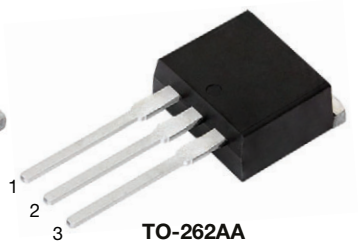
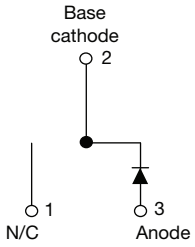
# Ultrafast Rectifier, 30 A FRED Pt®



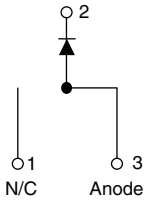

D²PAK (TO-263AB)




TO-262AA




VS-ETU3006S-M3




VS-ETU3006-1-M3

## FEATURES

- Low forward voltage drop
- Ultrafast recovery time
- 175 °C operating junction temperature
- Low leakage current
- Designed and qualified according to JEDEC®-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

RoHS COMPLIANT
HALOGEN FREE

## DESCRIPTION

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.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 30 A |
| $V_R$ | 600 V |
| $V_F$ at $I_F$ | 1.15 V |
| $t_{rr}$ (typ.) | 30 ns |
| $T_J$ max. | 175 °C |
| Package | D²PAK (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 | $I_{F(AV)}$ | $T_C$ = 113 °C | 30 | 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 | $V_F$ | $I_F$ = 30 A | - | 1.4 | 2.0 | V |
| | | $I_F$ = 30 A, $T_J$ = 150 °C | - | 1.15 | 1.35 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 0.02 | 30 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 30 | 250 | |
| Junction capacitance | $C_T$ | $V_R$ = 600 V | - | 20 | - | pF |
| Series inductance | $L_S$ | Measured lead to lead 5 mm from package body | - | 8.0 | - | nH |


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| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1 A, $dI_F/dt$ = 50 A/µs, $V_R$ = 30 V | | - | 30 | 45 | ns |
| | | $T_J$ = 25 °C | $I_F$ = 30 A<br>$dI_F/dt$ = 200 A/µs<br>$V_R$ = 200 V | - | 45 | - | |
| | | $T_J$ = 125 °C | | - | 100 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 5.6 | - | A |
| | | $T_J$ = 125 °C | | - | 10 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 127 | - | nC |
| | | $T_J$ = 125 °C | | - | 580 | - | |

| 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 | $R_{thJC}$ | | - | 0.95 | 1.4 | °C/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 $D^2PAK$ (TO-263AB) | ETU3006S | | | |
| | | Case style TO-262 | ETU3006-1 | | | |

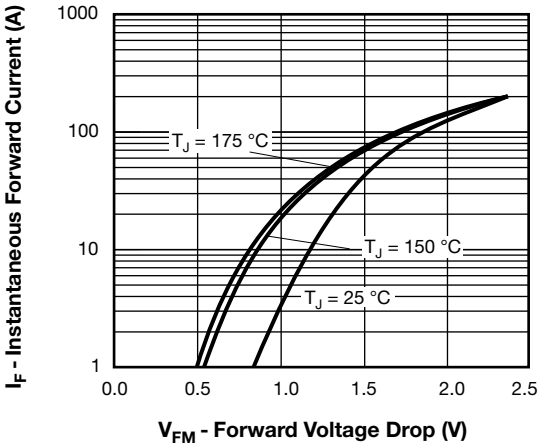



Fig. 1 - Typical Forward Voltage Drop Characteristics

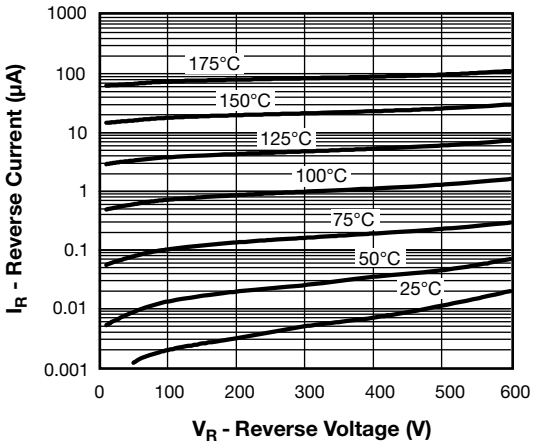



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage


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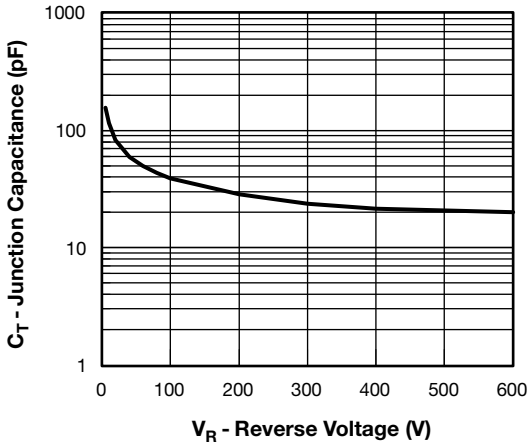



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

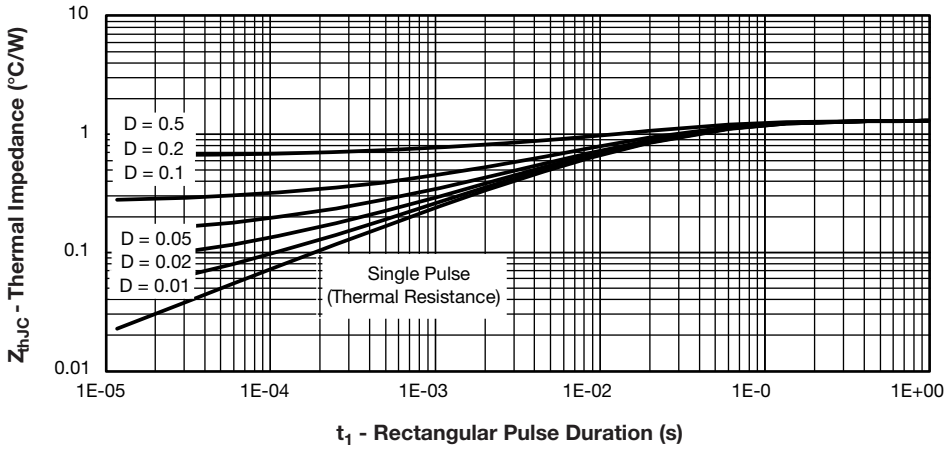



Fig. 4 - Max. Thermal Impedance $Z_{thJC}$ Characteristics

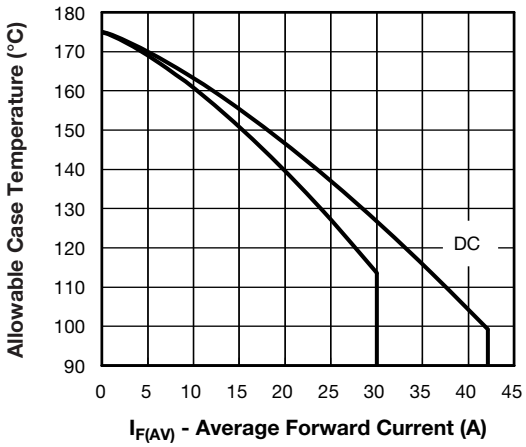



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

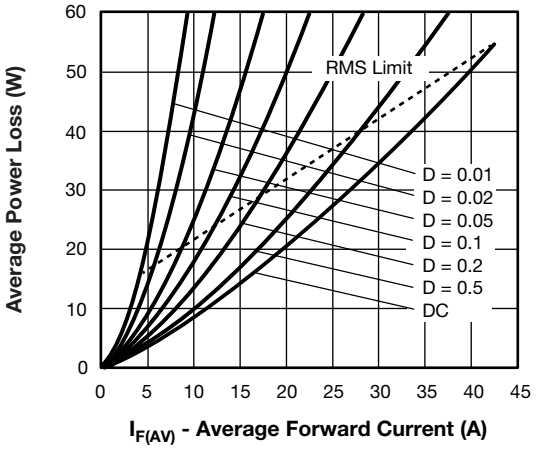



Fig. 6 - Forward Power Loss Characteristics


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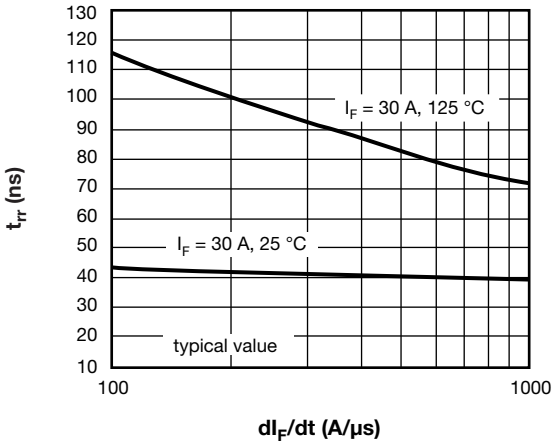



Fig. 7 - Typical Reverse Recovery vs. $dI_F/dt$

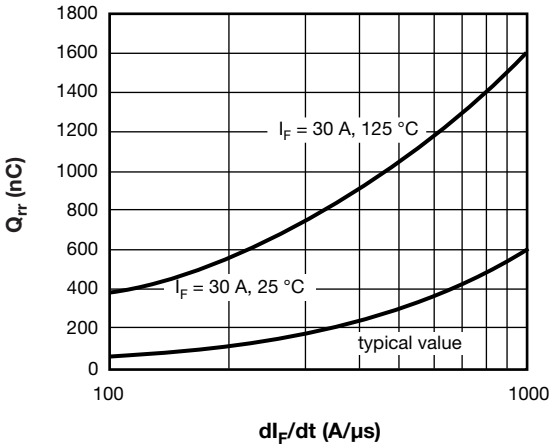
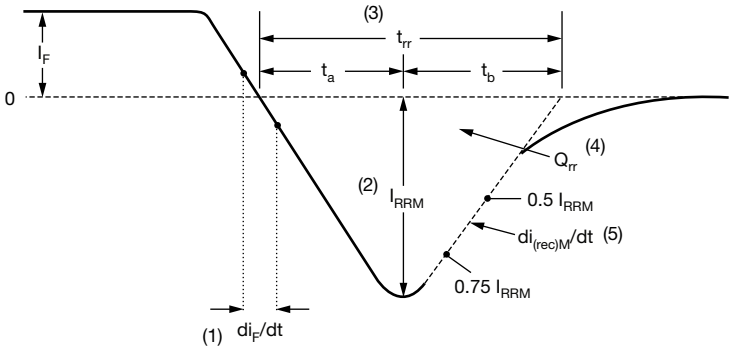



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$




(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 $I_{RRM}$

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

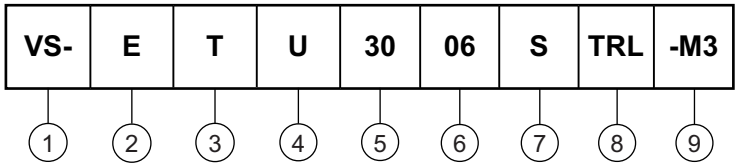
(5) $di_{(rec)M}/dt$ - peak rate of change of current during $t_b$ portion of $t_{rr}$

Fig. 9 - Reverse Recovery Waveform and Definitions


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## ORDERING INFORMATION TABLE

Device code




1 - Vishay Semiconductors product

2 - Circuit configuration
E = single

3 - T = TO-220

4 - U = ultrafast recovery time

5 - Current code (30 = 30 A)

6 - Voltage code (06 = 600 V)

7 - • S = $D^2PAK$ (TO-263AB)

- • -1 = TO-262AA

8 - • None = tube (50 pieces)

- • TRL = tape and reel (left oriented, for $D^2PAK$ (TO-263AB) package)

- • TRR = tape and reel (right oriented, for $D^2PAK$ (TO-263AB) package)

9 - -M3 = halogen-free, RoHS-compliant and terminations lead (Pb)-free

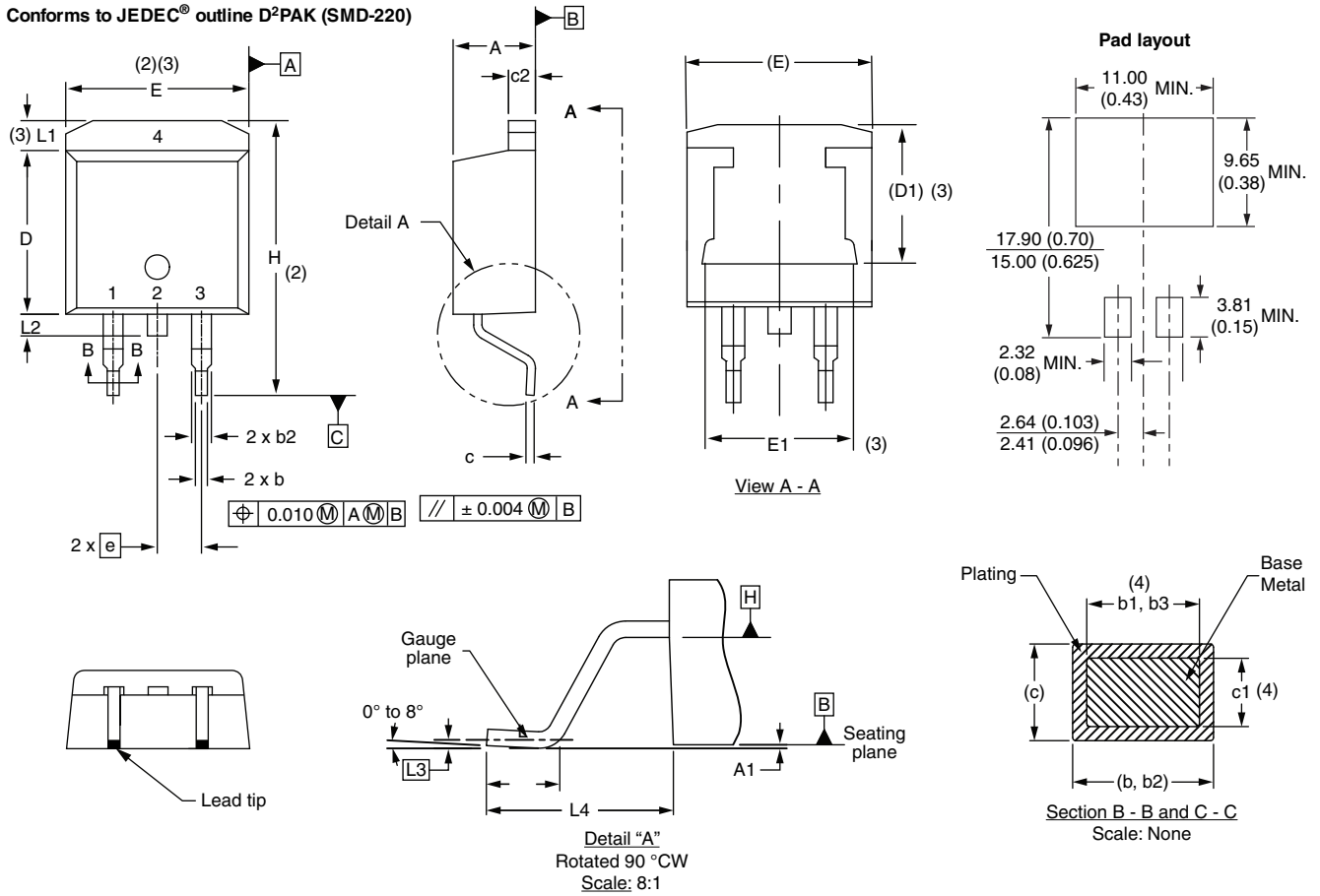
| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-ETU3006S-M3 | 50 | 1000 | Antistatic plastic tube |
| VS-ETU3006-1-M3 | 50 | 1000 | Antistatic plastic tube |
| VS-ETU3006STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-ETU3006STRL-M3 | 800 | 800 | 13" diameter reel |

| **LINKS TO RELATED DOCUMENTS** | | |
|---|---|---|
| Dimensions | $D^2PAK$ (TO-263AB) | www.vishay.com/doc?96164 |
| | TO-262AA | www.vishay.com/doc?96165 |
| Part marking information | $D^2PAK$ (TO-263AB) | www.vishay.com/doc?95444 |
| | TO-262AA | www.vishay.com/doc?95443 |
| Packaging information | $D^2PAK$ (TO-263AB) | www.vishay.com/doc?96424 |


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# $D^2PAK$

**DIMENSIONS** in millimeters and inches




| 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**

(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® outline TO-263AB



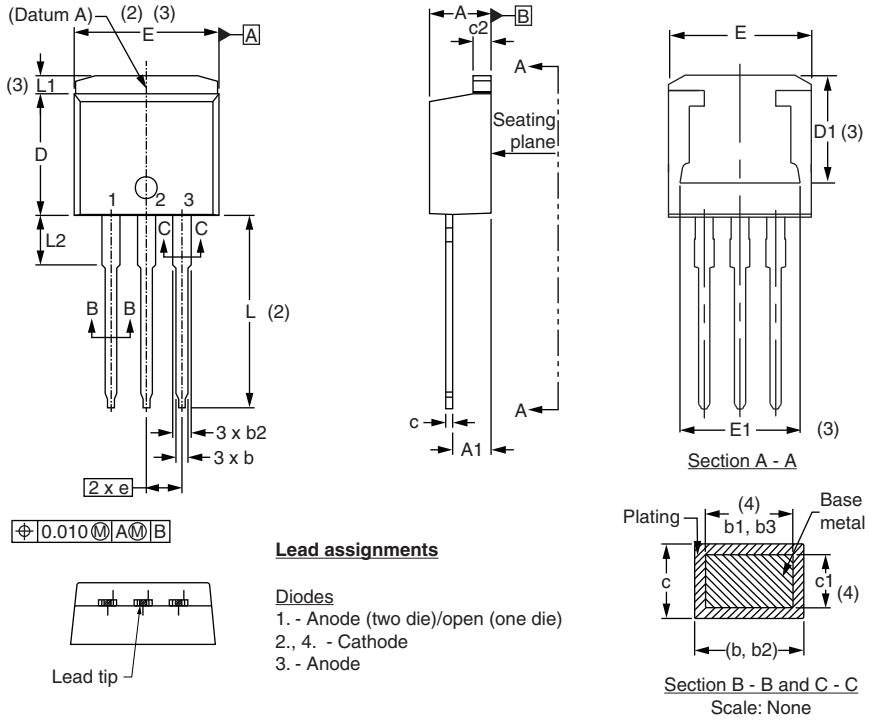
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# TO-262AA

**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

| 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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