CoolMOS® Power Transistor

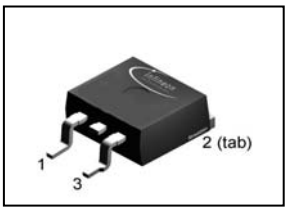
Product Summary

V_{DS}	600	V
$R_{DS(on),max}$	0.199	Ω
$Q_{g,typ}$	33	nC

Features

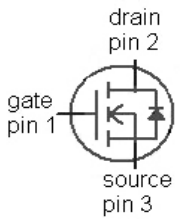
- Lowest figure-of-merit R_{on} x Q_g
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Automotive AEC Q101 qualified
- Green package (RoHS compliant)

PG-TO263-3



CoolMOS CPA is specially designed for:

- DC/DC converters for Automotive Applications



Type	Package	Marking
IPB60R199CPA	PG-TO263-3	6R199A

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	16	A
		T_C=100 °C	10	
Pulsed drain current[1]	$I_{D,pulse}$	T_C=25 °C	51	
Avalanche energy, single pulse	E_{AS}	I_D=6.6 A, V_{DD}=50 V	436	mJ
Avalanche energy, repetitive t_{AR}[1),2)]	E_{AR}	I_D=6.6 A, V_{DD}=50 V	0.66	
Avalanche current, repetitive t_{AR}[1),2)]	I_{AR}		6.6	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	139	W
Operating temperature	T_j		-40 ... 150	°C
Storage temperature	T_{stg}		-40 ... 150	

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	9.9	A
Diode pulse current[1]	$I_{S,pulse}$		51	
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}		-	-	0.9	K/W
Thermal resistance, junction - ambient	R_{thJA}	SMD version, device on PCB, minimal footprint	-	-	62	
		SMD version, device on PCB, 6 cm^2 cooling area[4]	-	35	-	
Soldering temperature, reflow soldering	T_{sold}	MSL 1	-	-	245	°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=1.1 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
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=9.9 A, T_j=25 °C	-	0.18	0.199	Ω
		V_{GS}=10 V, I_D=9.9 A, T_j=150 °C	-	0.49	-	
Gate resistance	R_G	f=1 MHz, open drain	-	2	-	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	-	1520	-	pF
Output capacitance	C_{oss}		-	72	-	
Effective output capacitance, energy related[5)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	69	-	
Effective output capacitance, time related[6)]	$C_{o(tr)}$		-	180	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=9.9 A, R_G=3.3 Ω	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	50	-	
Fall time	t_f		-	5	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=9.9 A, V_{GS}=0 to 10 V	-	8	-	nC
Gate to drain charge	Q_{gd}		-	11	-	
Gate charge total	Q_g		-	32	43	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=9.9 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	-	340	-	ns
Reverse recovery charge	Q_{rr}		-	5.5	-	µC
Peak reverse recovery current	I_{rrm}		-	33	-	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≤200A/µs, V_{DClink}=400V, V_{peak}<$V_{(BR)DSS}$, T_j<T_{jmax}, identical low side and high side switch.

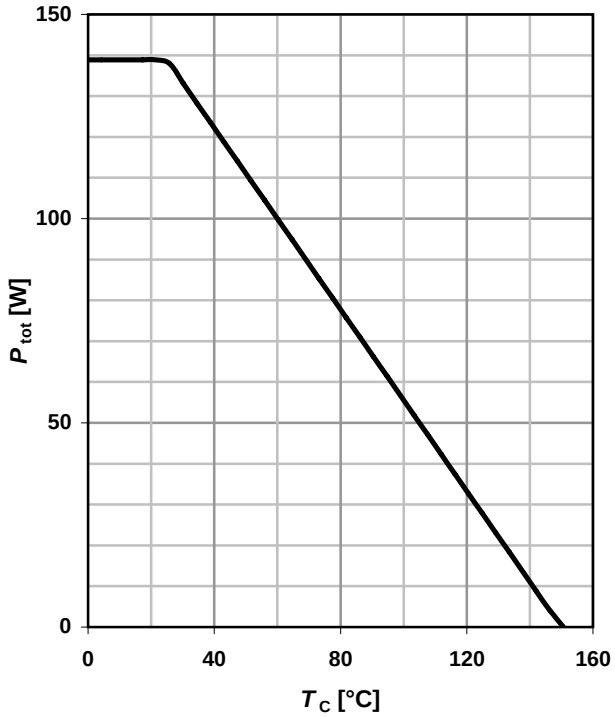
[4)] Device on 40mm*40mm*1.5 epoxy PCB FR4 with 6cm2 (one layer, 70µm thick) copper area for drain connection. PCB is vertical without blown air.

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

[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}.

1 Power dissipation

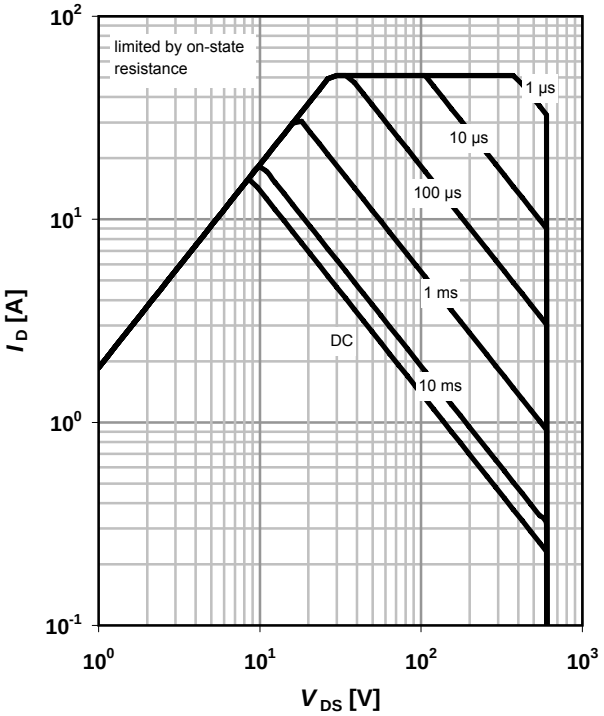
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS})$; T_C=25 °C; D=0

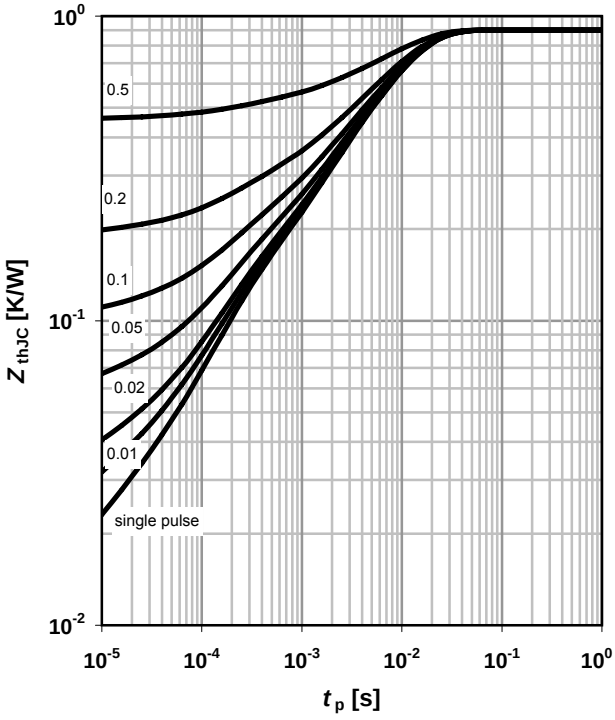
parameter: t_p



3 Max. transient thermal impedance

$Z_{thJC}=f(t_P)$

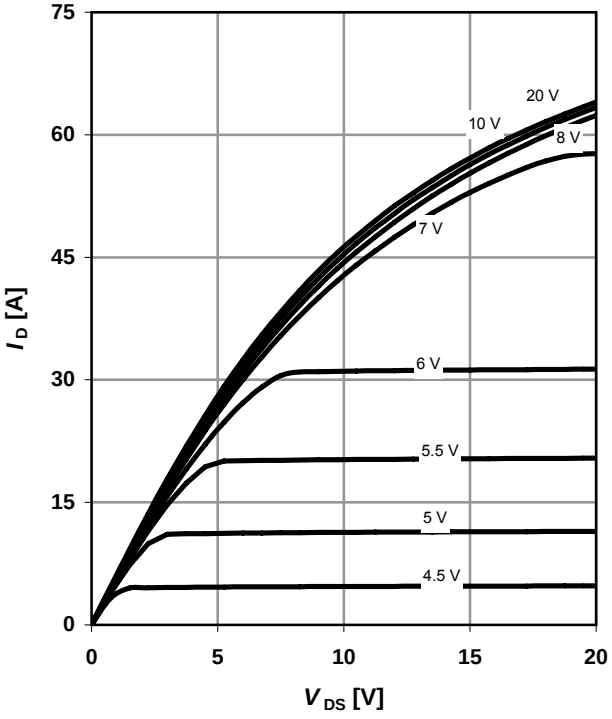
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS})$; T_j=25 °C

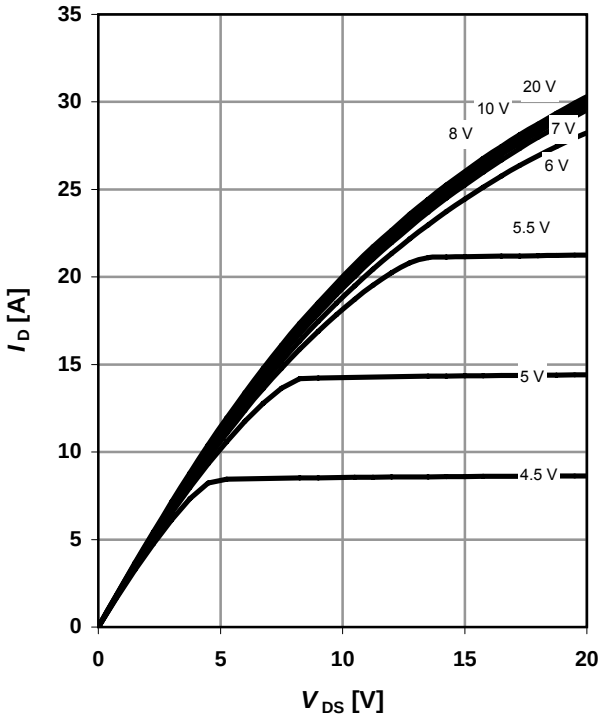
parameter: V_{GS}



5 Typ. output characteristics

$I_D=f(V_{DS})$; T_j=150 °C

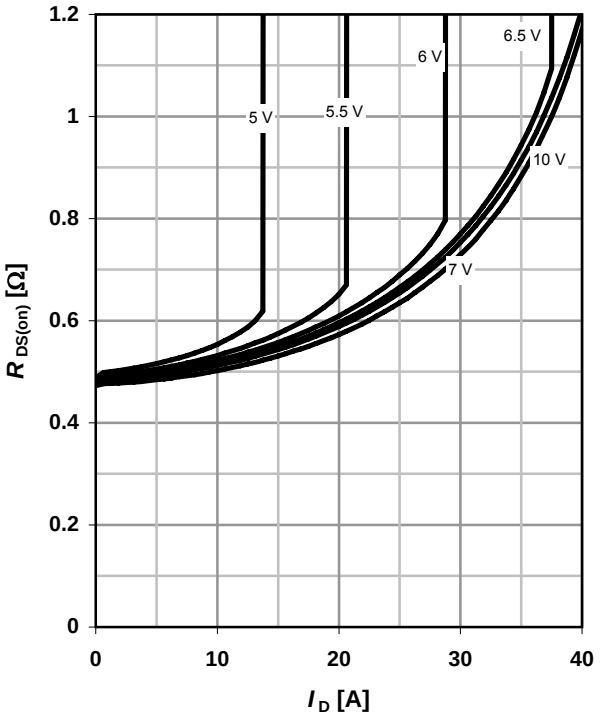
parameter: V_{GS}



6 Typ. drain-source on-state resistance

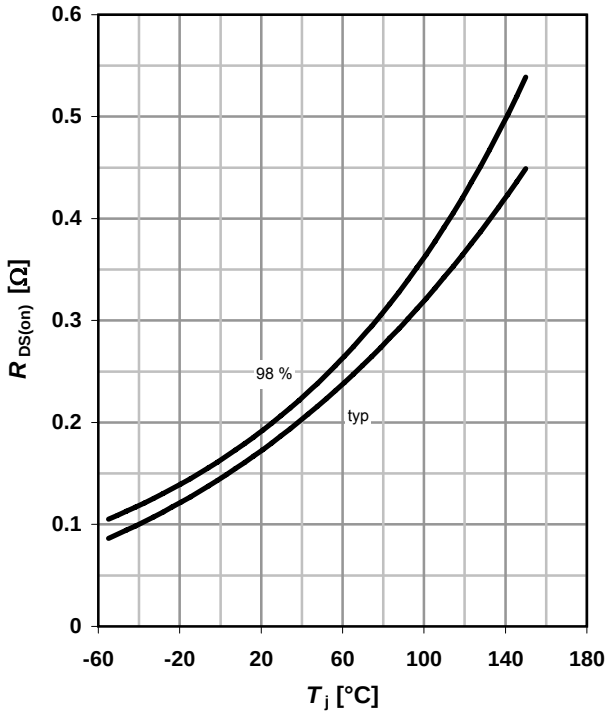
$R_{DS(on)}=f(I_D)$; T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

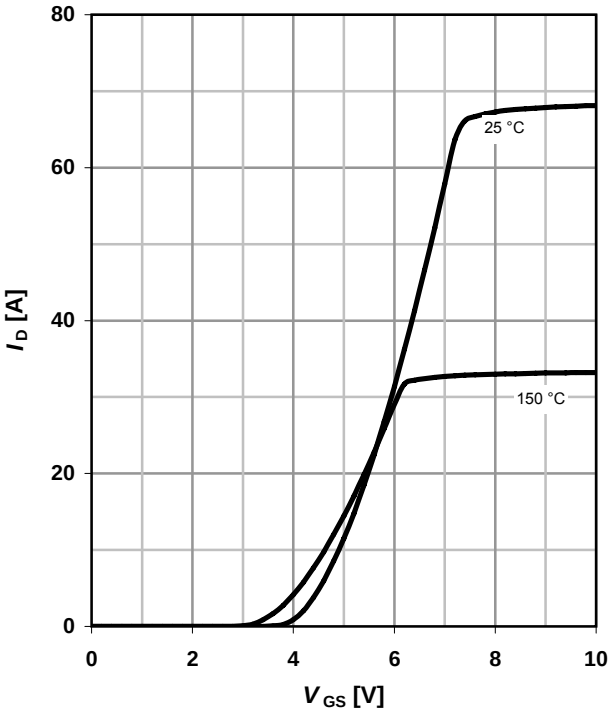
$R_{DS(on)}=f(T_j)$; I_D=9.9 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

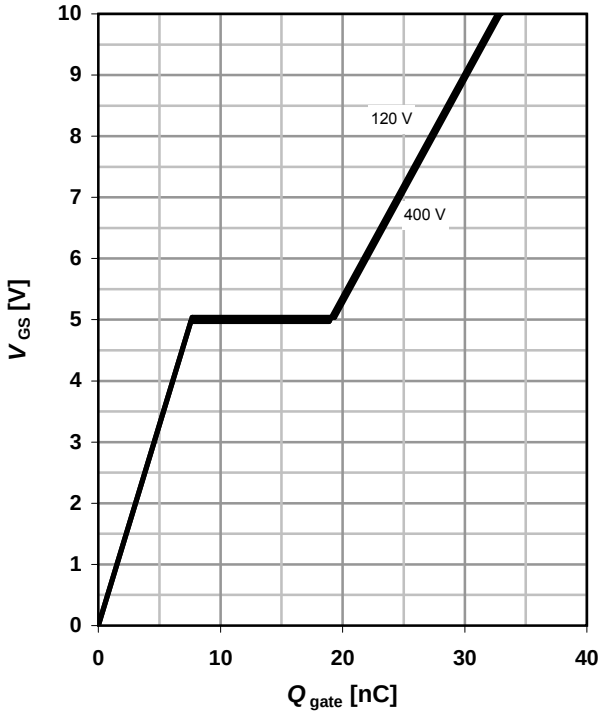
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=9.9 A pulsed

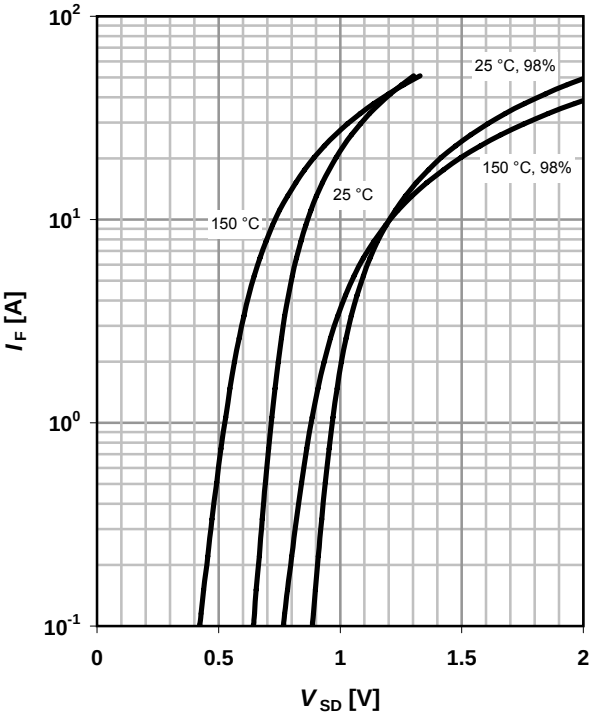
parameter: V_{DD}



10 Forward characteristics of reverse diode

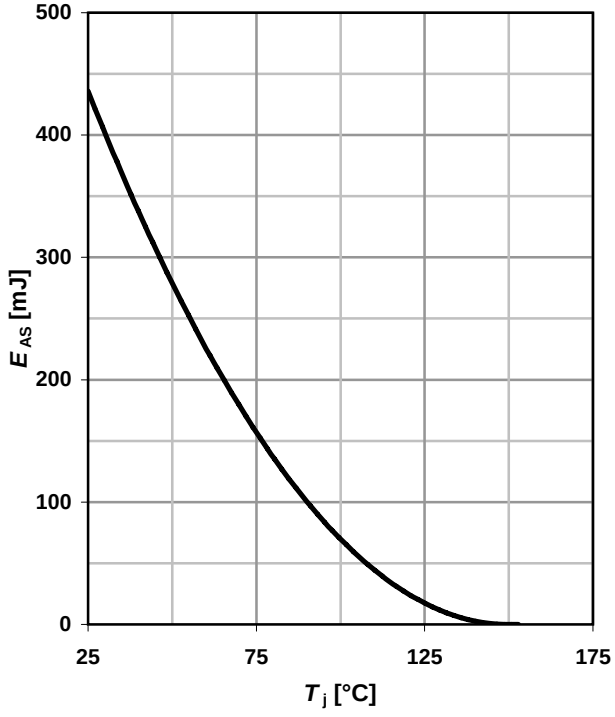
I_F=f(V_{SD})

parameter: T_j



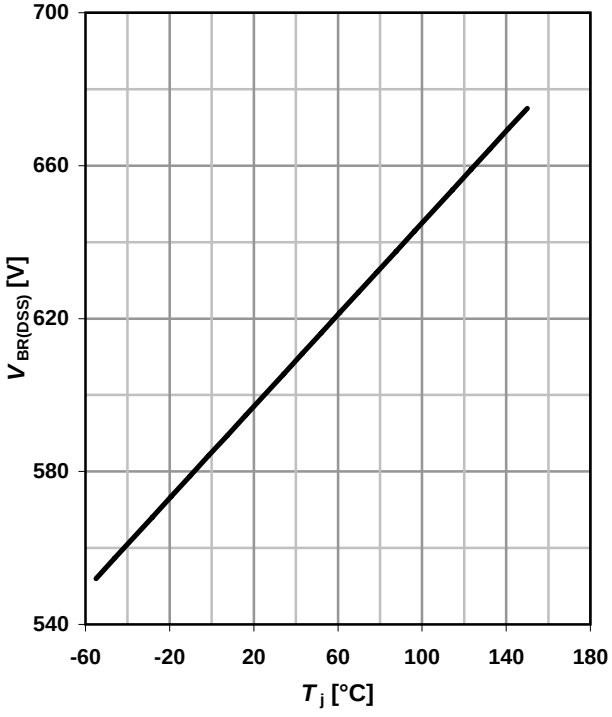
11 Avalanche energy

E_{AS}=f(T_j); I_D=6.6 A; V_{DD}=50 V



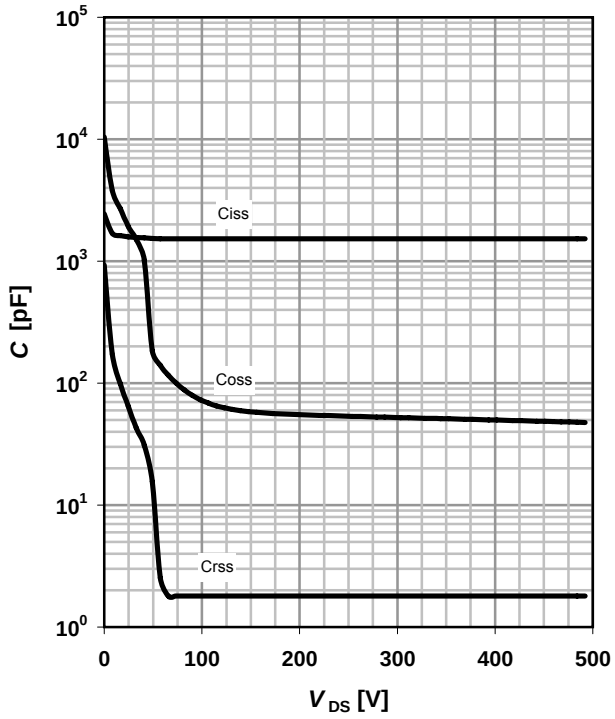
12 Drain-source breakdown voltage

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



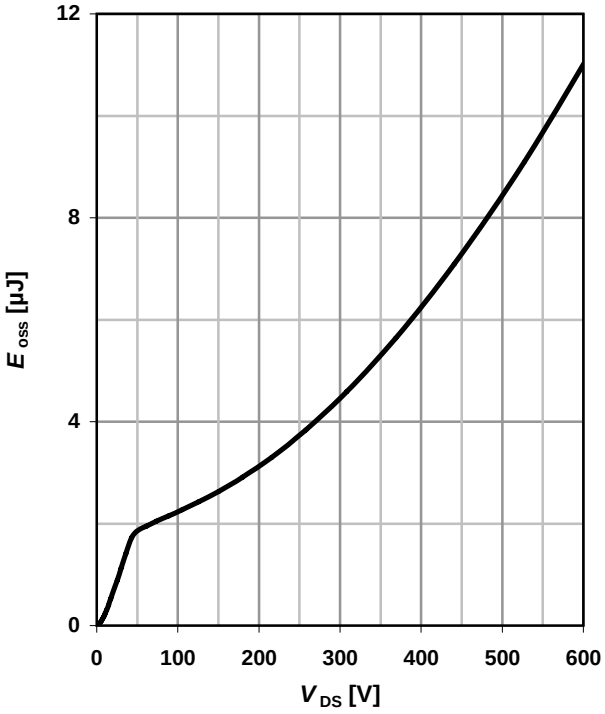
13 Typ. capacitances

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

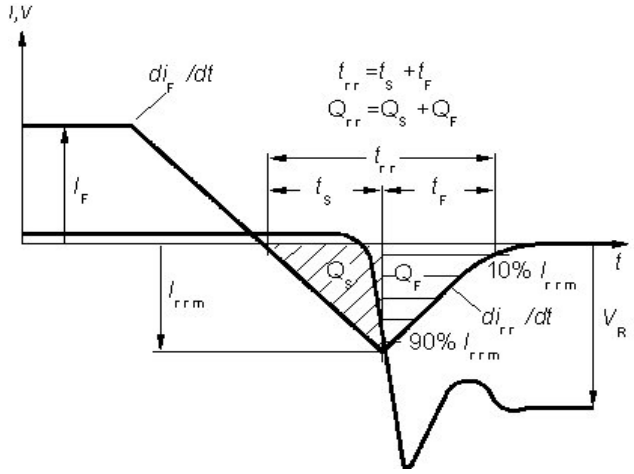


14 Typ. Coss stored energy

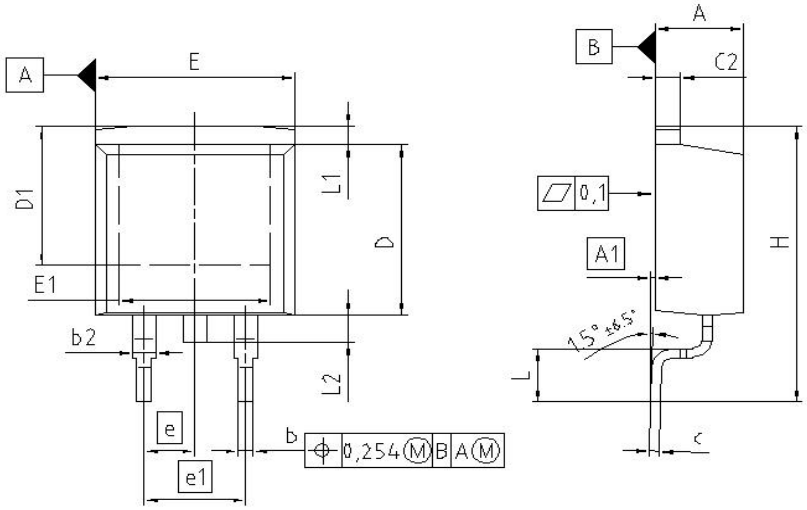
E_{oss}= f(V_{DS})



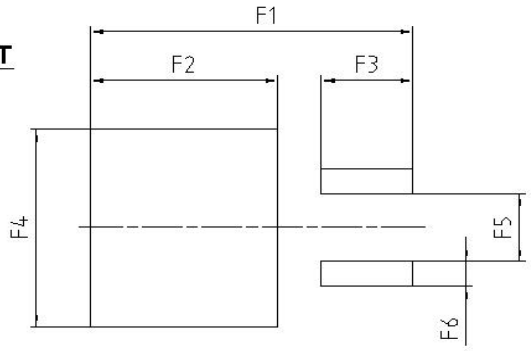
Definition of diode switching characteristics



PG-TO263-3: Outlines



FOOTPRINT



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	0.000	0.254	0.000	0.010
b	0.650	0.850	0.026	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.650	0.013	0.026
c2	0.170	1.400	0.046	0.055
D	8.509	9.450	0.335	0.372
D1	7.100	-	0.280	-
E	9.800	10.312	0.386	0.406
E1	6.500		0.256	
e	2.540		0.100	
e1	5.080		0.200	
N	2		2	
H	14.605	15.875	0.575	0.625
L	2.200	3.000	0.087	0.118
L1	-	1.600	-	0.063
L2	1.000	1.778	0.039	0.070
F1	16.050	16.250	0.632	0.640
F2	9.300	9.500	0.366	0.374
F3	4.500	4.700	0.177	0.185
F4	10.700	10.900	0.421	0.429
F5	3.630	3.830	0.143	0.151
F6	1.100	1.300	0.043	0.051

REFERENCE	JEDEC TO263
SCALE	0 5 5 7.5mm
EUROPEAN PROJECTION	
ISSUE DATE	12-02-2006
FILE	TO263_2

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NOTIFICATION

N° 040/10

Information on N-Channel MOSFET products designed for automotive applications

Products affected:

SalesName	Package
IPB60R099CPA	PG-TO263-3-2
IPB60R199CPA	PG-TO263-3-2
IPB60R299CPA	PG-TO263-3-2
IPC60R075CPA	Bare Die
IPI60R099CPA	PG-TO262-3-1
IPP60R099CPA	PG-TO220-3-1
IPW60R045CPA	PG-TO247-3-41
IPW60R075CPA	PG-TO247-3-41
IPW60R099CPA	PG-TO247-3-41

Dear Customer,

The devices listed for this notification are sensitive to hard commutation of the conducting body diode. This operating condition can occur in half-bridge configurations used in ZVS phase shift and resonant switching PWM converters. Using the device under such conditions may result in violation of the datasheet specification limits and may lead to permanent damage of the device.
Please take care that in the context of the application described above the datasheet limits are not exceeded.

Best Regards

Michael Paulu

If you have any questions, please do not hesitate to contact your local Sales office.