

## SIPMOS<sup>®</sup> Small-Signal-Transistor

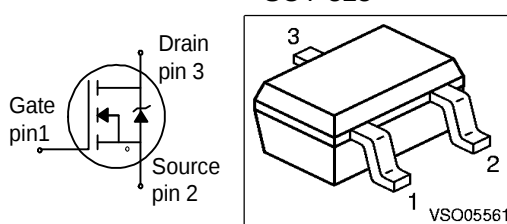
### Feature

- N-Channel
- Enhancement mode
- Logic Level
- dv/dt rated

### Product Summary

|              |      |          |
|--------------|------|----------|
| $V_{DS}$     | 60   | V        |
| $R_{DS(on)}$ | 5    | $\Omega$ |
| $I_D$        | 0.23 | A        |

SOT-323



| Type    | Package | Ordering Code | Tape and Reel Information | Marking |
|---------|---------|---------------|---------------------------|---------|
| SN7002W | SOT-323 | Q67042-S4186  | E6327: 3000 pcs/reel      | sSN     |
| SN7002W | SOT-323 | Q67042-S4193  | E6433: 10000 pcs/reel     | sSN     |

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

| Parameter                                                                                                                               | Symbol                | Value        | Unit              |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------|-------------------|
| Continuous drain current<br>$T_A=25^\circ\text{C}$<br>$T_A=70^\circ\text{C}$                                                            | $I_D$                 | 0.23<br>0.18 | A                 |
| Pulsed drain current<br>$T_A=25^\circ\text{C}$                                                                                          | $I_{D \text{ puls}}$  | 0.92         |                   |
| Reverse diode dv/dt<br>$I_S=0.23\text{A}$ , $V_{DS}=48\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ , $T_{j\text{max}}=150^\circ\text{C}$ | dv/dt                 | 6            | kV/ $\mu\text{s}$ |
| Gate source voltage                                                                                                                     | $V_{GS}$              | $\pm 20$     | V                 |
| ESD Sensitivity (HBM) as per MIL-STD 883                                                                                                |                       | Class 1      |                   |
| Power dissipation<br>$T_A=25^\circ\text{C}$                                                                                             | $P_{\text{tot}}$      | 0.5          | W                 |
| Operating and storage temperature                                                                                                       | $T_j, T_{\text{stg}}$ | -55... +150  | $^\circ\text{C}$  |
| IEC climatic category; DIN IEC 68-1                                                                                                     |                       | 55/150/56    |                   |

### Thermal Characteristics

| Parameter                                                      | Symbol     | Values |      |      | Unit |
|----------------------------------------------------------------|------------|--------|------|------|------|
|                                                                |            | min.   | typ. | max. |      |
| Characteristics                                                |            |        |      |      |      |
| Thermal resistance, junction - ambient<br>at minimal footprint | $R_{thJS}$ | -      | -    | 250  | K/W  |

### 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>$V_{GS}=0, I_D=250\mu A$                                                             | $V_{(BR)DSS}$ | 60     | -      | -        | V        |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=26\mu A$                                                             | $V_{GS(th)}$  | 0.8    | 1.4    | 1.8      |          |
| Zero gate voltage drain current<br>$V_{DS}=60V, V_{GS}=0, T_j=25^{\circ}C$<br>$V_{DS}=60V, V_{GS}=0, T_j=150^{\circ}C$ | $I_{DSS}$     | -<br>- | -<br>- | 0.1<br>5 | $\mu A$  |
| Gate-source leakage current<br>$V_{GS}=20V, V_{DS}=0$                                                                  | $I_{GSS}$     | -      | -      | 10       |          |
| Drain-source on-state resistance<br>$V_{GS}=4.5V, I_D=0.2A$                                                            | $R_{DS(on)}$  | -      | 4.1    | 7.5      | $\Omega$ |
| Drain-source on-state resistance<br>$V_{GS}=10V, I_D=0.23A$                                                            | $R_{DS(on)}$  | -      | 2.3    | 5        |          |

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

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

**Dynamic Characteristics**

|                              |              |                                                                                           |     |      |       |    |
|------------------------------|--------------|-------------------------------------------------------------------------------------------|-----|------|-------|----|
| Transconductance             | $g_{fs}$     | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ ,<br>$I_D = 0.18\text{A}$                   | 0.1 | 0.21 | -     | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0$ , $V_{DS} = 25\text{V}$ ,<br>$f = 1\text{MHz}$                               | -   | 34   | 45    | pF |
| Output capacitance           | $C_{oss}$    |                                                                                           | -   | 7.2  | 9.6   |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                           | -   | 3    | 4.5   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = 30\text{V}$ , $V_{GS} = 10\text{V}$ ,<br>$I_D = 0.23\text{A}$ , $R_G = 6\Omega$ | -   | 2.4  | 3.6   | ns |
| Rise time                    | $t_r$        |                                                                                           | -   | 2.8  | 4.2   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                           | -   | 6    | 9     |    |
| Fall time                    | $t_f$        |                                                                                           | -   | 8.5  | 12.75 |    |

**Gate Charge Characteristics**

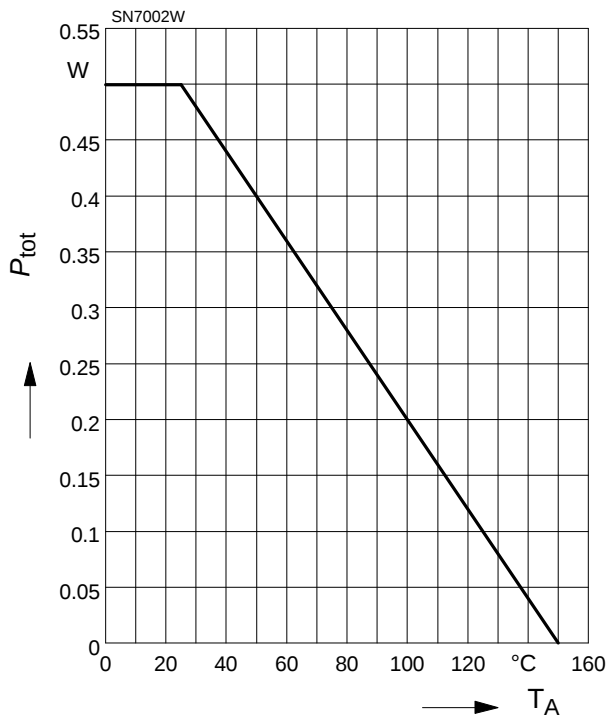
|                       |                 |                                                                                |   |      |      |    |
|-----------------------|-----------------|--------------------------------------------------------------------------------|---|------|------|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 48\text{V}$ , $I_D = 0.23\text{A}$                                   | - | 0.11 | 0.17 | nC |
| Gate to drain charge  | $Q_{gd}$        |                                                                                | - | 0.42 | 0.63 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 48\text{V}$ , $I_D = 0.23\text{A}$ ,<br>$V_{GS} = 0$ to $10\text{V}$ | - | 1    | 1.5  |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 48\text{V}$ , $I_D = 0.23\text{A}$                                   | - | 3.4  | -    | V  |

**Reverse Diode**

|                                          |          |                                                                           |   |      |      |    |
|------------------------------------------|----------|---------------------------------------------------------------------------|---|------|------|----|
| Inverse diode continuous forward current | $I_S$    | $T_A = 25^{\circ}\text{C}$                                                | - | -    | 0.23 | A  |
| Inv. diode direct current, pulsed        | $I_{SM}$ |                                                                           | - | -    | 0.92 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0$ , $I_F = 0.23\text{A}$                                       | - | 0.85 | 1.2  | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = 30\text{V}$ , $I_F = I_S$ ,<br>$di_F/dt = 100\text{A}/\mu\text{s}$ | - | 10.8 | 16.2 | ns |
| Reverse recovery charge                  | $Q_{rr}$ |                                                                           | - | 3.2  | 4.8  |    |

### 1 Power dissipation

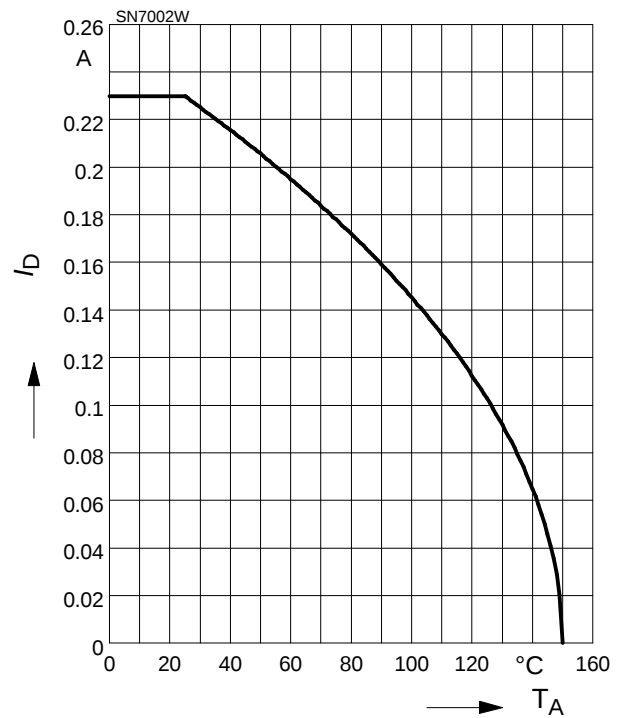
$$P_{\text{tot}} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

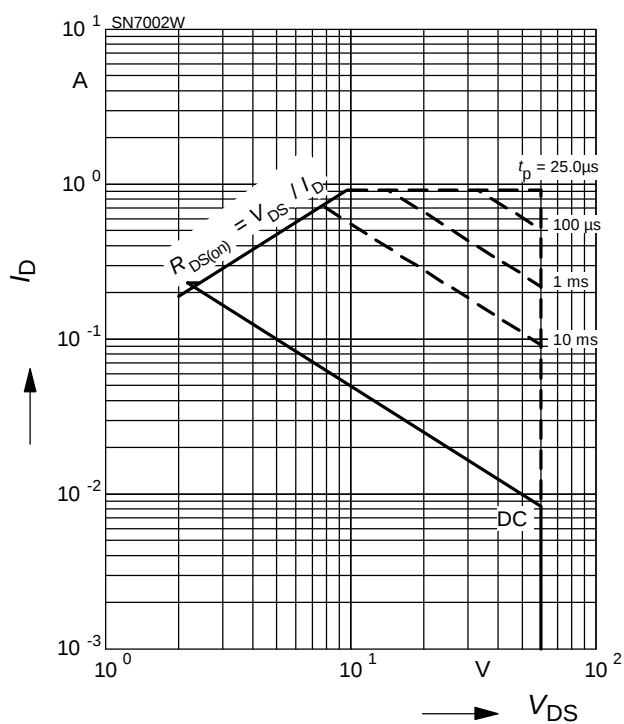
parameter:  $V_{GS} \geq 10$  V



### 3 Safe operating area

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

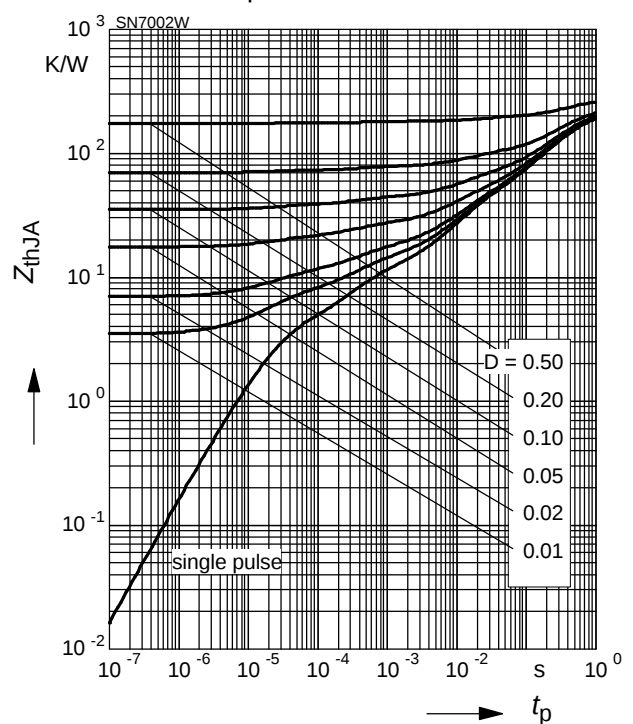
parameter:  $D = 0$ ,  $T_A = 25$  °C



### 4 Transient thermal impedance

$$Z_{thJA} = f(t_p)$$

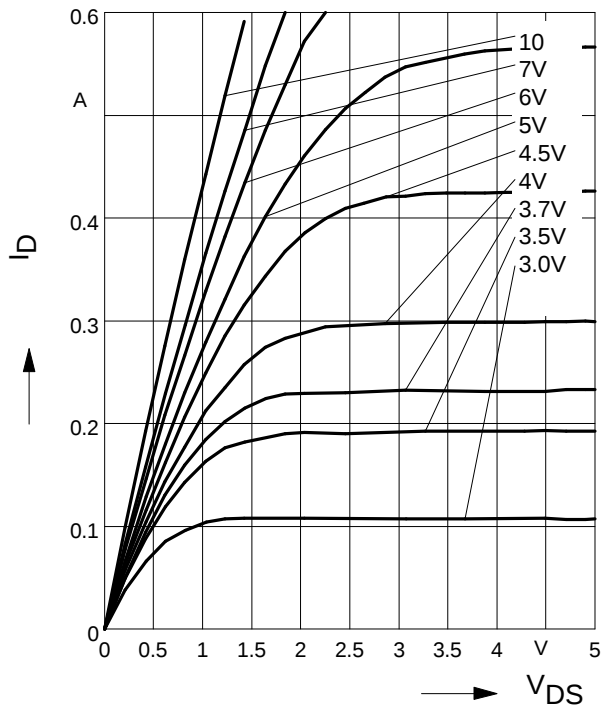
parameter:  $D = t_p / T$



### 5 Typ. output characteristic

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

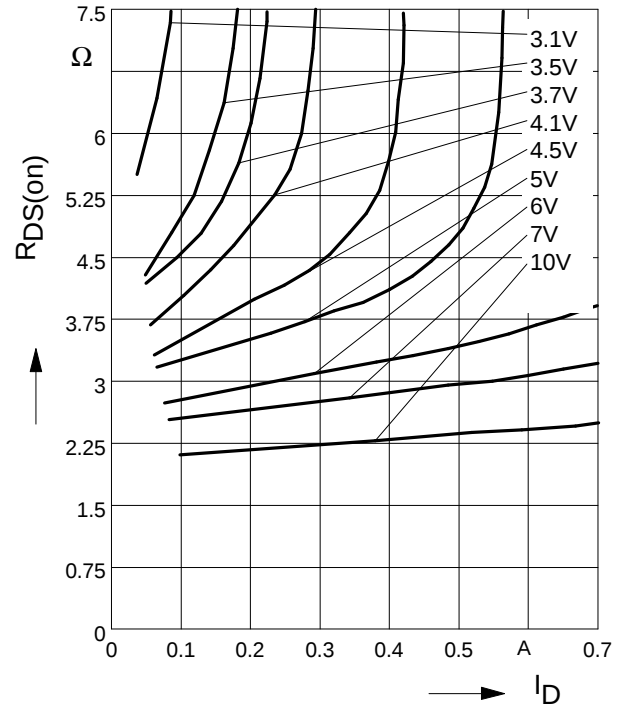
parameter:  $T_j = 25\text{ }^{\circ}\text{C}$ ,  $V_{GS}$



### 6 Typ. drain-source on resistance

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

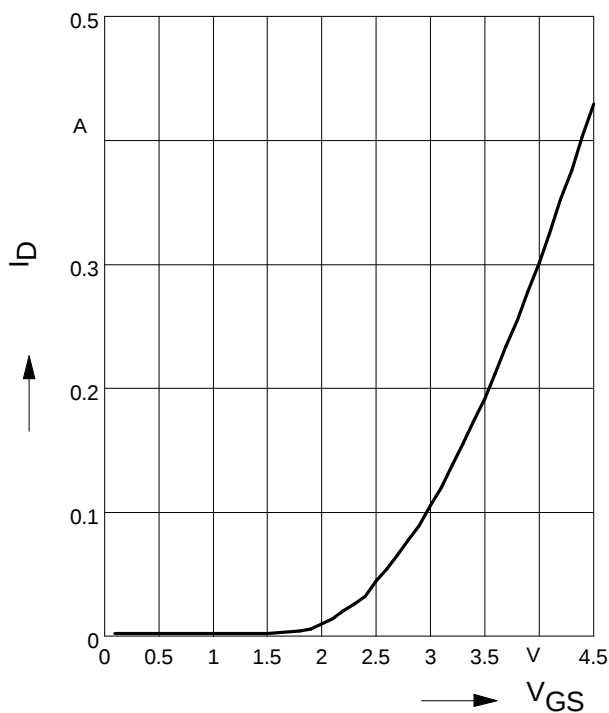
parameter:  $T_j = 25\text{ }^{\circ}\text{C}$ ,  $V_{GS}$



### 7 Typ. transfer characteristics

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

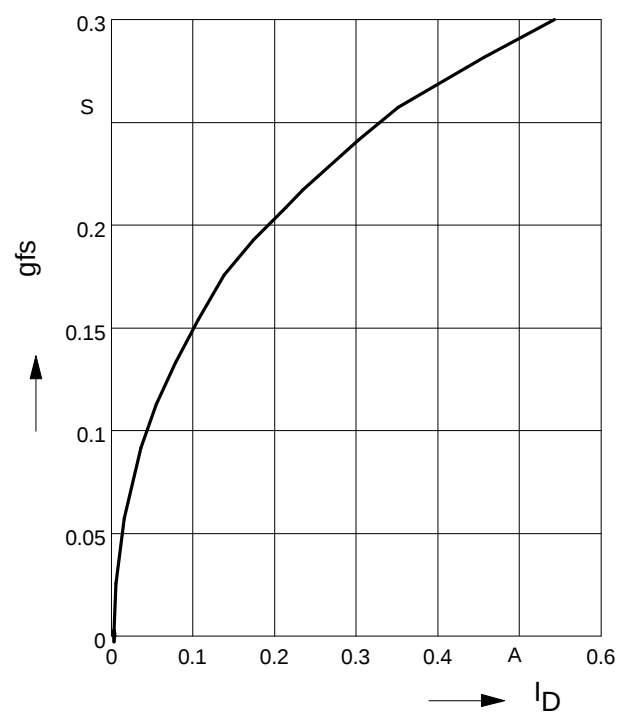
parameter:  $T_j = 25\text{ }^{\circ}\text{C}$



### 8 Typ. forward transconductance

$$g_{fs} = f(I_D)$$

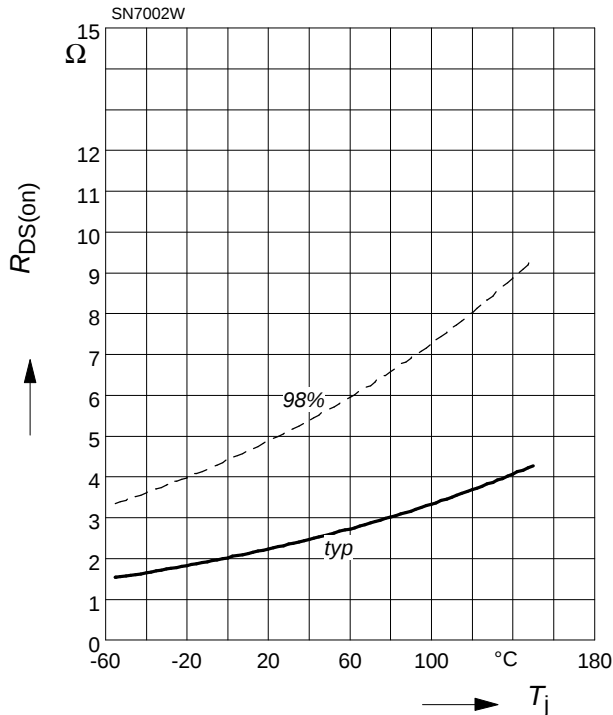
parameter:  $T_j = 25\text{ }^{\circ}\text{C}$



**(.) Drain-source on-state resistance**

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

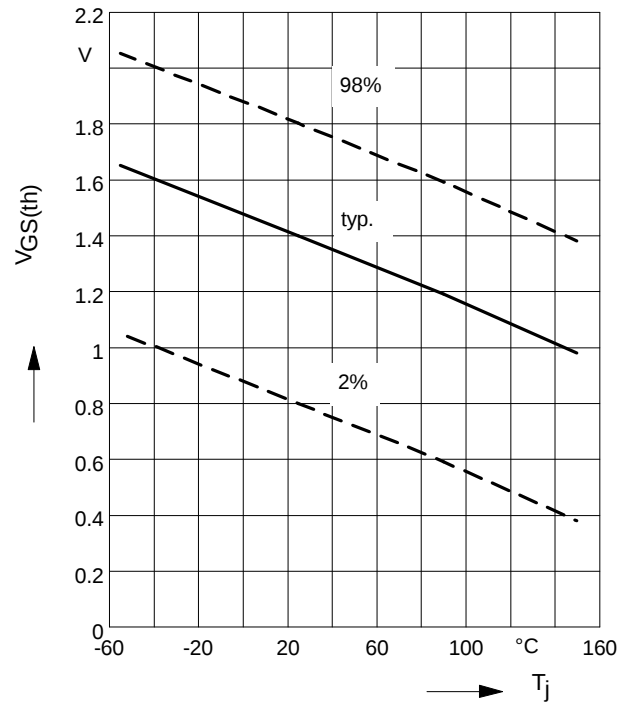
parameter:  $I_D = 0.23 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

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

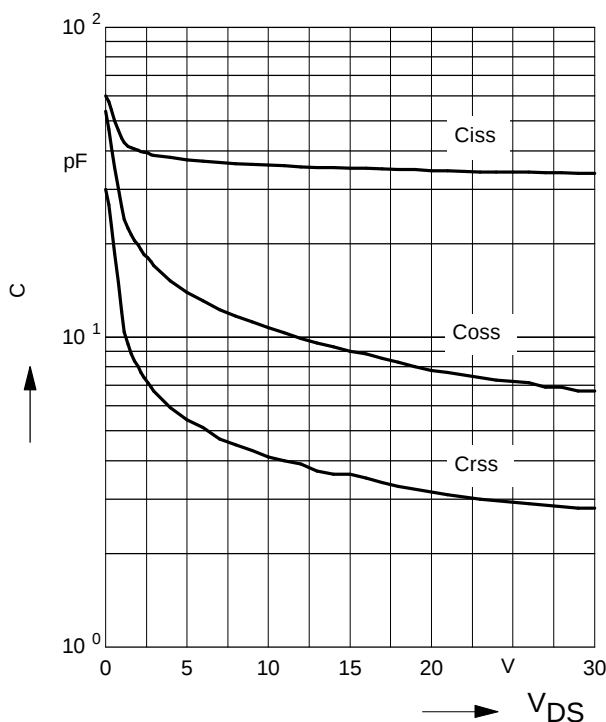
parameter:  $V_{GS} = V_{DS}$ ;  $I_D = 26 \mu\text{A}$



**11 Typ. capacitances**

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

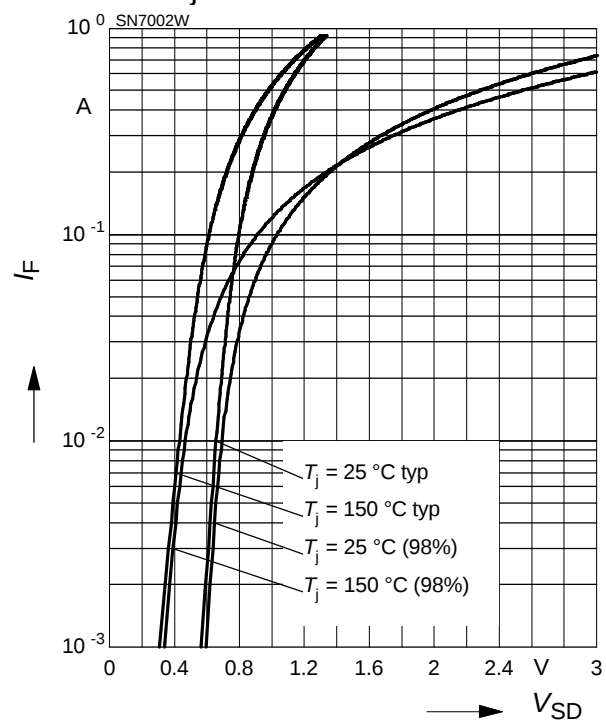
parameter:  $V_{GS}=0$ ,  $f=1 \text{ MHz}$ ,  $T_j = 25 \text{ }^\circ\text{C}$



**12 Forward character. of reverse diode**

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

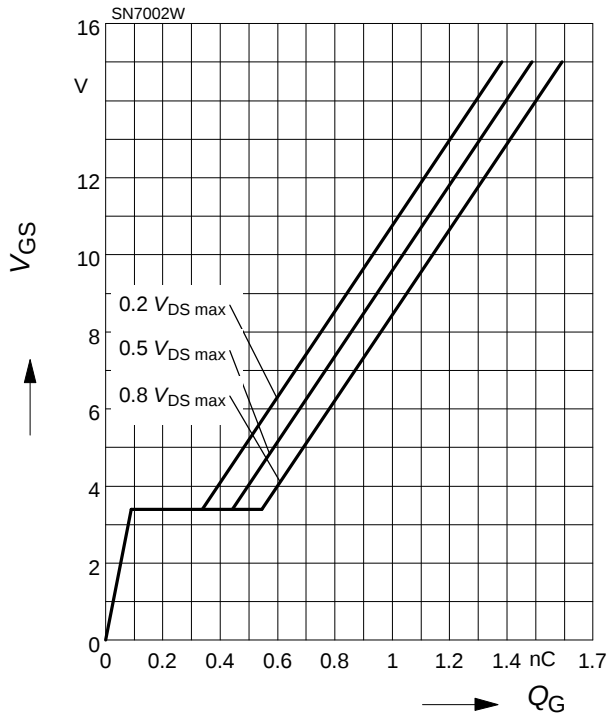
parameter:  $T_j$



### 13 Typ. gate charge

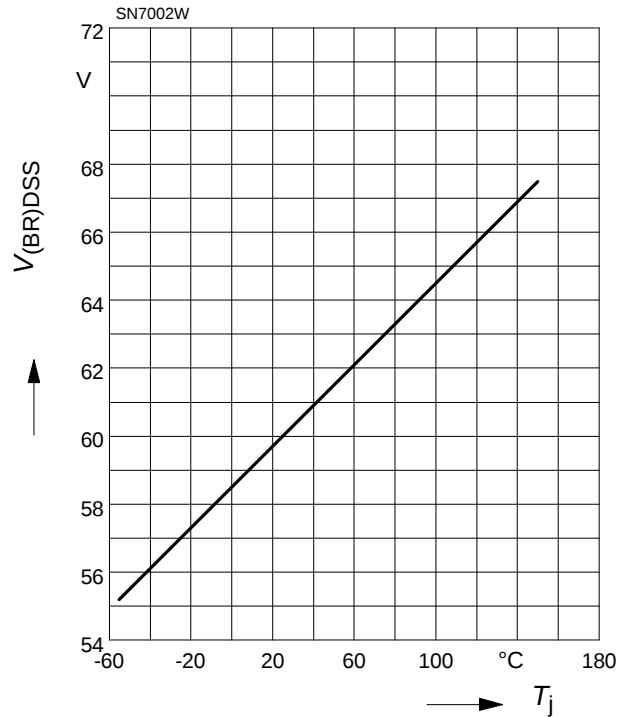
$V_{GS} = f(Q_G)$ ; parameter:  $V_{DS}$ ,

$I_D = 0.16$  A pulsed,  $T_j = 25$  °C



### 14 Drain-source breakdown voltage

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



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