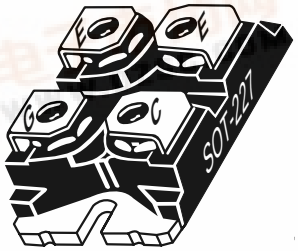
APT100GF60JRD

600V 140A

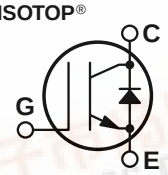
Fast IGBT & FRED



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**
- **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	APT100GF60JRD	UNIT
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{CGR}	Collector-Gate Voltage (R_{GE} = 20KΩ)	600	
V_{GE}	Gate-Emitter Voltage	±20	
I_{C1}	Continuous Collector Current @ T_C = 25°C	140	Amps
I_{C2}	Continuous Collector Current @ T_C = 90°C	100	
I_{CM1}	Pulsed Collector Current ① @ T_C = 25°C	280	
I_{CM2}	Pulsed Collector Current ① @ T_C = 90°C	200	
P_D	Total Power Dissipation	390	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 = 0.8mA)	600			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 = 50A, T_j = 25°C)		2.5	2.7	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 50A, T_j = 125°C)		3.3	3.9	
I_{CES}	Collector Cut-off Current (V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25°C) ②			0.8	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

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

052-6255 Rev A

DYNAMIC CHARACTERISTICS (IGBT)

APT100GF60JRD

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance** V_{GE} = 0V, V_{CE} = 25V, f = 1 MHz		4400	5900	pF
C_{oes}	Output Capacitance			890	1250	
C_{res}	Reverse Transfer Capacitance			290	435	
Q_g	Total Gate Charge ③	**Gate Charge** V_{GE} = 15V, V_{CC} = 0.5V_{CES}, I_C = I_{C2}		335		nC
Q_{ge}	Gate-Emitter Charge			40		
Q_{gc}	Gate-Collector ("Miller") Charge			195		
$t_d(on)$	Turn-on Delay Time	**Resistive Switching (25°C)** V_{GE} = 15V, V_{CC} = 0.8V_{CES}, I_C = I_{C2}, R_G = 5Ω		30		ns
t_r	Rise Time			105		
$t_d(off)$	Turn-off Delay Time			145		
t_f	Fall Time			135		
$t_d(on)$	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		40		ns
t_r	Rise Time			200		
$t_d(off)$	Turn-off Delay Time			250		
t_f	Fall Time			140		
E_{on}	Turn-on Switching Energy ④			7.0		mJ
E_{off}	Turn-off Switching Energy			5.6		
E_{ts}	Total Switching Losses ④			13.6		
$t_d(on)$	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		40		ns
t_r	Rise Time			200		
$t_d(off)$	Turn-off Delay Time			210		
t_f	Fall Time			115		
E_{ts}	Total Switching Losses ④			11.0		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)			0.32	°C/W
	Junction to Case (FRED)			0.42	
$R_{\Theta JA}$	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	APT100GF60JRD	UNIT
V_R	Maximum D.C. Reverse Voltage	600	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)	100	Amps
$I_F(RMS)$	RMS Forward Current	170	
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 45°C, 8.3ms)	1000	

STATIC ELECTRICAL CHARACTERISTICS (FRED)

Symbol	Characteristic / Test Conditions		MIN	TYP	MAX	UNIT
V_F	Maximum Forward Voltage	I_F = 100A			2.0	Volts
		I_F = 200A		1.7		
		I_F = 100A, T_J = 150°C			1.7	

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			60	75	ns
t_{rr2}	Reverse Recovery Time	T_J = 25°C		60		
t_{rr3}	I_F = 100A, di_F/dt = -800A/µs, V_R = 350V	T_J = 100°C		92		
t_{fr1}	Forward Recovery Time	T_J = 25°C		185		
t_{fr2}	I_F = 100A, di_F/dt = 800A/µs, V_R = 350V	T_J = 100°C		185		
I_{RRM1}	Reverse Recovery Current	T_J = 25°C		27	38	Amps
I_{RRM2}	I_F = 100A, di_F/dt = -800A/µs, V_R = 350V	T_J = 100°C		42	54	
Q_{rr1}	Recovery Charge	T_J = 25°C		810		nC
Q_{rr2}	I_F = 100A, di_F/dt = -800A/µs, V_R = 350V	T_J = 100°C		1930		
V_{fr1}	Forward Recovery Voltage	T_J = 25°C		10.2		Volts
V_{fr2}	I_F = 100A, di_F/dt = 800A/µs, V_R = 350V	T_J = 100°C		10.2		
diM/dt	Rate of Fall of Recovery Current	T_J = 25°C		600		A/µs
	I_F = 100A, di_F/dt = -800A/µs, V_R = 350V	T_J = 100°C		400		

052-6255 Rev A

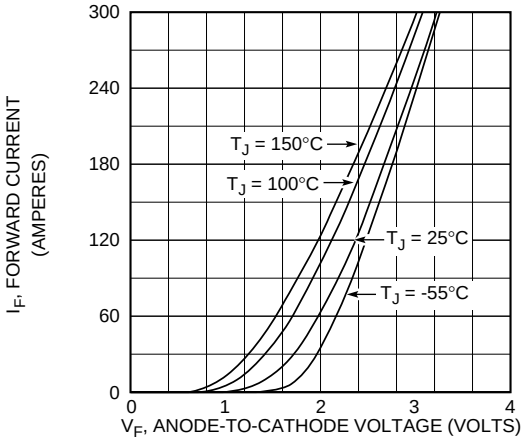


Figure 1, Forward Voltage Drop vs Forward Current

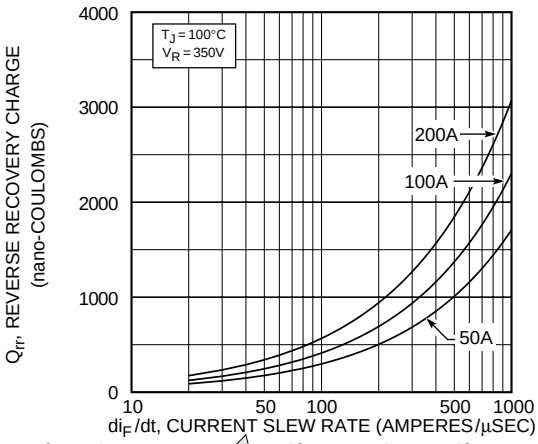


Figure 2, Reverse Recovery Charge vs Current Slew Rate

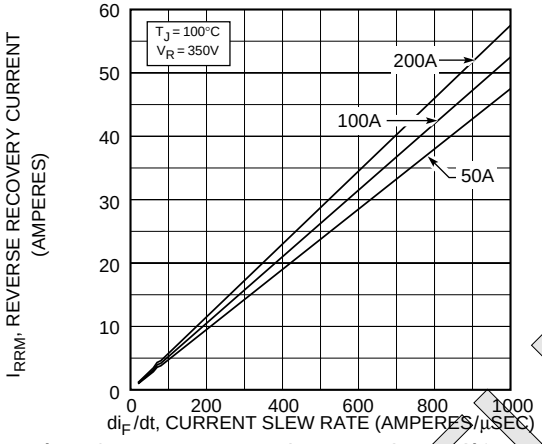


Figure 3, Reverse Recovery Current vs Current Slew Rate

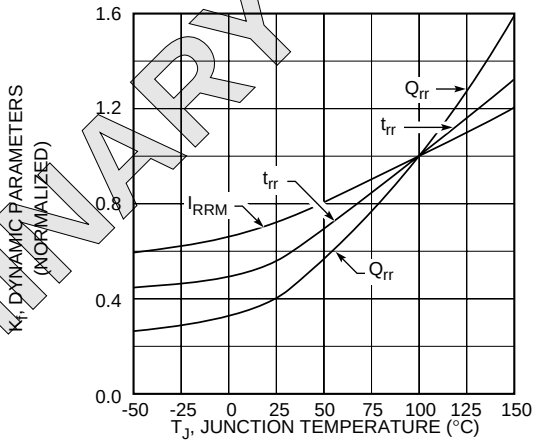


Figure 4, Dynamic Parameters vs Junction Temperature

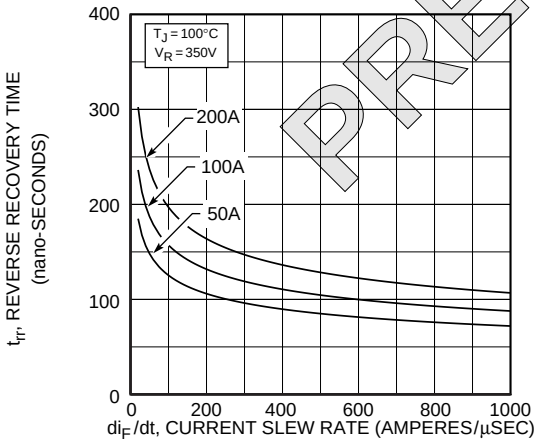


Figure 5, Reverse Recovery Time vs Current Slew Rate

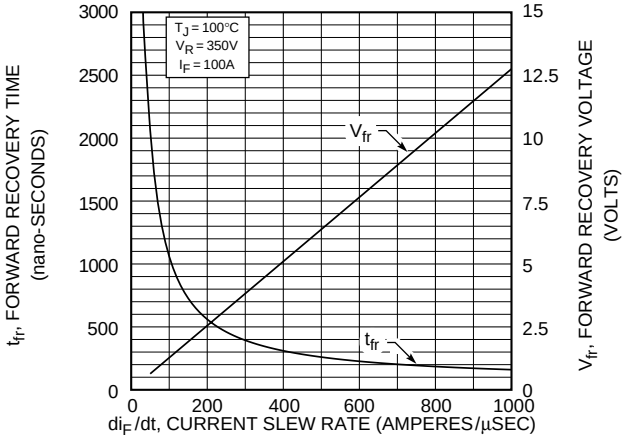


Figure 6, Forward Recovery Voltage/Time vs Current Slew Rate

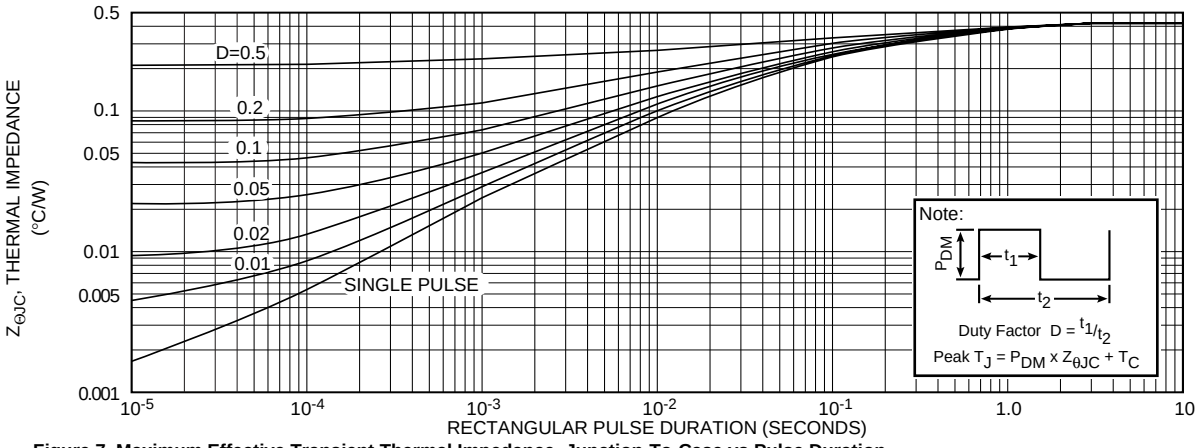


Figure 7, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

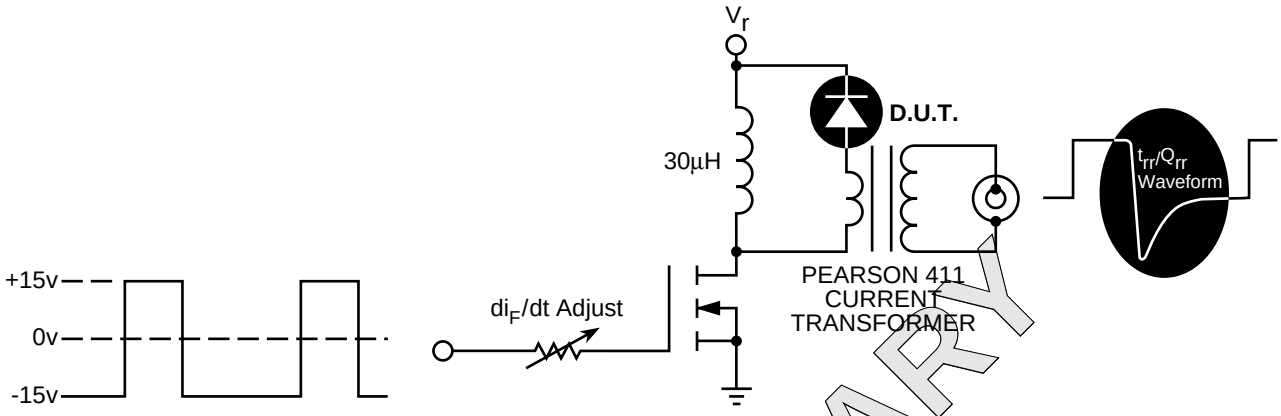


Figure 25, Diode Reverse Recovery Test Circuit and Waveforms

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}.

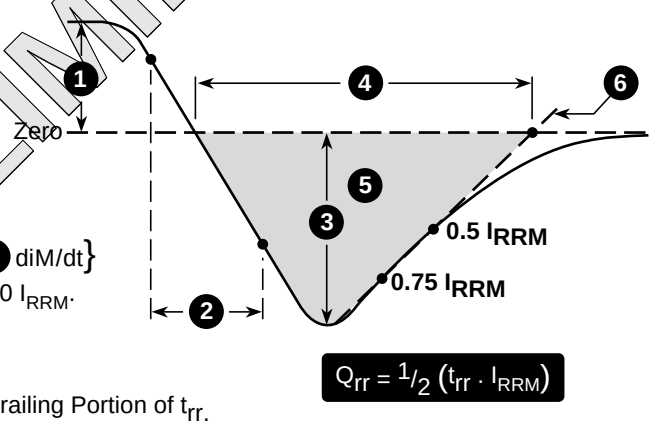
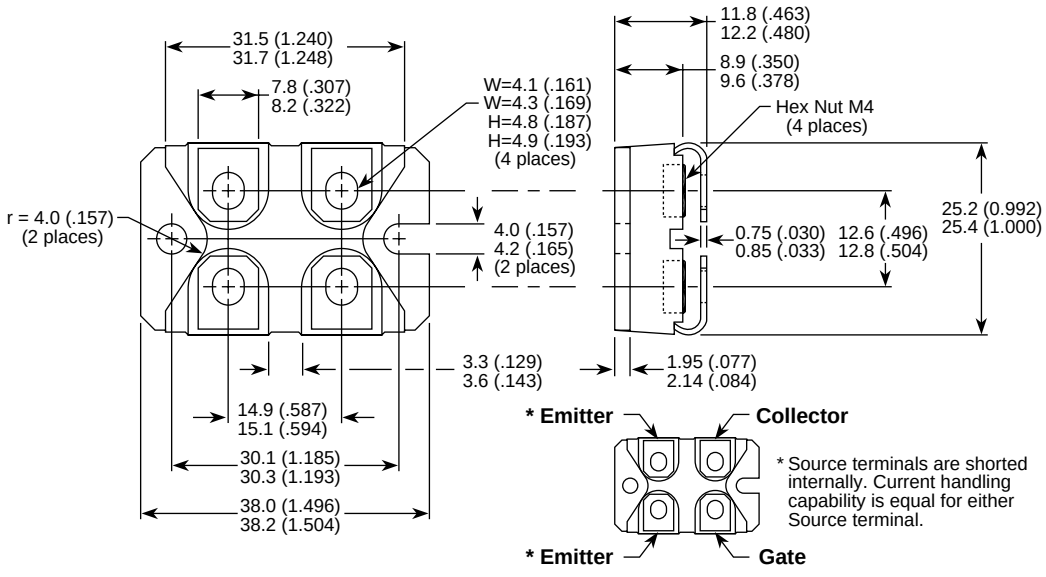


Figure 8, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)