

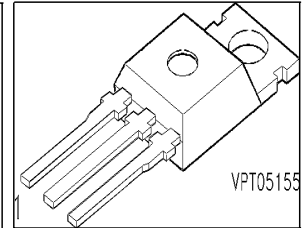
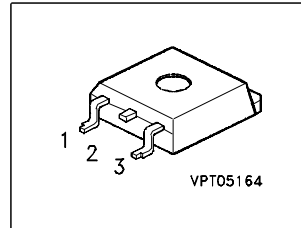
### SIPMOS® Power Transistor

#### Features

- N channel
- Enhancement mode
- Avalanche rated
- $dv/dt$  rated
- 175 °C operating temperature

#### Product Summary

|                                  |              |      |          |
|----------------------------------|--------------|------|----------|
| Drain source voltage             | $V_{DS}$     | 55   | V        |
| Drain-Source on-state resistance | $R_{DS(on)}$ | 0.05 | $\Omega$ |
| Continuous drain current         | $I_D$        | 22   | A        |



| Type           | Package     | Ordering Code   | Packaging     | Pin 1 | Pin 2 | Pin 3 |
|----------------|-------------|-----------------|---------------|-------|-------|-------|
| BUZ101S        | P-TO220-3-1 | Q67040-S4013-A2 | Tube          | G     | D     | S     |
| BUZ101S E3045A | P-TO263-3-2 | Q67040-S4013-A6 | Tape and Reel |       |       |       |
| BUZ101S E3045  | P-TO263-3-2 | Q67040-S4031-A5 | Tube          |       |       |       |

#### Maximum Ratings, at $T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter  | Symbol         | Value       | Unit               |
|--|----------------|-------------|--------------------|
| Continuous drain current<br>$T_C = 25\text{ °C}$<br>$T_C = 100\text{ °C}$  | $I_D$          | 22<br>16    | A                  |
| Pulsed drain current<br>$T_C = 25\text{ °C}$   | $I_{Dpulse}$   | 88          |                    |
| Avalanche energy, single pulse<br>$I_D = 22\text{ A}$ , $V_{DD} = 25\text{ V}$ , $R_{GS} = 25\text{ }\Omega$                               | $E_{AS}$       | 90          | mJ                 |
| Avalanche energy, periodic limited by $T_{jmax}$   | $E_{AR}$       | 5.5         |                    |
| Reverse diode $dv/dt$<br>$I_S = 22\text{ A}$ , $V_{DS} = 40\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ ,<br>$T_{jmax} = 175\text{ °C}$ | $dv/dt$        | 6           | kV/ $\mu\text{s}$  |
| Gate source voltage  | $V_{GS}$       | $\pm 20$    | V                  |
| Power dissipation<br>$T_C = 25\text{ °C}$  | $P_{tot}$      | 55          | W                  |
| Operating and storage temperature  | $T_j, T_{stg}$ | -55... +175 | $^{\circ}\text{C}$ |
| IEC climatic category; DIN IEC 68-1  |                | 55/175/56   |                    |

**Thermal Characteristics**

| Parameter   | Symbol     | Values |      |          | Unit |
|---|------------|--------|------|----------|------|
|   |            | min.   | typ. | max.     |      |
| <b>Characteristics</b>  |            |        |      |          |      |
| Thermal resistance, junction - case   | $R_{thJC}$ | -      | -    | 2.7      | K/W  |
| Thermal resistance, junction - ambient, leded   | $R_{thJA}$ | -      | -    | 62       |      |
| SMD version, device on PCB:<br>@ min. footprint<br>@ 6 cm <sup>2</sup> cooling area <sup>1)</sup> | $R_{thJA}$ | -      | -    | 62<br>40 |      |

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

| Parameter  | Symbol        | Values |       |          | Unit          |
|--|---------------|--------|-------|----------|---------------|
|  |               | min.   | typ.  | max.     |               |
| <b>Static Characteristics</b>  |               |        |       |          |               |
| Drain- source breakdown voltage<br>$V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$ , $T_j = 25\text{ }^\circ\text{C}$   | $V_{(BR)DSS}$ | 55     | -     | -        | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 40\text{ }\mu\text{A}$   | $V_{GS(th)}$  | 2.1    | 3     | 4        |               |
| Zero gate voltage drain current<br>$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$<br>$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ | $I_{DSS}$     | -      | 0.1   | 1<br>100 | $\mu\text{A}$ |
| Gate-source leakage current<br>$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$  | $I_{GSS}$     | -      | 10    | 100      | nA            |
| Drain-Source on-state resistance<br>$V_{GS} = 10\text{ V}$ , $I_D = 16\text{ A}$   | $R_{DS(on)}$  | -      | 0.042 | 0.05     | $\Omega$      |

<sup>1</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 $\mu\text{m}$  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       | Values |      |      | Unit |
|--|--------------|--------|------|------|------|
|  |              | min.   | typ. | max. |      |
| <b>Dynamic Characteristics</b>   |              |        |      |      |      |
| Transconductance<br>$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 16\text{ A}$                                    | $g_{fs}$     | 7      | 12   | -    | S    |
| Input capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                   | $C_{iss}$    | -      | 490  | 615  | pF   |
| Output capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                  | $C_{oss}$    | -      | 170  | 215  |      |
| Reverse transfer capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                        | $C_{rss}$    | -      | 95   | 120  |      |
| Turn-on delay time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 22\text{ A}$ ,<br>$R_G = 20\text{ }\Omega$  | $t_{d(on)}$  | -      | 15   | 25   | ns   |
| Rise time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 22\text{ A}$ ,<br>$R_G = 20\text{ }\Omega$           | $t_r$        | -      | 25   | 40   |      |
| Turn-off delay time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 22\text{ A}$ ,<br>$R_G = 20\text{ }\Omega$ | $t_{d(off)}$ | -      | 30   | 45   |      |
| Fall time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 22\text{ A}$ ,<br>$R_G = 20\text{ }\Omega$           | $t_f$        | -      | 25   | 40   |      |

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

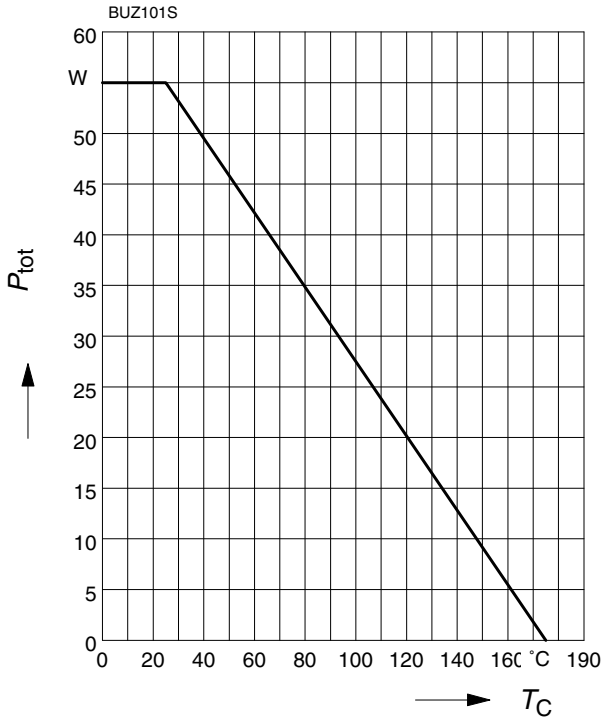
| Parameter  | Symbol                 | Values |      |      | Unit |
|--|------------------------|--------|------|------|------|
|  |                        | min.   | typ. | max. |      |
| <b>Dynamic Characteristics</b>   |                        |        |      |      |      |
| Gate to source charge<br>$V_{DD} = 40\text{ V}, I_D = 22\text{ A}$                               | $Q_{gs}$               | -      | 3    | 4.5  | nC   |
| Gate to drain charge<br>$V_{DD} = 40\text{ V}, I_D = 22\text{ A}$                                | $Q_{gd}$               | -      | 8    | 12   |      |
| Gate charge total<br>$V_{DD} = 40\text{ V}, I_D = 22\text{ A}, V_{GS} = 0\text{ to }10\text{ V}$ | $Q_g$                  | -      | 17   | 26   |      |
| Gate plateau voltage<br>$V_{DD} = 40\text{ V}, I_D = 22\text{ A}$                                | $V_{(\text{plateau})}$ | -      | 5.9  | -    | V    |

**Reverse Diode**

|   |          |   |      |      |               |
|---|----------|---|------|------|---------------|
| Inverse diode continuous forward current<br>$T_C = 25\text{ }^\circ\text{C}$                  | $I_S$    | - | -    | 22   | A             |
| Inverse diode direct current,pulsed<br>$T_C = 25\text{ }^\circ\text{C}$                       | $I_{SM}$ | - | -    | 88   |               |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}, I_F = 44\text{ A}$                     | $V_{SD}$ | - | 1.2  | 1.8  | V             |
| Reverse recovery time<br>$V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$   | $t_{rr}$ | - | 55   | 85   | ns            |
| Reverse recovery charge<br>$V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ | $Q_{rr}$ | - | 0.12 | 0.18 | $\mu\text{C}$ |

**Power Dissipation**

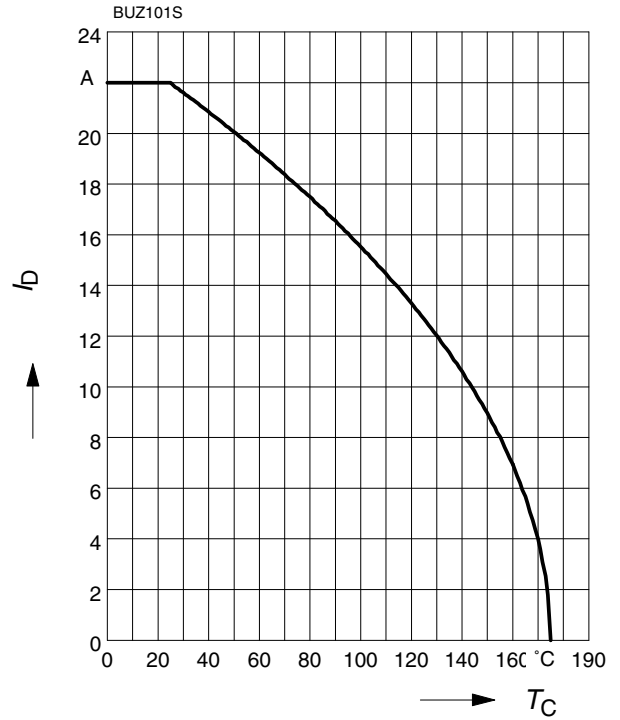
$P_{tot} = f(T_C)$



**Drain current**

$I_D = f(T_C)$

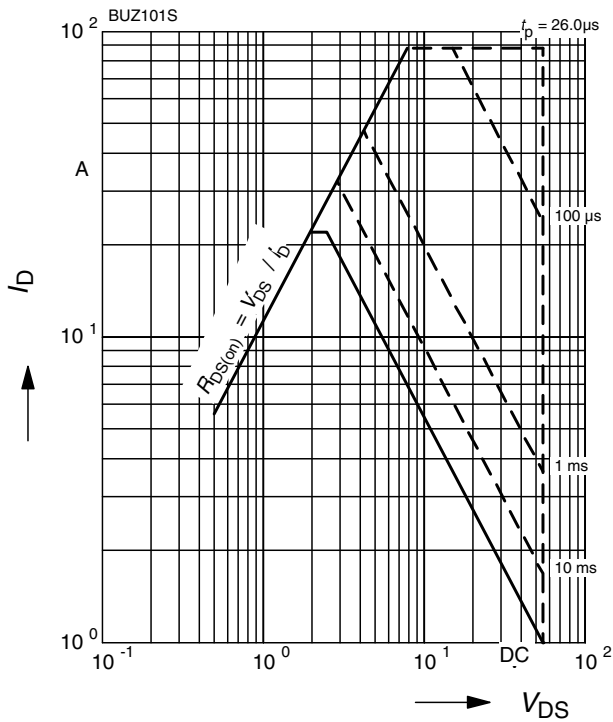
parameter:  $V_{GS} \geq 10\text{ V}$



**Safe operating area**

$I_D = f(V_{DS})$

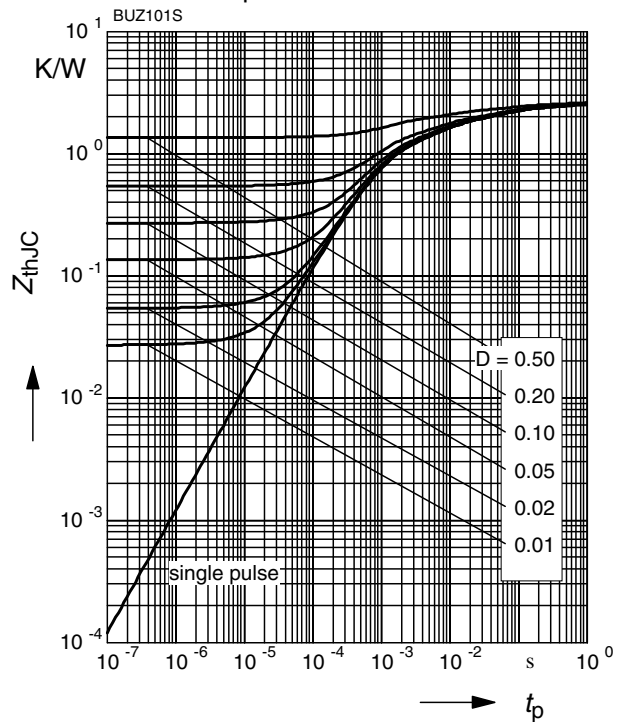
parameter:  $D = 0, T_C = 25\text{ °C}$



**Transient thermal impedance**

$Z_{thJC} = f(t_p)$

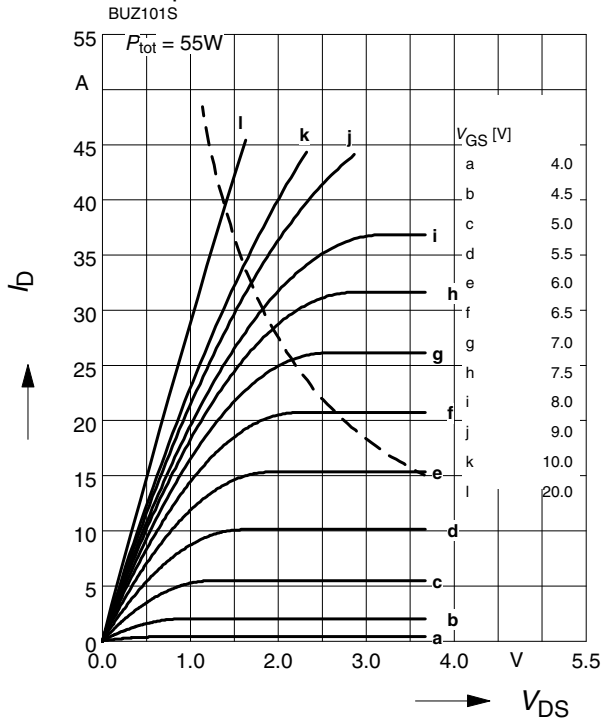
parameter:  $D = t_p/T$



**Typ. output characteristics**

$I_D = f(V_{DS})$

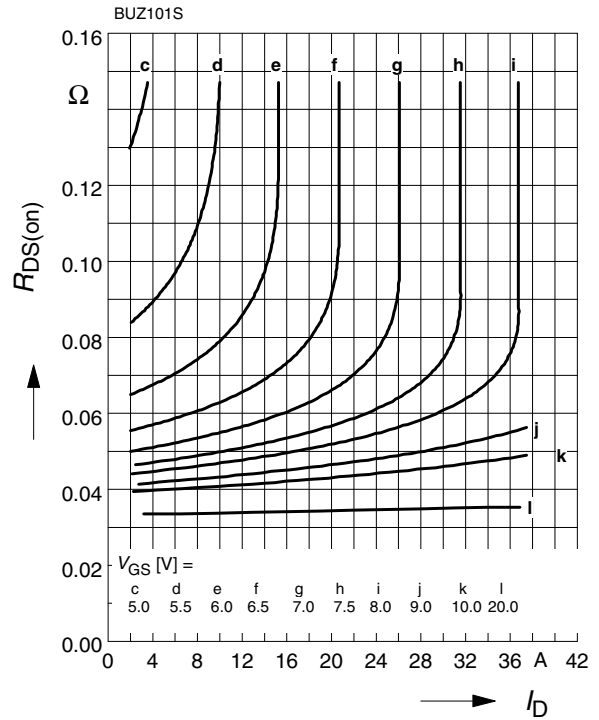
parameter:  $t_p = 80 \mu s$



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

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

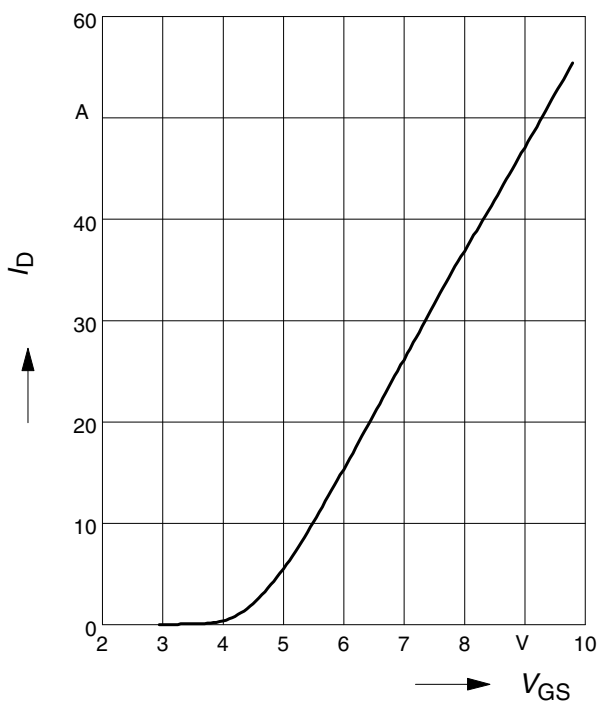
parameter:  $V_{GS}$



**Typ. transfer characteristics  $I_D = f(V_{GS})$**

parameter:  $t_p = 80 \mu s$

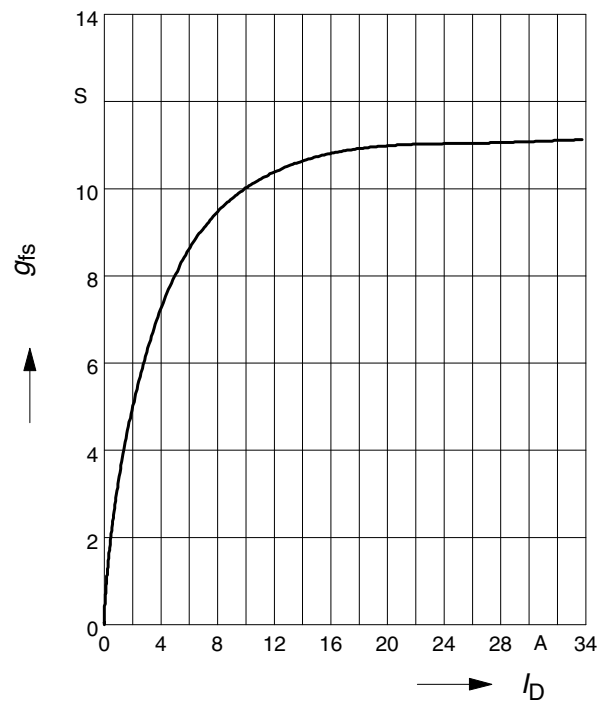
$V_{DS} \geq 2 \times I_D \times R_{DS(on)} \text{ max}$



**Typ. forward transconductance**

$g_{fs} = f(I_D); T_j = 25^\circ C$

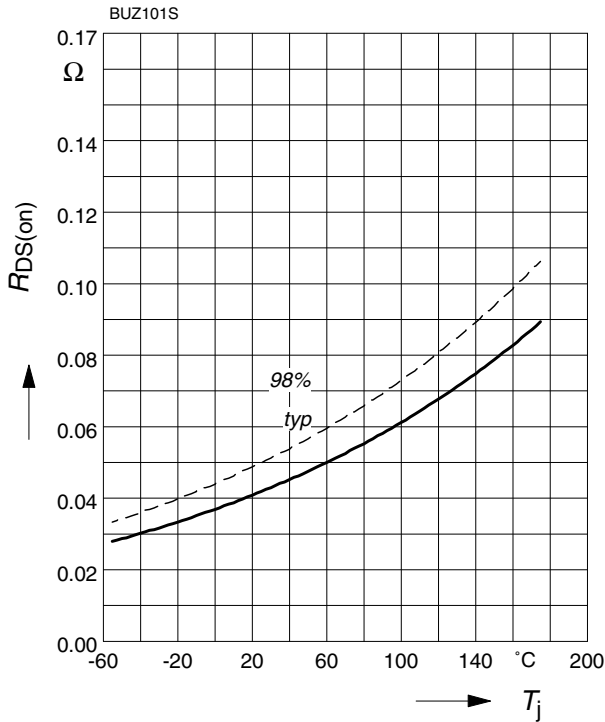
parameter:  $g_{fs}$



**Drain-source on-resistance**

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

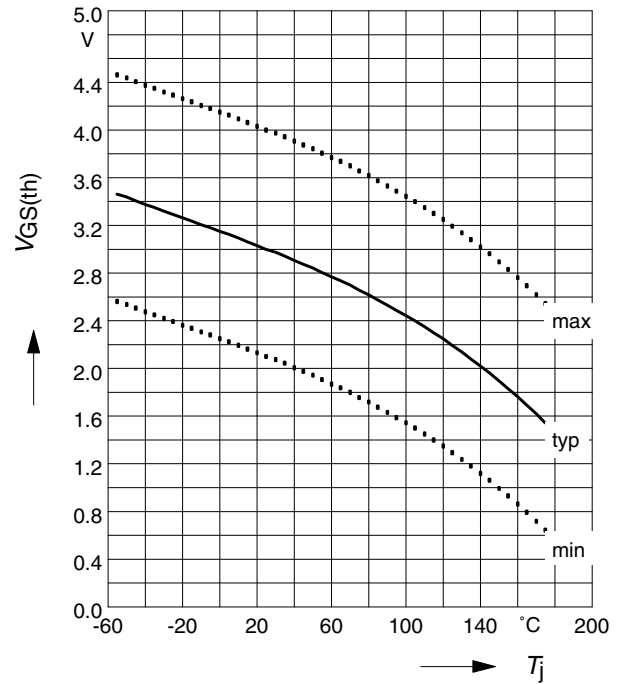
parameter :  $I_D = 16 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



**Gate threshold voltage**

$$V_{GS(th)} = f(T_j)$$

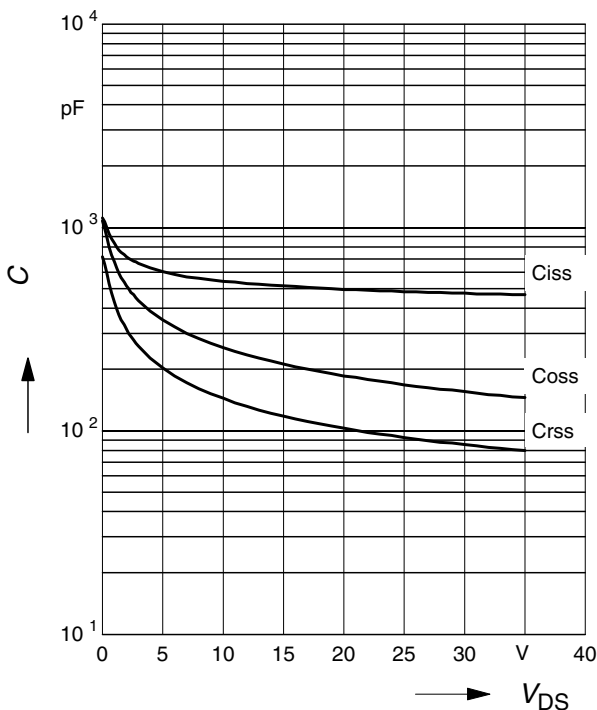
parameter :  $V_{GS} = V_{DS}$ ,  $I_D = 40 \mu\text{A}$



**Typ. capacitances**

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

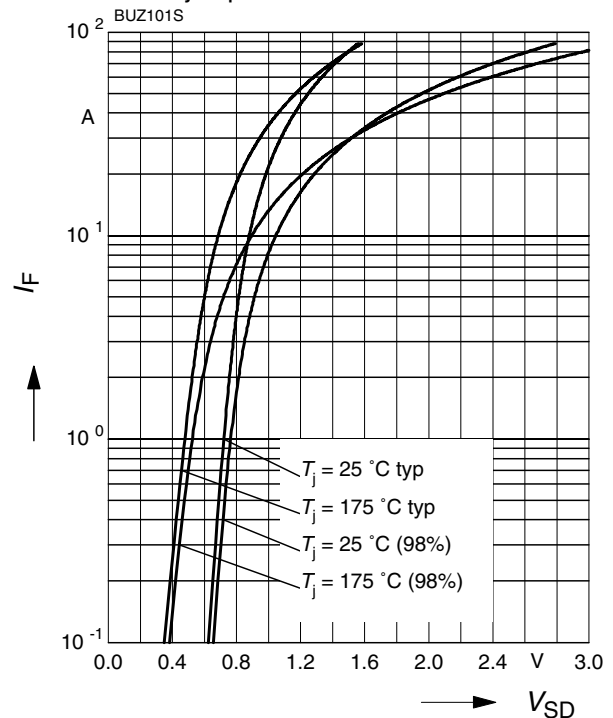
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



**Forward characteristics of reverse diode**

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

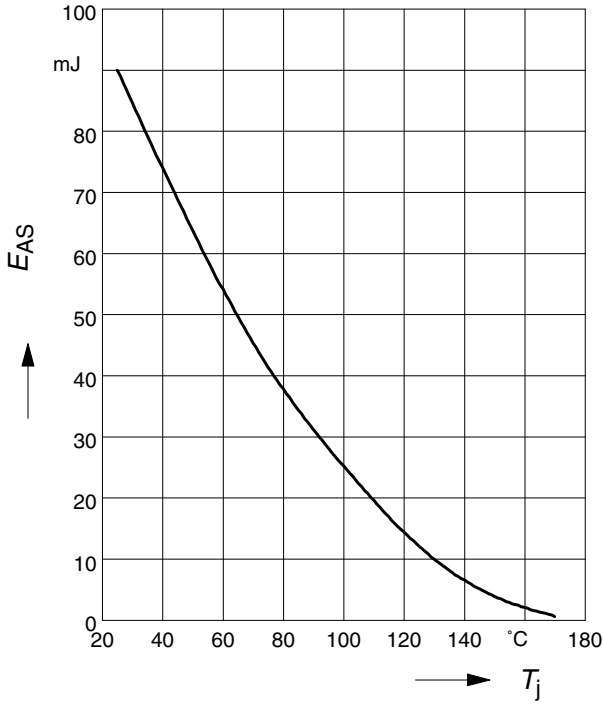
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**Avalanche Energy  $E_{AS} = f(T_j)$**

parameter:  $I_D = 22\text{ A}$ ,  $V_{DD} = 25\text{ V}$

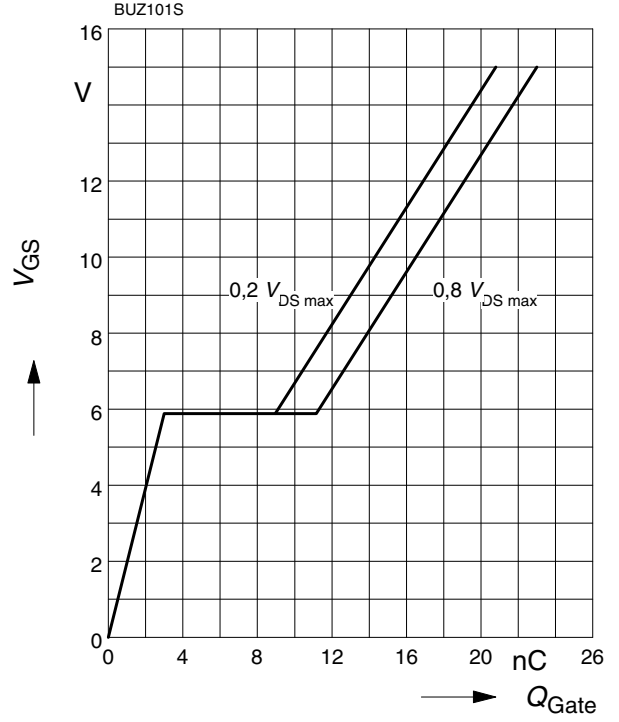
$R_{GS} = 25\ \Omega$



**Typ. gate charge  $V_{GS} = f(Q_{Gate})$**

parameter:  $I_{D\ puls} = 22\text{ A}$

parameter:  $I_{D\ puls} = 22\text{ A}$



**Drain-source breakdown voltage  $V_{(BR)DSS} = f(T_j)$**

parameter:  $I_{D\ puls} = 22\text{ A}$

