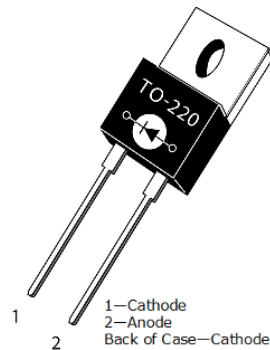


# APT15DQ120KG Ultrafast Soft Recovery Rectifier Diode

## Product Overview

The APT15DQ120KG is a 1200 V, 15 A Ultrafast Soft Recovery Rectifier Si Diode in a TO-220 package.



### Features

The following are key features of the APT15DQ120KG device:

- Ultrafast recovery times
- Soft recovery characteristics
- Low forward voltage
- Low leakage current
- Avalanche-energy rated
- RoHS compliant
- AEC-Q101 qualified

### Benefits

The following are benefits of the APT15DQ120KG device:

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

### Applications

The APT15DQ120KG 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

## Device Specifications

This section shows the specifications of the APT15DQ120KG device.

### Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the APT15DQ120KG device.

$T_C = 25^\circ\text{C}$ , unless otherwise specified.

**Table 1 • Absolute Maximum Ratings**

Symbol	Parameter	Rating	Unit
$V_R$	Maximum DC reverse voltage	1200	V
$V_{RRM}$	Maximum peak repetitive reverse voltage		
$V_{RWM}$	Maximum working peak reverse voltage		
$I_{F(AV)}$	Maximum average forward current ( $T_C = 127^\circ\text{C}$ , duty cycle = 0.5)	15	A
$I_{FSM}$	Non-repetitive forward surge current ( $T_J = 45^\circ\text{C}$ , 8.3 ms)	110	
$E_{AVL}$	Avalanche-energy (1 A, 40 mH)	20	mJ

The following table shows the thermal and mechanical characteristics of the APT15DQ120KG device.

**Table 2 • Thermal and Mechanical Characteristics**

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance			1.18	$^\circ\text{C}/\text{W}$
$T_J, T_{STG}$	Operating and storage temperature range	-55		175	$^\circ\text{C}$
$T_L$	Lead temperature for 10 seconds			300	
Wt	Package weight		0.07		oz
			1.9		g
	Mounting torque, 6-32 or M3 screw			10	lbf•m
				1.1	N•m

## Electrical Performance

The following table shows the static characteristics of the APT15DQ120KG 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	$I_F = 15\text{ A}$		2.8	3.3	V
		$I_F = 30\text{ A}$		3.4		
		$I_F = 15\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$		2.5		
$I_{RM}$	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	$V_R = 200\text{ V}$		17		pF

The following table shows the dynamic characteristics of the APT15DQ120KG device.

**Table 4 • Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1\text{ A}; di_F/dt = -100\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$		21		ns
$t_{rr}$	Reverse recovery time	$I_F = 15\text{ A}; di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}$		240		ns
$Q_{rr}$	Reverse recovery charge			260		nC
$I_{RRM}$	Maximum reverse recovery current			3		A
$t_{rr}$	Reverse recovery time	$I_F = 15\text{ A}; di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}; T_J = 125\text{ }^{\circ}\text{C}$		290		ns
$Q_{rr}$	Reverse recovery charge			960		nC
$I_{RRM}$	Maximum reverse recovery current			6		A
$t_{rr}$	Reverse recovery time	$I_F = 15\text{ A}; di_F/dt = -1000\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}; T_J = 125\text{ }^{\circ}\text{C}$		130		ns
$Q_{rr}$	Reverse recovery charge			1340		nC
$I_{RRM}$	Maximum reverse recovery current			19		A

## Typical Performance Curves

This section shows the typical performance curves of the APT15DQ120KG device.

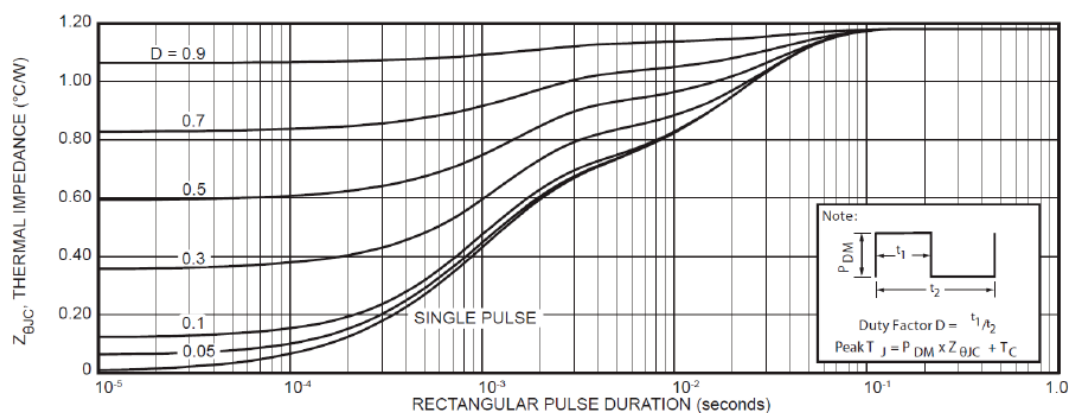


Figure 1 • Maximum Transient Thermal Impedance

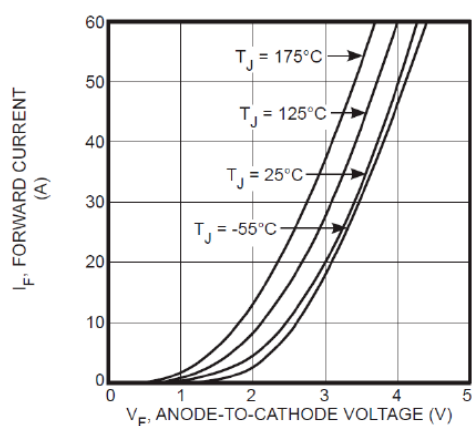


Figure 2 • Forward Current vs. Forward Voltage

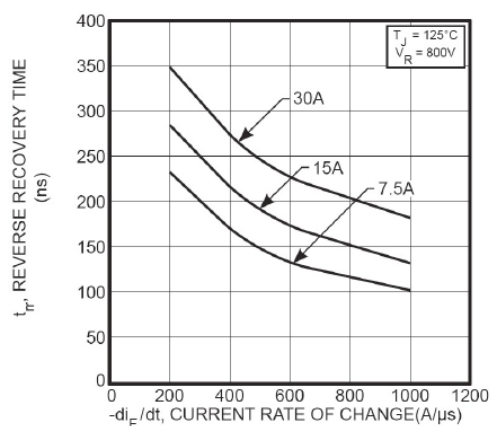
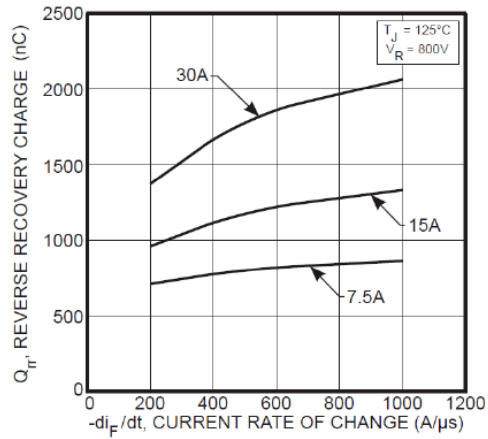
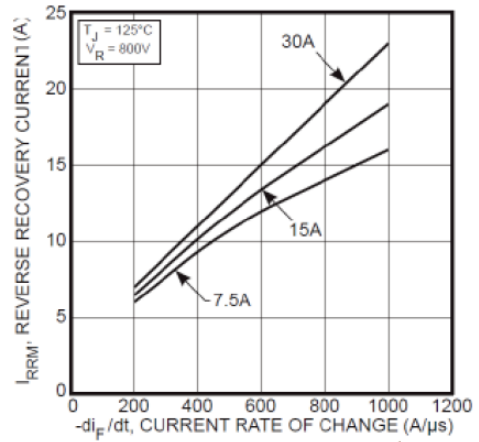


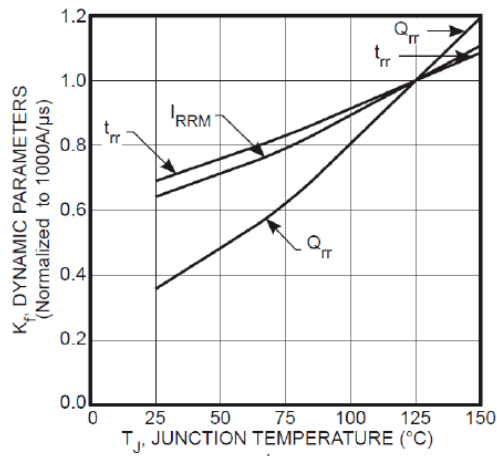
Figure 3 • Reverse Recovery Time vs. Current Rate of Change



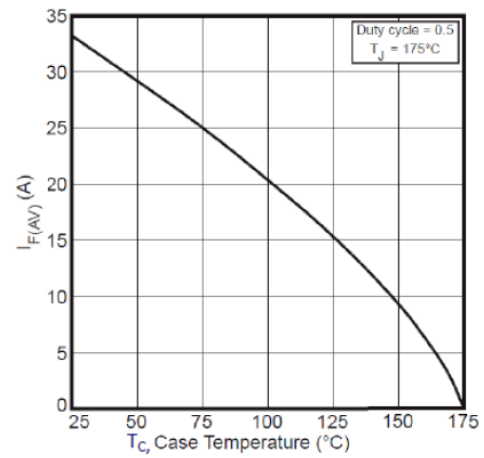
**Figure 4 • Reverse Recovery Charge vs. Current Rate of Change**



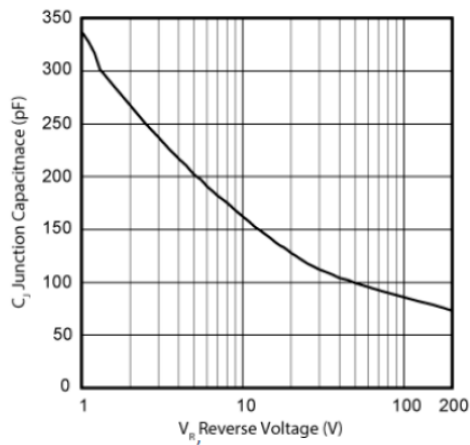
**Figure 5 • Reverse Recovery Current vs. Current Rate of Change**



**Figure 6 • Dynamic Parameters vs. Junction Temperature**



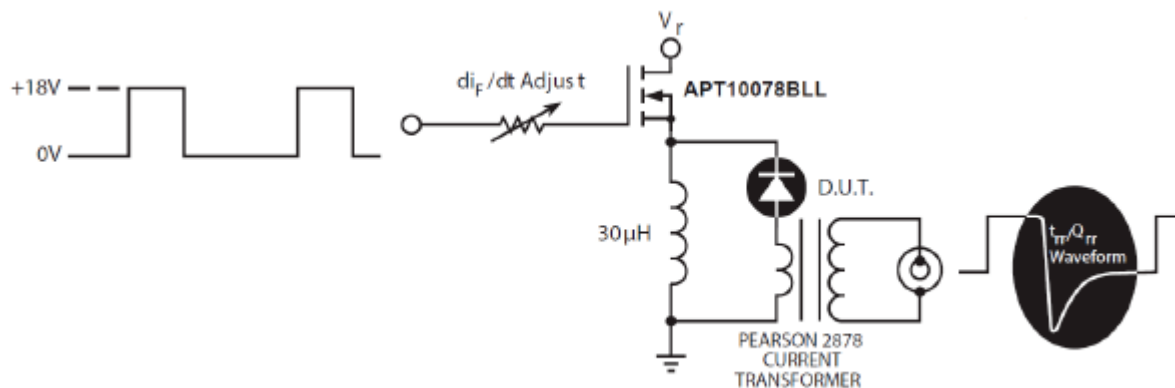
**Figure 7 • Maximum Average Forward Current vs. Case Temperature**



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

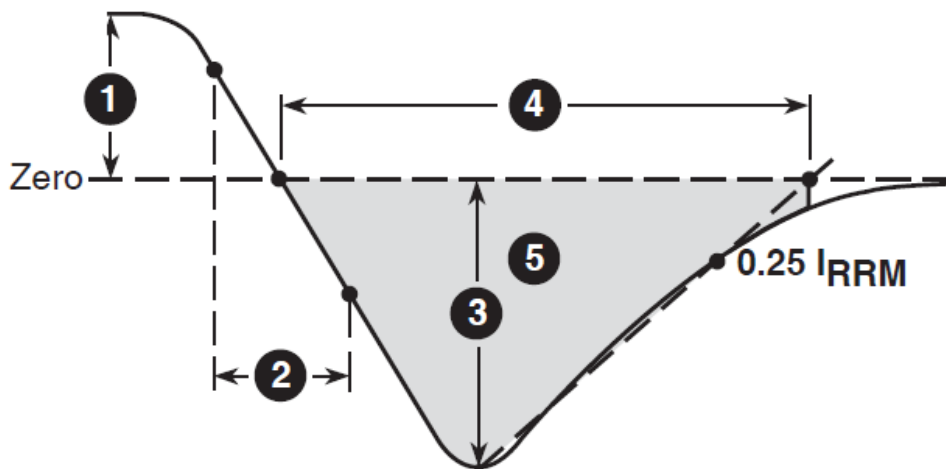
## Reverse Recovery Overview

The following figure illustrates the diode test circuit of the APT15DQ120KG device.



**Figure 9 • Diode Test Circuit**

The following figure illustrates the diode reverse recovery waveform and definitions of the APT15DQ120KG 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 APT15DQ120KG device.

### Package Outline Drawing

The following figure illustrates the TO-220 package outline of the APT15DQ120KG device.

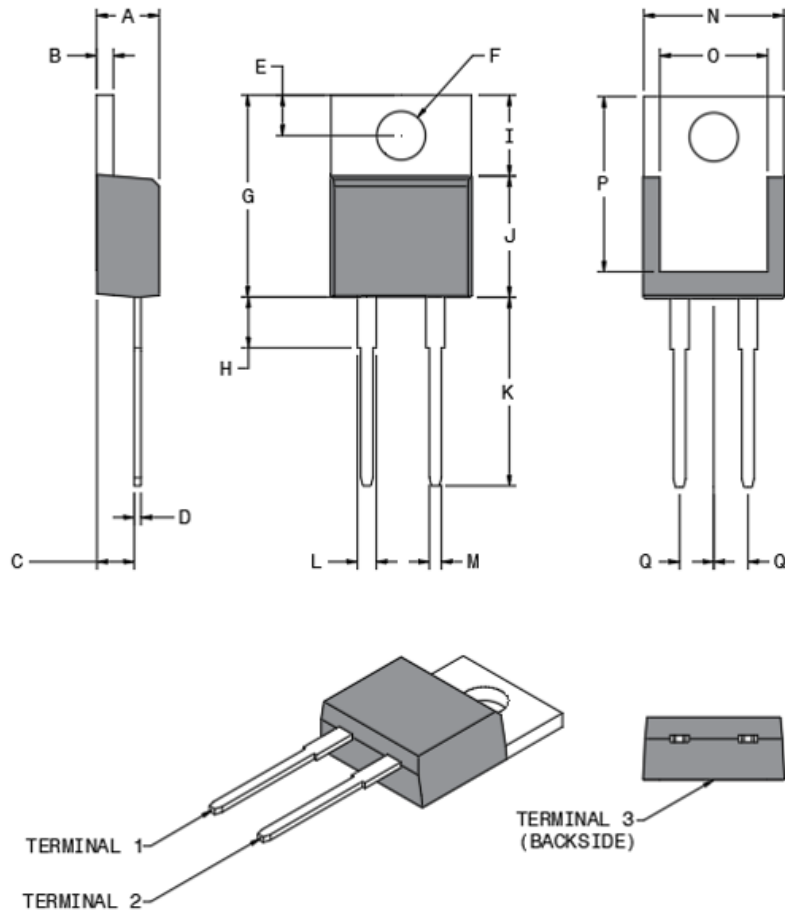


Figure 11 • Package Outline Drawing

The following table shows the TO-220 dimensions and should be used in conjunction with the package outline drawing.

**Table 5 • TO-220 Dimensions**

SYMBOL	MIN	MAX	MIN	MAX
	[mm]	[mm]	[INCH]	[INCH]
A	4.32	4.57	0.170	0.180
B	1.14	1.40	0.045	0.055
C	2.50	2.74	0.098	0.108
D	0.36	0.53	0.014	0.021
E	2.65	3.05	0.104	0.120
F	3.60	3.96	0.142	0.156
G	14.50	15.60	0.571	0.614
H	2.39	3.65	0.094	0.144
I	6.00	6.80	0.236	0.268
J	8.40	9.00	0.331	0.354
K	13.00	14.00	0.512	0.551
L	1.23	1.39	0.048	0.055
M	0.69	0.88	0.027	0.035
N	10.00	10.36	0.394	0.408
O	7.57	7.90	0.298	0.311
P	12.20	13.10	0.480	0.516
Q	2.54 BSC		0.100 BSC	
TERMINAL 1	CATHODE			
TERMINAL 2	ANODE			
TERMINAL 3	CATHODE			



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