

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

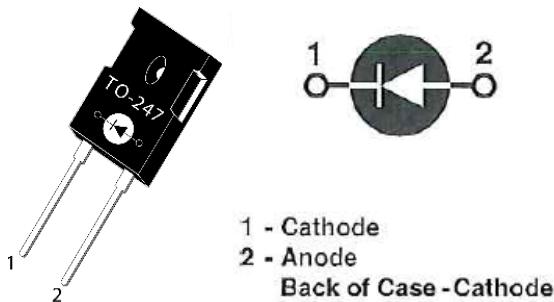
Revision B was published in July 2006. The following is a summary of the changes in revision B of this document.

- 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: $T_c = 25^\circ\text{C}$ 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 ($T_c = 110^\circ\text{C}$, duty cycle = 0.5)	60	A
$I_{F(RMS)}$	RMS forward current (square wave, 50% duty)	94	
I_{FSM}	Non-repetitive forward surge current ($T_j = 45^\circ\text{C}$, 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_{eic}	Junction-to-case thermal resistance		0.44		$^\circ\text{C/W}$
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
				2.44	
		$I_F = 60 \text{ A}, T_j = 125^\circ\text{C}$	1.7		
I_{RM}	Maximum reverse leakage current	$V_R = 600 \text{ V}, T_j = 125^\circ\text{C}$	25	500	μA
C_J	Junction capacitance, $V_R = 200 \text{ V}$	75		500	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	$I_F = 1 \text{ A}$, $dI_F/dt = -100 \text{ A}/\mu\text{s}$ $V_R = 30 \text{ V}$, $T_J = 25^\circ\text{C}$	26			ns
t_{rr}	Reverse recovery time	$I_F = 60 \text{ A}$, $dI_F/dt = -200 \text{ A}/\mu\text{s}$ $V_R = 400 \text{ V}$, $T_c = 25^\circ\text{C}$	35			
Q_{rr}	Reverse recovery charge	$V_R = 400 \text{ V}$, $T_c = 25^\circ\text{C}$	45			nC
I_{RRM}	Maximum reverse recovery current		4			A
t_{rr}	Reverse recovery time	$I_F = 60 \text{ A}$, $dI_F/dt = -200 \text{ A}/\mu\text{s}$ $V_R = 400 \text{ V}$, $T_c = 125^\circ\text{C}$	175			ns
Q_{rr}	Reverse recovery charge	$V_R = 400 \text{ V}$, $T_c = 125^\circ\text{C}$	680			nC
I_{RRM}	Maximum reverse recovery current		8			A
t_{rr}	Reverse recovery time	$I_F = 60 \text{ A}$, $dI_F/dt = -1000 \text{ A}/\mu\text{s}$ $V_R = 400 \text{ V}$, $T_c = 125^\circ\text{C}$	100			ns
Q_{rr}	Reverse recovery charge	$V_R = 400 \text{ V}$, $T_c = 125^\circ\text{C}$	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

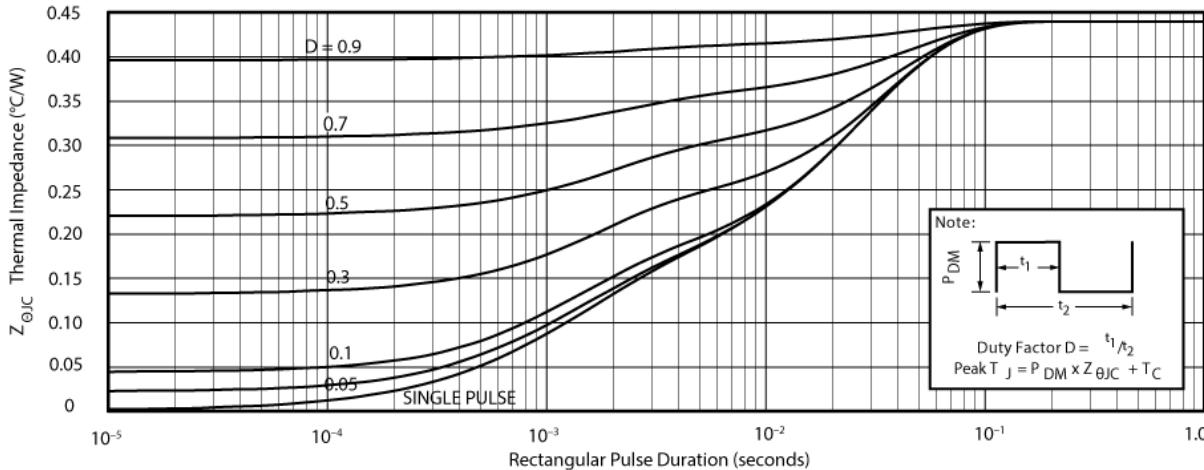
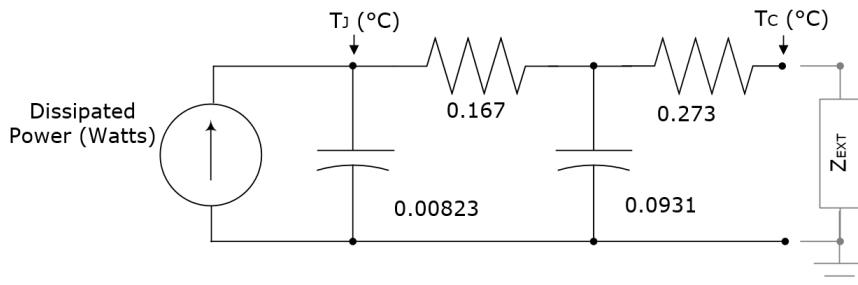


Figure 2 • Transient Thermal Impedance Model

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.

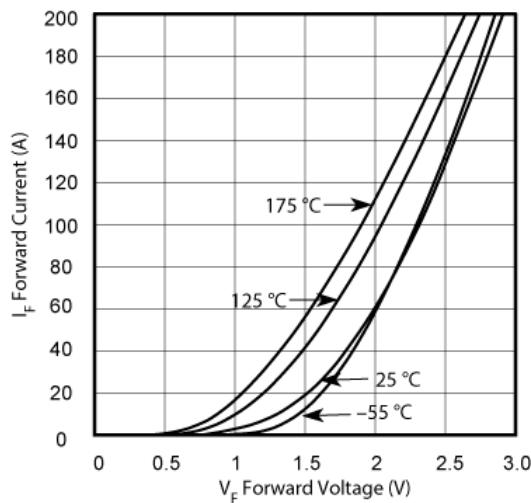
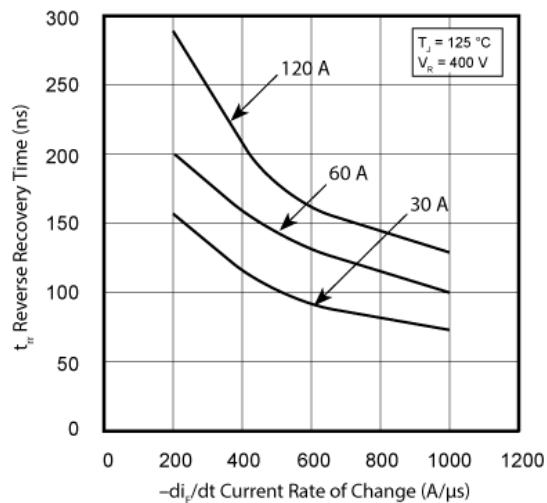
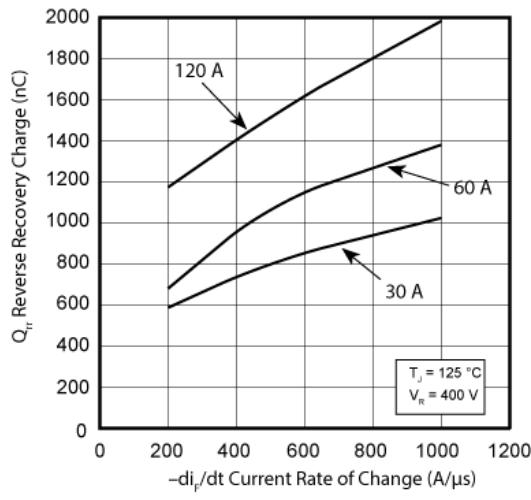
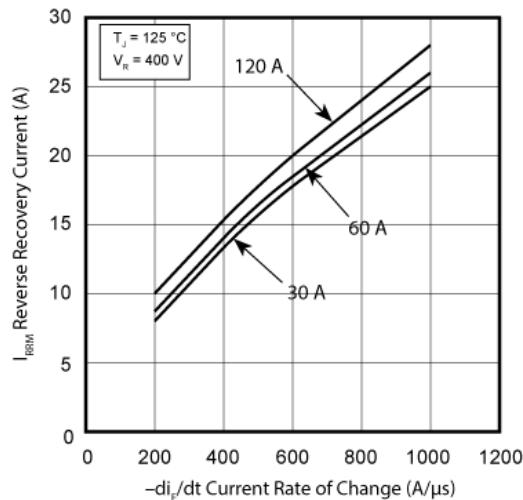
Figure 3 • Forward Current vs. Forward Voltage**Figure 4 • trr vs. Current Rate of Change****Figure 5 • Qrr vs. Current Rate of Change****Figure 6 • IRRM vs. Current Rate of Change**

Figure 7 • Dynamic Parameters vs. Junction Temperature

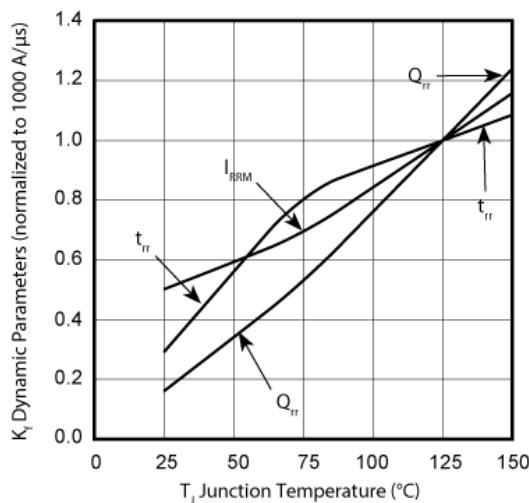


Figure 8 • Maximum Average Forward Current vs. Case Temperature

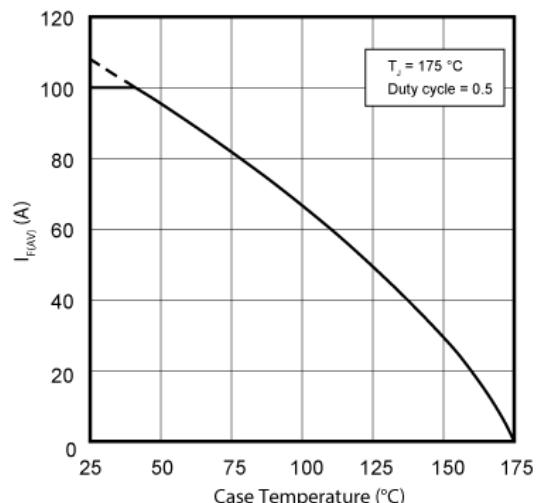
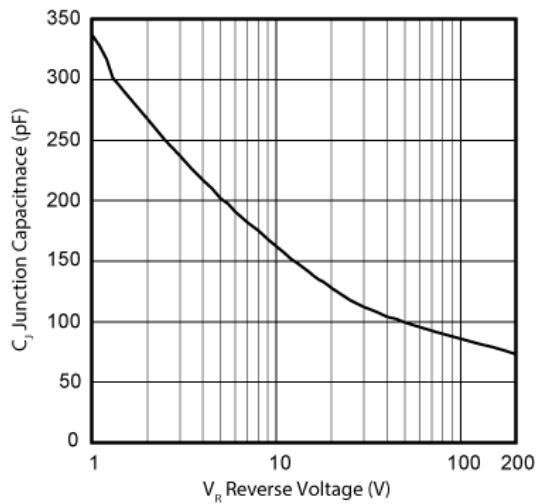
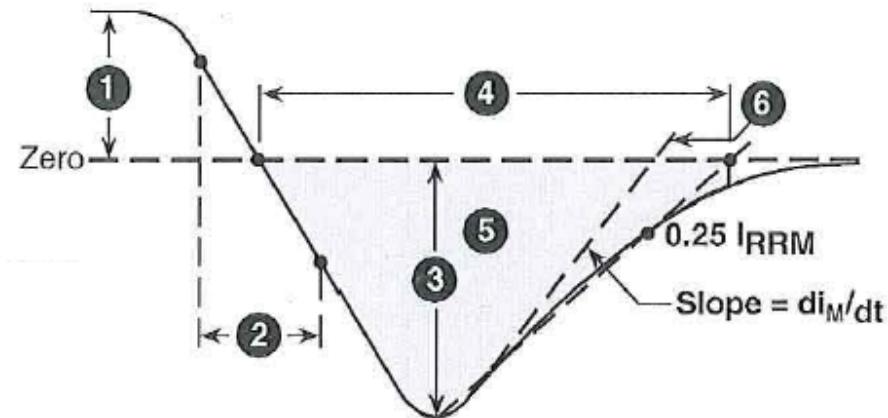


Figure 9 • Junction Capacitance vs. Reverse Voltage



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 × 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}.

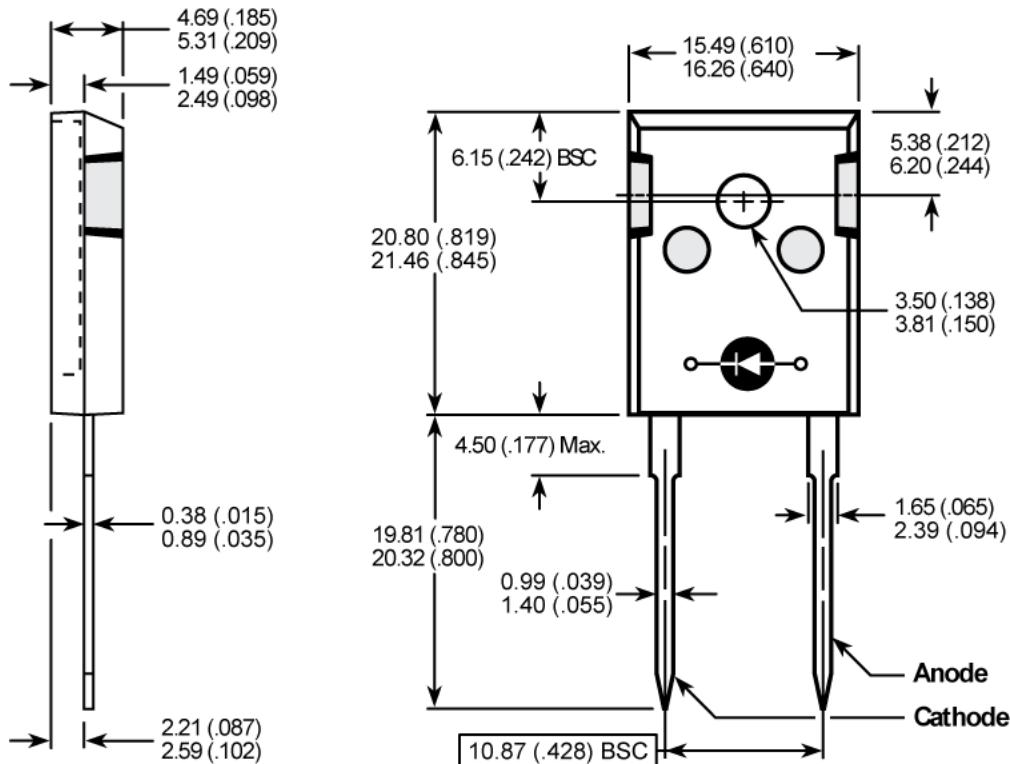
4 Package Specification

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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