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FAIRCHILD SEMICONDUCTOR®

April 2013

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.

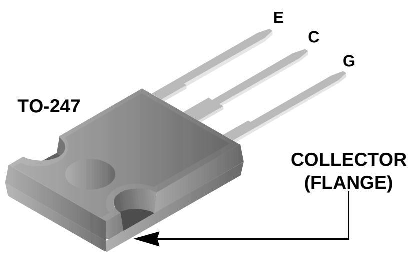
Applications

- SMPS

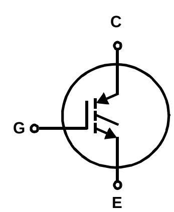
Features

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

Package



Symbol



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

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. $V_{CE(PK)}$ = 180V, T_J = 125°C, V_{GE} = 12Vdc, R_G = 5Ω

Package Marking and Ordering Information

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

Electrical Characteristics $T_J = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
Off State Characteristics							
BV_{CES}	Collector to Emitter Breakdown Voltage	$I_{CE} = 250\mu A$, $V_{GE} = 0V$		300V	-	-	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	$I_{EC} = 10mA$, $V_{GE} = 0V$		15V	-	-	V
I_{CES}	Collector to Emitter Leakage Current	$V_{CE} = 300V$	$T_J = 25°C$	-	-	250	µA
			$T_J = 125°C$	-	-	2.0	mA
I_{GES}	Gate to Emitter Leakage Current	$V_{GE} = \pm 20V$		-	-	±250	nA
On State Characteristics							
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE}= 30A$ $V_{GE} = 15V$	$T_J = 25°C$	-	1.30	1.4	V
			$T_J = 125°C$	-	1.25	1.4	V
Dynamic Characteristics							
$Q_{G(ON)}$	Gate Charge	$I_{CE} = 30A$ $V_{CE} = 150V$	$V_{GE} = 15V$	-	180	-	nC
			$V_{GE} = 20V$	-	228	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	$I_{CE} = 250\mu A$, $V_{CE} = V_{GE}$		4.0	4.8	5.5	V
V_{GEP}	Gate to Emitter Plateau Voltage	$I_{CE} = 30A$, $V_{CE} = 150V$		-	7.0	-	V
Switching Characteristics							
SSOA	Switching SOA	$T_J = 150°C$, $R_G = 5\Omega$, $V_{GE} = 15V$, L = 25µH, Vce = 300V		150	-	-	A
$t_{d(ON)I}$	Current Turn-On Delay Time	IGBT and Diode at $T_J = 25°C$, $I_{CE} = 30A$, $V_{CE} = 180V$, $V_{GE} = 15V$, $R_G = 5\Omega$, L = 100µH, 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	-	µJ
E_{OFF}	Turn-Off Energy (Note 2)			-	92	120	µJ
$t_{d(ON)I}$	Current Turn-On Delay Time	IGBT and Diode at $T_J = 125°C$, $I_{CE} = 30A$, $V_{CE} = 180V$, $V_{GE} = 15V$, $R_G = 5\Omega$, L = 100µH, 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	µJ
E_{OFF}	Turn-Off Energy (Note 2)			-	135	200	µJ
Thermal Characteristics							
$R_{\theta JC}$	Thermal Resistance Junction-Case	TO-247		-	-	0.27	°C/W

NOTE:

1. 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.

2. 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 ($I_{CE} = 0A$). 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°C unless otherwise noted

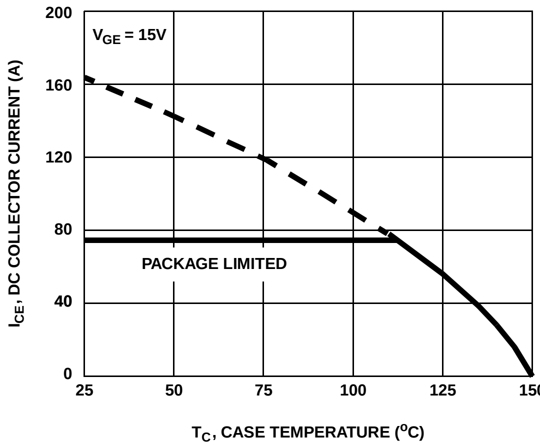


Figure 1. DC Collector Current vs Case Temperature

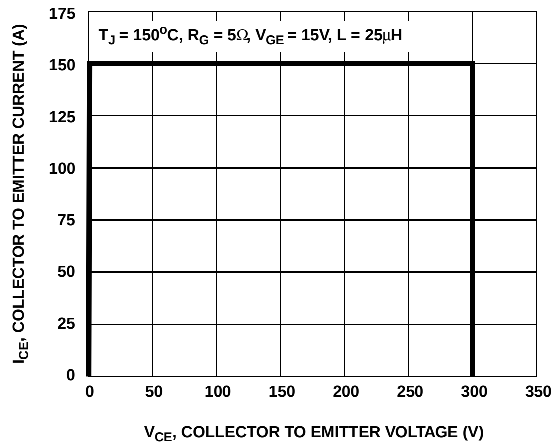


Figure 2. Minimum Switching Safe Operating Area

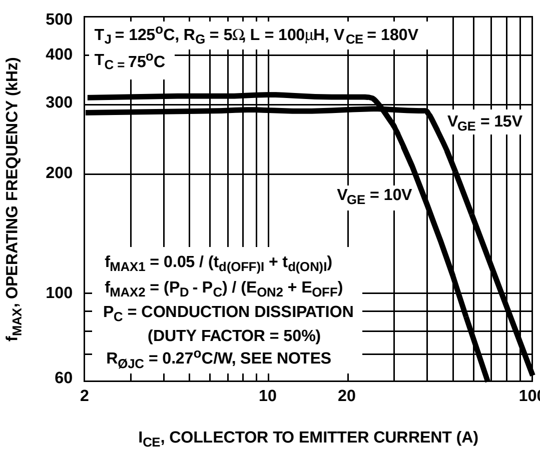


Figure 3. Operating Frequency vs Collector to Emitter Current

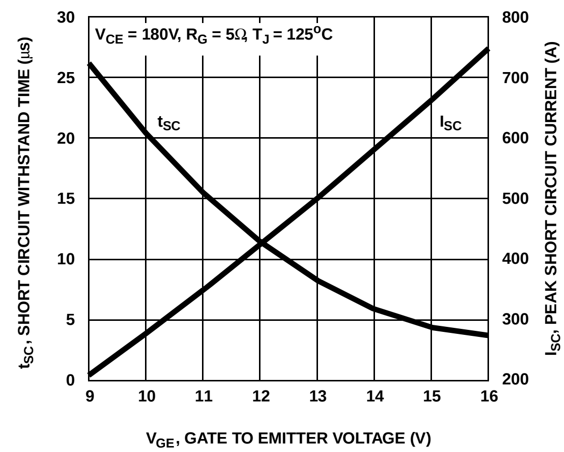


Figure 4. Short Circuit Withstand Time

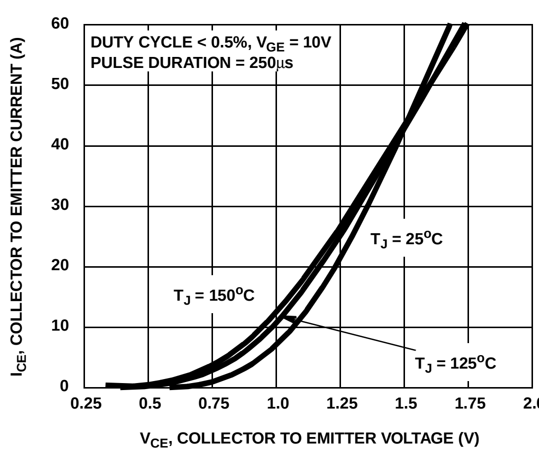


Figure 5. Collector to Emitter On-State Voltage

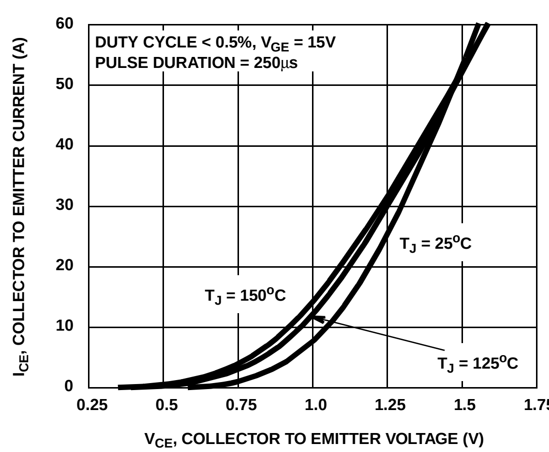


Figure 6. Collector to Emitter On-State Voltage

Typical Performance Curves T_J = 25°C unless otherwise noted (Continued)

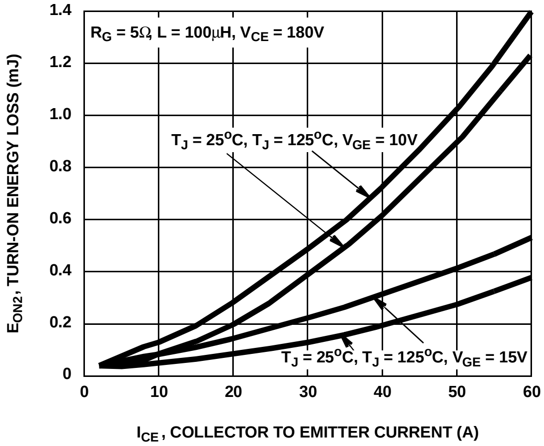


Figure 7. Turn-On Energy Loss vs Collector to Emitter Current

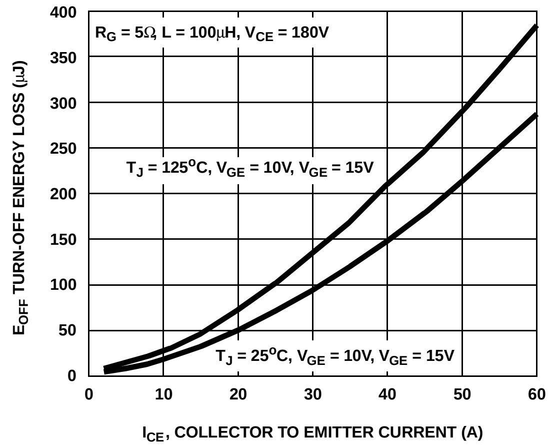


Figure 8. Turn-Off Energy Loss vs Collector to Emitter Current

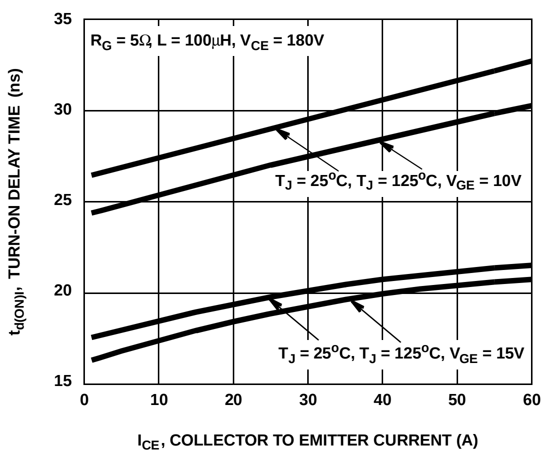


Figure 9. Turn-On Delay Time vs Collector to Emitter Current

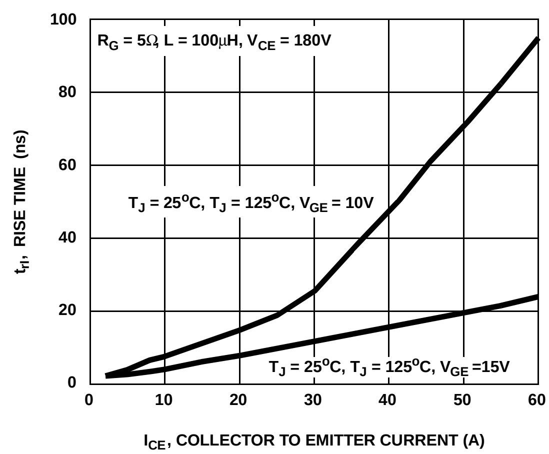


Figure 10. Turn-On Rise Time vs Collector to Emitter Current

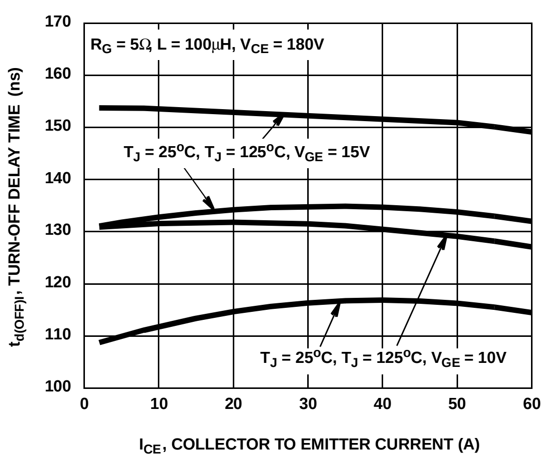


Figure 11. Turn-Off Delay Time vs Collector to Emitter Current

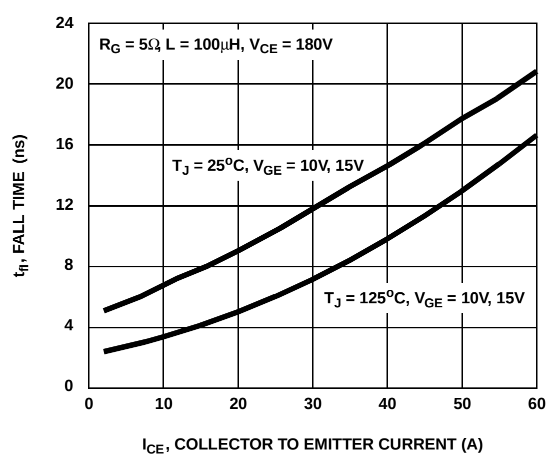


Figure 12. Fall Time vs Collector to Emitter Current

Typical Performance Curves T_J = 25°C unless otherwise noted (Continued)

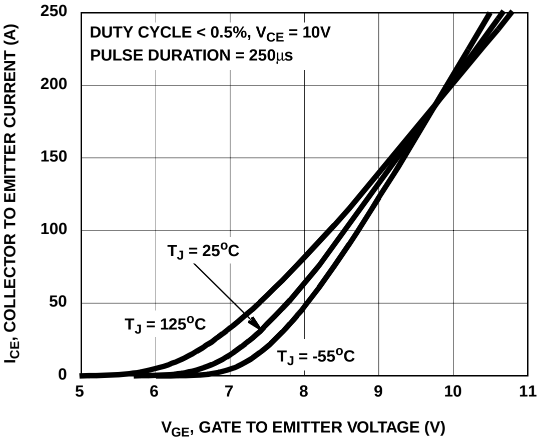


Figure 13. Transfer Characteristic

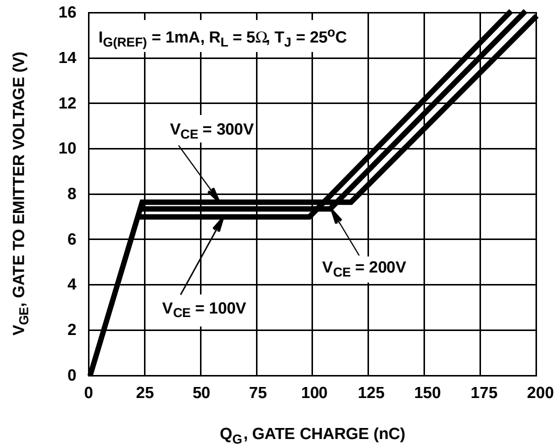


Figure 14. Gate Charge

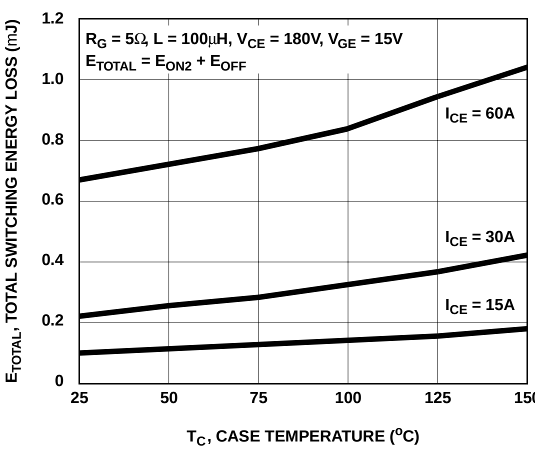


Figure 15. Total Switching Loss vs Case Temperature

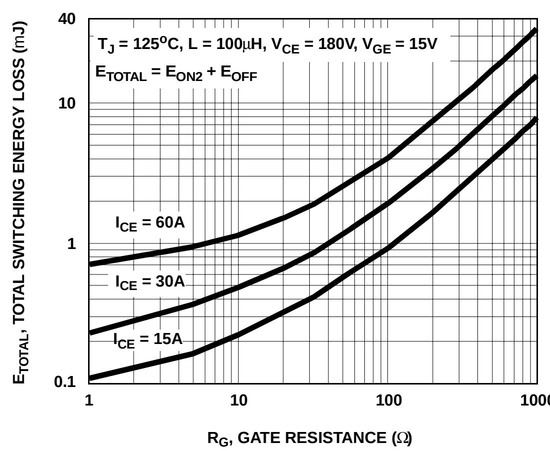


Figure 16. Total Switching Loss vs Gate Resistance

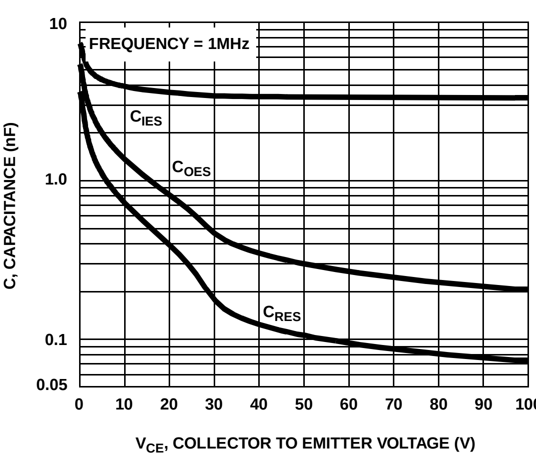


Figure 17. Capacitance vs Collector to Emitter Voltage

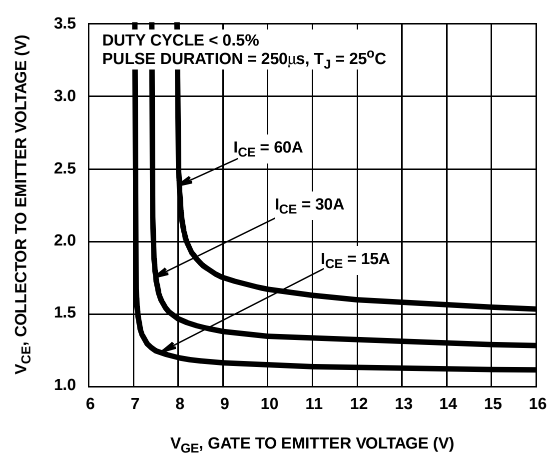


Figure 18. Collector to Emitter On-State Voltage vs Gate to Emitter Voltage

Typical Performance Curves T_J = 25°C unless otherwise noted (Continued)

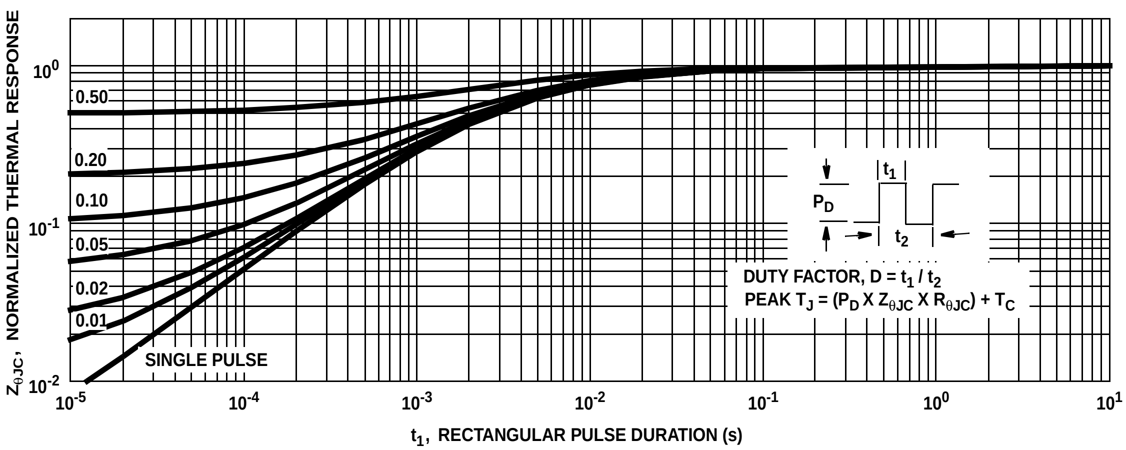


Figure 19. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

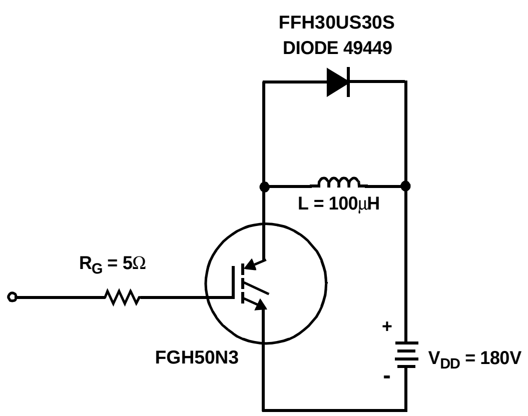


Figure 20. Inductive Switching Test Circuit

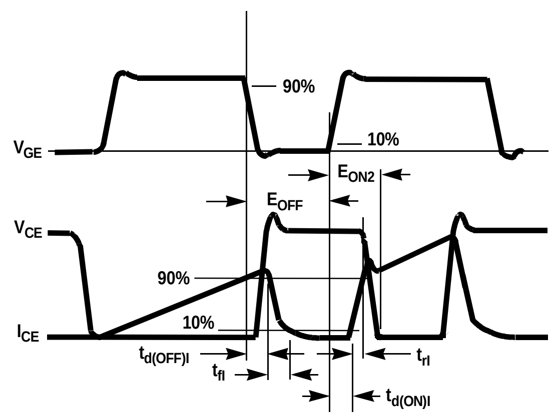
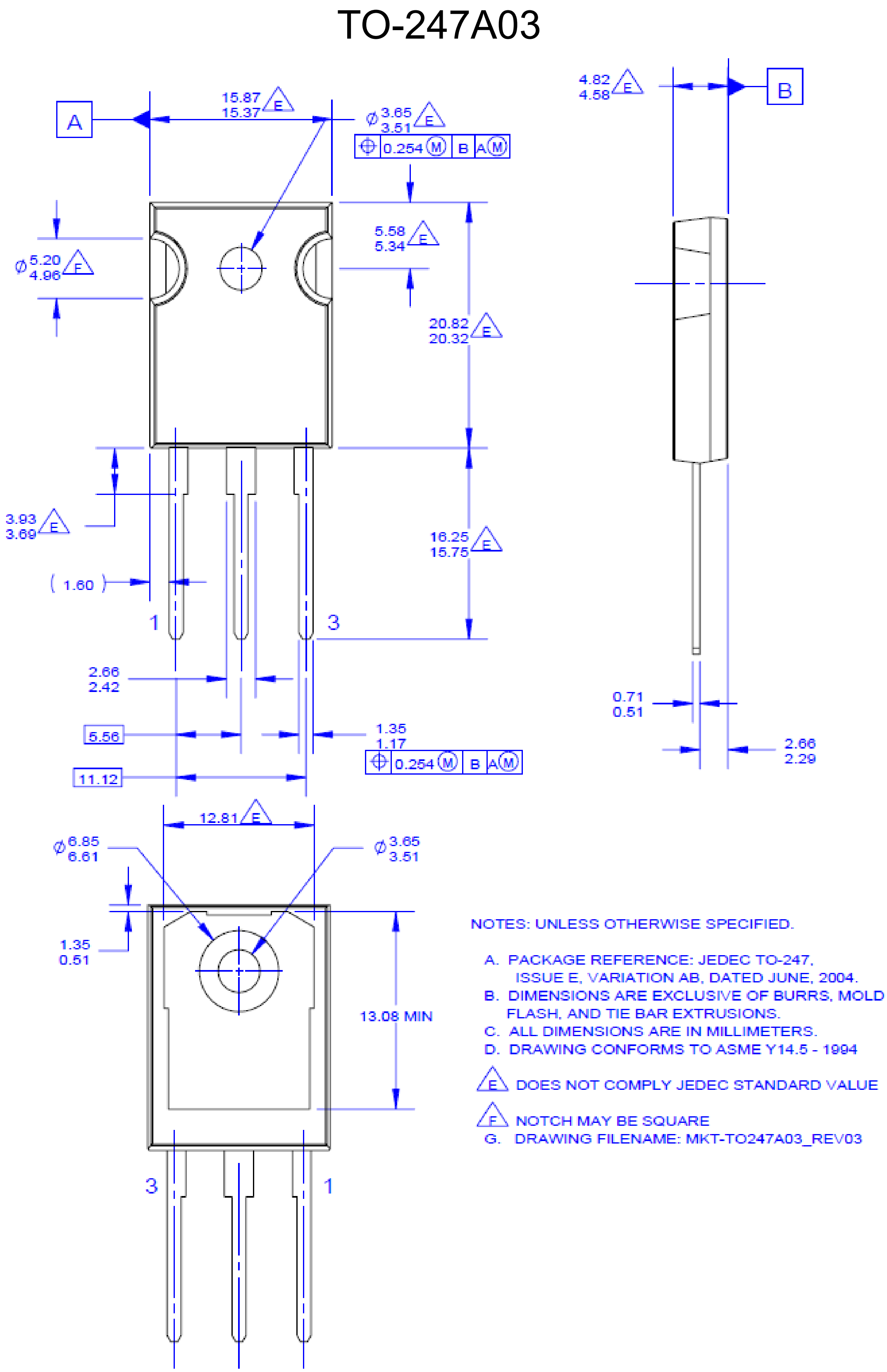


Figure 21. Switching Test Waveforms

Mechanical Dimensions



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Rev. I64

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