

OptiMOS[®] -T Power-Transistor



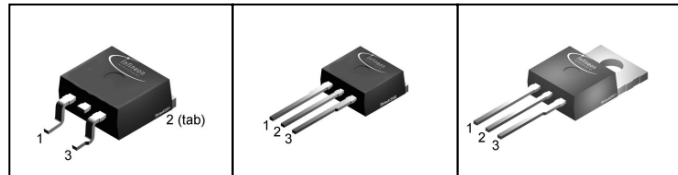
Features

- 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

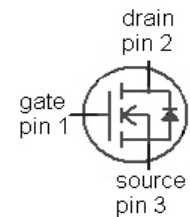
Product Summary

| | | |
|--------------------------------|-----|------------|
| V_{DS} | 100 | V |
| $R_{DS(on),max}$ (SMD version) | 12 | m Ω |
| I_D | 70 | A |

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



| Type | Package | Marking |
|----------------|--------------|---------|
| IPB70N10S3L-12 | PG-TO263-3-2 | 3N10L12 |
| IPI70N10S3L-12 | PG-TO262-3-1 | 3N10L12 |
| IPP70N10S3L-12 | PG-TO220-3-1 | 3N10L12 |



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

| Parameter | Symbol | Conditions | Value | Unit |
|--|-------------------|--|--------------|------|
| Continuous drain current | I_D | $T_C=25\text{ °C}$, $V_{GS}=10\text{ V}$ | 70 | A |
| | | $T_C=100\text{ °C}$, $V_{GS}=10\text{ V}^{1)}$ | 48 | |
| Pulsed drain current ¹⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | 280 | |
| Avalanche energy, single pulse ¹⁾ | E_{AS} | $I_D=35\text{ A}$ | 410 | mJ |
| Avalanche current, single pulse | I_{AS} | | 70 | A |
| Gate source voltage ²⁾ | V_{GS} | | ± 20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ °C}$ | 125 | 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. | |
| Thermal characteristics¹⁾ | | | | | | |
| Thermal resistance, junction - case | R_{thJC} | | - | - | 1.2 | 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 ³⁾ | - | - | 40 | |

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

Static characteristics

| | | | | | | |
|----------------------------------|---------------|---|-----|------|------|---------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$ | 100 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=83\mu\text{A}$ | 1.2 | 1.7 | 2.4 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ | - | 0.01 | 1 | μA |
| | | $V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}^{2)}$ | - | 0.1 | 10 | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$ | - | - | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=4.5\text{ V}, I_D=70\text{ A}$ | - | 12.2 | 15.8 | m Ω |
| | | $V_{GS}=4.5\text{ V}, I_D=70\text{ A},$ SMD version | - | 11.9 | 15.5 | |
| | | $V_{GS}=10\text{ V}, I_D=70\text{ A}$ | - | 10.1 | 12.1 | |
| | | $V_{GS}=10\text{ V}, I_D=70\text{ A},$ SMD version | - | 9.8 | 11.8 | |

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

Dynamic characteristics¹⁾

| | | | | | | |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance | C_{iss} | $V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$ | - | 4270 | 5550 | pF |
| Output capacitance | C_{oss} | | - | 950 | 1230 | |
| Reverse transfer capacitance | C_{rss} | | - | 90 | 135 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=20V, V_{GS}=10V,$ $I_D=50A, R_G=3.5\Omega$ | - | 10 | - | ns |
| Rise time | t_r | | - | 5 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 28 | - | |
| Fall time | t_f | | - | 5 | - | |

Gate Charge Characteristics¹⁾

| | | | | | | |
|-----------------------|---------------|--|---|-----|----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=80V, I_D=70A,$ $V_{GS}=0\text{ to }10V$ | - | 16 | 21 | nC |
| Gate to drain charge | Q_{gd} | | - | 11 | 17 | |
| Gate charge total | Q_g | | - | 60 | 80 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.7 | - | V |

Reverse Diode

| | | | | | | |
|--|---------------|---|-----|-----|-----|----|
| Diode continuous forward current ¹⁾ | I_S | $T_C=25^\circ C$ | - | - | 70 | A |
| Diode pulse current ¹⁾ | $I_{S,pulse}$ | | - | - | 280 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0V, I_F=70A,$ $T_j=25^\circ C$ | 0.6 | 1 | 1.2 | V |
| Reverse recovery time ¹⁾ | t_{rr} | $V_R=50V, I_F=I_S,$ $di_F/dt=100A/\mu s$ | - | 80 | - | ns |
| Reverse recovery charge ¹⁾ | Q_{rr} | | - | 185 | - | |

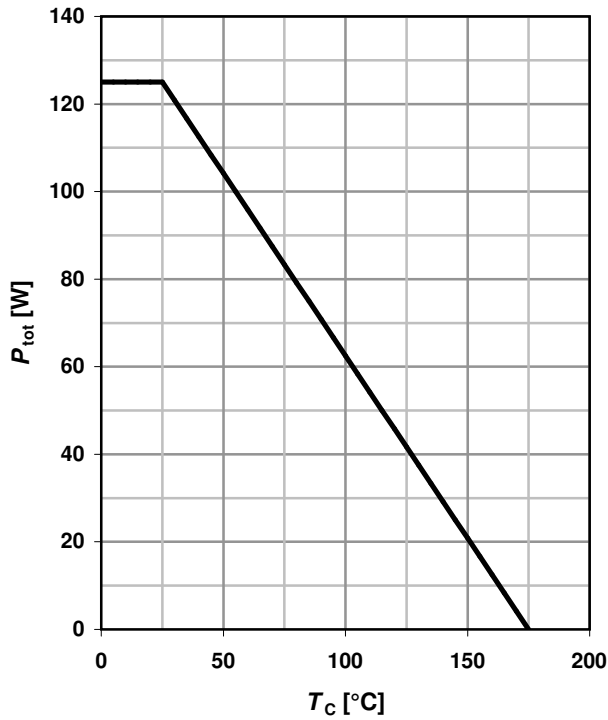
¹⁾ Defined by design. Not subject to production test.

²⁾ Qualified with $V_{GS} = +20/-5V$

³⁾ 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.

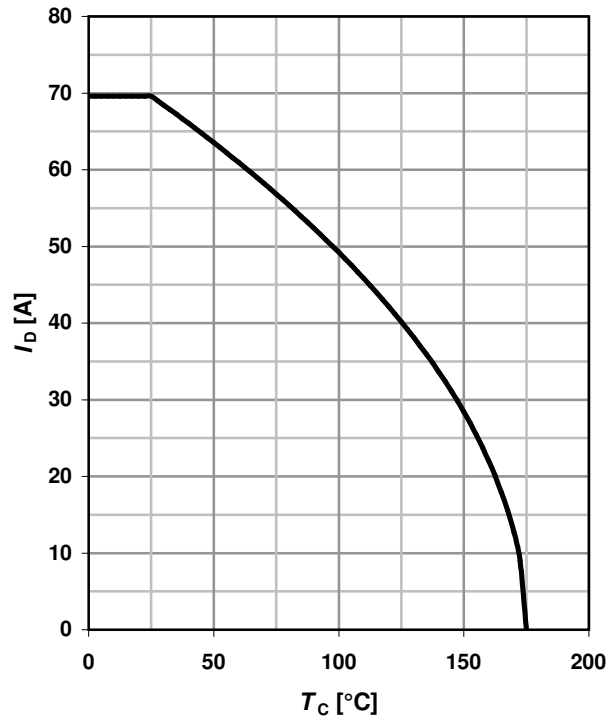
1 Power dissipation

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



2 Drain current

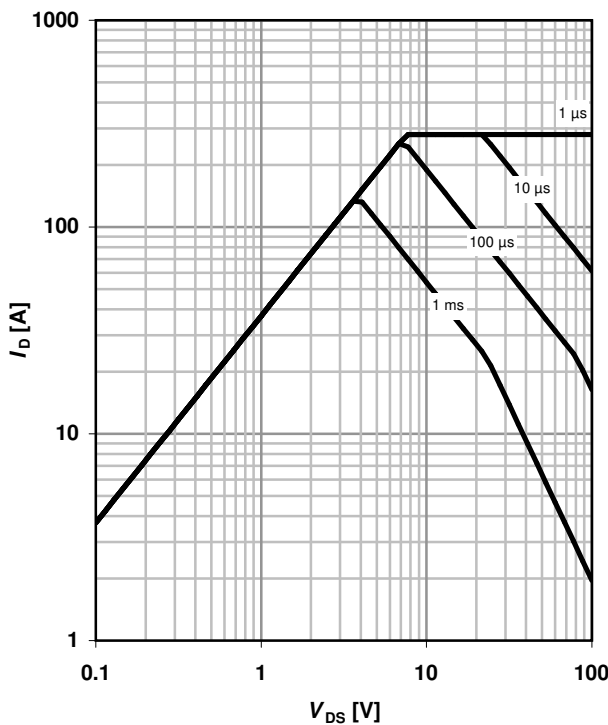
$I_D = f(T_C); V_{GS} \geq 6 \text{ V}; \text{SMD}$



3 Safe operating area

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

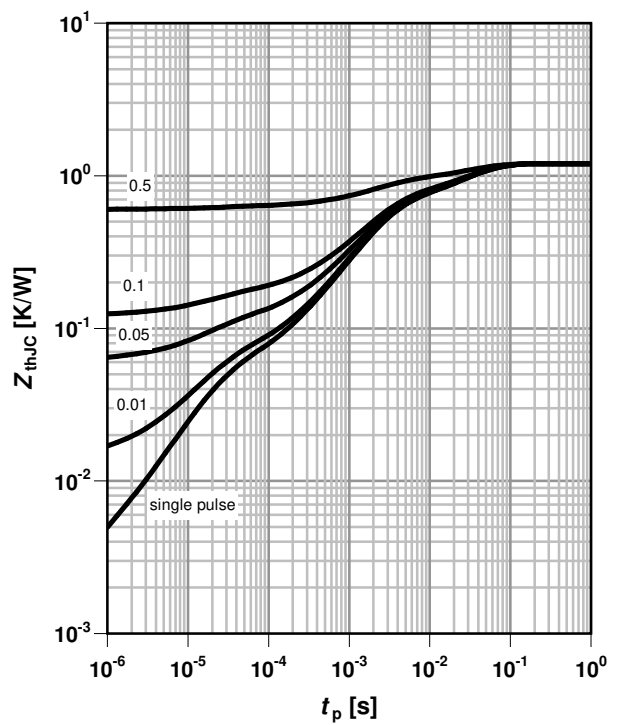
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

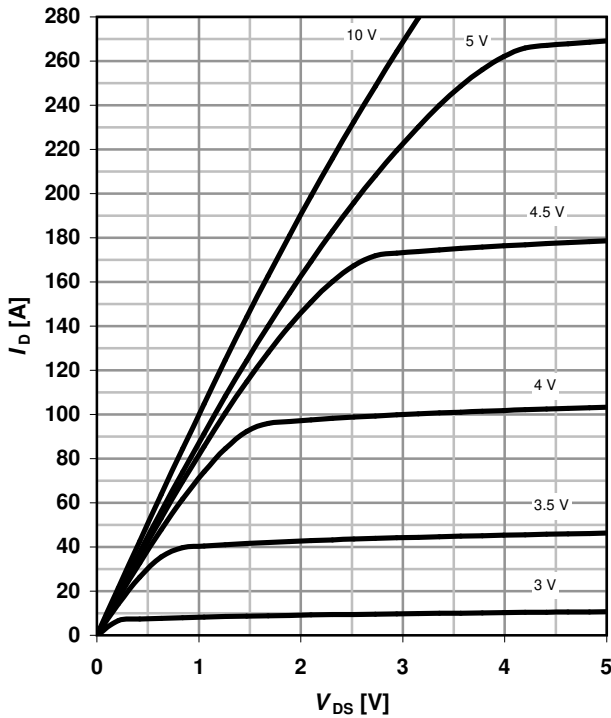
parameter: $D = t_p/T$



5 Typ. output characteristics

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

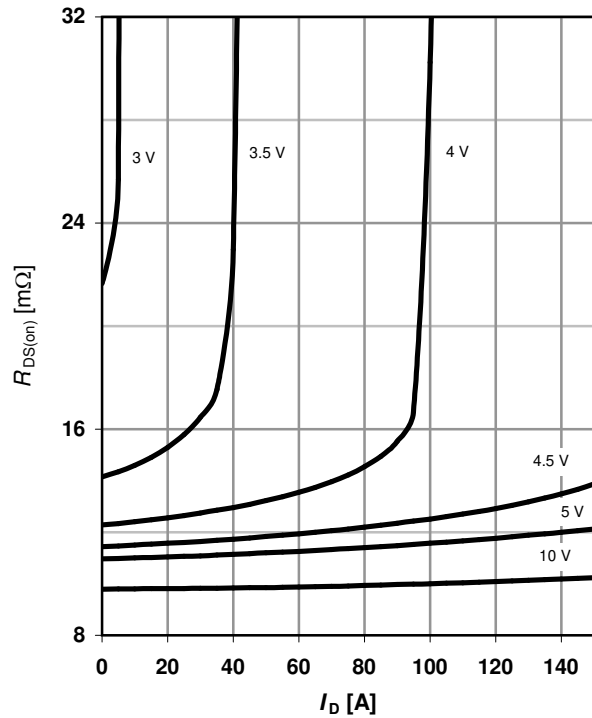
parameter: V_{GS}



6 Typ. drain-source on-state resistance

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

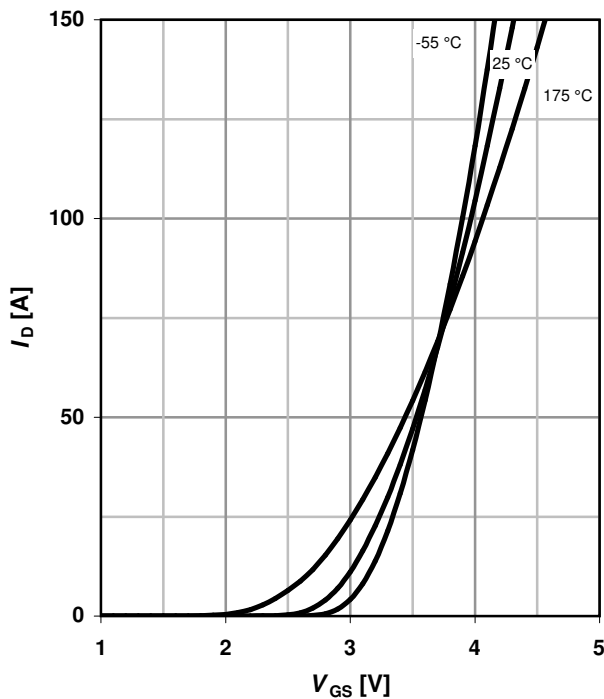
parameter: V_{GS}



7 Typ. transfer characteristics

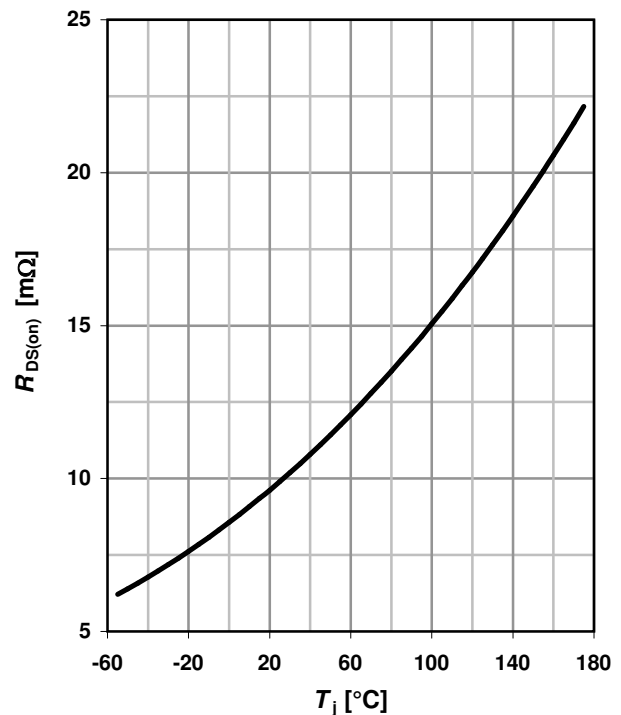
$I_D = f(V_{GS}); V_{DS} = 6\text{ V}$

parameter: T_j



8 Typ. drain-source on-state resistance

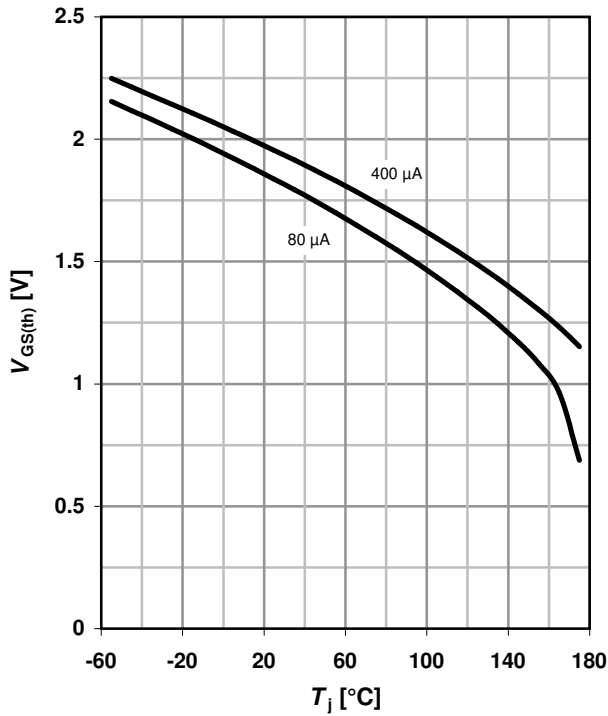
$R_{DS(on)} = f(T_j); I_D = 50\text{ A}; V_{GS} = 10\text{ V}; \text{SMD}$



9 Typ. gate threshold voltage

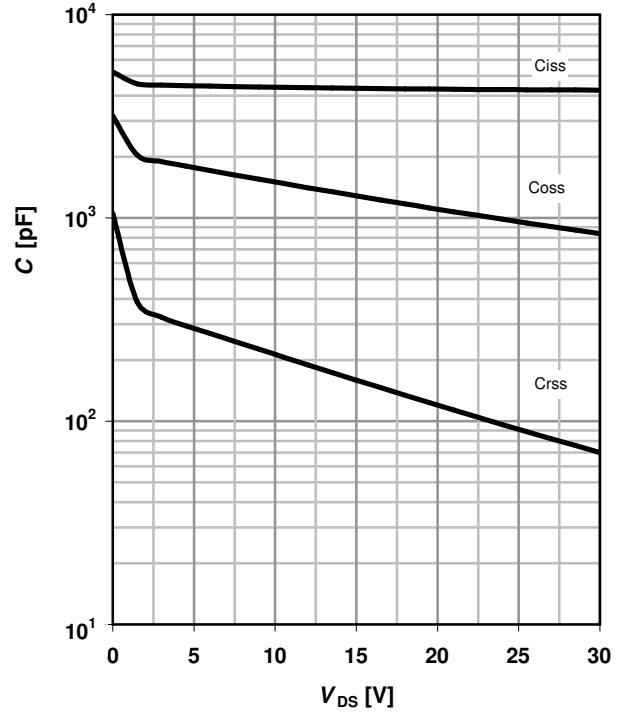
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

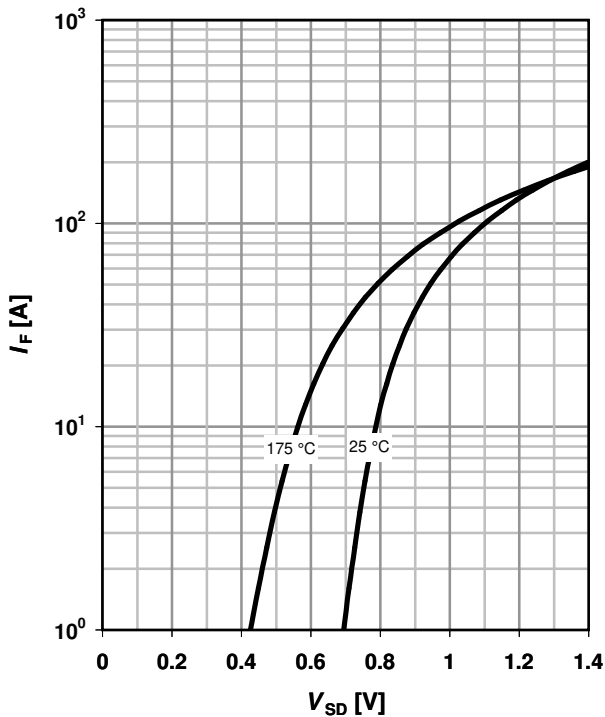
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



11 Typical forward diode characteristics

$I_F = f(V_{SD})$

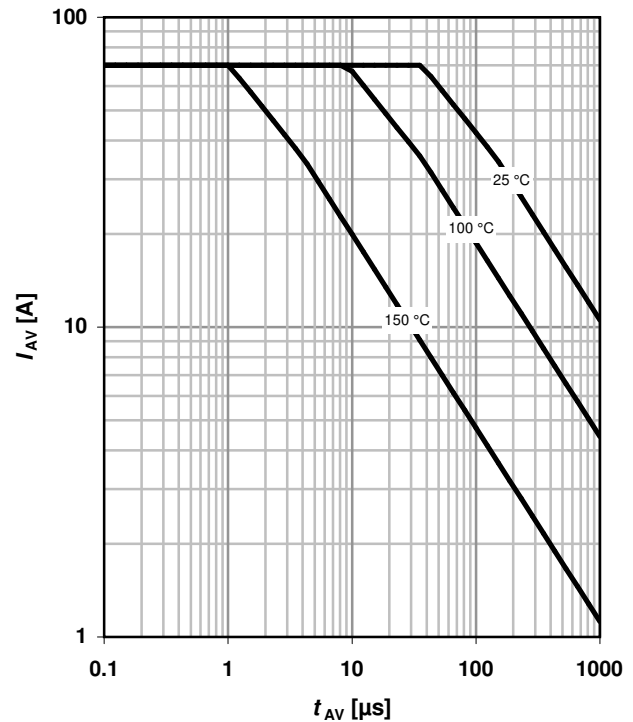
parameter: T_j



12 Typ. avalanche characteristics

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

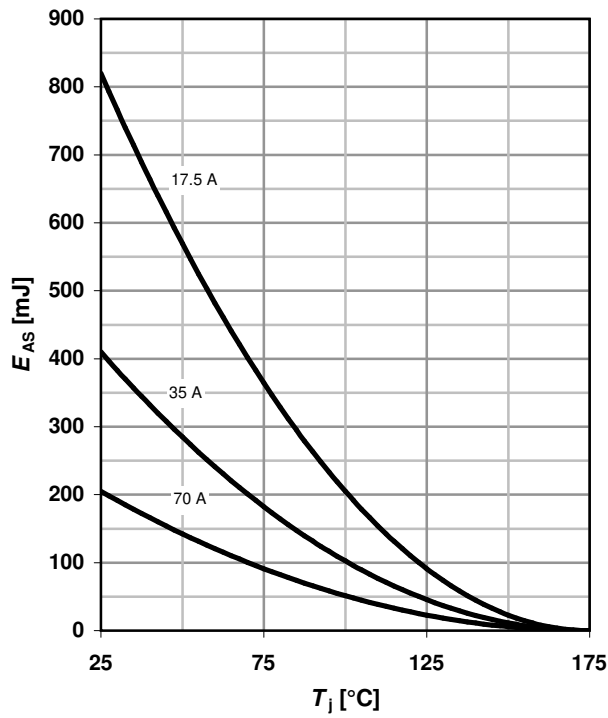
parameter: $T_{j(start)}$



13 Typical avalanche energy

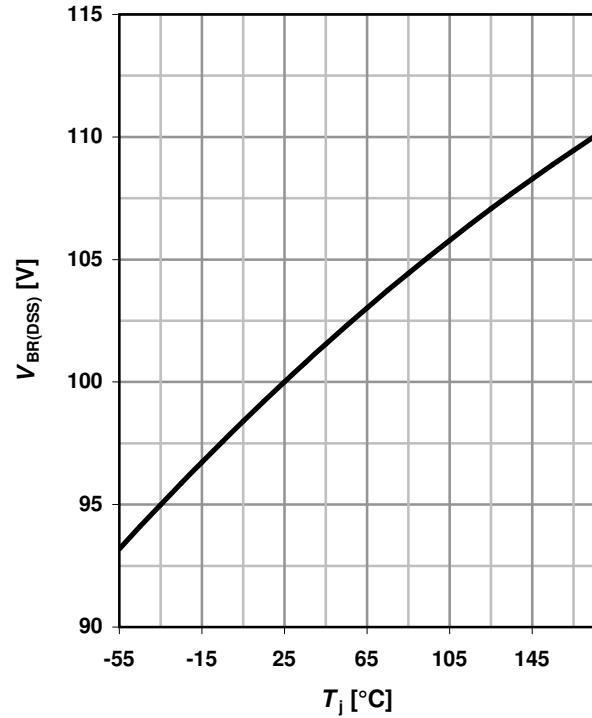
$$E_{AS} = f(T_j)$$

parameter: I_D



14 Typ. drain-source breakdown voltage

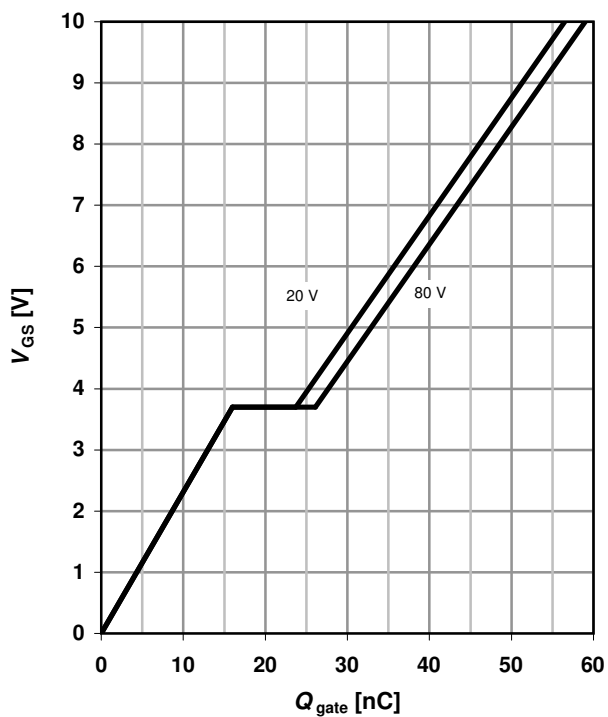
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



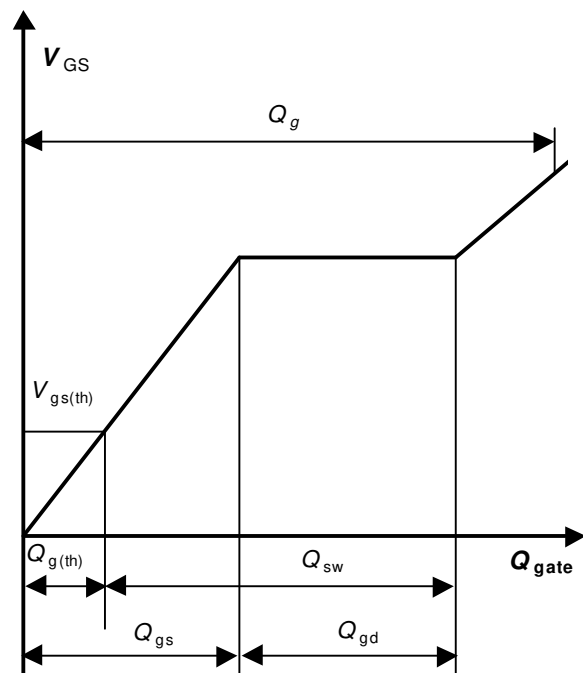
15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 70 \text{ A pulsed}$$

parameter: V_{DD}



16 Gate charge waveforms



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