

## 1. General description

Silicon Carbide Schottky diode in a TO247-2L plastic package, designed for high frequency switched-mode power supplies.



**Lead-Free**

## 2. Features and benefits

- New 6th Generation Technology
- Low Forward Voltage Drop
- Low Reverse Leakage Current
- High Forward Surge Capability  $I_{FSM}$
- Reduced losses in associated MOSFET
- Reduced EMI
- Reduced cooling requirements
- RoHS compliant

## 3. Applications

- Power factor correction
- Telecom / Server SMPS
- UPS
- PV inverter
- PC Silverbox
- LED / OLED TV
- Motor Drives

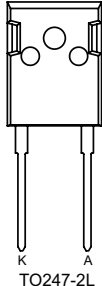
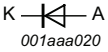
## 4. Quick reference data

Table 1. Quick reference data

| Table 1. Quick reference data |                                 |                                                                                                                                 |       |        |            |      |      |
|-------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------|--------|------------|------|------|
| Symbol                        | Parameter                       | Conditions                                                                                                                      | Notes | Values |            |      | Unit |
| Absolute maximum rating       |                                 |                                                                                                                                 |       |        |            |      |      |
| V <sub>RRM</sub>              | repetitive peak reverse voltage |                                                                                                                                 |       |        | 650        |      | V    |
| I <sub>F(AV)</sub>            | average forward current         | δ = 0.5 ; square-wave pulse; T <sub>mb</sub> ≤ 133 °C; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> |       |        | 20         |      | A    |
| T <sub>j</sub>                | junction temperature            |                                                                                                                                 |       |        | -55 to 175 |      | °C   |
| Symbol                        | Parameter                       | Conditions                                                                                                                      | Notes | Min    | Typ        | Max  | Unit |
| Static characteristics        |                                 |                                                                                                                                 |       |        |            |      |      |
| V <sub>F</sub>                | forward voltage                 | I <sub>F</sub> = 20 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 5</a>                                                           |       | -      | 1.26       | 1.40 | V    |
|                               |                                 | I <sub>F</sub> = 20 A; T <sub>j</sub> = 150 °C; <a href="#">Fig. 5</a>                                                          |       | -      | 1.35       | 1.55 | V    |
| Dynamic characteristics       |                                 |                                                                                                                                 |       |        |            |      |      |
| Q <sub>r</sub>                | recovered charge                | I <sub>F</sub> = 20 A; dI <sub>F</sub> /dt = 500 A/μs; V <sub>R</sub> = 400 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   |       | -      | 48         | -    | nC   |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                         | Simplified outline                                                                | Graphic symbol                                                                      |
|-----|--------|-------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | K      | cathode                             |  |  |
| 2   | A      | anode                               |                                                                                   |                                                                                     |
| mb  | mb     | mounting base; connected to cathode |                                                                                   |                                                                                     |

## 6. Ordering information

Table 3. Ordering information

| Type number  | Package name | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|--------------|--------------|-----------------------|----------------|------------------------|-----------------|--------------------|
| WNSC6D20650W | TO247-2L     | WNSC6D20650W6Q        | Tube           | 30                     | TO247L-2L       | 10-Nov-2020        |

## 7. Marking

Table 4. Marking codes

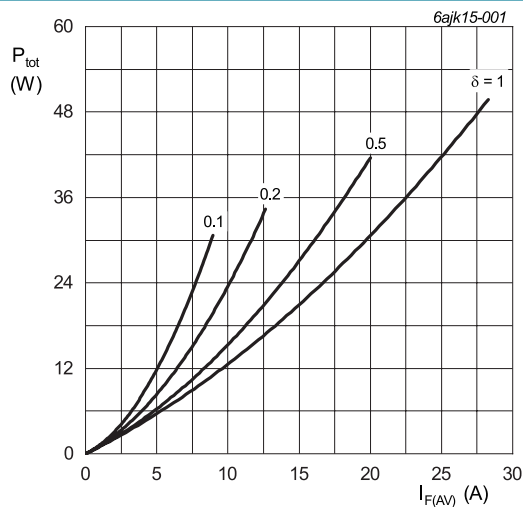
| Type number  | Marking codes    |
|--------------|------------------|
| WNSC6D20650W | WNSC6D<br>20650W |

## 8. Limiting values

**Table 5. Limiting values**

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

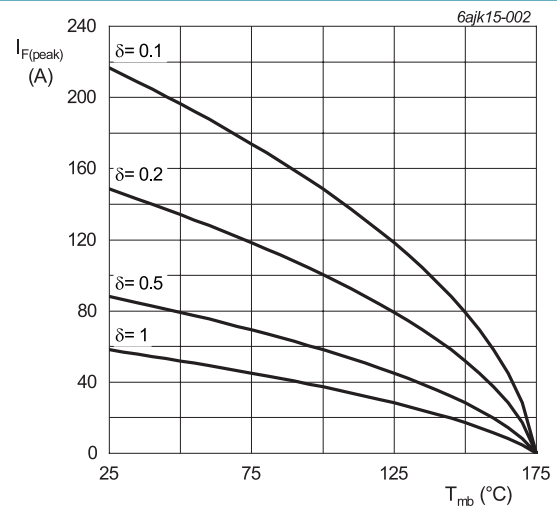
| Symbol      | Parameter                           | Conditions                                                                                                     | Notes | Values     | Unit                 |
|-------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------|-------|------------|----------------------|
| $V_{RRM}$   | repetitive peak reverse voltage     |                                                                                                                |       | 650        | V                    |
| $V_{RWM}$   | crest working reverse voltage       |                                                                                                                |       | 650        | V                    |
| $V_R$       | reverse voltage                     | DC                                                                                                             |       | 650        | V                    |
| $I_{F(AV)}$ | average forward current             | $\delta = 0.5$ ; square-wave pulse; $T_{mb} \leq 133\text{ }^{\circ}\text{C}$ ; Fig. 1; Fig. 2; Fig. 3         |       | 20         | A                    |
| $I_{FRM}$   | repetitive peak forward current     | $\delta = 0.5$ ; $t_p = 25\text{ }\mu\text{s}$ ; $T_{mb} \leq 133\text{ }^{\circ}\text{C}$ ; square-wave pulse |       | 40         | A                    |
| $I_{FSM}$   | non-repetitive peak forward current | $t_p = 10\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; sine-wave pulse                     |       | 170        | A                    |
|             |                                     | $t_p = 10\text{ }\mu\text{s}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; square-wave pulse          |       | 1000       | A                    |
| $I^2t$      | $I^2t$ for fusing                   | sine-wave pulse; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 10\text{ ms}$                      |       | 144.5      | $\text{A}^2\text{s}$ |
| $T_{stg}$   | storage temperature                 |                                                                                                                |       | -55 to 175 | $^{\circ}\text{C}$   |
| $T_j$       | junction temperature                |                                                                                                                |       | -55 to 175 | $^{\circ}\text{C}$   |



$$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

$$V_o = 0.984\text{ V}; R_s = 0.0274\text{ }\Omega$$

**Fig. 1. Forward power dissipation as a function of average forward current; square waveform; maximum values**



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

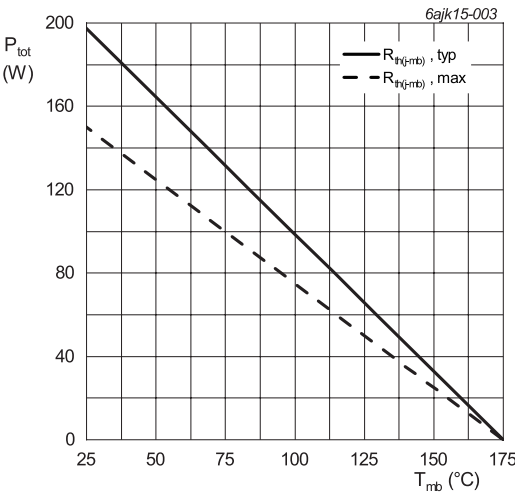


Fig. 3. Total power dissipation as a function of mounting base temperature

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter                                         | Conditions             | Notes | Min | Typ  | Max | Unit |
|----------------|---------------------------------------------------|------------------------|-------|-----|------|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | <a href="#">Fig. 4</a> |       | -   | 0.75 | 1   | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air            |       | -   | 60   | -   | K/W  |

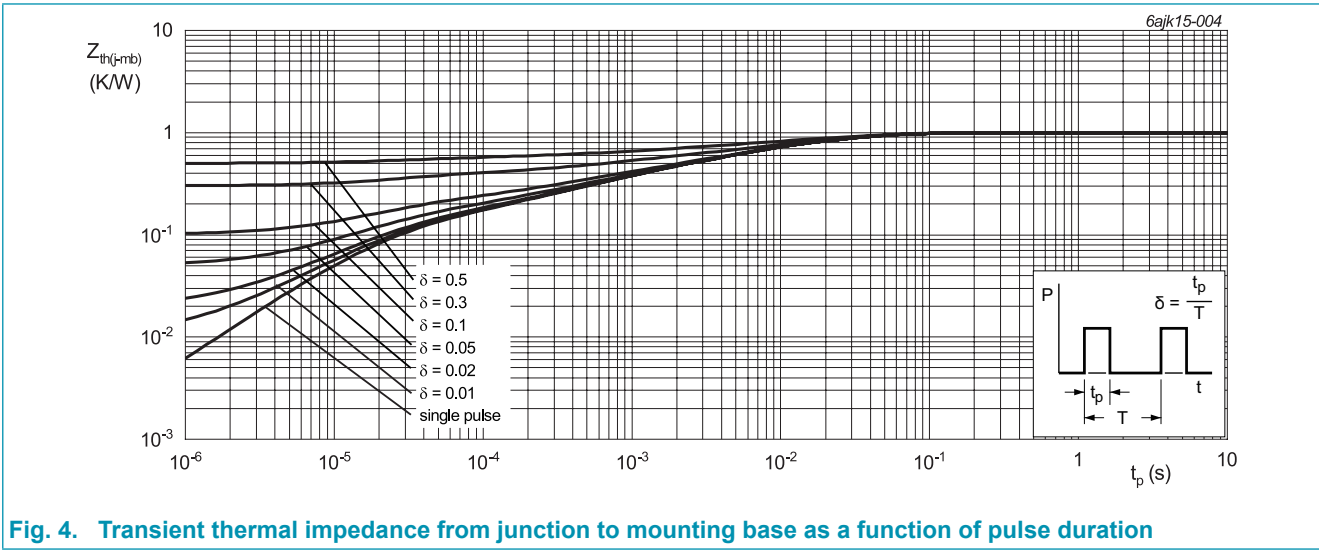
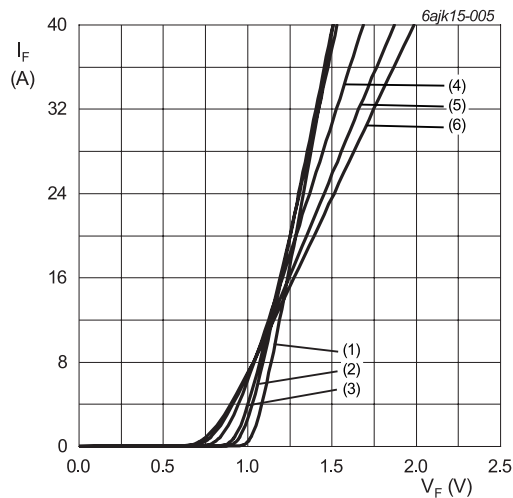


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

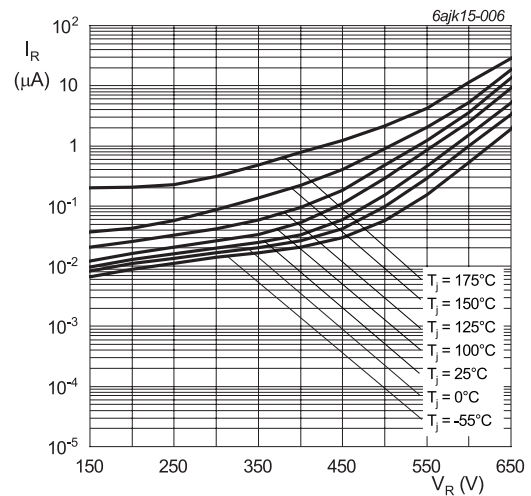
| Symbol                  | Parameter                       | Conditions                                                                                                                    | Notes | Min | Typ  | Max  | Unit |
|-------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------|-----|------|------|------|
| Static characteristics  |                                 |                                                                                                                               |       |     |      |      |      |
| V <sub>F</sub>          | forward current                 | I <sub>F</sub> = 20 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 5</a>                                                         |       | -   | 1.26 | 1.40 | V    |
|                         |                                 | I <sub>F</sub> = 20 A; T <sub>J</sub> = 150 °C; <a href="#">Fig. 5</a>                                                        |       | -   | 1.35 | 1.55 | V    |
|                         |                                 | I <sub>F</sub> = 20 A; T <sub>J</sub> = 175 °C; <a href="#">Fig. 5</a>                                                        |       | -   | 1.40 | 1.60 | V    |
| I <sub>R</sub>          | reverse current                 | V <sub>R</sub> = 650 V; T <sub>J</sub> = 25 °C; <a href="#">Fig. 6</a>                                                        |       | -   | 2    | 100  | μA   |
|                         |                                 | V <sub>R</sub> = 650 V; T <sub>J</sub> = 175 °C; <a href="#">Fig. 6</a>                                                       |       | -   | 30   | 400  | μA   |
| Dynamic characteristics |                                 |                                                                                                                               |       |     |      |      |      |
| Q <sub>r</sub>          | recovered charge                | I <sub>F</sub> = 20 A; V <sub>R</sub> = 400 V; dI <sub>F</sub> /dt = 500 A/μs; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a> |       | -   | 48   | -    | nC   |
| C <sub>d</sub>          | diode capacitance               | f = 1 MHz; V <sub>R</sub> = 1 V; T <sub>J</sub> = 25 °C                                                                       |       | -   | 1005 | -    | pF   |
|                         |                                 | f = 1 MHz; V <sub>R</sub> = 300 V; T <sub>J</sub> = 25 °C                                                                     |       | -   | 110  | -    | pF   |
|                         |                                 | f = 1 MHz; V <sub>R</sub> = 600 V; T <sub>J</sub> = 25 °C                                                                     |       | -   | 102  | -    | pF   |
| E <sub>as</sub>         | non-repetitive avalanche energy | I <sub>R</sub> = 7.8 A; L = 5 mH; T <sub>J</sub> (init) = 25 °C                                                               |       | 150 | -    | -    | mJ   |



$V_o = 0.984\text{ V}$ ;  $R_s = 0.0274\text{ }\Omega$

- (1)  $T_J = -55\text{ }^\circ\text{C}$ ; typical values
- (2)  $T_J = 0\text{ }^\circ\text{C}$ ; typical values
- (3)  $T_J = 25\text{ }^\circ\text{C}$ ; typical values
- (4)  $T_J = 100\text{ }^\circ\text{C}$ ; typical values
- (5)  $T_J = 150\text{ }^\circ\text{C}$ ; typical values
- (6)  $T_J = 175\text{ }^\circ\text{C}$ ; typical values

**Fig. 5. Forward current as a function of forward voltage; typical values**



**Fig. 6. Reverse leakage current as a function of reverse voltage; typical value**

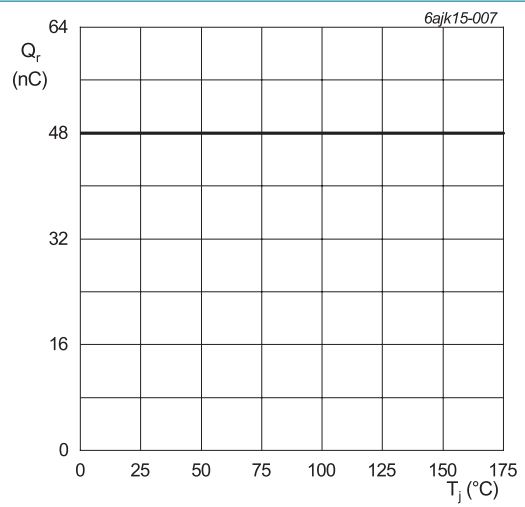
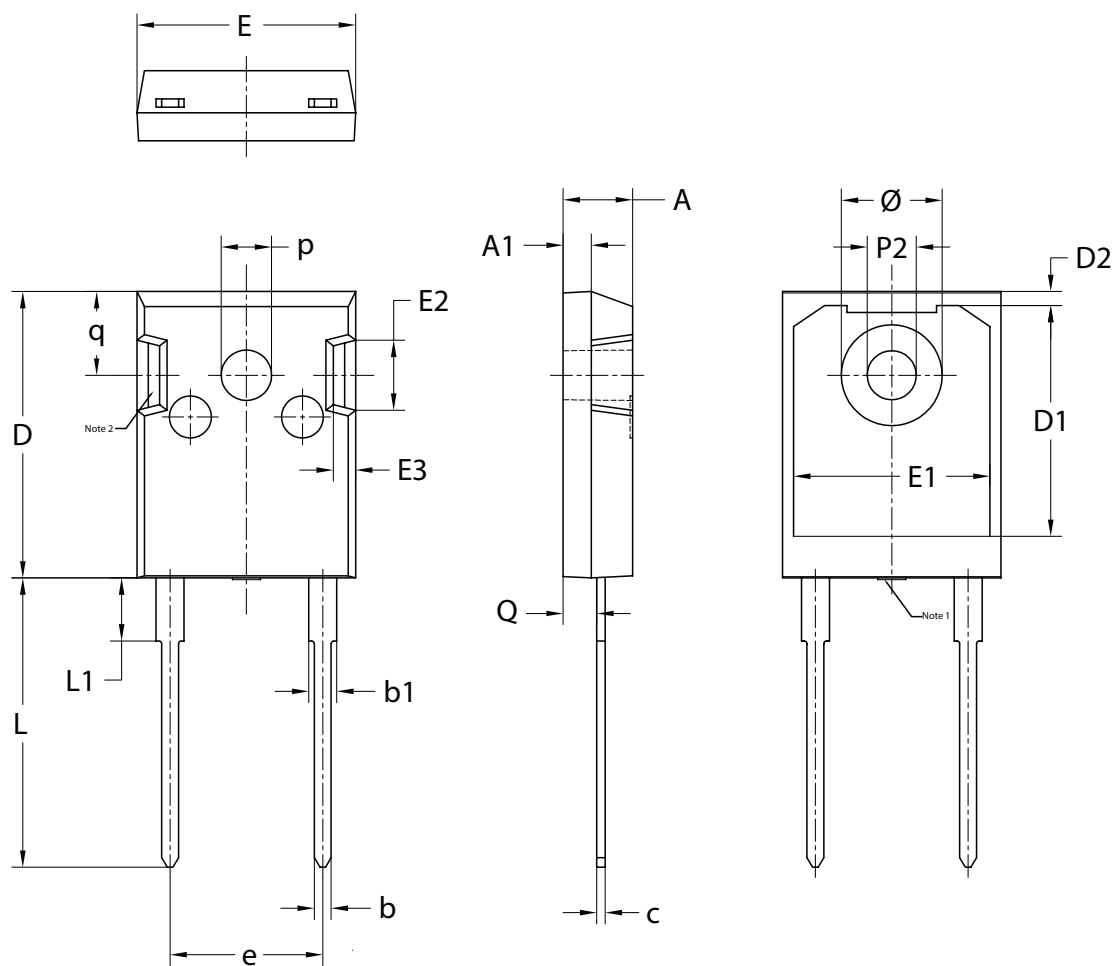


Fig. 7. Recovered charge as a function of junction temperature

11. Package outline

Plastic single-ended through-hole package; heatsink mounted;1 mounting hole;2 leads TO-247

TO247-2L



| UNIT | A            | A <sub>1</sub> | b            | b <sub>1</sub> | c            | D              | D <sub>1</sub><br>② | D <sub>2</sub> | E              | E <sub>1</sub> | E <sub>2</sub> | E <sub>3</sub> | e            | L              | L <sub>1</sub> | P <sub>2</sub> | p            | Q            | q            | Ø            |
|------|--------------|----------------|--------------|----------------|--------------|----------------|---------------------|----------------|----------------|----------------|----------------|----------------|--------------|----------------|----------------|----------------|--------------|--------------|--------------|--------------|
| mm   | 5.20<br>4.70 | 2.10<br>1.90   | 1.40<br>1.00 | 2.20<br>1.80   | 0.70<br>0.50 | 20.60<br>20.30 | 16.20<br>16.87      | 1.20<br>0.80   | 15.75<br>15.45 | 14.22<br>13.82 | 5.20<br>4.80   | 1.80<br>1.40   | 10.90<br>BSC | 20.72<br>20.22 | 4.75<br>4.25   | 3.60<br>3.40   | 3.70<br>3.50 | 2.60<br>2.20 | 6.18<br>5.78 | 7.30<br>7.10 |

Note:  
1. Mold resin protrusion max 0.127mm.  
2. Metal exposed with Sn plating.



## 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. |
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