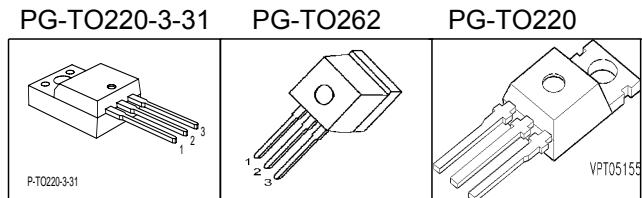


## Cool MOS™ Power Transistor

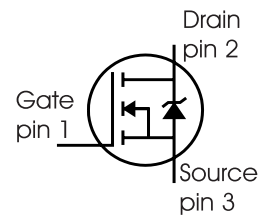
### Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme  $dv/dt$  rated
- Ultra low effective capacitances
- Improved transconductance
- PG-TO-220-3-31: Fully isolated package (2500 VAC; 1 minute)
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>0)</sup> for target applications

$V_{DS}$	800	V
$R_{DS(on)}$	0.65	$\Omega$
$I_D$	8	A



Type	Package	Ordering Code	Marking
SPP08N80C3	PG-TO220	Q67040-S4436	08N80C3
SPI08N80C3	PG-TO262	Q67040-S4632	08N80C3
SPA08N80C3	PG-TO220-3-31	SP000216310	08N80C3



### Maximum Ratings

Parameter	Symbol	Value		Unit
		SPP_I	SPA	
Continuous drain current $T_C = 25\text{ }^\circ\text{C}$ $T_C = 100\text{ }^\circ\text{C}$	$I_D$	8 5.1	8 <sup>1)</sup> 5.1 <sup>1)</sup>	A
Pulsed drain current, $t_p$ limited by $T_{jmax}$	$I_{D\text{ puls}}$	24	24	A
Avalanche energy, single pulse $I_D=1.6\text{A}$ , $V_{DD}=50\text{V}$	$E_{AS}$	340	340	mJ
Avalanche energy, repetitive $t_{AR}$ limited by $T_{jmax}$ <sup>2)</sup> $I_D=8\text{A}$ , $V_{DD}=50\text{V}$	$E_{AR}$	0.2	0.2	
Avalanche current, repetitive $t_{AR}$ limited by $T_{jmax}$	$I_{AR}$	8	8	A
Gate source voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Gate source voltage AC ( $f > 1\text{Hz}$ )	$V_{GS}$	$\pm 30$	$\pm 30$	
Power dissipation, $T_C = 25\text{ }^\circ\text{C}$	$P_{tot}$	104	40	W
Operating and storage temperature	$T_j, T_{stg}$	-55...+150		$^\circ\text{C}$

**Maximum Ratings**

Parameter	Symbol	Value	Unit
Drain Source voltage slope $V_{DS} = 640 \text{ V}, I_D = 8 \text{ A}, T_j = 125 \text{ }^\circ\text{C}$	$dv/dt$	50	V/ns

**Thermal Characteristics**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	$R_{thJC}$	-	-	1.2	K/W
Thermal resistance, junction - case, FullPAK	$R_{thJC \text{ FP}}$	-	-	3.8	
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	62	
Thermal resistance, junction - ambient, FullPAK	$R_{thJA \text{ FP}}$	-	-	80	
Soldering temperature, wavesoldering 1.6 mm (0.063 in.) from case for 10s	$T_{sold}$	-	-	260	$^\circ\text{C}$

**Electrical Characteristics, at  $T_j = 25^\circ\text{C}$  unless otherwise specified**

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{V}, I_D = 0.25\text{mA}$	800	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	$V_{GS} = 0\text{V}, I_D = 8\text{A}$	-	870	-	
Gate threshold voltage	$V_{GS(th)}$	$I_D = 470\mu\text{A}, V_{GS} = V_{DS}$	2.1	3	3.9	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 800\text{V}, V_{GS} = 0\text{V},$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	-	0.5	20	$\mu\text{A}$
			-	-	200	
Gate-source leakage current	$I_{GSS}$	$V_{GS} = 20\text{V}, V_{DS} = 0\text{V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{V}, I_D = 5.1\text{A}$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	-	0.56	0.65	$\Omega$
			-	1.5	-	
Gate input resistance	$R_G$	$f = 1\text{MHz}, \text{open drain}$	-	0.7	-	

**Electrical Characteristics**

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 5.1A$	-	5.5	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = 25V$ , $f = 1MHz$	-	1100	-	pF
Output capacitance	$C_{oss}$		-	500	-	
Reverse transfer capacitance	$C_{rss}$		-	25	-	
Effective output capacitance, <sup>3)</sup> energy related	$C_{o(er)}$	$V_{GS} = 0V$ , $V_{DS} = 0V$ to 480V	-	31.8	-	
Effective output capacitance, <sup>4)</sup> time related	$C_{o(tr)}$		-	70	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 400V$ , $V_{GS} = 0/10V$ , $I_D = 8A$ , $R_G = 10\Omega$	-	25	-	ns
Rise time	$t_r$		-	15	-	
Turn-off delay time	$t_{d(off)}$		-	65	75	
Fall time	$t_f$		-	7	10	

**Gate Charge Characteristics**

Gate to source charge	$Q_{gs}$	$V_{DD} = 640V$ , $I_D = 8A$	-	4.6	-	nC
Gate to drain charge	$Q_{gd}$		-	21	-	
Gate charge total	$Q_g$	$V_{DD} = 640V$ , $I_D = 8A$ , $V_{GS} = 0$ to 10V	-	40	52	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 640V$ , $I_D = 8A$	-	6	-	V

<sup>0</sup>J-STD20 and JESD22

<sup>1</sup>Limited only by maximum temperature

<sup>2</sup>Repetitive avalanche causes additional power losses that can be calculated as  $P_{AV} = E_{AR} \cdot f$ .

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

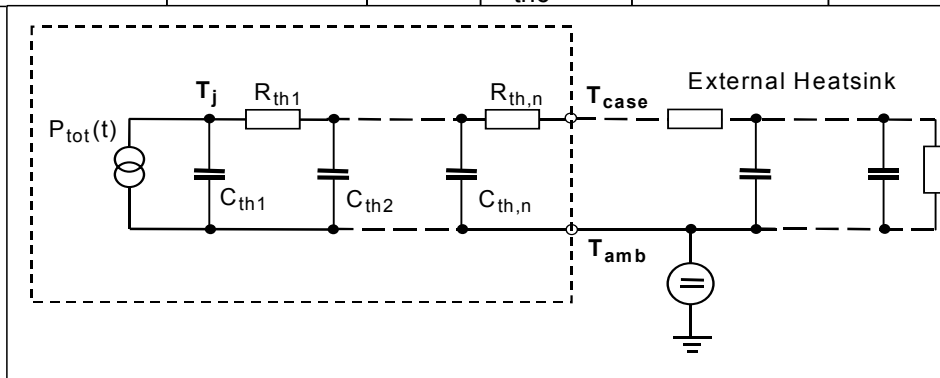
<sup>4</sup> $C_{o(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

**Electrical Characteristics**

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	$I_S$	$T_C=25^\circ\text{C}$	-	-	8	A
Inverse diode direct current, pulsed	$I_{SM}$		-	-	24	
Inverse diode forward voltage	$V_{SD}$	$V_{GS}=0\text{V}, I_F=I_S$	-	1	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=640\text{V}, I_F=I_S,$	-	550	-	ns
Reverse recovery charge	$Q_{rr}$	$di_F/dt=100\text{A}/\mu\text{s}$	-	7	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	24	-	A
Peak rate of fall of reverse recovery current	$di_{rr}/dt$	$T_j=25^\circ\text{C}$	-	500	-	$\text{A}/\mu\text{s}$

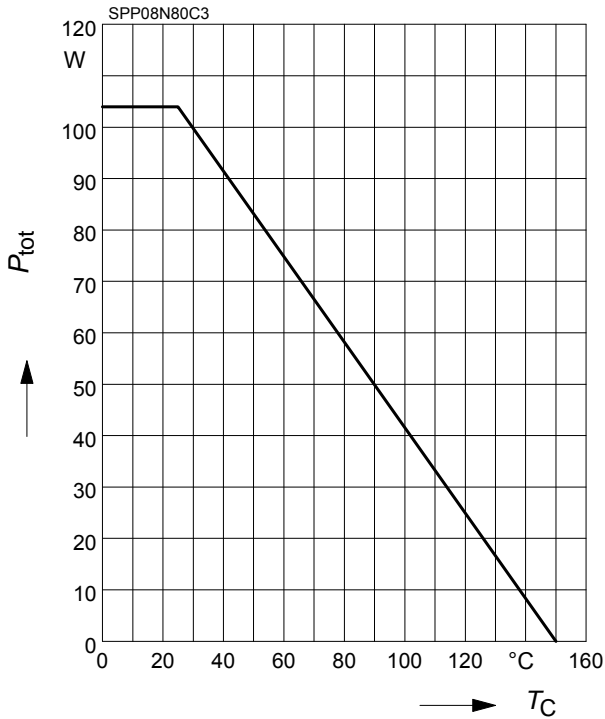
**Typical Transient Thermal Characteristics**

Symbol	Value		Unit	Symbol	Value		Unit
	SPP_I	SPA			SPP_I	SPA	
$R_{th1}$	0.017	0.017	K/W	$C_{th1}$	0.0001741	0.0001741	Ws/K
$R_{th2}$	0.032	0.032		$C_{th2}$	0.0006598	0.0006598	
$R_{th3}$	0.06	0.06		$C_{th3}$	0.0009193	0.0009193	
$R_{th4}$	0.245	0.189		$C_{th4}$	0.002607	0.002607	
$R_{th5}$	0.266	0.414		$C_{th5}$	0.005878	0.007619	
$R_{th6}$	0.101	2.518		$C_{th6}$	0.051	0.412	



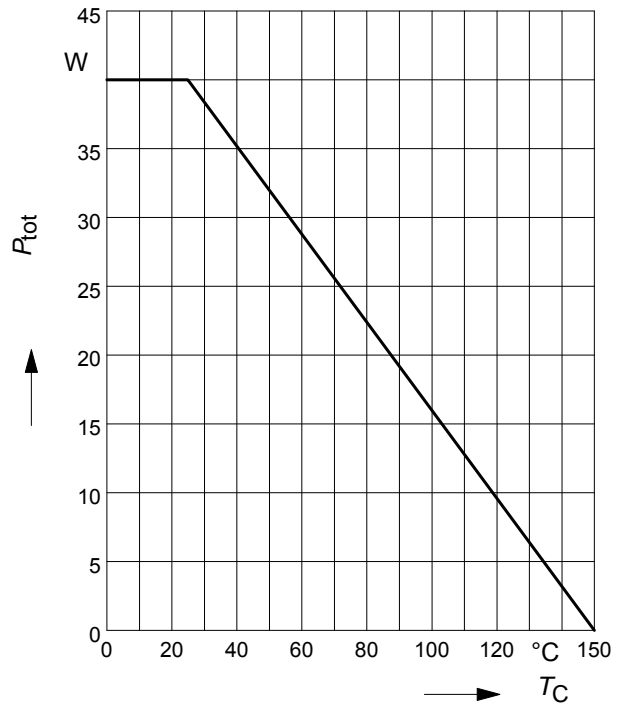
**1 Power dissipation**

$P_{tot} = f(T_C)$



**2 Power dissipation FullPAK**

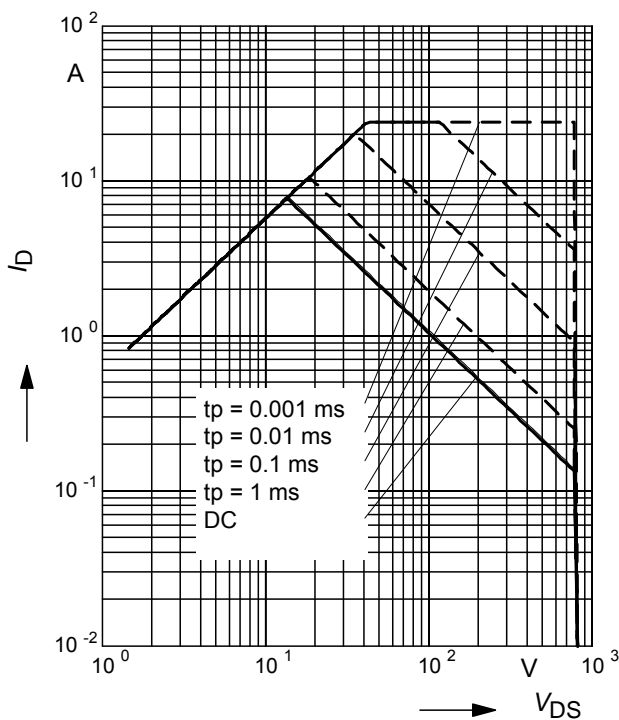
$P_{tot} = f(T_C)$



**3 Safe operating area**

$I_D = f(V_{DS})$

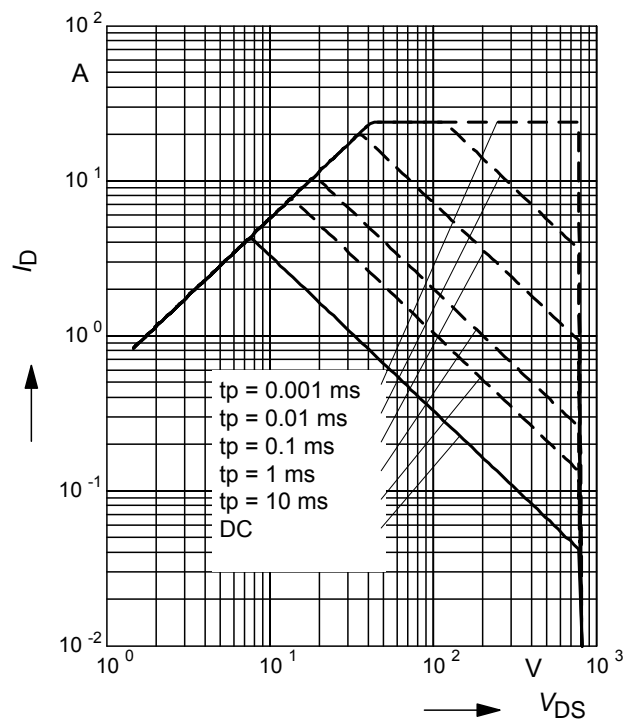
parameter :  $D = 0$  ,  $T_C = 25^\circ\text{C}$



**4 Safe operating area FullPAK**

$I_D = f(V_{DS})$

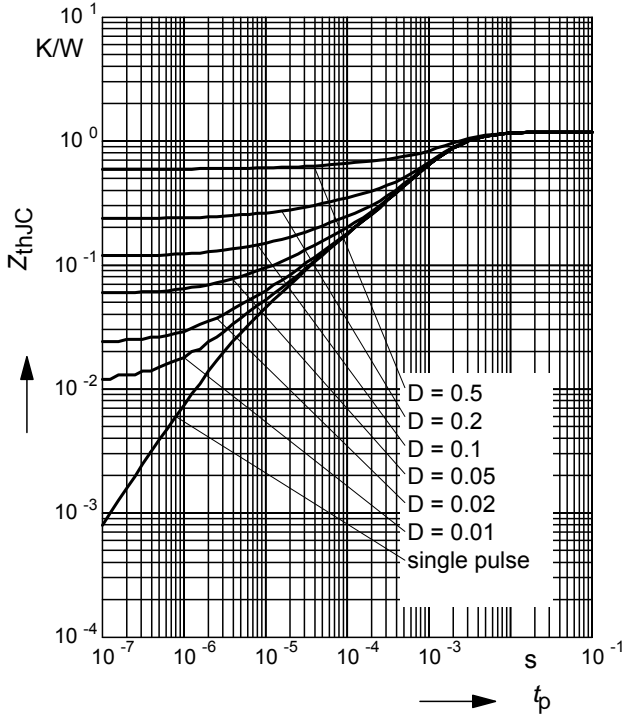
parameter:  $D = 0$  ,  $T_C = 25^\circ\text{C}$



### 5 Transient thermal impedance

$$Z_{thJC} = f(t_p)$$

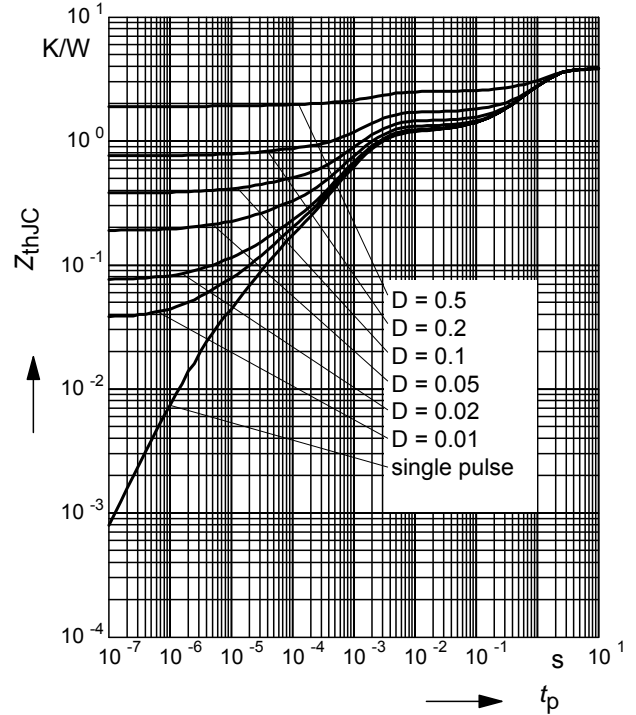
parameter:  $D = t_p/T$



### 6 Transient thermal impedance FullPAK

$$Z_{thJC} = f(t_p)$$

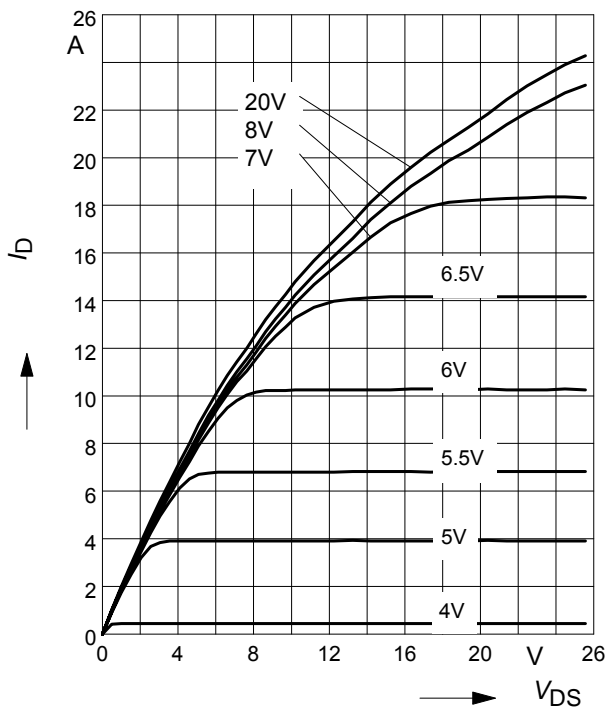
parameter:  $D = t_p/t$



### 7 Typ. output characteristic

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

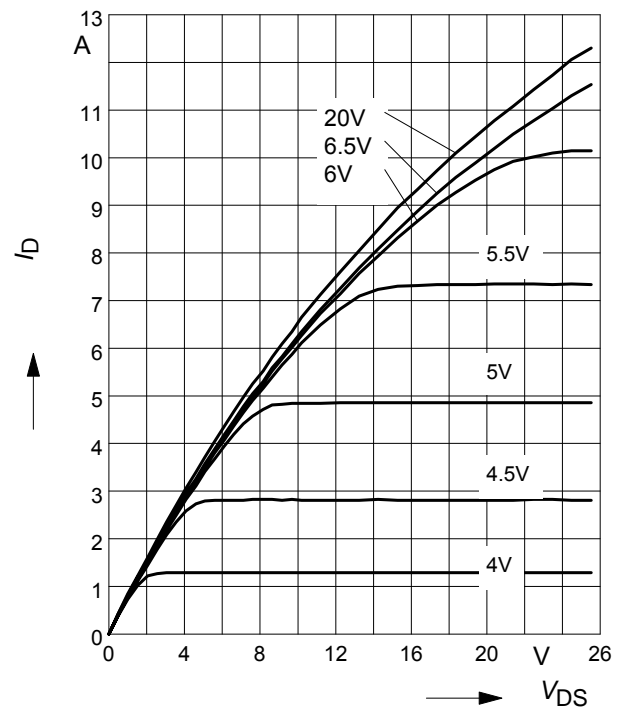
parameter:  $t_p = 10 \mu\text{s}, V_{GS}$



### 8 Typ. output characteristic

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

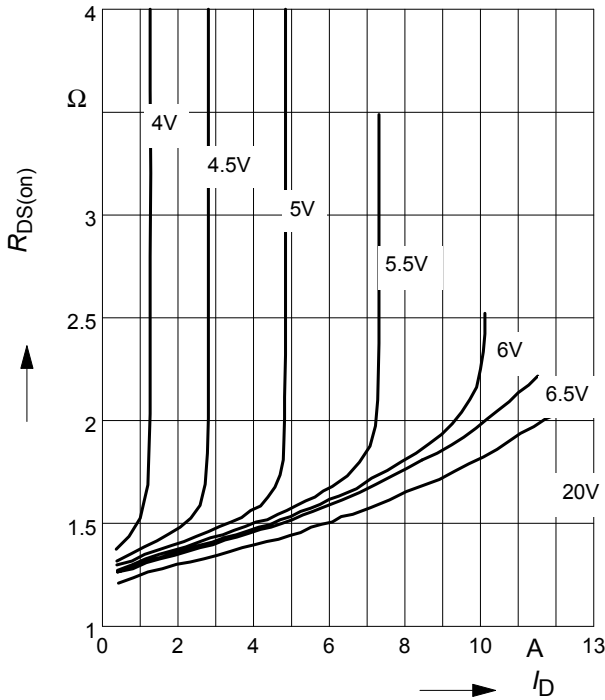
parameter:  $t_p = 10 \mu\text{s}, V_{GS}$



**9 Typ. drain-source on resistance**

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

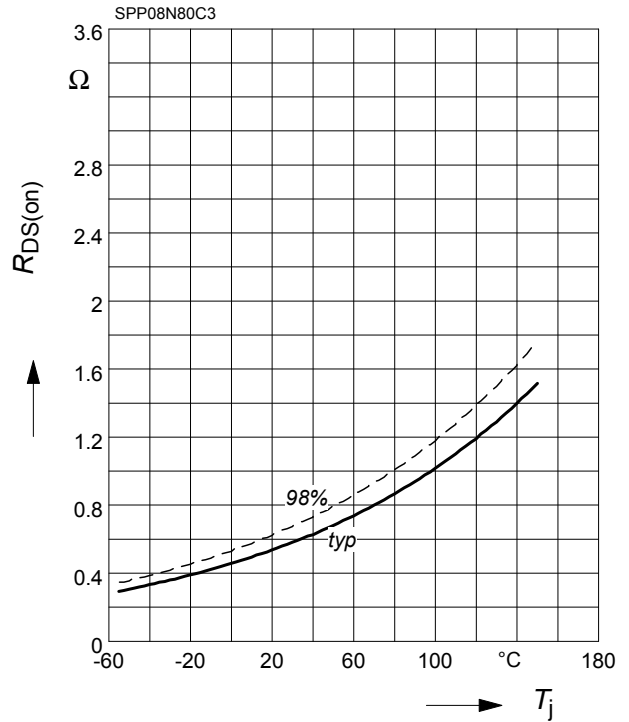
parameter:  $T_j = 150^\circ\text{C}$ ,  $V_{GS}$



**10 Drain-source on-state resistance**

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

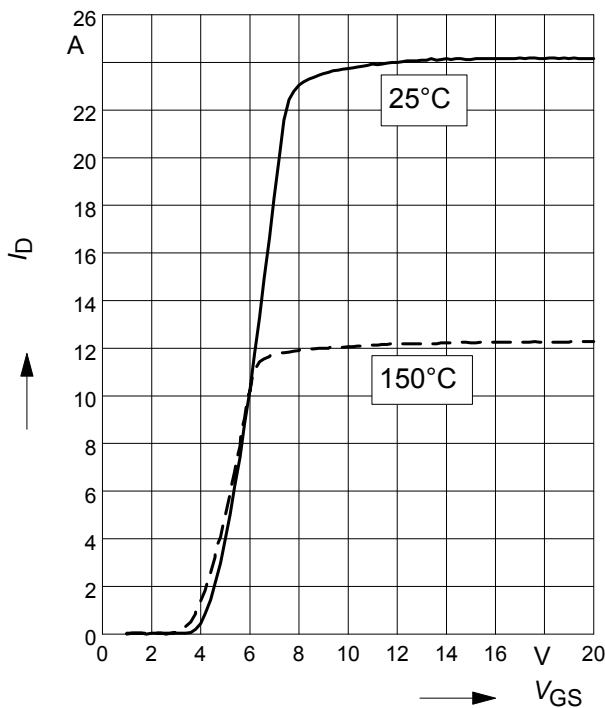
parameter:  $I_D = 5.1\text{ A}$ ,  $V_{GS} = 10\text{ V}$



**11 Typ. transfer characteristics**

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

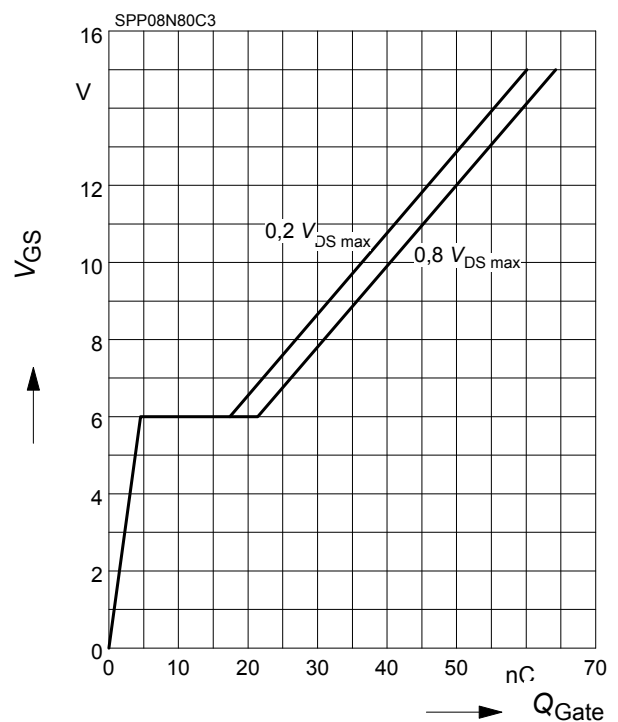
parameter:  $t_p = 10\ \mu\text{s}$



**12 Typ. gate charge**

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

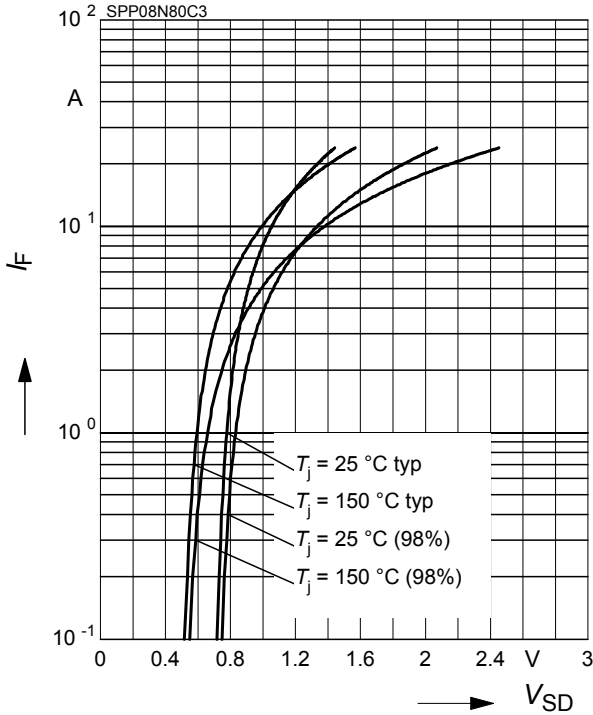
parameter:  $I_D = 8\text{ A pulsed}$



**13 Forward characteristics of body diode**

$I_F = f(V_{SD})$

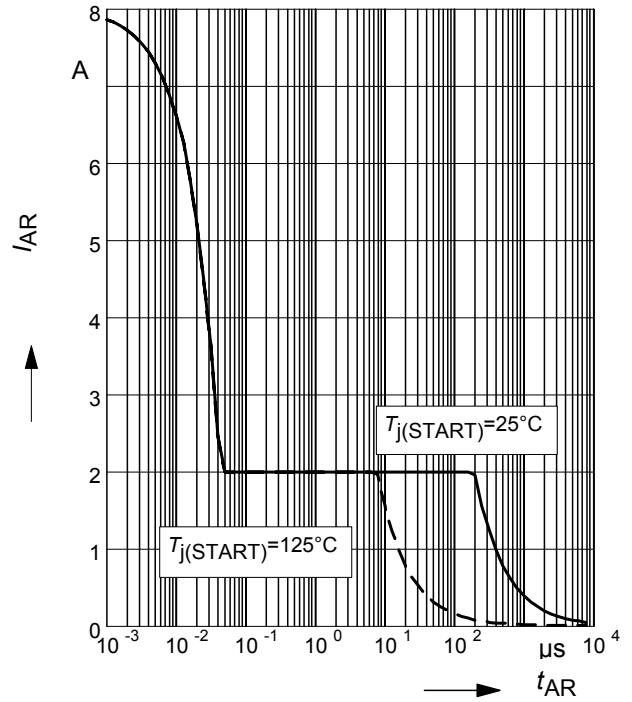
parameter:  $T_j$ ,  $t_p = 10 \mu s$



**14 Avalanche SOA**

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

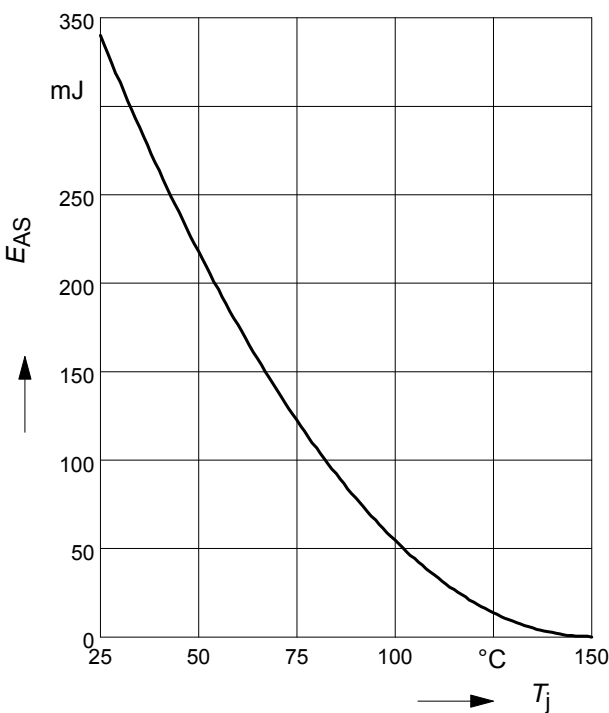
par.:  $T_j \leq 150 \text{ °C}$



**15 Avalanche energy**

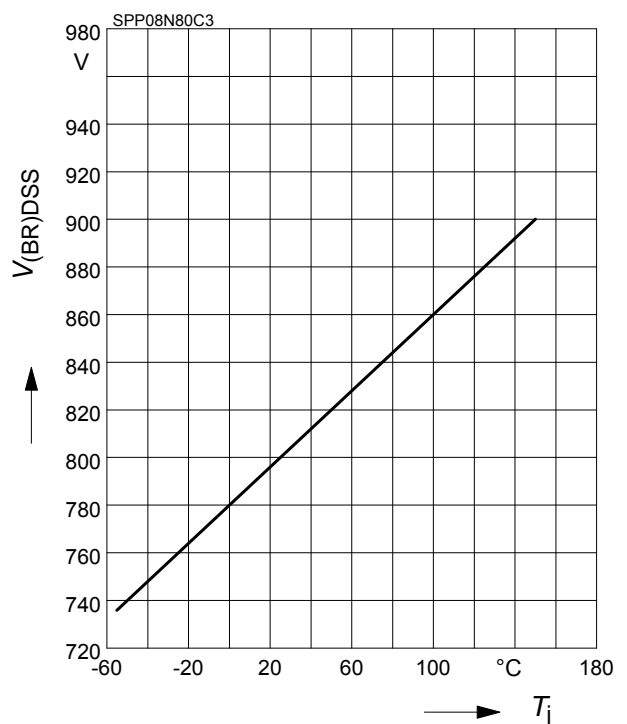
$E_{AS} = f(T_j)$

par.:  $I_D = 1.6 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$



**16 Drain-source breakdown voltage**

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

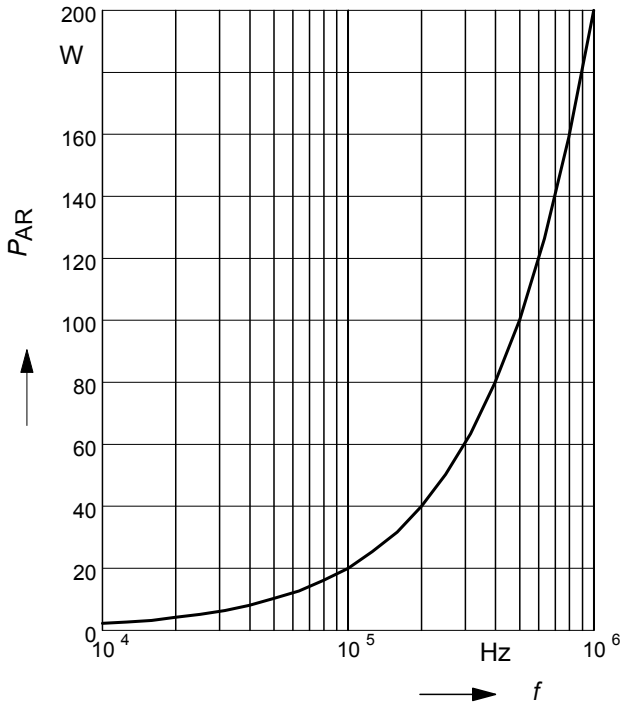




**17 Avalanche power losses**

$$P_{AR} = f(f)$$

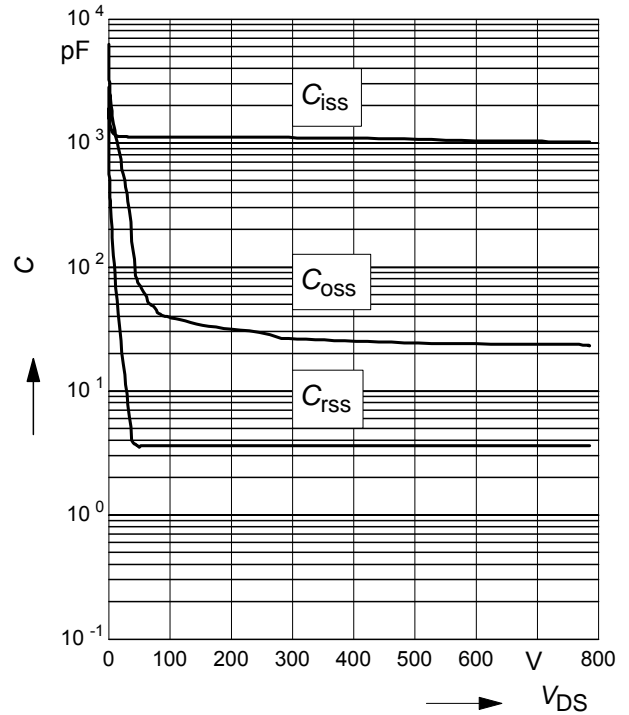
parameter:  $E_{AR}=0.2\text{mJ}$



**18 Typ. capacitances**

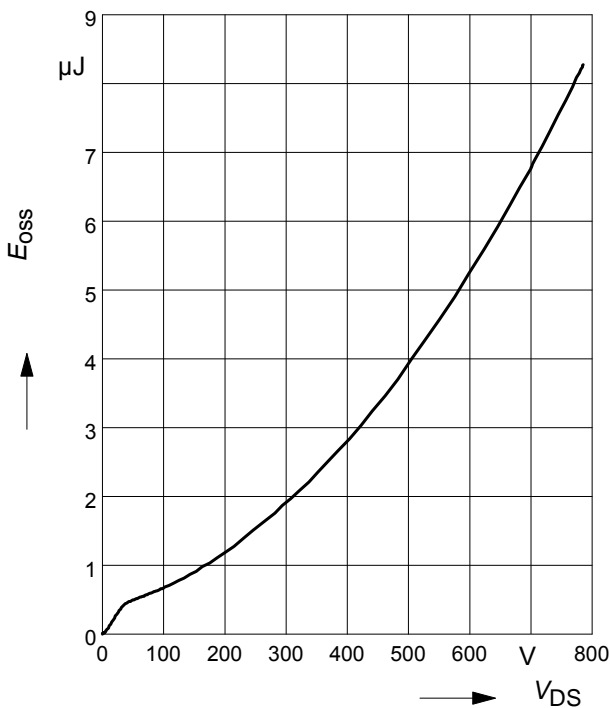
$$C = f(V_{DS})$$

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

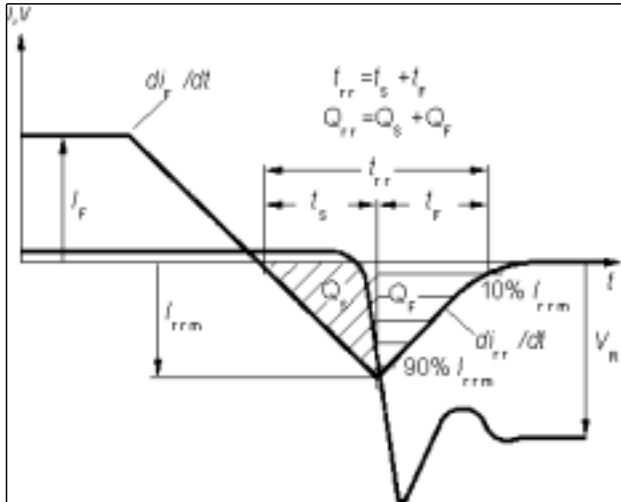


**19 Typ. C<sub>oss</sub> stored energy**

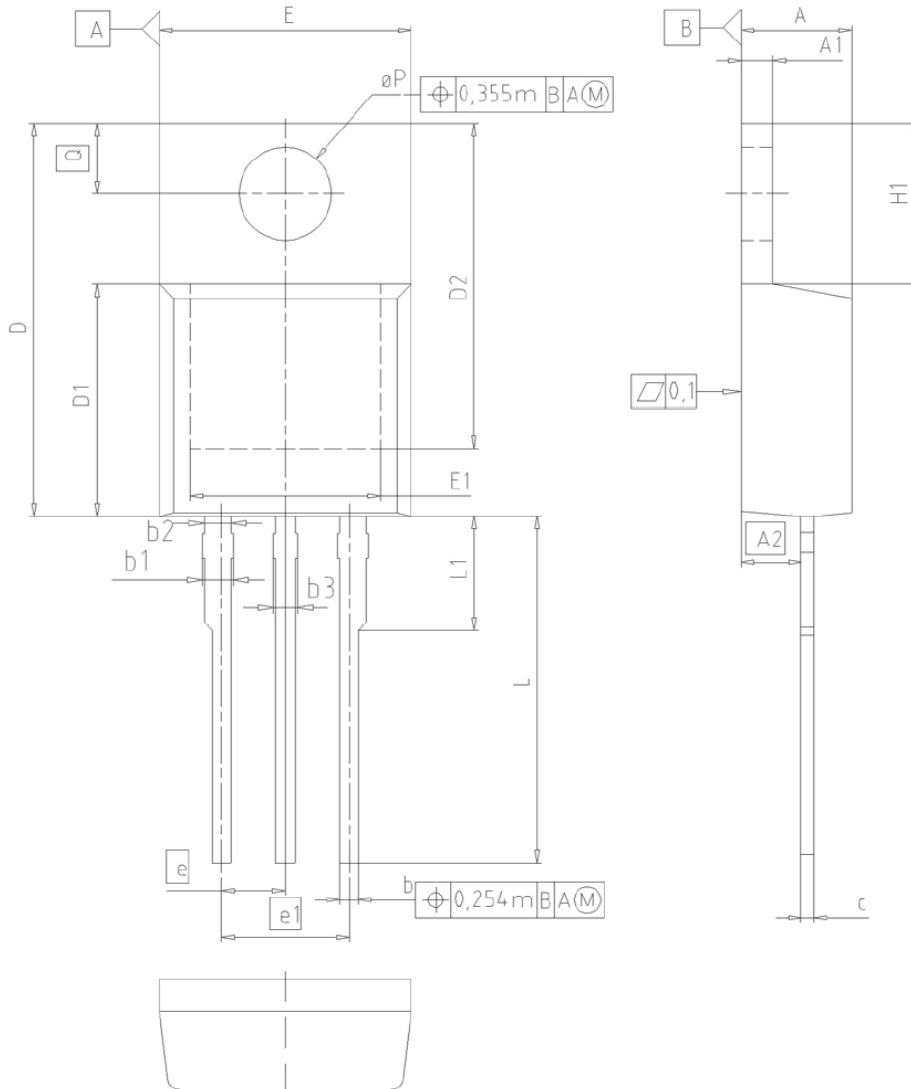
$$E_{oss} = f(V_{DS})$$



Definition of diodes switching characteristics



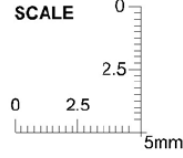
PG-TO220-3-1, PG-TO220-3-21




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
$\varnothing P$	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

**DOCUMENT NO.**  
Z8B00003318

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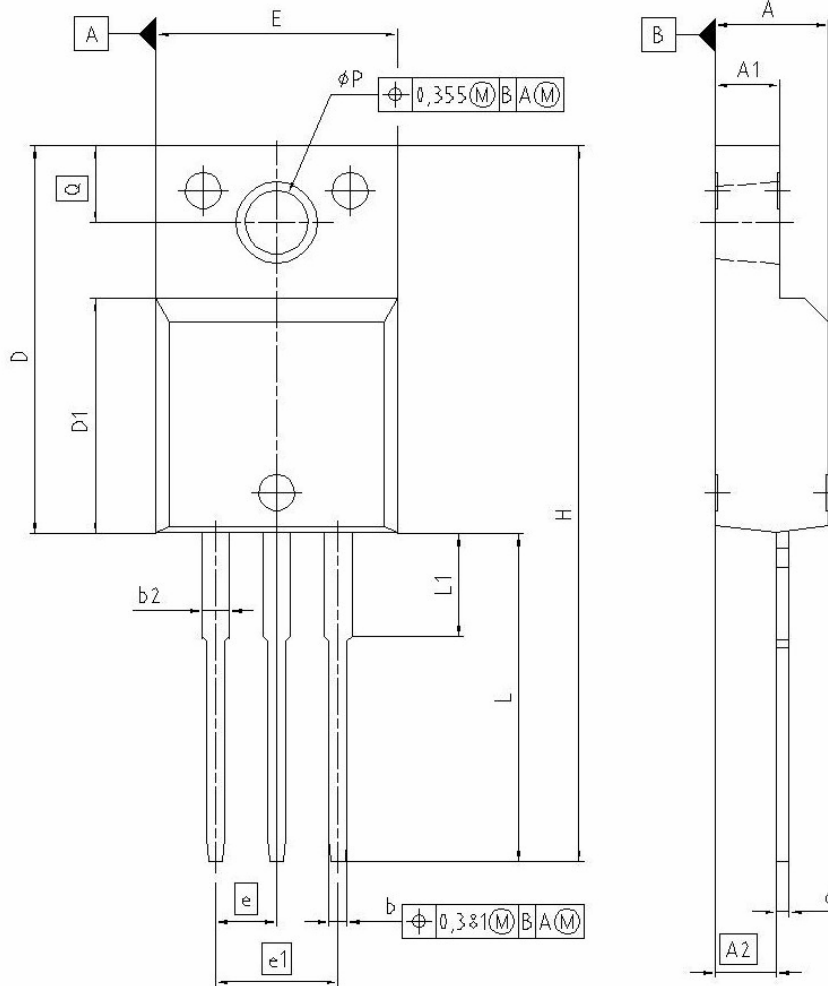
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**ISSUE DATE**  
23-08-2007

**REVISION**  
05

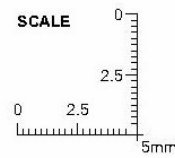
**PG-TO220-3-31 (FullPAK)**



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
φP	2.949	3.025	0.119	0.116
Q	3.149	3.251	0.124	0.128

**REFERENCE**  
J...

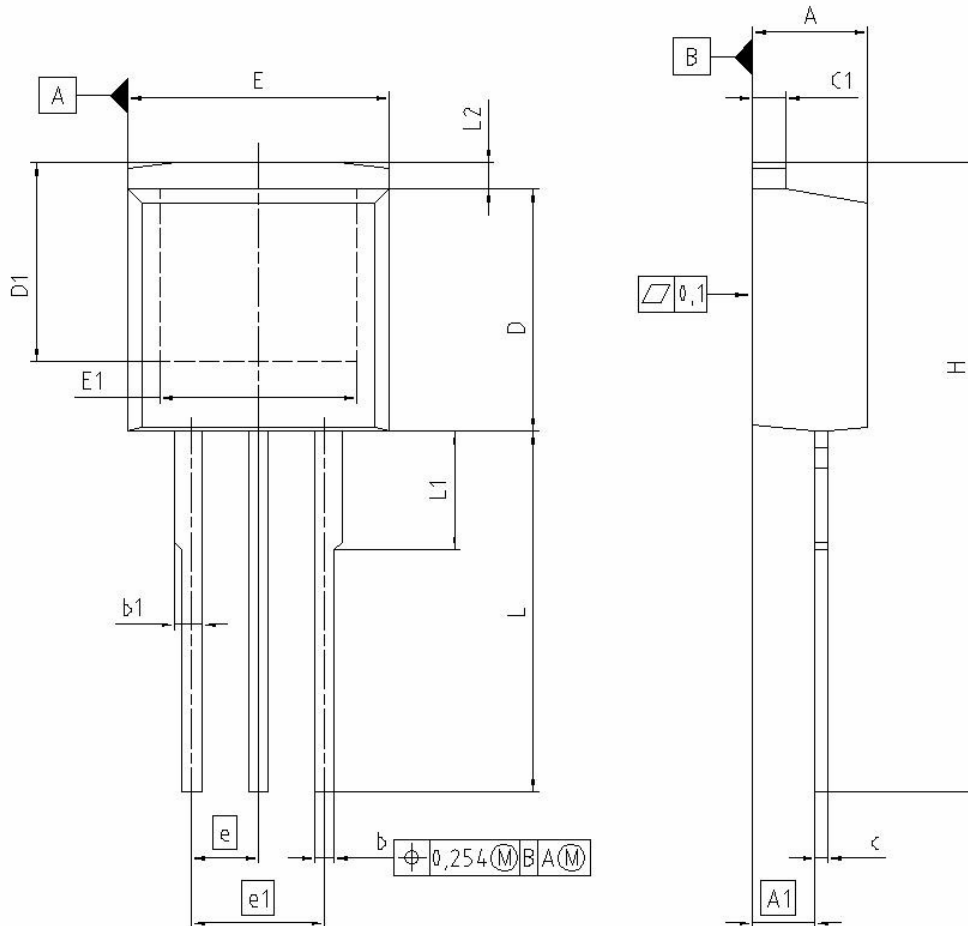
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0 2.5 5mm

**EUROPEAN PROJECTION**  


**ISSUE DATE**  
17-08-2005

**FILE**  
TO220\_2

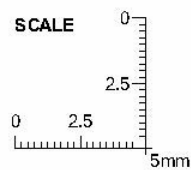
PG-TO262-3-1 (I<sup>2</sup>-PAK)



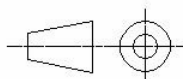
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.500	0.169	0.177
A1	2.150	2.650	0.085	0.104
b	0.650	0.850	0.026	0.033
b1	0.635	1.400	0.025	0.055
c	0.400	0.600	0.016	0.024
c1	1.170	1.370	0.046	0.054
D	9.050	9.450	0.356	0.372
D1	6.900	7.650	0.272	0.301
E	9.800	10.200	0.386	0.402
E1	7.250	8.600	0.285	0.339
e	2.540		0.100	
e1	5.080		0.200	
N	3		3	
L	13.000	14.000	0.512	0.551
L1	4.350	4.750	0.171	0.187
L2	0.700	1.300	0.028	0.051

**REFERENCE**  
JEDEC TO262

**SCALE**



**EUROPEAN PROJECTION**



**ISSUE DATE**  
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**FILE**  
TO262\_1

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