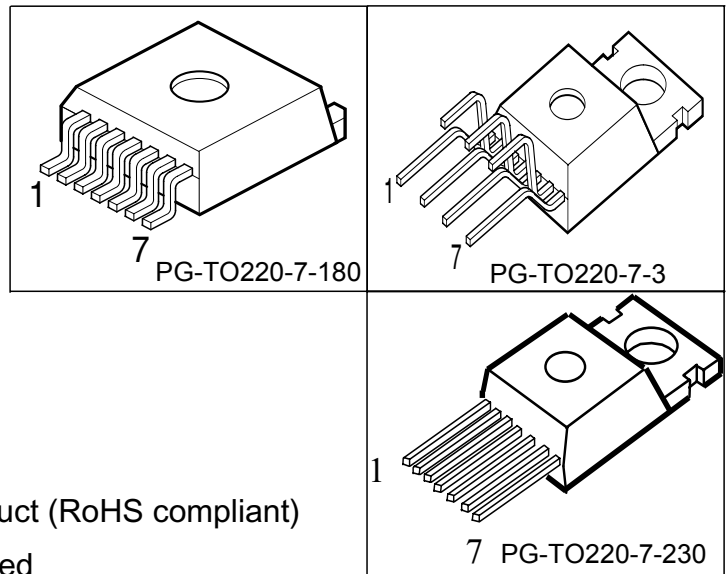
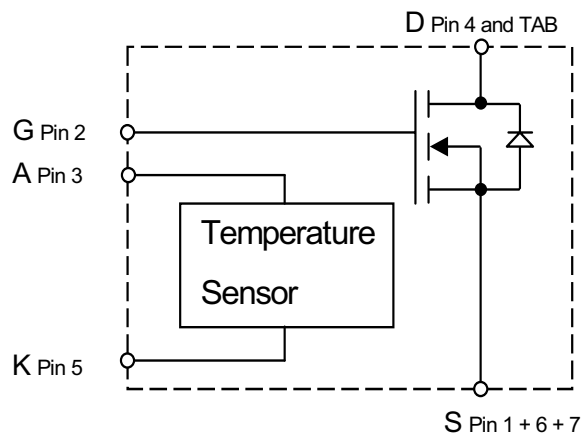


**Speed TEMPFET®**

- 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
- Green Product (RoHS compliant)
- AEC Qualified



Type	$V_{DS}$	$R_{DS(on)}$	Package
BTS 282 Z	49 V	6.5 mΩ	PG-TO220-7-3
			PG-TO220-7-180
			PG-TO220-7-230



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) $V_{GS} = 4.5 \text{ V}$ , $V_{DS} \leq 0.5 \text{ V}$ , $T_C = 85 \text{ }^\circ\text{C}$ $V_{GS} = 10 \text{ V}$ , $V_{DS} \leq 0.5 \text{ V}$ , $T_C = 85 \text{ }^\circ\text{C}$	$I_{D(ISO)}$	36 52	A
Continuous drain current <sup>1)</sup> $T_C = 100 \text{ }^\circ\text{C}$ , $V_{GS} = 4.5\text{V}$	$I_D$	80	
Pulsed drain current	$I_{D \text{ puls}}$	320	
Avalanche energy, single pulse $I_D = 36 \text{ A}$ , $R_{GS} = 25 \text{ }\Omega$	$E_{AS}$	2	J
Power dissipation $T_C = 25 \text{ }^\circ\text{C}$	$P_{\text{tot}}$	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 $V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	49	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 240\text{ }\mu\text{A}$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = -40\text{ }^\circ\text{C}$ $V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$ $V_{DS} = 45\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	$I_{DSS}$	-	-	0.1	$\mu\text{A}$
		-	0.1	1	
		-	-	100	
Gate-source leakage current $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$ $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	$I_{GSS}$	-	10	100	nA
		-	20	100	
Drain-Source on-state resistance $V_{GS} = 4.5\text{ V}$ , $I_D = 36\text{ A}$ $V_{GS} = 10\text{ V}$ , $I_D = 36\text{ A}$	$R_{DS(on)}$	-	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 at $T_j = 25^\circ\text{C}$ , unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	

**Dynamic Characteristics**

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

**Gate Charge Characteristics**

Gate charge at threshold $V_{DD} = 40\text{ V}$ , $I_D \geq 0,1\text{ A}$ , $V_{GS} = 0\text{ to }1\text{ V}$	$Q_{g(th)}$	-	3.8	5.7	nC
Gate charge at 5.0 V $V_{DD} = 40\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 0\text{ to }5\text{ V}$	$Q_{g(5)}$	-	92	138	
Gate charge total $V_{DD} = 40\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$	$Q_{g(total)}$	-	155	232	
Gate plateau voltage $V_{DD} = 40\text{ V}$ , $I_D = 80\text{ A}$	$V_{(plateau)}$	-	3.4	-	V

**Electrical Characteristics**

Parameter 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 $T_C = 25^\circ\text{C}$	$I_S$	80	-	-	A
Inverse diode direct current, pulsed $T_C = 25^\circ\text{C}$	$I_{FM}$	320	-	-	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$ , $I_F = 95\text{ A}$	$V_{SD}$	-	1.25	1.6	V
Reverse recovery time $V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	$t_{rr}$	-	105	157	ns
Reverse recovery charge $V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	$Q_{rr}$	-	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 $I_{AK(on)} = 5\text{ mA}$ , $T_j = -40\dots+150^\circ\text{C}$ $I_{AK(on)} = 1.5\text{ mA}$ , $T_j = 150^\circ\text{C}$	$V_{AK(on)}$	-	1.3	1.4	V
Sensor override $t_P = 100\ \mu\text{s}$ , $T_j = -40\dots+150^\circ\text{C}$		-	-	10	
Forward current $T_j = -40\dots+150^\circ\text{C}$	$I_{AK(on)}$	-	-	5	
Sensor override $t_P = 100\ \mu\text{s}$ , $T_j = -40\dots+150^\circ\text{C}$		-	-	600	

### Electrical Characteristics

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

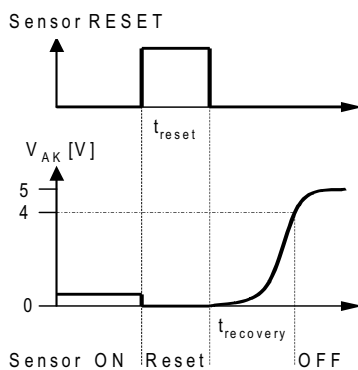
### Sensor Characteristics

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

### Characteristics

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

### Sensor recovery behaviour:

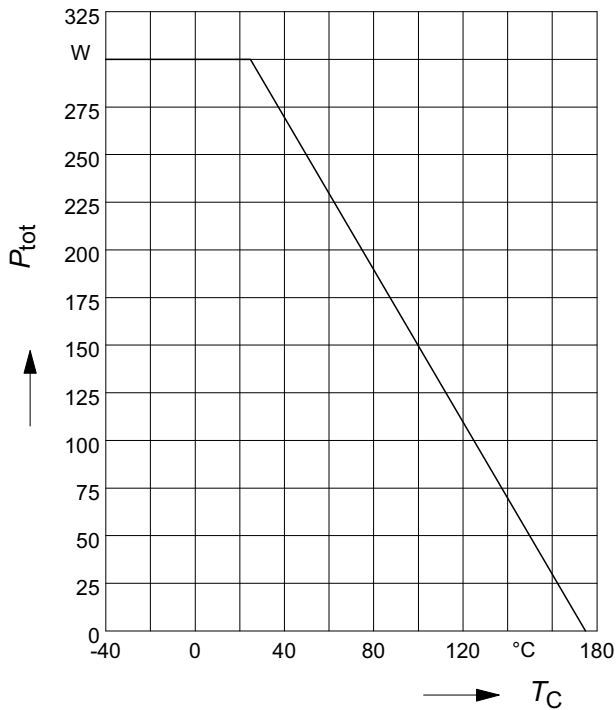


<sup>1</sup>See diagram Sensor recovery behaviour

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

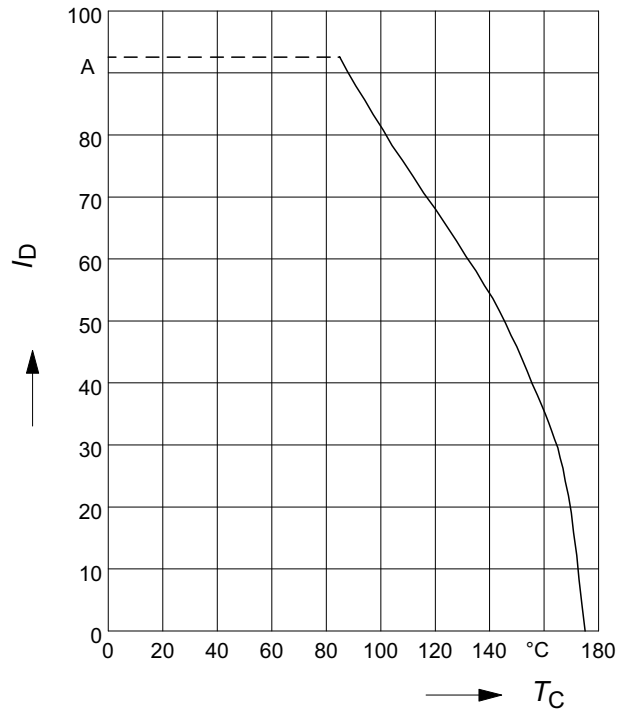
### 1 Maximum allowable power dissipation

$$P_{tot} = f(T_C)$$



### 2 Drain current

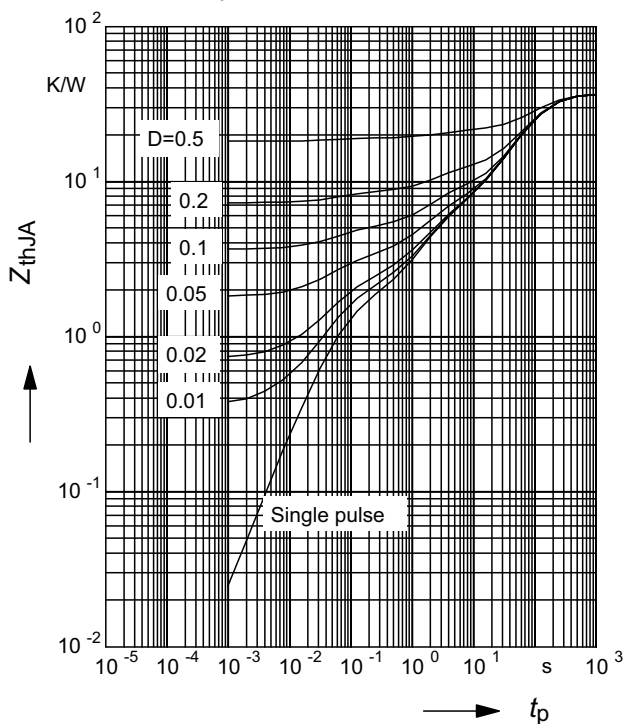
$$I_D = f(T_C); V_{GS} \geq 4.5V$$



### 3 Typ. transient thermal impedance

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

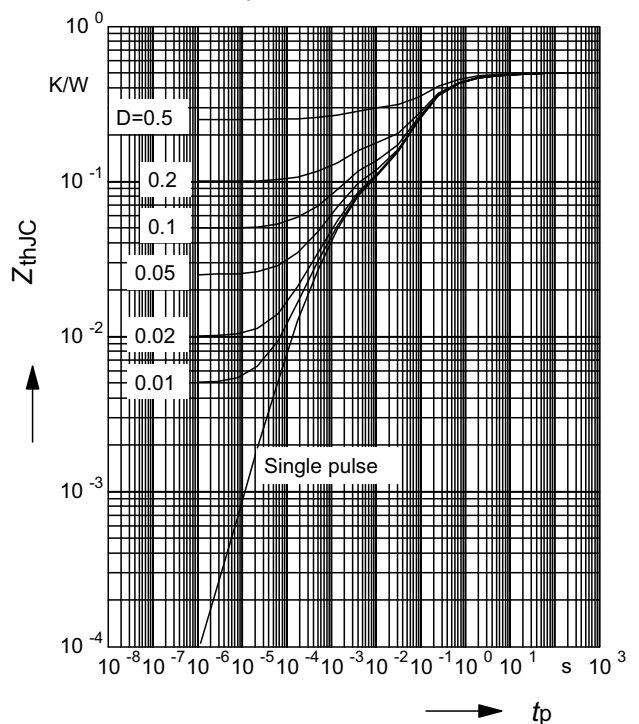
Parameter:  $D = t_p / T$



### 4 Transient thermal impedance

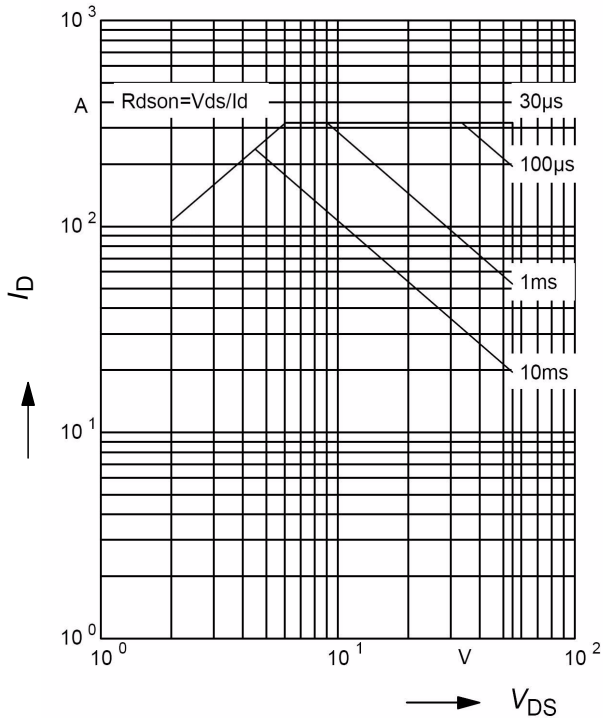
$$Z_{thJC} = f(t_p)$$

parameter :  $D = t_p / T$



### 5 Safe operating area

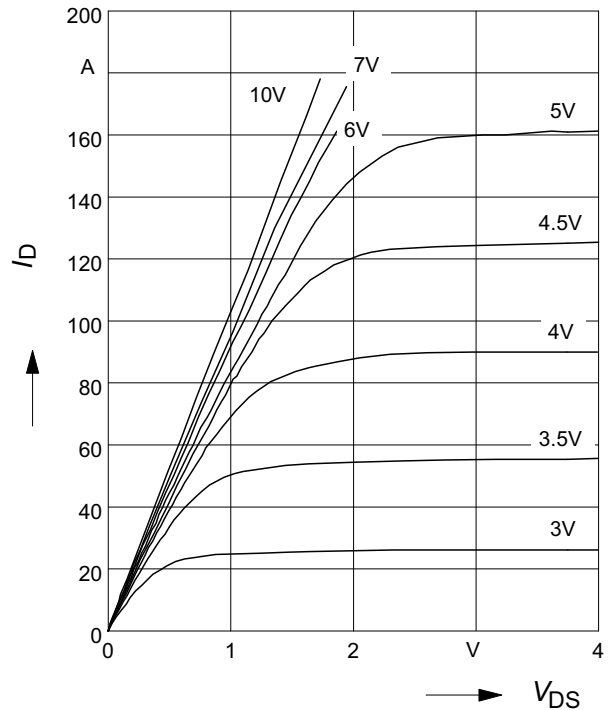
$I_D = f(V_{DS})$ ;  $D=0.01$ ;  $T_C=25^\circ\text{C}$ ;  $V_{GS}=4.5\text{V}$



### 6 Typ. output characteristic

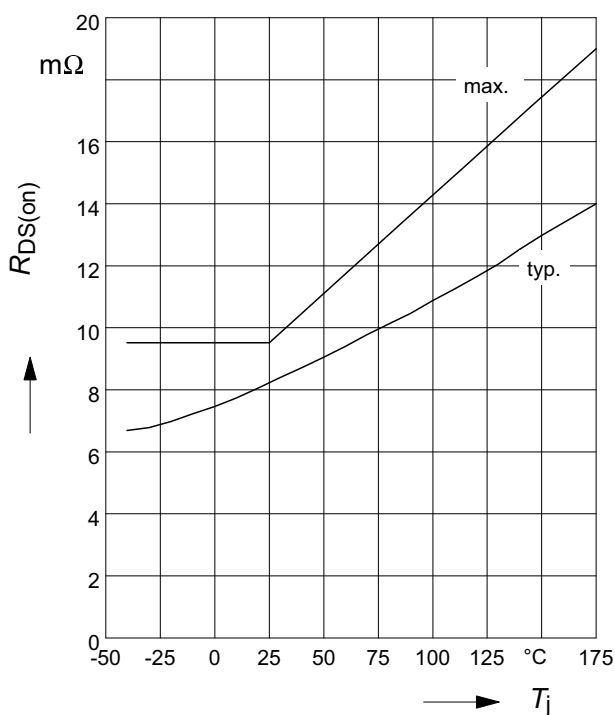
$I_D = f(V_{DS})$ ;  $T_j=25^\circ\text{C}$

Parameter:  $V_{GS}$



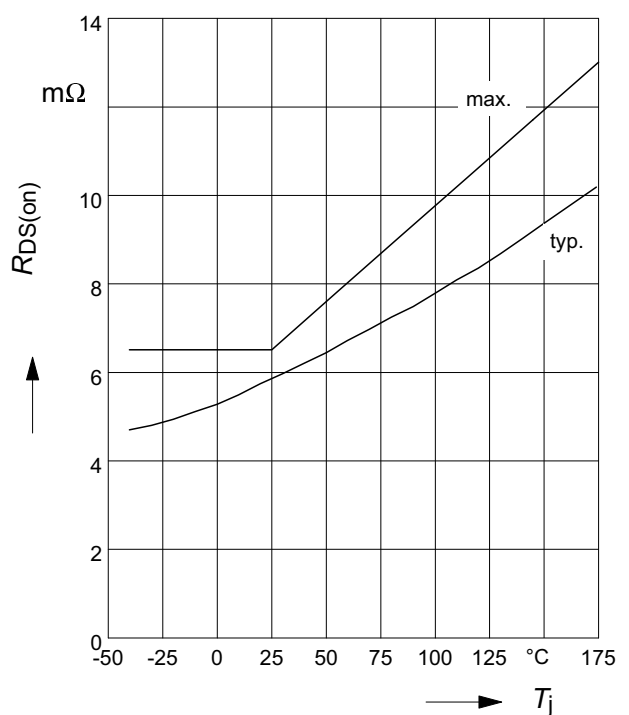
### 7 On-state resistance

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



### 8 On-state resistance

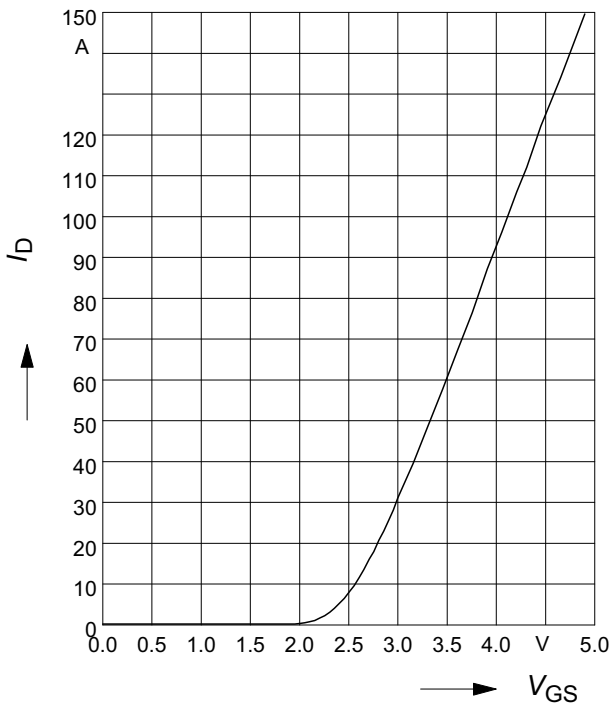
$R_{ON} = f(T_j)$ ;  $I_D=36\text{A}$ ;  $V_{GS} = 10\text{V}$





### 9 Typ. transfer characteristics

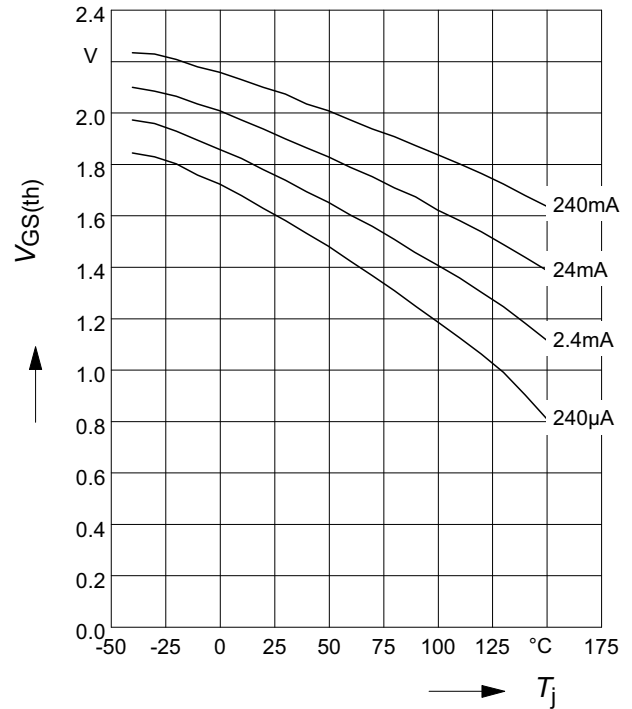
$$I_D = f(V_{GS}); V_{DS} = 12V; T_j = 25^\circ C$$



### 10 Typ. input threshold voltage

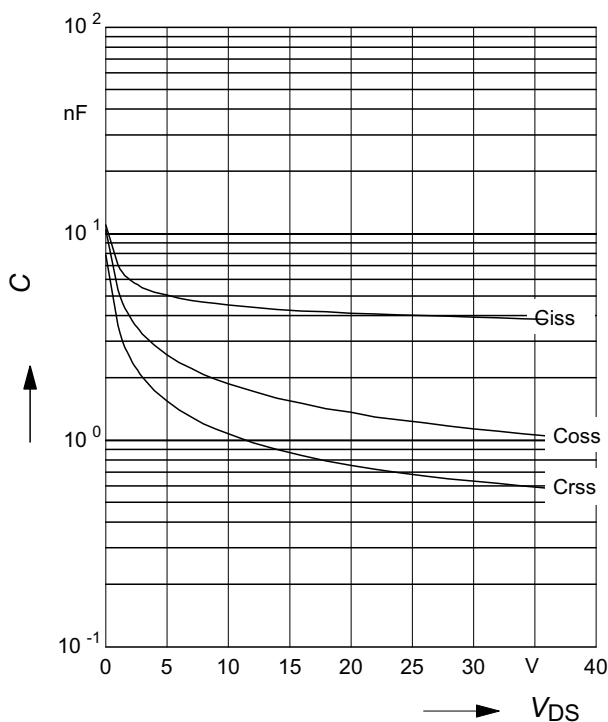
$$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}$$

Parameter:  $I_D$



### 11 Typ. capacitances

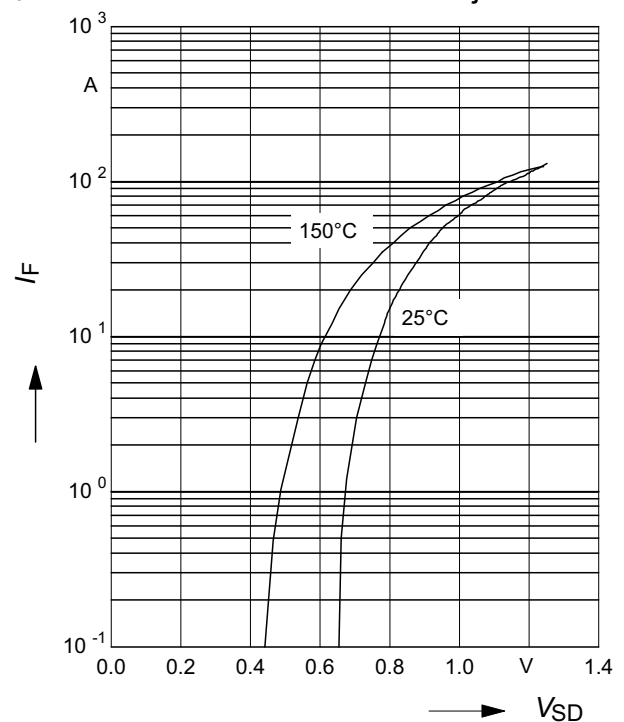
$$C = f(V_{DS}); V_{GS} = 0V, f = 1MHz$$



### 12 Typ. reverse diode forward characteristics

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

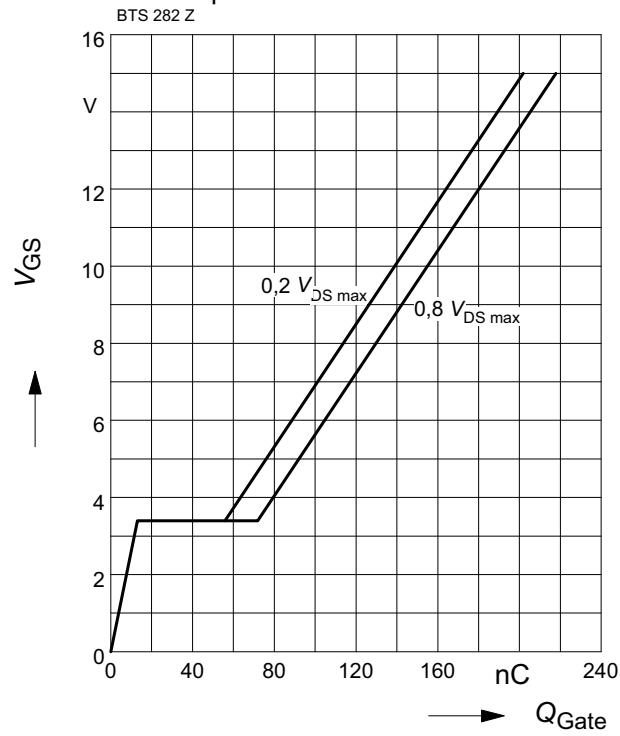
$t_p = 80\mu s$  (spread); Parameter:  $T_j$



### 13 Typ. gate charge

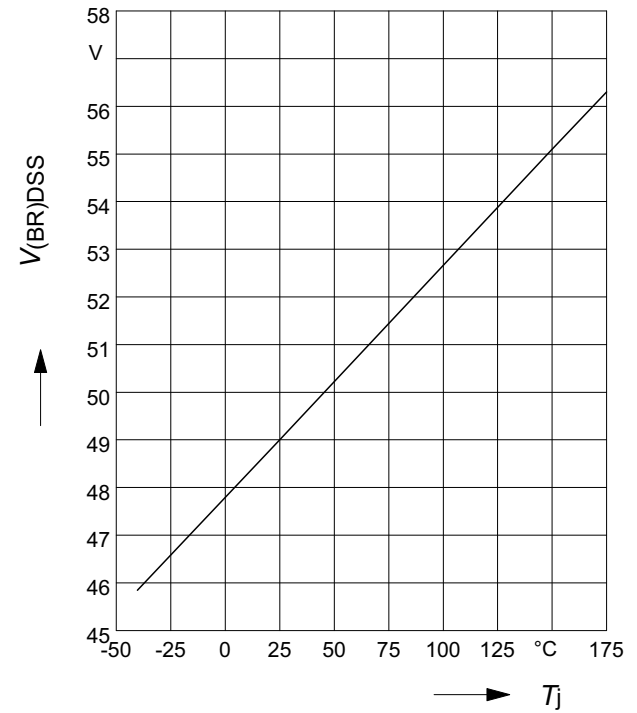
$$V_{GS} = f(Q_{Gate})$$

Parameter:  $I_{D\ puls} = 80\ A$



### 14 Drain-source break down voltage

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



# 1 Package Outlines

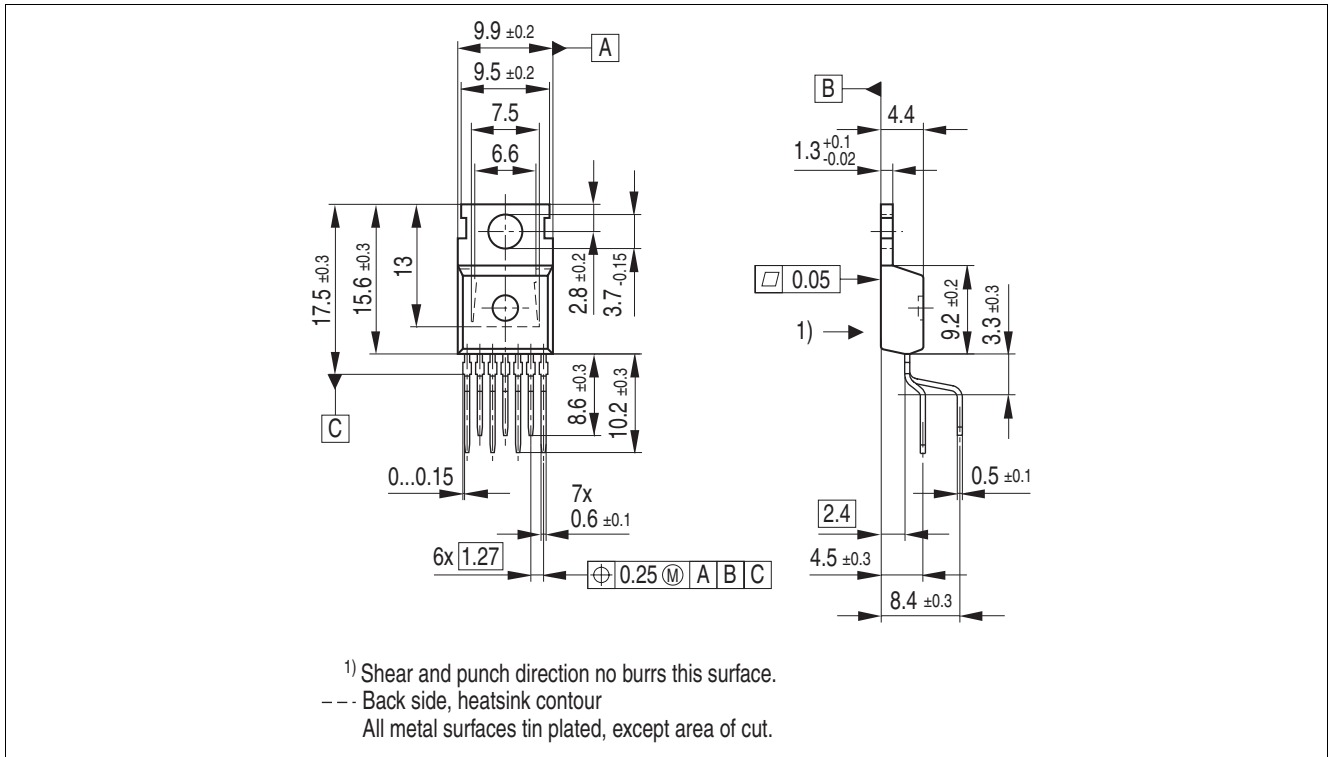


Figure 1 PG-TO220-7-3 (Please Insert Package Long Name!)

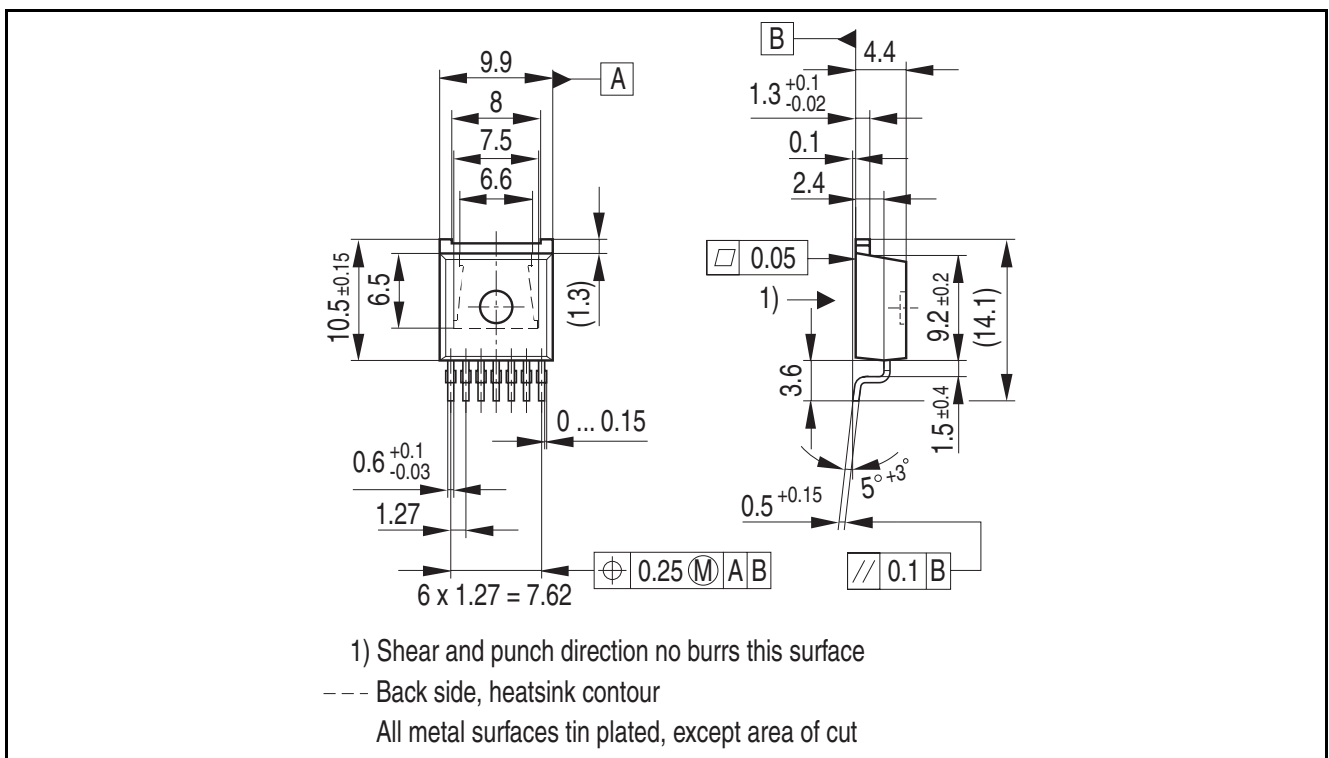


Figure 2 PG-TO220-7-180

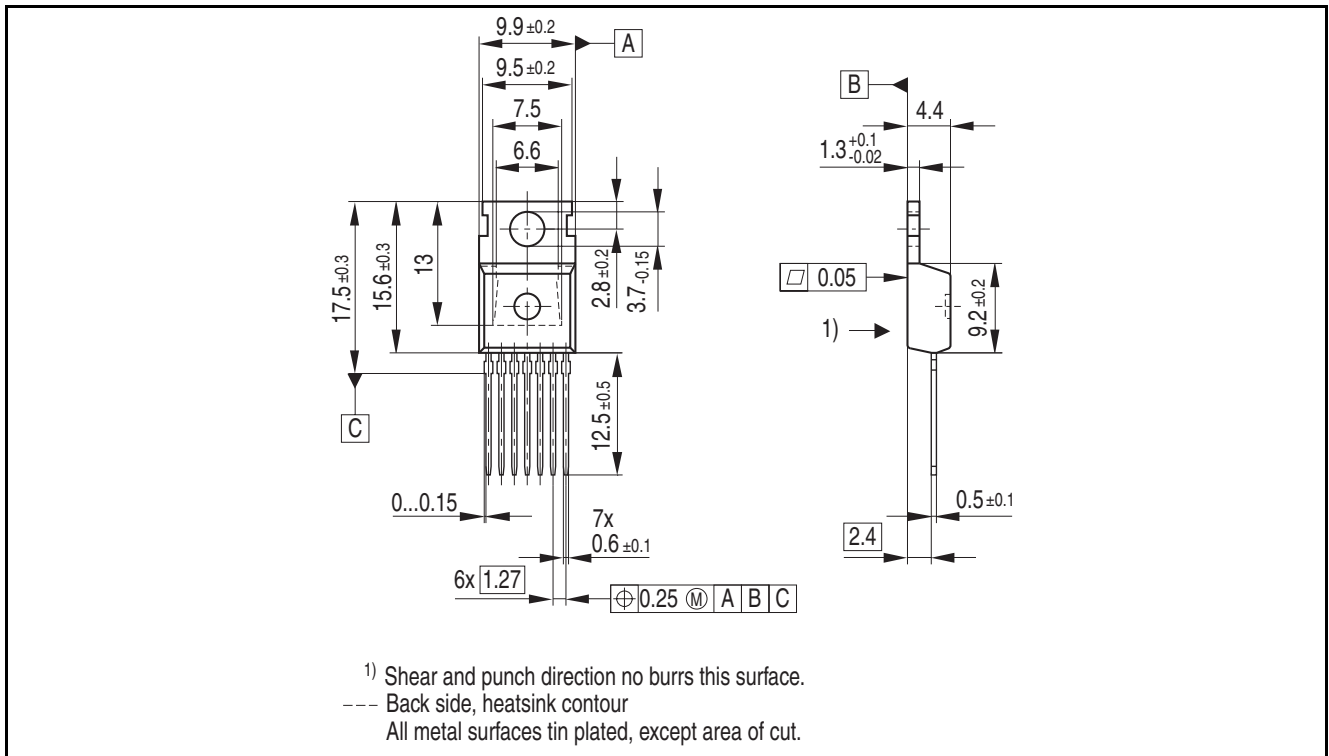


Figure 3 PG-TO220-7-230

**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
1.2	2009-07-31	removed 100ms and DC line in SOA diagram
1.1	2008-10-21	all pages: added new Infineon logo Creation of the green datasheet. Initial version of RoHS-compliant derivate of the BTS282Z Page 1 and 12: added RoHS compliance statement and Green product feature Page 1, 11 and 12: Package changed to RoHS compliant version page 13: added Revision history page 14: added Disclaimer

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