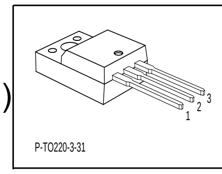
Cool MOS™ Power Transistor

V_{DS}	800	V
$R_{DS(on)}$	2.7	Ω
I_D	2	A

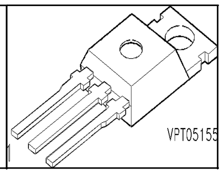
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme d*v*/d*t* rated
- PG-TO-220-3-31: Fully isolated package (2500 VAC; 1 minute)
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC[0)] for target applications

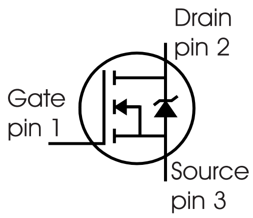
PG-TO220-3-31



PG-TO220



Type	Package	Ordering Code	Marking
SPP02N80C3	PG-TO220	Q67040-S4432	02N80C3
SPA02N80C3	PG-TO220-3-31	SP000216295	02N80C3



Maximum Ratings

Parameter	Symbol	Value		Unit
		SPP	SPA	
Continuous drain current	I_D			A
T_C = 25 °C		2	2[1)]	
T_C = 100 °C		1.2	1.2[1)]	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	6	6	A
Avalanche energy, single pulse I_D=1A, V_{DD}=50V	E_{AS}	90	90	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax}[2)] I_D=2A, V_{DD}=50V	E_{AR}	0.05	0.05	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	2	2	A
Gate source voltage	V_{GS}	±20	±20	V
Gate source voltage AC (f >1Hz)	V_{GS}	±30	±30	
Power dissipation, T_C = 25°C	P_{tot}	42	30.5	W
Operating and storage temperature	T_j , T_{stg}	-55...+150		°C

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain Source voltage slope V_{DS} = 640 V, I_D = 2 A, T_j = 125 °C	dv/dt	50	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	-	-	3	K/W
Thermal resistance, junction - case, FullPAK	R_{thJC_FP}	-	-	4.1	
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
Thermal resistance, junction - ambient, FullPAK	R_{thJA_FP}	-	-	80	
Soldering temperature, wavesoldering 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	°C

Electrical Characteristics, at T_j=25°C unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=0.25mA	800	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0V, I_D=2A	-	870	-	
Gate threshold voltage	$V_{GS(th)}$	I_D=120µA, V_{GS}=V_{DS}	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	V_{DS}=800V, V_{GS}=0V, T_j=25°C T_j=150°C	 - -	 0.5 -	 5 50	µA
Gate-source leakage current	I_{GSS}	V_{GS}=20V, V_{DS}=0V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=1.2A T_j=25°C T_j=150°C	 - -	 2.4 6.5	 2.7 -	Ω
Gate input resistance	R_G	f=1MHz, open drain	-	0.7	-	

Electrical Characteristics

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Transconductance	g_{fs}	$V_{DS} \geq 2 * I_D * R_{DS(on)max}$, I_D=1.2A	-	1.5	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	290	-	pF
Output capacitance	C_{oss}		-	130	-	
Reverse transfer capacitance	C_{rss}		-	6	-	
Effective output capacitance,[3] energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 480V	-	11.2	-	
Effective output capacitance,[4] time related	$C_{o(tr)}$		-	20.6	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400V, V_{GS}=0/10V, I_D=2A, R_G=47Ω	-	25	-	ns
Rise time	t_r		-	15	-	
Turn-off delay time	$t_{d(off)}$		-	65	75	
Fall time	t_f		-	18	23	

Gate Charge Characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Gate to source charge	Q_{gs}	V_{DD}=640V, I_D=2A	-	1	-	nC
Gate to drain charge	Q_{gd}		-	5	-	
Gate charge total	Q_g	V_{DD}=640V, I_D=2A, V_{GS}=0 to 10V	-	9	12	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=640V, I_D=2A	-	6	-	V

[0]J-STD20 and JESD22

[1]Limited only by maximum temperature

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

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

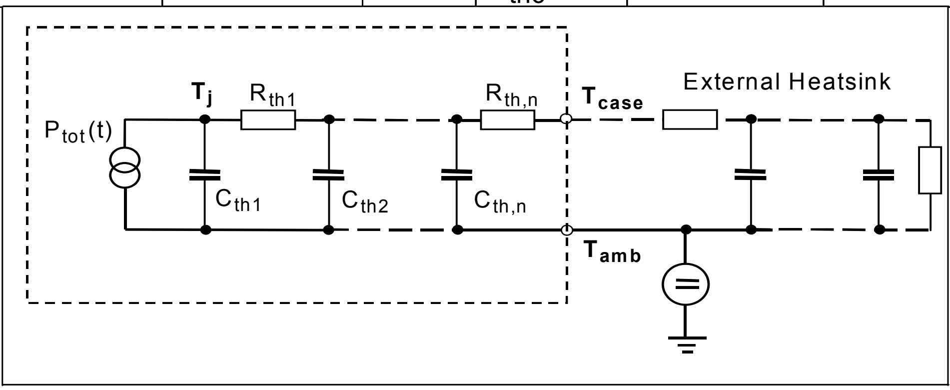
[4]$C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

Electrical Characteristics

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	2	A
Inverse diode direct current, pulsed	I_{SM}		-	-	6	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=640V, I_F=I_S ,	-	520	-	ns
Reverse recovery charge	Q_{rr}	di_F/dt=100A/µs	-	2	-	µC
Peak reverse recovery current	I_{rrm}		-	6	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j=25°C	-	200	-	A/µs

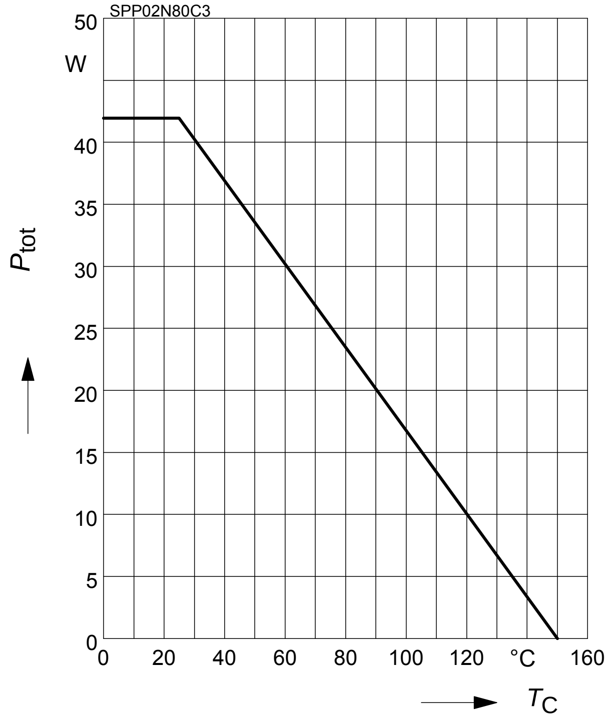
Typical Transient Thermal Characteristics

Symbol	Value		Unit	Symbol	Value		Unit
	SPP	SPA			SPP	SPA	
R_{th1}	0.067	0.067	K/W	C_{th1}	0.00004221	0.00004221	Ws/K
R_{th2}	0.126	0.126		C_{th2}	0.0001651	0.0001651	
R_{th3}	0.215	0.215		C_{th3}	0.0002432	0.0002432	
R_{th4}	0.655	0.419		C_{th4}	0.0007613	0.0007613	
R_{th5}	0.569	0.719		C_{th5}	0.002455	0.003835	
R_{th6}	0.161	2.543		C_{th6}	0.412	0.412	



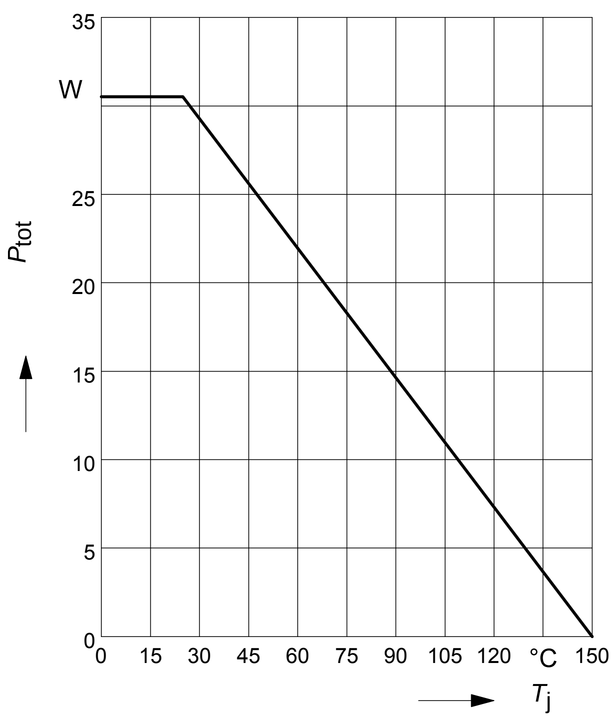
1 Power dissipation

$P_{tot} = f(T_C)$



2 Power dissipation FullPAK

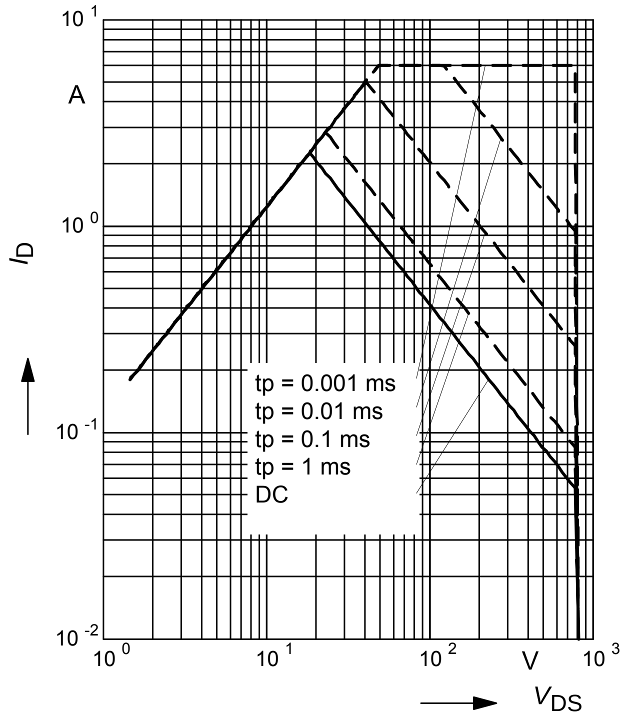
$P_{tot} = f(T_C)$



3 Safe operating area

$I_D = f(V_{DS})$

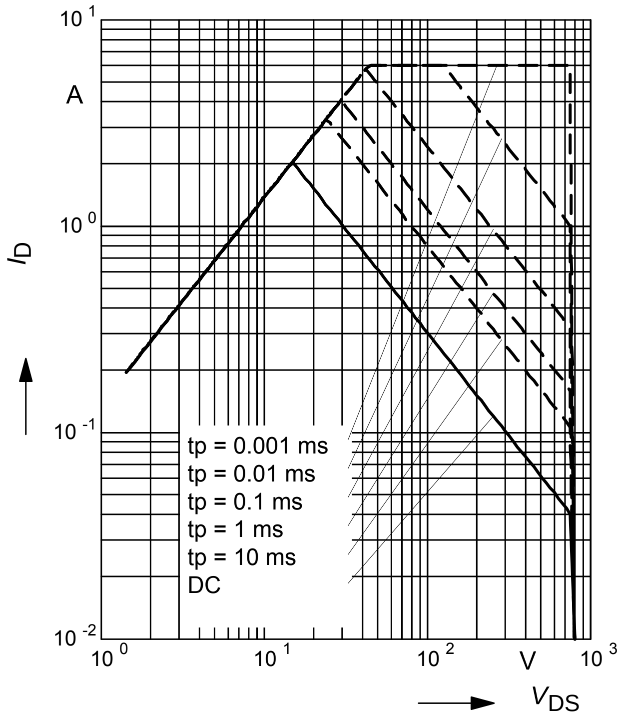
parameter : $D = 0$, T_C=25°C



4 Safe operating area FullPAK

$I_D = f(V_{DS})$

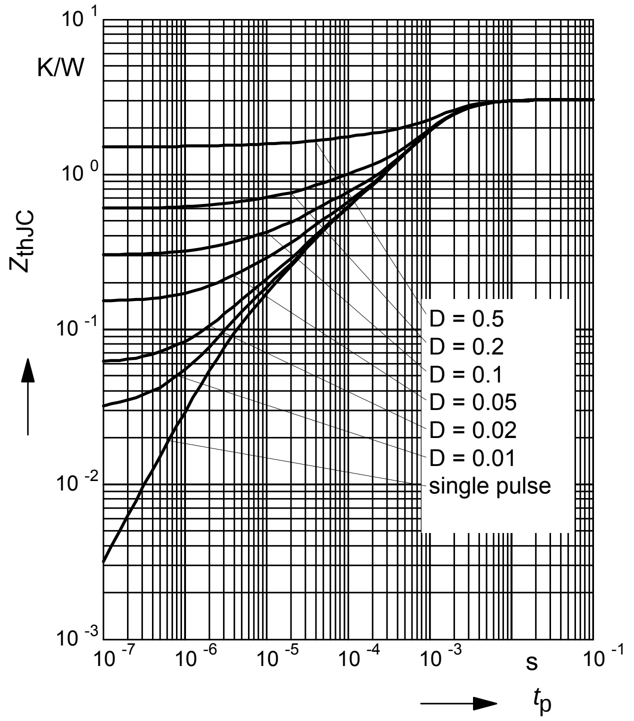
parameter: $D = 0$, T_C = 25°C



5 Transient thermal impedance

$Z_{thJC} = f(t_p)$

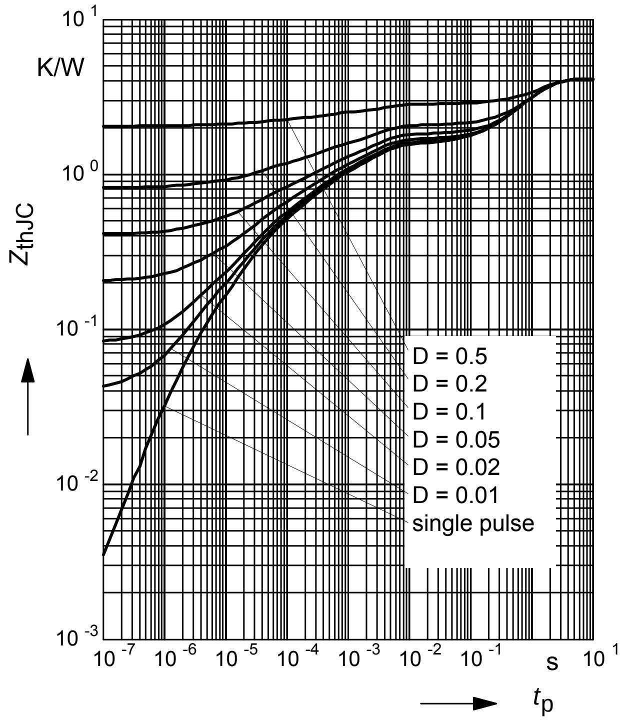
parameter: $D = t_p/T$



6 Transient thermal impedance FullPAK

$Z_{thJC} = f(t_p)$

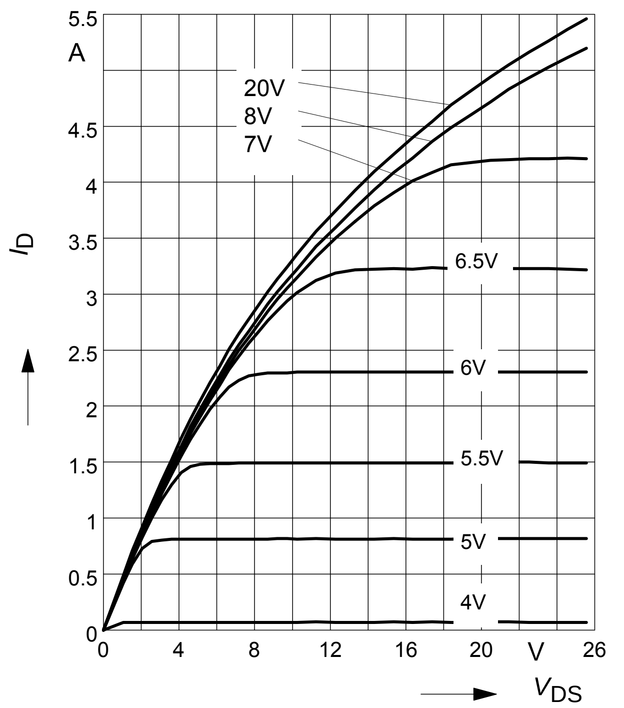
parameter: $D = t_p/t$



7 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

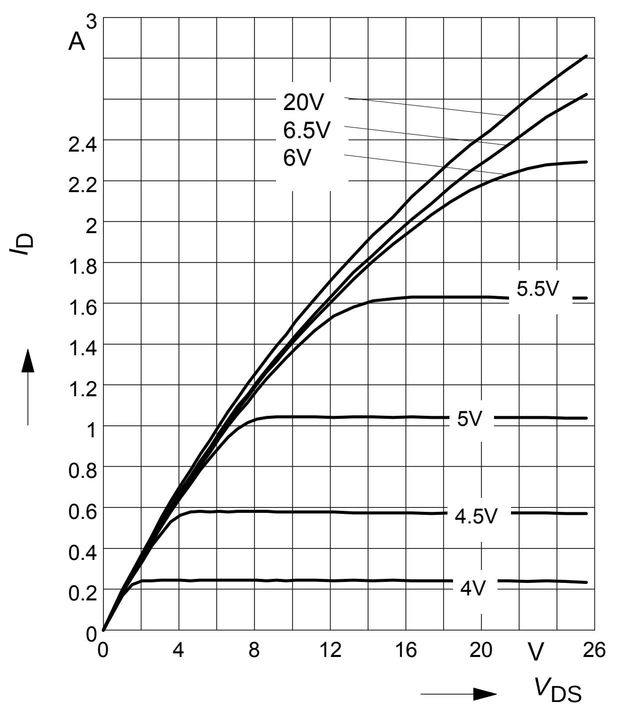
parameter: t_p = 10 µs, V_{GS}



8 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

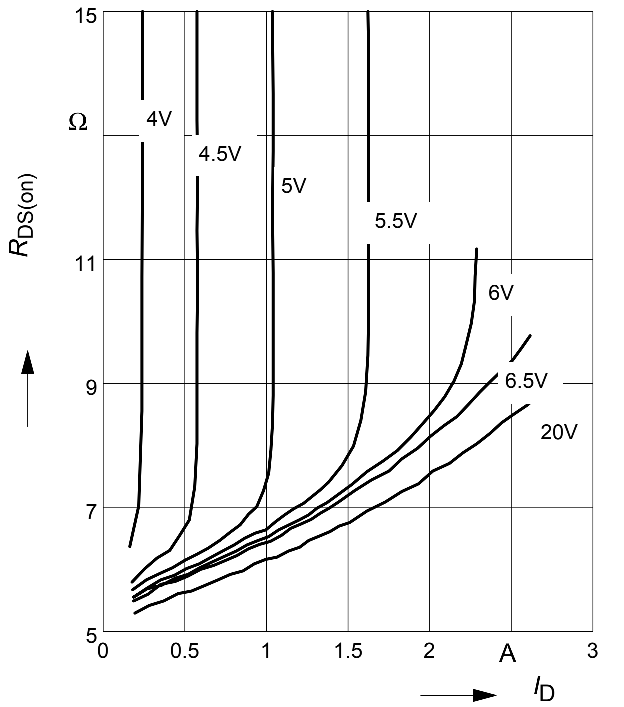
parameter: t_p = 10 µs, V_{GS}



9 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$

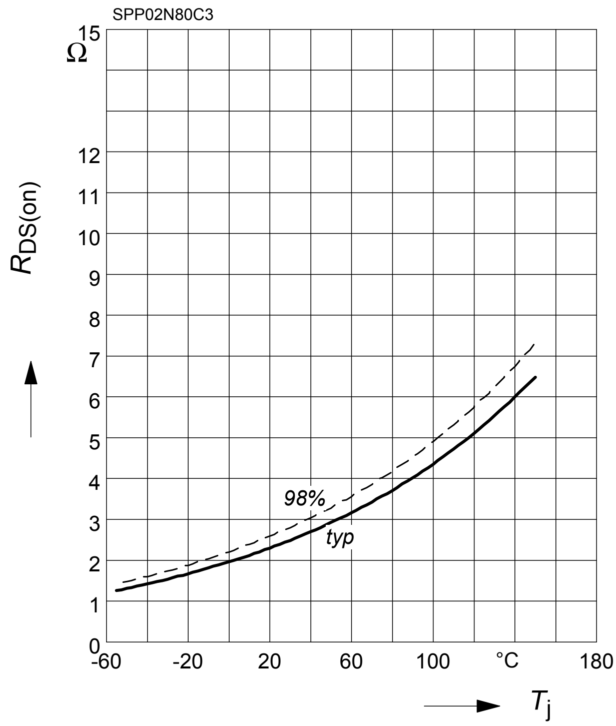
parameter: T_j=150°C, V_{GS}



10 Drain-source on-state resistance

$R_{DS(on)} = f\ (T_j)$

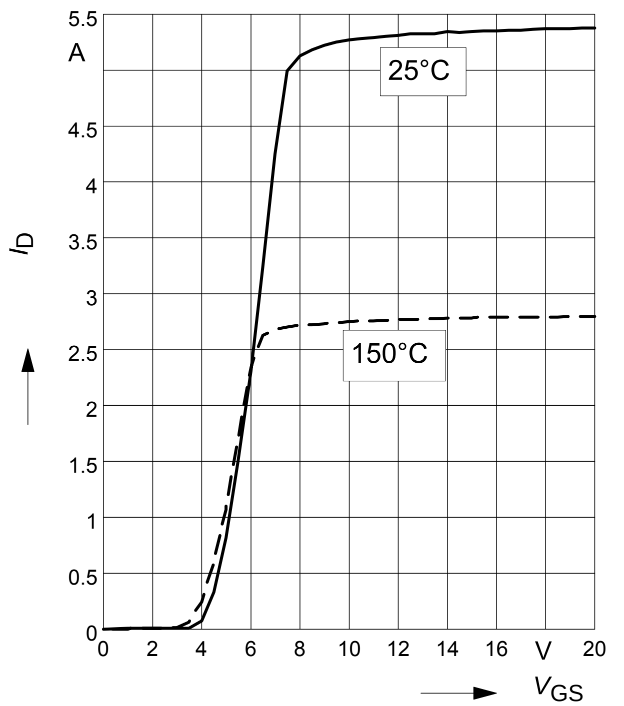
parameter : I_D = 1.2 A, V_{GS} = 10 V



11 Typ. transfer characteristics

$I_D= f\ (\ V_{GS}\ );\ V_{DS}\geq 2 \times I_D \times R_{DS(on)max}$

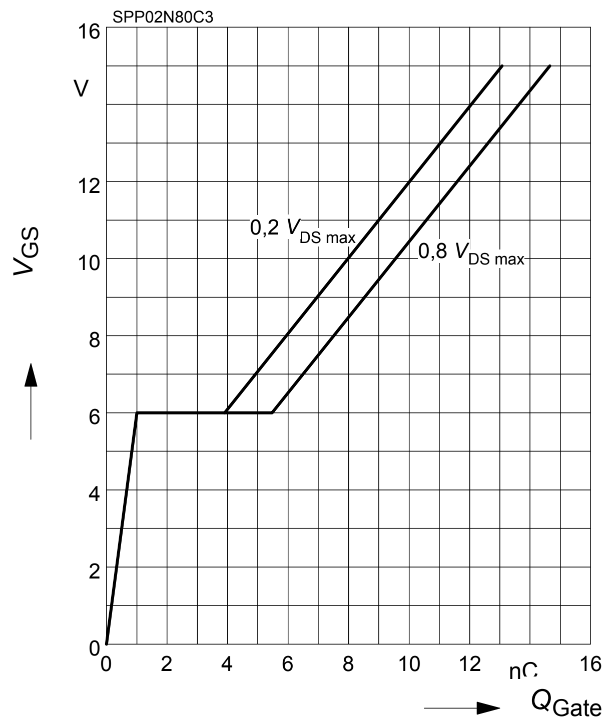
parameter: t_p = 10 µs



12 Typ. gate charge

$V_{GS} = f\ \ (Q_{Gate})$

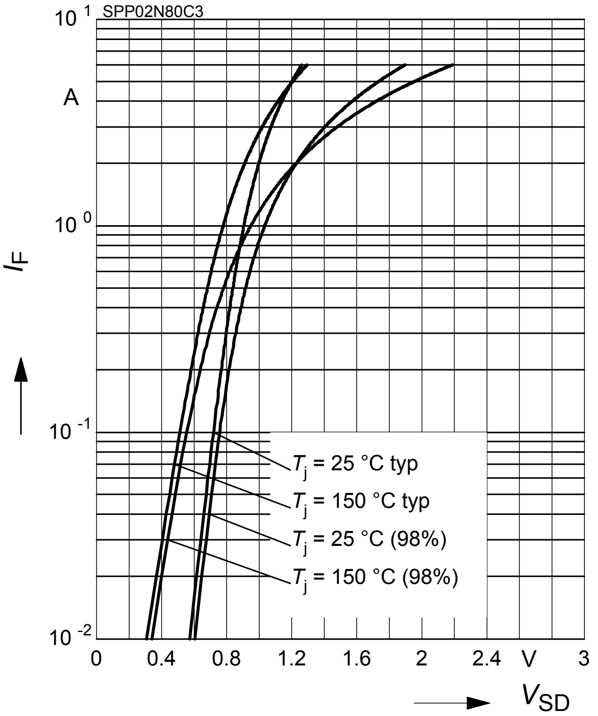
parameter: I_D = 2 A pulsed



13 Forward characteristics of body diode

$I_F = f(V_{SD})$

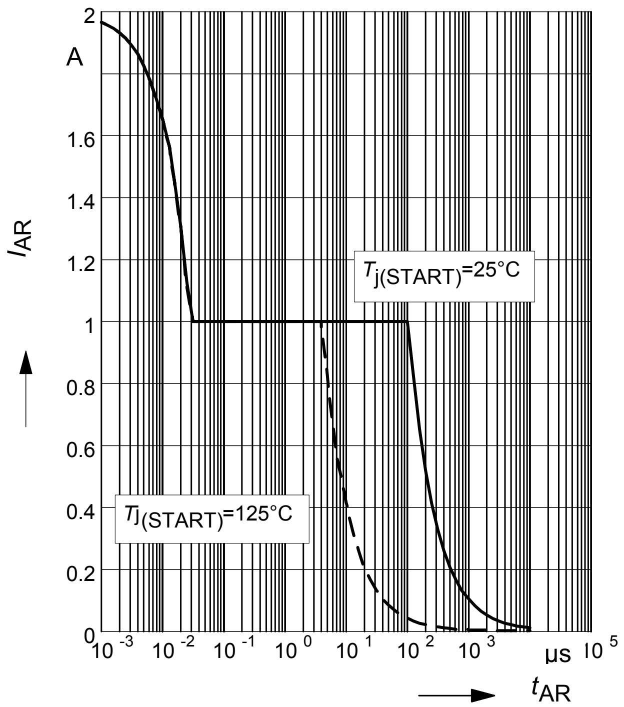
parameter: T_j , tp = 10 µs



14 Avalanche SOA

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

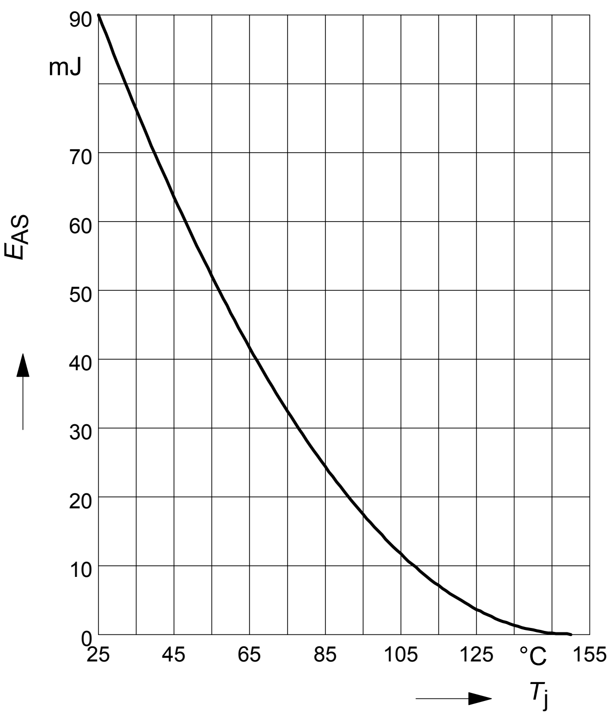
par.: $T_j \leq 150$ °C



15 Avalanche energy

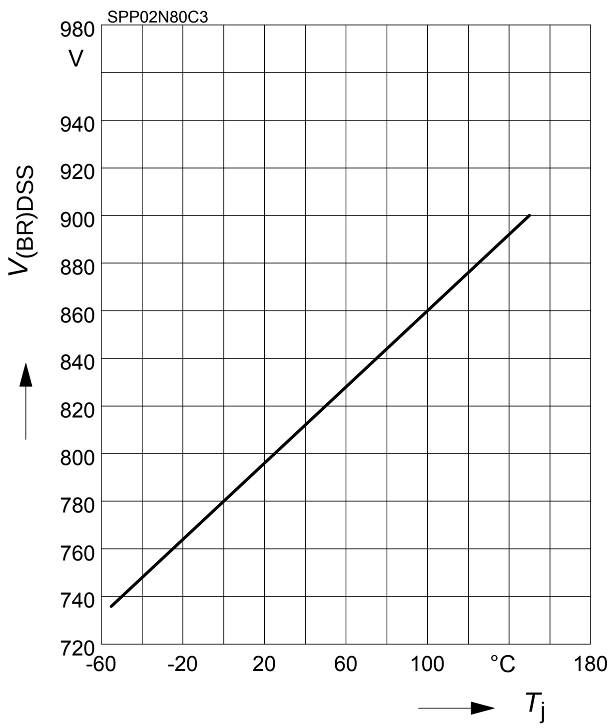
$E_{AS} = f(T_j)$

par.: $I_D = 1$ A, $V_{DD} = 50$ V



16 Drain-source breakdown voltage

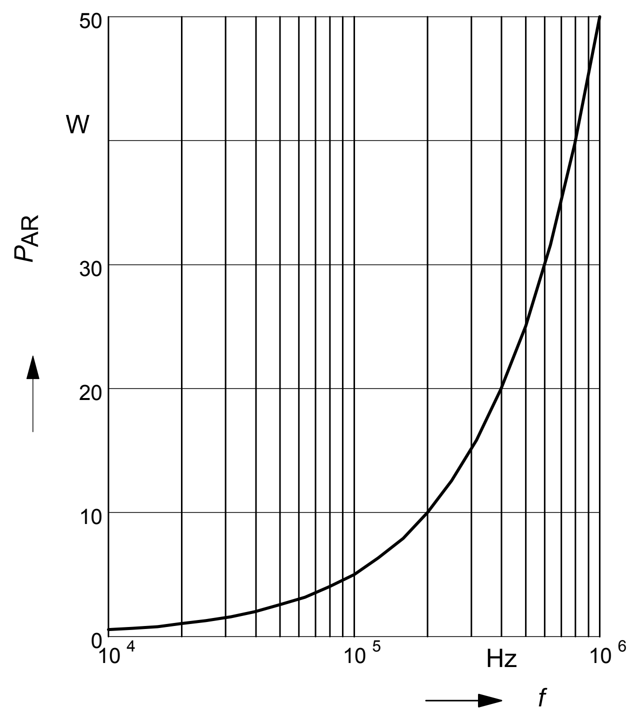
$V_{(BR)DSS} = f(T_j)$



17 Avalanche power losses

$P_{AR} = f(f)$

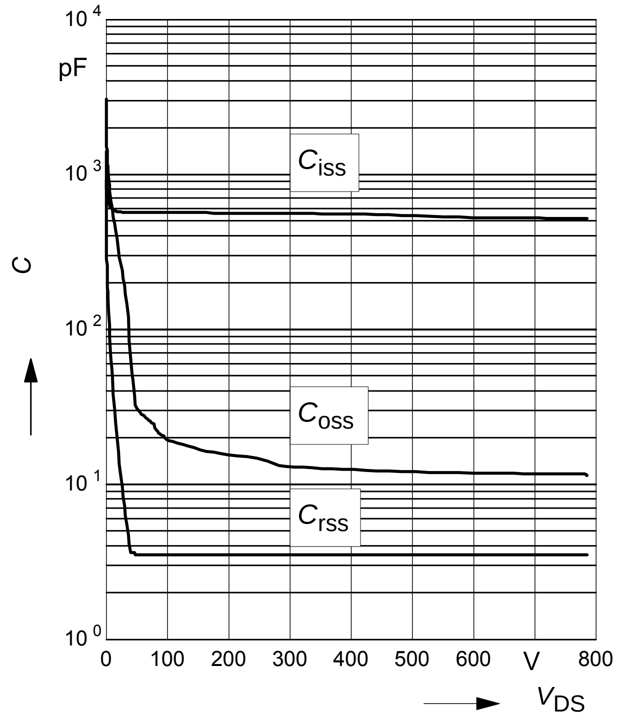
parameter: E_{AR}=0.05mJ



18 Typ. capacitances

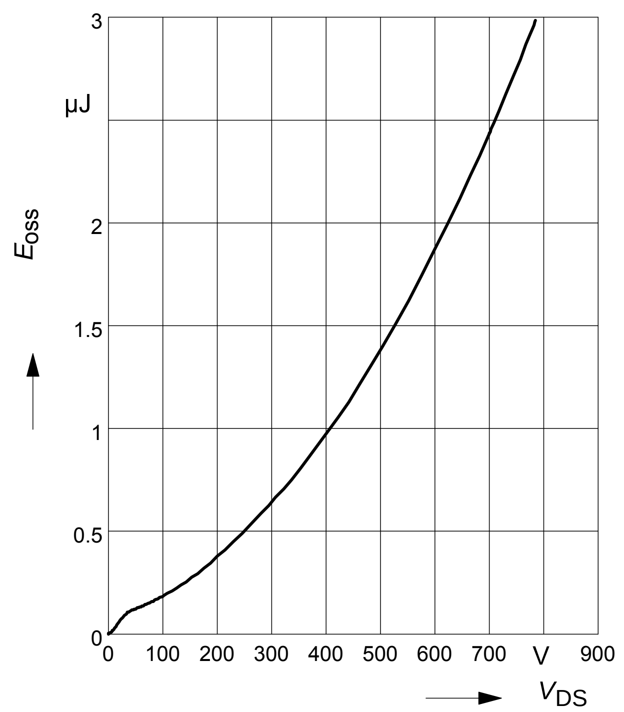
$C = f(V_{DS})$

parameter: V_{GS}=0V, f=1 MHz

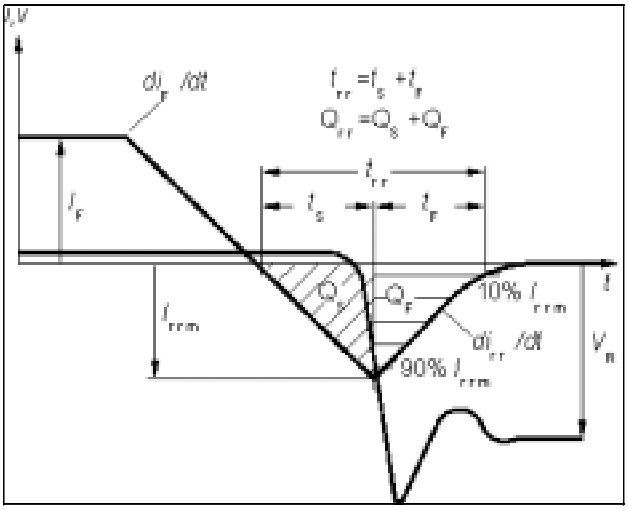


19 Typ. C_{oss} stored energy

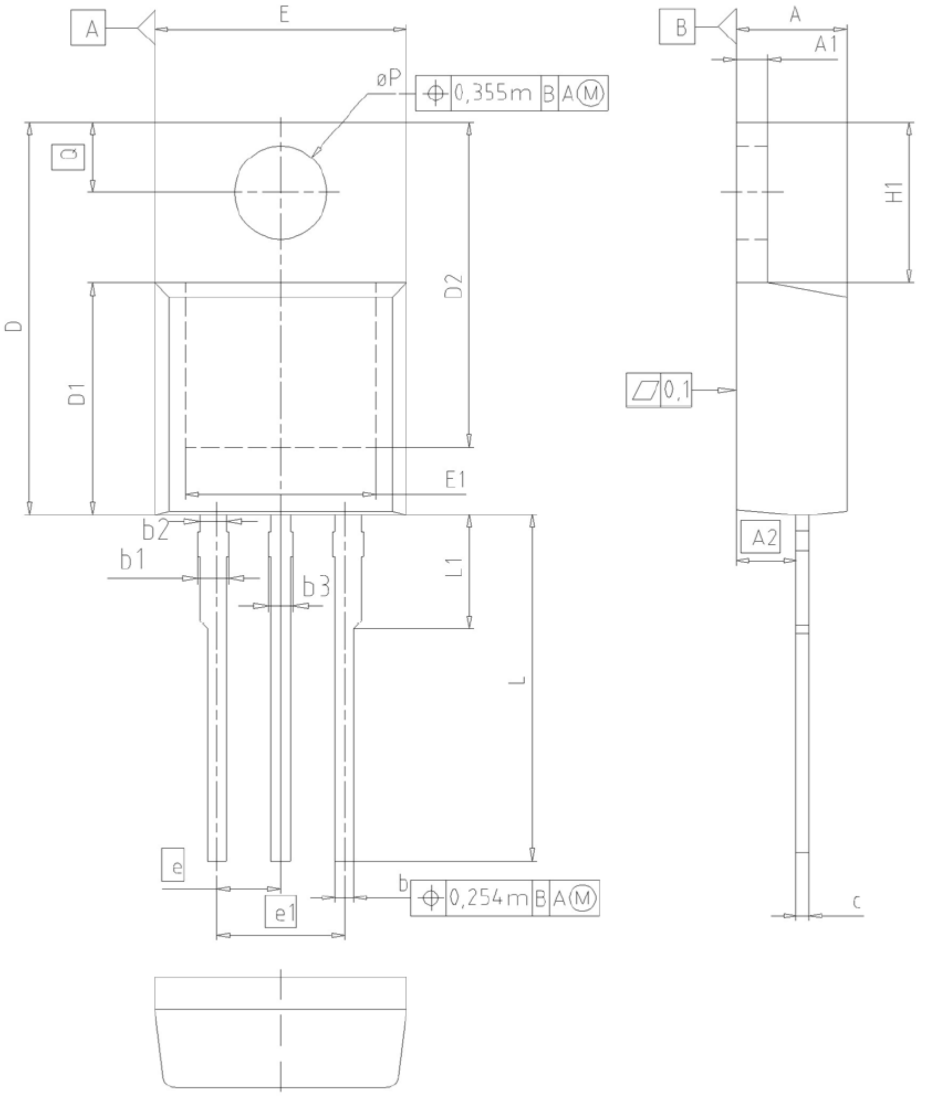
$E_{oss}=f(V_{DS})$



Definition of diodes switching characteristics



PG-TO220-3-1, PG-TO220-3-21



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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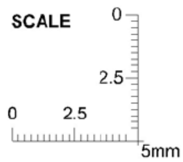
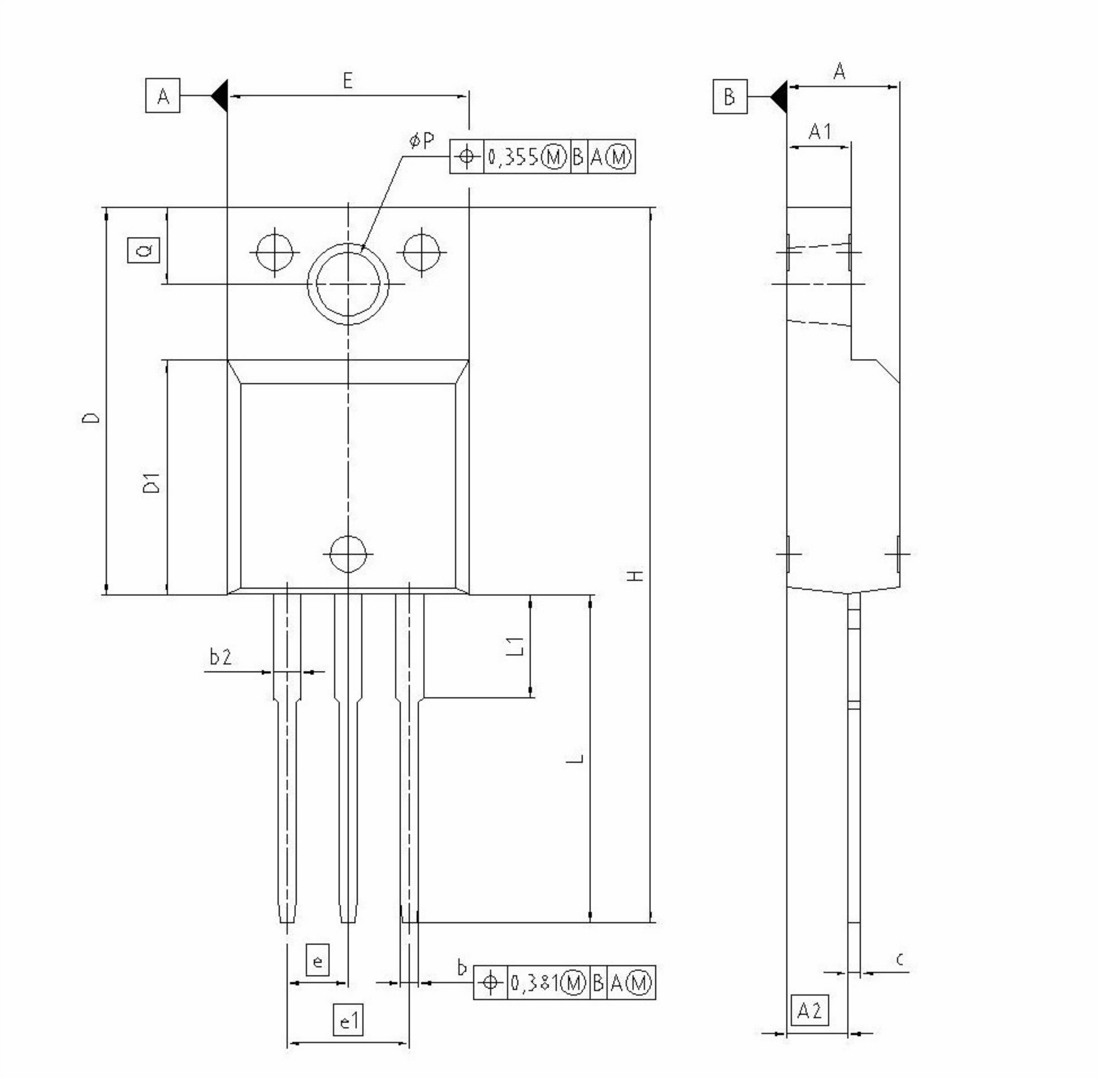


EUROPEAN PROJECTION

ISSUE DATE
23-08-2007

REVISION
05

PG-TO220-3-31 (FullPAK)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.572	4.826	0.180	0.190
A1	2.573	2.827	0.101	0.111
A2	2.514	2.616	0.099	0.103
b	0.649	0.776	0.025	0.030
b2	1.143	1.509	0.045	0.059
c	0.449	0.627	0.017	0.027
D	15.863	16.117	0.624	0.634
D1	9.554	9.808	0.376	0.386
E	10.373	10.627	0.408	0.418
e	2.540		0.100	
e1	5.080		0.200	
N	3		3	
H	29.463	29.717	1.160	1.170
L	13.473	13.727	0.530	0.540
L1	3.175	3.429	0.125	0.135
øP	2.949	3.025	0.119	0.116
Q	3.149	3.251	0.124	0.128

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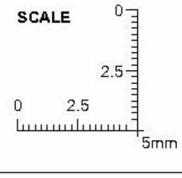

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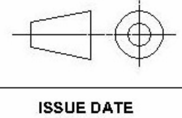

ISSUE DATE
17-08-2005

FILE
TO220_2

Published by
Infineon Technologies AG,
Bereichs Kommunikation
St.-Martin-Strasse 53,
D-81541 München

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