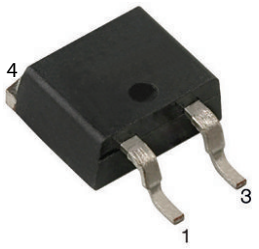
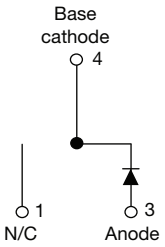
# 650 V Gen 3 Power SiC Merged PIN Schottky Diode, 20 A




D²PAK 2L (TO-263AB 2L)




## LINKS TO ADDITIONAL RESOURCES

3D Models

Application Notes

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 20 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 | 9 µA |
| $Q_C$ ($V_R$ = 400 V) | 53 nC |
| Package | D²PAK 2L (TO-263AB 2L) |
| Circuit configuration | Single |

## 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
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- MPS structure for high ruggedness to forward current surge events
- Meets JESD 201 class 1A whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

HALOGEN FREE

## 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:** D²PAK 2L (TO-263AB 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

**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) | $T_C$ = 123 °C (DC) | 20 | A |
| | $I_F$ (2) | $T_C$ = 136 °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 % | 63 | A |
| Non-repetitive peak forward surge current | $I_{FSM}$ | $T_C$ = 25 °C, $t_p$ = 10 ms, half sine wave | 110 | |
| | | $T_C$ = 110 °C, $t_p$ = 10 ms, half sine wave | 104 | |
| Power dissipation | $P_{tot}$ (1) | $T_C$ = 25 °C | 93 | W |
| | | $T_C$ = 110 °C | 41 | |
| | $P_{tot}$ (2) | $T_C$ = 25 °C | 125 | W |
| | | $T_C$ = 110 °C | 54 | |
| $I^2t$ value | $\int i^2 dt$ | $T_C$ = 25 °C | 60.5 | $A^2s$ |
| | | $T_C$ = 110 °C | 54 | |
| 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: $dP_D/dT_J < 1/R_{\theta JA}$



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| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Forward voltage | $V_F$ | $I_F$ = 20 A | - | 1.3 | 1.5 | V |
| | | $I_F$ = 20 A, $T_J$ = 150 °C | - | 1.5 | 1.85 | |
| | | $I_F$ = 20 A, $T_J$ = 175 °C | - | 1.60 | - | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 1.3 | 100 | µA |
| | | $V_R$ = $V_R$ rated, $T_J$ = 150 °C | - | 5.5 | 250 | |
| | | $V_R$ = $V_R$ rated, $T_J$ = 175 °C | - | 9 | - | |
| Total capacitance | C | $V_R$ = 1 V, f = 1 MHz | - | 845 | - | pF |
| | | $V_R$ = 400 V, f = 1 MHz | - | 82 | - | |
| Total capacitive charge | $Q_C$ | $V_R$ = 400 V, f = 1 MHz | - | 53 | - | nC |

| THERMAL - MECHANICAL SPECIFICATIONS ($T_A$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction to case | $R_{thJC}$ | | - | 1.2 | 1.6 | °C/W |
| Marking device | | | 3C20ET07S | | | |

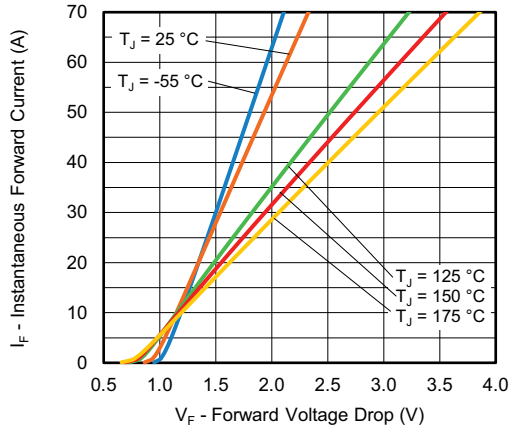



Fig. 1 - Typical Forward Voltage Drop Characteristics

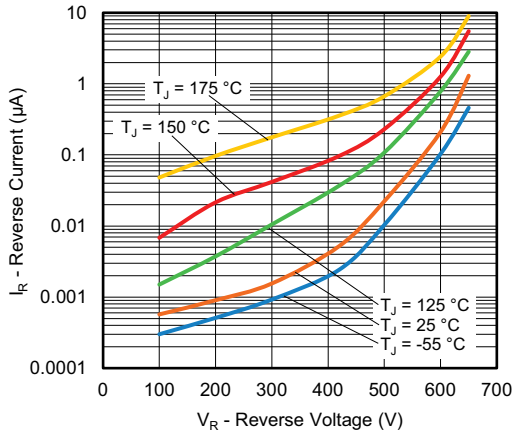



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

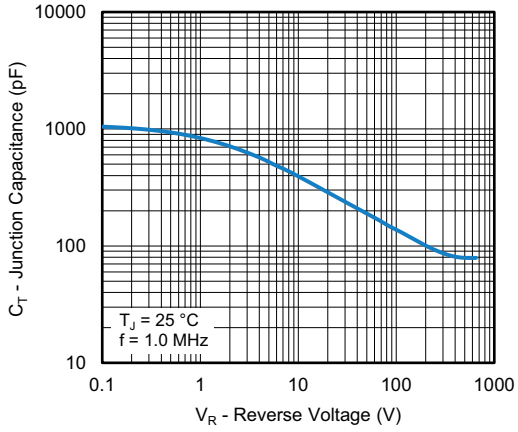



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

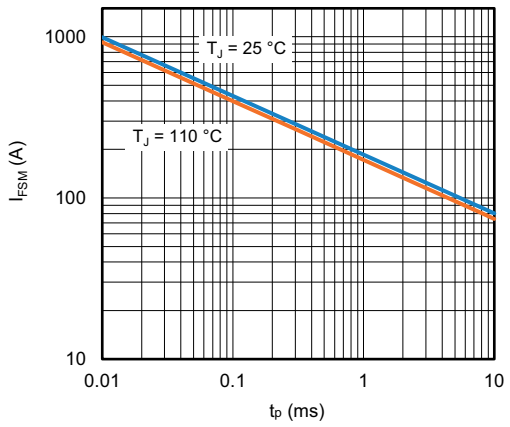



Fig. 4 - Non-Repetitive Peak Forward Surge Current vs. Pulse Duration (Square Wave)


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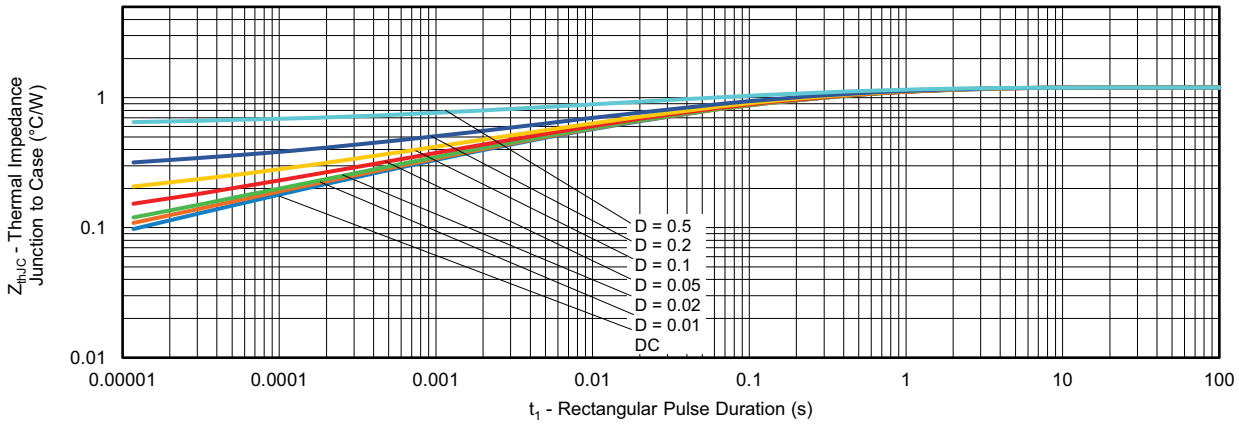



Fig. 5 - Typical Thermal Impedance $Z_{thJC}$ Characteristics

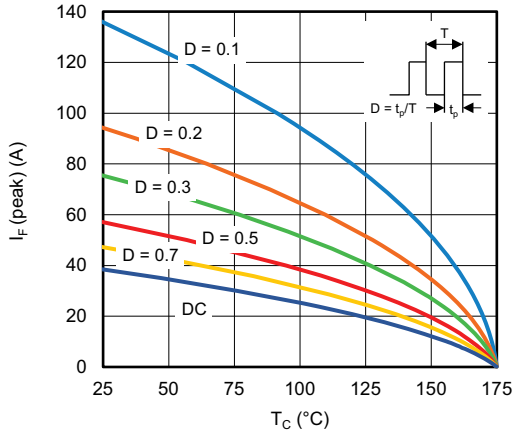



Fig. 6 - Peak Forward Current vs. Maximum Allowable Case Temperature

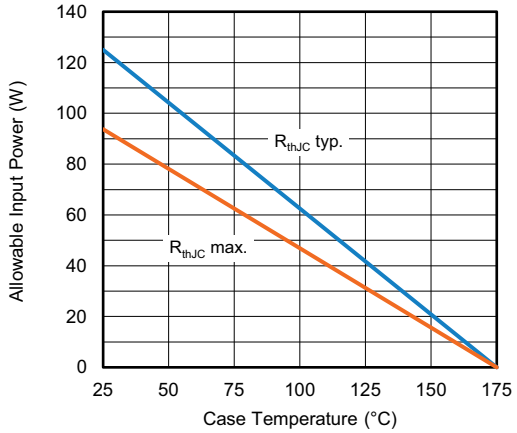



Fig. 7 - Forward Power Loss Characteristics

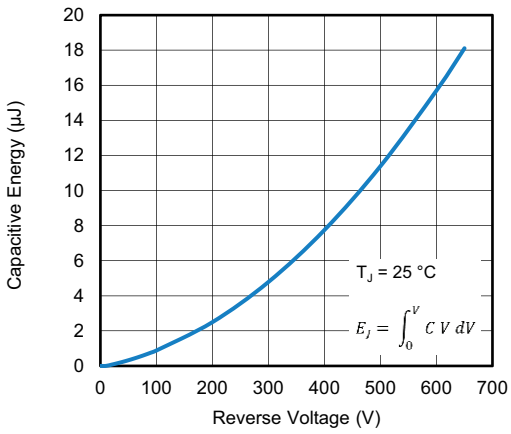



Fig. 8 - Typical Capacitive Energy vs. Reverse Voltage

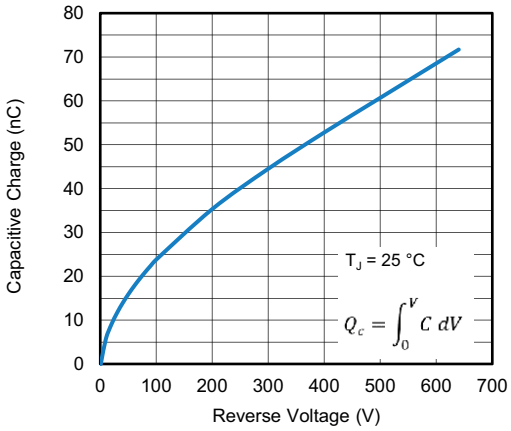



Fig. 9 - Typical Capacitive Charge vs. Reverse Voltage


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## ORDERING INFORMATION TABLE

Device code

| VS- | 3C | 20 | E | T | 07 | S | 2 | L | -M3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

1 - Vishay Semiconductors product
2 - 3C = SiC diode, generation 3
3 - Current rating (20 = 20 A)
4 - E = single diode
5 - T = $D^2PAK$ package
6 - Voltage rating: (07 = 650 V)
7 - S = surface mountable
8 - 2 = true 2 pin $D^2PAK$
9 - L = tape and reel (left oriented)
10 - Environmental digit:
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

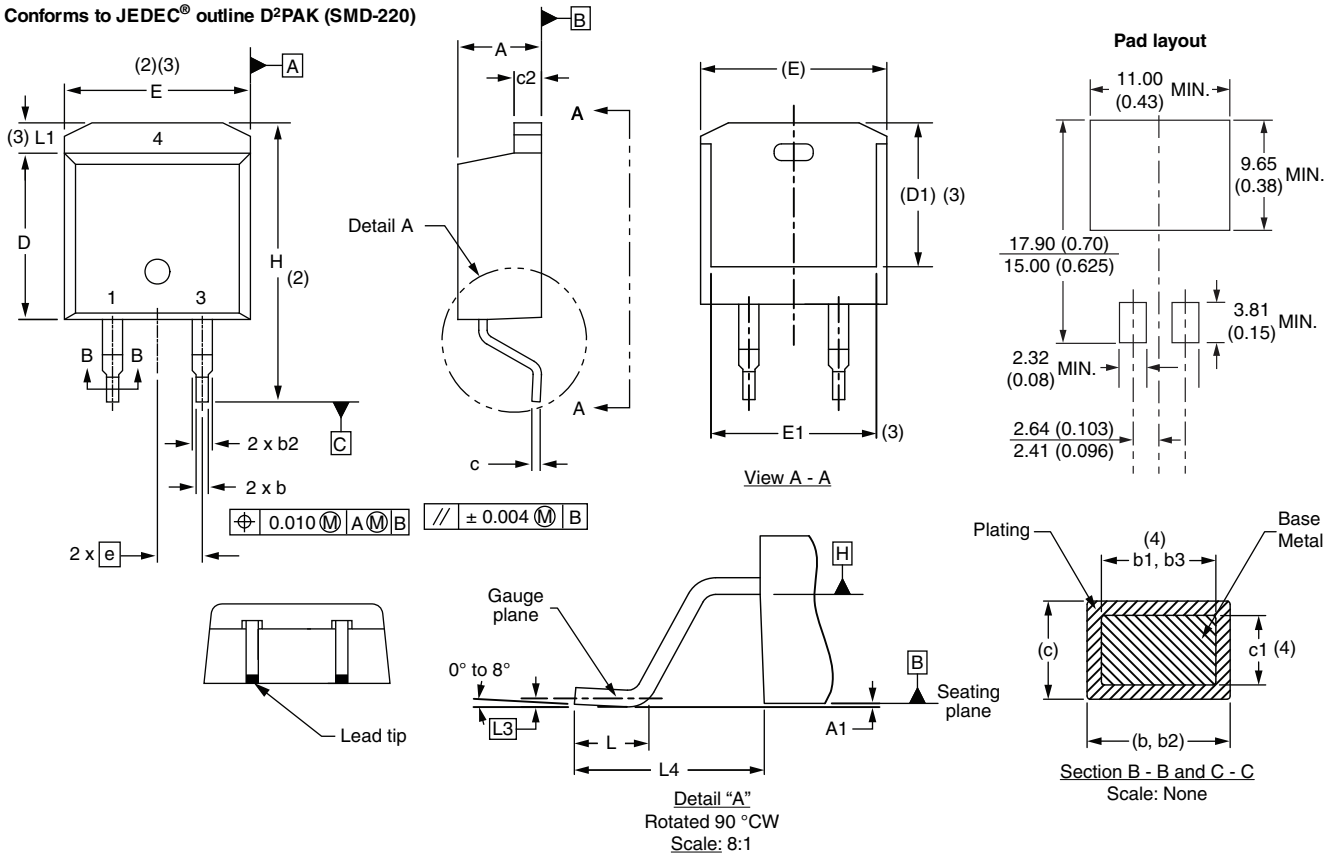
| ORDERING INFORMATION | | |
|---|---|---|
| **PREFERRED P/N** | **BASE QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-3C20ET07S2L-M3 | 800 per reel | 13" diameter reel |

| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?96683 |
| Part marking information | www.vishay.com/doc?96693 |
| Packaging information | www.vishay.com/doc?95032 |


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# D²PAK 2L (TO-263AB 2L)

**DIMENSIONS** in millimeters and inches




| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | |
| b | 0.51 | 0.99 | 0.020 | 0.039 | |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 | 4 |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 |
| c | 0.38 | 0.74 | 0.015 | 0.029 | |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 | 4 |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 | |
| D | 8.51 | 9.65 | 0.335 | 0.380 | 2 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| D1 | 6.86 | 8.00 | 0.270 | 0.315 | 3 |
| E | 9.65 | 10.67 | 0.380 | 0.420 | 2, 3 |
| E1 | 7.90 | 8.80 | 0.311 | 0.346 | 3 |
| e | 2.54 BSC | | 0.100 BSC | | |
| H | 14.61 | 15.88 | 0.575 | 0.625 | |
| L | 1.78 | 2.79 | 0.070 | 0.110 | |
| L1 | - | 1.65 | - | 0.066 | 3 |
| L3 | 0.25 BSC | | 0.010 BSC | | |
| L4 | 4.78 | 5.28 | 0.188 | 0.208 | |

**Notes**

(1) Dimensioning and tolerancing per ASME Y14.5 M-1994

(2) Dimension D 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 outmost extremes of the plastic body

(3) Thermal pad contour optional within dimension E, L1, D1 and E1

(4) Dimension b1 and c1 apply to base metal only

(5) Datum A and B to be determined at datum plane H

(6) Controlling dimension: inch

(7) Outline conforms to JEDEC® outline TO-263AB



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