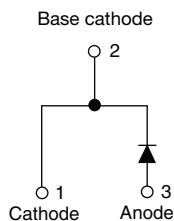
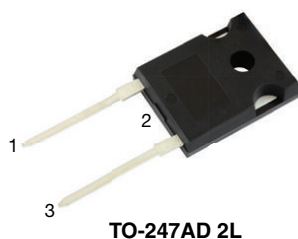


# 650 V Gen 4 Power Silicon Carbide Schottky Diode, 20 A



## FEATURES

- Positive  $V_F$  temperature coefficient for easy paralleling
- Virtually no recovery tail and no switching losses
- Temperature invariant switching behavior
- 175 °C maximum operating junction temperature
- Meets JESD 201 class 1A whisker test
- Solder bath temperature 275 °C maximum, 10 s per JESD 22-B106
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

## LINKS TO ADDITIONAL RESOURCES



| PRIMARY CHARACTERISTICS       |             |
|-------------------------------|-------------|
| $I_F$                         | 20 A        |
| $V_R$                         | 650 V       |
| $V_F$ at $I_F$ at 25 °C, typ. | 1.33 V      |
| $T_J$ max.                    | 175 °C      |
| $I_R$ at $V_R$ at 175 °C      | 110 $\mu$ A |
| $Q_C$ ( $V_R = 400$ V)        | 52 nC       |
| Package                       | TO-247AD 2L |
| Circuit configuration         | Single      |

## DESCRIPTION / APPLICATIONS

Wide band gap SiC based 650 V Schottky diode, designed for high performance and ruggedness.

Optimized for extreme high-speed hard switching across a wide temperature range. This SiC diode is ideal for demanding applications such as high efficiency PFC diodes and ultra-high frequency output rectifiers in AC/DC and DC/DC converters.

## MECHANICAL DATA

**Case:** TO-247AD 2L

Molding compound meets UL 94 V-0 flammability rating  
Base P/N-M3 - halogen-free, RoHS-compliant

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

**Mounting torque:** 10 in-lbs maximum

| MAXIMUM RATINGS ( $T_A = 25$ °C unless otherwise specified) |                      |                                                    |             |                  |
|-------------------------------------------------------------|----------------------|----------------------------------------------------|-------------|------------------|
| PARAMETER                                                   | SYMBOL               | TEST CONDITIONS                                    | VALUES      | UNITS            |
| Peak repetitive reverse voltage                             | $V_{RRM}$            |                                                    | 650         | V                |
| Continuous forward current                                  | $I_F^{(1)}$          | $T_C = 141$ °C (DC)                                | 20          | A                |
|                                                             | $I_F^{(2)}$          | $T_C = 127$ °C (DC)                                | 20          | A                |
| DC blocking voltage                                         | $V_{DC}$             |                                                    | 650         | V                |
| Repetitive peak forward current                             | $I_{FRM}$            | $T_C = 25$ °C, $f = 50$ Hz, square wave, DC = 25 % | 73          | A                |
| Non-repetitive peak forward surge current                   | $I_{FSM}$            | $T_C = 25$ °C, $t_p = 10$ ms, half sine wave       | 125         | A                |
|                                                             |                      | $T_C = 110$ °C, $t_p = 10$ ms, half sine wave      | 115         |                  |
| Power dissipation                                           | $P_{tot}^{(1)}$      | $T_C = 25$ °C                                      | 143         | W                |
|                                                             |                      | $T_C = 110$ °C                                     | 62          |                  |
|                                                             | $P_{tot}^{(2)}$      | $T_C = 25$ °C                                      | 100         | W                |
|                                                             |                      | $T_C = 110$ °C                                     | 43          |                  |
| $I^2t$ value                                                | $\int i^2 dt$        | $T_C = 25$ °C                                      | 78          | A <sup>2</sup> s |
|                                                             |                      | $T_C = 110$ °C                                     | 66          |                  |
| Operating junction and storage temperatures                 | $T_J^{(3)}, T_{Stg}$ |                                                    | -55 to +175 | °C               |

## Notes

(1) Based on typical  $R_{th}$

(2) Based on maximum  $R_{th}$

(3) The heat generated must be less than the thermal conductivity from junction-to-ambient:  $dP_D/dT_J < 1/R_{\theta JA}$



| ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) |        |                                                             |      |      |      |               |
|--------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------|------|------|------|---------------|
| PARAMETER                                                                                  | SYMBOL | TEST CONDITIONS                                             | MIN. | TYP. | MAX. | UNITS         |
| Forward voltage                                                                            | $V_F$  | $I_F = 20\text{ A}$                                         | -    | 1.33 | 1.5  | V             |
|                                                                                            |        | $I_F = 20\text{ A}, T_J = 150\text{ }^{\circ}\text{C}$      | -    | 1.5  | 1.75 |               |
|                                                                                            |        | $I_F = 20\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$      | -    | 1.6  | -    |               |
| Reverse leakage current                                                                    | $I_R$  | $V_R = V_R\text{ rated}$                                    | -    | 4.5  | 145  | $\mu\text{A}$ |
|                                                                                            |        | $V_R = V_R\text{ rated}, T_J = 150\text{ }^{\circ}\text{C}$ | -    | 55   | 300  |               |
|                                                                                            |        | $V_R = V_R\text{ rated}, T_J = 175\text{ }^{\circ}\text{C}$ | -    | 110  | -    |               |
| Total capacitance                                                                          | C      | $V_R = 1\text{ V}, f = 1\text{ MHz}$                        | -    | 860  | -    | pF            |
|                                                                                            |        | $V_R = 400\text{ V}, f = 1\text{ MHz}$                      | -    | 74   | -    |               |
| Total capacitive charge                                                                    | $Q_C$  | $V_R = 400\text{ V}, f = 1\text{ MHz}$                      | -    | 52   | -    | nC            |

| THERMAL - MECHANICAL SPECIFICATIONS ( $T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) |            |                 |      |           |      |                      |
|------------------------------------------------------------------------------------------------------|------------|-----------------|------|-----------|------|----------------------|
| PARAMETER                                                                                            | SYMBOL     | TEST CONDITIONS | MIN. | TYP.      | MAX. | UNITS                |
| Thermal resistance, junction-to-case                                                                 | $R_{thJC}$ |                 | -    | 1.05      | 1.5  | $^{\circ}\text{C/W}$ |
| Marking device                                                                                       |            |                 |      | 4C20EP07L |      |                      |

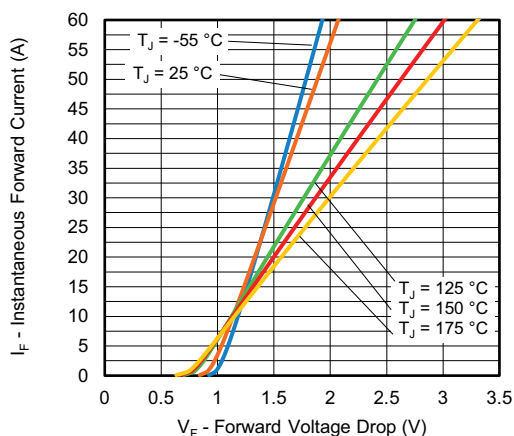


Fig. 1 - Typical Forward Voltage Drop Characteristics

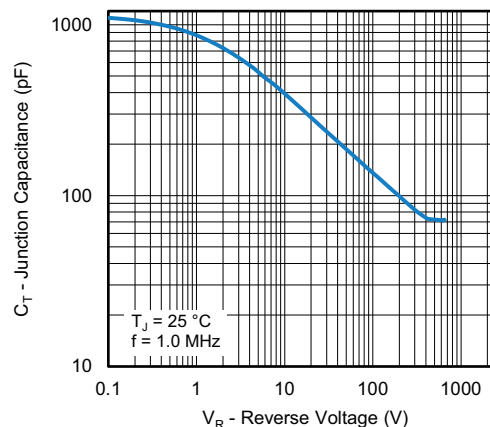


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

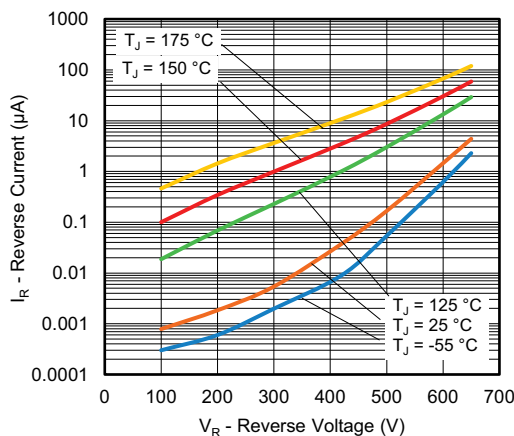


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

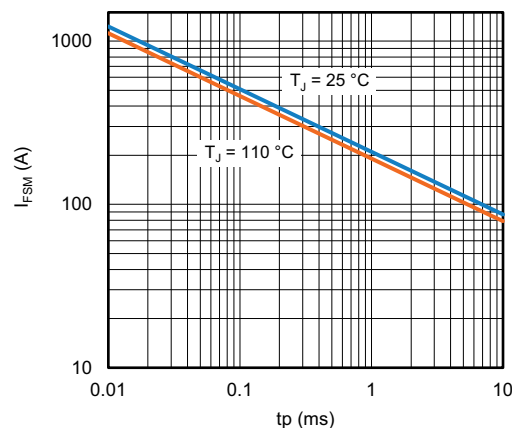


Fig. 4 - Non-Repetitive Peak Forward Surge Current vs. Pulse Duration (Square Wave)

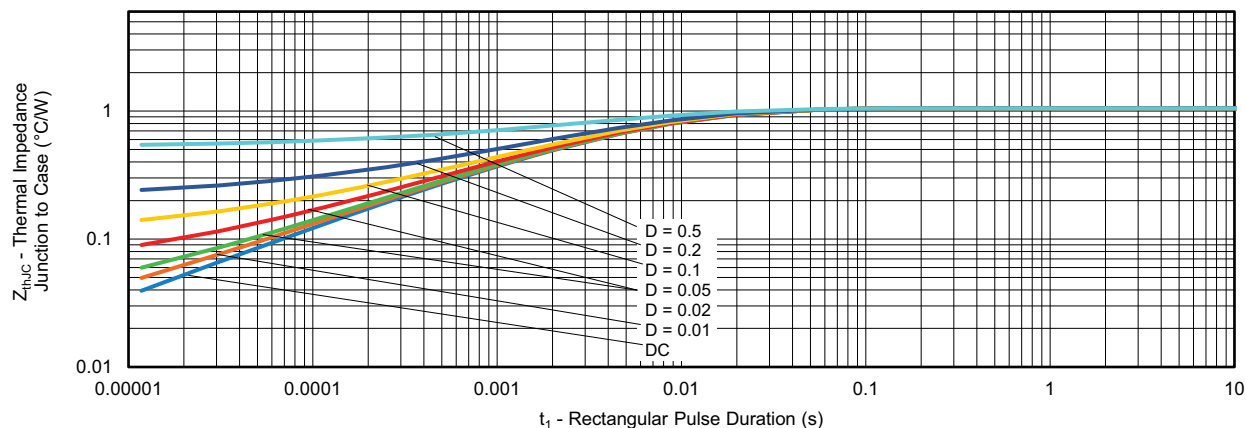
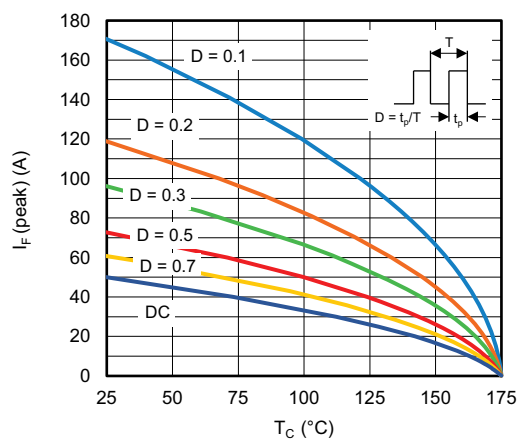

Fig. 5 - Thermal Impedance  $Z_{thJC}$  - Characteristics


Fig. 6 - Peak Forward Current vs. Maximum Allowable Case Temperature

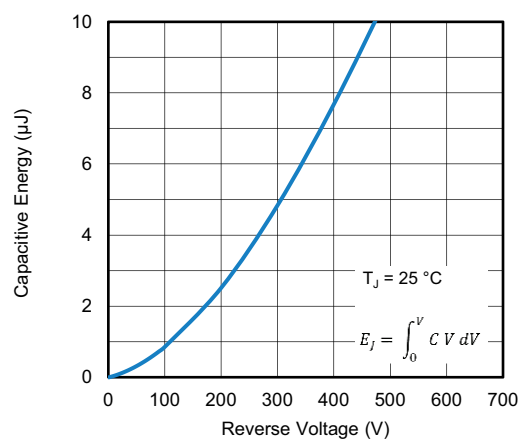


Fig. 8 - Capacitance Energy vs. Reverse Voltage

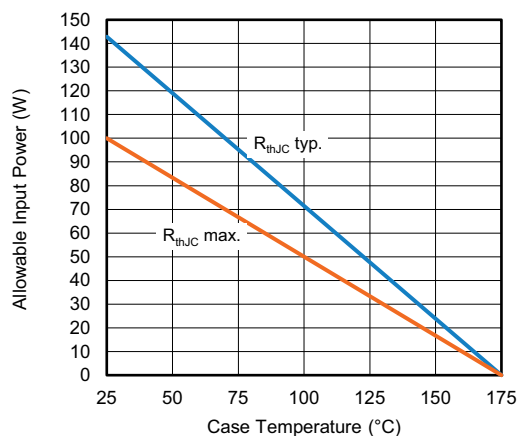


Fig. 7 - Allowable Input Power vs. Case Temperature

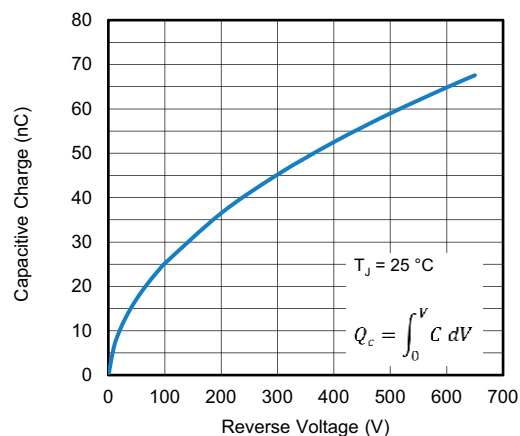


Fig. 9 - Capacitance Change vs. Reverse Voltage



ORDERING INFORMATION TABLE

|             |                                                                                              |    |    |   |   |    |   |     |
|-------------|----------------------------------------------------------------------------------------------|----|----|---|---|----|---|-----|
| Device code | VS-                                                                                          | 4C | 20 | E | P | 07 | L | -M3 |
|             | 1                                                                                            | 2  | 3  | 4 | 5 | 6  | 7 | 8   |
| 1           | - Vishay Semiconductors product                                                              |    |    |   |   |    |   |     |
| 2           | - 4C = SiC diode, Generation 4                                                               |    |    |   |   |    |   |     |
| 3           | - Current rating (20 = 20 A)                                                                 |    |    |   |   |    |   |     |
| 4           | - E = single diode                                                                           |    |    |   |   |    |   |     |
| 5           | - P = package TO-247                                                                         |    |    |   |   |    |   |     |
| 6           | - Voltage rating: 07 = 650 V                                                                 |    |    |   |   |    |   |     |
| 7           | - L = long lead                                                                              |    |    |   |   |    |   |     |
| 8           | - Environmental digit:<br>-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free |    |    |   |   |    |   |     |

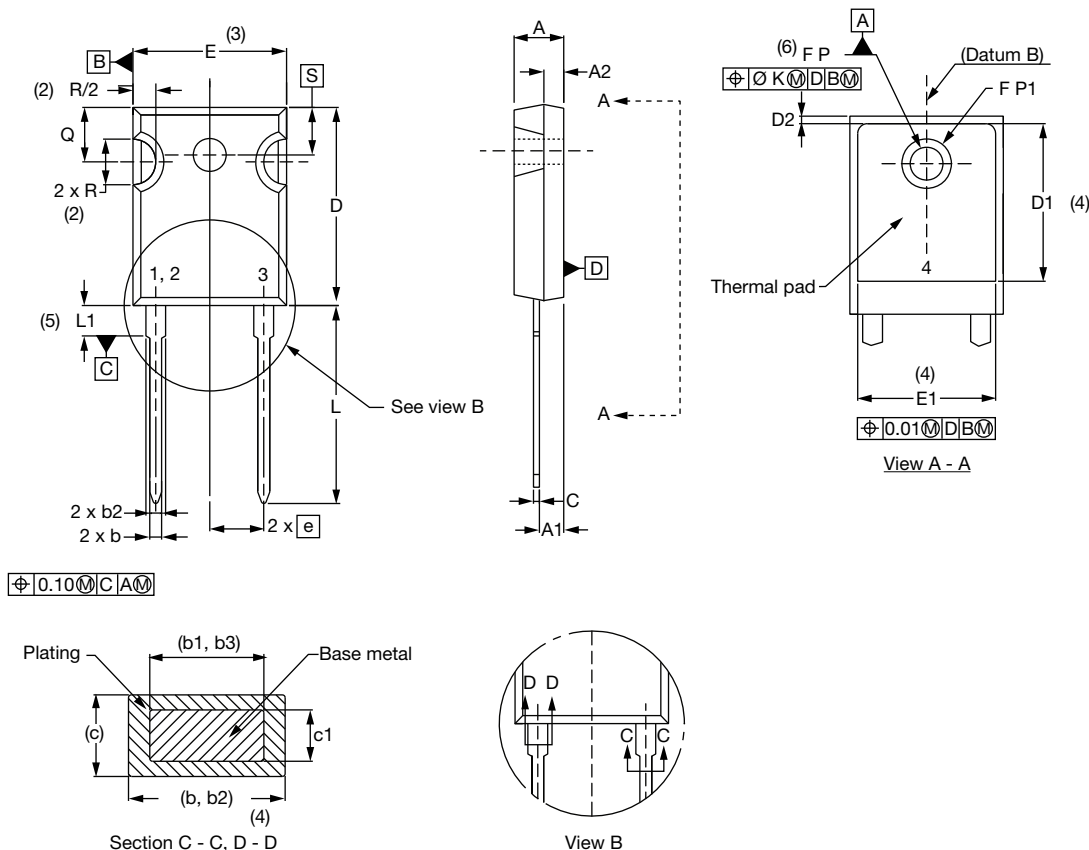
| ORDERING INFORMATION |             |               |                          |
|----------------------|-------------|---------------|--------------------------|
| PREFERRED P/N        | UNIT WEIGHT | BASE QUANTITY | PACKAGING DESCRIPTION    |
| VS-4C20EP07L-M3      | 5.5 g       | 25 / tube     | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95536">www.vishay.com/doc?95536</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95648">www.vishay.com/doc?95648</a> |



### TO-247AD 2L

**DIMENSIONS** in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.65        | 5.31  | 0.183  | 0.209 |       |
| A1     | 2.21        | 2.59  | 0.087  | 0.102 |       |
| A2     | 1.50        | 2.49  | 0.059  | 0.098 |       |
| b      | 0.99        | 1.40  | 0.039  | 0.055 |       |
| b1     | 0.99        | 1.35  | 0.039  | 0.053 |       |
| b2     | 1.65        | 2.39  | 0.065  | 0.094 |       |
| b3     | 1.65        | 2.34  | 0.065  | 0.092 |       |
| c      | 0.38        | 0.89  | 0.015  | 0.035 |       |
| c1     | 0.38        | 0.84  | 0.015  | 0.033 |       |
| D      | 19.71       | 20.70 | 0.776  | 0.815 | 3     |
| D1     | 13.08       | -     | 0.515  | -     | 4     |
| D2     | 0.51        | 1.35  | 0.020  | 0.053 |       |

| SYMBOL           | MILLIMETERS |       | INCHES    |       | NOTES |
|------------------|-------------|-------|-----------|-------|-------|
|                  | MIN.        | MAX.  | MIN.      | MAX.  |       |
| E                | 15.29       | 15.87 | 0.602     | 0.625 | 3     |
| E1               | 13.46       | -     | 0.53      | -     |       |
| e                | 5.46 BSC    |       | 0.215 BSC |       |       |
| $\varnothing K$  | 0.254       |       | 0.010     |       |       |
| L                | 19.81       | 20.32 | 0.780     | 0.800 |       |
| L1               | 3.71        | 4.29  | 0.146     | 0.169 |       |
| $\varnothing P$  | 3.56        | 3.66  | 0.14      | 0.144 |       |
| $\varnothing P1$ | -           | 6.98  | -         | 0.275 |       |
| Q                | 5.31        | 5.69  | 0.209     | 0.224 |       |
| R                | 4.52        | 5.49  | 0.178     | 0.216 |       |
| S                | 5.51 BSC    |       | 0.217 BSC |       |       |

#### Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6)  $\varnothing P$  to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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