

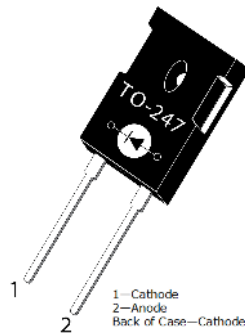
# APT60D40BG Fast Soft Recovery Rectifier Diode

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## Product Overview

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The APT60D40BG is a 400 V, 60 A Fast Soft Recovery Rectifier Si diode in a TO-247 package.



### Features

The following are key features of the APT60D40BG device:

- Fast recovery times
- Soft recovery characteristics
- Low forward voltage
- Low leakage current
- RoHS compliant

### Benefits

The following are benefits of the APT60D40BG device:

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

### Applications

The APT60D40BG device is designed for the following applications:

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

## Device Specifications

This section shows the specifications of the APT60D40BG device.

### Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the APT60D40BG device.  $T_C = 25\text{ }^\circ\text{C}$  unless otherwise specified.

**Table 1 • Absolute Maximum Ratings**

Symbol	Parameter	Ratings	Unit
$V_R$	Maximum DC reverse voltage	400	V
$V_{RRM}$	Maximum peak repetitive reverse voltage		
$V_{RWM}$	Maximum working peak reverse voltage		
$I_{F(AV)}$	Maximum average forward current ( $T_C = 140\text{ }^\circ\text{C}$ , duty cycle = 0.5)	60	A
$I_{FSM}$	Non-repetitive forward surge current ( $T_J = 45\text{ }^\circ\text{C}$ , 8.3 ms)	600	

The following table shows the thermal and mechanical characteristics of the APT60D40BG device.

**Table 2 • Thermal and Mechanical Characteristics**

Symbol	Characteristic/Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance			0.34	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-ambient thermal resistance			40	
$T_J, T_{STG}$	Operating and storage temperature range	-55		175	$^\circ\text{C}$
$T_L$	Lead temperature for 10 seconds			300	
$Wt$	Package weight		0.22		oz
			6.2		g
	Mounting torque, 6-32 or M3 screw			10	lbf-in
				1.1	N-m

## Electrical Performance

The following table shows the static characteristics of the APT60D40BG device.  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise specified.

**Table 3 • Static Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_F$	Forward voltage	$I_F = 60\text{ A}$		1.3	1.5	V
		$I_F = 120\text{ A}$		1.6		
		$I_F = 60\text{ A}, T_J = 125\text{ }^\circ\text{C}$		1.2		
$I_{RM}$	Maximum reverse leakage current	$V_R = V_R\text{ Rated}$			250	$\mu\text{A}$
		$V_R = V_R\text{ Rated}, T_J = 125\text{ }^\circ\text{C}$			500	
$C_J$	Junction capacitance	$V_R = 200\text{ V}$		120		pF

The following table shows the dynamic characteristics of the APT60D40BG device.

**Table 4 • Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1\text{ A}, di_F/dt = -100\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$		30		ns
$t_{rr}$	Reverse recovery time	$I_F = 60\text{ A}, di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 266\text{ V}$		37		
$Q_{rr}$	Reverse recovery charge			80		
$I_{RRM}$	Maximum reverse recovery current			4		A
$t_{rr}$	Reverse recovery time	$I_F = 60\text{ A}, di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 266\text{ V}, T_J = 125\text{ }^\circ\text{C}$		110		ns
$Q_{rr}$	Reverse recovery charge			540		nC
$I_{RRM}$	Maximum reverse recovery current			10		A
$t_{rr}$	Reverse recovery time	$I_F = 60\text{ A}, di_F/dt = -800\text{ A}/\mu\text{s}$ $V_R = 266\text{ V}, T_J = 125\text{ }^\circ\text{C}$		65		ns
$Q_{rr}$	Reverse recovery charge			1050		nC
$I_{RRM}$	Maximum reverse recovery current			27		

## Typical Performance Curves

This section shows the typical performance curves of the APT60D40BG device.

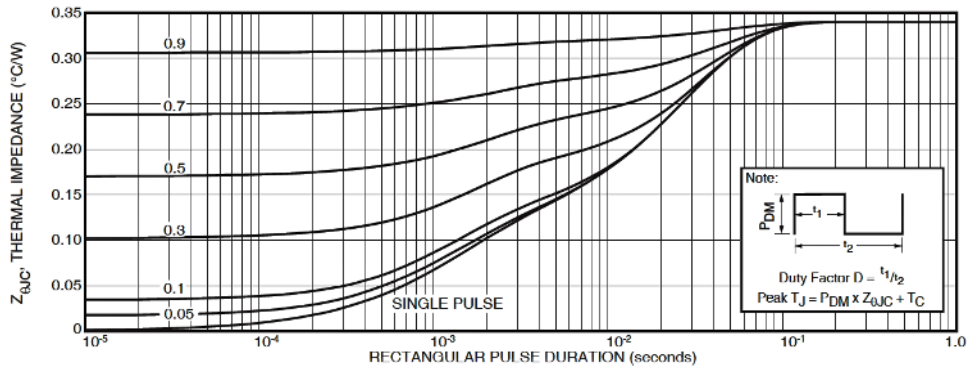


Figure 1 • Maximum Transient Thermal Impedance

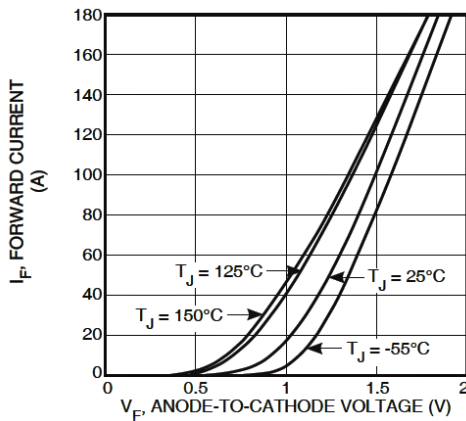


Figure 2 • Forward Current vs. Forward Voltage

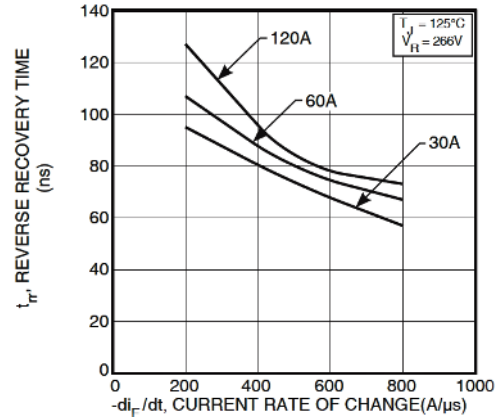


Figure 3 • Reverse Recovery Time vs. Current Rate of Change

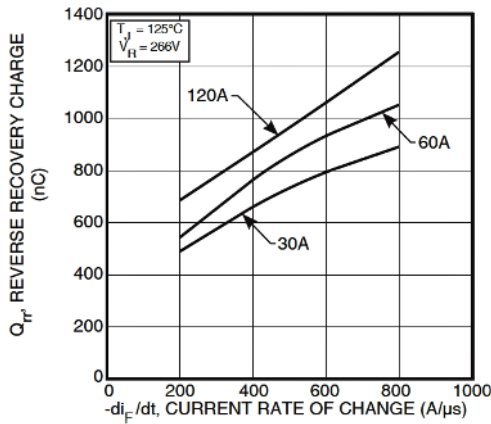


Figure 4 • Reverse Recovery Charge vs. Current Rate of Change

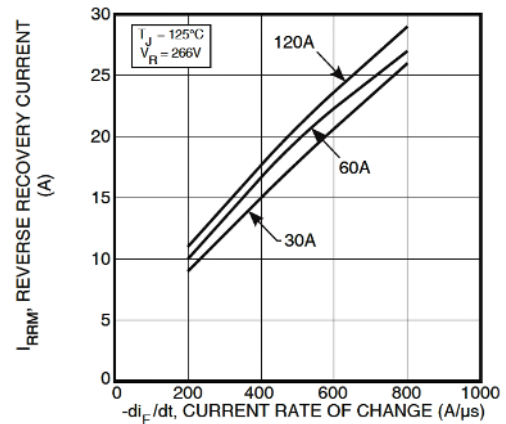


Figure 5 • Reverse Recovery Current vs. Current Rate of Change

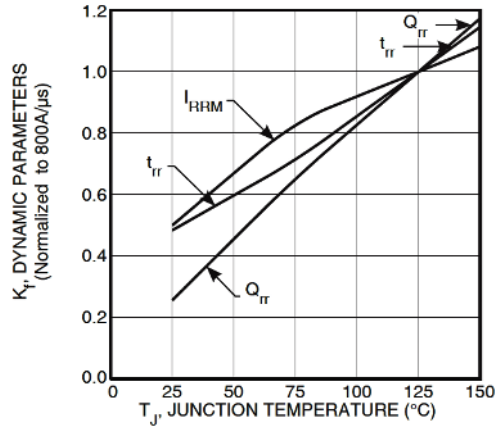


Figure 6 • Dynamic Parameters vs. Junction Temperature

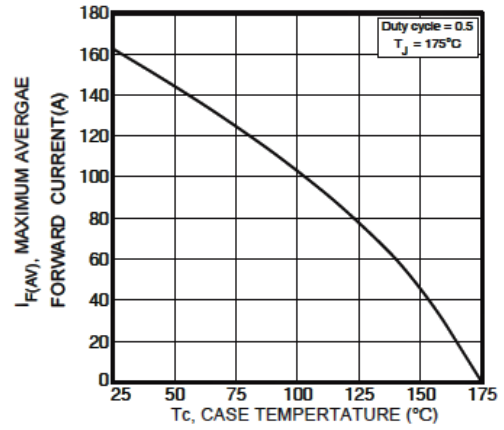


Figure 7 • Maximum Average Forward Current vs. Case Temperature

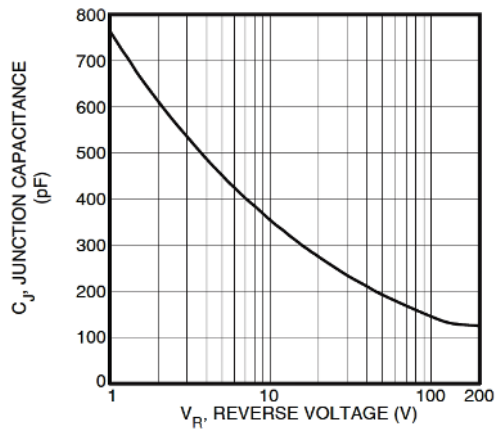
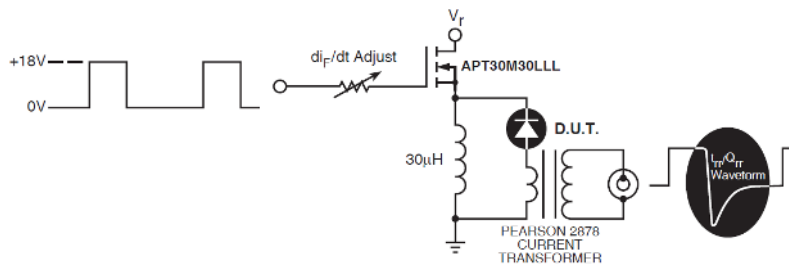


Figure 8 • Junction Capacitance vs. Reverse Voltage

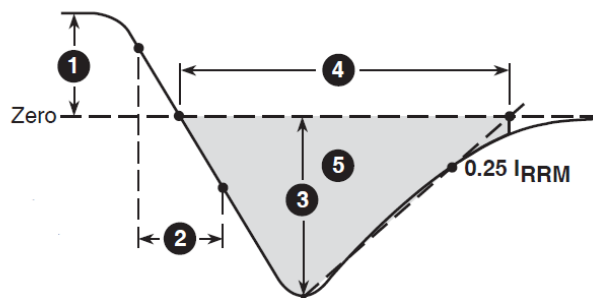
## Reverse Recovery Overview

The figure illustrates the diode test circuit of the APT60D40BG device.



**Figure 9 • Diode Test Circuit**

The following figure illustrates the diode reverse recovery waveform and definitions of the APT60D40BG device.



**Figure 10 • Diode Reverse Recovery Waveform and Definitions**

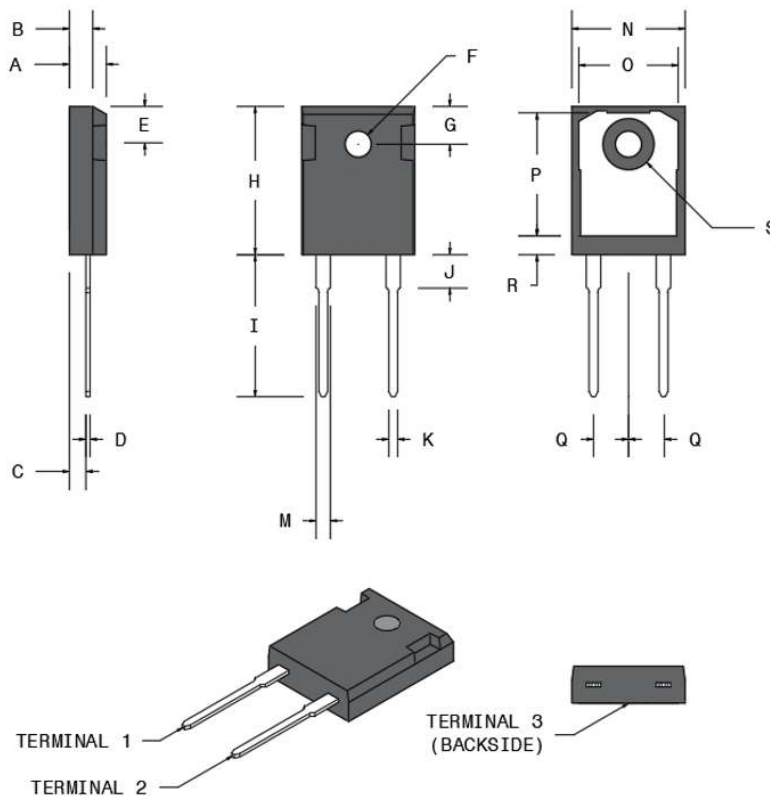
1.  $I_F$  — Forward conduction current.
2.  $di_F/dt$  — Rate of diode current change through zero crossing.
3.  $I_{RRM}$  — Maximum reverse recovery current.
4.  $t_{rr}$  — Reverse recovery time, measured from zero crossing where diode current goes from positive to negative, to the point at which 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  $t_{rr}$ .

## Package Specification

This section shows the package specification of the APT60D40BG device.

### Package Outline Drawing

The following figure illustrates the TO-247 package outline of the APT60D40BG device.



**Figure 11 • Package Outline Drawing**

The following table shows the TO-247 dimensions and should be used in conjunction with the package outline drawing.

**Table 5 • TO-247 Dimensions**

Symbol	Min	Max	Min	Max
	(mm)		(Inch)	
A	4.69	5.31	0.185	0.209
B	1.49	2.49	0.059	0.098
C	2.21	2.59	0.087	0.102
D	0.40	0.79	0.016	0.031
E	5.38	6.20	0.212	0.244

Symbol	Min	Max	Min	Max
	(mm)		(Inch)	
F	3.50	3.81	0.138	0.150
G	6.15 BSC	0.242 BSC		
H	20.80	21.46	0.819	0.845
I	19.81	20.32	0.780	0.800
J	4.00	4.50	0.157	0.177
K	1.01	1.40	0.040	0.055
L	2.87	3.12	0.113	0.123
M	1.65	2.13	0.065	0.084
N	15.49	16.26	0.610	0.640
O	13.50	14.50	0.531	0.571
P	16.50	17.50	0.650	0.689
Q	5.45 BSC	0.215 BSC		
R	2.00	2.75	0.079	0.108
S	7.10	7.50	0.280	0.295
TERMINAL 1	CATHODE			
TERMINAL 2	ANODE			
TERMINAL 3	CATHODE			



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