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# FGD3245G2\_F085 / FGB3245G2\_F085

## EcoSPARK<sup>®</sup> 2 320mJ, 450V, N-Channel Ignition IGBT

### Features

- SCIS Energy = 320mJ at T<sub>J</sub> = 25°C
- Logic Level Gate Drive
- Low Saturation Voltage
- Qualified to AEC Q101
- RoHS Compliant

### Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

### General Description

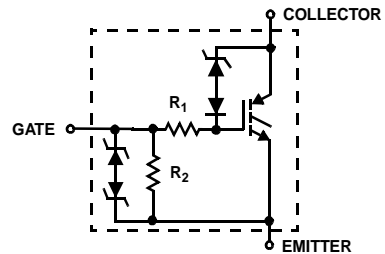
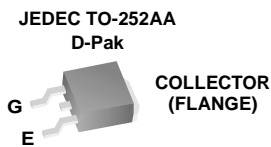
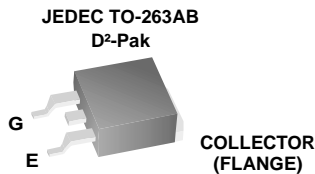
The FGB3245G2\_F085 and FGD3245G2 are N-channel IGBTs designed in Fairchild's EcoSPARK-2 technology which helps in eliminating external protection circuitry. The technology is optimized for driving the coil in the harsh environment of automotive ignition systems and offers outstanding V<sub>sat</sub> and SCIS Energy capability also at elevated operating temperatures. The logic level gate input is ESD protected and features an integrated gate resistor. An integrated zener-circuitry clamps the IGBT's collector- to-emitter voltage at 450V which enables systems requiring a higher spark voltage



FGD3245G2\_F085 / FGB3245G2\_F085

### Package

### Symbol



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

Symbol	Parameter	Rating	Units
$BV_{CER}$	Collector to Emitter Breakdown Voltage ( $I_C = 1\text{mA}$ )	450	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)	320	mJ
$E_{SCIS150}$	Self Clamping Inductive Switching Energy (Note 2)	180	mJ
$I_{C25}$	Collector Current Continuous, at $V_{GE} = 4.0\text{V}$ , $T_C = 25^\circ\text{C}$	23	A
$I_{C110}$	Collector Current Continuous, at $V_{GE} = 4.0\text{V}$ , $T_C = 110^\circ\text{C}$	23	A
$V_{GEM}$	Gate to Emitter Voltage Continuous	$\pm 10$	V
$P_D$	Power Dissipation Total, at $T_C = 25^\circ\text{C}$	150	W
	Power Dissipation Derating, for $T_C > 25^\circ\text{C}$	1.1	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 (Leads at 1.6mm from case for 10s)	300	$^\circ\text{C}$
$T_{PKG}$	Max. Lead Temp. for Soldering (Package Body for 10s)	260	$^\circ\text{C}$
ESD	Electrostatic Discharge Voltage at 100pF, 1500 $\Omega$	4	kV
	CDM-Electrostatic Discharge Voltage at 1 $\Omega$	2	kV

**Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGD3245G2	FGD3245G2_F085	TO252AA	330mm	16mm	2500 units
FGB3245G2	FGB3245G2_F085	TO263AB	330mm	24mm	800 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off State Characteristics**

$BV_{CER}$	Collector to Emitter Breakdown Voltage	$I_{CE} = 2\text{mA}$ , $V_{GE} = 0$ , $R_{GE} = 1\text{K}\Omega$ , $T_J = -40$ to $150^\circ\text{C}$	420	-	480	V	
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$I_{CE} = 10\text{mA}$ , $V_{GE} = 0\text{V}$ , $R_{GE} = 0$ , $T_J = -40$ to $150^\circ\text{C}$	440	-	500	V	
$BV_{ECS}$	Emitter to Collector Breakdown Voltage	$I_{CE} = -75\text{mA}$ , $V_{GE} = 0\text{V}$ , $T_J = 25^\circ\text{C}$	28	-	-	V	
$BV_{GES}$	Gate to Emitter Breakdown Voltage	$I_{GES} = \pm 2\text{mA}$	$\pm 12$	$\pm 14$	-	V	
$I_{CER}$	Collector to Emitter Leakage Current	$V_{CE} = 250\text{V}$ , $R_{GE} = 1\text{K}\Omega$	$T_J = 25^\circ\text{C}$	-	-	25	$\mu\text{A}$
			$T_J = 150^\circ\text{C}$	-	-	1	mA
$I_{ECS}$	Emitter to Collector Leakage Current	$V_{EC} = 24\text{V}$	$T_J = 25^\circ\text{C}$	-	-	1	mA
			$T_J = 150^\circ\text{C}$	-	-	40	
$R_1$	Series Gate Resistance		-	120	-	$\Omega$	
$R_2$	Gate to Emitter Resistance		10K	-	30K	$\Omega$	

**On State Characteristics**

$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 6\text{A}$ , $V_{GE} = 4\text{V}$ ,	$T_J = 25^\circ\text{C}$	-	1.13	1.25	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 10\text{A}$ , $V_{GE} = 4.5\text{V}$ ,	$T_J = 150^\circ\text{C}$	-	1.32	1.50	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 15\text{A}$ , $V_{GE} = 4.5\text{V}$ ,	$T_J = 150^\circ\text{C}$	-	1.64	1.85	V

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Dynamic Characteristics**

$Q_{G(ON)}$	Gate Charge	$I_{CE} = 10\text{A}, V_{CE} = 12\text{V}, V_{GE} = 5\text{V}$	-	23	-	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	1.6	2.2	V
			$T_J = 150^\circ\text{C}$		0.75	1.1	1.8	
$V_{GEP}$	Gate to Emitter Plateau Voltage	$V_{CE} = 12\text{V}, I_{CE} = 10\text{A}$	-	2.7	-	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	$\mu\text{s}$		
$t_{rR}$	Current Rise Time-Resistive	$V_{GE} = 5\text{V}, R_G = 1\text{K}\Omega$ $T_J = 25^\circ\text{C},$	-	2.6	7	$\mu\text{s}$		
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	$V_{CE} = 300\text{V}, L = 1\text{mH},$	-	5.4	15	$\mu\text{s}$		
$t_{fL}$	Current Fall Time-Inductive	$V_{GE} = 5\text{V}, R_G = 1\text{K}\Omega$ $I_{CE} = 6.5\text{A}, T_J = 25^\circ\text{C},$	-	2.7	15	$\mu\text{s}$		
$E_{SCIS}$	Self Clamped Inductive Switching	$L = 3.0\text{mHy}, R_G = 1\text{K}\Omega,$ $V_{GE} = 5\text{V}, (\text{Note } 1)$	$T_J = 25^\circ\text{C}$		-	-	320	mJ

**Thermal Characteristics**

$R_{\theta JC}$	Thermal Resistance Junction to Case	All packages	-	-	0.9	$^\circ\text{C/W}$
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**Notes:**

1: Self Clamping Inductive Switching Energy ( $E_{SCIS25}$ ) of 320 mJ is based on the test conditions that starting  $T_J=25^\circ\text{C}; L=3\text{mHy}, I_{SCIS}=14.6\text{A}, V_{CC}=100\text{V}$  during inductor charging and  $V_{CC}=0\text{V}$  during the time in clamp.

2: Self Clamping Inductive Switching Energy ( $E_{SCIS150}$ ) of 180 mJ is based on the test conditions that starting  $T_J=150^\circ\text{C}; L=3\text{mHy}, I_{SCIS}=10.9\text{A}, V_{CC}=100\text{V}$  during inductor charging and  $V_{CC}=0\text{V}$  during the time in clamp.

### Typical Performance Curves

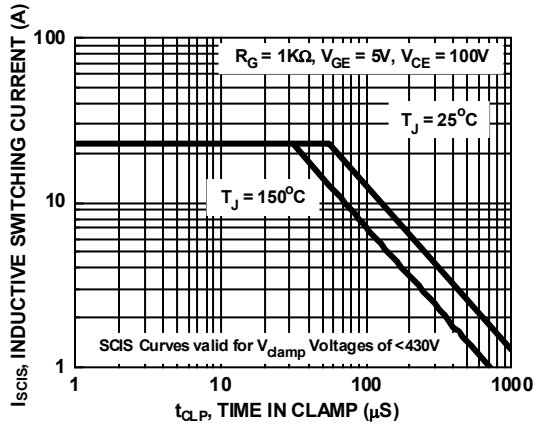


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

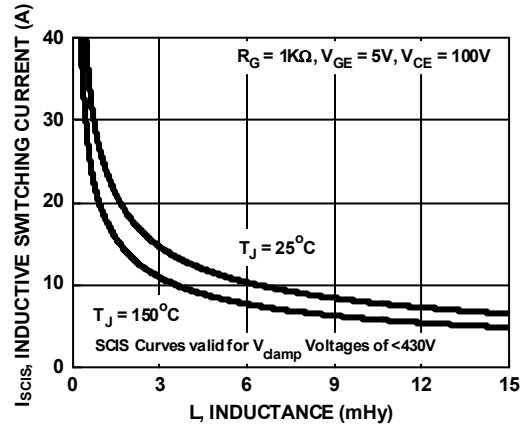


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

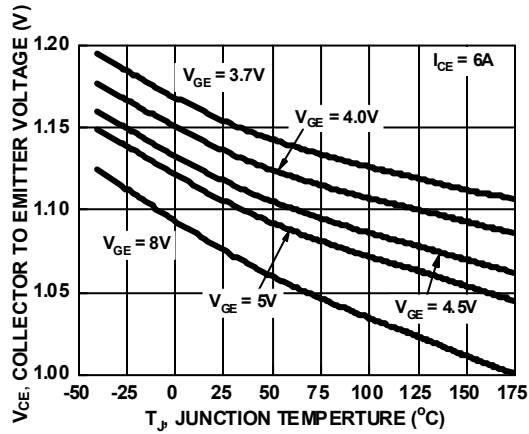


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

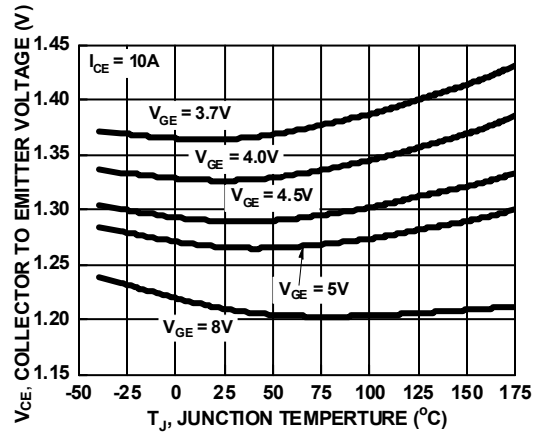


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

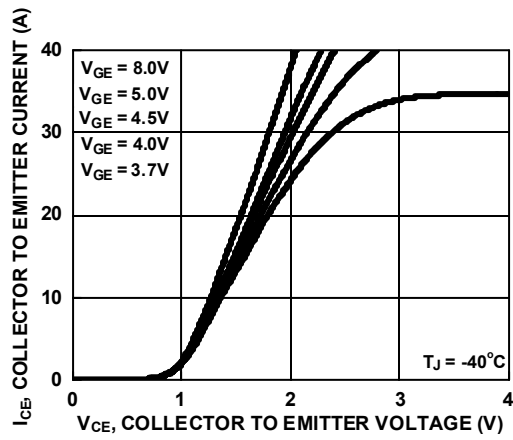


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

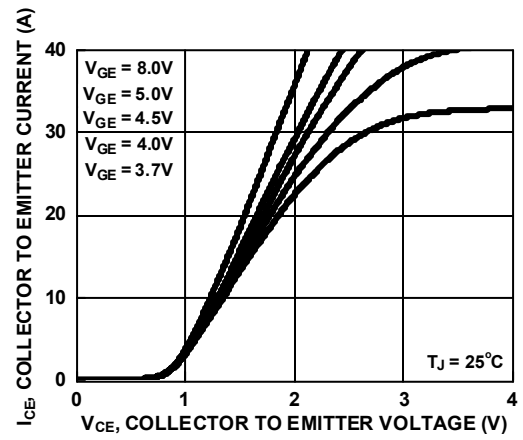
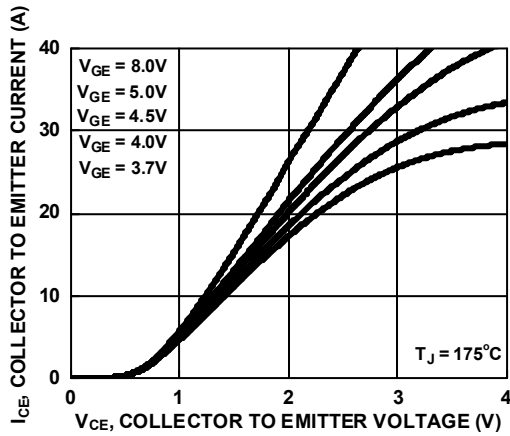
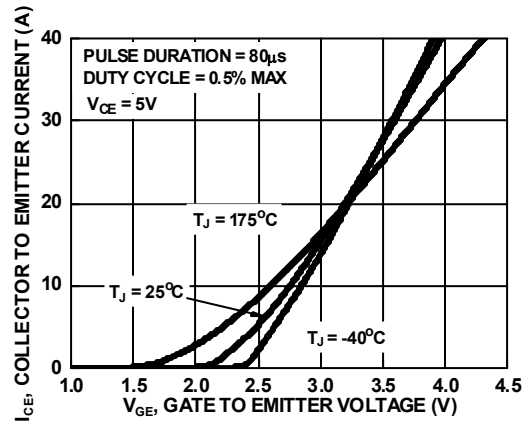


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

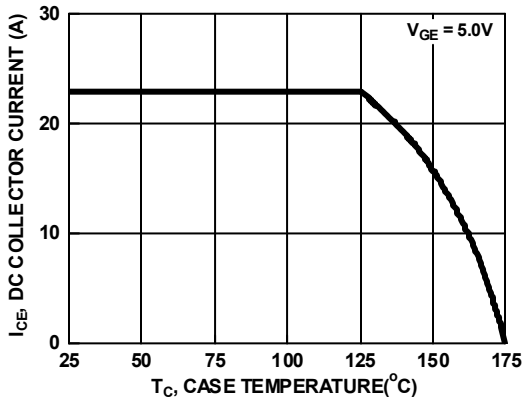
**Typical Performance Curves** (Continued)



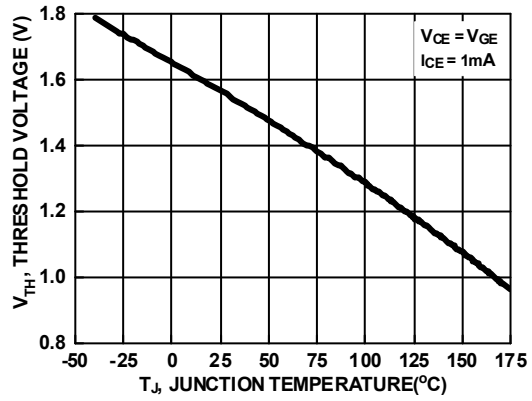
**Figure 7. Collector to Emitter On-State Voltage vs. Collector Current**



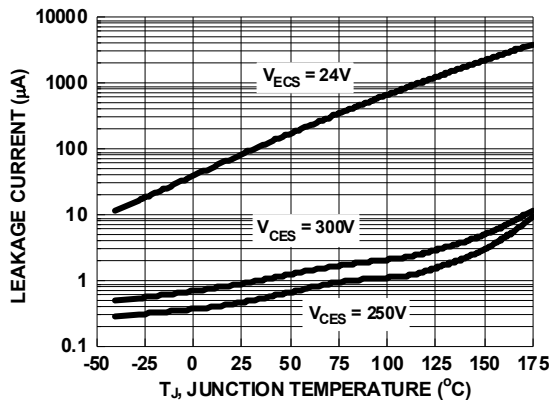
**Figure 8. Transfer Characteristics**



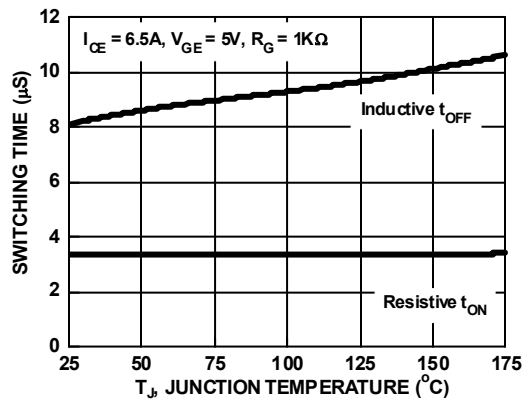
**Figure 9. DC Collector Current vs. Case Temperature**



**Figure 10. Threshold Voltage vs. Junction Temperature**

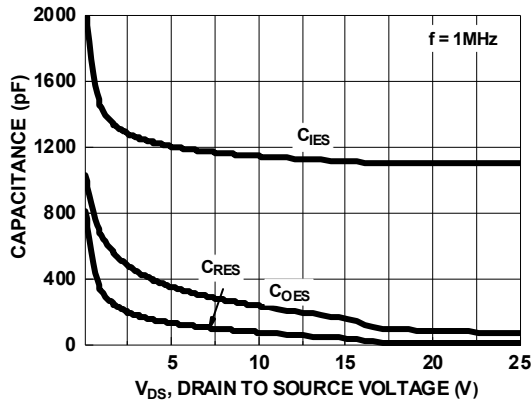


**Figure 11. Leakage Current vs. Junction Temperature**

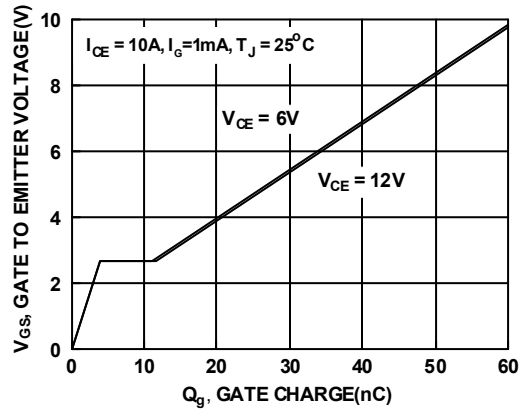


**Figure 12. Switching Time vs. Junction Temperature**

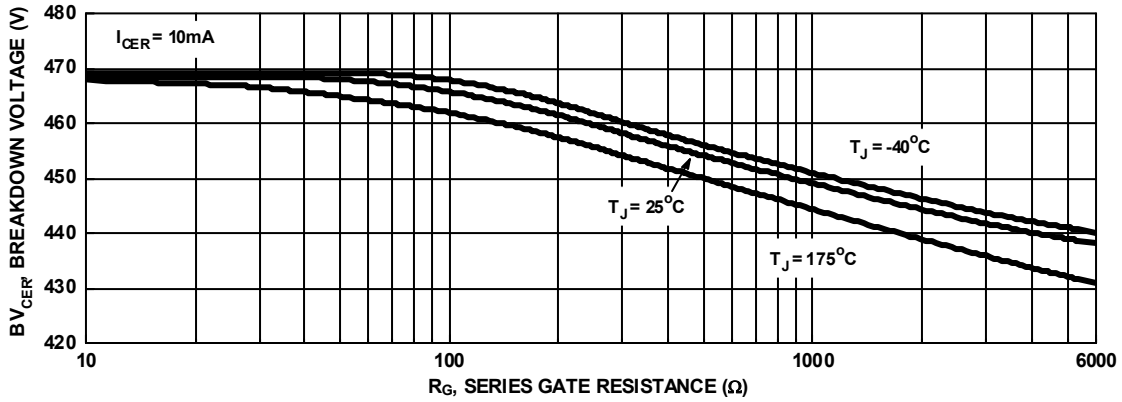
**Typical Performance Curves** (Continued)



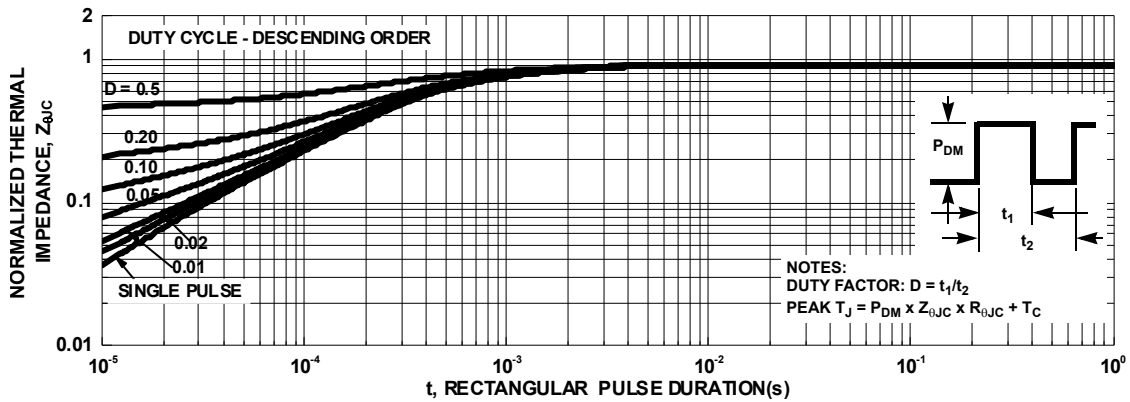
**Figure 13. Capacitance vs. Collector to Emitter Voltage**



**Figure 14. Gate Charge**



**Figure 15. Break down Voltage vs. Series Gate Resistance**



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

### Test Circuit and Waveforms

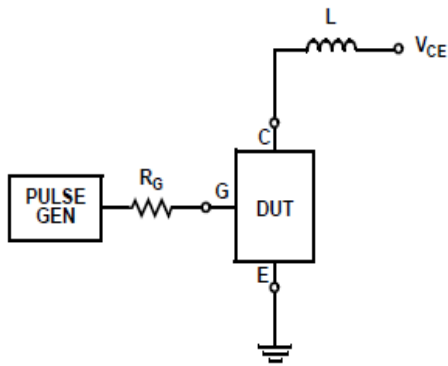


Figure 17. Inductive Switching Test Circuit

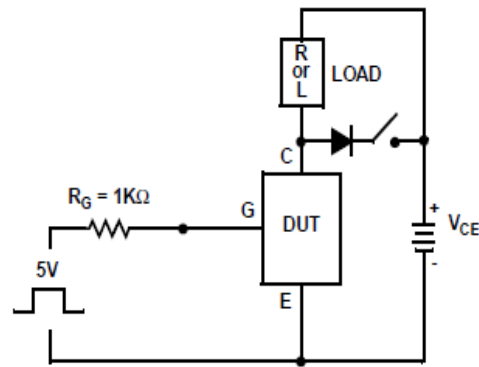


Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

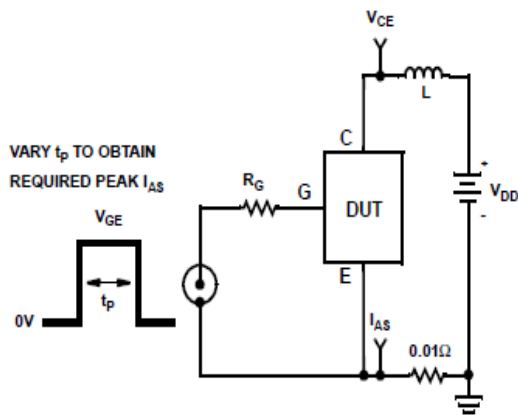


Figure 19. Energy Test Circuit

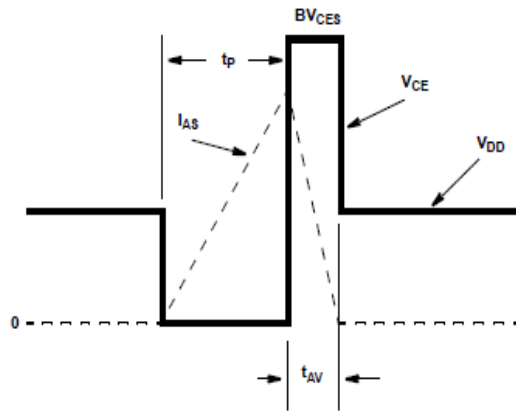







Figure 20. Energy Waveforms





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