CoolMOS^{TM} Power Transistor

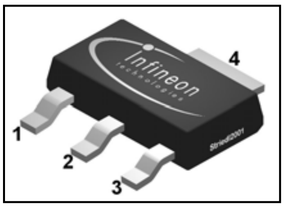
Features

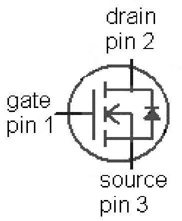
- New revolutionary high voltage technology
- Ultra low gate charge
- Ultra low effective capacitances
- Extreme dv/dt rated

Product Summary

V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	2.5	Ω
I_D	0.4	A

SOT223





Type	Package	Ordering Code	Marking
SPN02N60C3	SOT223	Q67040-S4553	02N60C3

Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_A=25 °C	0.4	A
		T_A=70 °C	0.3	
Pulsed drain current[1)]	$I_{D,pulse}$	T_A=25 °C	5.4	
Avalanche energy, single pulse	E_{AS}	I_D=0.9 A, V_{DD}=50 V	50	mJ
Avalanche energy, repetitive t_{AR}[1),2)]	E_{AR}	I_D=1.8 A, V_{DD}=50 V	0.07	
Avalanche current, repetitive t_{AR}[1)]	I_{AR}		1.8	A
Drain source voltage slope	dv/dt	I_D=1.8 A, V_{DS}=480 V, T_j=125 °C	50	V/ns
Gate source voltage	V_{GS}	static	±20	V
	V_{GS}	AC (f>1 Hz)	±30	
Power dissipation	P_{tot}	T_A=25 °C	1.8	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - soldering point	R_{thJS}		-	30	-	K/W
Thermal resistance, junction - ambient	R_{thJA}	SMD version, device on PCB, minimal footprint	-	110	-	
		SMD version, device on PCB, 6 cm^2 cooling area[2)]	-	70	-	
Soldering temperature	T_{sold}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	°C

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

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=250 µA	600	-	-	V
Avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0 V, I_D=0.25 A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=0.08 mA	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	0.5	1	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	-	50	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=1.1 A, T_j=25 °C	-	2.0	2.5	Ω
		V_{GS}=10 V, I_D=1.1 A, T_j=150 °C	-	5.2	-	
Gate resistance	R_G	f=1 MHz, open drain	-	9	-	
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=1.1 A	-	1.75	-	S

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=25 V, f=1 MHz	-	200	-	pF
Output capacitance	C_{oss}		-	90	-	
Reverse transfer capacitance	C_{rss}		-	4	-	
Effective output capacitance, energy related[3)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	8	-	
Effective output capacitance, time related[4)]	$C_{o(tr)}$		-	16	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=350 V, V_{GS}=10 V, I_D=1.8 A, R_G=25 Ω	-	6	-	ns
Rise time	t_r		-	3	-	
Turn-off delay time	$t_{d(off)}$		-	68	-	
Fall time	t_f		-	12	30	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=420 V, I_D=1.8 A, V_{GS}=0 to 10 V	-	1.6	-	nC
Gate to drain charge	Q_{gd}		-	4	-	
Gate charge total	Q_g		-	10	13	
Gate plateau voltage	$V_{plateau}$		-	5.5	-	V

1) Pulse width limited by maximum temperature $T_{j,max}$ only

2) Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

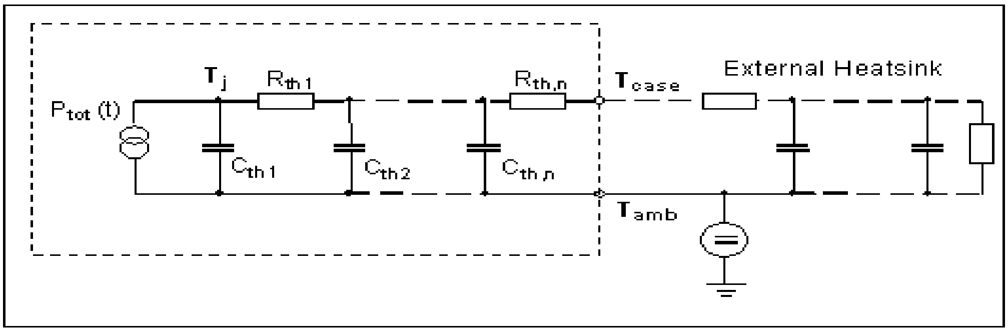
3) $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{DSS.}$

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 °C	-	-	0.4	A
Diode pulse current	$I_{S,pulse}$		-	-	5.4	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=0.4 A, T_j=25 °C	-	0.82	1.05	V
Reverse recovery time	t_{rr}	V_R=420 V, I_F=I_S, di_F/dt=100 A/µs	-	200	350	ns
Reverse recovery charge	Q_{rr}		-	1.3	-	µC
Peak reverse recovery current	I_{rrm}		-	9	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j=25 °C	-	200	-	A/µs

Typical Transient Thermal Characteristics

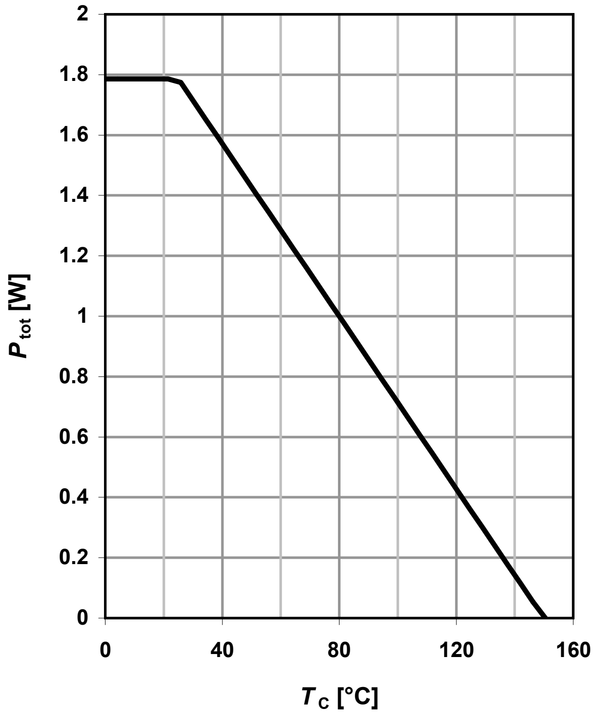
Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
R_{th1}	0.113	K/W	C_{th1}	0.0000144	Ws/K
R_{th2}	0.156		C_{th2}	0.000087	
R_{th3}	0.875		C_{th3}	0.000123	
R_{th4}	3.63		C_{th4}	0.0005	
R_{th5}	8.29		C_{th5}	0.012	
			C_{th6}	0.05[5)]	



[5)] C_{th6} models the additional heat capacitance of the package in case of non-ideal cooling. It is not needed if R_{thCA}=0 K/W.

1 Power dissipation

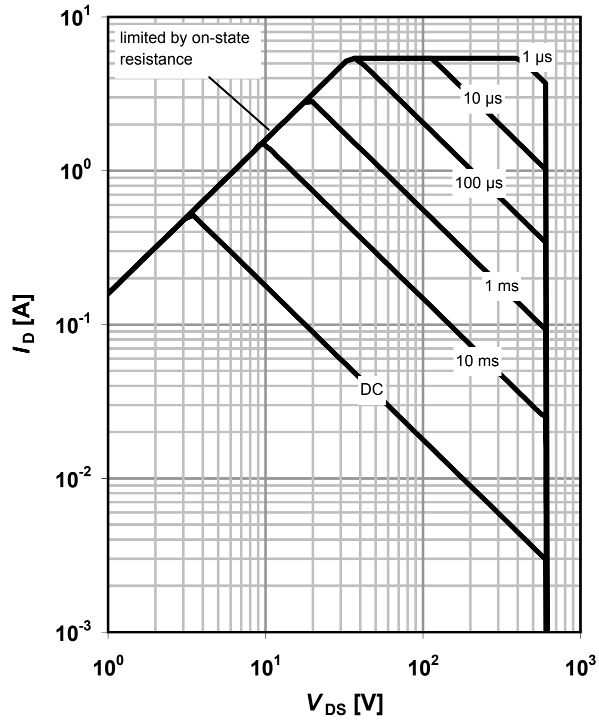
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS})$; T_C=25 °C; D=0

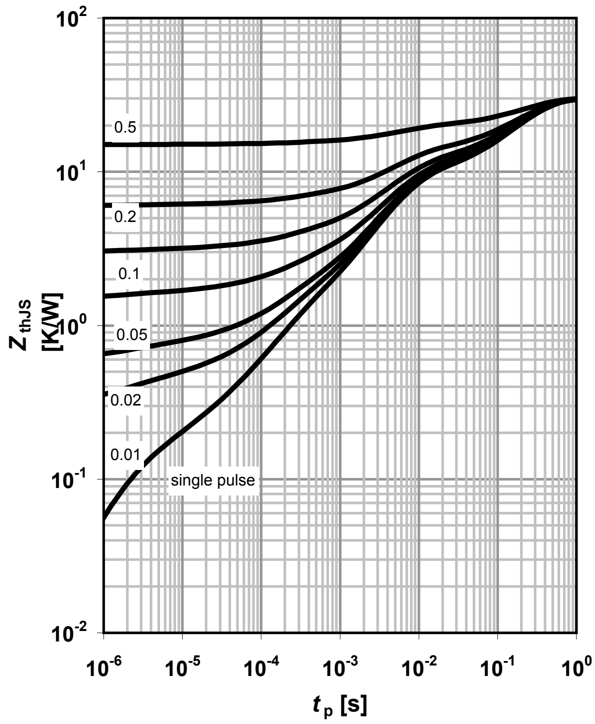
parameter: t_p



3 Max. transient thermal impedance

$I_D=f(V_{DS})$; T_j=25 °C

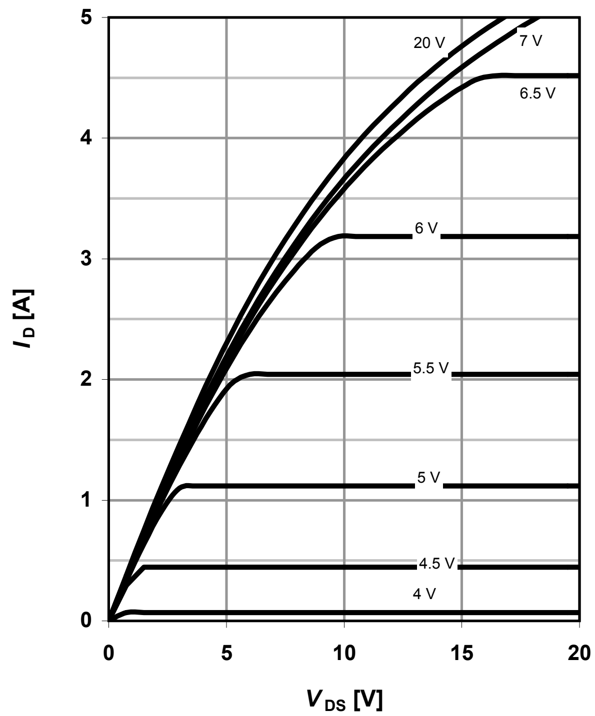
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS})$; T_j=25 °C

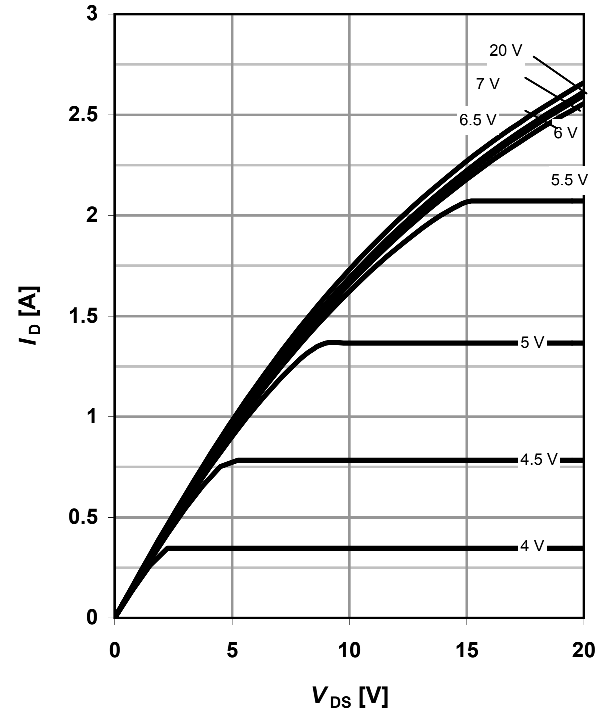
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

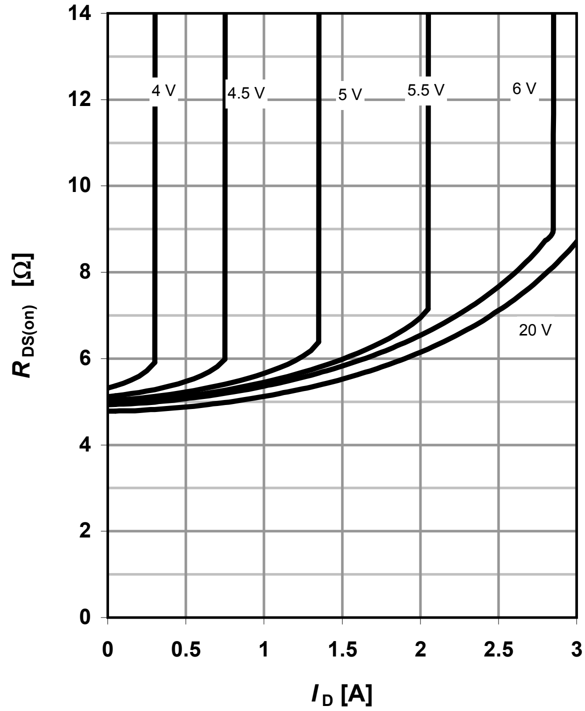
parameter: V_{GS}



6 Typ. drain-source on-state resistance

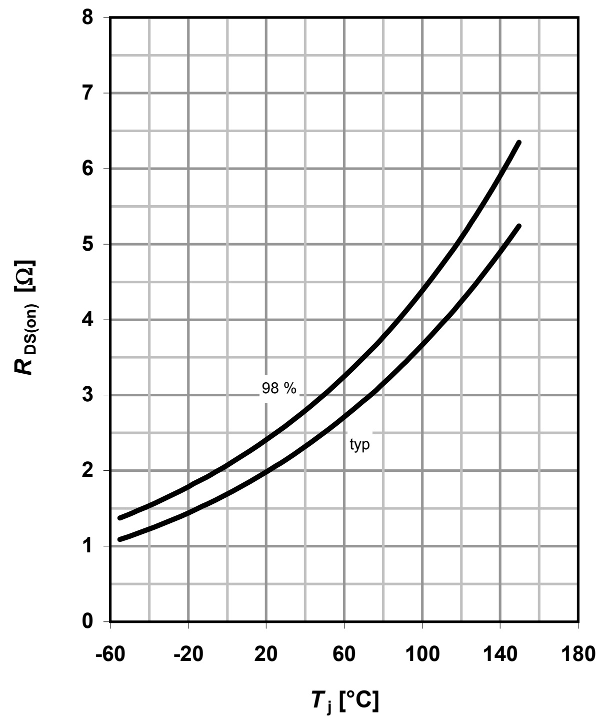
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

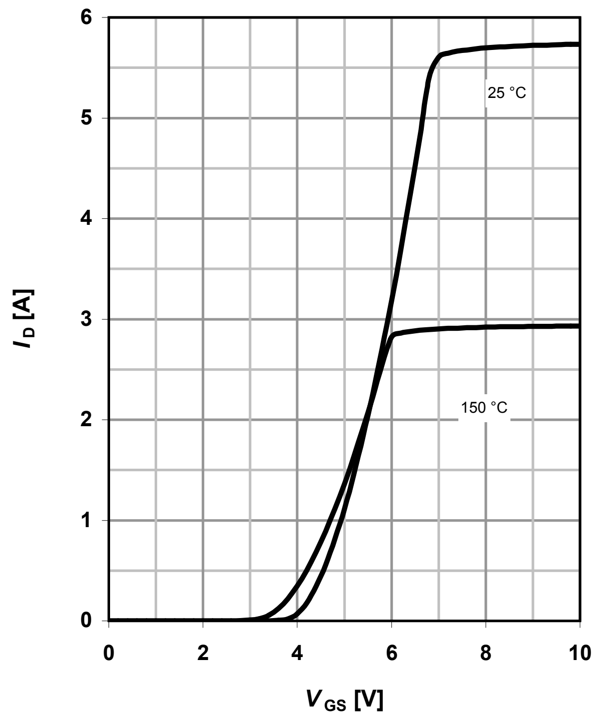
$R_{DS(on)}$=f(T_j); I_D=1.1 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

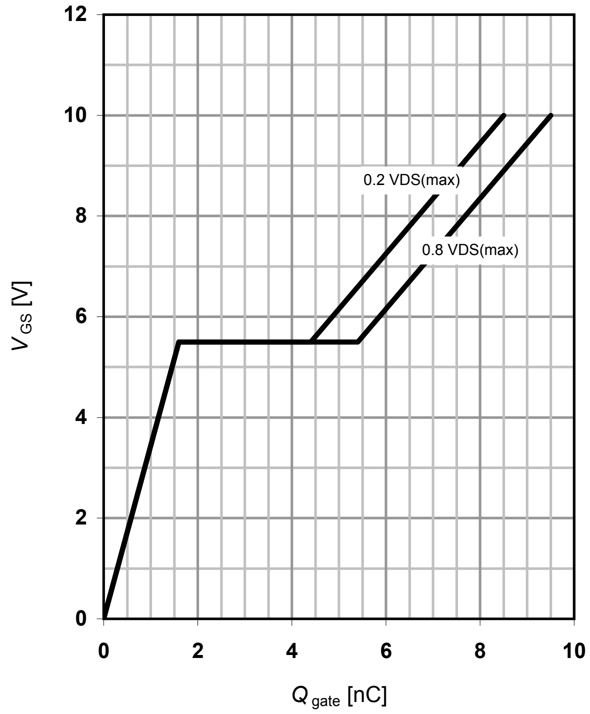
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=1.8 A pulsed

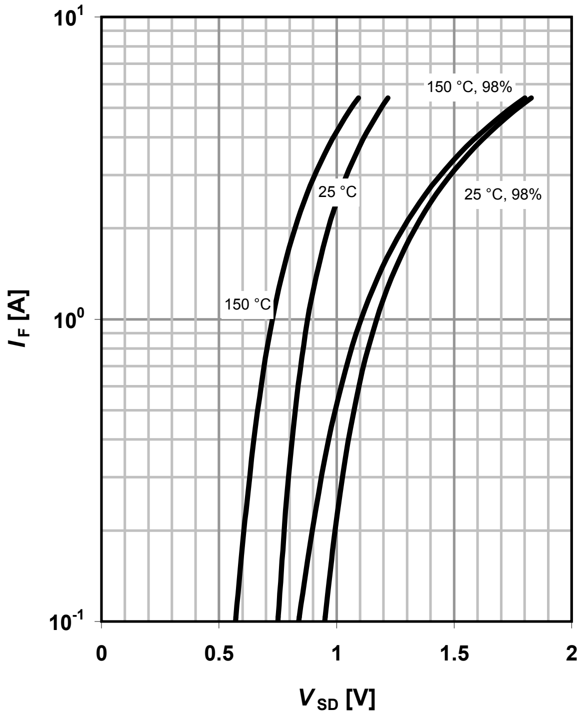
parameter: V_{DD}



10 Forward characteristics of reverse diode

I_F=f(V_{SD})

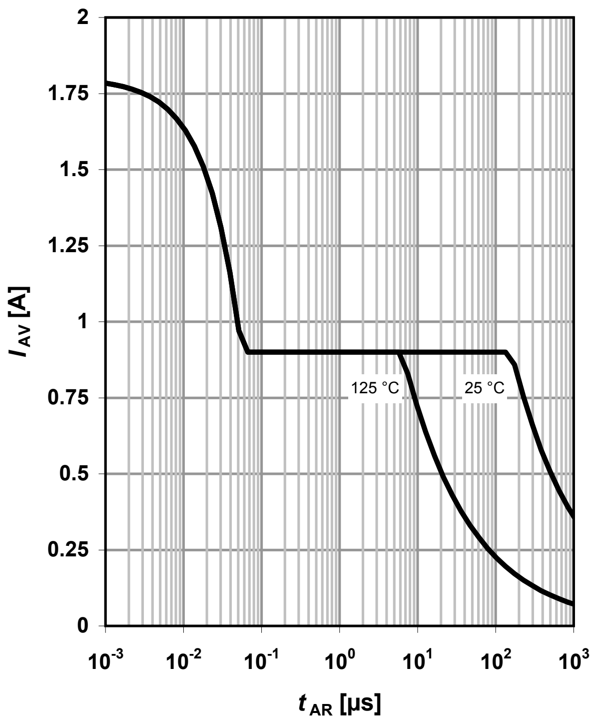
parameter: T_j



11 Avalanche SOA

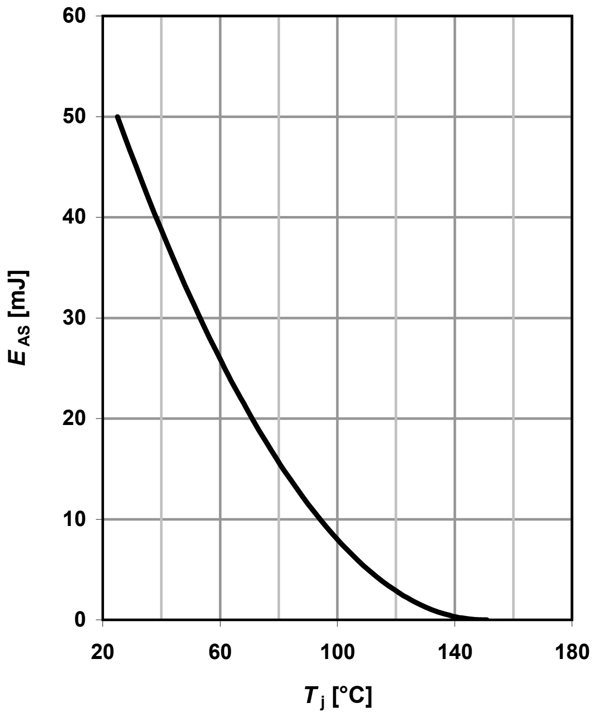
I_{AR}=f(t_{AR})

parameter: $T_{j(start)}$



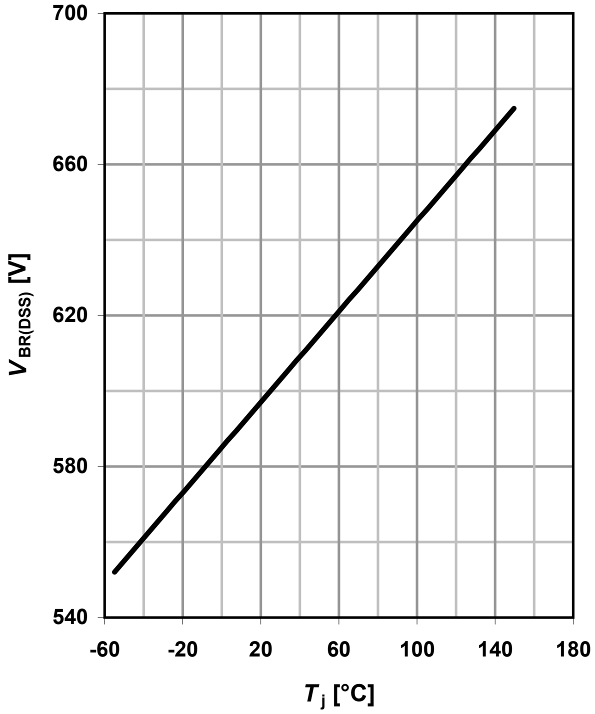
12 Avalanche energy

E_{AS}=f(T_j); I_D=0.9 A; V_{DD}=50 V



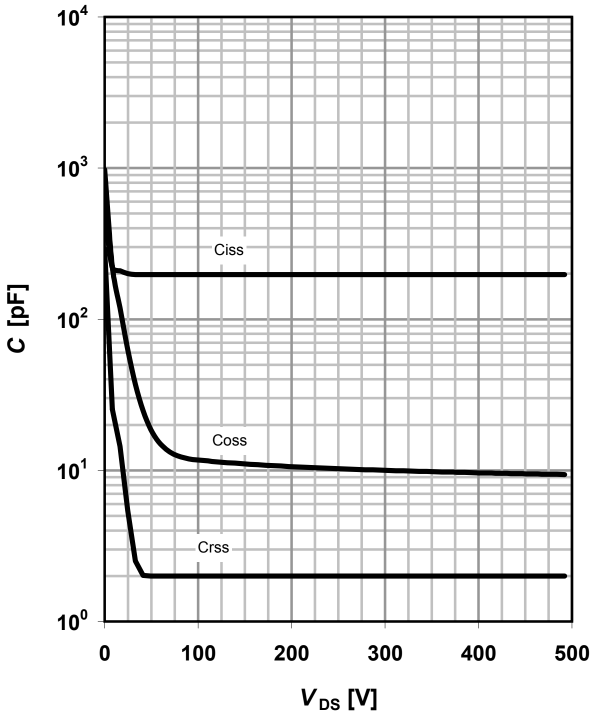
13 Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA



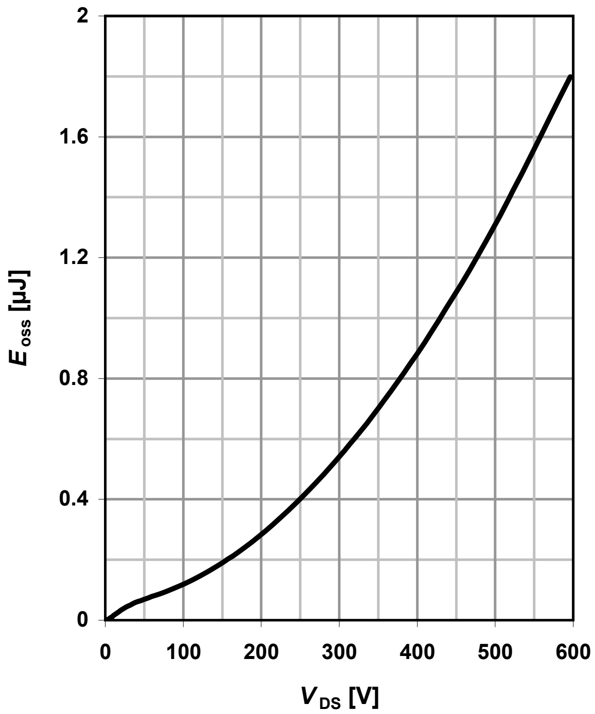
14 Typ. capacitances

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

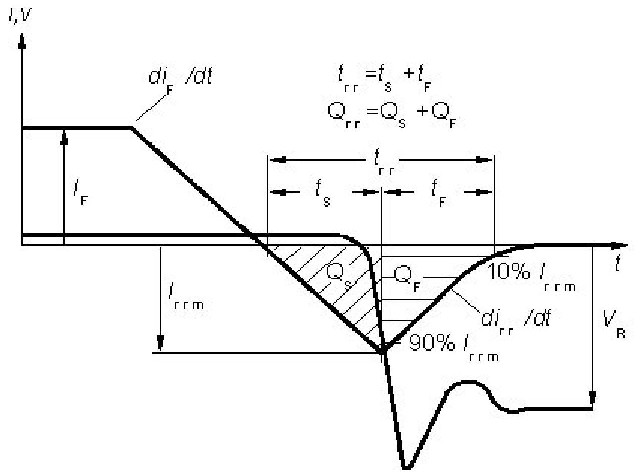


15 Typ. C_{oss} stored energy

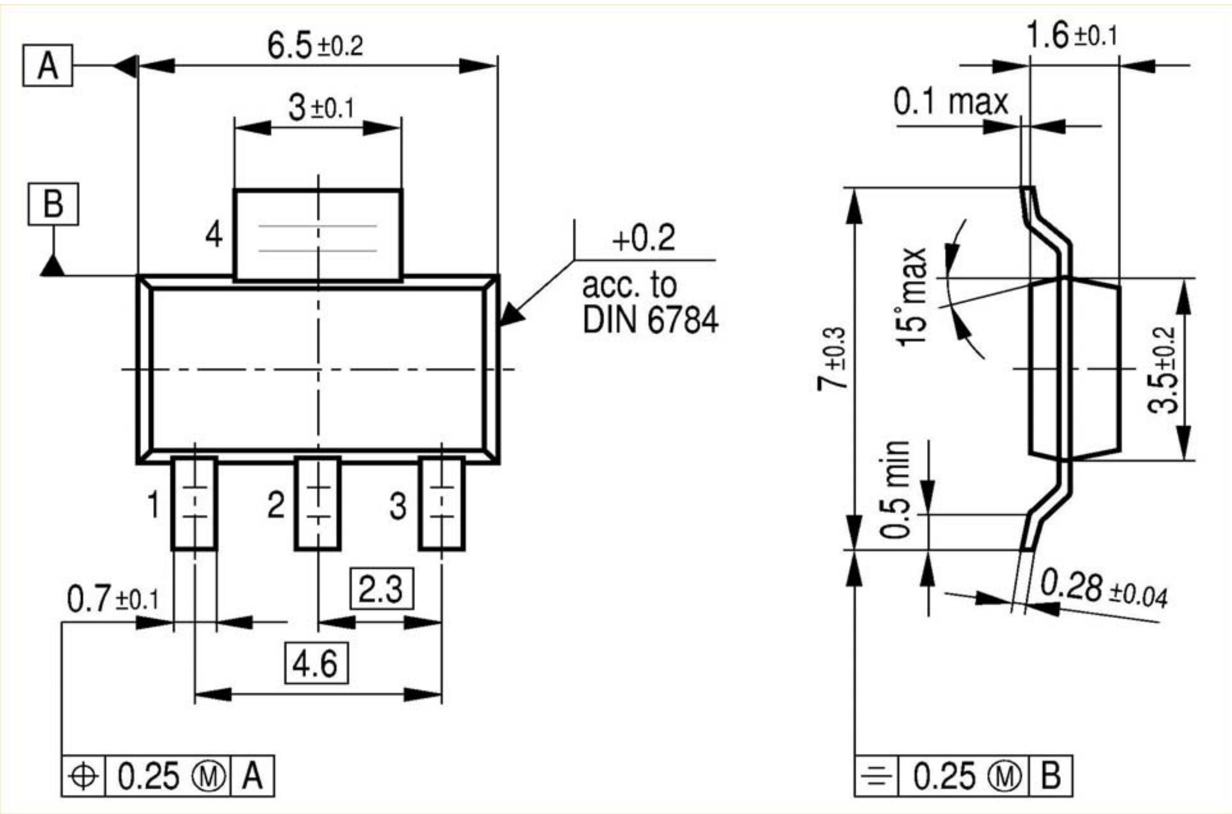
E_{oss}=f(V_{DS})



Definition of diode switching characteristics



SOT223: Outline



Dimensions in mm

Published by
Infineon Technologies AG
Bereich Kommunikation
St.-Martin-Straße 53
D-81541 München
© Infineon Technologies AG 1999
All Rights Reserved.

Attention please!
The information herein is given to describe certain components and shall not be considered as warranted characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Infineon Technologies is an approved CECC manufacturer.

Information
For further information on technology, delivery terms and conditions and prices, please contact your nearest Infineon Technologies office in Germany or our Infineon Technologies representatives worldwide (see address list).

Warnings
Due to technical requirements, components may contain dangerous substances.
For information on the types in question, please contact your nearest Infineon Technologies office.

Infineon Technologies' components may only be used in life-support devices or systems with the expressed written approval of Infineon Technologies if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.