

OptiMOS^â Buck converter series

Feature

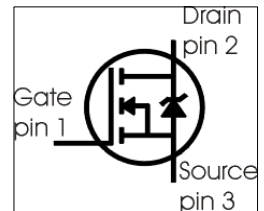
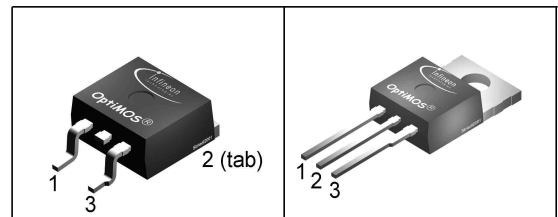
- N-Channel
- Logic Level
- Low On-Resistance $R_{DS(on)}$
- Excellent Gate Charge x $R_{DS(on)}$ product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- dv/dt rated
- Ideal for fast switching buck converters

Product Summary

| | | |
|-------------------------------|------|------------|
| V_{DS} | 30 | V |
| $R_{DS(on)}$ max. SMD version | 12.6 | m Ω |
| I_D | 42 | A |

P- TO263 -3-2

P- TO220 -3-1



| Type | Package | Ordering Code | Marking |
|-----------|---------------|---------------|---------|
| IPP15N03L | P- TO220 -3-1 | Q67042-S4039 | 15N03L |
| IPB15N03L | P- TO263 -3-2 | Q67040-S4344 | 15N03L |

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

| Parameter | Symbol | Value | Unit |
|--|----------------------|-------------|-------------------|
| Continuous drain current ¹⁾ $T_C=25^\circ\text{C}$ | I_D | 42 42 | A |
| Pulsed drain current $T_C=25^\circ\text{C}$ | $I_{D \text{ puls}}$ | 168 | |
| Avalanche energy, single pulse $I_D=20\text{A}, V_{DD}=25\text{V}, R_{GS}=25\Omega$ | E_{AS} | 20 | mJ |
| Repetitive avalanche energy, limited by T_{jmax} ²⁾ | E_{AR} | 8 | |
| Reverse diode dv/dt $I_S=42\text{A}, V_{DS}=-\text{V}, di/dt=200\text{A}/\mu\text{s}, T_{jmax}=175^\circ\text{C}$ | dv/dt | 6 | kV/ μs |
| Gate source voltage | V_{GS} | ± 20 | V |
| Power dissipation $T_C=25^\circ\text{C}$ | P_{tot} | 83 | 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. | |
| Characteristics | | | | | |
| Thermal resistance, junction - case | R_{thJC} | - | 1.2 | 1.8 | 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, $V_{GS} = V_{DS}$ $I_D=40\mu A$ | $V_{GS(th)}$ | 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 | μA |
| | | - | 10 | 100 | |
| Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$ | I_{GSS} | - | 1 | 100 | nA |
| Drain-source on-state resistance $V_{GS}=4.5V, I_D=21A$ $V_{GS}=4.5V, I_D=21A, \text{SMD version}$ | $R_{DS(on)}$ | - | 14.9 | 19.9 | m Ω |
| | | - | 14.5 | 19.6 | |
| Drain-source on-state resistance $V_{GS}=10V, I_D=21A$ $V_{GS}=10V, I_D=21A, \text{SMD version}$ | $R_{DS(on)}$ | - | 10.3 | 12.9 | m Ω |
| | | - | 9.9 | 12.6 | |

¹Current limited by bondwire ; with an $R_{thJC} = 1.8K/W$ the chip is able to carry $I_D = 64A$ 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.

Electrical Characteristics

| Parameter | Symbol | Conditions | Values | | | Unit |
|-----------|--------|------------|--------|------|------|------|
| | | | min. | typ. | max. | |

Dynamic Characteristics

| | | | | | | |
|------------------------------|--------------|---|----|------|------|----------|
| Transconductance | g_{fs} | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 42A$ | 21 | 42 | - | S |
| Input capacitance | C_{iss} | $V_{GS} = 0V$, $V_{DS} = 25V$, $f = 1MHz$ | - | 850 | 1130 | pF |
| Output capacitance | C_{oss} | | - | 330 | 330 | |
| Reverse transfer capacitance | C_{rss} | | - | 90 | 130 | |
| Gate resistance | R_G | | - | 1 | - | Ω |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 15V$, $V_{GS} = 10V$, $I_D = 21A$, $R_G = 7.8\Omega$ | - | 6.5 | 9.8 | ns |
| Rise time | t_r | | - | 20 | 30 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 24 | 36 | |
| Fall time | t_f | | - | 14.5 | 21.8 | |

Gate Charge Characteristics

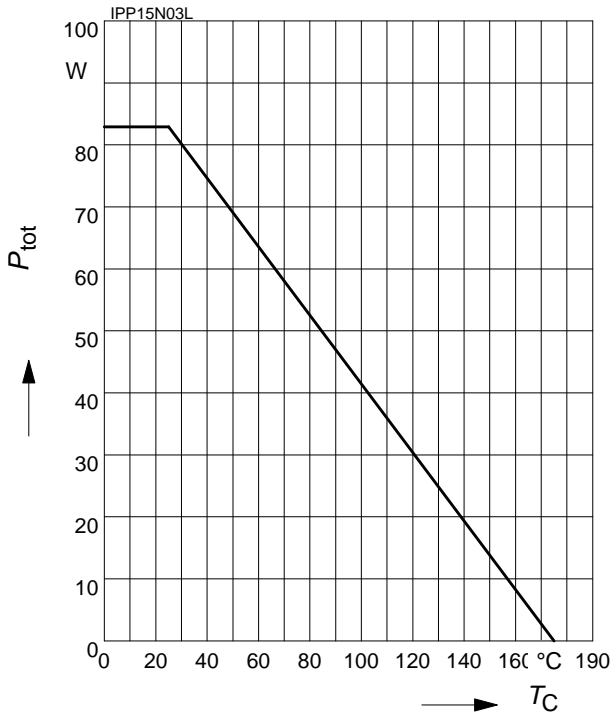
| | | | | | | |
|-----------------------|-----------------|--|---|------|------|----|
| Gate to source charge | Q_{gs} | $V_{DD} = 15V$, $I_D = 21A$ | - | 2.7 | 3.6 | nC |
| Gate to drain charge | Q_{gd} | | - | 7.4 | 9.3 | |
| Gate charge total | Q_g | $V_{DD} = 15V$, $I_D = 21A$, $V_{GS} = 0$ to $5V$ | - | 12.7 | 15.9 | |
| Output charge | Q_{oss} | $V_{DS} = 15V$, $I_D = 21A$, $V_{GS} = 0V$ | - | 12.2 | 15.3 | nC |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD} = 15V$, $I_D = 21A$ | - | 3.5 | - | V |

Reverse Diode

| | | | | | | |
|--|----------|--|---|------|------|----|
| Inverse diode continuous forward current | I_S | $T_C = 25^\circ C$ | - | - | 42 | A |
| Inv. diode direct current, pulsed | I_{SM} | | - | - | 168 | |
| Inverse diode forward voltage | V_{SD} | $V_{GS} = 0V$, $I_F = 42A$ | - | 0.95 | 1.25 | V |
| Reverse recovery time | t_{rr} | $V_R = -V$, $I_F = I_S$, $di_F/dt = 100A/\mu s$ | - | 24 | 31 | ns |
| Reverse recovery charge | Q_{rr} | | - | 18 | 23 | nC |

1 Power dissipation

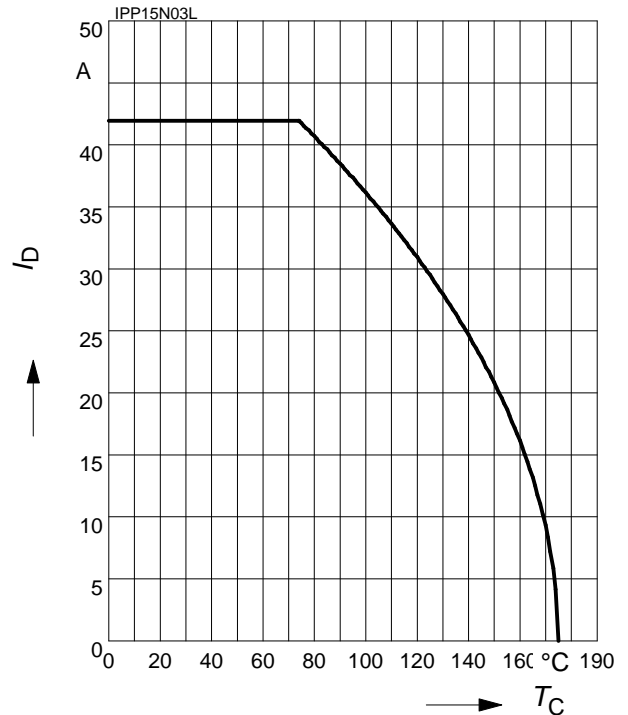
$$P_{tot} = f(T_C)$$



2 Drain current

$$I_D = f(T_C)$$

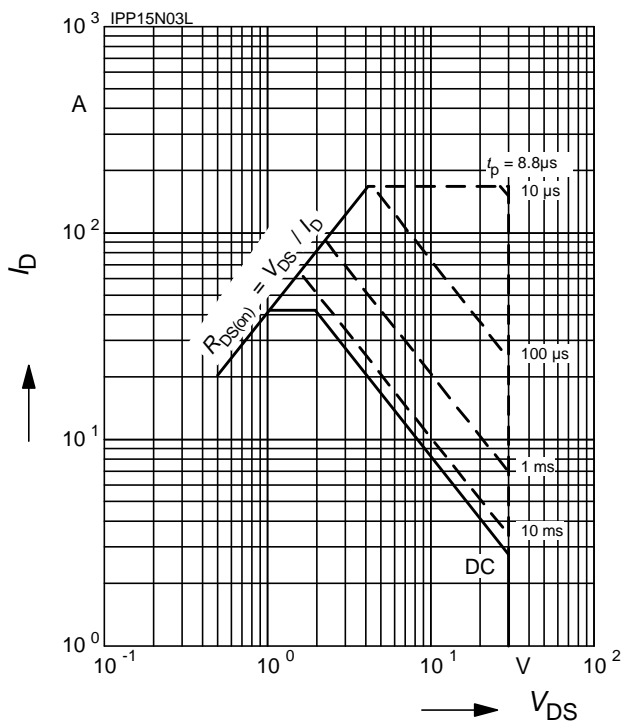
parameter: $V_{GS} \geq 10 \text{ V}$



3 Safe operating area

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

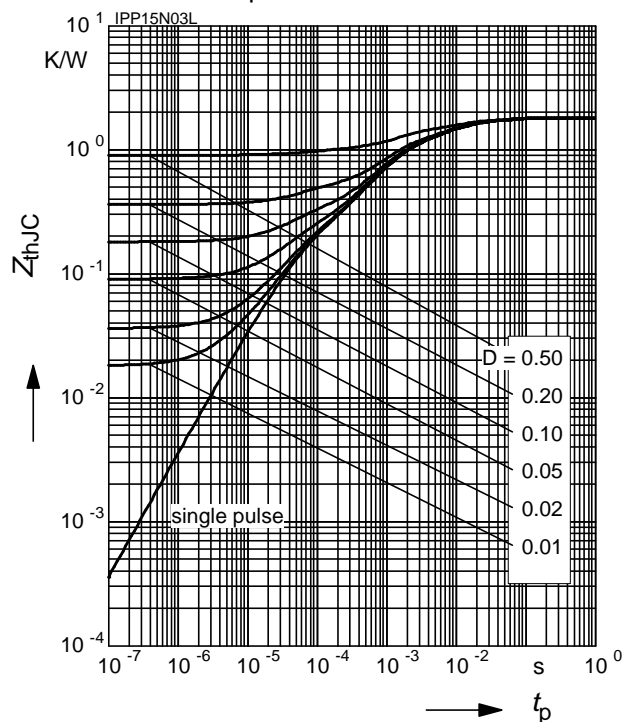
parameter: $D = 0, T_C = 25 \text{ °C}$



4 Max. transient thermal impedance

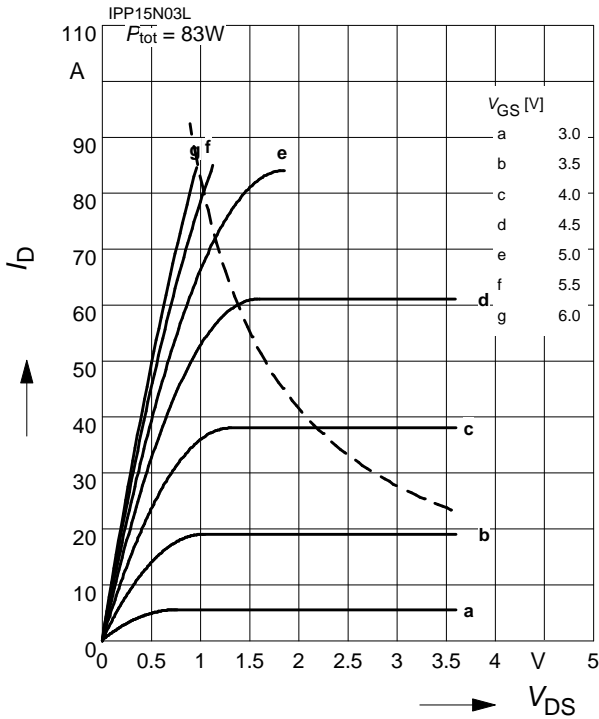
$$Z_{thJC} = f(t_p)$$

parameter: $D = t_p/T$



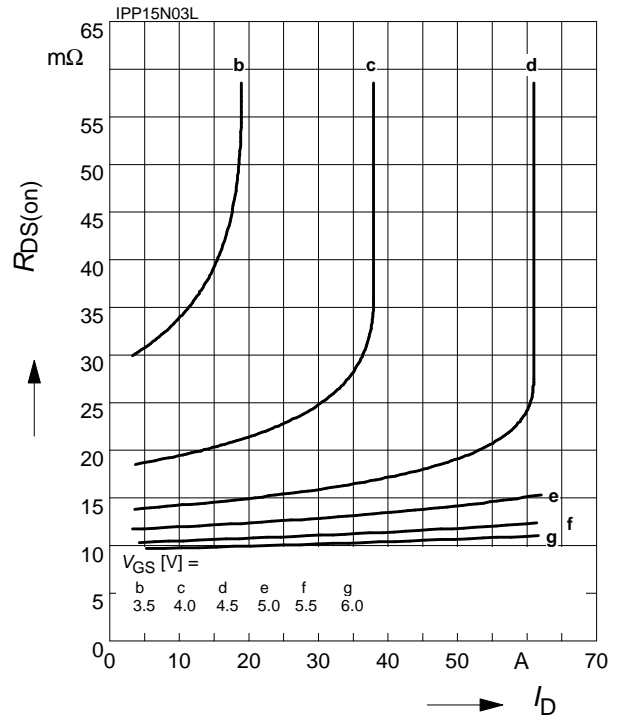
5 Typ. output characteristic

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



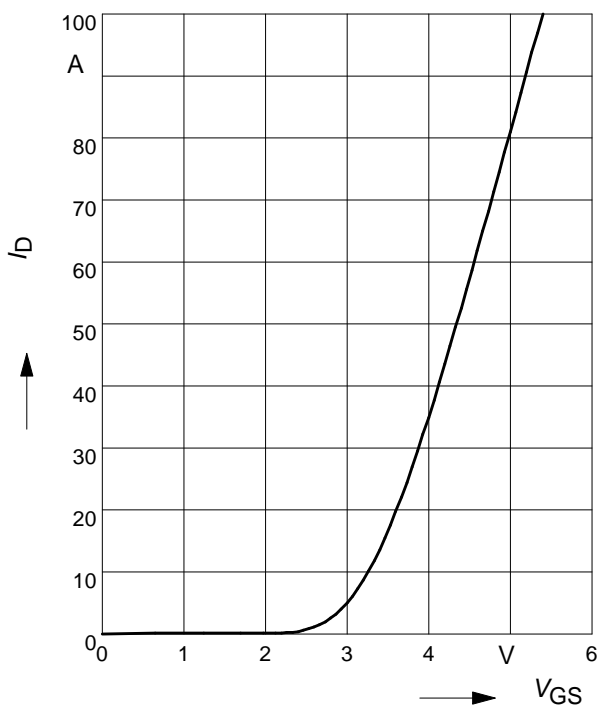
6 Typ. drain-source on resistance

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



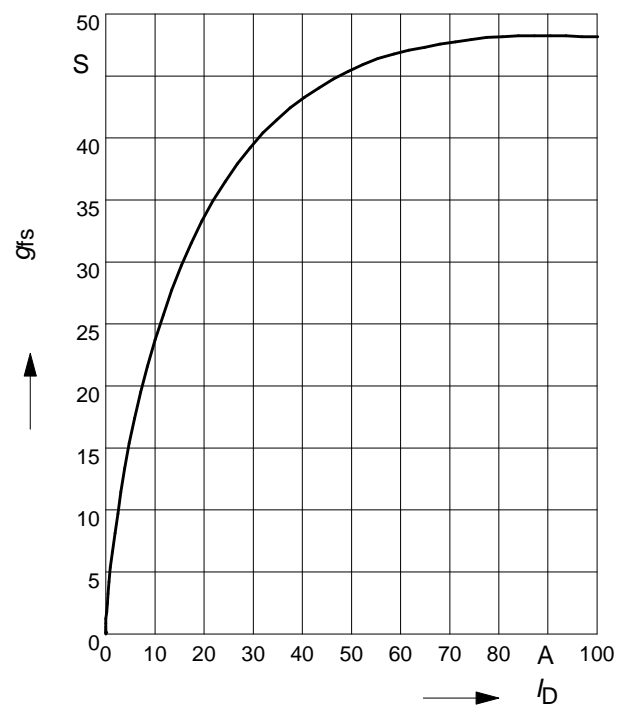
7 Typ. transfer characteristics

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



8 Typ. forward transconductance

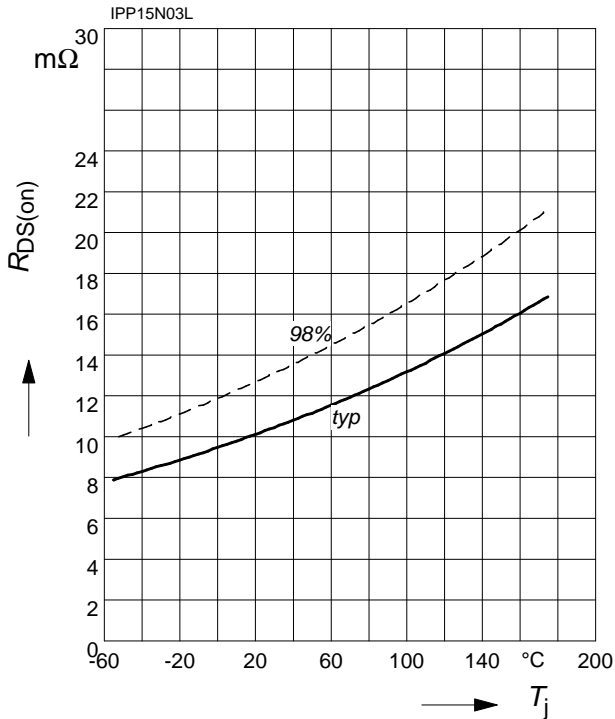
$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$
parameter: g_{fs}



9 Drain-source on-state resistance

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

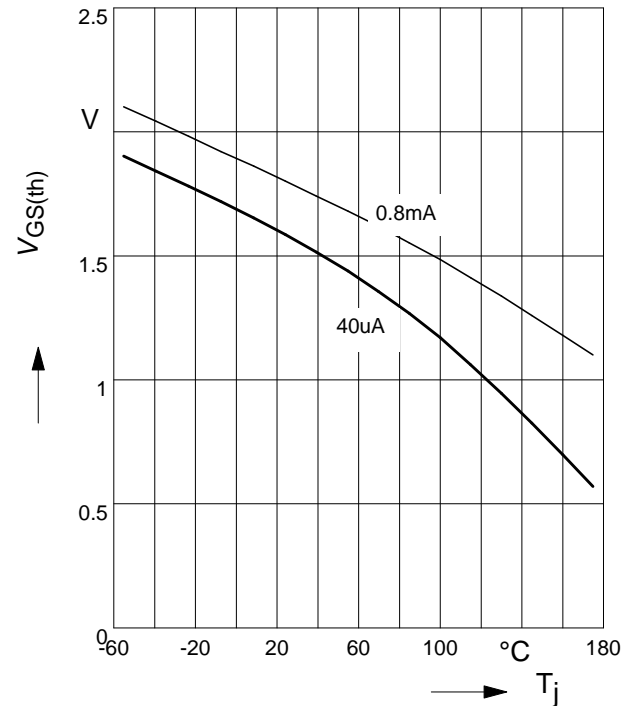
parameter: $I_D = 21\text{ A}$, $V_{GS} = 10\text{ V}$



10 Typ. gate threshold voltage

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

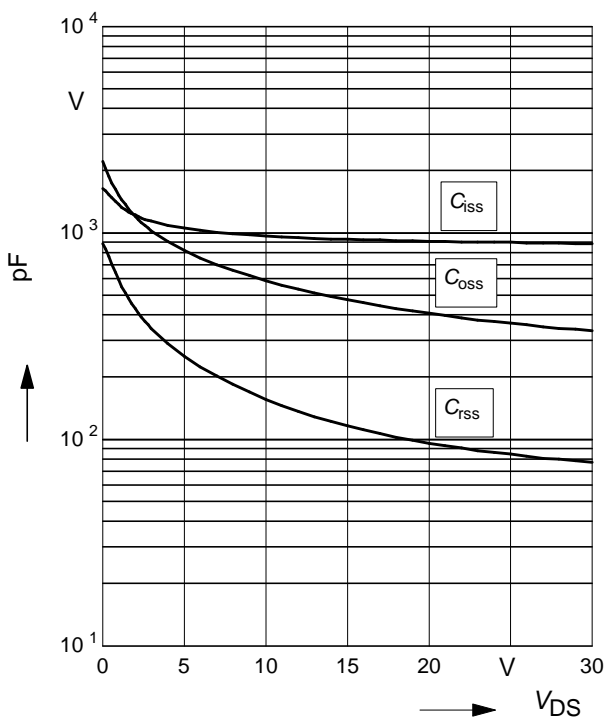
parameter: $V_{GS} = V_{DS}$



11 Typ. capacitances

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

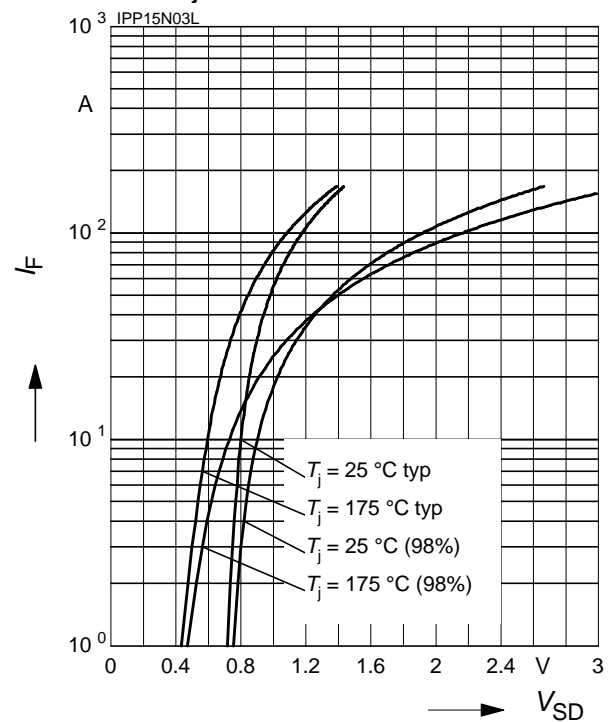
parameter: $V_{GS}=0\text{V}$, $f=1\text{ MHz}$



12 Forward character. of reverse diode

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

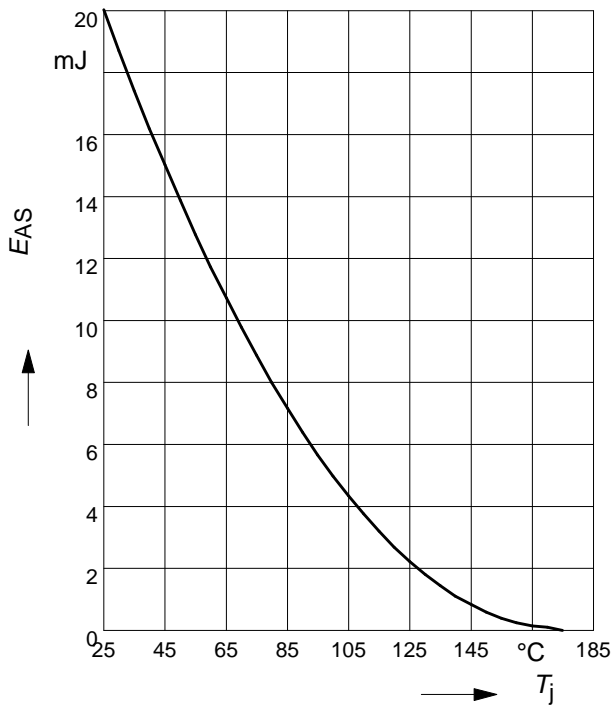
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



13 Typ. avalanche energy

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

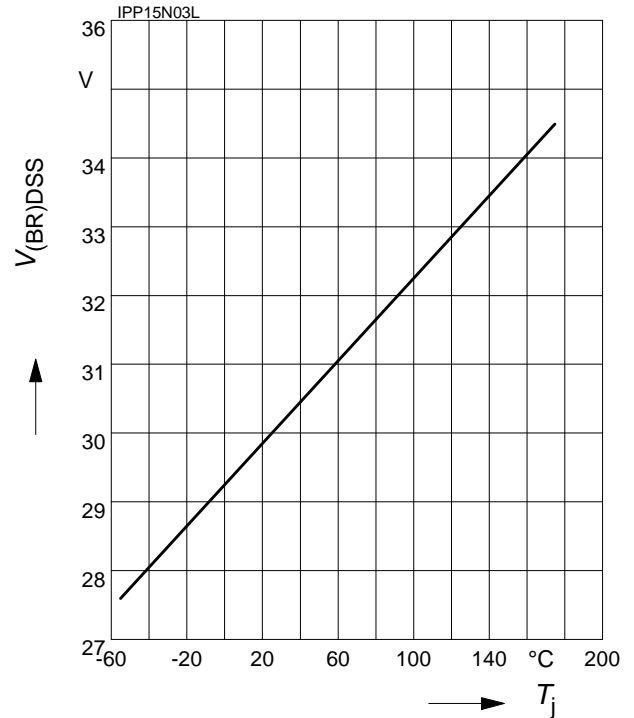
par.: $I_D = 20 \text{ A}$, $V_{DD} = 25 \text{ V}$, $R_{GS} = 25 \Omega$



15 Drain-source breakdown voltage

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

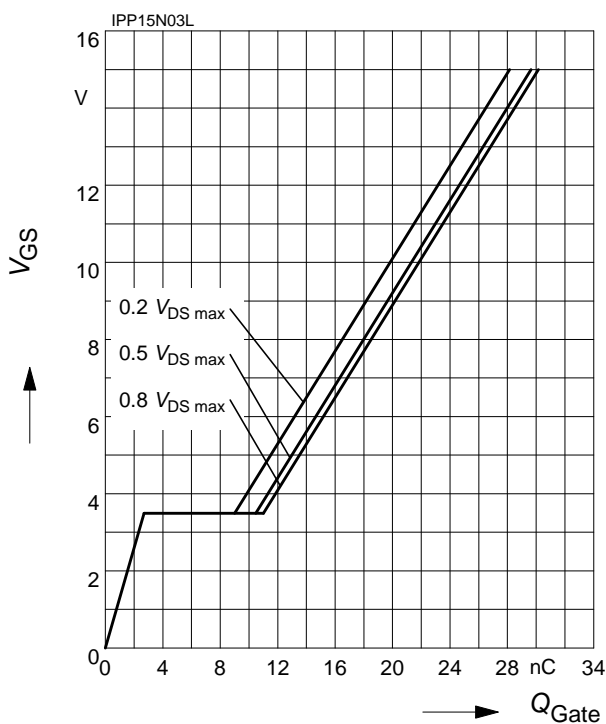
parameter: $I_D = 10 \text{ mA}$



14 Typ. gate charge

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

parameter: $I_D = 21 \text{ A pulsed}$



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