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May 2014

FGB3040G2_F085 / FGD3040G2_F085
FGP3040G2_F085 / FGI3040G2_F085

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

Features

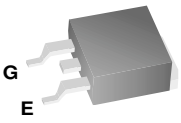
- SCIS Energy = 300mJ at T_J = 25°C
- Logic Level Gate Drive
- Qualified to AEC Q101
- RoHS Compliant

Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

Package

JEDEC TO-263AB
D²-Pak



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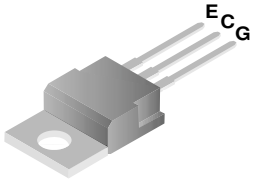
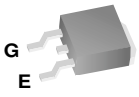
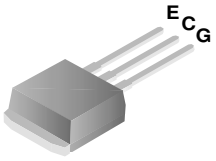


JEDEC TO-252AA
D-Pak

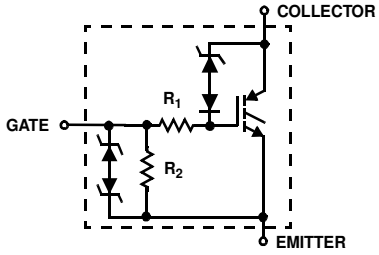


COLLECTOR
(FLANGE)

JEDEC TO-262AA



Symbol



Device Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
BV_{CER}	Collector to Emitter Breakdown Voltage (I_C = 1mA)	400	V
BV_{ECS}	Emitter to Collector Voltage - Reverse Battery Condition (I_C = 10mA)	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} = 5.0V, T_C = 25°C	41	A
I_{C110}	Collector Current Continuous, at V_{GE} = 5.0V, T_C = 110°C	25.6	A
V_{GEM}	Gate to Emitter Voltage Continuous	±10	V
P_D	Power Dissipation Total, at T_C = 25°C	150	W
	Power Dissipation Derating, for T_C > 25°C	1	W/°C
T_J	Operating Junction Temperature Range	-55 to +175	°C
T_{STG}	Storage Junction Temperature Range	-55 to +175	°C
T_L	Max. Lead Temp. for Soldering (Leads at 1.6mm from case for 10s)	300	°C
T_{PKG}	Reflow soldering according to JESD020C	260	°C
ESD	HBM-Electrostatic Discharge Voltage at100pF, 1500Ω	4	kV
	CDM-Electrostatic Discharge Voltage at 1Ω	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°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Off State Characteristics							
BV_{CER}	Collector to Emitter Breakdown Voltage	I_{CE} = 2mA, V_{GE} = 0, R_{GE} = 1KΩ, T_J = -40 to 150°C		370	400	430	V
BV_{CES}	Collector to Emitter Breakdown Voltage	I_{CE} = 10mA, V_{GE} = 0V, R_{GE} = 0, T_J = -40 to 150°C		390	420	450	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	I_{CE} = -20mA, V_{GE} = 0V, T_J = 25°C		28	-	-	V
BV_{GES}	Gate to Emitter Breakdown Voltage	I_{GES} = ±2mA		±12	±14	-	V
I_{CER}	Collector to Emitter Leakage Current	V_{CE} = 250V, R_{GE} = 1KΩ	T_J = 25°C	-	-	25	μA
			T_J = 150°C	-	-	1	mA
I_{ECS}	Emitter to Collector Leakage Current	V_{EC} = 24V,	T_J = 25°C	-	-	1	mA
			T_J = 150°C	-	-	40	
R_1	Series Gate Resistance			-	120	-	Ω
R_2	Gate to Emitter Resistance			10K	-	30K	Ω
On State Characteristics							
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 6A, V_{GE} = 4V,	T_J = 25°C	-	1.15	1.25	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 10A, V_{GE} = 4.5V,	T_J = 150°C	-	1.35	1.50	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 15A, V_{GE} = 4.5V,	T_J = 150°C	-	1.68	1.85	V
E_{SCIS}	Self Clamped Inductive Switching	L = 3.0 mHy, R_G = 1KΩ, V_{GE} = 5V, (Note 1)	T_J = 25°C	-	-	300	mJ
Thermal Characteristics							
$R_{\theta JC}$	Thermal Resistance Junction to Case			-	-	1	°C/W

Notes:

1: Self Clamping Inductive Switching Energy (E_{SCIS25}) of 300 mJ is based on the test conditions that starting Tj=25°C; L=3mHy, I_{SCIS}=14.2A,V_{CC}=100V during inductor charging and V_{CC}=0V during the time in clamp.

2: Self Clamping Inductive Switching Energy ($E_{SCIS150}$) of 170 mJ is based on the test conditions that starting Tj=150°C; L=3mHy, I_{SCIS}=10.8A,V_{CC}=100V during inductor charging and V_{CC}=0V during the time in clamp.

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Dynamic Characteristics							
$Q_{G(ON)}$	Gate Charge	I_{CE} = 10A, V_{CE} = 12V, V_{GE} = 5V		-	21	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	I_{CE} = 1mA, V_{CE} = V_{GE},	T_J = 25°C	1.3	1.7	2.2	V
			T_J = 150°C	0.75	1.2	1.8	
V_{GEP}	Gate to Emitter Plateau Voltage	V_{CE} = 12V, I_{CE} = 10A		-	2.8	-	V
Switching Characteristics							
$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	V_{CE} = 14V, R_L = 1Ω		-	0.9	4	μs
t_{rR}	Current Rise Time-Resistive	V_{GE} = 5V, R_G = 1KΩ T_J = 25°C,		-	1.9	7	μs
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	V_{CE} = 300V, L = 1mH,		-	4.8	15	μs
t_{fL}	Current Fall Time-Inductive	V_{GE} = 5V, R_G = 1KΩ I_{CE} = 6.5A, T_J = 25°C,		-	2.0	15	μs

Typical Performance Curves

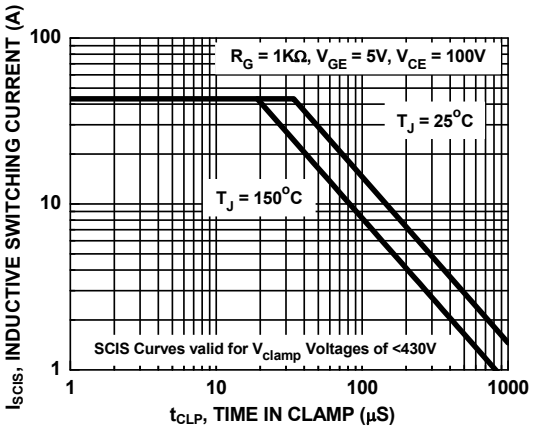


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

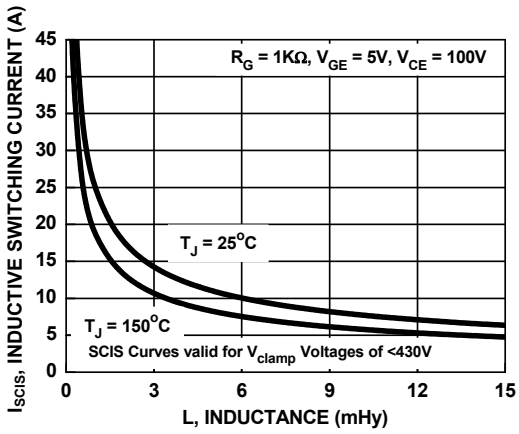


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

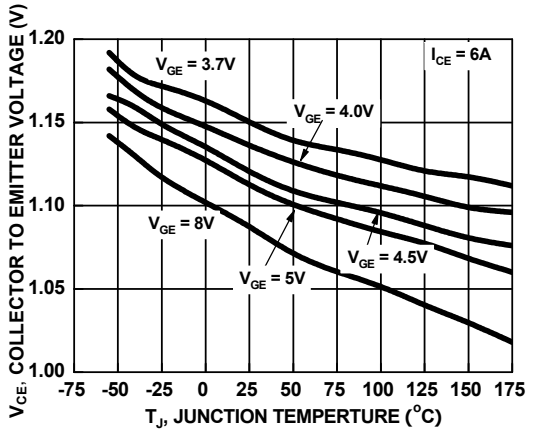


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

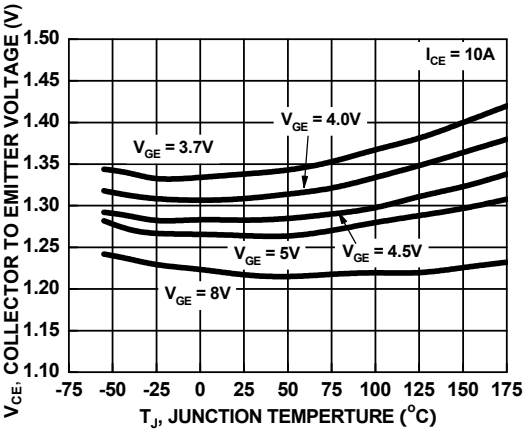


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

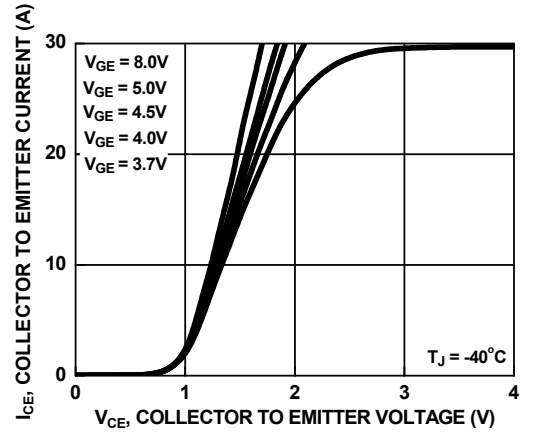


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

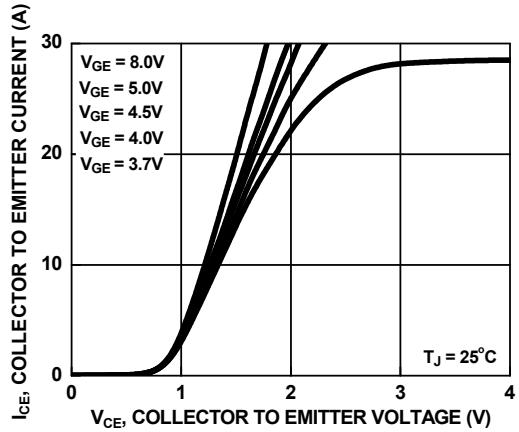


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves (Continued)

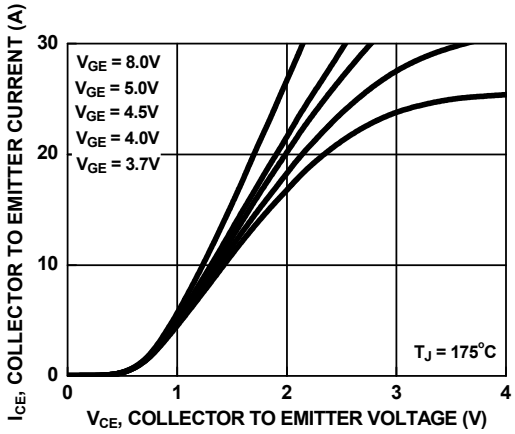


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

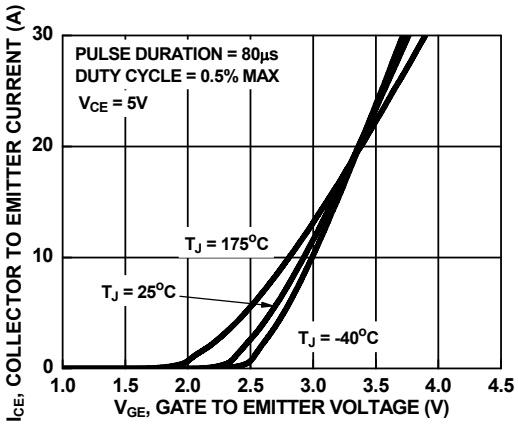


Figure 8. Transfer Characteristics

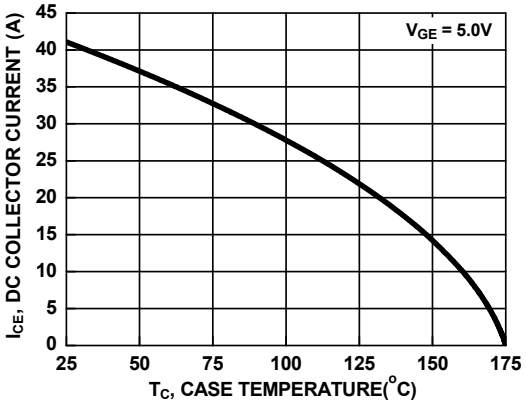


Figure 9. DC Collector Current vs. Case Temperature

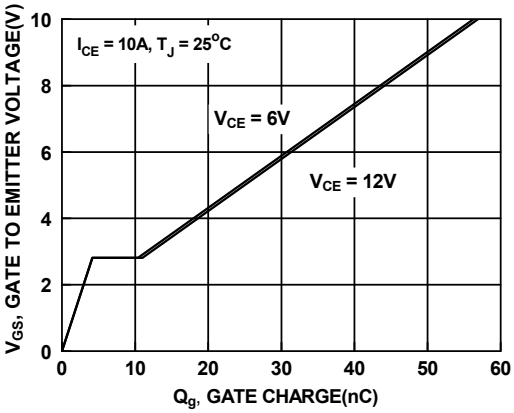


Figure 10. Gate Charge

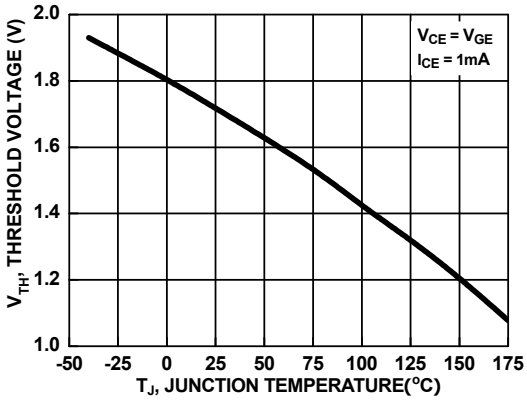


Figure 11. Threshold Voltage vs. Junction Temperature

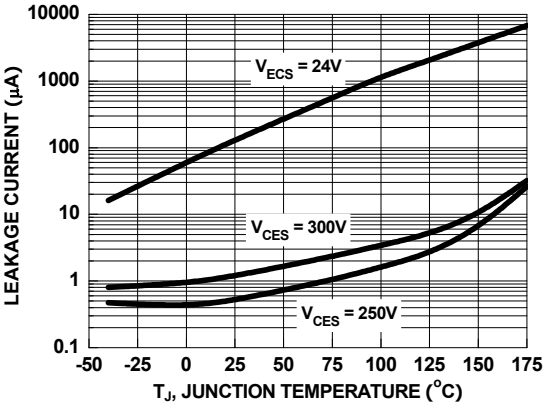


Figure 12. Leakage Current vs. Junction Temperature

Typical Performance Curves (Continued)

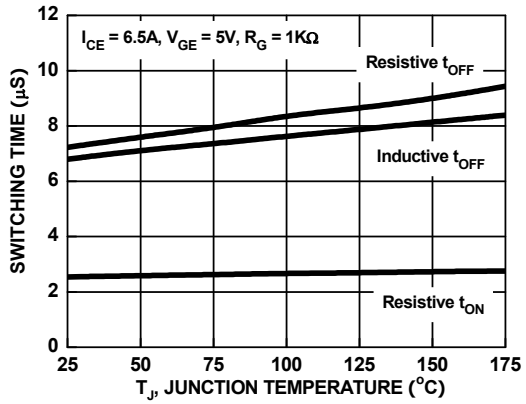


Figure 13. Switching Time vs. Junction Temperature

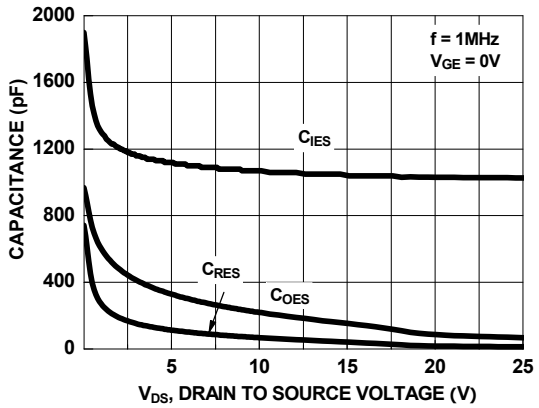


Figure 14. Capacitance vs. Collector to Emitter Voltage

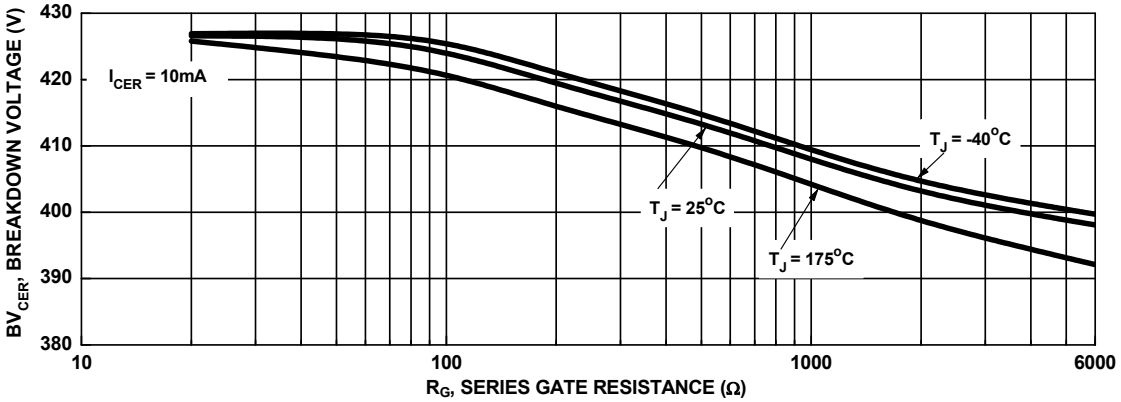


Figure 15. Break down Voltage vs. Series Gate Resistance

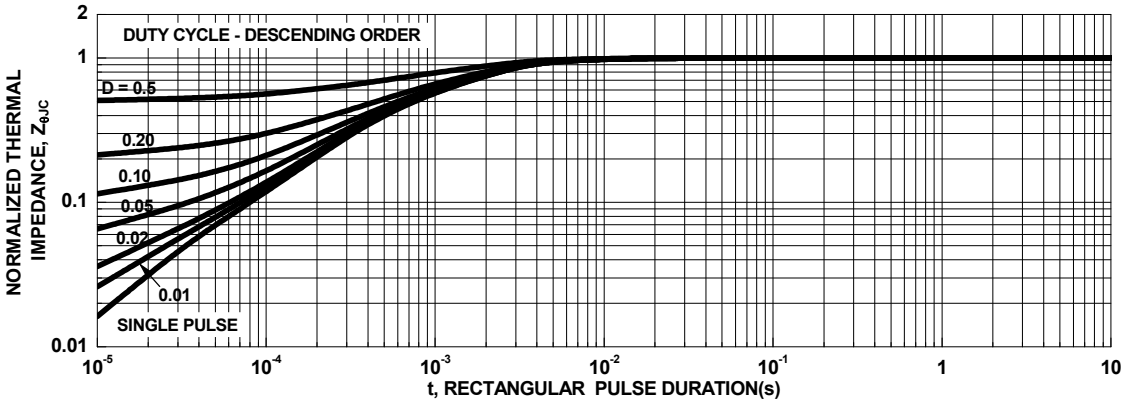


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

Typical Performance Curves

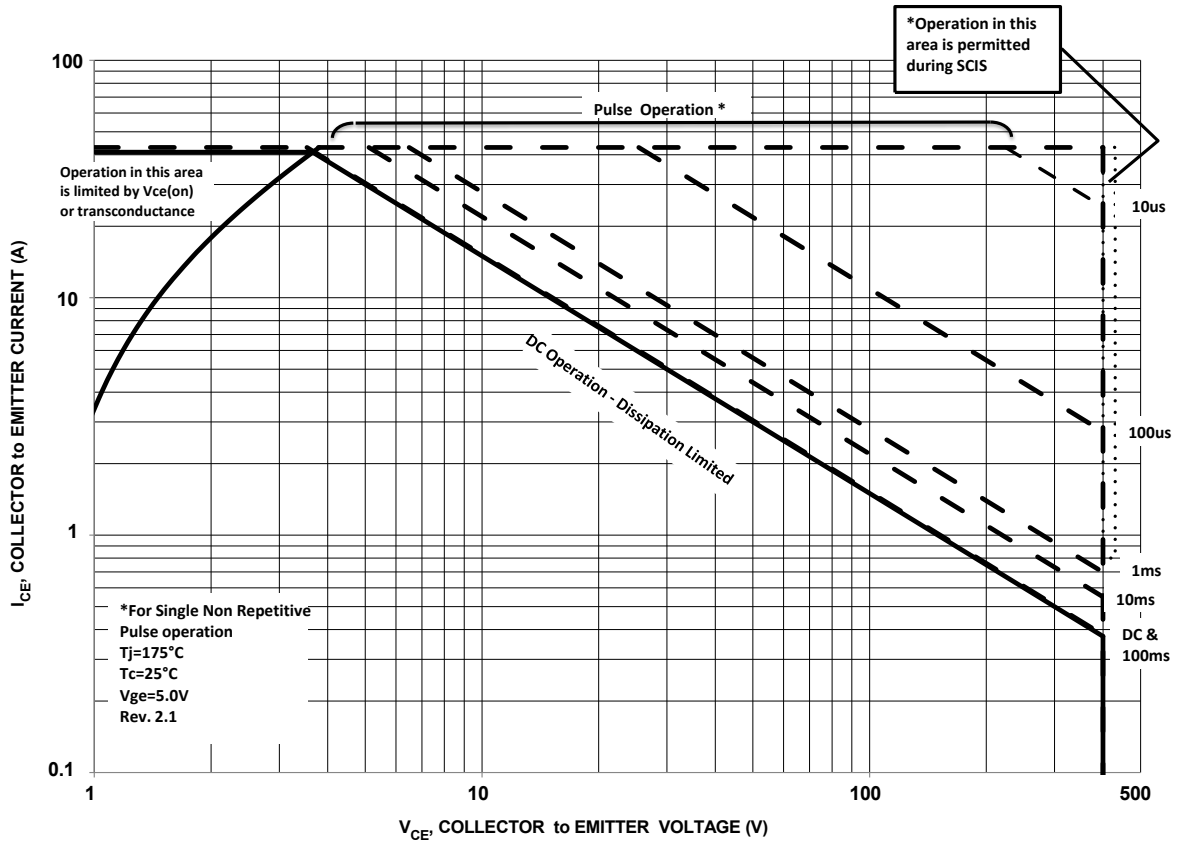


Figure 17. Forward Safe Operating Area

Test Circuit and Waveforms

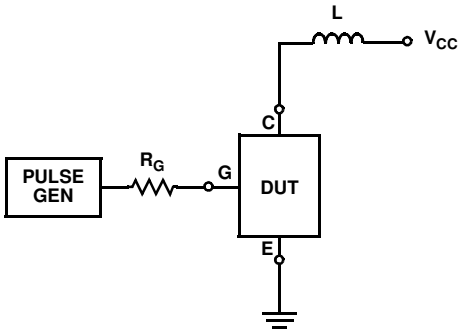


Figure 18. Inductive Switching Test Circuit

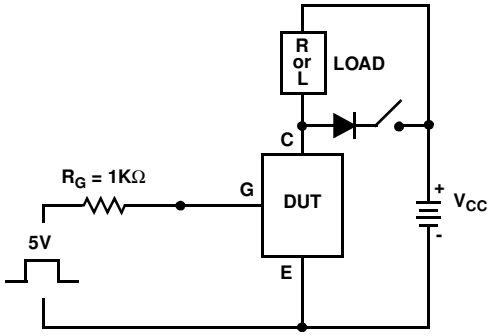


Figure 19. t_{ON} and t_{OFF} Switching Test Circuit

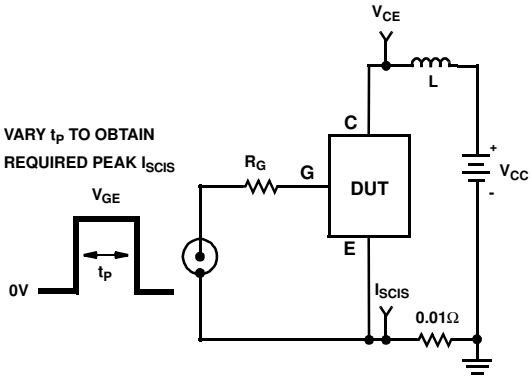


Figure 20. Energy Test Circuit

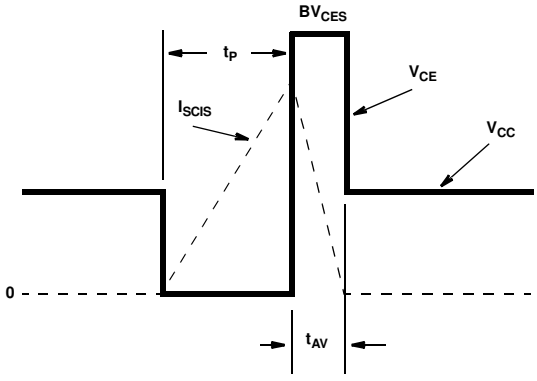


Figure 21. Energy Waveforms

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