CoolMOS™ Power Transistor

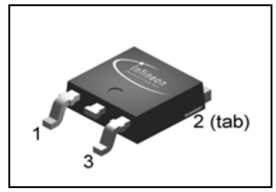
Product Summary

V_{DS} @ T_J=25°C	900	V
$R_{DS(on),max}$ @T_J=25°C	1.2	Ω
$Q_{g,typ}$	28	nC

Features

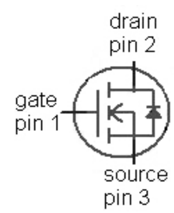
- Lowest figure-of-merit R_{ON} x Q_g
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC[1)] for target applications
- Pb-free lead plating; RoHS compliant
- Ultra low gate charge

PG-TO252



CoolMOS™ 900V is designed for:

- Quasi Resonant Flyback / Forward topologies
- PC Silverbox and consumer applications
- Industrial SMPS



Type	Package	Marking
IPD90R1K2C3	PG-TO252	9R1K2C

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	5.1	A
		T_C=100 °C	3.2	
Pulsed drain current [2)]	$I_{D,pulse}$	T_C=25 °C	10	
Avalanche energy, single pulse	E_{AS}	I_D=0.92 A, V_{DD}=50 V	68	mJ
Avalanche energy, repetitive t_{AR} [2),3)]	E_{AR}	I_D=0.92 A, V_{DD}=50 V	0.31	
Avalanche current, repetitive t_{AR} [2),3)]	I_{AR}		0.92	A
MOSFET d*v*/d*t* ruggedness	d*v*/d*t*	V_{DS}=0...400 V	50	V/ns
Gate source voltage	V_{GS}	static	±20	V
		AC (f>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	83	W
Operating and storage temperature	T_J, T_{stg}		-55 ... 150	°C

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

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current	I_S	T_C=25 °C	2.8	A
Diode pulse current [2]	$I_{S,pulse}$		11	
Reverse diode dv/dt [4]	*dv/dt*		4	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	1.5	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering only allowed at leads	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						
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=250 µA	900	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=0.31 mA	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=900 V, V_{GS}=0 V, T_j=25 °C	-	-	1	µA
		V_{DS}=900 V, V_{GS}=0 V, T_j=150 °C	-	10	-	
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=2.8 A, T_j=25 °C	-	0.94	1.2	Ω
		V_{GS}=10 V, I_D=2.8 A, T_j=150 °C	-	2.5	-	
Gate resistance	R_G	f=1 MHz, open drain	-	1.3	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz	-	710	-	pF
Output capacitance	C_{oss}		-	35	-	
Effective output capacitance, energy related [5]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 500 V	-	23	-	
Effective output capacitance, time related [6]	$C_{o(tr)}$		-	86	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=2.8 A, R_G=81.3 Ω	-	70	-	ns
Rise time	t_r		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	400	-	
Fall time	t_f		-	40	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=2.8 A, V_{GS}=0 to 10 V	-	3.2	-	nC
Gate to drain charge	Q_{gd}		-	12	-	
Gate charge total	Q_g		-	28	tbd	
Gate plateau voltage	$V_{plateau}$		-	4.6	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=2.8 A, T_j=25 °C	-	0.8	1.2	V
Reverse recovery time	t_{rr}	V_R=400 V, I_F=I_S, di_F/dt=100 A/μs	-	310	-	ns
Reverse recovery charge	Q_{rr}		-	3.7	-	μC
Peak reverse recovery current	I_{rrm}		-	19	-	A

[1] J-STD20 and JESD22

[2] Pulse width t_p limited by $T_{J,max}$

[3] Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

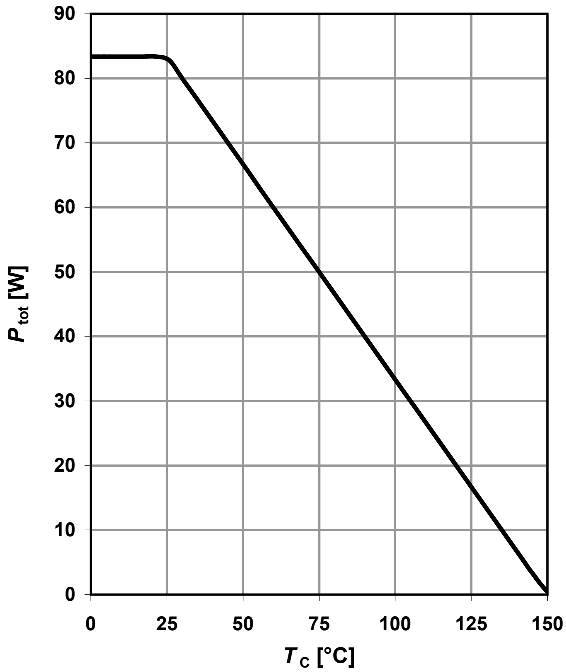
[4] $I_{SD} \leq I_D$, di/dt≤200A/μs, V_{DClink}=400V, $V_{peak}<V_{(BR)DSS}$, $T_J<T_{J,max}$, identical low side and high side switch

[5] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 50% V_{DSS}.

[6] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 50% V_{DSS}.

1 Power dissipation

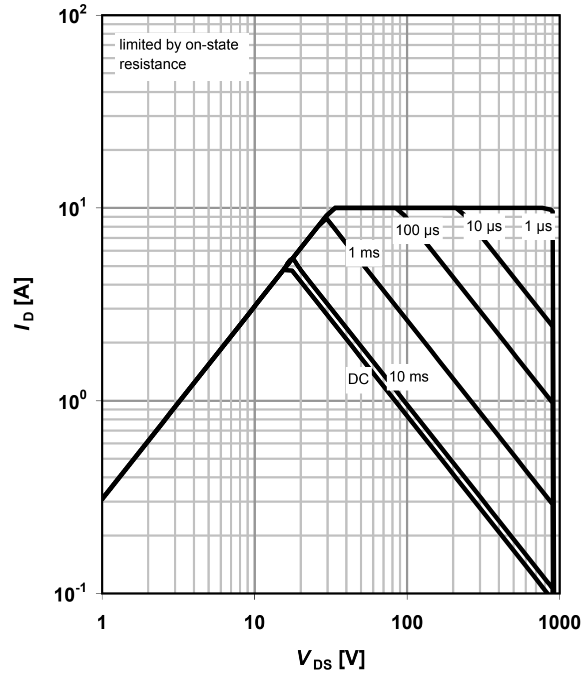
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

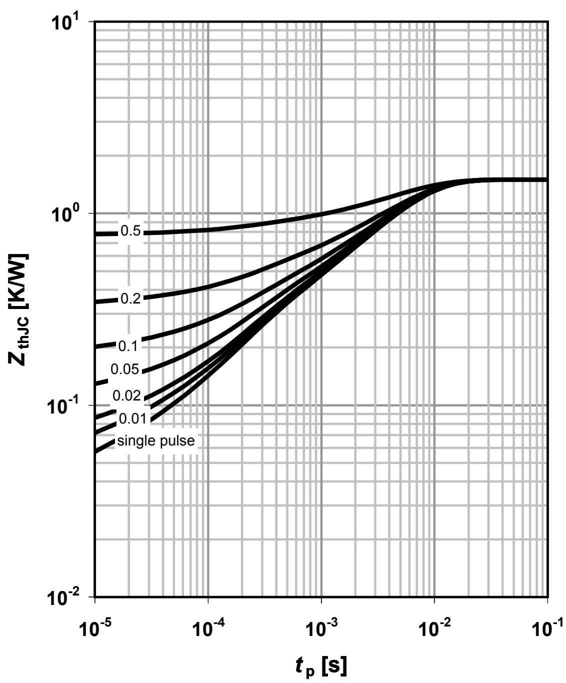
parameter: t_p



3 Max. transient thermal impedance

Z_{thJC}=f(t_P)

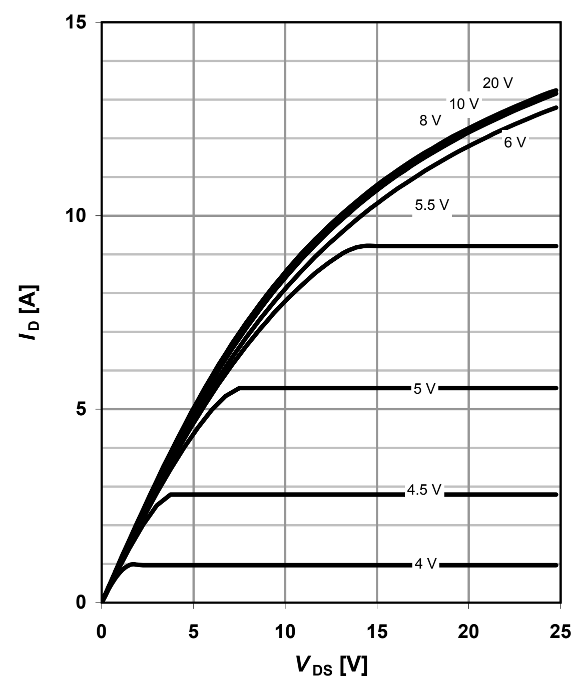
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_J=25 °C

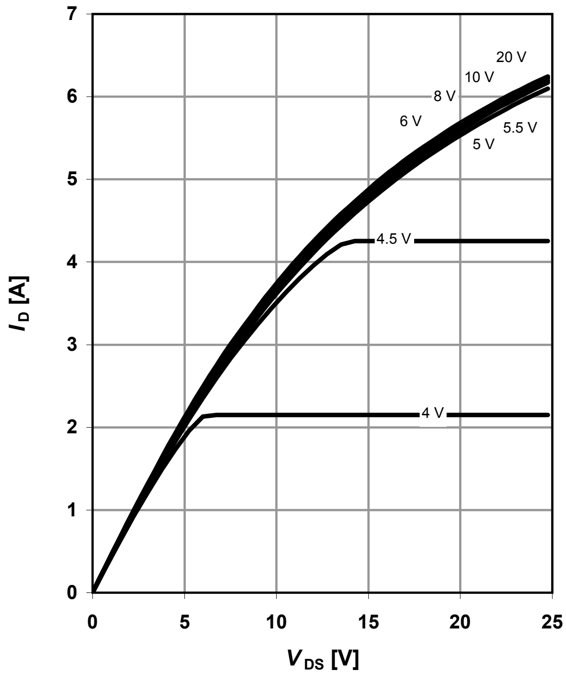
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_J=150 °C

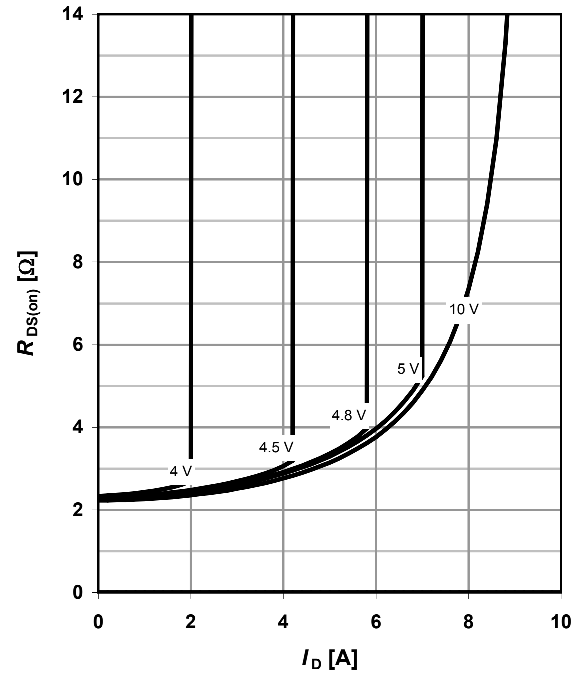
parameter: V_{GS}



6 Typ. drain-source on-state resistance

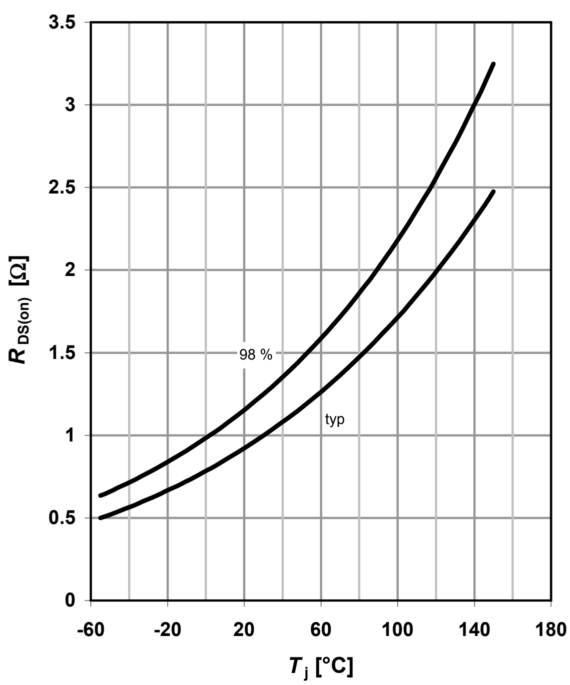
$R_{DS(on)}$=f(I_D); T_J=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

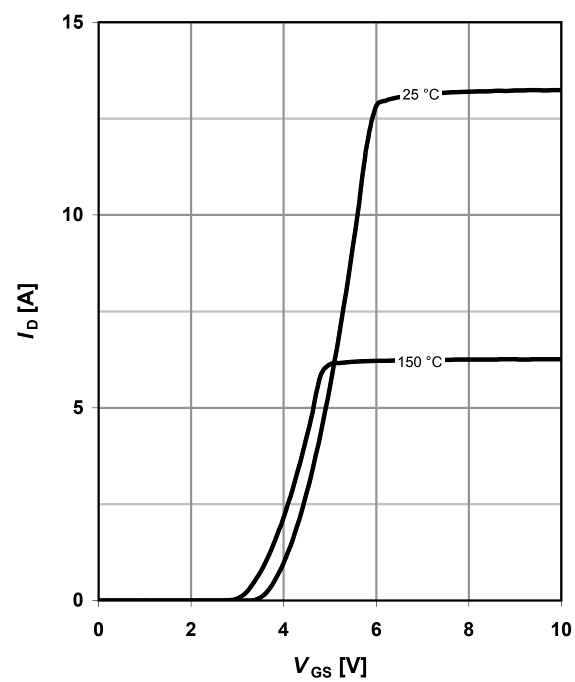
$R_{DS(on)}$=f(T_J); I_D=2.8 A; V_{GS}=10 V



8 Typ. transfer characteristics

I_D=f(V_{GS}); V_{DS}=20V

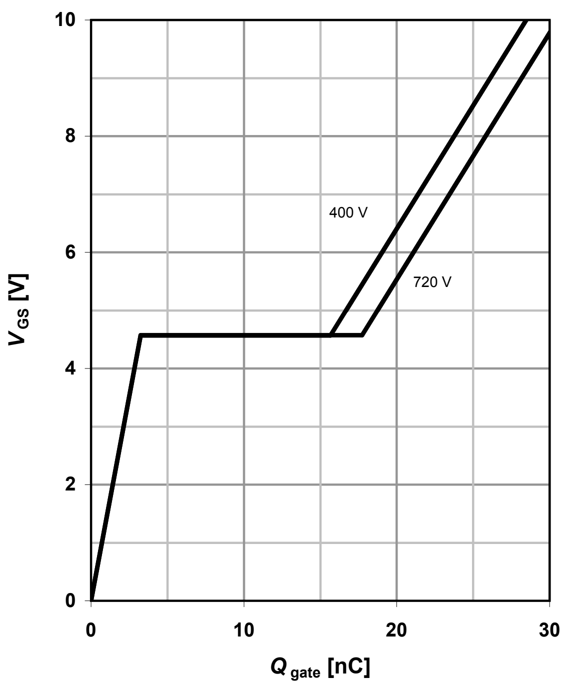
parameter: T_J



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=2.8 A pulsed

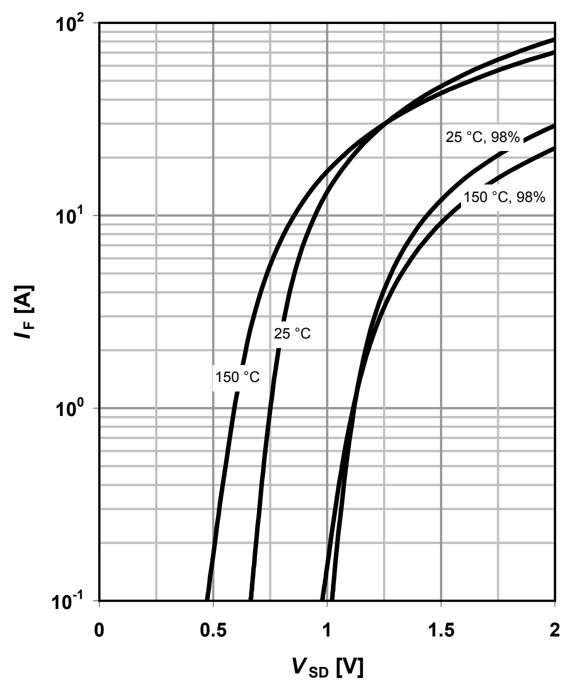
parameter: V_{DD}



10 Forward characteristics of reverse diode

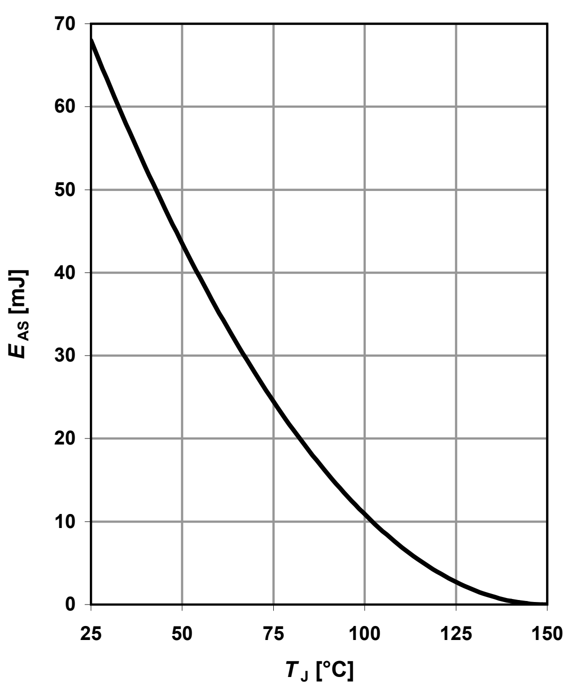
I_F=f(V_{SD})

parameter: T_J



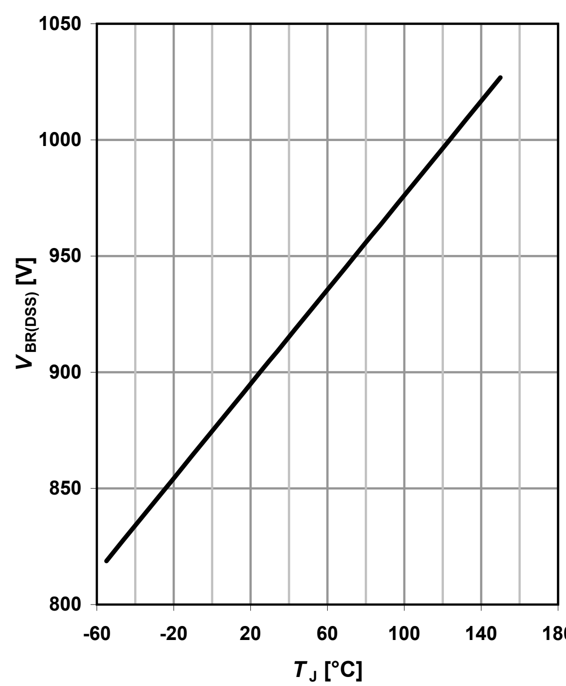
11 Avalanche energy

E_{AS}=f(T_j); I_D=0.92 A; V_{DD}=50 V



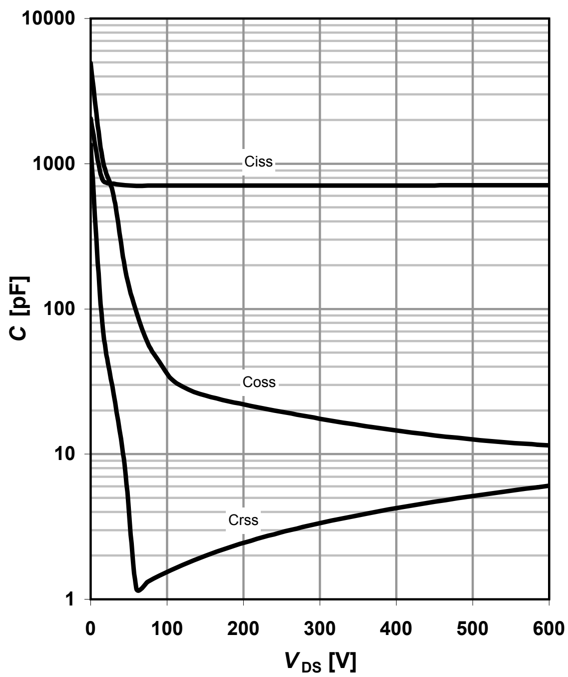
12 Drain-source breakdown voltage

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



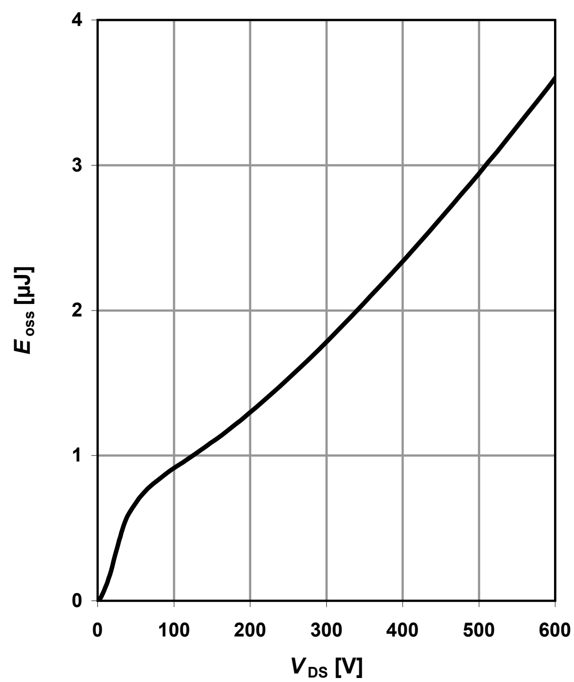
13 Typ. capacitances

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

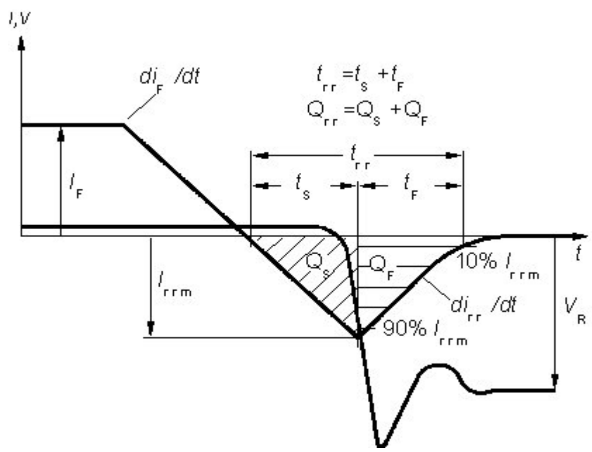


14 Typ. C_{oss} stored energy

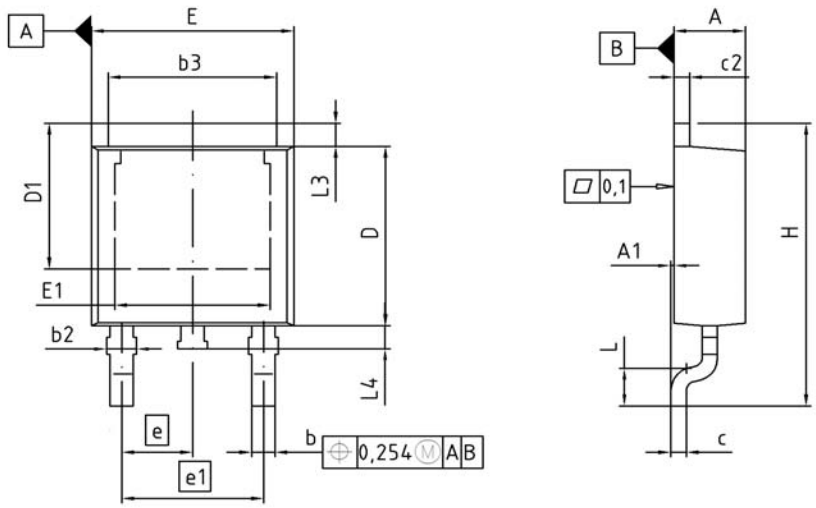
E_{oss}= f(V_{DS})

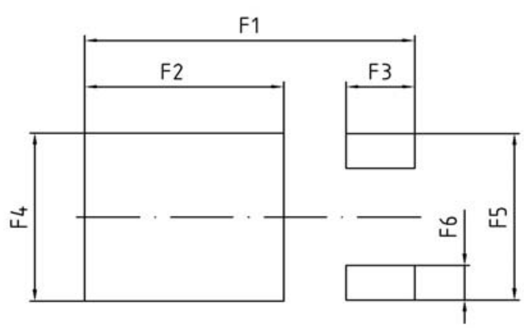


Definition of diode switching characteristics



PG-TO252 Outlines





DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.21	0.185	0.205
e	2.29		0.090	
e1	4.57		0.180	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.50	10.70	0.413	0.421
F2	6.30	6.50	0.248	0.256
F3	2.10	2.30	0.083	0.091
F4	5.70	5.90	0.224	0.232
F5	5.66	5.86	0.223	0.231
F6	1.10	1.30	0.043	0.051

DOCUMENT NO.
Z8B00003328
SCALE 0 2.0 0 2.0 4mm
EUROPEAN PROJECTION
ISSUE DATE 19-10-2007
REVISION 03

Dimensions in mm/inches

Published by
Infineon Technologies AG
81726 Munich, Germany

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