

APT60DQ60SG
Datasheet
Ultra-Fast Soft Recovery Rectifier Diode

Final
October 2017



Contents

- 1 Revision History 1
 - 1.1 Revision A 1
- 2 Product Overview 2
 - 2.1 Features 2
 - 2.2 Benefits 2
 - 2.3 Applications 2
- 3 Electrical Specifications 3
 - 3.1 Absolute Maximum Ratings 3
 - 3.2 Electrical Performance 3
 - 3.3 Dynamic Characteristics 4
 - 3.4 Typical Performance Curves 4
- 4 Package Specification 8
 - 4.1 Chip Outline Drawing 8

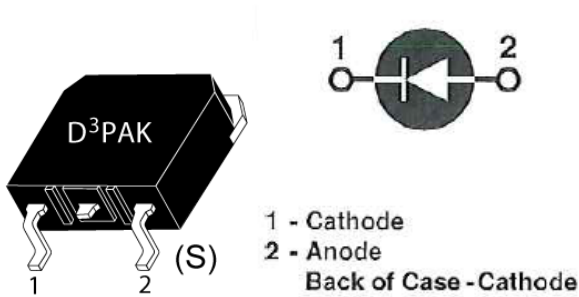
1 Revision History

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 A

Revision A was published in October 2017. It is the first publication of this document.

2 Product Overview



2.1 Features

The following are key features of the APT60DQ60SG device:

- Ultra-fast recovery times
- Soft recovery characteristics
- Low forward voltage
- Low leakage current
- Avalanche energy rated
- Popular D³PAK package
- RoHS compliant
- AEC-Q101 qualified

2.2 Benefits

The following are benefits of the APT60DQ60SG device:

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

2.3 Applications

The APT60DQ60SG 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 APT60DQ60SG device.

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the APT60DQ60SG 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 APT60DQ60SG 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		0.14		oz
			4.0		g

3.2 Electrical Performance

The following table shows the static characteristics of the APT60DQ60SG 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 APT60DQ60SG 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 APT60DQ60SG device.

Figure 1 • Maximum Transient Thermal Impedance

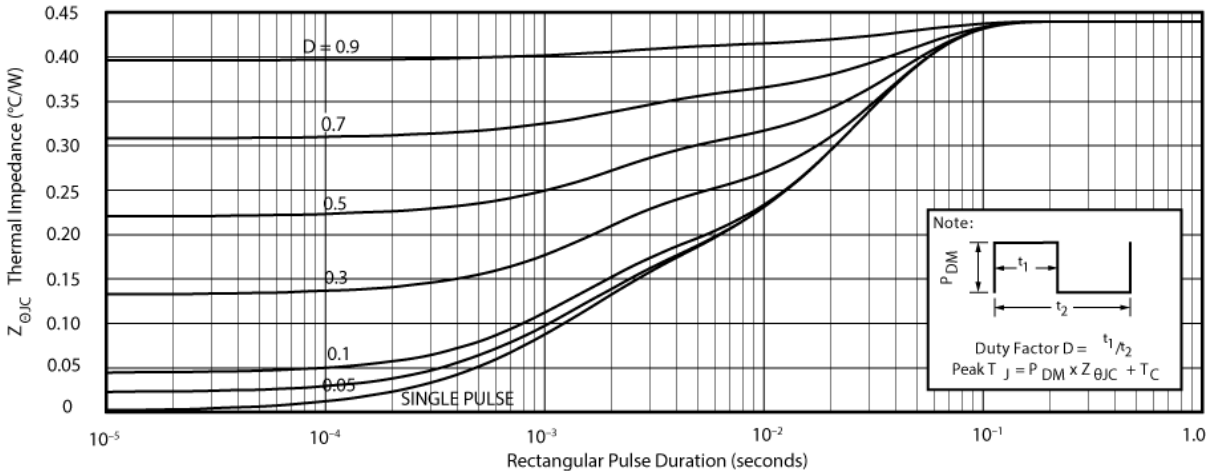
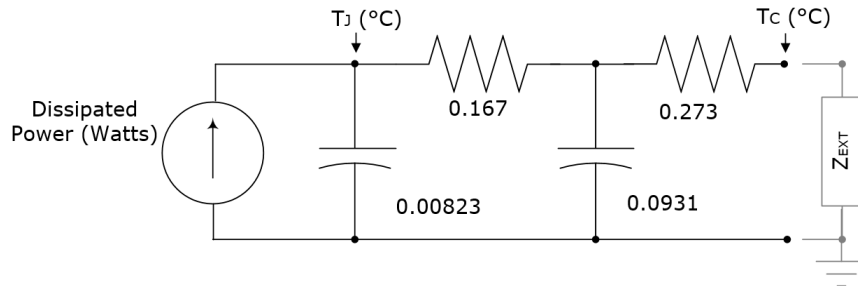


Figure 2 • Transient Thermal Impedance Model

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.

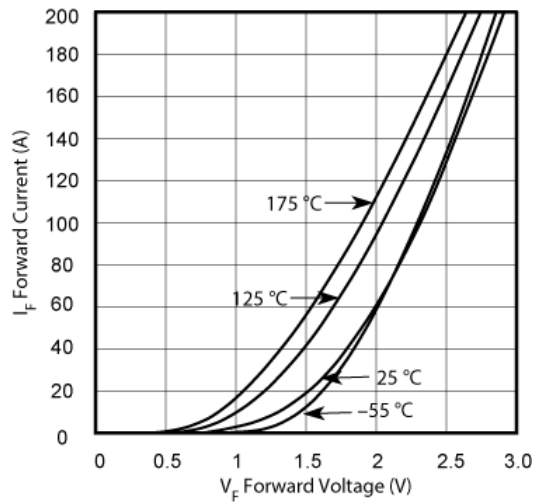
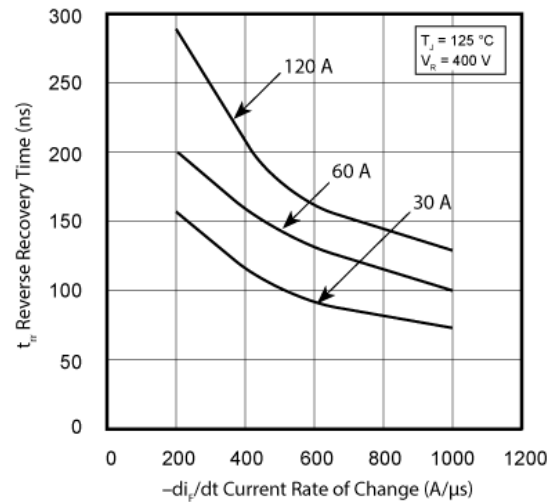
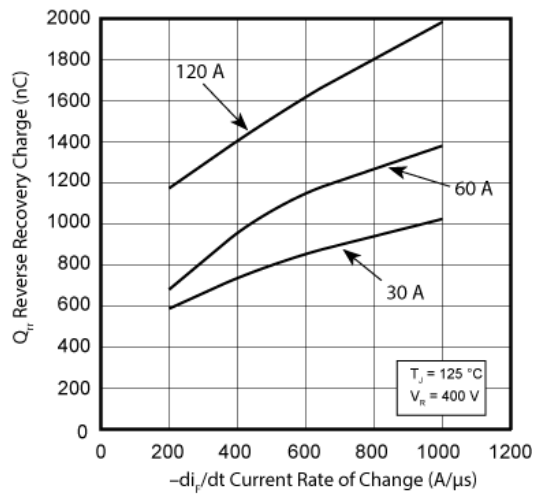
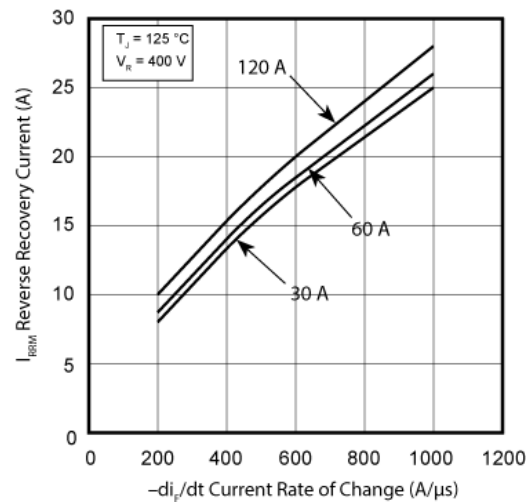
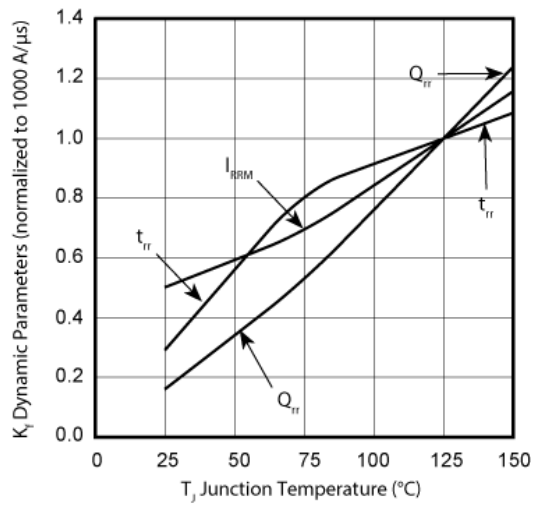
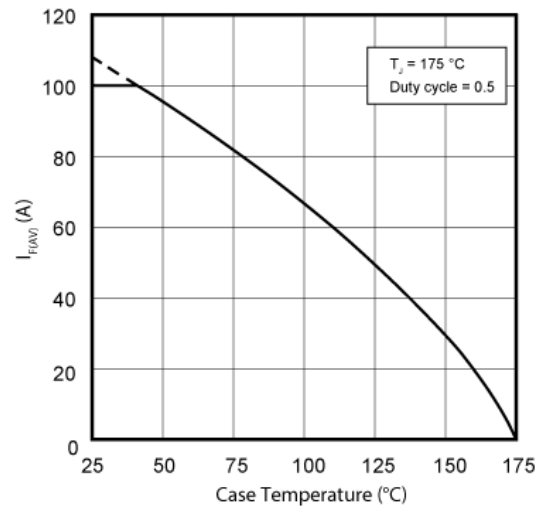
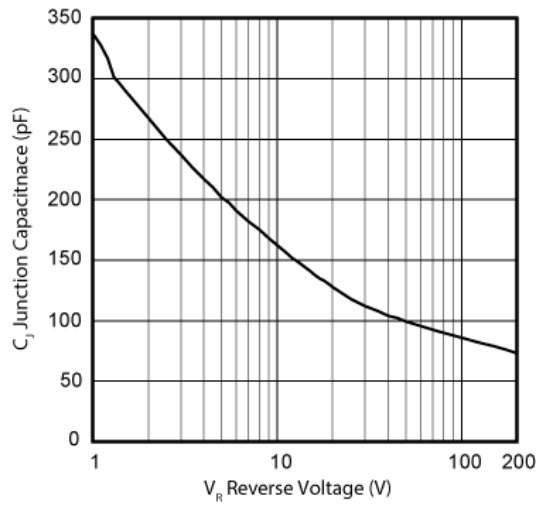
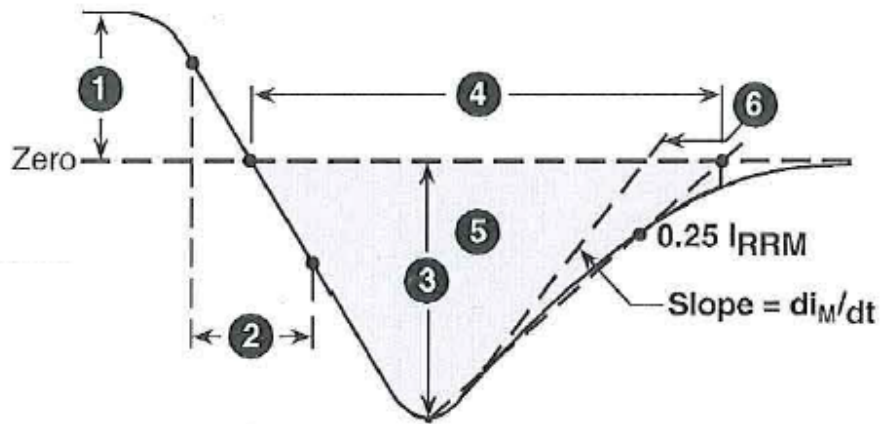
Figure 3 • Forward Current vs. Forward Voltage**Figure 4 • t_{rr} vs. Current Rate of Change****Figure 5 • Q_{rr} vs. Current Rate of Change****Figure 6 • IRRM vs. Current Rate of Change**

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 APT60DQ60SG 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} .

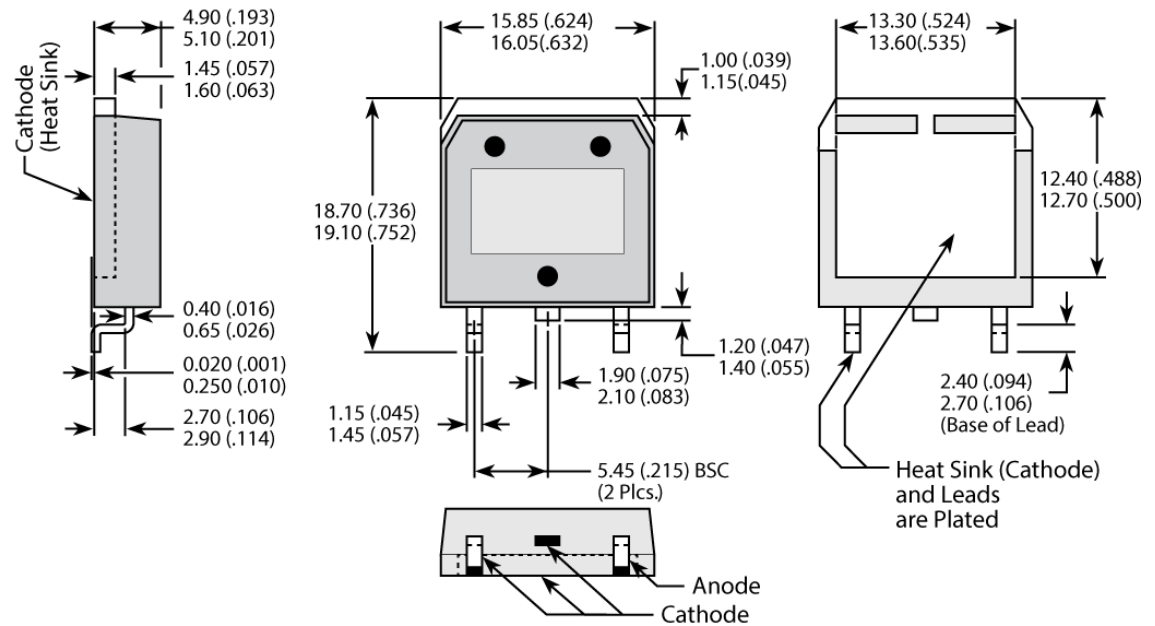
4 Package Specification

This section outlines the package specification for the APT60DQ60SG device.

4.1 Chip Outline Drawing

This section details the D³PAK package drawing of the APT60DQ60SG device. Dimensions are in millimeters and (inches).

Figure 11 • Package Outline Drawing



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