CoolMOS® Power Transistor

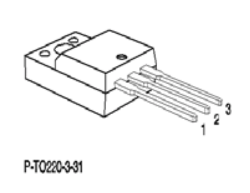
Features

- Lowest figure-of-merit $R_{ON}xQ_g$
- 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

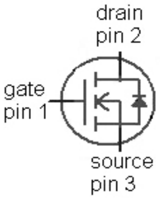
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$@T_j= 25°C	0.299	Ω
$Q_{g,typ}$	22	nC

PG-TO220FP



CoolMOS CP is specially designed for:

- Hard switching SMPS topologies



Type	Package	Ordering Code	Marking
IPA60R299CP	PG-TO220FP	SP000096438	6R299P

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	11	A
		T_C=100 °C	7	
Pulsed drain current[3)]	$I_{D,pulse}$	T_C=25 °C	34	
Avalanche energy, single pulse	E_{AS}	I_D=4.4 A, V_{DD}=50 V	290	mJ
Avalanche energy, repetitive t_{AR}[3),4)]	E_{AR}	I_D=4.4 A, V_{DD}=50 V	0.44	
Avalanche current, repetitive t_{AR}[3),4)]	I_{AR}		4.4	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	33	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M2.5 screws	50	Ncm

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	11	A
Diode pulse current[3)]	$I_{S,pulse}$		34	
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}		-	-	3.8	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	80	
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=0,44 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	-	-	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=6.6 A, T_j=25 °C	-	0.27	0.299	Ω
		V_{GS}=10 V, I_D=6.6 A, T_j=150 °C	-	0.73		
Gate resistance	R_G	f=1 MHz, open drain	-	1.9	-	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	-	1100	-	pF
Output capacitance	C_{oss}		-	60	-	
Effective output capacitance, energy related[6)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	46	-	
Effective output capacitance, time related[7)]	$C_{o(tr)}$		-	120	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=6,6 A, R_G=4,3 Ω	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	40	-	
Fall time	t_f		-	5	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=6.6 A, V_{GS}=0 to 10 V	-	5	-	nC
Gate to drain charge	Q_{gd}		-	7.6	-	
Gate charge total	Q_g		-	22	29	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=6.6 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	-	300	-	ns
Reverse recovery charge	Q_{rr}		-	3.9	-	µC
Peak reverse recovery current	I_{rrm}		-	26	-	A

1) J-STD20 and JESD22

2) Limited only by maximum temperature

3) Pulse width t_p limited by $T_{j,max}$

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

5) I_{SD}<=I_D, di/dt<=200A/µs, V_{DClink}=400V, V_{peak}<$V_{(BR)DSS}$, T_j<T_{jmax}, identical low side and high side switch.

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% $V_{DSS.}$

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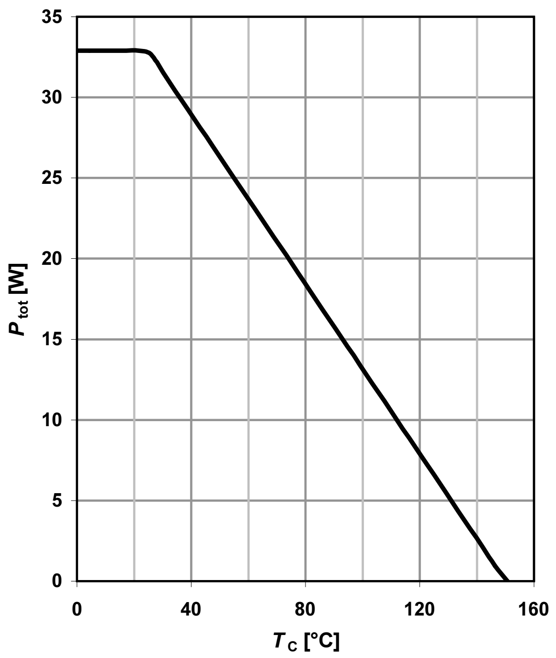
1 Power dissipation

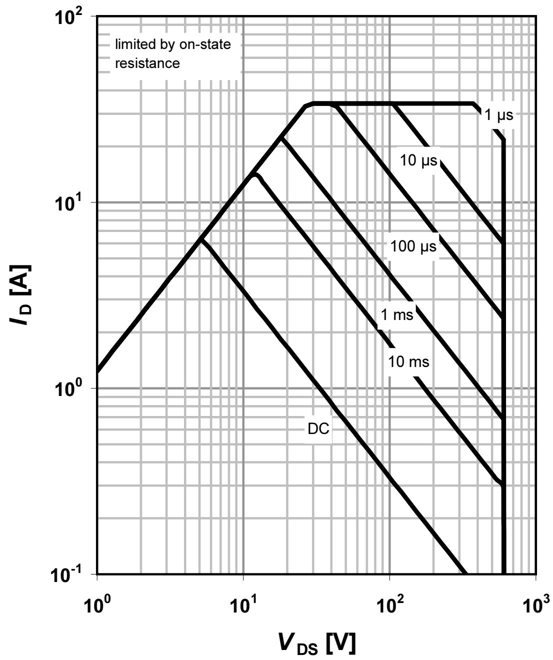
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

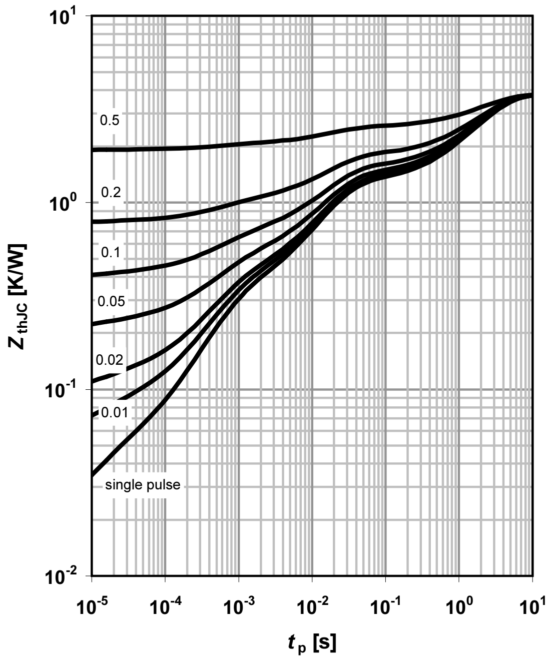
parameter: t_p



3 Max. transient thermal impedance

Z_{thJC}=f(t_P)

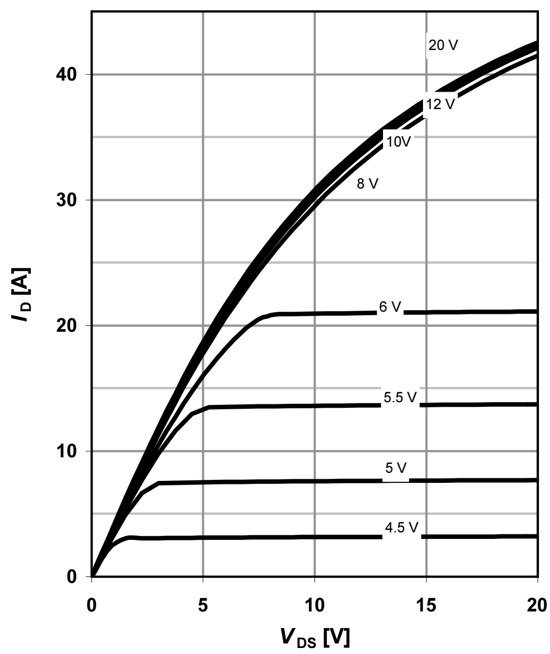
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

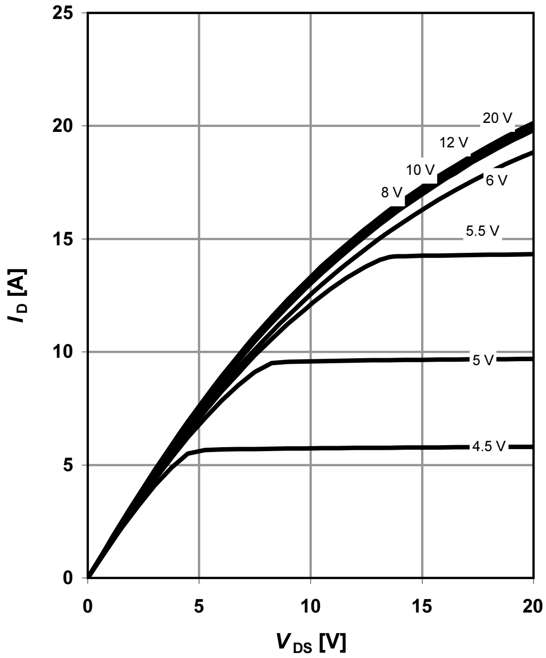
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

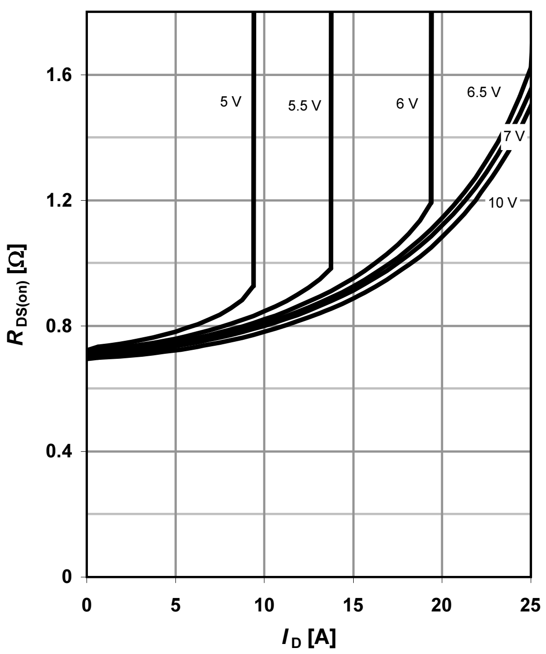
parameter: V_{GS}



6 Typ. drain-source on-state resistance

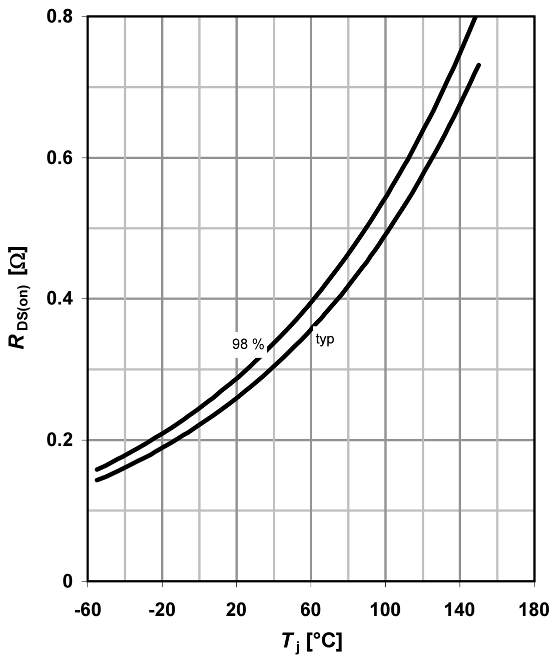
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

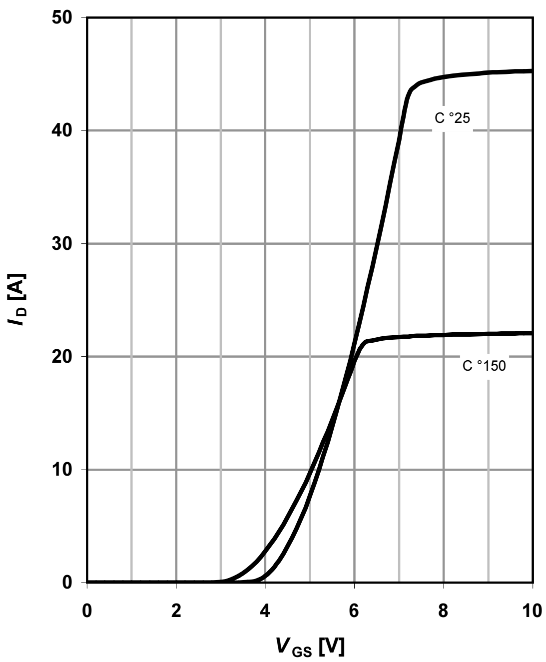
$R_{DS(on)}$=f(T_j); I_D=6.6 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

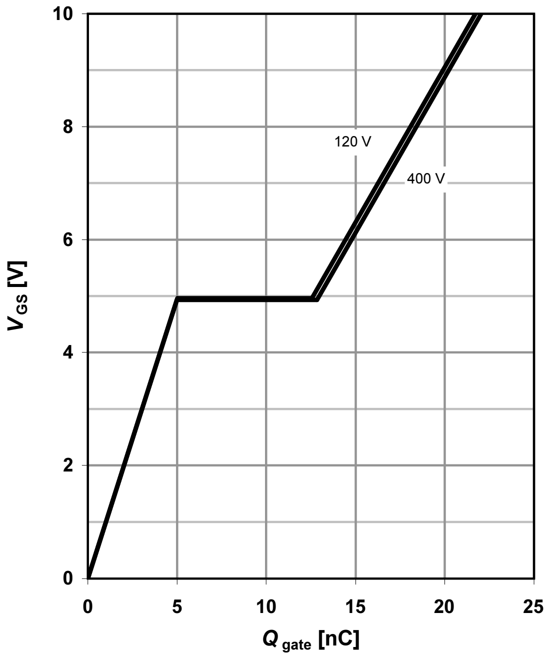
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=6.6 A pulsed

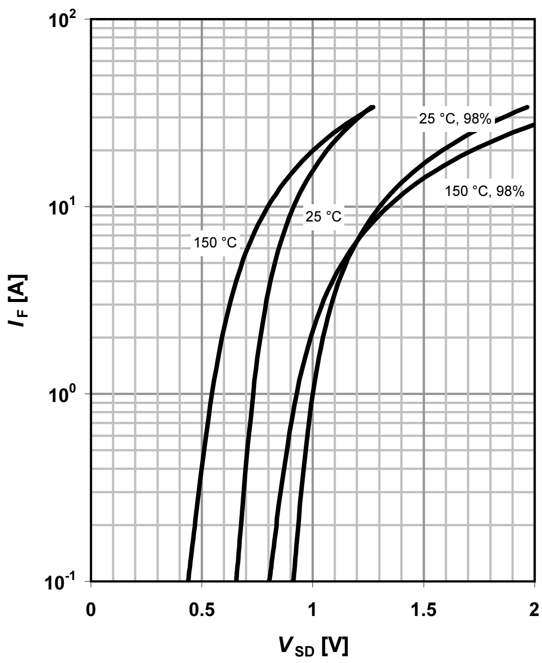
parameter: V_{DD}



10 Forward characteristics of reverse diode

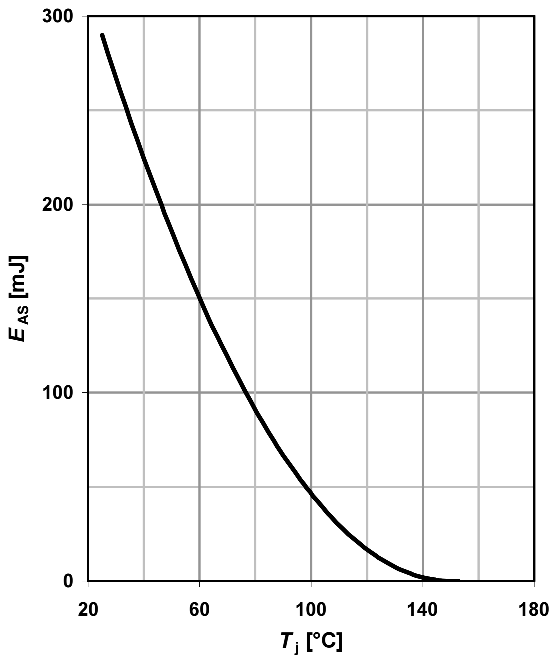
I_F=f(V_{SD})

parameter: T_j



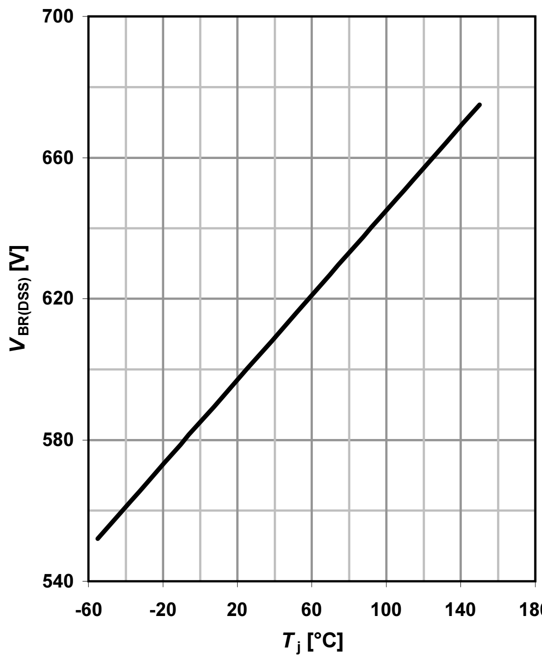
11 Avalanche energy

E_{AS}=f(T_j); I_D=4.4 A; V_{DD}=50 V



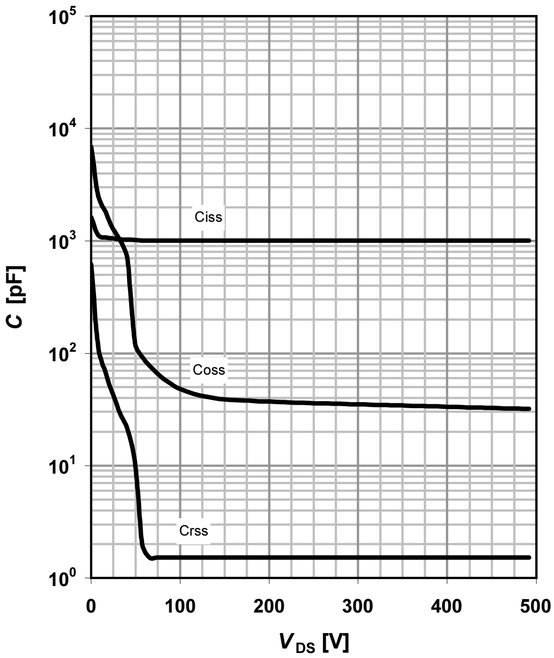
12 Drain-source breakdown voltage

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



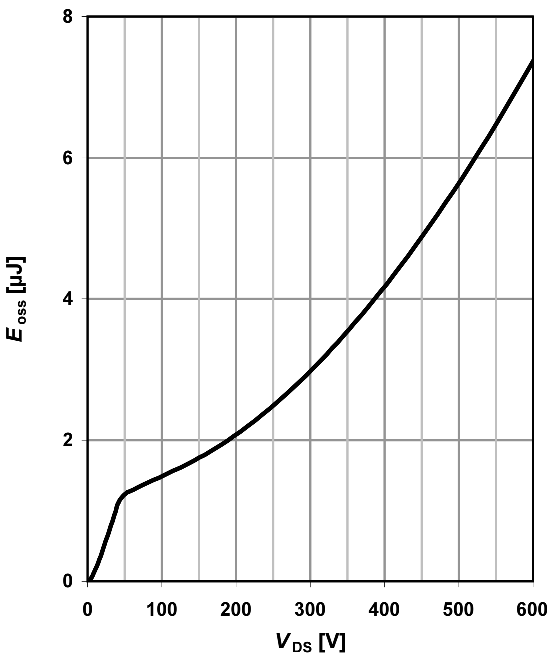
13 Typ. capacitances

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

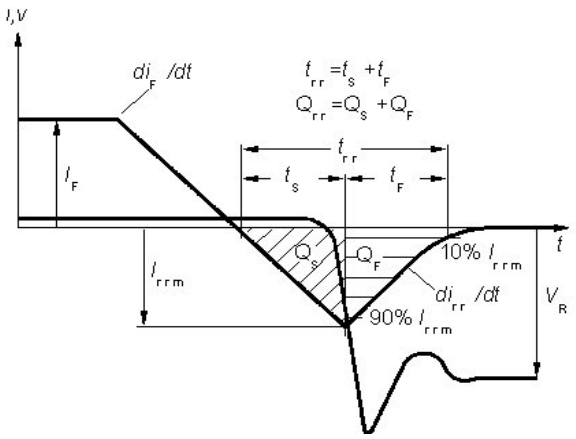


14 Typ. Coss stored energy

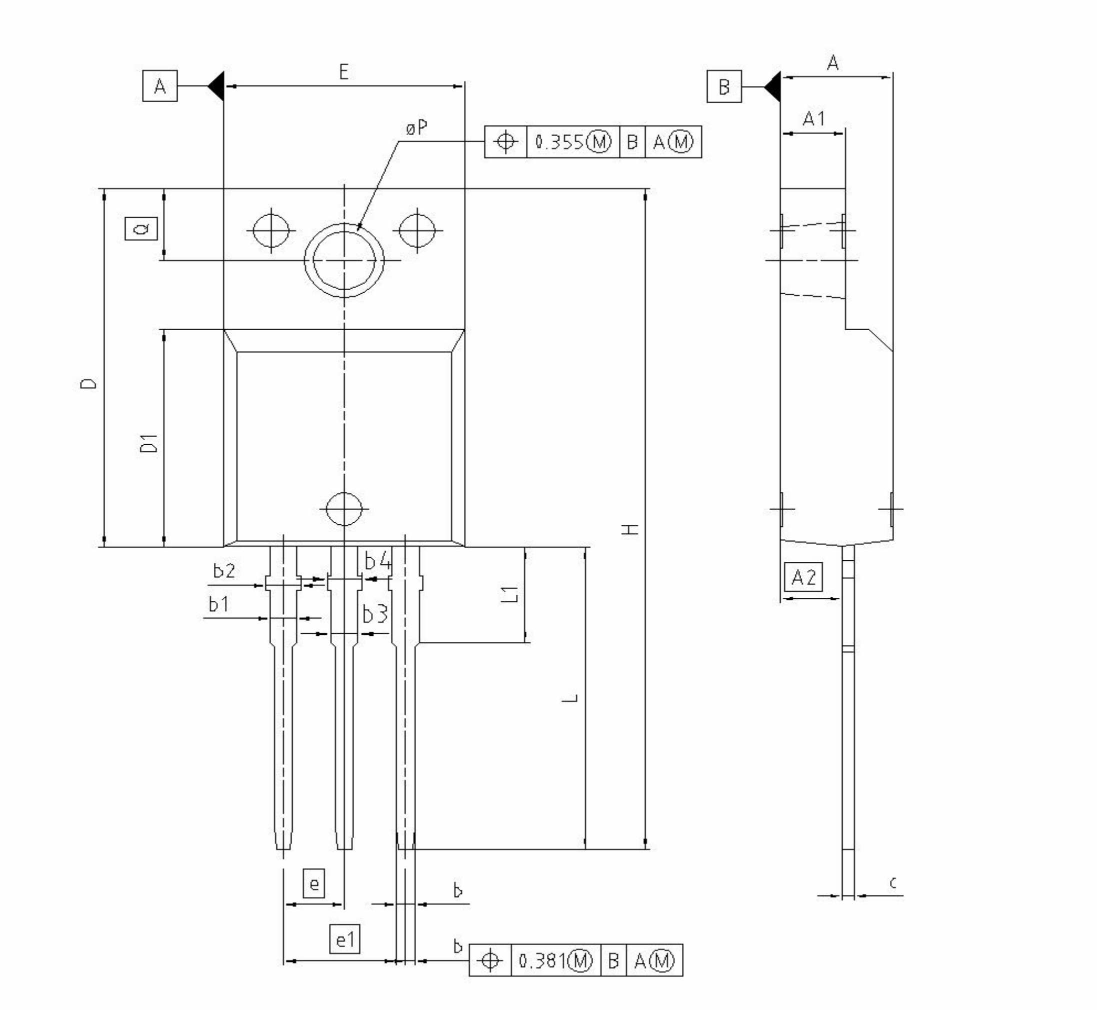
$E_{oss} = f(V_{DS})$



Definition of diode switching characteristics



PG-TO220-3-31/-3-11: Outline/ Fully isolated package (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

REFERENCE
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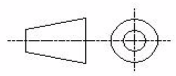
SCALE 0 – 2.5 – 5mm

EUROPEAN PROJECTION



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