



# STP30NF20 - STB30NF20 STW30NF20

N-channel 200V - 0.065Ω - 30A - TO-220/TO-247/D<sup>2</sup>PAK  
Low gate charge STripFET™ Power MOSFET

## Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> | P <sub>TOT</sub> |
|-----------|------------------|---------------------|----------------|------------------|
| STP30NF20 | 200V             | 0.075Ω              | 30A            | 125W             |
| STW30NF20 | 200V             | 0.075Ω              | 30A            | 125W             |
| STB30NF20 | 200V             | 0.075Ω              | 30A            | 125W             |

- Gate charge minimized
- 100% avalanche tested
- Excellent figure of merit ( $R_{DS} \cdot Q_g$ )
- Very good manufacturing repeatability
- Very low intrinsic capacitances

## Application

- Switching applications

## Description

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters.

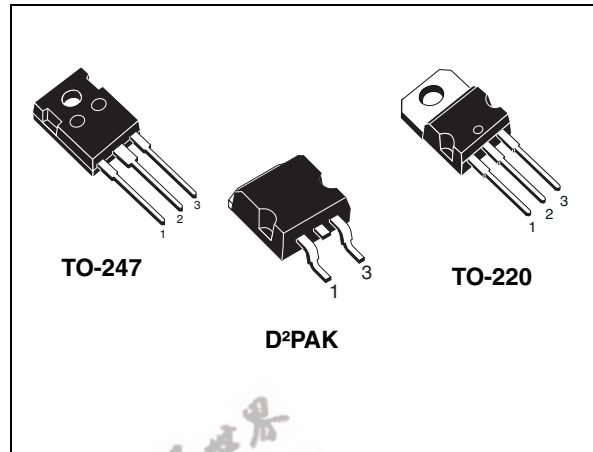


Figure 1. Internal schematic diagram

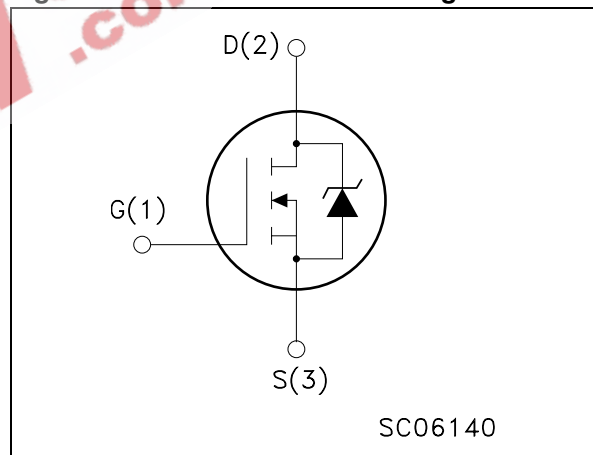


Table 1. Device summary

| Order codes | Marking | Package            | Packaging   |
|-------------|---------|--------------------|-------------|
| STP30NF20   | 30NF20  | TO-220             | Tube        |
| STW30NF20   | 30NF20  | TO-247             | Tube        |
| STB30NF20   | 30NF20  | D <sup>2</sup> PAK | Tape & reel |

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol             | Parameter                                               | Value      | Unit                |
|--------------------|---------------------------------------------------------|------------|---------------------|
| $V_{DS}$           | Drain-source voltage ( $V_{GS} = 0$ )                   | 200        | V                   |
| $V_{GS}$           | Gate-source voltage                                     | $\pm 20$   | V                   |
| $I_D$              | Drain current (continuous) at $T_C = 25^\circ\text{C}$  | 30         | A                   |
| $I_D$              | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 19         | A                   |
| $I_{DM}^{(1)}$     | Drain current (pulsed)                                  | 120        | A                   |
| $P_{TOT}$          | Total dissipation at $T_C = 25^\circ\text{C}$           | 125        | W                   |
|                    | Derating factor                                         | 1          | W/ $^\circ\text{C}$ |
| $dv/dt^{(2)}$      | Peak diode recovery voltage slope                       | 10         | V/ns                |
| $T_J$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature   | -55 to 150 | $^\circ\text{C}$    |
| $T_l$              | Maximum lead temperature for soldering purpose          | 300        | $^\circ\text{C}$    |

1. Pulse width limited by safe operating area

2.  $I_{SD} \leq 30\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} = 80\%V_{(BR)DSS}$

**Table 3. Thermal data**

| Symbol     | Parameter                               | TO-220/<br>D <sup>2</sup> PAK | TO-247 | Unit                      |
|------------|-----------------------------------------|-------------------------------|--------|---------------------------|
| $R_{thJC}$ | Thermal resistance junction-case max    | 1                             |        | $^\circ\text{C}/\text{W}$ |
| $R_{thJA}$ | Thermal resistance junction-ambient max | 62.5                          | 50     | $^\circ\text{C}/\text{W}$ |

**Table 4. Avalanche data**

| Symbol   | Parameter                                                                                                   | Value | Unit |
|----------|-------------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AR}$ | Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )                        | 30    | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{V}$ ) | 140   | mJ   |

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}\text{C}$  unless otherwise specified)

**Table 5. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                              | Min. | Typ.  | Max.      | Unit                           |
|---------------|--------------------------------------------------|----------------------------------------------------------------------------------------------|------|-------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 1\text{mA}$ , $V_{GS} = 0$                                                            | 200  |       |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$ ,<br>$V_{DS} = \text{Max rating}$ , $T_c = 125^{\circ}\text{C}$ |      |       | 1<br>10   | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{V}$                                                                    |      |       | $\pm 100$ | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                                                   | 2    | 3     | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{V}$ , $I_D = 15\text{A}$                                                   |      | 0.065 | 0.075     | $\Omega$                       |

**Table 6. Dynamic**

| Symbol                              | Parameter                                                               | Test conditions                                                                         | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------|-------------------|------|----------------|
| $g_{fs}^{(1)}$                      | Forward transconductance                                                | $V_{DS} = 15\text{V}$ , $I_D = 15\text{A}$                                              |      | 20                |      | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$ , $V_{GS} = 0$                                |      | 1597<br>320<br>43 |      | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 160\text{V}$ , $I_D = 30\text{A}$<br>$V_{GS} = 10\text{V}$<br>(see Figure 17) |      | 38<br>8<br>18     |      | nC<br>nC<br>nC |

1. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

**Table 7. Switching times**

| Symbol                | Parameter                        | Test conditions                                                                  | Min. | Typ.       | Max. | Unit     |
|-----------------------|----------------------------------|----------------------------------------------------------------------------------|------|------------|------|----------|
| $t_{d(on)}$<br>$t_r$  | Turn-on delay time<br>Rise time  | $V_{DD}=100V$ , $I_D=15A$ ,<br>$R_G=4.7\Omega$ , $V_{GS}=10V$<br>(see Figure 16) |      | 35<br>15.7 |      | ns<br>ns |
| $t_{d(off)}$<br>$t_f$ | Turn-off delay time<br>Fall time | $V_{DD}=100V$ , $I_D=15A$ ,<br>$R_G=4.7\Omega$ , $V_{GS}=10V$<br>(see Figure 16) |      | 38<br>8.8  |      | ns<br>ns |

**Table 8. Source drain diode**

| Symbol                            | Parameter                                                                    | Test conditions                                                            | Min. | Typ.                | Max.      | Unit               |
|-----------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------|------|---------------------|-----------|--------------------|
| $I_{SD}$<br>$I_{SDM}^{(1)}$       | Source-drain current<br>Source-drain current<br>(pulsed)                     |                                                                            |      |                     | 30<br>120 | A<br>A             |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD}=30A$ , $V_{GS}=0$                                                  |      |                     | 1.5       | V                  |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}=30A$ , $di/dt = 100A/\mu s$ ,<br>$V_{DD}=100V$ , $T_j=25^\circ C$  |      | 155<br>0.96<br>12.4 |           | ns<br>$\mu C$<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}=30A$ , $di/dt = 100A/\mu s$ ,<br>$V_{DD}=100V$ , $T_j=150^\circ C$ |      | 194<br>1.42<br>14.6 |           | ns<br>$\mu C$<br>A |

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-247

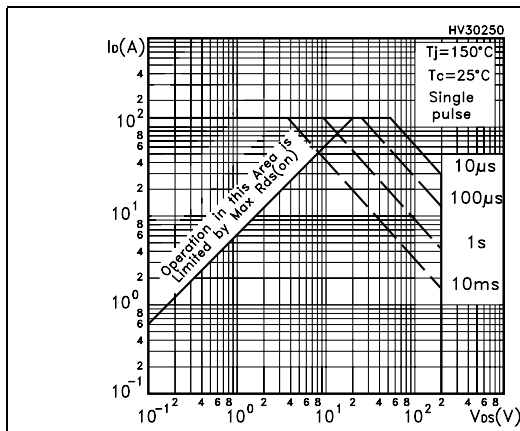


Figure 3. Thermal impedance for TO-247

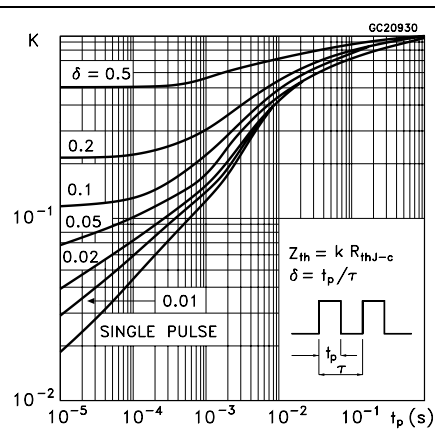
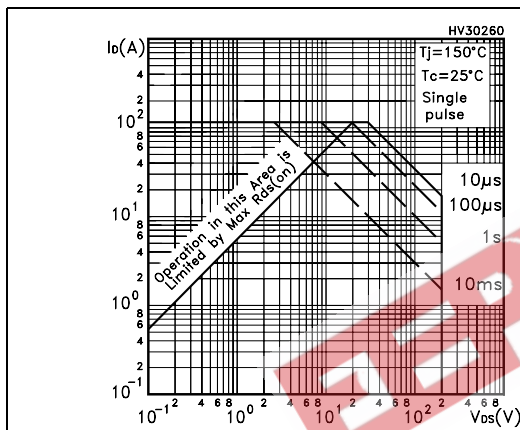
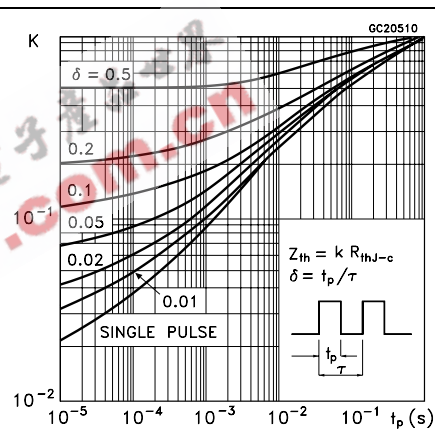
Figure 4. Safe operating area for TO-220/D<sup>2</sup>PAKFigure 5. Thermal impedance for TO-220/D<sup>2</sup>PAK

Figure 6. Output characteristics

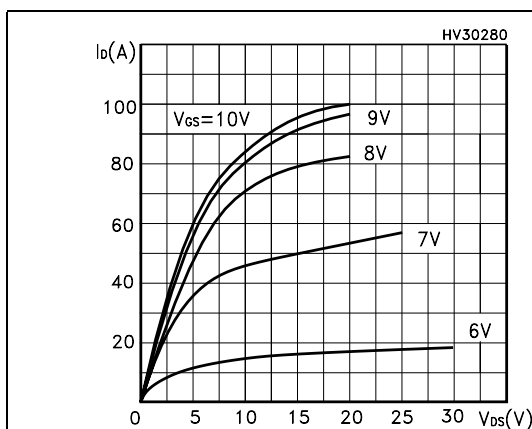


Figure 7. Transfer characteristics

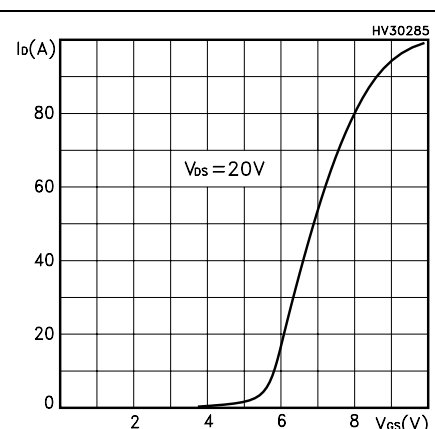


Figure 8. Normalized  $B_{V_{DS}}$  vs temperature      Figure 9. Static drain-source on resistance

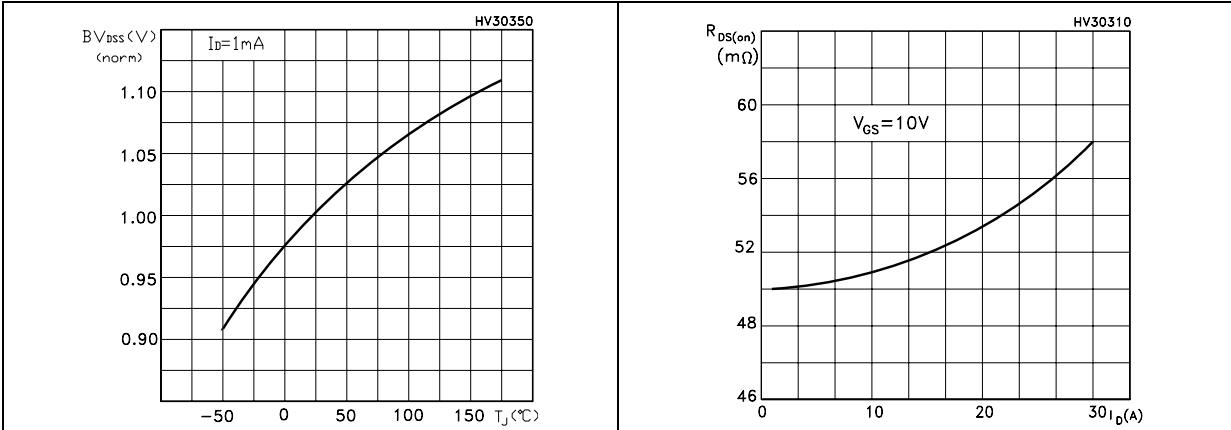


Figure 10. Gate charge vs gate-source voltage      Figure 11. Capacitance variations

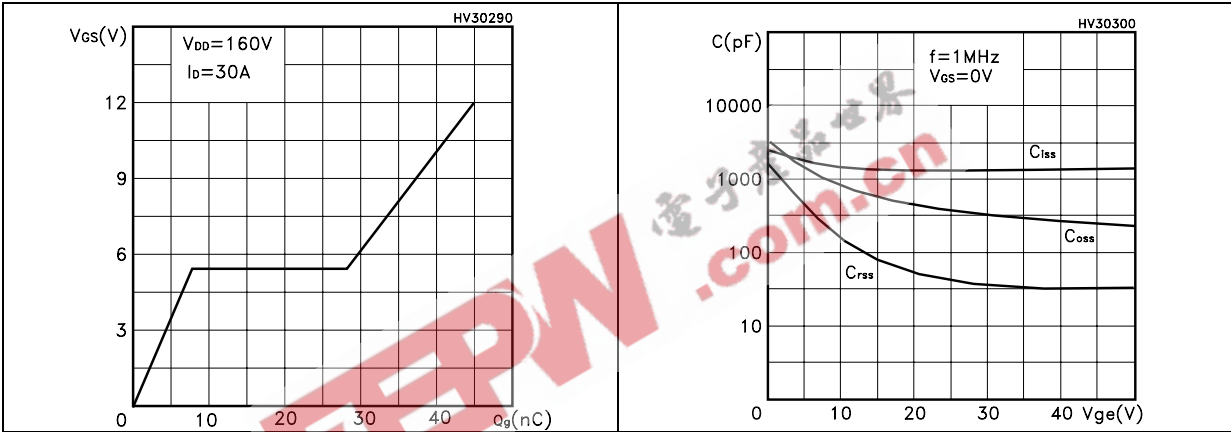


Figure 12. Normalized gate threshold voltage vs temperature      Figure 13. Normalized on resistance vs temperature

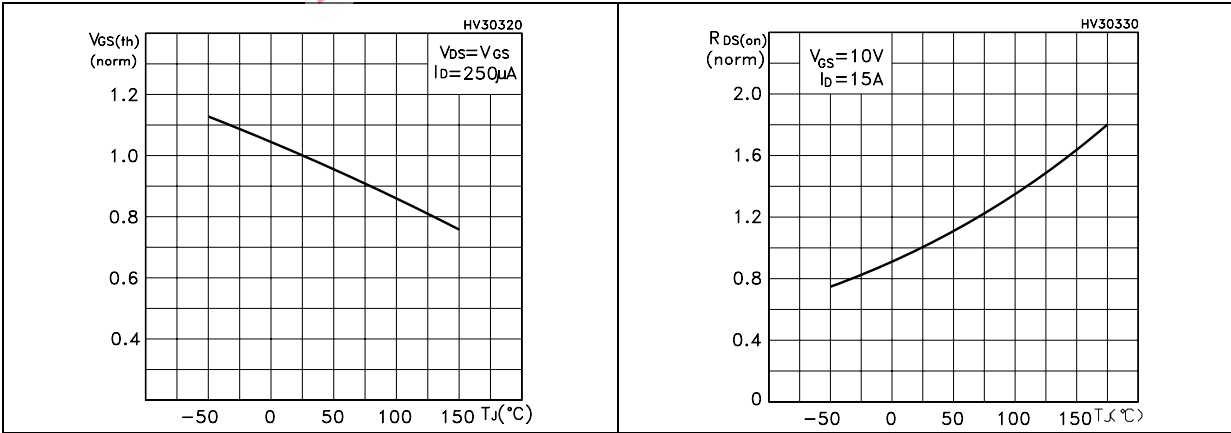


Figure 14. Source-drain diode forward characteristics

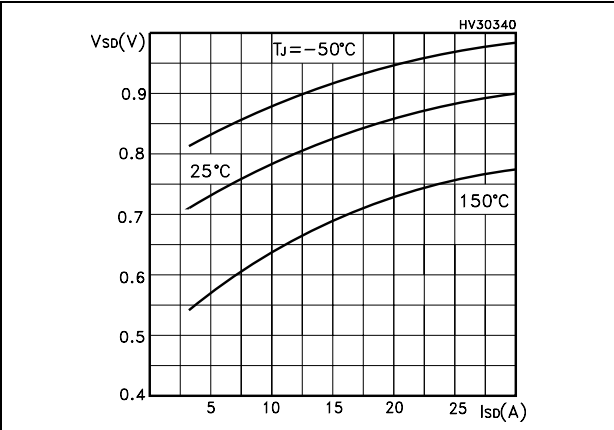
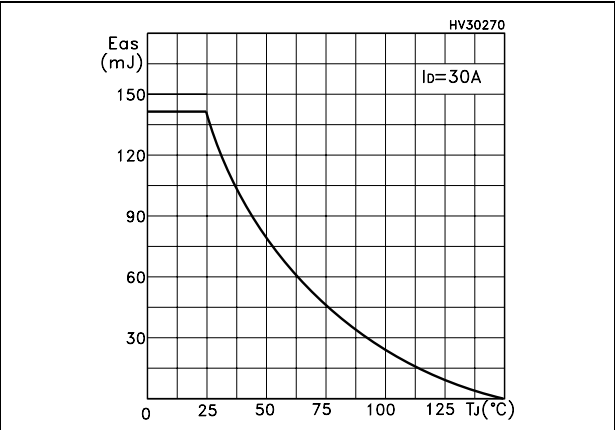


Figure 15. Maximum avalanche energy vs temperature



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### 3 Test circuit

Figure 16. Switching times test circuit for resistive load



Figure 17. Gate charge test circuit

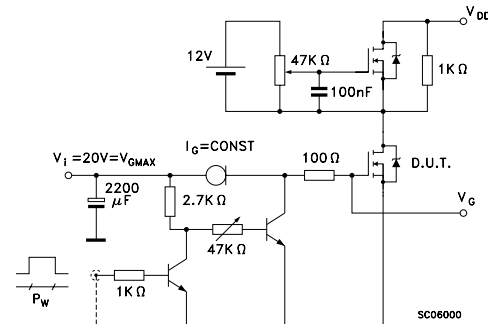


Figure 18. Test circuit for inductive load switching and diode recovery times

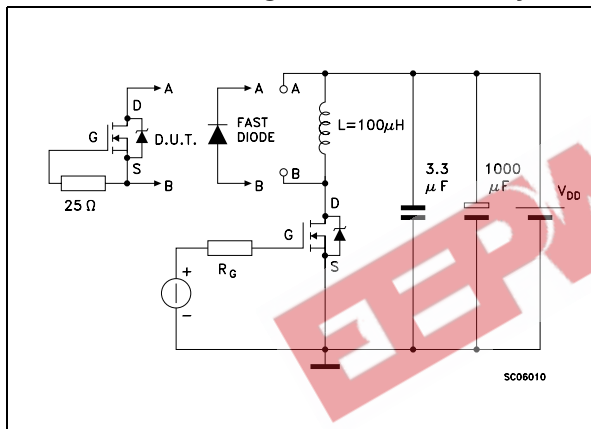


Figure 19. Unclamped inductive load test circuit

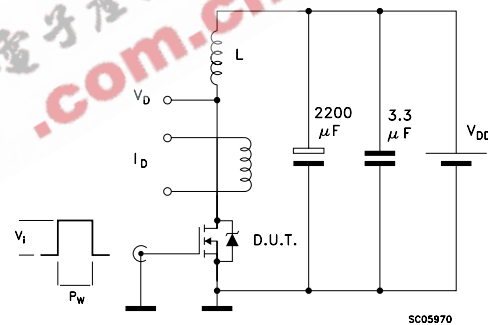


Figure 20. Unclamped inductive waveform

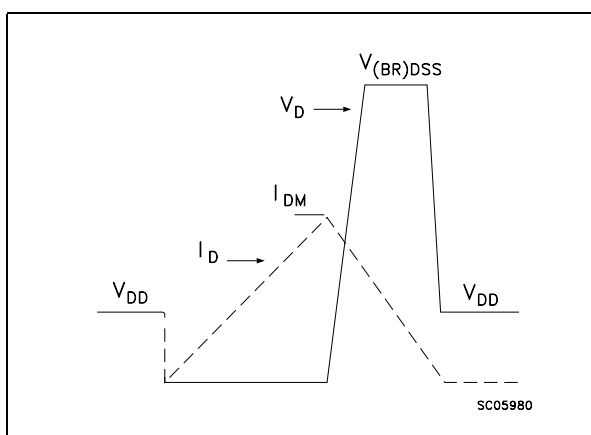
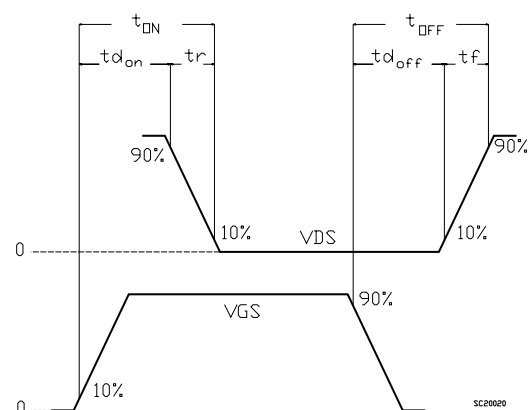


Figure 21. Switching time waveform



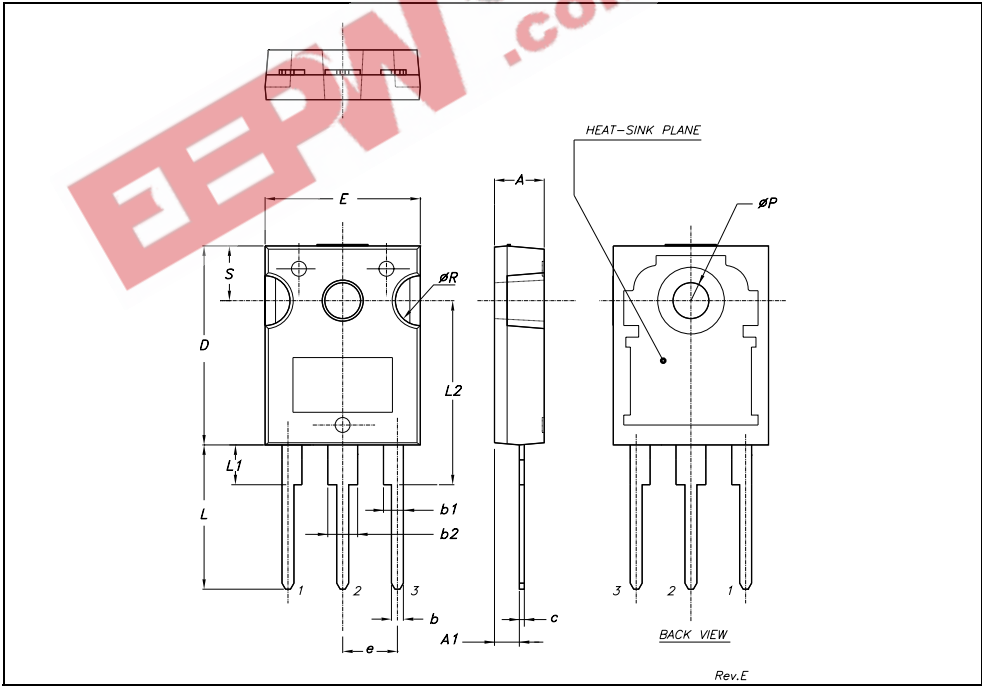
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

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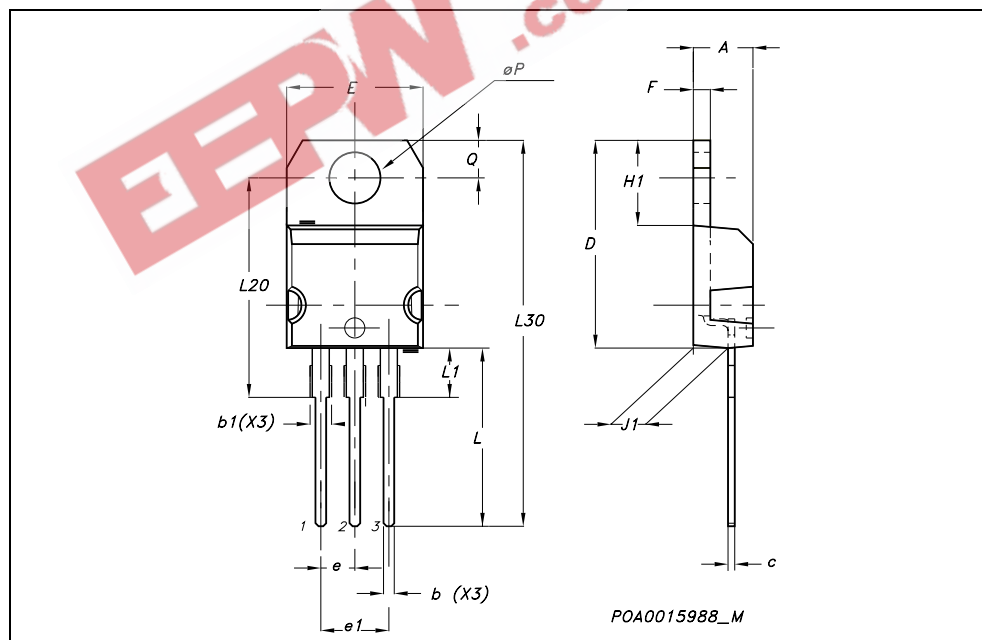
TO-247 MECHANICAL DATA

| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.85  |       | 5.15  | 0.19  |       | 0.20  |
| A1   | 2.20  |       | 2.60  | 0.086 |       | 0.102 |
| b    | 1.0   |       | 1.40  | 0.039 |       | 0.055 |
| b1   | 2.0   |       | 2.40  | 0.079 |       | 0.094 |
| b2   | 3.0   |       | 3.40  | 0.118 |       | 0.134 |
| c    | 0.40  |       | 0.80  | 0.015 |       | 0.03  |
| D    | 19.85 |       | 20.15 | 0.781 |       | 0.793 |
| E    | 15.45 |       | 15.75 | 0.608 |       | 0.620 |
| e    |       | 5.45  |       |       | 0.214 |       |
| L    | 14.20 |       | 14.80 | 0.560 |       | 0.582 |
| L1   | 3.70  |       | 4.30  | 0.14  |       | 0.17  |
| L2   |       | 18.50 |       |       | 0.728 |       |
| øP   | 3.55  |       | 3.65  | 0.140 |       | 0.143 |
| øR   | 4.50  |       | 5.50  | 0.177 |       | 0.216 |
| S    |       | 5.50  |       |       | 0.216 |       |



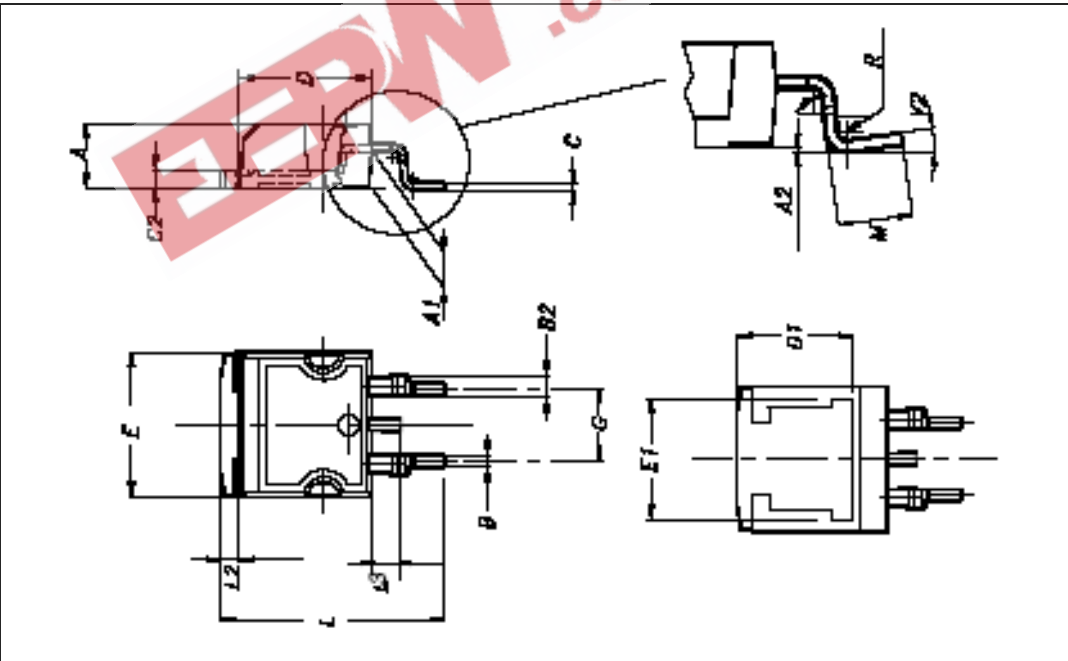
| TO-220 MECHANICAL DATA |
|------------------------|
|------------------------|

| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| b    | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| b1   | 1.15  |       | 1.70  | 0.045 |       | 0.066 |
| c    | 0.49  |       | 0.70  | 0.019 |       | 0.027 |
| D    | 15.25 |       | 15.75 | 0.60  |       | 0.620 |
| E    | 10    |       | 10.40 | 0.393 |       | 0.409 |
| e    | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| e1   | 4.95  |       | 5.15  | 0.194 |       | 0.202 |
| F    | 1.23  |       | 1.32  | 0.048 |       | 0.052 |
| H1   | 6.20  |       | 6.60  | 0.244 |       | 0.256 |
| J1   | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| L    | 13    |       | 14    | 0.511 |       | 0.551 |
| L1   | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| L20  |       | 16.40 |       |       | 0.645 |       |
| L30  |       | 28.90 |       |       | 1.137 |       |
| øP   | 3.75  |       | 3.85  | 0.147 |       | 0.151 |
| Q    | 2.65  |       | 2.95  | 0.104 |       | 0.116 |



D<sup>2</sup>PAK mechanical data

| Dim | mm   |     |       | inch  |       |       |
|-----|------|-----|-------|-------|-------|-------|
|     | Min  | Typ | Max   | Min   | Typ   | Max   |
| A   | 4.4  |     | 4.6   | 0.173 |       | 0.181 |
| A1  | 2.49 |     | 2.69  | 0.098 |       | 0.106 |
| A2  | 0.03 |     | 0.23  | 0.001 |       | 0.009 |
| B   | 0.7  |     | 0.93  | 0.027 |       | 0.036 |
| B2  | 1.14 |     | 1.7   | 0.044 |       | 0.067 |
| C   | 0.45 |     | 0.6   | 0.017 |       | 0.023 |
| C2  | 1.23 |     | 1.36  | 0.048 |       | 0.053 |
| D   | 8.95 |     | 9.35  | 0.352 |       | 0.368 |
| D1  |      | 8   |       |       | 0.315 |       |
| E   | 10   |     | 10.4  | 0.393 |       | 0.409 |
| E1  |      | 8.5 |       |       | 0.334 |       |
| G   | 4.88 |     | 5.28  | 0.192 |       | 0.208 |
| L   | 15   |     | 15.85 | 0.590 |       | 0.625 |
| L2  | 1.27 |     | 1.4   | 0.50  |       | 0.55  |
| L3  | 1.4  |     | 1.75  | 0.055 |       | 0.68  |
| M   | 2.4  |     | 3.2   | 0.094 |       | 0.126 |
| R   |      | 0.4 |       |       | 0.015 |       |
| V2  | 0°   |     | 4°    |       |       |       |

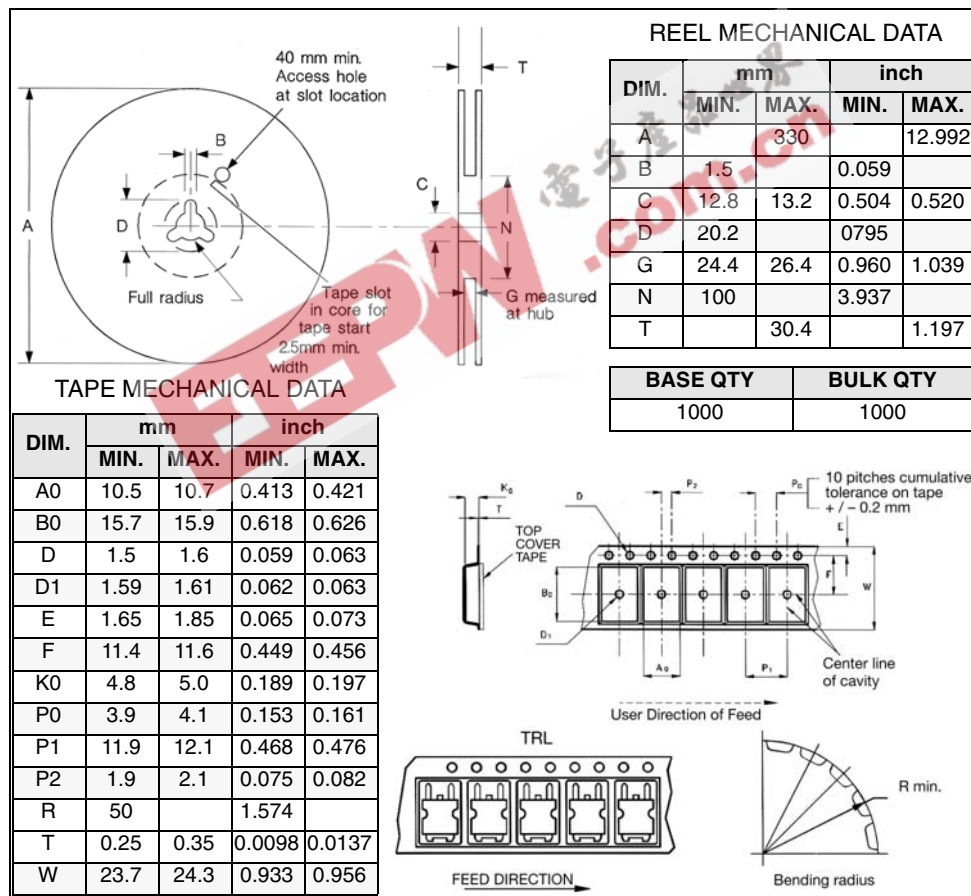


## 5 Packaging mechanical data

### D<sup>2</sup>PAK FOOTPRINT



### TAPE AND REEL SHIPMENT



\* on sales type

## 6 Revision history

Table 9. Document revision history

| Date        | Revision | Changes                  |
|-------------|----------|--------------------------|
| 25-Jan-2007 | 1        | First Release            |
| 18-Oct-2007 | 2        | Added D <sup>2</sup> PAK |

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