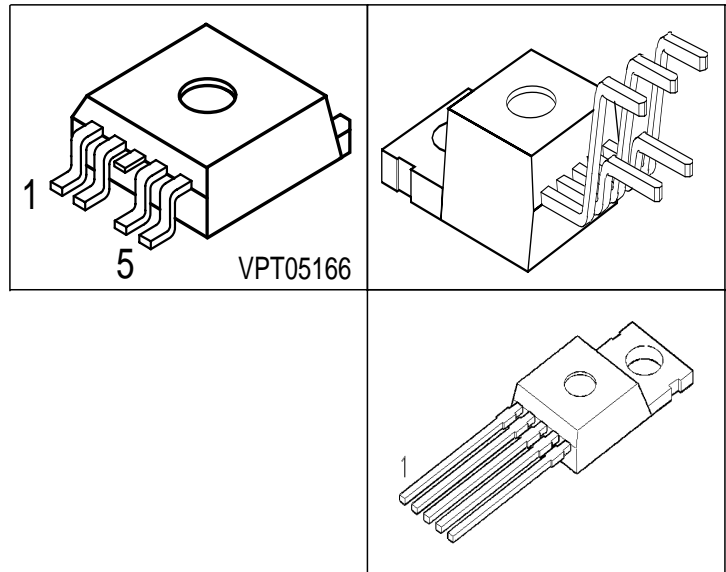
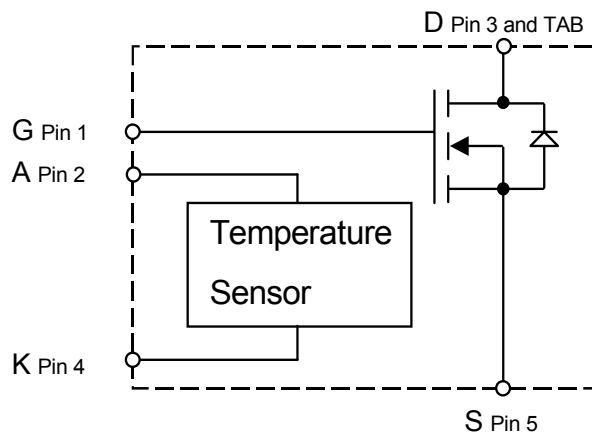


Speed TEMPFET®

- 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



Type	V_{DS}	$R_{DS(on)}$	Package	Ordering Code
BTS 247 Z	55 V	18 m Ω	P-TO220-5-3	Q67060-S6001-A2
			P-TO220-5-62	Q67060-S6002-A2
			TO-220-5-43	Q67060-S6006



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}	± 20	
Nominal load current (ISO 10483) $V_{GS} = 4.5\text{ V}$, $V_{DS} \leq 0.5\text{ V}$, $T_C = 85\text{ }^\circ\text{C}$ $V_{GS} = 10\text{ V}$, $V_{DS} \leq 0.5\text{ V}$, $T_C = 85\text{ }^\circ\text{C}$	$I_{D(ISO)}$	12 19	A
Continuous drain current ¹⁾ $T_C = 100\text{ }^\circ\text{C}$, $V_{GS} = 4.5\text{ V}$	I_D	33	
Pulsed drain current	$I_{D\text{ puls}}$	180	
Avalanche energy, single pulse $I_D = 12\text{ A}$, $R_{GS} = 25\text{ }\Omega$	E_{AS}	1.3	J
Power dissipation $T_C = 25\text{ }^\circ\text{C}$	P_{tot}	120	W
Operating temperature ²⁾	T_j	-40 ... +175	$^\circ\text{C}$
Peak temperature (single event)	$T_{j\text{ peak}}$	200	
Storage temperature	T_{stg}	-55 ... +150	
DIN humidity category, DIN 40 040		E	
IEC climatic category; DIN IEC 68-1		40/150/56	

¹current limited by bond wire

²Note: Thermal trip temperature of temperature sensor is below 175°C

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
junction - case:	R_{thJC}	-	-	1.25	K/W
Thermal resistance @ min. footprint	$R_{th(JA)}$	-	-	62	
Thermal resistance @ 6 cm ² cooling area ¹⁾	$R_{th(JA)}$	-	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 $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	55	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 90\ \mu\text{A}$ $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	1.2 -	1.6 1.65	2 -	
Zero gate voltage drain current $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = -40^\circ\text{C}$ $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25^\circ\text{C}$ $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 150^\circ\text{C}$	I_{DSS}	- - -	- 0.1 -	0.1 1 100	μA
Gate-source leakage current $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$, $T_j = 25^\circ\text{C}$ $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$, $T_j = 150^\circ\text{C}$	I_{GSS}	- -	10 20	100 100	nA
Drain-Source on-state resistance $V_{GS} = 4.5\text{ V}$, $I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 12\text{ A}$	$R_{DS(on)}$	- -	22 15	28 18	m Ω

¹ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μm 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 $V_{DS} > 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 33\text{ A}$	g_{fs}	10	-	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	1380	1730	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	410	515	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	230	290	
Turn-on delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 45\text{ A}$, $R_G = 3.6\ \Omega$	$t_{d(on)}$	-	15	25	ns
Rise time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 45\text{ A}$, $R_G = 3.6\ \Omega$	t_r	-	30	45	
Turn-off delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 45\text{ A}$, $R_G = 3.6\ \Omega$	$t_{d(off)}$	-	30	45	
Fall time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 45\text{ A}$, $R_G = 3.6\ \Omega$	t_f	-	20	30	

Gate Charge Characteristics

Gate charge at threshold $V_{DD} = 40\text{ V}$, $I_D = 0.1\text{ A}$, $V_{GS} = 0\text{ to }1\text{ V}$	$Q_{g(th)}$	-	2	3	nC
Gate charge at 5.0 V $V_{DD} = 40\text{ V}$, $I_D = 45\text{ A}$, $V_{GS} = 0\text{ to }5\text{ V}$	$Q_{g(5)}$	-	35	55	
Gate charge total $V_{DD} = 40\text{ V}$, $I_D = 45\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	$Q_{g(total)}$	-	60	90	
Gate plateau voltage $V_{DD} = 40\text{ V}$, $I_D = 45\text{ A}$	$V_{(plateau)}$	-	4.5	-	V

Electrical Characteristics

Parameter at $T_j = 25^\circ\text{C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Inverse diode continuous forward current $T_C = 25^\circ\text{C}$	I_S	33	-	-	A
Inverse diode direct current, pulsed $T_C = 25^\circ\text{C}$	I_{FM}	180	-	-	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 90\text{ A}$	V_{SD}	-	1.1	1.7	V
Reverse recovery time $V_R = 30\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	75	115	ns
Reverse recovery charge $V_R = 30\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	0.15	0.25	μC

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

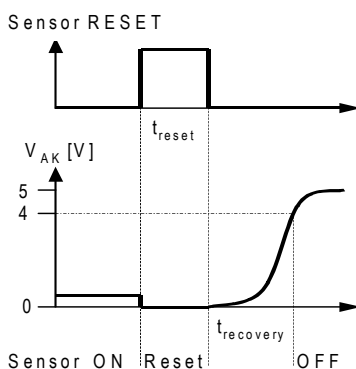
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
at $T_j = 25^\circ\text{C}$, unless otherwise specified					

Sensor Characteristics

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

Characteristics

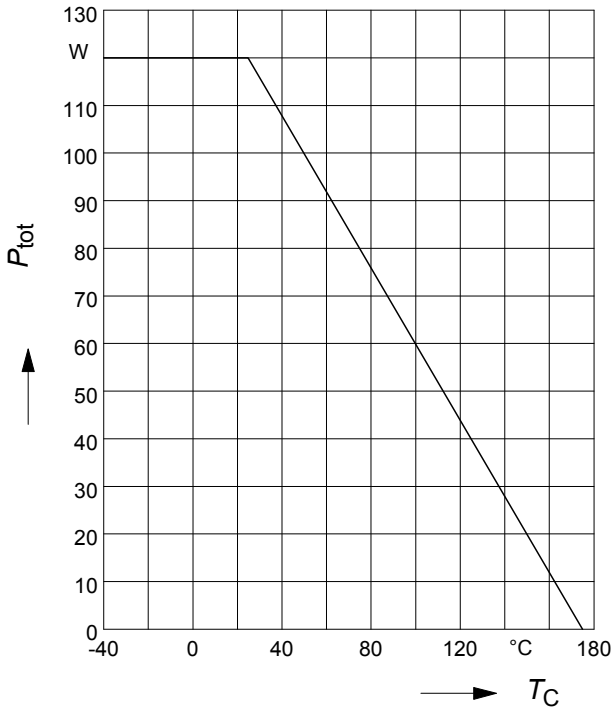
Holding current, $V_{AK(\text{off})} = 5\text{V}$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	$I_{AK(\text{hold})}$	0.05 0.05	- -	0.5 0.3	mA
Thermal trip temperature $V_{TS} = 5\text{V}$	$T_{TS(\text{on})}$	150	160	170	$^\circ\text{C}$
Turn-off time (Pin G+A and K+S connected) $V_{TS} = 5\text{V}$,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

Sensor recovery behaviour:

¹See diagram Sensor recovery behaviour

²Time after reset pulse until V_{AK} reaches 4V again

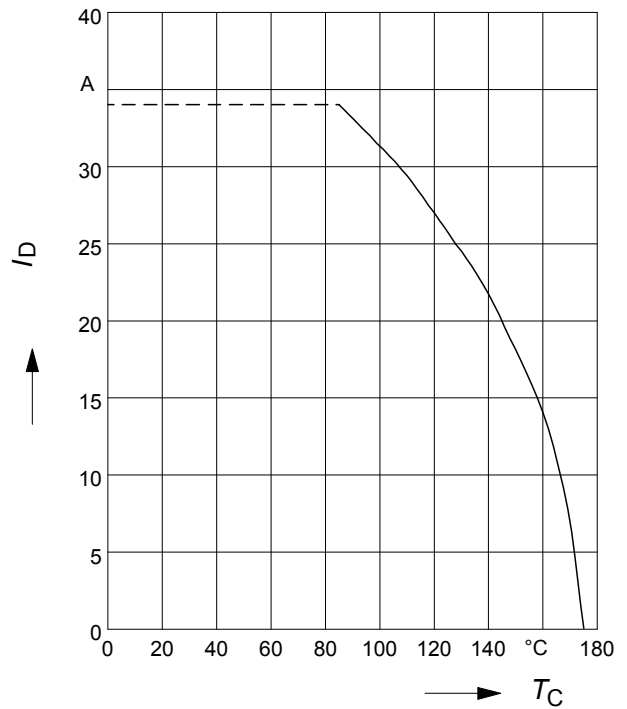
1 Maximum allowable power dissipation

$P_{tot} = f(T_C)$



2 Drain current

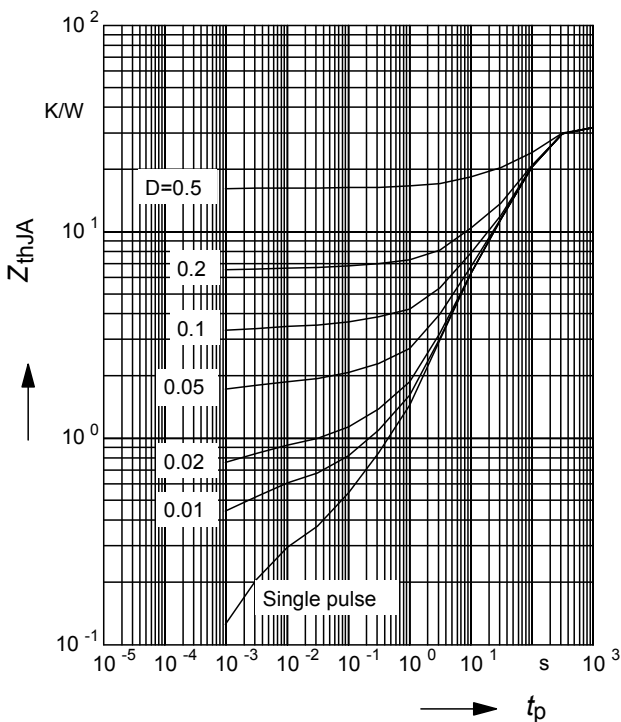
$I_D = f(T_C); V_{GS} \geq 4.5V$



3 Typ. transient thermal impedance

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

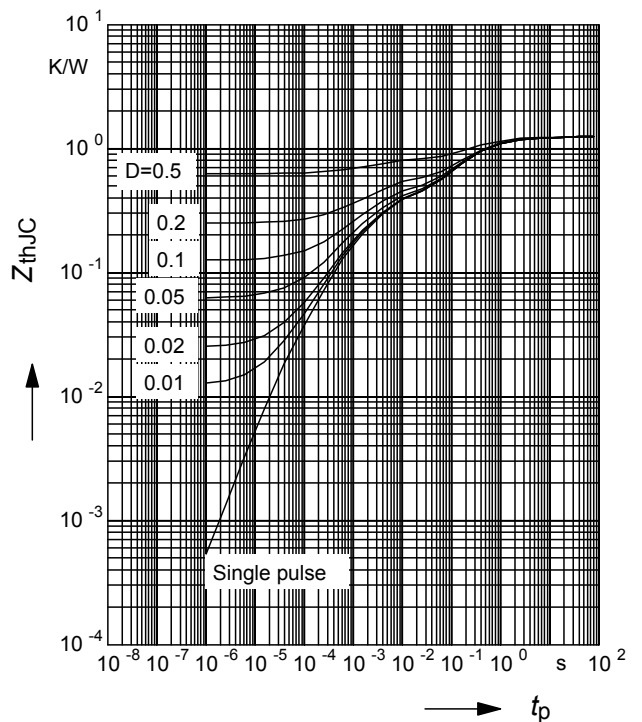
Parameter: $D = t_p / T$



4 Transient thermal impedance

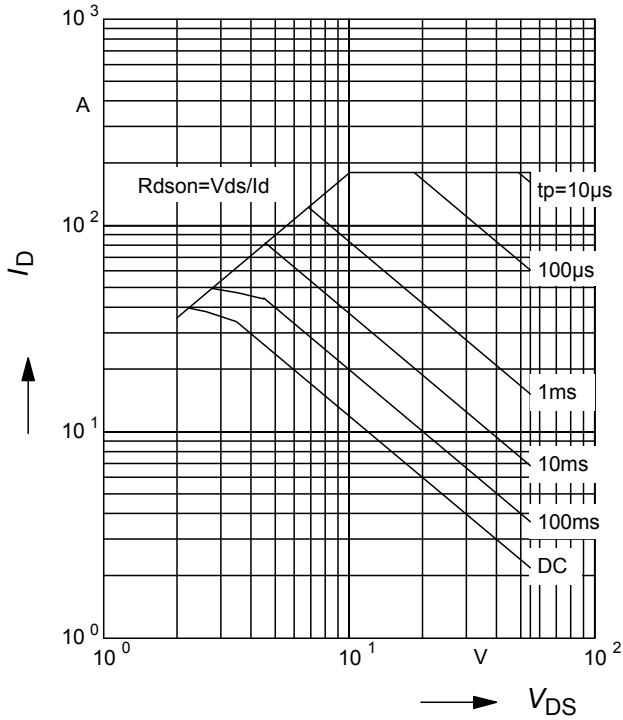
$Z_{thJC} = f(t_p)$

parameter : $D = t_p / T$



5 Safe operating area

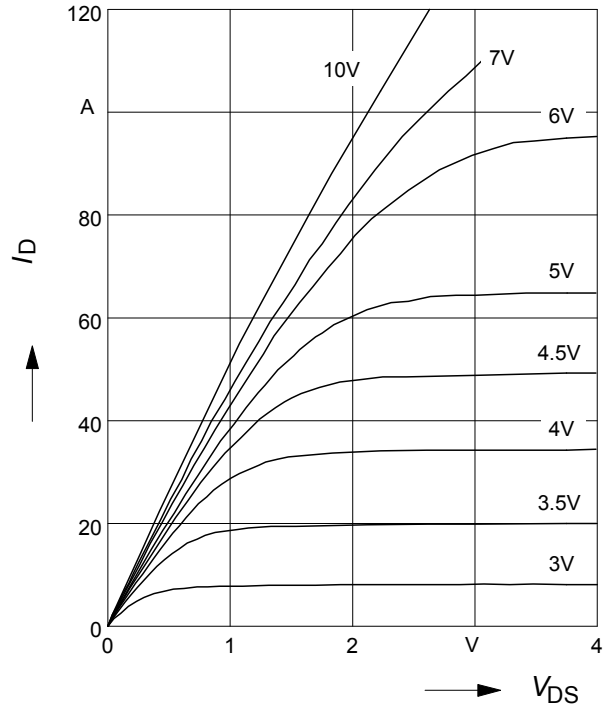
$I_D = f(V_{DS})$; $D=0.01$; $T_C=25^\circ\text{C}$; $V_{GS}=4.5\text{V}$



6 Typ. output characteristic

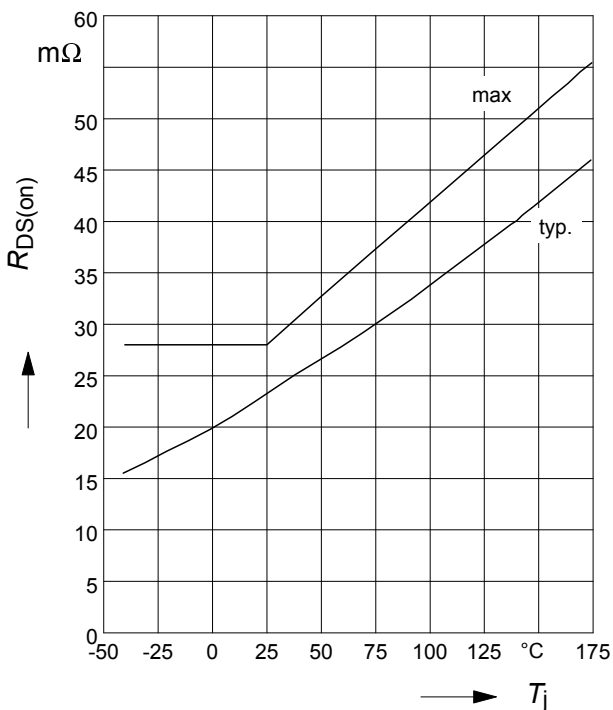
$I_D = f(V_{DS})$; $T_j=25^\circ\text{C}$

Parameter: V_{GS}



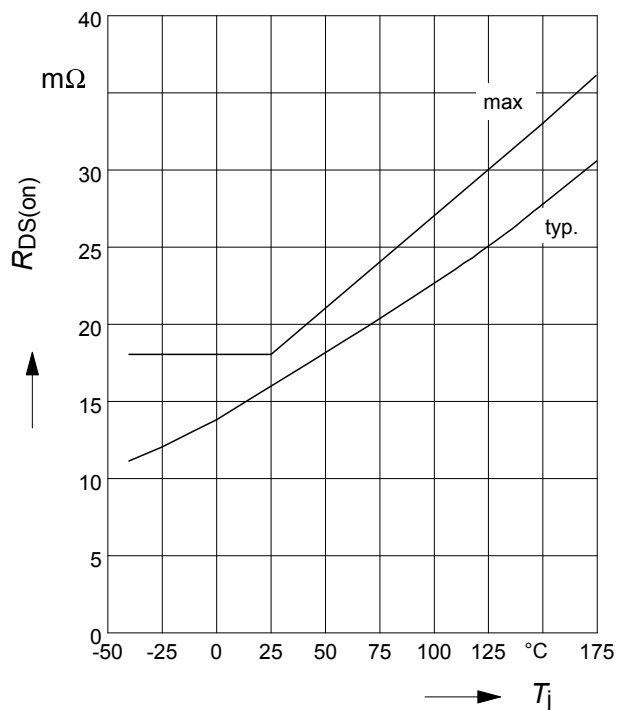
7 On-state resistance

$R_{ON} = f(T_j)$; $I_D=12\text{A}$; $V_{GS} = 4.5\text{V}$



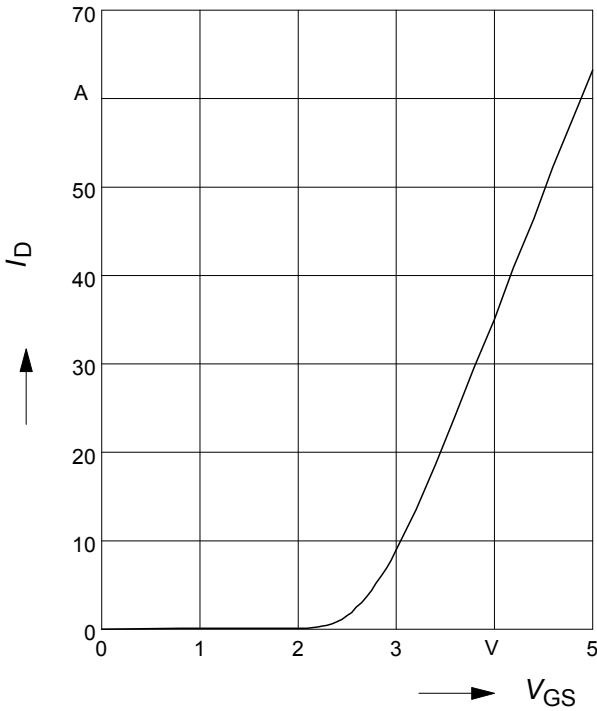
8 On-state resistance

$R_{ON} = f(T_j)$; $I_D=12\text{A}$; $V_{GS} = 10\text{V}$



9 Typ. transfer characteristics

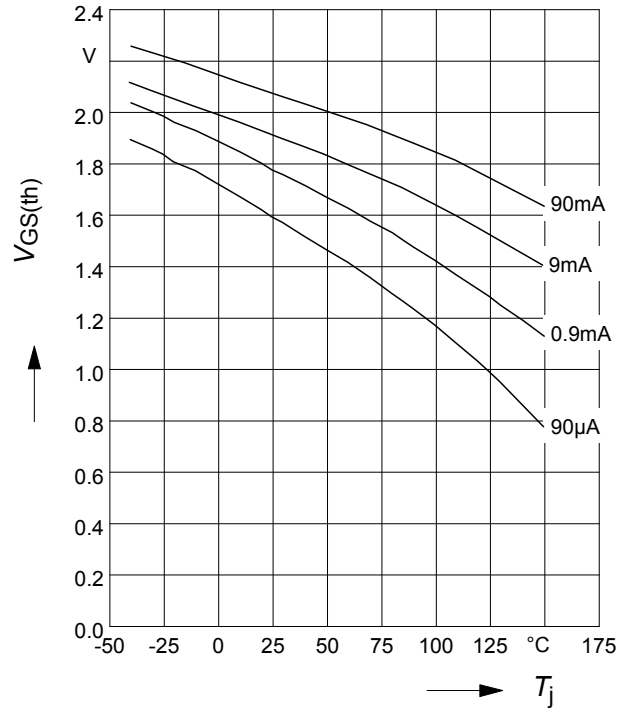
$I_D = f(V_{GS}); V_{DS} = 12V; T_j = 25^\circ C$



10 Typ. input threshold voltage

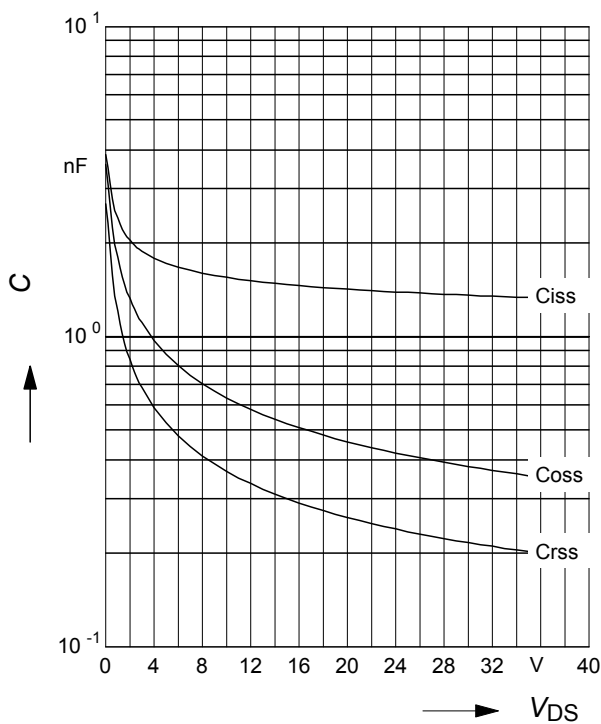
$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}$

Parameter: I_D



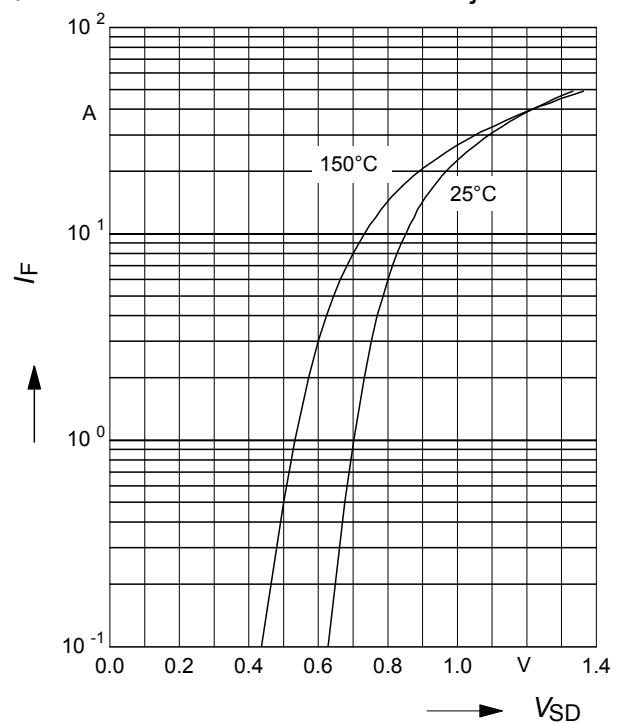
11 Typ. capacitances

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



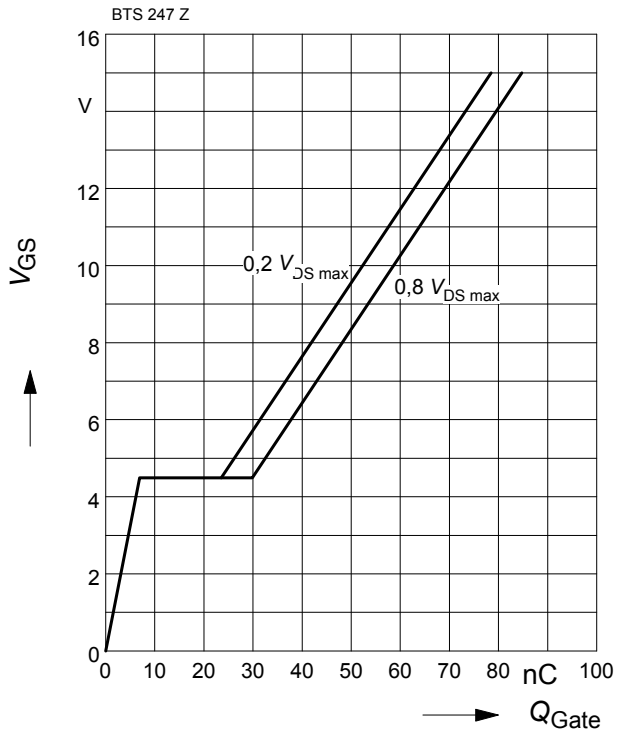
12 Typ. forward characteristics of reverse diode $I_F = f(V_{SD})$

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



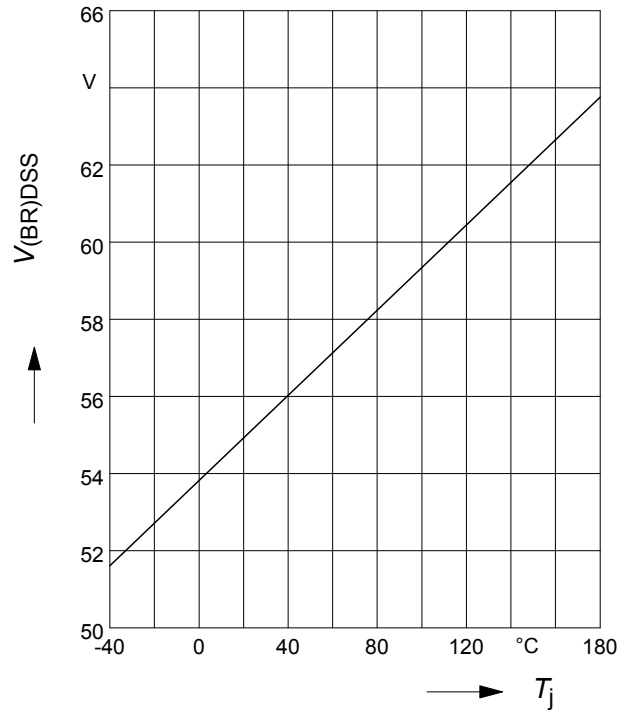
13 Typ. gate charge

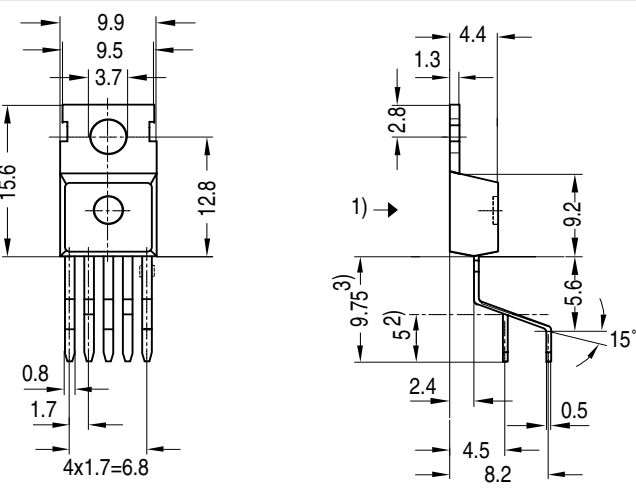
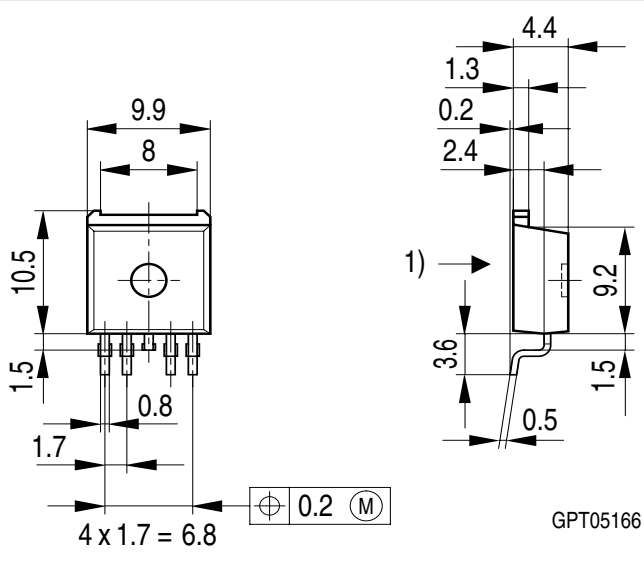
$V_{GS} = f(Q_{Gate}); I_D \text{ puls} = 45 \text{ A}$

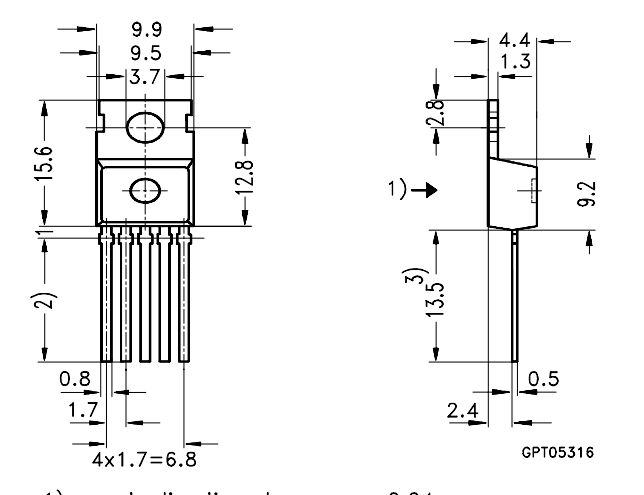


14 Drain-source break down voltage

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



Package	Ordering Code	Package	Ordering Code
P-TO220-5-3	Q67060-S6001-A2	P-TO220-5-62	Q67060-S6002-A2
 <p>1) shear and punch direction no burrs this surface 2) min. length by tinning 3) max. 11 mm allowable by tinning</p>		 <p>1) shear and punch direction no burrs this surface</p>	

Package	Ordering Code
TO-220-5-43	Q67060-S6006
 <p>1) punch direction, burr max. 0.04 2) dip finning 3) max. 14.5 by dip finning press burr max. 0.05</p>	

Published by
Infineon Technologies AG,
Bereichs Kommunikation
St.-Martin-Strasse 53,
D-81541 München
© Infineon Technologies AG 1999
All Rights Reserved.

Attention please!

The information herein is given to describe certain components and shall not be considered as warranted characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Infineon Technologies is an approved CECC manufacturer.

Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office in Germany or our Infineon Technologies Representatives worldwide (see address list).

Warnings

Due to technical requirements components may contain dangerous substances.

For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.