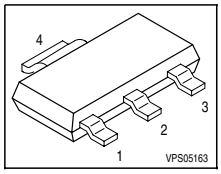
Cool MOS™ Power Transistor

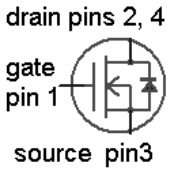
V_{DS}	600	V
$R_{DS(on)}$	0.95	Ω
I_D	0.8	A

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
- Qualified according to JEDEC[0)] for target applications

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

[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}.

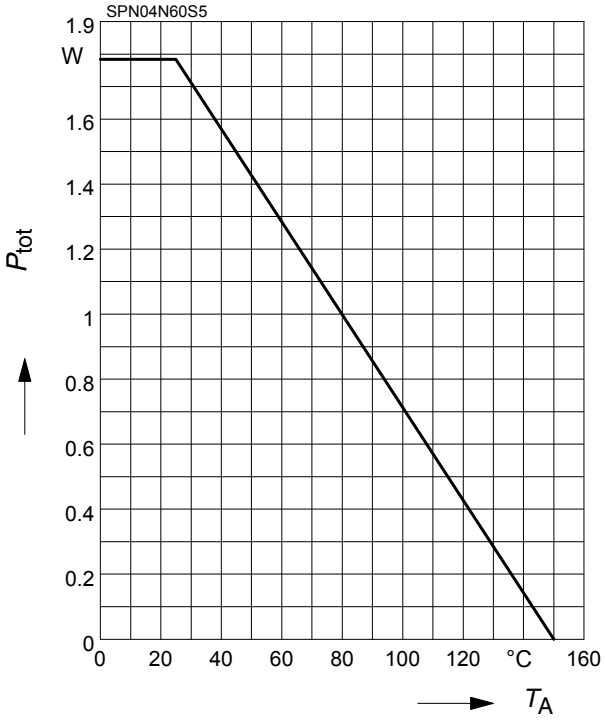
[3] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

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	-	-	0.8	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

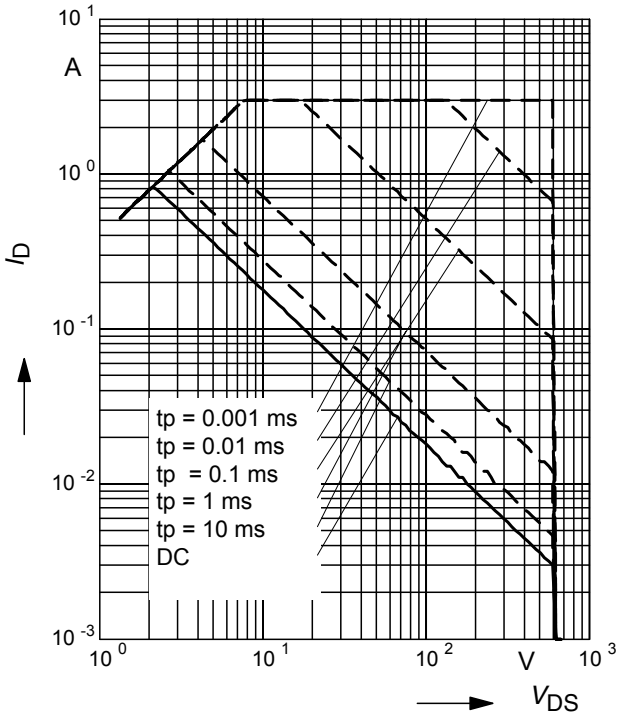
$P_{tot} = f(T_A)$



2 Safe operating area

$I_D = f(V_{DS})$

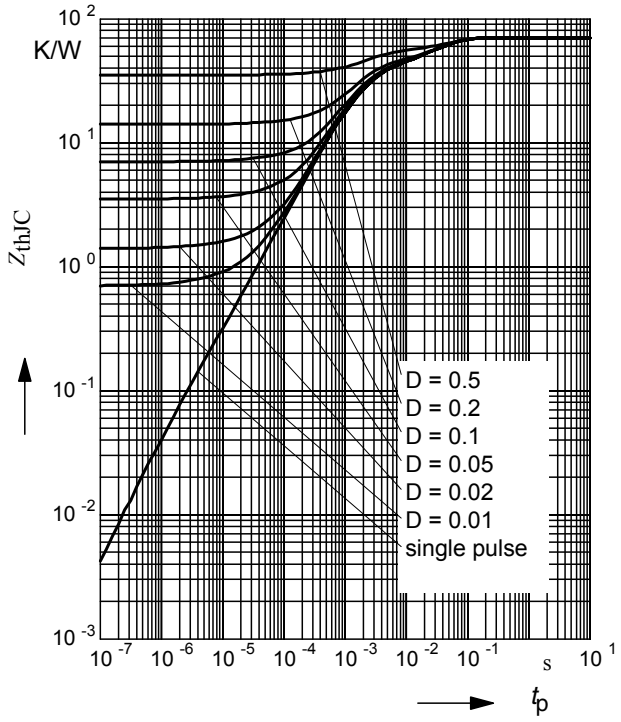
parameter : $D = 0$, T_A=25°C



3 Transient thermal impedance

$Z_{thJC} = f(t_p)$

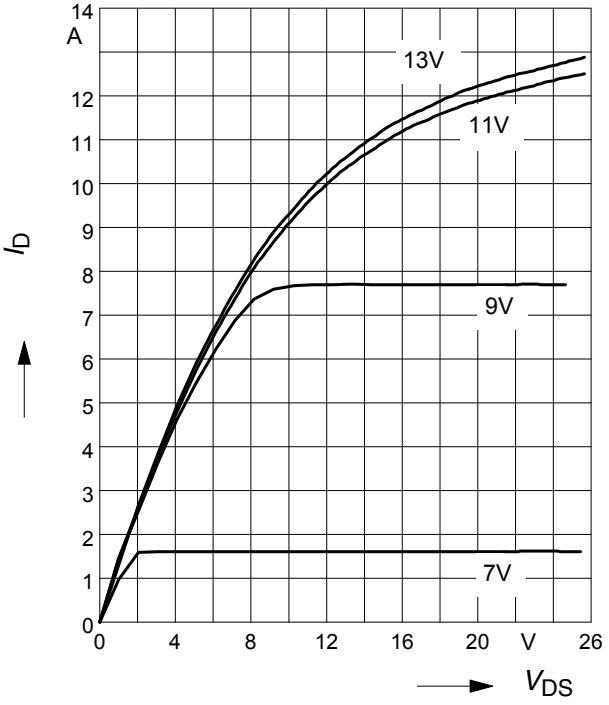
parameter: $D = t_p/T$



4 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

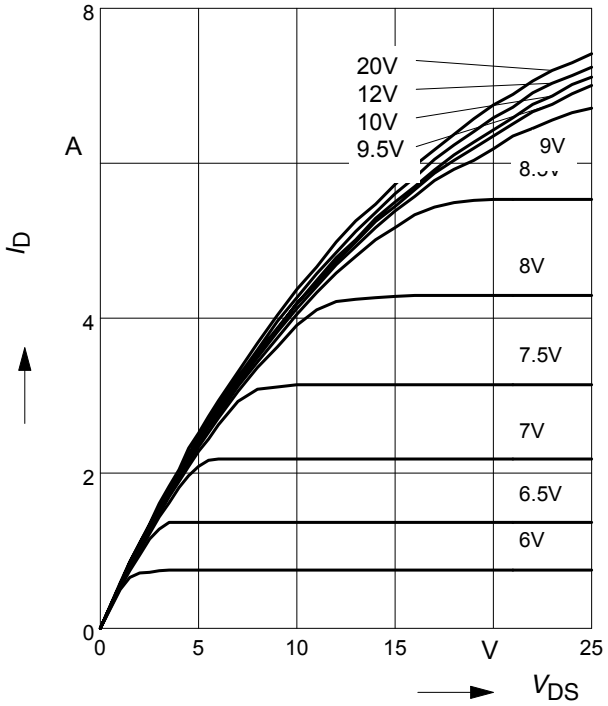
parameter: t_p = 10 µs, V_{GS}



5 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

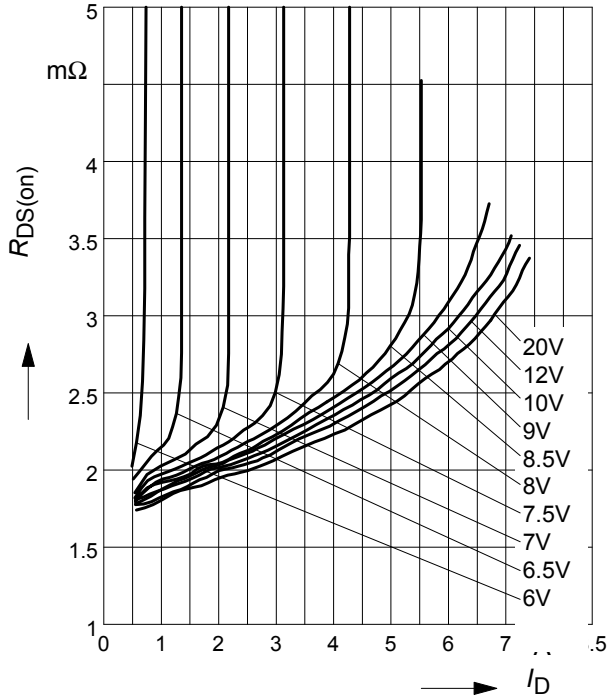
parameter: t_p = 10 µs, V_{GS}



6 Typ. drain-source on resistance

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

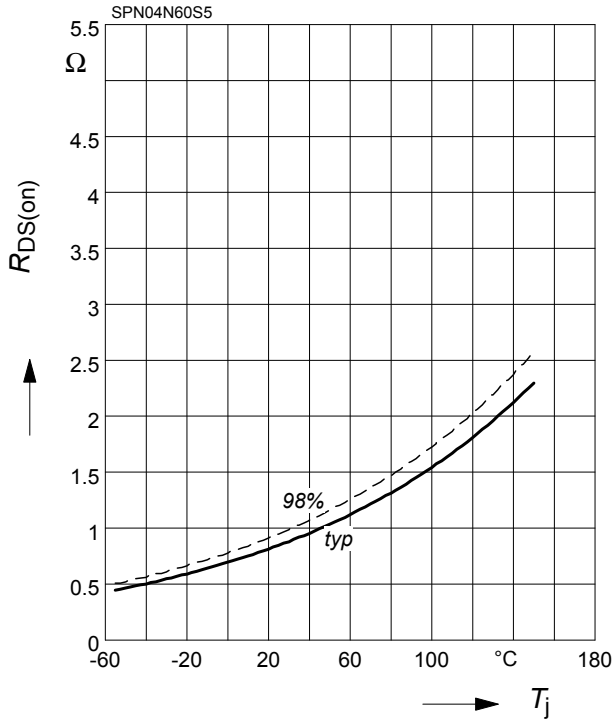
parameter: T_j=150°C, V_{GS}



7 Drain-source on-state resistance

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

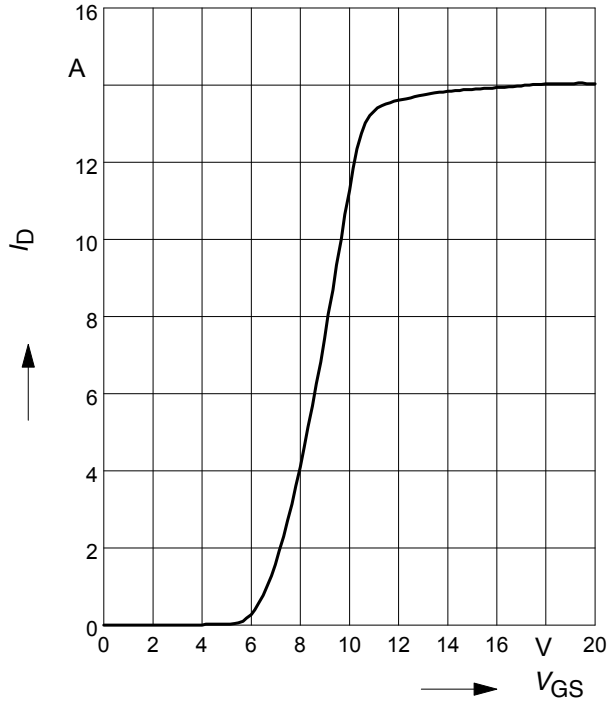
parameter : I_D = 0.65 A, V_{GS} = 10 V



8 Typ. transfer characteristics

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

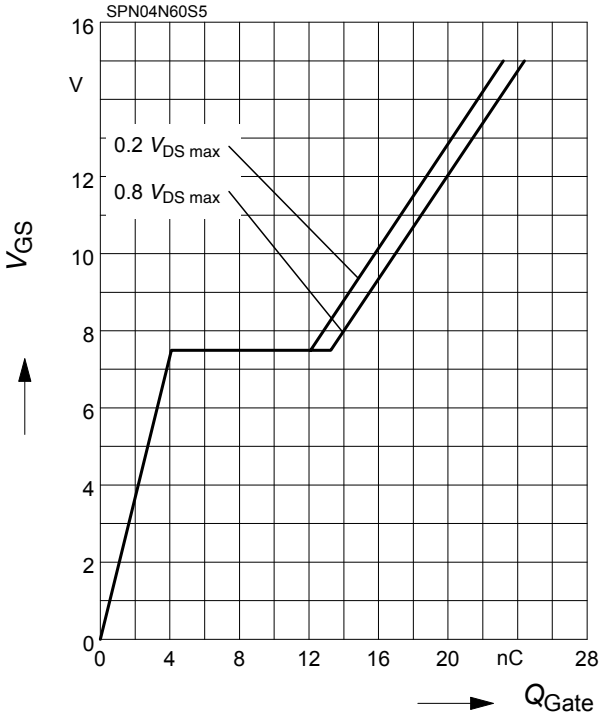
parameter: t_p = 10 µs



9 Typ. gate charge

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

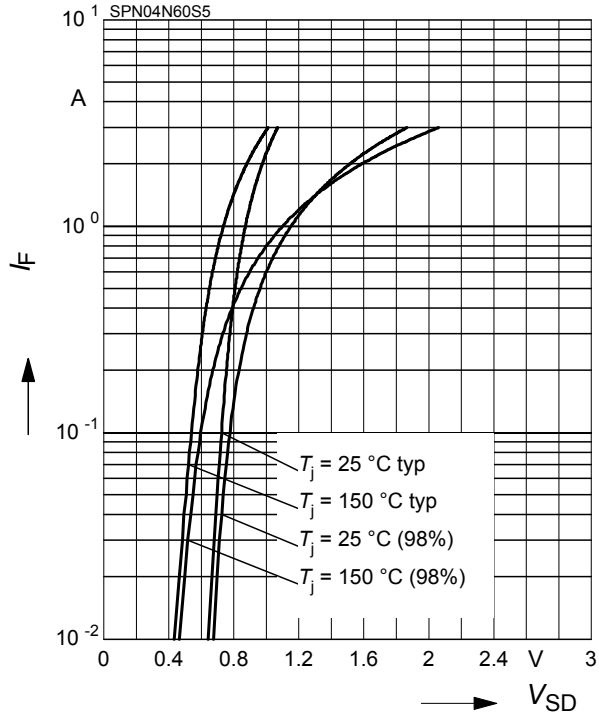
parameter: I_D = 0.8 A pulsed



10 Forward characteristics of body diode

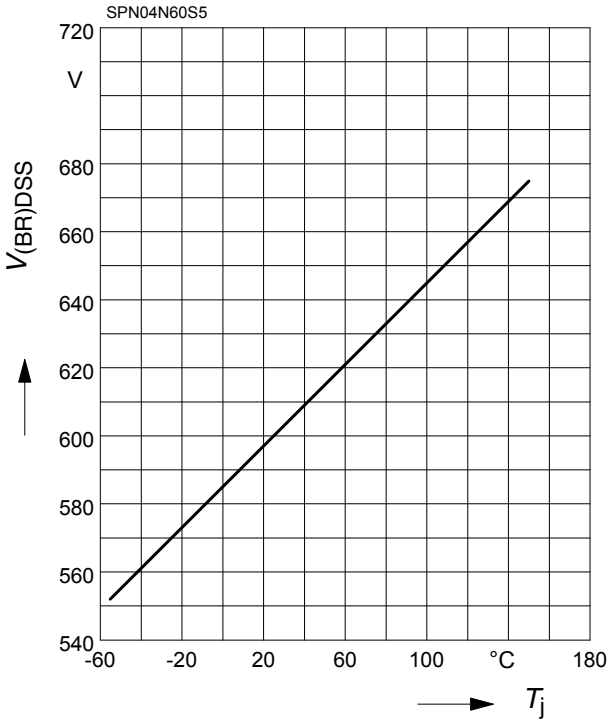
$I_F = f\ (V_{SD})$

parameter: T_j , tp = 10 µs



11 Drain-source breakdown voltage

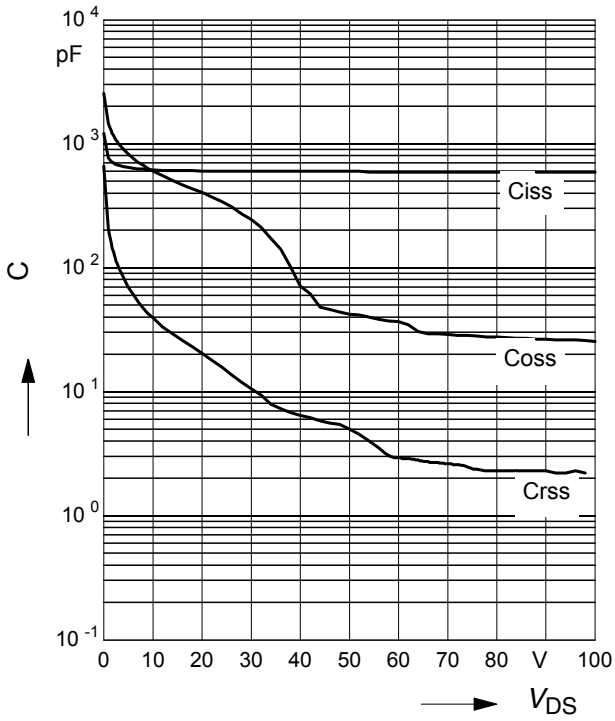
$V_{(BR)DSS} = f\ (T_j)$



12 Typ. capacitances

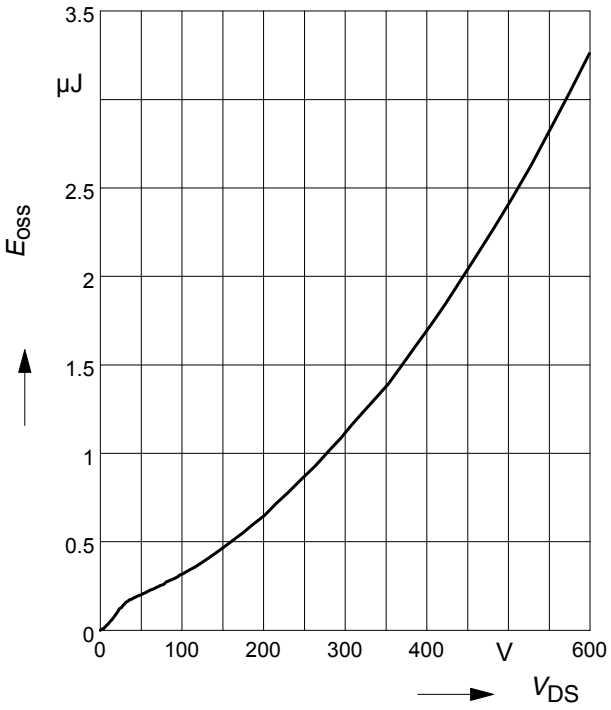
$C = f\ (V_{DS})$

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

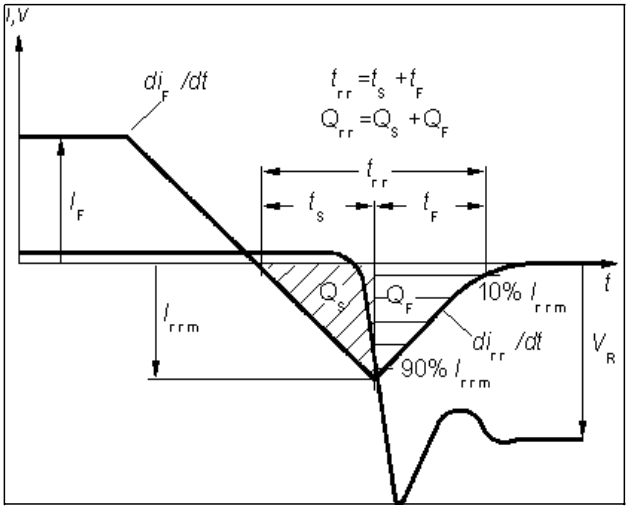


13 Typ. C_{oss} stored energy

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



Definition of diodes switching characteristics



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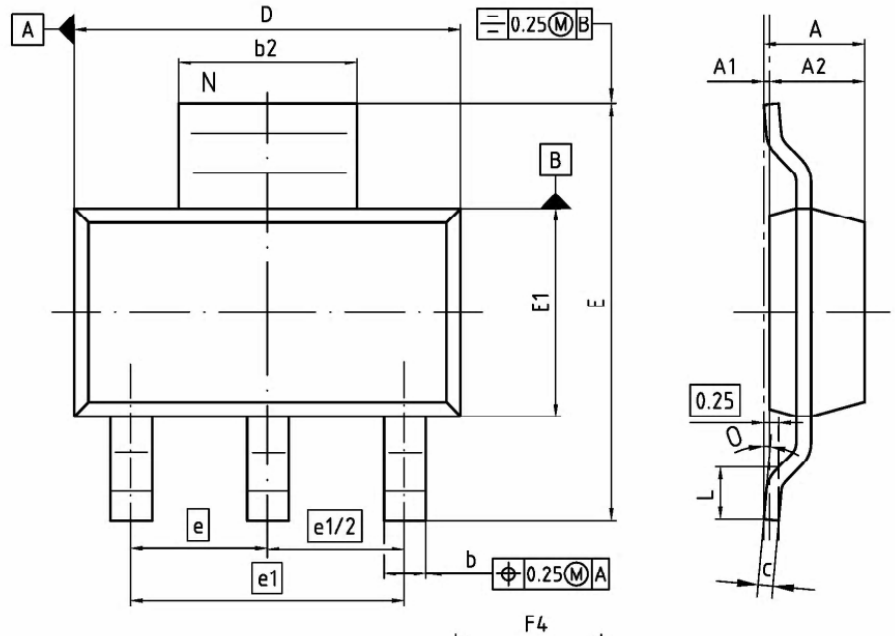
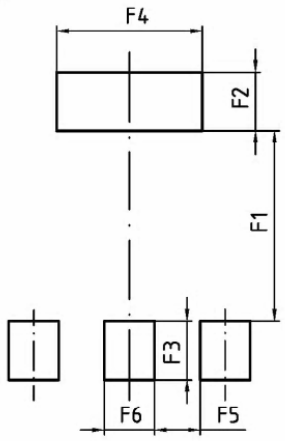




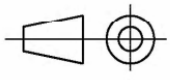
FOOTPRINT (REFLOW SOLDERING)

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
0 1 2 3mm

EUROPEAN PROJECTION



ISSUE DATE
04-28-2006

FILE
SOT223

Published by
Infineon Technologies AG,
Bereichs Kommunikation
St.-Martin-Strasse 53,
D-81541 München

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