CoolMOS^{TM} Power Transistor

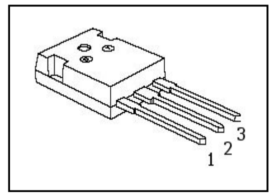
Features

- Worldwide best $R_{ds,on}$ in TO247
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC[1)] for target applications
- Pb-free lead plating; RoHS compliant

Product Summary

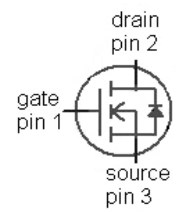
V_{DS} @ T_{jmax}	650	V
$R_{DS(on),max}$	0.045	Ω
$Q_{g,typ}$	150	nC

PG-TO247-3-1



CS CoolMOS is specially designed for:

- Hard switching SMPS topologies



Type	Package	Ordering Code	Marking
IPW60R045CP	PG-TO247-3-1	SP000067149	6R045

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	60	A
		T_C=100 °C	38	
Pulsed drain current[2)]	$I_{D,pulse}$	T_C=25 °C	230	
Avalanche energy, single pulse	E_{AS}	I_D=11 A, V_{DD}=50 V	1950	mJ
Avalanche energy, repetitive t_{AR}[2),3)]	E_{AR}	I_D=11 A, V_{DD}=50 V	3	
Avalanche current, repetitive t_{AR}[2),3)]	I_{AR}		11	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS}=0...480 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	431	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M3 and M3.5 screws	60	Ncm

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	44	A
Diode pulse current[2)]	$I_{S,pulse}$		230	
Reverse diode dv/dt[4)]	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	0.29	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	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=3 mA	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	-	10	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=44 A, T_j=25 °C	-	0.04	0.045	Ω
		V_{GS}=10 V, I_D=44 A, T_j=150 °C	-	0.11	-	
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	-	6800	-	pF
Output capacitance	C_{oss}		-	320	-	
Effective output capacitance, energy related[5]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	310	-	
Effective output capacitance, time related[6]	$C_{o(tr)}$		-	820	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=44 A, R_G=3.3 Ω	-	30	-	ns
Rise time	t_r		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	100	-	
Fall time	t_f		-	10	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=44 A, V_{GS}=0 to 10 V	-	34	-	nC
Gate to drain charge	Q_{gd}		-	51	-	
Gate charge total	Q_g		-	150	190	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=44 A, T_j=25 °C	-	0.9	1.2	V
Reverse recovery time	t_{rr}	V_R=400 V, I_F=I_S, di_F/dt=100 A/µs	-	600	-	ns
Reverse recovery charge	Q_{rr}		-	17	-	µC
Peak reverse recovery current	I_{rrm}		-	60	-	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.

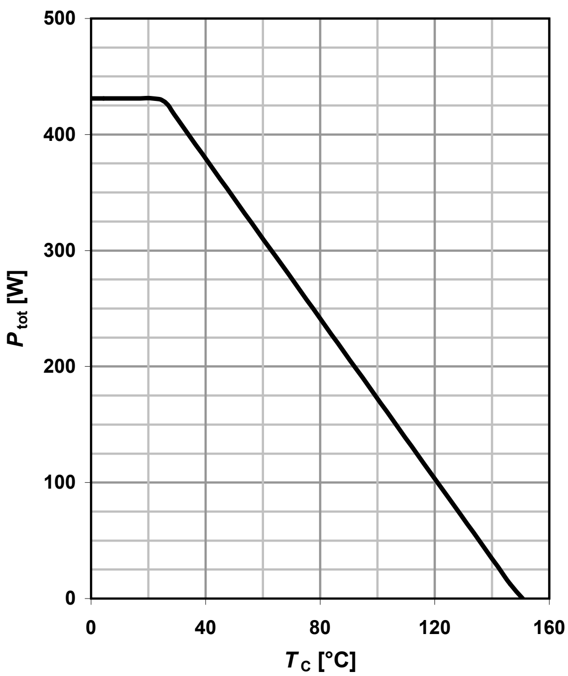
[4] I_{SD}<=I_D, di/dt<=100A/µs,V_{DClink} = 400V, Vpeak<$V_{(BR)DSS}$, T_j<T_{jmax}, identical low side and high side switch

[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 80% 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 80% V_{DSS}.

1 Power dissipation

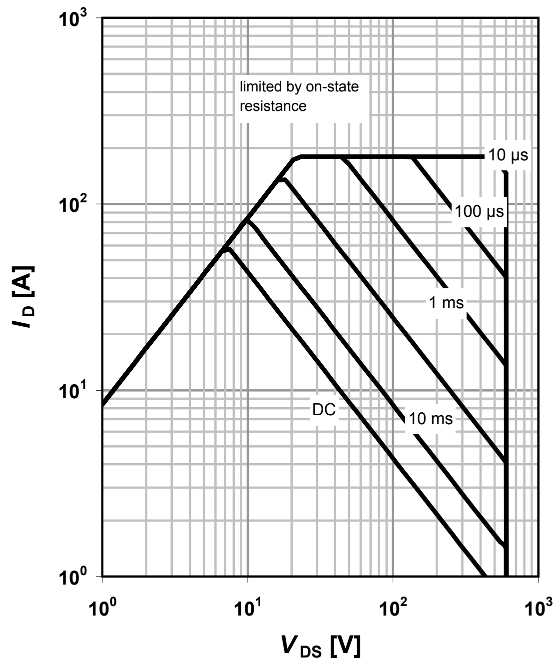
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

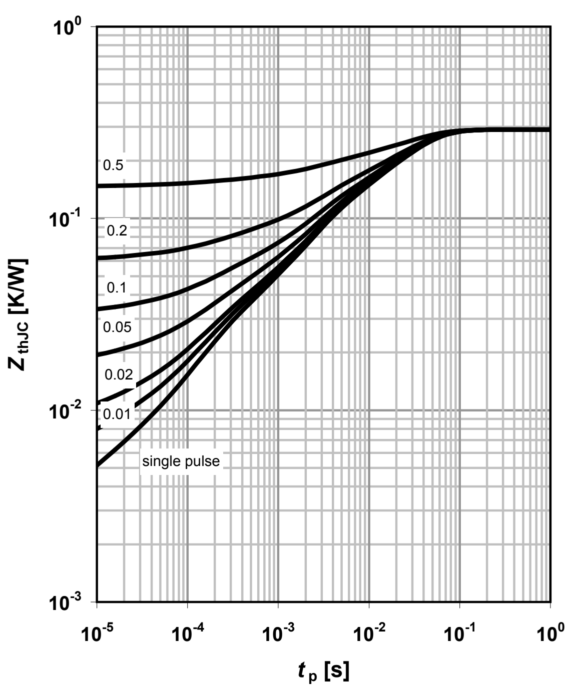
parameter: t_p



3 Max. transient thermal impedance

$Z_{(thJC)}=f(t_p)$

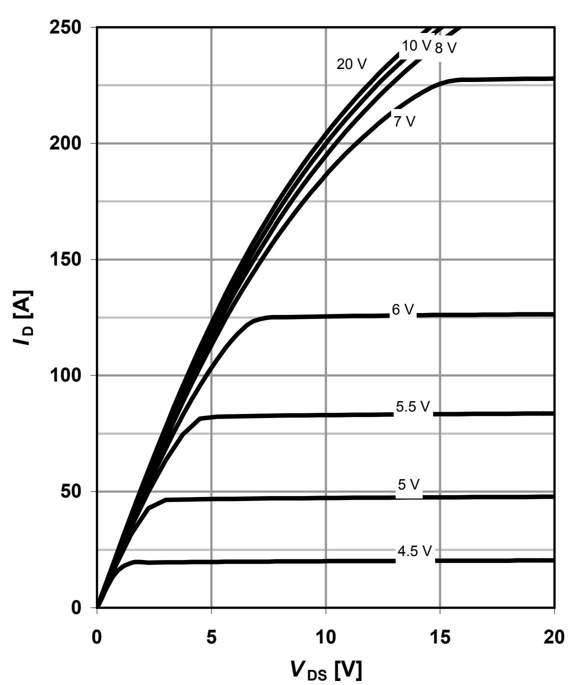
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

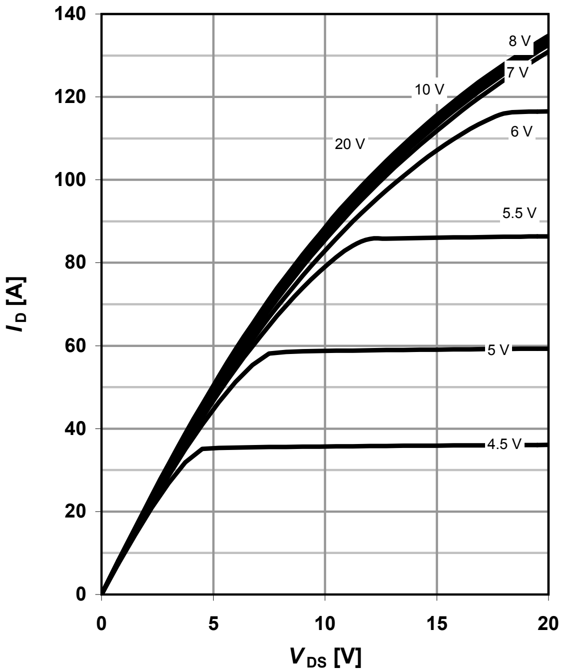
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

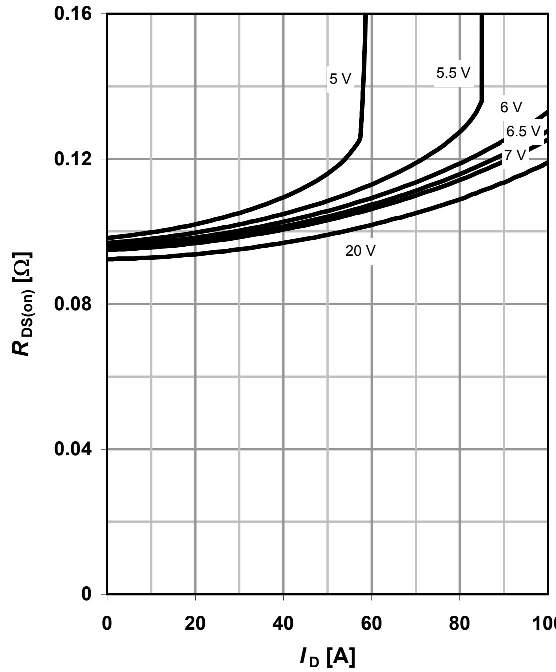
parameter: V_{GS}



6 Typ. drain-source on-state resistance

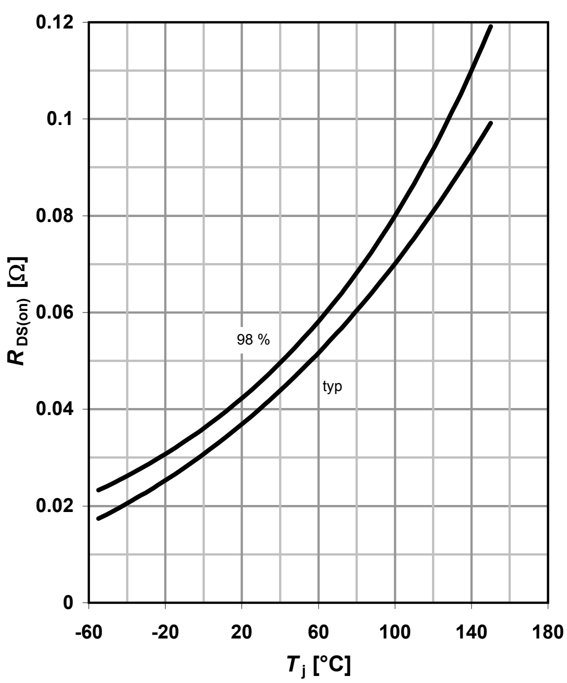
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

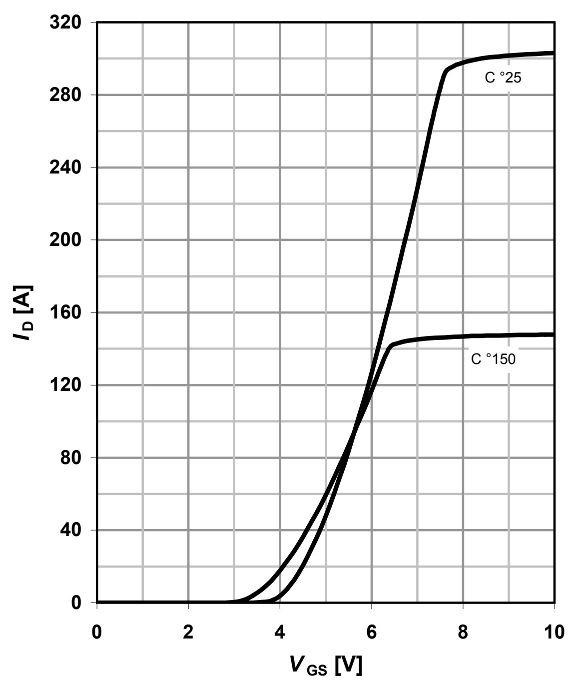
$R_{DS(on)}$=f(T_j); I_D=44 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

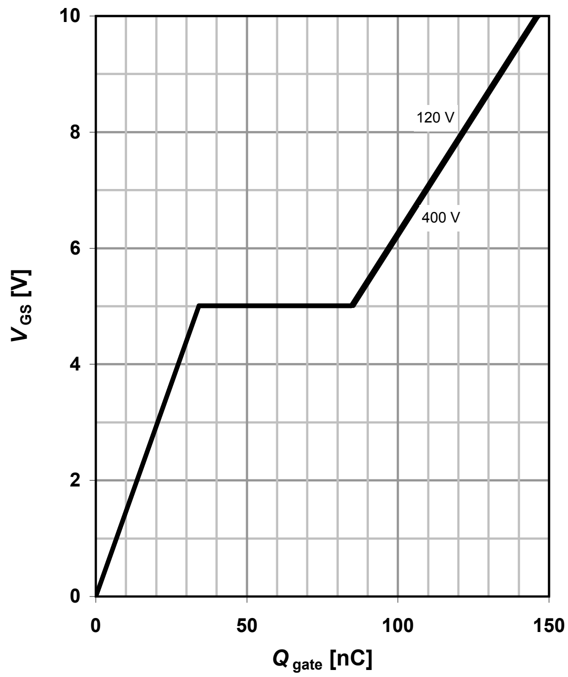
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=44 A pulsed

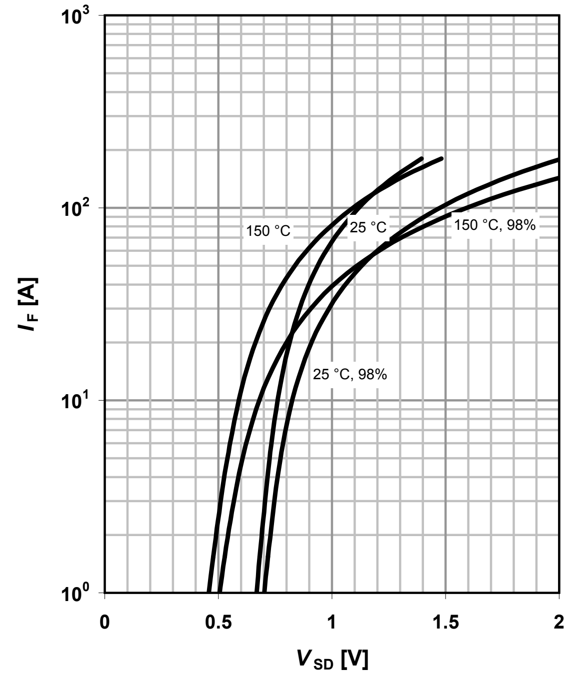
parameter: V_{DD}



10 Forward characteristics of reverse diode

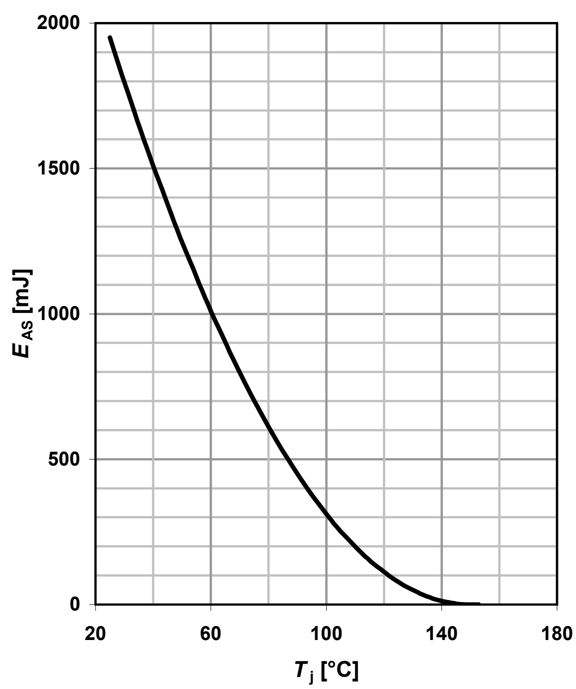
I_F=f(V_{SD})

parameter: T_j



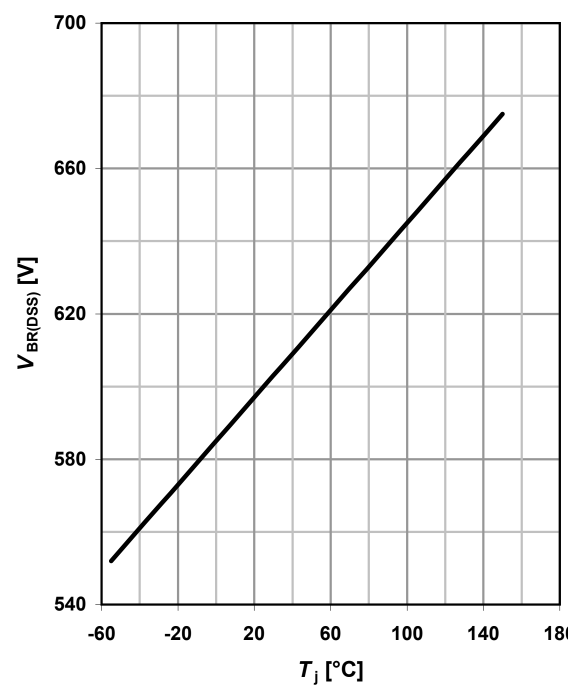
11 Avalanche energy

E_{AS}=f(T_j); I_D=11 A; V_{DD}=50 V



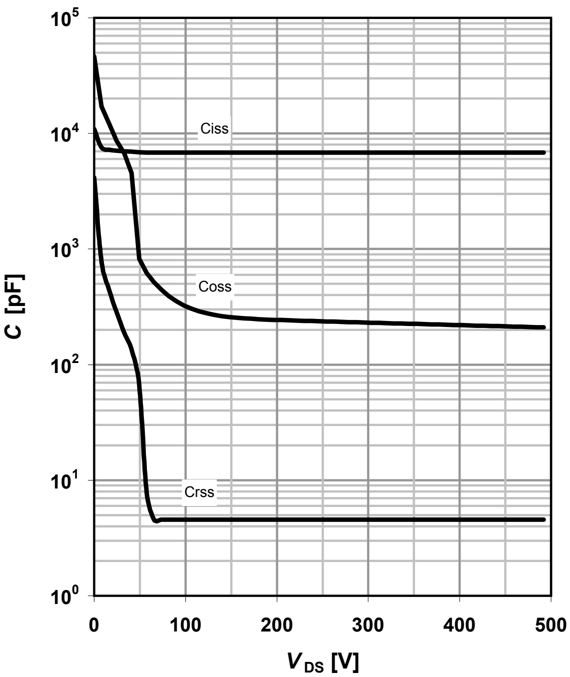
12 Drain-source breakdown voltage

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



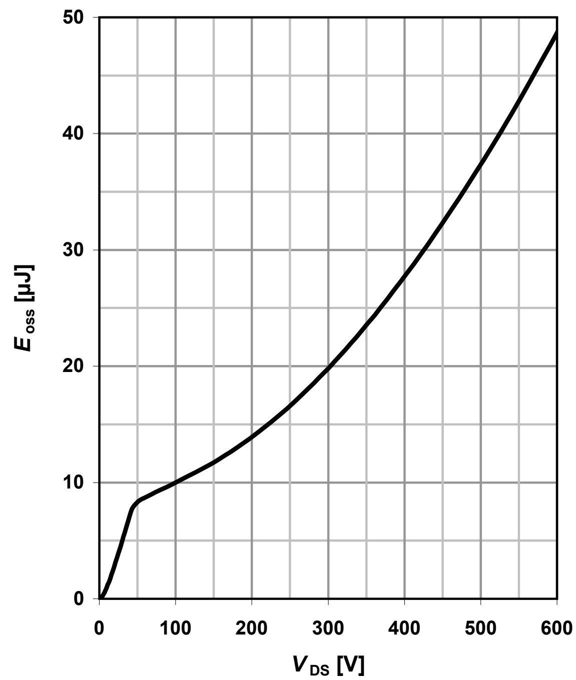
13 Typ. capacitances

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

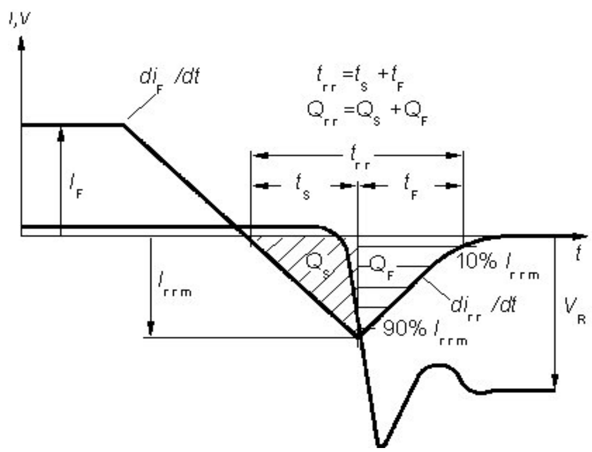


14 Typ. Coss stored energy

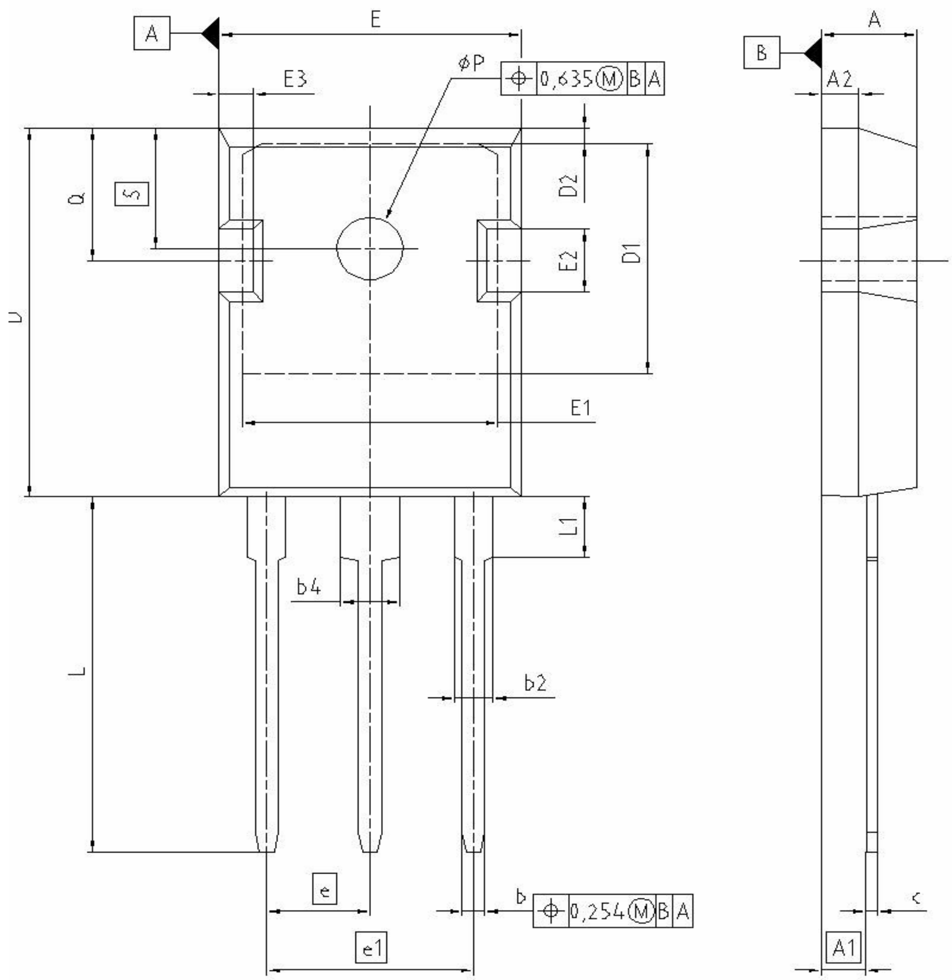
E_{oss}=f(V_{DS})



Definition of diode switching characteristics



PG-TO-247-3-1: Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.903	5.157	0.193	0.203
A1	2.273	2.527	0.092	0.096
A2	1.853	2.107	0.075	0.081
b	1.073	1.327	0.047	0.052
b2	1.903	2.386	0.075	0.094
b4	2.870	3.454	0.113	0.136
c	0.549	0.752	0.024	0.030
D	20.823	21.077	0.820	0.830
D1	17.323	17.831	0.682	0.702
D2	1.063	1.317	0.042	0.052
E	15.773	16.027	0.621	0.631
E1	13.893	14.147	0.547	0.557
E2	3.683	3.937	0.145	0.155
E3	1.683	1.937	0.066	0.076
e	5.450		0.215	
e1	10.900		0.430	
N	3		3	
L	20.053	20.307	0.789	0.799
L1	4.168	4.472	0.164	0.176
øP	3.559	3.661	0.140	0.144
Q	5.493	5.747	0.216	0.226
S	6.043	6.297	0.238	0.248

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SCALE 0 5 7.5mm
EUROPEAN PROJECTION
ISSUE DATE 28-06-2005
FILE TO247_1

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