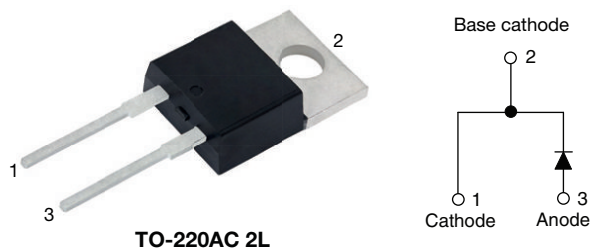


650 V Power SiC Gen 3 Merged PIN Schottky Diode, 12 A



FEATURES

- Majority carrier diode using Schottky technology on SiC wide band gap material
- Improved V_F and efficiency by thin wafer technology
- 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
- MPS structure for high ruggedness to forward current surge events
- 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



RoHS
COMPLIANT
HALOGEN
FREE

LINKS TO ADDITIONAL RESOURCES



3D Models



Application Notes

| PRIMARY CHARACTERISTICS | |
|------------------------------|-------------|
| $I_{F(AV)}$ | 12 A |
| V_R | 650 V |
| V_F at I_F at 25°C, typ. | 1.3 V |
| T_J max. | 175 °C |
| I_R at V_R at 175 °C | 5 μ A |
| Q_C ($V_R = 400$ V) | 34 nC |
| Package | TO-220AC 2L |
| Circuit configuration | Single |

DESCRIPTION / APPLICATIONS

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

Optimum choice for high speed hard switching and efficient operation over a wide temperature range, it is also recommended for all applications suffering from Silicon ultrafast recovery behavior.

Typical applications include AC/DC PFC and DC/DC ultra high frequency output rectification in FBPS and LLC converters.

MECHANICAL DATA

Case: TO-220AC 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 | $I_F^{(1)}$ | $T_C = 135$ °C (DC) | 12 | A |
| | $I_F^{(2)}$ | $T_C = 145$ °C (DC) | | |
| DC blocking voltage | V_{DC} | | 650 | V |
| Repetitive peak forward current | I_{FRM} | $T_C = 25$ °C, $f = 50$ Hz, square wave, DC = 25 % | 48 | A |
| Non-repetitive peak forward surge current | I_{FSM} | $T_C = 25$ °C, $t_p = 10$ ms, half sine wave | 83 | A |
| | | $T_C = 110$ °C, $t_p = 10$ ms, half sine wave | 74 | |
| Power dissipation | $P_{tot}^{(1)}$ | $T_C = 25$ °C | 73 | W |
| | | $T_C = 110$ °C | 32 | |
| | $P_{tot}^{(2)}$ | $T_C = 25$ °C | 94 | W |
| | | $T_C = 110$ °C | 40 | |
| I^2t value | $\int i^2 dt$ | $T_C = 25$ °C | 34.5 | A ² s |
| | | $T_C = 110$ °C | 27 | |
| Operating junction and storage temperatures | $T_J^{(2)}, T_{Stg}$ | | -55 to +175 | °C |

Notes

(1) Based on maximum R_{th}

(2) Based on typical 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 | $I_F = 12\text{ A}$ | - | 1.3 | 1.5 | V |
| | | $I_F = 12\text{ A}, T_J = 150\text{ }^{\circ}\text{C}$ | - | 1.50 | 1.85 | |
| | | $I_F = 12\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$ | - | 1.58 | - | |
| Reverse leakage current | I_R | $V_R = V_R\text{ rated}$ | - | 0.8 | 65 | μA |
| | | $V_R = V_R\text{ rated}, T_J = 150\text{ }^{\circ}\text{C}$ | - | 3 | 150 | |
| | | $V_R = V_R\text{ rated}, T_J = 175\text{ }^{\circ}\text{C}$ | - | 5 | - | |
| Total capacitance | C | $V_R = 1\text{ V}, f = 1\text{ MHz}$ | - | 535 | - | pF |
| | | $V_R = 400\text{ V}, f = 1\text{ MHz}$ | - | 54 | - | |
| Total capacitive charge | Q_C | $V_R = 400\text{ V}, f = 1\text{ MHz}$ | - | 34 | - | 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} | | - | 1.6 | 2.1 | $^{\circ}\text{C/W}$ |
| Marking device | | | 3C12ET07T | | | |

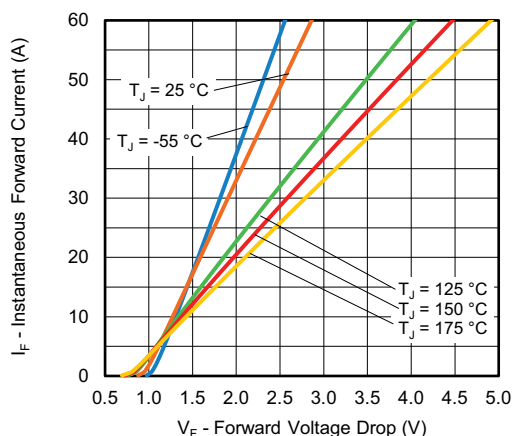


Fig. 1 - Typical Forward Voltage Drop Characteristics

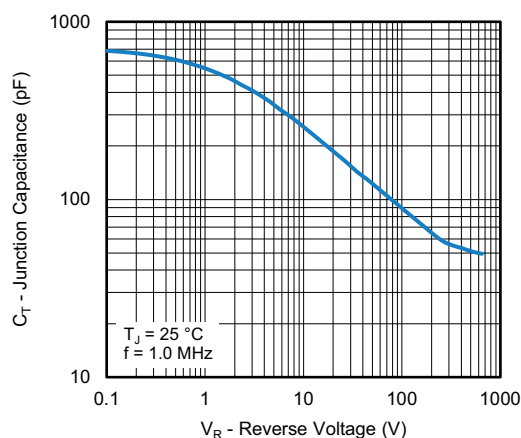


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

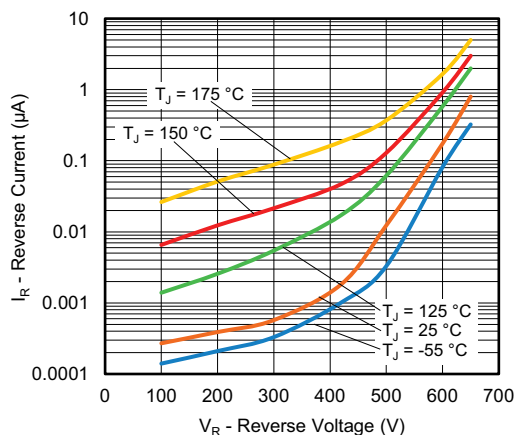


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

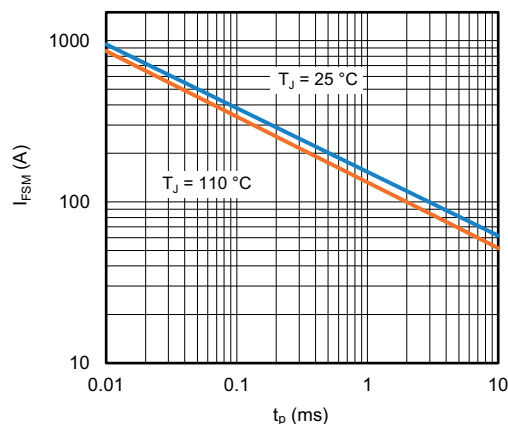


Fig. 4 - Non-Repetitive Peak Forward Surge Current vs. Pulse Duration (Square Wave)

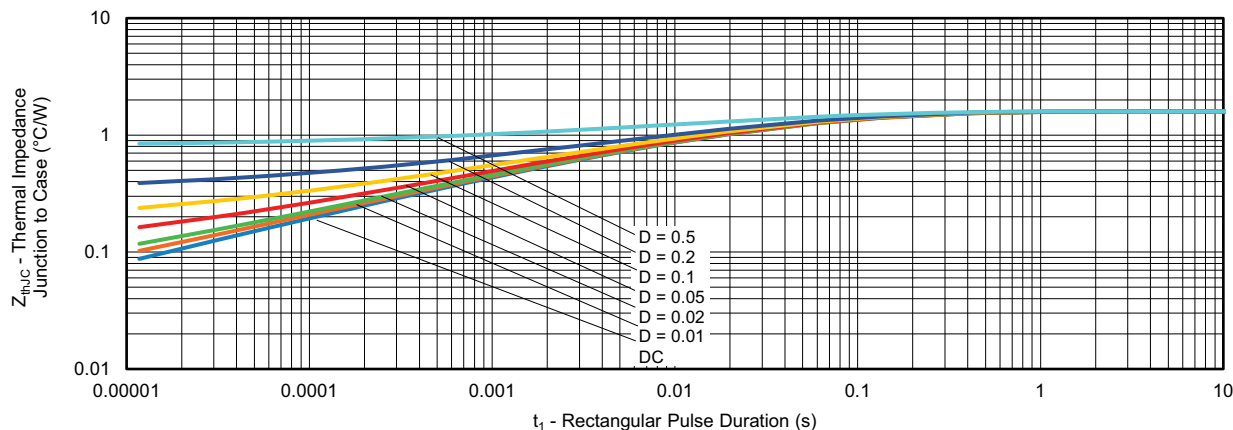
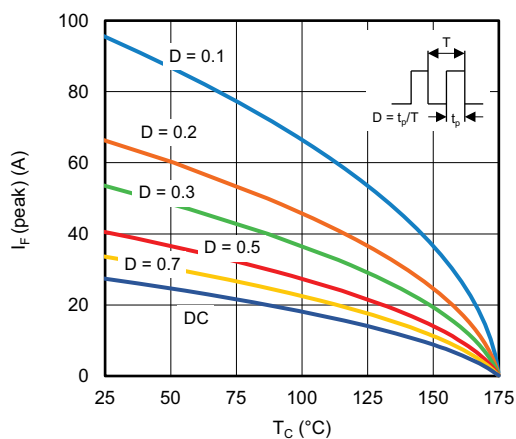

Fig. 5 - Typical Thermal Impedance Z_{thJC} Characteristics


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

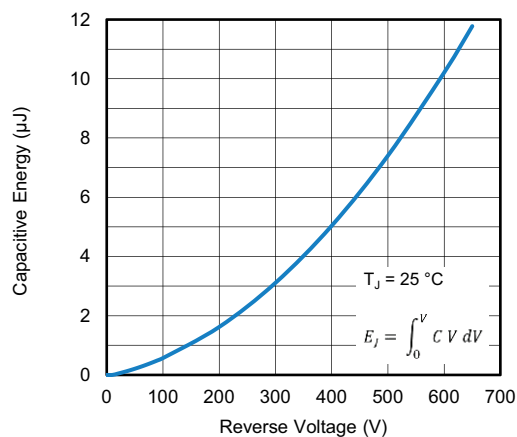


Fig. 8 - Typical Capacitive Energy vs. Reverse Voltage

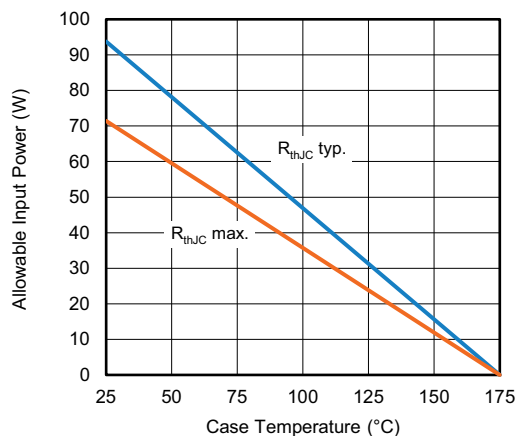


Fig. 7 - Forward Power Loss Characteristics

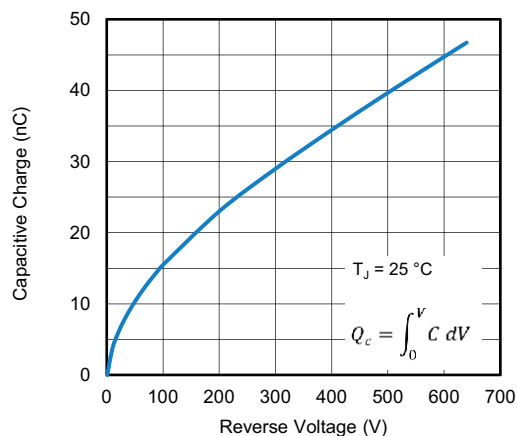


Fig. 9 - Typical Capacitive Charge vs. Reverse Voltage

**ORDERING INFORMATION TABLE**

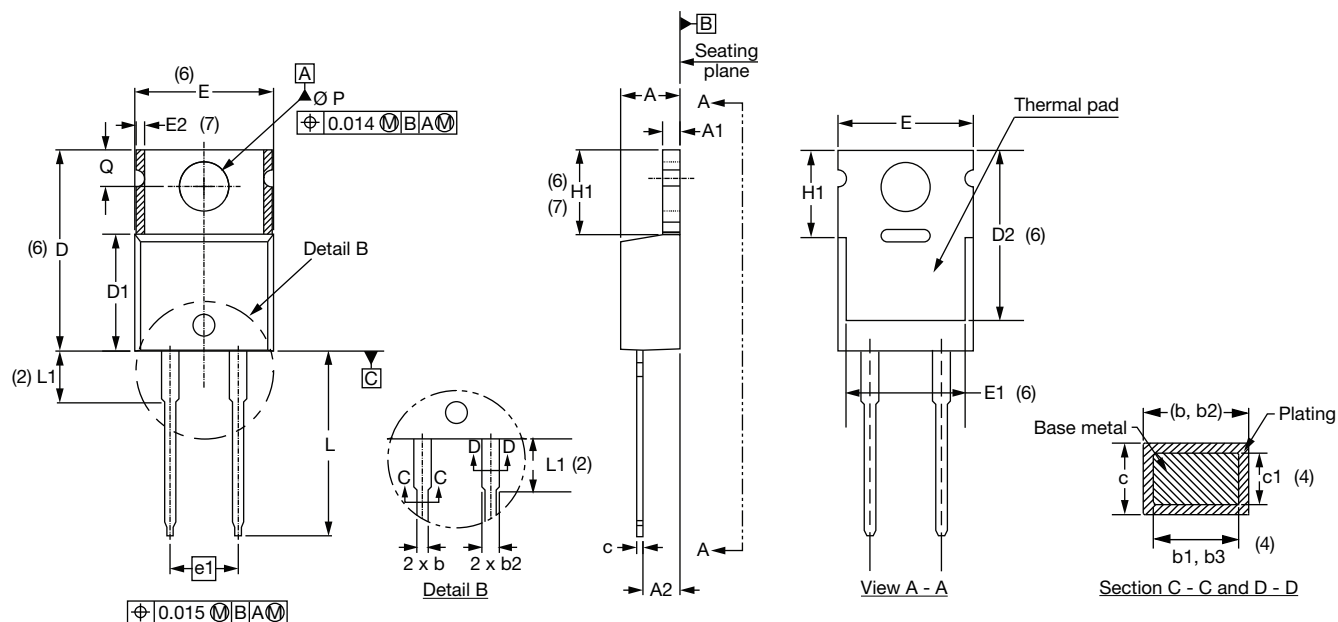
| | | | | | | | | |
|-------------|--|----|----|---|---|----|---|-----|
| Device code | VS- | 3C | 12 | E | T | 07 | T | -M3 |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | - Vishay Semiconductors product | | | | | | | |
| 2 | - 3C = SiC diode, Generation 3 | | | | | | | |
| 3 | - Current rating (12 = 12 A) | | | | | | | |
| 4 | - E = single diode | | | | | | | |
| 5 | - Package TO-220 | | | | | | | |
| 6 | - Voltage rating: (07 = 650 V) | | | | | | | |
| 7 | - T = true 2 pin | | | | | | | |
| 8 | - Environmental digit: -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free | | | | | | | |

| ORDERING INFORMATION | | |
|----------------------|---------------|--------------------------|
| PREFERRED P/N | BASE QUANTITY | PACKAGING DESCRIPTION |
| VS-3C12ET07T-M3 | 50/tube | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?96069 |
| Part marking information | www.vishay.com/doc?95391 |

TO-220AC 2L

DIMENSIONS in millimeters and inches



| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.25 | 4.65 | 0.167 | 0.183 | |
| A1 | 1.14 | 1.40 | 0.045 | 0.055 | |
| A2 | 2.56 | 2.92 | 0.101 | 0.115 | |
| b | 0.69 | 1.01 | 0.027 | 0.040 | |
| b1 | 0.38 | 0.97 | 0.015 | 0.038 | 4 |
| b2 | 1.20 | 1.73 | 0.047 | 0.068 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 |
| c | 0.36 | 0.61 | 0.014 | 0.024 | |
| c1 | 0.36 | 0.56 | 0.014 | 0.022 | 4 |
| D | 14.85 | 15.25 | 0.585 | 0.600 | 3 |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | |
| D2 | 11.68 | 12.88 | 0.460 | 0.507 | 6 |
| E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |

Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC® TO-220, except D2, where JEDEC® minimum is 0.480"



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