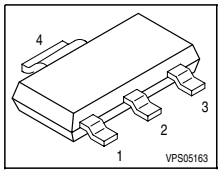
Cool MOS™ Power Transistor

V_{DS}	600	V
$R_{DS(on)}$	0.95	Ω
I_D	0.8	A

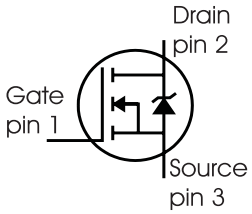
Feature

- New revolutionary high voltage technology
- Worldwide best $R_{DS(on)}$ in SOT 223
- Ultra low gate charge
- Extreme d*v*/d*t* rated
- Ultra low effective capacitances
- Improved transconductance

SOT-223



Type	Package	Ordering Code	Marking
SPN04N60S5	SOT-223	Q67040-S4211	04N60S5



Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current T_A = 25 °C T_A = 70 °C	I_D	 0.8 0.65	A
Pulsed drain current, t_p limited by T_{jmax} T_A = 25 °C	$I_{D\ puls}$	3	
Gate source voltage	V_{GS}	±20	V
Gate source voltage AC (f >1Hz)	V_{GS}	±30	
Power dissipation, T_A = 25°C	P_{tot}	1.8	W
Operating and storage temperature	T_j , T_{stg}	-55... +150	°C

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain Source voltage slope V_{DS} = 480 V, I_D = 4.5 A, T_j = 125 °C	dv/dt	20	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - soldering point	R_{thJS}	-	20	-	K/W
SMD version, device on PCB: @ min. footprint @ 6 cm^2 cooling area [1)]	R_{thJA}	 - -	 110 -	 - 70	
Soldering temperature, 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	°C

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=0.25mA	600	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0V, I_D=4.5A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	I_D=200µA, V_{GS}=V_{DS}	3.5	4.5	5.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600V, V_{GS}=0V, T_j=25°C, T_j=150°C	 - -	 0.5 -	 1 50	µA
Gate-source leakage current	I_{GSS}	V_{GS}=20V, V_{DS}=0V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=2.8A, T_j=25°C T_j=150°C	 - -	 0.8 2.3	 0.95 -	Ω
Gate input resistance	R_G	f=1MHz, open Drain	-	20	-	

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Characteristics						
Transconductance	g_{fs}	$V_{DS}\geq 2*I_D*R_{DS(on)max}$, I_D=0.65A	-	1	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	600	-	pF
Output capacitance	C_{oss}		-	325	-	
Reverse transfer capacitance	C_{rss}		-	15	-	
Effective output capacitance,[2] energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 480V	-	20	-	pF
Effective output capacitance,[3] time related	$C_{o(tr)}$		-	35	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=350V, V_{GS}=0/10V, I_D=0.8A, R_G=18Ω	-	40	-	ns
Rise time	t_r		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	130	-	
Fall time	t_f		-	30	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	V_{DD}=350V, I_D=0.8A	-	4.1	-	nC
Gate to drain charge	Q_{gd}		-	9.2	-	
Gate charge total	Q_g	V_{DD}=350V, I_D=0.8A, V_{GS}=0 to 10V	-	17	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=350V, I_D=0.8A	-	8	-	V

[1] Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical without blown air.

[2] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

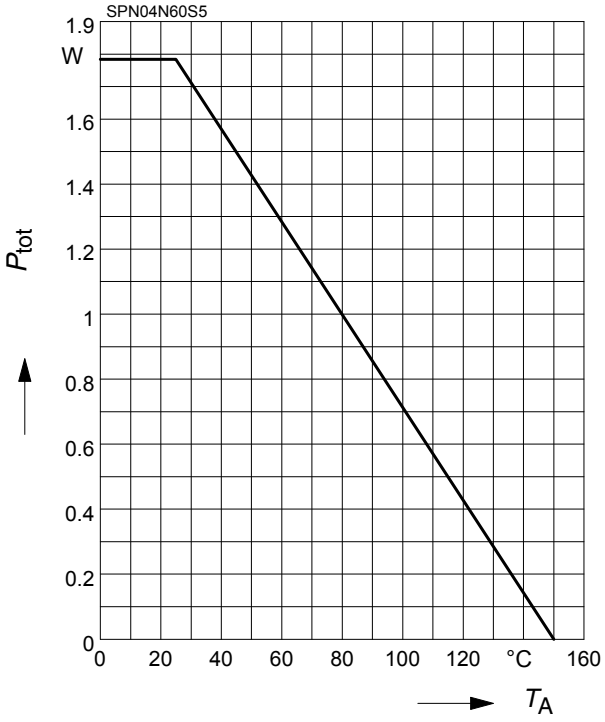
[3] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	T_A=25°C	-	-	0.8	A
Inverse diode direct current, pulsed	I_{SM}		-	-	3	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	0.85	1.05	V
Reverse recovery time	t_{rr}	V_R=350V, I_F=I_S ,	-	200	-	ns
Reverse recovery charge	Q_{rr}	di_F/dt=100A/µs	-	1.2	-	µC

1 Power dissipation

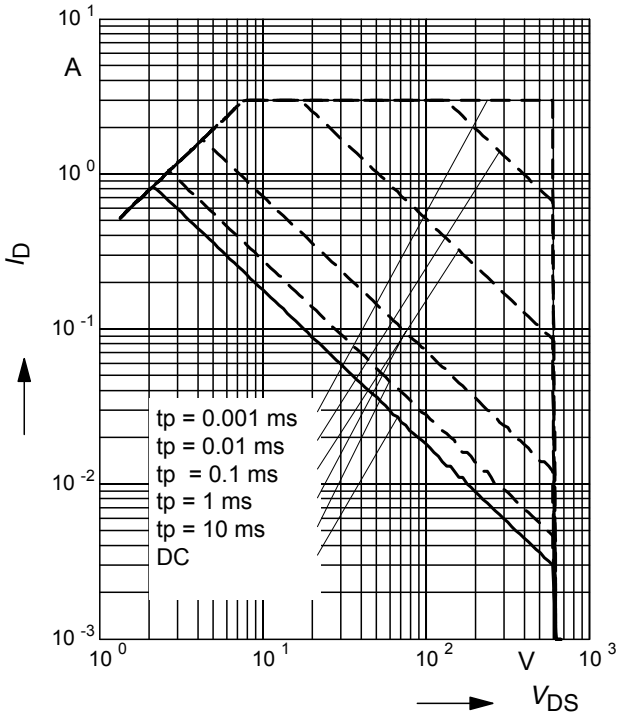
$P_{tot} = f(T_A)$



2 Safe operating area

$I_D = f(V_{DS})$

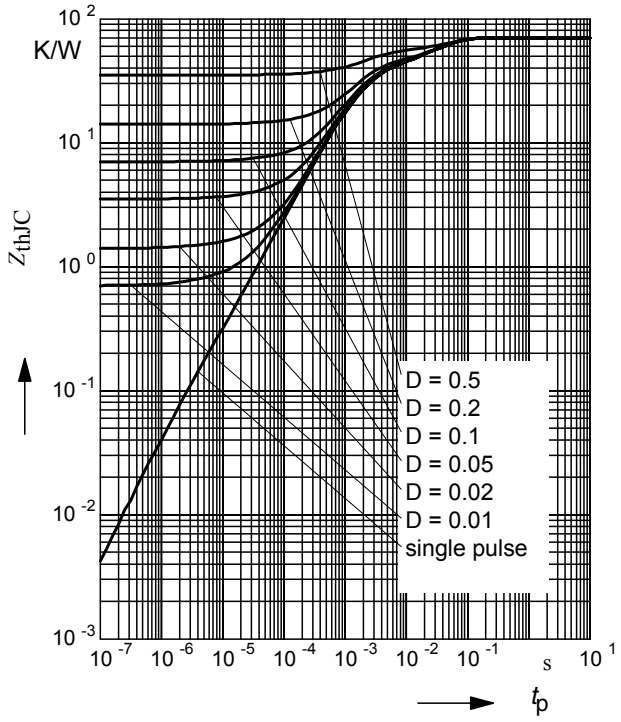
parameter : $D = 0$, T_A=25°C



3 Transient thermal impedance

$Z_{thJC} = f(t_p)$

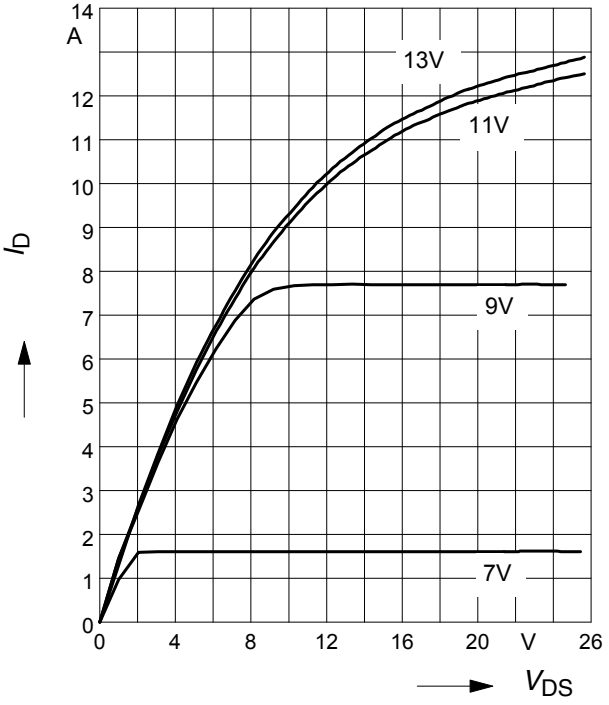
parameter: $D = t_p/T$



4 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

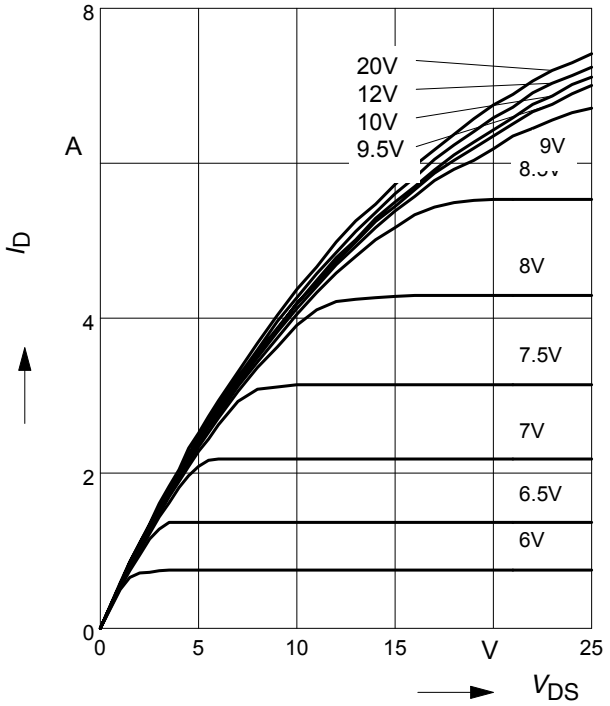
parameter: t_p = 10 µs, V_{GS}



5 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

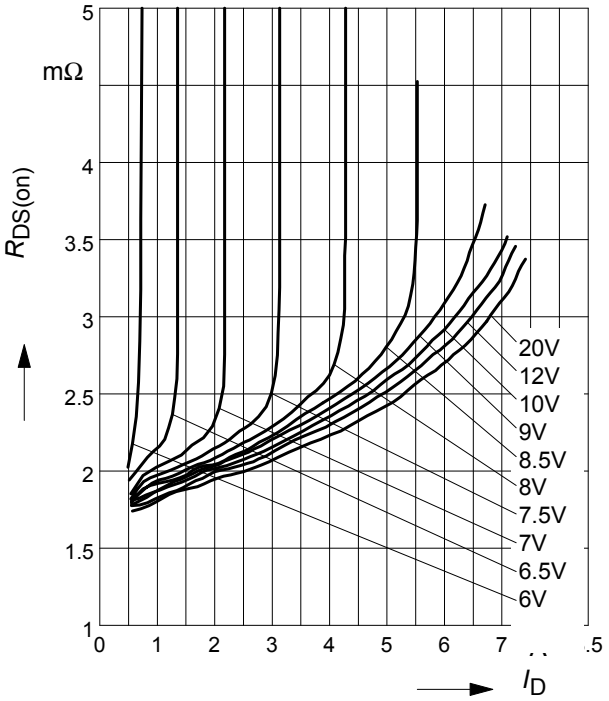
parameter: t_p = 10 µs, V_{GS}



6 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$

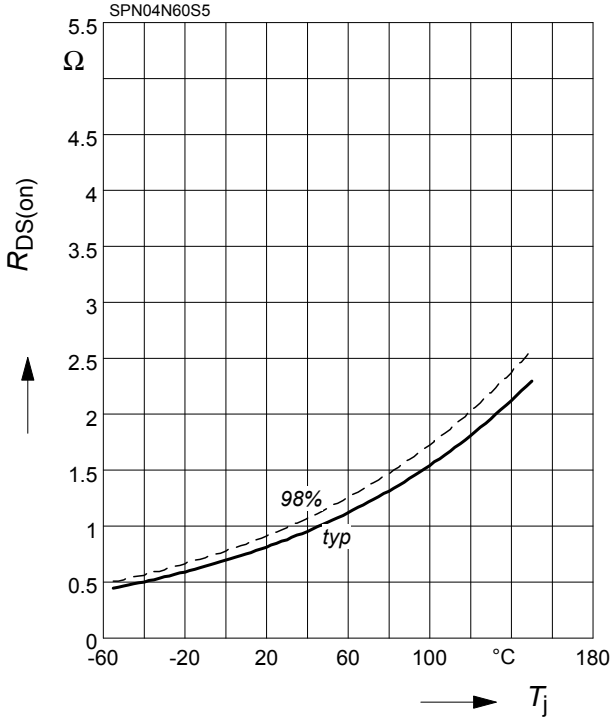
parameter: T_j=150°C, V_{GS}



7 Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$

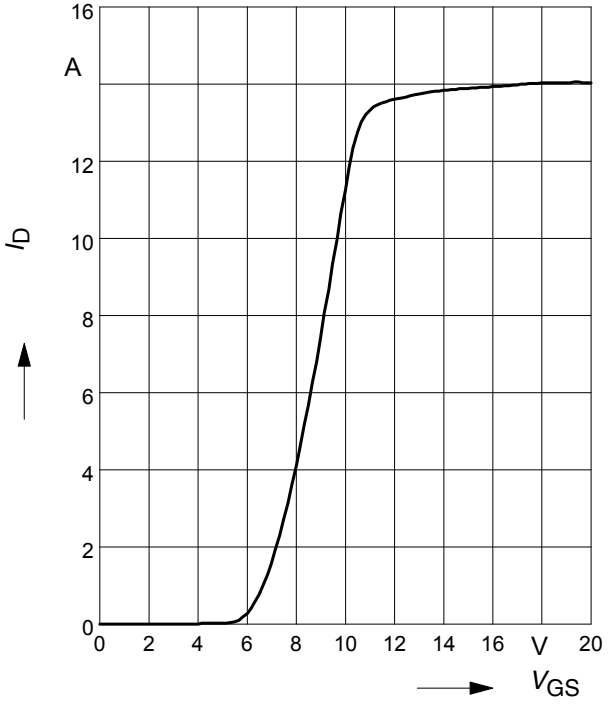
parameter : I_D = 0.65 A, V_{GS} = 10 V



8 Typ. transfer characteristics

$I_D= f(V_{GS})$; $V_{DS}\geq 2 \times I_D \times R_{DS(on)max}$

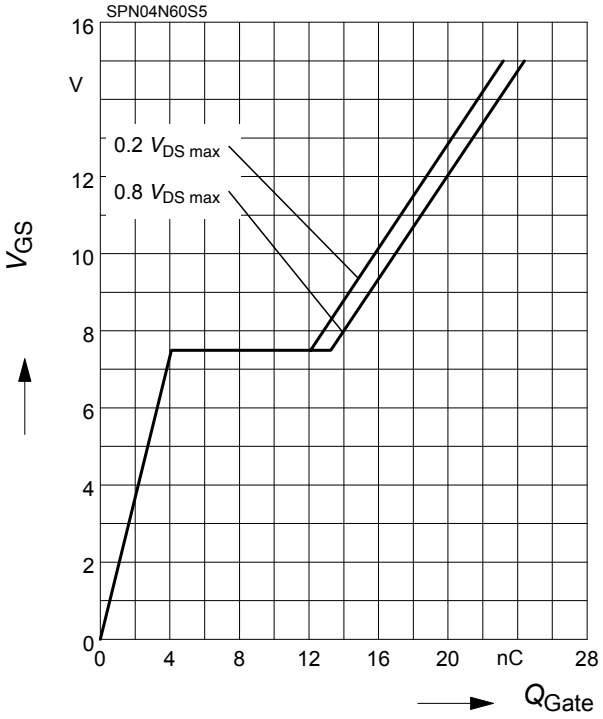
parameter: t_p = 10 µs



9 Typ. gate charge

$V_{GS} = f\ (Q_{Gate})$

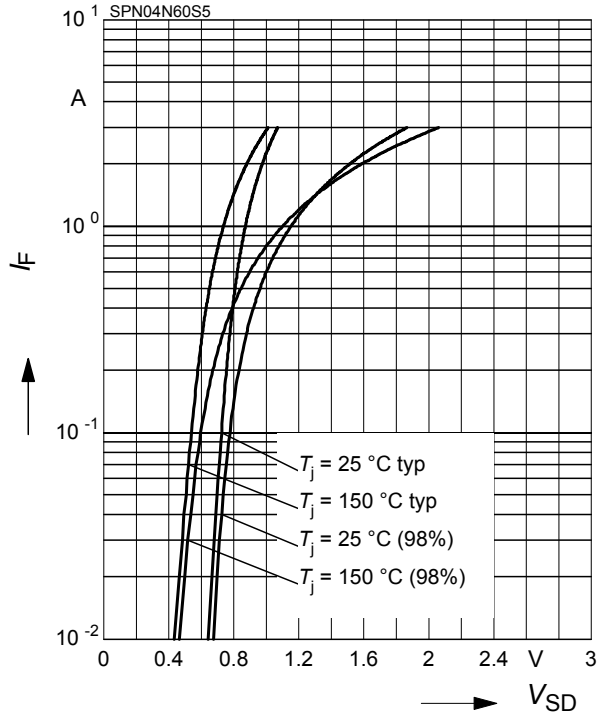
parameter: I_D = 0.8 A pulsed



10 Forward characteristics of body diode

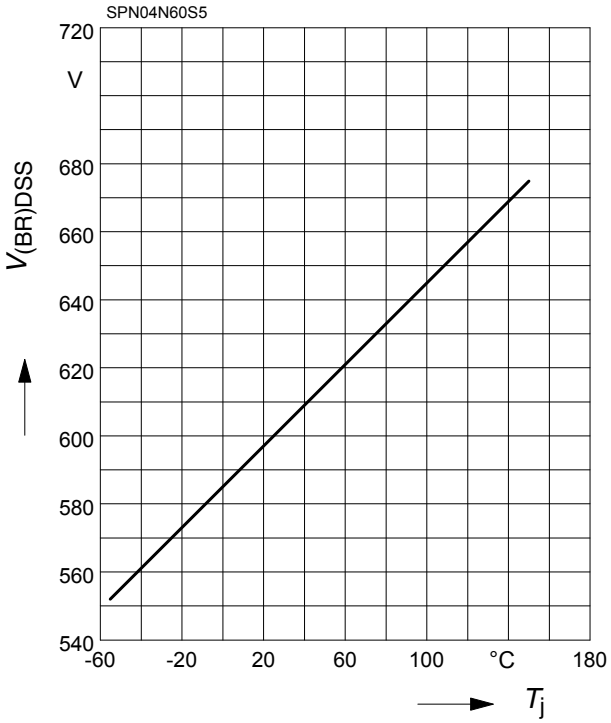
$I_F = f\ (V_{SD})$

parameter: T_j , tp = 10 µs



11 Drain-source breakdown voltage

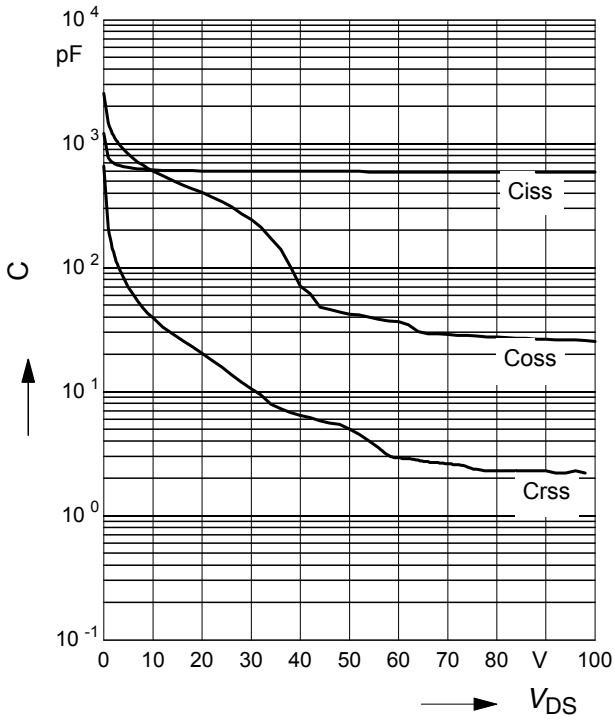
$V_{(BR)DSS} = f\ (T_j)$



12 Typ. capacitances

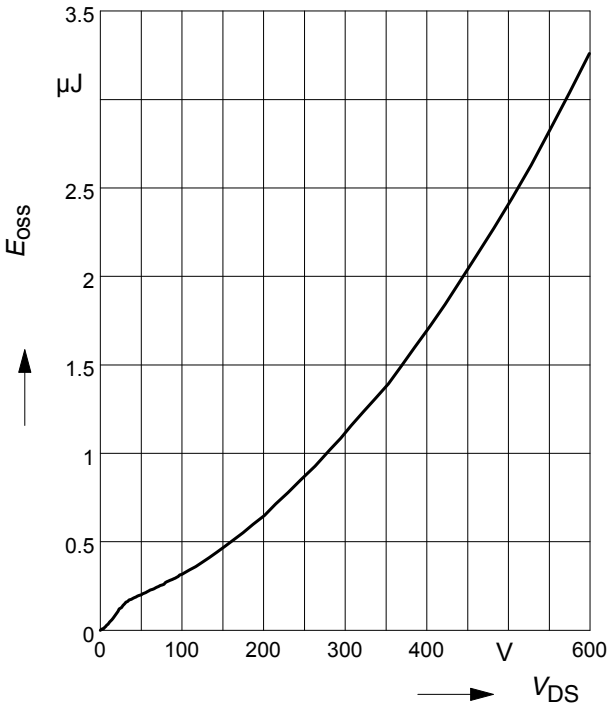
$C = f\ (V_{DS})$

parameter: V_{GS}=0V, f=1 MHz

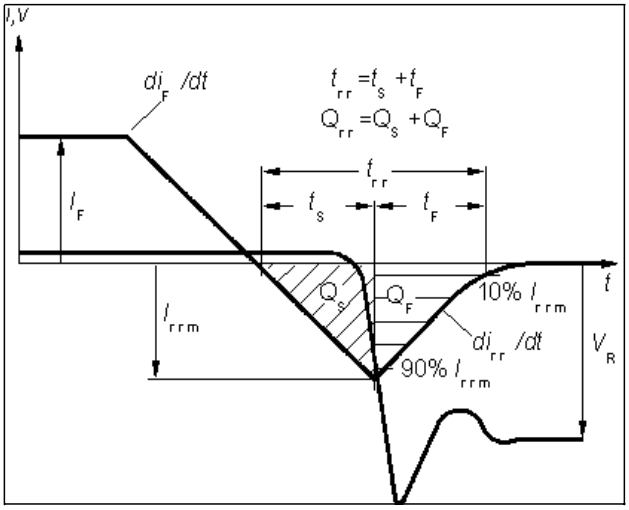


13 Typ. C_{oss} stored energy

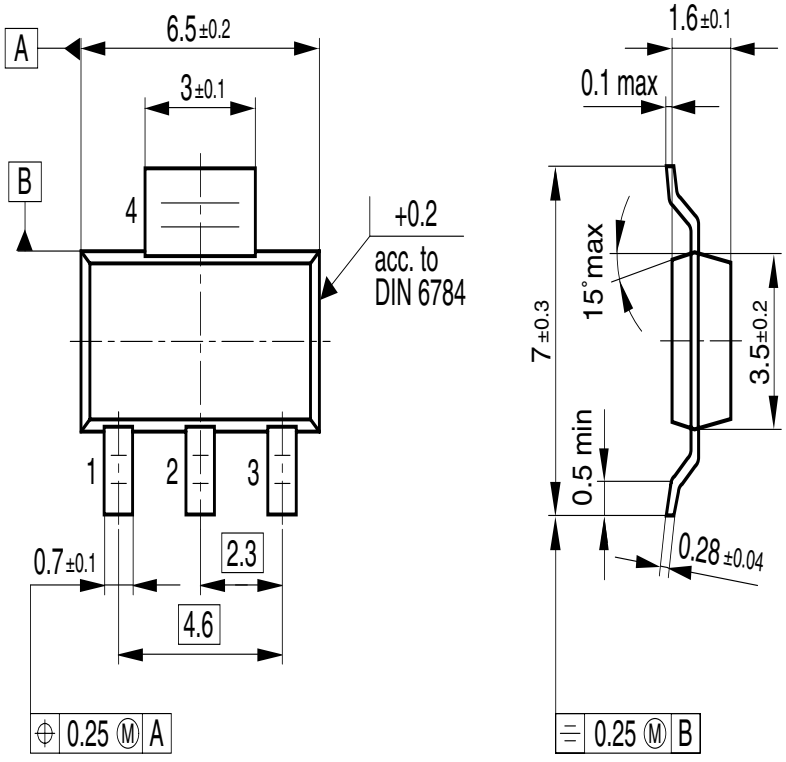
$E_{oss}=f(V_{DS})$



Definition of diodes switching characteristics



SOT223


A
6.5±0.2
3±0.1
B
4
+0.2
acc. to
DIN 6784
1
2
3
0.7±0.1
2.3
4.6
0.25 M A
1.6±0.1
0.1 max
15° max
7±0.3
3.5±0.2
0.5 min
0.28±0.04
0.25 M B

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