



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



FGB3040CS

EcoSPARK[®] 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.



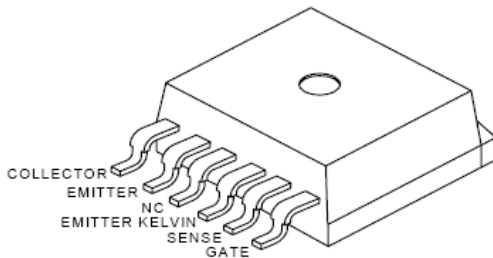
Applications

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

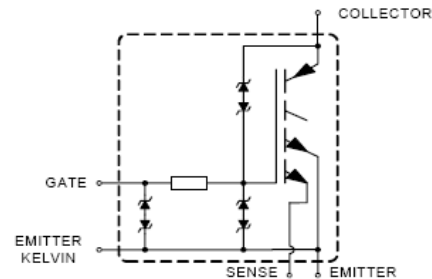
Features

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

Package



Symbol



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

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

FGB3040CS 300mJ, 400V, N-Channel Current Sensing Ignition IGBT

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 $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

Off State Characteristics

BV_{CER}	Collector to Emitter Breakdown Voltage	$I_{CE} = 2\text{mA}$, $V_{GE} = 0$, $R_{GE} = 1\text{k}\Omega$, See Fig. 17 $T_J = -40$ to 150°C	370	410	430	V	
BV_{CES}	Collector to Emitter Breakdown Voltage	$I_{CE} = 10\text{mA}$, $V_{GE} = 0\text{V}$ $R_{GE} = 0$, See Fig. 17 $T_J = -40$ to 150°C	390	430	450	V	
BV_{ECS}	Emitter to Collector Breakdown Voltage	$I_{CE} = -75\text{mA}$, $V_{GE} = 0\text{V}$, $T_C = 25^\circ\text{C}$	30	-	-	V	
BV_{GES}	Gate to Emitter Breakdown Voltage	$I_{GES} = \pm 2\text{mA}$	± 12	± 14	-	V	
I_{GEO}	Gate to Emitter Leakage Current	$V_{GE} = \pm 10\text{V}$	-	-	± 9	μA	
I_{CES}	Collector to Emitter Leakage Current	$V_{CES} = 250\text{V}$, See Fig. 13	$T_C = 25^\circ\text{C}$	-	-	25	μA
			$T_C = 150^\circ\text{C}$	-	-	1	mA
I_{ECS}	Emitter to Collector Leakage Current	$V_{EC} = 24\text{V}$, See Fig. 13	$T_C = 25^\circ\text{C}$	-	-	1	mA
			$T_C = 150^\circ\text{C}$	-	-	40	mA
R_1	Series Gate Resistance		-	100	-	Ω	

On State Characteristics

$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 6\text{A}$, $V_{GE} = 4\text{V}$	$T_C = 25^\circ\text{C}$ See Fig. 5	-	1.3	1.6	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 10\text{A}$, $V_{GE} = 4.5\text{V}$	$T_C = 150^\circ\text{C}$ See Fig. 6	-	1.6	1.85	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 15\text{A}$, $V_{GE} = 4.5\text{V}$	$T_C = 150^\circ\text{C}$	-	1.8	2.35	V
$I_{CE(ON)}$	Collector to Emitter On State Current	$V_{CE} = 5\text{V}$, $V_{GE} = 5\text{V}$		-	37	-	A

Dynamic Characteristics

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

Switching Characteristics

$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	$V_{CE} = 14\text{V}$, $R_L = 1\Omega$ $V_{GE} = 5\text{V}$, $R_G = 1\text{k}\Omega$ $T_J = 25^\circ\text{C}$, 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	$V_{CE} = 300\text{V}$, $L = 500\mu\text{H}$, $V_{GE} = 5\text{V}$, $R_G = 1\text{k}\Omega$ $T_J = 25^\circ\text{C}$, See Fig. 14	-	4.7	15	μs
t_{fL}	Current Fall Time-Inductive		-	2.6	15	μs
SCIS	Self Clamped inductive Switching	$T_J = 25^\circ\text{C}$, $L = 3.0\text{mH}$, $I_{CE} = 14.2\text{A}$, $R_G = 1\text{k}\Omega$, $V_{GE} = 5\text{V}$, See Fig. 3&4	-	-	300	mJ

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case	All Packages	-	-	1.0	$^\circ\text{C/W}$
-----------------	-------------------------------------	--------------	---	---	-----	--------------------

Typical Performance Curves

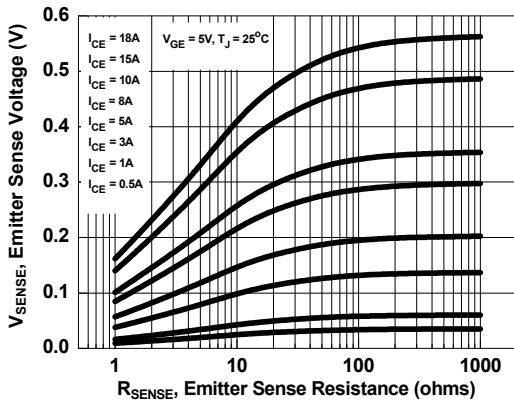


Figure 1. Emitter Sense Voltage vs. Emitter Sense Resistance

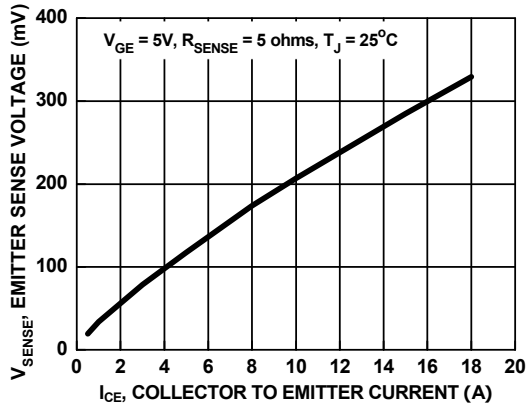


Figure 2. Emitter Sense Voltage vs. Collector to Emitter Current

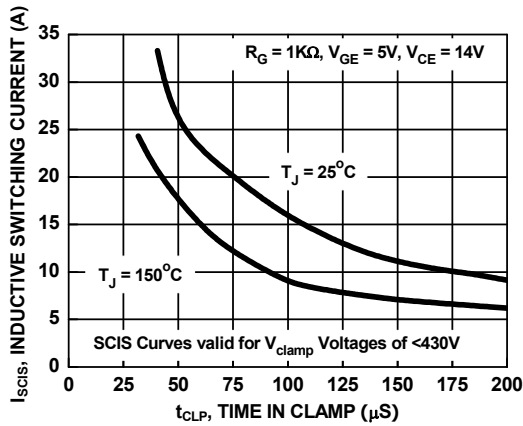


Figure 3. Self Clamped Inductive Switching Current vs. Time in Clamp

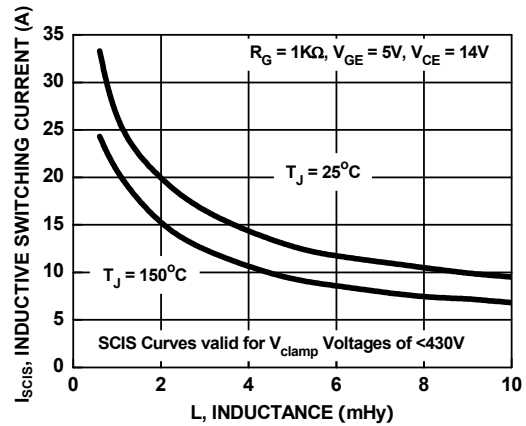


Figure 4. Self Clamped Inductive Switching Current vs. Inductance

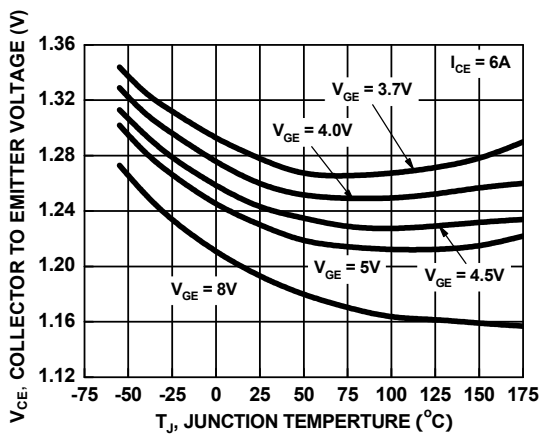


Figure 5. Collector to Emitter On-State Voltage vs. Junction Temperature

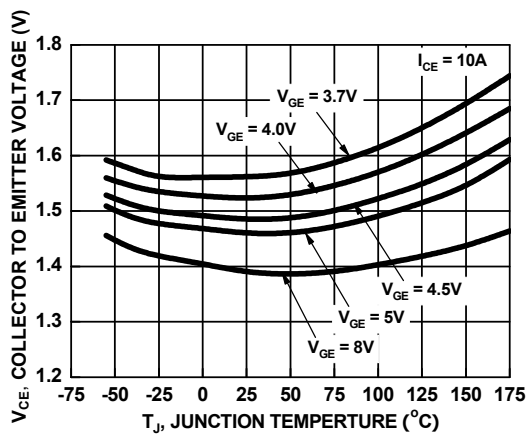


Figure 6. Collector to Emitter On-State Voltage vs. Junction Temperature

Typical Performance Curves (Continued)

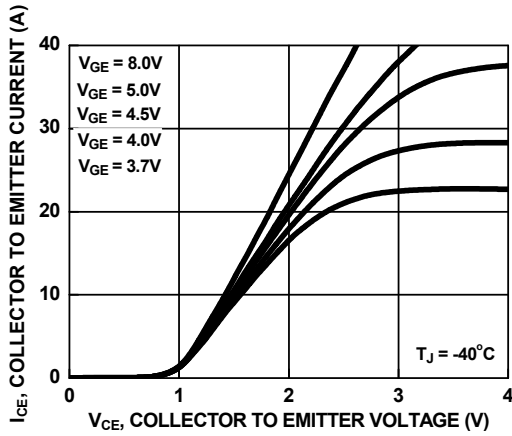


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

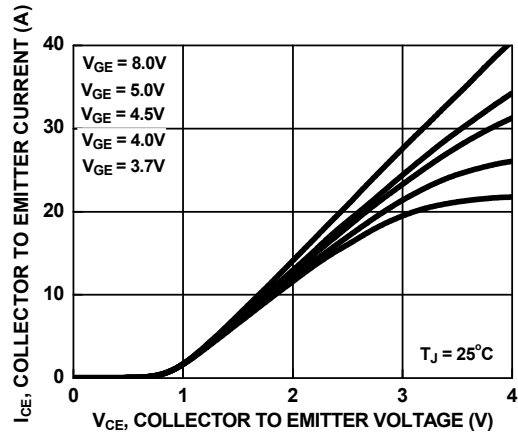


Figure 8. Collector to Emitter On-State Voltage vs. Collector Current

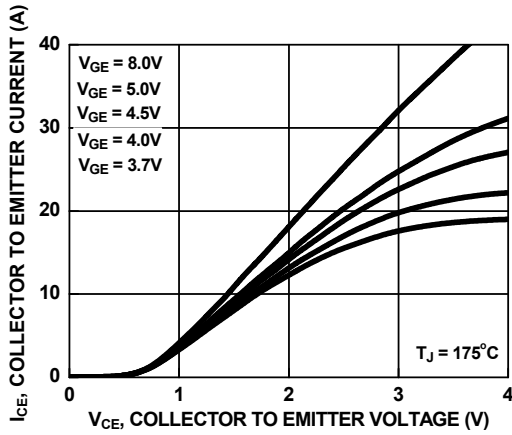


Figure 9. Collector to Emitter On-State Voltage vs. Collector Current

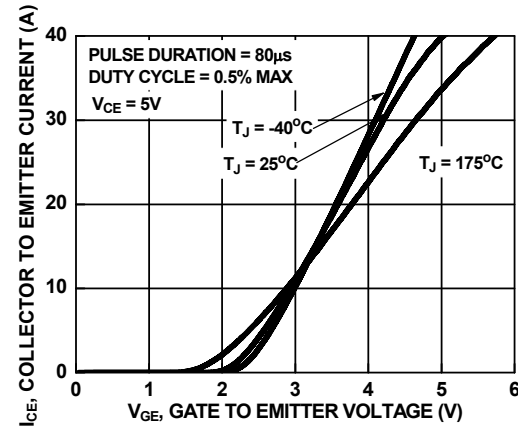


Figure 10. Transfer Characteristics

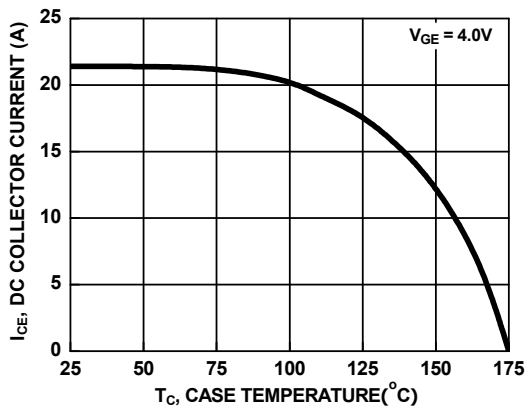


Figure 11. DC Collector Current vs. Case Temperature

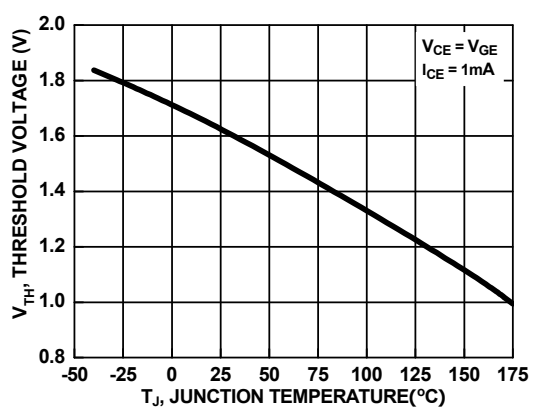


Figure 12. Threshold Voltage vs. Junction Temperature

Typical Performance Curves (Continued)

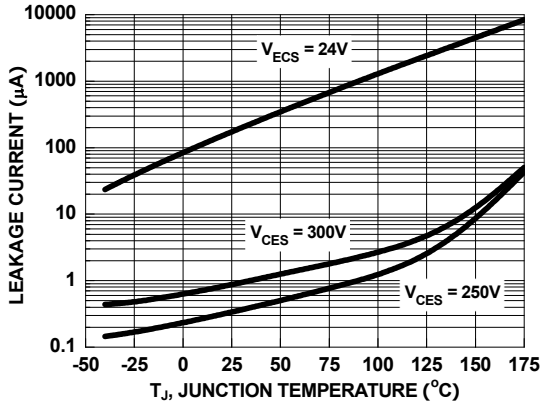


Figure 13. Leakage Current vs. Junction Temperature

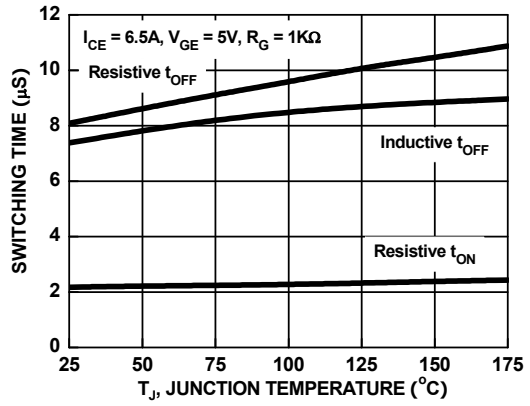


Figure 14. Switching Time vs. Junction Temperature

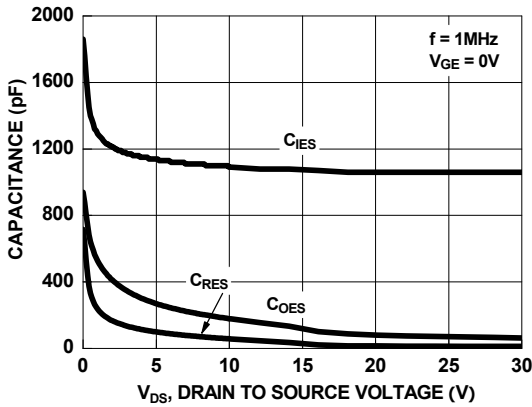


Figure 15. Capacitance vs. Collector to Emitter Voltage

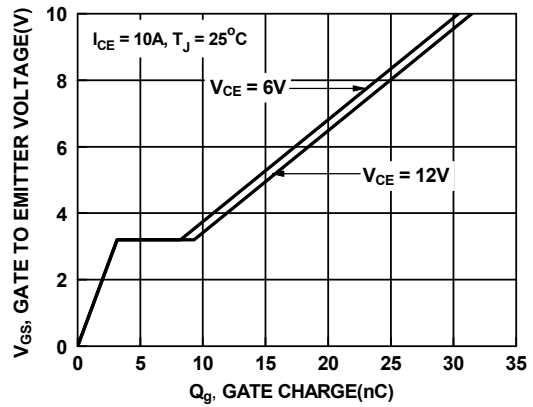


Figure 16. Gate Charge

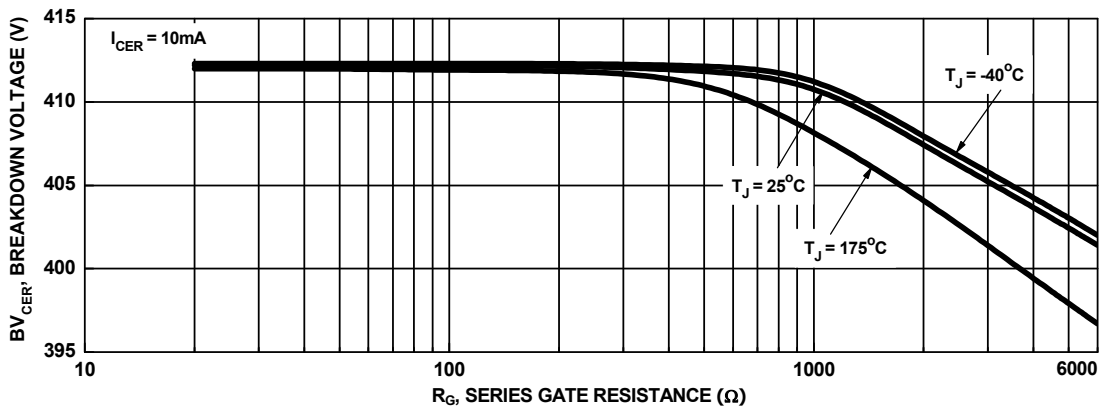


Figure 17. Breakdown Voltage vs. Series Gate Resistance

Typical Performance Curves

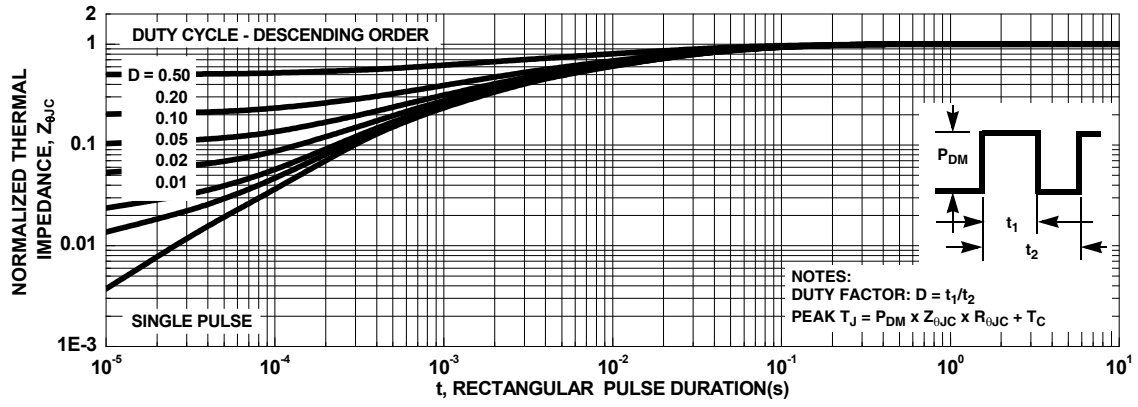


Figure 18. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

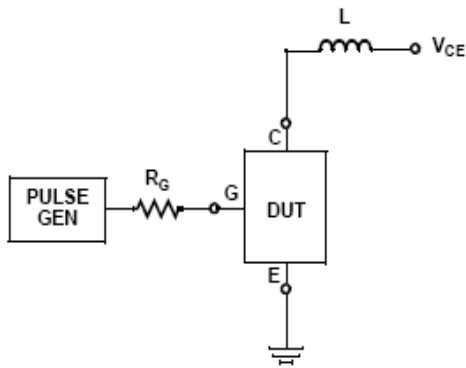


Figure 19. Inductive Switching Test Circuit

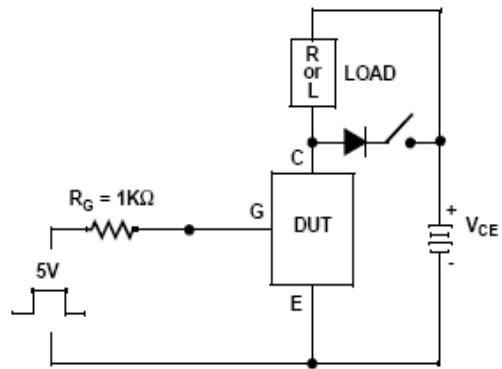


Figure 20. t_{ON} and t_{OFF} Switching Test Circuit

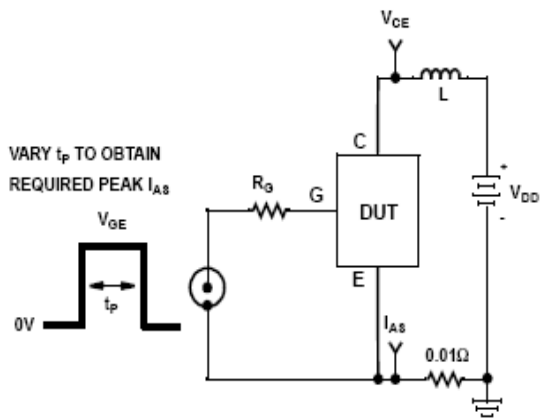


Figure 21. Energy Test Circuit

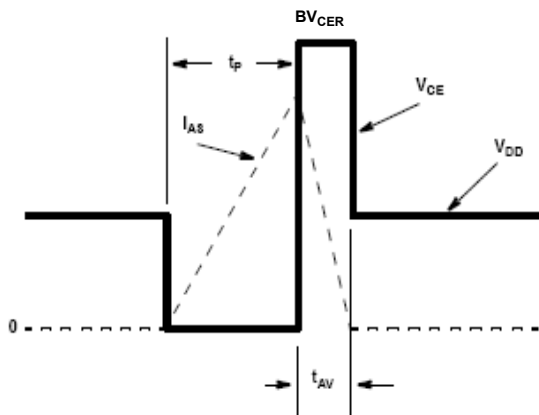
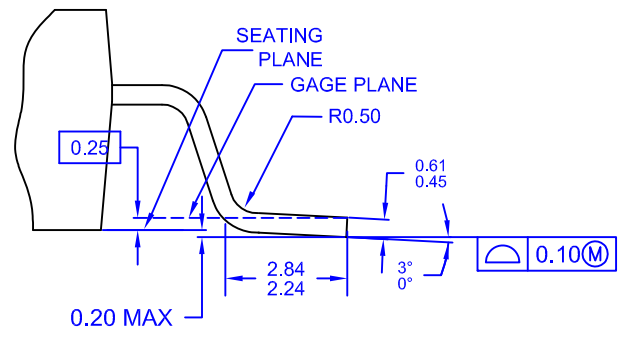
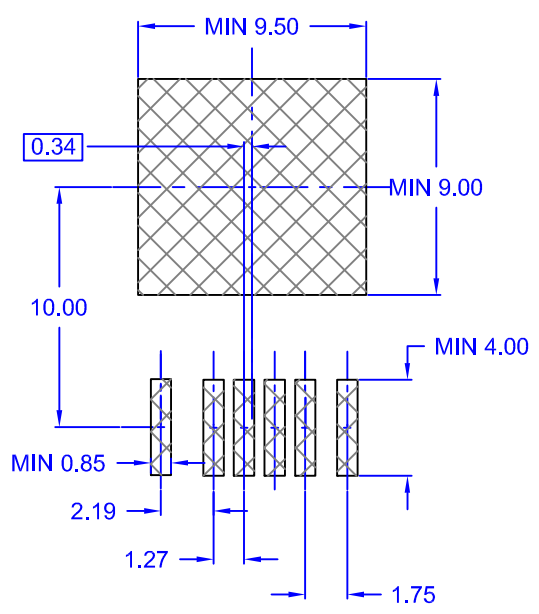
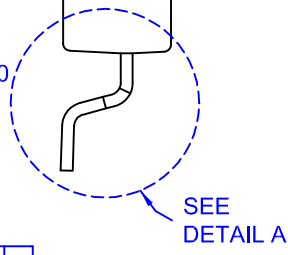
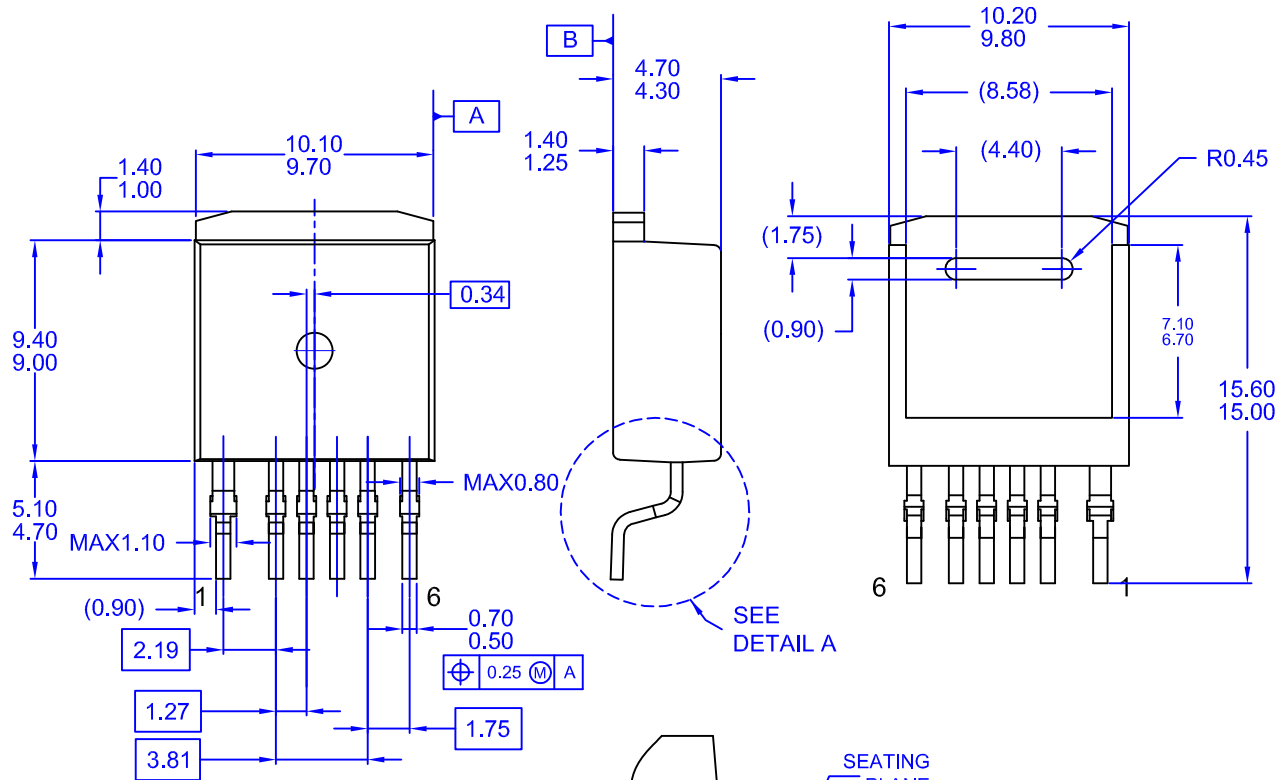


Figure 22. Energy Waveforms








DETAIL A, ROTATED 90°
SCALE: 2X

- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE DOES NOT COMPLY TO ANY CURRENT PACKAGING STANDARD.
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.
 - C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
 - D) DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994
 - E) DRAWING FILENAME AND REVISION: MKT-TO263A06REV6



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|---|--|---|---|
| AccuPower™ | F-PFS™ |  | Sync-Lock™ |
| AX-CAP®* | FRFET® | PowerXS™ |  |
| BitSiC™ | Global Power Resource SM | Programmable Active Droop™ | TinyBoost® |
| Build it Now™ | GreenBridge™ | QFET® | TinyBuck® |
| CorePLUS™ | Green FPS™ | QS™ | TinyCalc™ |
| CorePOWER™ | Green FPS™ e-Series™ | Quiet Series™ | TinyLogic® |
| CROSSVOLT™ | Gmax™ | RapidConfigure™ | TINYOPTO™ |
| CTL™ | GTO™ |  | TinyPower™ |
| Current Transfer Logic™ | IntelliMAX™ | Saving our world, 1mW/W/kW at a time™ | TinyPWM™ |
| DEUXPEED® | ISOPLANAR™ | SignalWise™ | TinyWire™ |
| Dual Cool™ | Making Small Speakers Sound Louder and Better™ | SmartMax™ | TranSiC™ |
| EcoSPARK® | MegaBuck™ | SMART START™ | TriFault Detect™ |
| EfficientMax™ | MICROCOUPLER™ | Solutions for Your Success™ | TRUECURRENT®* |
| ESBC™ | MicroFET™ | SPM® | μSerDes™ |
|  | MicroPak™ | STEALTH™ |  |
| Fairchild® | MicroPak2™ | SuperFET® | UHC® |
| Fairchild Semiconductor® | MillerDrive™ | SuperSOT™-3 | Ultra FRFET™ |
| FACT Quiet Series™ | MotionMax™ | SuperSOT™-6 | UniFET™ |
| FACT® | mWSaver® | SuperSOT™-8 | VcX™ |
| FAST® | OptoHiT™ | SupreMOS® | VisualMax™ |
| FastvCore™ | OPTOLOGIC® | SyncFET™ | VoltagePlus™ |
| FETBench™ | OPTOPLANAR® | | XS™ |
| FPS™ | | | |

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

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. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

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, and (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 a significant injury of the user.
2. A critical component in 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.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Fairchild Semiconductor:](#)

[FGB3040CS](#)