

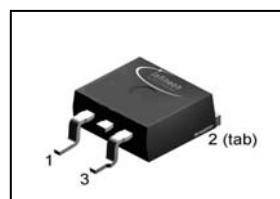
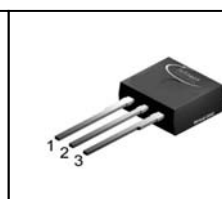
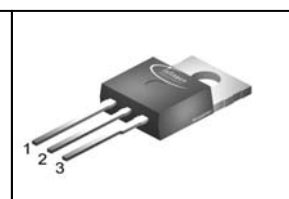
## OptiMOS<sup>®</sup> 2 Power-Transistor

### Features

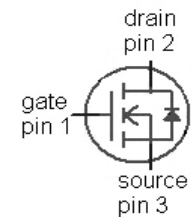
- Ideal for high-frequency dc/dc converters
- N-channel
- Logic level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- 175 °C operating temperature
- dv/dt rated

### Product Summary

|                                |      |            |
|--------------------------------|------|------------|
| $V_{DS}$                       | 25   | V          |
| $R_{DS(on),max}$ (SMD version) | 13.6 | m $\Omega$ |
| $I_D$                          | 30   | A          |

**P-TO263-3-2**

**P-TO262-3-1**

**P-TO220-3-1**


| Type       | Package     | Ordering Code | Marking |
|------------|-------------|---------------|---------|
| IPB14N03LA | P-TO263-3-2 | Q67042-S4156  | 14N03LA |
| IPI14N03LA | P-TO262-3-1 | Q67042-S4157  | 14N03LA |
| IPP14N03LA | P-TO220-3-1 | Q67042-S4158  | 14N03LA |



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

| Parameter                           | Symbol            | Conditions  | Value       | Unit              |
|-------------------------------------|-------------------|---|-------------|-------------------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}^1)$   | 30          | A                 |
|                                     |                   | $T_C=100\text{ °C}$   | 30          |                   |
| Pulsed drain current                | $I_{D,pulse}$     | $T_C=25\text{ °C}^2)$   | 210         |                   |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=24\text{ A}$ , $R_{GS}=25\ \Omega$   | 60          | mJ                |
| Reverse diode dv/dt                 | dv/dt             | $I_D=30\text{ A}$ , $V_{DS}=20\text{ V}$ ,<br>$di/dt=200\text{ A}/\mu\text{s}$ ,<br>$T_{j,max}=175\text{ °C}$ | 6           | kV/ $\mu\text{s}$ |
| Gate source voltage <sup>3)</sup>   | $V_{GS}$          |   | $\pm 20$    | V                 |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$  | 46          | 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 characteristics**

|                                     |            |  |   |   |     |     |
|-------------------------------------|------------|--|---|---|-----|-----|
| Thermal resistance, junction - case | $R_{thJC}$ |  | - | - | 3.2 | K/W |
| SMD version, device on PCB          | $R_{thJA}$ | minimal footprint                            | - | - | 62  |     |
|                                     |            | 6 cm <sup>2</sup> cooling area <sup>4)</sup> | - | - | 40  |     |

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

|                                  |               |  |     |      |      |               |
|----------------------------------|---------------|--|-----|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                       | 25  | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=20\text{ }\mu\text{A}$                 | 1.2 | 1.6  | 2    |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -   | 0.1  | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | -   | 10   | 100  |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                    | -   | 10   | 100  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=20\text{ A}$                     | -   | 18.5 | 23.1 | m $\Omega$    |
|                                  |               | $V_{GS}=4.5\text{ V}, I_D=20\text{ A},$<br>SMD version     | -   | 18.2 | 22.7 |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=30\text{ A}$                      | -   | 11.6 | 13.9 |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=30\text{ A},$<br>SMD version      | -   | 11.3 | 13.6 |               |
| Gate resistance                  | $R_G$         |  | -   | 0.9  | -    | $\Omega$      |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max},$<br>$I_D=30\text{ A}$       | 17  | 33   | -    | S             |

<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC}=3.2\text{ K/W}$  the chip is able to carry 45 A.

<sup>2)</sup> See figure 3

<sup>3)</sup>  $T_{j,max}=150\text{ °C}$  and duty cycle  $D<0.25$  for  $V_{GS}<-5\text{ V}$

<sup>4)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

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

**Dynamic characteristics**

|                              |              |  |   |     |      |    |
|------------------------------|--------------|--|---|-----|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$                    | - | 849 | 1129 | pF |
| Output capacitance           | $C_{oss}$    |  | - | 364 | 484  |    |
| Reverse transfer capacitance | $C_{rss}$    |  | - | 58  | 87   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=15\text{ V}, V_{GS}=10\text{ V}, I_D=20\text{ A}, R_G=2.7\ \Omega$ | - | 7   | 10   | ns |
| Rise time                    | $t_r$        |  | - | 27  | 41   |    |
| Turn-off delay time          | $t_{d(off)}$ |  | - | 18  | 27   |    |
| Fall time                    | $t_f$        |  | - | 3.4 | 5    |    |

**Gate Charge Characteristics<sup>5)</sup>**

|                              |               |  |   |     |     |    |
|------------------------------|---------------|--|---|-----|-----|----|
| Gate to source charge        | $Q_{gs}$      | $V_{DD}=15\text{ V}, I_D=15\text{ A}, V_{GS}=0\text{ to }5\text{ V}$ | - | 2.9 | 3.9 | nC |
| Gate charge at threshold     | $Q_{g(th)}$   |  | - | 1.4 | 1.8 |    |
| Gate to drain charge         | $Q_{gd}$      |  | - | 2.2 | 3.2 |    |
| Switching charge             | $Q_{sw}$      |  | - | 3.7 | 5.3 |    |
| Gate charge total            | $Q_g$         |  | - | 7.0 | 9.3 |    |
| Gate plateau voltage         | $V_{plateau}$ |  | - | 3.4 | -   | V  |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V}, V_{GS}=0\text{ to }5\text{ V}$                 | - | 6.0 | 7.9 | nC |
| Output charge                | $Q_{oss}$     | $V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$                              | - | 8   | 10  |    |

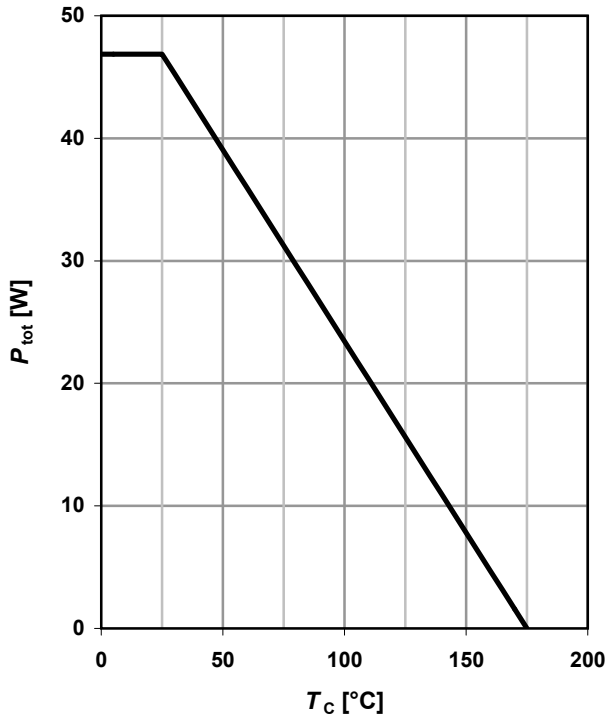
**Reverse Diode**

|                                  |               |  |   |      |     |    |
|----------------------------------|---------------|--|---|------|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ }^\circ\text{C}$                                     | - | -    | 30  | A  |
| Diode pulse current              | $I_{S,pulse}$ |  | - | -    | 210 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=30\text{ A}, T_J=25\text{ }^\circ\text{C}$ | - | 0.97 | 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 |

<sup>5)</sup> See figure 16 for gate charge parameter definition

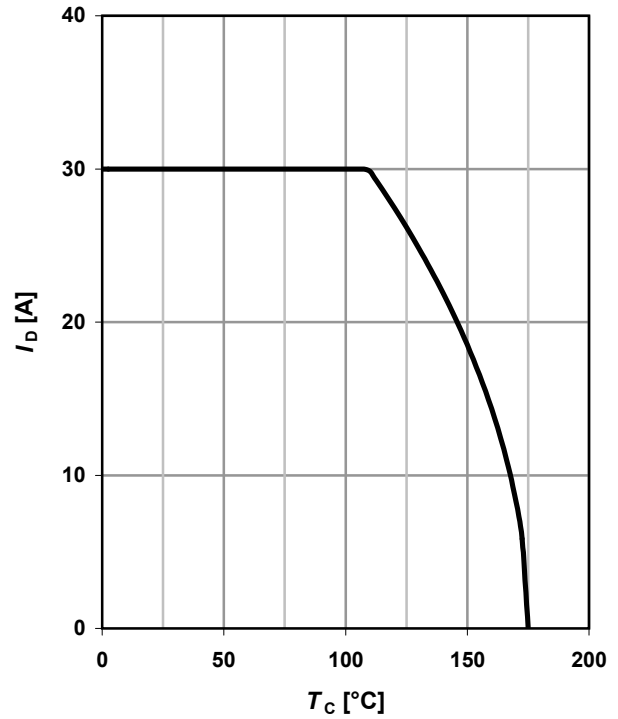
**1 Power dissipation**

$P_{tot}=f(T_C)$



**2 Drain current**

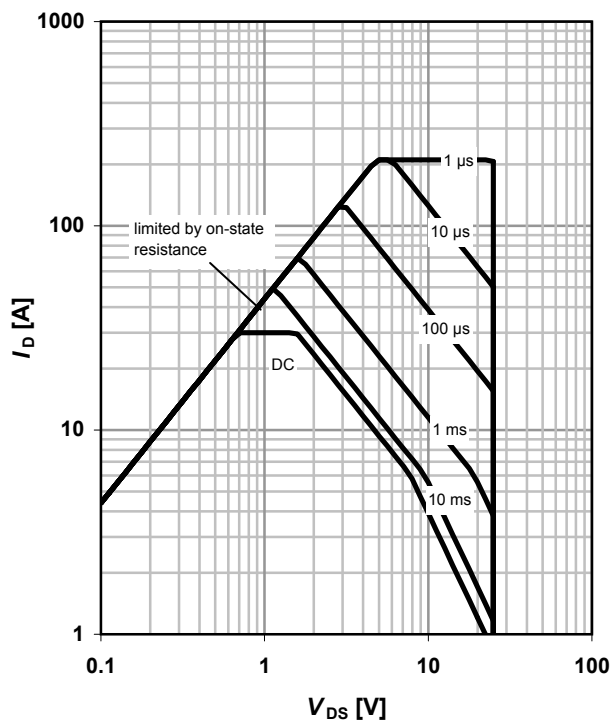
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



**3 Safe operation area**

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

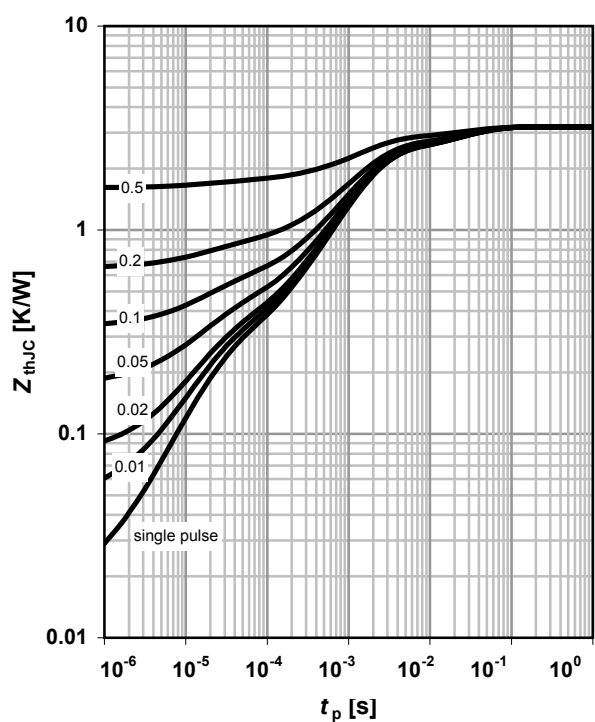
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC}=f(t_p)$

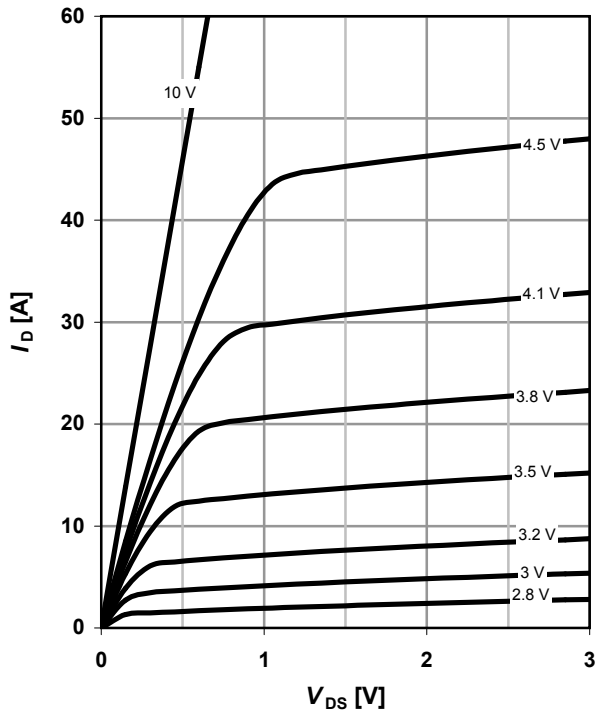
parameter:  $D=t_p/T$



**5 Typ. output characteristics**

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

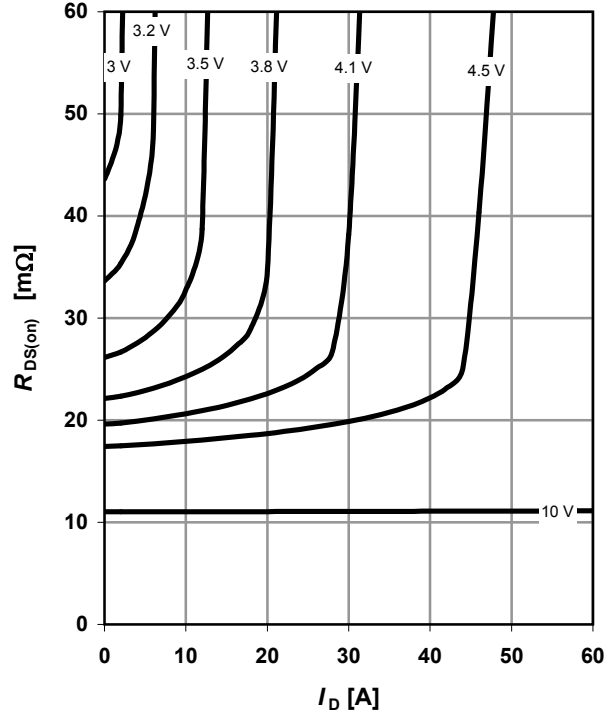
parameter:  $V_{GS}$



**6 Typ. drain-source on resistance**

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

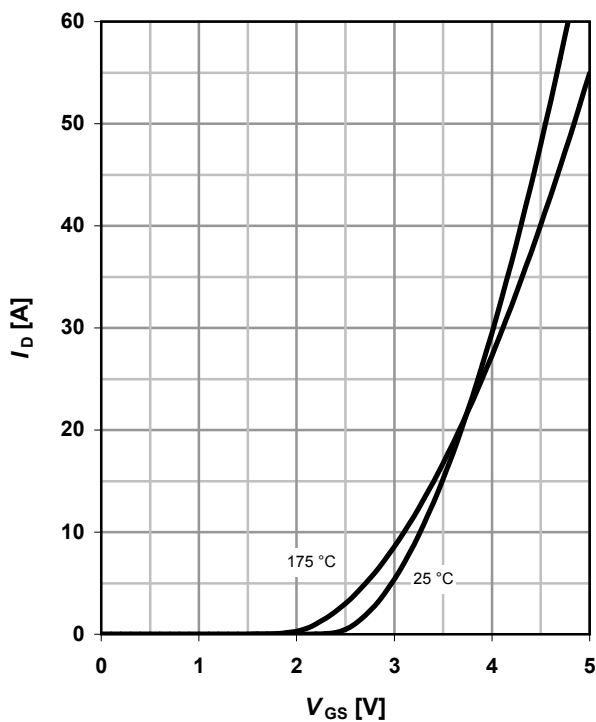
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

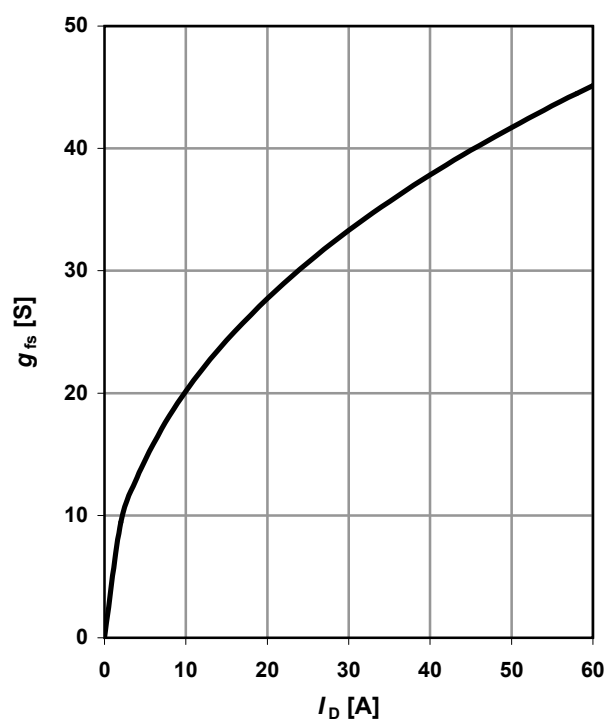
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



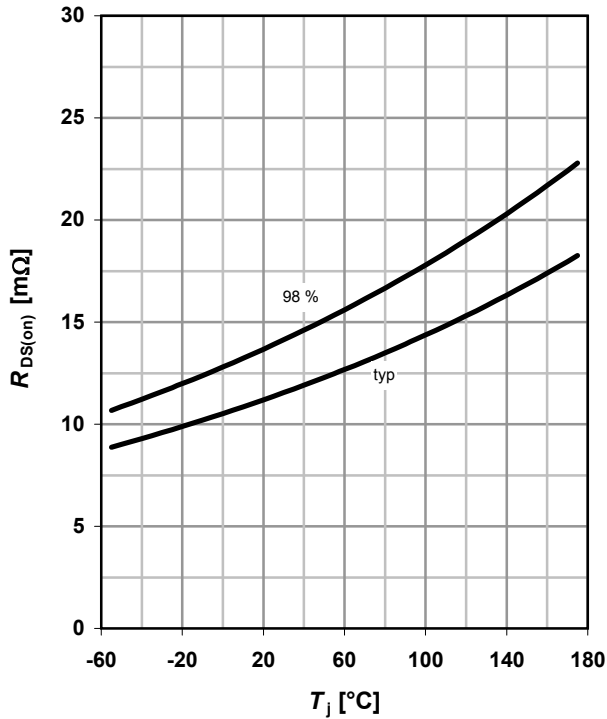
**8 Typ. forward transconductance**

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



**9 Drain-source on-state resistance**

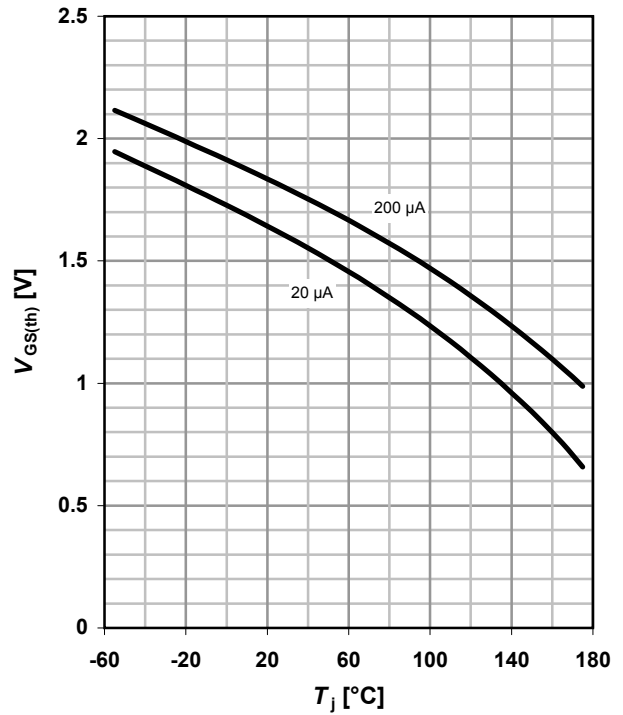
$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

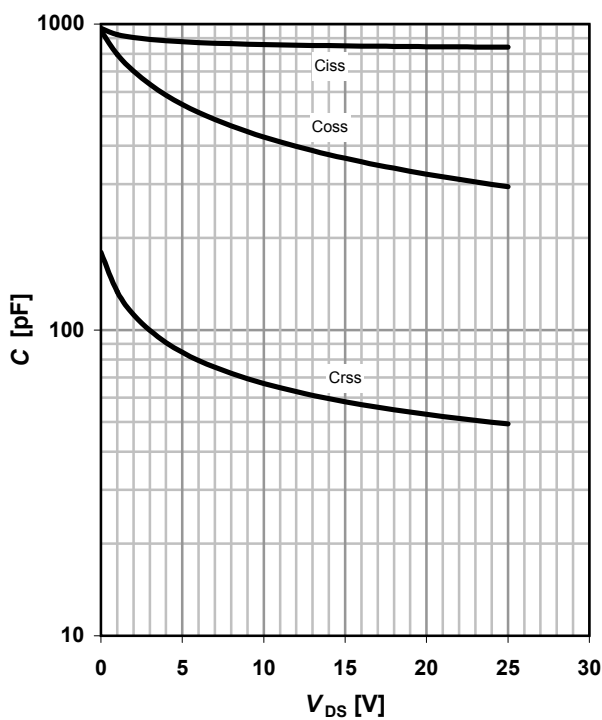
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**11 Typ. Capacitances**

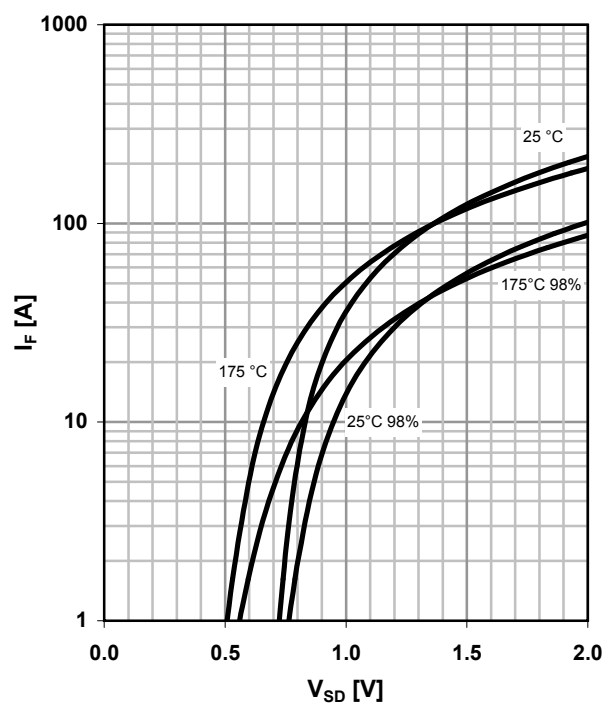
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**12 Forward characteristics of reverse diode**

$I_F = f(V_{SD})$

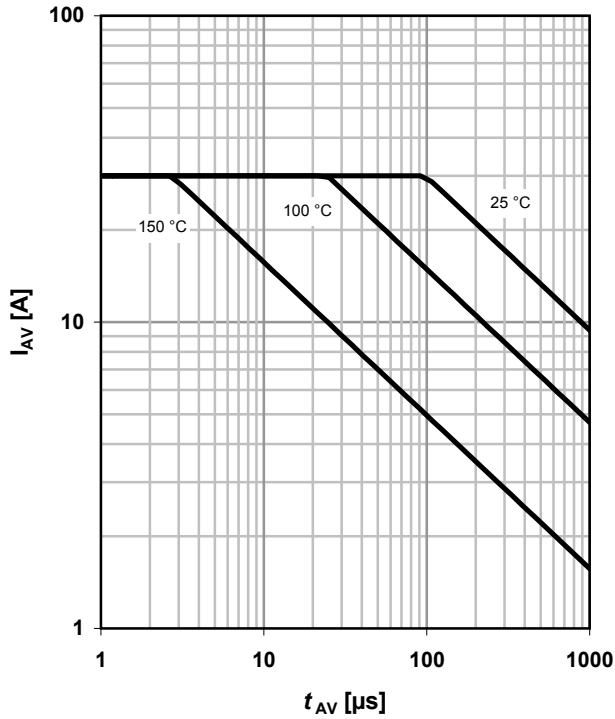
parameter:  $T_j$



**13 Avalanche characteristics**

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

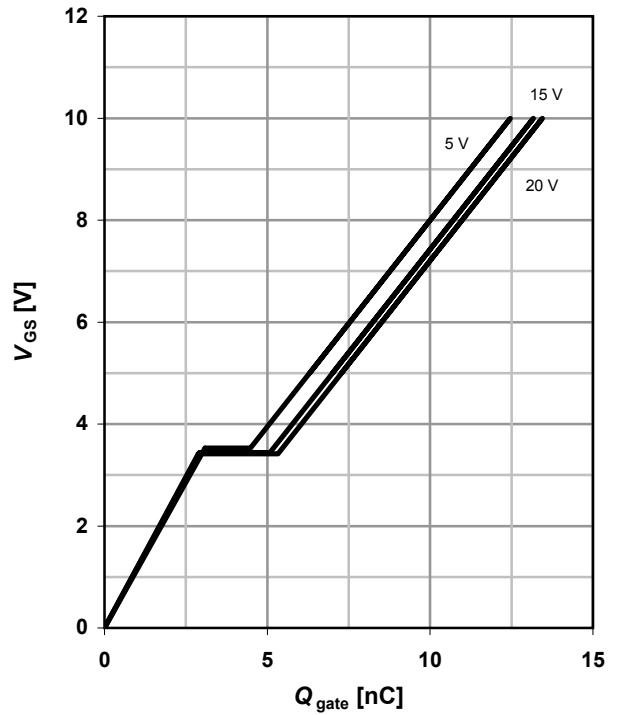
parameter:  $T_{j(start)}$



**14 Typ. gate charge**

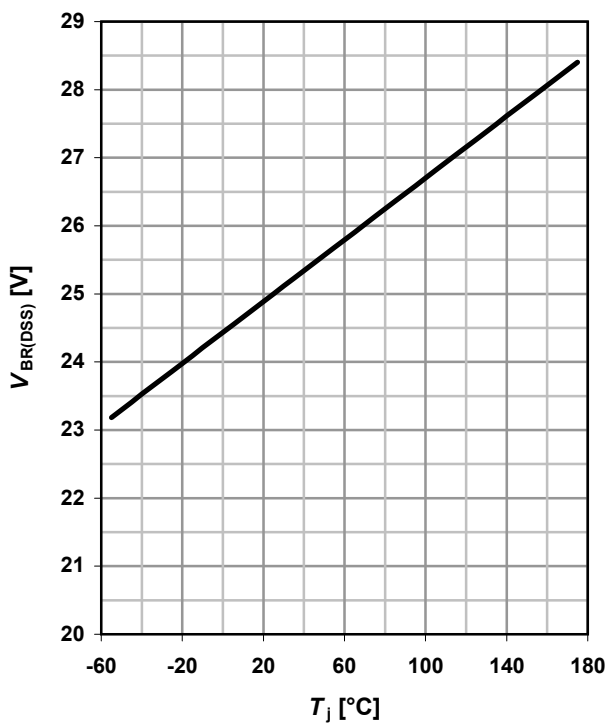
$V_{GS}=f(Q_{gate}); I_D=15\ A\ pulsed$

parameter:  $V_{DD}$

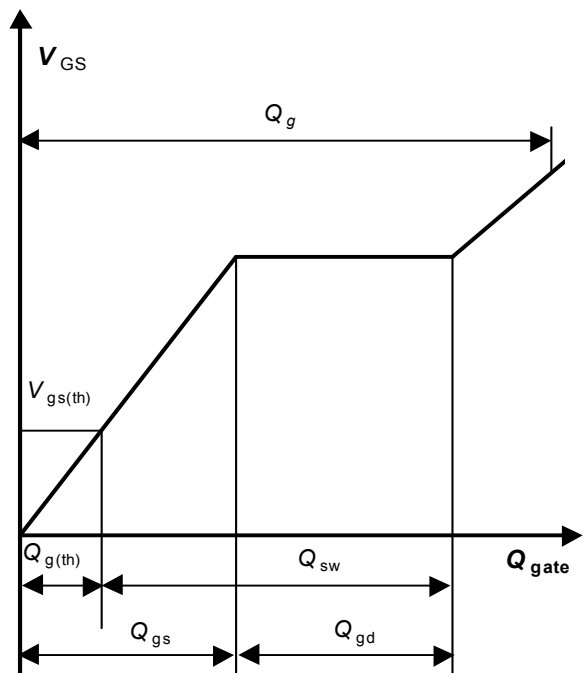


**15 Drain-source breakdown voltage**

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

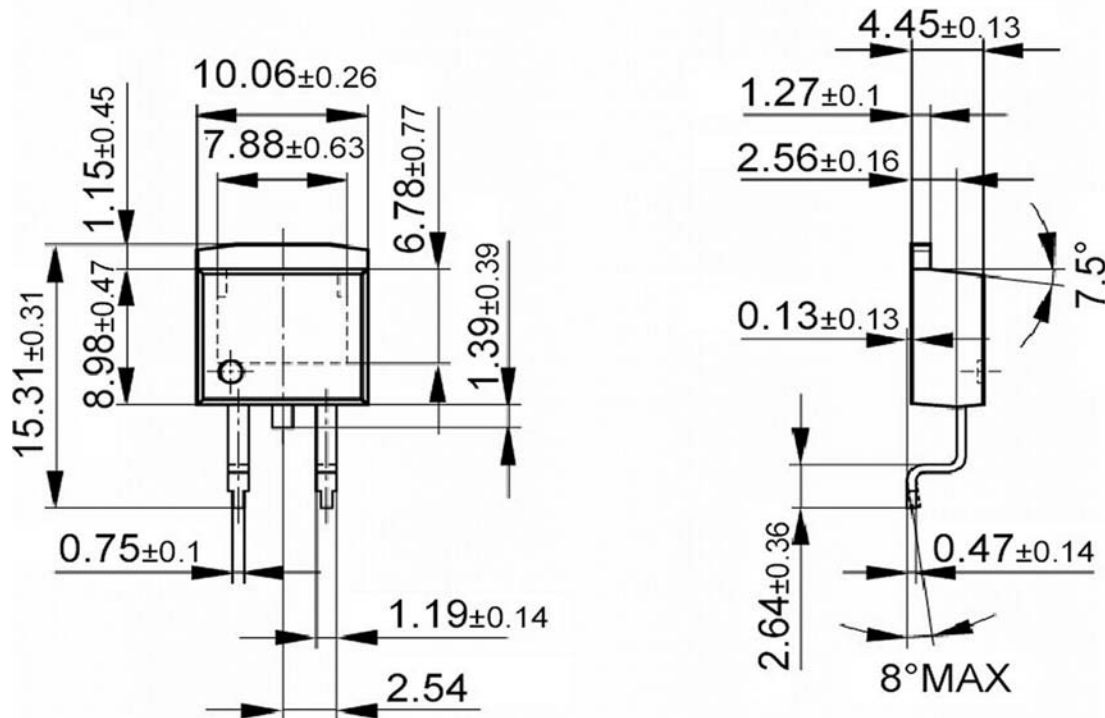


**16 Gate charge waveforms**

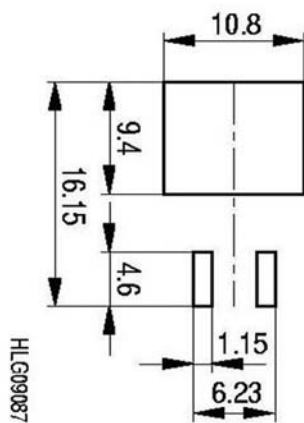


Package Outline

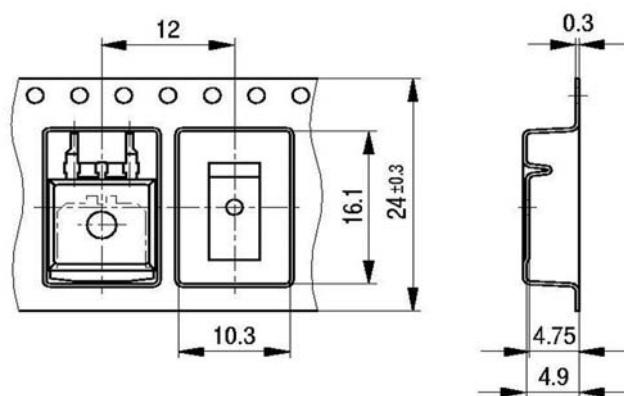
P-TO263-3-2: Outline



Footprint



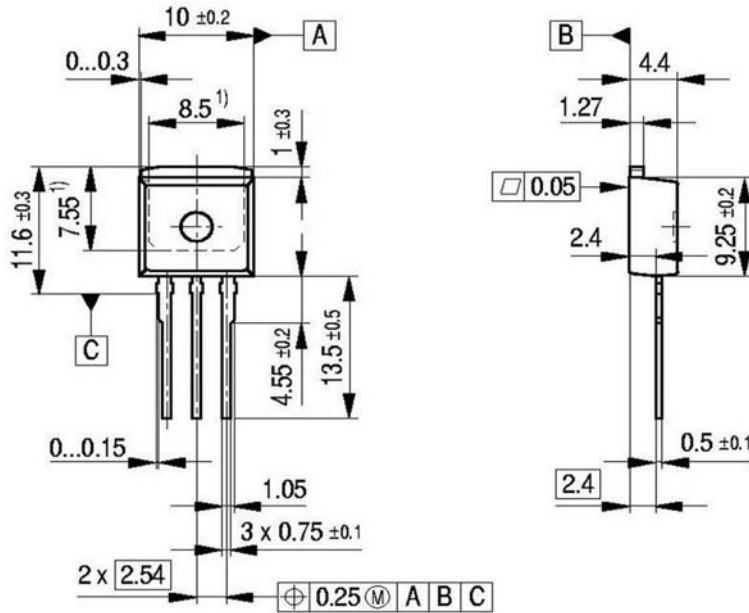
Packaging



Dimensions in mm



P-TO262-3-1: Outline

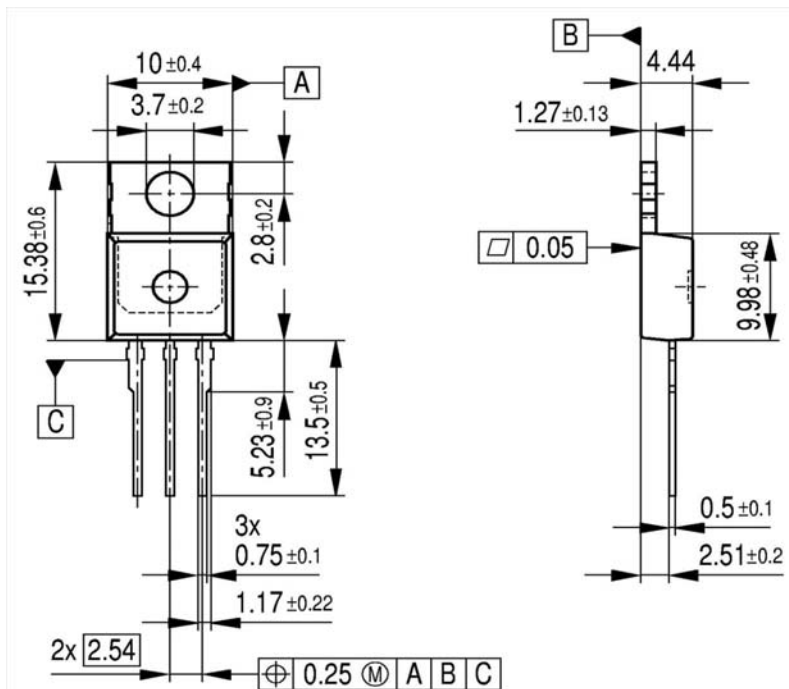


1) Typical

Metal surface min. X = 7.25, Y = 6.9

All metal surfaces tin plated, except area of cut.

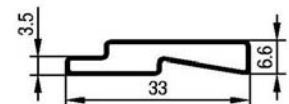
P-TO220-3-1: Outline



All metal surfaces tin plated, except area of cut.  
Metal surface min. x=7.25, y=12.3

Dimensions in mm

Packaging



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