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May 2014



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

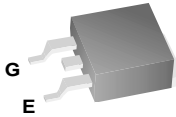
Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

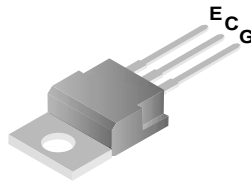


Package

JEDEC TO-263AB
D²-Pak



JEDEC TO-220AB

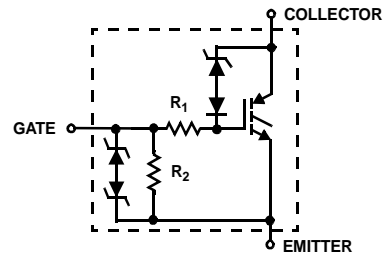


JEDEC TO-252AA
D-Pak



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 | ± 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 Ω | 4 | kV |

FGB3440G2_F085 / FGD3440G2_F085 / FGP3440G2_F085

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 |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Off State Characteristics

| | | | | | | | |
|------------|--|--|---------------------------|----------|-----|----------|---------------|
| BV_{CER} | Collector to Emitter Breakdown Voltage | $I_{CE} = 2\text{mA}, V_{GE} = 0,$ $R_{GE} = 1\text{K}\Omega,$ $T_J = -40 \text{ to } 150^\circ\text{C}$ | 370 | 400 | 430 | V | |
| BV_{CES} | Collector to Emitter Breakdown Voltage | $I_{CE} = 10\text{mA}, V_{GE} = 0V,$ $R_{GE} = 0,$ $T_J = -40 \text{ to } 150^\circ\text{C}$ | 390 | 420 | 450 | V | |
| BV_{ECS} | Emitter to Collector Breakdown Voltage | $I_{CE} = -20\text{mA}, V_{GE} = 0V,$ $T_J = 25^\circ\text{C}$ | 28 | - | - | V | |
| BV_{GES} | Gate to Emitter Breakdown Voltage | $I_{GES} = \pm 2\text{mA}$ | ± 12 | ± 14 | - | V | |
| I_{CER} | Collector to Emitter Leakage Current | $V_{CE} = 250V, R_{GE}=1\text{K}\Omega$ | $T_J = 25^\circ\text{C}$ | - | - | 25 | μA |
| | | | $T_J = 150^\circ\text{C}$ | - | - | 1 | mA |
| I_{ECS} | Emitter to Collector Leakage Current | $V_{EC} = 24V,$ | $T_J = 25^\circ\text{C}$ | - | - | 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

| | | | | | | | |
|---------------|---|---|---------------------------|---|-----|------|----|
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE} = 6A, V_{GE} = 4V,$ | $T_J = 25^\circ\text{C}$ | - | 1.1 | 1.2 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE} = 10A, V_{GE} = 4.5V,$ | $T_J = 150^\circ\text{C}$ | - | 1.3 | 1.45 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE} = 15A, V_{GE} = 4.5V,$ | $T_J = 150^\circ\text{C}$ | - | 1.6 | 1.75 | V |
| E_{SCIS} | Self Clamped Inductive Switching | $L = 3.0 \text{ mHy}, V_{GE} = 5V$ $R_G = 1\text{K}\Omega, (\text{Note } 1)$ | $T_J = 25^\circ\text{C}$ | - | - | 335 | mJ |

Notes:

- 1: Self Clamping Inductive Switching Energy (E_{SCIS25}) of 335mJ is based on the test conditions that is starting $T_J=25^\circ\text{C}; L=3\text{mHy}, I_{SCIS}=15A, V_{CC}=100V$ during inductor charging and $V_{CC}=0V$ during the time in clamp.
- 2: Self Clamping Inductive Switching Energy ($E_{SCIS150}$) of 195mJ is based on the test conditions that is starting $T_J=150^\circ\text{C}; L=3\text{mHy}, I_{SCIS}=11.4A, V_{CC}=100V$ during inductor charging and $V_{CC}=0V$ 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 | $I_{CE} = 10\text{A}, V_{CE} = 12\text{V}, V_{GE} = 5\text{V}$ | - | 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 | μs |
| 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 | μs |
| $t_{d(OFF)L}$ | Current Turn-Off Delay Time-Inductive | $V_{CE} = 300\text{V}, L = 1\text{mH}, V_{GE} = 5\text{V}, R_G = 1\text{K}\Omega$ | - | 5.3 | 15 | μs |
| t_{fL} | Current Fall Time-Inductive | $I_{CE} = 6.5\text{A}, T_J = 25^\circ\text{C}$ | - | 2.3 | 15 | μs |

Thermal Characteristics

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

Typical Performance Curves

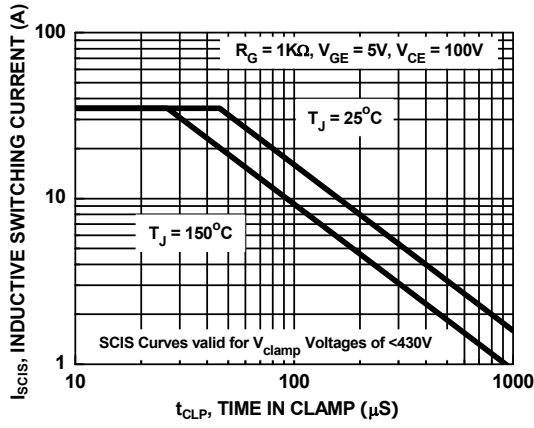


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

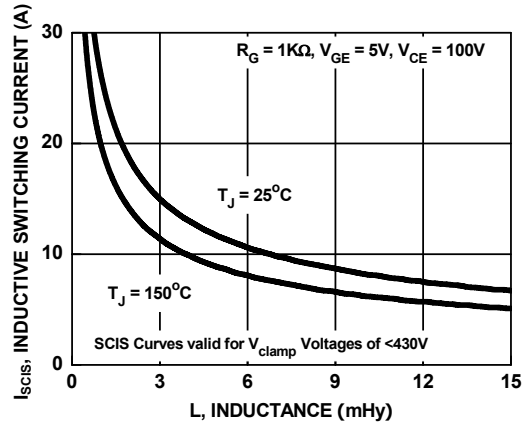


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

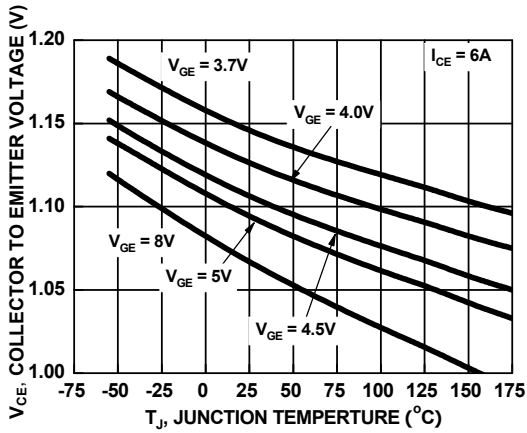


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

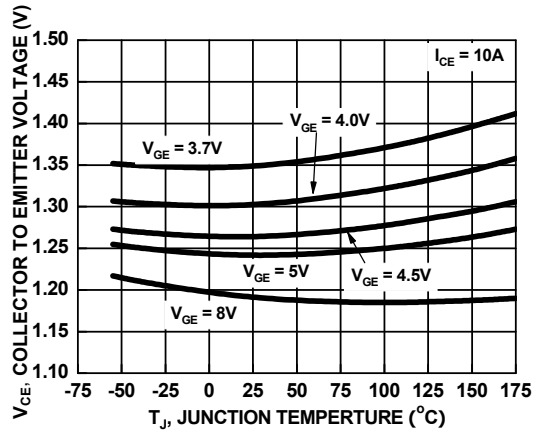


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

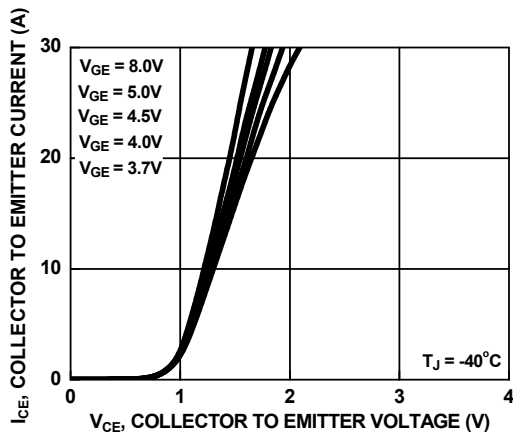


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

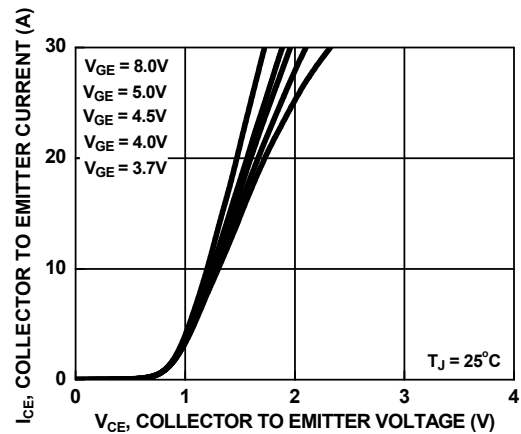


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves (Continued)

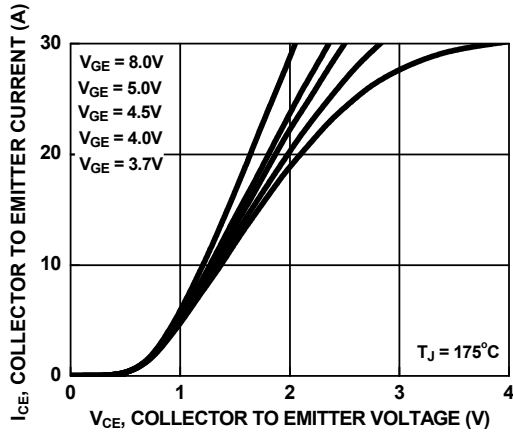


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

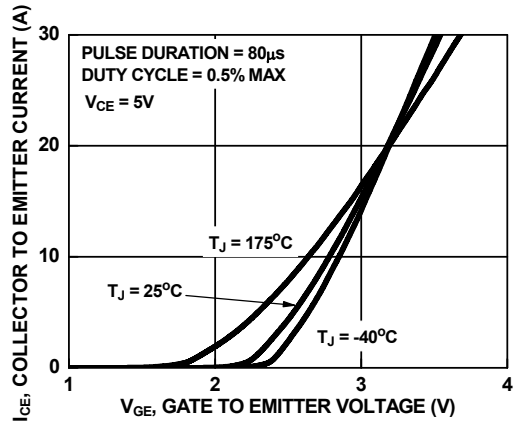


Figure 8. Transfer Characteristics

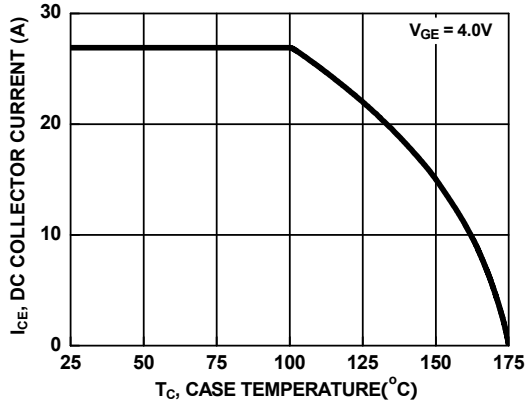


Figure 9. DC Collector Current vs. Case Temperature

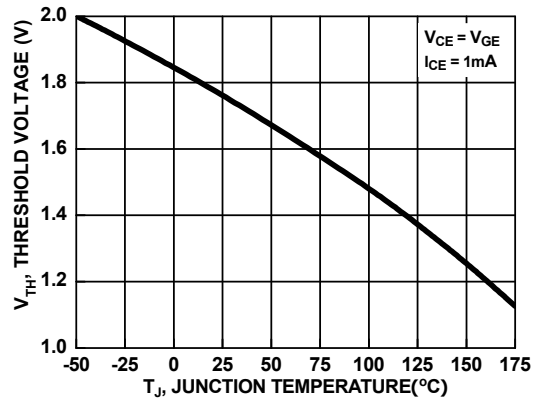


Figure 10. Threshold Voltage vs. Junction Temperature

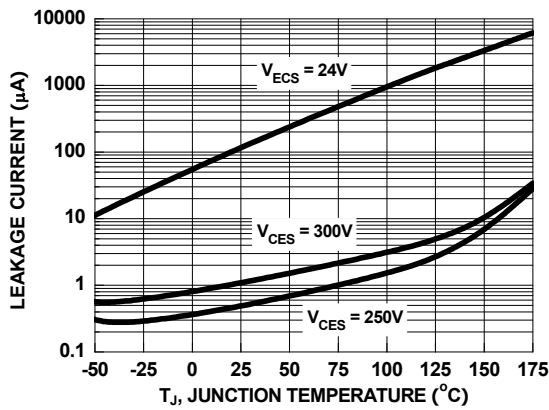


Figure 11. Leakage Current vs. Junction Temperature

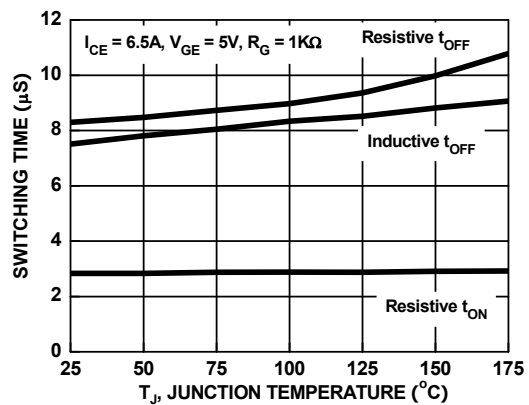


Figure 12. Switching Time vs. Junction Temperature

Typical Performance Curves (Continued)

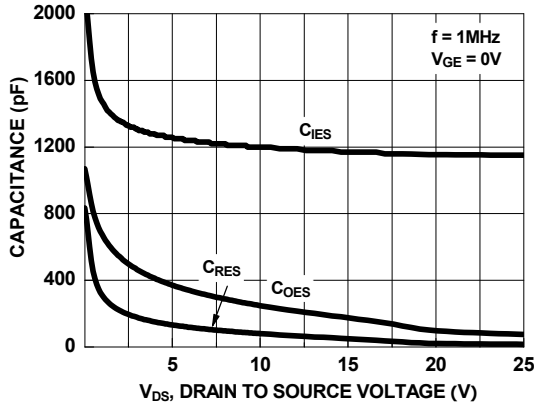


Figure 13. Capacitance vs. Collector to Emitter Voltage

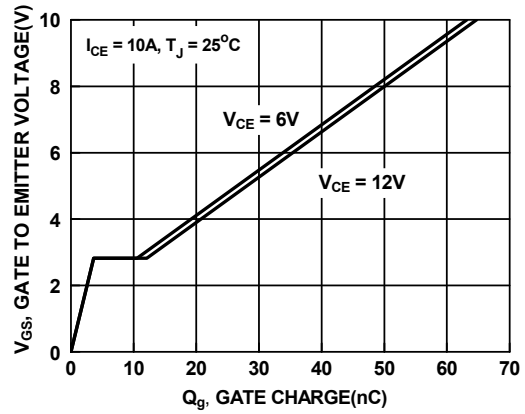


Figure 14. Gate Charge

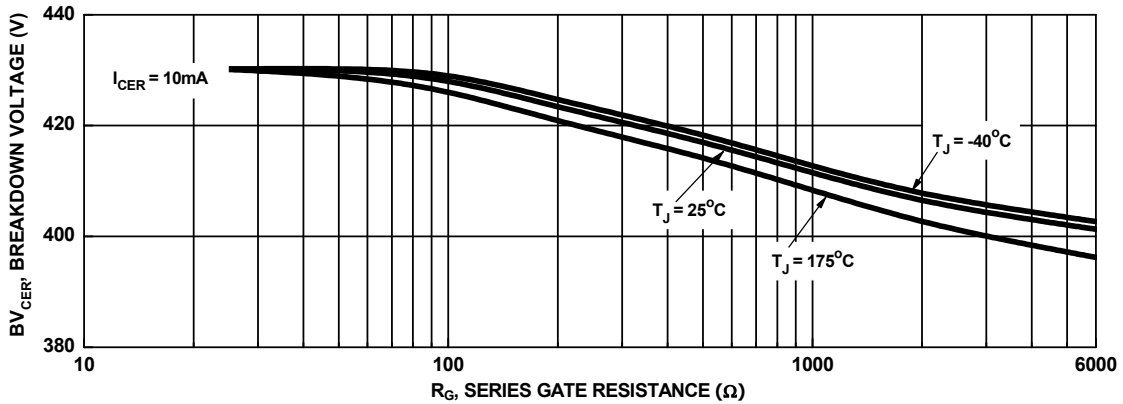


Figure 15. Break down Voltage vs. Series Gate Resistance

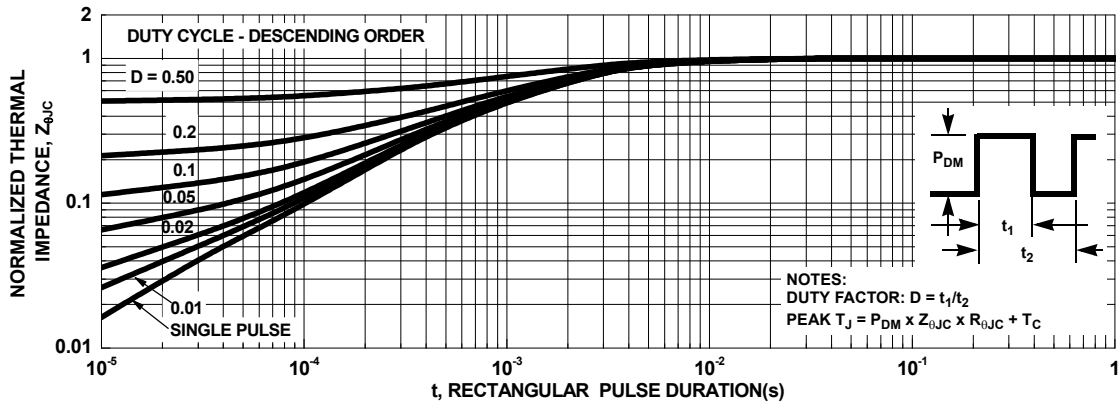


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

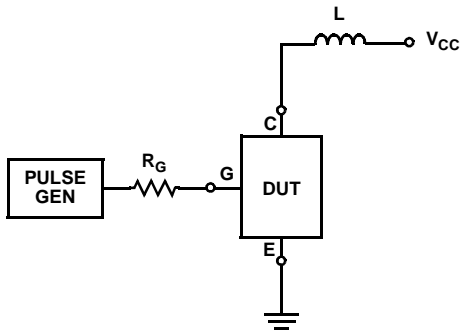


Figure 17. Inductive Switching Test Circuit

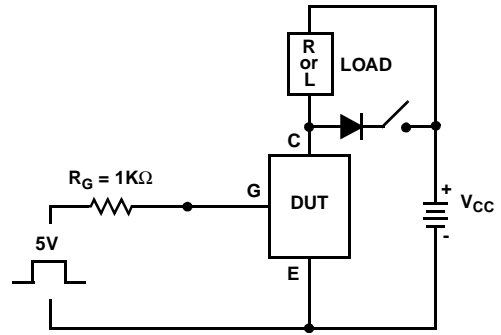


Figure 18. t_{ON} and t_{OFF} Switching Test Circuit

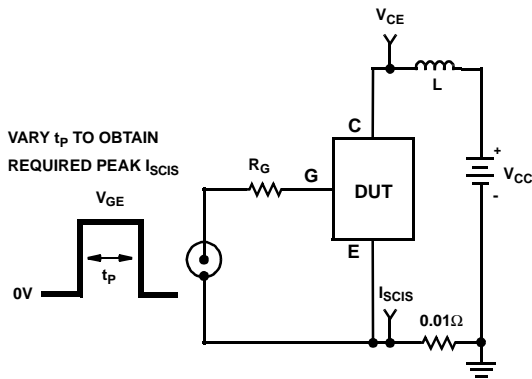


Figure 19. Energy Test Circuit

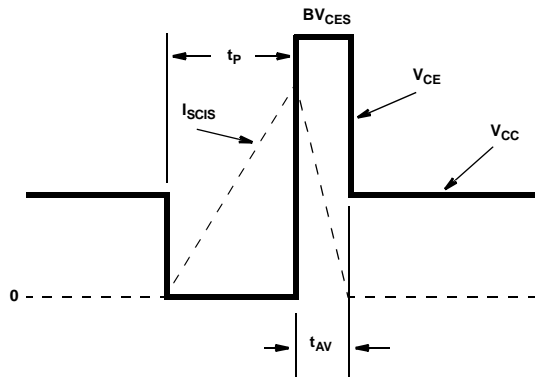







Figure 20. Energy Waveforms



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