

## 阅读申明

- 1.本站收集的数据手册和产品资料都来自互联网，版权归原作者所有。如读者和版权方有任何异议请及时告之，我们将妥善解决。
- 2.本站提供的中文数据手册是英文数据手册的中文翻译，其目的是协助用户阅读，该译文无法自动跟随原稿更新，同时也可能存在翻译上的不当。建议读者以英文原稿为参考以便获得更精准的信息。
- 3.本站提供的产品资料，来自厂商的技术支持或者使用者的心得体会等，其内容可能存在描述上的差异，建议读者做出适当判断。
- 4.如需与我们联系，请发邮件到marketing@iczoom.com，主题请标有“数据手册”字样。

## Read Statement

1. The datasheets and other product information on the site are all from network reference or other public materials, and the copyright belongs to the original author and original published source. If readers and copyright owners have any objections, please contact us and we will deal with it in a timely manner.
2. The Chinese datasheets provided on the website is a Chinese translation of the English datasheets. Its purpose is for reader's learning exchange only and do not involve commercial purposes. The translation cannot be automatically updated with the original manuscript, and there may also be improper translations. Readers are advised to use the English manuscript as a reference for more accurate information.
3. All product information provided on the website refer to solutions from manufacturers' technical support or users the contents may have differences in description, and readers are advised to take the original article as the standard.
4. If you have any questions, please contact us at marketing@iczoom.com and mark the subject with "Datasheets" .

# HGTP2N120CN, HGT1S2N120CN 13A, 1200V, NPT Series N-Channel IGBT

## Features

- 13A, 1200V,  $T_C = 25^\circ\text{C}$
- 1200V Switching SOA Capability
- Typical Fall Time 360ns at  $T_J = 150^\circ\text{C}$
- Short Circuit Rating
- Low Conduction Loss
- Avalanche Rated
- Temperature Compensating SABER™ Model  
Thermal Impedance SPICE Model  
[www.fairchildsemi.com](http://www.fairchildsemi.com)
- Related Literature
- TB334 "Guidelines for Soldering Surface Mount Components to PC Boards"

## Description

The HGTP2N120CN and HGT1S2N120CN are Non-Punch Through (NPT) IGBT designs. They are new members of the MOS gated high voltage switching IGBT family. IGBTs combine the best features of MOSFETs and bipolar transistors. This device has the high input impedance of a MOSFET and the low on-state conduction loss of a bipolar transistor.

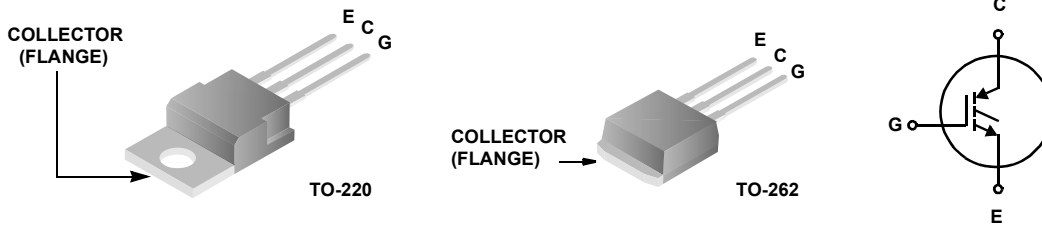
The IGBT is ideal for many high voltage switching applications operating at moderate frequencies where low conduction losses are essential, such as: AC and DC motor controls, power supplies and drivers for solenoids, relays and contactors.

Formerly Developmental Type TA49313

## Ordering Informations

Part Number	Package	Brand
HGTP2N120CN	TO-220AB	2N120CN
HGT1S2N120CN	TO-262	2N120CN

Note: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-263AB and TO-252AA variant in tape and reel, e.g., HGT1S2N120CNS9A.



### FAIRCHILD SEMICONDUCTOR IGBT PRODUCT IS COVERED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS

4,364,073	4,417,385	4,430,792	4,443,931	4,466,176	4,516,143	4,532,534	4,587,713
4,598,461	4,605,948	4,620,211	4,631,564	4,639,754	4,639,762	4,641,162	4,644,637
4,682,195	4,684,413	4,694,313	4,717,679	4,743,952	4,783,690	4,794,432	4,801,986
4,803,533	4,809,045	4,809,047	4,810,665	4,823,176	4,837,606	4,860,080	4,883,767
4,888,627	4,890,143	4,901,127	4,904,609	4,933,740	4,963,951	4,969,027	

**Absolute Maximum Ratings**  $T_C = 25^\circ\text{C}$ , Unless Otherwise Specified

Symbol	Parameter	HGTP2N120CN HGT1S2N120CN	Units
$BV_{CES}$	Collector to Emitter Voltage	1200	V
$I_{C25}$ $I_{C110}$	Collector Current Continuous At $T_C = 25^\circ\text{C}$ At $T_C = 110^\circ\text{C}$	13 7	A A
$I_{CM}$	Collector Current Pulsed (Note 1)	20	A
$V_{GES}$	Gate to Emitter Voltage Continuous	$\pm 20$	V
$V_{GEM}$	Gate to Emitter Voltage Pulsed	$\pm 30$	V
SSOA	Switching SOA Operating Area at $T_J = 150^\circ\text{C}$ (Figure 2)	13A at 1200V	
$P_D$	Power Dissipation Total at $T_C = 25^\circ\text{C}$	104	W
	Power Dissipation Derating $T_C > 25^\circ\text{C}$	0.83	W/ $^\circ\text{C}$
$E_{AV}$	Forward Voltage Avalanche Energy (Note 2)	18	mJ
$t_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$ $T_{PKG}$	Maximum Lead Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10s	300	$^\circ\text{C}$
	Package Body for 10s, see Tech Brief 334	260	$^\circ\text{C}$
$t_{SC}$	Short Circuit Withstand Time (Note 3) at $V_{GE} = 15\text{V}$	8	$\mu\text{s}$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**Notes:**

- Pulse width limited by maximum junction temperature.
- $I_{CE} = 3\text{A}$ ,  $L = 4\text{mH}$
- $V_{CE(PK)} = 840\text{V}$ ,  $T_J = 125^\circ\text{C}$ ,  $R_G = 51\Omega$ .

**Electrical Characteristics**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$I_C = 250\mu\text{A}$ , $V_{GE} = 0\text{V}$	1200	-	-	V	
$BV_{ECS}$	Emitter to Collector Breakdown Voltage	$I_C = 10\text{mA}$ , $V_{GE} = 0\text{V}$	15	-	-	V	
$I_{CES}$	Collector to Emitter Leakage Current	$V_{CE} = 1200\text{V}$	$T_J = 25^\circ\text{C}$	-	-	100	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	-	100	-	$\mu\text{A}$
			$T_J = 150^\circ\text{C}$	-	-	1.0	mA
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_C = 2.6\text{A}$ , $V_{GE} = 15\text{V}$	$T_J = 25^\circ\text{C}$	-	2.05	2.40	V
			$T_J = 150^\circ\text{C}$	-	2.75	3.50	V
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	$I_C = 45\mu\text{A}$ , $V_{CE} = V_{GE}$	6.4	6.7	-	V	
$I_{GES}$	Gate to Emitter Leakage Current	$V_{GE} = \pm 20\text{V}$	-	-	$\pm 250$	nA	
SSOA	Switching SOA	$T_J = 150^\circ\text{C}$ , $R_G = 51\Omega$ , $V_{GE} = 15\text{V}$ $L = 5\text{mH}$ , $V_{CE(PK)} = 1200\text{V}$	13	-	-	A	
$V_{GEP}$	Gate to Emitter Plateau Voltage	$I_C = 2.6\text{A}$ , $V_{CE} = 600\text{V}$	-	10.2	-	V	
$Q_{g(ON)}$	On-State Gate Charge	$I_C = 2.6\text{A}$ , $V_{CE} = 600\text{V}$	$V_{GE} = 15\text{V}$	-	30	36	nC
			$V_{GE} = 20\text{V}$	-	36	43	nC

**Electrical Characteristics**  $T_C = 25^\circ\text{C}$  unless otherwise noted (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(ON)}$	Current Trun-On Delay Time	IGBT and Diode at $T_J = 25^\circ\text{C}$ $I_{CE} = 2.6\text{A}$ $V_{CE} = 960\text{V}$ $V_{GE} = 15\text{V}$ $R_G = 51\Omega$ $L = 5\text{mH}$ Test Circuit (Figure 18)	-	25	30	ns
$t_{rl}$	Current Rise Time		-	11	15	ns
$t_{d(OFF)}$	Curent Turn-Off Delay Time		-	205	220	ns
$t_{fl}$	Current Fall Time		-	260	320	ns
$E_{ON1}$	Turn-On Energy (Note 4)		-	96	-	$\mu\text{J}$
$E_{ON2}$	Turn-On Energy (Note 4)		-	425	590	$\mu\text{J}$
$E_{OFF}$	Turn-Off Energy (Note 5)	-	355	390	$\mu\text{J}$	
$t_{d(ON)}$	Curent Turn-On Delay Time	IGBT and Diode at $T_J = 150^\circ\text{C}$ $I_{CE} = 2.6\text{A}$ $V_{CE} = 960\text{V}$ $V_{GE} = 15\text{V}$ $R_G = 51\Omega$ $L = 5\text{mH}$ Test Circuit (Figure 18)	-	21	25	ns
$t_{rl}$	Current Rise Time		-	11	15	ns
$t_{d(OFF)}$	Curent Turn-Off Delay Time		-	225	240	ns
$t_{fl}$	Current Fall Time		-	360	420	ns
$E_{ON1}$	Turn-On Energy (Note 4)		-	96	-	$\mu\text{J}$
$E_{ON2}$	Turn-On Energy (Note 4)		-	800	1100	$\mu\text{J}$
$E_{OFF}$	Turn-Off Energy (Note 5)	-	530	580	$\mu\text{J}$	
$R_{\theta JC}$	Thermal Resistance Junction to Case		-	-	1.20	$^\circ\text{C/W}$

**Notes:**

- Values for two Turn-On loss conditions are shown for the convenience of the circuit designer.  $E_{ON1}$  is the turn-on loss of the IGBT only.  $E_{ON2}$  is the turn-on loss when a typical diode is used in the test circuit and the diode is at the same  $T_J$  as the IGBT. The diode type is specified in Figure 18.
- Turn-Off Energy Loss ( $E_{OFF}$ ) is defined as the integral of the instantaneous power loss starting at the trailing edge of the input pulse and ending at the point where the collector current equals zero ( $I_{CE} = 0\text{A}$ ). All devices were tested per JEDEC Standard No. 24-1 Method for Measurement of Power Device Turn-Off Switching Loss. This test method produces the true total Turn-Off Energy Loss.

Typical Performance Characteristics

Figure 1. DC Collector Current vs Case Temperature

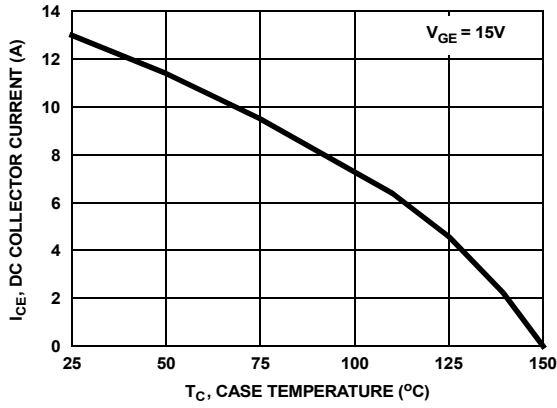


Figure 2. Minimum Switching Safe Operating Area

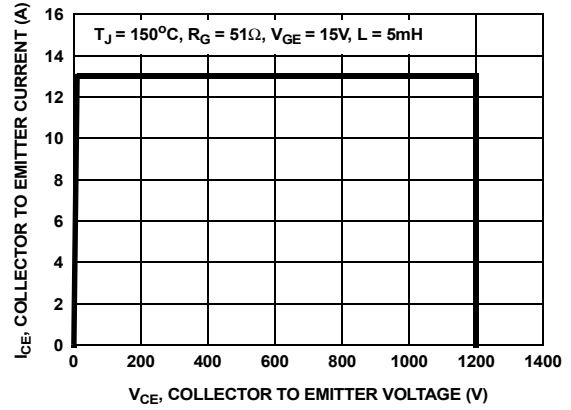


Figure 3. Operating Frequency vs Collector to Emitter Current

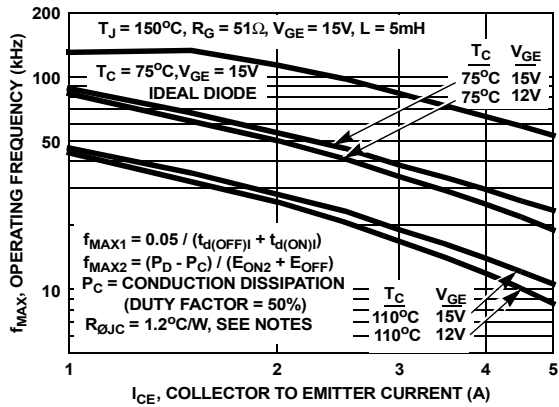


Figure 4. Short Circuit Withstand Time

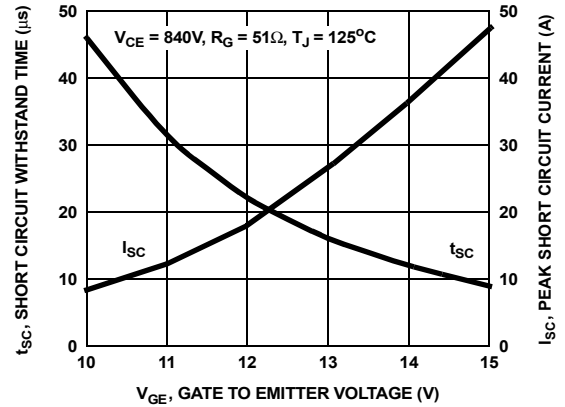


Figure 5. Collector to Emitter On-State Voltage

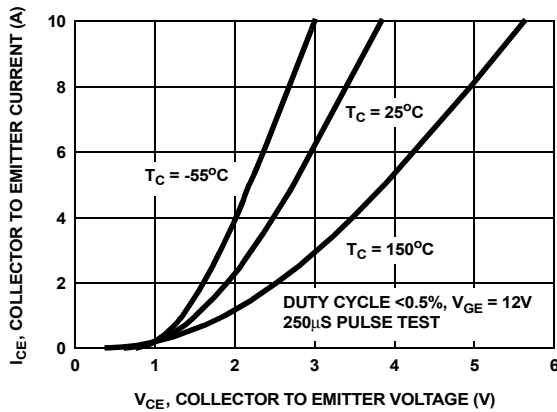
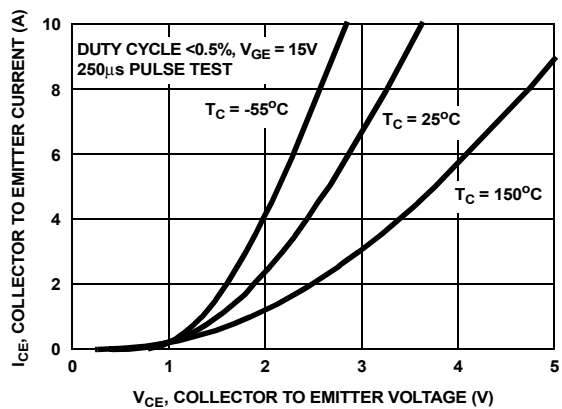
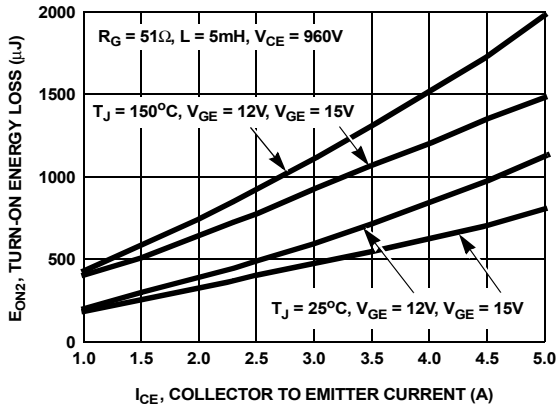


Figure 6. Collector to Emitter On-State Voltage

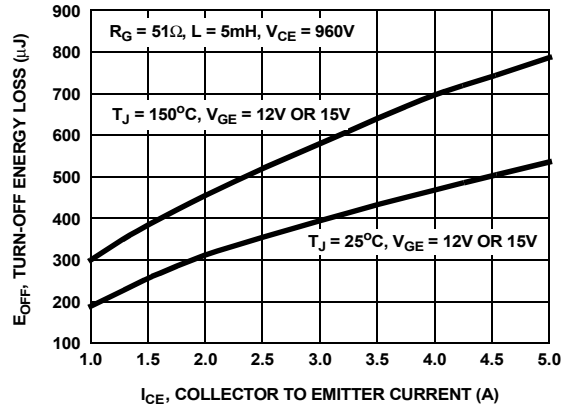


**Typical Performance Characteristics** (Continued)

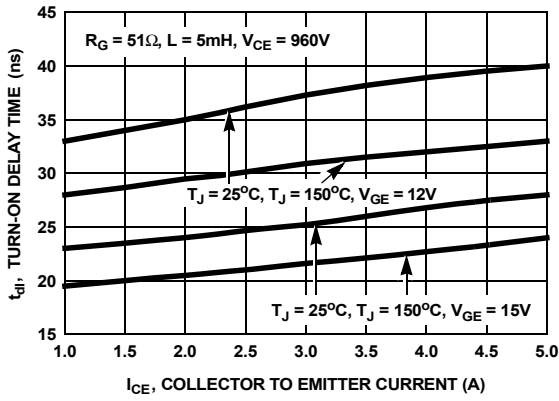
**Figure 7. Turn-On Energy Loss vs Collector to Emitter Current**



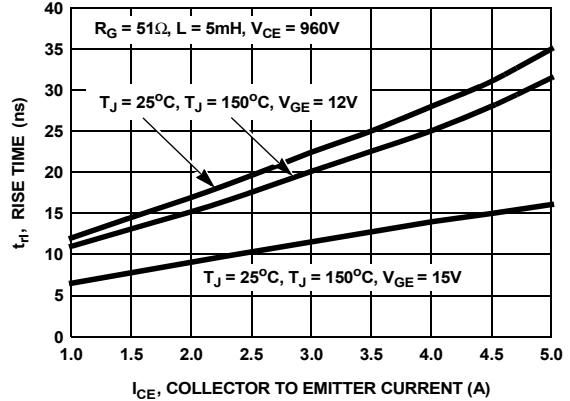
**Figure 8. Turn-Off Energy Loss vs Collector to Emitter Current**



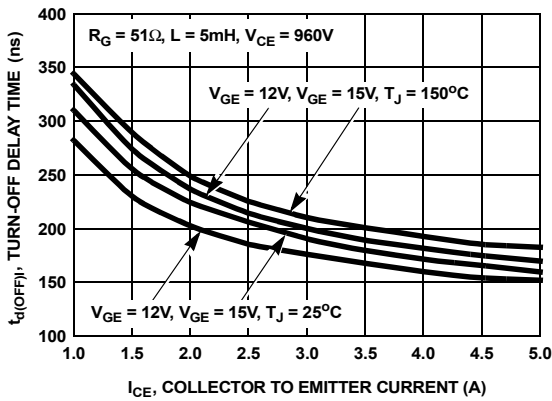
**Figure 9. Turn-On Delay Time vs Collector to Emitter Current**



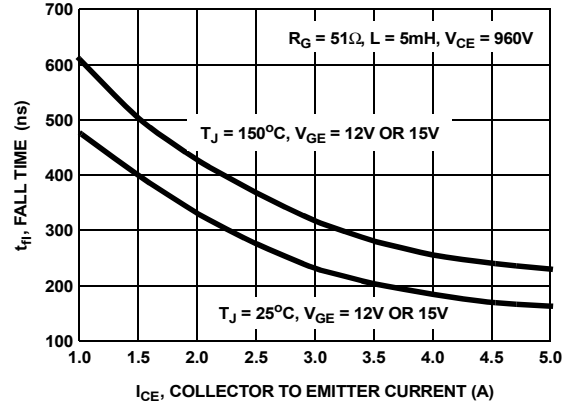
**Figure 10. Turn-On Rise Time vs Collector to Emitter Current**



**Figure 11. Turn-Off Delay Time vs Collector to Emitter Current**

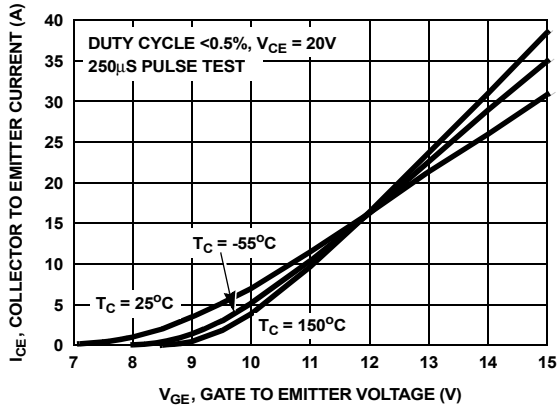


**Figure 12. Fall Time vs Collector to Emitter Current**

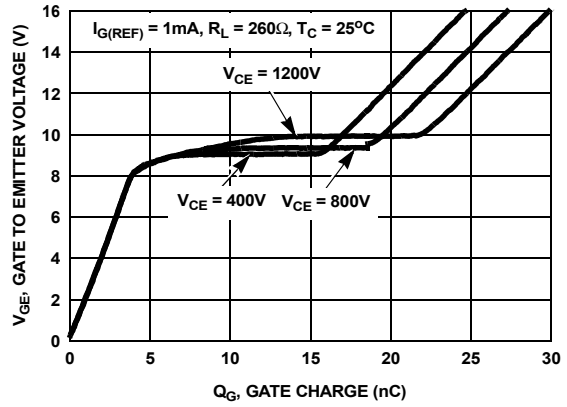


**Typical Performance Characteristics** (Continued)

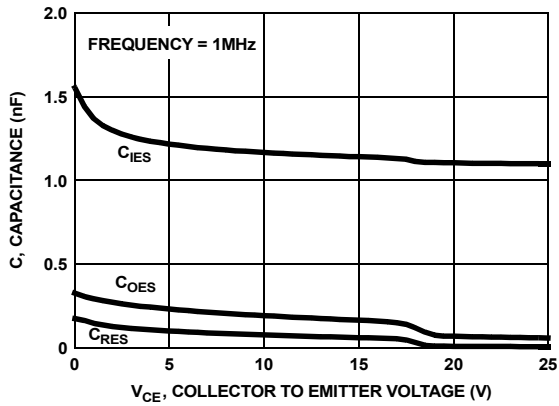
**Figure 13. Transfer Characteristic**



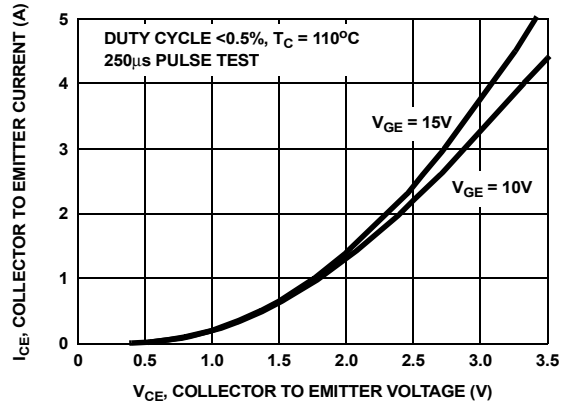
**Figure 14. Gate Charge Waveforms**



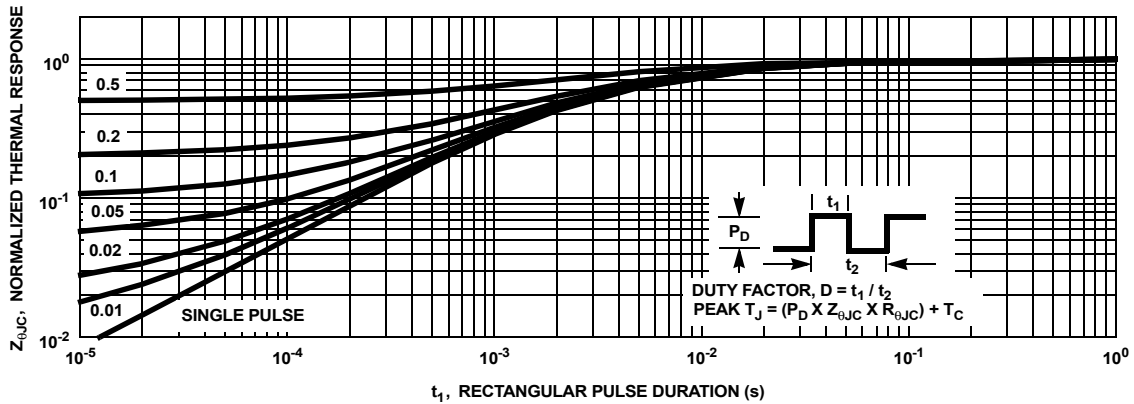
**Figure 15. Capacitance vs Collector to Emitter**



**Figure 16. Collector to Emitter On-Sate Voltage**

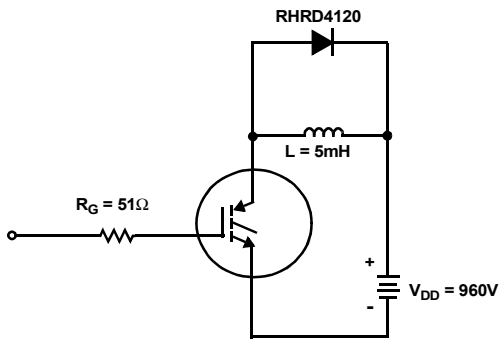


**Figure 17. Normalized Transient Thermal Response, Junction to Case**

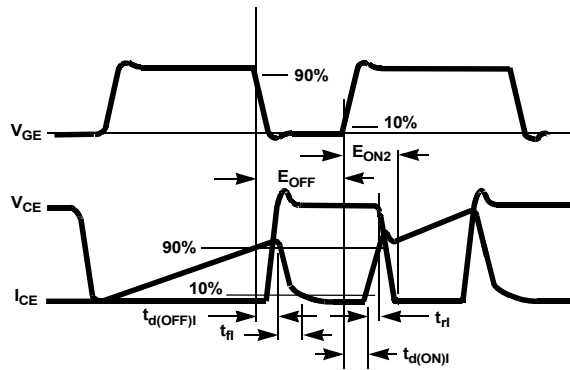


**Test Circuit and Waveforms** (Continued)

**Figure 18. Inductive Switching Test Circuit**



**Figure 19. Switching Test Waveforms**





## Handling Precautions for IGBTs

Insulated Gate Bipolar Transistors are susceptible to gate-insulation damage by the electrostatic discharge of energy through the devices. When handling these devices, care should be exercised to assure that the static charge built in the handler's body capacitance is not discharged through the device. With proper handling and application procedures, however, IGBTs are currently being extensively used in production by numerous equipment manufacturers in military, industrial and consumer applications, with virtually no damage problems due to electrostatic discharge. IGBTs can be handled safely if the following basic precautions are taken:

1. Prior to assembly into a circuit, all leads should be kept shorted together either by the use of metal shorting springs or by the insertion into conductive material such as "ECCOSORB™ LD26" or equivalent.
2. When devices are removed by hand from their carriers, the hand being used should be grounded by any suitable means - for example, with a metallic wristband.
3. Tips of soldering irons should be grounded.
4. Devices should never be inserted into or removed from circuits with power on.
5. **Gate Voltage Rating** - Never exceed the gate-voltage rating of  $V_{GEM}$ . Exceeding the rated  $V_{GE}$  can result in permanent damage to the oxide layer in the gate region.
6. **Gate Termination** - The gates of these devices are essentially capacitors. Circuits that leave the gate open-circuited or floating should be avoided. These conditions can result in turn-on of the device due to voltage buildup on the input capacitor due to leakage currents or pickup.
7. **Gate Protection** - These devices do not have an internal monolithic Zener diode from gate to emitter. If gate protection is required, an external Zener is recommended.

## Operating Frequency Information

Operating frequency information for a typical device (Figure 3) is presented as a guide for estimating device performance for a specific application. Other typical frequency vs collector current ( $I_{CE}$ ) plots are possible using the information shown for a typical unit in Figures 5, 6, 7, 8, 9 and 11. The operating frequency plot (Figure 3) of a typical device shows  $f_{MAX1}$  or  $f_{MAX2}$ ; whichever is smaller at each point. The information is based on measurements of a typical device and is bounded by the maximum rated junction temperature.

$f_{MAX1}$  is defined by  $f_{MAX1} = 0.05 / (t_{d(OFF)} + t_{d(ON)})$ . Deadtime (the denominator) has been arbitrarily held to 10% of the on-state time for a 50% duty factor. Other definitions are possible.  $t_{d(OFF)}$  and  $t_{d(ON)}$  are defined in Figure 19. Device turn-off delay can establish an additional frequency limiting condition for an application other than  $T_{JM}$ .  $t_{d(OFF)}$  is important when controlling output ripple under a lightly loaded condition.

$f_{MAX2}$  is defined by  $f_{MAX2} = (P_D - P_C) / (E_{OFF} + E_{ON2})$ . The allowable dissipation ( $P_D$ ) is defined by  $P_D = (T_{JM} - T_C) / R_{\theta JC}$ . The sum of device switching and conduction losses must not exceed  $P_D$ . A 50% duty factor was used (Figure 3) and the conduction losses ( $P_C$ ) are approximated by  $P_C = (V_{CE} \times I_{CE}) / 2$ .

$E_{ON2}$  and  $E_{OFF}$  are defined in the switching waveforms shown in Figure 19.  $E_{ON2}$  is the integral of the instantaneous power loss ( $I_{CE} \times V_{CE}$ ) during turn-on and  $E_{OFF}$  is the integral of the instantaneous power loss ( $I_{CE} \times V_{CE}$ ) during turn-off. All tail losses are included in the calculation for  $E_{OFF}$ ; i.e., the collector current equals zero ( $I_{CE} = 0$ ).

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™	FAST®	IntelliMAX™	POP™	SPM™
ActiveArray™	FASTr™	ISOPANAR™	Power247™	Stealth™
Bottomless™	FPS™	LittleFET™	PowerEdge™	SuperFET™
CoolFET™	FRFET™	MICROCOUPLER™	PowerSaver™	SuperSOT™-3
CROSSVOLT™	GlobalOptoisolator™	MicroFET™	PowerTrench®	SuperSOT™-6
DOVE™	GTO™	MicroPak™	QFET®	SuperSOT™-8
EcoSPARK™	HiSeC™	MICROWIRE™	QS™	SyncFET™
E <sup>2</sup> CMOS™	I <sup>2</sup> C™	MSX™	QT Optoelectronics™	TinyLogic®
EnSigna™	i-Lo™	MSXPro™	Quiet Series™	TINYOPTO™
FACT™	ImpliedDisconnect™	OCX™	RapidConfigure™	TruTranslation™
FACT Quiet Series™		OCXPro™	RapidConnect™	UHC™
Across the board. Around the world.™		OPTOLOGIC®	μSerDes™	UltraFET®
The Power Franchise®		OPTOPLANAR™	SILENT SWITCHER®	UniFET™
Programmable Active Droop™		PACMAN™	SMART START™	VCX™

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I15