



## STL20NF20

N-channel 200 V, 0.10  $\Omega$ , 15 A PowerFLAT™ (5x6)  
low gate charge STripFET™ Power MOSFET

### Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> | P <sub>W</sub> |
|-----------|------------------|---------------------|----------------|----------------|
| STL20NF20 | 200 V            | < 0.125 $\Omega$    | 15 A           | 60 W           |

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

### 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.

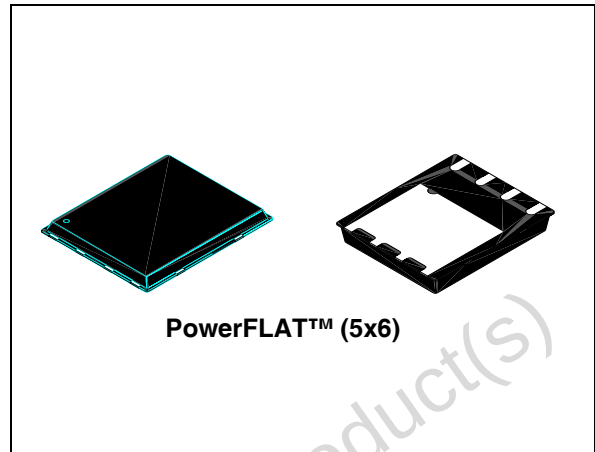


Figure 1. Internal schematic diagram

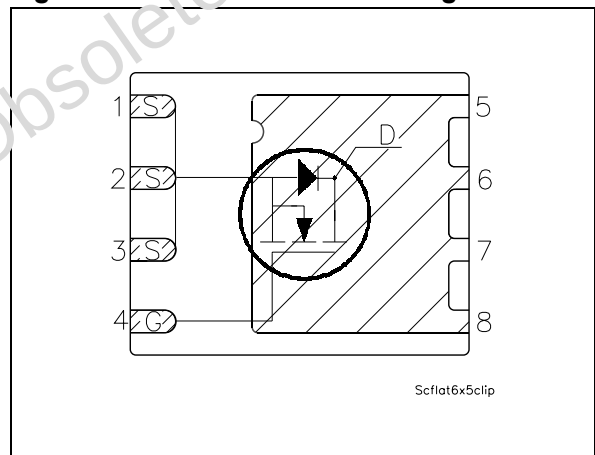


Table 1. Device summary

| Order code | Marking | Package          | Packaging     |
|------------|---------|------------------|---------------|
| STL20NF20  | 20NF20  | PowerFLAT™ (5x6) | Tape and reel |

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Obsolete Product(s) - Obsolete Product(s)



# 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                   |
| $I_D^{(1)}$     | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 15         | A                   |
| $I_D^{(1)}$     | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 11         | A                   |
| $I_D^{(3)}$     | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 2.8        | A                   |
| $I_{DM}^{(2)}$  | Drain current (pulsed)                                          | 12         | A                   |
| $P_{TOT}^{(1)}$ | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 60         | W                   |
| $P_{TOT}^{(3)}$ | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 4          | W                   |
|                 | Derating factor                                                 | 0.72       | W/ $^\circ\text{C}$ |
| $dv/dt^{(4)}$   | Peak diode recovery voltage slope                               | 15         | V/ns                |
| $T_{stg}$       | Storage temperature                                             | -55 to 150 | $^\circ\text{C}$    |
| $T_j$           | Max. operating junction temperature                             |            |                     |

1. This value is rated according  $R_{thj-c}$
2. Pulse width limited by safe operating area
3. This value is according to  $R_{thj-pcb}$
4.  $I_{SD} \leq 15\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$

**Table 3. Thermal data**

| Symbol              | Parameter                            | Value | Unit                      |
|---------------------|--------------------------------------|-------|---------------------------|
| $R_{thj-case}$      | Thermal resistance junction-case max | 2.08  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 31.3  | $^\circ\text{C}$          |

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 oz Cu,  $t < 10\text{ sec}$

**Table 4. Avalanche characteristics**

| Symbol   | Parameter                                                                                                            | Max value | Unit |
|----------|----------------------------------------------------------------------------------------------------------------------|-----------|------|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)                                   | 2.8       | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ ) | 110       | 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                           | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                         | 2    | 3    | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{ V}$ , $I_D = 2.8\text{ A}$                                              |      | 0.10 | 0.125     | $\Omega$                       |

**Table 6. Dynamic**

| Symbol                                        | Parameter                                                               | Test conditions                                                                                                          | Min. | Typ.                 | Max. | Unit                 |
|-----------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|----------------------|------|----------------------|
| $g_{fs}^{(1)}$                                | Forward transconductance                                                | $V_{DS} = 25\text{ V}$ , $I_D = 10\text{ A}$                                                                             | -    | 13                   |      | S                    |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$           | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0$                                                            | -    | 940<br>197<br>30     |      | pF<br>pF<br>pF       |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$ | Turn-on delay time<br>Rise time<br>Turn-off delay time<br>Fall time     | $V_{DD} = 100\text{ V}$ , $I_D = 10\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(see Figure 13) | -    | 15<br>30<br>40<br>10 |      | ns<br>ns<br>ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$                 | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 160\text{ V}$ , $I_D = 10\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$<br>(see Figure 14)                             | -    | 28<br>5.6<br>14.5    | 39   | nC<br>nC<br>nC       |

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

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<br>(pulsed)                     |                                                                                                                                              | -    |                     | 2.8<br>12 | A<br>A        |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD} = 10\text{ A}$ , $V_{GS} = 0$                                                                                                        | -    |                     | 1.6       | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 10\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 50\text{ V}$<br>(see Figure 18)                                     | -    | 155<br>775<br>10    |           | ns<br>nC<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 10\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 50\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$<br>(see Figure 18) | -    | 183<br>1061<br>11.6 |           | ns<br>nC<br>A |

1. Pulse width limited by safe operating area.

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

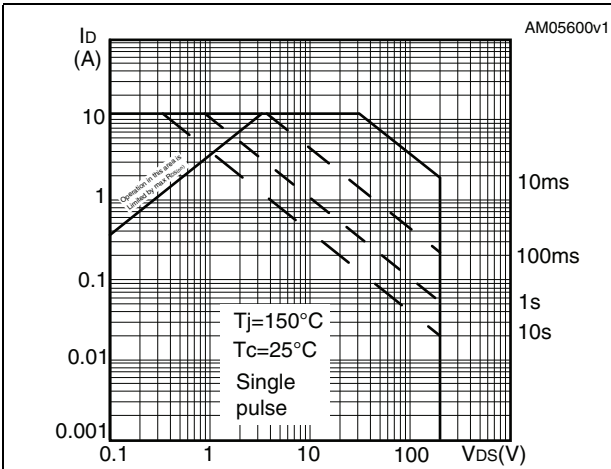


Figure 3. Thermal impedance area

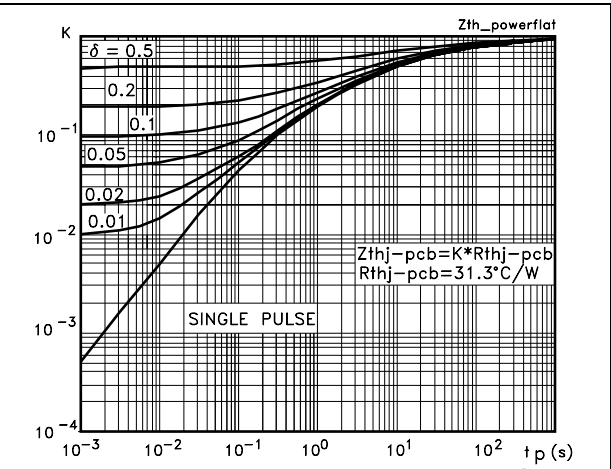


Figure 4. Output characteristics

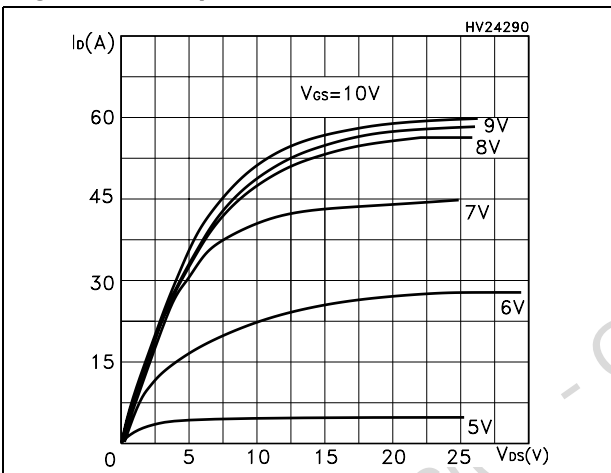


Figure 5. Transfer characteristics

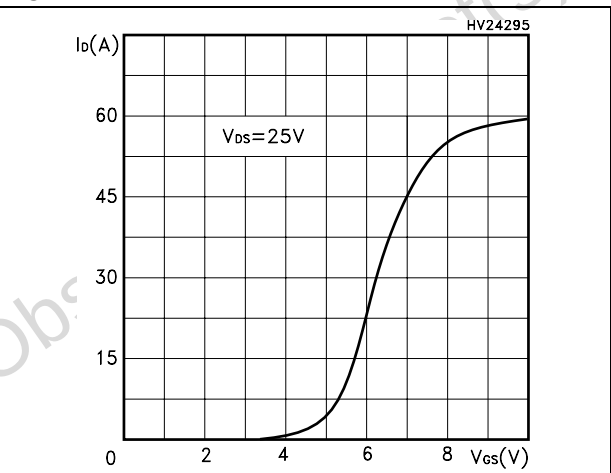


Figure 6. Transconductance

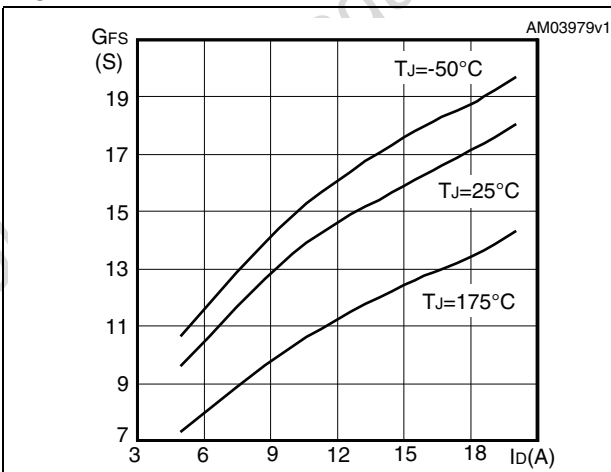


Figure 7. Static drain-source on resistance

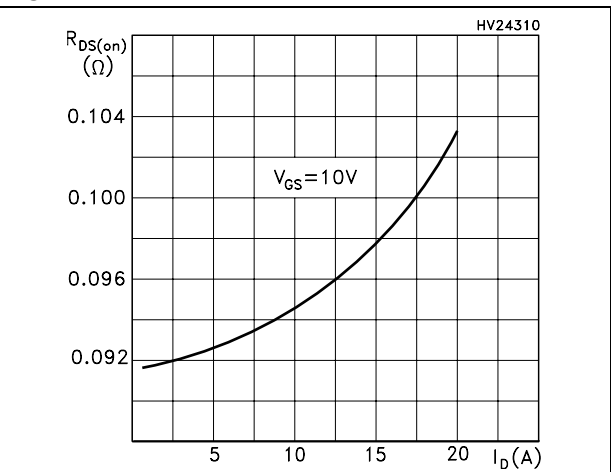


Figure 8. Gate charge vs gate-source voltage      Figure 9. Capacitance variations

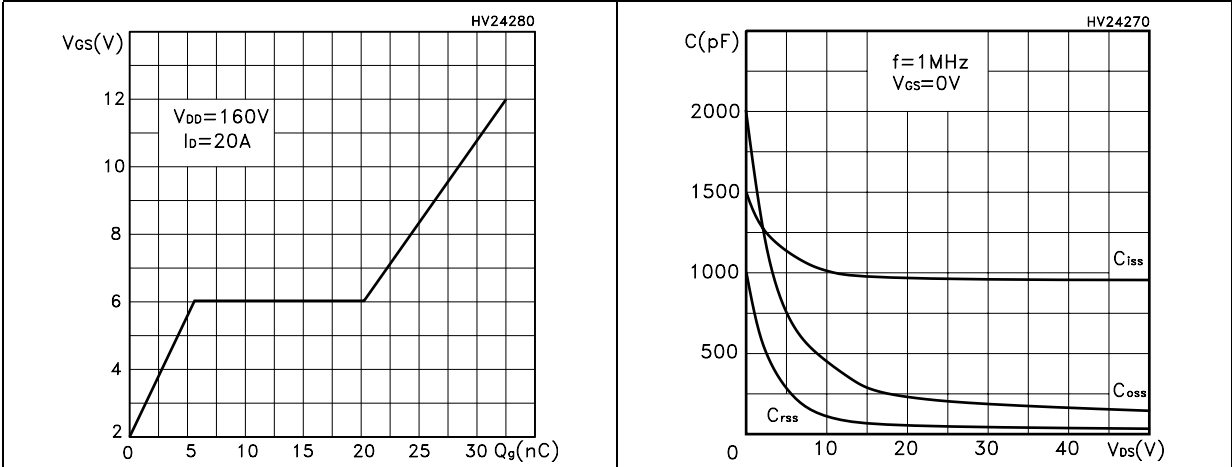


Figure 10. Normalized gate threshold voltage vs temperature      Figure 11. Normalized on resistance vs temperature

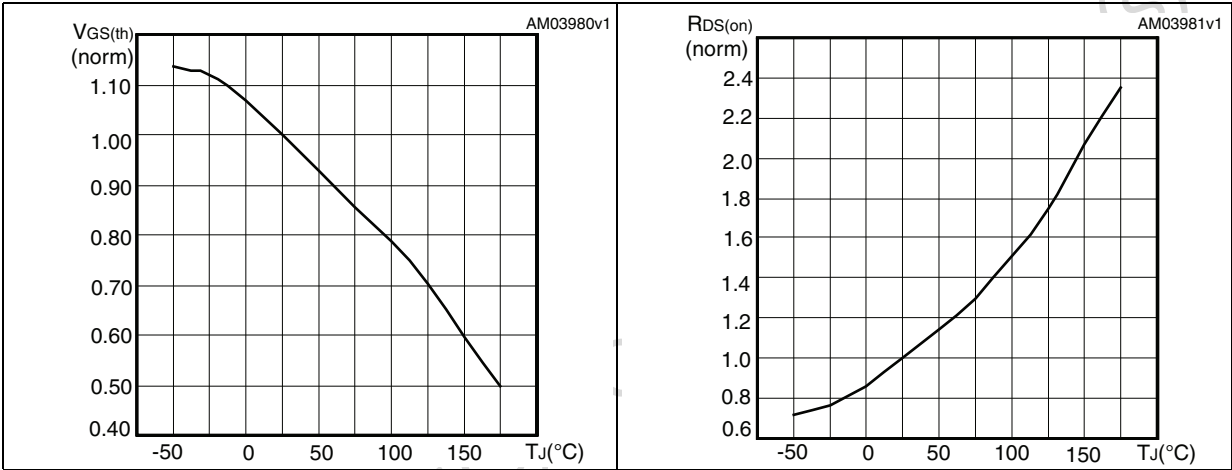
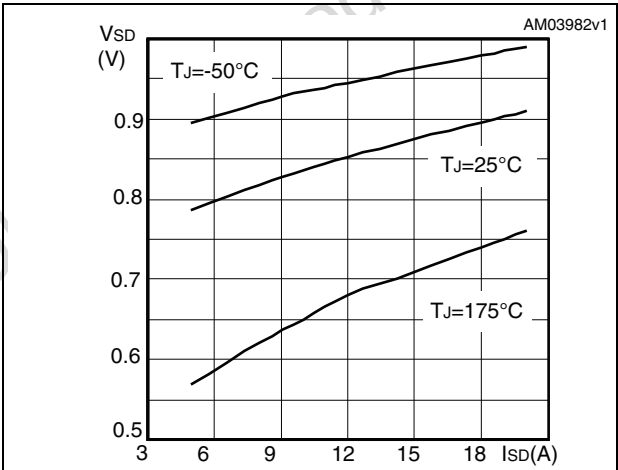
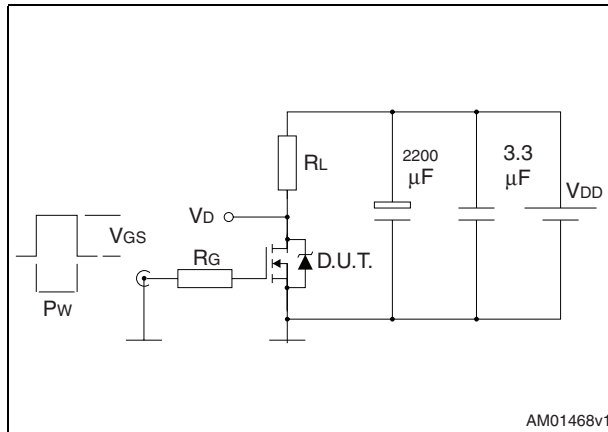


Figure 12. Source-drain diode forward characteristics

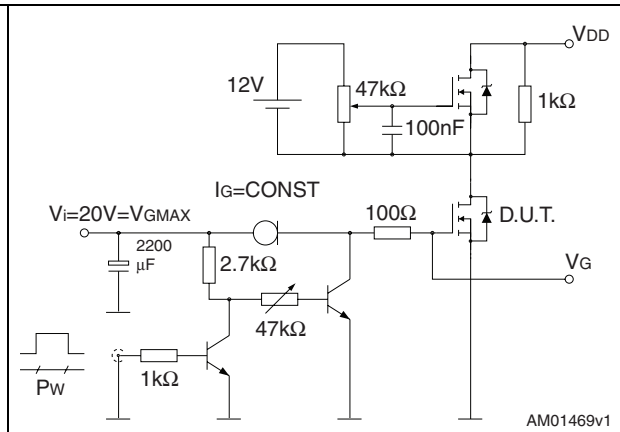


### 3 Test circuits

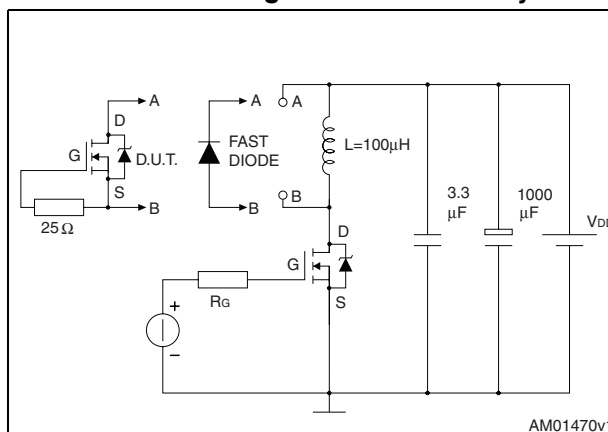
**Figure 13. Switching times test circuit for resistive load**



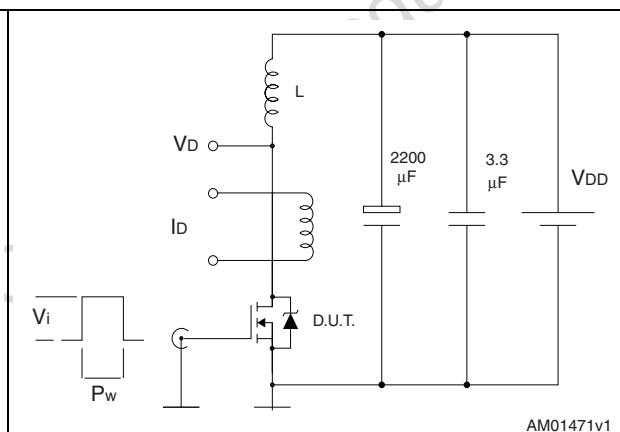
**Figure 14. Gate charge test circuit**



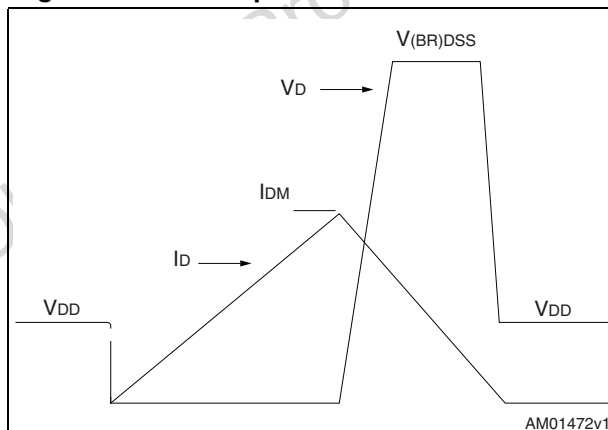
**Figure 15. Test circuit for inductive load switching and diode recovery times**



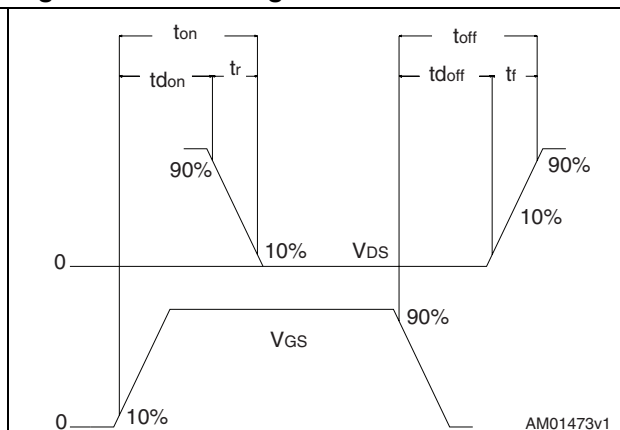
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**





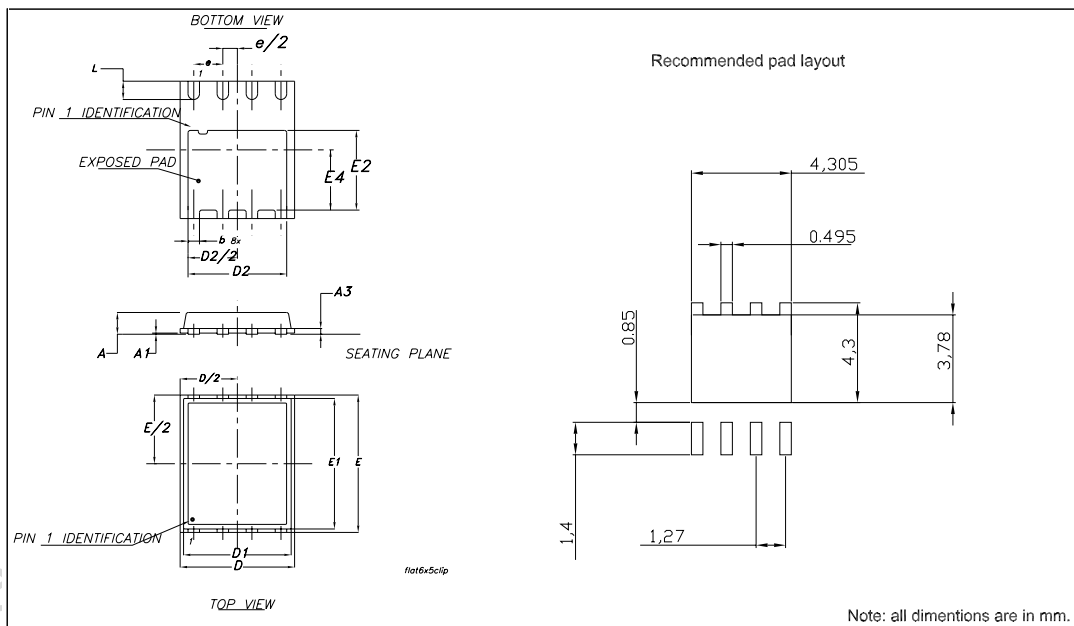
## 4 Package mechanical data

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](http://www.st.com). ECOPACK is an ST trademark.

Obsolete Product(s) - Obsolete Product(s)

## PowerFLAT™ (6x5) mechanical data

| DIM. | mm.  |      |      | inch  |        |        |
|------|------|------|------|-------|--------|--------|
|      | Min. | Typ. | Max. | Min.  | Typ.   | Max.   |
| A    | 0.80 | 0.83 | 0.93 | 0.031 | 0.32   | 0.036  |
| A1   |      | 0.02 | 0.05 |       | 0.0007 | 0.0019 |
| A3   |      | 0.20 |      |       | 0.007  |        |
| b    | 0.35 | 0.40 | 0.47 | 0.013 | 0.015  | 0.018  |
| D    |      | 5.00 |      |       | 0.196  |        |
| D1   |      | 4.75 |      |       | 0.187  |        |
| D2   | 4.15 | 4.20 | 4.25 | 0.163 | 0.165  | 0.167  |
| E    |      | 6.00 |      |       | 0.236  |        |
| E1   |      | 5.75 |      |       | 0.226  |        |
| E2   | 3.43 | 3.48 | 3.53 | 0.135 | 0.137  | 0.139  |
| E4   | 2.58 | 2.63 | 2.68 |       | 0.103  | 0.105  |
| e    |      | 1.27 |      |       | 0.050  |        |
| L    | 0.70 | 0.80 | 0.90 | 0.027 | 0.031  | 0.035  |



## 5 Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes        |
|-------------|----------|----------------|
| 11-Dec-2009 | 1        | First release. |

Obsolete Product(s) - Obsolete Product(s)

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