Microsemi
POWER PRODUCTS GROUP

APT70GR120JD60

1200V, 70A, $V_{ce(on)}$ = 2.5V Typical

Ultra Fast NPT - IGBT®

The Ultra Fast NPT - IGBT® is a new generation of high voltage power IGBTs. Using Non-Punch-Through Technology, the Ultra Fast NPT-IGBT® offers superior ruggedness and ultrafast switching speed.

Features

- **Low Saturation Voltage**
- **Low Tail Current**
- **RoHS Compliant**
- **Short Circuit Withstand Rated**
- **High Frequency Switching**
- **Ultra Low Leakage Current**

Unless stated otherwise, Microsemi discrete IGBTs contain a single IGBT die. This device is recommended for applications such as induction heating (IH), motor control, general purpose inverters and uninterruptible power supplies (UPS).

MAXIMUM RATINGS

All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	Ratings	Unit
V_{ces}	Collector Emitter Voltage	1200	V
V_{GE}	Gate-Emitter Voltage	±30	
I_{C1}	Continuous Collector Current @ T_C = 25°C	112	A
I_{C2}	Continuous Collector Current @ T_C = 86°C	70	
I_{CM}	Pulsed Collector Current ①	280	
SCWT	Short Circuit Withstand Time: V_{CE} = 600V, V_{GE} = 15V, T_C=125°C	10	µs
P_D	Total Power Dissipation @ T_C = 25°C	543	W
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Unit
$V_{(BR)CES}$	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 = 2.5mA, T_j = 25°C)	3.5	5.0	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 70A, T_j = 25°C)		2.5	3.2	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 70A, T_j = 125°C)		3.3		
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 140A, T_j = 25°C)		3.5		
I_{CES}	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 25°C) ②		20	1100	µA
	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 125°C) ②		200		
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)			±250	nA

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

DYNAMIC CHARACTERISTICS

APT70GR120JD60

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	Capacitance		7260		pF
C_{oes}	Output Capacitance	V_{GE} = 0V, V_{CE} = 25V		643		
C_{res}	Reverse Transfer Capacitance	f = 1MHz		199		
V_{GEP}	Gate to Emitter Plateau Voltage	Gate Charge		7.5		V
Q_g ③	Total Gate Charge	V_{GE} = 15V		412	544	nC
Q_{ge}	Gate-Emitter Charge	V_{CE}= 600V		48	62	
Q_{gc}	Gate- Collector Charge	I_C = 70A		204	275	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C)		33		ns
t_r	Current Rise Time	V_{CC} = 600V		48		
$t_{d(off)}$	Turn-Off Delay Time	V_{GE} = 15V		278		
t_f	Current Fall Time	I_C = 70A		64		
E_{on2} ⑤	Turn-On Switching Energy	R_G = 4.3 Ω④		3816	5720	µJ
E_{off} ⑥	Turn-Off Switching Energy	T_J = +25°C		2582	3870	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (125°C)		33		ns
t_r	Current Rise Time	V_{CC} = 600V		48		
$t_{d(off)}$	Turn-Off Delay Time	V_{GE} = 15V		320		
t_f	Current Fall Time	I_C = 70A		74		
E_{on2} ⑤	Turn-On Switching Energy	R_G = 4.3 Ω④		5651	8475	µJ
E_{off} ⑥	Turn-Off Switching Energy	T_J = +125°C		3323	4980	

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance (IGBT)	-	-	0.23	°C/W
$R_{\theta JC}$	Junction to Case Thermal Resistance (Diode)	-	-	0.56	
W_T	Package Weight	-	1.03	-	oz
Torque	Terminals and Mounting Screws.	-	-	10	in·lbf
		-	-	1.1	N·m
$V_{Isolation}$	RMS Voltage (50-60Hz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.)	2500	-	-	Volts

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

2 Pulse test: Pulse Width < 380μs, duty cycle < 2%.

3 See Mil-Std-750 Method 3471.

4 R_G is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

5 E_{on2} is the clamped inductive turn on energy that includes a commutating diode reverse recovery current in the IGBT turn on energy loss. A combi device is used for the clamping diode.

6 E_{off} is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1.

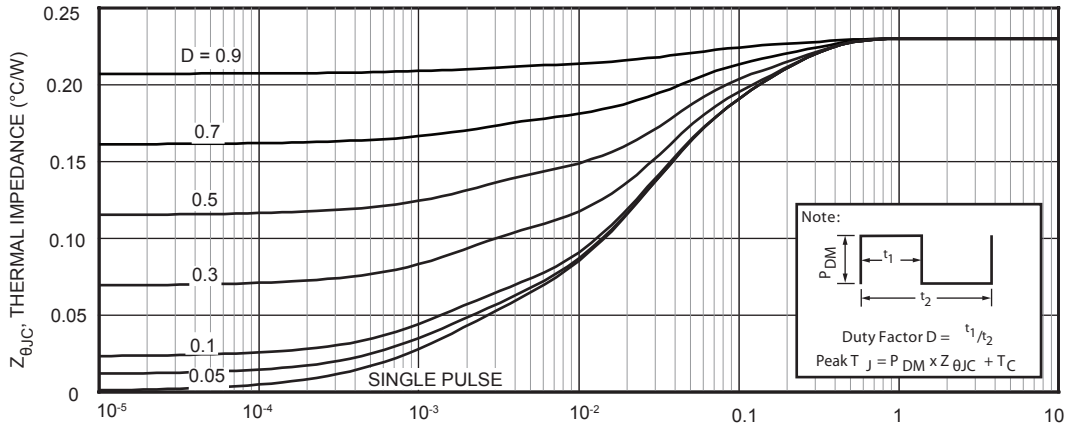

Figure 1, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

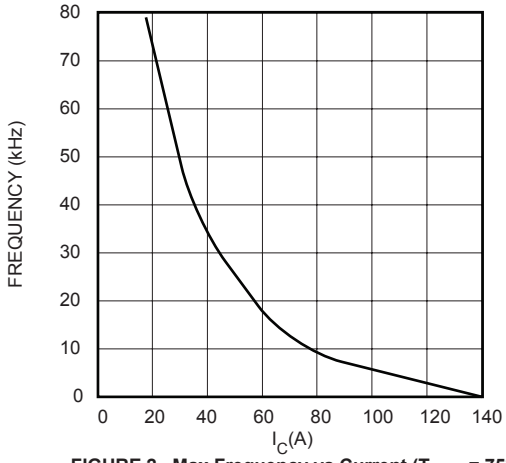

FIGURE 2, Max Frequency vs Current (T_{case} = 75°C)

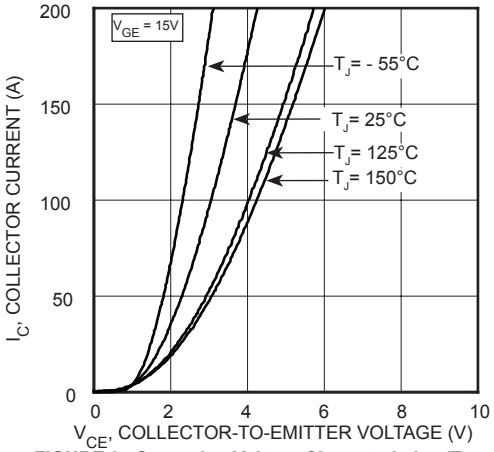

FIGURE 3, Saturation Voltage Characteristics (T_J = 25°C)

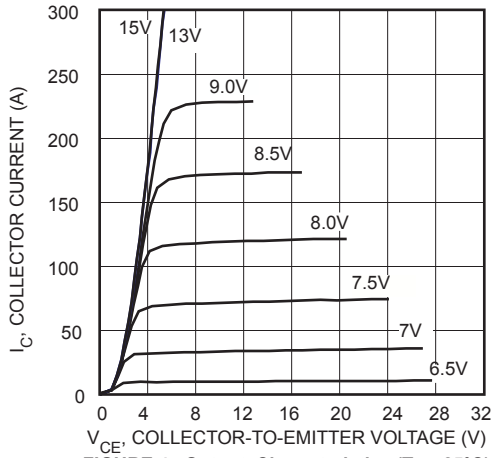

FIGURE 4, Output Characteristics (T_J = 25°C)

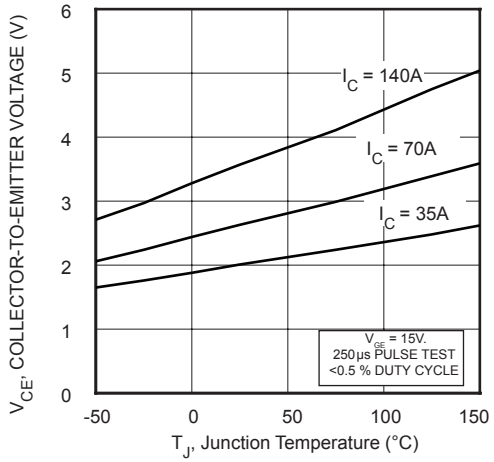

FIGURE 5, On State Voltage vs Junction Temperature

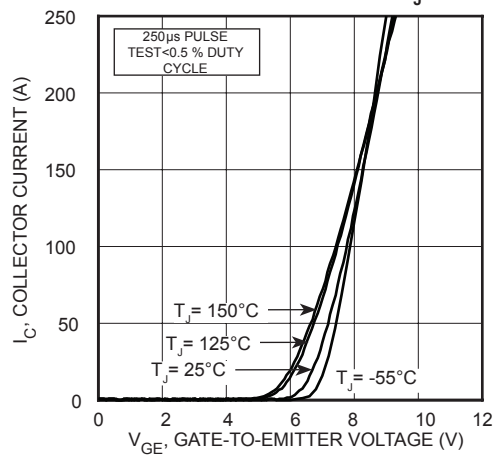

FIGURE 6, Transfer Characteristics

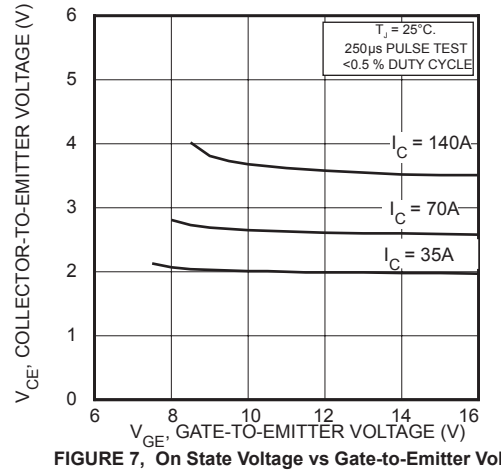

FIGURE 7, On State Voltage vs Gate-to-Emitter Voltage

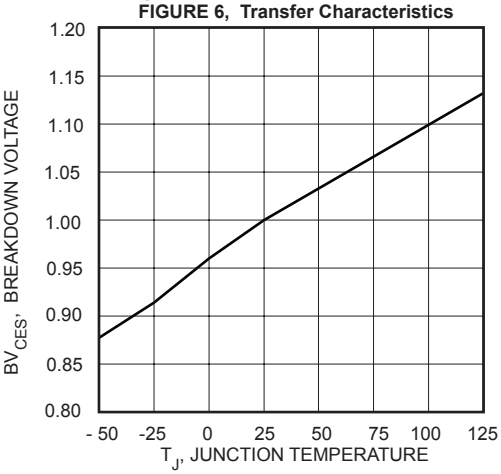

FIGURE 8, Threshold Voltage vs Junction Temperature

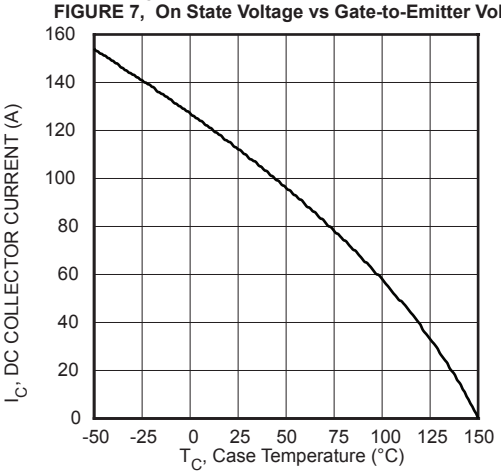

FIGURE 9, DC Collector Current vs Case Temperature

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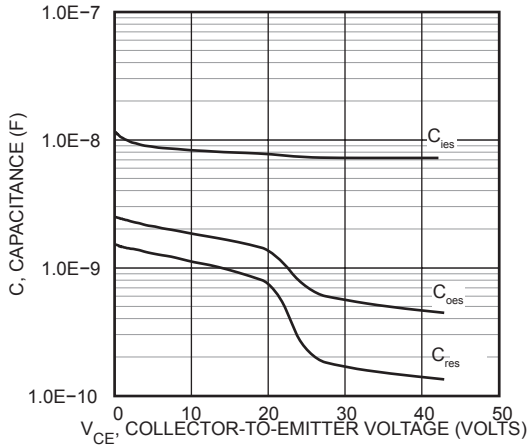

FIGURE 10, Capacitance vs Collector-To-Emitter Voltage

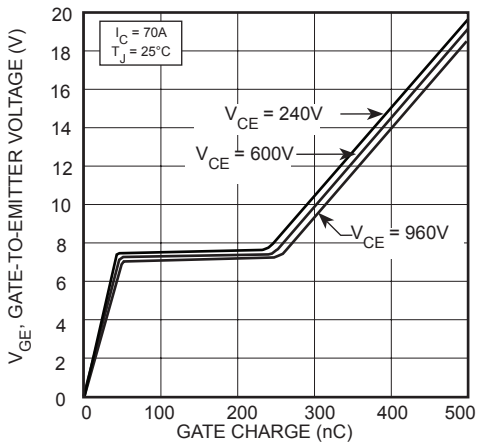

FIGURE 11, Gate charge

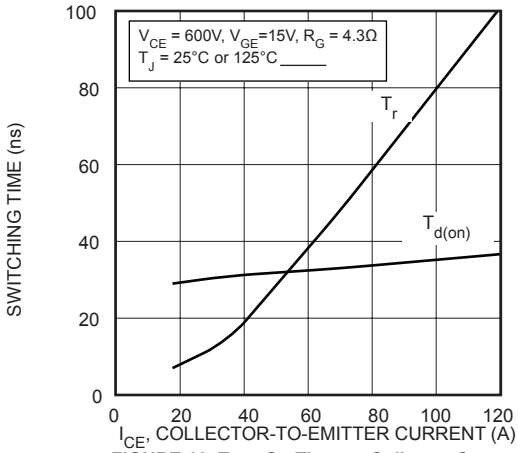

FIGURE 12, Turn-On Time vs Collector Current

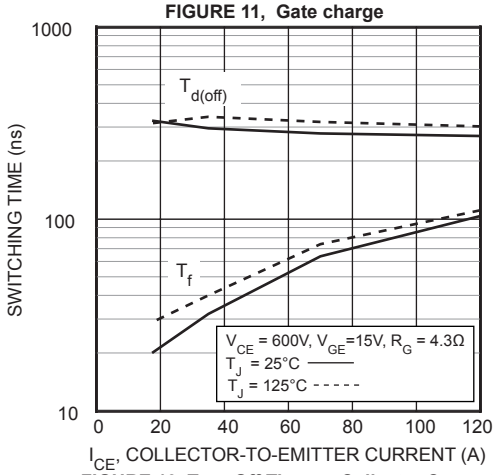

FIGURE 13, Turn-Off Time vs Collector Current

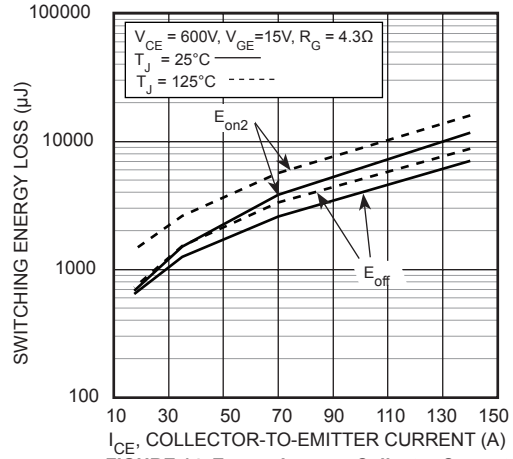

FIGURE 14, Energy Loss vs Collector Current

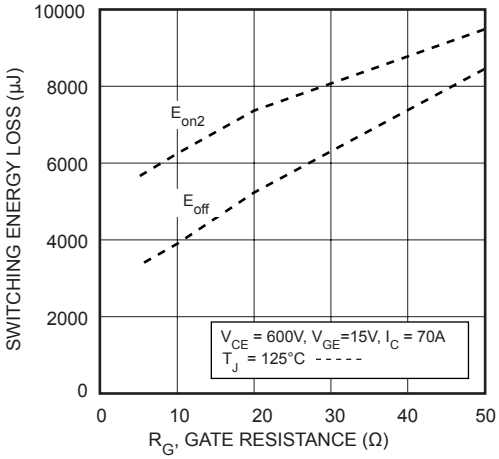

FIGURE 15, Energy Loss vs Gate Resistance

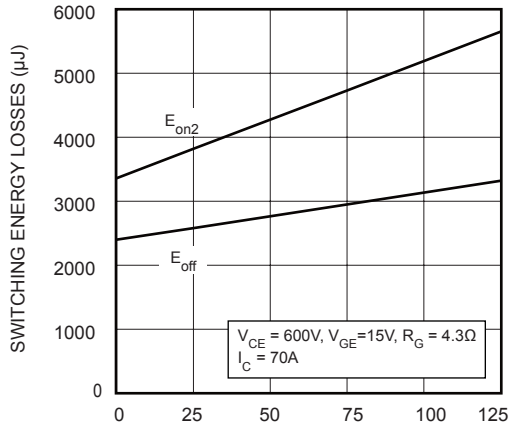

FIGURE 16, Swiitching Energy vs Junction Temperature

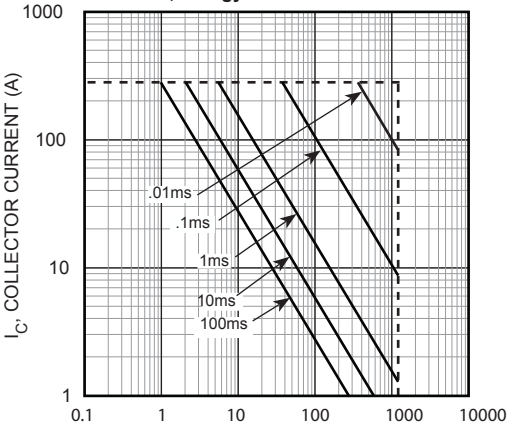

FIGURE 17, Minimum Switching Safe Operating Area

ULTRAFAST SOFT RECOVERY RECTIFIER DIODE

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

Symbol	Characteristic / Test Conditions	APT70GR120JD60	Unit
$I_{F(AV)}$	Maximum Average Forward Current (T_C = 92°C, Duty Cycle = 0.5)	60	Amps
$I_{F(RMS)}$	RMS Forward Current (Square wave, 50% duty)	73	
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 45°C, 8.3 ms)	540	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions		Min	Type	Max	Unit
V_F	Forward Voltage	I_F = 60A		2.5		Volts
		I_F = 120A		3.07		
		I_F = 60A, T_J = 125°C		1.82		

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse Recovery Time	I_F = 1A, di_F/dt = -100A/µs, V_R = 30V, T_J = 25°C	-	60	-	ns
t_{rr}	Reverse Recovery Time	I_F = 60A, di_F/dt = -200A/µs V_R = 800V, T_C = 25°C	-	265	-	
Q_{rr}	Reverse Recovery Charge		-	560	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	5	-	Amps
t_{rr}	Reverse Recovery Time	I_F = 60A, di_F/dt = -200A/µs V_R = 800V, T_C = 125°C	-	350	-	ns
Q_{rr}	Reverse Recovery Charge		-	2890	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	13	-	Amps
t_{rr}	Reverse Recovery Time	I_F = 60A, di_F/dt = -1000A/µs V_R = 800V, T_C = 125°C	-	150	-	ns
Q_{rr}	Reverse Recovery Charge		-	4720	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	40	-	Amps

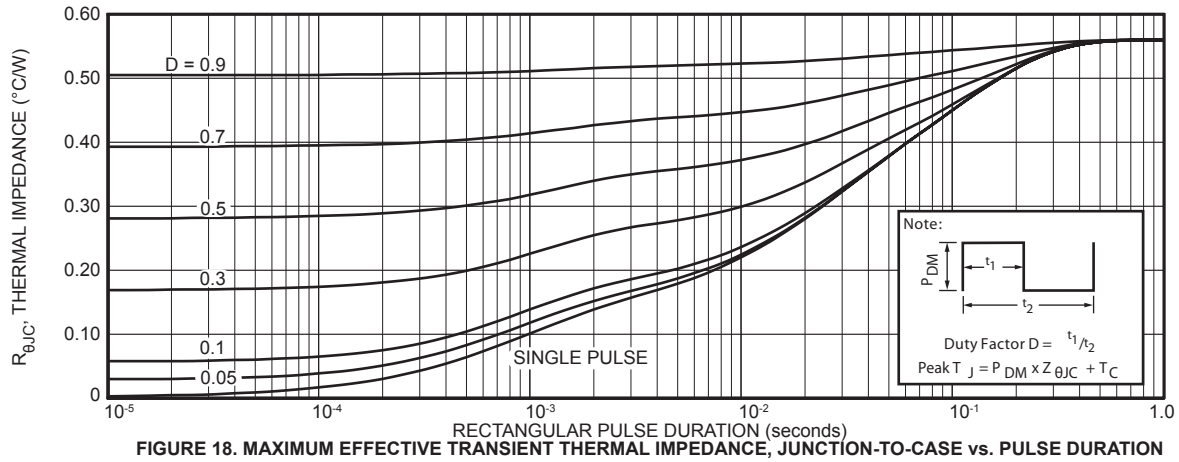

FIGURE 18. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

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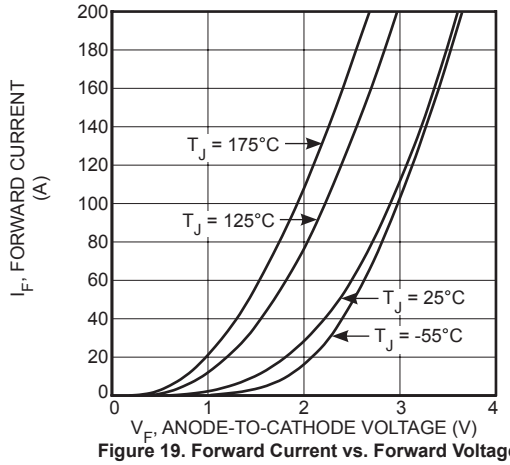


Figure 19. Forward Current vs. Forward Voltage

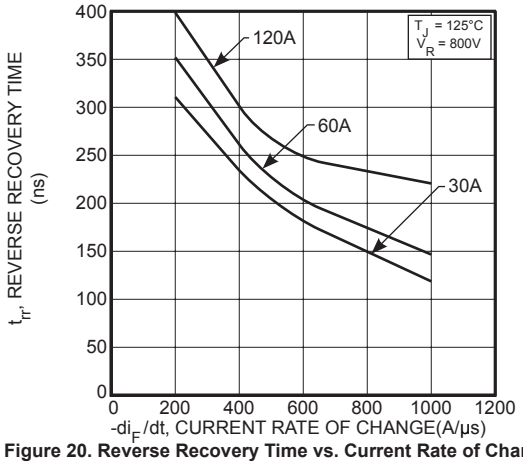


Figure 20. Reverse Recovery Time vs. Current Rate of Change

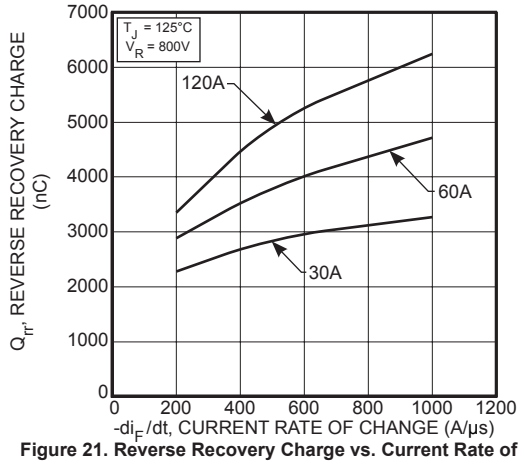


Figure 21. Reverse Recovery Charge vs. Current Rate of Change

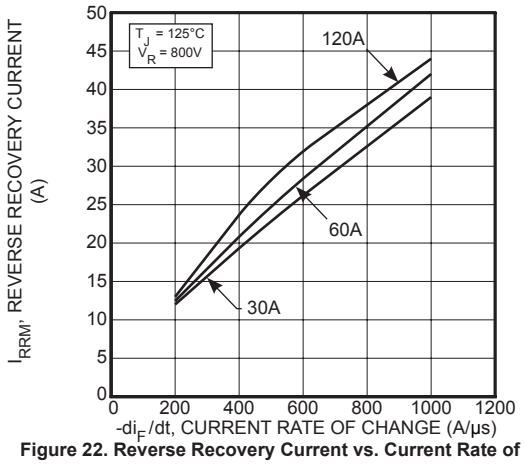


Figure 22. Reverse Recovery Current vs. Current Rate of Change

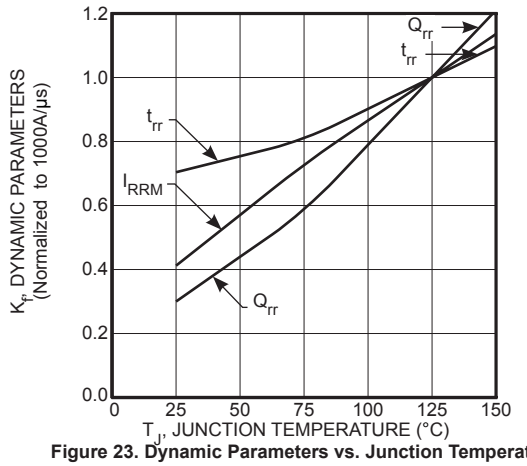


Figure 23. Dynamic Parameters vs. Junction Temperature

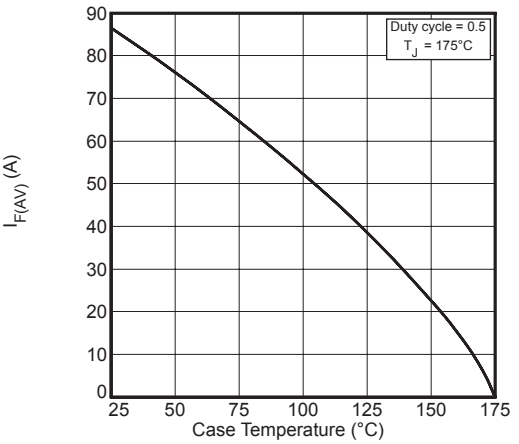


Figure 24. Maximum Average Forward Current vs. CaseTemperature

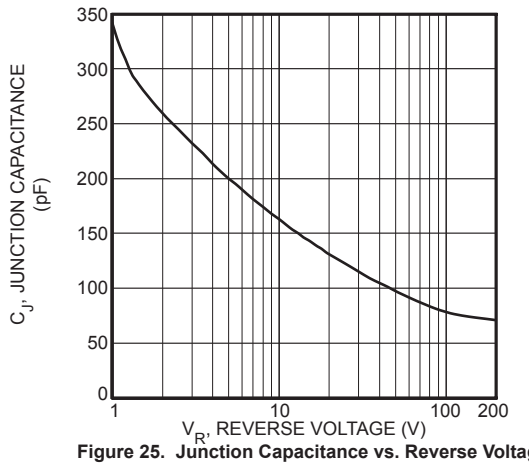


Figure 25. Junction Capacitance vs. Reverse Voltage

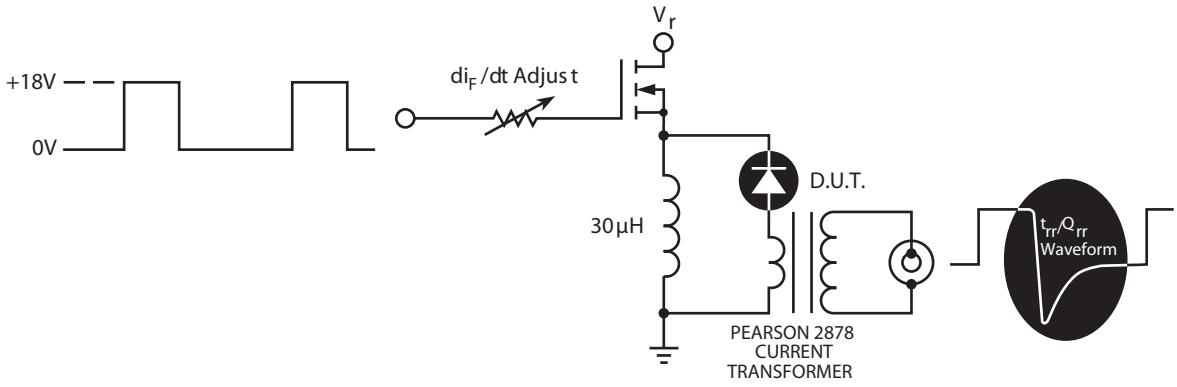


Figure 26. Diode Test Circuit

1. I_F - Forward Conduction Current
2. di_F/dt - Rate of Diode Current Change Through Zero Crossing.
3. I_{RRM} - Maximum Reverse Recovery Current
4. t_{rr} - Reverse Recovery Time measured from zero crossing where diode current goes from positive to negative, to the point at which the straight line through I_{RRM} and 0.25, I_{RRM} passes through zero.
5. Q_{rr} - Area Under the Curve Defined by I_{RRM} and $t_{RR.}$

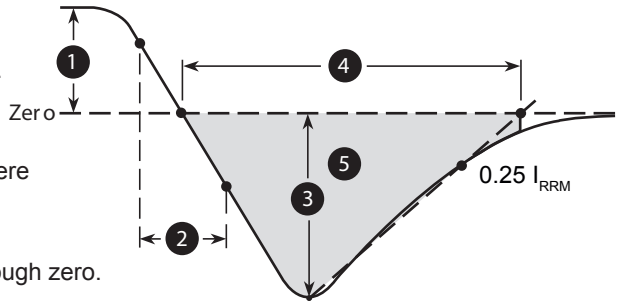
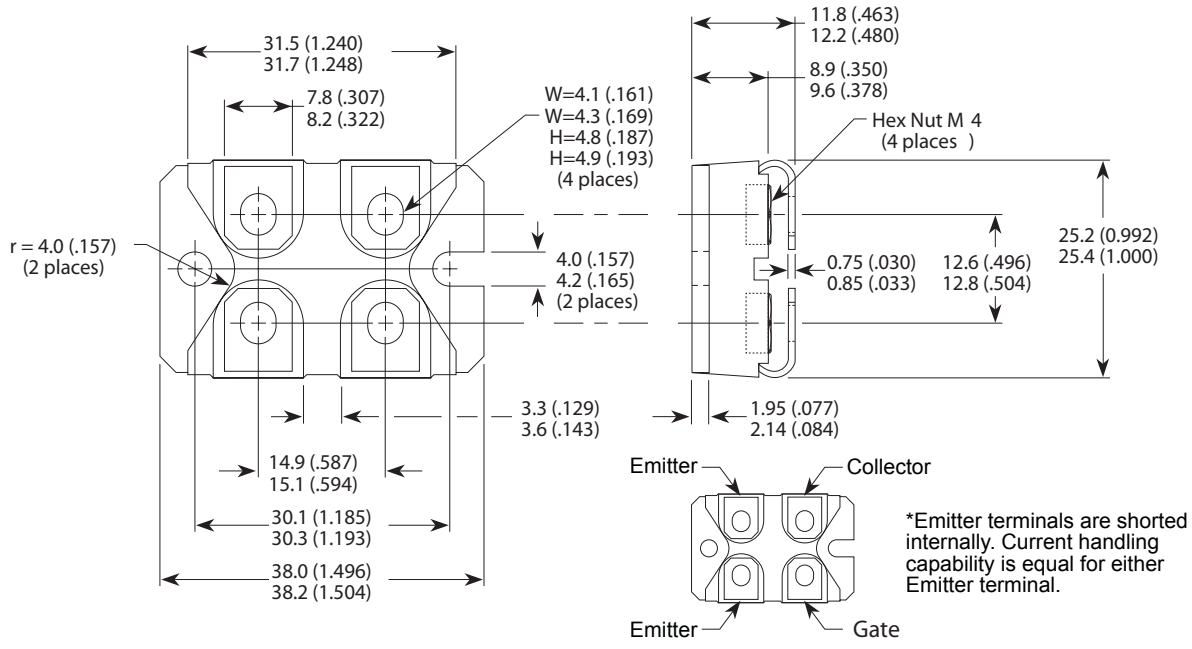


Figure 27. Diode Reverse Recovery Waveform Definition

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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