

N-channel 300 V, 0.063  $\Omega$  typ., 42 A STripFET™ II  
Power MOSFETs in D<sup>2</sup>PAK, TO-220 and TO-247 packages

Datasheet - production data

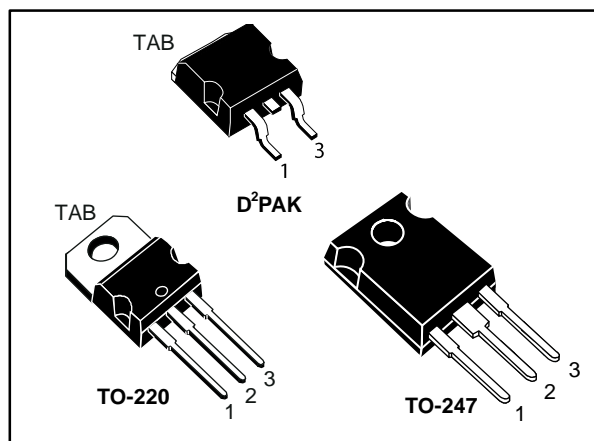
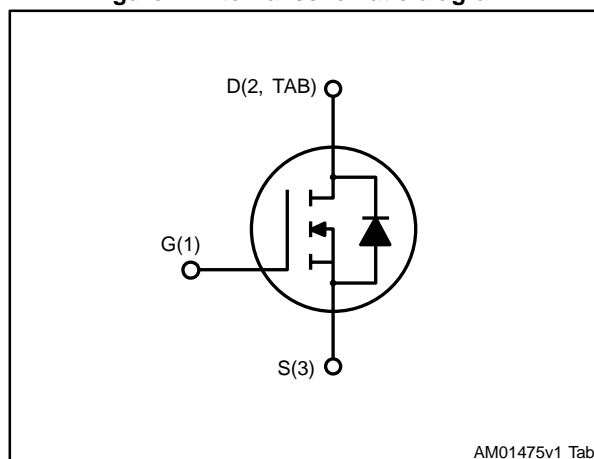


Figure 1: Internal schematic diagram



## Features

| Order code | V <sub>DSS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> | P <sub>w</sub> |
|------------|------------------|--------------------------|----------------|----------------|
| STB46NF30  | 300 V            | < 0.075 $\Omega$         | 42 A           | 300 W          |
| STP46NF30  |                  |                          |                |                |
| STW46NF30  |                  |                          |                |                |

- 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       |
|------------|---------|--------------------|---------------|
| STB46NF30  | 46NF30  | D <sup>2</sup> PAK | Tape and reel |
| STP46NF30  |         | TO-220             | Tube          |
| STW46NF30  |         | TO-247             |               |

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

| Symbol         | Parameter   | Value       | Unit                |
|----------------|---|-------------|---------------------|
| $V_{DS}$       | Drain-source voltage  | 300         | V                   |
| $V_{GS}$       | Gate-source voltage   | $\pm 20$    | V                   |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 42          | A                   |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 27          | A                   |
| $I_{DM}^{(1)}$ | Drain current (pulsed)  | 168         | A                   |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 300         | W                   |
|                | Derating factor   | 2           | W/ $^\circ\text{C}$ |
| $dv/dt^{(2)}$  | Peak diode recovery voltage slope                               | 10          | V/ns                |
| $T_J$          | Operating junction temperature range                            | - 55 to 175 | $^\circ\text{C}$    |
| $T_{stg}$      | Storage temperature range                                       |             |                     |

**Notes:**

(1)Pulse width limited by safe operating area.

(2) $I_{SD} \leq 34\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$ ,  $V_{DS\text{ peak}} < V_{(BR)DSS}$

**Table 3: Thermal data**

| Symbol              | Parameter                                      | Value              |        |        | Unit                      |
|---------------------|--|--------------------|--------|--------|---------------------------|
|                     |  | D <sup>2</sup> PAK | TO-220 | TO-247 |                           |
| $R_{thj-case}$      | Thermal resistance junction-case               | 0.5                |        |        | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$       | Thermal resistance junction-ambient max        | 30                 | 62.5   | 50     | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb                | 30                 |        |        | $^\circ\text{C}/\text{W}$ |
| $T_J$               | Maximum lead temperature for soldering purpose | 300                |        |        | $^\circ\text{C}$          |

**Notes:**

(1)When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu.

**Table 4: Avalanche characteristics**

| Symbol         | Parameter  | Value | Unit |
|----------------|--|-------|------|
| $I_{AR}^{(1)}$ | Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )                                 | 26    | A    |
| $E_{AS}$       | Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ ) | 290   | mJ   |

**Notes:**

(1)Pulse width limited by  $T_{jmax}$

## 2 Electrical characteristics

$T_C = 25\text{ °C}$  unless otherwise specified

**Table 5: On/off-state**

| Symbol        | Parameter                         | Test conditions   | Min. | Typ.  | Max.      | Unit          |
|---------------|-----------------------------------|---|------|-------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$   | 300  |       |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 300\text{ V}$   |      |       | 1         | $\mu\text{A}$ |
|               |                                   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 300\text{ V}$<br>$T_C = 125\text{ °C}$ <sup>(1)</sup> |      |       | 10        | $\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current         | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$                                      |      |       | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                      | 2    | 3     | 4         | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$ , $I_D = 17\text{ A}$  |      | 0.063 | 0.075     | $\Omega$      |

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 6: Dynamic**

| Symbol       | Parameter                    | Test conditions  | Min. | Typ. | Max. | Unit |
|--------------|------------------------------|--|------|------|------|------|
| $C_{iss}$    | Input capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$  | -    | 3200 | -    | pF   |
| $C_{oss}$    | Output capacitance           |  | -    | 442  | -    | pF   |
| $C_{rss}$    | Reverse transfer capacitance |  | -    | 57   | -    | pF   |
| $t_{d(on)}$  | Turn-on delay time           | $V_{DD} = 150\text{ V}$ , $I_D = 17\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 16: "Test circuit for resistive load switching times"</a> ) | -    | 25   | -    | ns   |
| $t_r$        | Rise time                    |  | -    | 38   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time          |  | -    | 80   | -    | ns   |
| $t_f$        | Fall time                    |  | -    | 46   | -    | ns   |
| $Q_g$        | Total gate charge            | $V_{DD} = 240\text{ V}$ , $I_D = 34\text{ A}$<br>$V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 17: "Test circuit for gate charge behavior"</a> )   | -    | 90   | -    | nC   |
| $Q_{gs}$     | Gate-source charge           |  | -    | 16   | -    | nC   |
| $Q_{gd}$     | Gate-drain charge            |  | -    | 40   | -    | nC   |

Table 7: Source-drain diode

| Symbol          | Parameter                     | Test conditions   | Min. | Typ. | Max. | Unit          |
|-----------------|-------------------------------|---|------|------|------|---------------|
| $I_{SD}$        | Source-drain current          |   | -    |      | 34   | A             |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |   | -    |      | 136  | A             |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 34 \text{ A}$ , $V_{GS} = 0 \text{ V}$  | -    |      | 1.6  | V             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 34 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 60 \text{ V}$<br>(see <a href="#">Figure 18: "Test circuit for inductive load switching and diode recovery times"</a> )                                      | -    | 215  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |   | -    | 1.7  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |   | -    | 16   |      | A             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 34 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 60 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$<br>(see <a href="#">Figure 18: "Test circuit for inductive load switching and diode recovery times"</a> ) | -    | 252  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |   | -    | 2.3  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |   | -    | 19   |      | A             |

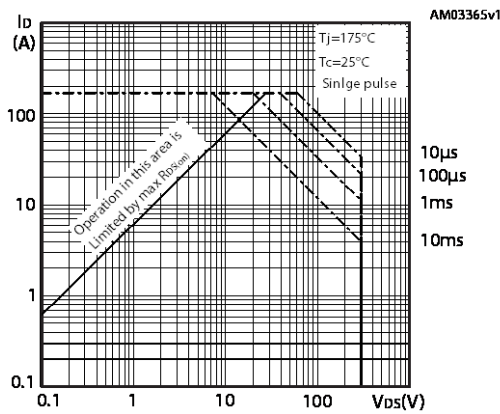
**Notes:**

(1)Pulse width limited by safe operating area

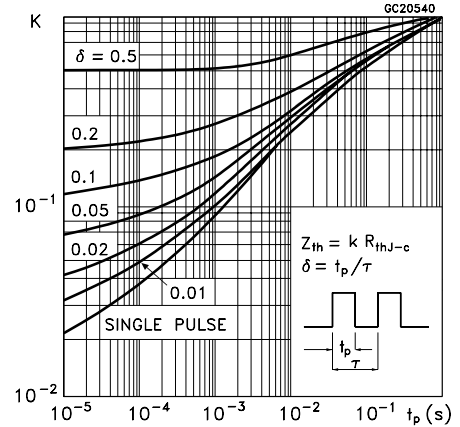
(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.2 Electrical characteristics (curves)

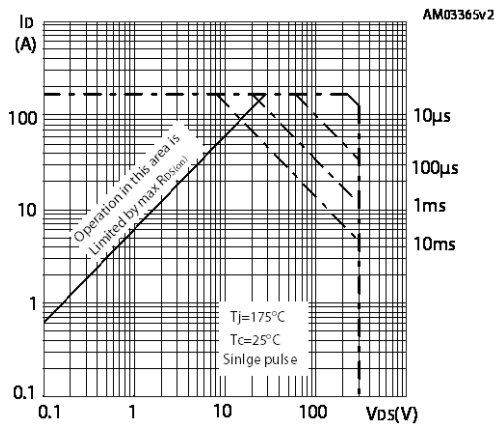
**Figure 2: Safe operating area for D<sup>2</sup>PAK and TO-220**



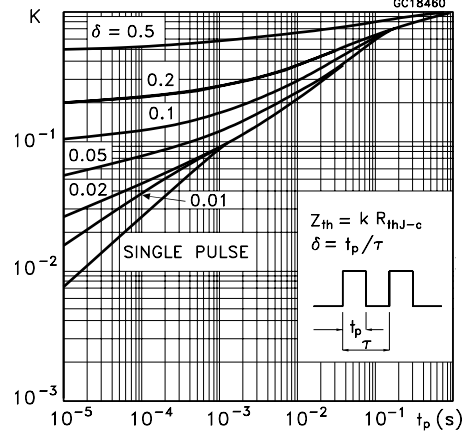
**Figure 3: Thermal impedance for D<sup>2</sup>PAK and TO-220**



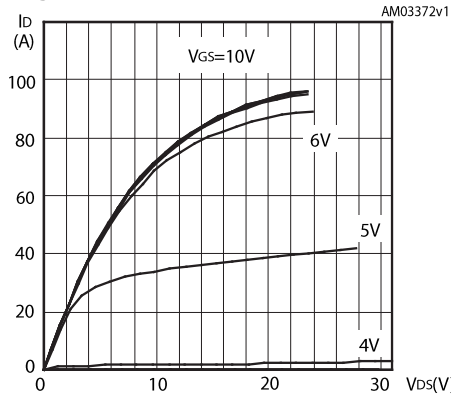
**Figure 4: Safe operating area for TO-247**



**Figure 5: Thermal impedance for TO-247**



**Figure 6: Output characteristics**



**Figure 7: Transfer characteristics**

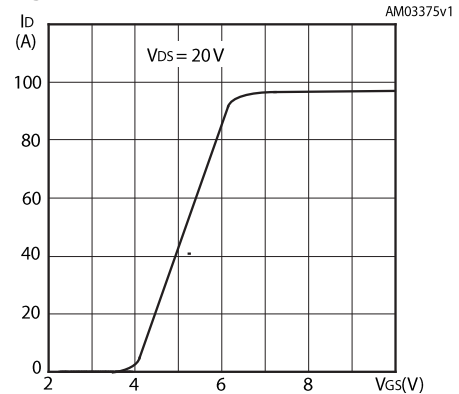


Figure 8: Gate charge vs gate-source voltage

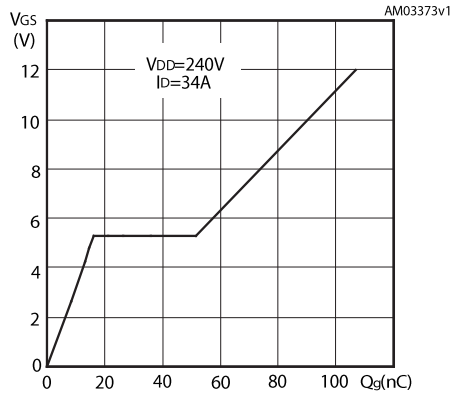


Figure 9: Static drain-source on-resistance

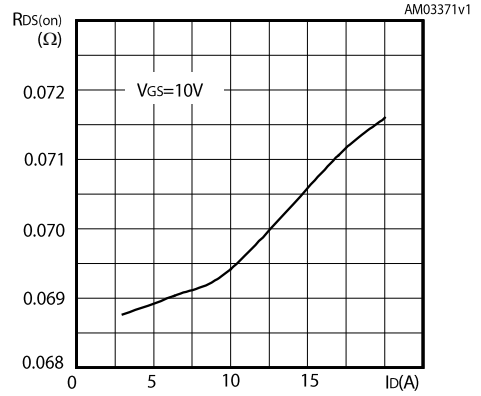


Figure 10: Capacitance variations

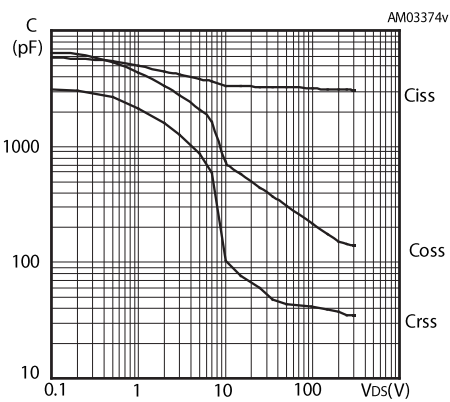


Figure 11: Normalized gate threshold voltage vs temperature

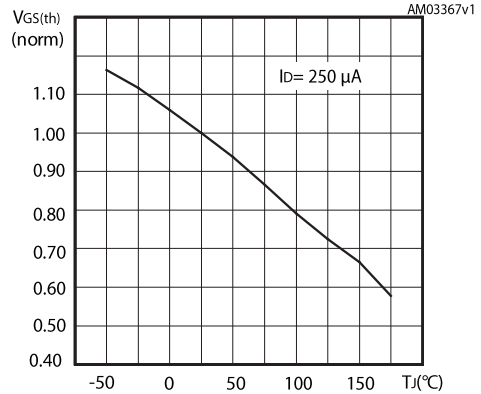


Figure 12: Normalized on-resistance vs temperature

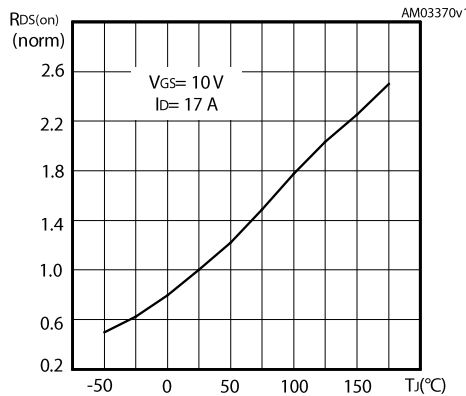


Figure 13: Normalized  $V_{(BR)DSS}$  vs temperature

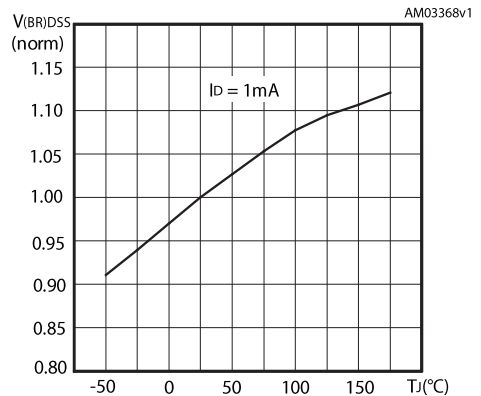


Figure 14: Avalanche energy vs starting  $T_j$

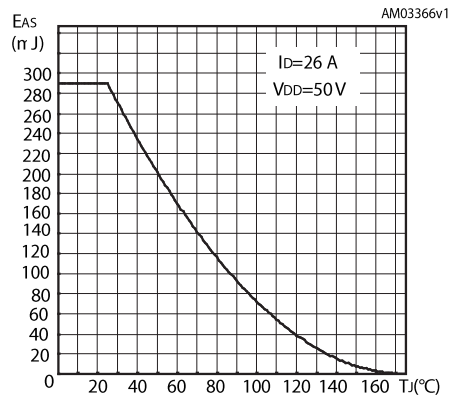
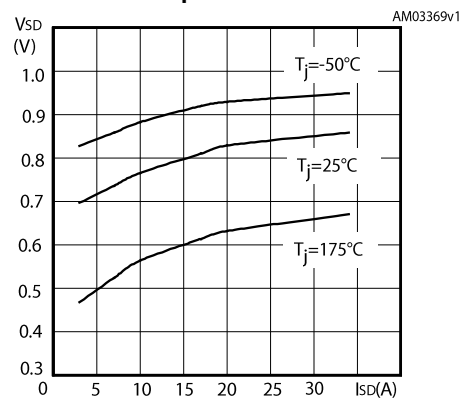


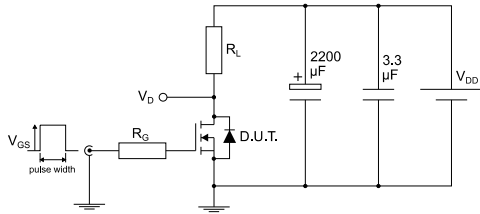
Figure 15: Source-drain diode forward vs temperature





### 3 Test circuits

**Figure 16: Test circuit for resistive load switching times**



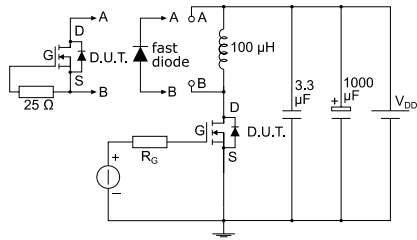
AM01468v1

**Figure 17: Test circuit for gate charge behavior**



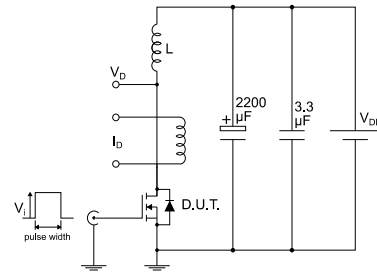
AM01469v1

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



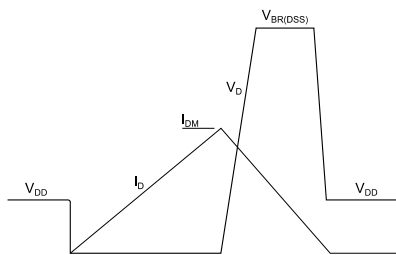
AM01470v1

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



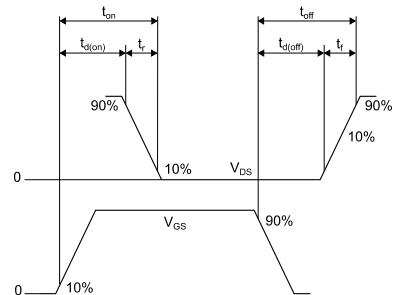
AM01471v1

**Figure 20: Unclamped inductive waveform**



AM01472v1

**Figure 21: Switching time waveform**



AM01473v1

## 4 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 D<sup>2</sup>PAK (TO-263) package information

Figure 22: D<sup>2</sup>PAK (TO-263) type A package outline

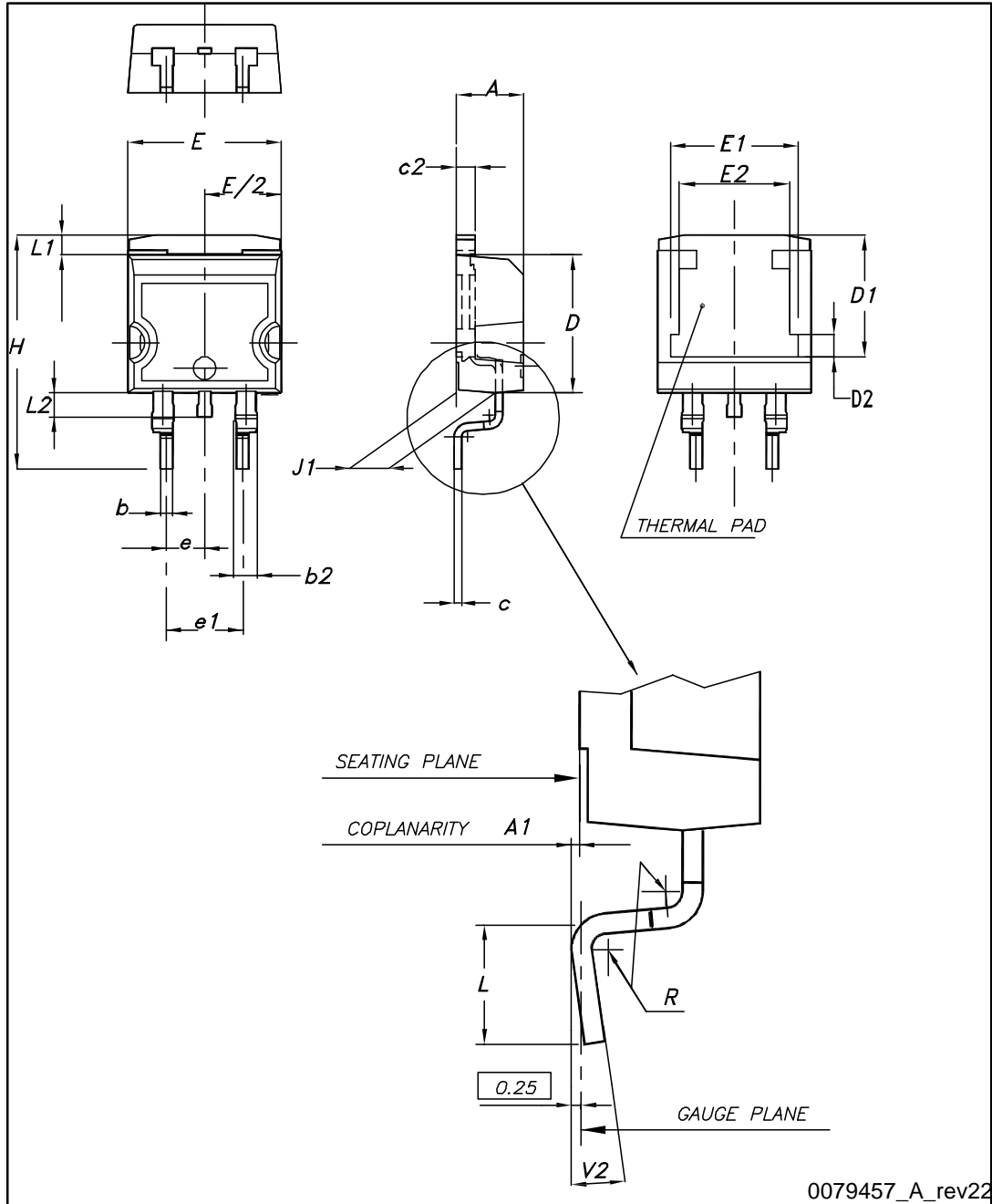
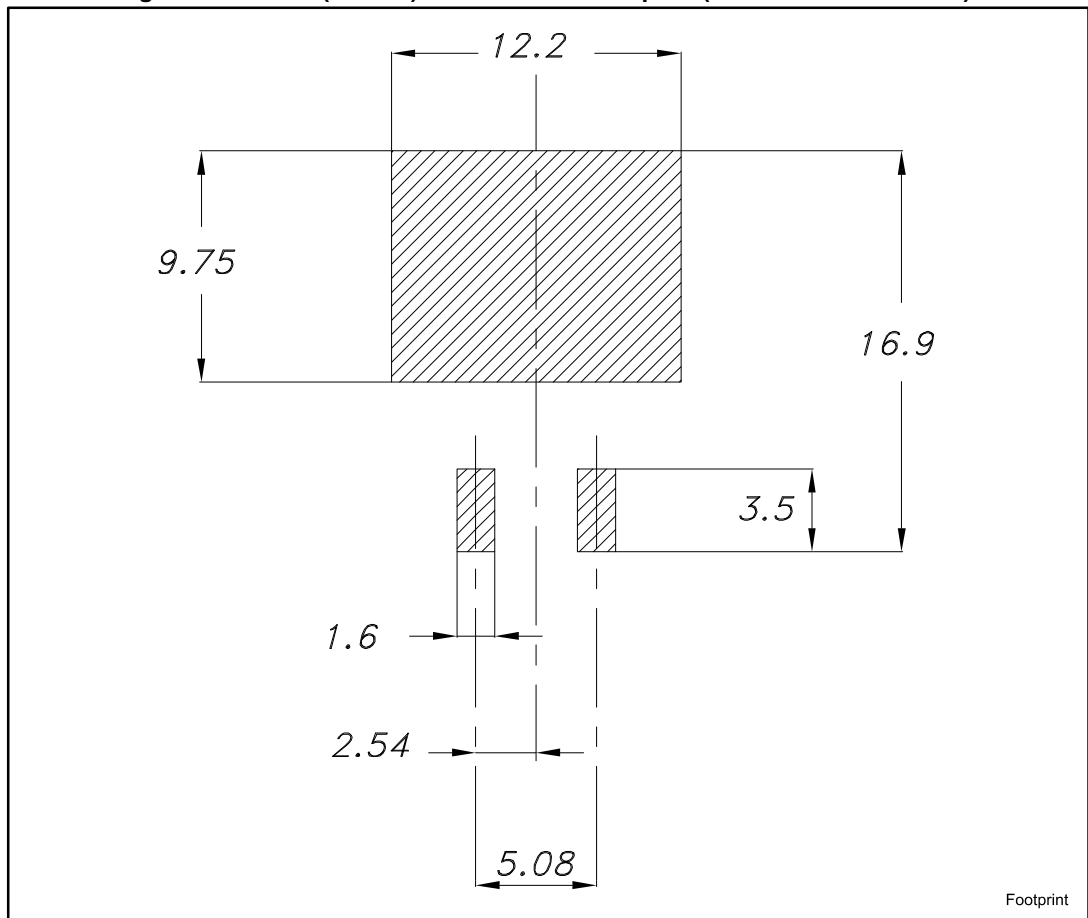


Table 8: D<sup>2</sup>PAK (TO-263) type A package mechanical data

| 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 23: D<sup>2</sup>PAK (TO-263) recommended footprint (dimensions are in mm)



### 4.2 D<sup>2</sup>PAK (TO-263) packing information

Figure 24: Tape outline

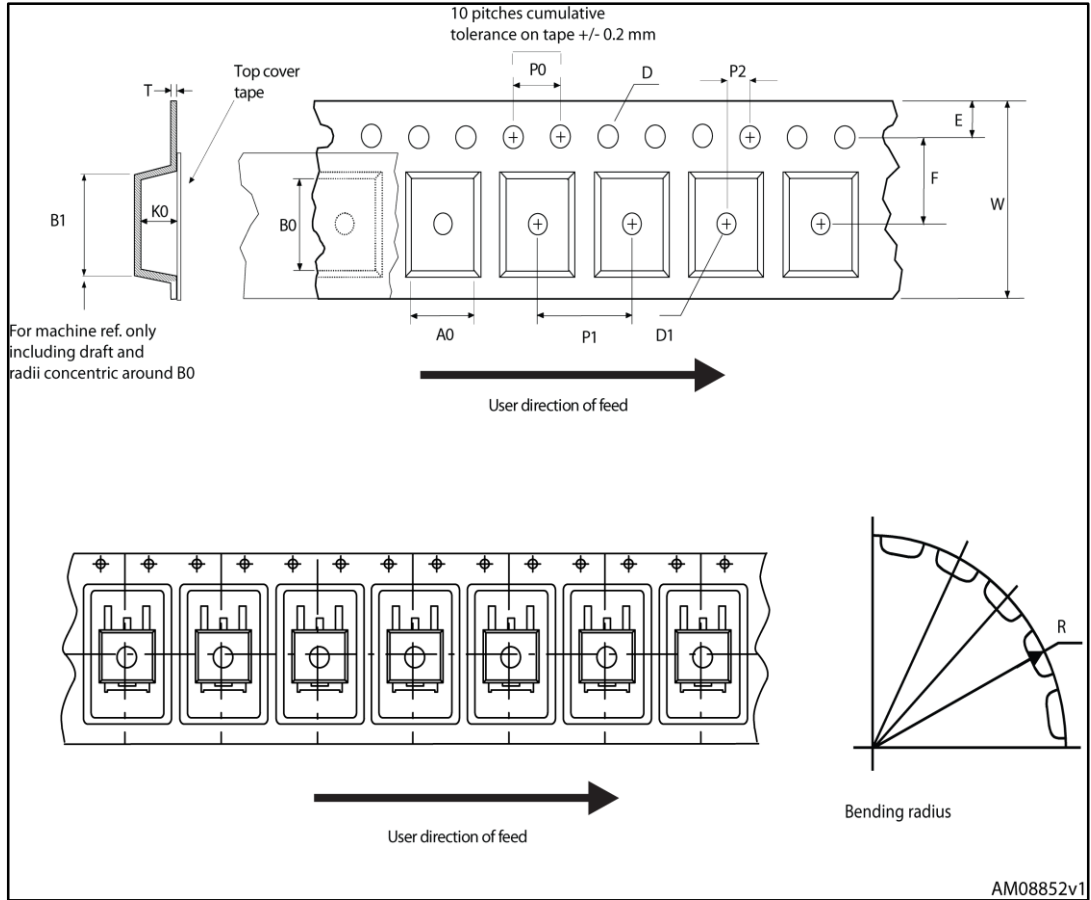
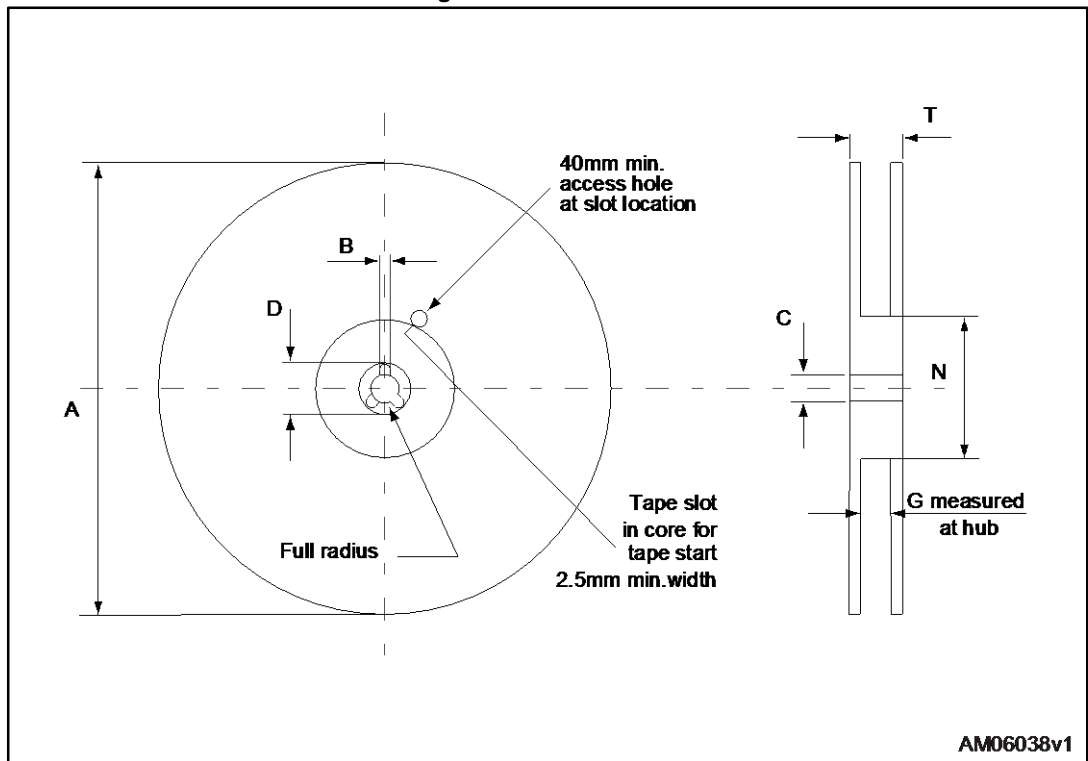


Figure 25: Reel outline



AM06038v1

Table 9: D<sup>2</sup>PAK 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 |               |      |      |

### 4.3 TO-220 type A package information

Figure 26: TO-220 type A package outline

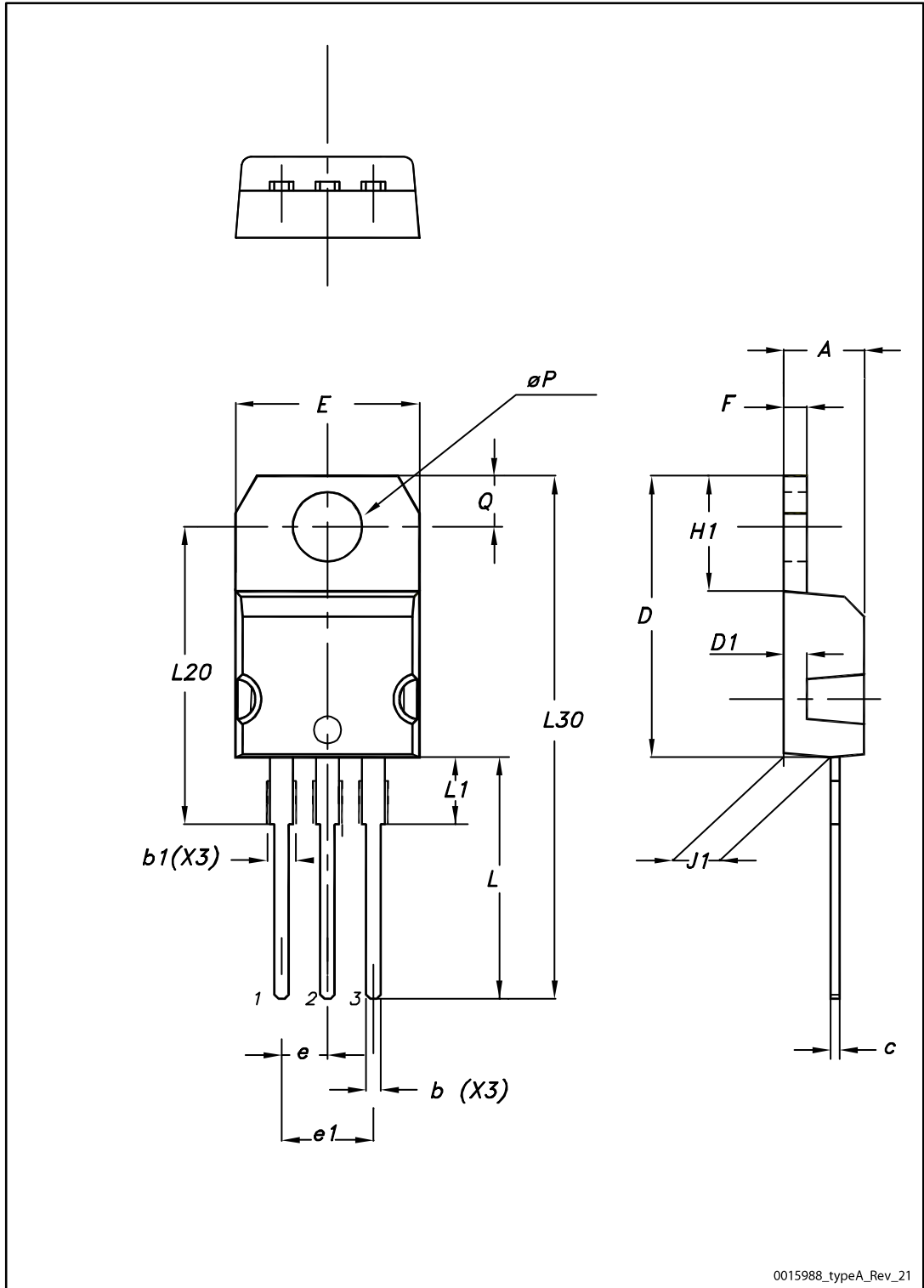


Table 10: TO-220 type A mechanical data

| 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  |



### 4.4 TO-247 package information

Figure 27: TO-247 package outline

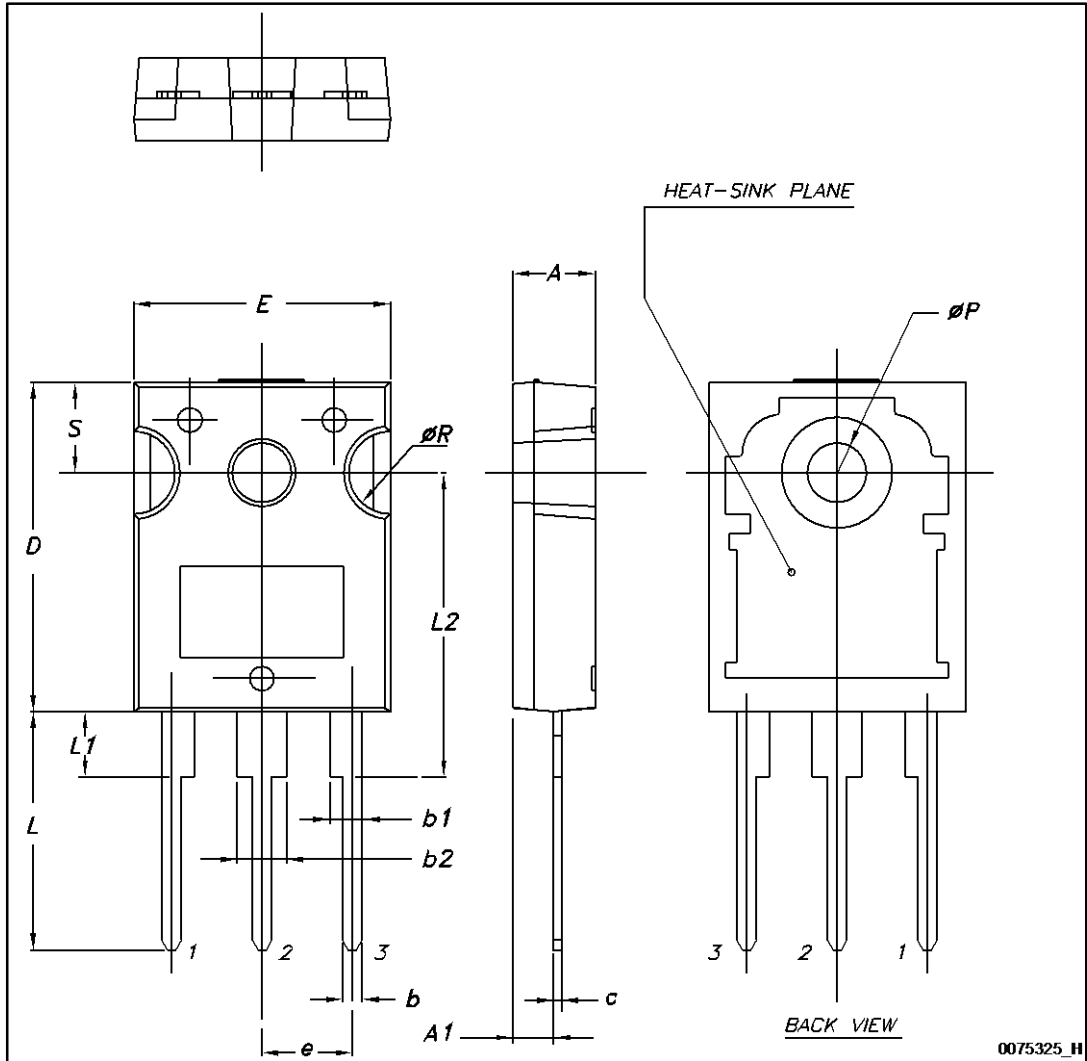


Table 11: TO-247 package mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.85  |       | 5.15  |
| A1   | 2.20  |       | 2.60  |
| b    | 1.0   |       | 1.40  |
| b1   | 2.0   |       | 2.40  |
| b2   | 3.0   |       | 3.40  |
| c    | 0.40  |       | 0.80  |
| D    | 19.85 |       | 20.15 |
| E    | 15.45 |       | 15.75 |
| e    | 5.30  | 5.45  | 5.60  |
| L    | 14.20 |       | 14.80 |
| L1   | 3.70  |       | 4.30  |
| L2   |       | 18.50 |       |
| ØP   | 3.55  |       | 3.65  |
| ØR   | 4.50  |       | 5.50  |
| S    | 5.30  | 5.50  | 5.70  |

## 5 Revision history

Table 12: Document revision history

| Date        | Revision | Changes   |
|-------------|----------|---|
| 28-Sep-2012 | 1        | First release.  |
| 24-Aug-2016 | 2        | Modified: <a href="#">Table 7: "Source-drain diode"</a><br>Minor text changes |

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