

**OptiMOS®-T2 Power-Transistor**

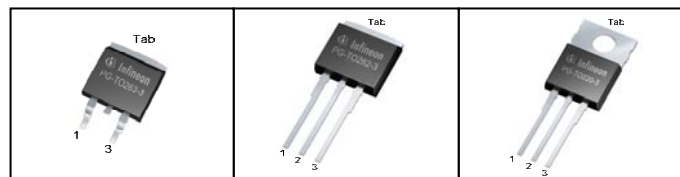
**Features**

- 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

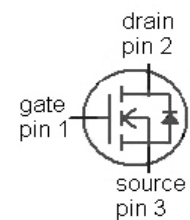
**Product Summary**

|                                |     |    |
|--------------------------------|-----|----|
| $V_{DS}$                       | 30  | V  |
| $R_{DS(on),max}$ (SMD version) | 3.4 | mΩ |
| $I_D$                          | 80  | A  |

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



| Type           | Package      | Marking |
|----------------|--------------|---------|
| IPB80N03S4L-03 | PG-TO263-3-2 | 4N03L03 |
| IPI80N03S4L-04 | PG-TO262-3-1 | 4N03L04 |
| IPP80N03S4L-04 | PG-TO220-3-1 | 4N03L04 |


**Maximum ratings, at  $T_j=25\text{ °C}$ , unless otherwise specified**

| Parameter                              | Symbol         | Conditions   | Value        | Unit |
|--|----------------|--|--------------|------|
| Continuous drain current <sup>1)</sup> | $I_D$          | $T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$          | 80           | A    |
|  |                | $T_C=100\text{ °C}$ ,<br>$V_{GS}=10\text{ V}^{2)}$ | 80           |      |
| Pulsed drain current <sup>2)</sup>     | $I_{D,pulse}$  | $T_C=25\text{ °C}$                                 | 320          |      |
| Avalanche energy, single pulse         | $E_{AS}$       | $I_D=80\text{ A}$                                  | 95           | mJ   |
| Avalanche current, single pulse        | $I_{AS}$       | $T_C=25\text{ °C}$                                 | 80           | A    |
| Gate source voltage                    | $V_{GS}$       | -  | ±16          | V    |
| Power dissipation                      | $P_{tot}$      | $T_C=25\text{ °C}$                                 | 94           | W    |
| Operating and storage temperature      | $T_j, T_{stg}$ | -  | -55 ... +175 | °C   |
| IEC climatic category; DIN IEC 68-1    | -              | -  | 55/175/56    |      |

| Parameter                                      | Symbol     | Conditions                                   | Values |      |      | Unit |
|--|------------|--|--------|------|------|------|
|  |            |  | min.   | typ. | max. |      |
| <b>Thermal characteristics<sup>2)</sup></b>    |            |  |        |      |      |      |
| Thermal resistance, junction - case            | $R_{thJC}$ | -  | -      | -    | 1.6  | K/W  |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | -  | -      | -    | 62   |      |
| SMD version, device on PCB                     | $R_{thJA}$ | minimal footprint                            | -      | -    | 62   |      |
|  |            | 6 cm <sup>2</sup> cooling area <sup>3)</sup> | -      | -    | 40   |      |

**Electrical characteristics, at  $T_j=25\text{ °C}$ , unless otherwise specified**

#### Static characteristics

|                                  |               |   |     |      |      |               |
|----------------------------------|---------------|---|-----|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                            | 30  | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=45\text{ }\mu\text{A}$                      | 1.0 | 1.6  | 2.2  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$       | -   | 0.01 | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$ | -   | 10   | 1000 |               |
|                                  |               | $V_{DS}=18\text{ V}, V_{GS}=0\text{ V}, T_j=85\text{ °C}^{2)}$  | -   | 5    | 60   |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=16\text{ V}, V_{DS}=0\text{ V}$                         | -   | 1    | 100  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=40\text{ A}$                          | -   | 3.9  | 5    | m $\Omega$    |
|                                  |               | $V_{GS}=4.5\text{ V}, I_D=40\text{ A},$<br>SMD version          | -   | 3.6  | 4.7  |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=80\text{ A}$                           | -   | 3.0  | 3.7  |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=80\text{ A},$<br>SMD version           | -   | 2.7  | 3.4  |               |

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

**Dynamic characteristics<sup>2)</sup>**

|                              |              |   |   |      |      |    |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$<br>$f=1\text{ MHz}$                    | - | 4000 | 5100 | pF |
| Output capacitance           | $C_{oss}$    |   | - | 1000 | 1300 |    |
| Reverse transfer capacitance | $C_{rss}$    |   | - | 53   | 100  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=80\text{ A}, R_G=3.5\ \Omega$ | - | 9    | -    | ns |
| Rise time                    | $t_r$        |   | - | 6    | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |   | - | 37   | -    |    |
| Fall time                    | $t_f$        |   | - | 7    | -    |    |

**Gate Charge Characteristics<sup>2)</sup>**

|                       |               |  |   |     |    |    |
|-----------------------|---------------|--|---|-----|----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=24\text{ V}, I_D=80\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 12  | 15 | nC |
| Gate to drain charge  | $Q_{gd}$      |  | - | 8   | 16 |    |
| Gate charge total     | $Q_g$         |  | - | 60  | 75 |    |
| Gate plateau voltage  | $V_{plateau}$ |  | - | 3.1 | -  | V  |

**Reverse Diode**

|  |               |   |     |     |     |    |
|--|---------------|---|-----|-----|-----|----|
| Diode continuous forward current <sup>2)</sup> | $I_S$         | $T_C=25\text{ }^\circ\text{C}$  | -   | -   | 80  | A  |
| Diode pulse current <sup>2)</sup>              | $I_{S,pulse}$ |   | -   | -   | 320 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=80\text{ A},$<br>$T_J=25\text{ }^\circ\text{C}$ | 0.6 | 0.9 | 1.3 | V  |
| Reverse recovery time <sup>2)</sup>            | $t_{rr}$      | $V_R=15\text{ V}, I_F=I_S,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$       | -   | 60  | -   | ns |
| Reverse recovery charge <sup>2)</sup>          | $Q_{rr}$      |   | -   | 50  | -   |    |

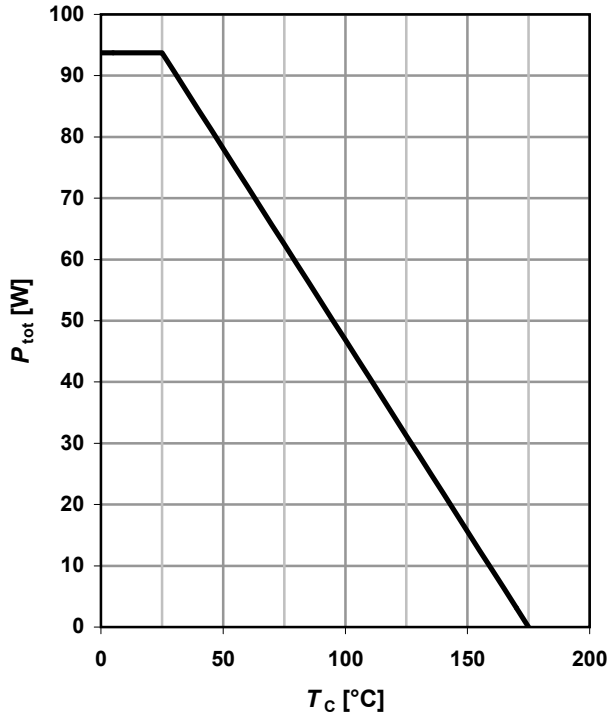
<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 1.6\text{K/W}$  the chip is able to carry 128A at 25°C.

<sup>2)</sup> Defined by design. Not subject to production test.

<sup>3)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

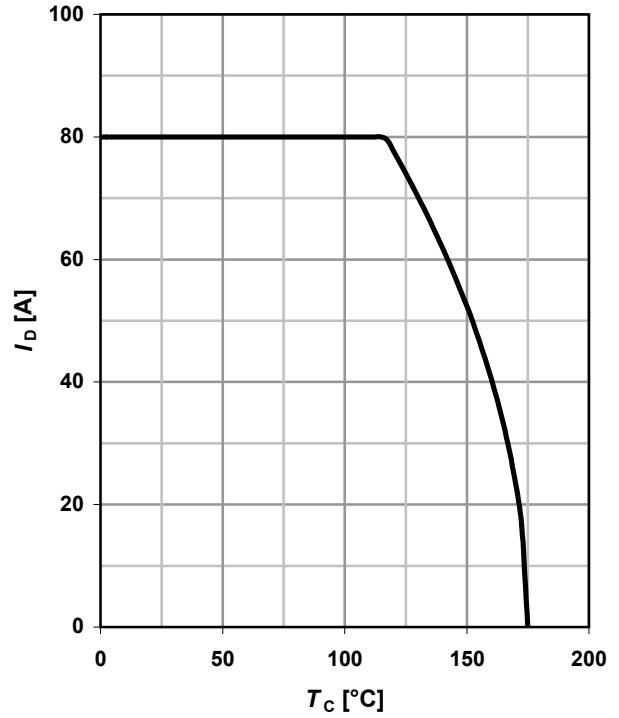
**1 Power dissipation**

$P_{tot} = f(T_C); V_{GS} \geq 6 V$



**2 Drain current**

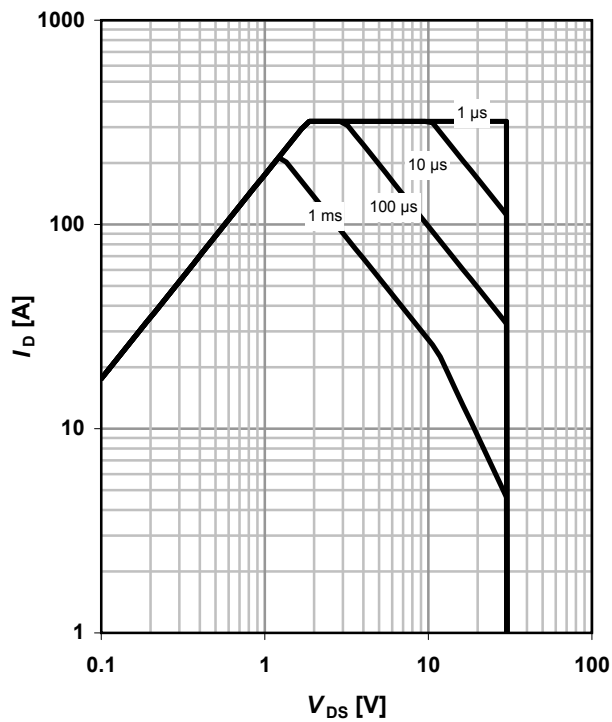
$I_D = f(T_C); V_{GS} \geq 6 V; SMD$



**3 Safe operating area**

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

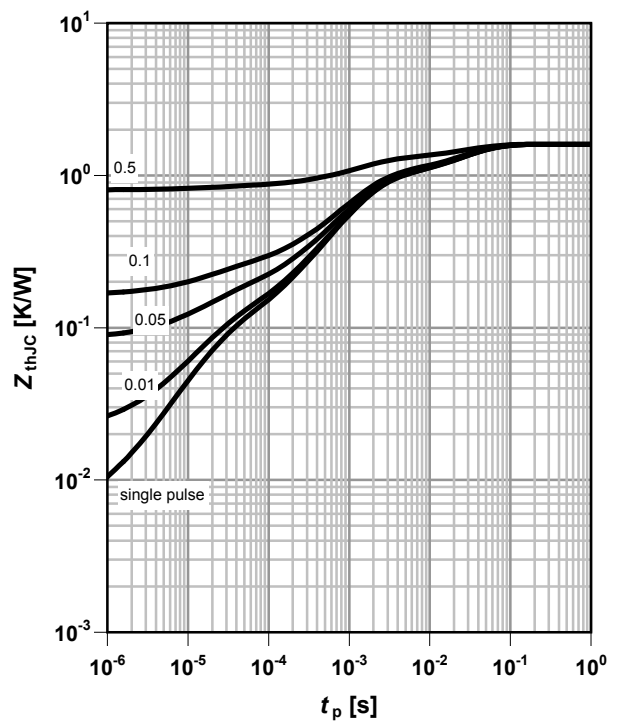
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

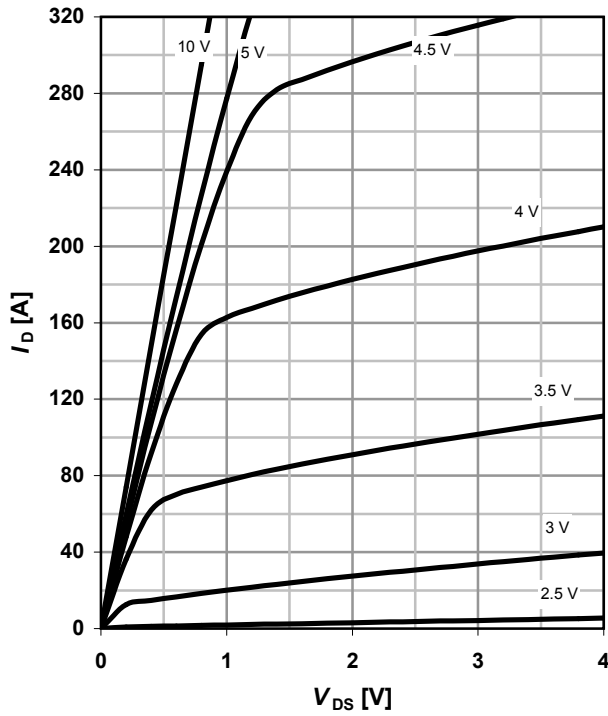
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

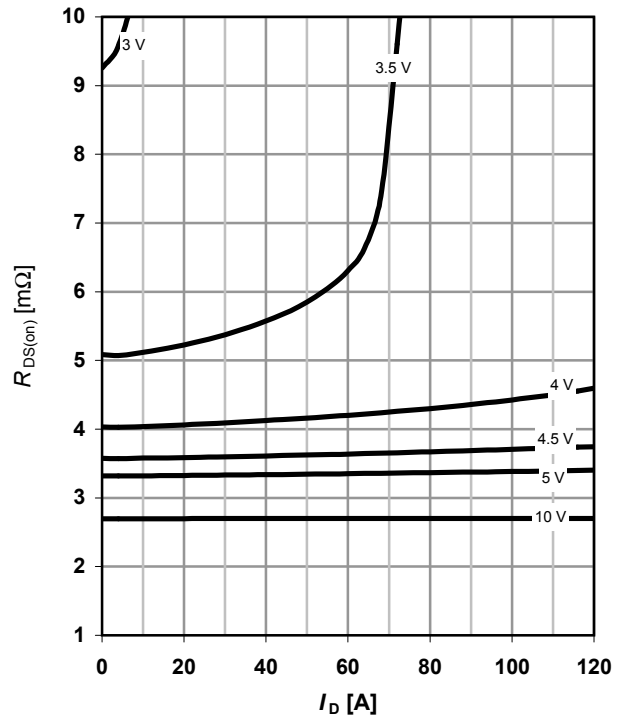
parameter:  $V_{GS}$



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

$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}, \text{SMD}$

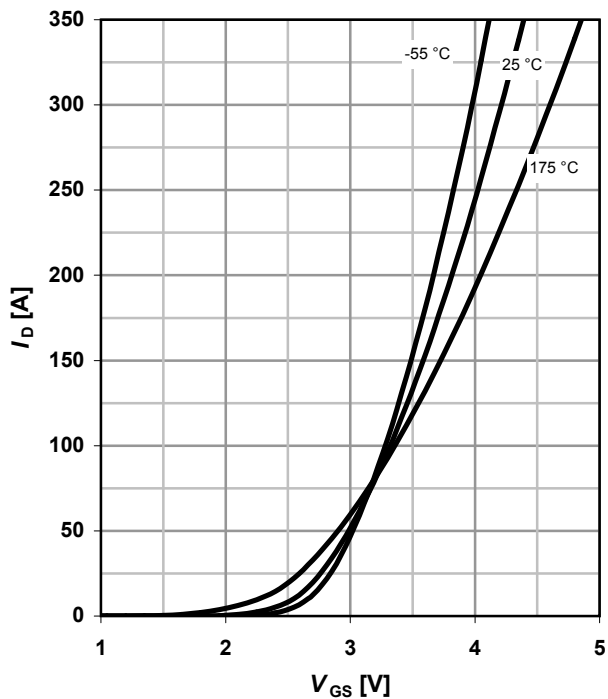
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

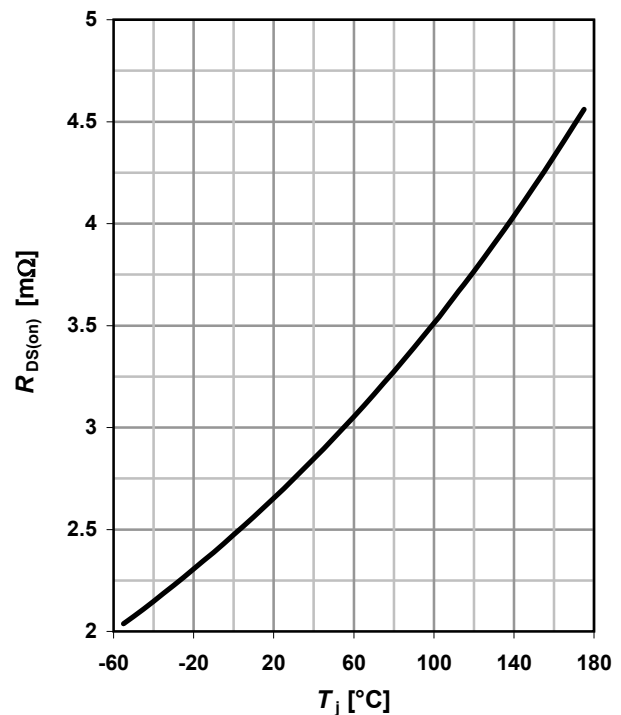
$I_D = f(V_{GS}); V_{DS} = 6\text{V}$

parameter:  $T_j$



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

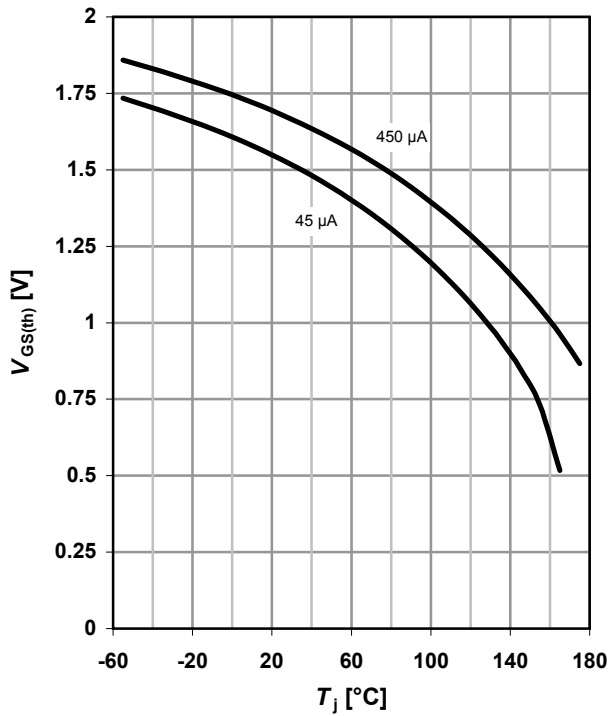
$R_{DS(on)} = f(T_j); I_D = 80\text{ A}; V_{GS} = 10\text{ V}, \text{SMD}$



**9 Typ. gate threshold voltage**

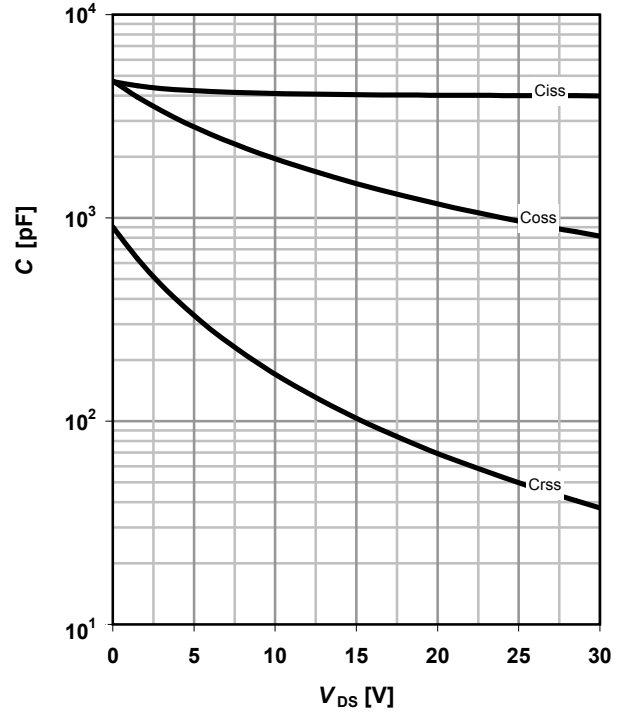
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

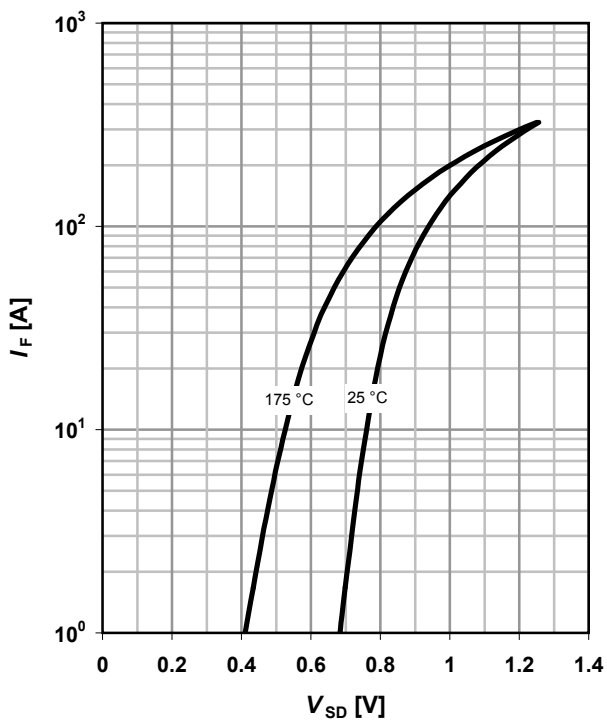
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**11 Typical forward diode characteristics**

$I_F = f(V_{SD})$

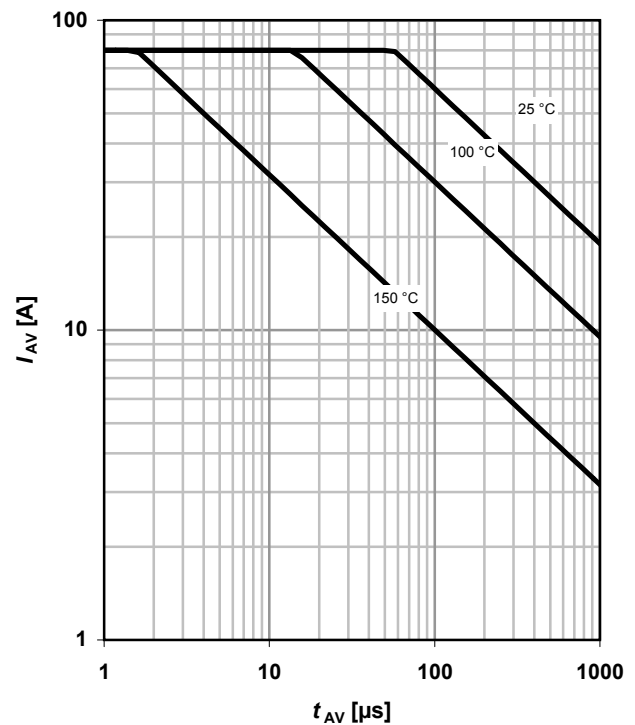
parameter:  $T_j$



**12 Typ. avalanche characteristics**

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

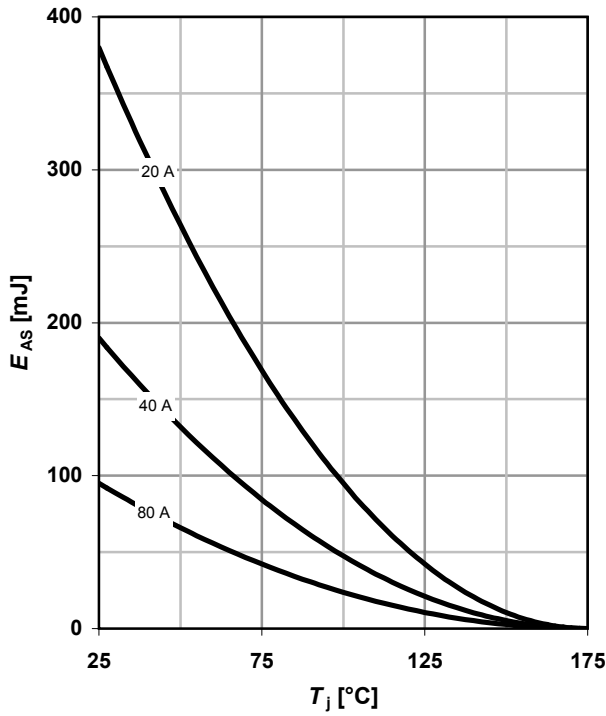
parameter:  $T_{j(start)}$



**13 Typical avalanche energy**

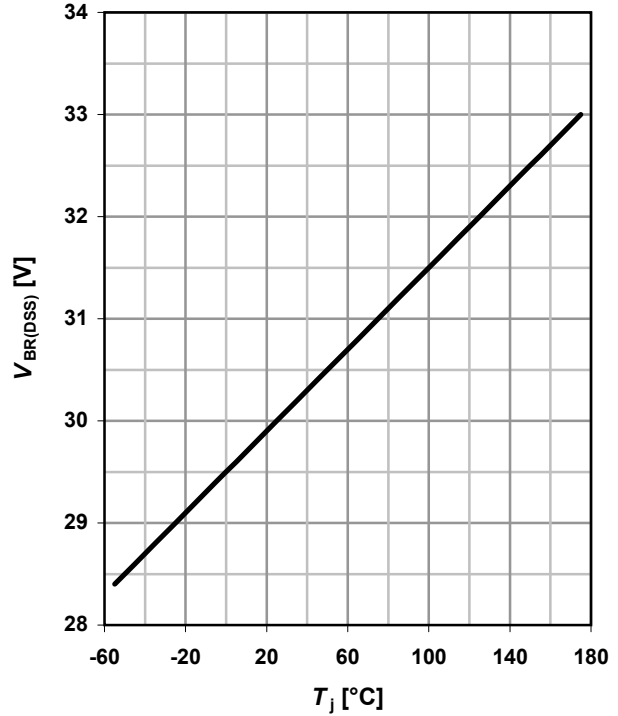
$E_{AS} = f(T_j)$

parameter:  $I_D$



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

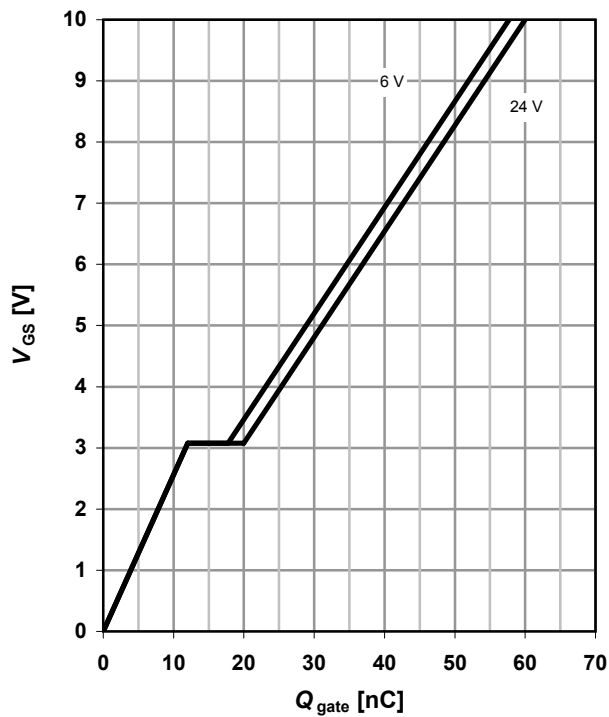
$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$



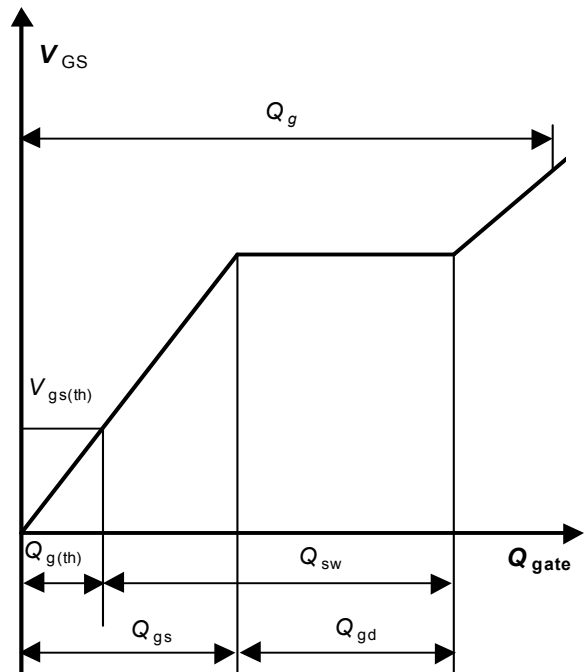
**15 Typ. gate charge**

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

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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## Revision History

| Version | Date       | Changes          |
|---------|------------|------------------|
| Rev 2.0 | 09.03.2007 | Final data sheet |
| Rev 2.1 | 08.03.2010 | Update of RDSon  |

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