

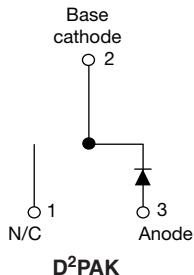
Ultrafast Rectifier, 15 A FRED Pt®



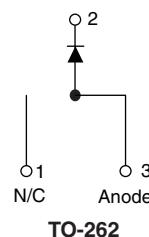
VS-ETL1506S-M3



VS-ETL1506-1-M3



D²PAK



TO-262

FEATURES

- State of the art low forward voltage drop
- Ultrafast recovery time
- 175 °C operating junction temperature
- Low leakage current
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition
- Designed and qualified according to JEDEC-JESD47



RoHS
COMPLIANT
HALOGEN
FREE

DESCRIPTION/APPLICATIONS

State of the art, ultralow V_F , soft-switching ultrafast rectifiers optimized for Discontinuous (Critical) Mode (DCM) Power Factor Correction (PFC).

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.

The device is also intended for use as a freewheeling diode in power supplies and other power switching applications.

APPLICATIONS

AC/DC SMPS 70 W to 400 W

e.g. laptop and printer AC adaptors, desktop PC, TV and monitor, games units, and DVD AC/DC power supplies.

PRODUCT SUMMARY

Package	TO-263AB (D ² PAK), TO-262AA
$I_F(AV)$	15 A
V_R	600 V
V_F at I_F	1.07 V
t_{rr} (typ.)	60 ns
T_J max.	175 °C
Diode variation	Single die

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Repetitive peak reverse voltage	V_{RRM}		600	V
Average rectified forward current	$I_F(AV)$	$T_C = 152$ °C	15	A
Non-repetitive peak surge current	I_{FSM}	$T_C = 25$ °C	200	
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	-	0.99	1.07	
		$I_F = 15$ A, $T_J = 150$ °C	-	0.85	0.91	
Reverse leakage current	I_R	$V_R = V_R$ rated	-	0.01	15	µA
		$T_J = 150$ °C, $V_R = V_R$ rated	-	6	100	
Junction capacitance	C_T	$V_R = 600$ V	-	12	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8.0	-	nH

VS-ETL1506S-M3, VS-ETL1506-1-M3

Vishay Semiconductors Ultrafast Rectifier, 15 A FRED Pt®

DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	$I_F = 1 \text{ A}, dI_F/dt = 100 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}$	-	60	110	ns
		$I_F = 15 \text{ A}, dI_F/dt = 100 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}$	-	185	270	
		$T_J = 25^\circ\text{C}$	-	210	-	
		$T_J = 125^\circ\text{C}$	-	290	-	
Peak recovery current	I_{RRM}	$T_J = 25^\circ\text{C}$	-	20	-	A
		$T_J = 125^\circ\text{C}$	-	26	-	
Reverse recovery charge	Q_{rr}	$T_J = 25^\circ\text{C}$	-	2.2	-	μC
		$T_J = 125^\circ\text{C}$	-	4.0	-	

THERMAL - MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}		-65	-	175	$^\circ\text{C}$
Thermal resistance, junction to case	R_{thJC}		-	1.3	1.51	$^\circ\text{C}/\text{W}$
Thermal resistance, junction to ambient	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 (5)	-	12 (10)	$\text{kgf} \cdot \text{cm}$ ($\text{lbf} \cdot \text{in}$)
Marking device		Case style D ² PAK modified	ETL1506S			
		Case style TO-262	ETL1506-1			

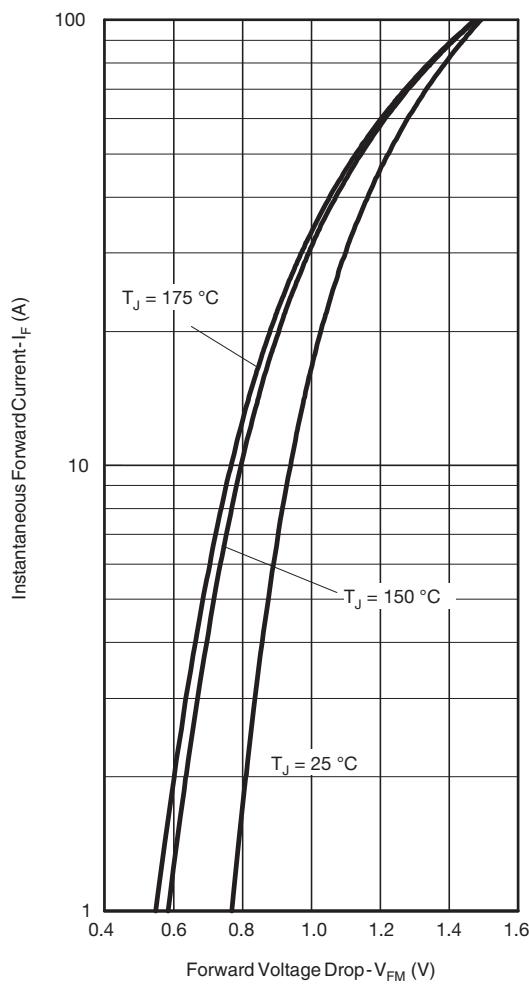


Fig. 1 - Typical Forward Voltage Drop Characteristics

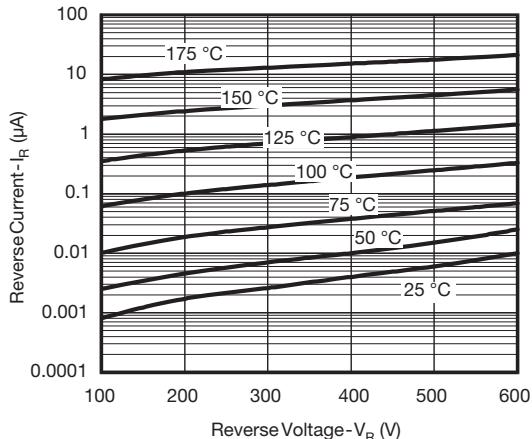


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

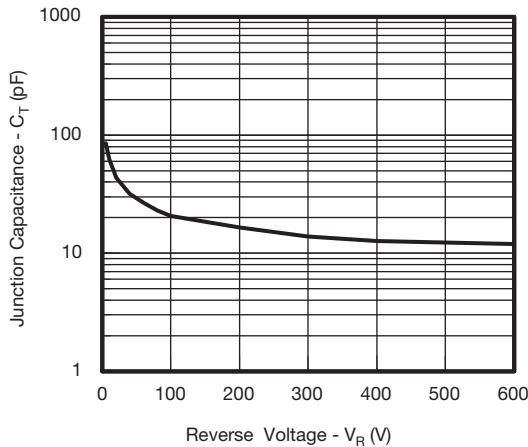


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

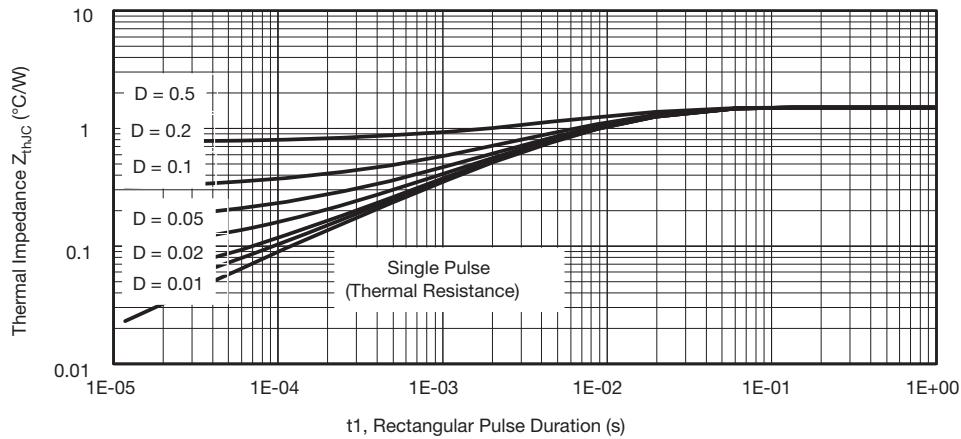


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics

VS-ETL1506S-M3, VS-ETL1506-1-M3

Vishay Semiconductors Ultrafast Rectifier, 15 A FRED Pt®

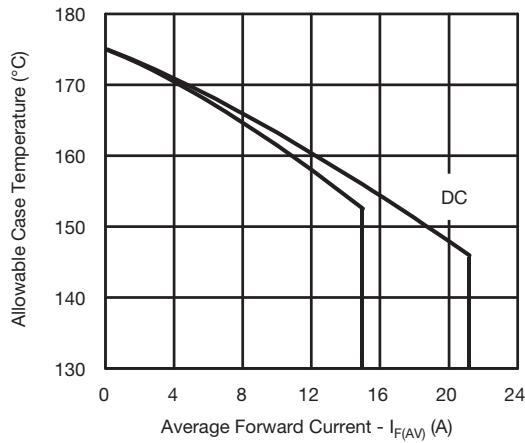


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

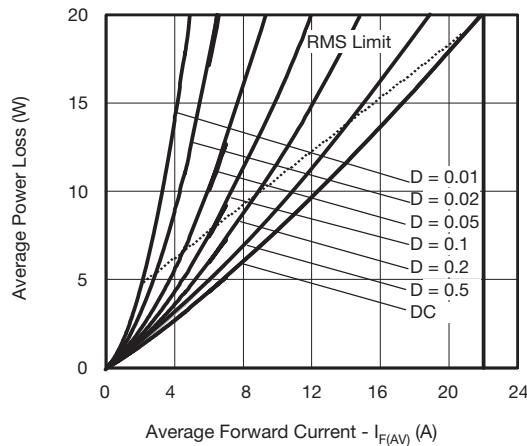
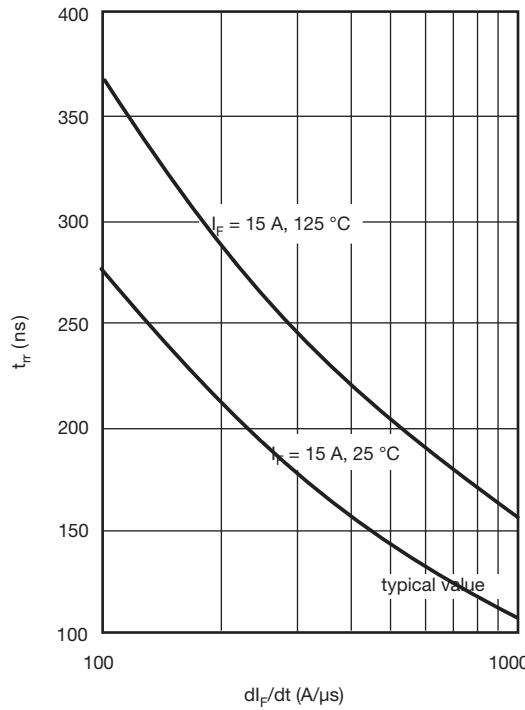
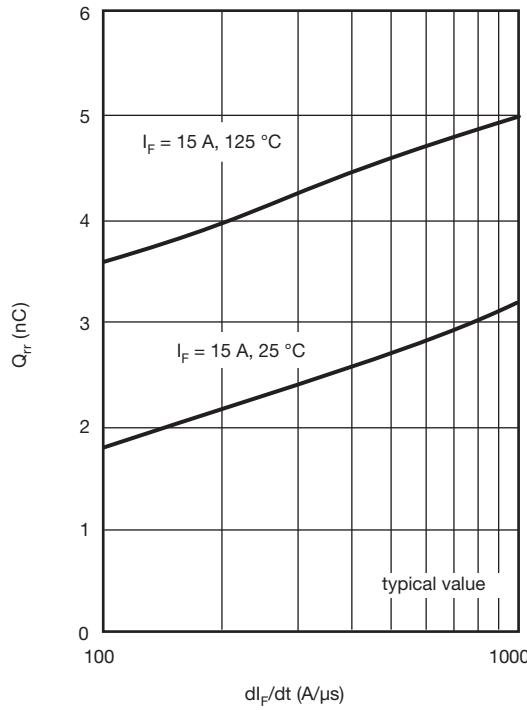


Fig. 6 - Forward Power Loss Characteristics

Fig. 7 - Typical Reverse Recovery Time vs. dI_F/dt Fig. 8 - Typical Stored Charge vs. dI_F/dt

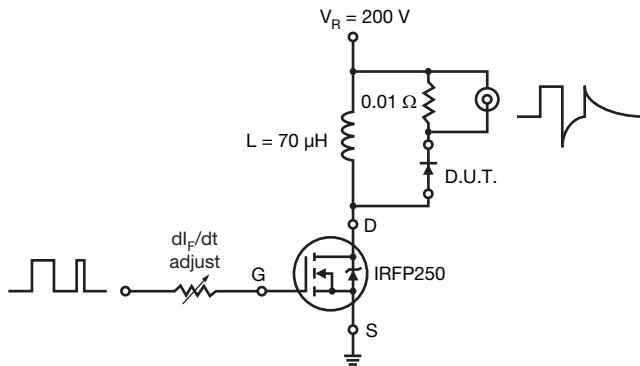
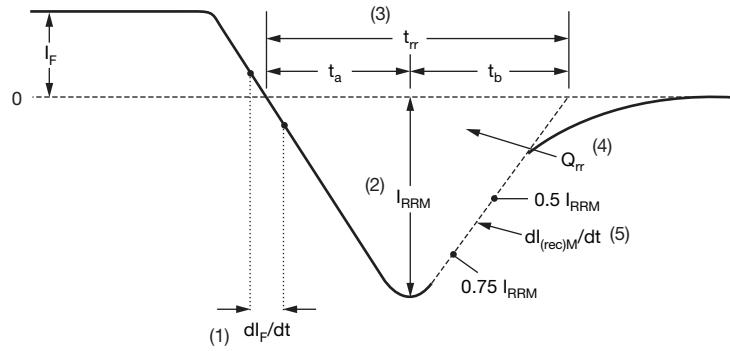


Fig. 9 - Reverse Recovery Parameter Test Circuit



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

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

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

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

(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.

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

Fig. 10 - Reverse Recovery Waveform and Definitions

VS-ETL1506S-M3, VS-ETL1506-1-M3

Vishay Semiconductors Ultrafast Rectifier, 15 A FRED Pt®

**ORDERING INFORMATION TABLE**

Device code	VS-	E	T	L	15	06	S	TRL	-M3
	1	2	3	4	5	6	7	8	9

1	- Vishay Semiconductors product
2	- Circuit configuration E = Single diode
3	- T = TO-220
4	- L = Ultrafast recovery time
5	- Current code (15 = 15 A)
6	- Voltage code (06 = 600 V)
7	<ul style="list-style-type: none"> - S = D²PAK - -1 = TO-262
8	<ul style="list-style-type: none"> - None = Tube (50 pieces) - TRL = Tape and reel (left oriented, for D²PAK package) - TRR = Tape and reel (right oriented, for D²PAK package)
9	- M3 = Halogen-free, RoHS compliant, and terminations lead (Pb)-free

ORDERING INFORMATION (Example)

PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-ETL1506S-M3	50	1000	Antistatic plastic tube
VS-ETL1506-1-M3	50	1000	Antistatic plastic tube
VS-ETL1506STRR-M3	800	800	13" diameter reel
VS-ETL1506STRL-M3	800	800	13" diameter reel

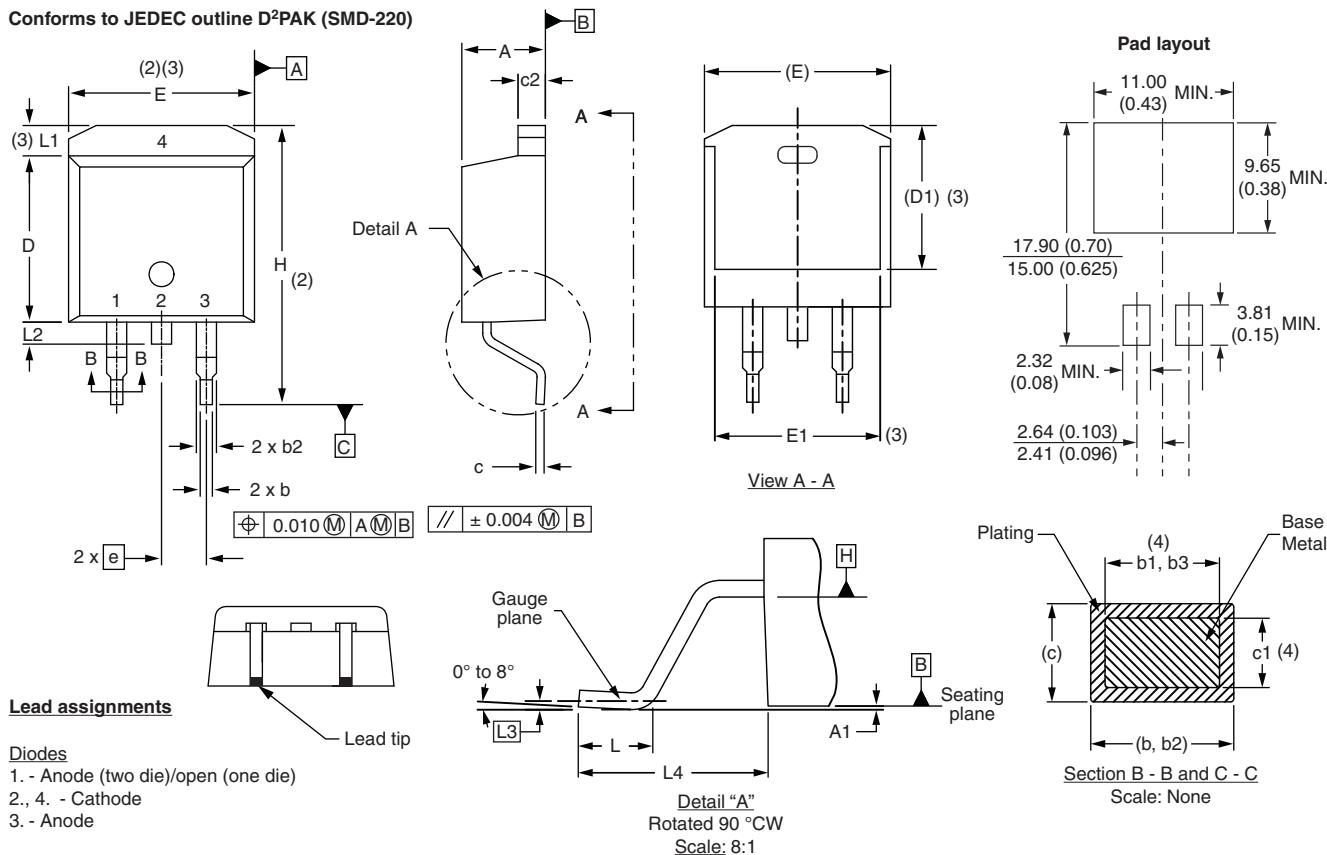
LINKS TO RELATED DOCUMENTS

Dimensions	TO-263AB (D ² PAK)	www.vishay.com/doc?95046
	TO-262AA	www.vishay.com/doc?95419
Part marking information	TO-263AB (D ² PAK)	www.vishay.com/doc?95444
	TO-262AA	www.vishay.com/doc?95443
Packaging information	TO-263AB (D ² PAK)	www.vishay.com/doc?95032

D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC outline D²PAK (SMD-220)



SYMBOL	MILLIMETERS		INCHES		NOTES		SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.				MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190			D1	6.86	8.00	0.270	0.315	3
A1	0.00	0.254	0.000	0.010			E	9.65	10.67	0.380	0.420	2, 3
b	0.51	0.99	0.020	0.039			E1	7.90	8.80	0.311	0.346	3
b1	0.51	0.89	0.020	0.035	4		e	2.54 BSC		0.100 BSC		
b2	1.14	1.78	0.045	0.070			H	14.61	15.88	0.575	0.625	
b3	1.14	1.73	0.045	0.068	4		L	1.78	2.79	0.070	0.110	
c	0.38	0.74	0.015	0.029			L1	-	1.65	-	0.066	3
c1	0.38	0.58	0.015	0.023	4		L2	1.27	1.78	0.050	0.070	
c2	1.14	1.65	0.045	0.065			L3	0.25 BSC		0.010 BSC		
D	8.51	9.65	0.335	0.380	2		L4	4.78	5.28	0.188	0.208	

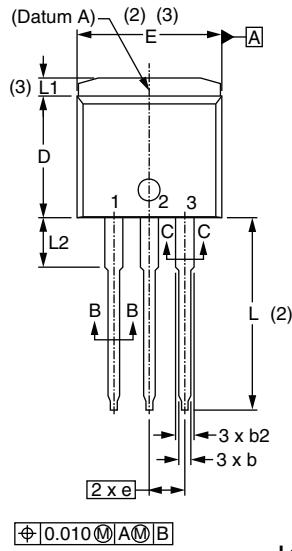
Notes

- (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

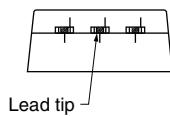
TO-262

DIMENSIONS in millimeters and inches

Modified JEDEC outline TO-262

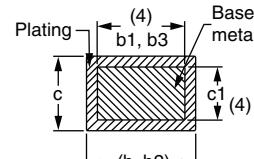
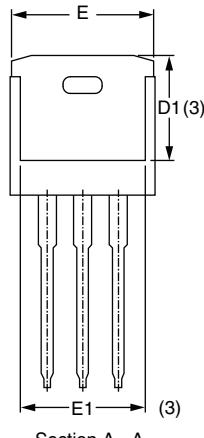
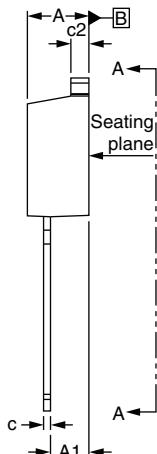


$\oplus 0.010 \ominus 0.005$ B



Lead assignments

Diodes
 1. - Anode (two die)/open (one die)
 2., 4. - Cathode
 3. - Anode



Section B-B and C-C
 Scale: None

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	2.03	3.02	0.080	0.119	
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
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		
L	13.46	14.10	0.530	0.555	
L1	-	1.65	-	0.065	3
L2	3.56	3.71	0.140	0.146	

Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-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) Controlling dimension: inches

(6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum) and D1 (minimum) where dimensions derived the actual package outline

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