



ON Semiconductor®

FGB3040G2-F085 / FGD3040G2-F085 FGP3040G2-F085 / FGI3040G2-F085

EcoSPARK® 2 300mJ, 400V, N-Channel Ignition IGBT

Features

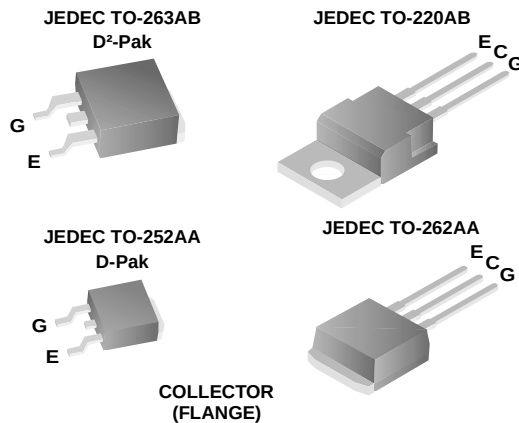
- SCIS Energy = 300mJ at $T_J = 25^\circ\text{C}$
- Logic Level Gate Drive
- Qualified to AEC Q101
- RoHS Compliant



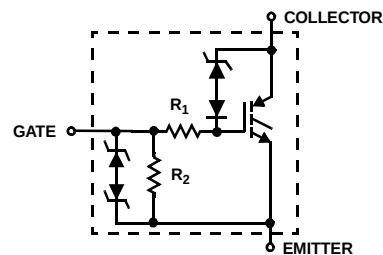
Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

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 ($I_C = 1\text{mA}$)	400	V
BV_{ECS}	Emitter to Collector Voltage - Reverse Battery Condition ($I_C = 10\text{mA}$)	28	V
E_{SCIS25}	Self Clamping Inductive Switching Energy (Note 1)	300	mJ
$E_{SCIS150}$	Self Clamping Inductive Switching Energy (Note 2)	170	mJ
I_{C25}	Collector Current Continuous, at $V_{GE} = 5.0\text{V}$, $T_C = 25^\circ\text{C}$	41	A
I_{C110}	Collector Current Continuous, at $V_{GE} = 5.0\text{V}$, $T_C = 110^\circ\text{C}$	25.6	A
V_{GEM}	Gate to Emitter Voltage Continuous	± 10	V
P_D	Power Dissipation Total, 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	-55 to +175	$^\circ\text{C}$
T_{STG}	Storage Junction Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Max. Lead Temp. for Soldering (Leads at 1.6mm from case for 10s)	300	$^\circ\text{C}$
T_{PKG}	Reflow soldering according to JESD020C	260	$^\circ\text{C}$
ESD	HBM-Electrostatic Discharge Voltage at 100pF, 1500 Ω	4	kV
	CDM-Electrostatic Discharge Voltage at 1 Ω	2	kV

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGB3040G2	FGB3040G2-F085	TO-263AB	330mm	24mm	800
FGD3040G2	FGD3040G2-F085	TO-252AA	330mm	16mm	2500
FGP3040G2	FGP3040G2-F085	TO-220AB	Tube	N/A	50
FGI3040G2	FGI3040G2-F085	TO-262AA	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	$I_{\text{CE}} = 2\text{mA}$, $V_{\text{GE}} = 0$, $R_{\text{GE}} = 1\text{K}\Omega$, $T_J = -40$ to 150°C	370	400	430	V
BV_{CES}	Collector to Emitter Breakdown Voltage	$I_{\text{CE}} = 10\text{mA}$, $V_{\text{GE}} = 0\text{V}$, $R_{\text{GE}} = 0$, $T_J = -40$ to 150°C	390	420	450	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	$I_{\text{CE}} = -20\text{mA}$, $V_{\text{GE}} = 0\text{V}$, $T_J = 25^\circ\text{C}$	28	-	-	V
BV_{GES}	Gate to Emitter Breakdown Voltage	$I_{\text{GES}} = \pm 2\text{mA}$	± 12	± 14	-	V
I_{CER}	Collector to Emitter Leakage Current	$V_{\text{CE}} = 250\text{V}$, $R_{\text{GE}} = 1\text{K}\Omega$	$T_J = 25^\circ\text{C}$	-	-	25 μA
			$T_J = 150^\circ\text{C}$	-	-	1 mA
I_{ECS}	Emitter to Collector Leakage Current	$V_{\text{EC}} = 24\text{V}$	$T_J = 25^\circ\text{C}$	-	-	1 mA
			$T_J = 150^\circ\text{C}$	-	-	40
R_1	Series Gate Resistance		-	120	-	Ω
R_2	Gate to Emitter Resistance		10K	-	30K	Ω

On State Characteristics

$V_{\text{CE(SAT)}}$	Collector to Emitter Saturation Voltage	$I_{\text{CE}} = 6\text{A}$, $V_{\text{GE}} = 4\text{V}$,	$T_J = 25^\circ\text{C}$	-	1.15	1.25	V
$V_{\text{CE(SAT)}}$	Collector to Emitter Saturation Voltage	$I_{\text{CE}} = 10\text{A}$, $V_{\text{GE}} = 4.5\text{V}$,	$T_J = 150^\circ\text{C}$	-	1.35	1.50	V
$V_{\text{CE(SAT)}}$	Collector to Emitter Saturation Voltage	$I_{\text{CE}} = 15\text{A}$, $V_{\text{GE}} = 4.5\text{V}$,	$T_J = 150^\circ\text{C}$	-	1.68	1.85	V
E_{SCIS}	Self Clamped Inductive Switching	$L = 3.0\text{ mHy}$, $R_G = 1\text{K}\Omega$, $V_{\text{GE}} = 5\text{V}$, (Note 1)	$T_J = 25^\circ\text{C}$	-	-	300	mJ

Thermal Characteristics

$R_{\theta\text{JC}}$	Thermal Resistance Junction to Case		-	-	1	$^\circ\text{C/W}$
-----------------------	-------------------------------------	--	---	---	---	--------------------

Notes:

1: Self Clamping Inductive Switching Energy ($E_{\text{SCIS}25}$) of 300 mJ is based on the test conditions that starting $T_J = 25^\circ\text{C}$; $L = 3\text{mHy}$, $I_{\text{SCIS}} = 14.2\text{A}$, $V_{\text{CC}} = 100\text{V}$ during inductor charging and $V_{\text{CC}} = 0\text{V}$ during the time in clamp.

2: Self Clamping Inductive Switching Energy ($E_{\text{SCIS}150}$) of 170 mJ is based on the test conditions that starting $T_J = 150^\circ\text{C}$; $L = 3\text{mHy}$, $I_{\text{SCIS}} = 10.8\text{A}$, $V_{\text{CC}} = 100\text{V}$ during inductor charging and $V_{\text{CC}} = 0\text{V}$ during the time in clamp.

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

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

Dynamic Characteristics

$Q_{G(ON)}$	Gate Charge	$I_{CE} = 10\text{A}$, $V_{CE} = 12\text{V}$, $V_{GE} = 5\text{V}$	-	21	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	$I_{CE} = 1\text{mA}$, $V_{CE} = V_{GE}$, $T_J = 25^\circ\text{C}$	1.3	1.7	2.2	V
		$T_J = 150^\circ\text{C}$	0.75	1.2	1.8	V
V_{GEP}	Gate to Emitter Plateau Voltage	$V_{CE} = 12\text{V}$, $I_{CE} = 10\text{A}$	-	2.8	-	V

Switching Characteristics

$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	$V_{CE} = 14\text{V}$, $R_L = 1\Omega$	-	0.9	4	μs
t_{rR}	Current Rise Time-Resistive	$V_{GE} = 5\text{V}$, $R_G = 1\text{K}\Omega$, $T_J = 25^\circ\text{C}$	-	1.9	7	μs
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	$V_{CE} = 300\text{V}$, $L = 1\text{mH}$, $V_{GE} = 5\text{V}$, $R_G = 1\text{K}\Omega$	-	4.8	15	μs
t_{fL}	Current Fall Time-Inductive	$I_{CE} = 6.5\text{A}$, $T_J = 25^\circ\text{C}$	-	2.0	15	μs

Typical Performance Curves

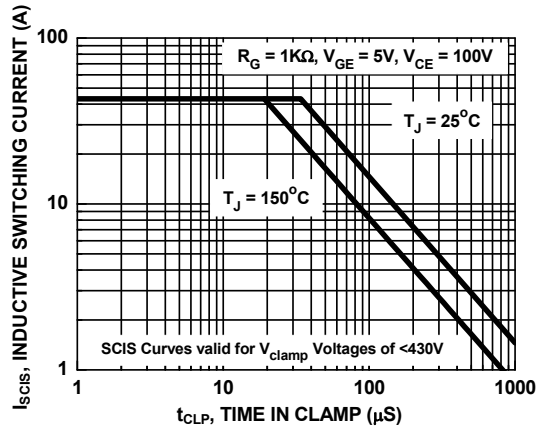


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

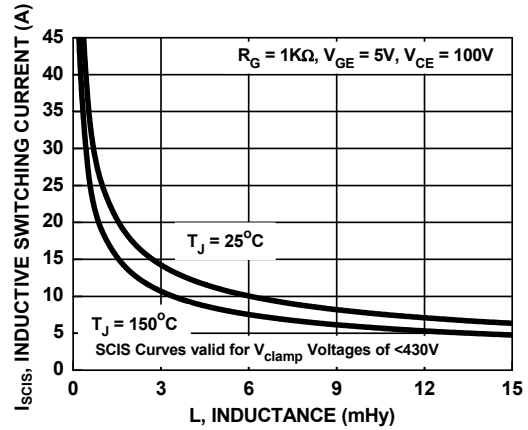


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

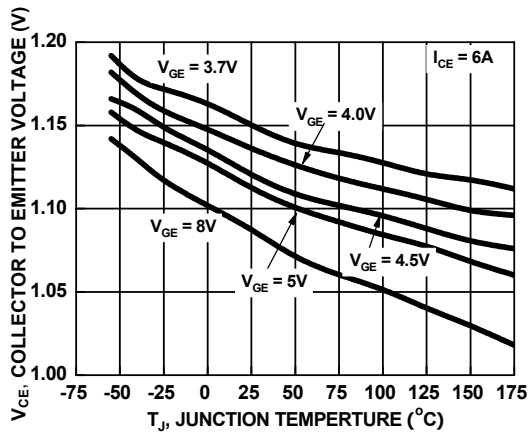


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

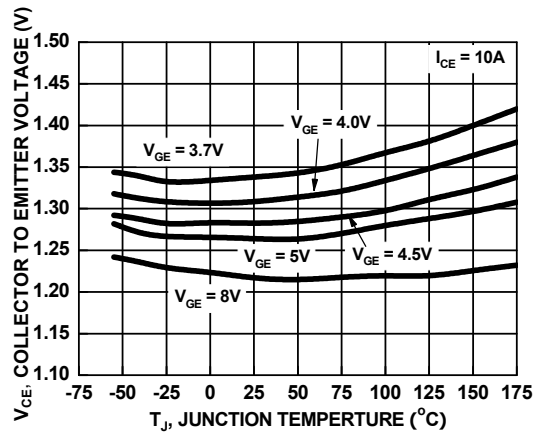


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

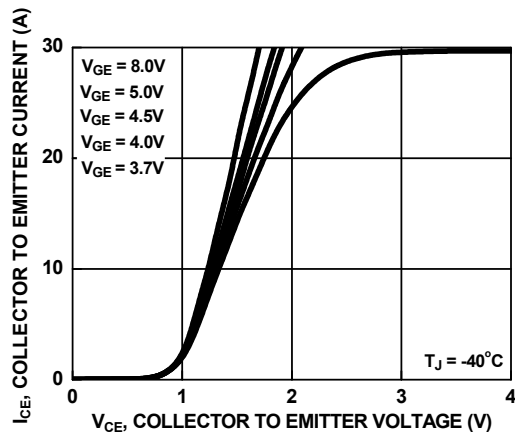


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

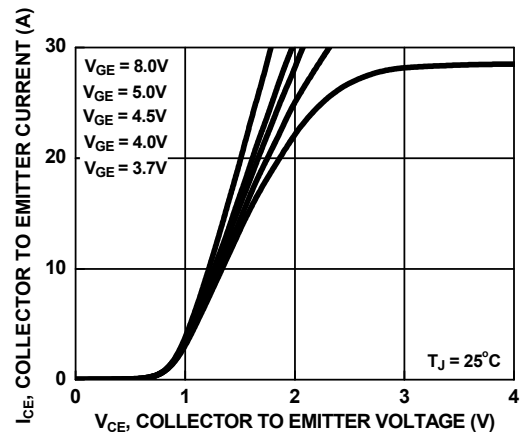


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves (Continued)

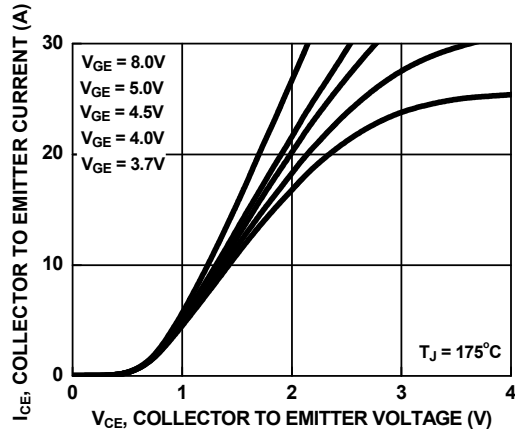


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

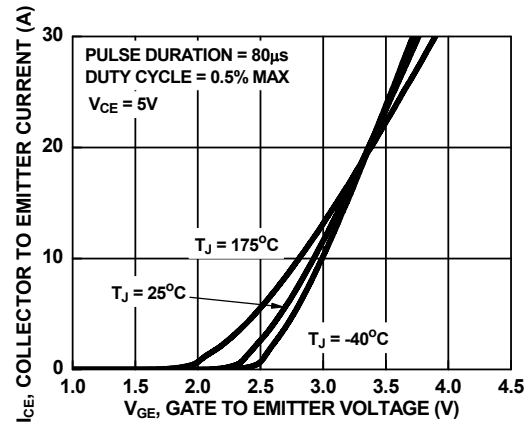


Figure 8. Transfer Characteristics

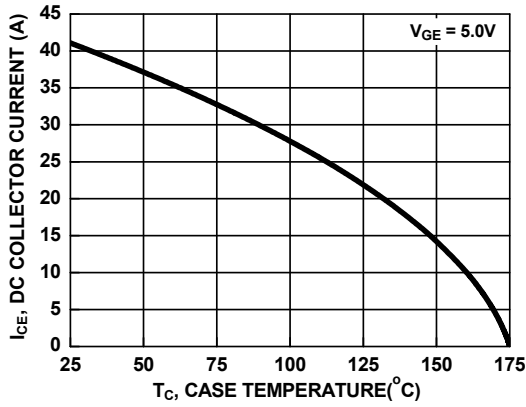


Figure 9. DC Collector Current vs. Case Temperature

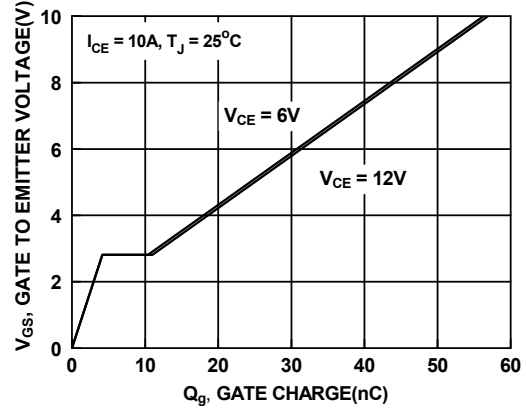


Figure 10. Gate Charge

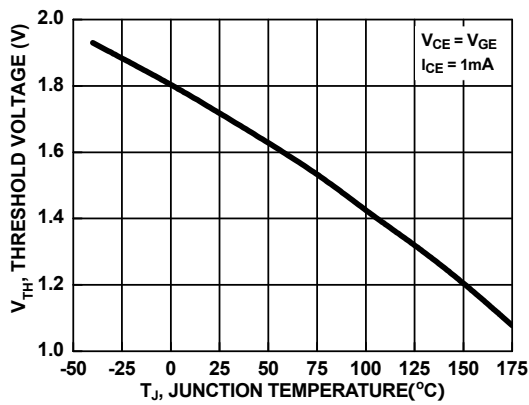


Figure 11. Threshold Voltage vs. Junction Temperature

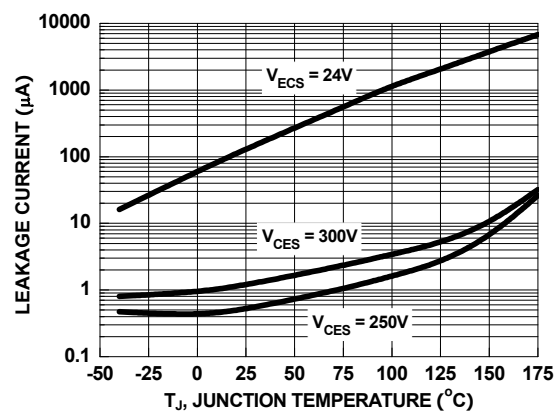


Figure 12. Leakage Current vs. Junction Temperature

Typical Performance Curves (Continued)

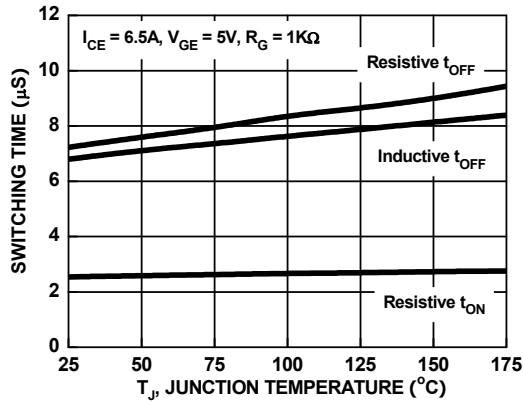


Figure 13. Switching Time vs. Junction Temperature

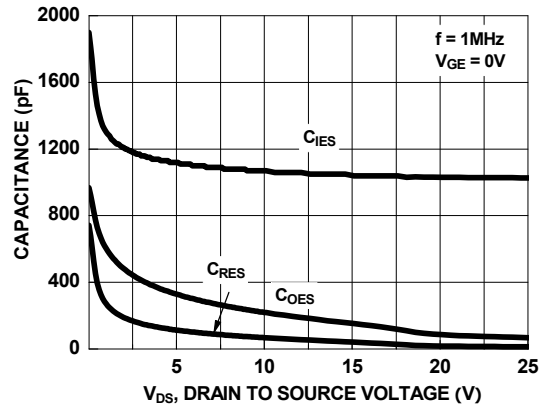


Figure 14. Capacitance vs. Collector to Emitter Voltage

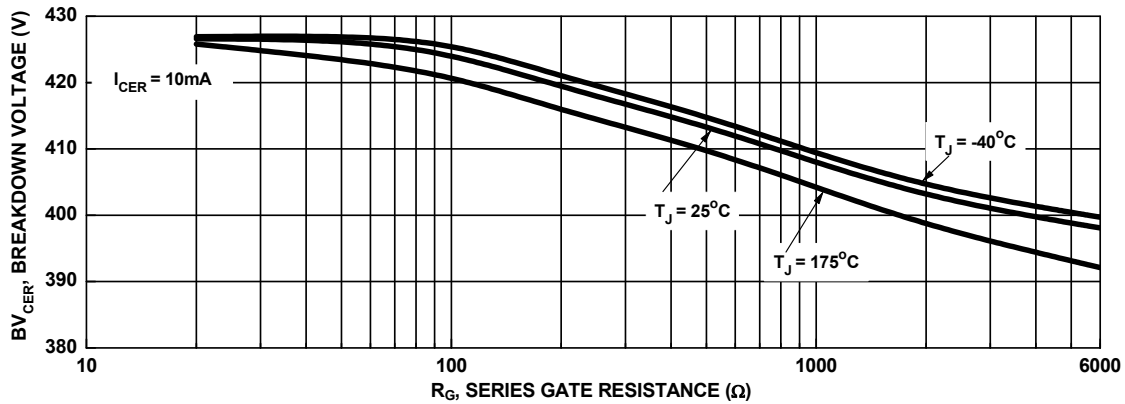


Figure 15. Break down Voltage vs. Series Gate Resistance

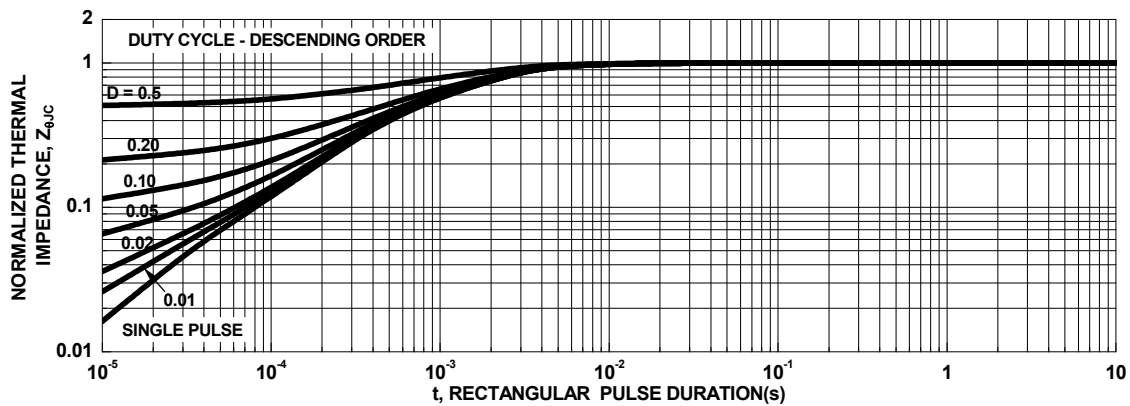


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

Typical Performance Curves

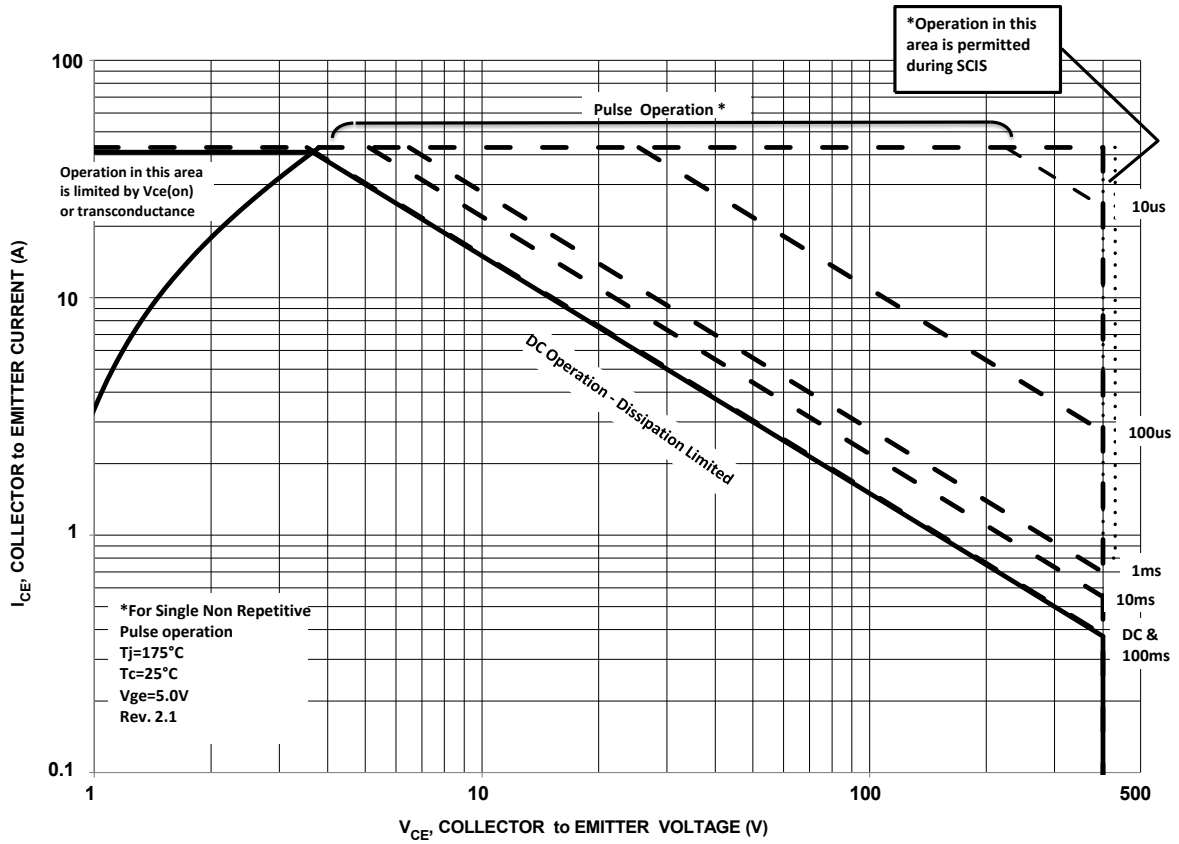


Figure 17. Forward Safe Operating Area

Test Circuit and Waveforms

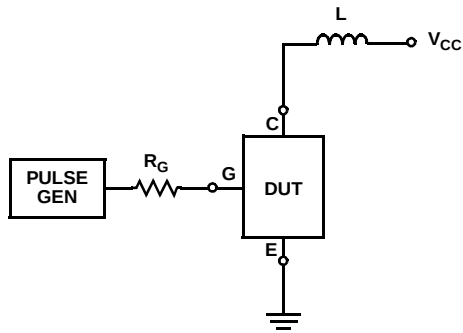


Figure 18. Inductive Switching Test Circuit

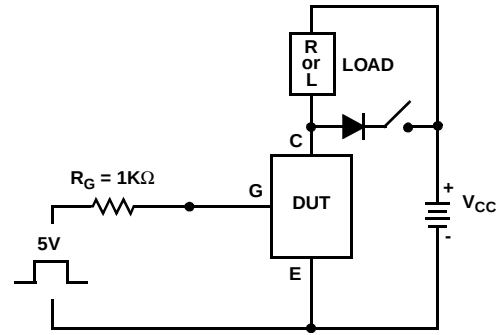


Figure 19. t_{ON} and t_{OFF} Switching Test Circuit

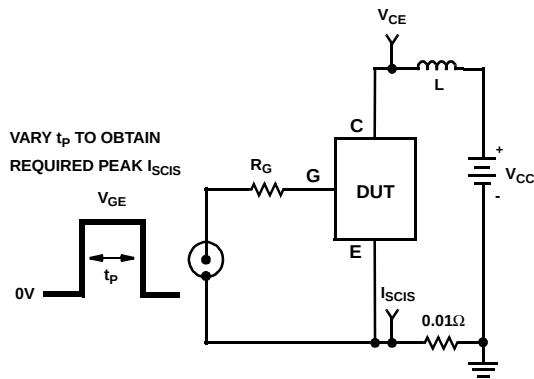


Figure 20. Energy Test Circuit

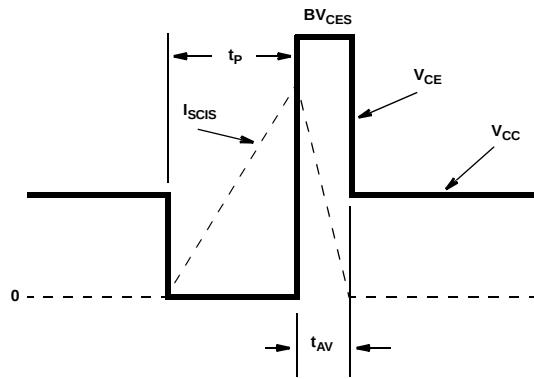


Figure 21. Energy Waveforms

ON Semiconductor and  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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative