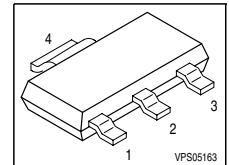


Cool MOS™ Power Transistor
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved transconductance
- Qualified according to JEDEC⁰⁾ for target applications

| | | |
|--------------|-----|----------|
| V_{DS} | 600 | V |
| $R_{DS(on)}$ | 1.4 | Ω |
| I_D | 0.7 | A |

SOT-223



| Type | Package | Ordering Code | Marking |
|------------|---------|---------------|---------|
| SPN03N60S5 | SOT-223 | Q67040-S4203 | 03N60S5 |

drain pins 2, 4



source pin3

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|----------------|-------------|--------------------|
| Continuous drain current $T_A = 25\text{ °C}$ $T_A = 70\text{ °C}$ | I_D | 0.7 0.4 | A |
| Pulsed drain current, t_p limited by T_{jmax} $T_A = 25\text{ °C}$ | I_D puls | 3 | |
| Gate source voltage | V_{GS} | ± 20 | V |
| Gate source voltage AC ($f > 1\text{Hz}$) | V_{GS} | ± 30 | |
| Power dissipation, $T_A = 25\text{ °C}$ | P_{tot} | 1.8 | W |
| Operating and storage temperature | T_j, T_{stg} | -55... +150 | $^{\circ}\text{C}$ |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|--|---------|-------|------|
| Drain Source voltage slope $V_{DS} = 480\text{ V}$, $I_D = 3.2\text{ A}$, $T_j = 125\text{ °C}$ | dv/dt | 20 | V/ns |

Thermal Characteristics

| Parameter | Symbol | Values | | | Unit |
|---|------------|--------|------|------|------|
| | | min. | typ. | max. | |
| Thermal resistance, junction - soldering point | R_{thJS} | - | 25 | - | K/W |
| SMD version, device on PCB: @ min. footprint @ 6 cm ² cooling area ¹⁾ | R_{thJA} | - | 110 | 62 | |
| | | - | - | 70 | |
| Soldering temperature, 1.6 mm (0.063 in.) from case for 10s | T_{sold} | - | - | 260 | °C |

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

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---------------|--|--------|------|------|------|
| | | | min. | typ. | max. | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{V}$, $I_D=0.25\text{mA}$ | 600 | - | - | V |
| Drain-Source avalanche breakdown voltage | $V_{(BR)DS}$ | $V_{GS}=0\text{V}$, $I_D=3.2\text{A}$ | - | 700 | - | |
| Gate threshold voltage | $V_{GS(th)}$ | $I_D=135\mu\text{A}$, $V_{GS}=V_{DS}$ | 3.5 | 4.5 | 5.5 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=600\text{V}$, $V_{GS}=0\text{V}$, $T_j=25\text{°C}$, $T_j=150\text{°C}$ | - | 0.5 | 1 | μA |
| | | | - | - | 50 | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20\text{V}$, $V_{DS}=0\text{V}$ | - | - | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{V}$, $I_D=2\text{A}$, $T_j=25\text{°C}$ $T_j=150\text{°C}$ | - | 1.26 | 1.4 | Ω |
| | | | - | 3.4 | - | |

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

| Parameter | Symbol | Conditions | Values | | | Unit |
|------------------------------|--------------|---|--------|------|------|------|
| | | | min. | typ. | max. | |
| Characteristics | | | | | | |
| Transconductance | g_{fs} | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 0.4\text{ A}$ | - | 0.73 | - | S |
| Input capacitance | C_{iss} | $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$ | - | 440 | - | pF |
| Output capacitance | C_{oss} | | - | 230 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 12 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 350\text{ V}$, $V_{GS} = 0/10\text{ V}$, $I_D = 0.7\text{ A}$, $R_G = 20\ \Omega$ | - | 35 | - | ns |
| Rise time | t_r | | - | 20 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 120 | - | |
| Fall time | t_f | | - | 30 | - | |

Gate Charge Characteristics

| | | | | | | |
|-----------------------|-----------------|--|---|------|---|----|
| Gate to source charge | Q_{gs} | $V_{DD} = 350\text{ V}$, $I_D = 0.7\text{ A}$ | - | 3 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 7.5 | - | |
| Gate charge total | Q_g | $V_{DD} = 350\text{ V}$, $I_D = 0.7\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ | - | 12.8 | - | |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD} = 350\text{ V}$, $I_D = 0.7\text{ A}$ | - | 8 | - | V |

⁰J-STD20 and JESD22

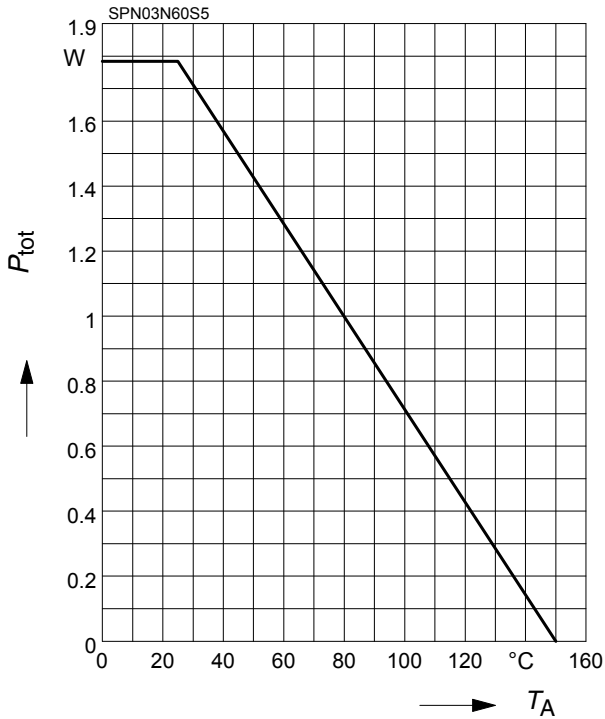
¹Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical without blown air.

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

| Parameter | Symbol | Conditions | Values | | | Unit |
|--|----------|-----------------------------------|--------|------|------|---------------|
| | | | min. | typ. | max. | |
| Inverse diode continuous forward current | I_S | $T_A=25^\circ\text{C}$ | - | - | 0.7 | A |
| Inverse diode direct current, pulsed | I_{SM} | | - | - | 3 | |
| Inverse diode forward voltage | V_{SD} | $V_{GS}=0\text{V}, I_F=I_S$ | - | 0.85 | 1.05 | V |
| Reverse recovery time | t_{rr} | $V_R=350\text{V}, I_F=I_S,$ | - | 200 | - | ns |
| Reverse recovery charge | Q_{rr} | $di_F/dt=100\text{A}/\mu\text{s}$ | - | 0.9 | - | μC |

1 Power dissipation

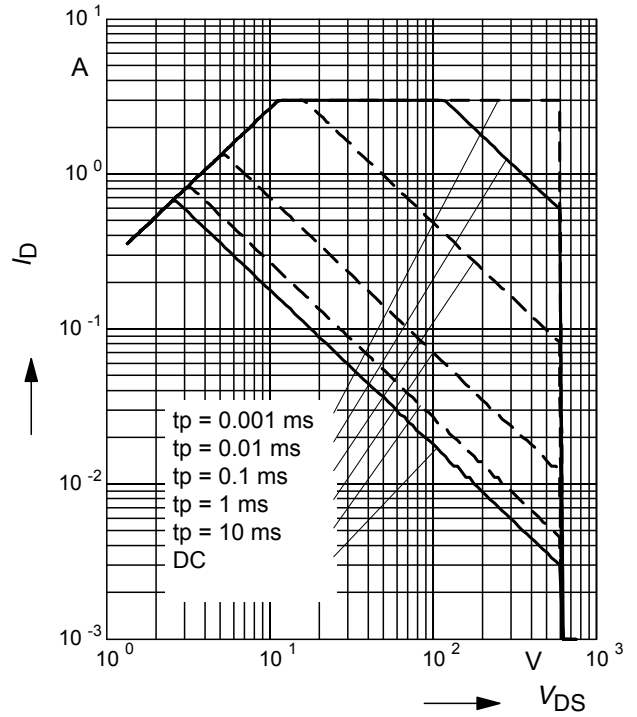
$P_{tot} = f(T_A)$



2 Safe operating area

$I_D = f(V_{DS})$

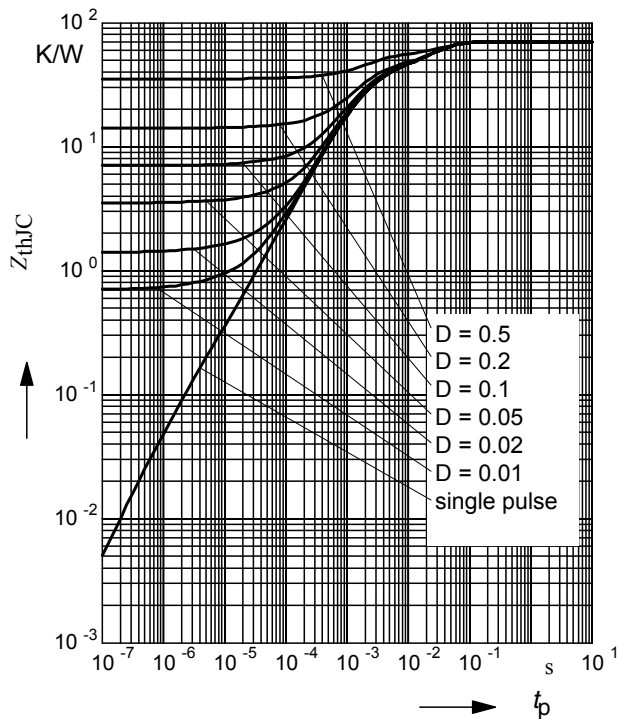
parameter : $D = 0$, $T_A = 25^\circ C$



3 Transient thermal impedance

$Z_{thJC} = f(t_p)$

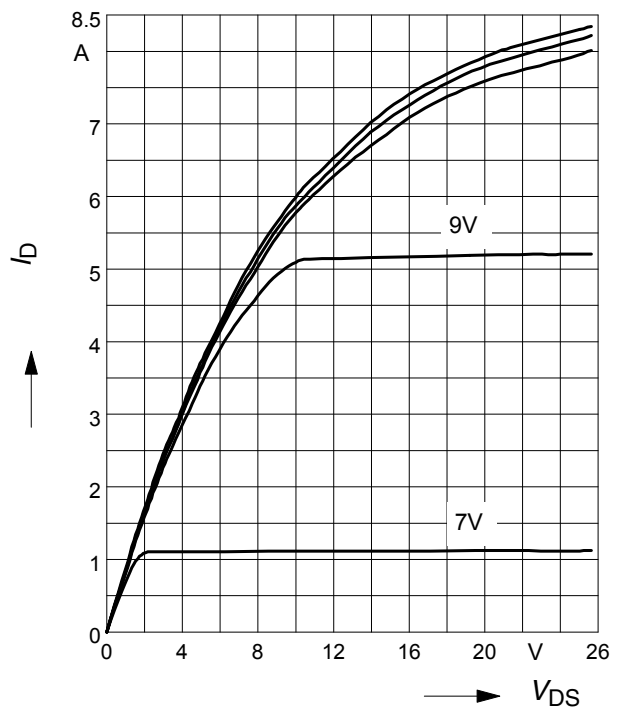
parameter: $D = t_p/T$



4 Typ. output characteristic

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

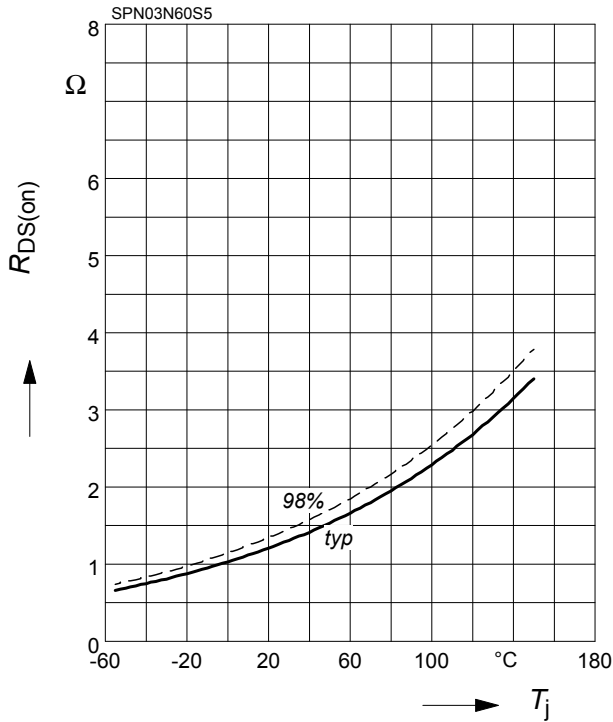
parameter: $t_p = 10 \mu s$, V_{GS}



5 Drain-source on-state resistance

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

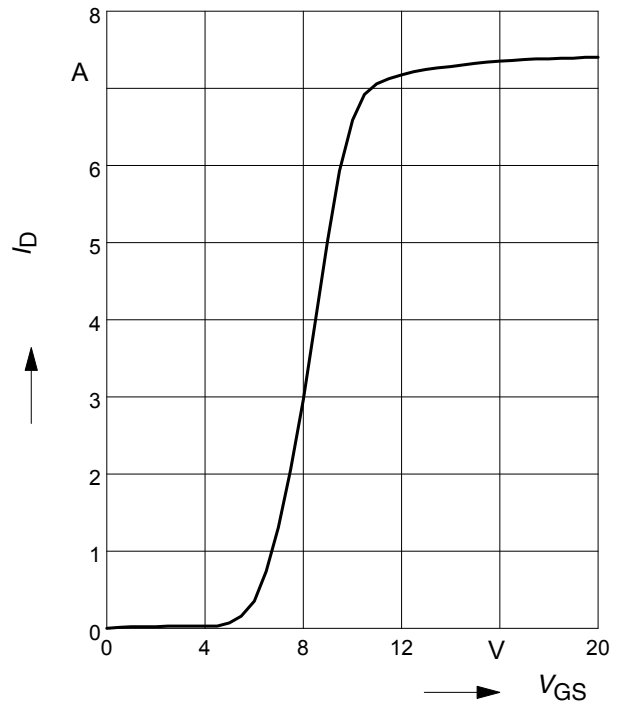
parameter: $I_D = 0.4 \text{ A}$, $V_{GS} = 10 \text{ V}$



6 Typ. transfer characteristics

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

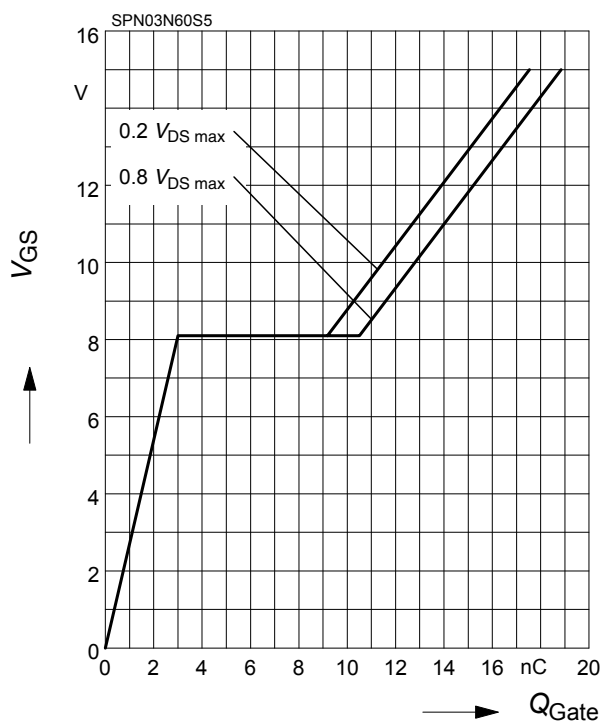
parameter: $t_p = 10 \mu\text{s}$



7 Typ. gate charge

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

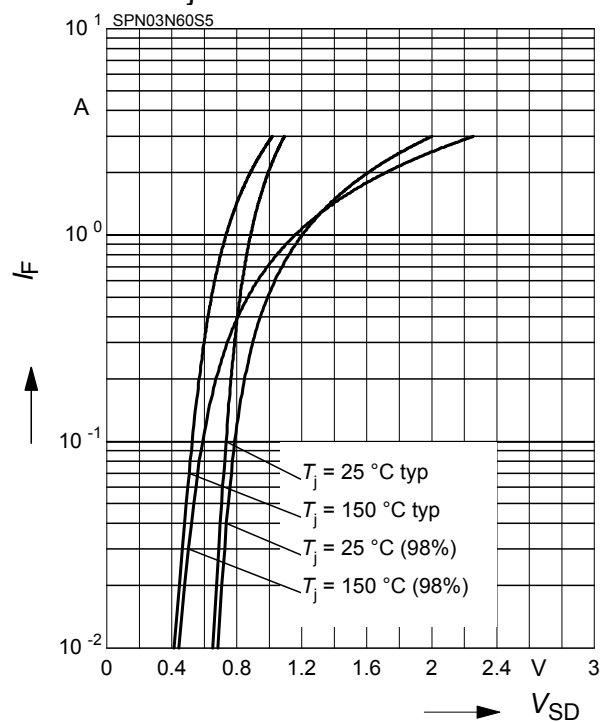
parameter: $I_D = 0.7 \text{ A}$ pulsed



8 Forward characteristics of body diode

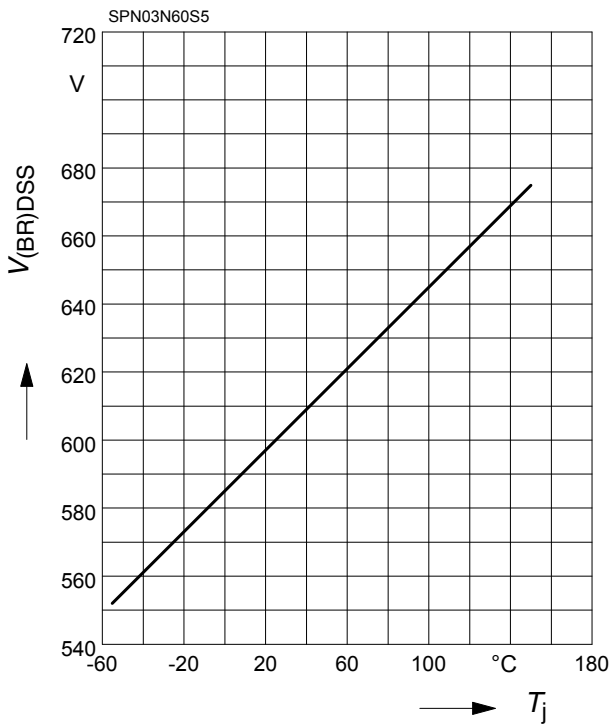
$$I_F = f(V_{SD})$$

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



9 Drain-source breakdown voltage

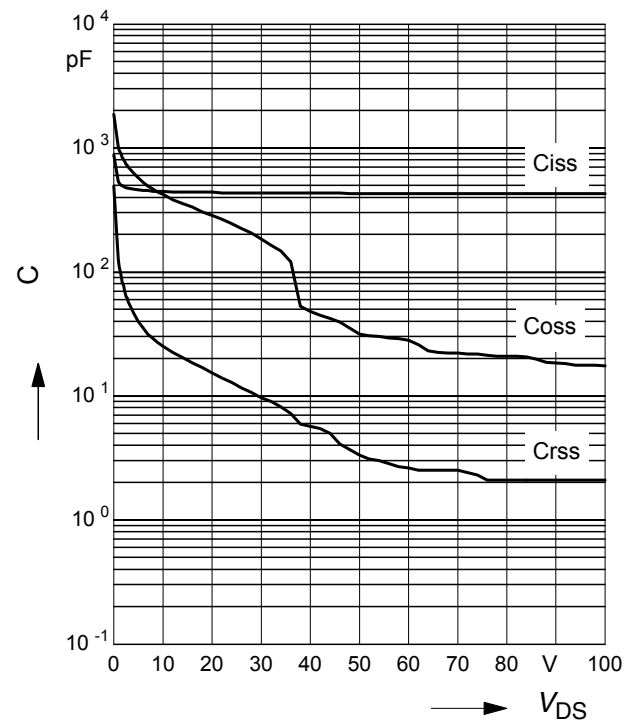
$$V_{(BR)DSS} = f(T_j)$$



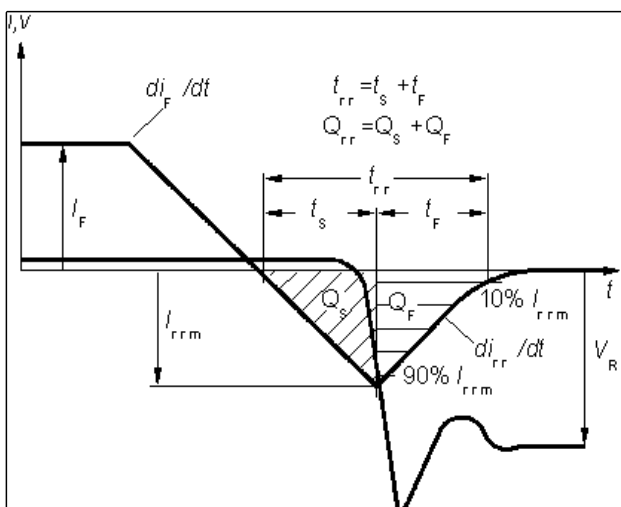
10 Typ. capacitances

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

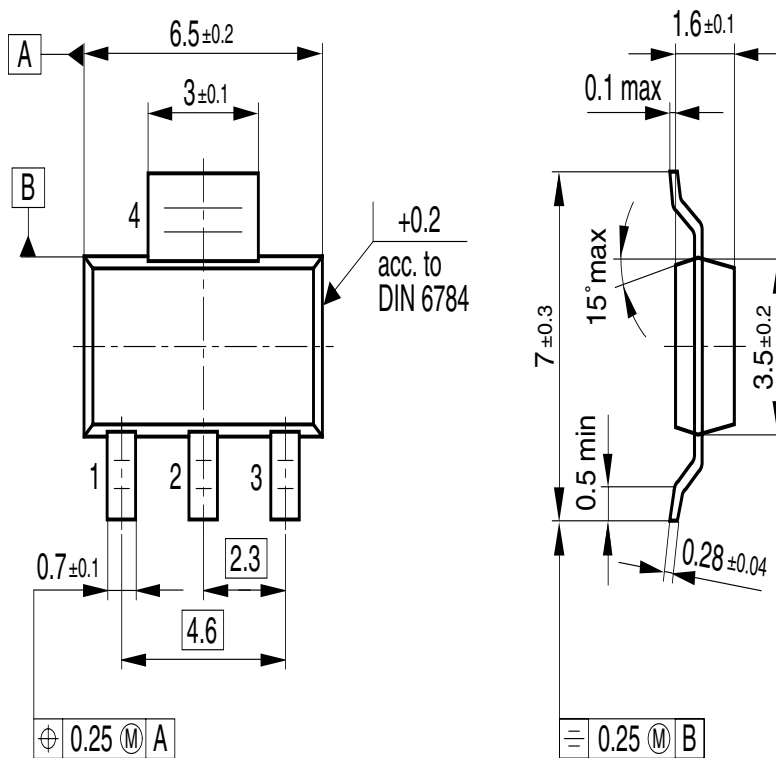
parameter: $V_{GS}=0V, f=1\text{ MHz}$



Definition of diodes switching characteristics



SOT223



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