# WSJT65R028DW

## Super-Junction Power MOSFET

Rev.01 - 12 December 2024 Product data sheet

## 1. General description

WSJT65R028DW is a high voltage N-channel MOSFET in TO247 package, which utilizes the advanced super-junction technology to provide superior FOM $R_{DS(on)}$ * $Q_g$ among silicon based MOSFETs. It is particularly suitable for applications require extreme high efficiency and power density.

RoHS Halogen-Free Lead-Free

## 2. Features and benefits

- Superior FOM $R_{DS(on)}$ * $Q_g$
- Extremely low switching loss
- Integrated ultrafast body diode
- 100% avalanche tested

## 3. Applications

- Suitable for soft switching topologies
- Optimized for phase-shift full bridge(ZVS)
- LLC applications
- EV charger
- Solar

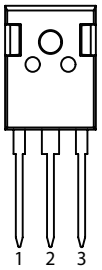
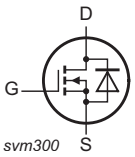
## 4. Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Notes | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| **Absolute maximum rating** | | | | | | | |
| $V_{DS}$ | drain-source voltage | | | 650 | | | V |
| $V_{GS}$ | gate-source voltage | | | ±30 | | | V |
| $I_D$ | continuous drain current | $T_{mb}$ = 25 °C | | 80 | | | A |
| $P_{tot}$ | power dissipation | $T_{mb}$ = 25 °C | | 520 | | | W |
| $T_j$ | junction temperature | | | -55 to 150 | | | °C |
| **Symbol** | **Parameter** | **Conditions** | **Notes** | **Min** | **Typ** | **Max** | **Unit** |
| **Static characteristics** | | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS}$ = 10 V, $I_D$ = 40 A | | - | 24 | 28 | mΩ |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 40 A; $V_{DS}$ = 400 V; $V_{GS}$ = 10 V | | - | 142 | - | nC |
| $E_{OSS}$ | coss stored erergy | $V_{GS}$ = 0 V; $V_{DS}$ = 0 to 400 V | | - | 21 | - | μJ |

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | G | gate |   |   |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package name | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|---|---|---|---|---|---|---|
| WSJT65R028DW | TO247 | WSJT65R028DWQ | Tube | 30 | TO247N | 20-July-2016 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking codes |
|---|---|
| WSJT65R028DW | WSJT<br>65R028DW |

# 8. Limiting values

**Table 5. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Notes | Values | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | | | 650 | V |
| $V_{GS}$ | gate-source voltage | | | ±30 | V |
| $I_D$ | continuous drain current | $T_{mb}$ = 25 °C | | 80 | A |
| | | $T_{mb}$ = 100 °C | | 50 | A |
| $I_{DM}$ | pulsed drain current | $T_{mb}$ = 25 °C | | 320 | A |
| $P_{tot}$ | power dissipation | $T_{mb}$ = 25 °C | | 520 | W |
| $E_{AS}$ | single pulse drain−to-source avalanche | $I_{AS}$ = 15 A; $R_{GS}$ = 25 Ω; $V_{DD}$ = 50 V; $T_j$ = 25 °C | | 1125 | mJ |
| $E_{AR}$ | repetitive avalanche energy | $I_{AS}$ = 15 A; $R_{GS}$ = 25 Ω; $V_{DD}$ = 50 V; $T_j$ = 25 °C | | 2.36 | mJ |
| $I_{AS}$ | avalanche current, single pulse | | | 15 | A |
| dv/dt | MOSFET dv/dt ruggedness | | | 50 | V/ns |
| dv/dt | reverse diode dv/dt | | | 50 | V/ns |
| $dI_F/dt$ | maximum diode commutation speed | | | 750 | A/µs |
| $T_{stg}$ | storage temperature | | | -55 to 150 | °C |
| $T_j$ | junction temperature | | | -55 to 150 | °C |

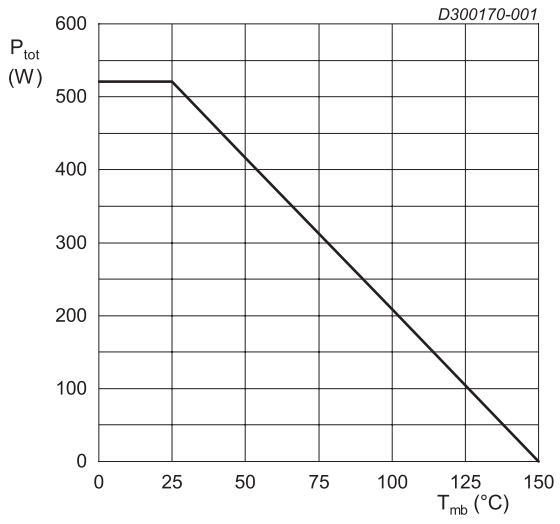



**Fig. 1. Total power dissipation as a function of mounting base temperature**

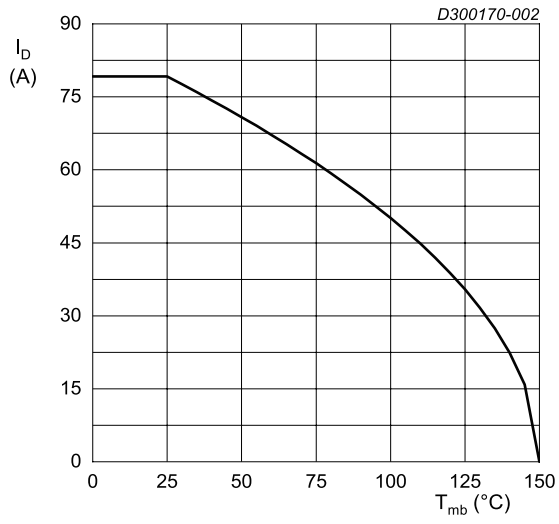



**Fig. 2. Continuous Drain Current as a function of mounting base temperature**

# 9. Thermal & Mechanical characteristics

**Table 6. Thermal & Mechanical characteristics**

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | | | - | 0.19 | 0.24 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | - | 45 | - | K/W |

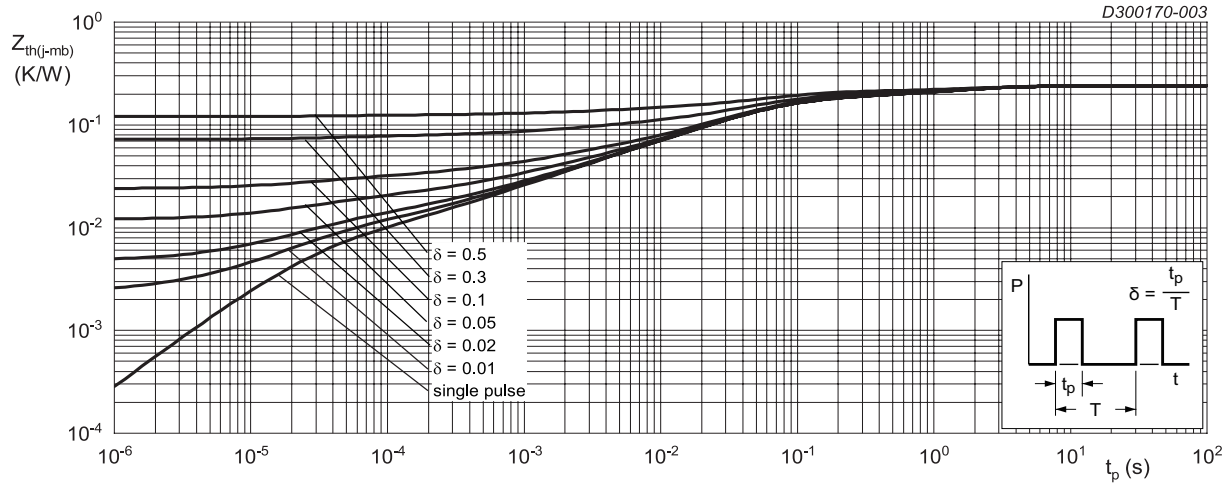



**Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration; maximum values**

# 10. Characteristics

**Table 7. Characteristics**

$T_j$ = 25 °C unless otherwise noted

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 1 mA; $V_{GS}$ = 0 V | | 650 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 250 µA; $V_{DS}$ = $V_{GS}$ | | 3.0 | - | 5.0 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 650 V; $V_{GS}$ = 0 V | | - | - | 20 | µA |
| | | $V_{DS}$ = 650 V; $V_{GS}$ = 0 V; $T_j$ = 125 °C | | - | 500 | - | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = ±30 V; $V_{DS}$ = 0 V | | - | - | ±100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 40 A | | - | 24 | 28 | mΩ |
| $R_G$ | gate resistance | f = 1 MHz | | - | 1.0 | - | Ω |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 40 A; $V_{DS}$ = 400 V; $V_{GS}$ = 10 V | | - | 142 | - | nC |
| $Q_{GS}$ | gate-source charge | | | - | 49 | - | nC |
| $Q_{GD}$ | gate-drain charge | | | - | 45 | - | nC |
| $C_{iss}$ | input capacitance | $V_{DS}$ = 400 V; $V_{GS}$ = 0 V; f = 250 KHz | | - | 8068 | - | pF |
| $C_{oss}$ | output capacitance | | | - | 159 | - | pF |
| $C_{rss}$ | reverse transfer capacitance | | | - | 1.7 | - | pF |
| $C_{o(er)}$ | effective output capacitance, energy related | $V_{GS}$ = 0 V; $V_{DS}$ = 0 to 400 V | | - | 264 | - | pF |
| $C_{o(tr)}$ | effective output capacitance, time related | | | - | 1873 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 400 V; $V_{GS}$ = 10 V; $R_G$ = 4 Ω; $I_D$ = 40 A | | - | 73 | - | ns |
| $t_r$ | rise time | | | - | 14 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 68 | - | ns |
| $t_f$ | fall time | | | - | 2.8 | - | ns |
| **Source-drain diode** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $V_{GS}$ = 0 V; $I_S$ = 40 A | | - | 0.9 | 1.2 | V |
| $I_S$ | body-diode continuous current | $T_{mb}$ = 25 °C | | - | - | 80 | A |
| $t_{rr}$ | reverse recovery time | $V_R$ = 400 V; $I_F$ = 40 A; $dI_F/dt$ = 100 A/µs | | - | 225 | - | ns |
| $Q_{rr}$ | reverse recovered charge | | | - | 2.4 | - | µC |
| $I_{rrm}$ | reverse recovery current | | | - | 20 | - | A |

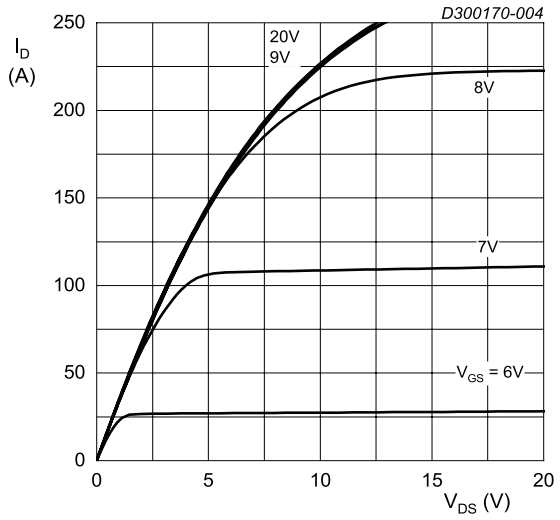
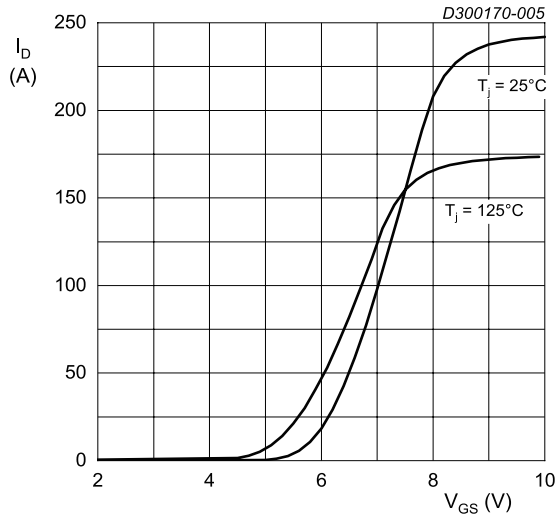
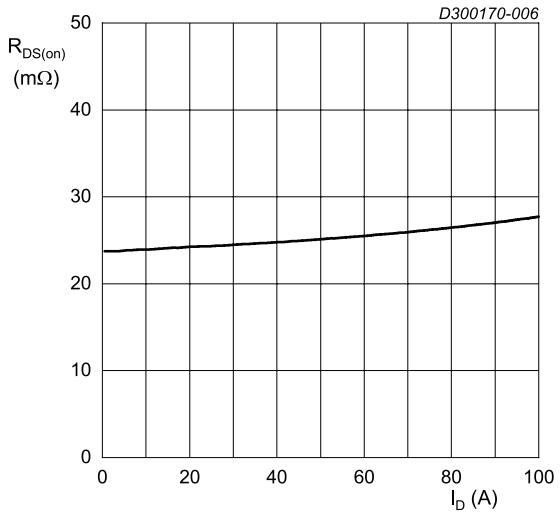



**Fig. 4. Drain current as a function of drain-source voltage; typical values**



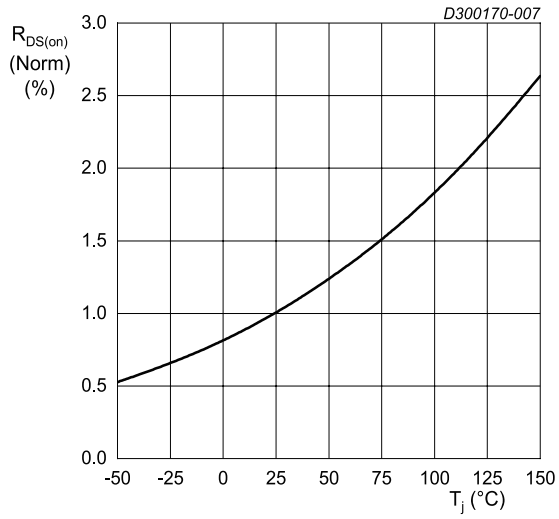

$V_{DS}$ = 20 V

**Fig. 5. Drain current as a function of gate-source voltage; typical values**



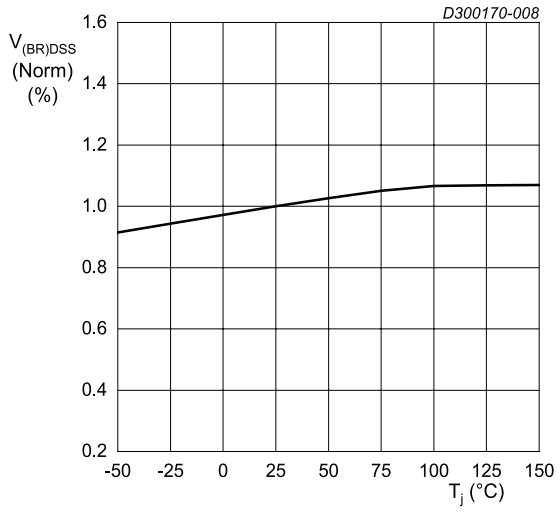

$V_{GS}$ = 10 V

**Fig. 6. Drain-source on-state resistance as a function of drain current; typical values**



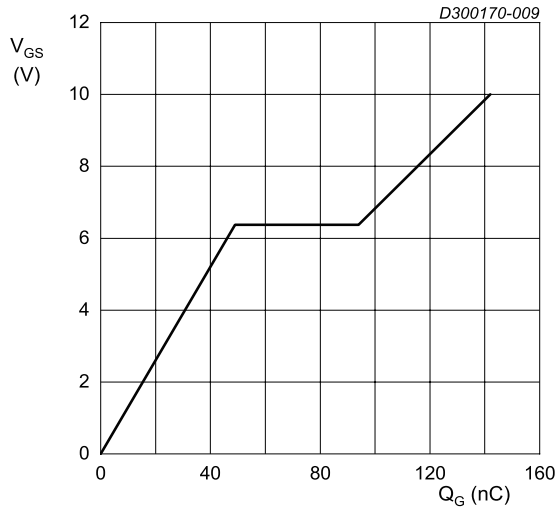

$V_{GS}$ = 10 V; $I_D$ = 40 A

**Fig. 7. Normalized drain-source on-state resistance as a function of junction temperature**



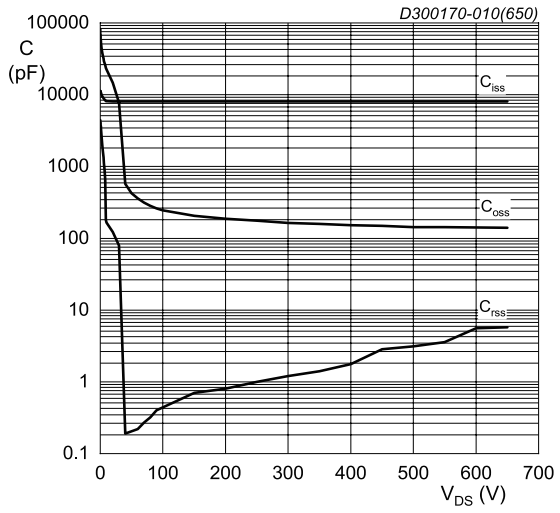

$I_D$ = 10 mA

**Fig. 8. Normalized drain-source breakdown voltage as a function of junction temperature**



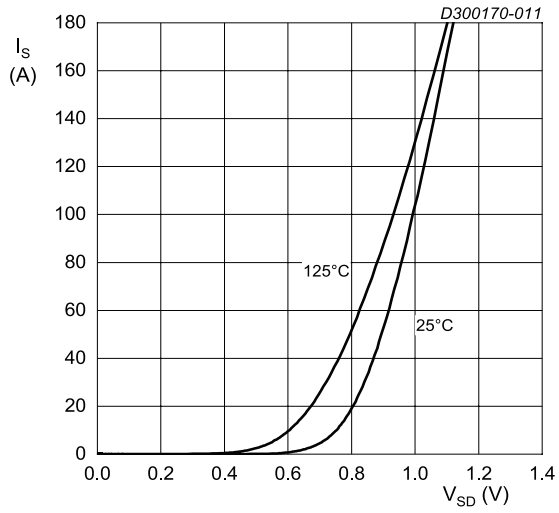

$I_D$ = 40 A; $V_{DS}$ = 400 V

**Fig. 9. Gate-source voltage as a function of gate charge; typical values**




$V_{GS}$ = 0 V; f = 250 KHz

**Fig 10. Capacitances as a function of drain-source voltage; typical values**




$V_{GS}$ = 0 V

**Fig 11. Source current as a function of source-drain voltage; typical values**

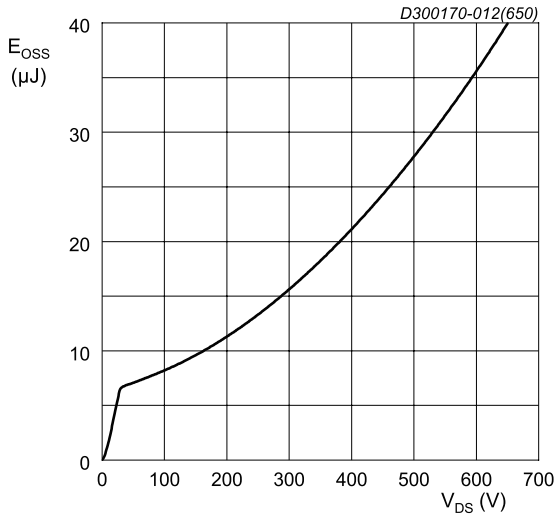
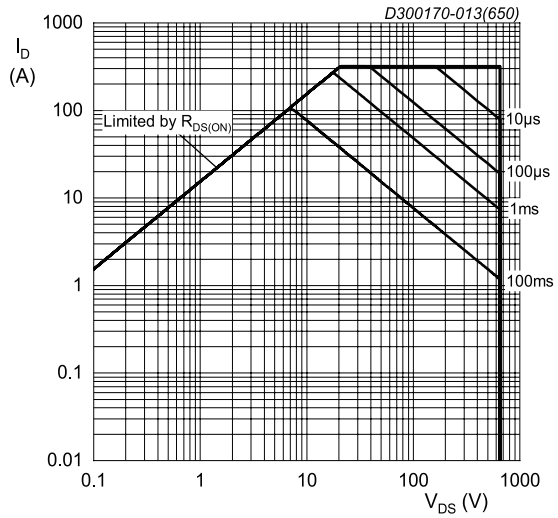



**Fig. 12. Output capacitance stored energy as a function of drain-source voltage**

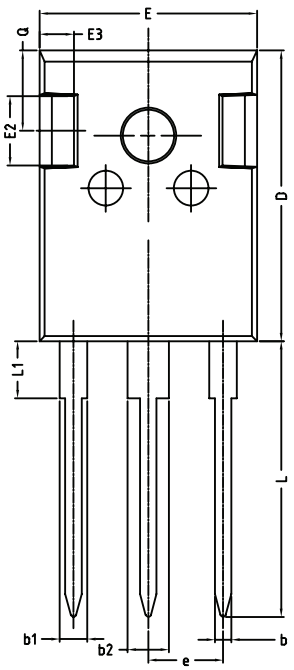



$T_{mb}$ = 25 °C

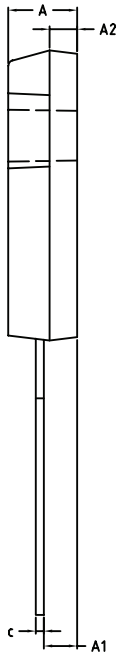
**Fig. 13. Safe operating area**

## 11. Package outline

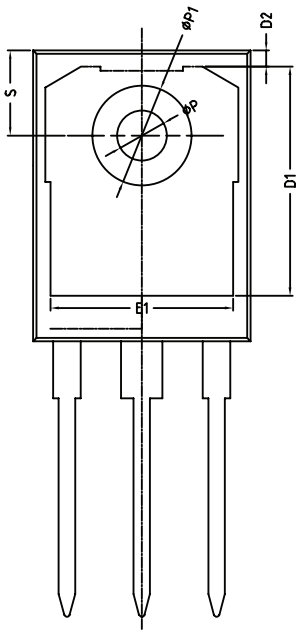
Plastic single-ended through-hole package; heatsink mounted; 1 mounting hole; 3-lead TO-247 SOT429N



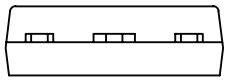

TOP VIEW




SIDE VIEW




BOTTOM VIEW



SIDE VIEW

| UNIT | | A | A1 | A2 | b | b1 | b2 | c | D | D1 | D2 | E | E1 | E2 | E3 | e | L | L1 | P | P1 | Q | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | MAX | 5.20 | 2.60 | 2.10 | 1.40 | 2.20 | 3.20 | 0.70 | 21.10 | 16.85 | 1.35 | 15.90 | 13.50 | 5.20 | 2.60 | 5.45 | 20.10 | 4.75 | 3.70 | 7.40 | 6.00 | 6.25 |
| | NOM | | | | | | | | | | | | | | | | | | | | | |
| | MIN | 4.70 | 2.20 | 1.90 | 1.00 | 1.80 | 2.80 | 0.50 | 20.90 | 16.25 | 1.05 | 15.70 | 13.10 | 4.80 | 2.40 | | 19.80 | - | 3.50 | - | 5.60 | 6.05 |

| OUTLINE VERSION | REFERENCES | | | | PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT429N | | TO-247 | | | | |

# 12. Legal information

## Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
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# 13. Contents





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**Date of release: 12 December 2024**