



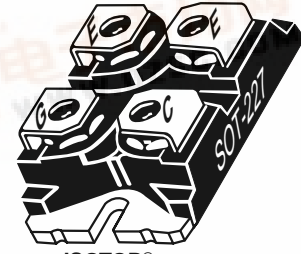
APT60GF120JRD

1200V 100A

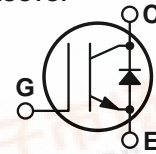
Fast IGBT & FRED

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



ISOTOP®



MAXIMUM RATINGS (IGBT)

All Ratings: $T_C = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	APT60GF120JRD	UNIT
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{CGR}	Collector-Gate Voltage ($R_{GE} = 20K\Omega$)	1200	
V_{GE}	Gate-Emitter Voltage	± 20	
I_{C1}	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	100	Amps
I_{C2}	Continuous Collector Current @ $T_C = 90^\circ\text{C}$	60	
I_{CM1}	Pulsed Collector Current ^① @ $T_C = 25^\circ\text{C}$	200	
I_{CM2}	Pulsed Collector Current ^① @ $T_C = 90^\circ\text{C}$	120	
P_D	Total Power Dissipation	520	Watts
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
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 ($V_{CE} = V_{GE}, I_C = 700\mu A, T_j = 25^\circ\text{C}$)	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 40A, T_j = 25^\circ\text{C}$)		2.9	3.4	
	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 40A, T_j = 125^\circ\text{C}$)		3.5	4.1	
I_{CES}	Collector Cut-off Current ($V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25^\circ\text{C}$) ^②			1.0	mA
	Collector Cut-off Current ($V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 125^\circ\text{C}$) ^②			TBD	
I_{GES}	Gate-Emitter Leakage Current ($V_{GE} = \pm 20V, V_{CE} = 0V$)			± 100	nA

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

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

DYNAMIC CHARACTERISTICS (IGBT)
APT60GF120JRD

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	Capacitance $V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1 \text{ MHz}$		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) $V_{GE} = 15V$ $V_{CC} = 0.8V_{CES}$ $I_C = I_{C2}$ $R_G = 5\Omega$		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) $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 5\Omega$ $T_J = +150^\circ C$		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	$R_G = 5\Omega$ $T_J = +150^\circ C$		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) $V_{CLAMP(Peak)} = 0.66V_{CES}$ $V_{GE} = 15V$ $I_C = I_{C2}$ $R_G = 5\Omega$ $T_J = +25^\circ C$		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
g_{fe}	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: $T_C = 25^\circ\text{C}$ 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 ($T_C = 60^\circ\text{C}$, Duty Cycle = 0.5)	60	Amps
$I_F(RMS)$	RMS Forward Current	100	
I_{FSM}	Non-Repetitive Forward Surge Current ($T_J = 45^\circ\text{C}$, 8.3ms)	540	

STATIC ELECTRICAL CHARACTERISTICS (FRED)

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
V_F	Maximum Forward Voltage			$I_F = 60\text{A}$	2.5
				$I_F = 120\text{A}$	2.0
				$I_F = 60\text{A}, T_J = 150^\circ\text{C}$	2.0

DYNAMIC CHARACTERISTICS (FRED)

Symbol	Characteristic	MIN	TYP	MAX	UNIT
t_{rr1}	Reverse Recovery Time, $I_F = 1.0\text{A}$, $di_F/dt = -15\text{A}/\mu\text{s}$, $V_R = 30\text{V}$, $T_J = 25^\circ\text{C}$		70	85	ns
t_{rr2}	Reverse Recovery Time		$T_J = 25^\circ\text{C}$ 70		
t_{rr3}	$I_F = 60\text{A}$, $di_F/dt = -480\text{A}/\mu\text{s}$, $V_R = 650\text{V}$		$T_J = 100^\circ\text{C}$ 130		
t_{fr1}	Forward Recovery Time		$T_J = 25^\circ\text{C}$ 170		
t_{fr2}	$I_F = 60\text{A}$, $di_F/dt = 480\text{A}/\mu\text{s}$, $V_R = 650\text{V}$		$T_J = 100^\circ\text{C}$ 170		
I_{RRM1}	Reverse Recovery Current		$T_J = 25^\circ\text{C}$ 18	30	Amps
I_{RRM2}	$I_F = 60\text{A}$, $di_F/dt = -480\text{A}/\mu\text{s}$, $V_R = 650\text{V}$		$T_J = 100^\circ\text{C}$ 29	40	
Q_{rr1}	Recovery Charge		$T_J = 25^\circ\text{C}$ 630		nC
Q_{rr2}	$I_F = 60\text{A}$, $di_F/dt = -480\text{A}/\mu\text{s}$, $V_R = 650\text{V}$		$T_J = 100^\circ\text{C}$ 1820		
V_{fr1}	Forward Recovery Voltage		$T_J = 25^\circ\text{C}$ 12		Volts
V_{fr2}	$I_F = 60\text{A}$, $di_F/dt = 480\text{A}/\mu\text{s}$, $V_R = 650\text{V}$		$T_J = 100^\circ\text{C}$ 12		
diM/dt	Rate of Fall of Recovery Current		$T_J = 25^\circ\text{C}$ 900		A/ μs
	$I_F = 60\text{A}$, $di_F/dt = -480\text{A}/\mu\text{s}$, $V_R = 650\text{V}$		$T_J = 100^\circ\text{C}$ 600		

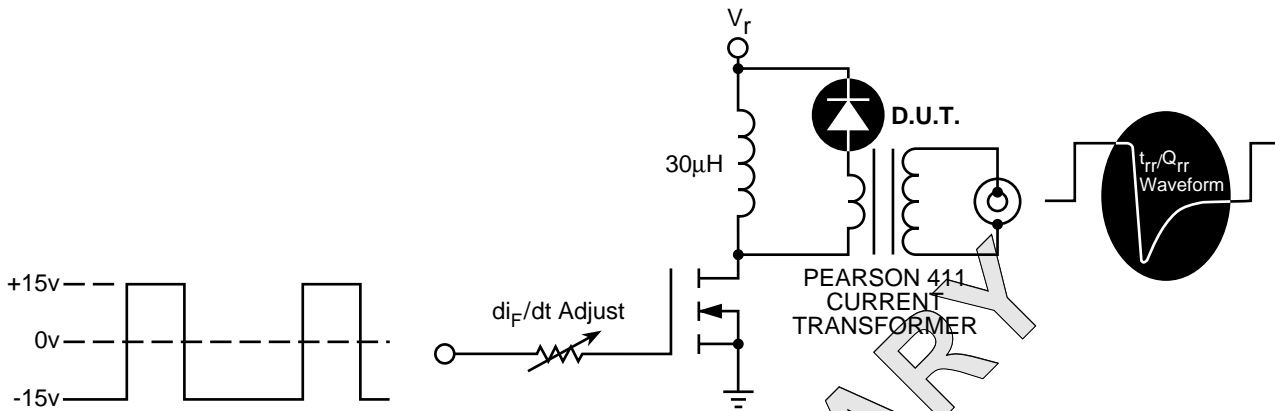
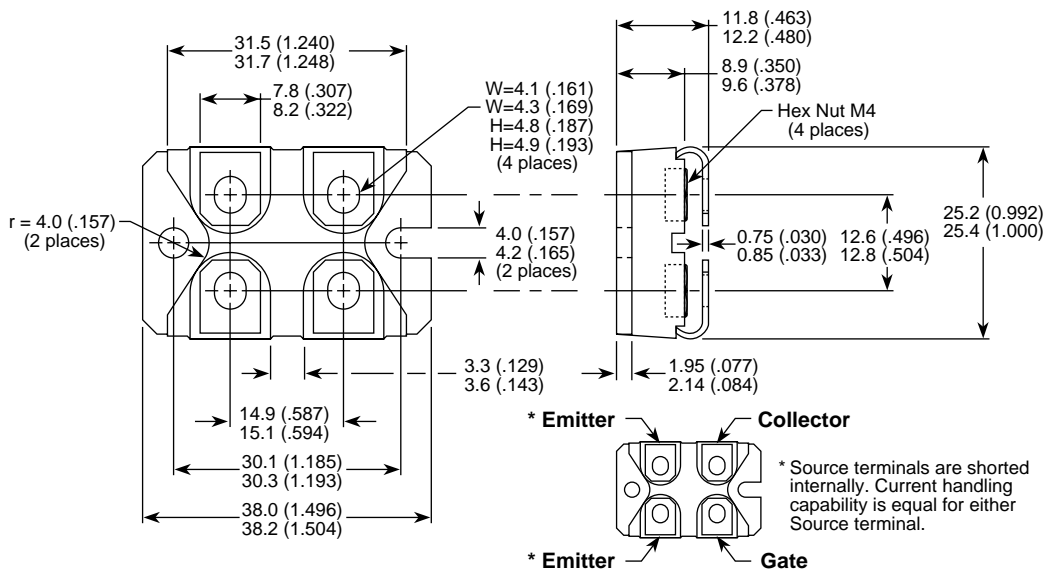


Figure 25, Diode Reverse Recovery Test Circuit and Waveforms

- 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 di_M/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 di_M/dt - Maximum Rate of Current Change During the Trailing Portion of t_{rr} .
- $$Q_{rr} = \frac{1}{2} (t_{rr} \cdot I_{RRM})$$

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)