

OptiMOS[®] Buck converter series

Feature

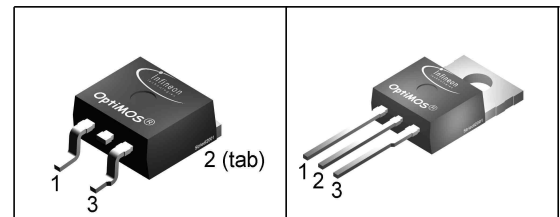
- N-Channel
- Logic Level
- Excellent Gate Charge x $R_{DS(on)}$ product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- dv/dt rated
- Ideal for fast switching buck converter

Product Summary

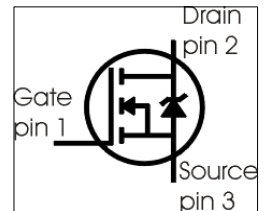
V_{DS}	30	V
$R_{DS(on)}$ max. SMD version	3.9	mΩ
I_D	80	A

P- TO263 -3-2

P- TO220 -3-1



Type	Package	Ordering Code	Marking
IPP04N03L	P- TO220 -3-1	Q67042-S4108	04N03L
IPB04N03L	P- TO263 -3-2	Q67042-S4107	04N03L



Maximum Ratings, at $T_i = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current ¹⁾ $T_C=25^\circ\text{C}^1)$	I_D	80 80	A
Pulsed drain current $T_C=25^\circ\text{C}$	$I_{D \text{ puls}}$	320	
Avalanche energy, single pulse $I_D=55\text{A}$, $V_{DD}=25\text{V}$, $R_{GS}=25\Omega$	E_{AS}	60	mJ
Repetitive avalanche energy, limited by $T_{jmax}^{2)}$	E_{AR}	18	
Reverse diode dv/dt $I_S=80\text{A}$, $V_{DS}=24\text{V}$, $di/dt=200\text{A}/\mu\text{s}$, $T_{jmax}=175^\circ\text{C}$	dv/dt	6	kV/ μs
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_C=25^\circ\text{C}$	P_{tot}	188	W
Operating and storage temperature	T_i, 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}	-	0.51	0.8	K/W
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 $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	30	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 130 \mu A$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS}=30V, V_{GS}=0V, T_j=25^{\circ}C$ $V_{DS}=30V, V_{GS}=0V, T_j=125^{\circ}C$	I_{DSS}	- -	0.01 10	1 100	μA
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	I_{GSS}	-	1	100	
Drain-source on-state resistance $V_{GS}=4.5V, I_D=45A$ $V_{GS}=4.5V, I_D=45A, SMD \text{ version}$	$R_{DS(on)}$	- -	4.9 4.6	6.2 5.9	m Ω
Drain-source on-state resistance ⁴⁾ $V_{GS}=10V, I_D=45A$ $V_{GS}=10V, I_D=45A, SMD \text{ version}$	$R_{DS(on)}$	- -	3.6 3.2	4.2 3.9	

¹Current limited by bondwire ; with an $R_{thJC} = 0.8\text{K/W}$ the chip is able to carry $I_D = 165\text{A}$ 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.

⁴Diagrams are related to straight lead versions

Electrical Characteristics

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic Characteristics

Transconductance	g_{fs}	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 80A$	11.5	23	-	S
Input capacitance	C_{iss}	$V_{GS} = 0V$, $V_{DS} = 25V$, $f = 1MHz$	-	2930	3900	pF
Output capacitance	C_{oss}		-	1150	1520	
Reverse transfer capacitance	C_{rss}		-	270	420	
Gate resistance	R_G		-	1.9	-	Ω
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15V$, $V_{GS} = 10V$, $I_D = 20A$, $R_G = 2.2\Omega$	-	12.7	19	ns
Rise time	t_r		-	20	30	
Turn-off delay time	$t_{d(off)}$		-	54.2	81.3	
Fall time	t_f		-	18.9	28.3	

Gate Charge Characteristics

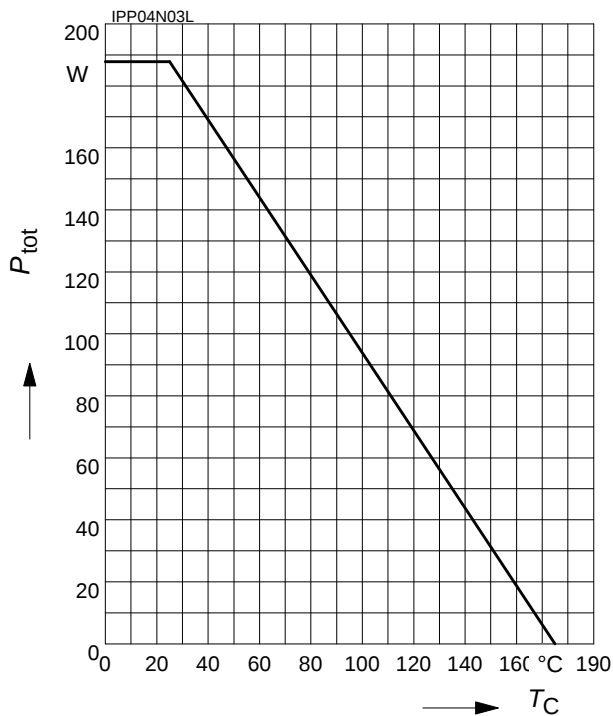
Gate to source charge	Q_{gs}	$V_{DD} = 15V$, $I_D = 40A$	-	9.9	12.4	nC
Gate to drain charge	Q_{gd}		-	23	35	
Gate charge total	Q_g	$V_{DD} = 15V$, $I_D = 40A$, $V_{GS} = 0$ to $5V$	-	41.8	52	
Output charge	Q_{oss}	$V_{DS} = 15V$, $I_D = 40A$, $V_{GS} = 0V$	-	40.4	50	nC
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 15V$, $I_D = 40A$	-	3.2	-	V

Reverse Diode

Inverse diode continuous forward current	I_S	$T_C = 25^\circ C$	-	-	80	A
Inv. diode direct current, pulsed	I_{SM}		-	-	320	
Inverse diode forward voltage	V_{SD}	$V_{GS} = 0V$, $I_F = 80A$	-	0.9	1.2	V
Reverse recovery time	t_{rr}	$V_R = -V$, $I_F = I_S$, $di_F/dt = 100A/\mu s$	-	50	62	ns
Reverse recovery charge	Q_{rr}		-	61	76	nC

1 Power dissipation

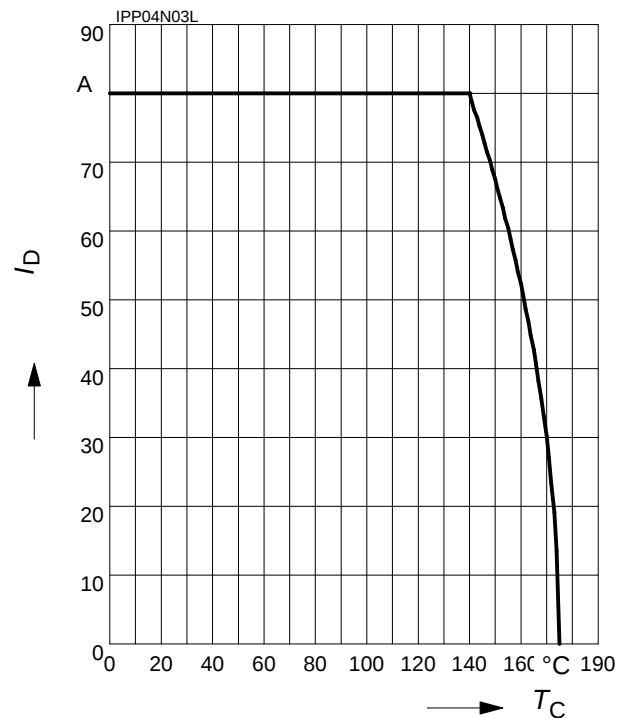
$$P_{\text{tot}} = f(T_C)$$



2 Drain current

$$I_D = f(T_C)$$

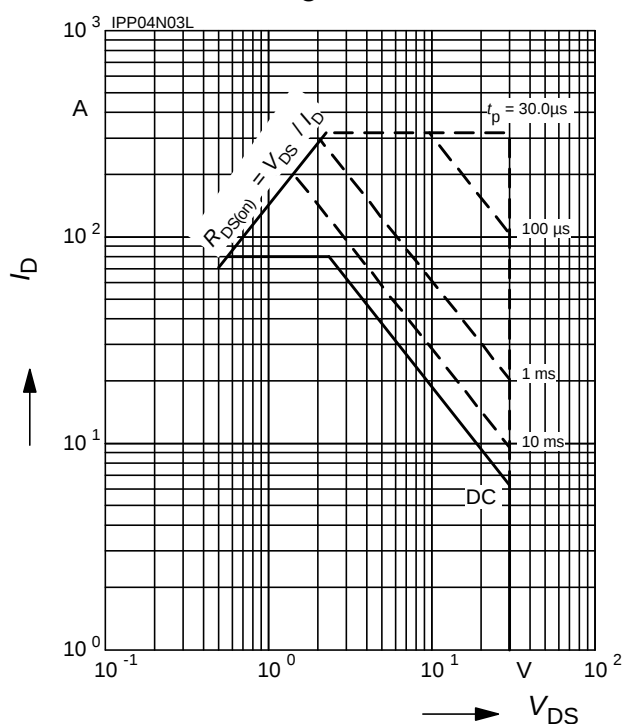
parameter: $V_{GS} \geq 10$ V



3 Safe operating area

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

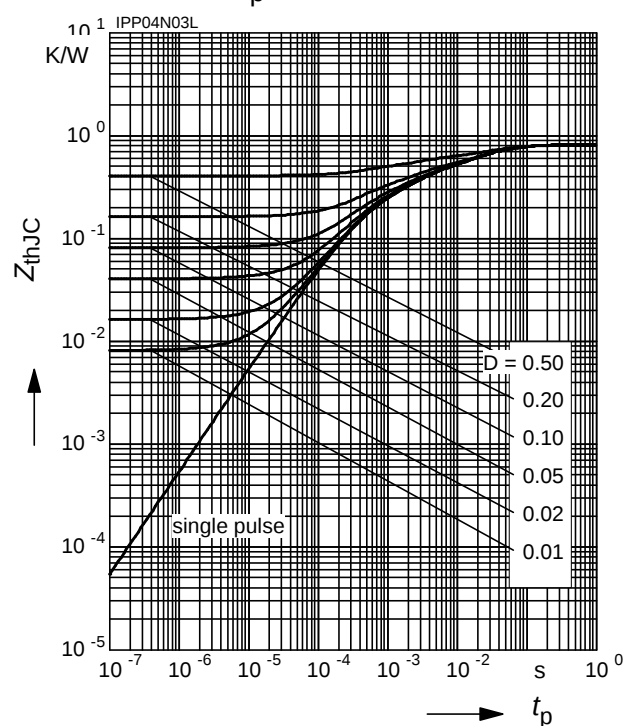
parameter: $D = 0$, $T_C = 25$ °C



4 Max. transient thermal impedance

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

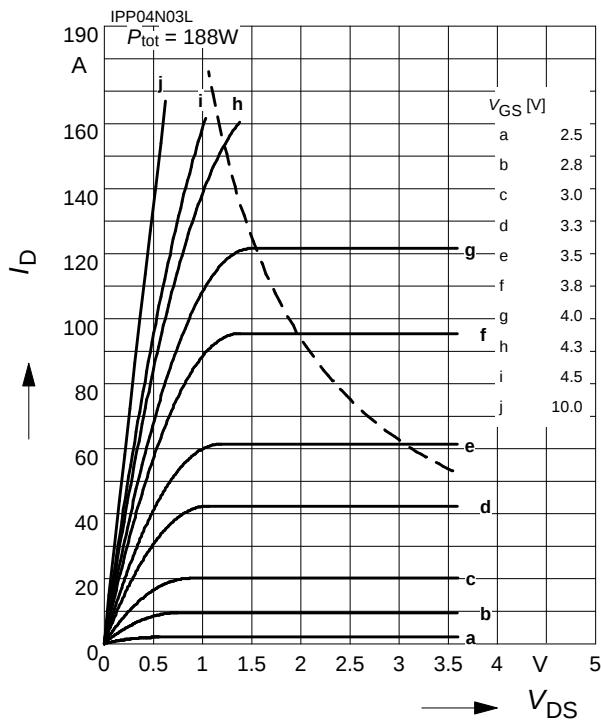
parameter: $D = t_p / T$



5 Typ. output characteristic

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

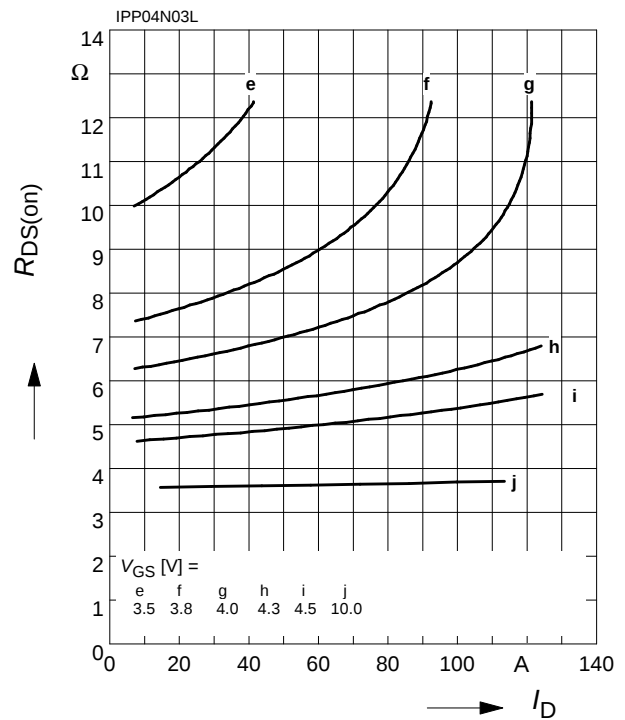
parameter: $t_p = 80 \mu\text{s}$



6 Typ. drain-source on resistance

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

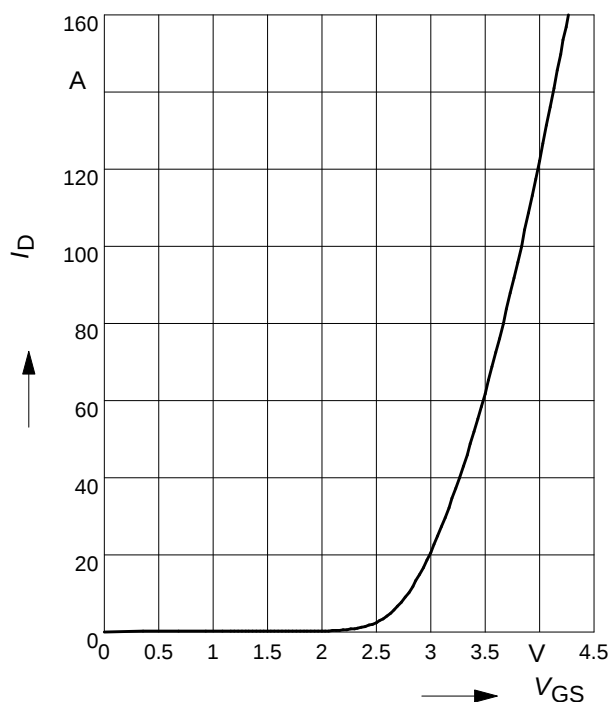
parameter: V_{GS}



7 Typ. transfer characteristics

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

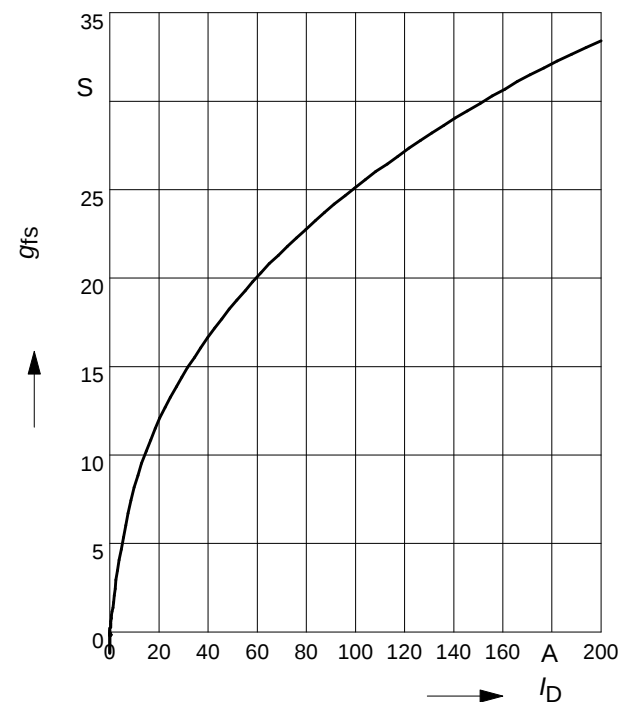
parameter: $t_p = 80 \mu\text{s}$



8 Typ. forward transconductance

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

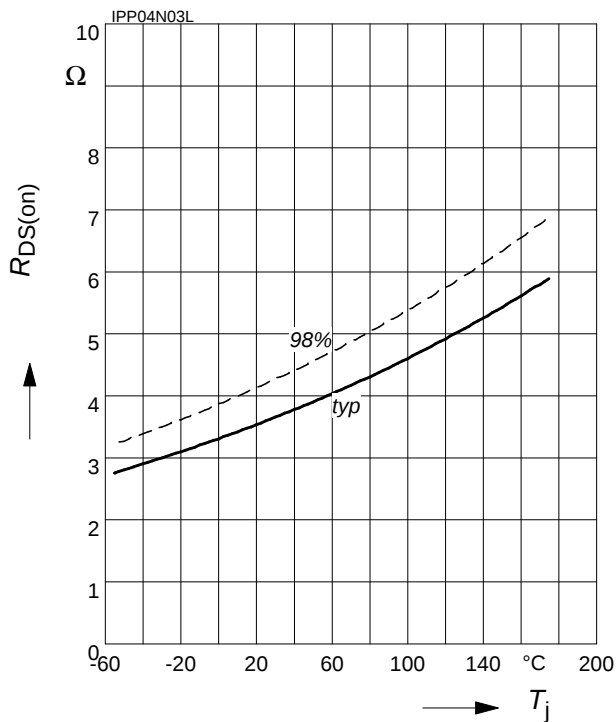
parameter: g_{fs}



9 Drain-source on-state resistance

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

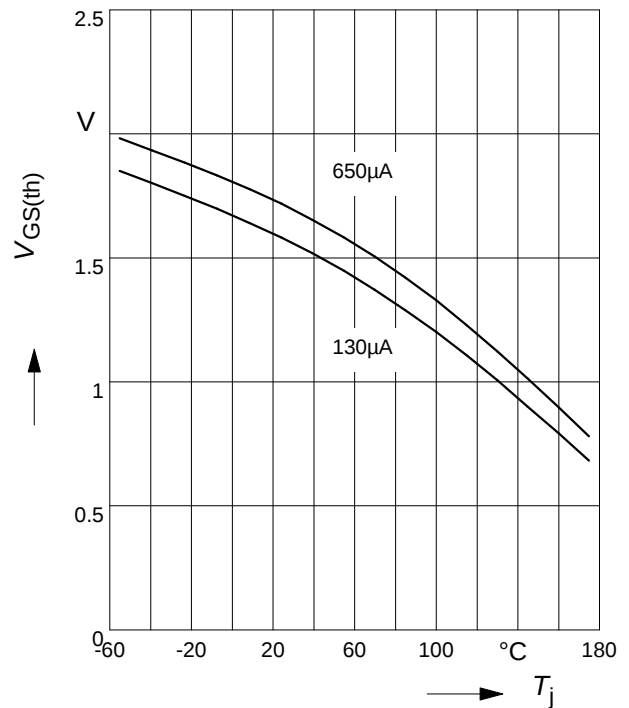
parameter: $I_D = 45\text{ A}$, $V_{GS} = 10\text{ V}$



10 Typ. gate threshold voltage

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

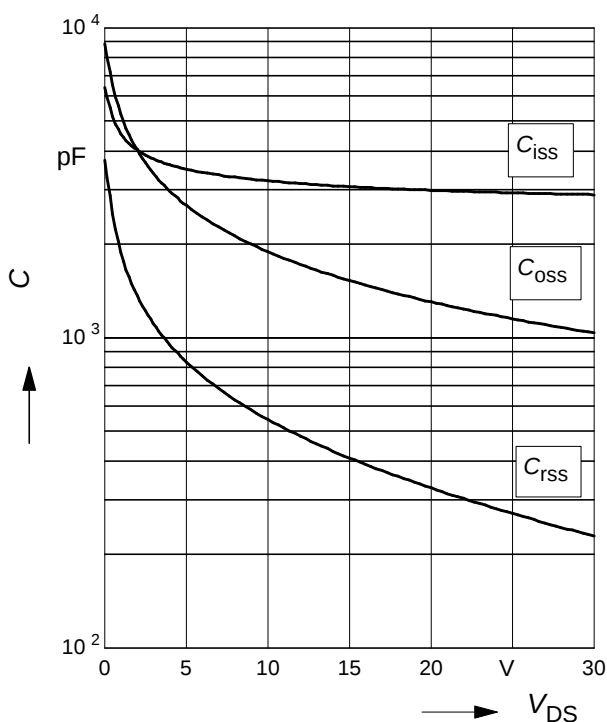
parameter: $V_{GS} = V_{DS}$



11 Typ. capacitances

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

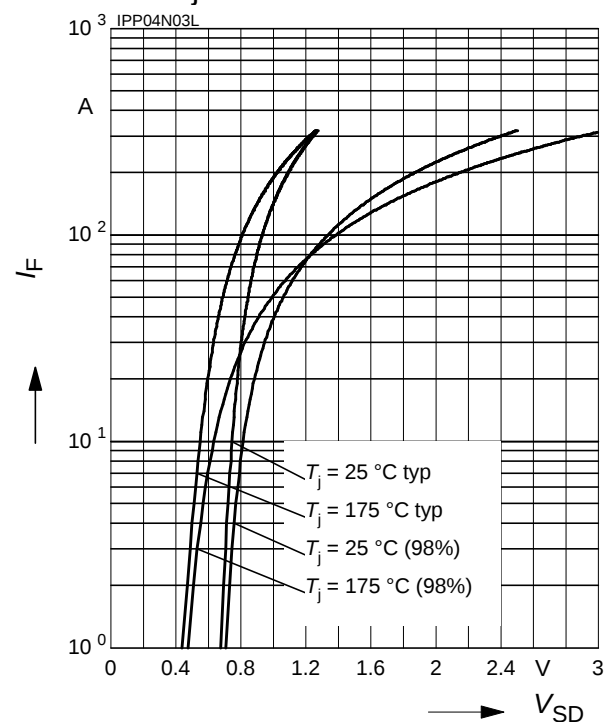
parameter: $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$



12 Forward character. of reverse diode

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

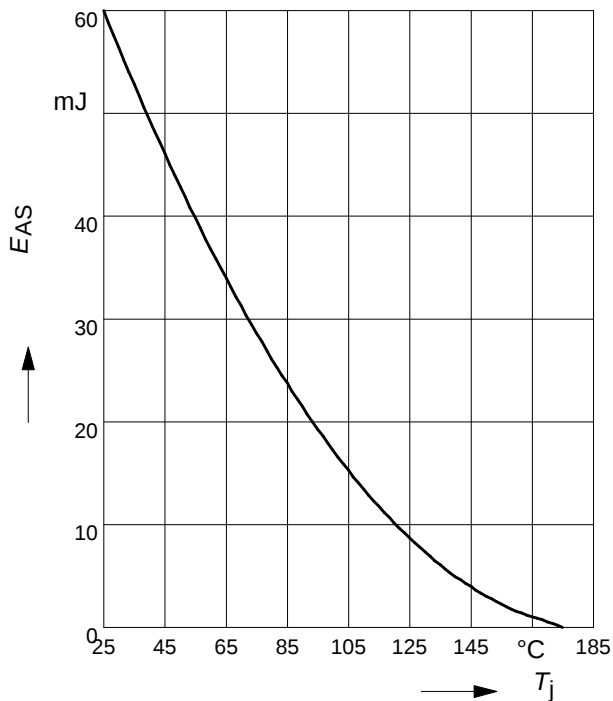
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



13 Typ. avalanche energy

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

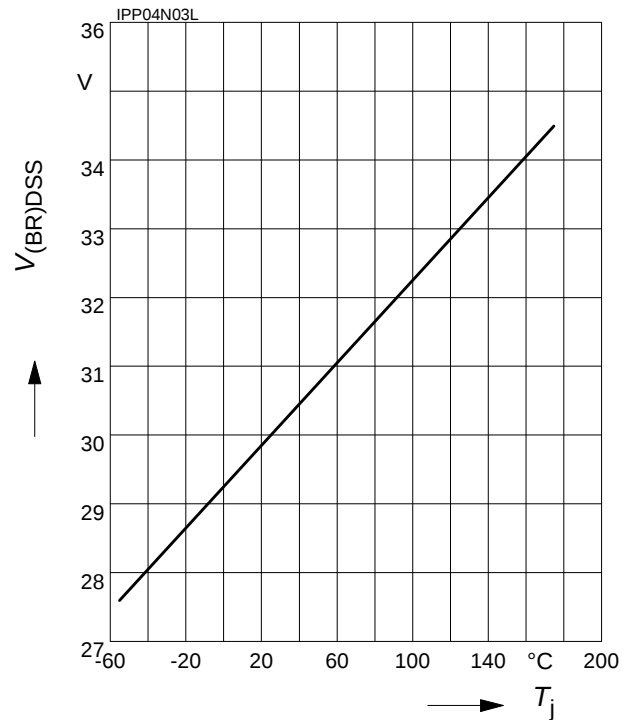
par.: $I_D = 55 \text{ A}$, $V_{DD} = 25 \text{ V}$, $R_{GS} = 25 \Omega$



15 Drain-source breakdown voltage

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

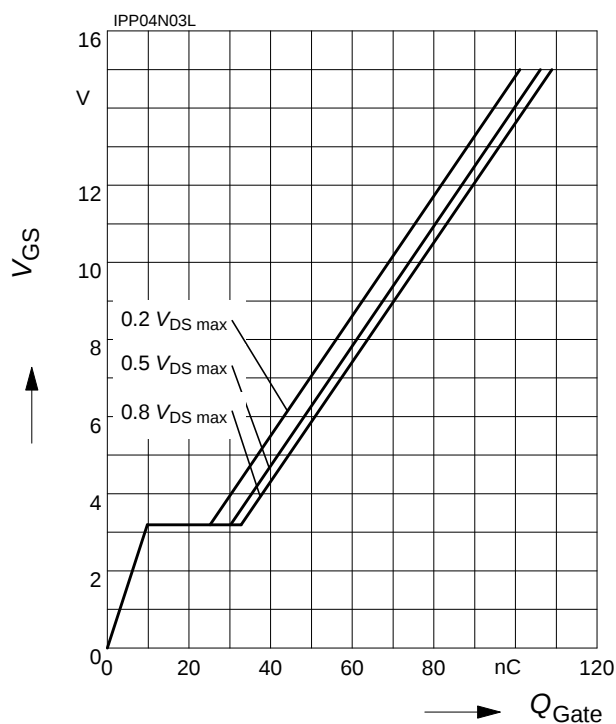
parameter: $I_D = 10 \text{ mA}$



14 Typ. gate charge

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

parameter: $I_D = 40 \text{ A pulsed}$



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