CoolMOS™ Power Transistor

Features

- Intrinsic fast-recovery body diode
- Extremely low reverse recovery charge
- Ultra low gate charge
- Extreme d*v*/d*t* rated
- High peak current capability
- Qualified for industrial grade applications according to JEDEC[1)]

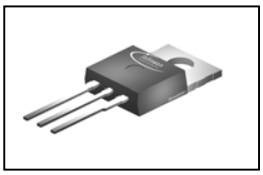
CoolMOS CFD designed for:

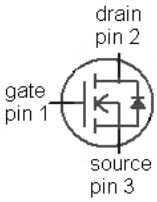
- Softswitching PWM Stages
- LCD & CRT TV

Product Summary

V_{DS} @ Tjmax	650	V
$R_{DS(on),max}$	0.330	Ω
I_D	13.4	A

PG-TO220





Type	Package	Marking
SPP15N60CFD	PG-TO220	15N60CFD

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	13.4	A
		T_C=100 °C	8.4	
Pulsed drain current[2)]	$I_{D,pulse}$	T_C=25 °C	33	
Avalanche energy, single pulse	E_{AS}	I_D=6.7 A, V_{DD}=50 V	460	mJ
Avalanche energy, repetitive[2),3)]	E_{AR}	I_D=13.4 A, V_{DD}=50 V	0.8	
Avalanche current, repetitive[2),3)]	I_{AR}		13.4	A
Drain source voltage slope	d*v*/d*t*	I_D=13.4 A, V_{DS}=480 V, T_j=125 °C	80	V/ns
Reverse diode d*v*/d*t*	d*v*/d*t*	I_S=13.4 A, V_{DS}=480 V, T_j=125 °C	40	V/ns
Maximum diode commutation speed	d*i*/d*t*		600	A/µs
Gate source voltage	V_{GS}	static	±20	V
		AC (*f*>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	156	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M3 & 3.5 screws	60	Ncm

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	0.8	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wave soldering 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
Avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0 V, I_D=13.4 A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=750 µA	3	4	5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	1.4	-	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	1200	-	
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=9.4 A, T_j=25 °C	-	0.28	0.33	Ω
		V_{GS}=10 V, I_D=9.4 A, T_j=150 °C	-	0.78	-	
Gate resistance	R_G	f=1 MHz, open drain	-	1.3	-	
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=9.4 A	-	8	-	S

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=25 V, f=1 MHz	-	1820	-	pF
Output capacitance	C_{oss}		-	520	-	
Reverse transfer capacitance	C_{rss}		-	21	-	
Effective output capacitance, energy related[4)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	61	-	
Effective output capacitance, time related[5)]	$C_{o(tr)}$		-	110	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=13.4 A, R_G=3.6 Ω	-	43	-	ns
Rise time	t_r		-	24	-	
Turn-off delay time	$t_{d(off)}$		-	47	-	
Fall time	t_f		-	5	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=480 V, I_D=13.4 A, V_{GS}=0 to 10 V	-	11	-	nC
Gate to drain charge	Q_{gd}		-	38	-	
Gate charge total	Q_g		-	63	84	
Gate plateau voltage	$V_{plateau}$		-	7.3	-	V

[1)] J-STD20 and JESD22

[2)] Pulse width t_p limited by $T_{j,max}$

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

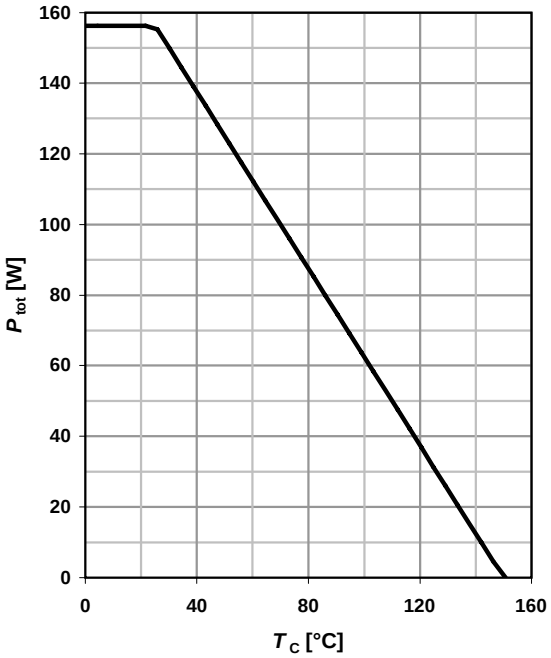
[4)] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

[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}.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 °C	-	-	13.4	A
Diode pulse current[2)]	$I_{S,pulse}$		-	-	33	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=I_S, T_j=25 °C	-	1.0	1.2	V
Reverse recovery time	t_{rr}	V_R=480 V, I_F=I_S, di_F/dt=100 A/µs	-	147	-	ns
Reverse recovery charge	Q_{rr}		-	1	-	µC
Peak reverse recovery current	I_{rrm}		-	12	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j=25 °C	-	1200	-	A/µs

1 Power dissipation

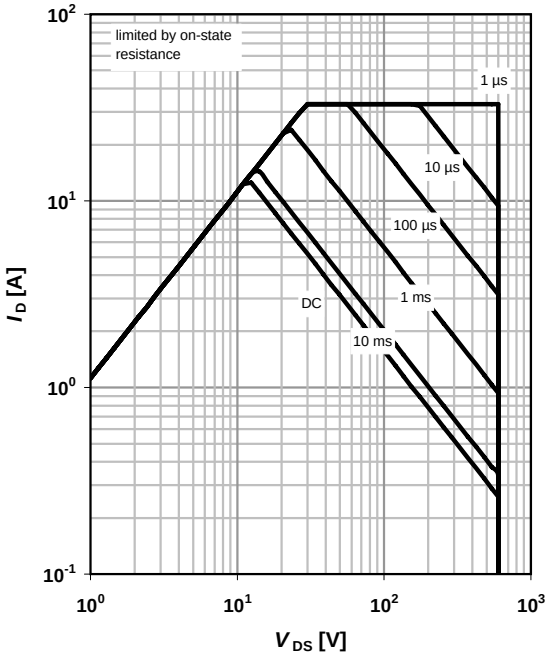
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

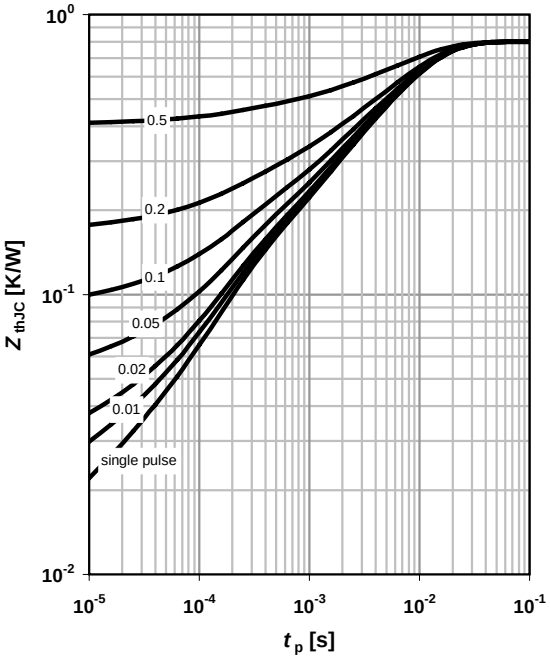
parameter: t_p



3 Max. transient thermal impedance

$I_D=f(V_{DS})$; $T_j=25$ °C

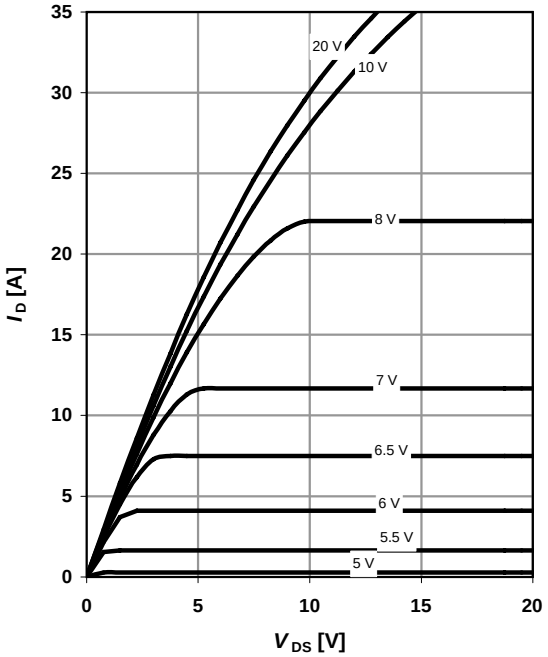
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

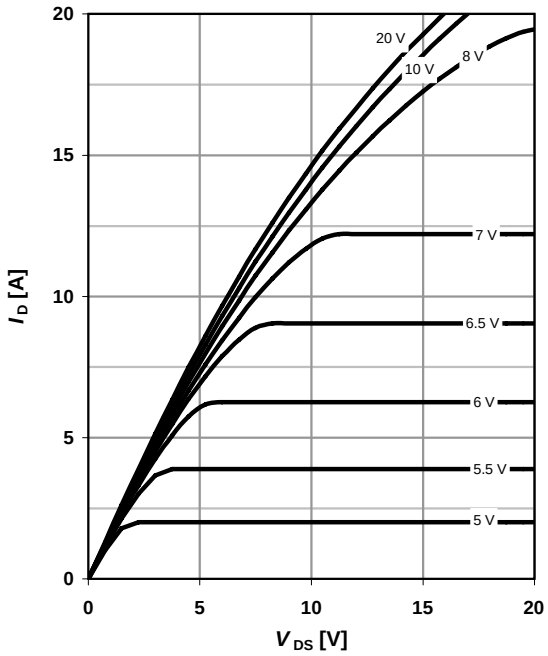
parameter: V_{GS}



5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=150$ °C

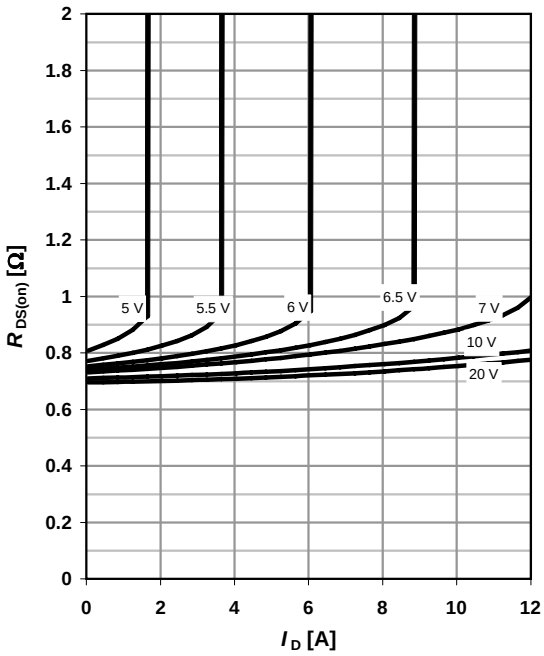
parameter: V_{GS}



6 Typ. drain-source on-state resistance

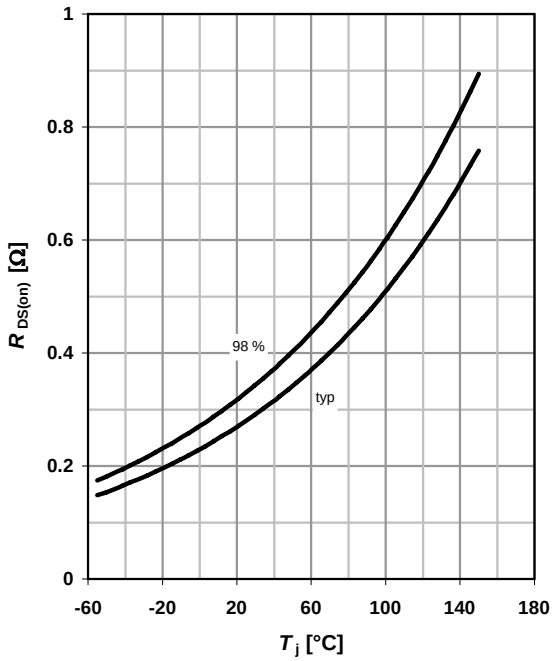
$R_{DS(on)}=f(I_D)$; $T_j=150$ °C

parameter: V_{GS}



7 Drain-source on-state resistance

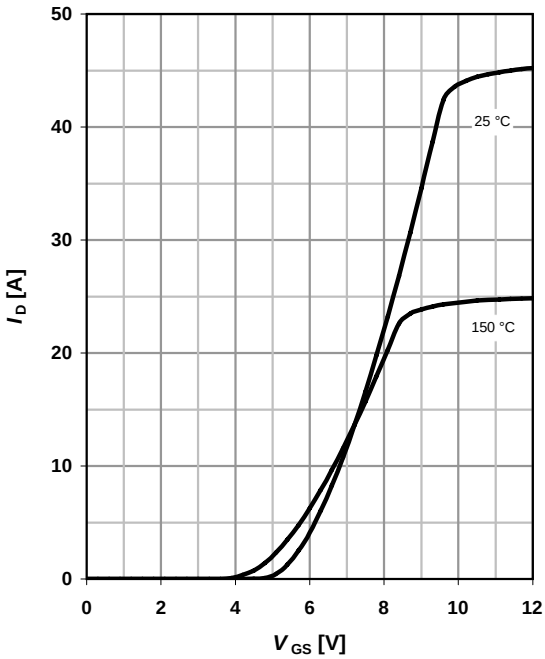
$R_{DS(on)}=f(T_j)$; $I_D=9.4$ A; $V_{GS}=10$ V



8 Typ. transfer characteristics

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

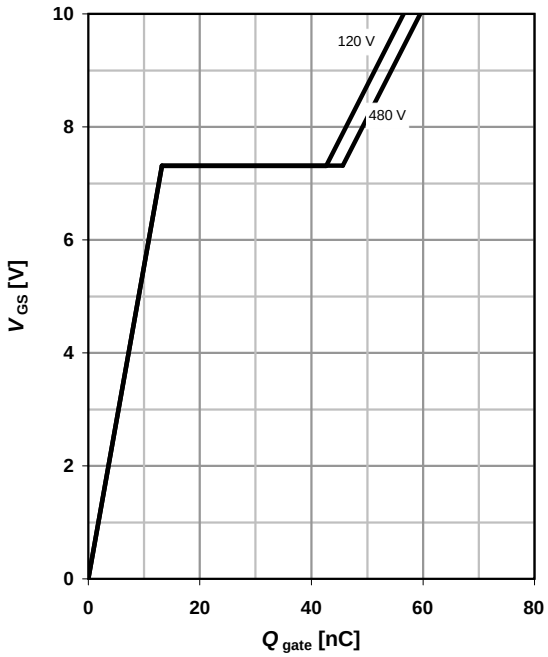
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=13.4 A pulsed

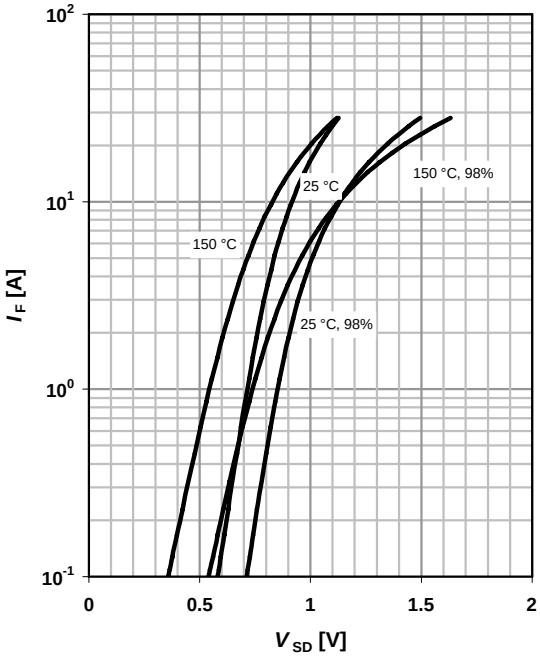
parameter: V_{DD}



10 Forward characteristics of reverse diode

I_F=f(V_{SD})

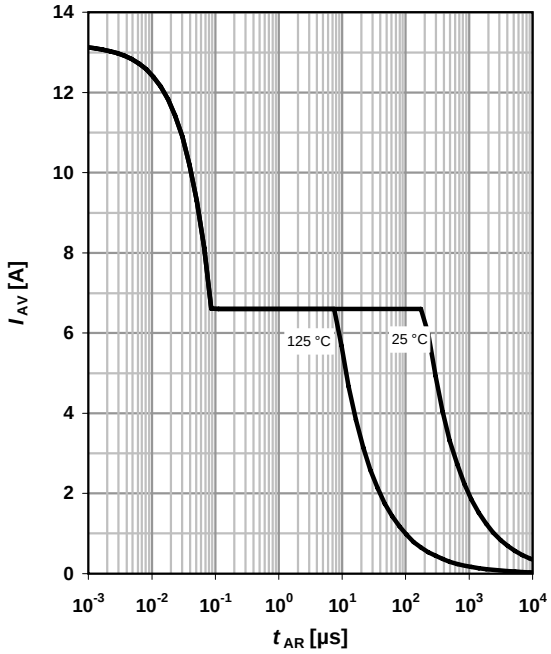
parameter: T_j



11 Avalanche SOA

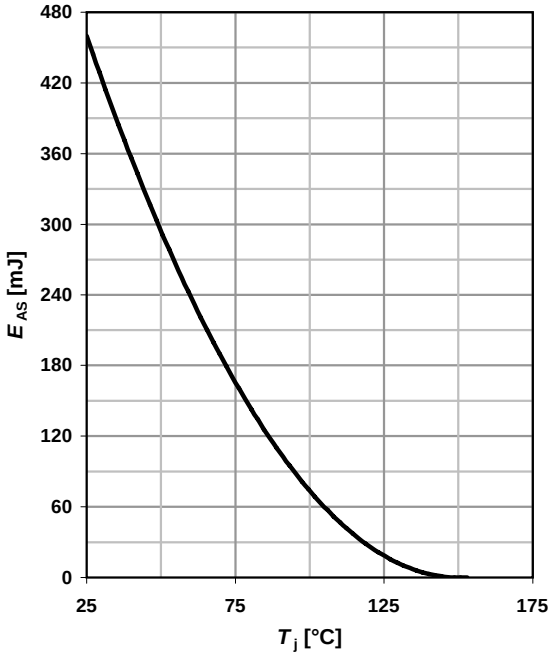
I_{AR}=f(t_{AR})

parameter: $T_{j(start)}$



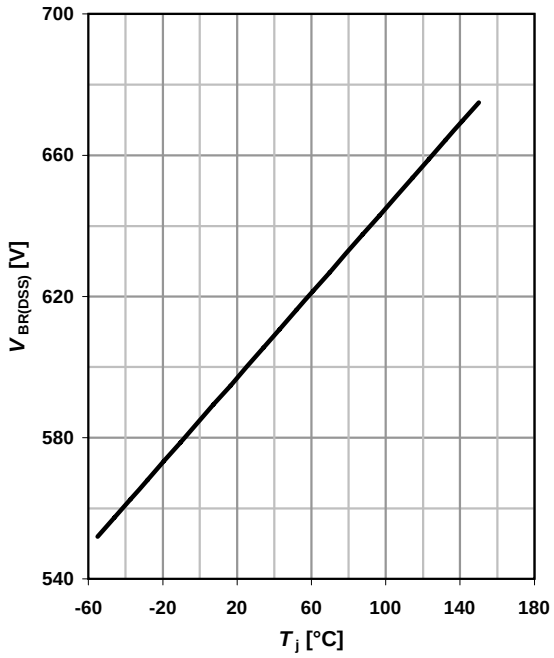
12 Avalanche energy

E_{AS}=f(T_j); I_D=6.7 A; V_{DD}=50 V



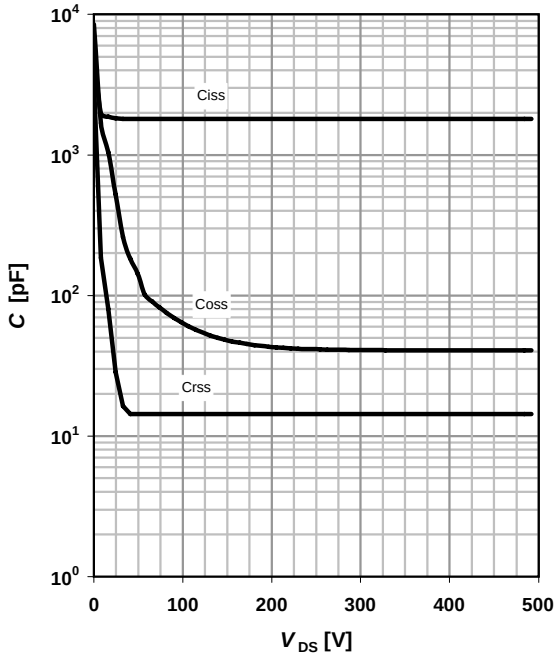
13 Drain-source breakdown voltage

$V_{BR(DSS)}=f(T_j)$



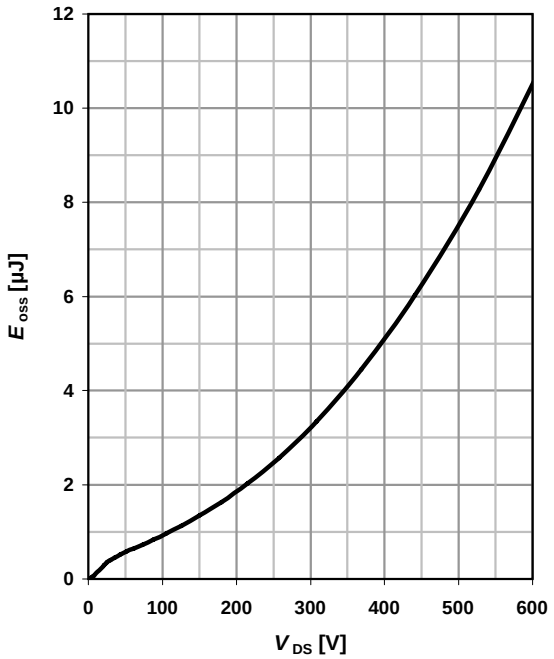
14 Typ. capacitances

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



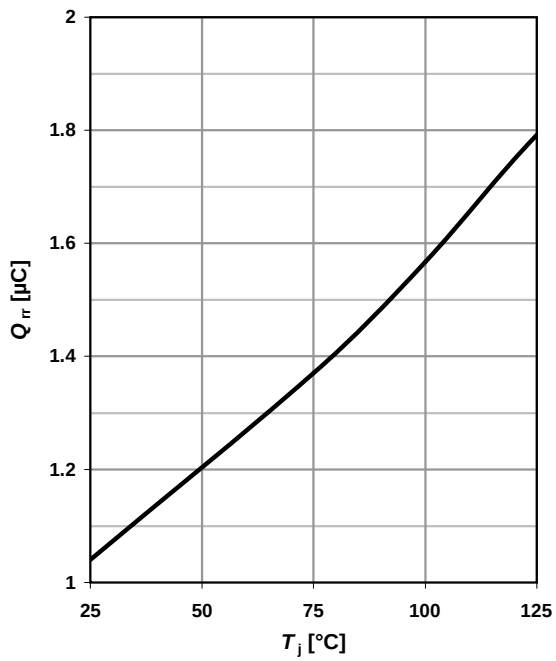
15 Typ. C_{oss} stored energy

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



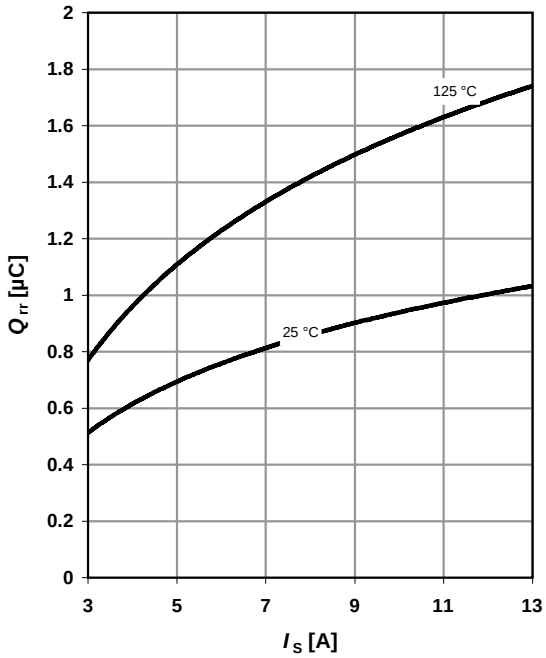
16 Typ. reverse recovery charge

$Q_{rr}=f(T_j)$;parameter: I_D =13.4 A



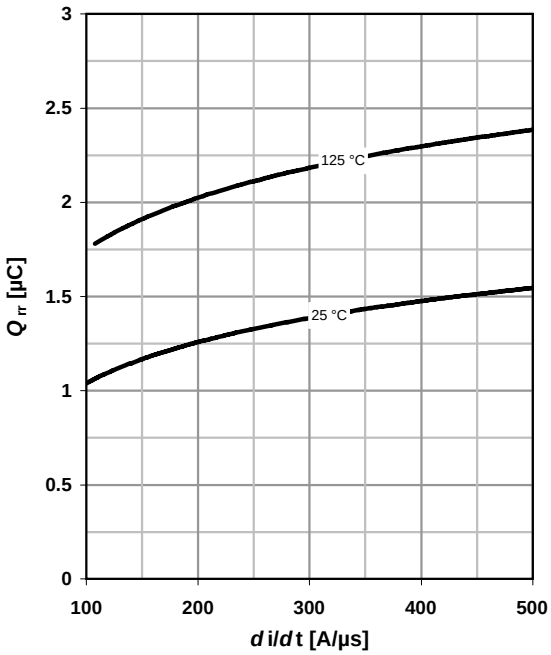
17 Typ. reverse recovery charge

$Q_{rr}=f(I_S)$; parameter: $di/dt=100$ A/µs

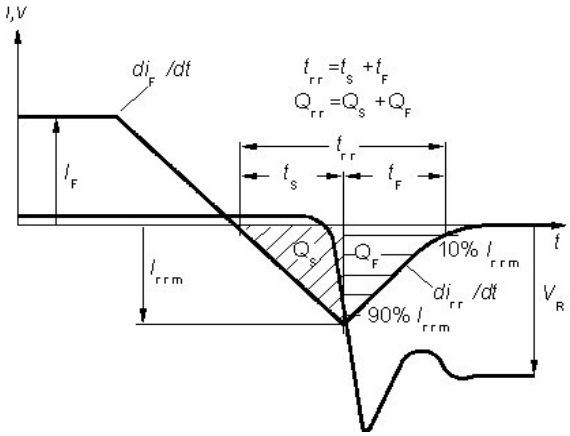


18 Typ. reverse recovery charge

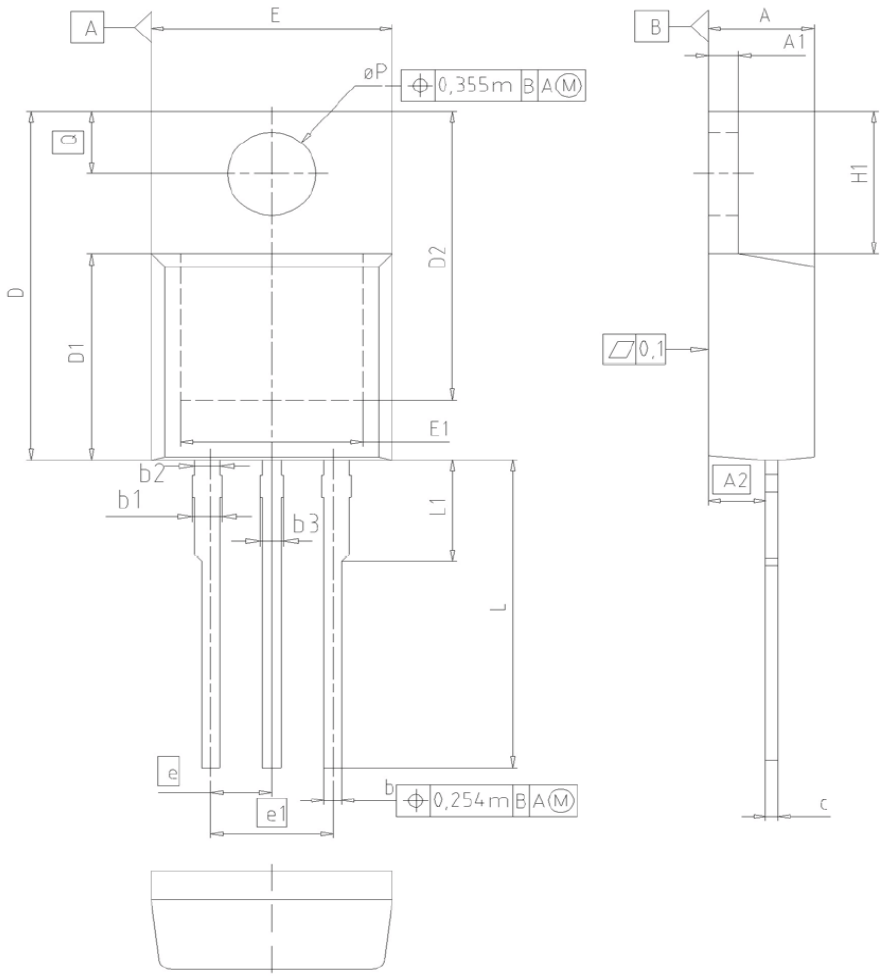
$Q_{rr}=f(di/dt)$; parameter: $I_D=13.4$ A



Definition of diode switching characteristics



PG-TO-220-3--1; -3-21



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	15.95	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

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