



# STD100N03L STD100N03L-1

N-channel 30V - 0.0045Ω - 80A - DPAK - IPAK  
Planar STripFET™ II Power MOSFET

## General features

| Type         | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub>      | P <sub>w</sub> |
|--------------|------------------|---------------------|---------------------|----------------|
| STD100N03L   | 30 V             | <0.0055 Ω           | 80 A <sup>(1)</sup> | 110 W          |
| STD100N03L-1 | 30 V             | <0.0055 Ω           | 80 A <sup>(1)</sup> | 110 W          |

1. Current limited by package

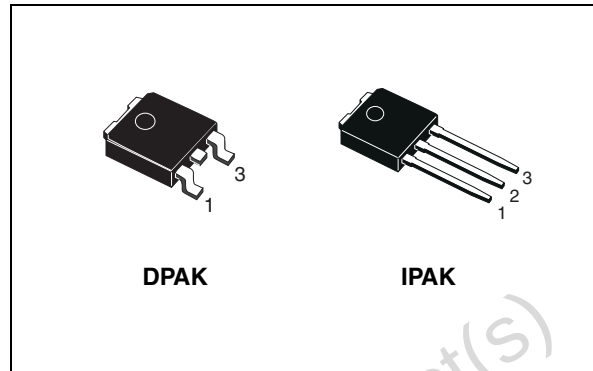
- 100% avalanche tested
- Logic level threshold

## Description

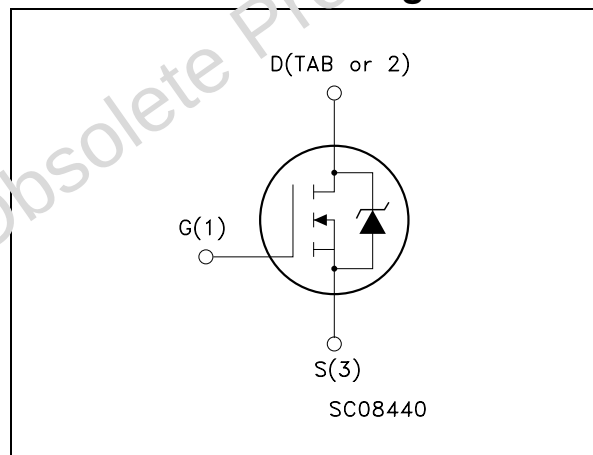
This MOSFET is the latest refinement of STMicroelectronic unique "Single Feature Size™" strippased process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics, low gate charge and less critical alignment steps therefore a remarkable manufacturing reproducibility. This new improved device has been specifically designed for Automotive application and DC-DC converters.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

| Part number  | Marking    | Package | Packaging   |
|--------------|------------|---------|-------------|
| STD100N03LT4 | D100N03L   | DPAK    | Tape & reel |
| STD100N03L-1 | D100N03L-1 | IPAK    | Tube        |

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter                                               | Value      | Unit                |
|----------------|---------------------------------------------------------|------------|---------------------|
| $V_{DS}$       | Drain-source voltage ( $V_{GS} = 0$ )                   | 30         | V                   |
| $V_{DGR}$      | Drain-gate voltage                                      | $\pm 20$   | V                   |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 25^\circ\text{C}$  | 80         | A                   |
| $I_D$          | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 70         | A                   |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                  | 320        | A                   |
| $P_{TOT}$      | Total dissipation at $T_C = 25^\circ\text{C}$           | 110        | W                   |
|                | Derating factor                                         | 0.73       | W/ $^\circ\text{C}$ |
| $dv/dt^{(3)}$  | Peak diode recovery voltage slope                       | 3.9        | V/ns                |
| $T_{stg}$      | Storage temperature                                     | -55 to 175 | $^\circ\text{C}$    |
| $T_J$          | Max. operating junction temperature                     |            |                     |

1. Current limited by package.
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 80\text{A}$ ,  $di/dt \leq 360\text{ A}/\mu\text{s}$ ,  $V_{DS} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$

**Table 2. Thermal data**

| Symbol     | Parameter                                      | Value | Unit                      |
|------------|------------------------------------------------|-------|---------------------------|
| $R_{thJC}$ | Thermal resistance junction-case Max           | 1.36  | $^\circ\text{C}/\text{W}$ |
| $R_{thJA}$ | Thermal resistance junction-ambient Max        | 100   | $^\circ\text{C}/\text{W}$ |
| $T_I$      | Maximum lead temperature for soldering purpose | 275   | $^\circ\text{C}$          |

**Table 3. Avalanche characteristics**

| Symbol   | Parameter                                                                                                    | Value | Unit |
|----------|--------------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AR}$ | Not-repetitive avalanche current (pulse width limited by $T_J$ max)                                          | 40    | A    |
| $E_{AS}$ | Single pulsed avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 24\text{V}$ ) | 500   | mJ   |

## 2 Electrical characteristics

(T<sub>CASE</sub>=25°C unless otherwise specified)

**Table 4. On/off states**

| Symbol               | Parameter                                             | Test conditions                                                       | Min. | Typ.   | Max.    | Unit     |
|----------------------|-------------------------------------------------------|-----------------------------------------------------------------------|------|--------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source breakdown voltage                        | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0                           | 30   |        |         | V        |
| I <sub>DSS</sub>     | Zero gate voltage drain current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max rating,<br>V <sub>DS</sub> = Max rating @ 125°C |      |        | 1<br>10 | μA<br>μA |
| I <sub>GSS</sub>     | Gate body leakage current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±20V                                                |      |        | ±200    | nA       |
| V <sub>GS(th)</sub>  | Gate threshold voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA            | 1    |        |         | V        |
| R <sub>DS(on)</sub>  | Static drain-source on resistance                     | V <sub>GS</sub> = 10V, I <sub>D</sub> = 40A                           |      | 0.0045 | 0.0055  | Ω        |
|                      |                                                       | V <sub>GS</sub> = 5V, I <sub>D</sub> = 20A                            |      | 0.008  | 0.01    | Ω        |
|                      |                                                       | V <sub>GS</sub> = 10 V,<br>I <sub>D</sub> = 40 A @ 125°C              |      | 0.0068 |         | Ω        |
|                      |                                                       | V <sub>GS</sub> = 5 V,<br>I <sub>D</sub> = 20 A @ 125°C               |      | 0.0146 |         | Ω        |

**Table 5. Dynamic**

| Symbol                         | Parameter                    | Test conditions                                                     | Min. | Typ. | Max. | Unit |
|--------------------------------|------------------------------|---------------------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> <sup>(1)</sup> | Forward transconductance     | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 15A                        |      | 31   |      | S    |
| C <sub>iss</sub>               | Input capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz,<br>V <sub>GS</sub> = 0            |      | 2060 |      | pF   |
| C <sub>oss</sub>               | Output capacitance           |                                                                     |      | 728  |      | pF   |
| C <sub>rss</sub>               | Reverse transfer capacitance |                                                                     |      | 67   |      | pF   |
| Q <sub>g</sub>                 | Total gate charge            | V <sub>DD</sub> = 24V, I <sub>D</sub> = 80A                         |      | 20   | 27   | nC   |
| Q <sub>gs</sub>                | Gate-source charge           | V <sub>GS</sub> = 5V                                                |      | 7    |      | nC   |
| Q <sub>gd</sub>                | Gate-drain charge            | <a href="#">Figure 15 on page 9</a>                                 |      | 7.5  |      | nC   |
| R <sub>G</sub>                 | Gate input resistance        | f = 1MHz gate DC Bias = 0<br>Test signal level = 20mV<br>Open drain |      | 1.9  |      | Ω    |

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

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions                                                                            | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD}=15V$ , $I_D=40A$ ,<br>$R_G=4.7\Omega$ , $V_{GS}=10V$<br><i>Figure 14 on page 9</i> |      | 9    |      | ns   |
| $t_r$        | Rise time           |                                                                                            |      | 205  |      | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                            |      | 31   |      | ns   |
| $t_f$        | Fall time           |                                                                                            |      | 35   |      | ns   |

**Table 7. 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            | $I_{SD}=40A$ , $V_{GS}=0$                                                                                |     |      | 1.3 | V       |
| $t_{rr}$        | Reverse recovery time         | $I_{SD}=80A$ ,<br>$di/dt=100A/\mu s$ ,<br>$V_{DD}=25V$ , $T_J=150^\circ C$<br><i>Figure 16 on page 9</i> |     | 40   |     | ns      |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                          |     | 40   |     | $\mu C$ |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                          |     | 2    |     | A       |

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

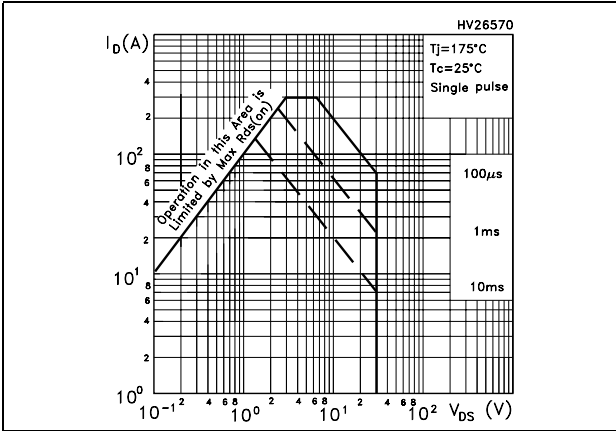


Figure 2. Thermal impedance

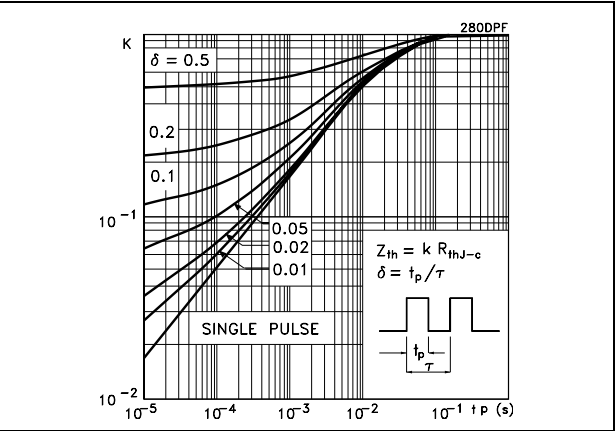


Figure 3. Output characteristics

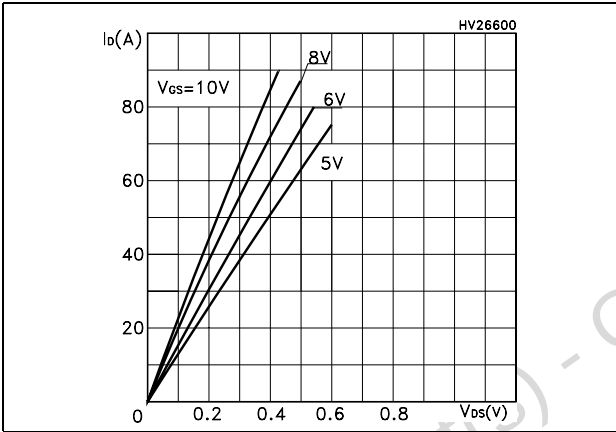


Figure 4. Transfer characteristics

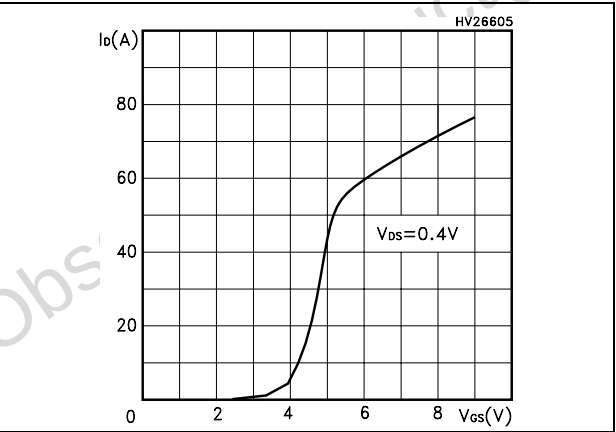


Figure 5. Transconductance

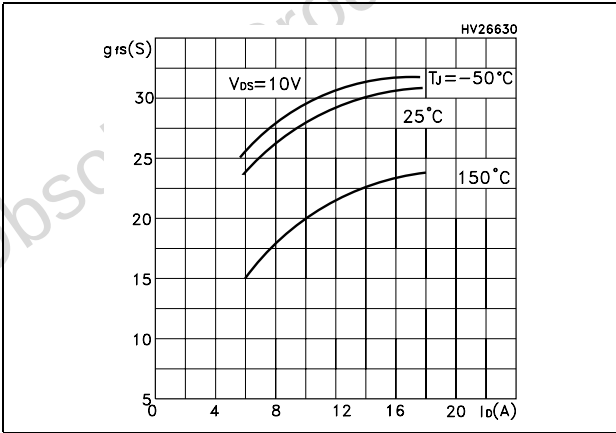


Figure 6. Static drain-source on resistance

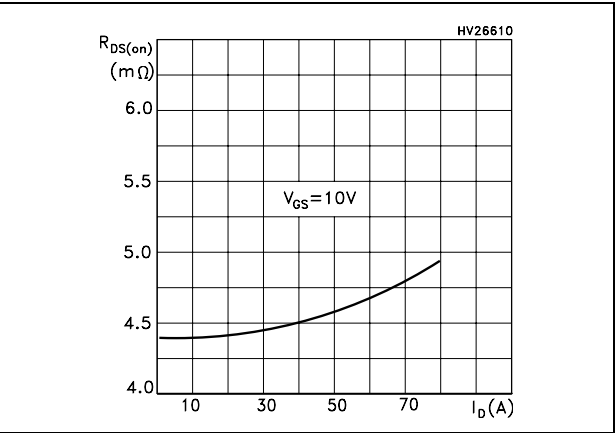


Figure 7. Gate charge vs gate-source voltage      Figure 8. Capacitance variations

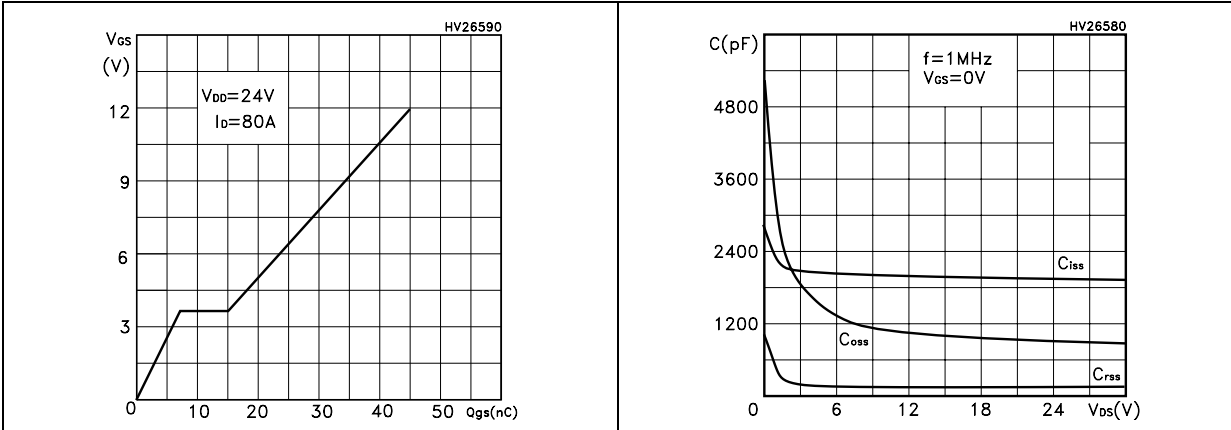


Figure 9. Normalized gate threshold voltage vs temperature      Figure 10. Normalized BVDSS vs temperature

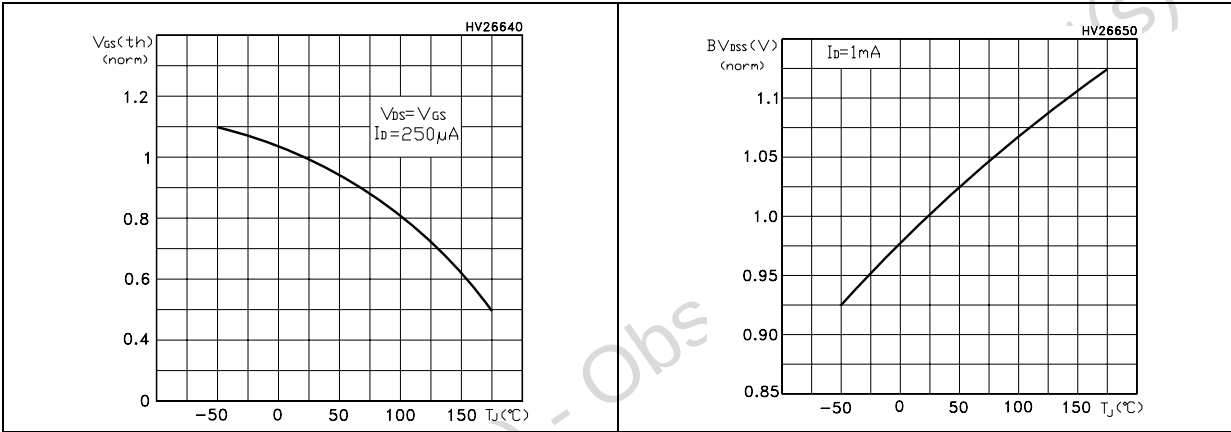
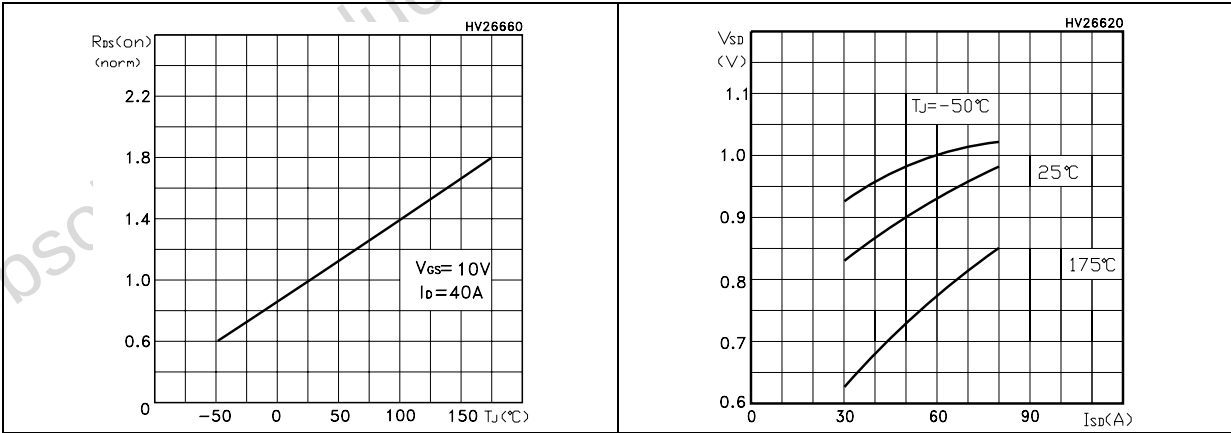
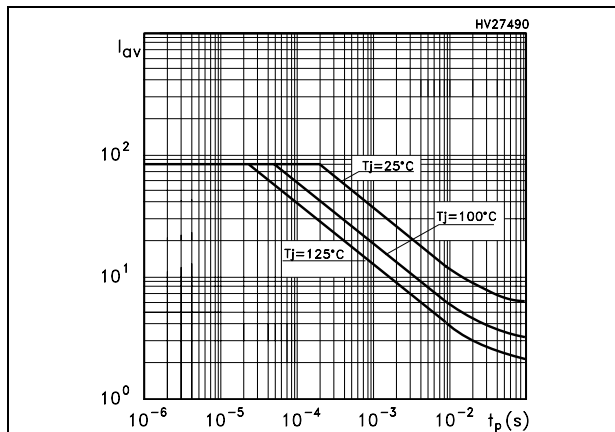


Figure 11. Normalized on resistance vs temperature      Figure 12. Source-drain diode forward characteristics



**Figure 13. Allowable  $I_{AV}$  vs time in avalanche**

The previous curve gives the single pulse safe operating area for unclamped inductive loads, under the following conditions:

$$P_{D(AVE)} = 0.5 * (1.3 * BV_{DSS} * I_{AV})$$

$$E_{AS(AR)} = P_{D(AVE)} * t_{AV}$$

Where:

$I_{AV}$  is the Allowable Current in Avalanche

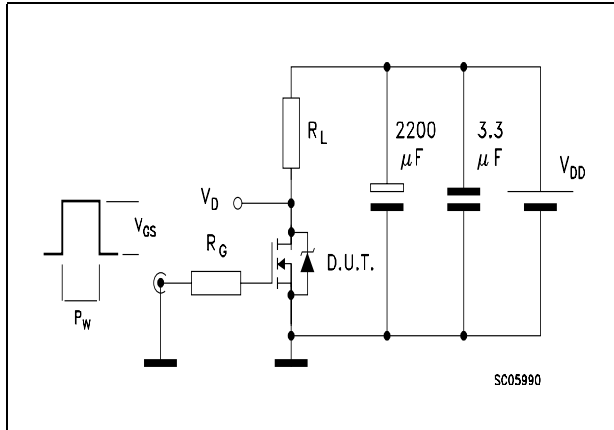
$P_{D(AVE)}$  is the Average Power Dissipation in Avalanche (Single Pulse)

$t_{AV}$  is the Time in Avalanche

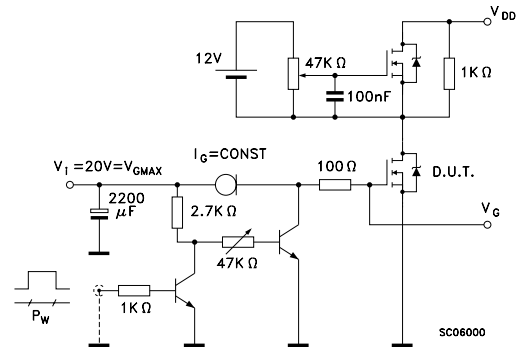


### 3 Test circuit

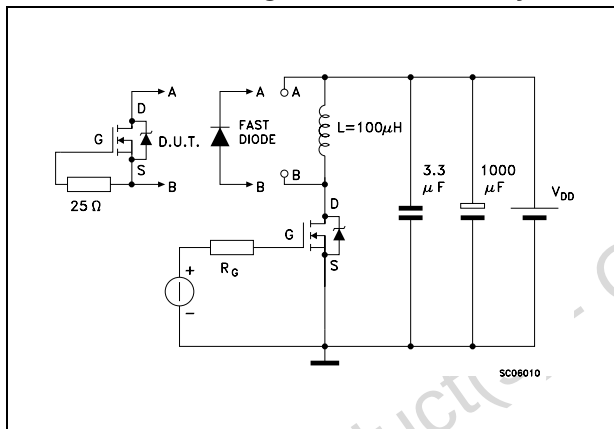
**Figure 14. Switching times test circuit for resistive load**



**Figure 15. Gate charge test circuit**



**Figure 16. Test circuit for inductive load switching and diode recovery times**



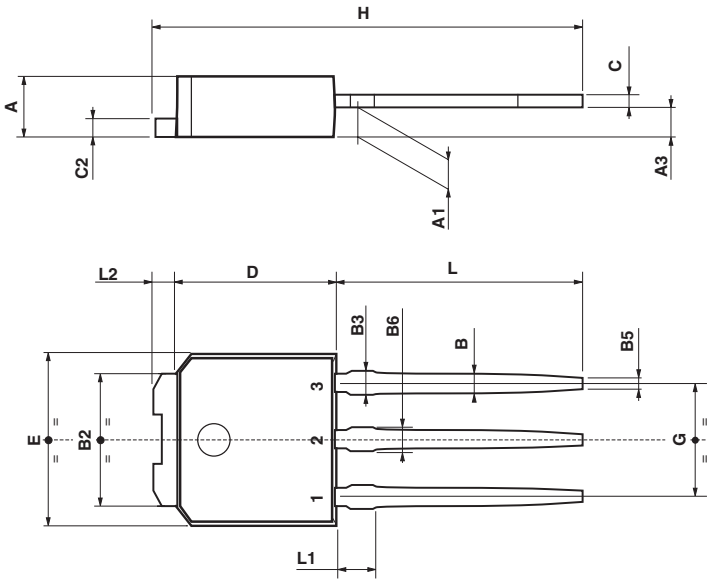
## 4 Package mechanical data

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](http://www.st.com)

Obsolete Product(s) - Obsolete Product(s)

TO-251 (IPAK) MECHANICAL DATA

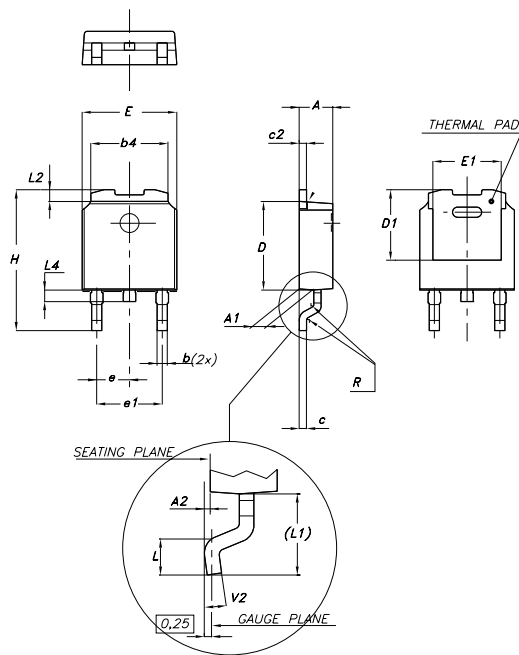
| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 2.2  |      | 2.4  | 0.086 |       | 0.094 |
| A1   | 0.9  |      | 1.1  | 0.035 |       | 0.043 |
| A3   | 0.7  |      | 1.3  | 0.027 |       | 0.051 |
| B    | 0.64 |      | 0.9  | 0.025 |       | 0.031 |
| B2   | 5.2  |      | 5.4  | 0.204 |       | 0.212 |
| B3   |      |      | 0.85 |       |       | 0.033 |
| B5   |      | 0.3  |      |       | 0.012 |       |
| B6   |      |      | 0.95 |       |       | 0.037 |
| C    | 0.45 |      | 0.6  | 0.017 |       | 0.023 |
| C2   | 0.48 |      | 0.6  | 0.019 |       | 0.023 |
| D    | 6    |      | 6.2  | 0.236 |       | 0.244 |
| E    | 6.4  |      | 6.6  | 0.252 |       | 0.260 |
| G    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| H    | 15.9 |      | 16.3 | 0.626 |       | 0.641 |
| L    | 9    |      | 9.4  | 0.354 |       | 0.370 |
| L1   | 0.8  |      | 1.2  | 0.031 |       | 0.047 |
| L2   |      | 0.8  | 1    |       | 0.031 | 0.039 |



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**DPAK MECHANICAL DATA**

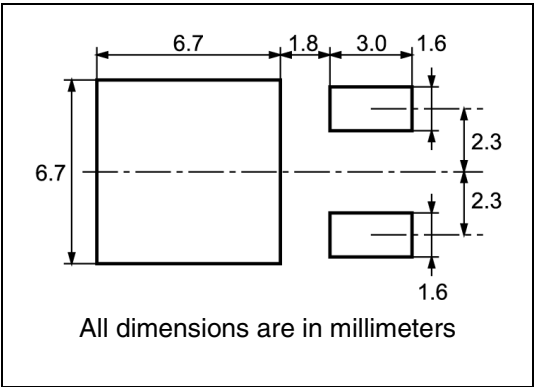
| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 2.2  |      | 2.4  | 0.086 |       | 0.094 |
| A1   | 0.9  |      | 1.1  | 0.035 |       | 0.043 |
| A2   | 0.03 |      | 0.23 | 0.001 |       | 0.009 |
| B    | 0.64 |      | 0.9  | 0.025 |       | 0.035 |
| b4   | 5.2  |      | 5.4  | 0.204 |       | 0.212 |
| C    | 0.45 |      | 0.6  | 0.017 |       | 0.023 |
| C2   | 0.48 |      | 0.6  | 0.019 |       | 0.023 |
| D    | 6    |      | 6.2  | 0.236 |       | 0.244 |
| D1   |      | 5.1  |      |       | 0.200 |       |
| E    | 6.4  |      | 6.6  | 0.252 |       | 0.260 |
| E1   |      | 4.7  |      |       | 0.185 |       |
| e    |      | 2.28 |      |       | 0.090 |       |
| e1   | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| H    | 9.35 |      | 10.1 | 0.368 |       | 0.397 |
| L    | 1    |      |      | 0.039 |       |       |
| (L1) |      | 2.8  |      |       | 0.110 |       |
| L2   |      | 0.8  |      |       | 0.031 |       |
| L4   | 0.6  |      | 1    | 0.023 |       | 0.039 |
| R    |      | 0.2  |      |       | 0.008 |       |
| V2   | 0°   |      | 8°   | 0°    |       | 8°    |



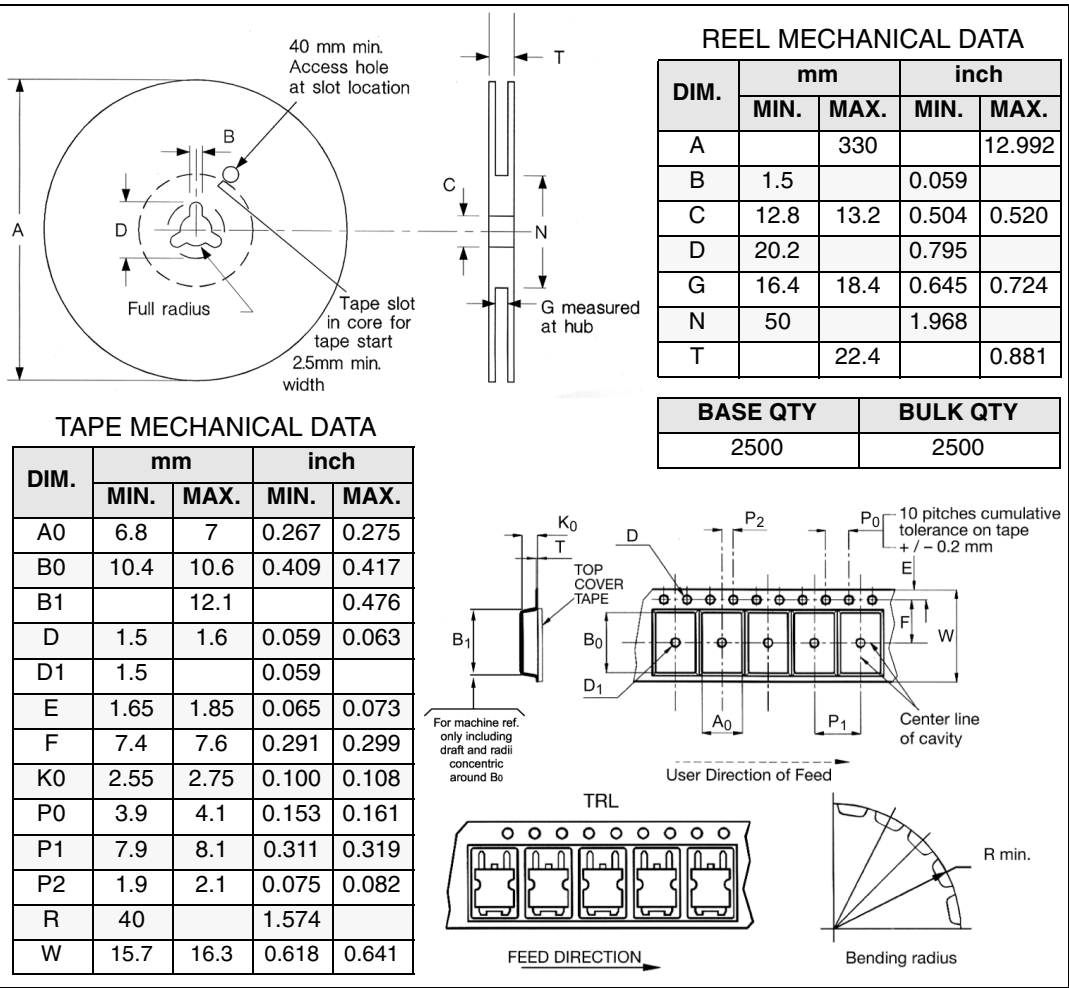
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# 5 Packaging mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT



## 6 Revision history

**Table 8. Revision history**

| Date        | Revision | Changes                          |
|-------------|----------|----------------------------------|
| 15-Sep-2005 | 1        | Initial release.                 |
| 14-Sep-2005 | 2        | Value changed on <i>Figure 1</i> |
| 08-Aug-2006 | 3        | New template, no content change  |

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