

OptiMOS® -T2 Power-Transistor



Product Summary

| | | |
|--------------------------------|------|----|
| V_{DS} | 30 | V |
| $R_{DS(on),max}$ (SMD version) | 14.6 | mΩ |
| I_D | 22 | A |

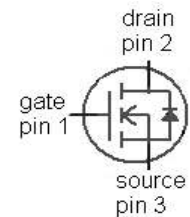
Features

- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green product (RoHS compliant)
- Ultra low $R_{ds(on)}$
- 100% Avalanche tested

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



| Type | Package | Marking |
|----------------|--------------|---------|
| IPB22N03S4L-15 | PG-TO263-3-2 | 4N03L15 |
| IPI22N03S4L-15 | PG-TO262-3-1 | 4N03L15 |
| IPP22N03S4L-15 | PG-TO220-3-1 | 4N03L15 |



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

| Parameter | Symbol | Conditions | Value | Unit |
|--|----------------|--|--------------|------|
| Continuous drain current ¹⁾ | I_D | $T_C=25\text{ °C}$, $V_{GS}=10\text{ V}$ | 22 | A |
| | | $T_C=100\text{ °C}$, $V_{GS}=10\text{ V}^{2)}$ | 22 | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | 88 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=22\text{ A}$ | 20 | mJ |
| Avalanche current, single pulse | I_{AS} | $T_C=25\text{ °C}$ | 22 | A |
| Gate source voltage | V_{GS} | | ±16 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ °C}$ | 31 | 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 characteristics²⁾ | | | | | | |
| Thermal resistance, junction - case | R_{thJC} | | - | - | 4.9 | 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 $T_j=25\text{ °C}$, 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 | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=10\text{ }\mu\text{A}$ | 1.0 | 1.5 | 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 | μA |
| | | $V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$ | - | 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 | $R_{DS(on)}$ | $V_{GS}=4.5\text{ V}, I_D=11\text{ A}$ | - | 17.5 | 19.8 | m Ω |
| | | $V_{GS}=4.5\text{ V}, I_D=11\text{ A},$ SMD version | - | 17.2 | 19.5 | |
| | | $V_{GS}=10\text{ V}, I_D=22\text{ A}$ | - | 12.7 | 14.9 | |
| | | $V_{GS}=10\text{ V}, I_D=22\text{ A},$ SMD version | - | 12.4 | 14.6 | |

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

Dynamic characteristics²⁾

| | | | | | | |
|------------------------------|--------------|---|---|-----|-----|----|
| Input capacitance | C_{iss} | $V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$ | - | 750 | 980 | pF |
| Output capacitance | C_{oss} | | - | 190 | 250 | |
| Reverse transfer capacitance | C_{rss} | | - | 10 | 20 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$ $I_D=22\text{ A}, R_G=3.5\ \Omega$ | - | 3 | - | ns |
| Rise time | t_r | | - | 2 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 12 | - | |
| Fall time | t_f | | - | 2 | - | |

Gate Charge Characteristics²⁾

| | | | | | | |
|-----------------------|---------------|--|---|-----|----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=24\text{ V}, I_D=22\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 2.2 | 3 | nC |
| Gate to drain charge | Q_{gd} | | - | 1.4 | 3 | |
| Gate charge total | Q_g | | - | 11 | 14 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.4 | - | V |

Reverse Diode

| | | | | | | |
|--|---------------|---|-----|------|-----|----|
| Diode continuous forward current ²⁾ | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | 22 | A |
| Diode pulse current ²⁾ | $I_{S,pulse}$ | | - | - | 88 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=22\text{ A},$ $T_j=25\text{ }^\circ\text{C}$ | 0.6 | 0.95 | 1.3 | V |
| Reverse recovery time ²⁾ | t_{rr} | $V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 12 | - | ns |
| Reverse recovery charge ²⁾ | Q_{rr} | | - | 10 | - | |

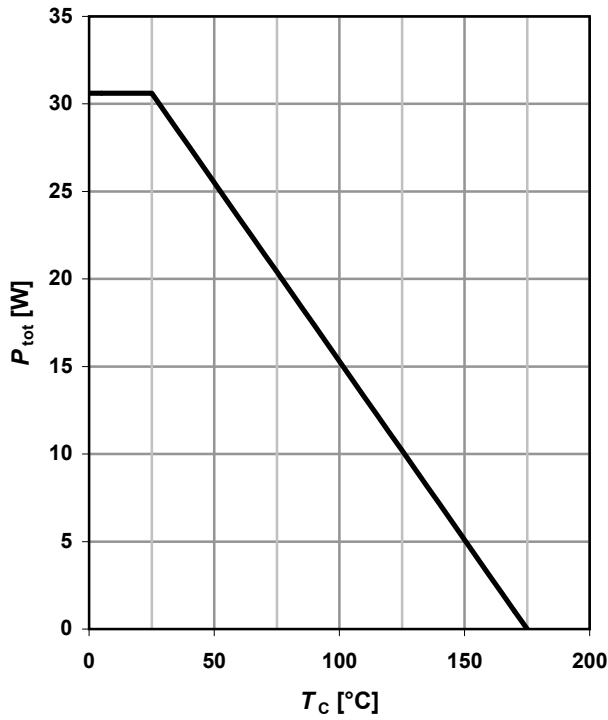
¹⁾ Current is limited by bondwire; with an $R_{thJC} = 4.9\text{K/W}$ the chip is able to carry 36A at 25°C. For detailed information see Application Note ANPS071E at www.infineon.com/optimos

²⁾ Defined by design. Not subject to production test.

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.

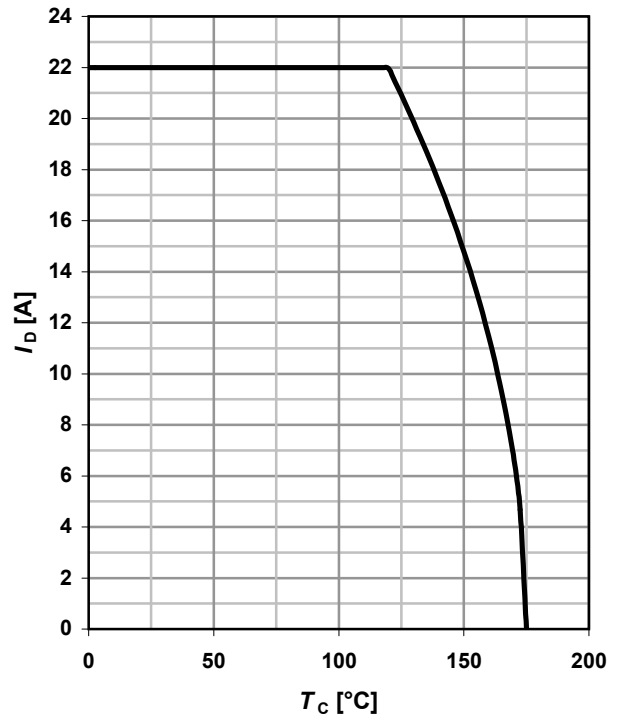
1 Power dissipation

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



2 Drain current

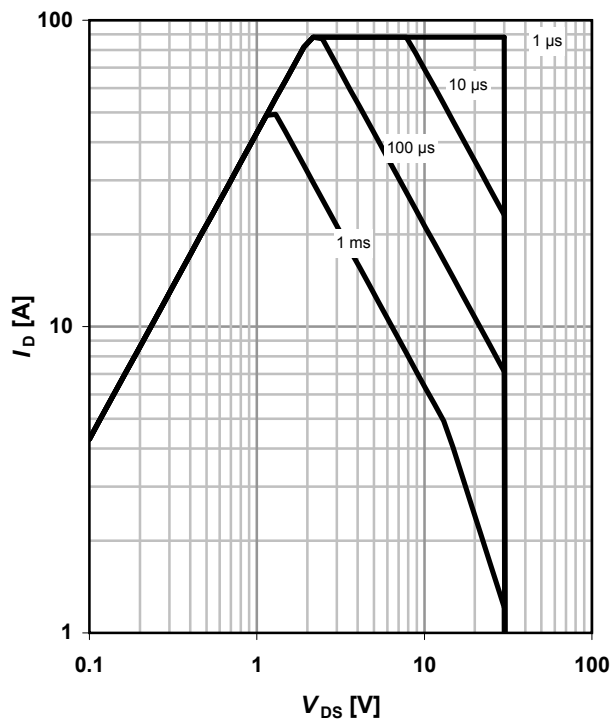
$I_D = f(T_C); V_{GS} \geq 6 V; SMD$



3 Safe operating area

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

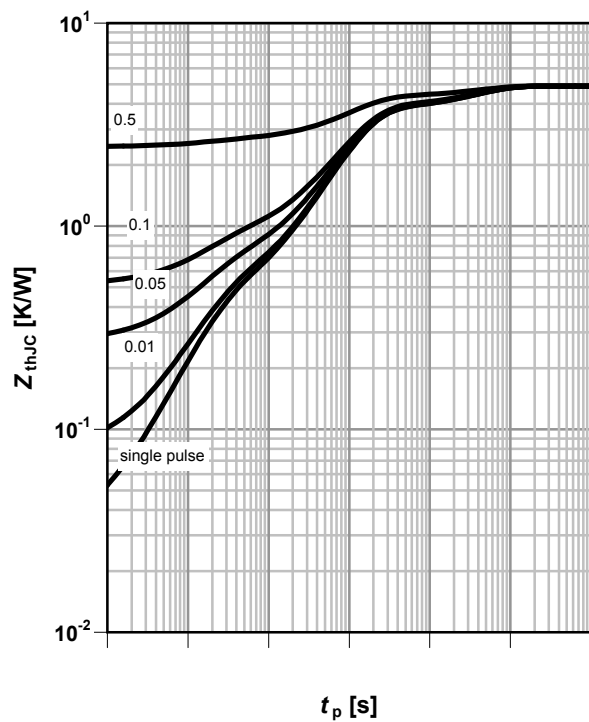
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

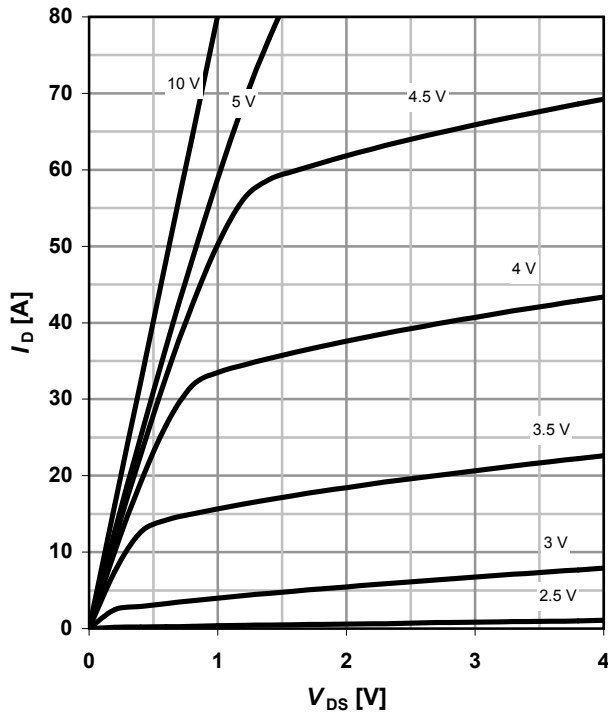
parameter: $D = t_p/T$



5 Typ. output characteristics

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

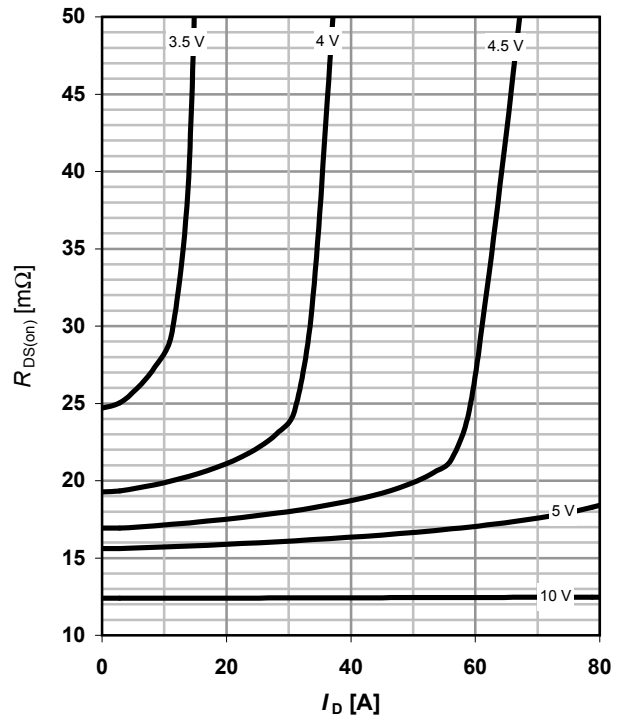
parameter: V_{GS}



6 Typ. drain-source on-state resistance

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

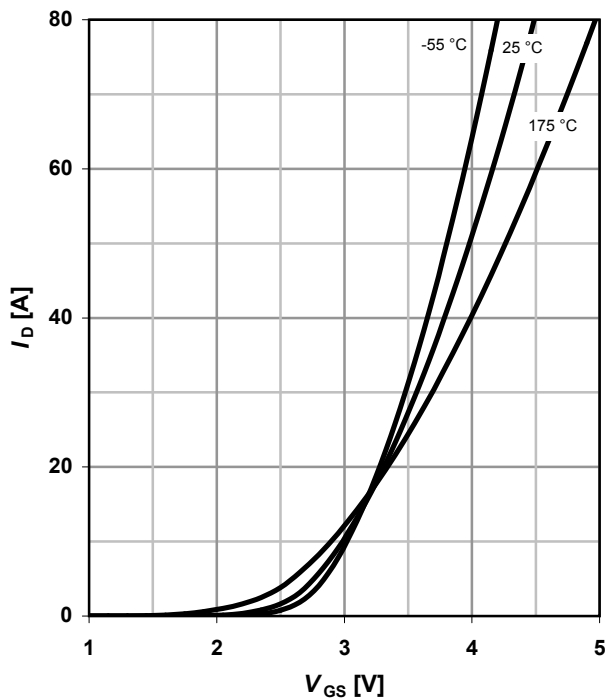
parameter: V_{GS}



7 Typ. transfer characteristics

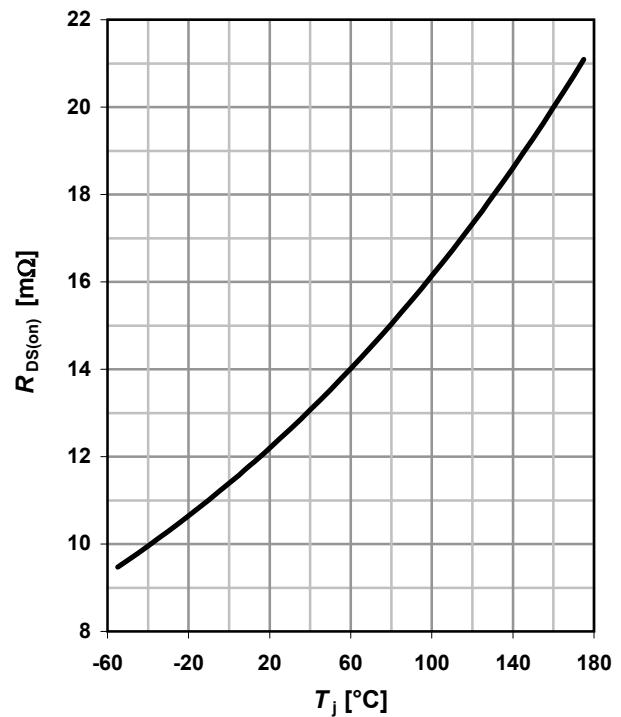
$I_D = f(V_{GS}); V_{DS} = 6\text{V}$

parameter: T_j



8 Typ. drain-source on-state resistance

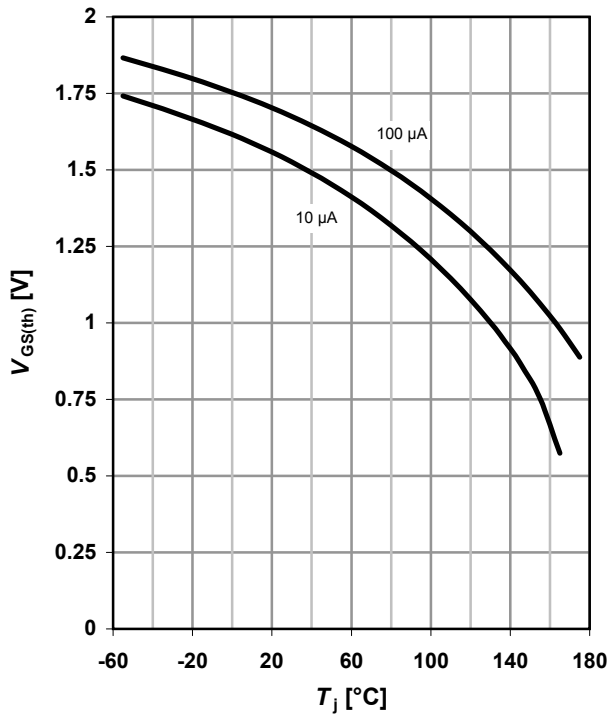
$R_{DS(on)} = f(T_j); I_D = 22\text{ A}; V_{GS} = 10\text{ V}, \text{SMD}$



9 Typ. gate threshold voltage

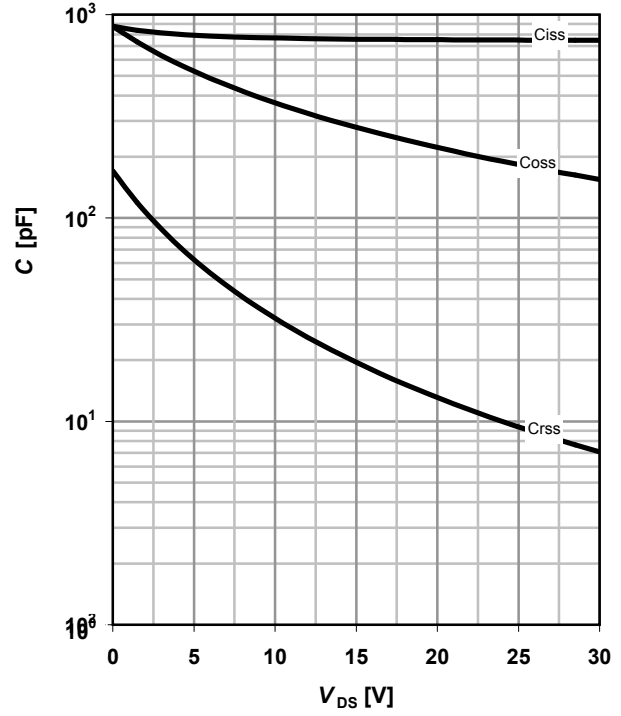
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

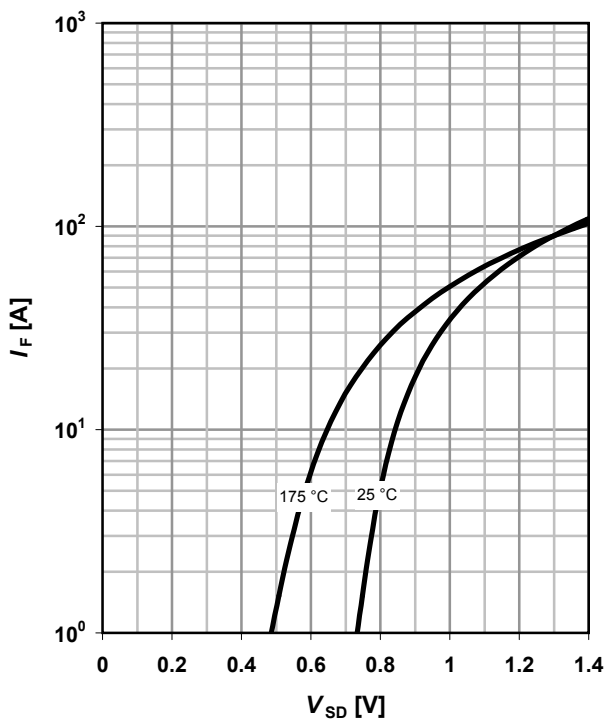
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



11 Typical forward diode characteristics

$I_F = f(V_{SD})$

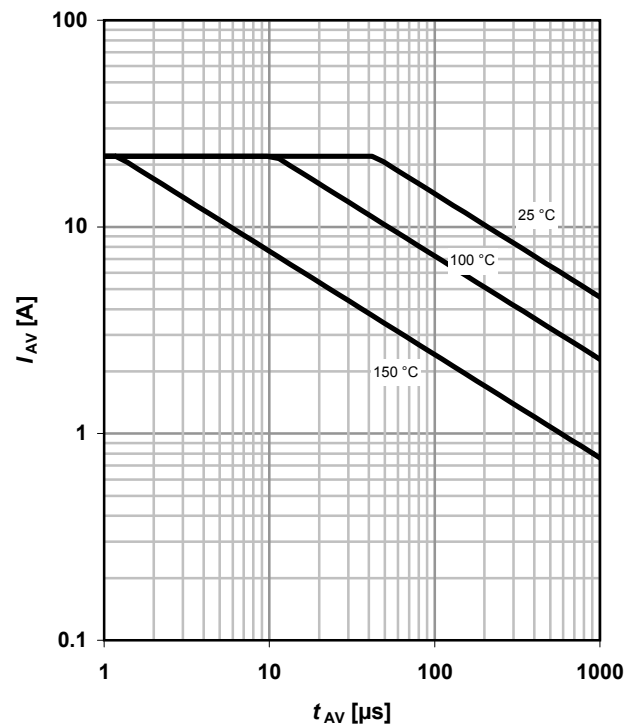
parameter: T_j



12 Typ. avalanche characteristics

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

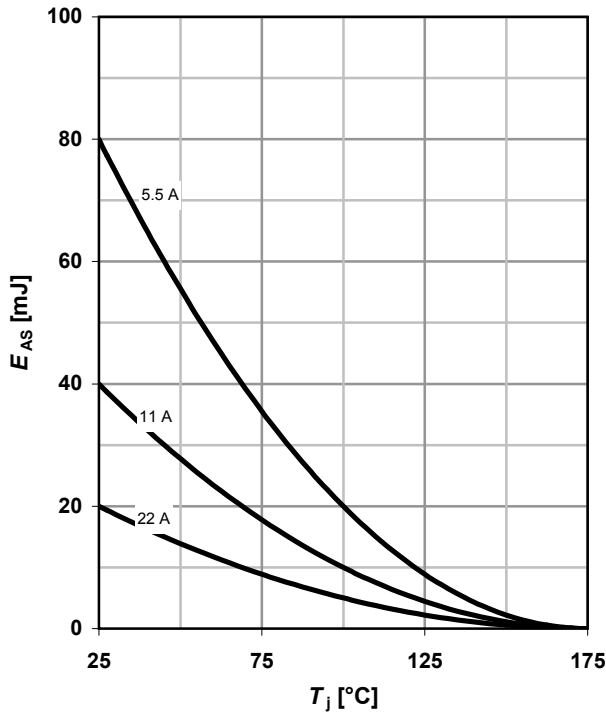
parameter: $T_{j(start)}$



13 Typical avalanche energy

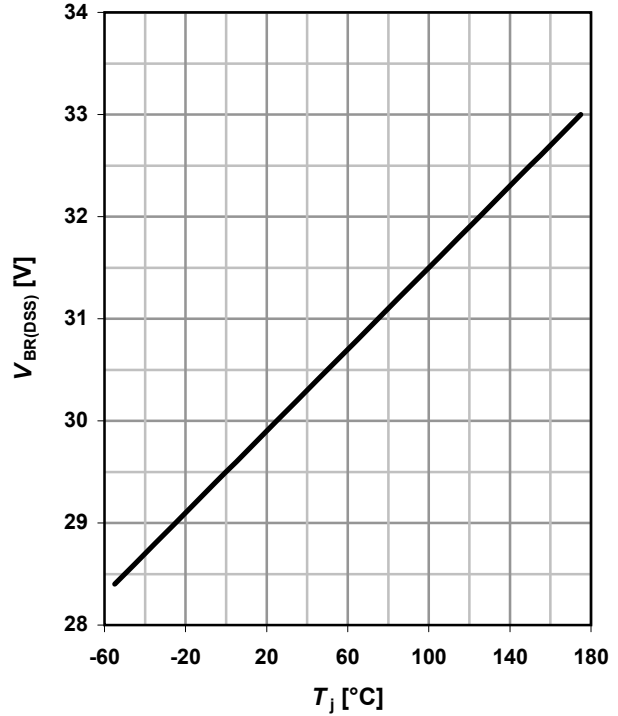
$E_{AS} = f(T_j)$

parameter: I_D



14 Typ. drain-source breakdown voltage

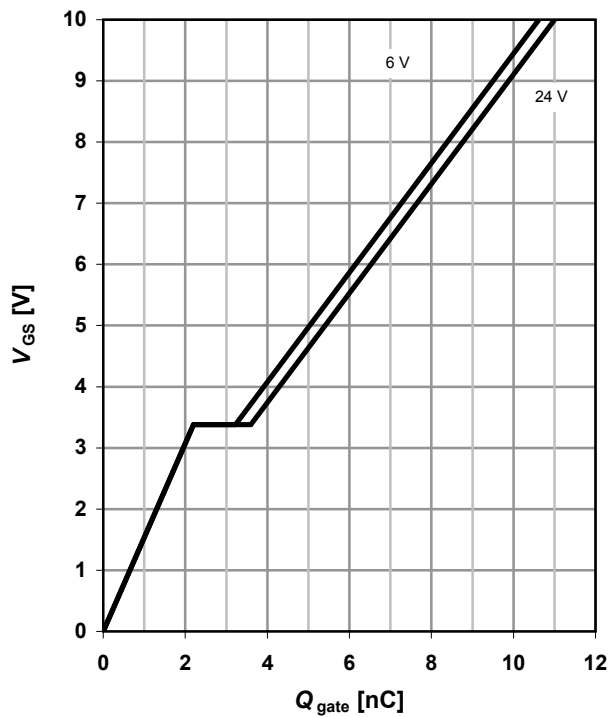
$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$



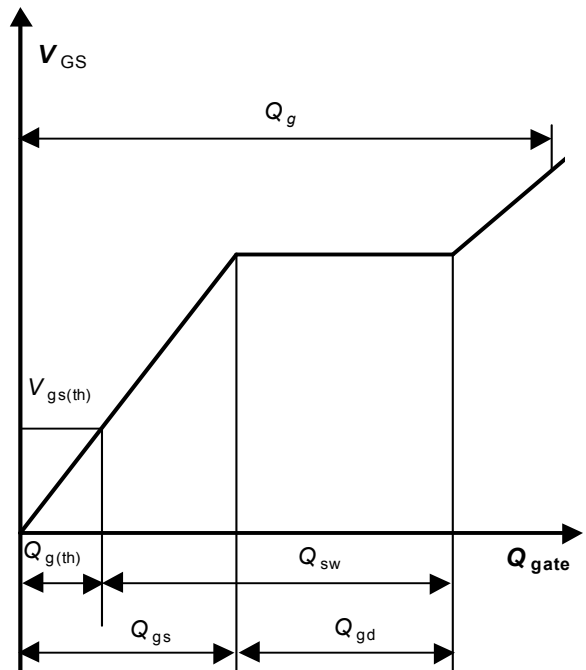
15 Typ. gate charge

$V_{GS} = f(Q_{gate}); I_D = 22 \text{ A pulsed}$

parameter: V_{DD}



16 Gate charge waveforms



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Revision History

| Version | Date | Changes |
|---------|------|---------|
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