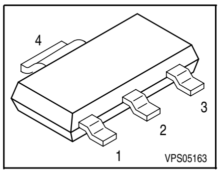
Cool MOS™ Power Transistor

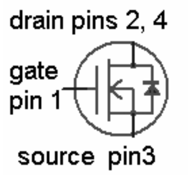
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Extreme d*v*/d*t* rated
- Ultra low effective capacitances
- Qualified according to JEDEC[0)] for target applications

V_{DS} @ T_{jmax}	650	V
$R_{DS(on)}$	1.4	Ω
I_D	0.7	A

SOT-223





Type	Package	Ordering Code	Marking
SPN03N60C3	SOT-223	Q67040S4552	03N60C3

Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current T_A = 25 °C T_A = 70 °C	I_D	 0.7 0.4	A
Pulsed drain current, t_p limited by T_{jmax} T_A = 25 °C	$I_{D\ puls}$	3	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	3.2	
Gate source voltage static	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 = 3.2 A, T_j = 125 °C	dv/dt	50	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - soldering point	R_{thJS}	-	25	-	K/W
SMD version, device on PCB:	R_{thJA}				
@ min. footprint		-	110	-	
@ 6 cm^2 cooling area [1)]		-	-	70	

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=3.2A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	I_D=135µA, V_{GS}=V_{DS}	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600V, V_{GS}=0V,				µA
		T_j=25°C,	-	0.5	1	
		T_j=150°C	-	-	70	
Gate-source leakage current	I_{GSS}	V_{GS}=30V, V_{DS}=0V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=2A,				Ω
		T_j=25°C	-	1.26	1.4	
		T_j=150°C	-	3.8	-	
Gate input resistance	R_G	f=1MHz, open Drain	-	10	-	

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Transconductance	g_{fs}	V_{DS}≥2*I_D*$R_{DS(on)max}$, I_D=0.4A	-	3.4	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	400	-	pF
Output capacitance	C_{oss}		-	150	-	
Reverse transfer capacitance	C_{rss}		-	5	-	
Effective output capacitance,[2] energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 480V	-	12	-	pF
Effective output capacitance,[3] time related	$C_{o(tr)}$		-	26	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=350V, V_{GS}=0/10V, I_D=0.7A, R_G=20Ω	-	7	-	ns
Rise time	t_r		-	3	-	
Turn-off delay time	$t_{d(off)}$		-	64	100	
Fall time	t_f		-	12	20	

Gate Charge Characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Gate to source charge	Q_{gs}	V_{DD}=420V, I_D=0.7A	-	2	-	nC
Gate to drain charge	Q_{gd}		-	6	-	
Gate charge total	Q_g	V_{DD}=420V, I_D=0.7A, V_{GS}=0 to 10V	-	13	17	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=420V, I_D=0.7A	-	5.5	-	V

[0]J-STD20 and JESD22

[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}.

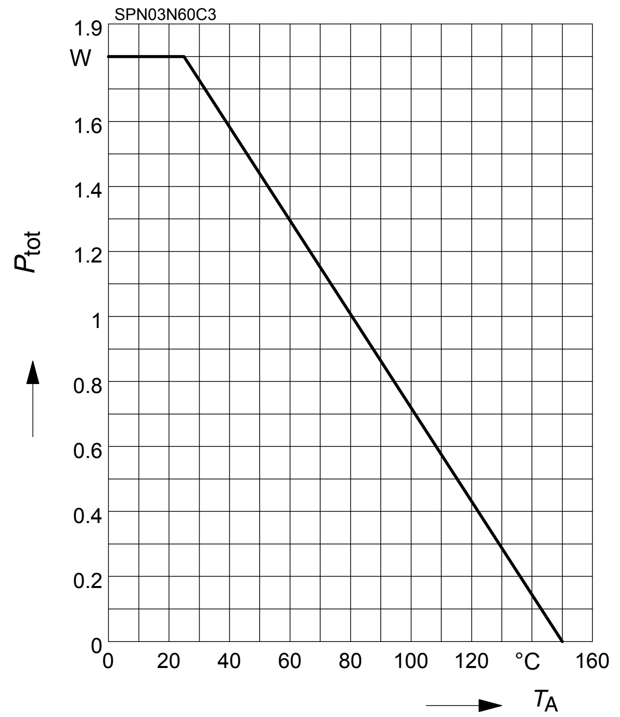
[3]$C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

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	-	-	0.7	A
Inverse diode direct current, pulsed	I_{SM}		-	-	3	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=420V, I_F=I_S ,	-	250	400	ns
Reverse recovery charge	Q_{rr}	di_F/dt=100A/µs	-	1.8	-	µC
Peak reverse recovery current	I_{rrm}		-	15	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt		-	-	540	A/µs

1 Power dissipation

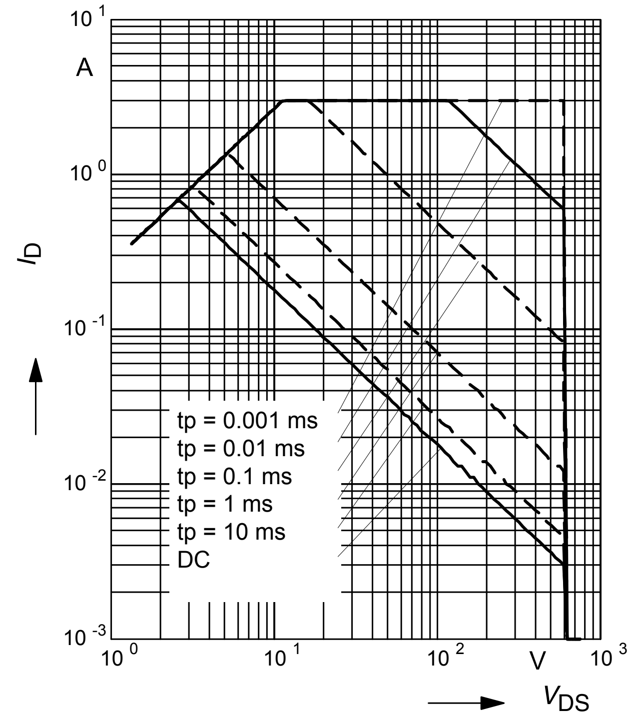
$P_{tot} = f(T_A)$



2 Safe operating area

$I_D = f(V_{DS})$

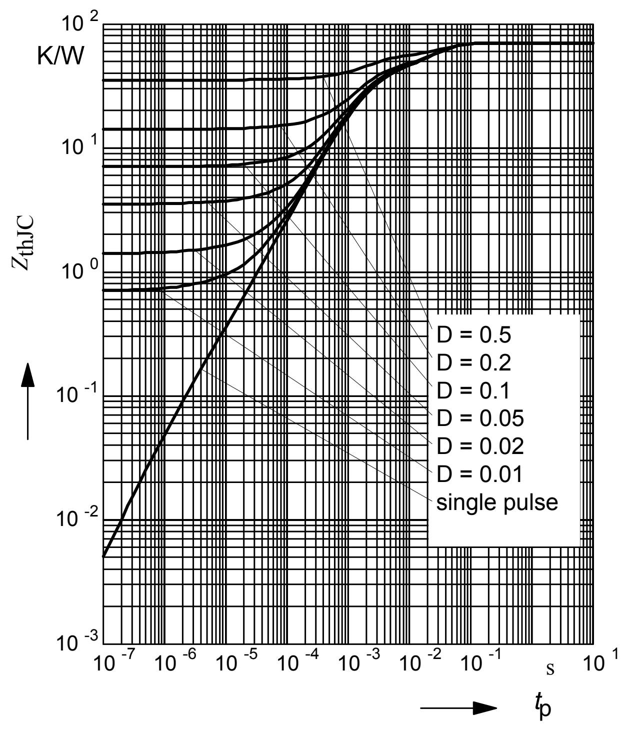
parameter : $D = 0$, T_A=25°C



3 Transient thermal impedance

$Z_{thJC} = f(t_p)$

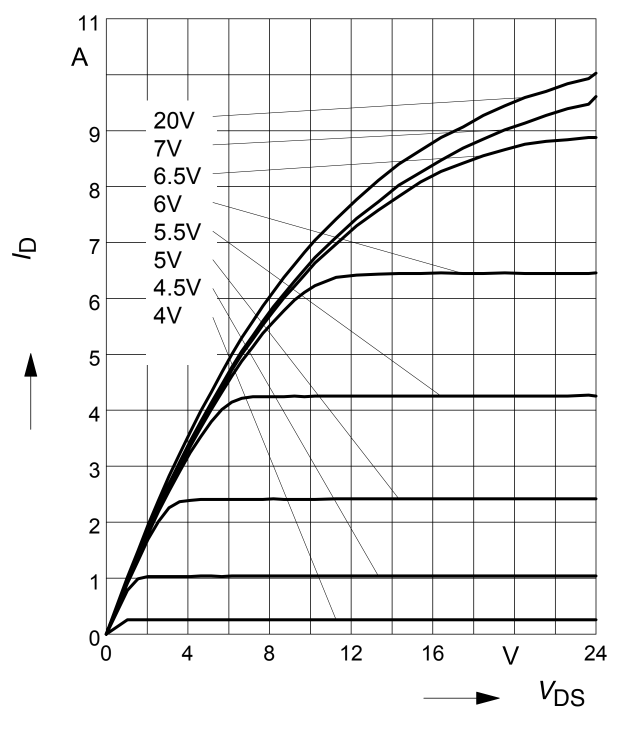
parameter: $D = t_p/T$



4 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

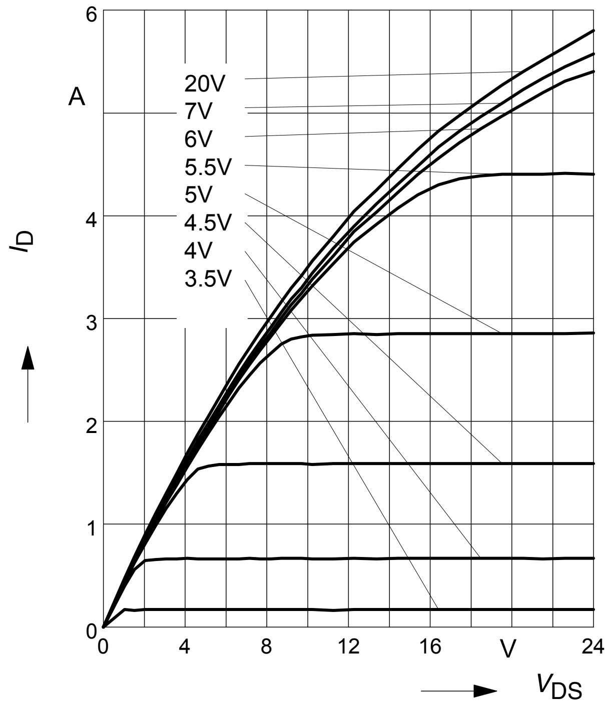
parameter: t_p = 10 µs, V_{GS}



5 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

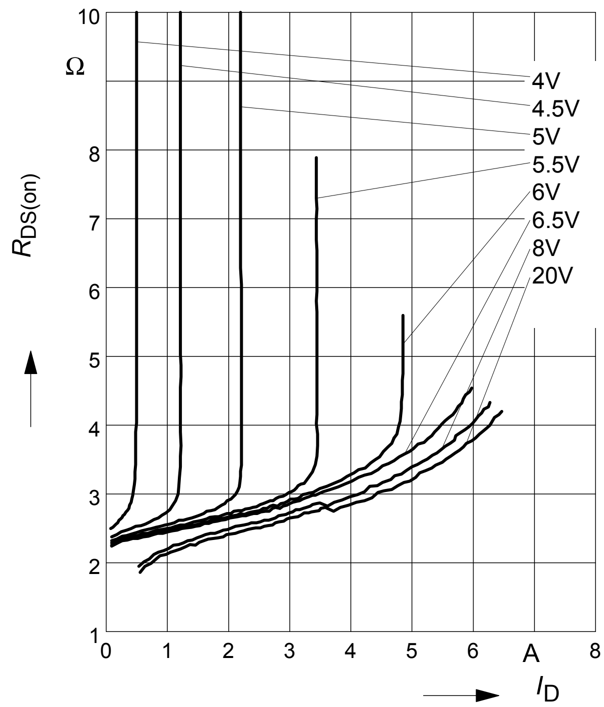
parameter: t_p = 10 µs, V_{GS}



6 Typ. drain-source on resistance

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

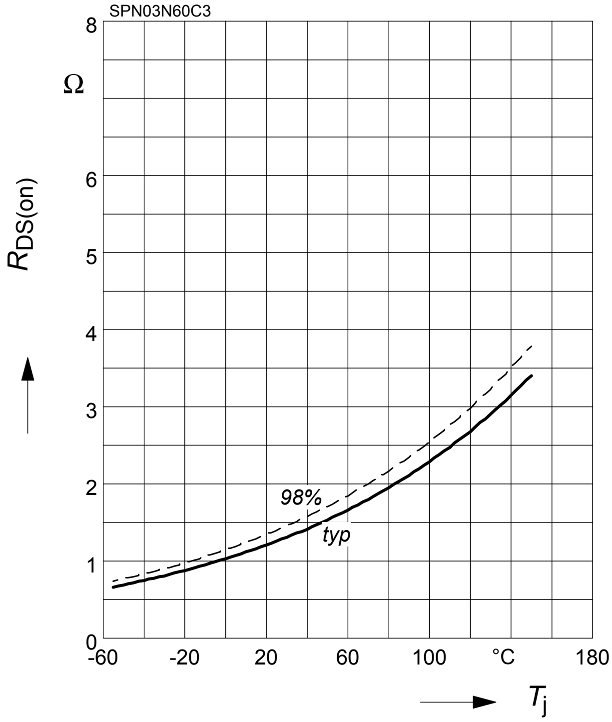
parameter: T_j=150°C, V_{GS}



7 Drain-source on-state resistance

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

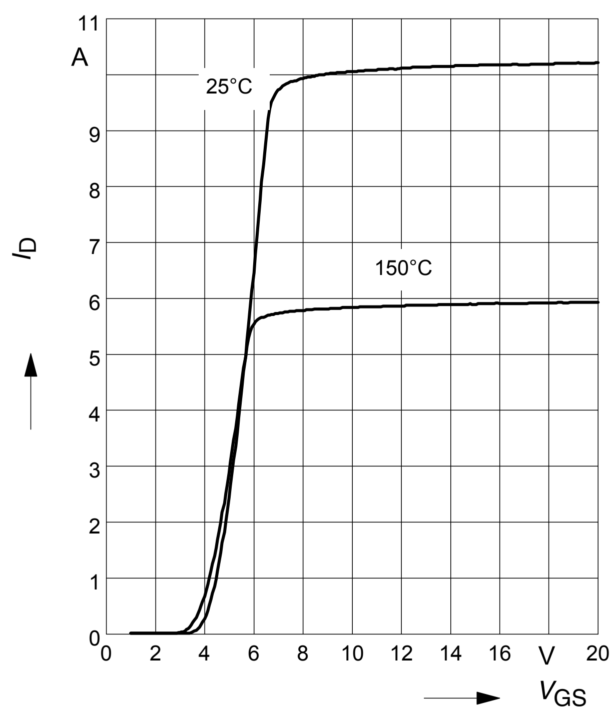
parameter : I_D = 0.4 A, V_{GS} = 10 V



8 Typ. transfer characteristics

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

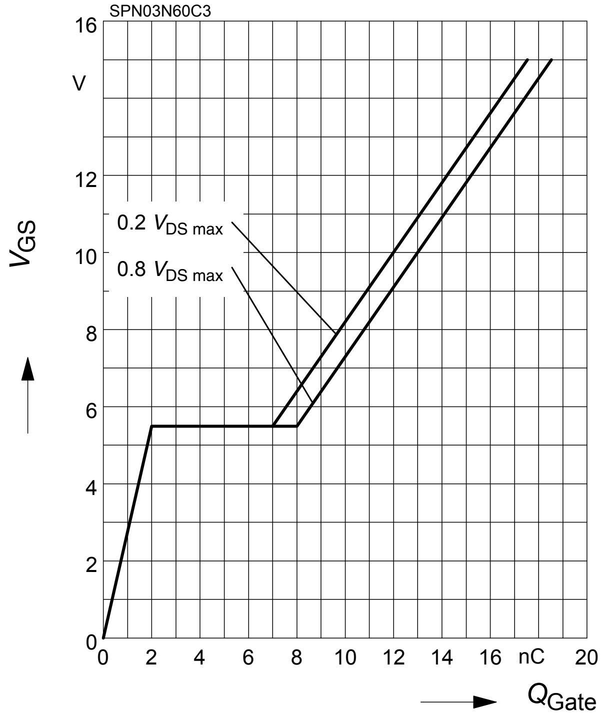
parameter: t_p = 10 µs



9 Typ. gate charge

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

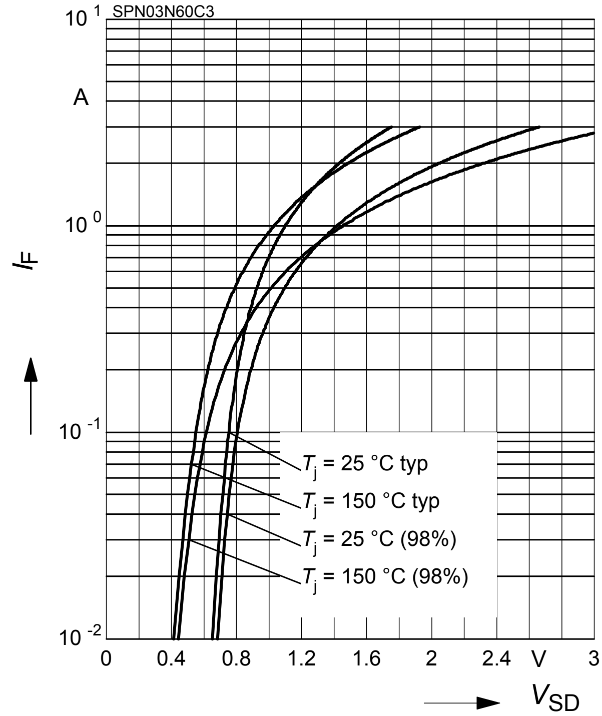
parameter: I_D = 0.7 A pulsed



10 Forward characteristics of body diode

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

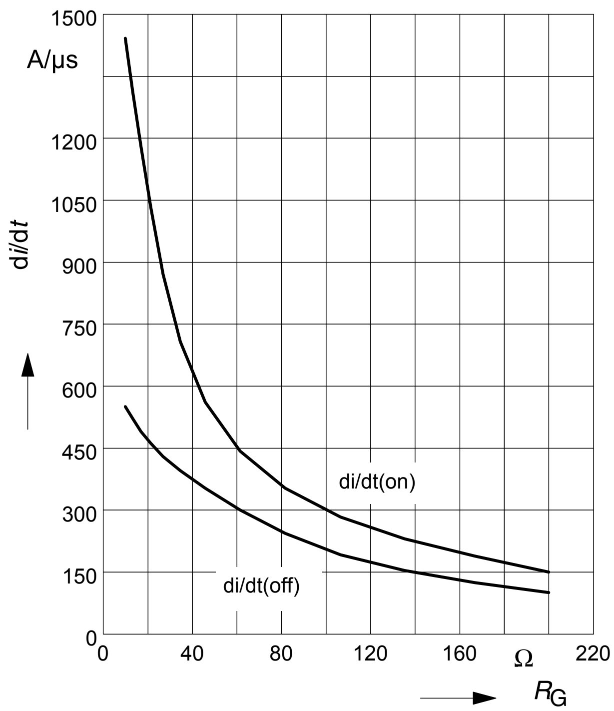
parameter: T_j , tp = 10 µs



11 Typ. drain current slope

di/dt = f(R_G), inductive load, T_j = 125°C

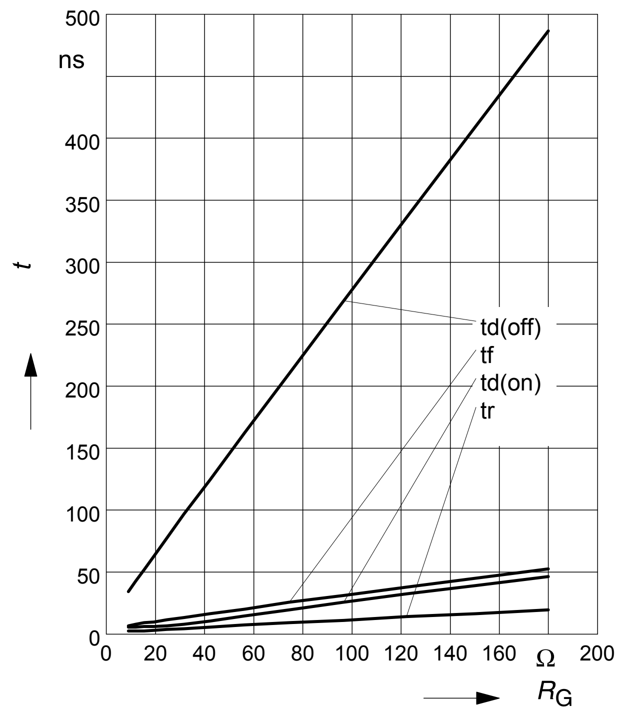
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=0.7A



12 Typ. switching time

$t = f\ (R_G)$, inductive load, T_j=125°C

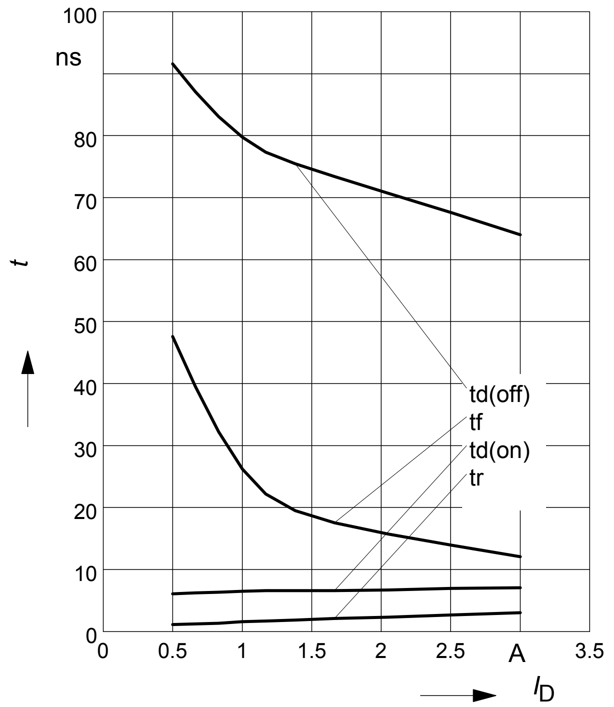
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=0.7 A



13 Typ. switching time

$t = f(I_D)$, inductive load, T_j=125°C

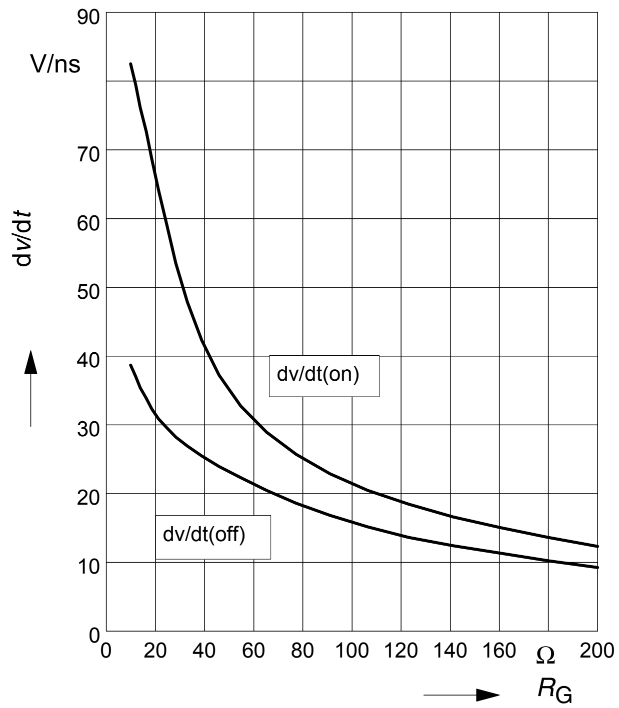
par.: V_{DS}=380V, V_{GS}=0/+13V, R_G=20Ω



14 Typ. drain source voltage slope

$dv/dt = f(R_G)$, inductive load, T_j = 125°C

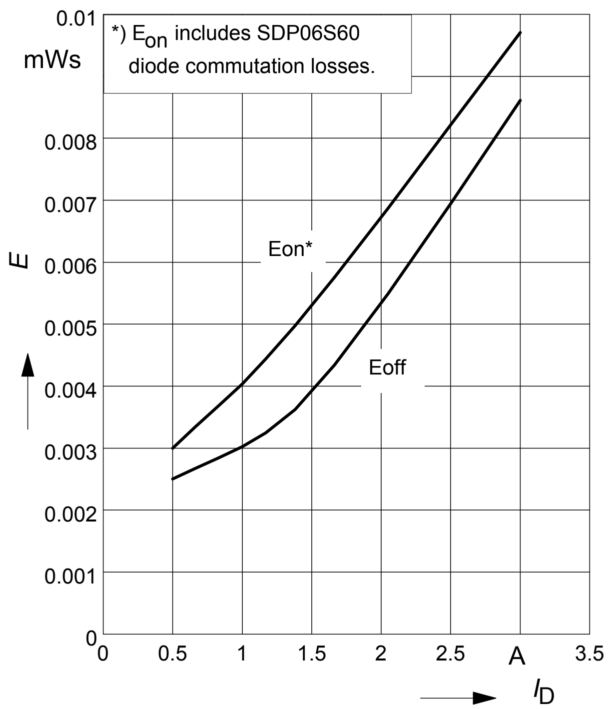
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=0.7A



15 Typ. switching losses

$E = f(I_D)$, inductive load, T_j=125°C

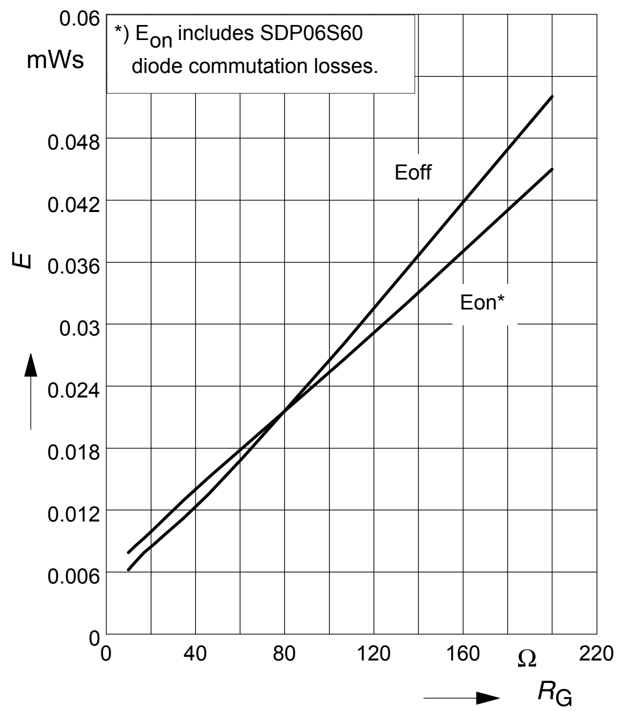
par.: V_{DS}=380V, V_{GS}=0/+13V, R_G=20Ω



16 Typ. switching losses

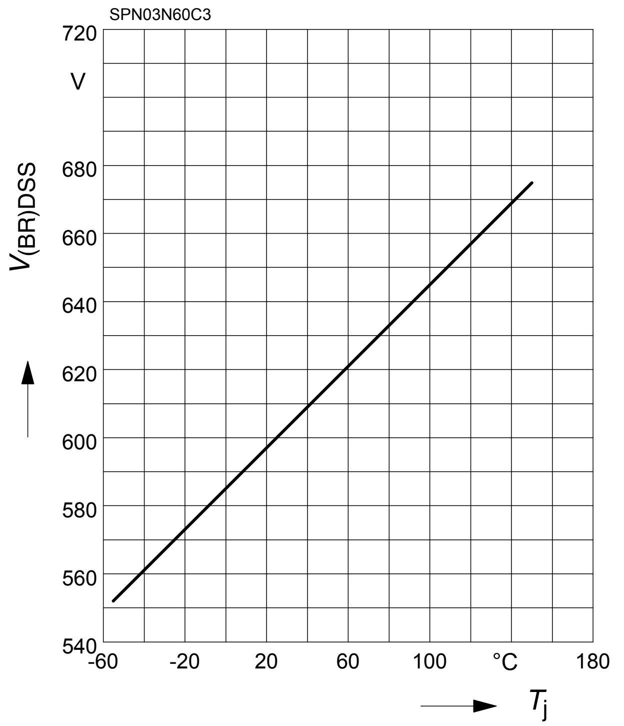
$E = f(R_G)$, inductive load, T_j=125°C

par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=0.7A



17 Drain-source breakdown voltage

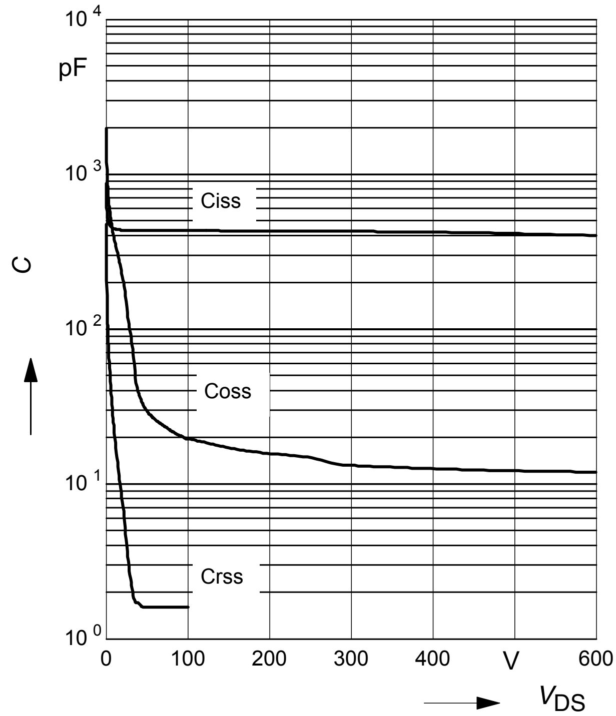
$V_{(BR)DSS} = f\,(T_j)$



18 Typ. capacitances

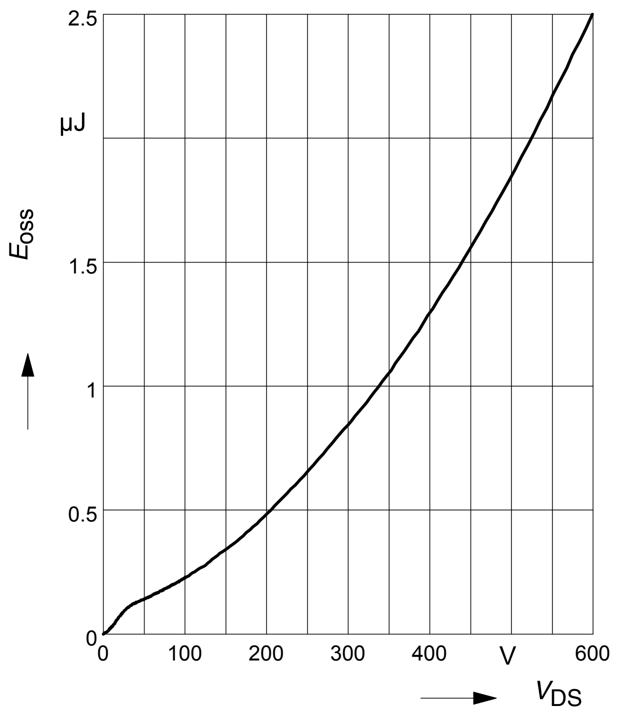
$C = f\,(V_{DS})$

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

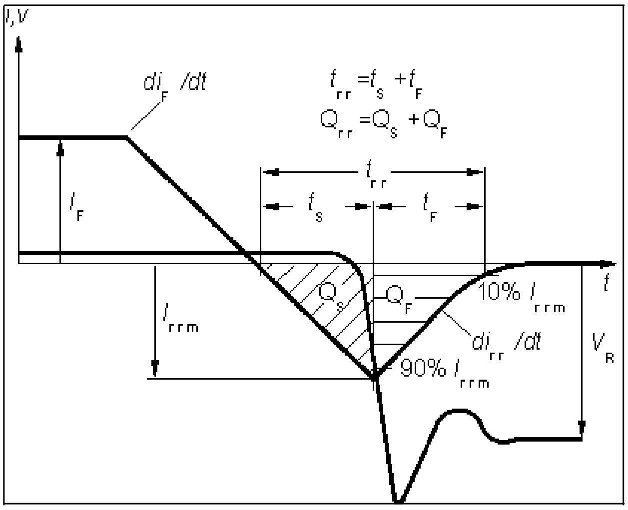


19 Typ. C_{oss} stored energy

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



Definition of diodes switching characteristics



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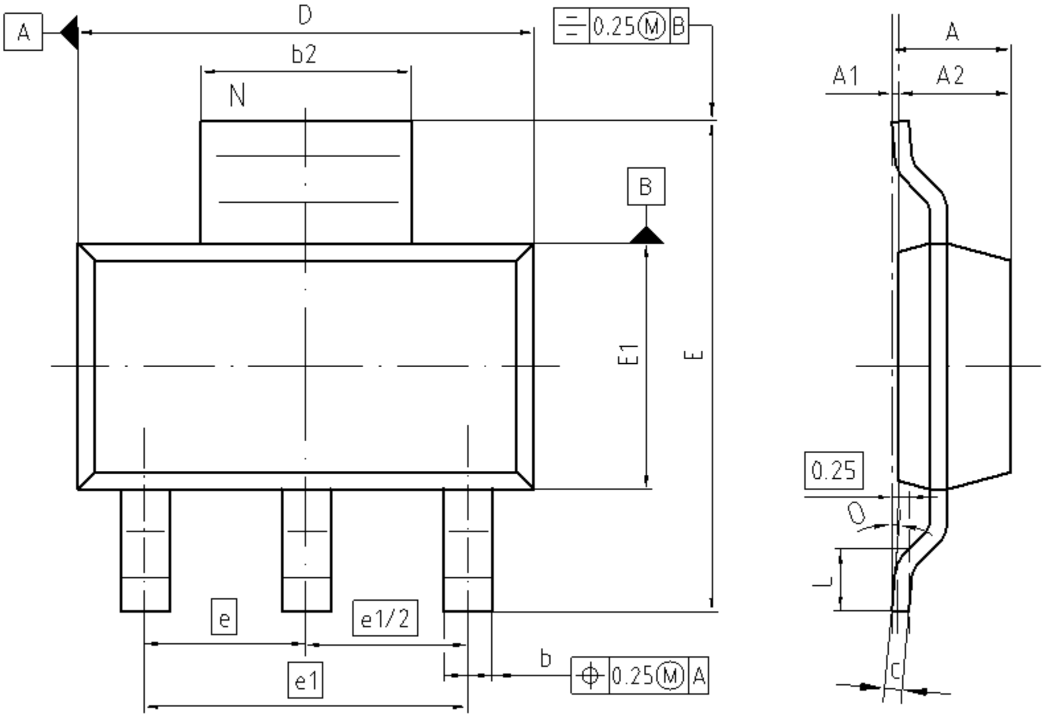
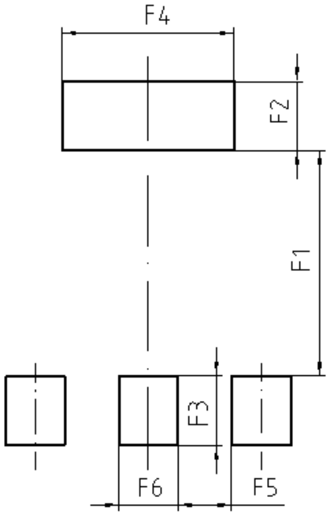


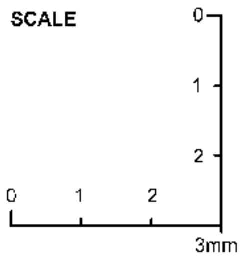


FOOTPRINT (REFLOW SOLDERING)

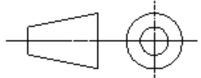
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.6	1.8	0.063	0.071
A1	-	0.1	-	0.004
A2	1.5	1.7	0.059	0.067
b	0.6	0.8	0.024	0.031
b2	2.9	3.1	0.114	0.122
c	0.24	0.32	0.009	0.013
D	6.3	6.7	0.248	0.264
E	6.7	7.3	0.264	0.287
E1	3.3	3.7	0.123	0.146
e	2.3 BASIC		0.091 BASIC	
e1	4.6 BASIC		0.181 BASIC	
L	0.75	-	0.023	-
N	4		4	
O	0°	10°	0°	10°
F1	4.8 BASIC		0.189 BASIC	
F2	1.4 BASIC		0.055 BASIC	
F3	1.4 BASIC		0.055 BASIC	
F4	3.5 BASIC		0.138 BASIC	
F5	1.1 BASIC		0.043 BASIC	
F6	1.2 BASIC		0.047 BASIC	

REFERENCE
JEDEC TO261 AA

SCALE



EUROPEAN PROJECTION



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SOT223

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