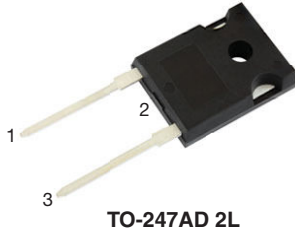




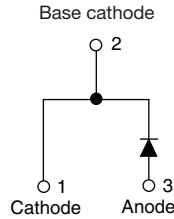
**THE DATASHEET OF  
VS-E4PH6006LHN3**



## Hyperfast Soft Recovery Diode, 60 A FRED Pt<sup>®</sup> Gen 4



TO-247AD 2L



### FEATURES

- Gen 4 FRED Pt<sup>®</sup> technology
- Low  $I_{RRM}$  and reverse recovery charge
- Very low forward voltage drop
- Polyimide passivated chip for high reliability standard
- 175 °C operating junction temperature
- AEC-Q101 qualified, meets JESD 201 class 1 whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



PRODUCT SUMMARY	
Package	TO-247AD 2L
$I_{F(AV)}$	60 A
$V_R$	600 V
$V_F$ at $I_F$	1.48 V
$t_{rr}$ typ.	see Recovery table
$T_J$ max.	175 °C
Diode variation	Single die

### DESCRIPTION

Gen 4 Fred technology, state of the art, ultralow  $V_F$ , soft switching optimized for Discontinuous (Critical) Mode (DCM) and IGBT F/W diode.

The minimized conduction loss, optimized stored charge and low recovery current minimized the switching losses and reduce over dissipation in the switching element and snubbers.

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Cathode to anode voltage	$V_R$		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 106$ °C	60	A
Single pulse forward current	$I_{FSM}$	$T_C = 25$ °C, $t_p = 8.3$ ms, half sine wave	425	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-55 to +175	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25$ °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100$ $\mu$ A	600	-	-	V
Forward voltage	$V_F$	$I_F = 50$ A	-	1.68	-	
		$I_F = 60$ A	-	1.75	2.0	
		$I_F = 50$ A, $T_J = 125$ °C	-	1.44	-	
		$I_F = 60$ A, $T_J = 125$ °C	-	1.55	-	
		$I_F = 50$ A, $T_J = 150$ °C	-	1.39	-	
		$I_F = 60$ A, $T_J = 150$ °C	-	1.48	1.65	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	50	$\mu$ A
		$T_J = 125$ °C, $V_R = V_R$ rated	-	-	500	
Junction capacitance	$C_T$	$V_R = 600$ V	-	30	-	pF

<b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 60\text{ A}$ $di_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	-	68	-	ns
		$T_J = 125\text{ }^\circ\text{C}$		-	92	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$		-	20	-	A
		$T_J = 125\text{ }^\circ\text{C}$		-	40	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$		-	945	-	nC
		$T_J = 125\text{ }^\circ\text{C}$		-	2500	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction to case	$R_{thJC}$			-	-	0.6	$^\circ\text{C}/\text{W}$
Thermal resistance, case to heat sink	$R_{thCS}$	Mounting surface, flat, smooth and greased		-	0.25	-	
Weight				-	6.0	-	g
				-	0.21	-	oz.
Mounting torque				6.0 (5)	-	12 (20)	kgf · cm (lbf · in)
Marking device		Case style TO-247AD 2L		E4PH6006LH			

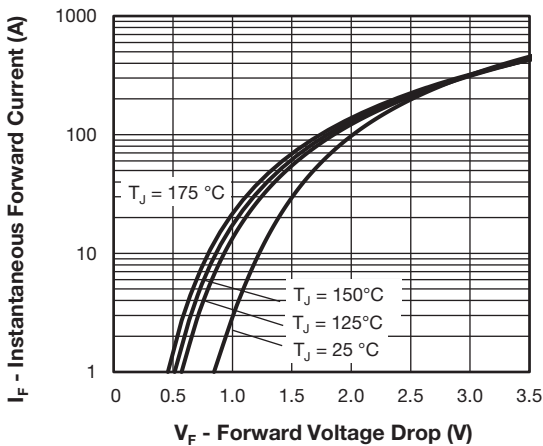


Fig. 1 - Typical Forward Voltage Drop Characteristics

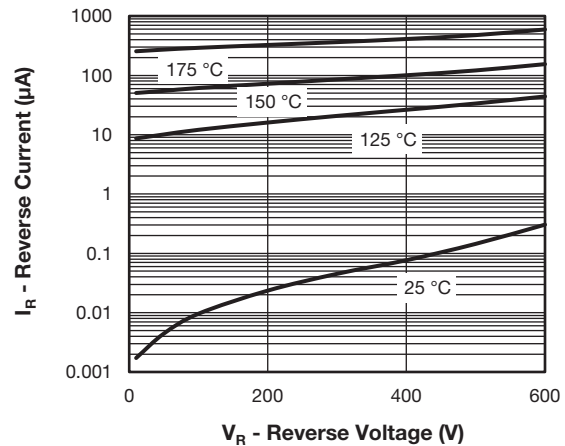


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

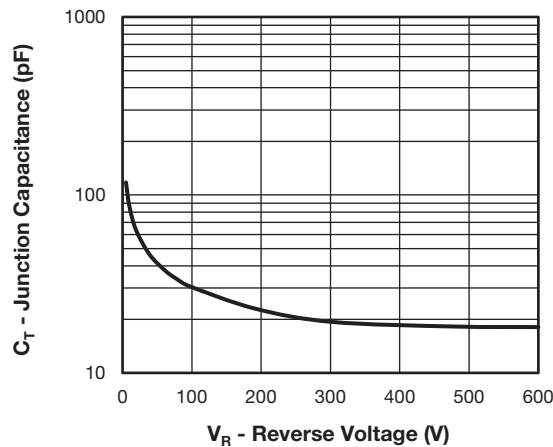


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

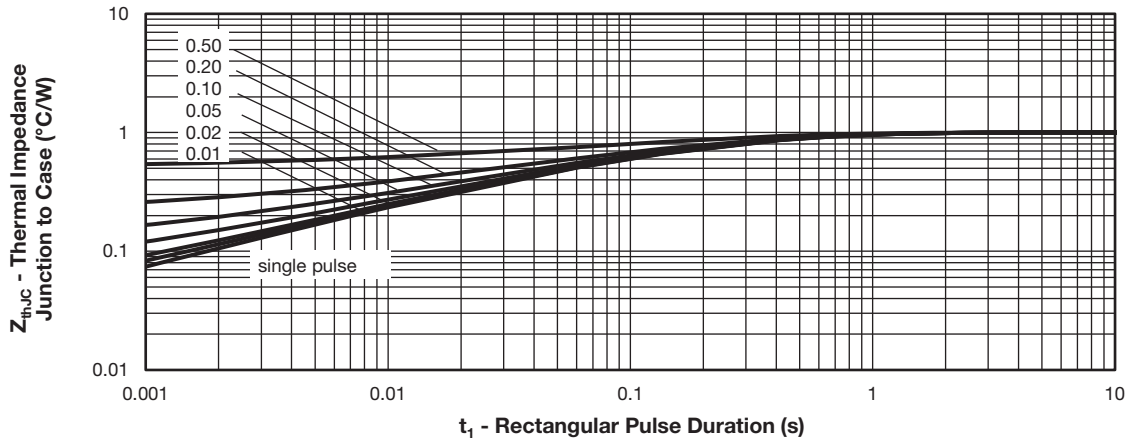


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

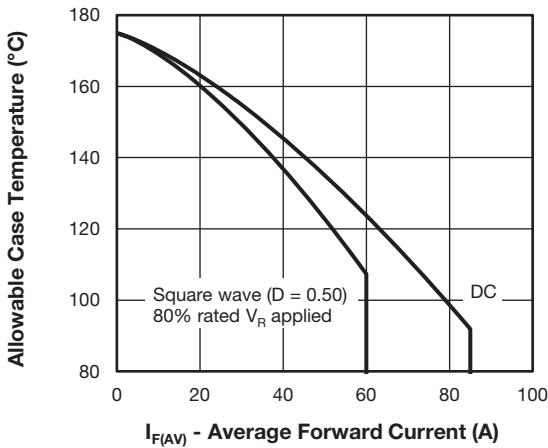


Fig. 5 - Max. Allowable Case Temperature vs. Average Forward Current

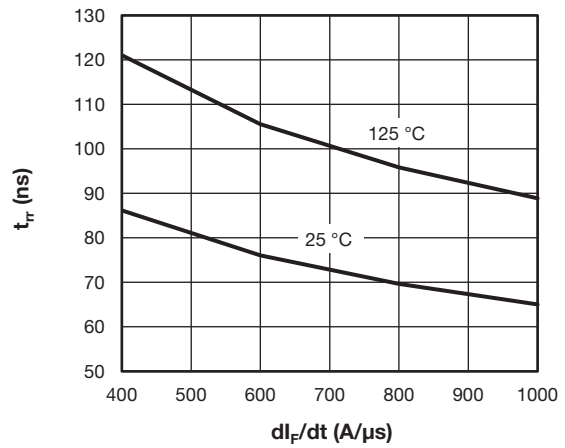


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

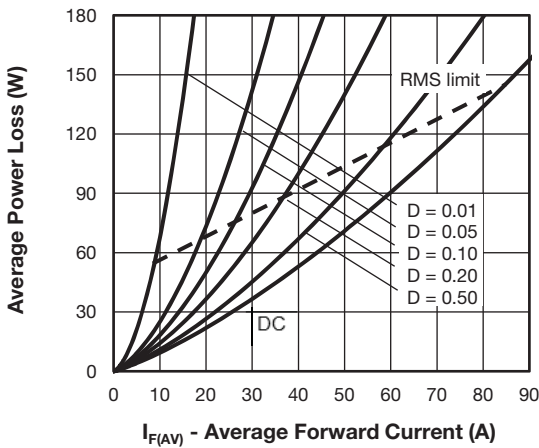


Fig. 6 - Forward Power Loss Characteristics

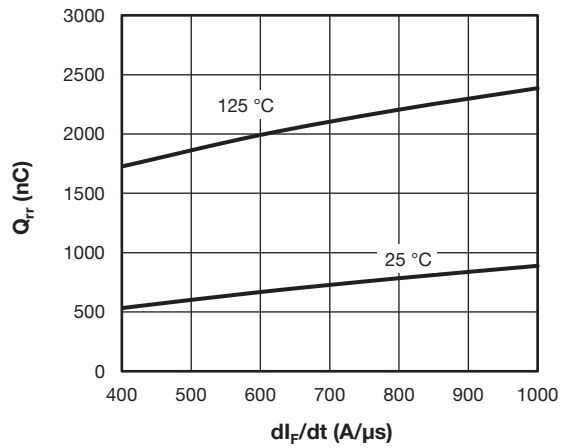


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see Fig.5)  
 $P_{dREV}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_R$  = rated  $V_R$

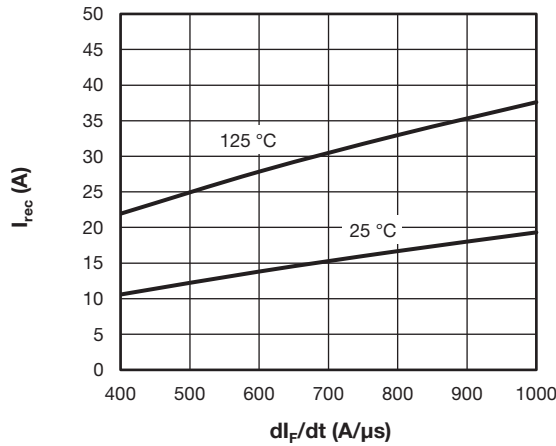


Fig. 9 - Typical Reverse Recovery vs. diF/dt

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>E</b>	<b>4</b>	<b>P</b>	<b>H</b>	<b>60</b>	<b>06</b>	<b>L</b>	<b>H</b>	<b>N3</b>
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

- 1** - Vishay Semiconductors product
- 2** - Circuit configuration:  
E = single diode 2 pins
- 3** - FRED Gen 4
- 4** - P = TO-247 package
- 5** - Process type:  
H = Hyperfast recovery
- 6** - Current rating (60 = 60 A)
- 7** - Voltage rating (06 = 600 V)
- 8** - L = long lead
- 9** - H = AEC-Q101 qualified
- 10** - Environmental digit:  
N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

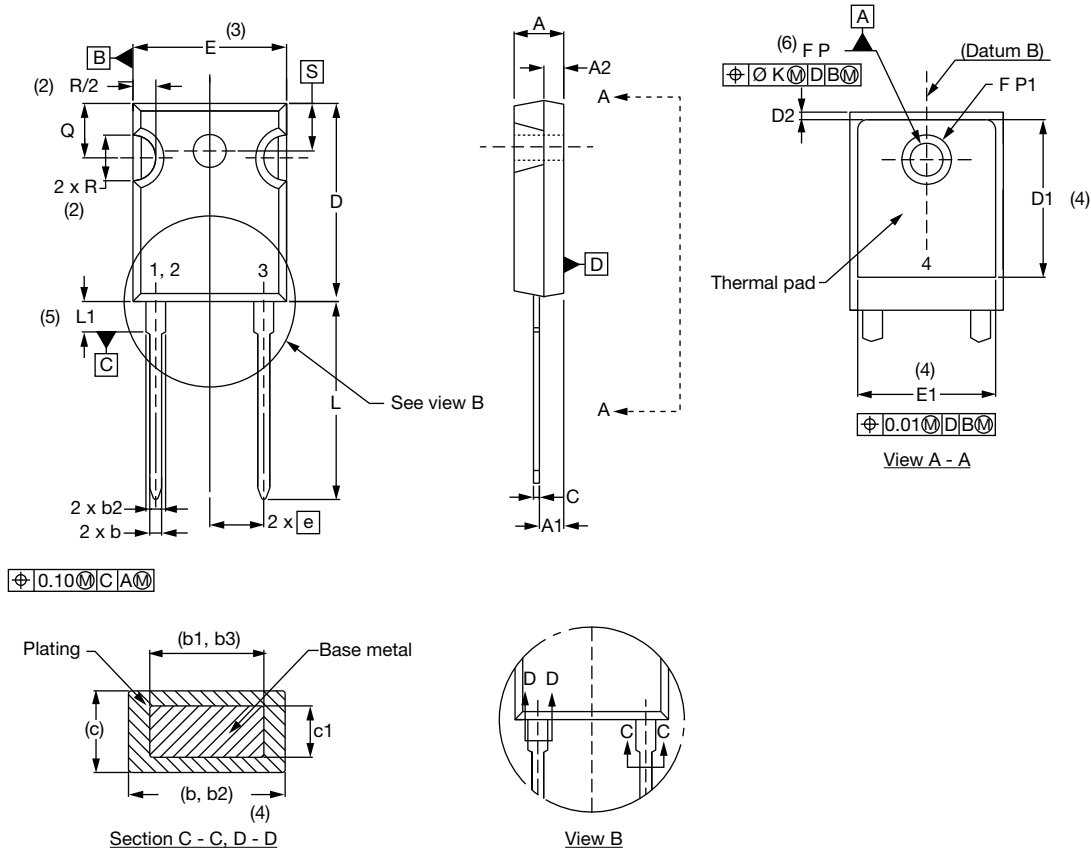
<b>ORDERING INFORMATION (Example)</b>			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-E4PH6006LHN3	25	500	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>		
Dimensions	TO-247AD 2L	<a href="http://www.vishay.com/doc?95536">www.vishay.com/doc?95536</a>
Part marking information	TO-247AD 2L	<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	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209		E	15.29	15.87	0.602	0.625	3
A1	2.21	2.59	0.087	0.102		E1	13.46	-	0.53	-	
A2	1.50	2.49	0.059	0.098		e	5.46 BSC		0.215 BSC		
b	0.99	1.40	0.039	0.055		Ø K	0.254		0.010		
b1	0.99	1.35	0.039	0.053		L	19.81	20.32	0.780	0.800	
b2	1.65	2.39	0.065	0.094		L1	3.71	4.29	0.146	0.169	
b3	1.65	2.34	0.065	0.092		Ø P	3.56	3.66	0.14	0.144	
c	0.38	0.89	0.015	0.035		Ø P1	-	6.98	-	0.275	
c1	0.38	0.84	0.015	0.033		Q	5.31	5.69	0.209	0.224	
D	19.71	20.70	0.776	0.815	3	R	4.52	5.49	0.178	0.216	
D1	13.08	-	0.515	-	4	S	5.51 BSC		0.217 BSC		
D2	0.51	1.35	0.020	0.053							

**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) Ø 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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