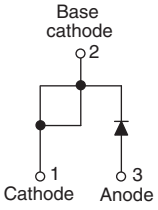
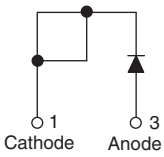
Ultrafast Rectifier, 15 A FRED Pt®

TO-220AC

TO-220 FULL-PAK



VS-15ETH06PbF



VS-15ETH06FPPbF

FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- Single die center tap module
- Fully isolated package (V_{INS} = 2500 V_{RMS})
- UL E78996 pending
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified for industrial level

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION/APPLICATIONS

State of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop, hyperfast recovery time, and soft recovery.
The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.
These devices are intended for use in PFC boost stage in the AC/DC section of SMPS, inverters or as freewheeling diodes.
Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

PRODUCT SUMMARY	
Package	TO-220AC, TO-220FP
$I_{F(AV)}$	15 A
V_R	600 V
V_F at I_F	2.2 V
t_{rr} typ.	22 ns
T_J max.	175 °C
Diode variation	Single die

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	V_{RRM}		600	V
Average rectified forward current	$I_{F(AV)}$	T_C = 140 °C	15	A
		T_C = 80 °C (FULL-PAK)		
Non-repetitive peak surge current	I_{FSM}	T_J = 25 °C	120	
		T_J = 25 °C (FULL-PAK)	180	
Peak repetitive forward current	I_{FM}		30	
Operating junction and storage temperatures	T_J, T_{Stg}		- 65 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 µA	600	-	-	V
Forward voltage	V_F	I_F = 15 A	-	1.8	2.2	
		I_F = 15 A, T_J = 150 °C	-	1.3	1.6	
Reverse leakage current	I_R	V_R = V_R rated	-	0.2	50	µA
		T_J = 150 °C, V_R = V_R rated	-	30	500	
Junction capacitance	C_T	V_R = 600 V	-	20	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8.0	-	nH

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

DYNAMIC RECOVERY CHARACTERISTICS (T_C = 25 °C unless otherwise specified)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNITS**
Reverse recovery time	t_{rr}	I_F = 1 A, dI_F/dt = 100 A/µs, V_R = 30 V		-	22	30	ns
		I_F = 15 A, dI_F/dt = 100 A/µs, V_R = 30 V		-	28	35	
		T_J = 25 °C	I_F = 15 A dI_F/dt = 200 A/µs V_R = 390 V	-	29	-	
		T_J = 125 °C		-	75	-	
Peak recovery current	I_{RRM}	T_J = 25 °C		-	3.5	-	A
		T_J = 125 °C		-	7	-	
Reverse recovery charge	Q_{rr}	T_J = 25 °C		-	57	-	nC
		T_J = 125 °C		-	300	-	
Reverse recovery time	t_{rr}	T_J = 125 °C	I_F = 15 A dI_F/dt = 800 A/µs V_R = 390 V	-	51	-	ns
Peak recovery current	I_{RRM}			-	20	-	A
Reverse recovery charge	Q_{rr}			-	580	-	nC

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Maximum junction and storage temperature range	T_J, T_{Stg}		- 65	-	175	°C
Thermal resistance, junction to case	R_{thJC}		-	1.0	1.3	°C/W
(FULL-PAK)			-	3.0	3.5	
Thermal resistance, junction to ambient per leg	R_{thJA}	Typical socket mount	-	-	70	
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth and greased	-	0.5	-	
Weight			-	2.0	-	g
			-	0.07	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-220AC	15ETH06			
		Case style TO-220 FULL-PAK	15ETH06FP			

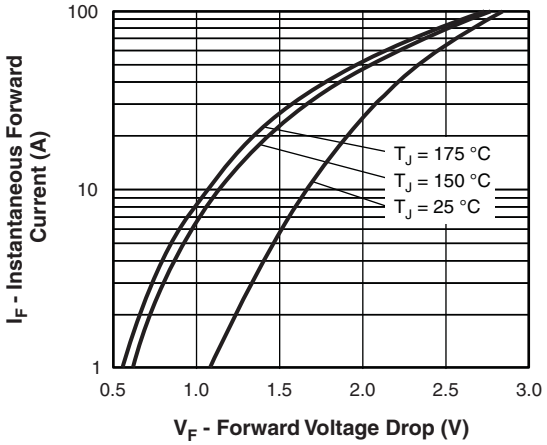


Fig. 1 - Typical Forward Voltage Drop Characteristics

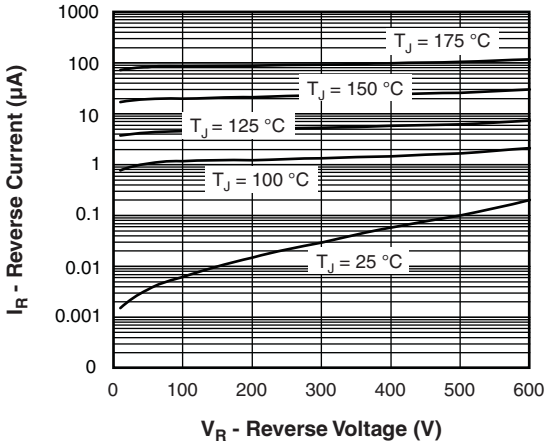


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

Document Number: 94002
Revision: 28-Apr-11

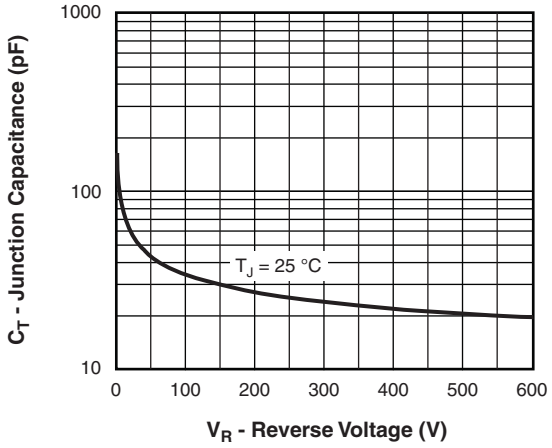


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

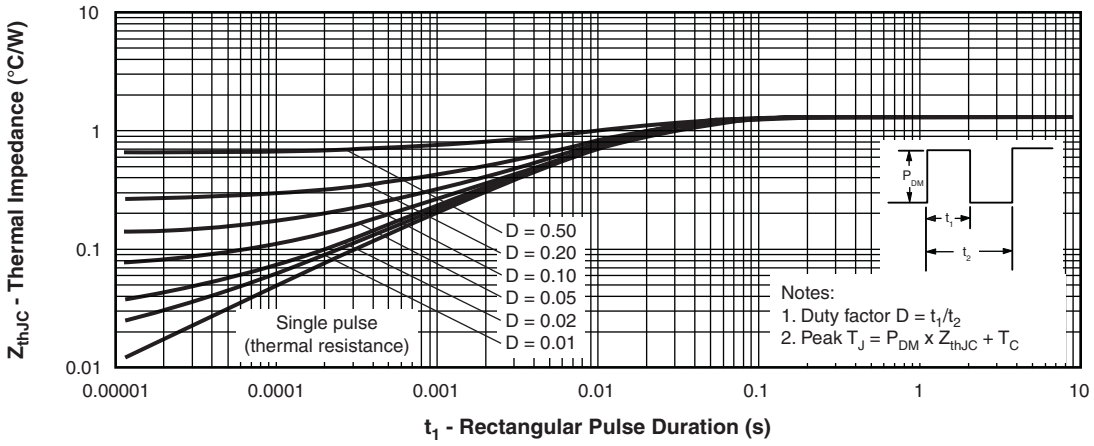


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

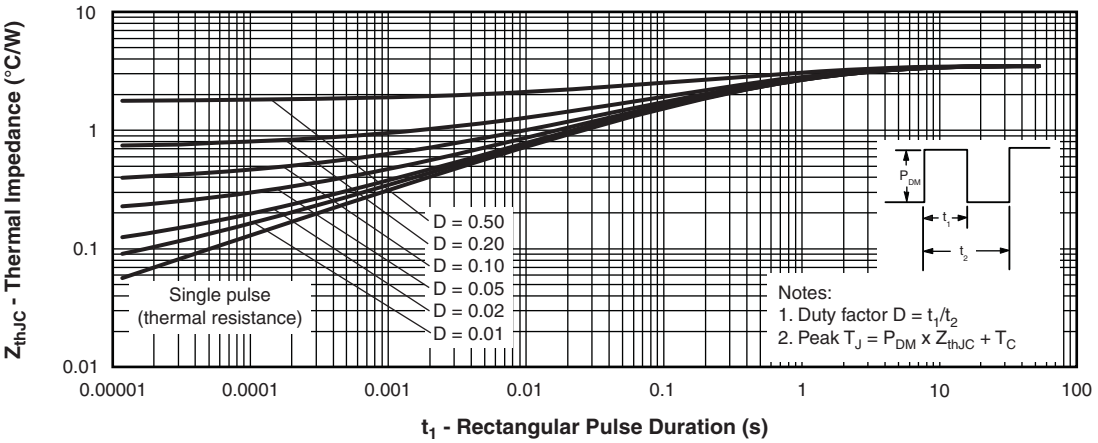


Fig. 5 - Maximum Thermal Impedance Z_{thJC} Characteristics (FULL-PAK)

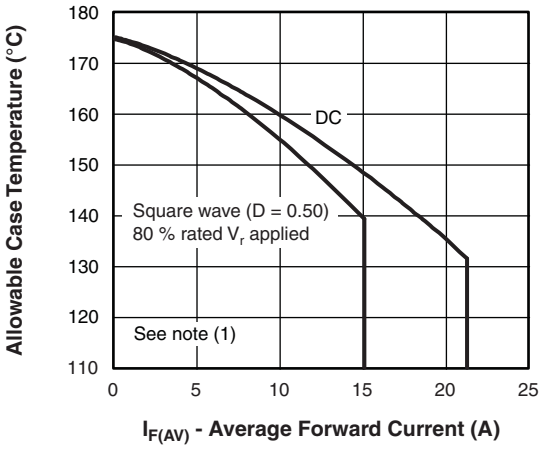


Fig. 6 - Maximum Allowable Case Temperature vs. Average Forward Current

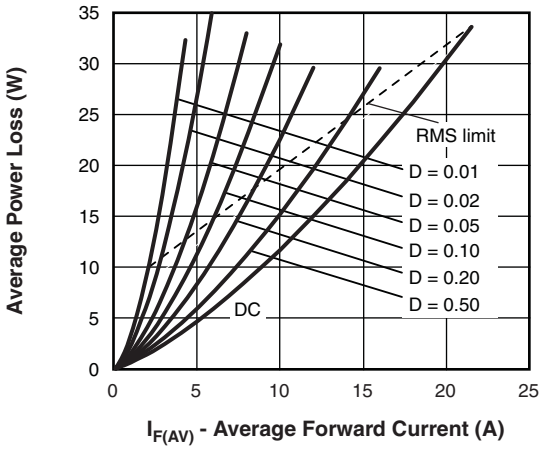


Fig. 8 - Forward Power Loss Characteristics

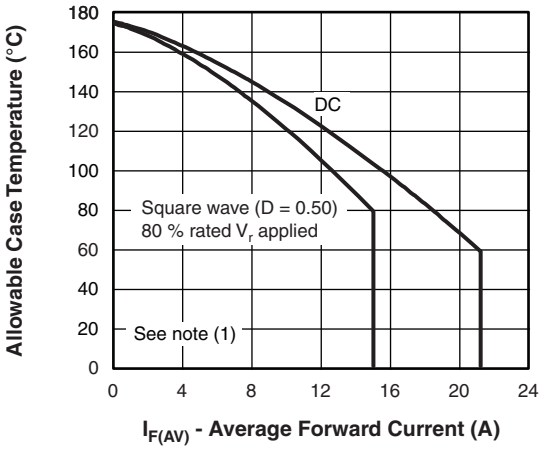


Fig. 7 - Maximum Allowable Case Temperature vs. Average Forward Current (FULL-PAK)

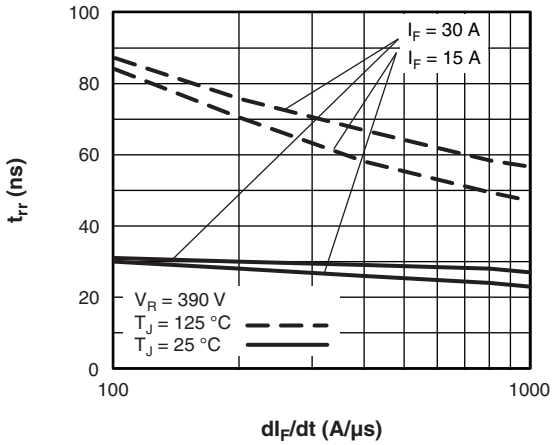


Fig. 9 - Typical Reverse Recovery Time vs. dI_F/dt

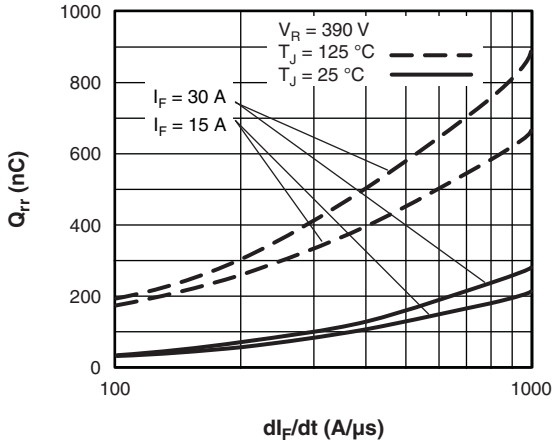


Fig. 10 - Typical Stored Charge vs. dI_F/dt

Note

(1) Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$;
Pd = Forward power loss = $I_{F(AV)} \times V_{FM}$ at ($I_{F(AV)}$/D) (see fig. 8);
Pd_{REV} = Inverse power loss = $V_{R1} \times I_R$ (1 - D); I_R at V_{R1} = Rated V_R

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

Document Number: 94002
Revision: 28-Apr-11

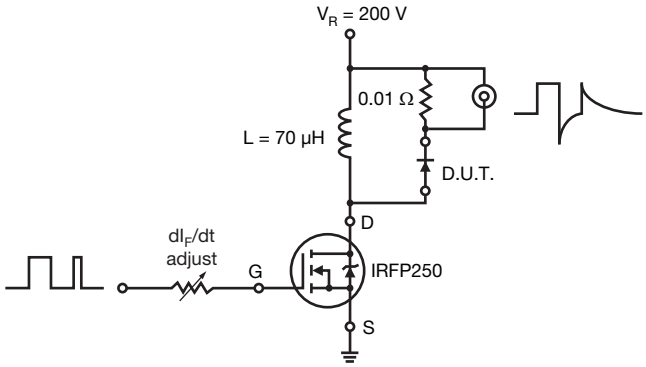
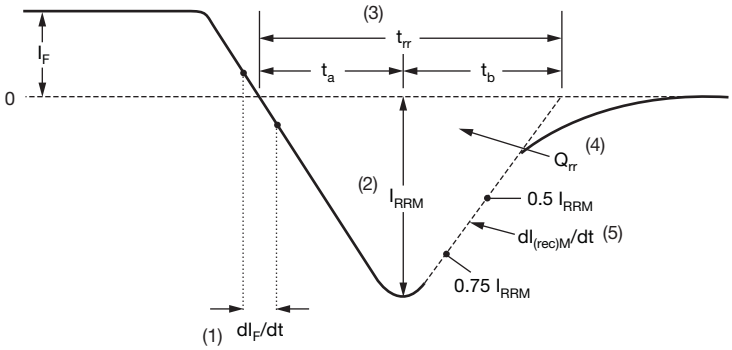


Fig. 11 - Reverse Recovery Parameter Test Circuit



(1) dI_F/dt - rate of change of current through zero crossing

(2) I_{RRM} - peak reverse recovery current

(3) t_{rr} - reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through 0.75 I_{RRM} and 0.50 I_{RRM} extrapolated to zero current.

(4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}

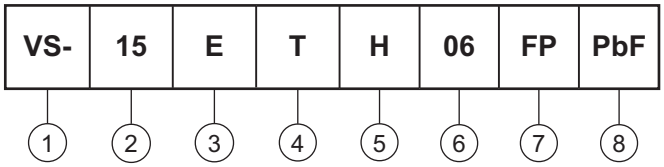
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5) $dI_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

Fig. 12 - Reverse Recovery Waveform and Definitions

ORDERING INFORMATION TABLE

Device code



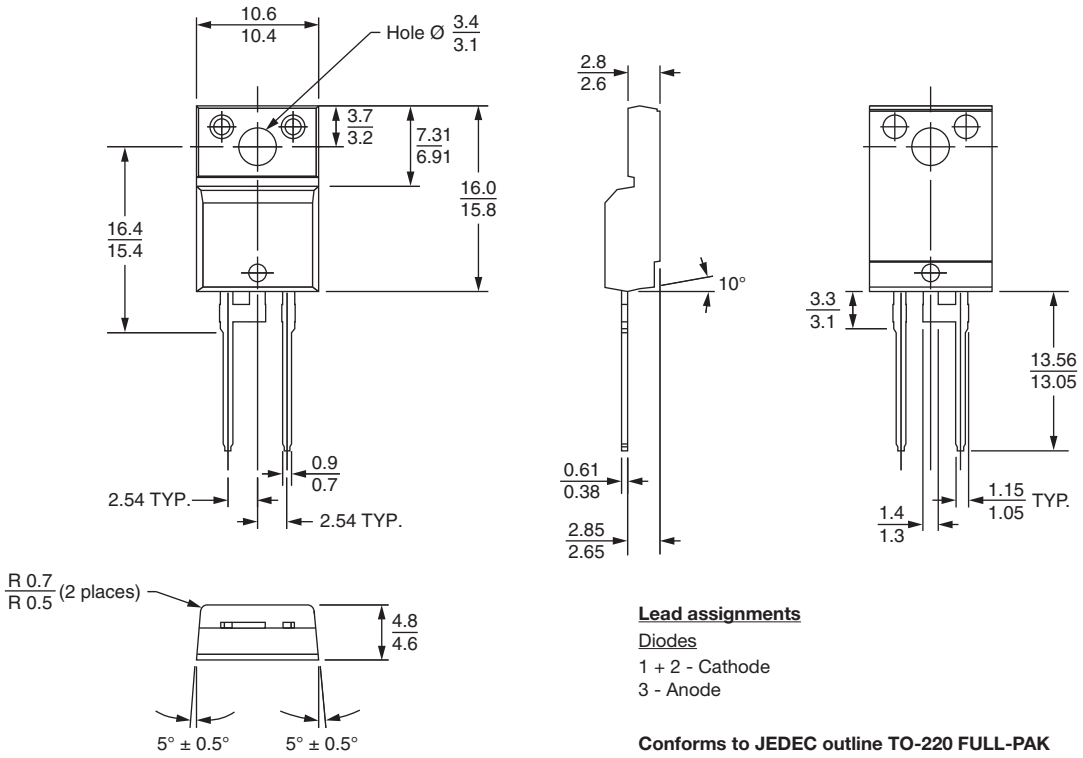
1	-	Vishay Semiconductors product
2	-	Current rating (15 = 15 A)
3	-	E = Single diode
4	-	T = TO-220, D^2PAK
5	-	H = Hyperfast recovery
6	-	Voltage rating (06 = 600 V)
7	-	• None = TO-220AC • FP = TO-220 FULL-PAK
8	-	PbF = Lead (Pb)-free

Tube standard pack quantity: 50 pieces

LINKS TO RELATED DOCUMENTS		
Dimensions	TO-220AC	www.vishay.com/doc?95221
	TO-220AC FULL-PAK	www.vishay.com/doc?95005
Part marking information	TO-220AC	www.vishay.com/doc?95224
	TO-220AC FULL-PAK	www.vishay.com/doc?95009

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 94002
Revision: 28-Apr-11

DIMENSIONS in millimeters



Lead assignments

Diodes

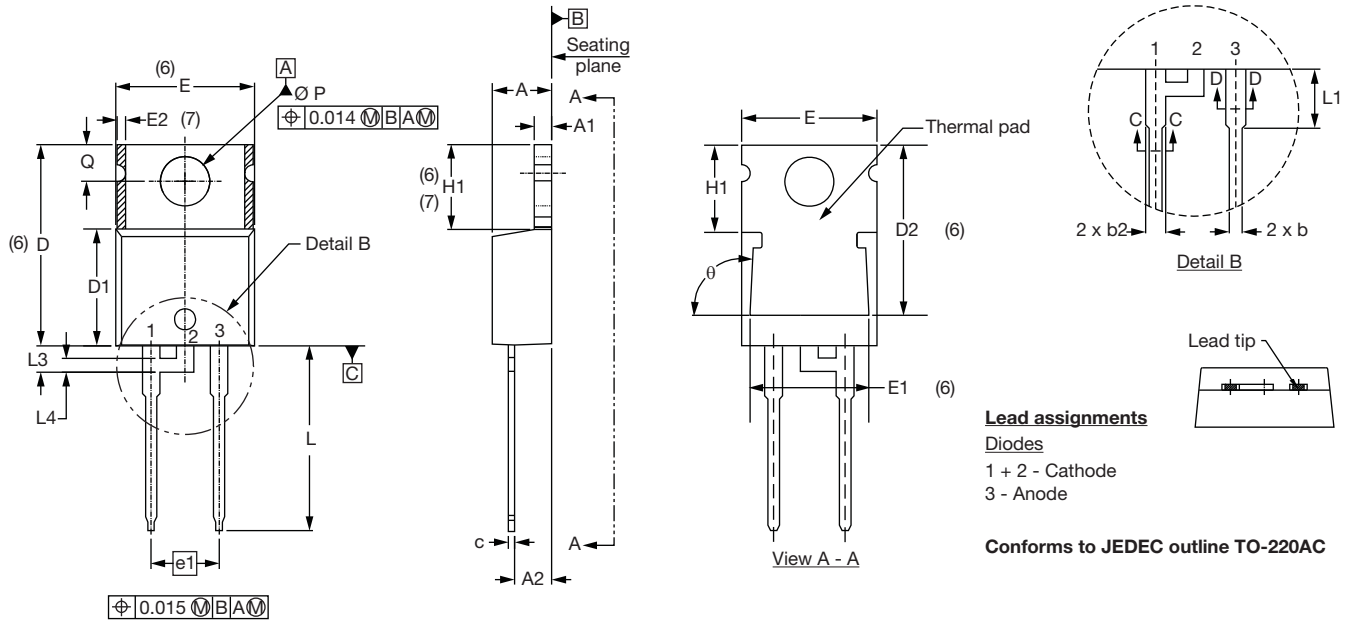
1 + 2 - Cathode

3 - Anode

Conforms to JEDEC outline TO-220 FULL-PAK

TO-220AC

DIMENSIONS in millimeters and inches



Lead assignments

Diodes

1 + 2 - Cathode

3 - Anode

Conforms to JEDEC outline TO-220AC

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
e	2.41	2.67	0.095	0.105	
e1	4.88	5.28	0.192	0.208	
H1	6.09	6.48	0.240	0.255	6, 7
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
L3	1.78	2.13	0.070	0.084	
L4	0.76	1.27	0.030	0.050	2
Ø P	3.54	3.73	0.139	0.147	
Q	2.60	3.00	0.102	0.118	
θ	90° to 93°		90° to 93°		

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, D2 (minimum) where dimensions are derived from the actual package outline

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.