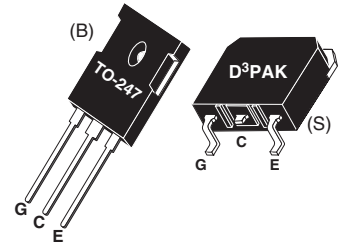


Utilizing the latest Field Stop and Trench Gate technologies, these IGBT's have ultra low  $V_{CE(ON)}$  and are ideal for low frequency applications that require absolute minimum conduction loss. Easy paralleling is a result of very tight parameter distribution and a slightly positive  $V_{CE(ON)}$  temperature coefficient. Low gate charge simplifies gate drive design and minimizes losses.

- 600V Field Stop
- Trench Gate: Low  $V_{CE(on)}$
- Easy Paralleling
- 6 $\mu$ s Short Circuit Capability
- 175°C Rated



**Applications: Welding, Inductive Heating, Solar Inverters, SMPS, Motor drives, UPS**

### MAXIMUM RATINGS

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

Symbol	Parameter	APT50GN60B(G)	UNIT
$V_{CES}$	Collector-Emitter Voltage	600	Volts
$V_{GE}$	Gate-Emitter Voltage	$\pm 30$	
$I_{C1}$	Continuous Collector Current <sup>(3)</sup> @ $T_C = 25^\circ\text{C}$	107	Amps
$I_{C2}$	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	64	
$I_{CM}$	Pulsed Collector Current <sup>(1)</sup> @ $T_C = 175^\circ\text{C}$	150	
SSOA	Switching Safe Operating Area @ $T_J = 175^\circ\text{C}$	150A @ 600V	
$P_D$	Total Power Dissipation	366	Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 175	$^\circ\text{C}$
$T_L$	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage ( $V_{GE} = 0V, I_C = 4mA$ )	600			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = V_{GE}, I_C = 800\mu A, T_J = 25^\circ\text{C}$ )	5.0	5.8	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 50A, T_J = 25^\circ\text{C}$ )	1.05	1.45	1.85	
	Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 50A, T_J = 125^\circ\text{C}$ )		1.7		
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = 600V, V_{GE} = 0V, T_J = 25^\circ\text{C}$ ) <sup>(2)</sup>			25	$\mu A$
	Collector Cut-off Current ( $V_{CE} = 600V, V_{GE} = 0V, T_J = 125^\circ\text{C}$ ) <sup>(2)</sup>			TBD	
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V$ )			600	nA
$R_{G(int)}$	Intergrated Gate Resistor		N/A		$\Omega$



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

## DYNAMIC CHARACTERISTICS

APT50GN60B\_S(G)

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT	
$C_{ies}$	Input Capacitance	<b>Capacitance</b> $V_{GE} = 0V, V_{CE} = 25V$ $f = 1 \text{ MHz}$		3200		pF	
$C_{oes}$	Output Capacitance			125			
$C_{res}$	Reverse Transfer Capacitance			100			
$V_{GEP}$	Gate-to-Emitter Plateau Voltage	Gate Charge		9.0		V	
$Q_g$	Total Gate Charge <sup>③</sup>	$V_{GE} = 15V$		325		nC	
$Q_{ge}$	Gate-Emitter Charge	$V_{CE} = 300V$		25			
$Q_{gc}$	Gate-Collector ("Miller") Charge	$I_C = 50A$		175			
SSOA	Switching Safe Operating Area	$T_J = 175^\circ\text{C}, R_G = 4.3\Omega^{\text{⑦}}, V_{GE} = 15V, L = 100\mu\text{H}, V_{CE} = 600V$	150			A	
SCSOA	Short Circuit Safe Operating Area	$V_{CC} = 360V, V_{GE} = 15V, T_J = 150^\circ\text{C}, R_G = 4.3\Omega^{\text{⑦}}$	6			$\mu\text{s}$	
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (25°C)</b>  $V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 50A$ $R_G = 4.3\Omega^{\text{⑦}}$ $T_J = +25^\circ\text{C}$		20		ns	
$t_r$	Current Rise Time			25			
$t_{d(off)}$	Turn-off Delay Time			230			
$t_f$	Current Fall Time			100			
$E_{on1}$	Turn-on Switching Energy <sup>④</sup>				1185		$\mu\text{J}$
$E_{on2}$	Turn-on Switching Energy (Diode) <sup>⑤</sup>				1275		
$E_{off}$	Turn-off Switching Energy <sup>⑥</sup>				1565		
$t_{d(on)}$	Turn-on Delay Time		<b>Inductive Switching (125°C)</b>  $V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 50A$ $R_G = 4.3\Omega^{\text{⑦}}$ $T_J = +125^\circ\text{C}$		20		ns
$t_r$	Current Rise Time			25			
$t_{d(off)}$	Turn-off Delay Time			260			
$t_f$	Current Fall Time			140			
$E_{on1}$	Turn-on Switching Energy <sup>④</sup>				1205		$\mu\text{J}$
$E_{on2}$	Turn-on Switching Energy (Diode) <sup>⑤</sup>				1850		
$E_{off}$	Turn-off Switching Energy <sup>⑥</sup>				2125		

## THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case (IGBT)			.41	$^\circ\text{C/W}$
$R_{\theta JC}$	Junction to Case (DIODE)			N/A	
$W_T$	Package Weight		5.9		gm

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② For Combi devices,  $I_{ces}$  includes both IGBT and FRED leakages
- ③ See MIL-STD-750 Method 3471.
- ④  $E_{on1}$  is the clamped inductive turn-on energy of the IGBT only, without the effect of a commutating diode reverse recovery current adding to the IGBT turn-on loss. Tested in inductive switching test circuit shown in figure 21, but with a Silicon Carbide diode.
- ⑤  $E_{on2}$  is the clamped inductive turn-on energy that includes a commutating diode reverse recovery current in the IGBT turn-on switching loss. (See Figures 21, 22.)
- ⑥  $E_{off}$  is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1. (See Figures 21, 23.)
- ⑦  $R_G$  is external gate resistance, not including  $R_{G(int)}$  nor gate driver impedance. (MIC4452)
- ⑧ Continuous current limited by package lead temperature.

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

# TYPICAL PERFORMANCE CURVES

APT50GN60B\_S(G)

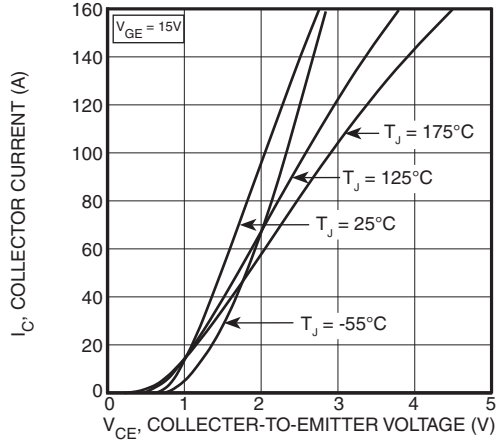


FIGURE 1, Output Characteristics ( $T_J = 25^\circ\text{C}$ )

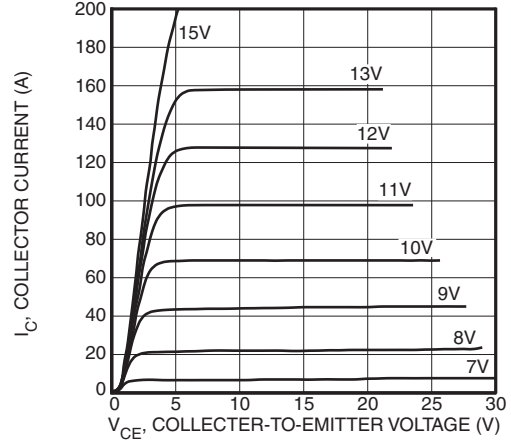


FIGURE 2, Output Characteristics ( $T_J = 125^\circ\text{C}$ )

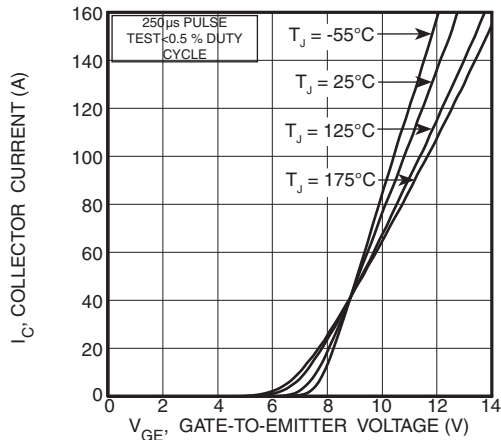


FIGURE 3, Transfer Characteristics

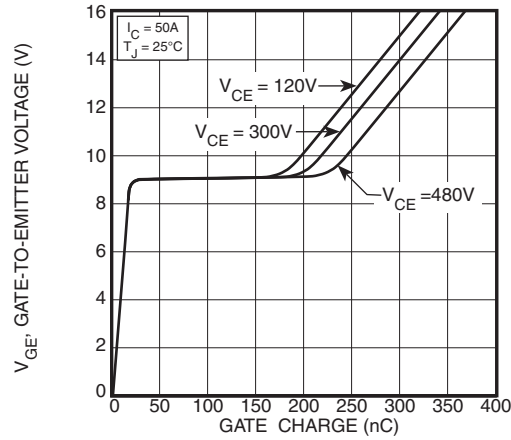


FIGURE 4, Gate Charge

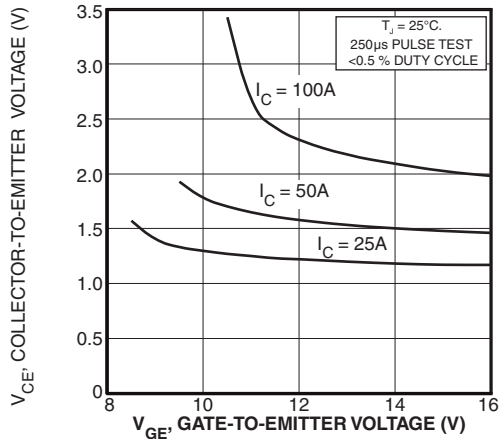


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

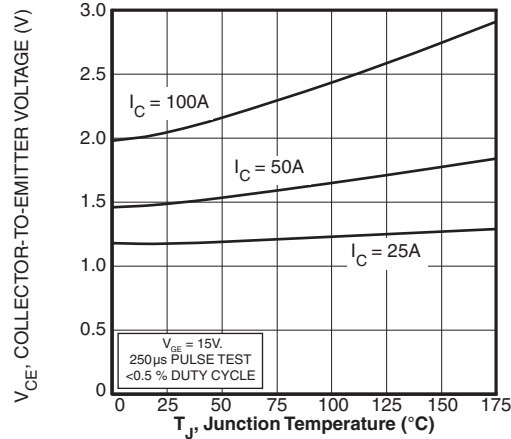


FIGURE 6, On State Voltage vs Junction Temperature

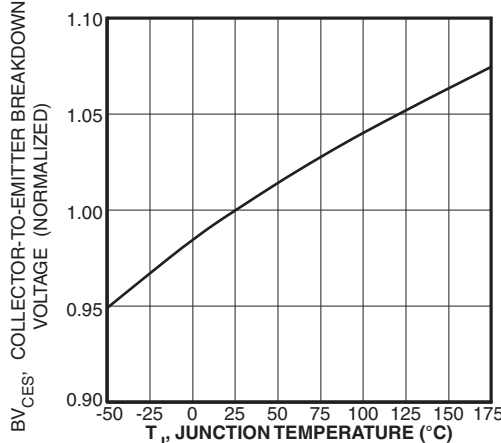


FIGURE 7, Breakdown Voltage vs. Junction Temperature

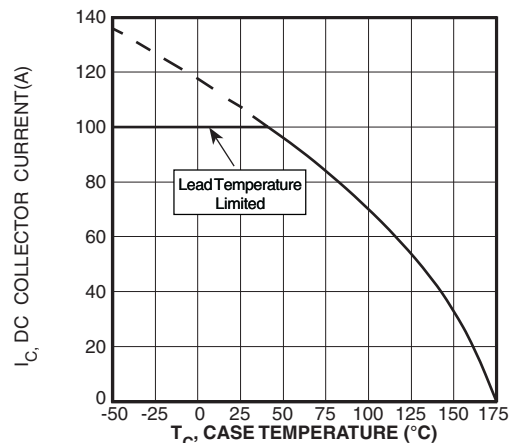


FIGURE 8, DC Collector Current vs Case Temperature

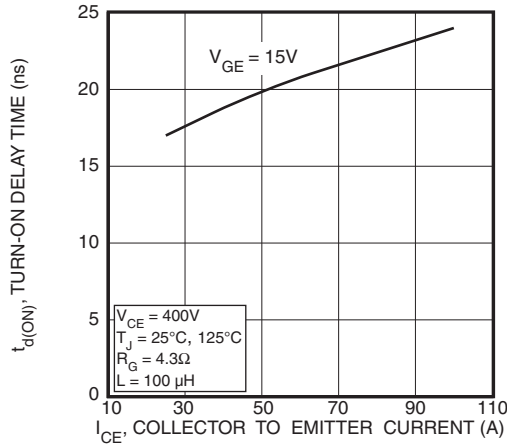


FIGURE 9, Turn-On Delay Time vs Collector Current

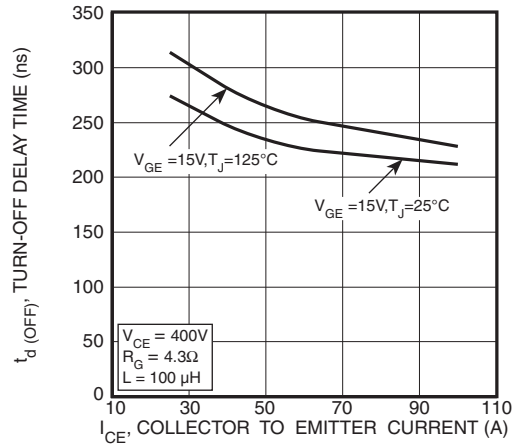


FIGURE 10, Turn-Off Delay Time vs Collector Current

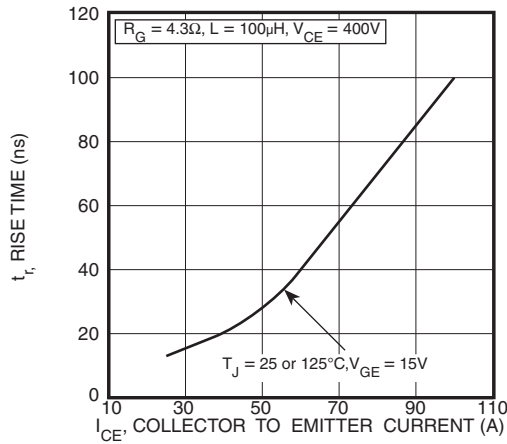


FIGURE 11, Current Rise Time vs Collector Current

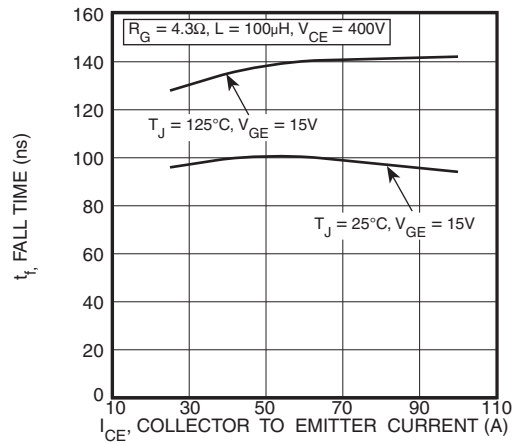


FIGURE 12, Current Fall Time vs Collector Current

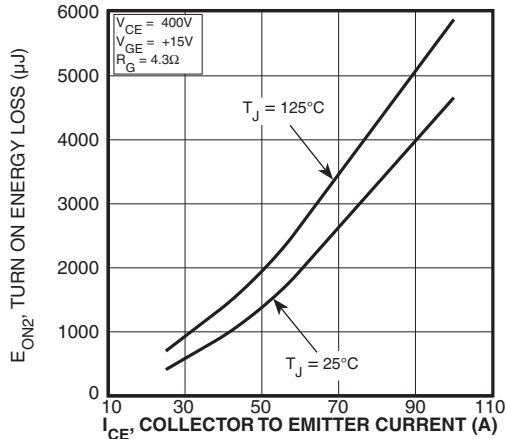


FIGURE 13, Turn-On Energy Loss vs Collector Current

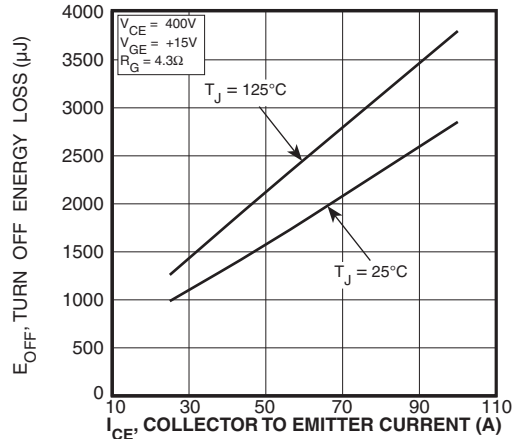


FIGURE 14, Turn Off Energy Loss vs Collector Current

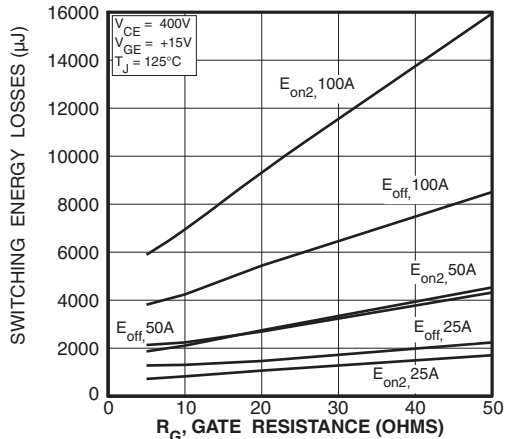


FIGURE 15, Switching Energy Losses vs. Gate Resistance

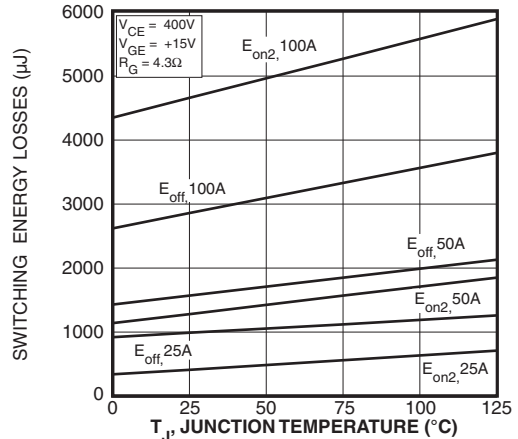


FIGURE 16, Switching Energy Losses vs Junction Temperature

# TYPICAL PERFORMANCE CURVES

APT50GN60B\_S(G)

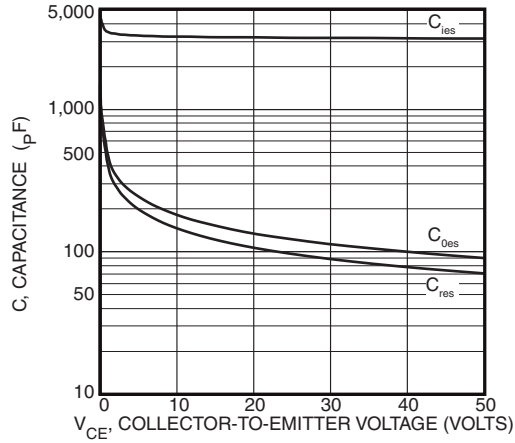


Figure 17, Capacitance vs Collector-To-Emitter Voltage

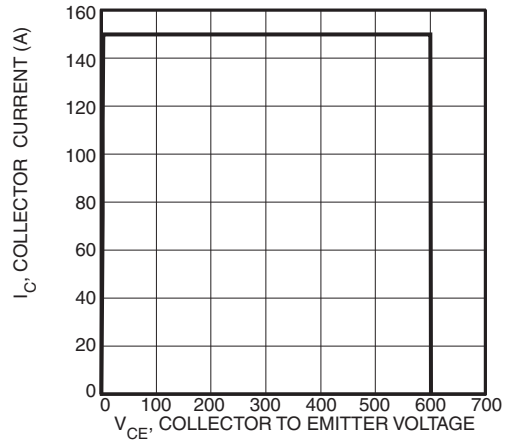


Figure 18, Minimum Switching Safe Operating Area

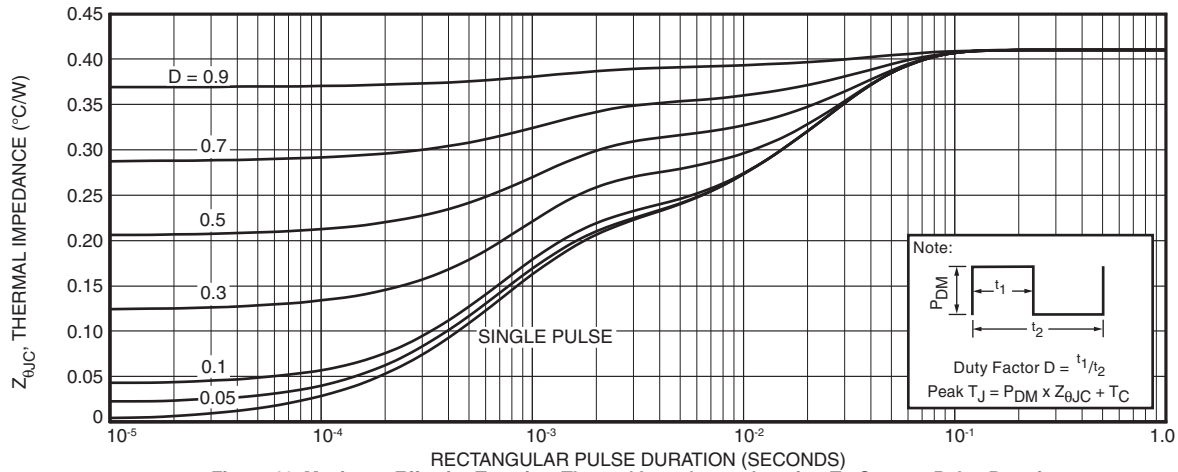


Figure 19, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

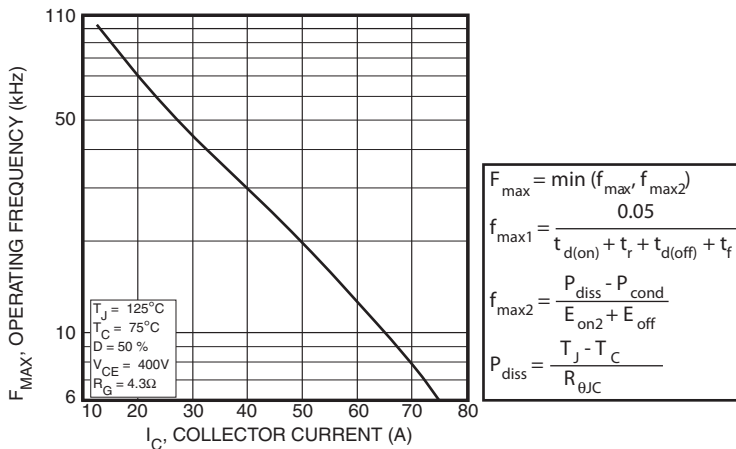


Figure 20, Operating Frequency vs Collector Current

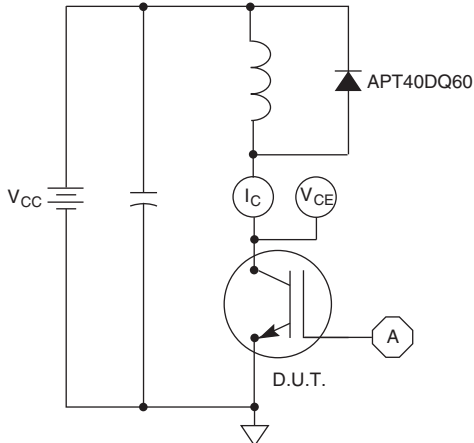


Figure 21, Inductive Switching Test Circuit

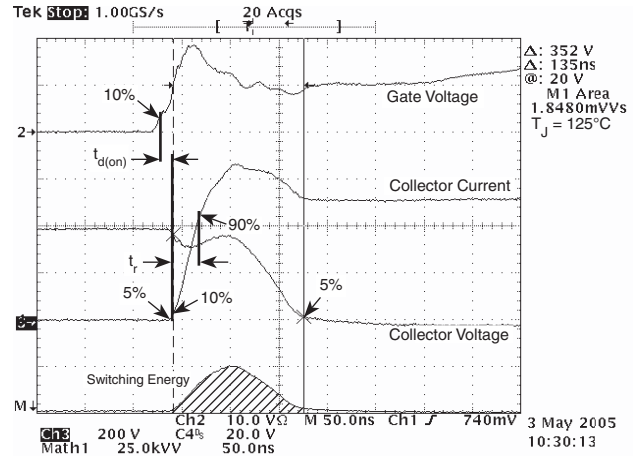


Figure 22, Turn-on Switching Waveforms and Definitions

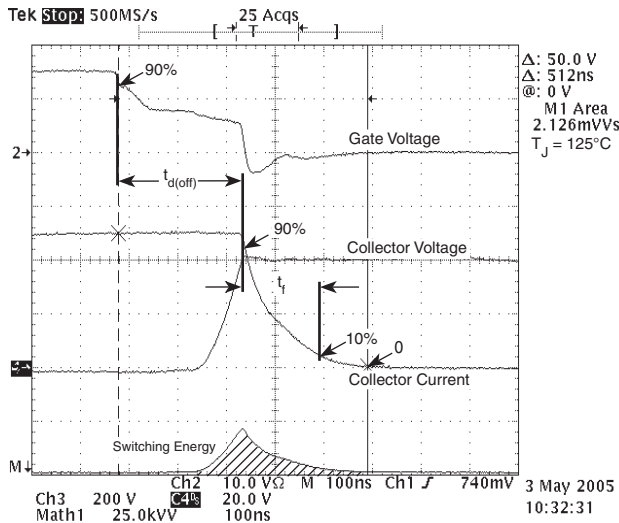
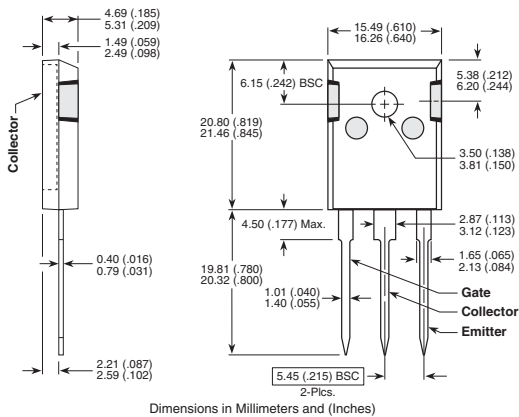


Figure 23, Turn-off Switching Waveforms and Definitions

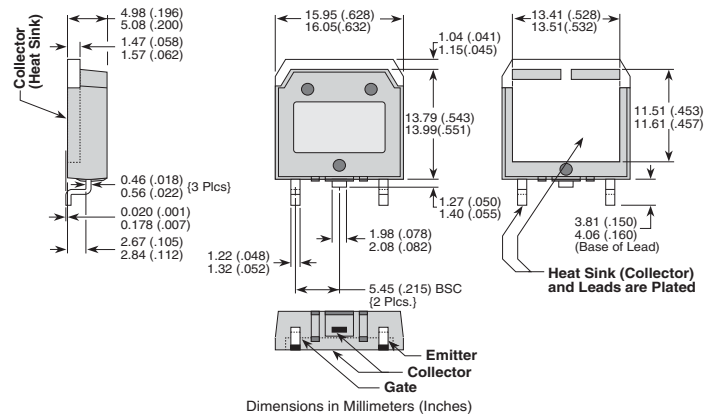
**TO-247 Package Outline**

e1 SAC: Tin, Silver, Copper



**D<sup>3</sup>PAK Package Outline**

e3 SAC: Tin, Silver, Copper



Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А