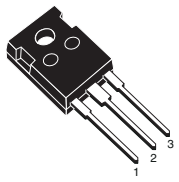
# STP30NF20
# STW30NF20

## N-channel 200V - 0.065Ω - 30A - TO-220/TO-247
## Low gate charge STripFET™ Power MOSFET

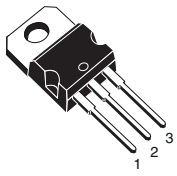
## General features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ | $P_{TOT}$ |
|---|---|---|---|---|
| STP30NF20 | 200V | 0.075Ω | 30A | 125W |
| STW30NF20 | 200V | 0.075Ω | 30A | 125W |

- Gate charge minimized
- 100% avalanche tested
- Excellent figure of merit ($R_{DS}$*$Q_g$)
- Very good manufactuing repeability
- Very low intrinsic capacitances




TO-247

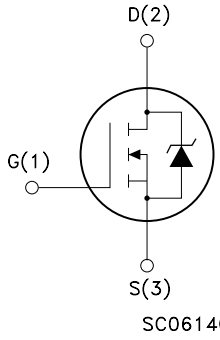



TO-220

## 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.

## Internal schematic diagram




## Applications

- Switching application

## Order codes

| Part number | Marking | Package | Packaging |
|---|---|---|---|
| STP30NF20 | 30NF20 | TO-220 | Tube |
| STW30NF20 | 30NF20 | TO-247 | Tube |

# Contents

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 200 | V |
| $V_{GS}$ | Gate-source voltage | ±20 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25°C | 30 | A |
| $I_D$ | Drain current (continuous) at $T_C$=100°C | 19 | A |
| $I_{DM}$(1) | Drain current (pulsed) | 120 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25°C | 125 | W |
| | Derating factor | 1 | W/°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 | °C |
| $T_l$ | Maximum lead temperature for soldering purpose | 300 | °C |

1. Pulse width limited by safe operating area
2. $I_{SD}$ ≤30A, di/dt ≤200A/µs, $V_{DD}$ =80%$V_{(BR)DSS}$

**Table 2. Thermal data**

| Symbol | Parameter | TO-220 | TO-247 | Unit |
|---|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case max | 1 | | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient max | 62.5 | 50 | °C/W |

**Table 3. Avalanche data**

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

# 2 Electrical characteristics

($T_{CASE}$=25°C unless otherwise specified)

**Table 4. On/off states**

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

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ =15V, $I_D$ = 15A | | 20 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ =25V, f=1 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 | $V_{DD}$=160V, $I_D$ = 30A<br>$V_{GS}$ =10V<br>*(see Figure 16)* | | 38<br>8<br>18 | | nC<br>nC<br>nC |

1. Pulsed: pulse duration=300µs, duty cycle 1.5%

**Table 6. 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>$R_G$=4.7Ω, $V_{GS}$=10V<br>(see Figure 15) | | 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>$R_G$=4.7Ω, $V_{GS}$=10V<br>(see Figure 15) | | 38<br>8.8 | | ns<br>ns |

**Table 7. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$(1) | Source-drain current<br>Source-drain current (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/µs,<br>$V_{DD}$=100 V, Tj=25°C | | 155<br>0.96<br>12.4 | | ns<br>µC<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/µs,<br>$V_{DD}$=100 V, Tj=150°C | | 194<br>1.42<br>14.6 | | ns<br>µC<br>A |

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area for TO-247**

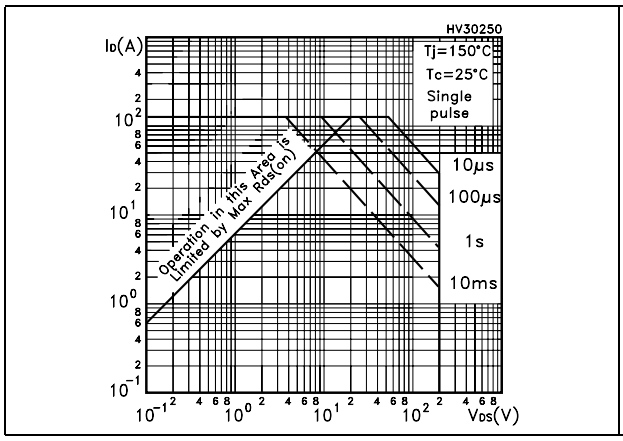



**Figure 2. Thermal impedance for TO-247**

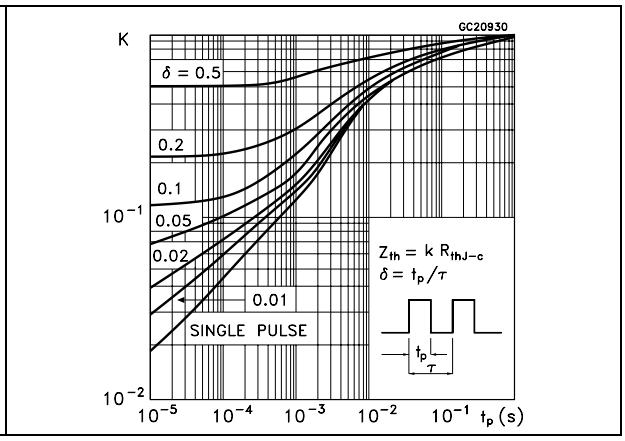



**Figure 3. Safe operating area for TO-220**

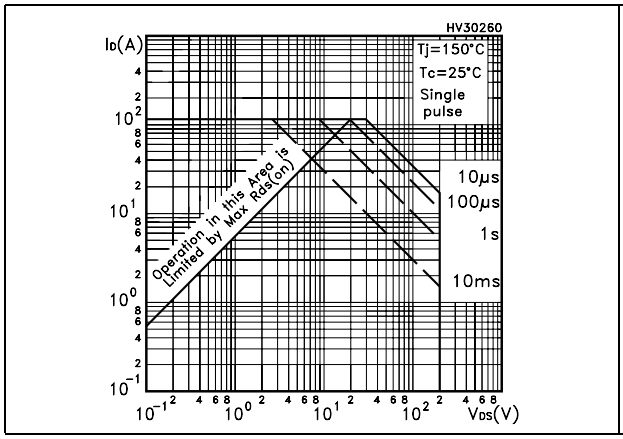



**Figure 4. Thermal impedance for TO-220**

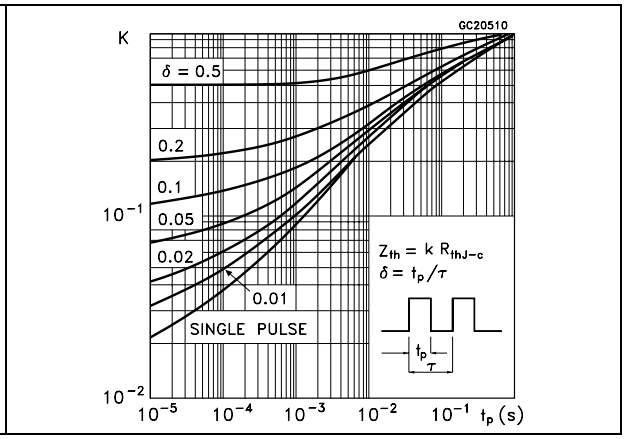



**Figure 5. Output characteristics**

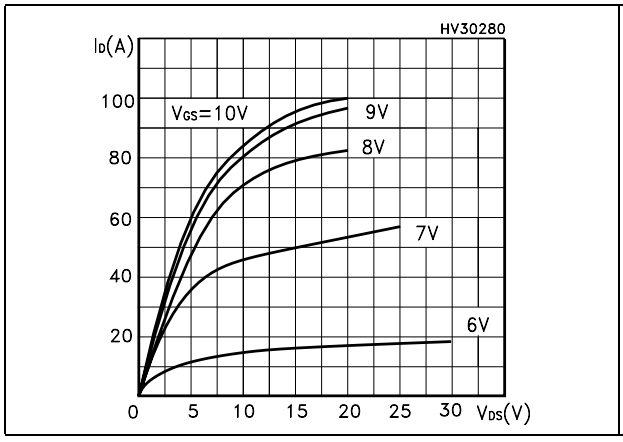



**Figure 6. Transfer characteristics**

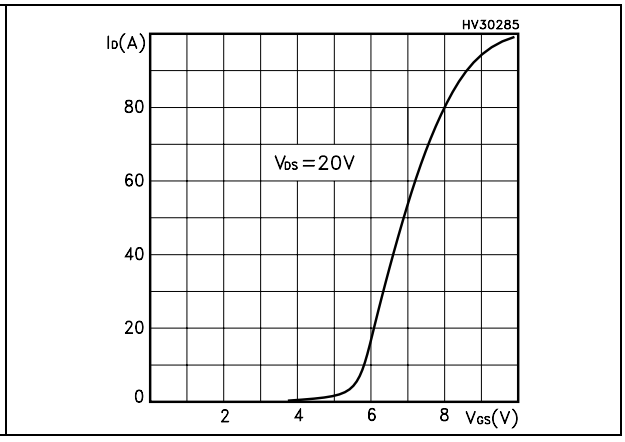


**Figure 7. Normalized $B_{VDSS}$ vs temperature**

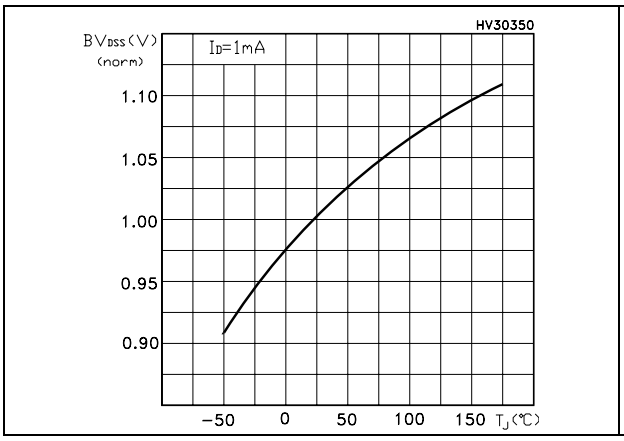



**Figure 8. Static drain-source on resistance**

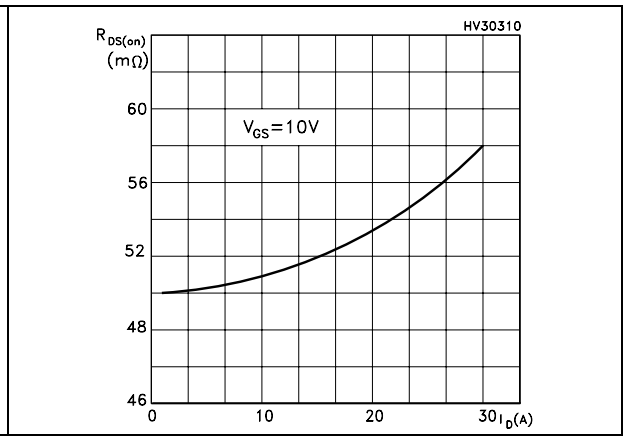



**Figure 9. Gate charge vs gate-source voltage**

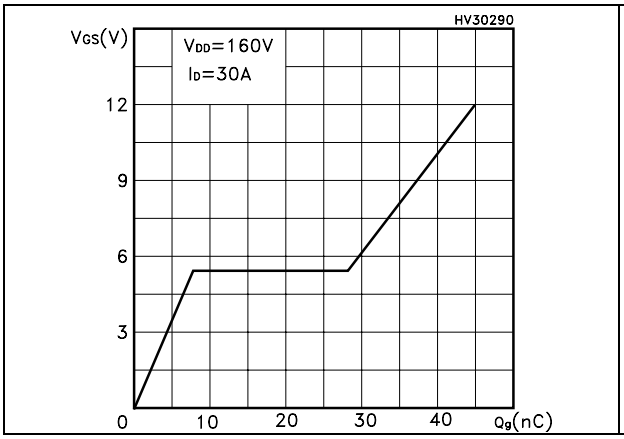



**Figure 10. Capacitance variations**

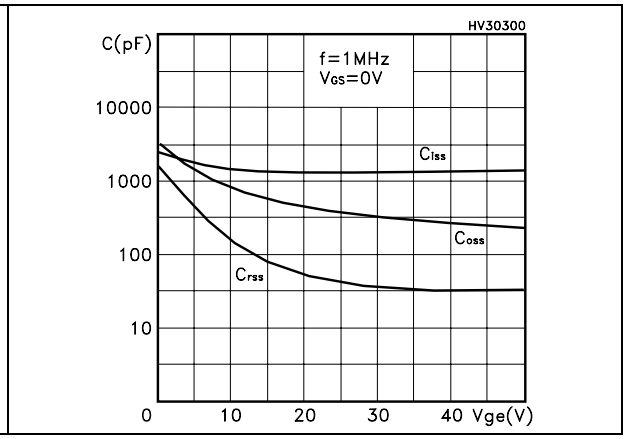



**Figure 11. Normalized gate threshold voltage vs temperature**

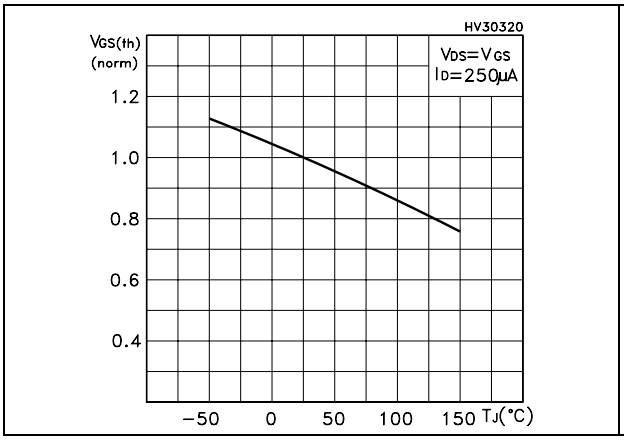



**Figure 12. Normalized on resistance vs temperature**

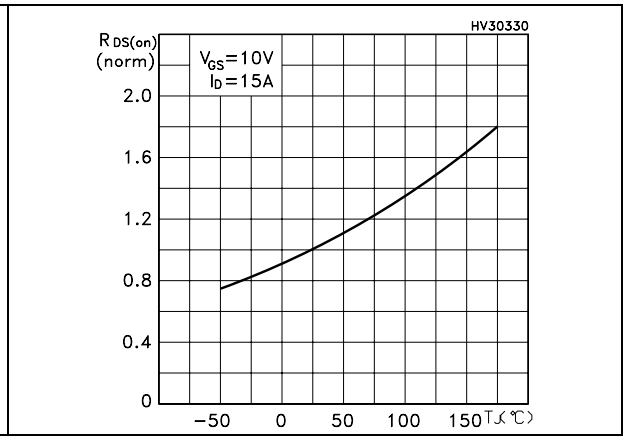


**Figure 13. Source-drain diode forward characteristics**

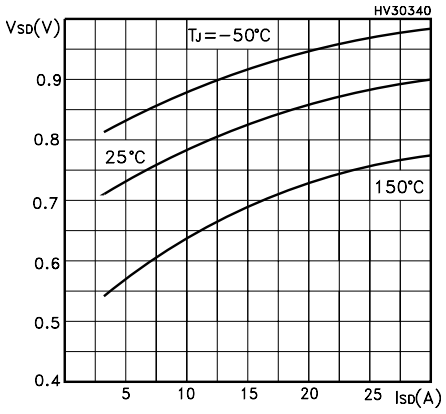
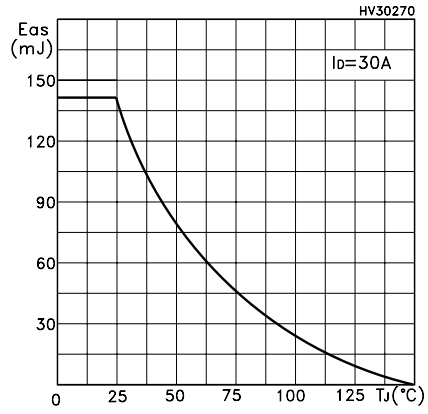



**Figure 14. Maximum avalanche energy vs temperature**



# 3 Test circuit

**Figure 15. Switching times test circuit for resistive load**

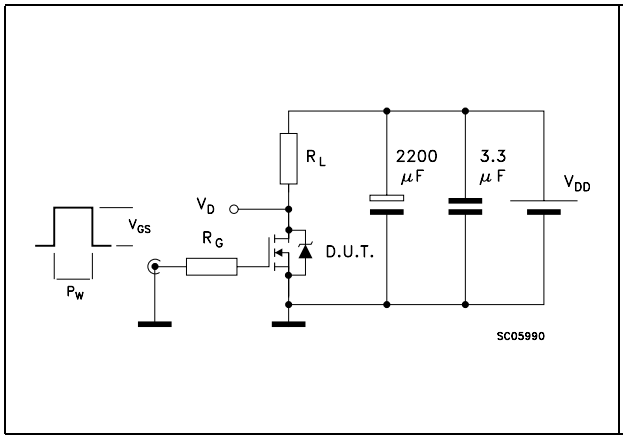



**Figure 16. Gate charge test circuit**

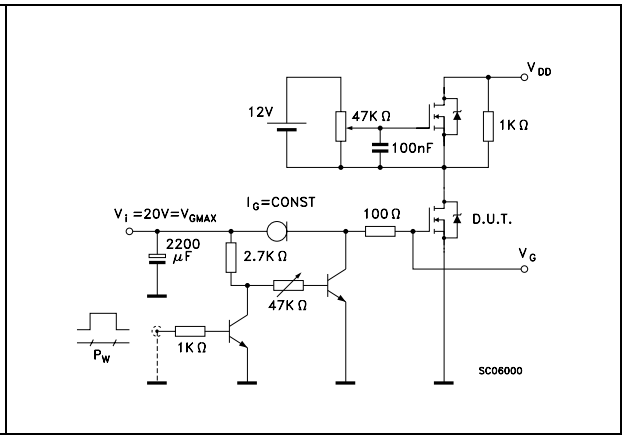



**Figure 17. Test circuit for inductive load switching and diode recovery times**

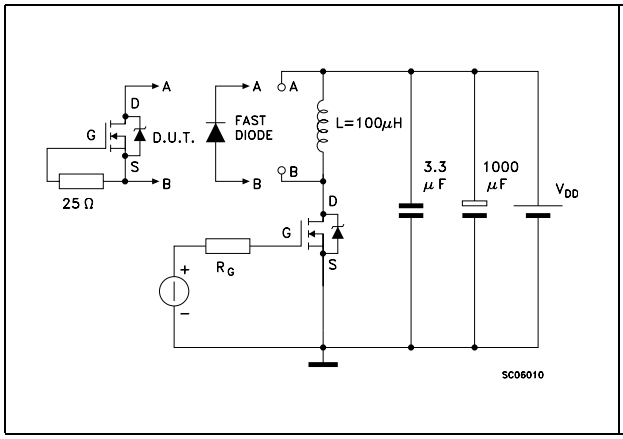



**Figure 18. Unclamped inductive load test circuit**

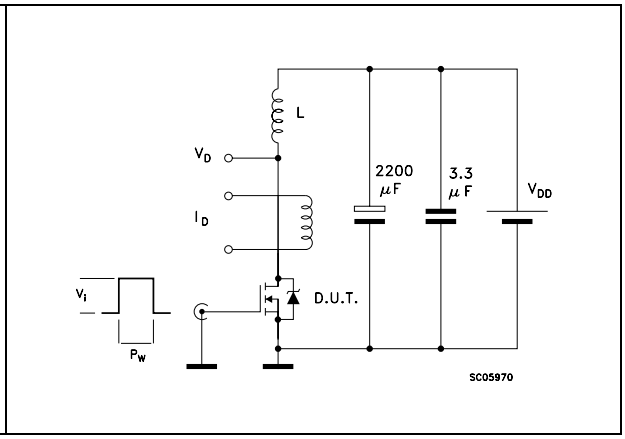



**Figure 19. Unclamped inductive waveform**

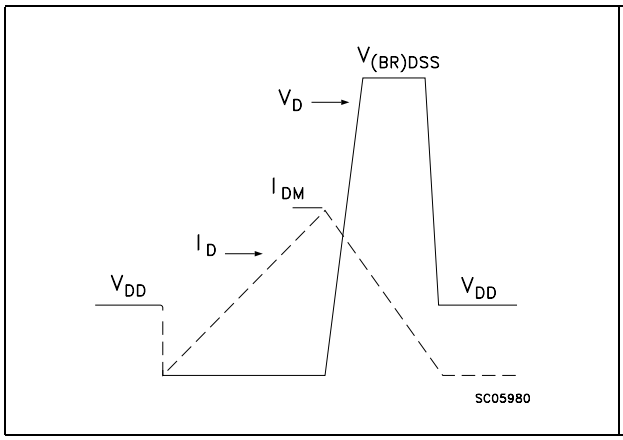
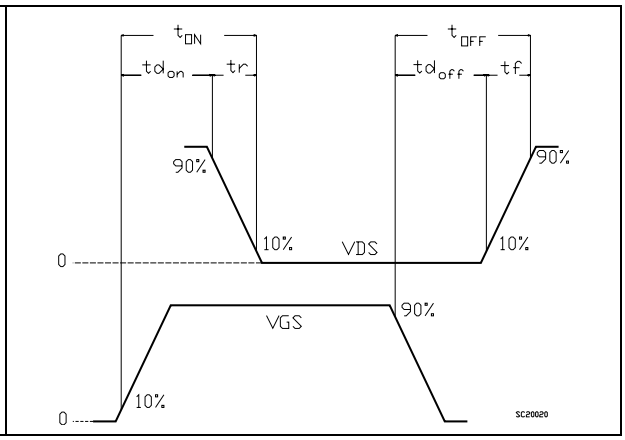



**Figure 20. Switching time waveform**

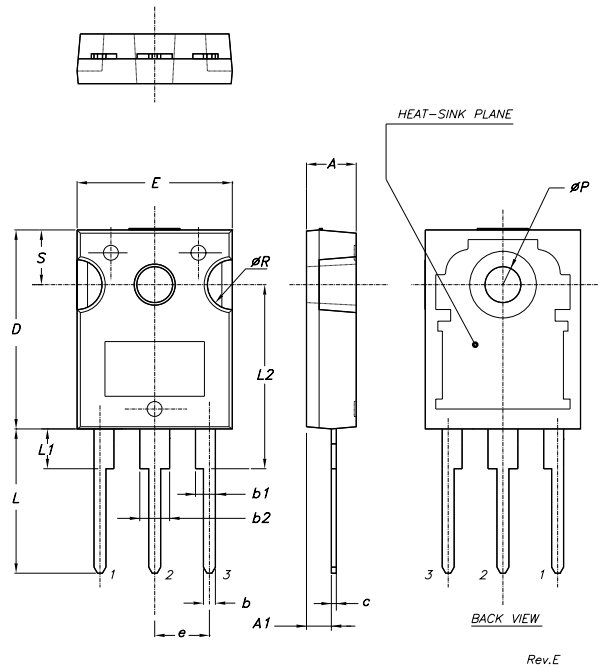


# 4 Package mechanical data

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*

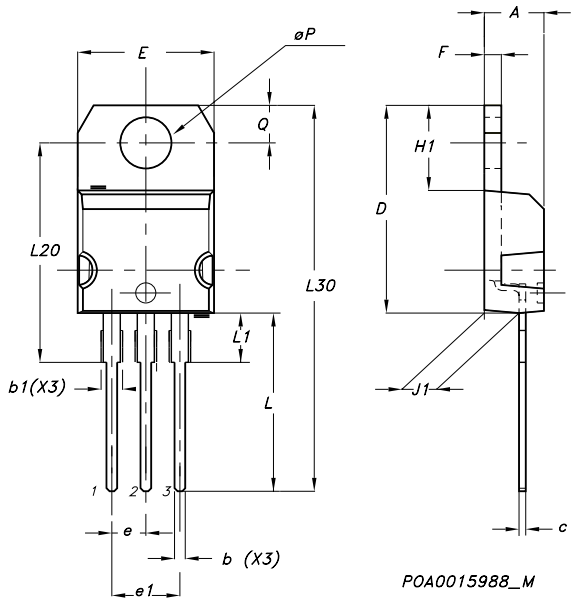
## TO-247 MECHANICAL DATA

| 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 |



# 5 Revision history

**Table 8. Revision history**

| Date | Revision | Changes |
|---|---|---|
| 06-Mar-2006 | 1 | First Release |
| 17-Nov-2006 | 2 | Part number has been updated |

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