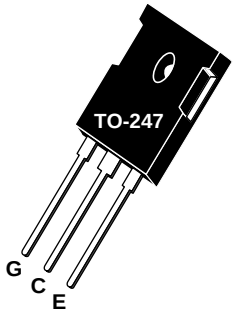
APT11GF120BRD1

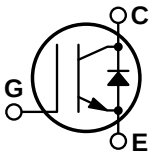
1200V 22A

Fast IGBT & FRED



The Fast IGBT™ is a new generation of high voltage power IGBTs. Using Non-Punch Through Technology the Fast IGBT™ combined with an APT free-wheeling ultraFast Recovery Epitaxial Diode (FRED) offers superior ruggedness and fast switching speed.

- **Low Forward Voltage Drop**
- **High Freq. Switching to 20KHz**
- **Low Tail Current**
- **Ultra Low Leakage Current**
- **RBSOA and SCSOA Rated**
- **Ultrafast Soft Recovery Antiparallel Diode**



MAXIMUM RATINGS (IGBT) All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	APT11GF120BRD1	UNIT
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{CGR}	Collector-Gate Voltage (R_{GE} = 20KΩ)	1200	
V_{GE}	Gate-Emitter Voltage	±20	
I_{C1}	Continuous Collector Current @ T_C = 25°C	22	Amps
I_{C2}	Continuous Collector Current @ T_C = 110°C	11	
I_{CM1}	Pulsed Collector Current ① @ T_C = 25°C	44	
I_{CM2}	Pulsed Collector Current ① @ T_C = 110°C	22	
P_D	Total Power Dissipation	125	Watts
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C
T_L	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

STATIC ELECTRICAL CHARACTERISTICS (IGBT)

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{CES}	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 0.6mA)	1200			Volts
V_{GE}(TH)	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 350µA, T_j = 25°C)	4.5	5.5	6.5	
V_{CE}(ON)	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = I_{C2}, T_j = 25°C)		2.5	3.0	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = I_{C2}, T_j = 125°C)		3.1	3.7	
I_{CES}	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25°C)			0.6	mA
	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 125°C)			3.0	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V, V_{CE} = 0V)			±100	nA

CAUTION: These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

APT Website - http://www.advancedpower.com

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DYNAMIC CHARACTERISTICS (IGBT)

APT11GF120BRD1

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance** V_{GE} = 0V, V_{CE} = 25V, f = 1 MHz		600	800	pF
C_{oes}	Output Capacitance			90	130	
C_{res}	Reverse Transfer Capacitance			38	65	
Q_g	Total Gate Charge ②	**Gate Charge** V_{GE} = 15V, V_{CC} = 0.5V_{CES}, I_C = I_{C2}		60		nC
Q_{ge}	Gate-Emitter Charge			8		
Q_{gc}	Gate-Collector ("Miller") Charge			38		
t_d(on)	Turn-on Delay Time	**Resistive Switching (25°C)** V_{GE} = 15V, V_{CC} = 0.8V_{CES}, I_C = I_{C2}, R_G = 10Ω		10		ns
t_r	Rise Time			50		
t_d(off)	Turn-off Delay Time			55		
t_f	Fall Time			110		
t_d(on)	Turn-on Delay Time	**Inductive Switching (125°C)** V_{CLAMP}(Peak) = 0.66V_{CES}, V_{GE} = 15V, I_C = I_{C2}, R_G = 10Ω, T_J = +125°C		13		ns
t_r	Rise Time			20		
t_d(off)	Turn-off Delay Time			125		
t_f	Fall Time			90		
E_{on}	Turn-on Switching Energy ③			.5		mJ
E_{off}	Turn-off Switching Energy			1.0		
E_{ts}	Total Switching Losses ③			1.5		
t_d(on)	Turn-on Delay Time	**Inductive Switching (25°C)** V_{CLAMP}(Peak) = 0.66V_{CES}, V_{GE} = 15V, I_C = I_{C2}, R_G = 10Ω, T_J = +25°C		13		ns
t_r	Rise Time			20		
t_d(off)	Turn-off Delay Time			110		
t_f	Fall Time			90		
E_{ts}	Total Switching Losses ③			1.0		mJ
gfe	Forward Transconductance	V_{CE} = 20V, I_C = I_{C2}	4.7			S

THERMAL AND MECHANICAL CHARACTERISTICS (IGBT and FRED)

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\Theta JC}$	Junction to Case (IGBT)			1.00	°C/W
	Junction to Case (FRED)			2.0	
$R_{\Theta JA}$	Junction to Ambient			40	
W_T	Package Weight		0.22		oz
			6.1		gm
Torque	Mounting Torque using a 6-32 or 3mm Binding Head Machine Screw			10	lb•in
				1.1	N•m

① Repetitive Rating: Pulse width limited by maximum junction temperature.

② See MIL-STD-750 Method 3471

③ Switching losses include the FRED and IGBT.

ULTRAFAST SOFT RECOVERY PARALLEL DIODE

MAXIMUM RATINGS (FRED) All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Characteristic / Test Conditions	APT11GF120BRD1	UNIT
V_R	Maximum D.C. Reverse Voltage	1200	Volts
V_{RRM}	Maximum Peak Repetitive Reverse Voltage		
V_{RWM}	Maximum Working Peak Reverse Voltage		
I_F(AV)	Maximum Average Forward Current (T_C = 85°C, Duty Cycle = 0.5)	15	Amps
I_F(RMS)	RMS Forward Current	29	
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 45°C, 8.3ms)	110	

STATIC ELECTRICAL CHARACTERISTICS (FRED)

Symbol	Characteristic / Test Conditions		MIN	TYP	MAX	UNIT
V_F	Maximum Forward Voltage	I_F = 15A			2.5	Volts
		I_F = 30A		2.5		
		I_F = 15A, T_J = 150°C			2.2	
I_{RM}	Maximum Reverse Leakage Current	V_R = V_R Rated			250	µA
	Maximum Reverse Leakage Current	V_R = V_R Rated, T_J = 125°C			500	
L_S	Series Inductance (Lead to Lead 5mm from Base)			10		nH

DYNAMIC CHARACTERISTICS (FRED)

Symbol	Characteristic		MIN	TYP	MAX	UNIT
t_{rr1}	Reverse Recovery Time, I_F = 1.0A, di_F/dt = -15A/µs, V_R = 30V, T_J = 25°C			48	TBD	ns
t_{rr2}	Reverse Recovery Time	T_J = 25°C		60		
t_{rr3}	I_F = 15A, di_F/dt = -100A/µs, V_R = 650V	T_J = 100°C		132		
t_{fr1}	Forward Recovery Time	T_J = 25°C		192		
t_{fr2}	I_F = 15A, di_F/dt = 100A/µs, V_R = 650V	T_J = 100°C		211		
I_{RRM1}	Reverse Recovery Current	T_J = 25°C		4.0	TBD	Amps
I_{RRM2}	I_F = 15A, di_F/dt = -100A/µs, V_R = 650V	T_J = 100°C		7	TBD	
Q_{rr1}	Recovery Charge	T_J = 25°C		126		nC
Q_{rr2}	I_F = 15A, di_F/dt = -100A/µs, V_R = 650V	T_J = 100°C		523		
V_{fr1}	Forward Recovery Voltage	T_J = 25°C		12		Volts
V_{fr2}	I_F = 15A, di_F/dt = 100A/µs, V_R = 650V	T_J = 100°C		18		
diM/dt	Rate of Fall of Recovery Current	T_J = 25°C		166		A/µs
	I_F = 15A, di_F/dt = -100A/µs, V_R =650V	T_J = 100°C		81		

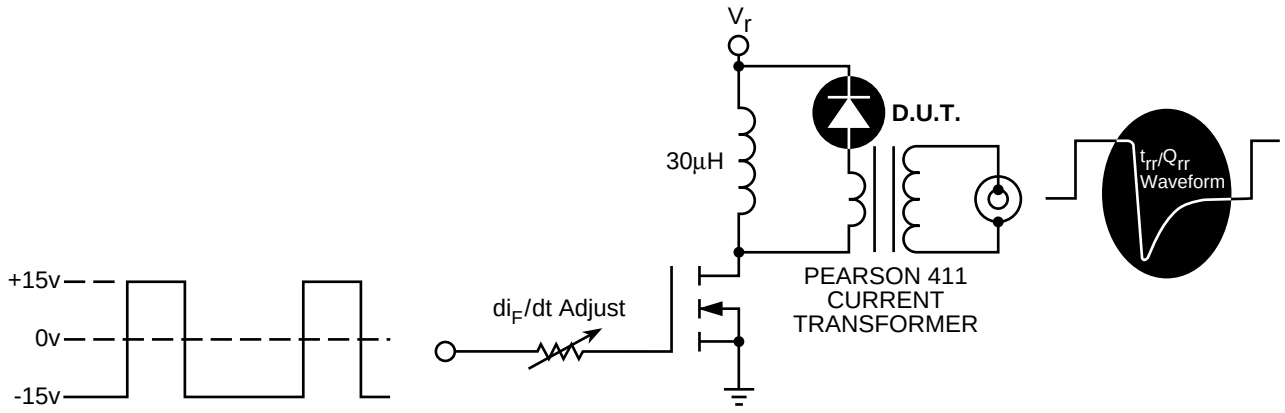


Figure 25, Diode Reverse Recovery Test Circuit and Waveforms

1. I_F - Forward Conduction Current
2. di_F/dt - Current Slew Rate, Rate of Forward Current Change Through Zero Crossing.
3. I_{RRM} - Peak Reverse Recovery Current.
4. t_{rr} - Reverse Recovery Time Measured from Point of I_F Current Falling Through Zero to a Tangent Line {6 diM/dt} Extrapolated Through Zero Defined by 0.75 and 0.50 I_{RRM}.
5. Q_{rr} - Area Under the Curve Defined by I_{RRM} and t_{rr}.
6. diM/dt - Maximum Rate of Current Change During the Trailing Portion of t_{rr}.

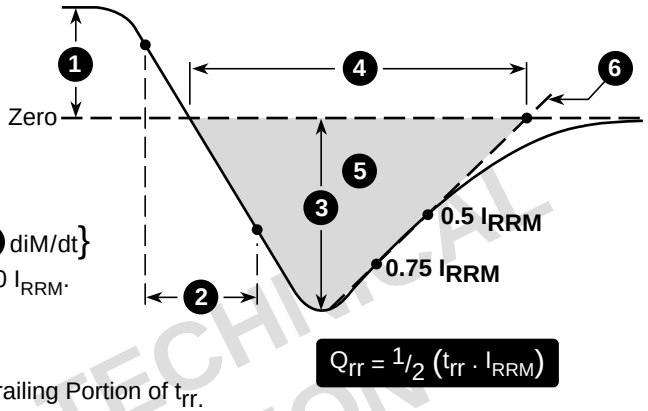
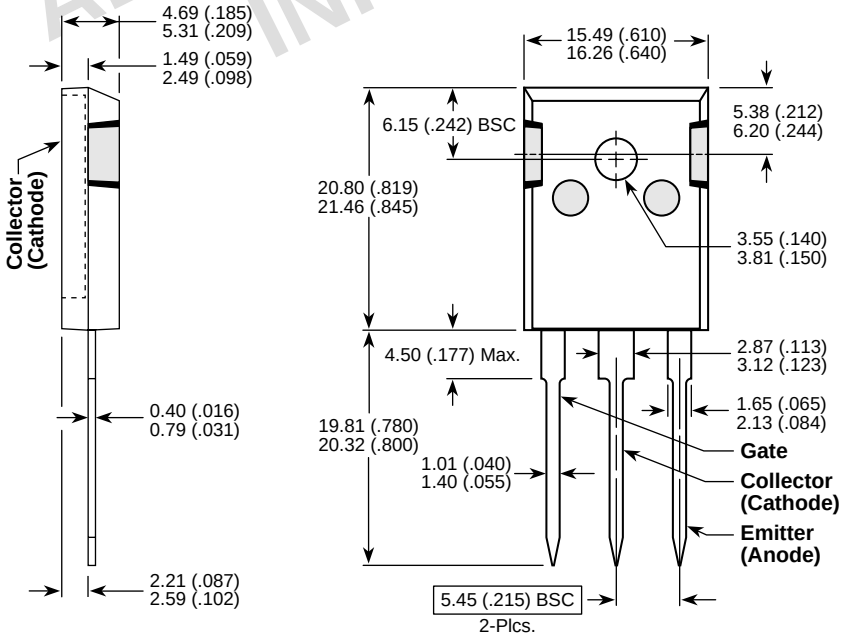


Figure 8, Diode Reverse Recovery Waveform and Definitions

TO-247 Package Outline



Dimensions in Millimeters and (Inches)