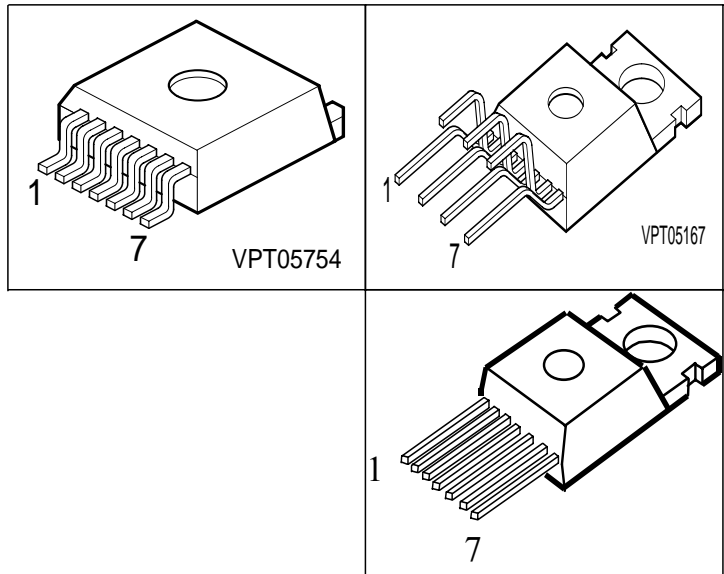
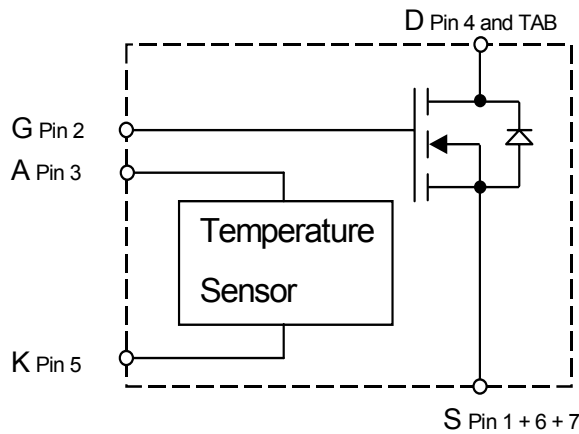


**Speed TEMPFET®**

- 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
- High current pinning



| Type      | $V_{DS}$ | $R_{DS(on)}$ | Package       | Ordering Code   |
|-----------|----------|--------------|---------------|-----------------|
| BTS 282 Z | 49 V     | 6.5 mΩ       | P-TO220-7-3   | Q67060-S6004-A2 |
|           |          |              | P-TO220-7-180 | Q67060-S6005-A2 |
|           |          |              | P-TO220-7-230 | Q67060-S6007    |



| Pin | Symbol | Function                   |
|-----|--------|----------------------------|
| 1   | S      | Source                     |
| 2   | G      | Gate                       |
| 3   | A      | Anode Temperature Sensor   |
| 4   | D      | Drain                      |
| 5   | K      | Cathode Temperature Sensor |
| 6   | S      | Source                     |
| 7   | S      | Source                     |

**Maximum Ratings**

| Parameter                                                                                                                                                                                                                   | Symbol               | Value        | Unit             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------|------------------|
| Drain source voltage                                                                                                                                                                                                        | $V_{DS}$             | 49           | V                |
| Drain-gate voltage, $R_{GS} = 20 \text{ k}\Omega$                                                                                                                                                                           | $V_{DGR}$            | 49           |                  |
| 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>$V_{GS} = 10 \text{ V}$ , $V_{DS} \leq 0.5 \text{ V}$ , $T_C = 85 \text{ }^\circ\text{C}$ | $I_{D(ISO)}$         | 36<br>52     | A                |
| Continuous drain current <sup>1)</sup><br>$T_C = 100 \text{ }^\circ\text{C}$ , $V_{GS} = 4.5 \text{ V}$                                                                                                                     | $I_D$                | 80           |                  |
| Pulsed drain current                                                                                                                                                                                                        | $I_{D \text{ puls}}$ | 320          |                  |
| Avalanche energy, single pulse<br>$I_D = 36 \text{ A}$ , $R_{GS} = 25 \text{ }\Omega$                                                                                                                                       | $E_{AS}$             | 2            | J                |
| Power dissipation<br>$T_C = 25 \text{ }^\circ\text{C}$                                                                                                                                                                      | $P_{\text{tot}}$     | 300          | 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:                                                  | $R_{thJC}$   | -      | -    | 0.5  | 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>$V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$                                                                                                                                                                                                                 | $V_{(BR)DSS}$ | 49  | -   | -   | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 240\text{ }\mu\text{A}$                                                                                                                                                                                                                      | $V_{GS(th)}$  | 1.2 | 1.6 | 2   |               |
| Zero gate voltage drain current<br>$V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = -40\text{ }^\circ\text{C}$<br>$V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$<br>$V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ | $I_{DSS}$     | -   | -   | 0.1 | $\mu\text{A}$ |
|                                                                                                                                                                                                                                                                                                  |               | -   | 0.1 | 1   |               |
|                                                                                                                                                                                                                                                                                                  |               | -   | -   | 100 |               |
| Gate-source leakage current<br>$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$<br>$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$                                                                                           | $I_{GSS}$     | -   | 10  | 100 | nA            |
|                                                                                                                                                                                                                                                                                                  |               | -   | 20  | 100 |               |
| Drain-Source on-state resistance<br>$V_{GS} = 4.5\text{ V}$ , $I_D = 36\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $I_D = 36\text{ A}$                                                                                                                                                                | $R_{DS(on)}$  | -   | 8.2 | 9.5 | m $\Omega$    |
|                                                                                                                                                                                                                                                                                                  |               | -   | 5.8 | 6.5 |               |

<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>$V_{DS} > 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 80\text{ A}$                           | $g_{fs}$     | 30 | 70   | -    | S  |
| Input capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                               | $C_{iss}$    | -  | 3850 | 4800 | pF |
| Output capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                              | $C_{oss}$    | -  | 1090 | 1357 |    |
| Reverse transfer capacitance<br>$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                    | $C_{rss}$    | -  | 570  | 715  |    |
| Turn-on delay time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$R_G = 1.3\ \Omega$  | $t_{d(on)}$  | -  | 30   | 45   | ns |
| Rise time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$R_G = 1.3\ \Omega$           | $t_r$        | -  | 37   | 56   |    |
| Turn-off delay time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$R_G = 1.3\ \Omega$ | $t_{d(off)}$ | -  | 70   | 105  |    |
| Fall time<br>$V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$R_G = 1.3\ \Omega$           | $t_f$        | -  | 36   | 55   |    |

**Gate Charge Characteristics**

|                                                                                                                  |                 |   |     |     |    |
|------------------------------------------------------------------------------------------------------------------|-----------------|---|-----|-----|----|
| Gate charge at threshold<br>$V_{DD} = 40\text{ V}$ , $I_D \geq 0,1\text{ A}$ , $V_{GS} = 0\text{ to }1\text{ V}$ | $Q_{g(th)}$     | - | 3.8 | 5.7 | nC |
| Gate charge at 5.0 V<br>$V_{DD} = 40\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 0\text{ to }5\text{ V}$         | $Q_{g(5)}$      | - | 92  | 138 |    |
| Gate charge total<br>$V_{DD} = 40\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$           | $Q_{g(total)}$  | - | 155 | 232 |    |
| Gate plateau voltage<br>$V_{DD} = 40\text{ V}$ , $I_D = 80\text{ A}$                                             | $V_{(plateau)}$ | - | 3.4 | -   | 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>$T_C = 25^\circ\text{C}$                                | $I_S$    | 80     | -    | -    | A             |
| Inverse diode direct current, pulsed<br>$T_C = 25^\circ\text{C}$                                    | $I_{FM}$ | 320    | -    | -    |               |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}$ , $I_F = 95\text{ A}$                        | $V_{SD}$ | -      | 1.25 | 1.6  | V             |
| Reverse recovery time<br>$V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$   | $t_{rr}$ | -      | 105  | 157  | ns            |
| Reverse recovery charge<br>$V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ | $Q_{rr}$ | -      | 0.31 | 0.47 | $\mu\text{C}$ |

**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   |   |
| Sensor override<br>$t_P = 100\ \mu\text{s}$ , $T_j = -40\dots+150^\circ\text{C}$                                                               |              | - | -   | 600 |   |

**Electrical Characteristics**

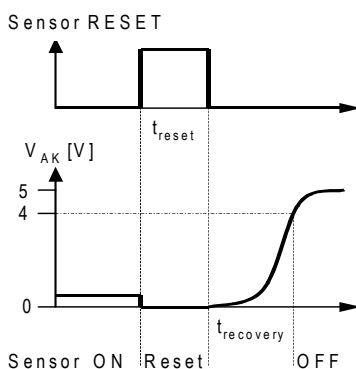
| Parameter<br>at $T_j = 25^\circ\text{C}$ , unless otherwise specified | Symbol | Values |      |      | Unit |
|-----------------------------------------------------------------------|--------|--------|------|------|------|
|                                                                       | 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

**Sensor Characteristics**

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

**Characteristics**

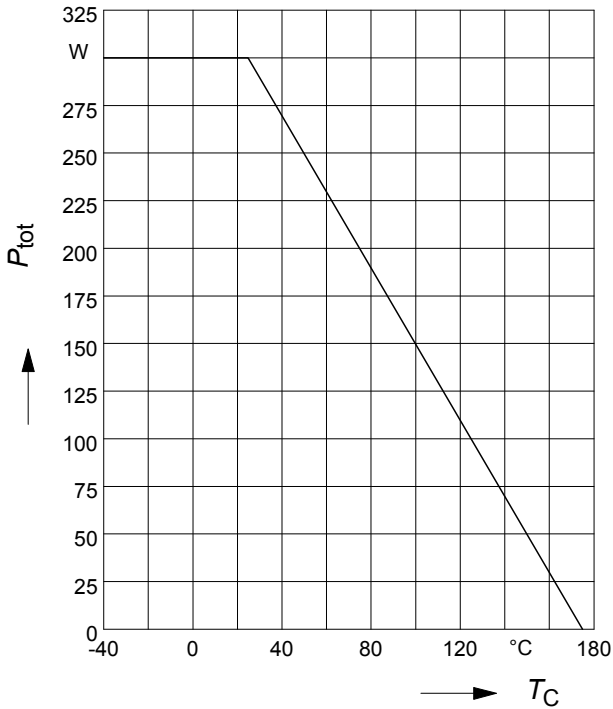
|                                                                                                            |                        |              |        |            |                  |
|------------------------------------------------------------------------------------------------------------|------------------------|--------------|--------|------------|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

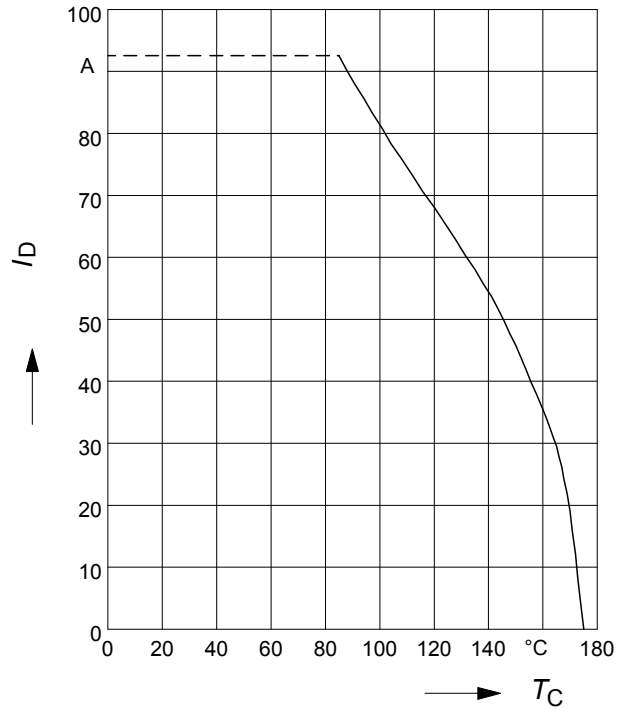
**1 Maximum allowable power dissipation**

$P_{tot} = f(T_C)$



**2 Drain current**

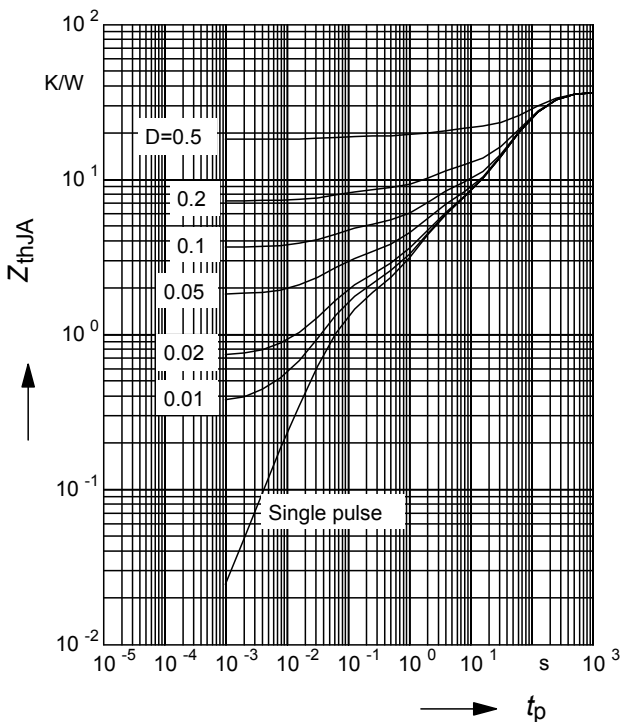
$I_D = f(T_C); V_{GS} \geq 4.5V$



**3 Typ. transient thermal impedance**

$Z_{thJA} = f(t_p) @ 6 \text{ cm}^2 \text{ cooling area}$

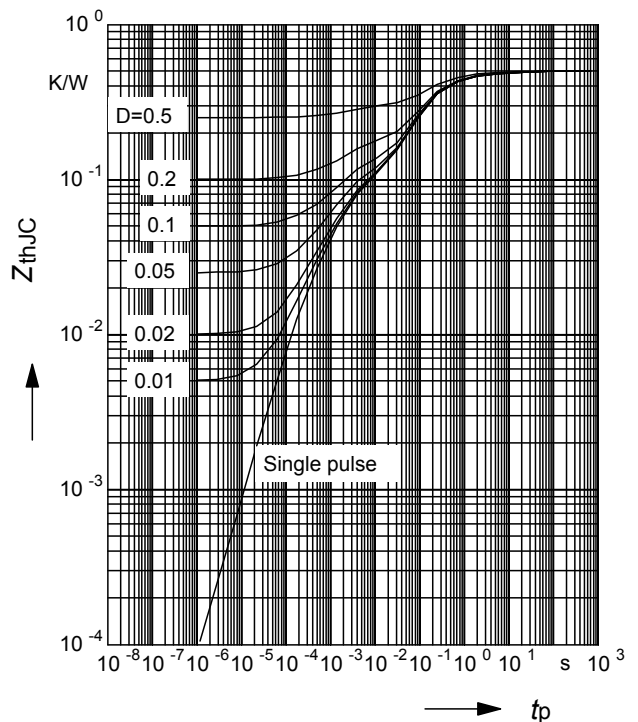
Parameter:  $D = t_p / T$



**4 Transient thermal impedance**

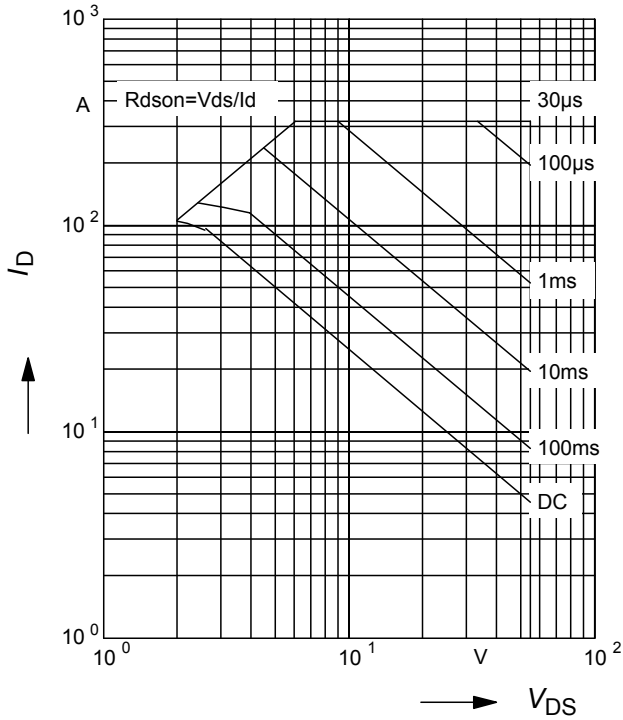
$Z_{thJC} = f(t_p)$

parameter :  $D = t_p / T$



**5 Safe operating area**

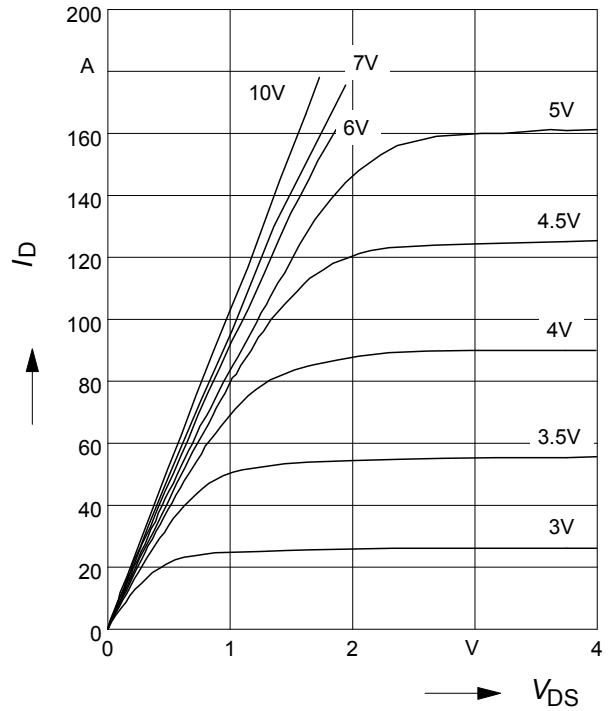
$I_D = f(V_{DS})$ ;  $D=0.01$ ;  $T_C=25^\circ\text{C}$ ;  $V_{GS}=4.5\text{V}$



**6 Typ. output characteristic**

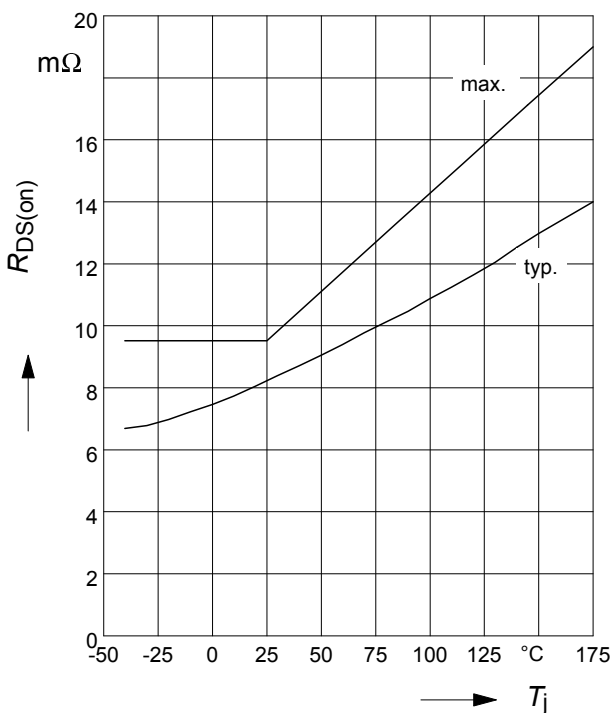
$I_D = f(V_{DS})$ ;  $T_j=25^\circ\text{C}$

Parameter:  $V_{GS}$



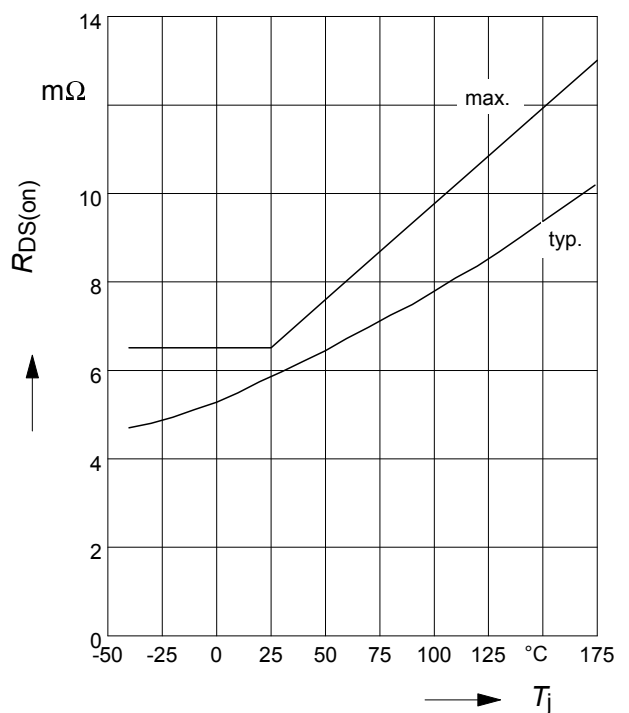
**7 On-state resistance**

$R_{ON} = f(T_j)$ ;  $I_D=36\text{A}$ ;  $V_{GS} = 4.5\text{V}$



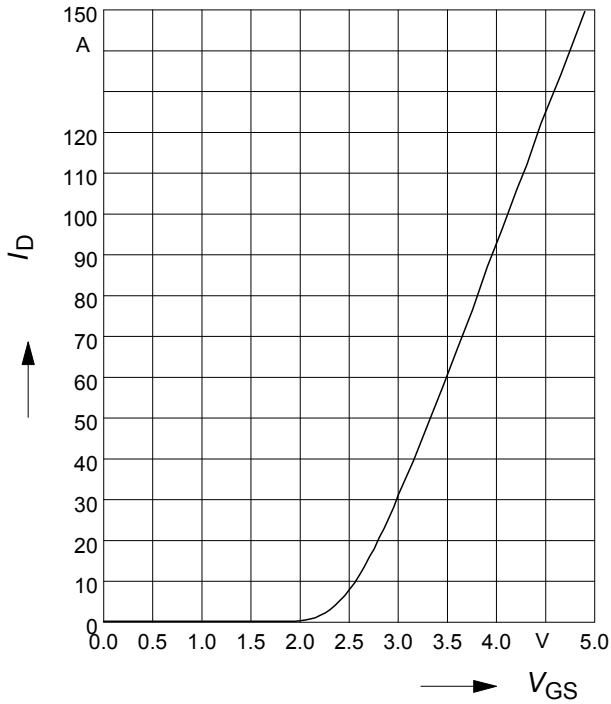
**8 On-state resistance**

$R_{ON} = f(T_j)$ ;  $I_D=36\text{A}$ ;  $V_{GS} = 10\text{V}$



**9 Typ. transfer characteristics**

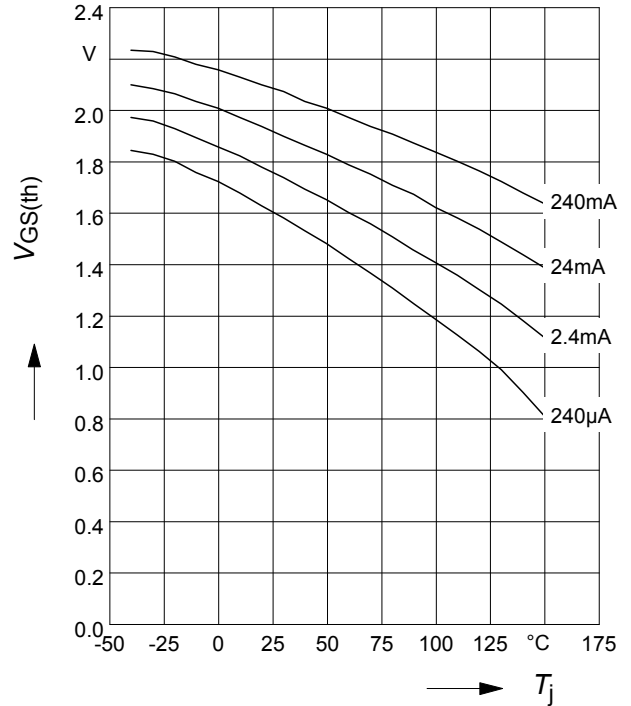
$I_D = f(V_{GS}); V_{DS} = 12V; T_j = 25^\circ C$



**10 Typ. input threshold voltage**

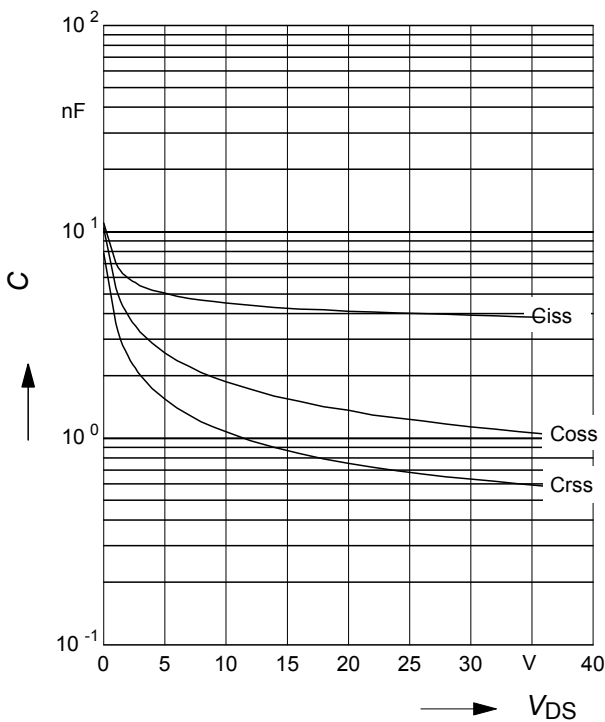
$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}$

Parameter:  $I_D$



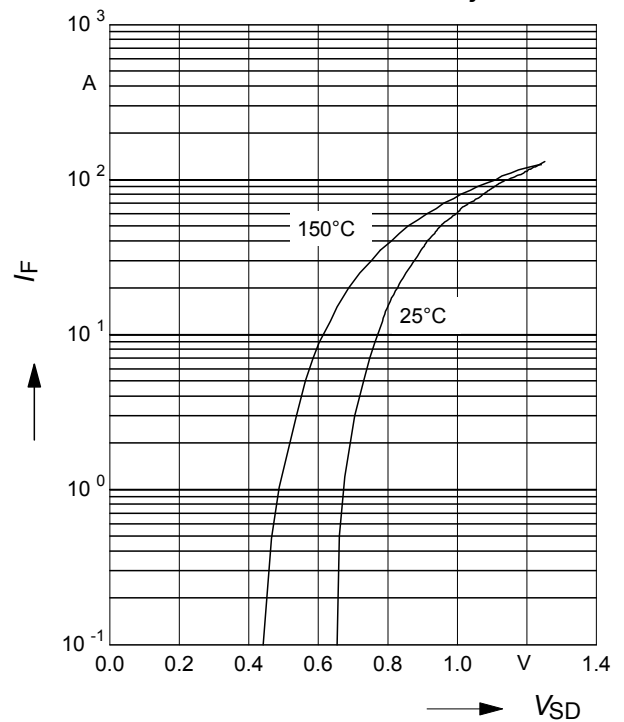
**11 Typ. capacitances**

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



**12 Typ. reverse diode forward characteristics  $I_F = f(V_{SD})$**

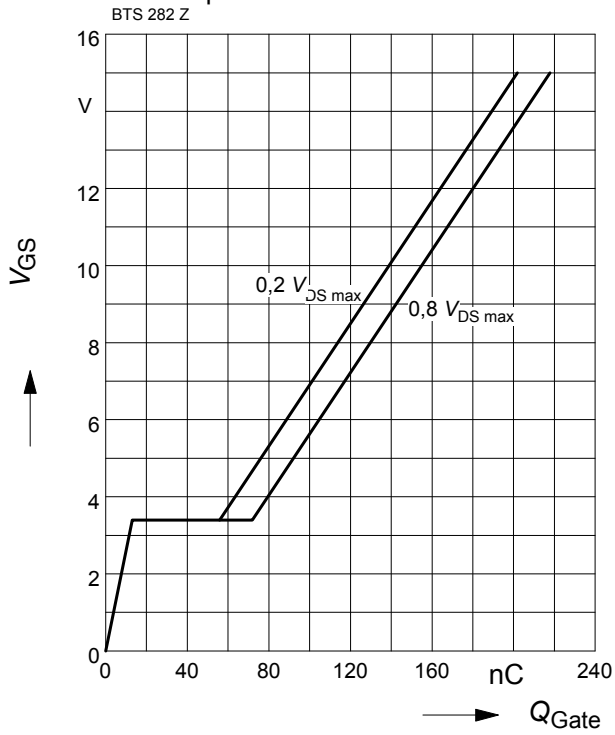
$t_p = 80\mu s$  (spread); Parameter:  $T_j$



**13 Typ. gate charge**

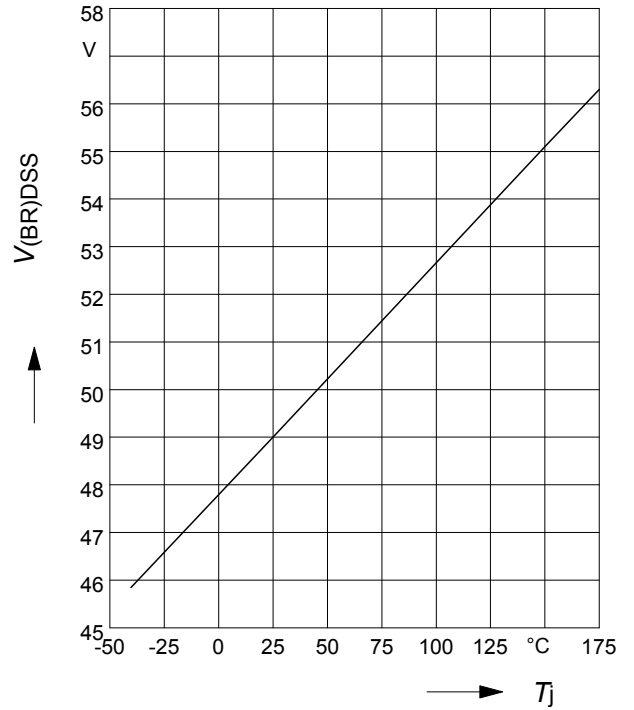
$V_{GS} = f(Q_{Gate})$

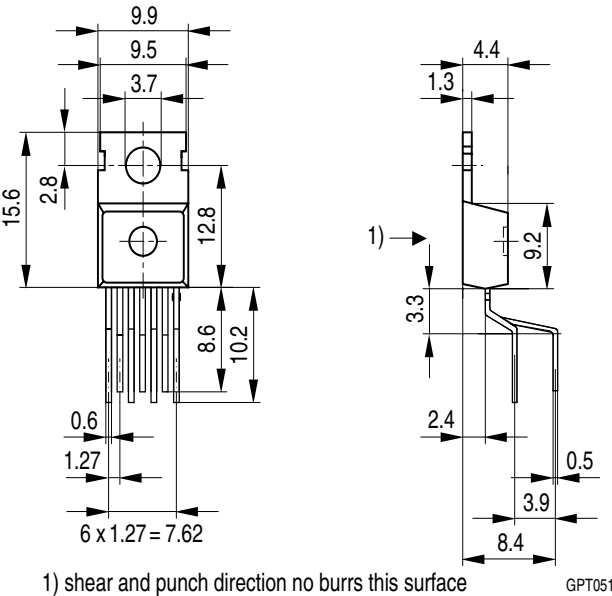
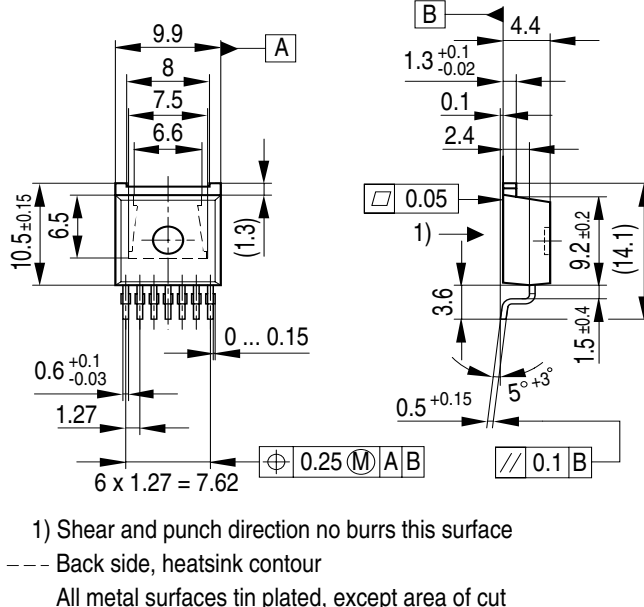
Parameter:  $I_D \text{ puls} = 80 \text{ A}$

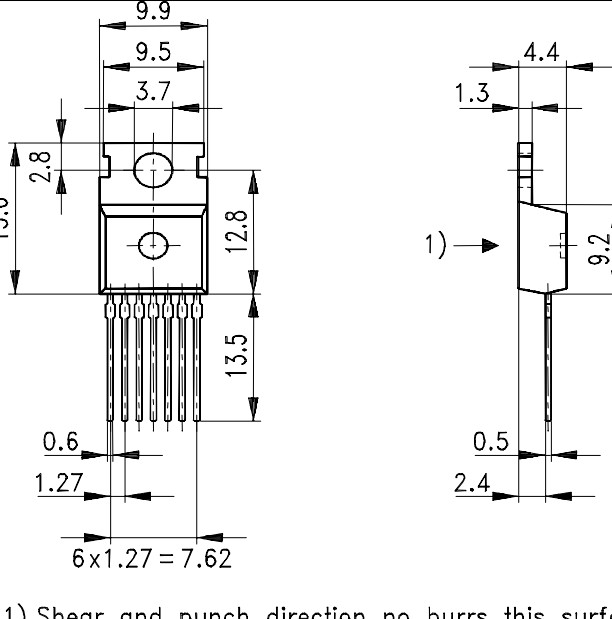


**14 Drain-source break down voltage**

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



| Package                                                                            | Ordering Code   | Package                                                                             | Ordering Code   |
|------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------|-----------------|
| P-TO220-7-3                                                                        | Q67060-S6004-A2 | P-TO220-7-180                                                                       | Q67060-S6005-A2 |
|  |                 |  |                 |

| Package                                                                             | Ordering Code |
|-------------------------------------------------------------------------------------|---------------|
| P-TO220-7-230                                                                       | Q67060-S6007  |
|  |               |

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