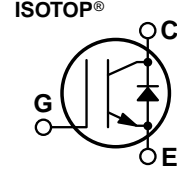
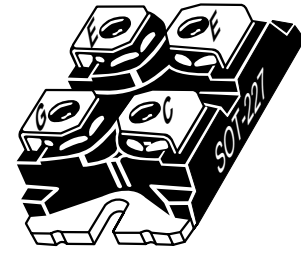


Fast IGBT & FRED

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




MAXIMUM RATINGS (IGBT)

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

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

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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		
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		
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 _{θJC}	Junction to Case (IGBT)			0.32	°C/W
	Junction to Case (FRED)			0.42	
R _{θJA}	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.

APT Reserves the right to change, without notice, the specifications and information contained herein.

ULTRAFAST SOFT RECOVERY PARALLEL DIODE

MAXIMUM RATINGS (FRED)

All Ratings: $T_C = 25^\circ\text{C}$ 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 ($T_C = 60^\circ\text{C}$, Duty Cycle = 0.5)	100	Amps
$I_F(RMS)$	RMS Forward Current	170	
I_{FSM}	Non-Repetitive Forward Surge Current ($T_J = 45^\circ\text{C}$, 8.3ms)	1000	

STATIC ELECTRICAL CHARACTERISTICS (FRED)

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
V_F	Maximum Forward Voltage			2.0	Volts
				$I_F = 100\text{A}$	
			$I_F = 200\text{A}$	1.7	
	$I_F = 100\text{A}, T_J = 150^\circ\text{C}$			1.7	

DYNAMIC CHARACTERISTICS (FRED)

Symbol	Characteristic	MIN	TYP	MAX	UNIT
t_{rr1}	Reverse Recovery Time, $I_F = 1.0\text{A}$, $di_F/dt = -15\text{A}/\mu\text{s}$, $V_R = 30\text{V}$, $T_J = 25^\circ\text{C}$		60	75	ns
t_{rr2}	Reverse Recovery Time		$T_J = 25^\circ\text{C}$ 60		
t_{rr3}	$I_F = 100\text{A}$, $di_F/dt = -800\text{A}/\mu\text{s}$, $V_R = 350\text{V}$		$T_J = 100^\circ\text{C}$ 92		
t_{fr1}	Forward Recovery Time		$T_J = 25^\circ\text{C}$ 185		Volts
t_{fr2}	$I_F = 100\text{A}$, $di_F/dt = 800\text{A}/\mu\text{s}$, $V_R = 350\text{V}$		$T_J = 100^\circ\text{C}$ 185		
I_{RRM1}	Reverse Recovery Current		$T_J = 25^\circ\text{C}$ 27	38	Amps
I_{RRM2}	$I_F = 100\text{A}$, $di_F/dt = -800\text{A}/\mu\text{s}$, $V_R = 350\text{V}$		$T_J = 100^\circ\text{C}$ 42	54	
Q_{rr1}	Recovery Charge		$T_J = 25^\circ\text{C}$ 810		nC
Q_{rr2}	$I_F = 100\text{A}$, $di_F/dt = -800\text{A}/\mu\text{s}$, $V_R = 350\text{V}$		$T_J = 100^\circ\text{C}$ 1930		
V_{fr1}	Forward Recovery Voltage		$T_J = 25^\circ\text{C}$ 10.2		Volts
V_{fr2}	$I_F = 100\text{A}$, $di_F/dt = 800\text{A}/\mu\text{s}$, $V_R = 350\text{V}$		$T_J = 100^\circ\text{C}$ 10.2		
diM/dt	Rate of Fall of Recovery Current		$T_J = 25^\circ\text{C}$ 600		A/ μs
	$I_F = 100\text{A}$, $di_F/dt = -800\text{A}/\mu\text{s}$, $V_R = 350\text{V}$		$T_J = 100^\circ\text{C}$ 400		

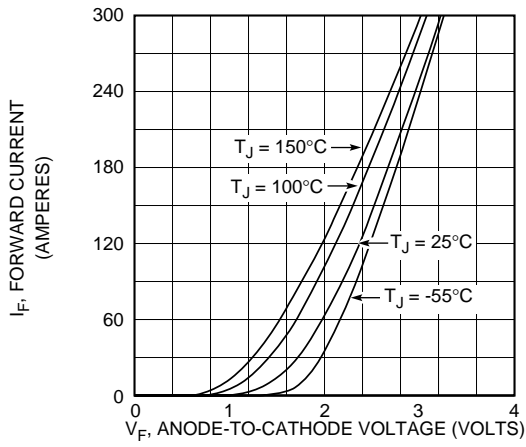


Figure 1, Forward Voltage Drop vs Forward Current

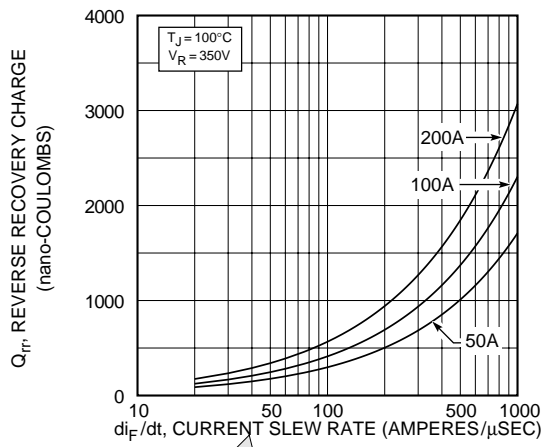


Figure 2, Reverse Recovery Charge vs Current Slew Rate

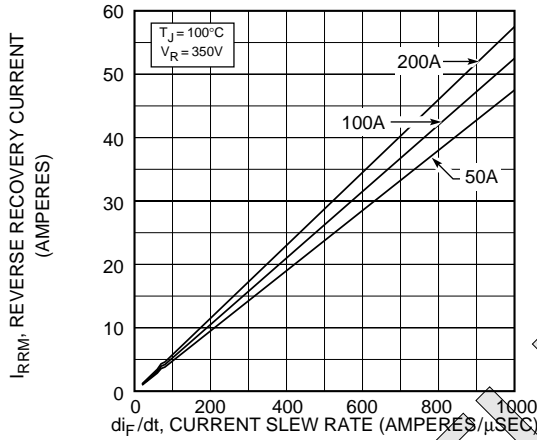


Figure 3, Reverse Recovery Current vs Current Slew Rate

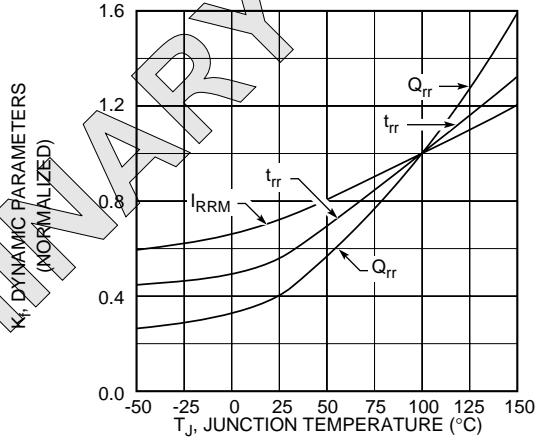


Figure 4, Dynamic Parameters vs Junction Temperature

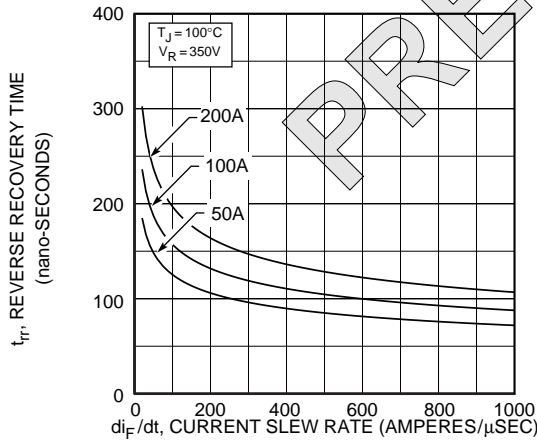


Figure 5, Reverse Recovery Time vs Current Slew Rate

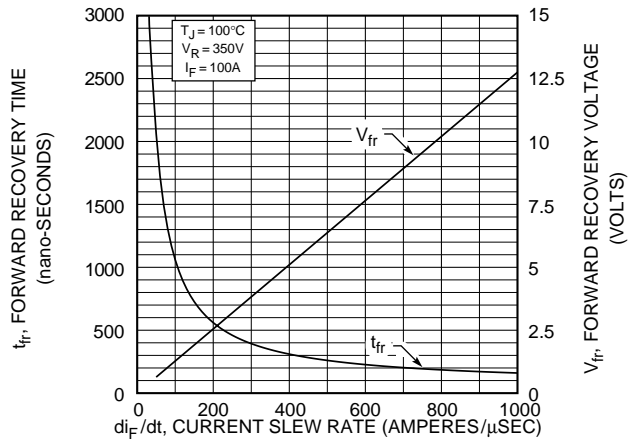


Figure 6, Forward Recovery Voltage/Time vs Current Slew Rate

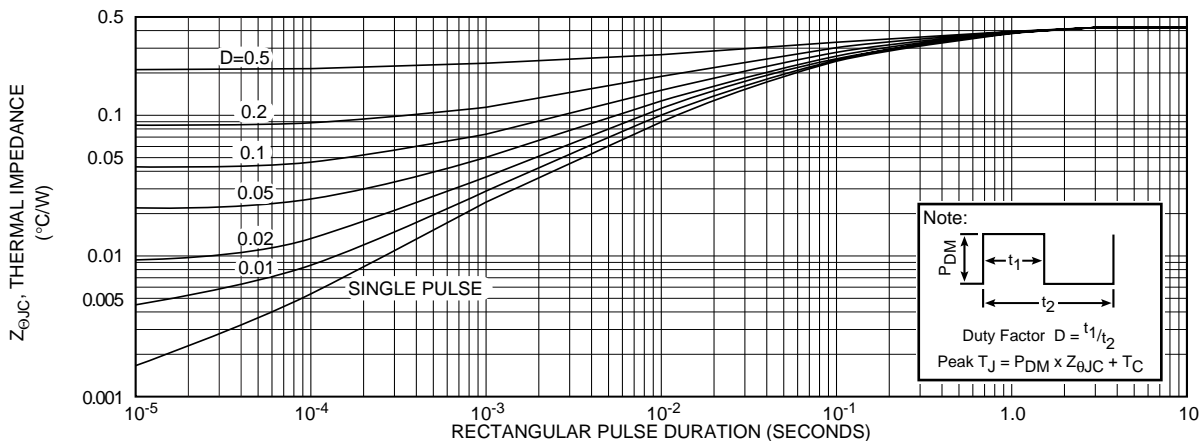


Figure 7, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

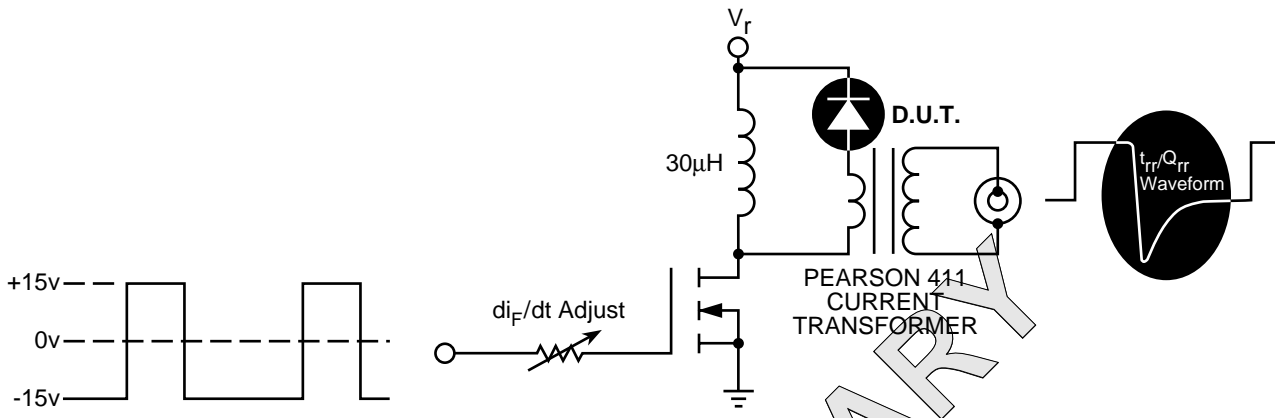


Figure 25, Diode Reverse Recovery Test Circuit and Waveforms

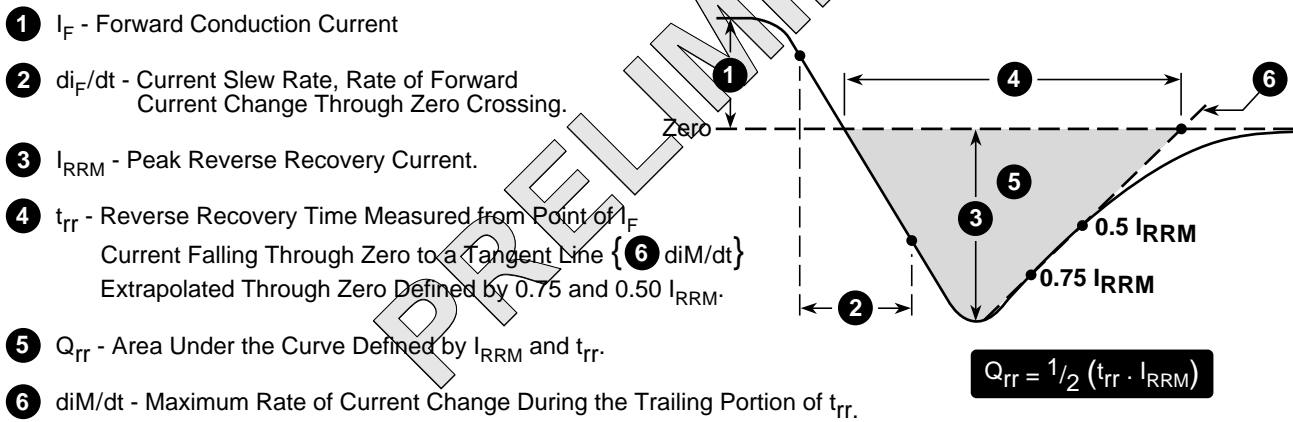
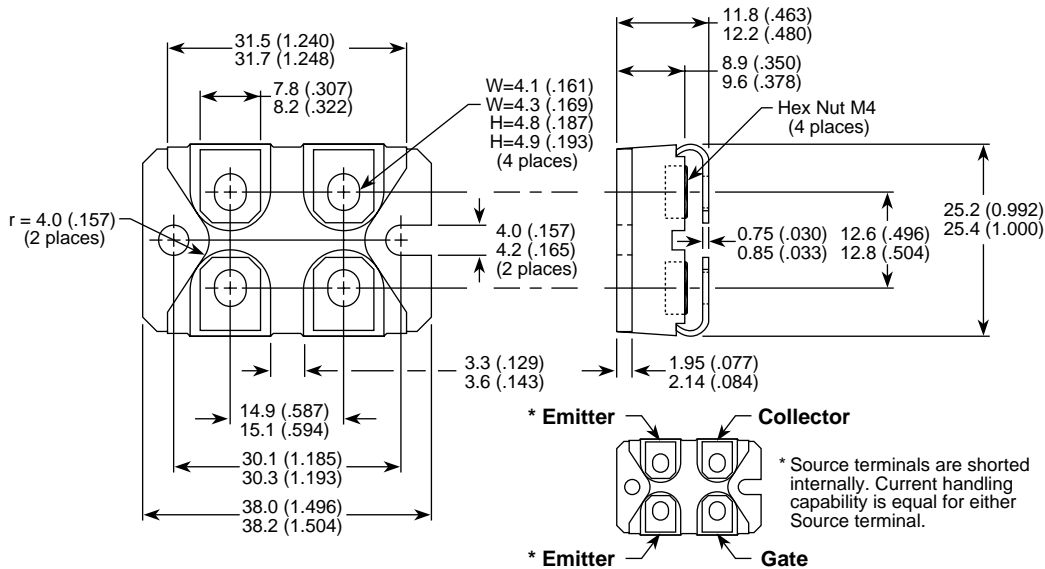


Figure 8, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)