

APT60DQ60BG
Datasheet
Ultra-Fast Soft Recovery Rectifier Diode

Final
October 2017



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1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision C

Revision C was published in October 2017. The following is a summary of the changes in revision C of this document.

- The product overview was updated. For more information, see [Product Overview \(see page 2\)](#).
- The static characteristics was updated. For more information, see [Table 3 \(see page 3\)](#).
- The package outline drawing was updated. For more information, see [Package Outline Drawing \(see page 8\)](#).

1.2 Revision B

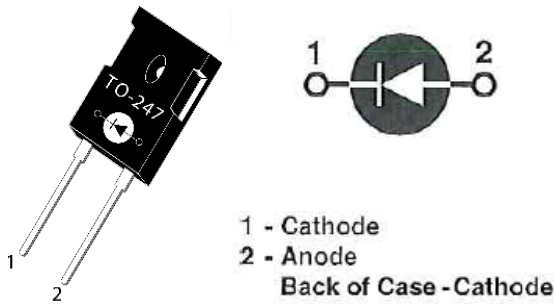
Revision B was published in July 2006. The following is a summary of the changes in revision B of this document.

- The product features was updated. For more information, see [Product Overview \(see page 2\)](#).
- The leakage current was updated. For more information, see [Table 3 \(see page 3\)](#).

1.3 Revision A

Revision A was published in December 2004. It is the first publication of this document.

2 Product Overview



2.1 Features

The following are key features of the APT60DQ60BG device:

- Ultra-fast recovery times
- Soft recovery characteristics
- Low forward voltage
- Low leakage current
- Avalanche energy rated
- Popular TO-247 package
- RoHS compliant
- AEC-Q101 qualified

2.2 Benefits

The following are benefits of the APT60DQ60BG device:

- Higher switching frequency
- Low switching losses
- Low noise (EMI) switching
- Easy to parallel
- Improved system reliability

2.3 Applications

The APT60DQ60BG device is designed for the following applications:

- PFC
 - Continuous conduction mode
- Freewheeling diode
 - Inverters
 - Hard- or soft-switched high frequency SMPS
- Clamp diode
 - Single- and two-switch forward
 - Bridge circuits
- Fast output rectifier
 - High output voltage SMPS

3 Electrical Specifications

This section details the electrical specifications for the APT60DQ60BG device.

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the APT60DQ60BG device.

All Ratings: $T_c = 25\text{ }^\circ\text{C}$ unless otherwise specified.

Table 1 • Absolute Maximum Ratings

| Symbol | Parameter | Ratings | Unit |
|----------------|---|------------|------------------|
| V_R | Maximum DC reverse voltage | 600 | V |
| V_{RRM} | Maximum peak repetitive reverse voltage | | |
| V_{RWM} | Maximum working peak reverse voltage | | |
| $I_{F(AV)}$ | Maximum average forward current ($T_c = 110\text{ }^\circ\text{C}$, duty cycle = 0.5) | 60 | A |
| $I_{F(RMS)}$ | RMS forward current (square wave, 50% duty) | 94 | |
| I_{FSM} | Non-repetitive forward surge current ($T_j = 45\text{ }^\circ\text{C}$, 8.3 ms) | 600 | |
| E_{AVL} | Avalanche energy (1 A, 40 mH) | 20 | mJ |
| T_j, T_{STG} | Operating and storage temperature range | -55 to 175 | $^\circ\text{C}$ |
| T_L | Lead temperature for 10 seconds | 300 | |

The following table shows the thermal and mechanical characteristics of the APT60DQ60BG device.

Table 2 • Thermal and Mechanical Characteristics

| Symbol | Characteristic | Min | Typ | Max | Unit |
|-----------------|-------------------------------------|-----|------|------|---------------------------|
| $R_{\theta JC}$ | Junction-to-case thermal resistance | | | 0.44 | $^\circ\text{C}/\text{W}$ |
| W_T | Package weight | | 0.22 | | oz |
| | | | 5.9 | | g |
| Torque | Maximum mounting torque | | | 10 | lb-in |
| | | | | 1.1 | N-m |

3.2 Electrical Performance

The following table shows the static characteristics of the APT60DQ60BG device.

Table 3 • Static Characteristics

| Symbol | Characteristic/Test Conditions | Min | Typ | Max | Unit |
|----------|--|---|------|-----|---------------|
| V_F | Forward Voltage | $I_F = 60\text{ A}$ | 2.0 | 2.4 | V |
| | | $I_F = 120\text{ A}$ | 2.44 | | |
| | | $I_F = 60\text{ A}, T_j = 125\text{ }^\circ\text{C}$ | 1.7 | | |
| I_{RM} | Maximum reverse leakage current | $V_R = 600\text{ V}$ | | 25 | μA |
| | | $V_R = 600\text{ V}, T_j = 125\text{ }^\circ\text{C}$ | | 500 | |
| C_j | Junction capacitance, $V_R = 200\text{ V}$ | | 75 | | pF |

3.3 Dynamic Characteristics

The following table shows the dynamic characteristics of the APT60DQ60BG device.

Table 4 • Dynamic Characteristics

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|-----------|----------------------------------|--|-----|------|-----|------|
| t_{rr} | Reverse recovery time | $I_F = 1\text{ A}$, $di_F/dt = -100\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ | | 26 | | ns |
| t_{rr} | Reverse recovery time | $I_F = 60\text{ A}$, $di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$, $T_c = 25\text{ }^\circ\text{C}$ | | 35 | | |
| Q_{rr} | Reverse recovery charge | | | 45 | | nC |
| I_{RRM} | Maximum reverse recovery current | | | 4 | | A |
| t_{rr} | Reverse recovery time | $I_F = 60\text{ A}$, $di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$, $T_c = 125\text{ }^\circ\text{C}$ | | 175 | | ns |
| Q_{rr} | Reverse recovery charge | | | 680 | | nC |
| I_{RRM} | Maximum reverse recovery current | | | 8 | | A |
| t_{rr} | Reverse recovery time | $I_F = 60\text{ A}$, $di_F/dt = -1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$, $T_c = 125\text{ }^\circ\text{C}$ | | 100 | | ns |
| Q_{rr} | Reverse recovery charge | | | 1380 | | nC |
| I_{RRM} | Maximum reverse recovery current | | | 26 | | A |

3.4 Typical Performance Curves

This section shows the typical performance curves for the APT60DQ60BG device.

Figure 1 • Maximum Transient Thermal Impedance

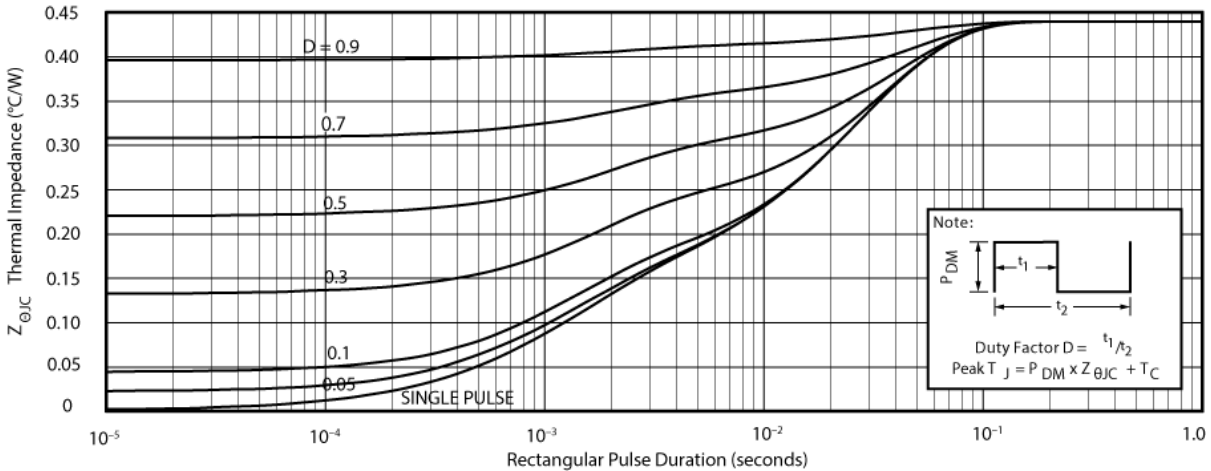
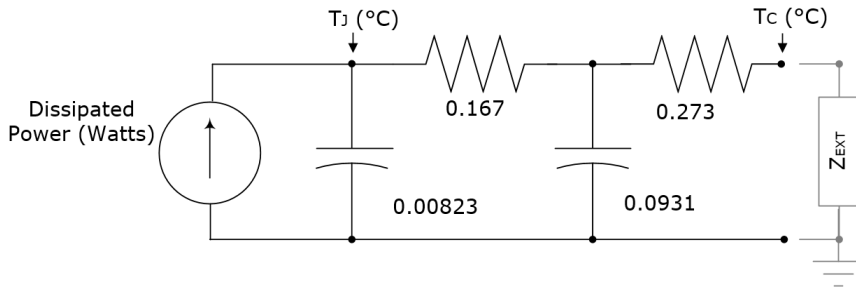


Figure 2 • Transient Thermal Impedance Model



Note: Z_{EXT} are the external thermal impedances (case to sink, sink to ambient, etc.). Set to zero when modeling only the case to junction.

Figure 3 • Forward Current vs. Forward Voltage

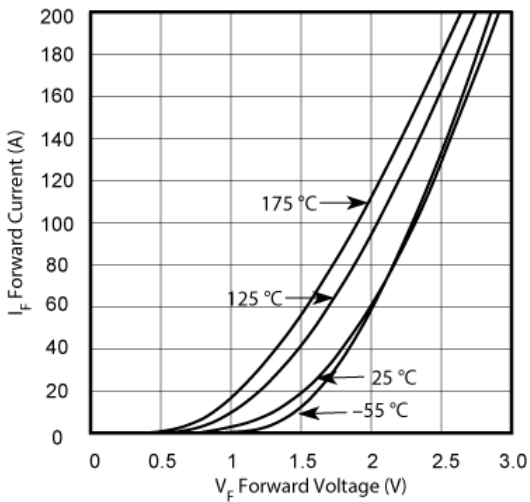


Figure 4 • t_{rr} vs. Current Rate of Change

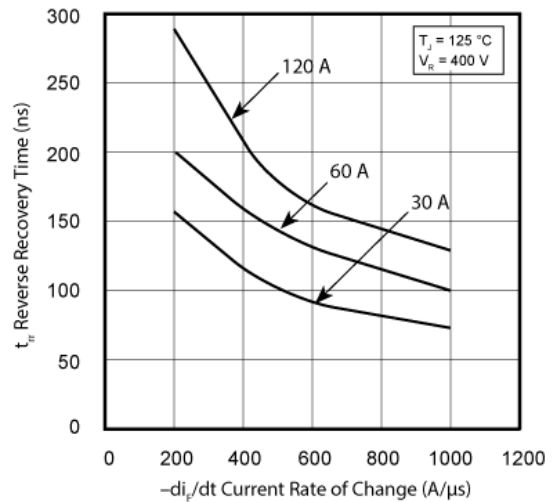


Figure 5 • Q_{rr} vs. Current Rate of Change

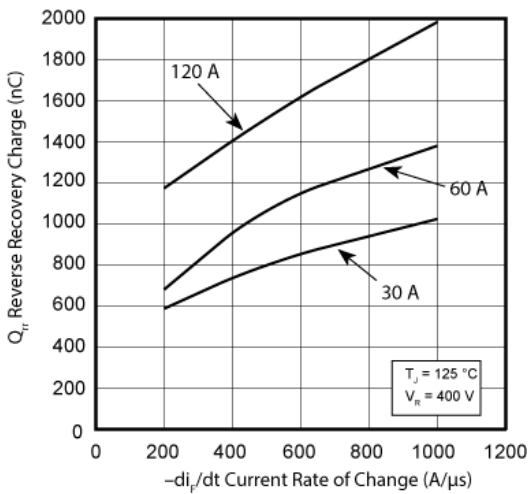


Figure 6 • IRRM vs. Current Rate of Change

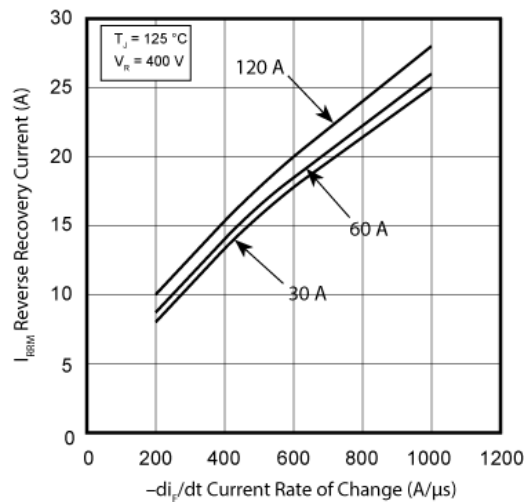


Figure 7 • Dynamic Parameters vs. Junction Temperature

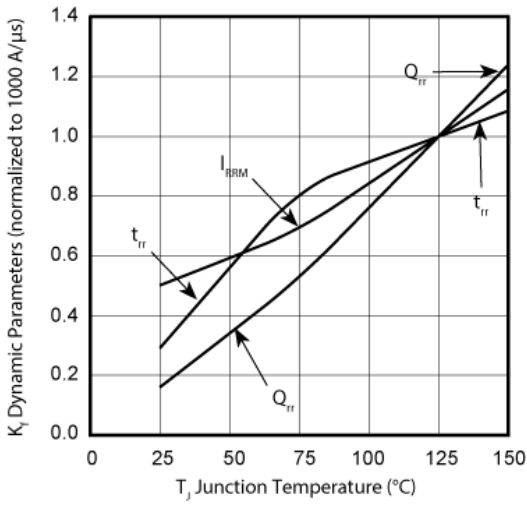


Figure 8 • Maximum Average Forward Current vs. Case Temperature

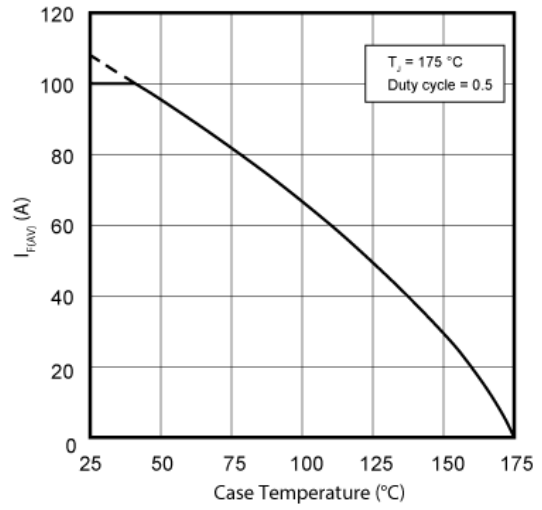
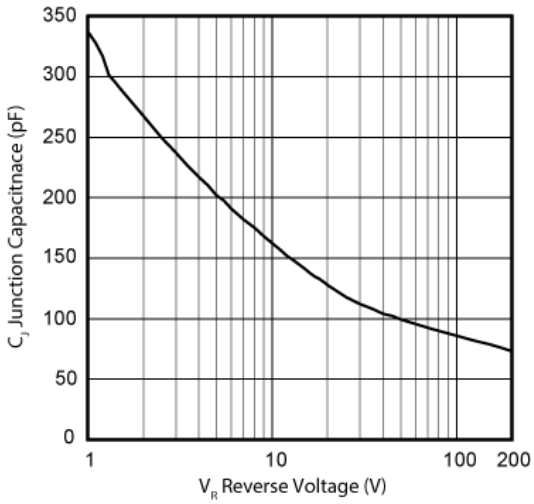
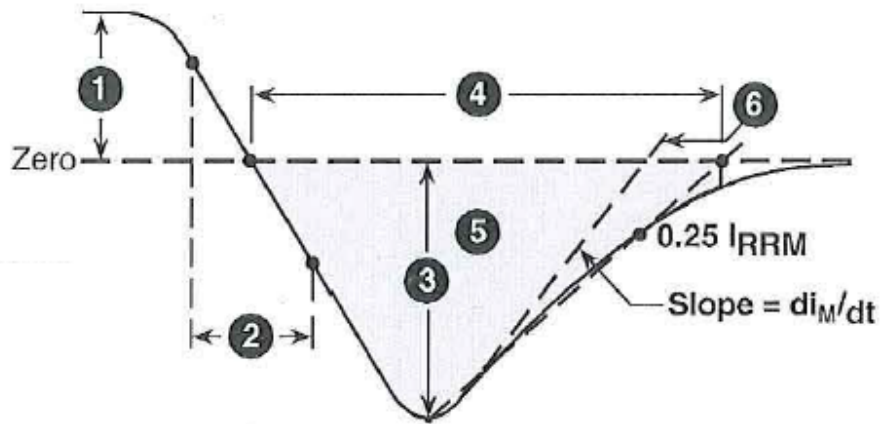


Figure 9 • Junction Capacitance vs. Reverse Voltage



The following illustration shows the diode reverse recovery waveform and definitions for the APT60DQ60BG device.

Figure 10 • Diode Reverse Recovery Waveform and Definitions



1. I_F —Forward conduction current.
2. di_F/dt —Rate of diode current change through zero crossing.
3. I_{RRM} —Maximum reverse recovery current.
4. t_{rr} —Reverse recovery time, measured from zero crossing where diode current goes from positive to negative, to the point at which the straight line through I_{RRM} and $0.25 \times I_{RRM}$ passes through zero.
5. Q_{rr} —Area under the curve defined by I_{RRM} and t_{rr} .
6. di_M/dt —Maximum rate of current increase during the trailing portion of t_{rr} .

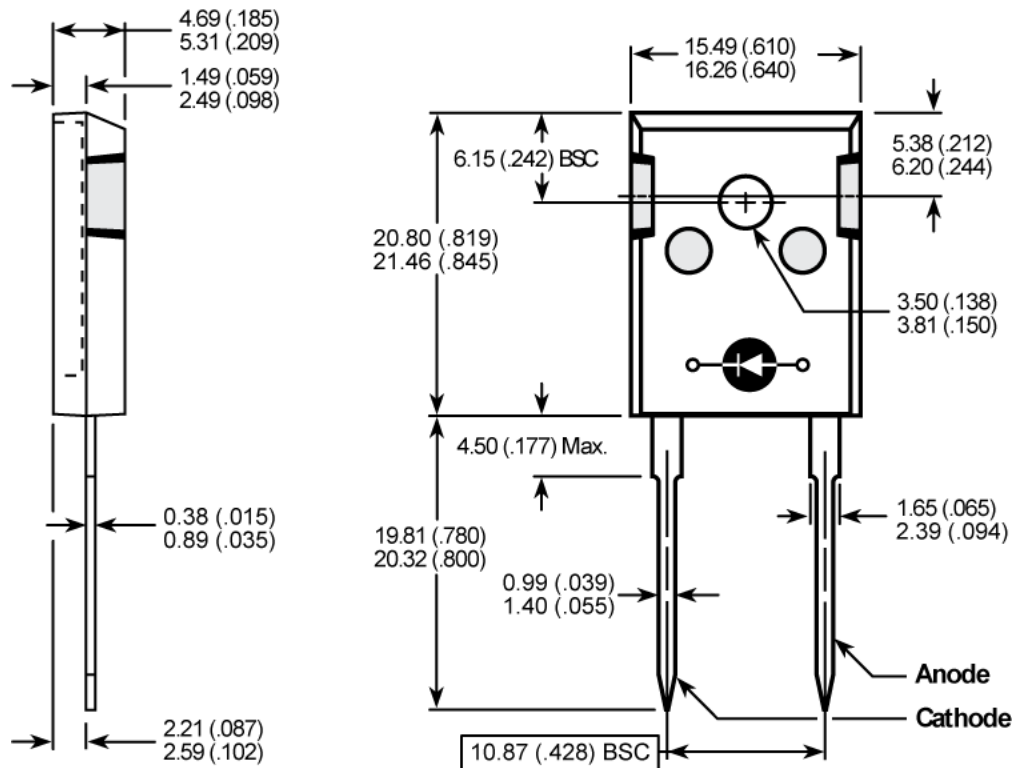
4 Package Specification

This section outlines the package specification for the APT60DQ60BG device.

4.1 Package Outline Drawing

This section details the TO-247 package drawing of the APT60DQ60BG device. Dimensions are in millimeters and (inches).

Figure 11 • Package Outline Drawing



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