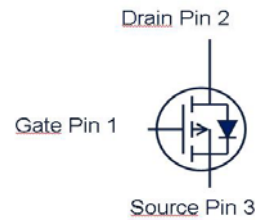
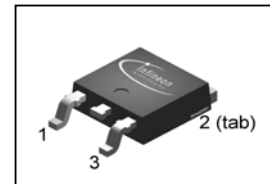


SIPMOS® Power-Transistor
Features

- P-Channel
- Enhancement mode
- Logic level
- Avalanche rated
- Pb-free lead plating; RoHS compliant


Product Summary

| | | |
|------------------|------|------------|
| V_{DS} | -100 | V |
| $R_{DS(on),max}$ | 850 | m Ω |
| I_D | -4.2 | A |


PG-TO-252-3


| Type | Package | Marking | Lead free | Packing | Tape and reel information |
|--------------|------------|---------|-----------|---------|---------------------------|
| SPD04P10PL G | PG-TO252-3 | 04P10PL | Yes | Non dry | 1000 pcs / reel |

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

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|----------------|---|----------------------|------------------|
| | | | steady state | |
| Continuous drain current | I_D | $T_C=25\text{ }^\circ\text{C}$ | -4.2 | A |
| | | $T_C=100\text{ }^\circ\text{C}$ | 3.0 | |
| Pulsed drain current | $I_{D,pulse}$ | $T_C=25\text{ }^\circ\text{C}$ | -16.8 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=-4.2\text{ A}$, $R_{GS}=25\text{ }\Omega$ | 57 | mJ |
| Gate source voltage | V_{GS} | | ± 20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ }^\circ\text{C}$ | 38 | W |
| Operating and storage temperature | T_j, T_{stg} | | -55 ... 175 | $^\circ\text{C}$ |
| ESD class | | JESD22-C101-HBM | 1A (250 V to 500 V) | |
| Soldering temperature | | | 260 $^\circ\text{C}$ | |
| IEC climatic category; DIN IEC 68-1 | | | 55/175/56 | |

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

Thermal characteristics

| | | | | | | |
|--|------------|---|---|---|-----|-----|
| Thermal resistance, junction - soldering point | R_{thJC} | | - | - | 3.9 | K/W |
| Thermal resistance, junction - ambient | R_{thJA} | minimal footprint, steady state | - | - | 75 | |
| | | 6 cm ² cooling area ¹⁾ , steady state | - | - | 50 | |

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

| | | | | | | |
|----------------------------------|---------------|--|------|------|------|------------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=-250\text{ mA}$ | -100 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-380\text{ }\mu\text{A}$ | -1 | -1.5 | -2 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=-100\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ | - | -0.1 | -1 | μA |
| | | $V_{DS}=-100\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ }^\circ\text{C}$ | - | -10 | -100 | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=-20\text{ V}, V_{DS}=0\text{ V}$ | - | -10 | -100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=-4.5\text{ V}, I_D=-2.75\text{ A}$ | - | 787 | 1050 | $\text{m}\Omega$ |
| | | $V_{GS}=-10\text{ V}, I_D=-3.0\text{ A}$ | - | 550 | 850 | |
| Transconductance | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=-3.0\text{ A}$ | 1.5 | 3.0 | - | S |

¹⁾ 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} | $V_{GS}=0\text{ V}, V_{DS}=-25\text{ V},$ $f=1\text{ MHz}$ | - | 280 | 372 | pF |
| Output capacitance | C_{oss} | | - | 70 | 94 | |
| Reverse transfer capacitance | C_{rss} | | - | 34 | 51 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=-50\text{ V}, V_{GS}=-$ $10\text{ V}, I_D=-4.2\text{ A},$ $R_G=6\ \Omega$ | - | 4.6 | 6.9 | ns |
| Rise time | t_r | | - | 5.7 | 8.6 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 18 | 27 | |
| Fall time | t_f | | - | 5.0 | 7.5 | |

Gate Charge Characteristics²⁾

| | | | | | | |
|-----------------------|---------------|--|---|-----|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=-80\text{ V}, I_D=-4.2\text{ A},$ $V_{GS}=0\text{ to }-10\text{ V}$ | - | 1.1 | 1.5 | nC |
| Gate to drain charge | Q_{gd} | | - | 4.6 | 6.9 | |
| Gate charge total | Q_g | | - | 12 | 16 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.1 | - | V |

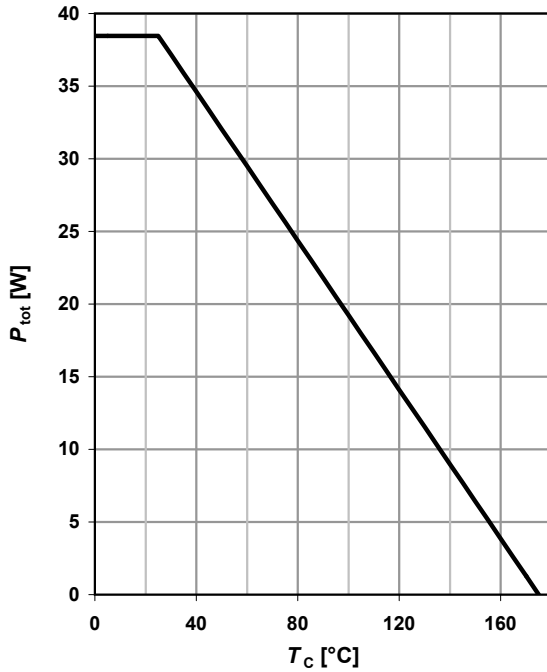
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|---|---|------|------|----|
| Diode continuous forward current | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | -4.2 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 16.8 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=-4.2\text{ A},$ $T_j=25\text{ }^\circ\text{C}$ | - | 0.94 | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=50\text{ V}, I_F= I_S ,$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 68 | 85 | ns |
| Reverse recovery charge | Q_{rr} | | - | 178 | 223 | nC |

²⁾ See figure 16 for gate charge parameter definition

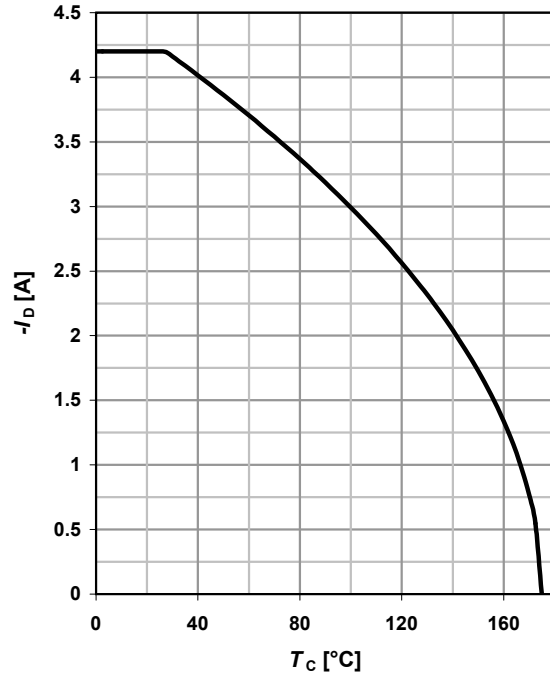
1 Power dissipation

$$P_{tot} = f(T_C)$$



2 Drain current

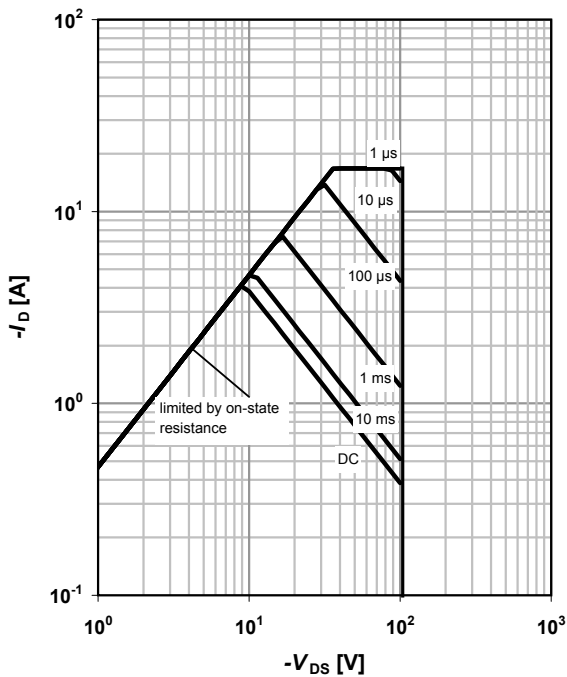
$$I_D = f(T_C); |V_{GS}| \geq 10 \text{ V}$$



3 Safe operating area

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

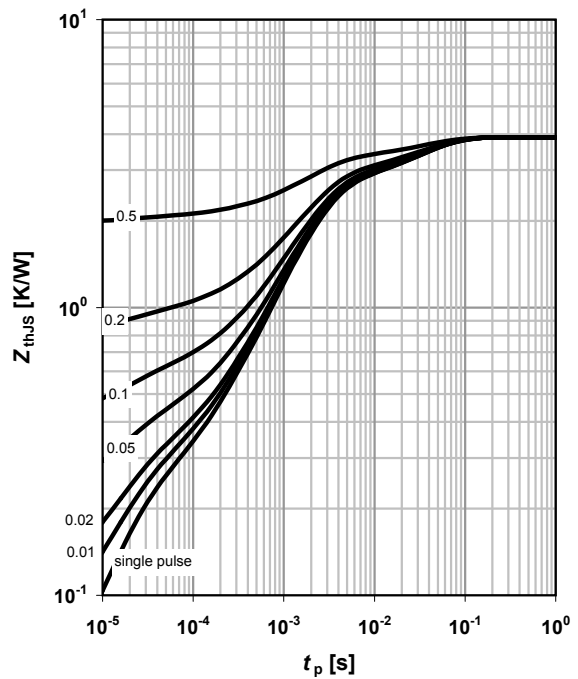
parameter: t_p



4 Max. transient thermal impedance

$$Z_{thJC} = f(t_p)$$

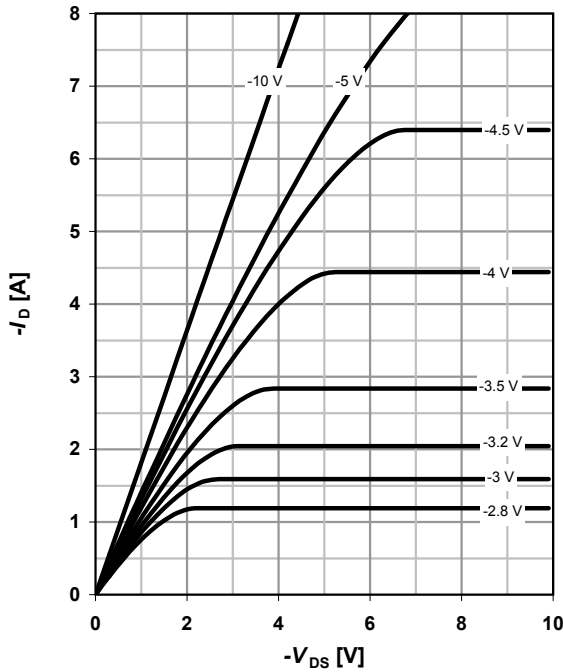
parameter: $D = t_p / T$



5 Typ. output characteristics

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

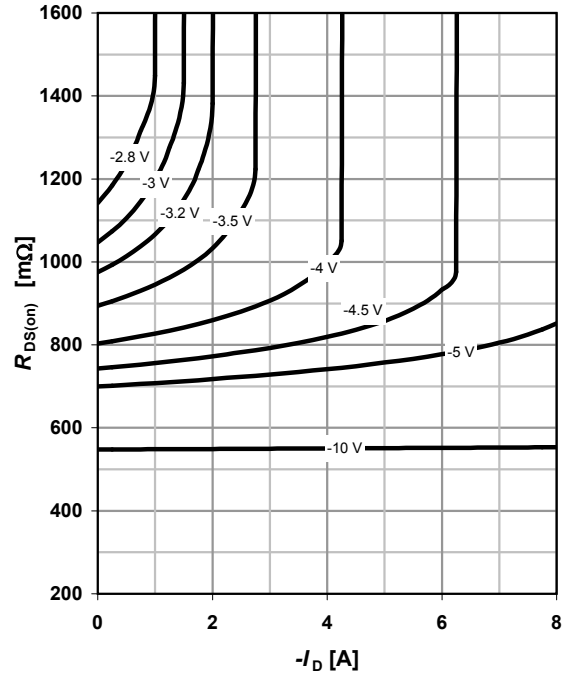
parameter: V_{GS}



6 Typ. drain-source on resistance

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

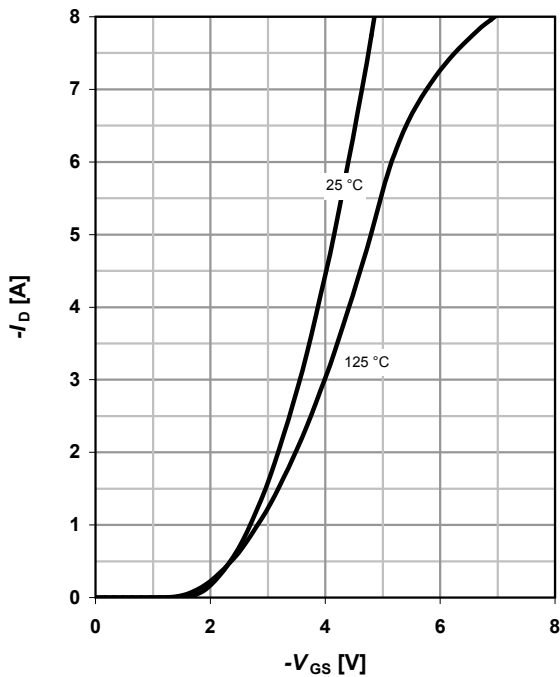
parameter: V_{GS}



7 Typ. transfer characteristics

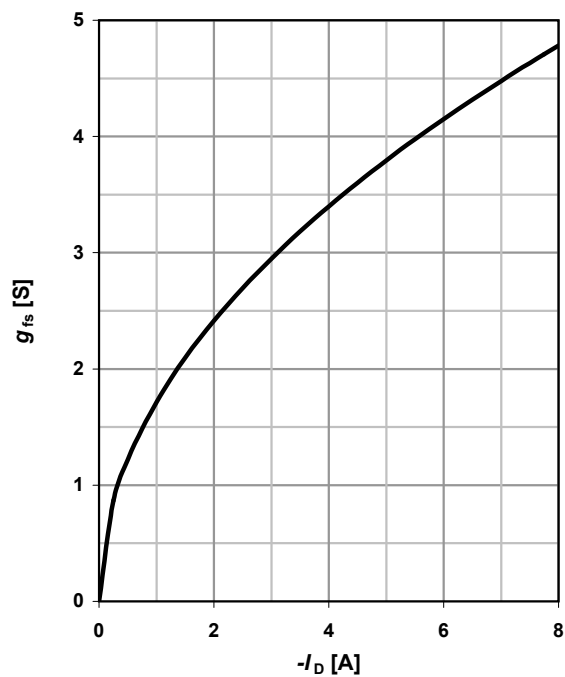
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



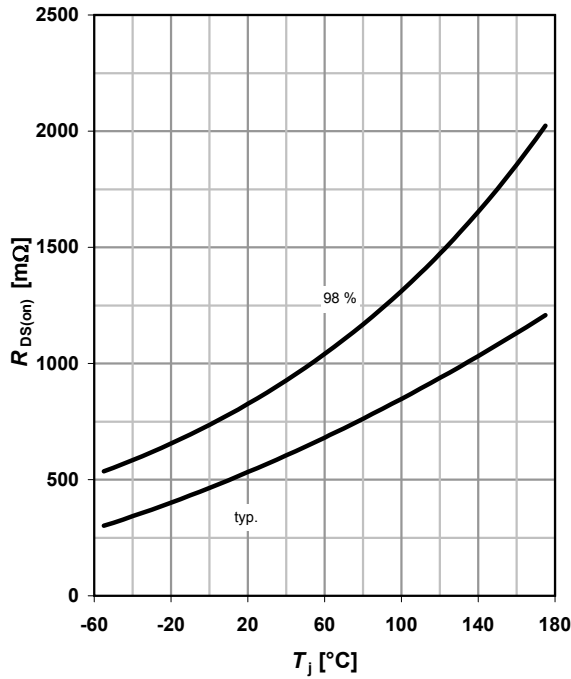
8 Typ. forward transconductance

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



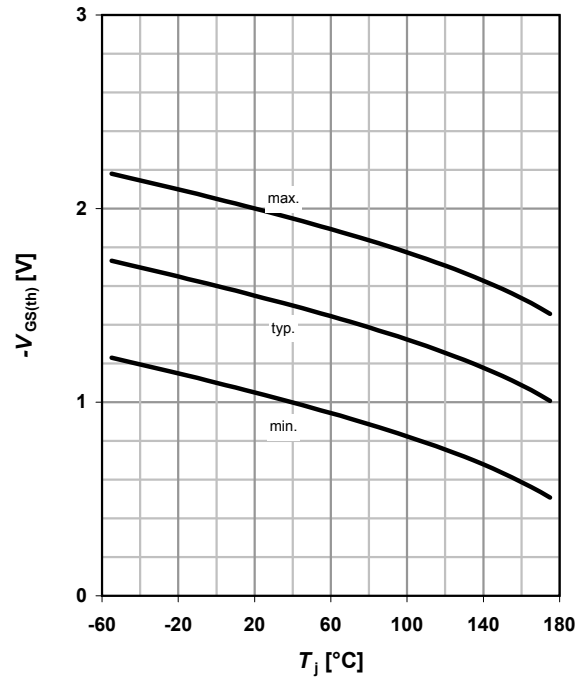
9 Drain-source on-state resistance

$R_{DS(on)} = f(T_j); I_D = -3 \text{ A}; V_{GS} = -10 \text{ V}$



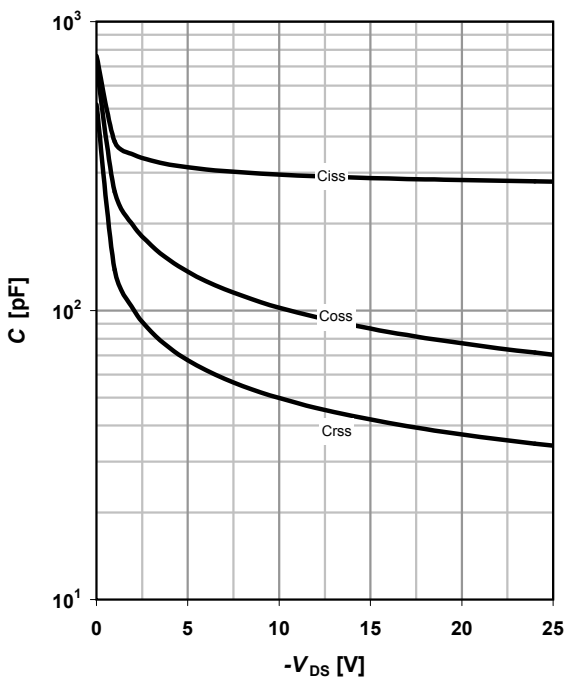
10 Typ. gate threshold voltage

$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = -380 \mu\text{A}$



11 Typ. capacitances

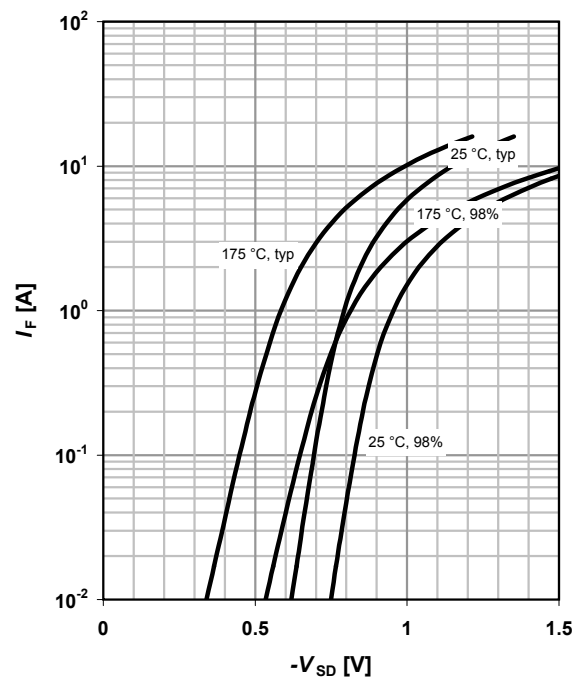
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

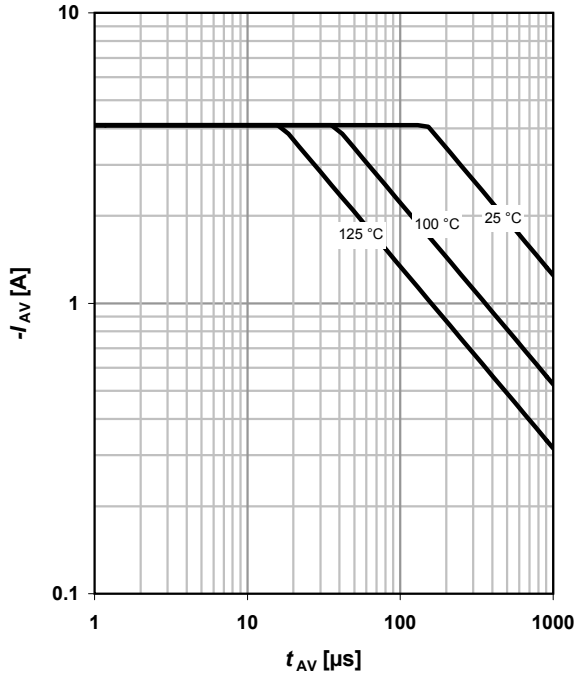
parameter: T_j



13 Avalanche characteristics

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

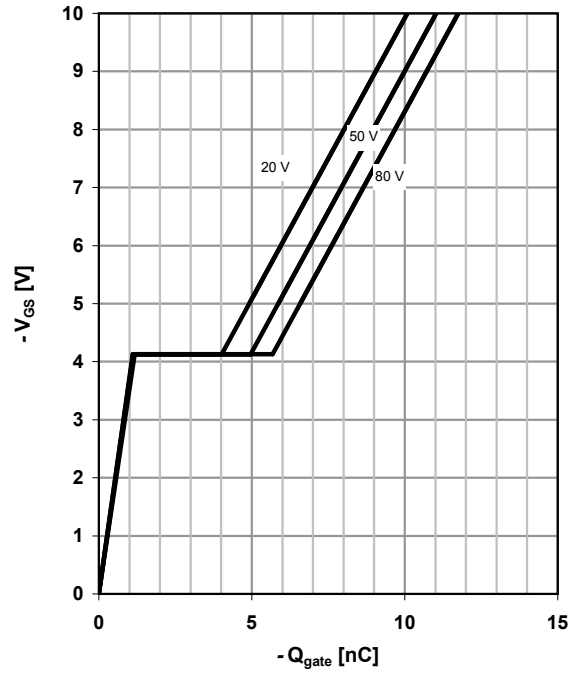
parameter: $T_{j(start)}$



14 Typ. gate charge

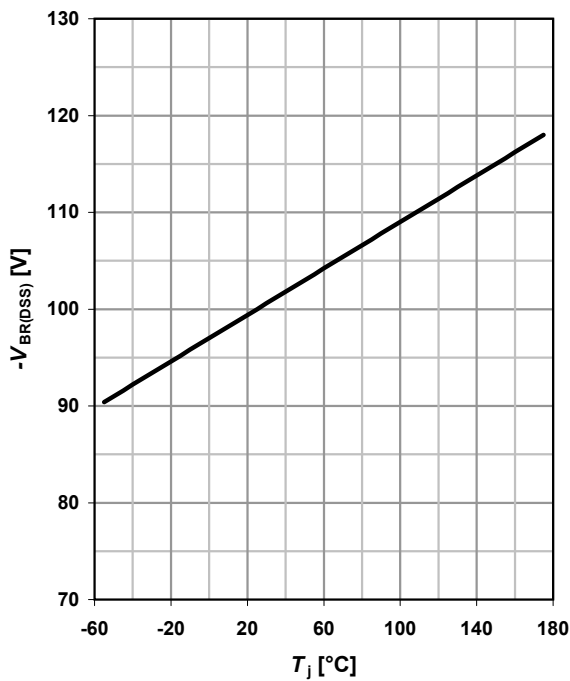
$V_{GS}=f(Q_{gate}); I_D=-4.2 \text{ A pulsed}$

parameter: V_{DD}

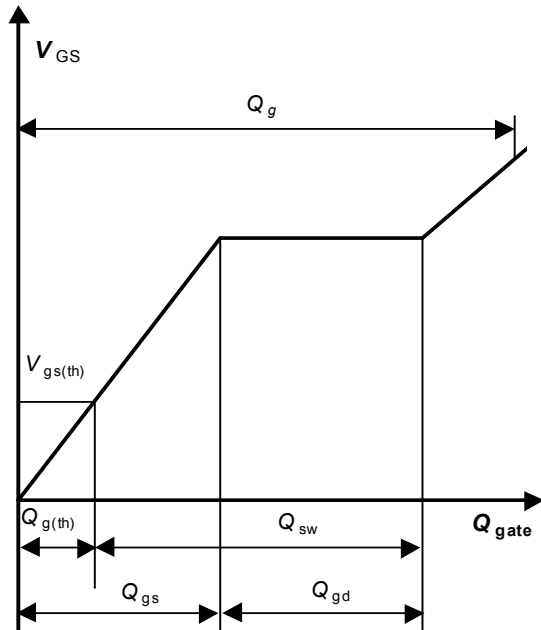


15 Drain-source breakdown voltage

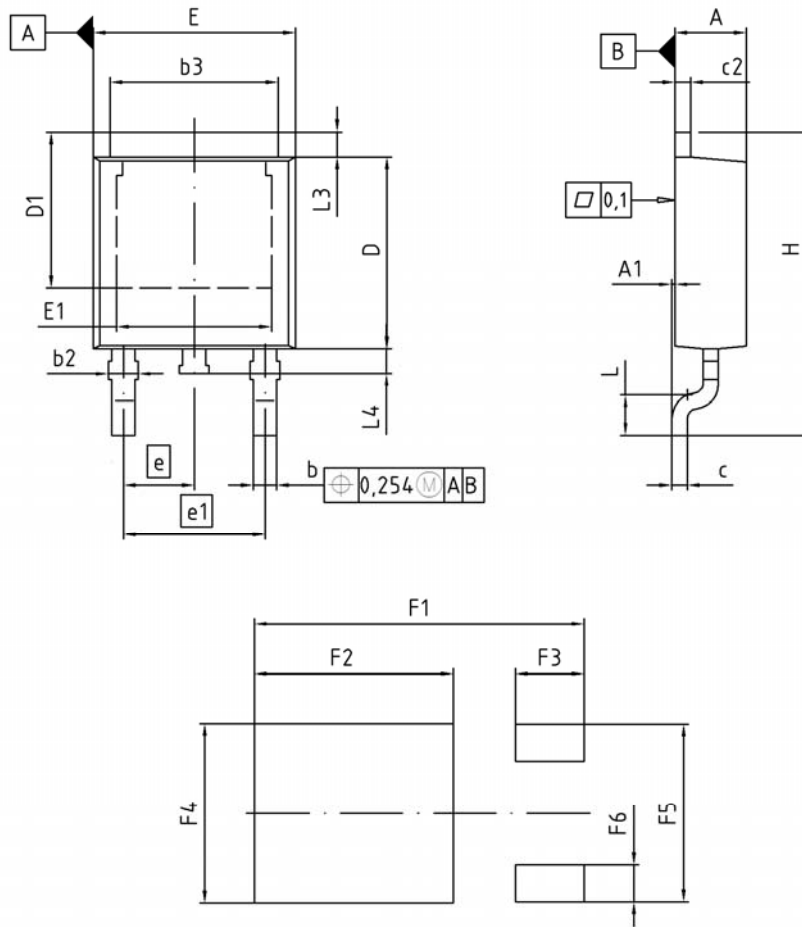
$V_{BR(DSS)}=f(T_j); I_D=-250 \mu\text{A}$



16 Gate charge waveforms



Package Outline: PG-TO-252-3



| 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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