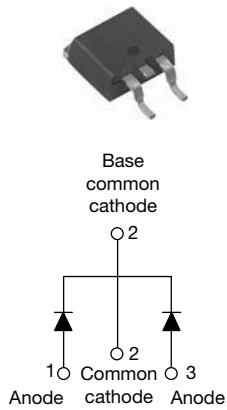
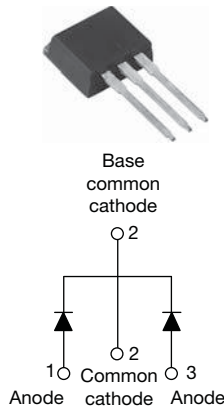


## High Performance Schottky Rectifier, 2 x 20 A

TO-263AB (D<sup>2</sup>PAK)


VS-40CTQ045SPbF

TO-262AA



VS-40CTQ045-1PbF

### FEATURES

- 150 °C T<sub>J</sub> operation
- Center tap configuration
- Very low forward voltage drop
- High frequency operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Guard ring for enhanced ruggedness and long term reliability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

### PRODUCT SUMMARY

Package	TO-263AB (D <sup>2</sup> PAK), TO-262AA
I <sub>F(AV)</sub>	2 x 20 A
V <sub>R</sub>	45 V
V <sub>F</sub> at I <sub>F</sub>	0.48 V
I <sub>RM</sub> max.	115 mA at 125 °C
T <sub>J</sub> max.	150 °C
Diode variation	Common cathode
E <sub>AS</sub>	20

### DESCRIPTION

This center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
I <sub>F(AV)</sub>	Rectangular waveform	40	A
V <sub>RRM</sub>		45	V
I <sub>FSM</sub>	t <sub>p</sub> = 5 μs sine	1240	A
V <sub>F</sub>	20 A <sub>pk</sub> , T <sub>J</sub> = 125 °C (per leg)	0.48	V
T <sub>J</sub>	Range	-55 to +150	°C

### VOLTAGE RATINGS

PARAMETER	SYMBOL	VS-40CTQ045SPbF VS-40CTQ045-1PbF	UNITS
Maximum DC reverse voltage	V <sub>R</sub>	45	V
Maximum working peak reverse voltage	V <sub>RWM</sub>		

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current, see fig. 5	I <sub>F(AV)</sub>	50 % duty cycle at T <sub>C</sub> = 116 °C, rectangular waveform	20 40	A
Maximum peak one cycle non-repetitive surge current per leg, see fig. 7	I <sub>FSM</sub>	5 μs sine or 3 μs rect. pulse	1240	
		10 ms sine or 6 ms rect. pulse	350	
Non-repetitive avalanche energy per leg	E <sub>AS</sub>	T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 3 A, L = 4.40 mH	20	mJ
Repetitive avalanche current per leg	I <sub>AR</sub>	Current decaying linearly to zero in 1 μs Frequency limited by T <sub>J</sub> maximum V <sub>A</sub> = 1.5 x V <sub>R</sub> typical	3	A

**ELECTRICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum forward voltage drop per leg See fig. 1	$V_{FM}^{(1)}$	20 A	$T_J = 25\text{ }^{\circ}\text{C}$	0.53	V
		40 A		0.68	
		20 A	$T_J = 125\text{ }^{\circ}\text{C}$	0.48	
		40 A		0.67	
Maximum reverse leakage current per leg See fig. 2	$I_{RM}^{(1)}$	$T_J = 25\text{ }^{\circ}\text{C}$	$V_R = \text{Rated } V_R$	3	mA
		$T_J = 125\text{ }^{\circ}\text{C}$		115	
Threshold voltage	$V_{F(TO)}$	$T_J = T_J \text{ maximum}$		0.27	V
Forward slope resistance	$r_t$			8.72	$\text{m}\Omega$
Maximum junction capacitance per leg	$C_T$	$V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$		2800	pF
Typical series inductance per leg	$L_S$	Measured lead to lead 5 mm from package body		8.0	nH
Maximum voltage rate of change	$dV/dt$	Rated $V_R$		10 000	V/ $\mu\text{s}$

**Note**(1) Pulse width < 300  $\mu\text{s}$ , duty cycle < 2 %**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER		SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range		T <sub>J</sub> , T <sub>Stg</sub>		-55 to +150	°C
Maximum thermal resistance, junction to case per leg		R <sub>thJC</sub>	DC operation	2.0	°C/W
Maximum thermal resistance, junction to case per package				1.0	
Typical thermal resistance, case to heatsink				R <sub>thCS</sub>	
Approximate weight				2	g
				0.07	oz.
Mounting torque	minimum			6 (5)	kgf · cm (lbf · in)
	maximum			12 (10)	
Marking device			Case style TO-263AB (D <sup>2</sup> PAK)	40CTQ045S	
			Case style TO-262AA	40CTQ045-1	

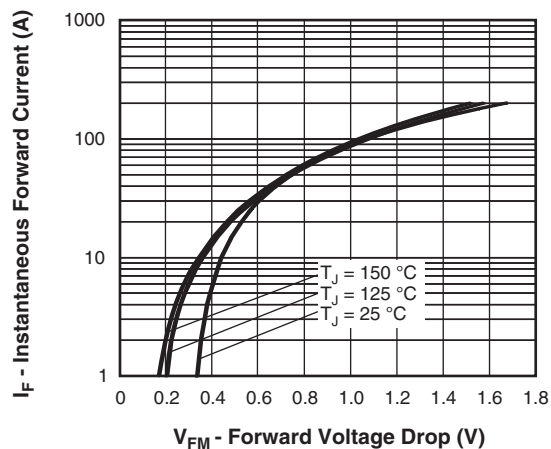


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

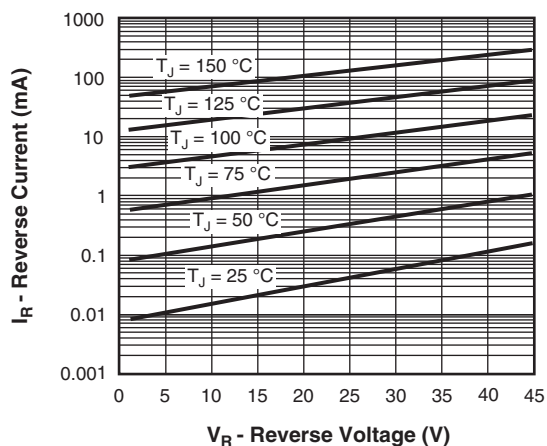


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

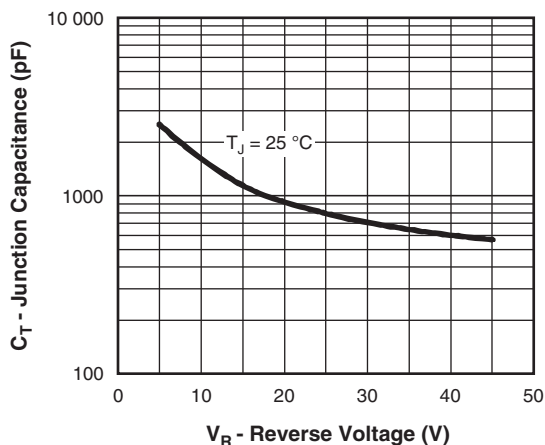


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

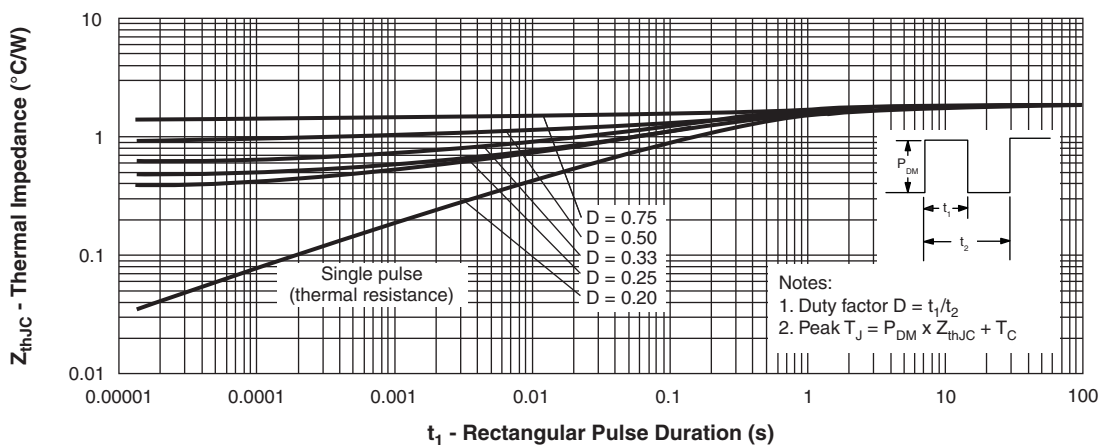


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

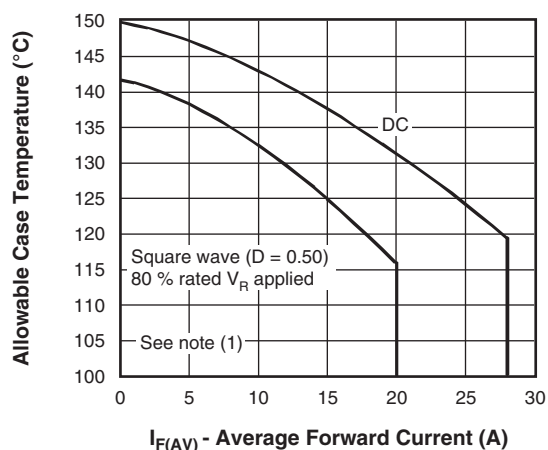


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

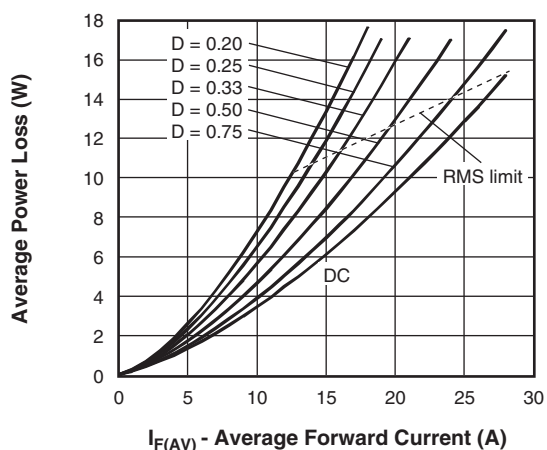


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

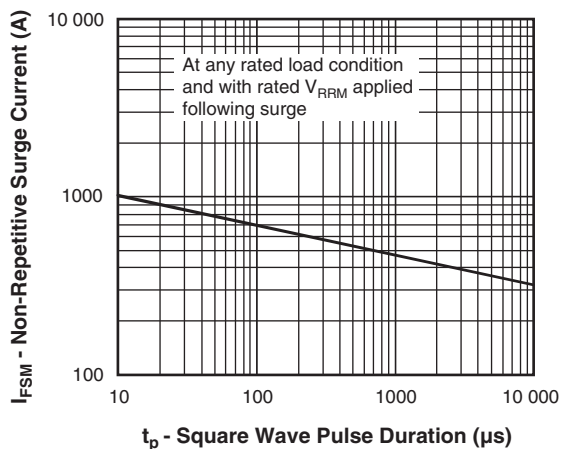


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

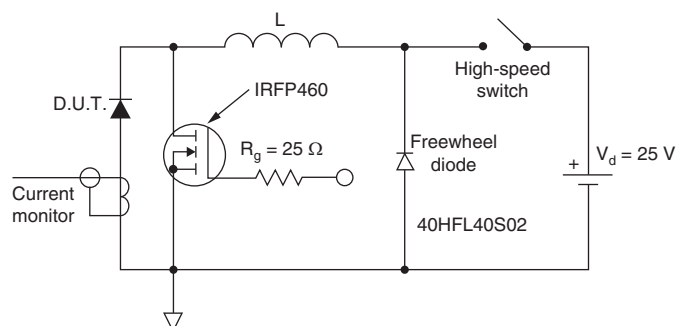


Fig. 8 - Unclamped Inductive Test Circuit

#### Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{d_{REV}}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 10$  V

**ORDERING INFORMATION TABLE**

Device code	VS-	40	C	T	Q	045	S	TRL	PbF
	1	2	3	4	5	6	7	8	9

- |          |   |  |
|----------|---|--|
| <b>1</b> | - | Vishay Semiconductors product  |
| <b>2</b> | - | Current rating (40 A)  |
| <b>3</b> | - | Circuit configuration: C = common cathode  |
| <b>4</b> | - | T = TO-220   |
| <b>5</b> | - | Schottky "Q" series  |
| <b>6</b> | - | Voltage rating (045 = 45 V)  |
| <b>7</b> | - | • S = D <sup>2</sup> PAK<br>• -1 = TO-262  |
| <b>8</b> | - | • None = tube (50 pieces)<br>• TRL = tape and reel (left oriented - for D <sup>2</sup> PAK only)<br>• TRR = tape and reel (right oriented - for D <sup>2</sup> PAK only) |
| <b>9</b> | - | PbF = lead (Pb)-free   |

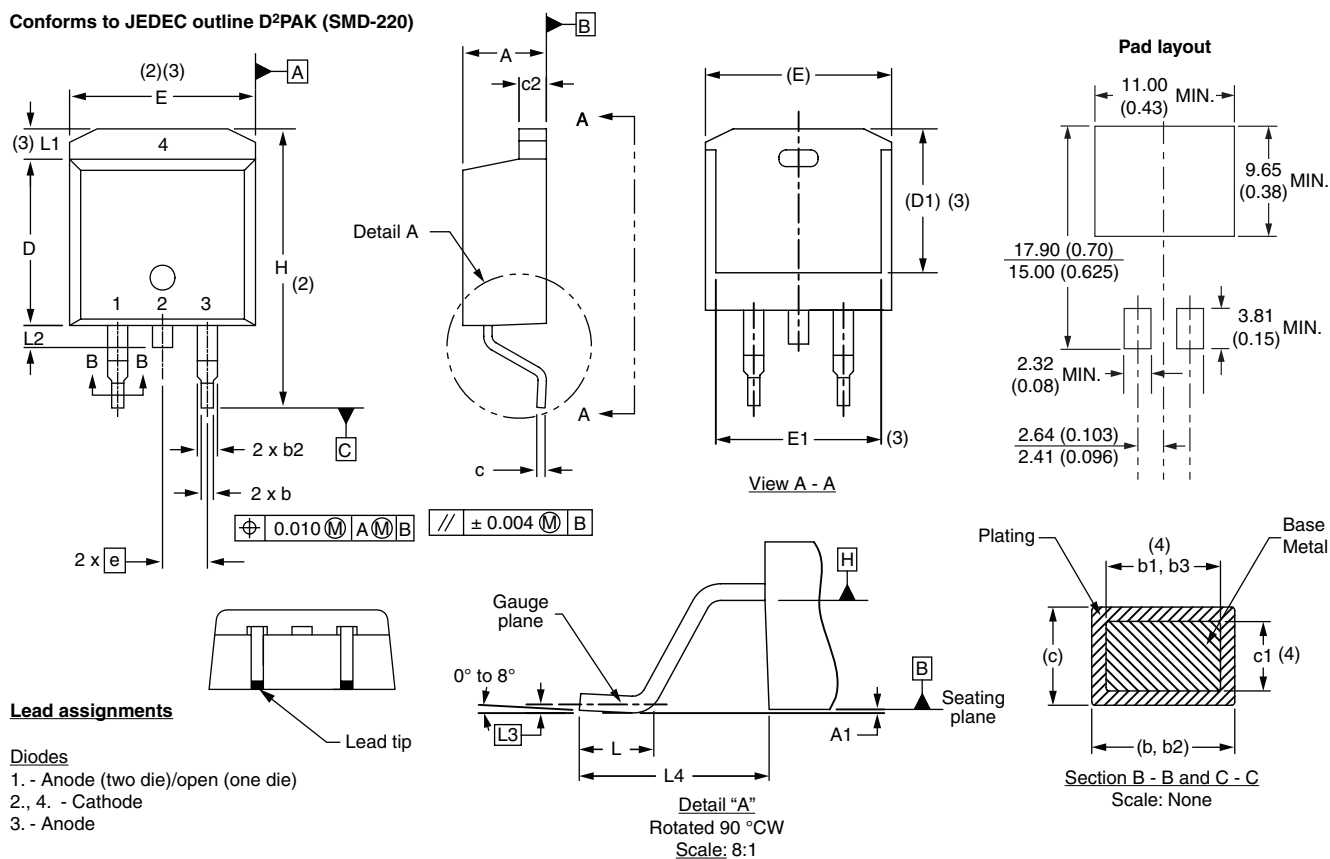
ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER REEL	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-40CTQ045SPBF	50	1000	Antistatic plastic tubes
VS-40CTQ045STRRPBF	800	800	13" diameter plastic tape and reel
VS-40CTQ045STRLPBF	800	800	13" diameter plastic tape and reel
VS-40CTQ045-1PBF	50	1000	Antistatic plastic tubes

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		<a href="http://www.vishay.com/doc?95008">www.vishay.com/doc?95008</a>
Packaging information		<a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a>

## D<sup>2</sup>PAK, TO-262

### DIMENSIONS FOR D<sup>2</sup>PAK in millimeters and inches

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

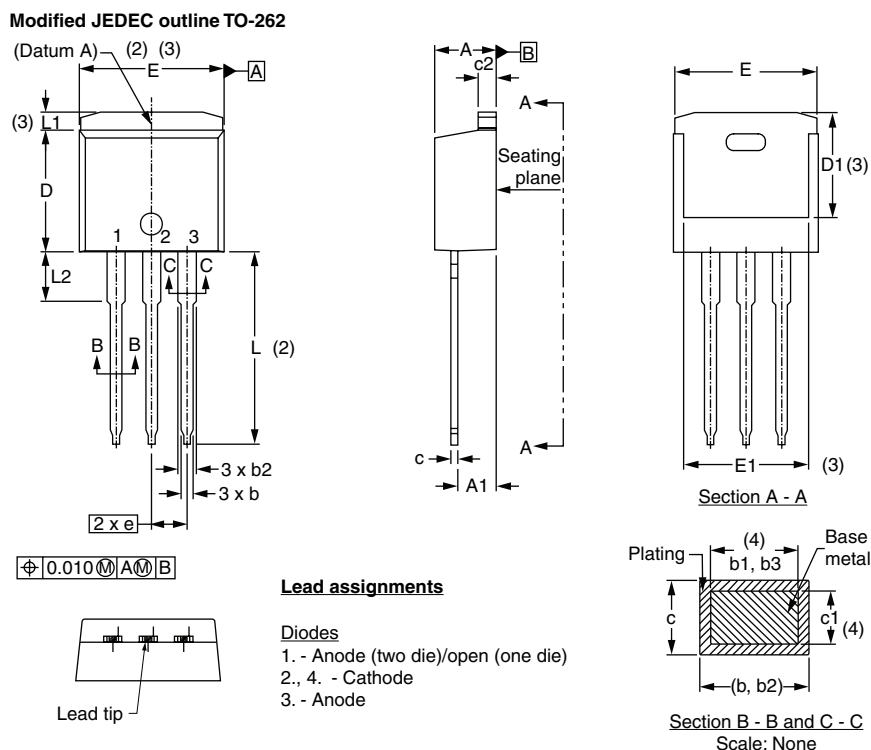


SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	0.00	0.254	0.000	0.010	
b	0.51	0.99	0.020	0.039	
b1	0.51	0.89	0.020	0.035	4
b2	1.14	1.78	0.045	0.070	
b3	1.14	1.73	0.045	0.068	4
c	0.38	0.74	0.015	0.029	
c1	0.38	0.58	0.015	0.023	4
c2	1.14	1.65	0.045	0.065	
D	8.51	9.65	0.335	0.380	2

## 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

## DIMENSIONS FOR TO-262 in millimeters and inches



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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