



Final data

SPP02N80C3
SPA02N80C3

Cool MOS™ Power Transistor

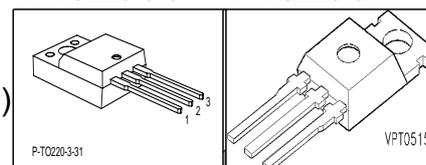
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- P-TO-220-3-31: Fully isolated package (2500 VAC; 1 minute)

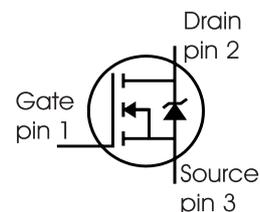
| | | |
|--------------|-----|----------|
| V_{DS} | 800 | V |
| $R_{DS(on)}$ | 2.7 | Ω |
| I_D | 2 | A |

P-TO220-3-31

P-TO220-3-1



| Type | Package | Ordering Code | Marking |
|------------|--------------|---------------|---------|
| SPP02N80C3 | P-TO220-3-1 | Q67040-S4432 | 02N80C3 |
| SPA02N80C3 | P-TO220-3-31 | Q67040S4634 | 02N80C3 |



Maximum Ratings

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



Final data

SPP02N80C3
SPA02N80C3**Maximum Ratings**

| Parameter | Symbol | Value | Unit |
|---|---------|-------|------|
| Drain Source voltage slope $V_{DS} = 640 \text{ V}$, $I_D = 2 \text{ A}$, $T_j = 125 \text{ }^\circ\text{C}$ | dv/dt | 50 | V/ns |

Thermal Characteristics

| Parameter | Symbol | Values | | | Unit |
|--|-----------------------|--------|------|------|------------------|
| | | min. | typ. | max. | |
| Thermal resistance, junction - case | R_{thJC} | - | - | 3 | K/W |
| Thermal resistance, junction - case, FullPAK | $R_{thJC \text{ FP}}$ | - | - | 4.1 | |
| Thermal resistance, junction - ambient, leaded | R_{thJA} | - | - | 62 | |
| Thermal resistance, junction - ambient, FullPAK | $R_{thJA \text{ FP}}$ | - | - | 80 | |
| Soldering temperature, 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 | $V_{(BR)DS}$ | $V_{GS}=0\text{V}$, $I_D=2\text{A}$ | - | 870 | - | |
| Gate threshold voltage | $V_{GS(th)}$ | $I_D=120\mu\text{A}$, $V_{GS}=V_{DS}$ | 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 - | 5 50 | μA |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20\text{V}$, $V_{DS}=0\text{V}$ | - | - | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{V}$, $I_D=1.2\text{A}$, $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | - - | 2.4 6.5 | 2.7 - | Ω |
| Gate input resistance | R_G | $f=1\text{MHz}$, open drain | - | 0.7 | - | |



Electrical Characteristics

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|--------------|---|--------|------|------|------|
| | | | min. | typ. | max. | |
| Transconductance | g_{fs} | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 1.2A$ | - | 1.5 | - | S |
| Input capacitance | C_{iss} | $V_{GS} = 0V$, $V_{DS} = 25V$, | - | 290 | - | pF |
| Output capacitance | C_{oss} | $f = 1MHz$ | - | 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 | $t_{d(on)}$ | $V_{DD} = 400V$, $V_{GS} = 0/10V$, | - | 25 | - | ns |
| Rise time | t_r | $I_D = 2A$, | - | 15 | - | |
| Turn-off delay time | $t_{d(off)}$ | $R_G = 47\Omega$ | - | 65 | 75 | |
| Fall time | t_f | | - | 18 | 23 | |

Gate Charge Characteristics

| | | | | | | |
|-----------------------|-----------------|---|---|---|----|----|
| 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 |

¹Limited only by maximum temperature

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

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} .

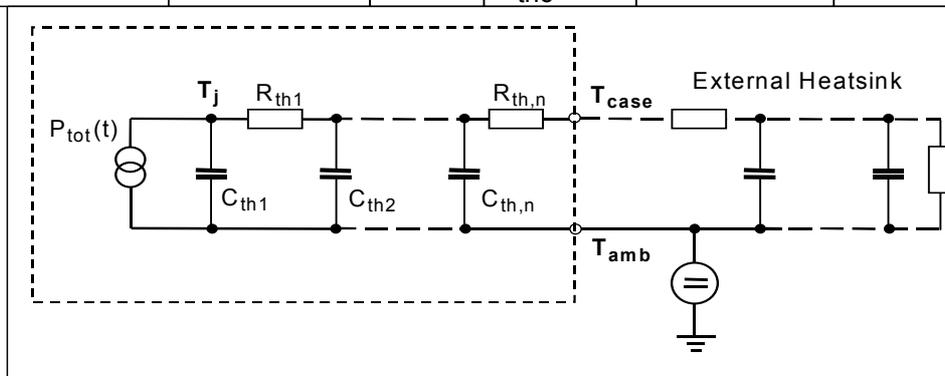
⁴ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

Electrical Characteristics

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

Typical Transient Thermal Characteristics

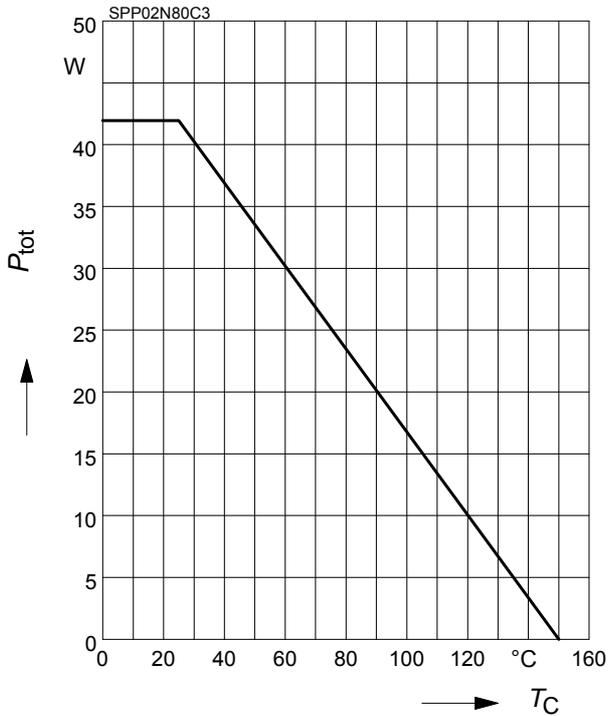
| Symbol | Value | | Unit | Symbol | Value | | Unit |
|-----------|-------|-------|------|-----------|------------|------------|------|
| | SPP | SPA | | | SPP | SPA | |
| R_{th1} | 0.067 | 0.067 | K/W | C_{th1} | 0.00004221 | 0.00004221 | Ws/K |
| R_{th2} | 0.126 | 0.126 | | C_{th2} | 0.0001651 | 0.0001651 | |
| 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 | |





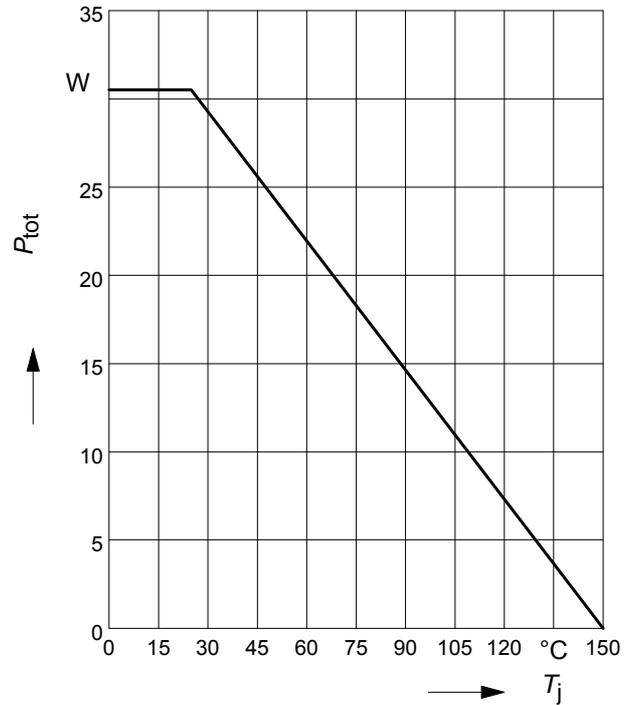
1 Power dissipation

$P_{tot} = f(T_C)$



2 Power dissipation FullPAK

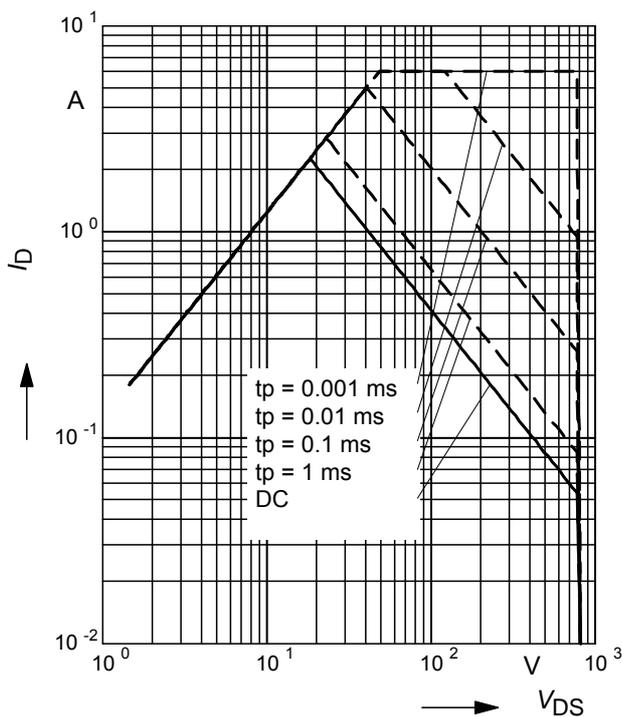
$P_{tot} = f(T_C)$



3 Safe operating area

$I_D = f(V_{DS})$

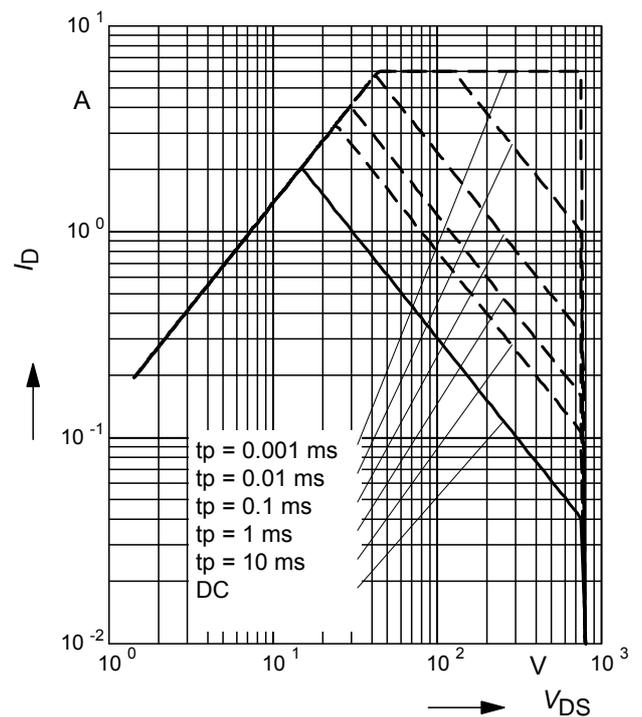
parameter : $D = 0$, $T_C = 25^\circ\text{C}$



4 Safe operating area FullPAK

$I_D = f(V_{DS})$

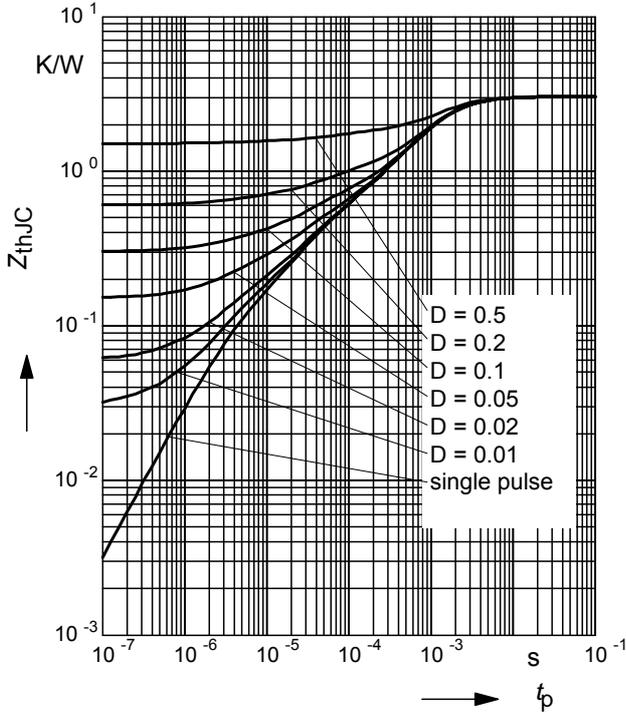
parameter: $D = 0$, $T_C = 25^\circ\text{C}$



5 Transient thermal impedance

$Z_{thJC} = f(t_p)$

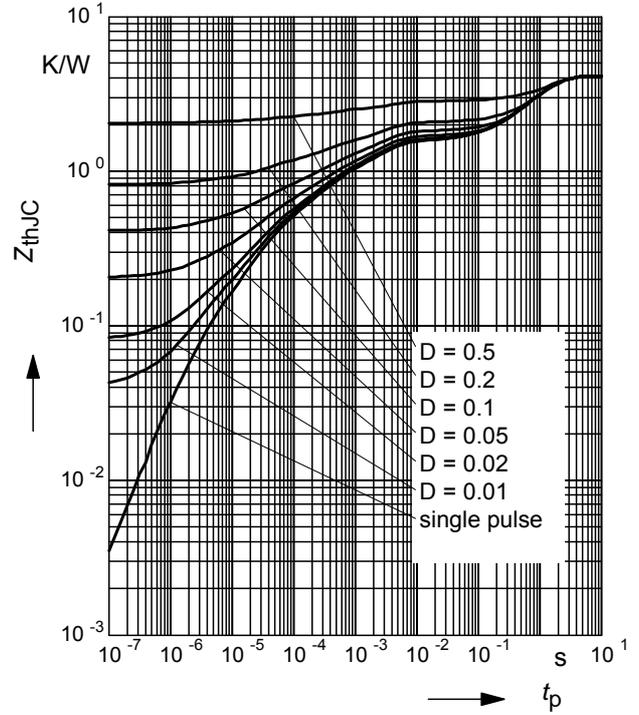
parameter: $D = t_p/T$



6 Transient thermal impedance FullPAK

$Z_{thJC} = f(t_p)$

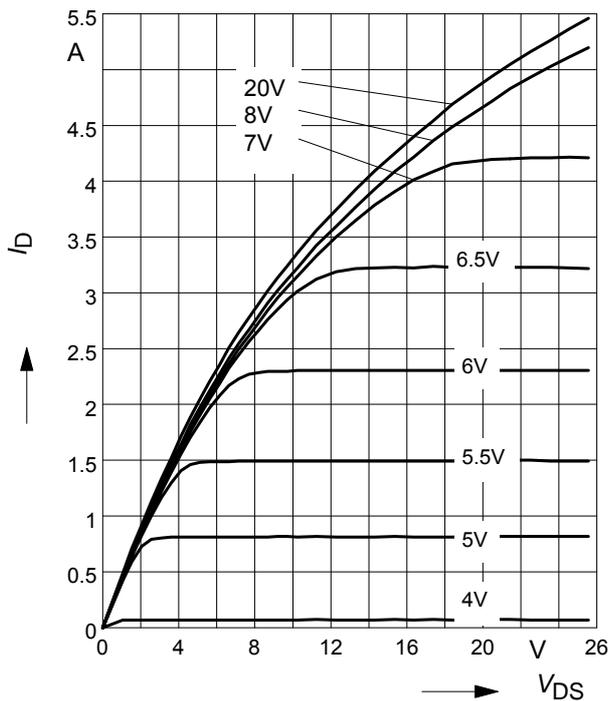
parameter: $D = t_p/t$



7 Typ. output characteristic

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

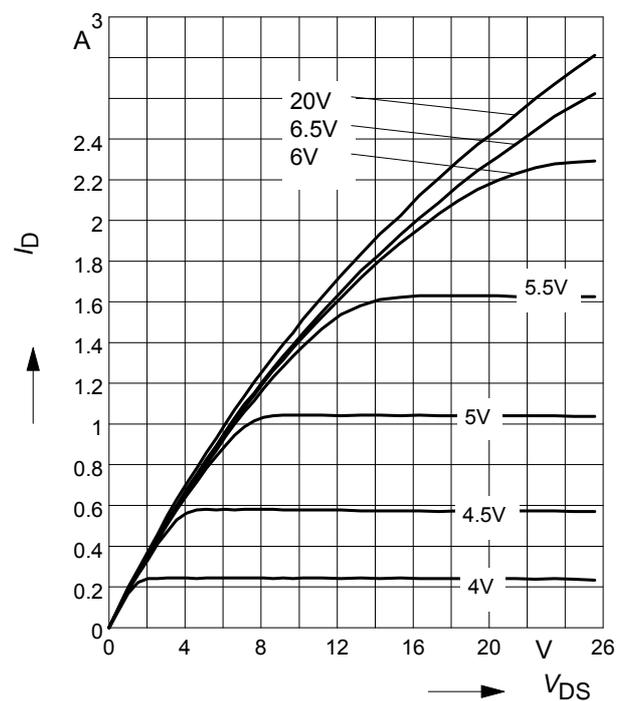
parameter: $t_p = 10 \mu s, V_{GS}$



8 Typ. output characteristic

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

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

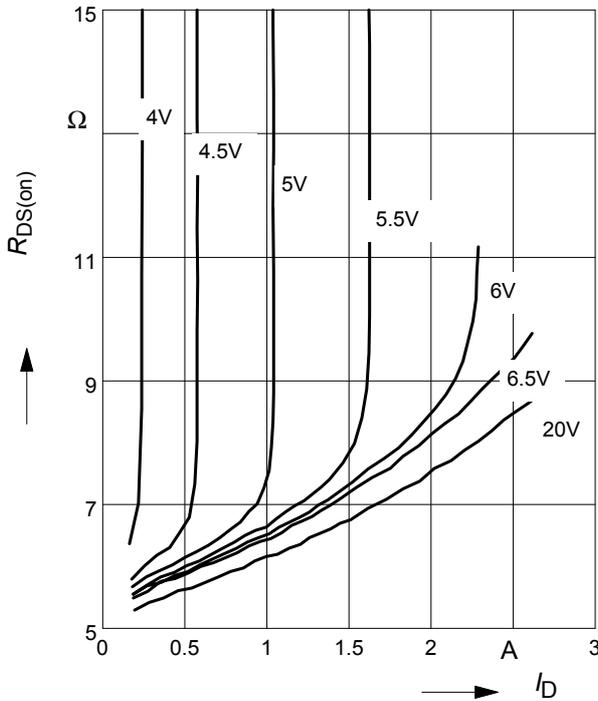




9 Typ. drain-source on resistance

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

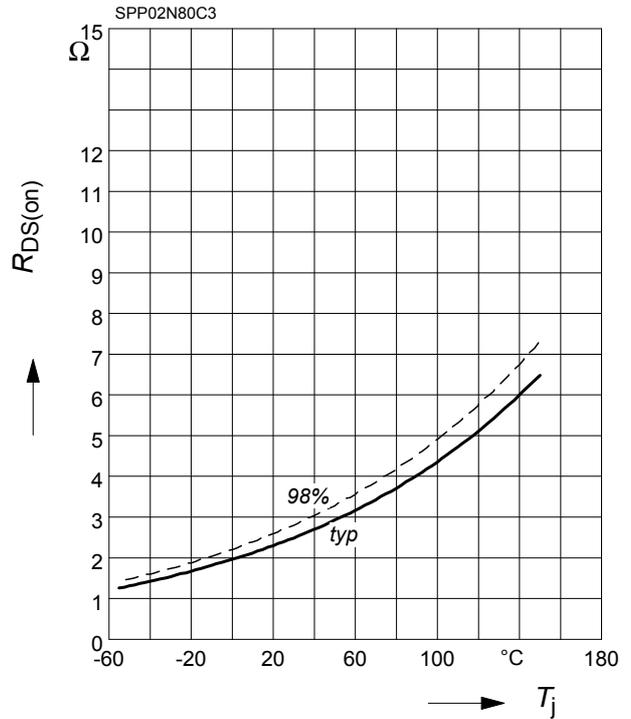
parameter: $T_j = 150^\circ\text{C}$, V_{GS}



10 Drain-source on-state resistance

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

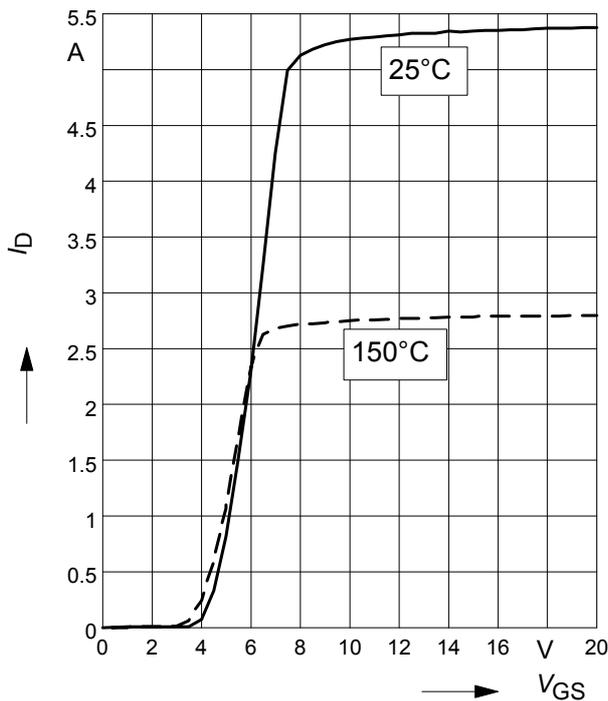
parameter: $I_D = 1.2\text{ A}$, $V_{GS} = 10\text{ V}$



11 Typ. transfer characteristics

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

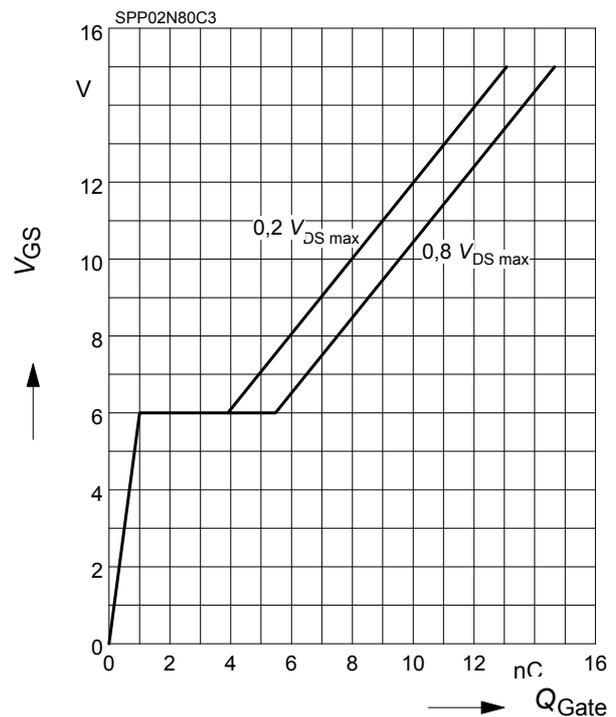
parameter: $t_p = 10\ \mu\text{s}$



12 Typ. gate charge

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

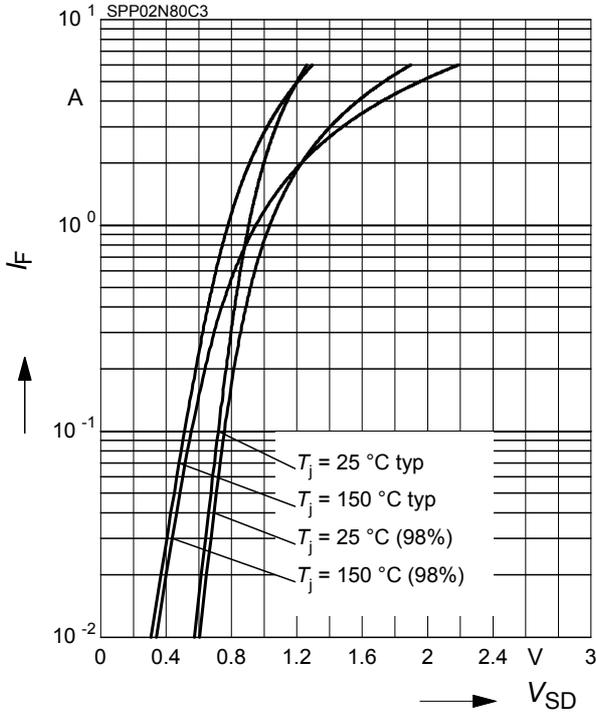
parameter: $I_D = 2\text{ A pulsed}$



13 Forward characteristics of body diode

$I_F = f(V_{SD})$

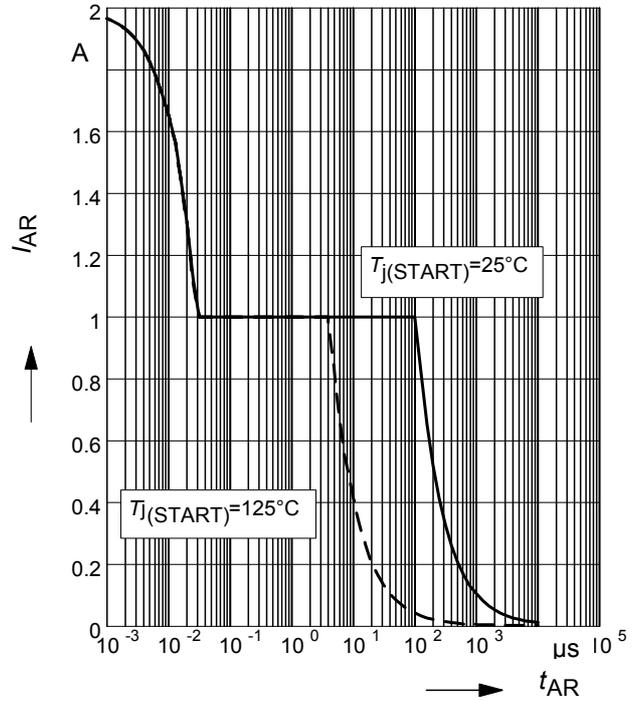
parameter: T_j , $t_p = 10 \mu s$



14 Avalanche SOA

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

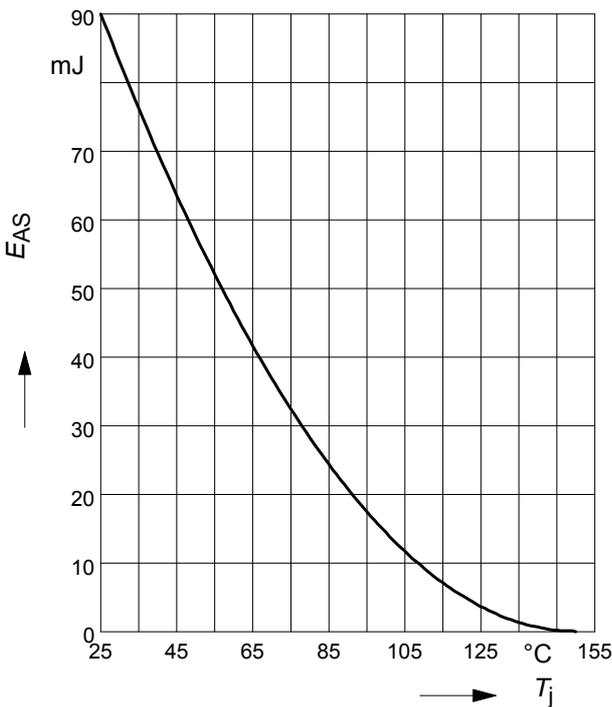
par.: $T_j \leq 150 \text{ °C}$



15 Avalanche energy

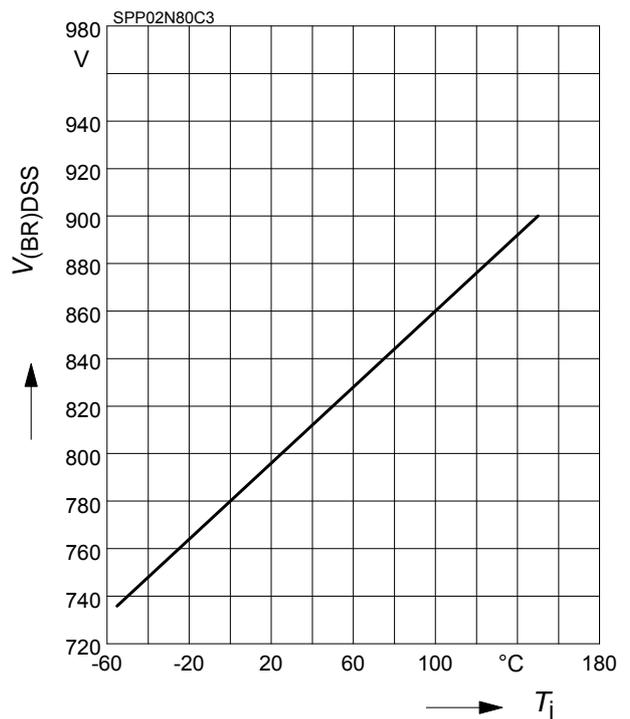
$E_{AS} = f(T_j)$

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



16 Drain-source breakdown voltage

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

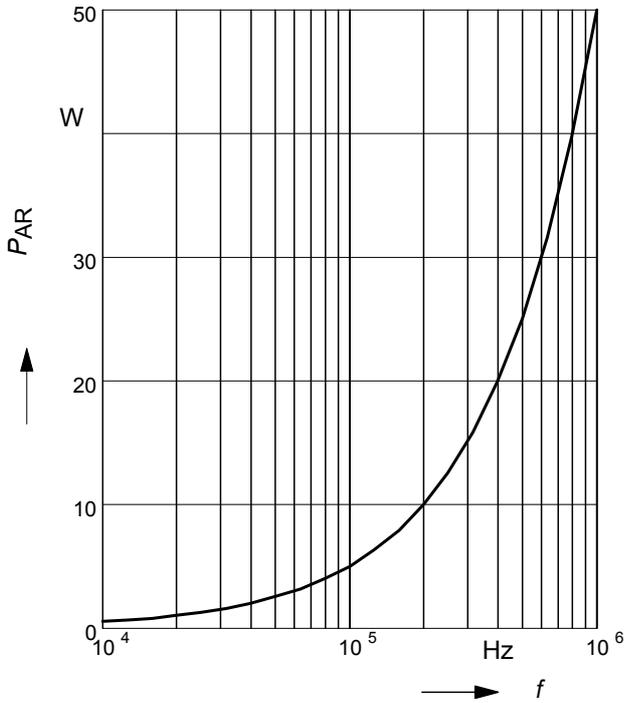




17 Avalanche power losses

$P_{AR} = f(f)$

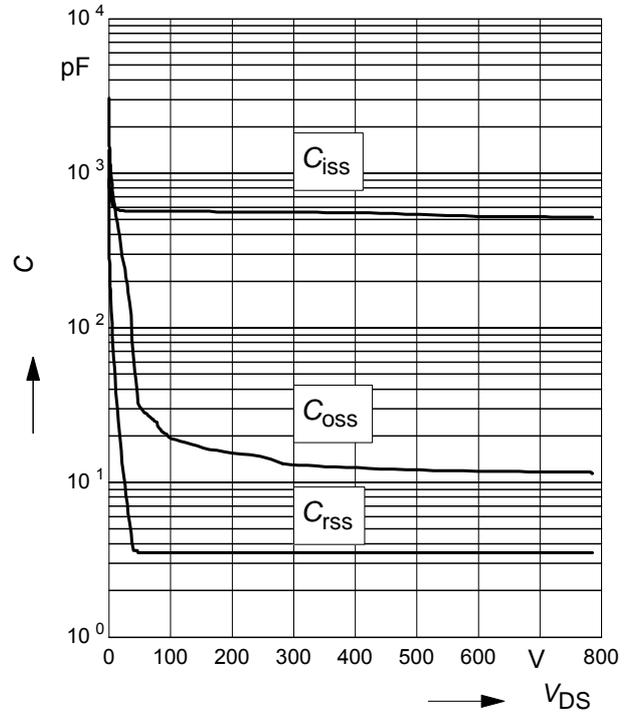
parameter: $E_{AR}=0.05mJ$



18 Typ. capacitances

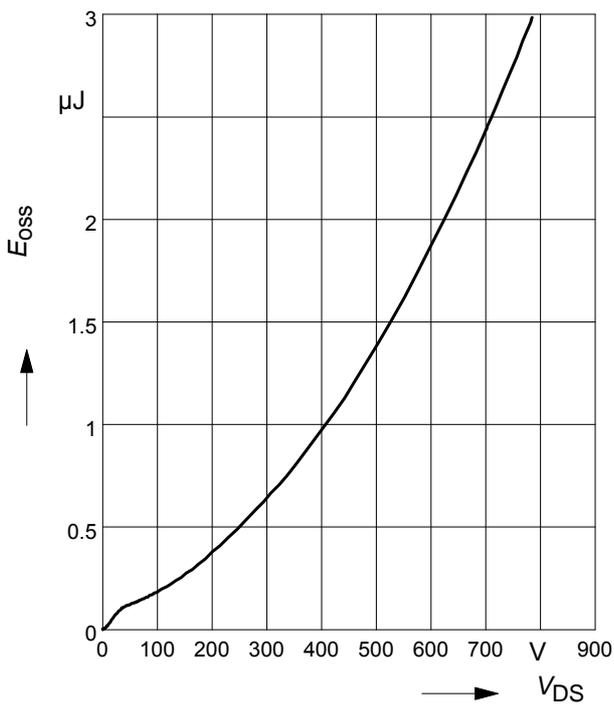
$C = f(V_{DS})$

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

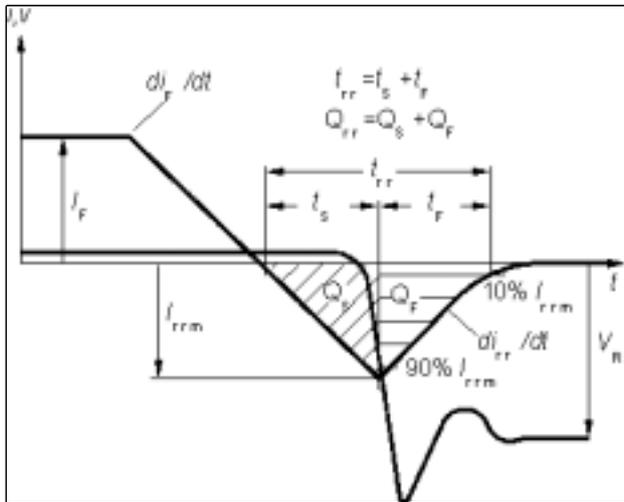


19 Typ. C_{oss} stored energy

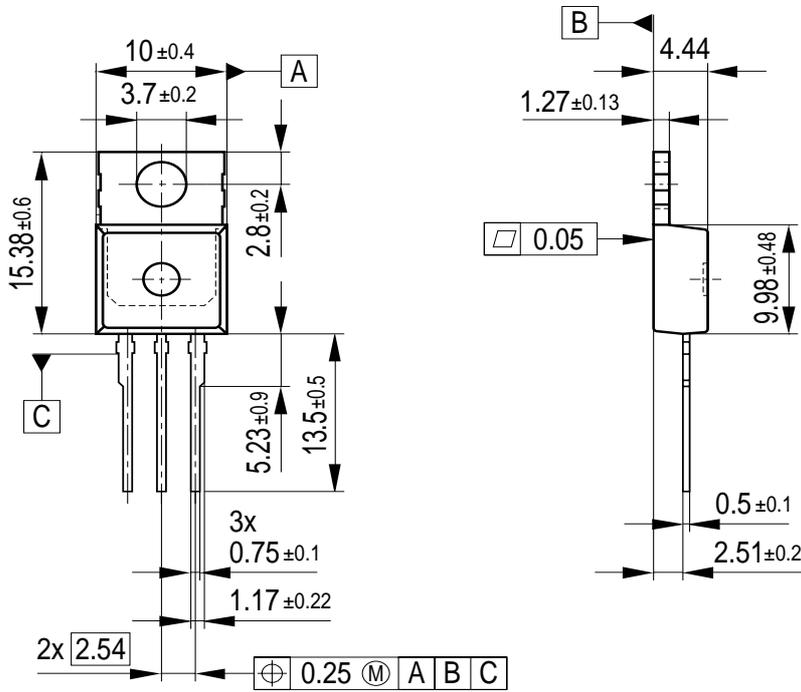
$E_{oss}=f(V_{DS})$



Definition of diodes switching characteristics

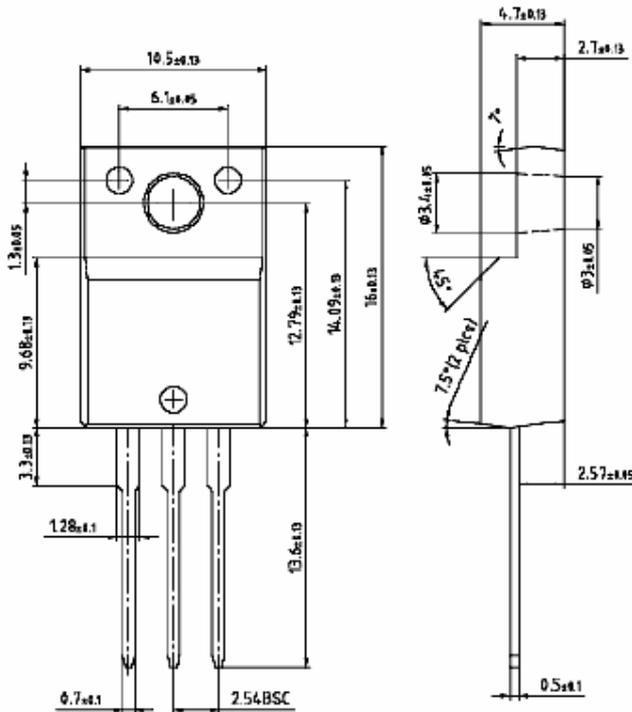


P-TO-220-3-1



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

P-TO-220-3-31 (FullPAK)



Please refer to mounting instructions (application note AN-TO220-3-31-01)



Final data

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