

## CoolMOS™ Power Transistor

### Features

- New revolutionary high voltage technology
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Ultra low gate charge
- Ultra low effective capacitances

### Product Summary

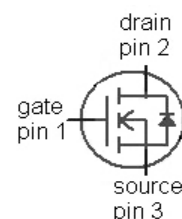
|                                     |      |          |
|-------------------------------------|------|----------|
| $V_{DS}$                            | 800  | V        |
| $R_{DS(on)max} @ T_j = 25^{\circ}C$ | 0.29 | $\Omega$ |
| $Q_{g,typ}$                         | 88   | nC       |

PG-TO247-3



### CoolMOS™ 800V designed for:

- Industrial application with high DC bulk voltage
- Switching Application (i.e. active clamp forward)



| Type       | Package    | Marking |
|------------|------------|---------|
| SPW17N80C3 | PG-TO247-3 | 17N80C3 |

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

| Parameter                                      | Symbol         | Conditions               | Value       | Unit        |
|------------------------------------------------|----------------|--------------------------|-------------|-------------|
| Continuous drain current                       | $I_D$          | $T_C=25^{\circ}C$        | 17          | A           |
|                                                |                | $T_C=100^{\circ}C$       | 11          |             |
| Pulsed drain current <sup>2)</sup>             | $I_{D,pulse}$  | $T_C=25^{\circ}C$        | 51          |             |
| Avalanche energy, single pulse                 | $E_{AS}$       | $I_D=3.4 A, V_{DD}=50 V$ | 670         | mJ          |
| Avalanche energy, repetitive $t_{AR}^{2),3)}$  | $E_{AR}$       | $I_D=17 A, V_{DD}=50 V$  | 0.5         |             |
| Avalanche current, repetitive $t_{AR}^{2),3)}$ | $I_{AR}$       |                          | 17          | A           |
| MOSFET dv/dt ruggedness                        | dv/dt          | $V_{DS}=0...640 V$       | 50          | V/ns        |
| Gate source voltage                            | $V_{GS}$       | static                   | $\pm 20$    | V           |
|                                                |                | AC ( $f>1 Hz$ )          | $\pm 30$    |             |
| Power dissipation                              | $P_{tot}$      | $T_C=25^{\circ}C$        | 227         | W           |
| Operating and storage temperature              | $T_j, T_{stg}$ |                          | -55 ... 150 | $^{\circ}C$ |
| Mounting torque                                |                | M2.5 screws              | 50          | Ncm         |

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

| Parameter                           | Symbol        | Conditions         | Value | Unit |
|-------------------------------------|---------------|--------------------|-------|------|
| Continuous diode forward current    | $I_S$         | $T_C=25\text{ °C}$ | 17    | A    |
| Diode pulse current <sup>2)</sup>   | $I_{S,pulse}$ |                    | 51    |      |
| Reverse diode $dv/dt$ <sup>4)</sup> | $dv/dt$       |                    | 4     | V/ns |

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

#### Thermal characteristics

|                                                             |            |                                      |   |   |      |     |
|-------------------------------------------------------------|------------|--------------------------------------|---|---|------|-----|
| Thermal resistance, junction - case                         | $R_{thJC}$ |                                      | - | - | 0.55 | K/W |
| Thermal resistance, junction - ambient                      | $R_{thJA}$ | leaded                               | - | - | 62   |     |
| Soldering temperature, wave soldering only allowed at leads | $T_{sold}$ | 1.6 mm (0.063 in.) from case for 10s | - | - | 260  | °C  |

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

#### Static characteristics

|                                  |               |                                                                   |     |      |      |               |
|----------------------------------|---------------|-------------------------------------------------------------------|-----|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$                | 800 | -    | -    | V             |
| Avalanche breakdown voltage      | $V_{(BR)DS}$  | $V_{GS}=0\text{ V}$ , $I_D=17\text{ A}$                           | -   | 870  | -    |               |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ , $I_D=1.0\text{ mA}$                             | 2.1 | 3    | 3.9  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=800\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$  | -   | -    | 25   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=800\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=150\text{ °C}$ | -   | 150  | -    |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                        | -   | -    | 100  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=10\text{ V}$ , $I_D=11\text{ A}$ , $T_j=25\text{ °C}$     | -   | 0.25 | 0.29 | $\Omega$      |
|                                  |               | $V_{GS}=10\text{ V}$ , $I_D=11\text{ A}$ , $T_j=150\text{ °C}$    | -   | 0.67 | -    |               |
| Gate resistance                  | $R_G$         | $f=1\text{ MHz}$ , open drain                                     | -   | 0.85 | -    | $\Omega$      |

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

### Dynamic characteristics

|                                                            |              |                                                                                                                           |   |      |   |    |
|------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------|---|------|---|----|
| Input capacitance                                          | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$<br>$f=1\text{ MHz}$                                                             | - | 2300 | - | pF |
| Output capacitance                                         | $C_{oss}$    |                                                                                                                           | - | 94   | - |    |
| Effective output capacitance, energy related <sup>5)</sup> | $C_{o(er)}$  |                                                                                                                           | - | 72   | - |    |
| Effective output capacitance, time related <sup>6)</sup>   | $C_{o(tr)}$  | $V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$<br>to 480 V                                                                        | - | 210  | - |    |
| Turn-on delay time                                         | $t_{d(on)}$  | $V_{DD}=400\text{ V},$<br>$V_{GS}=10\text{ V}, I_D=17\text{ A},$<br>$R_G=4.7\text{ }\Omega, T_j=25\text{ }^\circ\text{C}$ | - | 25   | - | ns |
| Rise time                                                  | $t_r$        |                                                                                                                           | - | 15   | - |    |
| Turn-off delay time                                        | $t_{d(off)}$ |                                                                                                                           | - | 72   | - |    |
| Fall time                                                  | $t_f$        |                                                                                                                           | - | 12   | - |    |

### Gate Charge Characteristics

|                       |               |                                                                             |   |     |     |    |
|-----------------------|---------------|-----------------------------------------------------------------------------|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=640\text{ V}, I_D=17\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 12  | -   | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                             | - | 45  | -   |    |
| Gate charge total     | $Q_g$         |                                                                             | - | 88  | 117 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                             | - | 5.5 | -   | V  |

### Reverse Diode

|                               |           |                                                                                     |   |     |     |               |
|-------------------------------|-----------|-------------------------------------------------------------------------------------|---|-----|-----|---------------|
| Diode forward voltage         | $V_{SD}$  | $V_{GS}=0\text{ V}, I_F=I_S=17\text{ A},$<br>$T_j=25\text{ }^\circ\text{C}$         | - | 1   | 1.2 | V             |
| Reverse recovery time         | $t_{rr}$  | $V_R=400\text{ V},$<br>$I_F=I_S=17\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 550 | -   | ns            |
| Reverse recovery charge       | $Q_{rr}$  |                                                                                     | - | 15  | -   | $\mu\text{C}$ |
| Peak reverse recovery current | $I_{rrm}$ |                                                                                     | - | 51  | -   | A             |

<sup>1)</sup> J-STD20 and JESD22

<sup>2)</sup> Pulse width  $t_p$  limited by  $T_{j,max}$

<sup>3)</sup> Repetitive avalanche causes additional power losses that can be calculated as  $P_{AV}=E_{AR} \cdot f$ .

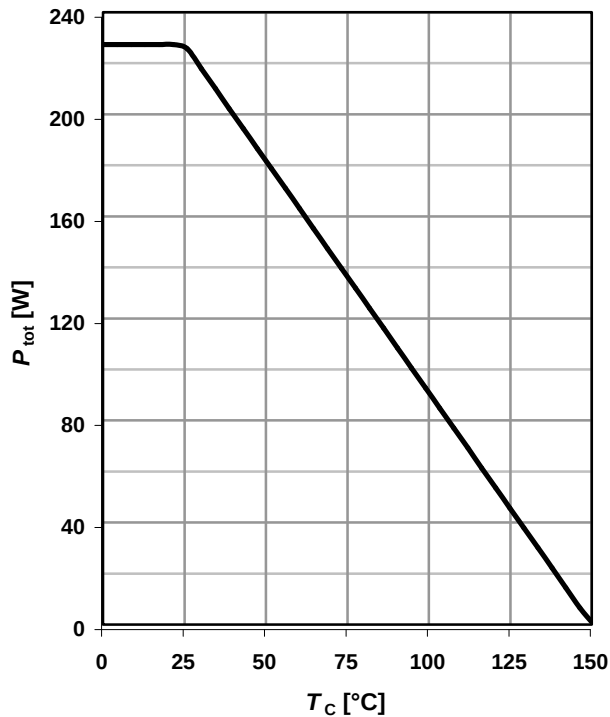
<sup>4)</sup>  $I_{SD}=I_D, di/dt=200\text{ A}/\mu\text{s}, V_{DClk}=400\text{ V}, V_{peak}<V_{(BR)DSS}, T_j<T_{j,max}$ , identical low side and high side switch

<sup>5)</sup>  $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

<sup>6)</sup>  $C_{o(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

## 1 Power dissipation

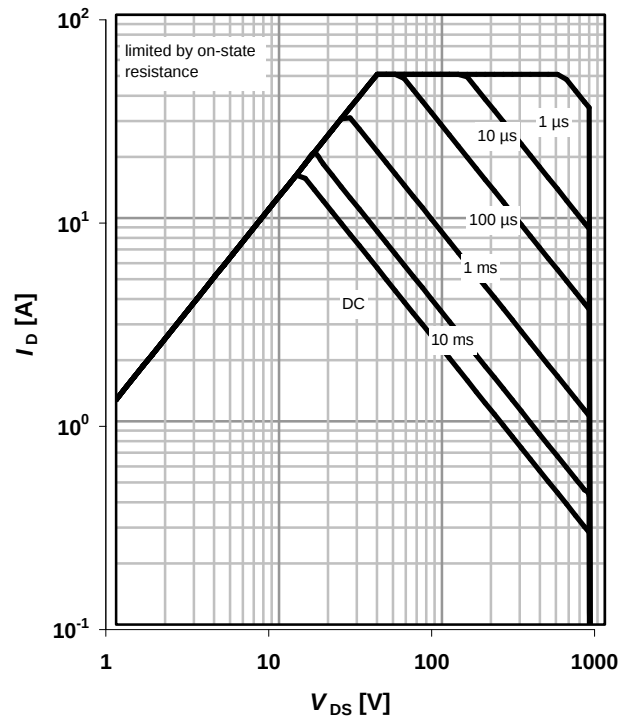
$$P_{\text{tot}} = f(T_C)$$



## 2 Safe operating area

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

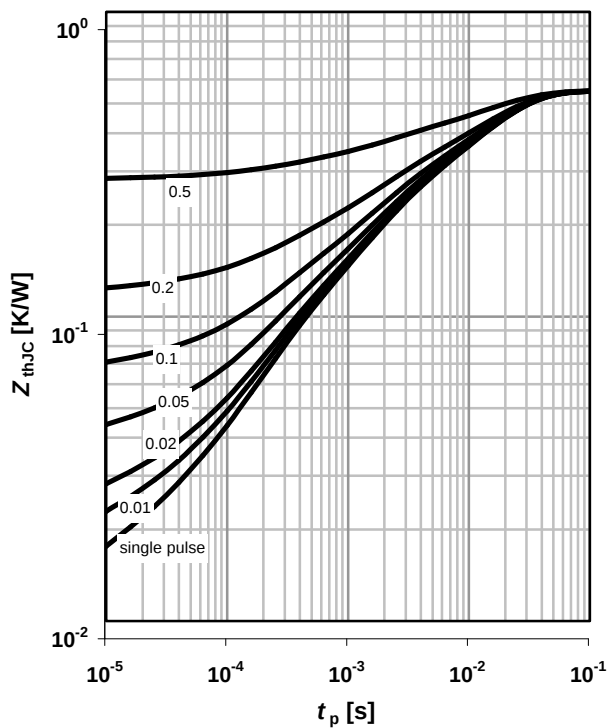
parameter:  $t_p$



## 3 Max. transient thermal impedance

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

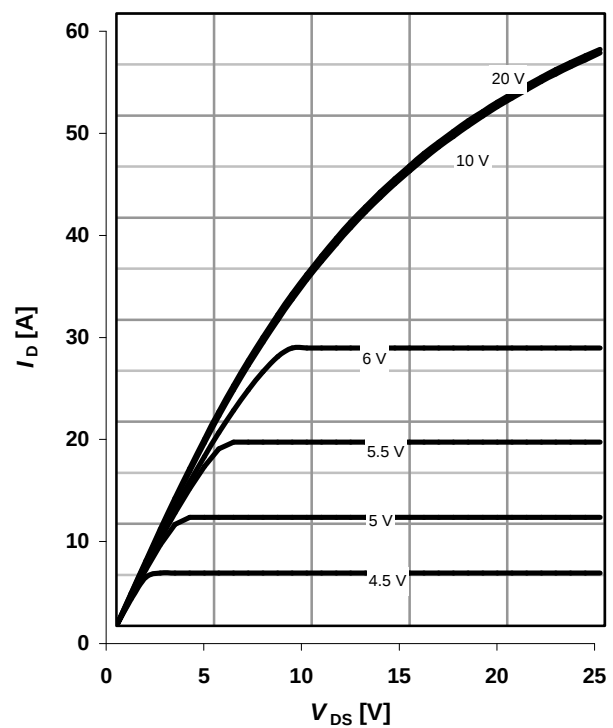
parameter:  $D = t_p/T$



## 4 Typ. output characteristics

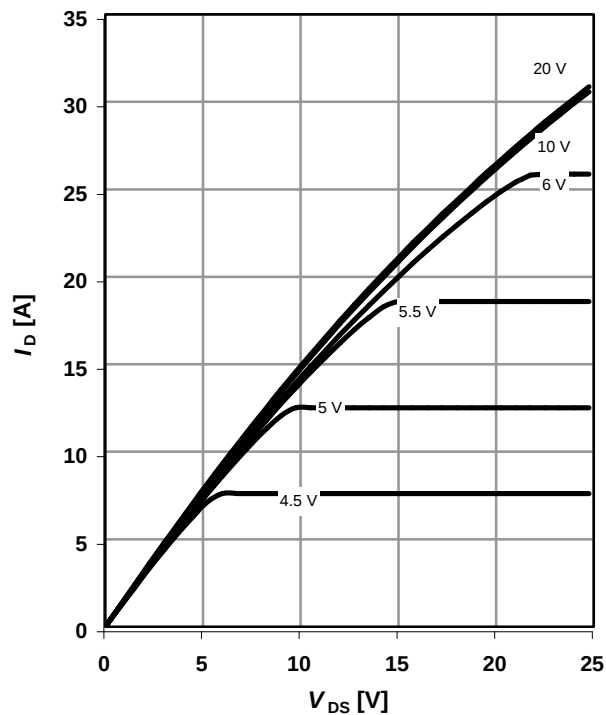
$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}; t_p = 10 \mu\text{s}$$

parameter:  $V_{GS}$



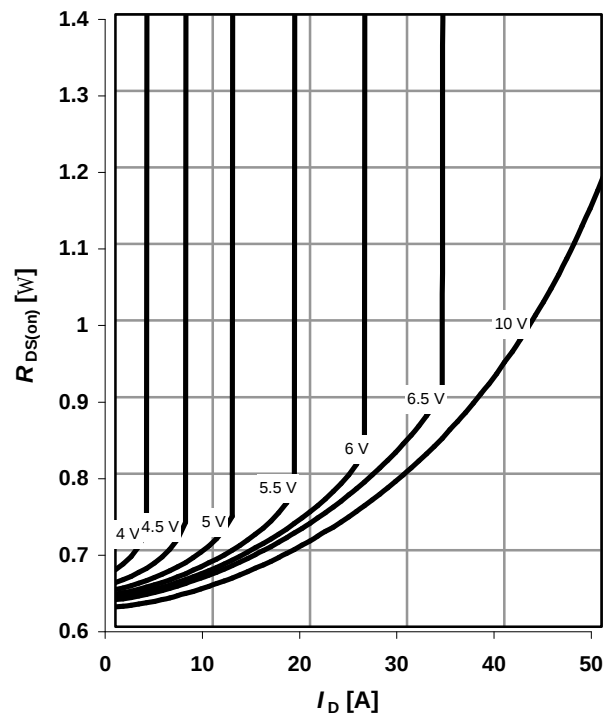
## 5 Typ. output characteristics

 $I_D = f(V_{DS}); T_j = 150^\circ\text{C}; t_p = 10\ \mu\text{s}$ 

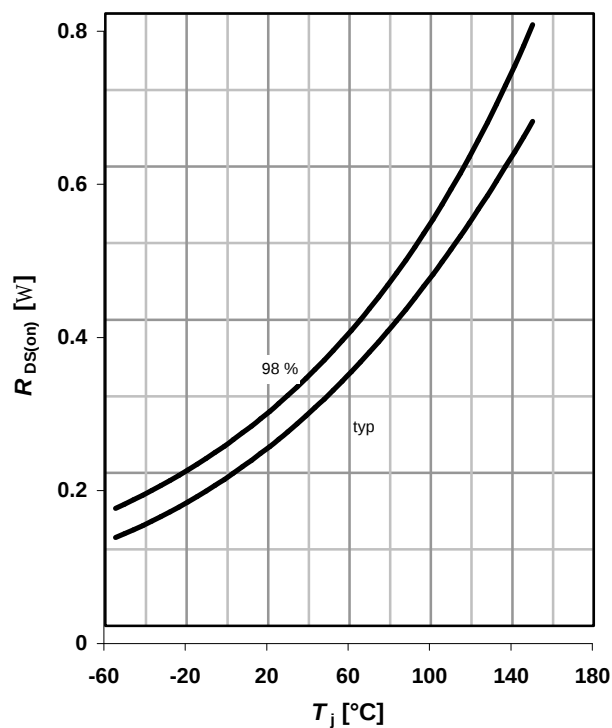
parameter:  $V_{GS}$ 


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

 $R_{DS(on)} = f(I_D); T_j = 150^\circ\text{C}$ 

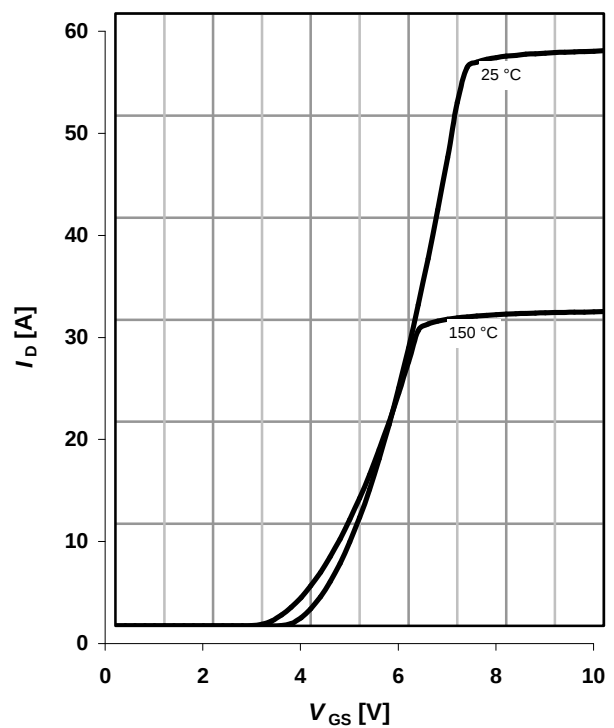
parameter:  $V_{GS}$ 


## 7 Drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 11\ \text{A}; V_{GS} = 10\ \text{V}$ 


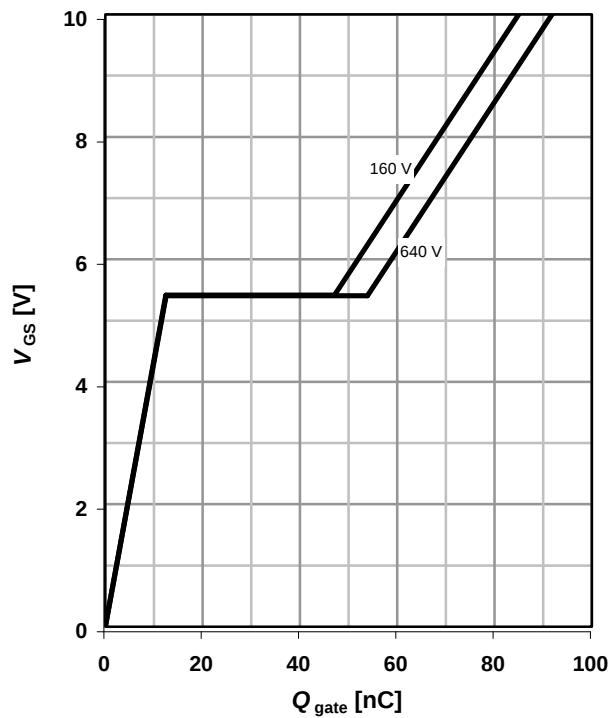
## 8 Typ. transfer characteristics

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)\text{max}}; t_p = 10\ \mu\text{s}$ 

parameter:  $T_j$ 


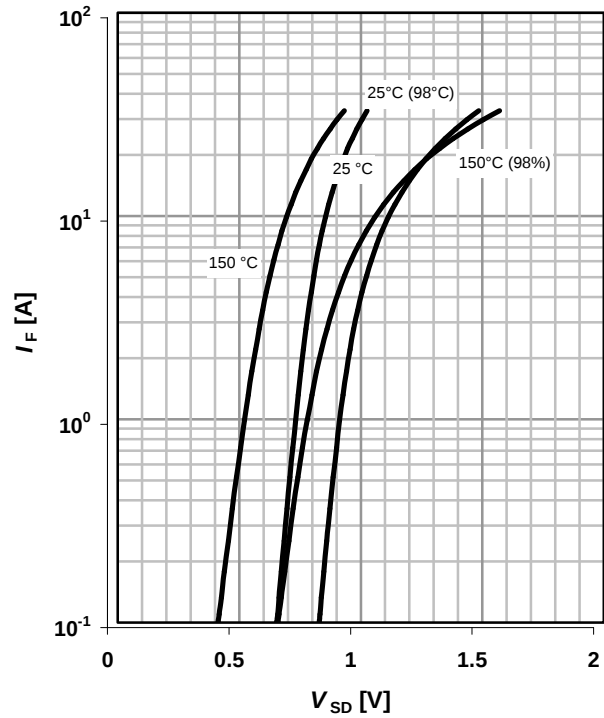
### 9 Typ. gate charge

 $V_{GS}=f(Q_{gate}); I_D=17\text{ A pulsed}$ 

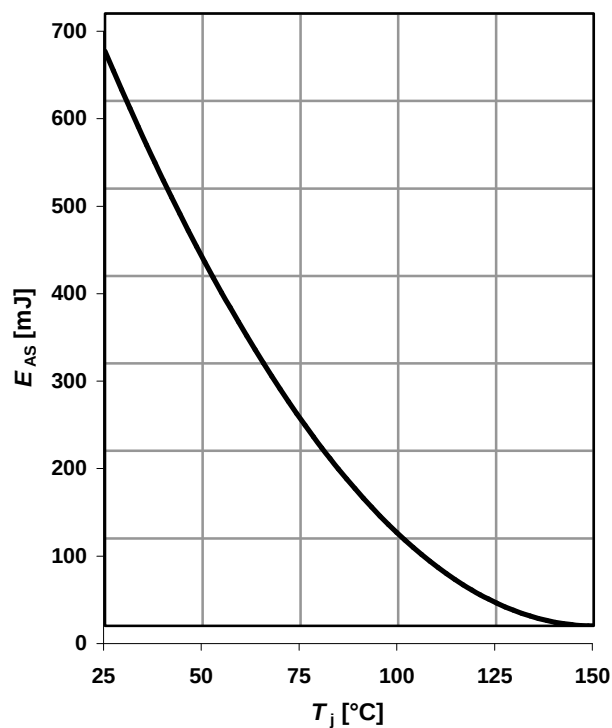
parameter:  $V_{DD}$ 


### 10 Forward characteristics of reverse diode

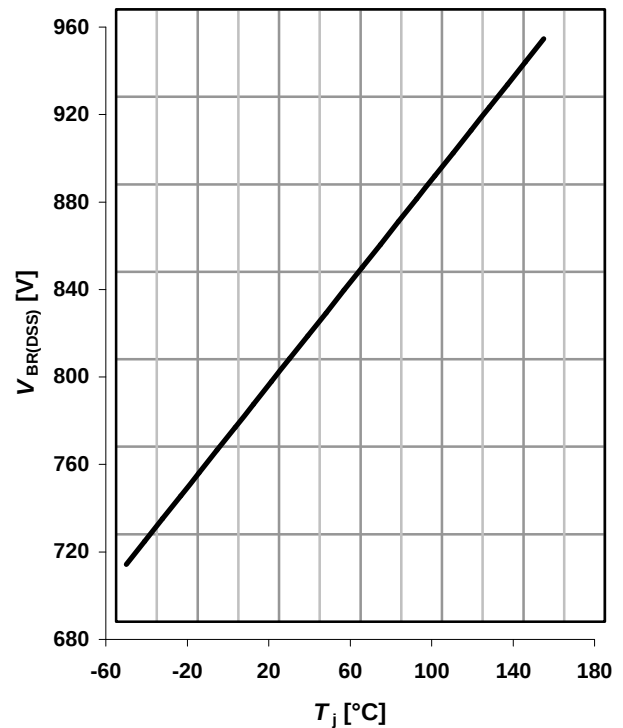
 $I_F=f(V_{SD}); t_p=10\text{ }\mu\text{s}$ 

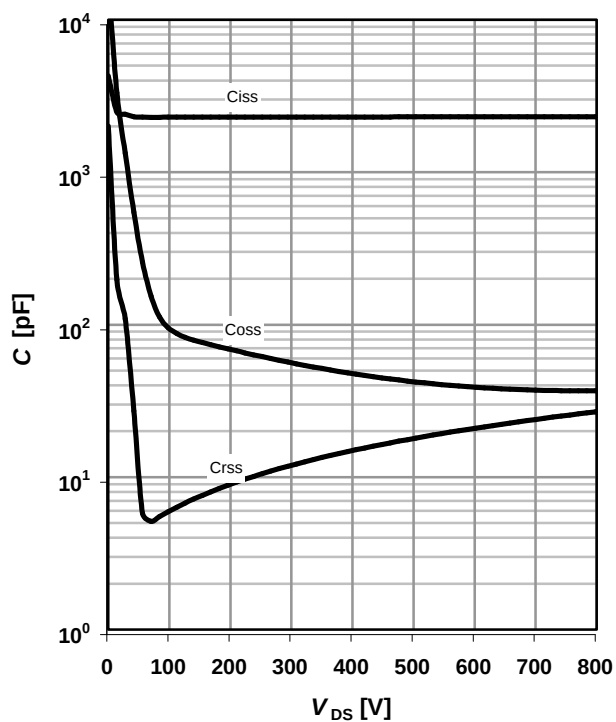
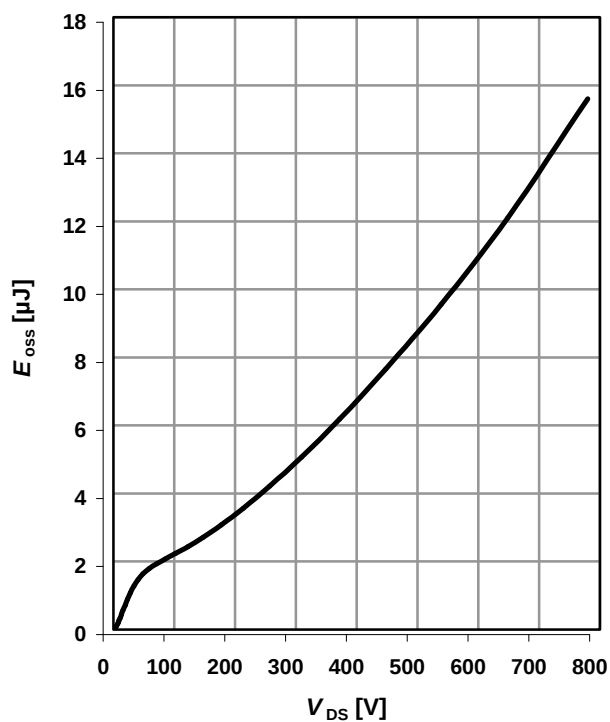
parameter:  $T_j$ 


### 11 Avalanche energy

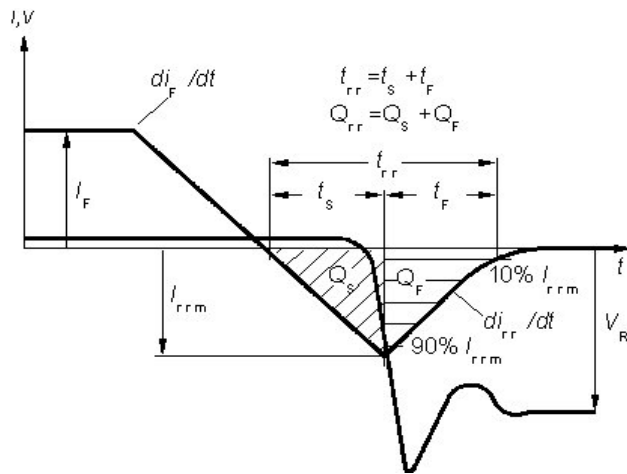
 $E_{AS}=f(T_j); I_D=3.4\text{ A}; V_{DD}=50\text{ V}$ 


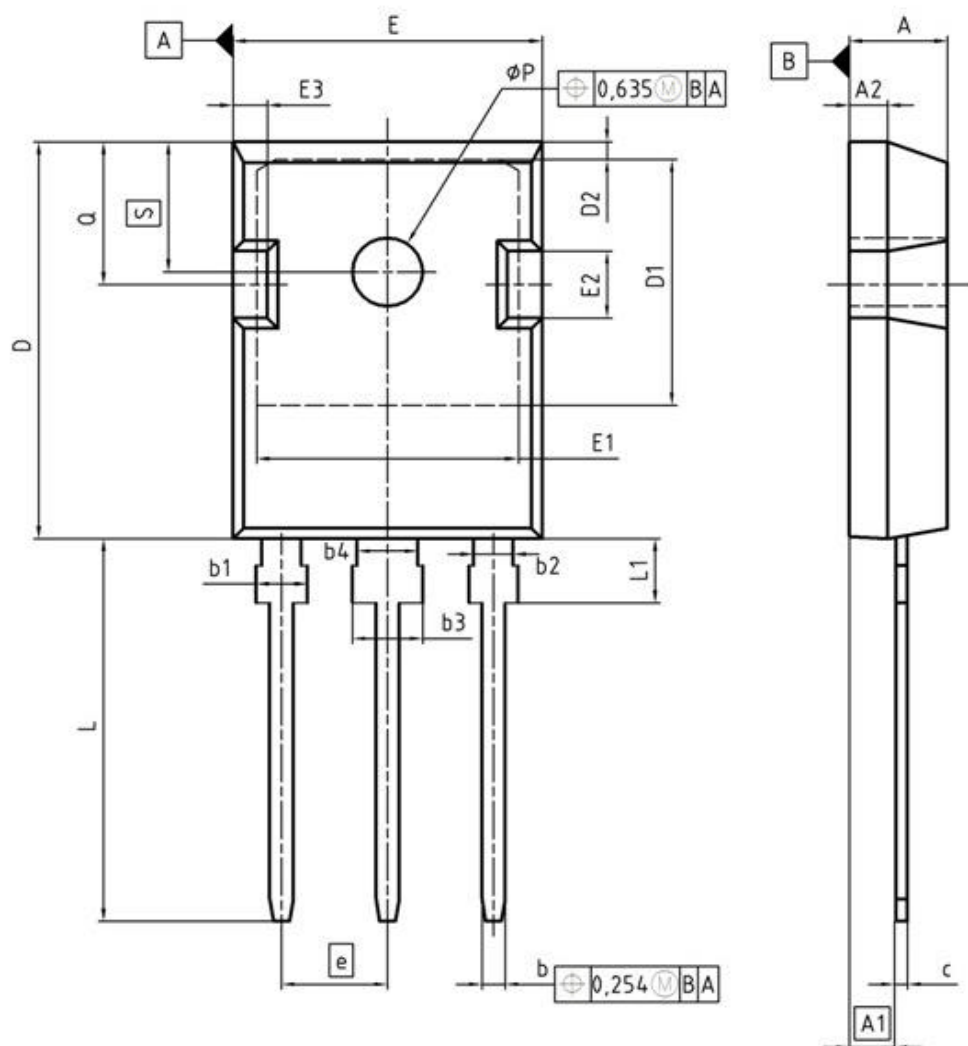
### 12 Drain-source breakdown voltage

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


**13 Typ. capacitances**
 $C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$ 

**14 Typ. Coss 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        | 3.43 | 0.113  | 0.133 |

\*Please refer to the last page for the updated specification.

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| 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 |
| phi P | 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<br>0<br>5<br>7.5mm                                                                                     |
| EUROPEAN PROJECTION<br> |
| ISSUE DATE<br>17-12-2007                                                                                     |
| REVISION<br>03                                                                                               |

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## 1 New package outlines TO-247

Assembly capacity extension for CoolMOSTM technology products assembled in lead-free package  
PG-TO247-3 at subcontractor ASE (Weihai) Inc., China (Changes are marked in blue.)



Figure 1 Outlines TO-247, dimensions in mm/inches

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