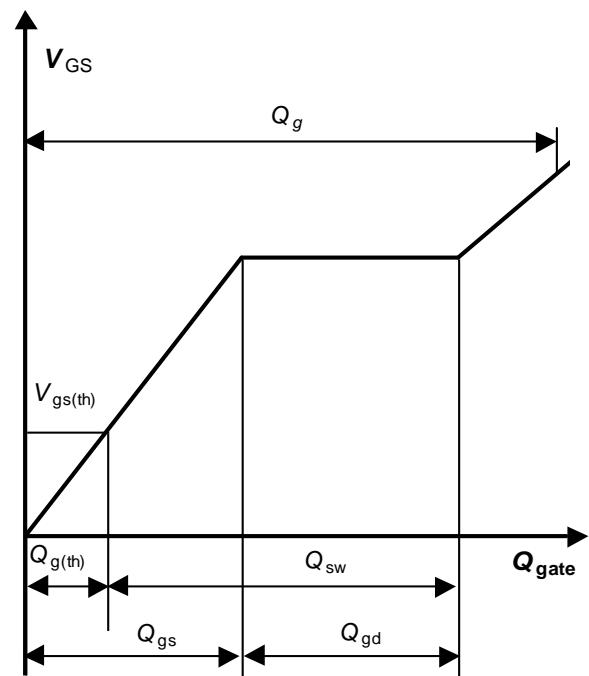
PG-TO252-3: Outline
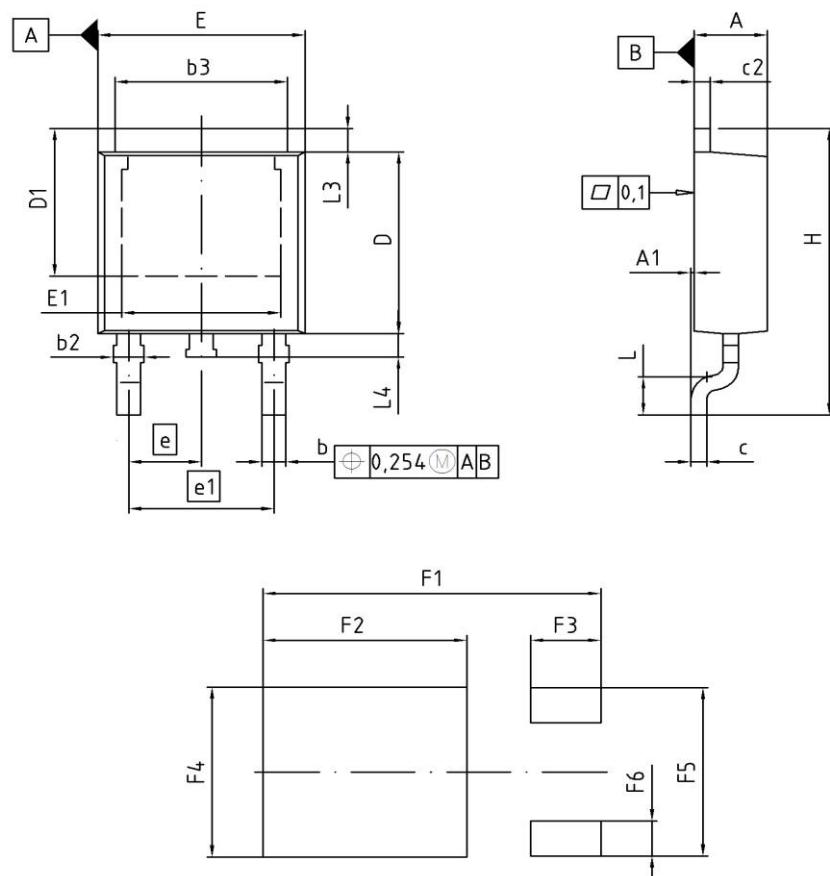
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.21	0.185	0.205
e	2.29		0.090	
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	10.50	10.70	0.413	0.421
F2	6.30	6.50	0.248	0.256
F3	2.10	2.30	0.083	0.091
F4	5.70	5.90	0.224	0.232
F5	5.66	5.86	0.223	0.231
F6	1.10	1.30	0.043	0.051

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