

OptiMOS^â Buck converter series

Feature

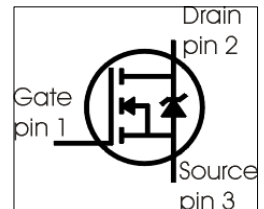
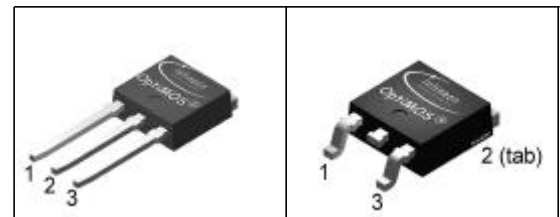
- N-Channel
- Logic Level
- Low On-Resistance $R_{DS(on)}$
- Excellent Gate Charge x $R_{DS(on)}$ product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- dv/dt rated
- Ideal for fast switching buck converters

Product Summary

| | | |
|--------------|----|------------|
| V_{DS} | 30 | V |
| $R_{DS(on)}$ | 20 | m Ω |
| 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 ¹⁾ $T_C=25^\circ\text{C}$ | 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/ μs |
| Gate source voltage | V_{GS} | ± 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. | |
| Characteristics | | | | | |
| 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 ² cooling area ³⁾ | R_{thJA} | - | - | 75 50 | |

Electrical Characteristics, at $T_j = 25\text{ }^\circ\text{C}$, 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, $V_{GS} = V_{DS}$ $I_D=25\mu A$ | $V_{GS(th)}$ | 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 | μA |
| Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$ | I_{GSS} | - | 1 | 100 | |
| Drain-source on-state resistance $V_{GS}=4.5V, I_D=15A$ | $R_{DS(on)}$ | - | 22.9 | 31 | m Ω |
| Drain-source on-state resistance $V_{GS}=10V, I_D=15A$ | $R_{DS(on)}$ | - | 15.5 | 20 | |

¹Current 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

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} | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 30A$ | 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 | - | Ω |
| 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

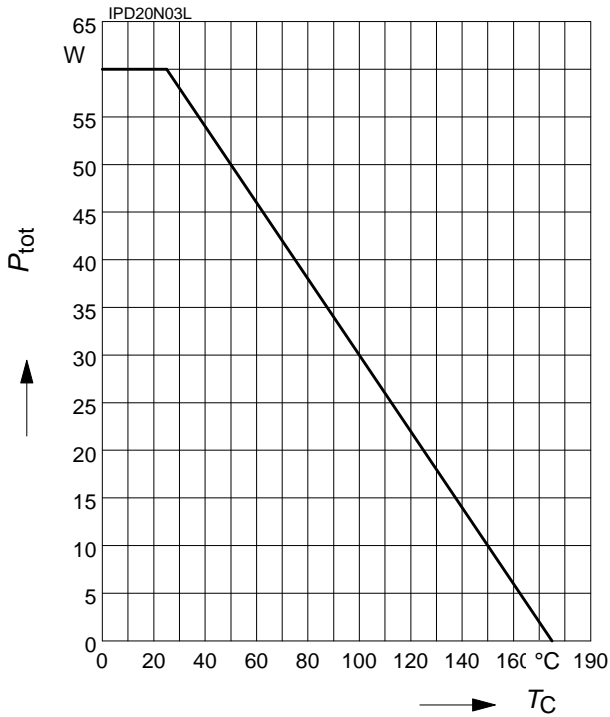
| | | | | | | |
|-----------------------|-----------------|--|---|-----|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD} = 15V$, $I_D = 15A$ | - | 2.5 | 3.1 | nC |
| Gate to drain charge | Q_{gd} | | - | 6.4 | 9.6 | |
| Gate charge total | Q_g | $V_{DD} = 15V$, $I_D = 15A$, $V_{GS} = 0$ to $5V$ | - | 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} | $V_R = 15V$, $I_F = I_S$, $dI_F/dt = 100A/\mu s$ | - | 15 | 18 | ns |
| Reverse recovery charge | Q_{rr} | | - | 2 | 3 | nC |

1 Power dissipation

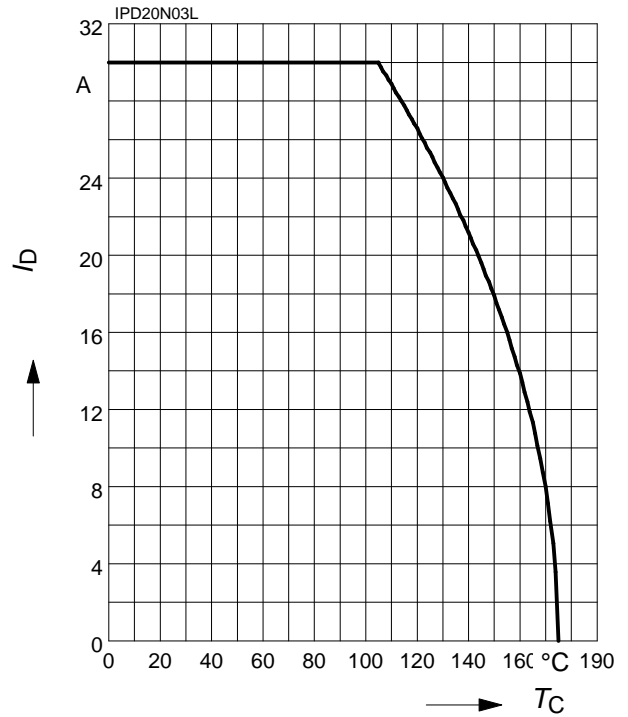
$P_{tot} = f(T_C)$



2 Drain current

$I_D = f(T_C)$

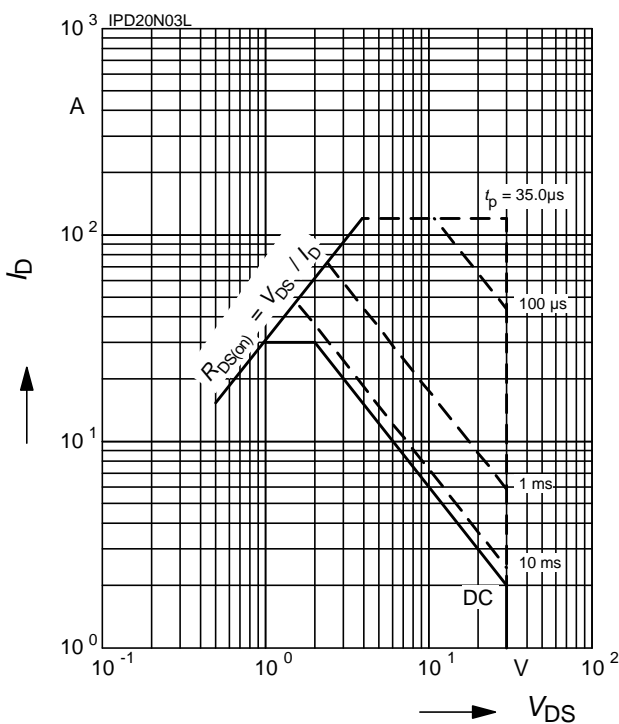
parameter: $V_{GS} \geq 10 \text{ V}$



3 Safe operating area

$I_D = f(V_{DS})$

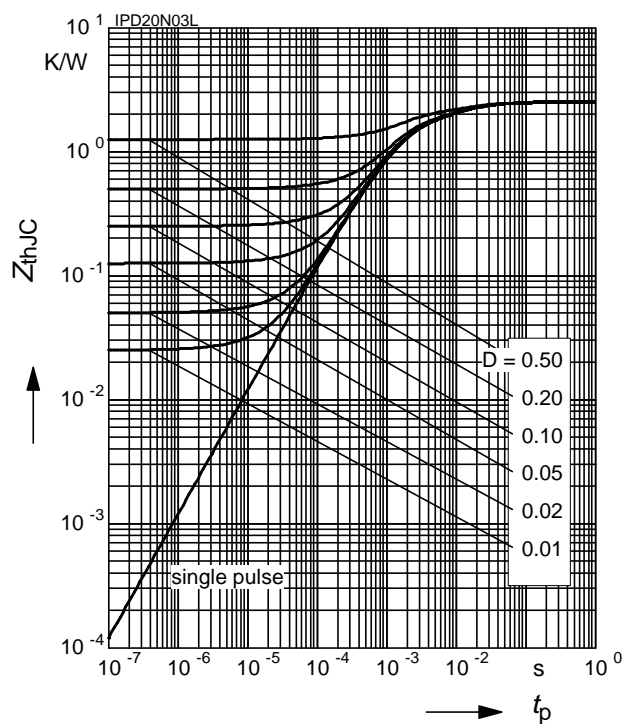
parameter: $D = 0, T_C = 25 \text{ °C}$



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

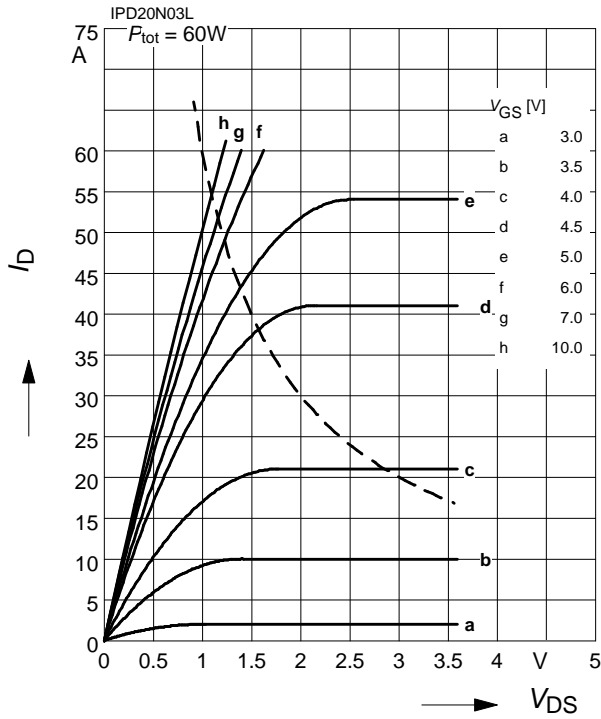
parameter: $D = t_p/T$



5 Typ. output characteristic

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

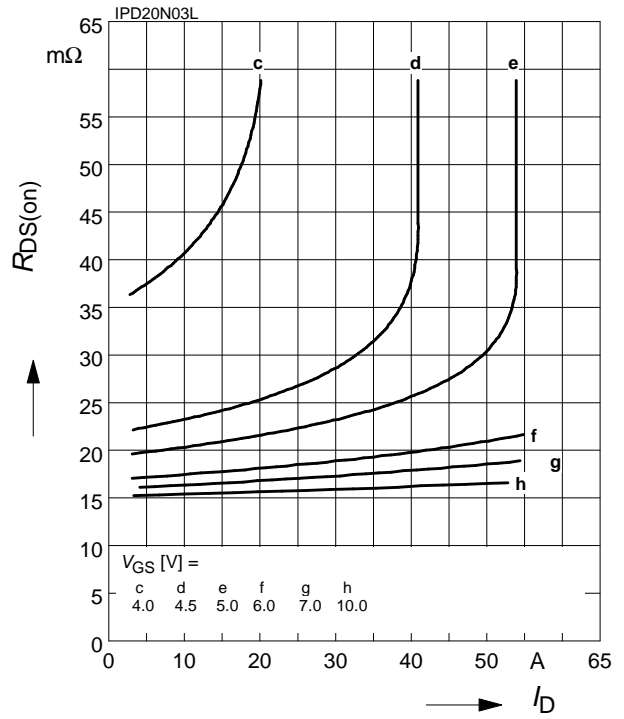
parameter: $t_p = 80 \mu\text{s}$



6 Typ. drain-source on resistance

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

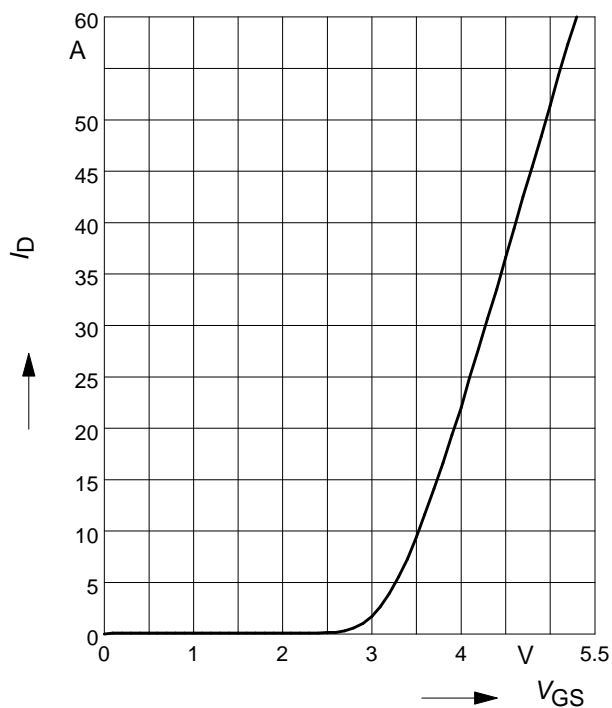
parameter: V_{GS}



7 Typ. transfer characteristics

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

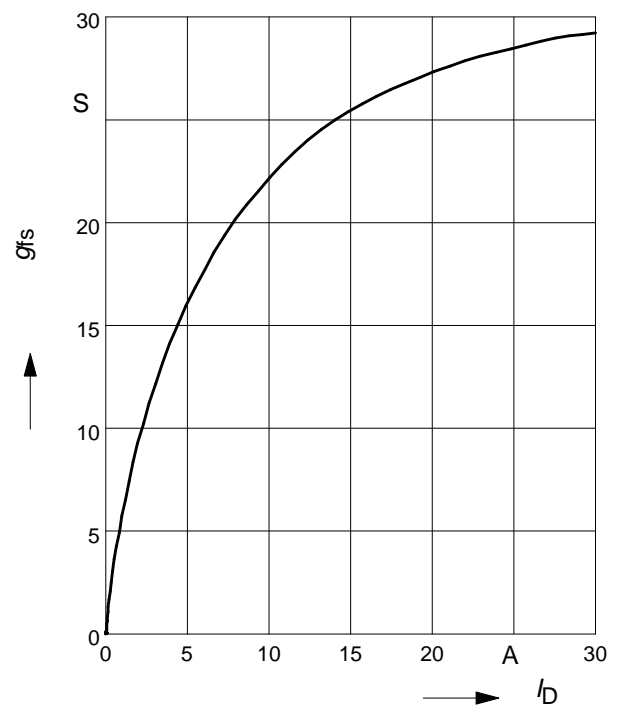
parameter: $t_p = 80 \mu\text{s}$



8 Typ. forward transconductance

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

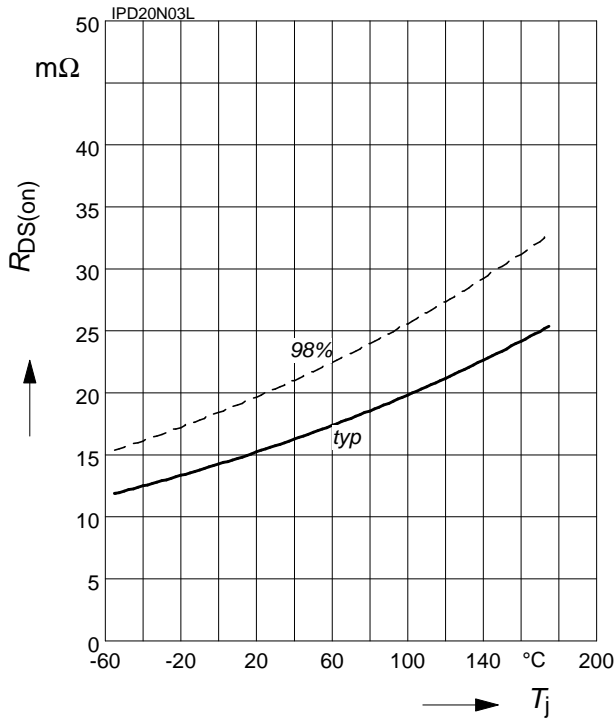
parameter: g_{fs}



9 Drain-source on-state resistance

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

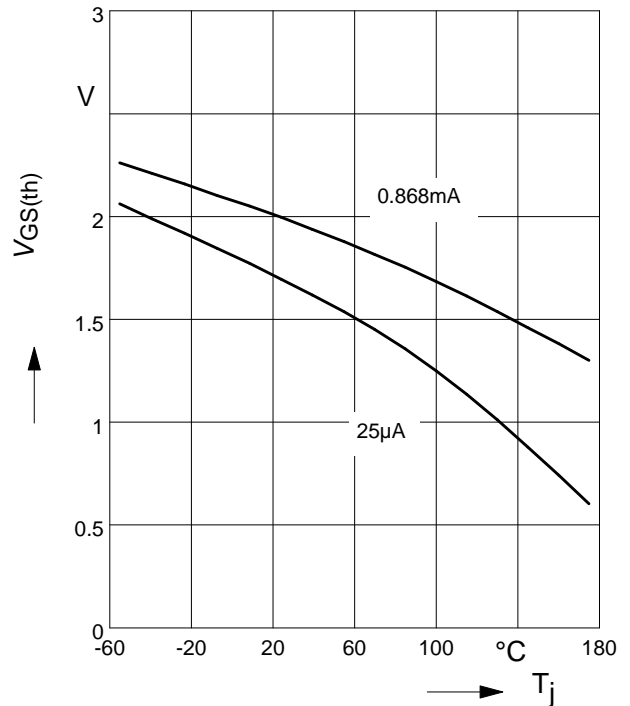
parameter : $I_D = 15\text{ A}$, $V_{GS} = 10\text{ V}$



10 Typ. gate threshold voltage

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

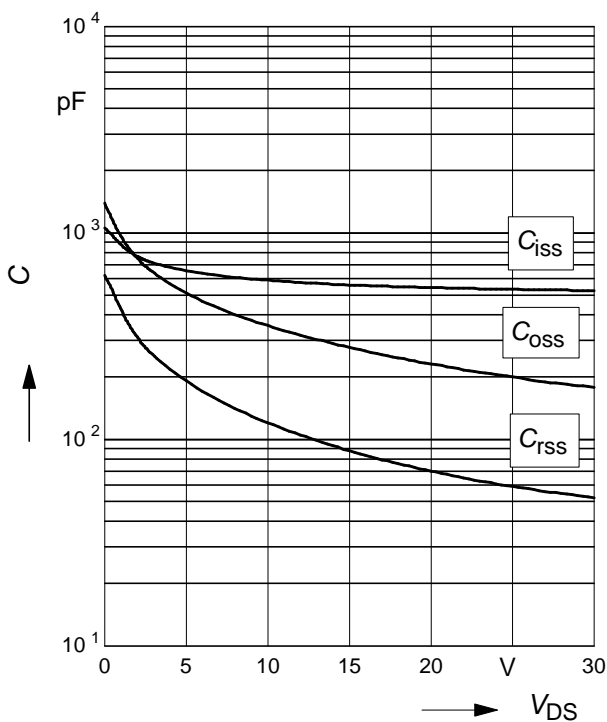
parameter: $V_{GS} = V_{DS}$



11 Typ. capacitances

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

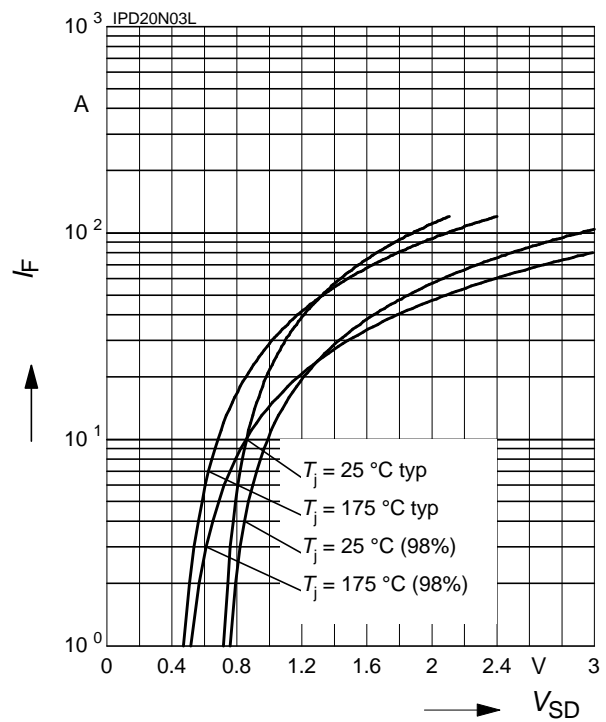
parameter: $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$



12 Forward character. of reverse diode

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

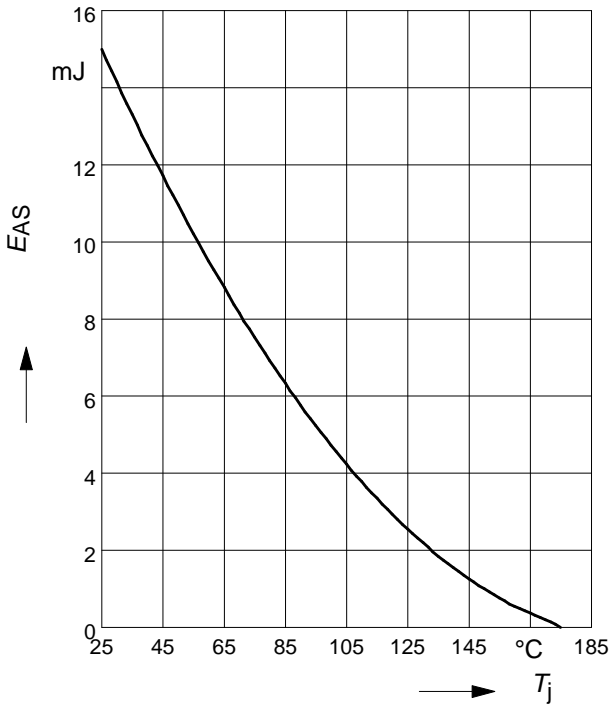
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



13 Typ. avalanche energy

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

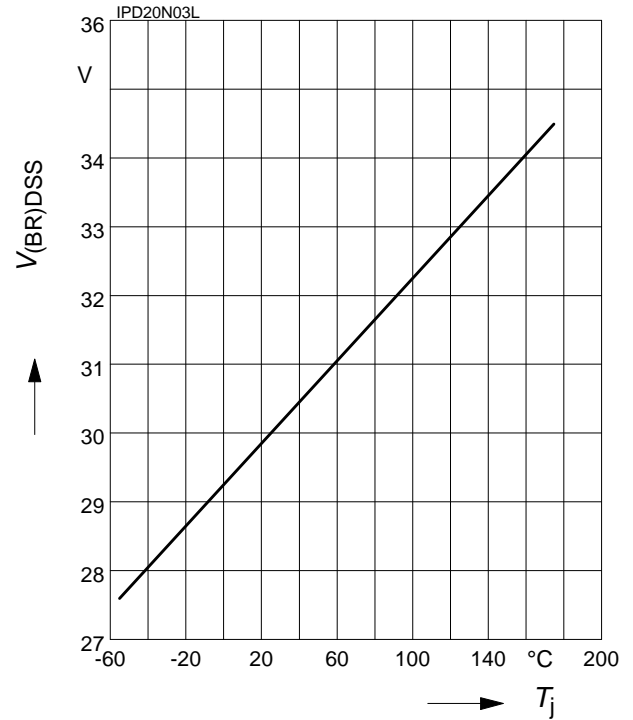
par.: $I_D = 15 \text{ A}$, $V_{DD} = 25 \text{ V}$, $R_{GS} = 25 \Omega$



15 Drain-source breakdown voltage

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

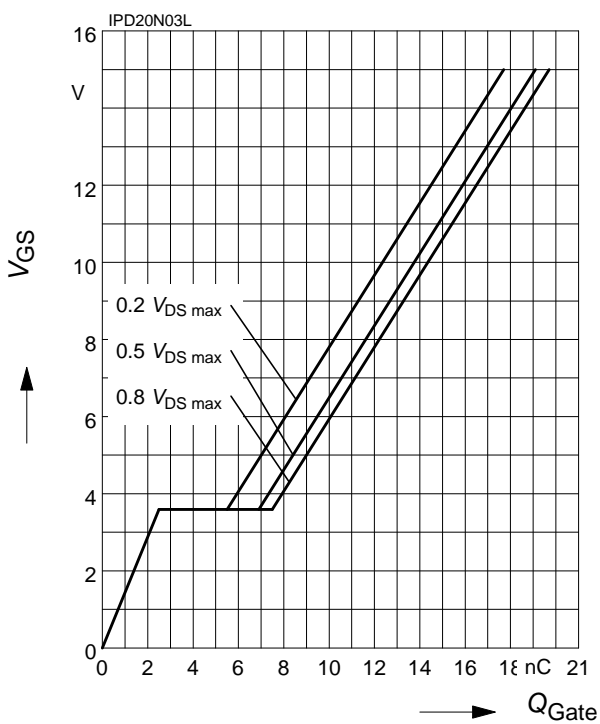
parameter: $I_D = 10 \text{ mA}$



14 Typ. gate charge

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

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



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