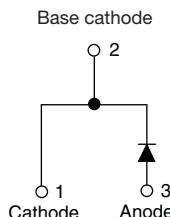
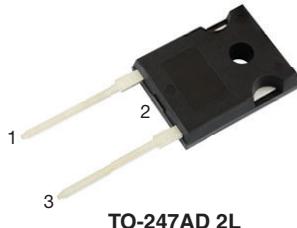


Ultrafast Soft Recovery Diode, 60 A FRED Pt® Gen 4



FEATURES

- Gen 4 FRED Pt® technology
- Low I_{RRM} and reverse recovery charge
- Very low forward voltage drop
- Polymide passivated chip for high reliability standard
- 175 °C operating junction temperature
- AEC-Q101 qualified, meets JESD 201 class 1A whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



PRIMARY CHARACTERISTICS

| | |
|-----------------------|--------------------|
| $I_{F(AV)}$ | 60 A |
| V_R | 600 V |
| V_F at I_F | 1.29 V |
| t_{rr} typ. | See Recovery table |
| T_J max. | 175 °C |
| Package | TO-247AD 2L |
| Circuit configuration | Single |

DESCRIPTION

Gen 4 Fred technology, state of the art, ultralow V_F , soft switching optimized for Discontinuous (Critical) Mode (DCM) and IGBT F/W diode.

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.

ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
|--|-------------------|--|-------------|-------|
| Peak repetitive reverse voltage | V_{RRM} | | 600 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C = 116$ °C | 60 | A |
| Non-repetitive peak surge current | I_{FSM} | $T_C = 25$ °C, $t_p = 8.3$ ms half sine wave | 450 | |
| Operating junction and storage temperature | T_J , T_{Stg} | | -55 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 | - | |
| | | $I_F = 60$ A | - | 1.46 | 1.7 | |
| | | $I_F = 30$ A, $T_J = 125$ °C | - | 1.26 | - | |
| | | $I_F = 60$ A, $T_J = 125$ °C | - | 1.33 | - | |
| | | $I_F = 30$ A, $T_J = 150$ °C | - | 1.22 | - | |
| | | $I_F = 60$ A, $T_J = 150$ °C | - | 1.29 | - | |
| Reverse leakage current | I_R | $V_R = V_R$ rated | - | - | 50 | µA |
| | | $T_J = 125$ °C, $V_R = V_R$ rated | - | - | 500 | |
| Junction capacitance | C_T | $V_R = 600$ V | - | 30 | - | pF |

| 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} | $T_J = 25^\circ\text{C}$ | $I_F = 60\text{ A}$ $dI_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ | - | 74 | - | ns |
| | | $T_J = 125^\circ\text{C}$ | | - | 105 | - | |
| Peak recovery current | I_{RRM} | $T_J = 25^\circ\text{C}$ | $V_R = 400\text{ V}$ | - | 31 | - | A |
| | | $T_J = 125^\circ\text{C}$ | | - | 50 | - | |
| Reverse recovery charge | Q_{rr} | $T_J = 25^\circ\text{C}$ | $V_R = 400\text{ V}$ | - | 1530 | - | nC |
| | | $T_J = 125^\circ\text{C}$ | | - | 3520 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | | |
|---------------------------------------|------------|------------------------|--|------------|------|------------|--|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction to case | R_{thJC} | | | - | - | 0.6 | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, case to heat sink | R_{thCS} | | | - | 0.25 | - | |
| Weight | | | | - | 6.0 | - | g |
| | | | | - | 0.21 | - | oz. |
| Mounting torque | | | | 6.0 (5) | - | 12 (20) | $\text{kgf} \cdot \text{cm}$ (lbf · in) |
| Marking device | | Case style TO-247AD 2L | | E4PU6006LH | | | |

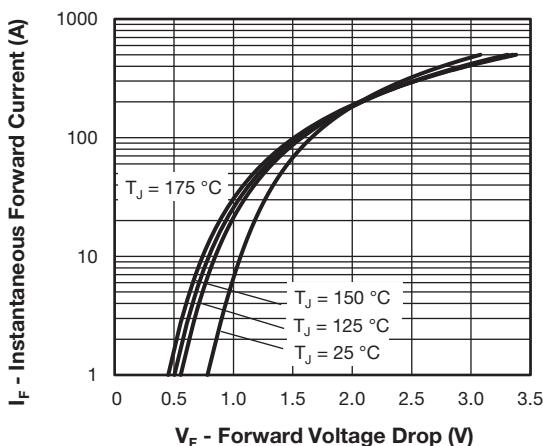


Fig. 1 - Typical Forward Voltage Drop Characteristics

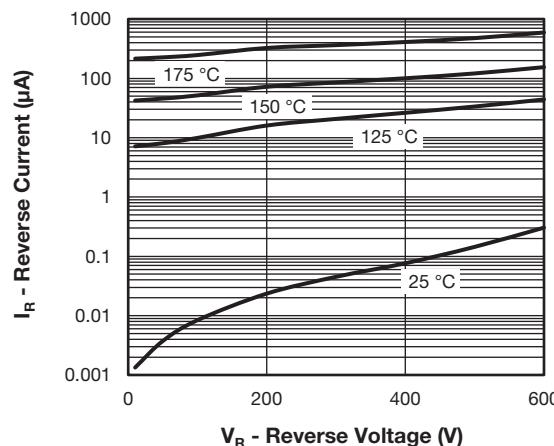


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

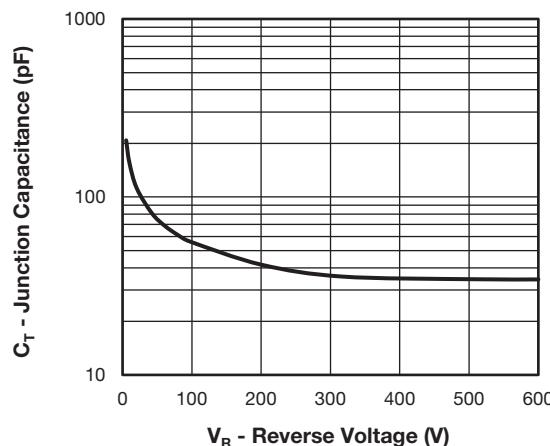


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

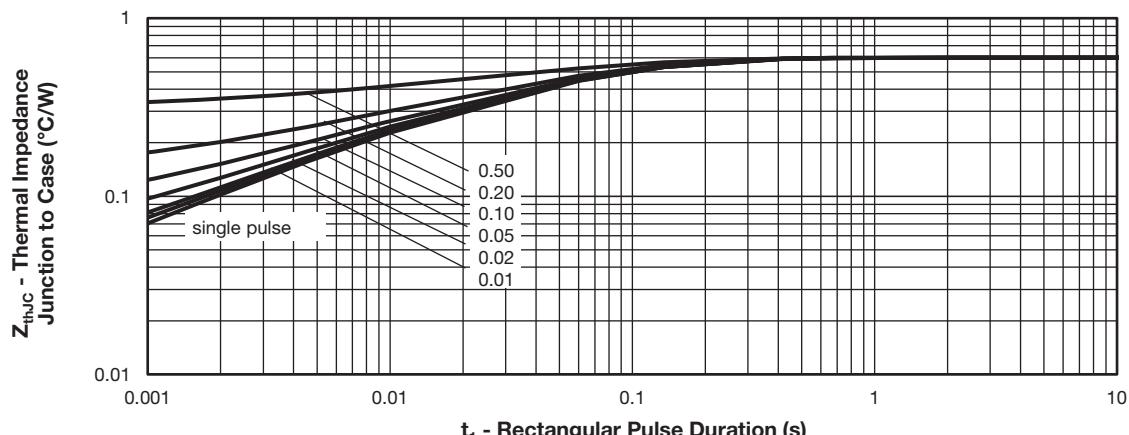


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics

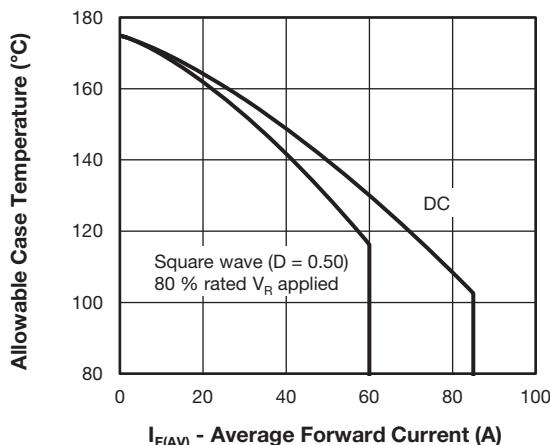


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

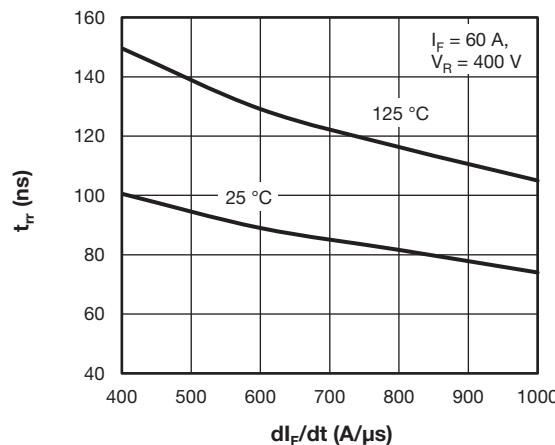


Fig. 7 - Typical Reverse Recovery Time vs. dI_F/dt

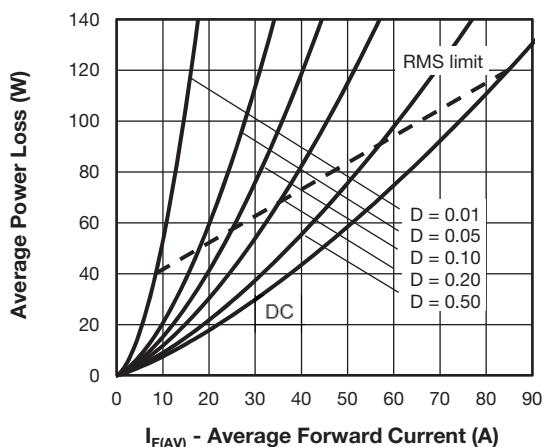


Fig. 6 - Forward Power Loss Characteristics

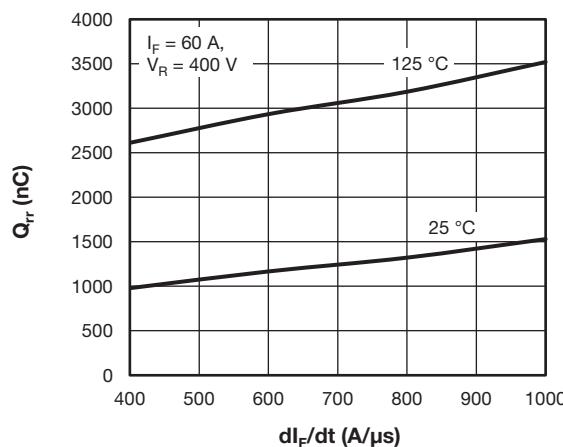
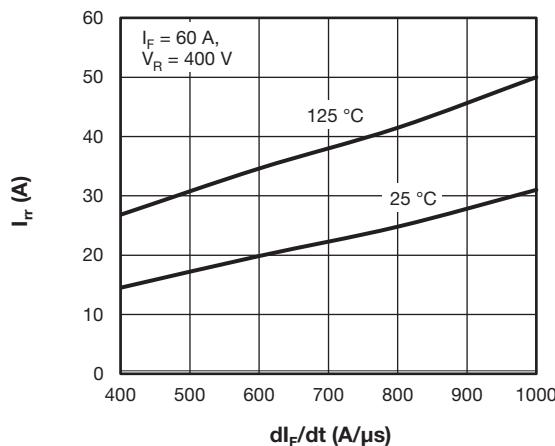


Fig. 8 - Typical Stored Charge vs. dI_F/dt

Note

(1) Formula used: $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$;
 P_d = Forward power loss = $I_{F(AV)} \times V_{FM}$ at $(I_{F(AV)}/D)$ (see Fig.5)
 P_{dREV} = Inverse power loss = $V_{R1} \times I_R (1 - D)$; I_R at V_R = rated V_R


Fig. 9 - Typical Reverse Current vs. dI_F/dt
ORDERING INFORMATION TABLE

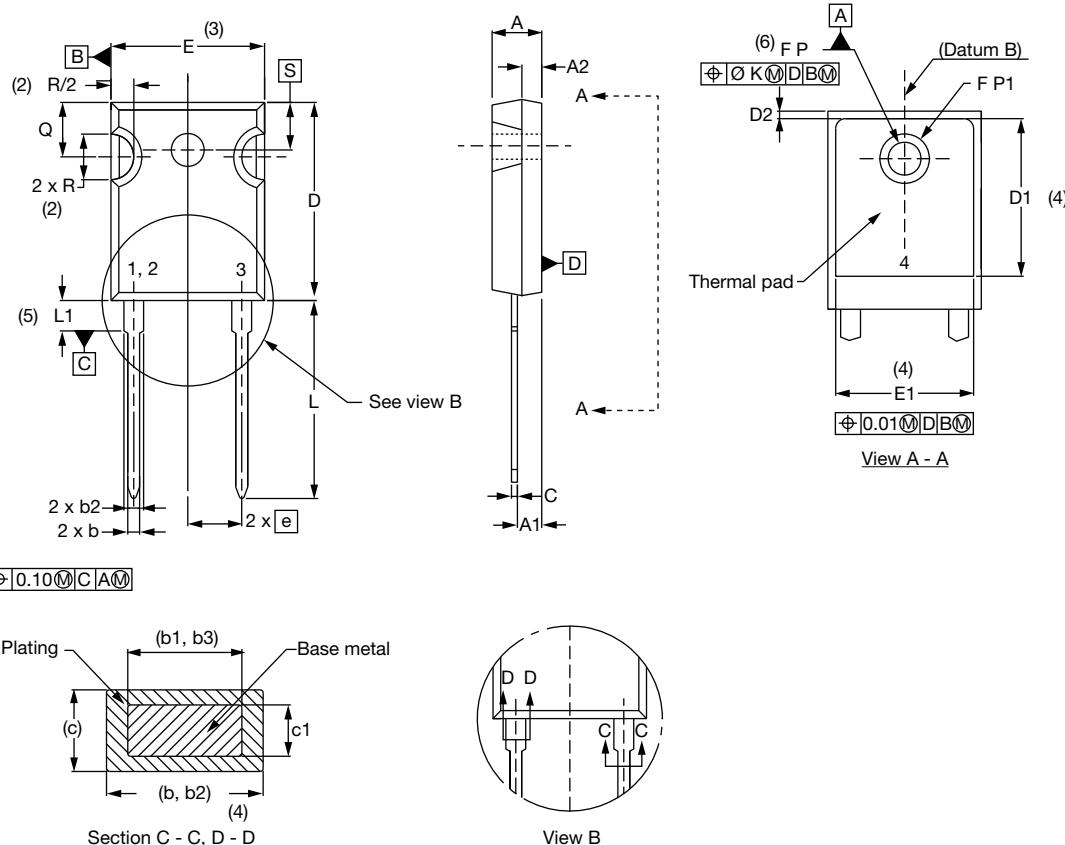
| Device code | VS- | E | 4 | P | U | 60 | 06 | L | H | N3 |
|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 1 | - Vishay Semiconductors product | | | | | | | | | |
| 2 | - Circuit configuration: | | | | | | | | | |
| | E = single diode | | | | | | | | | |
| 3 | - FRED Gen 4 | | | | | | | | | |
| 4 | - P = TO-247 package | | | | | | | | | |
| 5 | - Process type: | | | | | | | | | |
| | U = ultrafast recovery | | | | | | | | | |
| 6 | - Current rating (60 = 60 A) | | | | | | | | | |
| 7 | - Voltage rating (06 = 600 V) | | | | | | | | | |
| 8 | - L = long lead | | | | | | | | | |
| 9 | - H = AEC-Q101 qualified | | | | | | | | | |
| 10 | - Environmental digit: | | | | | | | | | |
| | N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free | | | | | | | | | |

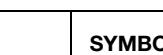
| ORDERING INFORMATION (Example) | | | |
|--------------------------------|-------------------|------------------------|-------------------------|
| PREFERRED P/N | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-E4PU6006LHN3 | 25 | 500 | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS | | |
|----------------------------|-------------|--|
| Dimensions | TO-247AD 2L | www.vishay.com/doc?95536 |
| Part marking information | TO-247AD 2L | www.vishay.com/doc?95648 |

TO-247AD 2L

DIMENSIONS in millimeters and inches



| SYMBOL | MILLIMETERS | | INCHES | | NOTES |  | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|---|------------------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | | MIN. | MAX. | MIN. | MAX. | |
| A | 4.65 | 5.31 | 0.183 | 0.209 | | | E | 15.29 | 15.87 | 0.602 | 0.625 | 3 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 | | | E1 | 13.46 | - | 0.53 | - | |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 | | | e | 5.46 BSC | | 0.215 BSC | | |
| b | 0.99 | 1.40 | 0.039 | 0.055 | | | \varnothing K | 0.254 | | 0.010 | | |
| b1 | 0.99 | 1.35 | 0.039 | 0.053 | | | L | 19.81 | 20.32 | 0.780 | 0.800 | |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 | | | L1 | 3.71 | 4.29 | 0.146 | 0.169 | |
| b3 | 1.65 | 2.34 | 0.065 | 0.092 | | | \varnothing P | 3.56 | 3.66 | 0.14 | 0.144 | |
| c | 0.38 | 0.89 | 0.015 | 0.035 | | | \varnothing P1 | - | 6.98 | - | 0.275 | |
| c1 | 0.38 | 0.84 | 0.015 | 0.033 | | | Q | 5.31 | 5.69 | 0.209 | 0.224 | |
| D | 19.71 | 20.70 | 0.776 | 0.815 | 3 | | R | 4.52 | 5.49 | 0.178 | 0.216 | |
| D1 | 13.08 | - | 0.515 | - | 4 | | S | 5.51 BSC | | 0.217 BSC | | |
| D2 | 0.51 | 1.35 | 0.020 | 0.053 | | | | | | | | |

Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) \varnothing P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4

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