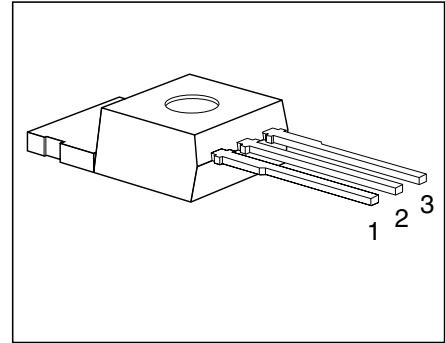


**Features**

- N channel
- Logic level
- Enhancement mode
- Temperature sensor with thyristor characteristic
- The drain pin is electrically shorted to the tab



| Pin | 1 | 2 | 3 |
|-----|---|---|---|
|     | G | D | S |

| Type     | $V_{DS}$ | $I_D$  | $R_{DS(on)}$  | Package  | Ordering Code   |
|----------|----------|--------|---------------|----------|-----------------|
| BTS 115A | 50 V     | 15.5 A | 0.12 $\Omega$ | TO-220AB | C67078-S5004-A2 |

**Maximum Ratings**

| Parameter  | Symbol               | Values           | Unit             |
|--|----------------------|------------------|------------------|
| Drain-source voltage   | $V_{DS}$             | 50               | V                |
| Drain-gate voltage, $R_{GS} = 20 \text{ k}\Omega$  | $V_{DGR}$            | 50               |                  |
| Gate-source voltage  | $V_{GS}$             | $\pm 10$         |                  |
| Continuous drain current, $T_C = 25 \text{ }^\circ\text{C}$  | $I_D$                | 15.5             | A                |
| ISO drain current<br>$T_C = 85 \text{ }^\circ\text{C}$ , $V_{GS} = 4.5 \text{ V}$ , $V_{DS} = 0.5 \text{ V}$ | $I_{D-ISO}$          | 3.2              |                  |
| Pulsed drain current, $T_C = 25 \text{ }^\circ\text{C}$  | $I_{D \text{ puls}}$ | 62               |                  |
| Short circuit current, $T_j = -55 \dots +150 \text{ }^\circ\text{C}$   | $I_{SC}$             | 37               |                  |
| Short circuit dissipation, $T_j = -55 \dots +150 \text{ }^\circ\text{C}$                                     | $P_{SCmax}$          | 550              | W                |
| Power dissipation  | $P_{tot}$            | 50               |                  |
| Operating and storage temperature range  | $T_j, T_{stg}$       | $-55 \dots +150$ | $^\circ\text{C}$ |
| DIN humidity category, DIN 40 040  | –                    | E                |                  |
| IEC climatic category, DIN IEC 68-1  | –                    | 55/150/56        |                  |
| Thermal resistance   |                      |                  | K/W              |
| Chip-case  | $R_{th \text{ JC}}$  | $\leq 2.5$       |                  |
| Chip-ambient   | $R_{th \text{ JA}}$  | $\leq 75$        |                  |

**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>$V_{GS} = 0, I_D = 0.25\text{ mA}$            | $V_{(BR)DSS}$ | 50                    | –    | –    | V             |
| Gate threshold voltage<br>$V_{GS} = V_{DS}, I_D = 1.0\text{ mA}$                | $V_{GS(th)}$  | 1.5                   | 2.0  | 2.5  |               |
| Zero gate voltage drain current<br>$V_{GS} = 0\text{ V}, V_{DS} = 50\text{ V}$  | $I_{DSS}$     |                       |      |      | $\mu\text{A}$ |
|   |               | $T_j = 25\text{ °C}$  | 0.1  | 1.0  |               |
|   |               | $T_j = 125\text{ °C}$ | 10   | 100  |               |
| Gate-source leakage current<br>$V_{GS} = 20\text{ V}, V_{DS} = 0$               | $I_{GSS}$     |                       |      |      |               |
|   |               | $T_j = 25\text{ °C}$  | 10   | 100  | nA            |
|   |               | $T_j = 150\text{ °C}$ | 2    | 4    | $\mu\text{A}$ |
| Drain-source on-state resistance<br>$V_{GS} = 4.5\text{ V}, I_D = 7.8\text{ A}$ | $R_{DS(on)}$  | –                     | 0.09 | 0.12 | $\Omega$      |

**Dynamic Characteristics**

|   |              |     |     |     |               |
|---|--------------|-----|-----|-----|---------------|
| Forward transconductance<br>$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}, I_D = 7.8\text{ A}$   | $g_{fs}$     | 5.5 | 9.5 | –   | S             |
| Input capacitance<br>$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$   | $C_{iss}$    | –   | 550 | 735 | $\mu\text{F}$ |
| Output capacitance<br>$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$  | $C_{oss}$    | –   | 220 | 320 |               |
| Reverse transfer capacitance<br>$V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$  | $C_{rss}$    | –   | 85  | 150 |               |
| Turn-on time $t_{on}$ , ( $t_{on} = t_{d(on)} + t_r$ )<br>$V_{CC} = 30\text{ V}, V_{GS} = 5\text{ V}, I_D = 3\text{ A}, R_{GS} = 50\text{ }\Omega$      | $t_{d(on)}$  | –   | 15  | 25  | ns            |
|   | $t_r$        | –   | 70  | 100 |               |
| Turn-off time $t_{off}$ , ( $t_{off} = t_{d(off)} + t_f$ )<br>$V_{CC} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_{GS} = 50\text{ }\Omega$ | $t_{d(off)}$ | –   | 70  | 90  |               |
|   | $t_f$        | –   | 50  | 70  |               |

**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   | $I_S$    | – | –    | 15.5 | A             |
| Pulsed source current   | $I_{SM}$ | – | –    | 62   |               |
| Diode forward on-voltage<br>$I_F = 15.5\text{ A}$ , $V_{GS} = 0\text{ V}$                           | $V_{SD}$ | – | 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>$I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | $Q_{rr}$ | – | 0.10 | –    | $\mu\text{C}$ |

**Temperature Sensor**

|  |              |              |            |            |               |
|--|--------------|--------------|------------|------------|---------------|
| Forward voltage<br>$I_{TS(on)} = 5.0\text{ mA}$ , $T_j = -55 \dots +150\text{ °C}$<br>Sensor override, $t_p \leq 100\text{ }\mu\text{s}$<br>$T_j = -55 \dots +160\text{ °C}$ | $V_{TS(on)}$ |              | 1.3        | 1.4        | V             |
|  |              | –            | –          | 10         |               |
| Forward current<br>$T_j = -55 \dots +150\text{ °C}$<br>Sensor override, $t_p \leq 100\text{ }\mu\text{s}$<br>$T_j = -55 \dots +160\text{ °C}$                                | $I_{TS(on)}$ | –            | –          | 5          | mA            |
|  |              | –            | –          | 600        |               |
| Holding current, $V_{TS(off)} = 5\text{ V}$ ,<br>$T_j = 25\text{ °C}$<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>$V_{TS} = 5\text{ V}$   | $T_{TS(on)}$ | 150          | –          | –          | $\text{°C}$   |
| Turn-off time<br>$V_{TS} = 5\text{ V}$ , $I_{TS(on)} = 2\text{ mA}$  | $t_{off}$    | 0.5          | –          | 2.5        | $\mu\text{s}$ |

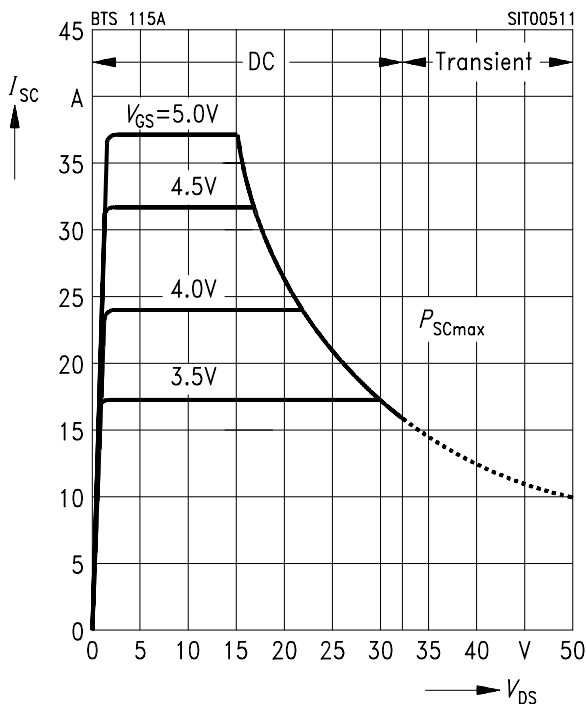
**Examples for short-circuit protection**

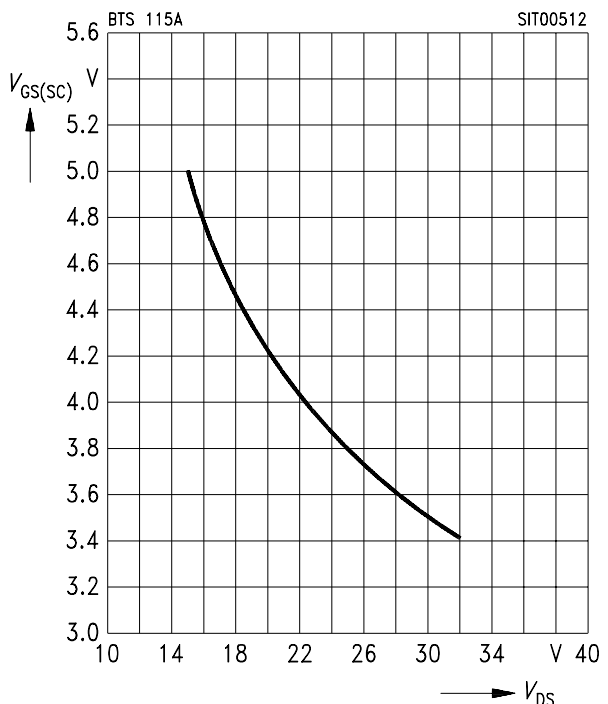
 at  $T_j = -55 \dots +150 \text{ }^\circ\text{C}$ , unless otherwise specified.

| Parameter   | Symbol        | Examples |     |   | Unit |
|---|---------------|----------|-----|---|------|
|   |               | 1        | 2   | – |      |
| Drain-source voltage  | $V_{DS}$      | 15       | 30  | – | V    |
| Gate-source voltage   | $V_{GS}$      | 5.0      | 3.5 | – |      |
| Short-circuit current   | $I_{SC}$      | 37       | 17  | – | A    |
| Short-circuit dissipation   | $P_{SC}$      | 550      | 510 | – | W    |
| Response time<br>$T_j = 25 \text{ }^\circ\text{C}$ , before short circuit | $t_{SC(off)}$ | 25       | 25  | – | ms   |

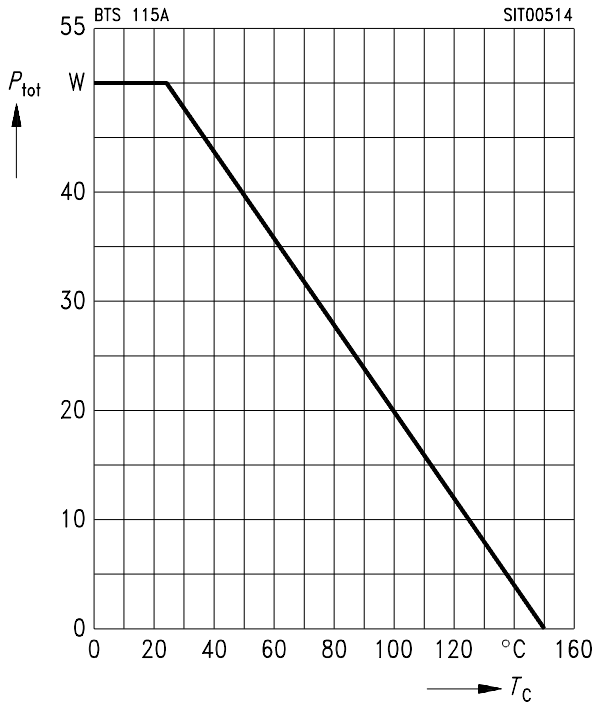
**Short-circuit protection  $I_{SC} = f(V_{DS})$** 

 Parameter:  $V_{GS}$ 

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

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

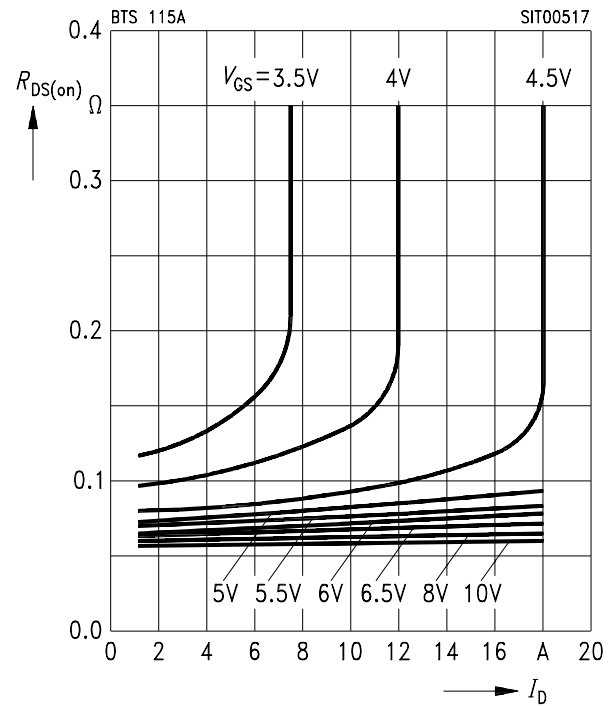
 Parameter:  $T_j = -55 \dots +150 \text{ }^\circ\text{C}$ 


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



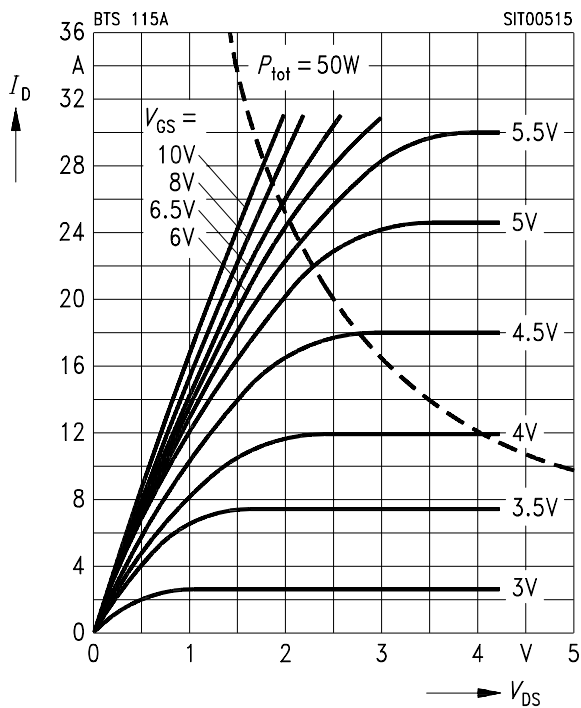
**Typ. drain-source on-state resistance  $R_{DS(on)} = f(I_D)$**

Parameter:  $V_{GS}$



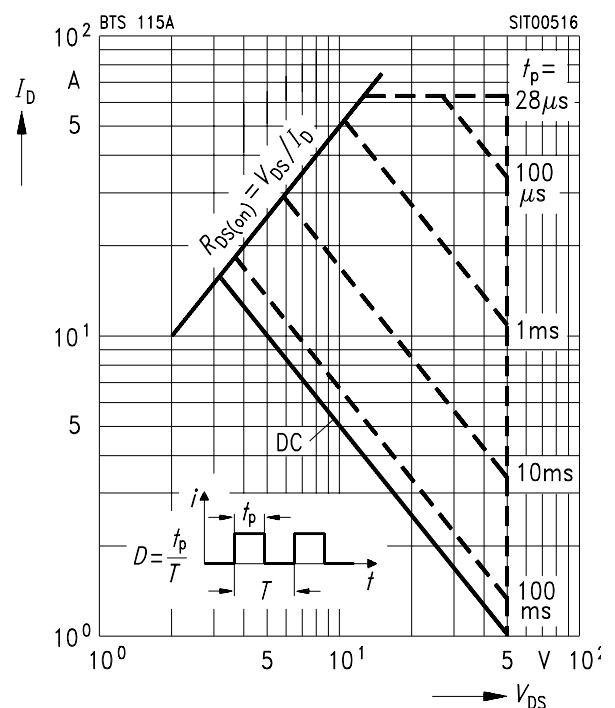
**Typical output characteristics  $I_D = f(V_{DS})$**

Parameter:  $t_p = 80 \mu s$



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

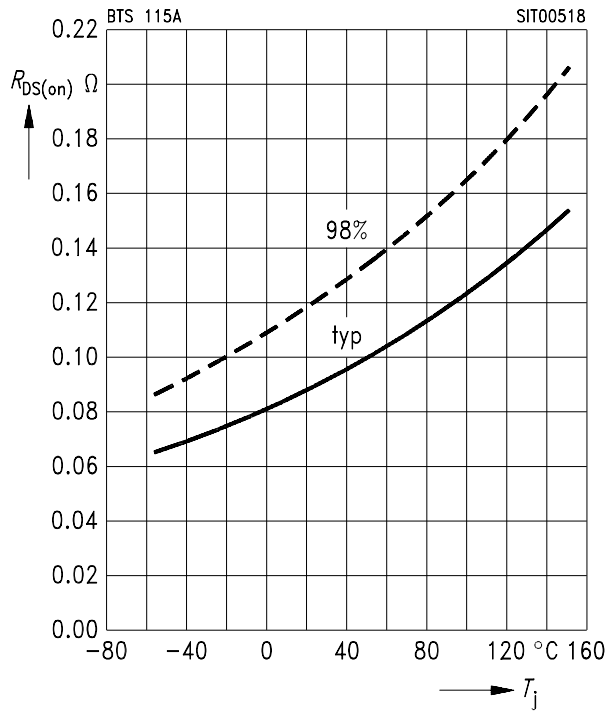
Parameter:  $D = 0.01$ ,  $T_C = 25^\circ C$



**Drain-source on-state resistance**

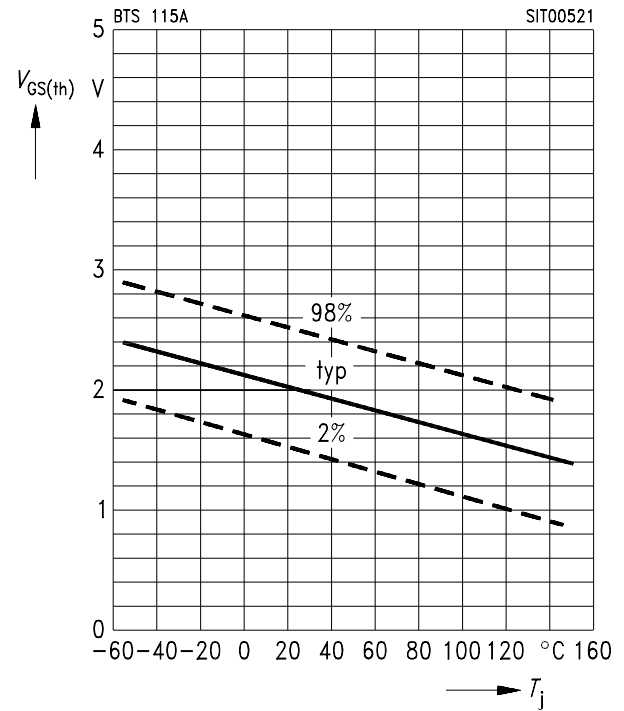
$R_{DS(on)} = f(T_j)$

Parameter:  $I_D = 7.8 \text{ A}$ ,  $V_{GS} = 4.5 \text{ V}$



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

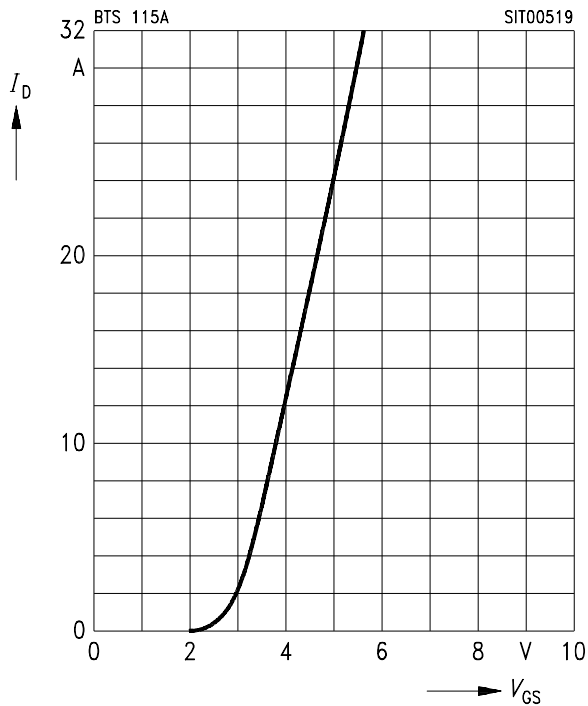
Parameter:  $V_{DS} = V_{GS}$ ,  $I_D = -1 \text{ mA}$



**Typ. transfer characteristic**

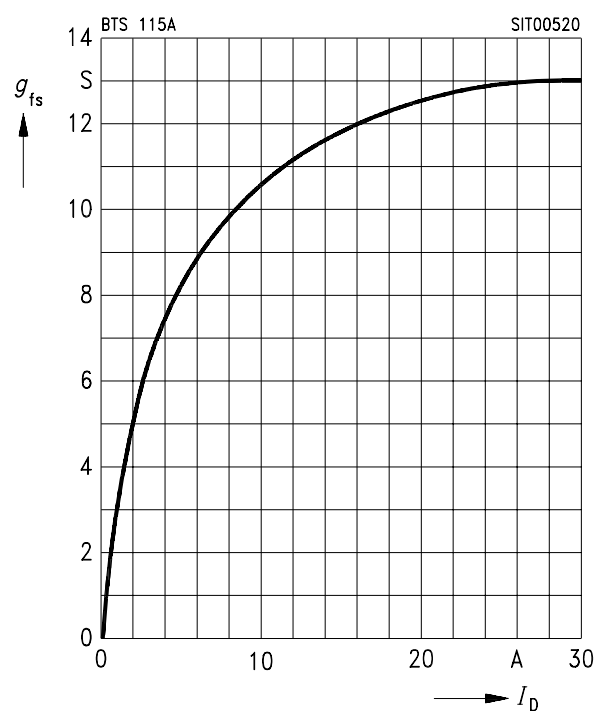
$I_D = f(V_{GS})$

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



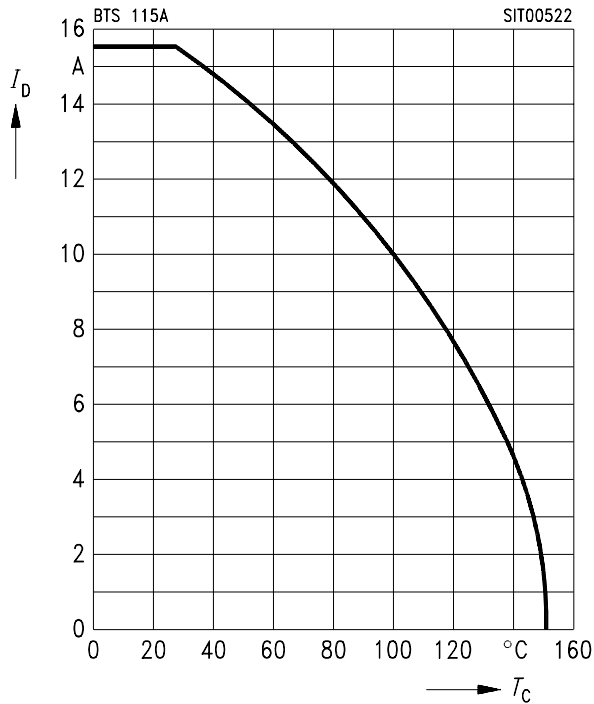
**Typ. transconductance  $g_{fs} = f(I_D)$**

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



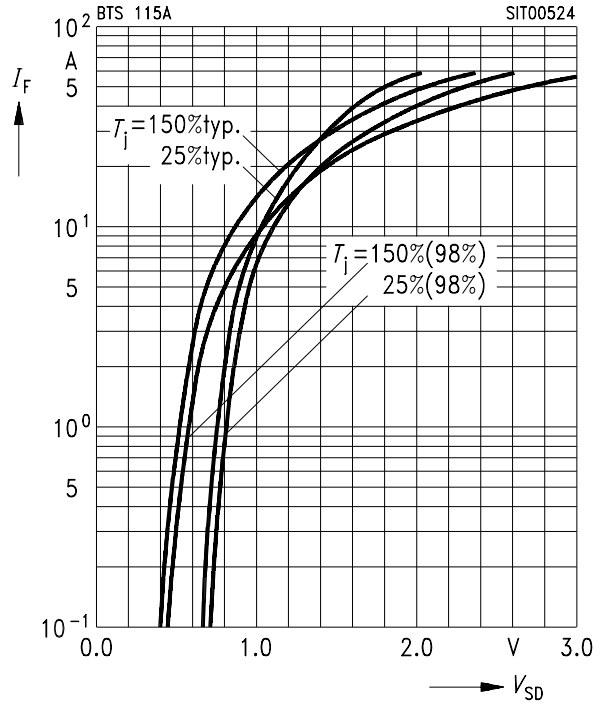
**Continuous drain current  $I_D = f(T_C)$**

Parameter:  $V_{GS} \geq 4.5 \text{ V}$



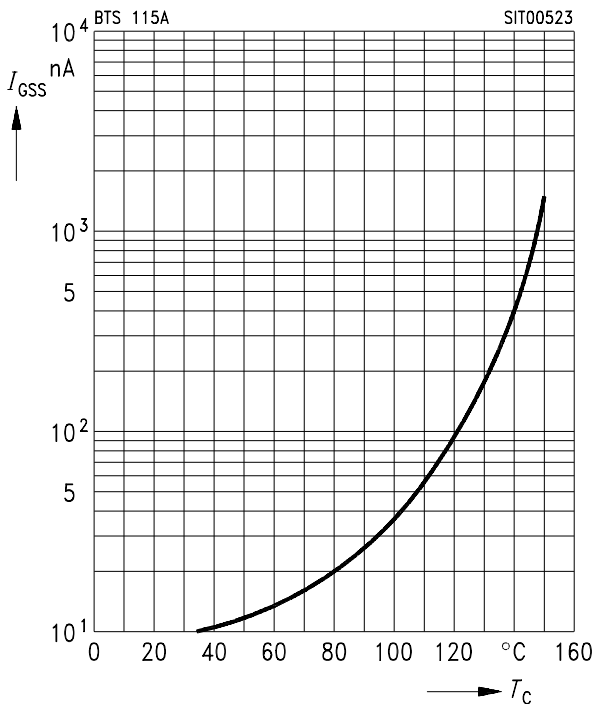
**Forward characteristics of reverse diode  $I_F = f(V_{SD})$**

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



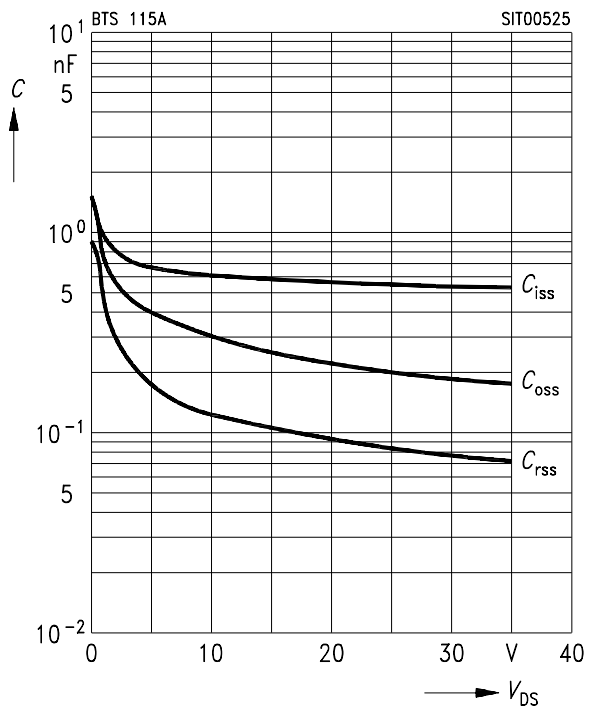
**Typ. gate-source leakage current  $I_{GSS} = f(T_C)$**

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

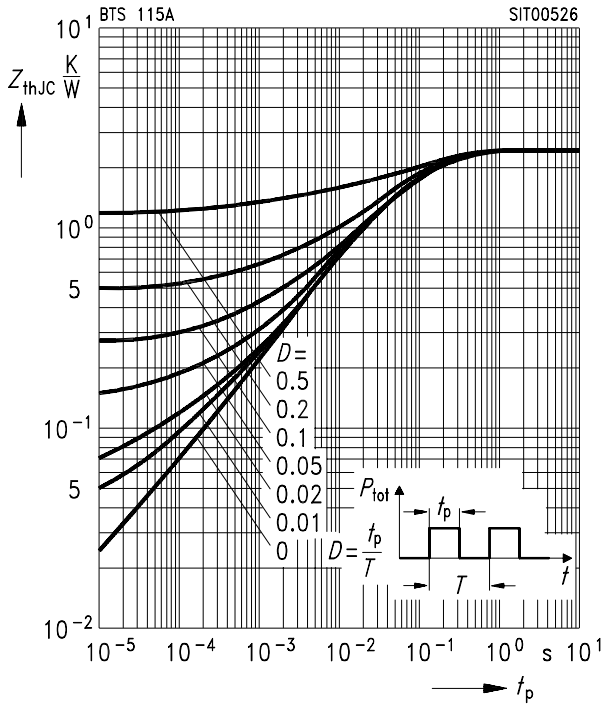


**Typ. capacitances  $C = f(V_{DS})$**

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

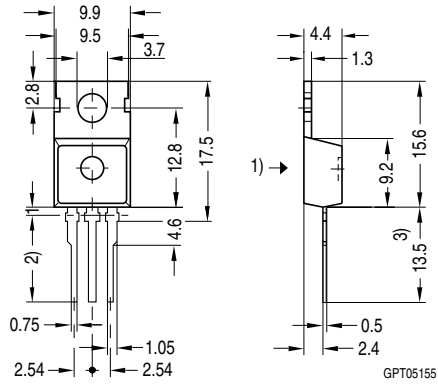


Transient thermal impedance  $Z_{thJC} = f(t_p)$   
 Parameter:  $D = t_p/T$



**TO 220 AB**  
Standard

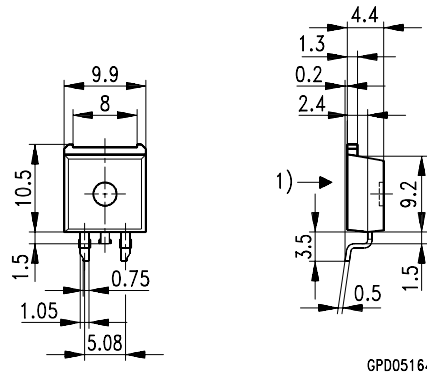
**Ordering Code**  
C67078-S5004-A2



- 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

**Ordering Code**  
C67078-S5004-A8



- 1) shear and punch direction no burrs this surface

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