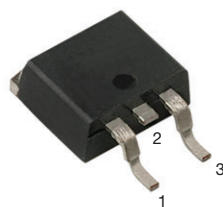
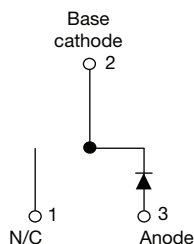
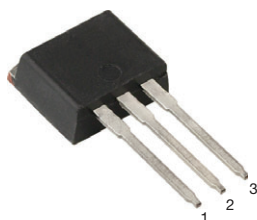
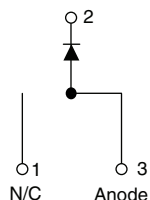


# Ultrafast Rectifier, 15 A FRED Pt®


**TO-263AB (D²PAK)**

**VS-ETL1506SHM3**

**TO-262AA**

**VS-ETL1506-1HM3**

## 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®-JESD 47
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?999912](http://www.vishay.com/doc?999912)


**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 (D²PAK), TO-262AA
$I_{F(AV)}$	15 A
$V_R$	600 V
$V_F$ at $I_F$ (typ.)	0.85 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	$I_{F(AV)}$	$T_C = 152\text{ °C}$	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	$V_{BR}, V_R$	$I_R = 100\text{ }\mu\text{A}$	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



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

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
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)	kgf · cm (lbf · in)
Marking device		Case style D <sup>2</sup> PAK modified	ETL1506SH			
		Case style TO-262	ETL1506-1H			

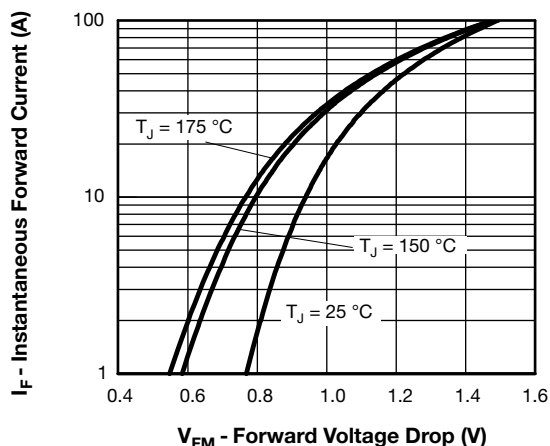


Fig. 1 - Typical Forward Voltage Drop Characteristics

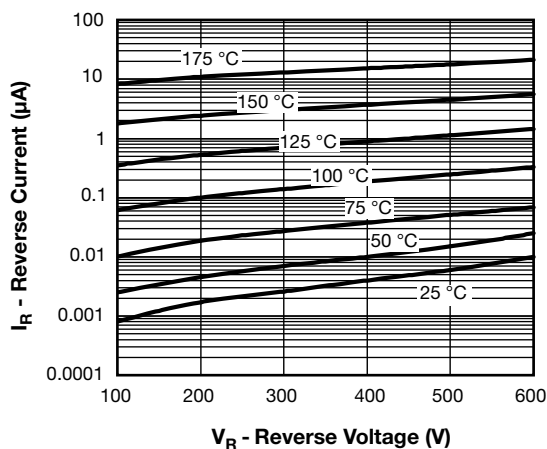


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

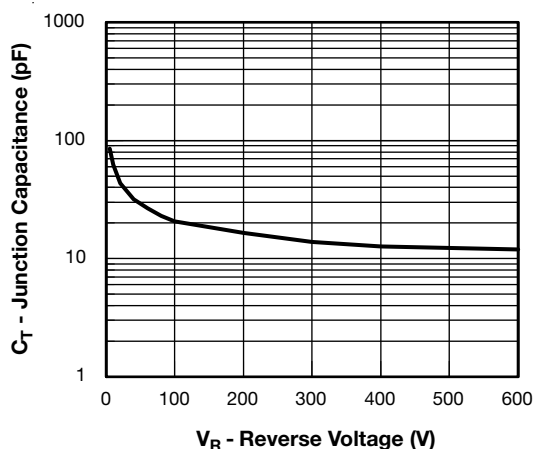


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

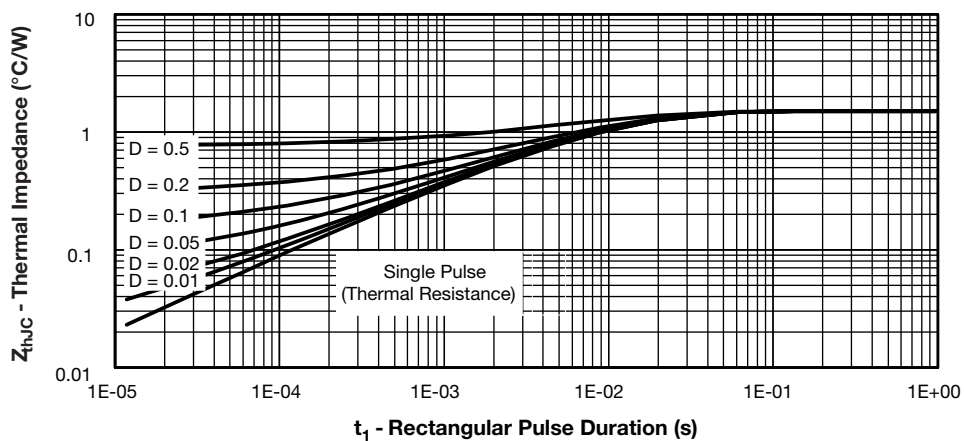
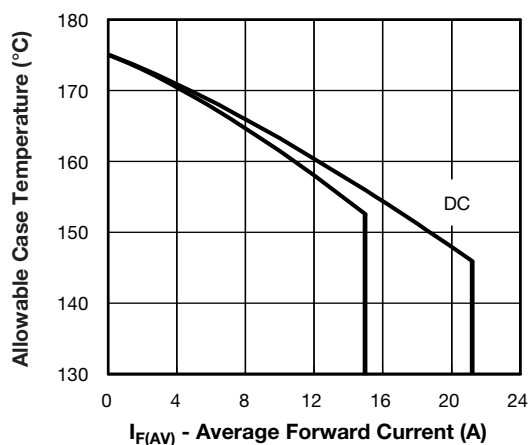

Fig. 4 - Max. Thermal Impedance  $Z_{thJC}$  Characteristics


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

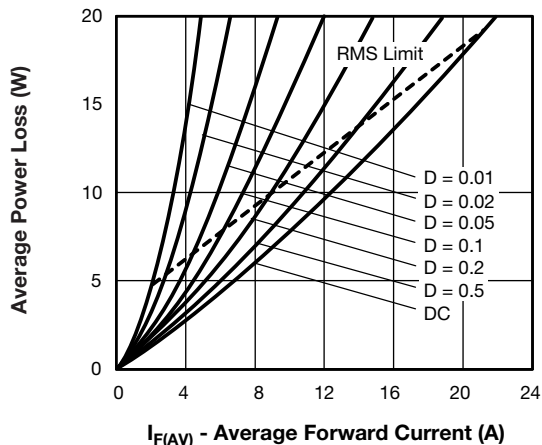


Fig. 6 - Forward Power Loss Characteristics

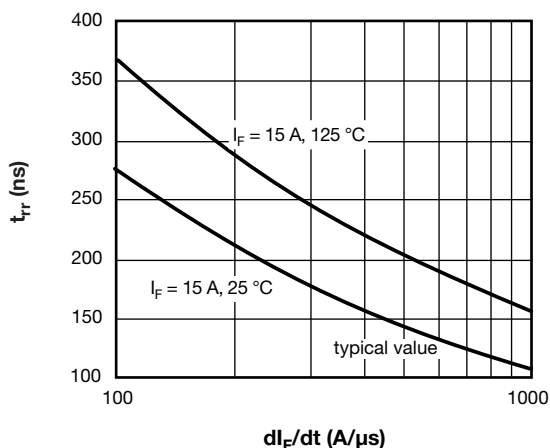
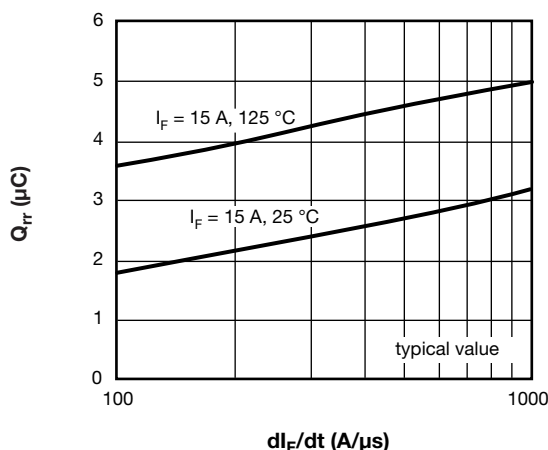
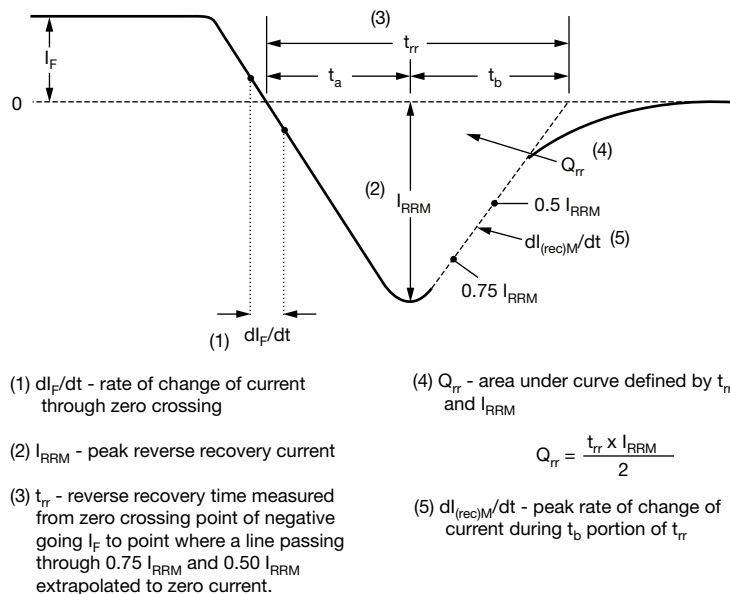

Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$ 

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


Fig. 9 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

Device code	VS-	E	T	L	15	06	S	TRL	H	M3
	1	2	3	4	5	6	7	8	9	10
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	- • S = D <sup>2</sup> PAK • -1 = TO-262									
8	- • None = tube (50 pieces) • TRL = tape and reel (left oriented, for D <sup>2</sup> PAK package) • TRR = tape and reel (right oriented, for D <sup>2</sup> PAK package)									
9	- H = AEC-Q101 qualified									
10	- 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-ETL1506SHM3	50	1000	Antistatic plastic tube
VS-ETL1506-1HM3	50	1000	Antistatic plastic tube
VS-ETL1506STRRHM3	800	800	13" diameter reel
VS-ETL1506STRLHM3	800	800	13" diameter reel

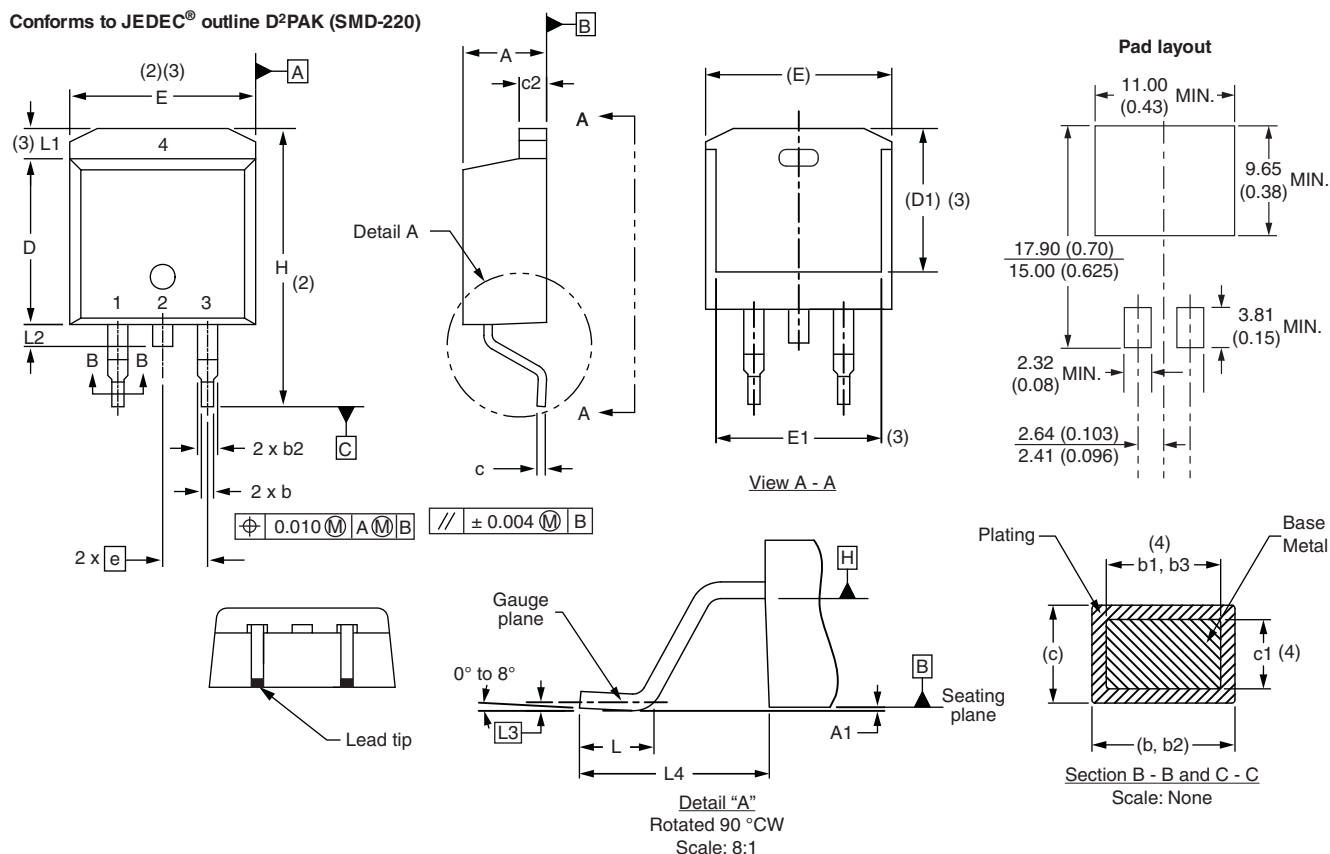
**LINKS TO RELATED DOCUMENTS**

Dimensions	TO-263AB (D <sup>2</sup> PAK)	<a href="http://www.vishay.com/doc?95046">www.vishay.com/doc?95046</a>
	TO-262AA	<a href="http://www.vishay.com/doc?95419">www.vishay.com/doc?95419</a>
Part marking information	TO-263AB (D <sup>2</sup> PAK)	<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	TO-263AB (D <sup>2</sup> PAK)	<a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a>

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

#### DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (SMD-220)



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	0.00	0.254	0.000	0.010	
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

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
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		
H	14.61	15.88	0.575	0.625	
L	1.78	2.79	0.070	0.110	
L1	-	1.65	-	0.066	3
L2	1.27	1.78	0.050	0.070	
L3	0.25 BSC		0.010 BSC		
L4	4.78	5.28	0.188	0.208	

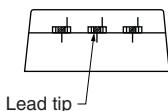
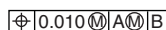
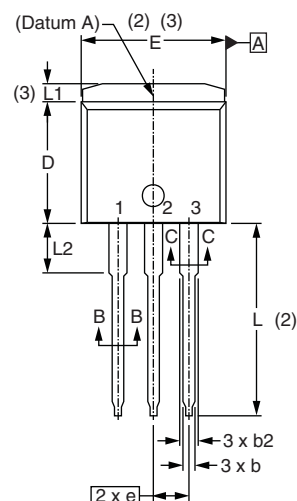
#### Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB

### TO-262

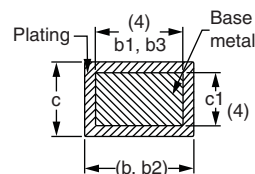
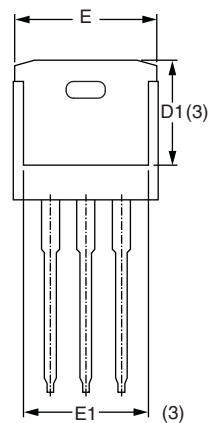
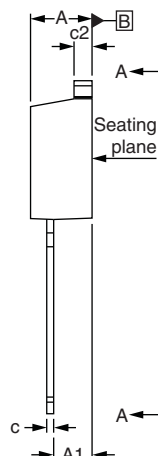
**DIMENSIONS** in millimeters and inches

Modified JEDEC® outline TO-262



#### 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	3.36	3.71	0.132	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), D1 (minimum) and L2 where dimensions derived the actual package outline



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