

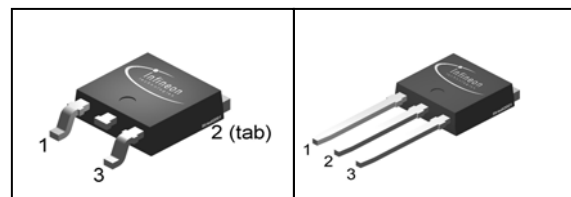
OptiMOS[®] 2 Power-Transistor

Features

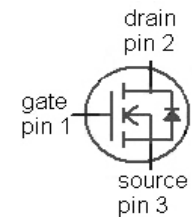
- Ideal for high-frequency dc/dc converters
- Qualified according to JEDEC¹⁾ for target application
- N-channel
- Logic level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- 175 °C operating temperature
- dv/dt rated

Product Summary

| | | |
|--------------------------------|-----|------------|
| V_{DS} | 25 | V |
| $R_{DS(on),max}$ (SMD version) | 5.7 | m Ω |
| I_D | 50 | A |

P-TO252-3-11
P-TO251-3-21


| Type | Package | Ordering Code | Marking |
|------------|--------------|---------------|---------|
| IPD06N03LA | P-TO252-3-11 | Q67042-S4149 | 06N03LA |
| IPU06N03LA | P-TO251-3-21 | Q67042-S4145 | 06N03LA |



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

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|-------------------|---|-------------|-------------------|
| Continuous drain current | I_D | $T_C=25\text{ °C}^2)$ | 50 | A |
| | | $T_C=100\text{ °C}$ | 50 | |
| Pulsed drain current | $I_{D,pulse}$ | $T_C=25\text{ °C}^3)$ | 350 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=45\text{ A}$, $R_{GS}=25\ \Omega$ | 225 | mJ |
| Reverse diode dv/dt | dv/dt | $I_D=50\text{ A}$, $V_{DS}=20\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=175\text{ °C}$ | 6 | kV/ μs |
| Gate source voltage ⁴⁾ | V_{GS} | | ± 20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ °C}$ | 83 | 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

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

Thermal characteristics

| | | | | | | |
|-------------------------------------|------------|--|---|---|-----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 1.8 | K/W |
| SMD version, device on PCB | R_{thJA} | minimal footprint | - | - | 75 | |
| | | 6 cm ² cooling area ⁵⁾ | - | - | 50 | |

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

| | | | | | | |
|----------------------------------|---------------|--|-----|-----|-----|---------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$ | 25 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=40\text{ }\mu\text{A}$ | 1.2 | 1.6 | 2 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ | - | 0.1 | 1 | μA |
| | | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}$ | - | 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 | $R_{DS(on)}$ | $V_{GS}=4.5\text{ V}, I_D=30\text{ A}$ | - | 7.7 | 9.6 | m Ω |
| | | $V_{GS}=4.5\text{ V}, I_D=30\text{ A},$ SMD version | - | 7.5 | 9.4 | |
| | | $V_{GS}=10\text{ V}, I_D=30\text{ A}$ | - | 5.0 | 5.9 | |
| | | $V_{GS}=10\text{ V}, I_D=30\text{ A},$ SMD version | - | 4.8 | 5.7 | |
| Gate resistance | R_G | | - | 1 | - | Ω |
| Transconductance | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=30\text{ A}$ | 29 | 59 | - | S |

²⁾ Current is limited by bondwire; with an $R_{thJC}=1.8\text{ K/W}$ the chip is able to carry 94 A.

³⁾ See figure 3

⁴⁾ $T_{j,max}=150\text{ }^\circ\text{C}$ and duty cycle $D<0.25$ for $V_{GS}<-5\text{ V}$

⁵⁾ 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} | $V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$ | - | 2093 | 2783 | pF |
| Output capacitance | C_{oss} | | - | 800 | 1064 | |
| Reverse transfer capacitance | C_{rss} | | - | 98 | 147 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=15\text{ V}, V_{GS}=10\text{ V}, I_D=25\text{ A}, R_G=2.7\ \Omega$ | - | 10 | 14 | ns |
| Rise time | t_r | | - | 7 | 11 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 29 | 43 | |
| Fall time | t_f | | - | 5 | 7 | |

Gate Charge Characteristics⁶⁾

| | | | | | | |
|------------------------------|---------------|--|---|-----|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=15\text{ V}, I_D=25\text{ A}, V_{GS}=0\text{ to }5\text{ V}$ | - | 7 | 9 | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | - | 3.3 | 4.5 | |
| Gate to drain charge | Q_{gd} | | - | 4.6 | 6.9 | |
| Switching charge | Q_{sw} | | - | 8 | 11 | |
| Gate charge total | Q_g | | - | 17 | 22 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.2 | - | V |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V}, V_{GS}=0\text{ to }5\text{ V}$ | - | 15 | 20 | nC |
| Output charge | Q_{oss} | $V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$ | - | 17 | 23 | |

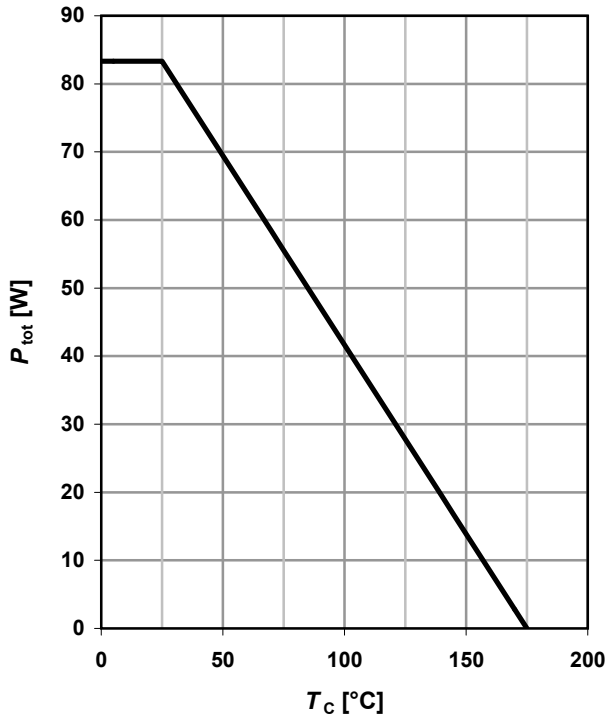
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|--|---|------|-----|----|
| Diode continuous forward current | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | 50 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 350 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=50\text{ A}, T_J=25\text{ }^\circ\text{C}$ | - | 0.92 | 1.2 | V |
| Reverse recovery charge | Q_{rr} | $V_R=15\text{ V}, I_F=I_S, di_F/dt=400\text{ A}/\mu\text{s}$ | - | - | 10 | nC |

⁶⁾ See figure 16 for gate charge parameter definition

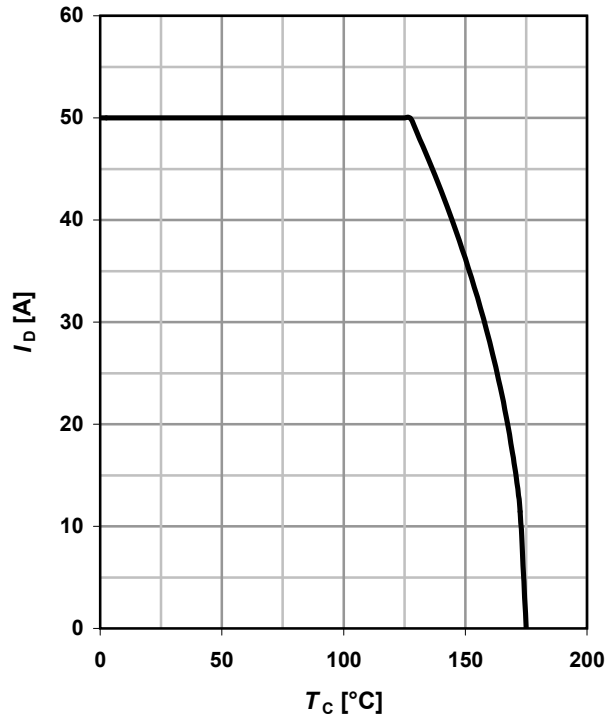
1 Power dissipation

$P_{tot}=f(T_C)$



2 Drain current

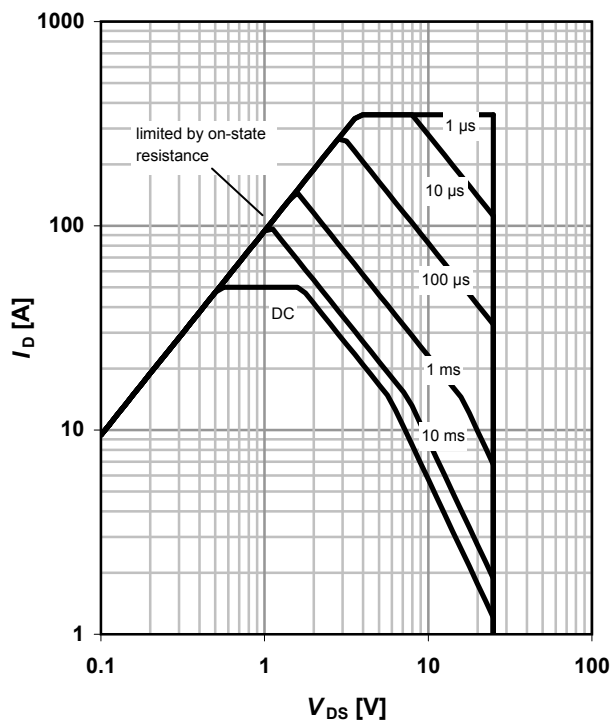
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



3 Safe operation area

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

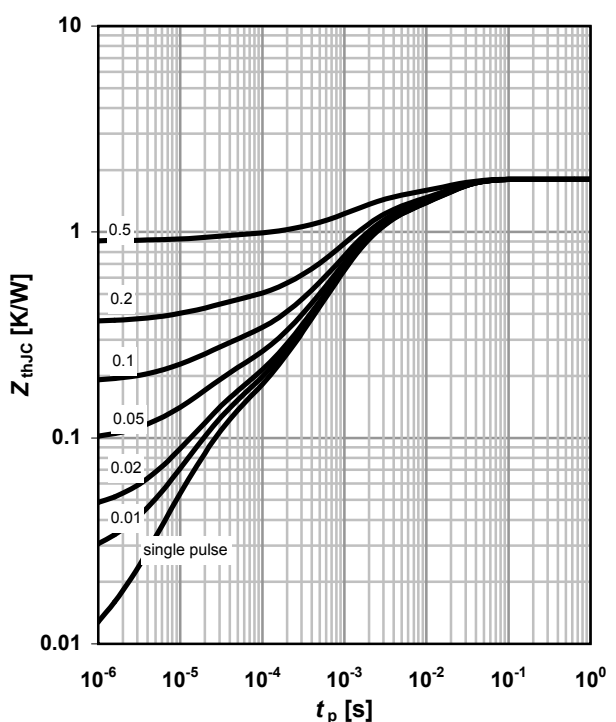
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

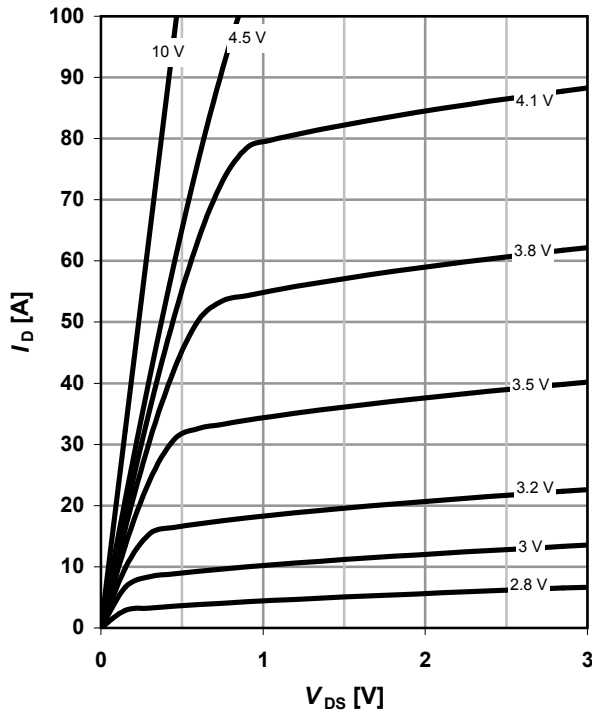
parameter: $D=t_p/T$



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

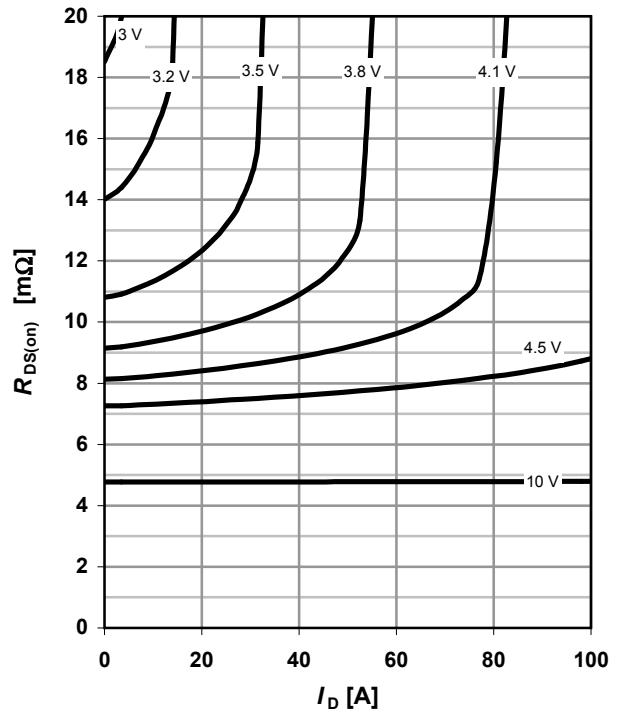
parameter: V_{GS}



6 Typ. drain-source on resistance

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

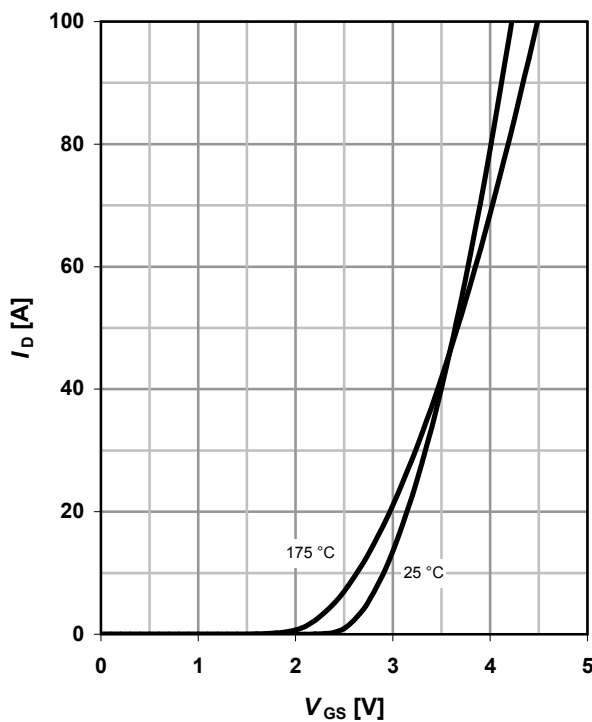
parameter: V_{GS}



7 Typ. transfer characteristics

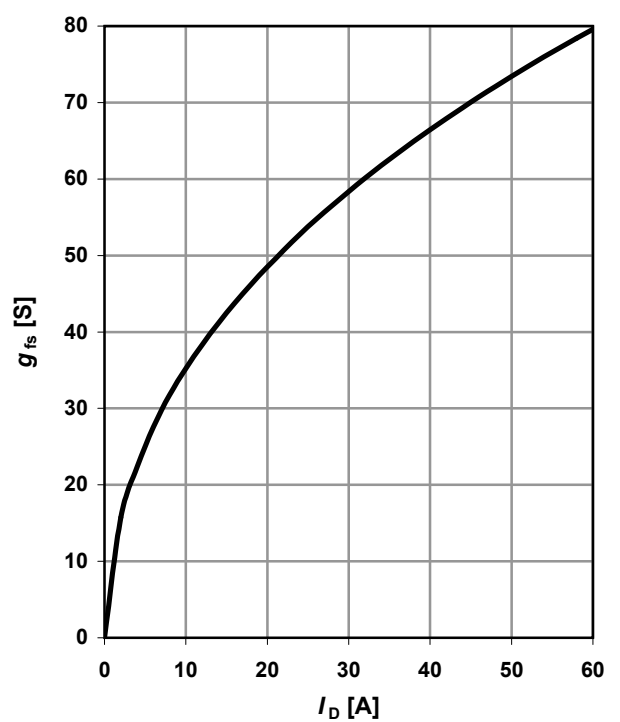
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



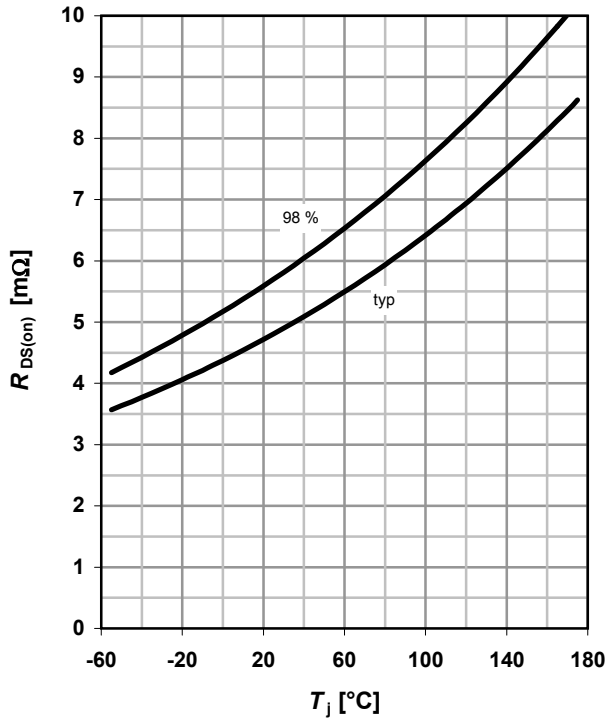
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



9 Drain-source on-state resistance

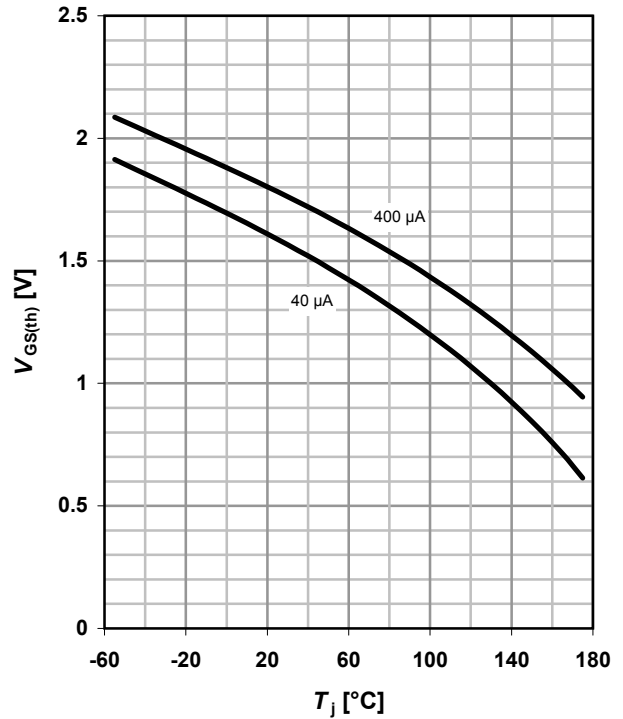
$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$



10 Typ. gate threshold voltage

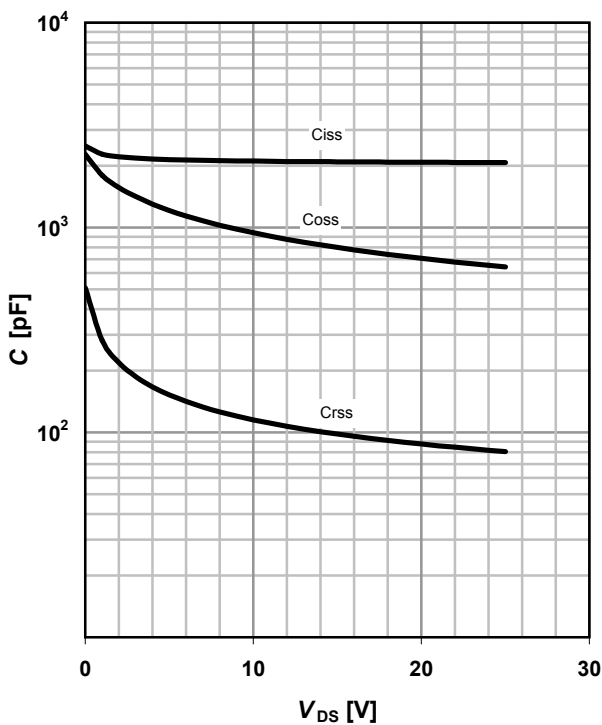
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



11 Typ. Capacitances

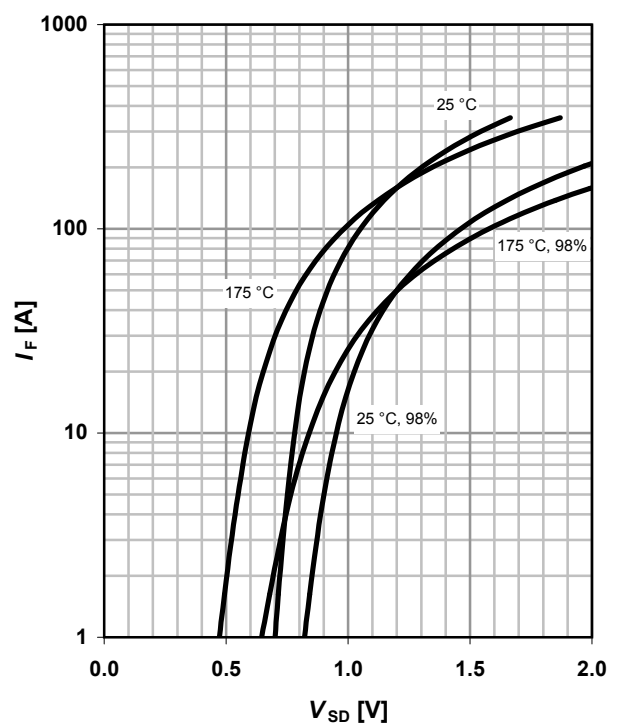
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

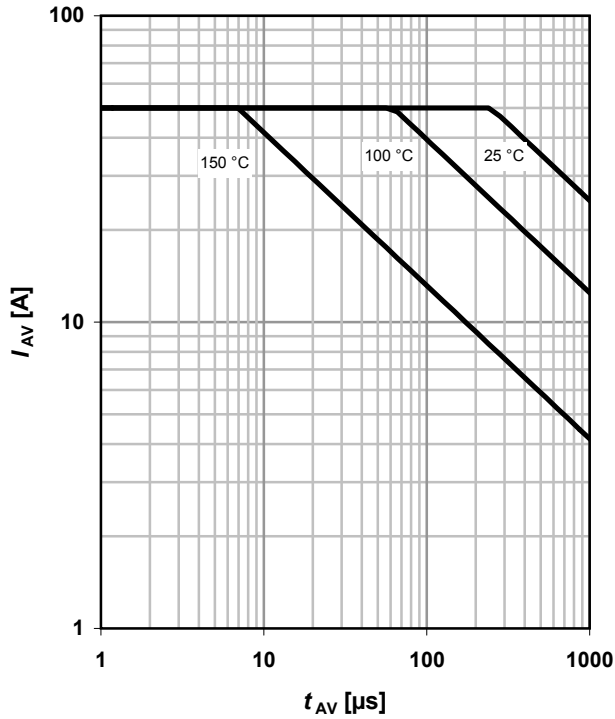
parameter: T_j



13 Avalanche characteristics

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

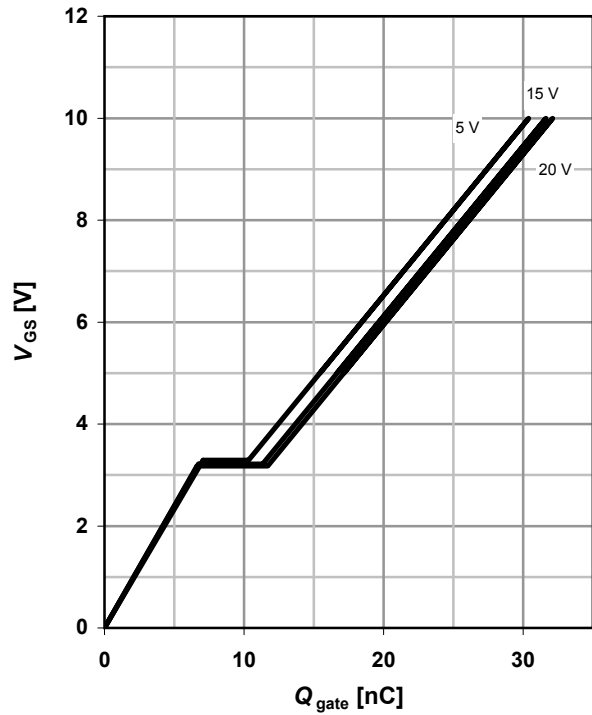
parameter: $T_{j(start)}$



14 Typ. gate charge

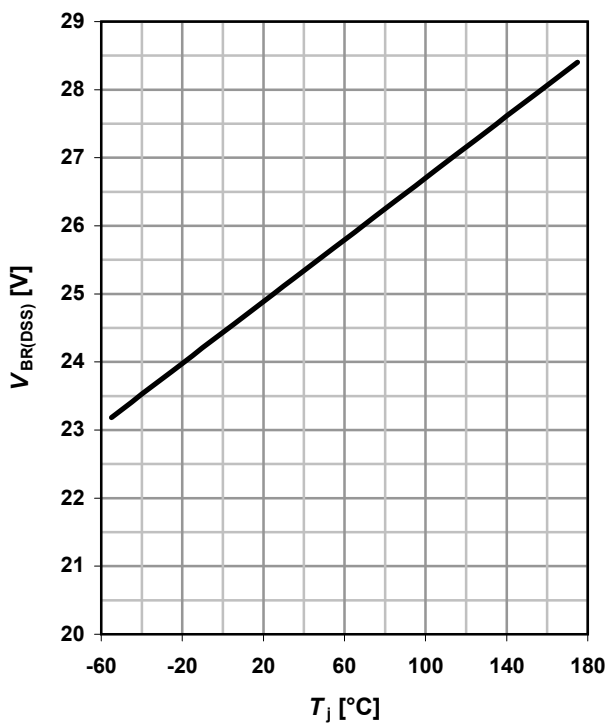
$V_{GS}=f(Q_{gate}); I_D=25 \text{ A pulsed}$

parameter: V_{DD}

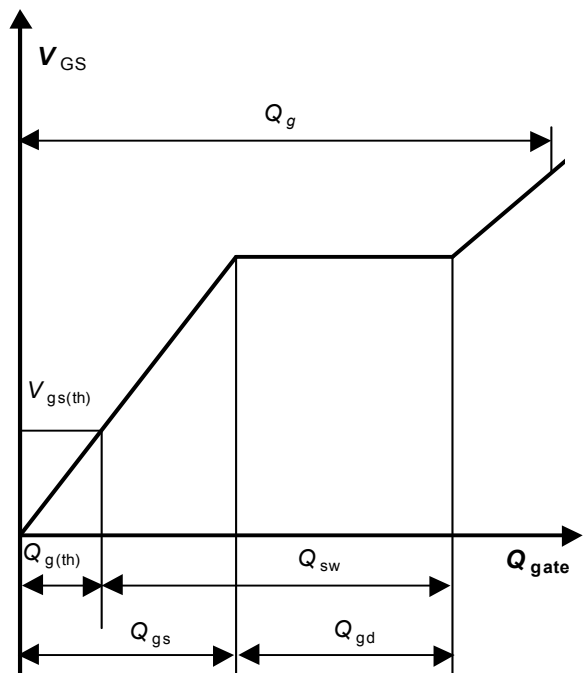


15 Drain-source breakdown voltage

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

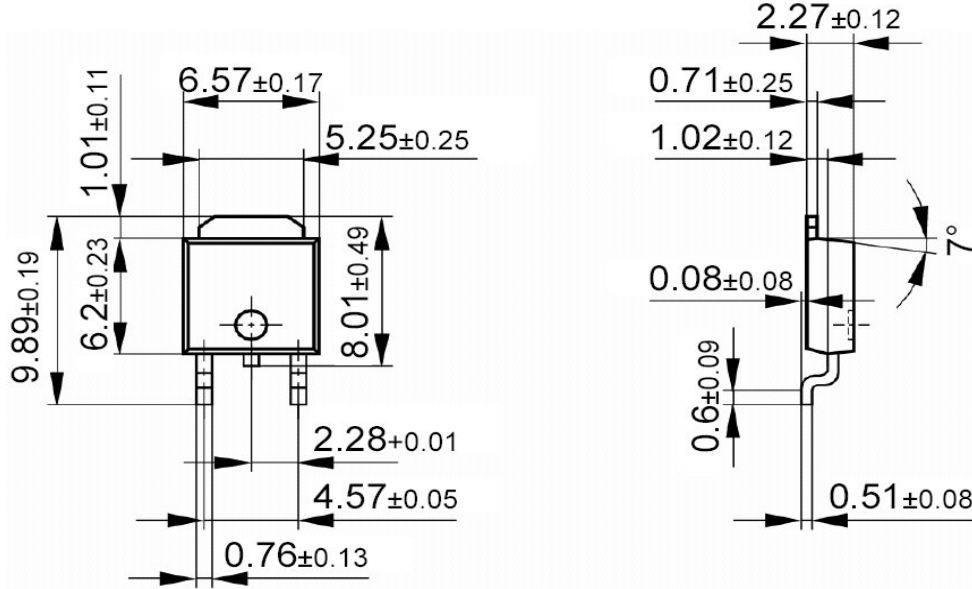


16 Gate charge waveforms

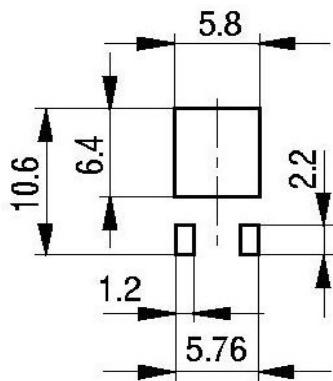


Package Outline

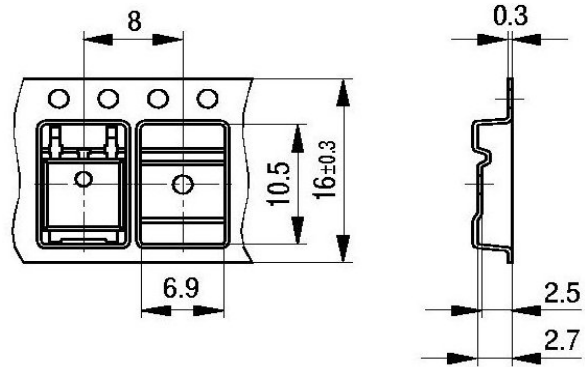
P-TO252-3-11: Outline



Footprint:



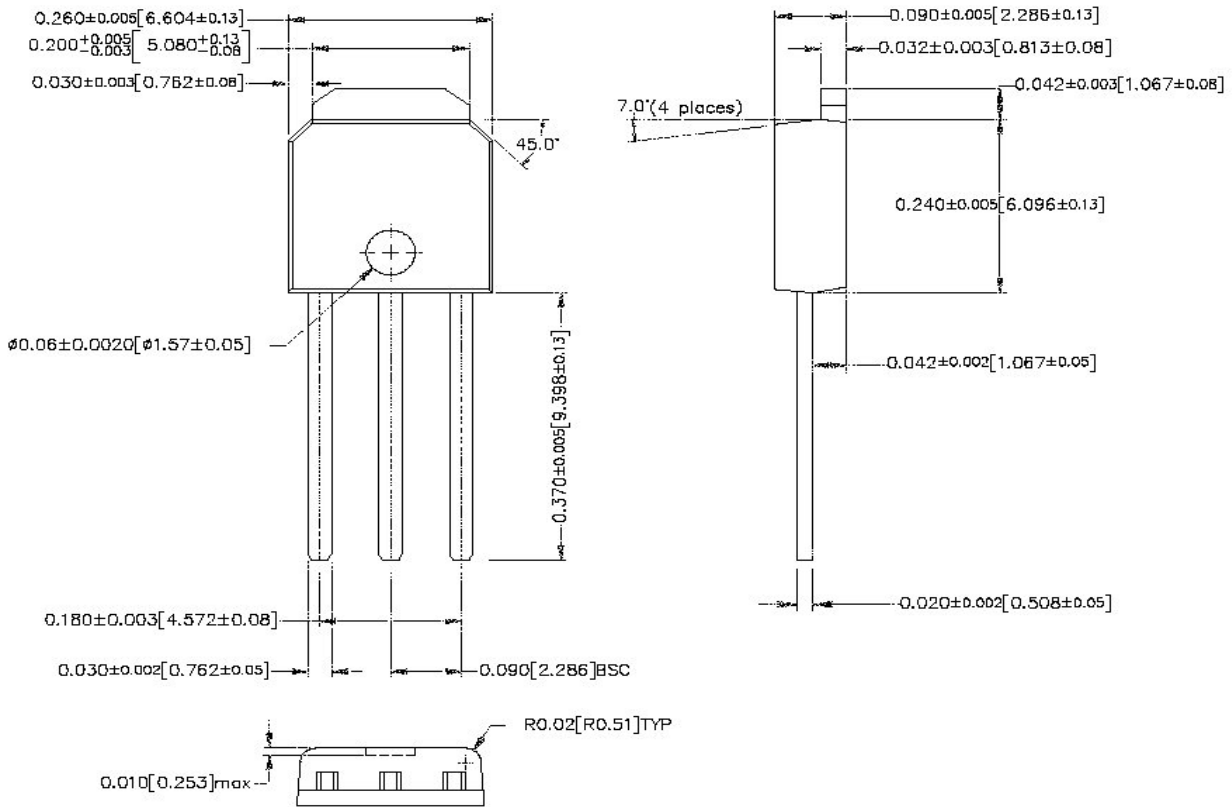
Packaging:



Dimensions in mm

Package Outline

P-TO251-3-21: Outline



Dimensions in inch [mm]

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