查询STD1LNK60Z-1供应商 捷多邦，专业PCB打样工厂，24小时加急出货

# STD1LNK60Z-1
# STQ1NK60ZR - STN1NK60Z

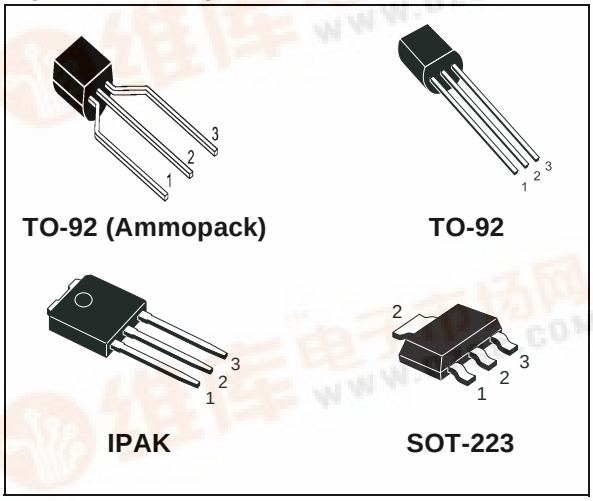
## N-CHANNEL 600V 13Ω 0.8A TO-92/IPAK/SOT-223
## Zener-Protected SuperMESH™MOSFET

**Table 1: General Features**

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ | Pw |
|---|---|---|---|---|
| STQ1NK60ZR | 600 V | < 15 Ω | 0.3 A | 3 W |
| STD1LNK60Z-1 | 600 V | < 15 Ω | 0.8 A | 25 W |
| STN1NK60Z | 600 V | < 15 Ω | 0.3 A | 3.3 W |

- TYPICAL $R_{DS}(on)$ = 13Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- ESD IMPROVED CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

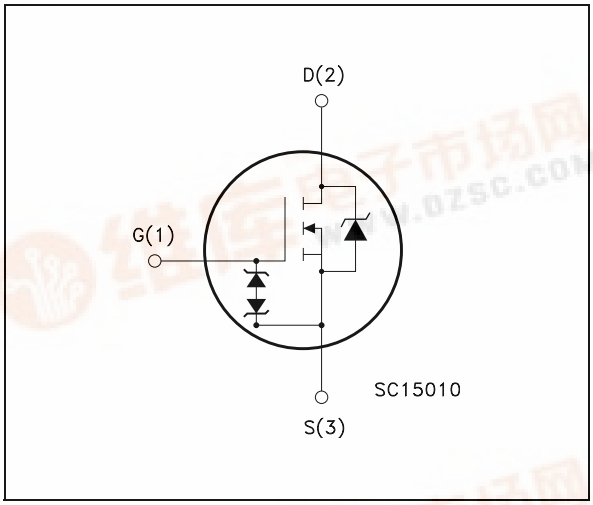
**Figure 1: Package**




### 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, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage MOSFETs including revolutionary MDmesh™ products.

**Figure 2: Internal Schematic Diagram**




### APPLICATIONS

- AC ADAPTORS AND BATTERY CHARGERS
- SWITH MODE POWER SUPPLIES (SMPS)

**Table 2: Order Codes**

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|---|---|---|---|
| STQ1NK60ZR | Q1NK60ZR | TO-92 | BULK |
| STQ1NK60ZR-AP | Q1NK60ZR | TO-92 | AMMOPAK |
| STD1LNK60Z-1 | D1LNK60Z | IPAK | TUBE |
| STN1NK60Z | N1NK60Z | SOT-223 | TAPE & REEL |



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**Table 3: Absolute Maximum ratings**

| Symbol | Parameter | Value | | | Unit |
|---|---|---|---|---|---|
| | | IPAK | TO-92 | SOT-223 | |
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 600 | | | V |
| $V_{DGR}$ | Drain-gate Voltage ($R_{GS}$ = 20 kΩ) | 600 | | | V |
| $V_{GS}$ | Gate- source Voltage | ± 30 | | | V |
| $I_D$ | Drain Current (continuous) at $T_C$ = 25°C | 0.8 | 0.3 | 0.3 | A |
| $I_D$ | Drain Current (continuous) at $T_C$ = 100°C | 0.5 | 0.189 | 0.189 | A |
| $I_{DM}$ (•) | Drain Current (pulsed) | 3.2 | 1.2 | 1.2 | A |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C | 25 | 3 | 3.3 | W |
| | Derating Factor | 0.24 | 0.025 | 0.026 | W/°C |
| $V_{ESD(G-S)}$ | Gate source ESD(HBM-C=100pF, R=1.5KΩ) | 800 | | | V |
| dv/dt (1) | Peak Diode Recovery voltage slope | 4.5 | | | V/ns |
| $T_j$<br>$T_{stg}$ | Operating Junction Temperature<br>Storage Temperature | -55 to 150 | | | °C |

(•) Pulse width limited by safe operating area
(1) $I_{SD}$ ≤0.3A, di/dt ≤200A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_j$ ≤ $T_{JMAX}$.

**Table 4: Thermal Data**

| | | IPAK | TO-92 | SOT-223 | |
|---|---|---|---|---|---|
| Rthj-case | Thermal Resistance Junction-case Max | 5 | -- | -- | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 100 | 120 | 37.87(#) | °C/W |
| Rthj-lead | Thermal Resistance Junction-lead Max | -- | 40 | -- | °C/W |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | 275 | 260 | 260 | °C |

(#) When mounted on 1 inch² Fr-4 board, 2 Oz Cu

**Table 5: Avalanche Characteristics**

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max) | 0.8 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | 60 | mJ |

**Table 6: Gate-Source Zener Diode**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{GSO}$ | Gate-Source Breakdown Voltage | Igs=± 1mA (Open Drain) | 30 | | | V |

**PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES**

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.

**ELECTRICAL CHARACTERISTICS** ($T_{CASE}$ =25°C UNLESS OTHERWISE SPECIFIED)

**Table 7: On /Off**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D$ = 1 mA, $V_{GS}$ = 0 | 600 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating, $T_C$ = 125 °C | | | 1<br>50 | µA<br>µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ± 20V | | | ±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 | $V_{GS}$ = 10V, $I_D$ = 0.4 A | | 13 | 15 | Ω |

**Table 8: Dynamic**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward Transconductance | $V_{DS}$ = V, $I_D$ = 0.4 A | | 0.5 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | | 94<br>17.6<br>2.8 | | pF<br>pF<br>pF |
| $C_{oss\ eq.}$ (3) | Equivalent Output Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 480V | | 11 | | 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 | $V_{DD}$ = 300V, $I_D$ = 0.4 A<br>$R_G$ = 4.7Ω $V_{GS}$ = 10 V<br>(see Figure 21) | | 5.5<br>5<br>13<br>28 | | 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 | $V_{DD}$ = 480V, $I_D$ = 0.8 A,<br>$V_{GS}$ = 10V<br>(see Figure 25) | | 4.9<br>1<br>2.7 | 6.9 | nC<br>nC<br>nC |

**Table 9: Source Drain Diode**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$ (2) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 0.8<br>2.4 | A<br>A |
| $V_{SD}$ (1) | Forward On Voltage | $I_{SD}$ = 0.8A, $V_{GS}$ = 0 | | | 1.6 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD}$ = 0.8 A, di/dt = 100A/µs<br>$V_{DD}$ = 20V, $T_j$ = 25°C<br>(see Figure 23) | | 135<br>216<br>3.2 | | ns<br>nC<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD}$ = 0.8 A, di/dt = 100A/µs<br>$V_{DD}$ = 20V, $T_j$ = 150°C<br>(see Figure 23) | | 140<br>224<br>3.2 | | ns<br>nC<br>A |

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
2. Pulse width limited by safe operating area.
3. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as $C_{oss}$ when $V_{DS}$ increases from 0 to 80% $V_{DSS}$.

**Figure 3: Safe Operating Area for IPAK**

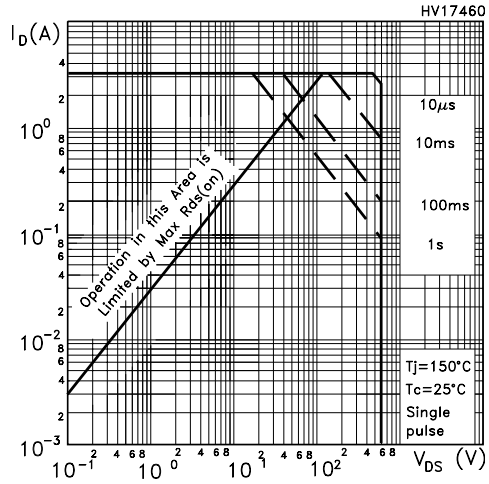



**Figure 4: Safe Operating Area for TO-92**

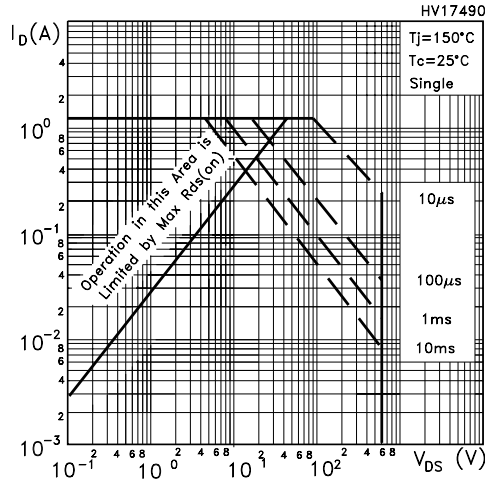



**Figure 5: Safe Operating Area for SOT-223**

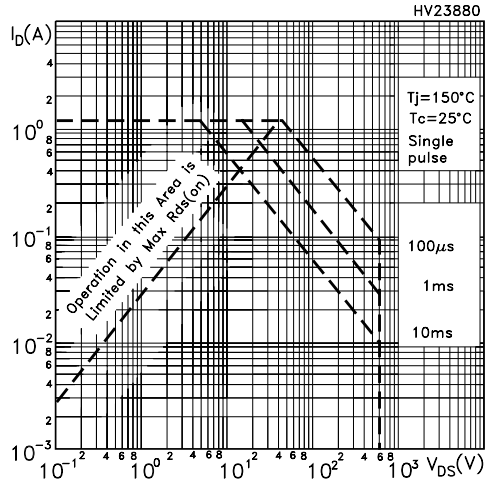



**Figure 6: Thermal Impedance for IPAK**

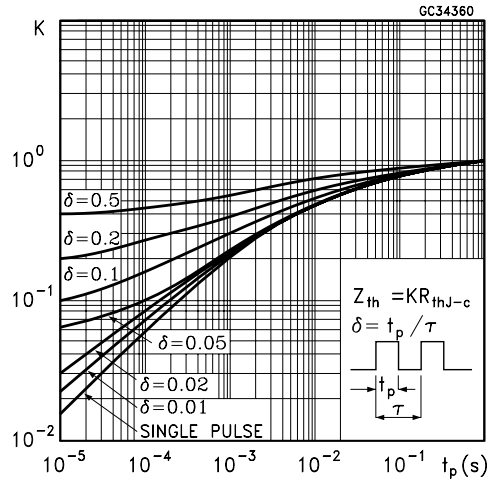



**Figure 7: Thermal Impedance for TO-92**

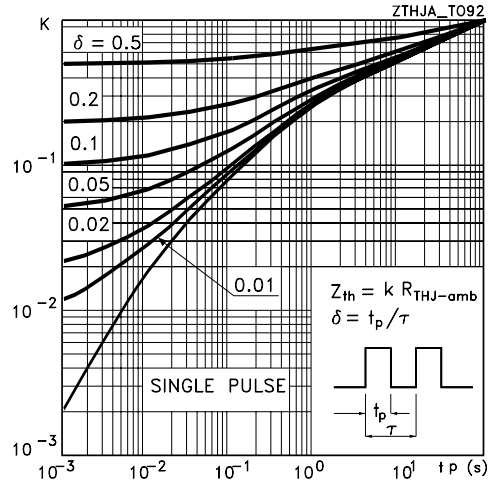



**Figure 8: Thermal Impedance for SOT-223**

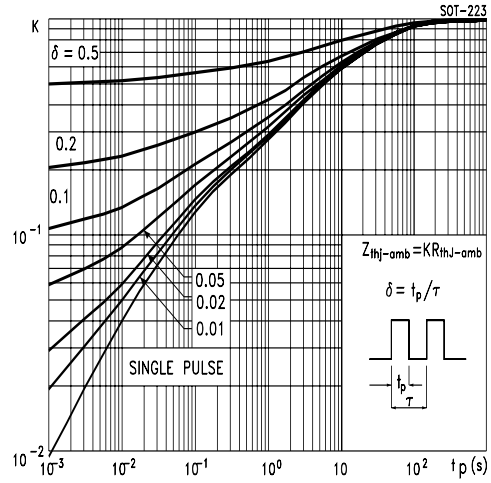


**Figure 9: Output Characteristics**

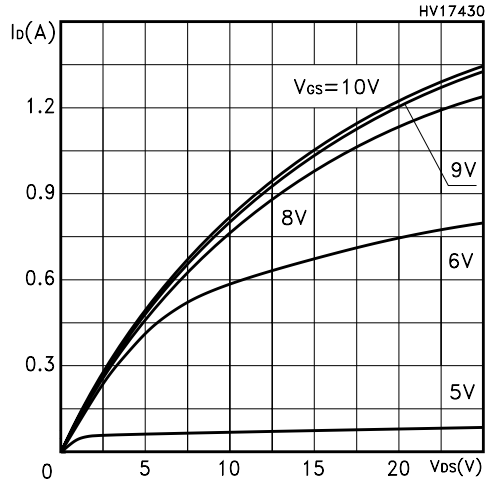



**Figure 10: Transconductance**

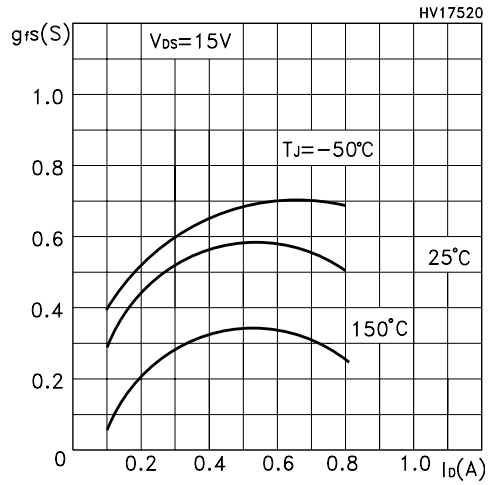



**Figure 11: Gate Charge vs Gate-source Voltage**

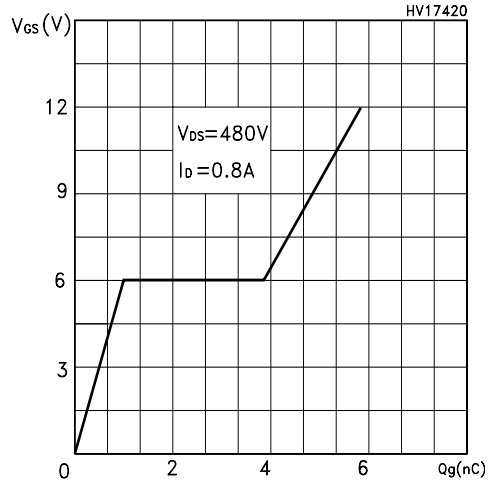



**Figure 12: Transfer Characteristics**

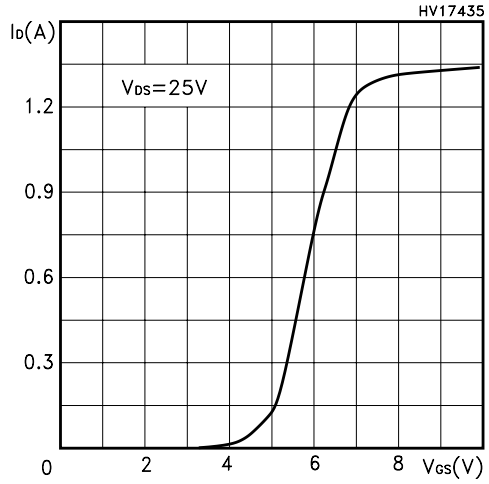



**Figure 13: Statis Drain-Source On Resistance**

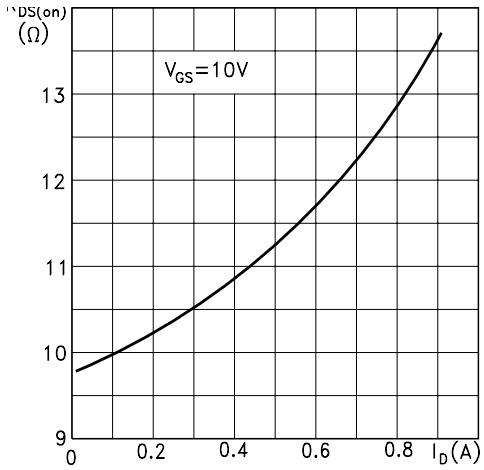



**Figure 14: Capacitance Variation**

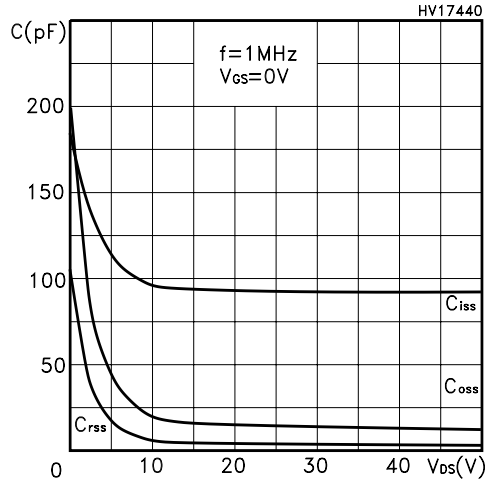


**Figure 15: Normalized Gate Thereshold Voltage vs Temperature**

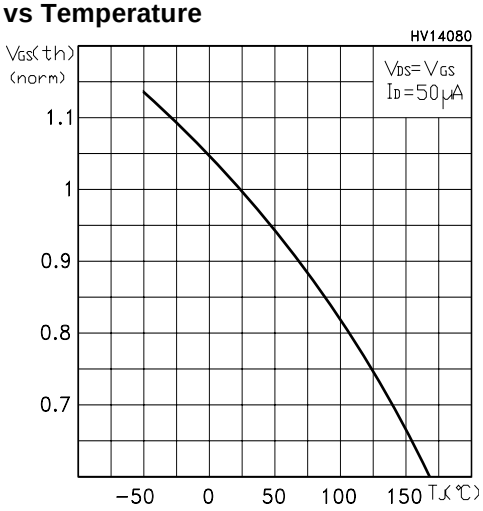



**Figure 16: Source-Drain Diode Forward Characteristics**

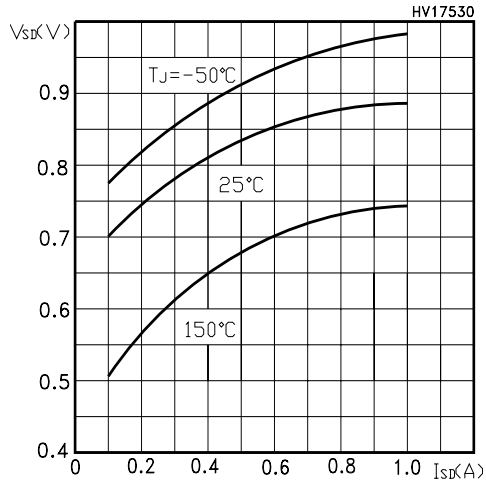



**Figure 17: Maximum Avalanche Energy vs Temperature**

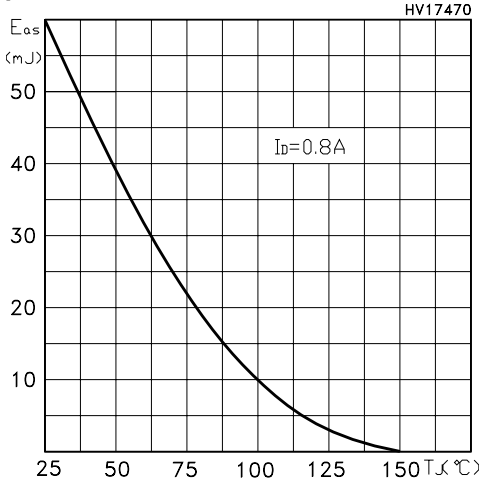



**Figure 18: Normalized On Resistance vs Temperature**

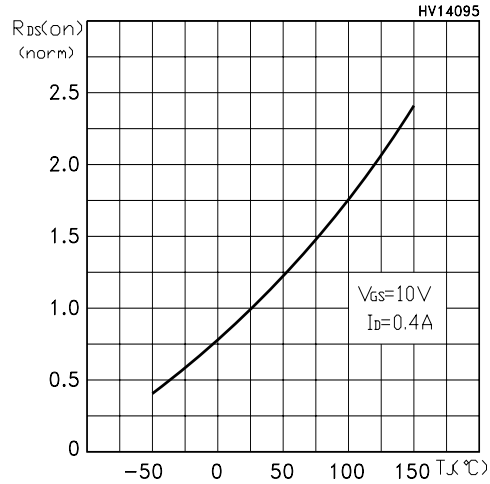



**Figure 19: Normalized BVdss vs Temperature**

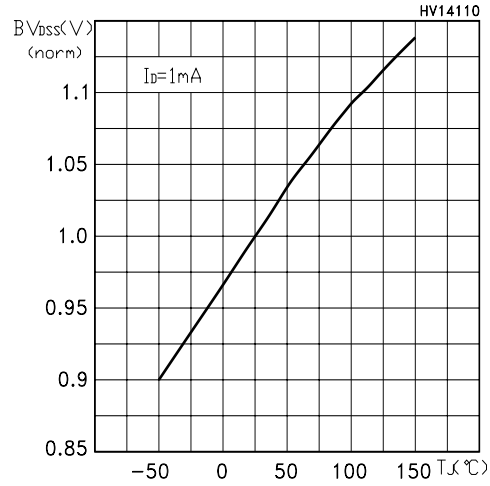



**Figure 20: Max Id Current vs Tc**

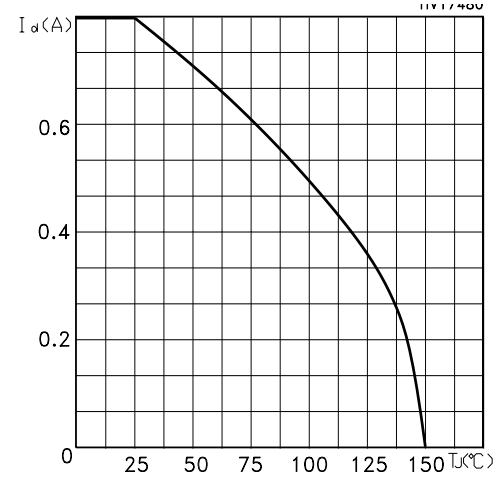


**Figure 21: Unclamped Inductive Load Test Circuit**

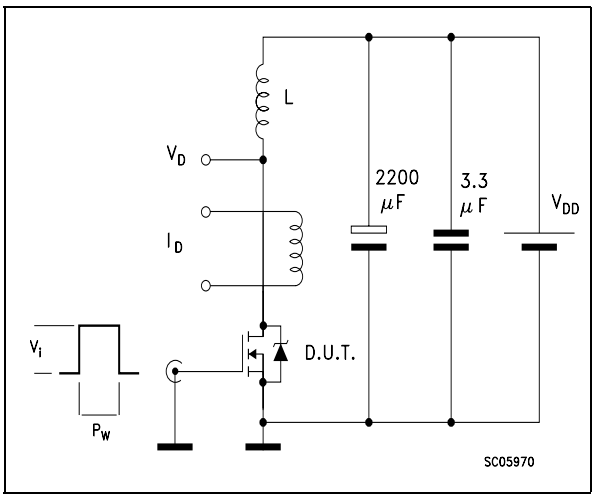



**Figure 22: Switching Times Test Circuit For Resistive Load**

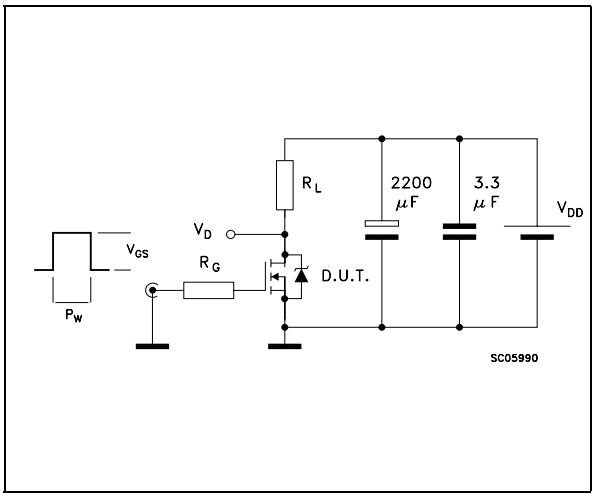



**Figure 23: Test Circuit For Inductive Load Switching and Diode Recovery Times**

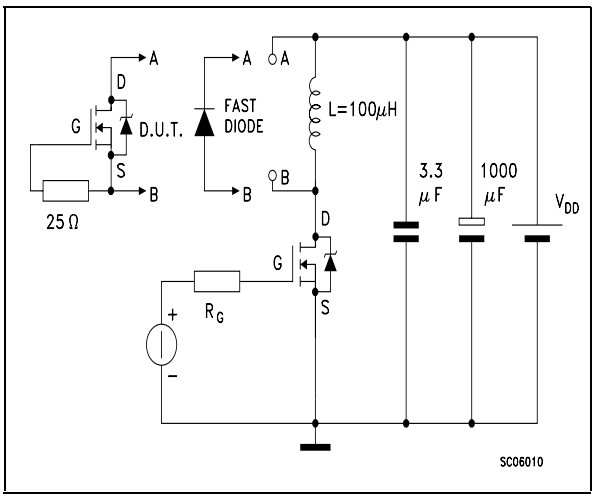



**Figure 24: Unclamped Inductive Wafeform**

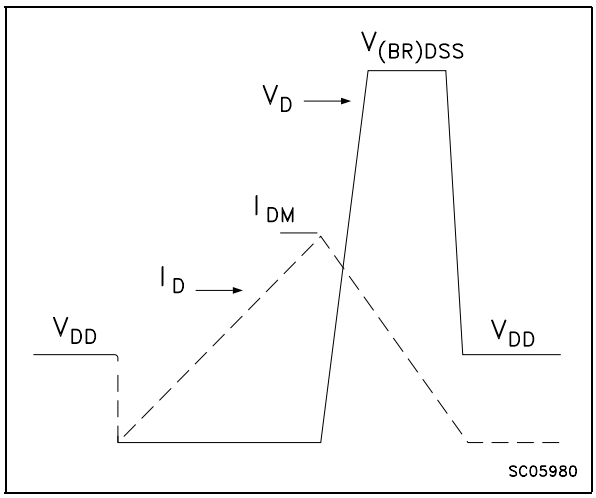
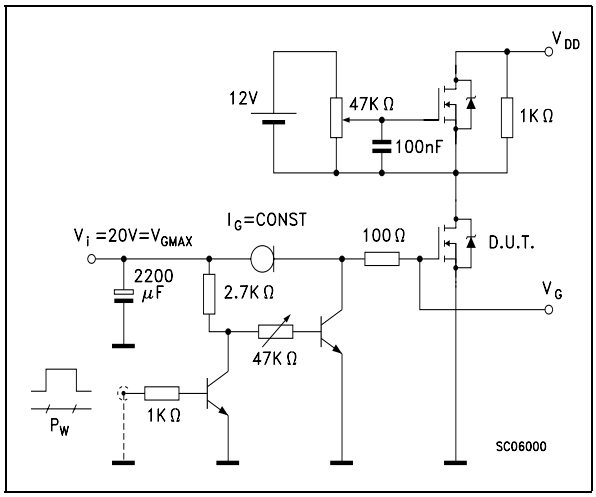


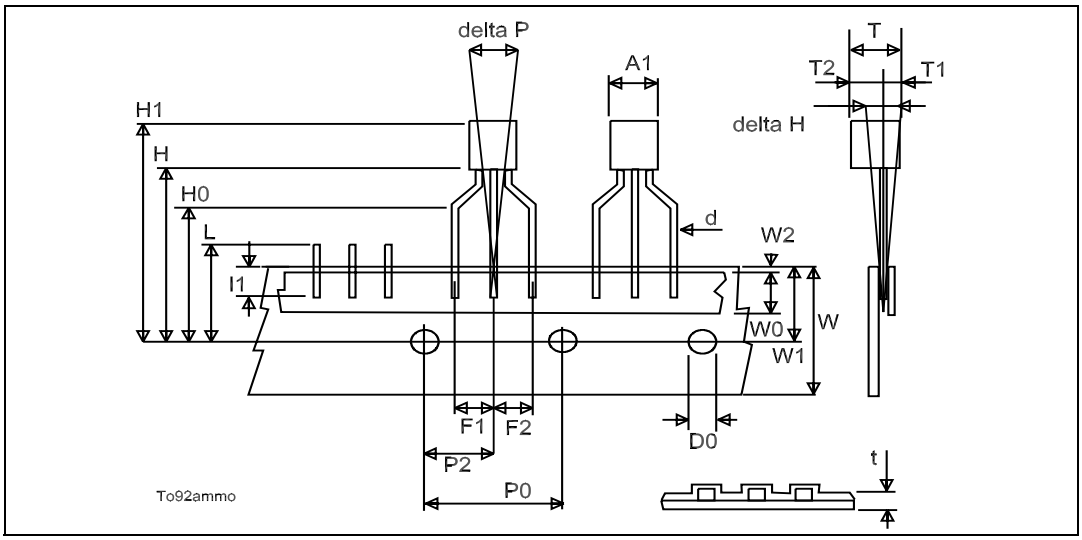

**Figure 25: Gate Charge Test Circuit**



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

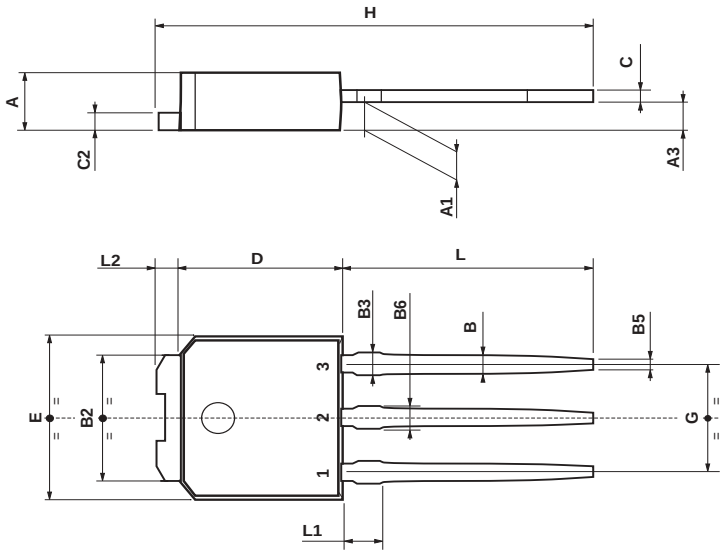
## TO-92 AMMOPACK

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A1 | 4.45 | | 4.95 | 0.170 | | 0.194 |
| T | 3.30 | | 3.94 | 0.130 | | 0.155 |
| T1 | | | 1.6 | | | 0.06 |
| T2 | | | 2.3 | | | 0.09 |
| d | 0.41 | | 0.56 | 0.016 | | 0.022 |
| P0 | 12.5 | 12.7 | 12.9 | 0.49 | 0.5 | 0.51 |
| P2 | 5.65 | 6.35 | 7.05 | 0.22 | 0.25 | 0.27 |
| F1, F2 | 2.44 | 2.54 | 2.94 | 0.09 | 0.1 | 0.11 |
| delta H | -2 | | 2 | -0.08 | | 0.08 |
| W | 17.5 | 18 | 19 | 0.69 | 0.71 | 0.74 |
| W0 | 5.7 | 6 | 6.3 | 0.22 | 0.23 | 0.24 |
| W1 | 8.5 | 9 | 9.25 | 0.33 | 0.35 | 0.36 |
| W2 | | | 0.5 | | | 0.02 |
| H | 18.5 | | 20.5 | 0.72 | | 0.80 |
| H0 | 15.5 | 16 | 16.5 | 0.61 | 0.63 | 0.65 |
| H1 | | | 25 | | | 0.98 |
| D0 | 3.8 | 4 | 4.2 | 0.15 | 0.157 | 0.16 |
| t | | | 0.9 | | | 0.035 |
| L | | | 11 | | | 0.43 |
| l1 | 3 | | | 0.11 | | |
| delta P | -1 | | 1 | -0.04 | | 0.04 |



## TO-251 (IPAK) MECHANICAL DATA

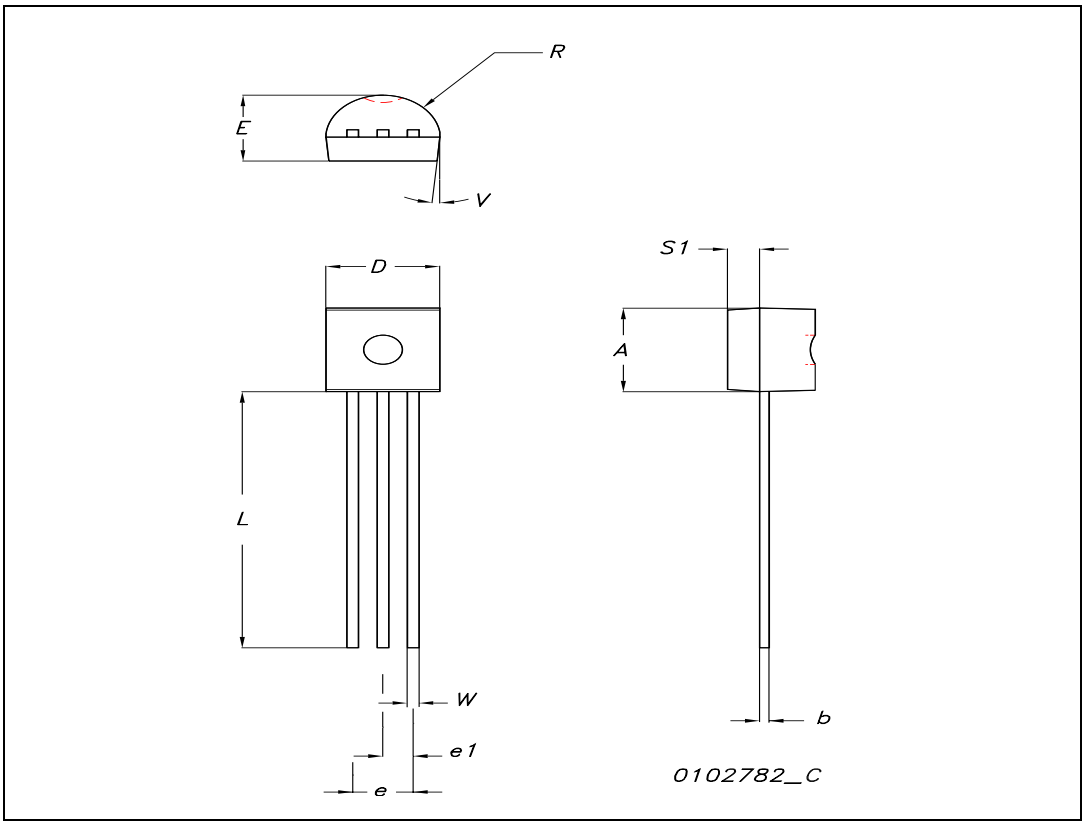
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| A3 | 0.7 | | 1.3 | 0.027 | | 0.051 |
| B | 0.64 | | 0.9 | 0.025 | | 0.031 |
| B2 | 5.2 | | 5.4 | 0.204 | | 0.212 |
| 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 |




0068771-E

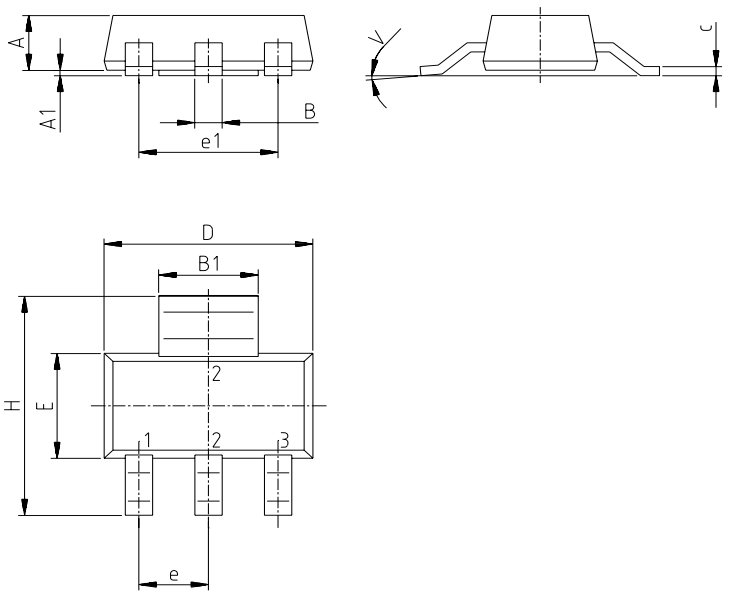
## TO-92 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.32 | | 4.95 | 0.170 | | 0.194 |
| b | 0.36 | | 0.51 | 0.014 | | 0.020 |
| D | 4.45 | | 4.95 | 0.175 | | 0.194 |
| E | 3.30 | | 3.94 | 0.130 | | 0.155 |
| e | 2.41 | | 2.67 | 0.094 | | 0.105 |
| e1 | 1.14 | | 1.40 | 0.044 | | 0.055 |
| L | 12.70 | | 15.49 | 0.50 | | 0.610 |
| R | 2.16 | | 2.41 | 0.085 | | 0.094 |
| S1 | 0.92 | | 1.52 | 0.036 | | 0.060 |
| W | 0.41 | | 0.56 | 0.016 | | 0.022 |
| V | | 5° | | | 5° | |



## SOT-223 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.80 | | | 0.071 |
| B | 0.60 | 0.70 | 0.80 | 0.024 | 0.027 | 0.031 |
| B1 | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| c | 0.24 | 0.26 | 0.32 | 0.009 | 0.010 | 0.013 |
| D | 6.30 | 6.50 | 6.70 | 0.248 | 0.256 | 0.264 |
| e | | 2.30 | | | 0.090 | |
| e1 | | 4.60 | | | 0.181 | |
| E | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.146 |
| H | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| V | | | $10^o$ | | | $10^o$ |
| A1 | | 0.02 | | | | |




P008B

**Table 10: Revision History**

| Date | Revision | Description of Changes |
|---|---|---|
| 19-Mar-2003 | 1 | First Release |
| 15-May-2003 | 2 | Removed DPAK |
| 09-Jun-2003 | 3 | Final Datasheet |
| 17-Nov-2004 | 4 | Inserted SOT-223. |
| 15-Feb-2005 | 5 | Modified Curve 4 |
| 07-Sep-2005 | 6 | Inserted Ecopack indication |

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