

# Ultrafast Rectifier

## 50 A, 600 V

### RURG5060-F085

#### Description

The RURG5060-F085 is an ultrafast diode with soft recovery characteristics ( $t_{rr} < 90\text{ns}$ ). It has low forward voltage drop and is silicon nitride passivated ionimplanted epitaxial planar construction.

This device is intended for use as a freewheeling/clamping diode and rectifier in a variety of switching power supplies and other power switching applications. Its low stored charge and ultrafast recovery with soft recovery characteristic minimizes ringing and electrical noise in many power switching circuits, thus reducing power loss in the switching transistors.

#### Features

- High Speed Switching ( $t_{rr} = 70\text{ ns (Typ.) @ } I_F = 50\text{ A}$ )
- Low Forward Voltage ( $V_F = 1.6\text{ V (Max.) @ } I_F = 50\text{ A}$ )
- Avalanche Energy Rated
- This Device is Pb-Free
- AEC-Q101 Qualified

#### Applications

- Automotive DCDC Converter
- Automotive On Board Charger
- Switching Power Supply
- Power Switching Circuits

#### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

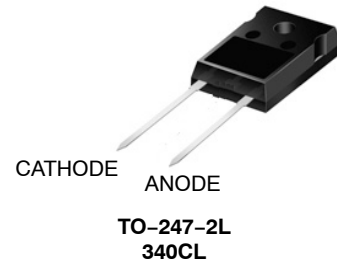
| Rating  | Symbol         | Value          | Unit             |
|---|----------------|----------------|------------------|
| Peak Repetitive Reverse Voltage                                 | $V_{RRM}$      | 600            | V                |
| Working Peak Reverse Voltage                                    | $V_{RWM}$      | 600            | V                |
| DC Blocking Voltage   | $V_R$          | 600            | V                |
| Average Rectified Forward Current<br>@ $T_C = 25^\circ\text{C}$ | $I_{F(AV)}$    | 50             | A                |
| Non-repetitive Peak Surge Current<br>(Halfwave 1 Phase 50 Hz)   | $I_{FSM}$      | 150            | A                |
| Avalanche Energy (1.4 A, 40 mH)                                 | $E_{AVL}$      | 40             | mJ               |
| Operating Junction and Storage<br>Temperature                   | $T_J, T_{STG}$ | -55 to<br>+175 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

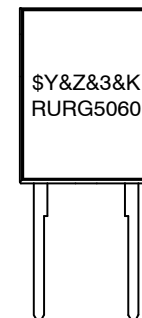


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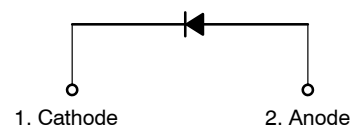
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#### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
 &Z = Assembly Plant Code  
 &3 = Numeric Date Code  
 &K = Lot Code  
 RURG5060 = Specific Device Code



#### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

## RURG5060-F085

### THERMAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol          | Parameter                                       | Max | Units                     |
|-----------------|---|-----|---------------------------|
| $R_{\theta JC}$ | Maximum Thermal Resistance, Junction to Case    | 0.4 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Maximum Thermal Resistance, Junction to Ambient | 45  | $^\circ\text{C}/\text{W}$ |

### PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device        | Package | Tube | Quantity |
|----------------|---------------|---------|------|----------|
| RURG5060       | RURG5060-F085 | TO-247  | -    | 30       |

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol                     | Parameter  | Test Conditions  | Min.                      | Typ. | Max.            | Unit        |   |
|----------------------------|--|--|---------------------------|------|-----------------|-------------|---|
| $I_R$                      | Instantaneous Reverse Current                    | $V_R = 600\text{ V}$   | $T_C = 25^\circ\text{C}$  | -    | -               | 250         | $\mu\text{A}$                             |
|                            |  |  | $T_C = 175^\circ\text{C}$ | -    | -               | 2           | $\text{mA}$                               |
| $V_{FM}$<br>(Note 1)       | Instantaneous Forward Voltage                    | $I_F = 50\text{ A}$  | $T_C = 25^\circ\text{C}$  | -    | 1.28            | 1.6         | $\text{V}$                                |
|                            |  |  | $T_C = 175^\circ\text{C}$ | -    | 1.09            | 1.4         | $\text{V}$                                |
| $t_{rr}$<br>(Note 2)       | Reverse Recovery Time                            | $I_F = 1\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{CC} = 390\text{ V}$  | $T_C = 25^\circ\text{C}$  | -    | 42              | 65          | $\text{ns}$                               |
|                            |  |  | $T_C = 25^\circ\text{C}$  | -    | 70              | 90          | $\text{ns}$                               |
|                            |  |  | $T_C = 175^\circ\text{C}$ | -    | 285             | -           | $\text{ns}$                               |
| $t_a$<br>$t_b$<br>$Q_{rr}$ | Reverse Recovery Time<br>Reverse Recovery Charge | $I_F = 50\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{CC} = 390\text{ V}$ | $T_C = 25^\circ\text{C}$  | -    | 36<br>34<br>112 | -<br>-<br>- | $\text{ns}$<br>$\text{ns}$<br>$\text{nC}$ |
| $E_{AVL}$                  | Avalanche Energy                                 | $I_{AV} = 1.4\text{ A}$ , $L = 40\text{mH}$  |                           | 40   | -               | -           | $\text{mJ}$                               |

1. Pulse : Test Pulse width =  $300\ \mu\text{s}$ , Duty Cycle = 2%

2. Guaranteed by design

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TEST CIRCUITS AND WAVEFORMS

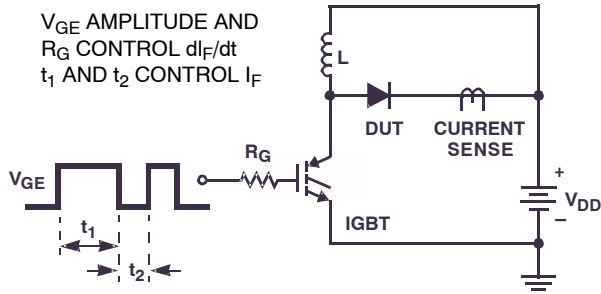


Figure 1.  $T_{rr}$  Test Circuit

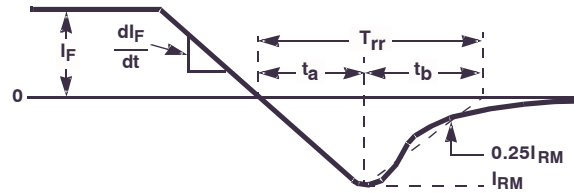


Figure 2.  $T_{rr}$  Waveforms and Definitions

$I = 1.4 \text{ A}$   
 $L = 40 \text{ mH}$   
 $R < 0.1 \Omega$   
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)}/(V_{R(AVL)} - V_{DD})]$   
 $Q_1 = \text{IGBT (} BV_{CES} > \text{DUT } V_{R(AVL)})$

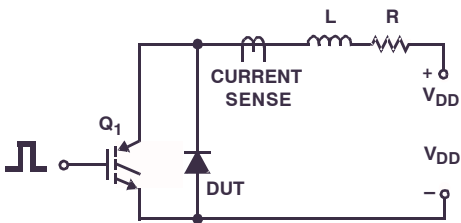


Figure 3. Avalanche Energy Test Circuit

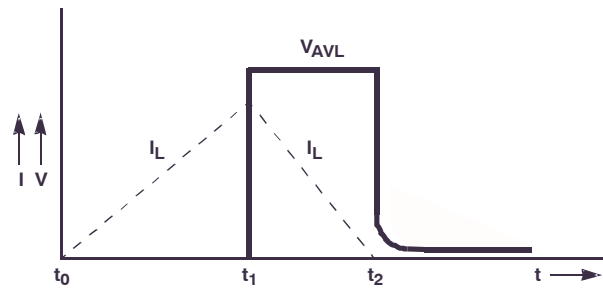


Figure 4. Avalanche Current and Voltage Waveforms

TYPICAL PERFORMANCE CHARECTERISTICS

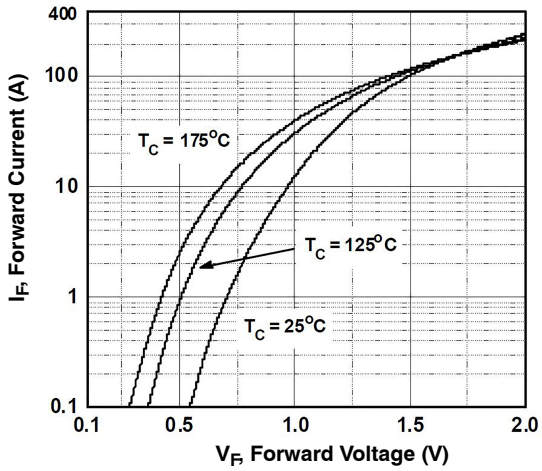


Figure 5. Typical Forward Voltage Drop vs. Forward Current

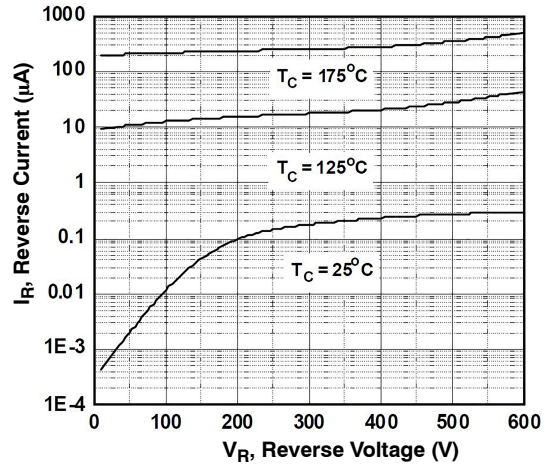


Figure 6. Typical Reverse Current vs. Reverse Voltage

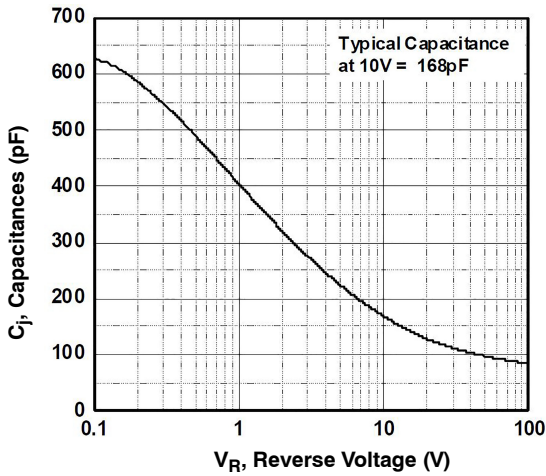


Figure 7. Typical Junction Capacitance

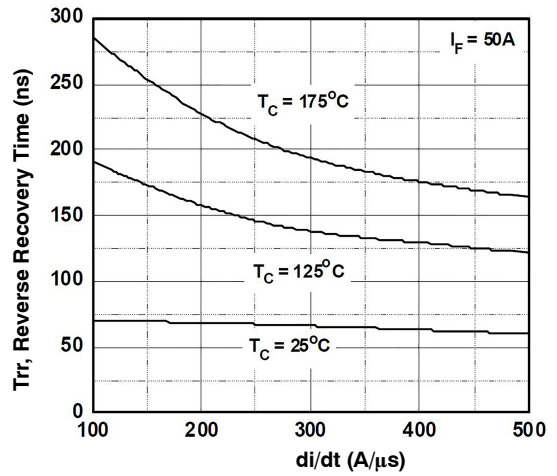


Figure 8. Typical Reverse Recovery Time vs. di/dt

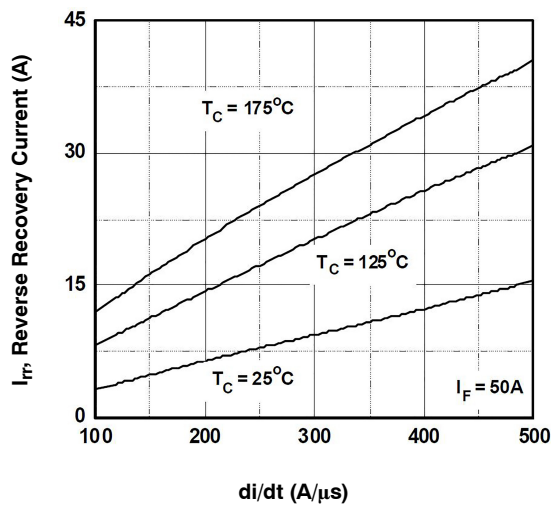


Figure 9. Typical Reverse Recovery Current vs. di/dt

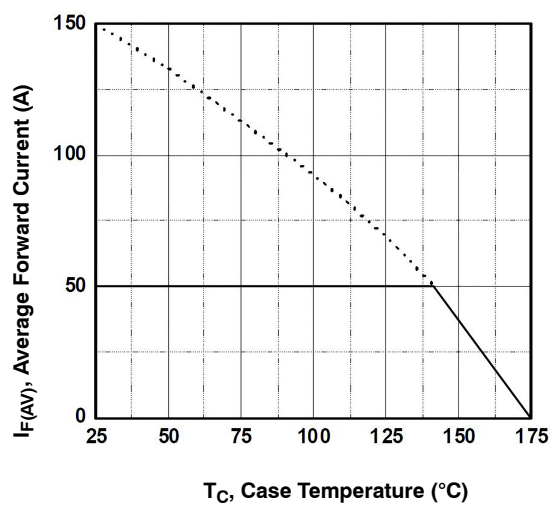


Figure 10. Forward Current Derating Curve

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

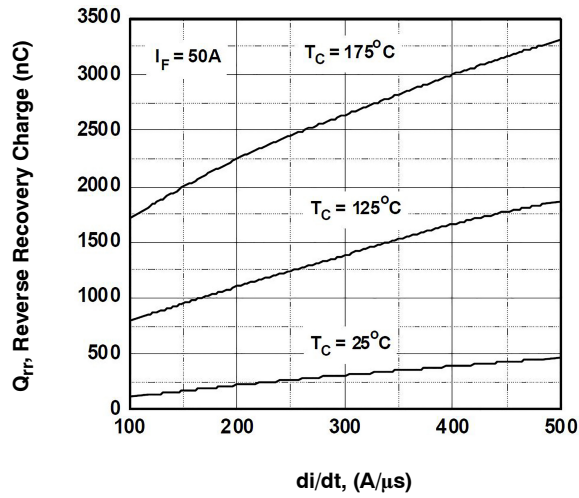


Figure 11. Reverse Recovery Charge

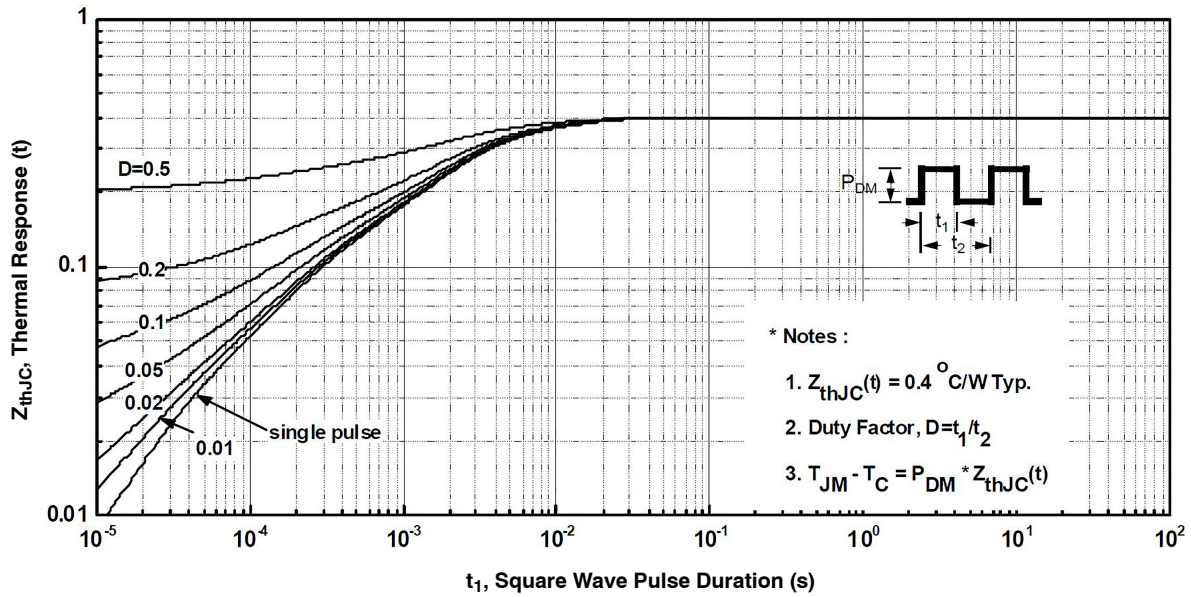


Figure 12. Transient Thermal Response Curve

# MECHANICAL CASE OUTLINE

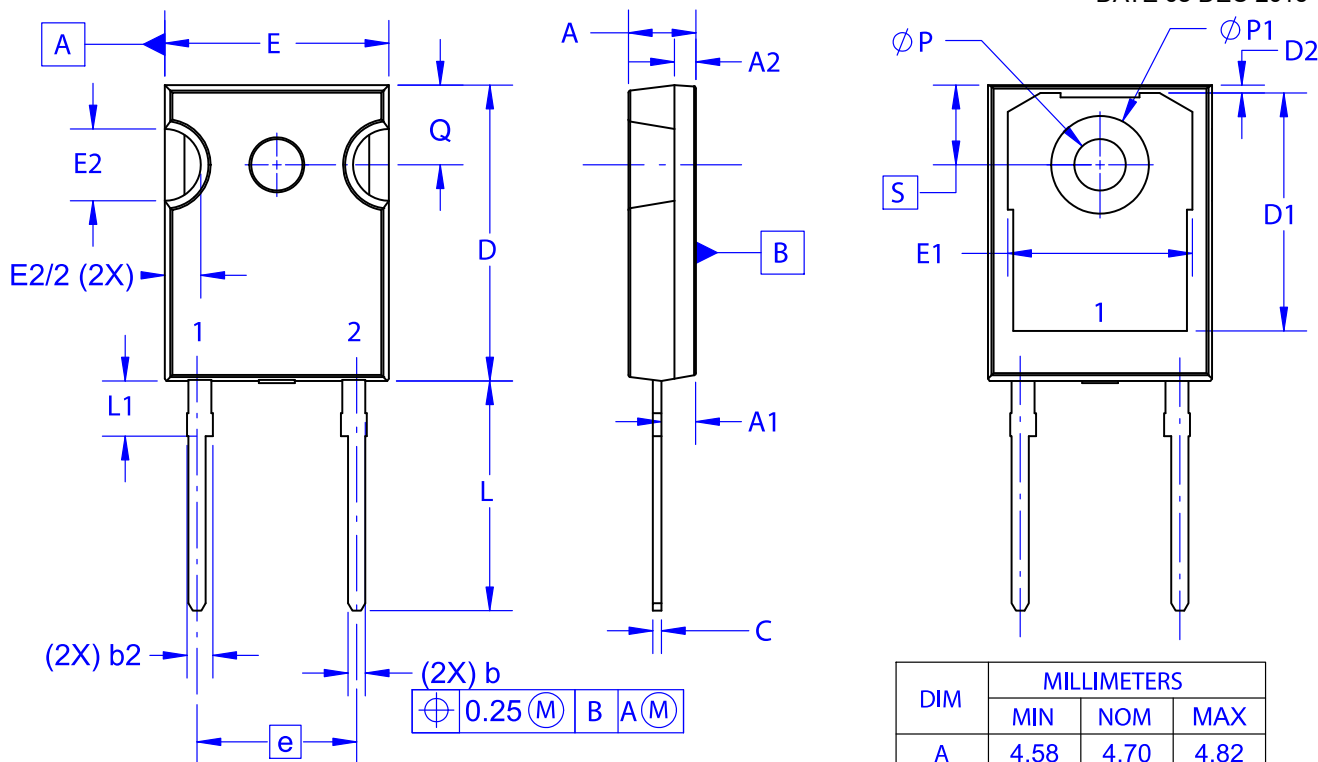
## PACKAGE DIMENSIONS

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TO-247-2LD  
CASE 340CL  
ISSUE A

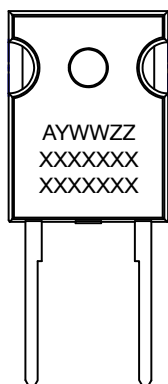
DATE 03 DEC 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

### GENERIC MARKING DIAGRAM\*



XXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN         | NOM   | MAX   |
| A   | 4.58        | 4.70  | 4.82  |
| A1  | 2.29        | 2.40  | 2.66  |
| A2  | 1.30        | 1.50  | 1.70  |
| b   | 1.17        | 1.26  | 1.35  |
| b2  | 1.53        | 1.65  | 1.77  |
| c   | 0.51        | 0.61  | 0.71  |
| D   | 20.32       | 20.57 | 20.82 |
| D1  | 16.37       | 16.57 | 16.77 |
| D2  | 0.51        | 0.93  | 1.35  |
| E   | 15.37       | 15.62 | 15.87 |
| E1  | 12.81       | ~     | ~     |
| E2  | 4.96        | 5.08  | 5.20  |
| e   | ~           | 11.12 | ~     |
| L   | 15.75       | 16.00 | 16.25 |
| L1  | 3.69        | 3.81  | 3.93  |
| ∅P  | 3.51        | 3.58  | 3.65  |
| ∅P1 | 6.61        | 6.73  | 6.85  |
| Q   | 5.34        | 5.46  | 5.58  |
| S   | 5.34        | 5.46  | 5.58  |

|                         |                    |  |
|-------------------------|--------------------|--|
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