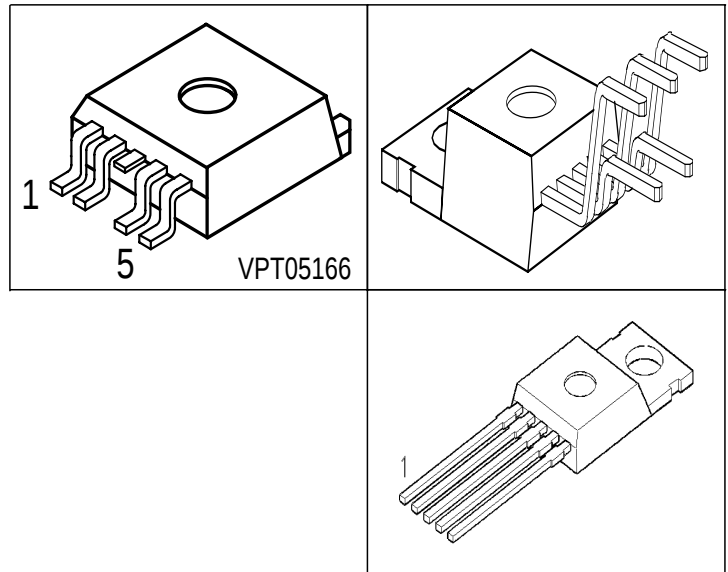
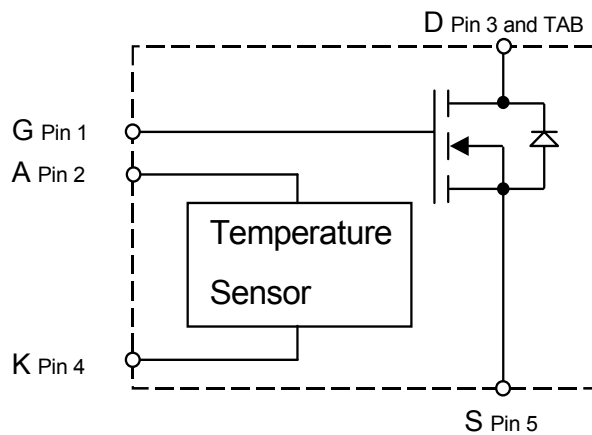


Speed TEMPFET®

- 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 244 Z	55 V	13 m Ω	P-TO220-5-3	Q67060-S6000-A2
			P-TO220-5-62	Q67060-S6003-A2
			TO-220-5-43	Q67060-S6008



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) $V_{GS} = 4.5 \text{ V}$, $V_{DS} \leq 0.5 \text{ V}$, $T_C = 85 \text{ }^\circ\text{C}$ $V_{GS} = 10 \text{ V}$, $V_{DS} \leq 0.5 \text{ V}$, $T_C = 85 \text{ }^\circ\text{C}$	$I_{D(ISO)}$	19 26	A
Continuous drain current ¹⁾ $T_C = 100 \text{ }^\circ\text{C}$, $V_{GS} = 4.5 \text{ V}$	I_D	35	
Pulsed drain current	$I_{D \text{ puls}}$	188	
Avalanche energy, single pulse $I_D = 19 \text{ A}$, $R_{GS} = 25 \text{ }\Omega$	E_{AS}	1.65	J
Power dissipation $T_C = 25 \text{ }^\circ\text{C}$	P_{tot}	170	W
Operating temperature ²⁾	T_j	-40 ... +175	$^\circ\text{C}$
Peak temperature (single event)	T_{jpeak}	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}	-	-	0.88	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 at $T_j = 25^{\circ}\text{C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
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, $V_{GS} = V_{DS}$ $I_D = 130\text{ }\mu\text{A}$	$V_{GS(th)}$	1.2	1.6	2	
$I_D = 250\text{ }\mu\text{A}$		-	1.65	-	
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	μA
		-	0.1	1	
		-	-	100	
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	100	nA
		-	20	100	
Drain-Source on-state resistance $V_{GS} = 4.5\text{ V}$, $I_D = 19\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 19\text{ A}$	$R_{DS(on)}$	-	16	18	m Ω
		-	11.5	13	

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

Gate Charge Characteristics

Gate charge at threshold $V_{DD} = 40\text{ V}$, $I_D = 0.1\text{ A}$, $V_{GS} = 0\text{ to }1\text{ V}$	$Q_{g(th)}$	-	2.5	3.8	nC
Gate charge at 5.0 V $V_{DD} = 40\text{ V}$, $I_D = 47\text{ A}$, $V_{GS} = 0\text{ to }5\text{ V}$	$Q_{g(5)}$	-	50	75	
Gate charge total $V_{DD} = 40\text{ V}$, $I_D = 47\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	$Q_{g(total)}$	-	85	130	
Gate plateau voltage $V_{DD} = 40\text{ V}$, $I_D = 47\text{ A}$	$V_{(plateau)}$	-	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	35	-	-	A
Inverse diode direct current,pulsed $T_C = 25^{\circ}\text{C}$	I_{FM}	188	-	-	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 94\text{ A}$	V_{SD}	-	1.25	1.8	V
Reverse recovery time $V_R = 30\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	110	165	ns
Reverse recovery charge $V_R = 30\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	0.23	0.35	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 $t_P = 100\text{ }\mu\text{s}$, $T_j = -40\dots+150^\circ\text{C}$		-	-	10	
Forward current $T_j = -40\dots+150^\circ\text{C}$ Sensor override $t_P = 100\text{ }\mu\text{s}$, $T_j = -40\dots+150^\circ\text{C}$	$I_{AK(on)}$	-	-	5	mA
		-	-	600	

Electrical Characteristics

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

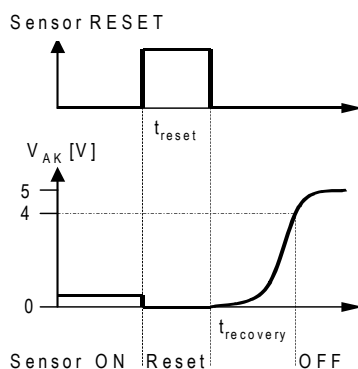
Sensor Characteristics

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

Characteristics

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

Sensor recovery behaviour:

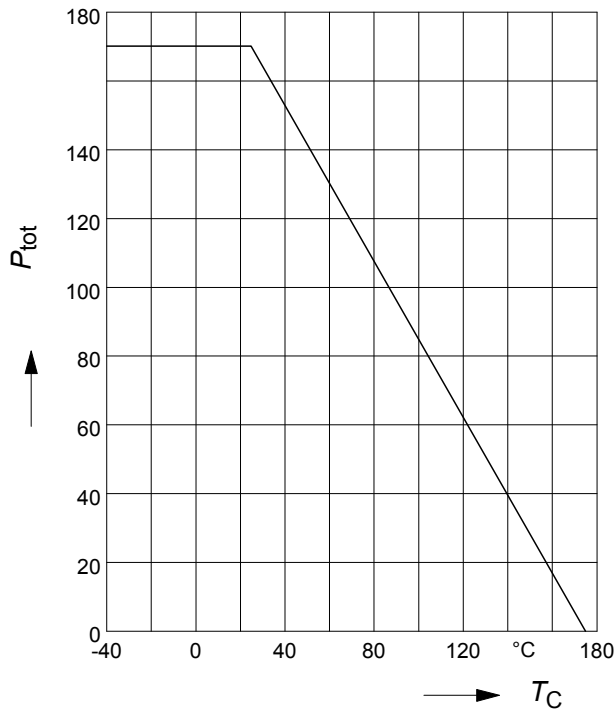


¹See diagram Sensor recovery behaviour

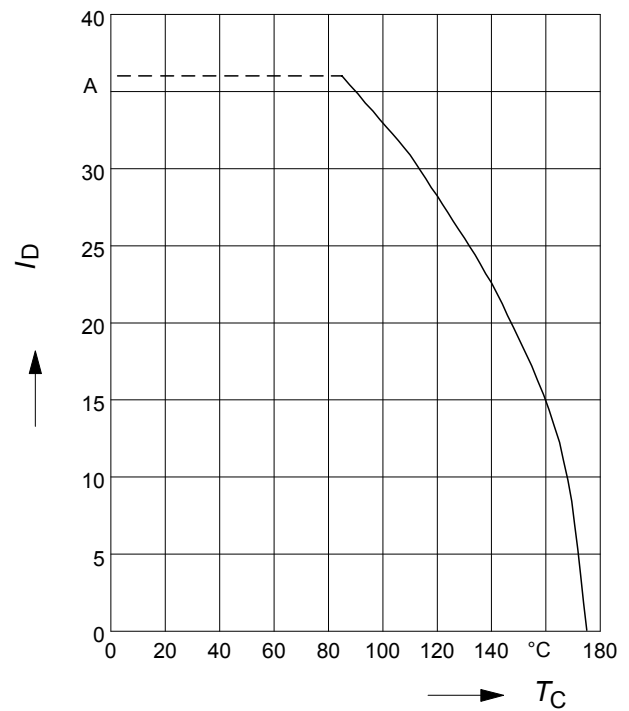
²Time after reset pulse until V_{AK} reaches 4V again

1 Maximum allowable power dissipation

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

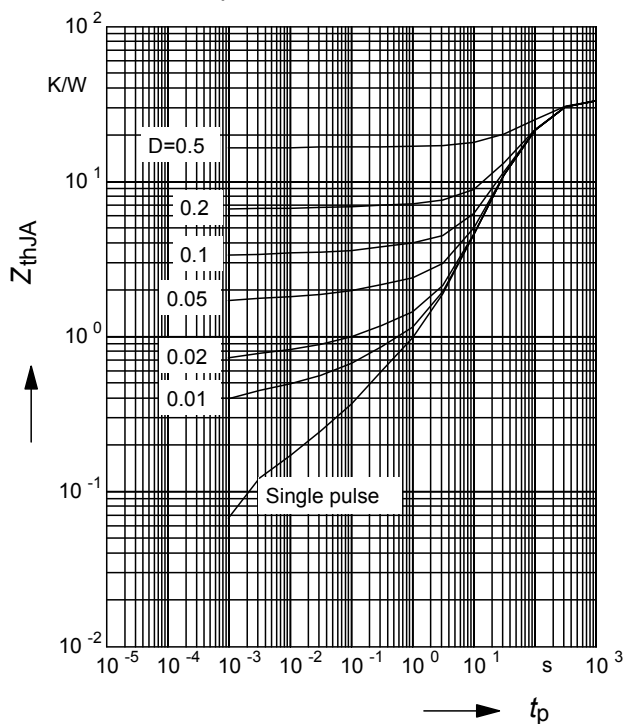

2 Drain current

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


3 Typ. transient thermal impedance

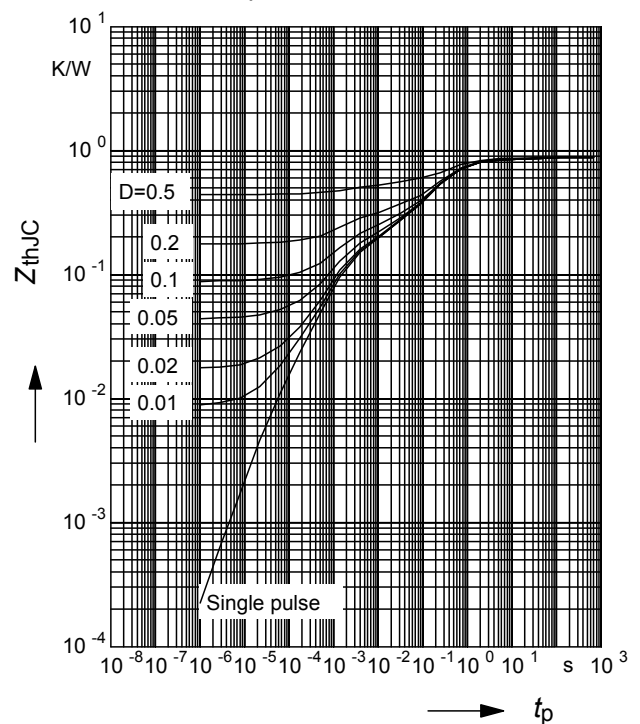
$$Z_{\text{thJA}} = f(t_p) \text{ @ } 6 \text{ cm}^2 \text{ cooling area}$$

$$\text{Parameter: } D = t_p / T$$


4 Transient thermal impedance

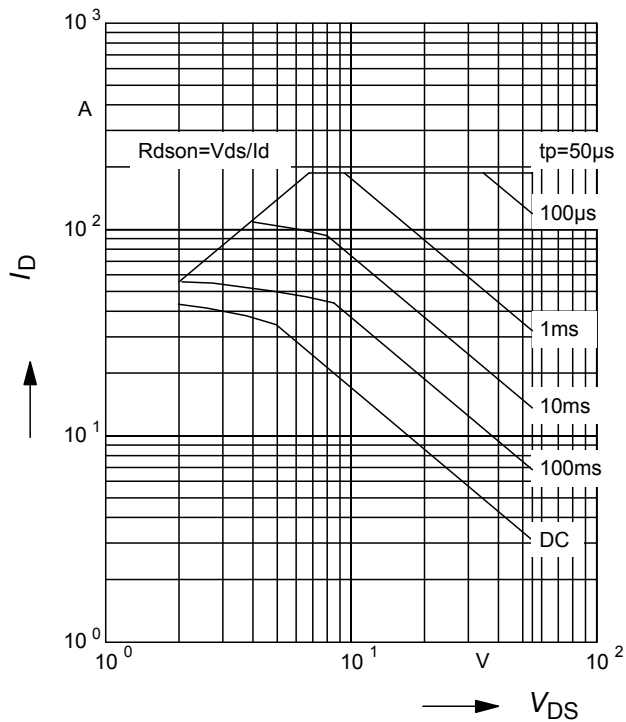
$$Z_{\text{thJC}} = f(t_p)$$

$$\text{parameter: } D = t_p / T$$



5 Safe operating area

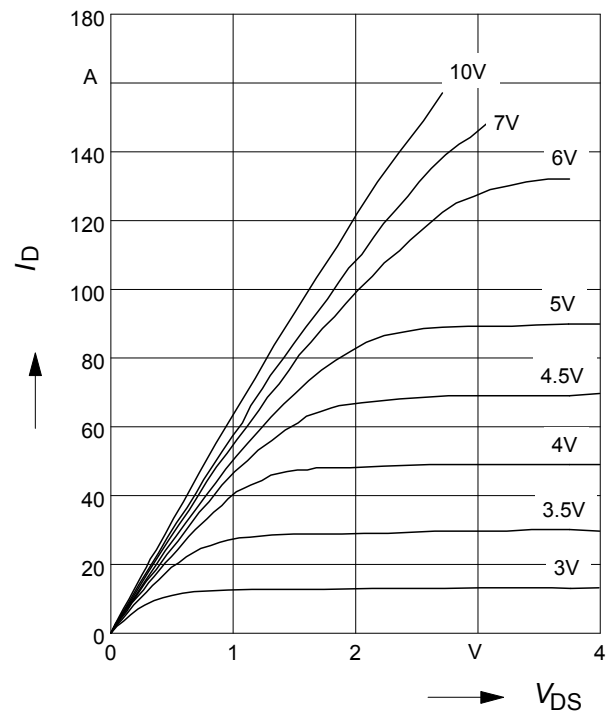
$I_D = f(V_{DS})$; $D=0.01$; $T_C=25^\circ\text{C}$; $V_{GS}=4.5\text{V}$



6 Typ. output characteristic

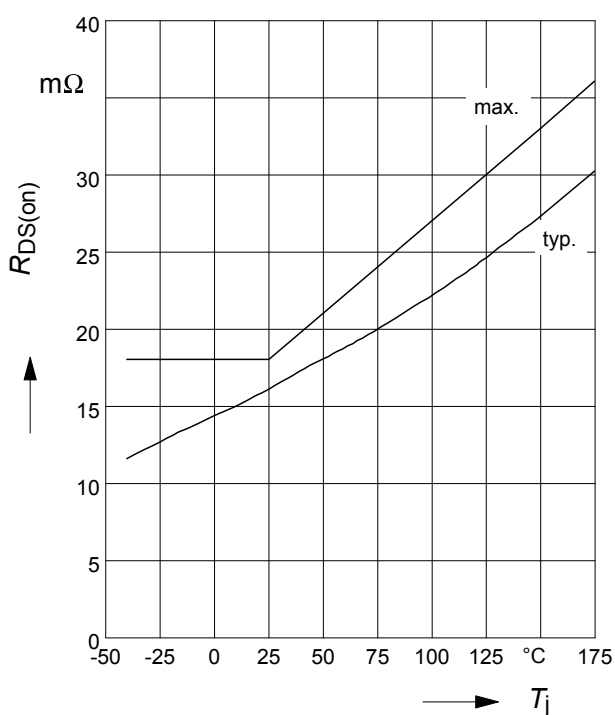
$I_D = f(V_{DS})$; $T_j=25^\circ\text{C}$

Parameter: V_{GS}



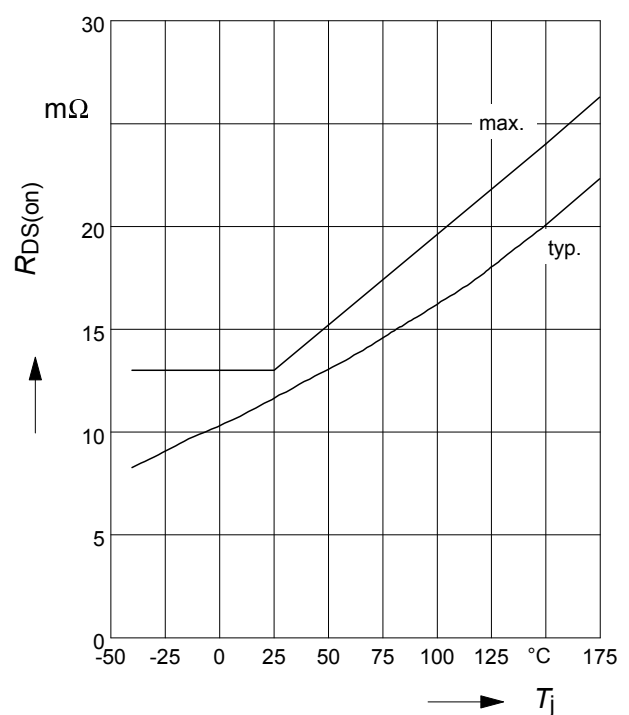
7 On-state resistance

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



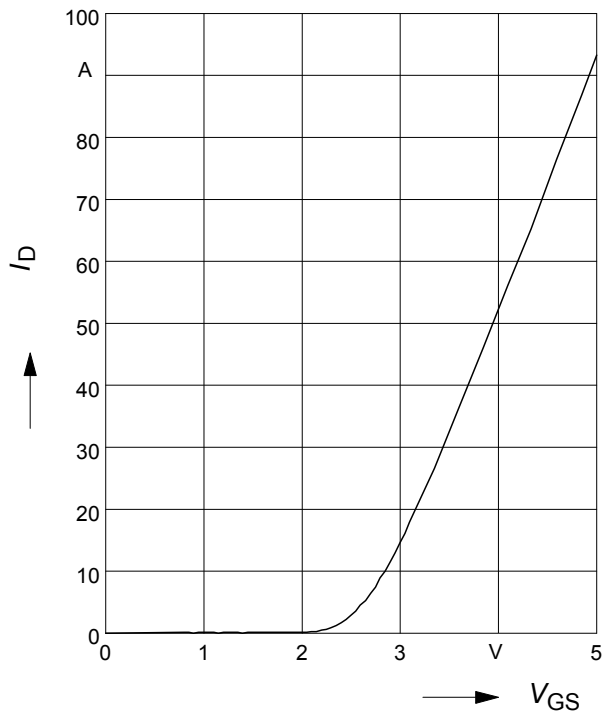
8 On-state resistance

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



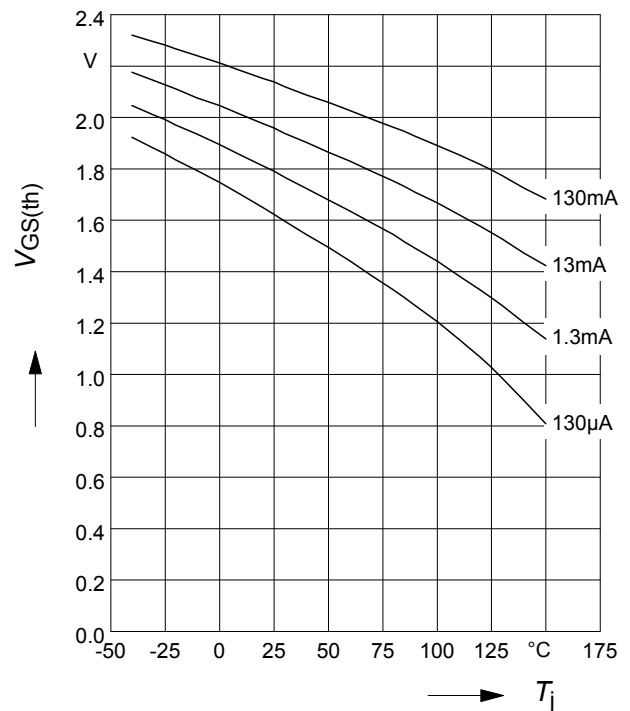
9 Typ. transfer characteristics

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

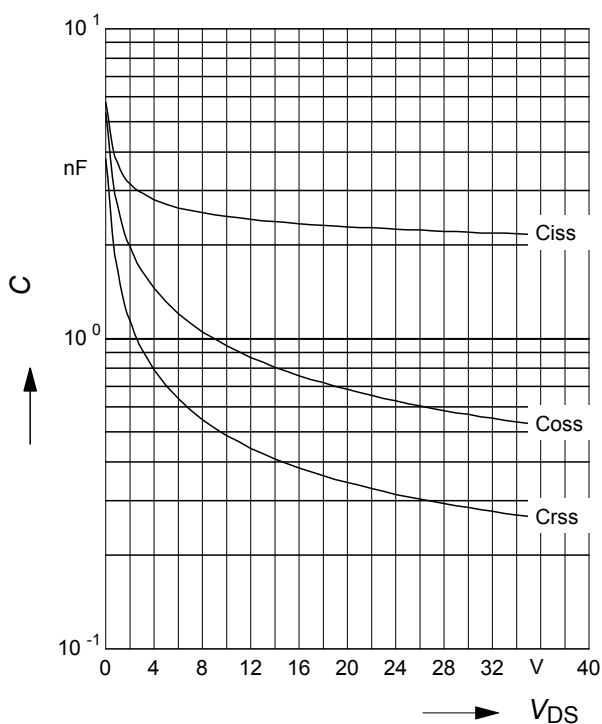

10 Typ. input threshold voltage

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

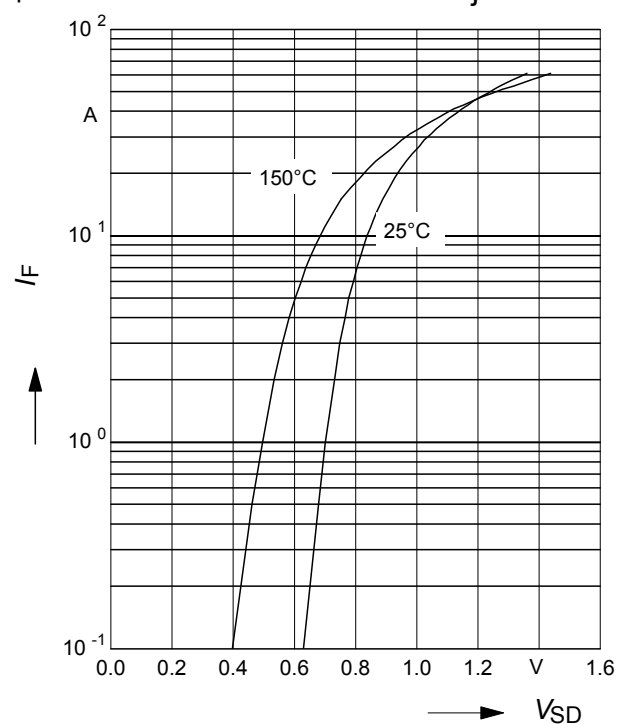
Parameter: I_D


11 Typ. capacitances

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

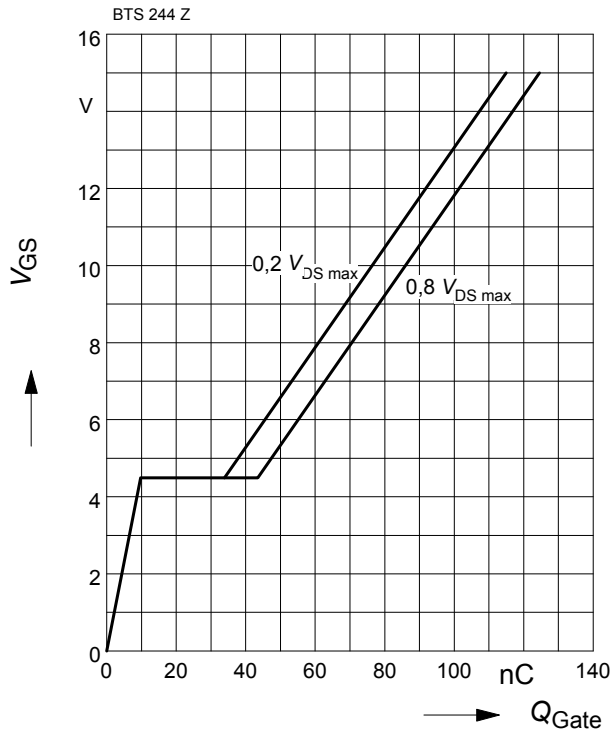

12 Typ. forward characteristics of reverse diode $I_F = f(V_{SD})$

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

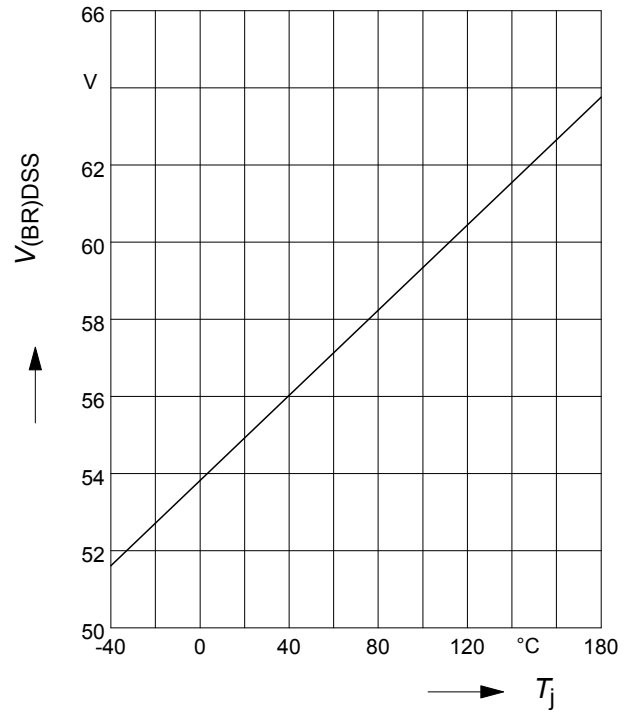


13 Typ. gate charge

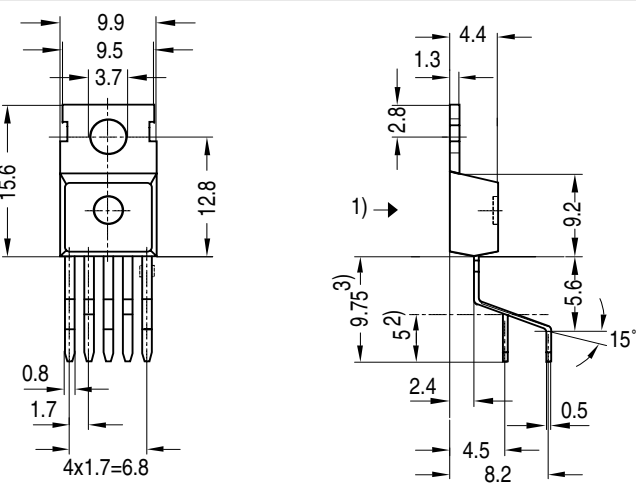
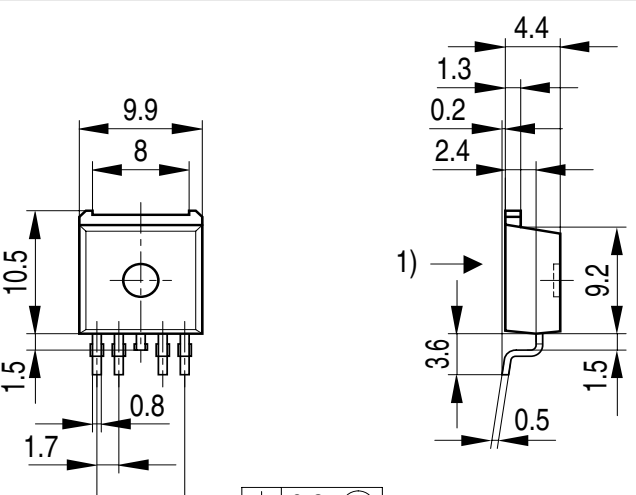
$$V_{GS} = f(Q_{Gate}); I_{D \text{ puls}} = 47A$$


14 Drain-source break down voltage

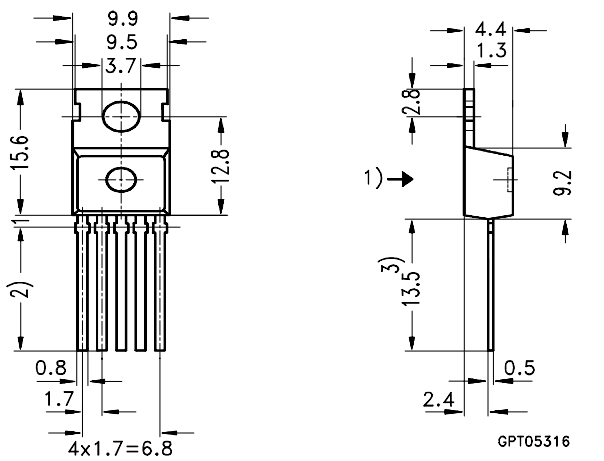
$$V_{(BR)DSS} = f(T_j)$$



Package	Ordering Code	Package	Ordering Code
P-TO220-5-3	Q67060-S6000-A2	P-TO220-5-62	Q67060-S6003-A2

 1) shear and punch direction no burrs this surface 2) min. length by tinning 3) max. 11 mm allowable by tinning GPT05165	 1) shear and punch direction no burrs this surface GPT05166
--	--

Package	Ordering Code
TO-220-5-43	Q67060-S6008

 1) punch direction, burr max. 0.04 2) dip tinning 3) max. 14.5 by dip tinning press burr max. 0.05 GPT05316

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