

## OptiMOS<sup>â</sup> Buck converter series

### Feature

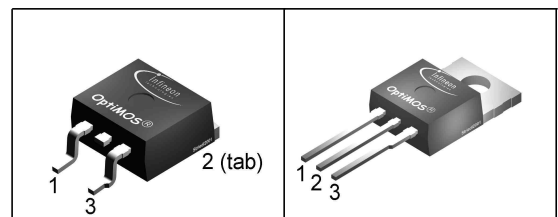
- N-Channel
- Logic Level
- Excellent Gate Charge x  $R_{DS(on)}$  product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- dv/dt rated
- Ideal for fast switching buck converter

### Product Summary

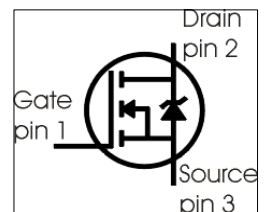
$V_{DS}$	30	V
$R_{DS(on)}$ max. SMD version	3.9	m $\Omega$
$I_D$	80	A

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 <sup>1)</sup> $T_C=25^\circ\text{C}^1)$	$I_D$	80	A
		80	
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/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation $T_C=25^\circ\text{C}$	$P_{tot}$	188	W
Operating and storage temperature	$T_i, T_{stg}$	-55... +175	$^\circ\text{C}$
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	$R_{thJC}$	-	0.51	0.8	K/W
SMD version, device on PCB:	$R_{thJA}$				
@ min. footprint		-	-	62	
@ 6 cm <sup>2</sup> cooling area <sup>3)</sup>		-	-	40	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	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 $V_{DS}=30V, V_{GS}=0V, T_j=25^\circ\text{C}$ $V_{DS}=30V, V_{GS}=0V, T_j=125^\circ\text{C}$	$I_{DSS}$	-	0.01	1	$\mu A$
		-	10	100	
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	$I_{GSS}$	-	1	100	nA
Drain-source on-state resistance $V_{GS}=4.5V, I_D=45A$ $V_{GS}=4.5V, I_D=45A, \text{SMD version}$	$R_{DS(on)}$	-	4.9	6.2	m $\Omega$
		-	4.6	5.9	
Drain-source on-state resistance <sup>4)</sup> $V_{GS}=10V, I_D=45A$ $V_{GS}=10V, I_D=45A, \text{SMD version}$	$R_{DS(on)}$	-	3.6	4.2	
		-	3.2	3.9	

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 0.8K/W$  the chip is able to carry  $I_D = 165A$  at  $25^\circ\text{C}$ , 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  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

<sup>4</sup>Diagrams 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	-	$\Omega$
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**

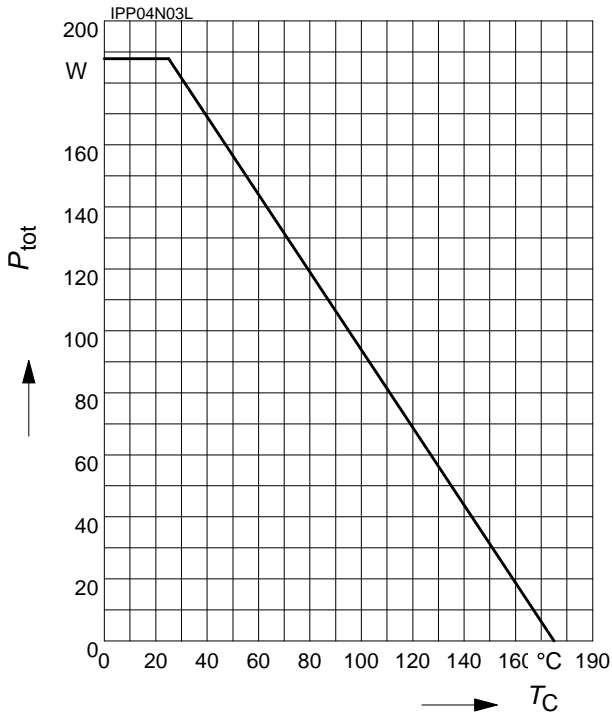
Gate to source charge	$Q_{gs}$	$V_{DD} = 15V$ , $I_D = 40A$	-	9.9	12.4	nC
Gate to drain charge	$Q_{gd}$		-	23	35	
Gate charge total	$Q_g$	$V_{DD} = 15V$ , $I_D = 40A$ , $V_{GS} = 0$ to $5V$	-	41.8	52	
Output charge	$Q_{oss}$	$V_{DS} = 15V$ , $I_D = 40A$ , $V_{GS} = 0V$	-	40.4	50	nC
Gate plateau voltage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

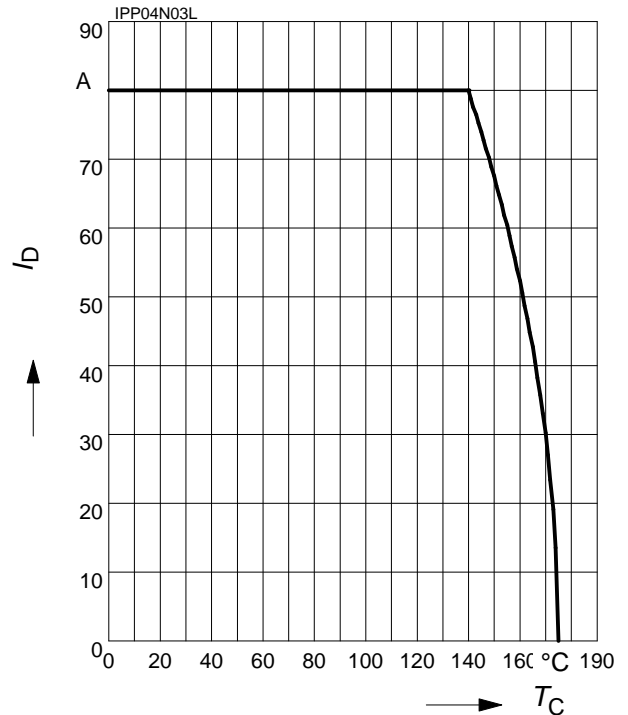
$$P_{tot} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

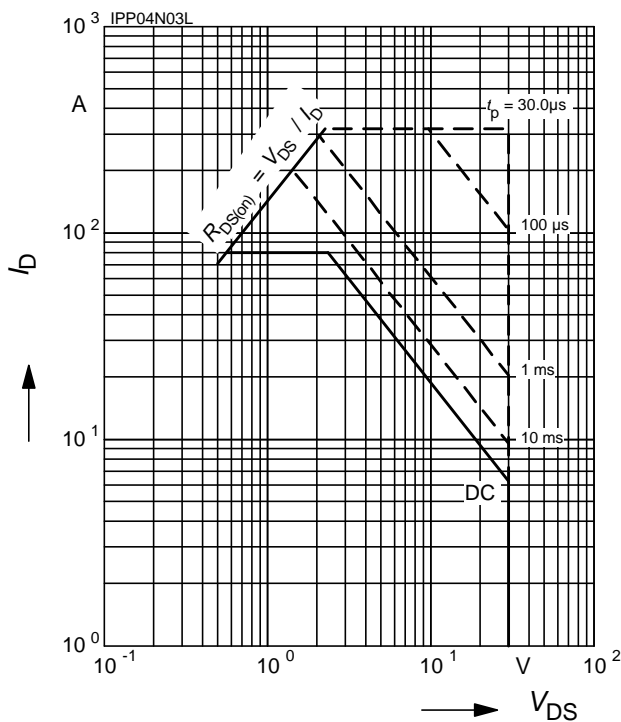
parameter:  $V_{GS} \geq 10\text{ V}$



### 3 Safe operating area

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

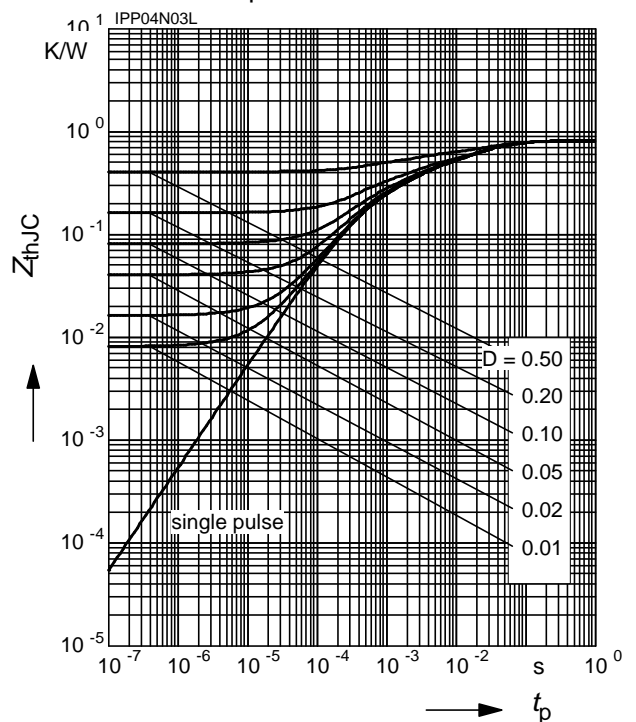
parameter:  $D = 0$ ,  $T_C = 25\text{ °C}$



### 4 Max. transient thermal impedance

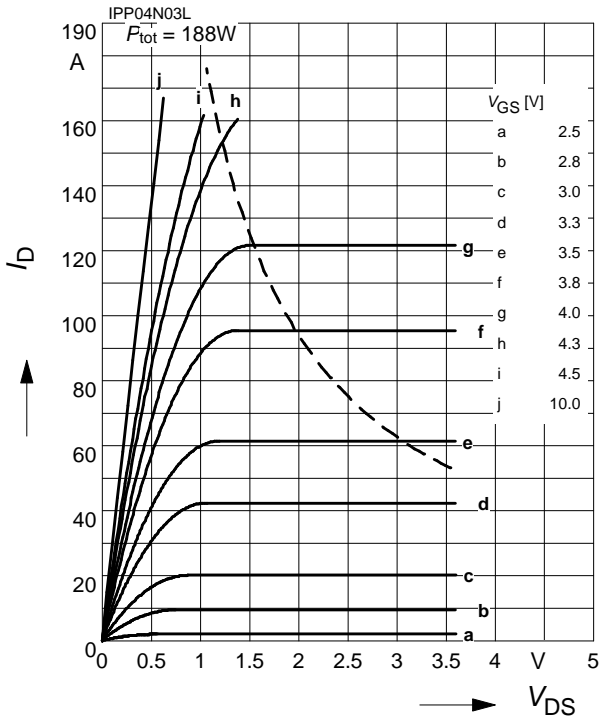
$$Z_{thJC} = f(t_p)$$

parameter:  $D = t_p/T$



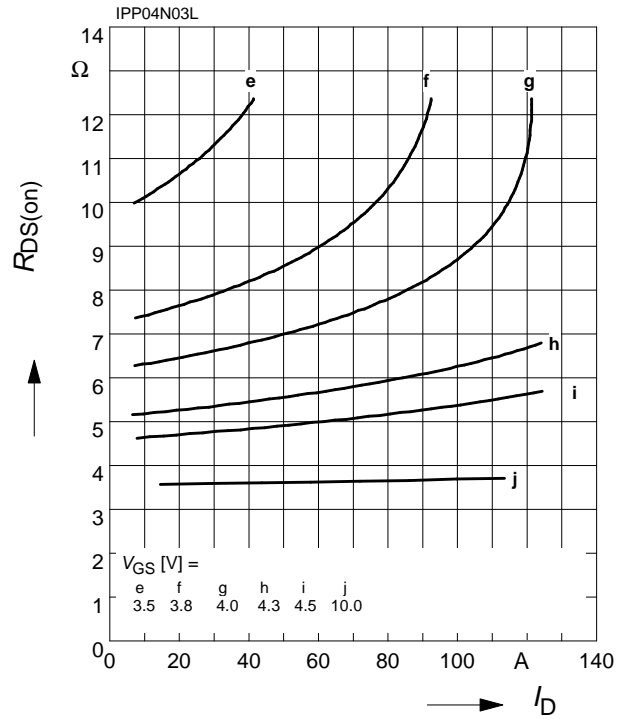
**5 Typ. output characteristic**

$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$   
parameter:  $t_p = 80 \mu\text{s}$



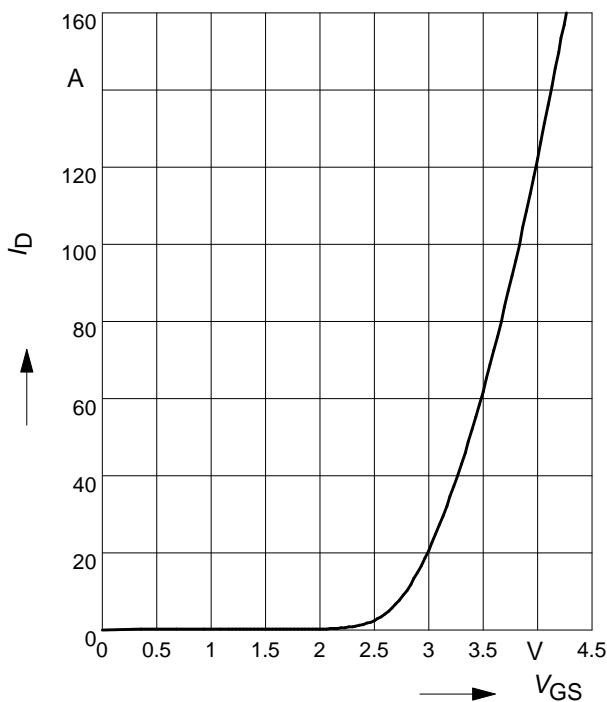
**6 Typ. drain-source on resistance**

$R_{DS(on)} = f(I_D)$   
parameter:  $V_{GS}$



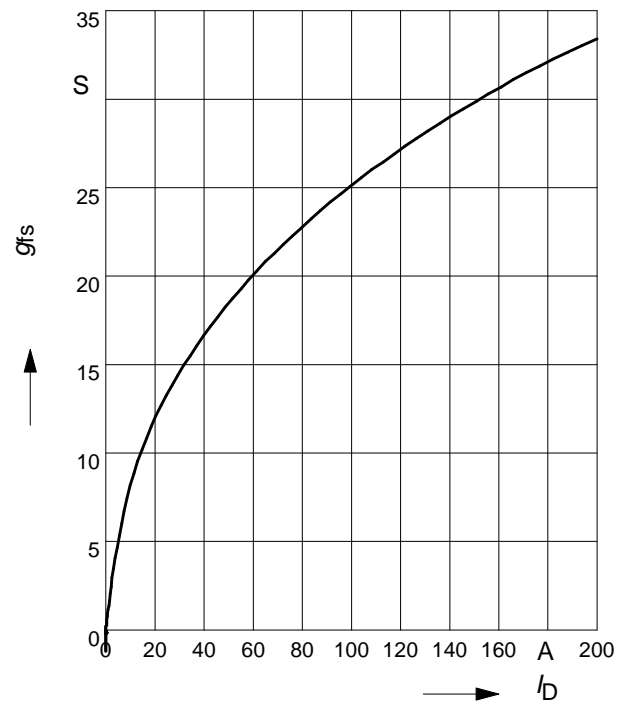
**7 Typ. transfer characteristics**

$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$   
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

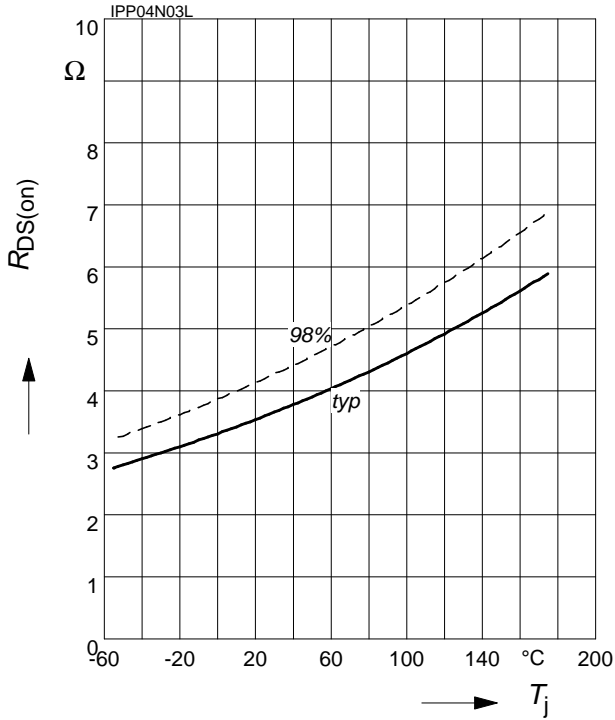
$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$   
parameter:  $g_{fs}$



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

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

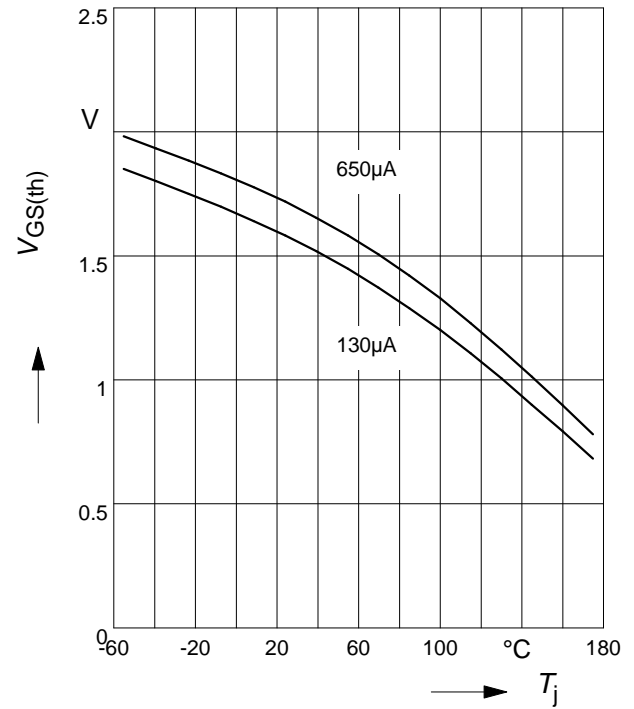
parameter:  $I_D = 45\text{ A}$ ,  $V_{GS} = 10\text{ V}$



**10 Typ. gate threshold voltage**

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

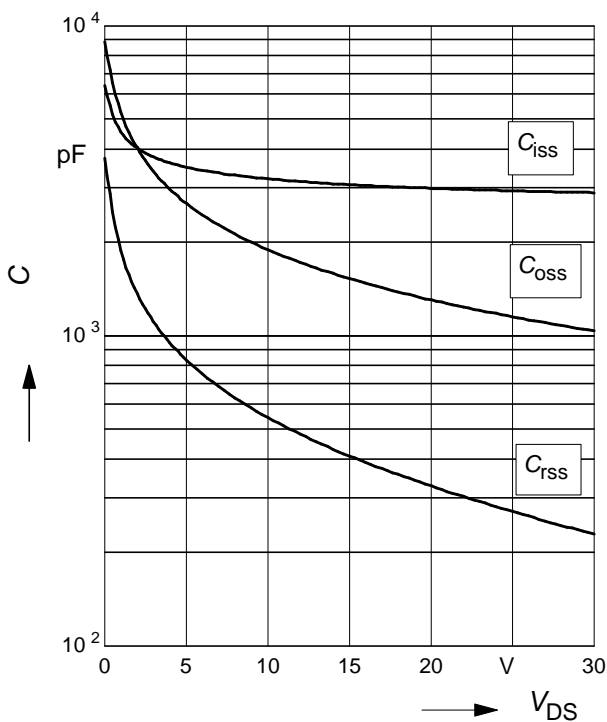
parameter:  $V_{GS} = V_{DS}$



**11 Typ. capacitances**

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

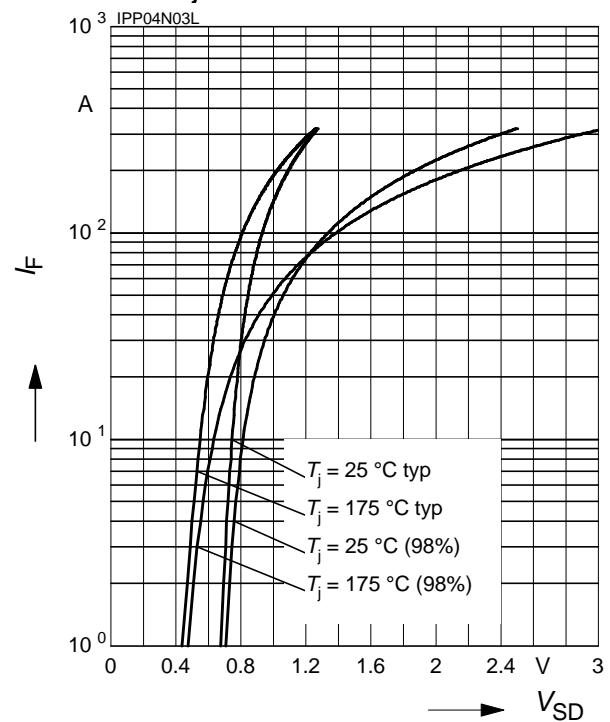
parameter:  $V_{GS}=0\text{V}$ ,  $f=1\text{ MHz}$



**12 Forward character. of reverse diode**

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

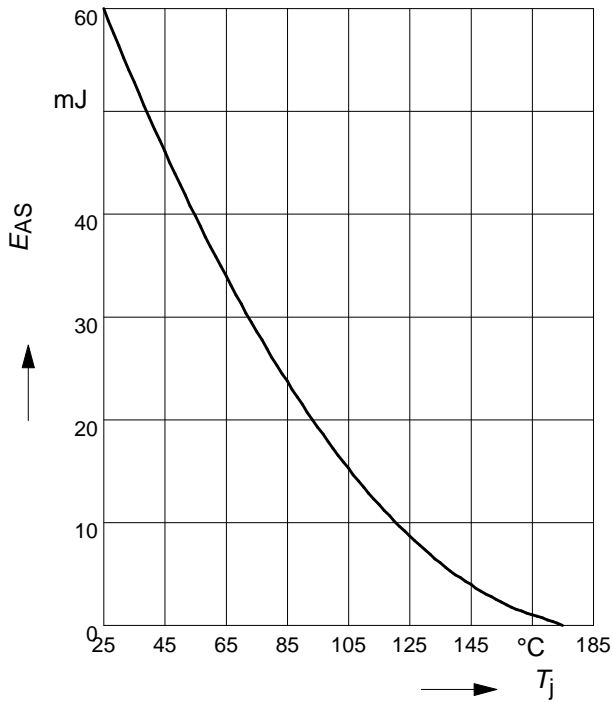
parameter:  $T_j$ ,  $t_p = 80\text{ }\mu\text{s}$



### 13 Typ. avalanche energy

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

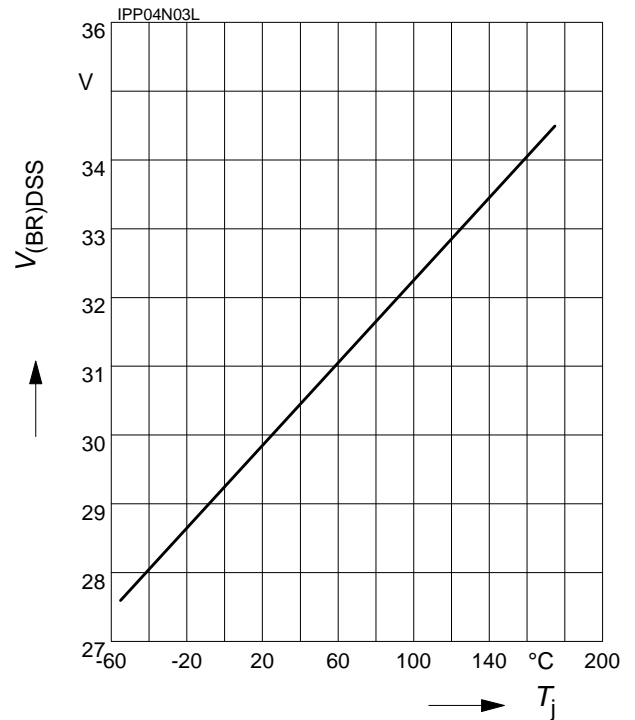
par.:  $I_D = 55 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



### 15 Drain-source breakdown voltage

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

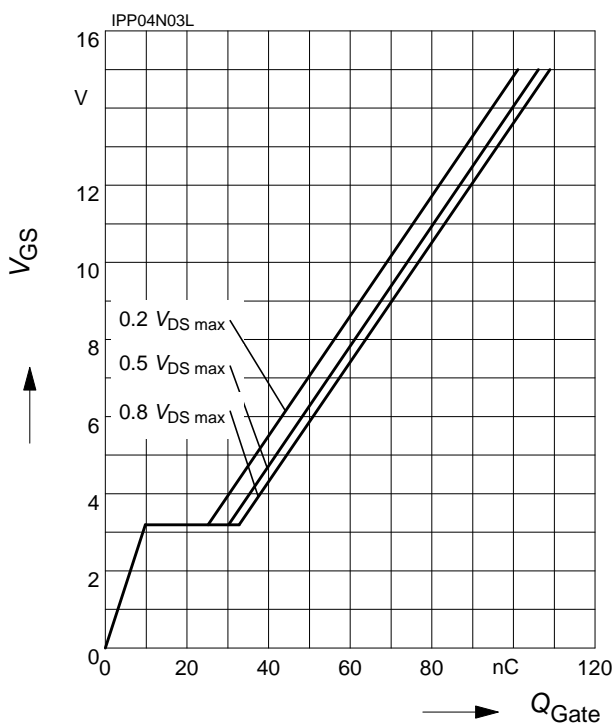
parameter:  $I_D = 10 \text{ mA}$



### 14 Typ. gate charge

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

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



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