

**APT40DQ120BG**  
**Datasheet**  
**Ultrafast Soft Recovery Rectifier Diode**

Final  
March 2018



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# 1 Revision History

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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 D

Revision D was published in March 2018. The following is a summary of the changes in revision D of this document.

- The new Microsemi template and format was applied.
- The package outline drawing was updated. For more information, see [Package Outline Drawing](#).

## 1.2 Revision C

Revision C was published in May 2011. The following is a summary of the changes in revision C of this document.

- 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 B

Revision B was published in August 2005. The following is a summary of the changes in revision B of this document.

- The  $I_{RM}$  in the static characteristics table was updated. For more information, see [Electrical Performance](#).

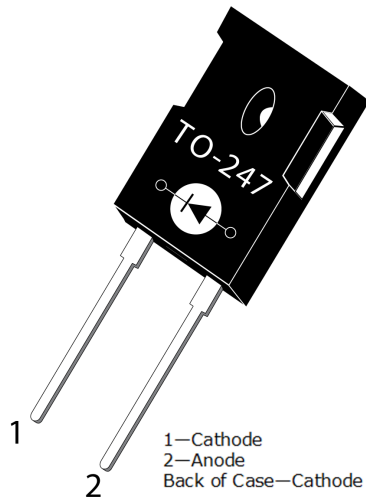
## 1.4 Revision A

Revision A was published in May 2005. It is the first publication of this document.

## 2 Product Overview

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This section outlines the product overview for the APT40DQ120BG device.



### 2.1 Features

The following are key features of the APT40DQ120BG 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 APT40DQ120BG device:

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

### 2.3 Applications

The APT40DQ120BG 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 shows the electrical specifications for the APT40DQ120BG device.

#### 3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the APT40DQ120BG 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	1200	V
$V_{RRM}$	Maximum peak repetitive reverse voltage	1200	
$V_{RWM}$	Maximum working peak reverse voltage	1200	
$I_{F(AV)}$	Maximum average forward current ( $T_c = 112\text{ }^\circ\text{C}$ , duty cycle = 0.5)	40	A
$I_{F(RMS)}$	RMS forward current	63	
$I_{FSM}$	Non-repetitive forward surge current ( $T_J = 45\text{ }^\circ\text{C}$ , 8.3 ms)	210	
$E_{AVL}$	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 APT40DQ120BG device.

**Table 2 • Thermal and Mechanical Characteristics**

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance			0.61	$^\circ\text{C}/\text{W}$
$W_T$	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 APT40DQ120BG device.

**Table 3 • Static Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_F$	Forward voltage	$I_F = 30\text{ A}$		2.8	3.3	V
		$I_F = 60\text{ A}$		3.4		
		$I_F = 30\text{ A}, T_J = 125\text{ }^\circ\text{C}$		2.1		
$I_{RM}$	Maximum reverse leakage current	$V_R = 1200\text{ V}$			100	$\mu\text{A}$
		$V_R = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$			500	
$C_J$	Junction capacitance	$V_R = 200\text{ V}$		36		pF

### 3.3 Dynamic Characteristics

The following table shows the dynamic characteristics of the APT40DQ120BG device.

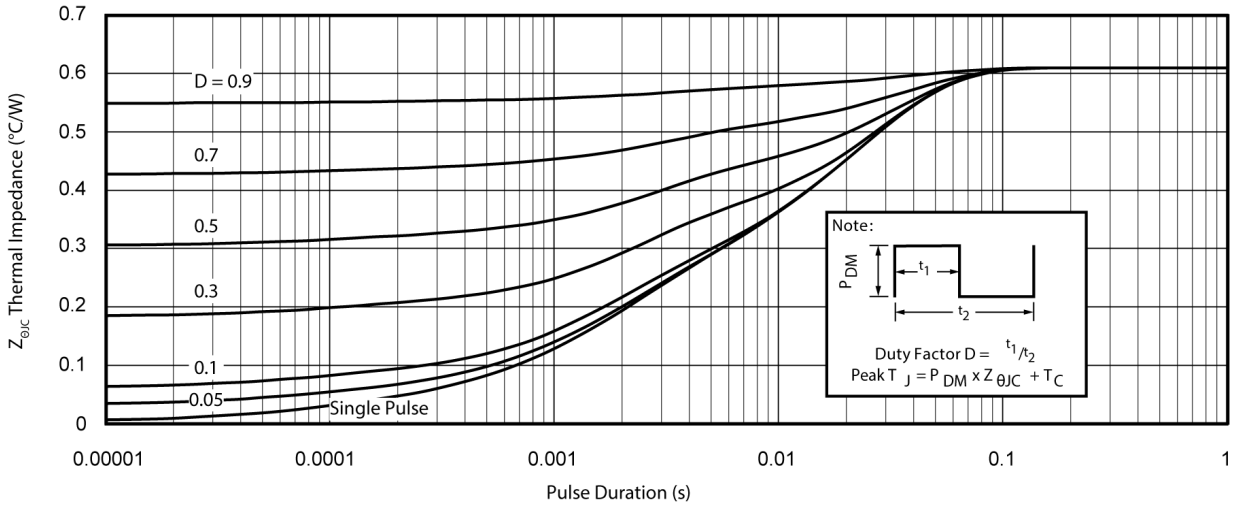
**Table 4 • Dynamic Characteristics**

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	$I_F = 40\text{ A}$		350		
$Q_{rr}$	Reverse recovery charge	$di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}$		570		nC
$I_{RRM}$	Maximum reverse recovery current	$T_C = 25\text{ }^\circ\text{C}$		4		A
$t_{rr}$	Reverse recovery time	$I_F = 40\text{ A}$		430		ns
$Q_{rr}$	Reverse recovery charge	$di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}$		2200		nC
$I_{RRM}$	Maximum reverse recovery current	$T_C = 125\text{ }^\circ\text{C}$		9		A
$t_{rr}$	Reverse recovery time	$I_F = 40\text{ A}$		210		ns
$Q_{rr}$	Reverse recovery charge	$di_F/dt = -1000\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}$		3400		nC
$I_{RRM}$	Maximum reverse recovery current	$T_C = 125\text{ }^\circ\text{C}$		29		A

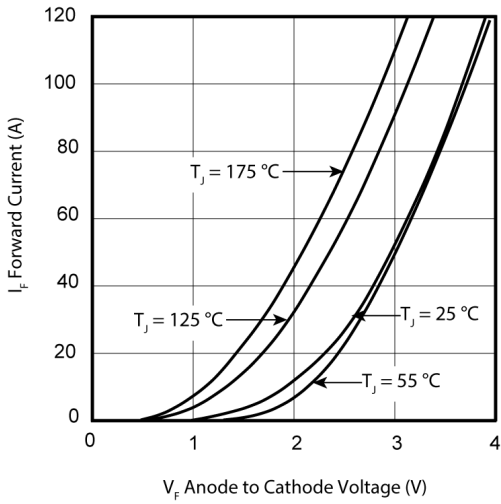
### 3.4 Typical Performance Curves

This section shows the typical performance curves for the APT40DQ120BG device.

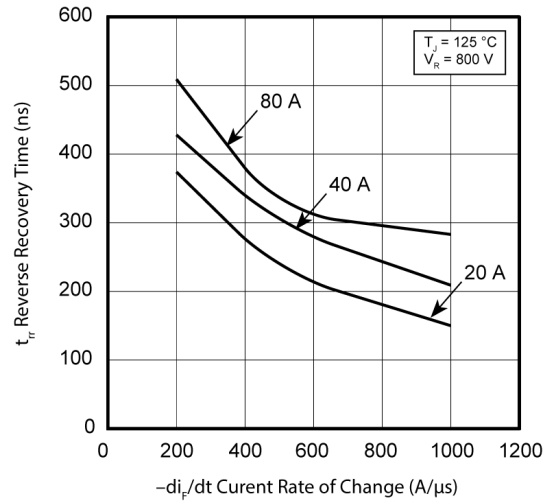
**Figure 1 • Maximum Transient Thermal Impedance**



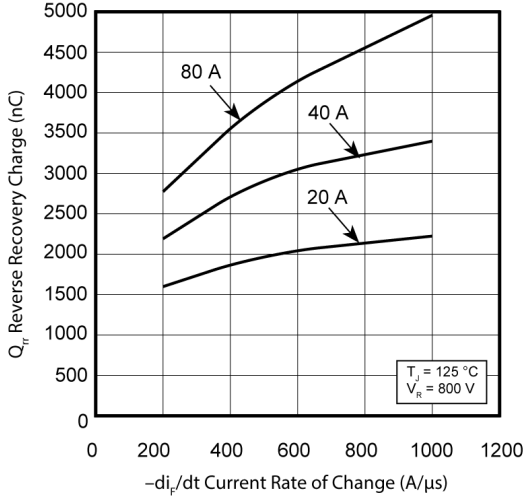
**Figure 2 • Forward Current vs. Forward Voltage**



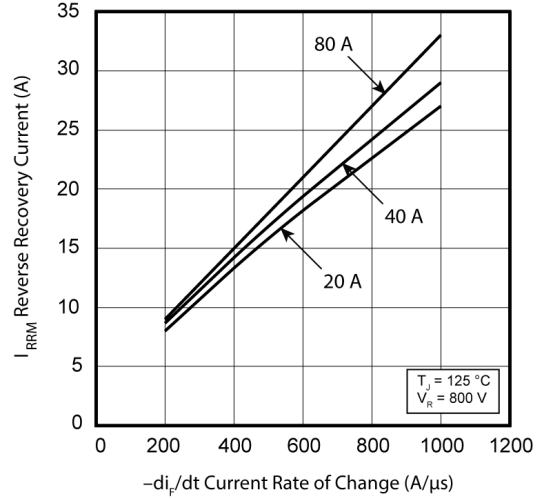
**Figure 3 •  $t_{rr}$  vs. Current Rate of Change**



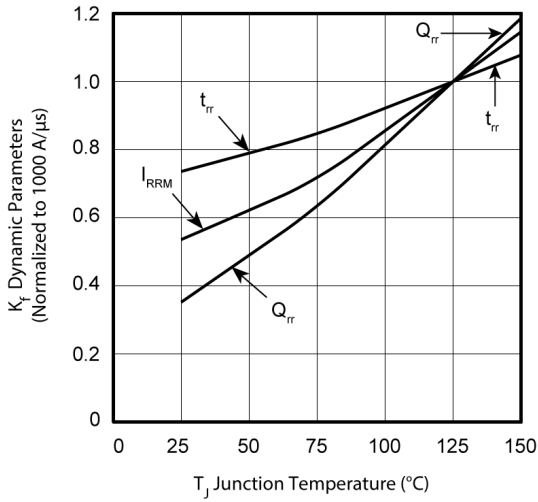
**Figure 4 • Q<sub>rr</sub> vs. Current Rate of Change**



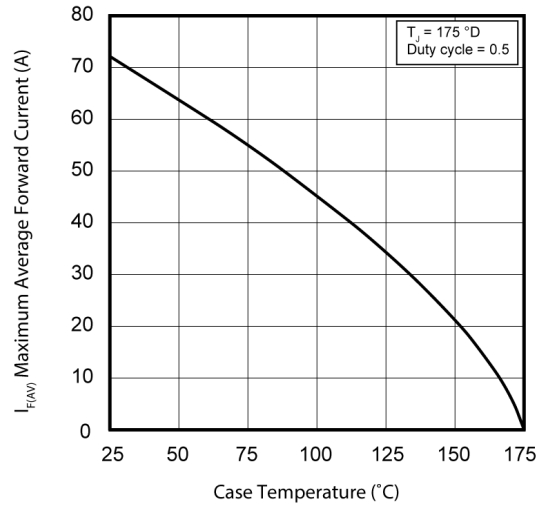
**Figure 5 • I<sub>RRM</sub> vs. Current Rate of Change**



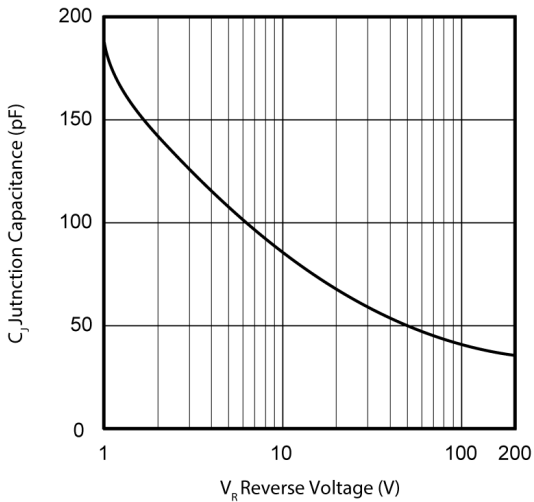
**Figure 6 • K<sub>f</sub> vs. Junction Temperature**



**Figure 7 • IF(AV) vs. Case Temperature**



**Figure 8 • Junction Capacitance vs. Reverse Voltage**

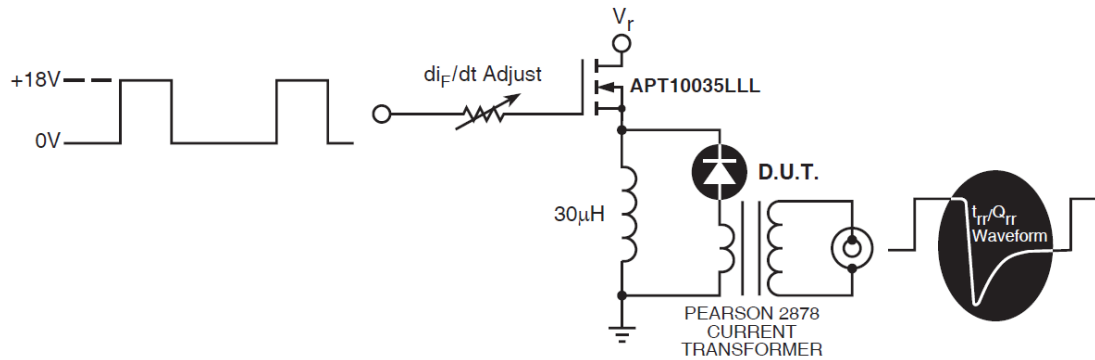




### 3.5 Reverse Recovery Overview

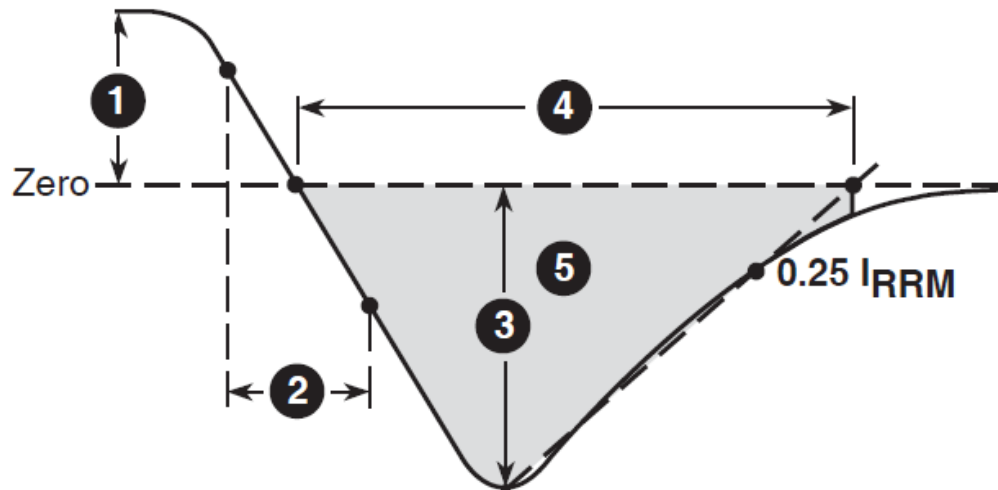
The following illustration shows the diode test circuit for the APT40DQ120BG device.

Figure 9 • Diode Test Circuit



The following illustration shows the diode reverse recovery waveform and definitions for the APT40DQ120BG 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  $0.25 \cdot I_{RRM}$  passes through zero.
5.  $Q_{rr}$ —Area under the curve defined by  $I_{RRM}$  and  $t_{rr}$ .

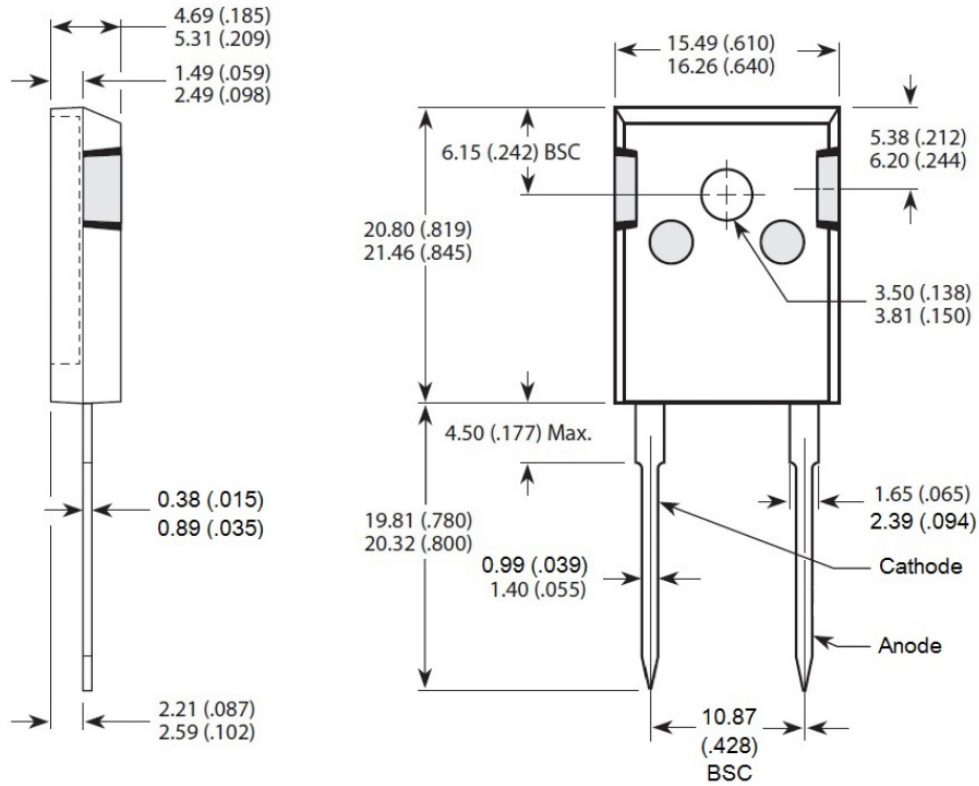
## 4 Package Specification

This section shows the package specification for the APT40DQ120BG device.

### 4.1 Package Outline Drawing

This section shows the TO-247 package drawing of the APT40DQ120BG device. Dimensions are in millimeters and (inches).

Figure 11 • Package Outline Drawing



**Microsemi Corporate Headquarters**

One Enterprise, Aliso Viejo,  
 CA 92656 USA  
 Within the USA: +1 (800) 713-4113  
 Outside the USA: +1 (949) 380-6100  
 Fax: +1 (949) 215-4996  
 Email: [sales.support@microsemi.com](mailto:sales.support@microsemi.com)  
[www.microsemi.com](http://www.microsemi.com)

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

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