CoolMOS™ Power Transistor

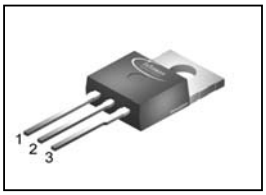
Product Summary

V_{DS}	600	V
$R_{DS(on),max}$	0.105	Ω
$Q_{g,typ}$	60	nC

Features

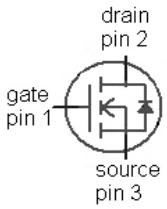
- Worldwide best $R_{ds,on}$ in TO220
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Automotive AEC Q101 qualified
- Green package (RoHS compliant)

PG-TO220-3-1



CoolMOS CPA is specially designed for:

- DC/DC converters for Automotive Applications



Type	Package	Marking
IPP60R099CPA	PG-TO220-3-1	6R099A

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[1]	$I_{D,pulse}$	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}[1),2)]	E_{AR}	I_D=11 A, V_{DD}=50 V	1.2	
Avalanche current, repetitive t_{AR}[1),2)]	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
Power dissipation	P_{tot}	T_C=25 °C	255	W
Operating temperature	T_j		-40 ... 150	°C
Storage temperature	T_{stg}		-40 ... 150	
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[1)]	$I_{S,pulse}$		93	
Reverse diode dv/dt[3)]	dv/dt		15	V/ns

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 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=1.2 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	-	-	5	µA
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	0.105	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] Pulse width t_p limited by $T_{j,max}$

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

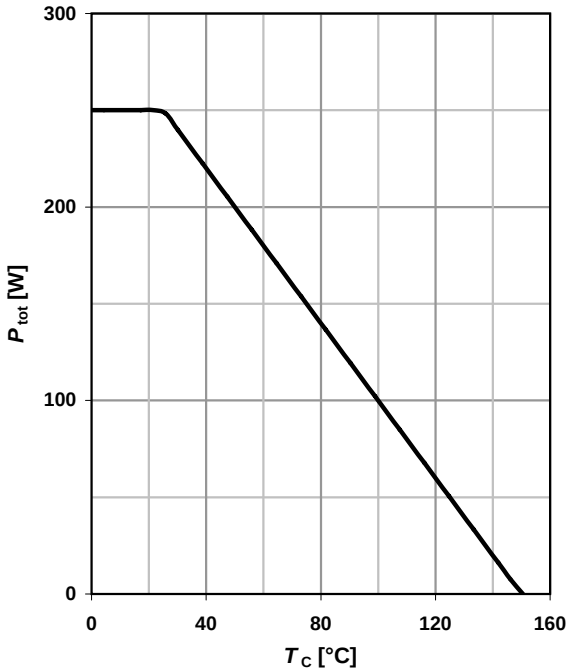
[3] I_{SD}<=I_D, di/dt<=100A/µs, V_{DClink} = 400V, V_{peak}<$V_{(BR)DSS}$, T_j<T_{jmax}, identical low side and high side switch

[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

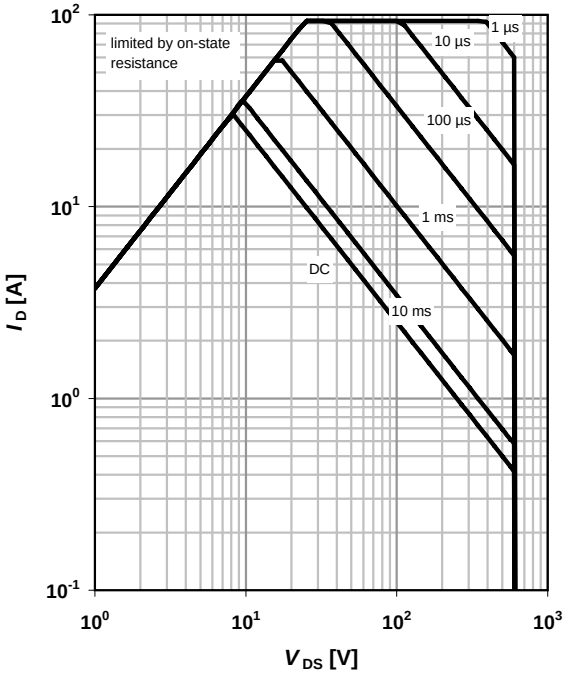
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

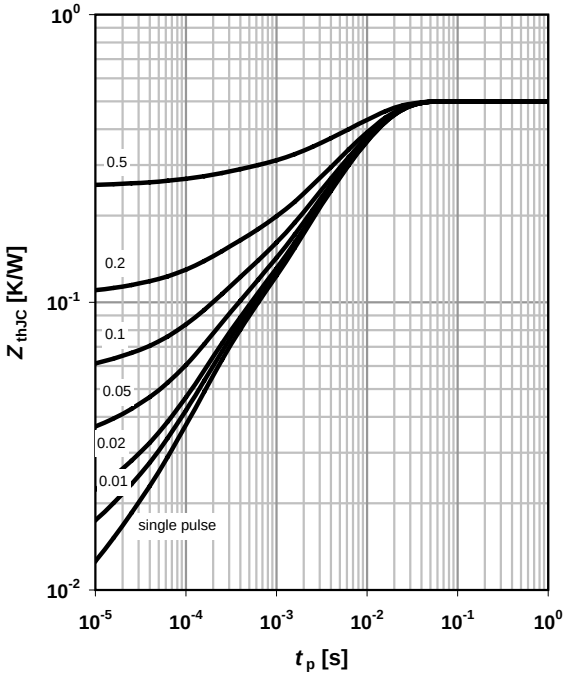
parameter: t_p



3 Max. transient thermal impedance

$Z_{thJC}=f(t_P)$

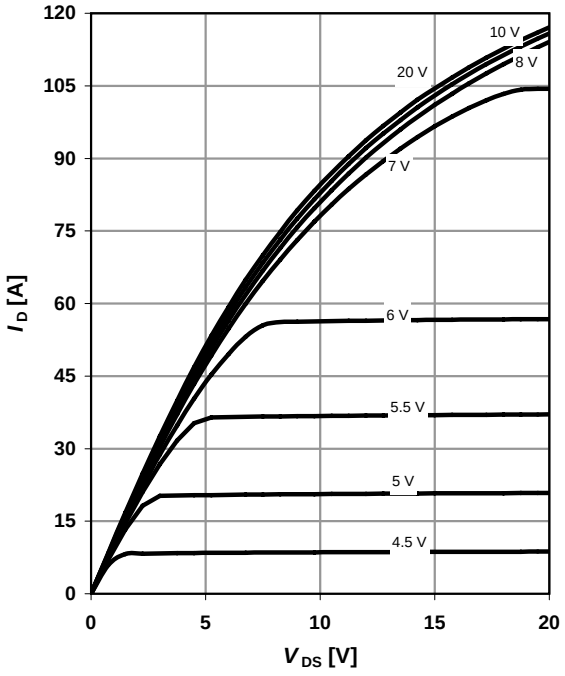
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

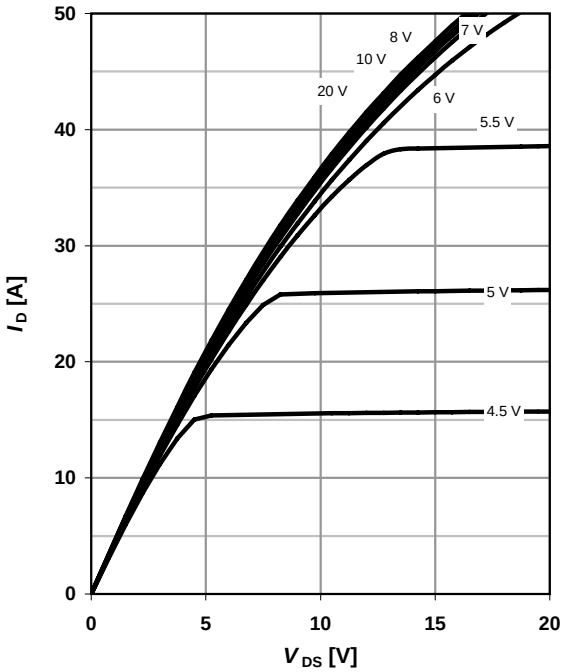
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

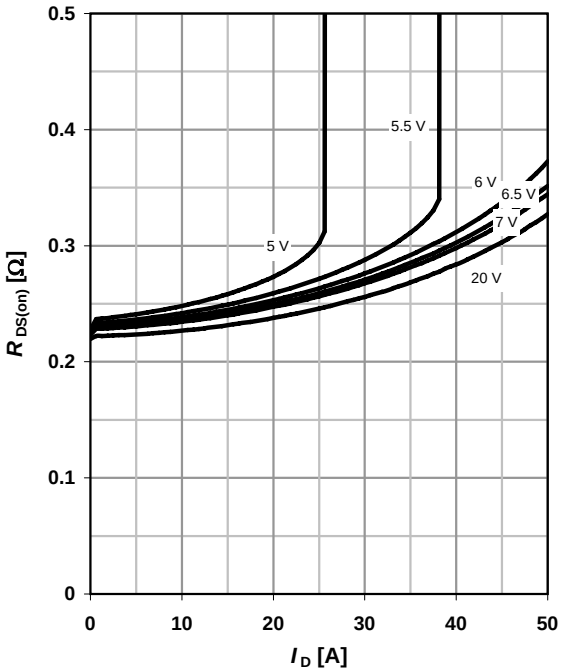
parameter: V_{GS}



6 Typ. drain-source on-state resistance

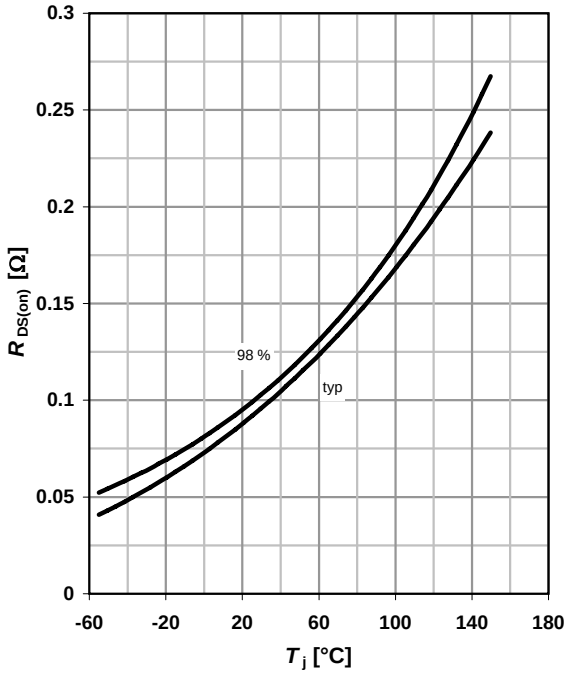
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

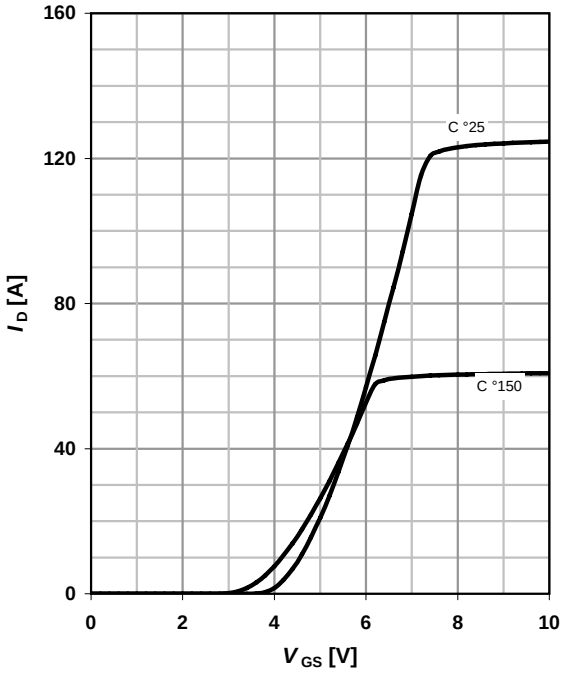
$R_{DS(on)}$=f(T_j); I_D=18 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

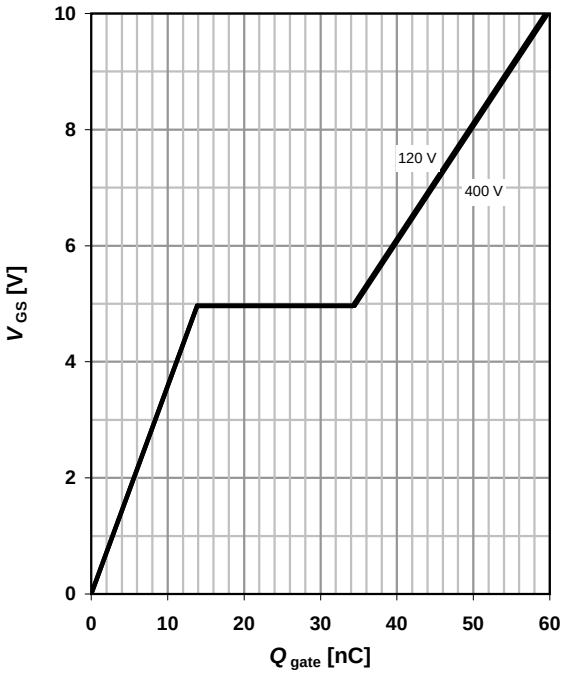
parameter: T_j



9 Typ. gate charge

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

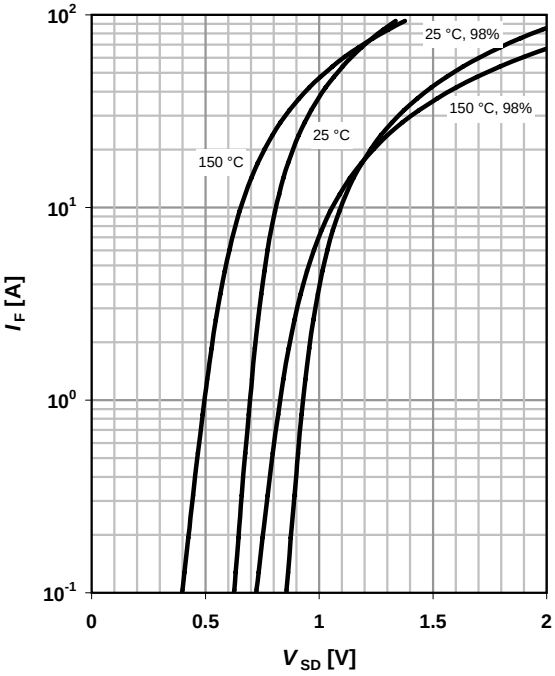
parameter: V_{DD}



10 Forward characteristics of reverse diode

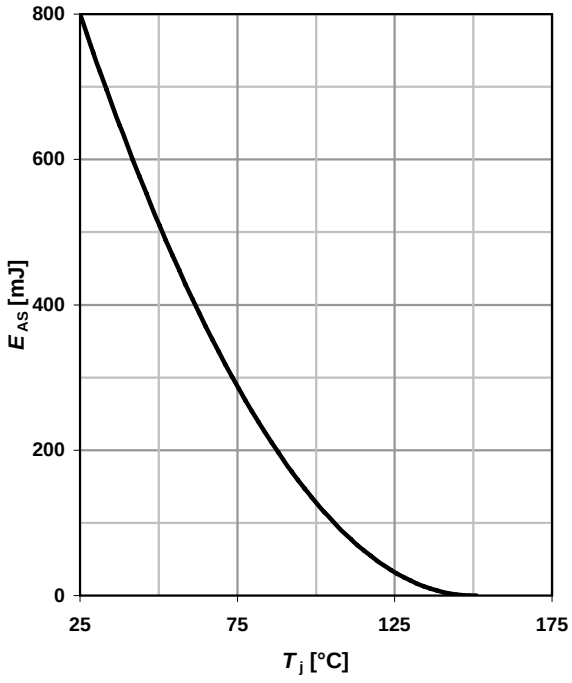
I_F=f(V_{SD})

parameter: T_j



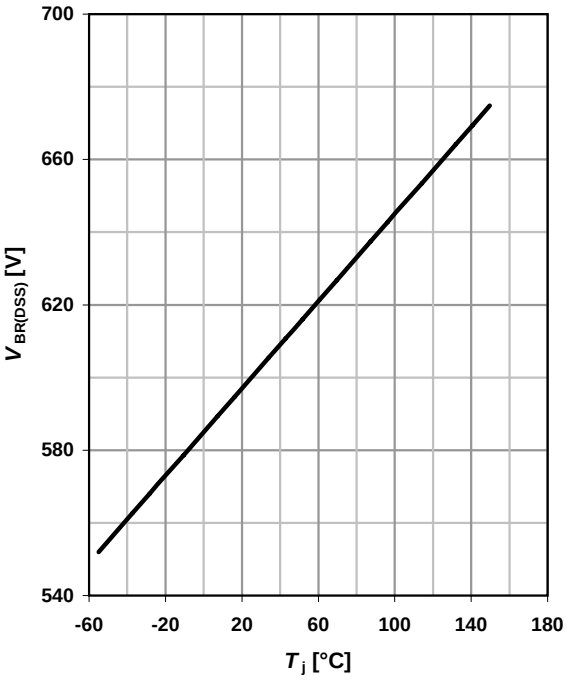
11 Avalanche energy

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



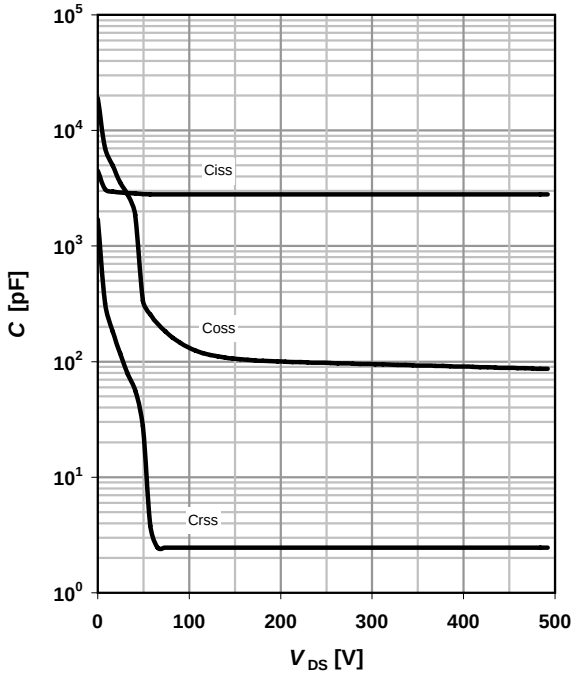
12 Drain-source breakdown voltage

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



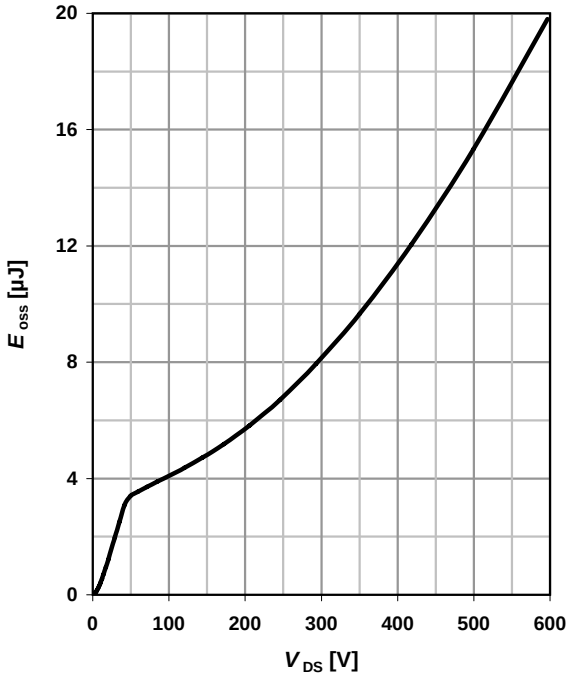
13 Typ. capacitances

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

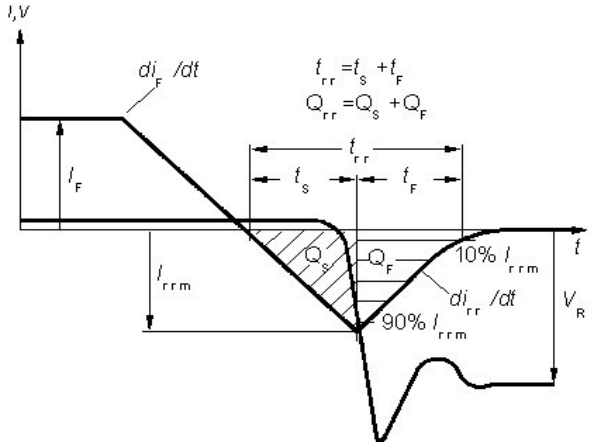


14 Typ. Coss stored energy

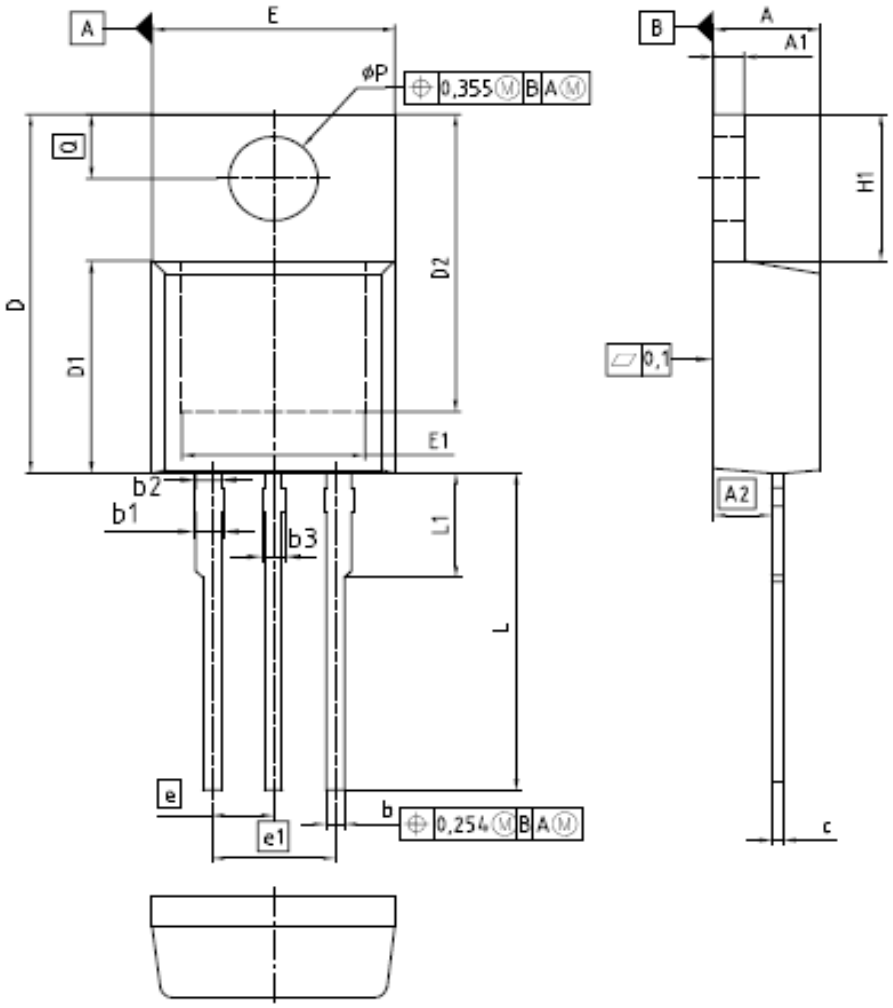
$E_{oss} = f(V_{DS})$



Definition of diode switching characteristics



PG-TO220-3: Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1,17	1,40	0,046	0,055
A2	2,15	2,72	0,085	0,107
b	0,65	0,86	0,026	0,034
b1	0,95	1,40	0,037	0,055
b2	0.95	1.15	0.037	0.045
b3	0,65	1,15	0,026	0,045
c	0,33	0,60	0,013	0,024
D	14.81	15.96	0.583	0.628
D1	8,51	9,45	0,335	0,372
D2	12,19	13,10	0,480	0,516
E	9,70	10,36	0,382	0,408
E1	6,50	8,60	0,256	0,339
e	2.54		0.100	
e1	5,08		0,200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13,00	14,00	0,512	0,551
L1	-	4,80	-	0,189
øP	3,60	3,89	0,142	0,153
Q	2,60	3,00	0,102	0,118

DOCUMENT NO.
Z8B00003318

SCALE 0 2,5 5mm

EUROPEAN PROJECTION

ISSUE DATE
30-07-2009

REVISION
08

Dimensions in mm/inches:

Published by
Infineon Technologies AG
81726 München, Germany

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