



# STB155N3H6 STD155N3H6

N-channel 30 V, 2.5 mΩ, 80 A, D<sup>2</sup>PAK, DPAK  
STripFET™ VI DeepGATE™ Power MOSFET

## Features

| Order codes | V <sub>DSS</sub> | R <sub>DS(on)</sub> max | I <sub>D</sub>      |
|-------------|------------------|-------------------------|---------------------|
| STB155N3H6  | 30 V             | < 3 mΩ                  | 80 A <sup>(1)</sup> |
| STD155N3H6  | 30 V             | < 3 mΩ                  | 80 A <sup>(1)</sup> |

1. Limited by wire bonding

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- High avalanche ruggedness

## Application

- Switching applications
- Automotive

## Description

These devices are 30 V N-channel Power MOSFETs realized using ST's proprietary STripFET™ VI technology. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

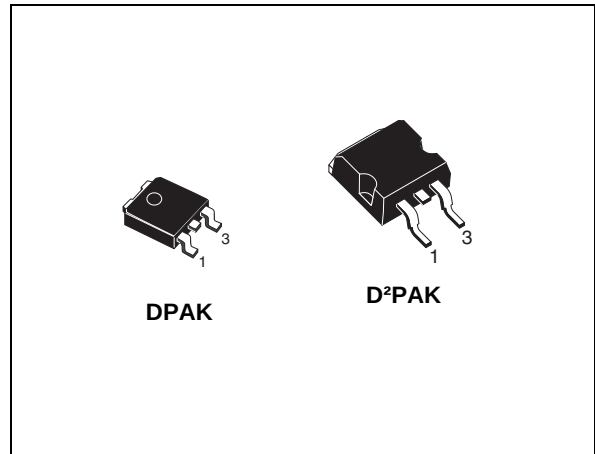


Figure 1. Internal schematic diagram

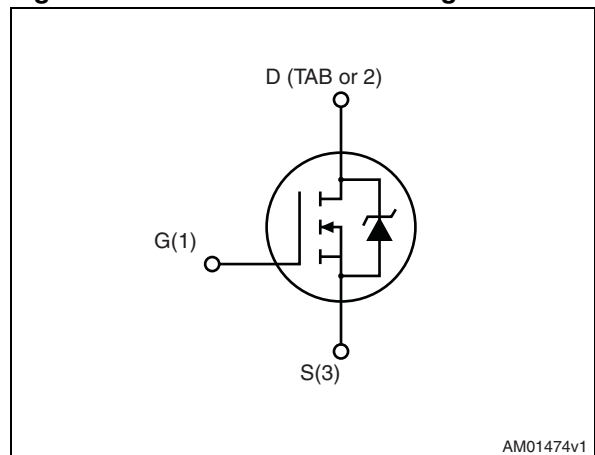


Table 1. Device summary

| Order codes | Marking | Package            | Packaging     |
|-------------|---------|--------------------|---------------|
| STB155N3H6  | 155N3H6 | D <sup>2</sup> PAK | Tape and reel |
| STD155N3H6  |         | DPAK               |               |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter                                                       | Value      | Unit                |
|----------------|-----------------------------------------------------------------|------------|---------------------|
| $V_{DS}$       | Drain-source voltage ( $V_{GS} = 0$ )                           | 30         | V                   |
| $V_{GS}$       | Gate-source voltage                                             | $\pm 20$   | V                   |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 80         | A                   |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 80         | A                   |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                          | 320        | A                   |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 110        | W                   |
|                | Derating factor                                                 | 0.73       | W/ $^\circ\text{C}$ |
| $T_{stg}$      | Storage temperature                                             | -55 to 175 | $^\circ\text{C}$    |
| $T_j$          | Operating junction temperature                                  |            | $^\circ\text{C}$    |

1. Limited by wire bonding

2. Pulse width limited by safe operating area

**Table 3. Thermal resistance**

| Symbol              | Parameter                            | Value              |      | Unit               |
|---------------------|--------------------------------------|--------------------|------|--------------------|
|                     |                                      | D <sup>2</sup> PAK | DPAK |                    |
| $R_{thj-case}$      | Thermal resistance junction-case max | 1.36               |      | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 35                 | 50   | $^\circ\text{C/W}$ |

1. When mounted on 1 inch<sup>2</sup> 2 oz Cu board

**Table 4. Avalanche characteristics**

| Symbol   | Parameters                                                                                                              | Value | Unit |
|----------|-------------------------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AV}$ | Not-repetitive avalanche current                                                                                        | 40    | A    |
| $E_{AS}$ | Single pulse avalanche energy<br>(starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 22\text{ V}$ ) | 525   | mJ   |

## 2 Electrical characteristics

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

**Table 5. Static**

| Symbol        | Parameter                                        | Test conditions                                                          | Min. | Typ. | Max.      | Unit                |
|---------------|--------------------------------------------------|--------------------------------------------------------------------------|------|------|-----------|---------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown Voltage                   | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0$                            | 30   |      |           | V                   |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = 20\text{ V}$<br>$V_{DS} = 20\text{ V}$ , $T_c = 125\text{ °C}$ |      |      | 1<br>100  | $\mu\text{A}$<br>nA |
| $I_{GSS}$     | 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    |      | 4         | V                   |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$                             |      | 2.5  | 3.0       | m $\Omega$          |

**Table 6. Dynamic**

| Symbol    | Parameter                    | Test conditions                                               | Min | Typ. | Max. | Unit     |
|-----------|------------------------------|---------------------------------------------------------------|-----|------|------|----------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0$ | -   | 3650 | -    | pF       |
| $C_{oss}$ | Output capacitance           |                                                               |     | 765  |      | pF       |
| $C_{rss}$ | Reverse transfer capacitance |                                                               |     | 390  |      | pF       |
| $Q_g$     | Total gate charge            | $V_{DD} = 15\text{ V}$ , $I_D = 80\text{ A}$                  | -   | 62   | -    | nC       |
| $Q_{gs}$  | Gate-source charge           | $V_{GS} = 10\text{ V}$                                        |     | 17   |      | nC       |
| $Q_{gd}$  | Gate-drain charge            | <a href="#">Figure 14</a>                                     |     | 16   |      | nC       |
| $R_G$     | Intrinsic gate resistance    | $f = 1\text{ MHz}$ open drain                                 | -   | 1.5  | -    | $\Omega$ |

**Table 7. Switching on/off (inductive load)**

| Symbol       | Parameter           | Test conditions                                                                                                                    | Min. | Typ. | Max. | Unit |
|--------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 13</a> ) | -    | 20   | -    | ns   |
| $t_r$        | Rise time           |                                                                                                                                    |      | 90   |      | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                                                    | -    | 50   | -    | ns   |
| $t_f$        | Fall time           |                                                                                                                                    |      | 20   |      | ns   |

**Table 8. Source drain diode**

| Symbol          | Parameter                     | Test conditions                                                                                                                                                    | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}$        | Source-drain current          |                                                                                                                                                                    | -    |      | 80   | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                                                                                                                                    |      |      | 320  | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 80\text{ A}$ , $V_{GS} = 0$                                                                                                                              | -    |      | 1.3  | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 80\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 24\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$<br>(see <a href="#">Figure 15</a> ) | -    | 40   |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                                    |      | 50   |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                                    |      | 2.5  |      | 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

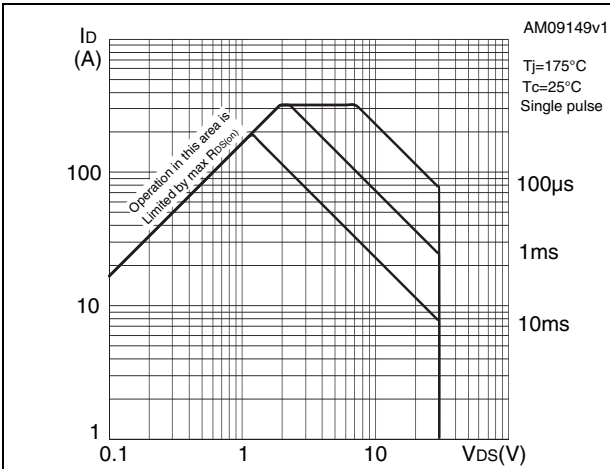


Figure 3. Thermal impedance

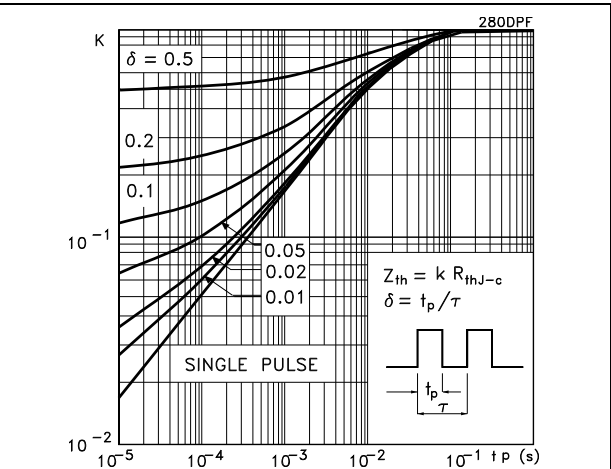


Figure 4. Output characteristics

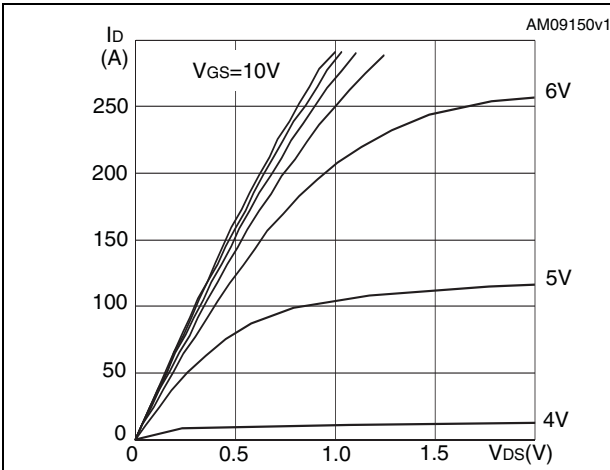


Figure 5. Transfer characteristics

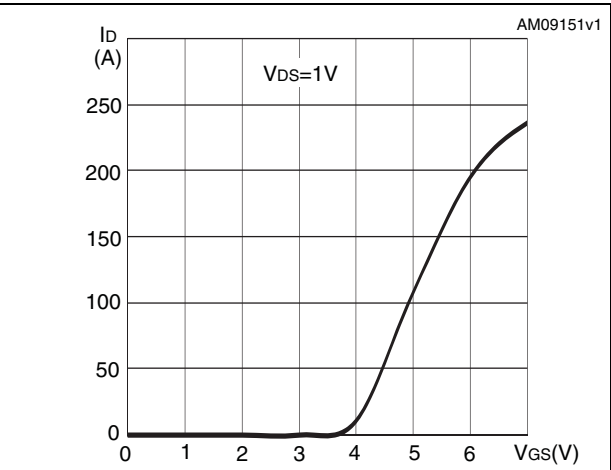


Figure 6. Normalized  $B_{V_{DSS}}$  vs temperature

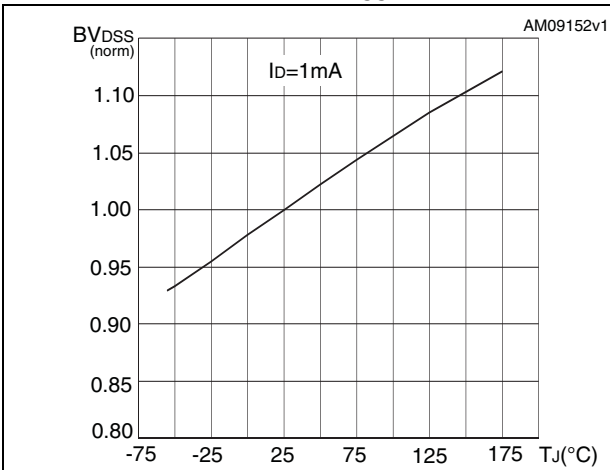


Figure 7. Static drain-source on resistance

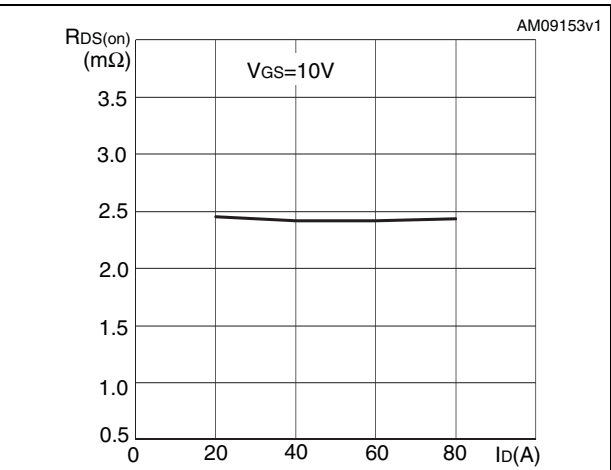


Figure 8. Gate charge vs gate-source voltage

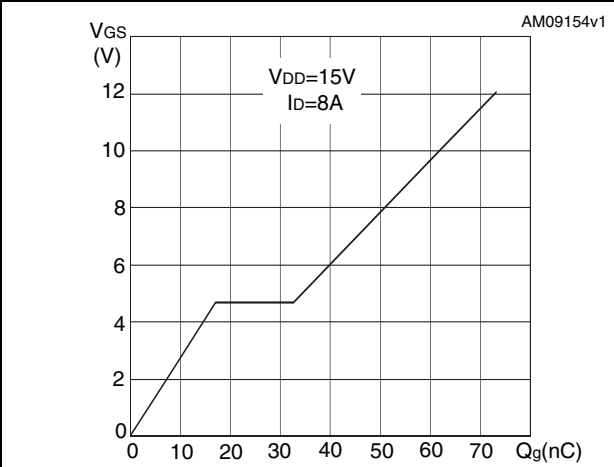


Figure 9. Capacitance variations

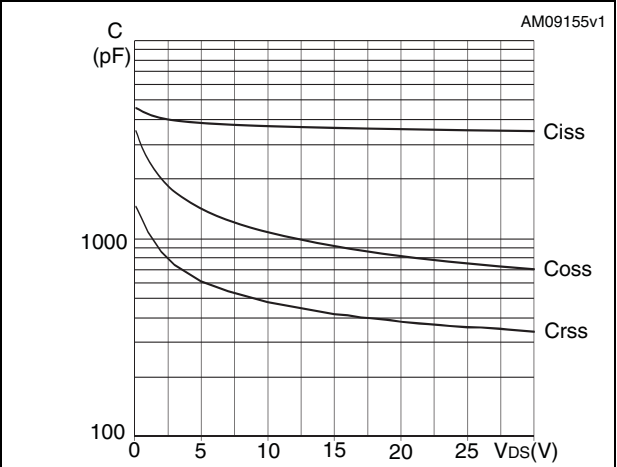


Figure 10. Normalized gate threshold voltage vs temperature

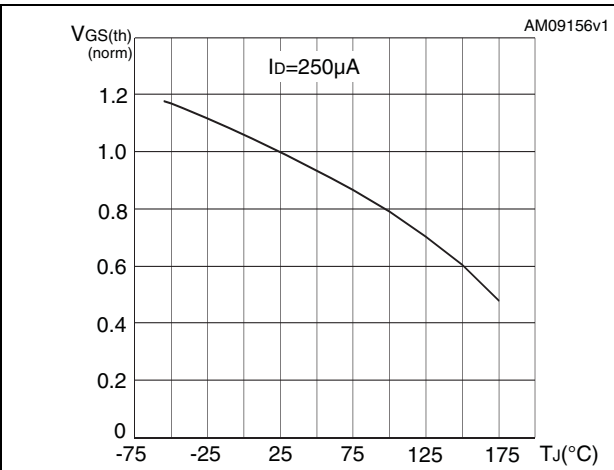


Figure 11. Normalized on resistance vs temperature

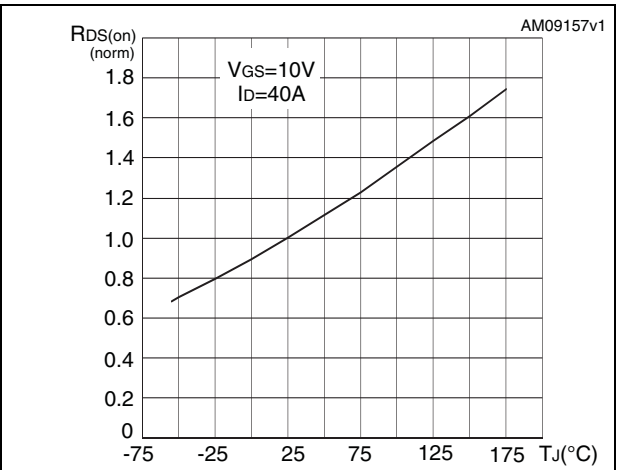
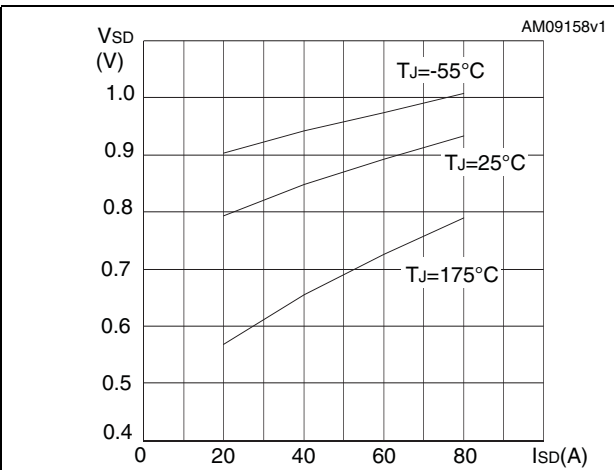
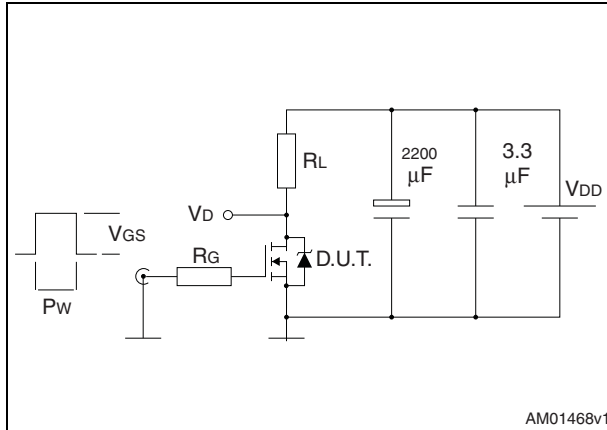


Figure 12. Source-drain diode forward characteristics

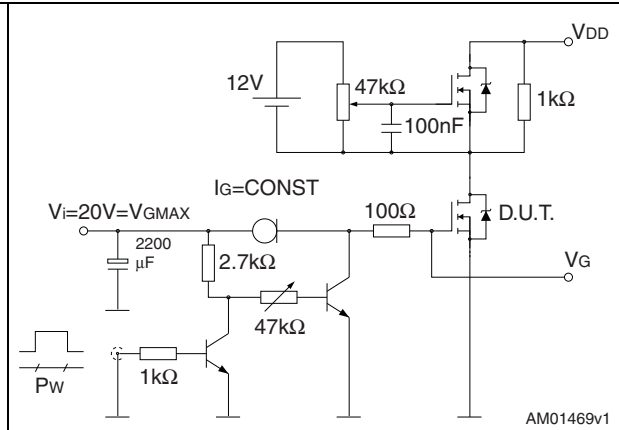


### 3 Test circuits

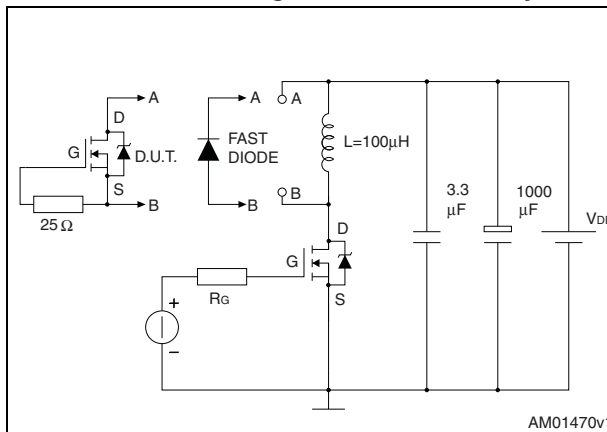
**Figure 13. Switching times test circuit for resistive load**



**Figure 14. Gate charge test circuit**



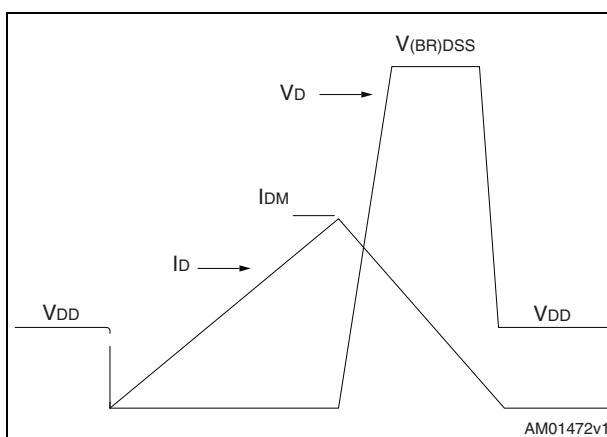
**Figure 15. Test circuit for inductive load switching and diode recovery times**



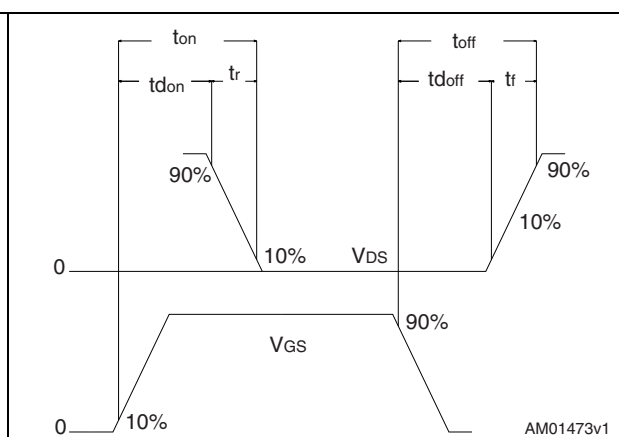
**Figure 16. Unclamped inductive load test circuit**



**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<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 9. D<sup>2</sup>PAK (TO-263) mechanical data

| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    | 4.40 |      | 4.60  |
| A1   | 0.03 |      | 0.23  |
| b    | 0.70 |      | 0.93  |
| b2   | 1.14 |      | 1.70  |
| c    | 0.45 |      | 0.60  |
| c2   | 1.23 |      | 1.36  |
| D    | 8.95 |      | 9.35  |
| D1   | 7.50 |      |       |
| E    | 10   |      | 10.40 |
| E1   | 8.50 |      |       |
| e    |      | 2.54 |       |
| e1   | 4.88 |      | 5.28  |
| H    | 15   |      | 15.85 |
| J1   | 2.49 |      | 2.69  |
| L    | 2.29 |      | 2.79  |
| L1   | 1.27 |      | 1.40  |
| L2   | 1.30 |      | 1.75  |
| R    |      | 0.4  |       |
| V2   | 0°   |      | 8°    |

Figure 19. D<sup>2</sup>PAK footprint<sup>(a)</sup>

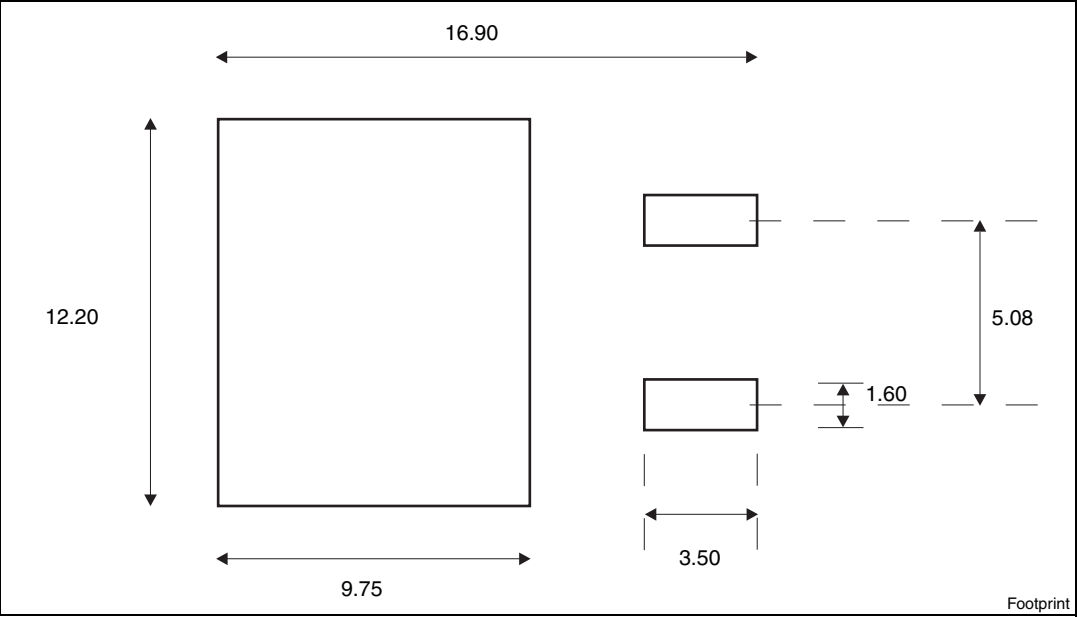
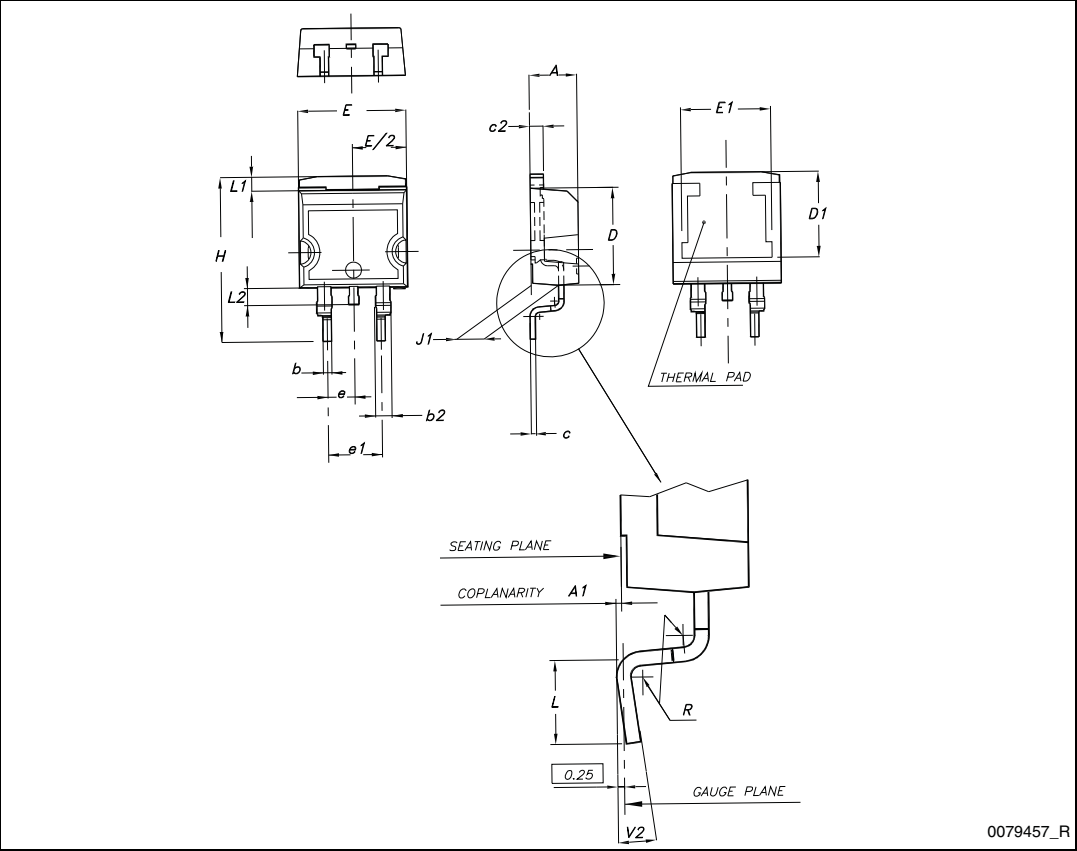


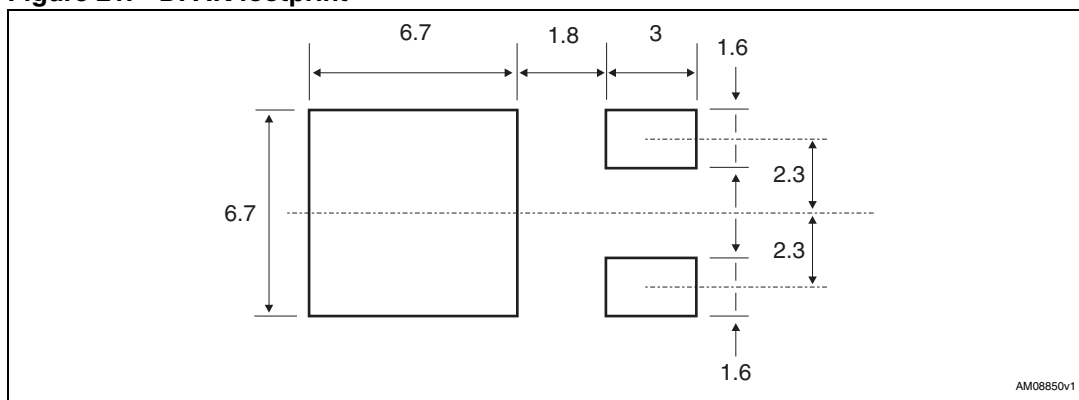
Figure 20. D<sup>2</sup>PAK (TO-263) drawing



a. All dimension are in millimeters

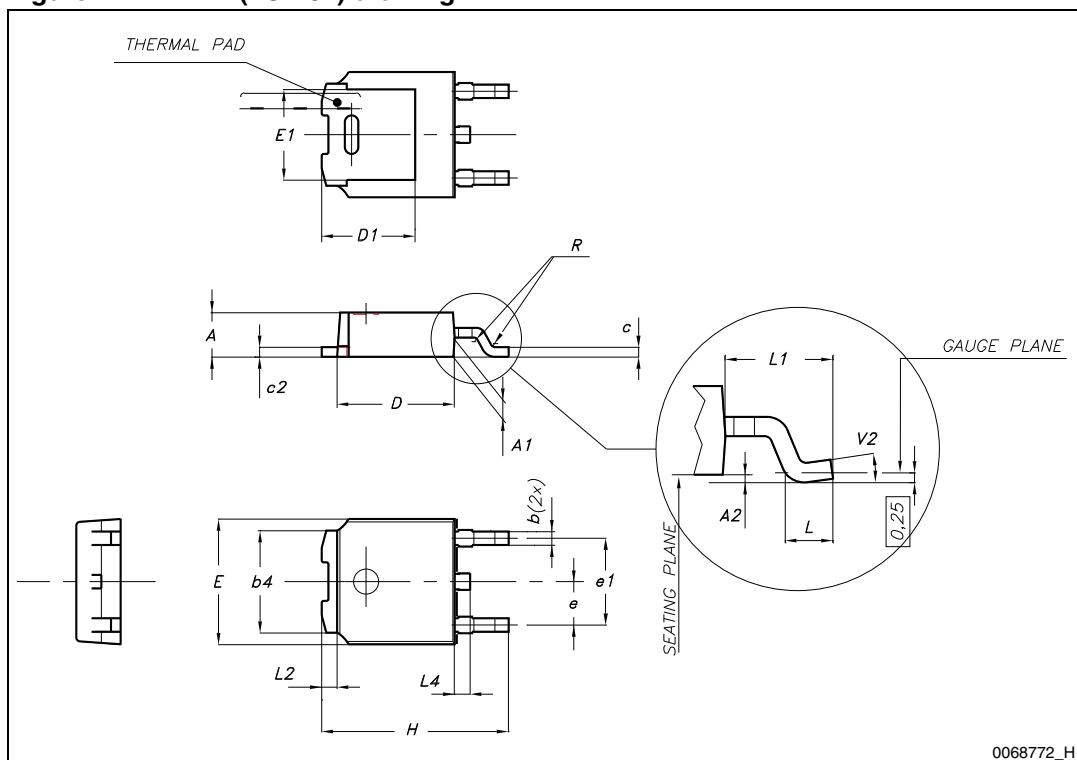
Table 10. DPAK (TO-252) mechanical data

| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1    |      | 1.50  |
| L1   |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1     |
| R    |      | 0.20 |       |
| V2   | 0°   |      | 8°    |

Figure 21. DPAK footprint<sup>(b)</sup>

b. All dimension are in millimeters

Figure 22. DPAK (TO-252) drawing



## 5 Packaging mechanical data

Table 11. D<sup>2</sup>PAK (TO-263) tape and reel mechanical data

| Tape |      |      | Reel     |      |      |
|------|------|------|----------|------|------|
| Dim. | mm   |      | Dim.     | mm   |      |
|      | Min. | Max. |          | Min. | Max. |
| A0   | 10.5 | 10.7 | A        |      | 330  |
| B0   | 15.7 | 15.9 | B        | 1.5  |      |
| D    | 1.5  | 1.6  | C        | 12.8 | 13.2 |
| D1   | 1.59 | 1.61 | D        | 20.2 |      |
| E    | 1.65 | 1.85 | G        | 24.4 | 26.4 |
| F    | 11.4 | 11.6 | N        | 100  |      |
| K0   | 4.8  | 5.0  | T        |      | 30.4 |
| P0   | 3.9  | 4.1  |          |      |      |
| P1   | 11.9 | 12.1 | Base qty |      | 1000 |
| P2   | 1.9  | 2.1  | Bulk qty |      | 1000 |
| R    | 50   |      |          |      |      |
| T    | 0.25 | 0.35 |          |      |      |
| W    | 23.7 | 24.3 |          |      |      |

Table 12. DPAK (TO-252) tape and reel mechanical data

| Tape |      |      | Reel      |      |      |
|------|------|------|-----------|------|------|
| Dim. | mm   |      | Dim.      | mm   |      |
|      | Min. | Max. |           | Min. | Max. |
| A0   | 6.8  | 7    | A         |      | 330  |
| B0   | 10.4 | 10.6 | B         | 1.5  |      |
| B1   |      | 12.1 | C         | 12.8 | 13.2 |
| D    | 1.5  | 1.6  | D         | 20.2 |      |
| D1   | 1.5  |      | G         | 16.4 | 18.4 |
| E    | 1.65 | 1.85 | N         | 50   |      |
| F    | 7.4  | 7.6  | T         |      | 22.4 |
| K0   | 2.55 | 2.75 |           |      |      |
| P0   | 3.9  | 4.1  | Base qty. |      | 2500 |
| P1   | 7.9  | 8.1  | Bulk qty. |      | 2500 |
| P2   | 1.9  | 2.1  |           |      |      |
| R    | 40   |      |           |      |      |
| T    | 0.25 | 0.35 |           |      |      |
| W    | 15.7 | 16.3 |           |      |      |

Figure 23. Tape for D<sup>2</sup>PAK (TO-263) and DPAK (TO-252)

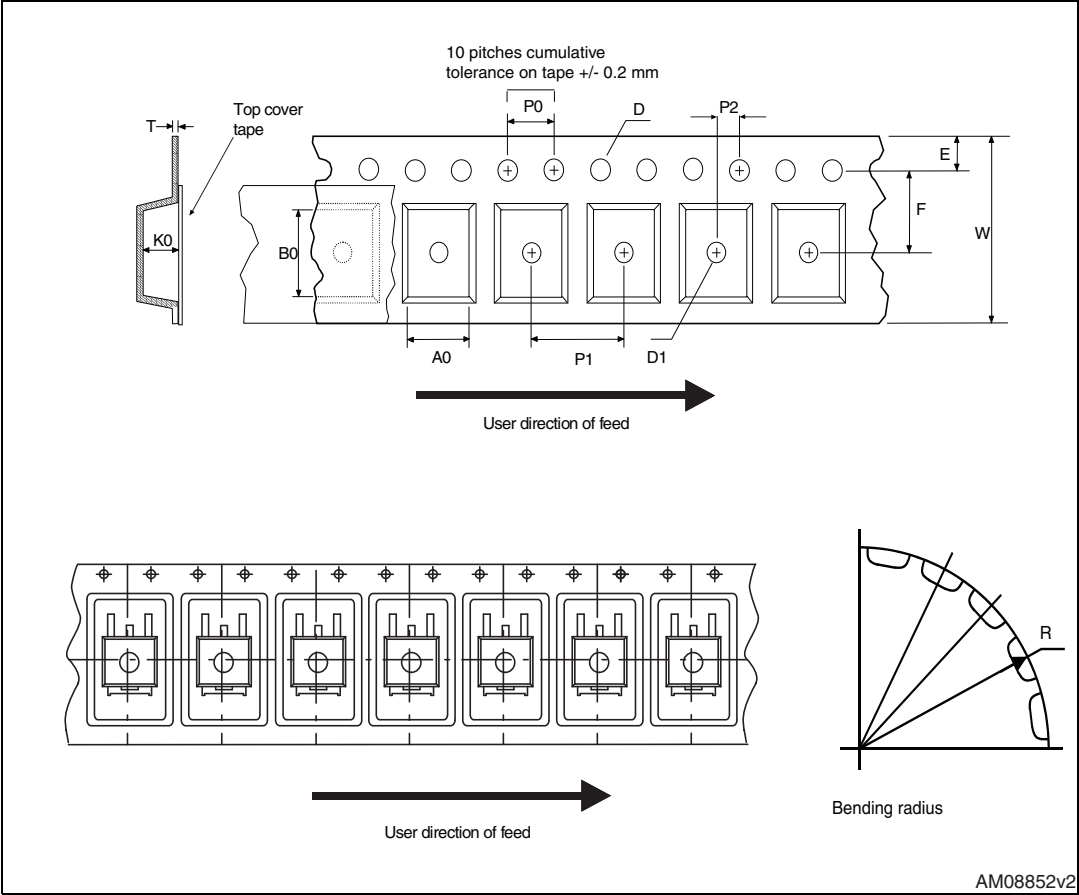
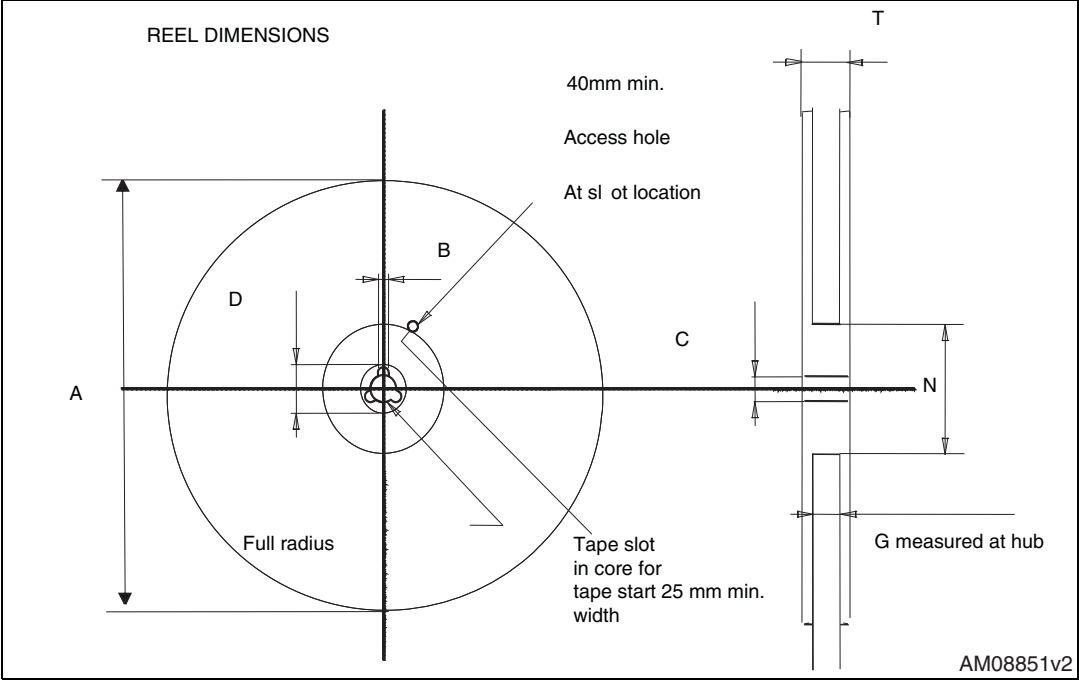


Figure 24. Reel for D<sup>2</sup>PAK (TO-263) and DPAK (TO-252)



## 6 Revision history

**Table 13. Document revision history**

| Date        | Revision | Changes                                                      |
|-------------|----------|--------------------------------------------------------------|
| 03-May-2011 | 1        | First release.                                               |
| 11-May-2011 | 2        | Document status promoted from preliminary data to datasheet. |

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