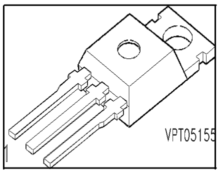
## Cool MOS™ Power Transistor

**Feature**

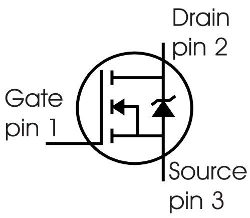
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme d*v*/d*t* rated

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

P-TO220-3-1




| Type | Package | Ordering Code | Marking |
|---|---|---|---|
| SPP02N80C3 | P-TO220-3-1 | Q67040-S4432 | 02N80C3 |




**Maximum Ratings, at $T_C$ = 25°C, unless otherwise specified**

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

**Maximum Ratings**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain Source voltage slope<br>$V_{DS}$ = 640 V, $I_D$ = 2 A, $T_j$ = 125 °C | d$v$/d$t$ | 50 | V/ns |

**Thermal Characteristics**

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | 3 | K/W |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | - | - | 62 | |
| Soldering temperature,<br>1.6 mm (0.063 in.) from case for 10s [2] | $T_{sold}$ | - | - | 260 | °C |

**Electrical Characteristics**

| 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,<br>$T_j$=25°C,<br>$T_j$=150°C | <br>-<br>- | <br>0.5<br>- | <br>5<br>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,<br>$T_j$=25°C<br>$T_j$=150°C | <br>-<br>- | <br>2.4<br>6.5 | <br>2.7<br>- | Ω |
| Gate input resistance | $R_G$ | $f$=1MHz, open Drain | - | 0.7 | - | |

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

| 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 | - | pF |
| 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 |

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

[2]Soldering temperature for TO-263: 220°C, reflow

[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% $V_{DSS}$.

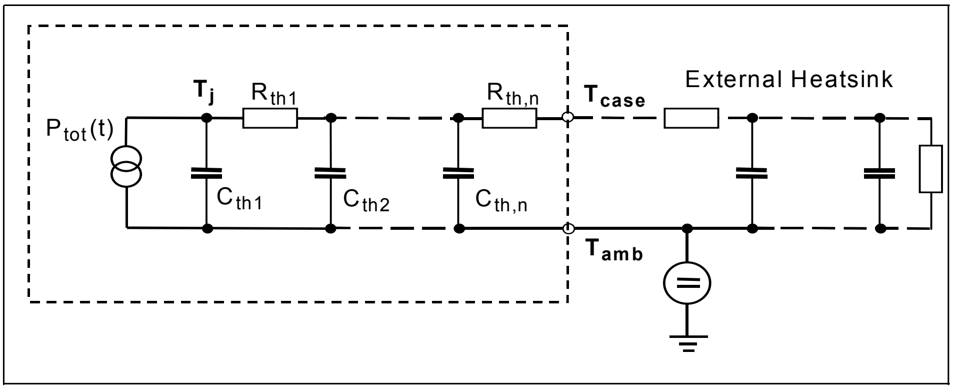
[4]$C_{o(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.

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

| 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 | $di_{rr}/dt$ | | - | 200 | - | A/μs |

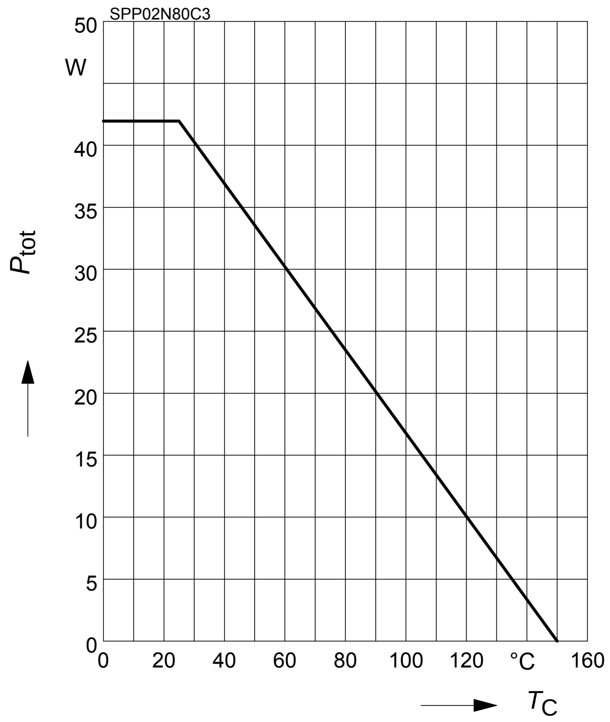
**Typical Transient Thermal Characteristics**

| Symbol | Value | Unit | Symbol | Value | Unit |
|---|---|---|---|---|---|
| | typ. | | | typ. | |
| Thermal resistance | | | Thermal capacitance | | |
| $R_{th1}$ | 0.067 | K/W | $C_{th1}$ | 0.00004221 | Ws/K |
| $R_{th2}$ | 0.126 | | $C_{th2}$ | 0.0001651 | |
| $R_{th3}$ | 0.215 | | $C_{th3}$ | 0.0002432 | |
| $R_{th4}$ | 0.655 | | $C_{th4}$ | 0.0007613 | |
| $R_{th5}$ | 0.569 | | $C_{th5}$ | 0.002455 | |
| $R_{th6}$ | 0.161 | | $C_{th6}$ | 0.412 | |



## 1 Power dissipation

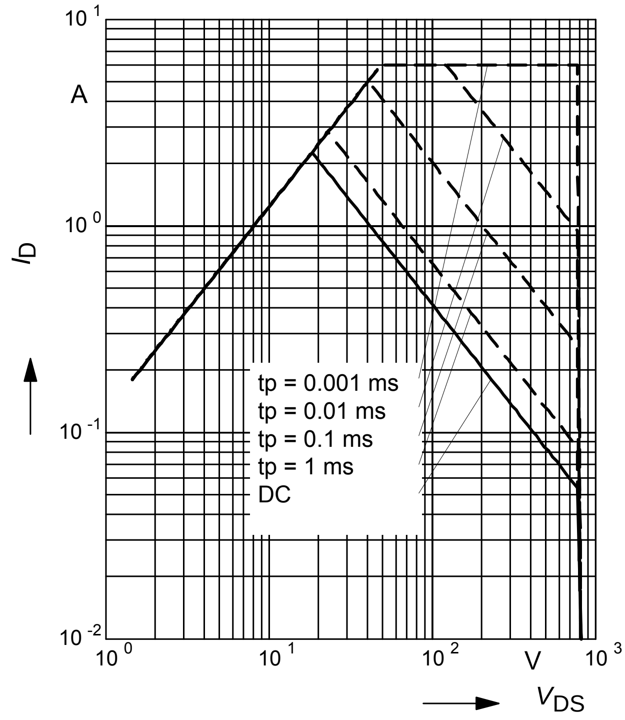
$P_{tot} = f(T_C)$




## 2 Safe operating area

$I_D = f(V_{DS})$

parameter : $D = 0$ , $T_C$=25°C




## 3 Safe operating area FullPAK

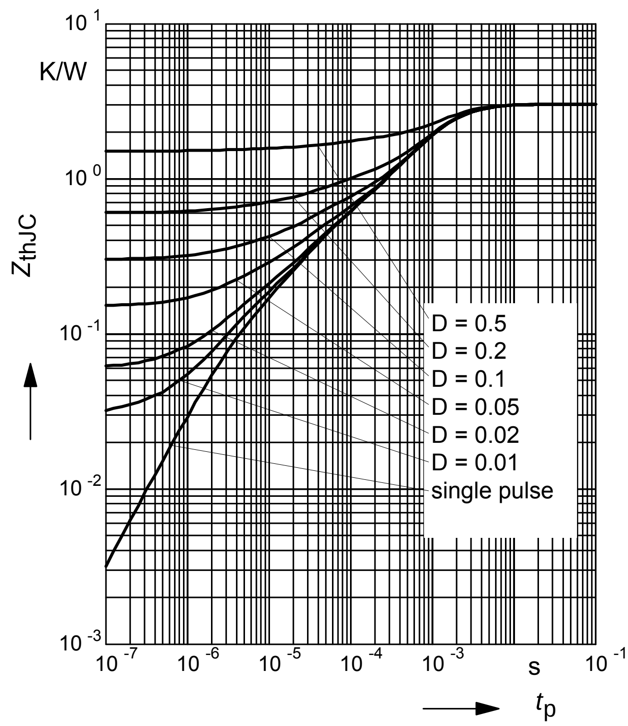
$I_D = f(V_{DS})$

parameter: $D = 0$, $T_C$ = 25°C

## 4 Transient thermal impedance

$Z_{thJC} = f(t_p)$

parameter: $D = t_p/T$



## 5 Transient thermal impedance FullPAK

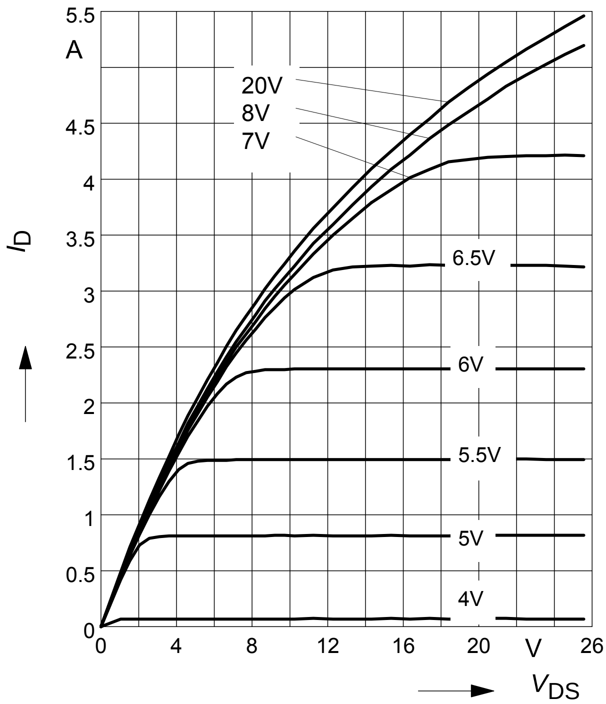
$Z_{thJC} = f\,(t_p)$

parameter: $D = t_p/t$

## 6 Typ. output characteristic

$I_D = f\,(V_{DS})$; $T_j$=25°C

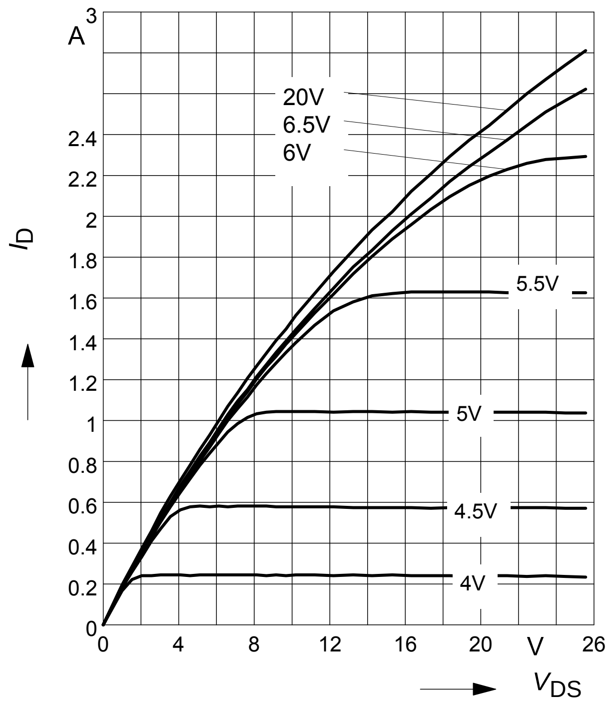
parameter: $t_p$ = 10 µs, $V_{GS}$




## 7 Typ. output characteristic

$I_D = f\,(V_{DS})$; $T_j$=150°C

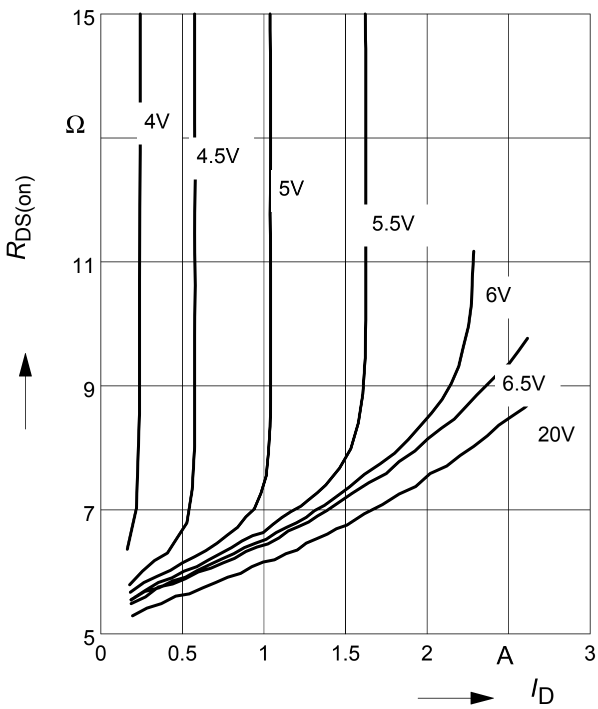
parameter: $t_p$ = 10 µs, $V_{GS}$




## 8 Typ. drain-source on resistance

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

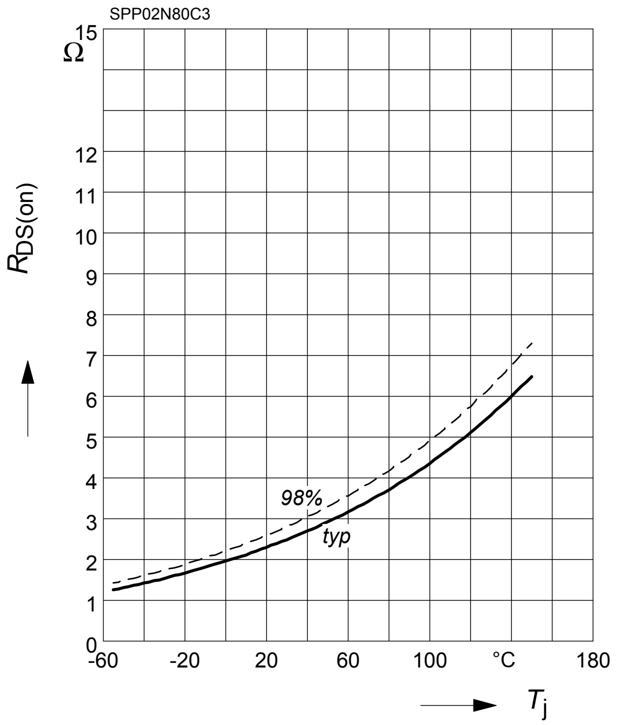
parameter: $T_j$=150°C, $V_{GS}$



## 9 Drain-source on-state resistance

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

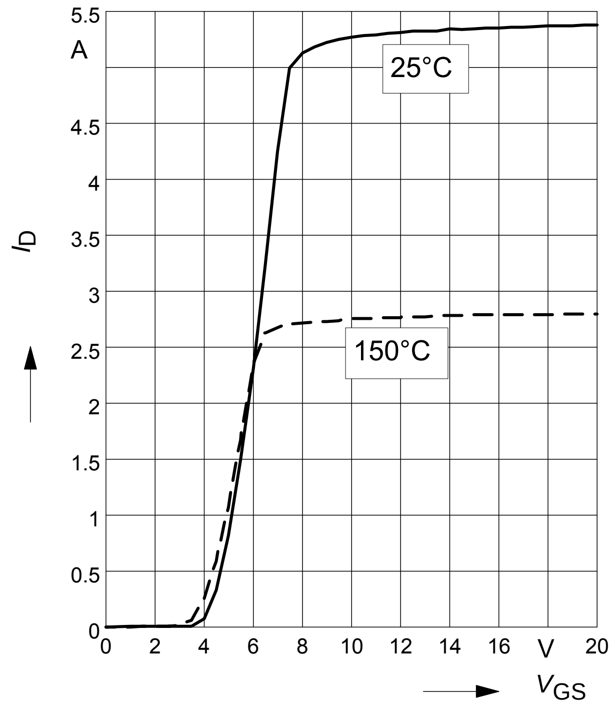
parameter : $I_D$ = 1.2 A, $V_{GS}$ = 10 V




## 10 Typ. transfer characteristics

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

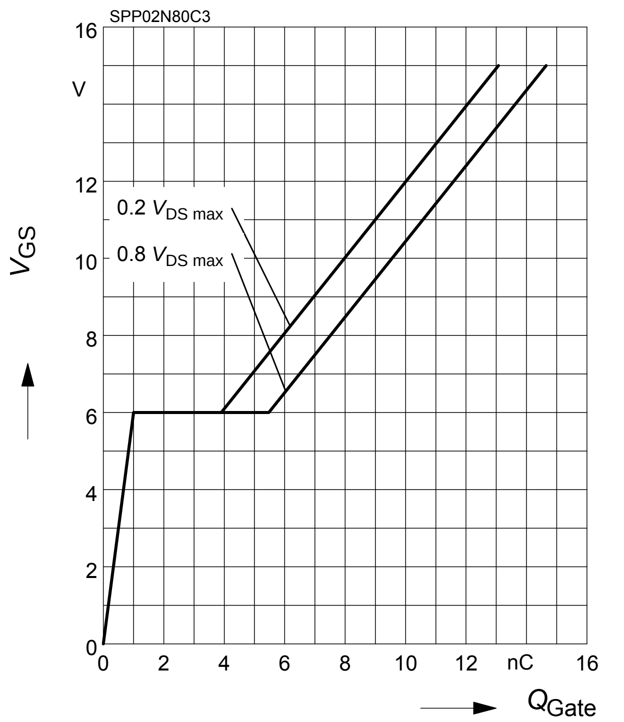
parameter: $t_p$ = 10 µs




## 11 Typ. gate charge

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

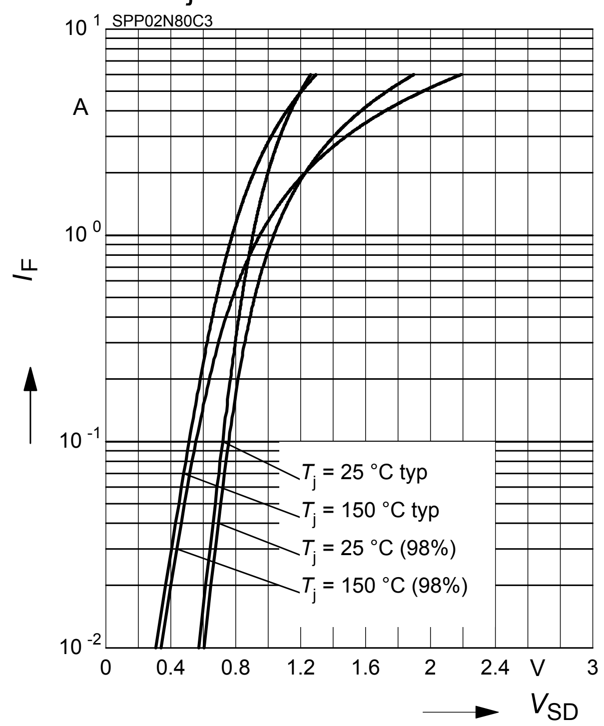
parameter: $I_D$ = 2 A pulsed




## 12 Forward characteristics of body diode

$I_F = f(V_{SD})$

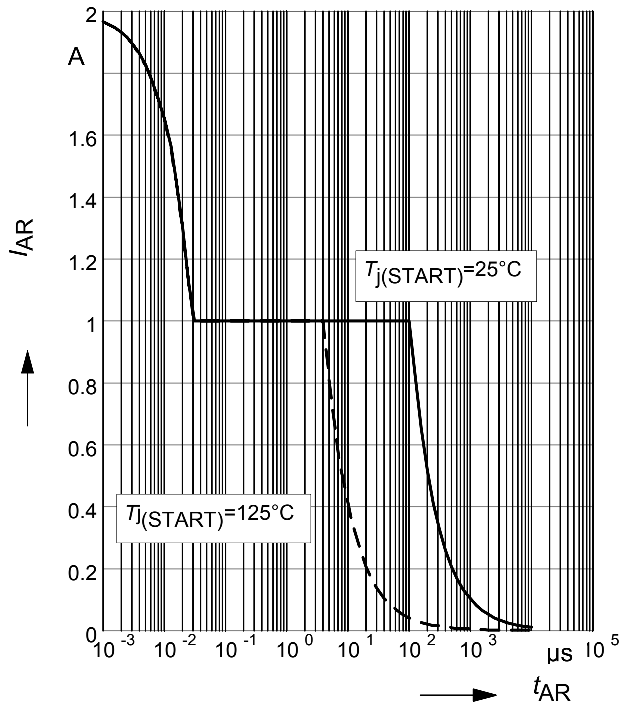
parameter: $T_j$ , tp = 10 µs



## 13 Avalanche SOA

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

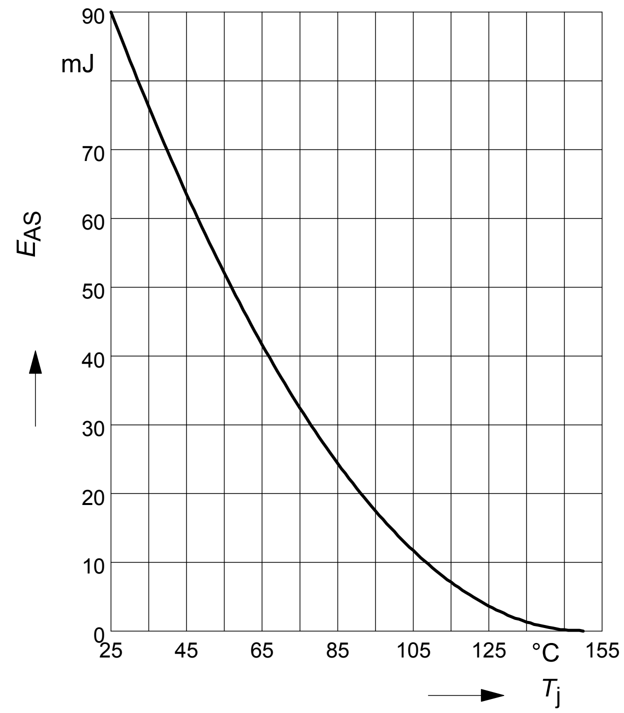
par.: $T_j \leq 150$ °C




## 14 Avalanche energy

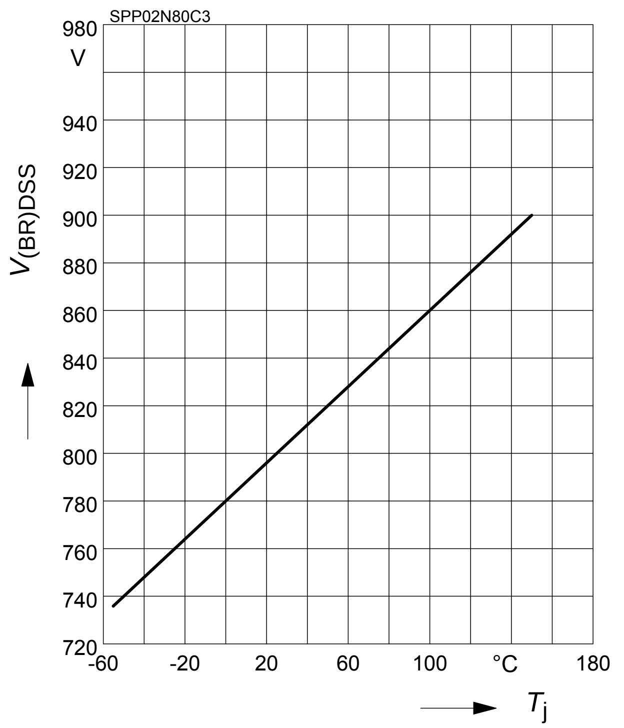
$E_{AS} = f(T_j)$

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




## 15 Drain-source breakdown voltage

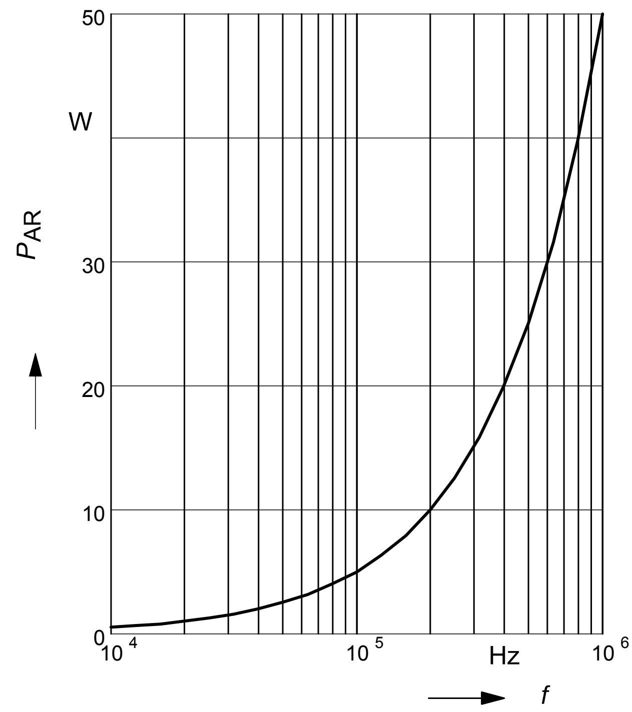
$V_{(BR)DSS} = f(T_j)$




## 16 Avalanche power losses

$P_{AR} = f(f)$

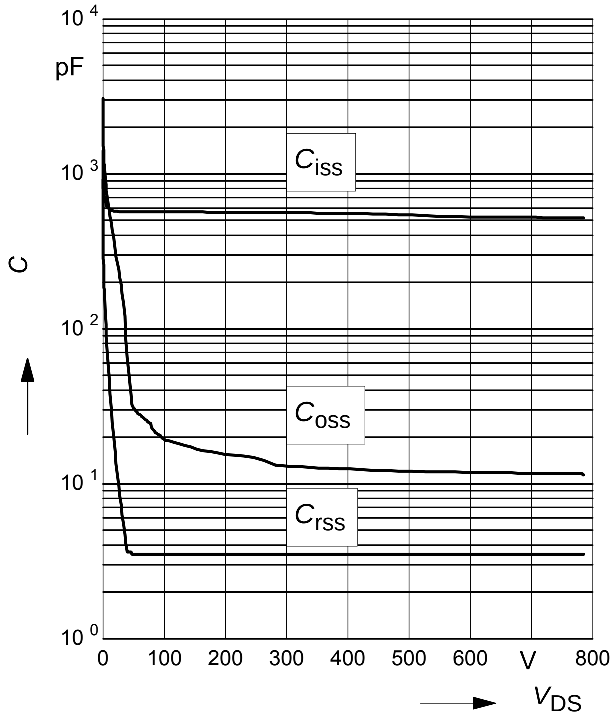
parameter: $E_{AR}$=0.05mJ



**17 Typ. capacitances**

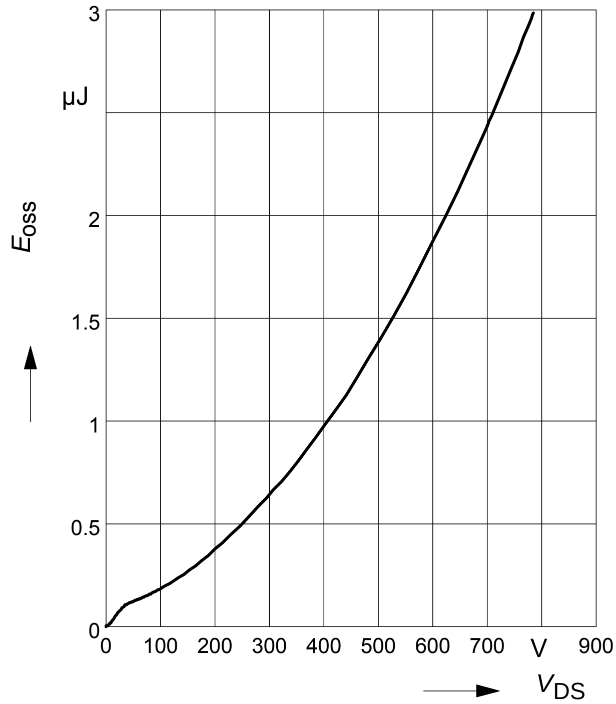
$C = f(V_{DS})$

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

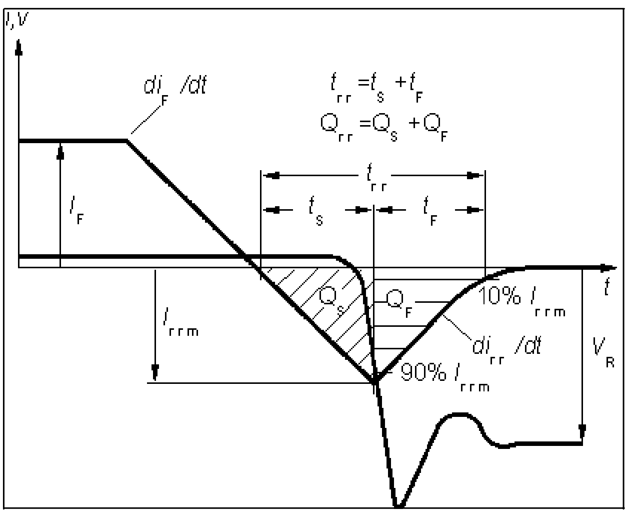



**18 Typ. $C_{oss}$ stored energy**

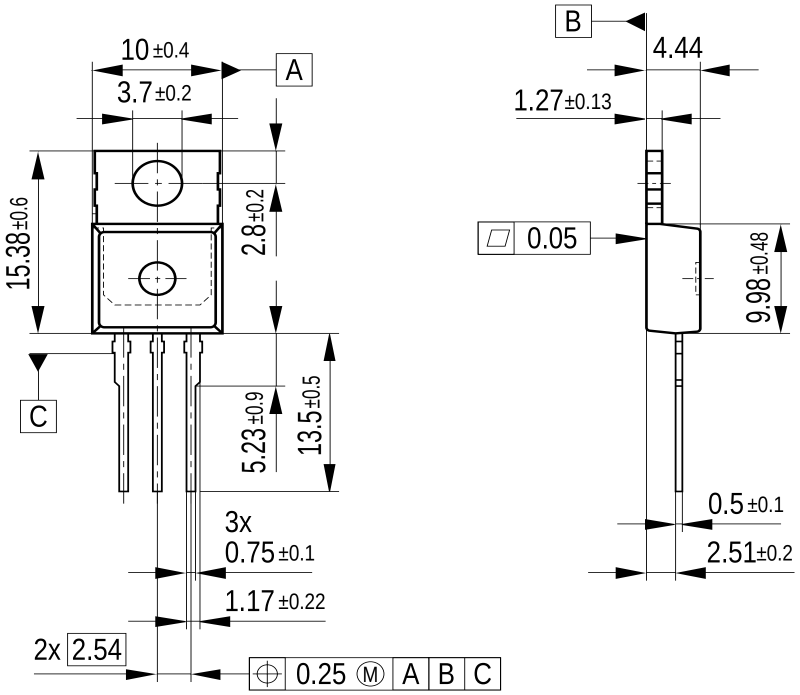
$E_{oss}=f(V_{DS})$




Definition of diodes switching characteristics



P-TO-220-3-1




All metal surfaces tin plated, except area of cut.
Metal surface min. x=7.25, y=12.3

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