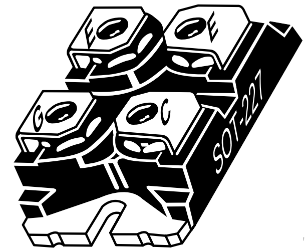
ADVANCED POWER TECHNOLOGY®

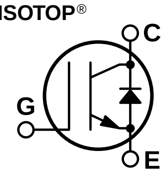
APT60GF120JRD

1200V 100A

Fast IGBT & FRED



ISOTOP®



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

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

Symbol	Parameter	APT60GF120JRD	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	100	Amps
I_{C2}	Continuous Collector Current @ T_C = 90°C	60	
I_{CM1}	Pulsed Collector Current ① @ T_C = 25°C	200	
I_{CM2}	Pulsed Collector Current ① @ T_C = 90°C	120	
P_D	Total Power Dissipation	520	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 = 1.0mA)	1200			Volts
V_{GE}(TH)	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 700μA, T_j = 25°C)	4.5	5.5	6.5	
V_{CE}(ON)	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 40A, T_j = 25°C)		2.9	3.4	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 40A, T_j = 125°C)		3.5	4.1	
I_{CES}	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25°C) ②			1.0	mA
	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 125°C) ②			TBD	
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

USA
405 S.W. Columbia Street Bend, Oregon 97702-1035 Phone: (541) 382-8028 FAX: (541) 388-0364
EUROPE
Avenue J.F. Kennedy Bât B4 Parc Cadéra Nord F-33700 Merignac - France Phone: (33) 5 57 92 15 15 FAX: (33) 5 56 47 97 61

052-6259 Rev A

DYNAMIC CHARACTERISTICS (IGBT)

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance** V_{GE} = 0V V_{CE} = 25V f = 1 MHz		7200	9600	pF
C_{oes}	Output Capacitance			790	1100	
C_{res}	Reverse Transfer Capacitance			420	630	
Q_g	Total Gate Charge ③	**Gate Charge** V_{GE} = 15V V_{CC} = $0.5V_{CES}$ I_C = I_{C2}		690		nC
Q_{ge}	Gate-Emitter Charge			55		
Q_{gc}	Gate-Collector ("Miller") Charge			390		
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 = 5Ω		60		ns
t_r	Rise Time			205		
t_d(off)	Turn-off Delay Time			295		
t_f	Fall Time			210		
t_d(on)	Turn-on Delay Time	**Inductive Switching (150°C)** V_{CLAMP}(Peak) = $0.66V_{CES}$ V_{GE} = 15V I_C = I_{C2} R_G = 5Ω T_J = +150°C		55		ns
t_r	Rise Time			130		
t_d(off)	Turn-off Delay Time			750		
t_f	Fall Time			80		
E_{on}	Turn-on Switching Energy ④			9		mJ
E_{off}	Turn-off Switching Energy			10		
E_{ts}	Total Switching Losses ④			19		
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 = 5Ω T_J = +25°C		55		ns
t_r	Rise Time			145		
t_d(off)	Turn-off Delay Time			650		
t_f	Fall Time			70		
E_{ts}	Total Switching Losses ④			17		mJ
gfe	Forward Transconductance	V_{CE} = 20V, I_C = I_{C2}	6			S

THERMAL AND MECHANICAL CHARACTERISTICS (IGBT and FRED)

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\Theta JC}$	Junction to Case (IGBT)			0.24	°C/W
	Junction to Case (FRED)			0.66	
$R_{\Theta JA}$	Junction to Ambient			40	
W_T	Package Weight		1.03		oz
			29.2		gm
Torque	Mounting Torque (Mounting = 8-32 or 4mm Machine and Terminals = 4mm Machine)			10	lb•in
				1.1	N•m

① Repetitive Rating: Pulse width limited by maximum junction temperature.
② Leakages include the FRED and IGBT.
③ See MIL-STD-750 Method 3471
④ 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	APT60GF120JRD	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 = 60°C, Duty Cycle = 0.5)	60	Amps
$I_F(RMS)$	RMS Forward Current	100	
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 45°C, 8.3mS)	540	

STATIC ELECTRICAL CHARACTERISTICS (FRED)

Symbol	Characteristic / Test Conditions		MIN	TYP	MAX	UNIT
V_F	Maximum Forward Voltage	I_F = 60A			2.5	Volts
		I_F = 120A		2.0		
		I_F = 60A, T_J = 150°C			2.0	

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			70	85	ns
t_{rr2}	Reverse Recovery Time	T_J = 25°C		70		
t_{rr3}	I_F = 60A, di_F/dt = -480A/µs, V_R = 650V	T_J = 100°C		130		
t_{fr1}	Forward Recovery Time	T_J = 25°C		170		
t_{fr2}	I_F = 60A, di_F/dt = 480A/µs, V_R = 650V	T_J = 100°C		170		
I_{RRM1}	Reverse Recovery Current	T_J = 25°C		18	30	Amps
I_{RRM2}	I_F = 60A, di_F/dt = -480A/µs, V_R = 650V	T_J = 100°C		29	40	
Q_{rr1}	Recovery Charge	T_J = 25°C		630		nC
Q_{rr2}	I_F = 60A, di_F/dt = -480A/µs, V_R = 650V	T_J = 100°C		1820		
V_{fr1}	Forward Recovery Voltage	T_J = 25°C		12		Volts
V_{fr2}	I_F = 60A, di_F/dt = 480A/µs, V_R = 650V	T_J = 100°C		12		
diM/dt	Rate of Fall of Recovery Current	T_J = 25°C		900		A/µs
	I_F = 60A, di_F/dt = -480A/µs, V_R =650V	T_J = 100°C		600		

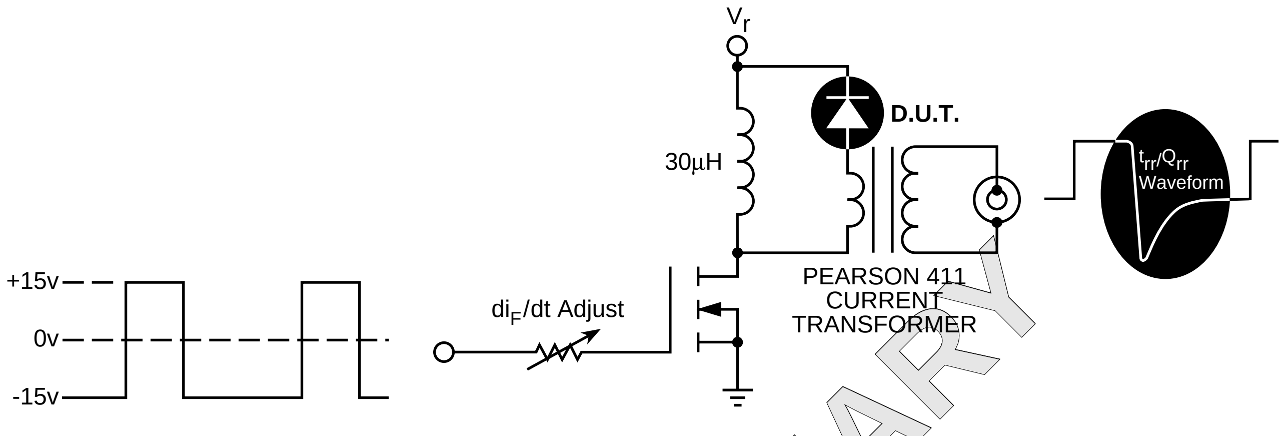
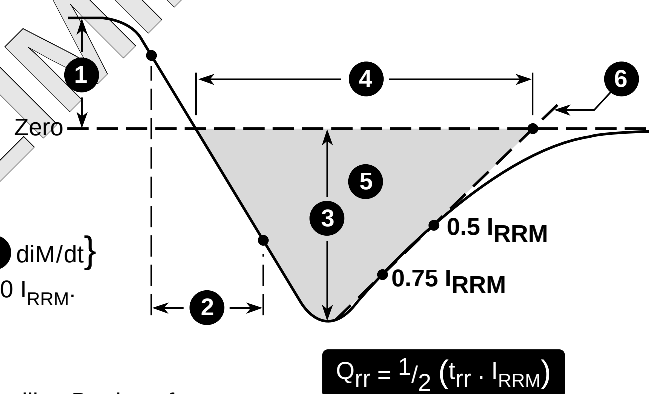
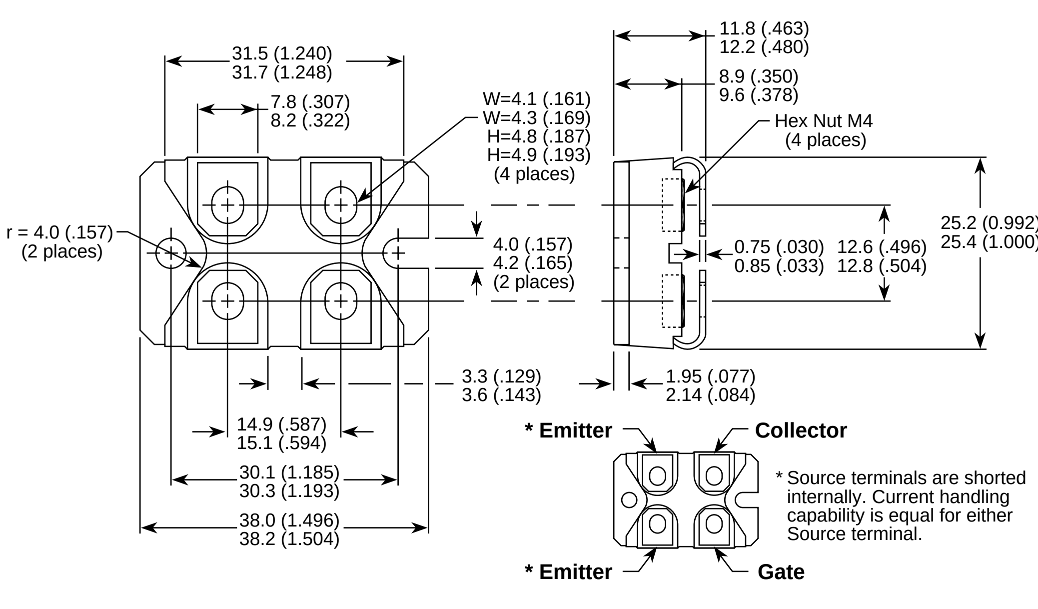


Figure 25, Diode Reverse Recovery Test Circuit and Waveforms

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}.



SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)