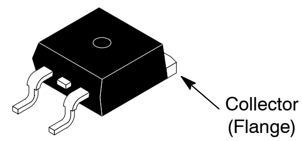
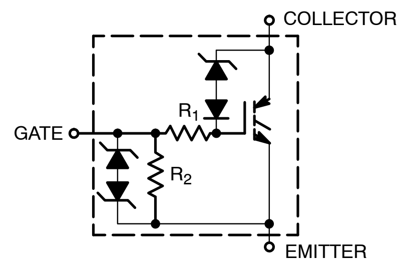
EcoSPARK® 2 HV-HE IGBT

500 mJ, 560 V, N-Channel PTC Heater IGBT

FGB5056G2-F085



D²PAK−3
CASE 418AJ



Features

- SCIS Energy = 500 mJ at T_J = 25°C
- Logic Level Gate Drive
- RoHS Compliant
- AEC−Q101 Qualification and PPAP Capable

Applications

- PTC Heater Circuits
- High Current Systems
- Ignition Systems

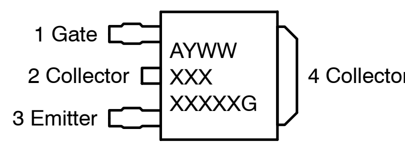
MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
BV_{CER}	Collector−to−Emitter Breakdown Voltage (I_C = 1 mA)	560	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)	500	mJ
$E_{SCIS150}$	Self Clamping Inductive Switching Energy (Note 2)	300	mJ
I_{C25}	Collector Current Continuous at V_{GE} = 5.0 V, T_C = 25°C	80	A
I_{C100}	Collector Current Continuous at V_{GE} = 5.0 V, T_C = 100°C	56	A
V_{GEM}	Gate−to−Emitter Voltage Continuous	±10	V
P_D	Power Dissipation Total, T_C = 25°C	300	W
	Power Dissipation Derating, T_C > 25°C	2	W/°C
T_J, T_{STG}	Operating Junction and Storage Temperature Range	−55 to +175	°C
T_L	Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)	300	°C
T_{PKG}	Reflow Soldering according to JESD020C	260	°C
ESD	HBM−Electrostatic Discharge Voltage at 100 pF, 1500 Ω	8	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 (E_{SCIS25}) of 500 mJ is based on the test conditions that is starting T_J = 25°C, L = 3 mHy, I_{SCIS} = 18.3 A, V_{CC} = 100 V during inductor charging and VCC = 0 V during time in clamp.
2. Self Clamped inductive Switching Energy ($E_{SCIS150}$) of 300 mJ is based on the test conditions that is starting T_J = 150°C, L = 3 mHy, I_{SCIS} = 14.2 A, V_{CC} = 100 V during inductor charging and V_{CC} = 0 V during time in clamp.

MARKING DIAGRAM



A	=	Assembly Location
Y	=	Year
WW	=	Work Week
XXXX	=	Device Code
G	=	Pb−Free Package

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)	$R_{\theta JC}$	0.5	°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		520	560	600	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		–	583	–	V
BV_{ECS}	Emitter−to−Collector Breakdown Voltage	I_{CE} = −75 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			–	116	–	Ω
R_2	Gate−to−Emitter Resistance			10K	–	30K	Ω
ON CHARACTERISTICS							
$V_{CE(SAT)}$	Collector−to−Emitter Saturation Voltage	I_{CE} = 10 A, V_{GE} = 4.5 V, T_J = 25°C		–	1.11	1.25	V
		I_{CE} = 30 A, V_{GE} = 5 V, T_J = 25°C		–	1.54	1.75	
		I_{CE} = 50 A, V_{GE} = 10 V, T_J = 25°C		–	1.76	2.1	
		I_{CE} = 15 A, V_{GE} = 5 V, T_J = 150°C		–	1.4	1.6	
DYNAMIC CHARACTERISTICS							
$Q_{G(ON)}$	Gate Charge	I_{CE} = 10 A, V_{CE} = 12 V, V_{GE} = 5 V		–	39	–	nC
$V_{GE(TH)}$	Gate−to−Emitter Threshold Voltage	I_{CE} = 1 mA, V_{CE} = V_{GE}	T_J = 25°C	1.18	1.5	2.2	V
			T_J = 150°C	0.75	–	1.8	
V_{GEP}	Gate−to−Emitter Plateau Voltage	V_{CE} = 12 V, I_{CE} = 10 A		–	2.6	–	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 = 470 Ω, T_J = 25°C		–	0.74	3	µs
t_{rR}	Current Rise Time−Resistive			–	1.7	7	
$td_{(OFF)L}$	Current Turn−Off Delay Time−Inductive	V_{CE} = 300 V, L = 1 mH, V_{GE} = 5 V, R_G = 470 Ω, I_{CE} = 6.5 A, T_J = 25°C		–	7.1	12	
t_{fL}	Current Fall Time−Inductive			–	3.5	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 ORDERING INFORMATION

Device	Package	Shipping†
FGB5056G2−F085	D^2PAK (Pb−Free)	800 Units / Tape & Reel

†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

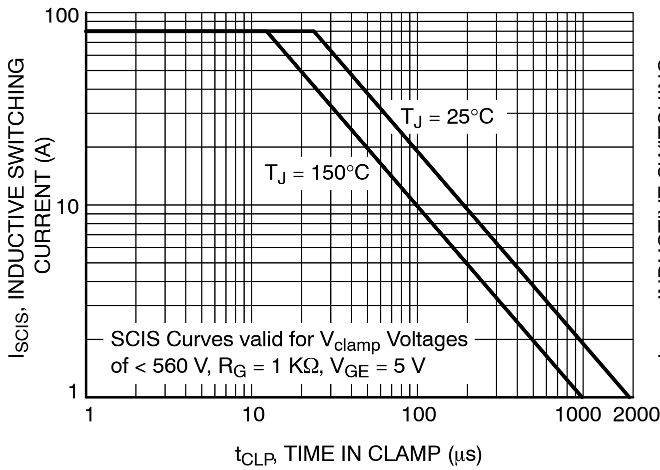


Figure 1. Self−Clamped Inductive Switching Current vs. Time in Clamp

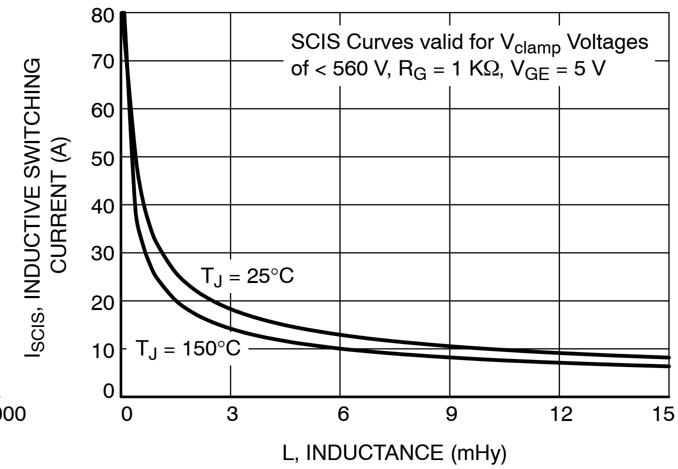


Figure 2. Self−Clamped Inductive Switching Current vs. Inductance

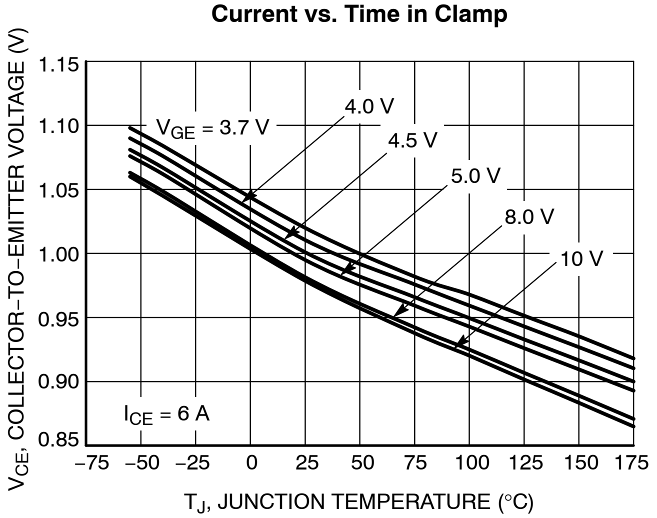


Figure 3. Collector−to−Emitter On−State Voltage vs. Junction Temperature

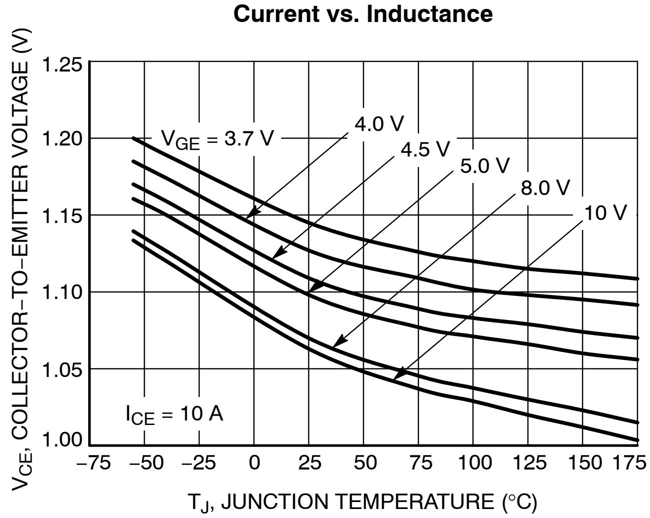


Figure 4. Collector−to−Emitter On−State Voltage vs. Junction Temperature

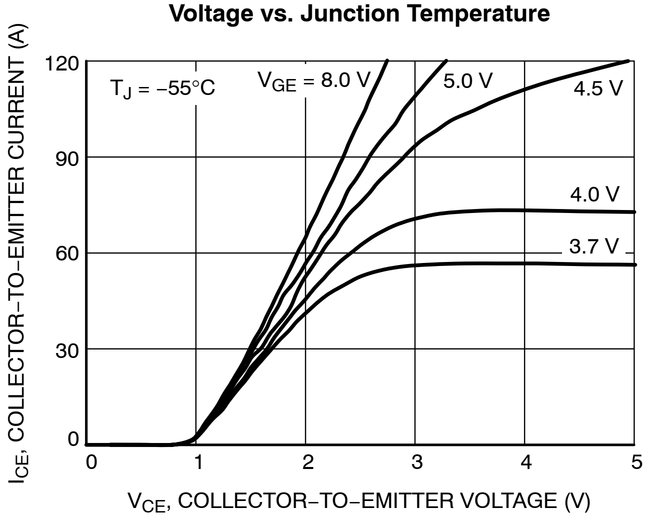


Figure 5. Collector−to−Emitter On−State Voltage vs. Collector Current

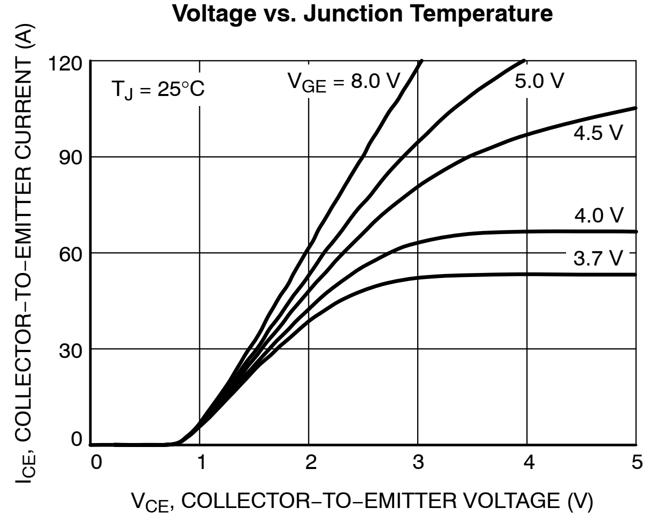


Figure 6. Collector−to−Emitter On−State Voltage vs. Collector Current

TYPICAL CHARACTERISTICS

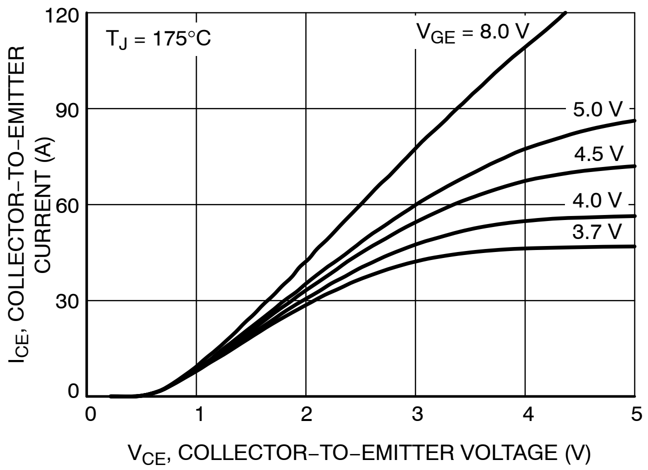


Figure 7. Collector−to−Emitter On−State Voltage vs. Collector Current

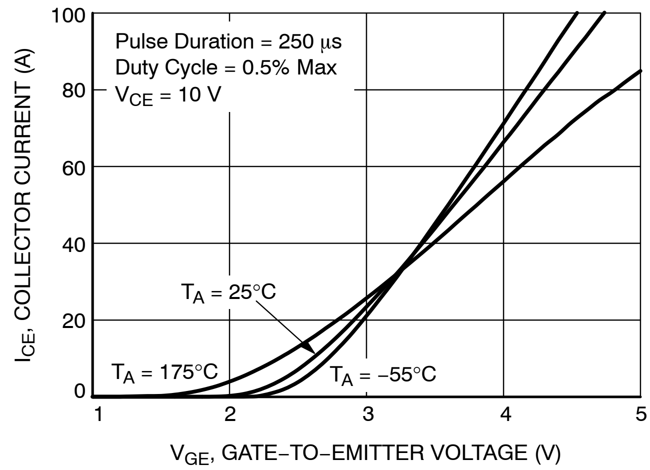


Figure 8. Transfer Characteristics

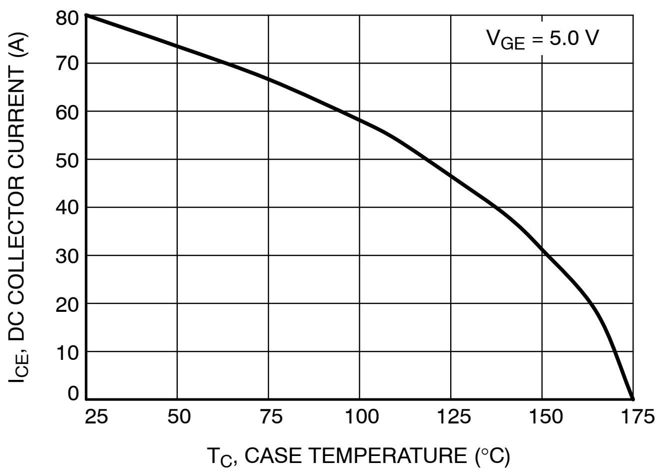


Figure 9. DC Collector Current vs. Case Temperature

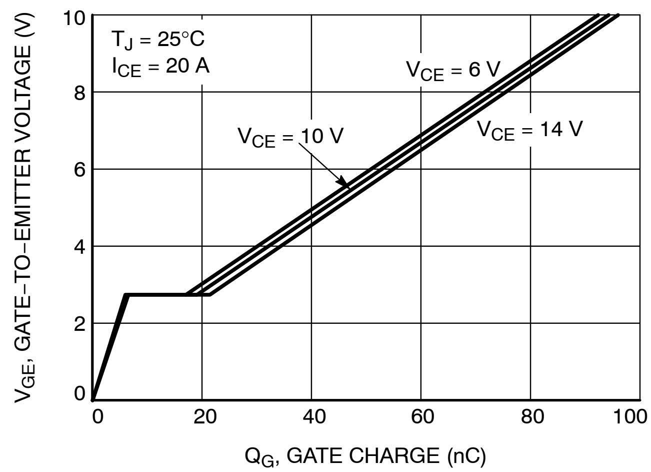


Figure 10. Gate Charge

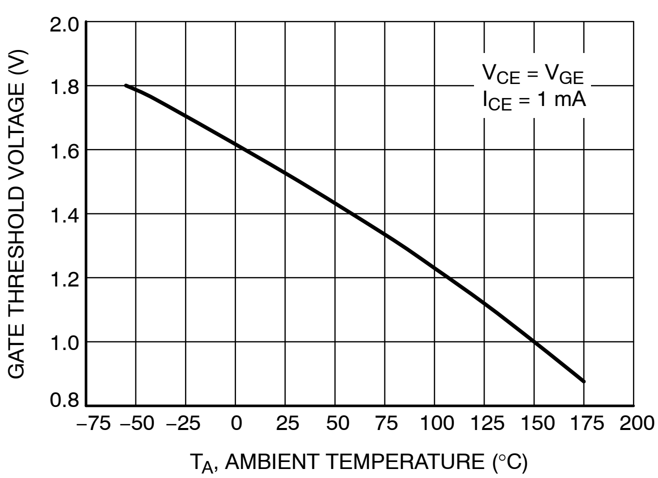


Figure 11. Threshold Voltage vs. Junction Temperature

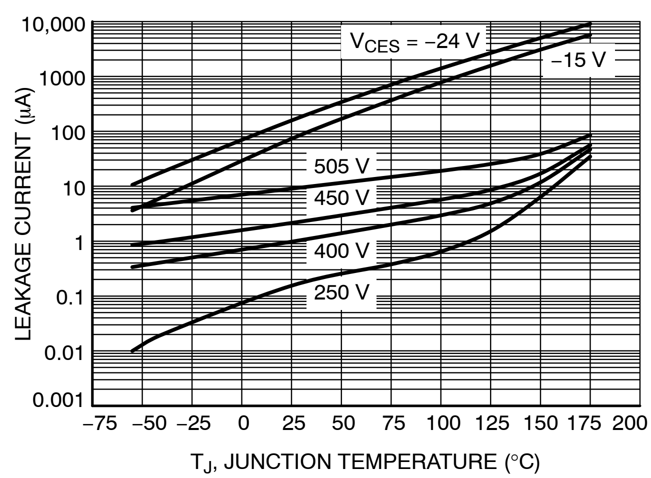


Figure 12. Leakage Current vs. Junction Temperature

TYPICAL CHARACTERISTICS

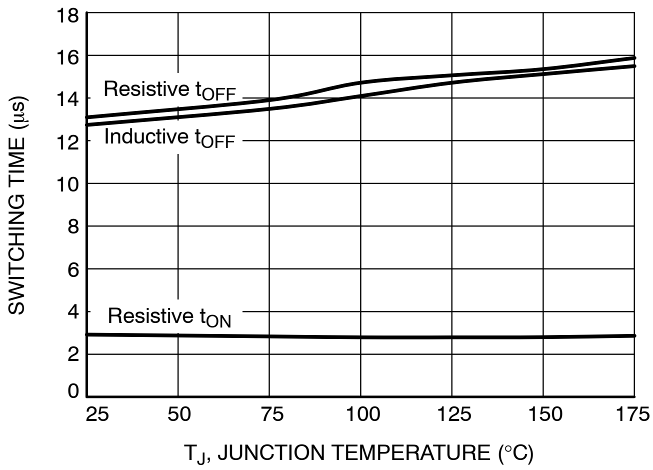


Figure 13. Switching Time vs. Junction Temperature

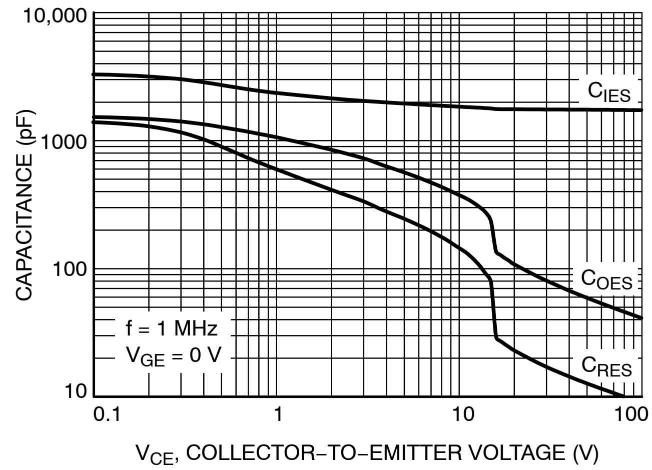


Figure 14. Capacitance vs. Collector−to−Emitter Voltage

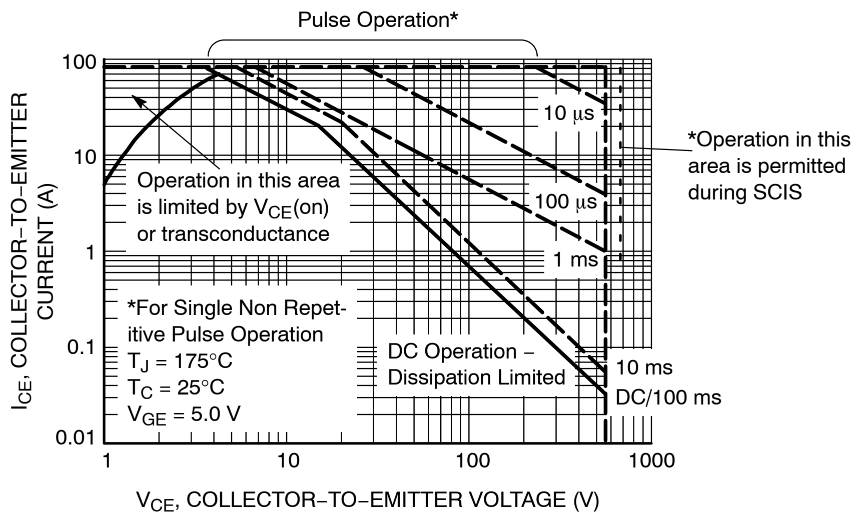


Figure 15. Forward Bias Safe Operating Area

TYPICAL CHARACTERISTICS

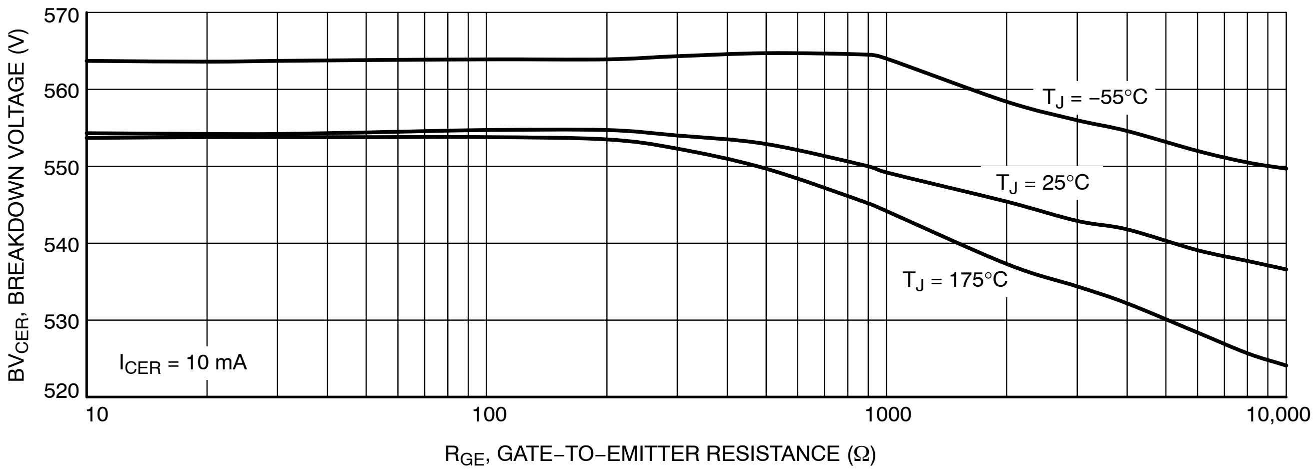


Figure 16. Breakdown Voltage vs. Series Resistance

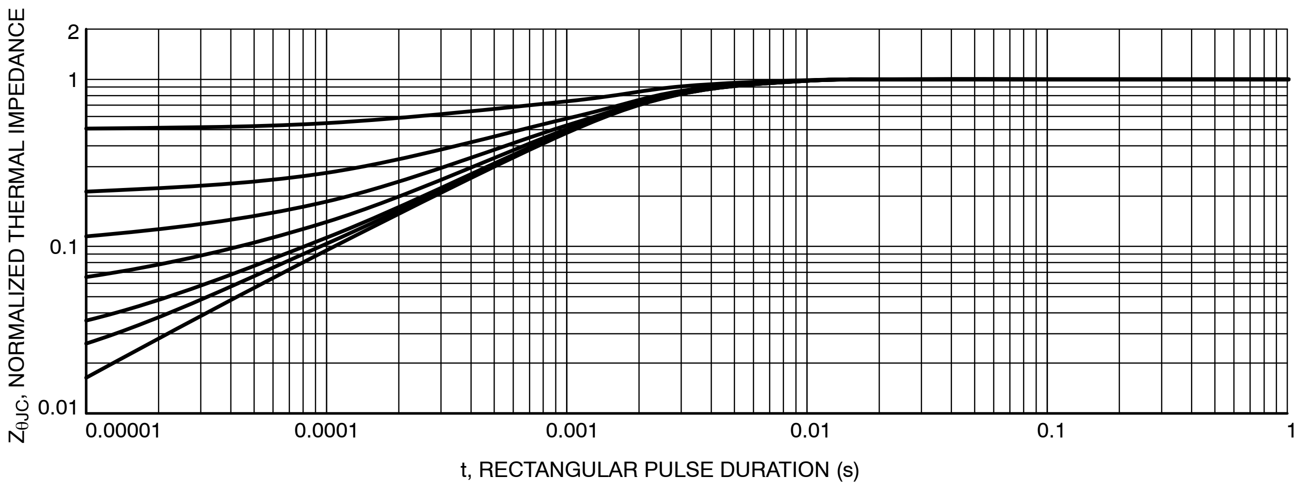


Figure 17. Normalized Transient Thermal Impedance, Junction−to−Case ($Z_{\theta JC}$)

TEST CIRCUIT AND WAVEFORMS

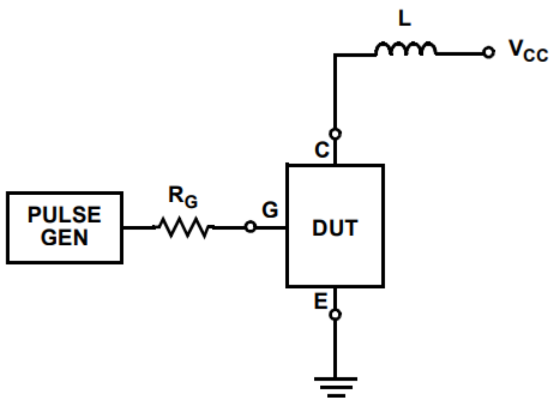


Figure 18. Inductive Switching Test Circuit

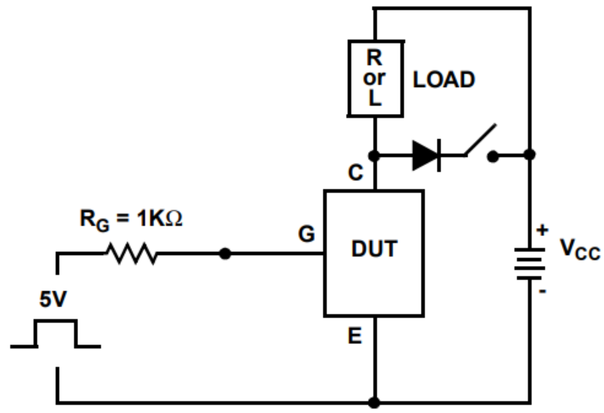


Figure 19. t_{ON} and t_{OFF} Switching Test Circuit

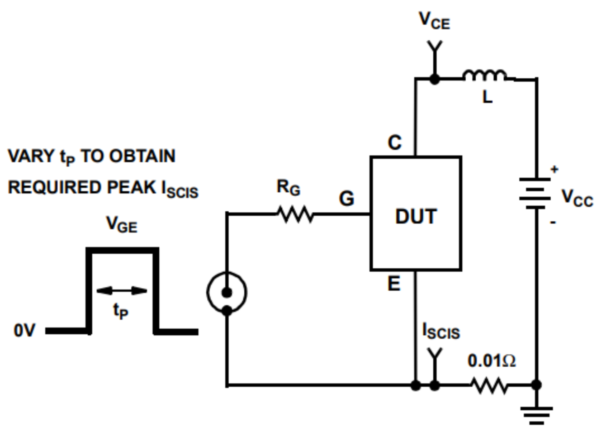


Figure 20. Energy Test Circuit

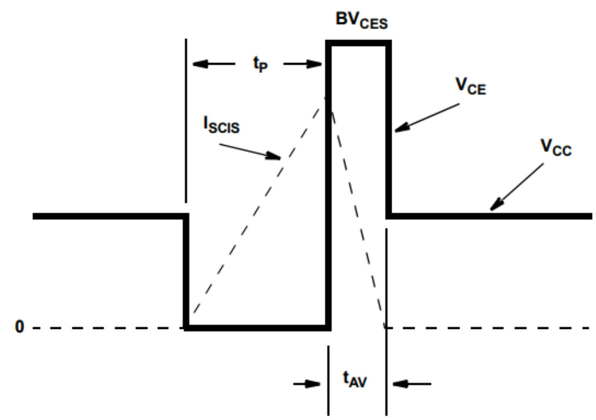
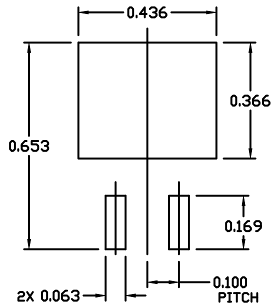


Figure 21. Energy Waveforms

PACKAGE DIMENSIONS

D^2PAK−3 (TO−263, 3−LEAD)
CASE 418AJ
ISSUE F

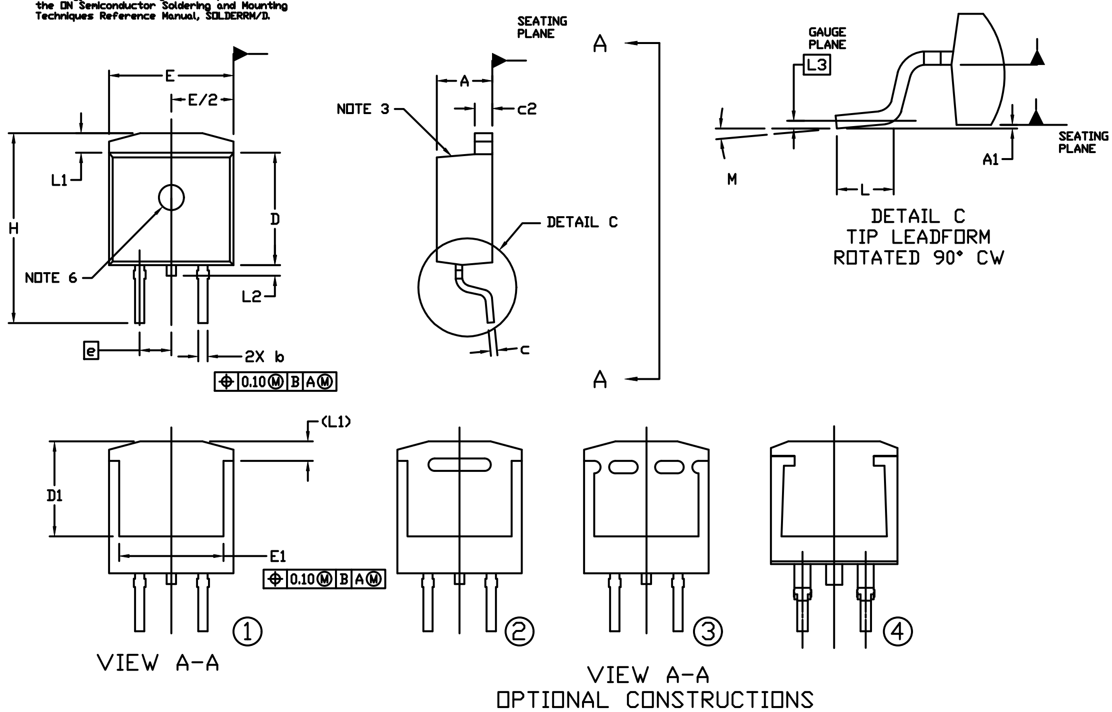


RECOMMENDED
MOUNTING FOOTPRINT

* For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
6. OPTIONAL MOLD FEATURE.
7. ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

DIM	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100 BSC		2.54 BSC	
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	---	0.066	---	1.68
L2	---	0.070	---	1.78
L3	0.010 BSC		0.25 BSC	
M	0°	8°	0°	8°



ADDITIONAL INFORMATION

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