

**OptiMOS® Power-Transistor**
**Feature**

- Dual N-Channel
- Enhancement mode
- Logic Level
- 150 °C operating temperature
- Avalanche rated
- dv/dt rated

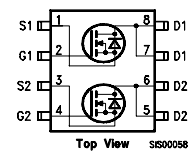
**Product Summary**

|              |    |    |
|--------------|----|----|
| $V_{DS}$     | 55 | V  |
| $R_{DS(on)}$ | 35 | mΩ |
| $I_D$        | 5  | A  |

P-DSO-8 -3



| Type      | Package    | Ordering Code | Marking |
|-----------|------------|---------------|---------|
| BSO604NS2 | P-DSO-8 -3 | Q67060-S7309  | 2N604L  |


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

| Parameter                                                                                                           | Symbol              | Value       | Unit  |
|---------------------------------------------------------------------------------------------------------------------|---------------------|-------------|-------|
| Continuous drain current<br>$T_A=25\text{ °C}$ , one channel active<br>$T_A=70\text{ °C}$ , one channel active      | $I_D$               | 5<br>4      | A     |
| Pulsed drain current, one channel active<br>$T_A=25\text{ °C}$                                                      | $I_{D\text{ puls}}$ | 20          |       |
| Avalanche energy, single pulse<br>$I_D=5\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ Ω}$                    | $E_{AS}$            | 90          | mJ    |
| Reverse diode dv/dt<br>$I_S=5\text{ A}$ , $V_{DS}=44\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{jmax}=150\text{ °C}$ | dv/dt               | 6           | kV/μs |
| Gate source voltage                                                                                                 | $V_{GS}$            | ±20         | V     |
| Power dissipation, one channel active<br>$T_A=25\text{ °C}$                                                         | $P_{tot}$           | 2           | W     |
| Operating and storage temperature                                                                                   | $T_j, T_{stg}$      | -55... +150 | °C    |
| IEC climatic category; DIN IEC 68-1                                                                                 |                     | 55/150/56   |       |

**Thermal Characteristics**

| Parameter                                                | Symbol     | Values |      |      | Unit |
|----------------------------------------------------------|------------|--------|------|------|------|
|                                                          |            | min.   | typ. | max. |      |
| Characteristics                                          |            |        |      |      |      |
| Thermal resistance, junction - soldering point           | $R_{thJS}$ | -      | 34   | 50   | K/W  |
| SMD version, device on PCB:                              | $R_{thJA}$ |        |      |      |      |
| @ min. footprint ; t ≤ 10 s                              |            | -      | -    | 100  |      |
| @ 6 cm <sup>2</sup> cooling area <sup>1)</sup> ; t ≤10 s |            | -      | -    | 62.5 |      |

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

| Parameter                                                                                                                | Symbol        | Values |           |          | Unit       |
|--------------------------------------------------------------------------------------------------------------------------|---------------|--------|-----------|----------|------------|
|                                                                                                                          |               | min.   | typ.      | max.     |            |
| Static Characteristics                                                                                                   |               |        |           |          |            |
| Drain-source breakdown voltage<br>$V_{GS}=0V, I_D=1mA$                                                                   | $V_{(BR)DSS}$ | 55     | -         | -        | V          |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=30\mu A$                                                               | $V_{GS(th)}$  | 1.2    | 1.6       | 2        |            |
| Zero gate voltage drain current<br>$V_{DS}=55V, V_{GS}=0V, T_j=25^{\circ}C$<br>$V_{DS}=55V, V_{GS}=0V, T_j=150^{\circ}C$ | $I_{DSS}$     | -<br>- | 0.01<br>1 | 1<br>100 | $\mu A$    |
| Gate-source leakage current<br>$V_{GS}=20V, V_{DS}=0V$                                                                   | $I_{GSS}$     | -      | 1         | 100      |            |
| Drain-source on-state resistance<br>$V_{GS}=4.5V, I_D=2.5A$                                                              | $R_{DS(on)}$  | -      | 38        | 44       | m $\Omega$ |
| Drain-source on-state resistance<br>$V_{GS}=10V, I_D=2.5A$                                                               | $R_{DS(on)}$  | -      | 31        | 35       |            |

<sup>1</sup>Device on  $40\text{mm} \times 40\text{mm} \times 1.5\text{mm}$  epoxy PCB FR4 with  $6\text{cm}^2$  (one layer,  $70 \mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

**Electrical Characteristics**

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

**Dynamic Characteristics**

|                              |              |                                                             |     |      |     |    |
|------------------------------|--------------|-------------------------------------------------------------|-----|------|-----|----|
| Transconductance             | $g_{fs}$     | $V_{DS} \geq 2 * I_D *$<br>$R_{DS(on)max}=0.4V, I_D=5A$     | 6.7 | 13.4 | -   | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=25V,$<br>$f=1MHz$                        | -   | 656  | 870 | pF |
| Output capacitance           | $C_{oss}$    |                                                             | -   | 154  | 205 |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                             | -   | 49   | 75  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=27.5V, V_{GS}=4.5V,$<br>$I_D=5A,$<br>$R_G=75\Omega$ | -   | 9    | 14  | ns |
| Rise time                    | $t_r$        |                                                             | -   | 8    | 13  |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                             | -   | 52   | 78  |    |
| Fall time                    | $t_f$        |                                                             | -   | 8    | 12  |    |

**Gate Charge Characteristics**

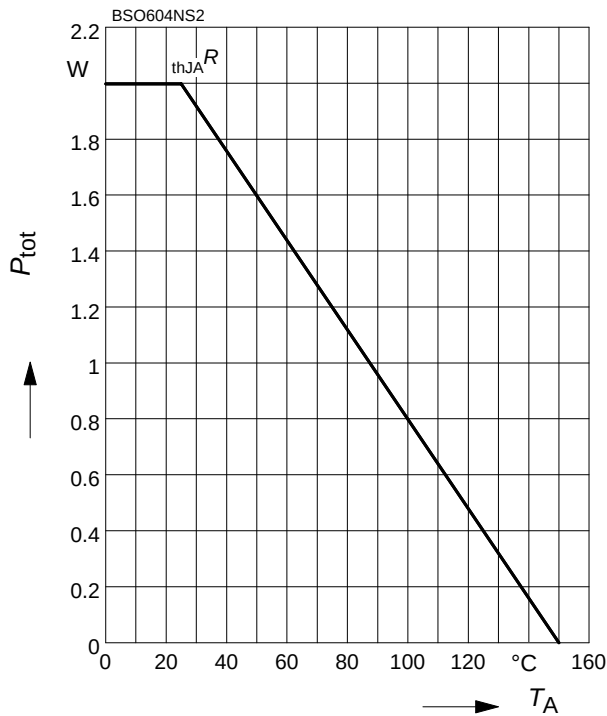
|                       |                 |                                                     |   |      |    |    |
|-----------------------|-----------------|-----------------------------------------------------|---|------|----|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD}=44V, I_D=5A$                                | - | 2    | 3  | nC |
| Gate to drain charge  | $Q_{gd}$        |                                                     | - | 6.6  | 10 |    |
| Gate charge total     | $Q_g$           | $V_{DD}=44V, I_D=5A,$<br>$V_{GS}=0 \text{ to } 10V$ | - | 19.7 | 26 |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD}=44V, I_D=5A$                                | - | 2.9  | -  | V  |

**Reverse Diode**

|                                          |          |                                               |   |     |     |    |
|------------------------------------------|----------|-----------------------------------------------|---|-----|-----|----|
| Inverse diode continuous forward current | $I_S$    | $T_A=25^\circ C$                              | - | -   | 5   | A  |
| Inv. diode direct current, pulsed        | $I_{SM}$ |                                               | - | -   | 20  |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS}=0V, I_F=5A$                           | - | 0.9 | 1.3 | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R=27.5V, I_F=I_S,$<br>$di_F/dt=100A/\mu s$ | - | 32  | 40  | ns |
| Reverse recovery charge                  | $Q_{rr}$ |                                               | - | 34  | 43  | nC |

### 1 Power dissipation

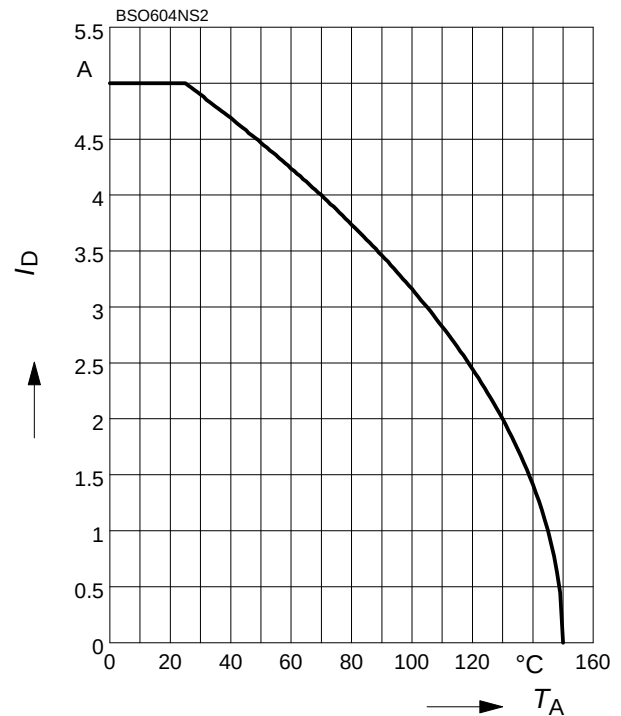
$$P_{\text{tot}} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

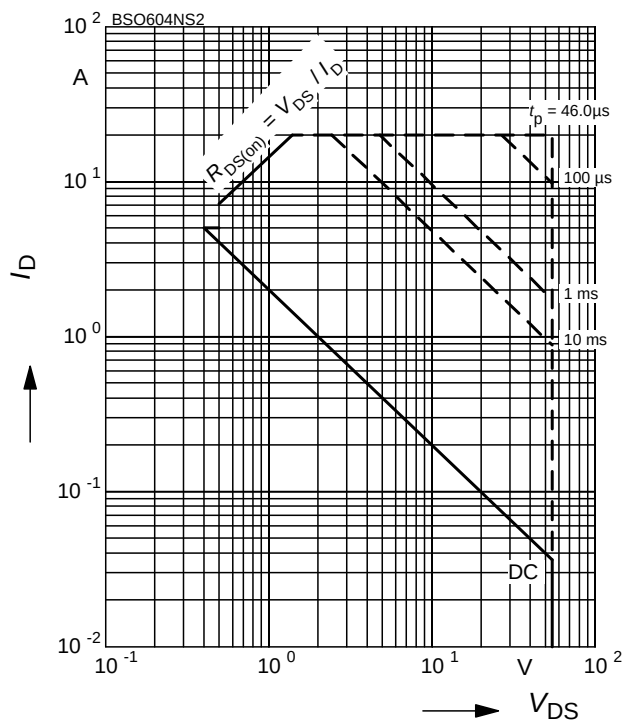
parameter:  $V_{\text{GS}} \geq 10$  V



### 3 Safe operating area

$$I_D = f(V_{\text{DS}})$$

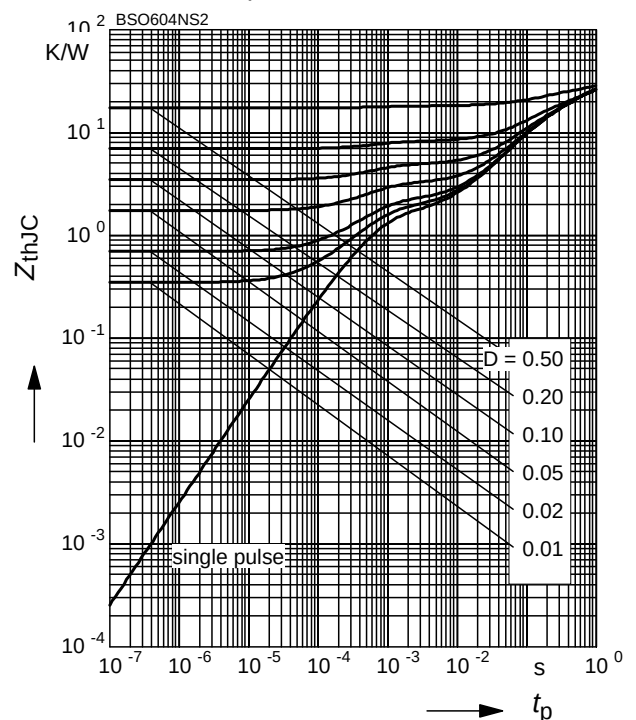
parameter:  $D = 0$ ,  $T_A = 25$  °C



### 4 Max. transient thermal impedance

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

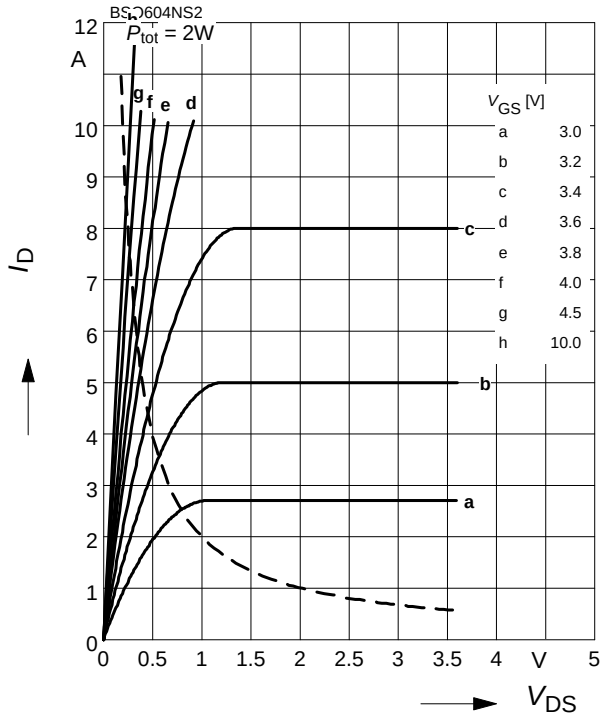
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

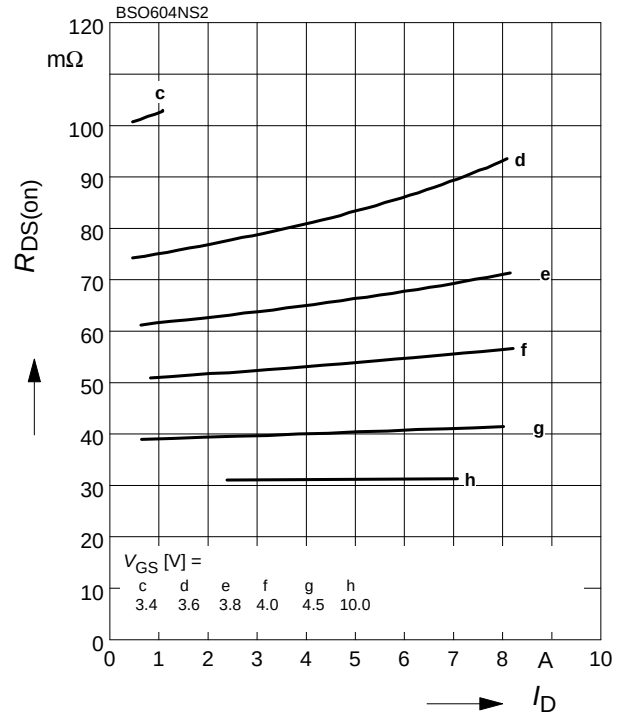
$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

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


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

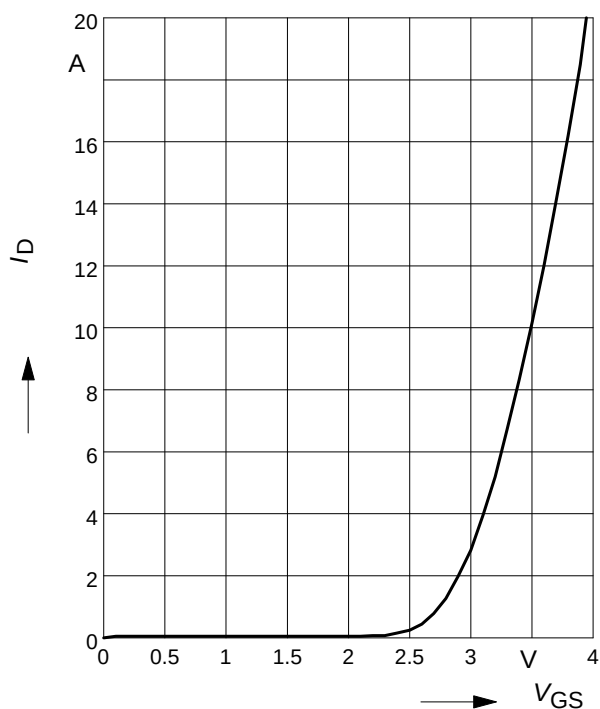
$$R_{DS(\text{on})} = f(I_D)$$

parameter:  $V_{GS}$


**7 Typ. transfer characteristics**

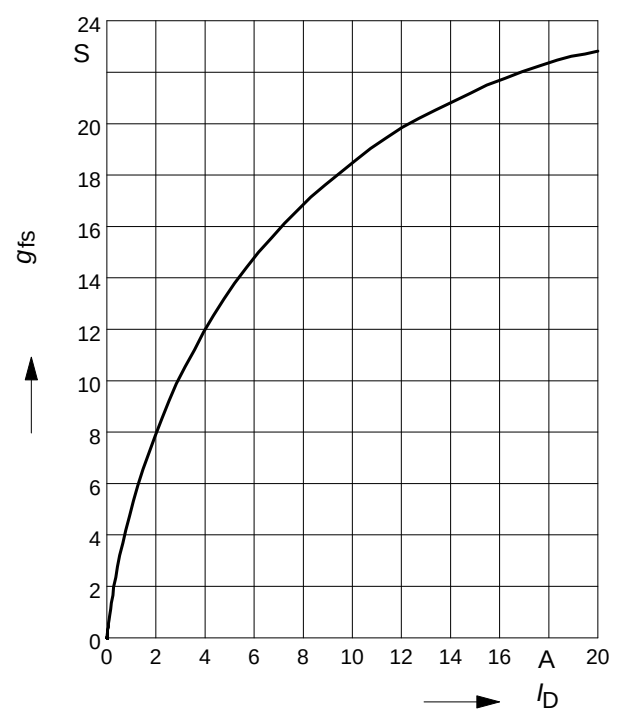
$$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(\text{on})\text{max}}$$

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


**8 Typ. forward transconductance**

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

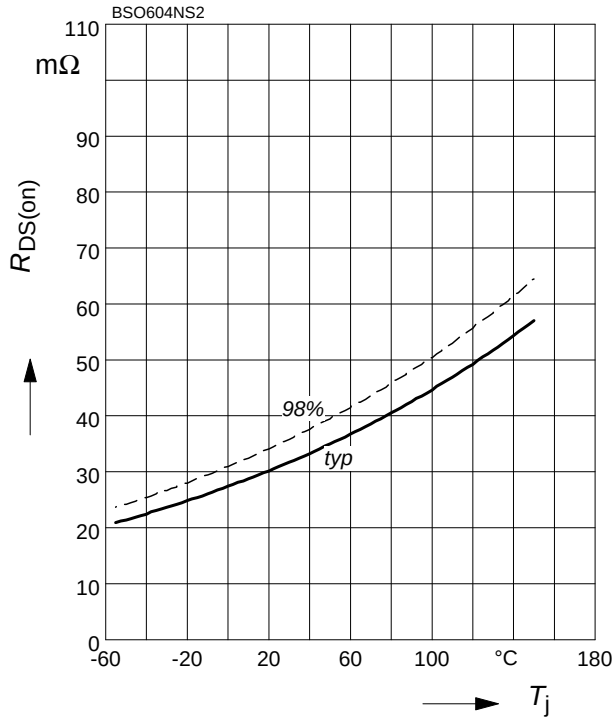
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

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

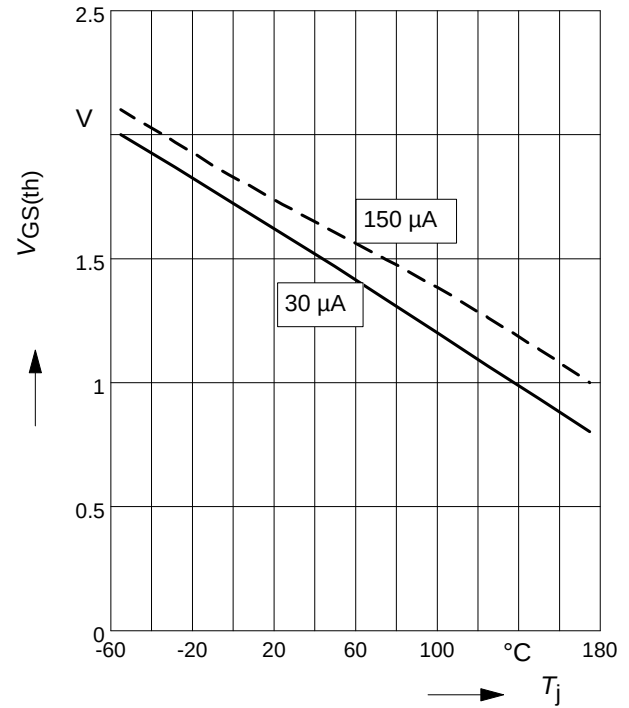
parameter :  $I_D = 2.5 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### 10 Typ. gate threshold voltage

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

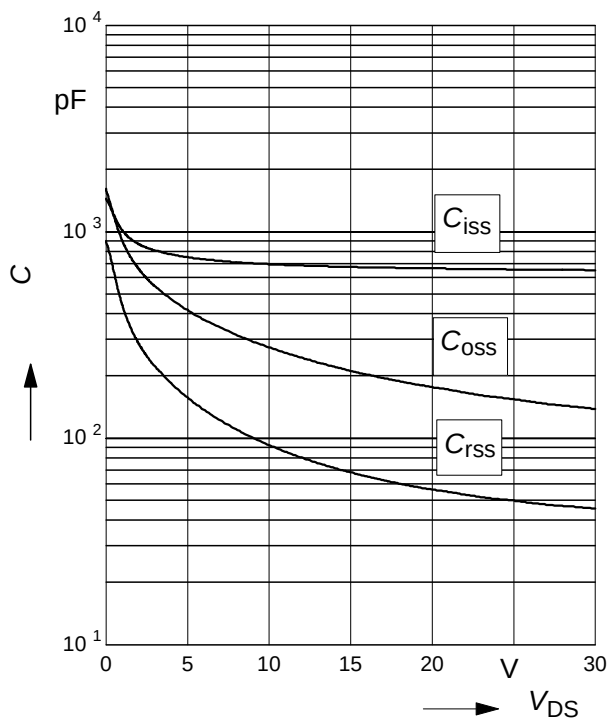
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

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

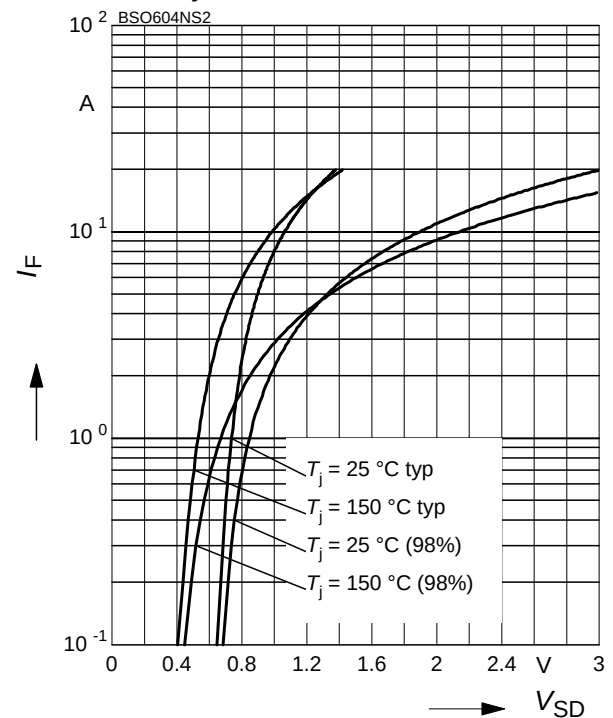
parameter:  $V_{GS}=0\text{V}$ ,  $f=1 \text{ MHz}$



### 12 Forward character. of reverse diode

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

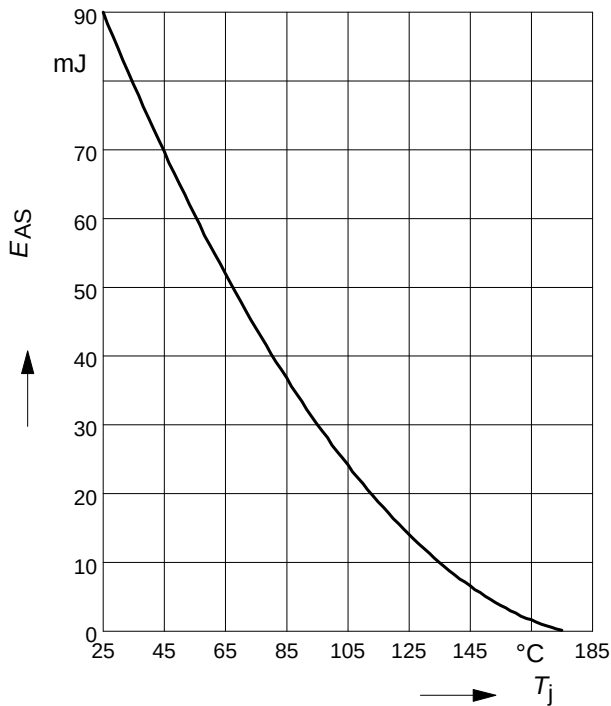
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

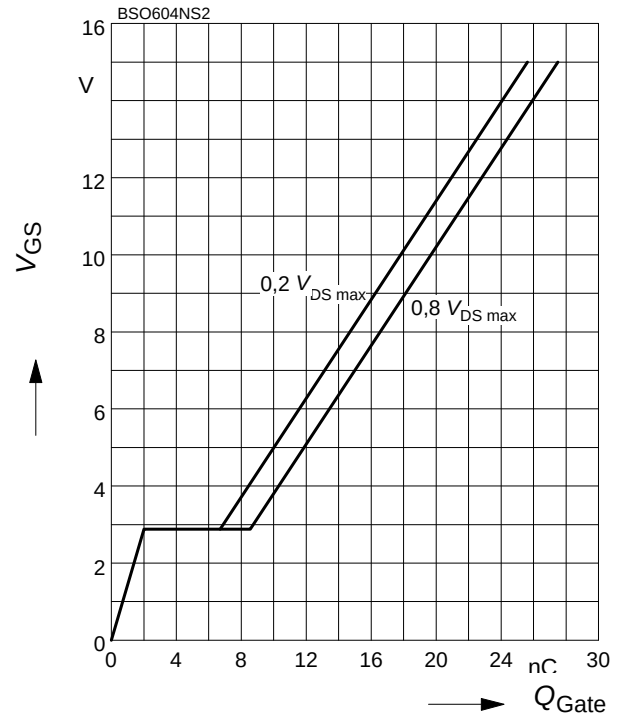
$$E_{AS} = f(T_j)$$

par.:  $I_D = 5\text{ A}$  ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$


**14 Typ. gate charge**

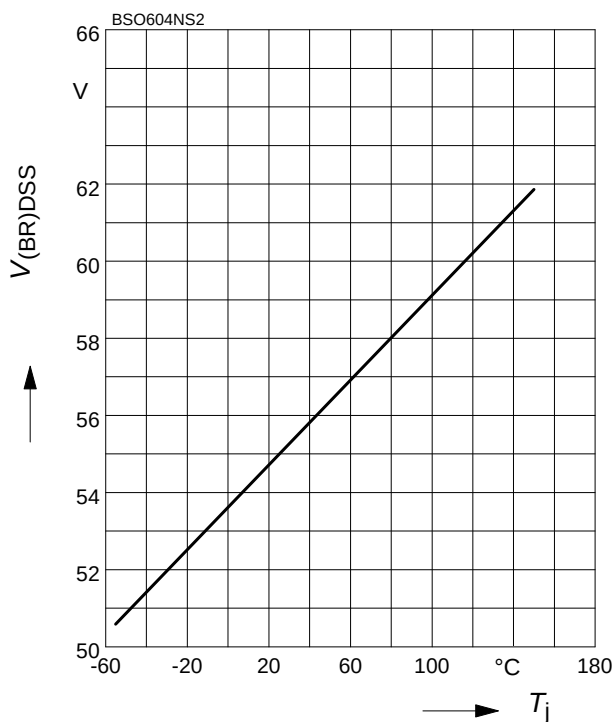
$$V_{GS} = f(Q_{Gate})$$

parameter:  $I_D = 5\text{ A}$  pulsed


**15 Drain-source breakdown voltage**

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

parameter:  $I_D = 10\text{ mA}$



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**Further information**

Please notice that the part number is BBSO604NS2, for simplicity the device is referred to by the term BSO604NS2 throughout this documentation.