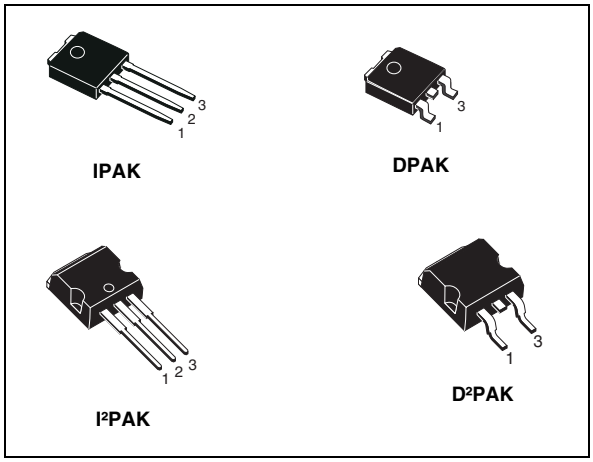
# STGB18N40LZ
# STGD18N40LZ

## $E_{AS}$ 180 mJ - 400 V - internally clamped IGBT

## Features

- AEC Q101 compliant
- 180 mJ of avalanche energy @ $T_C$ = 150 °C, L = 3 mH
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate drive
- Low saturation voltage
- High pulsed current capability
- Gate and gate-emitter resistor




## Application

- Pencil coil electronic ignition driver

## Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

**Figure 1. Internal schematic diagram**

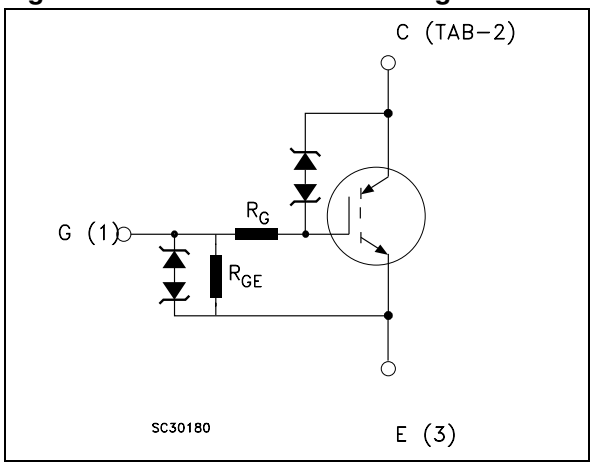



**Table 1. Device summary**

| Order codes | Marking | Package | Packaging |
|---|---|---|---|
| STGD18N40LZT4 | GD18N40LZ | DPAK | Tape and reel |
| STGD18N40LZ-1 | GD18N40LZ | IPAK | Tube |
| STGB18N40LZT4 | GB18N40LZ | D²PAK | Tape and reel |
| STGB18N40LZ-1 | GB18N40LZ | I²PAK | Tube |

# Contents

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | DPAK IPAK | D²PAK I²PAK | |
| $V_{CES}$ | Collector-emitter voltage ($v_{GE}$ = 0) | $V_{CES(clamped)}$ | | V |
| $V_{ECS}$ | Emitter collector voltage ($V_{GE}$ = 0) | 20 | | V |
| $I_C$ (1) | Collector current (continuous) at $T_C$ = 100 °C | 25 | 30 | A |
| $I_{CP}$ (2) | Pulsed collector current | 40 | | A |
| $V_{GE}$ | Gate-emitter voltage | $V_{GE(clamped)}$ | | V |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 125 | 150 | W |
| $E_{AS}$ | Single pulse energy $T_C$= 25 °C, L = 3 mH, $R_G$ = 1 KΩ | 300 | | mJ |
| $E_{AS}$ | Single pulse energy $T_C$=150 °C, L = 3 mH, $R_G$ = 1 KΩ | 180 | | mJ |
| $E_{SD}$ | Human body model, R= 1550 Ω, C = 100 pF | 8 | | kV |
| | Machine model, R = 0, C = 100 pF | 800 | | V |
| | Charged device model | 2 | | kV |
| $T_{stg}$ | Storage temperature | – 55 to 175 | | °C |
| $T_j$ | Operating junction temperature | | | |

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

2. Pulse width limited by max. junction temperature allowed

**Table 3. Thermal resistance**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | DPAK IPAK | D²PAK I²PAK | |
| $R_{thj\text{-}case}$ | Thermal resistance junction-case max | 1.2 | 1 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient max | 65 | 62.5 | °C/W |

# 2 Electrical characteristics

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

**Table 4. Static electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CES(clamped)}$ | Collector emitter clamped voltage ($V_{GE}$ = 0) | $I_C$ = 2 mA, $R_G$ = 1 kΩ<br>$T_C$ = - 40 °C to 150 °C | 370 | 400 | 430 | V |
| $V_{(BR)ECS}$ | Emitter collector break-down voltage ($V_{GE}$ = 0) | $I_C$ = 75 mA | 20 | 28 | | V |
| $V_{GE(clamped)}$ | Gate emitter clamped voltage | $I_G$ = ±2 mA | 12 | | 16 | V |
| $I_{CES}$ | Collector cut-off current ($V_{GE}$ = 0) | $V_{CE}$ = 15 V, $T_C$ = 150 °C | | | 10 | µA |
| | | $V_{CE}$ = 200 V,$T_C$ = 150 °C | | | 100 | µA |
| $I_{GES}$ | Gate cut-off current ($V_{CE}$ = 0) | $V_{GE}$ = ±10 V | 450 | 625 | 830 | µA |
| $R_{GE}$ | Gate emitter resistance | | 12 | 16 | 22 | KΩ |
| $R_G$ | Gate resistance | | | 1.6 | | KΩ |
| $V_{GE(th)}$ | Gate threshold voltage | $V_{CE}$ = 12 V, $I_C$ = 1 mA,$T_C$ = -40 °C | 1.4 | | | V |
| | | $V_{CE}$ = 12 V, $I_C$ = 1 mA | 1.2 | 1.6 | 2.3 | V |
| | | $V_{CE}$ = 12 V, $I_C$ = 1 mA, $T_C$ =150 °C | 0.7 | | | V |
| $V_{GEP}$ | Gate emitter plateau voltage | $V_{CE}$ = 12 V, $I_C$ = 10 A | | 2.9 | | V |
| $V_{CE(sat)}$ | Collector emitter saturation voltage | $V_{GE}$ = 4.5 V, $I_C$ = 10 A | | 1.35 | 1.7 | V |
| | | $V_{GE}$ = 4.5 V, $I_C$ = 10 A,<br>$T_C$ = 150 °C | | 1.30 | | V |
| | | $V_{GE}$ = 3.8 V, $I_C$ = 6 A | | 1.30 | | V |

**Table 5. Dynamic electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{ies}$ | Input capacitance | $V_{CE}$ = 25 V, f = 1 MHz, $V_{GE}$ = 0 | | 490 | | pF |
| $C_{oes}$ | Output capacitance | | | 90 | | pF |
| $C_{res}$ | Reverse transfer capacitance | | | 6.5 | | pF |
| $Q_g$ | Gate charge | $V_{CE}$ = 280 V, $I_C$ = 10 A, $V_{GE}$ = 5 V | | 23 | | nC |

**Table 6. Switching on/off**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| | **Resistive load** | $V_{CC}$ = 14 V, $I_C$ = 10 A | | | | |
| $t_{d(on)}$ | Turn-on delay time | $R_G$ = 1 kΩ, $V_{GE}$ = 5 V | | 1 | | µs |
| $t_r$ | Rise time | | | 5.8 | | µs |
| | **Resistive load** | $V_{CC}$ = 14 V, $I_C$ = 10 A | | | | |
| $t_{d(on)}$ | Turn-on delay time | $R_G$ = 1 kΩ, $V_{GE}$ = 5 V, | | 1 | | µs |
| $t_r$ | Rise time | $T_C$ = 150 °C | | 5.9 | | µs |
| | **Inductive load** | | | | | |
| $t_{d(off)}$ | Turn-off delay time | $V_{CC}$ = 300 V, L = 1 mH | | 14 | | µs |
| $t_f$ | Fall time | $R_G$ = 1 kΩ, $V_{GE}$ = 5 V | | 6.7 | | µs |
| dv/dt | Turn-off voltage slope | | | 90 | | V/µs |
| | **Inductive load** | | | | | |
| $t_{d(off)}$ | Turn-off delay time | $V_{CC}$ = 300 V, L = 1 mH | | 15 | | µs |
| $t_f$ | Fall time | $R_G$ = 1 kΩ, $V_{GE}$ = 5 V | | 9.8 | | µs |
| dv/dt | Turn-off voltage slope | $T_C$ = 150 °C | | 80 | | V/µs |

## 2.1 Electrical characteristics (curves)

**Figure 2. Collector-emitter voltage vs temperature**

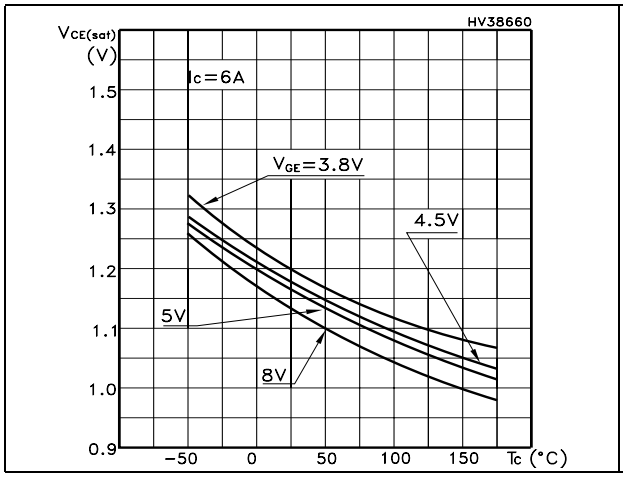



**Figure 3. Collector-emitter voltage vs temperature**

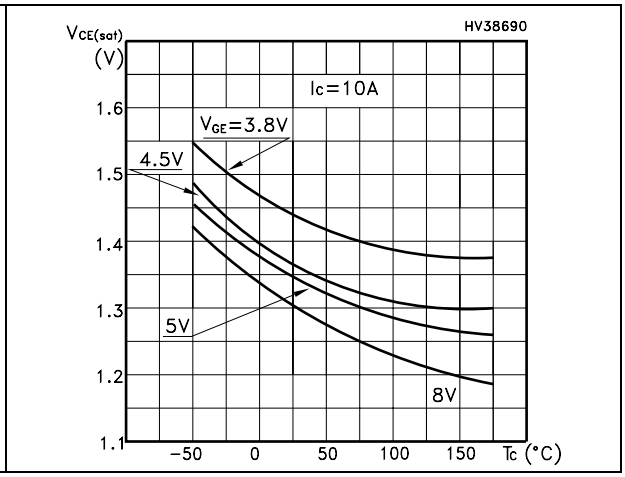



**Figure 4. Collector-emitter voltage vs temperature**

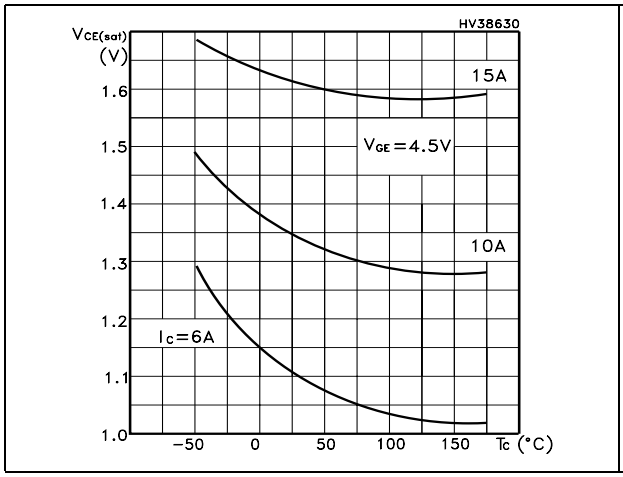



**Figure 5. Self clamped inductive switch**

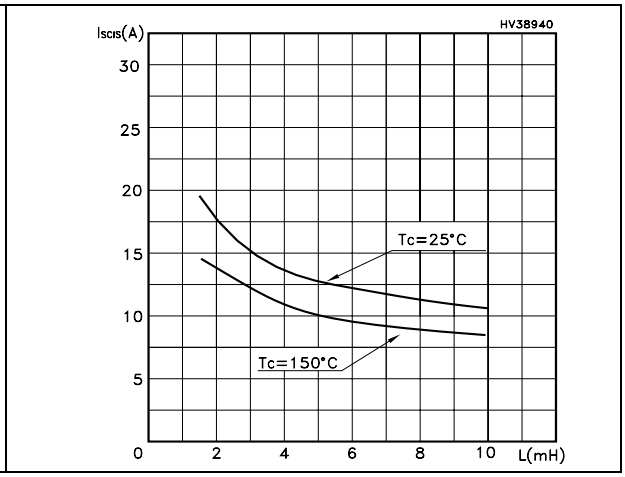



**Figure 6. Collector current vs collector emitter voltage @ 25 °C**

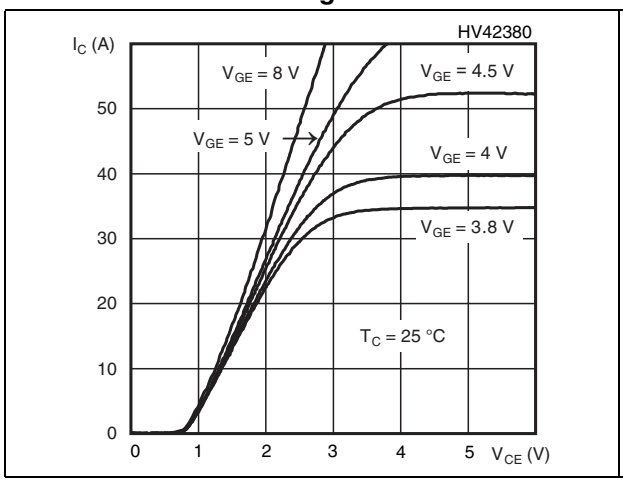



**Figure 7. Collector current vs collector emitter voltage @ -40 °C**

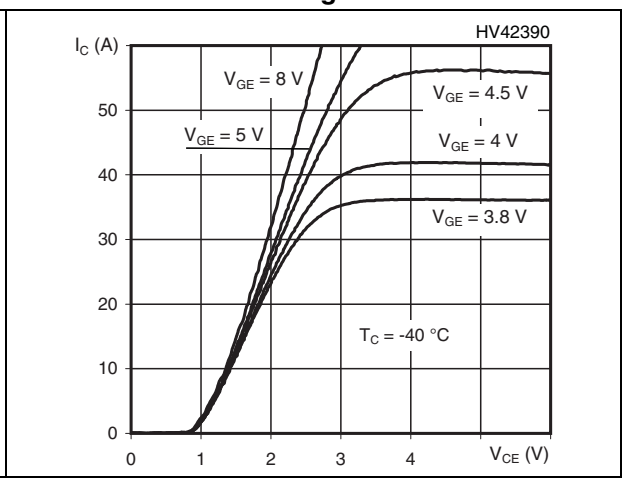


**Figure 8. Collector current vs collector emitter voltage @ 175 °C**

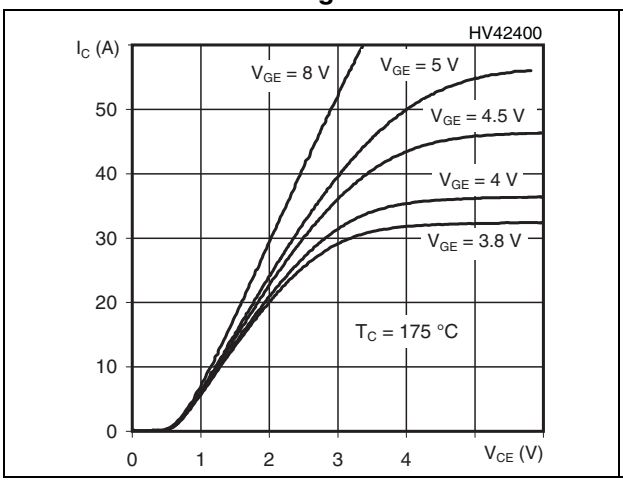



**Figure 9. Transfer characteristics**

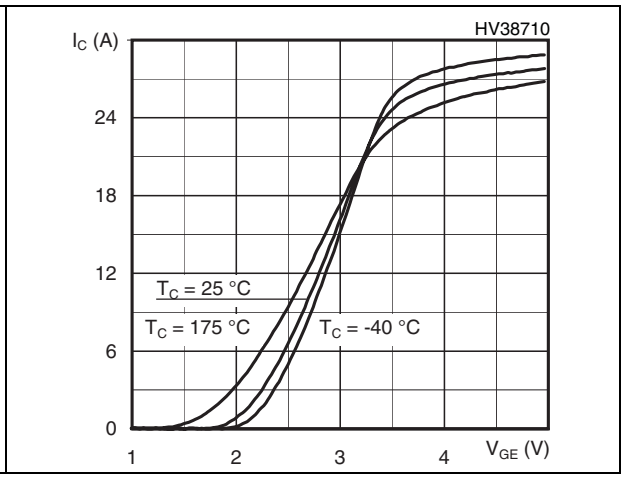



**Figure 10. Collector emitter leakage current vs. temperature**

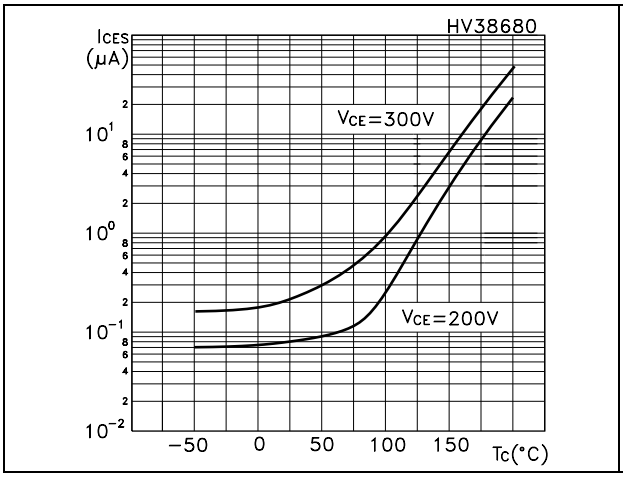



**Figure 11. Normalized collector emitter breakdown voltage vs temperature**

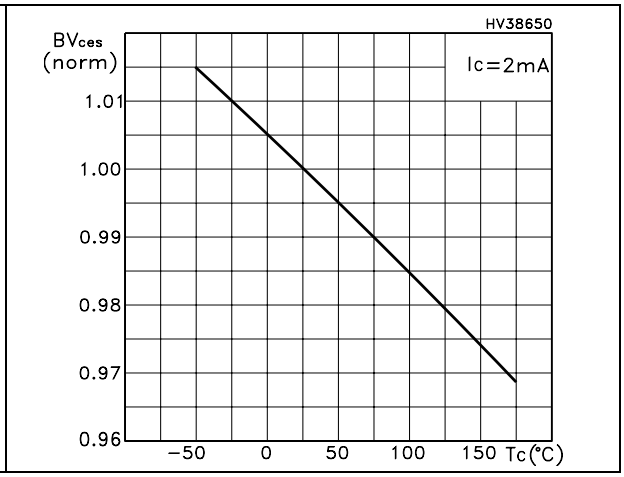



**Figure 12. Normalized gate threshold voltage vs temperature**

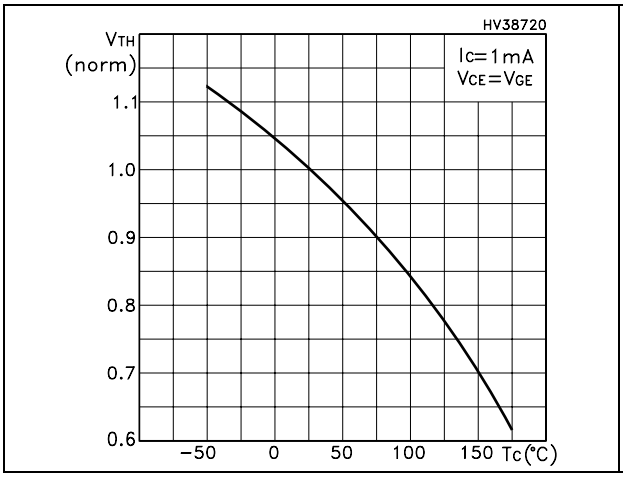



**Figure 13. Normalized collector emitter voltage vs temperature**

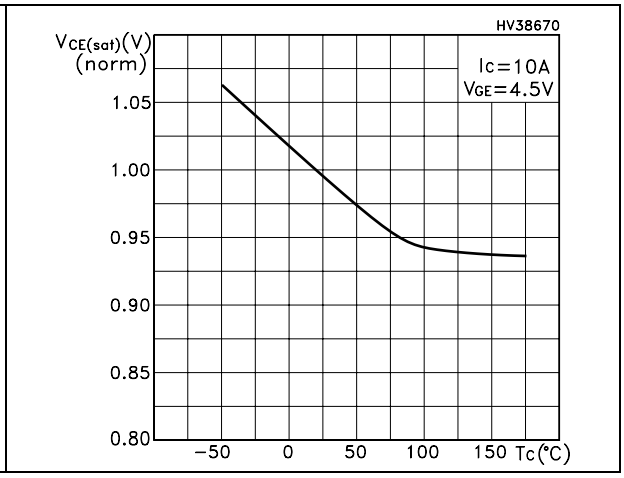


**Figure 14. Thermal impedance for D²PAK / I²PAK**

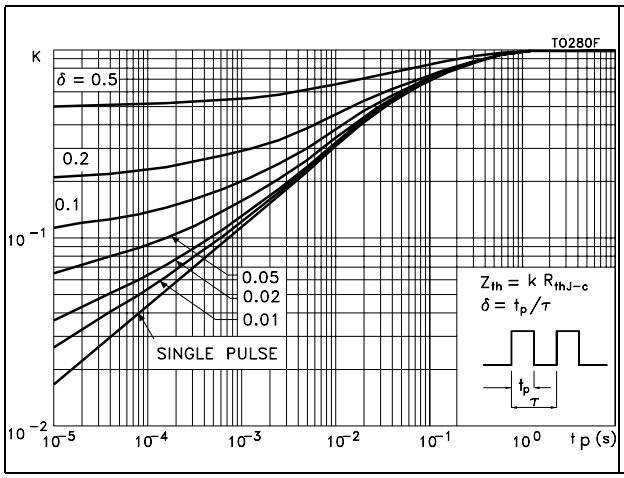
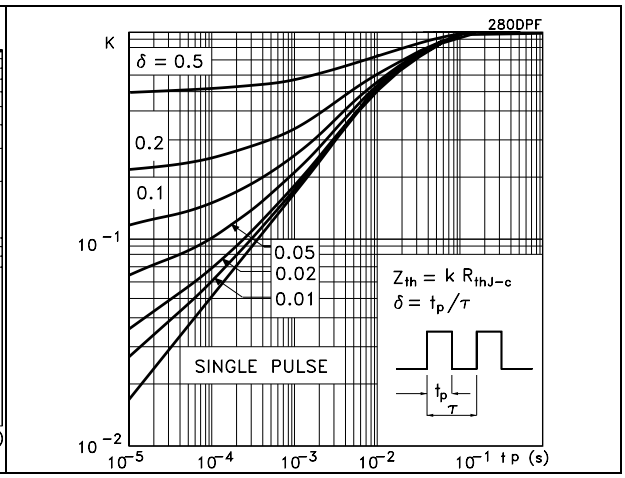



**Figure 15. Thermal impedance for DPAK / IPAK**



# 3 Test circuits

**Figure 16. Test circuit for inductive load switching**

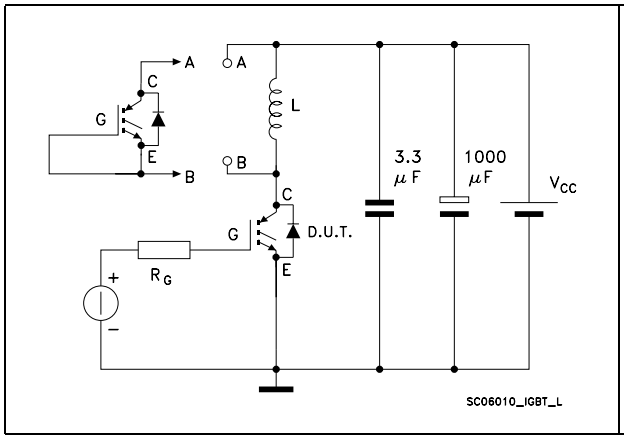



**Figure 17. Gate charge test circuit**

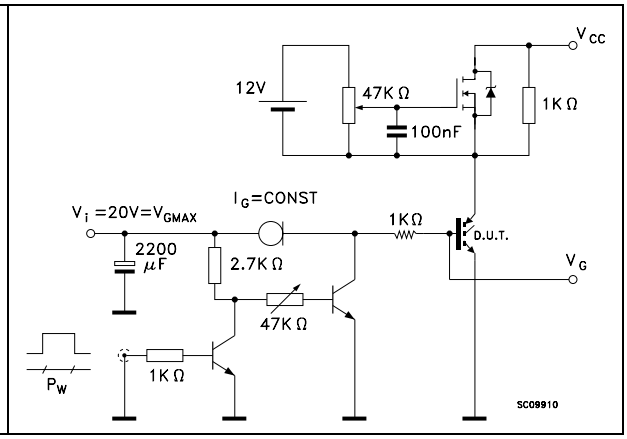



**Figure 18. Switching waveform**

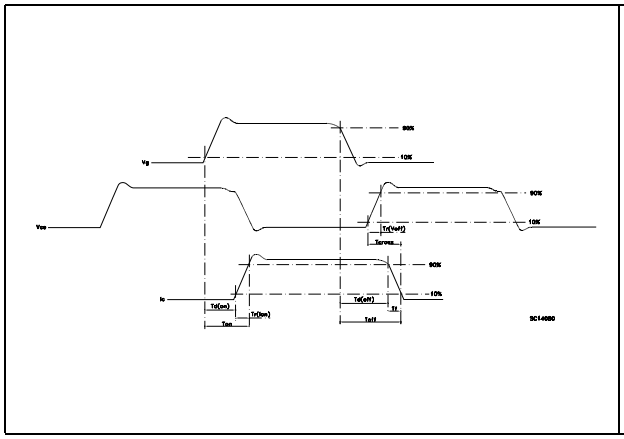
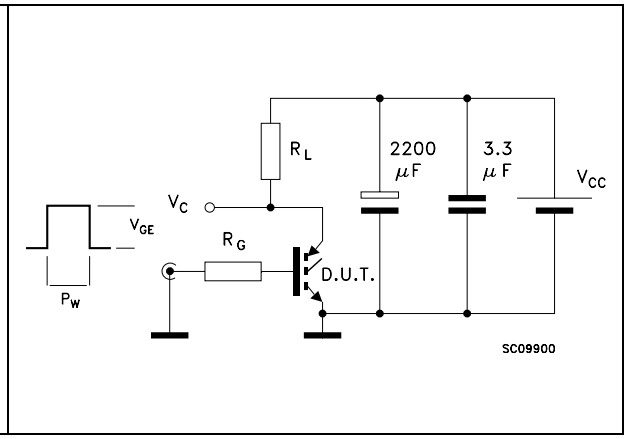


**Figure 19. Test circuit for resistive load switching**

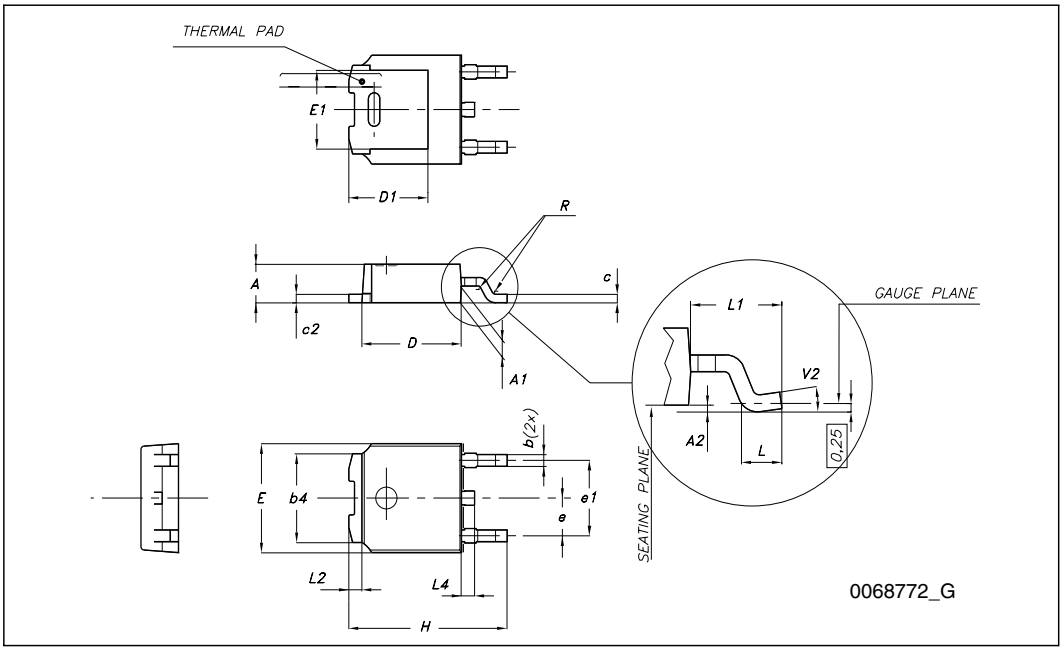


# 4 Package mechanical data

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*

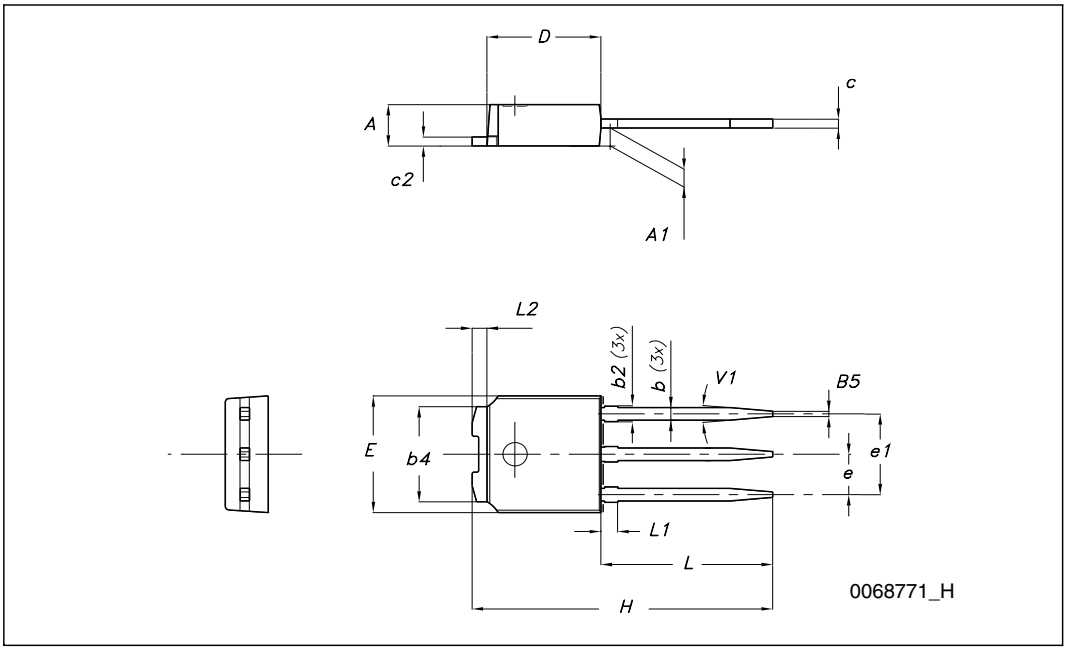
## TO-252 (DPAK) mechanical data

| 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 ° |



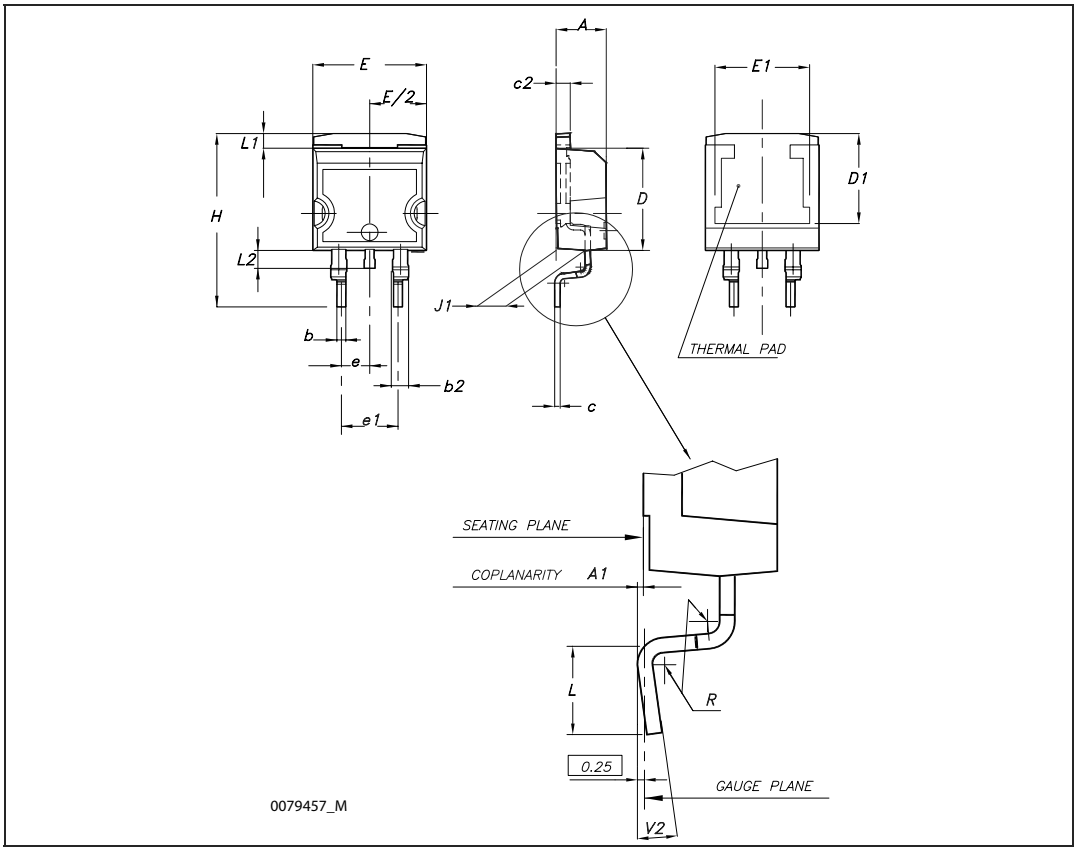
## TO-251 (IPAK) mechanical data

| 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 ° | |



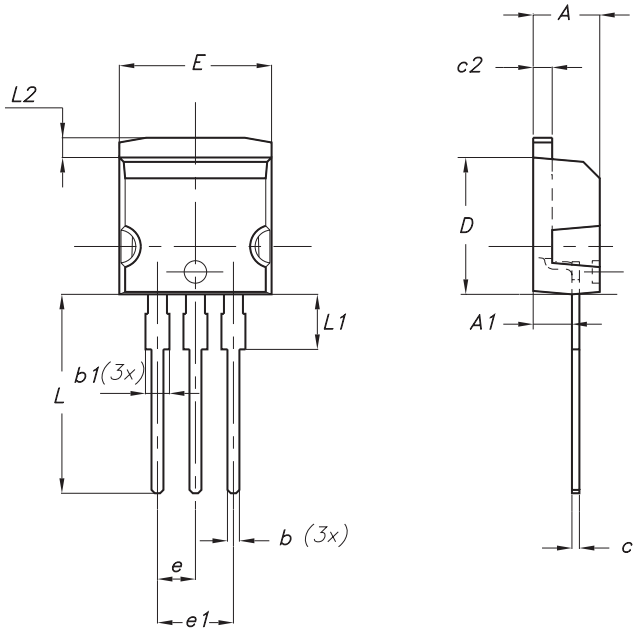
## D²PAK (TO-263) mechanical data

| Dim | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| A1 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| b | 0.70 | | 0.93 | 0.027 | | 0.037 |
| b2 | 1.14 | | 1.70 | 0.045 | | 0.067 |
| c | 0.45 | | 0.60 | 0.017 | | 0.024 |
| c2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | 7.50 | | | 0.295 | | |
| E | 10 | | 10.40 | 0.394 | | 0.409 |
| E1 | 8.50 | | | 0.334 | | |
| e | | 2.54 | | | 0.1 | |
| e1 | 4.88 | | 5.28 | 0.192 | | 0.208 |
| H | 15 | | 15.85 | 0.590 | | 0.624 |
| J1 | 2.49 | | 2.69 | 0.099 | | 0.106 |
| L | 2.29 | | 2.79 | 0.090 | | 0.110 |
| L1 | 1.27 | | 1.40 | 0.05 | | 0.055 |
| L2 | 1.30 | | 1.75 | 0.051 | | 0.069 |
| R | | 0.4 | | | 0.016 | |
| V2 | 0° | | 8° | 0° | | 8° |



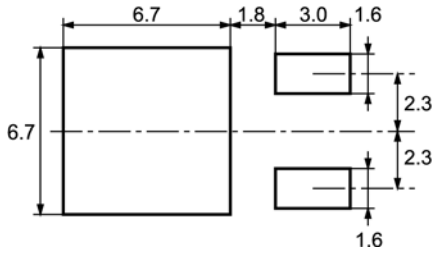
## I²PAK (TO-262) mechanical data

| Dim | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| A1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| c2 | 1.23 | | 1.32 | 0.048 | | 0.052 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| E | 10 | | 10.40 | 0.393 | | 0.410 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L2 | 1.27 | | 1.40 | 0.050 | | 0.055 |



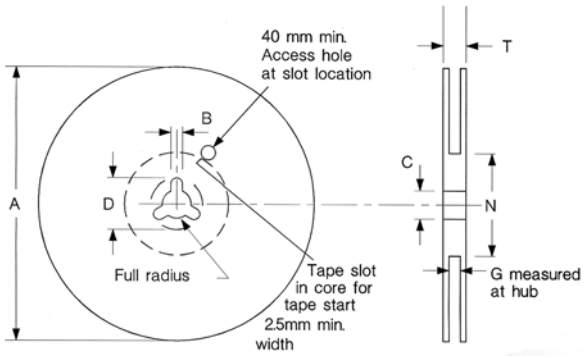
# 5 Packaging mechanical data

### DPAK FOOTPRINT




All dimensions are in millimeters

### TAPE AND REEL SHIPMENT



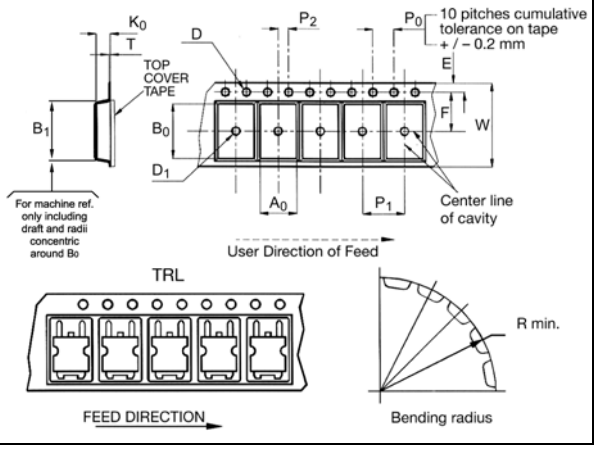

REEL MECHANICAL DATA

| 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 |

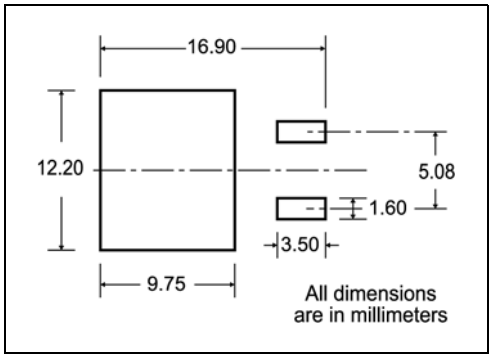
| BASE QTY | BULK QTY |
|---|---|
| 2500 | 2500 |

TAPE MECHANICAL DATA

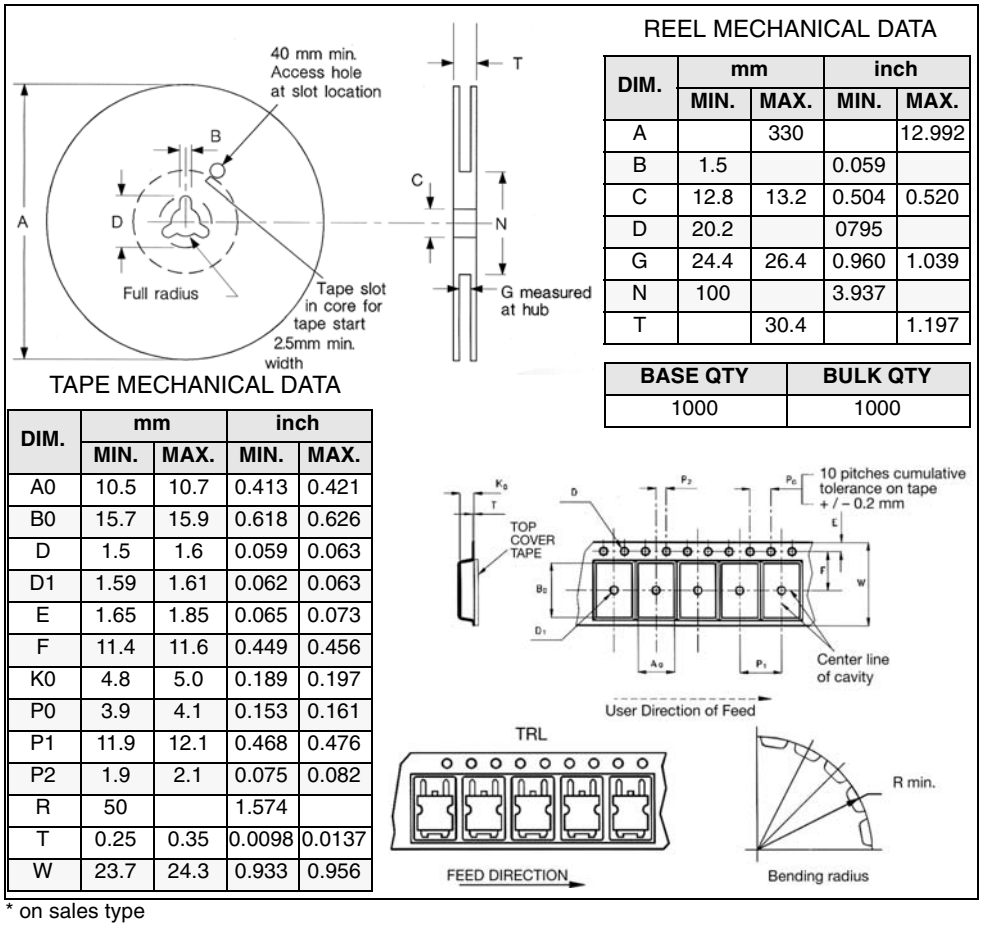
| DIM. | mm | | inch | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 6.8 | 7 | 0.267 | 0.275 |
| B0 | 10.4 | 10.6 | 0.409 | 0.417 |
| B1 | | 12.1 | | 0.476 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.5 | | 0.059 | |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 7.4 | 7.6 | 0.291 | 0.299 |
| 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 |



## D²PAK FOOTPRINT




## 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 | | 0795 | |
| G | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

| BASE QTY | BULK QTY |
|---|---|
| 1000 | 1000 |

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 10.5 | 10.7 | 0.413 | 0.421 |
| B0 | 15.7 | 15.9 | 0.618 | 0.626 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.59 | 1.61 | 0.062 | 0.063 |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 11.4 | 11.6 | 0.449 | 0.456 |
| K0 | 4.8 | 5.0 | 0.189 | 0.197 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 11.9 | 12.1 | 0.468 | 0.476 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 50 | | 1.574 | |
| T | 0.25 | 0.35 | 0.0098 | 0.0137 |
| W | 23.7 | 24.3 | 0.933 | 0.956 |

* on sales type

# 6 Revision history

Table 7. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 18-Jan-2008 | 1 | Initial release. |
| 07-Mar-2008 | 2 | Modified *Figure 7*, *Figure 8*, *Figure 10*. |

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