



ON Semiconductor®

FGD3245G2-F085 / FGB3245G2-F085

EcoSPARK® 2 320mJ, 450V, N-Channel Ignition IGBT

Features

- SCIS Energy = 320mJ at $T_J = 25^\circ\text{C}$
- 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

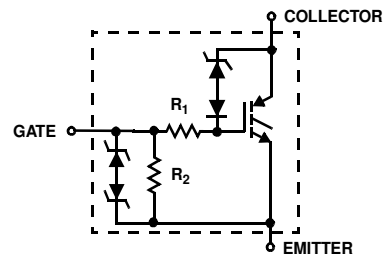
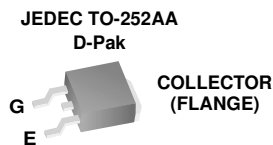
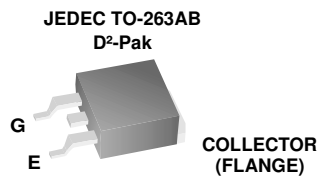
The FGB3245G2-F085 and FGD3245G2 are N-channel IGBTs designed in ON Semiconductor's EcoSPARK-2 technology which helps in eliminating external protection circuitry. The technology is optimized for driving the coil in the harsh environment of automotive ignition systems and offers out-standing V_{sat} 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 | ± 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 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 |
|----------------|----------------|---------|-----------|------------|------------|
| 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 |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

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°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°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 | $I_{GES} = \pm 2\text{mA}$ | ± 12 | ± 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 | μA |
| | | | $T_J = 150^\circ\text{C}$ | - | - | 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 | - | Ω | |
| R_2 | Gate to Emitter Resistance | | 10K | - | 30K | Ω | |

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

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 | μs | |
| t_{rR} | Current Rise Time-Resistive | $V_{GE} = 5\text{V}, R_G = 1\text{K}\Omega$ $T_J = 25^\circ\text{C},$ | - | 2.6 | 7 | μs | |
| $t_{d(OFF)L}$ | Current Turn-Off Delay Time-Inductive | $V_{CE} = 300\text{V}, L = 1\text{mH},$ | - | 5.4 | 15 | μs | |
| 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 | μs | |
| 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 | $^\circ\text{C/W}$ |
|-----------------|-------------------------------------|--------------|---|---|-----|--------------------|

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

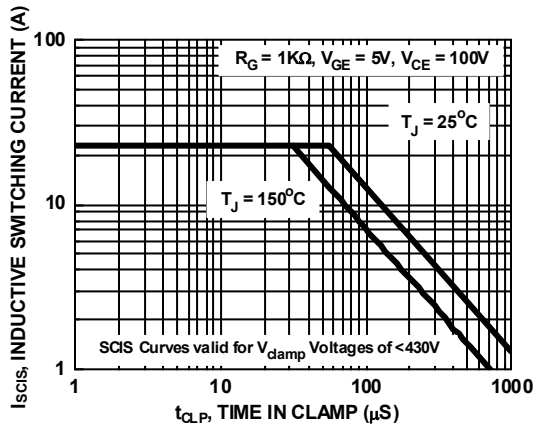


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

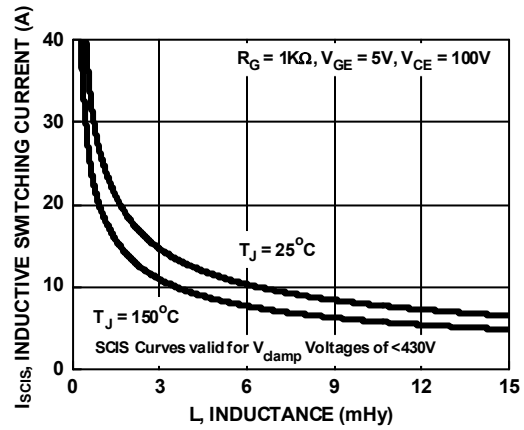


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

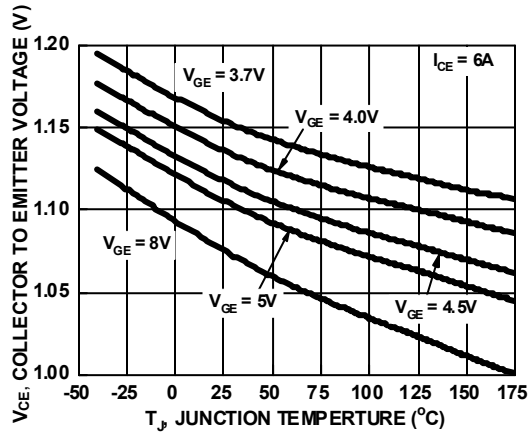


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

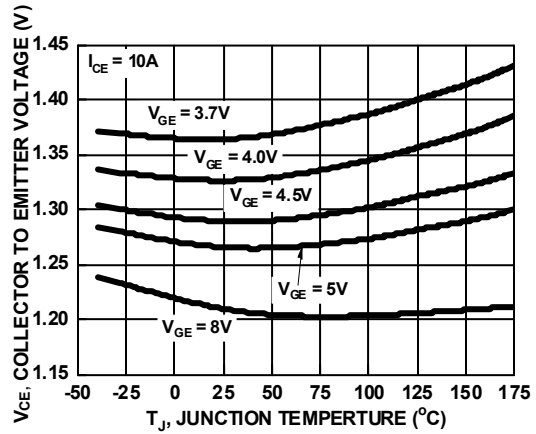


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

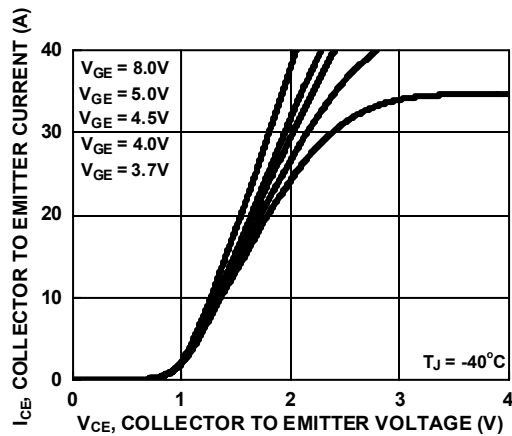


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

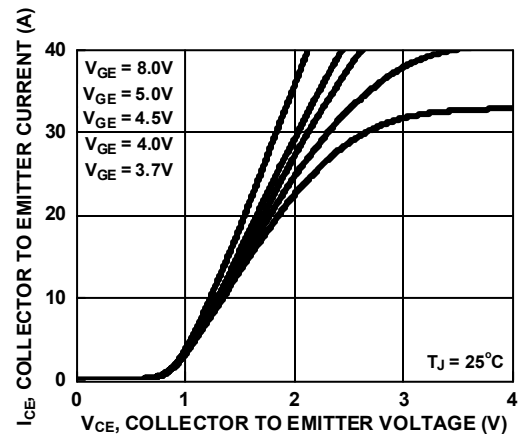


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves (Continued)

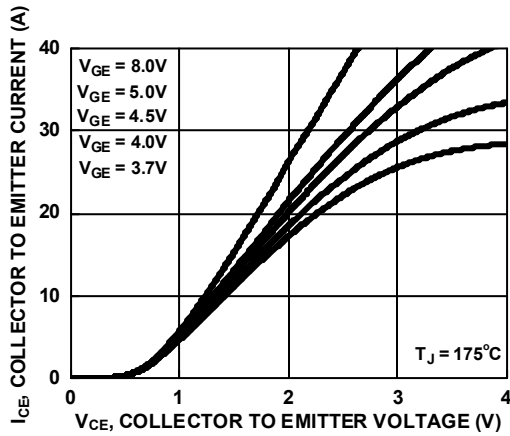


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

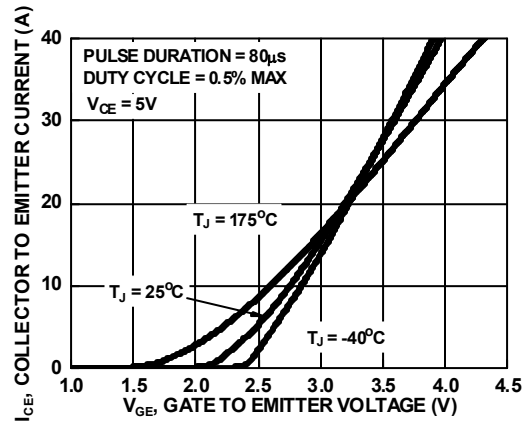


Figure 8. Transfer Characteristics

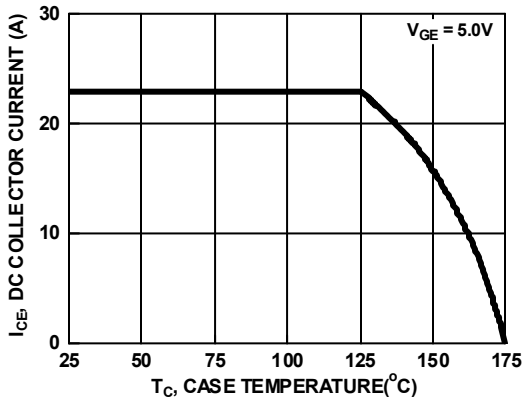


Figure 9. DC Collector Current vs. Case Temperature

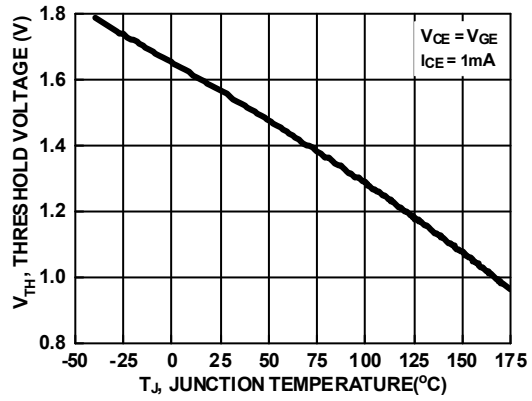


Figure 10. Threshold Voltage vs. Junction Temperature

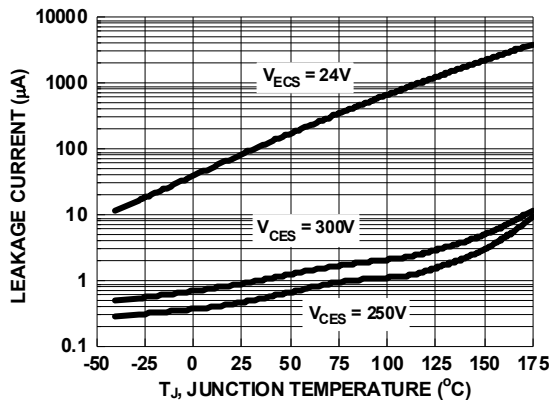


Figure 11. Leakage Current vs. Junction Temperature

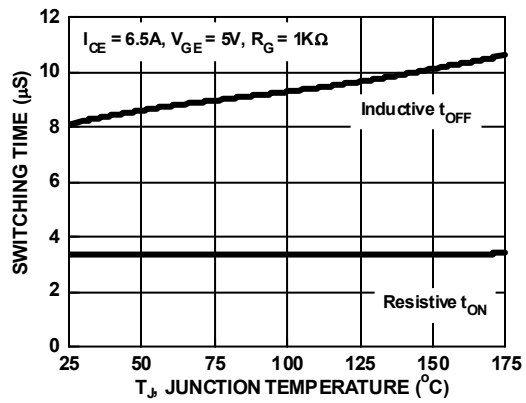


Figure 12. Switching Time vs. Junction Temperature

Typical Performance Curves (Continued)

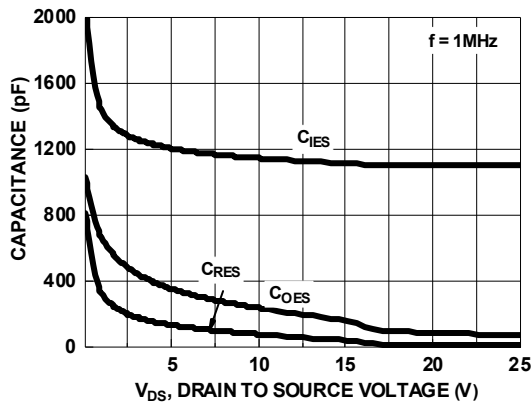


Figure 13. Capacitance vs. Collector to Emitter Voltage

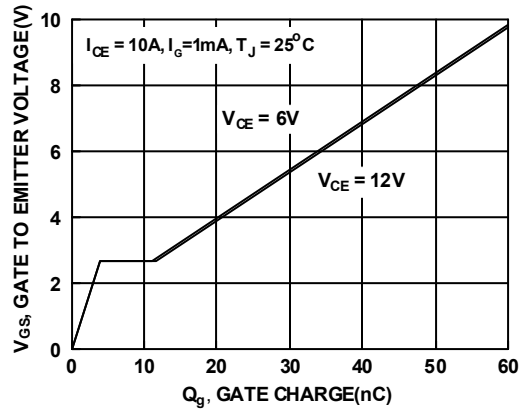


Figure 14. Gate Charge

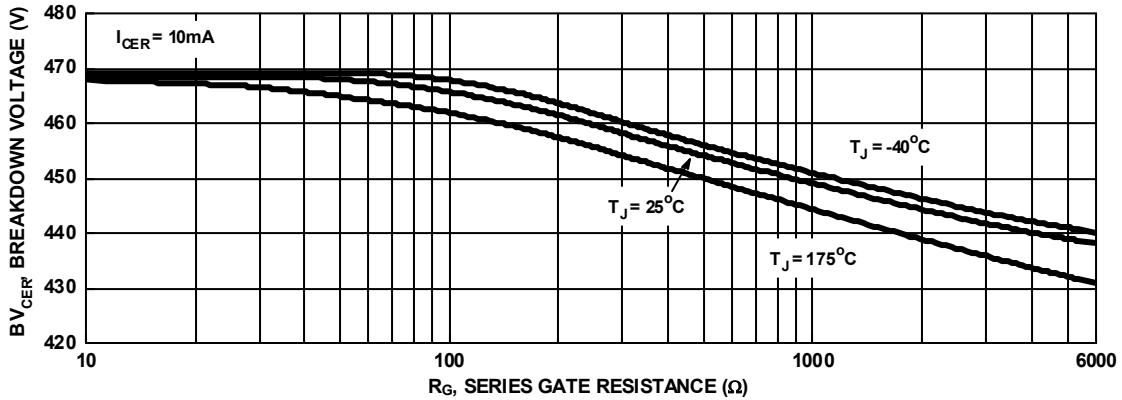


Figure 15. Break down Voltage vs. Series Gate Resistance

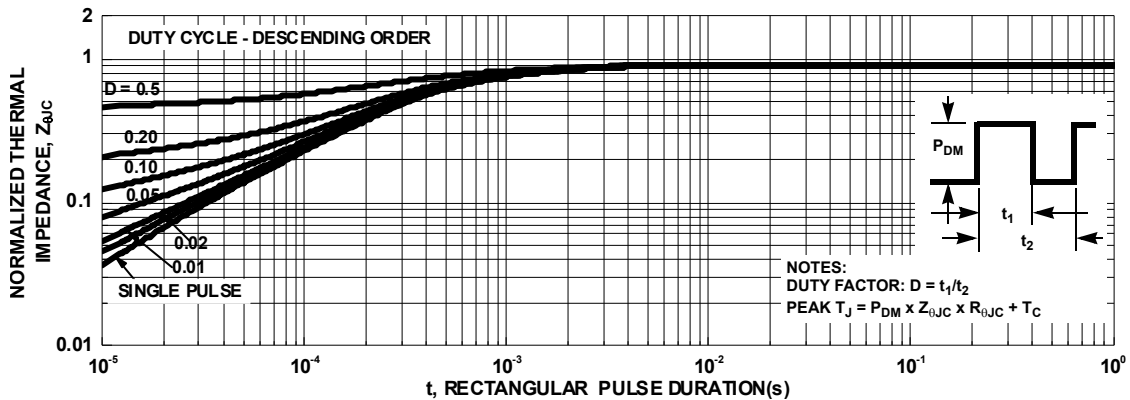


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

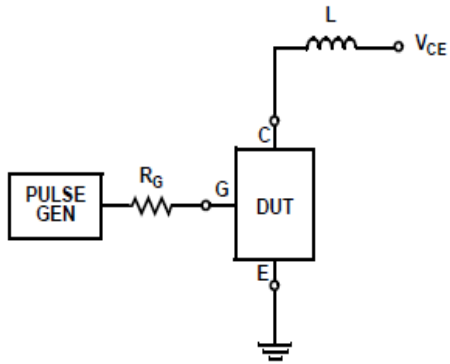


Figure 17. Inductive Switching Test Circuit

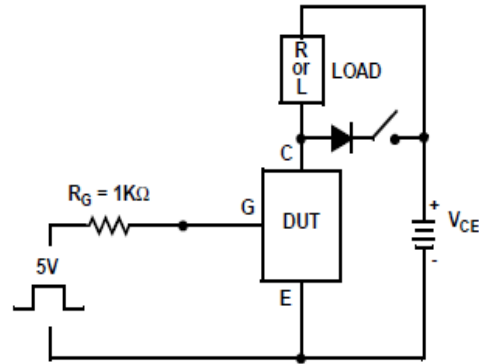


Figure 18. t_{ON} and t_{OFF} Switching Test Circuit

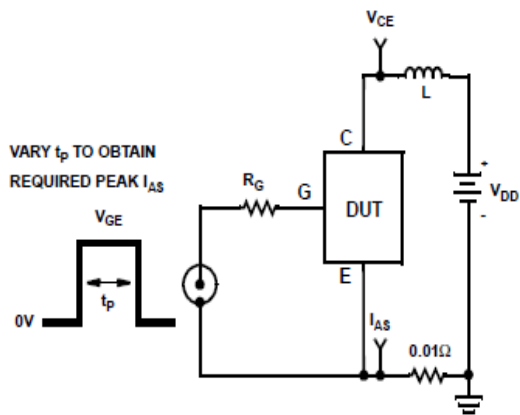


Figure 19. Energy Test Circuit

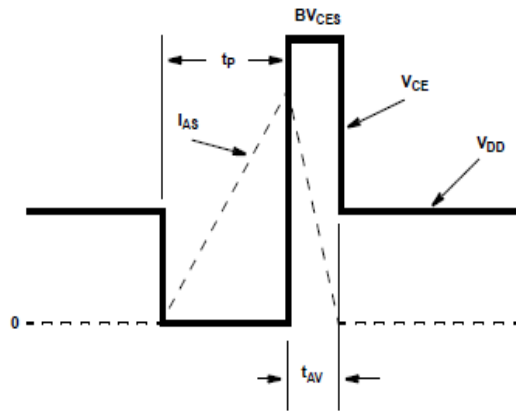



Figure 20. Energy Waveforms

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