



ON Semiconductor®

## FGB3440G2-F085 / FGD3440G2-F085 FGP3440G2-F085

**EcoSPARK®2 335mJ, 400V, N-Channel Ignition IGBT**

### Features

- SCIS Energy = 335mJ at  $T_J = 25^\circ\text{C}$
- Logic Level Gate Drive
- Qualified to AEC Q101
- RoHS Compliant

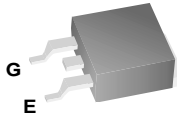


### Applications

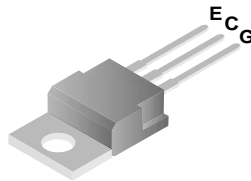
- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

### Package

JEDEC TO-263AB  
D<sup>2</sup>-Pak



JEDEC TO-220AB

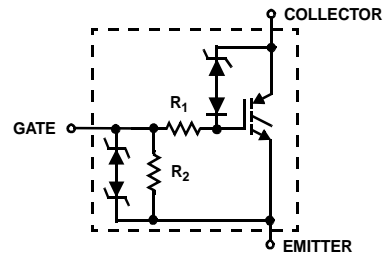


JEDEC TO-252AA  
D-Pak



COLLECTOR  
(FLANGE)

### 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)	335	mJ
$E_{SCIS150}$	Self Clamping Inductive Switching Energy (Note 2)	195	mJ
$I_{C25}$	Collector Current Continuous, at $V_{GE} = 4.0\text{V}$ , $T_C = 25^\circ\text{C}$	26.9	A
$I_{C110}$	Collector Current Continuous, at $V_{GE} = 4.0\text{V}$ , $T_C = 110^\circ\text{C}$	25	A
$V_{GEM}$	Gate to Emitter Voltage Continuous	$\pm 10$	V
$P_D$	Power Dissipation Total, at $T_C = 25^\circ\text{C}$	166	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

**Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGB3440G2	FGB3440G2-F085	TO-263AB	330mm	24mm	800
FGD3440G2	FGD3440G2-F085	TO-252AA	330mm	16mm	2500
FGP3440G2	FGP3440G2-F085	TO-220AB	Tube	N/A	50

**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 $150^\circ\text{C}$	370	400	430	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 $150^\circ\text{C}$	390	420	450	V
$BV_{ECS}$	Emitter to Collector Breakdown Voltage	$I_{CE} = -20\text{mA}$ , $V_{GE} = 0\text{V}$ , $T_J = 25^\circ\text{C}$	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 mA
$R_1$	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	$I_{CE} = 6\text{A}$ , $V_{GE} = 4\text{V}$ ,	$T_J = 25^\circ\text{C}$	-	1.1	1.2	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 10\text{A}$ , $V_{GE} = 4.5\text{V}$ ,	$T_J = 150^\circ\text{C}$	-	1.3	1.45	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 15\text{A}$ , $V_{GE} = 4.5\text{V}$ ,	$T_J = 150^\circ\text{C}$	-	1.6	1.75	V
$E_{SCIS}$	Self Clamped Inductive Switching	$L = 3.0\text{mH}$ , $V_{GE} = 5\text{V}$ $R_G = 1\text{K}\Omega$ , (Note 1)	$T_J = 25^\circ\text{C}$	-	-	335	mJ

**Notes:**

- 1: Self Clamping Inductive Switching Energy( $E_{SCIS25}$ ) of 335mJ is based on the test conditions that is starting  $T_J = 25^\circ\text{C}$ ;  $L = 3\text{mH}$ ,  $I_{SCIS} = 15\text{A}$ ,  $V_{CC} = 100\text{V}$  during inductor charging and  $V_{CC} = 0\text{V}$  during the time in clamp.
- 2: Self Clamping Inductive Switching Energy ( $E_{SCIS150}$ ) of 195mJ is based on the test conditions that is starting  $T_J = 150^\circ\text{C}$ ;  $L = 3\text{mH}$ ,  $I_{SCIS} = 11.4\text{A}$ ,  $V_{CC} = 100\text{V}$  during inductor charging and  $V_{CC} = 0\text{V}$  during the time in clamp.

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

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

$Q_{G(ON)}$	Gate Charge	$I_{CE} = 10\text{A}$ , $V_{CE} = 12\text{V}$ , $V_{GE} = 5\text{V}$	-	24	-	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	$V_{CE} = 14\text{V}$ , $R_L = 1\Omega$	-	1.0	4	$\mu\text{s}$
$t_{rR}$	Current Rise Time-Resistive	$V_{GE} = 5\text{V}$ , $R_G = 1\text{K}\Omega$ , $T_J = 25^\circ\text{C}$	-	2.0	7	$\mu\text{s}$
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	$V_{CE} = 300\text{V}$ , $L = 1\text{mH}$ , $V_{GE} = 5\text{V}$ , $R_G = 1\text{K}\Omega$	-	5.3	15	$\mu\text{s}$
$t_{fL}$	Current Fall Time-Inductive	$I_{CE} = 6.5\text{A}$ , $T_J = 25^\circ\text{C}$	-	2.3	15	$\mu\text{s}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case		-	-	0.9	$^\circ\text{C/W}$
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## Typical Performance Curves

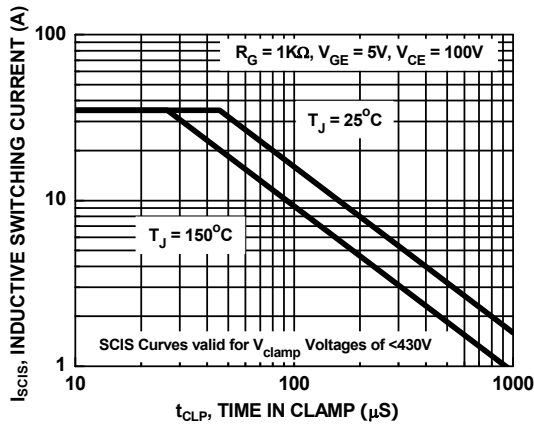


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

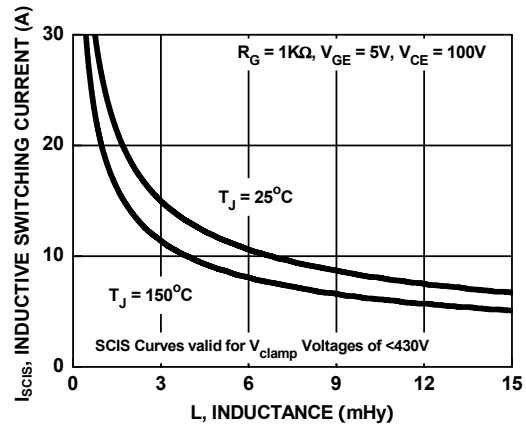


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

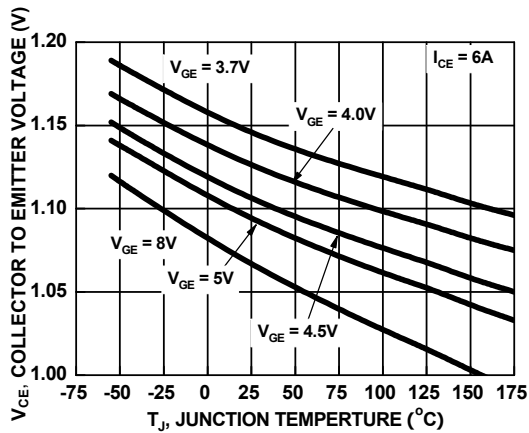


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

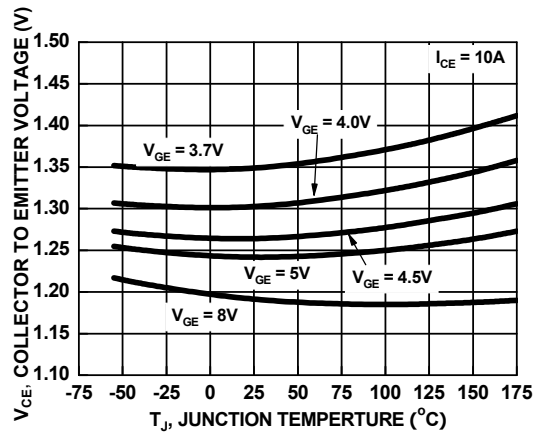


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

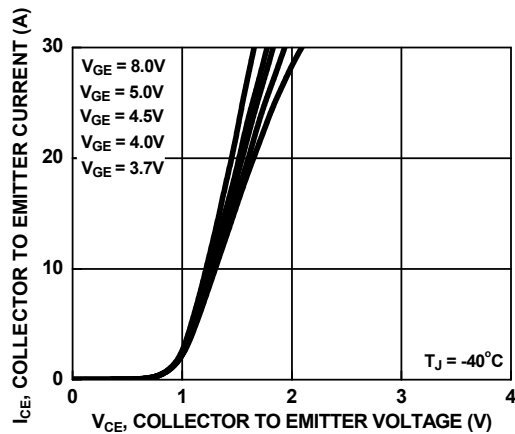


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

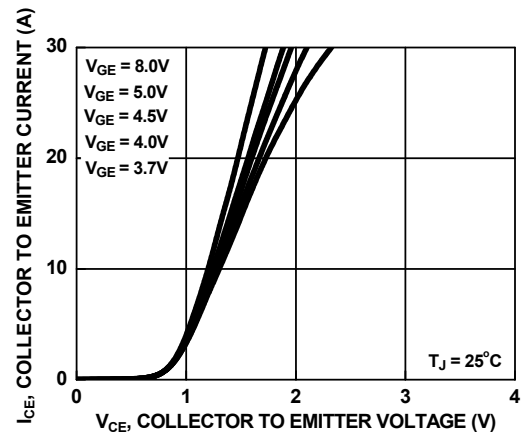


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

## Typical Performance Curves (Continued)

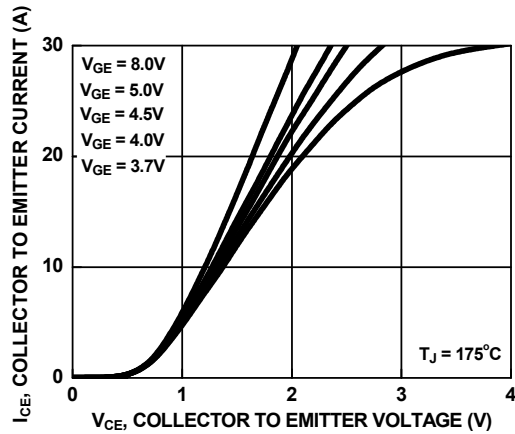


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

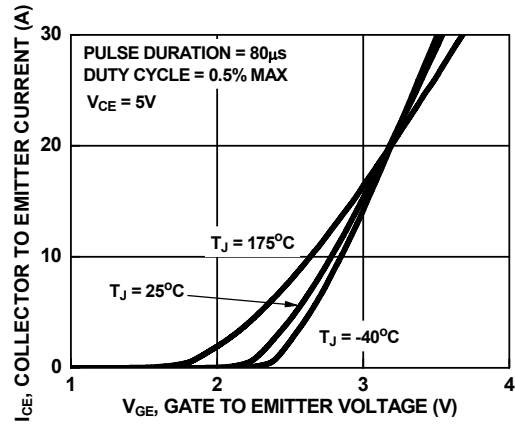


Figure 8. Transfer Characteristics

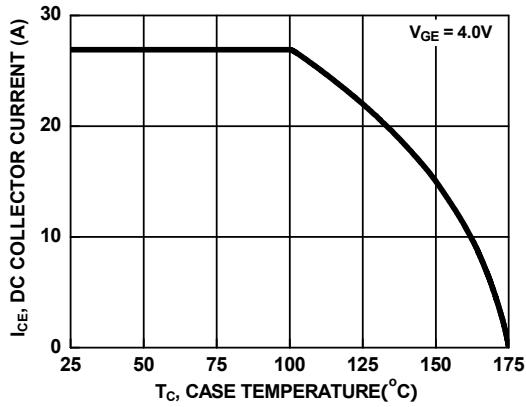


Figure 9. DC Collector Current vs. Case Temperature

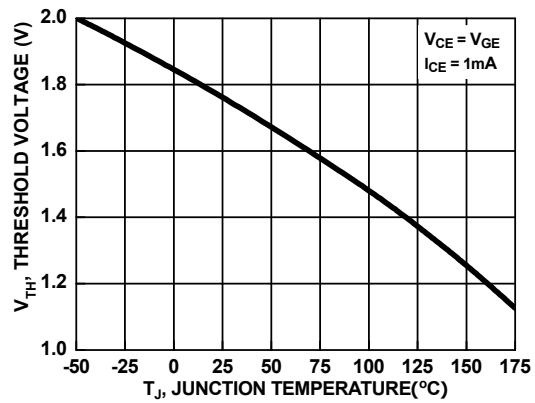


Figure 10. Threshold Voltage vs. Junction Temperature

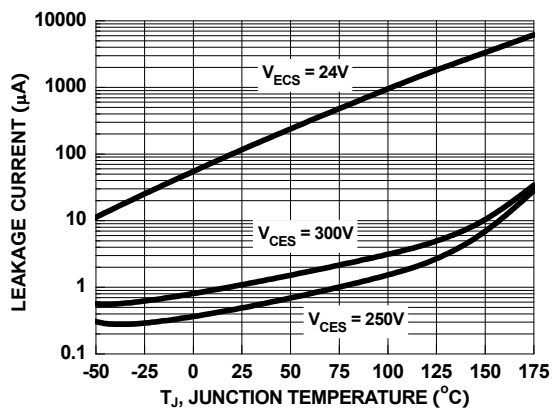


Figure 11. Leakage Current vs. Junction Temperature

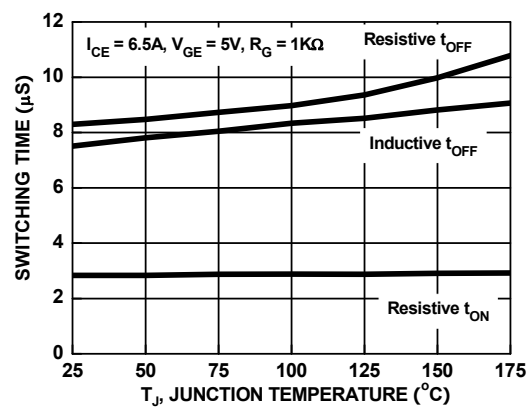


Figure 12. Switching Time vs. Junction Temperature

## Typical Performance Curves (Continued)

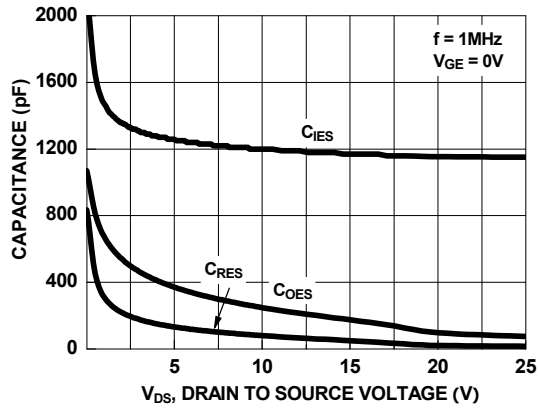


Figure 13. Capacitance vs. Collector to Emitter Voltage

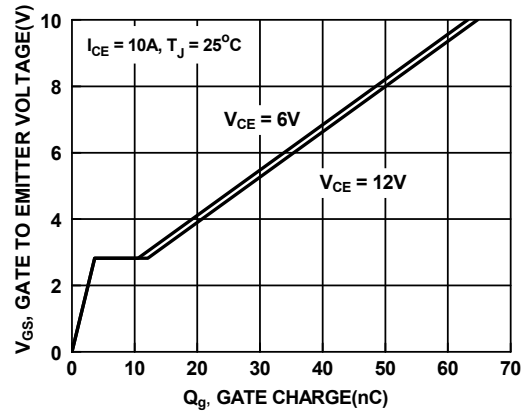


Figure 14. Gate Charge

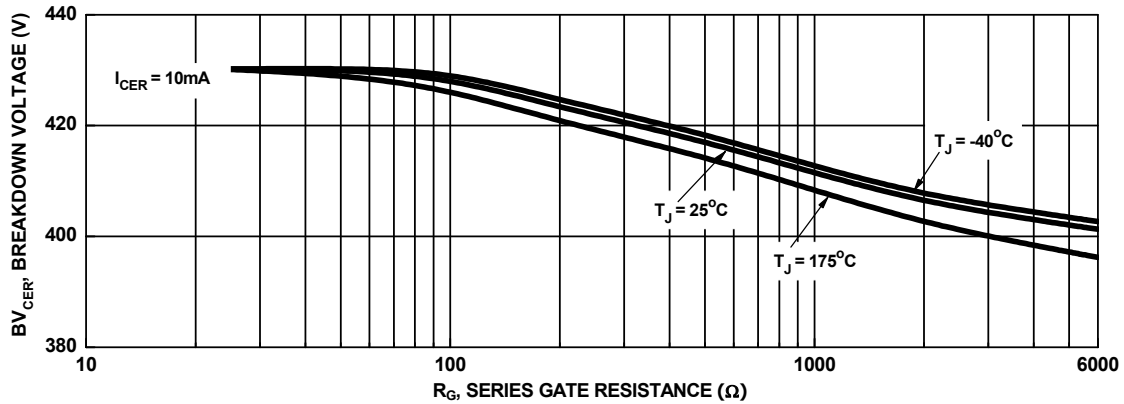


Figure 15. Break down Voltage vs. Series Gate Resistance

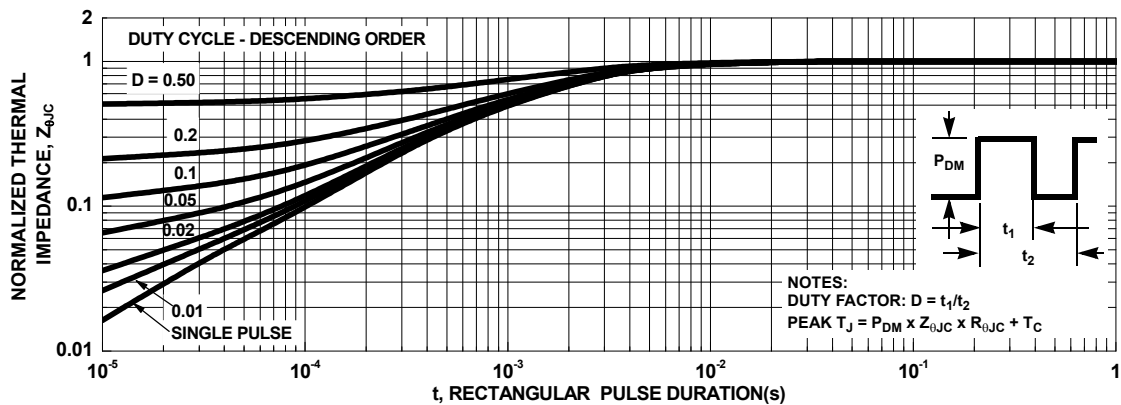


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

## Test Circuit and Waveforms

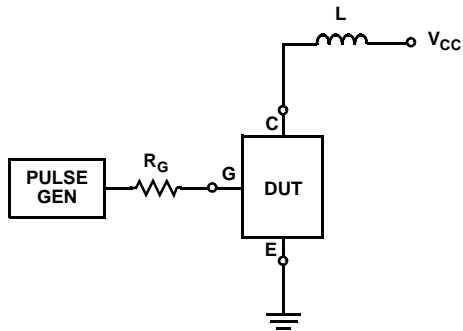


Figure 17. Inductive Switching Test Circuit

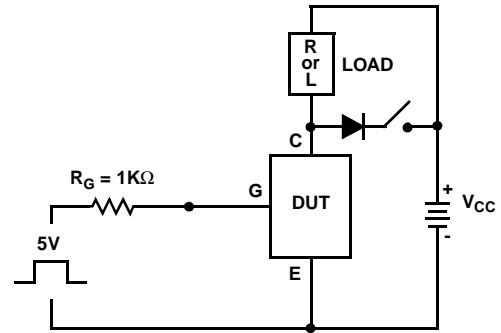


Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

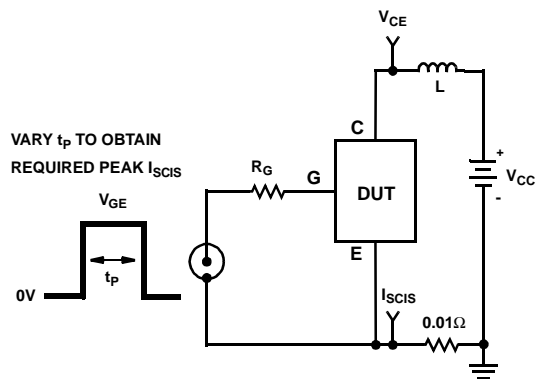


Figure 19. Energy Test Circuit

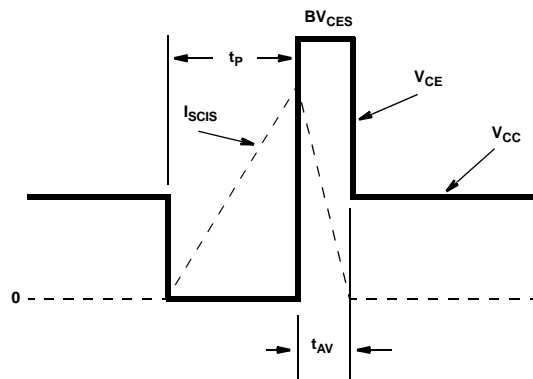



Figure 20. Energy Waveforms

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