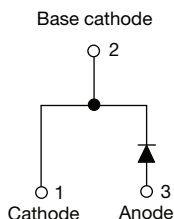


# 650 V Gen 4 Power Silicon Carbide Schottky Diode, 12 A



TO-220AC 2L



## 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
- AEC-Q101 qualified meets JESD 201 class 2 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



3D Models

## 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	84 $\mu$ A
$Q_C$ ( $V_R = 400$ V)	33 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.

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

## MECHANICAL DATA

**Case:** TO-220AC 2L

Molding compound meets UL 94 V-0 flammability rating  
Base P/NHM3 - halogen-free, RoHS-compliant, and AEC-Q101 qualified

**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	$I_F^{(1)}$	$T_C = 145$ °C (DC)	12	A
	$I_F^{(2)}$	$T_C = 139$ °C (DC)	12	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 %	51	A
Non-repetitive peak forward surge current	$I_{FSM}$	$T_C = 25$ °C, $t_p = 10$ ms, half sine wave	72	
		$T_C = 110$ °C, $t_p = 10$ ms, half sine wave	57	
Power dissipation	$P_{tot}^{(1)}$	$T_C = 25$ °C	91	W
		$T_C = 110$ °C	39	
	$P_{tot}^{(2)}$	$T_C = 25$ °C	75	W
		$T_C = 110$ °C	32.5	
$I^2t$ value	$\int i^2 dt$	$T_C = 25$ °C	25.9	A <sup>2</sup> s
		$T_C = 110$ °C	16.2	
Operating junction and storage temperatures	$T_J^{(2)}$ , $T_{Stg}$		-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:  $dP_D/dT_J < 1/R_{thJA}$



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
		$I_F = 12\text{ A}, T_J = 150\text{ }^{\circ}\text{C}$	-	1.45	1.75	
		$I_F = 12\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$	-	1.55	-	
Reverse leakage current	$I_R$	$V_R = V_R\text{ rated}$	-	2.2	80	$\mu\text{A}$
		$V_R = V_R\text{ rated}, T_J = 150\text{ }^{\circ}\text{C}$	-	38	190	
		$V_R = V_R\text{ rated}, T_J = 175\text{ }^{\circ}\text{C}$	-	84	-	
Total capacitance	C	$V_R = 1\text{ V}, f = 1\text{ MHz}$	-	549	-	pF
		$V_R = 400\text{ V}, f = 1\text{ MHz}$	-	48	-	
Total capacitive charge	$Q_C$	$V_R = 400\text{ V}, f = 1\text{ MHz}$	-	33	-	nC

THERMAL AND 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	$R_{thJC}$		-	1.65	2.0	$^{\circ}\text{C/W}$
Marking device			4C12ET07T			

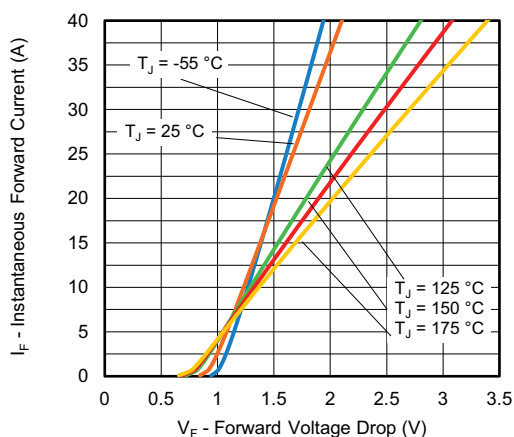


Fig. 1 - Typical Forward Voltage Drop Characteristics

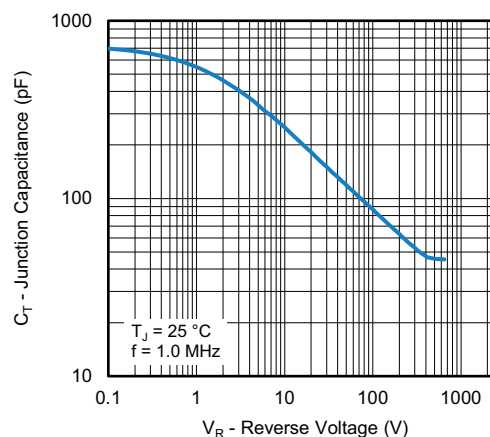


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

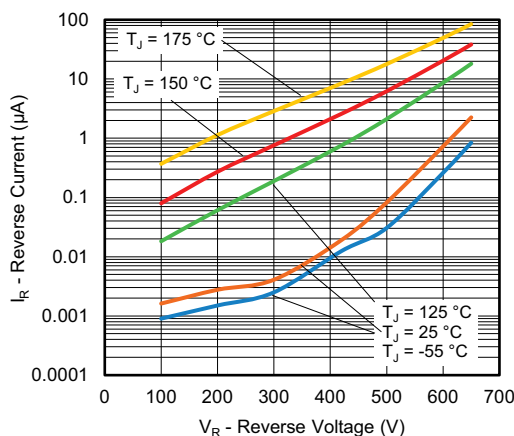


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

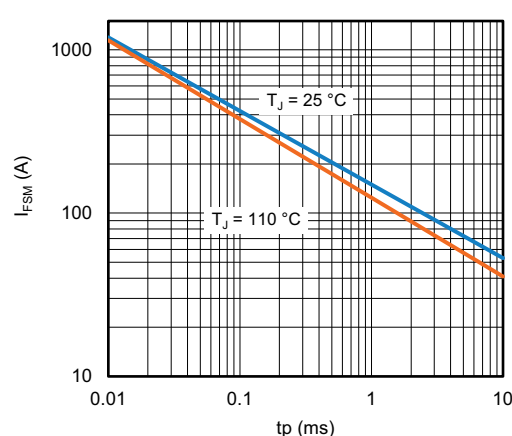


Fig. 4 - Non-Repetitive Peak Forward Surge Current vs. Pulse Duration (Square Wave)

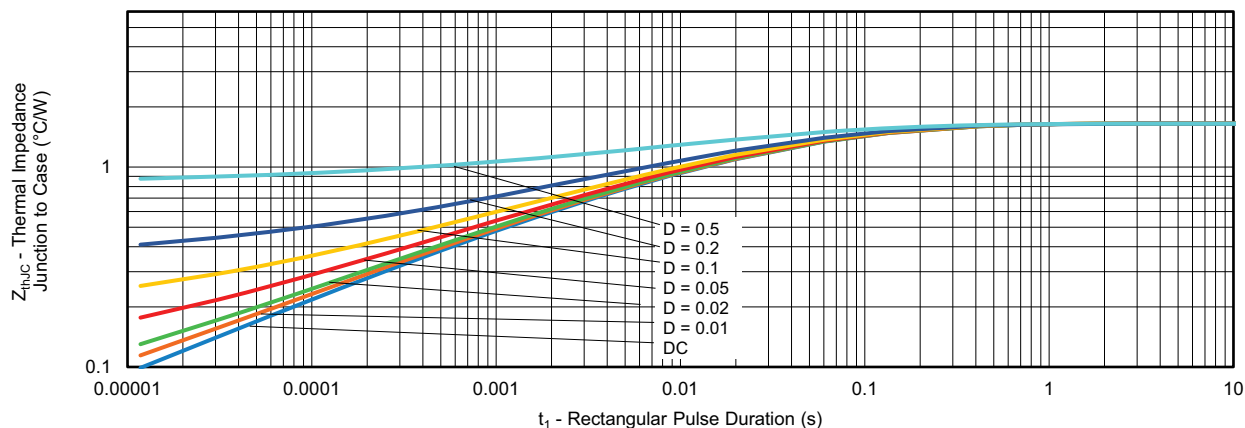
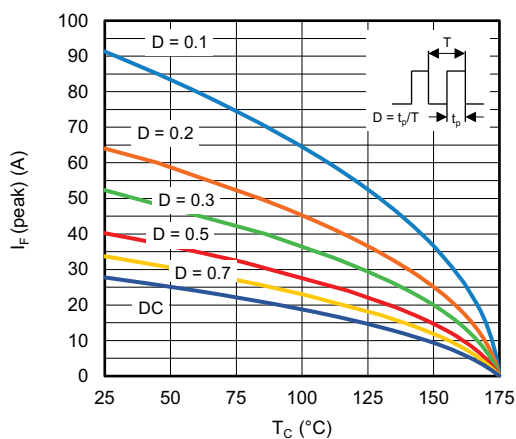

Fig. 5 - Typical Thermal Impedance  $Z_{thJC}$  Characteristics


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

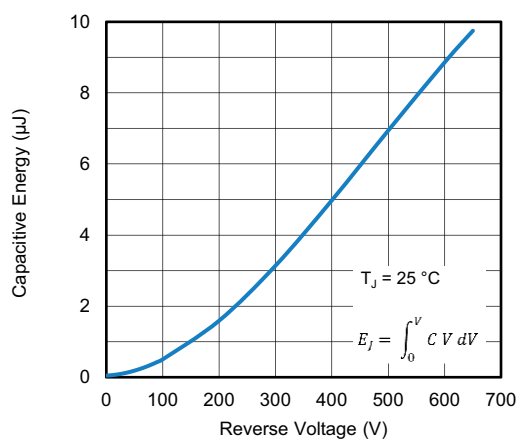


Fig. 8 - Typical Capacitive Energy vs. Reverse Voltage

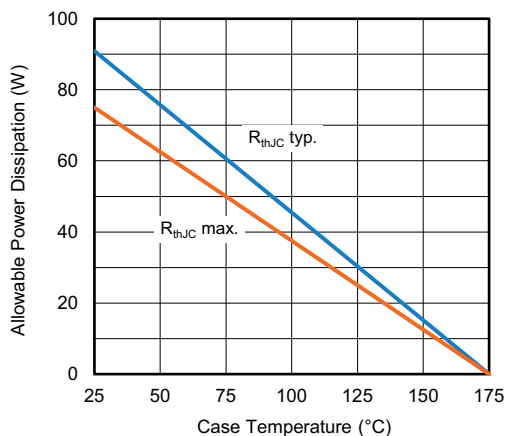


Fig. 7 - Forward Power Loss Characteristics

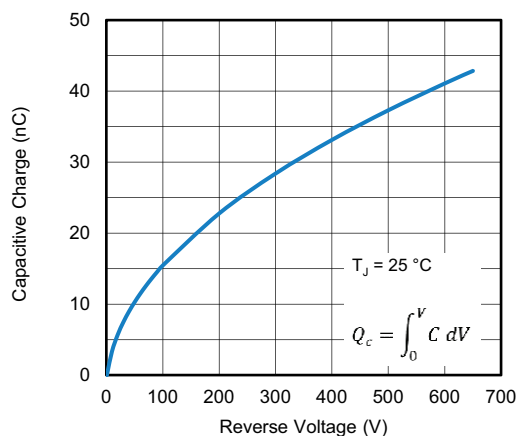


Fig. 9 - Typical Capacitive Charge vs. Reverse Voltage



## ORDERING INFORMATION TABLE

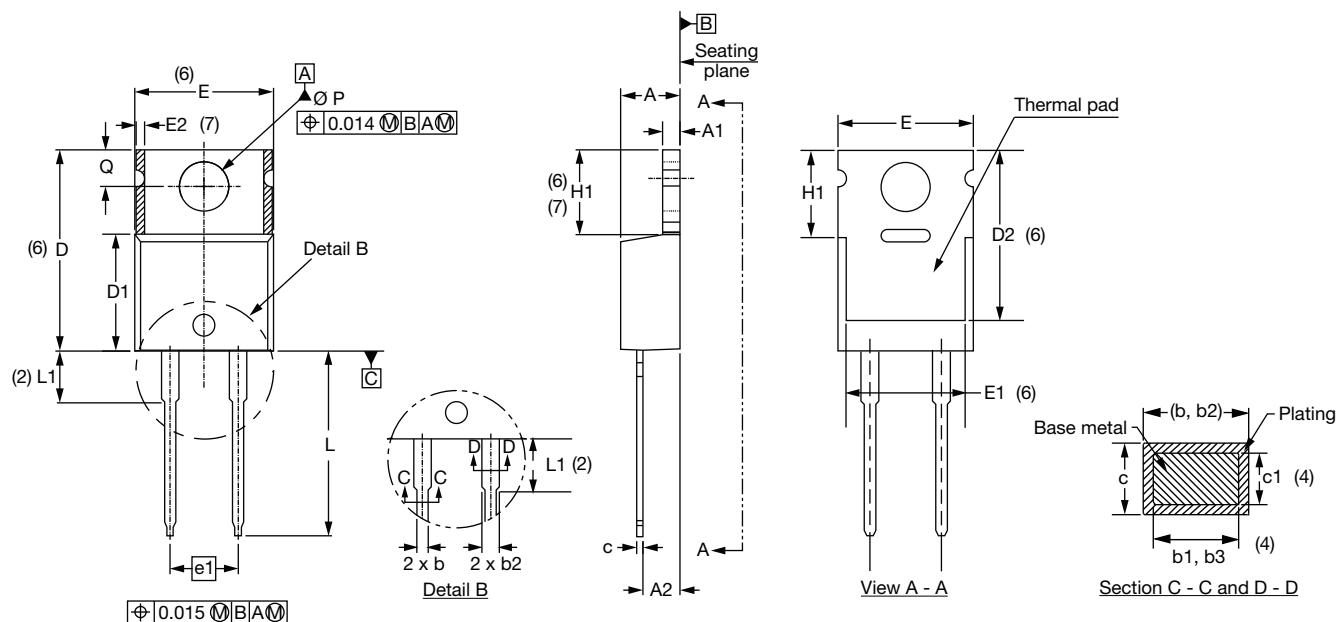
Device code	VS-	4C	12	E	T	07	T	H	M3
	1	2	3	4	5	6	7	8	9
1	- Vishay Semiconductors product								
2	- 4C = SiC diode, generation 4								
3	- Current rating (12 = 12 A)								
4	- E = single diode								
5	- T = TO-220 package								
6	- Voltage rating: (07 = 650 V)								
7	- T = true 2 pin								
8	- H = AEC-Q101 qualified								
9	- Environmental digit: M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free								

ORDERING INFORMATION			
PREFERRED P/N	UNIT WEIGHT	BASE QUANTITY	PACKAGING DESCRIPTION
VS-4C12ET07THM3	2 g	50 per tube	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?96069">www.vishay.com/doc?96069</a>
Part marking information	<a href="http://www.vishay.com/doc?95391">www.vishay.com/doc?95391</a>

# 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

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
E1	6.86	8.89	0.270	0.350	6
E2	-	0.76	-	0.030	7
e1	4.88	5.28	0.192	0.208	
H1	5.84	6.86	0.230	0.270	6, 7
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
Ø P	3.54	3.73	0.139	0.147	
Q	2.60	3.00	0.102	0.118	

## 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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