CoolMOS^{TM} Power Transistor

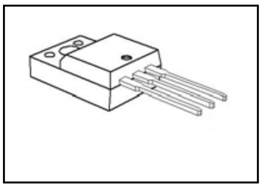
Features

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

Product Summary

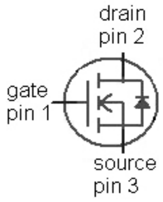
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$ @ T_j =25°C	0.6	Ω
$Q_{g,typ}$	21	nC

PG-TO220 FP



CoolMOS CP is designed for:

- Hard switching SMPS topologies



Type	Package	Marking
IPA60R600CP	PG-TO220FP	6R600P

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current[2)]	I_D	T_C=25 °C	6.1	A
		T_C=100 °C	3.8	
Pulsed drain current[3)]	$I_{D,pulse}$	T_C=25 °C	15	
Avalanche energy, single pulse	E_{AS}	I_D=2.2 A, V_{DD}=50 V	144	mJ
Avalanche energy, repetitive t_{AR}[3),4)]	E_{AR}	I_D=2.2 A, V_{DD}=50 V	0.2	
Avalanche current, repetitive t_{AR}[3),4)]	I_{AR}		2.2	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	28	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[2)]	I_S	T_C=25 °C	3.3	A
Diode pulse current[3)]	$I_{S,pulse}$		15	
Reverse diode dv/dt[5)]	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	4.5	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

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
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=220µA	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	-	1	µA
		V_{DS}=600 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=3.3 A, T_j=25 °C	-	0.54	0.6	Ω
		V_{GS}=10 V, I_D=3.3 A, T_j=150 °C	-	1.5	-	
Gate resistance	R_G	f=1 MHz, open drain	-	1.5	-	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	-	550	-	pF
Output capacitance	C_{oss}		-	28	-	
Effective output capacitance, energy related[6]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	26	-	
Effective output capacitance, time related[7]	$C_{o(tr)}$		-	67	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=3.3 A, R_G=23.1 Ω	-	17	-	ns
Rise time	t_r		-	12	-	
Turn-off delay time	$t_{d(off)}$		-	75	-	
Fall time	t_f		-	17	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=480 V, I_D=3.3 A, V_{GS}=0 to 10 V	-	2	-	nC
Gate to drain charge	Q_{gd}		-	10	-	
Gate charge total	Q_g		-	21	27	
Gate plateau voltage	$V_{plateau}$		-	4.7	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=3.3 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	-	220	-	ns
Reverse recovery charge	Q_{rr}		-	2.3	-	µC
Peak reverse recovery current	I_{rrm}		-	18	-	A

[1] J-STD20 and JESD22

[2] Limited only by maximum temperature

[3] Pulse width tp limited by Tj,max

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

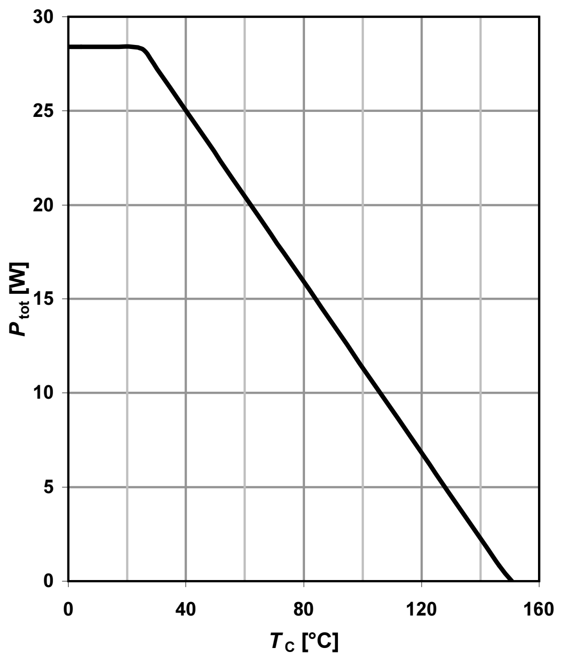
[5] $I_{SD}=I_D$, di/dt≤400A/µs, V_{DClink}=400V, $V_{peak}<V_{(BR)DSS}$, $T_j<T_{jmax}$, identical low side and high side switch

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

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

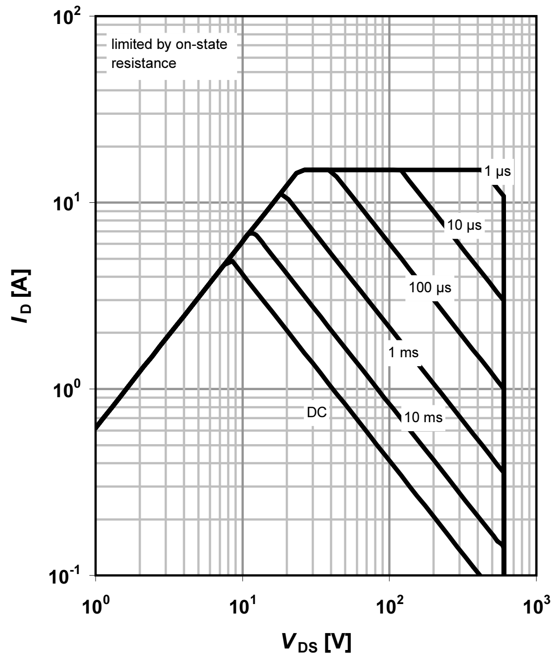
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

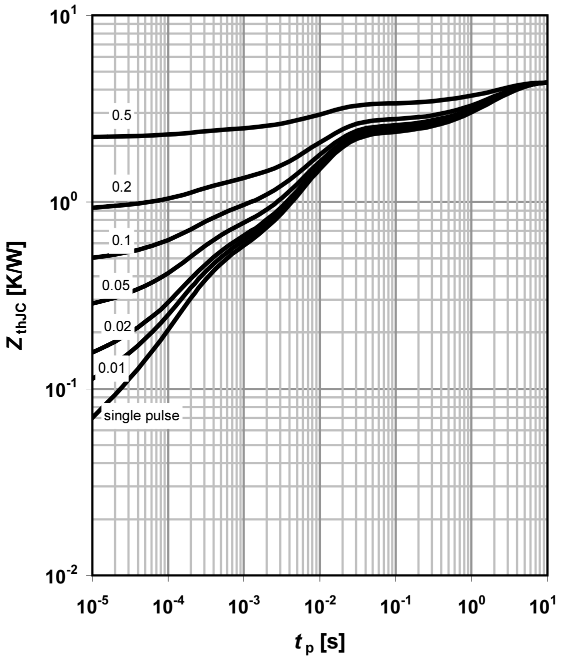
parameter: t_p



3 Max. transient thermal impedance

Z_{thJC}=f(t_P)

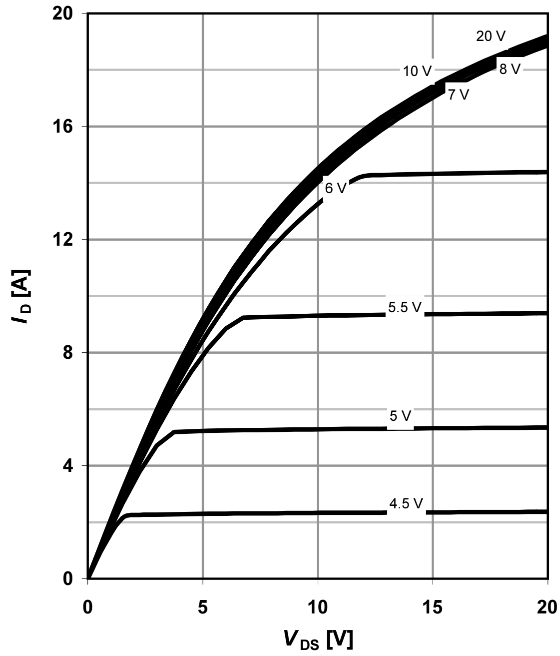
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

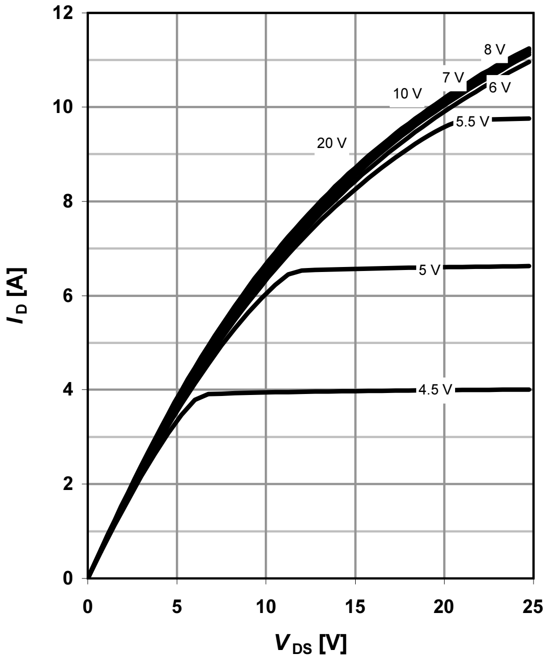
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

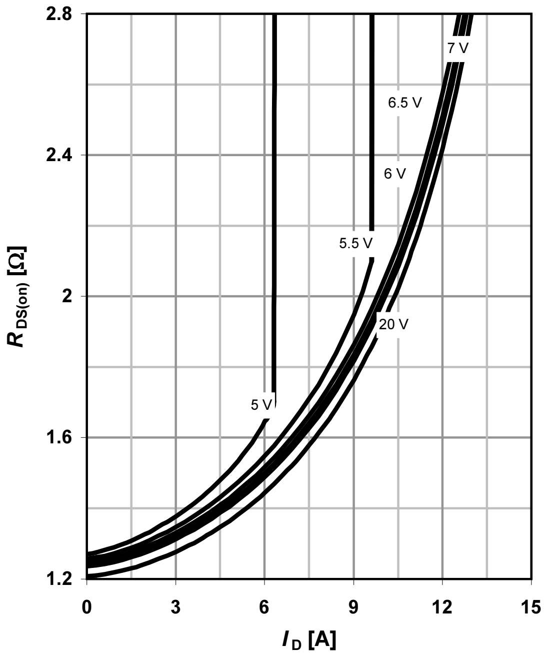
parameter: V_{GS}



6 Typ. drain-source on-state resistance

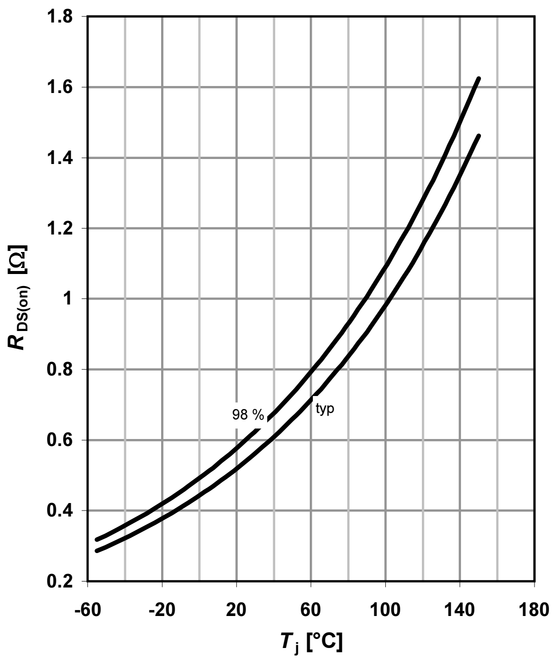
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

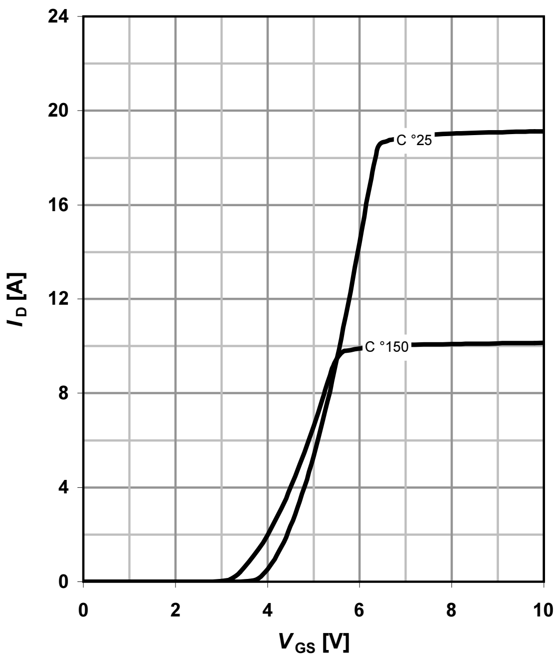
$R_{DS(on)}$=f(T_j); I_D=3.3 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

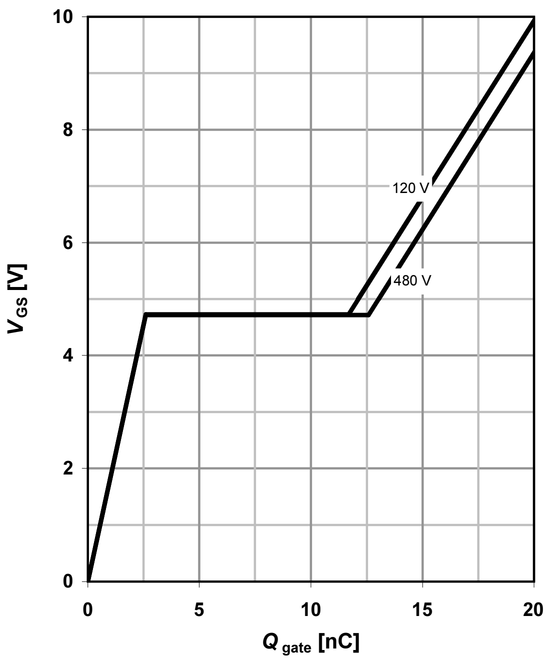
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=3.3 A pulsed

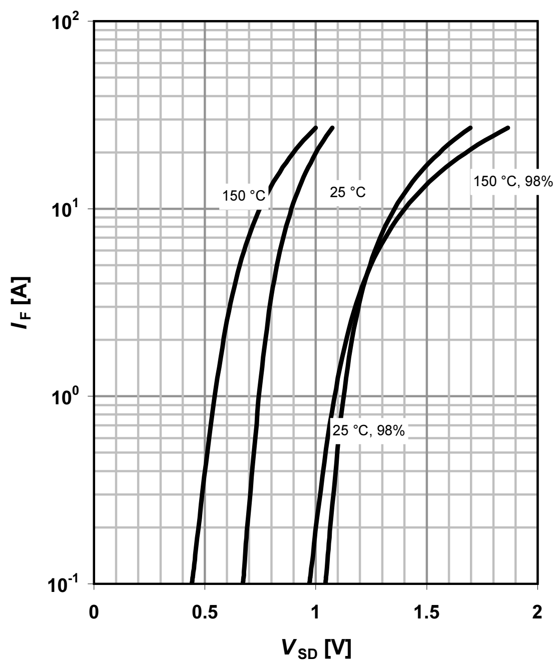
parameter: V_{DD}



10 Forward characteristics of reverse diode

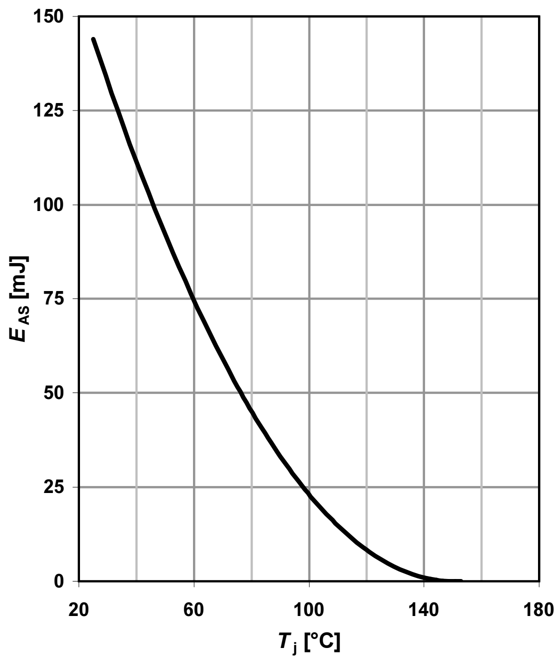
I_F=f(V_{SD})

parameter: T_j



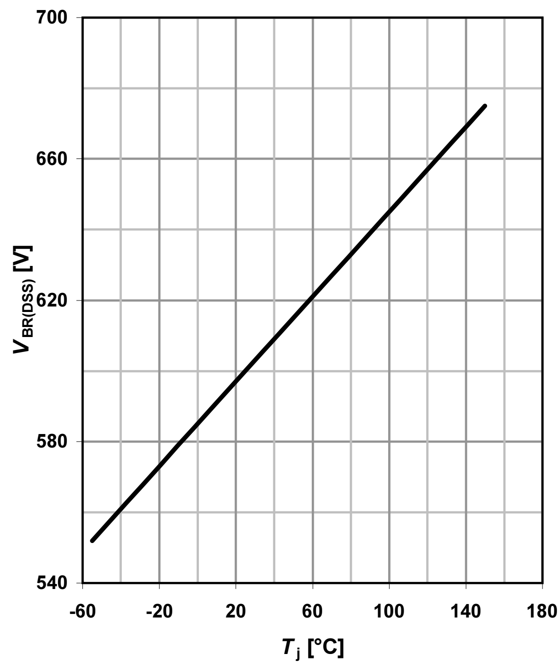
11 Avalanche energy

E_{AS}=f(T_j); I_D=2.2 A; V_{DD}=50 V



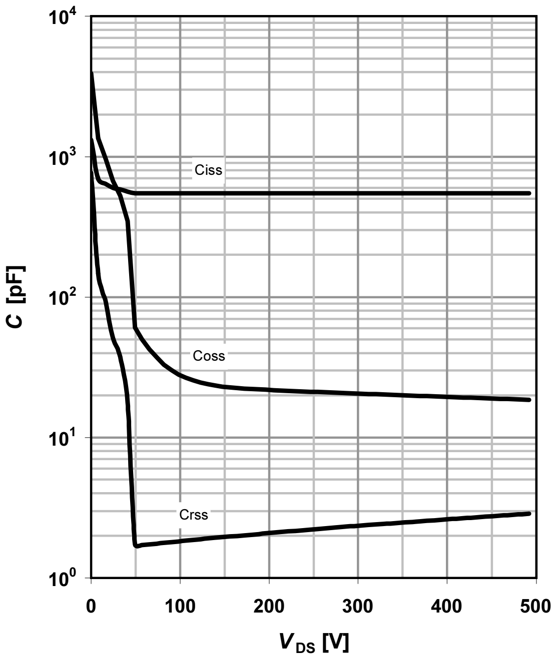
12 Drain-source breakdown voltage

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



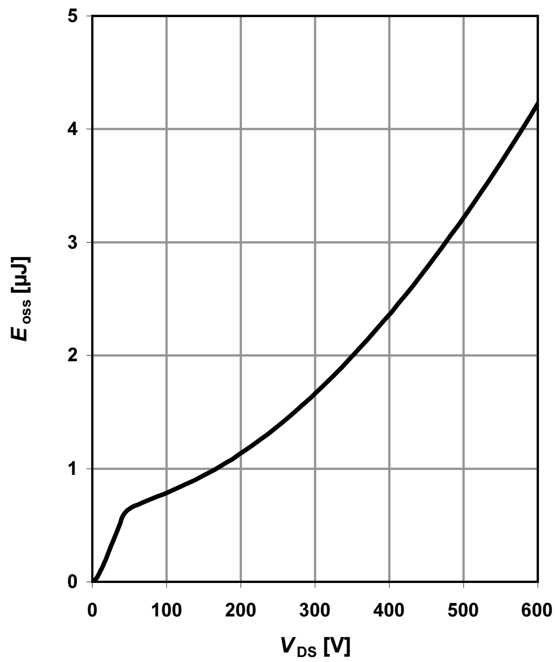
13 Typ. capacitances

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

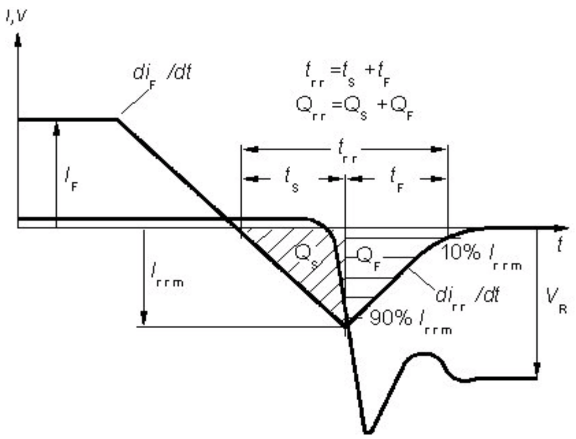


14 Typ. Coss stored energy

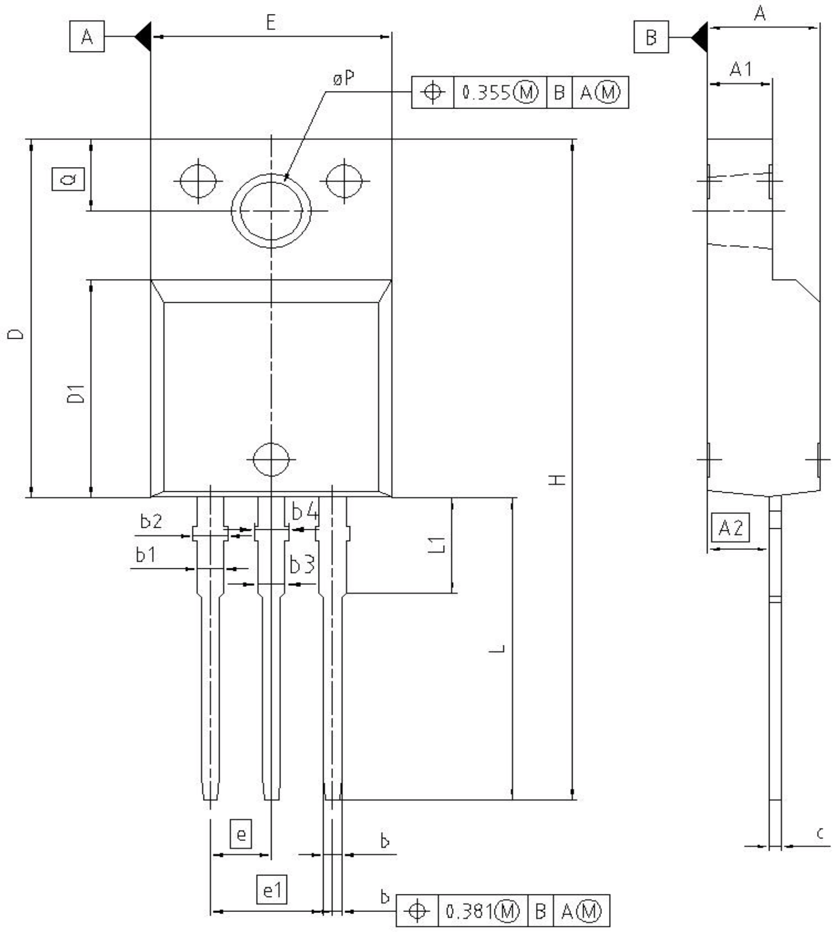
E_{oss}=f(V_{DS})



Definition of diode switching characteristics



PG-TO220 FP-3: Outlines/Fully isolated packages (2500VAC; 1 minute)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.55	4.85	0.179	0.191
A1	2.55	2.85	0.100	0.112
A2	2.42	2.72	0.095	0.107
b	0.65	0.85	0.026	0.033
b1	0.95	1.33	0.037	0.052
b2	0.95	1.51	0.037	0.059
b3	0.65	1.33	0.026	0.052
b4	0.65	1.51	0.026	0.059
c	0.40	0.63	0.016	0.025
D	15.85	16.15	0.624	0.636
D1	9.53	9.83	0.375	0.387
E	10.35	10.65	0.407	0.419
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H	29.45	29.75	1.159	1.171
L	13.45	13.75	0.530	0.541
L1	3.15	3.45	0.124	0.136
øP	2.95	3.20	0.116	0.126
Q	3.15	3.50	0.124	0.138

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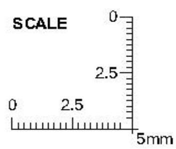
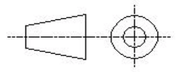
SCALE 
EUROPEAN PROJECTION 
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