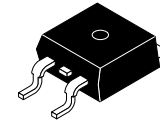


# ECOSPARK<sup>®</sup> Ignition IGBT

## 500 mJ, 450 V, N-Channel Ignition IGBT

### ISL9V5045S3ST-F085C



D2PAK-3  
CASE 418AJ

#### Features

- SCIS Energy = 500 mJ at  $T_J = 25^\circ\text{C}$
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

#### Applications

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

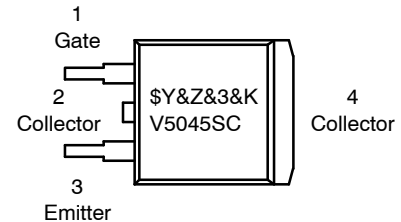
#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Value	Unit
Collector to Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ )	$BV_{CER}$	480	V
Emitter to Collector Voltage – Reverse Battery Condition ( $I_C = 10\text{ mA}$ )	$BV_{ECS}$	24	V
$I_{SCIS} = 39.2\text{ A}$ , $L = 650\text{ }\mu\text{H}$ , $R_{GE} = 1\text{ k}\Omega$ , $T_C = 25^\circ\text{C}$ (Note 1)	$ESCIS_{25}$	500	mJ
$I_{SCIS} = 31.1\text{ A}$ , $L = 650\text{ }\mu\text{H}$ , $R_{GE} = 1\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ (Note 2)	$ESCIS_{150}$	315	mJ
Collector Current Continuous, at $V_{GE} = 4.0\text{ V}$ , $T_C = 25^\circ\text{C}$	$IC_{25}$	51	A
Collector Current Continuous, at $V_{GE} = 4.0\text{ V}$ , $T_C = 110^\circ\text{C}$	$IC_{110}$	43	A
Gate to Emitter Voltage Continuous	$V_{GEM}$	$\pm 10$	V
Power Dissipation Total, $T_C = 25^\circ\text{C}$	PD	300	W
Power Dissipation Derating, $T_C > 25^\circ\text{C}$	PD	2	W/ $^\circ\text{C}$
Operating Junction and Storage Temperature	$T_J, T_{STG}$	$-40$ 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

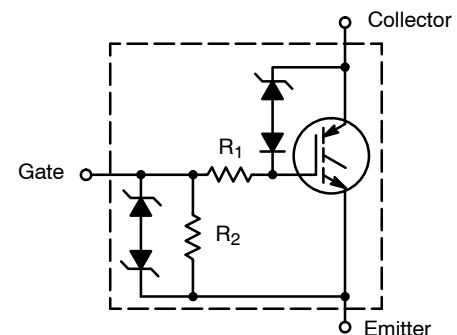
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Self Clamped inductive Switching Energy ( $ESCIS_{25}$ ) of 500 mJ is based on the test conditions that is starting  $T_J = 25^\circ\text{C}$ ,  $L = 650\text{ }\mu\text{H}$ ,  $I_{SCIS} = 39.2\text{ A}$ ,  $V_{CC} = 100\text{ V}$  during inductor charging and  $V_{CC} = 0\text{ V}$  during time in clamp.
2. Self Clamped inductive Switching Energy ( $ESCIS_{150}$ ) of 315 mJ is based on the test conditions that is starting  $T_J = 150^\circ\text{C}$ ,  $L = 650\text{ }\mu\text{H}$ ,  $I_{SCIS} = 31.1\text{ A}$ ,  $V_{CC} = 100\text{ V}$  during inductor charging and  $V_{CC} = 0\text{ V}$  during time in clamp.

#### MARKING DIAGRAM



$\$Y$  = ON Semiconductor Logo  
 $\&Z$  = Assembly Plant Code  
 $\&3$  = Date Code (Week & Year)  
 $\&K$  = Lot Code  
 $V5045SC$  = Specific Device Code



#### ORDERING INFORMATION

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

# ISL9V5045S3ST-F085C

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Drain)	$R_{\theta JC}$	0.9	°C/W

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
-----------	--------	----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

Collector to Emitter Breakdown Voltage	$BV_{CER}$	$I_{CE} = 2\text{ mA}$ , $V_{GE} = 0\text{ V}$ , $R_{GE} = 1\text{ k}\Omega$ , $T_J = -40\text{ to }150^\circ\text{C}$		420	450	480	V
Collector to Emitter Breakdown Voltage	$BV_{CES}$	$I_{CE} = 10\text{ mA}$ , $V_{GE} = 0\text{ V}$ , $R_{GE} = 0\text{ }\Omega$ , $T_J = -40\text{ to }150^\circ\text{C}$		445	475	505	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	mA
Series Gate Resistance	$R_1$			–	100	–	$\Omega$
Gate to Emitter Resistance	$R_2$			10	–	30	k $\Omega$

### ON CHARACTERISTICS

Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_{CE} = 10\text{ A}$ , $V_{GE} = 4.0\text{ V}$ , $T_J = 25^\circ\text{C}$		–	1.25	1.6	V
Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_{CE} = 15\text{ A}$ , $V_{GE} = 4.5\text{ V}$ , $T_J = 150^\circ\text{C}$		–	1.47	1.8	V

### DYNAMIC CHARACTERISTICS

Gate Charge	$Q_{G(ON)}$	$I_{CE} = 10\text{ A}$ , $V_{CE} = 12\text{ V}$ , $V_{GE} = 5\text{ V}$		–	32	–	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	V
Gate to Emitter Plateau Voltage	$V_{GEP}$	$V_{CE} = 12\text{ V}$ , $I_{CE} = 12\text{ A}$		–	3.1	–	V

### SWITCHING CHARACTERISTICS

Current Turn-On Delay Time-Resistive	$td_{(ON)R}$	$V_{CE} = 14\text{ V}$ , $R_L = 1\text{ }\Omega$ , $V_{GE} = 5\text{ V}$ , $R_G = 1\text{ k}\Omega$ , $T_J = 25^\circ\text{C}$	–	0.7	4	$\mu\text{s}$
Current Rise Time-Resistive	$t_{rR}$		–	2.1	7	
Current Turn-Off Delay Time-Inductive	$td_{(OFF)L}$	$V_{CE} = 300\text{ V}$ , $L = 650\text{ }\mu\text{H}$ , $V_{GE} = 5\text{ V}$ , $R_G = 1\text{ k}\Omega$ , $T_J = 25^\circ\text{C}$	–	10.8	15	
Current Fall Time-Inductive	$t_{fL}$		–	2.8	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.

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
ISL9V5045S3ST-F085C	D <sup>2</sup> PAK-3 (Pb-Free)	800 / 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.

TYPICAL CHARACTERISTICS

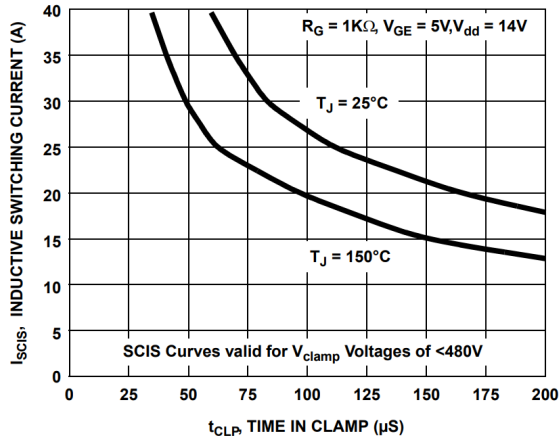


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

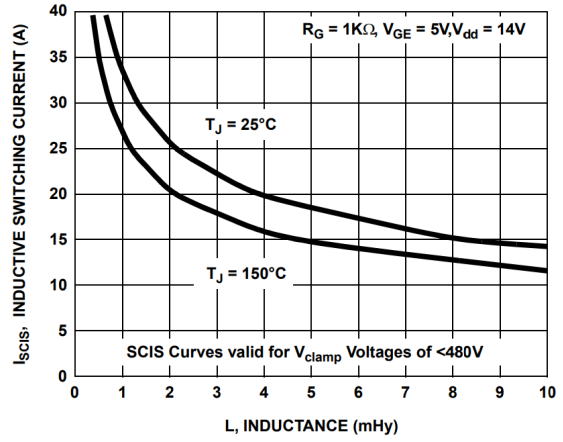


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

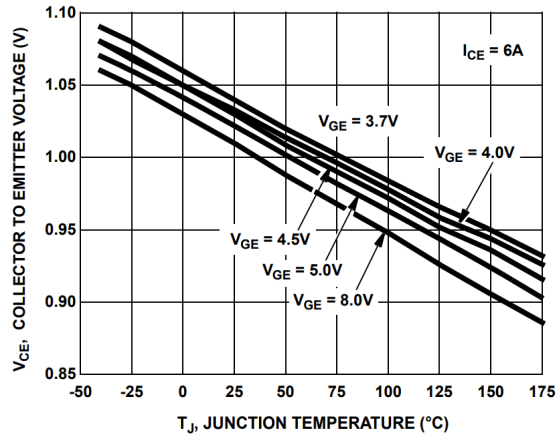


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

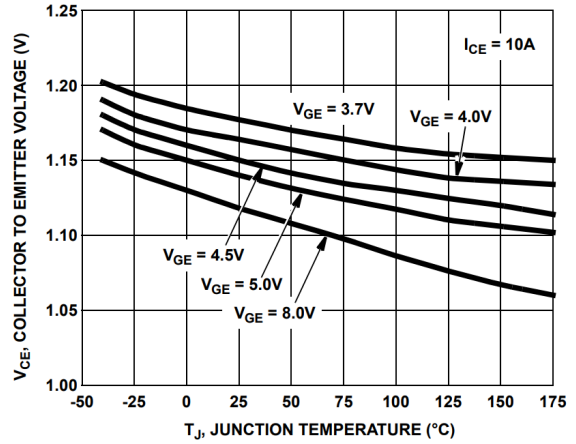


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

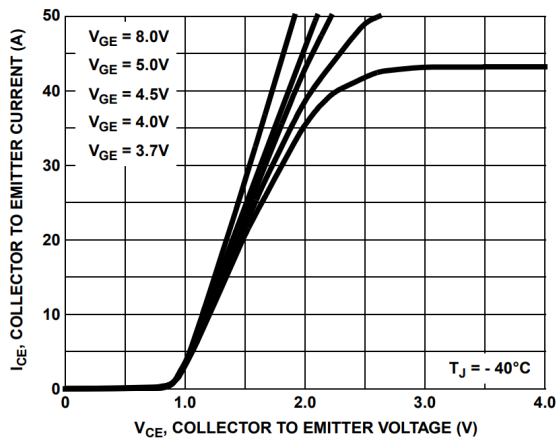


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

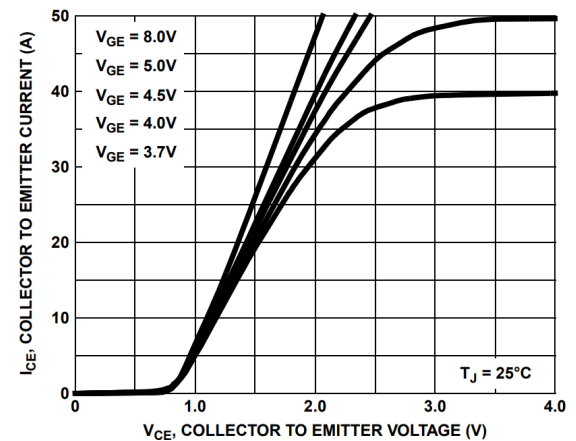


Figure 6. Collector to Emitter On- State Voltage vs. Collector Current

TYPICAL CHARACTERISTICS (Continued)

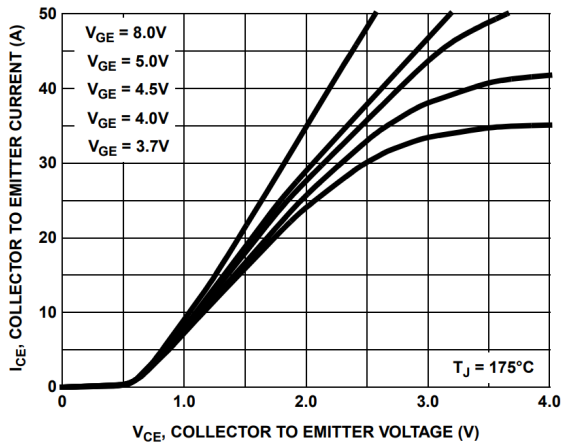


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

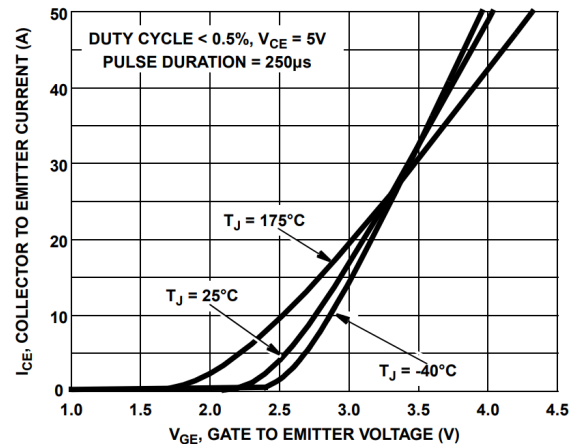


Figure 8. Transfer Characteristics

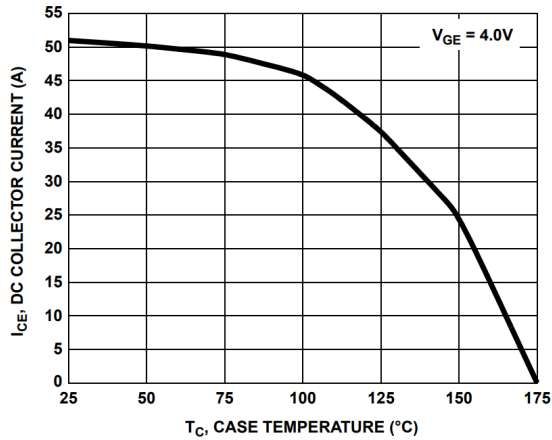


Figure 9. DC Collector Current vs. Case Temperature

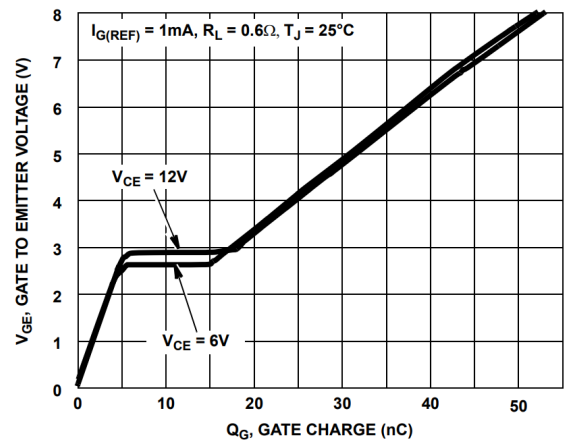


Figure 10. Gate Charge

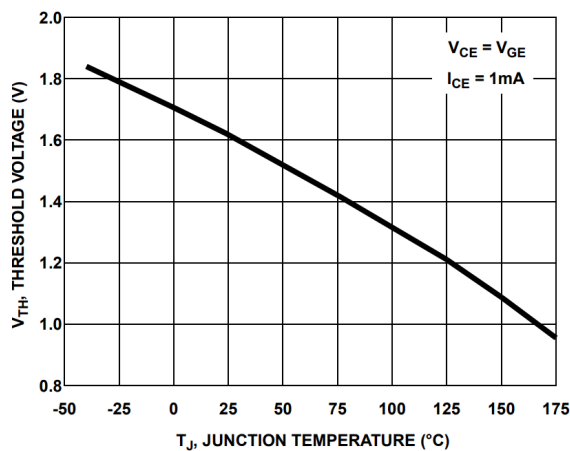


Figure 11. Threshold Voltage vs. Junction Temperature

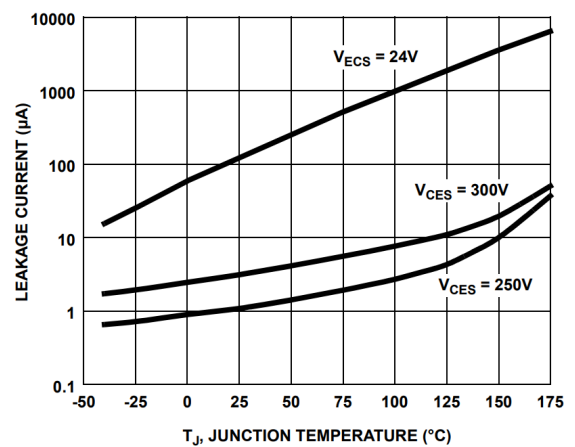


Figure 12. Leakage Current vs. Junction Temperature

TYPICAL CHARACTERISTICS (Continued)

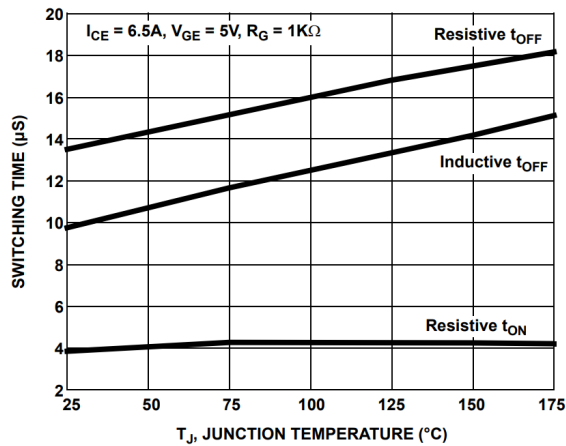


Figure 13. Switching Time vs. Junction Temperature

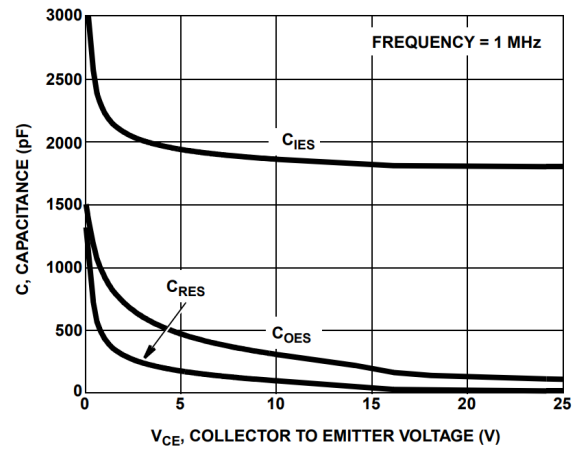


Figure 14. Capacitance vs. Collector to Emitter Voltage

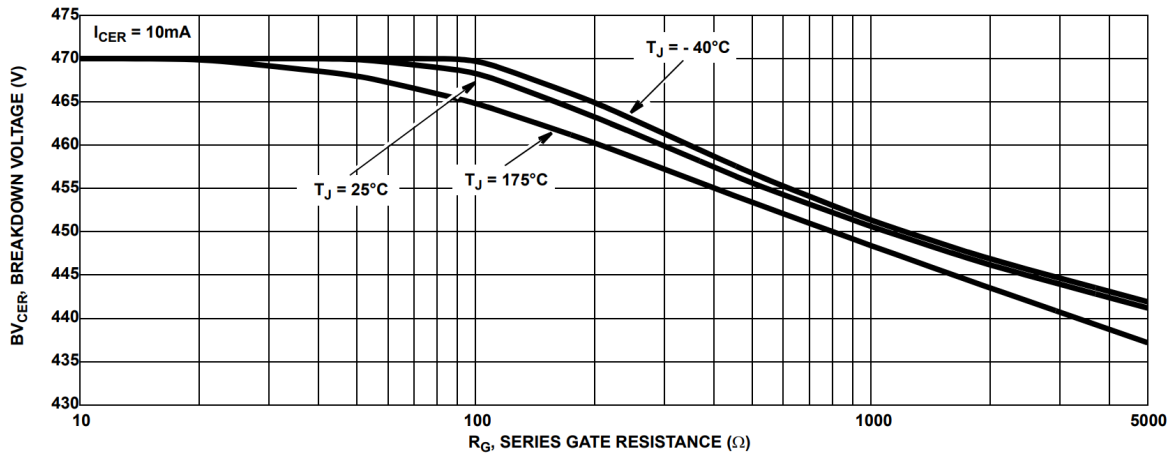


Figure 15. Break down Voltage vs. Series Resistance

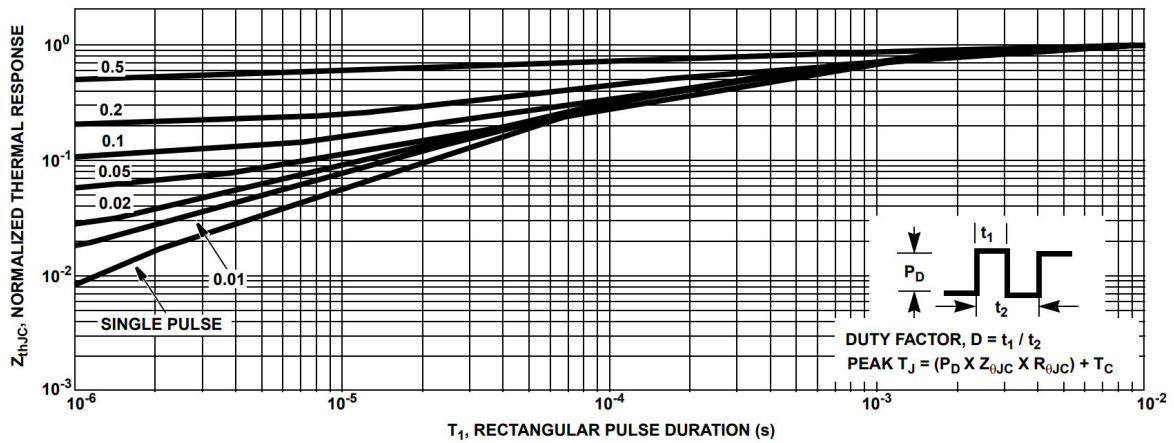


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

TEST CIRCUIT AND WAVEFORMS

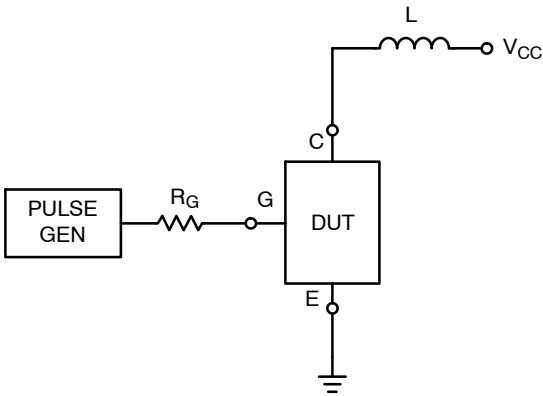


Figure 17. Inductive Switching Test Circuit

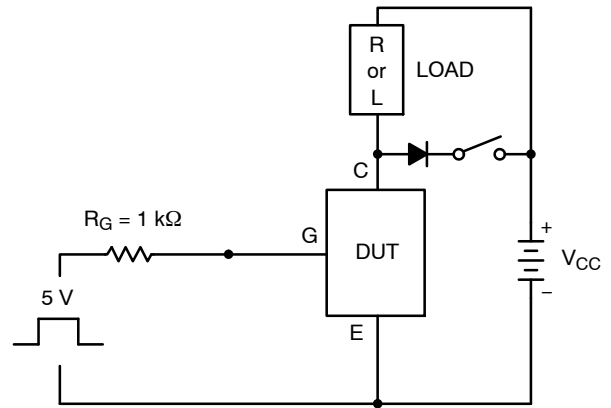


Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

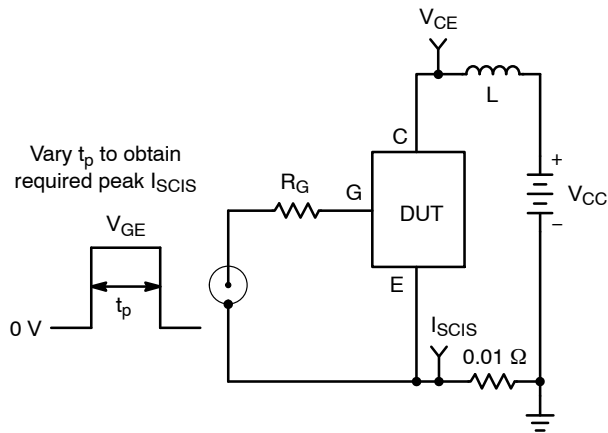


Figure 19. Energy Test Circuit

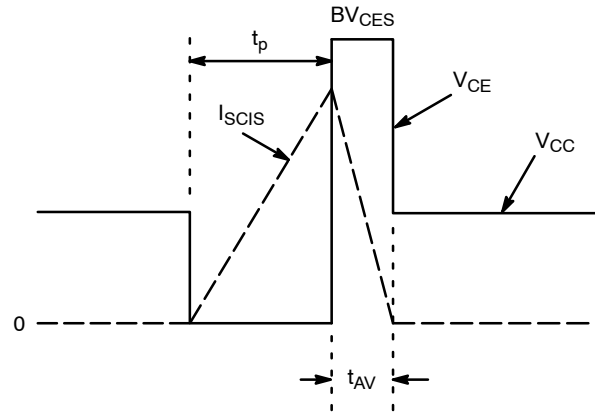
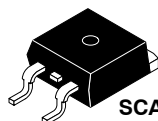


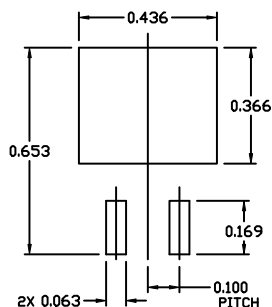
Figure 20. Energy Waveforms



SCALE 1:1

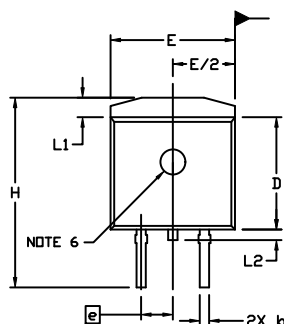
D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)  
CASE 418AJ  
ISSUE F

DATE 11 MAR 2021



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, SOLDERM1.

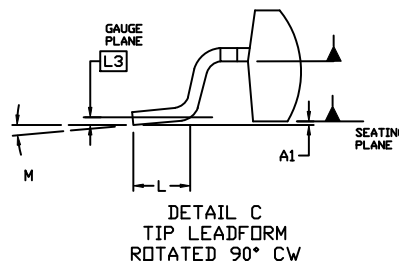
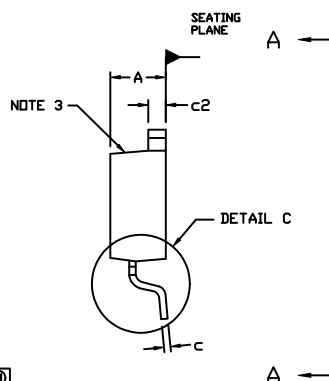


0.100 BSC 0.100 BSC 0.100 BSC

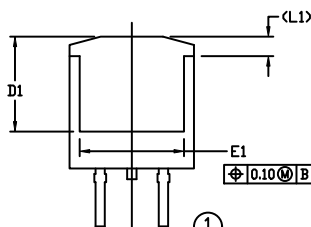
NOTES:

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.

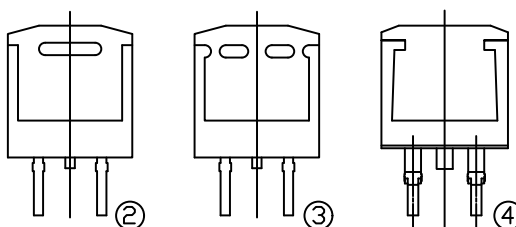
DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100 BSC	---	2.54 BSC	---
H	0.575	0.625	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°



DETAIL C  
TIP LEADFORM  
ROTATED 90° CW

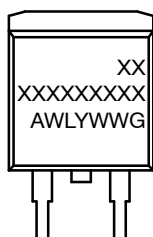


VIEW A-A

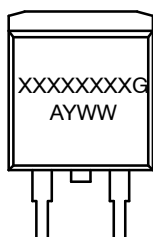


VIEW A-A  
OPTIONAL CONSTRUCTIONS

GENERIC MARKING DIAGRAMS\*



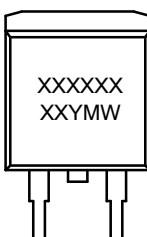
IC



Standard



Rectifier



SSG

XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
W = Week Code (SSG)  
M = Month Code (SSG)  
G = Pb-Free Package  
AKA = Polarity Indicator

\*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.

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DESCRIPTION:	D <sup>2</sup> PAK-3 (TO-263, 3-LEAD)	PAGE 1 OF 1

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## ADDITIONAL INFORMATION

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onsemi Website: [www.onsemi.com](http://www.onsemi.com)

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For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)



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