

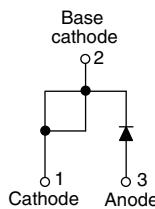
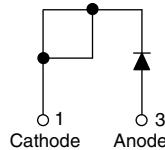
Hyperfast Rectifier, 15 A FRED Pt®



TO-220AC



TO-220 FULL-PAK


VS-15ETX06PbF
VS-15ETX06-N3

VS-15ETX06FPPbF
VS-15ETX06FP-N3

FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Benchmark ultralow forward voltage drop
- Low leakage current
- Fully isolated package ($V_{INS} = 2500 \text{ V}_{RMS}$)
- UL E78996 pending
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified according to JEDEC-JESD47
- Halogen-free according to IEC 61249-2-21 definition (-N3 only)



RoHS
COMPLIANT
HALOGEN
FREE
Available

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	3.2 V
t_{rr} typ.	18 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	$I_{F(AV)}$	$T_C = 133 \text{ }^\circ\text{C}$	15	
		$T_C = 62 \text{ }^\circ\text{C}$ (FULL-PAK)		
Non-repetitive peak surge current	I_{FSM}	$T_J = 25 \text{ }^\circ\text{C}$	170	A
Peak repetitive forward current	I_{FM}		30	
Operating junction and storage temperatures	T_J, T_{Stg}		- 65 to 175	°C

ELECTRICAL SPECIFICATIONS ($T_J = 25 \text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	V_{BR}, V_R	$I_R = 100 \mu\text{A}$	600	-	-	V
		$I_F = 15 \text{ A}$	-	2.3	3.2	
Forward voltage	V_F	$I_F = 15 \text{ A}, T_J = 150 \text{ }^\circ\text{C}$	-	1.5	1.8	
		$V_R = V_R$ rated	-	0.1	50	
Reverse leakage current	I_R	$T_J = 150 \text{ }^\circ\text{C}, V_R = V_R$ rated	-	40	300	μA
		$V_R = 600 \text{ V}$	-	20	-	
Junction capacitance	C_J	Measured lead to lead 5 mm from package body	-	8.0	-	pF
Series inductance	L_S		-			nH

DYNAMIC RECOVERY CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	$I_F = 1 \text{ A}$, $dI_F/dt = 100 \text{ A}/\mu\text{s}$, $V_R = 30 \text{ V}$		-	18	22	ns
		$I_F = 15 \text{ A}$, $dI_F/dt = 100 \text{ A}/\mu\text{s}$, $V_R = 30 \text{ V}$		-	20	32	
		$T_J = 25^\circ\text{C}$		-	22	-	
		$T_J = 125^\circ\text{C}$		-	52	-	
Peak recovery current	I_{RRM}	$T_J = 25^\circ\text{C}$		-	2.4	-	A
		$T_J = 125^\circ\text{C}$		-	5.1	-	
Reverse recovery charge	Q_{rr}	$T_J = 25^\circ\text{C}$		-	25	-	C
		$T_J = 125^\circ\text{C}$		-	150	-	
Reverse recovery time	t_{rr}	$T_J = 125^\circ\text{C}$	$I_F = 15 \text{ A}$, $dI_F/dt = 200 \text{ A}/\mu\text{s}$, $V_R = 390 \text{ V}$	-	37	-	ns
Peak recovery current	I_{RRM}		-	16	-	A	
Reverse recovery charge	Q_{rr}		-	350	-	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 (FULL-PAK)	R_{thJC}			-	1.0	1.3	°C/W
				-	3.0	3.5	
Thermal resistance, junction to ambient per leg	R_{thJA}	Typical socket mount		-	-	70	°C/W
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		15ETX06			
		Case style TO-220 FULL-PAK		15ETX06FP			

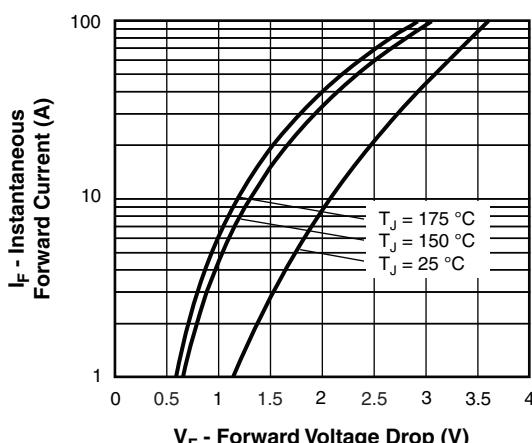


Fig. 1 - Typical Forward Voltage Drop Characteristics

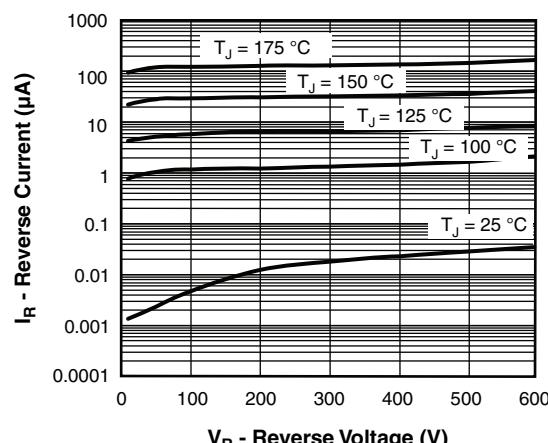


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

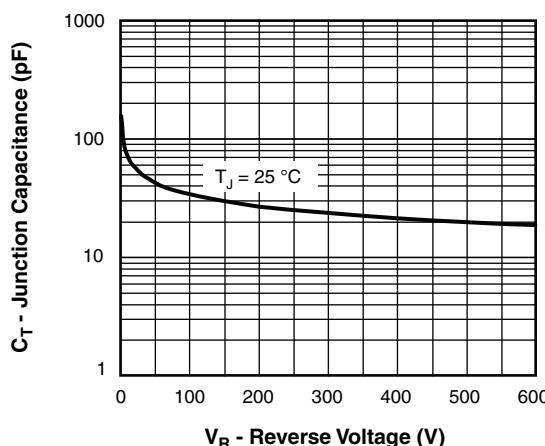


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

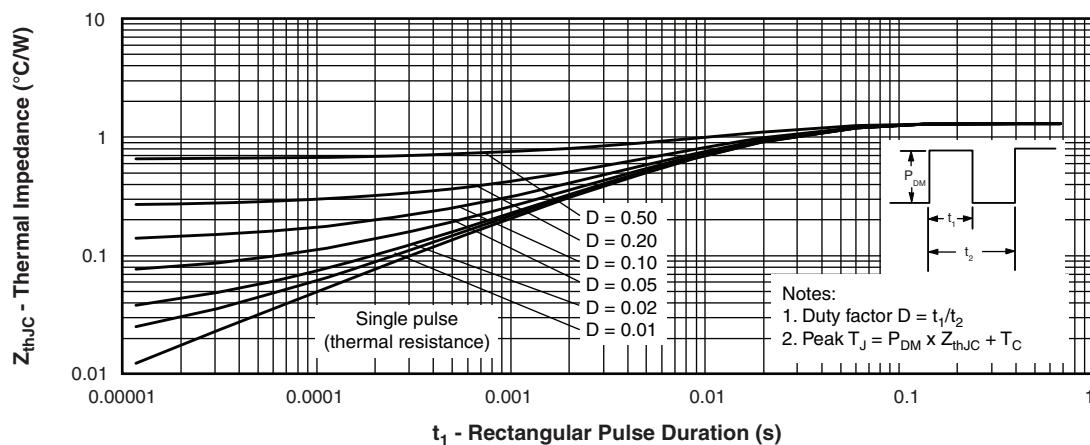


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

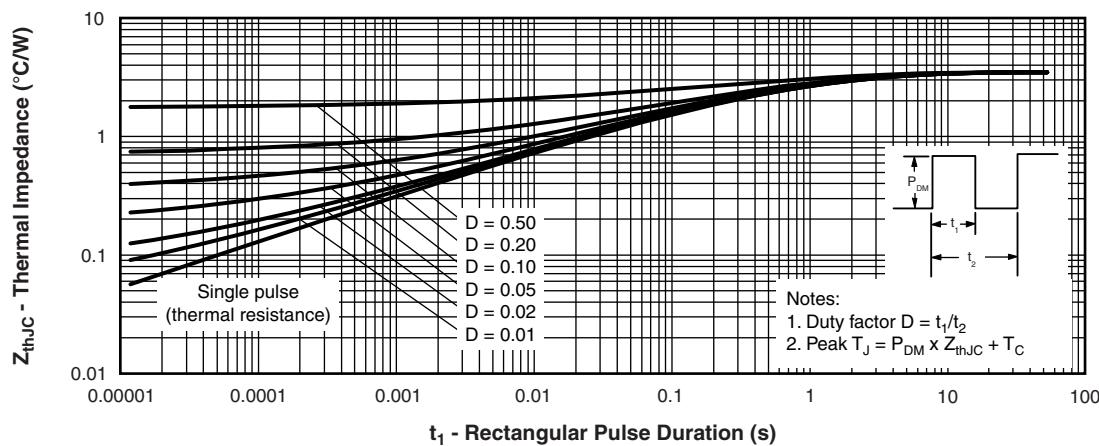


Fig. 5 - Maximum Thermal Impedance Z_{thJC} Characteristics (FULL-PAK)

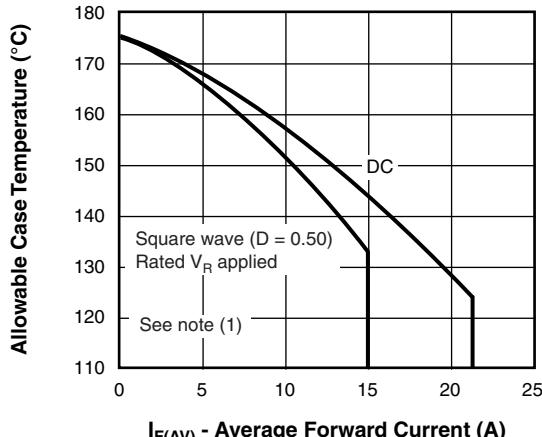


Fig. 6 - Maximum Allowable Case Temperature vs.
Average Forward Current

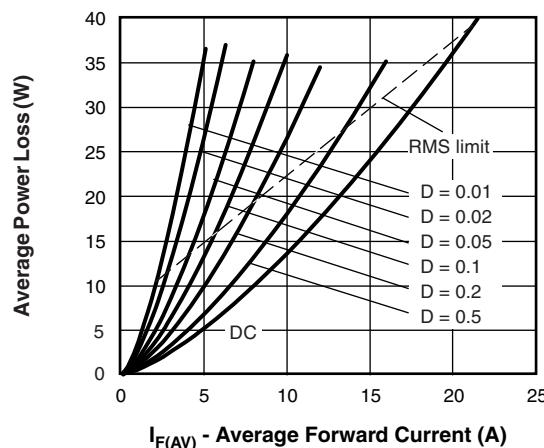


Fig. 8 - Forward Power Loss Characteristics

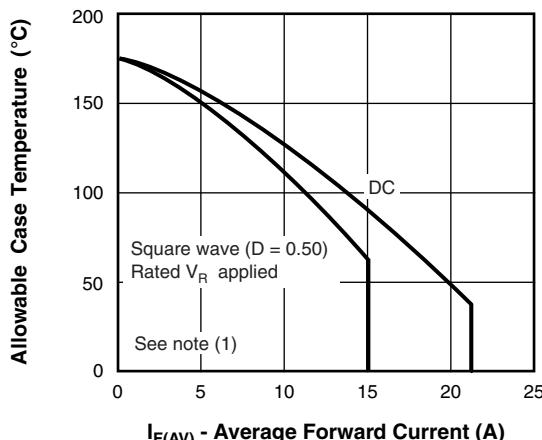


Fig. 7 - Maximum Allowable Case Temperature vs.
Average Forward Current (FULL-PAK)

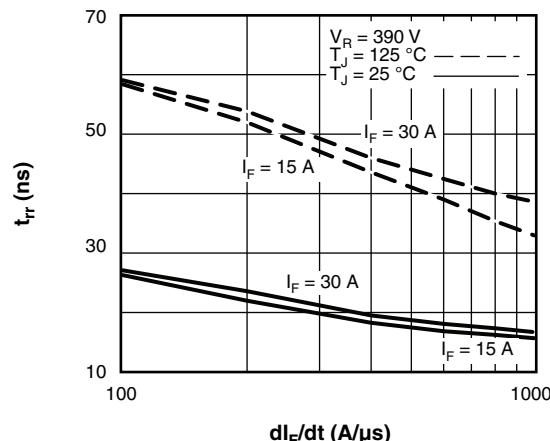


Fig. 9 - Typical Reverse Recovery Time vs. dI_F/dt

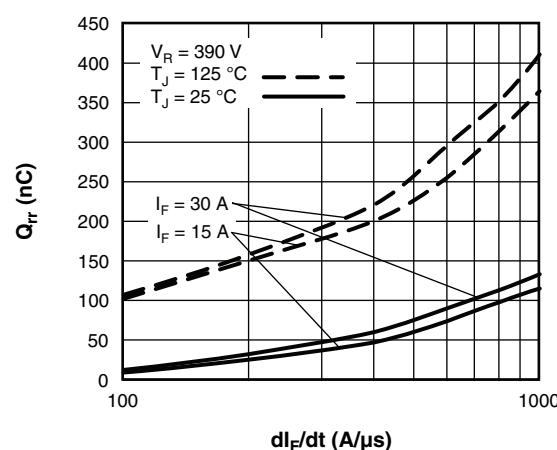


Fig. 10 - Typical Stored Charge vs. dI_F/dt

Note

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

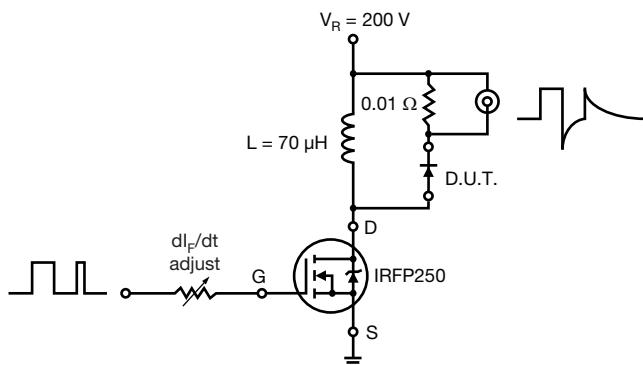


Fig. 11 - Reverse Recovery Parameter Test Circuit

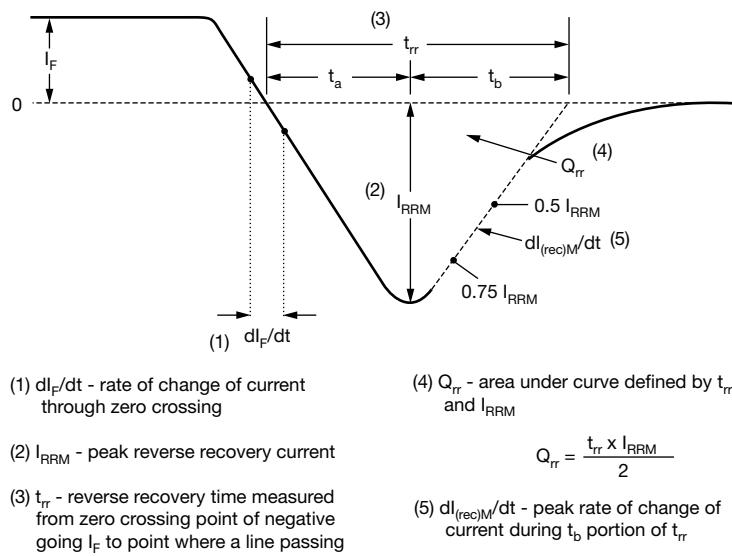


Fig. 12 - Reverse Recovery Waveform and Definitions

ORDERING INFORMATION TABLE

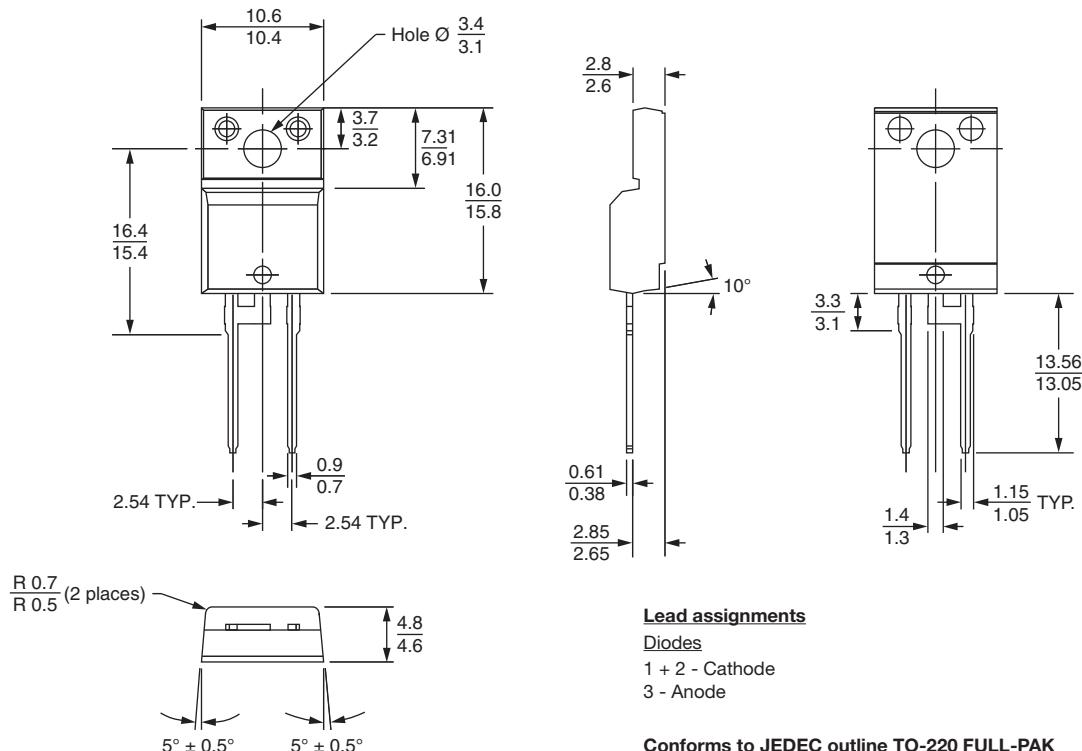
Device code	VS-	15	E	T	X	06	FP	PbF
	1	2	3	4	5	6	7	8

- 1** - Vishay Semiconductors product
- 2** - Current rating (15 = 15 A)
- 3** - E = Single diode
- 4** - T = TO-220, D²PAK
- 5** - X = Hyperfast recovery
- 6** - Voltage rating (06 = 600 V)
- 7** - • None = TO-220AC
 - FP = TO-220 FULL-PAK
- 8** - Environmental digit:
 - PbF = Lead (Pb)-free and RoHS compliant
 - N3 = Halogen-free, RoHS compliant and totally lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-15ETX06PbF	50	1000	Antistatic plastic tube
VS-15ETX06-N3	50	1000	Antistatic plastic tube
VS-15ETX06FPPbF	50	1000	Antistatic plastic tube
VS-15ETX06FP-N3	50	1000	Antistatic plastic tube

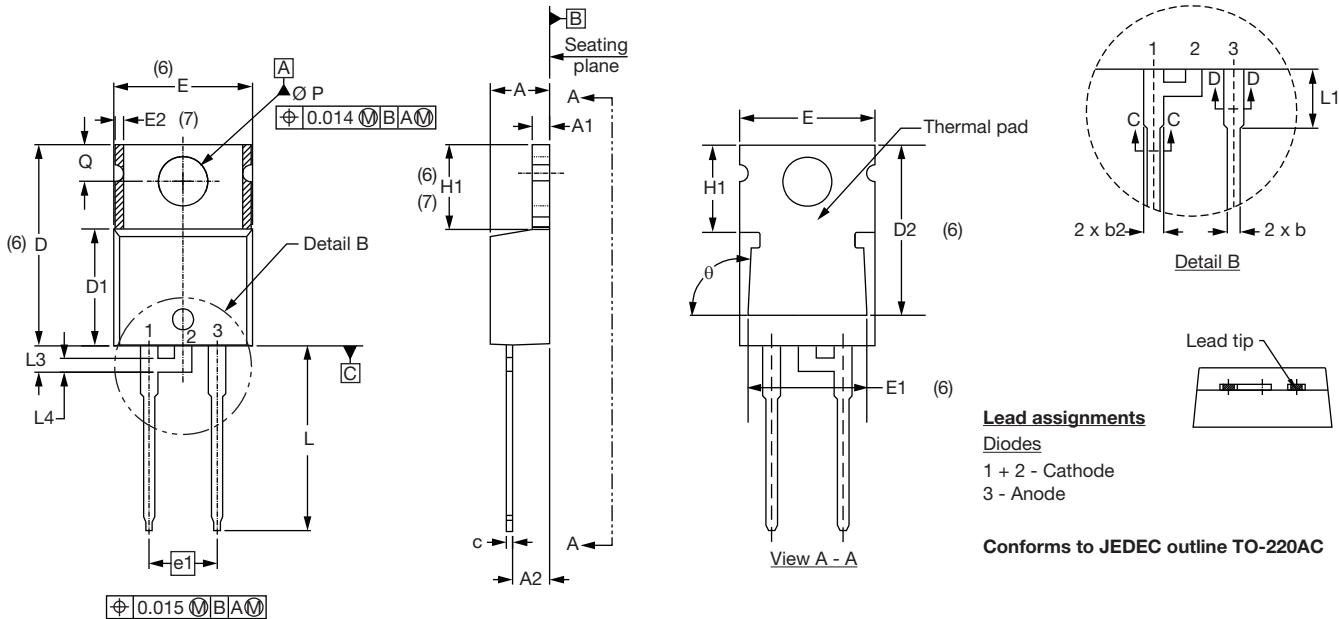
LINKS TO RELATED DOCUMENTS			
Dimensions	TO-220AC	www.vishay.com/doc?95221	
	TO-220FP	www.vishay.com/doc?95005	
Part marking information	TO-220ACPbF	www.vishay.com/doc?95224	
	TO-220AC-N3	www.vishay.com/doc?95068	
	TO-220AFPPbF	www.vishay.com/doc?95009	
	TO-220FP-N3	www.vishay.com/doc?95440	

DIMENSIONS in millimeters



TO-220AC

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
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

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