

# ECOSPARK® II, Ignition IGBT

300 mJ, 500 V, N-Channel Ignition IGBT

## FGD3050G2

### Features

- SCIS Energy = 300 mJ at  $T_J = 25^\circ\text{C}$
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- This Device is Pb-Free, Halid Free and is RoHS Compliant

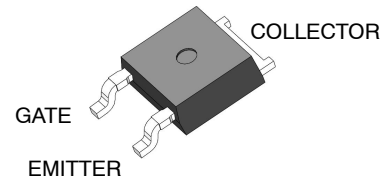
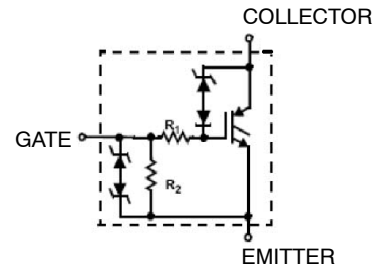
### Applications

- Automotive Ignition Coil Driver Circuits
- Coil on Plug Application

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

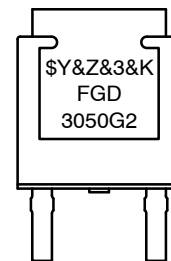
| Symbol               | Parameter                                                                                                                     | Value           | Unit                |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------|
| $BV_{\text{CER}}$    | Collector to Emitter Breakdown Voltage ( $I_C = 1 \text{ mA}$ )                                                               | 500             | V                   |
| $BV_{\text{ECS}}$    | Emitter to Collector Voltage – Reverse Battery Condition ( $I_C = 10 \text{ mA}$ )                                            | 20              | V                   |
| $E_{\text{SCIS25}}$  | $I_{\text{SCIS}} = 14.2 \text{ A}$ , $L = 3.0 \text{ mHy}$ , $R_{\text{GE}} = 1 \text{ k}\Omega$<br>$T_C = 25^\circ\text{C}$  | 300             | mJ                  |
| $E_{\text{SCIS150}}$ | $I_{\text{SCIS}} = 11.0 \text{ A}$ , $L = 3.0 \text{ mHy}$ , $R_{\text{GE}} = 1 \text{ k}\Omega$<br>$T_C = 150^\circ\text{C}$ | 180             | mJ                  |
| $I_{\text{C25}}$     | Collector Current Continuous at $V_{\text{GE}} = 5.0 \text{ V}$ , $T_C = 25^\circ\text{C}$                                    | 32              | A                   |
| $I_{\text{C110}}$    | Collector Current Continuous at $V_{\text{GE}} = 5.0 \text{ V}$ , $T_C = 110^\circ\text{C}$                                   | 27              | A                   |
| $V_{\text{GEM}}$     | Gate to Emitter Voltage Continuous                                                                                            | $\pm 10$        | V                   |
| $P_D$                | Power Dissipation Total, $T_C = 25^\circ\text{C}$                                                                             | 150             | W                   |
|                      | Power Dissipation Derating, $T_C > 25^\circ\text{C}$                                                                          | 1.1             | W/ $^\circ\text{C}$ |
| $T_J$                | Operating Junction Temperature Range                                                                                          | $-40$ to $+175$ | $^\circ\text{C}$    |
| $T_{\text{STG}}$     | Storage Junction Temperature Range                                                                                            | $-40$ to $+175$ | $^\circ\text{C}$    |
| $T_L$                | Max. Lead Temperature for Soldering (Leads at 1.6 mm from case for 10 s)                                                      | 300             | $^\circ\text{C}$    |
| $T_{\text{PKG}}$     | Max. Lead Temperature for Soldering (Package Body for 10 s)                                                                   | 260             | $^\circ\text{C}$    |
| ESD                  | Electrostatic Discharge Voltage at 100 pF, 1500 $\Omega$                                                                      | 4               | kV                  |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



DPAK3 (TO-252 3 LD)  
CASE 369AS

### MARKING DIAGRAM



$\$Y$  = onsemi Logo  
 $\&Z$  = Assembly Plant Code  
 $\&3$  = 3-Digit Date Code  
 $\&K$  = 2-Digits Lot Run Traceability Code  
FGD3050G2 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# FGD3050G2

## THERMAL CHARACTERISTICS

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

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^{\circ}\text{C}$ unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|--------|-----------|-----------------|-----|------|------|-------|
|--------|-----------|-----------------|-----|------|------|-------|

### OFF CHARACTERISTICS

|            |                                        |                                                                                                                                  |                             |          |          |     |               |
|------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|----------|-----|---------------|
| $BV_{CER}$ | Collector to Emitter Breakdown Voltage | $I_{CE} = 2 \text{ mA}$ , $V_{GE} = 0 \text{ V}$ ,<br>$R_{GE} = 1 \text{ k}\Omega$ , $T_J = -40 \text{ to } 150^{\circ}\text{C}$ |                             | 470      | –        | 530 | V             |
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage | $I_{CE} = 10 \text{ mA}$ , $V_{GE} = 0 \text{ V}$ ,<br>$R_{GE} = 0 \Omega$ , $T_J = -40 \text{ to } 150^{\circ}\text{C}$         |                             | 495      | –        | 555 | V             |
| $BV_{ECS}$ | Emitter to Collector Breakdown Voltage | $I_{CE} = -75 \text{ mA}$ , $V_{GE} = 0 \text{ V}$ ,<br>$T_J = 25^{\circ}\text{C}$                                               |                             | 20       | –        | –   | V             |
| $BV_{GES}$ | Gate to Emitter Breakdown Voltage      | $I_{GES} = \pm 5 \text{ mA}$                                                                                                     |                             | $\pm 12$ | $\pm 14$ | –   | V             |
| $I_{CER}$  | Collector to Emitter Leakage Current   | $V_{CE} = 250 \text{ V}$<br>$R_{GE} = 1 \text{ k}\Omega$                                                                         | $T_J = 25^{\circ}\text{C}$  | –        | –        | 25  | $\mu\text{A}$ |
|            |                                        |                                                                                                                                  | $T_J = 150^{\circ}\text{C}$ | –        | –        | 1   | mA            |
| $I_{ECS}$  | Emitter to Collector Leakage Current   | $V_{EC} = 15 \text{ V}$                                                                                                          | $T_J = 25^{\circ}\text{C}$  | –        | –        | 1   | mA            |
|            |                                        |                                                                                                                                  | $T_J = 150^{\circ}\text{C}$ | –        | –        | 40  |               |
| $R_1$      | Series Gate Resistance                 |                                                                                                                                  |                             | –        | 111      | –   | $\Omega$      |
| $R_2$      | Gate to Emitter Resistance             |                                                                                                                                  |                             | 10       | –        | 30  | k $\Omega$    |

### ON 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 |

### DYNAMIC CHARACTERISTICS

|              |                                   |                                                                            |                             |      |     |     |    |
|--------------|-----------------------------------|----------------------------------------------------------------------------|-----------------------------|------|-----|-----|----|
| $Q_{G(ON)}$  | Gate Charge                       | $I_{CE} = 10 \text{ A}$ , $V_{CE} = 12 \text{ V}$ , $V_{GE} = 5 \text{ V}$ |                             | –    | 22  | –   | nC |
| $V_{GE(TH)}$ | Gate to Emitter Threshold Voltage | $I_{CE} = 1 \text{ mA}$<br>$V_{CE} = V_{GE}$                               | $T_J = 25^{\circ}\text{C}$  | 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  | $V_{CE} = 14 \text{ V}$ , $R_L = 1 \Omega$ ,<br>$V_{GE} = 5 \text{ V}$ , $R_G = 1 \text{ k}\Omega$ ,    | – | 0.9 | 4  | $\mu\text{s}$ |
| $t_{rR}$      | Current Rise Time–Resistive           |                                                                                                         | – | 1.6 | 7  | $\mu\text{s}$ |
| $t_{d(OFF)L}$ | Current Turn-Off Delay Time–Inductive | $V_{CE} = 300 \text{ V}$ , $L = 2 \text{ mH}$ ,<br>$V_{GE} = 5 \text{ V}$ , $R_G = 1 \text{ k}\Omega$ , | – | 5.4 | 15 | $\mu\text{s}$ |
| $t_{fL}$      | Current Fall Time–Inductive           |                                                                                                         | – | 1.4 | 15 | $\mu\text{s}$ |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

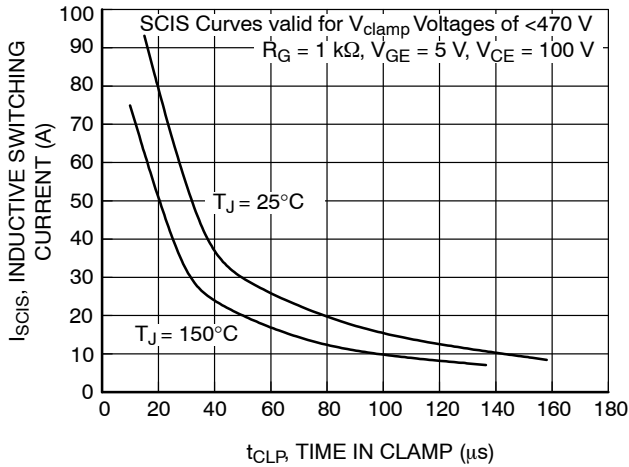


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

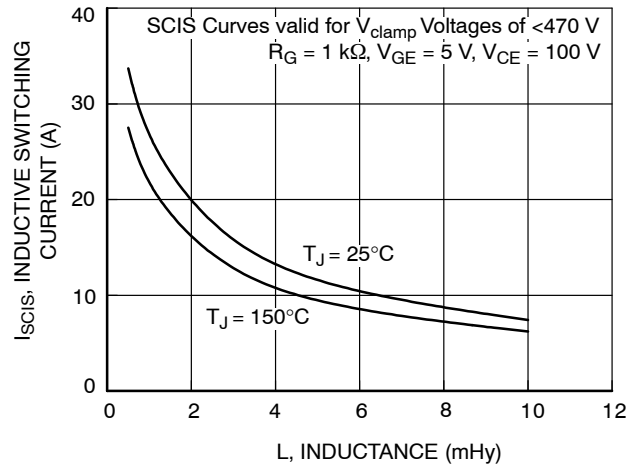


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

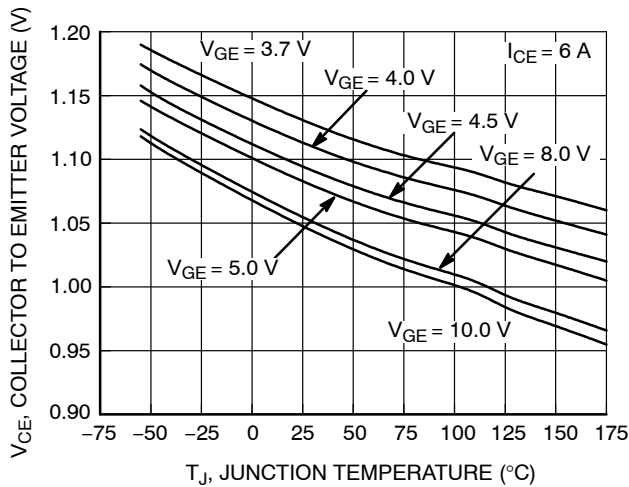


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

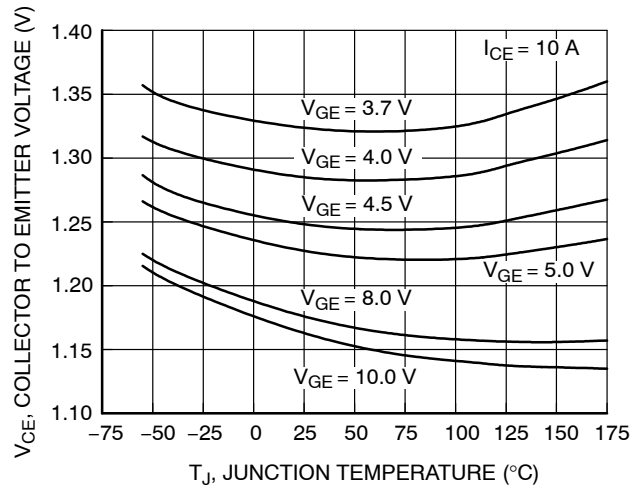


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

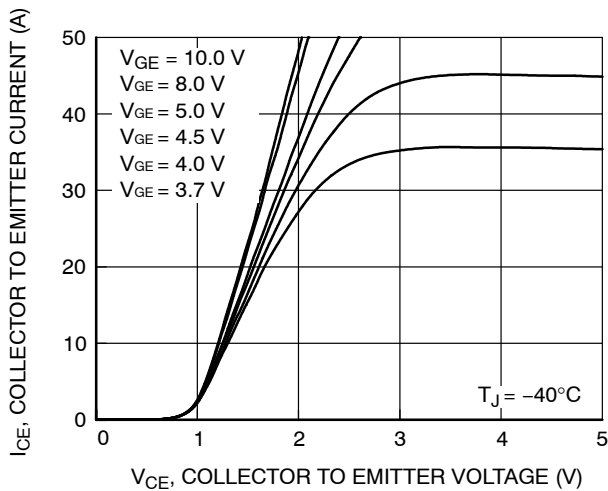


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

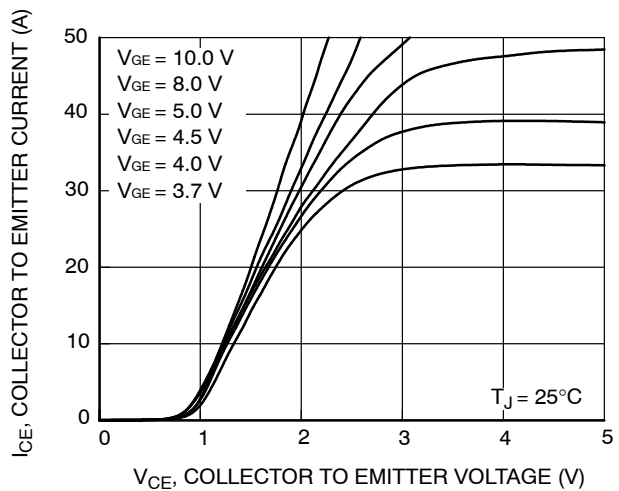


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

TYPICAL CHARACTERISTICS (continued)

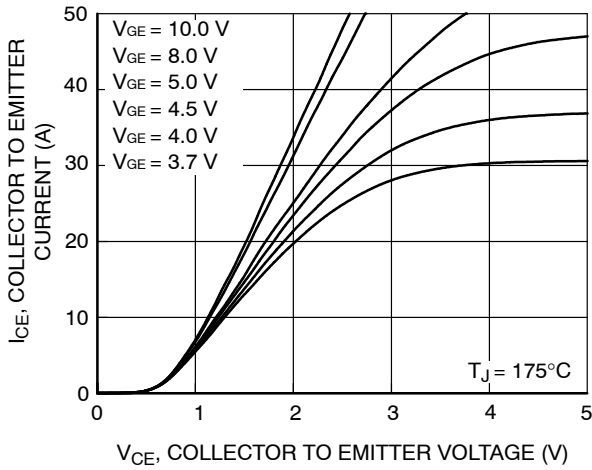


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

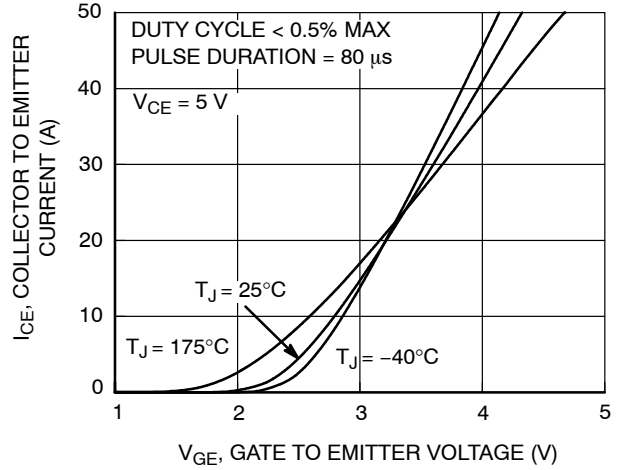


Figure 8. Transfer Characteristics

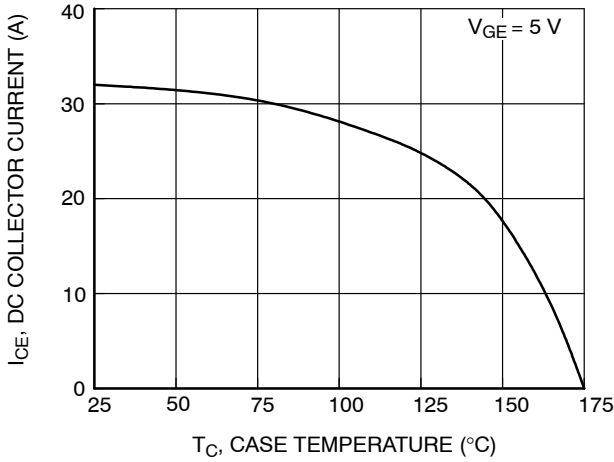


Figure 9. DC Collector Current vs. Case Temperature

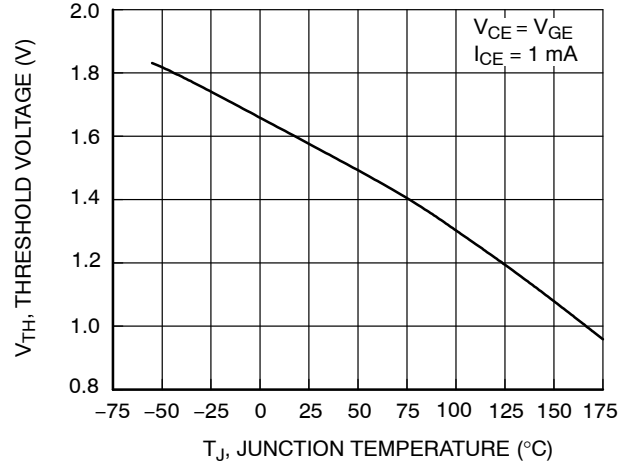


Figure 10. Threshold Voltage vs. Junction Temperature

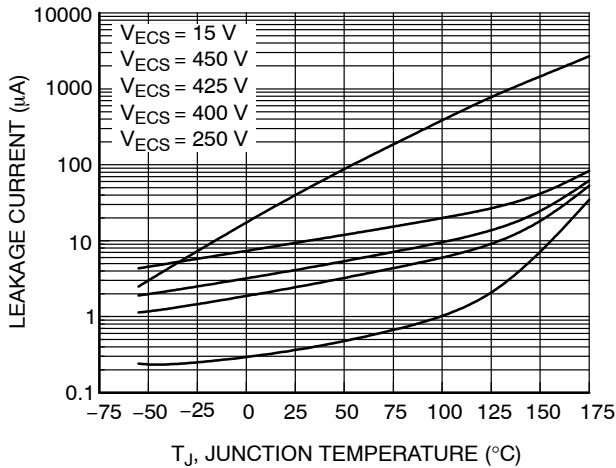


Figure 11. Leakage Current vs. Junction Temperature

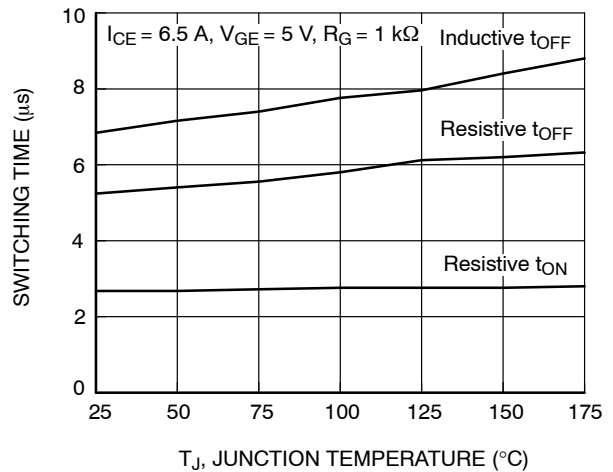


Figure 12. Switching Time vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

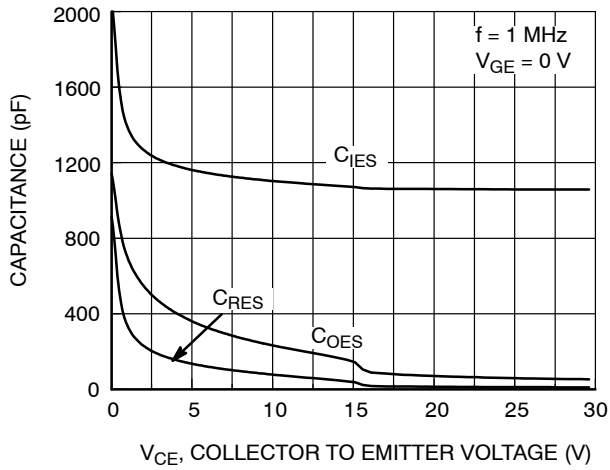


Figure 13. Capacitance vs. Collector to Emitter Voltage

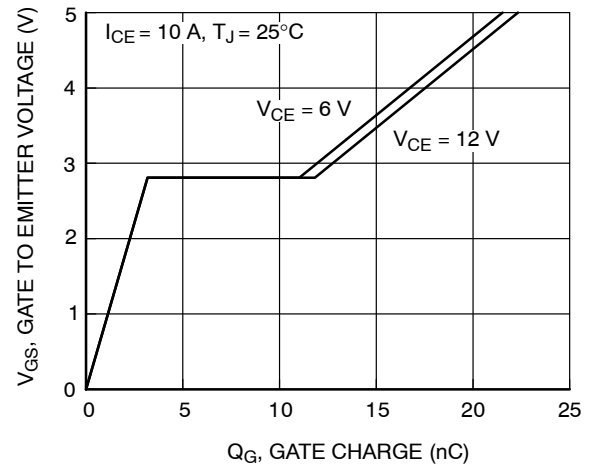


Figure 14. Gate Charge

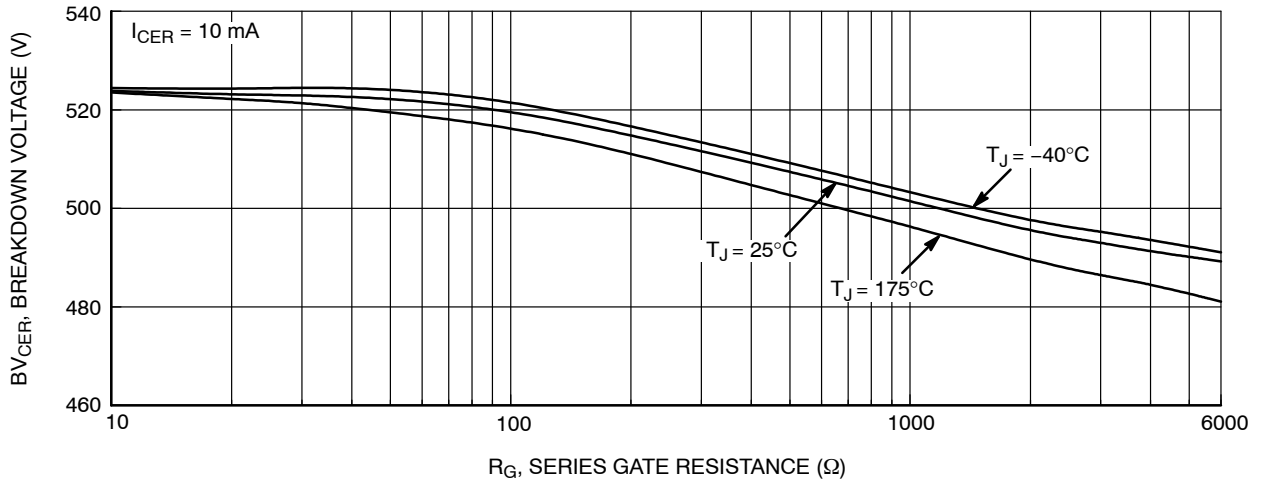


Figure 15. Breakdown Voltage vs. Series Gate Resistance

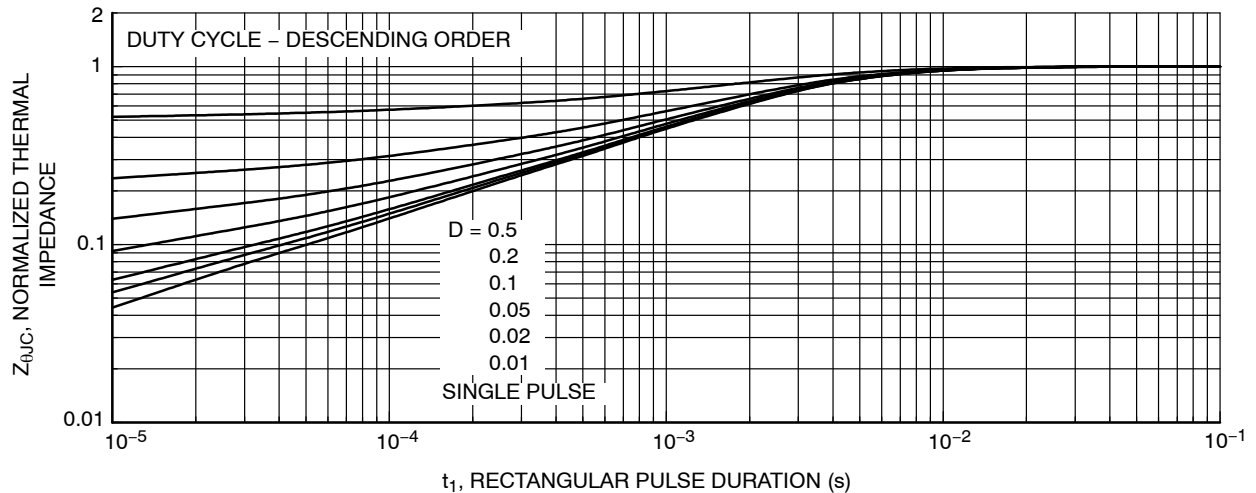
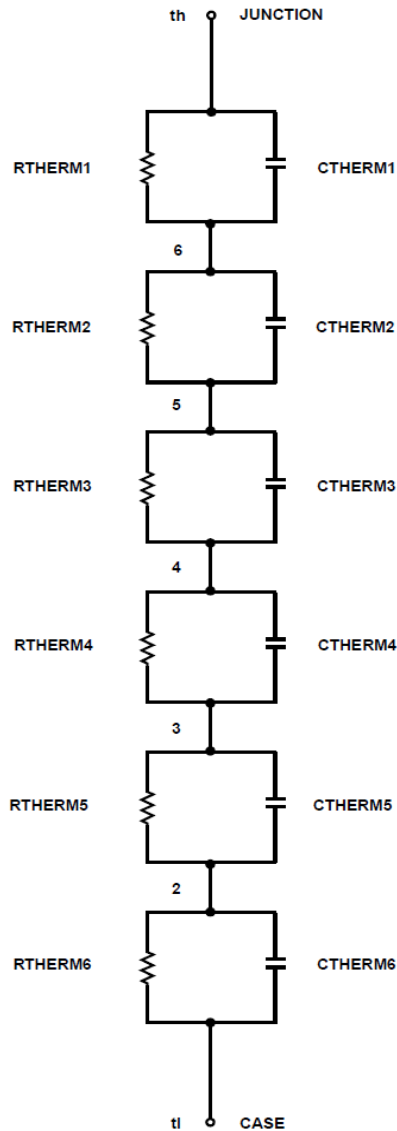


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

## SPICE THERMAL MODEL

```
CTHERM1 th 6 5.7337E-05
CTHERM2 6 5 5.3736E-03
CTHERM3 5 4 1.1141E-03
CTHERM4 4 3 2.8690E-04
CTHERM5 3 2 7.4429E-04
CTHERM6 2 tl 3.7019E-03
```

```
RTHERM1 th 6 6.6403E-03
RTHERM2 6 5 5.8449E-01
RTHERM3 5 4 5.3930E-02
RTHERM4 4 3 9.2492E-03
RTHERM5 3 2 1.5794E-02
RTHERM6 2 tl 1.7974E-01
```



## PACKAGE MARKING AND ORDERING INFORMATION

| Device    | Device Marking | Package                          | Shipping <sup>†</sup> |
|-----------|----------------|----------------------------------|-----------------------|
| FGD3050G2 | FGD3050G2      | DPAK3 (TO-252 3 LD)<br>(Pb-Free) | 2500 / Tape & Reel    |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).


**DPAK3 6.10x6.54x2.29, 4.57P**  
**CASE 369AS**  
**ISSUE B**

DATE 20 DEC 2023



NON-DIODE PRODUCTS VERSION



NON-DIODE PRODUCTS VERSION



NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE F, VARIATION AA.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2018.

D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.

E) FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX PLASTIC BODY STUB WITHOUT CENTER LEAD.

F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.

G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TD228P991X239-3N.


**LAND PATTERN RECOMMENDATION**

\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

| DIM | MILLIMETERS |      |       |
|-----|-------------|------|-------|
|     | MIN.        | NDM. | MAX.  |
| A   | 2.18        | 2.29 | 2.39  |
| A1  | 0.00        | —    | 0.127 |
| b   | 0.64        | 0.77 | 0.89  |
| b2  | 0.76        | 0.95 | 1.14  |
| b3  | 5.21        | 5.34 | 5.46  |
| c   | 0.45        | 0.53 | 0.61  |
| c2  | 0.45        | 0.52 | 0.58  |
| D   | 5.97        | 6.10 | 6.22  |
| D1  | 5.21        | ---  | ---   |
| E   | 6.35        | 6.54 | 6.73  |
| E1  | 4.32        | ---  | ---   |
| e   | 2.286 BSC   |      |       |
| e1  | 4.572 BSC   |      |       |
| H   | 9.40        | 9.91 | 10.41 |
| L   | 1.40        | 1.59 | 1.78  |
| L1  | 2.90 REF    |      |       |
| L2  | 0.51 BSC    |      |       |
| L3  | 0.89        | 1.08 | 1.27  |
| L4  | ---         | ---  | 1.02  |
| θ   | 0°          | ---  | 10°   |

**GENERIC MARKING DIAGRAM\***


\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

|                         |                                    |                                                                                                                                                                                  |
|-------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>DPAK3 6.10x6.54x2.29, 4.57P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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