## OptiMOS®-T Power-Transistor

**Product Summary**

| | | |
|---|---|---|
| $V_{DS}$ | 120 | V |
| $R_{DS(on),max}$ (SMD version) | 15.4 | mΩ |
| $I_D$ | 50 | A |

**Features**

• OptiMOS™ - power MOSFET for automotive applications

• N-channel - Enhancement mode

• Automotive AEC Q101 qualified

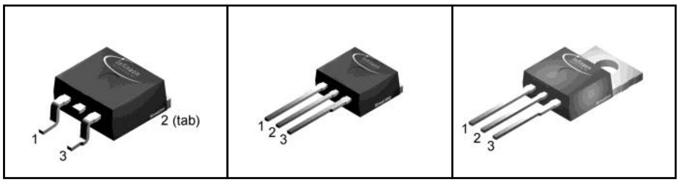
• MSL1 up to 260°C peak reflow

• 175°C operating temperature

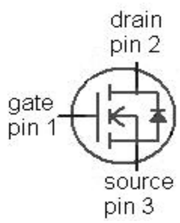
• Green product (RoHS compliant)

• 100% Avalanche tested

PG-TO263-3-2 PG-TO262-3-1 PG-TO220-3-1




| Type | Package | Marking |
|---|---|---|
| IPB50N12S3L-15 | PG-TO263-3-2 | 3N12L15 |
| IPI50N12S3L-15 | PG-TO262-3-1 | 3N12L15 |
| IPP50N12S3L-15 | PG-TO220-3-1 | 3N12L15 |




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

| **Parameter** | **Symbol** | **Conditions** | **Value** | **Unit** |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_C$=25 °C, $V_{GS}$=10 V | 50 | A |
| | | $T_C$=100 °C, $V_{GS}$=10 V[1)] | 37 | |
| Pulsed drain current[1)] | $I_{D,pulse}$ | $T_C$=25 °C | 200 | |
| Avalanche energy, single pulse[1)] | $E_{AS}$ | $I_D$=25A | 330 | mJ |
| Avalanche current, single pulse | $I_{AS}$ | - | 50 | A |
| Gate source voltage | $V_{GS}$ | - | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 100 | W |
| Operating and storage temperature | $T_j$, $T_{stg}$ | - | -55 ... +175 | °C |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics**[1] | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | - | 1.5 | 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[2] | - | - | 40 | |

**Electrical characteristics,** at $T_j$=25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$= 1mA | 120 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=60µA | 1.2 | 1.7 | 2.4 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=120V, $V_{GS}$=0V, $T_j$=25°C | - | 0.01 | 0.1 | µA |
| | | $V_{DS}$=120V, $V_{GS}$=0V, $T_j$=125°C[2] | - | 1 | 10 | |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20V, $V_{DS}$=0V | - | - | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=4.5V, $I_D$=50A | - | 16.1 | 20.9 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=50A, SMD version | - | 15.8 | 20.6 | |
| | | $V_{GS}$=10V, $I_D$=50A | - | 13.1 | 15.7 | |
| | | $V_{GS}$=10V, $I_D$=50A, SMD version | - | 12.8 | 15.4 | |

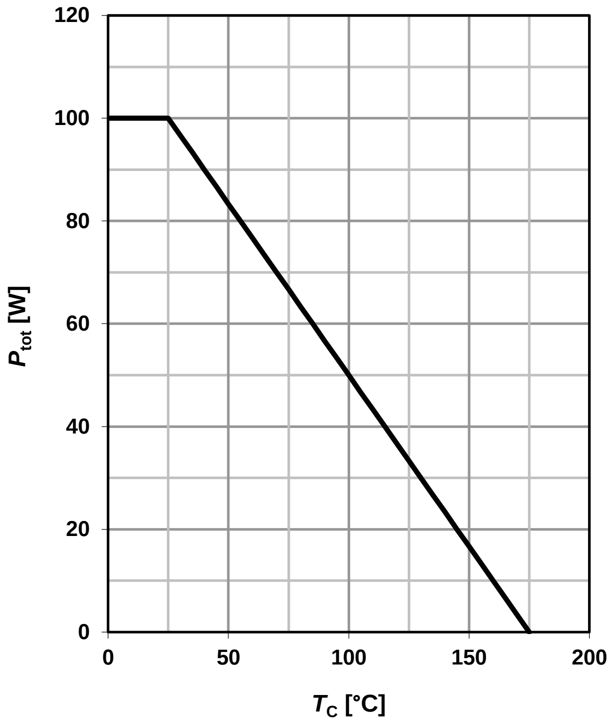
| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics**[1] | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=25V, $f$=1MHz | - | 3215 | 4180 | pF |
| Output capacitance | $C_{oss}$ | | - | 730 | 949 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 63 | 95 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=20 V, $V_{GS}$=10 V, $I_D$=50 A, $R_G$=3.5 Ω | - | 10 | - | ns |
| Rise time | $t_r$ | | - | 5 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 28 | - | |
| Fall time | $t_f$ | | - | 5 | - | |
| **Gate Charge Characteristics**[1] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=96V, $I_D$=70A, $V_{GS}$=0 to 10V | - | 11 | 14 | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 8 | 12 | |
| Gate charge total | $Q_g$ | | - | 44 | 57 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.7 | - | V |
| **Reverse Diode** | | | | | | |
| Diode continous forward current[1] | $I_S$ | $T_C$=25°C | - | - | 50 | A |
| Diode pulse current[1] | $I_{S,pulse}$ | | - | - | 200 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=50 A, $T_j$=25 °C | 0.6 | 1 | 1.2 | V |
| Reverse recovery time[1] | $t_{rr}$ | $V_R$=50V, $I_F$=$I_S$, $di_F/dt$=100A/µs | - | 80 | - | ns |
| Reverse recovery charge[1] | $Q_{rr}$ | | - | 185 | - | nC |

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

[2] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air

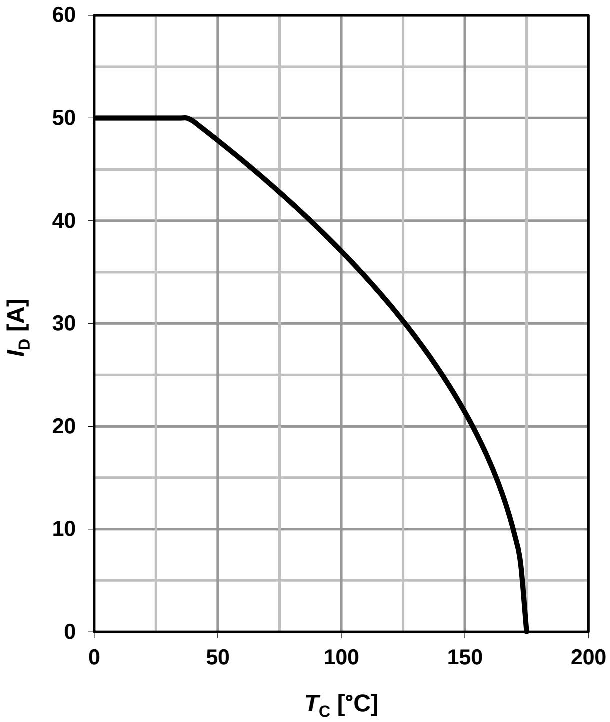
**1 Power dissipation**

$P_{tot} = f(T_C)$; $V_{GS} = 10$ V




**2 Drain current**

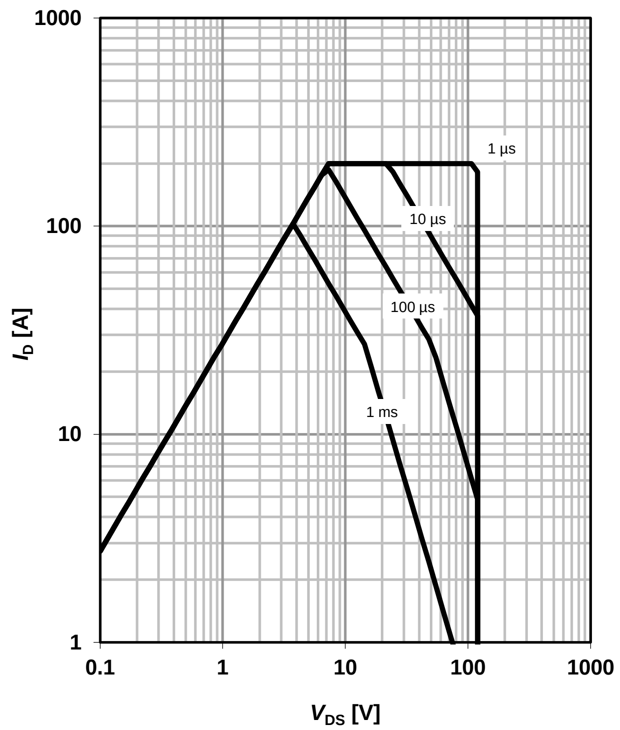
$I_D = f(T_C)$; $V_{GS} = 10$ V; SMD




**3 Safe operating area**

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

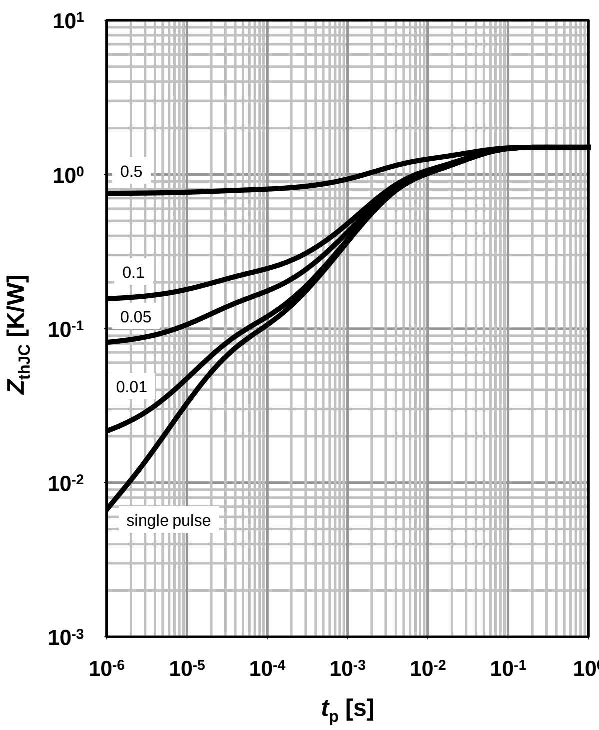
parameter: $t_p$




**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

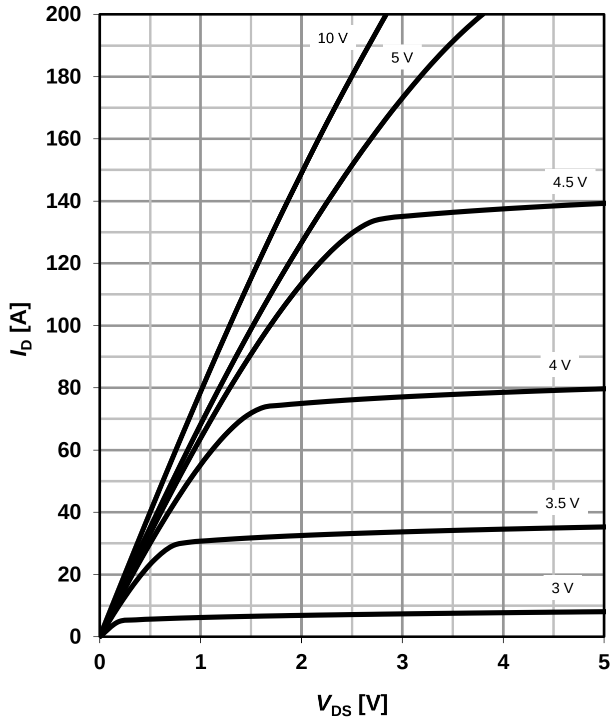
parameter: $D = t_p/T$



**5 Typ. output characteristics**

$I_D = f(V_{DS})$; $T_j = 25\ °C$; SMD

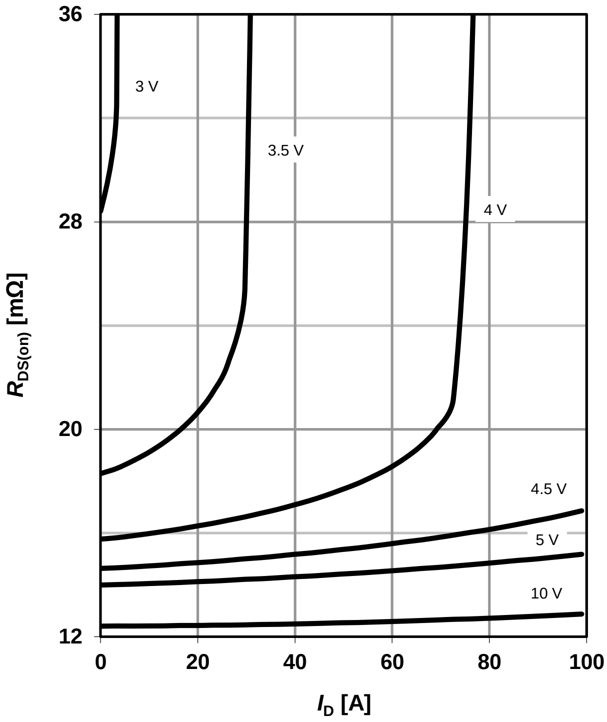
parameter: $V_{GS}$




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

$R_{DS(on)} = f(I_D)$; $T_j = 25\ °C$; SMD

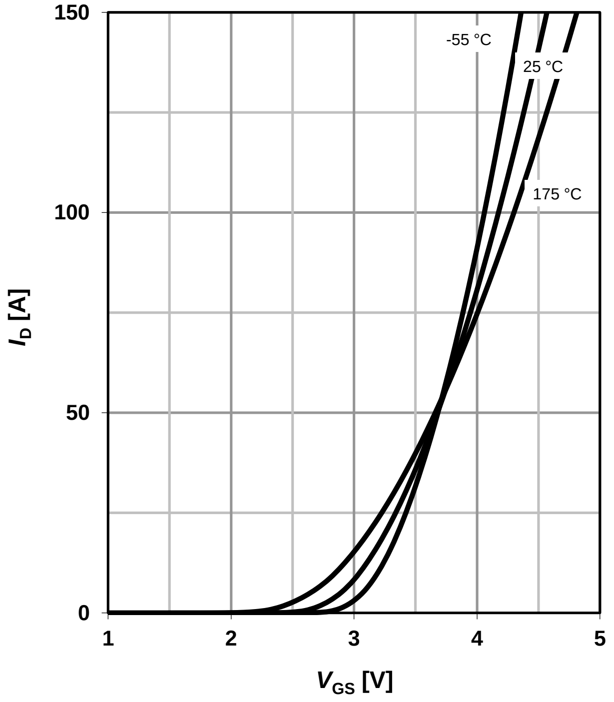
parameter: $V_{GS}$




**7 Typ. transfer characteristics**

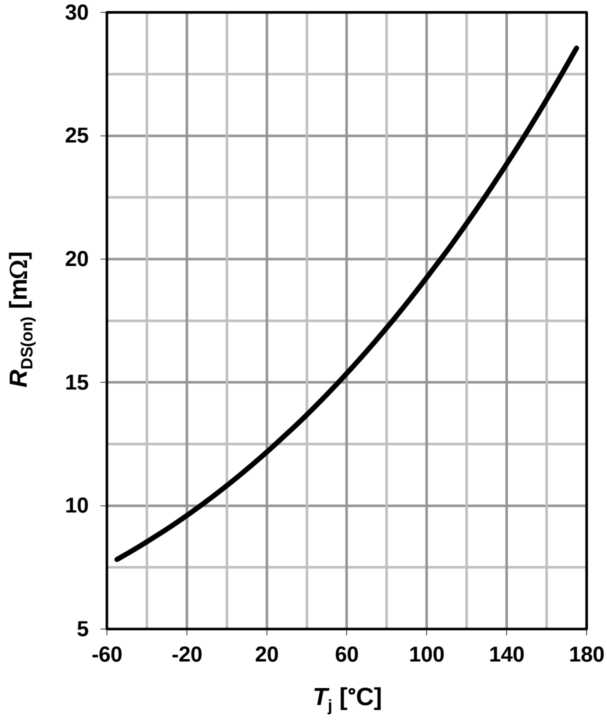
$I_D = f(V_{GS})$; $V_{DS} = 6V$

parameter: $T_j$




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

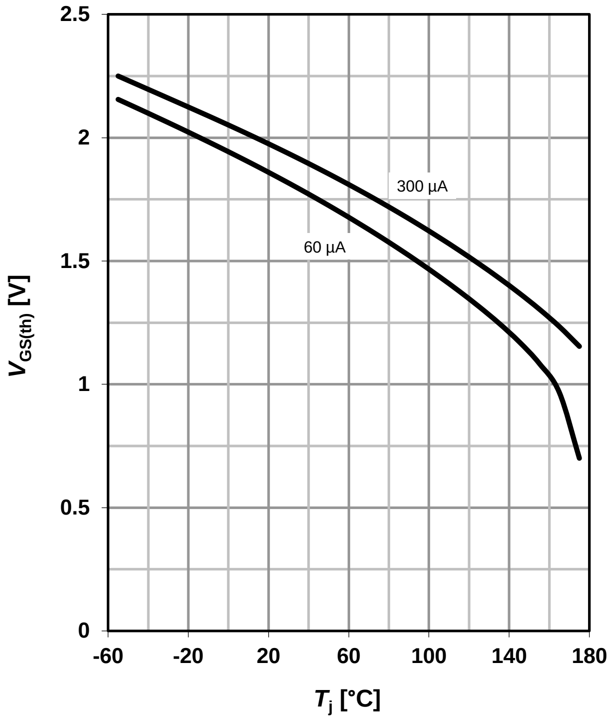
$R_{DS(on)} = f(T_j)$; $I_D = 50\ A$; $V_{GS} = 10\ V$; SMD



**9 Typ. gate threshold voltage**

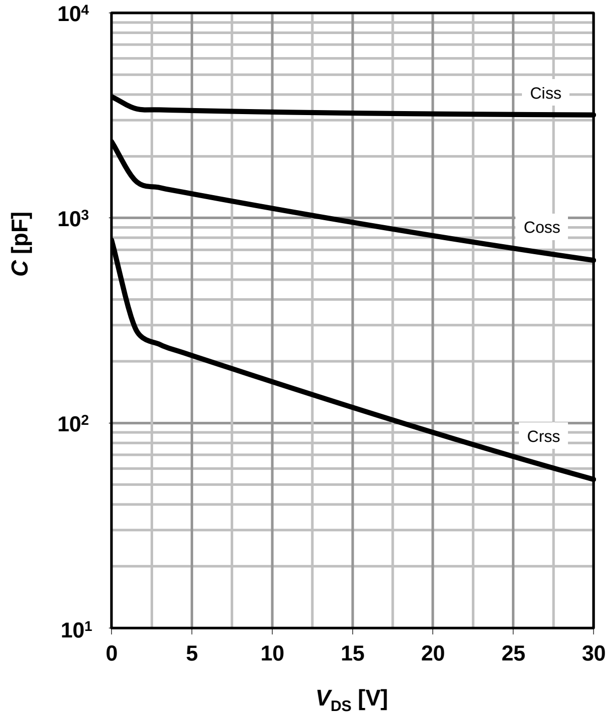
$V_{GS(th)} = f(T_j)$; $V_{GS} = V_{DS}$

parameter: $I_D$




**10 Typ. capacitances**

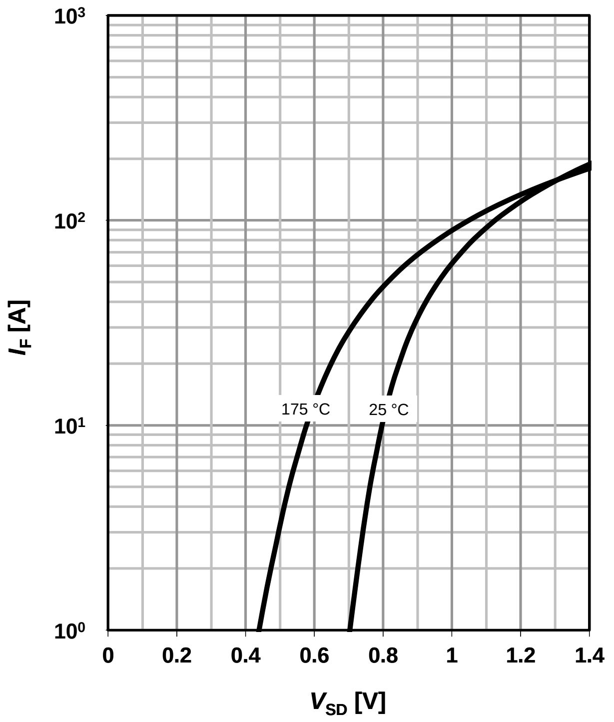
$C = f(V_{DS})$; $V_{GS} = 0$ V; $f = 1$ MHz




**11 Typical forward diode characteristics**

$IF = f(V_{SD})$

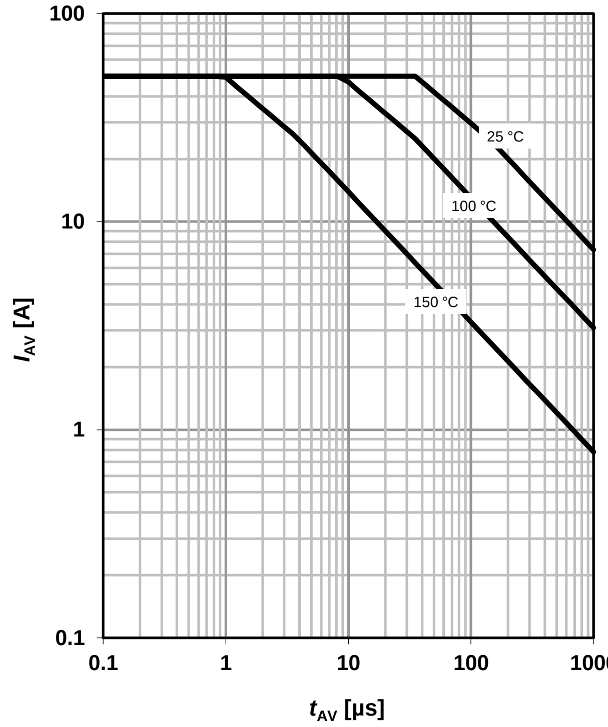
parameter: $T_j$




**12 Typ. avalanche characteristics**

$I_{AS} = f(t_{AV})$

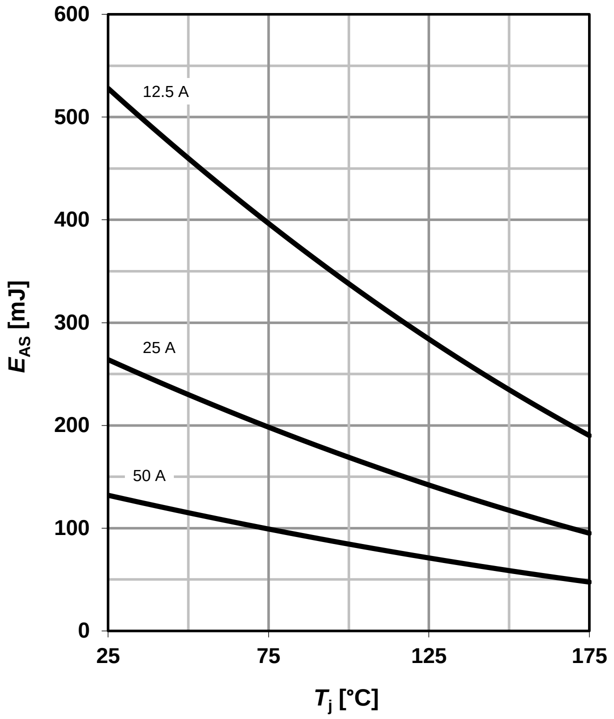
parameter: $T_{j(start)}$



**13 Typical avalanche energy**

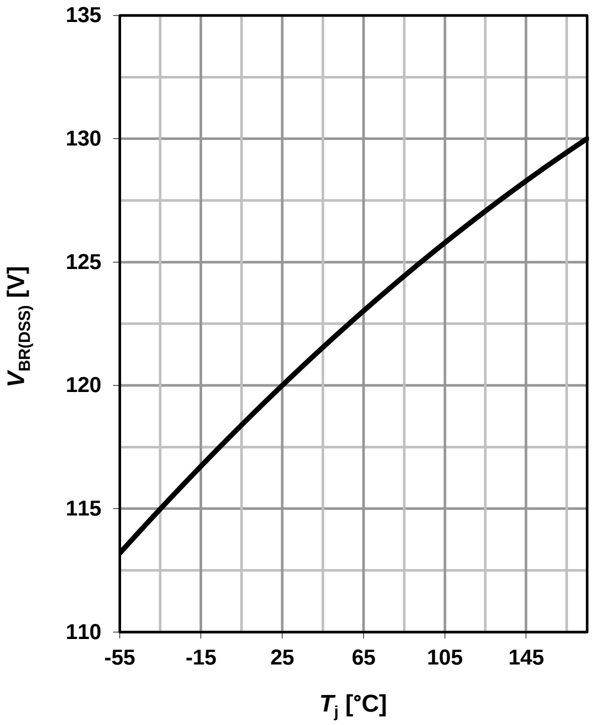
$E_{AS} = f(T_j)$

parameter: $I_D$




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

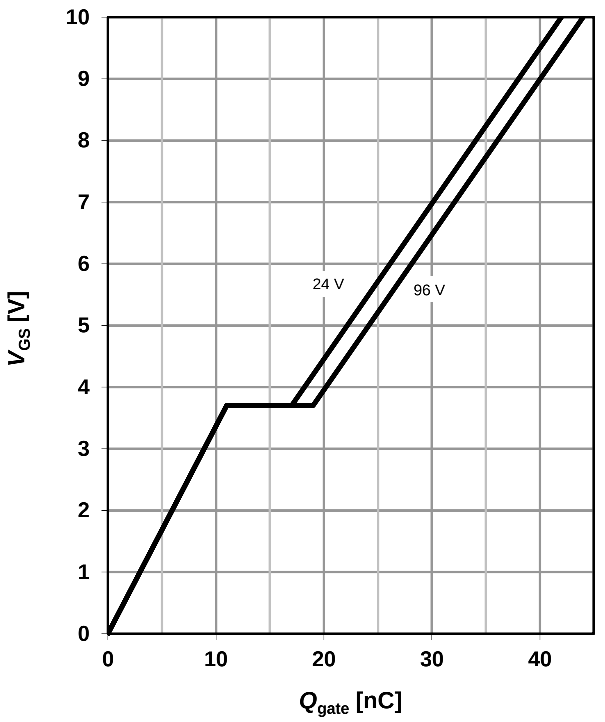
$V_{BR(DSS)} = f(T_j)$; $I_D = 1$ mA



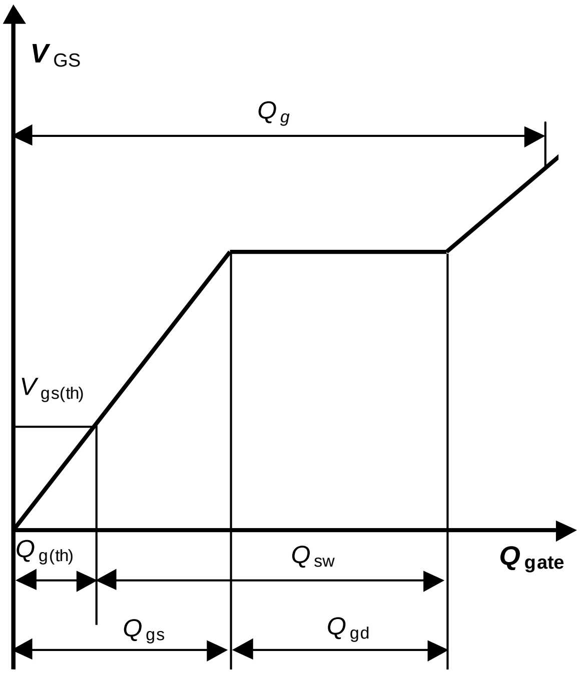

**15 Typ. gate charge**

$V_{GS} = f(Q_{gate})$; $I_D = 50$ A pulsed

parameter: $V_{DD}$




**16 Gate charge waveforms**



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Revision History

| **Version** | Date | Changes |
| --- | --- | --- |
| Revision 1.0 | 20.06.2016 | Final Data Sheet |