## CoolMOS™ Power Transistor

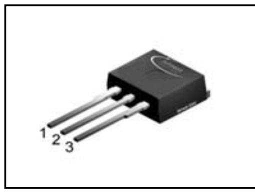
**Product Summary**

| | | |
|---|---|---|
| $V_{DS}$ @ $T_J$=25°C | 900 | V |
| $R_{DS(on),max}$ @ $T_J$= 25°C | 1.0 | Ω |
| $Q_{g,typ}$ | 34 | nC |

### Features

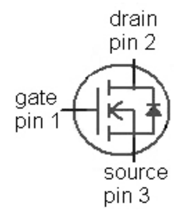
- Lowest figure-of-merit $R_{ON}$ x $Q_g$
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC[1)] for target applications
- Pb-free lead plating; RoHS compliant
- Ultra low gate charge

PG-TO262




### CoolMOS™ 900V is designed for:

- Quasi Resonant Flyback / Forward topologies
- PC Silverbox and consumer applications
- Industrial SMPS




| Type | Package | Marking |
|---|---|---|
| IPI90R1K0C3 | PG-TO262 | 9R1K0C |

**Maximum ratings,** at $T_J$=25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_C$=25 °C | 5.7 | A |
| | | $T_C$=100 °C | 3.6 | |
| Pulsed drain current [2)] | $I_{D,pulse}$ | $T_C$=25 °C | 12 | |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=1.1 A, $V_{DD}$=50 V | 97 | mJ |
| Avalanche energy, repetitive $t_{AR}$ [2),3)] | $E_{AR}$ | $I_D$=1.1 A, $V_{DD}$=50 V | 0.37 | |
| Avalanche current, repetitive $t_{AR}$ [2),3)] | $I_{AR}$ | | 1.1 | A |
| MOSFET d$v$/d$t$ ruggedness | d$v$/d$t$ | $V_{DS}$=0...400 V | 50 | V/ns |
| Gate source voltage | $V_{GS}$ | static | ±20 | V |
| | | AC (f>1 Hz) | ±30 | |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 89 | W |
| Operating and storage temperature | $T_J$, $T_{stg}$ | | -55 ... 150 | °C |

**Maximum ratings,** at $T_J$=25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous diode forward current | $I_S$ | $T_C$=25 °C | 3.3 | A |
| Diode pulse current [2] | $I_{S,pulse}$ | | 13 | |
| Reverse diode d$v$/d$t$ [4] | d$v$/d$t$ | | 4 | V/ns |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics** | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | | - | - | 1.4 | K/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | leaded | - | - | 62 | |
| Soldering temperature, wavesoldering only allowed at leads | $T_{sold}$ | 1.6 mm (0.063 in.) from case for 10 s | - | - | 260 | °C |

**Electrical characteristics,** at $T_J$=25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$=250 µA | 900 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=0.37 mA | 2.5 | 3 | 3.5 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=900 V, $V_{GS}$=0 V, $T_j$=25 °C | - | - | 1 | µA |
| | | $V_{DS}$=900 V, $V_{GS}$=0 V, $T_j$=150 °C | - | 10 | - | |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20 V, $V_{DS}$=0 V | - | - | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=10 V, $I_D$=3.3 A, $T_j$=25 °C | - | 0.78 | 1 | Ω |
| | | $V_{GS}$=10 V, $I_D$=3.3 A, $T_j$=150 °C | - | 2.1 | - | |
| Gate resistance | $R_G$ | $f$=1 MHz, open drain | - | 1.3 | - | Ω |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=100 V, $f$=1 MHz | - | 850 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 42 | - | |
| Effective output capacitance, energy related [5] | $C_{o(er)}$ | $V_{GS}$=0 V, $V_{DS}$=0 V to 500 V | - | 28 | - | |
| Effective output capacitance, time related [6] | $C_{o(tr)}$ | | - | 100 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=400 V, $V_{GS}$=10 V, $I_D$=3.3 A, $R_G$=62.4 Ω | - | 70 | - | ns |
| Rise time | $t_r$ | | - | 20 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 400 | - | |
| Fall time | $t_f$ | | - | 35 | - | |
| Gate Charge Characteristics | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=400 V, $I_D$=3.3 A, $V_{GS}$=0 to 10 V | - | 4 | - | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 15 | - | |
| Gate charge total | $Q_g$ | | - | 34 | tbd | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.6 | - | V |
| **Reverse Diode** | | | | | | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=3.3 A, $T_j$=25 °C | - | 0.8 | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=400 V, $I_F$=$I_S$, $di_F/dt$=100 A/µs | - | 340 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 4.1 | - | µC |
| Peak reverse recovery current | $I_{rrm}$ | | - | 21 | - | A |

[1] J-STD20 and JESD22

[2] Pulse width $t_p$ limited by $T_{J,max}$

[3] Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

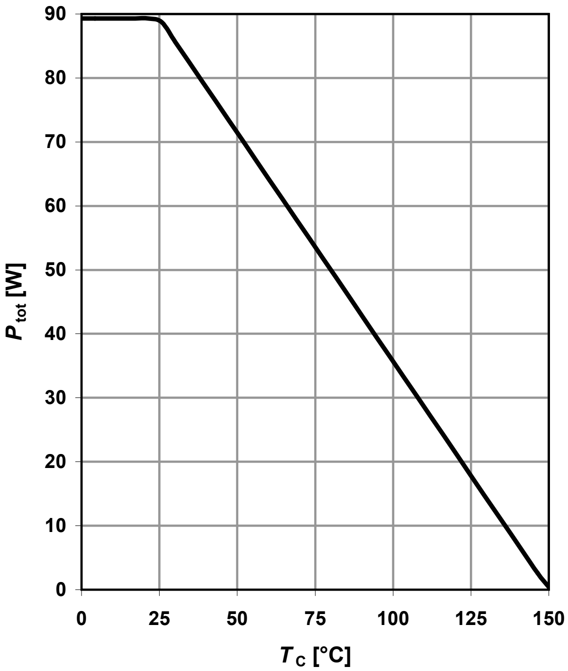
[4] $I_{SD}≤I_D$, di/dt≤ 200 A/µs, $V_{DClink}$=400V, $V_{peak}<V_{(BR)DSS}$, $T_J<T_{J,max}$, identical low side and high side switch

[5] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 50% $V_{DSS}$.

[6] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 50% $V_{DSS}$.

**1 Power dissipation**

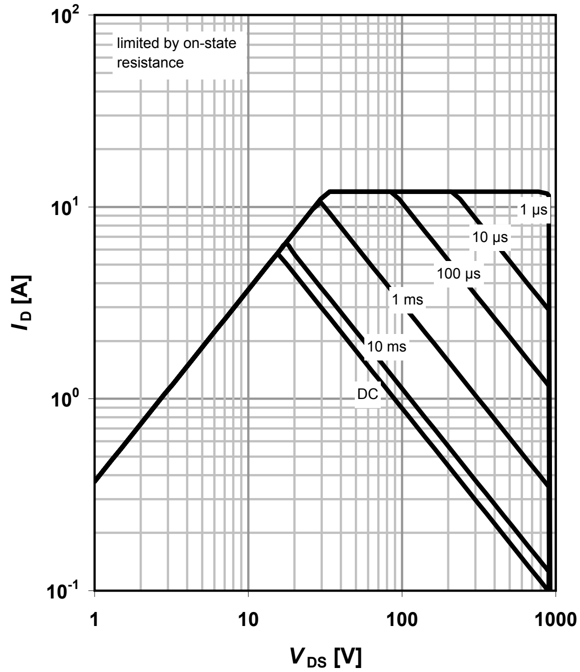
$P_{tot}$=f($T_C$)




**2 Safe operating area**

$I_D$=f($V_{DS}$); $T_C$=25 °C; $D$=0

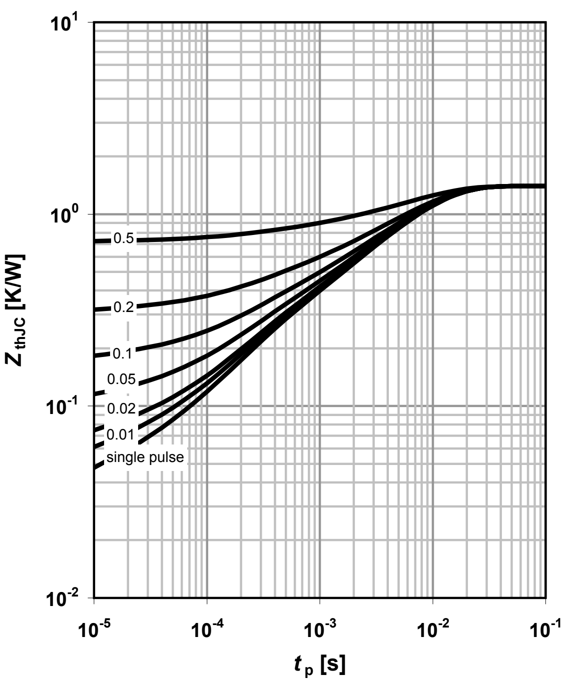
parameter: $t_p$




**3 Max. transient thermal impedance**

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

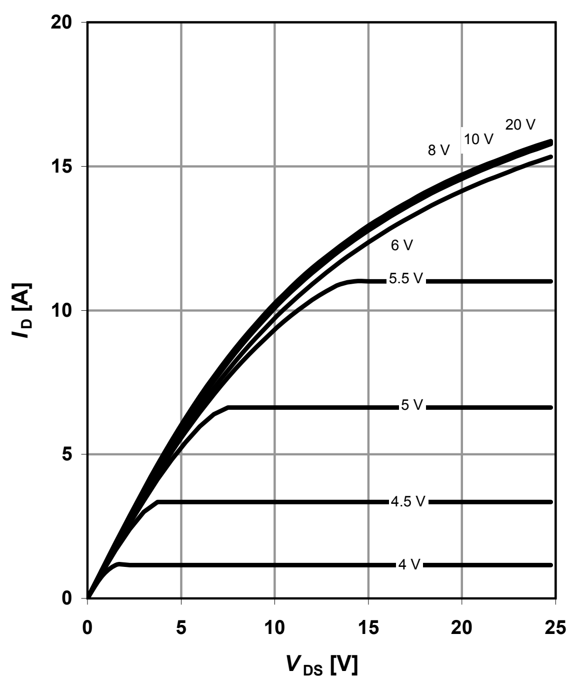
parameter: $D$=$t_p$/$T$




**4 Typ. output characteristics**

$I_D$=f($V_{DS}$); $T_J$=25 °C

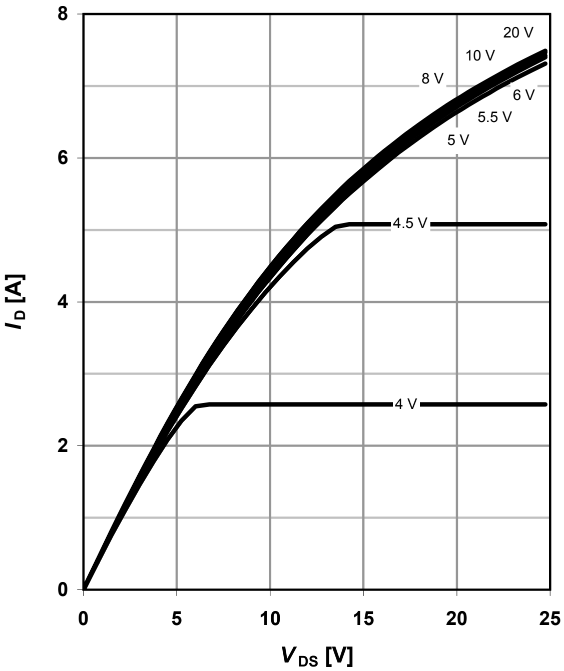
parameter: $V_{GS}$



**5 Typ. output characteristics**

$I_D$=f($V_{DS}$); $T_J$=150 °C

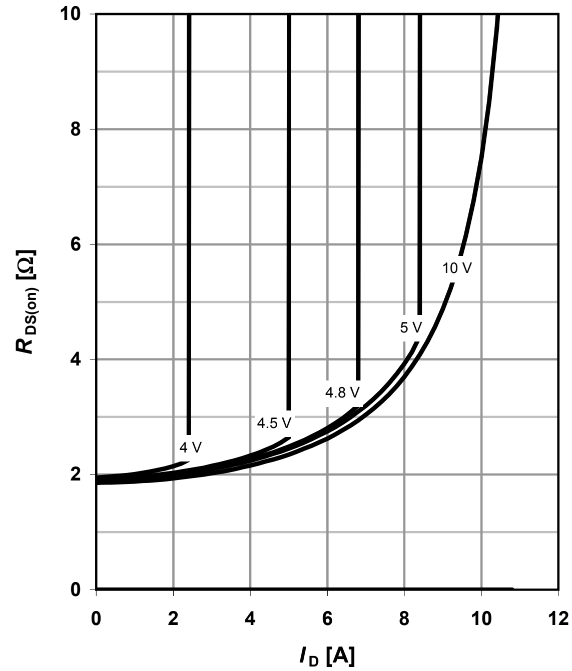
parameter: $V_{GS}$




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

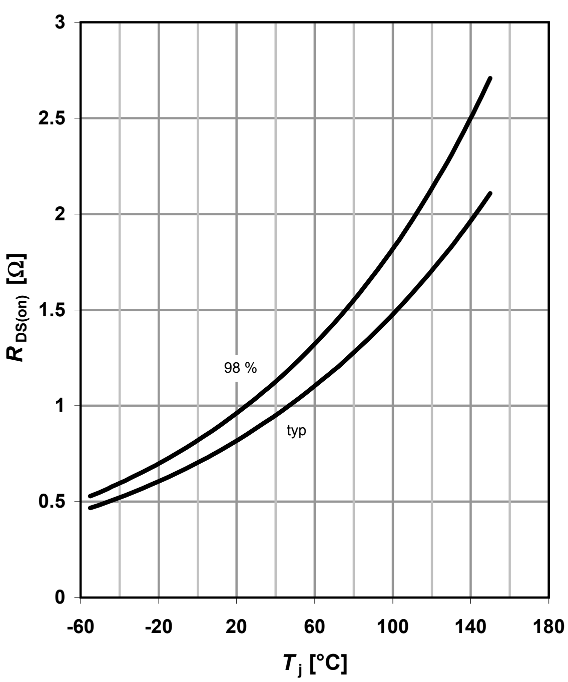
$R_{DS(on)}$=f($I_D$); $T_J$=150 °C

parameter: $V_{GS}$




**7 Drain-source on-state resistance**

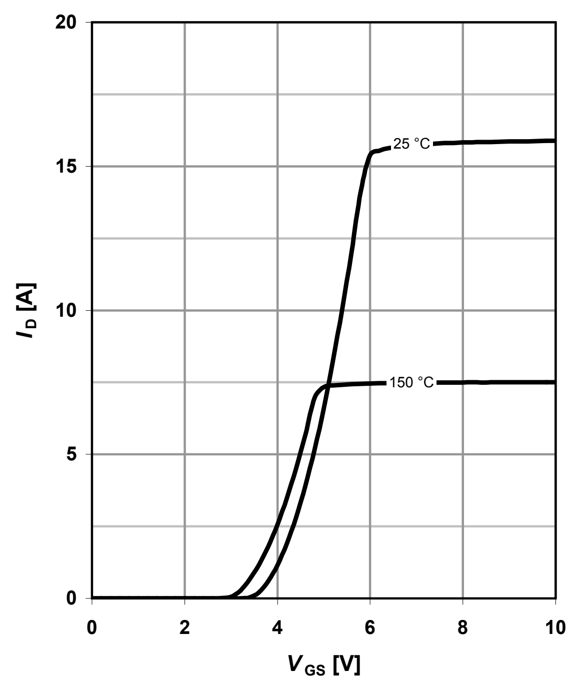
$R_{DS(on)}$=f($T_J$); $I_D$=3.3 A; $V_{GS}$=10 V




**8 Typ. transfer characteristics**

$I_D$=f($V_{GS}$); $V_{DS}$≥20V

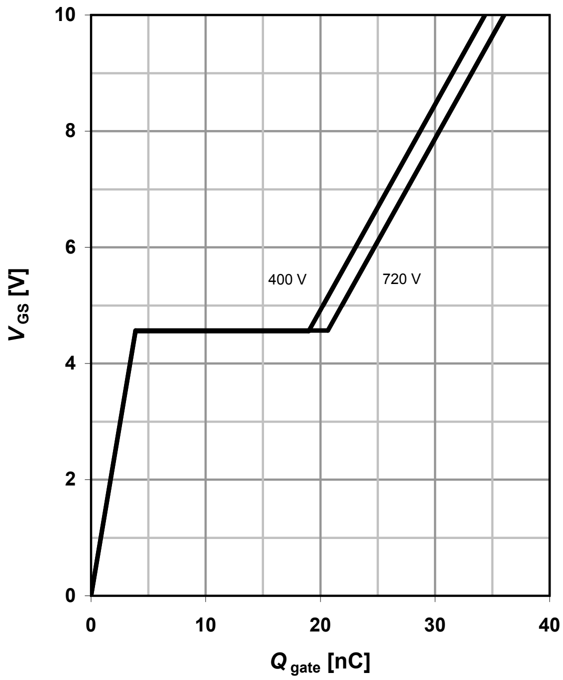
parameter: $T_J$



**9 Typ. gate charge**

$V_{GS}$=f($Q_{gate}$); $I_D$=3.3 A pulsed

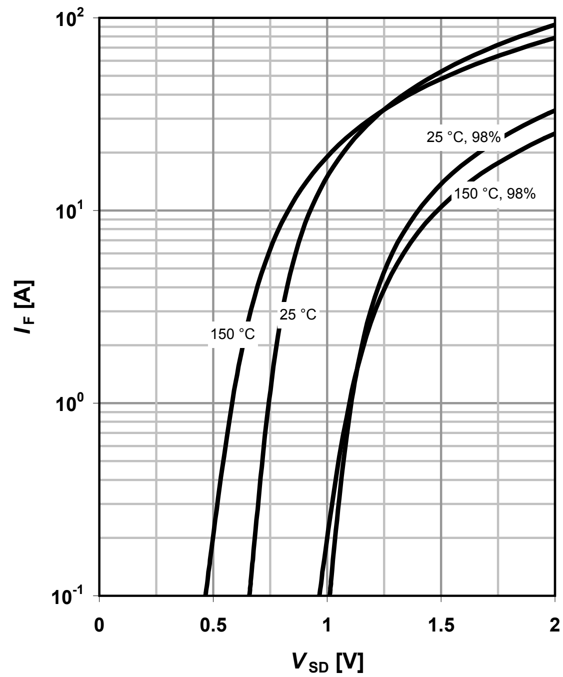
parameter: $V_{DD}$




**10 Forward characteristics of reverse diode**

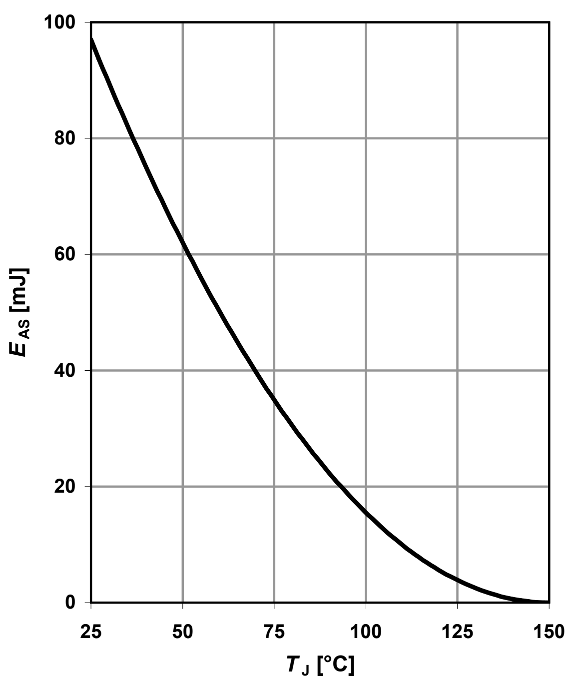
$I_F$=f($V_{SD}$)

parameter: $T_J$



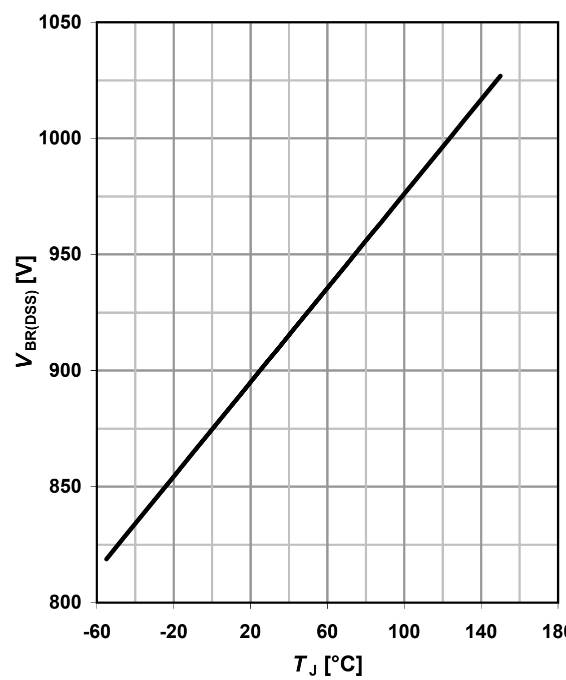

**11 Avalanche energy**

$E_{AS}$=f($T_j$); $I_D$=1.1 A; $V_{DD}$=50 V



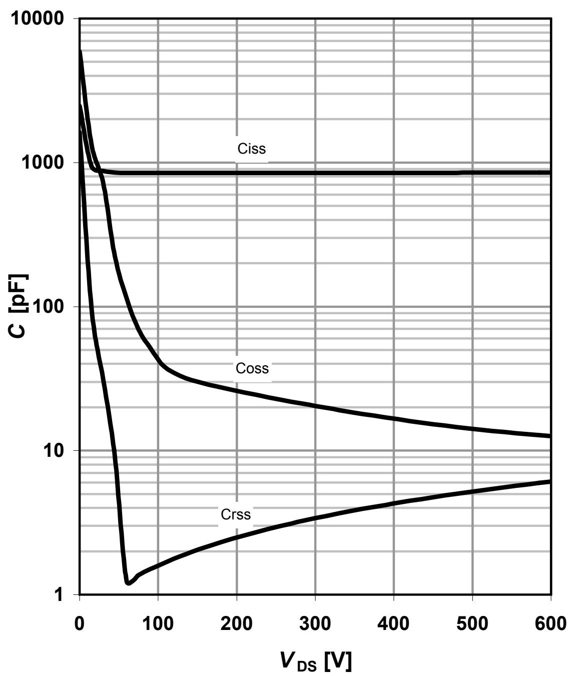

**12 Drain-source breakdown voltage**

$V_{BR(DSS)}$=f($T_j$); $I_D$=0.25 mA



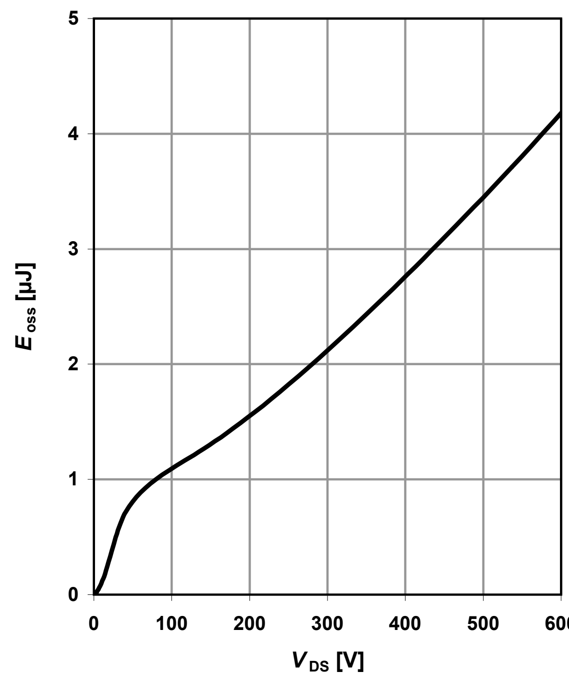
**13 Typ. capacitances**

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

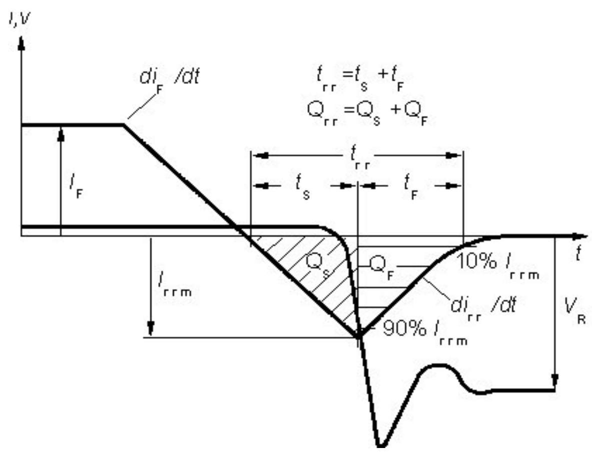



**14 Typ. $C_{oss}$ stored energy**

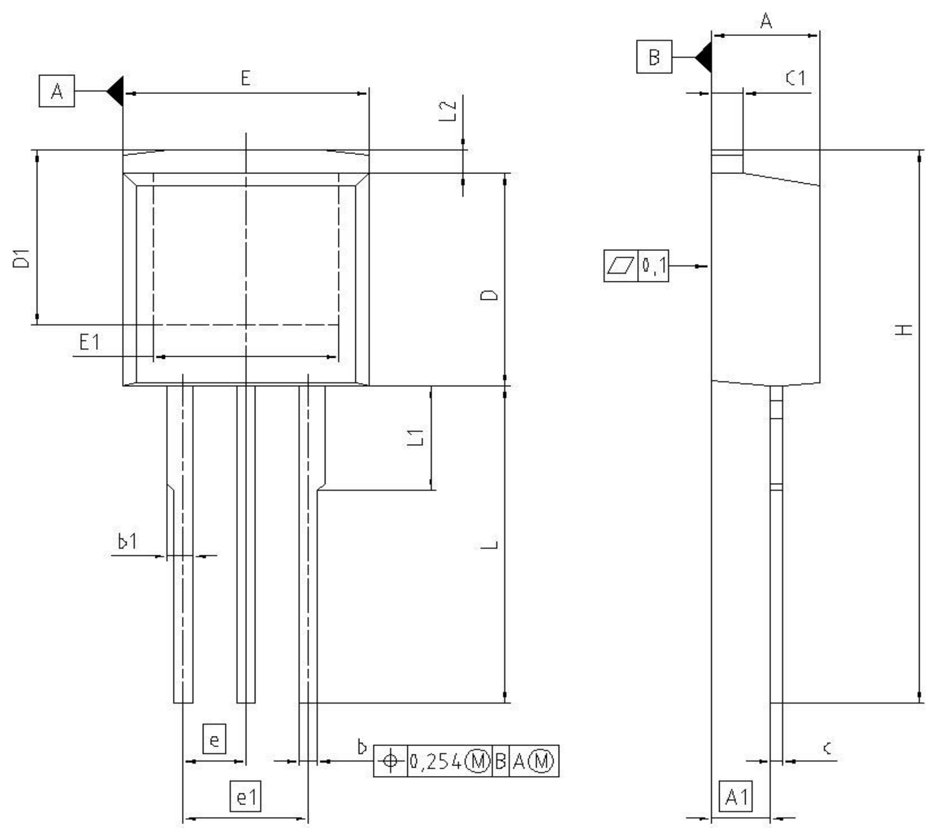
$E_{oss}=\mathrm{f}(V_{DS})$



**Definition of diode switching characteristics**



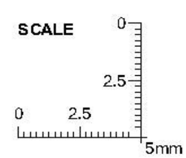
**PG-TO262 Outlines**



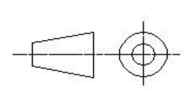

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| **A** | 4.300 | 4.500 | 0.169 | 0.177 |
| **A1** | 2.150 | 2.650 | 0.085 | 0.104 |
| **b** | 0.650 | 0.850 | 0.026 | 0.033 |
| **b1** | 0.635 | 1.400 | 0.025 | 0.055 |
| **c** | 0.400 | 0.600 | 0.016 | 0.024 |
| **c1** | 1.170 | 1.370 | 0.046 | 0.054 |
| **D** | 9.050 | 9.450 | 0.356 | 0.372 |
| **D1** | 6.900 | 7.650 | 0.272 | 0.301 |
| **E** | 9.800 | 10.200 | 0.386 | 0.402 |
| **E1** | 7.250 | 8.600 | 0.285 | 0.339 |
| **e** | 2.540 | | 0.100 | |
| **e1** | 5.080 | | 0.200 | |
| **N** | 3 | | 3 | |
| **L** | 13.000 | 14.000 | 0.512 | 0.551 |
| **L1** | 4.350 | 4.750 | 0.171 | 0.187 |
| **L2** | 0.700 | 1.300 | 0.028 | 0.051 |

**REFERENCE**
JEDEC TO262

**SCALE**




**EUROPEAN PROJECTION**



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TO262_1

Dimensions in mm/inches

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