

# ISL9V3040D3STV

## ECOSPARK<sup>®</sup> Ignition IGBT

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

#### Features

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

#### Applications

- Automotive Ignition Coil Driver Circuits
- High Current Ignition System
- Coil on Plug Applications

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ Unless Otherwise Stated)

Parameter	Symbol	Value	Units
Collector to Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ )	$BV_{CER}$	400	V
Emitter to Collector Voltage – Reverse Battery Condition ( $I_C = 10\text{ mA}$ )	$BV_{ECS}$	24	V
ISCIS = 14.2 A, L = 3.0 mHz, $R_{GE} = 1\text{ K}\Omega$ (Note 1), $T_C = 25^\circ\text{C}$	$E_{SCIS25}$	300	mJ
ISCIS = 10.6 A, L = 3.0 mHz, $R_{GE} = 1\text{ K}\Omega$ (Note 2), $T_C = 150^\circ\text{C}$	$E_{SCIS150}$	170	mJ
Collector Current Continuous, at $V_{GE} = 4.0\text{ V}$ , $T_C = 25^\circ\text{C}$	$I_{C25}$	21	A
Collector Current Continuous, at $V_{GE} = 4.0\text{ V}$ , $T_C = 110^\circ\text{C}$	$I_{C110}$	17	A
Gate to Emitter Voltage Continuous	$V_{GEM}$	$\pm 10$	V
Power Dissipation Total, $T_C = 25^\circ\text{C}$	PD	150	W
Power Dissipation Derating, $T_C > 25^\circ\text{C}$	PD	1	W/ $^\circ\text{C}$
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	300	$^\circ\text{C}$
Reflow soldering according to JESD020C	$T_{PKG}$	260	$^\circ\text{C}$
HBM-Electrostatic Discharge Voltage at 100 pF, 1500 $\Omega$	ESD	4	kV
CDM-Electrostatic Discharge Voltage at 1 $\Omega$	ESD	2	kV

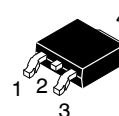
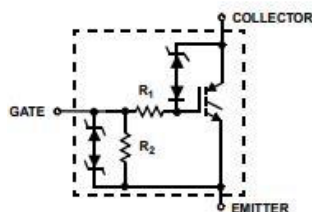
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Self Clamped inductive Switching Energy ( $E_{SCIS25}$ ) of 300 mJ is based on the test conditions that is starting  $T_J = 25^\circ\text{C}$ , L = 3 mHz, ISCIS = 14.2 A,  $V_{CC} = 100\text{ V}$  during inductor charging and  $V_{CC} = 0\text{ V}$  during time in clamp.
2. Self Clamped inductive Switching Energy ( $E_{SCIS150}$ ) of 170 mJ is based on the test conditions that is starting  $T_J = 150^\circ\text{C}$ , L = 3 mHz, ISCIS = 10.6 A,  $V_{CC} = 100\text{ V}$  during inductor charging and  $V_{CC} = 0\text{ V}$  during time in clamp.



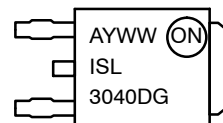
ON Semiconductor<sup>®</sup>

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DPAK (SINGLE GAUGE)  
CASE 369C

#### MARKING DIAGRAM



ISL3040DG = Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

#### ORDERING INFORMATION

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

# ISL9V3040D3STV

## THERMAL RESISTANCE RATINGS

Characteristic	Symbol	Max	Units
Junction-to-Case – Steady State (Drain) (Notes 1, 3 and 4)	$R_{\theta JC}$	1	°C/W

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector to Emitter Breakdown Voltage	$BV_{CER}$	$I_{CE} = 2\text{ mA}$ , $V_{GE} = 0\text{ V}$ , $R_{GE} = 1\text{ K}\Omega$ , $T_J = -40\text{ to }150^\circ\text{C}$	370	400	430	V	
Collector to Emitter Breakdown Voltage	$BV_{CES}$	$I_{CE} = 10\text{ mA}$ , $V_{GE} = 0\text{ V}$ , $R_{GE} = 0$ , $T_J = -40\text{ to }150^\circ\text{C}$	390	420	450	V	
Emitter to Collector Breakdown Voltage	$BV_{ECS}$	$I_{CE} = -75\text{ mA}$ , $V_{GE} = 0\text{ V}$ , $T_J = 25^\circ\text{C}$	30	–	–	V	
Gate to Emitter Breakdown Voltage	$BV_{GES}$	$I_{GES} = \pm 2\text{ mA}$	$\pm 12$	$\pm 14$	–	V	
Collector to Emitter Leakage Current	$I_{CER}$	$V_{CE} = 175\text{ V}$ , $R_{GE} = 1\text{ K}\Omega$	$T_J = 25^\circ\text{C}$	–	–	25	$\mu\text{A}$
			$T_J = 150^\circ\text{C}$	–	–	1	mA
Emitter to Collector Leakage Current	$I_{ECS}$	$V_{EC} = 24\text{ V}$	$T_J = 25^\circ\text{C}$	–	–	1	mA
			$T_J = 150^\circ\text{C}$	–	–	40	
Series Gate Resistance	$R_1$		–	70	–	$\Omega$	
Gate to Emitter Resistance	$R_2$		10 K	–	26 K	$\Omega$	

### ON CHARACTERISTICS

Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_{CE} = 6\text{ A}$ , $V_{GE} = 4\text{ V}$ , $T_J = 25^\circ\text{C}$	–	1.25	1.65	V
Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_{CE} = 10\text{ A}$ , $V_{GE} = 4.5\text{ V}$ , $T_J = 150^\circ\text{C}$	–	1.58	1.80	V
Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_{CE} = 15\text{ A}$ , $V_{GE} = 4.5\text{ V}$ , $T_J = 150^\circ\text{C}$	–	1.90	2.20	V

### DYNAMIC CHARACTERISTICS

Gate Charge	$Q_{G(ON)}$	$I_{CE} = 10\text{ A}$ , $V_{CE} = 12\text{ V}$ , $V_{GE} = 5\text{ V}$	–	17	–	nC	
Gate to Emitter Threshold Voltage	$V_{GE(TH)}$	$I_{CE} = 1\text{ mA}$ , $V_{CE} = V_{GE}$	$T_J = 25^\circ\text{C}$	1.3	–	2.2	V
			$T_J = 150^\circ\text{C}$	0.75	–	1.8	
Gate to Emitter Plateau Voltage	$V_{GEP}$	$V_{CE} = 12\text{ V}$ , $I_{CE} = 10\text{ A}$	–	3.0	–	V	

### SWITCHING CHARACTERISTICS

Current Turn-On Delay Time-Resistive	$t_{d(ON)R}$	$V_{CE} = 14\text{ V}$ , $R_L = 1\text{ }\Omega$ , $V_{GE} = 5\text{ V}$ , $R_G = 470\text{ }\Omega$ , $T_J = 25^\circ\text{C}$	–	0.7	4	$\mu\text{s}$
Current Rise Time-Resistive	$t_{rR}$		–	2.1	7	
Current Turn-Off Delay Time-Inductive	$t_{d(OFF)L}$	$V_{CE} = 300\text{ V}$ , $L = 1\text{ mH}$ , $V_{GE} = 5\text{ V}$ , $R_G = 470\text{ }\Omega$ , $I_{CE} = 6.5\text{ A}$ , $T_J = 25^\circ\text{C}$	–	4.8	15	
Current Fall Time-Inductive	$t_{fL}$		–	2.8	15	

## PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Diameter	Tape Width	Qty
ISL9V3040G1	ISL9V3040D3STV	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.

# ISL9V3040D3STV

## TYPICAL CHARACTERISTICS

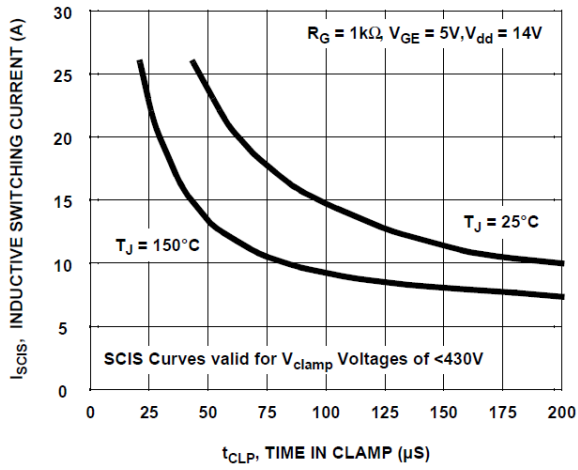


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

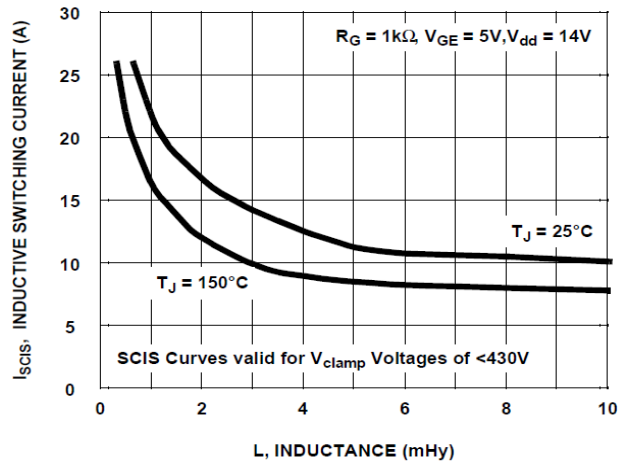


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

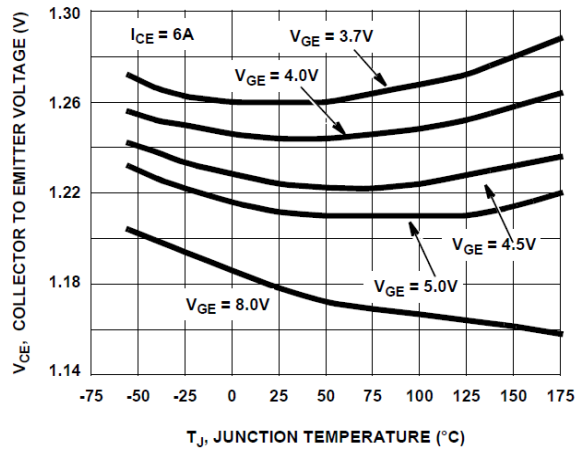


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

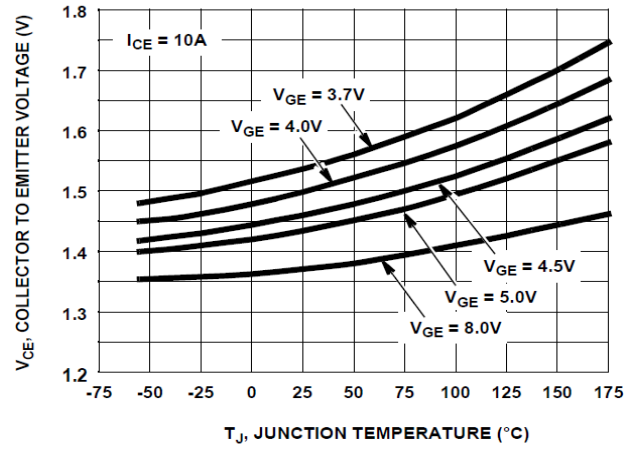


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

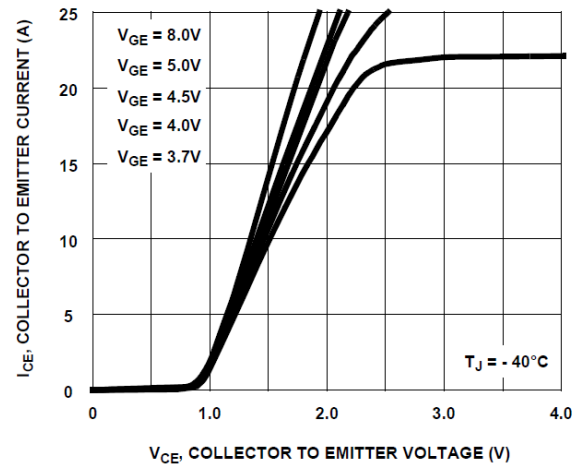


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

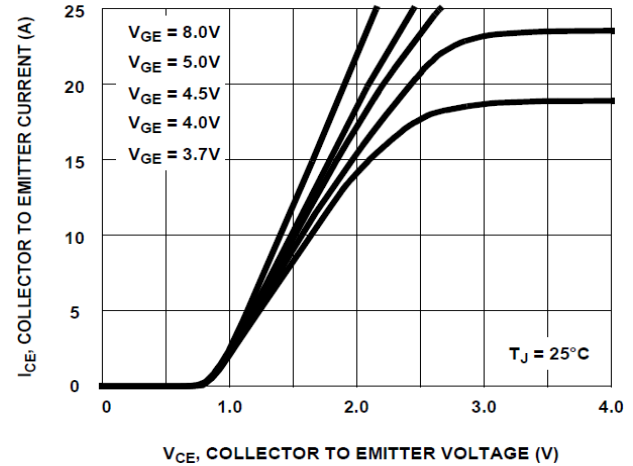


Figure 6. Collector to Emitter On- State Voltage vs. Collector Current

# ISL9V3040D3STV

## TYPICAL CHARACTERISTICS (continued)

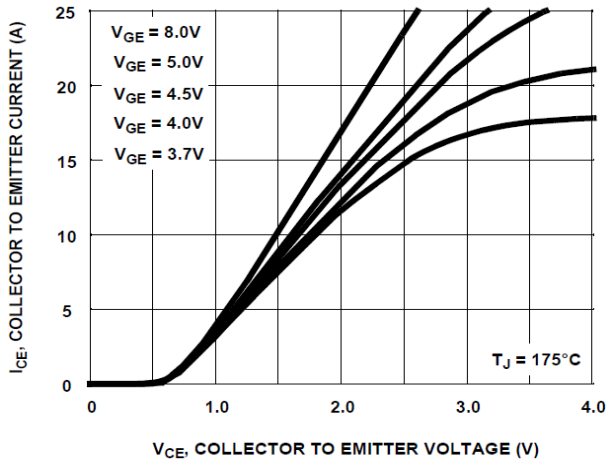


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

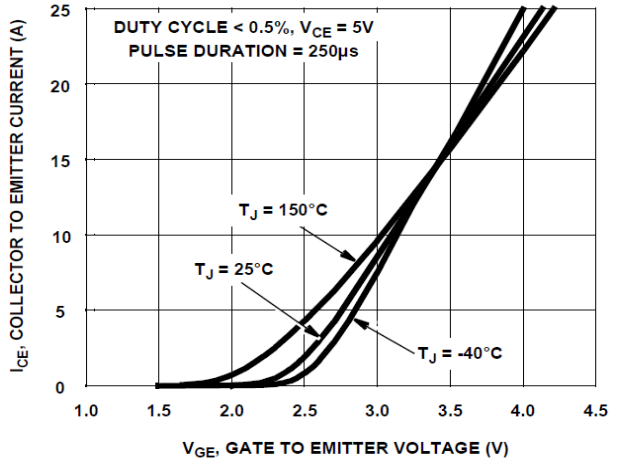


Figure 8. Transfer Characteristics

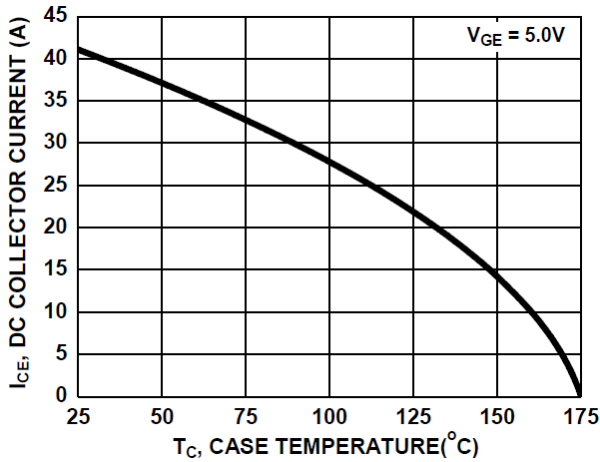


Figure 9. DC Collector Current vs. Case Temperature

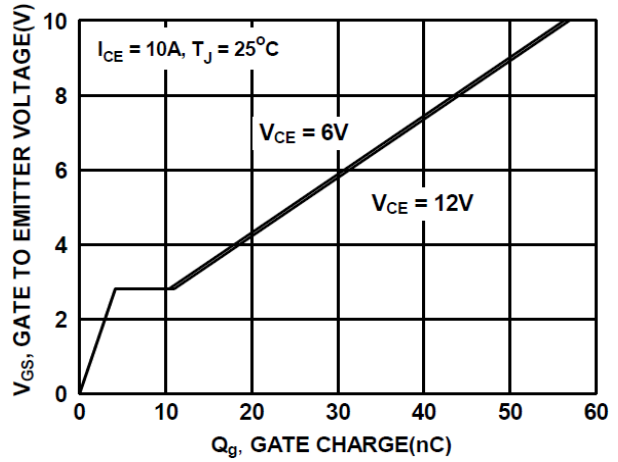


Figure 10. Gate Charge

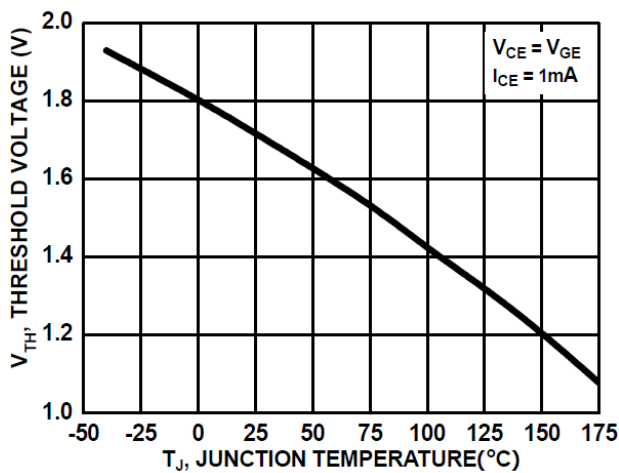


Figure 11. Threshold Voltage vs. Junction Temperature

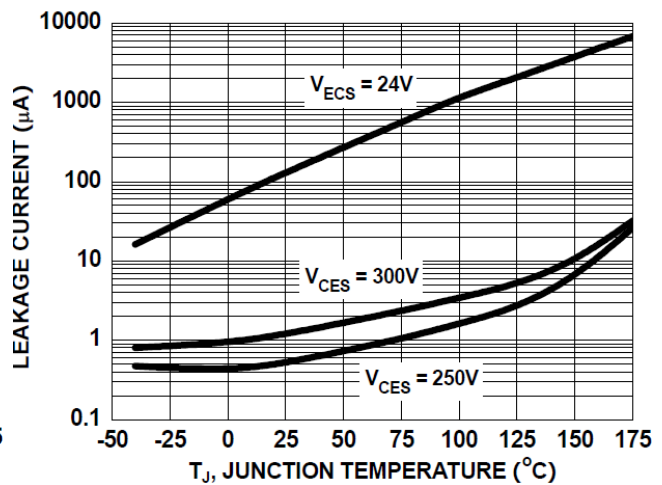


Figure 12. Leakage Current vs. Junction Temperature

# ISL9V3040D3STV

## TYPICAL CHARACTERISTICS (continued)

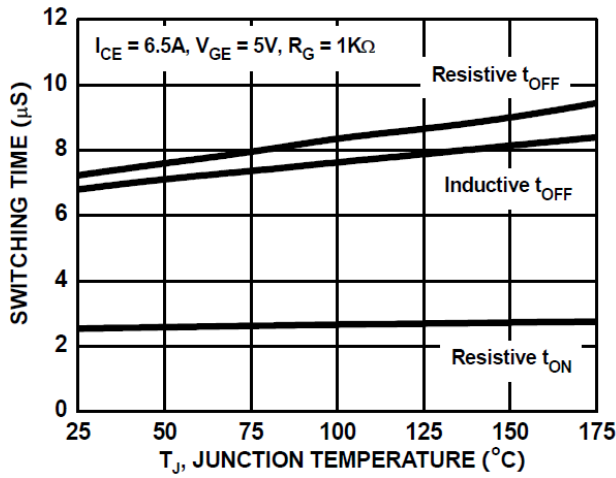


Figure 13. Switching Time vs. Junction Temperature

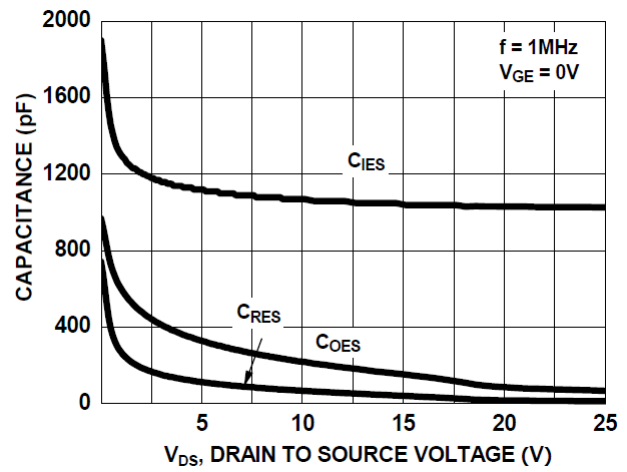


Figure 14. Capacitance vs. Collector to Emitter Voltage

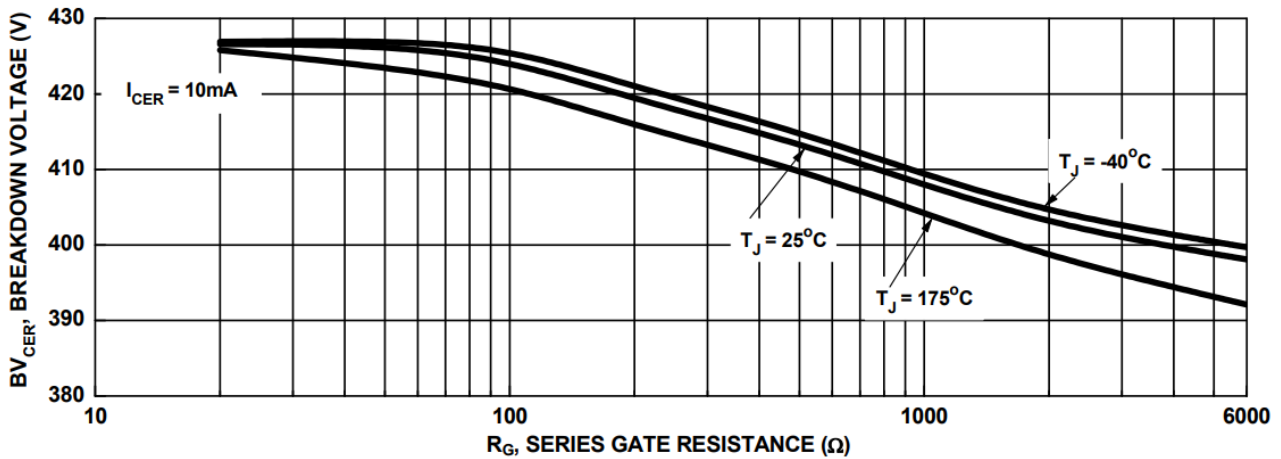


Figure 15. Break down Voltage vs. Series Resistance

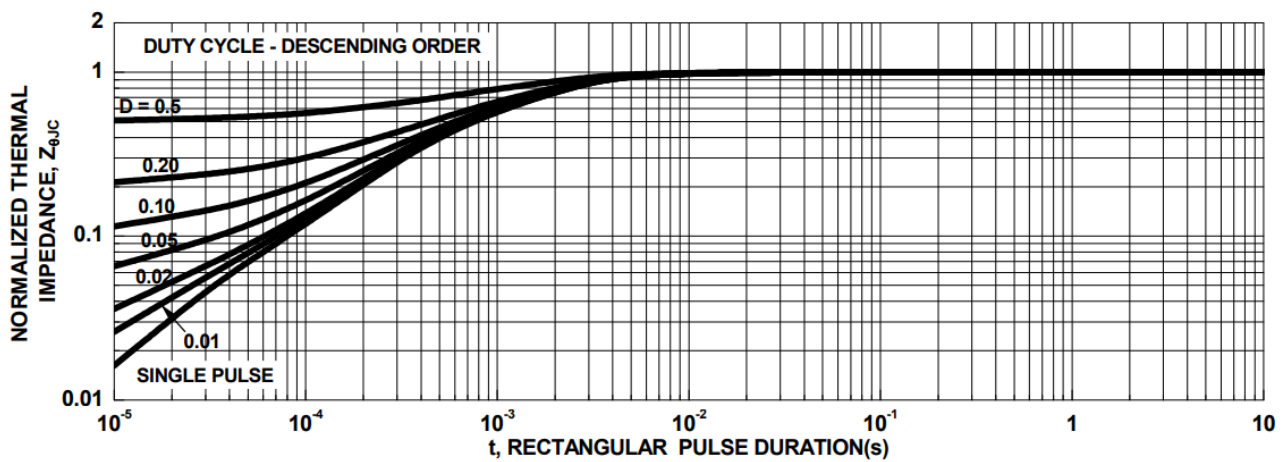


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

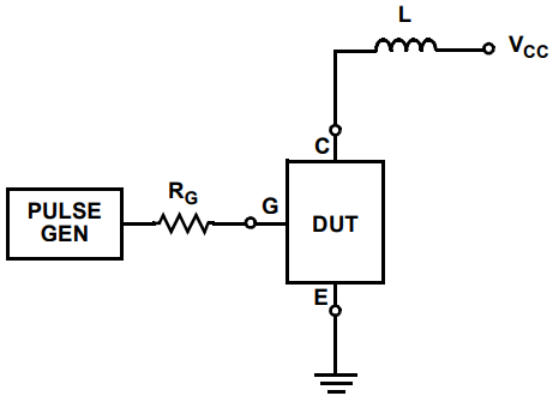


Figure 17. Inductive Switching Test Circuit

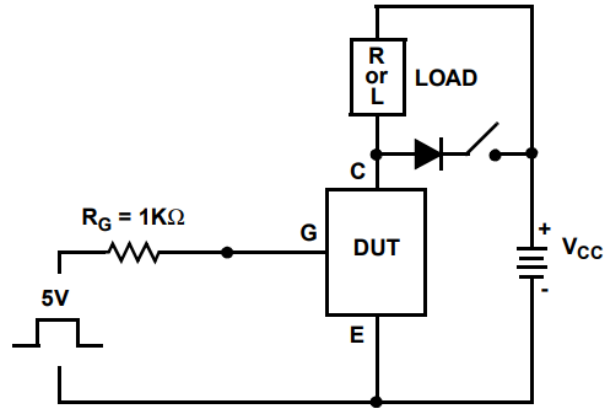


Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

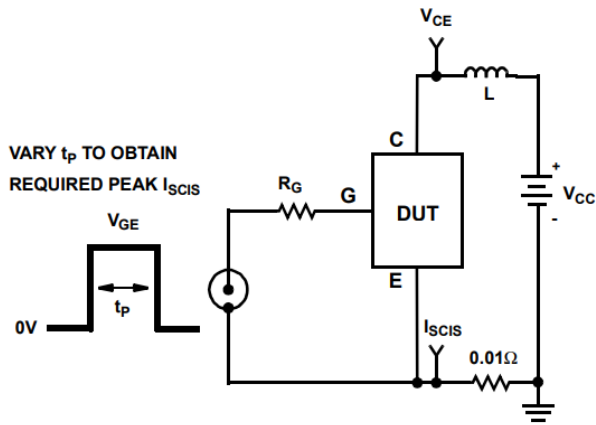


Figure 19. Energy Test Circuit

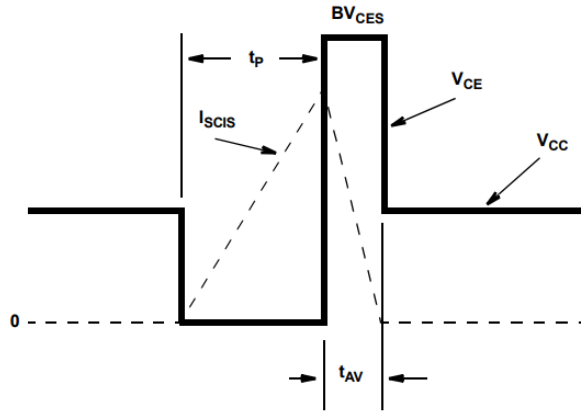
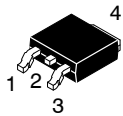


Figure 20. Energy Waveforms

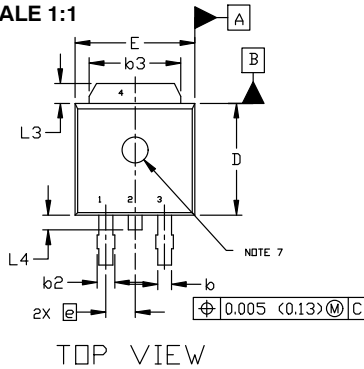
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



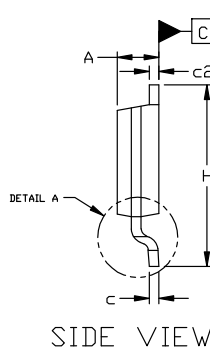
## DPAK (SINGLE GAUGE) CASE 369C ISSUE G

DATE 31 MAY 2023

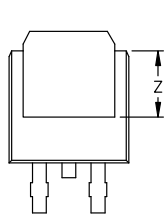
SCALE 1:1



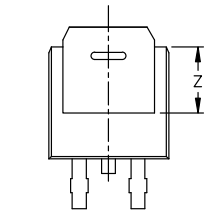
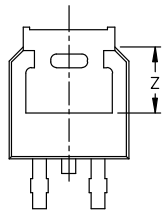
TOP VIEW



SIDE VIEW

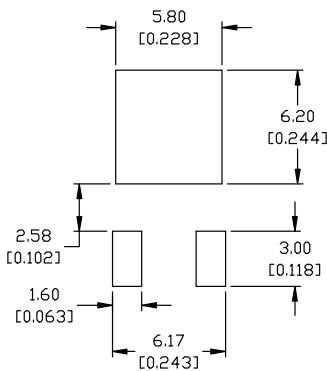


BOTTOM VIEW



BOTTOM VIEW

ALTERNATE CONSTRUCTIONS



### RECOMMENDED MOUNTING FOOTPRINT\*

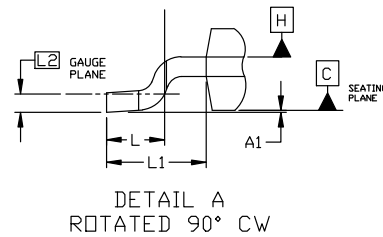
\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

- |  |  |   |   |  |
|--|--|---|---|--|
| <b>STYLE 1:</b><br>PIN 1. BASE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR | <b>STYLE 2:</b><br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE<br>4. DRAIN          | <b>STYLE 3:</b><br>PIN 1. ANODE<br>2. CATHODE<br>3. ANODE<br>4. CATHODE | <b>STYLE 4:</b><br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE<br>4. ANODE              | <b>STYLE 5:</b><br>PIN 1. GATE<br>2. ANODE<br>3. CATHODE<br>4. ANODE     |
| <b>STYLE 6:</b><br>PIN 1. MT1<br>2. MT2<br>3. GATE<br>4. MT2                 | <b>STYLE 7:</b><br>PIN 1. GATE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR | <b>STYLE 8:</b><br>PIN 1. N/C<br>2. CATHODE<br>3. ANODE<br>4. CATHODE   | <b>STYLE 9:</b><br>PIN 1. ANODE<br>2. CATHODE<br>3. RESISTOR ADJUST<br>4. CATHODE | <b>STYLE 10:</b><br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE<br>4. ANODE |

### NOTES:

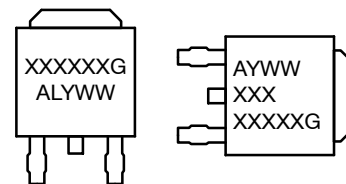
- DIMENSIONING AND TOLERANCING ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3, AND Z.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
- OPTIONAL MOLD FEATURE.

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.028	0.045	0.72	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090	BSC	2.29	BSC
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.114	REF	2.90	REF
L2	0.020	BSC	0.51	BSC
L3	0.035	0.050	0.89	1.27
L4	----	0.040	---	1.01
Z	0.155	----	3.93	---



DETAIL A  
ROTATED 90° CW

### GENERIC MARKING DIAGRAM\*



- IC**  
 XXXXXX = Device Code  
 A = Assembly Location  
 L = Wafer Lot  
 Y = Year  
 WW = Work Week  
 G = Pb-Free Package
- Discrete**  
 AYWW  
 XXX  
 XXXXXG

\*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.

<b>DOCUMENT NUMBER:</b>	<b>98AON10527D</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>DPAK (SINGLE GAUGE)</b>	<b>PAGE 1 OF 1</b>

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