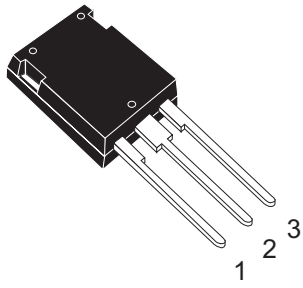
# STY130NF20D

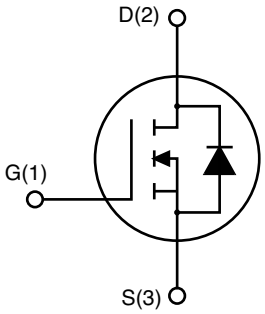
## N-channel 200 V, 0.01 Ω typ., 130 A STripFET™ II with fast recovery diode Power MOSFET in a Max247 package

**Datasheet - production data**




Max247

**Figure 1. Internal schematic diagram**




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ | $P_{TOT}$ |
|---|---|---|---|---|
| STY130NF20D | 200 V | 0.012 Ω | 130 A | 450 W |

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

## Applications

- Switching applications

## Description

This Power MOSFET is produced using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. The device offers extremely fast switching performance thanks to the intrinsic fast body diode, making the device ideal for hard switching topologies.

**Table 1. Device summary**

| Order code | Marking | Packages | Packaging |
|---|---|---|---|
| STY130NF20D | 130NF20D | Max247 | Tube |



This is information on a product in full production. www.st.com

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2 Electrical characteristics . . . . . 4

2.1 Electrical characteristics (curves) . . . . . 6

3 Test circuit . . . . . 9

4 Package mechanical data . . . . . 10

5 Revision history . . . . . 13

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{GS}$ | Gate-source voltage | ± 20 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 130 | A |
| $I_D$ | Drain current (continuous) at $T_C$=100 °C | 82 | A |
| $I_{DM}$ (1) | Drain current (pulsed) | 520 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 450 | W |
| $I_{AR}$ (1) | Avalanche current, repetitive or not repetitive | 130 | A |
| $E_{AS}$ | Single pulse avalanche energy (2) | 800 | mJ |
| dv/dt(3) | Peak diode recovery voltage slope | 25 | V/ns |
| $T_J$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature | - 55 to 150 | °C |

1. Pulse width limited by $T_{jmax}$
2. Starting $T_j$ = 25 °C, $I_D = I_{AR}$, $V_{DD}$ = 50 V
3. $I_{SD} \leq$ 130 A, di/dt $\leq$ 1000 A/$\mu$s, peak $V_{DS} \leq V_{(BR)DSS}$

**Table 3. Thermal resistance**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 0.28 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient | 30 | °C/W |

# 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 | $V_{GS}$= 0, $I_D$ = 1 mA | 200 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0, $V_{DS}$ = 200 V | | | 10 | µA |
| | | $V_{GS}$ = 0, $V_{DS}$ =200 V, $T_C$=125 °C | | | 100 | µA |
| $I_{GSS}$ | Gate body leakage current | $V_{DS}$ = 0, $V_{GS}$ = ± 20 V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$= $V_{GS}$, $I_D$ = 250 µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on- resistance | $V_{GS}$= 10 V, $I_D$= 65 A | | 0.01 | 0.012 | Ω |

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{GS}$=0, $V_{DS}$ = 25 V, f=1 MHz, | - | 11100 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 2190 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 334 | - | pF |
| $C_{o(tr)}$(1) | Equivalent capacitance time related | $V_{GS}$=0, $V_{DS}$ = o to 160 | - | 1525 | - | pF |
| $C_{o(er)}$(2) | Equivalent capacitance energy related | | - | 1139 | - | pF |
| $R_G$ | Intrinsic gate resistance | f=1 MHz, $I_D$=0 | - | 1.4 | - | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$=160 V, $I_D$ = 130 A $V_{GS}$= 10 V *(see Figure 16)* | - | 338 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 47 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 183 | - | nC |

1. $C_{o(er)}$ is a constant capacitance value that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$
2. $C_{o(tr)}$ is a constant capacitance value that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 100 V, $I_D$= 65 A, $R_G$= 4.7 Ω, $V_{GS}$ =10 V *(see Figure 15)* | - | 232 | - | ns |
| $t_r$ | Rise time | | - | 218 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 283 | - | ns |
| $t_f$ | Fall time | | - | 250 | - | ns |

**Table 7. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 130 | A |
| $I_{SDM}$(1) | Source-drain current (pulsed) | | - | | 520 | A |
| $V_{SD}$(2) | Forward on voltage | $I_{SD}$ = 130 A, $V_{GS}$=0 | - | | 1.6 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 130 A, di/dt = 100 A/µs, $V_{DD}$= 100 V | - | 190 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 1.4 | | µC |
| $I_{RRM}$ | Reverse recovery current | | - | 14 | | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 130 A, di/dt = 100 A/µs, $V_{DD}$= 100 V, Tj=150 °C | - | 257 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 2.4 | | µC |
| $I_{RRM}$ | Reverse recovery current | | - | 18 | | A |

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

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area**

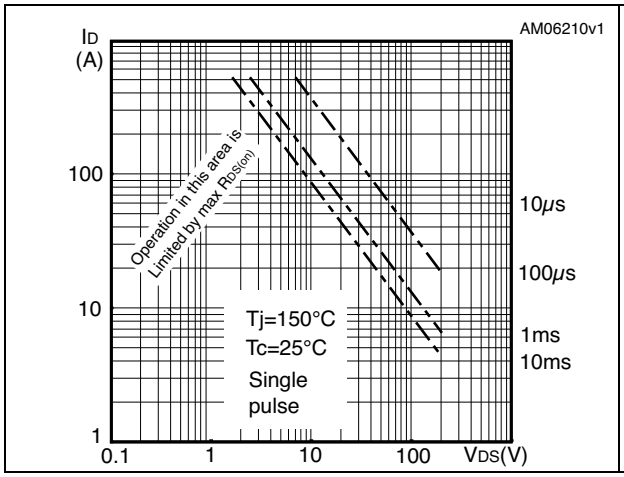



**Figure 3. Thermal impedance**

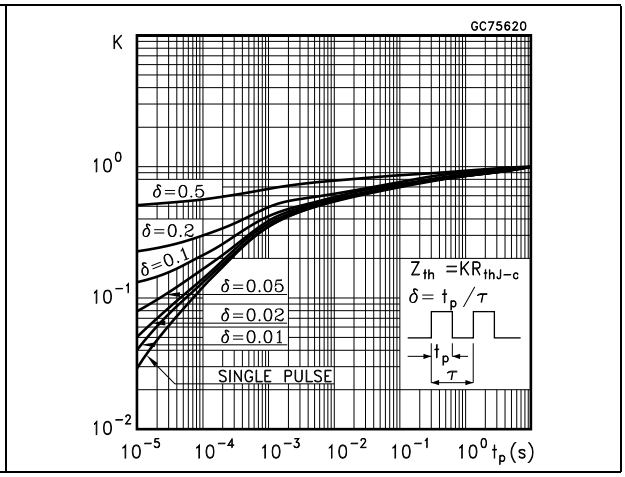



**Figure 4. Output characteristics**

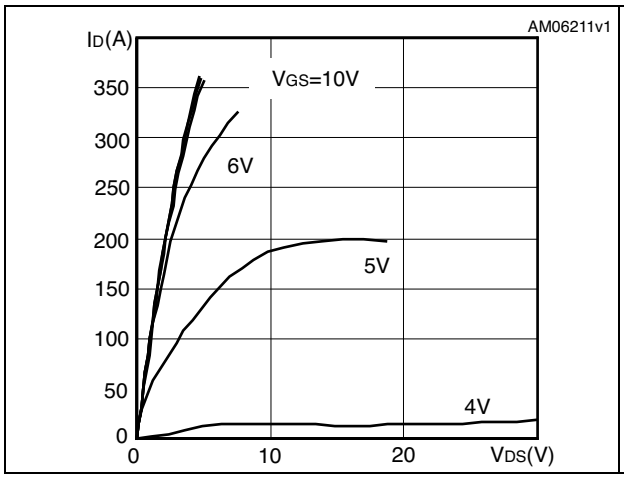



**Figure 5. Transfer characteristics**

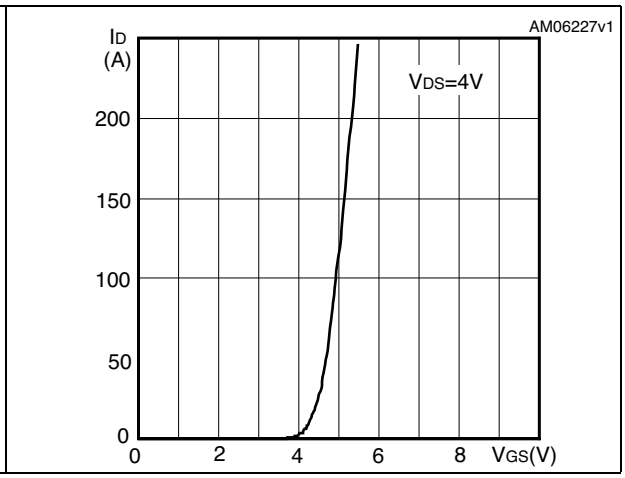



**Figure 6. Gate charge vs gate-source voltage**

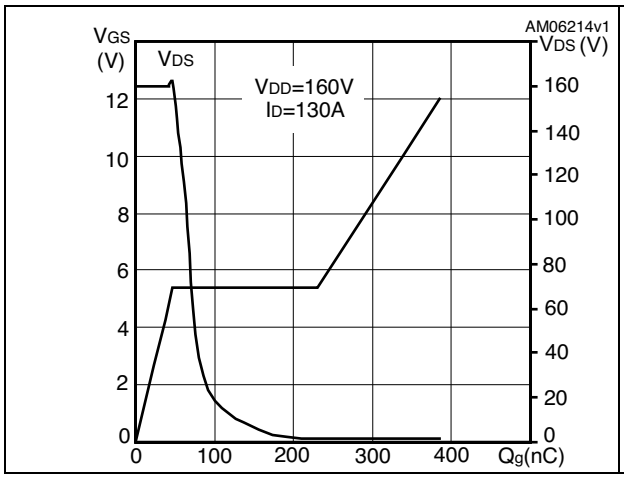



**Figure 7. Static drain-source on-resistance**

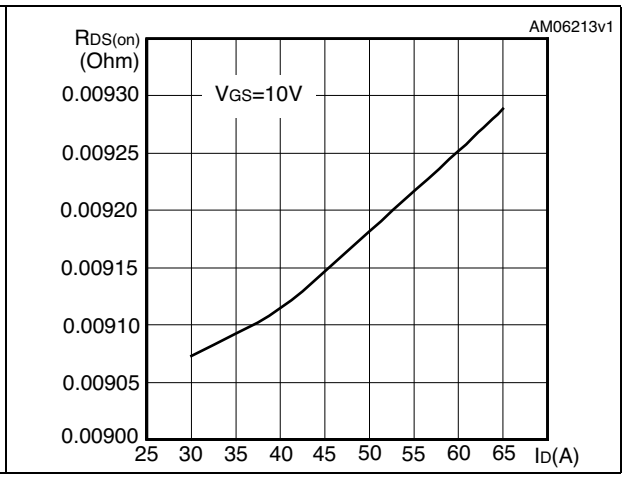


**Figure 8. Capacitance variations**

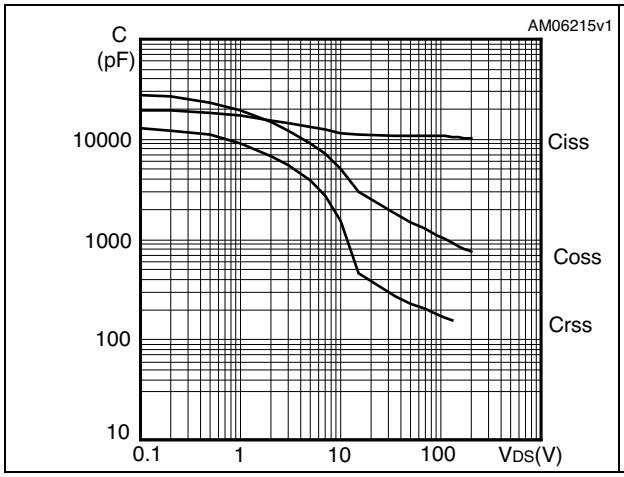



**Figure 9. Output capacitance stored energy**

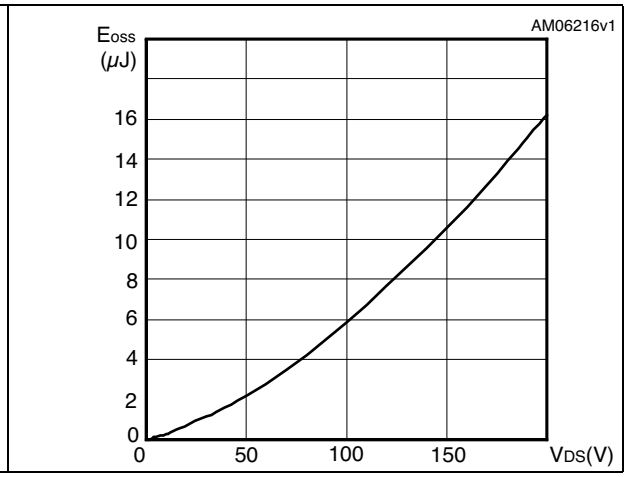



**Figure 10. Normalized gate threshold voltage vs temperature**

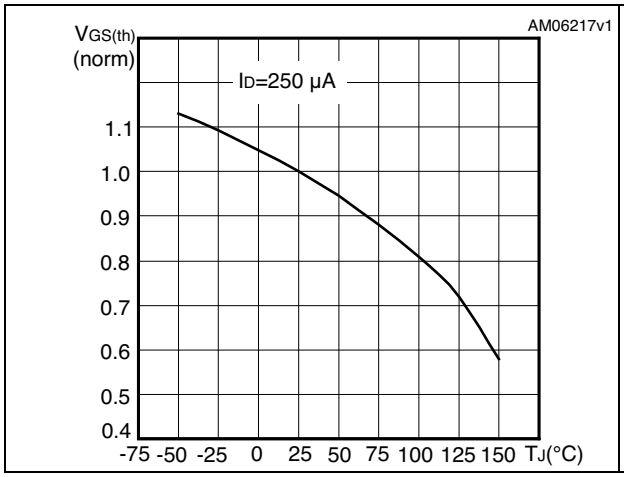



**Figure 11. Normalized on-resistance vs temperature**

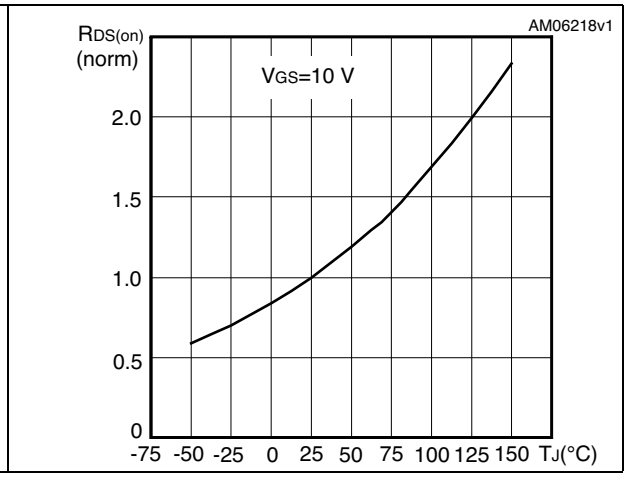



**Figure 12. Source-drain diode forward characteristics**

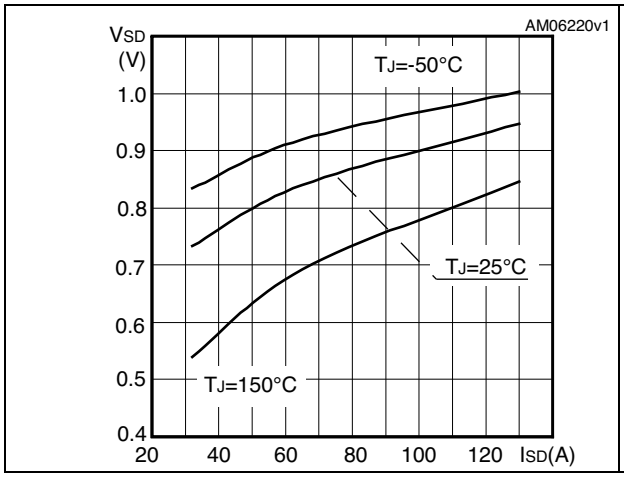



**Figure 13. Normalized $V_{(BR)DSS}$ vs temperature**

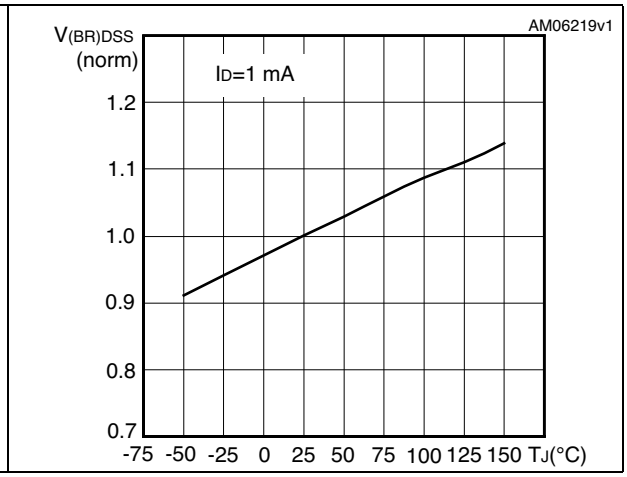
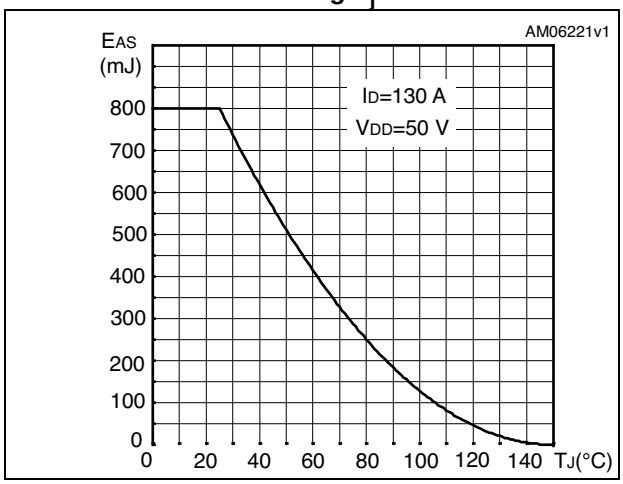


**Figure 14. Maximum avalanche energy vs starting $T_j$**



# 3 Test circuit

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

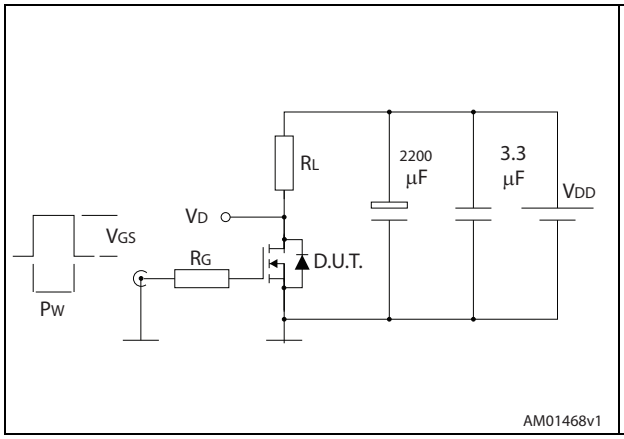



**Figure 16. Gate charge test circuit**

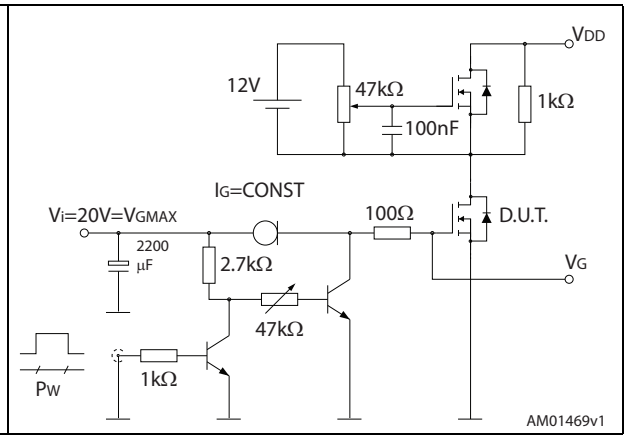



**Figure 17. Test circuit for inductive load switching and diode recovery times**

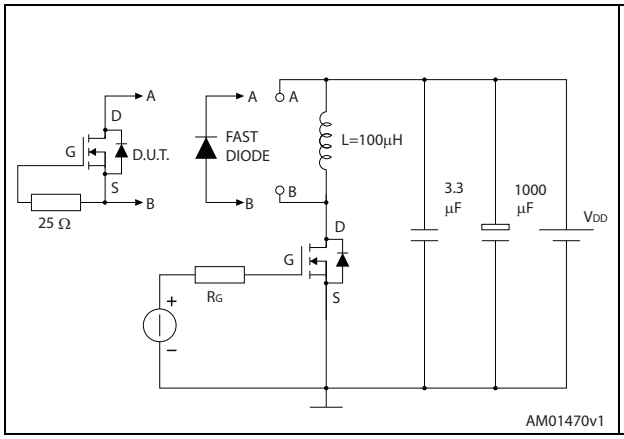



**Figure 18. Unclamped inductive load test circuit**

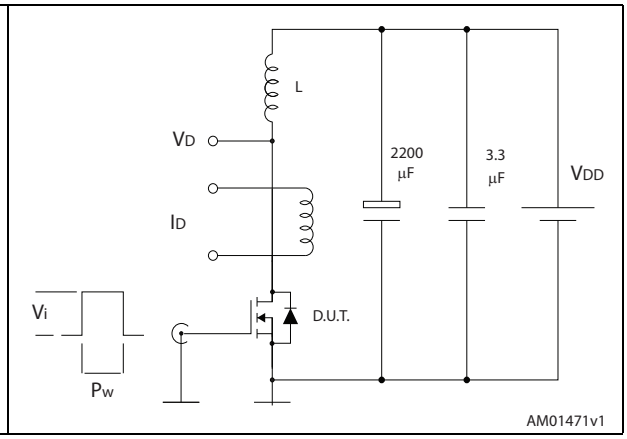



**Figure 19. Unclamped inductive waveform**

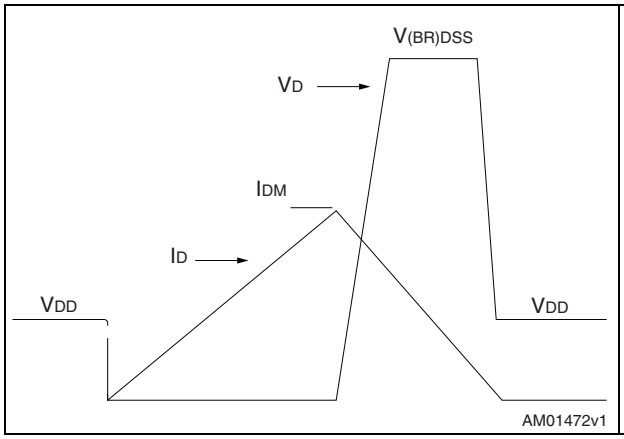
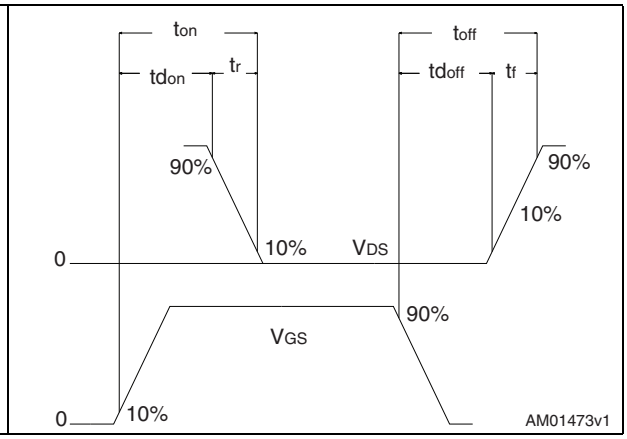



**Figure 20. Switching time waveform**



# 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

**Figure 21. Max247 drawing**

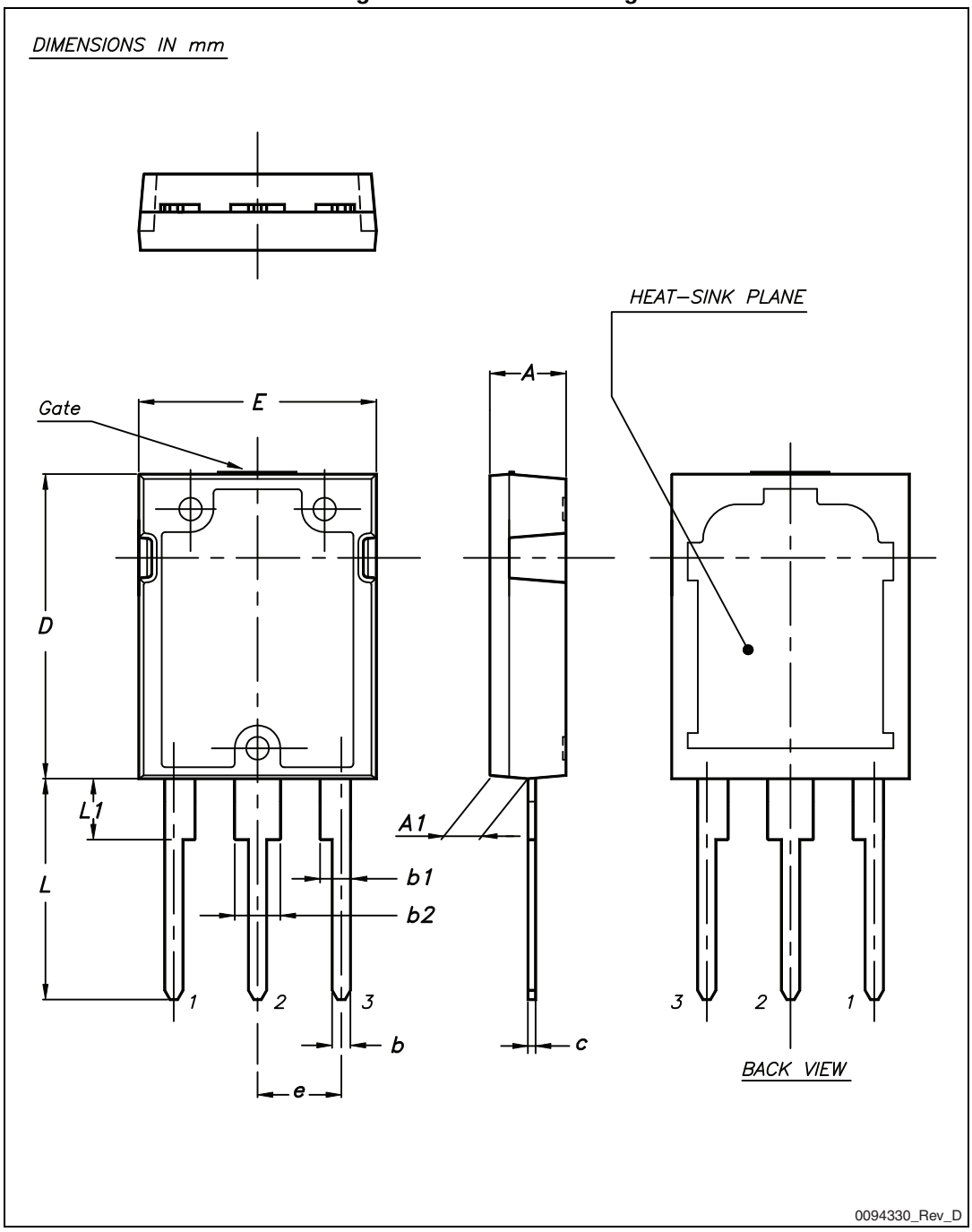


**Table 8. Max247 mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.70 | | 5.30 |
| A1 | 2.20 | | 2.60 |
| b | 1.00 | | 1.40 |
| b1 | 2.00 | | 2.40 |
| b2 | 3.00 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.70 | | 20.30 |
| e | 5.35 | | 5.55 |
| E | 15.30 | | 15.90 |
| L | 14.20 | | 15.20 |
| L1 | 3.70 | | 4.30 |

# 5 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 27-Jan-2009 | 1 | First release |
| 29-Oct-2009 | 2 | Some values have been updated in *Table 4*, *Table 5*, *Table 6* and *Table 7* |
| 11-Jan-2010 | 3 | Document status promoted from preliminary data to datasheet. |
| 16-May-2014 | 4 | – Modified: title<br>– Modified: *Figure 5*, *6*, *10*, *11* and *13*<br>– Minor text changes in the cover page. |

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