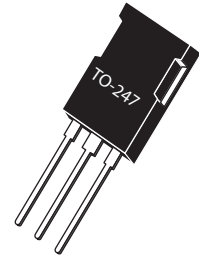


## Ultra Fast NPT - IGBT®

The Ultra Fast 650V NPT-IGBT® family of products is the newest generation of IGBTs optimized for outstanding ruggedness and best trade-off between conduction and switching losses.

### Features

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



Combi (IGBT and Diode)



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

Symbol	Parameter	Ratings	Unit
$V_{CES}$	Collector Emitter Voltage	650	V
$V_{GE}$	Gate-Emitter Voltage	$\pm 30$	
$I_{C1}$	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	134	A
$I_{C2}$	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	65	
$I_{CM}$	Pulsed Collector Current <sup>①</sup>	260	
SCWT	Short Circuit Withstand Time: $V_{CE} = 600V$ , $V_{GE} = 15V$ , $T_C = 125^\circ\text{C}$	10	$\mu\text{s}$
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	595	W
$T_J, T_{STG}$	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

Symbol	Parameter	Min	Typ	Max	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage ( $V_{GE} = 0V$ , $I_C = 250\mu\text{A}$ )	650			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = V_{GE}$ , $I_C = 1.0\text{mA}$ , $T_J = 25^\circ\text{C}$ )	3.5	5.0	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ( $V_{GE} = 15V$ , $I_C = 70A$ , $T_J = 25^\circ\text{C}$ )		1.9	2.4	
	Collector-Emitter On Voltage ( $V_{GE} = 15V$ , $I_C = 70A$ , $T_J = 125^\circ\text{C}$ )		2.4		
	Collector-Emitter On Voltage ( $V_{GE} = 15V$ , $I_C = 140A$ , $T_J = 25^\circ\text{C}$ )		2.6		
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = 650V$ , $V_{GE} = 0V$ , $T_J = 25^\circ\text{C}$ ) <sup>②</sup>		40	850	$\mu\text{A}$
	Collector Cut-off Current ( $V_{CE} = 650V$ , $V_{GE} = 0V$ , $T_J = 125^\circ\text{C}$ ) <sup>②</sup>		500		
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V$ )			$\pm 250$	nA



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

# DYNAMIC CHARACTERISTICS

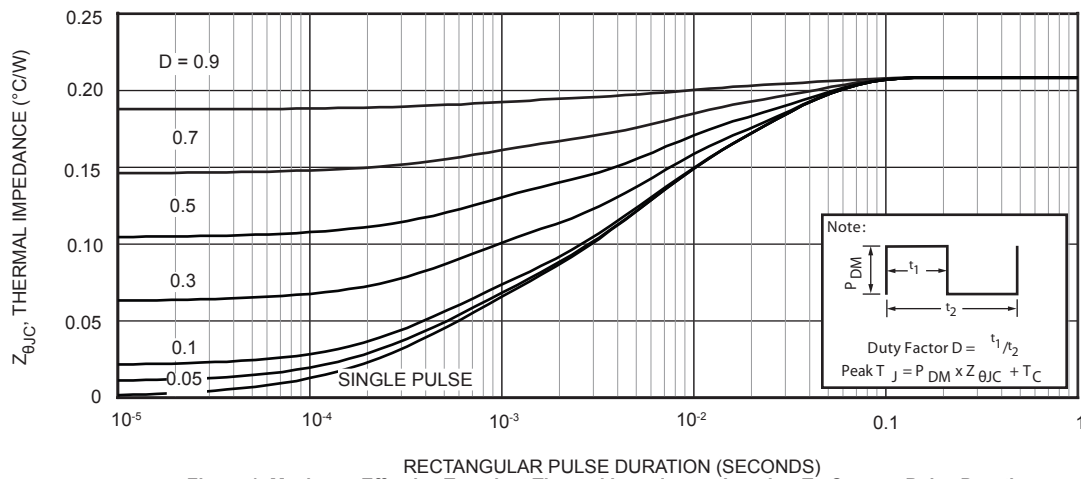
APT70GR65B2SCD30

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$C_{ies}$	Input Capacitance	Capacitance $V_{GE} = 0V, V_{CE} = 25V$ $f = 1MHz$		4250		pF
$C_{oes}$	Output Capacitance			847		
$C_{res}$	Reverse Transfer Capacitance			415		
$V_{GEP}$	Gate to Emitter Plateau Voltage	Gate Charge $V_{GE} = 15V$ $V_{CE} = 325V$ $I_C = 70A$		7.0		V
$Q_g^{(3)}$	Total Gate Charge			226	305	nC
$Q_{ge}$	Gate-Emitter Charge			26	35	
$Q_{gc}$	Gate- Collector Charge			104	140	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C) $V_{CC} = 433V$ $V_{GE} = 15V$ $I_C = 70A$ $R_G = 4.3\Omega^{(4)}$ $T_J = +25^\circ C$		19		ns
$t_r$	Current Rise Time			45		
$t_{d(off)}$	Turn-Off Delay Time			170		
$t_f$	Current Fall Time			67		
$E_{on2}^{(5)}$	Turn-On Switching Energy			1790	2685	μJ
$E_{off}^{(6)}$	Turn-Off Switching Energy			1460	1970	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (125°C) $V_{CC} = 433V$ $V_{GE} = 15V$ $I_C = 70A$ $R_G = 4.3\Omega^{(4)}$ $T_J = +125^\circ C$		19		ns
$t_r$	Current Rise Time			45		
$t_{d(off)}$	Turn-Off Delay Time			190		
$t_f$	Current Fall Time			74		
$E_{on2}^{(5)}$	Turn-On Switching Energy			1760	2640	μJ
$E_{off}^{(6)}$	Turn-Off Switching Energy			1720	2580	

# THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			.21	°C/W
$R_{\theta JA}$	Junction to Ambient Thermal Resistance			40	
$W_T$	Package Weight		.22 6.2		oz g

- 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 energy loss at turn-on and includes the charge stored in the freewheeling diode.
  - 6  $E_{off}$  is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1.
- Microsemi reserves the right to change, without notice, the specifications and information contained herein.



# TYPICAL PERFORMANCE CURVES

AP70GR65B2SCD30

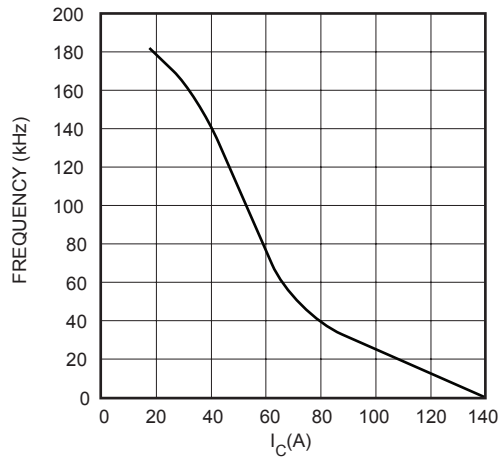


FIGURE 2, Max Frequency vs Current ( $T_{case} = 75^{\circ}C$ )

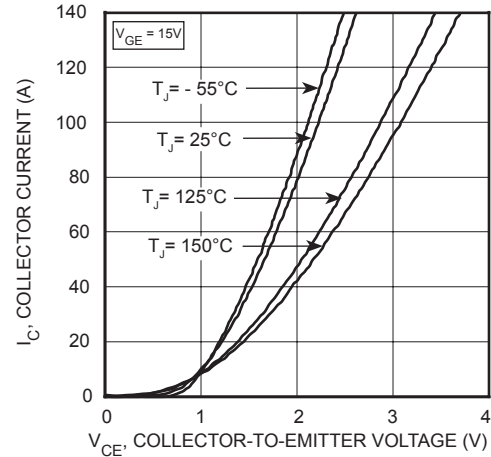


FIGURE 3, Saturation Voltage Characteristics ( $T_J = 25^{\circ}C$ )

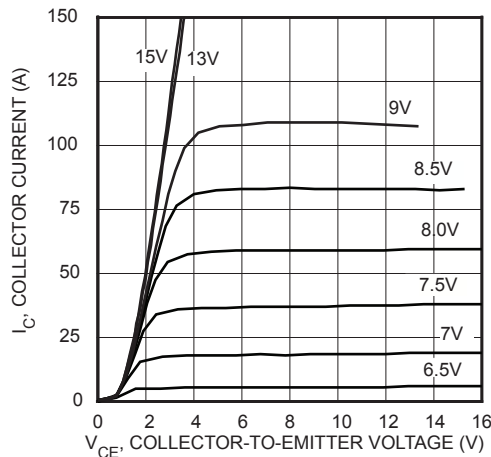


FIGURE 4, Output Characteristics ( $T_J = 25^{\circ}C$ )

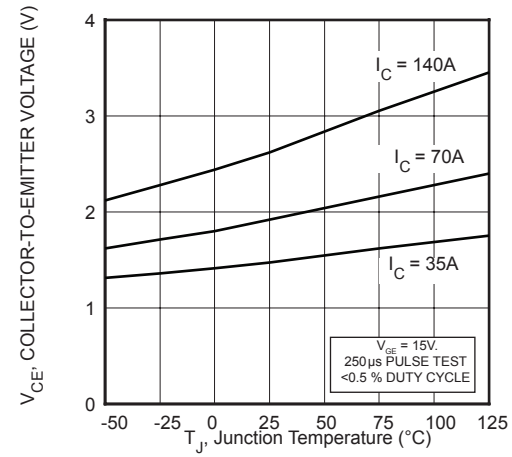


FIGURE 5, On State Voltage vs Junction Temperature

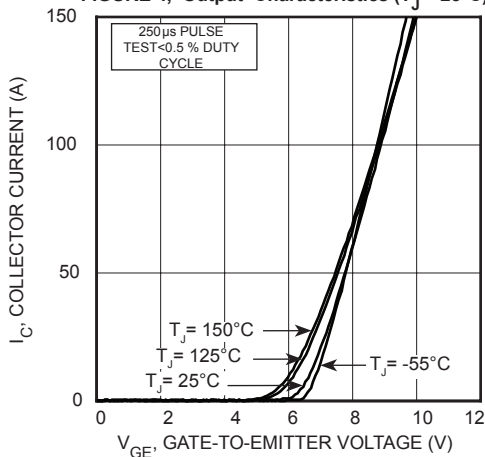


FIGURE 6, Transfer Characteristics

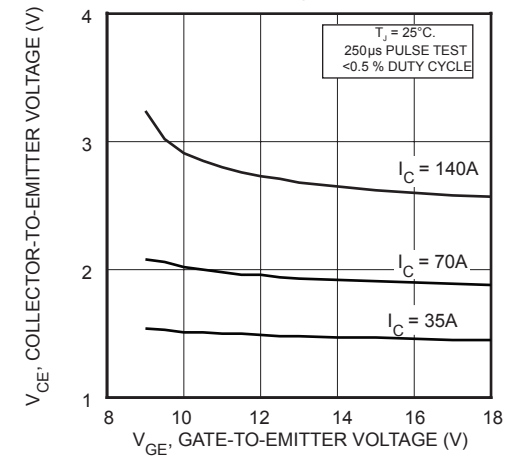


FIGURE 7, On State Voltage vs Gate-to-Emitter Voltage

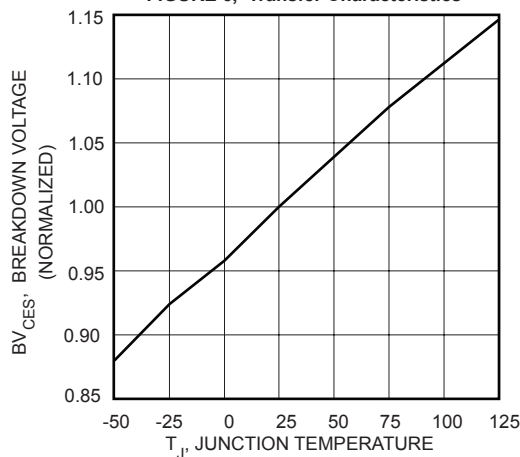


FIGURE 8, Breakdown Voltage vs Junction Temperature

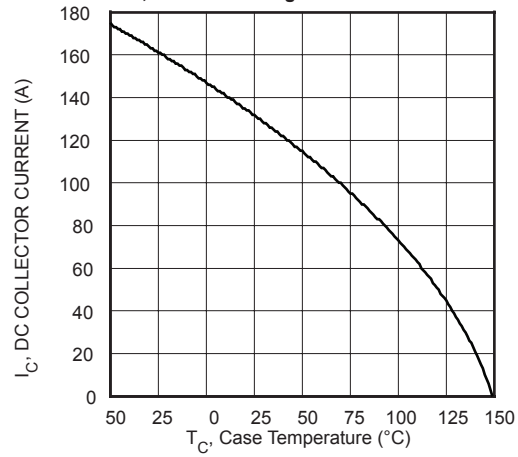


FIGURE 9, DC Collector Current vs Case Temperature

# TYPICAL PERFORMANCE CURVES

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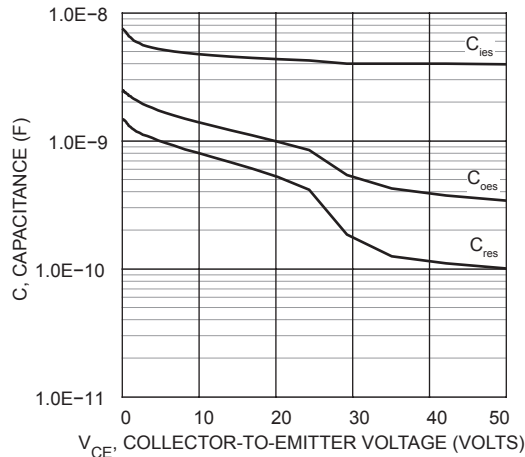


FIGURE 10, Capacitance vs Collector-To-Emitter Voltage

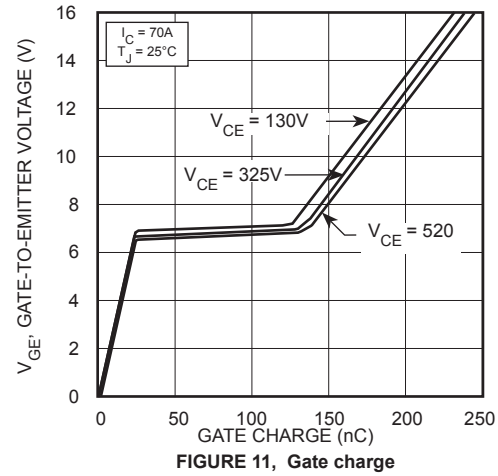


FIGURE 11, Gate charge

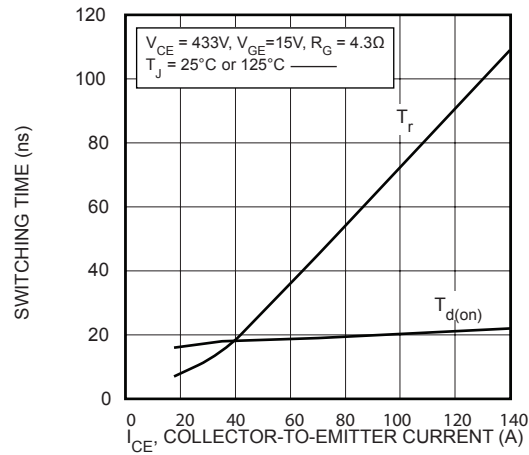


FIGURE 12, Turn-On Time vs Collector Current

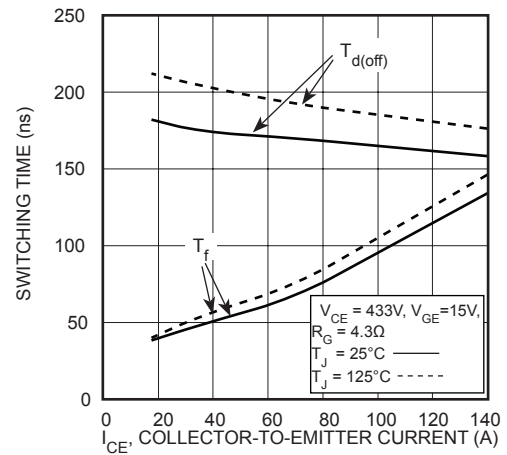


FIGURE 13, Turn-Off Time vs Collector Current

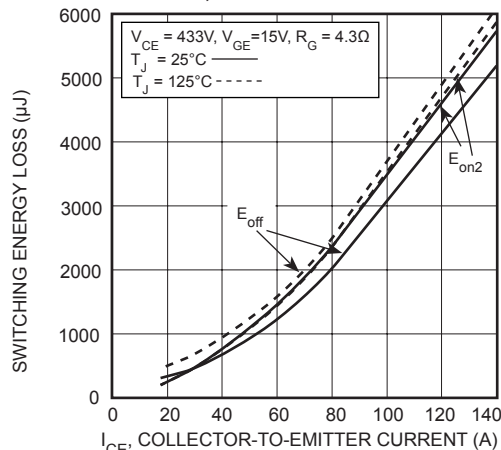


FIGURE 14, Energy Loss vs Collector Current

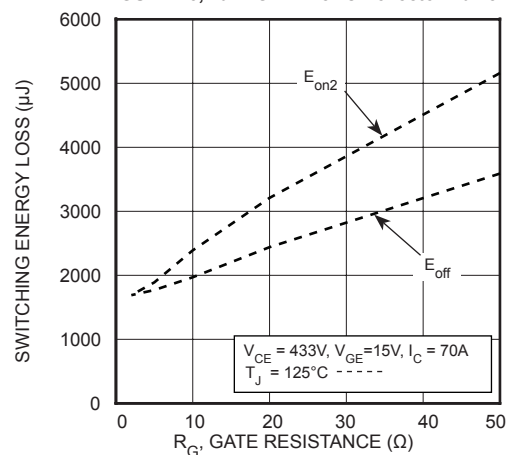


FIGURE 15, Energy Loss vs Gate Resistance

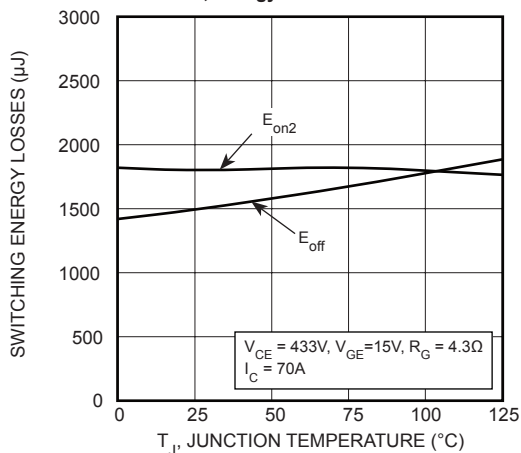


FIGURE 16, Switching Energy vs Junction Temperature

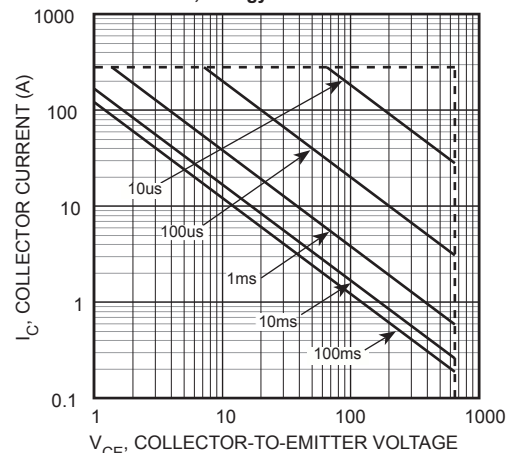


FIGURE 17, Minimum Switching Safe Operating Area

# ZERO RECOVERY LOW LEAKAGE SIC ANTI-PARALLEL DIODE

## MAXIMUM RATINGS

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

Symbol	Characteristic / Test Conditions	Ratings	Unit
$I_F$	Maximum D.C. Forward Current	$T_C = 25^\circ\text{C}$	46
		$T_C = 85^\circ\text{C}$	30
$I_{FSM}$	Non-Repetitive Forward Surge Current ( $T_J = 25^\circ\text{C}$ , $t_p = 10\text{ms}$ , Half Sine)	247	Amps

## STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$V_F$	Forward Voltage		$I_F = 30\text{A}$ , $T_J = 25^\circ\text{C}$	1.5	Volts
			$I_F = 30\text{A}$ , $T_J = 150^\circ\text{C}$	1.9	
$Q_c$	Total Capacitive Charge $V_R = 325\text{V}$ , $I_F = 30\text{A}$ , $di/dt = -500\text{A}/\mu\text{s}$ , $T_J = 25^\circ\text{C}$		150		nC
$C_T$	Junction Capacitance $V_R = 1\text{V}$ , $T_J = 25^\circ\text{C}$ , $f = 1\text{MHz}$		945		pF
	Junction Capacitance $V_R = 200\text{V}$ , $T_J = 25^\circ\text{C}$ , $f = 1\text{MHz}$		138		
	Junction Capacitance $V_R = 400\text{V}$ , $T_J = 25^\circ\text{C}$ , $f = 1\text{MHz}$		105		

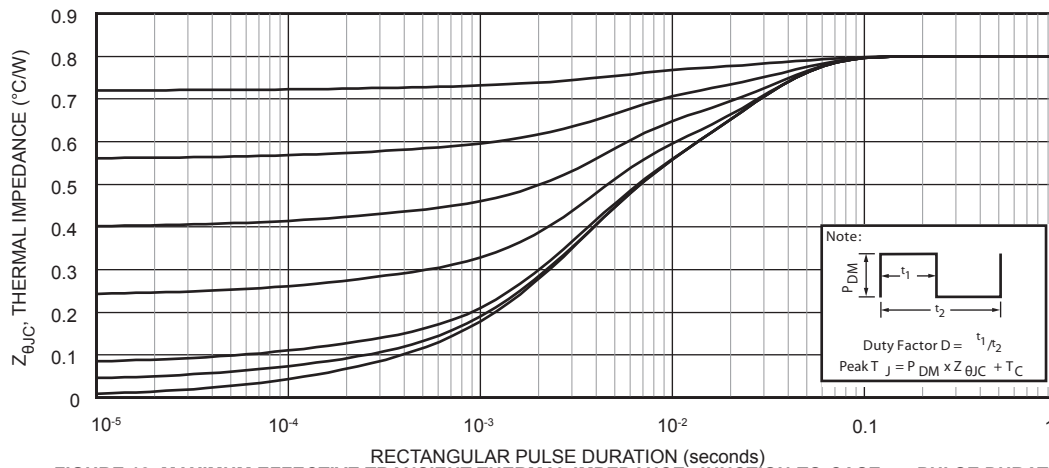


FIGURE 18. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

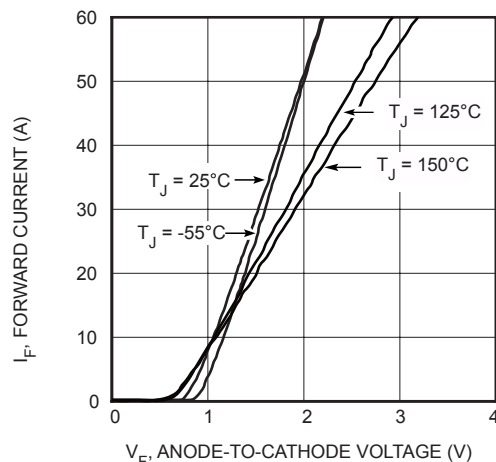


FIGURE 19. Forward Current vs. Forward Voltage

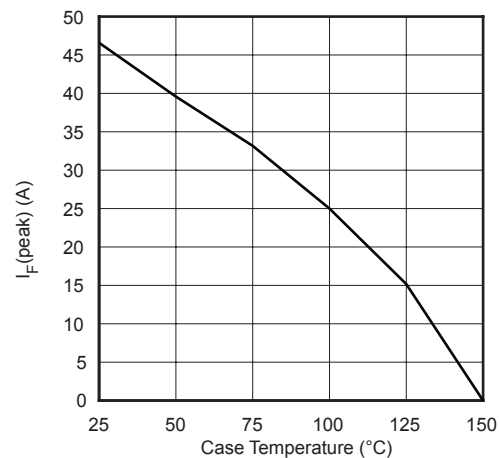


FIGURE 20. Maximum Forward Current vs. Case Temperature

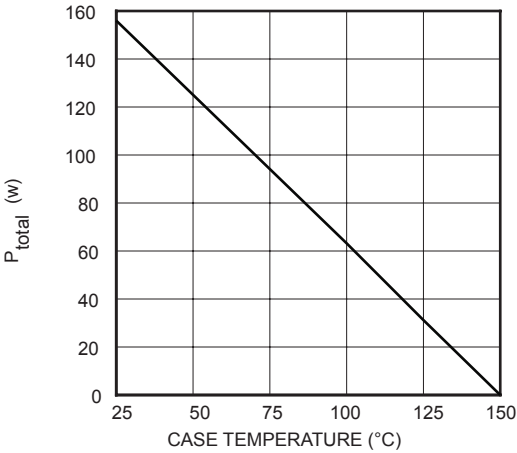


Figure 21. Maximum Power Dissipation vs. Case Temperature

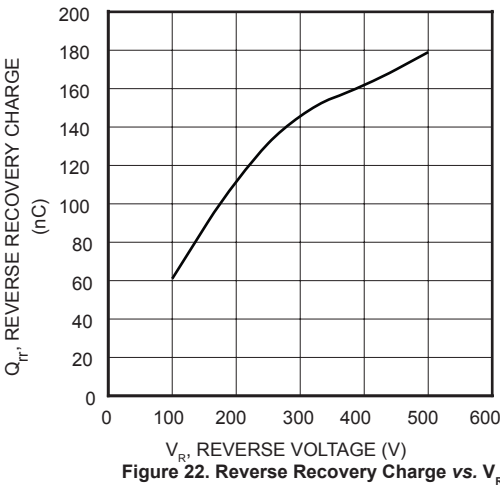


Figure 22. Reverse Recovery Charge vs. V<sub>R</sub>

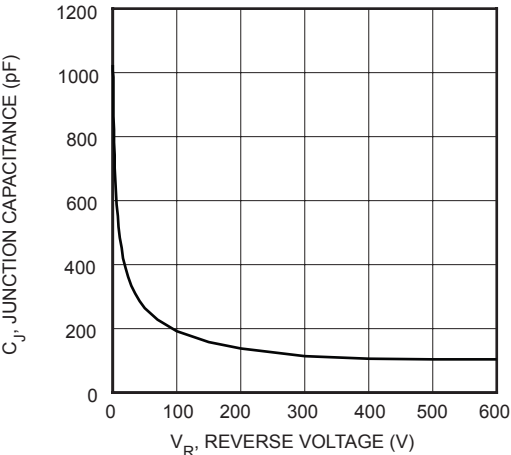
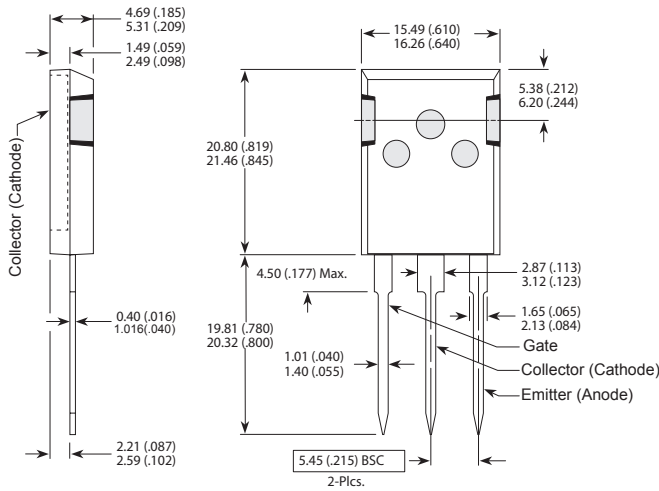


Figure 23. Junction Capacitance vs. Reverse Voltage

T-MAX® (B2) Package Outline



These dimensions are equal to the TO-247 without the mounting hole.  
Dimensions in Millimeters and (Inches)

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