

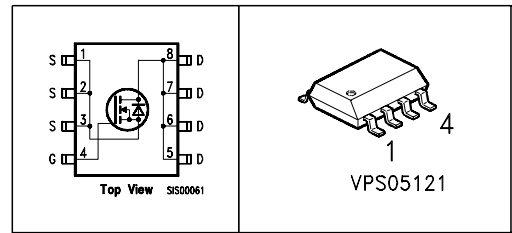
## OptiMOS® Small-Signal-Transistor

### Feature

- N-Channel
- Enhancement mode
- Logic Level
- Excellent Gate Charge x  $R_{DS(on)}$  product (FOM)
- 150°C operating temperature
- Avalanche rated
- dv/dt rated
- Ideal for fast switching applications

### Product Summary

|              |      |    |
|--------------|------|----|
| $V_{DS}$     | 30   | V  |
| $R_{DS(on)}$ | 13   | mΩ |
| $I_D$        | 11.1 | A  |



| Type    | Package | Ordering Code | Marking |
|---------|---------|---------------|---------|
| BSO4410 | SO 8    | Q67042-S4096  | 4410    |

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

| Parameter  | Symbol              | Value       | Unit  |
|--|---------------------|-------------|-------|
| Continuous drain current<br>$T_A=25\text{ °C}$<br>$T_A=70\text{ °C}$   | $I_D$               | 11.1<br>8.9 | A     |
| Pulsed drain current<br>$T_A=25\text{ °C}$   | $I_{D\text{ puls}}$ | 44.5        |       |
| Avalanche energy, single pulse<br>$I_D=11.1\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ Ω}$                    | $E_{AS}$            | 126         | mJ    |
| Reverse diode dv/dt<br>$I_S=11.1\text{ A}$ , $V_{DS}=24\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{jmax}=150\text{ °C}$ | dv/dt               | 6           | kV/μs |
| Gate source voltage  | $V_{GS}$            | ±20         | V     |
| Power dissipation<br>$T_A=25\text{ °C}$  | $P_{tot}$           | 2.5         | 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. |      |
| <b>Characteristics</b>  |            |        |      |      |      |
| Thermal resistance, junction - soldering point  | $R_{thJS}$ | -      | -    | 35   | K/W  |
| SMD version, device on PCB:   | $R_{thJA}$ | -      | -    | 110  |      |
| @ min. footprint; $t \leq 10$ sec.<br>@ 6 cm <sup>2</sup> cooling area <sup>1)</sup> ; $t \leq 10$ sec. |            | -      | -    | 50   |      |

**Electrical Characteristics, at  $T_j = 25$  °C, unless otherwise specified**

| Parameter  | Symbol        | Values |            |          | Unit       |
|--|---------------|--------|------------|----------|------------|
|  |               | min.   | typ.       | max.     |            |
| <b>Static Characteristics</b>  |               |        |            |          |            |
| Drain-source breakdown voltage<br>$V_{GS}=0V, I_D=1mA$   | $V_{(BR)DSS}$ | 30     | -          | -        | V          |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=42\mu A$   | $V_{GS(th)}$  | 1.2    | 1.6        | 2        |            |
| Zero gate voltage drain current<br>$V_{DS}=30V, V_{GS}=0V, T_j=25^\circ C$<br>$V_{DS}=30V, V_{GS}=0V, T_j=125^\circ C$ | $I_{DSS}$     | -      | 0.01<br>10 | 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>$V_{GS}=4.5V, I_D=9.2A$  | $R_{DS(on)}$  | -      | 15.6       | 18.8     | m $\Omega$ |
| Drain-source on-state resistance<br>$V_{GS}=10V, I_D=11.1A$  | $R_{DS(on)}$  | -      | 11         | 13       |            |

<sup>1</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu m$  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       | Conditions  | Values |      |      | Unit     |
|--------------------------------|--------------|---|--------|------|------|----------|
|                                |              |   | min.   | typ. | max. |          |
| <b>Dynamic Characteristics</b> |              |   |        |      |      |          |
| Transconductance               | $g_{fs}$     | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ ,<br>$I_D = 8.9A$ | 13.5   | 27   | -    | S        |
| Input capacitance              | $C_{iss}$    | $V_{GS} = 0V, V_{DS} = 25V,$<br>$f = 1MHz$                      | -      | 1020 | 1280 | pF       |
| Output capacitance             | $C_{oss}$    |   | -      | 420  | 530  |          |
| Reverse transfer capacitance   | $C_{rss}$    |   | -      | 100  | 150  |          |
| Gate resistance                | $R_G$        |   | -      | 1.2  | -    | $\Omega$ |
| Turn-on delay time             | $t_{d(on)}$  | $V_{DD} = 15V, V_{GS} = 10V,$<br>$I_D = 11.1A, R_G = 6.8\Omega$ | -      | 7.5  | 11.3 | ns       |
| Rise time                      | $t_r$        |   | -      | 33   | 49   |          |
| Turn-off delay time            | $t_{d(off)}$ |   | -      | 31   | 47   |          |
| Fall time                      | $t_f$        |   | -      | 23   | 35   |          |

Gate Charge Characteristics

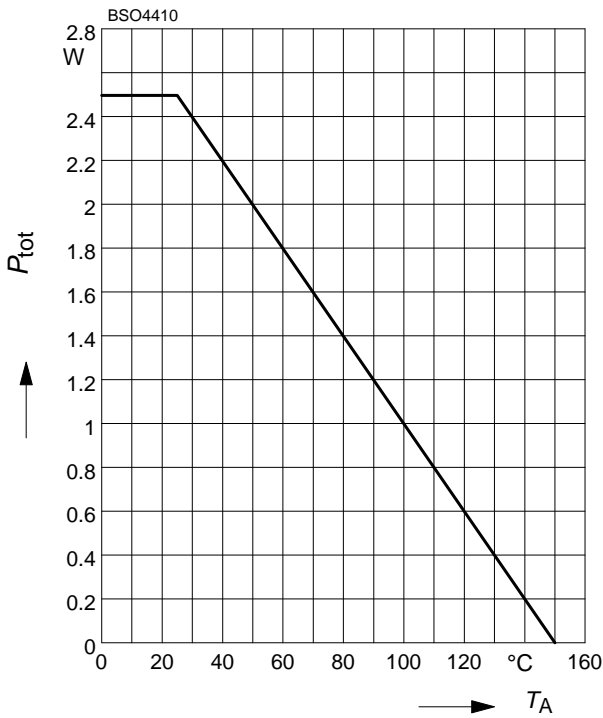
|                       |                 |   |   |      |    |    |
|-----------------------|-----------------|---|---|------|----|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 15V, I_D = 11.1A$                                 | - | 3.2  | 4  | nC |
| Gate to drain charge  | $Q_{gd}$        |   | - | 9.3  | 14 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 15V, I_D = 11.1A,$<br>$V_{GS} = 0 \text{ to } 5V$ | - | 17   | 21 |    |
| Output charge         | $Q_{oss}$       | $V_{DS} = 15V, I_D = 11.1A,$<br>$V_{GS} = 0V$               | - | 14.6 | 18 |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 15V, I_D = 11.1A$                                 | - | 3    | -  | V  |

Reverse Diode

|  |          |   |   |      |      |    |
|--|----------|---|---|------|------|----|
| Inverse diode continuous forward current | $I_S$    | $T_A = 25^\circ\text{C}$                          | - | -    | 2    | A  |
| Inverse diode direct current, pulsed     | $I_{SM}$ |   | - | -    | 44.5 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0V, I_F = 2A$                           | - | 0.84 | 1.2  | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = 15V, I_F = I_S,$<br>$di_F/dt = 100A/\mu s$ | - | 29   | 36   | ns |
| Reverse recovery charge                  | $Q_{rr}$ |   | - | 28   | 35   | nC |

### 1 Power dissipation

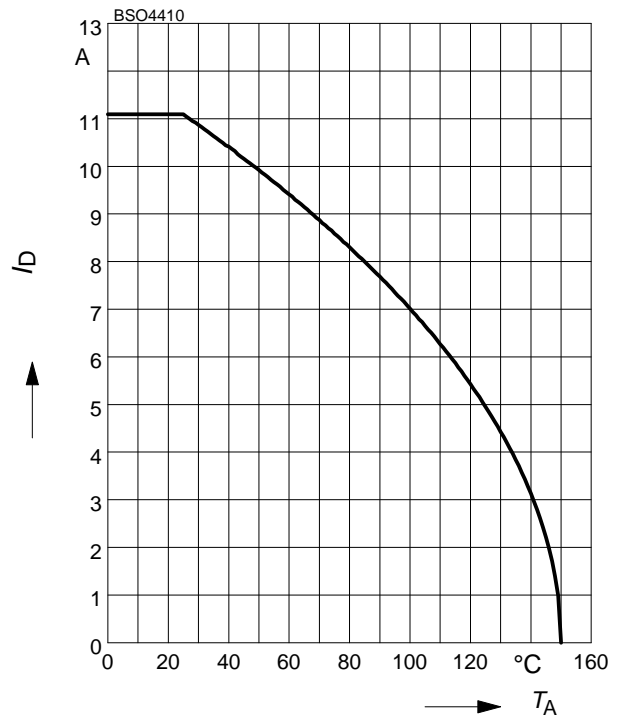
$$P_{\text{tot}} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

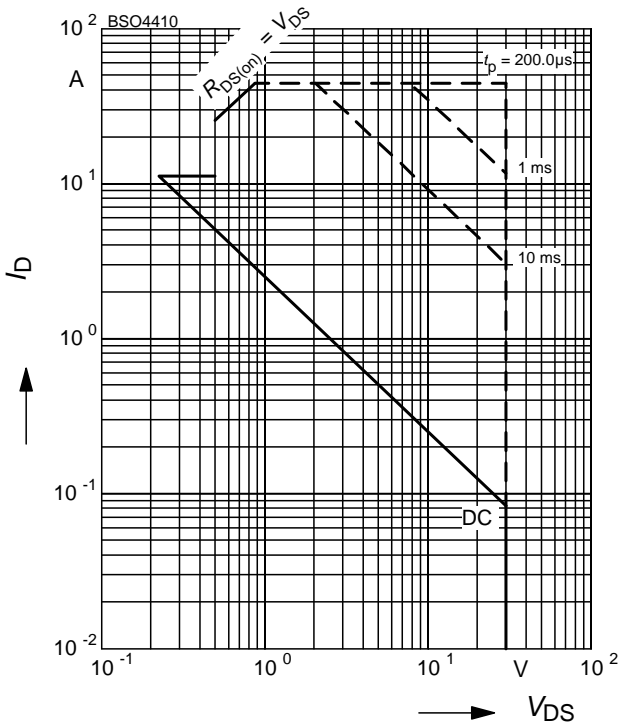
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

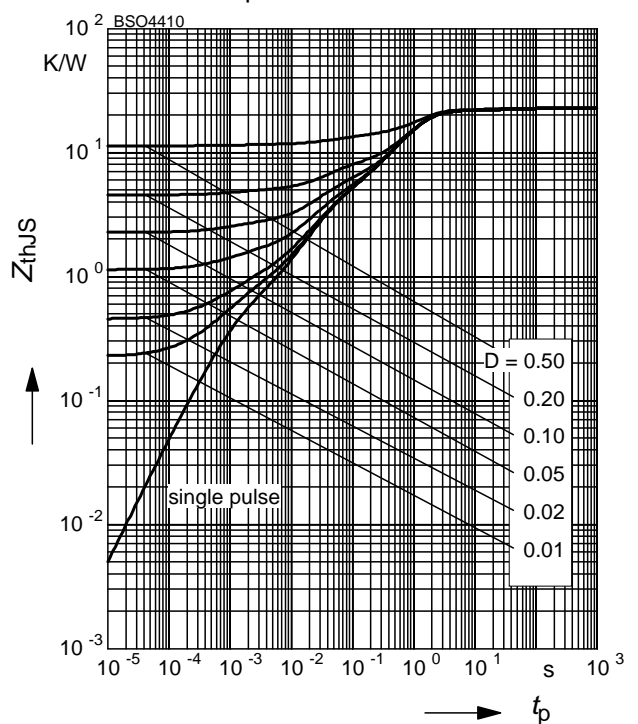
parameter:  $D = 0, T_A = 25 \text{ °C}$



### 4 Transient thermal impedance

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

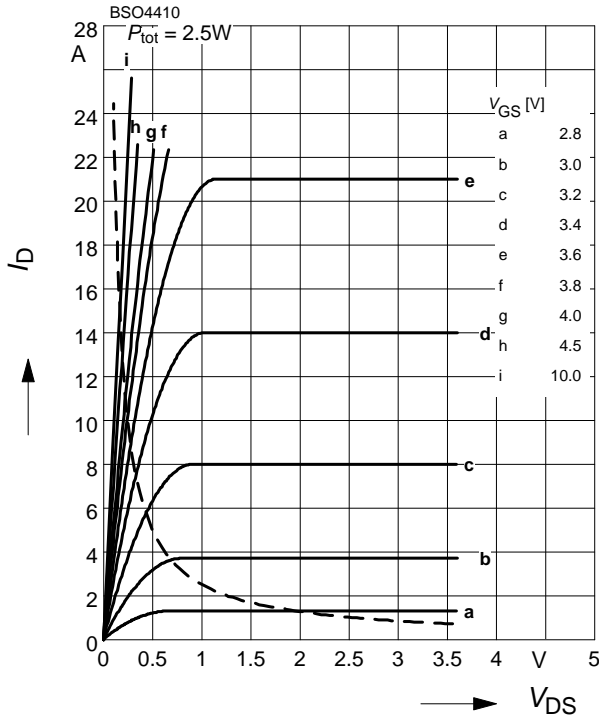
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

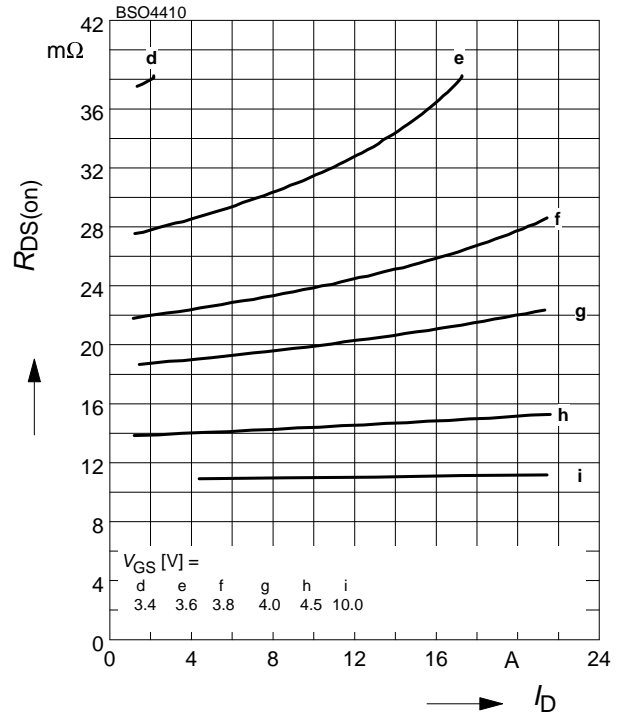
parameter:  $t_p = 80 \mu\text{s}$



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

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

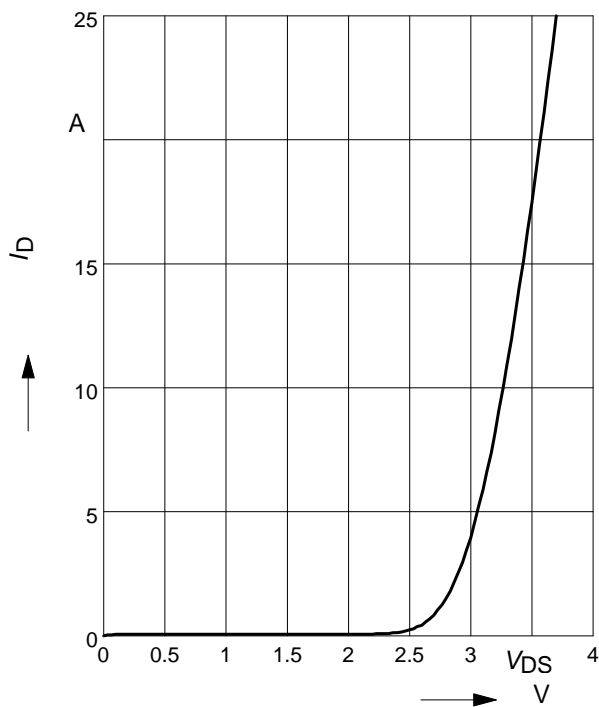
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

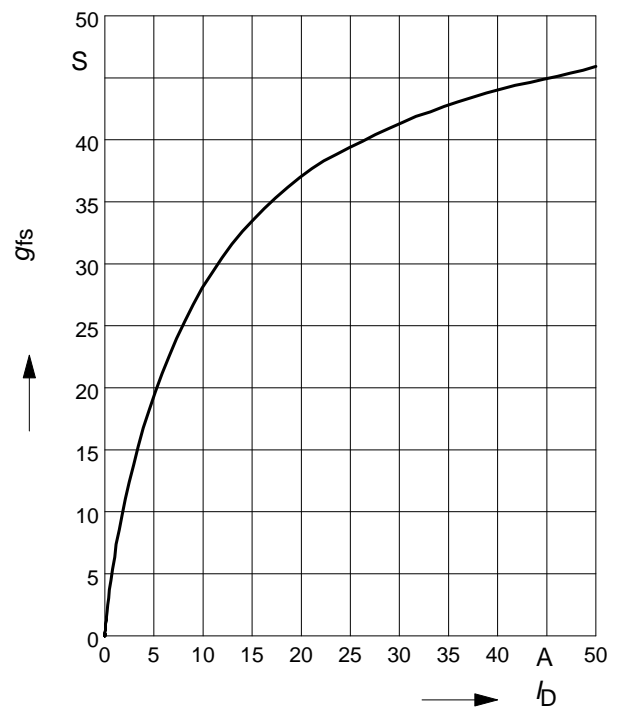
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

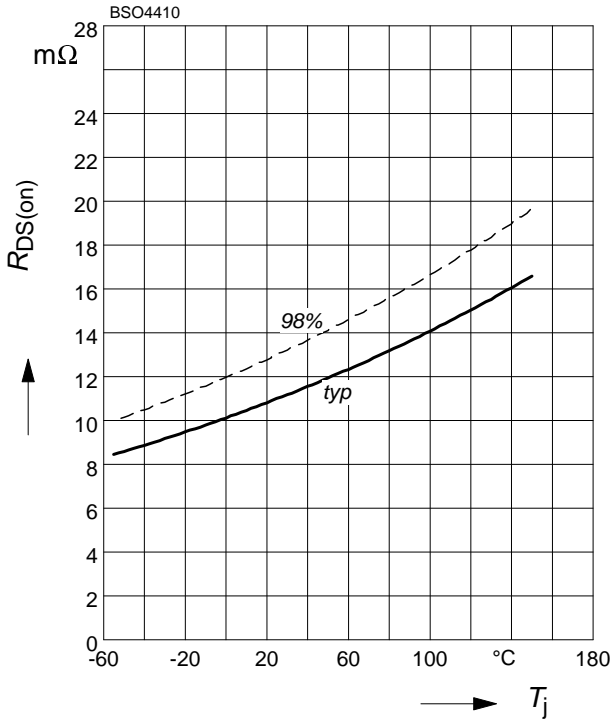
parameter:  $g_{fs}$



**9 Drain-source on-state resistance**

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

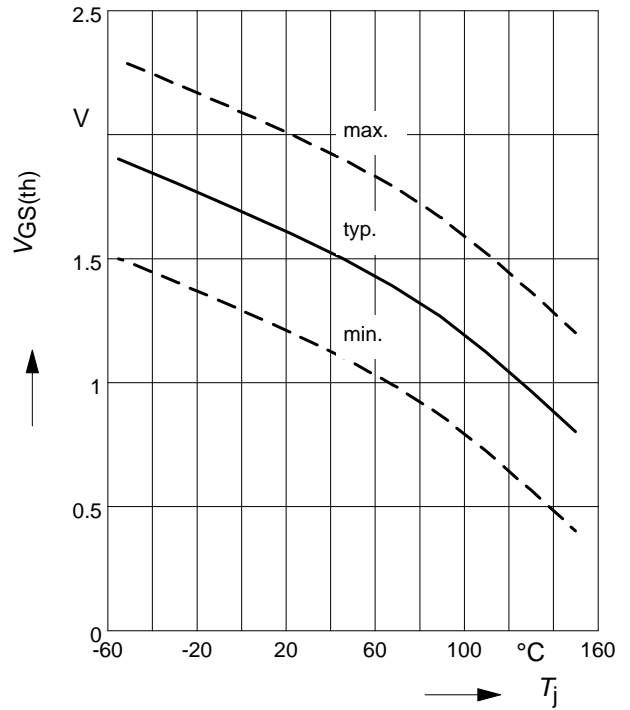
parameter :  $I_D = 11.1 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



**10 Gate threshold voltage**

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

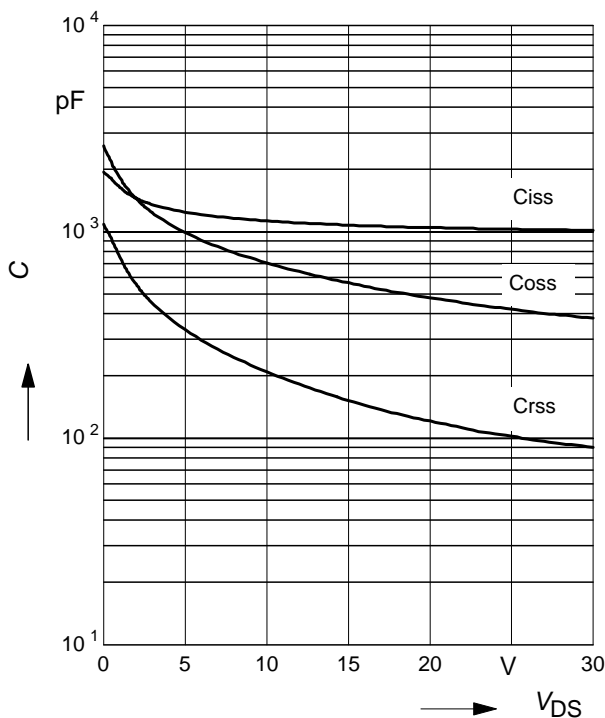
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 42 \mu\text{A}$



**11 Typ. capacitances**

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

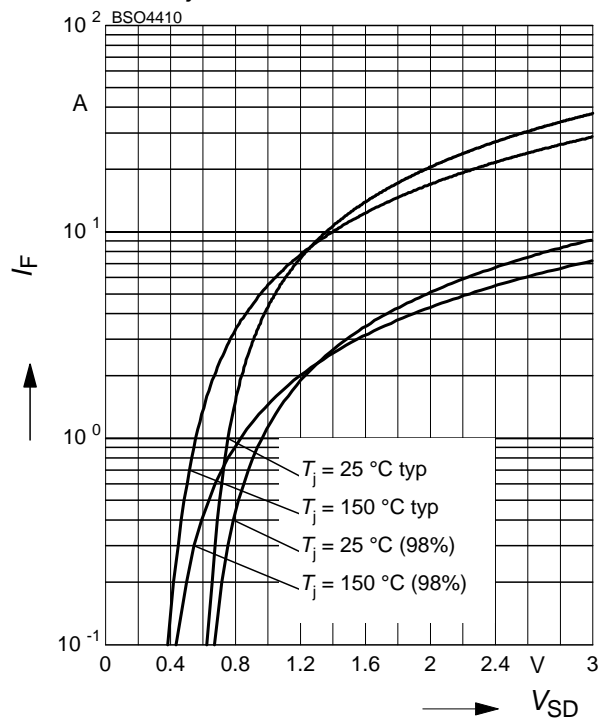
parameter:  $V_{GS}=0\text{V}$ ,  $f=1 \text{ MHz}$



**12 Forward character. of reverse diode**

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

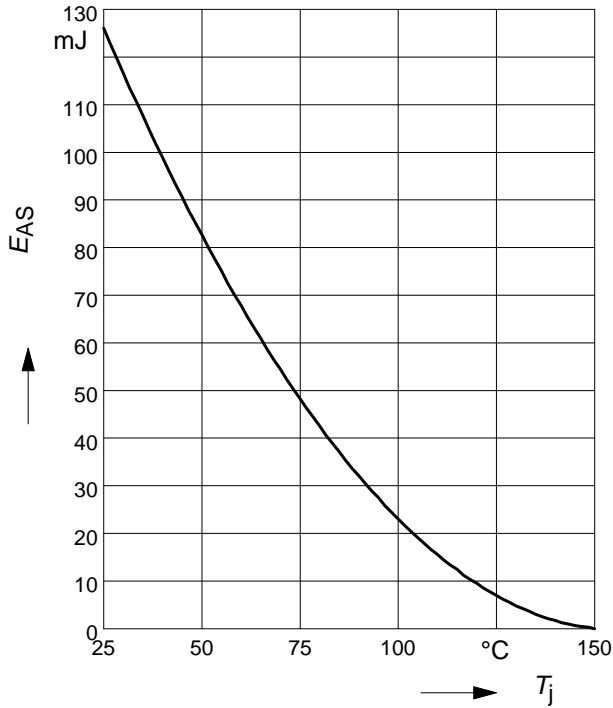
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

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

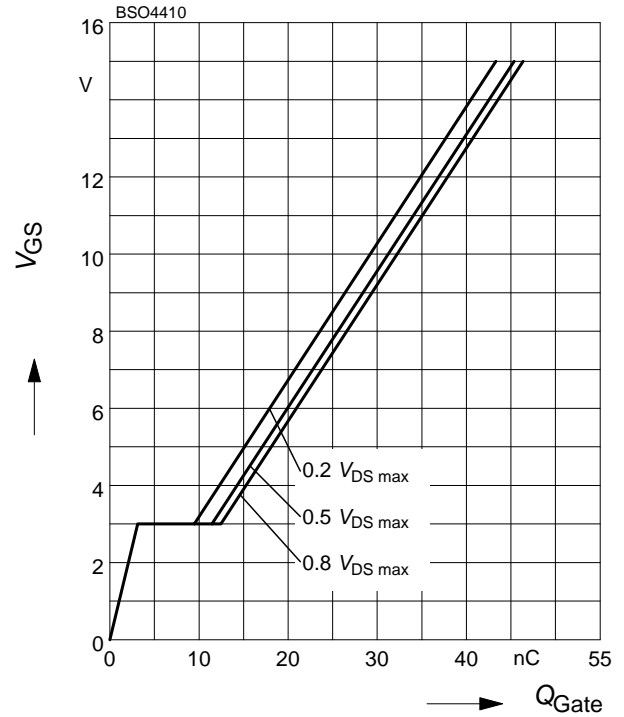
par.:  $I_D = 11.1 \text{ A}$  ,  $V_{DD} = 25 \text{ V}$  ,  $R_{GS} = 25 \Omega$



**14 Typ. gate charge**

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

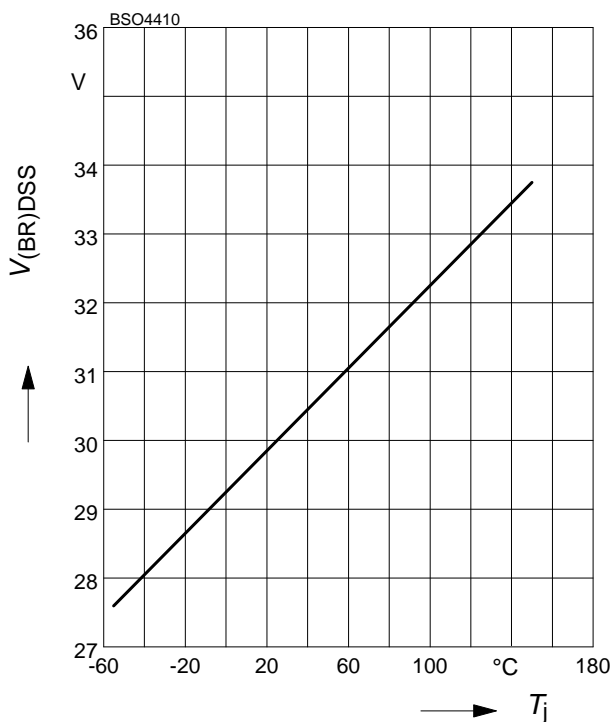
parameter:  $I_D = 11.1 \text{ A}$  pulsed



**15 Drain-source breakdown voltage**

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

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



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