

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

Feature

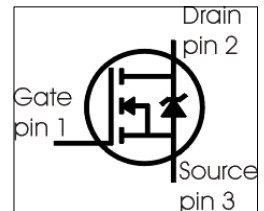
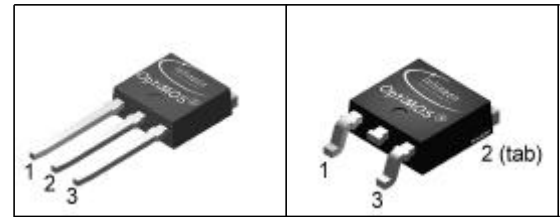
- N-Channel
- Logic Level
- Low On-Resistance  $R_{DS(on)}$
- Excellent Gate Charge x  $R_{DS(on)}$  product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- $dv/dt$  rated
- Ideal for fast switching buck converters

Product Summary

$V_{DS}$	30	V
$R_{DS(on)}$	20	m $\Omega$
$I_D$	30	A

P- TO251 -3-1

P- TO252 -3-11



Type	Package	Ordering Code	Marking
IPD20N03L	P- TO252 -3-11	Q67042-S4050	20N03L
IPU20N03L	P- TO251 -3-1	Q67042-S4106	20N03L

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

Parameter	Symbol	Value	Unit
Continuous drain current <sup>1)</sup> $T_C=25^\circ\text{C}$	$I_D$	30 30	A
Pulsed drain current $T_C=25^\circ\text{C}$	$I_{D \text{ puls}}$	120	
Avalanche energy, single pulse $I_D=15\text{A}, V_{DD}=25\text{V}, R_{GS}=25\Omega$	$E_{AS}$	15	mJ
Repetitive avalanche energy, limited by $T_{jmax}^{2)}$	$E_{AR}$	6	
Reverse diode $dv/dt$ $I_S=30\text{A}, V_{DS}=24\text{V}, di/dt=200\text{A}/\mu\text{s}, T_{jmax}=175^\circ\text{C}$	$dv/dt$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation $T_C=25^\circ\text{C}$	$P_{tot}$	60	W
Operating and storage temperature	$T_j, T_{stg}$	-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	$R_{thJC}$	-	1.7	2.5	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	100	
SMD version, device on PCB: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>3)</sup>	$R_{thJA}$	-	-	75 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, $V_{GS} = V_{DS}$ $I_D=25\mu A$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS}=30V, V_{GS}=0V, T_f=25^\circ C$ $V_{DS}=30V, V_{GS}=0V, T_f=125^\circ C$	$I_{DSS}$	-	0.01 10	1 100	$\mu A$
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	$I_{GSS}$	-	1	100	
Drain-source on-state resistance $V_{GS}=4.5V, I_D=15A$	$R_{DS(on)}$	-	22.9	31	m $\Omega$
Drain-source on-state resistance $V_{GS}=10V, I_D=15A$	$R_{DS(on)}$	-	15.5	20	

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 2.5K/W$  the chip is able to carry  $I_D= 42A$  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	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 30A$	14	28	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = 25V$ , $f = 1MHz$	-	530	700	pF
Output capacitance	$C_{oss}$		-	200	275	
Reverse transfer capacitance	$C_{rss}$		-	60	90	
Gate resistance	$R_G$		-	1.3	-	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15V$ , $V_{GS} = 10V$ , $I_D = 15A$ , $R_G = 12.7\Omega$	-	6.2	9.3	ns
Rise time	$t_r$		-	11	17	
Turn-off delay time	$t_{d(off)}$		-	23	34	
Fall time	$t_f$		-	18	27	

**Gate Charge Characteristics**

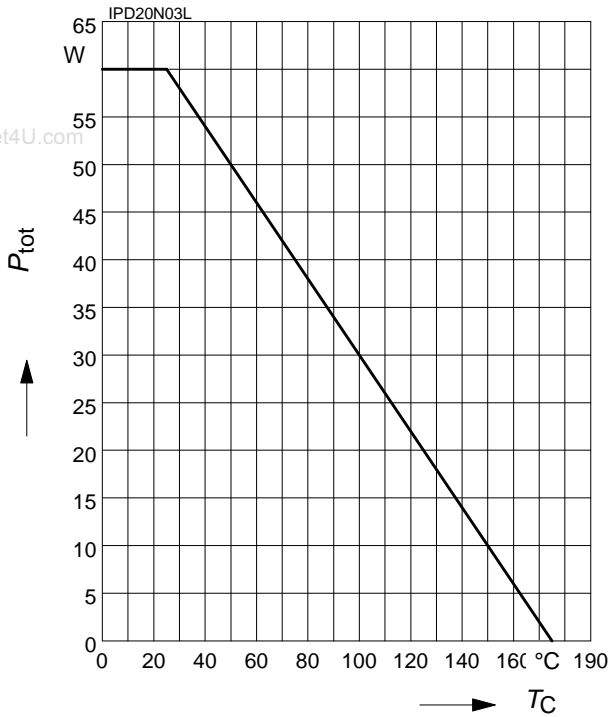
Gate to source charge	$Q_{gs}$	$V_{DD} = 15V$ , $I_D = 15A$	-	2.5	3.1	nC
Gate to drain charge	$Q_{gd}$		-	6.4	9.6	
Gate charge total	$Q_g$	$V_{DD} = 15V$ , $I_D = 15A$ , $V_{GS} = 0$ to $5V$	-	8.4	11	
Output charge	$Q_{oss}$	$V_{DS} = 15V$ , $I_D = 15A$ , $V_{GS} = 0V$	-	8	10	nC
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 15V$ , $I_D = 15A$	-	3.6	-	V

**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_C = 25^\circ C$	-	-	30	A
Inv. diode direct current, pulsed	$I_{SM}$		-	-	120	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0V$ , $I_F = 30A$	-	1.1	1.4	V
Reverse recovery time	$t_{rr}$	$V_R = 15V$ , $I_F = I_S$ , $dI/dt = 100A/\mu s$	-	15	18	ns
Reverse recovery charge	$Q_{rr}$		-	2	3	nC

**1 Power dissipation**

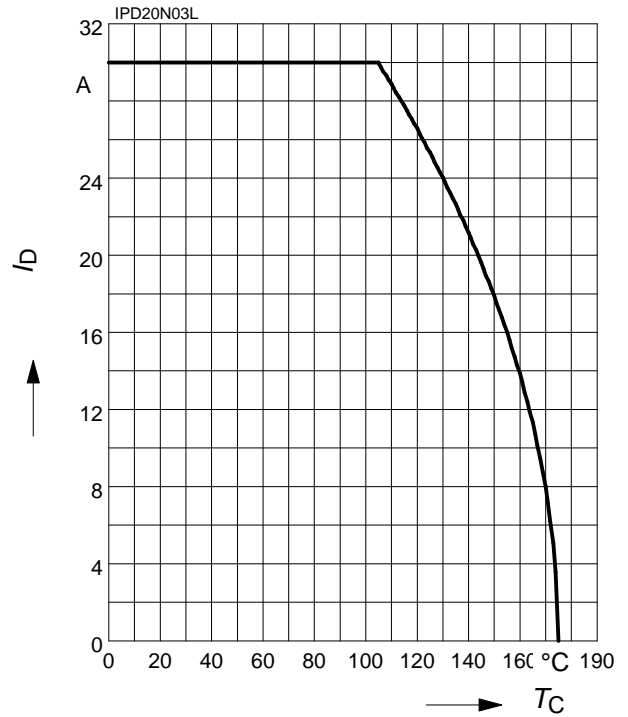
$P_{tot} = f(T_C)$



**2 Drain current**

$I_D = f(T_C)$

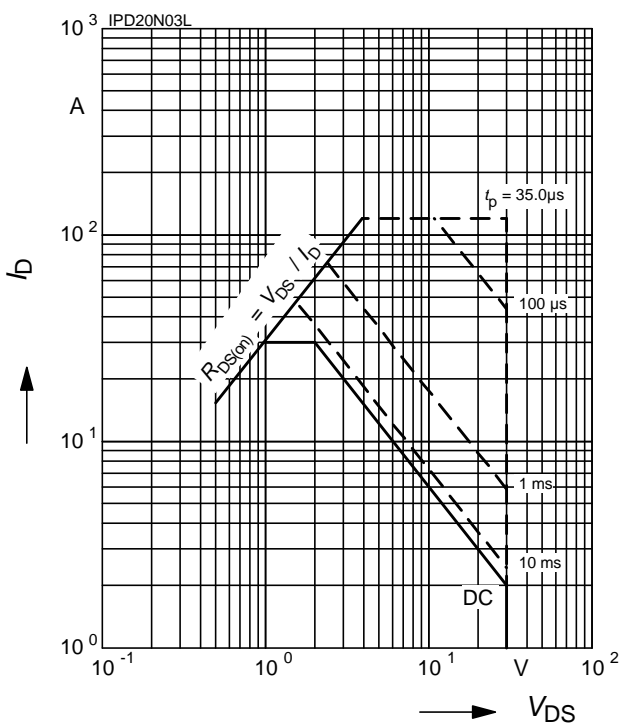
parameter:  $V_{GS} \geq 10\text{ V}$



**3 Safe operating area**

$I_D = f(V_{DS})$

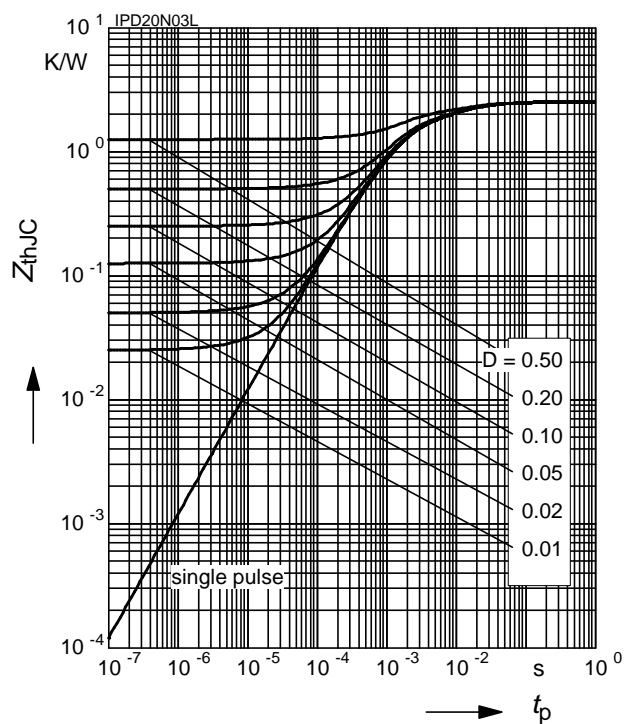
parameter:  $D = 0, T_C = 25\text{ °C}$



**4 Max. transient thermal impedance**

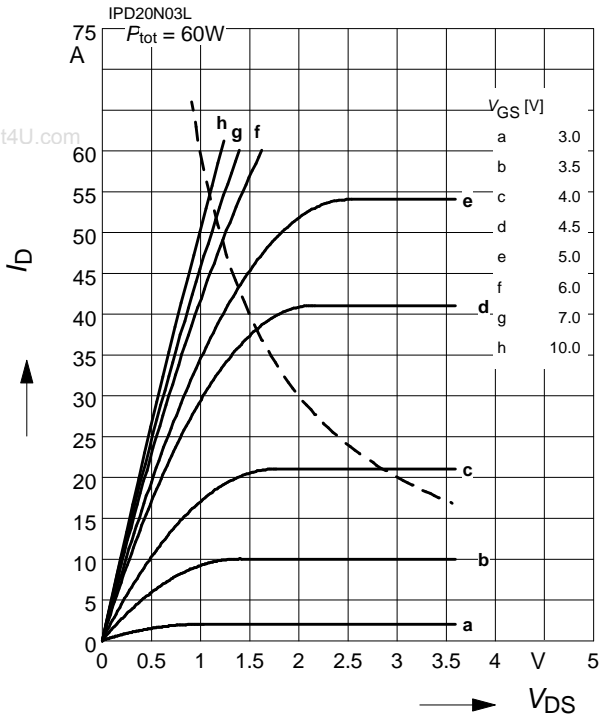
$Z_{thJC} = f(t_p)$

parameter:  $D = t_p/T$



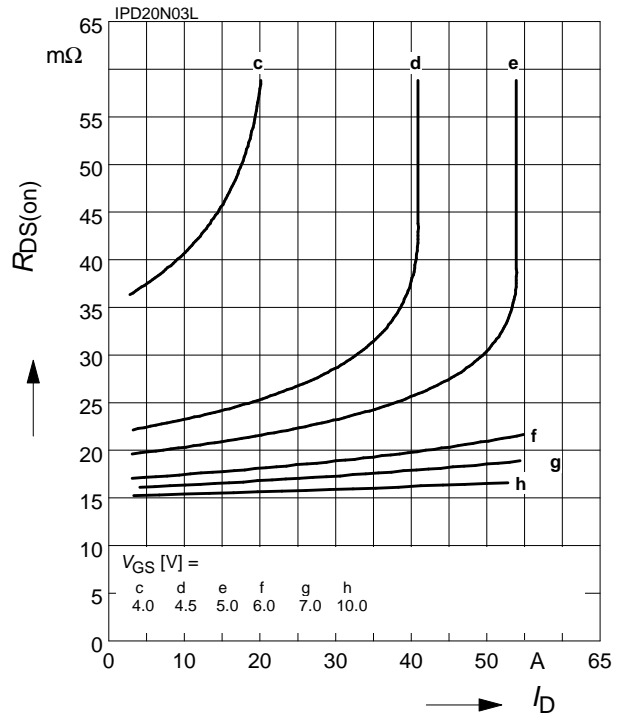
**5 Typ. output characteristic**

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



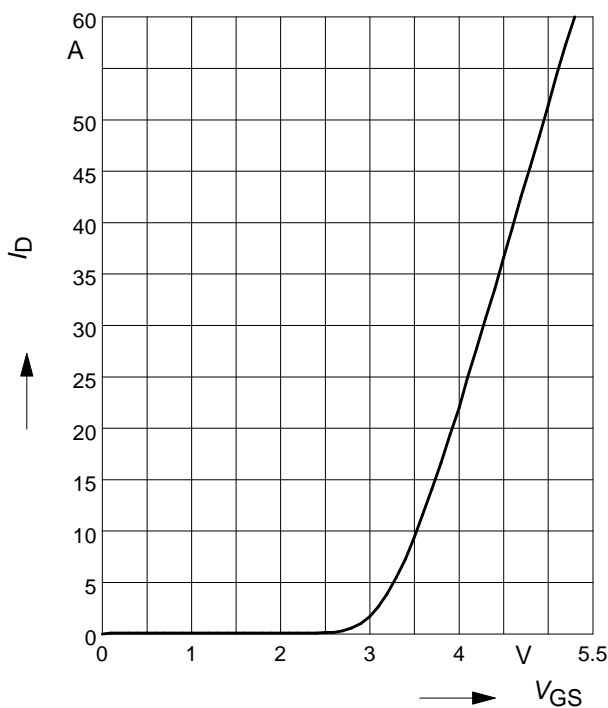
**6 Typ. drain-source on resistance**

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



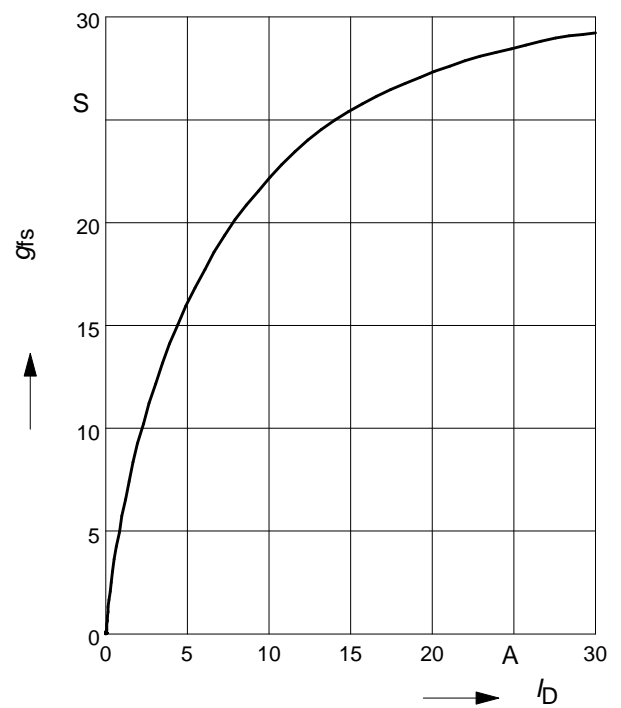
**7 Typ. transfer characteristics**

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



**8 Typ. forward transconductance**

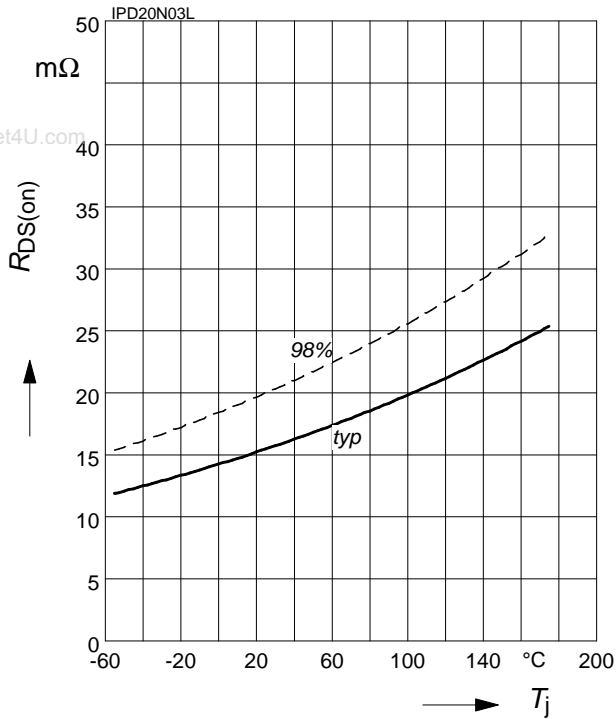
$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$   
parameter:  $g_{fs}$



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

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

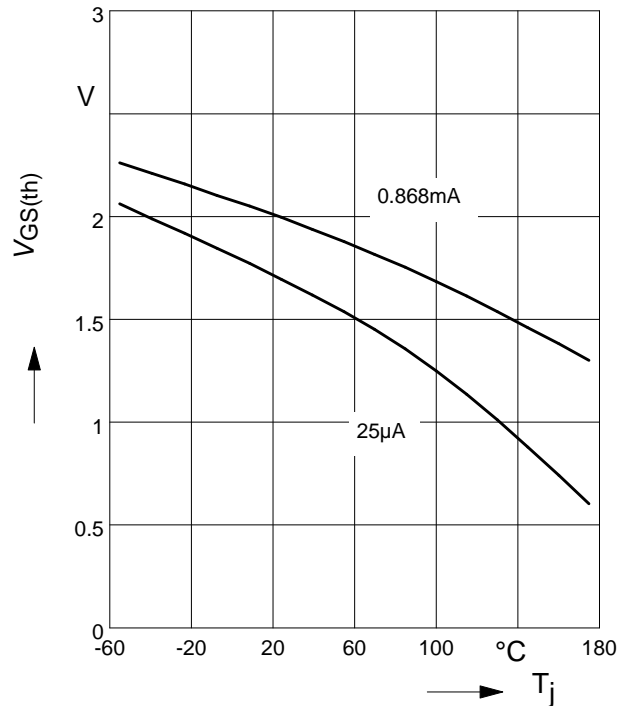
parameter :  $I_D = 15\text{ A}$ ,  $V_{GS} = 10\text{ V}$



**10 Typ. gate threshold voltage**

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

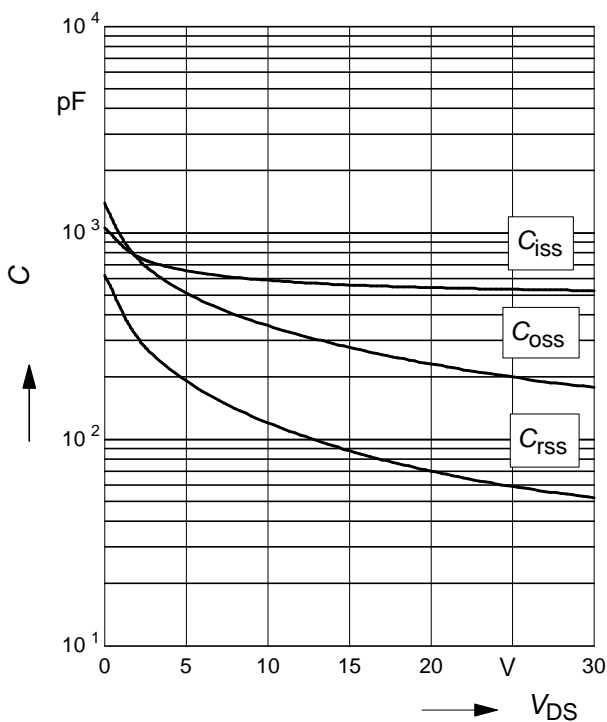
parameter:  $V_{GS} = V_{DS}$



**11 Typ. capacitances**

$C = f(V_{DS})$

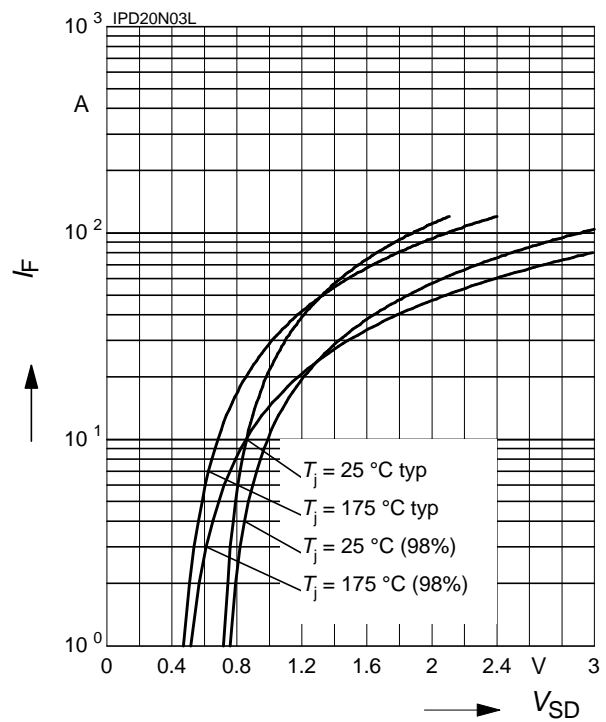
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



**12 Forward character. of reverse diode**

$I_F = f(V_{SD})$

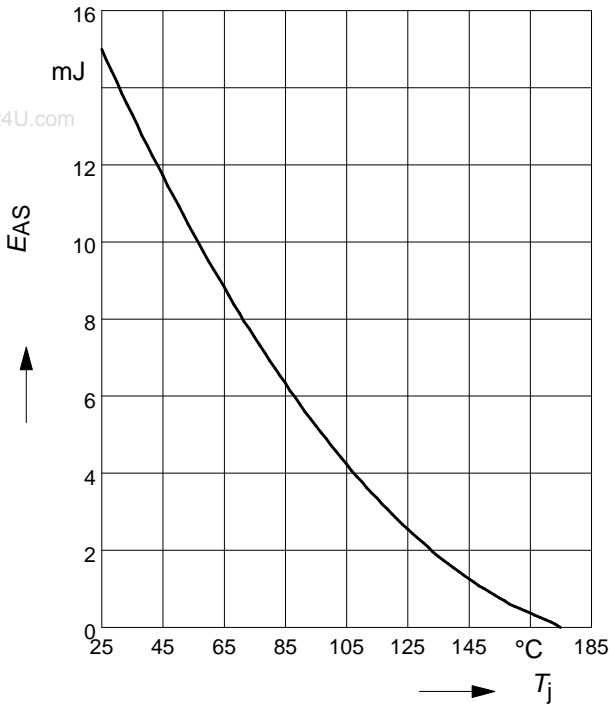
parameter:  $T_j$ ,  $t_p = 80\ \mu\text{s}$



**13 Typ. avalanche energy**

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

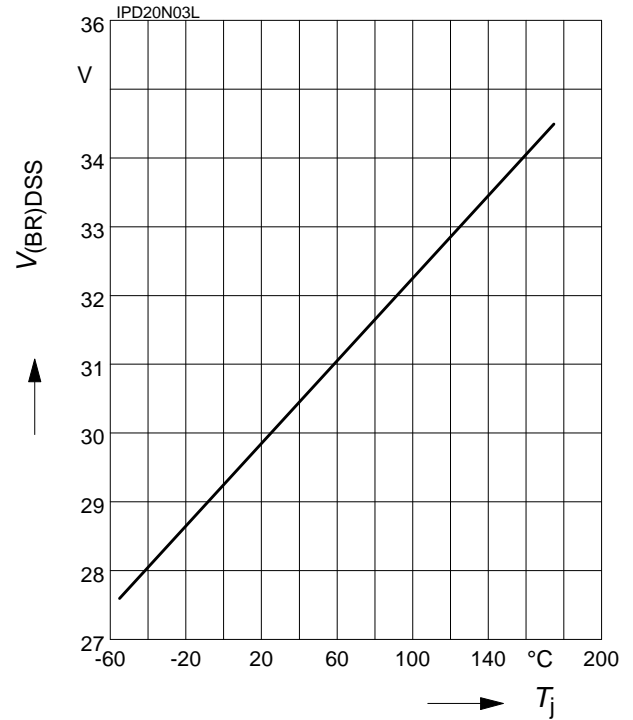
par.:  $I_D = 15 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



**15 Drain-source breakdown voltage**

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

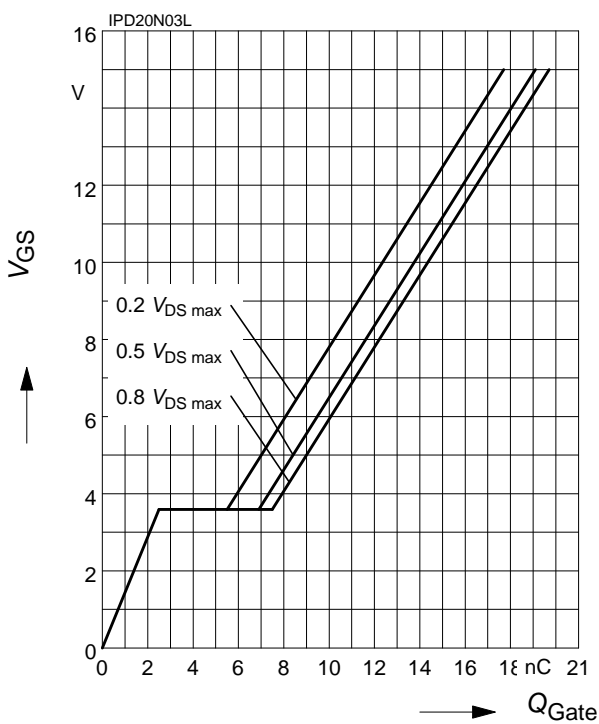
parameter:  $I_D = 10 \text{ mA}$



**14 Typ. gate charge**

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

parameter:  $I_D = 15 \text{ A pulsed}$



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