# OptiMOS® Power-Transistor

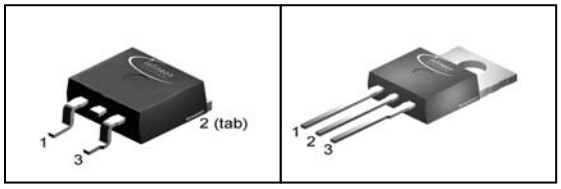
## Features

- N-channel Logic Level - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (lead free)
- Ultra low Rds(on)
- 100% Avalanche tested

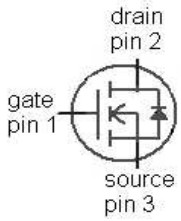
## Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 40 | V |
| $R_{DS(on),max}$ (SMD version) | 3.1 | mΩ |
| $I_D$ | 80 | A |

PG-TO263-3-2 PG-TO220-3-1




| Type | Package | Ordering Code | Marking |
|---|---|---|---|
| IPB80N04S2L-03 | PG-TO263-3-2 | SP0002-20158 | 2N04L03 |
| IPP80N04S2L-03 | PG-TO220-3-1 | SP0002-19063 | 2N04L03 |




**Maximum ratings,** at $T_j$=25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous drain current[1)] | $I_D$ | $T_C$=25 °C, $V_{GS}$=10 V | 80 | A |
| | | $T_C$=100 °C, $V_{GS}$=10 V[2)] | 80 | |
| Pulsed drain current[2)] | $I_{D,pulse}$ | $T_C$=25 °C | 320 | |
| Avalanche energy, single pulse[2)] | $E_{AS}$ | $I_D$=80A | 810 | mJ |
| Gate source voltage[4)] | $V_{GS}$ | | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 300 | W |
| Operating and storage temperature | $T_j$, $T_{stg}$ | | -55 ... +175 | °C |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics**[2] | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | | - | - | 0.5 | K/W |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | | - | - | 62 | |
| SMD version, device on PCB | $R_{thJA}$ | minimal footprint | - | - | 62 | |
| | | 6 cm$^2$ cooling area[5] | - | - | 40 | |
| **Electrical characteristics,** at $T_j$=25 °C, unless otherwise specified | | | | | | |
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$= 1 mA | 40 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250 µA | 1.2 | 1.6 | 2.0 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=40 V, $V_{GS}$=0 V, $T_j$=25 °C | - | 0.01 | 1 | µA |
| | | $V_{DS}$=40 V, $V_{GS}$=0 V, $T_j$=125 °C[2] | - | 1 | 100 | |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20 V, $V_{DS}$=0 V | - | 1 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=4.5 V, $I_D$=80 A | - | 3.6 | 4.5 | mΩ |
| | | $V_{GS}$=4.5 V, $I_D$=80 A, SMD version | - | 3.3 | 4.2 | |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=10 V, $I_D$=80 A | - | 2.7 | 3.4 | mΩ |
| | | $V_{GS}$=10 V, $I_D$=80 A, SMD version | - | 2.4 | 3.1 | |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics**[2] | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=25 V, $f$=1 MHz | - | 6000 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 2200 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 700 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=20 V, $V_{GS}$=10 V, $I_D$=80 A, $R_G$=1.1 Ω | - | 19 | - | ns |
| Rise time | $t_r$ | | - | 50 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 77 | - | |
| Fall time | $t_f$ | | - | 27 | - | |
| **Gate Charge Characteristics**[2] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=32 V, $I_D$=80 A, $V_{GS}$=0 to 10 V | - | 19 | 24 | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 55 | 81 | |
| Gate charge total | $Q_g$ | | - | 163 | 213 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.2 | - | V |
| **Reverse Diode** | | | | | | |
| Diode continous forward current[2] | $I_S$ | $T_C$=25 °C | - | - | 80 | A |
| Diode pulse current[2] | $I_{S,pulse}$ | | - | - | 320 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=80 A, $T_j$=25 °C | - | 0.9 | 1.3 | V |
| Reverse recovery time[2] | $t_{rr}$ | $V_R$=20 V, $I_F$=$I_S$, $di_F/dt$=100 A/µs | - | 62 | 78 | ns |
| Reverse recovery charge[2] | $Q_{rr}$ | $V_R$=20 V, $I_F$=$I_S$, $di_F/dt$=100 A/µs | - | 145 | 180 | nC |

[1] Current is limited by bondwire; with an $R_{thJC}$ = 0.5K/W the chip is able to carry 217A at 25°C. For detailed information see Application Note ANPS071E at *www.infineon.com/optimos*

[2] Defined by design. Not subject to production test.

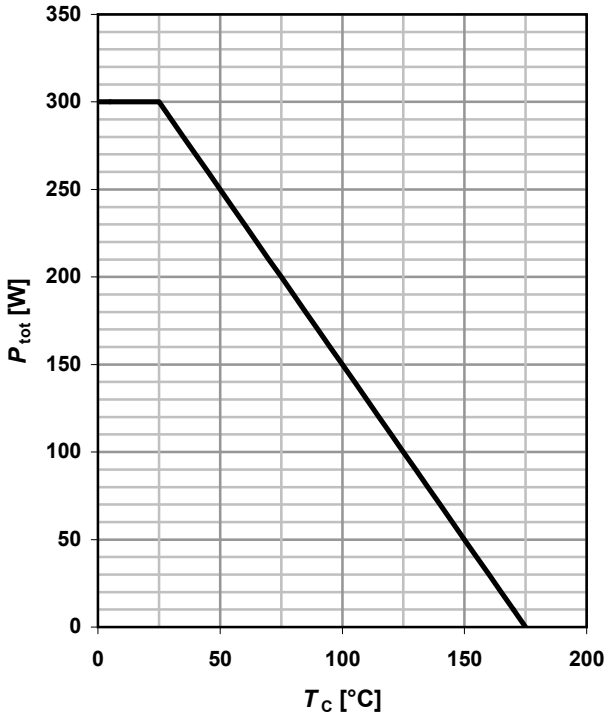
[3] See diagram 13

[4] Qualified at -20V and +20V.

[5] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 $cm^2$ (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

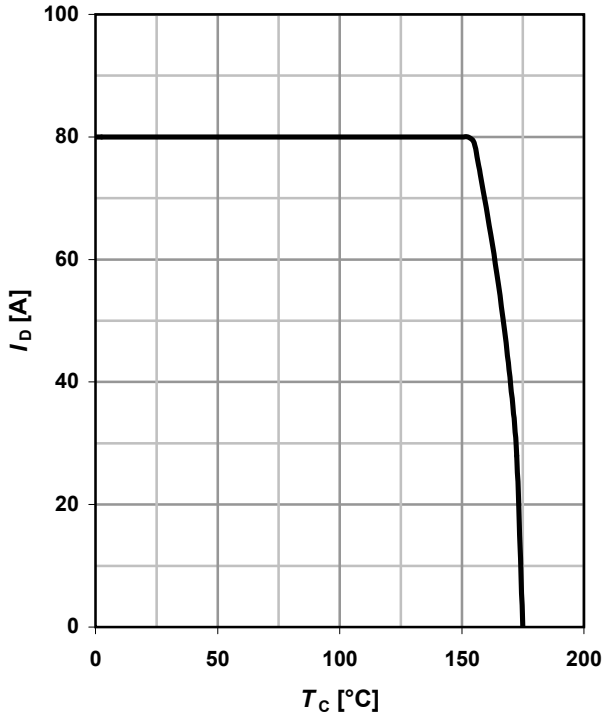
**1 Power dissipation**

$P_{tot} = f(T_C)$; $V_{GS} \geq 4$ V




**2 Drain current**

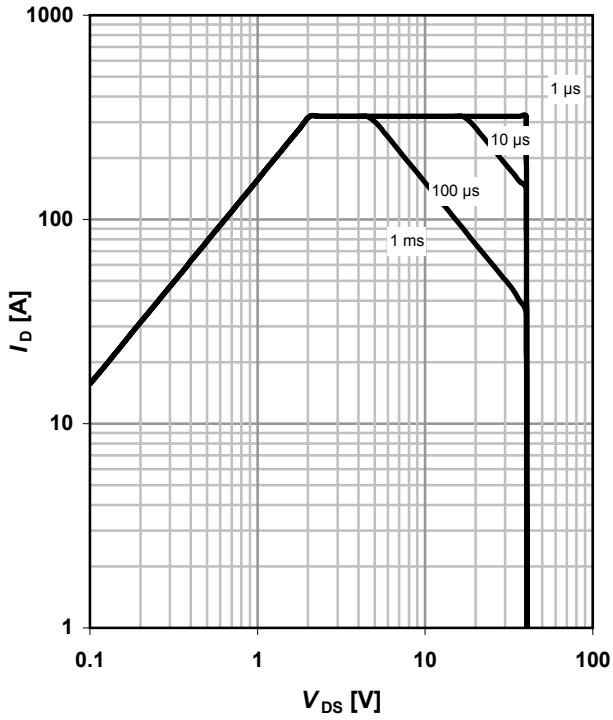
$I_D = f(T_C)$; $V_{GS} \geq 10$ V




**3 Safe operating area**

$I_D = f(V_{DS})$; $T_C = 25$ °C; $D = 0$

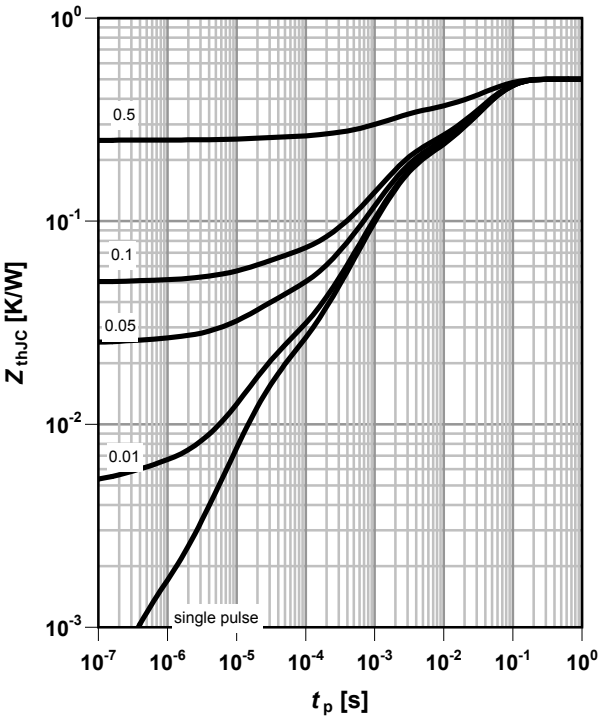
parameter: $t_p$




**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

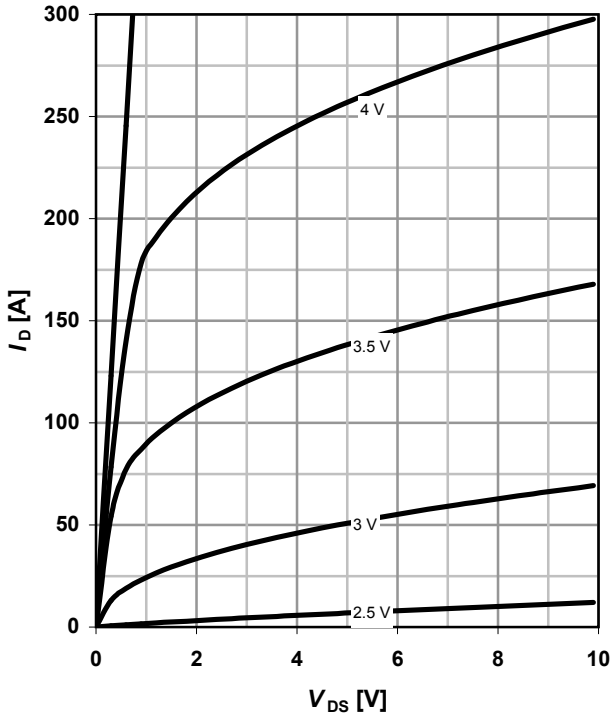
parameter: $D = t_p/T$



**5 Typ. output characteristics**

$I_D = f(V_{DS})$; $T_j = 25$ °C

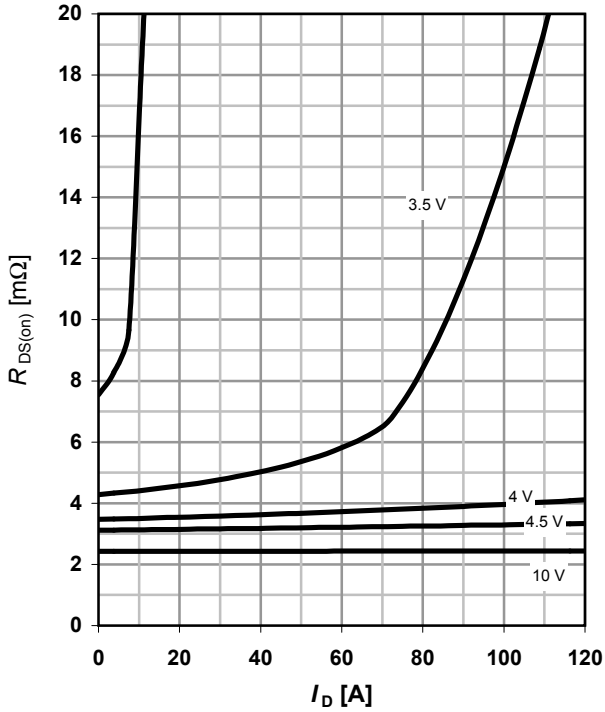
parameter: $V_{GS}$




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

$R_{DS(on)} = (I_D)$; $T_j = 25$ °C

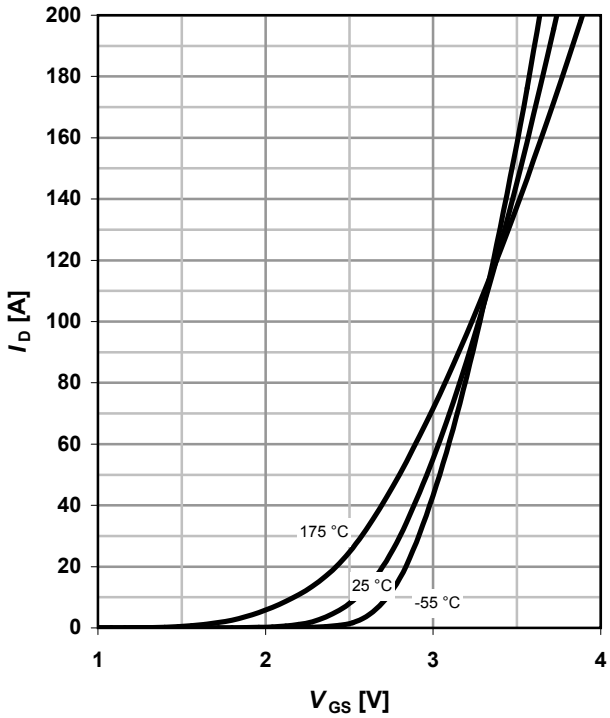
parameter: $V_{GS}$




**7 Typ. transfer characteristics**

$I_D = f(V_{GS})$; $V_{DS} = 6$V

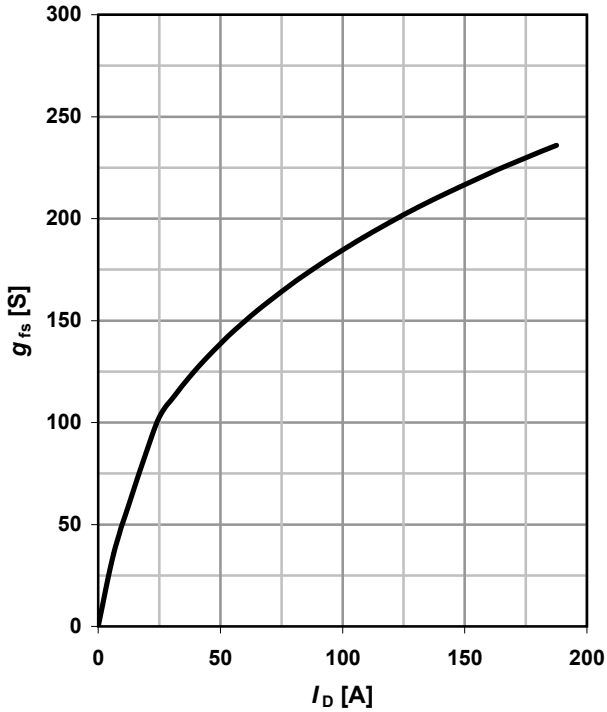
parameter: $T_j$




**8 Typ. Forward transconductance**

$g_{fs} = f(I_D)$; $T_j = 25$°C

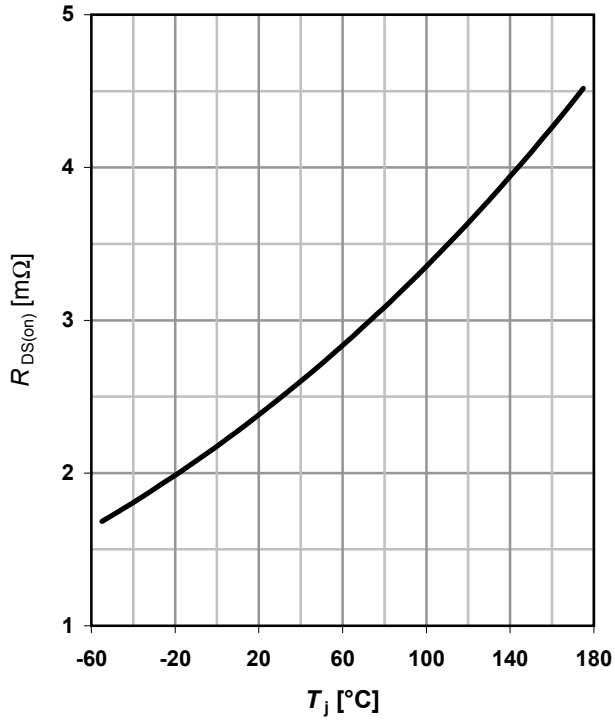
parameter: $g_{fs}$



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

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

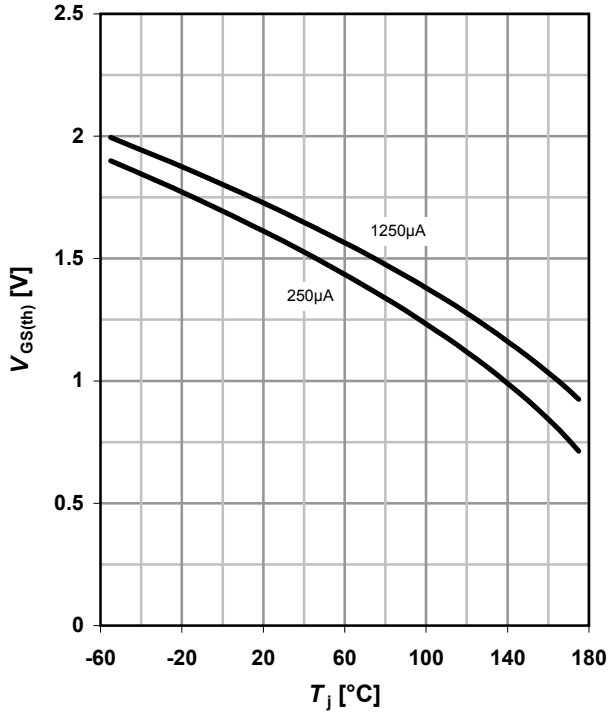
parameter: $I_D$ = 80 A; $V_{GS}$ = 10 V




**10 Typ. gate threshold voltage**

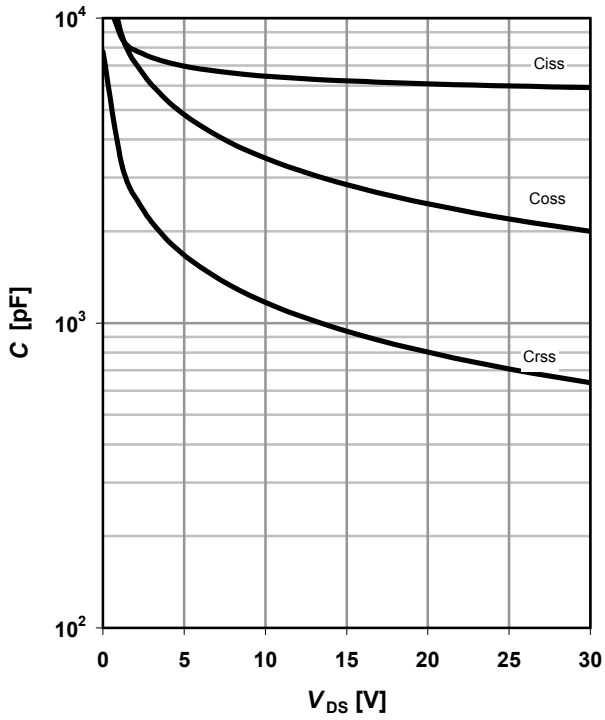
$V_{GS(th)} = f(T_j)$; $V_{GS} = V_{DS}$

parameter: $I_D$




**11 Typ. capacitances**

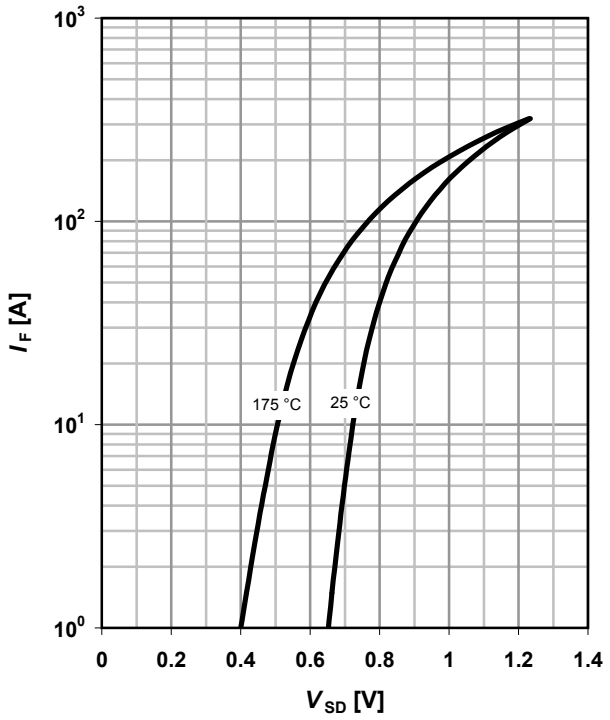
$C = f(V_{DS})$; $V_{GS}$ = 0 V; $f$ = 1 MHz




**12 Typical forward diode characteristicis**

IF = f($V_{SD}$)

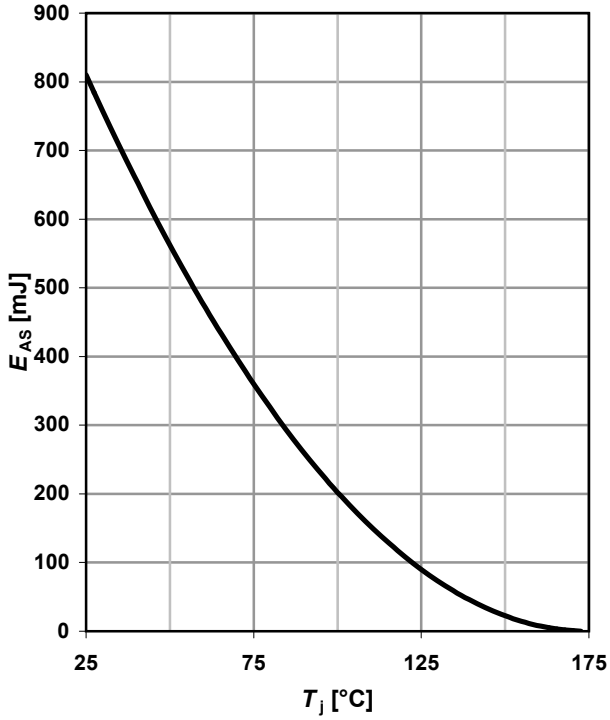
parameter: $T_j$



**13 Typical avalanche energy**

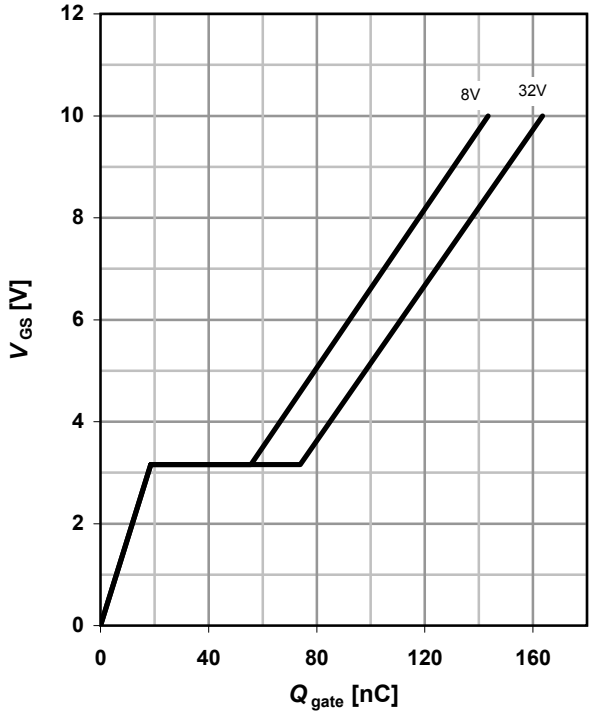
$E_{AS} = f(T_j)$

parameter: $I_D$=80A



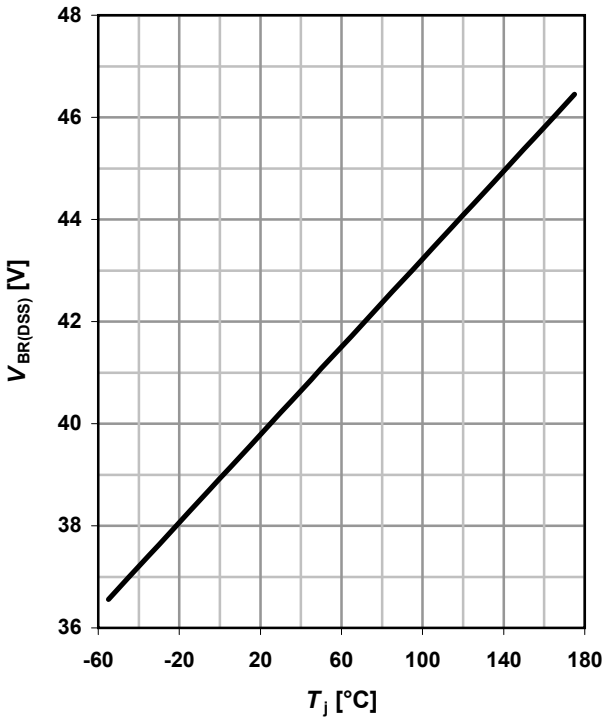

**14 Typ. gate charge**

$V_{GS} = f(Q_{gate})$; $I_D$ = 80 A pulsed

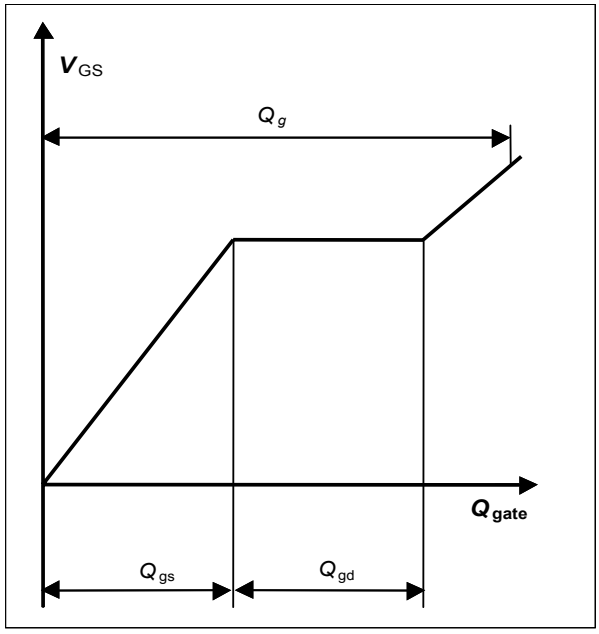



**15 Typ. drain-source breakdown voltage**

$V_{BR(DSS)} = f(T_j)$; $I_D$ = 1 mA




**16 Gate charge waveforms**



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