

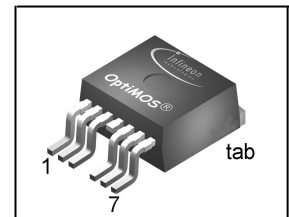
**OptiMOS® Power-Transistor**
**Feature**

- N-Channel
- Enhancement mode
- High Current Rating
- Low On-Resistance  $R_{DS(on)}$
- 175°C operating temperature
- Avalanche rated
- $dv/dt$  rated

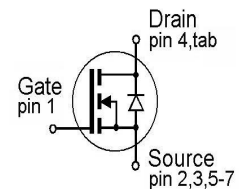
**Product Summary**

$V_{DS}$	40	V
$R_{DS(on)}$	2.9	mΩ
$I_D$	160	A

P- TO263 -7-3



Type	Package	Ordering Code	Marking
SPB160N04S2-03	P- TO263 -7-3	Q67060-S6123	P2N0403


**Maximum Ratings, at  $T_j = 25\text{ °C}$ , unless otherwise specified**

Parameter	Symbol	Value	Unit
Continuous drain current <sup>1)</sup> $T_C=25\text{ °C}$	$I_D$	160 160	A
Pulsed drain current $T_C=25\text{ °C}$	$I_{D\text{ puls}}$	640	
Avalanche energy, single pulse $I_D=80\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ Ω}$	$E_{AS}$	810	mJ
Repetitive avalanche energy, limited by $T_{jmax}^{2)}$	$E_{AR}$	30	
Reverse diode $dv/dt$ $I_S=160\text{ A}$ , $V_{DS}=44\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{jmax}=175\text{ °C}$	$dv/dt$	6	kV/μs
Gate source voltage	$V_{GS}$	±20	V
Power dissipation $T_C=25\text{ °C}$	$P_{tot}$	300	W
Operating and storage temperature	$T_j, T_{stg}$	-55... +175	°C
IEC climatic category; DIN IEC 68-1		55/175/56	

**Thermal Characteristics**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Thermal resistance, junction - case	$R_{thJC}$	-	0.3	0.5	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	62	
SMD version, device on PCB: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>3)</sup>	$R_{thJA}$	-	-	62 40	

**Electrical Characteristics, at  $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	40	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 250\mu A$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS}=40V, V_{GS}=0V, T_j=25^\circ C$ $V_{DS}=40V, V_{GS}=0V, T_j=125^\circ C^2)$	$I_{DSS}$	-	0.01 1	1 100	$\mu A$
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	$I_{GSS}$	-	1	100	nA
Drain-source on-state resistance $V_{GS}=10V, I_D=80A$	$R_{DS(on)}$	-	2.3	2.9	m $\Omega$

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 0.5K/W$  the chip is able to carry  $I_D = 235A$  at  $25^\circ C$ , for detailed information see app.-note ANPS071E available at [www.infineon.com/optimos](http://www.infineon.com/optimos)

<sup>2</sup>Defined by design. Not subject to production test.

<sup>3</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu m$  thick) copper area for drain connection. PCB is vertical without blown air.

**Electrical Characteristics**

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic Characteristics**

Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 160A$	90	180	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = 25V$ , $f = 1MHz$	-	5500	7320	pF
Output capacitance	$C_{oss}$		-	1900	2530	
Reverse transfer capacitance	$C_{rss}$		-	500	750	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 20V$ , $V_{GS} = 10V$ , $I_D = 160A$ , $R_G = 2.2\Omega$	-	21	32	ns
Rise time	$t_r$		-	50	75	
Turn-off delay time	$t_{d(off)}$		-	61	92	
Fall time	$t_f$		-	40	60	

**Gate Charge Characteristics**

Gate to source charge	$Q_{gs}$	$V_{DD} = 32V$ , $I_D = 160A$	-	25	30	nC
Gate to drain charge	$Q_{gd}$		-	50	75	
Gate charge total	$Q_g$	$V_{DD} = 32V$ , $I_D = 160A$ , $V_{GS} = 0$ to $10V$	-	135	170	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 32V$ , $I_D = 160A$	-	5.3	-	V

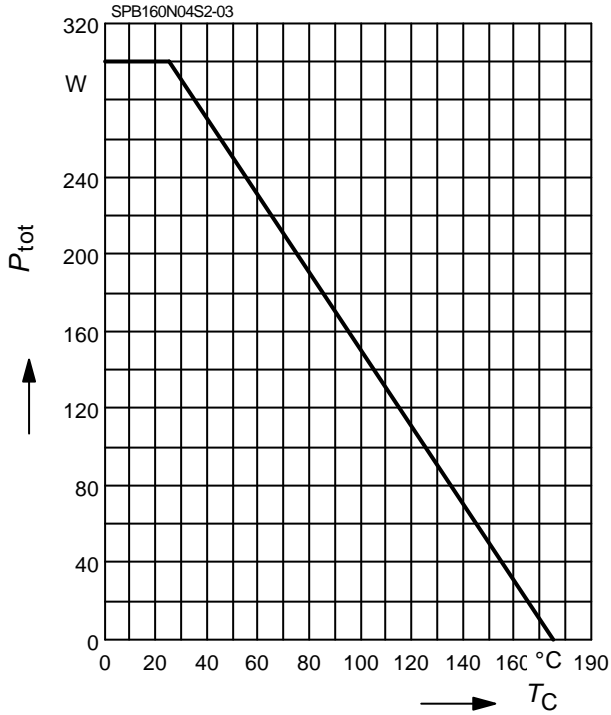
**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_C = 25^\circ C$	-	-	160	A
Inv. diode direct current, pulsed	$I_{SM}$		-	-	640	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0V$ , $I_F = 80A$	-	0.9	1.3	V
Reverse recovery time	$t_{rr}$	$V_R = 20V$ , $I_F = I_S$ , $di_F/dt = 100A/\mu s$	-	60	75	ns
Reverse recovery charge	$Q_{rr}$		-	100	125	

### 1 Power dissipation

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

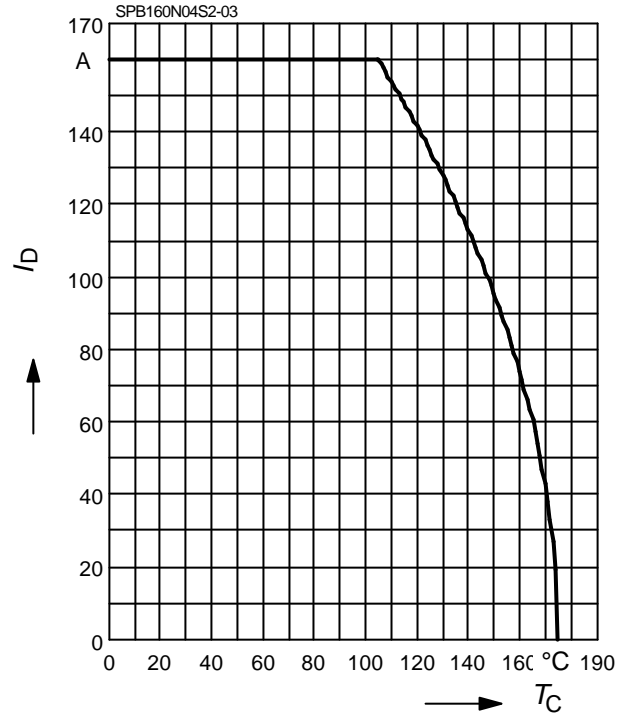
parameter:  $V_{GS} \geq 6\text{ V}$



### 2 Drain current

$$I_D = f(T_C)$$

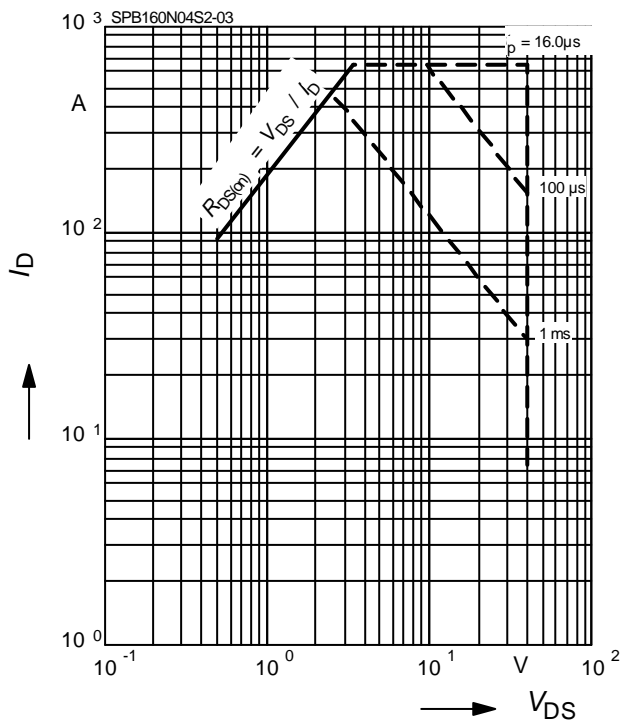
parameter:  $V_{GS} \geq 10\text{ V}$



### 3 Safe operating area

$$I_D = f(V_{DS})$$

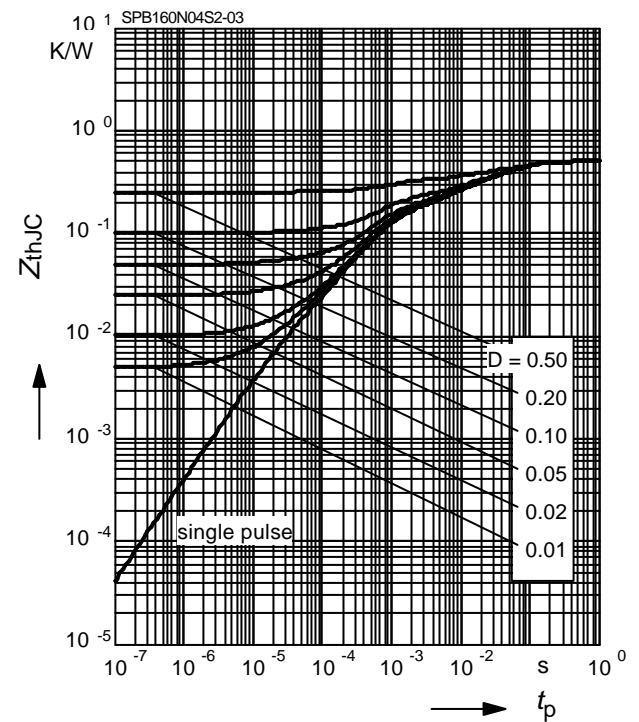
parameter:  $D = 0, T_C = 25\text{ °C}$



### 4 Max. transient thermal impedance

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

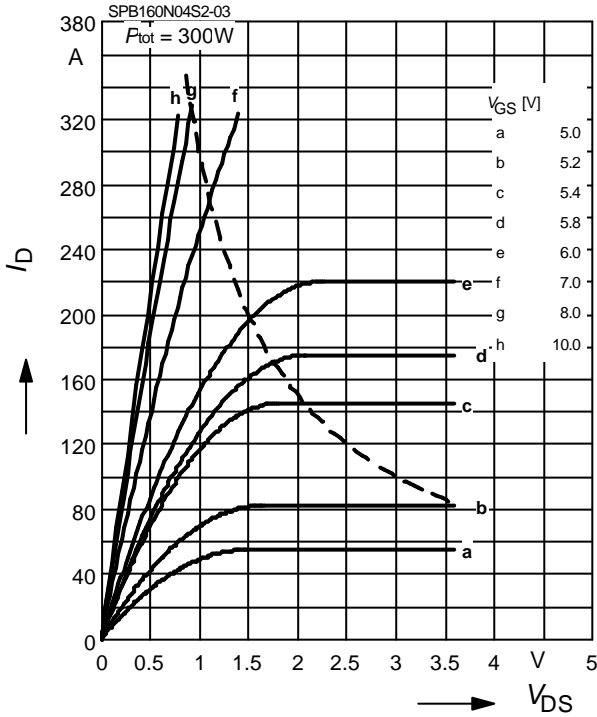
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

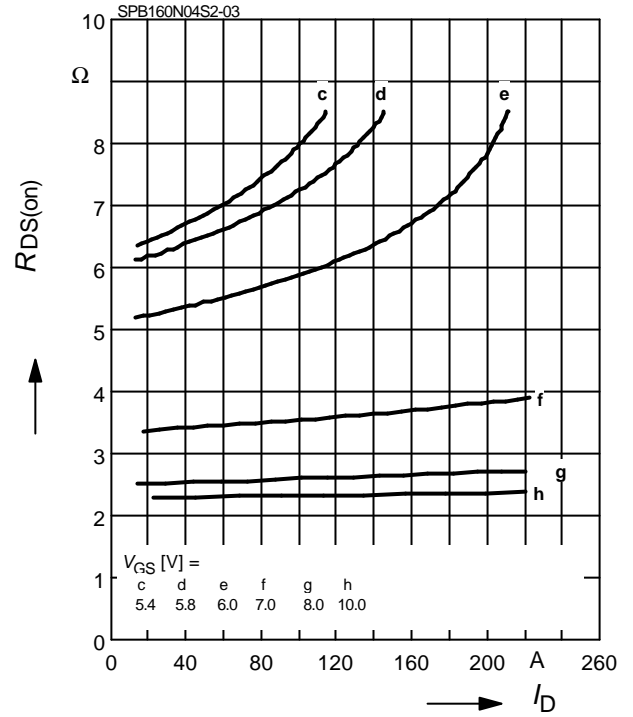
parameter:  $t_p = 80 \mu\text{s}$



**6 Typ. drain-source on resistance**

$R_{DS(\text{on})} = f(I_D)$

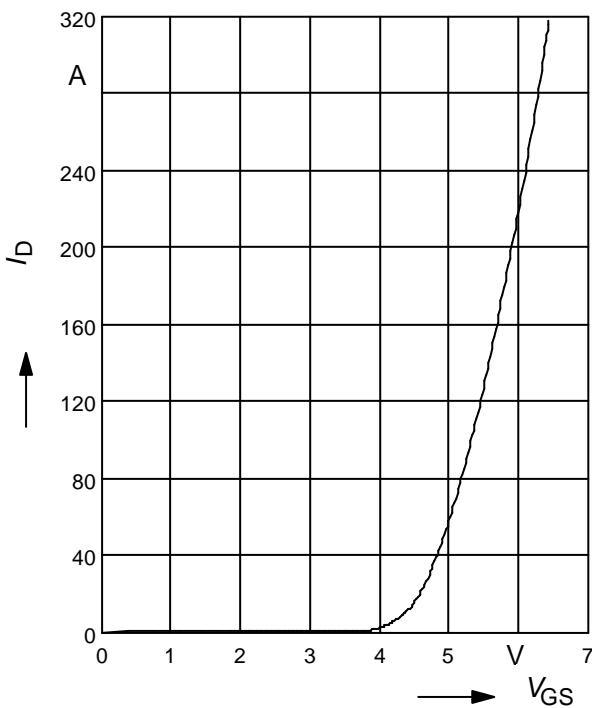
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(\text{on})\text{max}}$

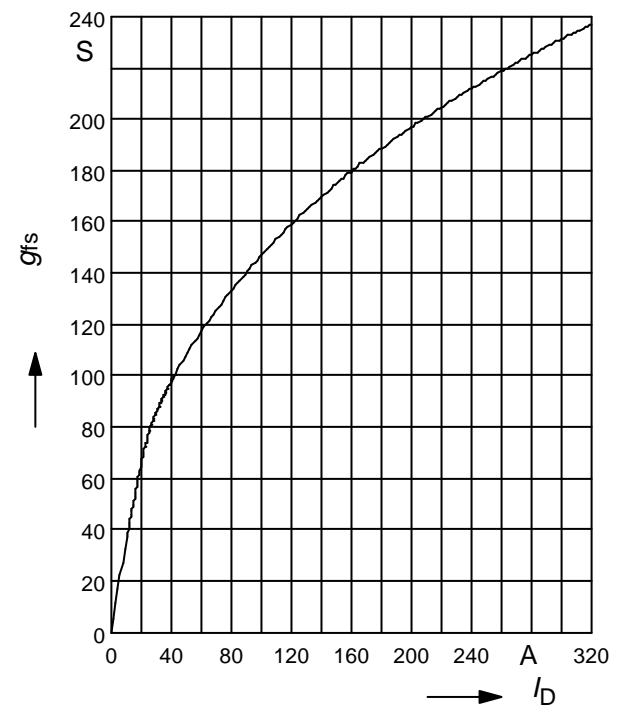
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

$g_{fs} = f(I_D); T_J = 25^\circ\text{C}$

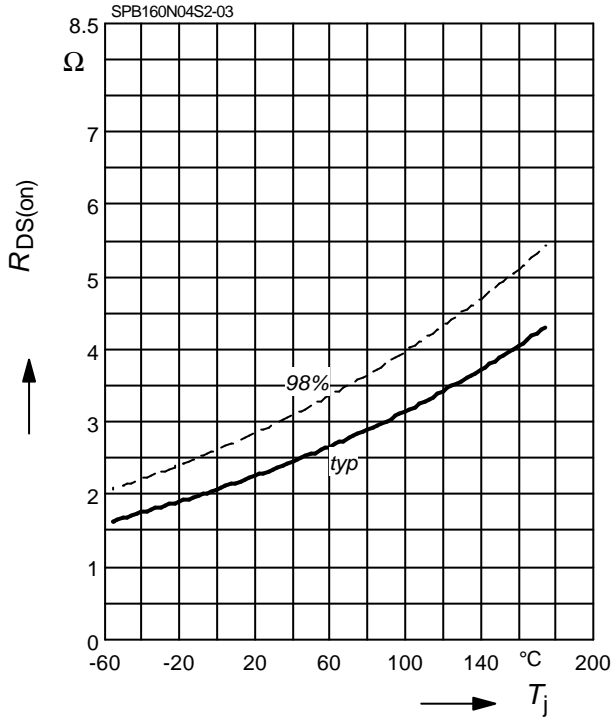
parameter:  $g_{fs}$



**9 Drain-source on-state resistance**

$$R_{DS(on)} = f(T_j)$$

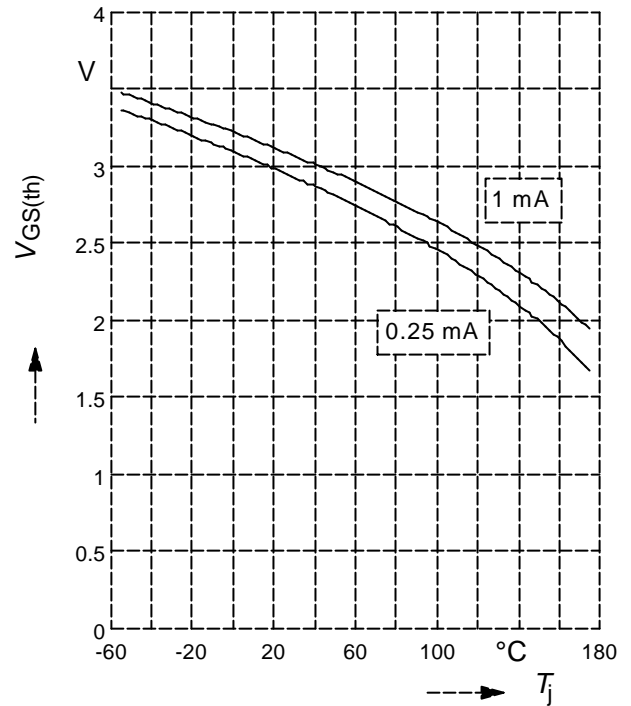
parameter :  $I_D = 80\text{ A}$ ,  $V_{GS} = 10\text{ V}$



**10 Typ. gate threshold voltage**

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

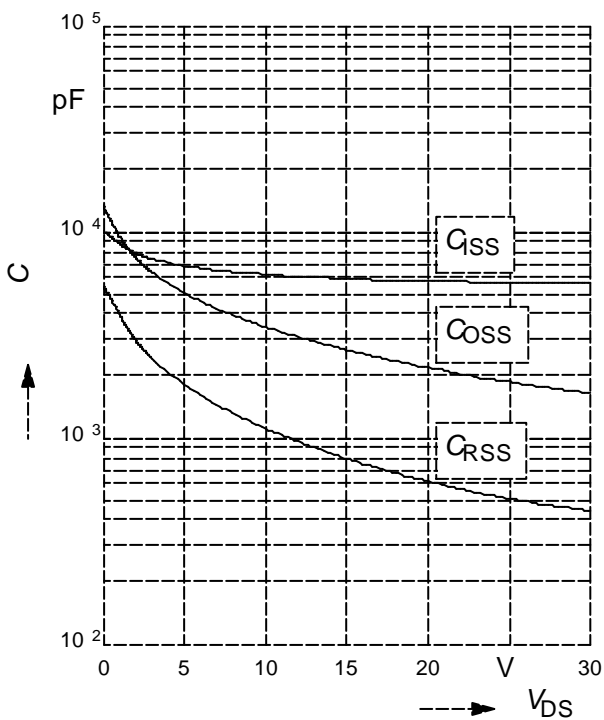
parameter:  $V_{GS} = V_{DS}$



**11 Typ. capacitances**

$$C = f(V_{DS})$$

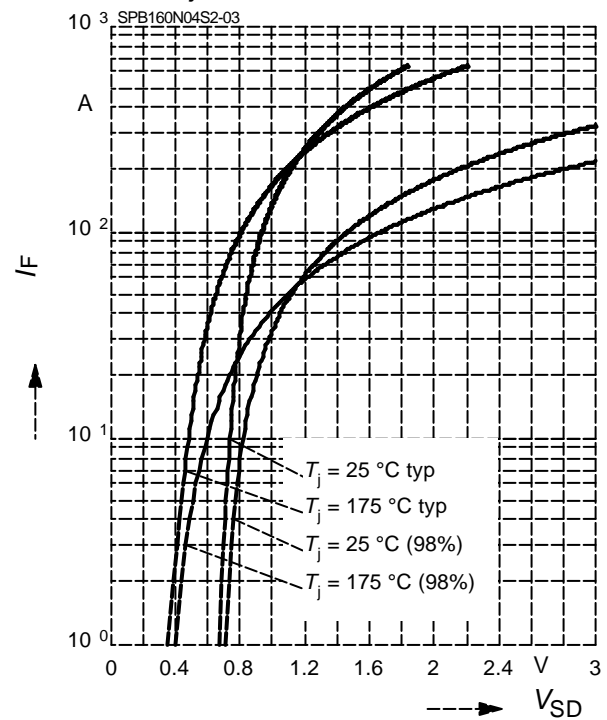
parameter:  $V_{GS}=0\text{V}$ ,  $f=1\text{ MHz}$



**12 Forward character. of reverse diode**

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

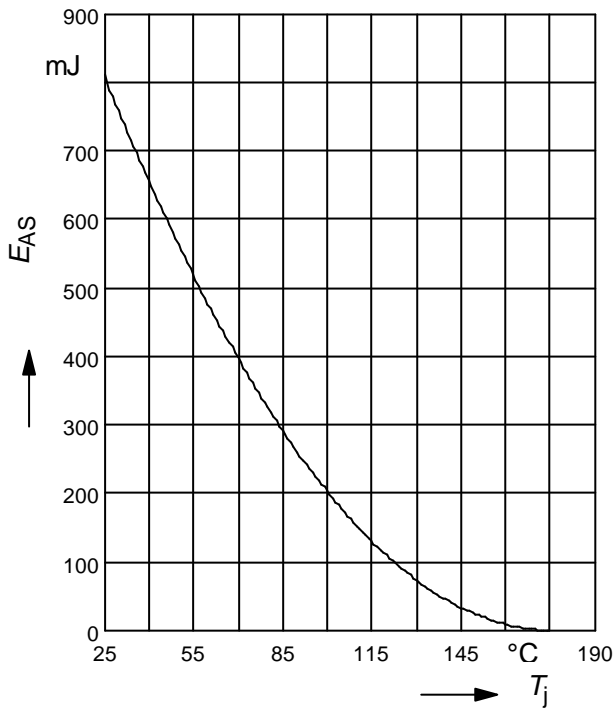
parameter:  $T_j$ ,  $t_p = 80\text{ }\mu\text{s}$



**13 Typ. avalanche energy**

$$E_{AS} = f(T_j)$$

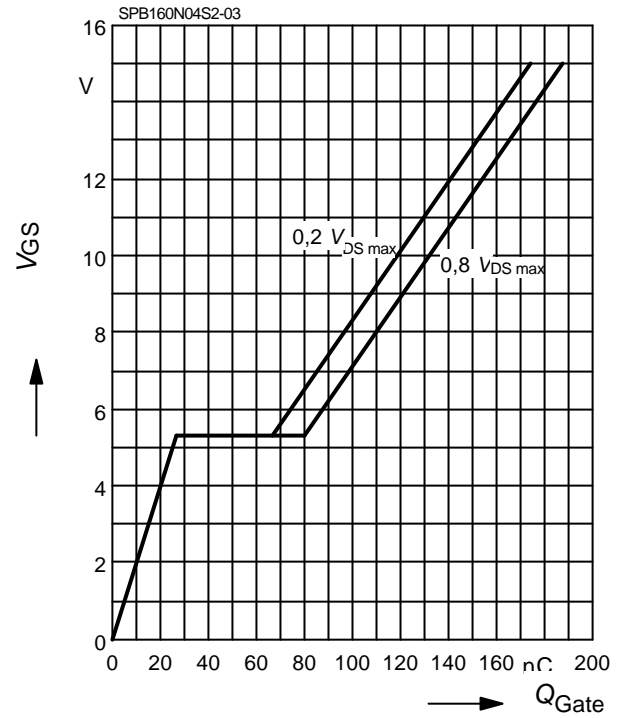
par.:  $I_D = 80 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



**14 Typ. gate charge**

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

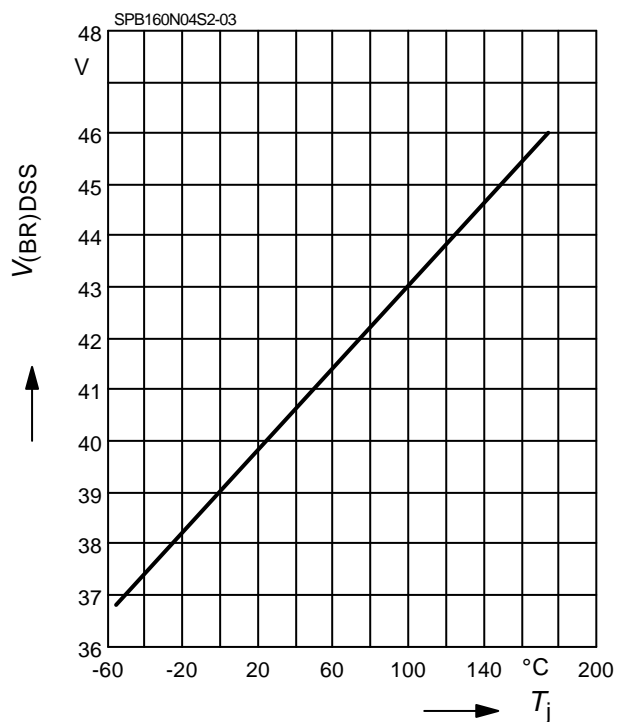
parameter:  $I_D = 160 \text{ A}$  pulsed



**15 Drain-source breakdown voltage**

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

parameter:  $I_D = 10 \text{ mA}$



**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.

**Further information**

Please notice that the part number is BSPB160N04S2-03, for simplicity the device is referred to by the term SPB160N04S2-03 throughout this documentation.