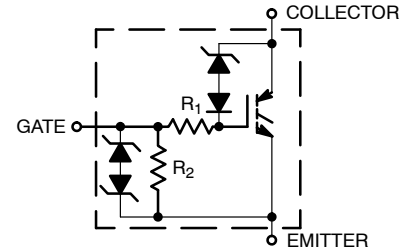


# ECOSPARK<sup>®</sup> Ignition IGBT

300 mJ, 400 V, N-Channel Ignition IGBT

**ISL9V3040D3S,  
ISL9V3040S3S,  
ISL9V3040P3**



## General Description

The ISL9V3040D3S, ISL9V3040S3S, and ISL9V3040P3 are the next generation ignition IGBTs that offer outstanding SCIS capability in the space saving D-Pak (TO-252), as well as the industry standard D<sup>2</sup>-Pak (TO-263), and TO-262 and TO-220 plastic packages. This device is intended for use in automotive ignition circuits, specifically as a coil driver. Internal diodes provide voltage clamping without the need for external components.

ECOSPARK devices can be custom made to specific clamp voltages. Contact your nearest **onsemi** sales office for more information.

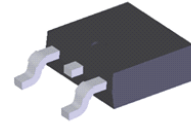
Formerly Developmental Type 49362.

## Features

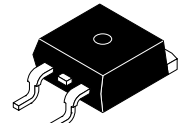
- Space Saving D-Pak Package Availability
- SCIS Energy = 300 mJ at T<sub>J</sub> = 25°C
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- These are Pb-Free Devices

## Applications

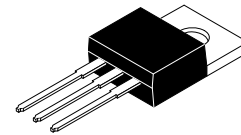
- Automotive Ignition Coil Driver Circuits
- Coil-On Plug Application



**DPAK3**  
CASE 369AS



**D<sup>2</sup>PAK-3**  
CASE 418AJ



**TO-220-3LD**  
CASE 340AT

## MARKING DIAGRAMS



- A = Assembly Location
- Y = Year
- WW = Work Week
- XXXX = Device Code
- ZZ = Assembly Lot Number
- G = Pb-Free Package

## ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

# ISL9V3040D3S, ISL9V3040S3S, ISL9V3040P3

## MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Rating	Unit
BV <sub>CER</sub>	Collector to Emitter Breakdown Voltage (I <sub>C</sub> = 1 mA)	430	V
BV <sub>ECS</sub>	Emitter to Collector Voltage – Reverse Battery Condition (I <sub>C</sub> = 10 mA)	24	V
E <sub>SCIS25</sub>	At Starting T <sub>J</sub> = 25°C, I <sub>SCIS</sub> = 14.2 A, L = 3.0 mHy	300	mJ
E <sub>SCIS150</sub>	At Starting T <sub>J</sub> = 150°C, I <sub>SCIS</sub> = 10.6 A, L = 3.0 mHy	170	mJ
I <sub>C25</sub>	Collector Current Continuous, At T <sub>C</sub> = 25°C, See Fig 9	21	A
I <sub>C110</sub>	Collector Current Continuous, At T <sub>C</sub> = 110°C, See Fig 9	17	A
V <sub>GEM</sub>	Gate to Emitter Voltage Continuous	±10	V
P <sub>D</sub>	Power Dissipation Total T <sub>C</sub> = 25°C	150	W
	Power Dissipation Derating T <sub>C</sub> > 25°C	1.0	W/°C
T <sub>J</sub>	Operating Junction Temperature Range	-40 to 175	°C
T <sub>STG</sub>	Storage Junction Temperature Range	-40 to 175	°C
T <sub>L</sub>	Max Lead Temp for Soldering (Leads at 1.6 mm from Case for 10 s)	300	°C
T <sub>pkg</sub>	Max Lead Temp for Soldering (Package Body for 10 s)	260	°C
ESD	Electrostatic Discharge Voltage at 100 pF, 1500 Ω	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.

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Units
Thermal Resistance Junction Case	R <sub>θJC</sub>	1.0	°C/W

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

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

### OFF CHARACTERISTICS

BV <sub>CER</sub>	Collector to Emitter Breakdown Voltage	I <sub>C</sub> = 2 mA, V <sub>GE</sub> = 0 V, R <sub>G</sub> = 1 kΩ, See Figure 15 T <sub>J</sub> = -40 to 150°C	370	400	430	V	
BV <sub>CES</sub>	Collector to Emitter Breakdown Voltage	I <sub>C</sub> = 10 mA, V <sub>GE</sub> = 0 V, R <sub>G</sub> = 0, See Figure 15 T <sub>J</sub> = -40 to 150°C	390	420	450	V	
BV <sub>ECS</sub>	Emitter to Collector Breakdown Voltage	I <sub>C</sub> = -75 mA, V <sub>GE</sub> = 0 V, T <sub>C</sub> = 25°C	30	-	-	V	
BV <sub>GES</sub>	Gate to Emitter Breakdown Voltage	I <sub>GES</sub> = ±2 mA	±12	±14	-	V	
I <sub>CER</sub>	Collector to Emitter Leakage Current	V <sub>CER</sub> = 250 V R <sub>G</sub> = 1 kΩ See Figure 11	T <sub>C</sub> = 25°C	-	-	25	μA
			T <sub>C</sub> = 150°C	-	-	1	mA
I <sub>ECS</sub>	Emitter to Collector Leakage Current	V <sub>EC</sub> = 24 V, See Figure 11	T <sub>C</sub> = 25°C	-	-	1	mA
			T <sub>C</sub> = 150°C	-	-	40	
R <sub>1</sub>	Series Gate Resistance		-	70	-	Ω	
R <sub>2</sub>	Gate to Emitter Resistance		10K	-	26K	Ω	

### ON CHARACTERISTICS

V <sub>CE(SAT)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 6 A, V <sub>GE</sub> = 4 V	T <sub>C</sub> = 25°C, See Figure 3	-	1.25	1.60	V
V <sub>CE(SAT)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 10 A, V <sub>GE</sub> = 4.5 V	T <sub>C</sub> = 150°C, See Figure 4	-	1.58	1.80	V
V <sub>CE(SAT)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 15 A, V <sub>GE</sub> = 4.5 V	T <sub>C</sub> = 150°C	-	1.90	2.20	V

# ISL9V3040D3S, ISL9V3040S3S, ISL9V3040P3

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units	
<b>DYNAMIC CHARACTERISTICS</b>							
$Q_{G(ON)}$	Gate Charge	$I_C = 10\text{ A}$ , $V_{CE} = 12\text{ V}$ , $V_{GE} = 5\text{ V}$ See Figure 14	-	17	-	nC	
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	$I_C = 1.0\text{ mA}$ $V_{CE} = V_{GE}$ See Figure 10	$T_C = 25^\circ\text{C}$	1.3	-	2.2	V
			$T_C = 150^\circ\text{C}$	0.75	-	1.8	
$V_{GEP}$	Gate to Emitter Plateau Voltage	$V_{CE} = 12\text{ V}$ , $I_C = 10\text{ A}$	-	3.0	-	V	

## SWITCHING CHARACTERISTICS

$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	$V_{CE} = 14\text{ V}$ , $R_L = 1\ \Omega$ , $V_{GE} = 5\text{ V}$ , $R_G = 1\text{ k}\Omega$ , $T_J = 25^\circ\text{C}$ , See Figure 12	-	0.7	4	$\mu\text{s}$
$t_{rR}$	Current Rise Time-Resistive		-	2.1	7	
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	$V_{CE} = 300\text{ V}$ , $L = 500\ \mu\text{H}$ , $V_{GE} = 5\text{ V}$ , $R_G = 1\text{ k}\Omega$ , $T_J = 25^\circ\text{C}$ , See Figure 12	-	4.8	15	$\mu\text{s}$
$t_{fL}$	Current Fall Time-Inductive		-	2.8	15	
SCIS	Self Clamped Inductive Switching	$T_J = 25^\circ\text{C}$ , $L = 3.0\text{ mH}$ , $V_{GE} = 5\text{ V}$ , $R_G = 1\text{ k}\Omega$ , See Figure 1 and Figure 2	-	-	300	mJ

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

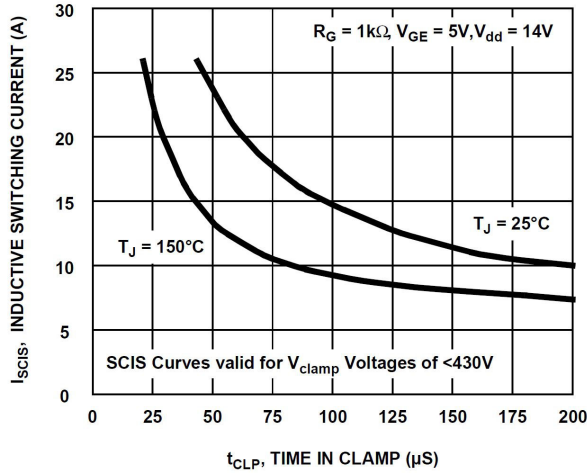


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

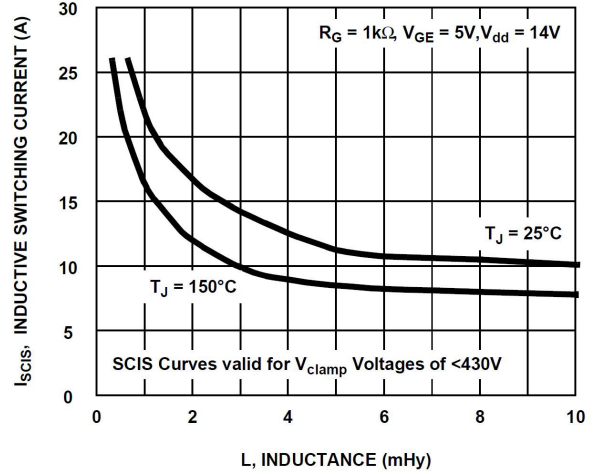


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

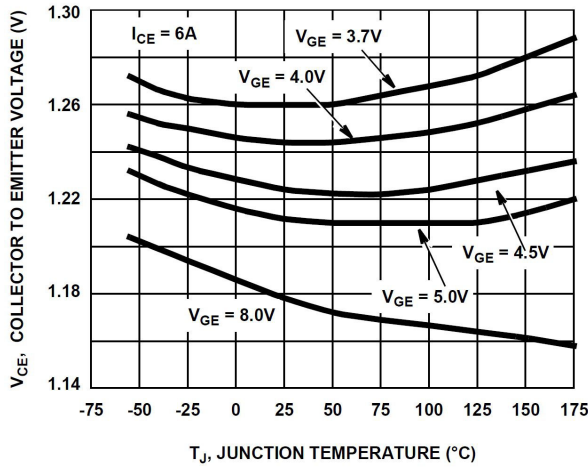


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

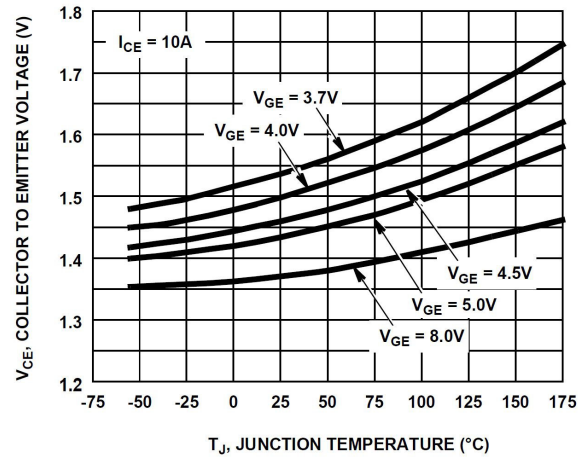


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

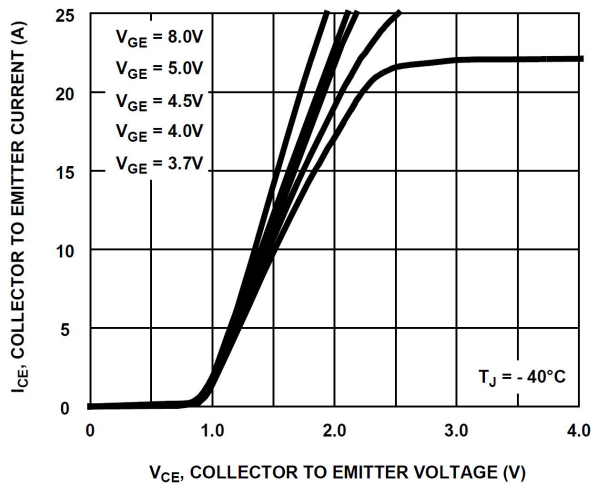


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

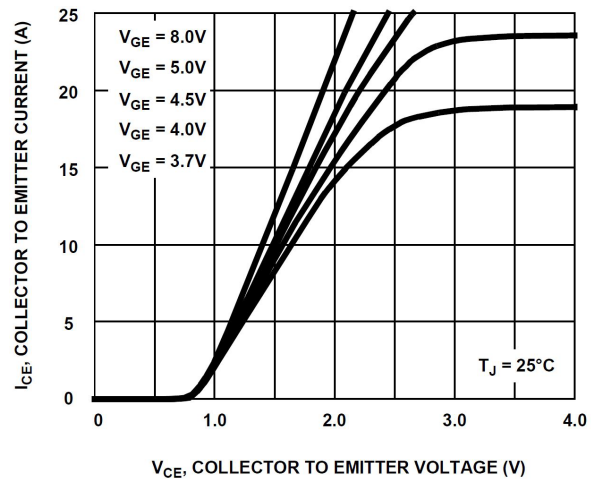


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

TYPICAL CHARACTERISTICS (continued)

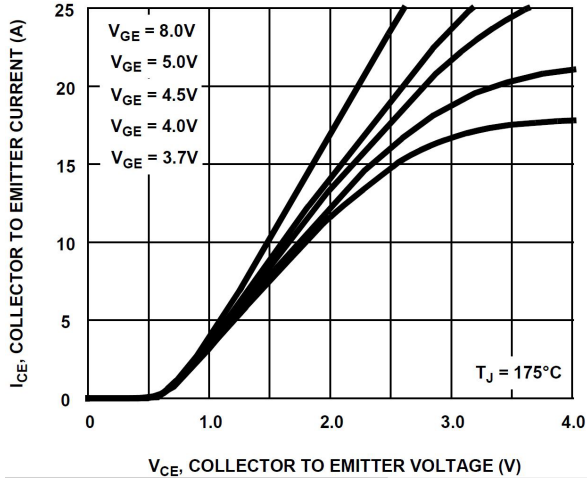


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

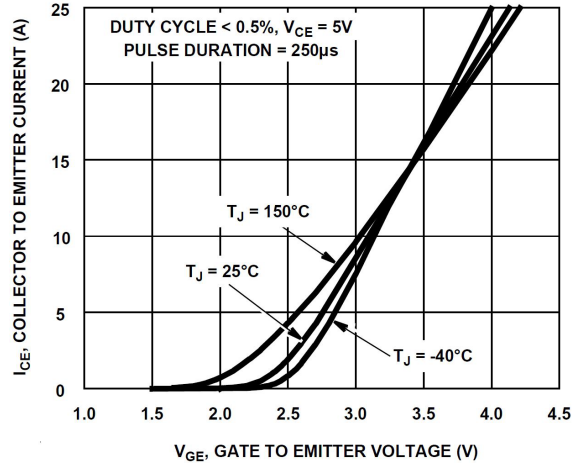


Figure 8. Transfer Characteristics

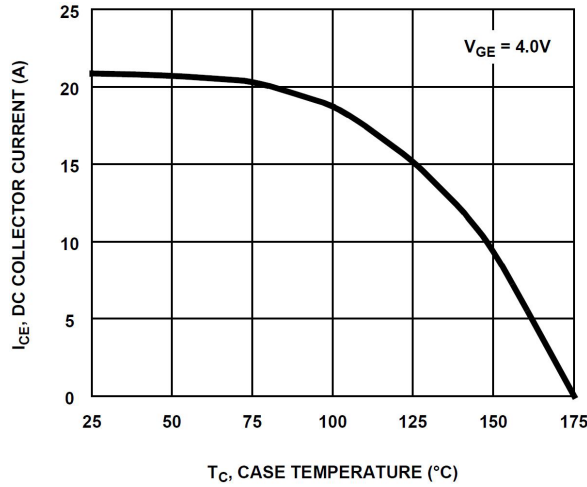


Figure 9. DC Collector Current vs. Case Temperature

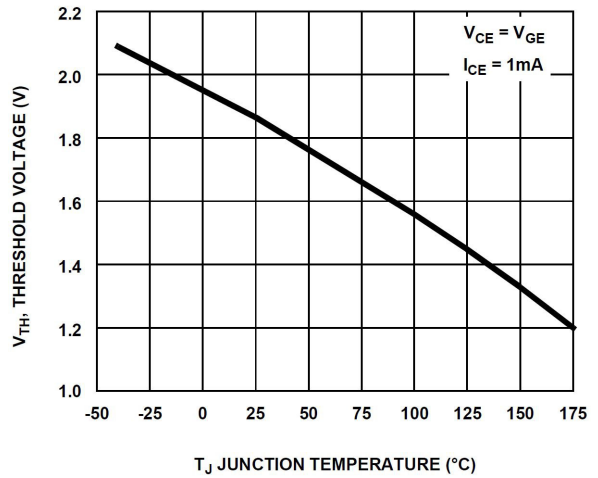


Figure 10. Threshold Voltage vs. Junction Temperature

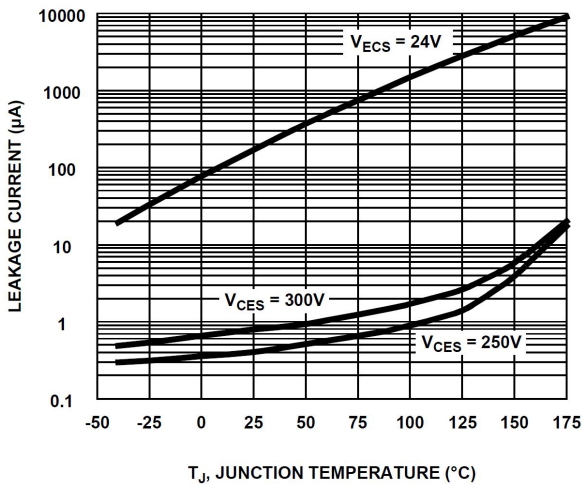


Figure 11. Leakage Current vs. Junction Temperature

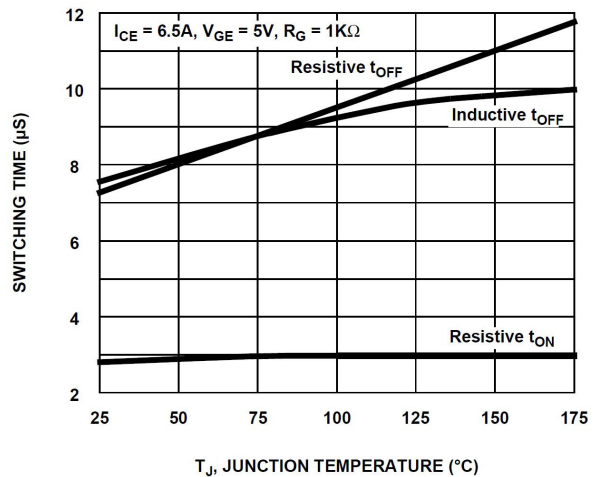


Figure 12. Switching Time vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

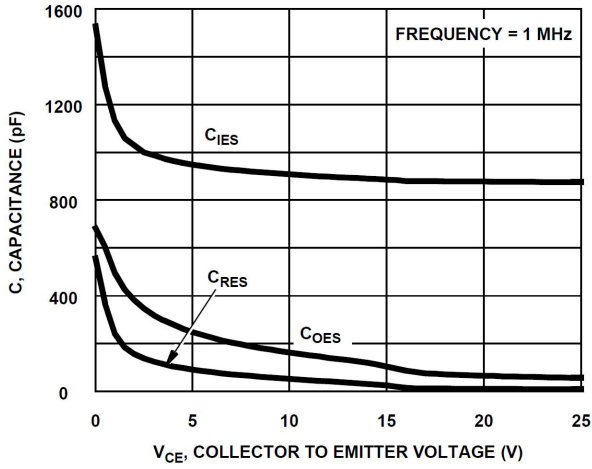


Figure 13. Capacitance vs. Collector to Emitter Voltage

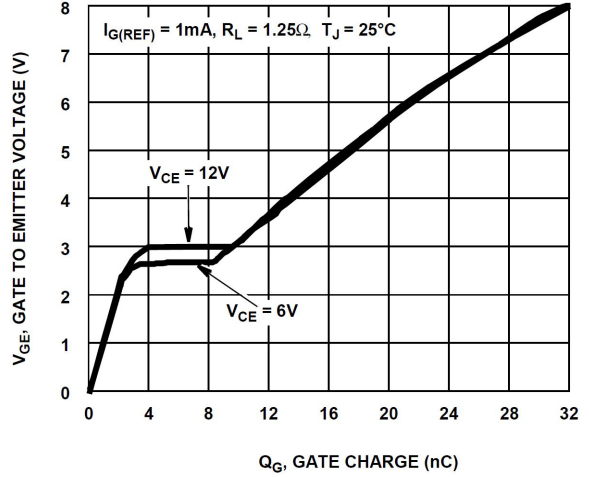


Figure 14. Gate Charge

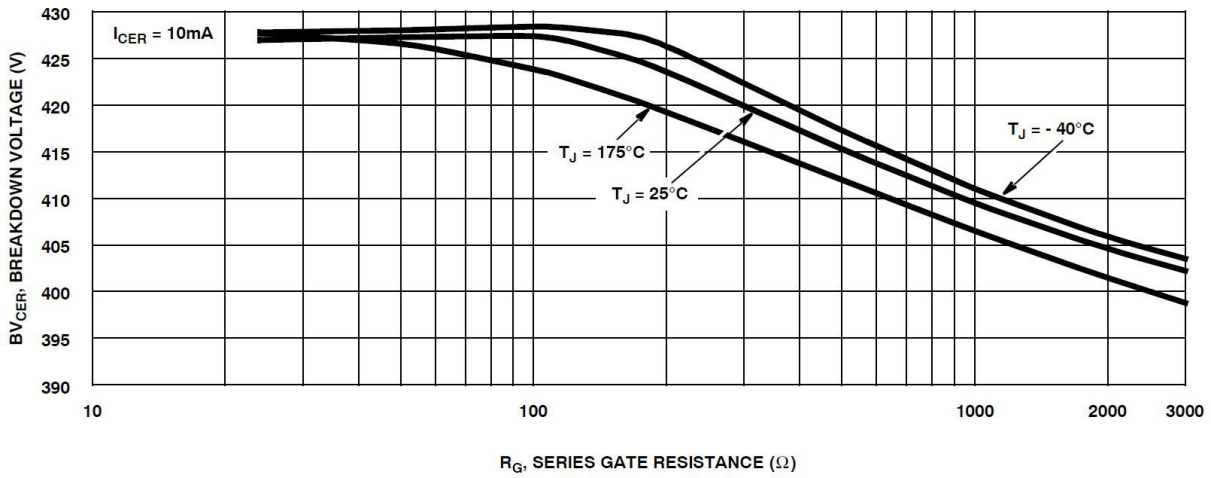


Figure 15. Breakdown Voltage vs. Series Resistance

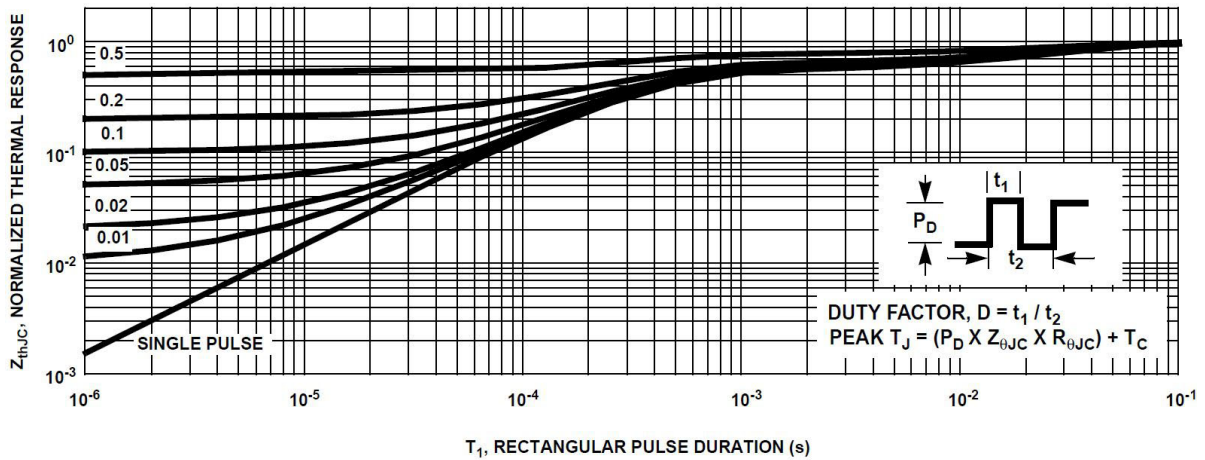


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

TEST CIRCUIT AND WAVEFORMS

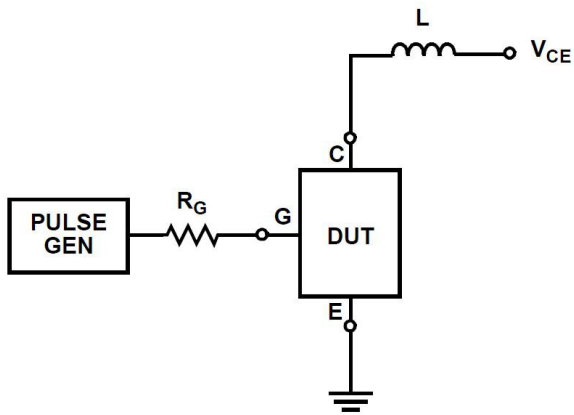


Figure 17. Inductive Switching Test Circuit

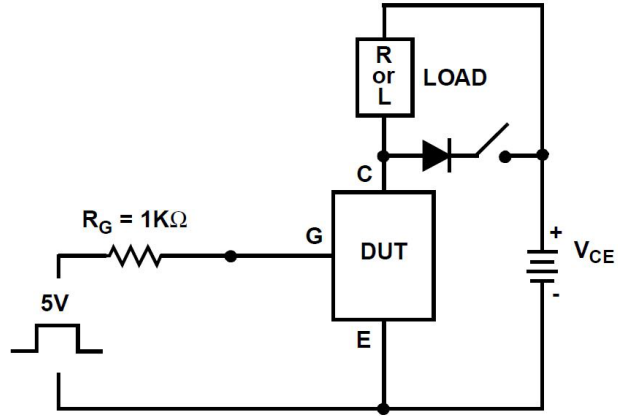


Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

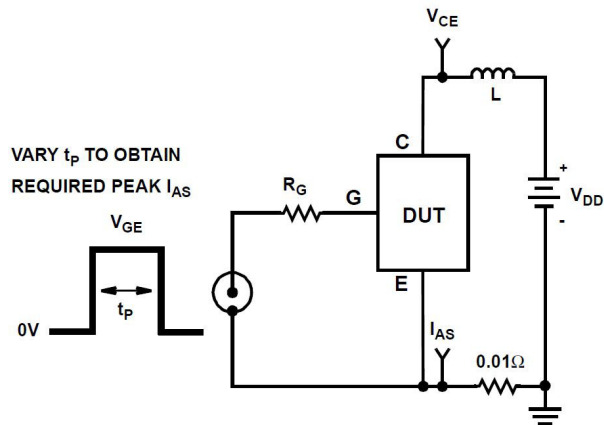


Figure 19. Energy Test Circuit

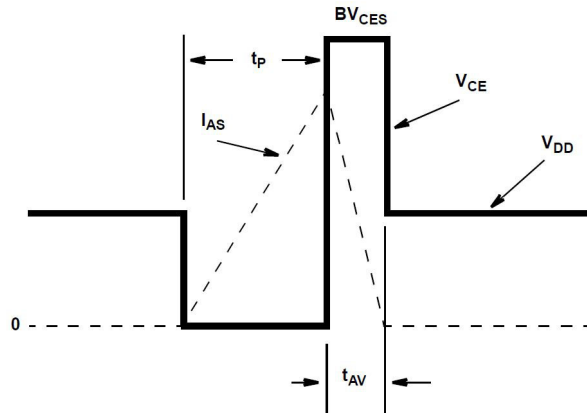


Figure 20. Energy Waveforms

# ISL9V3040D3S, ISL9V3040S3S, ISL9V3040P3

## PACKAGE MARKING AND ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
ISL9V3040D3ST	DPAK (Pb-Free)	2500 Units/Tape & Reel
ISL9V3040S3ST	D2PAK (Pb-Free)	800 Units/Tape & Reel
ISL9V3040P3	TO220 (Pb-Free)	50 Units/Tube

<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.

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



Scale 1:1

### TO-220-3LD CASE 340AT ISSUE A

DATE 03 OCT 2017



#### NOTES:

- A) REFERENCE JEDEC, TO-220, VARIATION AB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
- D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
- E) DOES NOT COMPLY JEDEC STANDARD VALUE.
- F) "A1" DIMENSIONS AS BELOW:  
SINGLE GAUGE = 0.51 - 0.61  
DUAL GAUGE = 1.10 - 1.45
- G) PRESENCE IS SUPPLIER DEPENDENT
- H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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<b>DESCRIPTION:</b>	<b>TO-220-3LD</b>	<b>PAGE 1 OF 1</b>

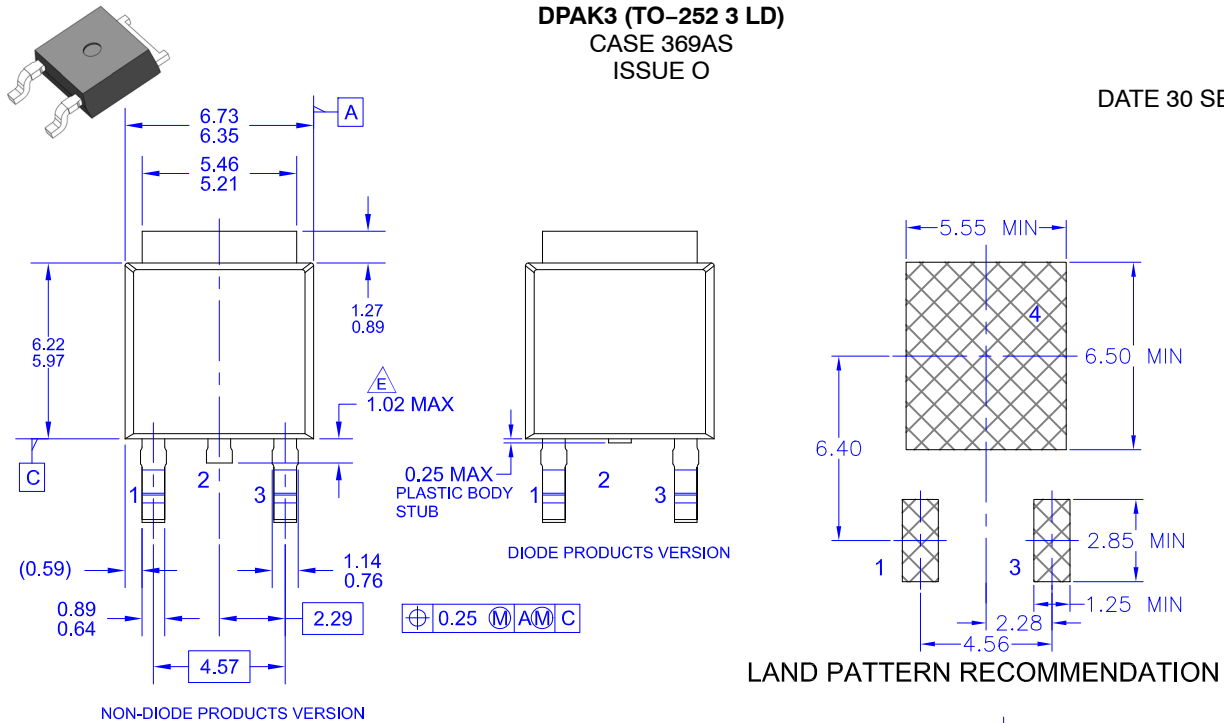
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

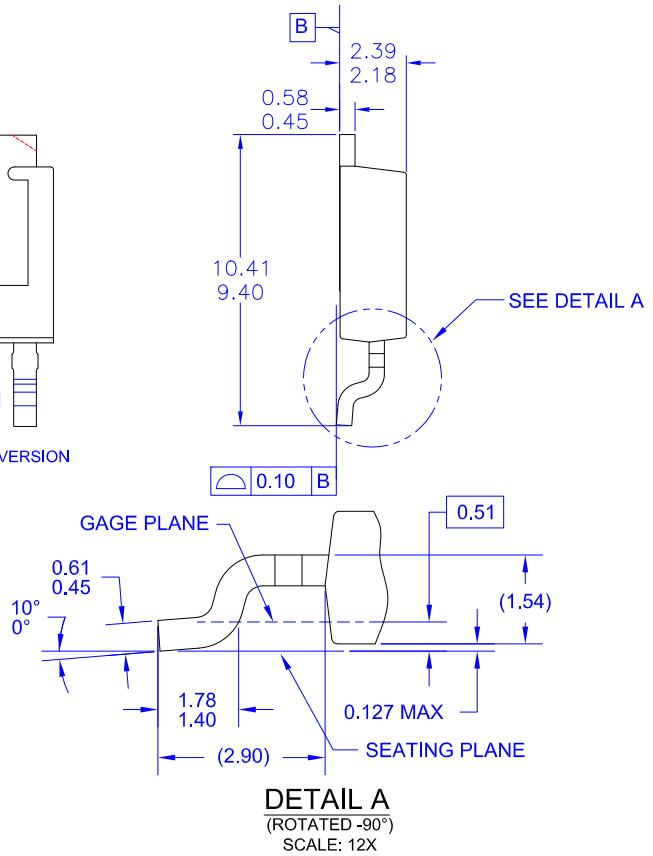


## DPAK3 (TO-252 3 LD) CASE 369AS ISSUE O

DATE 30 SEP 2016



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
  - D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
  - E) TRIMMED CENTER LEAD IS PRESENT ONLY FOR DIODE PRODUCTS
  - F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
  - G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.



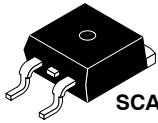
<b>DOCUMENT NUMBER:</b>	<b>98AON13810G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>DPAK3 (TO-252 3 LD)</b>	<b>PAGE 1 OF 1</b>

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



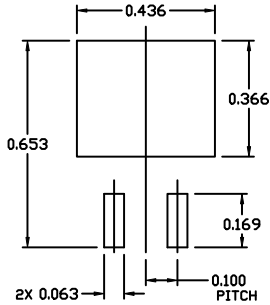
SCALE 1:1

### D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)

#### CASE 418AJ

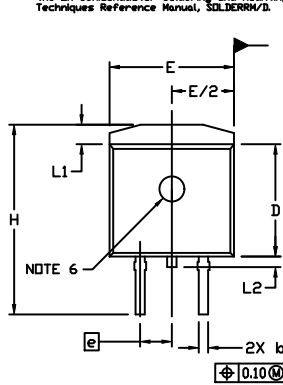
#### ISSUE F

DATE 11 MAR 2021



#### RECOMMENDED MOUNTING FOOTPRINT

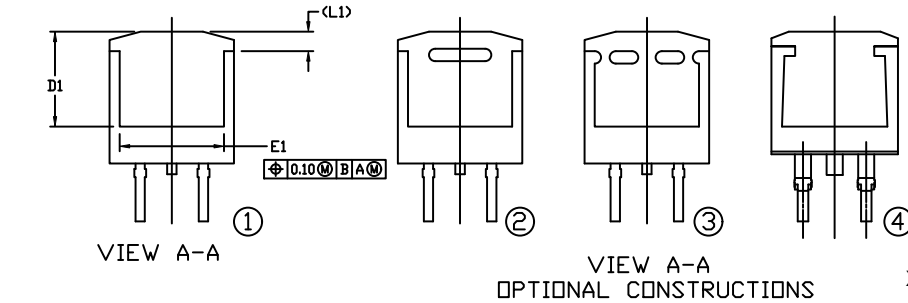
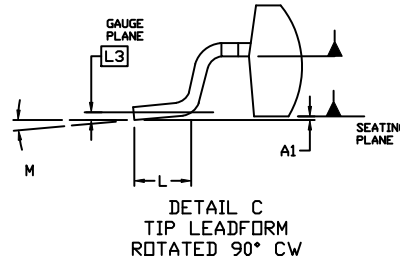
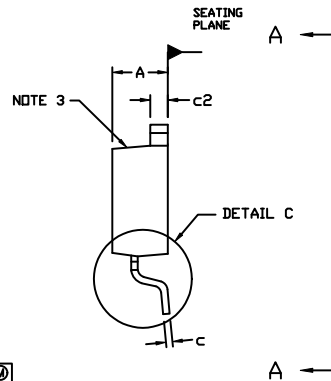
■ For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



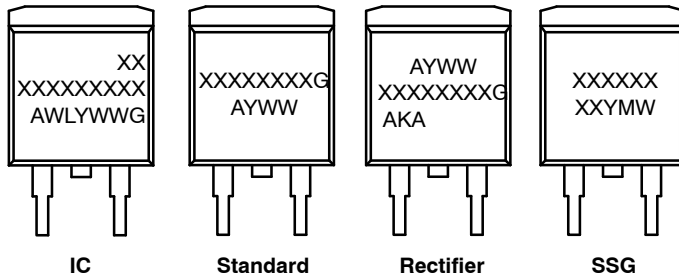
#### NOTES:

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. Ⓚ, Ⓛ ... 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*



#### GENERIC MARKING DIAGRAMS\*



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

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