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ON Semiconductor®

## FGD3325G2-F085

### EcoSPARK®2 330mJ, 250V, N-Channel Ignition IGBT

#### Features

- SCIS Energy = 330mJ at  $T_j = 25^\circ\text{C}$
- Logic Level Gate Drive
- Qualified to AEC Q101
- RoHS Compliant

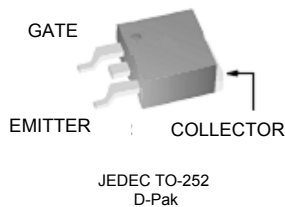
#### Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

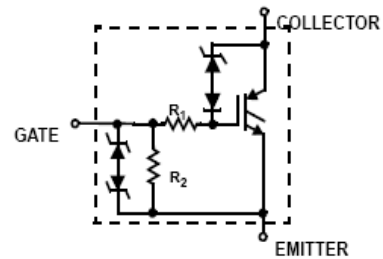


FGD3325G2-F085 EcoSPARK®2 330mJ, 250V, N-Channel Ignition IGBT

#### Package



#### Symbol



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

| Symbol        | Parameter                                                                                               | Ratings     | Units               |
|---------------|---------------------------------------------------------------------------------------------------------|-------------|---------------------|
| $BV_{CER}$    | Collector to Emitter Breakdown Voltage ( $I_C = 1\text{mA}$ )                                           | 250         | V                   |
| $BV_{ECS}$    | Emitter to Collector Voltage - Reverse Battery Condition ( $I_C = 10\text{mA}$ )                        | 28          | V                   |
| $E_{SCIS25}$  | $I_{SCIS} = 14.8\text{A}$ , $L = 3.0\text{mH}$ , $R_{GE} = 1\text{K}\Omega$ , $T_C = 25^\circ\text{C}$  | 330         | mJ                  |
| $E_{SCIS150}$ | $I_{SCIS} = 11.4\text{A}$ , $L = 3.0\text{mH}$ , $R_{GE} = 1\text{K}\Omega$ , $T_C = 150^\circ\text{C}$ | 195         | mJ                  |
| $I_{C25}$     | Collector Current Continuous, at $V_{GE} = 5.0\text{V}$ , $T_C = 25^\circ\text{C}$                      | 41          | A                   |
| $I_{C110}$    | Collector Current Continuous, at $V_{GE} = 5.0\text{V}$ , $T_C = 110^\circ\text{C}$                     | 25          | A                   |
| $V_{GEM}$     | Gate to Emitter Voltage Continuous                                                                      | $\pm 10$    | V                   |
| $P_D$         | Power Dissipation Total, at $T_C = 25^\circ\text{C}$                                                    | 150         | W                   |
|               | Power Dissipation Derating, for $T_C > 25^\circ\text{C}$                                                | 1.0         | W/ $^\circ\text{C}$ |
| $T_J$         | Operating Junction Temperature Range                                                                    | -55 to +175 | $^\circ\text{C}$    |
| $T_{STG}$     | Storage Junction Temperature Range                                                                      | -55 to +175 | $^\circ\text{C}$    |
| $T_L$         | Max. Lead Temp. for Soldering (Leads at 1.6mm from case for 10s)                                        | 300         | $^\circ\text{C}$    |
| $T_{PKG}$     | Reflow soldering according to JESD020C                                                                  | 260         | $^\circ\text{C}$    |
| ESD           | HBM-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   |
|----------------|----------------|---------|-----------|------------|------------|
| FGD3325G2      | FGD3325G2-F085 | TO252   | 330mm     | 16mm       | 2500 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 | $I_{CE} = 2\text{mA}$ , $V_{GE} = 0$ ,<br>$R_{GE} = 1\text{K}\Omega$ ,<br>$T_J = -40$ to $150^\circ\text{C}$ | 225                       | -        | 275 | V        |               |
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage | $I_{CE} = 10\text{mA}$ , $V_{GE} = 0\text{V}$ ,<br>$R_{GE} = 0$ ,<br>$T_J = -40$ to $150^\circ\text{C}$      | 240                       | -        | 290 | V        |               |
| $BV_{ECS}$ | Emitter to Collector Breakdown Voltage | $I_{CE} = -75\text{mA}$ , $V_{GE} = 0\text{V}$ ,<br>$T_J = 25^\circ\text{C}$                                 | 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   | $V_{CE} = 175\text{V}$ , $R_{GE} = 1\text{K}\Omega$                                                          | $T_J = 25^\circ\text{C}$  | -        | -   | 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 | $I_{CE} = 6\text{A}$ , $V_{GE} = 4\text{V}$ ,<br>$T_J = 25^\circ\text{C}$     | - | 1.15 | 1.25 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE} = 10\text{A}$ , $V_{GE} = 4.5\text{V}$ ,<br>$T_J = 150^\circ\text{C}$ | - | 1.35 | 1.50 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE} = 15\text{A}$ , $V_{GE} = 4.5\text{V}$ ,<br>$T_J = 150^\circ\text{C}$ | - | 1.68 | 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                       | $I_{CE} = 10\text{A}$ , $V_{CE} = 12\text{V}$ ,<br>$V_{GE} = 5\text{V}$ | -    | 21  | -   | nC |
| $V_{GE(TH)}$ | Gate to Emitter Threshold Voltage | $I_{CE} = 1\text{mA}$ , $V_{CE} = V_{GE}$ ,<br>$T_J = 25^\circ\text{C}$ | 1.3  | 1.5 | 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  | $V_{CE} = 14\text{V}$ , $R_L = 1\Omega$                                                               | - | 0.8 | 4  | $\mu\text{s}$ |
| $t_{rR}$      | Current Rise Time-Resistive           | $V_{GE} = 5\text{V}$ , $R_G = 1\text{K}\Omega$ ,<br>$T_J = 25^\circ\text{C}$                          | - | 1.2 | 7  |               |
| $t_{d(OFF)L}$ | Current Turn-Off Delay Time-Inductive | $V_{CE} = 190\text{V}$ , $L = 1\text{mH}$ ,                                                           | - | 5.1 | 15 | $\mu\text{s}$ |
| $t_{fL}$      | Current Fall Time-Inductive           | $V_{GE} = 5\text{V}$ , $R_G = 1\text{K}\Omega$ ,<br>$I_{CE} = 6.5\text{A}$ , $T_J = 25^\circ\text{C}$ | - | 2.2 | 15 |               |

**Thermal Characteristics**

|                 |                                     |  |   |   |   |                    |
|-----------------|-------------------------------------|--|---|---|---|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case |  | - | - | 1 | $^\circ\text{C/W}$ |
|-----------------|-------------------------------------|--|---|---|---|--------------------|

## Typical Performance Curves

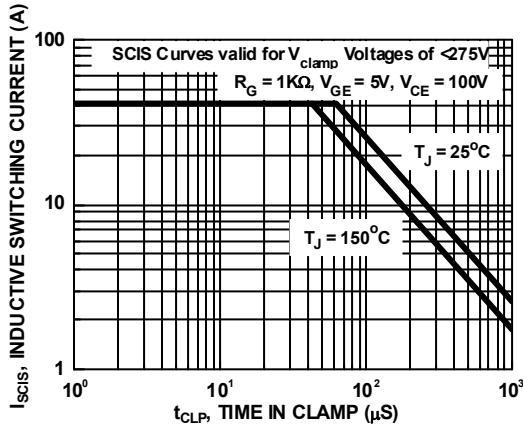


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

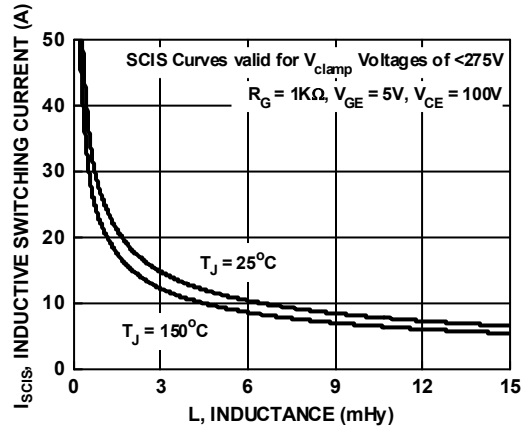


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

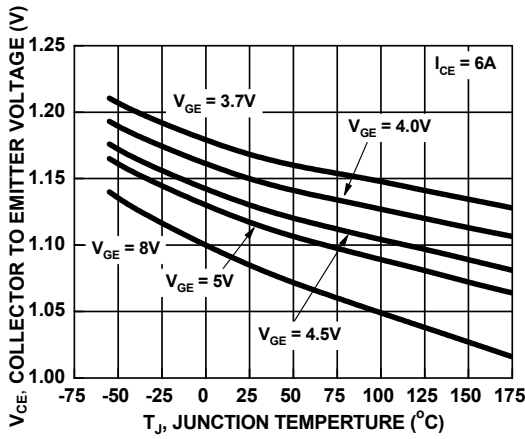


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

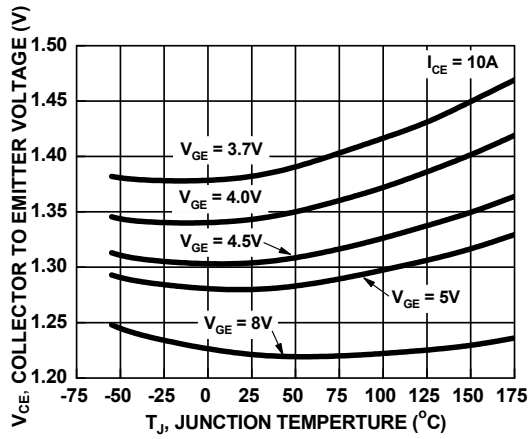


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

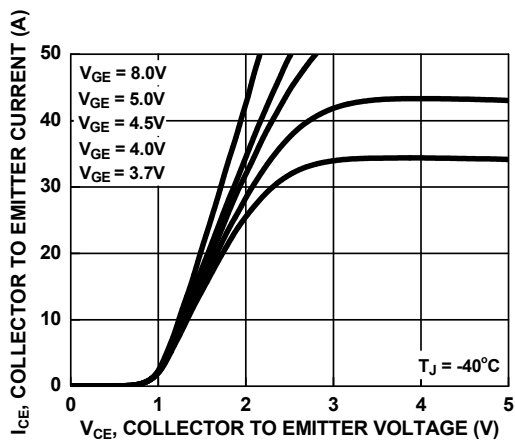


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

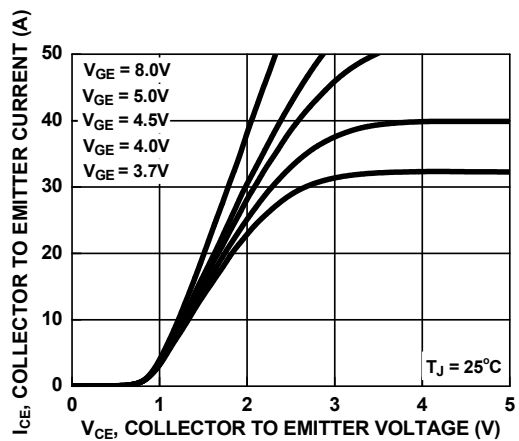


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves (Continued)

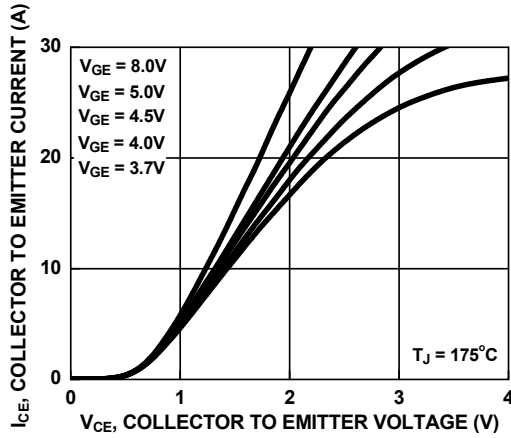


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

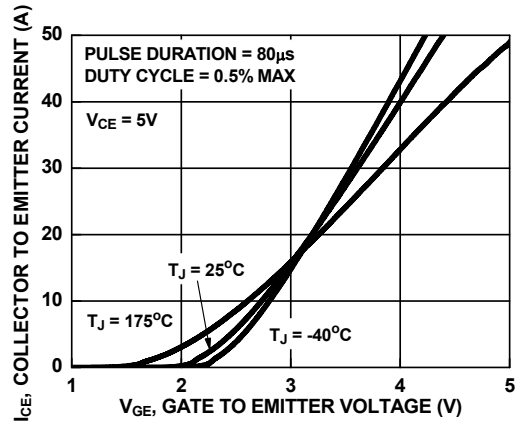


Figure 8. Transfer Characteristics

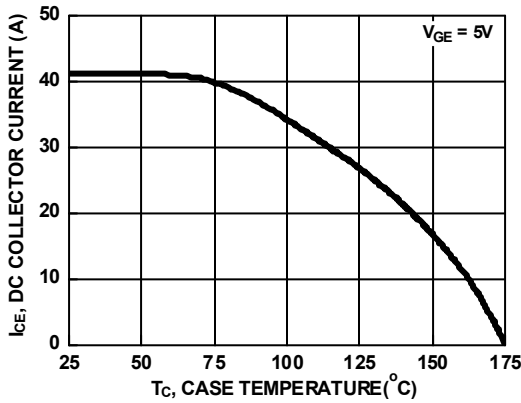


Figure 9. DC Collector Current vs. Case Temperature

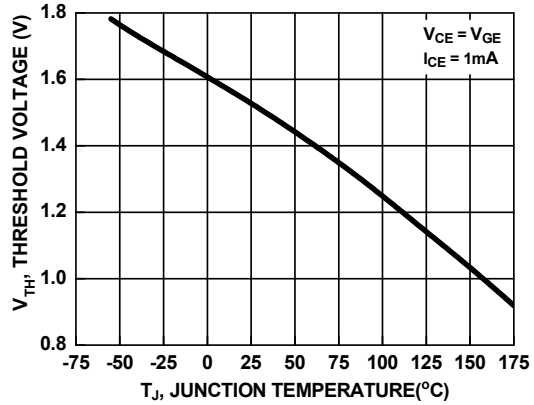


Figure 10. Threshold Voltage vs. Junction Temperature

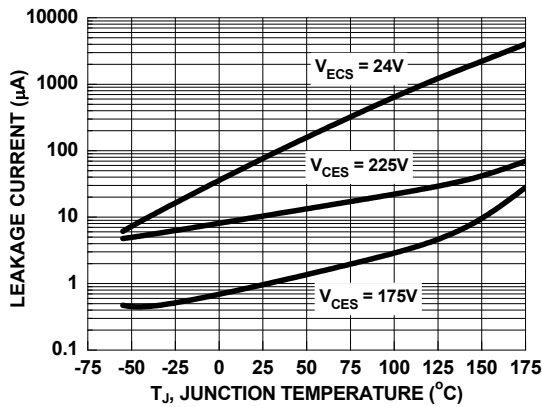


Figure 11. Leakage Current vs. Junction Temperature

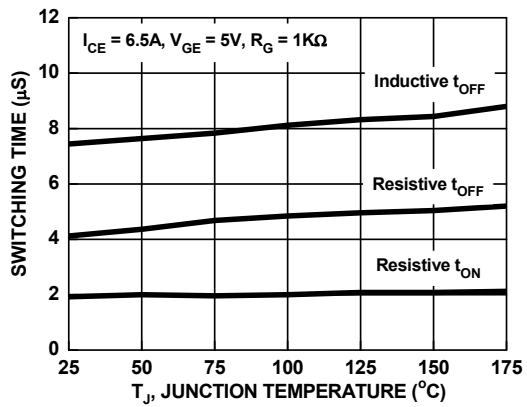


Figure 12. Switching Time vs. Junction Temperature

Typical Performance Curves (Continued)

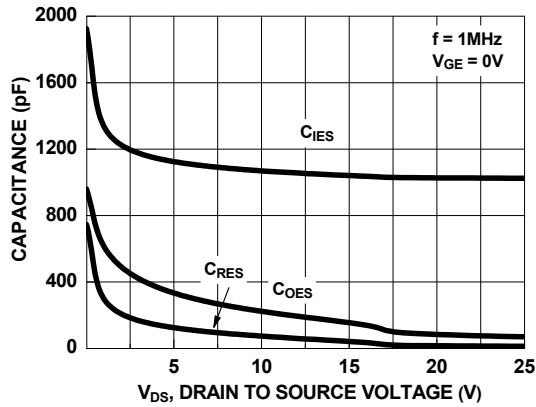


Figure 13. Capacitance vs. Collector to Emitter Voltage

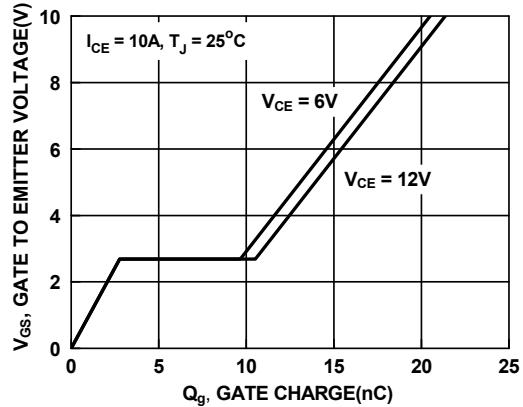


Figure 14. Gate Charge

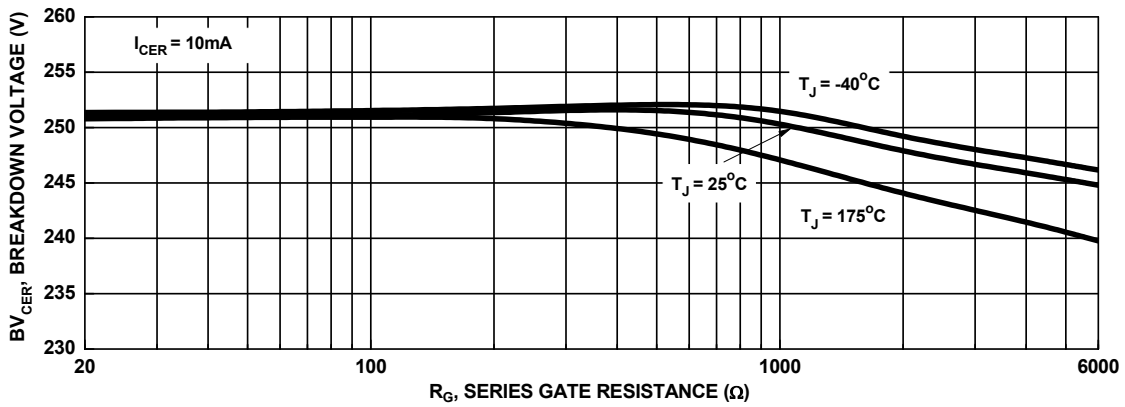


Figure 15. Break down Voltage vs. Series Gate Resistance

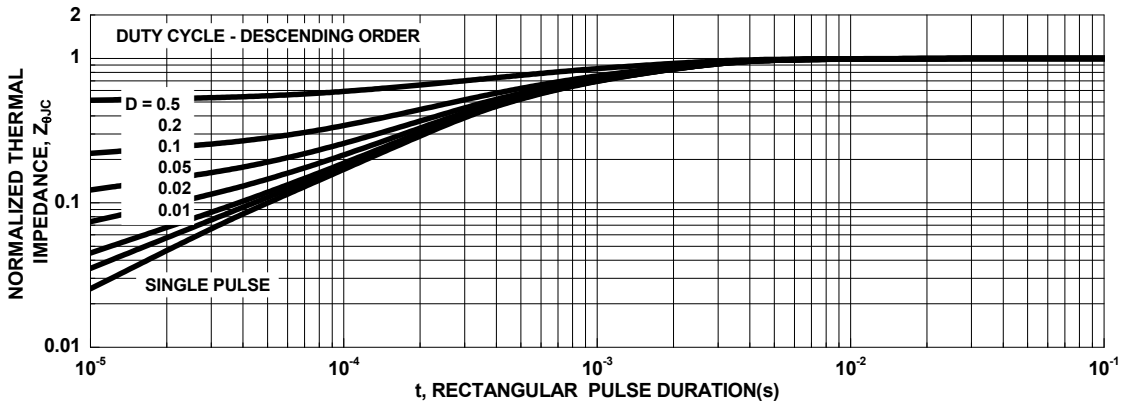
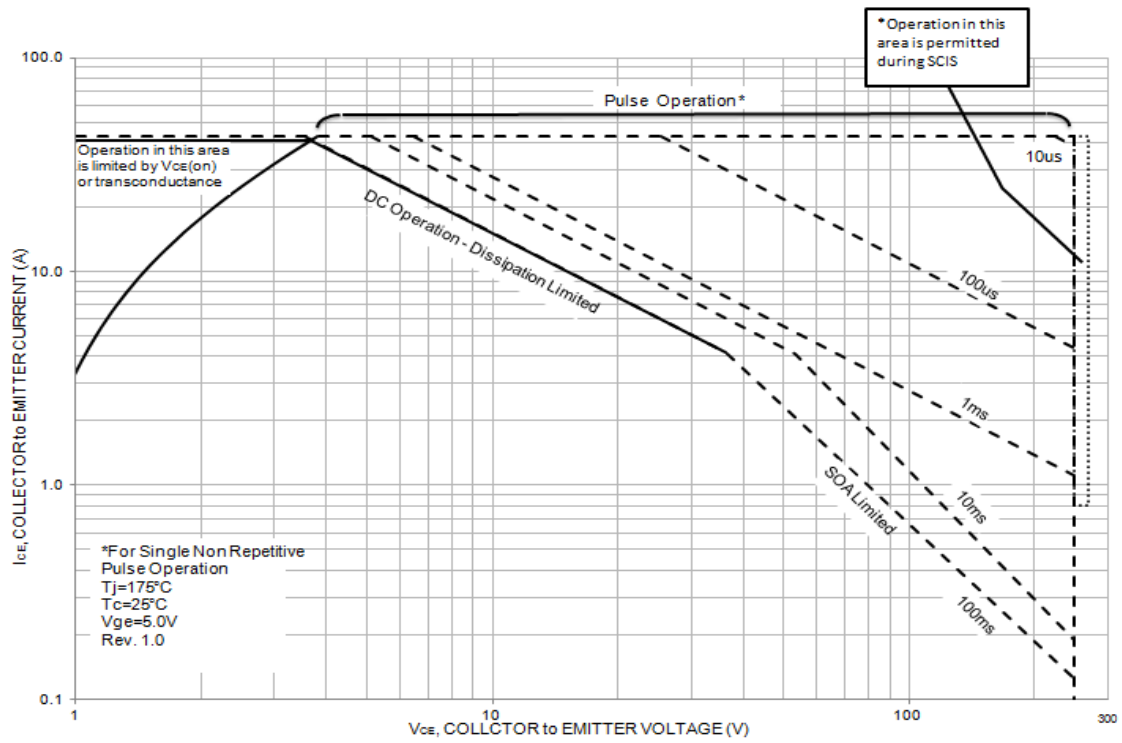


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

## Typical Performance Curves





## Test Circuit and Waveforms

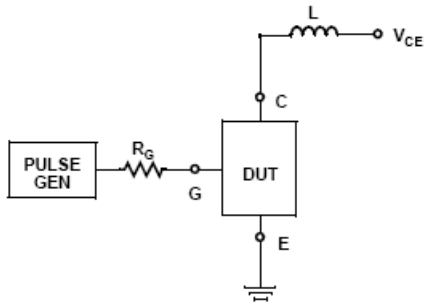


Figure 17. Inductive Switching Test Circuit

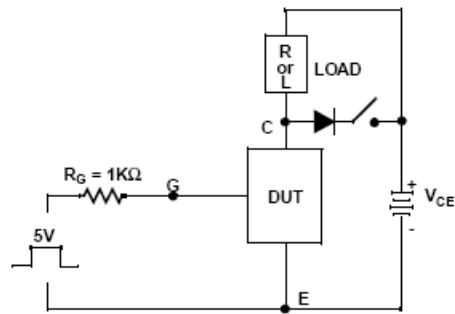


Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

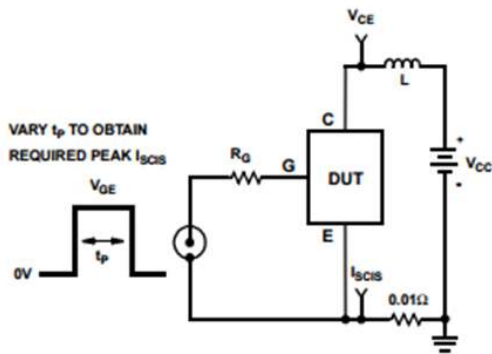


Figure 19. Energy Test Circuit

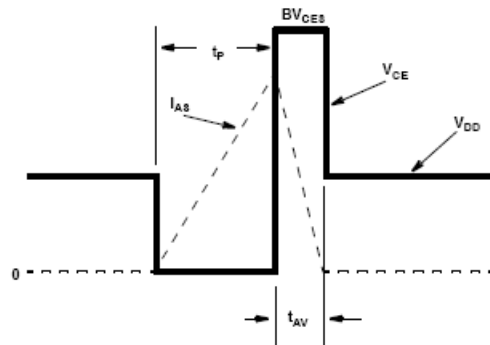
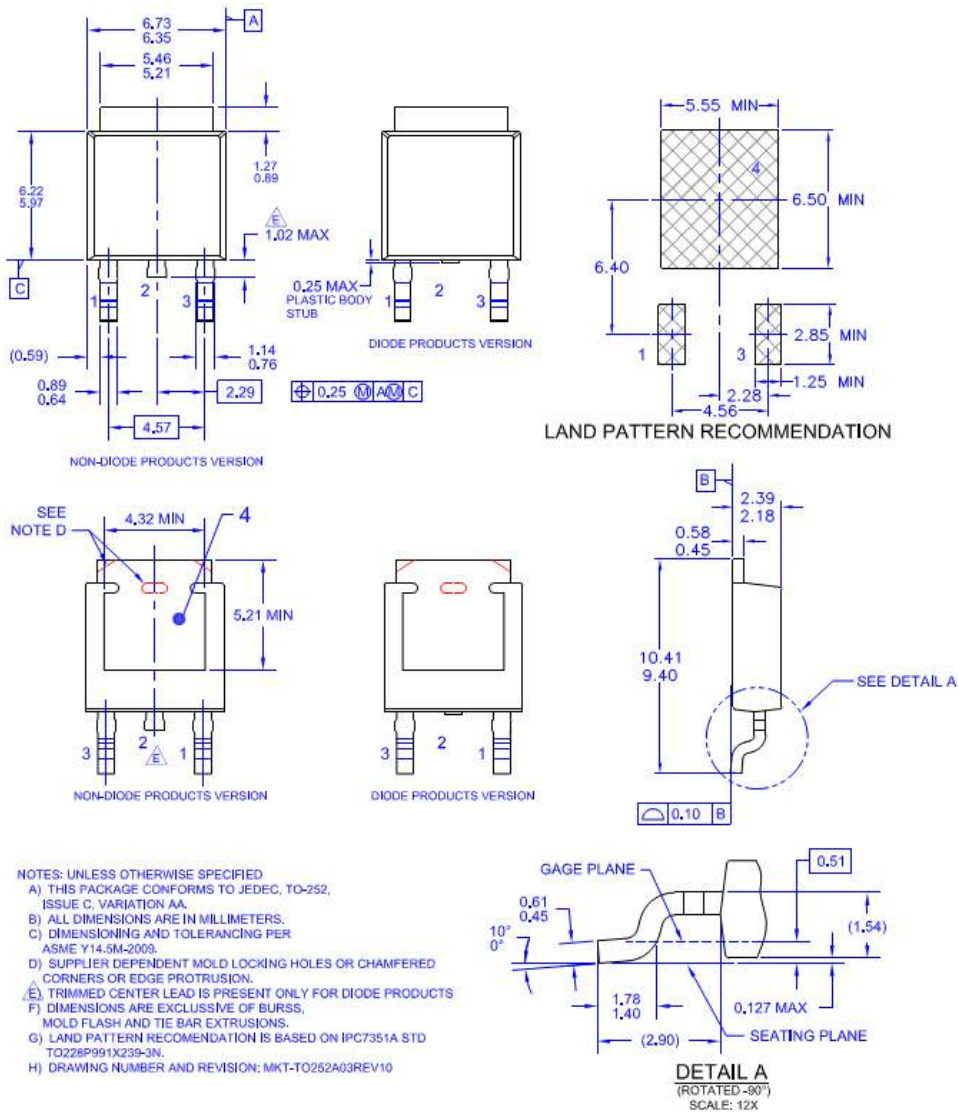



Figure 20. Energy Waveforms

## Mechanical Dimensions

### D-PAK



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