



# STB55NF06, STP55NF06, STP55NF06FP

N-channel 60 V, 0.015  $\Omega$  50 A STripFET™ II Power MOSFET in D<sup>2</sup>PAK, TO-220 and TO-220FP packages

Datasheet — production data

## Features

| Order code  | V <sub>DSS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub>      |
|-------------|------------------|--------------------------|---------------------|
| STB55NF06   | 60 V             | < 0.018 $\Omega$         | 50 A                |
| STP55NF06   |                  |                          | 50 A                |
| STP55NF06FP |                  |                          | 50 A <sup>(1)</sup> |

1. Refer to soa for the max allowable current value on FP-type due to R<sub>th</sub> value

- 100% avalanche tested
- Exceptional dv/dt capability

## Applications

- Switching application

## Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

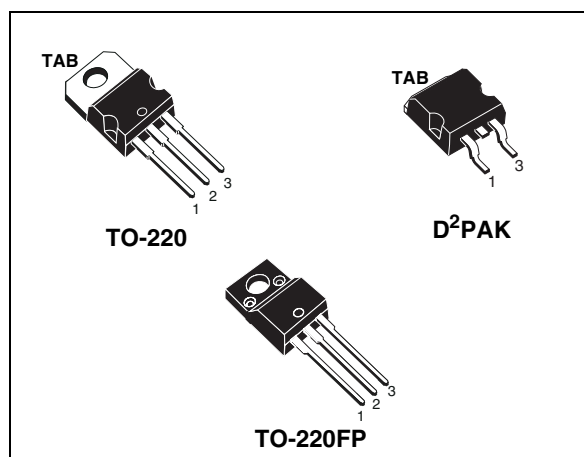
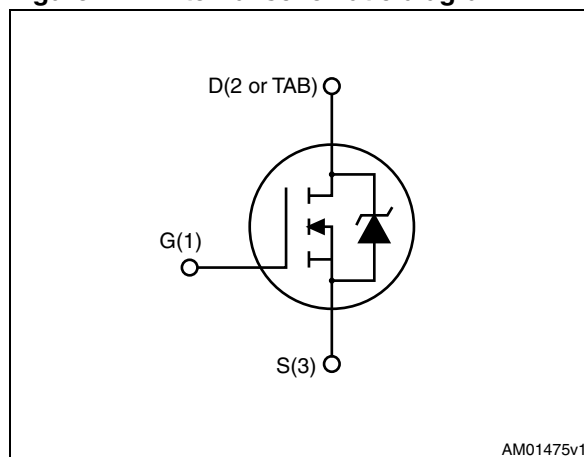


Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

| Order code  | Marking   | Package            | Packaging     |
|-------------|-----------|--------------------|---------------|
| STB55NF06   | B55NF06   | D <sup>2</sup> PAK | Tape and reel |
| STP55NF06   | P55NF06   | TO-220             | Tube          |
| STP55NF06FP | P55NF06FP | TO-220             |               |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter                                                         | Value                         |                    | Unit                  |
|----------------|-------------------------------------------------------------------|-------------------------------|--------------------|-----------------------|
|                |                                                                   | TO-220,<br>D <sup>2</sup> PAK | TO-220FP           |                       |
| $V_{DS}$       | Drain-source voltage                                              | 60                            |                    | V                     |
| $V_{GS}$       | Gate- source voltage                                              | $\pm 20$                      |                    | V                     |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$  | 50                            | 50 <sup>(1)</sup>  | A                     |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$ | 35                            | 35 <sup>(1)</sup>  | A                     |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                            | 200                           | 200 <sup>(1)</sup> | A                     |
| $P_{tot}$      | Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$           | 110                           | 30                 | W                     |
|                | Derating factor                                                   | 0.73                          | 0.20               | W/ $^{\circ}\text{C}$ |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy                                     | 340                           |                    | mJ                    |
| $dv/dt^{(4)}$  | Peak diode recovery voltage slope                                 | 7                             |                    | V/ns                  |
| $V_{ISO}$      | Insulation withstand voltage (DC)                                 |                               | 2500               | V                     |
| $T_{stg}$      | Storage temperature                                               | -55 to 175                    |                    | $^{\circ}\text{C}$    |
| $T_j$          | Max. operating junction temperature                               |                               |                    |                       |

1. Refer to soa for the max allowable current value on FP-type due to  $R_{th}$  value
2. Pulse width limited by safe operating area.
3. Starting  $T_j = 25\text{ }^{\circ}\text{C}$ ,  $V_{DD} = 30\text{ V}$ ,  $I_D = 25\text{ A}$
4.  $I_{SD} \leq 50\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$

**Table 3. Thermal data**

| Symbol         | Parameter                               | Value              |        |          | Unit                        |
|----------------|-----------------------------------------|--------------------|--------|----------|-----------------------------|
|                |                                         | D <sup>2</sup> PAK | TO-220 | TO-220FP |                             |
| $R_{thj-case}$ | Thermal resistance junction-case max    | 1.36               |        | 5        | $^{\circ}\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max | 62.5               |        |          | $^{\circ}\text{C}/\text{W}$ |

## 2 Electrical characteristics

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

**Table 4. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                      | Min. | Typ.  | Max.      | Unit                           |
|---------------|--------------------------------------------------|--------------------------------------------------------------------------------------|------|-------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$                                              | 60   |       |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = 60\ \text{V}$<br>$V_{DS} = 60\ \text{V}$ , @ $T_J = 125\ ^{\circ}\text{C}$ |      |       | 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                | $V_{GS} = 10\ \text{V}$ , $I_D = 27.5\ \text{A}$                                     |      | 0.015 | 0.018     | $\Omega$                       |

**Table 5. Dynamic**

| Symbol                                        | Parameter                                                               | Test conditions                                                                                                                       | Min. | Typ.                 | Max. | Unit                 |
|-----------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|------|----------------------|------|----------------------|
| $C_{iss}$<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>$V_{GS} = 0$                                                                       | -    | 1300<br>300<br>105   |      | 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     | $V_{DD} = 30\ \text{V}$ , $I_D = 27.5\ \text{A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$<br>(see <a href="#">Figure 15</a> ) | -    | 20<br>50<br>36<br>15 |      | 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            | $V_{DD} = 48\ \text{V}$ , $I_D = 55\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$<br>(see <a href="#">Figure 16</a> )                       | -    | 44.5<br>10.5<br>17.5 | 60   | nC<br>nC<br>nC       |

**Table 6. 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)                     |                                                                                                                                                                      | -    |                  | 50<br>200 | A<br>A        |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD} = 50\text{ A}$ , $V_{GS} = 0$                                                                                                                                | -    |                  | 1.5       | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 50\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 30\text{ V}$ , $T_j = 150\text{ }^{\circ}\text{C}$<br>(see <a href="#">Figure 17</a> ) | -    | 75<br>170<br>4.5 |           | 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 for TO-220, D<sup>2</sup>PAK

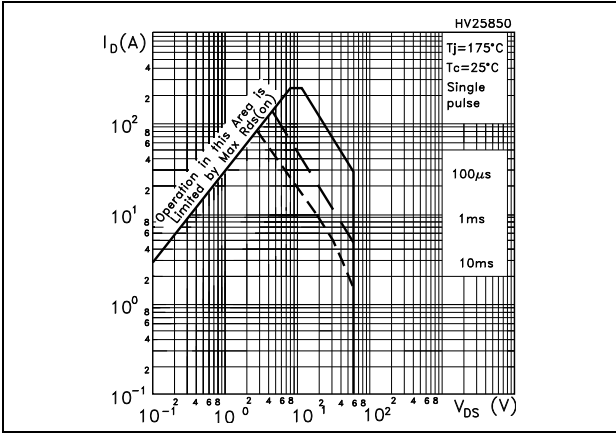


Figure 3. Thermal impedance for TO-220, D<sup>2</sup>PAK

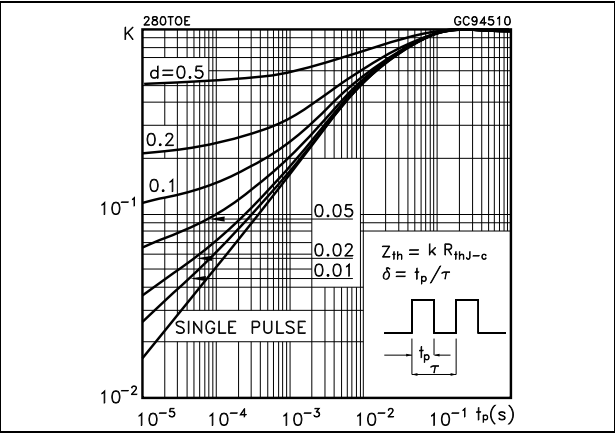


Figure 4. Safe operating area for TO-220FP

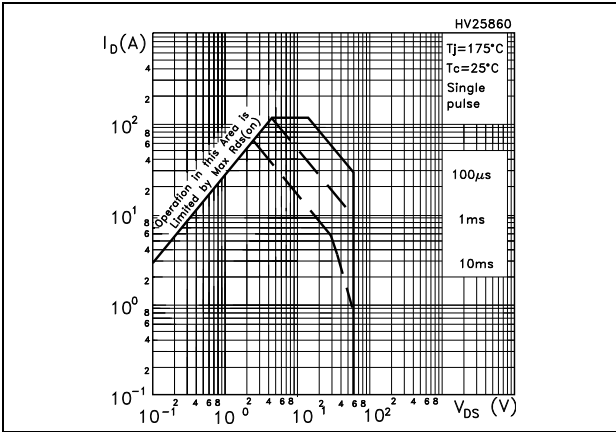


Figure 5. Thermal impedance TO-220FP

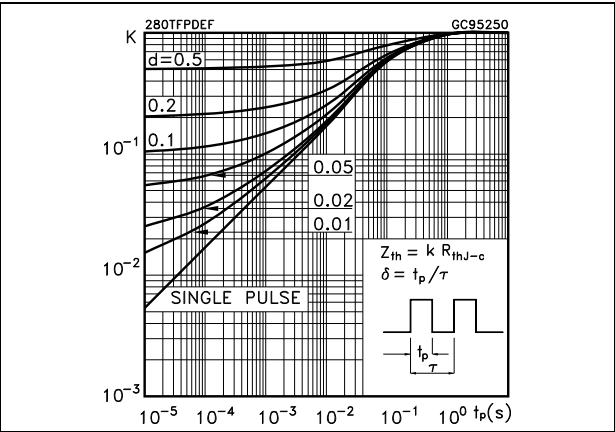


Figure 6. Output characteristics

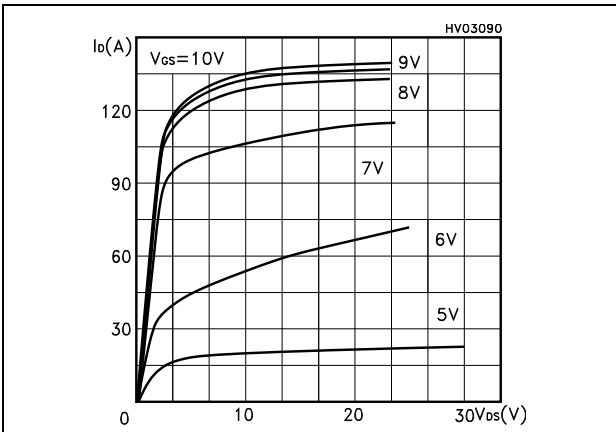


Figure 7. Transfer characteristics

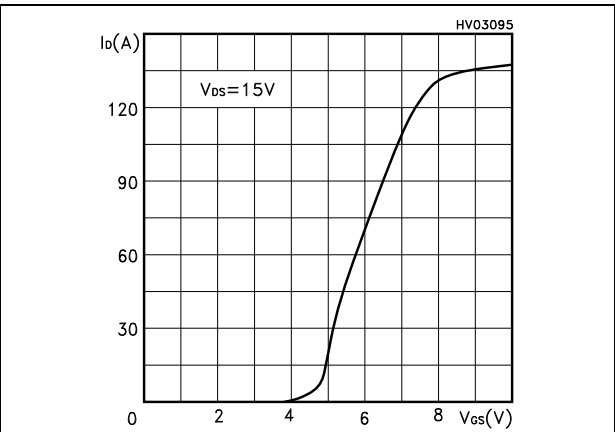


Figure 8. Transconductance

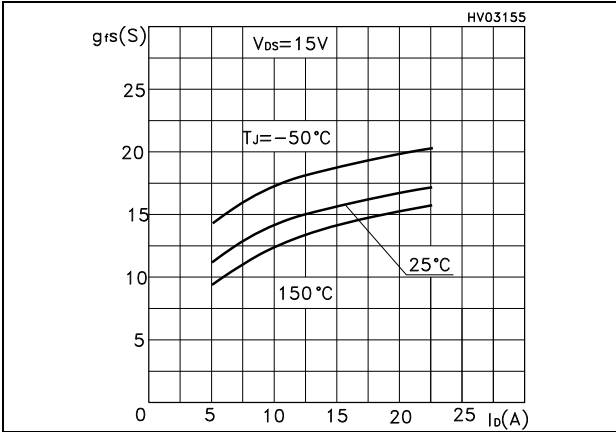


Figure 9. Static drain-source on-resistance

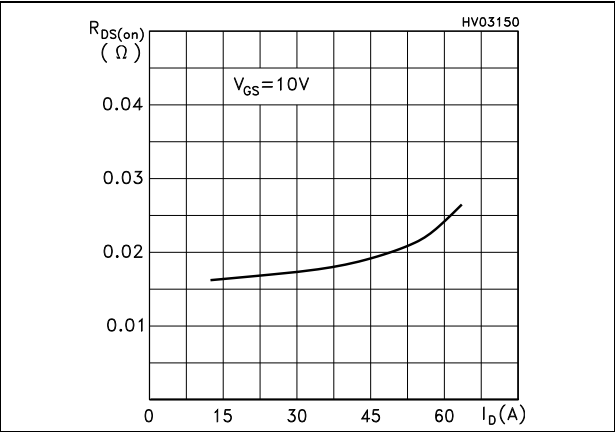


Figure 10. Gate charge vs gate-source voltage

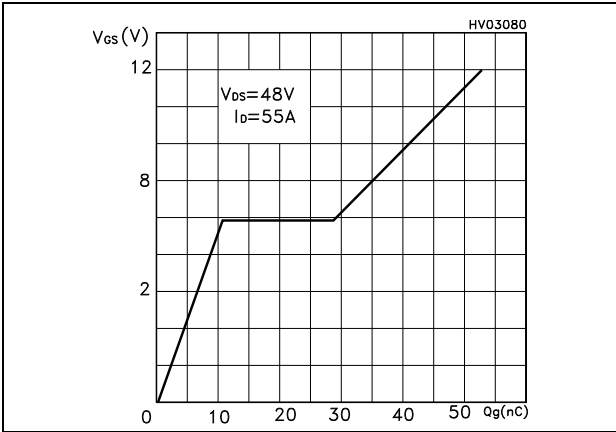


Figure 11. Capacitance variations

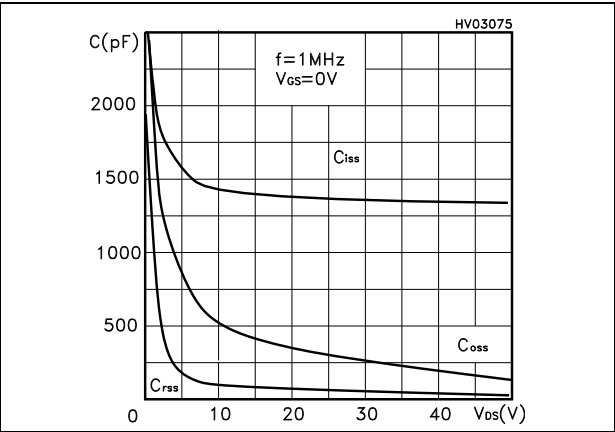


Figure 12. Normalized gate threshold voltage vs temperature

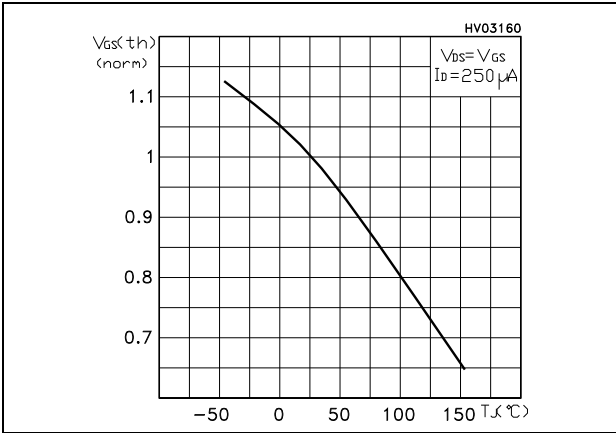


Figure 13. Normalized on-resistance vs temperature

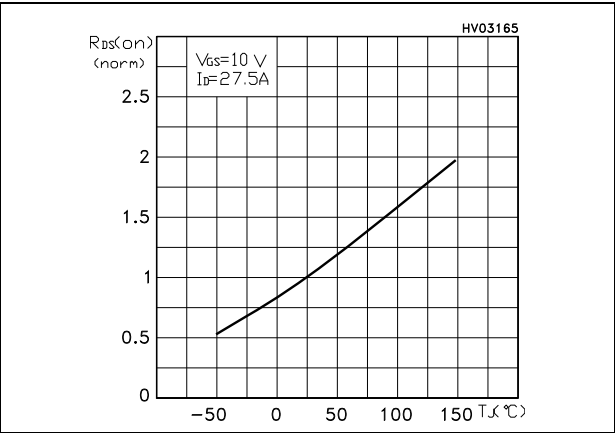
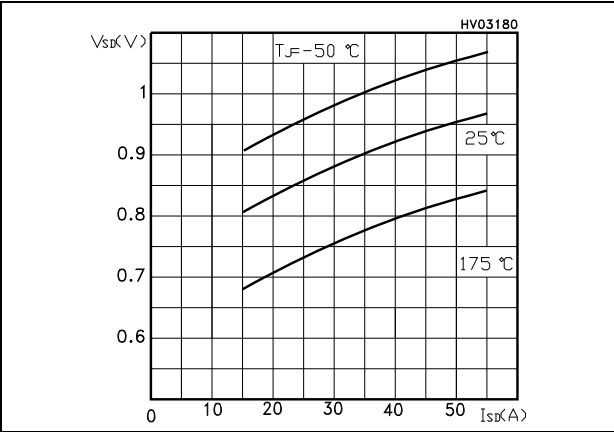


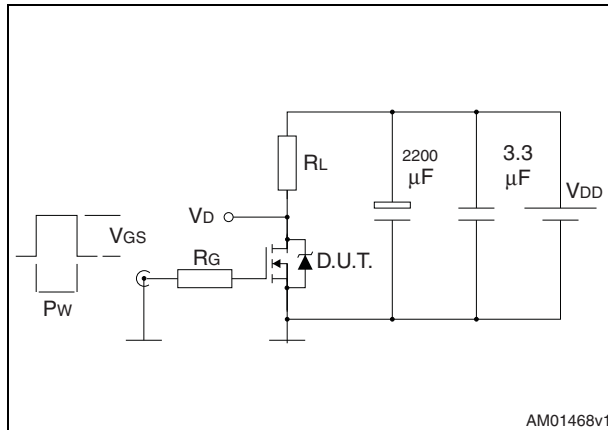
Figure 14. Source-drain diode forward characteristics



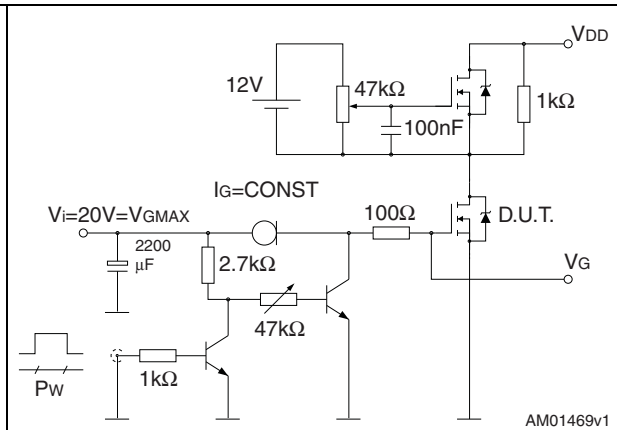


### 3 Test circuit

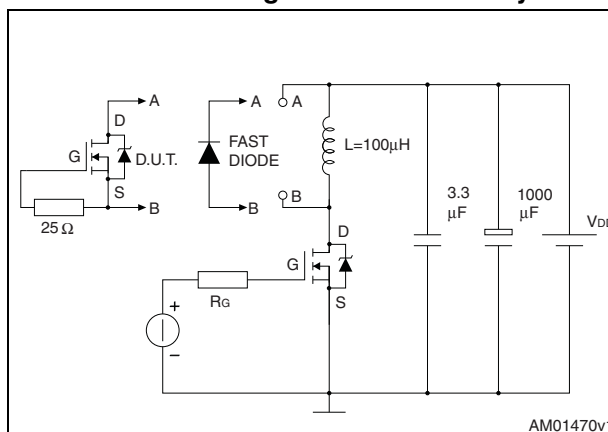
**Figure 15. Switching times test circuit for resistive load**



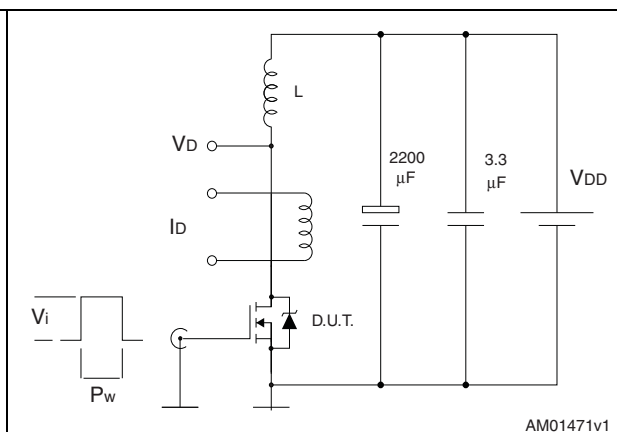
**Figure 16. Gate charge test circuit**



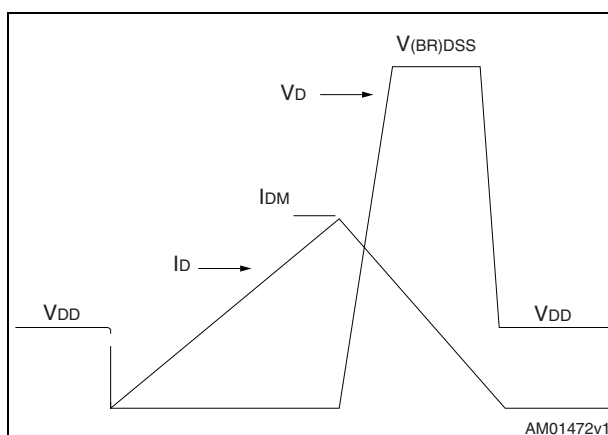
**Figure 17. Test circuit for inductive load switching and diode recovery times**



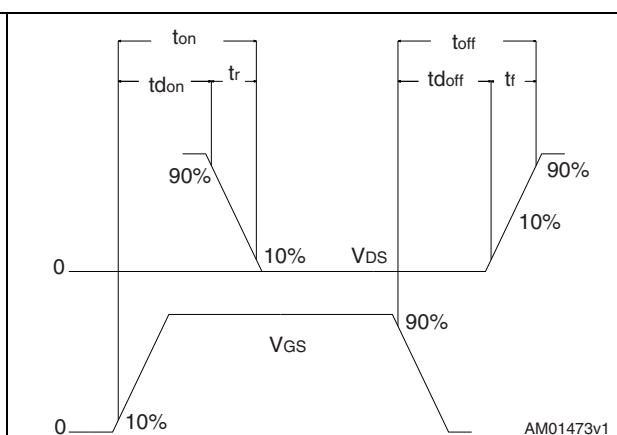
**Figure 18. Unclamped inductive load test circuit**



**Figure 19. Unclamped inductive waveform**



**Figure 20. Switching time waveform**

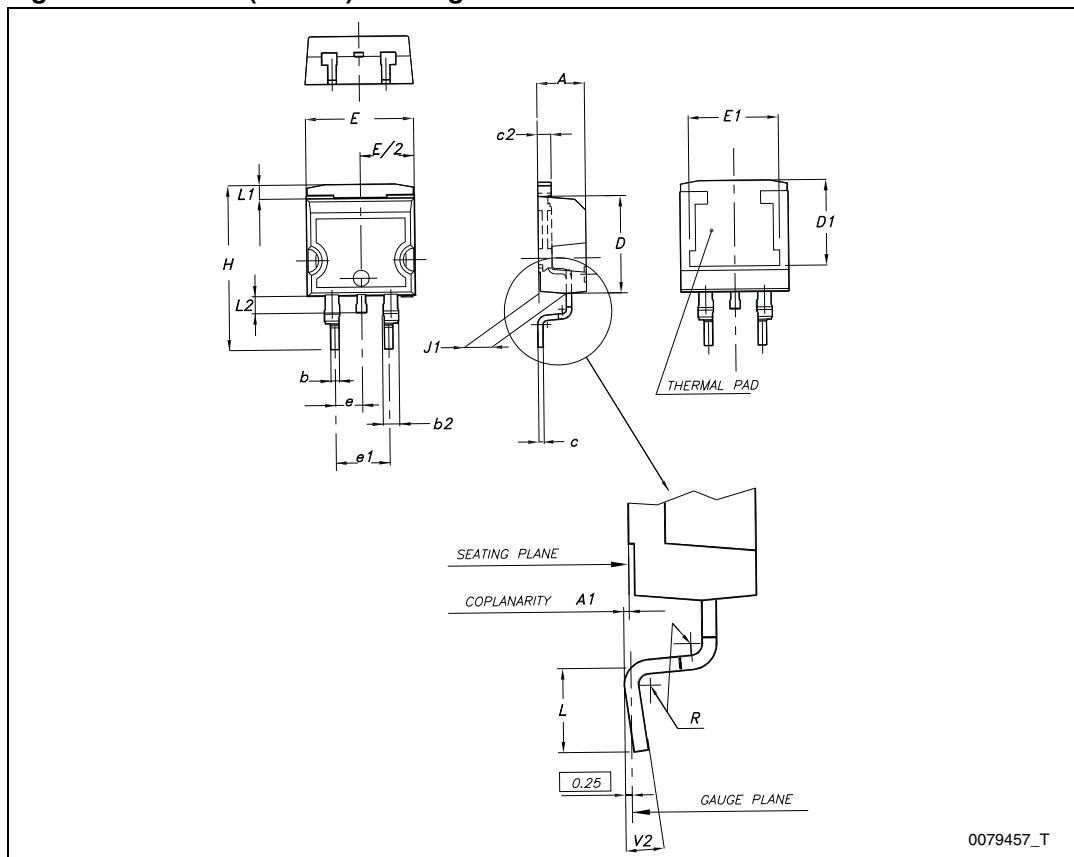
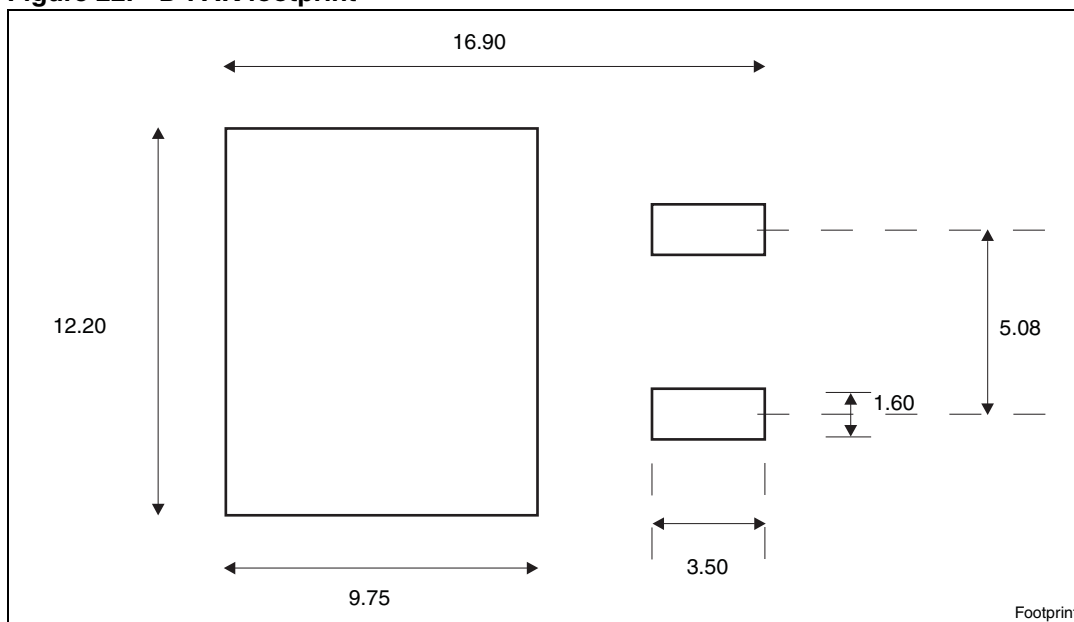


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<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<sup>®</sup> is an ST trademark.

**Table 7. 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 21. D<sup>2</sup>PAK (TO-263) drawingFigure 22. D<sup>2</sup>PAK footprint<sup>(a)</sup>

a. All dimensions are in millimeters

Table 8. TO-220 type A mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.40  |       | 4.60  |
| b    | 0.61  |       | 0.88  |
| b1   | 1.14  |       | 1.70  |
| c    | 0.48  |       | 0.70  |
| D    | 15.25 |       | 15.75 |
| D1   |       | 1.27  |       |
| E    | 10    |       | 10.40 |
| e    | 2.40  |       | 2.70  |
| e1   | 4.95  |       | 5.15  |
| F    | 1.23  |       | 1.32  |
| H1   | 6.20  |       | 6.60  |
| J1   | 2.40  |       | 2.72  |
| L    | 13    |       | 14    |
| L1   | 3.50  |       | 3.93  |
| L20  |       | 16.40 |       |
| L30  |       | 28.90 |       |
| ØP   | 3.75  |       | 3.85  |
| Q    | 2.65  |       | 2.95  |

Figure 23. TO-220 type A drawing

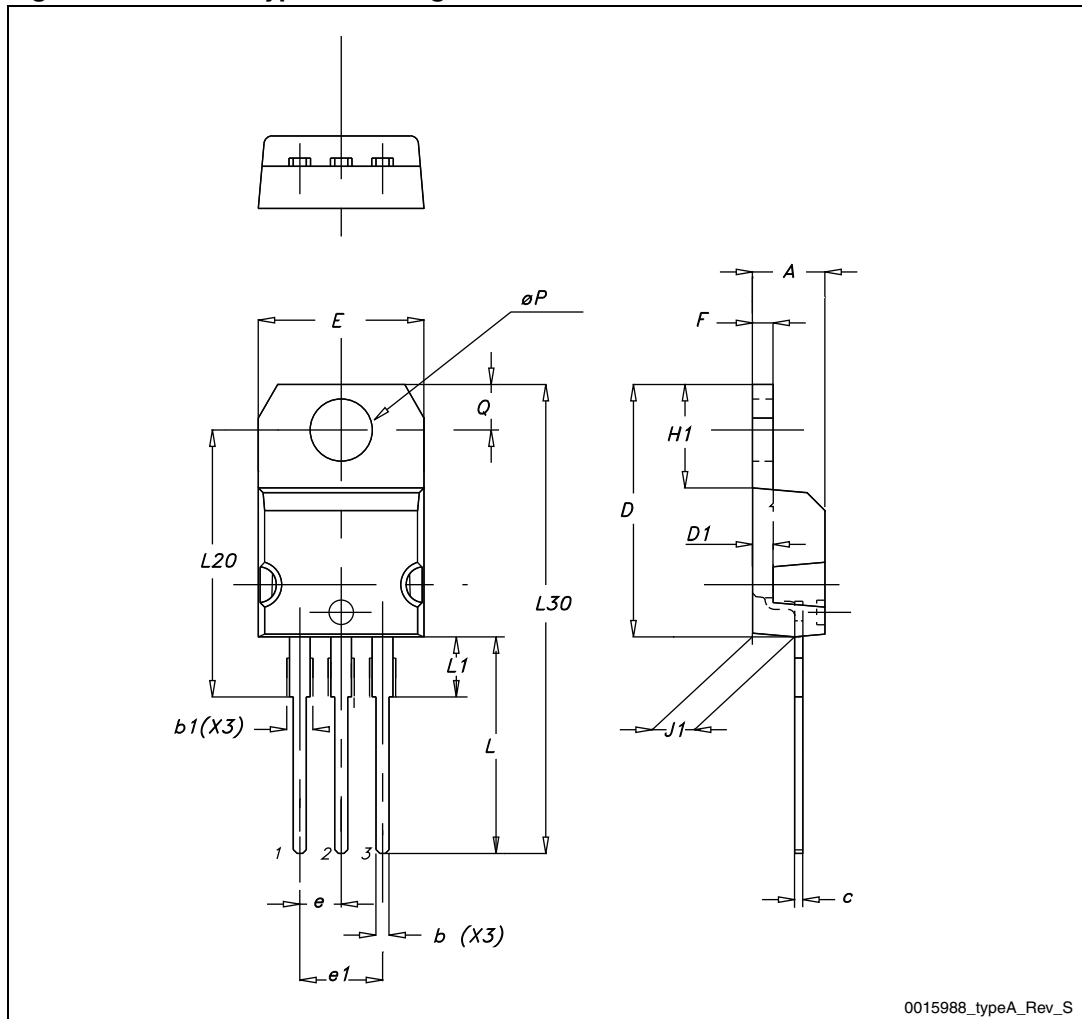
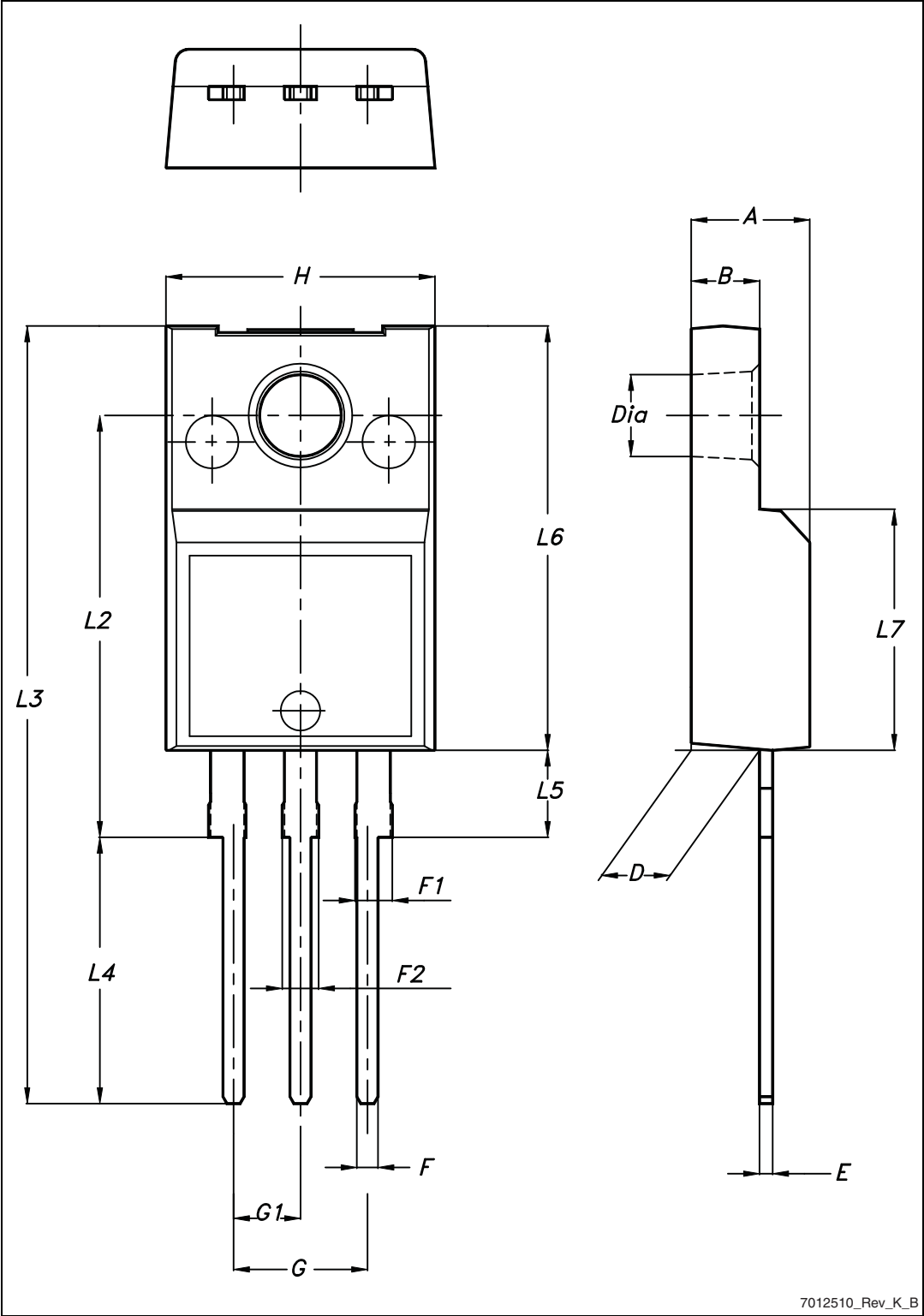


Table 9. TO-220FP mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 4.4  |      | 4.6  |
| B    | 2.5  |      | 2.7  |
| D    | 2.5  |      | 2.75 |
| E    | 0.45 |      | 0.7  |
| F    | 0.75 |      | 1    |
| F1   | 1.15 |      | 1.70 |
| F2   | 1.15 |      | 1.70 |
| G    | 4.95 |      | 5.2  |
| G1   | 2.4  |      | 2.7  |
| H    | 10   |      | 10.4 |
| L2   |      | 16   |      |
| L3   | 28.6 |      | 30.6 |
| L4   | 9.8  |      | 10.6 |
| L5   | 2.9  |      | 3.6  |
| L6   | 15.9 |      | 16.4 |
| L7   | 9    |      | 9.3  |
| Dia  | 3    |      | 3.2  |

Figure 24. TO-220FP drawing



## 5 Packaging mechanical data

Table 10. 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 |          |      |      |



Figure 25. Tape

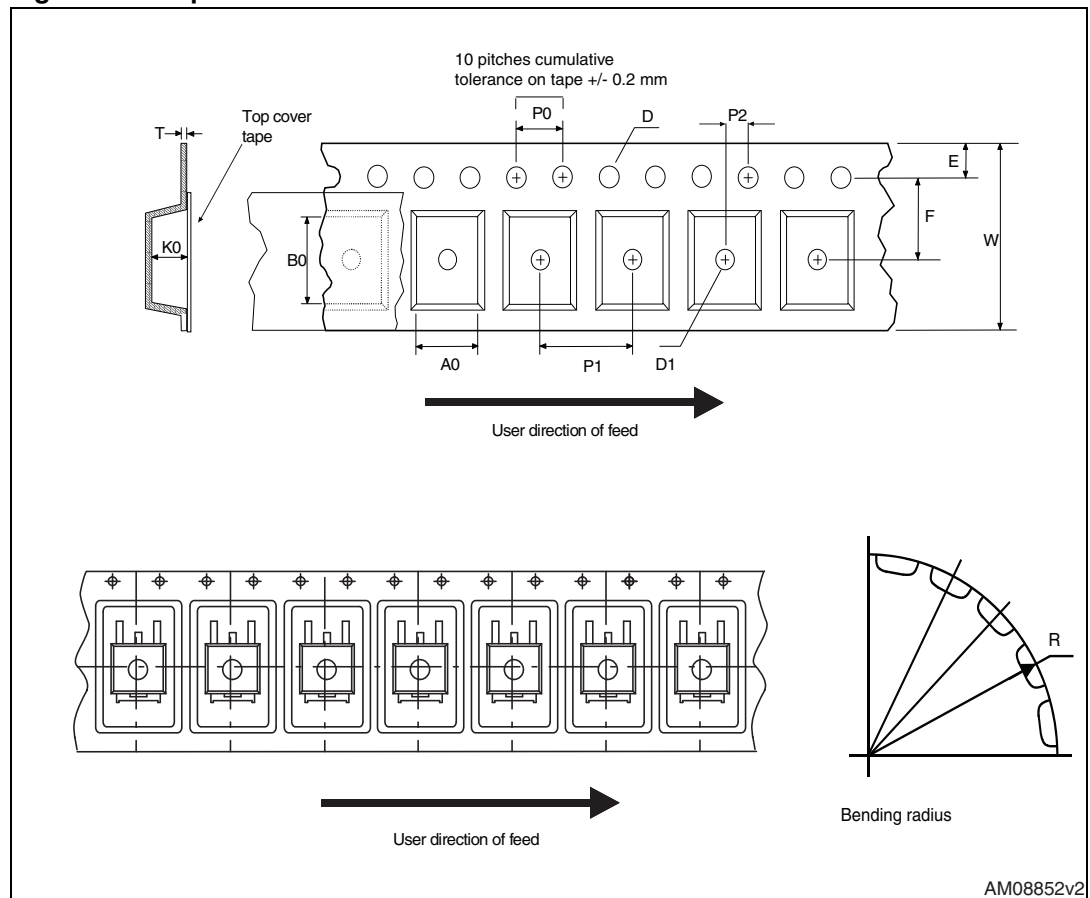
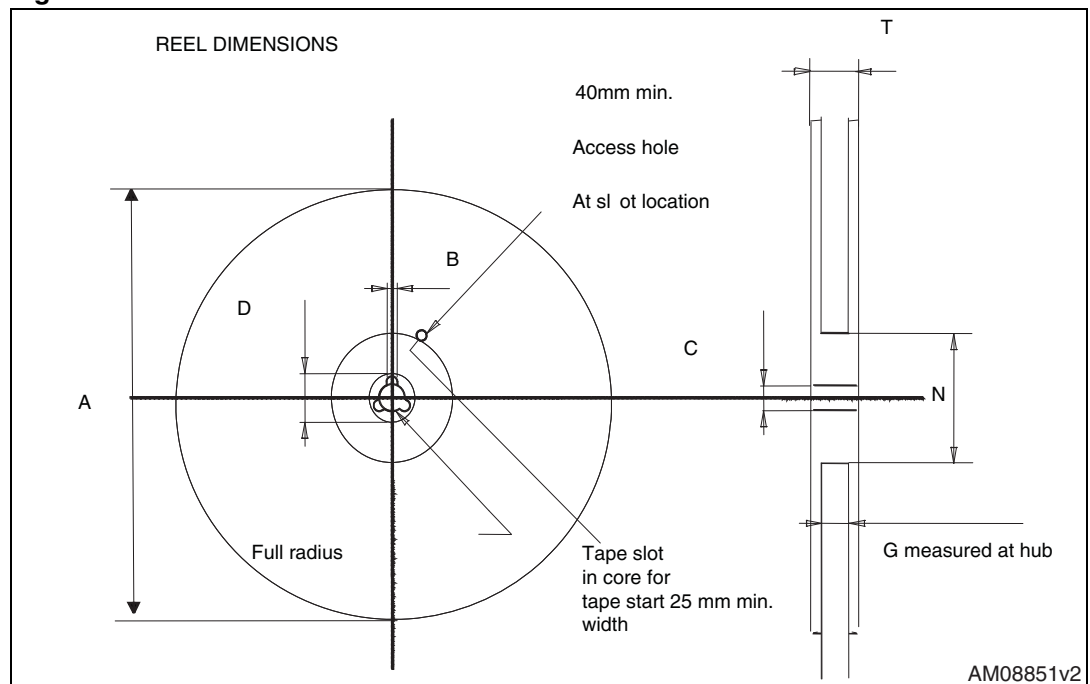


Figure 26. Reel



## 6 Revision history

**Table 11. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                            |
|-------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19-Oct-2005 | 7        | Preliminary document                                                                                                                                                                               |
| 02-Dec-2005 | 8        | New datasheet according to PCN MLD-PMT/05/1115                                                                                                                                                     |
| 28-Mar-2006 | 9        | Inserted ecopack indication                                                                                                                                                                        |
| 26-Jun-2006 | 10       | New template, no content change                                                                                                                                                                    |
| 25-May-2012 | 11       | Removed part number STB55NF06-1 in I <sup>2</sup> PAK package<br><i>Section 4: Package mechanical data</i> and <i>Section 5: Packaging mechanical data</i> have been updated<br>Minor text changes |

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- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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