Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!


## Contact us

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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

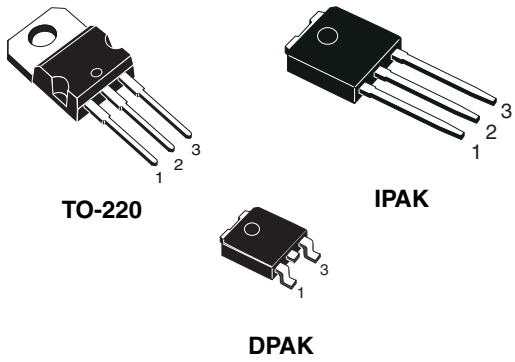
# STD2NK100Z
# STP2NK100Z - STU2NK100Z

## N-channel 1000 V, 6.25 Ω 1.85 A, TO-220, DPAK, IPAK Zener-protected SuperMESH™ Power MOSFET

## Features

| Type | $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ | $P_{TOT}$ |
|---|---|---|---|---|
| STD2NK100Z | 1000 V | < 8.5 Ω | 1.85 A | 70 W |
| STP2NK100Z | 1000 V | < 8.5 Ω | 1.85 A | 70 W |
| STU2NK100Z | 1000 V | < 8.5 Ω | 1.85 A | 70 W |

- Extremely high dv/dt capability
- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitances
- Very good manufacturing repeatability




## Application

- Switching applications

## Description

The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, specialties is taken to ensure a very good dv/dt capability for the most demanding application. Such series complements ST full range of high voltage Power MOSFETs.

**Figure 1. Internal schematic diagram**

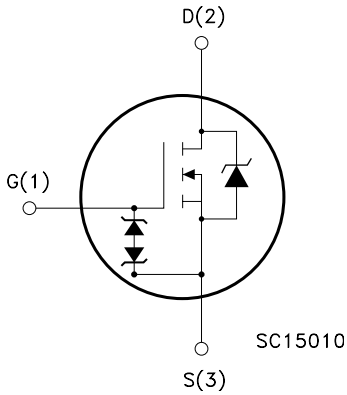



**Table 1. Device summary**

| Order codes | Marking | Package | Packaging |
|---|---|---|---|
| STD2NK100Z | 2NK100Z | DPAK | Tape and reel |
| STP2NK100Z | 2NK100Z | TO-220 | Tube |
| STU2NK100Z | 2NK100Z | IPAK | Tube |

# Contents

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 1000 | V |
| $V_{GS}$ | Gate-source voltage | ± 30 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 1.85 | A |
| $I_D$ | Drain current (continuous) at $T_C$ = 100 °C | 1.16 | A |
| $I_{DM}$ (1) | Drain current (pulsed) | 7.4 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 70 | W |
| | Derating factor | 0.56 | W/°C |
| $V_{ESD(G-S)}$ | G-S ESD (HBM C=100 pF, R=1.5 kΩ) | 3000 | V |
| dv/dt (2) | Peak diode recovery voltage slope | 2.5 | V/ns |
| $T_j$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature | -55 to 150 | °C |

1. Pulse width limited by safe operating area
2. $I_{SD}$ ≤1.85 A, di/dt ≤ 200 A/µs, $V_{DD}$ = 80% $V_{(BR)DSS}$

**Table 3. Thermal data**

| Symbol | Parameter | Value | | | Unit |
|---|---|---|---|---|---|
| | | TO-220 | IPAK | DPAK | |
| $R_{thj\text{-}case}$ | Thermal resistance junction-case max | 1.79 | | | °C/W |
| $R_{thj\text{-}pcb}$ | Thermal resistance junction-pcb minimum footprint | -- | -- | 50 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-amb max | 62.5 | 100 | | °C/W |
| $T_l$ | Maximum lead temperature for soldering purpose | 300 | | | °C |

**Table 4. Avalanche data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$ (1) | Avalanche current, repetitive or not-repetitive | 1.85 | A |
| $E_{AS}$ (2) | Single pulse avalanche energy | 170 | mJ |

1. Pulse width limited by Tjmax
2. Starting Tj = 25°C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50V

# 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 | $I_D$ = 1 mA, $V_{GS}$= 0 | 1000 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = Max rating,<br>$V_{DS}$ = Max rating,Tc=125 °C | | | 1<br>50 | µA<br>µA |
| $I_{GSS}$ | Gate body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ± 30 V | | | ±10 | µA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$= $V_{GS}$, $I_D$ = 50 µA | 3 | 3.75 | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$= 10 V, $I_D$= 0.9 A | | 6.25 | 8.5 | Ω |

**Table 6. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ =15 V, $I_D$ = 0.9 A | | 2.4 | | 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, $V_{GS}$=0 | | 499<br>53<br>9 | | pF<br>pF<br>pF |
| $C_{oss\ eq.}$ (2) | Equivalent output capacitance | $V_{GS}$ =0, $V_{DS}$ =0 to 800 V | | 28 | | pF |
| $R_G$ | Gate input resistance | f=1 MHz, open drain | | 6.6 | | Ω |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$=800 V, $I_D$ = 1.85 A<br>$V_{GS}$ =10 V<br>*(see Figure 17)* | | 16<br>3<br>9 | | nC<br>nC<br>nC |

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5%
2. $C_{oss\ eq.}$ is defined as constant equivalent capacitance giving the same charging time as $C_{oss}$ when $V_{DS}$ increases from 0 to 80% $V_{DSS}$

**Table 7. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$ | Turn-on delay time<br>Rise time | $V_{DD}$= 500 V, $I_D$= 0.9 A,<br>$R_G$=4.7 Ω, $V_{GS}$=10 V<br>*(see Figure 16)* | | 7.2<br>6.5 | | ns<br>ns |
| $t_{d(off)}$<br>$t_r$ | Turn-off delay time<br>Fall time | | | 41.5<br>32.5 | | ns<br>ns |

**Table 8. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$ (1) | Source-drain current<br>Source-drain current (pulsed) | | | | 1.85<br>7.4 | A<br>A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$= 1.85 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 | $I_{SD}$= 1.85 A, di/dt= 100 A/µs,<br>$V_{DD}$= 60 V<br>*(see Figure 21)* | | 476<br>1.6<br>6.9 | | ns<br>µC<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$= 1.85 A, di/dt= 100 A/µs,<br>$V_{DD}$= 60 V, Tj=150 °C<br>*(see Figure 21)* | | 532<br>1.9<br>88 | | ns<br>µC<br>A |

1. Pulse width limited by package
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

**Table 9. Gate-source zener diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{GSO}$ (1) | Gate-source breakdown voltage | $I_{GS}$ = ±1mA (open drain) | 30 | | | V |

1. The built in back-to-back zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated zener diodes thus avoid the usage of external components.

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area for TO-220**

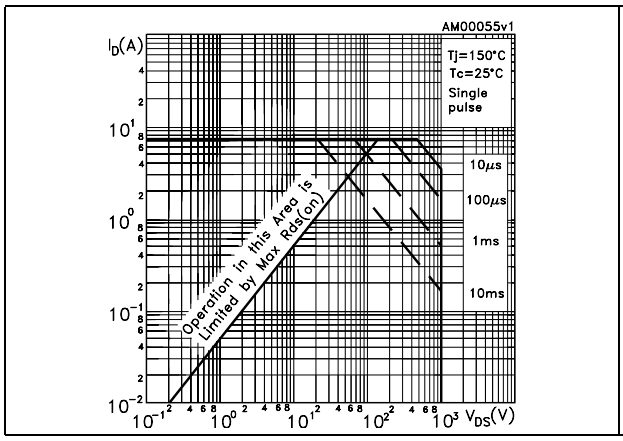



**Figure 3. Thermal impedance for TO-220**

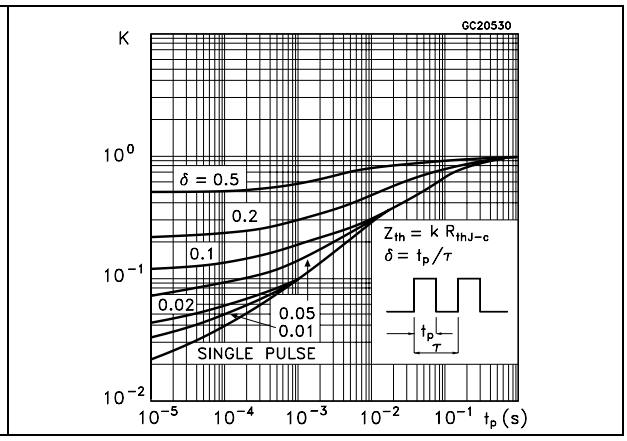



**Figure 4. Safe operating area for DPAK, IPAK**

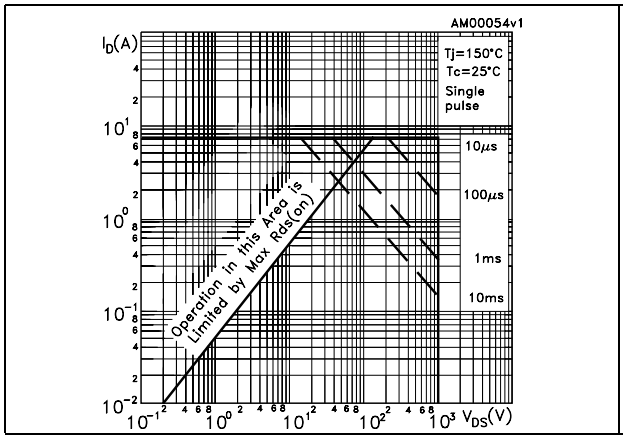



**Figure 5. Thermal impedance for DPAK, IPAK**

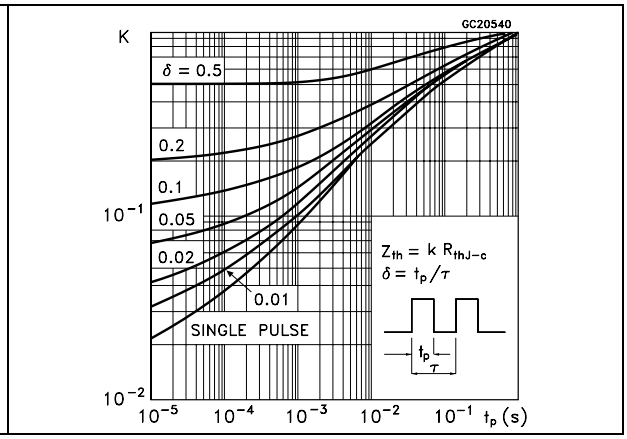



**Figure 6. Output characteristics**

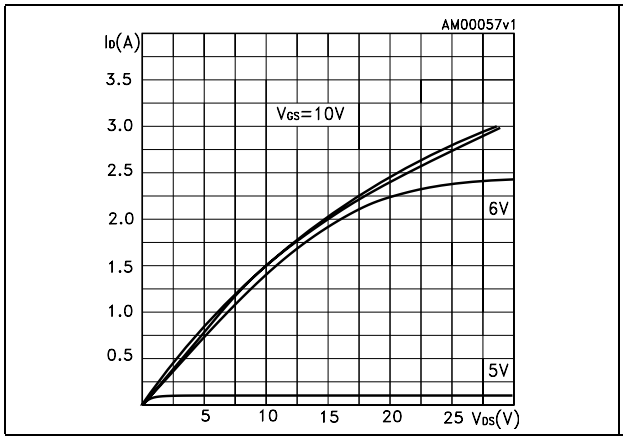



**Figure 7. Transfer characteristics**

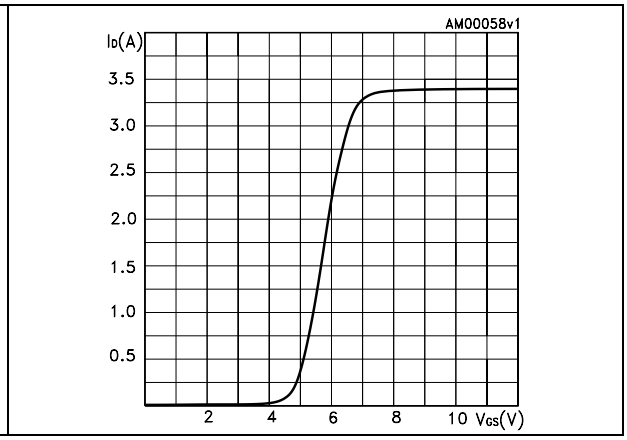


**Figure 8. Normalized $B_{VDSS}$ vs temperature**

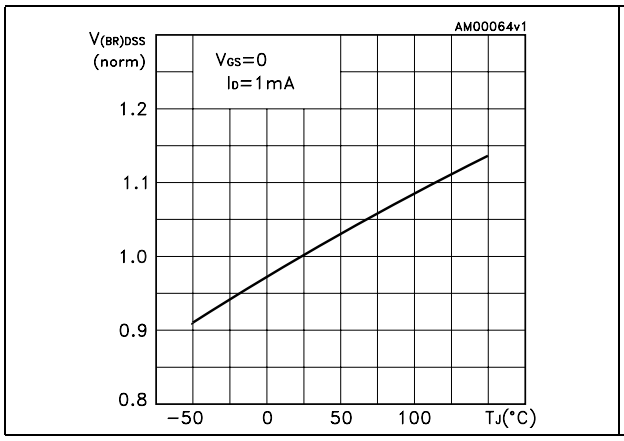



**Figure 9. Static drain-source on resistance**

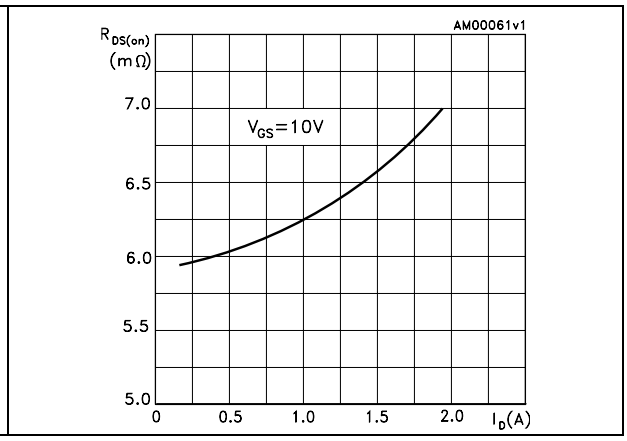



**Figure 10. Gate charge vs gate-source voltage**

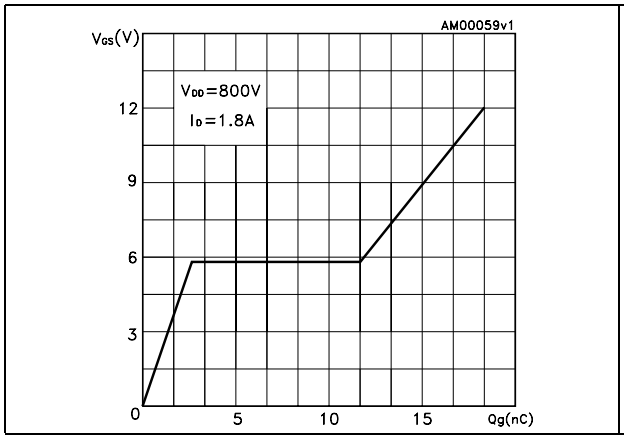



**Figure 11. Capacitance variations**

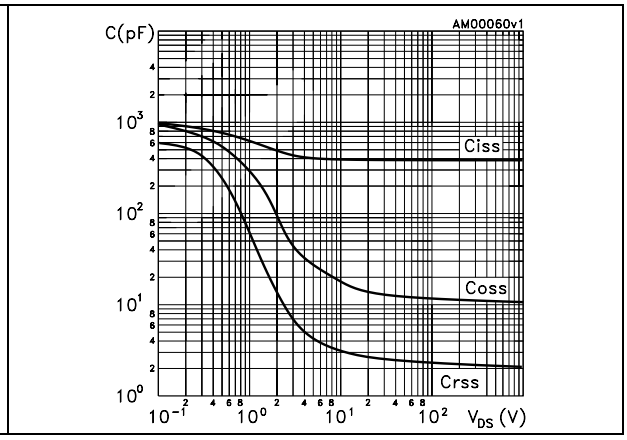



**Figure 12. Normalized gate threshold voltage vs temperature**

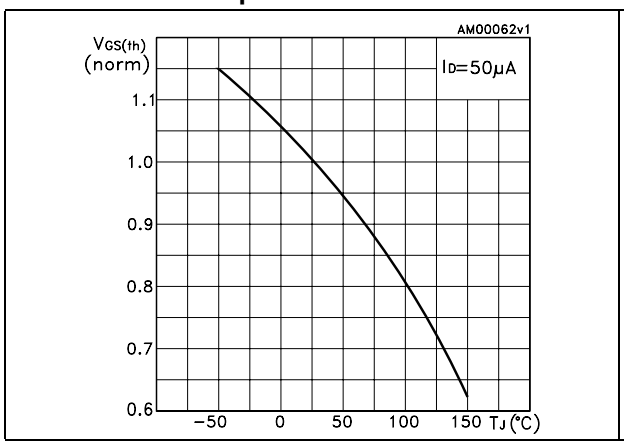



**Figure 13. Normalized on resistance vs temperature**

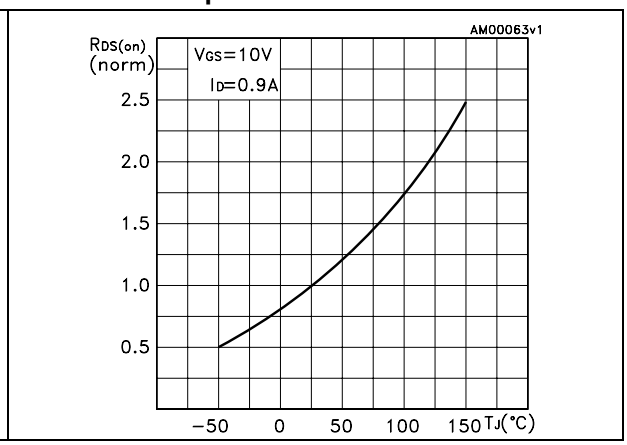


**Figure 14. Source-drain diode forward characteristics**

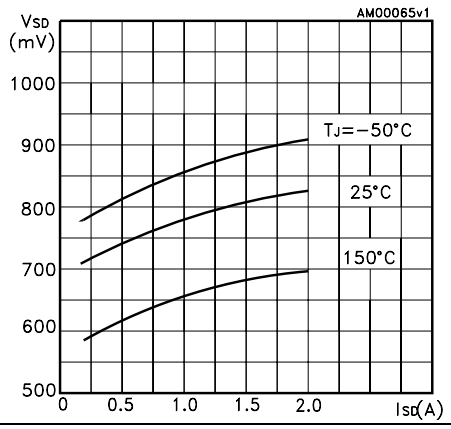
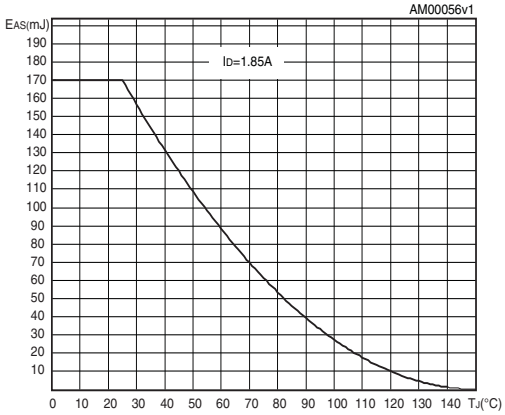



**Figure 15. Maximum avalanche energy vs temperature**



# 3 Test circuits

**Figure 16. Switching times test circuit for resistive load**

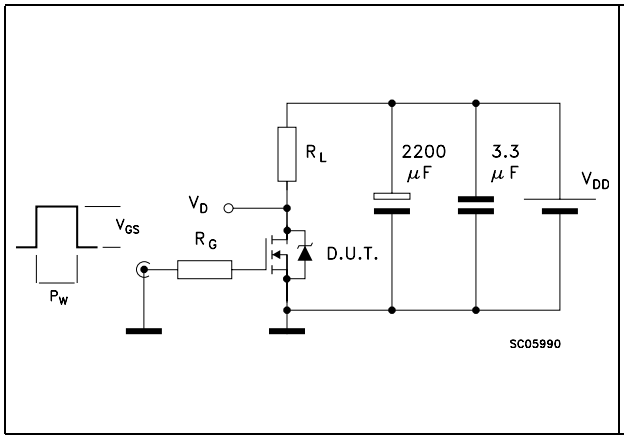



**Figure 17. Gate charge test circuit**

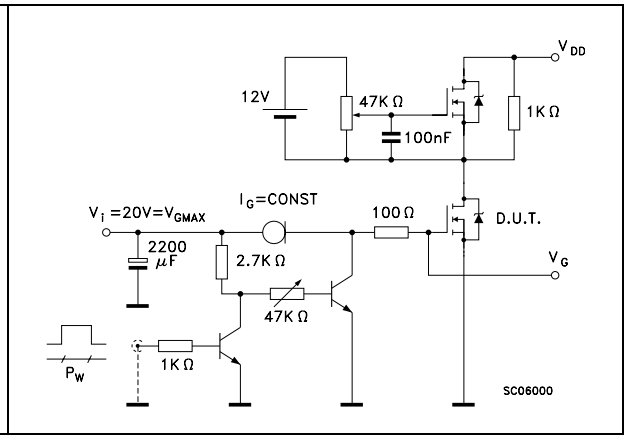



**Figure 18. Test circuit for inductive load switching and diode recovery times**

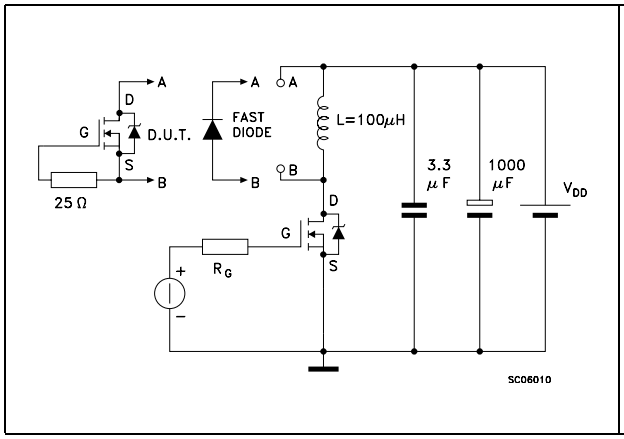



**Figure 19. Unclamped inductive load test circuit**

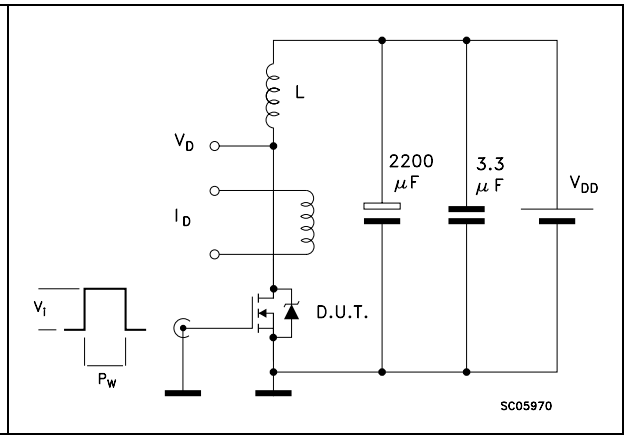



**Figure 20. Unclamped inductive waveform**

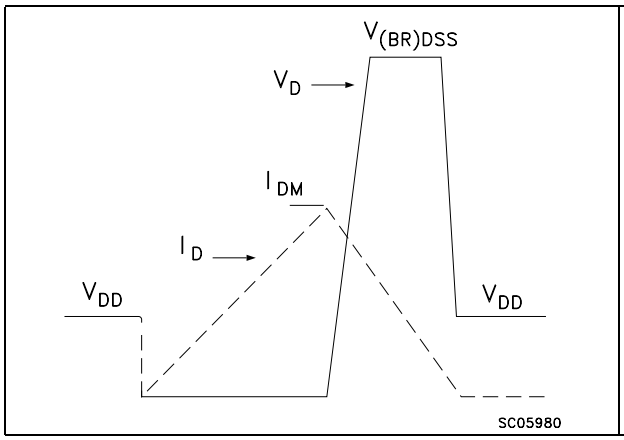
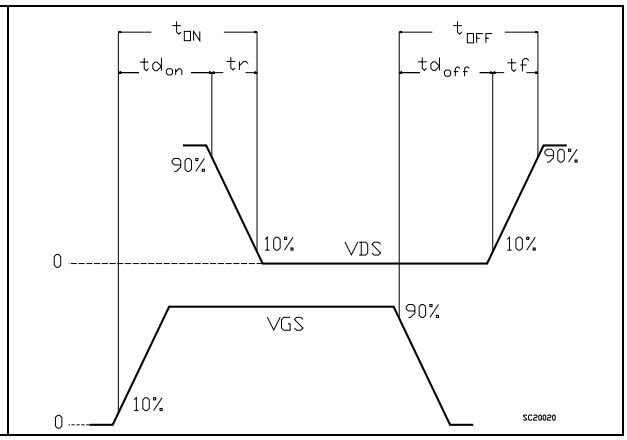



**Figure 21. Switching time waveform**

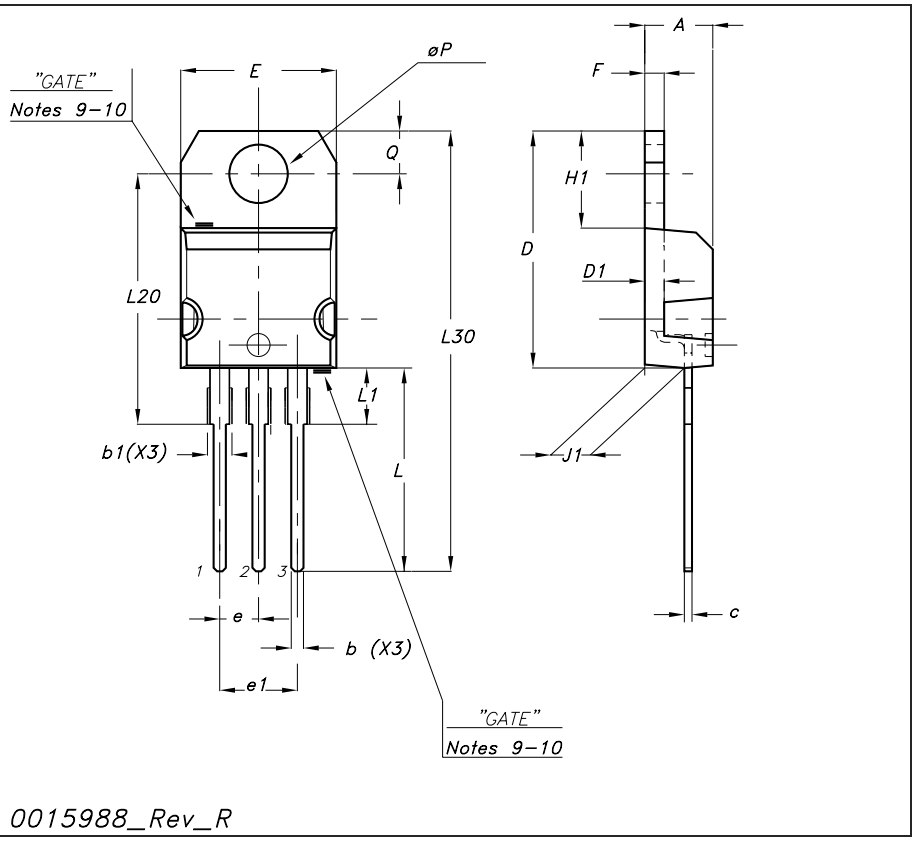


# 4 Package mechanical data

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*

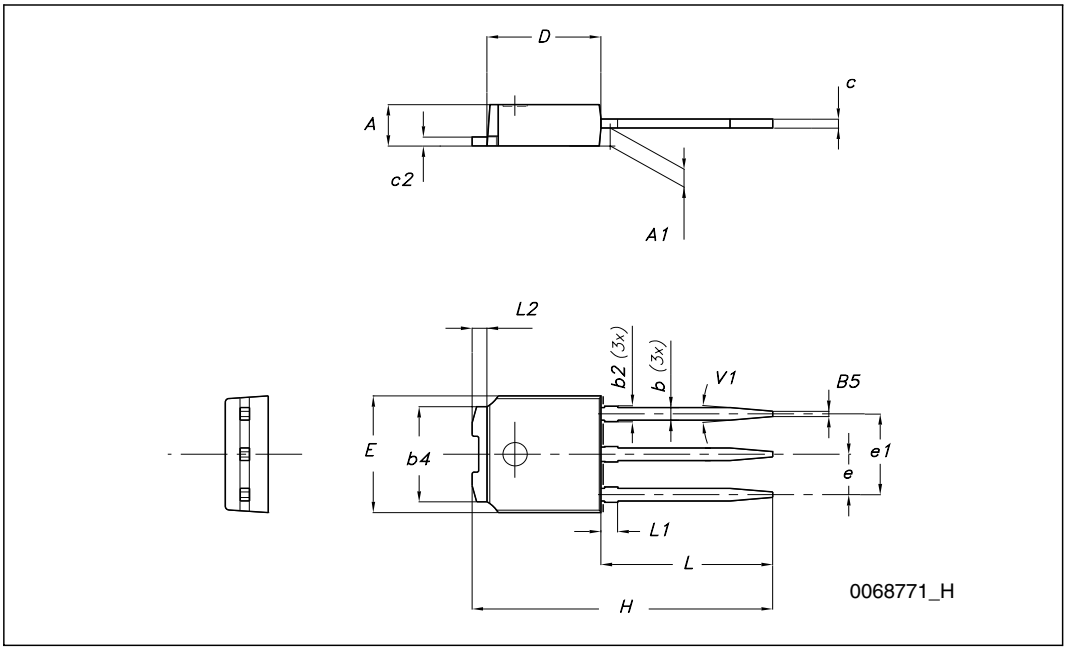
## TO-220 mechanical data

| Dim | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.48 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.6 | | 0.62 |
| D1 | | 1.27 | | | 0.050 | |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| F | 1.23 | | 1.32 | 0.048 | | 0.051 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| ∅P | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



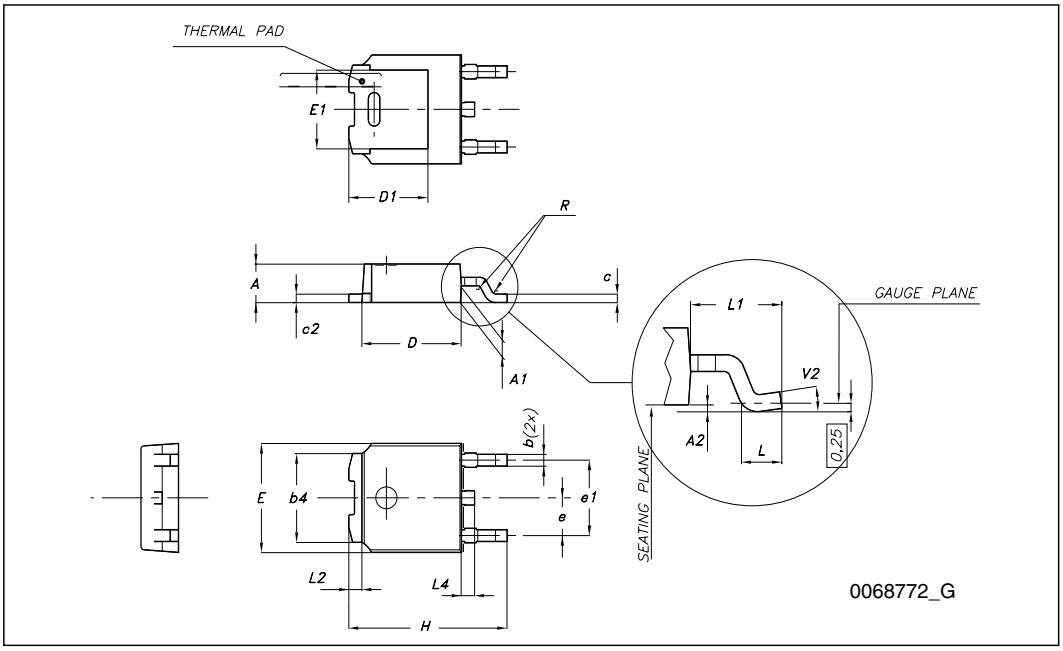
## TO-251 (IPAK) mechanical data

| DIM. | mm. | | |
|---|---|---|---|
| | min. | typ | max. |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| b | 0.64 | | 0.90 |
| b2 | | | 0.95 |
| b4 | 5.20 | | 5.40 |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| E | 6.40 | | 6.60 |
| e | | 2.28 | |
| e1 | 4.40 | | 4.60 |
| H | | 16.10 | |
| L | 9.00 | | 9.40 |
| (L1) | 0.80 | | 1.20 |
| L2 | | 0.80 | |
| V1 | | 10 ° | |



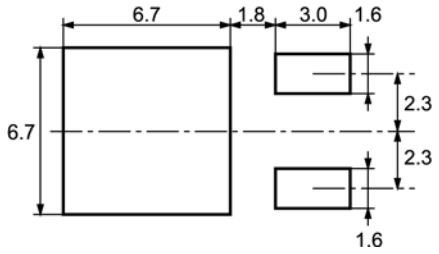
## TO-252 (DPAK) mechanical data

| 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 ° |



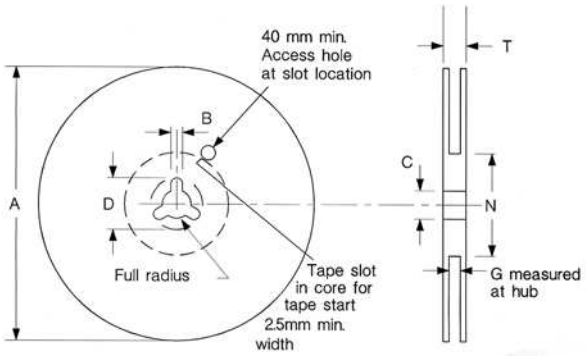
# 5 Packaging mechanical data

### DPAK FOOTPRINT




All dimensions are in millimeters

### TAPE AND REEL SHIPMENT



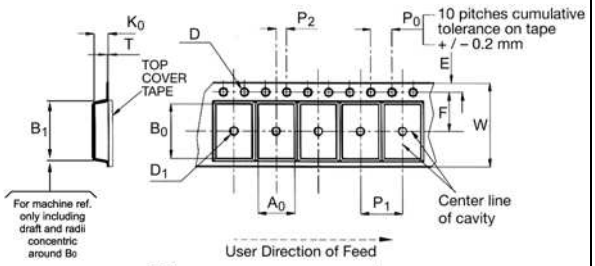

REEL MECHANICAL DATA

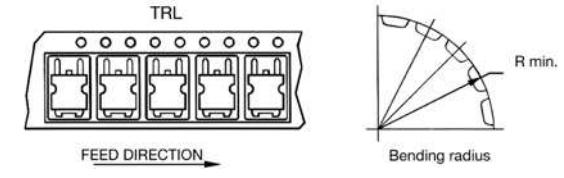
| DIM. | mm | | inch | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 16.4 | 18.4 | 0.645 | 0.724 |
| N | 50 | | 1.968 | |
| T | | 22.4 | | 0.881 |

| 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 10. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 24-Oct-2007 | 1 | First release |
| 18-Jun-2008 | 2 | – Inserted new package, mechanical data IPAK<br>– Document status promoted from preliminary data to datasheet. |