CoolMOS™ Power Transistor

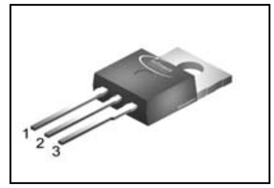
Features

- Worldwide best $R_{ds,on}$ in TO220
- 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

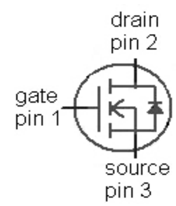
V_{DS}	600	V
$R_{DS(on),max}$	0.099	Ω
$Q_{g,typ}$	60	nC

PG-TO220-3-1



CoolMOS CS is specially designed for:

- Hard switching SMPS topologies
- Zero-voltage switching SMPS topologies
- CCM PFC



Type	Package	Ordering Code	Marking
IPP60R099CS	PG-TO220-3-1	Q67045A5018	6R099

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	31	A
		T_C=100 °C	19	
Pulsed drain current[2]	$I_{D,pulse}$	T_C=25 °C	93	
Avalanche energy, single pulse	E_{AS}	I_D=11 A, V_{DD}=50 V	800	mJ
Avalanche energy, repetitive t_{AR}[2),3)]	E_{AR}	I_D=11 A, V_{DD}=50 V	1.2	
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	255	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	18	A
Diode pulse current	$I_{S,pulse}$		93	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	0.5	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering	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=1.2 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	-	-	10	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	tbd	-	
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=18 A, T_j=25 °C	-	0.09	0.099	Ω
		V_{GS}=10 V, I_D=18 A, T_j=150 °C	-	0.24	-	
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	-	2800	-	pF
Output capacitance	C_{oss}		-	130	-	
Effective output capacitance, energy related[4]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	130	-	
Effective output capacitance, time related[5]	$C_{o(tr)}$		-	340	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=18 A, R_G=3.3 Ω	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	60	-	
Fall time	t_f		-	5	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=18 A, V_{GS}=0 to 10 V	-	14	-	nC
Gate to drain charge	Q_{gd}		-	20	-	
Gate charge total	Q_g		-	60	80	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=18 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	-	450	-	ns
Reverse recovery charge	Q_{rr}		-	12	-	µC
Peak reverse recovery current	I_{rrm}		-	70	-	A

[1] J-STD20 and JESD22

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

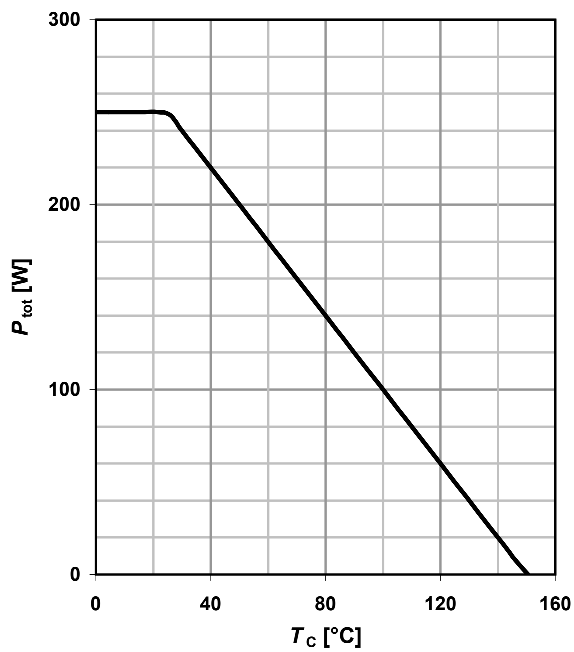
[3] Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

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

[5] $C_{o(tr)}$ 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

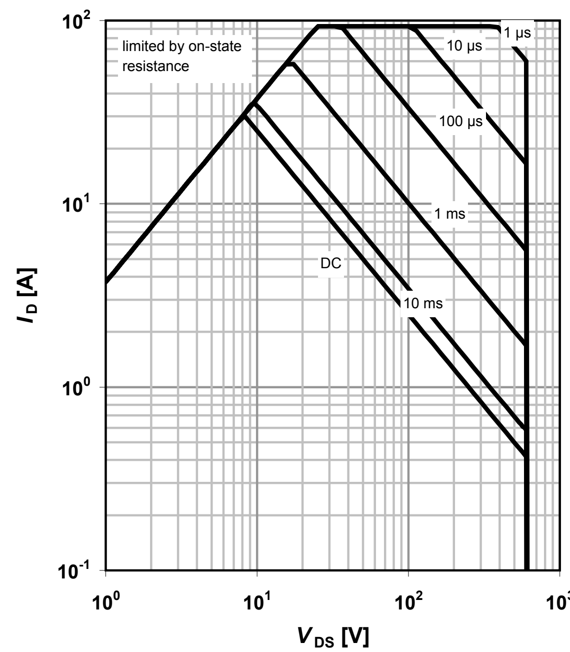
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

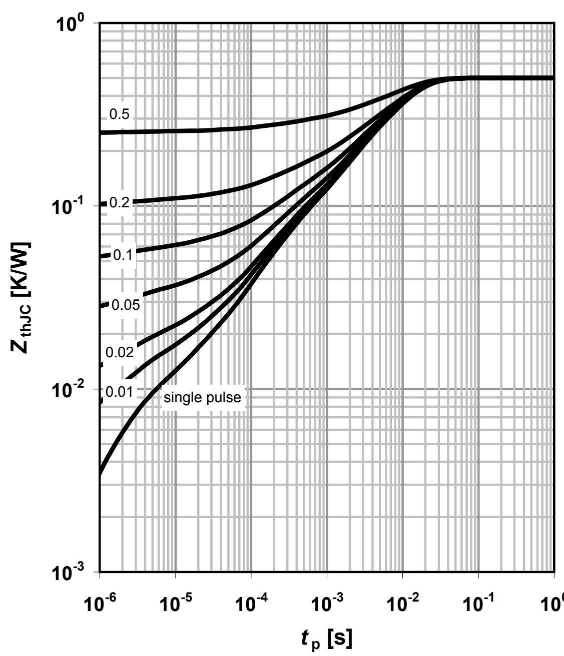
parameter: t_p



3 Max. transient thermal impedance

I_D=f(V_{DS}); T_j=25 °C

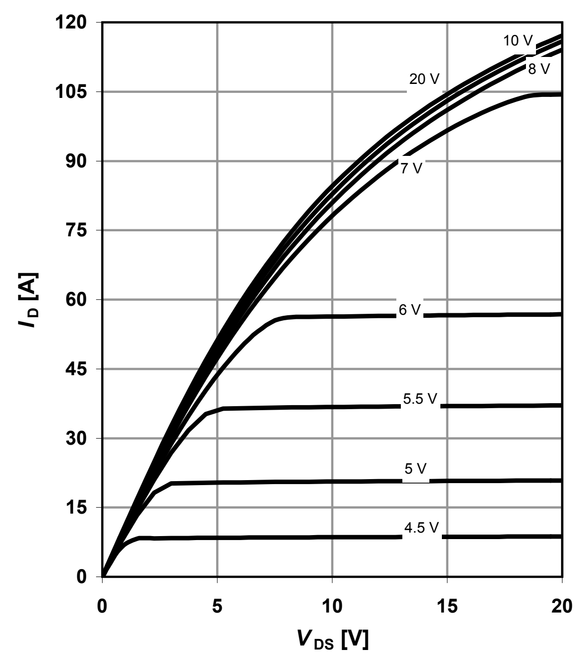
parameter: $D=t_p/T$



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

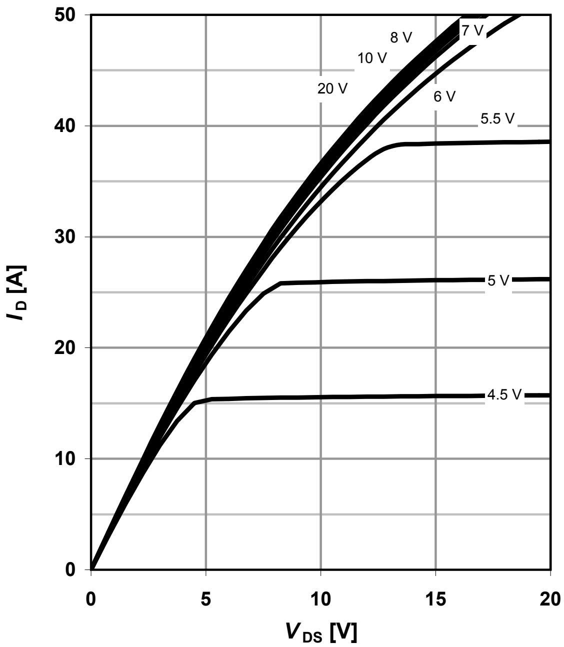
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

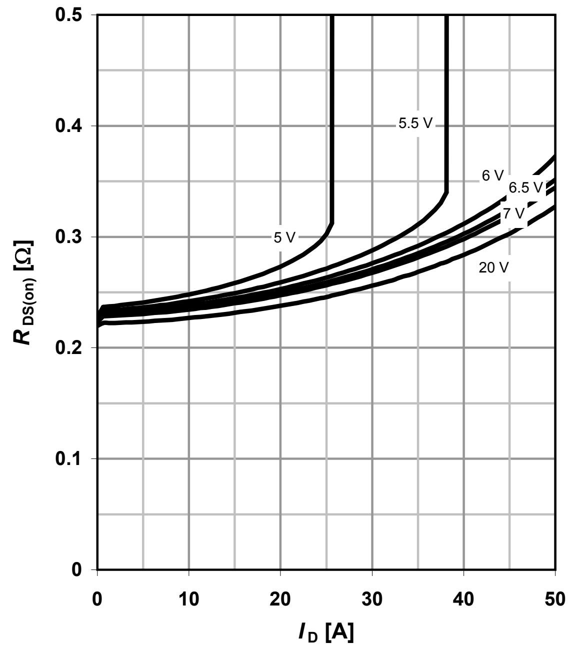
parameter: V_{GS}



6 Typ. drain-source on-state resistance

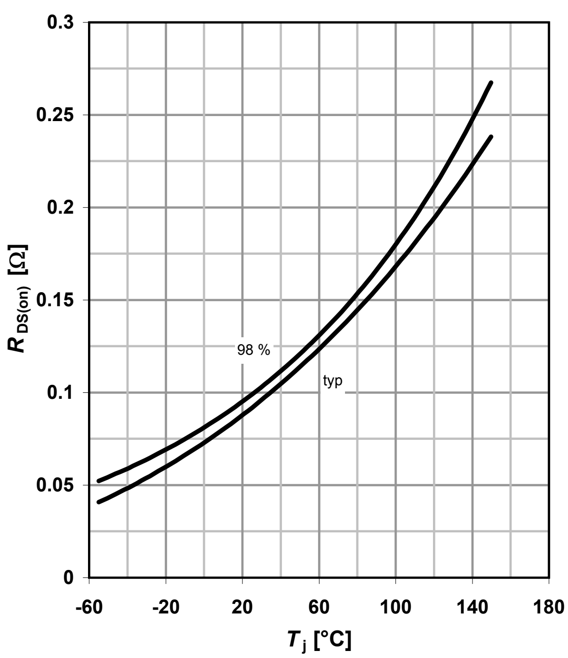
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

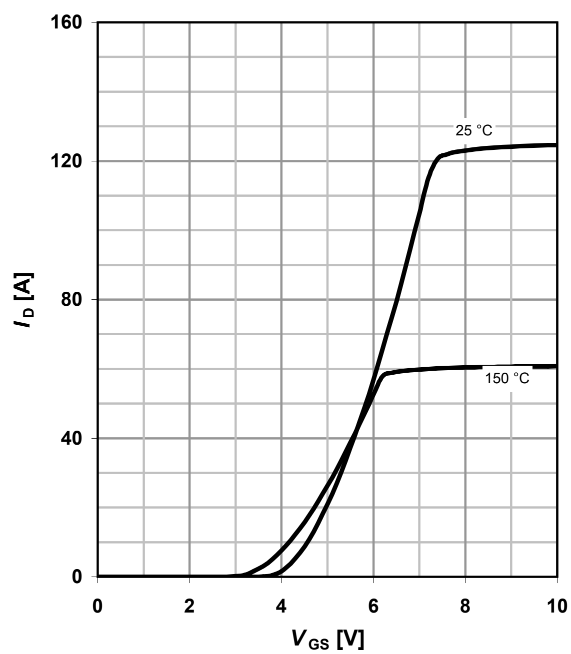
$R_{DS(on)}$=f(T_j); I_D=18 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

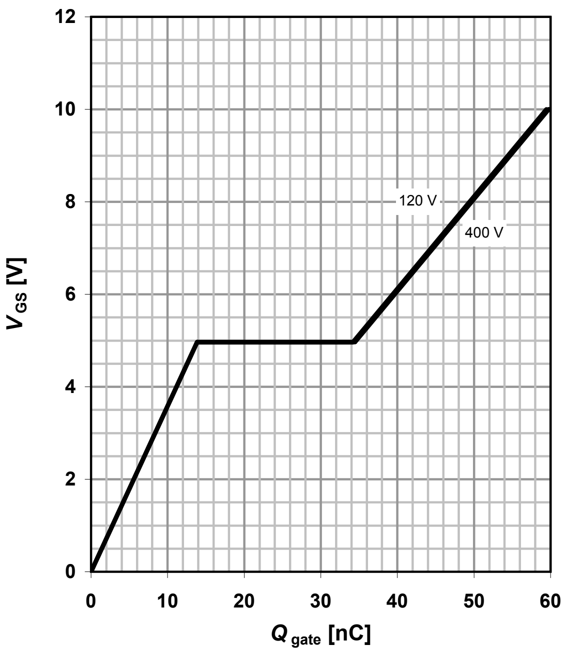
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=18 A pulsed

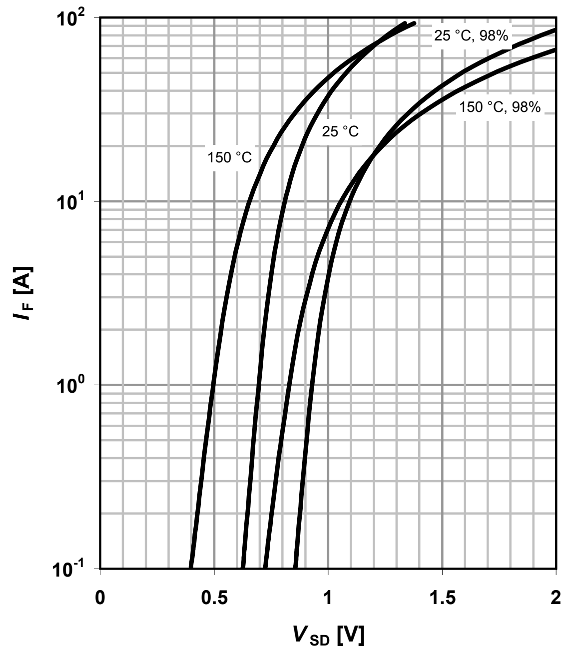
parameter: V_{DD}



10 Forward characteristics of reverse diode

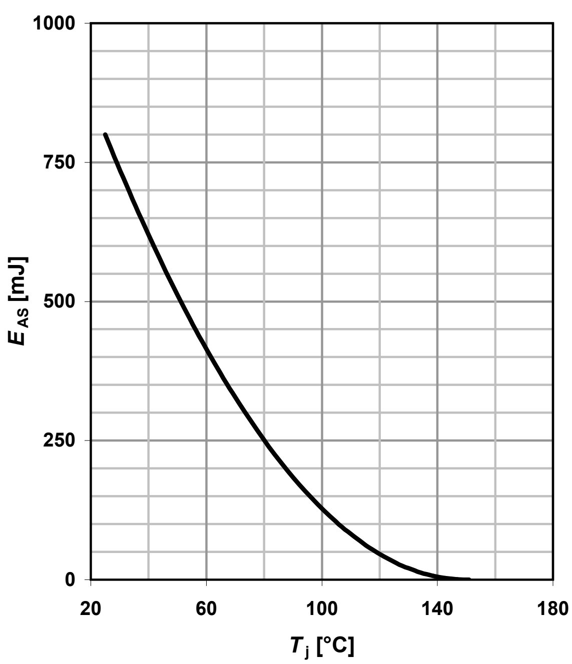
I_F=f(V_{SD})

parameter: T_j



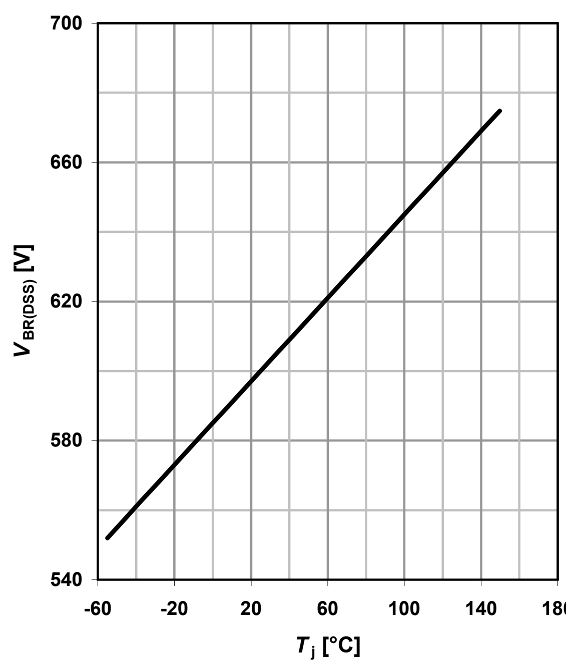
11 Avalanche energy

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



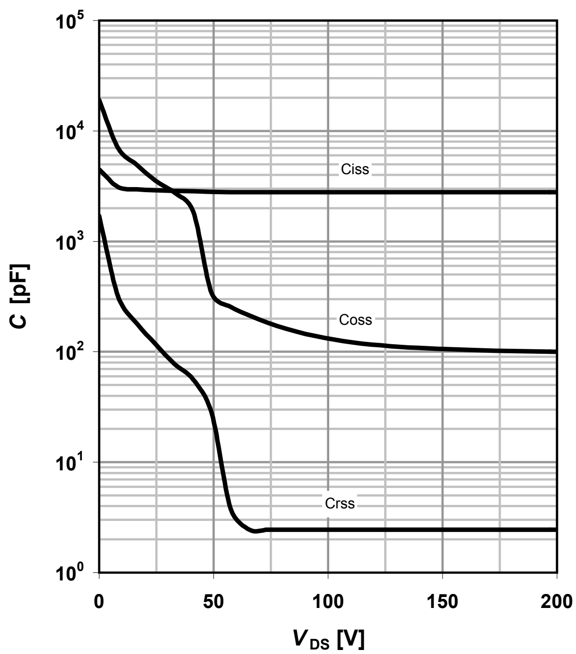
12 Drain-source breakdown voltage

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



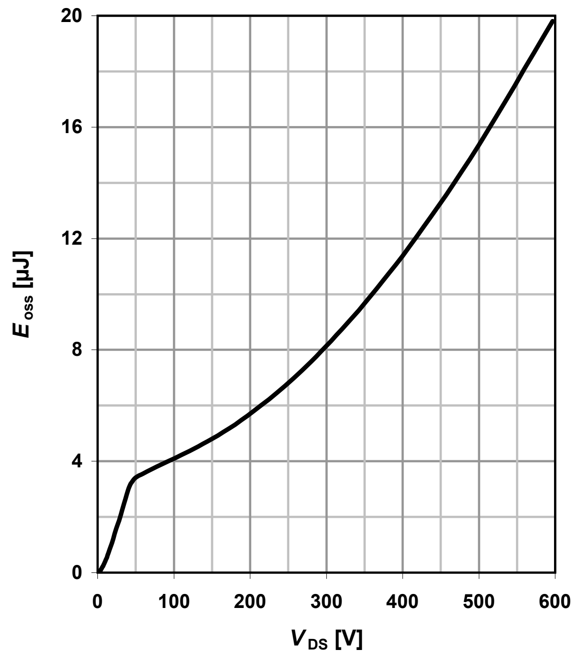
13 Typ. capacitances

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

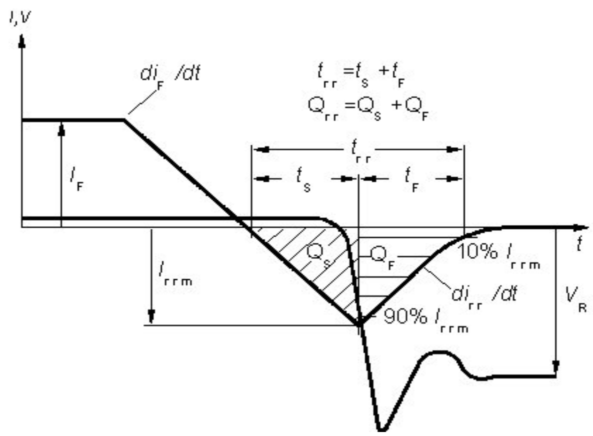


14 Typ. Coss stored energy

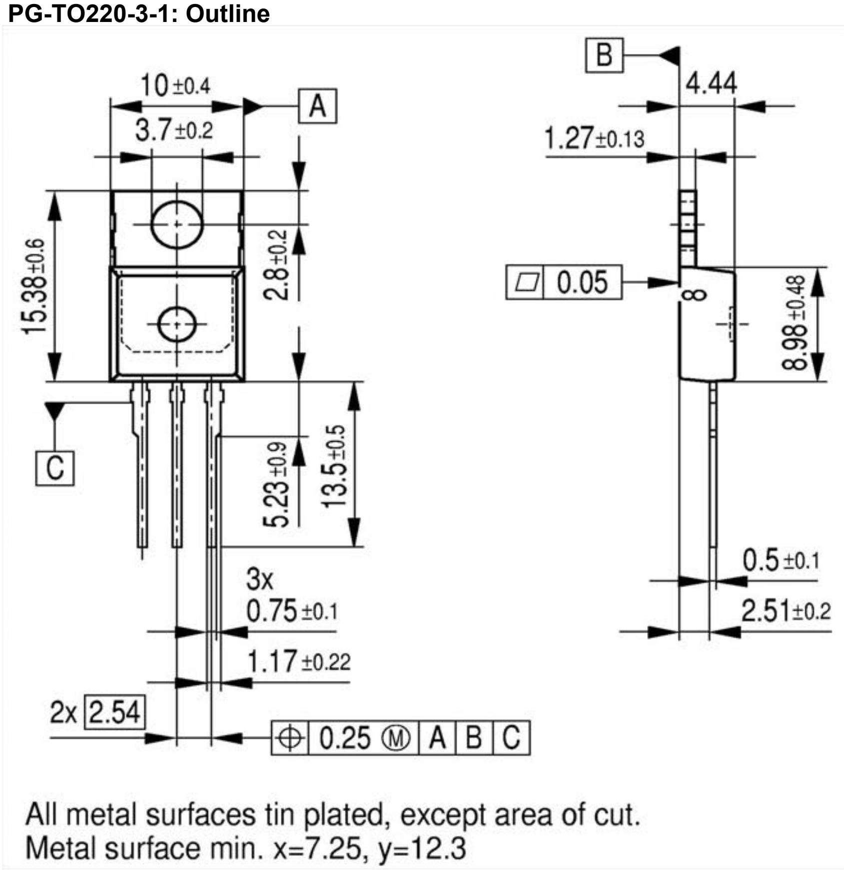
$E_{oss} = f(V_{DS})$



Definition of diode switching characteristics



PG-TO220-3-1: Outline



Dimensions in mm

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