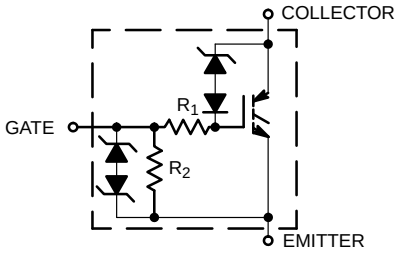
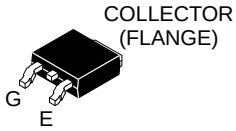
# ECOSPARK® 2 Ignition IGBT

## 300 mJ, 400 V, N-Channel Ignition IGBT

# FGD3040G2-F085V




**DPAK (SINGLE GAUGE)**
**CASE 369C**

### Features

- SCIS Energy = 300 mJ at $T_J$ = 25 °C
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- RoHS Compliant

### Applications

- Automotive Ignition Coil Driver Circuits
- Coil on Plug Application

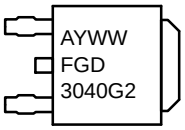
**MAXIMUM RATINGS** ($T_J$ = 25 °C unless otherwise stated)

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $BV_{CER}$ | Collector to Emitter Breakdown Voltage ($I_C$ = 1 mA) | 400 | V |
| $BV_{ECS}$ | Emitter to Collector Voltage − Reverse Battery Condition ($I_C$ = 10 mA) | 28 | V |
| $E_{SCIS25}$ | Self Clamping Inductive Switching Energy (Note 1) | 300 | mJ |
| $E_{SCIS150}$ | Self Clamping Inductive Switching Energy (Note 2) | 170 | mJ |
| $I_{C25}$ | Collector Current Continuous at VGE = 5.0 V, $T_C$ = 25 °C | 41 | A |
| $I_{C110}$ | Collector Current Continuous at VGE = 5.0 V, $T_C$ = 110 °C | 25.6 | A |
| $V_{GEM}$ | Gate to Emitter Voltage Continuous | ±10 | V |
| $P_D$ | Power Dissipation Total, $T_C$ = 25 °C | 150 | W |
| | Power Dissipation Derating, $T_C$ > 25 °C | 1 | W/°C |
| $T_J$ | Operating Junction and Storage Temperature | −55 to 175 | °C |
| $T_{STG}$ | Storage Junction Temperature Range | −55 to 175 | °C |
| $T_L$ | Max. Lead Temperature for Soldering (Package Body for 10 s) | 300 | °C |
| $T_{PKG}$ | Max. Lead Temperature for Soldering (Package Body for 10 s) | 260 | °C |
| ESD | HBM − Electrostatic Discharge Voltage at 100 pF, 1500 Ω | 4 | kV |
| | CDM − Electrostatic Discharge Voltage at 1 Ω | 2 | 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.

1. Self clamped inductive Switching Energy (ESCIS25) of 300 mJ is based on the test conditions that is starting $T_J$ = 25 °C, L = 3 mHy, ISCIS = 14.2 A, VCC = 100 V during inductor charging and VCC = 0 V during time in clamp.
2. Self Clamped inductive Switching Energy (ESCIS150) of 170 mJ is based on the test conditions that is starting $T_J$ = 150 °C, L = 3 mHy, ISCIS = 10.8 A, VCC = 100 V during inductor charging and VCC = 0 V during time in clamp.

### MARKING DIAGRAM




A = Assembly Location
Y = Year
WW = Work Week
FGD3040G2 = Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

## THERMAL RESISTANCE RATINGS

| Characteristic | Symbol | Max | Units |
|---|---|---|---|
| Junction-to-Case − Steady State (Drain) | $R_{\theta JC}$ | 1 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified)

| Symbol | Parameter | Test Conditions | | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| $BV_{CER}$ | Collector to Emitter Breakdown Voltage | $I_{CE}$ = 2 mA, $V_{GE}$ = 0 V, $R_{GE}$ = 1 kΩ, $T_J$ = −40 to 150 °C | | 370 | 400 | 430 | V |
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage | $I_{CE}$ = 10 mA, $V_{GE}$ = 0 V, $R_{GE}$ = 0, $T_J$ = −40 to 150 °C | | 390 | 420 | 450 | V |
| $BV_{ECS}$ | Emitter to Collector Breakdown Voltage | $I_{CE}$ = −20 mA, $V_{GE}$ = 0 V, $T_J$ = 25 °C | | 28 | – | – | V |
| $BV_{GES}$ | Gate to Emitter Breakdown Voltage | $I_{GES}$ = ±2 mA | | ±12 | ±14 | – | V |
| $I_{CER}$ | Collector to Emitter Leakage Current | $V_{CE}$ = 250 V, $R_{GE}$ = 1 kΩ | $T_J$ = 25 °C | – | – | 25 | μA |
| | | | $T_J$ = 150 °C | – | – | 1 | mA |
| $I_{ECS}$ | Emitter to Collector Leakage Current | $V_{EC}$ = 24 V | $T_J$ = 25 °C | – | – | 1 | mA |
| | | | $T_J$ = 150 °C | – | – | 40 | |
| $R_1$ | Series Gate Resistance | | | – | 120 | – | Ω |
| $R_2$ | Gate to Emitter Resistance | | | 10K | – | 30K | Ω |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE}$ = 6 A, $V_{GE}$ = 4 V, $T_J$ = 25 °C | | – | 1.15 | 1.25 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE}$ = 10 A, $V_{GE}$ = 4.5 V, $T_J$ = 150 °C | | – | 1.35 | 1.50 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE}$ = 15 A, $V_{GE}$ = 4.5 V, $T_J$ = 150 °C | | – | 1.68 | 1.85 | V |
| $E_{SCIS}$ | Self Clamped Inductive Switching | L = 3.0 mHy, RG = 1 kΩ, VGE = 5 V, (Note 1) | | – | – | 300 | mJ |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| $Q_{G(ON)}$ | Gate Charge | $I_{CE}$ = 10 A, $V_{CE}$ = 12 V, $V_{GE}$ = 5 V | | – | 21 | – | nC |
| $V_{GE(TH)}$ | Gate to Emitter Threshold Voltage | $I_{CE}$ = 1 mA, $V_{CE}$ = $V_{GE}$ | $T_J$ = 25 °C | 1.3 | 1.7 | 2.2 | V |
| | | | $T_J$ = 150 °C | 0.75 | 1.2 | 1.8 | |
| $V_{GEP}$ | Gate to Emitter Plateau Voltage | $V_{CE}$ = 12 V, $I_{CE}$ = 10 A | | – | 2.8 | – | V |
| **SWITCHING CHARACTERISTICS** | | | | | | | |
| $td_{(ON)R}$ | Current Turn-On Delay Time-Resistive | $V_{CE}$ = 14 V, $R_L$ = 1 Ω, $V_{GE}$ = 5 V, $R_G$ = 1 kΩ, $T_J$ = 25 °C | | – | 0.9 | 4 | μs |
| $t_{rR}$ | Current Rise Time-Resistive | | | – | 1.9 | 7 | |
| $td_{(OFF)L}$ | Current Turn-Off Delay Time-Inductive | $V_{CE}$ = 300 V, L = 1 mH, $V_{GE}$ = 5 V, $R_G$ = 1 kΩ, $I_{CE}$ = 6.5 A, $T_J$ = 25 °C | | – | 4.8 | 15 | |
| $t_{fL}$ | Current Fall Time-Inductive | | | – | 2.0 | 15 | |

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.

## PACKAGE MARKING AND DEVICE ORDERING INFORMATION

| Device Marking | Device | Package | Reel Diameter | Tape Width | Qty† |
|---|---|---|---|---|---|
| FGD3040G2 | FGD3040G2-F085V | DPAK (Pb-Free) | 330 mm | 16 mm | 2500 |

† 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.

## TYPICAL CHARACTERISTICS

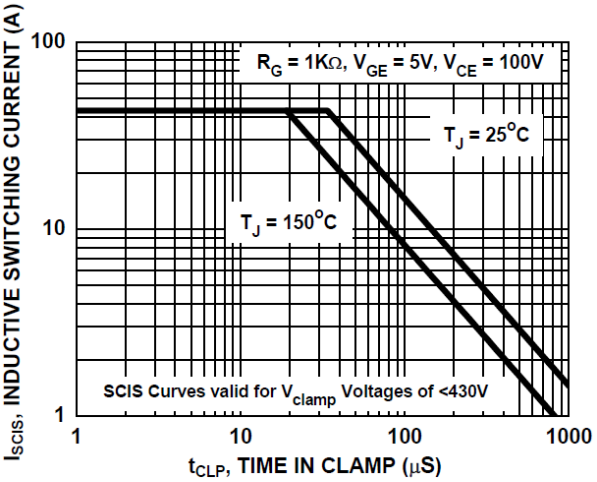



**Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp**

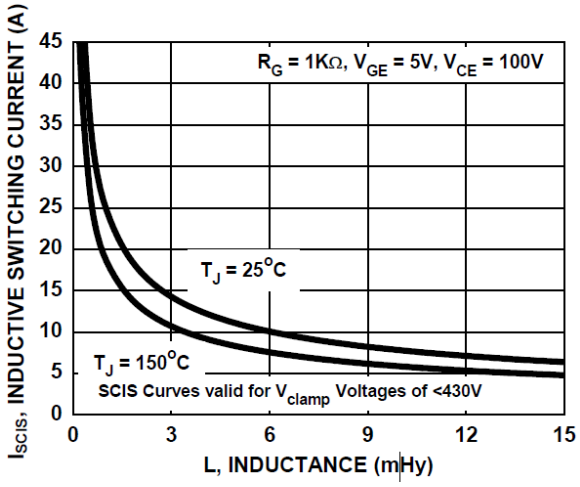



**Figure 2. Self Clamped Inductive Switching Current vs. Inductance**

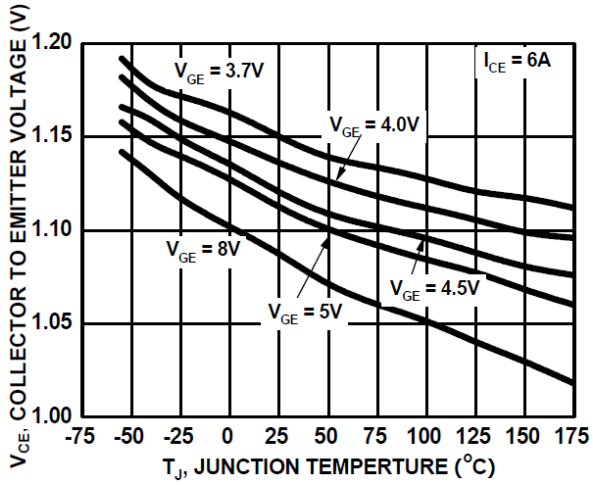



**Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature**

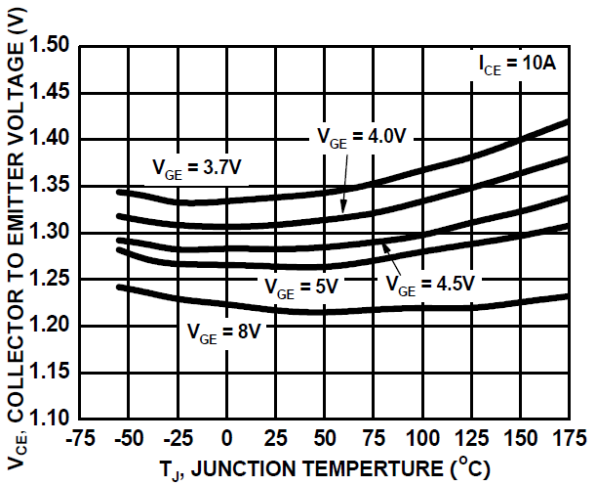



**Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature**

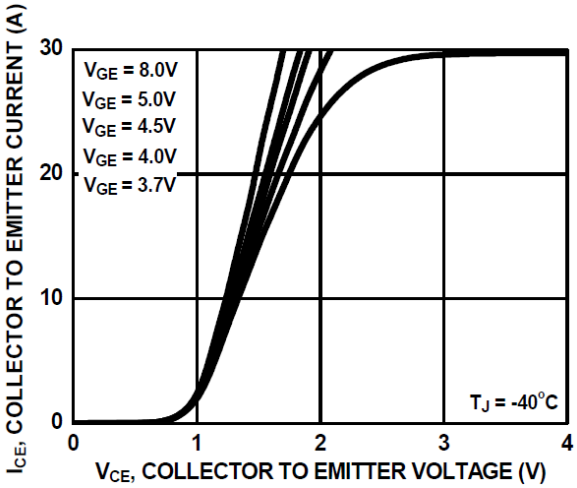



**Figure 5. Collector to Emitter On-State Voltage vs. Collector Current**

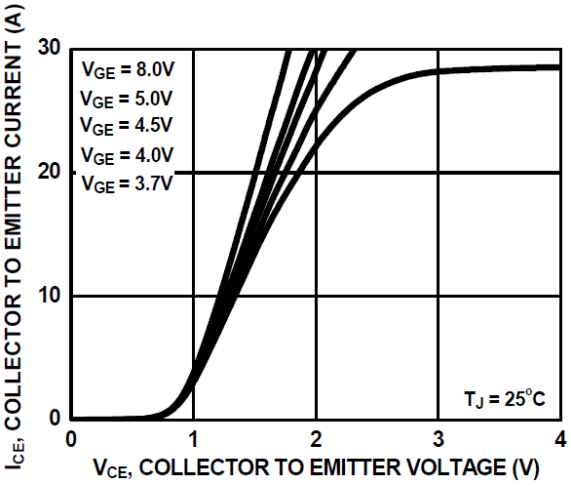



**Figure 6. Collector to Emitter On-State Voltage vs. Collector Current**

## TYPICAL CHARACTERISTICS (continued)

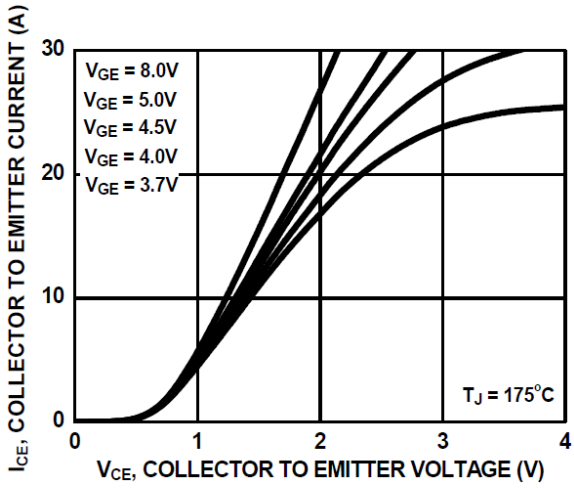



**Figure 7. Collector to Emitter On-State Voltage vs. Collector Current**

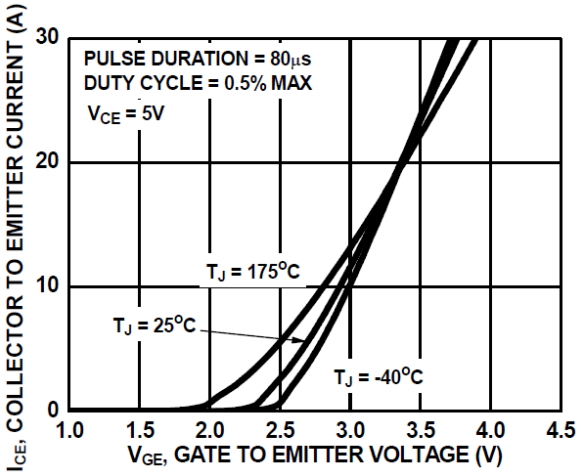



**Figure 8. Transfer Characteristics**

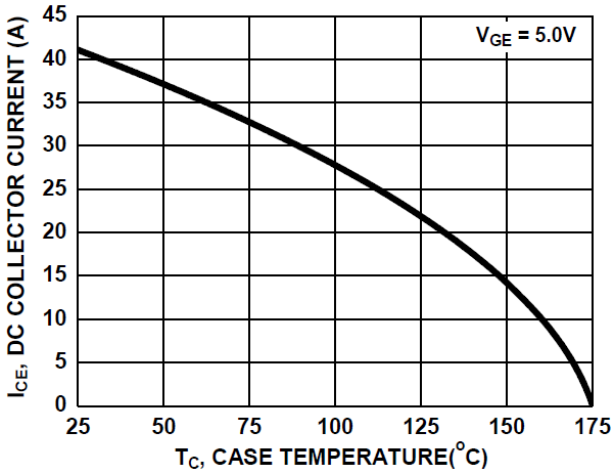



**Figure 9. DC Collector Current vs. Case Temperature**

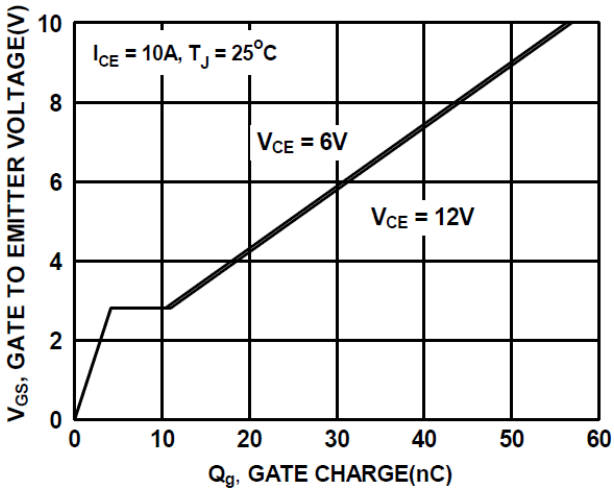



**Figure 10. Gate Charge**

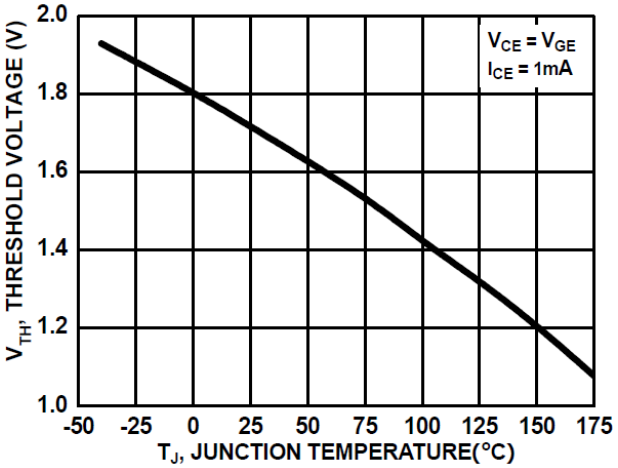



**Figure 11. Threshold Voltage vs. Junction Temperature**

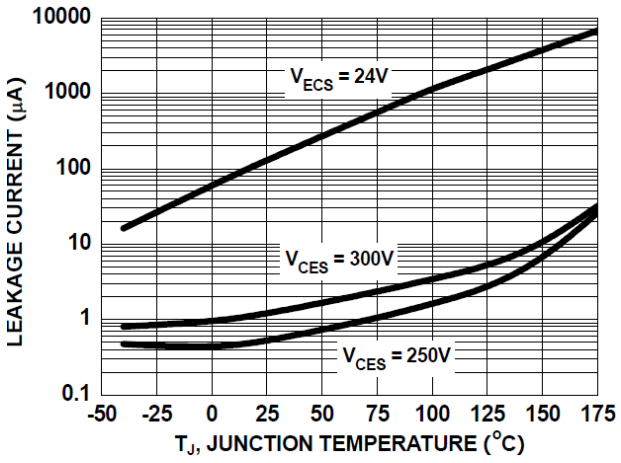



**Figure 12. Leakage Current vs. Junction Temperature**

## TYPICAL CHARACTERISTICS (continued)

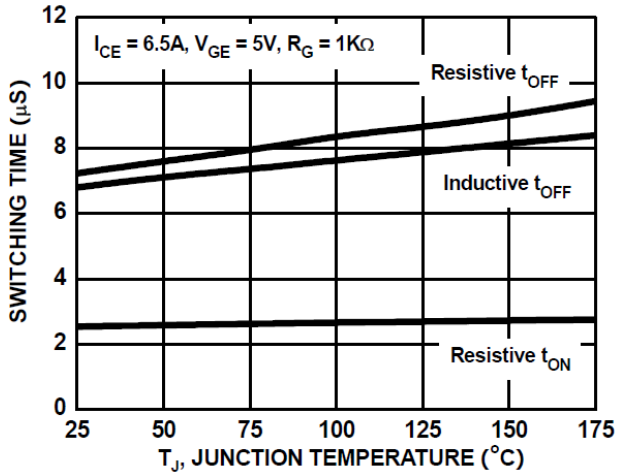



Figure 13. Switching Time vs. Junction Temperature

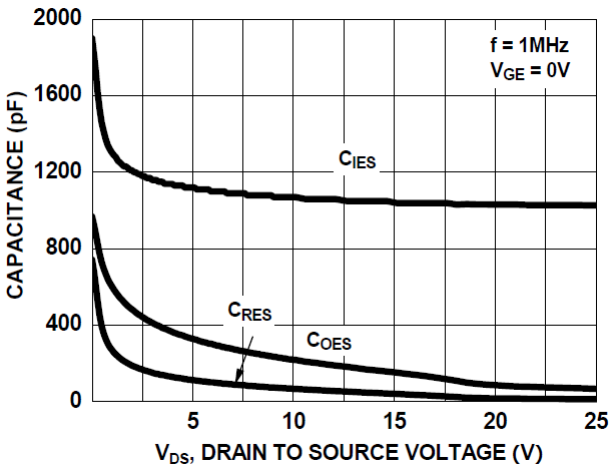



Figure 14. Capacitance vs. Collector to Emitter Voltage

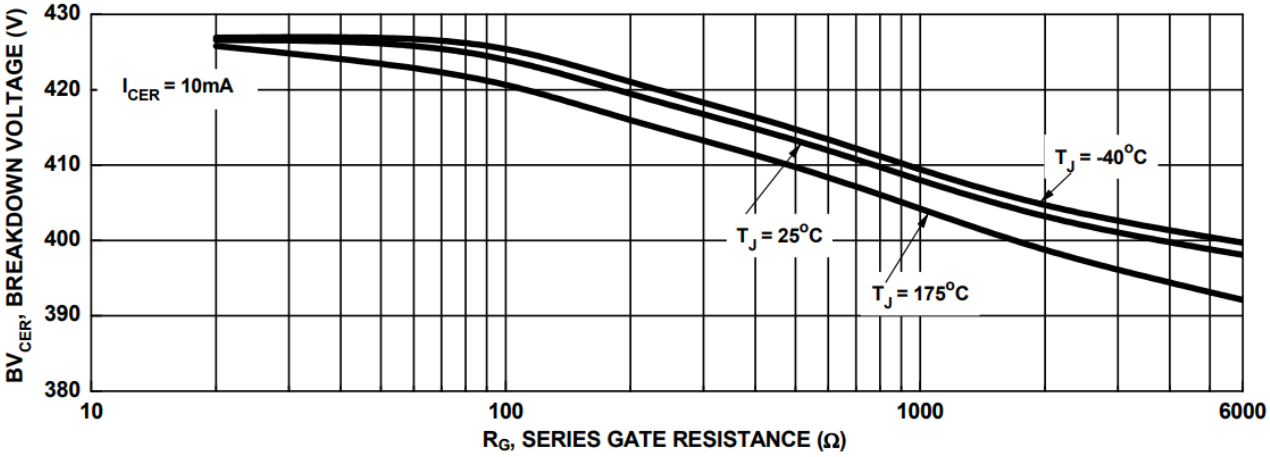



Figure 15. Break down Voltage vs. Series Resistance

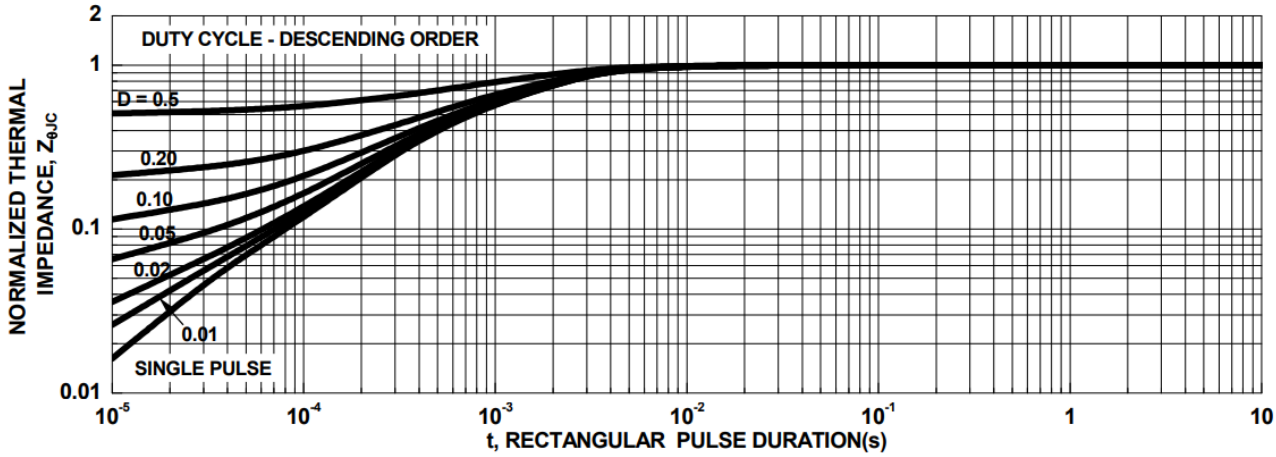



Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

## TYPICAL CHARACTERISTICS (continued)

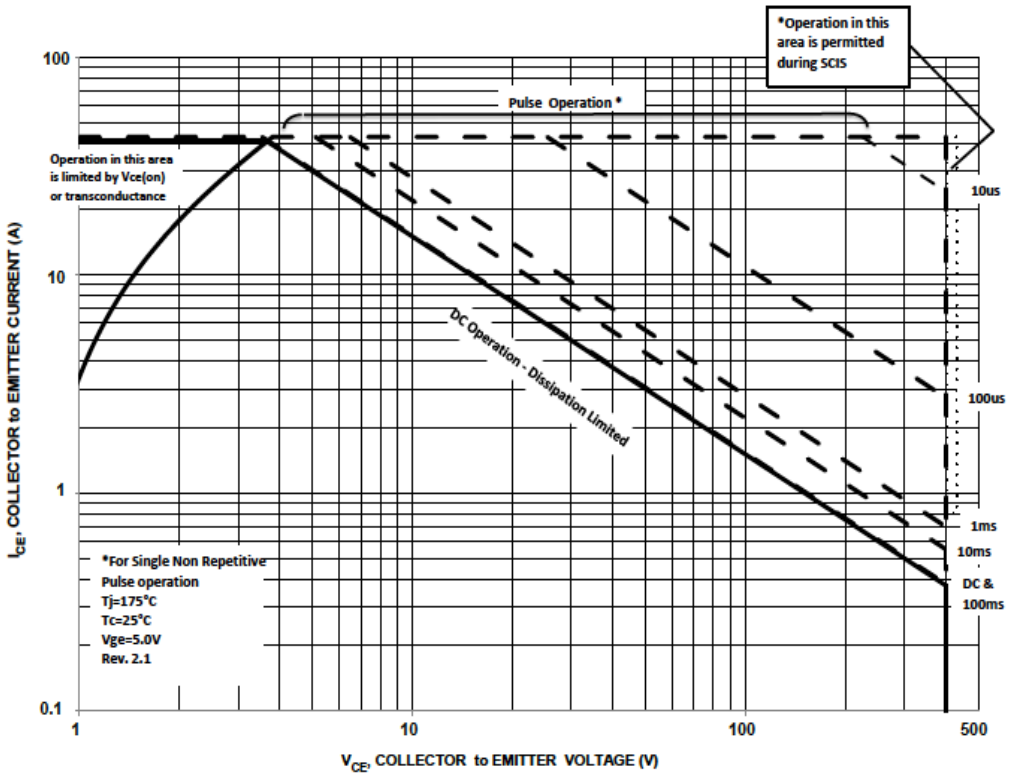



**Figure 17. Forward Safe Operating Area**

## TEST CIRCUIT AND WAVEFORMS

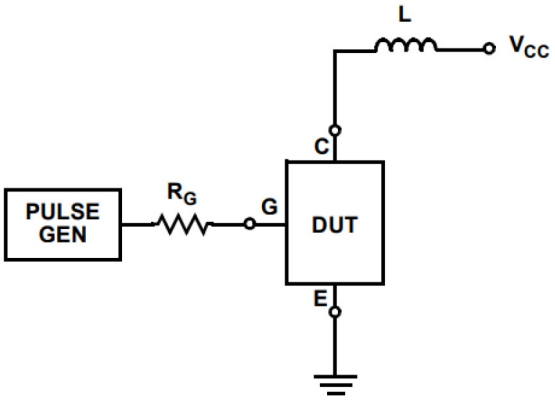



Figure 18. Inductive Switching Test Circuit

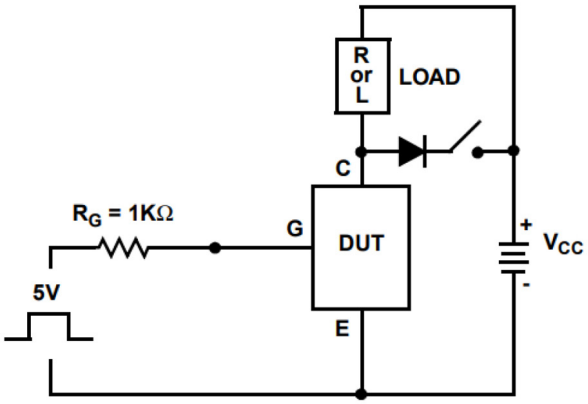



Figure 19. $t_{ON}$ and $t_{OFF}$ Switching Test Circuit

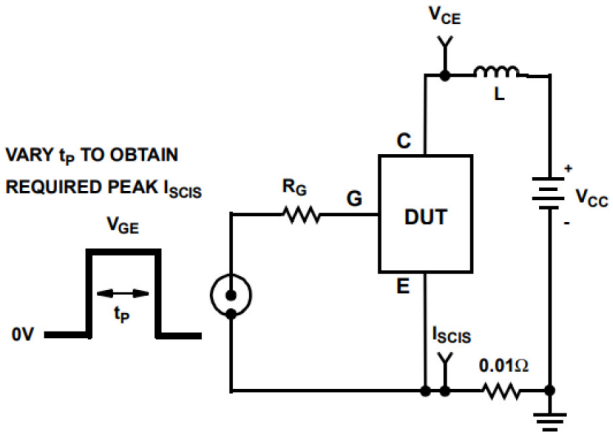



Figure 20. Energy Test Circuit

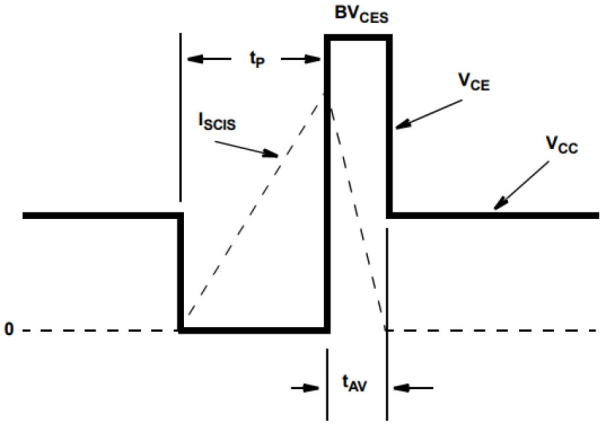
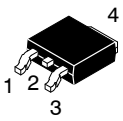



Figure 21. Energy Waveforms

**REVISION HISTORY**

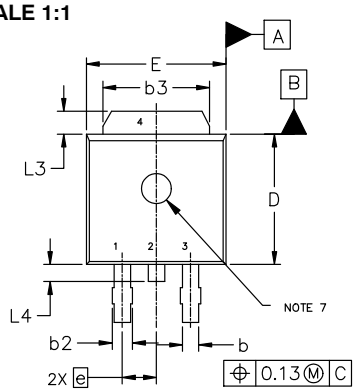
| Revision | Description of Changes | Date |
|---|---|---|
| 4 | Missing package pinout on Preview list | 5/28/2025 |



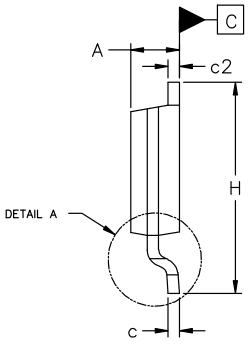

**SCALE 1:1**

**DPAK3 6.10x6.54x2.28, 2.29P**
CASE 369C
ISSUE J

DATE 12 AUG 2025

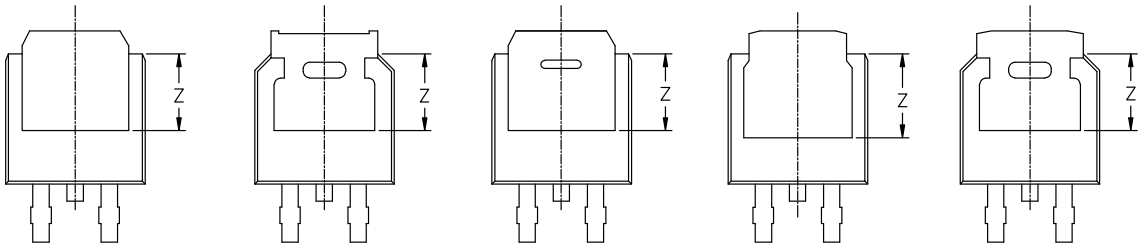



TOP VIEW




SIDE VIEW

| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 2.18 | 2.28 | 2.38 |
| A1 | 0.00 | --- | 0.13 |
| b | 0.63 | 0.76 | 0.89 |
| b2 | 0.72 | 0.93 | 1.14 |
| b3 | 4.57 | 5.02 | 5.46 |
| c | 0.46 | 0.54 | 0.61 |
| c2 | 0.46 | 0.54 | 0.61 |
| D | 5.97 | 6.10 | 6.22 |
| E | 6.35 | 6.54 | 6.73 |
| e | 2.29 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 | --- | 1.27 |
| L4 | --- | --- | 1.01 |
| Z | 3.93 | --- | --- |

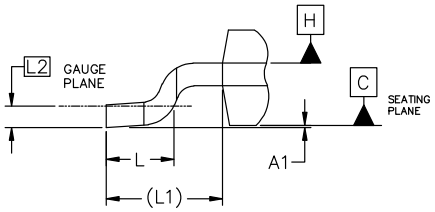



BOTTOM VIEW

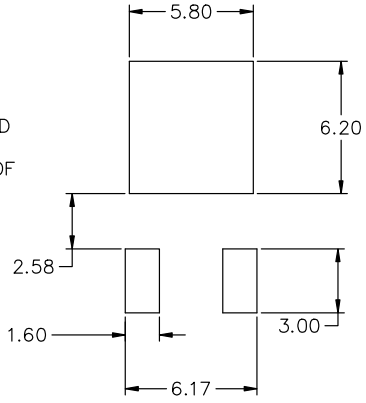
ALTERNATE CONSTRUCTIONS

NOTES:

1. DIMENSIONING AND TOLERANCING ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3, AND Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.




DETAIL A
ROTATED 90° CW




RECOMMENDED MOUNTING FOOTPRINT*

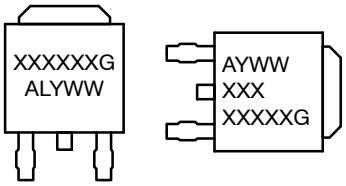
*FOR ADDITIONAL INFORMATION ON OUR PB–FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON10527D** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| **DESCRIPTION:** | **DPAK3 6.10x6.54x2.28, 2.29P** | **PAGE 1 OF 2** |

**DPAK3 6.10x6.54x2.28, 2.29P**
CASE 369C
ISSUE J

DATE 12 AUG 2025

## GENERIC MARKING DIAGRAM*




**IC** **Discrete**

| | |
|---|---|
| XXXXXX | = Device Code |
| A | = Assembly Location |
| L | = Wafer Lot |
| Y | = Year |
| WW | = Work Week |
| G | = Pb−Free Package |

*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.

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE

STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

## ADDITIONAL INFORMATION

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