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APT30DQ60BG
Datasheet
Ultrafast Soft Recovery Rectifier Diode

Final
March 2018



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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 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

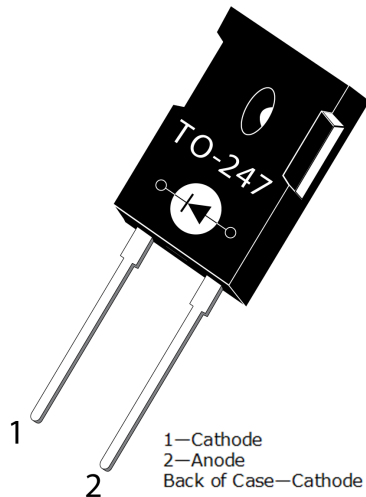
Revision B was published in December 2005. Information was updated to add full characterization for the small die DQ 30A 600 V.

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: $T_c = 25\text{ °C}$ 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 ($T_c = 117\text{ °C}$, duty cycle = 0.5)	30	A
$I_{F(RMS)}$	RMS forward current	51	
I_{FSM}	Non-repetitive forward surge current ($T_j = 45\text{ °C}$, 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	$I_F = 30\text{ A}$		2.0	2.4	V
		$I_F = 60\text{ A}$		2.4		
		$I_F = 30\text{ A}, T_j = 125\text{ °C}$		1.7		
I_{RM}	Maximum reverse leakage current	$V_R = 600\text{ V}$			25	μA
		$V_R = 600\text{ V}, T_j = 125\text{ °C}$			500	
C_T	Junction capacitance	$V_R = 200\text{ V}$		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	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 25\text{ }^\circ\text{C}$		23		ns
t_{rr}	Reverse recovery time	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 25\text{ }^\circ\text{C}$		30		
Q_{rr}	Reverse recovery charge	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 25\text{ }^\circ\text{C}$		55		nC
I_{RRM}	Maximum reverse recovery current	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 25\text{ }^\circ\text{C}$		3		A
t_{rr}	Reverse recovery time	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$		175		ns
Q_{rr}	Reverse recovery charge	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$		485		nC
I_{RRM}	Maximum reverse recovery current	$I_F = 30\text{ A}$ $di_r/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$		6		A
t_{rr}	Reverse recovery time	$I_F = 30\text{ A}$ $di_r/dt = -1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$		75		ns
Q_{rr}	Reverse recovery charge	$I_F = 30\text{ A}$ $di_r/dt = -1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$		855		nC
I_{RRM}	Maximum reverse recovery current	$I_F = 30\text{ A}$ $di_r/dt = -1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$		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	$^\circ\text{C}/\text{W}$
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

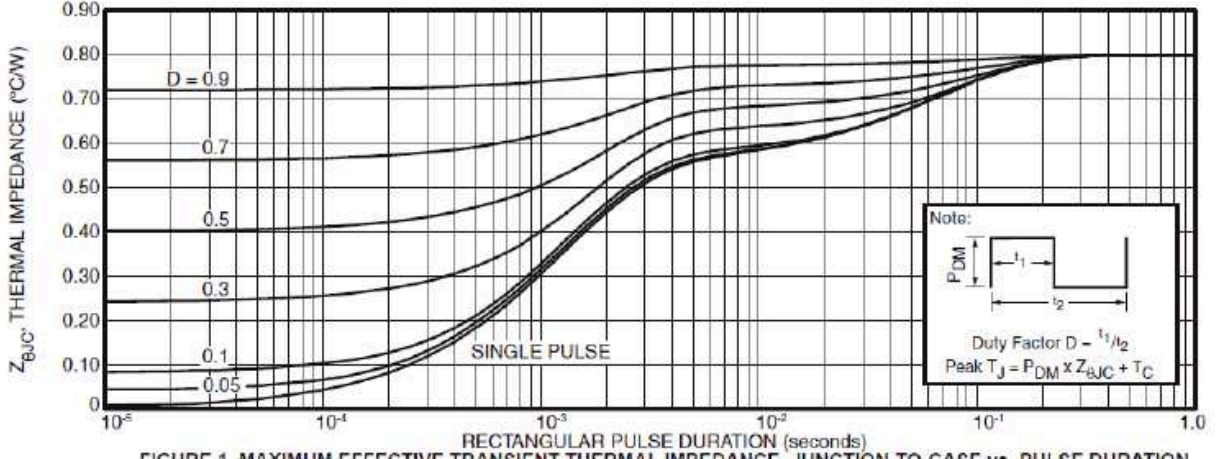


FIGURE 1. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

Figure 2 • Forward Current vs. Forward Voltage

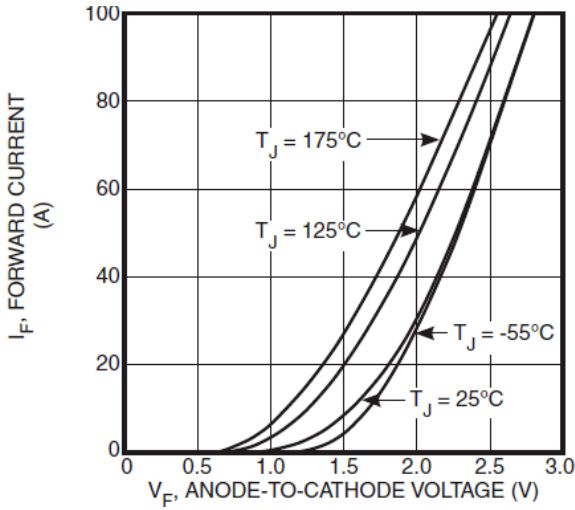


Figure 3 • t_{rr} vs. Current Rate of Change

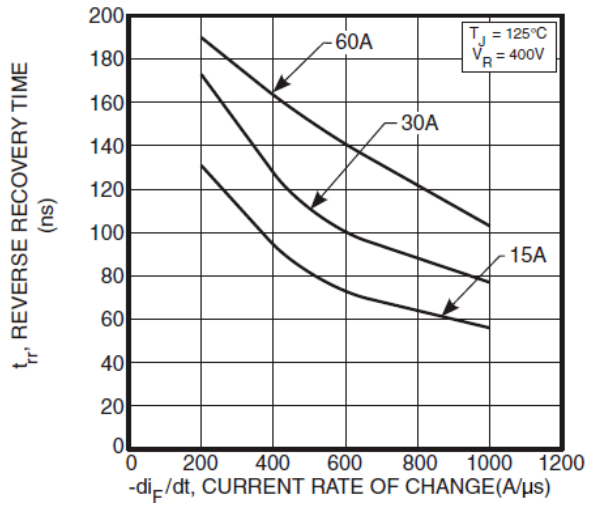


Figure 4 • Q_{rr} vs. Current Rate of Change

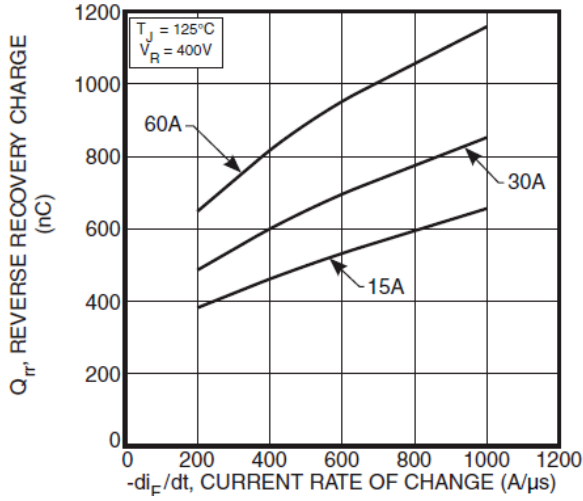


Figure 5 • I_{RRM} vs. Current Rate of Change

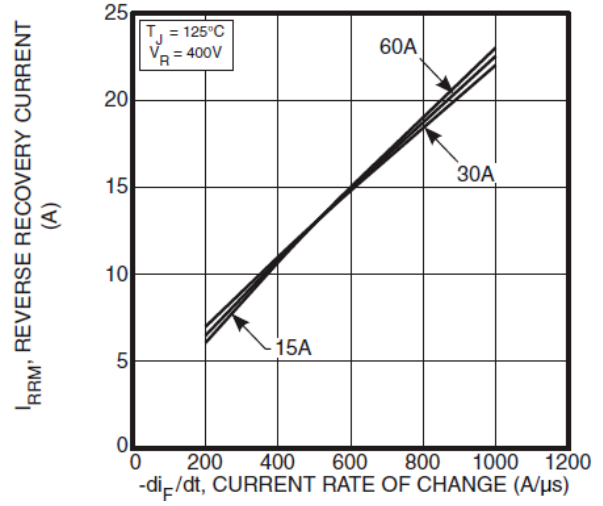


Figure 6 • Dynamic Parameters vs. Junction Temperature

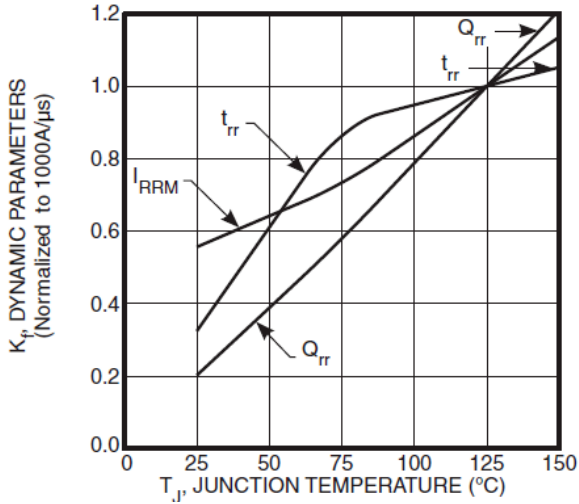


Figure 7 • Maximum Average Forward Current vs. Case Temperature

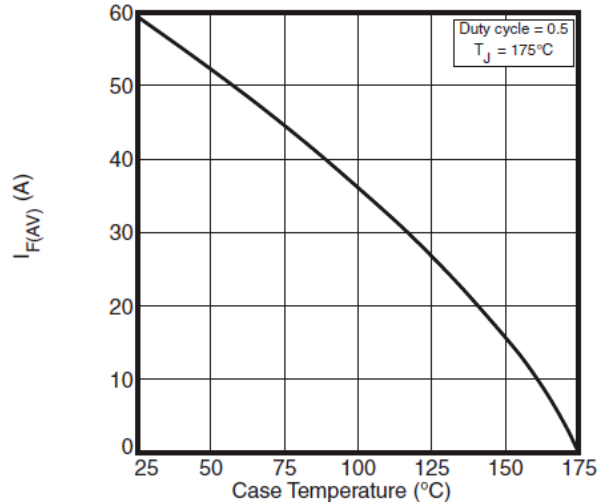
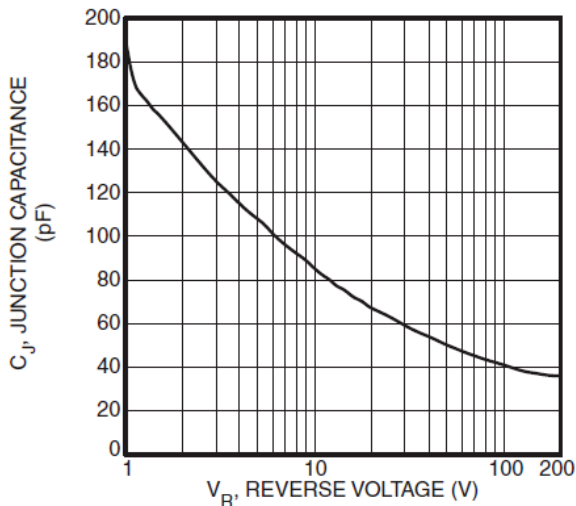


Figure 8 • Junction Capacitance vs. Reverse Voltage



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

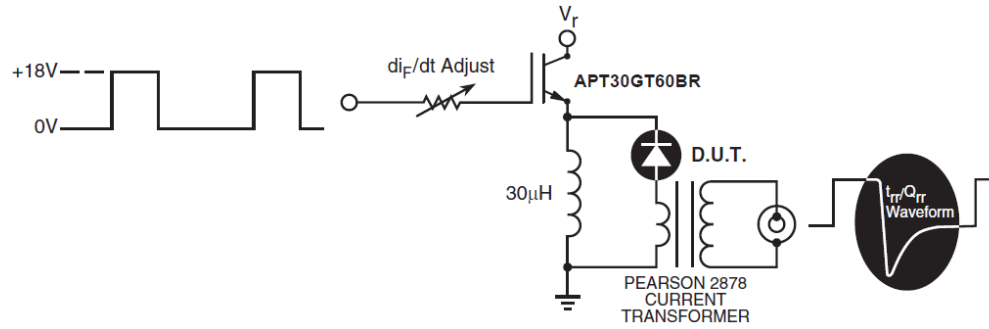
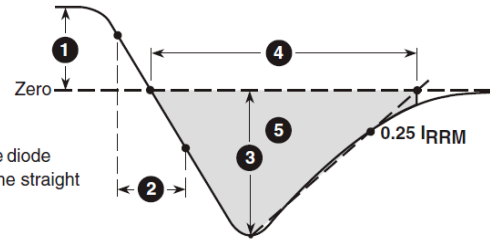


Figure 10 • Diode Reverse Recovery Waveform and Definitions

- 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 $0.25 \cdot I_{RRM}$ passes through zero.
- 5 Q_{rr} - Area Under the Curve Defined by I_{RRM} and t_{rr} .



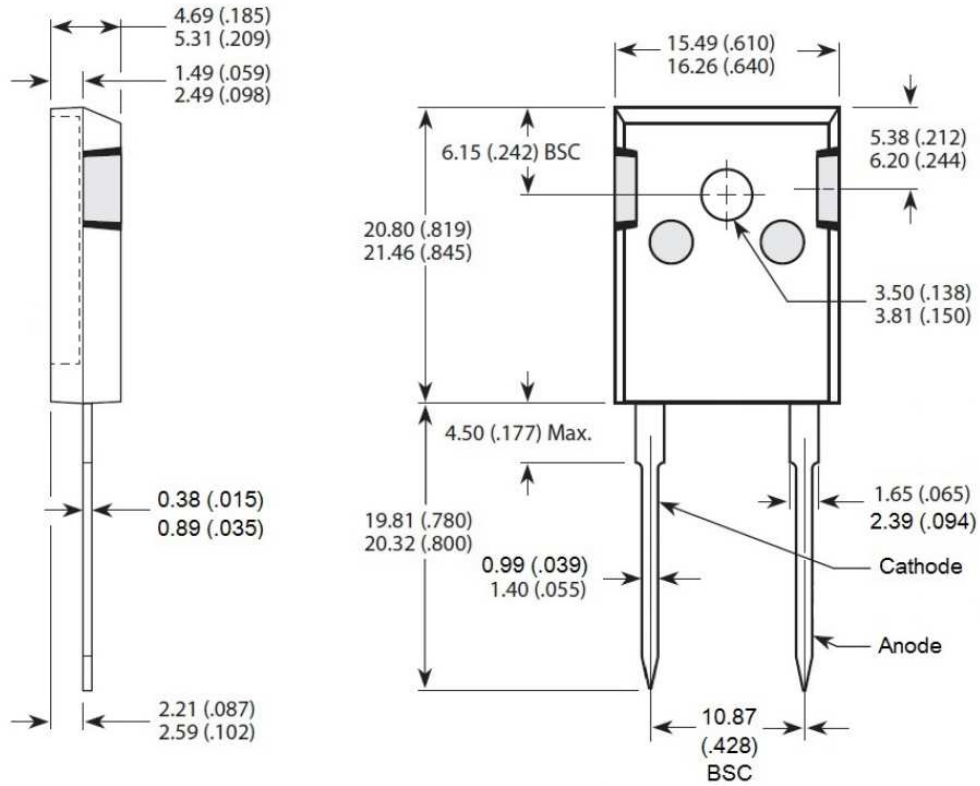
4 Package Specification

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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