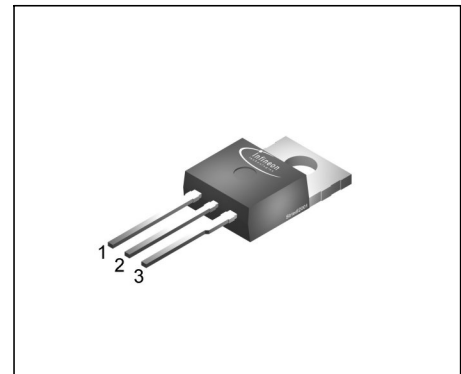


SIPMOS® Power Transistor

- N channel
- Enhancement mode
- Avalanche-rated
- Logic Level
- Pb-free lead plating; RoHS compliant



| Pin 1 | Pin 2 | Pin 3 |
|-------|-------|-------|
| G | D | S |

| Type | V_{DS} | I_D | $R_{DS(on)}$ | Package | Pb-free |
|----------|----------|--------|--------------|------------|---------|
| BUZ 31 L | 200 V | 13.5 A | 0.2 Ω | PG-TO220-3 | Yes |

Maximum Ratings

| Parameter | Symbol | Values | Unit |
|---|-------------|---------------|------------------|
| Continuous drain current $T_C = 28\text{ }^\circ\text{C}$ | I_D | 13.5 | A |
| Pulsed drain current $T_C = 25\text{ }^\circ\text{C}$ | I_{Dpuls} | 54 | |
| Avalanche current, limited by T_{jmax} | I_{AR} | 13.5 | |
| Avalanche energy, periodic limited by T_{jmax} | E_{AR} | 9 | mJ |
| Avalanche energy, single pulse $I_D = 13.5\text{ A}$, $V_{DD} = 50\text{ V}$, $R_{GS} = 25\text{ }\Omega$ $L = 1.65\text{ mH}$, $T_j = 25\text{ }^\circ\text{C}$ | E_{AS} | 200 | |
| Gate source voltage | V_{GS} | ± 20 | V |
| ESD-Sensitivity HBM as per MIL-STD 883 | | Class 1 | |
| Power dissipation $T_C = 25\text{ }^\circ\text{C}$ | P_{tot} | 95 | W |
| Operating temperature | T_j | -55 ... + 150 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55 ... + 150 | |
| Thermal resistance, chip case | R_{thJC} | ≤ 1.32 | K/W |
| Thermal resistance, chip to ambient | R_{thJA} | 75 | |
| DIN humidity category, DIN 40 040 | | E | |
| IEC climatic category, DIN IEC 68-1 | | 55 / 150 / 56 | |

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

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

Static Characteristics

| | | | | | |
|--|---------------|-----|-----------|----------|---------------|
| Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$, $T_j = 25^\circ\text{C}$ | $V_{(BR)DSS}$ | 200 | - | - | V |
| Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1\text{ mA}$ | $V_{GS(th)}$ | 1.2 | 1.6 | 2 | |
| Zero gate voltage drain current $V_{DS} = 200\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25^\circ\text{C}$ $V_{DS} = 200\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 125^\circ\text{C}$ | I_{DSS} | - | 0.1 10 | 1 100 | μA |
| Gate-source leakage current $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$ | I_{GSS} | - | 10 | 100 | nA |
| Drain-Source on-resistance $V_{GS} = 5\text{ V}$, $I_D = 7\text{ A}$ | $R_{DS(on)}$ | - | 0.16 | 0.2 | Ω |

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

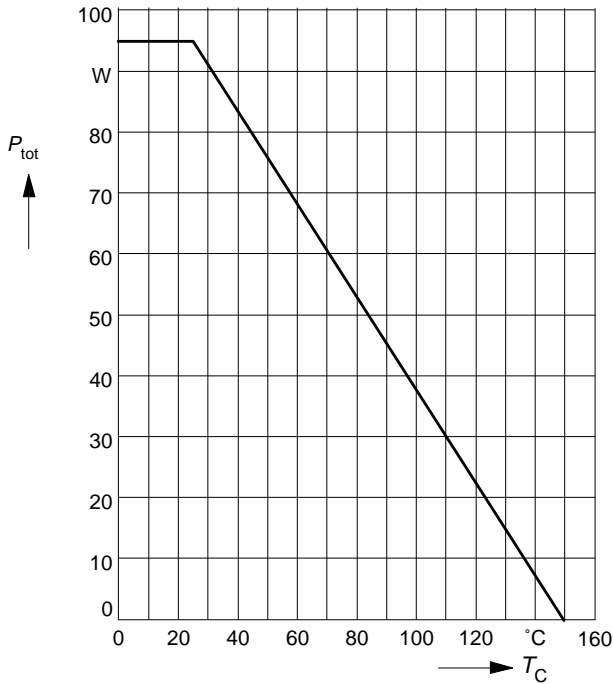
| Parameter | Symbol | Values | | | Unit |
|---|--------------|--------|------|------|------|
| | | min. | typ. | max. | |
| Dynamic Characteristics | | | | | |
| Transconductance $V_{DS} \geq 2 * I_D * R_{DS(on)max}, I_D = 7 \text{ A}$ | g_{fs} | 5 | 12 | - | S |
| Input capacitance $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$ | C_{iss} | - | 1200 | 1600 | pF |
| Output capacitance $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$ | C_{oss} | - | 200 | 300 | |
| Reverse transfer capacitance $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$ | C_{rss} | - | 100 | 150 | |
| Turn-on delay time $V_{DD} = 30 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 3 \text{ A}$ $R_{GS} = 50 \Omega$ | $t_{d(on)}$ | - | 25 | 40 | ns |
| Rise time $V_{DD} = 30 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 3 \text{ A}$ $R_{GS} = 50 \Omega$ | t_r | - | 80 | 120 | |
| Turn-off delay time $V_{DD} = 30 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 3 \text{ A}$ $R_{GS} = 50 \Omega$ | $t_{d(off)}$ | - | 210 | 270 | |
| Fall time $V_{DD} = 30 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 3 \text{ A}$ $R_{GS} = 50 \Omega$ | t_f | - | 65 | 85 | |

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

| Parameter | Symbol | Values | | | Unit |
|--|----------|--------|------|------|---------------|
| | | min. | typ. | max. | |
| Reverse Diode | | | | | |
| Inverse diode continuous forward current $T_C = 25^\circ\text{C}$ | I_S | - | - | 13.5 | A |
| Inverse diode direct current, pulsed $T_C = 25^\circ\text{C}$ | I_{SM} | - | - | 54 | |
| Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = 27\text{ A}$ | V_{SD} | - | 1.2 | 1.6 | V |
| Reverse recovery time $V_R = 100\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ | t_{rr} | - | 180 | - | ns |
| Reverse recovery charge $V_R = 100\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ | Q_{rr} | - | 1.2 | - | μC |

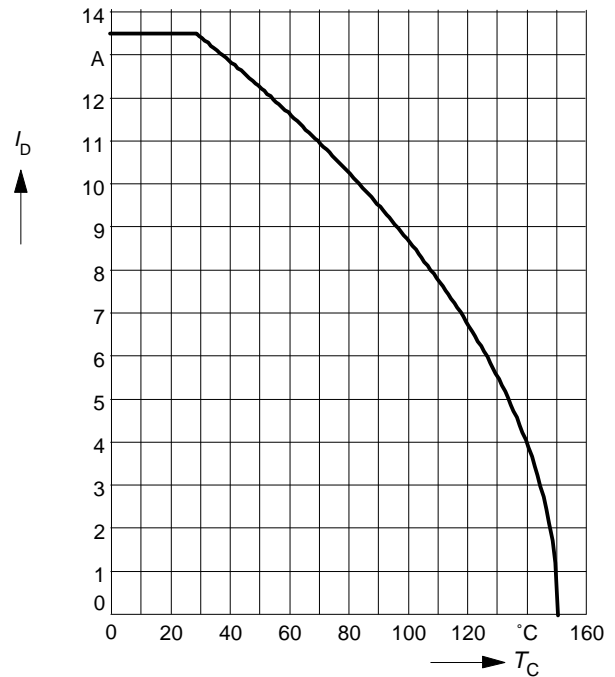
Power dissipation

$P_{tot} = f(T_C)$



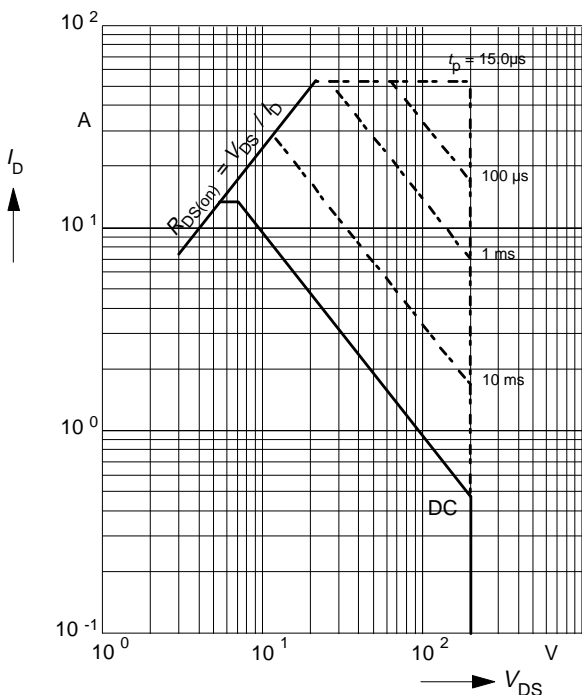
Drain current

$I_D = f(T_C)$
parameter: $V_{GS} \geq 5\text{ V}$



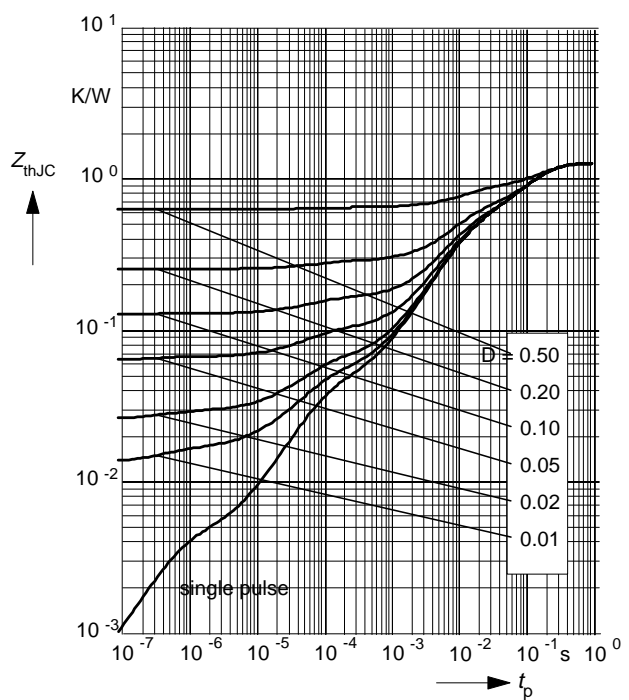
Safe operating area

$I_D = f(V_{DS})$
parameter: $D = 0.01, T_C = 25^\circ\text{C}$



Transient thermal impedance

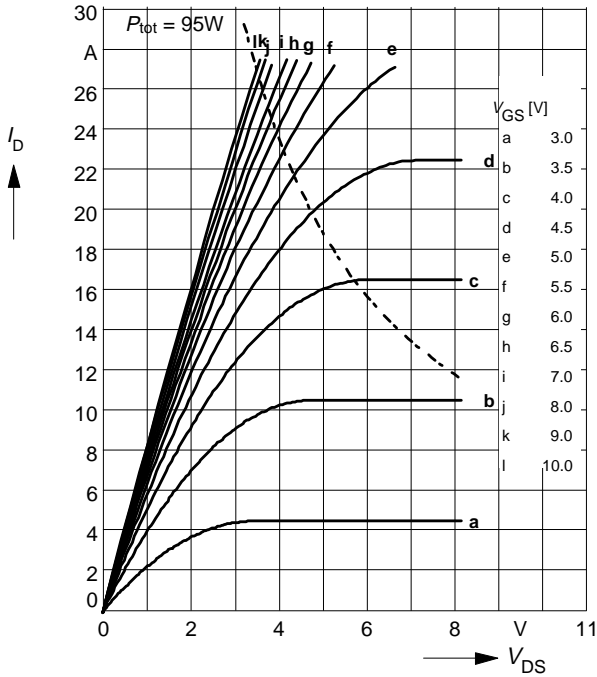
$Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. output characteristics

$I_D = f(V_{DS})$

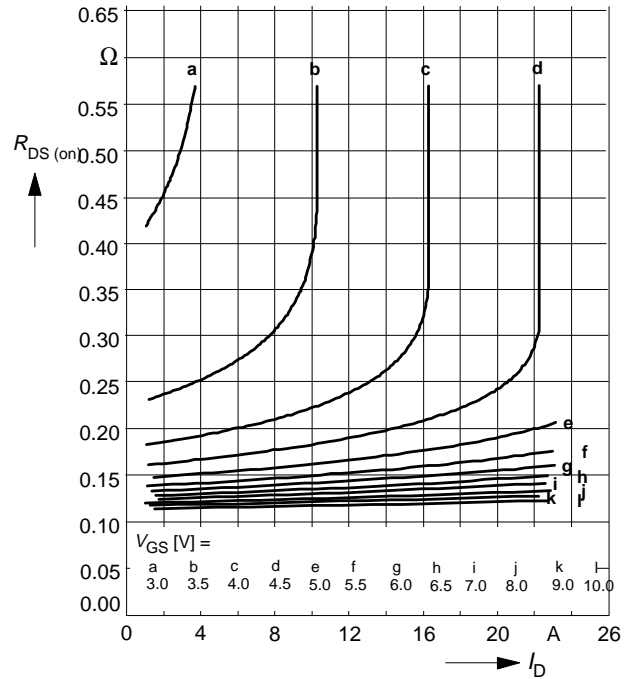
parameter: $t_p = 80 \mu s$, $T_j = 25^\circ C$



Typ. drain-source on-resistance

$R_{DS(on)} = f(I_D)$

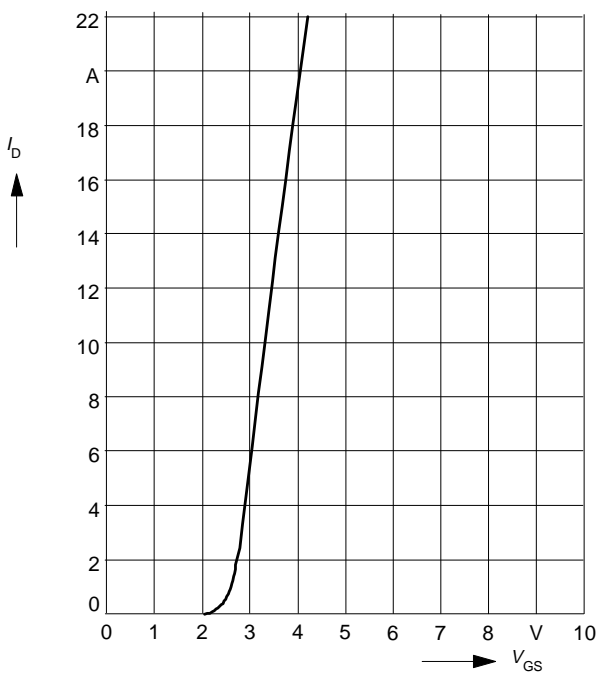
parameter: $t_p = 80 \mu s$, $T_j = 25^\circ C$



Typ. transfer characteristics $I_D = f(V_{GS})$

parameter: $t_p = 80 \mu s$

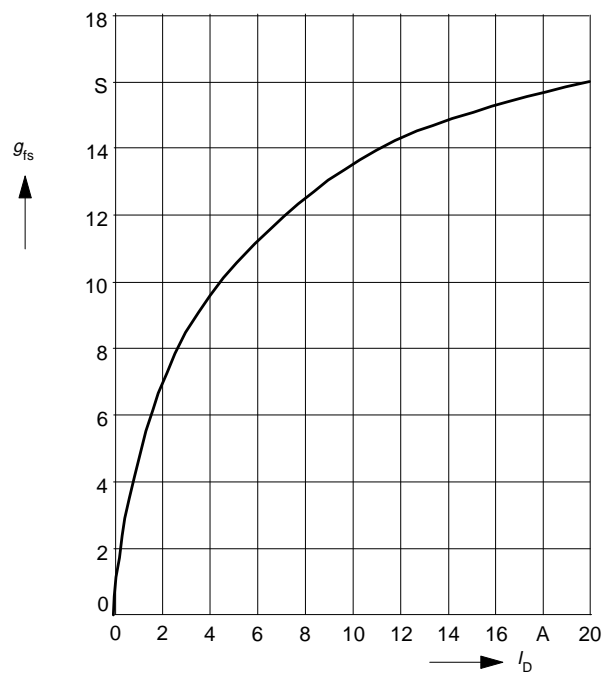
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Typ. forward transconductance $g_{fs} = f(I_D)$

parameter: $t_p = 80 \mu s$,

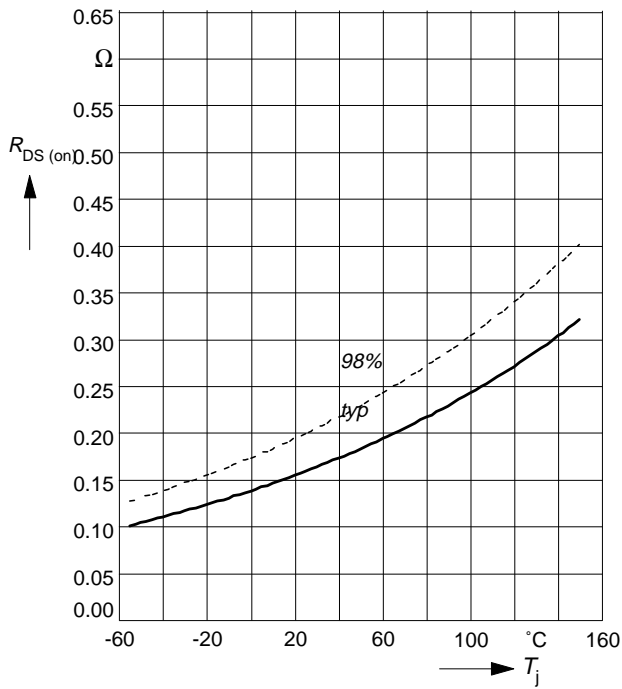
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Drain-source on-resistance

$$R_{DS(on)} = f(T_j)$$

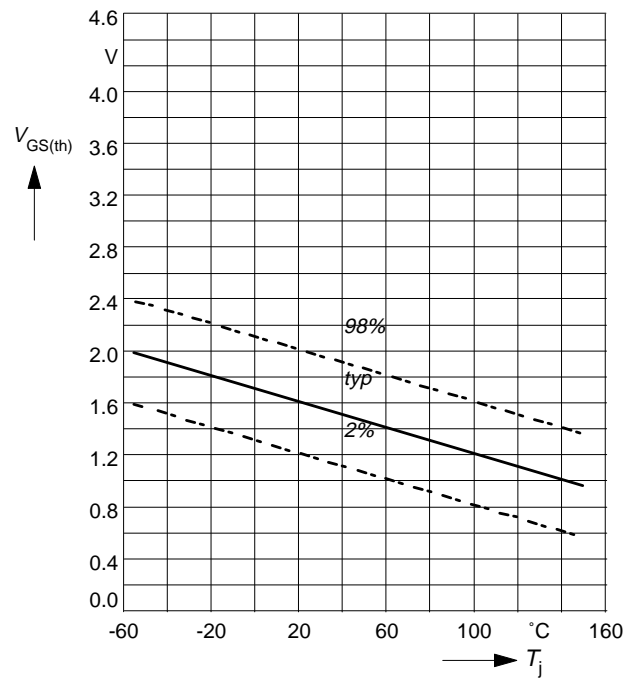
parameter: $I_D = 7\text{ A}$, $V_{GS} = 5\text{ V}$



Gate threshold voltage

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

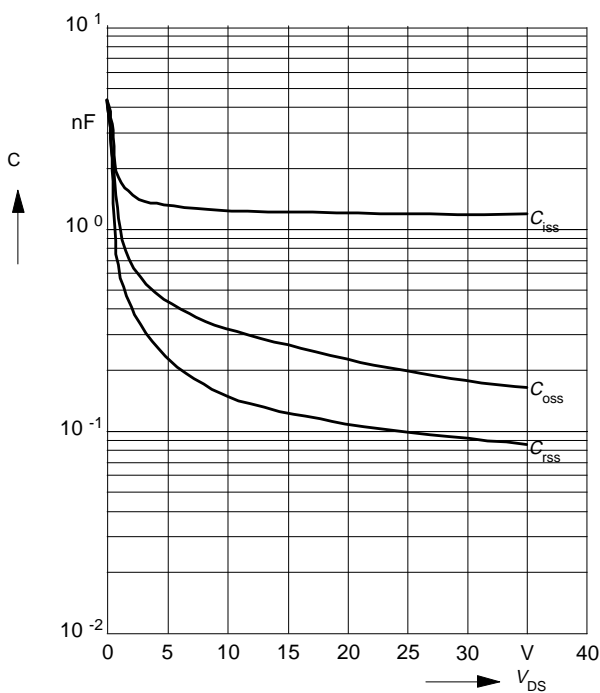
parameter: $V_{GS} = V_{DS}$, $I_D = 1\text{ mA}$



Typ. capacitances

$$C = f(V_{DS})$$

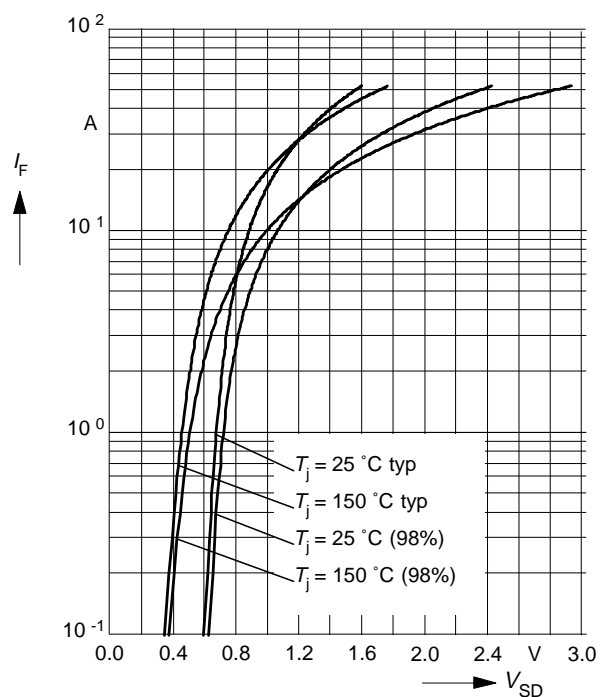
parameter: $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$



Forward characteristics of reverse diode

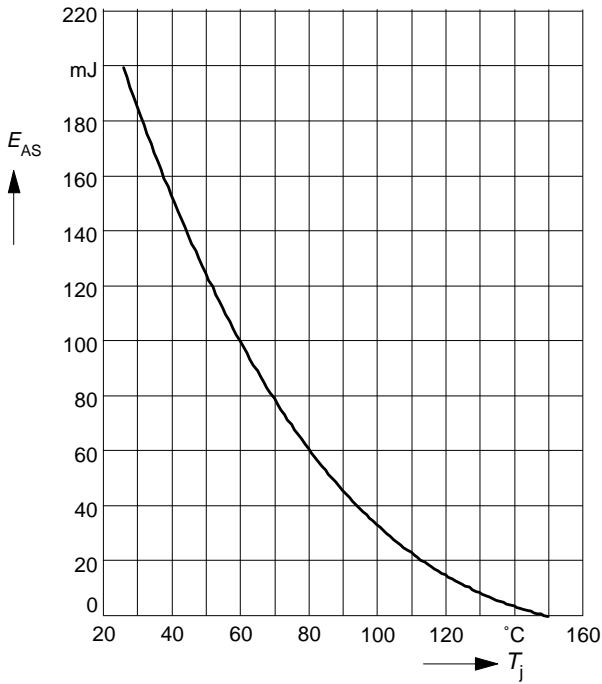
$$I_F = f(V_{SD})$$

parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



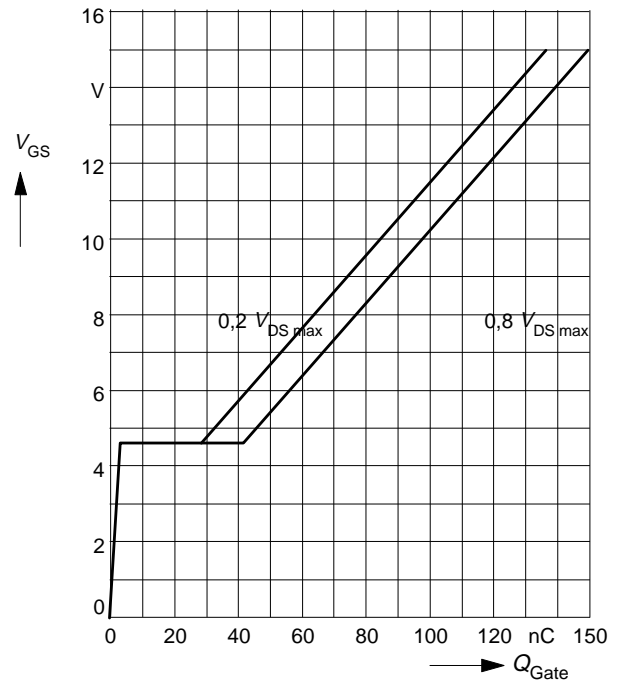
Avalanche energy $E_{AS} = f(T_j)$

parameter: $I_D = 13.5 \text{ A}$, $V_{DD} = 50 \text{ V}$
 $R_{GS} = 25 \Omega$, $L = 1.65 \text{ mH}$



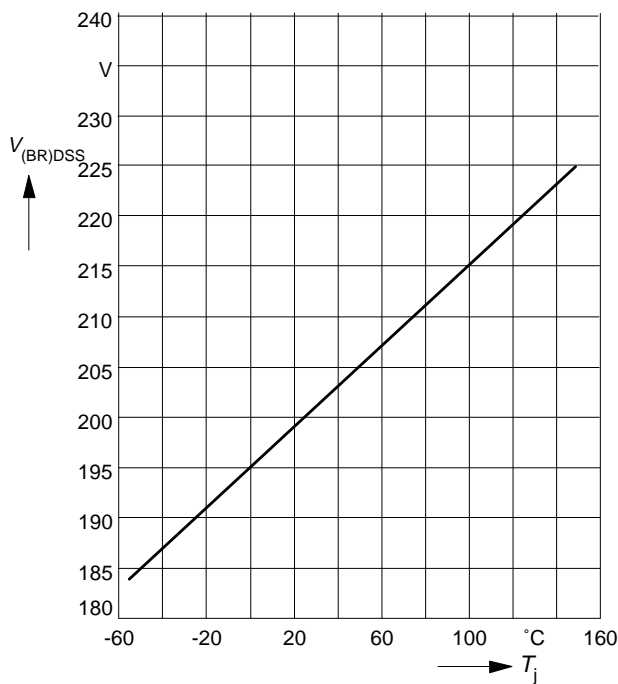
Typ. gate charge

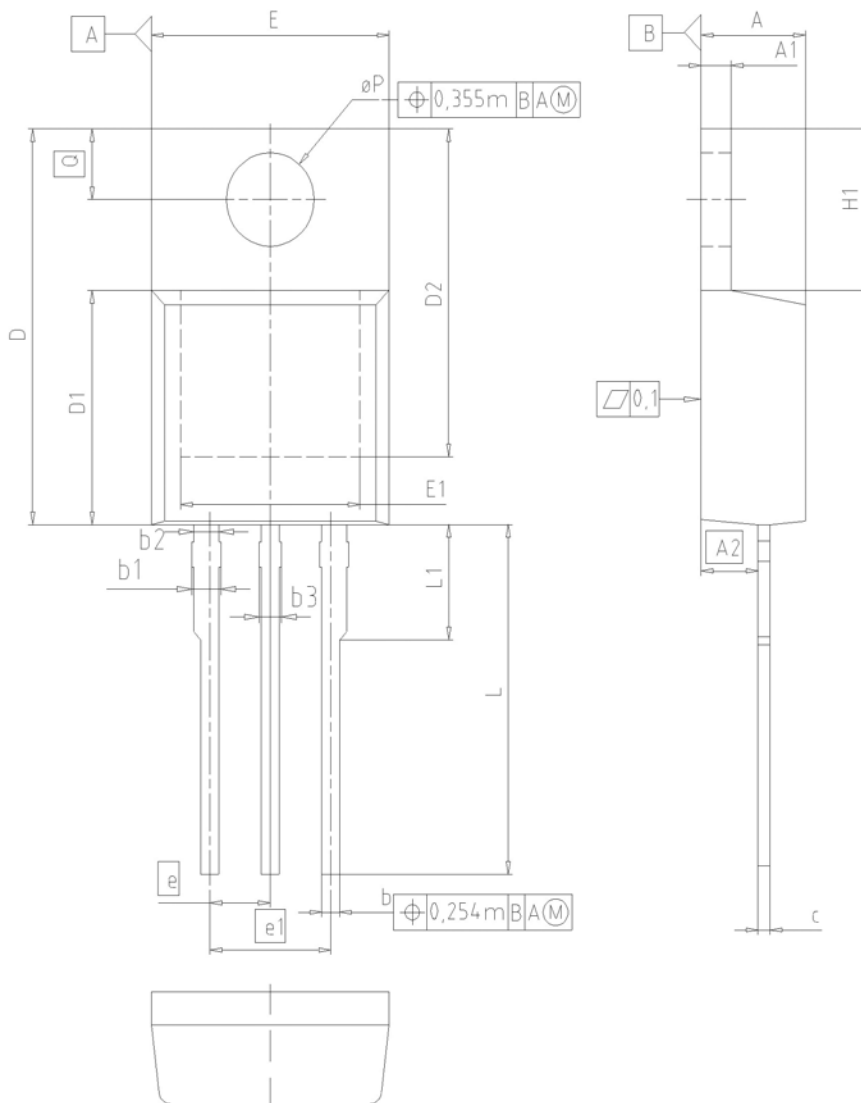
$V_{GS} = f(Q_{Gate})$
parameter: $I_{D \text{ puls}} = 21 \text{ A}$



Drain-source breakdown voltage

$V_{(BR)DSS} = f(T_j)$



PG-TO220-3


| DIM | MILLIMETERS | | INCHES | |
|----------|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 1.17 | 1.40 | 0.046 | 0.055 |
| A2 | 2.15 | 2.72 | 0.085 | 0.107 |
| b | 0.65 | 0.86 | 0.026 | 0.034 |
| b1 | 0.95 | 1.40 | 0.037 | 0.055 |
| b2 | 0.95 | 1.15 | 0.037 | 0.045 |
| b3 | 0.65 | 1.15 | 0.026 | 0.045 |
| c | 0.33 | 0.60 | 0.013 | 0.024 |
| D | 14.81 | 15.95 | 0.583 | 0.628 |
| D1 | 8.51 | 9.45 | 0.335 | 0.372 |
| D2 | 12.19 | 13.10 | 0.480 | 0.516 |
| E | 9.70 | 10.36 | 0.382 | 0.408 |
| E1 | 6.50 | 8.60 | 0.256 | 0.339 |
| e | 2.54 | | 0.100 | |
| e1 | 5.08 | | 0.200 | |
| N | 3 | | 3 | |
| H1 | 5.90 | 6.90 | 0.232 | 0.272 |
| L | 13.00 | 14.00 | 0.512 | 0.551 |
| L1 | - | 4.80 | - | 0.189 |
| ϕP | 3.60 | 3.89 | 0.142 | 0.153 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |

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