

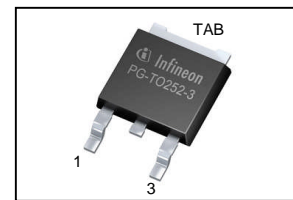
**OptiMOS™-T2 Power-Transistor**

**Features**

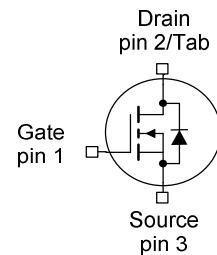
- N-channel - Enhancement mode
- AEC qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green Product (RoHS compliant)
- 100% Avalanche tested

**Product Summary**

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 100 | V  |
| $R_{DS(on),max}$ | 12  | mΩ |
| $I_D$            | 60  | A  |

**PG-TO252-3-313**


| Type           | Package        | Marking |
|----------------|----------------|---------|
| IPD60N10S4L-12 | PG-TO252-3-313 | 4N10L12 |


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

| Parameter                                    | Symbol            | Conditions                                     | Value        | Unit |
|--|-------------------|--|--------------|------|
| Continuous drain current                     | $I_D$             | $T_C=25\text{ °C}$ , $V_{GS}=10\text{V}$       | 60           | A    |
|  |                   | $T_C=100\text{ °C}$ , $V_{GS}=10\text{V}^{1)}$ | 43           |      |
| Pulsed drain current <sup>1)</sup>           | $I_{D,pulse}$     | $T_C=25\text{ °C}$                             | 240          |      |
| Avalanche energy, single pulse <sup>1)</sup> | $E_{AS}$          | $I_D=30\text{A}$                               | 120          | mJ   |
| Avalanche current, single pulse              | $I_{AS}$          | -  | 40           | 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>1)</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>2)</sup> | -      | -    | 40   |      |

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

#### Static characteristics

|                                  |               |  |     |      |     |            |
|----------------------------------|---------------|--|-----|------|-----|------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=1mA$                         | 100 | -    | -   | V          |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=46\mu A$                 | 1.1 | 1.6  | 2.1 |            |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=100V, V_{GS}=0V$                     | -   | 0.01 | 1   | $\mu A$    |
|                                  |               | $V_{DS}=100V, V_{GS}=0V, T_j=125^\circ C^2)$ | -   | 1    | 100 |            |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20V, V_{DS}=0V$                      | -   | -    | 100 | nA         |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5V, I_D=30A$                       | -   | 12.3 | 15  | m $\Omega$ |
|                                  |               | $V_{GS}=10V, I_D=60A$                        | -   | 9.8  | 12  |            |

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

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

|                              |              |   |   |      |      |    |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=25V,$<br>$f=1MHz$                  | - | 2440 | 3170 | pF |
| Output capacitance           | $C_{oss}$    |   | - | 824  | 1070 |    |
| Reverse transfer capacitance | $C_{rss}$    |   | - | 77   | 155  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=50V, V_{GS}=10V,$<br>$I_D=60A, R_G=3.5\Omega$ | - | 4    | -    | ns |
| Rise time                    | $t_r$        |   | - | 3    | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |   | - | 20   | -    |    |
| Fall time                    | $t_f$        |   | - | 21   | -    |    |

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

|                       |               |   |   |     |    |    |
|-----------------------|---------------|---|---|-----|----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=80V, I_D=60A,$<br>$V_{GS}=0$ to 10V | - | 8   | 10 | nC |
| Gate to drain charge  | $Q_{gd}$      |   | - | 9   | 18 |    |
| Gate charge total     | $Q_g$         |   | - | 38  | 49 |    |
| Gate plateau voltage  | $V_{plateau}$ |   | - | 3.5 | -  | V  |

**Reverse Diode**

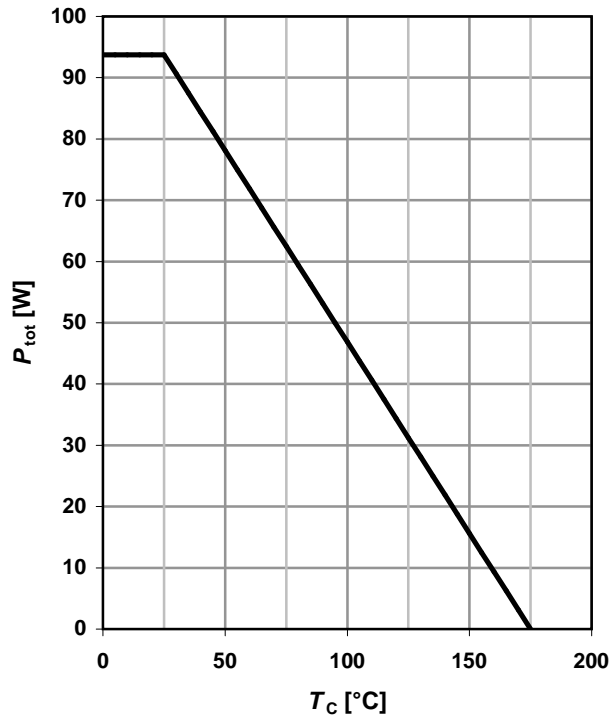
|  |               |   |   |     |     |    |
|--|---------------|---|---|-----|-----|----|
| Diode continuous forward current <sup>1)</sup> | $I_S$         | $T_C=25^\circ C$                            | - | -   | 60  | A  |
| Diode pulse current <sup>1)</sup>              | $I_{S,pulse}$ |   | - | -   | 240 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0V, I_F=60A,$<br>$T_j=25^\circ C$   | - | 1.0 | 1.3 | V  |
| Reverse recovery time <sup>1)</sup>            | $t_{rr}$      | $V_R=50V, I_F=50A,$<br>$di_F/dt=100A/\mu s$ | - | 70  | -   | ns |
| Reverse recovery charge <sup>1)</sup>          | $Q_{rr}$      |   | - | 150 | -   | nC |

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

<sup>2)</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.

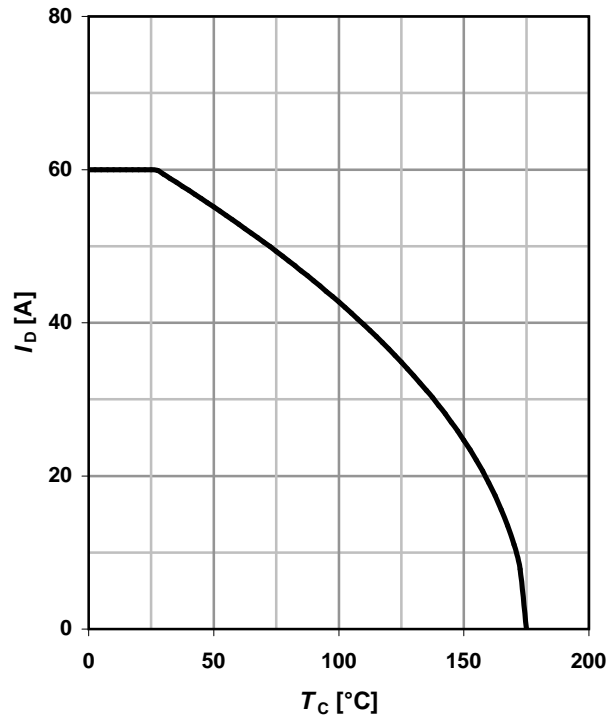
**1 Power dissipation**

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



**2 Drain current**

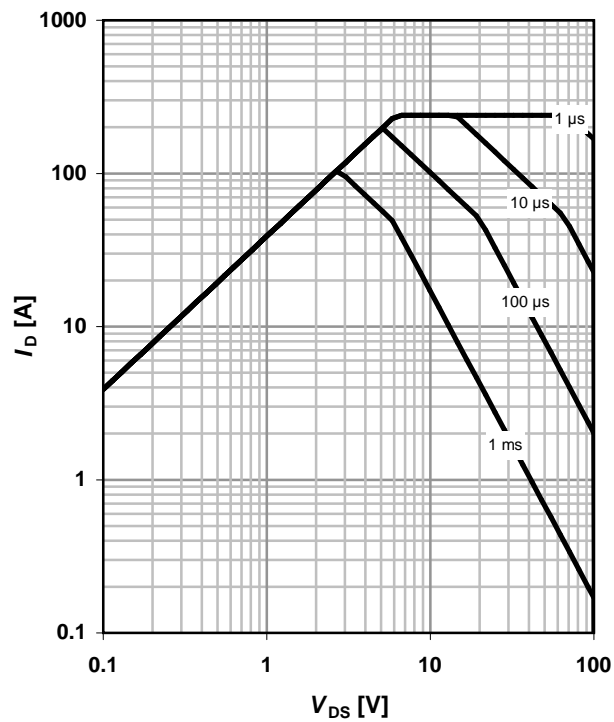
$I_D = f(T_C); V_{GS} \geq 6 V$



**3 Safe operating area**

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

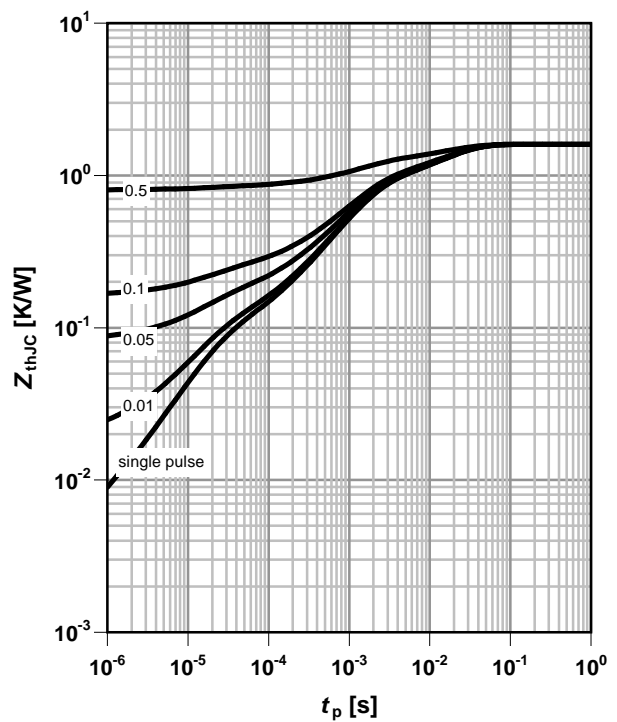
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

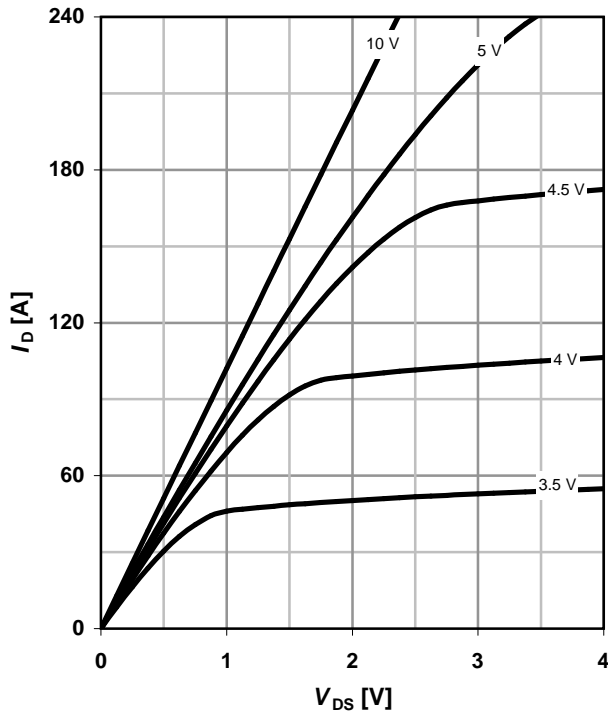
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

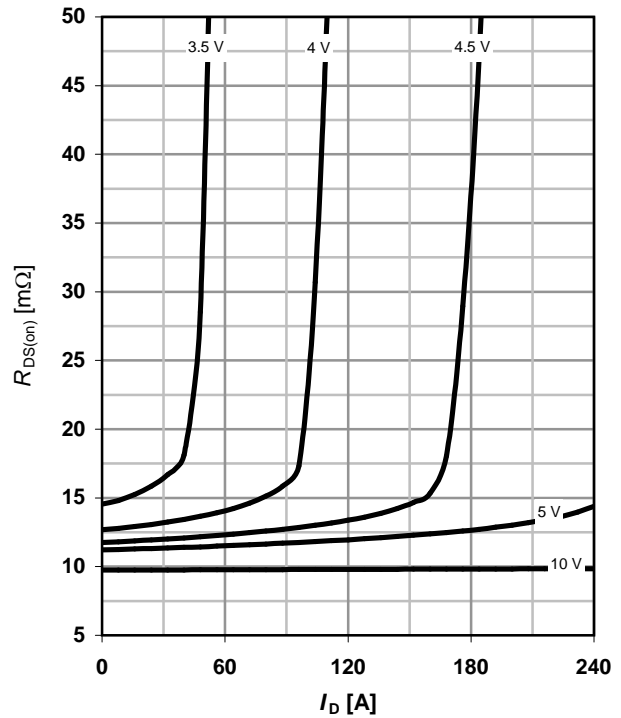
parameter:  $V_{GS}$



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

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

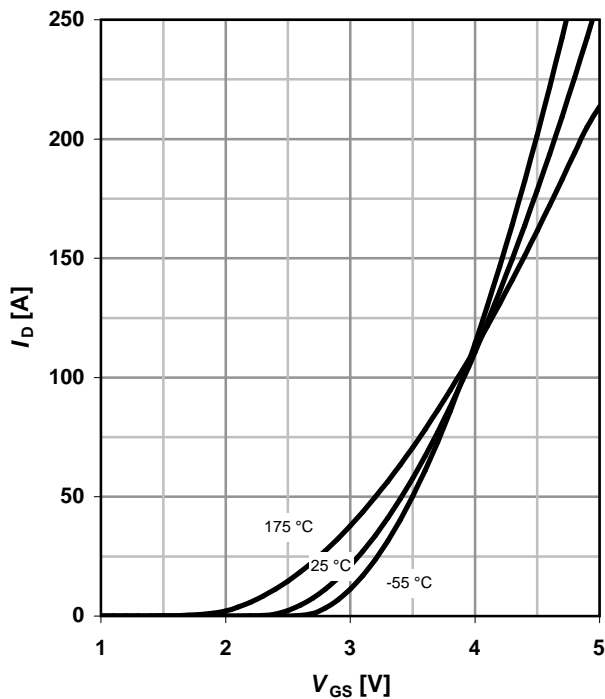
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

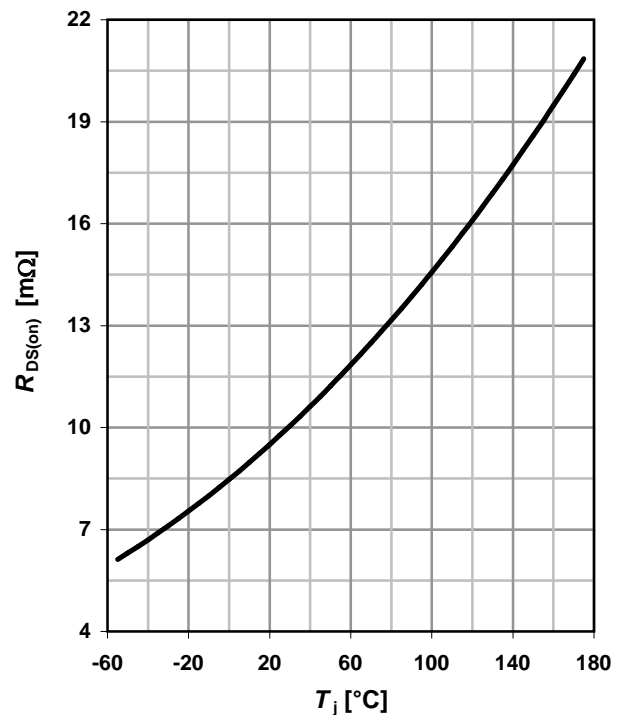
$I_D = f(V_{GS}); V_{DS} = 6\text{ V}$

parameter:  $T_j$



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

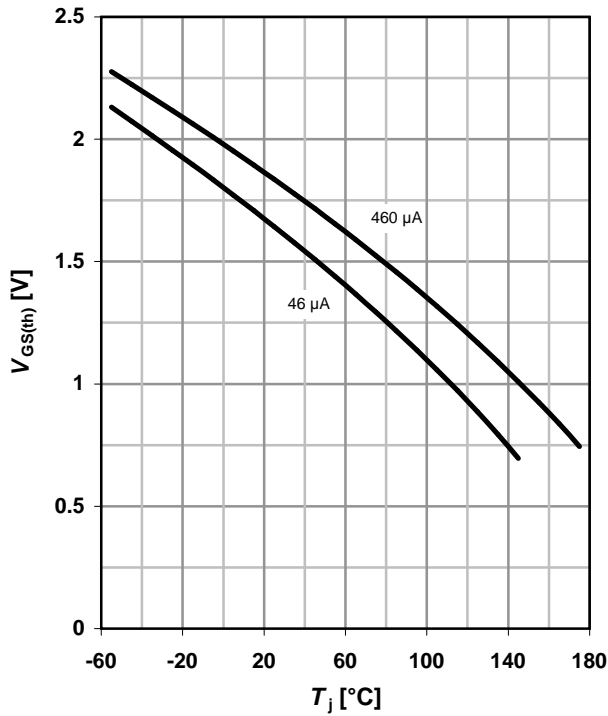
$R_{DS(on)} = f(T_j); I_D = 60\text{ A}; V_{GS} = 10\text{ V}$



**9 Typ. gate threshold voltage**

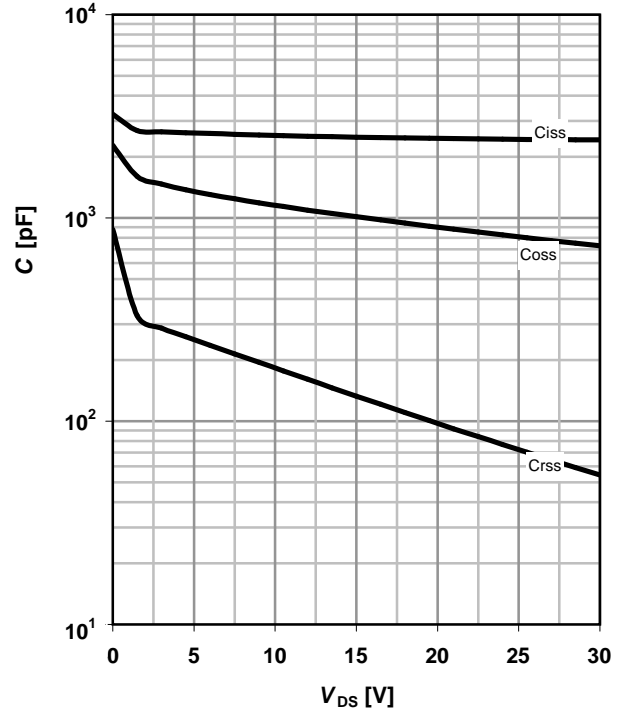
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

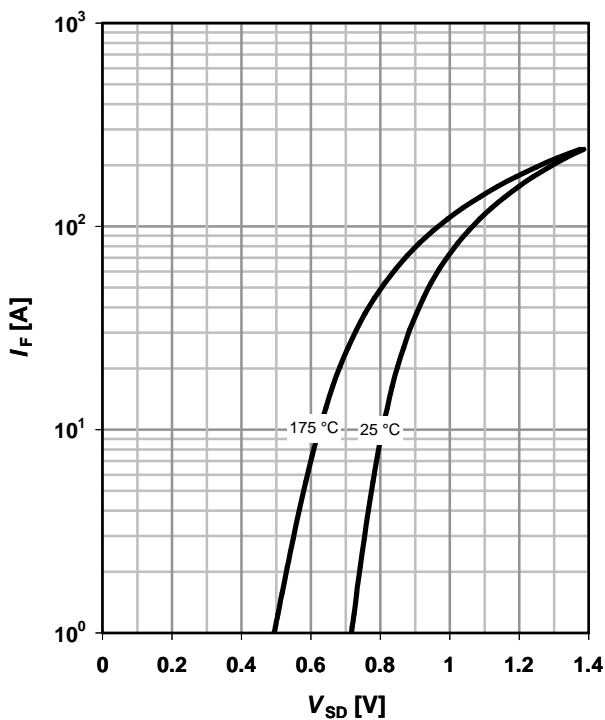
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**11 Typical forward diode characteristics**

$I_F = f(V_{SD})$

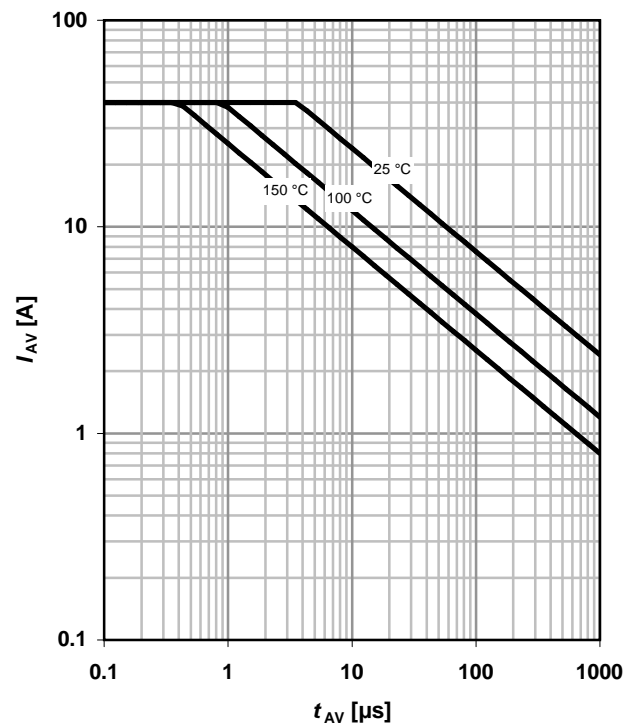
parameter:  $T_j$



**12 Avalanche characteristics**

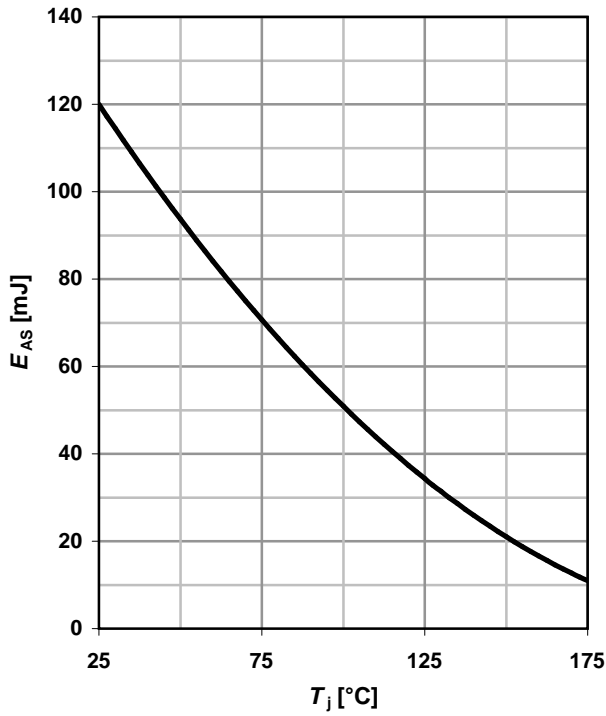
$I_{AS} = f(t_{AV})$

parameter:  $T_{j(start)}$



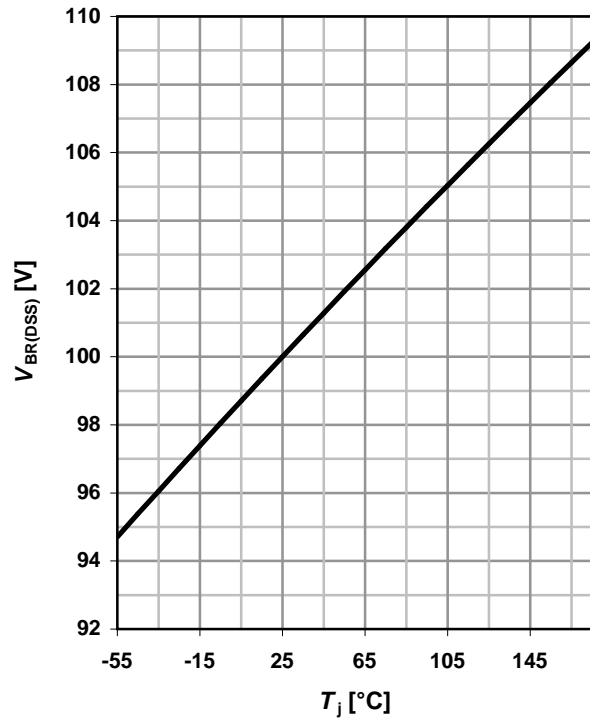
**13 Avalanche energy**

$E_{AS} = f(T_j); I_D = 40 \text{ A}$



**14 Drain-source breakdown voltage**

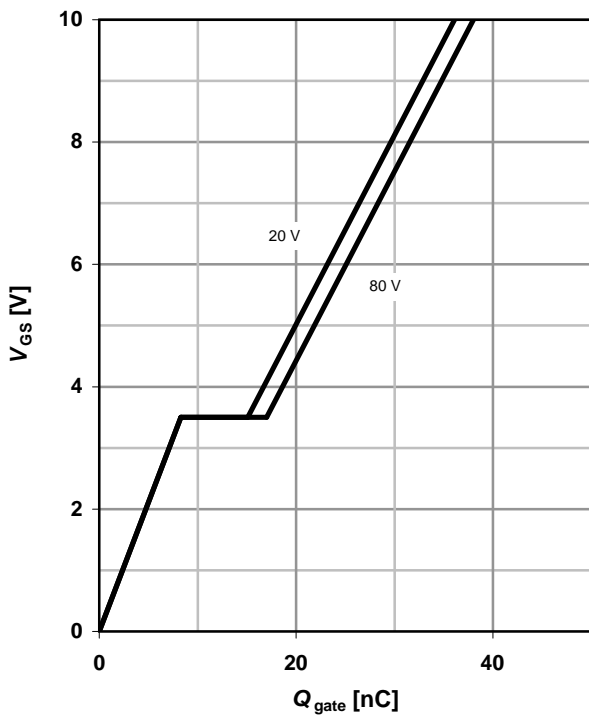
$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$



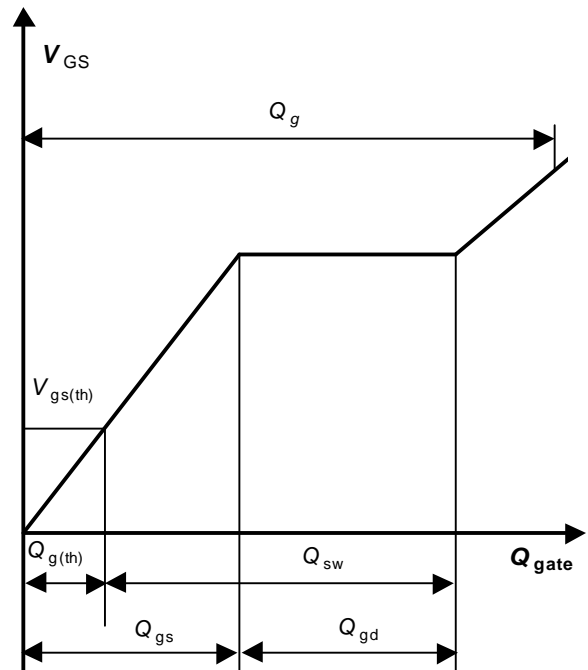
**15 Typ. gate charge**

$V_{GS} = f(Q_{gate}); I_D = 60 \text{ A pulsed}$

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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