APT60DQ60BG

Datasheet

Ultra-Fast Soft Recovery Rectifier Diode

Final

October 2017

Microsemi

Power Matters.™

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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

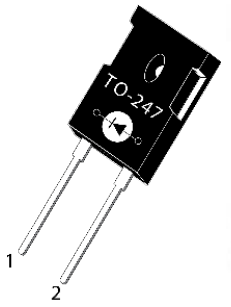
Revision B was published in July 2006. The following is a summary of the changes in revision B of this document.

- 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



1 - Cathode
2 - Anode
Back of Case - Cathode

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 °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 °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 °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	°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	°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 A		2.0	2.4	V
		I_F = 120 A		2.44		
		I_F = 60 A, T_J = 125 °C		1.7		
I_{RM}	Maximum reverse leakage current	V_R = 600 V			25	µA
		V_R = 600 V, T_J = 125 °C			500	
C_J	Junction capacitance, V_R = 200 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 A, di_F/dt = –100 A/µs V_R = 30 V, T_J = 25 °C		26		ns
t_{rr}	Reverse recovery time	I_F = 60 A, di_F/dt = –200 A/µs V_R = 400 V, T_C = 25 °C		35		
Q_{rr}	Reverse recovery change			45		nC
I_{RRM}	Maximum reverse recovery current			4		A
t_{rr}	Reverse recovery time	I_F = 60 A, di_F/dt = –200 A/µs V_R = 400 V, T_C = 125 °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 A, di_F/dt = –1000 A/µs V_R = 400 V, T_C = 125 °C		100		ns
Q_{rr}	Reverse recovery change			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

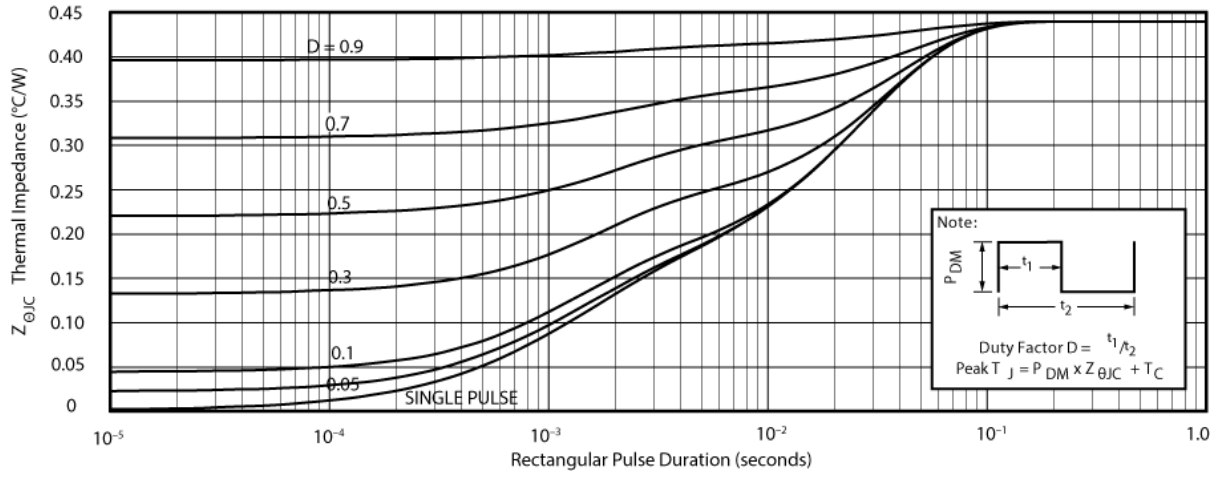
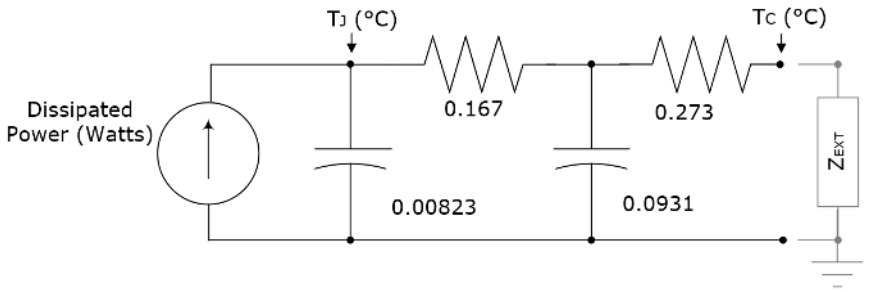


Figure 2 • Transient Thermal Impedance Model



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

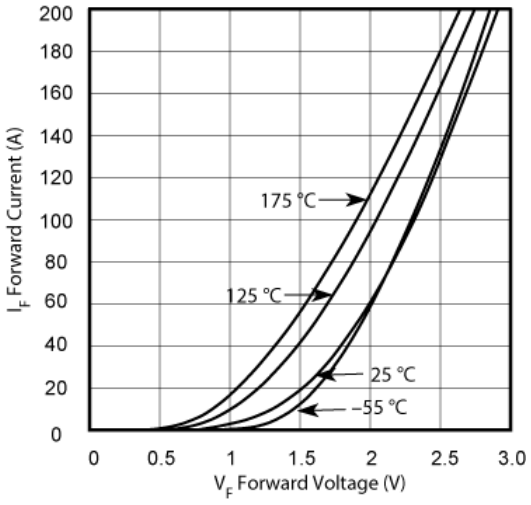


Figure 4 • trr vs. Current Rate of Change

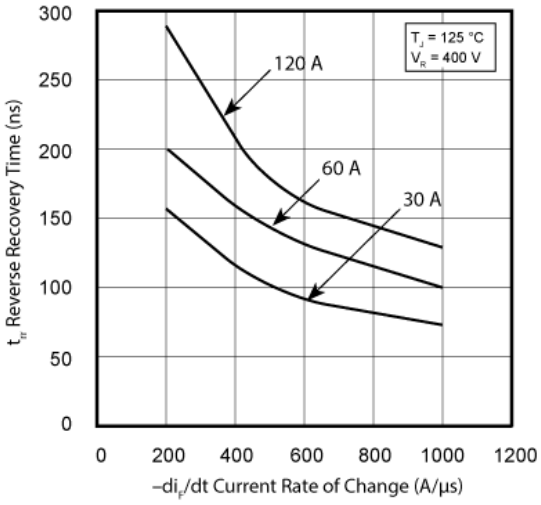


Figure 5 • Qrr vs. Current Rate of Change

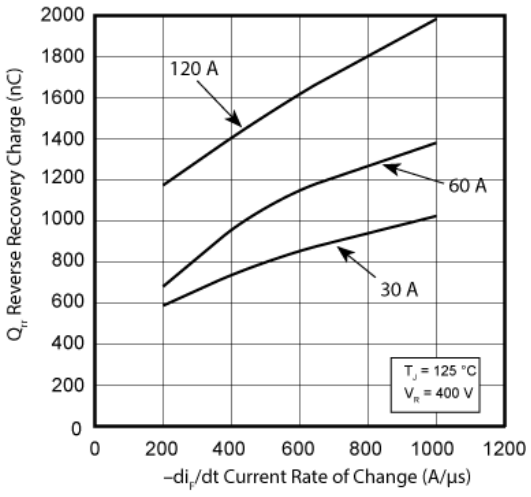


Figure 6 • IRRM vs. Current Rate of Change

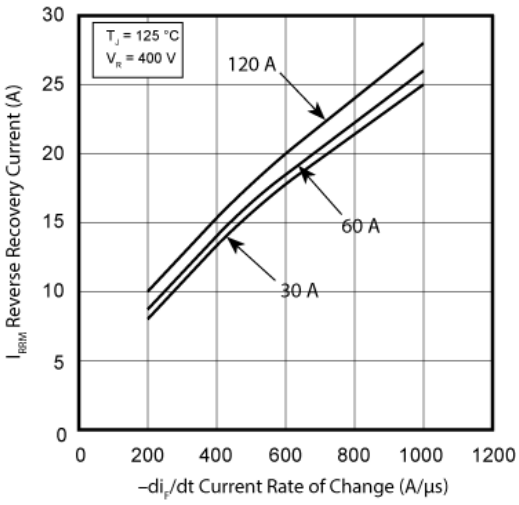


Figure 7 • Dynamic Parameters vs. Junction Temperature

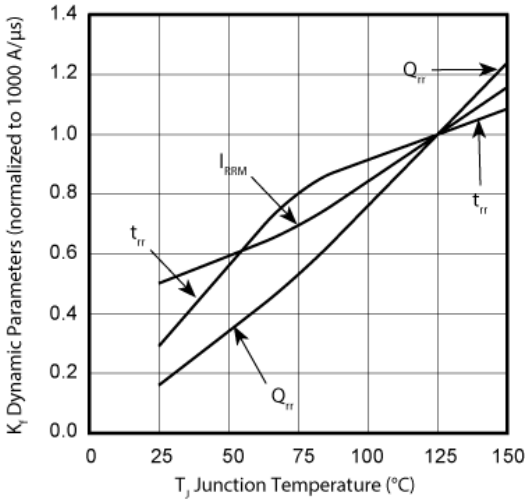


Figure 8 • Maximum Average Forward Current vs. Case Temperature

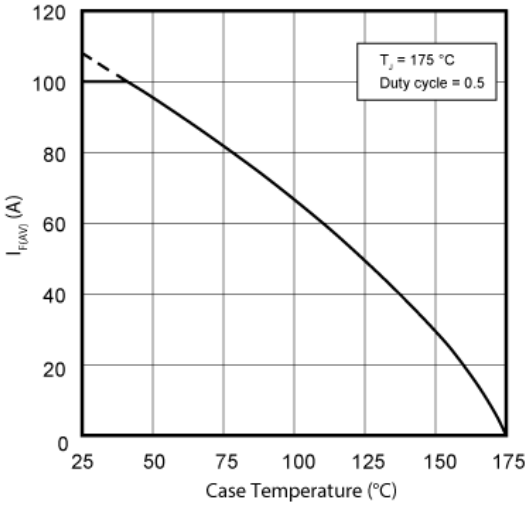
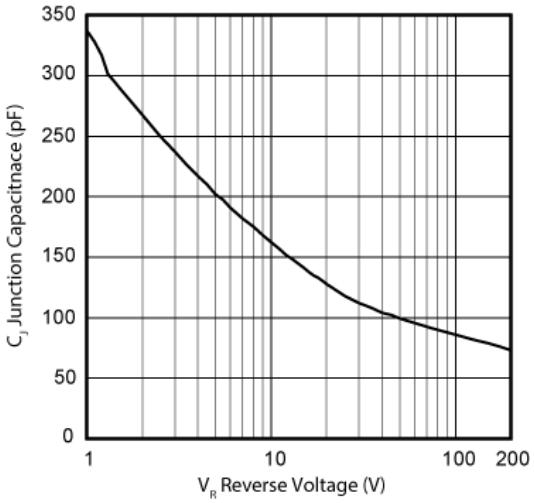
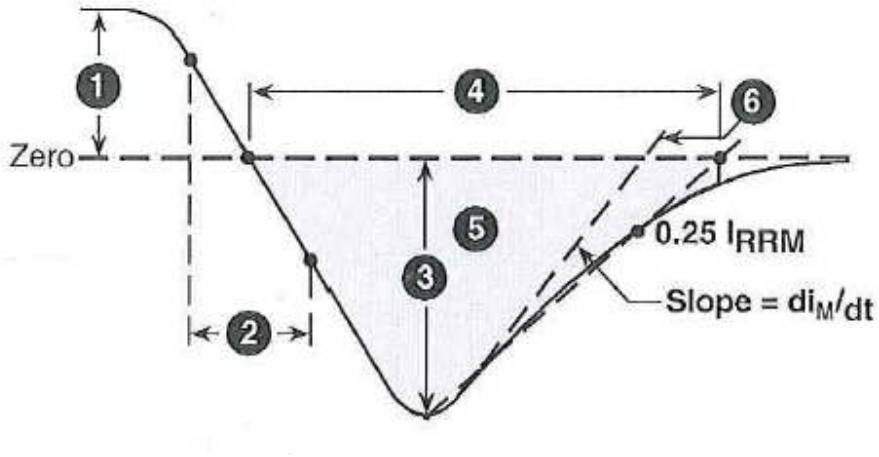


Figure 9 • Junction Capacitance vs. Reverse Voltage



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}.

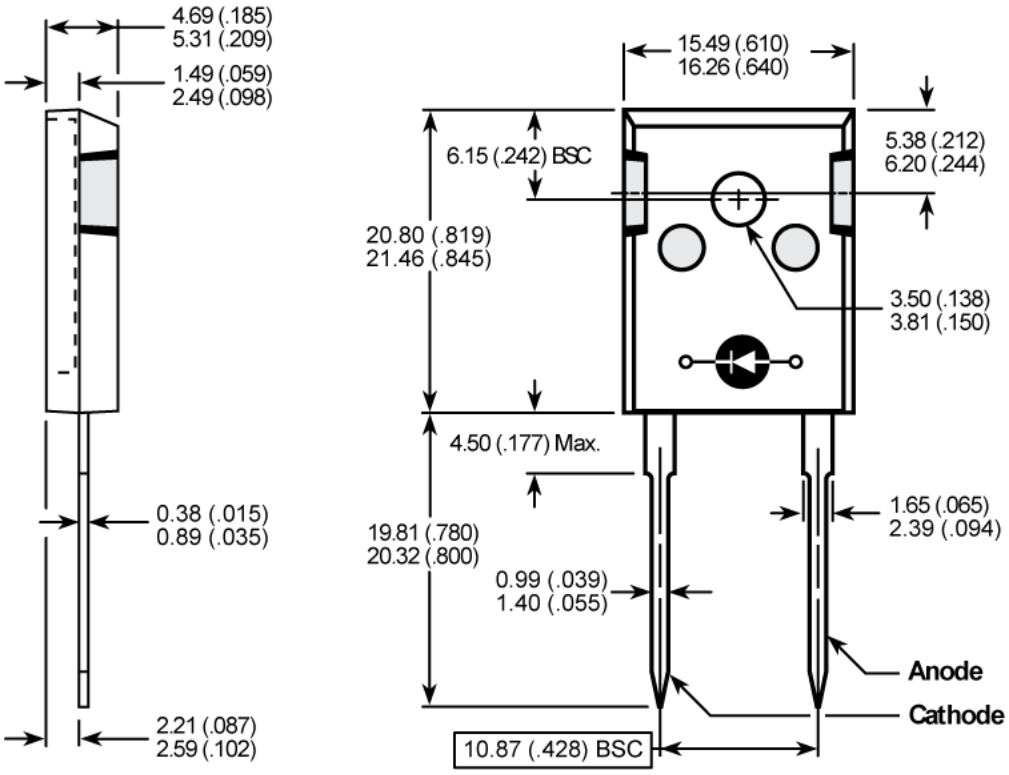
4 Package Specification

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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