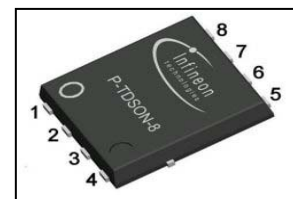


**OptiMOS<sup>®</sup> 2 Power-Transistor**
**Features**

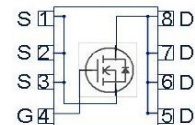
- Fast switching MOSFET for SMPS
- Optimized technology for notebook DC/DC converters
- Qualified according to JEDEC<sup>1</sup> for target applications
- N-channel
- Logic level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- Avalanche rated
- $dv/dt$  rated

**Product Summary**

$V_{DS}$	30	V
$R_{DS(on),max}$	5.5	m $\Omega$
$I_D$	50	A

**P-TDSON-8**


Type	Package	Ordering Code	Marking
BSC059N03S	P-TDSON-8	Q67042-S4222	59N03S


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ }^\circ\text{C}$	50	A
		$T_C=100\text{ }^\circ\text{C}$	46	
		$T_A=25\text{ }^\circ\text{C}$ , $R_{thJA}=45\text{ K/W}^2$	17.5	
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ }^\circ\text{C}^3$	200	
Avalanche energy, single pulse	$E_{AS}$	$I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$	150	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=50\text{ A}$ , $V_{DS}=24\text{ V}$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{j,max}=150\text{ }^\circ\text{C}$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ }^\circ\text{C}$	48	W
		$T_A=25\text{ }^\circ\text{C}$ , $R_{thJA}=45\text{ K/W}^2$	2.8	
Operating and storage temperature	$T_j$ , $T_{stg}$		-55 ... 150	$^\circ\text{C}$
IEC climatic category; DIN IEC 68-1			55/150/56	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	-	2.6	K/W
Thermal resistance, junction - ambient	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>2)</sup>	-	-	45	

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	30	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=35\text{ }\mu\text{A}$	1.2	1.6	2	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	10	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	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=50\text{ A}$	-	6.9	8.6	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=50\text{ A}$	-	4.6	5.5	
Gate resistance	$R_G$		-	0.9	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=50\text{ A}$	42	84	-	S

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

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

<sup>3)</sup> See figure 3

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$	-	2010	2670	pF
Output capacitance	$C_{oss}$		-	720	950	
Reverse transfer capacitance	$C_{rss}$		-	93	140	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V}, I_D=25\text{ A}, R_G=2.7\ \Omega$	-	5.7	8.5	ns
Rise time	$t_r$		-	4.8	7.2	
Turn-off delay time	$t_{d(off)}$		-	22	33	
Fall time	$t_f$		-	3.8	5.7	

**Gate Charge Characteristics<sup>4)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=15\text{ V}, I_D=25\text{ A}, V_{GS}=0\text{ to }5\text{ V}$	-	6.3	8.4	nC
Gate charge at threshold	$Q_{g(th)}$		-	3.2	4.3	
Gate to drain charge	$Q_{gd}$		-	4.0	6.0	
Switching charge	$Q_{sw}$		-	7.1	10	
Gate charge total	$Q_g$		-	15	21	
Gate plateau voltage	$V_{plateau}$		-	3.1	-	V
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V}, V_{GS}=0\text{ to }5\text{ V}$	-	14	18	nC
Output charge	$Q_{oss}$	$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	17	23	

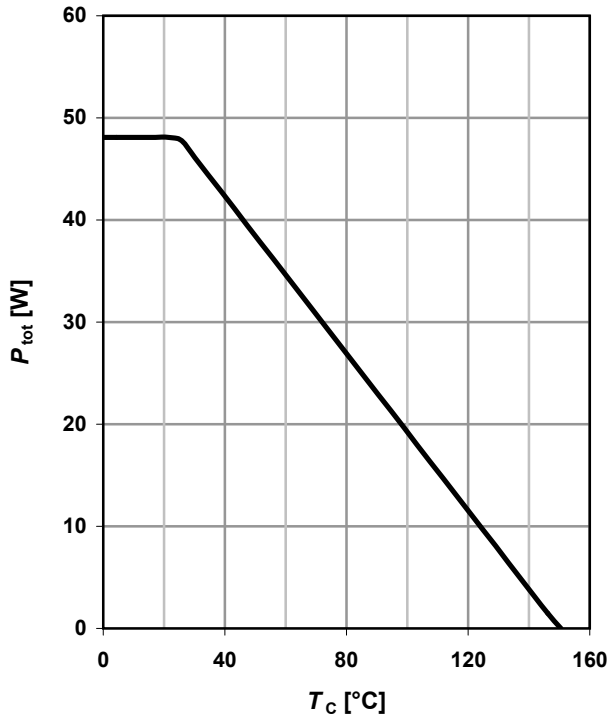
**Reverse Diode**

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	48	A
Diode pulse current	$I_{S,pulse}$		-	-	200	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=48\text{ A}, T_J=25\text{ }^\circ\text{C}$	-	0.87	1.1	V
Reverse recovery charge	$Q_{rr}$	$V_R=15\text{ V}, I_F=I_S, di_F/dt=400\text{ A}/\mu\text{s}$	-	-	10	nC

<sup>4)</sup> See figure 16 for gate charge parameter definition

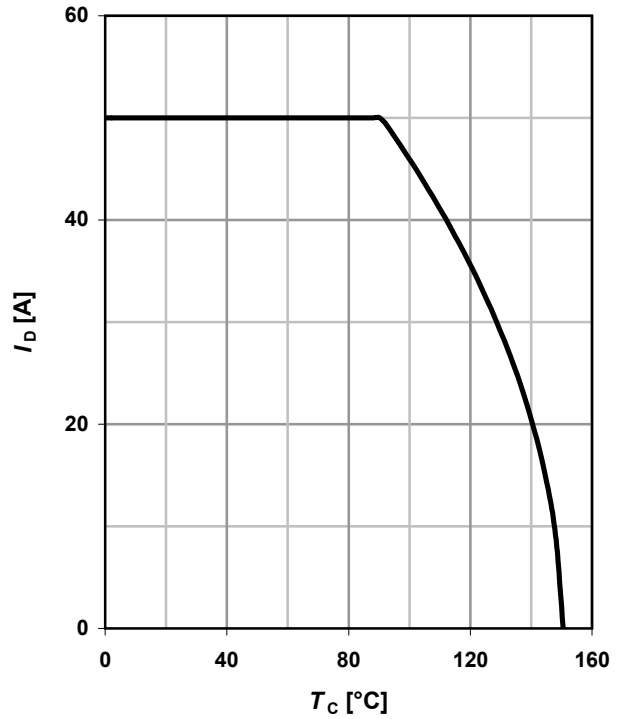
**1 Power dissipation**

$P_{tot}=f(T_C)$



**2 Drain current**

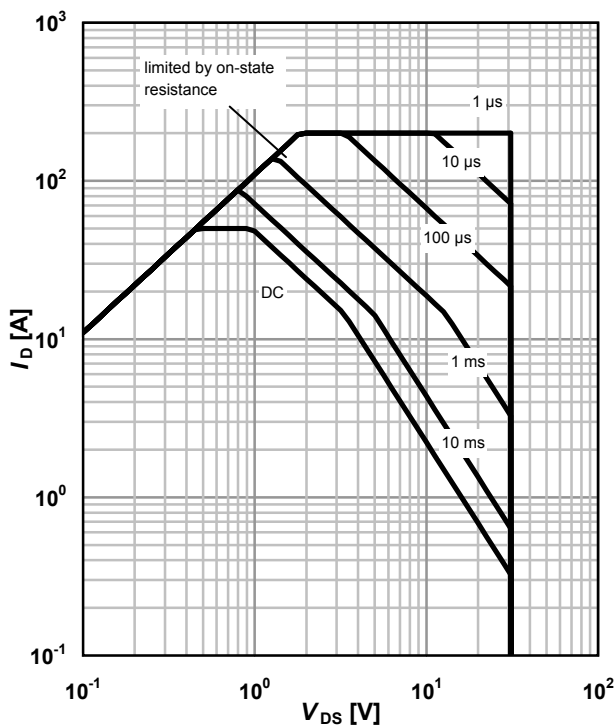
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



**3 Safe operation area**

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

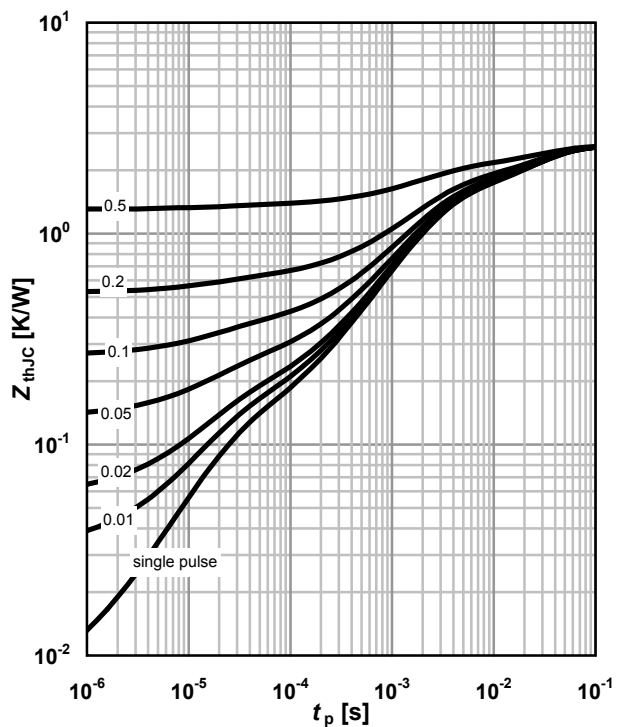
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC}=f(t_p)$

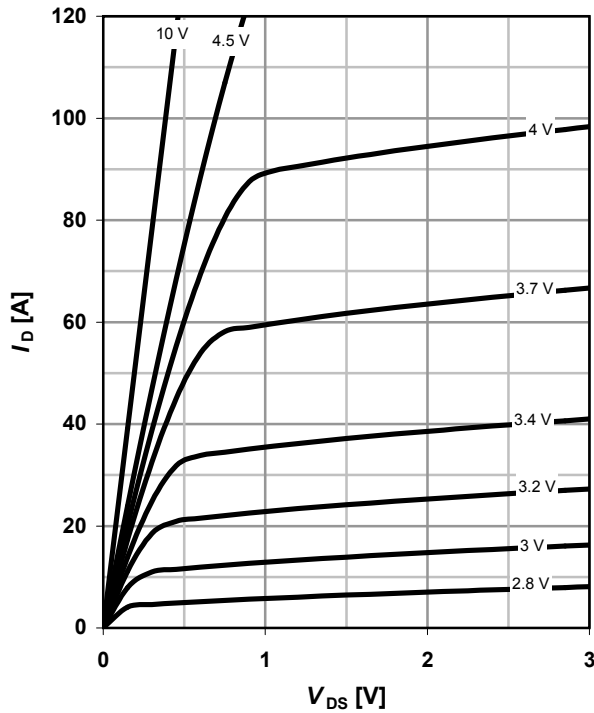
parameter:  $D=t_p/T$



**5 Typ. output characteristics**

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

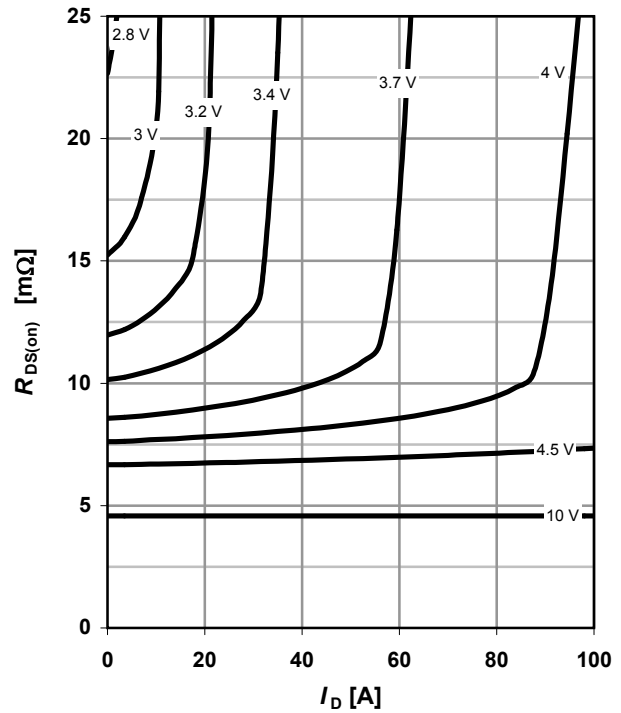
parameter:  $V_{GS}$



**6 Typ. drain-source on resistance**

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

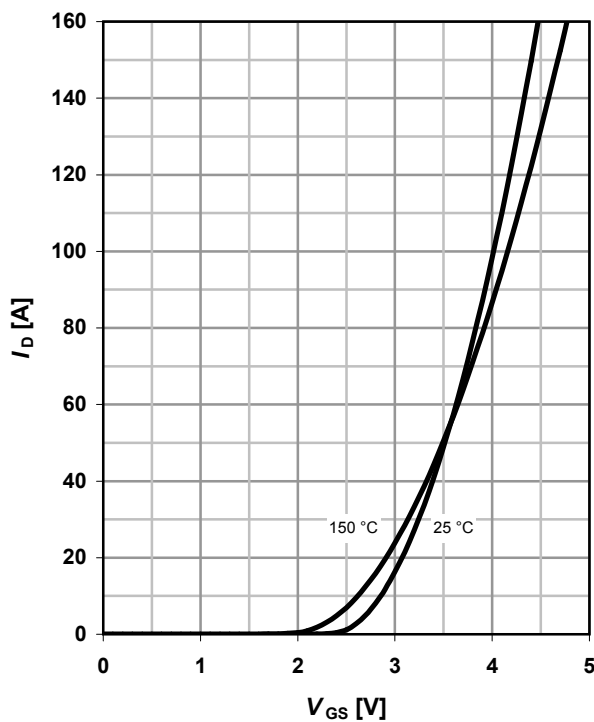
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

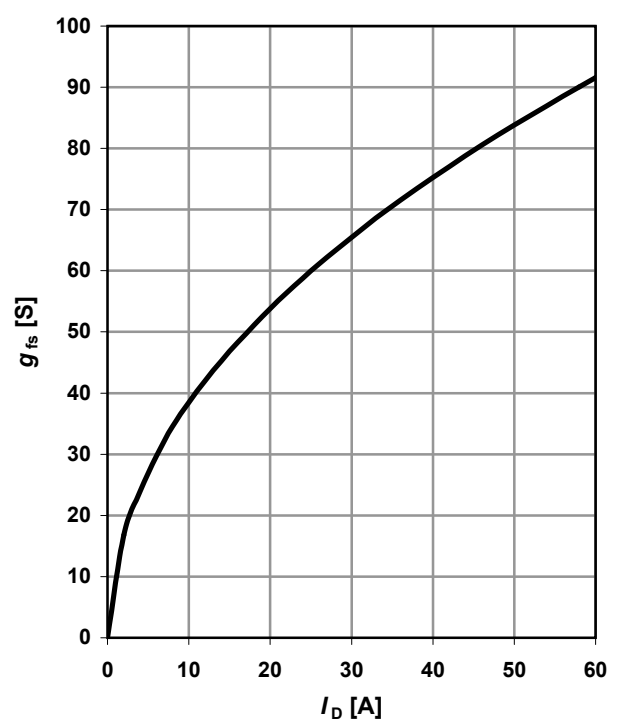
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



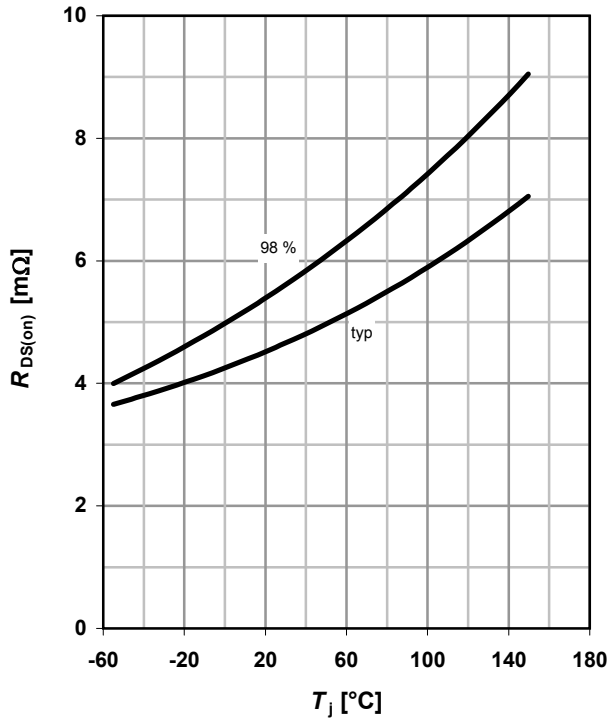
**8 Typ. forward transconductance**

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



**9 Drain-source on-state resistance**

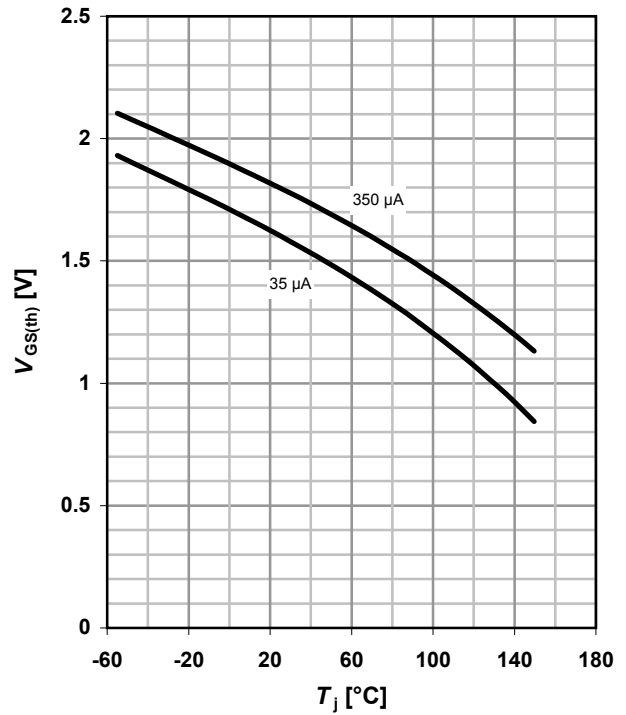
$R_{DS(on)} = f(T_j); I_D = 50 \text{ A}; V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

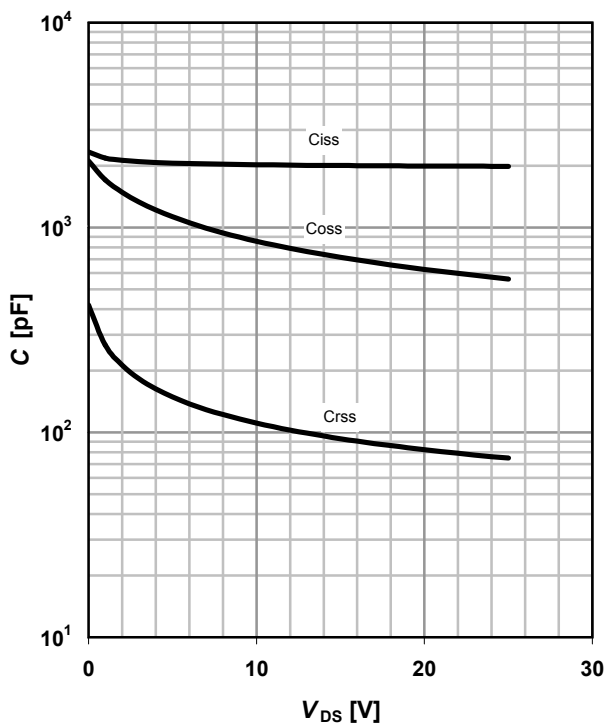
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**11 Typ. capacitances**

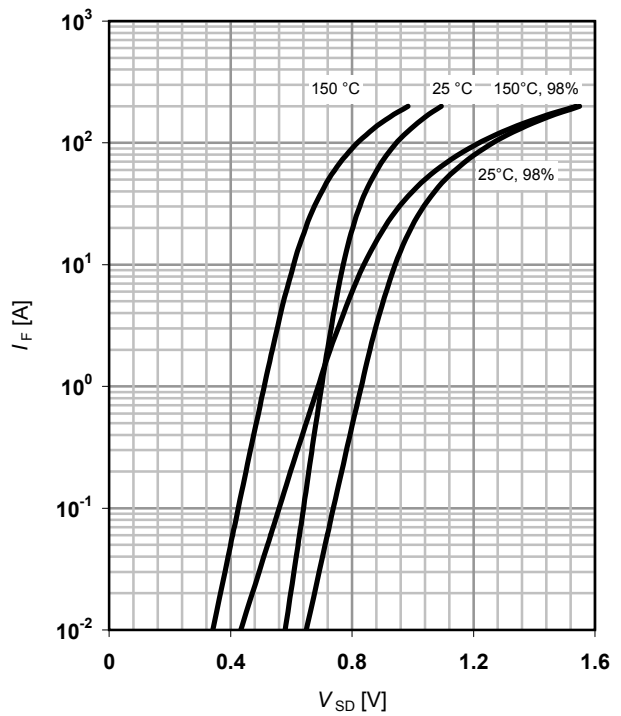
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**12 Forward characteristics of reverse diode**

$I_F = f(V_{SD})$

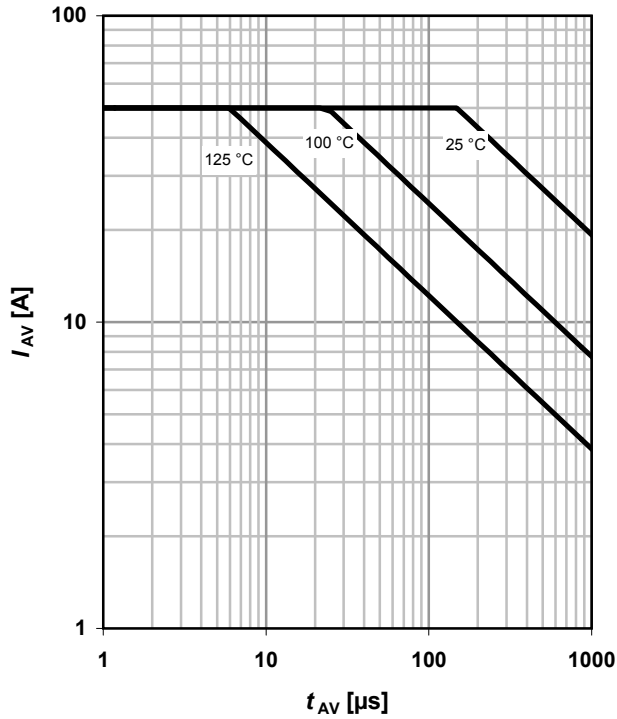
parameter:  $T_j$



**13 Avalanche characteristics**

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

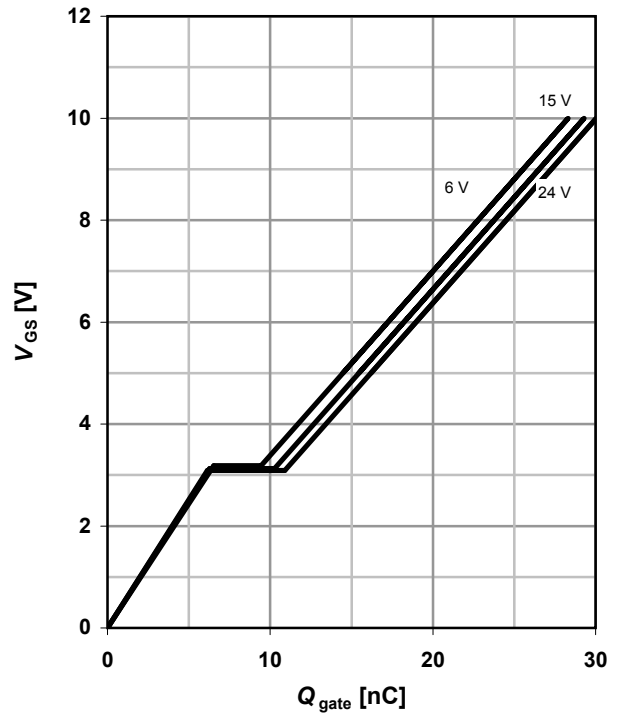
parameter:  $T_{j(\text{start})}$



**14 Typ. gate charge**

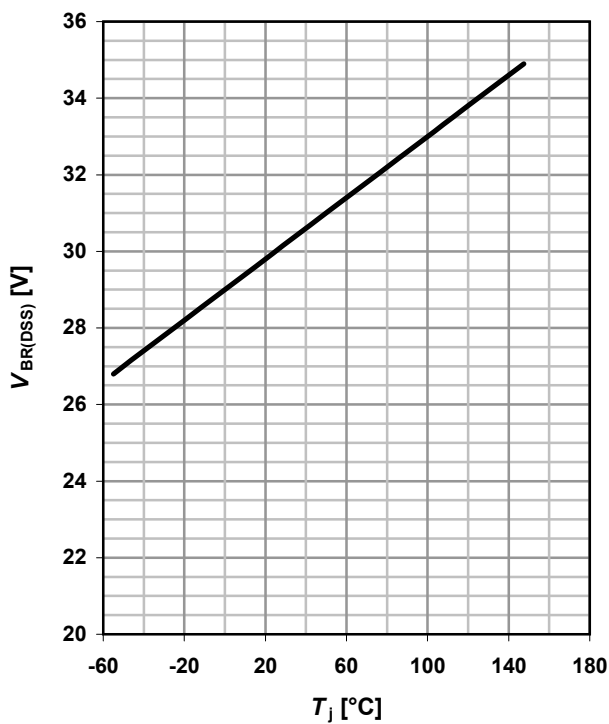
$V_{GS}=f(Q_{\text{gate}}); I_D=25\ \text{A pulsed}$

parameter:  $V_{DD}$

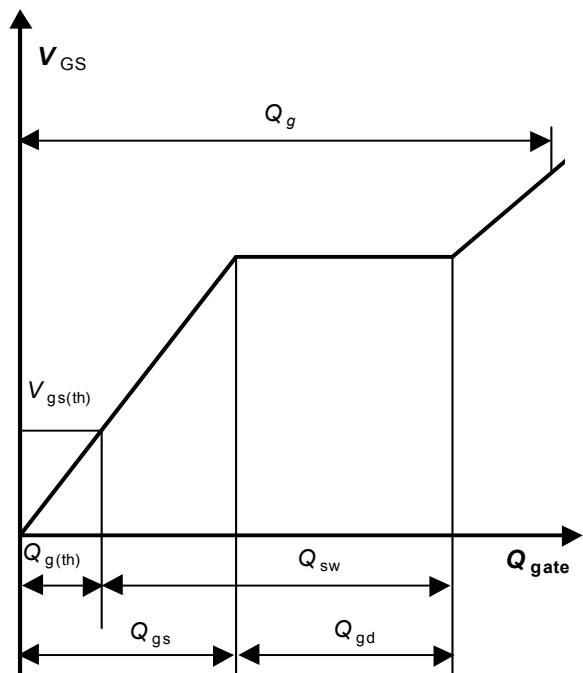


**15 Drain-source breakdown voltage**

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

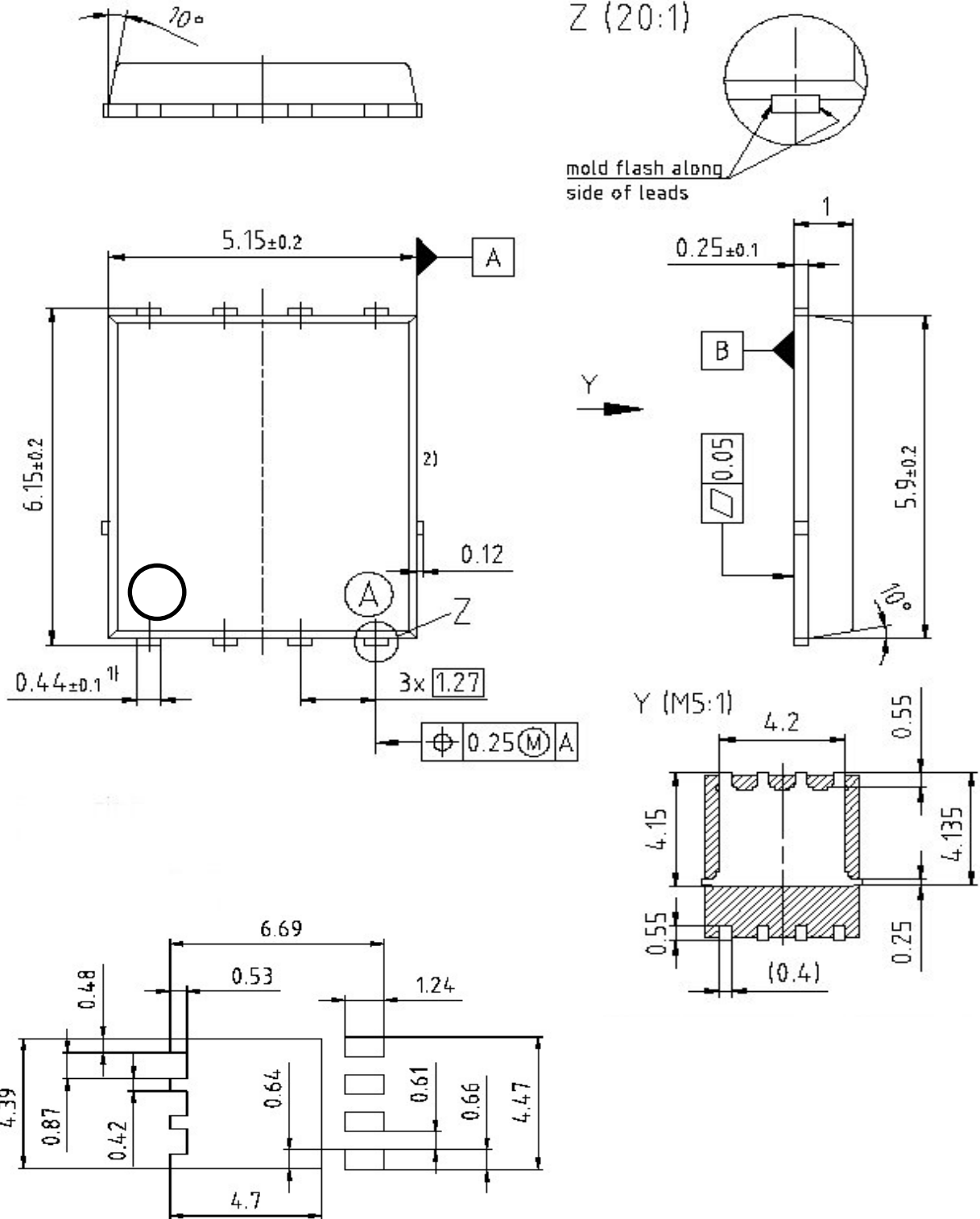


**16 Gate charge waveforms**



Package Outline

P-TDSON-8: Outline



Footprint

Dimensions in mm





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