# STB100NF04T4, STP100NF04

## Automotive-grade N-channel 40 V, 4.3 mΩ typ., 120 A STripFET™ II Power MOSFET in a D²PAK and TO-220

Datasheet - production data

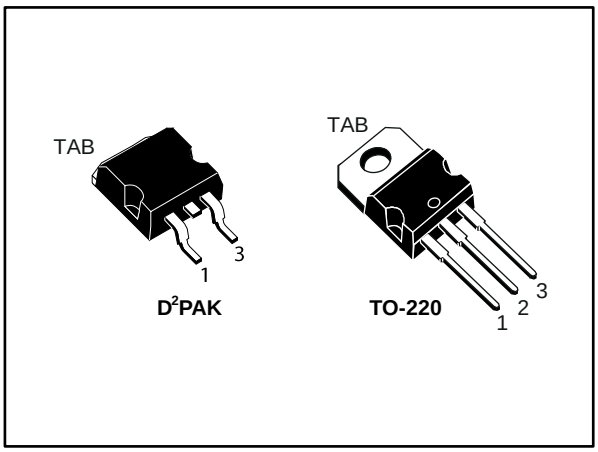
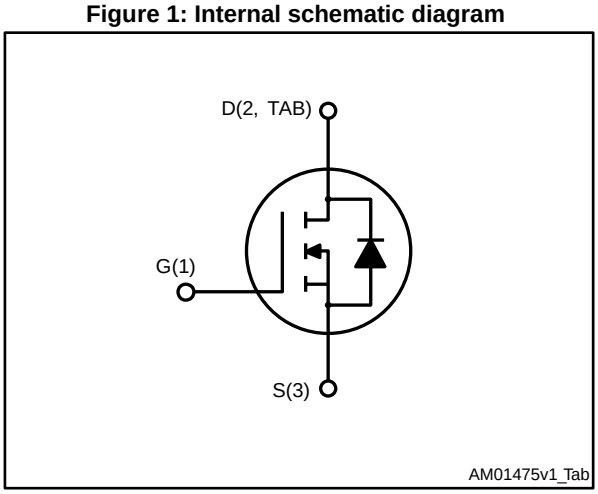



**Figure 1: Internal schematic diagram**




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ | $P_{tot}$ |
|---|---|---|---|---|
| STB100NF04T4 | 40 V | 4.6 mΩ | 120 A | 300 W |
| STP100NF04 | 40 V | 4.6 mΩ | 120 A | 300 W |

- AEC-Q101 qualified
- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

## Applications

- Switching applications

## Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

**Table 1: Device summary**

| Order code | Marking | Package | Packing |
|---|---|---|---|
| STB100NF04T4 | B100NF04 | D²PAK | Tape and reel |
| STP100NF04 | P100NF04 | TO-220 | Tube |

# Contents

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage | 40 | V |
| $V_{GS}$ | Gate- source voltage | ±20 | V |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 25°C | 120 | A |
| $I_D$ (1) | Drain current (continuous) at $T_C$=100°C | 120 | A |
| $I_{DM}$ (2) | Drain current (pulsed) | 480 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25°C | 300 | W |
| dv/dt(3) | Peak diode recovery voltage slope | 6 | V/ns |
| $E_{AS}$ (4) | Single pulse avalanche energy | 1.2 | J |
| $T_j$ | Operating junction temperature range | - 55 to 175 | °C |
| $T_{stg}$ | Storage temperature range | | |

**Notes:**

(1)Current limited by package

(2)Pulse width limited by safe operating area.

(3)$I_{SD}$ ≤120 A, di/dt ≤300A/µs, $V_{DD}$ =$V_{(BR)DSS}$, Tj ≤ $T_{JMAX}$

(4)Starting Tj = 25 °C, $I_D$ = 60 A, $V_{DD}$ = 30 V.

**Table 3: Thermal data**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | D²PAK | TO-220 | |
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 0.5 | | °C/W |
| $R_{thj\text{-}pcb}$(1) | Thermal resistance junction-pcb | 35 | | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient | | 62.5 | °C/W |

**Notes:**

(1)When mounted on a 1-inch² FR-4 board, 2oz Cu.

# 2 Electrical characteristics

($T_C$ = 25 °C unless otherwise specified)

**Table 4: 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 V | 40 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{DS}$ = 40 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $V_{DS}$ = 40 V, $V_{GS}$ = 0 V $T_C$ = 125°C(1) | | | 10 | µA |
| $I_{GSS}$ | Gate body leakage current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on- resistance | $V_{GS}$ = 10 V, $I_D$= 50 A | | 4.3 | 4.6 | mΩ |

**Notes:**

(1)Defined by design,not subject to production test

**Table 5: Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 5100 | | pF |
| $C_{oss}$ | Output capacitance | | - | 1300 | | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 160 | | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 32 V, $I_D$ = 120 A , $V_{GS}$ = 10 V (see *Figure 21: "Test circuit for gate charge behavior"*) | - | 110 | 150 | nC |
| $Q_{gs}$ | Gate-source charge | | - | 35 | | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 70 | | nC |
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 20 V, $I_D$ = 60 A , $R_G$ = 4.7 Ω ,$V_{GS}$ = 10 V (see *Figure 20: "Test circuit for resistive load switching times"* and *Figure 25: "Switching time waveform"*) | - | 35 | | ns |
| $t_r$ | Rise time | | - | 220 | | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 80 | | ns |
| $t_f$ | Fall time | | - | 50 | | ns |

**Table 6: Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 120 | A |
| $I_{SDM}$(1) | Source-drain current (pulsed) | | - | | 480 | A |
| $V_{SD}$(2) | Forward on voltage | $I_{SD}$ = 120 A, $V_{GS}$ = 0 V | - | | 1.3 | V |
| $t_r$ | Reverse recovery time | $I_{SD}$ = 120 A, $V_{DD}$ = 20 V, di/dt = 100 A/µs V, $T_j$ = 150 °C (see *Figure 22: "Test circuit for inductive load switching and diode recovery times"*) | - | 75 | - | ns |
| $t_{d(off)}$ | Reverse recovery charge | | - | 185 | - | nC |
| $t_f$ | Reverse recovery current | | - | 5 | - | A |

**Notes:**

(1)Pulse width limited by safe operating area.

(2)Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2: Power dissipation vs. temperature

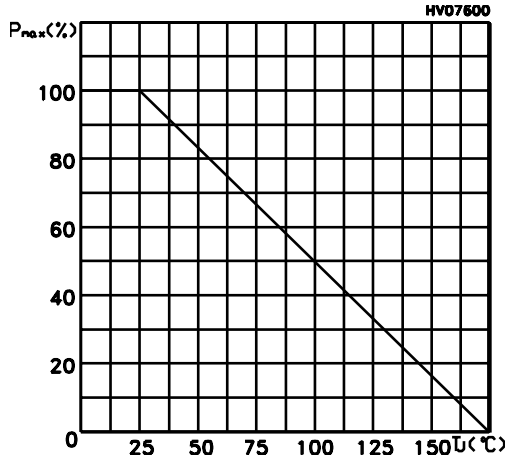



Figure 3: Max Id current vs. temperature

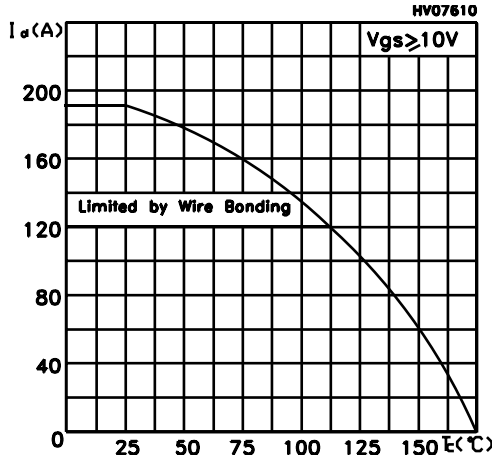



Figure 4: Output characteristics

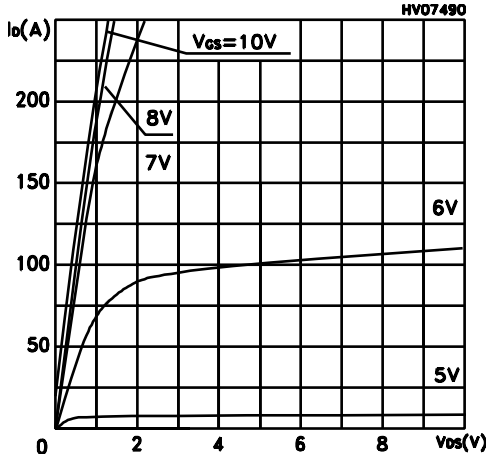



Figure 5: Transfer characteristics

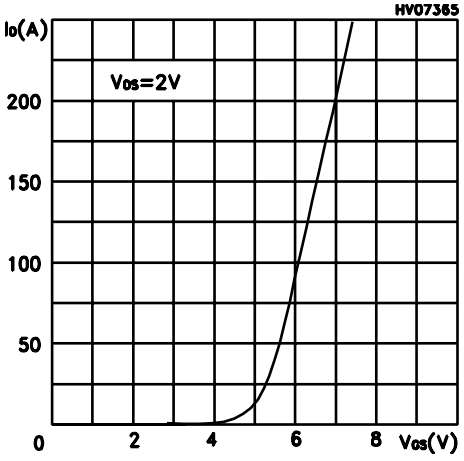



Figure 6: Transconductance

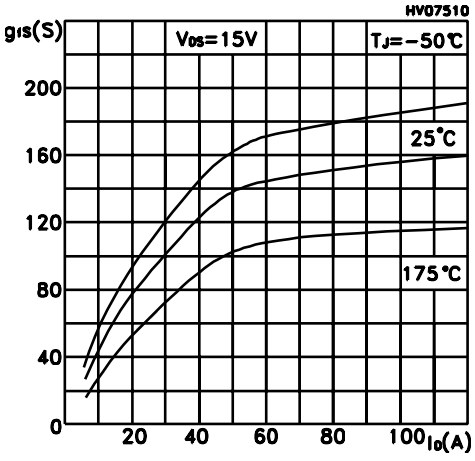



Figure 7: Static drain-source on-resistance

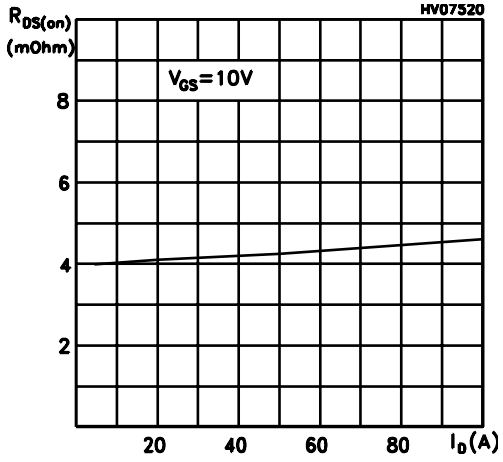


Figure 8: Gate charge vs. gate-source voltage

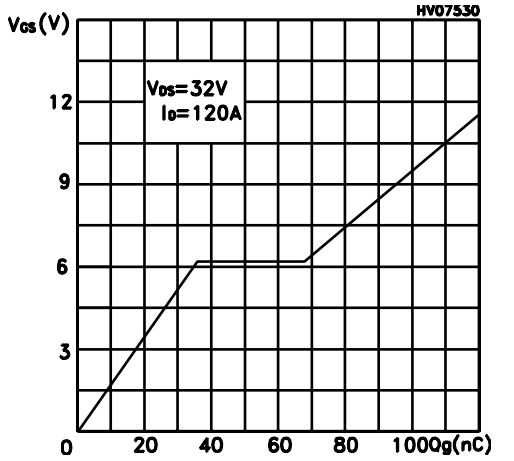



Figure 9: Capacitance variations

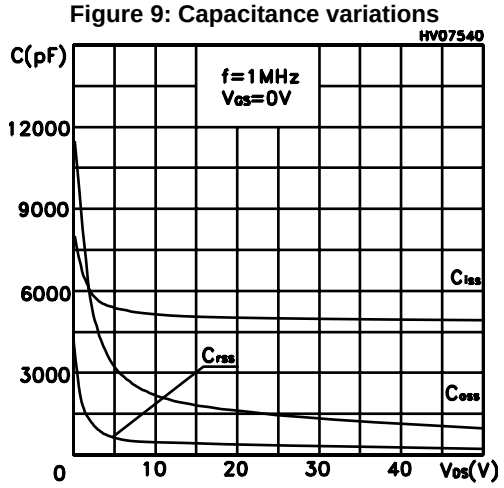



Figure 10: Normalized gate threshold voltage vs. temperature

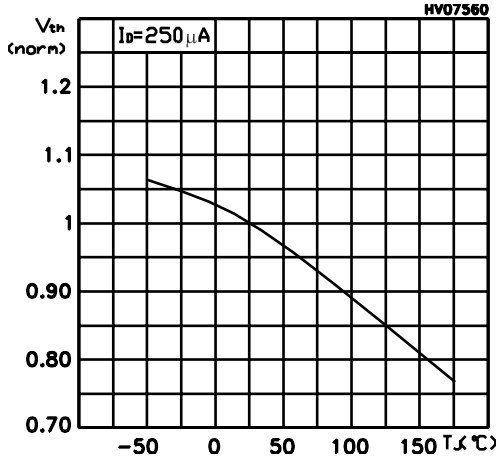



Figure 11: Normalized on-resistance vs. temperature

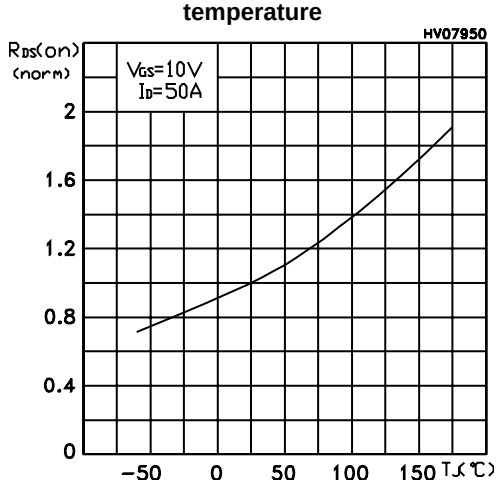



Figure 12: Source-drain diode forward characteristics

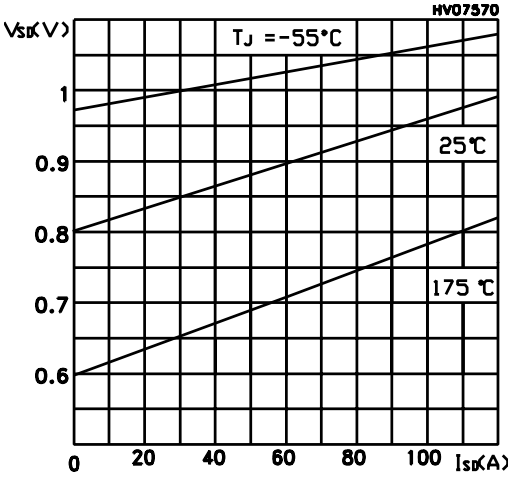



Figure 13: Normalized BVDSS vs. temperature

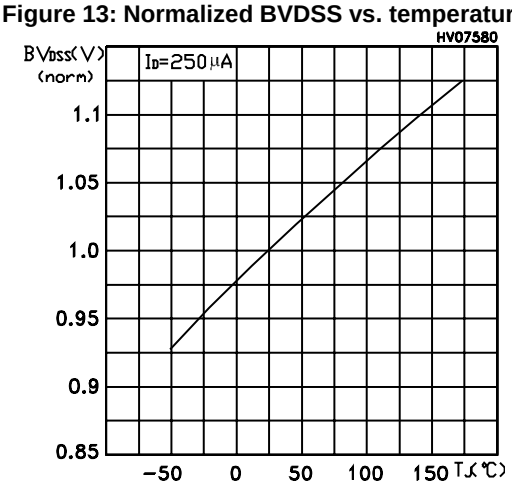


**Figure 14: Thermal resistance Rthj-pcb vs. PCB copper area**

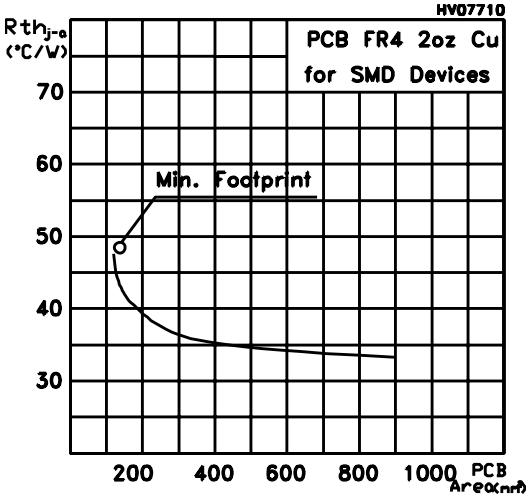



**Figure 15: Thermal impedance**

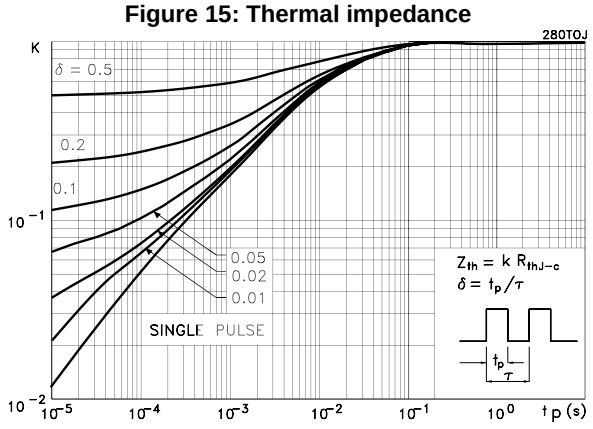



**Figure 16: Max power dissipation vs. PCB copper area**

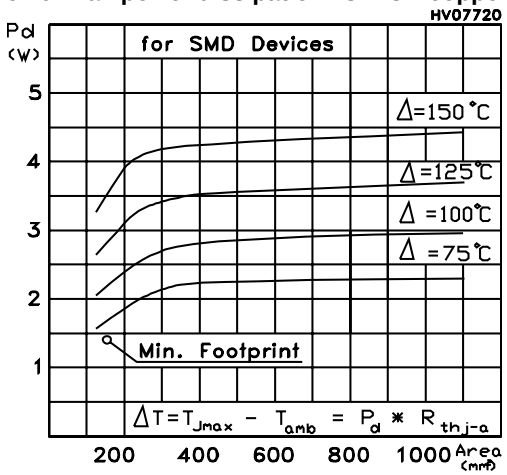



**Figure 17: Safe operating area**

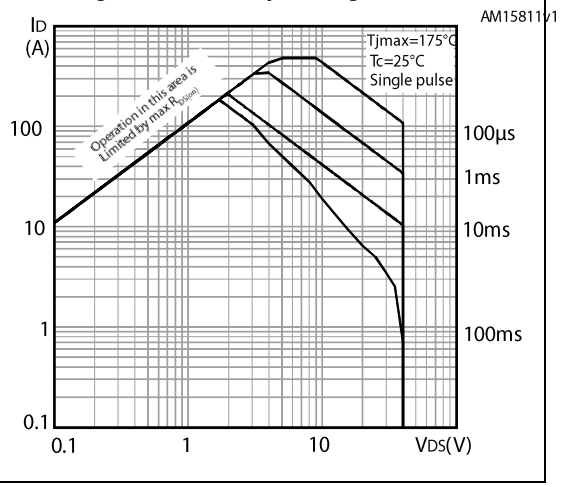
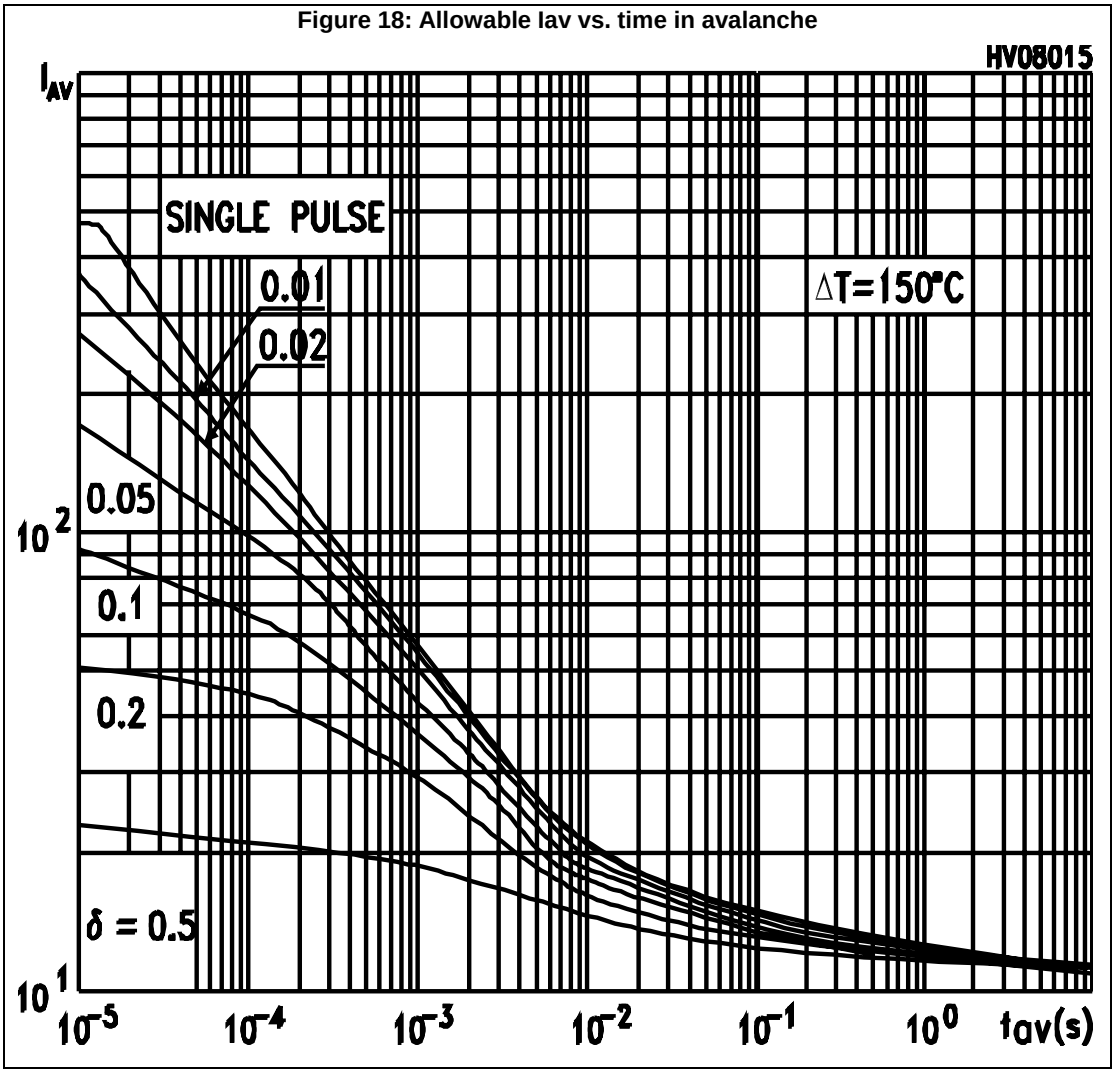


Figure 18: Allowable Iav vs. time in avalanche




The previous curve give the safe operating area for unclamped inductive loads, single pulse or repetitive, 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 avalnche(single pulse)

$t_{AV}$ is the time in avalanche

To de rate above 25°C, at fixed IAV, the following equation must be applied:

$IAV = 2*(Tjmax-T_{CASE})/(1.3*B_{VDSS}*Zth)$

Where:

Zth= K*Rth is the value coming from normalized thermal response at fixed pulse width equal to $T_{AV}$

# 3 Spice thermal model

**Figure 19: Spice model schematic**

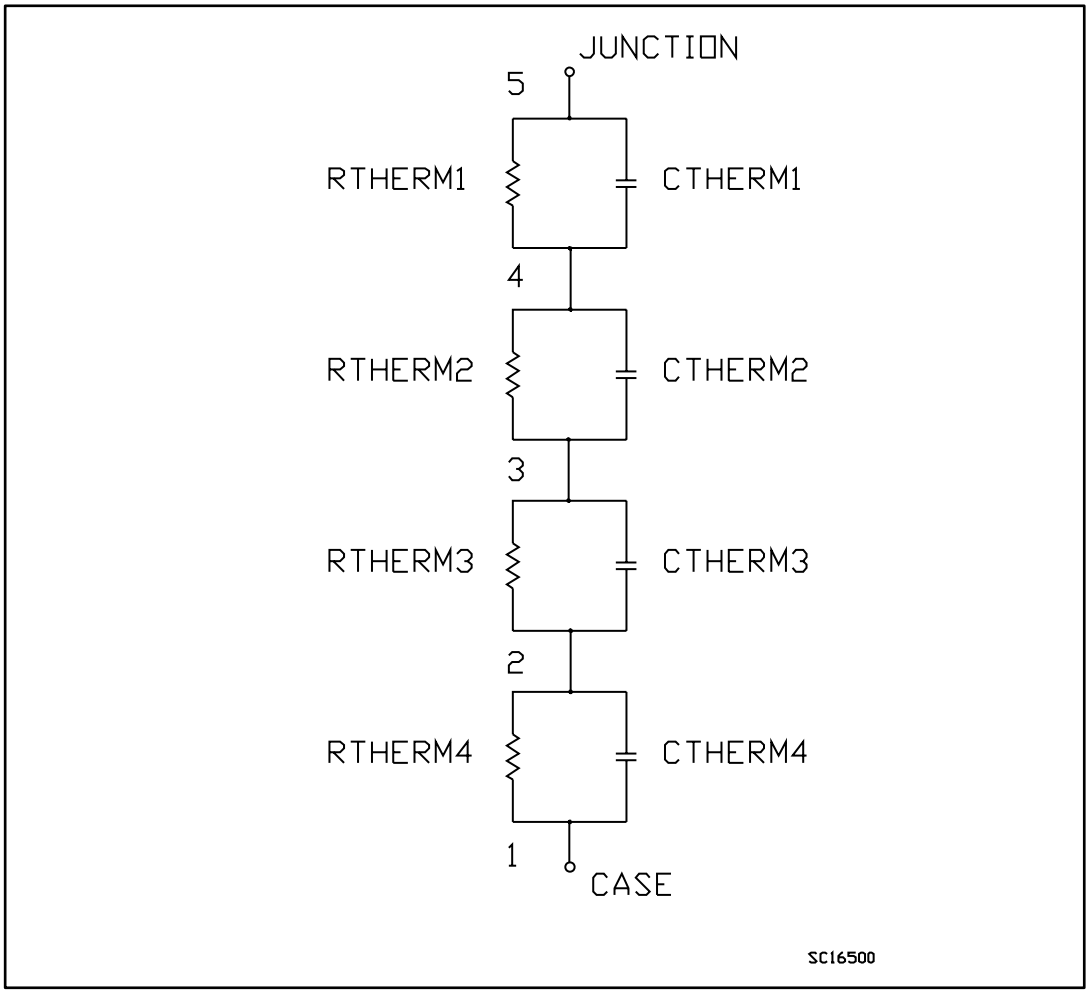



**Table 7: Spice parameter**

| Parameter | Node | Value |
|---|---|---|
| CTHERM1 | 5 - 4 | 0.011 |
| CTHERM1 | 4 - 3 | 0.0012 |
| CTHERM3 | 3 - 2 | 0.05 |
| CTHERM4 | 2 - 1 | 0.1 |
| RTHERM1 | 5 - 4 | 0.09 |
| RTHERM2 | 4 - 3 | 0.02 |
| RTHERM3 | 3 - 2 | 0.11 |
| RTHERM4 | 2 - 1 | 0.17 |

# 4 Test circuits

**Figure 20: Test circuit for resistive load switching times**

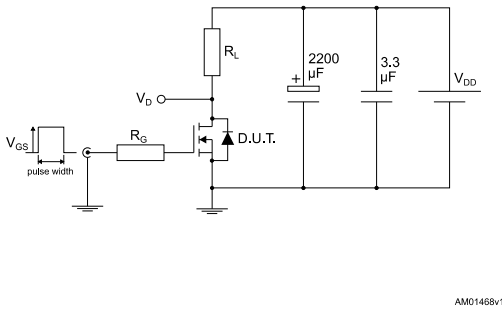



**Figure 21: Test circuit for gate charge behavior**

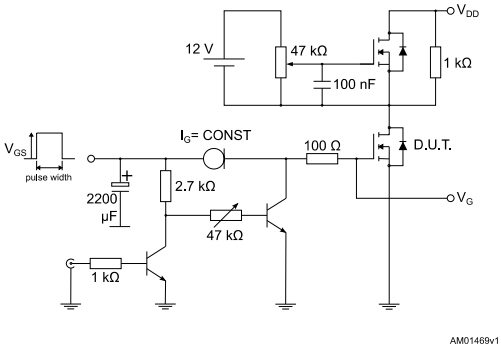



**Figure 22: Test circuit for inductive load switching and diode recovery times**

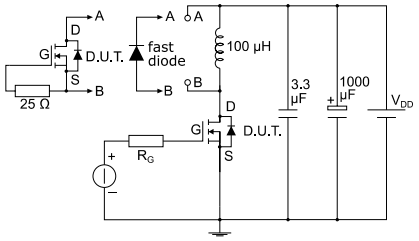



**Figure 23: Unclamped inductive load test circuit**

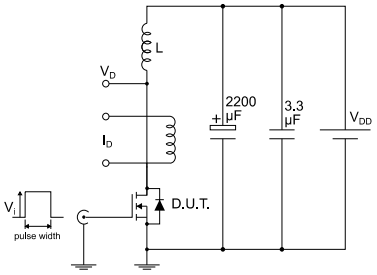



**Figure 24: Unclamped inductive waveform**

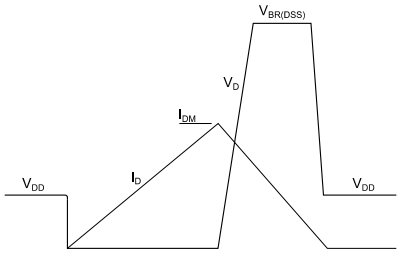
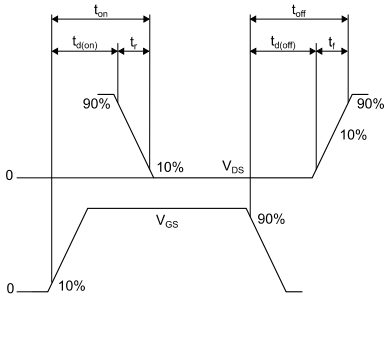



**Figure 25: Switching time waveform**



# 5 Package information

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.

## 5.1 D²PAK packing information

**Figure 26: D²PAK (TO-263) type A package outline**

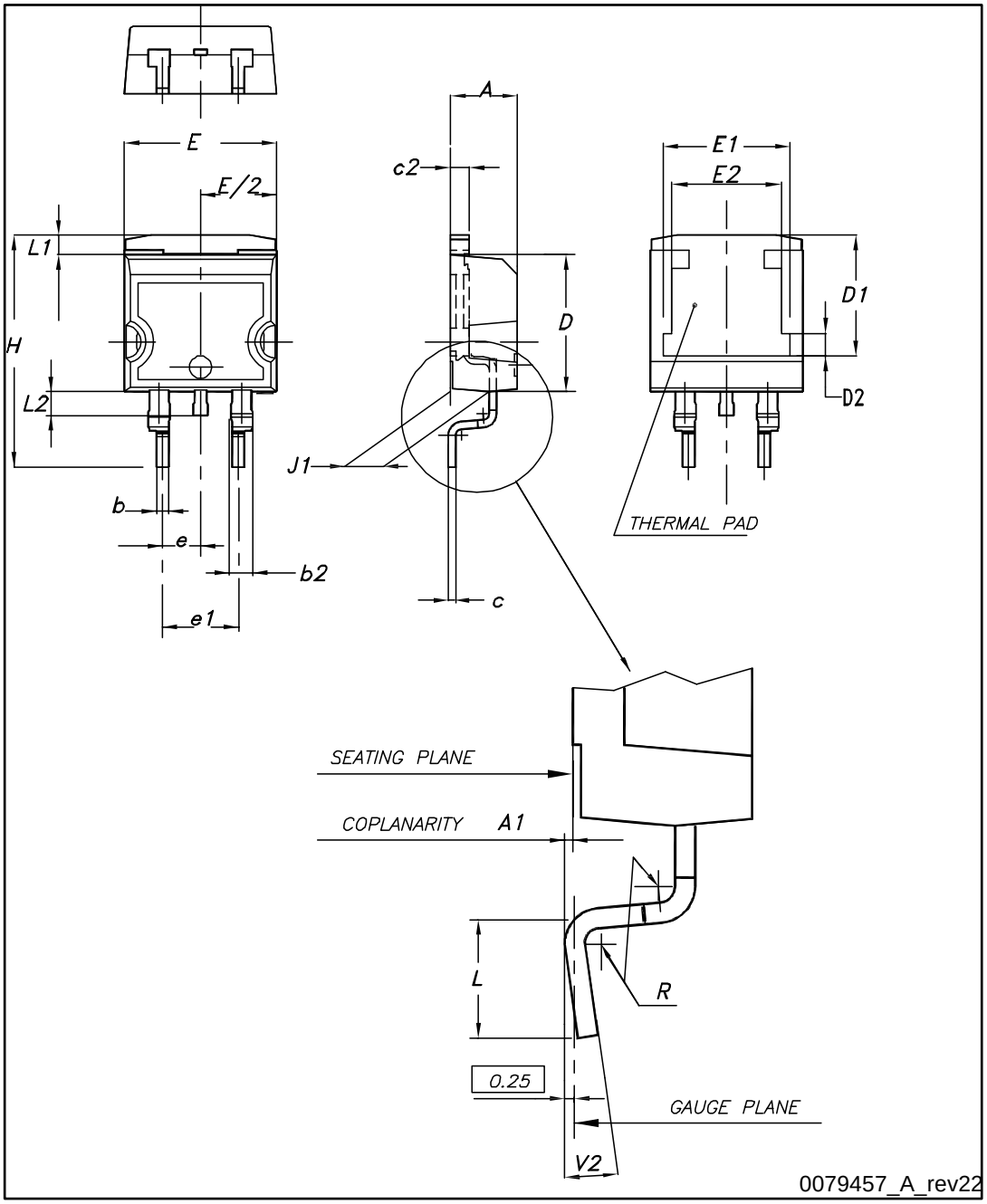
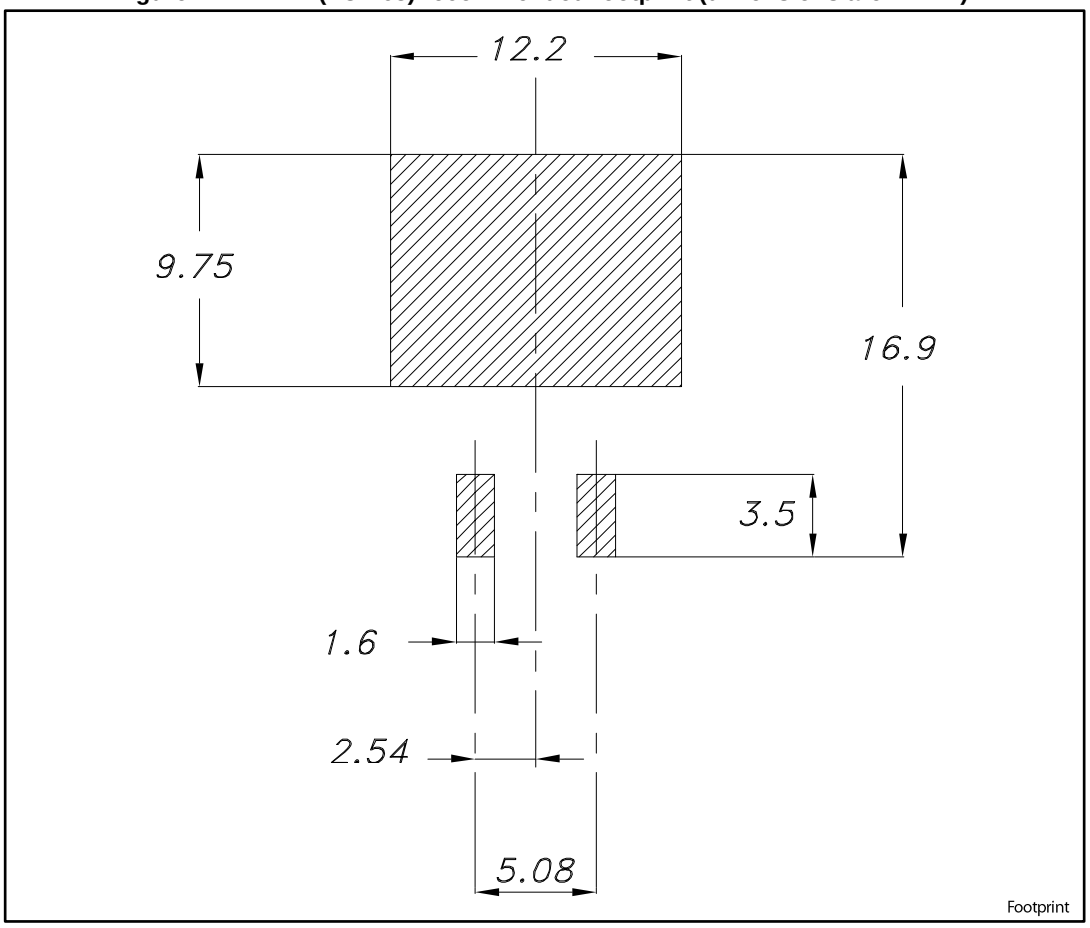


Table 8: D²PAK (TO-263) type A package mechanical data

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| A1 | 0.03 | | 0.23 |
| b | 0.70 | | 0.93 |
| b2 | 1.14 | | 1.70 |
| c | 0.45 | | 0.60 |
| c2 | 1.23 | | 1.36 |
| D | 8.95 | | 9.35 |
| D1 | 7.50 | 7.75 | 8.00 |
| D2 | 1.10 | 1.30 | 1.50 |
| E | 10 | | 10.40 |
| E1 | 8.50 | 8.70 | 8.90 |
| E2 | 6.85 | 7.05 | 7.25 |
| e | | 2.54 | |
| e1 | 4.88 | | 5.28 |
| H | 15 | | 15.85 |
| J1 | 2.49 | | 2.69 |
| L | 2.29 | | 2.79 |
| L1 | 1.27 | | 1.40 |
| L2 | 1.30 | | 1.75 |
| R | | 0.4 | |
| V2 | 0° | | 8° |

Figure 27: D²PAK (TO-263) recommended footprint (dimensions are in mm)



## 5.2 D²PAK packing information

**Figure 28: Tape outline**

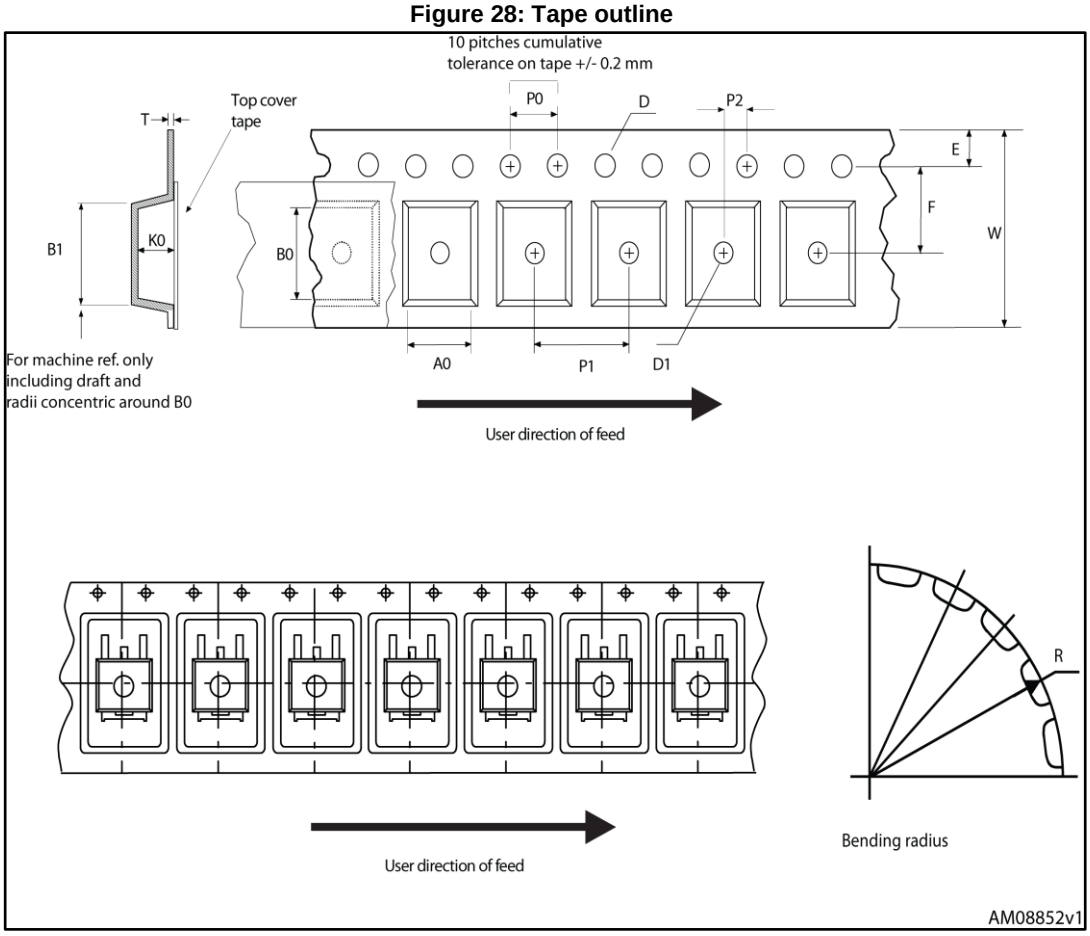


Figure 29: Reel outline

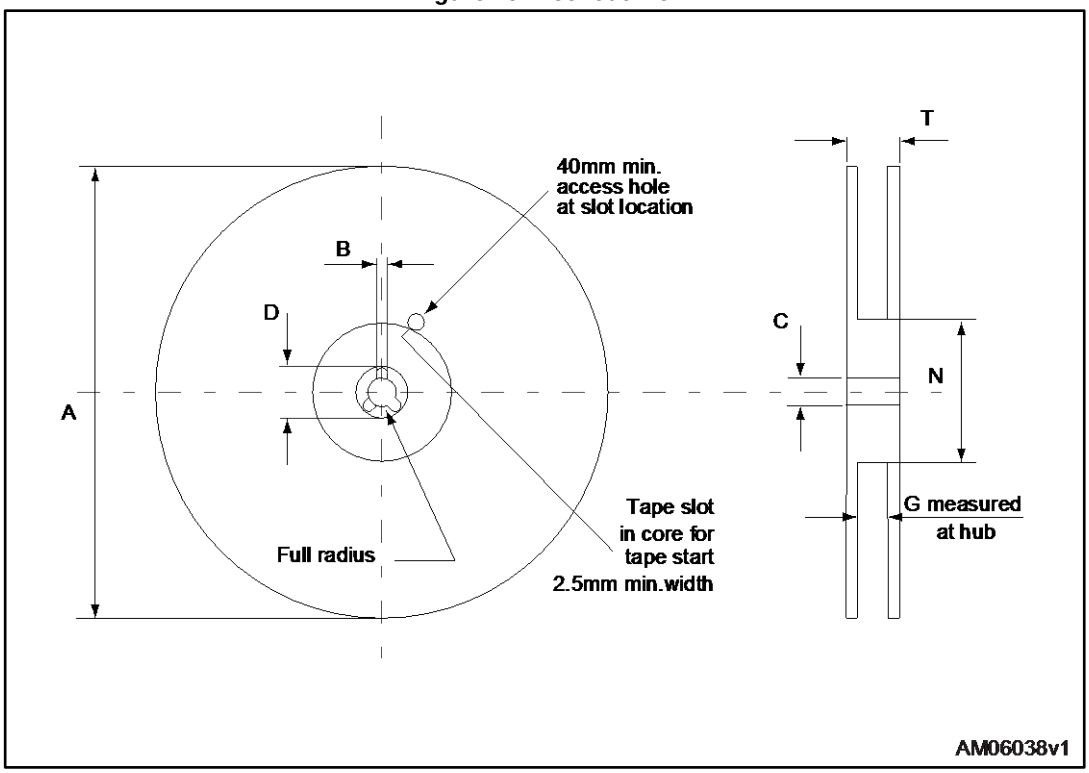



Table 9: D²PAK tape and reel mechanical data

| Tape | | | Reel | | |
|---|---|---|---|---|---|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 10.5 | 10.7 | A | | 330 |
| B0 | 15.7 | 15.9 | B | 1.5 | |
| D | 1.5 | 1.6 | C | 12.8 | 13.2 |
| D1 | 1.59 | 1.61 | D | 20.2 | |
| E | 1.65 | 1.85 | G | 24.4 | 26.4 |
| F | 11.4 | 11.6 | N | 100 | |
| K0 | 4.8 | 5.0 | T | | 30.4 |
| P0 | 3.9 | 4.1 | | | |
| P1 | 11.9 | 12.1 | Base quantity | | 1000 |
| P2 | 1.9 | 2.1 | Bulk quantity | | 1000 |
| R | 50 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 23.7 | 24.3 | | | |

## 5.3 TO-220 package information

**Figure 30: TO-220 type A package outline**

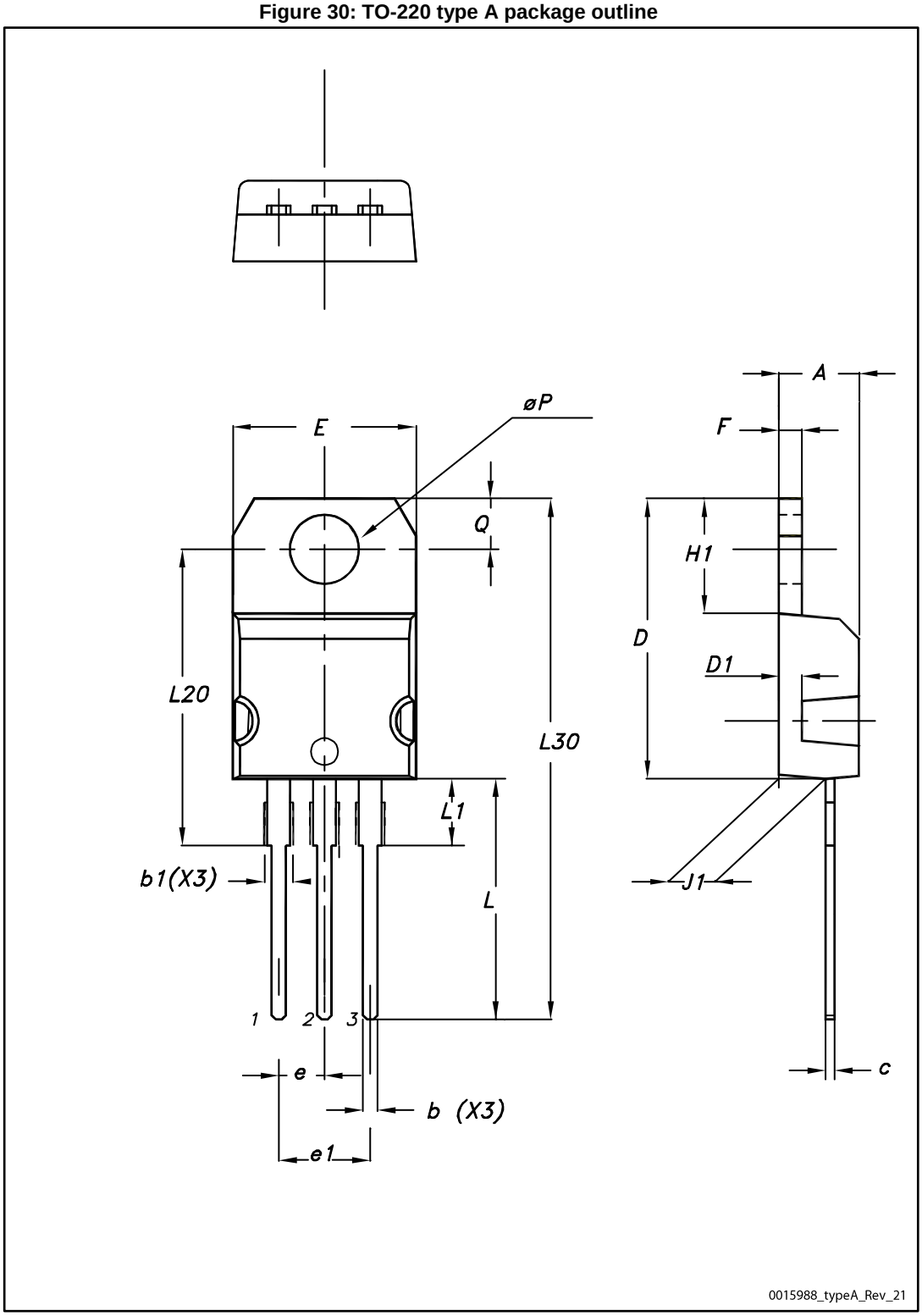


Table 11: TO-220 type A mechanical data

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.55 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10.00 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| øP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

# 6 Revision history

**Table 12: Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 23-Mar-2005 | 2 | New template |
| 01-Mar-2006 | 3 | Removed I²PAK and inserted D²PAK. |
| 04-Sep-2006 | 4 | New template,no content change |
| 20-Feb-2007 | 5 | Typo mistake on page 1 |
| 16-Mar-2013 | 6 | Minor text changes – Modified: *Figure 17* – Updated: Section 4: *Package mechanical data* and Section 5: *Packaging mechanical data* |
| 21-Nov-2016 | 7 | Updated title in cover page.<br>Updated *Section 2: "Electrical characteristics"*.<br>Minor text changes. |

## IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

# X-ON Electronics

Largest Supplier of Electrical and Electronic Components

***Click to view similar products for*** MOSFET ***category:***

***Click to view products by*** STMicroelectronics ***manufacturer:***

Other Similar products are found below :

614233C 648584F IRFD120 JANTX2N5237 FCA20N60_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L SBVS138LT1G 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C BUK954R8-60E NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE455 NTE6400A NTE2910 NTE2916 NTE2956 NTE2911 DMN2080UCB4-7 TK10A80W,S4X(S SSM6P69NU,LF DMP22D4UFO-7B DMN1006UCA6-7