

**OptiMOS<sup>®</sup> Buck converter series**

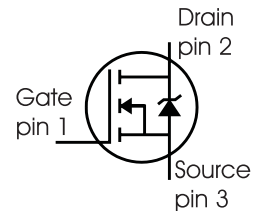
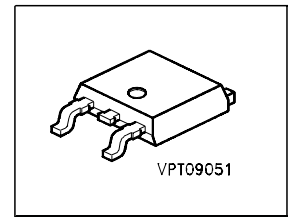
**Feature**

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

**Product Summary**

$V_{DS}$	30	V
$R_{DS(on)}$	5.9	mΩ
$I_D$	50	A

P-TO252



Type	Package	Ordering Code	Marking
IPD06N03L	P-TO252	Q67042-S4109	06N03L

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

Parameter	Symbol	Value	Unit
Continuous drain current $T_C=25\text{ °C}^1)$ $T_C=100\text{ °C}$	$I_D$	50 50	A
Pulsed drain current $T_C=25\text{ °C}$	$I_{D\text{ puls}}$	200	
Avalanche energy, single pulse $I_D=20\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ Ω}$	$E_{AS}$	30	mJ
Reverse diode dv/dt $I_S=50\text{ A}$ , $V_{DS}=24\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{j\text{max}}=175\text{ °C}$	dv/dt	6	kV/μs
Gate source voltage	$V_{GS}$	±20	V
Power dissipation $T_C=25\text{ °C}$	$P_{\text{tot}}$	125	W
Operating and storage temperature	$T_j, T_{\text{stg}}$	-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	$R_{thJC}$	-	-	1.2	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	100	
SMD version, device on PCB:	$R_{thJA}$				
@ min. footprint		-	-	75	
@ 6 cm <sup>2</sup> cooling area <sup>2)</sup>		-	-	50	

**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 $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	30	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 80\ \mu A$	$V_{GS(th)}$	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	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 $V_{GS}=4.5V, I_D=30A$	$R_{DS(on)}$	-	6.8	8.7	m $\Omega$
Drain-source on-state resistance $V_{GS}=10V, I_D=30A$	$R_{DS(on)}$	-	4.7	5.9	

<sup>1</sup>Current limited by bondwire and calculated with max. source pin temperature of 85°C; with a  $R_{thJC} = 1.2K/W$  the chip is able to carry  $I_D = 91A$ .

<sup>2</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, at  $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic Characteristics**

Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 30\text{A}$	29	58	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$	-	1900	2370	pF
Output capacitance	$C_{oss}$		-	750	940	
Reverse transfer capacitance	$C_{rss}$		-	170	250	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15\text{V}$ , $V_{GS} = 10\text{V}$ , $I_D = 25\text{A}$ , $R_G = 3.6\Omega$	-	7.3	11	ns
Rise time	$t_r$		-	22	33	
Turn-off delay time	$t_{d(off)}$		-	34	50	
Fall time	$t_f$		-	20.5	30.7	

**Gate Charge Characteristics**

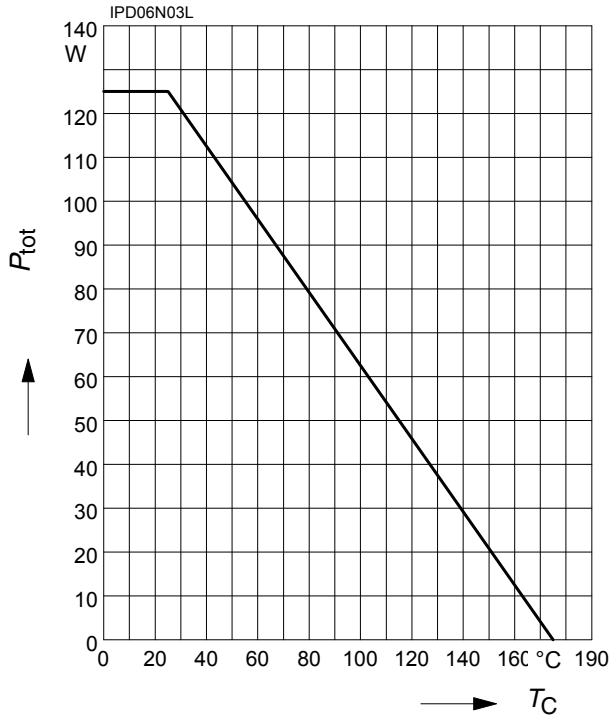
Gate to source charge	$Q_{gs}$	$V_{DD} = 15\text{V}$ , $I_D = 25\text{A}$	-	6.3	8.4	nC
Gate to drain charge	$Q_{gd}$		-	12.3	16.4	
Gate charge total	$Q_g$	$V_{DD} = 15\text{V}$ , $I_D = 25\text{A}$ , $V_{GS} = 0$ to $5\text{V}$	-	25.8	34.3	
Output charge	$Q_{oss}$		$V_{DS} = 15\text{V}$ , $I_D = 25\text{A}$ , $V_{GS} = 0\text{V}$	-	25.5	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 15\text{V}$ , $I_D = 25\text{A}$	-	3.1	-	V

**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	50	A
Inverse diode direct current, pulsed	$I_{SM}$		-	-	200	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0\text{V}$ , $I_F = 50\text{A}$	-	0.9	1.3	V
Reverse recovery time	$t_{rr}$	$V_R = 15\text{V}$ , $I_F = I_S$ , $di_F/dt = 100\text{A}/\mu\text{s}$	-	43	54	ns
Reverse recovery charge	$Q_{rr}$		-	50	63	nC

### 1 Power dissipation

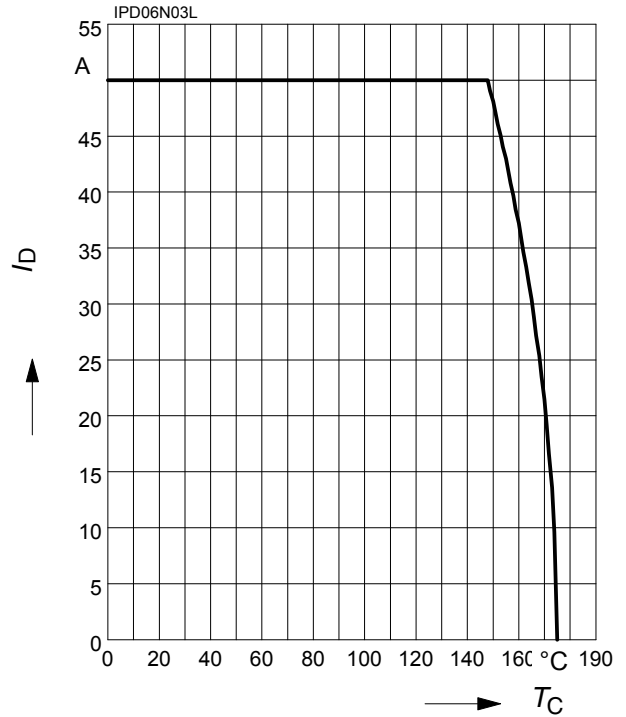
$$P_{tot} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

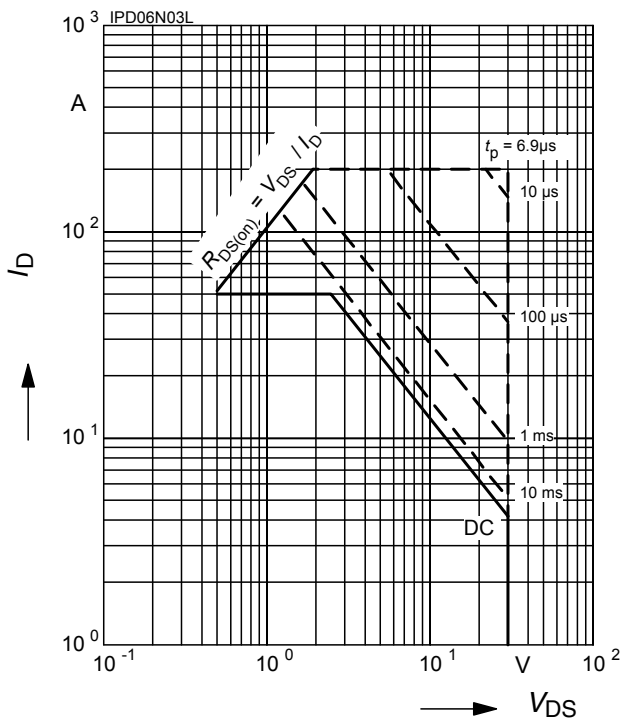
parameter:  $V_{GS} \geq 10\text{ V}$



### 3 Safe operating area

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

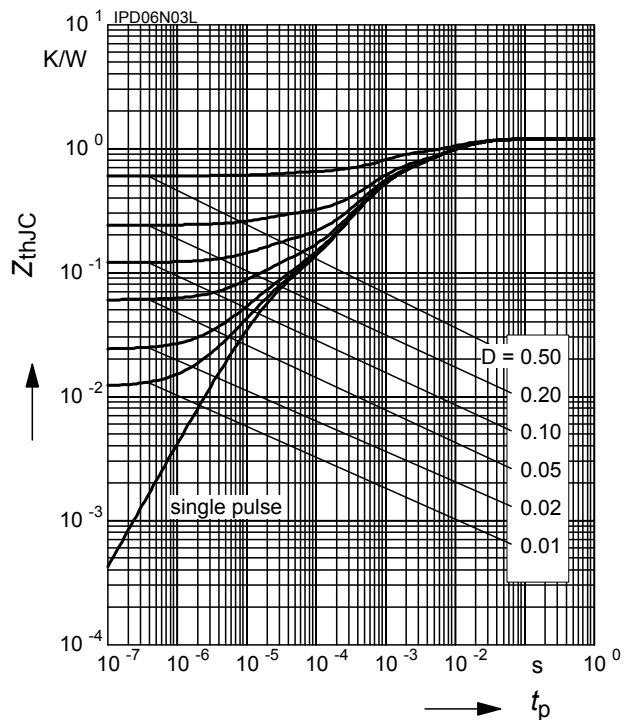
parameter:  $D = 0$ ,  $T_C = 25\text{ }^\circ\text{C}$



### 4 Transient thermal impedance

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

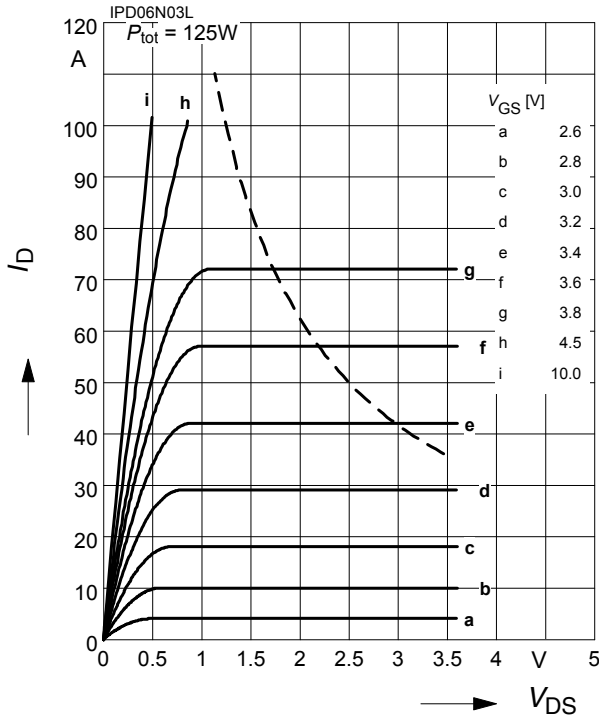
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

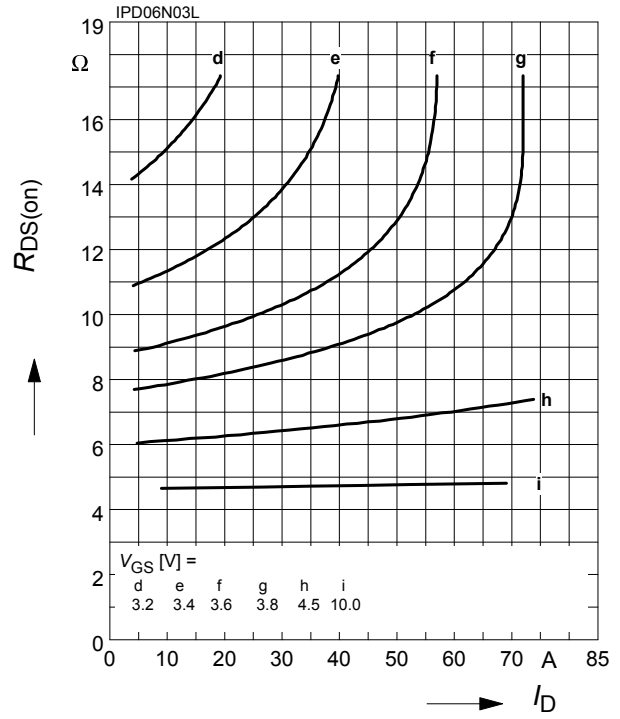
parameter:  $t_p = 80 \mu\text{s}$



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

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

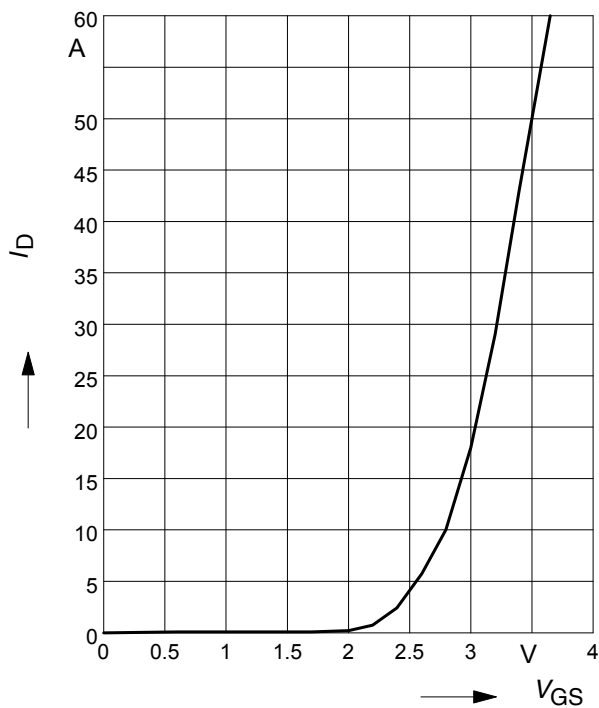
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

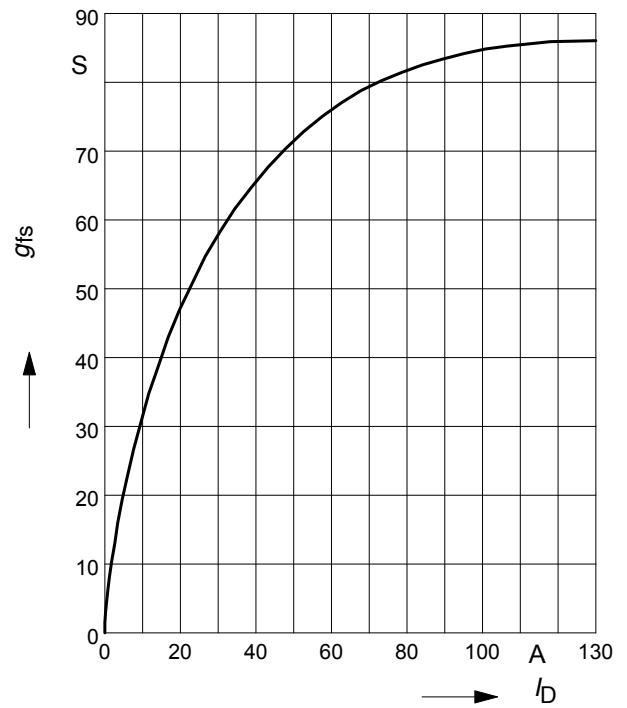
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

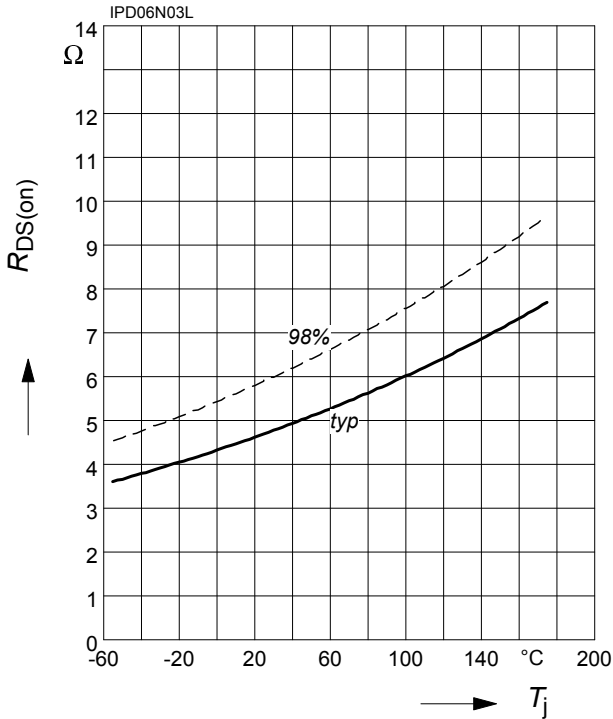
parameter:  $g_{fs}$



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

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

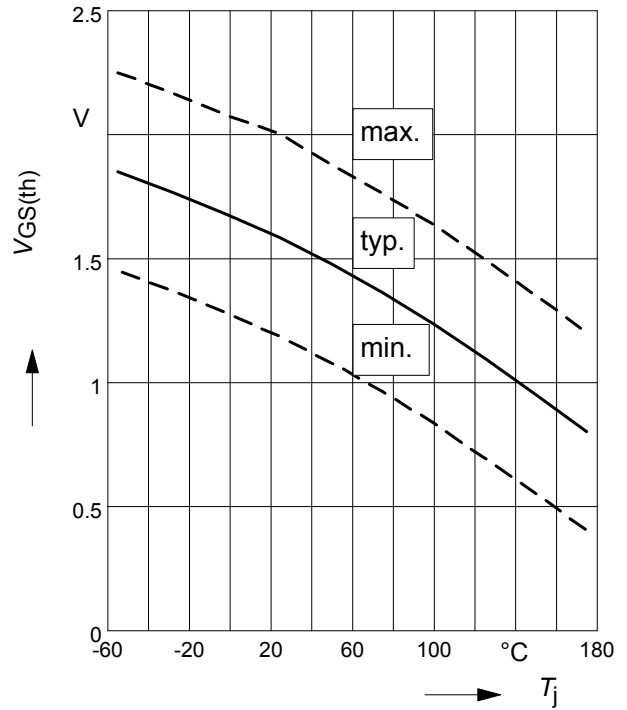
parameter :  $I_D = 30\text{ A}$ ,  $V_{GS} = 10\text{ V}$



**10 Gate threshold voltage**

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

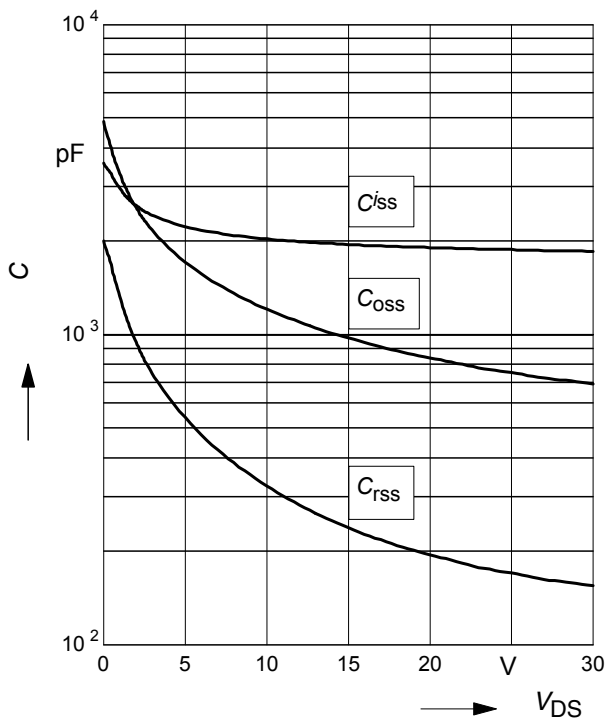
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 80\ \mu\text{A}$



**11 Typ. capacitances**

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

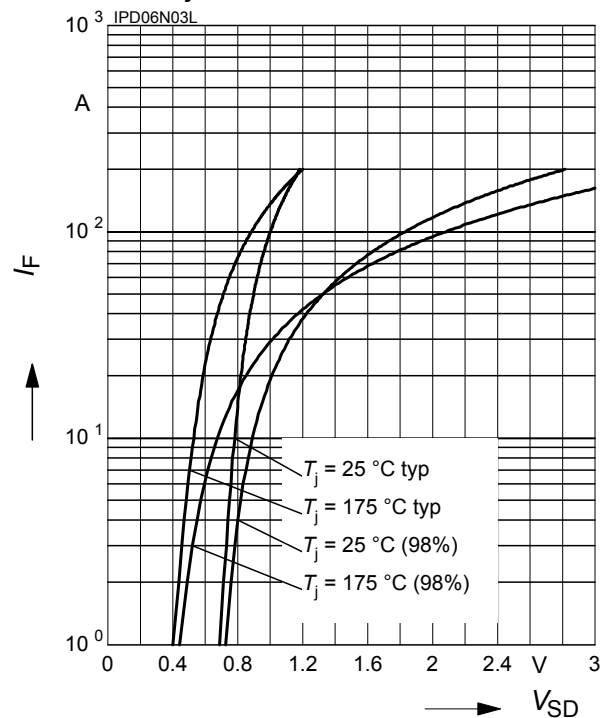
parameter:  $V_{GS}=0\text{V}$ ,  $f=1\text{ MHz}$



**12 Forward character. of reverse diode**

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

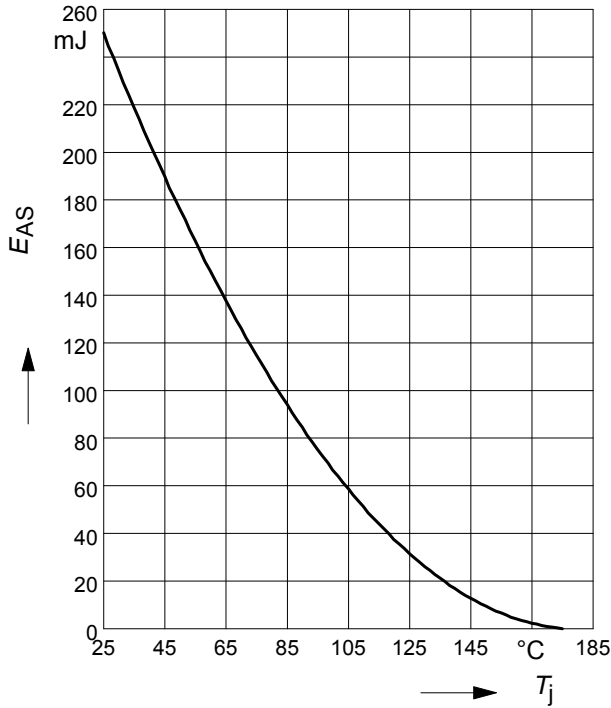
parameter:  $T_j$ ,  $t_p = 80\ \mu\text{s}$



**13 Typ. avalanche energy**

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

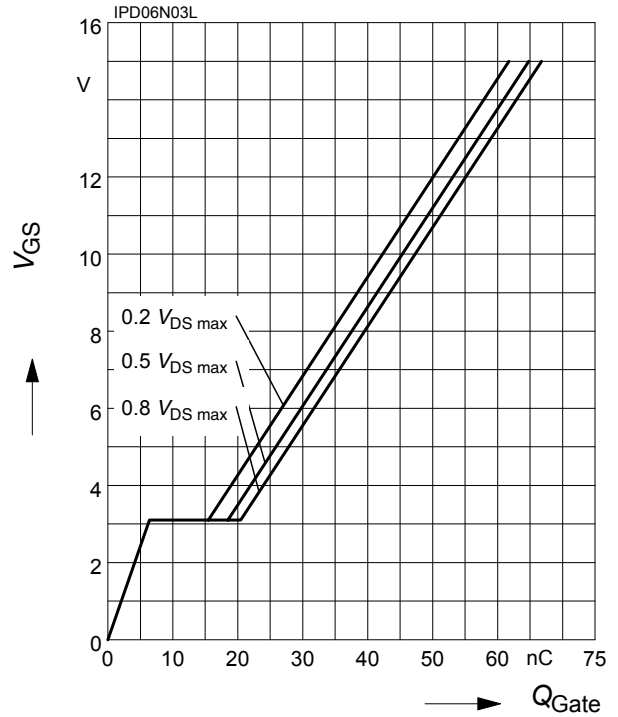
par.:  $I_D = 20\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$



**14 Typ. gate charge**

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

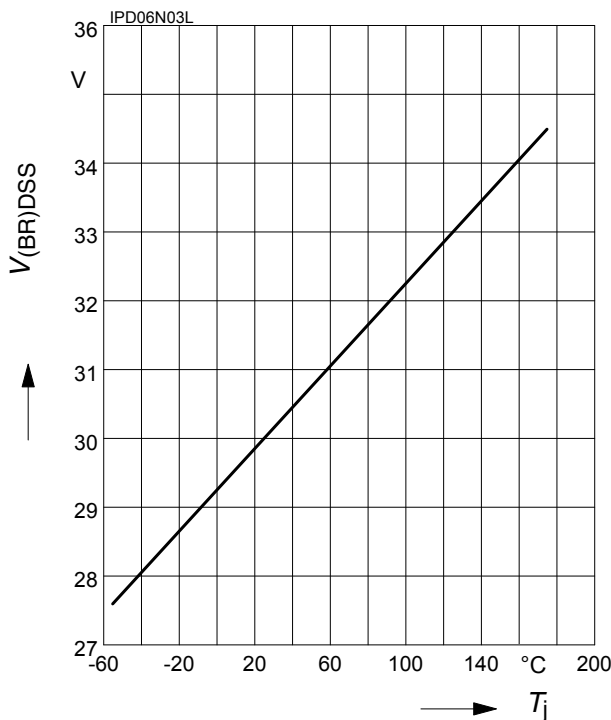
parameter:  $I_D = 25\text{ A}$  pulsed



**15 Drain-source breakdown voltage**

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

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



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