

## Electrical Characteristics

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

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

## Static Characteristics

|                                                                                                                        |               |        |           |            |          |
|------------------------------------------------------------------------------------------------------------------------|---------------|--------|-----------|------------|----------|
| Drain-source breakdown voltage<br>$V_{GS} = 0, I_D = 0.25\text{ mA}$                                                   | $V_{(BR)DSS}$ | 60     | –         | –          | V        |
| Gate threshold voltage<br>$V_{GS} = V_{DS}, I_D = 1.0\text{ mA}$                                                       | $V_{GS(th)}$  | 2.5    | 3.0       | 3.5        |          |
| Zero gate voltage drain current<br>$V_{GS} = 60\text{ V}, V_{DS} = 0$<br>$T_j = 25\text{ °C}$<br>$T_j = 150\text{ °C}$ | $I_{DSS}$     | –<br>– | 0.1<br>10 | 1.0<br>100 | μA       |
| Gate-source leakage current<br>$V_{GS} = \pm 20\text{ V}, V_{DS} = 0$<br>$T_j = 25\text{ °C}$<br>$T_j = 150\text{ °C}$ | $I_{GSS}$     | –<br>– | 10<br>2   | 100<br>4   | nA<br>μA |
| Drain-source on-state resistance<br>$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$                                         | $R_{DS(on)}$  | –      | 0.12      | 0.15       | Ω        |

## Dynamic Characteristics

|                                                                                                                                               |              |     |     |     |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----|-----|-----|----|
| Forward transconductance<br>$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}, I_D = 7.5\text{ A}$                                               | $g_{fs}$     | 3.0 | 5.7 | –   | S  |
| Input capacitance<br>$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                                     | $C_{iss}$    | –   | 360 | 480 | pF |
| Output capacitance<br>$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                                    | $C_{oss}$    | –   | 160 | 250 |    |
| Reverse transfer capacitance<br>$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                          | $C_{rss}$    | –   | 50  | 90  |    |
| Turn-on time $t_{on}, (t_{on} = t_{d(on)} + t_r)$<br>$V_{CC} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_{GS} = 50\text{ Ω}$     | $t_{d(on)}$  | –   | 15  | 25  | ns |
|                                                                                                                                               | $t_r$        | –   | 30  | 45  |    |
| Turn-off time $t_{off}, (t_{off} = t_{d(off)} + t_f)$<br>$V_{CC} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_{GS} = 50\text{ Ω}$ | $t_{d(off)}$ | –   | 40  | 55  |    |
|                                                                                                                                               | $t_f$        | –   | 55  | 75  |    |

**Electrical Characteristics (cont'd)**

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

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

**Reverse Diode**

|                                                                                                     |          |   |     |     |               |
|-----------------------------------------------------------------------------------------------------|----------|---|-----|-----|---------------|
| Continuous source current                                                                           | $I_S$    | – | –   | 12  | A             |
| Pulsed source current                                                                               | $I_{SM}$ | – | –   | 48  |               |
| Diode forward on-voltage<br>$I_F = 12\text{ A}$ , $V_{GS} = 0\text{ V}$                             | $V_{SD}$ | – | 1.3 | 1.6 | V             |
| Reverse recovery time<br>$I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$   | $t_{rr}$ | – | 60  | –   | ns            |
| Reverse recovery charge<br>$I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | $Q_{rr}$ | – | 0.1 | –   | $\mu\text{C}$ |

**Temperature Sensor**

|                                                                                                                                                                             |              |              |            |            |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|------------|------------|---------------|
| Forward voltage<br>$I_{TS(on)} = 10\text{ mA}$ , $T_j = -55 \dots +150\text{ °C}$<br>Sensor override, $t_p \leq 100\text{ }\mu\text{s}$<br>$T_j = -55 \dots +160\text{ °C}$ | $V_{TS(on)}$ | –            | 1.4        | 1.5        | V             |
|                                                                                                                                                                             |              | –            | –          | 10         |               |
| Forward current<br>$T_j = -55 \dots +150\text{ °C}$<br>Sensor override, $t_p \leq 100\text{ }\mu\text{s}$<br>$T_j = -55 \dots +160\text{ °C}$                               | $I_{TS(on)}$ | –            | –          | 10         | mA            |
|                                                                                                                                                                             |              | –            | –          | 600        |               |
| Holding current, $V_{TS(off)} = 5.0\text{ V}$ , $T_j = 25\text{ °C}$<br>$T_j = 150\text{ °C}$                                                                               | $I_H$        | 0.05<br>0.05 | 0.1<br>0.2 | 0.5<br>0.3 |               |
| Switching temperature<br>$V_{TS} = 5.0\text{ V}$                                                                                                                            | $T_{TS(on)}$ | 150          | –          | –          | $\text{°C}$   |
| Turn-off time<br>$V_{TS} = 5.0\text{ V}$ , $I_{TS(on)} = 2\text{ mA}$                                                                                                       | $t_{off}$    | 0.5          | –          | 2.5        | $\mu\text{s}$ |

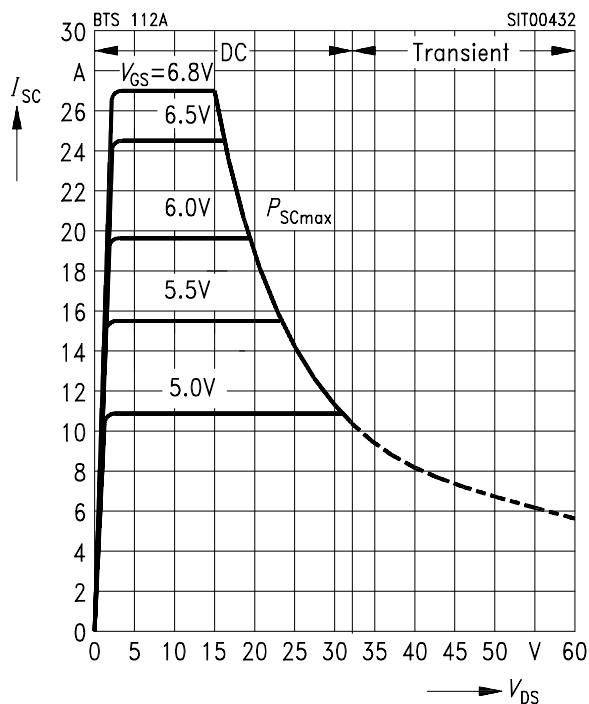
**Examples for short-circuit protection**

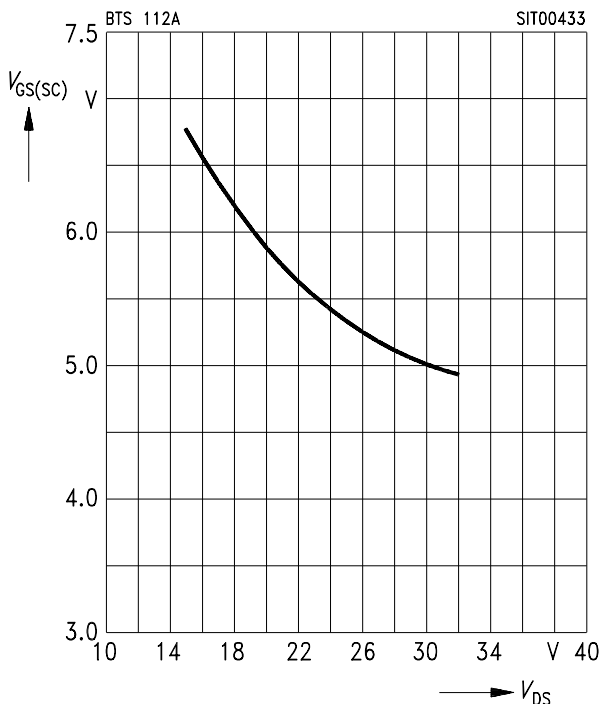
 at  $T_j = -55 \dots +150\text{ }^{\circ}\text{C}$ , unless otherwise specified.

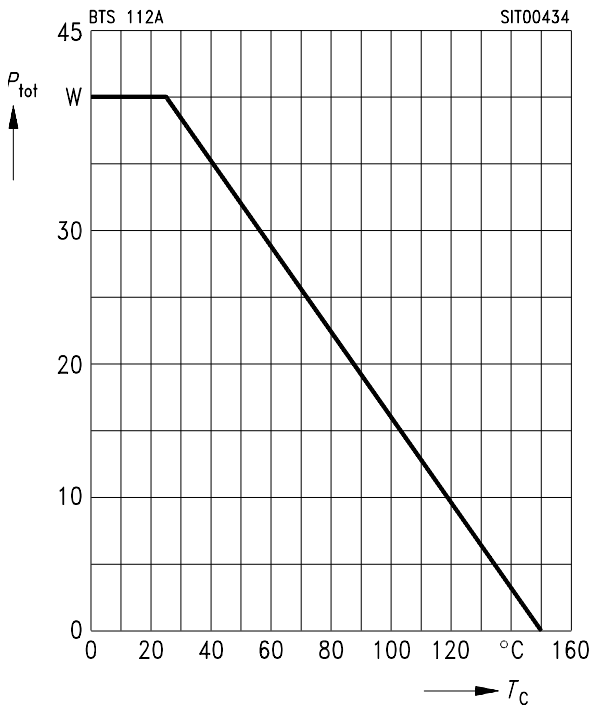
| Parameter                                                                  | Symbol        | Examples |     |   | Unit |
|----------------------------------------------------------------------------|---------------|----------|-----|---|------|
|                                                                            |               | 1        | 2   | – |      |
| Drain-source voltage                                                       | $V_{DS}$      | 15       | 30  | – | V    |
| Gate-source voltage                                                        | $V_{GS}$      | 6.8      | 5.0 | – |      |
| Short-circuit current                                                      | $I_{SC}$      | 27       | 11  | – | A    |
| Short-circuit dissipation                                                  | $P_{SC}$      | 400      | 330 | – | W    |
| Response time<br>$T_j = 25\text{ }^{\circ}\text{C}$ , before short circuit | $t_{SC(off)}$ | 20       | 20  | – | ms   |

**Short-circuit protection  $I_{SC} = f(V_{DS})$** 

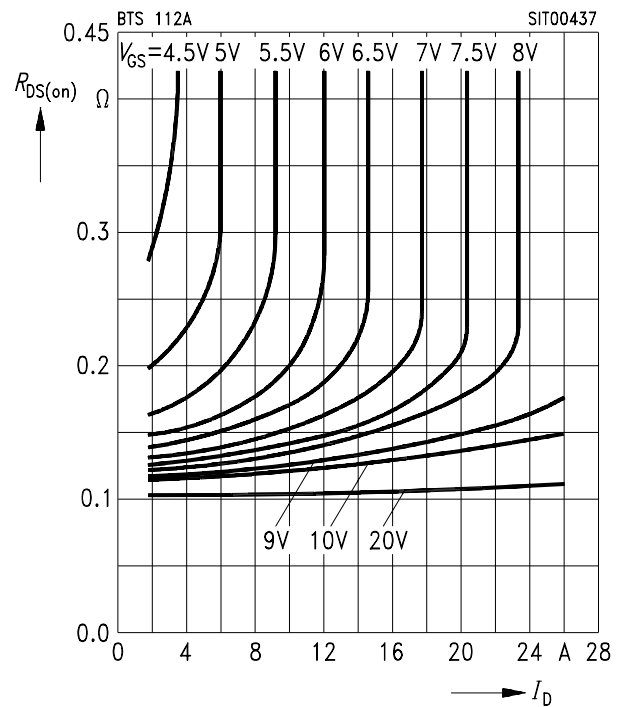
 Parameter:  $V_{GS}$ 

 Diagram to determine  $I_{SC}$  for  $T_j = -55 \dots +150\text{ }^{\circ}\text{C}$ 

**Max. gate voltage  $V_{GS(SC)} = f(V_{DS})$** 

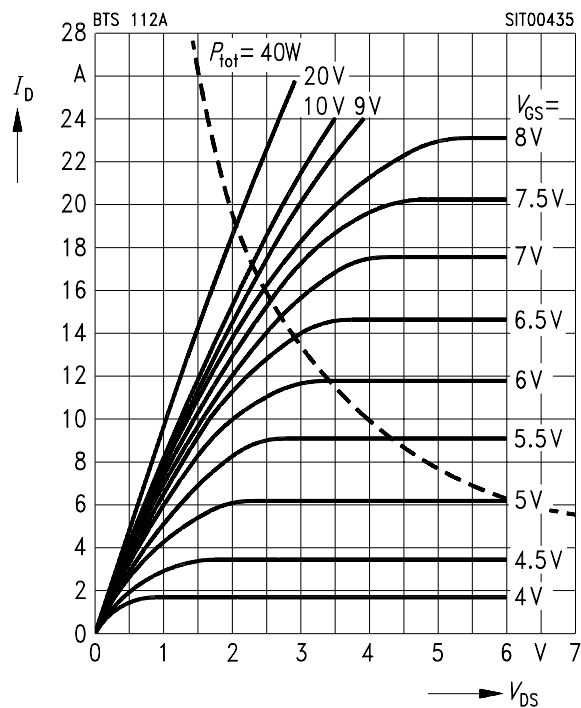
 Parameter:  $T_j = -55 \dots +150\text{ }^{\circ}\text{C}$ 


**Max. power dissipation  $P_{\text{tot}} = f(T_C)$** 

**Typ. drain-source on-state resistance  $R_{\text{DS(on)}} = f(I_D)$** 

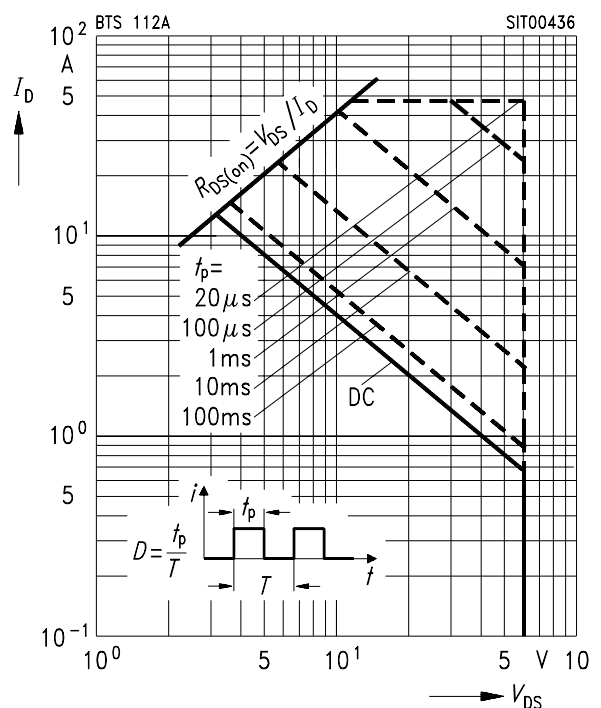
Parameter:  $V_{\text{GS}}$


**Typical output characteristics  $I_D = f(V_{\text{DS}})$** 

Parameter:  $t_p = 80 \text{ s}$


**Safe operating area  $I_D = f(V_{\text{DS}})$** 

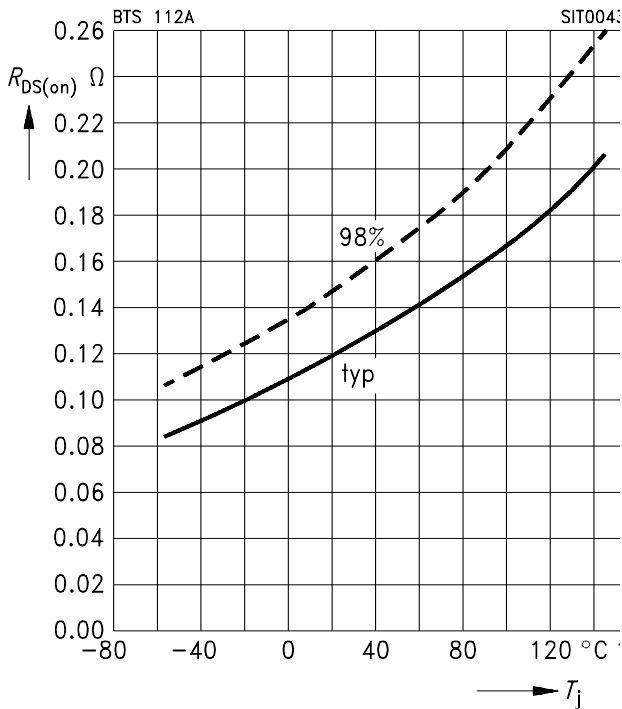
Parameter:  $D = 0.01$ ,  $T_C = 25^\circ\text{C}$



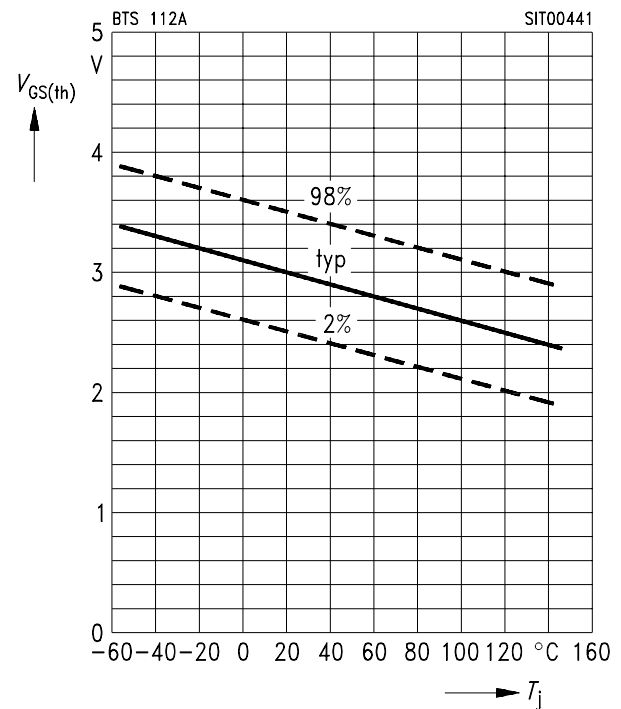
**Drain-source on-state resistance**

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

Parameter:  $I_D = 5 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$

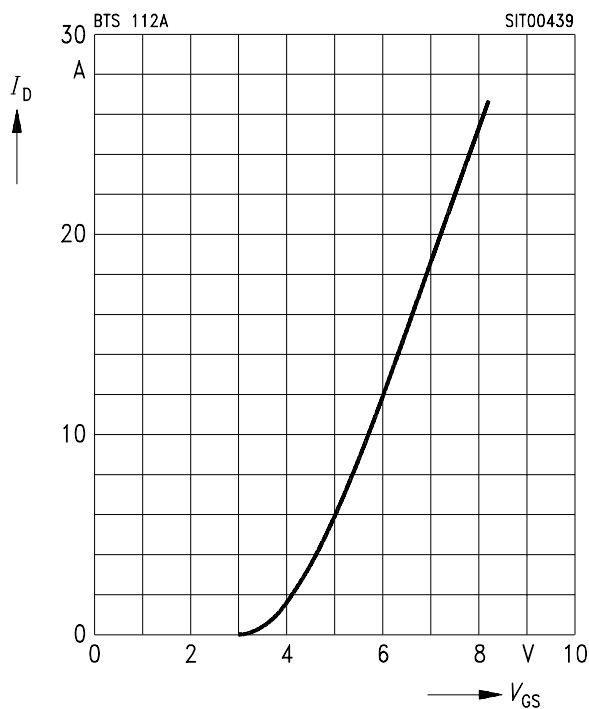

**Gate threshold voltage  $V_{GS(th)} = f(T_j)$** 

Parameter:  $V_{DS} = V_{GS}$ ,  $I_D = 1 \text{ mA}$

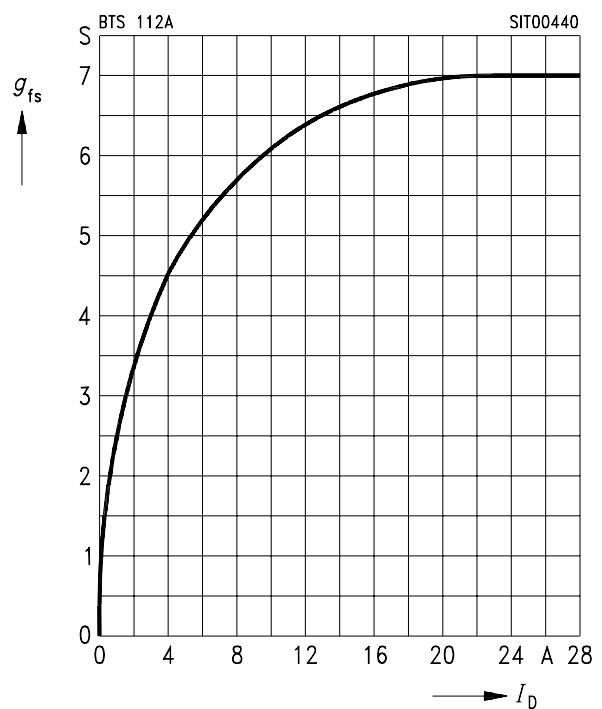

**Typ. transfer characteristic**

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

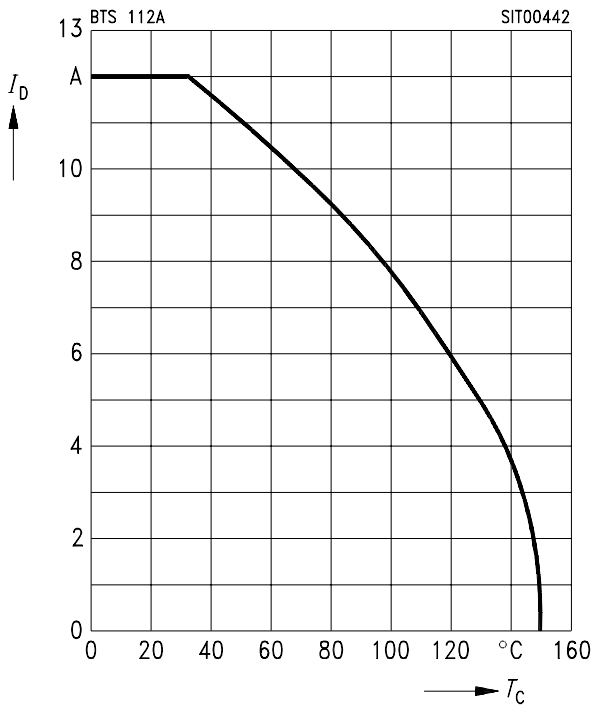
Parameter:  $t_p = 80 \mu\text{s}$ ,  $V_{DS} = 25 \text{ V}$

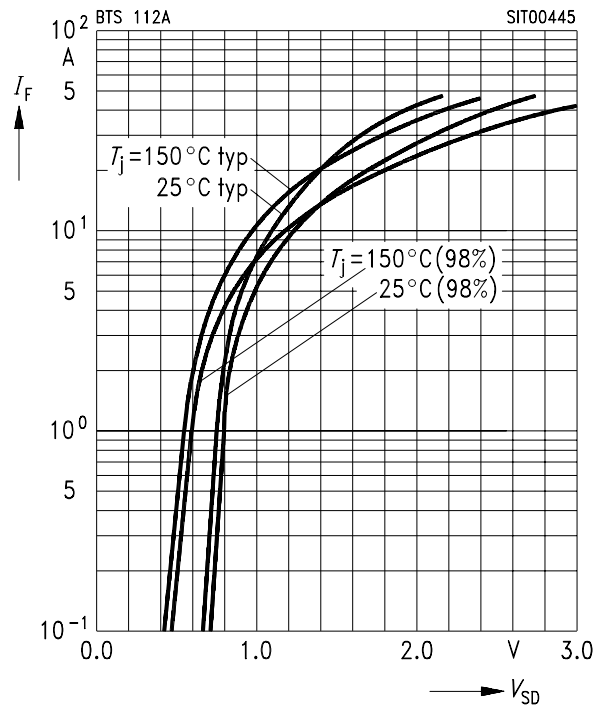

**Typ. transconductance  $g_{fs} = f(I_D)$** 

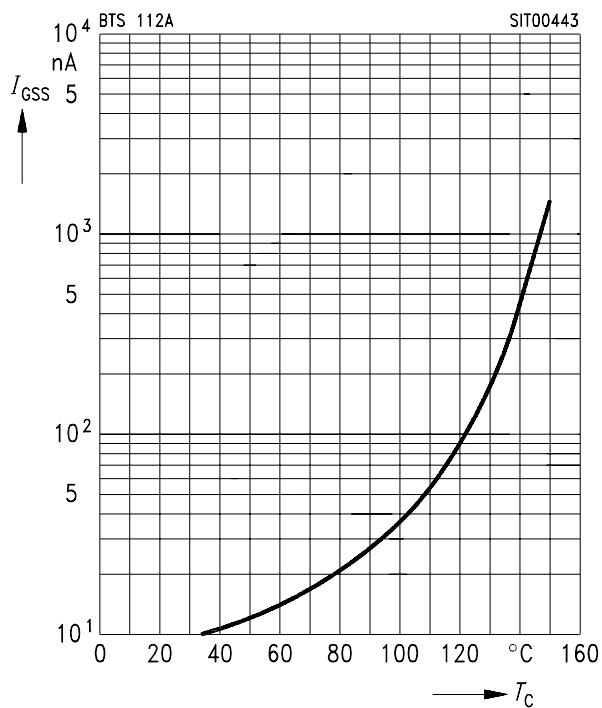
Parameter:  $t_p = 80 \mu\text{s}$ ,  $V_{DS} = 25 \text{ V}$

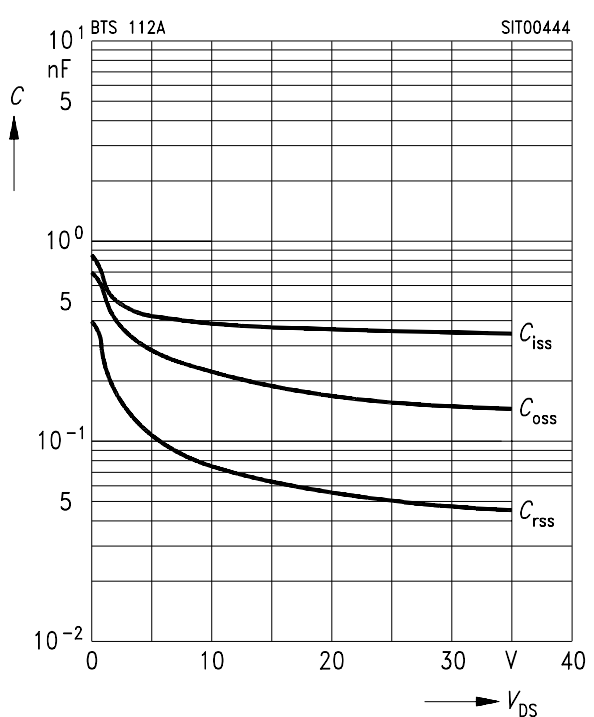


**Continuous drain current  $I_D = f(T_C)$** 

 Parameter:  $V_{GS} \geq -10 \text{ V}$ 

**Forward characteristics of reverse diode  $I_F = f(V_{SD})$** 

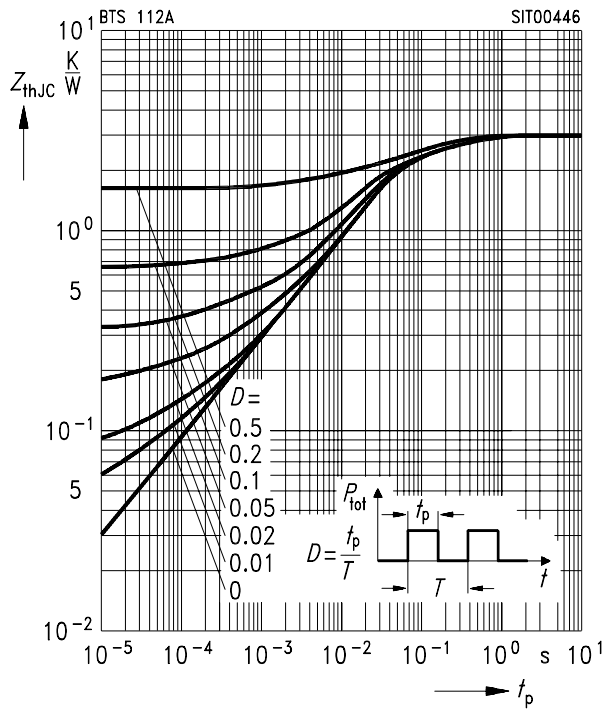
 Parameter:  $T_j, t_p = 80 \mu\text{s}$ 

**Typ. gate-source leakage current  $I_{GSS} = f(T_C)$** 

 Parameter:  $V_{GS} = -20 \text{ V}, V_{DS} = 0$ 

**Typ. capacitances  $C = f(V_{DS})$** 

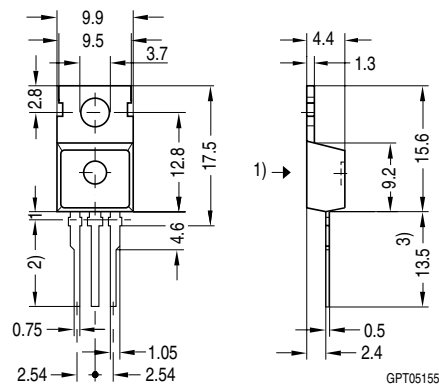
 Parameter:  $V_{GS} = 0, f = 1 \text{ MHz}$ 


**Transient thermal impedance  $Z_{thJC} = f(t_p)$**

Parameter:  $D = t_p/T$

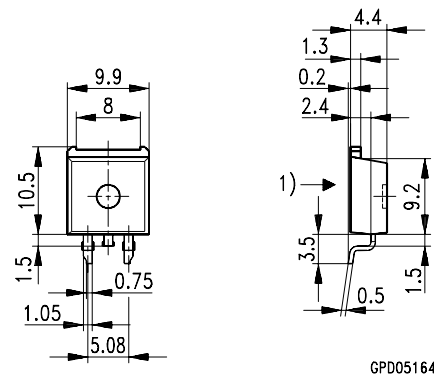


**TO 220 AB**  
 Standard

**Ordering Code**  
 C67078-S5014-A3


- 1) punch direction, burr max. 0.04  
 2) dip tinning  
 3) max. 14.5 by dip tinning press burr max. 0.05

**TO 220 AB**  
 SMD Version E 3045  
 Tape & reel E 3045 A

**Ordering Code**  
 C67078-S5014-A4  
 C67078-S5014-A5


- 1) shear and punch direction no burrs this surface



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