

OptiMOS[®]3 Power-Transistor
Features

- Fast switching MOSFET for SMPS
- Optimized technology for DC/DC converters
- Qualified according to JEDEC¹⁾ for target applications
- N-channel
- Normal level
- Excellent gate charge $\times R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- 100% Avalanche tested
- Pb-free plating; RoHS compliant

Product Summary

V_{DS}	40	V
$R_{DS(on),max}$	16.5	m Ω
I_D	31	A

PG-TSDSON-8



Type	Package	Marking
BSZ165N04NS G	PG-TSDSON-8	165N04N


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$V_{GS}=10\text{ V}, T_C=25\text{ }^\circ\text{C}$	31	A
		$V_{GS}=10\text{ V}, T_C=100\text{ }^\circ\text{C}$	20	
		$V_{GS}=10\text{ V}, T_A=25\text{ }^\circ\text{C}, R_{thJA}=60\text{ K/W}^2)$	8.9	
Pulsed drain current ³⁾	$I_{D,pulse}$	$T_C=25\text{ }^\circ\text{C}$	124	
Avalanche current, single pulse ⁴⁾	I_{AS}	$T_C=25\text{ }^\circ\text{C}$	20	
Avalanche energy, single pulse	E_{AS}	$I_D=20\text{ A}, R_{GS}=25\text{ }\Omega$	5	mJ
Gate source voltage	V_{GS}		± 20	V

¹⁾ J-STD20 and JESD22

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

Parameter	Symbol	Conditions	Value	Unit
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	25	W
		$T_A=25\text{ °C}$, $R_{\text{thJA}}=60\text{ K/W}^2)$	2.1	
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
IEC climatic category; DIN IEC 68-1			55/150/56	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	5	K/W
Device on PCB	R_{thJA}	6 cm ² cooling area ²⁾	-	-	60	

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

Drain-source breakdown voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{ V}$, $I_{\text{D}}=1\text{ mA}$	40	-	-	V
Gate threshold voltage	$V_{\text{GS(th)}}$	$V_{\text{DS}}=V_{\text{GS}}$, $I_{\text{D}}=10\text{ }\mu\text{A}$	2	-	4	
Zero gate voltage drain current	I_{DSS}	$V_{\text{DS}}=40\text{ V}$, $V_{\text{GS}}=0\text{ V}$, $T_j=25\text{ °C}$	-	0.1	1	μA
		$V_{\text{DS}}=40\text{ V}$, $V_{\text{GS}}=0\text{ V}$, $T_j=125\text{ °C}$	-	10	100	
Gate-source leakage current	I_{GSS}	$V_{\text{GS}}=20\text{ V}$, $V_{\text{DS}}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance	$R_{\text{DS(on)}}$	$V_{\text{GS}}=10\text{ V}$, $I_{\text{D}}=20\text{ A}$	-	13.8	16.5	m Ω
Gate resistance	R_{G}		-	1.1	-	Ω
Transconductance	g_{fs}	$ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}$, $I_{\text{D}}=20\text{ A}$	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.

³⁾ See figure 3 for more detailed information

⁴⁾ See figure 13 for more detailed information

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=20\text{ V},$ $f=1\text{ MHz}$	-	630	840	pF
Output capacitance	C_{oss}		-	220	290	
Reverse transfer capacitance	C_{rss}		-	6.7	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{ V}, V_{GS}=10\text{ V},$ $I_D=20\text{ A}, R_G=1.6\ \Omega$	-	5.4	-	ns
Rise time	t_r		-	1.0	-	
Turn-off delay time	$t_{d(off)}$		-	6.8	-	
Fall time	t_f		-	2.2	-	

Gate Charge Characteristics⁵⁾

Gate to source charge	Q_{gs}	$V_{DD}=20\text{ V}, I_D=20\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	3.7	-	nC
Gate charge at threshold	$Q_{g(th)}$		-	1.9	-	
Gate to drain charge	Q_{gd}		-	1.0	-	
Switching charge	Q_{sw}		-	2.9	-	
Gate charge total	Q_g		-	7.8	10	
Gate plateau voltage	$V_{plateau}$		-	5.9	-	
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }10\text{ V}$	-	7.4	-	nC
Output charge	Q_{oss}	$V_{DD}=20\text{ V}, V_{GS}=0\text{ V}$	-	8.0	-	

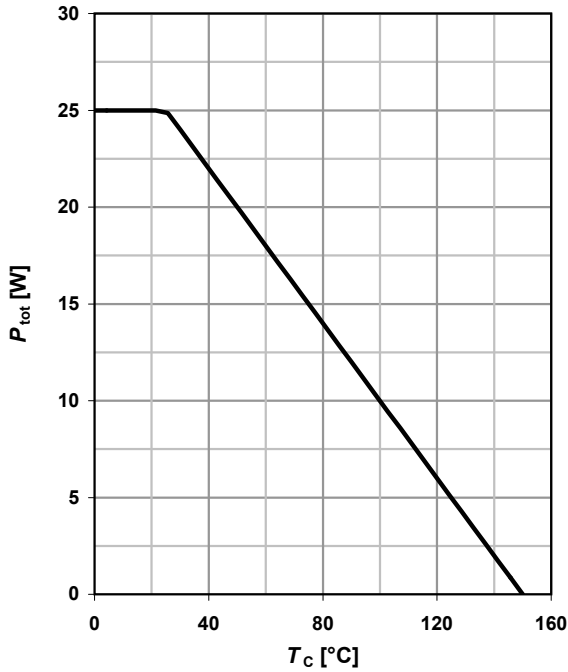
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ }^\circ\text{C}$	-	-	21	A
Diode pulse current	$I_{S,pulse}$		-	-	124	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=20\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.92	1.2	V
Reverse recovery charge	Q_{rr}	$V_R=20\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$	-	10	-	nC

⁵⁾ See figure 16 for gate charge parameter definition

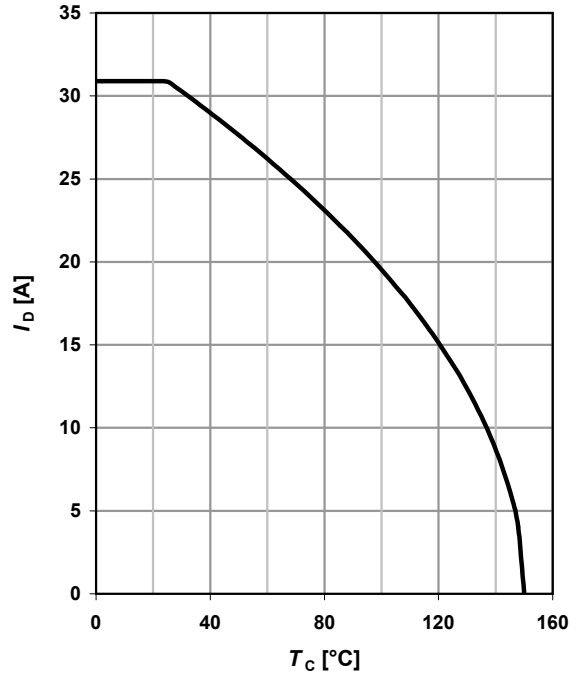
1 Power dissipation

$$P_{tot} = f(T_C)$$



2 Drain current

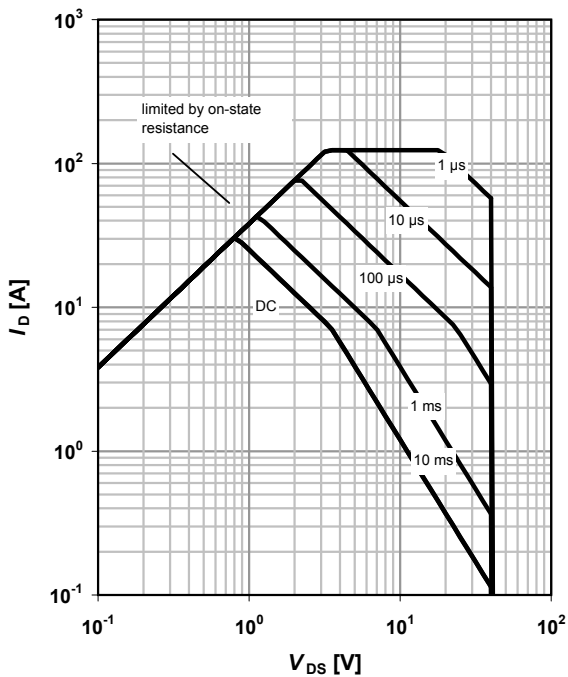
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

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

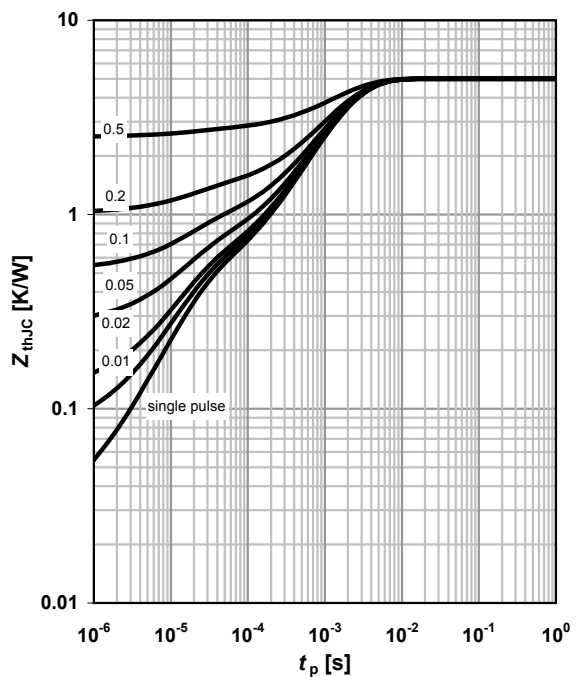
parameter: t_p



4 Max. transient thermal impedance

$$Z_{thJC} = f(t_p)$$

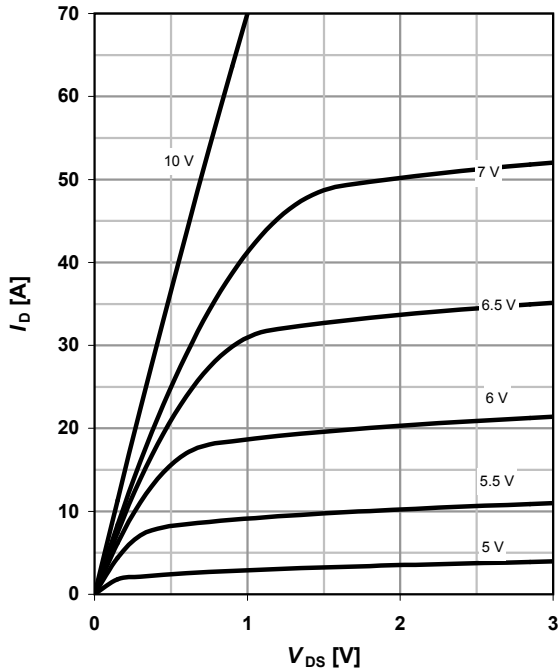
parameter: $D = t_p / T$



5 Typ. output characteristics

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

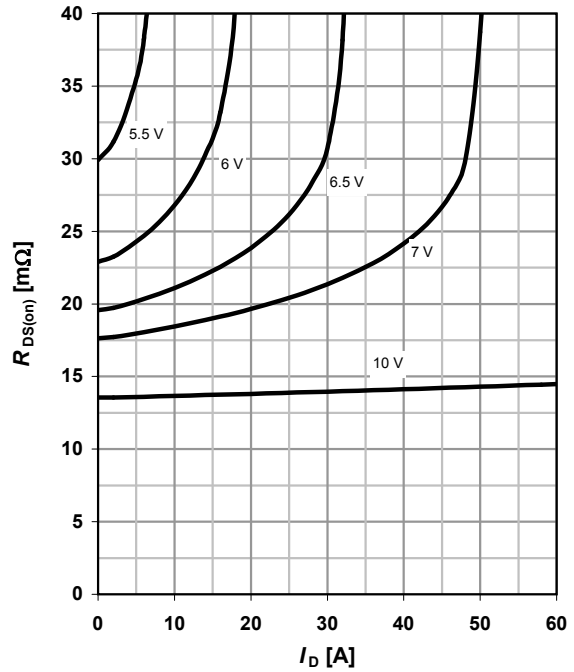
parameter: V_{GS}



6 Typ. drain-source on resistance

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

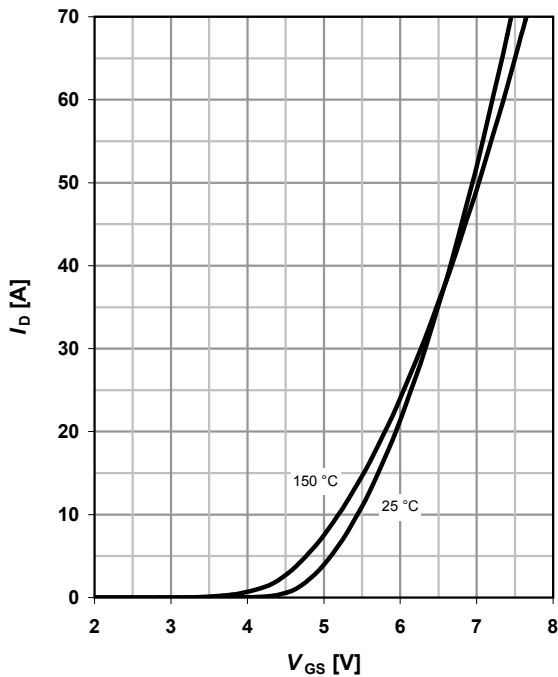
parameter: V_{GS}



7 Typ. transfer characteristics

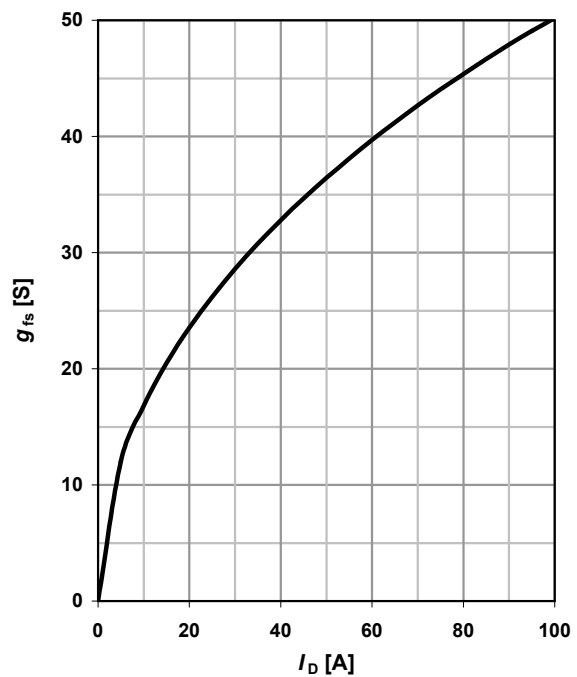
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



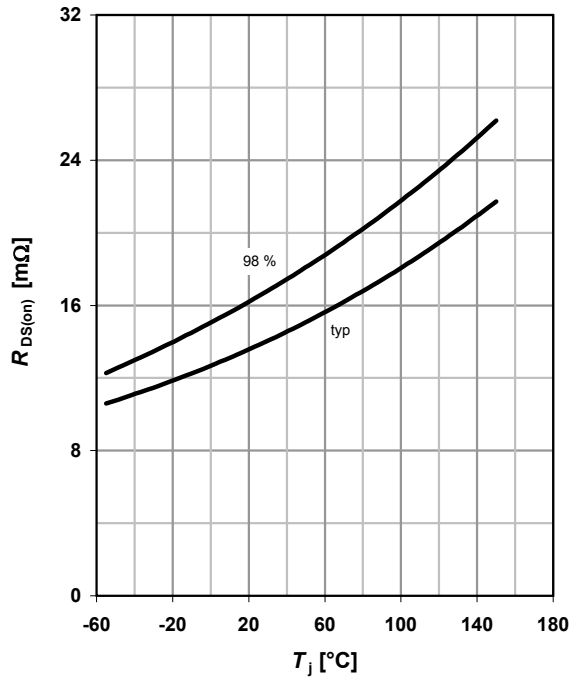
8 Typ. forward transconductance

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

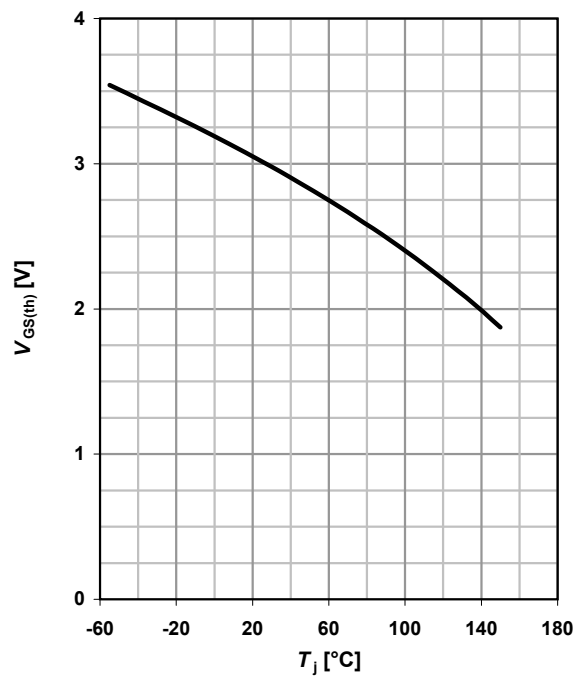


9 Drain-source on-state resistance

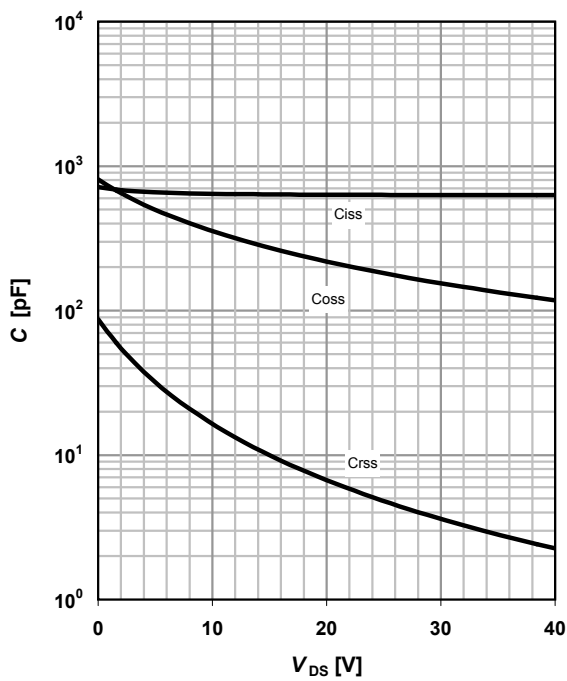
$$R_{DS(on)} = f(T_j); I_D = 20 \text{ A}; V_{GS} = 10 \text{ V}$$


10 Typ. gate threshold voltage

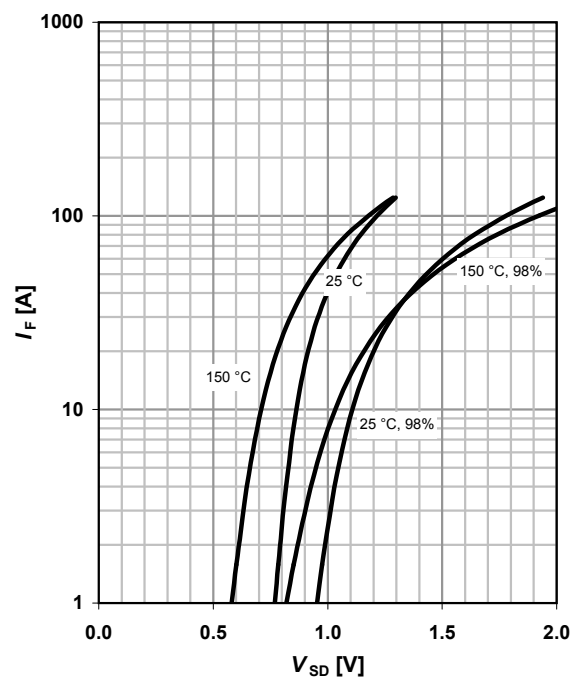
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 10 \mu\text{A}$$


11 Typ. capacitances

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

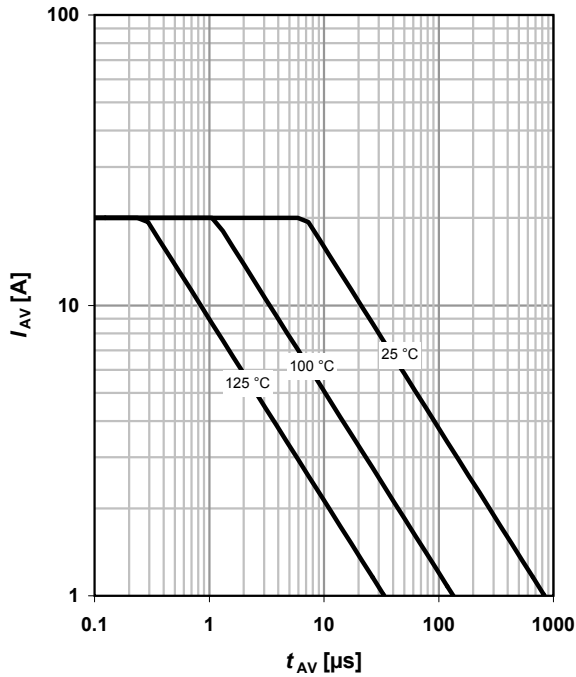

12 Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

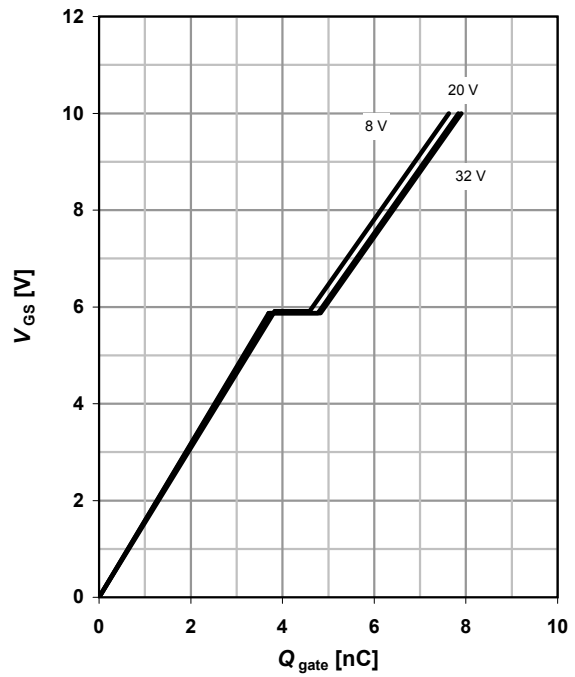
 parameter: T_j


13 Avalanche characteristics

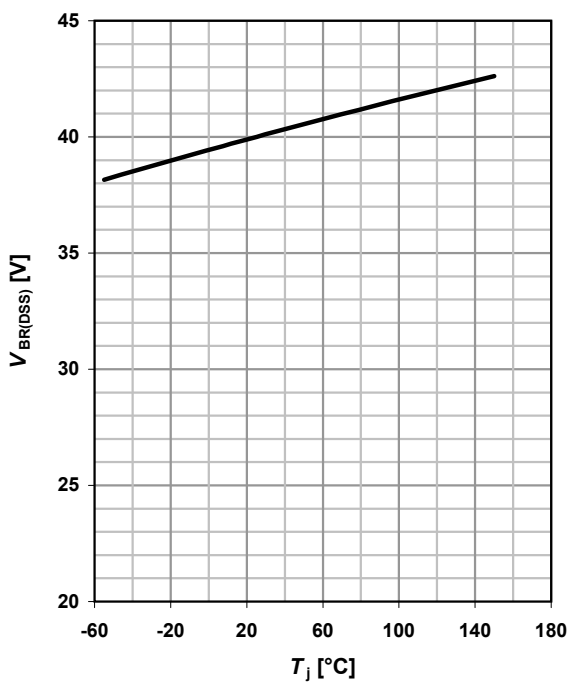
$$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$$

 parameter: $T_{j(\text{start})}$

14 Typ. gate charge

$$V_{GS}=f(Q_{\text{gate}}); I_D=20 \text{ A pulsed}$$

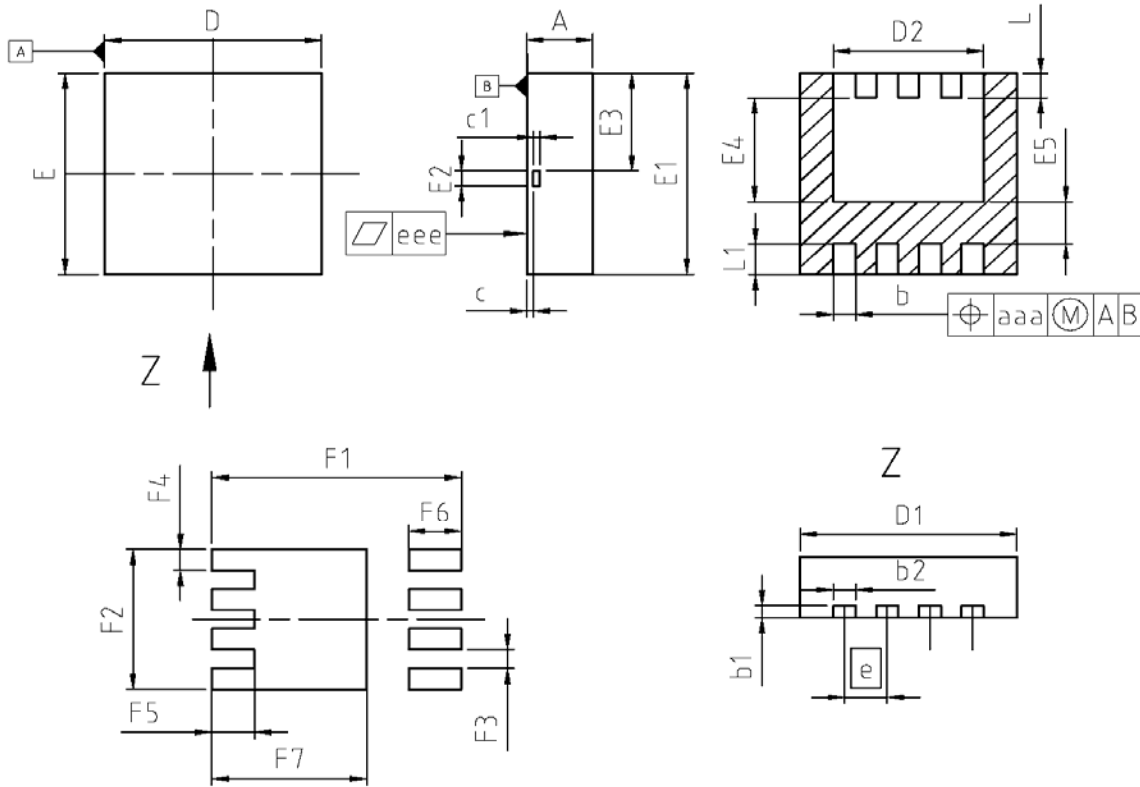
 parameter: V_{DD}

15 Drain-source breakdown voltage

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


16 Gate charge waveforms


Package Outline

PG-TSDSON-8



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.95	1.00	0.037	0.039
b	0.25	0.35	0.010	0.014
b1	0.10	0.30	0.004	0.012
b2	0.20	0.40	0.008	0.016
c	0.00	0.20	0.000	0.008
D=D1	3.20	3.40	0.126	0.134
D2	2.15	2.35	0.085	0.093
E=E1	3.20	3.40	0.126	0.134
E2	0.10	0.30	0.004	0.012
E3	1.35	1.55	0.053	0.061
E4	1.60	1.80	0.063	0.071
E5	0.66	0.86	0.026	0.034
e	0.60	0.70	0.024	0.028
N	8		8	
L	0.31	0.51	0.012	0.020
L1	0.33	0.53	0.013	0.021
aaa	0.25		0.010	
eee	0.05		0.002	
F1	3.70	3.90	0.146	0.154
F2	2.19	2.39	0.086	0.094
F3	0.21	0.41	0.008	0.016
F4	0.24	0.44	0.009	0.017
F5	0.55	0.75	0.022	0.030
F6	0.70	0.90	0.028	0.035
F7	2.28	2.46	0.089	0.097

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