APT40DQ120SG

Datasheet

Ultrafast Soft Recovery Rectifier Diode

Final

June 2018

Microsemi

Power Matters.™

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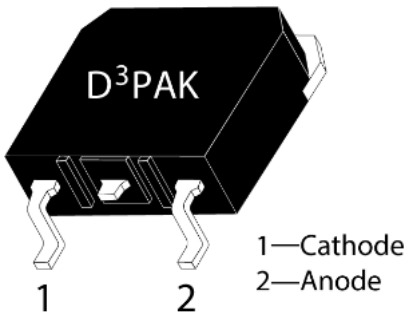
1 Revision History

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 A

Revision A was published in June 2018. It is the first publication of this document.

2 Product Overview



2.1 Features

The following are key features of the APT40DQ120SG device:

- Ultra-fast recovery times
- Soft recovery characteristics
- Low forward voltage
- Low leakage current
- Avalanche energy rated
- RoHS compliant

2.2 Benefits

The following are benefits of the APT40DQ120SG device:

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

2.3 Applications

The APT40DQ120SG 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 APT40DQ120SG device.

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the APT40DQ120SG 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	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 °C, duty cycle = 0.5)	40	A
$I_{F(RMS)}$	RMS forward current	63	
I_{FSM}	Non-repetitive forward surge current (T_J = 45 °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	°C
T_L	Lead temperature for 10 seconds	300	

The following table shows the thermal and mechanical characteristics of the APT40DQ120SG device.

Table 2 • Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance			0.61	°C/W
W_T	Package weight		0.14		oz
			4.0		g

3.2 Electrical Performance

The following table shows the static characteristics of the APT40DQ120SG device.

Table 3 • Static Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_F	Forward voltage	I_F = 40 A		2.8	3.4	V
		I_F = 80 A		3.4		
		I_F = 40 A, T_J = 125 °C		2.1		
I_{RM}	Maximum reverse leakage current	V_R = 1200 V			100	µA
		V_R = 1200 V, T_J = 125 °C			500	
C_J	Junction capacitance, V_R = 200 V			36		pF

3.3 Dynamic Characteristics

The following table shows the dynamic characteristics of the APT40DQ120SG 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 = 40 A, di_F/dt = –200 A/µs V_R = 800 V, T_C = 25 °C		350		
Q_{rr}	Reverse recovery change			570		nC
I_{RRM}	Maximum reverse recovery current			4		A
t_{rr}	Reverse recovery time	I_F = 40 A, di_F/dt = –200 A/µs V_R = 800 V, T_C = 125 °C		430		ns
Q_{rr}	Reverse recovery charge			2200		nC
I_{RRM}	Maximum reverse recovery current			9		A
t_{rr}	Reverse recovery time	I_F = 40 A, di_F/dt = –1000 A/µs V_R = 800 V, T_C = 125 °C		210		ns
Q_{rr}	Reverse recovery change			3400		nC
I_{RRM}	Maximum reverse recovery current			29		A

3.4 Typical Performance Curves

This section shows the typical performance curves for the APT40DQ120SG device.

Figure 1 • Maximum Transient Thermal Impedance

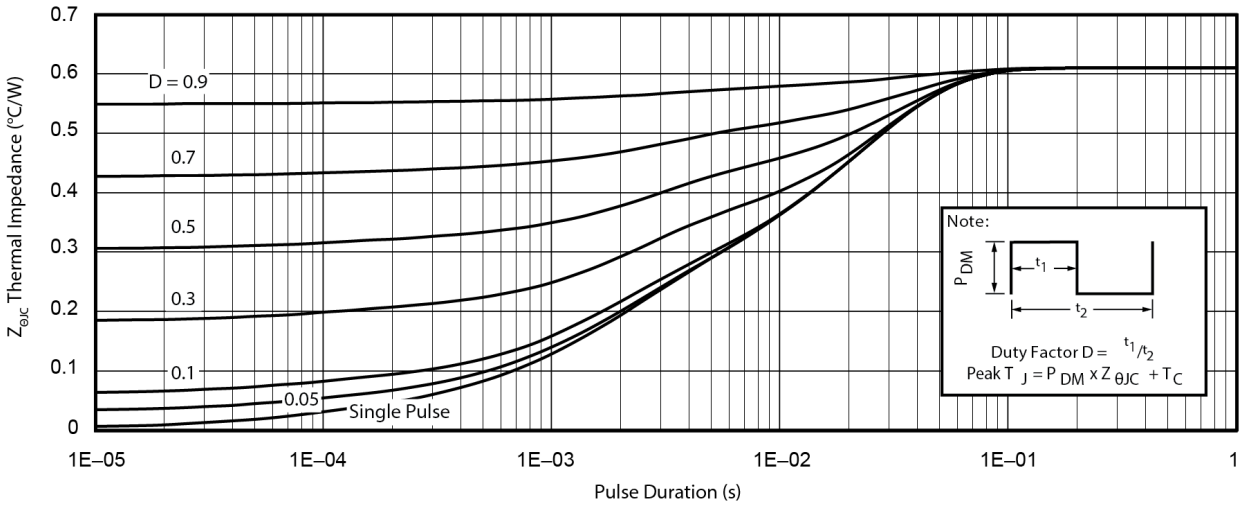


Figure 2 • Forward Current vs. Forward Voltage

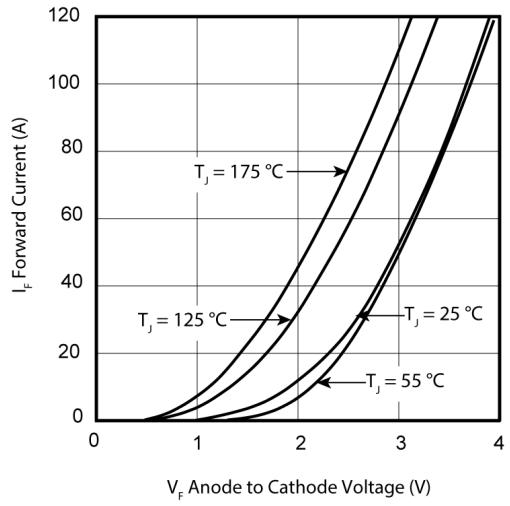


Figure 3 • trr vs. Current Rate of Change

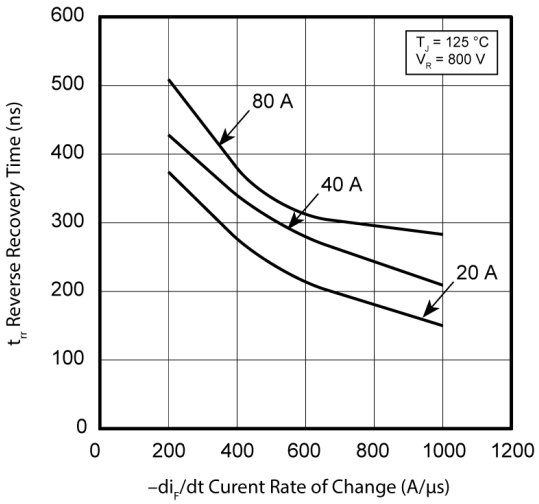


Figure 4 • Qrr vs. Current Rate of Change

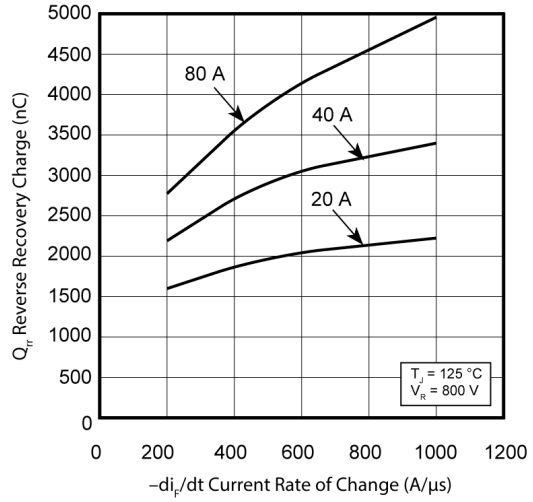


Figure 5 • IRRM vs. Current Rate of Change

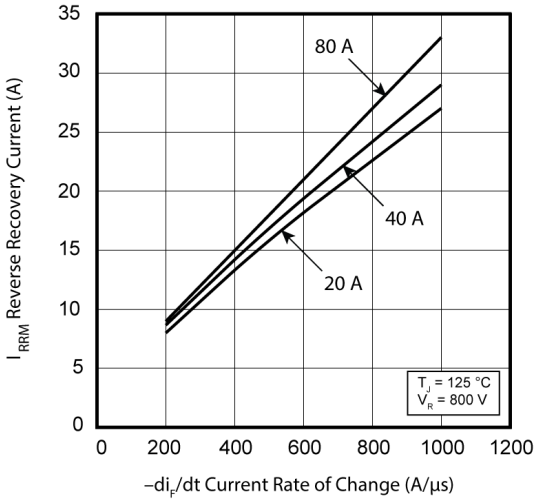


Figure 6 • Dynamic Parameters vs. Junction Temperature

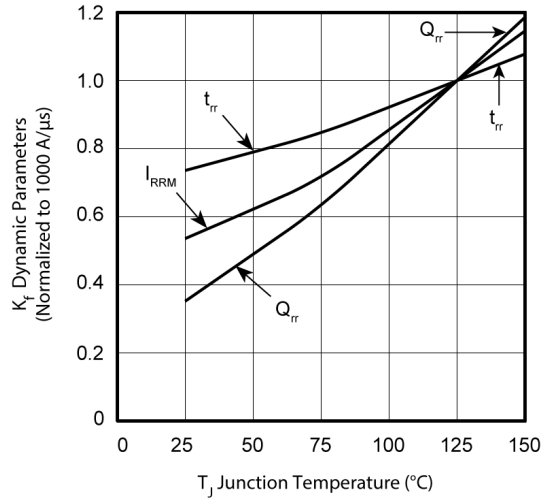


Figure 7 • Maximum Average Forward Current vs. Case Temperature

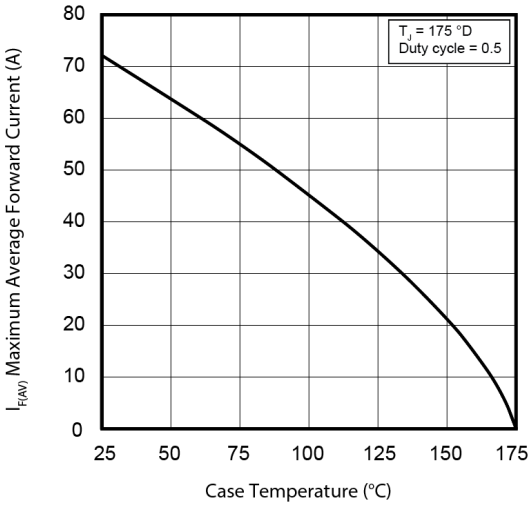
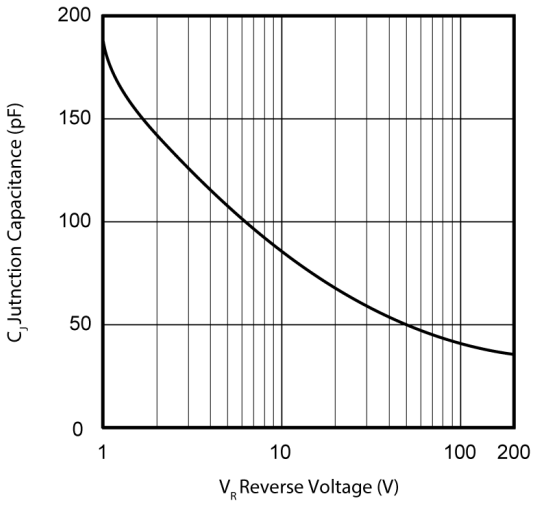


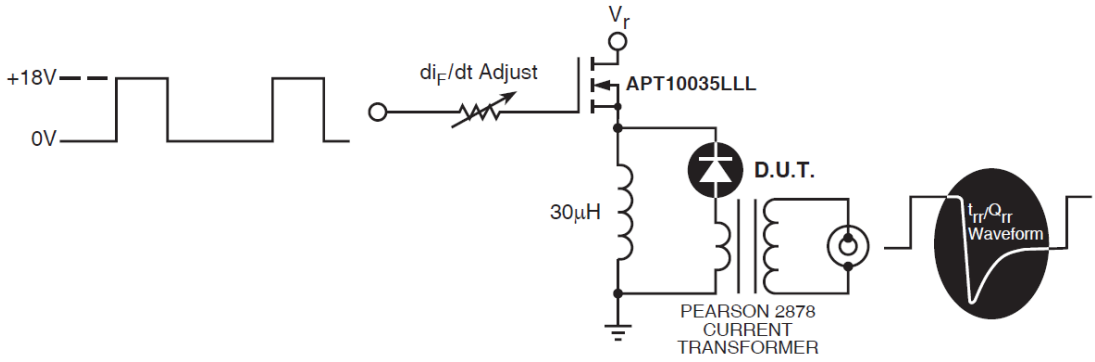
Figure 8 • Junction Capacitance vs. Reverse Voltage



3.5 Reverse Recovery Overview

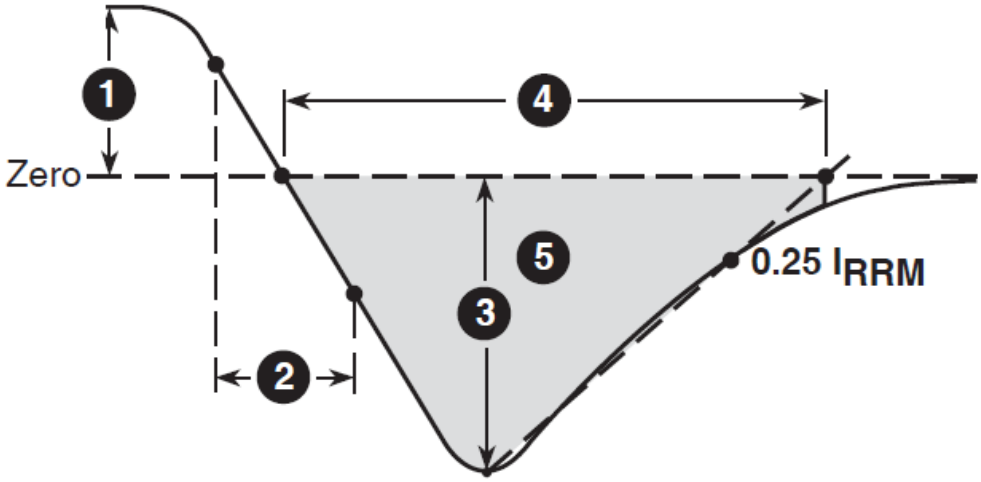
The following illustration shows the diode test circuit for the APT40DQ120SG device.

Figure 9 • Diode Test Circuit



The following illustration shows the diode reverse recovery waveform and definitions for the APT40DQ120SG 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}.

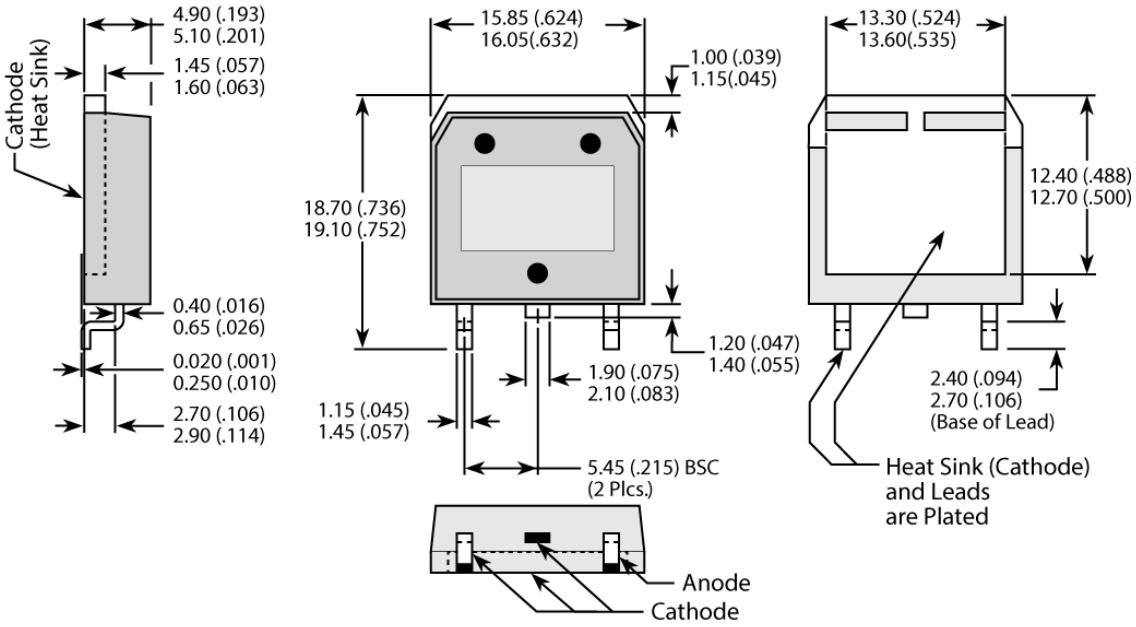
4 Package Specification

This section shows the package specification for the APT40DQ120SG device.

4.1 Package Outline Drawing

This section shows the D³PAK package drawing of the APT40DQ120SG device. Dimensions are in millimeters and (inches).

Figure 11 • Package Outline Drawing



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