# NXPSC20650W-A

## Silicon Carbide Diode

Rev.01 25 February 2019 Product data sheet

## 1. General description

Dual Silicon Carbide Schottky diode in a 3-lead TO-247 plastic package, designed for high frequency switched-mode power supplies. This product is qualified to AEC-Q101 standard for use in automotive applications.

RoHS Halogen-Free

AEC - Q101 Qualified

## 2. Features and benefits

- Highly stable switching performance
- High forward surge capability $I_{FSM}$
- Extremely fast reverse recovery time
- Superior in efficiency to Silicon Diode alternatives
- Reduced losses in associated MOSFET
- Reduced EMI
- Reduced cooling requirements
- RoHS compliant
- AEC-Q101 compliant
- High junction operating temperature capability ($T_{j(max)}$ = 175 °C)

## 3. Applications

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

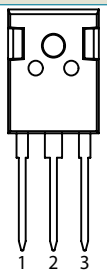
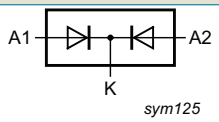
## 4. Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Values | | | | Unit |
|---|---|---|---|---|---|---|---|
| **Absolute maximum rating** | | | | | | | |
| $V_{RRM}$ | repetitive peak reverse voltage | | 650 | | | | V |
| $I_{O(AV)}$ | limiting average output current | δ = 0.5 ; square-wave pulse; $T_{mb} \leq 105$ °C; both diodes conducting; Fig. 1; Fig. 2 | 20 | | | | A |
| $T_j$ | junction temperature | | 175 | | | | °C |
| **Symbol** | **Parameter** | **Conditions** | | **Min** | **Typ** | **Max** | **Unit** |
| **Static characteristics** | | | | | | | |
| $V_F$ | forward voltage | $I_F$ = 10 A; $T_j$ = 25 °C; per diode; Fig. 4 | | - | 1.5 | 1.7 | V |
| | | $I_F$ = 10 A; $T_j$ = 150 °C; per diode; Fig. 4 | | - | 1.8 | 2.1 | V |
| **Dynamic characteristics** | | | | | | | |
| $Q_r$ | recovered charge | $I_F$ = 10 A; $V_R$ = 400 V; $dI_F/dt$ = 500 A/µs; $T_j$ = 25 °C; per diode; Fig. 6 | | - | 16 | - | nC |

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | A1 | anode |   |   |
| 2 | K | cathode | | |
| 3 | A2 | anode | | |
| mb | K | 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 |
|---|---|---|---|---|---|---|
| NXPSC20650W-A | TO247 | NXPSC20650W-AQ | Tube | 30 | TO247N | 20-Jul-2016 |

## 7. Marking

**Table 4. Marking codes**

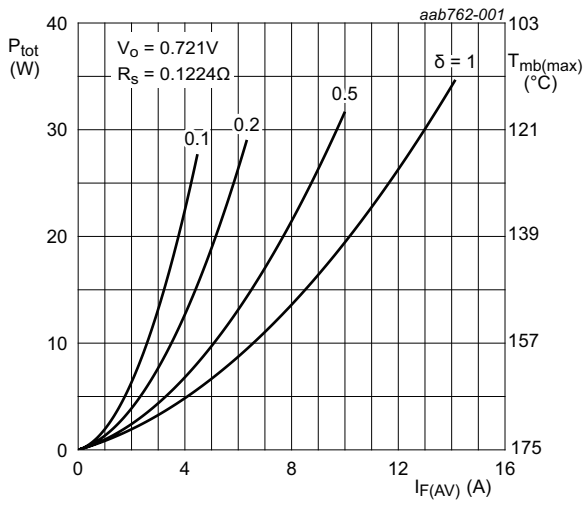
| Type number | Marking codes |
|---|---|
| NXPSC20650W-A | NXPSC20650W-A |

# 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | 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 |
| $I_{FRM}$ | repetitive peak forward current | $\delta = 0.5$ ; $t_p = 25$ µs; $T_{mb} \leq 112$ °C; square-wave pulse; per diode | 20 | A |
| $I_{O(AV)}$ | limiting average output current | $\delta = 0.5$ ; square-wave pulse; $T_{mb} \leq 105$ °C; both diodes conducting; Fig. 1; Fig. 2 | 20 | A |
| $I_{FSM}$ | non-repetitive peak forward current | $t_p = 10$ ms; $T_{j(init)} = 25$ °C; sine-wave pulse; per diode | 50 | A |
| | | $t_p = 10$ µs; $T_{j(init)} = 25$ °C; sine-wave pulse; per diode | 450 | A |
| $I^2t$ | $I^2t$ for fusing | sine-wave pulse; $T_{j(init)} = 25$ °C; $t_p = 10$ ms; per diode | 12.5 | $A^2s$ |
| $T_{stg}$ | storage temperature | | -55 to 175 | °C |
| $T_j$ | junction temperature | | 175 | °C |




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

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

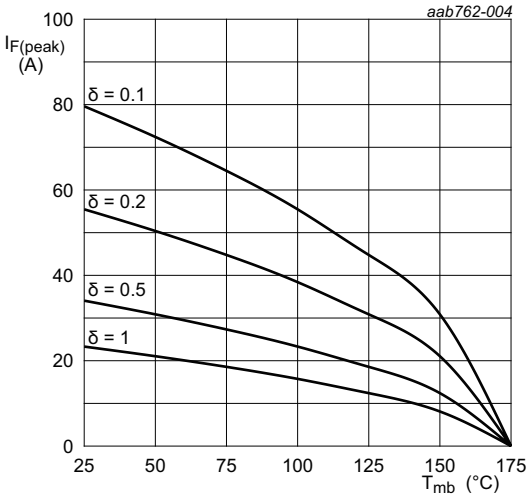



**Fig. 2. Current derating as a function of mounting base temperature; per diode**

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Per diode; Fig. 3 | | - | - | 1.8 | K/W |
| | | both diodes conducting | | - | - | 1 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | in free air | | - | 45 | - | K/W |

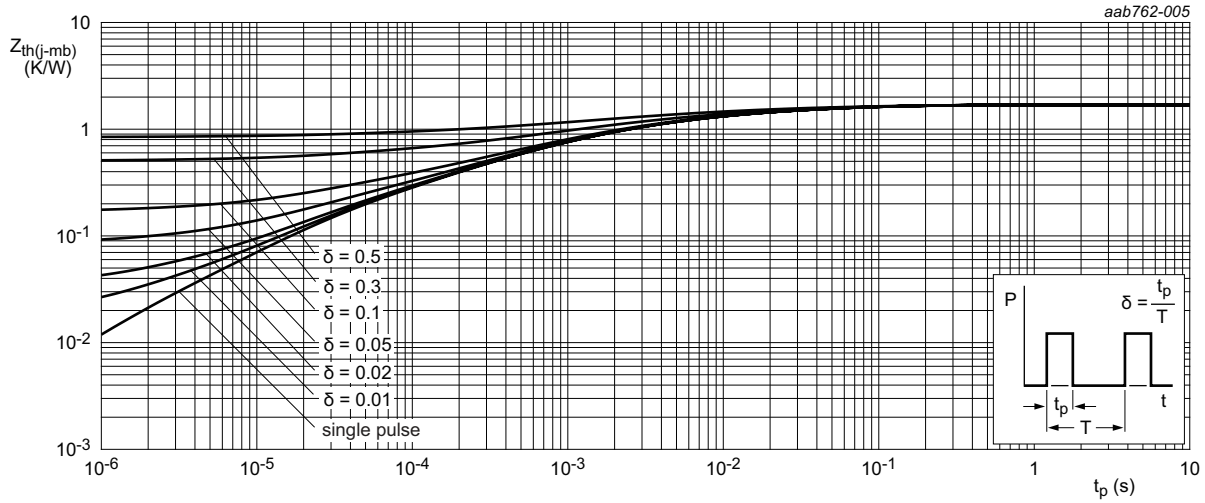
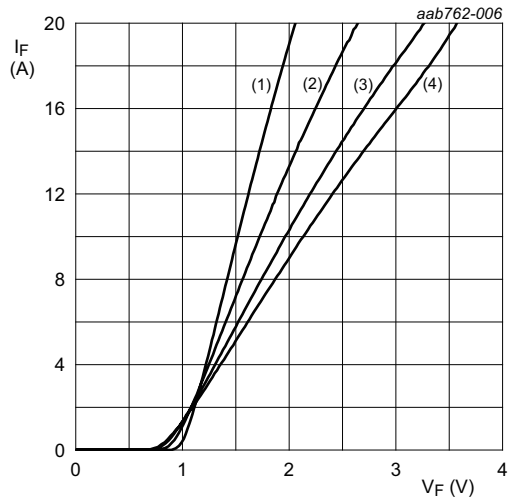



**Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration; per diode**

# 10. Characteristics

**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_F$ | forward current | $I_F$ = 10 A; $T_j$ = 25 °C; per diode; Fig. 4 | | - | 1.5 | 1.7 | V |
| | | $I_F$ = 10 A; $T_j$ = 150 °C; per diode; Fig. 4 | | - | 1.8 | 2.1 | V |
| $I_R$ | reverse current | $V_R$ = 650 V; $T_j$ = 25 °C; per diode; Fig. 5 | | - | - | 60 | µA |
| | | $V_R$ = 650 V; $T_j$ = 150 °C; per diode; Fig. 5 | | - | - | 240 | µA |
| **Dynamic characteristics** | | | | | | | |
| $Q_r$ | recovered charge | $I_F$ = 10 A; $V_R$ = 400 V; $dI_F/dt$ = 500 A/µs; $T_j$ = 25 °C; per diode; Fig. 6 | | - | 16 | - | nC |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 1 V; $T_j$ = 25 °C; per diode | | - | 328 | - | pF |
| | | f = 1 MHz; $V_R$ = 300 V; $T_j$ = 25 °C; per diode | | - | 44 | - | pF |
| | | f = 1 MHz; $V_R$ = 600 V; $T_j$ = 25 °C; per diode | | - | 42 | - | pF |
| $E_{as}$ | non-repetitive avalanche energy | $I_R$ = 5.5 A; $T_{j(init)}$ = 25 °C; L = 5 mH; per diode | | 75 | - | - | mJ |




(1) $T_j$ = 25 °C; typical values
(2) $T_j$ = 100 °C; typical values
(3) $T_j$ = 150 °C; typical values
(4) $T_j$ = 175 °C; typical values

**Fig. 4. Forward current as a function of forward voltage; typical values; per diode**

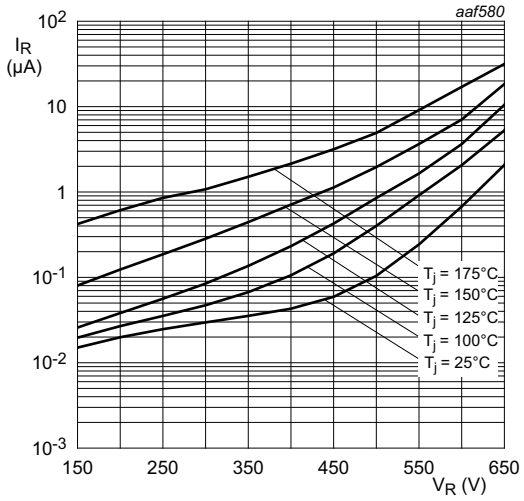



**Fig. 5. Reverse leakage current as a function of reverse voltage; typical value; per diode**

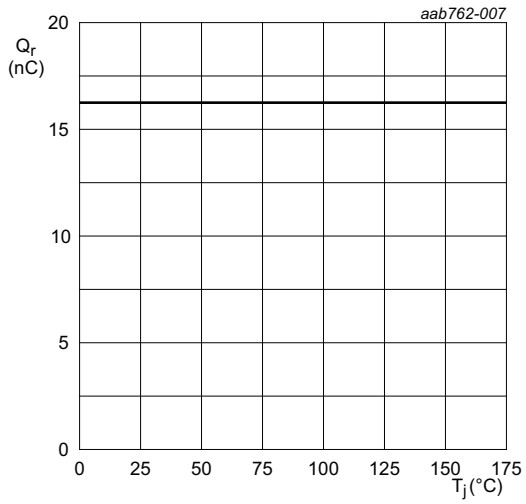
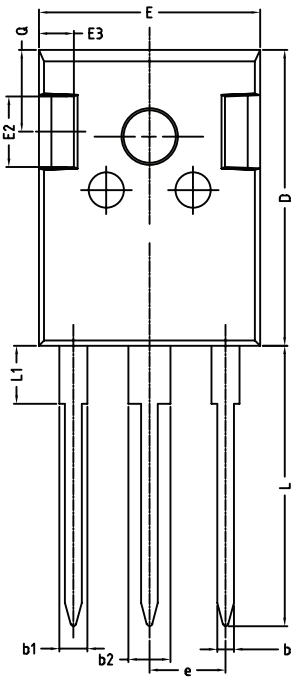


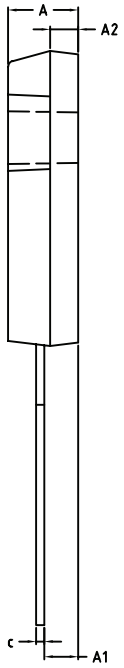

**Fig. 6. Recovered charge as a function of junction temperature; per diode**

## 11. Package outline

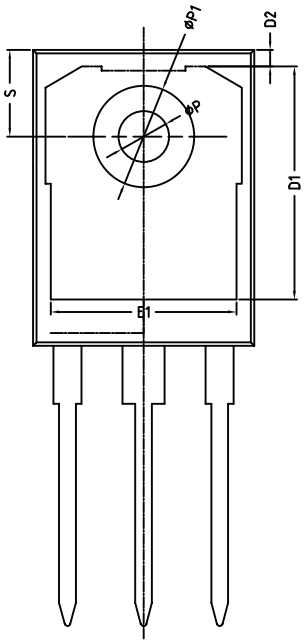
Plastic single-ended through-hole package; heatsink mounted; 1 mounting hole; 3-lead TO-247 SOT429N



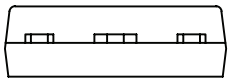

TOP VIEW




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 | | | | |

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|---|---|---|
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# 13. Contents





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**Date of release: 25 February 2019**