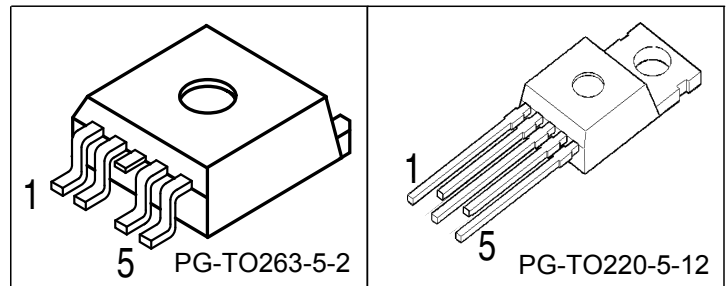
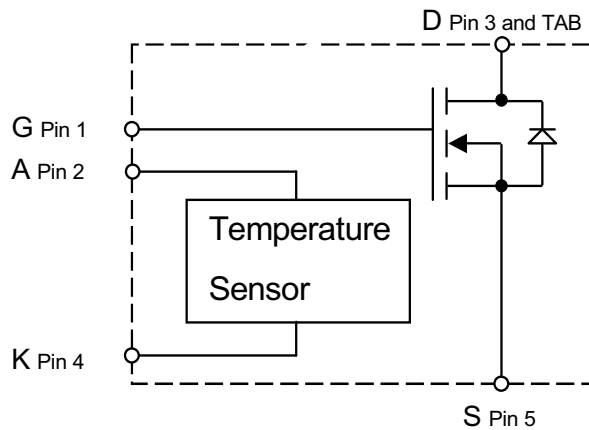


**Speed TEMPFET®**

- N-Channel
- Enhancement mode
- Logic Level Input
- Analog driving possible
- Fast switching up to 1 MHz
- Potential-free temperature sensor with thyristor characteristics
- Overtemperature protection
- Avalanche rated
- Green Product (RoHS Compliant)
- AEC Qualified



| Type           | $V_{DS}$ | $R_{DS(on)}$  | Package       |
|----------------|----------|---------------|---------------|
| BTS244Z E3062A | 55 V     | 13 m $\Omega$ | PG-TO263-5-2  |
| BTS244Z E3043  |          |               | PG-TO220-5-12 |



| Pin | Symbol | Function                   |
|-----|--------|----------------------------|
| 1   | G      | Gate                       |
| 2   | A      | Anode Temperature Sensor   |
| 3   | D      | Drain                      |
| 4   | K      | Cathode Temperature Sensor |
| 5   | S      | Source                     |

**Maximum Ratings**

| Parameter   | Symbol               | Value        | Unit             |
|---|----------------------|--------------|------------------|
| Drain source voltage  | $V_{DS}$             | 55           | V                |
| Drain-gate voltage, $R_{GS} = 20 \text{ k}\Omega$   | $V_{DGR}$            | 55           |                  |
| Gate source voltage   | $V_{GS}$             | $\pm 20$     |                  |
| Nominal load current (ISO 10483)<br>$V_{GS} = 4.5 \text{ V}$ , $V_{DS} \leq 0.5 \text{ V}$ , $T_C = 85 \text{ }^\circ\text{C}$<br>$V_{GS} = 10 \text{ V}$ , $V_{DS} \leq 0.5 \text{ V}$ , $T_C = 85 \text{ }^\circ\text{C}$ | $I_{D(ISO)}$         | 19<br>26     | A                |
| Continuous drain current <sup>1)</sup><br>$T_C = 100 \text{ }^\circ\text{C}$ , $V_{GS} = 4.5\text{V}$   | $I_D$                | 35           |                  |
| Pulsed drain current  | $I_{D \text{ puls}}$ | 188          |                  |
| Avalanche energy, single pulse<br>$I_D = 19 \text{ A}$ , $R_{GS} = 25 \text{ }\Omega$   | $E_{AS}$             | 1.65         | J                |
| Power dissipation<br>$T_C = 25 \text{ }^\circ\text{C}$  | $P_{\text{tot}}$     | 170          | W                |
| Operating temperature <sup>2)</sup>   | $T_j$                | -40 ... +175 | $^\circ\text{C}$ |
| Peak temperature ( single event )   | $T_{j\text{peak}}$   | 200          |                  |
| Storage temperature   | $T_{\text{stg}}$     | -55 ... +150 |                  |
| DIN humidity category, DIN 40 040   |                      | E            |                  |
| IEC climatic category; DIN IEC 68-1   |                      | 40/150/56    |                  |

<sup>1</sup>current limited by bond wire

<sup>2</sup>Note: Thermal trip temperature of temperature sensor is below 175°C

**Thermal Characteristics**

| Parameter   | Symbol       | Values |      |      | Unit |
|---|--------------|--------|------|------|------|
|   |              | min.   | typ. | max. |      |
| <b>Characteristics</b>  |              |        |      |      |      |
| junction - case:  | $R_{thJC}$   | -      | -    | 0.88 | K/W  |
| Thermal resistance @ min. footprint                               | $R_{th(JA)}$ | -      | -    | 62   |      |
| Thermal resistance @ 6 cm <sup>2</sup> cooling area <sup>1)</sup> | $R_{th(JA)}$ | -      | 33   | 40   |      |

**Electrical Characteristics**

| Parameter  | Symbol | Values |      |      | Unit |
|--|--------|--------|------|------|------|
|  |        | min.   | typ. | max. |      |
| at $T_j = 25^\circ\text{C}$ , unless otherwise specified |        |        |      |      |      |

**Static Characteristics**

|  |               |             |               |                 |                  |
|--|---------------|-------------|---------------|-----------------|------------------|
| Drain-source breakdown voltage<br>$V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$   | $V_{(BR)DSS}$ | 55          | -             | -               | V                |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 130\text{ }\mu\text{A}$<br>$I_D = 250\text{ }\mu\text{A}$  | $V_{GS(th)}$  | 1.2<br>-    | 1.6<br>1.65   | 2<br>-          |                  |
| Zero gate voltage drain current<br>$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = -40\text{ }^\circ\text{C}$<br>$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$<br>$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ | $I_{DSS}$     | -<br>-<br>- | -<br>0.1<br>- | 0.1<br>1<br>100 | $\mu\text{A}$    |
| Gate-source leakage current<br>$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$<br>$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$   | $I_{GSS}$     | -<br>-      | 10<br>20      | 100<br>100      | nA               |
| Drain-Source on-state resistance<br>$V_{GS} = 4.5\text{ V}$ , $I_D = 19\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $I_D = 19\text{ A}$  | $R_{DS(on)}$  | -<br>-      | 16<br>11.5    | 18<br>13        | $\text{m}\Omega$ |

<sup>1</sup> Device on 50mm\*50mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70 $\mu\text{m}$  thick) copper area for drain connection. PCB mounted vertical without blown air.

**Electrical Characteristics**

| Parameter<br>at $T_j = 25^\circ\text{C}$ , unless otherwise specified | Symbol | Values |      |      | Unit |
|---|--------|--------|------|------|------|
|   |        | min.   | typ. | max. |      |

**Dynamic Characteristics**

|  |              |    |      |      |    |
|--|--------------|----|------|------|----|
| Forward transconductance<br>$V_{DS} > 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 35\text{ A}$                           | $g_{fs}$     | 25 | -    | -    | S  |
| Input capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                               | $C_{iss}$    | -  | 2130 | 2660 | pF |
| Output capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                              | $C_{oss}$    | -  | 600  | 750  |    |
| Reverse transfer capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                    | $C_{rss}$    | -  | 320  | 400  |    |
| Turn-on delay time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 47\text{ A}$ ,<br>$R_G = 2.2\ \Omega$  | $t_{d(on)}$  | -  | 15   | 25   | ns |
| Rise time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 47\text{ A}$ ,<br>$R_G = 2.2\ \Omega$           | $t_r$        | -  | 70   | 105  |    |
| Turn-off delay time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 47\text{ A}$ ,<br>$R_G = 2.2\ \Omega$ | $t_{d(off)}$ | -  | 40   | 60   |    |
| Fall time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 47\text{ A}$ ,<br>$R_G = 2.2\ \Omega$           | $t_f$        | -  | 25   | 40   |    |

**Gate Charge Characteristics**

|   |                 |   |     |     |    |
|---|-----------------|---|-----|-----|----|
| Gate charge at threshold<br>$V_{DD} = 40\text{ V}$ , $I_D = 0.1\text{ A}$ , $V_{GS} = 0\text{ to }1\text{ V}$ | $Q_{g(th)}$     | - | 2.5 | 3.8 | nC |
| Gate charge at 5.0 V<br>$V_{DD} = 40\text{ V}$ , $I_D = 47\text{ A}$ , $V_{GS} = 0\text{ to }5\text{ V}$      | $Q_{g(5)}$      | - | 50  | 75  |    |
| Gate charge total<br>$V_{DD} = 40\text{ V}$ , $I_D = 47\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$        | $Q_{g(total)}$  | - | 85  | 130 |    |
| Gate plateau voltage<br>$V_{DD} = 40\text{ V}$ , $I_D = 47\text{ A}$  | $V_{(plateau)}$ | - | 4.5 | -   | V  |

**Electrical Characteristics**

| Parameter<br>at $T_j = 25^\circ\text{C}$ , unless otherwise specified                               | Symbol   | Values |      |      | Unit          |
|---|----------|--------|------|------|---------------|
|   |          | min.   | typ. | max. |               |
| <b>Reverse Diode</b>  |          |        |      |      |               |
| Inverse diode continuous forward current<br>$T_C = 25^\circ\text{C}$                                | $I_S$    | 35     | -    | -    | A             |
| Inverse diode direct current, pulsed<br>$T_C = 25^\circ\text{C}$                                    | $I_{FM}$ | 188    | -    | -    |               |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}$ , $I_F = 94\text{ A}$                        | $V_{SD}$ | -      | 1.25 | 1.8  | V             |
| Reverse recovery time<br>$V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$   | $t_{rr}$ | -      | 110  | 165  | ns            |
| Reverse recovery charge<br>$V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ | $Q_{rr}$ | -      | 0.23 | 0.35 | $\mu\text{C}$ |

**Sensor Characteristics**

For temperature sensing, i.e. temperature protection, please consider application note "Temperature sense concept - Speed TEMPFET".

For short circuit protection please consider application note "Short circuit behaviour of the Speed TEMPFET family".

All application notes are available at <http://www.infineon.com/tempfet/>

|  |              |   |     |     |    |
|--|--------------|---|-----|-----|----|
| Forward voltage<br>$I_{AK(on)} = 5\text{ mA}$ , $T_j = -40\dots+150^\circ\text{C}$<br>$I_{AK(on)} = 1.5\text{ mA}$ , $T_j = 150^\circ\text{C}$ | $V_{AK(on)}$ | - | 1.3 | 1.4 | V  |
| Sensor override<br>$t_P = 100\ \mu\text{s}$ , $T_j = -40\dots+150^\circ\text{C}$   |              | - | -   | 10  |    |
| Forward current<br>$T_j = -40\dots+150^\circ\text{C}$  | $I_{AK(on)}$ | - | -   | 5   | mA |
| Sensor override<br>$t_P = 100\ \mu\text{s}$ , $T_j = -40\dots+150^\circ\text{C}$   |              | - | -   | 600 |    |

### Electrical Characteristics

| Parameter<br>at $T_j = 25^\circ\text{C}$ , unless otherwise specified | Symbol | Values |      |      | Unit |
|---|--------|--------|------|------|------|
|   |        | min.   | typ. | max. |      |

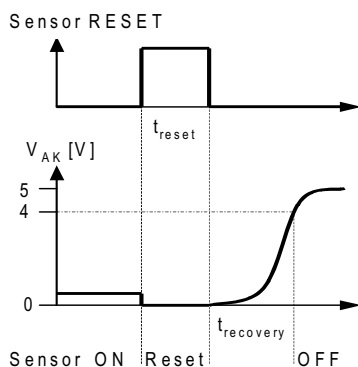
### Sensor Characteristics

|   |                |     |   |     |               |
|---|----------------|-----|---|-----|---------------|
| Temperature sensor leakage current<br>$T_j = 150^\circ\text{C}$   | $I_{AK(off)}$  | -   | - | 4   | $\mu\text{A}$ |
| Min. reset pulse duration <sup>1)</sup><br>$T_j = -40\dots+150^\circ\text{C}$ , $I_{AK(on)} = 0.3\text{ mA}$ ,<br>$V_{AK(Reset)} < 0.5\text{V}$ | $t_{reset}$    | 100 | - | -   | $\mu\text{s}$ |
| $V_{AK}$ Recovery time <sup>1)2)</sup><br>$T_j = -40\dots+150^\circ\text{C}$ , $I_{AK(on)} = 0.3\text{ mA}$                                     | $t_{recovery}$ | -   | - | 150 |               |

### Characteristics

|   |                 |              |        |            |                  |
|---|-----------------|--------------|--------|------------|------------------|
| Holding current, $V_{AK(off)} = 5\text{V}$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | $I_{AK(hold)}$  | 0.05<br>0.05 | -<br>- | 0.5<br>0.3 | $\text{mA}$      |
| Thermal trip temperature<br>$V_{TS} = 5\text{V}$  | $T_{TS(on)}$    | 150          | 160    | 170        | $^\circ\text{C}$ |
| Turn-off time (Pin G+A and K+S connected)<br>$V_{TS} = 5\text{V}$ , $I_{TS(on)} = 2\text{ mA}$      | $t_{off}$       | 0.5          | -      | 2.5        | $\mu\text{s}$    |
| Reset voltage<br>$T_j = -40\dots+150^\circ\text{C}$   | $V_{AK(reset)}$ | 0.5          | -      | -          | $\text{V}$       |

### Sensor recovery behaviour:

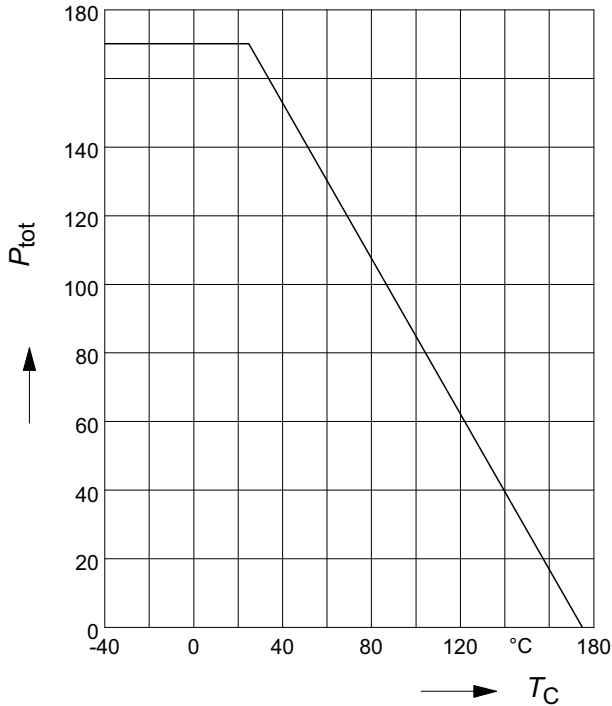


<sup>1</sup>See diagram Sensor recovery behaviour

<sup>2</sup>Time after reset pulse until  $V_{AK}$  reaches 4V again

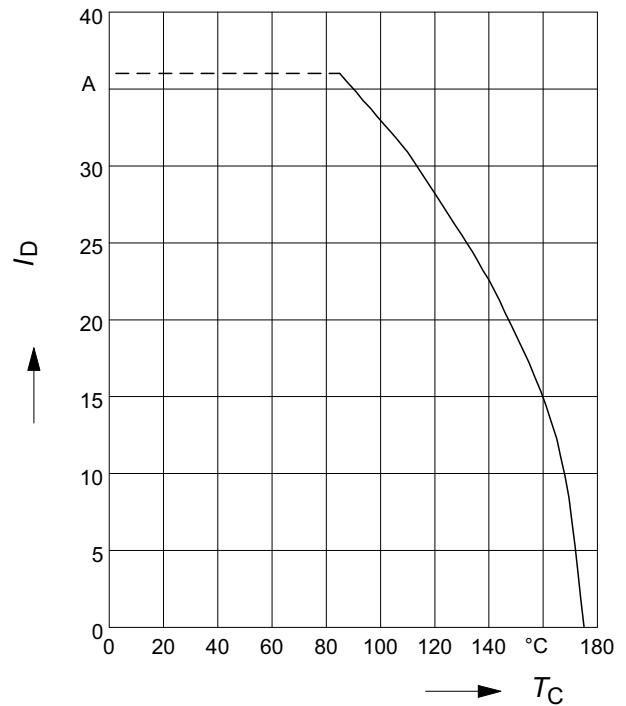
**1 Maximum allowable power dissipation**

$P_{tot} = f(T_C)$



**2 Drain current**

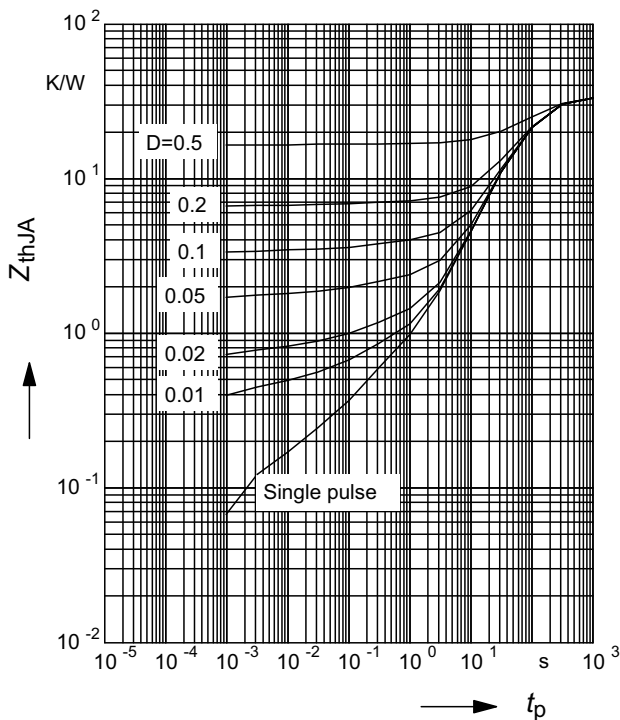
$I_D = f(T_C); V_{GS} \geq 4.5V$



**3 Typ. transient thermal impedance**

$Z_{thJA} = f(t_p)$  @ 6 cm<sup>2</sup> cooling area

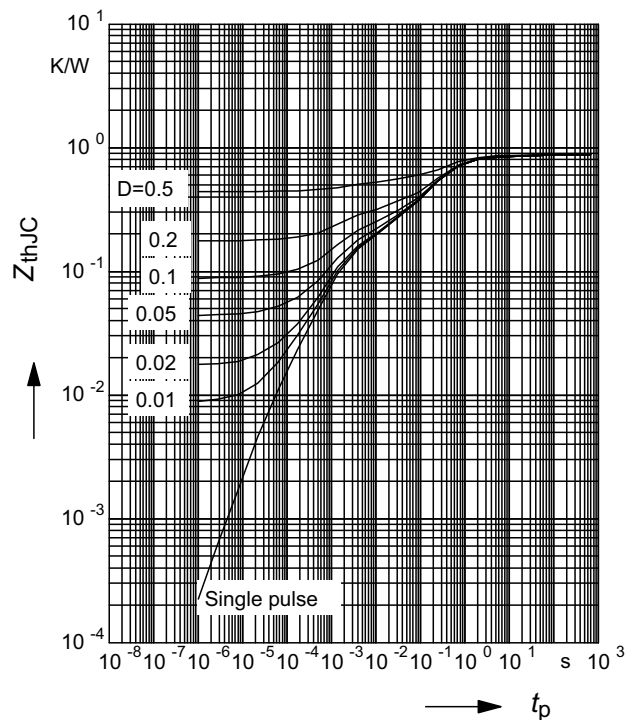
Parameter:  $D = t_p/T$



**4 Transient thermal impedance**

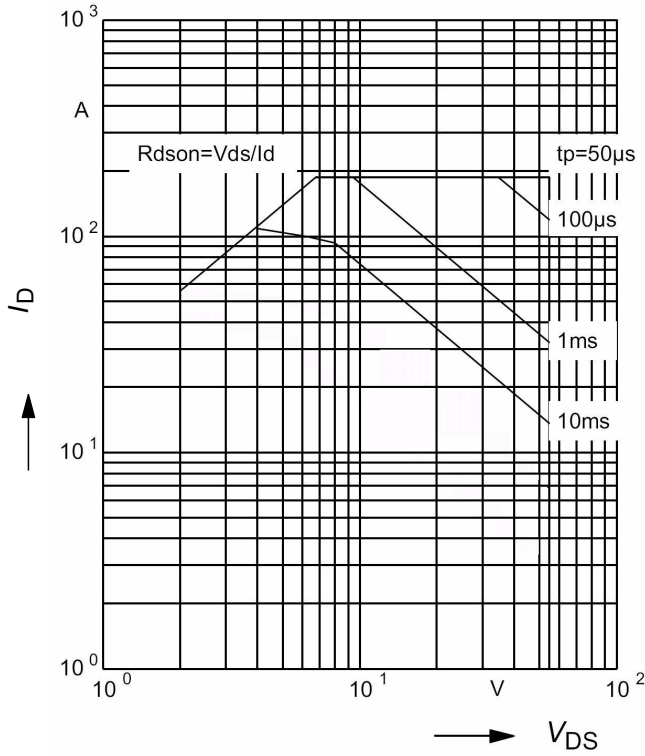
$Z_{thJC} = f(t_p)$

parameter :  $D = t_p/T$



### 5 Safe operating area

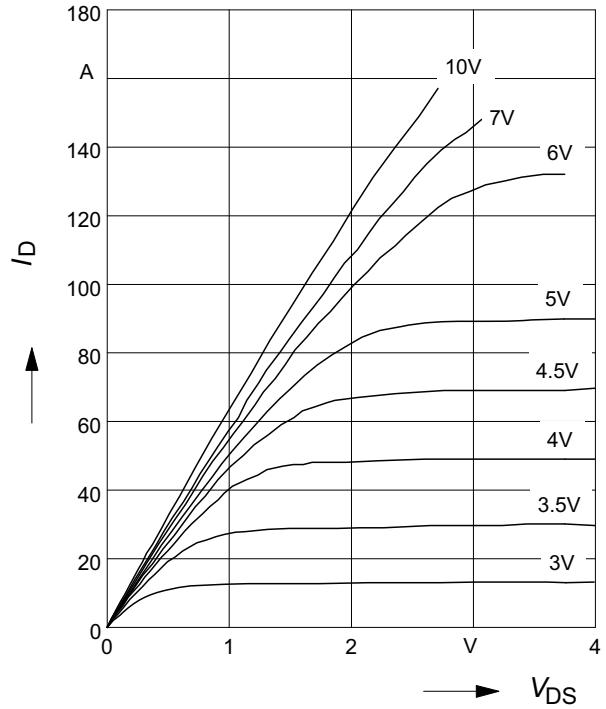
$I_D = f(V_{DS}); D=0.01; T_C=25^\circ\text{C}$



### 6 Typ. output characteristic

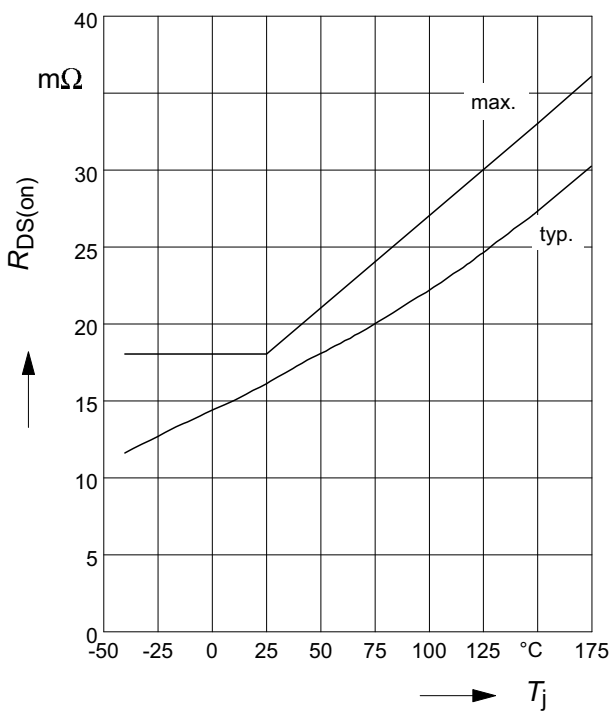
$I_D = f(V_{DS}); T_j=25^\circ\text{C}$

Parameter:  $V_{GS}$



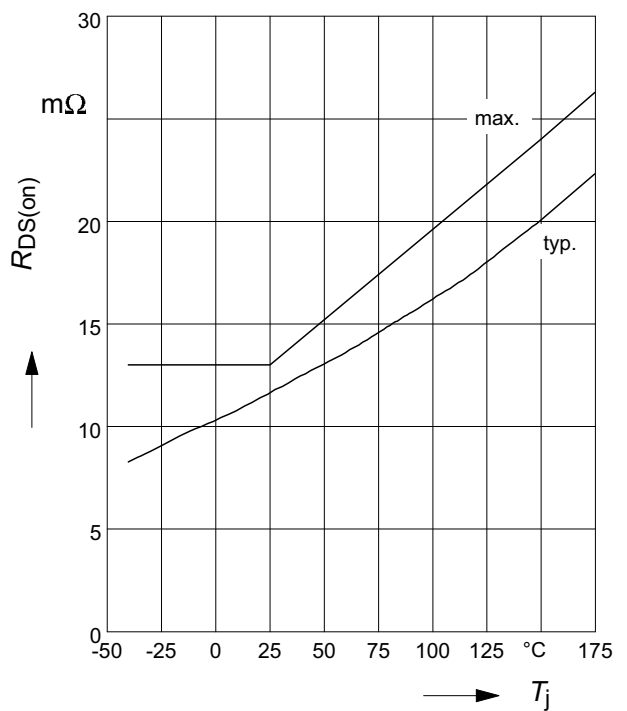
### 7 On-state resistance

$R_{ON} = f(T_j); I_D=19\text{A}; V_{GS} = 4.5\text{V}$



### 8 On-state resistance

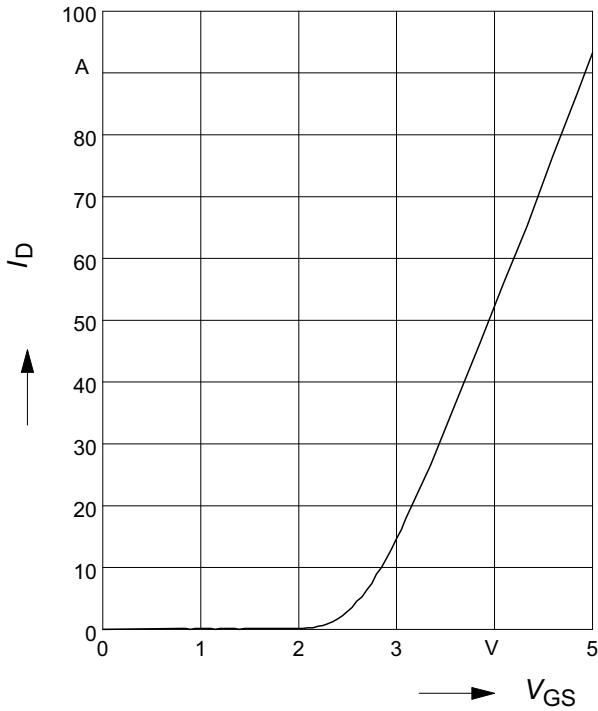
$R_{ON} = f(T_j); I_D=19\text{A}; V_{GS} = 10\text{V}$





**9 Typ. transfer characteristics**

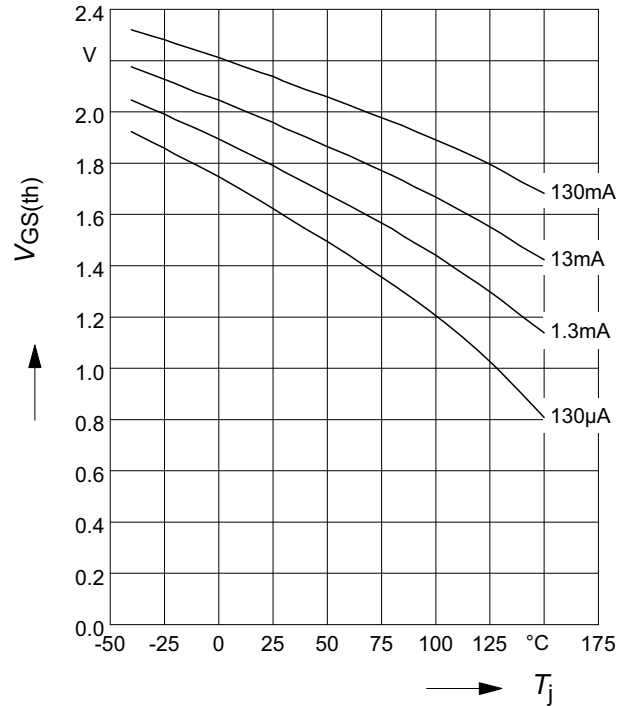
$I_D = f(V_{GS}); V_{DS} = 12V; T_j = 25^\circ C$



**10 Typ. input threshold voltage**

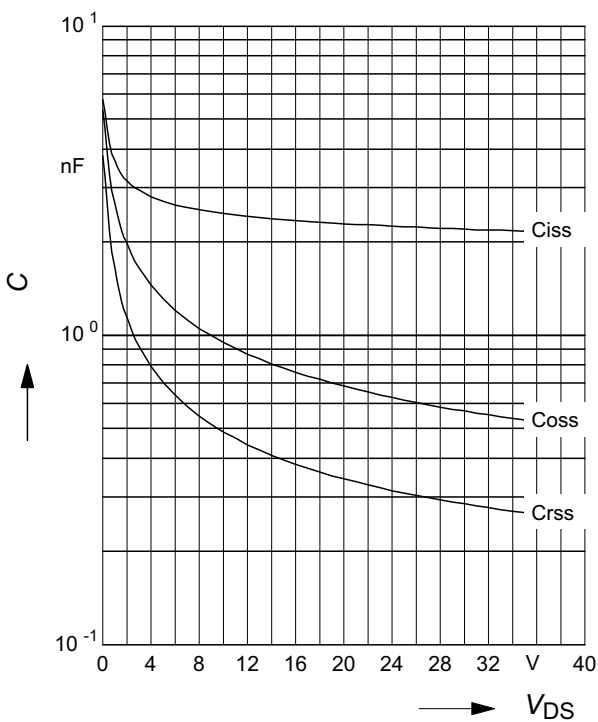
$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}$

Parameter:  $I_D$



**11 Typ. capacitances**

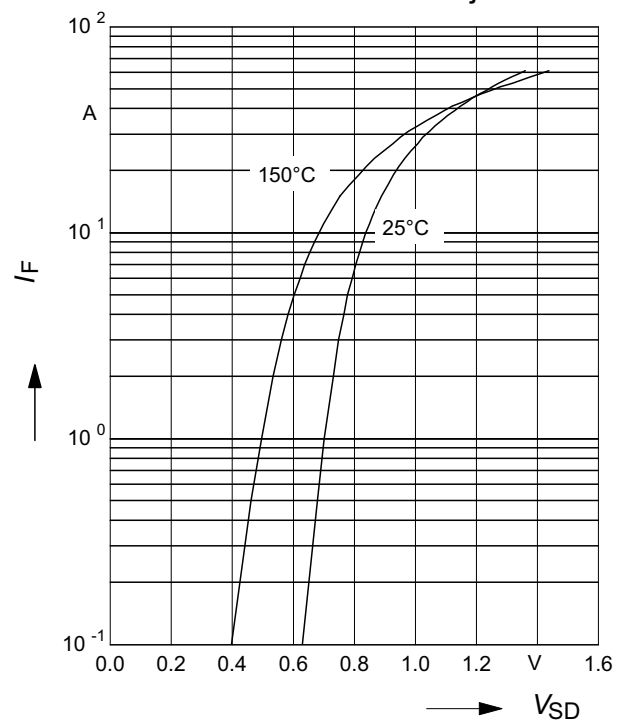
$C = f(V_{DS}); V_{GS} = 0V, f = 1MHz$



**12 Typ. forward characteristics of reverse diode**

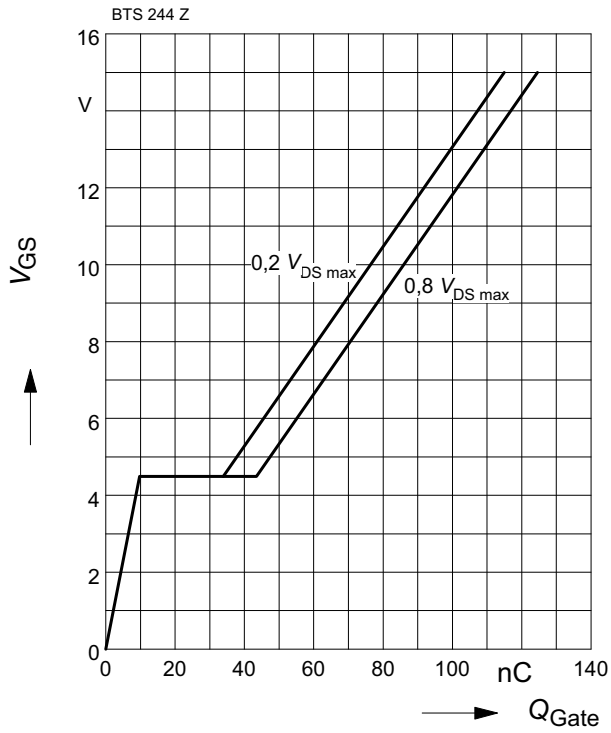
$I_F = f(V_{SD})$

$t_p = 80\mu s$  (spread); Parameter:  $T_j$



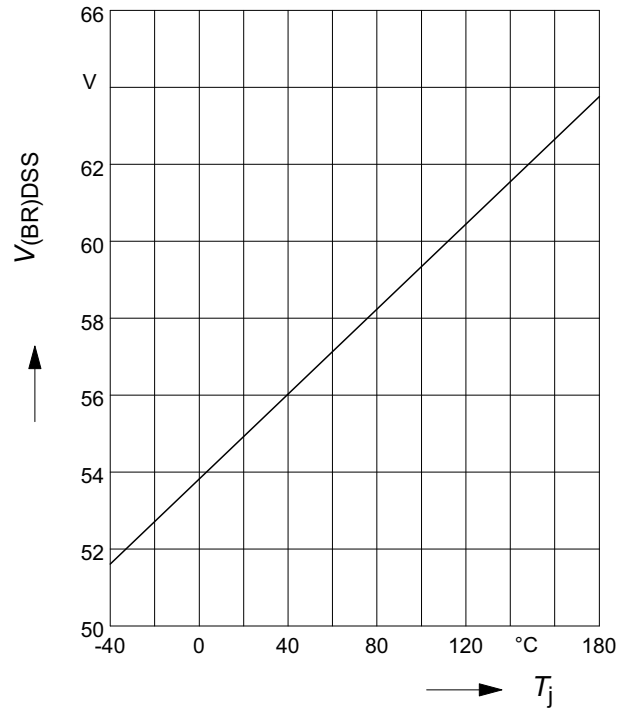
### 13 Typ. gate charge

$V_{GS} = f(Q_{Gate}); I_{D\ puls} = 47A$



### 14 Drain-source break down voltage

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



# 1 Package Outlines

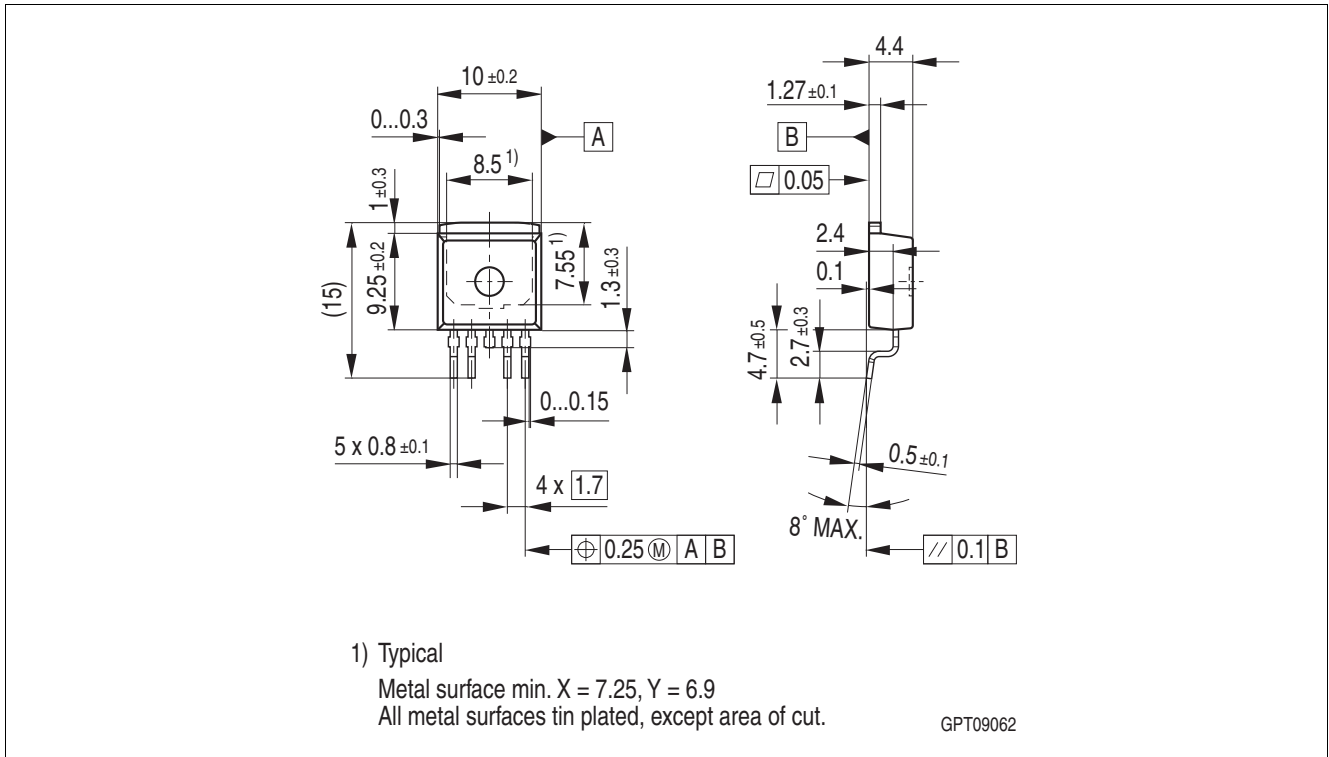


Figure 1 PG-TO263-5-2

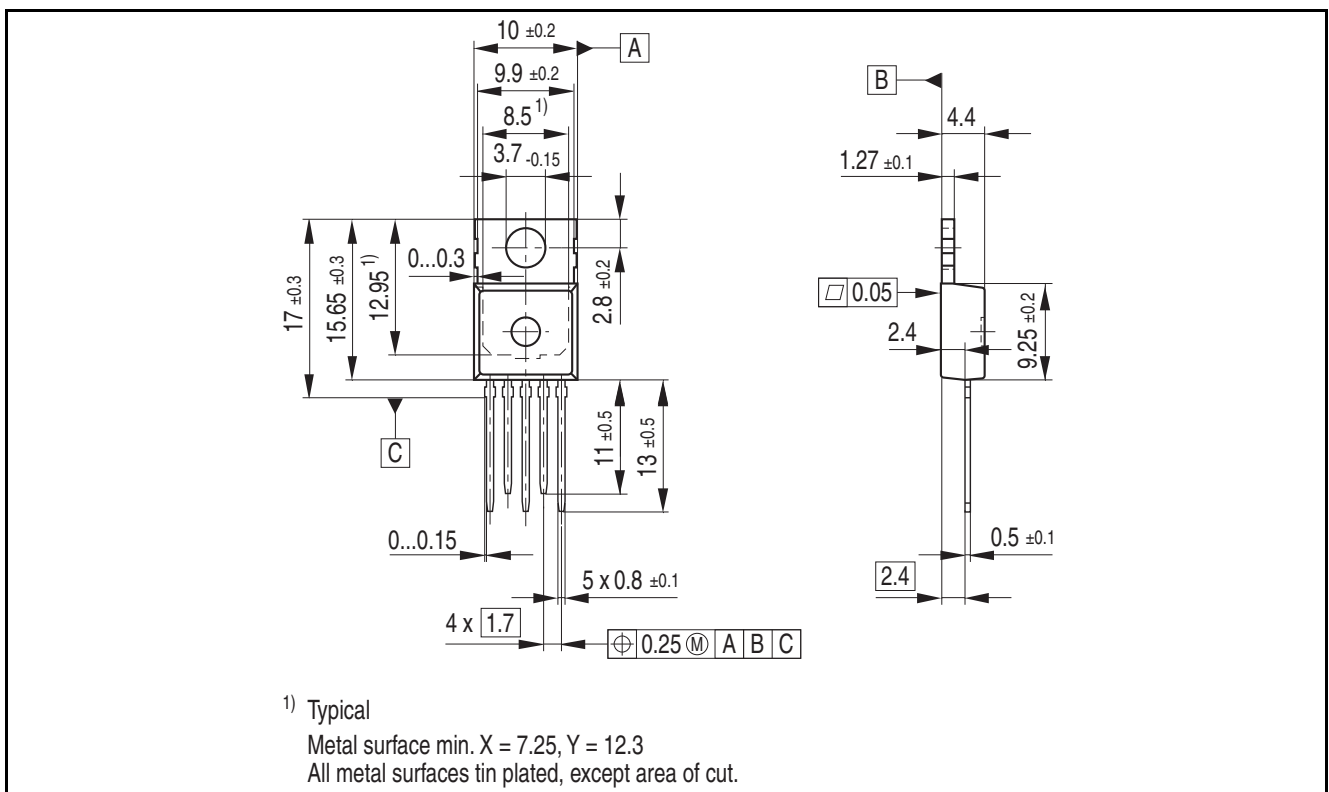


Figure 2 PG-TO220-5-12

**Green Product (RoHS compliant)**

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e. Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

## 2 Revision History

| Revision | Date       | Changes   |
|----------|------------|---|
| 1.4      | 2013-07-26 | page 1, 11: updated package name and package drawing:<br>PG-TO220-5-62 to PG-TO263-5-2 (SMD)<br>PG-TO220-5-43 to PG-TO220-5-12 (THD, straight leads);<br>page 1, 11/12: removed package: PG-TO220-5-3 (THD, staggered leads)<br>page 1: added sales names for the different packages;<br>page 8: updated description figure 5 |
| 1.3      | 2009-12-04 | updated package drawing of PG-TO220-5-62  |
| 1.2      | 2009-07-31 | removed 100ms and DC line in SOA diagram  |
| 1.1      | 2008-11-10 | all pages:<br>added new Infineon logo<br>Initial version of RoHS-compliant derivate of the BTS244Z<br>Page 1 and 12: added RoHS compliance statement and Green product feature<br>Page 1, 11 and 12: Package changed to RoHS compliant version<br>page 13: added Revision history<br>page 14: update of disclaimer            |

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