

OptiMOS™3 Power-Transistor
Features

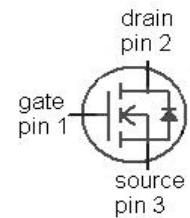
- N-channel, normal level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target application
- Ideal for high-frequency switching and synchronous rectification
- Halogen-free according to IEC61249-2-21

Product Summary

| | | |
|-------------------------|-----|----|
| V_{DS} | 100 | V |
| $R_{DS(on),max}$ TO-263 | 18 | mΩ |
| I_D | 43 | A |



| | |
|----------------|---------------|
| Type | IPD180N10N3 G |
| | |
| Package | PG-TO252-3 |
| Marking | 180N10N |


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

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|-------------------|---|-------------|------|
| Continuous drain current | I_D | $T_C=25\text{ °C}^{2)}$ | 43 | A |
| | | $T_C=100\text{ °C}$ | 30 | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | 172 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=33\text{ A}$, $R_{GS}=25\text{ }\Omega$ | 50 | mJ |
| Gate source voltage | V_{GS} | | ± 20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ °C}$ | 71 | W |
| Operating and storage temperature | T_j , T_{stg} | | -55 ... 175 | °C |
| IEC climatic category; DIN IEC 68-1 | | | 55/175/56 | |

¹⁾J-STD20 and JESD22

²⁾ See figure 3

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

Thermal characteristics

| | | | | | | |
|---|------------|--|---|---|-----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 2.1 | K/W |
| Thermal resistance, junction - ambient | R_{thJA} | minimal footprint | - | - | 75 | |
| | | 6 cm ² cooling area ³⁾ | - | - | 50 | |

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 | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=33\text{ }\mu\text{A}$ | 2 | 2.7 | 3.5 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$ | - | 0.1 | 1 | μA |
| | | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | - | 10 | 100 | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$ | - | 1 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=33\text{ A}$ | - | 14.7 | 18 | m Ω |
| | | $V_{GS}=6\text{ V}, I_D=16\text{ A}$ | - | 18.4 | 33 | |
| Gate resistance | R_G | | - | 1.4 | - | Ω |
| Transconductance | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=33\text{ A}$ | 20 | 40 | - | S |

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.

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

Dynamic characteristics

| | | | | | | |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance | C_{iss} | $V_{GS}=0\text{ V}, V_{DS}=50\text{ V},$ $f=1\text{ MHz}$ | - | 1350 | 1800 | pF |
| Output capacitance | C_{oss} | | - | 237 | 315 | |
| Reverse transfer capacitance | C_{rss} | | - | 11 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$ $I_D=33\text{ A}, R_{G,ext}=1.6\ \Omega$ | - | 12 | - | ns |
| Rise time | t_r | | - | 12 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 19 | - | |
| Fall time | t_f | | - | 5 | - | |

Gate Charge Characteristics⁶⁾

| | | | | | | |
|-----------------------|---------------|--|---|-----|----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=50\text{ V}, I_D=33\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 7 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 4 | - | |
| Switching charge | Q_{sw} | | - | 6 | - | |
| Gate charge total | Q_g | | - | 19 | 25 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.9 | - | |
| Output charge | Q_{oss} | $V_{DD}=50\text{ V}, V_{GS}=0\text{ V}$ | - | 25 | 33 | nC |

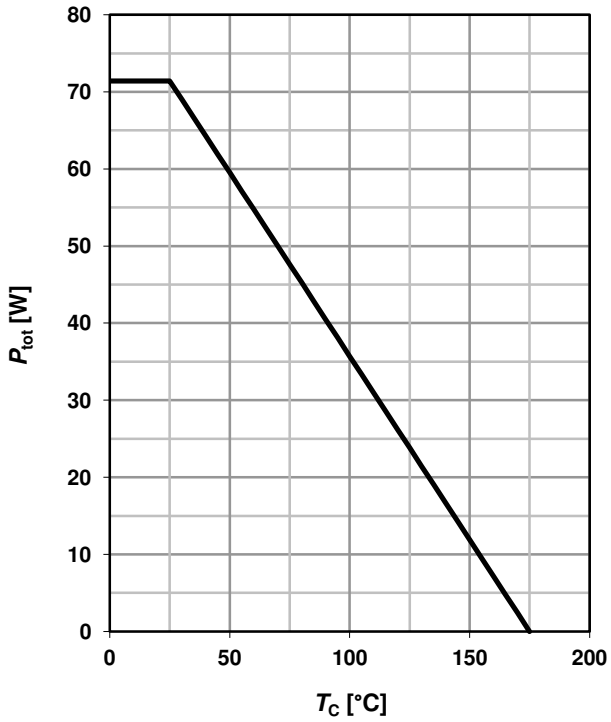
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|---|---|----|-----|----|
| Diode continuous forward current | I_S | $T_C=25\text{ °C}$ | - | - | 43 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 172 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=33\text{ A},$ $T_j=25\text{ °C}$ | - | 1 | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=15\text{ V}, I_F=33\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 55 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 92 | - | nC |

⁶⁾ See figure 16 for gate charge parameter definition

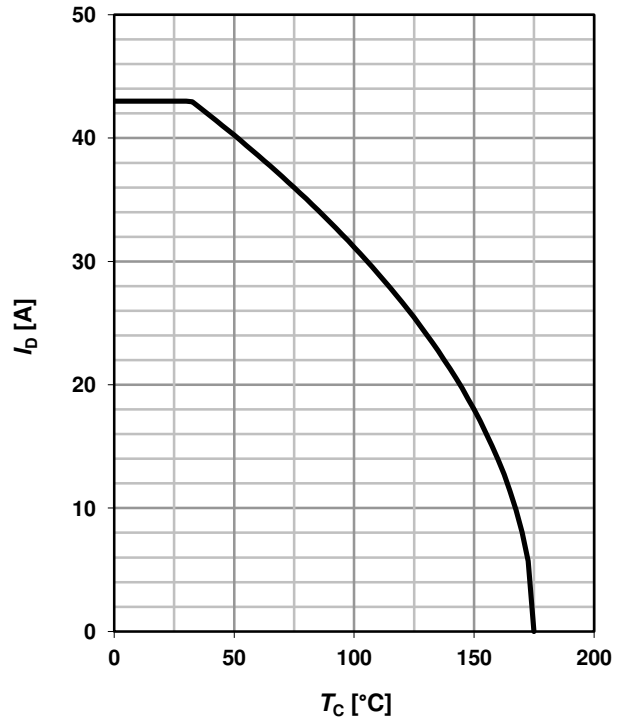
1 Power dissipation

$P_{tot}=f(T_C)$



2 Drain current

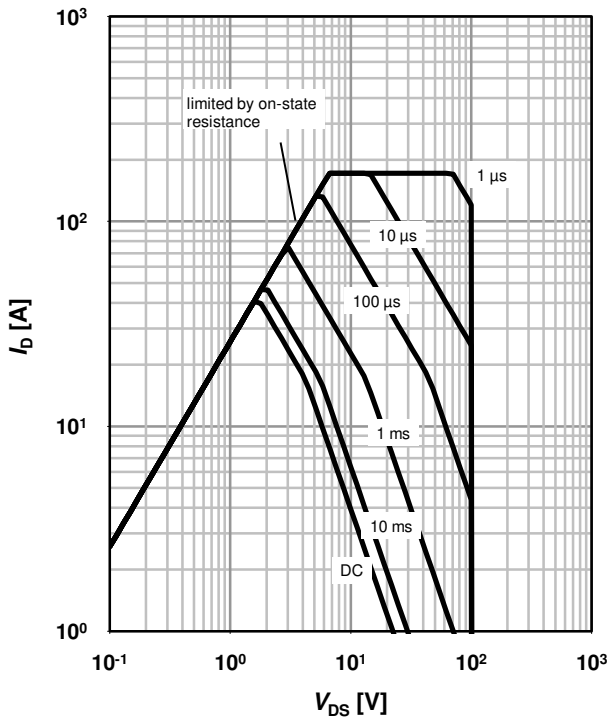
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



3 Safe operating area

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

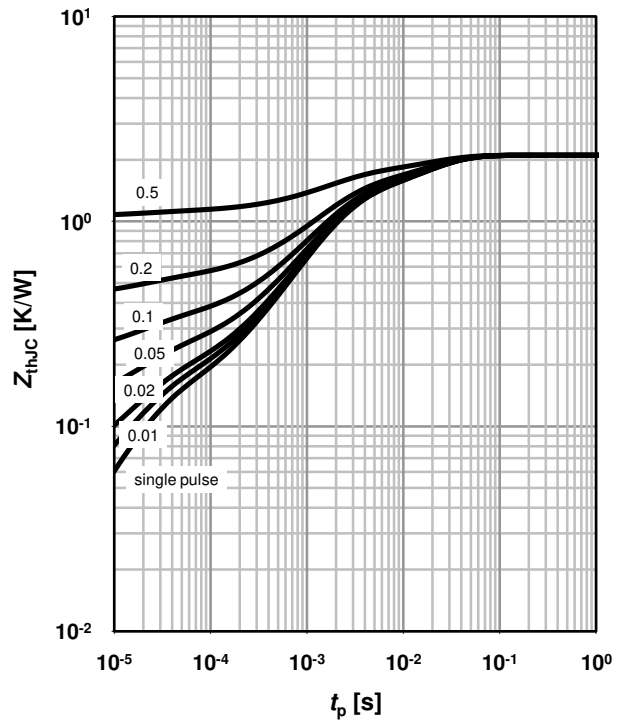
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

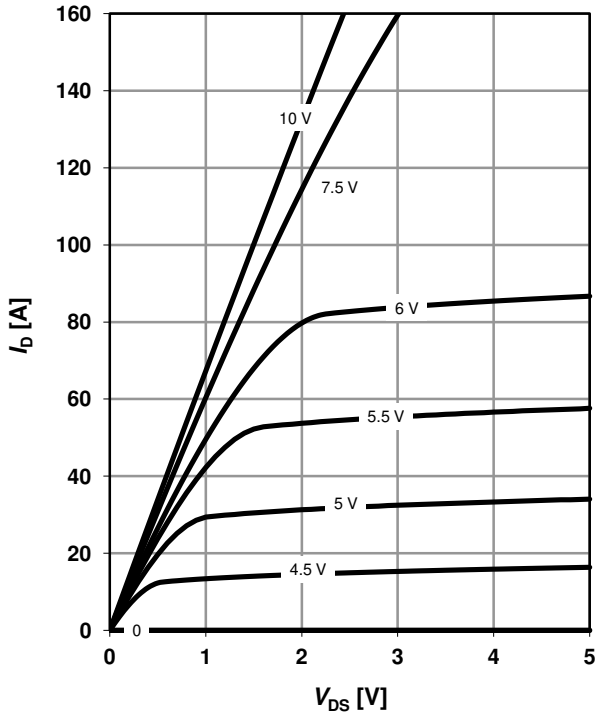
parameter: $D=t_p/T$



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

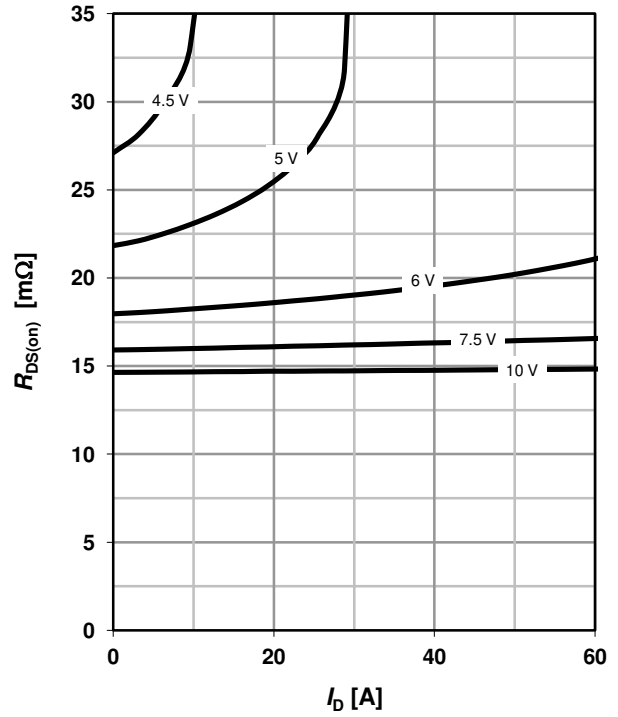
parameter: V_{GS}



6 Typ. drain-source on resistance

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

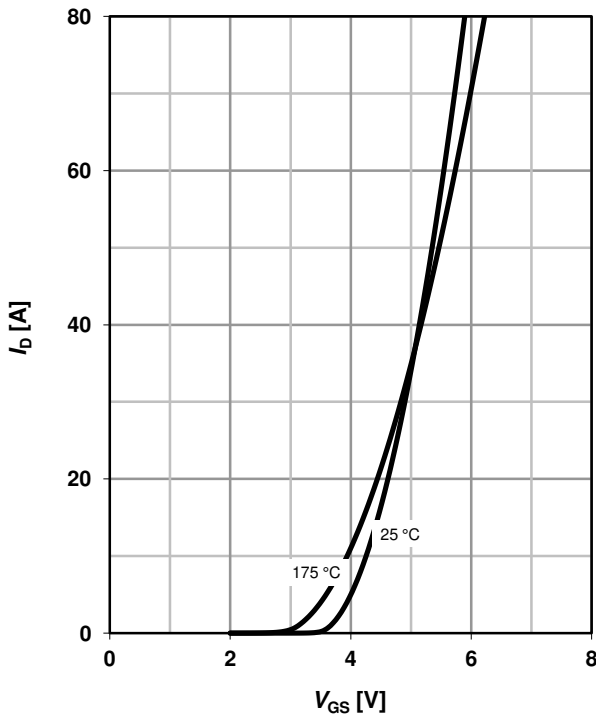
parameter: V_{GS}



7 Typ. transfer characteristics

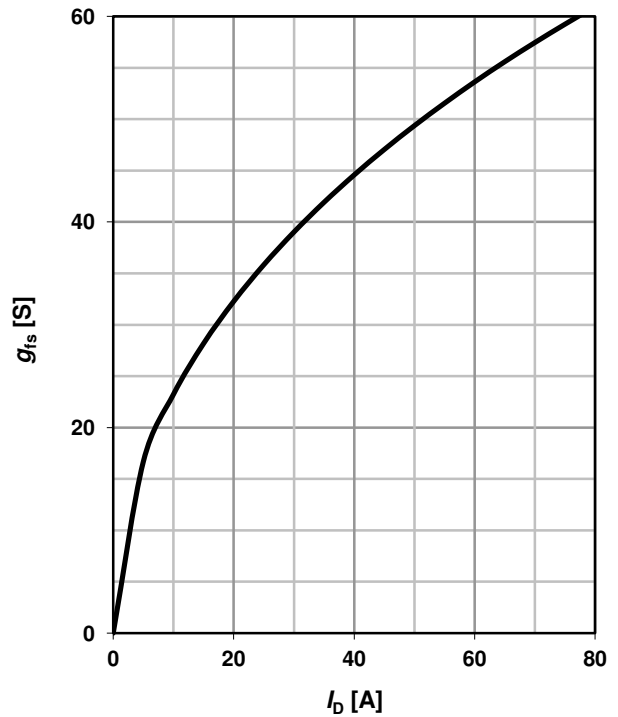
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



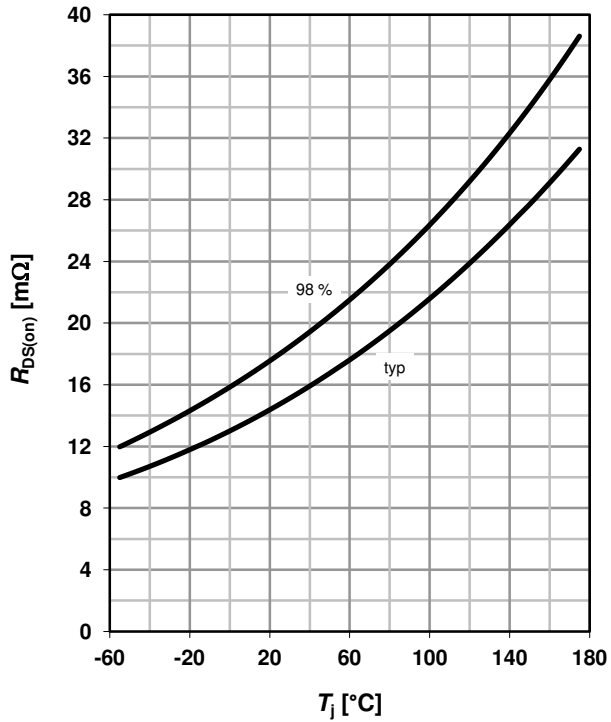
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



9 Drain-source on-state resistance

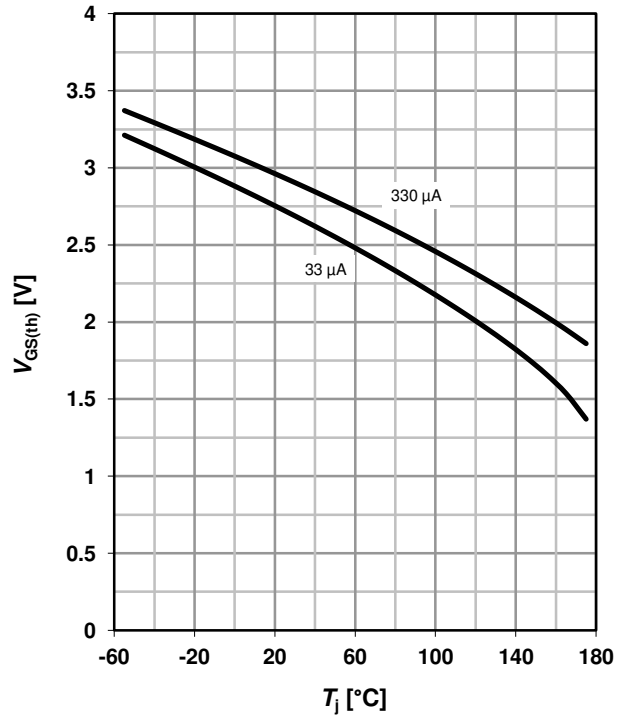
$R_{DS(on)}=f(T_j); I_D=33\text{ A}; V_{GS}=10\text{ V}$



10 Typ. gate threshold voltage

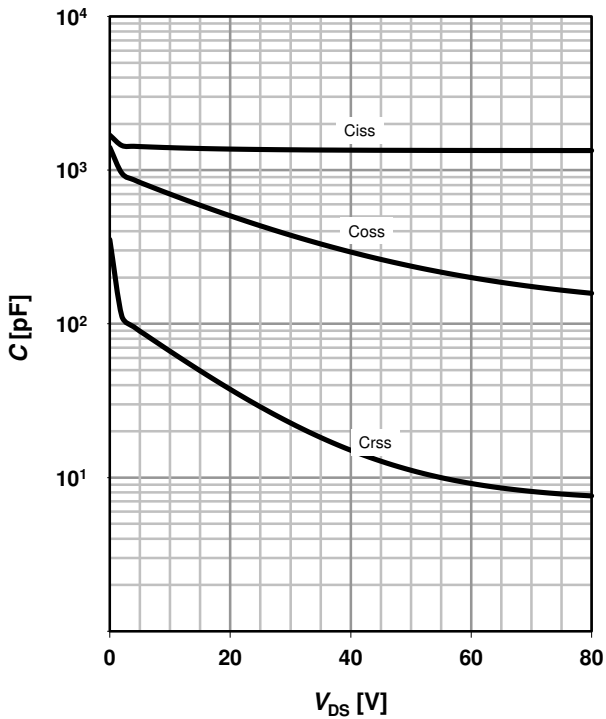
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}$

parameter: I_D



11 Typ. capacitances

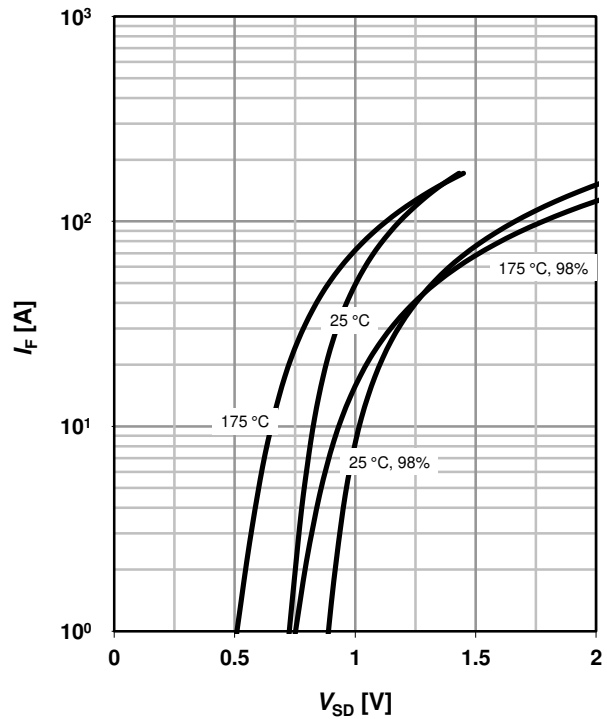
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$



12 Forward characteristics of reverse diode

$I_F=f(V_{SD})$

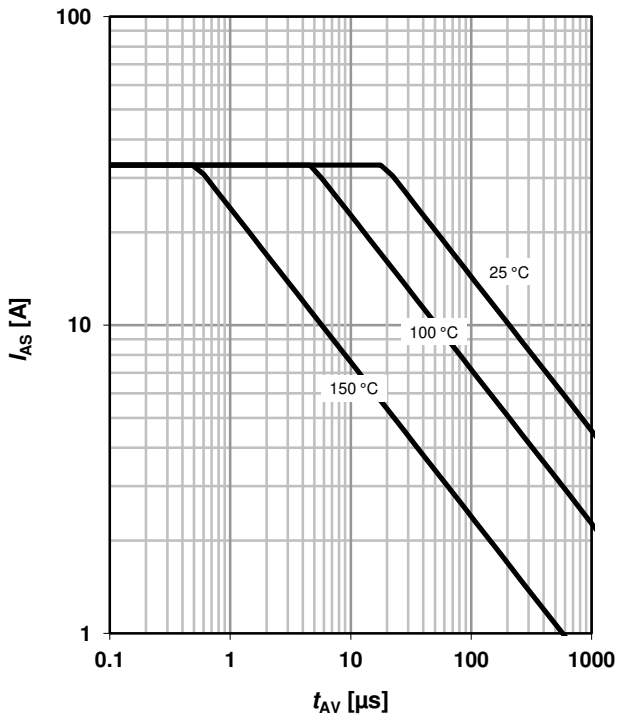
parameter: T_j



13 Avalanche characteristics

$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$

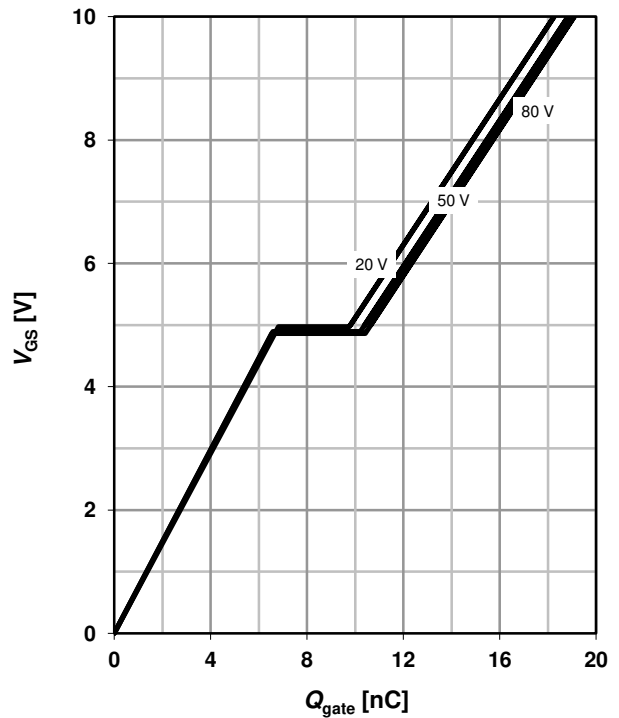
parameter: $T_{j(\text{start})}$



14 Typ. gate charge

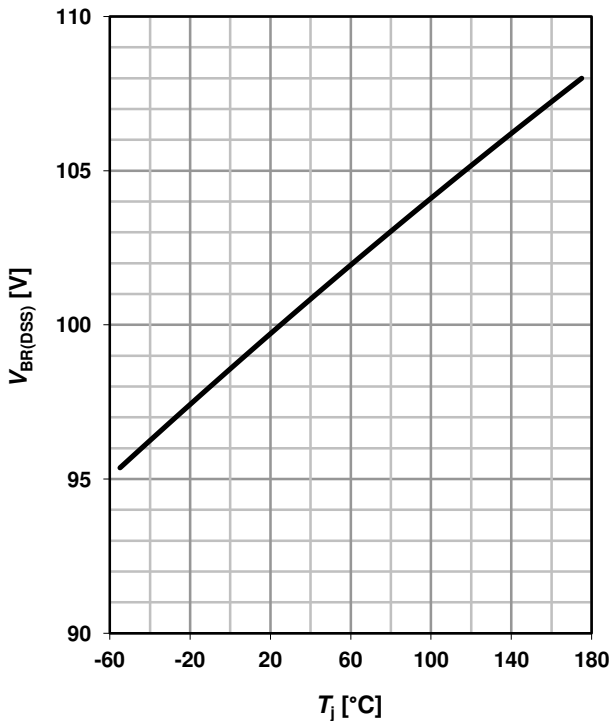
$V_{GS}=f(Q_{\text{gate}}); I_D=33 \text{ A pulsed}$

parameter: V_{DD}

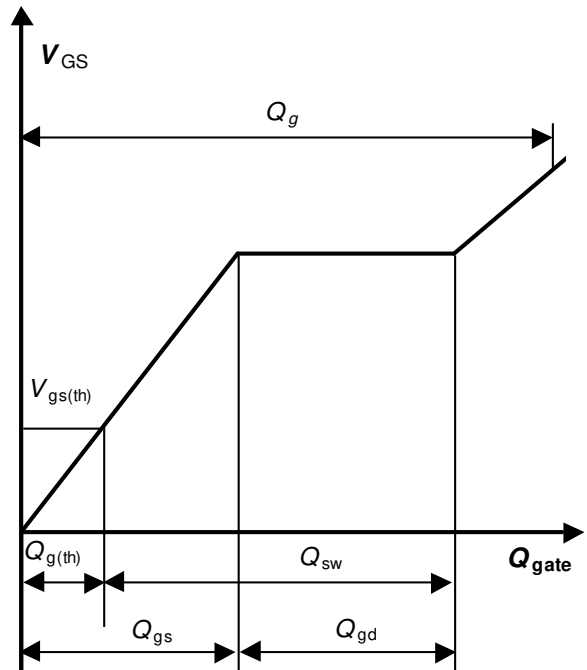


15 Drain-source breakdown voltage

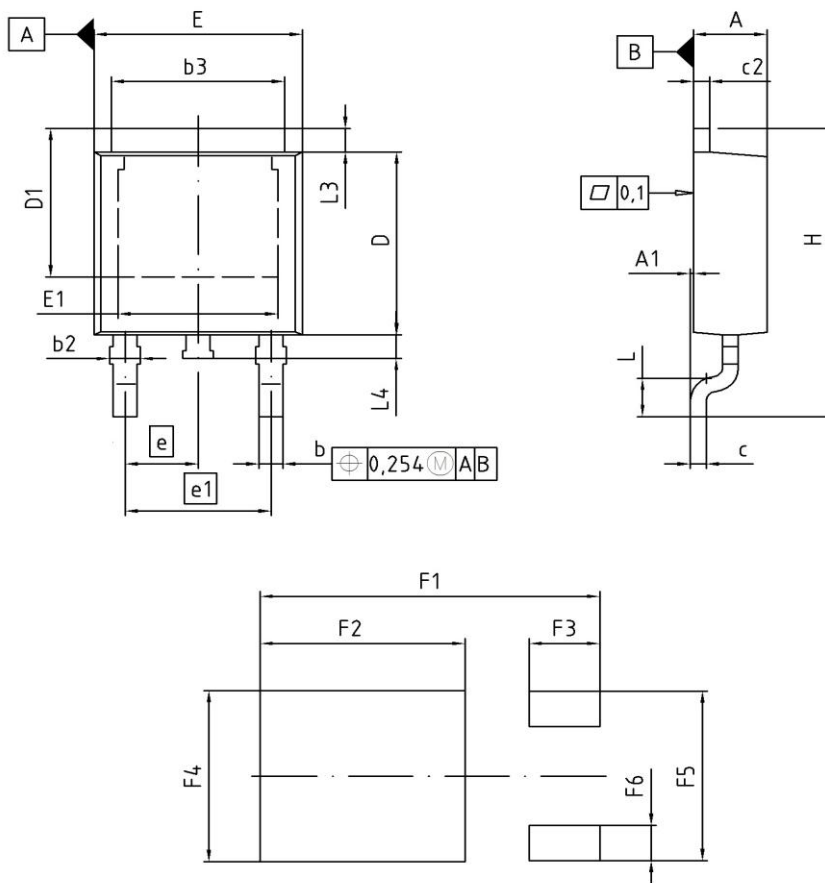
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$



16 Gate charge waveforms



PG-TO-252



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 2.16 | 2.41 | 0.085 | 0.095 |
| A1 | 0.00 | 0.15 | 0.000 | 0.006 |
| b | 0.64 | 0.89 | 0.025 | 0.035 |
| b2 | 0.65 | 1.15 | 0.026 | 0.045 |
| b3 | 5.00 | 5.50 | 0.197 | 0.217 |
| c | 0.46 | 0.60 | 0.018 | 0.024 |
| c2 | 0.46 | 0.98 | 0.018 | 0.039 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |
| D1 | 5.02 | 5.84 | 0.198 | 0.230 |
| E | 6.40 | 6.73 | 0.252 | 0.265 |
| E1 | 4.70 | 5.21 | 0.185 | 0.205 |
| e | 2.29 | | 0.090 | |
| e1 | 4.57 | | 0.180 | |
| N | 3 | | 3 | |
| H | 9.40 | 10.48 | 0.370 | 0.413 |
| L | 1.18 | 1.70 | 0.046 | 0.067 |
| L3 | 0.90 | 1.25 | 0.035 | 0.049 |
| L4 | 0.51 | 1.00 | 0.020 | 0.039 |
| F1 | 10.50 | 10.70 | 0.413 | 0.421 |
| F2 | 6.30 | 6.50 | 0.248 | 0.256 |
| F3 | 2.10 | 2.30 | 0.083 | 0.091 |
| F4 | 5.70 | 5.90 | 0.224 | 0.232 |
| F5 | 5.66 | 5.86 | 0.223 | 0.231 |
| F6 | 1.10 | 1.30 | 0.043 | 0.051 |

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