

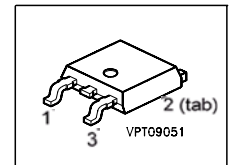
**Cool MOS™ Power Transistor**
**Feature**

- New revolutionary high voltage technology
- Worldwide best  $R_{DS(on)}$  in TO-252
- Ultra low gate charge
- Periodic avalanche rated
- Extreme  $dv/dt$  rated
- Ultra low effective capacitances
- Improved transconductance
- Pb-free lead plating; RoHS compliant, available in Halogen free mold compound<sup>a)</sup>
- Fully qualified according to JEDEC for Industrial Applications

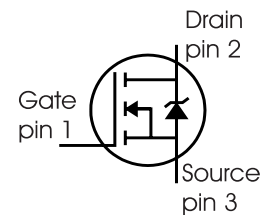
|                     |     |          |
|---------------------|-----|----------|
| $V_{DS} @ T_{jmax}$ | 560 | V        |
| $R_{DS(on)}$        | 0.6 | $\Omega$ |
| $I_D$               | 7.6 | A        |



PG-TO252



| Type       | Package  | Ordering Code | Marking |
|------------|----------|---------------|---------|
| SPD08N50C3 | PG-TO252 | Q67040-S4569  | 08N50C3 |


**Maximum Ratings, at  $T_C = 25^\circ\text{C}$ , unless otherwise specified**

| Parameter   | Symbol         | Value       | Unit             |
|---|----------------|-------------|------------------|
| Continuous drain current<br>$T_C = 25^\circ\text{C}$<br>$T_C = 100^\circ\text{C}$                                 | $I_D$          | 7.6<br>4.6  | A                |
| Pulsed drain current, $t_p$ limited by $T_{jmax}$   | $I_{D\ puls}$  | 22.8        |                  |
| Avalanche energy, single pulse<br>$I_D=5.5\text{A}, V_{DD}=50\text{V}$  | $E_{AS}$       | 230         | mJ               |
| Avalanche energy, repetitive $t_{AR}$ limited by $T_{jmax}$ <sup>1)</sup><br>$I_D=7.6\text{A}, V_{DD}=50\text{V}$ | $E_{AR}$       | 0.5         |                  |
| Avalanche current, repetitive $t_{AR}$ limited by $T_{jmax}$  | $I_{AR}$       | 7.6         | A                |
| Gate source voltage   | $V_{GS}$       | $\pm 20$    | V                |
| Gate source voltage AC ( $f > 1\text{Hz}$ )   | $V_{GS}$       | $\pm 30$    |                  |
| Power dissipation, $T_C = 25^\circ\text{C}$   | $P_{tot}$      | 83          | W                |
| Operating and storage temperature   | $T_j, T_{stg}$ | -55... +150 | $^\circ\text{C}$ |
| Reverse diode $dv/dt$ <sup>6)</sup>   | $dv/dt$        | 15          | V/ns             |

<sup>a)</sup> non-Halogen free (OPN: SPD08N50C3BT), Halogen free (OPN: SPD08N50C3AT)

**Maximum Ratings**

| Parameter   | Symbol  | Value | Unit |
|---|---------|-------|------|
| Drain Source voltage slope<br>$V_{DS} = 400 \text{ V}$ , $I_D = 7.6 \text{ A}$ , $T_j = 125 \text{ }^\circ\text{C}$ | $dv/dt$ | 50    | V/ns |

**Thermal Characteristics**

| Parameter   | Symbol     | Values |      |          | Unit             |
|---|------------|--------|------|----------|------------------|
|   |            | min.   | typ. | max.     |                  |
| Thermal resistance, junction - case   | $R_{thJC}$ | -      | -    | 1.5      | K/W              |
| Thermal resistance, junction - ambient, leaded  | $R_{thJA}$ | -      | -    | 75       |                  |
| SMD version, device on PCB:<br>@ min. footprint<br>@ 6 cm <sup>2</sup> cooling area <sup>2)</sup>   | $R_{thJA}$ | -      | -    | 75<br>50 |                  |
| Soldering temperature, reflow soldering, MSL3<br>1.6 mm (0.063 in.) from case for 10s <sup>3)</sup> | $T_{sold}$ | -      | -    | 260      | $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                                   | Symbol        | Conditions   | Values |            |          | Unit          |
|---|---------------|--|--------|------------|----------|---------------|
|   |               |  | min.   | typ.       | max.     |               |
| Drain-source breakdown voltage              | $V_{(BR)DSS}$ | $V_{GS}=0\text{V}$ , $I_D=0.25\text{mA}$   | 500    | -          | -        | V             |
| Drain-Source avalanche<br>breakdown voltage | $V_{(BR)DS}$  | $V_{GS}=0\text{V}$ , $I_D=7.6\text{A}$   | -      | 600        | -        |               |
| Gate threshold voltage                      | $V_{GS(th)}$  | $I_D=350\mu\text{A}$ , $V_{GS}=V_{DS}$   | 2.1    | 3          | 3.9      |               |
| Zero gate voltage drain current             | $I_{DSS}$     | $V_{DS}=500\text{V}$ , $V_{GS}=0\text{V}$ ,<br>$T_j=25^\circ\text{C}$ ,<br>$T_j=150^\circ\text{C}$ | -      | 0.5        | 1<br>100 | $\mu\text{A}$ |
| Gate-source leakage current                 | $I_{GSS}$     | $V_{GS}=20\text{V}$ , $V_{DS}=0\text{V}$   | -      | -          | 100      | nA            |
| Drain-source on-state resistance            | $R_{DS(on)}$  | $V_{GS}=10\text{V}$ , $I_D=4.6\text{A}$ ,<br>$T_j=25^\circ\text{C}$<br>$T_j=150^\circ\text{C}$     | -      | 0.5<br>1.5 | 0.6<br>- | $\Omega$      |
| Gate input resistance                       | $R_G$         | $f=1\text{MHz}$ , open Drain   | -      | 1.2        | -        |               |

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

| Parameter   | Symbol       | Conditions   | Values |      |      | Unit |
|---|--------------|--|--------|------|------|------|
|   |              |  | min.   | typ. | max. |      |
| Transconductance  | $g_{fs}$     | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$<br>$I_D = 4.6A$    | -      | 6    | -    | S    |
| Input capacitance   | $C_{iss}$    | $V_{GS} = 0V, V_{DS} = 25V,$<br>$f = 1MHz$                       | -      | 750  | -    | pF   |
| Output capacitance  | $C_{oss}$    |  | -      | 350  | -    |      |
| Reverse transfer capacitance                                  | $C_{rss}$    |  | -      | 12   | -    |      |
| Effective output capacitance, <sup>4)</sup><br>energy related | $C_{o(er)}$  | $V_{GS} = 0V,$<br>$V_{DS} = 0V \text{ to } 400V$                 | -      | 56   | -    | pF   |
| Effective output capacitance, <sup>5)</sup><br>time related   | $C_{o(tr)}$  |  | -      | 30   | -    |      |
| Turn-on delay time  | $t_{d(on)}$  | $V_{DD} = 400V, V_{GS} = 0/10V,$<br>$I_D = 7.6A, R_G = 12\Omega$ | -      | 6    | -    | ns   |
| Rise time   | $t_r$        |  | -      | 5    | -    |      |
| Turn-off delay time   | $t_{d(off)}$ |  | -      | 60   | -    |      |
| Fall time   | $t_f$        |  | -      | 7    | -    |      |

**Gate Charge Characteristics**

|                       |                 |  |   |    |   |    |
|-----------------------|-----------------|--|---|----|---|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 400V, I_D = 7.6A$                                  | - | 3  | - | nC |
| Gate to drain charge  | $Q_{gd}$        |  | - | 17 | - |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 400V, I_D = 7.6A,$<br>$V_{GS} = 0 \text{ to } 10V$ | - | 32 | - |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 400V, I_D = 7.6A$                                  | - | 5  | - | V  |

<sup>1</sup> Repetitive avalanche causes additional power losses that can be calculated as  $P_{AV} = E_{AR} \cdot f$ .

<sup>2</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70 μm thick) copper area for drain connection. PCB is vertical without blown air.

<sup>3</sup> Soldering temperature for TO-263: 220°C, reflow

<sup>4</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>5</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%  $V_{DSS}$ .

<sup>6</sup>  $I_{SD} \leq I_D, di/dt \leq 400A/\mu s, V_{DClink} = 400V, V_{peak} < V_{BR, DSS}, T_j < T_{j,max}$ .

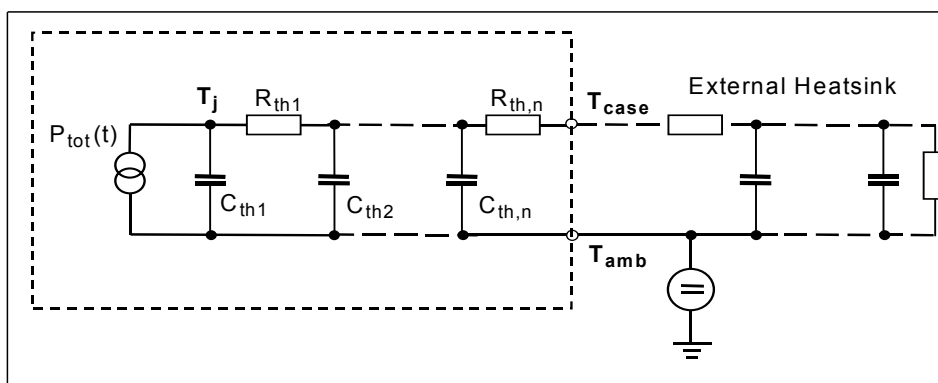
Identical low-side and high-side switch.

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

| Parameter                                     | Symbol       | Conditions           | Values |      |      | Unit      |
|---|--------------|----------------------|--------|------|------|-----------|
|   |              |                      | min.   | typ. | max. |           |
| Inverse diode continuous forward current      | $I_S$        | $T_C=25\text{ °C}$   | -      | -    | 7.6  | A         |
| Inverse diode direct current, pulsed          | $I_{SM}$     |                      | -      | -    | 22.8 |           |
| Inverse diode forward voltage                 | $V_{SD}$     | $V_{GS}=0V, I_F=I_S$ | -      | 1    | 1.2  | V         |
| Reverse recovery time                         | $t_{rr}$     | $V_R=400V, I_F=I_S,$ | -      | 370  | -    | ns        |
| Reverse recovery charge                       | $Q_{rr}$     | $di_F/dt=100A/\mu s$ | -      | 3.6  | -    | $\mu C$   |
| Peak reverse recovery current                 | $I_{rrm}$    |                      | -      | 25   | -    | A         |
| Peak rate of fall of reverse recovery current | $di_{rr}/dt$ |                      | -      | 700  | -    | $A/\mu s$ |

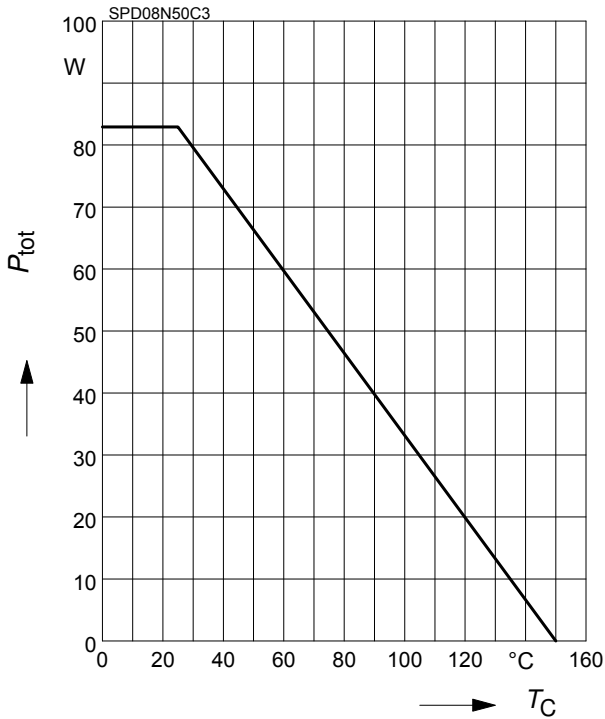
**Typical Transient Thermal Characteristics**

| Symbol             | Value | Unit | Symbol              | Value     | Unit |
|--------------------|-------|------|---------------------|-----------|------|
|                    | typ.  |      |                     | typ.      |      |
| Thermal resistance |       |      | Thermal capacitance |           |      |
| $R_{th1}$          | 0.024 | K/W  | $C_{th1}$           | 0.00012   | Ws/K |
| $R_{th2}$          | 0.046 |      | $C_{th2}$           | 0.0004578 |      |
| $R_{th3}$          | 0.085 |      | $C_{th3}$           | 0.000645  |      |
| $R_{th4}$          | 0.308 |      | $C_{th4}$           | 0.001867  |      |
| $R_{th5}$          | 0.317 |      | $C_{th5}$           | 0.004795  |      |
| $R_{th6}$          | 0.112 |      | $C_{th6}$           | 0.045     |      |



**1 Power dissipation**

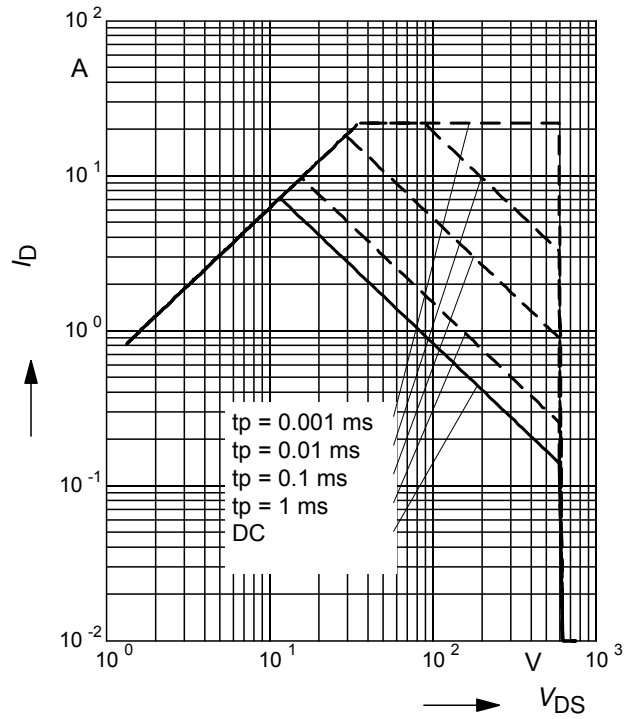
$P_{tot} = f(T_C)$



**2 Safe operating area**

$I_D = f(V_{DS})$

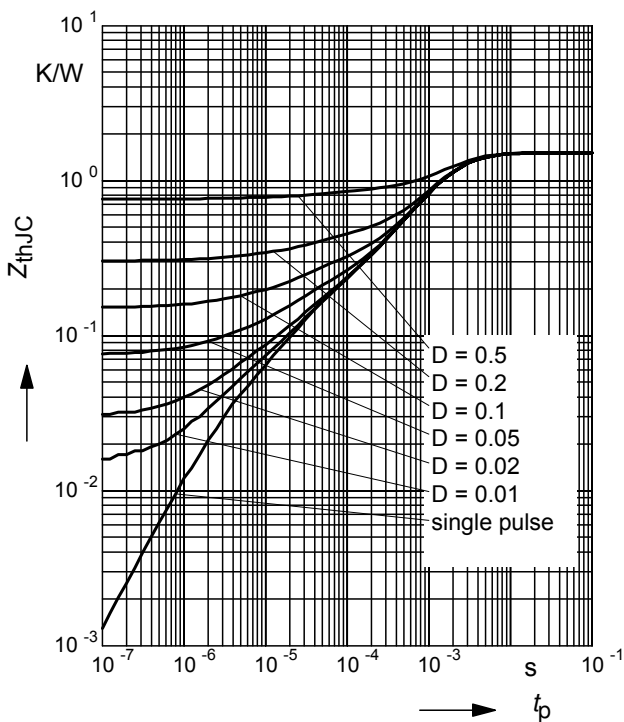
parameter :  $D = 0$  ,  $T_C = 25^\circ C$



**3 Transient thermal impedance**

$Z_{thJC} = f(t_p)$

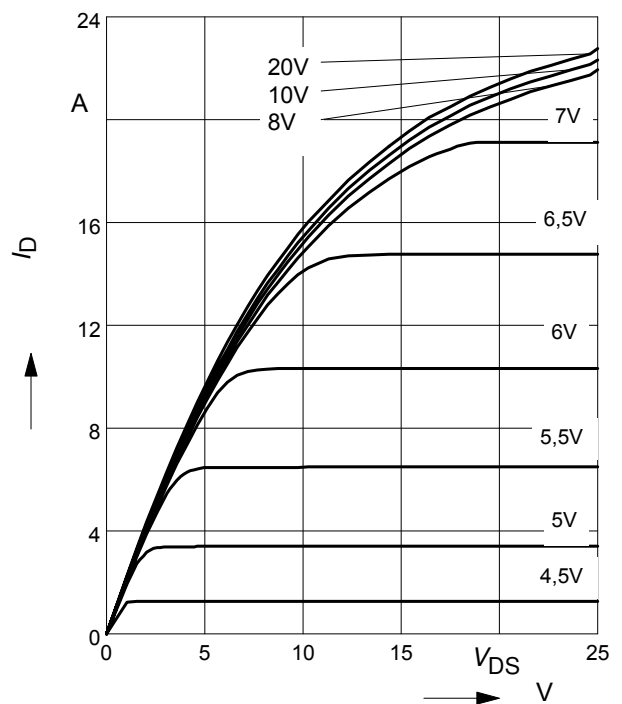
parameter:  $D = t_p/T$



**4 Typ. output characteristic**

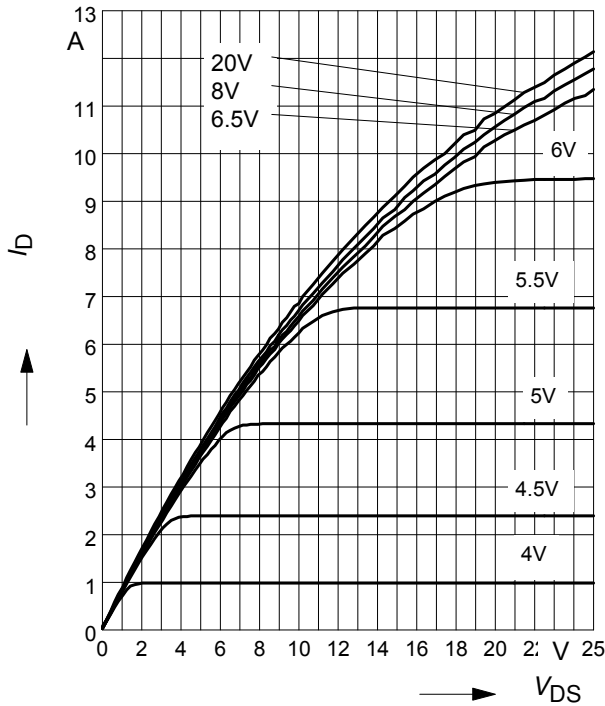
$I_D = f(V_{DS})$ ;  $T_j = 25^\circ C$

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



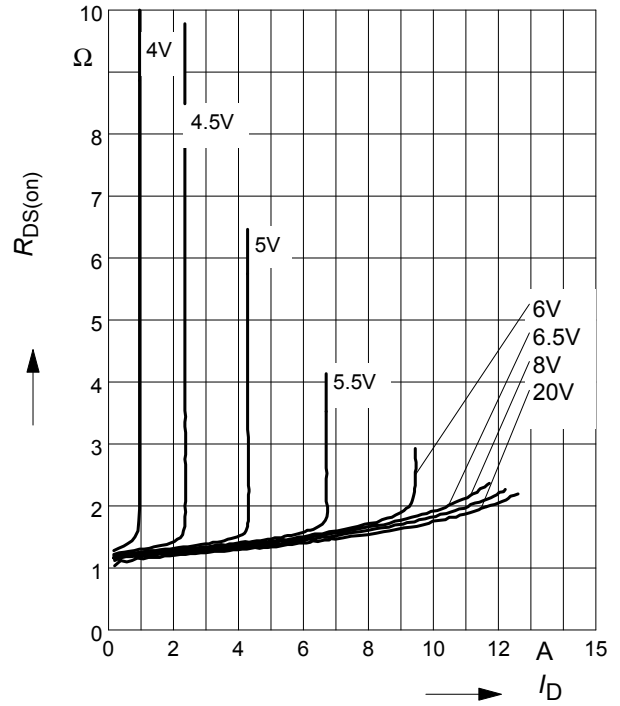
**5 Typ. output characteristic**

$I_D = f(V_{DS}); T_j = 150^\circ\text{C}$   
 parameter:  $t_p = 10 \mu\text{s}, V_{GS}$



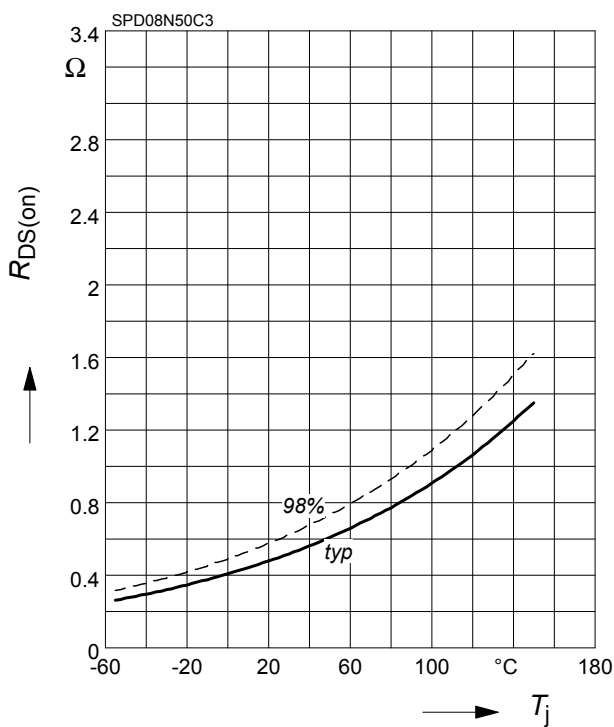
**6 Typ. drain-source on resistance**

$R_{DS(on)} = f(I_D)$   
 parameter:  $T_j = 150^\circ\text{C}, V_{GS}$



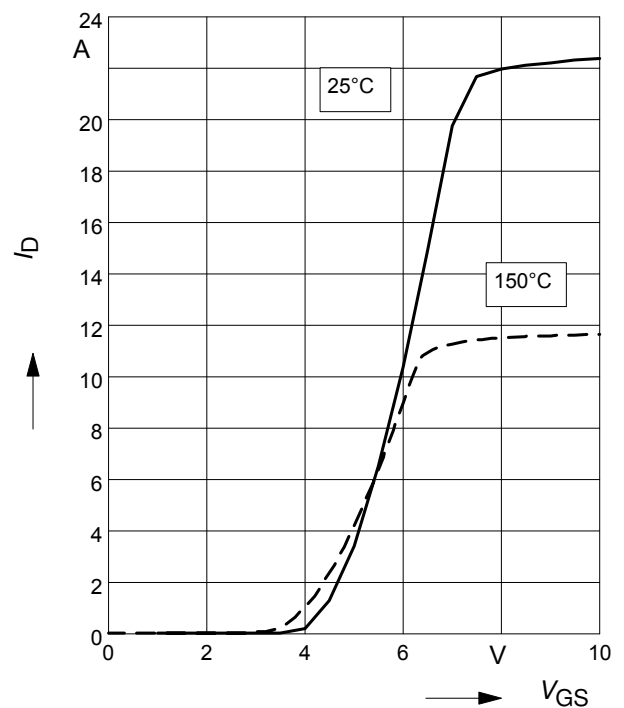
**7 Drain-source on-state resistance**

$R_{DS(on)} = f(T_j)$   
 parameter:  $I_D = 4.6 \text{ A}, V_{GS} = 10 \text{ V}$



**8 Typ. transfer characteristics**

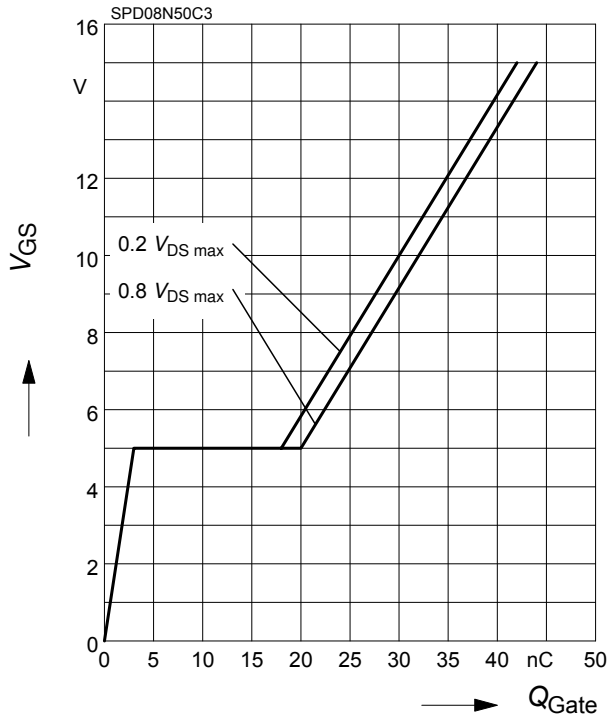
$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$   
 parameter:  $t_p = 10 \mu\text{s}$



**9 Typ. gate charge**

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

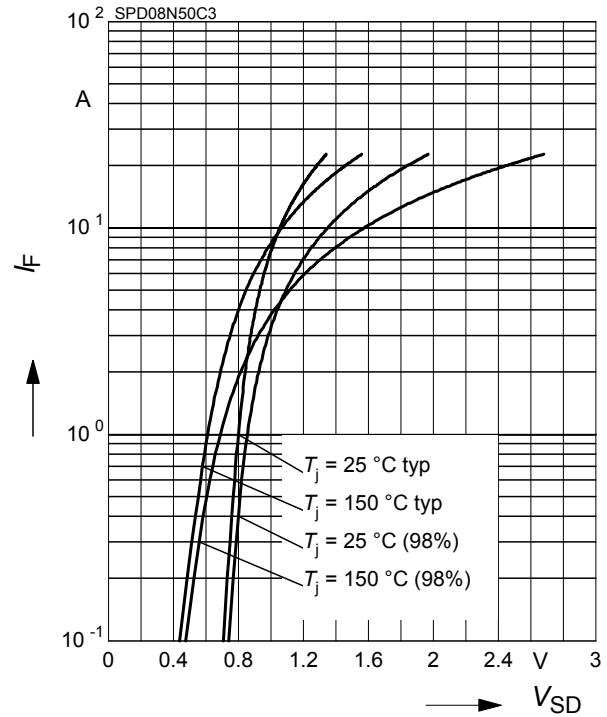
parameter:  $I_D = 7.6 \text{ A pulsed}$



**10 Forward characteristics of body diode**

$$I_F = f(V_{SD})$$

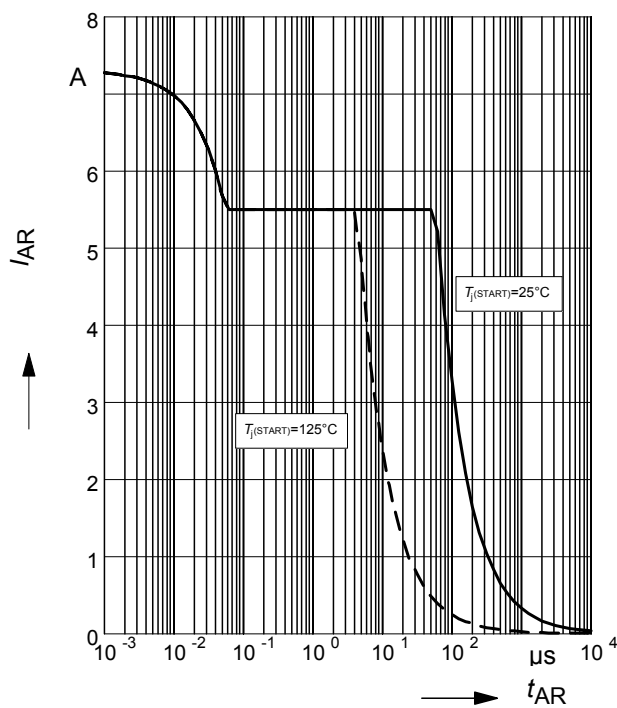
parameter:  $T_j, t_p = 10 \mu\text{s}$



**11 Avalanche SOA**

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

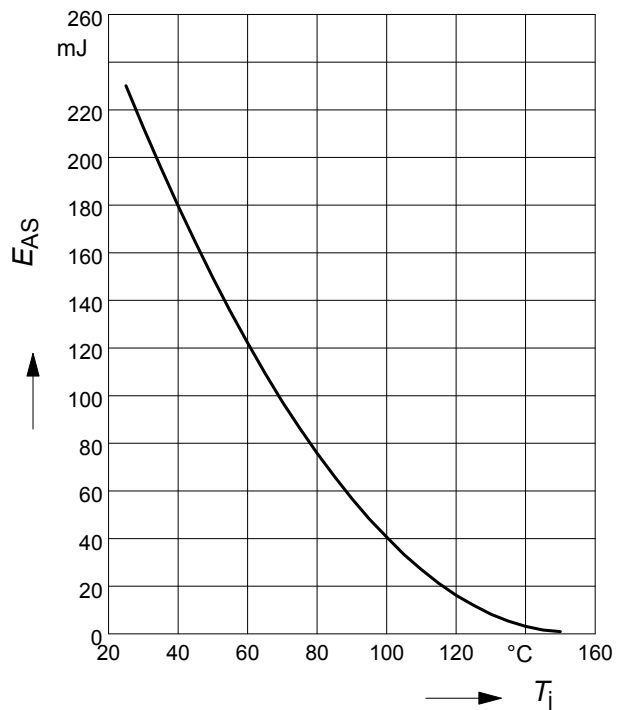
par.:  $T_j \leq 150 \text{ °C}$



**12 Avalanche energy**

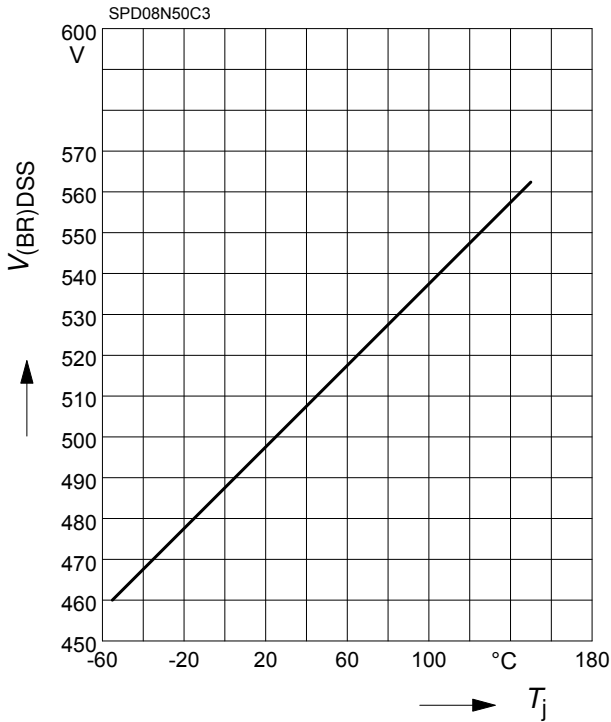
$$E_{AS} = f(T_j)$$

par.:  $I_D = 5.5 \text{ A}, V_{DD} = 50 \text{ V}$



**13 Drain-source breakdown voltage**

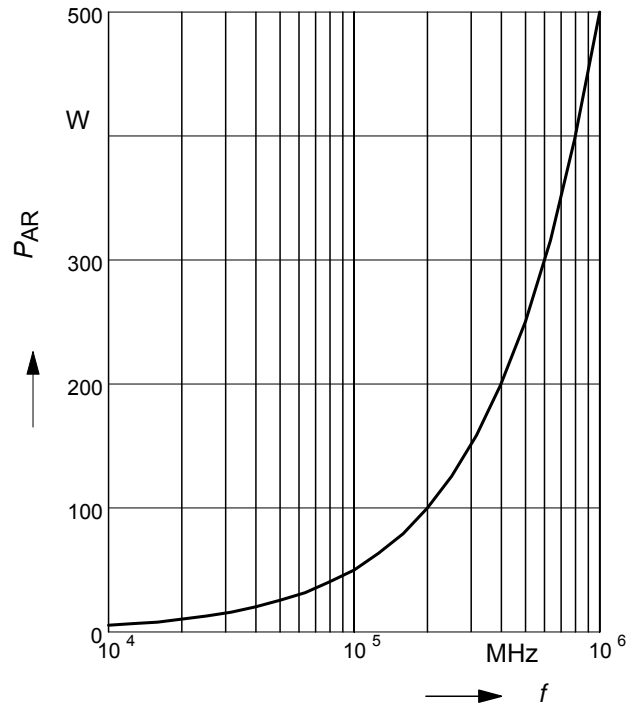
$$V_{(BR)DSS} = f(T_j)$$



**14 Avalanche power losses**

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

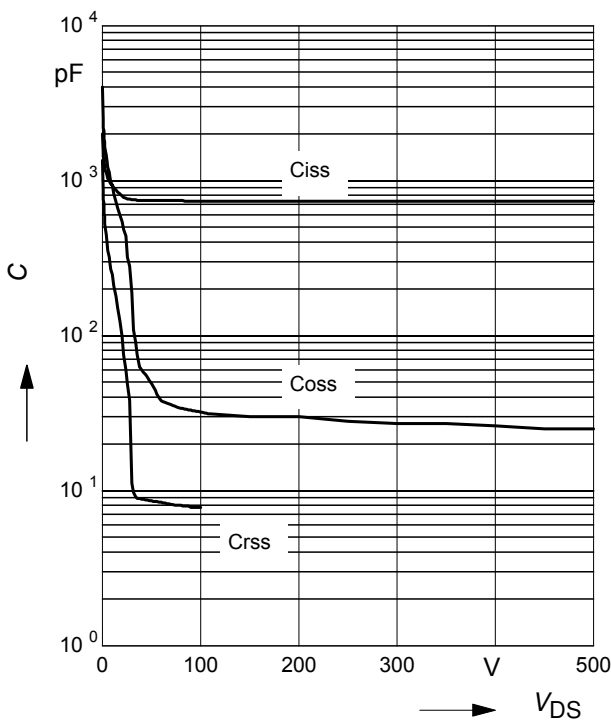
parameter:  $E_{AR}=0.5mJ$



**15 Typ. capacitances**

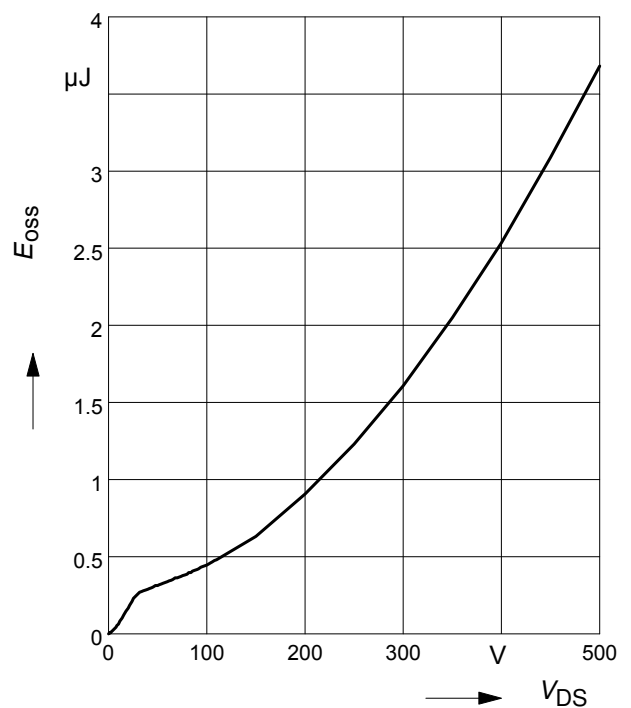
$$C = f(V_{DS})$$

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



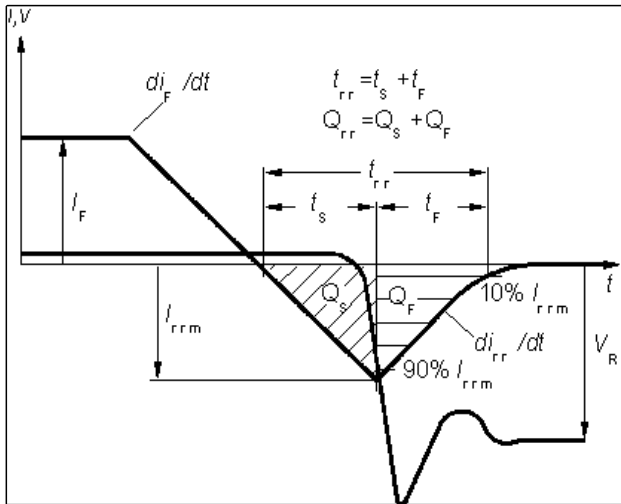
**16 Typ.  $C_{OSS}$  stored energy**

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

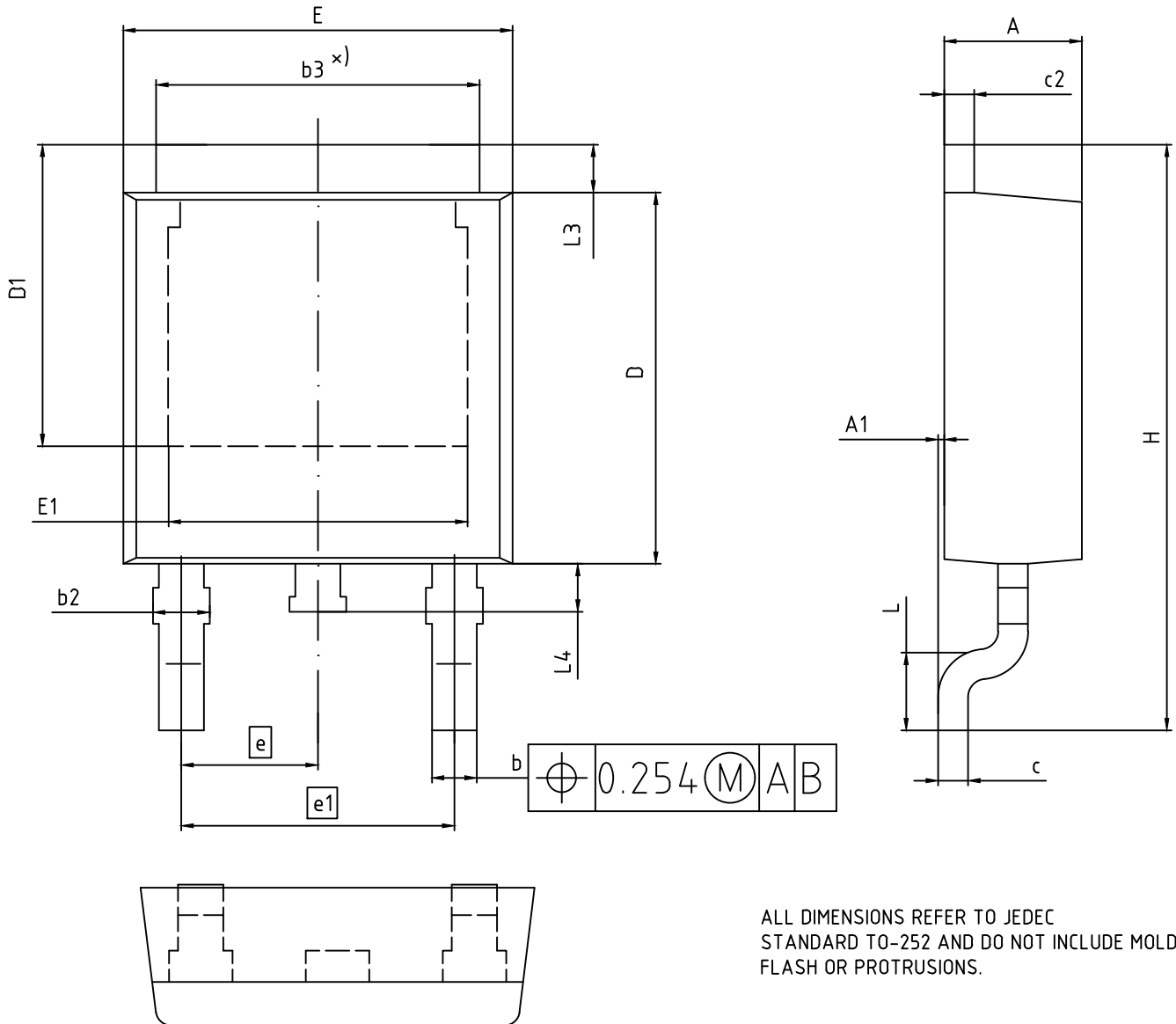




Definition of diodes switching characteristics



PG-TO252-3-1, PG-TO252-3-11, PG-TO252-3-21 (D-PAK)



ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

| DIMENSION | MILLIMETERS |       |
|-----------|-------------|-------|
|           | MIN.        | MAX.  |
| A         | 2.16        | 2.41  |
| A1        | 0.00        | 0.15  |
| b         | 0.64        | 0.89  |
| b2        | 0.65        | 1.15  |
| b3        | 4.95        | 5.50  |
| c         | 0.46        | 0.61  |
| c2        | 0.40        | 0.98  |
| D         | 5.97        | 6.22  |
| D1        | 5.02        | 5.84  |
| E         | 6.35        | 6.73  |
| E1        | 4.32        | 5.50  |
| e         | 2.29        |       |
| e1        | 4.57        |       |
| N         | 3           |       |
| H         | 9.40        | 10.48 |
| L         | 1.18        | 1.78  |
| L3        | 0.89        | 1.27  |
| L4        | 0.51        | 1.02  |

|                                      |
|--------------------------------------|
| <b>DOCUMENT NO.</b><br>Z8B00003328   |
| <b>REVISION</b><br>07                |
| <b>SCALE:</b><br>10:1<br>0 1 2mm<br> |
| <b>EUROPEAN PROJECTION</b><br>       |
| <b>ISSUE DATE</b><br>01.04.2020      |

## Revision History

SPD08N50C3

**Revision: 2020-05-26, Rev. 2.7**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.7      | 2020-05-26 | Update package outline                       |

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[SSM6P54TU,LF](#) [SSM6P69NU,LF](#) [DMP22D4UFO-7B](#)