

**OptiMOS™-T Power-Transistor**

**Features**

- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested

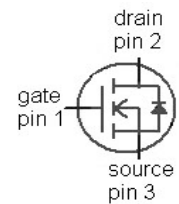
**Product Summary**

|                                |      |    |
|--------------------------------|------|----|
| $V_{DS}$                       | 100  | V  |
| $R_{DS(on),max}$ (SMD version) | 15.4 | mΩ |
| $I_D$                          | 50   | A  |

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



| Type           | Package      | Marking |
|----------------|--------------|---------|
| IPB50N10S3L-16 | PG-TO263-3-2 | 3N10L16 |
| IPI50N10S3L-16 | PG-TO262-3-1 | 3N10L16 |
| IPP50N10S3L-16 | PG-TO220-3-1 | 3N10L16 |


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

| Parameter                                    | Symbol            | Conditions   | Value        | Unit |
|--|-------------------|--|--------------|------|
| Continuous drain current                     | $I_D$             | $T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$          | 50           | A    |
|  |                   | $T_C=100\text{ °C}$ ,<br>$V_{GS}=10\text{ V}^{1)}$ | 37           |      |
| Pulsed drain current <sup>1)</sup>           | $I_{D,pulse}$     | $T_C=25\text{ °C}$                                 | 200          |      |
| Avalanche energy, single pulse <sup>1)</sup> | $E_{AS}$          | $I_D=25\text{ A}$                                  | 330          | mJ   |
| Avalanche current, single pulse              | $I_{AS}$          |  | 50           | A    |
| Gate source voltage <sup>2)</sup>            | $V_{GS}$          |  | ±20          | V    |
| Power dissipation                            | $P_{tot}$         | $T_C=25\text{ °C}$                                 | 100          | 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>1)</sup></b>    |            |  |        |      |      |      |
| 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 <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   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                            | 100 | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=60\mu\text{A}$                              | 1.2 | 1.7  | 2.4  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$       | -   | 0.01 | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$ | -   | 1    | 100  |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=16\text{ V}, V_{DS}=0\text{ V}$                         | -   | -    | 100  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=50\text{ A}$                          | -   | 16.1 | 20.9 | m $\Omega$    |
|                                  |               | $V_{GS}=4.5\text{ V}, I_D=50\text{ A},$<br>SMD version          | -   | 15.8 | 20.6 |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=50\text{ A}$                           | -   | 13.1 | 15.7 |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=50\text{ A},$<br>SMD version           | -   | 12.8 | 15.4 |               |

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

### Dynamic characteristics<sup>1)</sup>

|                              |              |   |   |      |      |    |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=25V,$<br>$f=1MHz$                  | - | 3215 | 4180 | pF |
| Output capacitance           | $C_{oss}$    |   | - | 730  | 949  |    |
| Reverse transfer capacitance | $C_{rss}$    |   | - | 63   | 95   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=20V, V_{GS}=10V,$<br>$I_D=50A, R_G=3.5\Omega$ | - | 10   | -    | ns |
| Rise time                    | $t_r$        |   | - | 5    | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |   | - | 28   | -    |    |
| Fall time                    | $t_f$        |   | - | 5    | -    |    |

### Gate Charge Characteristics<sup>1)</sup>

|                       |               |  |   |     |    |    |
|-----------------------|---------------|--|---|-----|----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=80V, I_D=70A,$<br>$V_{GS}=0\text{ to }10V$ | - | 9   | 12 | nC |
| Gate to drain charge  | $Q_{gd}$      |  | - | 8   | 12 |    |
| Gate charge total     | $Q_g$         |  | - | 49  | 64 |    |
| Gate plateau voltage  | $V_{plateau}$ |  | - | 3.7 | -  | V  |

### Reverse Diode

|  |               |   |     |     |     |    |
|--|---------------|---|-----|-----|-----|----|
| Diode continuous forward current <sup>1)</sup> | $I_S$         | $T_C=25^\circ C$                            | -   | -   | 50  | A  |
| Diode pulse current <sup>1)</sup>              | $I_{S,pulse}$ |   | -   | -   | 200 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0V, I_F=50A,$<br>$T_J=25^\circ C$   | 0.6 | 1   | 1.2 | V  |
| Reverse recovery time <sup>1)</sup>            | $t_{rr}$      | $V_R=50V, I_F=I_S,$<br>$di_F/dt=100A/\mu s$ | -   | 80  | -   | ns |
| Reverse recovery charge <sup>1)</sup>          | $Q_{rr}$      |   | -   | 185 | -   | nC |

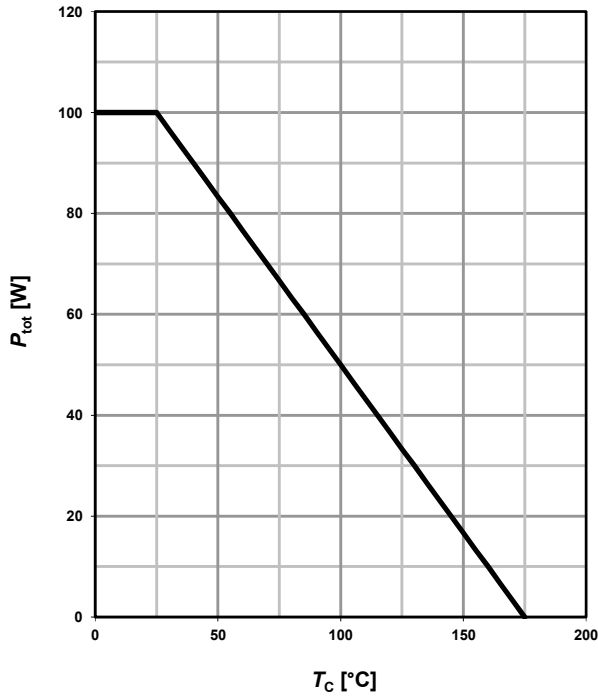
<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</sup> -5V to -20V for max. 168 non-consecutive hours.

<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.

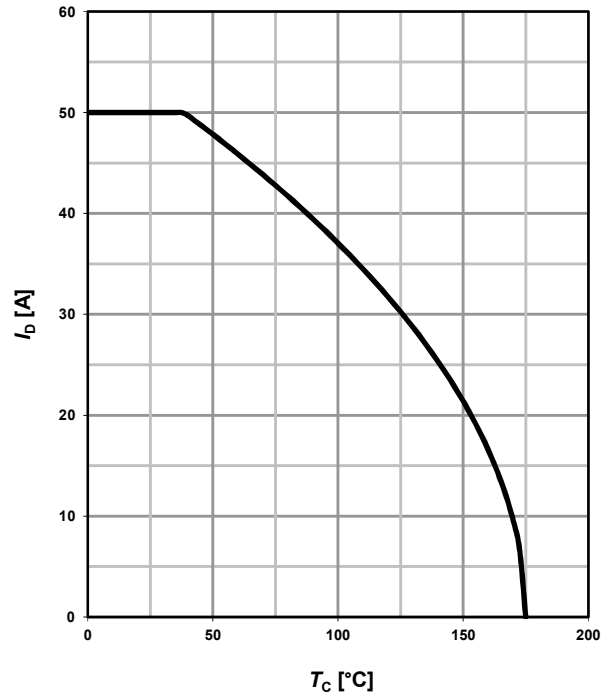
**1 Power dissipation**

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



**2 Drain current**

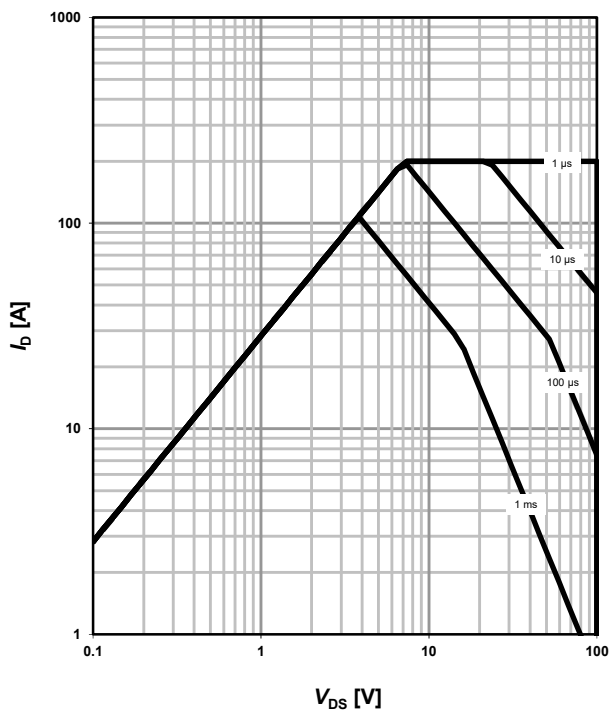
$I_D = f(T_C); V_{GS} \geq 6 V; SMD$



**3 Safe operating area**

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

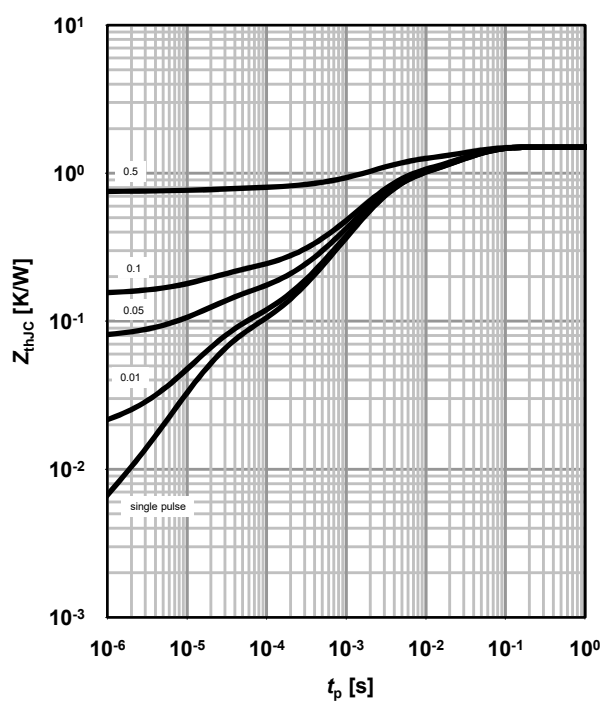
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

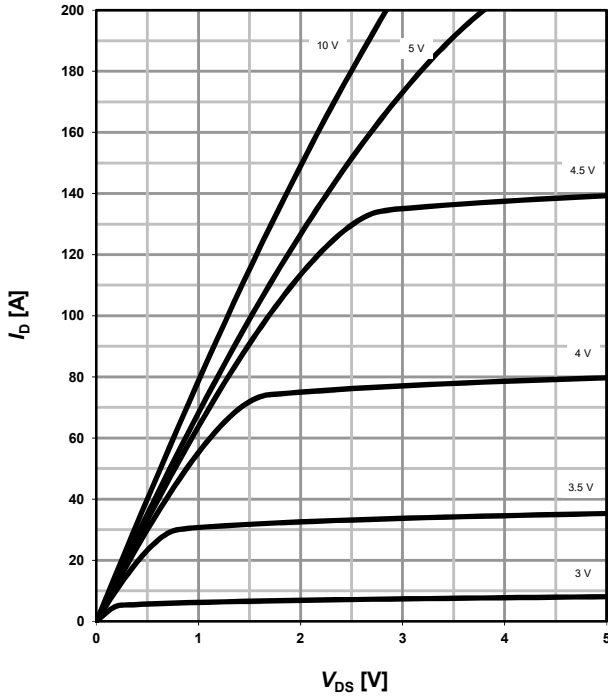
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

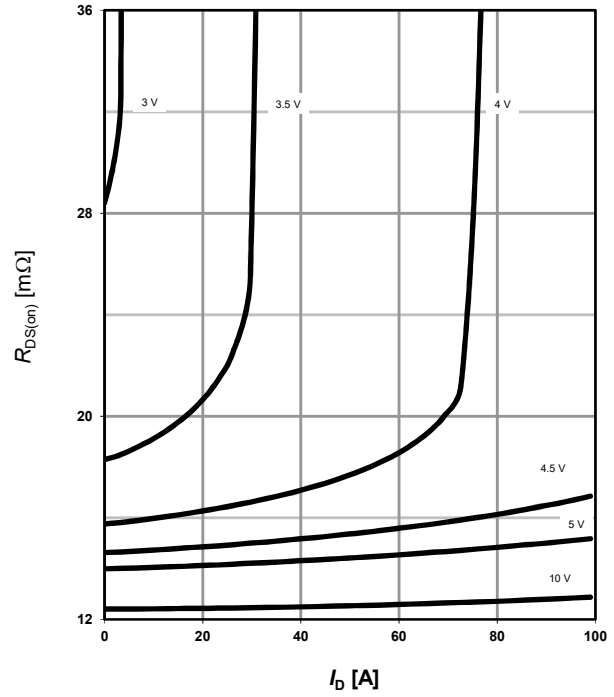
parameter:  $V_{GS}$



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

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

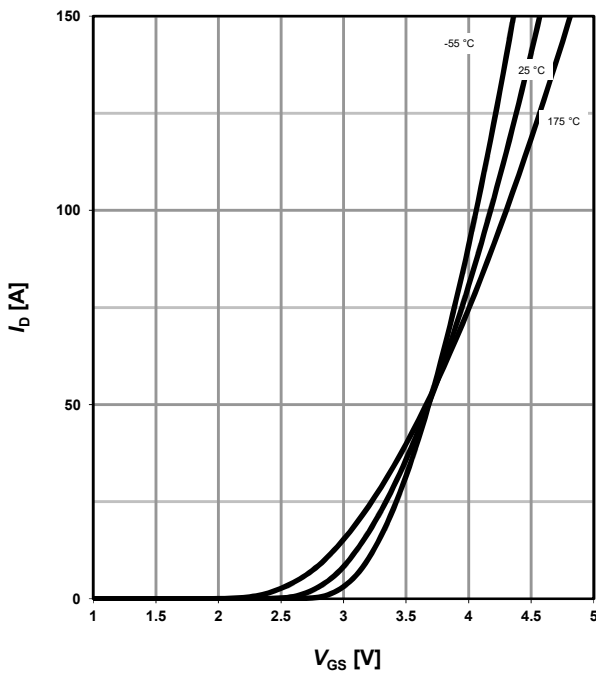
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

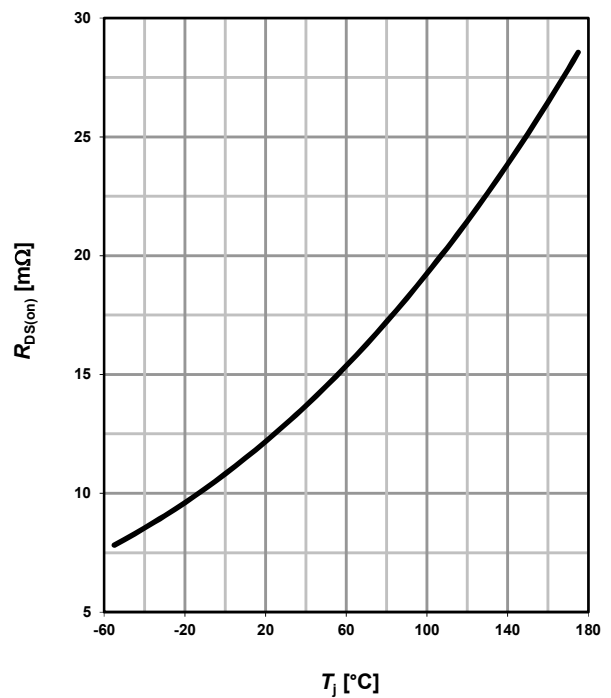
parameter:  $T_j$



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

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

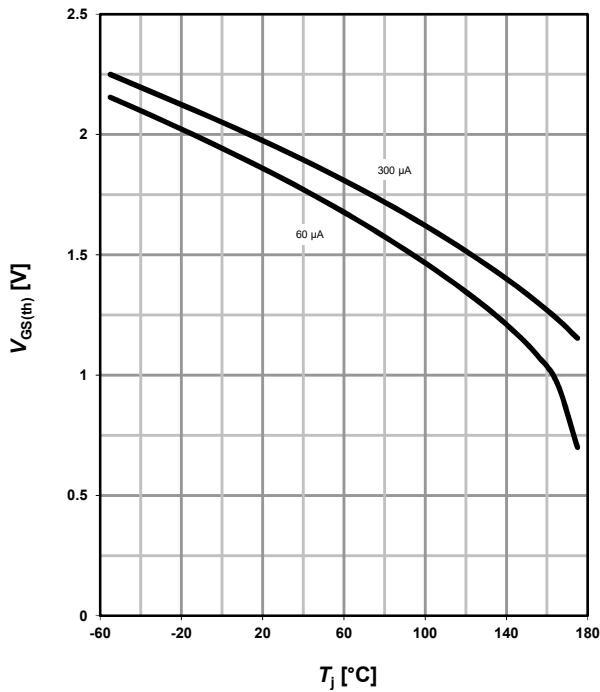
$\alpha = 0.56$



**9 Typ. gate threshold voltage**

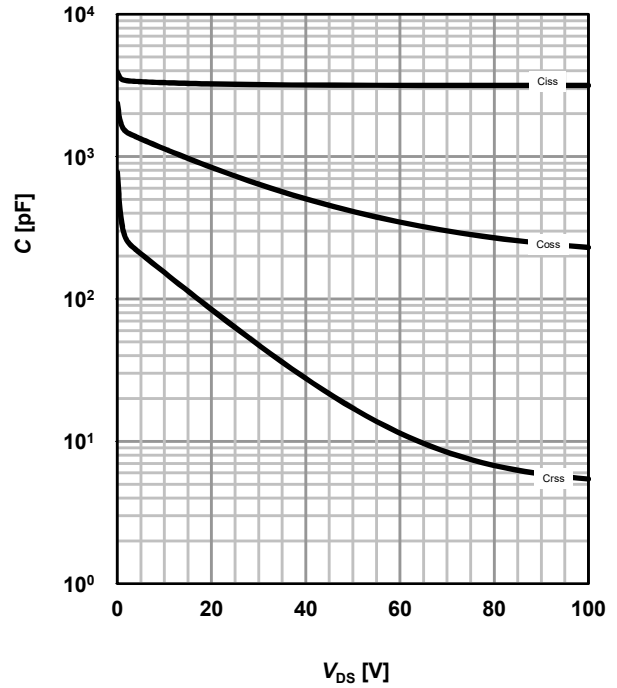
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

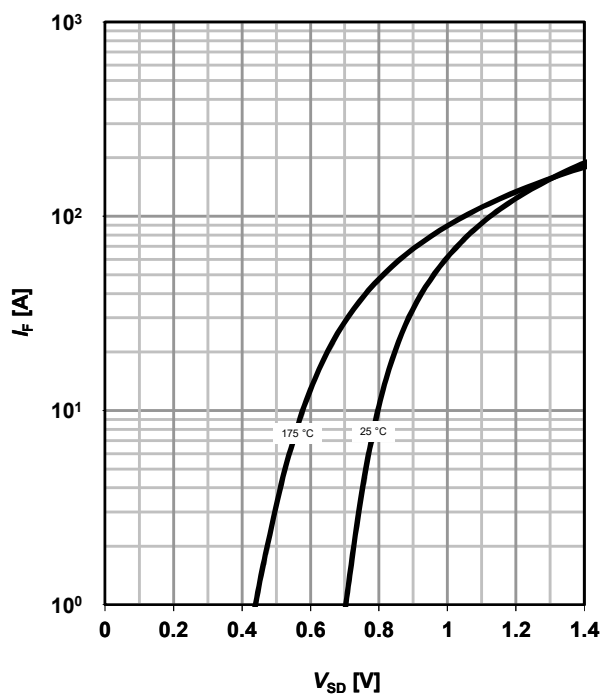
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**11 Typical forward diode characteristics**

$I_F = f(V_{SD})$

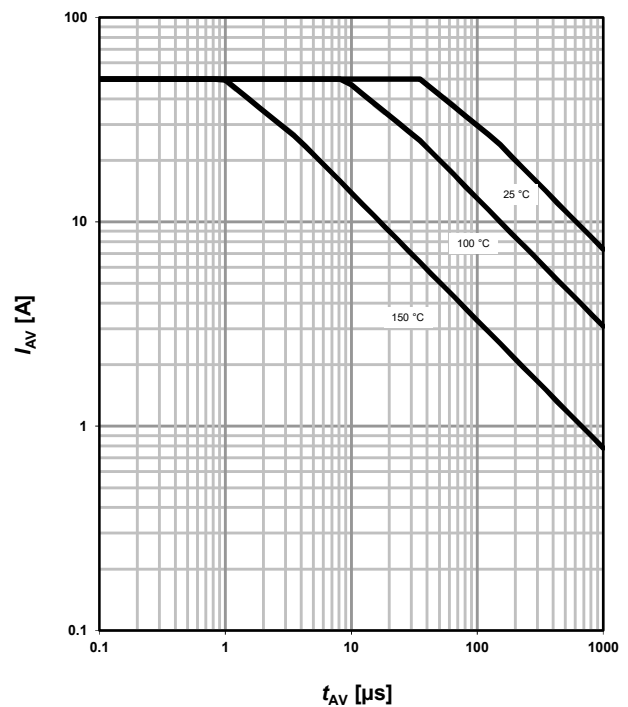
parameter:  $T_j$



**12 Typ. avalanche characteristics**

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

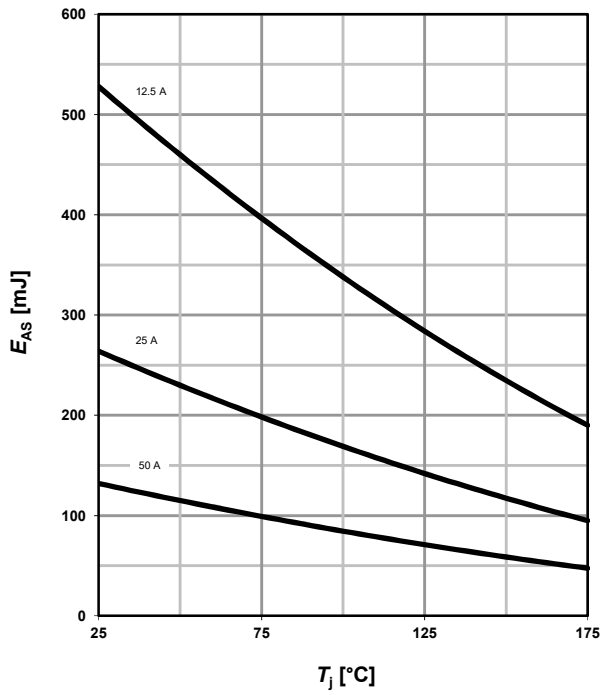
parameter:  $T_{j(start)}$



**13 Typical avalanche energy**

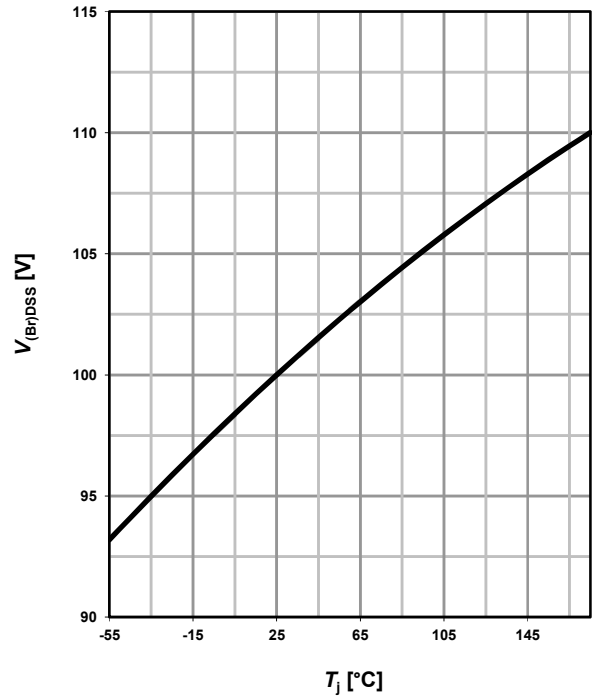
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



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

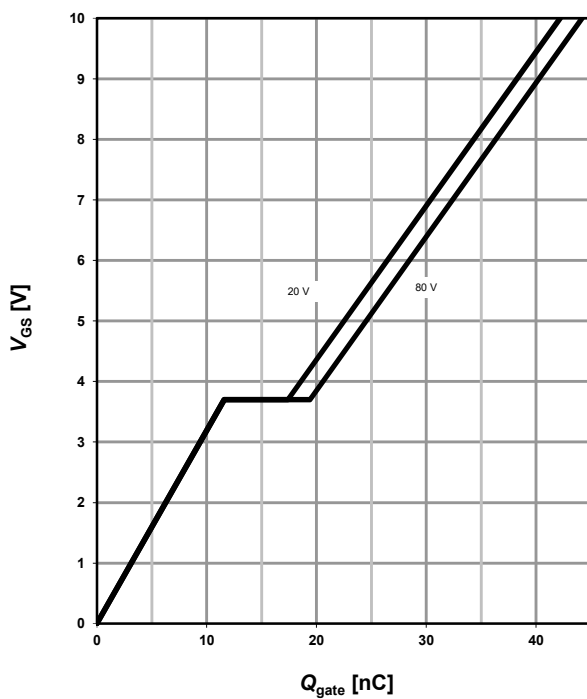
$$V_{(BR)DSS} = f(T_j); I_D = 1 \text{ mA}$$



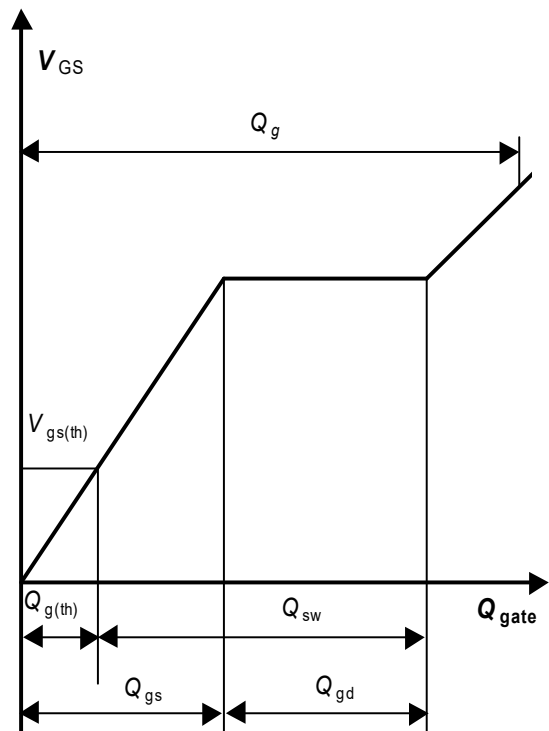
**15 Typ. gate charge**

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

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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Revision History

| Version | Date       | Changes  |
|---------|------------|--|
| Rev 1.1 | 2008-04-09 | Page 1: $E_{AS}$ changed from 264mJ to 330mJ                                   |
|         |            | Page 1: $V_{GS}$ changed from $\pm 16V$ to $\pm 20V$                           |
|         |            | Page 3: Footnote <sup>2)</sup> added   |
| Rev 1.2 | 2023-06-15 | Diagram 8 Typ. drain-source on-state resistance: used $\alpha$ value clarified |
| Rev 1.2 | 2023-06-15 | Ratings of Gate Source Voltage $V_{GS}$ refined in footnote <sup>2)</sup>      |
| Rev 1.2 | 2023-06-15 | Corrected diagram 3 safe operating area  |
| Rev 1.2 | 2023-06-15 | Corrected diagram 10 typical capacitances                                      |