

CoolMOS™ Power Transistor
Features

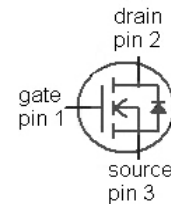
- Lowest figure-of-merit $R_{ON} \times Q_g$
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Worldwide best $R_{DS,on}$ in TO247
- Ultra low gate charge

CoolMOS™ 900V is designed for:

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

Product Summary

| | | |
|---|------|----------|
| $V_{DS} @ T_J=25^\circ\text{C}$ | 900 | V |
| $R_{DS(on),max} @ T_J=25^\circ\text{C}$ | 0.12 | Ω |
| $Q_{g,typ}$ | 270 | nC |

PG-TO247


| Type | Package | Marking |
|-------------|----------|---------|
| IPW90R120C3 | PG-TO247 | 9R120C |

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

| Parameter | Symbol | Conditions | Value | Unit |
|---|----------------|--|-------------|------------------|
| Continuous drain current | I_D | $T_C=25^\circ\text{C}$ | 36 | A |
| | | $T_C=100^\circ\text{C}$ | 23 | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | $T_C=25^\circ\text{C}$ | 96 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=8.8\text{ A}, V_{DD}=50\text{ V}$ | 1940 | mJ |
| Avalanche energy, repetitive t_{AR} ^{2),3)} | E_{AR} | $I_D=8.8\text{ A}, V_{DD}=50\text{ V}$ | 2.9 | |
| Avalanche current, repetitive t_{AR} ^{2),3)} | I_{AR} | | 8.8 | A |
| MOSFET dv/dt ruggedness | dv/dt | $V_{DS}=0\dots400\text{ V}$ | 50 | V/ns |
| Gate source voltage | V_{GS} | static | ± 20 | V |
| | | AC ($f>1\text{ Hz}$) | ± 30 | |
| Power dissipation | P_{tot} | $T_C=25^\circ\text{C}$ | 417 | W |
| Operating and storage temperature | T_J, T_{stg} | | -55 ... 150 | $^\circ\text{C}$ |
| Mounting torque | | M3 and M3.5 screws | 60 | Ncm |

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

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|---------------|--------------------|-------|------|
| Continuous diode forward current | I_S | $T_C=25\text{ °C}$ | 26 | A |
| Diode pulse current ²⁾ | $I_{S,pulse}$ | | 81 | |
| Reverse diode dv/dt ⁴⁾ | dv/dt | | 4 | V/ns |

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

Thermal characteristics

| | | | | | | |
|--|------------|---------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 0.3 | 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 $T_j=25\text{ °C}$, unless otherwise specified
Static characteristics

| | | | | | | |
|----------------------------------|---------------|---|-----|------|------|---------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$ | 900 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}$, $I_D=2.9\text{ mA}$ | 2.5 | 3 | 3.5 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=900\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ | - | - | 10 | μA |
| | | $V_{DS}=900\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=150\text{ °C}$ | - | 50 | - | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$ | - | - | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{ V}$, $I_D=26\text{ A}$, $T_j=25\text{ °C}$ | - | 0.10 | 0.12 | Ω |
| | | $V_{GS}=10\text{ V}$, $I_D=26\text{ A}$, $T_j=150\text{ °C}$ | - | 0.27 | - | |
| Gate resistance | R_G | $f=1\text{ MHz}$, open drain | - | 0.9 | - | Ω |

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

Dynamic characteristics

| | | | | | | |
|--|--------------|---|---|------|---|----|
| Input capacitance | C_{iss} | $V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$ $f=1\text{ MHz}$ | - | 6800 | - | pF |
| Output capacitance | C_{oss} | | - | 330 | - | |
| Effective output capacitance, energy related ⁵⁾ | $C_{o(er)}$ | $V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$ to 500 V | - | 200 | - | |
| Effective output capacitance, time related ⁶⁾ | $C_{o(tr)}$ | | - | 790 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=400\text{ V},$ $V_{GS}=10\text{ V}, I_D=26\text{ A},$ $R_G=7.3\ \Omega$ | - | 70 | - | ns |
| Rise time | t_r | | - | 20 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 400 | - | |
| Fall time | t_f | | - | 25 | - | |

Gate Charge Characteristics

| | | | | | | |
|-----------------------|---------------|---|---|-----|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=400\text{ V}, I_D=26\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 32 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 115 | - | |
| Gate charge total | Q_g | | - | 270 | tbd | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.7 | - | V |

Reverse Diode

| | | | | | | |
|-------------------------------|-----------|---|---|-----|-----|---------------|
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=26\text{ A},$ $T_j=25\text{ }^\circ\text{C}$ | - | 0.8 | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=400\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 920 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 30 | - | μC |
| Peak reverse recovery current | I_{rrm} | | - | 65 | - | 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 $P_{AV}=E_{AR} \cdot f$.

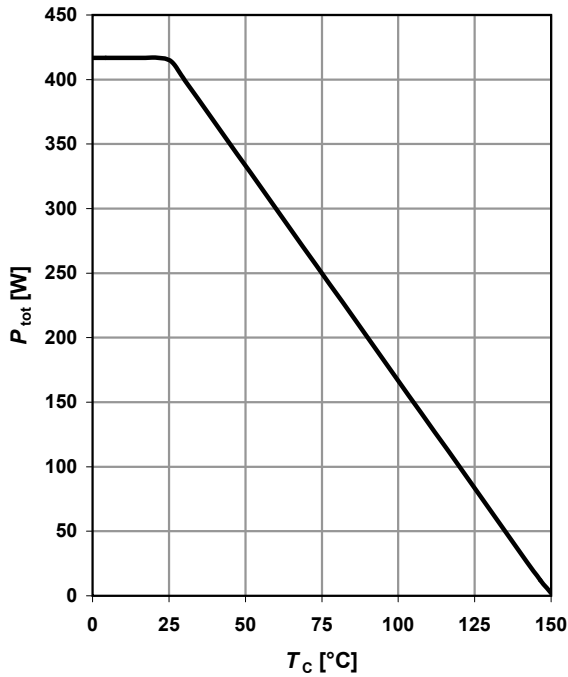
⁴⁾ $I_{SD} \leq I_D, di/dt \leq 100\text{ A}/\mu\text{s}, V_{DClink}=400\text{ V}, V_{peak} < V_{(BR)DSS}, T_J < T_{J,max}$, identical low side and high side switch

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

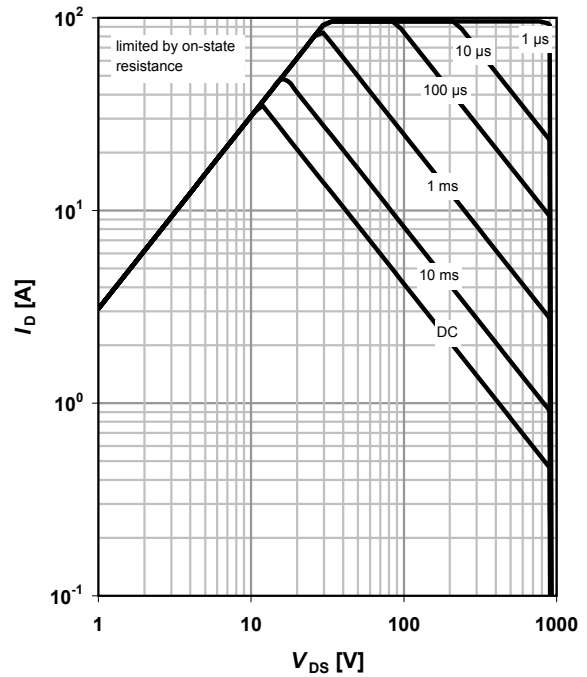
$$P_{tot} = f(T_C)$$



2 Safe operating area

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

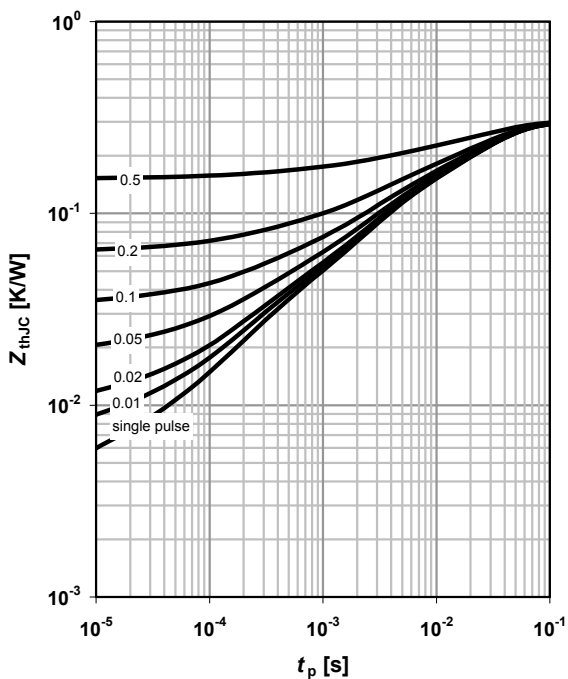
parameter: t_p



3 Max. transient thermal impedance

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

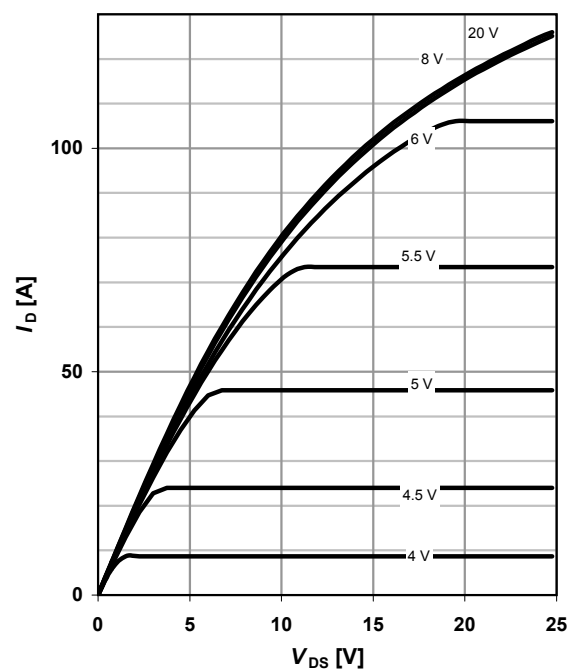
parameter: $D = t_p / T$



4 Typ. output characteristics

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

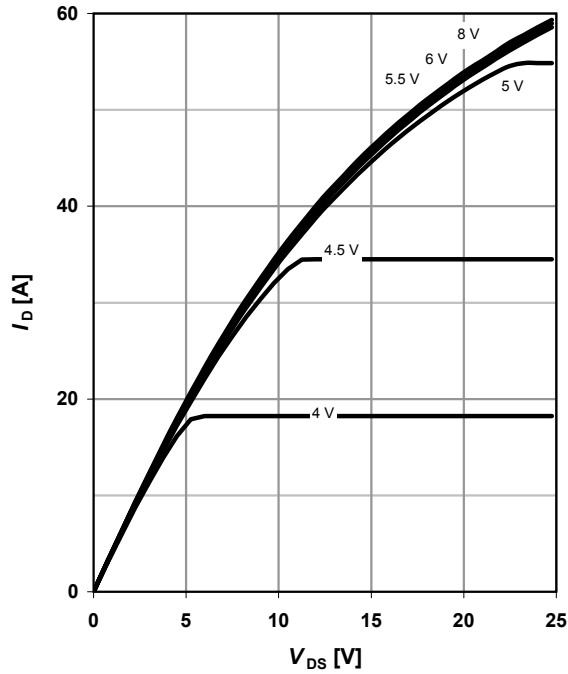
parameter: V_{GS}



5 Typ. output characteristics

$I_D = f(V_{DS}); T_J = 150\text{ °C}$

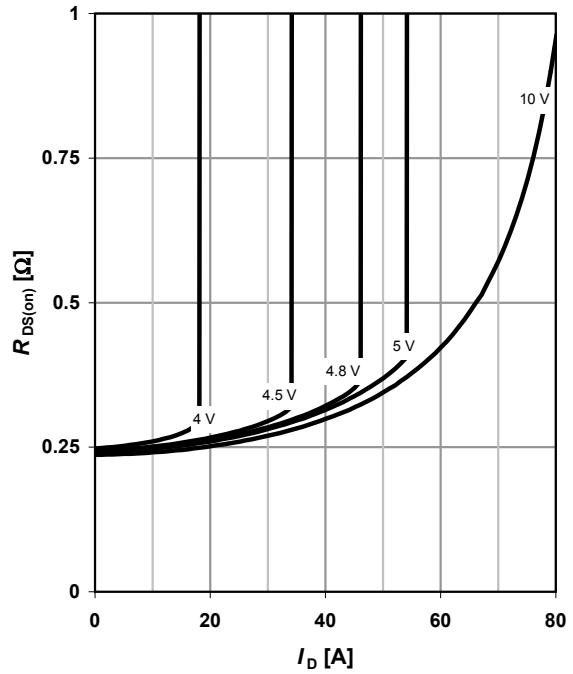
parameter: V_{GS}



6 Typ. drain-source on-state resistance

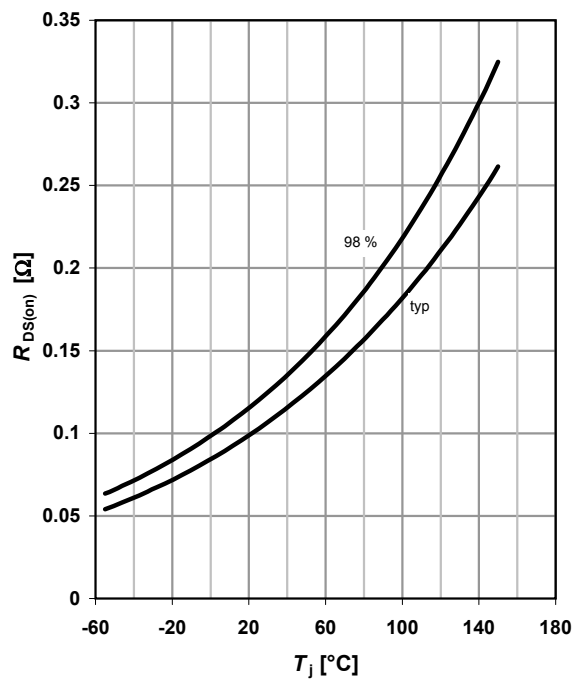
$R_{DS(on)} = f(I_D); T_J = 150\text{ °C}$

parameter: V_{GS}



7 Drain-source on-state resistance

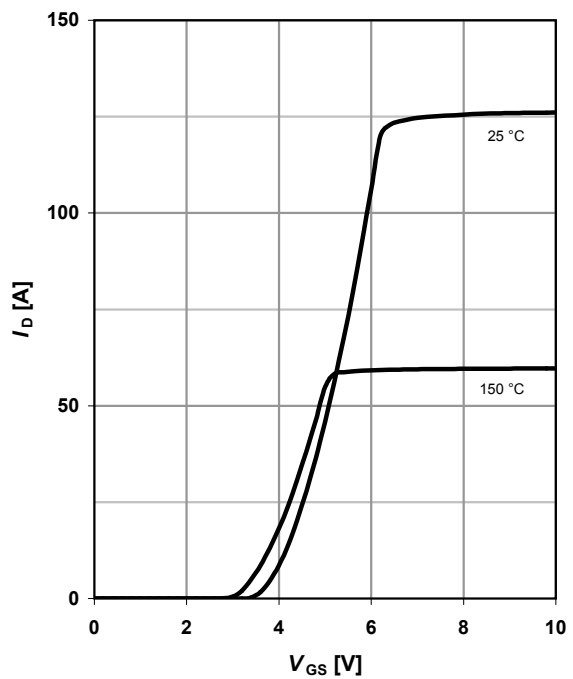
$R_{DS(on)} = f(T_J); I_D = 26\text{ A}; V_{GS} = 10\text{ V}$



8 Typ. transfer characteristics

$I_D = f(V_{GS}); V_{DS} = 20\text{ V}$

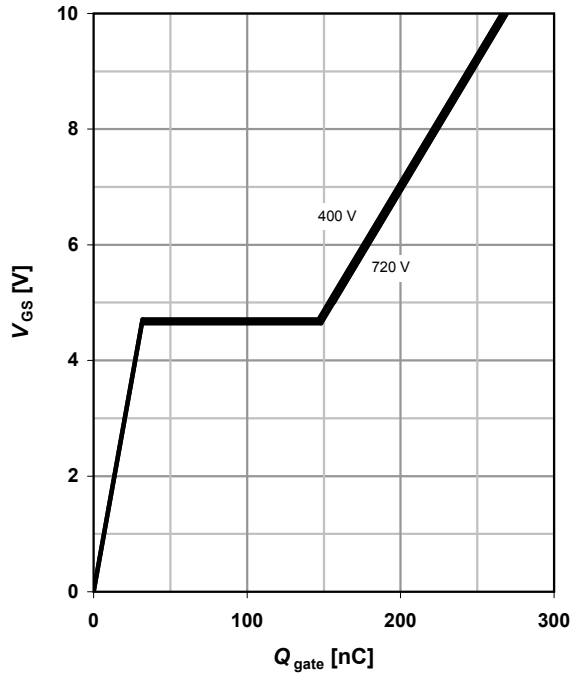
parameter: T_J



9 Typ. gate charge

$V_{GS}=f(Q_{gate}); I_D=26\text{ A pulsed}$

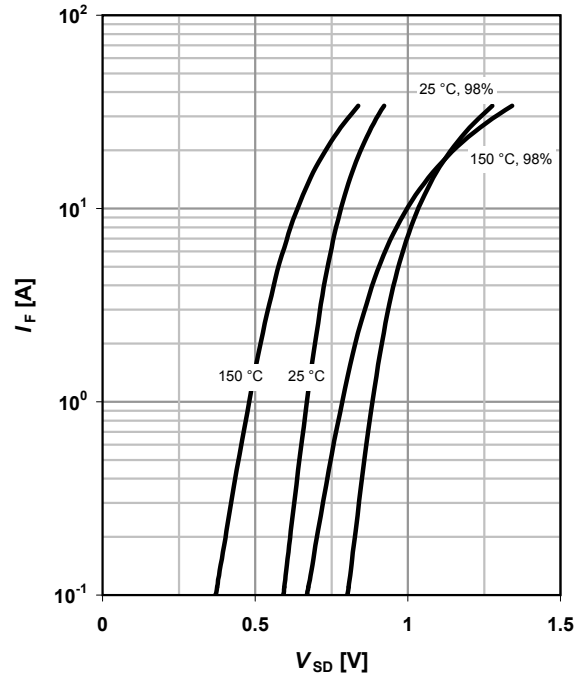
parameter: V_{DD}



10 Forward characteristics of reverse diode

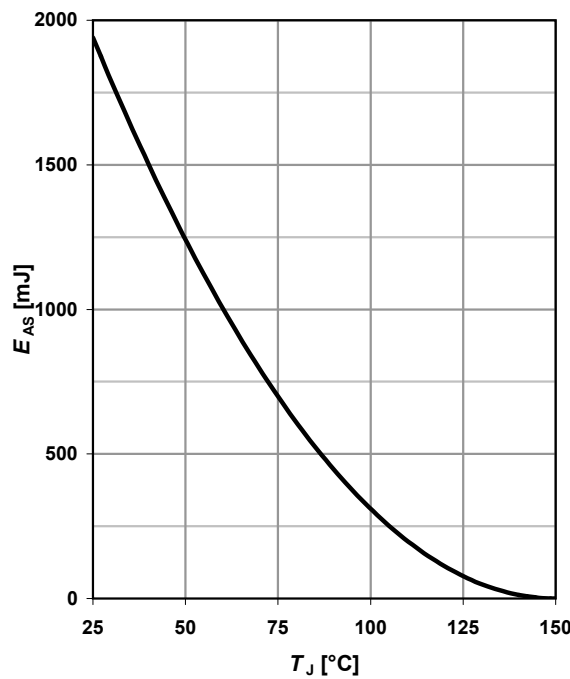
$I_F=f(V_{SD})$

parameter: T_J



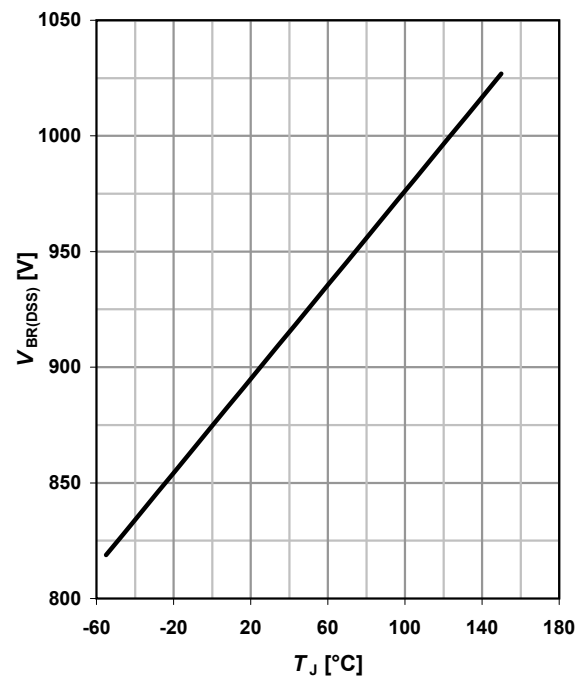
11 Avalanche energy

$E_{AS}=f(T_J); I_D=8.8\text{ A}; V_{DD}=50\text{ V}$



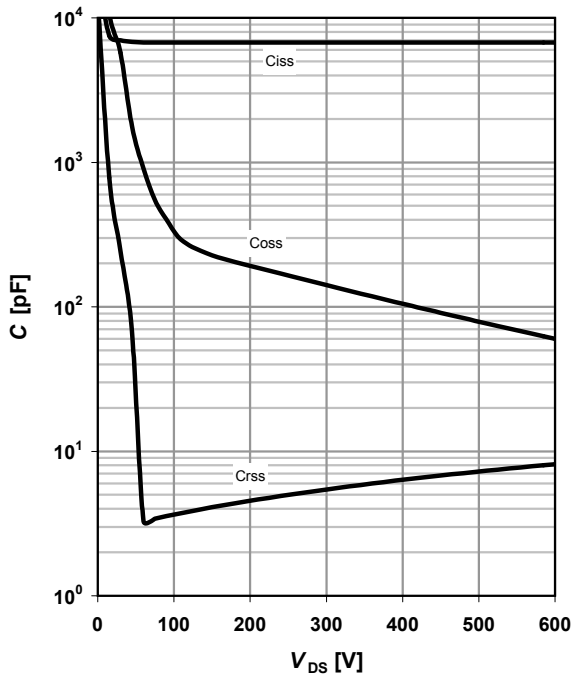
12 Drain-source breakdown voltage

$V_{BR(DSS)}=f(T_J); I_D=0.25\text{ mA}$



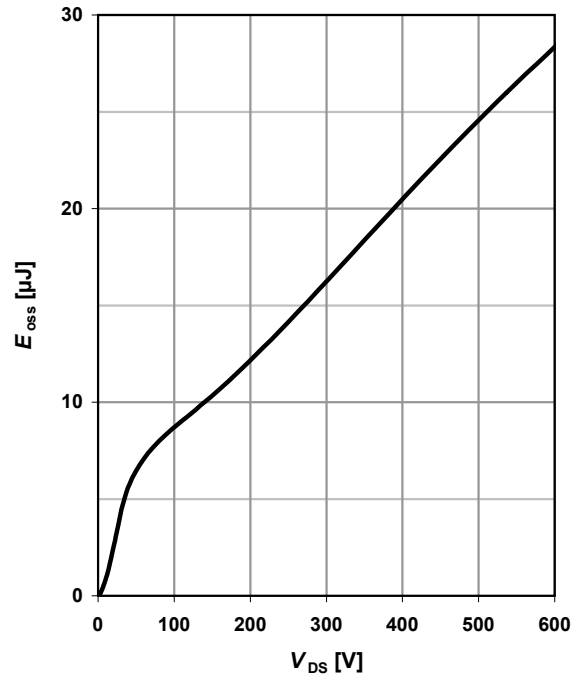
13 Typ. capacitances

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

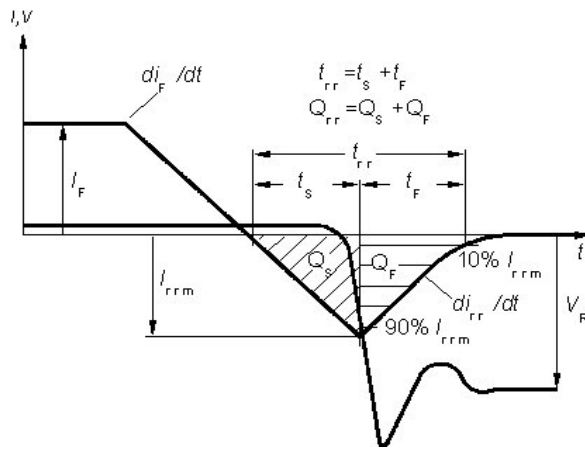


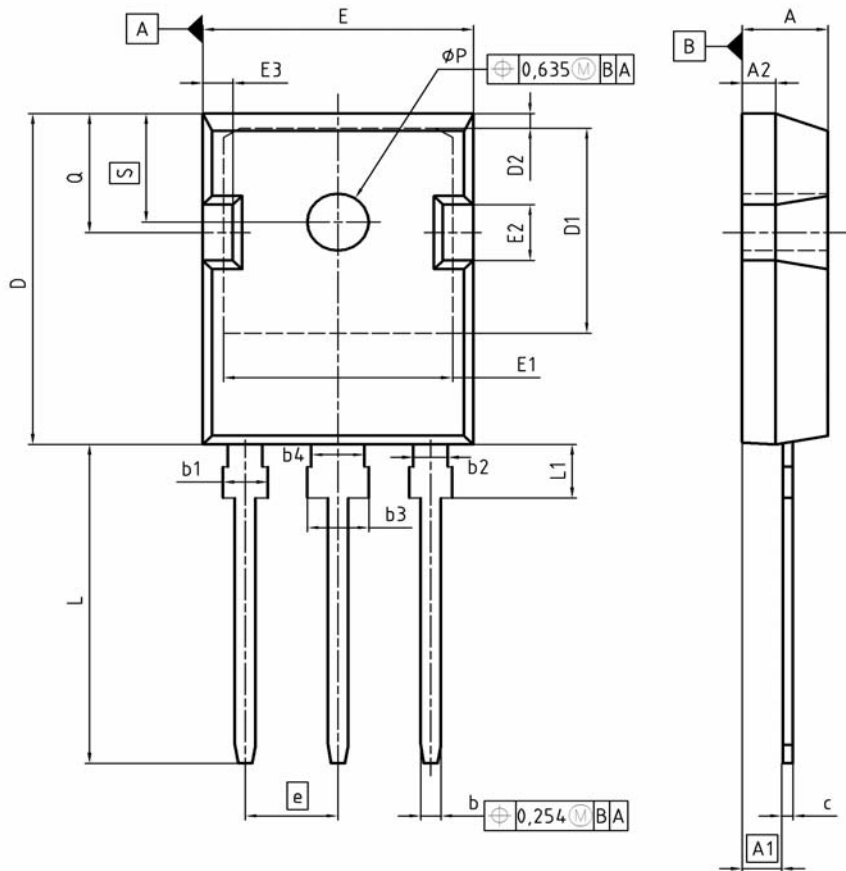
14 Typ. C_{oss} stored energy

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



Definition of diode switching characteristics





| DIM | MILLIMETERS | | INCHES | |
|----------|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.16 | 0.193 | 0.203 |
| A1 | 2.27 | 2.53 | 0.089 | 0.099 |
| A2 | 1.85 | 2.11 | 0.073 | 0.083 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 1.90 | 2.41 | 0.075 | 0.095 |
| b2 | 1.90 | 2.16 | 0.075 | 0.085 |
| b3 | 2.87 | 3.38 | 0.113 | 0.133 |
| b4 | 2.87 | 3.13 | 0.113 | 0.123 |
| c | 0.55 | 0.68 | 0.022 | 0.027 |
| D | 20.82 | 21.10 | 0.820 | 0.831 |
| D1 | 16.25 | 17.65 | 0.640 | 0.695 |
| D2 | 1.05 | 1.35 | 0.041 | 0.053 |
| E | 15.70 | 16.03 | 0.618 | 0.631 |
| E1 | 13.10 | 14.15 | 0.516 | 0.557 |
| E2 | 3.68 | 5.10 | 0.145 | 0.201 |
| E3 | 1.68 | 2.60 | 0.066 | 0.102 |
| e | 5.44 | | 0.214 | |
| N | 3 | | 3 | |
| L | 19.80 | 20.31 | 0.780 | 0.799 |
| L1 | 4.17 | 4.47 | 0.164 | 0.176 |
| ϕP | 3.50 | 3.70 | 0.138 | 0.146 |
| Q | 5.49 | 6.00 | 0.216 | 0.236 |
| S | 6.04 | 6.30 | 0.238 | 0.248 |

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SCALE

EUROPEAN PROJECTION

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