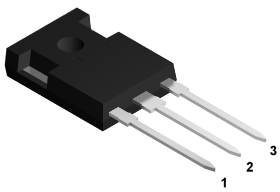
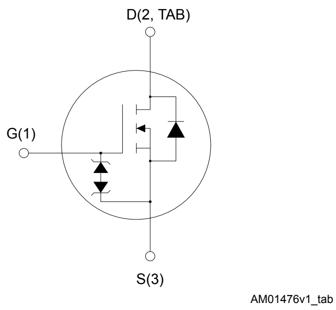
# STWA72N60DM2AG

Datasheet

## Automotive-grade N-channel 600 V, 37 mΩ typ., 66 A MDmesh DM2 Power MOSFET in a TO-247 long leads package




TO-247 long leads




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| STWA72N60DM2AG | 600 V | 42 mΩ | 66 A |

- AEC-Q101 qualified
- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

## Applications

- Switching applications

## Description

This high-voltage N-channel Power MOSFET is part of the MDmesh DM2 fast-recovery diode series. It offers very low recovery charge ($Q_{rr}$) and time ($t_{rr}$) combined with low $R_{DS(on)}$, rendering it suitable for the most demanding high-efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

| Product status link |
|---|
| STWA72N60DM2AG |

| Product summary | |
|---|---|
| **Order code** | STWA72N60DM2AG |
| **Marking** | 72N60DM2 |
| **Package** | TO-247 long leads |
| **Packing** | Tube |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
| --- | --- | --- | --- |
| $V_{GS}$ | Gate-source voltage | ±25 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 66 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 42 | |
| $I_{DM}$ (1) | Drain current (pulsed) | 220 | A |
| $P_{TOT}$ | Total dissipation at $T_{case}$ = 25 °C | 446 | W |
| dv/dt (2) | Peak diode recovery voltage slope | 50 | V/ns |
| dv/dt (3) | MOSFET dv/dt ruggedness | 50 | V/ns |
| $T_{stg}$ | Storage temperature range | -55 to 150 | °C |
| $T_J$ | Operating junction temperature range | | °C |

1. *Pulse width is limited by safe operating area.*
2. *$I_{SD}$ ≤ 66 A, $V_{DS}$ (peak) < $V_{(BR)DSS}$, di/dt = 800 A/µs, $V_{DD}$ = 480 V.*
3. *$V_{DS}$ ≤ 480 V*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
| --- | --- | --- | --- |
| $R_{thJC}$ | Thermal resistance, junction-to-case | 0.28 | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 50 | °C/W |

**Table 3. Avalanche characteristics**

| Symbol | Parameter | Value | Unit |
| --- | --- | --- | --- |
| $I_{AR}$ | Avalanche current, repetitive or not repetitive (pulse width limited by $T_J$ max.) | 8 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | 1500 | mJ |

# 2 Electrical characteristics

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

**Table 4. Static**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 600 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 600 V | | | 10 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 600 V, $T_C$ = 125 °C[1] | | | 100 | |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0 V, $V_{GS}$ = ±25 V | | | ±5 | µA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 3 | 4 | 5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$ = 33 A | | 37 | 42 | mΩ |

1. *Specified by design, not tested in production.*

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 100 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 5508 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 241 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 2.8 | - | pF |
| $C_{oss\ eq.}$[1] | Equivalent output capacitance | $V_{DS}$ = 0 to 480 V, $V_{GS}$ = 0 V | - | 470 | - | pF |
| $R_g$ | Intrinsic gate resistance | f = 1 MHz open drain | - | 2 | - | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$ = 480 V, $I_D$ = 66 A, $V_{GS}$ = 0 to 10 V (see Figure 14. Test circuit for gate charge behavior) | - | 121 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 26 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 61 | - | nC |

1. *$C_{oss\ eq}$ is defined as a constant equivalent capacitance giving the same charging time as $C_{oss}$ when $V_{DS}$ increases from 0 to stated value.*

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 300 V, $I_D$ = 33 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform) | - | 32 | - | ns |
| $t_r$ | Rise time | | - | 67 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 112 | - | ns |
| $t_f$ | Fall time | | - | 10.4 | - | ns |

Table 7. **Source-drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 66 | A |
| $I_{SDM}$[(1)] | Source-drain current (pulsed) | | - | | 220 | A |
| $V_{SD}$[(2)] | Forward on voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 66 A | - | | 1.6 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 66 A, di/dt = 100 A/µs, $V_{DD}$ = 480 V (see Figure 15. Test circuit for inductive load switching and diode recovery times) | - | 150 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 0.75 | | µC |
| $I_{RRM}$ | Reverse recovery current | | - | 10.5 | | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 66 A, di/dt = 100 A/µs, $V_{DD}$ = 480 V, $T_j$ = 150 °C (see Figure 15. Test circuit for inductive load switching and diode recovery times) | - | 250 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 2.5 | | µC |
| $I_{RRM}$ | Reverse recovery current | | - | 20.7 | | A |

1. *Pulse width is limited by safe operating area.*
2. *Pulse test: pulse duration = 300 µs, duty cycle 1.5%.*

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

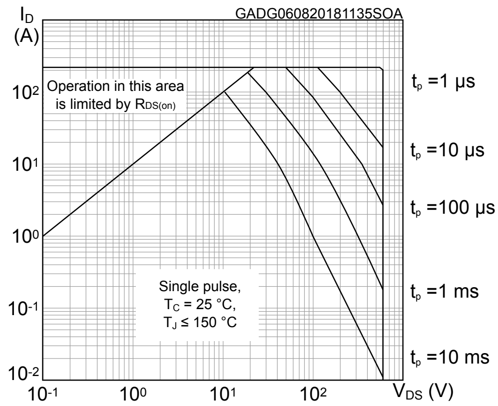



Figure 2. Normalized transient thermal impedance

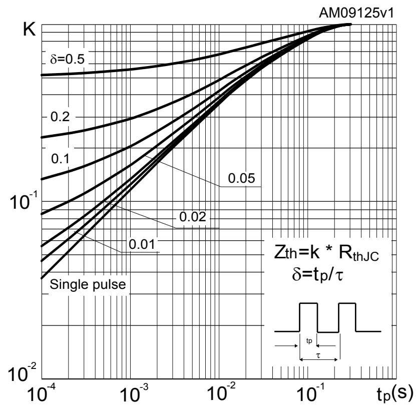



Figure 3. Tipical output characteristics

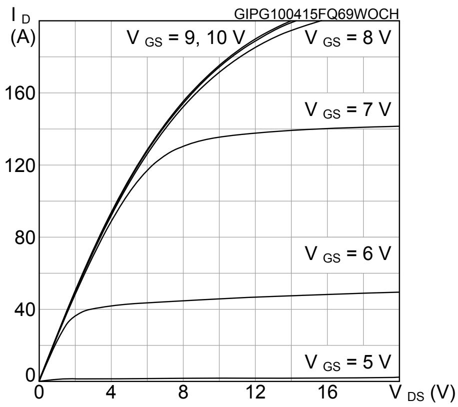



Figure 4. Tipical transfer characteristics

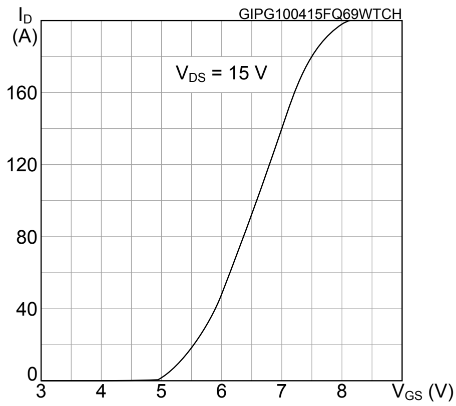



Figure 5. Typical gate charge characteristics

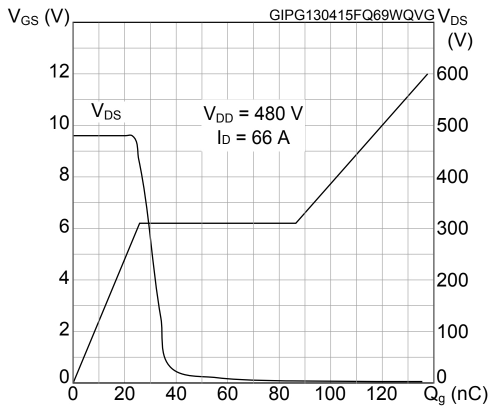



Figure 6. Typical drain-source on-resistance

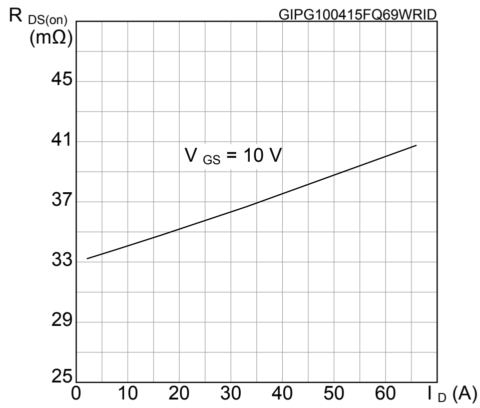


**Figure 7. Typical capacitance characteristics**

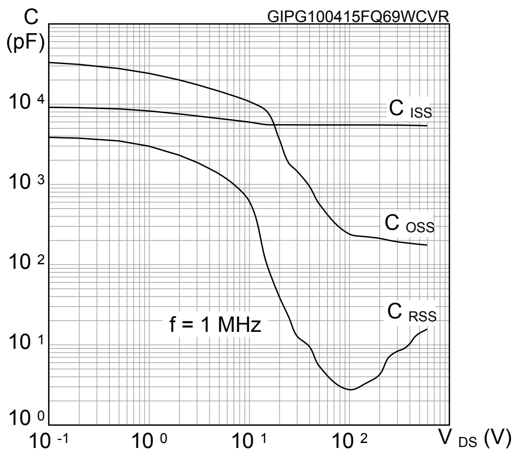



**Figure 8. Normalized gate threshold vs temperature**

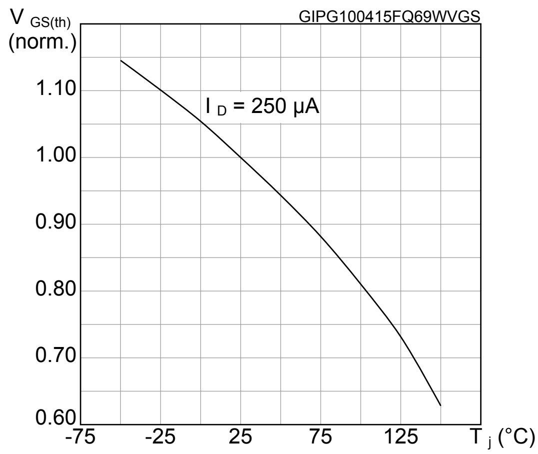



**Figure 9. Normalized on-resistance vs temperature**

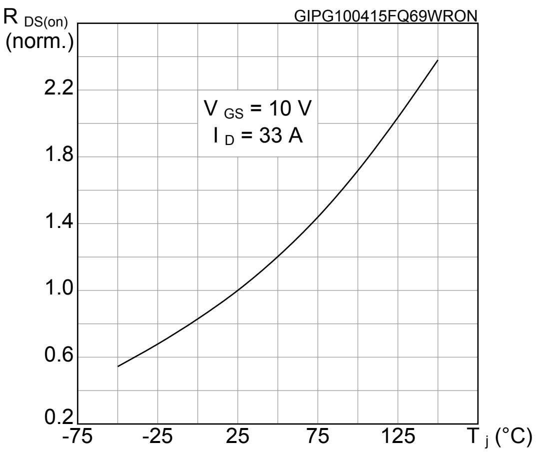



**Figure 10. Normalized breakdown voltage vs temperature**

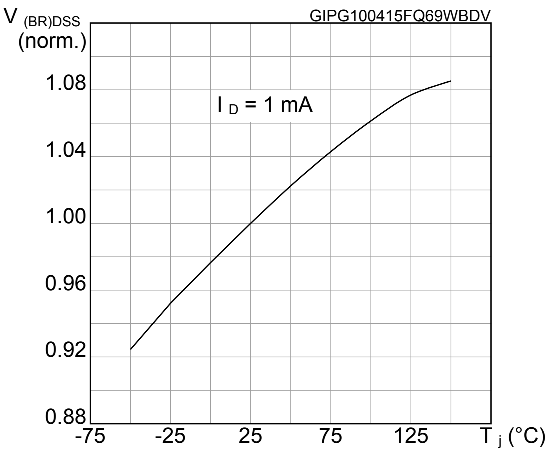



**Figure 11. Typical output capacitance stored energy**

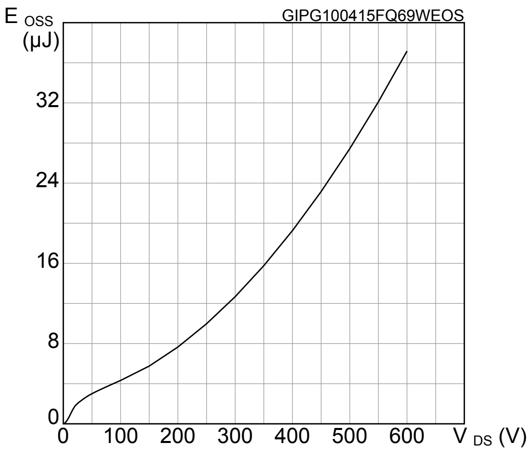
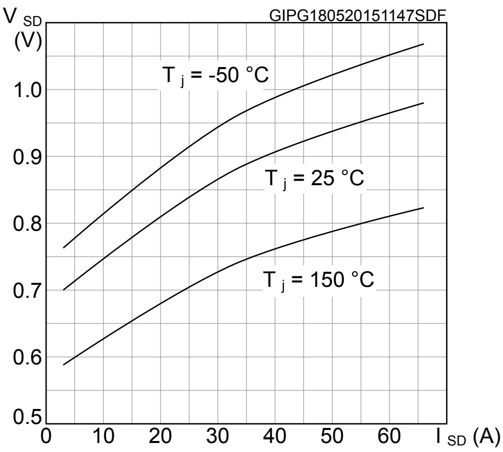



**Figure 12. Typical reverse diode forward characteristics**



# 3 Test circuits

**Figure 13. Test circuit for resistive load switching times**

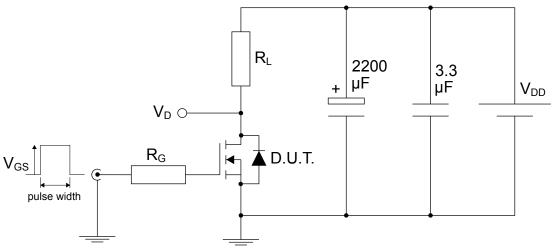



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**Figure 14. Test circuit for gate charge behavior**

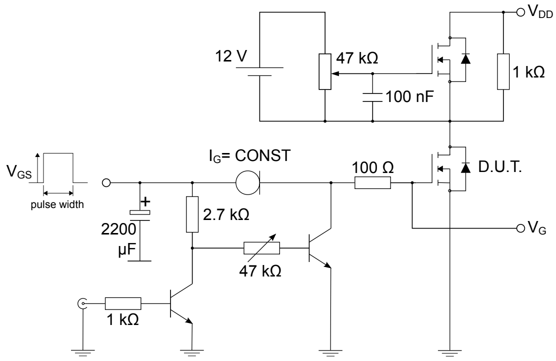


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**Figure 15. Test circuit for inductive load switching and diode recovery times**

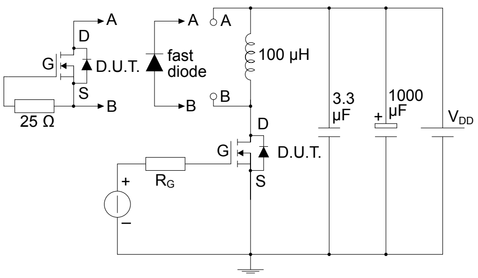


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**Figure 16. Unclamped inductive load test circuit**

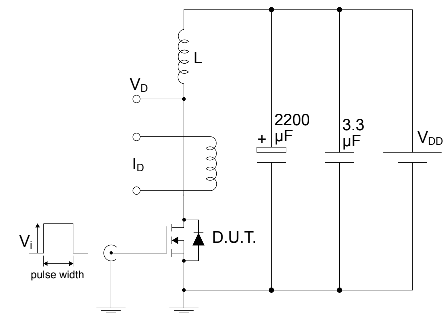


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**Figure 17. Unclamped inductive waveform**

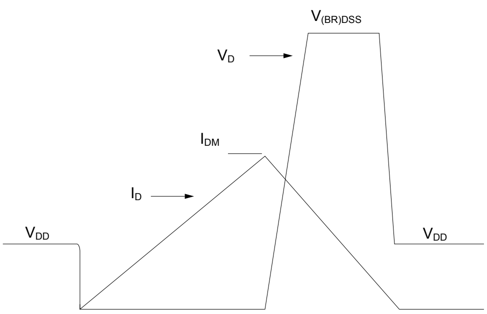


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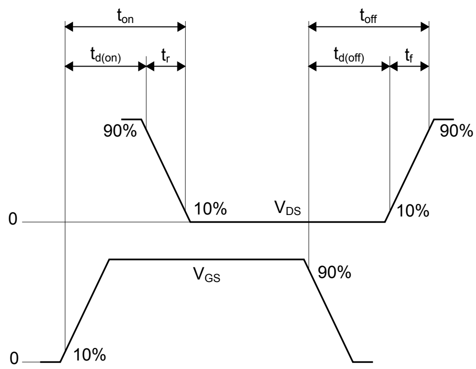
**Figure 18. Switching time waveform**

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# 4 Package information

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.

## 4.1 TO-247 long leads package information

Figure 19. TO-247 long leads package outline

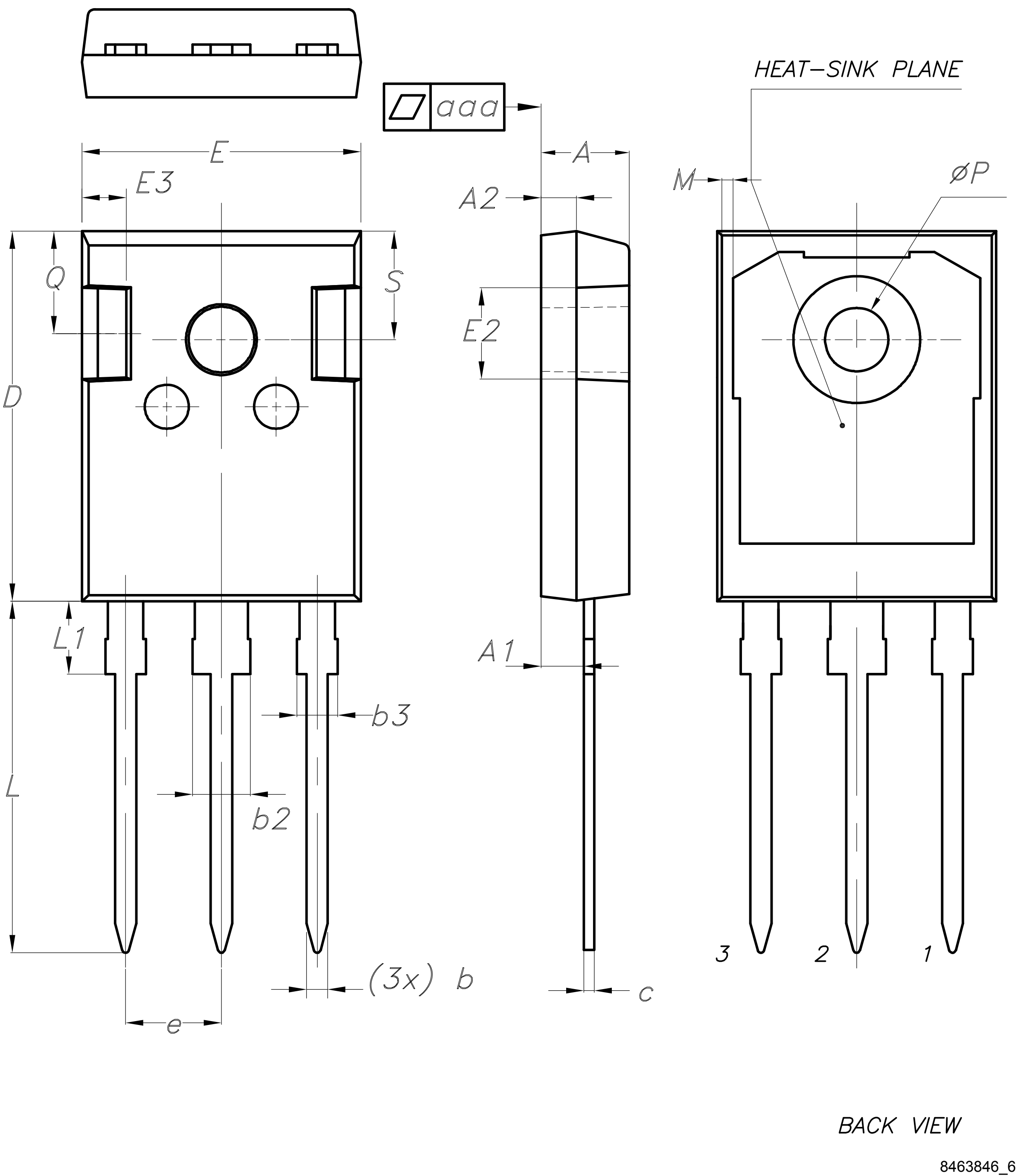

Table 8. **TO-247 long leads package mechanical data**

| 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 | | 1.26 |
| b2 | | | 3.25 |
| b3 | | | 2.25 |
| c | 0.59 | | 0.66 |
| D | 20.90 | 21.00 | 21.10 |
| E | 15.70 | 15.80 | 15.90 |
| E2 | 4.90 | 5.00 | 5.10 |
| E3 | 2.40 | 2.50 | 2.60 |
| e | 5.34 | 5.44 | 5.54 |
| L | 19.80 | 19.92 | 20.10 |
| L1 | | | 4.30 |
| M | 0.35 | | 0.95 |
| P | 3.50 | 3.60 | 3.70 |
| Q | 5.60 | | 6.00 |
| S | 6.05 | 6.15 | 6.25 |
| aaa | | 0.04 | 0.10 |

## Revision history

Table 9. **Document revision history**

| Date | Version | Changes |
|---|---|---|
| 07-Aug-2018 | 1 | Initial release. The document status is production data. |
| 20-Mar-2025 | 2 | Updated Section 4.1: TO-247 long leads package information.<br>Minor text changes. |

## Contents