# STD100N3LF3

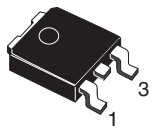
## N-channel 30 V, 0.0045 Ω, 80 A, DPAK planar STripFET™ II Power MOSFET

## Features

| Type | $V_{DSSS}$ | $R_{DS(on)}$ | $I_D$ | Pw |
|---|---|---|---|---|
| STD100N3LF3 | 30 V | <0.0055 Ω | 80 A(1) | 110 W |

1. Current limited by package

- 100% avalanche tested
- Logic level threshold




**DPAK**

## Applications

- Switching application
  - Automotive

## Description

This STripFET™ II Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance providing superior switching performance.

**Figure 1. Internal schematic diagram**

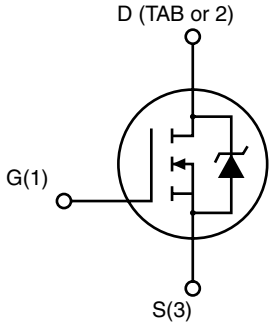



**Table 1. Device summary**

| Order codes | Marking | Package | Packaging |
|---|---|---|---|
| STD100N3LF3 | 100N3LF3 | DPAK | Tape and reel |

# Contents

# 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 | ± 20 | V |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 25 °C | 80 | A |
| $I_D$ | Drain current (continuous) at $T_C$=100 °C | 70 | A |
| $I_{DM}$ (2) | Drain current (pulsed) | 320 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 110 | W |
| | Derating factor | 0.73 | W/°C |
| dv/dt (3) | Peak diode recovery voltage slope | 3.9 | V/ns |
| $T_{stg}$ | Storage temperature | -55 to 175 | °C |
| $T_J$ | Max. operating junction temperature | | |

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

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case max | 1.36 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient max | 100 | °C/W |
| $T_l$ | Maximum lead temperature for soldering purpose | 275 | °C |

**Table 4. 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 °C, $I_D = I_{AV}$, $V_{DD}$ = 24 V) | 500 | mJ |

# 2 Electrical characteristics

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

**Table 5. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D$ = 250 µA, $V_{GS}$ = 0 | 30 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = Max rating,<br>$V_{DS}$ = Max rating @125 °C | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ±20 V | | | ±200 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$= $V_{GS}$, $I_D$ = 250 µA | 1 | | 2.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$ = 10 V, $I_D$ = 40 A<br>$V_{GS}$ = 5 V, $I_D$ = 20 A | | 0.0045<br>0.008 | 0.0055<br>0.01 | Ω<br>Ω |
| | | $V_{GS}$ = 10 V,<br>$I_D$ = 40 A @125 °C<br>$V_{GS}$ = 5 V,<br>$I_D$ = 20 A @125 °C | | 0.0068<br><br>0.0146 | | Ω<br><br>Ω |

**Table 6. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ = 10 V, $I_D$ = 15 A | - | 31 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ = 25 V, f = 1 MHz,<br>$V_{GS}$ = 0 | - | 2060<br>728<br>67 | | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$ = 24 V, $I_D$ = 80 A<br>$V_{GS}$ = 5 V<br>*Figure 16 on page 9* | - | 20<br>7<br>7.5 | 27 | nC<br>nC<br>nC |
| $R_G$ | Gate input resistance | f = 1 MHz gate DC Bias = 0<br>test signal level = 20 mV<br>open drain | - | 1.9 | | Ω |

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

**Table 7. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<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 | $V_{DD}$= 15 V, $I_D$= 40 A,<br>$R_G$=4.7Ω, $V_{GS}$=10 V<br>*Figure 15 on page 9* | - | 9<br>205<br>31<br>35 | - | ns<br>ns<br>ns<br>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 | $I_{SD}$ = 40 A, $V_{GS}$ = 0 | - | | 1.3 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 80 A,<br>di/dt = 100 A/µs,<br>$V_{DD}$ = 25 V, $T_J$ = 150 °C<br>*Figure 17 on page 9* | - | 40<br>40<br>2 | | ns<br>µC<br>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**

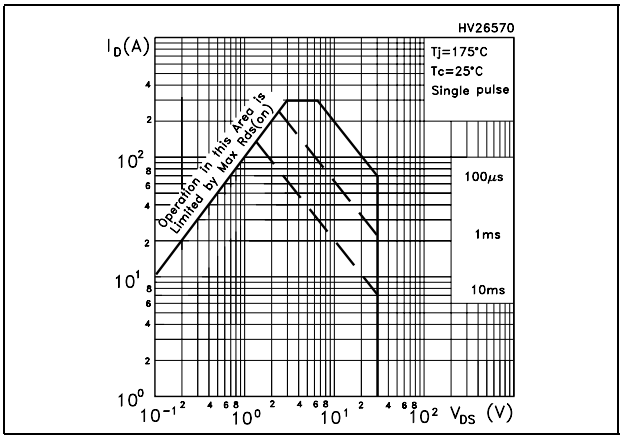



**Figure 3. Thermal impedance**

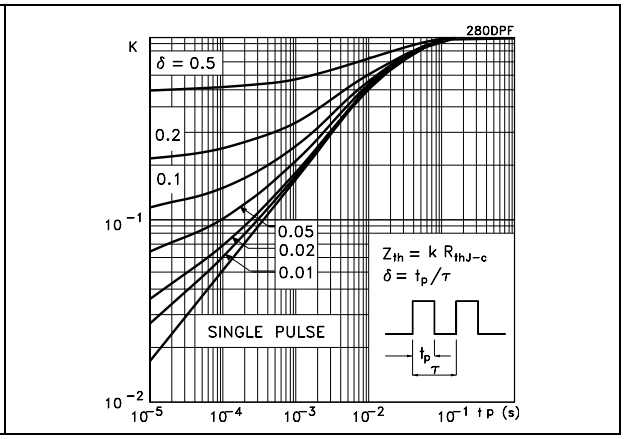



**Figure 4. Output characteristics**

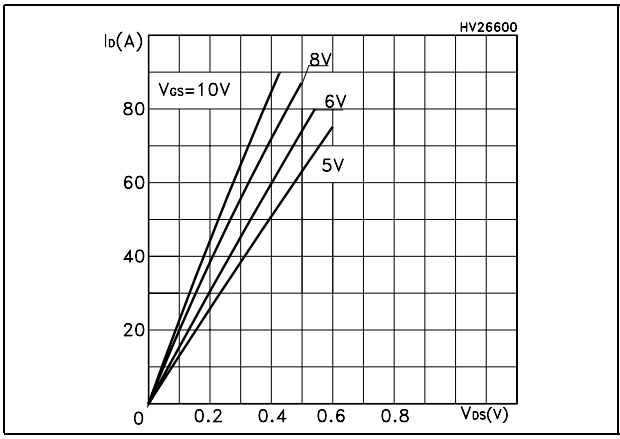



**Figure 5. Transfer characteristics**

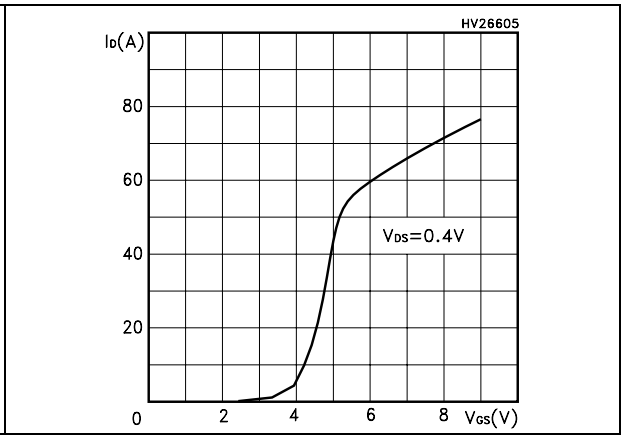



**Figure 6. Transconductance**

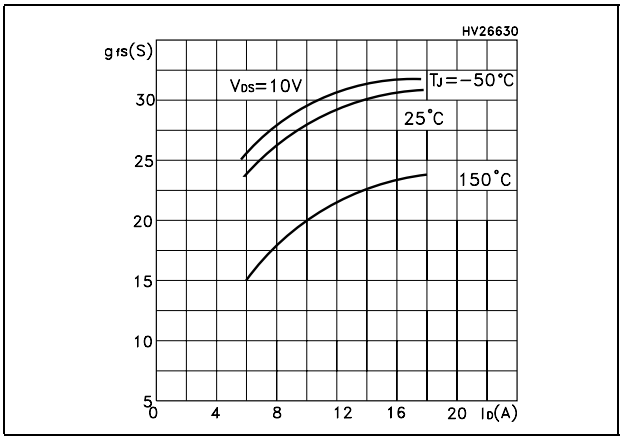



**Figure 7. Static drain-source on resistance**

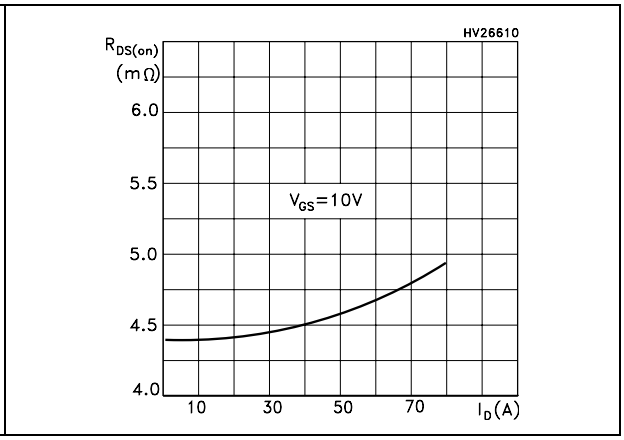


**Figure 8. Gate charge vs gate-source voltage**

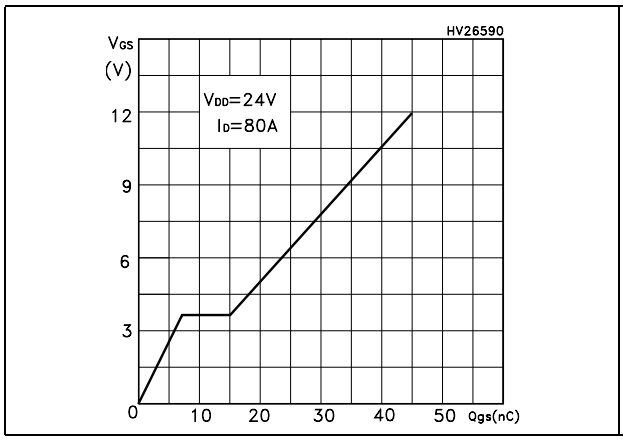



**Figure 9. Capacitance variations**

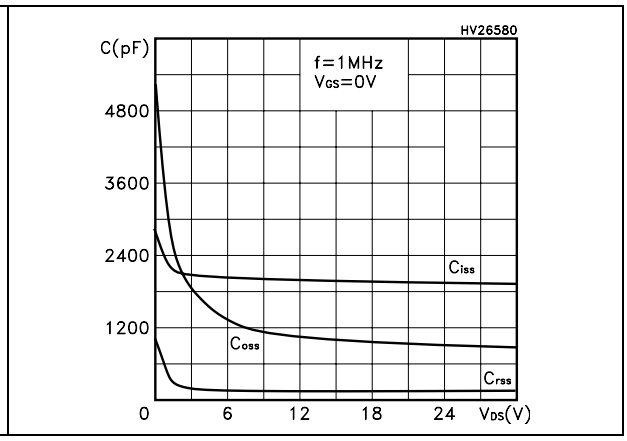



**Figure 10. Normalized gate threshold voltage vs temperature**

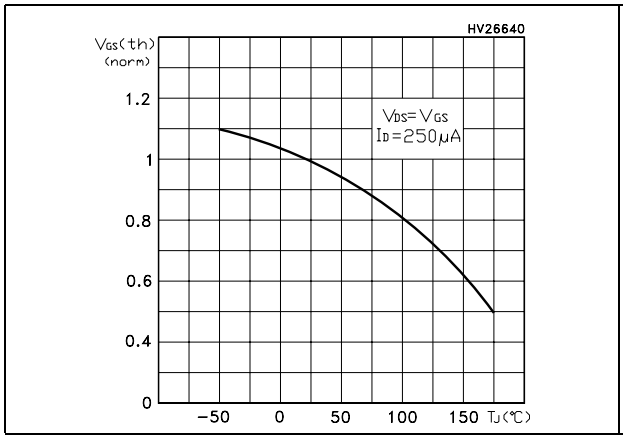



**Figure 11. Normalized $BV_{DSS}$ vs temperature**

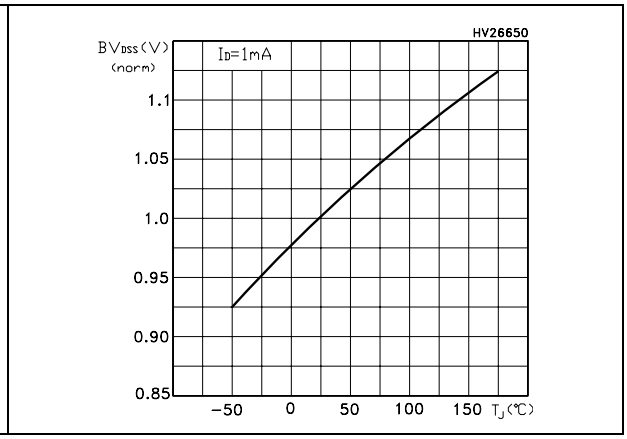



**Figure 12. Normalized on resistance vs temperature**

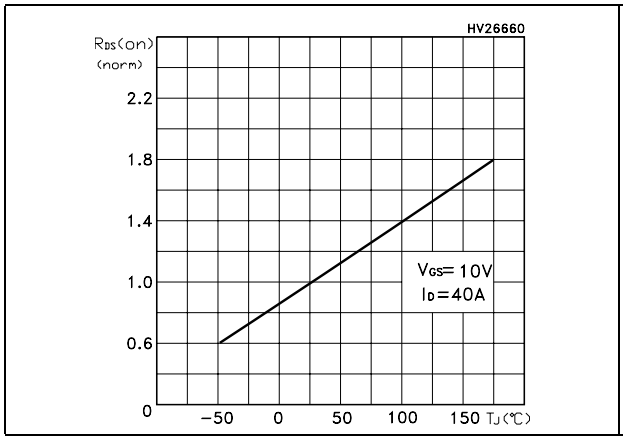



**Figure 13. Source-drain diode forward characteristics**

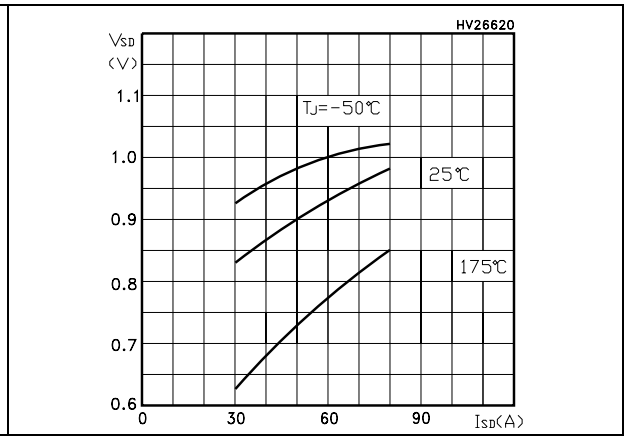
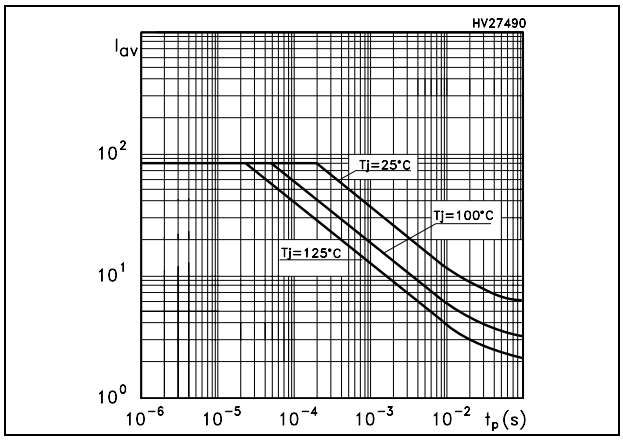


**Figure 14. Allowable Iav vs time in avalanche**




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 circuits

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

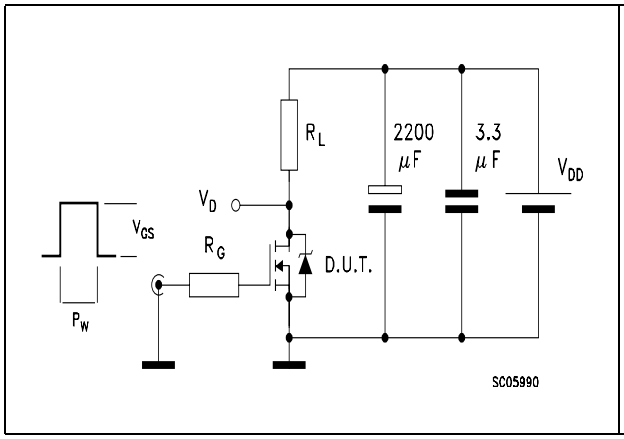



**Figure 16. Gate charge test circuit**

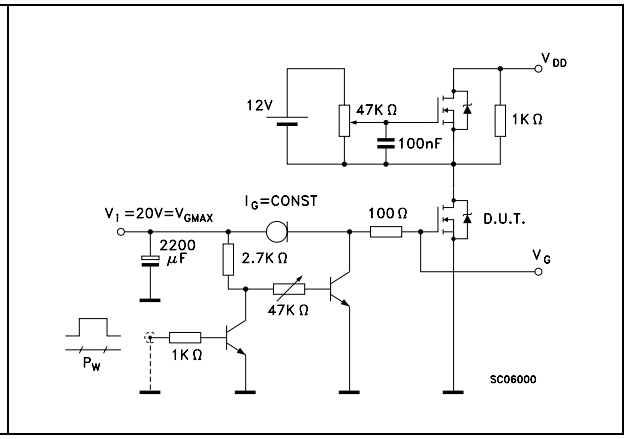
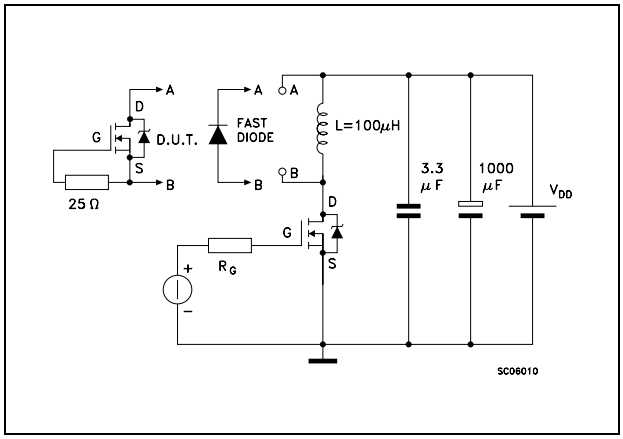



**Figure 17. Test circuit for inductive load switching and diode recovery times**

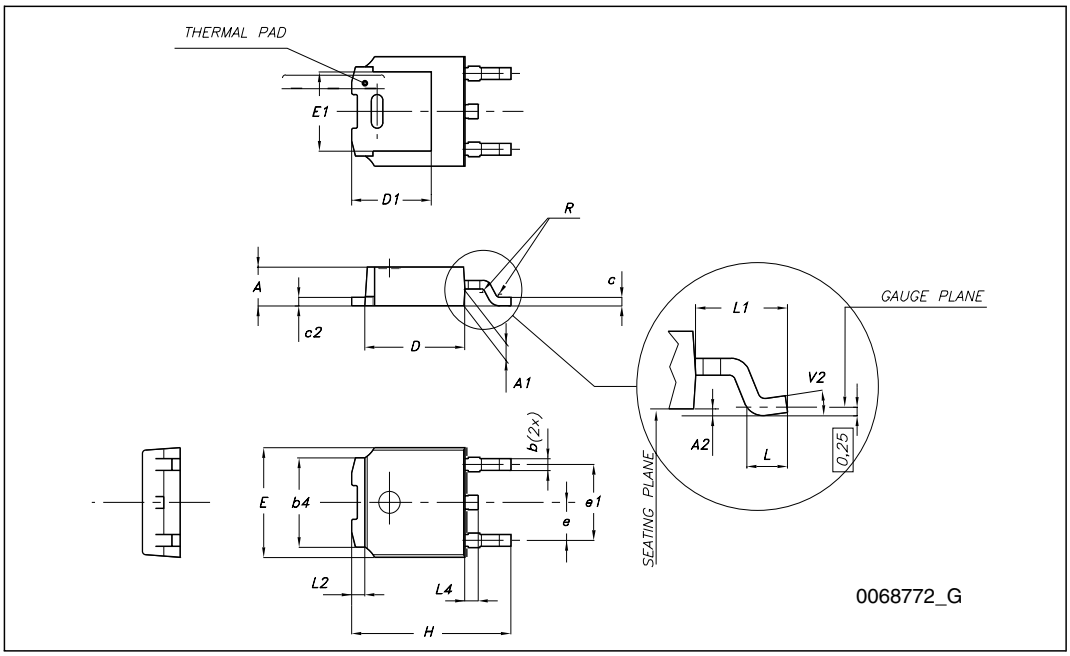


# 4 Package mechanical data

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.

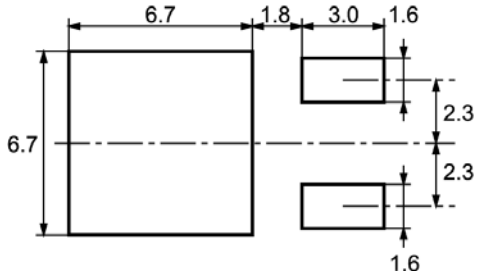
## TO-252 (DPAK) mechanical data

| 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 | | |
| L1 | | 2.80 | |
| L2 | | 0.80 | |
| L4 | 0.60 | | 1 |
| R | | 0.20 | |
| V2 | 0 ° | | 8 ° |



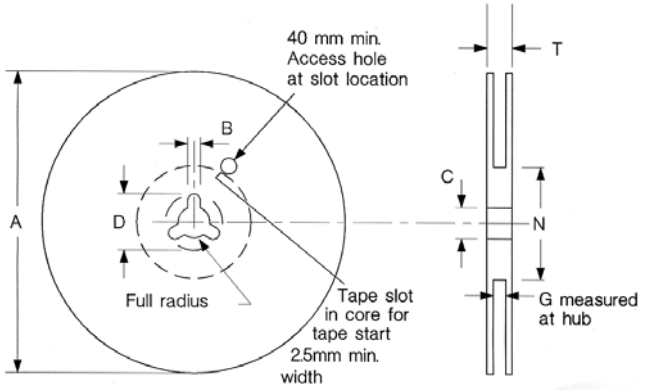
# 5 Packaging mechanical data

## DPAK FOOTPRINT




All dimensions are in millimeters

## TAPE AND REEL SHIPMENT



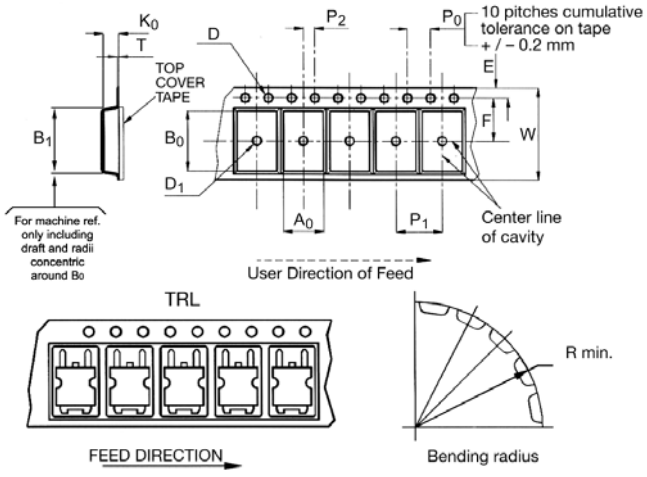

REEL MECHANICAL DATA

| DIM. | mm | | inch | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 16.4 | 18.4 | 0.645 | 0.724 |
| N | 50 | | 1.968 | |
| T | | 22.4 | | 0.881 |

| BASE QTY | BULK QTY |
|---|---|
| 2500 | 2500 |

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 6.8 | 7 | 0.267 | 0.275 |
| B0 | 10.4 | 10.6 | 0.409 | 0.417 |
| B1 | | 12.1 | | 0.476 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.5 | | 0.059 | |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 7.4 | 7.6 | 0.291 | 0.299 |
| K0 | 2.55 | 2.75 | 0.100 | 0.108 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 7.9 | 8.1 | 0.311 | 0.319 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 40 | | 1.574 | |
| W | 15.7 | 16.3 | 0.618 | 0.641 |



# 6 Revision history

**Table 9. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 07-Feb-2006 | 1 | Initial release. |
| 07-May-2009 | 2 | Added $V_{GS(th)}$ max value in *Table 5: On/off states* |
| 09-Nov-2009 | 3 | Added $V_{GS}$ parameter in *Table 2: Absolute maximum ratings* |

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