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With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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CoolMOS™ Power Transistor
Features

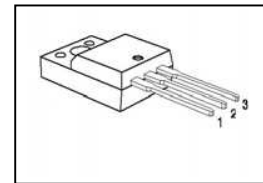
- Worldwide best $R_{DS(on)}$ in TO220
- Lowest figure of merit $R_{ON} \times Q_g$
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Pb-free lead plating; RoHS compliant; Halogen free for mold compound
- Qualified for industrial grade applications according to JEDEC⁰⁾

Product Summary

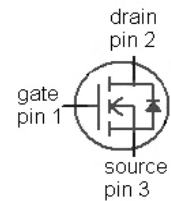
$V_{DS} @ T_{jmax}$	550	V
$R_{DS(on),max}$	0.140	Ω
$Q_{g,typ}$	48	nC

CoolMOS CP is designed for:

- Hard and softswitching SMPS for server power supplies
- CCM PFC for ATX, Notebook adapter, PDP and LCD TV
- PWM stages for Server, Adapter

TO- 220 FP


Type	Package	Marking
IPA50R140CP	PG-TO220FP	5R140P


Maximum ratings, at $T_j=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current ¹⁾	I_D	$T_C=25\text{ °C}$	23	A
		$T_C=100\text{ °C}$	15	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	56	
Avalanche energy, single pulse	E_{AS}	$I_D=9.3\text{ A}, V_{DD}=50\text{ V}$	616	mJ
Avalanche energy, repetitive t_{AR} ^{2),3)}	E_{AR}	$I_D=9.3\text{ A}, V_{DD}=50\text{ V}$	0.93	
Avalanche current, repetitive t_{AR} ^{2),3)}	I_{AR}		9.3	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0\dots 400\text{ V}$	50	V/ns
Gate source voltage	V_{GS}	static	± 20	V
		AC ($f>1\text{ Hz}$)	± 30	
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	34	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	$^{\circ}\text{C}$
Mounting torque		M2.5 screws	50	Ncm

Maximum ratings, at $T_j=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current ¹⁾	I_S	$T_C=25\text{ °C}$	14	A
Diode pulse current ²⁾	$I_{S,pulse}$		56	
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}		-	-	3.65	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 $T_j=25\text{ °C}$, unless otherwise specified
Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$	500	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.93\text{ mA}$	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=500\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	-	2	μA
		$V_{DS}=500\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ °C}$	-	20	-	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=14\text{ A}, T_j=25\text{ °C}$	-	0.13	0.14	Ω
		$V_{GS}=10\text{ V}, I_D=14\text{ A}, T_j=150\text{ °C}$	-	0.32	-	
Gate resistance	R_G	$f=1\text{ MHz}, \text{open drain}$	-	2.2	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$ $f=1\text{ MHz}$	-	2540	-	pF
Output capacitance	C_{oss}		-	110	-	
Effective output capacitance, energy related ⁵⁾	$C_{o(er)}$	$V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$ to 400 V	-	110	-	
Effective output capacitance, time related ⁶⁾	$C_{o(tr)}$		-	230	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400\text{ V},$ $V_{GS}=10\text{ V}, I_D=14\text{ A},$ $R_G=12.2\ \Omega$	-	35	-	ns
Rise time	t_r		-	14	-	
Turn-off delay time	$t_{d(off)}$		-	80	-	
Fall time	t_f		-	8.0	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD}=400\text{ V}, I_D=14\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	11	-	nC
Gate to drain charge	Q_{gd}		-	15	-	
Gate charge total	Q_g		-	48	64	
Gate plateau voltage	$V_{plateau}$		-	5.2	-	V

Reverse Diode

Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=14\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.9	1.2	V
Reverse recovery time	t_{rr}	$V_R=400\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	400	-	ns
Reverse recovery charge	Q_{rr}		-	5.6	-	μC
Peak reverse recovery current	I_{rrm}		-	26	-	A

⁰⁾ J-STD20 and JESD22

¹⁾ Limited only by $T_{j,max}$
²⁾ Pulse width t_p limited by $T_{j,max}$
³⁾ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR} \cdot f$.

⁴⁾ $I_{SD} \leq I_D$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DClink}=400\text{ V}$, $V_{peak} < V_{(BR)DSS}$, $T_j < T_{j,max}$, identical low and high side switch

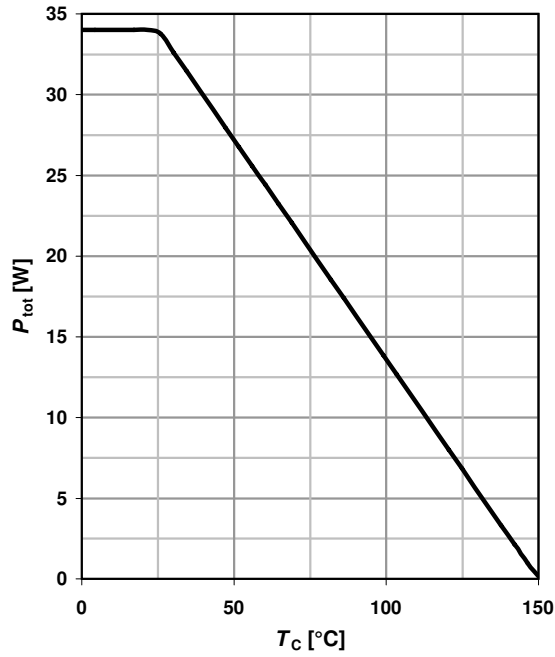
⁵⁾ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

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

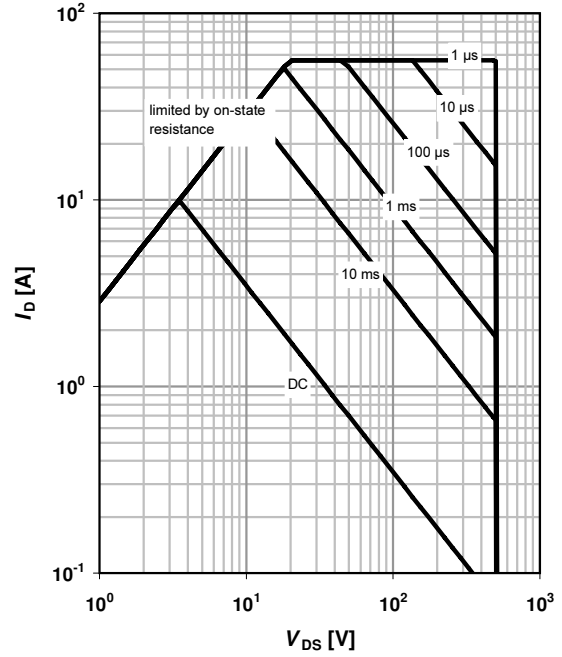
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS}); T_C=25\text{ °C}; D=0$

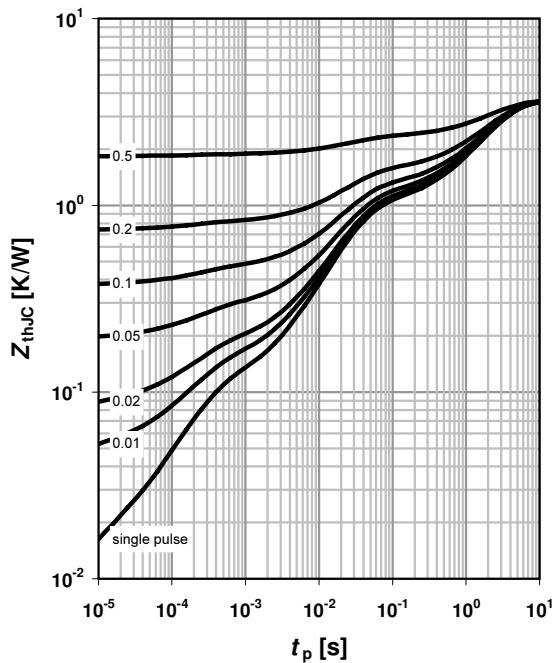
parameter: t_p



3 Max. transient thermal impedance

$Z_{(th)JC}=f(t_p)$

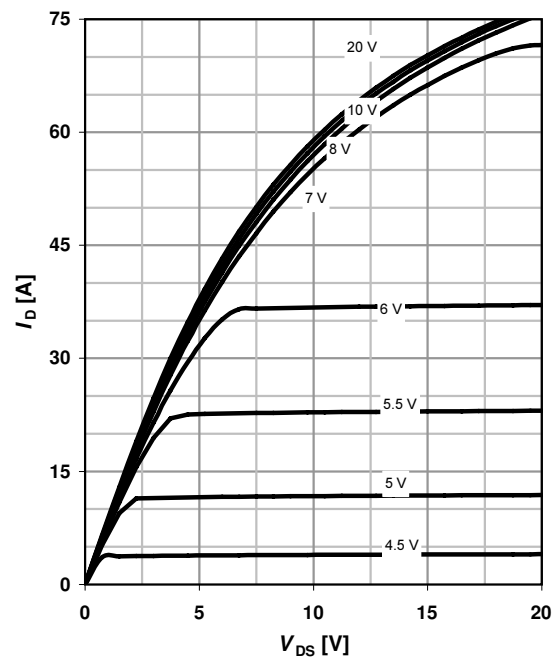
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS}); T_J=25\text{ °C}$

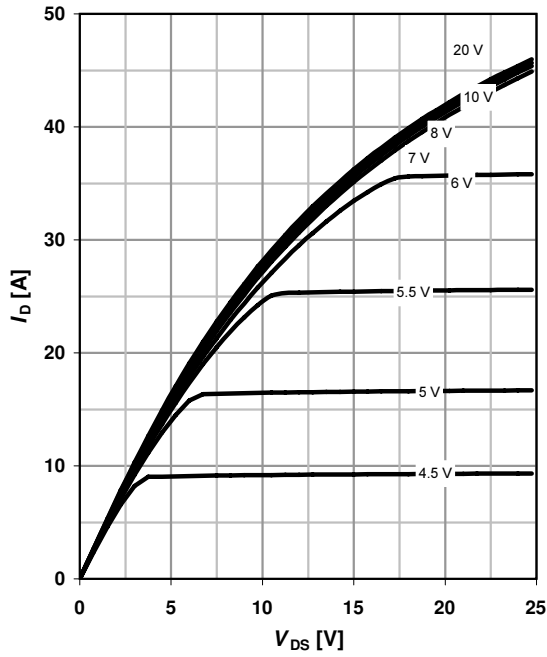
parameter: V_{GS}



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 150\text{ °C}$

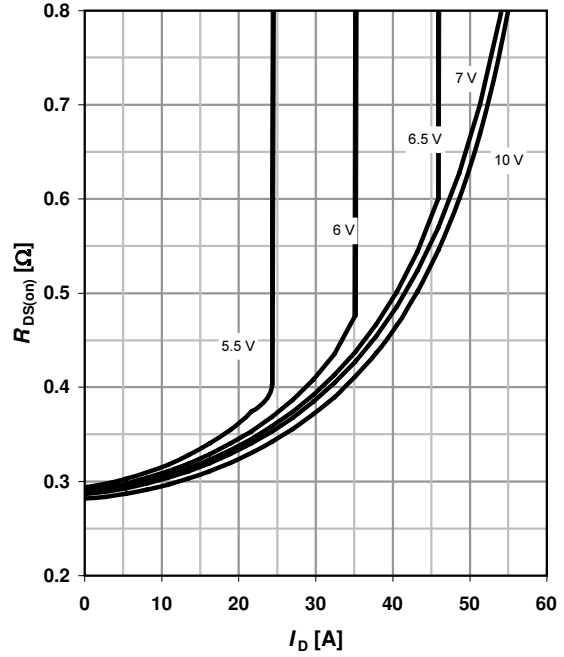
parameter: V_{GS}



6 Typ. drain-source on-state resistance

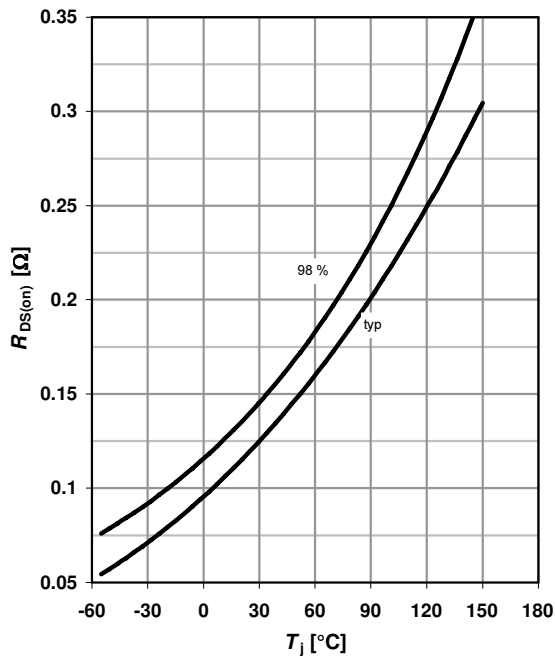
$R_{DS(on)} = f(I_D); T_j = 150\text{ °C}$

parameter: V_{GS}



7 Drain-source on-state resistance

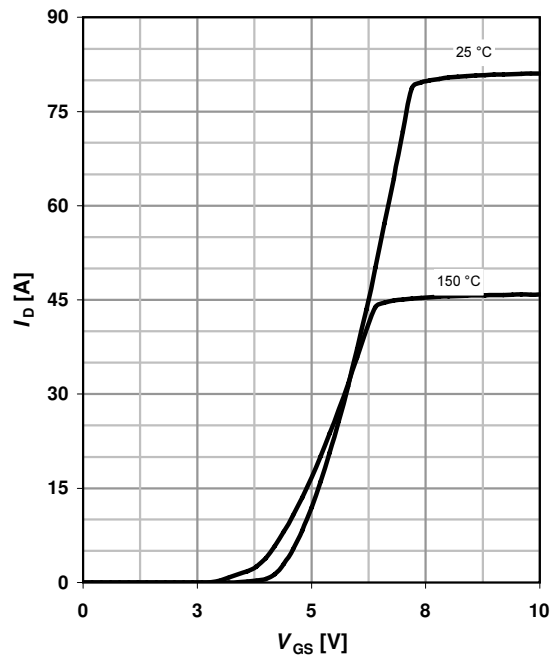
$R_{DS(on)} = f(T_j); I_D = 14\text{ A}; V_{GS} = 10\text{ V}$



8 Typ. transfer characteristics

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

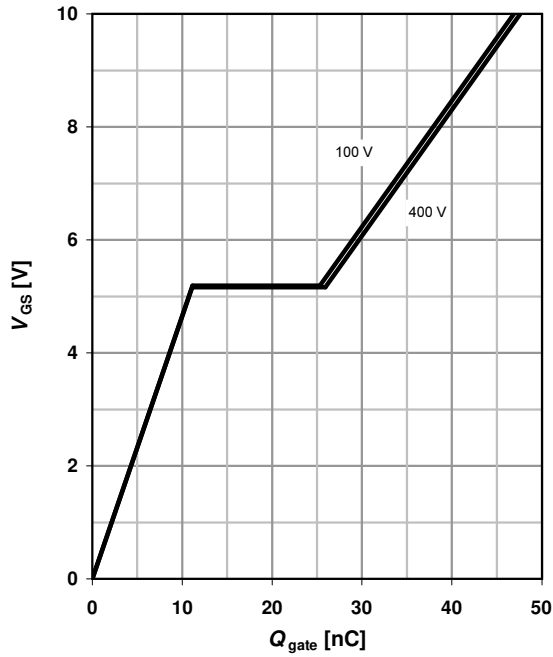
parameter: T_j



9 Typ. gate charge

$V_{GS}=f(Q_{gate}); I_D=14\text{ A pulsed}$

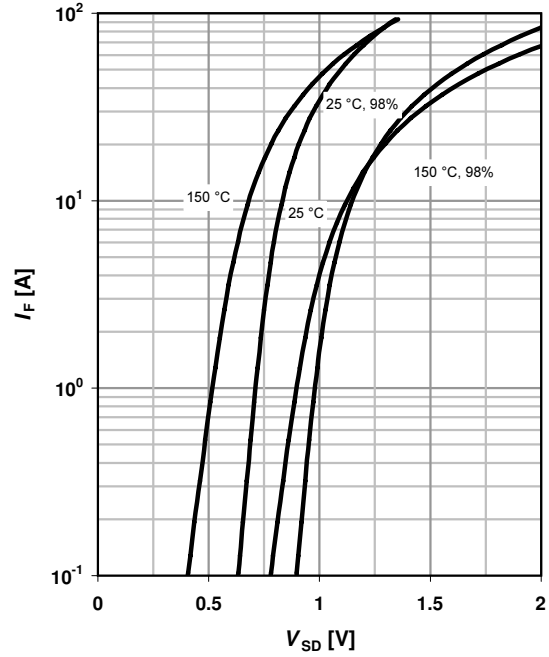
parameter: V_{DD}



10 Forward characteristics of reverse diode

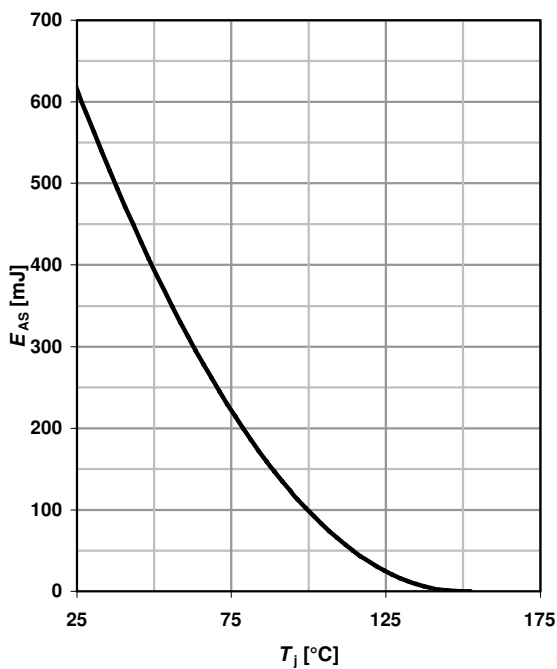
$I_F=f(V_{SD})$

parameter: T_j



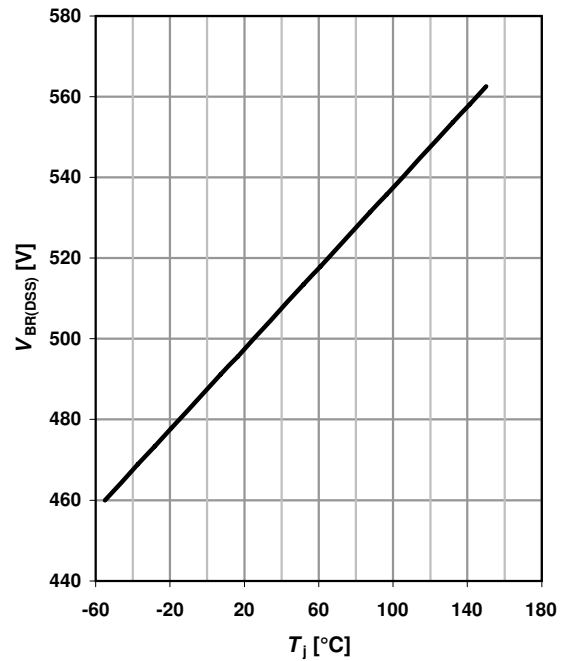
11 Avalanche energy

$E_{AS}=f(T_j); I_D=9.3\text{ A}; V_{DD}=50\text{ V}$



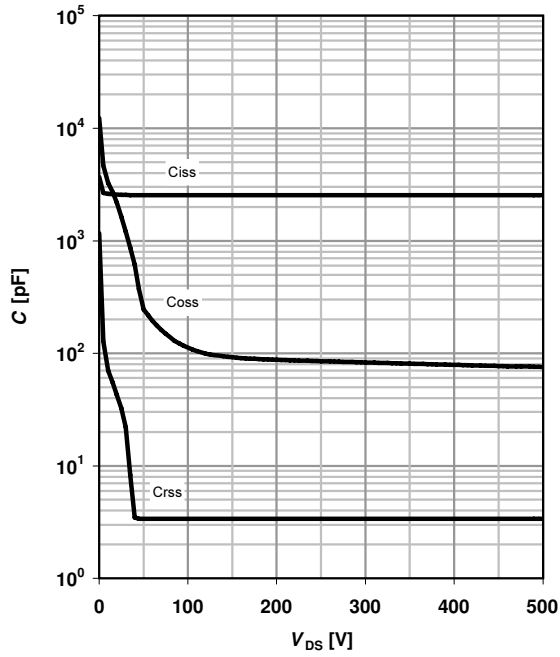
12 Drain-source breakdown voltage

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



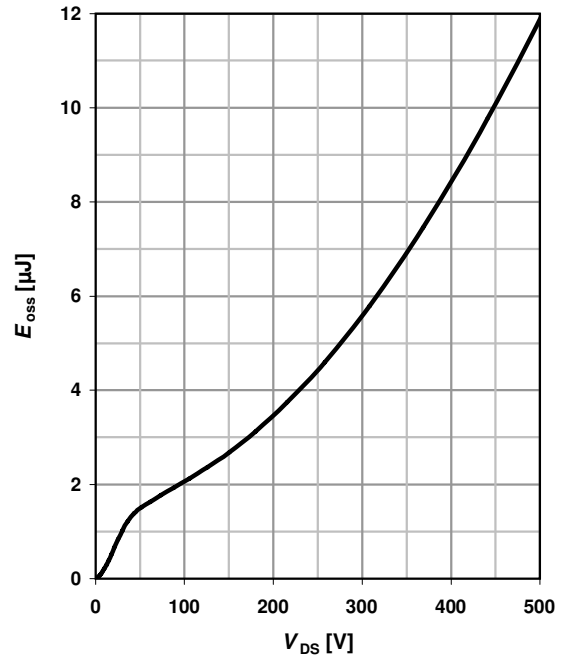
13 Typ. capacitances

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

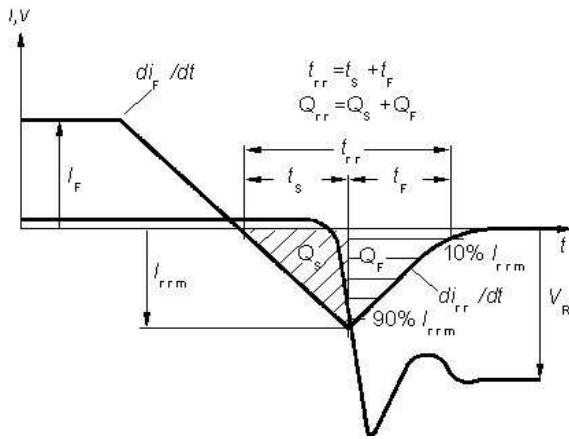


14 Typ. E_{oss} stored energy

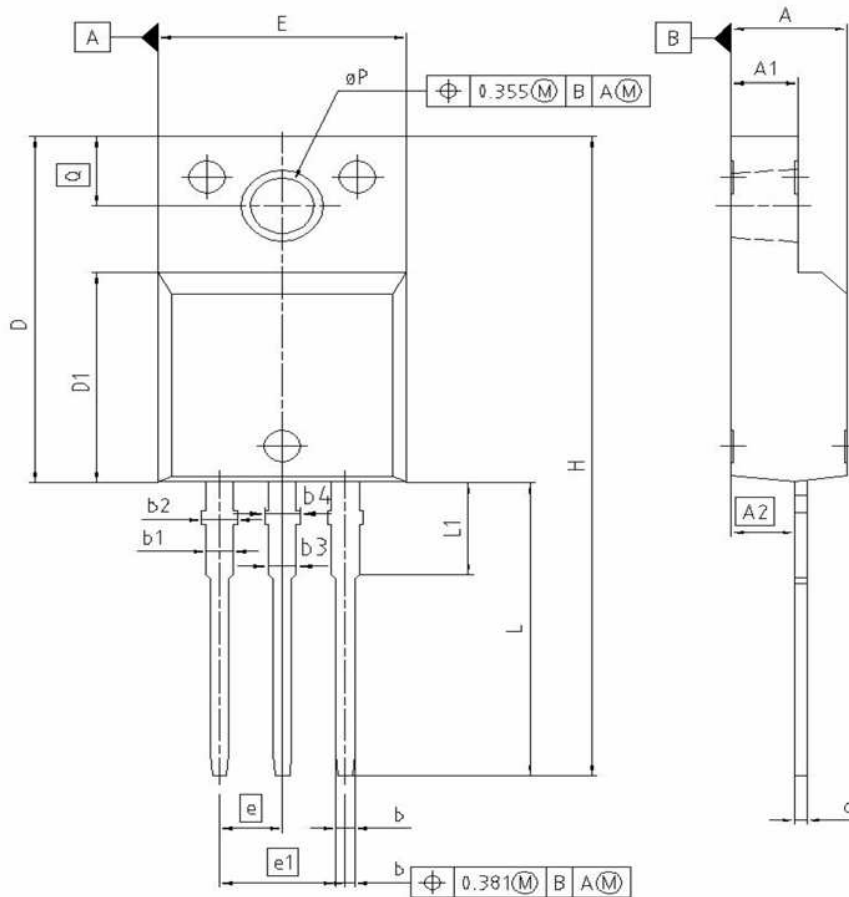
$$E_{oss} = f(V_{DS})$$



Definition of diode switching characteristics



PG-TO220-3-31: Outline / Fully isolated package (2500VAC; 1minute)



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
phi P	2.95	3.20	0.116	0.126
Q	3.15	3.50	0.124	0.138

REFERENCE
J..

SCALE
0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
08-01-2007

FILE
TO220_2

Published by
Infineon Technologies AG
81726 Munich, Germany
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