

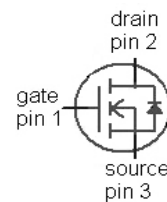
OptiMOS® Power-Transistor
Features

- For fast switching converters and sync. rectification
- N-channel enhancement - normal level
- 175 °C operating temperature
- Avalanche rated
- Pb-free lead plating, RoHS compliant


Product Summary

V_{DS}	60	V
$R_{DS(on),max}$	40	mΩ
I_D	27	A

Type	IPD400N06N G
Package	PG-TO252-3
Marking	400N06N


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}$	27	A
		$T_C=100\text{ °C}$	19	
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ °C}^{1)}$	108	
Avalanche energy, single pulse	E_{AS}	$I_D=27\text{ A}, R_{GS}=25\text{ }\Omega$	80	mJ
Reverse diode dv/dt	dv/dt	$I_D=27\text{ A}, V_{DS}=20\text{ V},$ $di/dt=200\text{ A}/\mu\text{s},$ $T_{j,max}=175\text{ °C}$	6	kV/ μs
Gate source voltage	V_{GS}		± 20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	68	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

¹⁾ See figure 3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	2.2	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	75	
		6 cm ² cooling area ²⁾	-	-	50	

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	60	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=28\text{ }\mu\text{A}$	2	3	4	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.01	1	μA
		$V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	1	100	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=27\text{ A}$	-	31	40	m Ω
Gate resistance	R_G		-	1.5	-	Ω
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=27\text{ A}$	12	24	-	S

²⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (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}	$V_{GS}=0\text{ V}, V_{DS}=30\text{ V},$ $f=1\text{ MHz}$	-	490	650	pF
Output capacitance	C_{oss}		-	130	170	
Reverse transfer capacitance	C_{rss}		-	36	54	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=27\text{ A}, R_G=22\ \Omega$	-	9	13	ns
Rise time	t_r		-	24	36	
Turn-off delay time	$t_{d(off)}$		-	24	36	
Fall time	t_f		-	23	35	

Gate Charge Characteristics³⁾

Gate to source charge	Q_{gs}	$V_{DD}=30\text{ V}, I_D=27\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	2.9	3.9	nC
Gate charge at threshold	$Q_{g(th)}$		-	1.5	1.9	
Gate to drain charge	Q_{gd}		-	5.7	8.5	
Switching charge	Q_{sw}		-	7.1	10	
Gate charge total	Q_g		-	13	17	
Gate plateau voltage	$V_{plateau}$		-	6.0	-	V
Output charge	Q_{oss}	$V_{DD}=30\text{ V}, V_{GS}=0\text{ V}$	-	4.9	6	

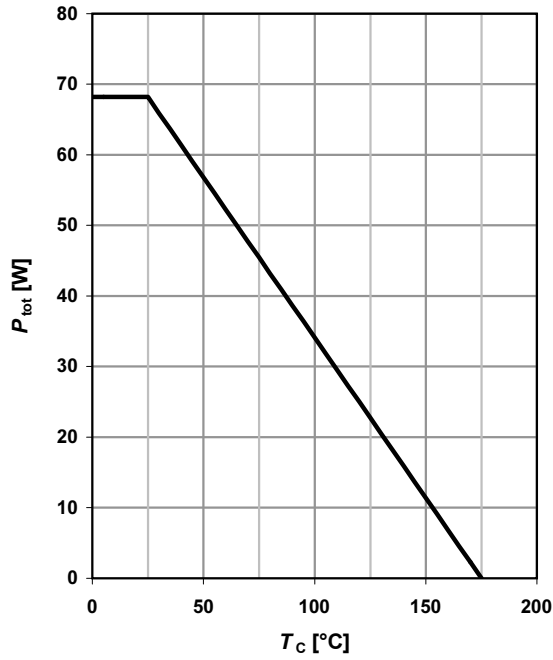
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ }^\circ\text{C}$	-	-	30	A
Diode pulse current	$I_{S,pulse}$		-	-	108	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=27\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.96	1.3	V
Reverse recovery time	t_{rr}	$V_R=30\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	31	40	ns
Reverse recovery charge	Q_{rr}		-	40	50	nC

³⁾ See figure 16 for gate charge parameter definition

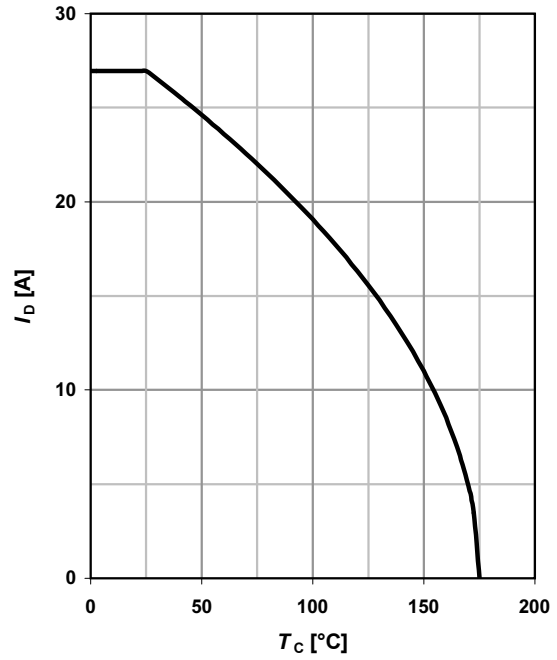
1 Power dissipation

$P_{tot}=f(T_C); V_{GS} \geq 6\text{ V}$



2 Drain current

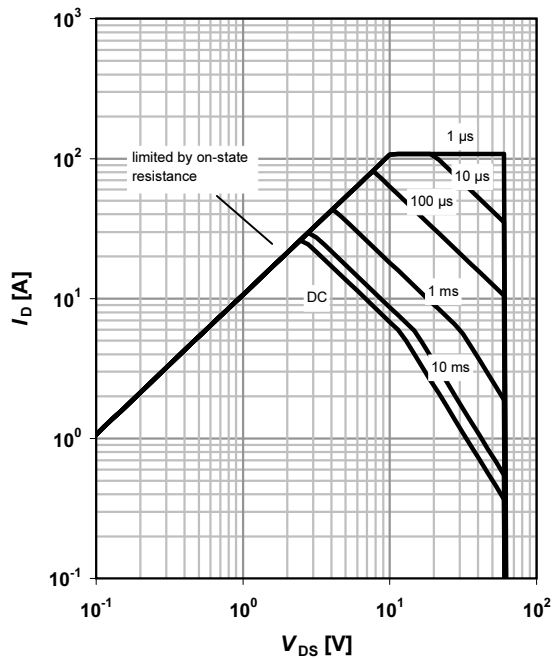
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



3 Safe operating area

$I_D=f(V_{DS}); T_C=25\text{ °C}; D=0$

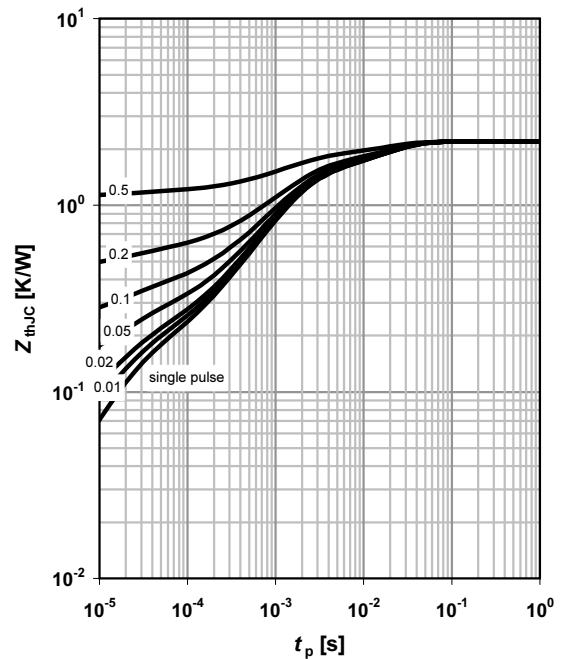
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

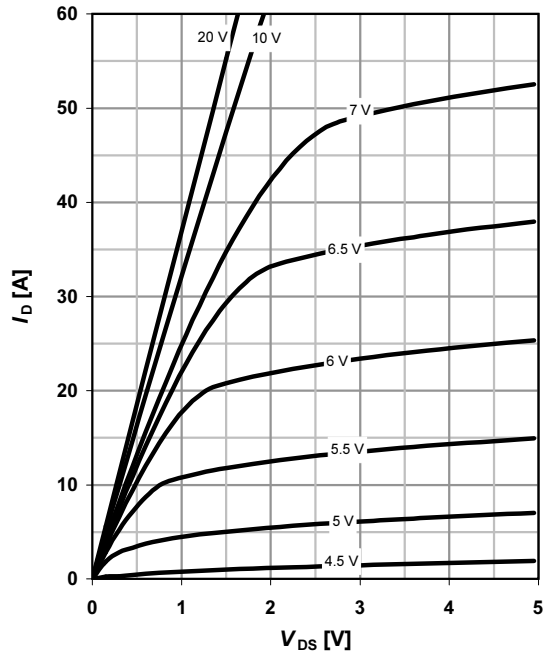
parameter: $D=t_p/T$



5 Typ. output characteristics

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

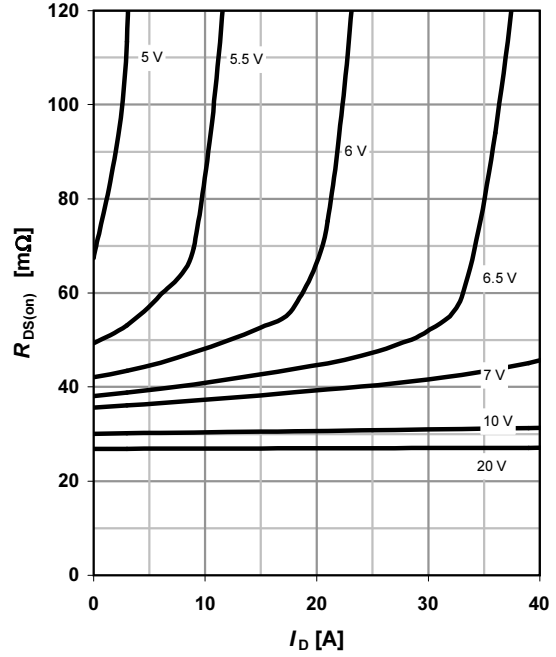
parameter: V_{GS}



6 Typ. drain-source on resistance

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

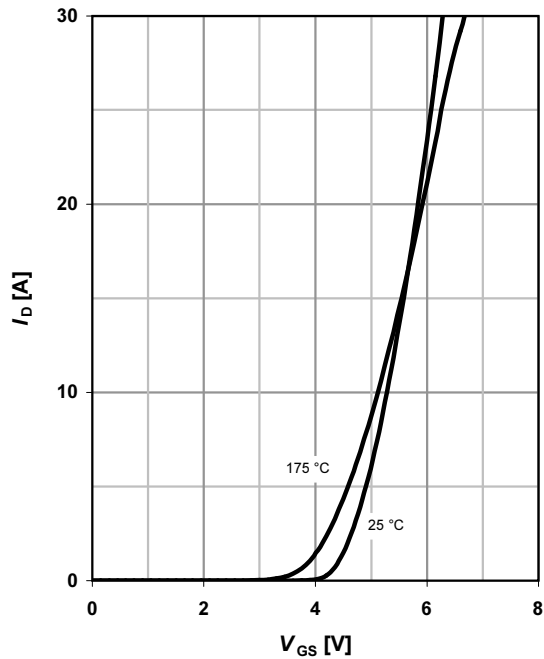
parameter: V_{GS}



7 Typ. transfer characteristics

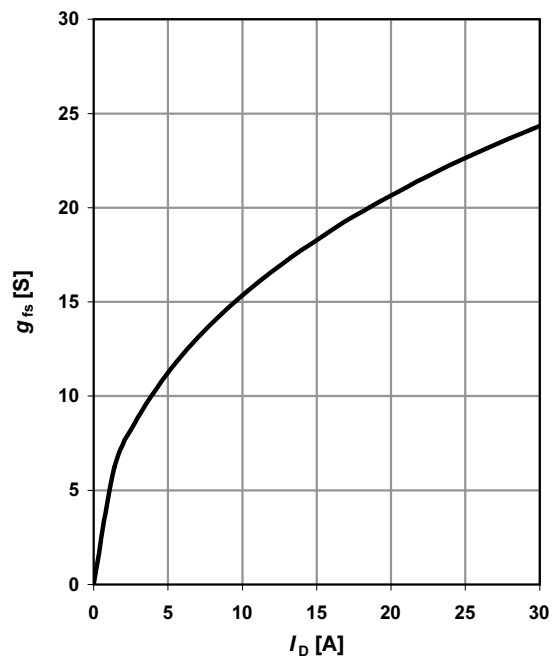
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



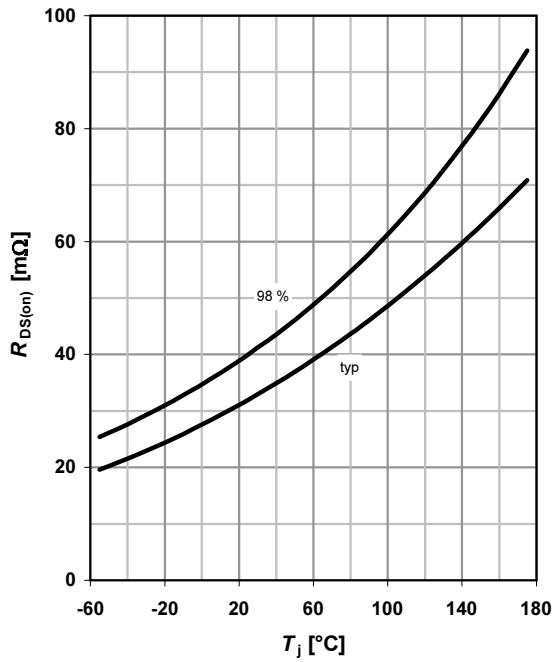
8 Typ. forward transconductance

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



9 Drain-source on-state resistance

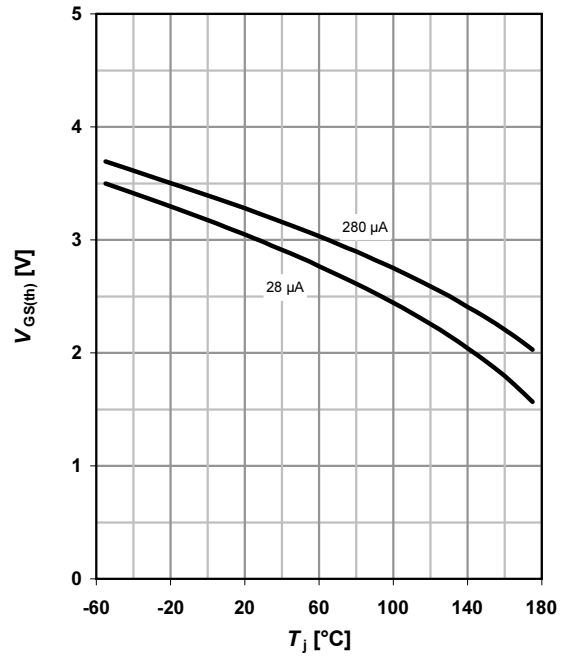
$R_{DS(on)} = f(T_j); I_D = 27 \text{ A}; V_{GS} = 10 \text{ V}$



10 Typ. gate threshold voltage

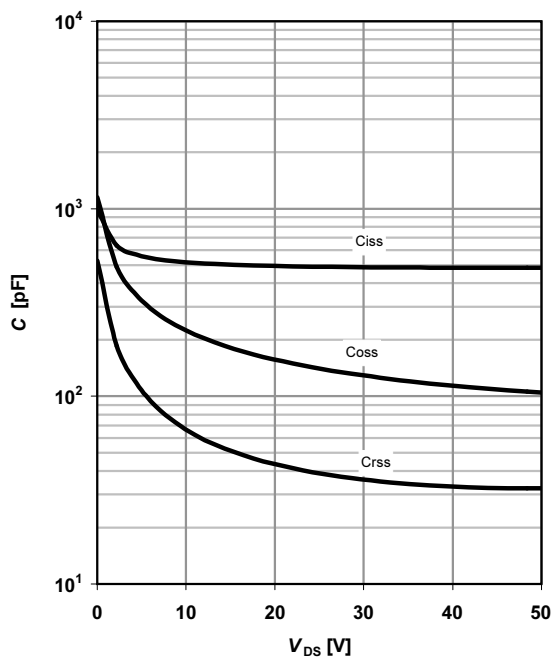
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



11 Typ. capacitances

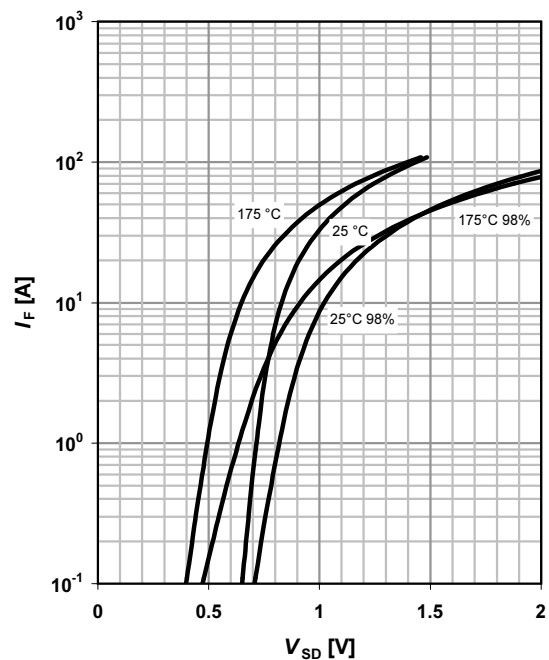
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

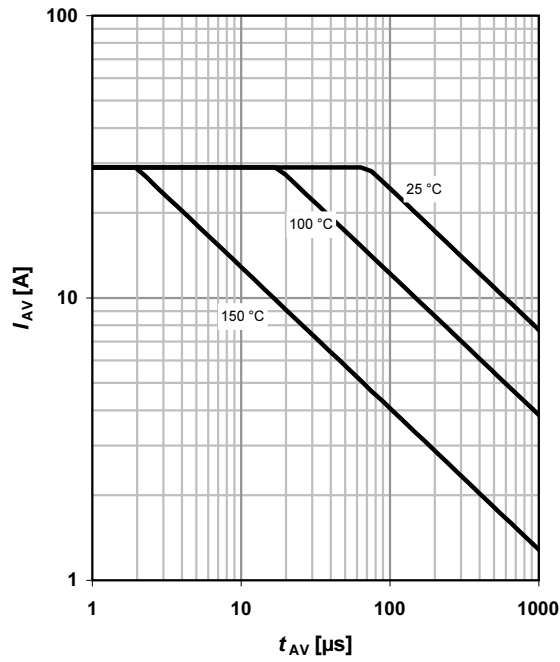
parameter: T_j



13 Avalanche characteristics

$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$

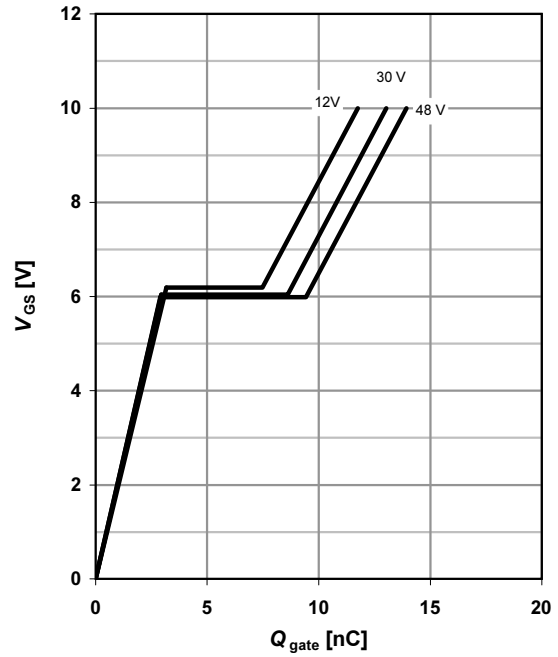
parameter: $T_{j(start)}$



14 Typ. gate charge

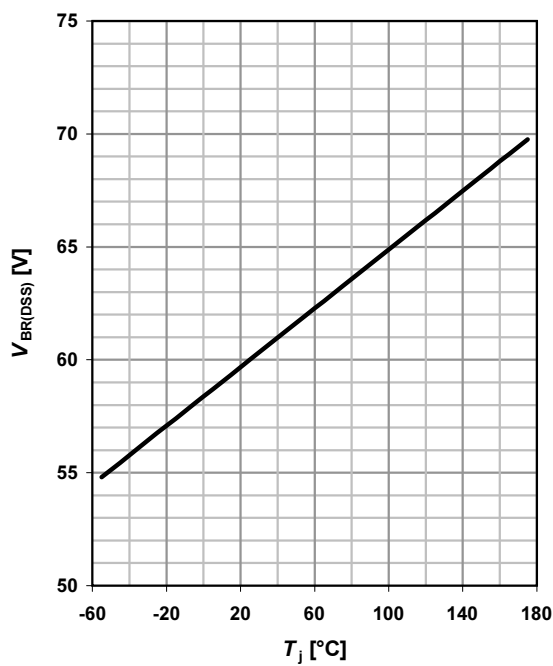
$V_{GS}=f(Q_{gate}); I_D=27 \text{ A pulsed}$

parameter: V_{DD}

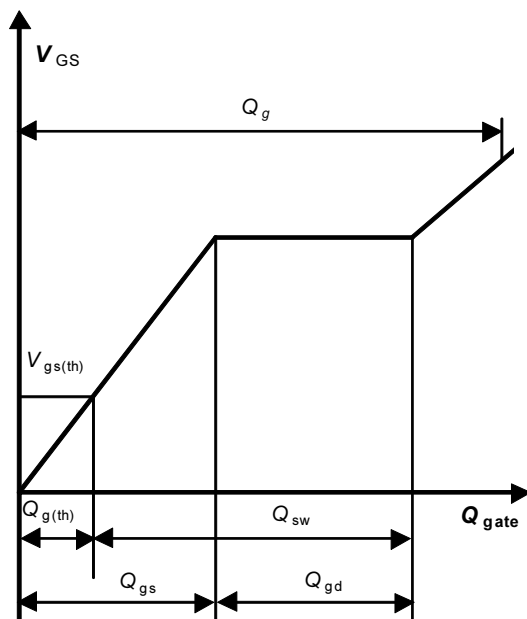


15 Drain-source breakdown voltage

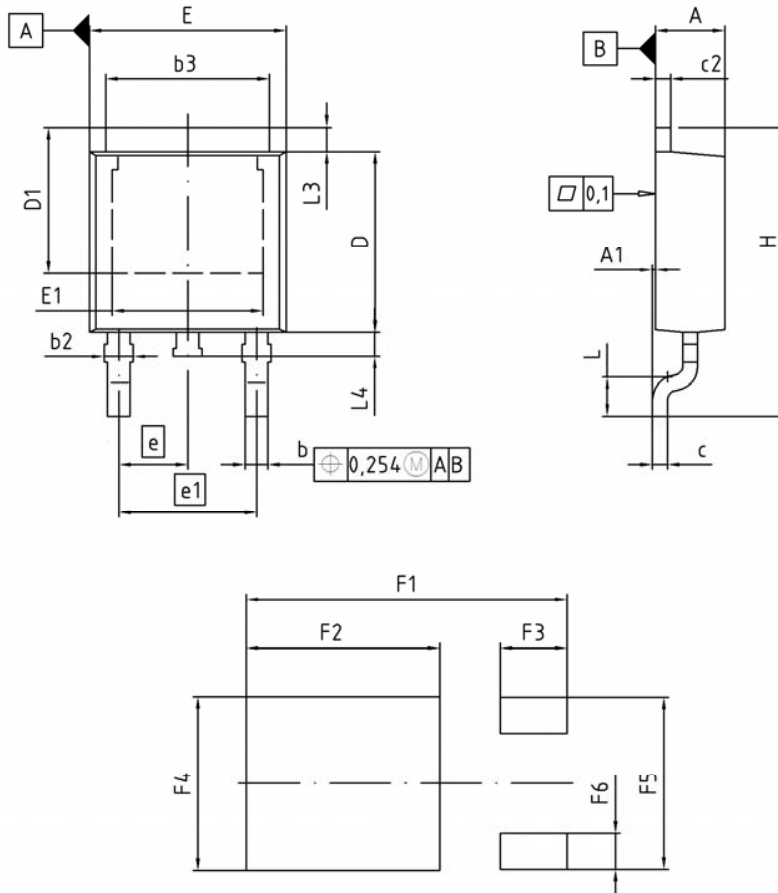
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$



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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