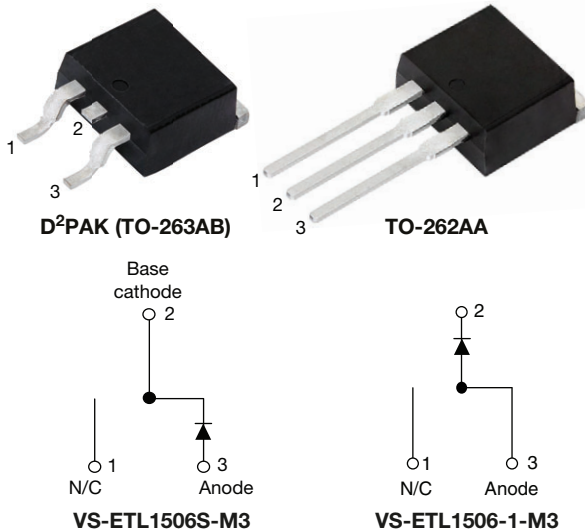




**THE DATASHEET OF  
VS-ETL1506-1-M3**



## Ultrafast Rectifier, 15 A FRED Pt<sup>®</sup>



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### FEATURES

- State of the art low forward voltage drop
- Ultrafast recovery time
- 175 °C operating junction temperature
- Low leakage current
- Designed and qualified according to JEDEC<sup>®</sup>-JESD 47
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### DESCRIPTION

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.

### MECHANICAL DATA

**Case:** D<sup>2</sup>PAK (TO-263AB), TO-262AA

Molding compound meets UL 94 V-0 flammability rating

**Terminals:** matte tin plated leads, solderable per J-STD-002

### LINKS TO ADDITIONAL RESOURCES



PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	15 A
$V_R$	600 V
$V_F$ at $I_F$	0.85 V
$t_{rr}$ (typ.)	60 ns
$T_J$ max.	175 °C
Package	D <sup>2</sup> PAK (TO-263AB), TO-262AA
Circuit configuration	Single

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Repetitive peak reverse voltage	$V_{RRM}$		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 152\text{ °C}$	15	A
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 25\text{ °C}$	200	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-65 to +175	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ 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
Forward voltage	$V_F$	$I_F = 15\text{ A}$	-	0.99	1.07	
		$I_F = 15\text{ A}, T_J = 150\text{ °C}$	-	0.85	0.91	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	0.01	15	$\mu\text{A}$
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	6	100	
Junction capacitance	$C_T$	$V_R = 600\text{ V}$	-	12	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8.0	-	nH



DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 1 A, dI <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V	-	60	110	ns
		I <sub>F</sub> = 15 A, dI <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V	-	185	270	
		T <sub>J</sub> = 25 °C	-	210	-	
		T <sub>J</sub> = 125 °C	-	290	-	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 25 °C	-	20	-	A
		T <sub>J</sub> = 125 °C	-	26	-	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	2.2	-	μC
		T <sub>J</sub> = 125 °C	-	4.0	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-65	-	175	°C
Thermal resistance, junction to case	R <sub>thJC</sub>		-	1.3	1.51	°C/W
Thermal resistance, junction to ambient	R <sub>thJA</sub>	Typical socket mount	-	-	70	
Thermal resistance, case to heatsink	R <sub>thCS</sub>	Mounting surface, flat, smooth, and greased	-	0.5	-	
Weight			-	2.0	-	g
Mounting torque			6 (5)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style D <sup>2</sup> PAK (TO-263AB)	ETL1506S			
		Case style TO-262AA	ETL1506-1			

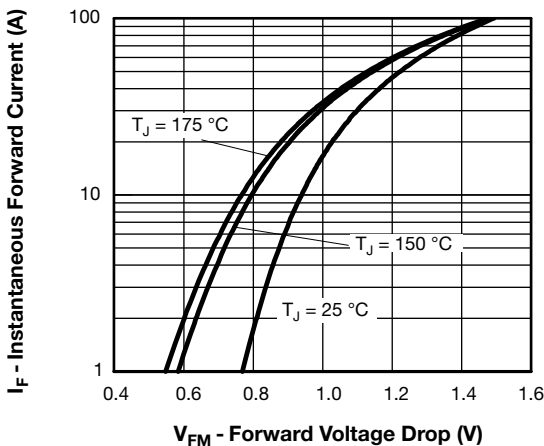


Fig. 1 - Typical Forward Voltage Drop Characteristics

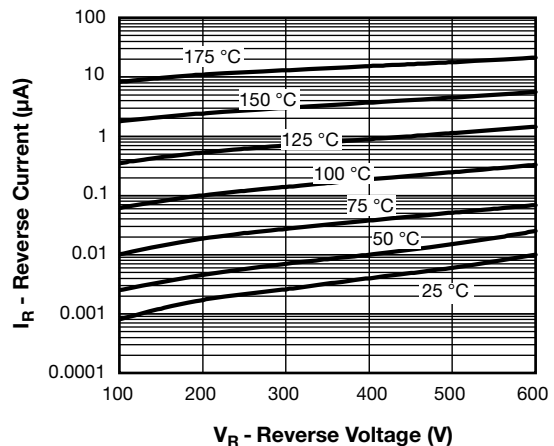


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

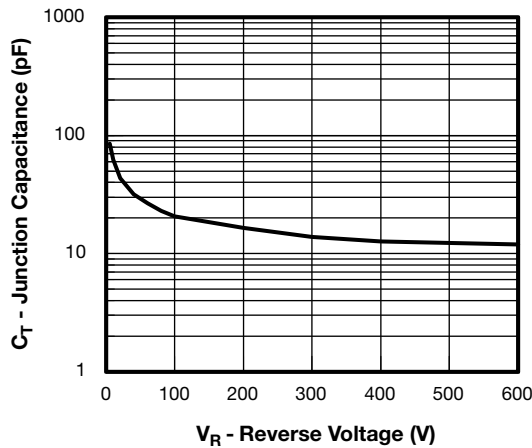


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

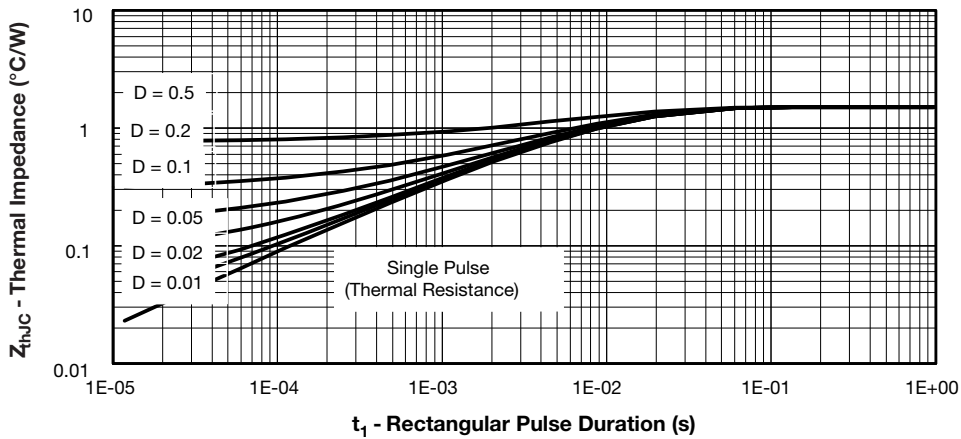


Fig. 4 - Max. Thermal Impedance  $Z_{thJC}$  Characteristics

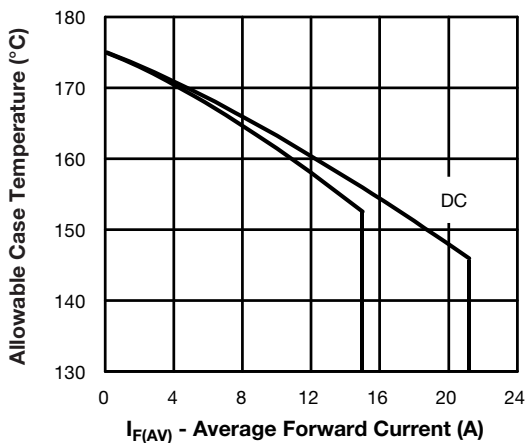


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

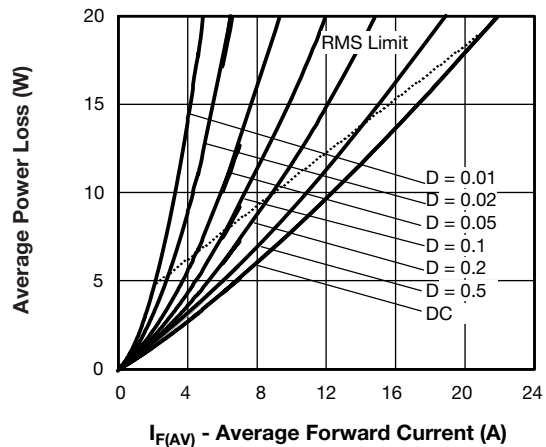


Fig. 6 - Forward Power Loss Characteristics

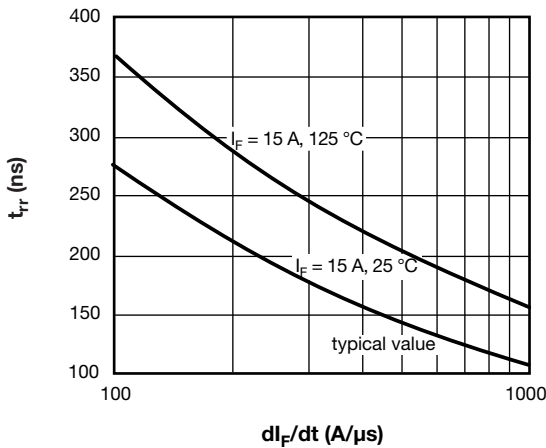


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

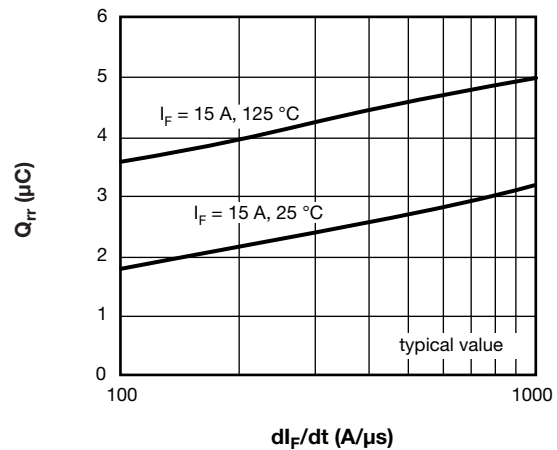
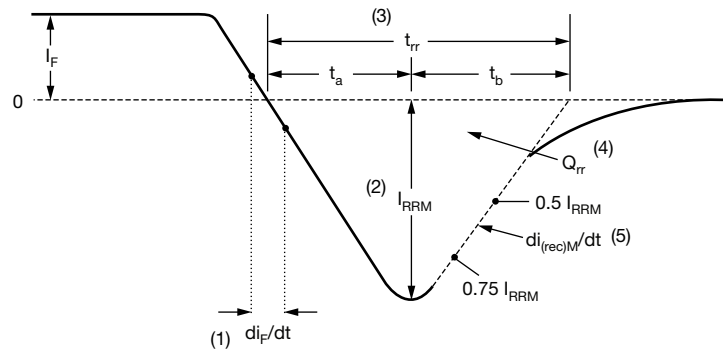


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$



(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  $I_{RRM}$

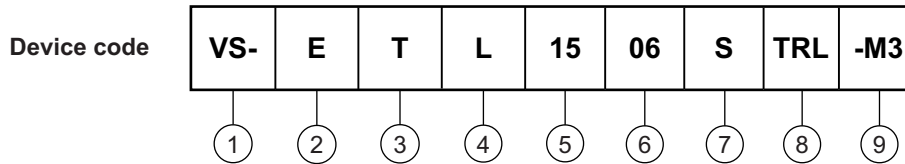
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

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

Fig. 9 - Reverse Recovery Waveform and Definitions



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Circuit configuration  
E = single
- 3** - T = TO-220
- 4** - L = ultrafast recovery time
- 5** - Current code (15 = 15 A)
- 6** - Voltage code (06 = 600 V)
- 7** - • S = D<sup>2</sup>PAK (TO-263AB)  
• -1 = TO-262AA
- 8** - • None = tube (50 pieces)  
• TRL = tape and reel (left oriented, for D<sup>2</sup>PAK (TO-263AB) package)  
• TRR = tape and reel (right oriented, for D<sup>2</sup>PAK (TO-263AB) package)
- 9** - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

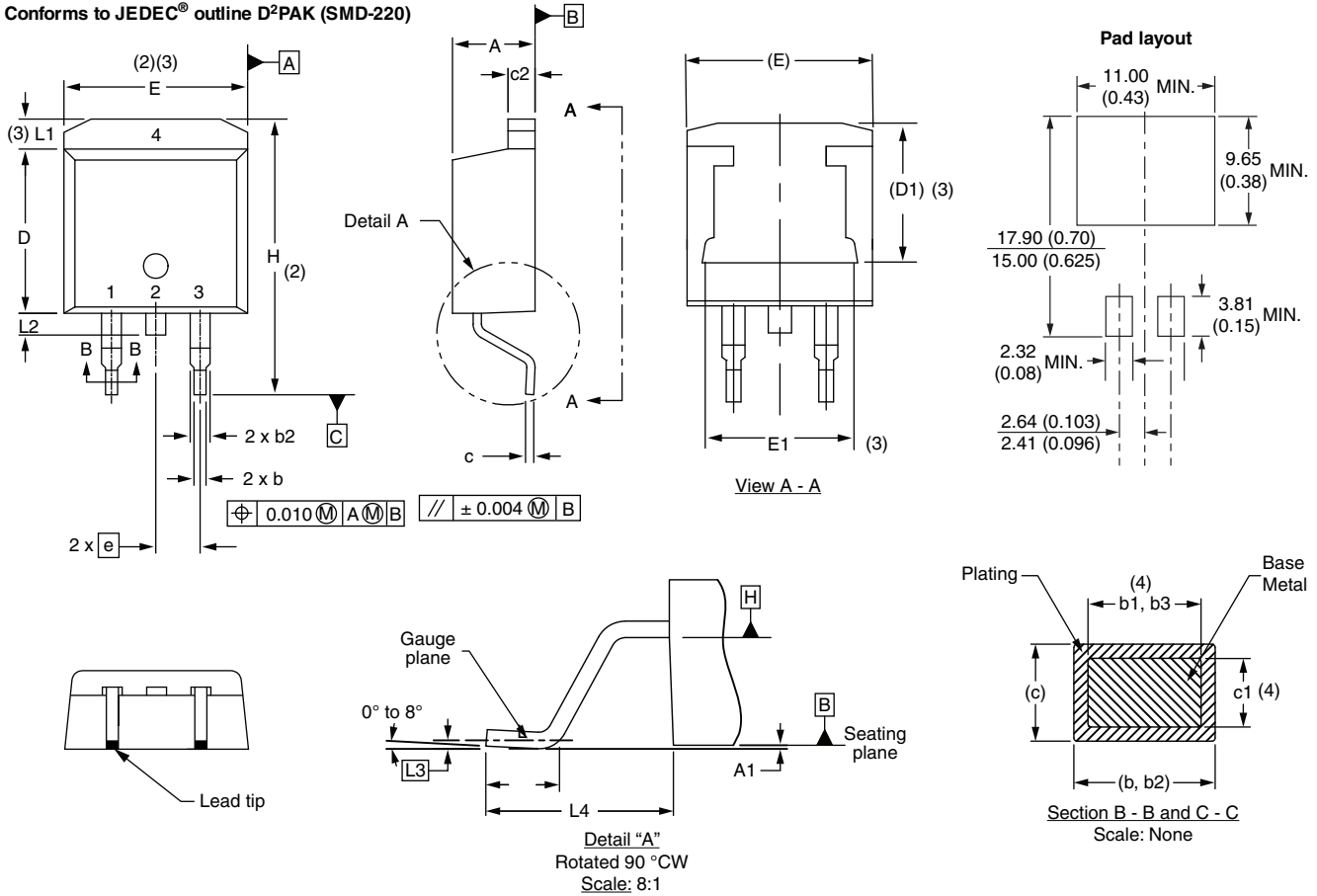
ORDERING INFORMATION (Example)		
PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-ETL1506S-M3	50	Antistatic plastic tubes
VS-ETL1506STRR-M3	800	13" diameter plastic tape and reel
VS-ETL1506STRL-M3	800	13" diameter plastic tape and reel
VS-ETL1506-1-M3	50	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS		
Dimensions	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a>
	TO-262AA	<a href="http://www.vishay.com/doc?96165">www.vishay.com/doc?96165</a>
Part marking information	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a>
	TO-262AA	<a href="http://www.vishay.com/doc?95443">www.vishay.com/doc?95443</a>
Packaging information	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a>
SPIICE model	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?97050">www.vishay.com/doc?97050</a>

### D<sup>2</sup>PAK

**DIMENSIONS** in millimeters and inches

Conforms to JEDEC<sup>®</sup> outline D<sup>2</sup>PAK (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: inches
- (7) Outline conforms to JEDEC<sup>®</sup> outline TO-263AB

### TO-262AA

**DIMENSIONS** in millimeters and inches

Modified JEDEC® outline TO-262



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 (max.), b (min., max.), b1 (min.), b2 (max.), c (min.), c1(min.), c2 (max.), D (min.), E (max.), L1 (max.), L2 (min., max.)



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