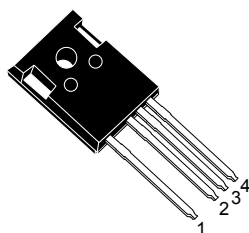
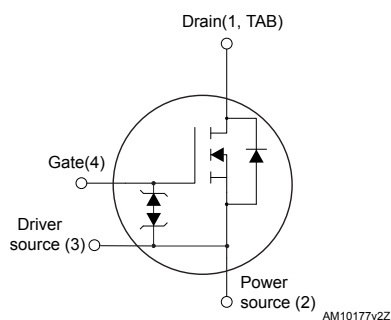


## N-channel 600 V, 32 mΩ typ., 72 A, MDmesh™ M6 Power MOSFET in a TO247-4 package



TO247-4



### Features

| Order code   | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|--------------|-----------------|--------------------------|----------------|
| STW75N60M6-4 | 600 V           | 36 mΩ                    | 72 A           |

- Reduced switching losses
- Lower R<sub>DS(on)</sub> per area vs previous generation
- Low gate input resistance
- 100% avalanche tested
- Zener-protected
- Excellent switching performance thanks to the extra driving source pin

### Applications

- Switching applications
- LLC converters
- Boost PFC converters

### Description

The new MDmesh™ M6 technology incorporates the most recent advancements to the well-known and consolidated MDmesh family of SJ MOSFETs. STMicroelectronics builds on the previous generation of MDmesh devices through its new M6 technology, which combines excellent R<sub>DS(on)</sub> per area improvement with one of the most effective switching behaviors available, as well as a user-friendly experience for maximum end-application efficiency.

#### Product status link

[STW75N60M6-4](#)

#### Product summary

|            |              |
|------------|--------------|
| Order code | STW75N60M6-4 |
| Marking    | 75N60M6      |
| Package    | TO247-4      |
| Packing    | Tube         |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter                                                       | Value      | Unit             |
|----------------|-----------------------------------------------------------------|------------|------------------|
| $V_{GS}$       | Gate-source voltage                                             | $\pm 25$   | V                |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 72         | A                |
|                | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 45         | A                |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                                          | 288        | A                |
| $P_{TOT}$      | Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$     | 446        | W                |
| $dv/dt^{(2)}$  | Peak diode recovery voltage slope                               | 15         | V/ns             |
| $dv/dt^{(3)}$  | MOSFET $dv/dt$ ruggedness                                       | 100        |                  |
| $T_{stg}$      | Storage temperature range                                       | -55 to 150 | $^\circ\text{C}$ |
| $T_J$          | Operating junction temperature range                            |            |                  |

1. Pulse width is limited by safe operating area.
2.  $I_{SD} \leq 72\text{ A}$ ,  $di/dt = 400\text{ A}/\mu\text{s}$ ,  $V_{DS(peak)} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$
3.  $V_{DS} \leq 480\text{ V}$

**Table 2. Thermal data**

| Symbol         | Parameter                           | Value | Unit                      |
|----------------|-------------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case    | 0.28  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient | 50    | $^\circ\text{C}/\text{W}$ |

**Table 3. Avalanche characteristics**

| Symbol   | Parameter                                                                                                            | Value | Unit |
|----------|----------------------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AR}$ | Avalanche current, repetitive or not repetitive (pulse width limited by $T_{Jmax}$ )                                 | 11    | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ ) | 1.4   | J    |

## 2 Electrical characteristics

( $T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

**Table 4. On/off-states**

| Symbol        | Parameter                         | Test conditions                                                                                | Min. | Typ. | Max.    | Unit          |
|---------------|-----------------------------------|------------------------------------------------------------------------------------------------|------|------|---------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$                                                    | 600  |      |         | V             |
| $I_{DSS}$     | Zero-gate voltage drain current   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$                                                |      |      | 1       | $\mu\text{A}$ |
|               |                                   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$ ,<br>$T_C = 125\text{ }^{\circ}\text{C}^{(1)}$ |      |      | 100     |               |
| $I_{GSS}$     | Gate-body leakage current         | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 25\text{ V}$                                             |      |      | $\pm 5$ | $\mu\text{A}$ |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                             | 3.25 | 4    | 4.75    | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$ , $I_D = 36\text{ A}$                                                   |      | 32   | 36      | m $\Omega$    |

1. Defined by design, not subject to production test.

**Table 5. Dynamic**

| Symbol                     | Parameter                     | Test conditions                                                                                         | Min. | Typ. | Max. | Unit     |
|----------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------|------|------|------|----------|
| $C_{iss}$                  | Input capacitance             | $V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$                                    | -    | 4850 | -    | pF       |
| $C_{oss}$                  | Output capacitance            |                                                                                                         | -    | 380  | -    | pF       |
| $C_{rss}$                  | Reverse transfer capacitance  |                                                                                                         | -    | 3.5  | -    | pF       |
| $C_{oss\text{ eq.}}^{(1)}$ | Equivalent output capacitance | $V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ to }480\text{ V}$                                             | -    | 851  | -    | pF       |
| $R_G$                      | Intrinsic gate resistance     | $f = 1\text{ MHz}$ open drain                                                                           | -    | 1.5  | -    | $\Omega$ |
| $Q_g$                      | Total gate charge             | $V_{DD} = 480\text{ V}$ , $I_D = 72\text{ A}$ ,<br>$V_{GS} = 0\text{ to }10\text{ V}$<br>(see Figure 2) | -    | 106  | -    | nC       |
| $Q_{gs}$                   | Gate-source charge            |                                                                                                         | -    | 32   | -    | nC       |
| $Q_{gd}$                   | Gate-drain charge             |                                                                                                         | -    | 45   | -    | nC       |

1.  $C_{oss\text{ eq.}}$  is defined as the constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$ .

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions                                                                                                                      | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 300\text{ V}$ , $I_D = 36\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(see Figure 1 and Figure 6) | -    | TBD  | -    | ns   |
| $t_r$        | Rise time           |                                                                                                                                      | -    | TBD  | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                                                      | -    | TBD  | -    | ns   |
| $t_f$        | Fall time           |                                                                                                                                      | -    | TBD  | -    | ns   |

**Table 7. Source-drain diode**

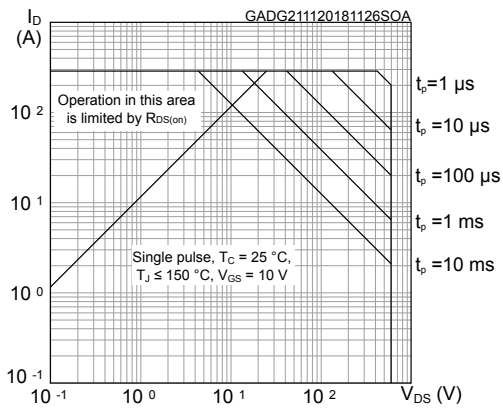
| Symbol          | Parameter                     | Test conditions                                                                                                                               | Min. | Typ. | Max. | Unit          |
|-----------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{SD}$        | Source-drain current          |                                                                                                                                               | -    |      | 72   | A             |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                                                                                                               | -    |      | 288  | A             |
| $V_{SD}^{(2)}$  | Forward on voltage            | $V_{GS} = 0\text{ V}$ , $I_{SD} = 72\text{ A}$                                                                                                | -    |      | 1.6  | V             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 72\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 60\text{ V}$<br>(see Figure 3)                                     | -    | 367  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                               | -    | 6.4  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                               | -    | 35   |      | A             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 72\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 60\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$<br>(see Figure 3) | -    | 552  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                               | -    | 13.7 |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                               | -    | 49.6 |      | A             |

1. Pulse width is limited by safe operating area.

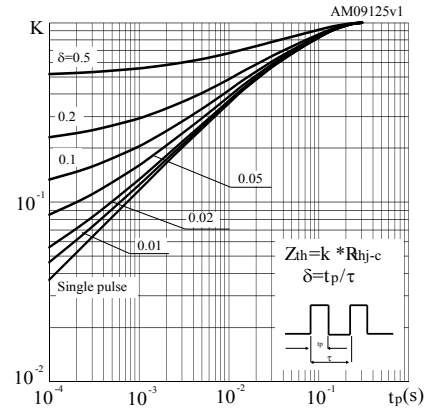
2. Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

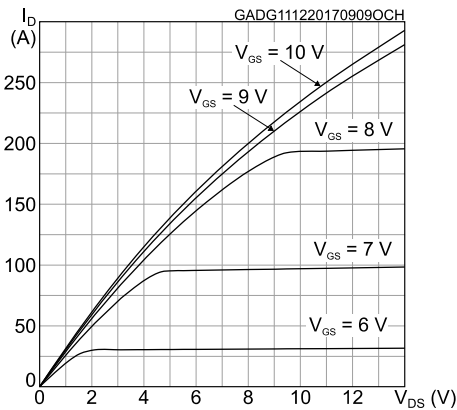
**Figure 1. Safe operating area**



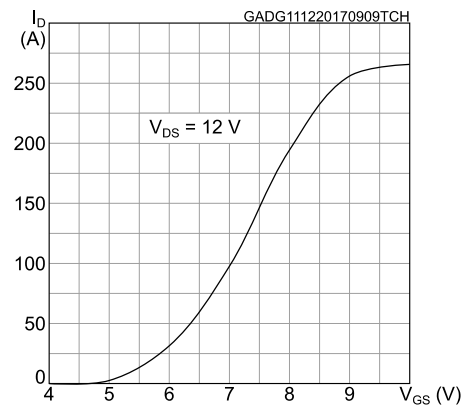
**Figure 2. Thermal impedance**



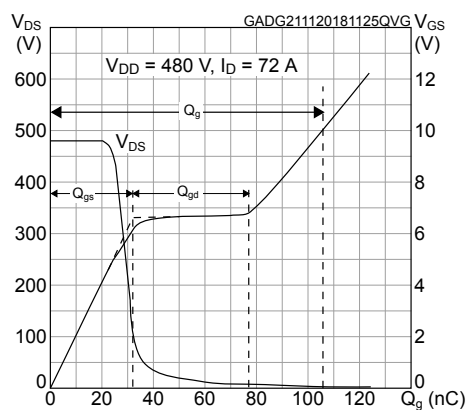
**Figure 3. Output characteristics**



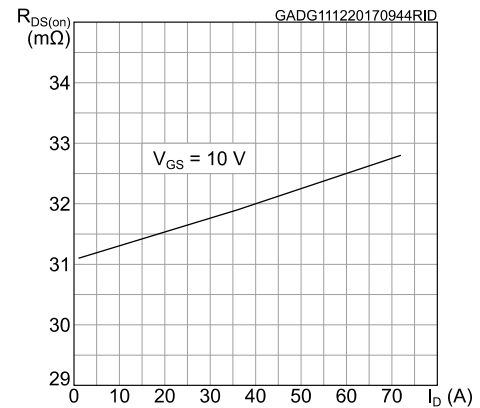
**Figure 4. Transfer characteristics**



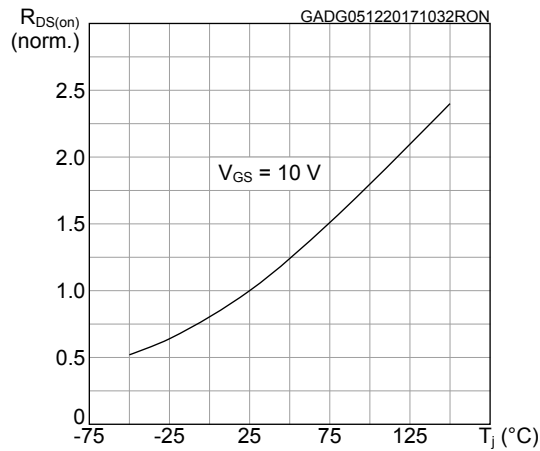
**Figure 5. Gate charge vs gate-source voltage**



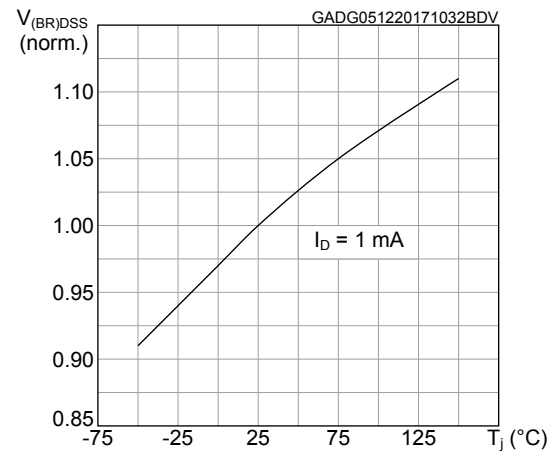
**Figure 6. Static drain-source on-resistance**



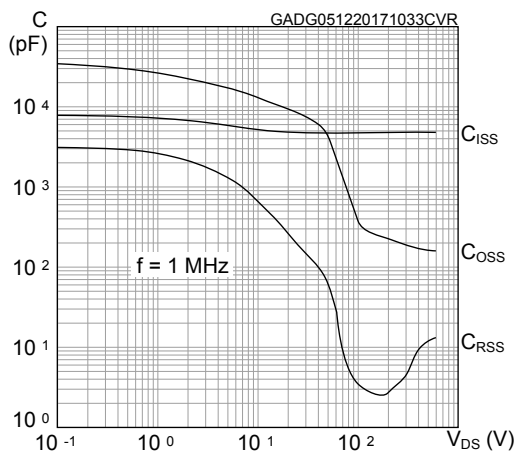
**Figure 7. Normalized on-resistance vs temperature**



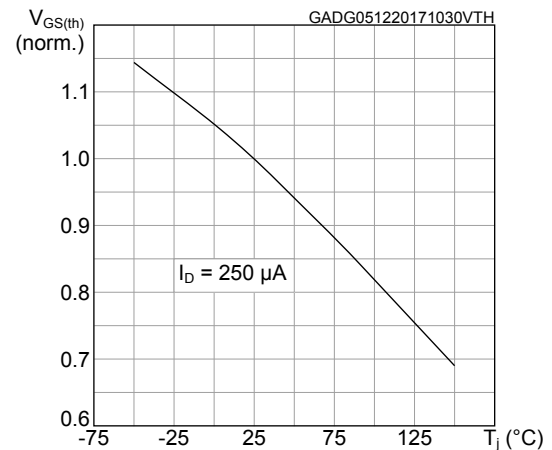
**Figure 8. Normalized  $V_{(BR)DSS}$  vs temperature**



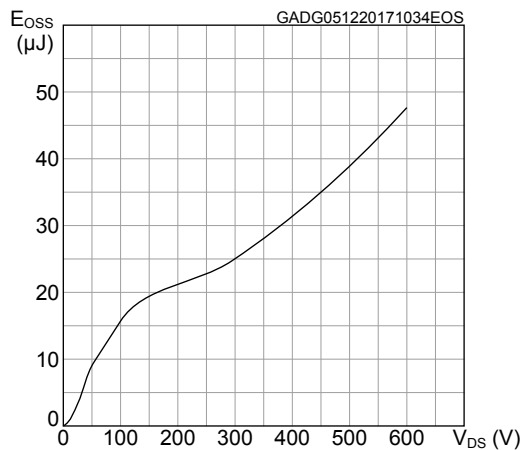
**Figure 9. Capacitance variations**



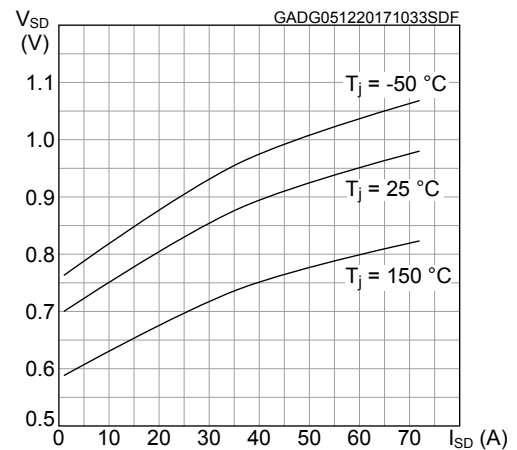
**Figure 10. Normalized gate threshold voltage vs temperature**



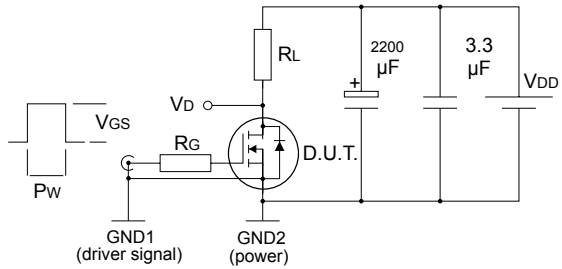
**Figure 11. Output capacitance stored energy**



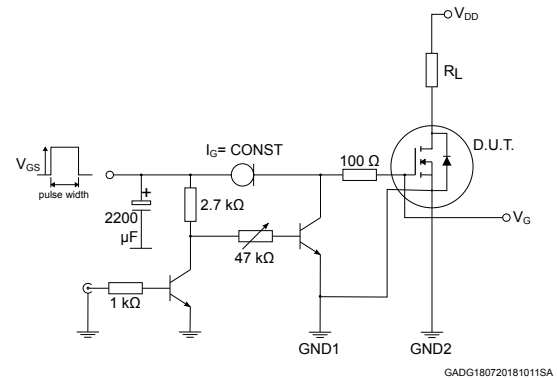
**Figure 12. Source-drain diode forward characteristics**



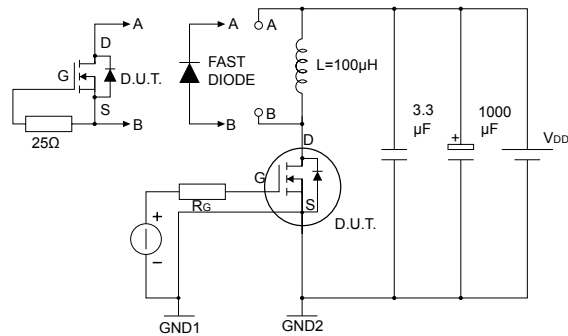
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**


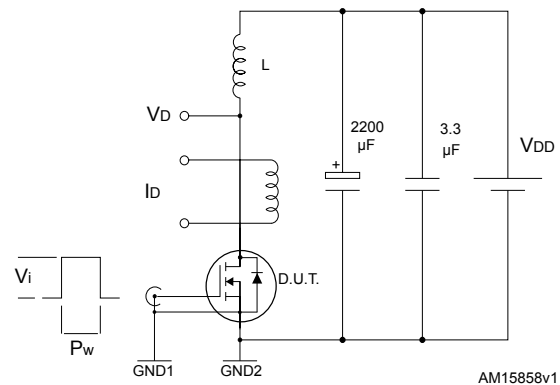
AM15855v1

**Figure 14. Test circuit for gate charge behavior**


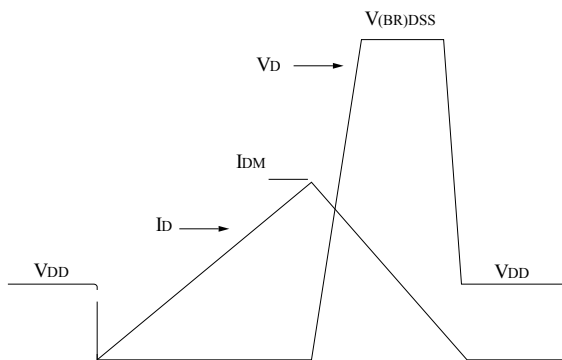
GADG180720181011SA

**Figure 15. Test circuit for inductive load switching and diode recovery times**


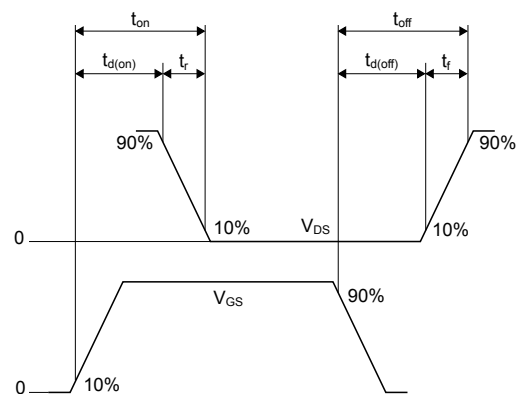
AM15857v1

**Figure 16. Unclamped inductive load test circuit**


AM15858v1

**Figure 17. Unclamped inductive waveform**


AM01472v1

**Figure 18. Switching time waveform**


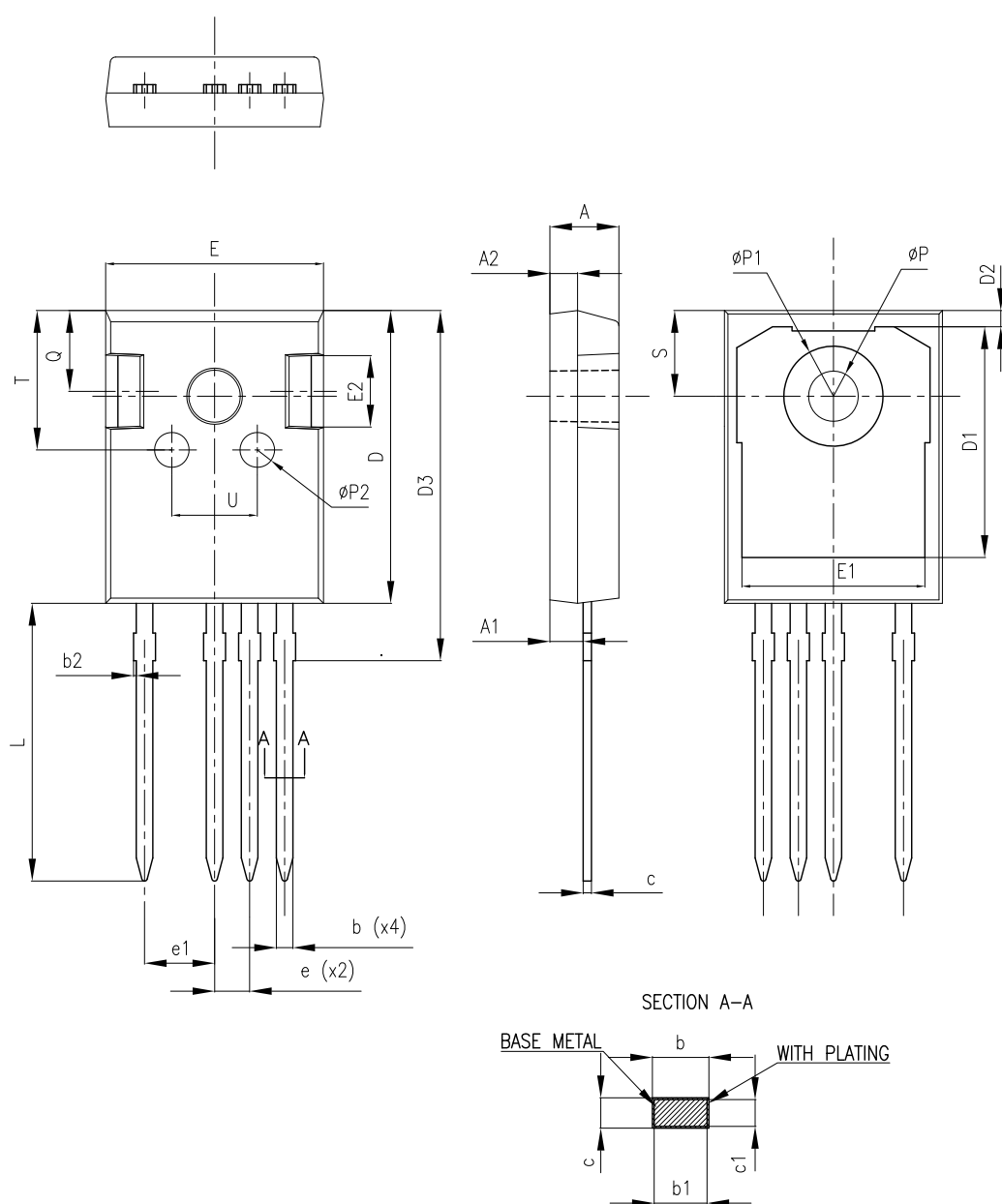
AM01473v1

## 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 TO247-4 package information

Figure 19. TO247-4 package outline



8405626\_2

**Table 8. TO247-4 mechanical data**

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.90  | 5.00  | 5.10  |
| A1   | 2.31  | 2.41  | 2.51  |
| A2   | 1.90  | 2.00  | 2.10  |
| b    | 1.16  |       | 1.29  |
| b1   | 1.15  | 1.20  | 1.25  |
| b2   | 0     |       | 0.20  |
| c    | 0.59  |       | 0.66  |
| c1   | 0.58  | 0.60  | 0.62  |
| D    | 20.90 | 21.00 | 21.10 |
| D1   | 16.25 | 16.55 | 16.85 |
| D2   | 1.05  | 1.20  | 1.35  |
| D3   | 24.97 | 25.12 | 25.27 |
| E    | 15.70 | 15.80 | 15.90 |
| E1   | 13.10 | 13.30 | 13.50 |
| E2   | 4.90  | 5.00  | 5.10  |
| E3   | 2.40  | 2.50  | 2.60  |
| e    | 2.44  | 2.54  | 2.64  |
| e1   | 4.98  | 5.08  | 5.18  |
| L    | 19.80 | 19.92 | 20.10 |
| P    | 3.50  | 3.60  | 3.70  |
| P1   |       |       | 7.40  |
| P2   | 2.40  | 2.50  | 2.60  |
| Q    | 5.60  |       | 6.00  |
| S    |       | 6.15  |       |
| T    | 9.80  |       | 10.20 |
| U    | 6.00  |       | 6.40  |

## Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11-Dec-2017 | 1        | Initial version                                                                                                                                                                                                                                                                                                                                                                                                  |
| 07-Dec-2018 | 2        | <p>Removed maturity status indication from cover page. The document status is production data.</p> <p>Updated schematic diagram on cover page.</p> <p>Updated <a href="#">Table 1. Absolute maximum ratings</a>, <a href="#">Table 5. Dynamic</a> and <a href="#">Table 7. Source-drain diode</a>.</p> <p>Updated <a href="#">Section 2.1 Electrical characteristics (curves)</a>.</p> <p>Minor text changes</p> |

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