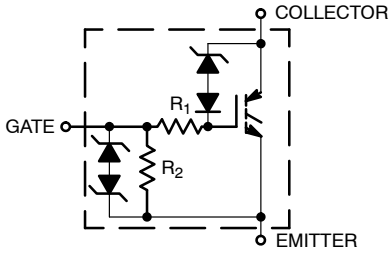
ECOSPARK® Ignition IGBT

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^2−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.

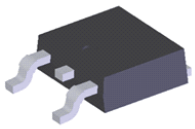
Formerly Developmental Type 49362.

Features

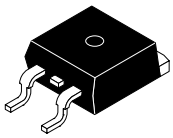
- Space Saving D−Pak Package Availability
- SCIS Energy = 300 mJ at T_J = 25°C
- Logic Level Gate Drive
- AEC−Q101 Qualified and PPAP Capable
- These are Pb−Free Devices

Applications

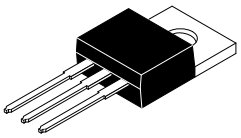
- Automotive Ignition Coil Driver Circuits
- Coil−On Plug Application



DPAK3
CASE 369AS

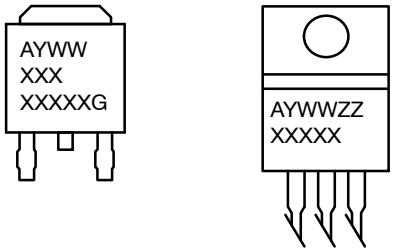


D^2PAK−3
CASE 418AJ



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.

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

Symbol	Parameter	Rating	Unit
BV_{CER}	Collector to Emitter Breakdown Voltage (I_C = 1 mA)	430	V
BV_{ECS}	Emitter to Collector Voltage − Reverse Battery Condition (I_C = 10 mA)	24	V
E_{SCIS25}	At Starting T_J = 25°C, I_{SCIS} = 14.2 A, L = 3.0 mHy	300	mJ
$E_{SCIS150}$	At Starting T_J = 150°C, I_{SCIS} = 10.6 A, L = 3.0 mHy	170	mJ
I_{C25}	Collector Current Continuous, At T_C = 25°C, See Fig 9	21	A
I_{C110}	Collector Current Continuous, At T_C = 110°C, See Fig 9	17	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	1.0	W/°C
T_J	Operating Junction Temperature Range	−40 to 175	°C
T_{STG}	Storage Junction Temperature Range	−40 to 175	°C
T_L	Max Lead Temp for Soldering (Leads at 1.6 mm from Case for 10 s)	300	°C
T_{pkg}	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	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Typ.	Max.	Units
OFF CHARACTERISTICS							
BV_{CER}	Collector to Emitter Breakdown Voltage	I_C = 2 mA, V_{GE} = 0 V, R_G = 1 kΩ, See Figure 15 T_J = −40 to 150°C		370	400	430	V
BV_{CES}	Collector to Emitter Breakdown Voltage	I_C = 10 mA, V_{GE} = 0 V, R_G = 0, See Figure 15 T_J = −40 to 150°C		390	420	450	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	I_C = −75 mA, V_{GE} = 0 V, T_C = 25°C		30	–	–	V
BV_{GES}	Gate to Emitter Breakdown Voltage	I_{GES} = ±2 mA		±12	±14	–	V
I_{CER}	Collector to Emitter Leakage Current	V_{CER} = 250 V R_G = 1 kΩ See Figure 11	T_C = 25°C	–	–	25	μA
			T_C = 150°C	–	–	1	mA
I_{ECS}	Emitter to Collector Leakage Current	V_{EC} = 24 V, See Figure 11	T_C = 25°C	–	–	1	mA
			T_C = 150°C	–	–	40	
R_1	Series Gate Resistance			–	70	–	Ω
R_2	Gate to Emitter Resistance			10K	–	26K	Ω
ON CHARACTERISTICS							
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_C = 6 A, V_{GE} = 4 V	T_C = 25°C, See Figure 3	–	1.25	1.60	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_C = 10 A, V_{GE} = 4.5 V	T_C = 150°C, See Figure 4	–	1.58	1.80	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_C = 15 A, V_{GE} = 4.5 V	T_C = 150°C	–	1.90	2.20	V

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (continued)

Symbol	Parameter	Test Conditions		Min	Typ.	Max.	Units
DYNAMIC CHARACTERISTICS							
$Q_{G(ON)}$	Gate Charge	I_C = 10 A, V_{CE} = 12 V, V_{GE} = 5 V See Figure 14		–	17	–	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	I_C = 1.0 mA V_{CE} = V_{GE} See Figure 10	T_C = 25°C	1.3	–	2.2	V
			T_C = 150°C	0.75	–	1.8	
V_{GEP}	Gate to Emitter Plateau Voltage	V_{CE} = 12 V, I_C = 10 A		–	3.0	–	V
SWITCHING CHARACTERISTICS							
$t_{d(ON)R}$	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, See Figure 12		–	0.7	4	μs
t_{rR}	Current Rise Time−Resistive			–	2.1	7	
$td_{(OFF)L}$	Current Turn−Off Delay Time−Inductive	V_{CE} = 300 V, L = 500 μH, V_{GE} = 5 V, R_G = 1 kΩ, T_J = 25°C, See Figure 12		–	4.8	15	μs
t_{fL}	Current Fall Time−Inductive			–	2.8	15	
SCIS	Self Clamped Inductive Switching	T_J = 25°C, L = 3.0 mH, V_{GE} = 5 V, R_G = 1 kΩ, 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

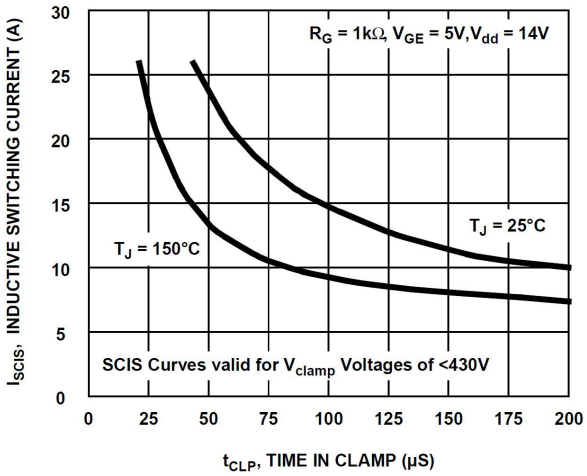


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

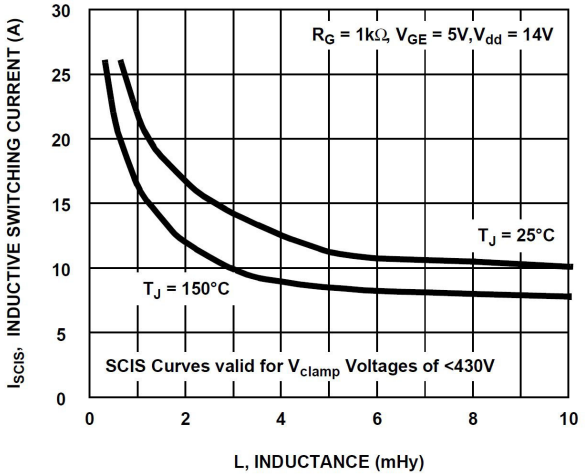


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

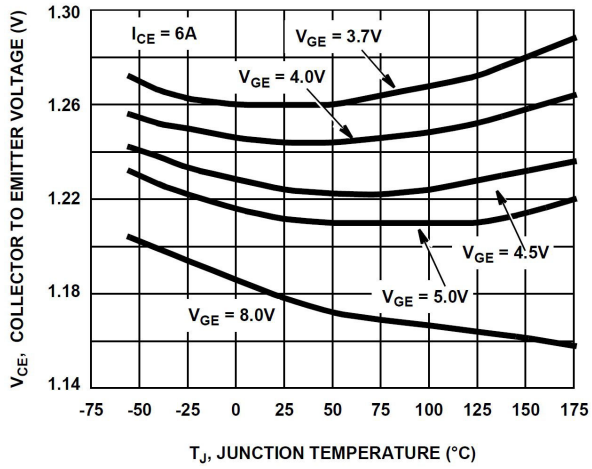


Figure 3. Collector to Emitter On−State Voltage vs. Junction Temperature

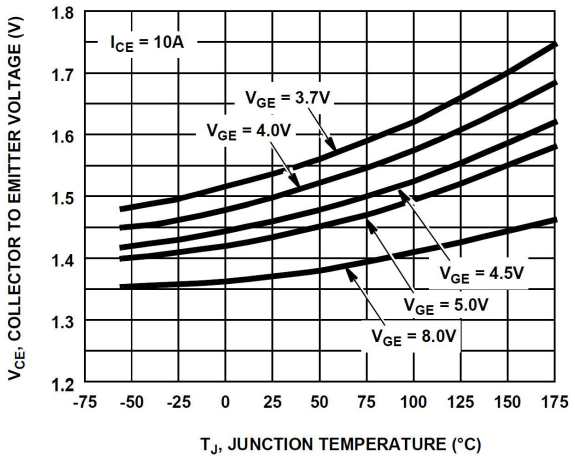


Figure 4. Collector to Emitter On−State Voltage vs. Junction Temperature

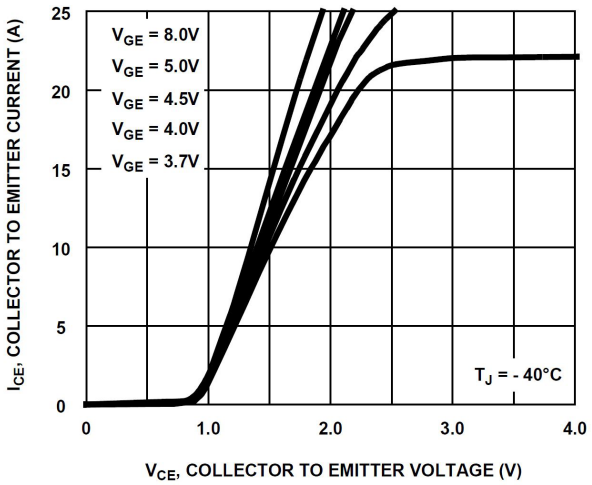


Figure 5. Collector to Emitter On−State Voltage vs. Collector Current

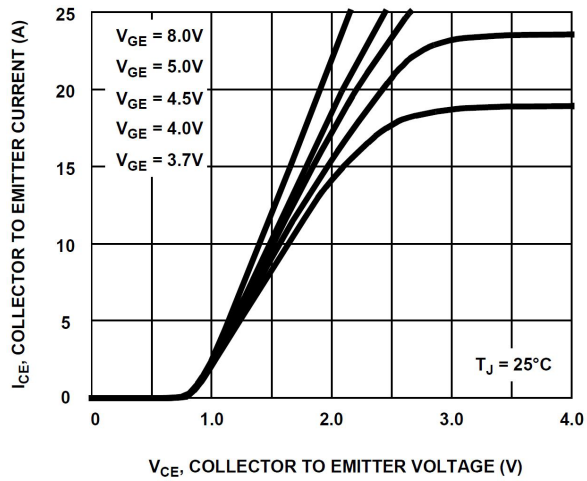


Figure 6. Collector to Emitter On−State Voltage vs. Collector Current

TYPICAL CHARACTERISTICS (continued)

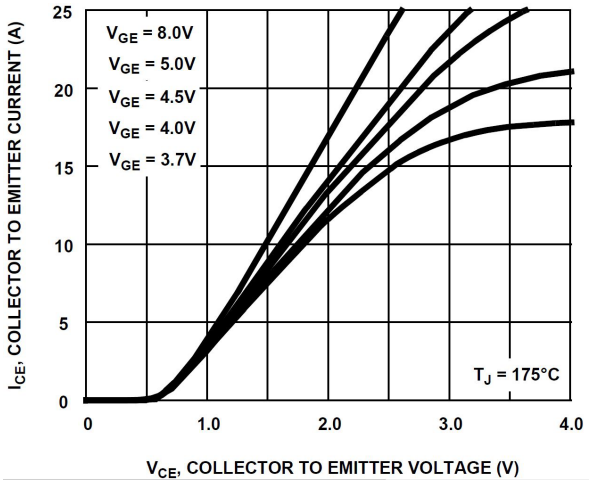


Figure 7. Collector to Emitter On−State Voltage vs. Collector Current

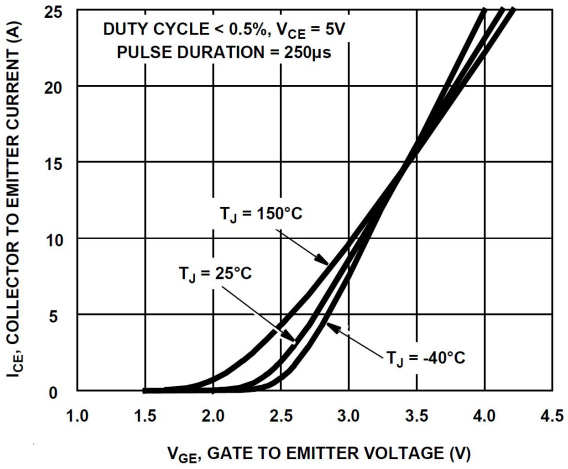


Figure 8. Transfer Characteristics

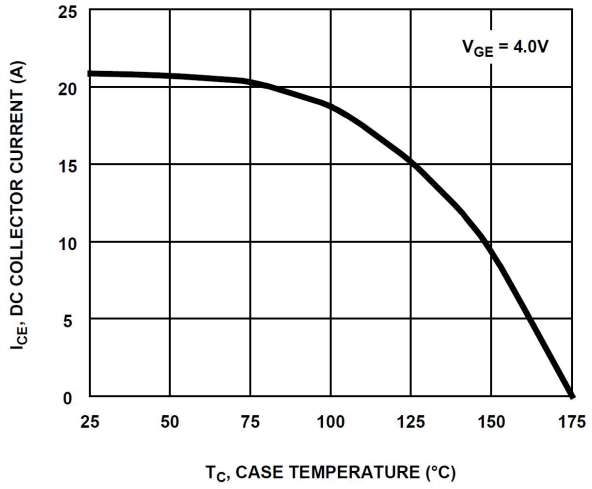


Figure 9. DC Collector Current vs. Case Temperature

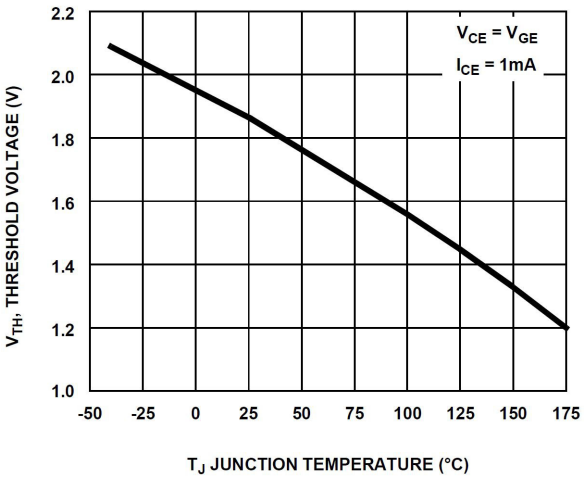


Figure 10. Threshold Voltage vs. Junction Temperature

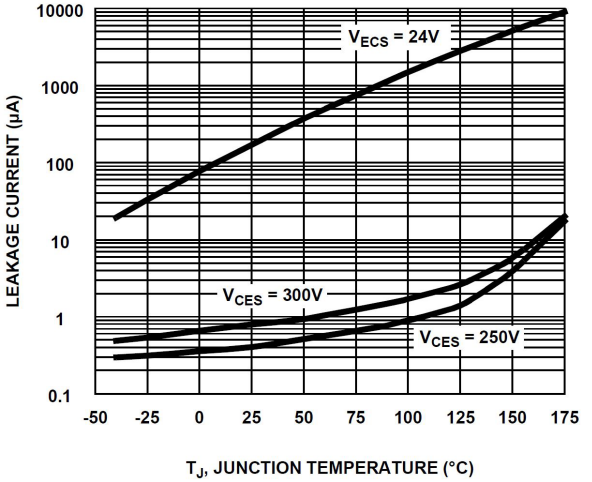


Figure 11. Leakage Current vs. Junction Temperature

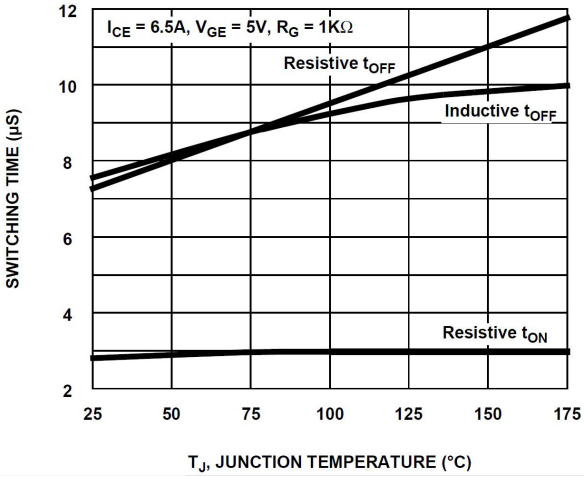


Figure 12. Switching Time vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

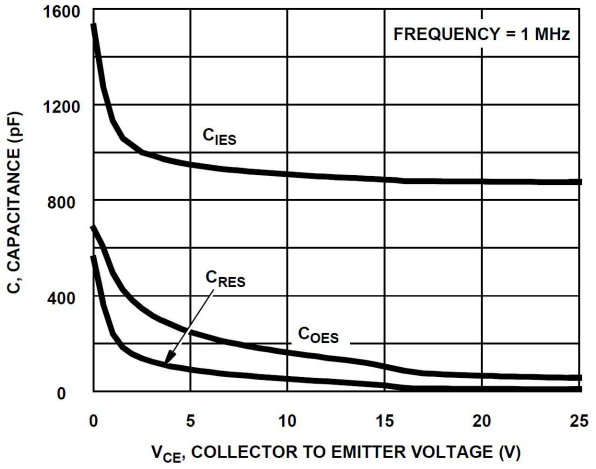


Figure 13. Capacitance vs. Collector to Emitter Voltage

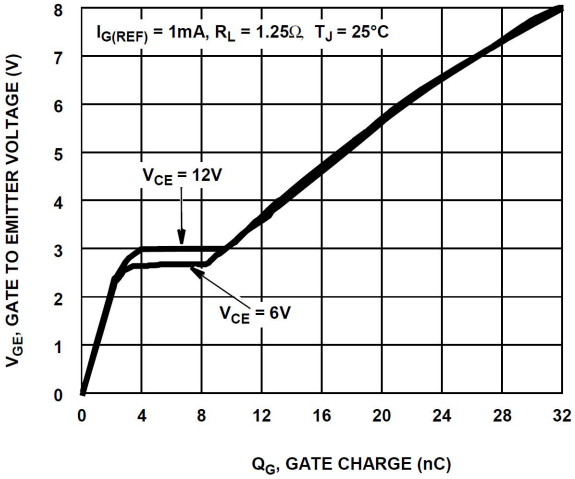


Figure 14. Gate Charge

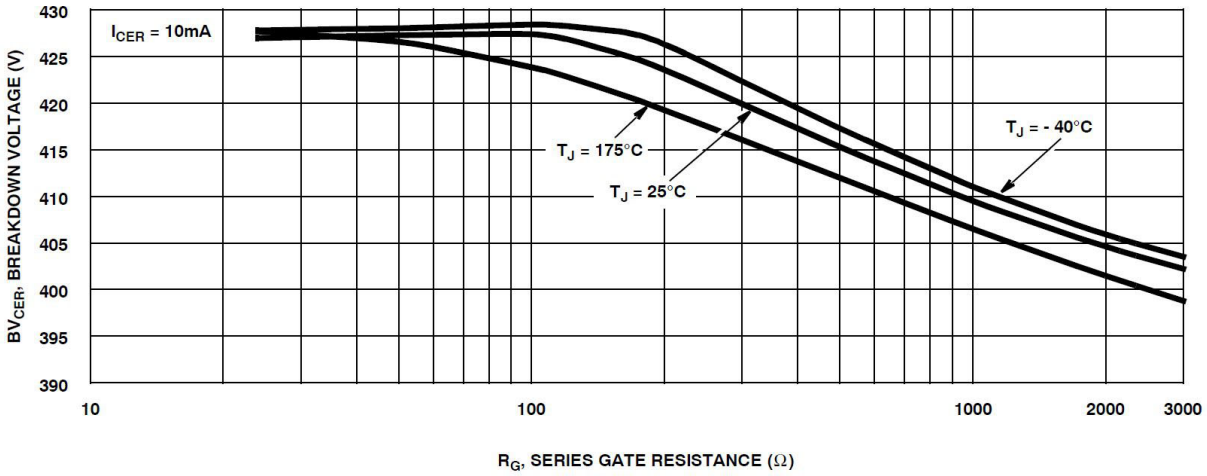


Figure 15. Breakdown Voltage vs. Series Resistance

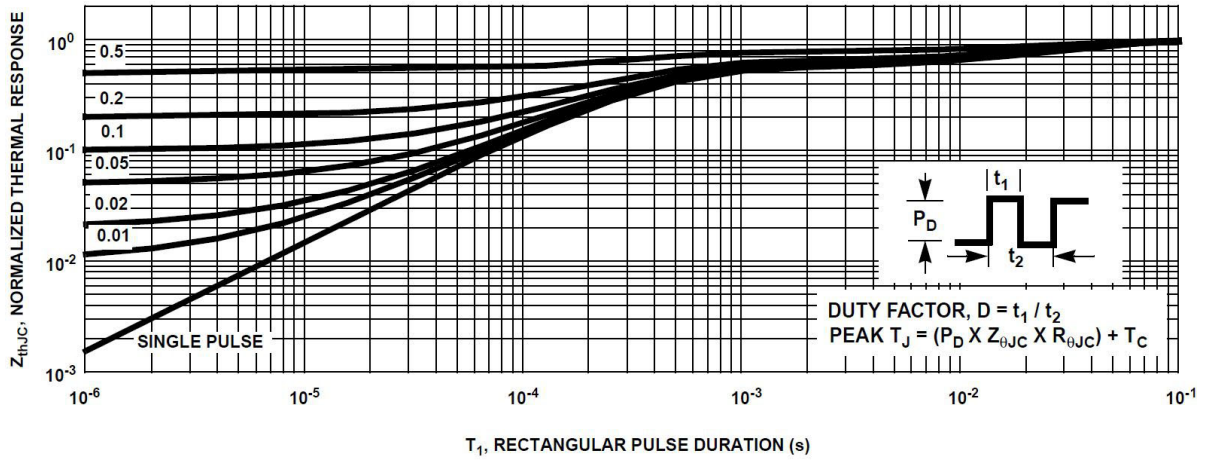


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

TEST CIRCUIT AND WAVEFORMS

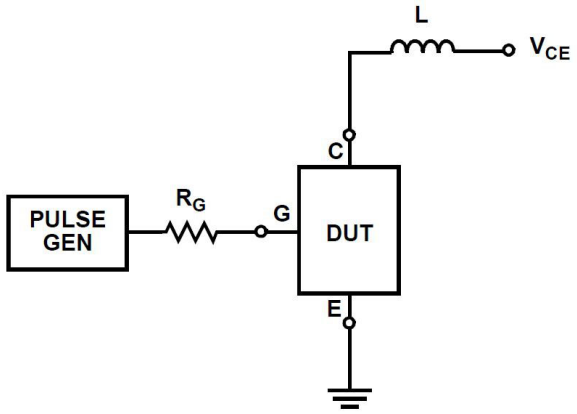


Figure 17. Inductive Switching Test Circuit

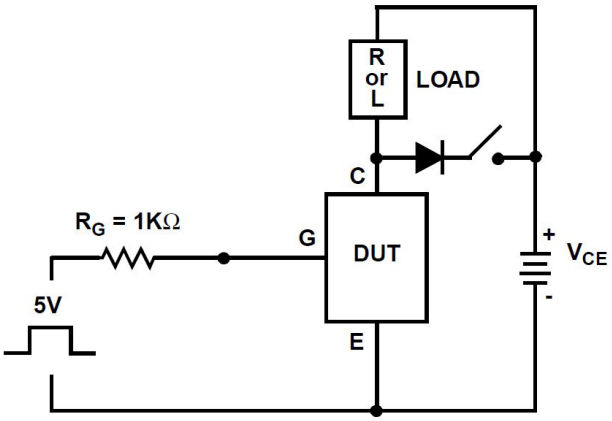


Figure 18. t_{ON} and t_{OFF} Switching Test Circuit

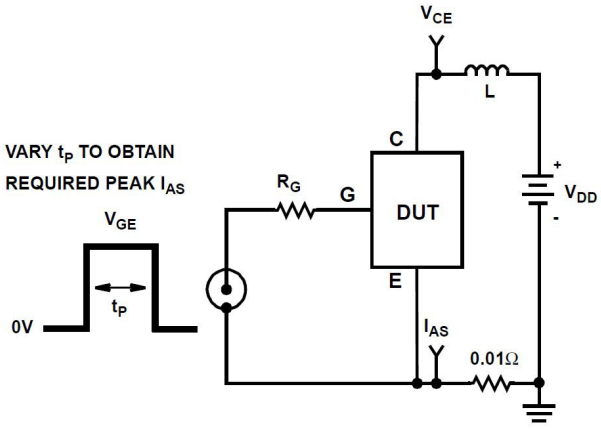


Figure 19. Energy Test Circuit

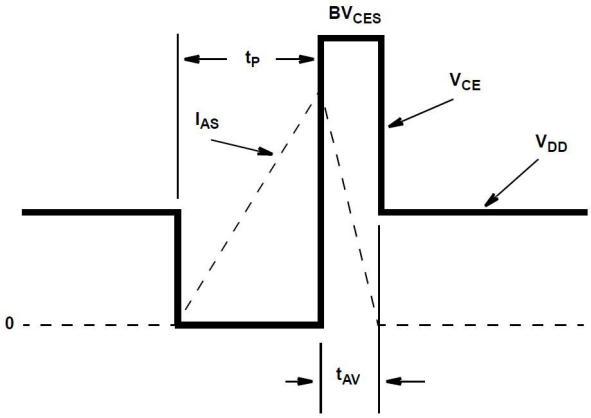


Figure 20. Energy Waveforms

PACKAGE MARKING AND ORDERING INFORMATION

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

†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.

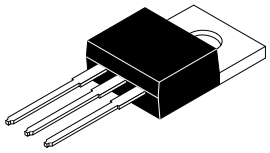
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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

TO−220−3LD
CASE 340AT
ISSUE A

DATE 03 OCT 2017



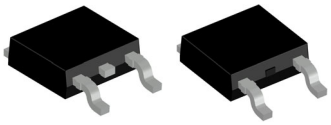
Scale 1:1

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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DESCRIPTION:	**TO−220−3LD**	**PAGE 1 OF 1**

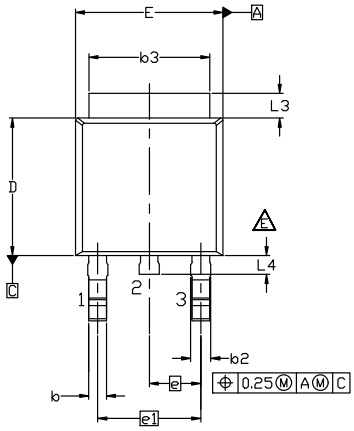
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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

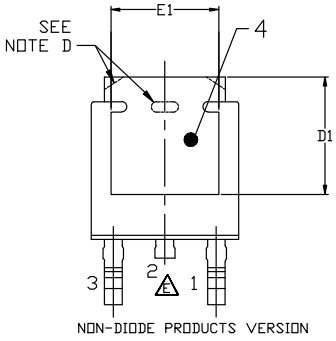


DPAK3 6.10x6.54x2.29, 4.57P
CASE 369AS
ISSUE B

DATE 20 DEC 2023

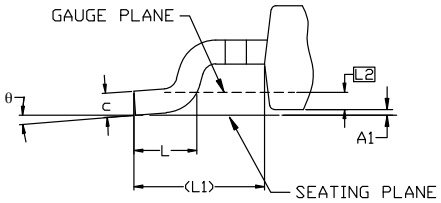


NON-DIODE PRODUCTS VERSION



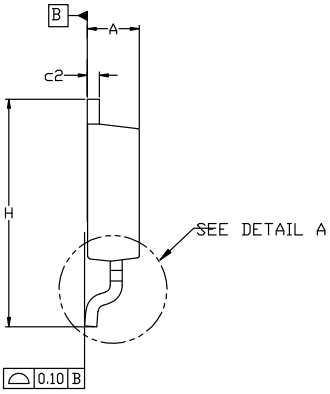
NON-DIODE PRODUCTS VERSION

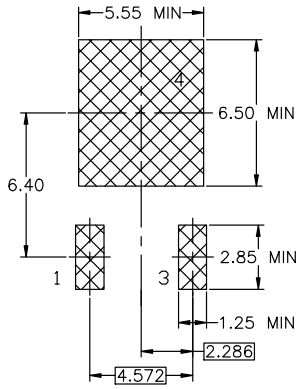
NOTES: UNLESS OTHERWISE SPECIFIED
A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE F, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2018.
D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
E) FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX PLASTIC BODY STUB WITHOUT CENTER LEAD.
F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.



DETAIL A
(ROTATED -90°)
SCALE: 12X

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.18	2.29	2.39
A1	0.00	–	0.127
b	0.64	0.77	0.89
b2	0.76	0.95	1.14
b3	5.21	5.34	5.46
c	0.45	0.53	0.61
c2	0.45	0.52	0.58
D	5.97	6.10	6.22
D1	5.21	---	---
E	6.35	6.54	6.73
E1	4.32	---	---
e	2.286 BSC		
e1	4.572 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	1.08	1.27
L4	---	---	1.02
θ	0°	---	10°





LAND PATTERN RECOMMENDATION

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

GENERIC MARKING DIAGRAM*



*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.

XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

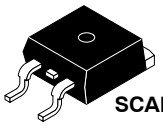
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DESCRIPTION:	**DPAK3 6.10x6.54x2.29, 4.57P**	**PAGE 1 OF 1**

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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

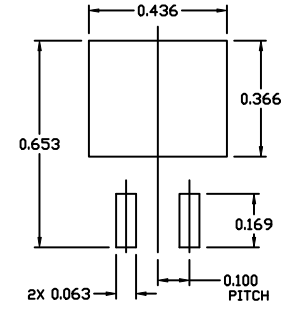
ON Semiconductor®



SCALE 1:1

D²PAK–3 (TO–263, 3–LEAD)
CASE 418AJ
ISSUE F

DATE 11 MAR 2021



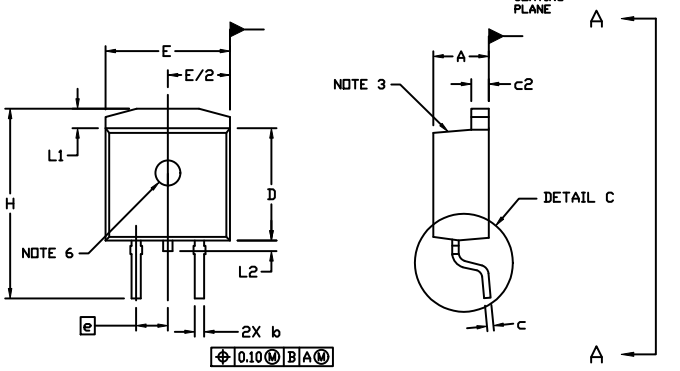
RECOMMENDED
MOUNTING FOOTPRINT

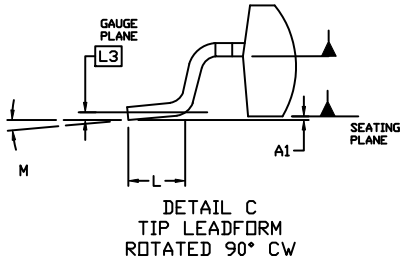
* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NOTES:

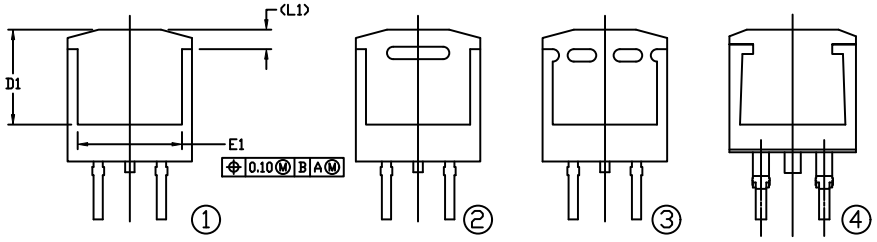
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL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

	INCHES		MILLIMETERS	
DIM	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°





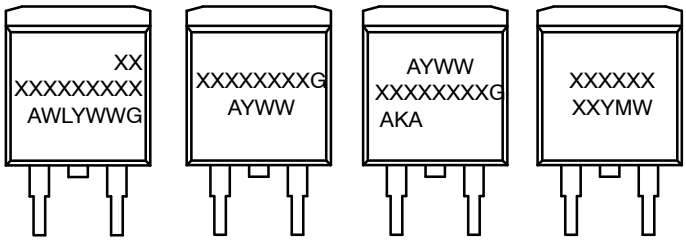
DETAIL C
TIP LEADFORM
ROTATED 90° CW



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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