

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 D²-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.

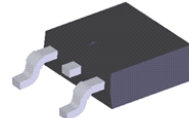
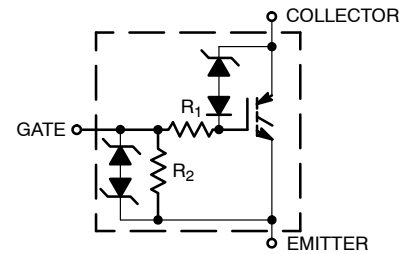
Formerly Developmental Type 49362.

Features

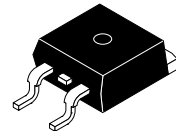
- Space Saving D-Pak Package Availability
- SCIS Energy = 300 mJ at T_J = 25°C
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- These are Pb-Free Devices

Applications

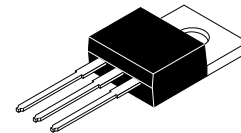
- Automotive Ignition Coil Driver Circuits
- Coil-On Plug Application



**DPAK3
CASE 369AS**



**D2PAK-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_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 _{θJC}	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

ISL9V3040D3S, ISL9V3040S3S, ISL9V3040P3

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

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

DYNAMIC CHARACTERISTICS

$Q_{G(ON)}$	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	μs
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	μs
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

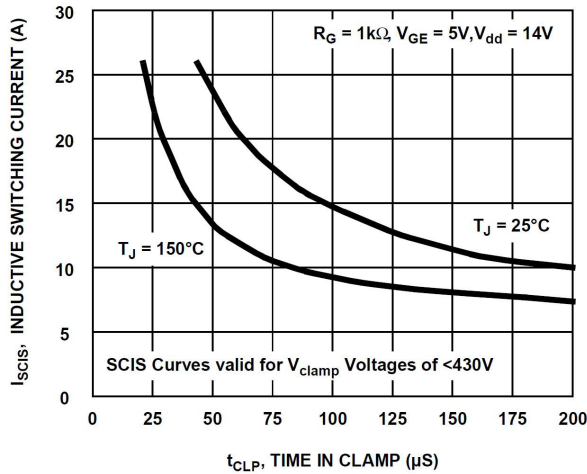


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

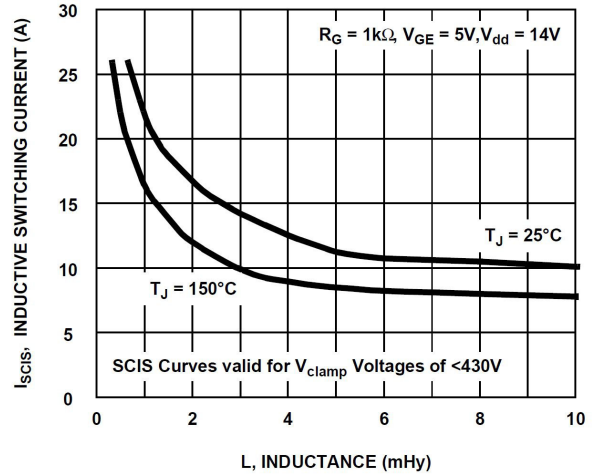


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

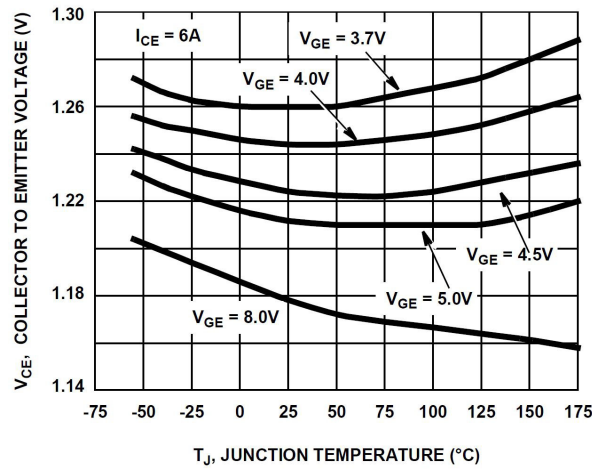


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

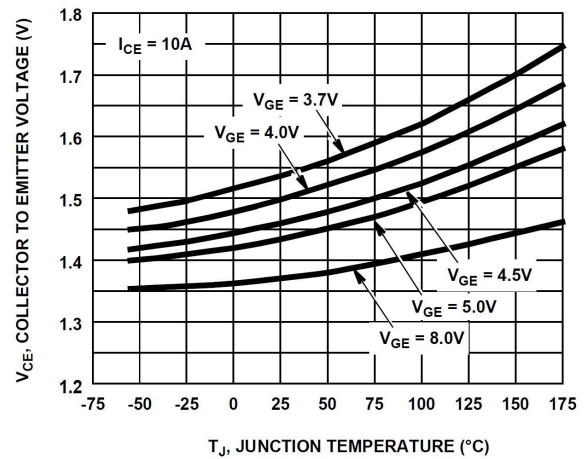


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

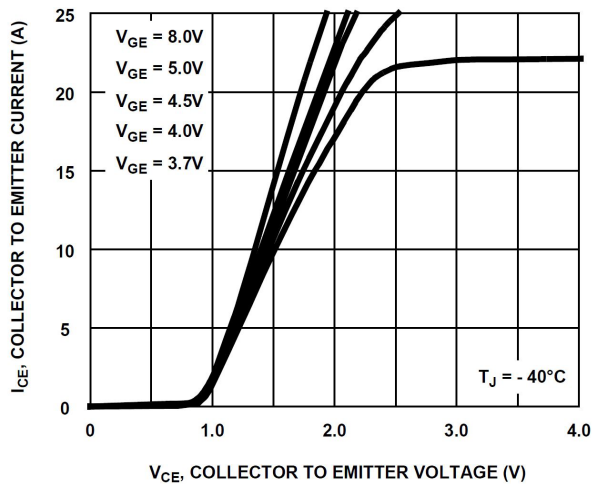


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

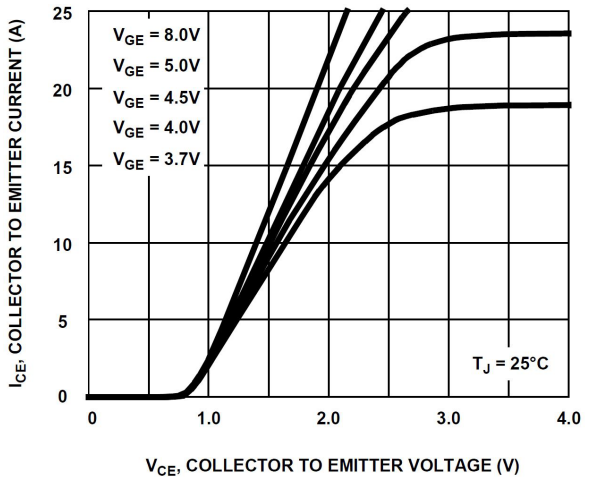


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

TYPICAL CHARACTERISTICS (continued)

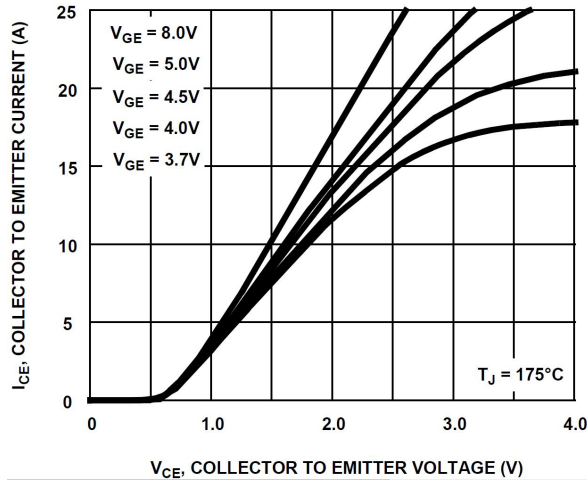


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

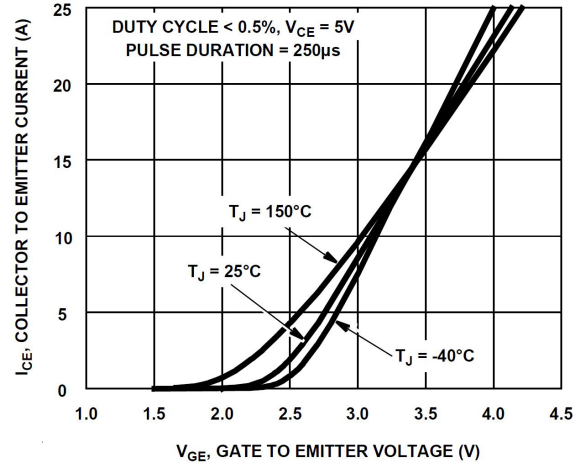


Figure 8. Transfer Characteristics

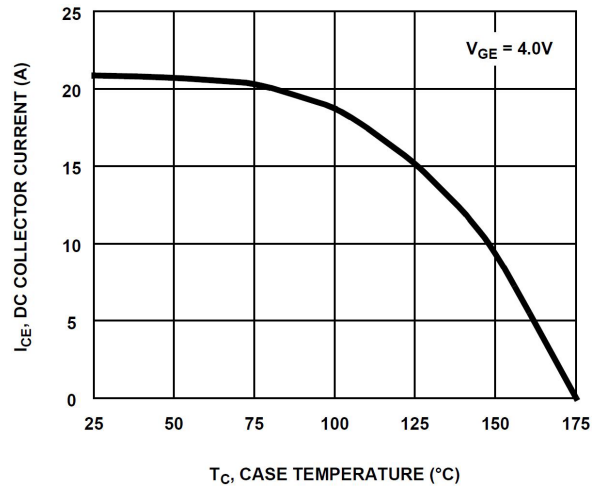


Figure 9. DC Collector Current vs. Case Temperature

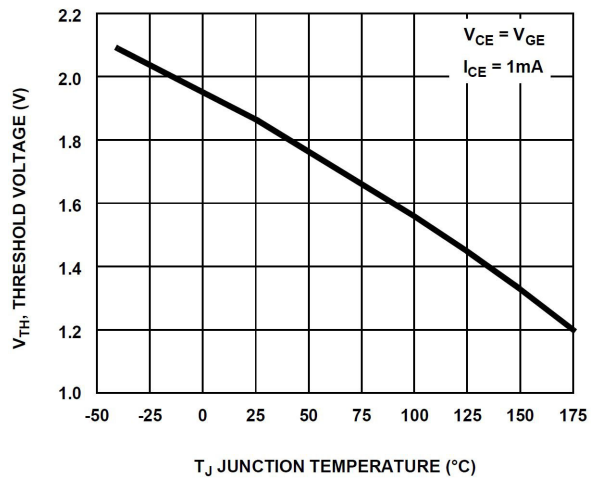


Figure 10. Threshold Voltage vs. Junction Temperature

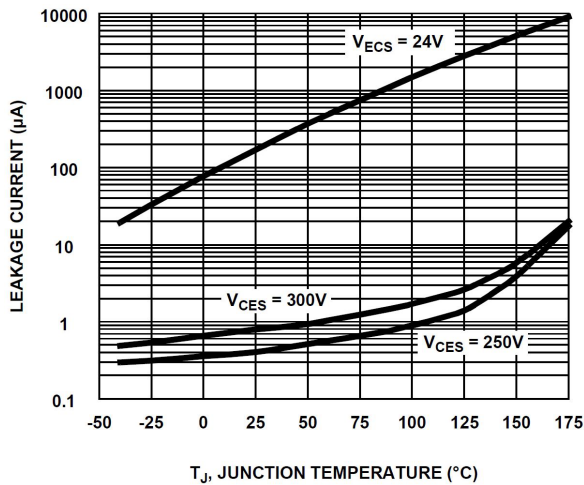


Figure 11. Leakage Current vs. Junction Temperature

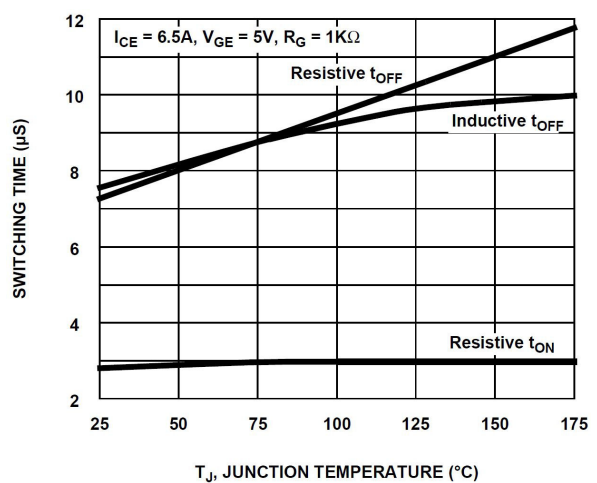


Figure 12. Switching Time vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

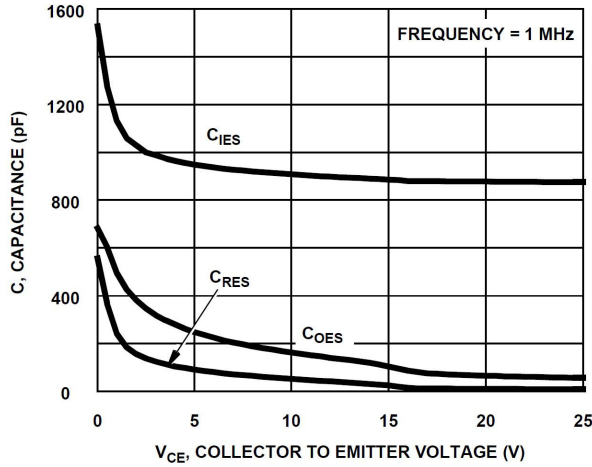


Figure 13. Capacitance vs. Collector to Emitter Voltage

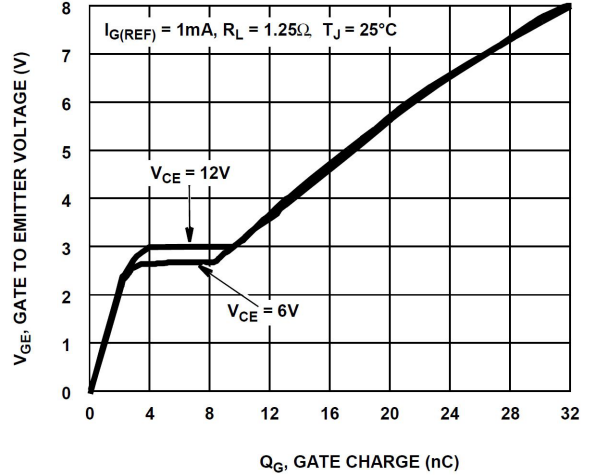


Figure 14. Gate Charge

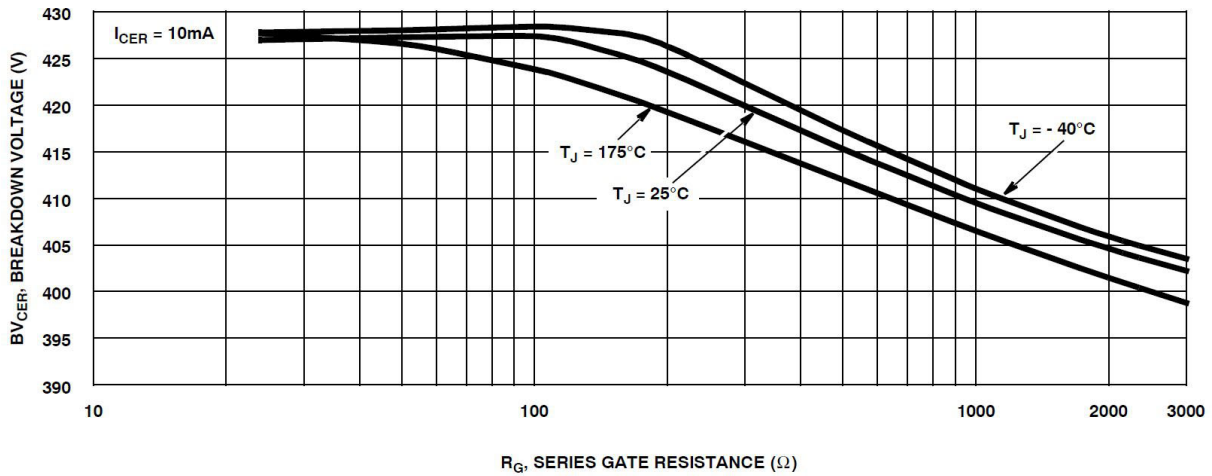


Figure 15. Breakdown Voltage vs. Series Resistance

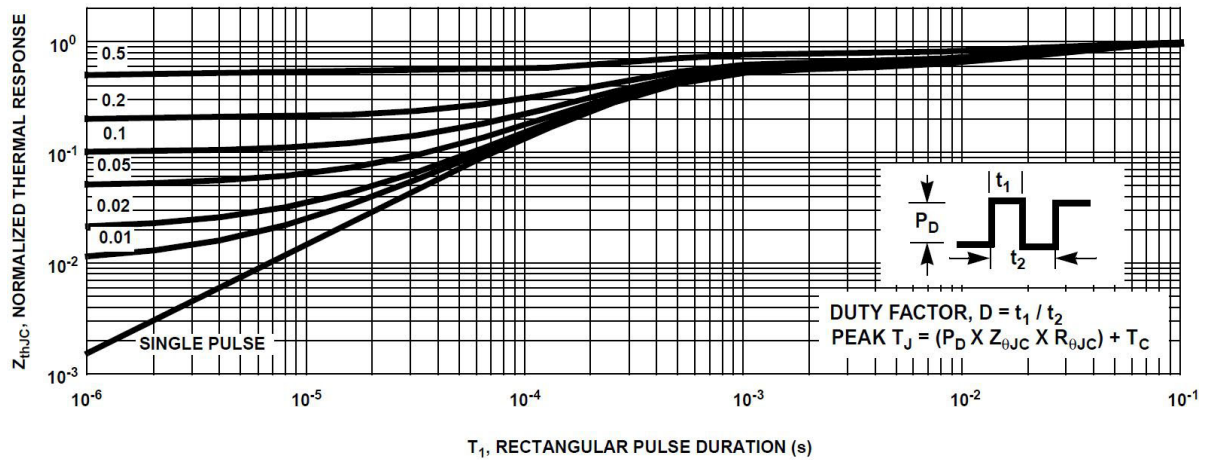


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

TEST CIRCUIT AND WAVEFORMS

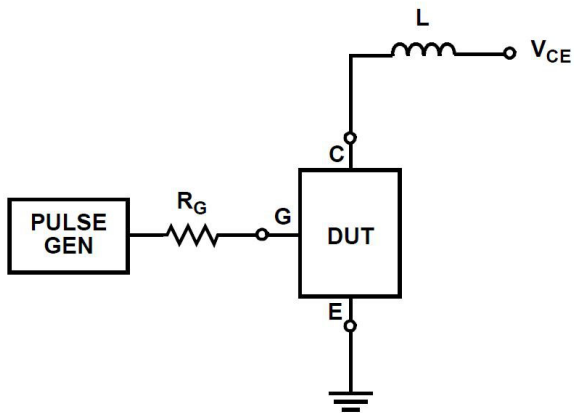


Figure 17. Inductive Switching Test Circuit

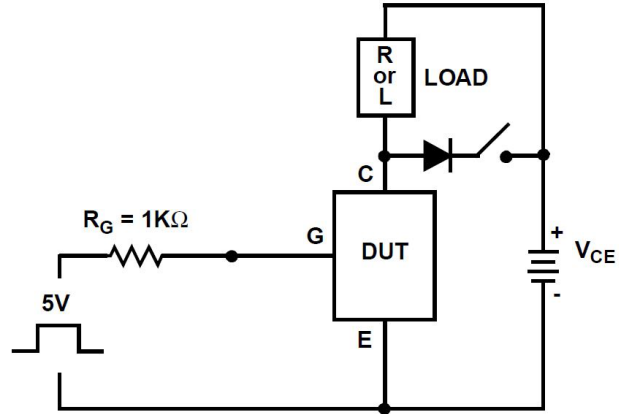


Figure 18. t_{ON} and t_{OFF} Switching Test Circuit

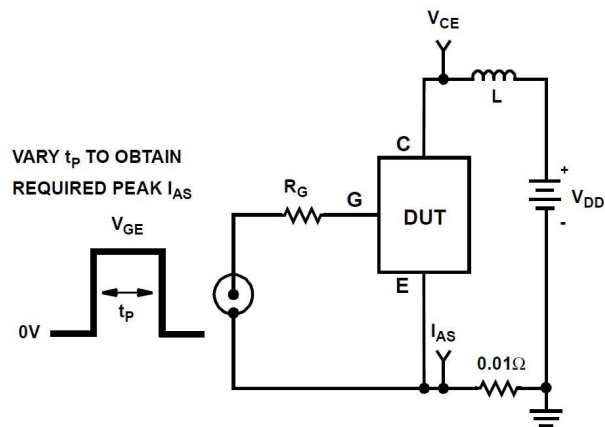


Figure 19. Energy Test Circuit

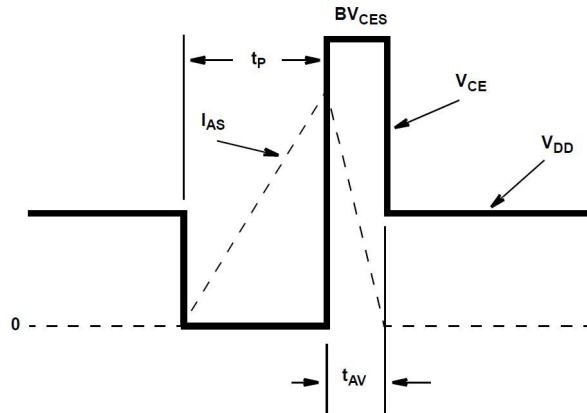


Figure 20. Energy Waveforms

ISL9V3040D3S, ISL9V3040S3S, ISL9V3040P3

PACKAGE MARKING AND ORDERING INFORMATION

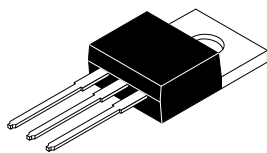
Device	Package	Shipping [†]
ISL9V3040D3ST	DPAK (Pb-Free)	2500 Units/Tape & Reel
ISL9V3040S3ST	D2PAK (Pb-Free)	800 Units/Tape & Reel
ISL9V3040P3	TO220 (Pb-Free)	50 Units/Tube

[†]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.

ECOSPARK is a registered trademark of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

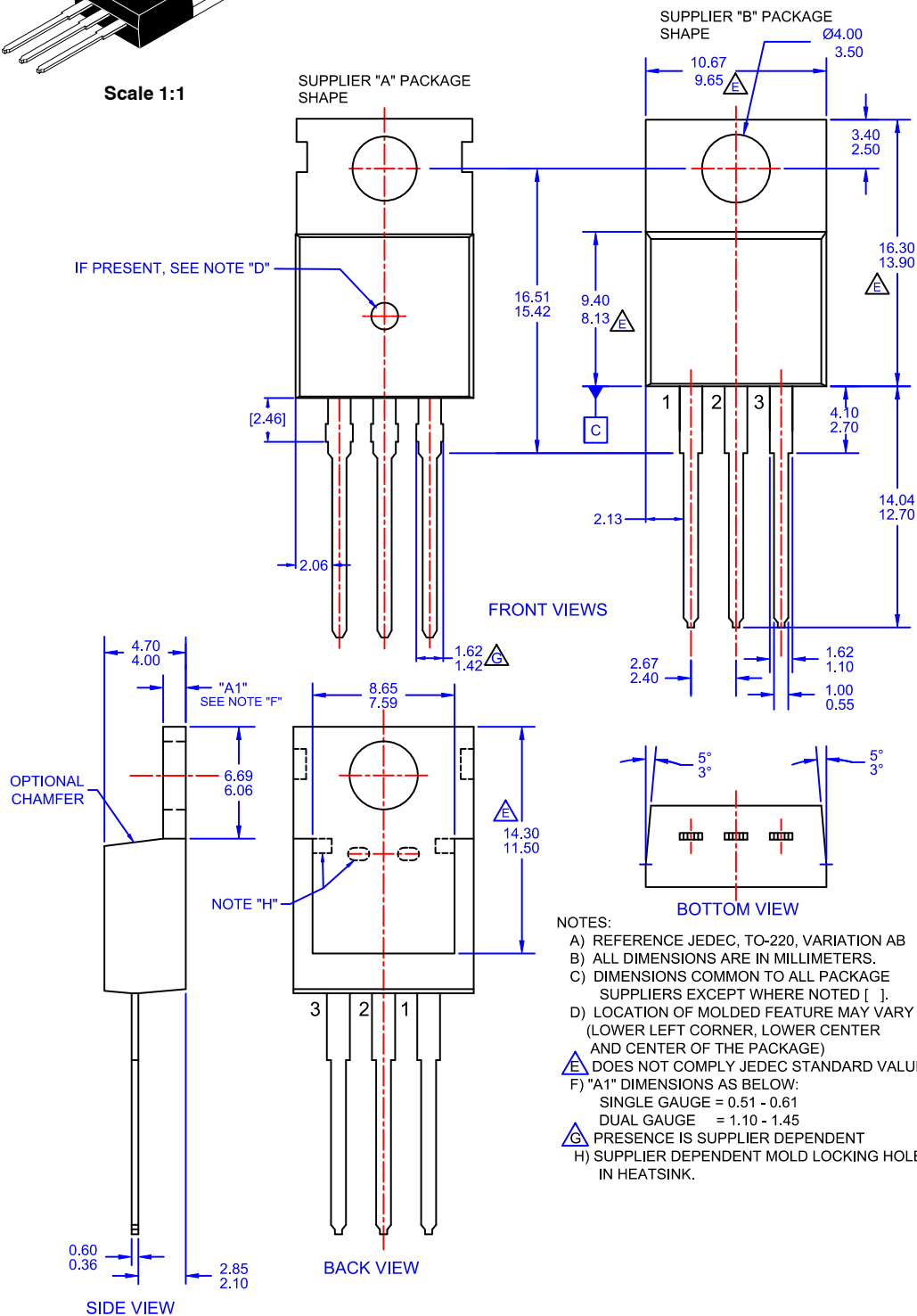
ON Semiconductor®



Scale 1:1

TO-220-3LD CASE 340AT ISSUE A

DATE 03 OCT 2017



NOTES:

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

DOCUMENT NUMBER:	98AON13818G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TO-220-3LD	PAGE 1 OF 1

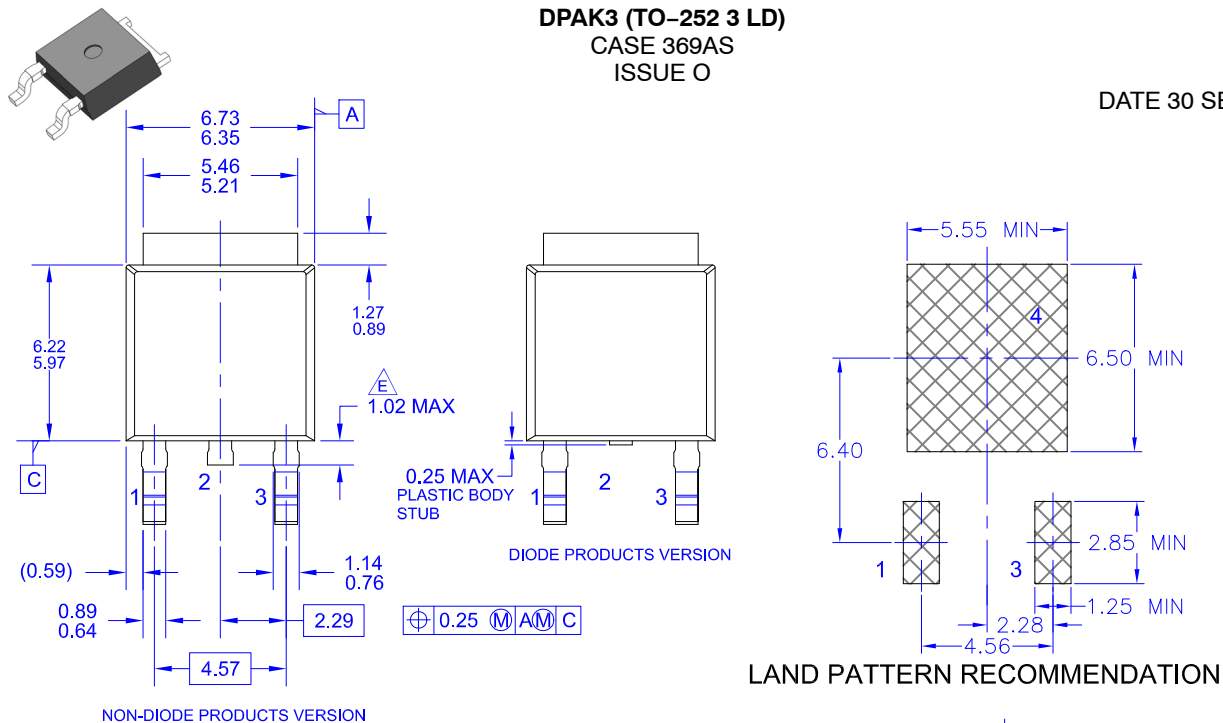
ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



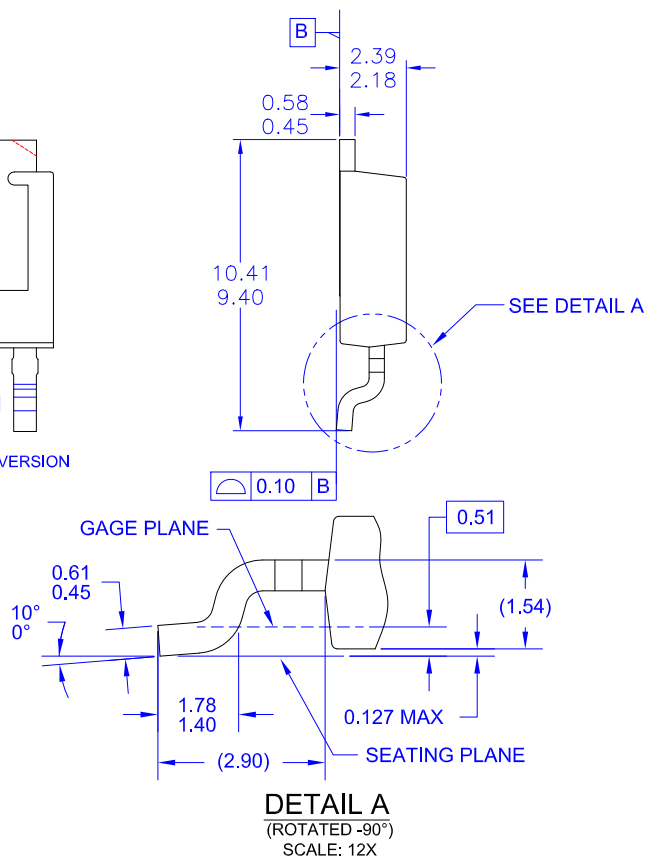
DPAK3 (TO-252 3 LD) CASE 369AS ISSUE O

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.



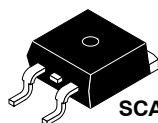
DOCUMENT NUMBER:	98AON13810G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	DPAK3 (TO-252 3 LD)	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



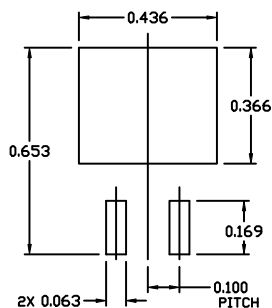
SCALE 1:1

D²PAK-3 (TO-263, 3-LEAD)

CASE 418AJ

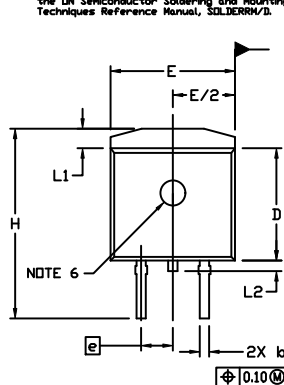
ISSUE F

DATE 11 MAR 2021



RECOMMENDED MOUNTING FOOTPRINT

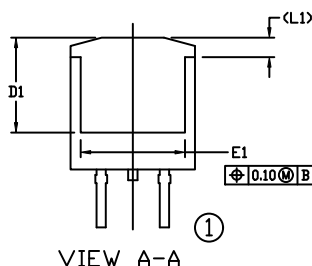
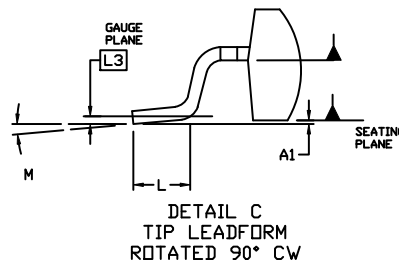
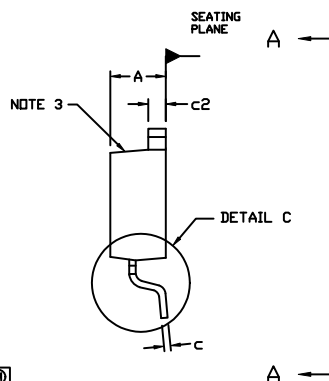
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/T.



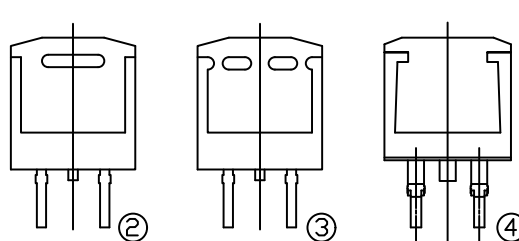
NOTES:

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*

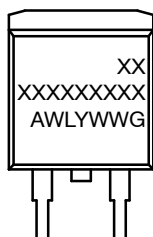


VIEW A-A

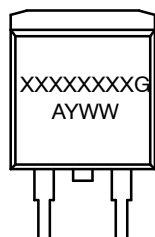


VIEW A-A
OPTIONAL CONSTRUCTIONS

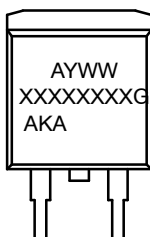
GENERIC MARKING DIAGRAMS*



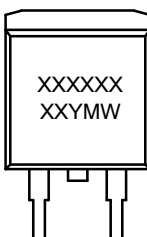
IC



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.

DOCUMENT NUMBER:	98AON56370E	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	D ² PAK-3 (TO-263, 3-LEAD)	PAGE 1 OF 1

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative