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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

October 2013

FGB3040CS

EcoSPARKÈ 300mJ, 400V, N-Channel Current Sensing Ignition IGBT

General Description

The FGB3040CS is an Ignition IGBT that offers outstanding SCIS capability along with a ratiometric emitter current sensing capability. This sensing is based on a emitter active area ratio of 200:1. The output is provided through a fourth (sense) lead. This signal provides a current level that is proportional to the main collector to emitter current. The effective ratio as measured on the sense lead is a function of the sense output, the collector current and the gate to emitter drive voltage.

100% RoHS COMPLIANT

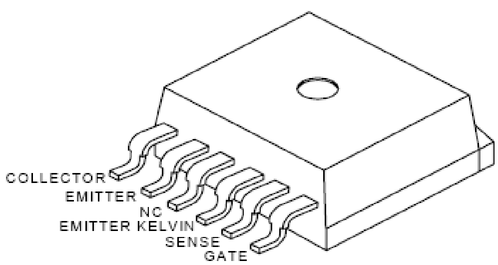
Applications

- Smart Automotive Ignition Coil Driver Circuits
- ECU Based Systems
- Distributorless Based Systems
- Coil on Plug Based Systems

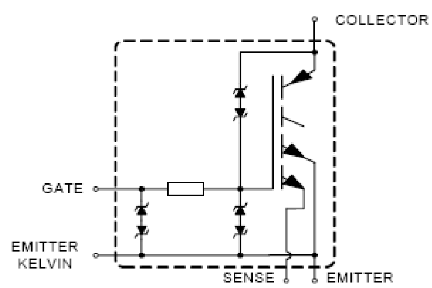
Features

- SCIS Energy = 300mJ at T_J = 25^{o}C
- Logic Level Gate Drive
- Qualified to AEC Q101
- RoHS Compliant

Package



Symbol



Device Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
BV_{CER}	Collector to Emitter Breakdown Voltage (I_C = 2mA)	430	V
BV_{ECS}	Emitter to Collector Breakdown Voltage (I_C = 1mA) (Reverse Battery Condition)	24	V
E_{SCIS25}	Self Clamping Inductive Switching Energy (at starting T_J = 25°C)	300	mJ
$E_{SCIS150}$	Self Clamping Inductive Switching Energy (at starting T_J = 150°C)	170	mJ
I_{C25}	Continuous Collector Current, at V_{GE} = 4.0V, T_C = 25°C	21	A
I_{C110}	Continuous Collector Current, at V_{GE} = 4.0V, T_C = 110°C	19	A
V_{GEM}	Maximum Continuous Gate to Emitter Voltage	±10	V
P_D	Power Dissipation, at T_C = 25°C	150	W
	Power Dissipation Derating, for T_C > 25^{o}C	1	W/^{o}C
T_J	Operating Junction Temperature Range	-40 to 175	^{o}C
T_{STG}	Storage Junction Temperature Range	-40 to 175	^{o}C
T_L	Max. Lead Temp. for Soldering (at 1.6mm from case for 10sec)	300	^{o}C
T_{PKG}	Max. Package Temp. for Soldering (Package Body for 10 sec)	260	^{o}C
ESD	Electrostatic Discharge Voltage, HBM model (100pfd, 1500 ohms)	4	kV

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
3040CS	FGB3040CS	TO-263 6 Lead	300mm	24mm	800
3040CS	FGB3040CS	TO-263 6 Lead	Tube	N/A	50

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units

Off State Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
BV_{CER}	Collector to Emitter Breakdown Voltage	I_{CE} = 2mA, V_{GE} = 0, R_{GE} = 1KΩ, See Fig. 17, T_J = -40 to 150°C		370	410	430	V
BV_{CES}	Collector to Emitter Breakdown Voltage	I_{CE} = 10mA, V_{GE} = 0V, R_{GE} = 0, See Fig. 17, T_J = -40 to 150°C		390	430	450	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	I_{CE} = -75mA, V_{GE} = 0V, T_C = 25°C		30	-	-	V
BV_{GES}	Gate to Emitter Breakdown Voltage	I_{GES} = ±2mA		±12	±14	-	V
I_{GEO}	Gate to Emitter Leakage Current	V_{GE} = ±10V		-	-	±9	μA
I_{CES}	Collector to Emitter Leakage Current	V_{CES} = 250V, See Fig. 13	T_C = 25°C	-	-	25	μA
			T_C = 150°C	-	-	1	mA
I_{ECS}	Emitter to Collector Leakage Current	V_{EC} = 24V, See Fig. 13	T_C = 25°C	-	-	1	mA
			T_C = 150°C	-	-	40	
R_1	Series Gate Resistance			-	100	-	Ω

On State Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 6A, V_{GE} = 4V	T_C = 25°C, See Fig. 5	-	1.3	1.6	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 10A, V_{GE} = 4.5V	T_C = 150°C, See Fig. 6	-	1.6	1.85	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 15A, V_{GE} = 4.5V	T_C = 150°C	-	1.8	2.35	V
$I_{CE(ON)}$	Collector to Emitter On State Current	V_{CE} = 5V, V_{GE} = 5V		-	37	-	A

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
$Q_{G(ON)}$	Gate Charge	I_{CE} = 10A, V_{CE} = 12V, V_{GE} = 5V, See Fig. 16		-	15	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	I_{CE} = 1mA, V_{CE} = V_{GE} See Fig. 12	T_C = 25°C	1.3	1.6	2.2	V
			T_C = 150°C	0.75	1.1	1.8	
V_{GEP}	Gate to Emitter Plateau Voltage	I_{CE} = 10A, V_{CE} = 12V		-	3.0	-	V
β_{AREA}	Emitter Sense Area Ratio	Sense Area/Total Area		-	1/200	-	-
$\beta_{5\Omega}$	Emitter Current Sense Ratio	I_{CE} = 8.0A, V_{GE} = 5V, R_{SENSE} = 5 Ω		-	230	-	-
$\beta_{20\Omega}$	Emitter Current Sense Ratio	I_{CE} = 9.0A, V_{GE} = 5V, R_{SENSE} = 20 Ω		550	640	765	-

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	V_{CE} = 14V, R_L = 1Ω, V_{GE} = 5V, R_G = 1KΩ, T_J = 25°C, See Fig. 14	-	0.6	4	μs
t_{rR}	Current Rise Time-Resistive		-	1.5	7	μs
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	V_{CE} = 300V, L = 500μHy, V_{GE} = 5V, R_G = 1KΩ, T_J = 25°C, See Fig. 14	-	4.7	15	μs
t_{fL}	Current Fall Time-Inductive		-	2.6	15	μs
SCIS	Self Clamped inductive Switching	T_J = 25°C, L = 3.0mHy, I_{CE} = 14.2A, R_G = 1k Ω, V_{GE} = 5V, See Fig. 3&4	-	-	300	mJ

Thermal Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance Junction to Case	All Packages	-	-	1.0	°C/W

Typical Performance Curves

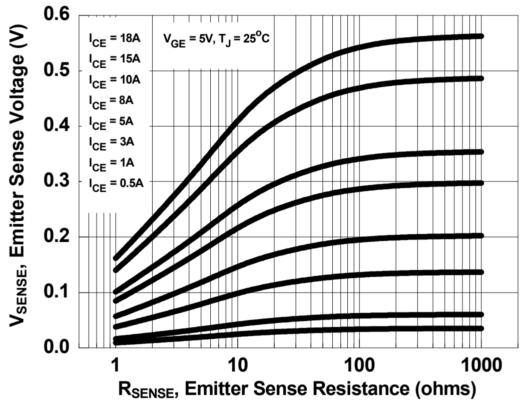


Figure 1. Emitter Sense Voltage vs. Emitter Sense Resistance

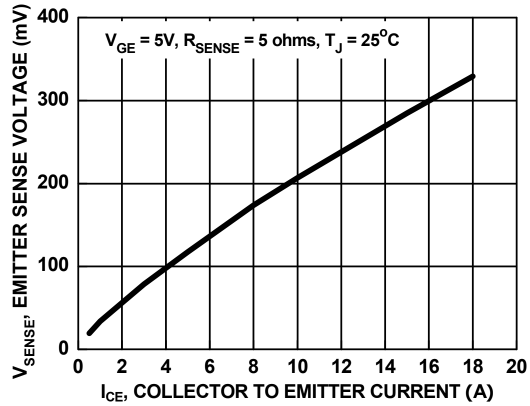


Figure 2. Emitter Sense Voltage vs. Collector to Emitter Current

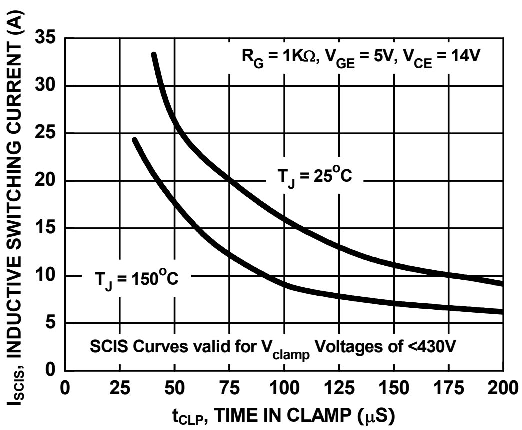


Figure 3. Self Clamped Inductive Switching Current vs. Time in Clamp

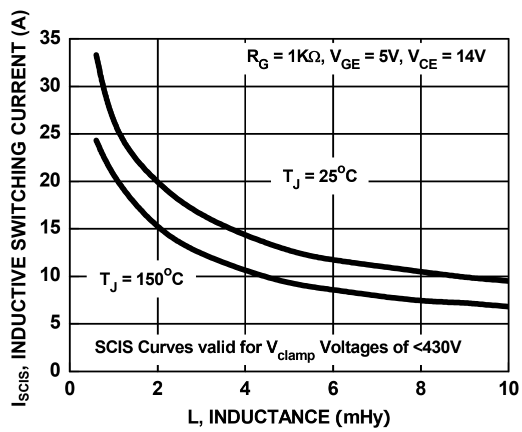


Figure 4. Self Clamped Inductive Switching Current vs. Inductance

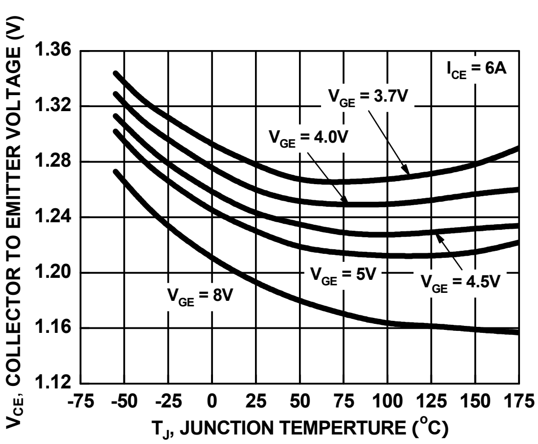


Figure 5. Collector to Emitter On-State Voltage vs. Junction Temperature

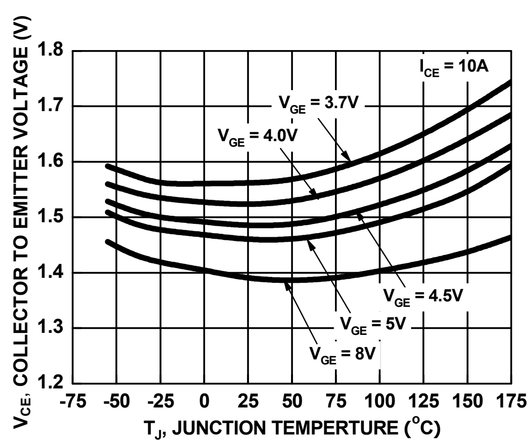


Figure 6. Collector to Emitter On-State Voltage vs. Junction Temperature

Typical Performance Curves (Continued)

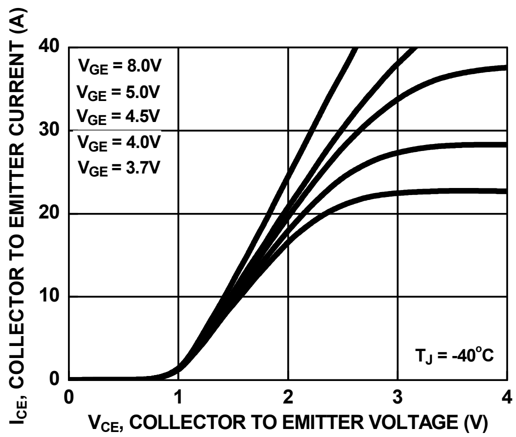


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

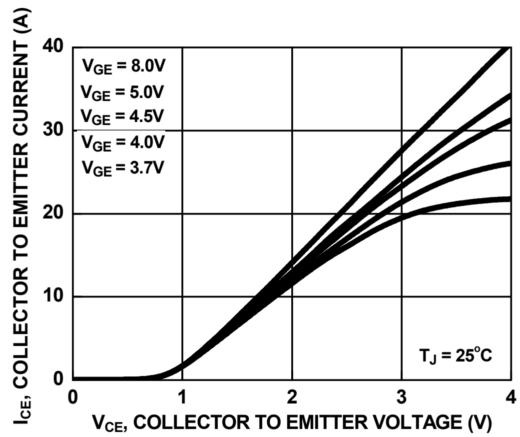


Figure 8. Collector to Emitter On-State Voltage vs. Collector Current

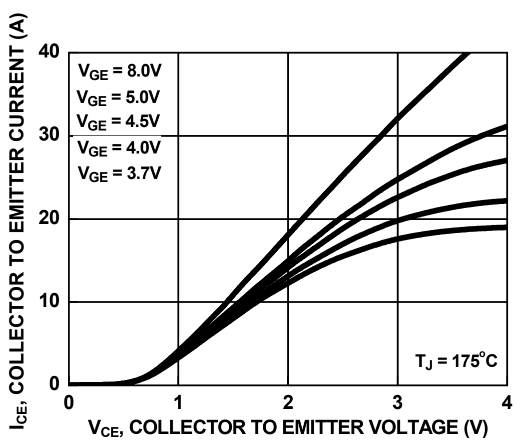


Figure 9. Collector to Emitter On-State Voltage vs. Collector Current

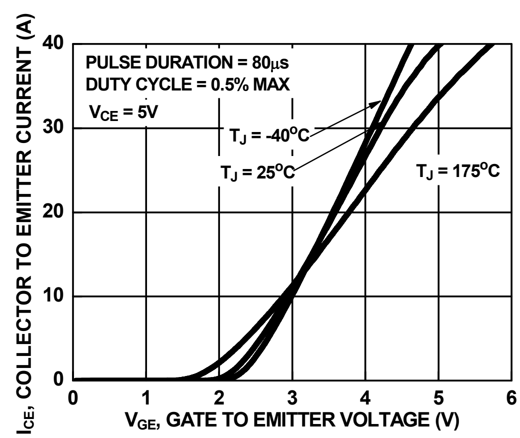


Figure 10. Transfer Characteristics

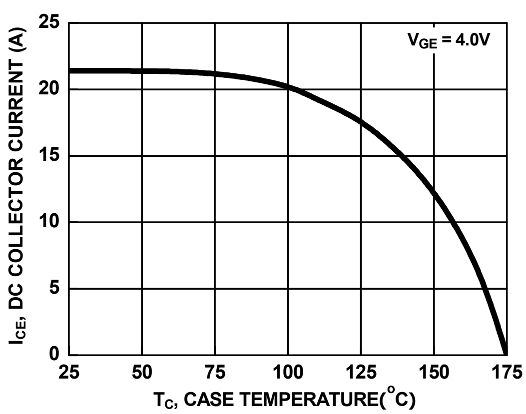


Figure 11. DC Collector Current vs. Case Temperature

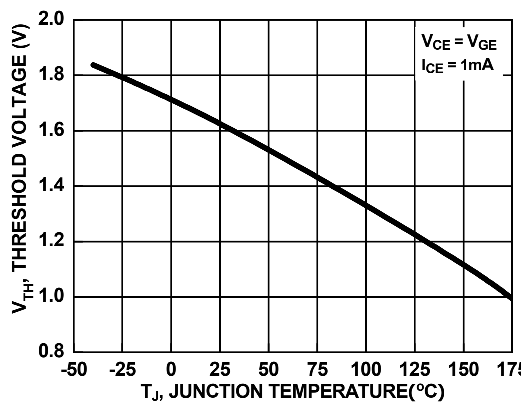


Figure 12. Threshold Voltage vs. Junction Temperature

Typical Performance Curves (Continued)

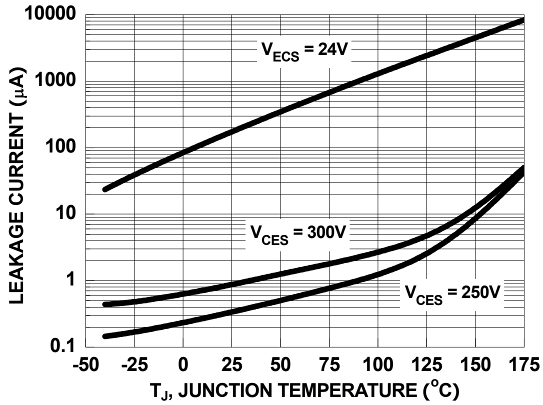


Figure 13. Leakage Current vs. Junction Temperature

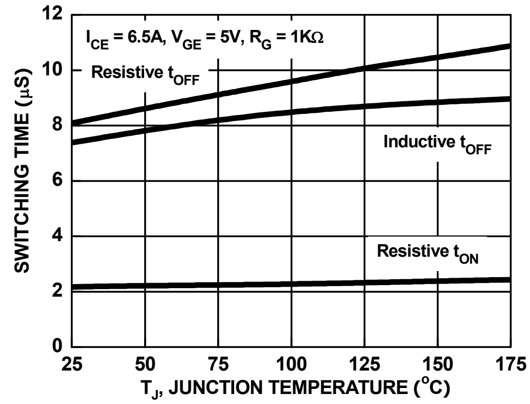


Figure 14. Switching Time vs. Junction Temperature

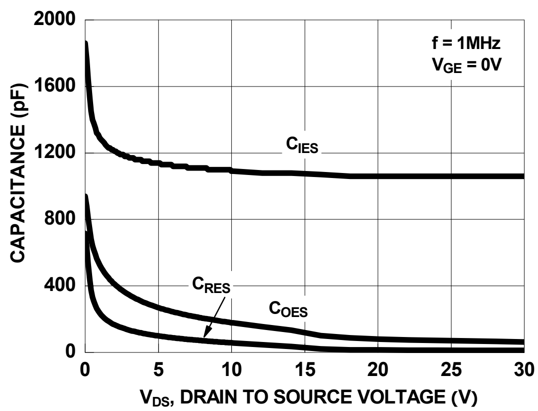


Figure 15. Capacitance vs. Collector to Emitter Voltage

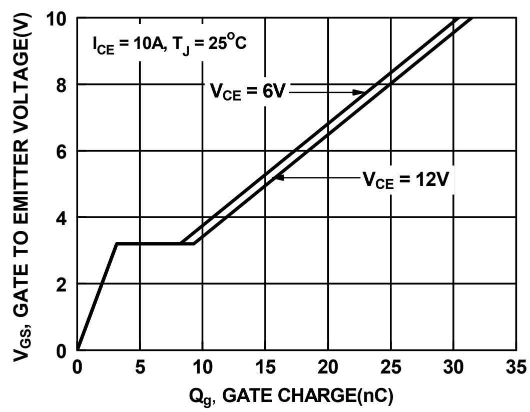


Figure 16. Gate Charge

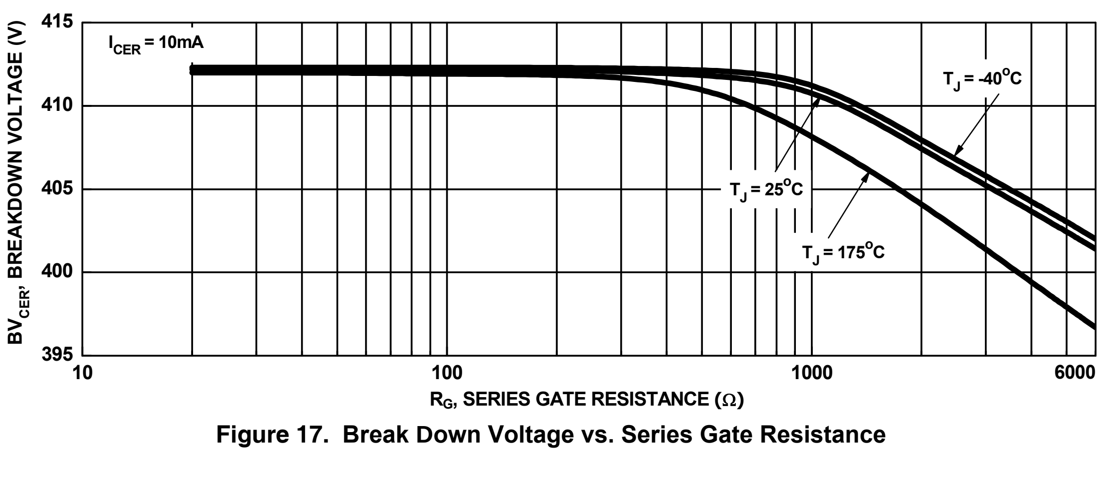


Figure 17. Break Down Voltage vs. Series Gate Resistance

Typical Performance Curves

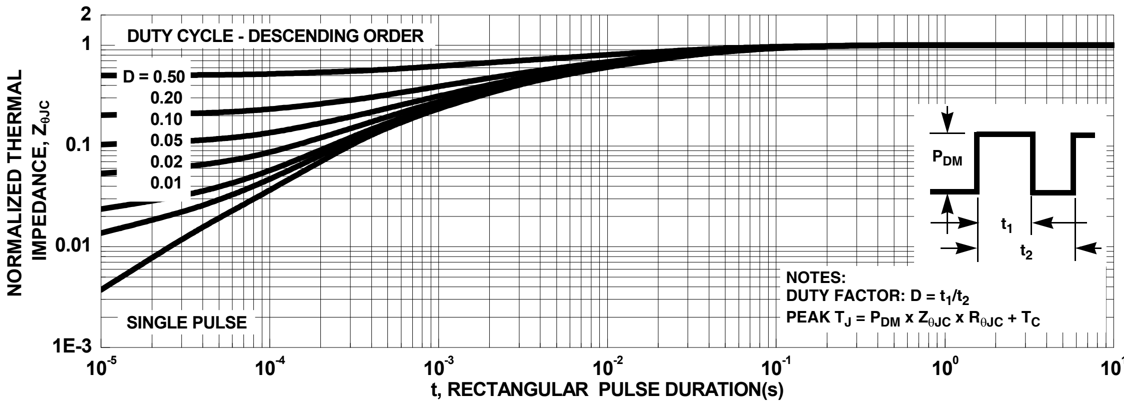


Figure 18. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

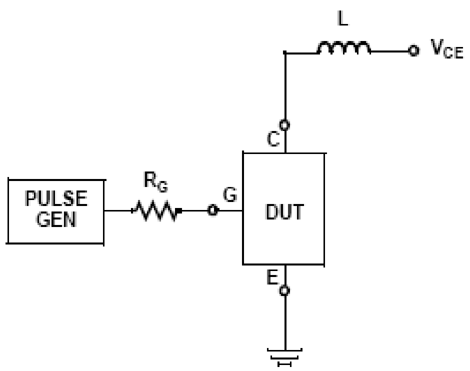


Figure 19. Inductive Switching Test Circuit

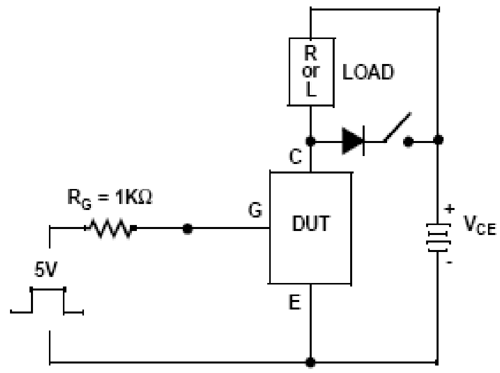


Figure 20. t_{ON} and t_{OFF} Switching Test Circuit

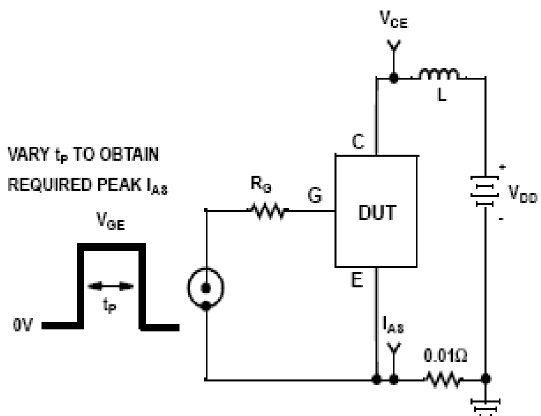


Figure 21. Energy Test Circuit

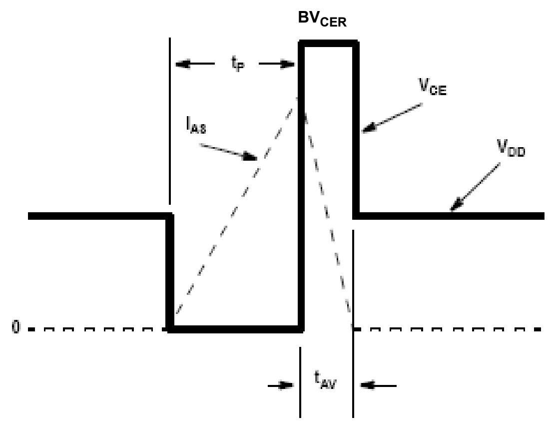
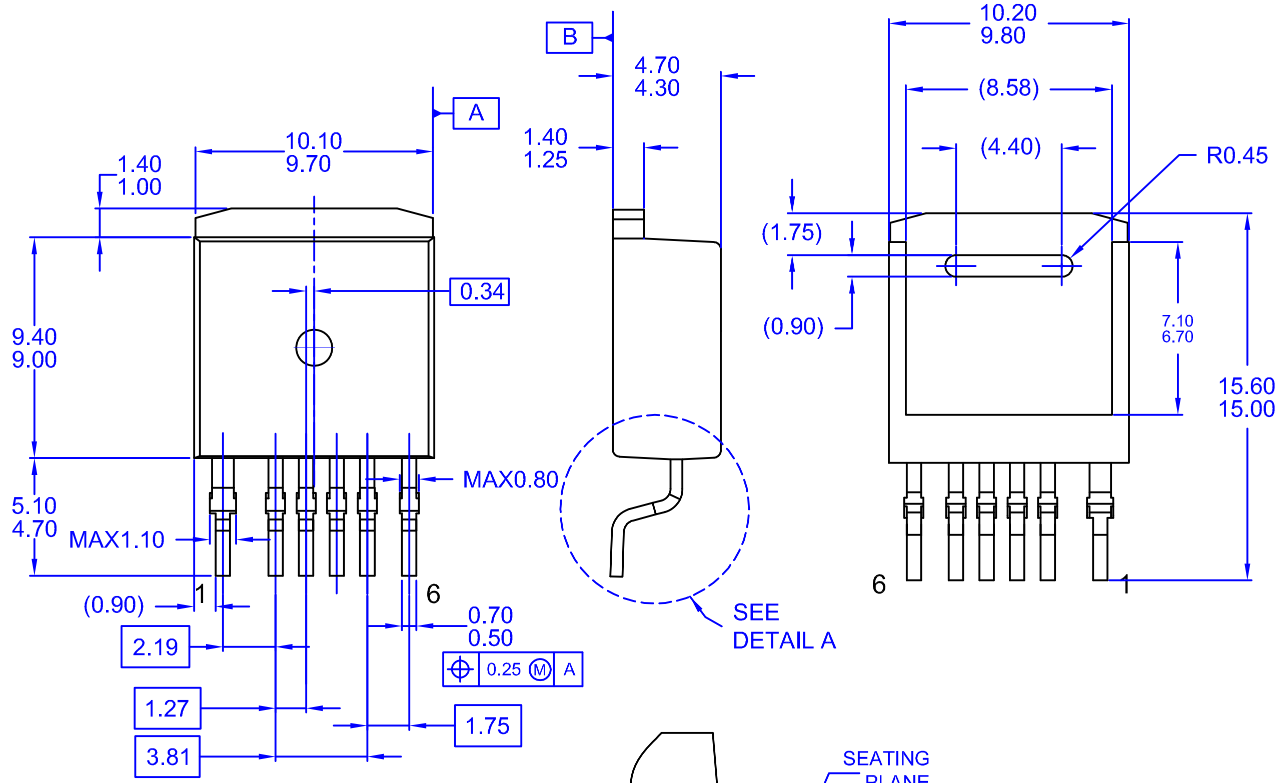
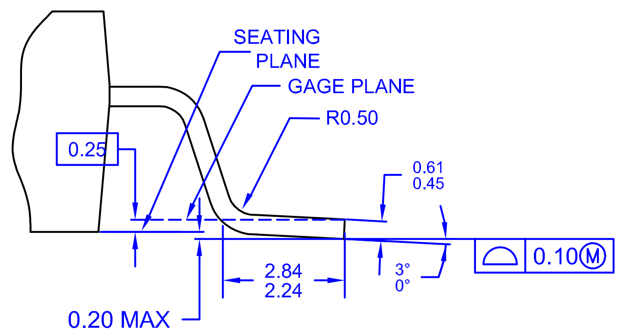
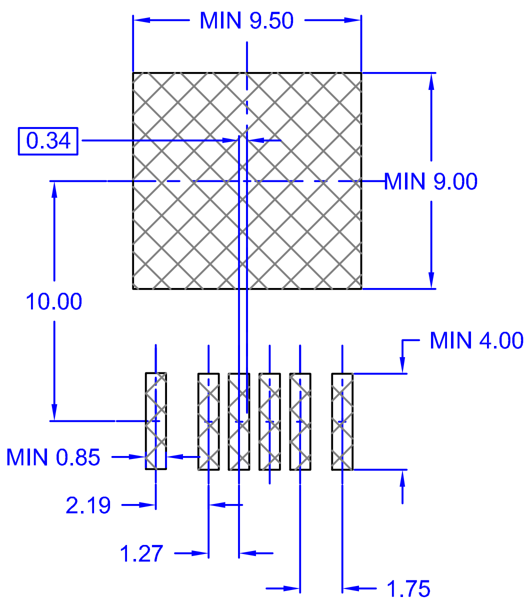


Figure 22. Energy Waveforms





DETAIL A, ROTATED 90°
SCALE: 2X



LAND PATTERN RECOMMENDATION

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Definition of Terms

Datasheet Identification	Product Status	Definition
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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I66

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