APT30DQ60BG

Datasheet

Ultrafast Soft Recovery Rectifier Diode

Final

March 2018

Microsemi

Power Matters.™

Contents

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 E

Revision E was published in March 2018. The new Microsemi template and format was applied. The package outline drawing was updated. For more information, see Package Outline Drawing (see page 8).

1.2 Revision D

Revision D was published in May 2011. The patent information was removed from the document. For TO-247 packages: the maximum lead thickness was changed from 0.70 in (0.031 mm) to 1.016 in (0.040 mm).

1.3 Revision C

Revision C was published in July 2010. The update included adding E1 and E3 notes to the back page.

1.4 Revision B

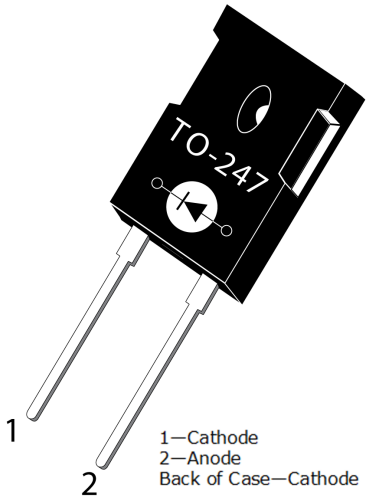
Revision B was published in December 2005. Information was updated to add full characterization for the small die DQ 30A 600 V.

1.5 Revision A

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

2 Product Overview

This section outlines the product overview for the APT30DQ60BG device.



2.1 Features

The following are key features of the APT30DQ60BG device:

- Ultrafast recovery times
- Soft recovery characteristics
- Low forward voltage
- Low leakage current
- Avalanche energy rated
- RoHS compliant
- AEC-Q101 qualified

2.2 Benefits

The following are benefits of the APT30DQ60BG device:

- High switching frequency
- Low switching losses
- Low noise (EMI) switching
- Higher reliability systems
- Increased system power density

2.3 Applications

The APT30DQ60BG device is designed for the following applications:

- Power factor correction (PFC)
- Anti-parallel diode
  - Switch-mode power supply
  - Inverters/converters
  - Motor controllers
- Freewheeling diode
  - Switch-mode power supply
  - Inverters/converters
- Snubber/clamp diode

3 Electrical Specifications

This section outlines the electrical specifications for the APT30DQ60BG device.

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the APT30DQ60BG device.

All ratings: T_C = 25 °C unless otherwise specified.

Table 1 • Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_R	Maximum DC reverse voltage	600	V
V_{RRM}	Maximum peak repetitive reverse voltage	600	
V_{RWM}	Maximum working peak reverse voltage	600	
$I_{F(AV)}$	Maximum average forward current (T_C = 117 °C, duty cycle = 0.5)	30	A
$I_{F(RMS)}$	RMS forward current	51	
I_{FSM}	Non-repetitive forward surge current (T_J = 45 °C, 8.3 ms)	320	
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 s	300	

3.2 Electrical Performance

The following table shows the static electrical characteristics of the APT30DQ60BG device.

Table 2 • Static Electrical Characteristics

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	Unit
V_F	Forward voltage	I_F = 30 A		2.0	2.4	V
		I_F = 60 A		2.4		
		I_F = 30 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_T	Junction capacitance	V_R = 200 V		36		pF

The following table shows the dynamic characteristics of the APT30DQ60BG device.

Table 3 • Dynamic Characteristics

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	Unit
t_{rr}	Reverse recovery time	I_F = 30 A di_F/dt = –200 A/µs V_R = 400 V T_C = 25 °C		23		ns
t_{rr}	Reverse recovery time	I_F = 30 A di_F/dt = –200 A/µs V_R = 400 V T_C = 25 °C		30		
Q_{rr}	Reverse recovery charge			55		nC
I_{RRM}	Maximum reverse recovery current			3		A
t_{rr}	Reverse recovery time	I_F = 30 A di_F/dt = –200 A/µs V_R = 400 V T_C = 125 °C		175		ns
Q_{rr}	Reverse recovery charge			485		nC
I_{RRM}	Maximum reverse recovery current			6		A
t_{rr}	Reverse recovery time	I_F = 30 A di_F/dt = –1000 A/µs V_R = 400 V T_C = 125 °C		75		ns
Q_{rr}	Reverse recovery charge			855		nC
I_{RRM}	Maximum reverse recovery current			22		A

The following table shows the thermal and mechanical characteristics of the APT30DQ60BG device.

Table 4 • Thermal and Mechanical Characteristics

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance			0.80	°C/W
W_T	Package weight		0.22		oz
			5.9		g
Torque	Maximum mounting torque				lb•m
				1.1	N•m

3.3 Typical Performance Curves

This section shows the typical performance curves for the APT30DQ60BG device.

Figure 1 • Maximum Effective Transient Thermal Impedance, Junction-to-Case vs. Pulse

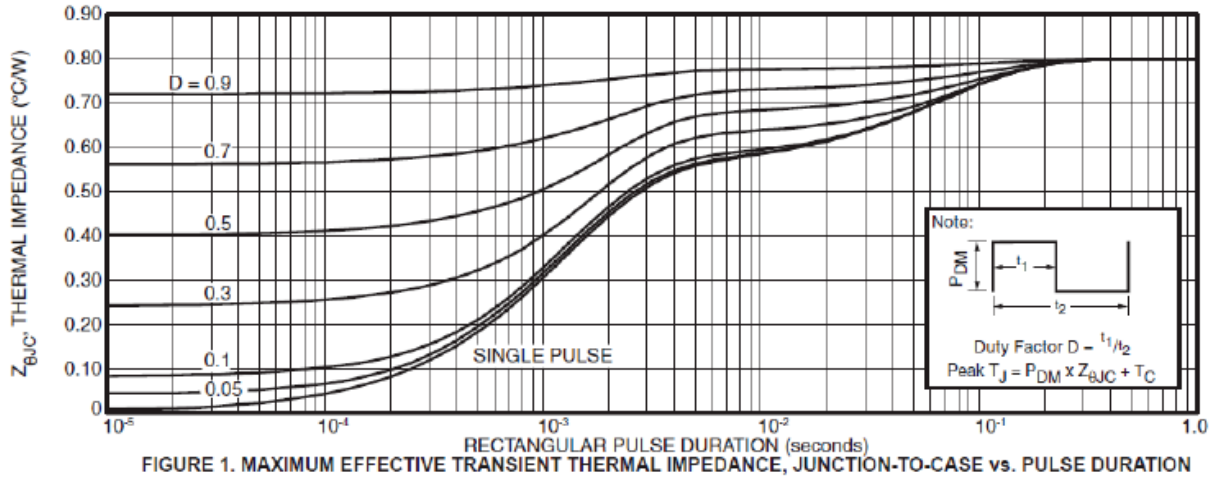


FIGURE 1. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

Figure 2 • Forward Current vs. Forward Voltage

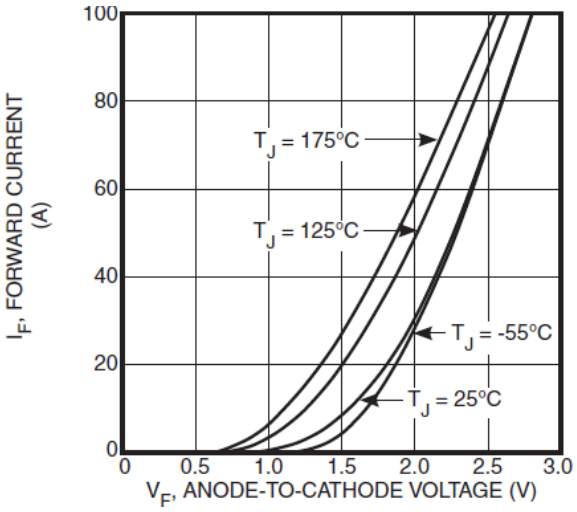


Figure 3 • trr vs. Current Rate of Change

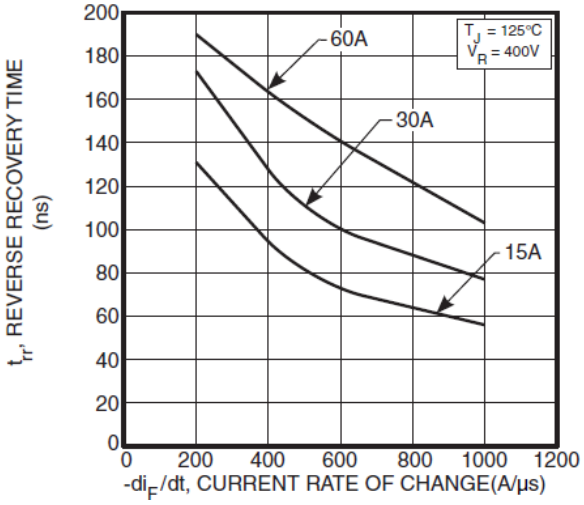


Figure 4 • Qrr vs. Current Rate of Change

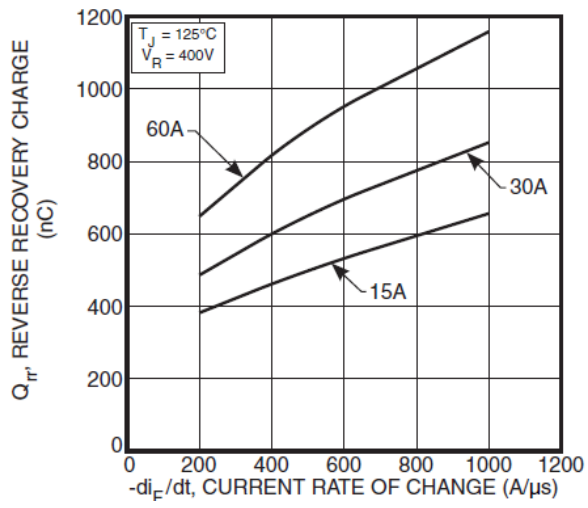


Figure 5 • Irrm vs. Current Rate of Change

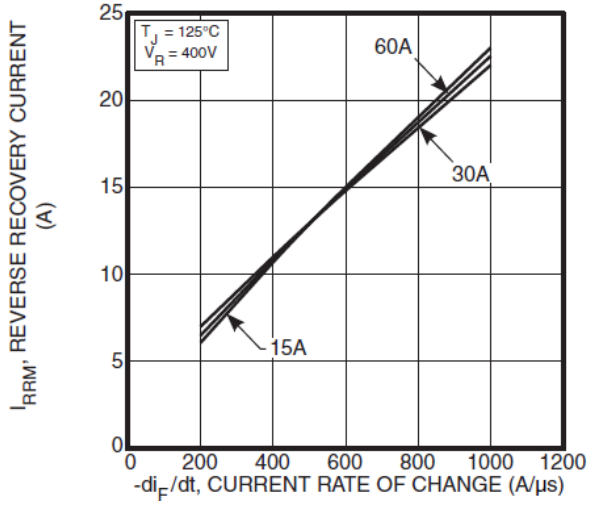


Figure 6 • Dynamic Parameters vs. Junction Temperature

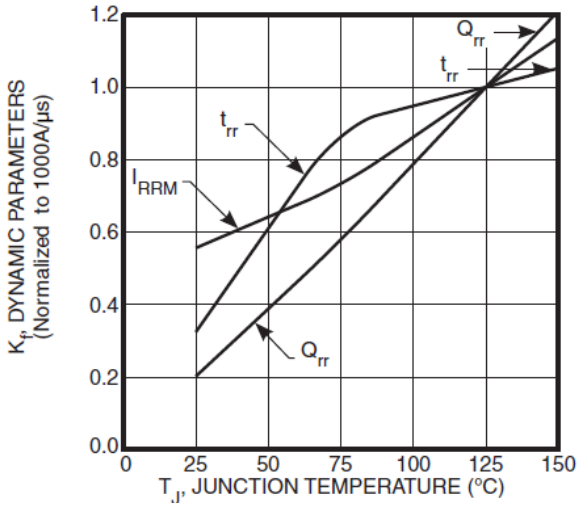


Figure 7 • Maximum Average Forward Current vs. Case Temperature

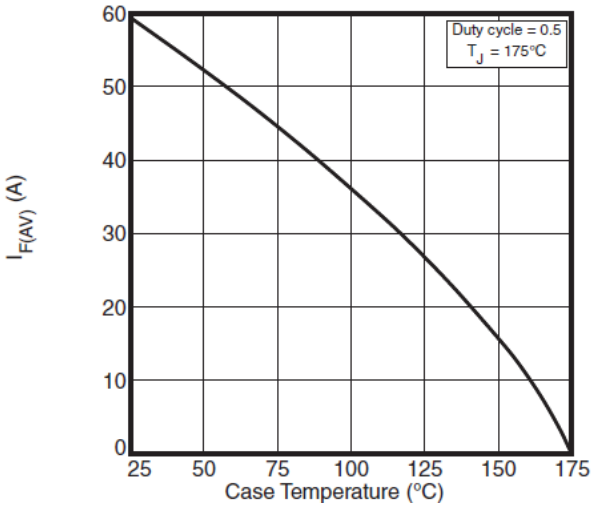
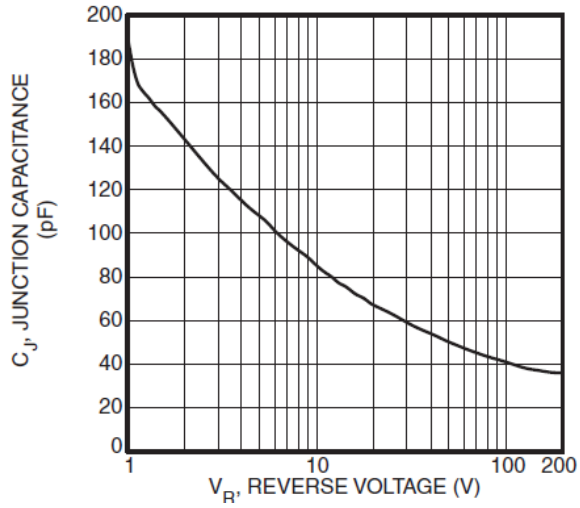


Figure 8 • Junction Capacitance vs. Reverse Voltage



3.4 Reverse Recovery Overview

The following illustration shows the reverse recovery testing and measurement information for the APT30DQ60BG device.

Figure 9 • Diode Test Circuit

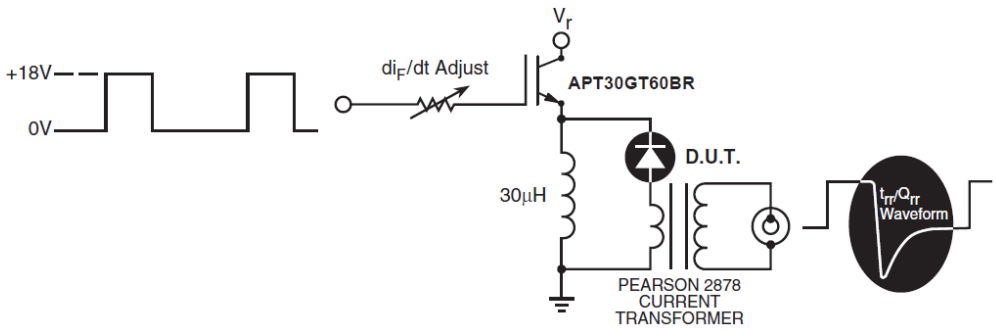
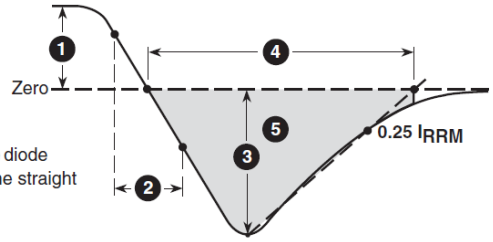


Figure 10 • Diode Reverse Recovery Waveform and Definitions



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}.

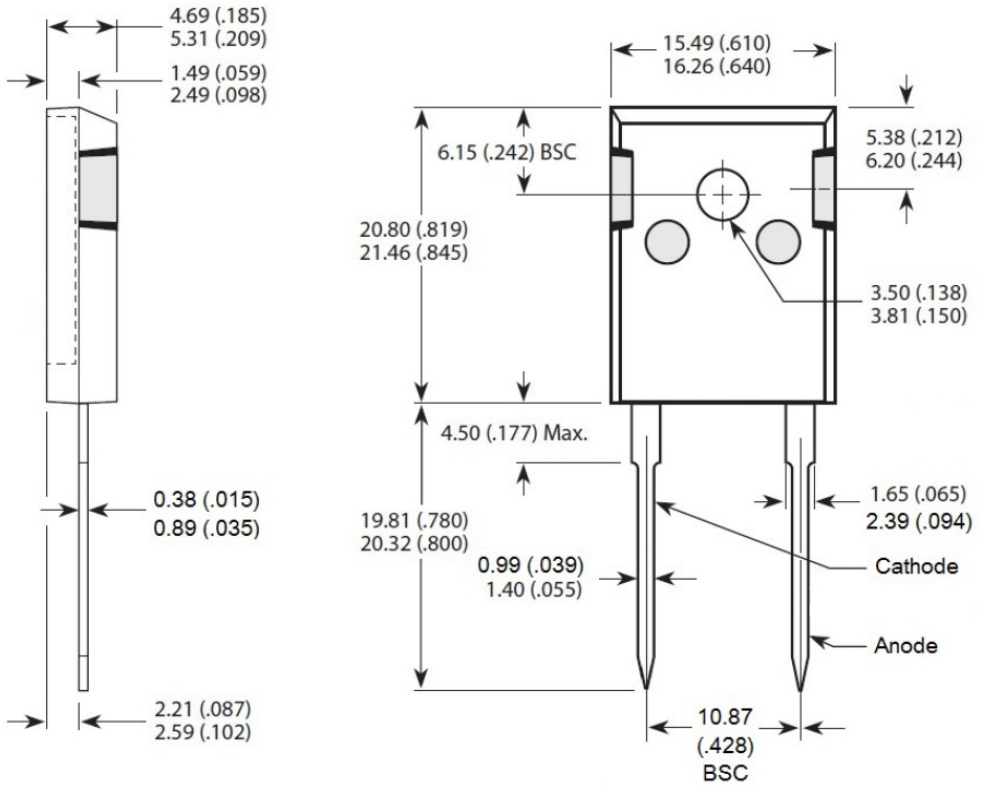
4 Package Specification

This section outlines the package specification for the APT30DQ60BG device.

4.1 Package Outline Drawing

This section details the TO-247 package drawing of the APT30DQ60BG device. Dimensions are in millimeters and (inches).

Figure 11 • TO 247 Package Outline



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