

OptiMOS® Power-Transistor

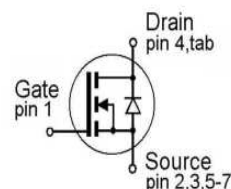
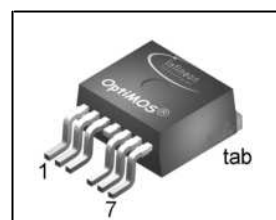
Feature

- 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 ¹⁾ $T_C=25\text{ °C}$	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.	
Characteristics					
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:	R_{thJA}				
@ min. footprint		-	-	62	
@ 6 cm ² cooling area ³⁾		-	-	40	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
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	μA
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	I_{GSS}	-	1	100	
Drain-source on-state resistance $V_{GS}=10V, I_D=80A$	$R_{DS(on)}$	-	2.3	2.9	$m\Omega$

¹Current limited by bondwire ; with an $R_{thJC} = 0.5\text{K/W}$ the chip is able to carry $I_D = 235\text{A}$ at 25°C , for detailed information see app.-note ANPS071E available at www.infineon.com/optimos

²Defined by design. Not subject to production test.

³Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μm 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

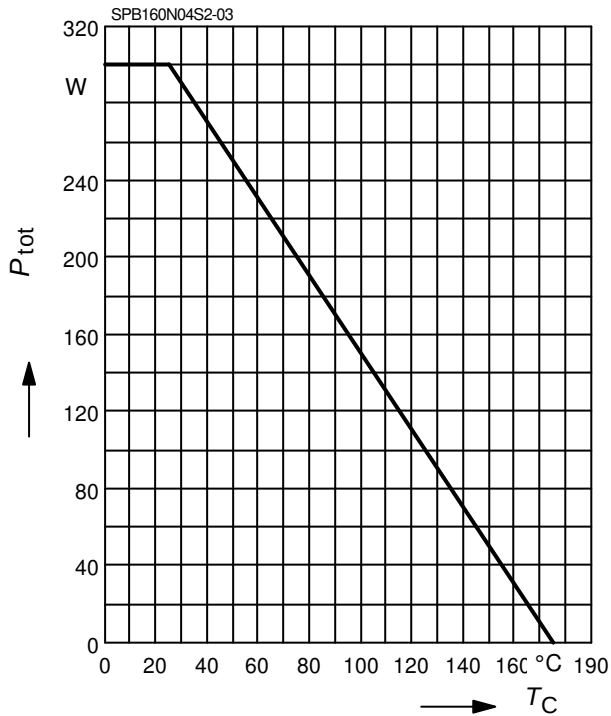
Reverse Diode

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	nC

1 Power dissipation

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

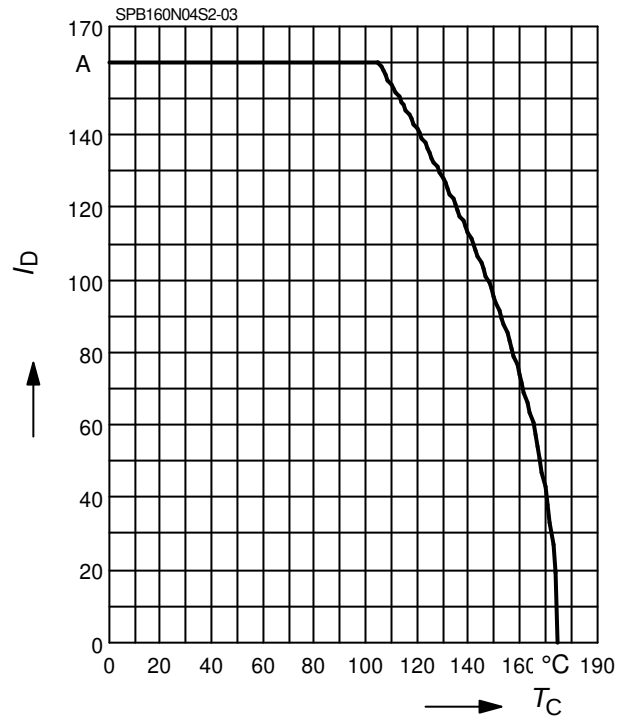
parameter: $V_{GS} \geq 6 \text{ V}$



2 Drain current

$$I_D = f(T_C)$$

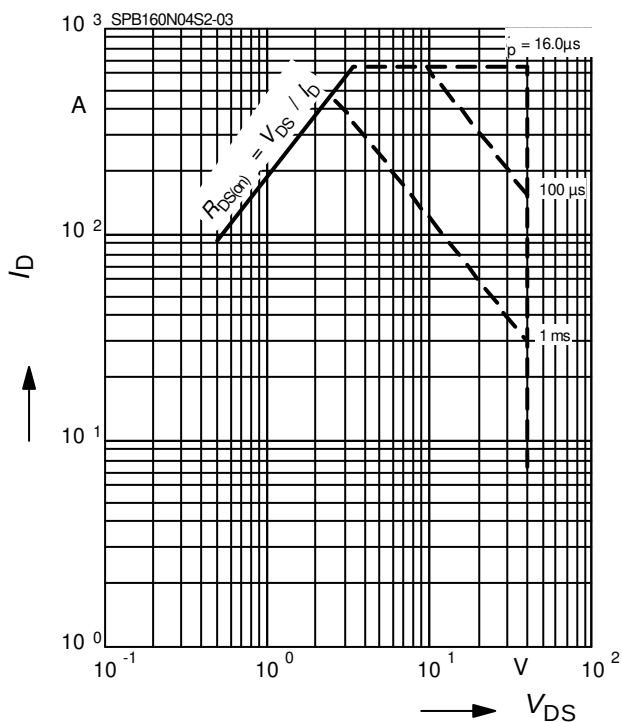
parameter: $V_{GS} \geq 10 \text{ V}$



3 Safe operating area

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

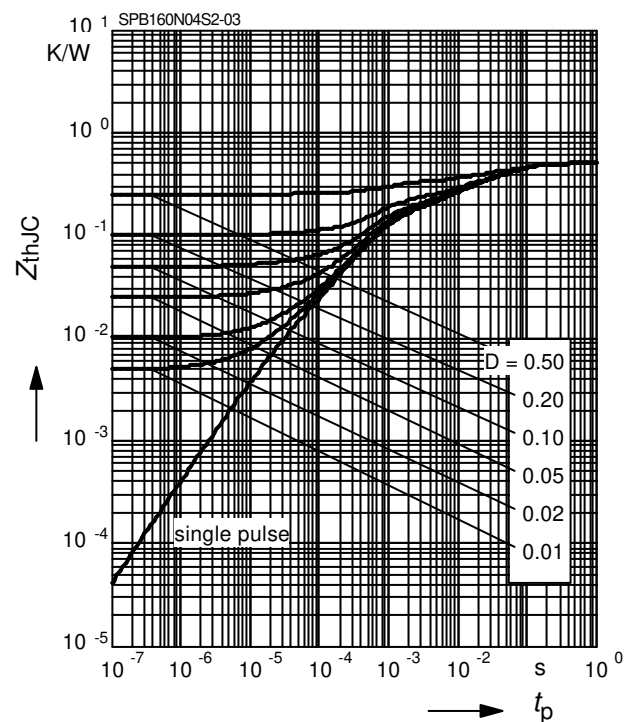
parameter: $D = 0$, $T_C = 25 \text{ °C}$



4 Max. transient thermal impedance

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

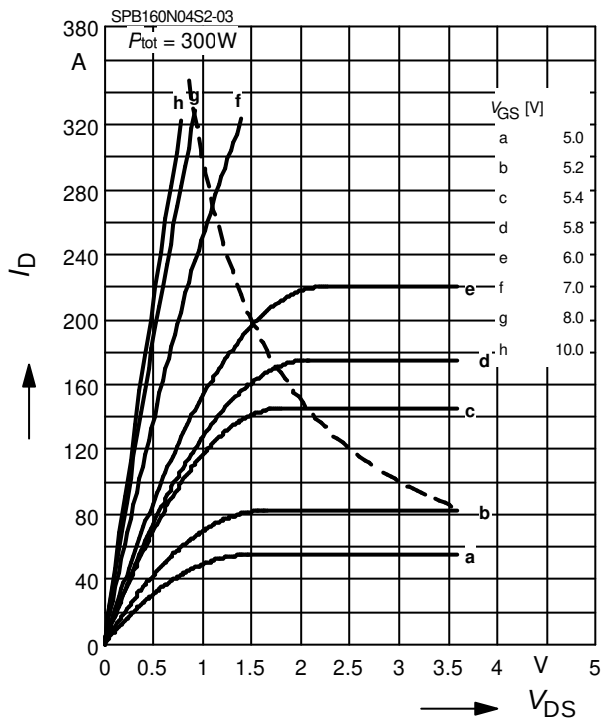
parameter: $D = t_p/T$



5 Typ. output characteristic

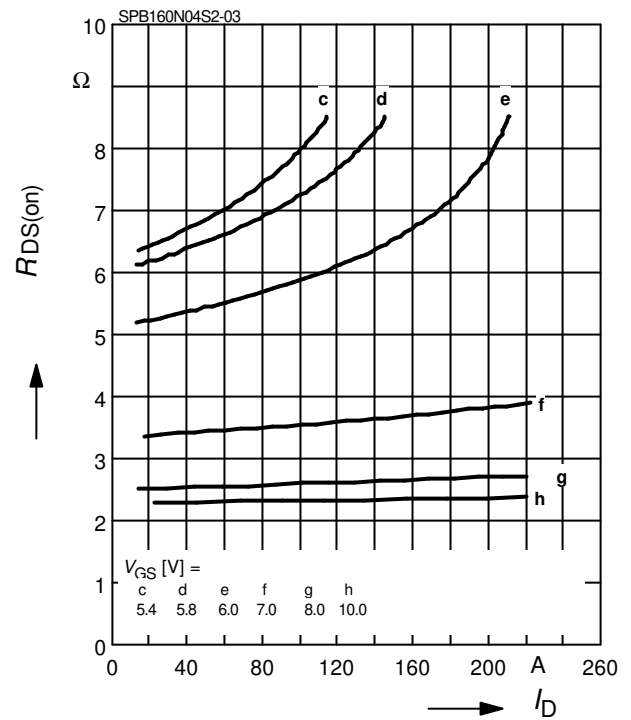
$$I_D = f(V_{DS}); T_J = 25^\circ\text{C}$$

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


6 Typ. drain-source on resistance

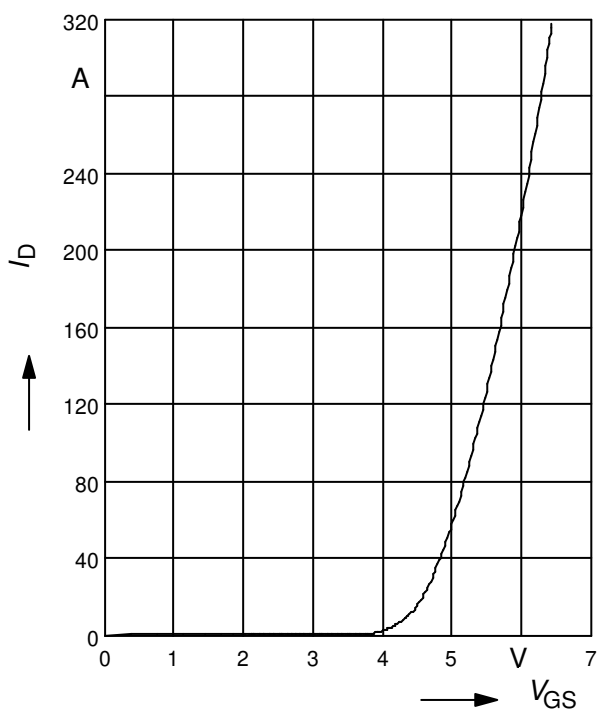
$$R_{DS(\text{on})} = f(I_D)$$

parameter: V_{GS}


7 Typ. transfer characteristics

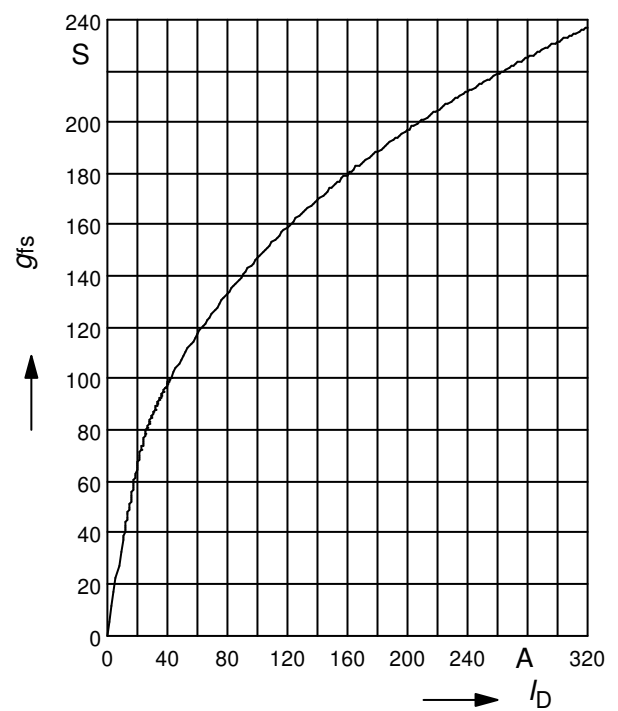
$$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(\text{on})\text{max}}$$

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


8 Typ. forward transconductance

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

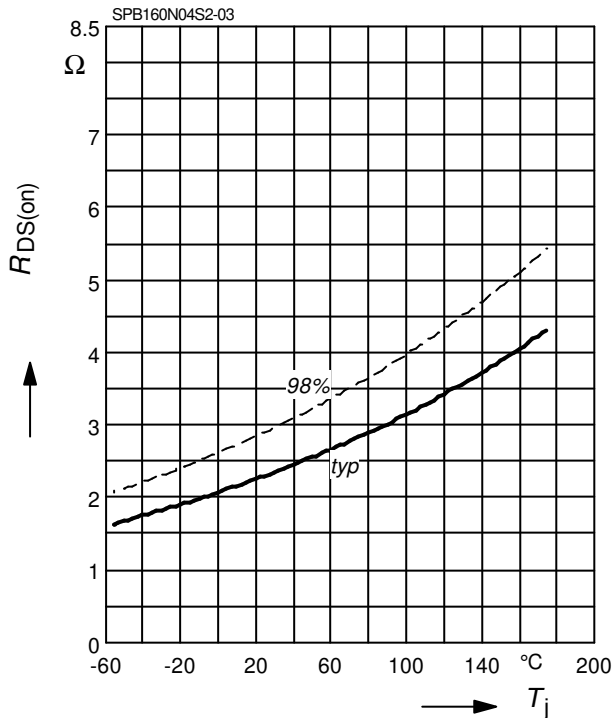
parameter: g_{fs}



9 Drain-source on-state resistance

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

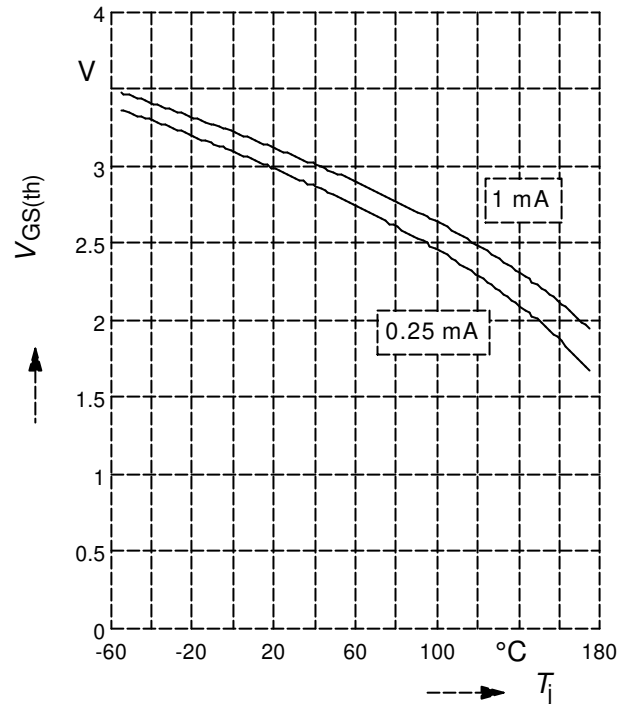
parameter: $I_D = 80\text{ A}$, $V_{GS} = 10\text{ V}$



10 Typ. gate threshold voltage

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

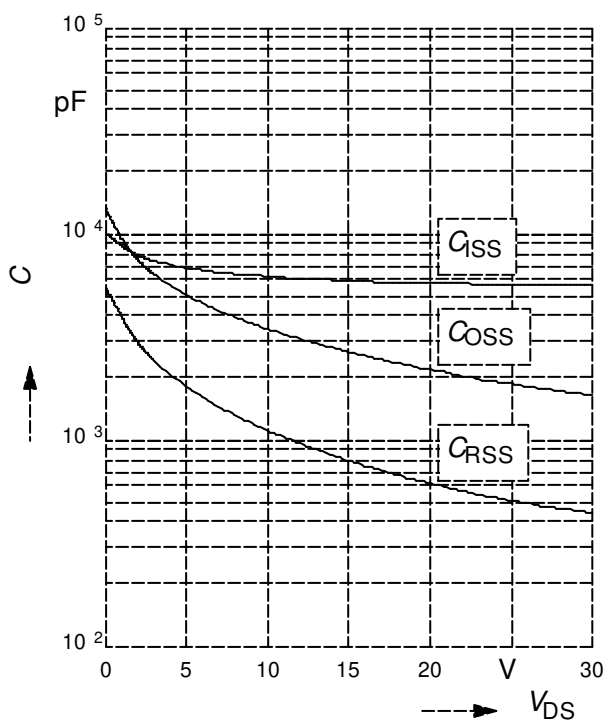
parameter: $V_{GS} = V_{DS}$



11 Typ. capacitances

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

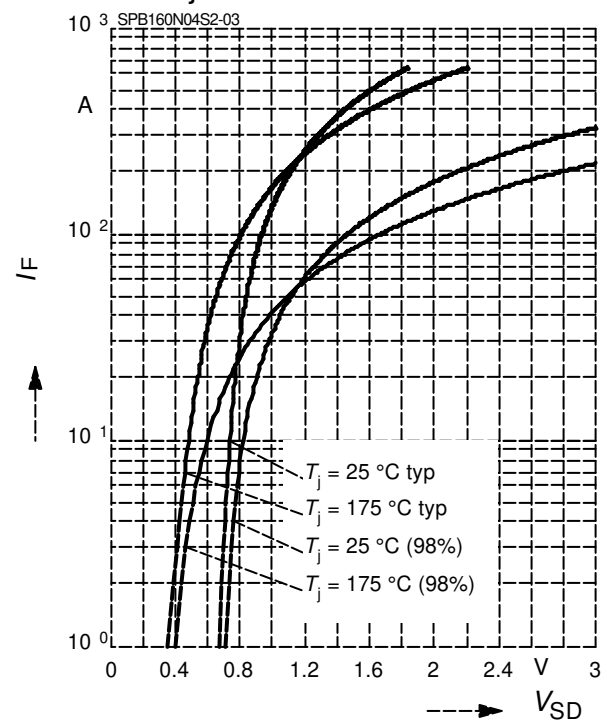
parameter: $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$



12 Forward character. of reverse diode

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

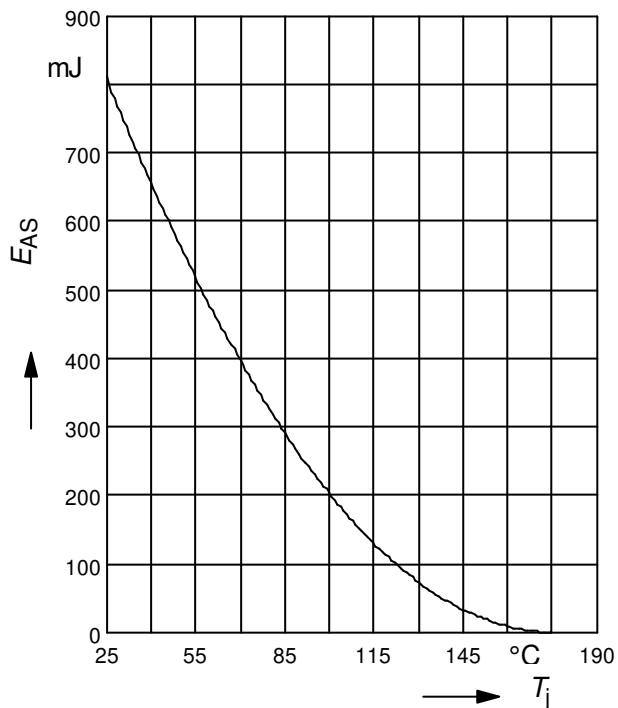
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



13 Typ. avalanche energy

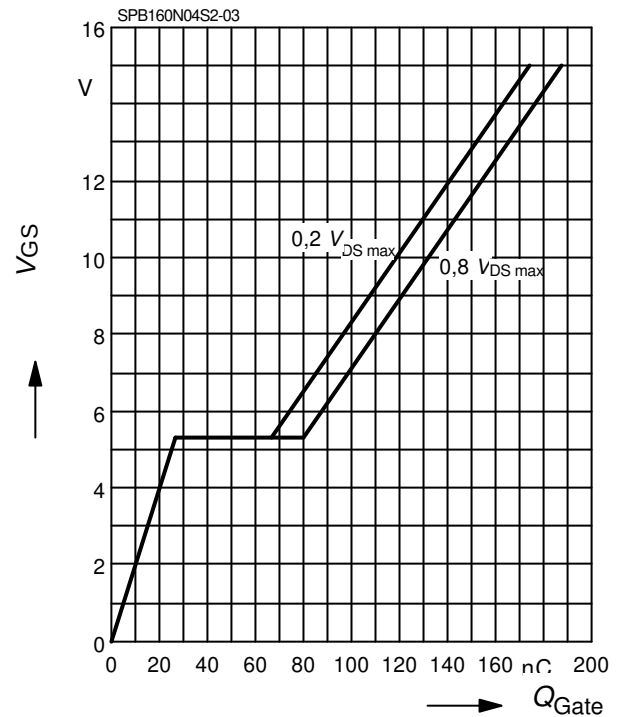
$$E_{AS} = f(T_j)$$

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


14 Typ. gate charge

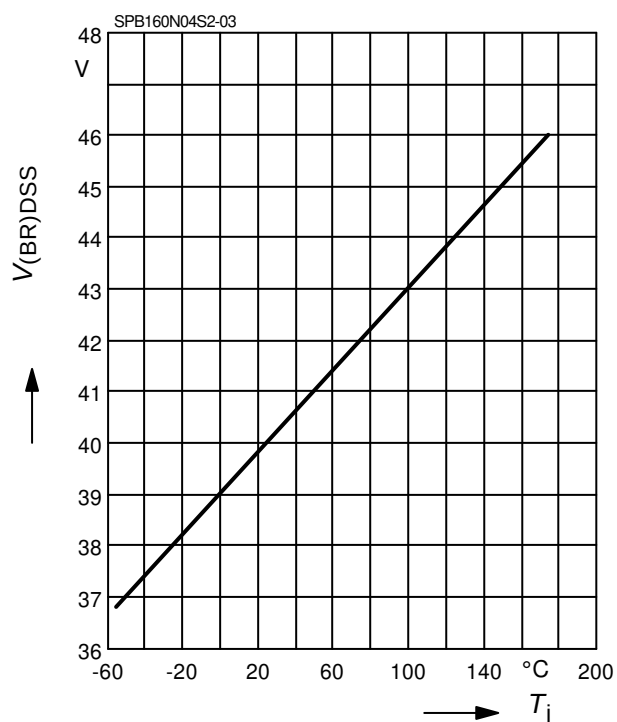
$$V_{GS} = f(Q_{Gate})$$

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


15 Drain-source breakdown voltage

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

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



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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.