



# FGH50N3

## 300 V SMPS IGBT

### General Description

Using Fairchild®'s planar technology, this IGBT is ideal for many high voltage switching applications operating at high frequencies where low conduction losses are essential. This device has been optimized for medium frequency switch mode power supplies.

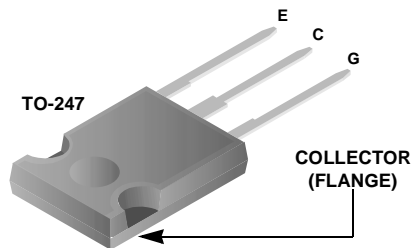
### Features

- Low Saturation Voltage:  $V_{CE(sat)} = 1.4 \text{ V max}$
- Low  $E_{OFF} = 6.6 \text{ uJ/A}$
- $SCWT = 8 \text{ us @ } 125^\circ\text{C}$
- 300V Switching SOA Capability
- Positive Temperature Coefficient above 50 A

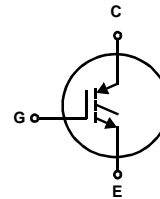
### Applications

- SMPS

### Package



### Symbol



### Device Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Unit
$BV_{CES}$	Collector to Emitter Breakdown Voltage	300	V
$I_{C25}$	Collector Current Continuous, $T_C = 25^\circ\text{C}$	75	A
$I_{C110}$	Collector Current Continuous, $T_C = 110^\circ\text{C}$	75	A
$I_{CM}$	Collector Current Pulsed (Note 1)	240	A
$V_{GES}$	Gate to Emitter Voltage Continuous	$\pm 20$	V
$V_{GEM}$	Gate to Emitter Voltage Pulsed	$\pm 30$	V
SSOA	Switching Safe Operating Area at $T_J = 150^\circ\text{C}$ , Figure 2	150A at 300V	
$E_{AS}$	Single Pulse Avalanche Energy, $I_{CE} = 30\text{A}$ , $L = 1.78\text{mH}$ , $V_{DD} = 50\text{V}$	800	mJ
$E_{ARV}$	Single Pulse Reverse Avalanche Energy, $I_{EC} = 30\text{A}$ , $L = 1.78\text{mH}$ , $V_{DD} = 50\text{V}$	800	mJ
$P_D$	Power Dissipation Total $T_C = 25^\circ\text{C}$	463	W
	Power Dissipation Derating $T_C > 25^\circ\text{C}$	3.7	W/ $^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_{STG}$	Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$t_{SC}$	Short Circuit Withstand Time (Note 2)	8	$\mu\text{s}$

**CAUTION:** Stresses above those listed in "Device 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.

**NOTE:**

1. Pulse width limited by maximum junction temperature.
2.  $V_{CE(PK)} = 180\text{V}$ ,  $T_J = 125^\circ\text{C}$ ,  $V_{GE} = 12\text{Vdc}$ ,  $R_G = 5\Omega$

## Package Marking and Ordering Information

Device Marking	Device	Package	Tape Width	Quantity
FGH50N3	FGH50N3	TO-247	N/A	30

## Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### Off State Characteristics

$BV_{CES}$	Collector to Emitter Breakdown Voltage	$I_{CE} = 250\mu\text{A}$ , $V_{GE} = 0\text{V}$	300V	-	-	V	
$BV_{ECS}$	Emitter to Collector Breakdown Voltage	$I_{EC} = 10\text{mA}$ , $V_{GE} = 0\text{V}$	15V	-	-	V	
$I_{CES}$	Collector to Emitter Leakage Current	$V_{CE} = 300\text{V}$	$T_J = 25^\circ\text{C}$	-	-	250	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	-	-	2.0	mA
$I_{GES}$	Gate to Emitter Leakage Current	$V_{GE} = \pm 20\text{V}$	-	-	$\pm 250$	nA	

### On State Characteristics

$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 30\text{A}$ $V_{GE} = 15\text{V}$	$T_J = 25^\circ\text{C}$	-	1.30	1.4	V
			$T_J = 125^\circ\text{C}$	-	1.25	1.4	V

### Dynamic Characteristics

$Q_{G(ON)}$	Gate Charge	$I_{CE} = 30\text{A}$ $V_{CE} = 150\text{V}$	$V_{GE} = 15\text{V}$	-	180	-	nC
			$V_{GE} = 20\text{V}$	-	228	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	$I_{CE} = 250\mu\text{A}$ , $V_{CE} = V_{GE}$	4.0	4.8	5.5	V	
$V_{GEP}$	Gate to Emitter Plateau Voltage	$I_{CE} = 30\text{A}$ , $V_{CE} = 150\text{V}$	-	7.0	-	V	

### Switching Characteristics

SSOA	Switching SOA	$T_J = 150^\circ\text{C}$ , $R_G = 5\Omega$ , $V_{GE} = 15\text{V}$ , $L = 25\mu\text{H}$ , $V_{ce} = 300\text{V}$	150	-	-	A	
$t_{d(ON)I}$	Current Turn-On Delay Time	IGBT and Diode at $T_J = 25^\circ\text{C}$ , $I_{CE} = 30\text{A}$ , $V_{CE} = 180\text{V}$ , $V_{GE} = 15\text{V}$ , $R_G = 5\Omega$ , $L = 100\mu\text{H}$ , Test Circuit - Figure 20	-	20	-	ns	
$t_{rI}$	Current Rise Time		-	15	-	ns	
$t_{d(OFF)I}$	Current Turn-Off Delay Time		-	135	-	ns	
$t_{fI}$	Current Fall Time		-	12	-	ns	
$E_{ON2}$	Turn-On Energy (Note 1)		-	130	-	$\mu\text{J}$	
$E_{OFF}$	Turn-Off Energy (Note 2)		-	92	120	$\mu\text{J}$	
$t_{d(ON)I}$	Current Turn-On Delay Time		IGBT and Diode at $T_J = 125^\circ\text{C}$ , $I_{CE} = 30\text{A}$ , $V_{CE} = 180\text{V}$ , $V_{GE} = 15\text{V}$ , $R_G = 5\Omega$ , $L = 100\mu\text{H}$ , Test Circuit - Figure 20	-	19	-	ns
$t_{rI}$	Current Rise Time			-	13	-	ns
$t_{d(OFF)I}$	Current Turn-Off Delay Time			-	155	190	ns
$t_{fI}$	Current Fall Time			-	7	15	ns
$E_{ON2}$	Turn-On Energy (Note 1)	-		225	270	$\mu\text{J}$	
$E_{OFF}$	Turn-Off Energy (Note 2)	-		135	200	$\mu\text{J}$	

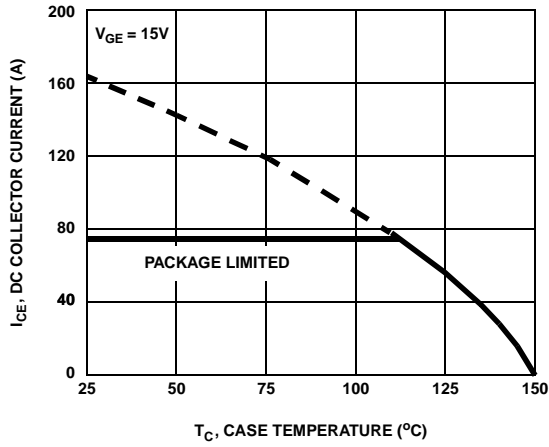
### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction-Case	TO-247	-	-	0.27	$^\circ\text{C/W}$
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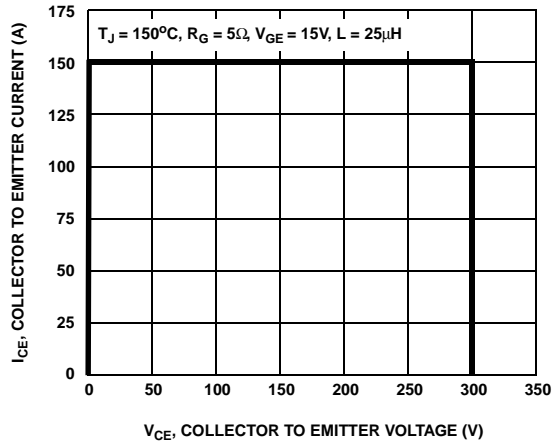
NOTE:

- $E_{ON2}$  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 20.
- 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.

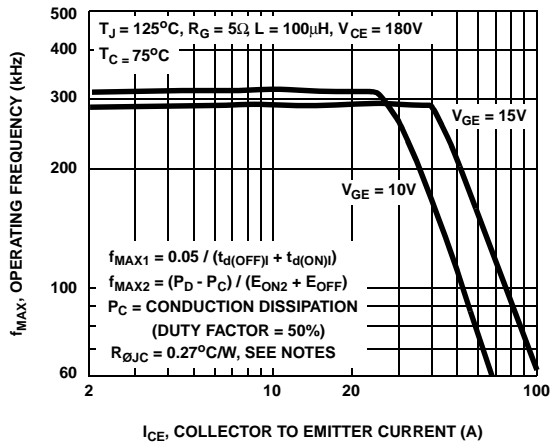
**Typical Performance Curves**  $T_J = 25^\circ\text{C}$  unless otherwise noted



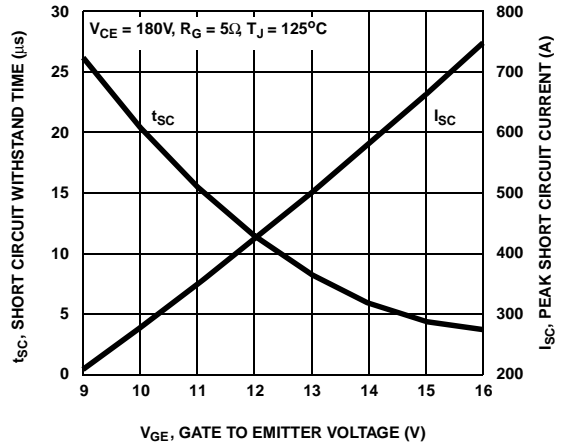
**Figure 1. DC Collector Current vs Case Temperature**



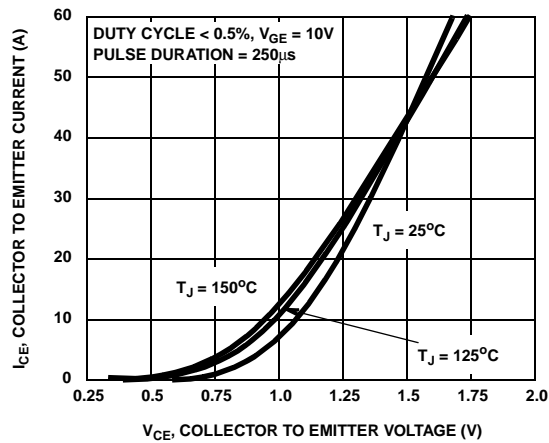
**Figure 2. Minimum Switching Safe Operating Area**



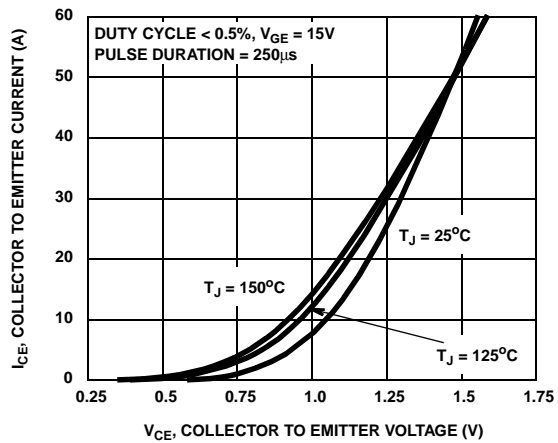
**Figure 3. Operating Frequency vs Collector to Emitter Current**



**Figure 4. Short Circuit Withstand Time**

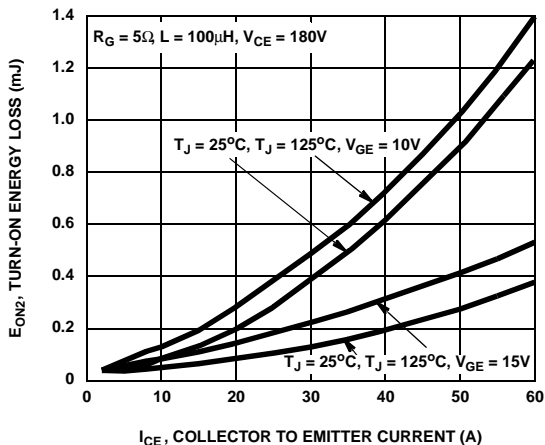


**Figure 5. Collector to Emitter On-State Voltage**

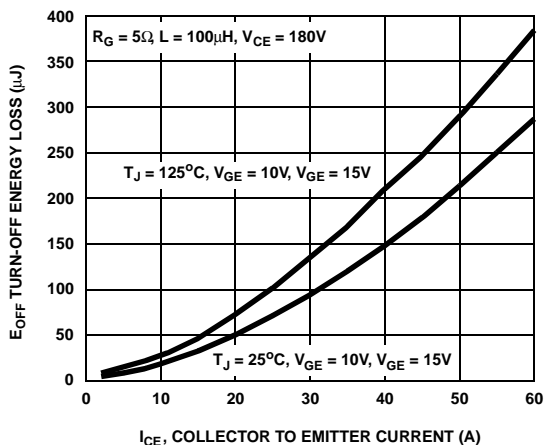


**Figure 6. Collector to Emitter On-State Voltage**

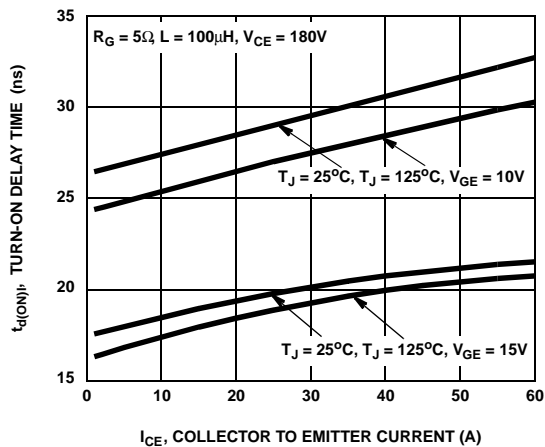
**Typical Performance Curves**  $T_J = 25^\circ\text{C}$  unless otherwise noted (Continued)



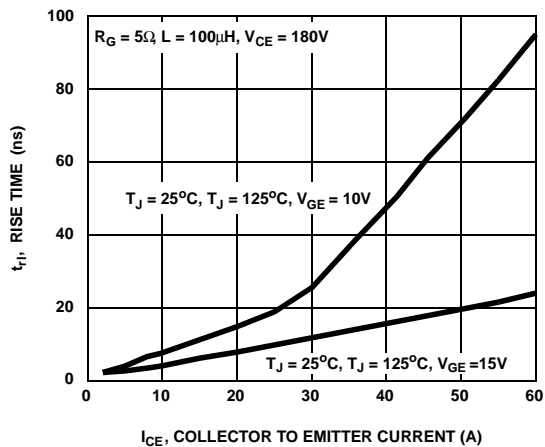
**Figure 7. Turn-On Energy Loss vs Collector to Emitter Current**



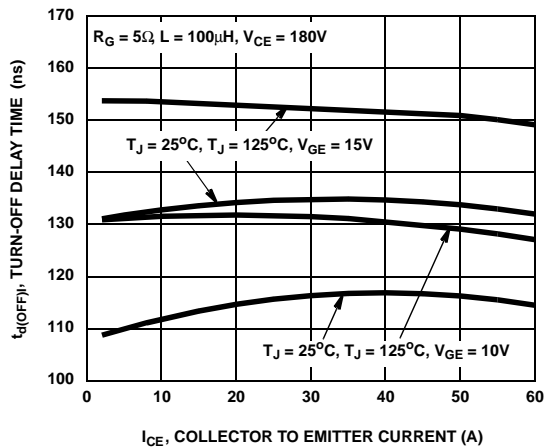
**Figure 8. Turn-Off Energy Loss vs Collector to Emitter Current**



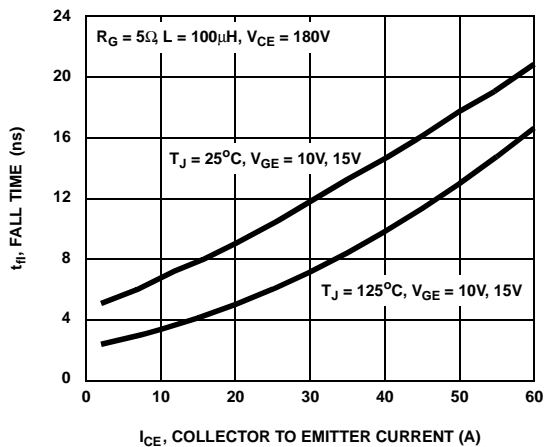
**Figure 9. Turn-On Delay Time vs Collector to Emitter Current**



**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 Curves**  $T_J = 25^\circ\text{C}$  unless otherwise noted (Continued)

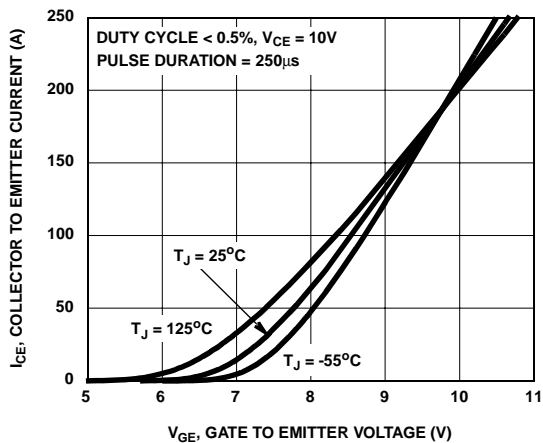


Figure 13. Transfer Characteristic

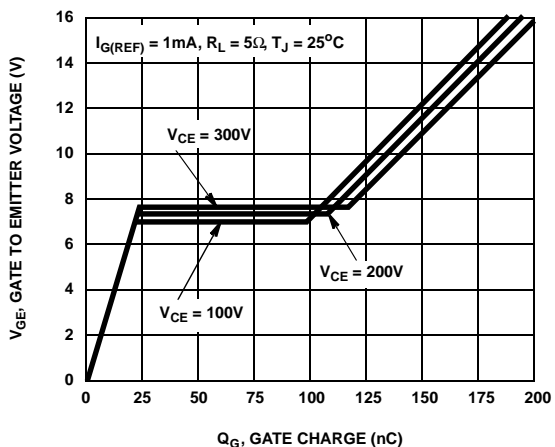


Figure 14. Gate Charge

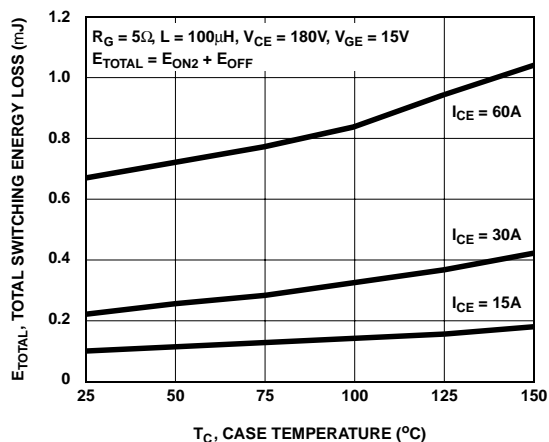


Figure 15. Total Switching Loss vs Case Temperature

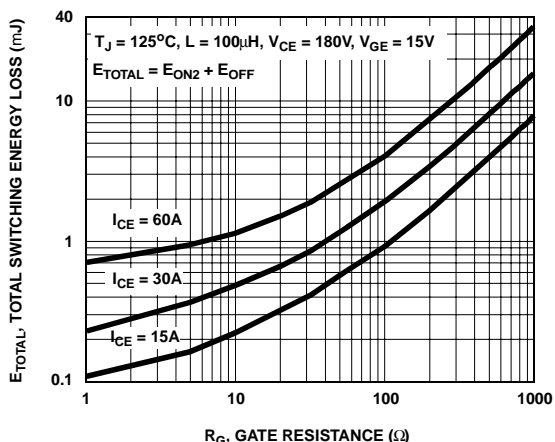


Figure 16. Total Switching Loss vs Gate Resistance

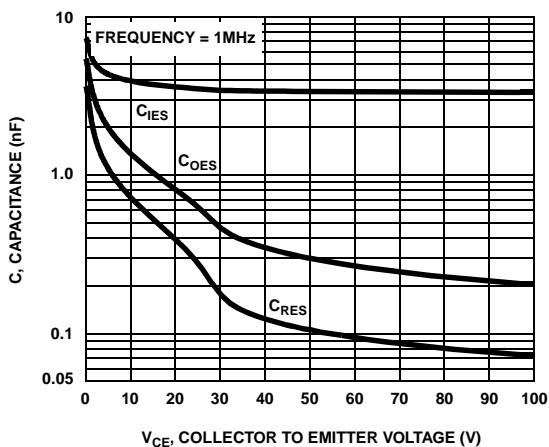


Figure 17. Capacitance vs Collector to Emitter Voltage

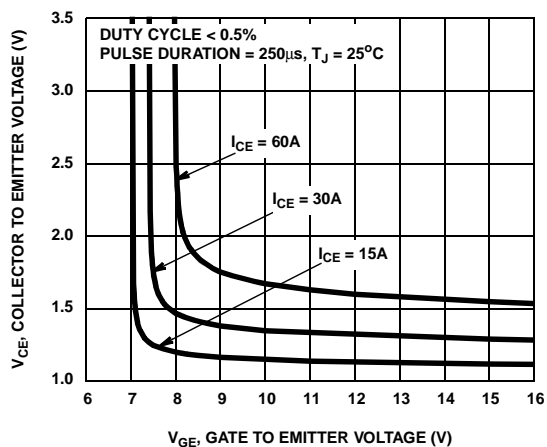


Figure 18. Collector to Emitter On-State Voltage vs Gate to Emitter Voltage

**Typical Performance Curves**  $T_J = 25^\circ\text{C}$  unless otherwise noted (Continued)

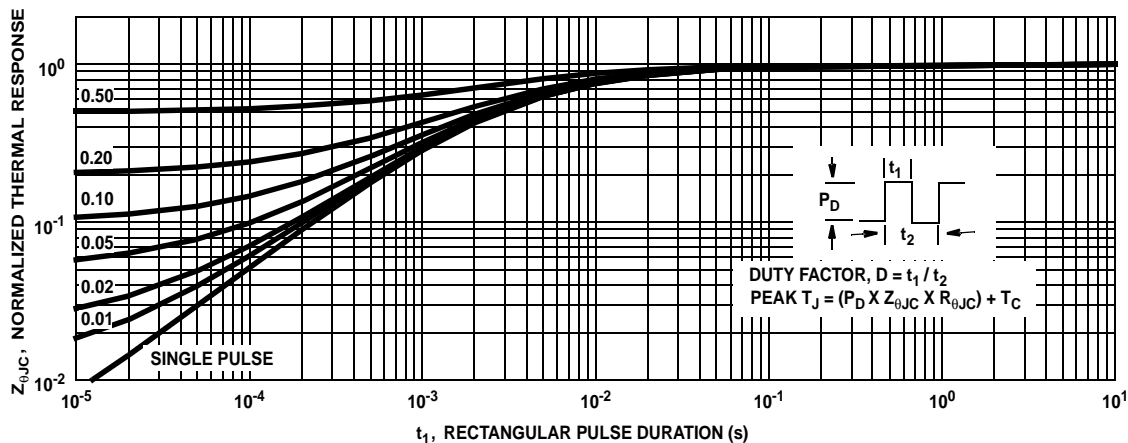


Figure 19. IGBT Normalized Transient Thermal Impedance, Junction to Case

**Test Circuit and Waveforms**

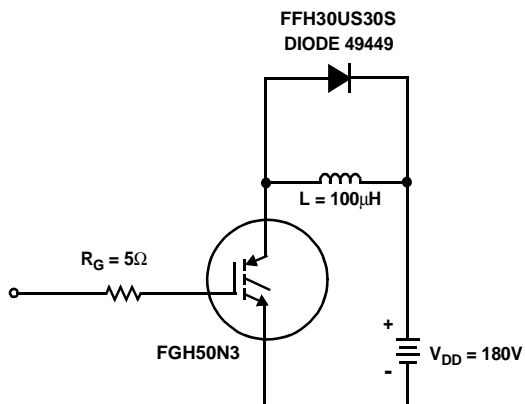


Figure 20. Inductive Switching Test Circuit

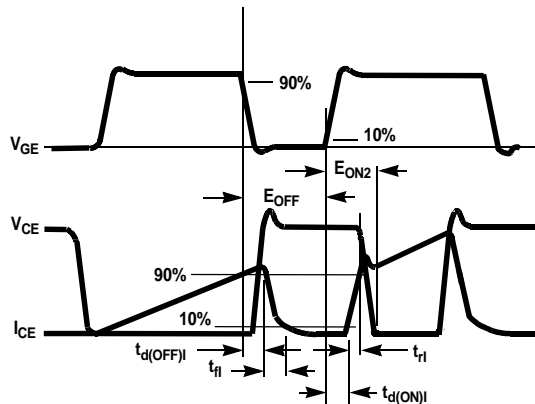
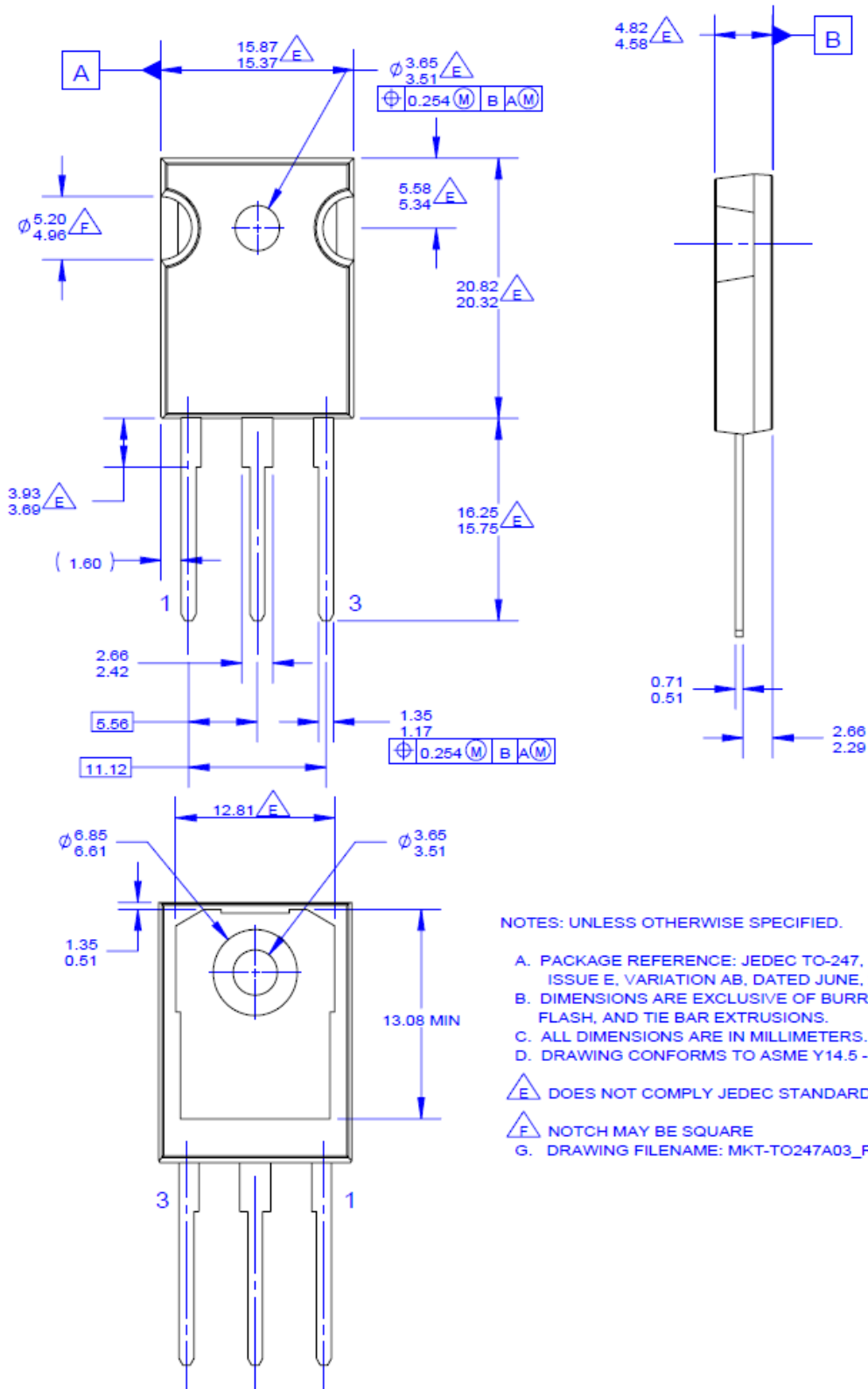




Figure 21. Switching Test Waveforms

Mechanical Dimensions

TO-247A03



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994
-  DOES NOT COMPLY JEDEC STANDARD VALUE
-  NOTCH MAY BE SQUARE
- G. DRAWING FILENAME: MKT-TO247A03\_REV03

