

# KA2803B

## Earth Leakage Detector

### Description

The KA2803B is designed for use in earth leakage circuit interrupters, for operation directly off the AC line in breakers. The input of the differential amplifier is connected to the secondary coil of ZCT (Zero Current Transformer). The amplified output of differential amplifier is integrated at external capacitor to gain adequate time delay specified in KSC4613. The level comparator generates a high level when earth leakage current is greater than the fixed level.

### Features

- Low Power Consumption: 5 mW, 100 V/200 V
- Built-In Voltage Regulator
- High-Gain Differential Amplifier
- 0.4 mA Output Current Pulse to Trigger SCRs
- Low External Part Count
- DIP & SOP Packages, High Packing Density
- High Noise Immunity, Large Surge Margin
- Super Temperature Characteristic of Input Sensitivity
- Wide Operating Temperature Range:  
 $T_A = -25^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$
- Operation from 12 V to 20 V Input

### Functions

- Differential Amplifier
- Level Comparator
- Latch Circuit



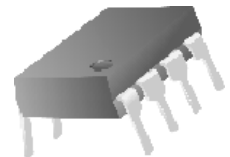
**ON Semiconductor®**

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



8-SOP

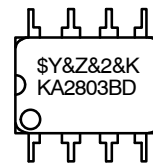
**SOIC8  
CASE 751EB**



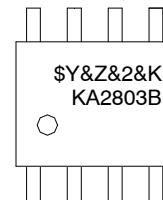
8-DIP

**PDIP-8  
CASE 626-05**

### MARKING DIAGRAMS



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot
KA2803BD	= Specific Device Code



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot
KA2803B	= Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# KA2803B

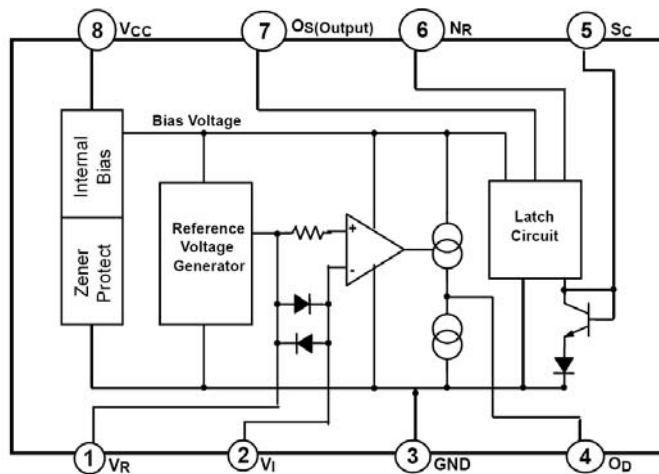


Figure 1. Block Diagram

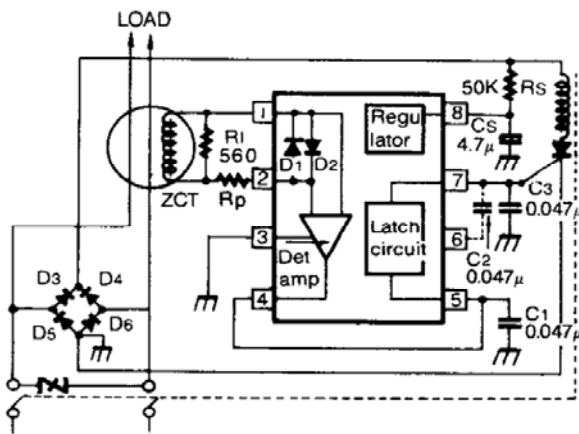


Figure 2. Full-Wave Application Circuit

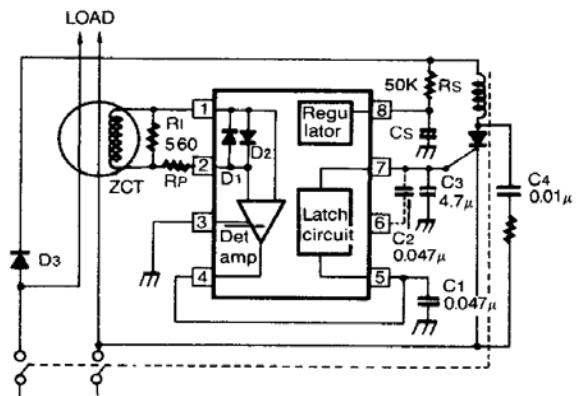


Figure 3. Half-Wave Application Circuit

## Application Information

(Refer to full-wave application circuit in Figure 2)

Figure 2 shows the KA2803B connected in a typical leakage current detector system. The power is applied to the V<sub>CC</sub> terminal (Pin 8) directly from the power line. The resistor R<sub>S</sub> and capacitor C<sub>S</sub> are chosen so that Pin 8 voltage is at least 12 V. The value of C<sub>S</sub> is recommended above 1 μF.

If the leakage current is at the load, it is detected by the zero current transformer (ZCT). The output voltage signal of ZCT is amplified by the differential amplifier of the KA2803B internal circuit and appears as a half-cycle sine wave signal referred to input signal at the output of the amplifier. The amplifier closed-loop gain is fixed about 1000 times with internal feedback resistor to compensate for zero current transformer (ZCT) variations. The resistor R<sub>L</sub> should be selected so that the breaker satisfies the required sensing current. The protection resistor R<sub>P</sub> is not usually used when high current is injected at the breaker; this resistor

should be used to protect the earth leakage detector IC (KA2803B). The range of R<sub>P</sub> is from several hundred Ω to several kΩ.

Capacitor C<sub>1</sub> is for the noise canceller and a standard value of C<sub>1</sub> is 0.047 μF. Capacitor C<sub>2</sub> is also a noise canceller capacitance, but it is not usually used.

When high noise is present, a 0.047 μF capacitor may be connected between Pins 6 and 7. The amplified signal finally appears at the Pin 7 with pulse signal through the internal latch circuit of the KA2803B. This signal drives the gate of the external SCR, which energizes the trip coil, which opens the circuit breaker. The trip time of the breaker is determined by capacitor C<sub>3</sub> and the mechanism breaker. This capacitor should be selected under 1 μF to satisfy the required trip time. The full-wave bridge supplies power to the KA2803B during both the positive and negative half cycles of the line voltage. This allows the hot and neutral lines to be interchanged.

# KA2803B

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min.	Max.	Unit
V <sub>CC</sub>	Supply Voltage		20	V
I <sub>CC</sub>	Supply Current		8	mA
P <sub>D</sub>	Power Dissipation		300	mW
T <sub>L</sub>	Lead Temperature, Soldering 10 Seconds		260	°C
T <sub>A</sub>	Operation Temperature Range	-25	+80	°C
T <sub>STG</sub>	Storage Temperature Range	-65	+150	°C

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.

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Operating Temperature Range	Package	Packing Method
KA2803B	-25 to +80°C	8-Lead, Dual Inline Package (DIP)	Tube
KA2803BD	-25 to +80°C	8-Lead, Small Outline Package (SOP)	Tape and Reel

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = -25°C to +80°C unless otherwise noted)

Symbol	Parameter	Conditions	Test Circuit	Min.	Typ.	Max.	Units
I <sub>CC</sub>	Supply Current 1	V <sub>CC</sub> = 12V V <sub>R</sub> = OPEN V <sub>I</sub> = 2 V	Figure 4			580	μA
		T <sub>A</sub> = -25°C		300	400	530	
		T <sub>A</sub> = +80°C				480	
V <sub>T</sub>	Trip Voltage	V <sub>CC</sub> = 16 V, V <sub>R</sub> = 2 V~2.02 V, V <sub>I</sub> = 2	Figure 5	14	16	18	mV (ms)
		Note 1		12.5	14.2	17.0	
I <sub>O(D)</sub>	Differential Amplifier Current Current 1	V <sub>CC</sub> = 16 V, V <sub>R</sub> ~V <sub>I</sub> = 30 mV, V <sub>OD</sub> = 1.2 V	Figure 7	-12	20	-30	μA
	Differential Amplifier Current Current 2	V <sub>CC</sub> = 16 V, V <sub>OD</sub> = 0.8 V, V <sub>R</sub> , V <sub>I</sub> Short = V <sub>P</sub>	Figure 8	17	27	37	
I <sub>O</sub>	Output Current	V <sub>SC</sub> = 1.4 V, V <sub>OS</sub> = 0.8 V, V <sub>CC</sub> = 16.0 V	Figure 9			800	μA
		T <sub>A</sub> = -25°C		200	400	800	
		T <sub>A</sub> = +25°C		200	400	800	
		T <sub>A</sub> = +80°C	100	300	600		
V <sub>SCON</sub>	Latch-On Voltage	V <sub>CC</sub> = 16 V	Figure 10	0.7	1.0	1.4	V
I <sub>SCON</sub>	Latch Input Current	V <sub>CC</sub> = 16 V	Figure 11	-13	-7	-1	μA
I <sub>OSL</sub>	Output Low Current	V <sub>CC</sub> = 12 V, V <sub>OSL</sub> = 0.2 V	Figure 12	200	800	1400	μA
V <sub>IDC</sub>	Differential Input Clamp Voltage	V <sub>CC</sub> = 16 V, I <sub>IDC</sub> = 100 mA	Figure 13	0.4	1.2	2.0	V
V <sub>SM</sub>	Maximum Current Voltage	I <sub>SM</sub> = 7 mA	Figure 14	20	24	28	V
I <sub>S2</sub>	Supply Current 2	V <sub>CC</sub> = 12.0 V, V <sub>OSL</sub> = 0.6 V	Figure 15	200	400	900	μA
V <sub>SOFF</sub>	Latch-Off Supply Voltage	V <sub>OS</sub> = 12.0 V	Figure 16	7	8	9	V
		V <sub>SC</sub> = 1.8 V					
		I <sub>IDC</sub> = 100.0 mA					
t <sub>ON</sub>	Response Time	V <sub>CC</sub> = 16 V, V <sub>R</sub> -V <sub>I</sub> = 0.3 V, 1 V<V <sub>X</sub> <5 V	Figure 17	2	3	4	ms

1. Guaranteed by design, not tested in production.

TEST CIRCUITS

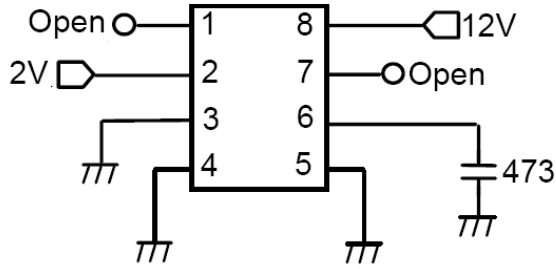


Figure 4. Supply Current 1

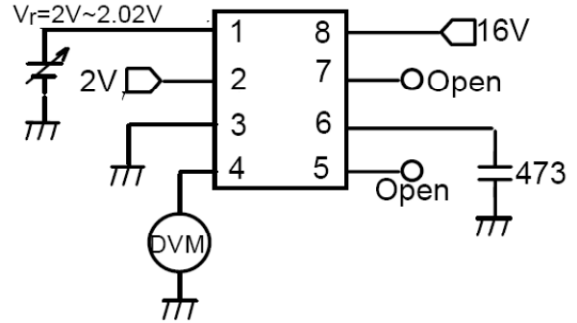


Figure 5. Trip Voltage

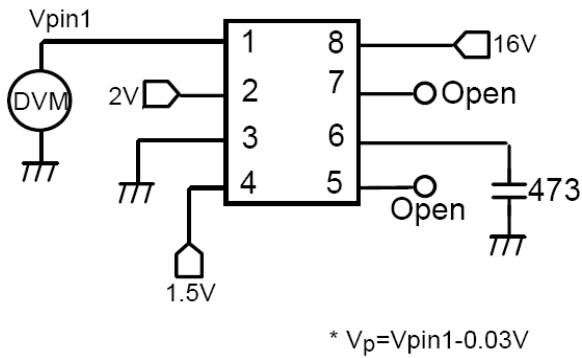


Figure 6.  $V_{PN1}$  for  $V_p$  Measurement

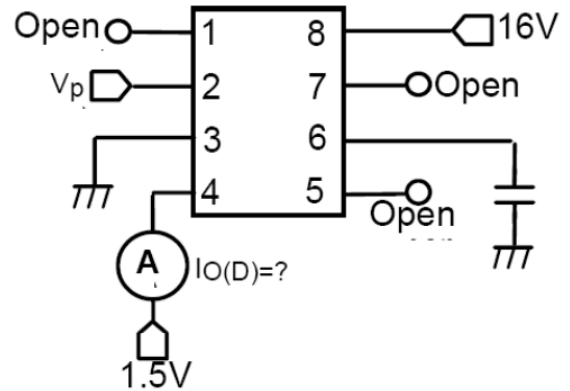


Figure 7. Differential Amplifier Output Current 1

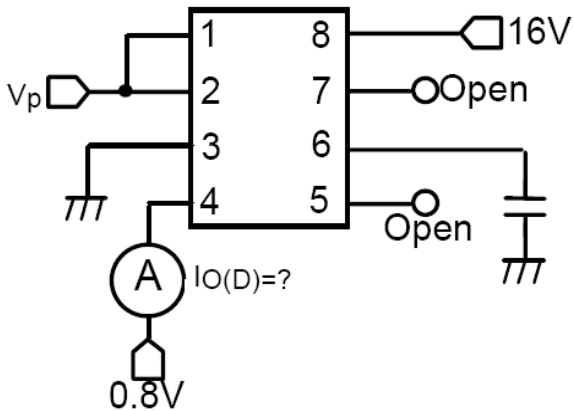


Figure 8. Differential Amplifier Output Current 2

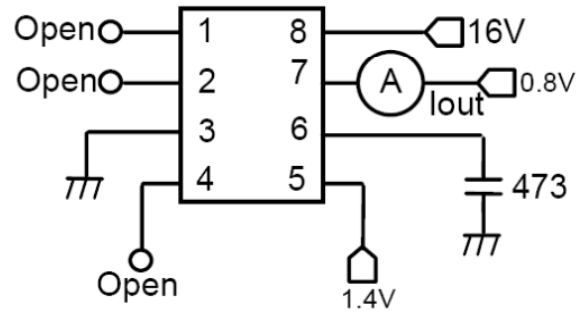


Figure 9. Output Current

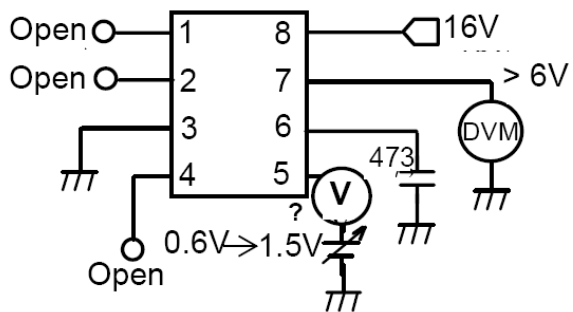


Figure 10. Latch-On Voltage

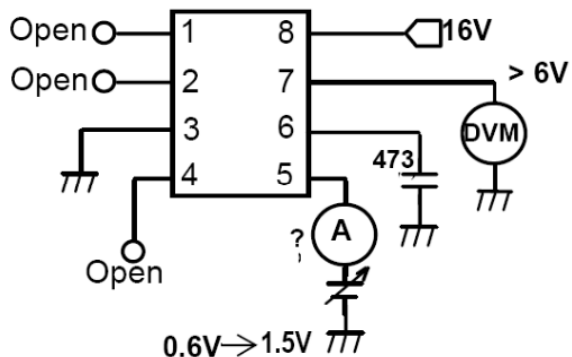


Figure 11. Latch Input Current

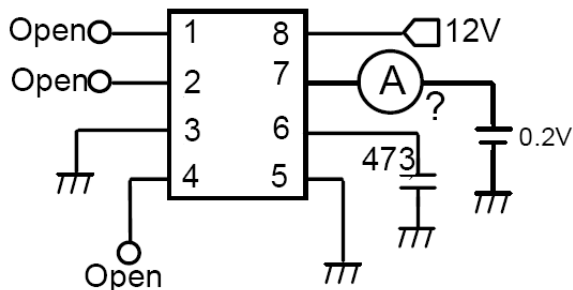


Figure 12. Output Low Current

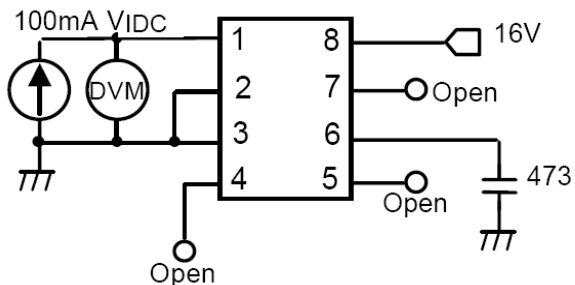


Figure 13. Differential Input Clamp Voltage

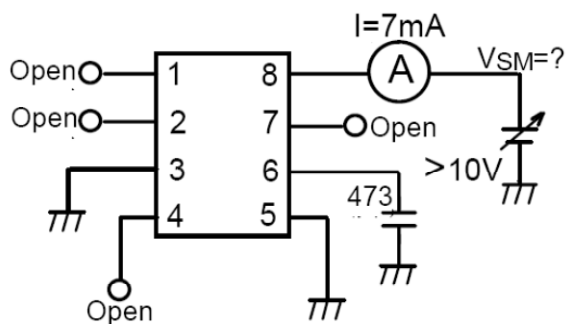


Figure 14. Maximum Current Voltage

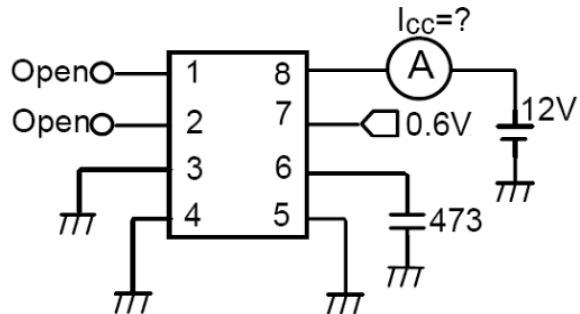


Figure 15. Supply Current 2

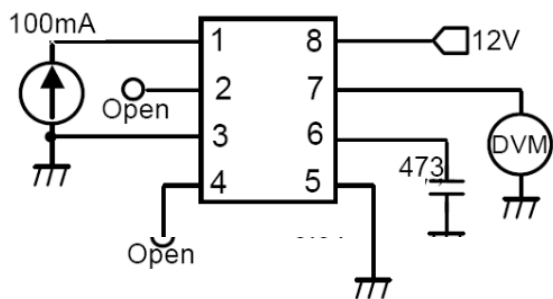


Figure 16. Latch-Off Supply Voltage

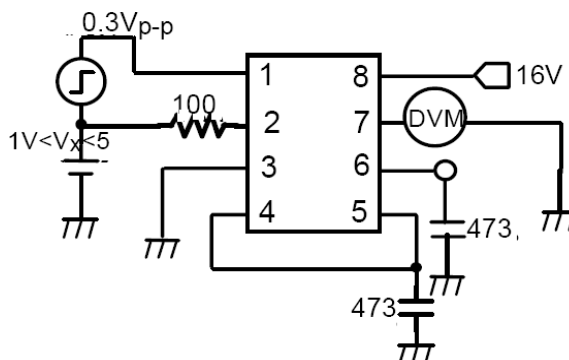


Figure 17. Response Time

TYPICAL PERFORMANCE CHARACTERISTICS

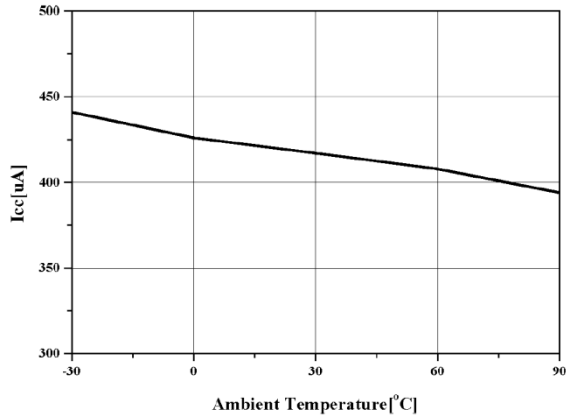


Figure 18. Supply Current

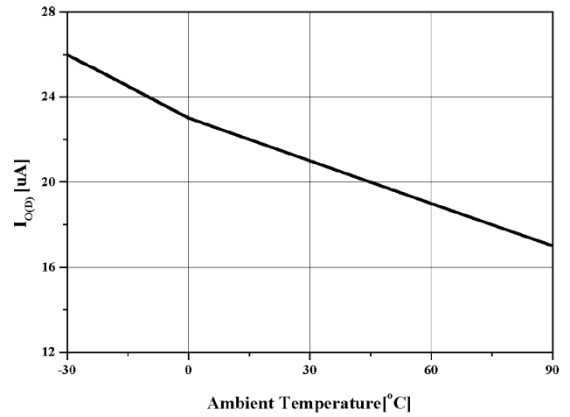


Figure 19. Differential Amplifier Output Current  
( $V_R - V_I = 30 \text{ mV}$ ,  $V_{OD} = 1.2 \text{ V}$ )

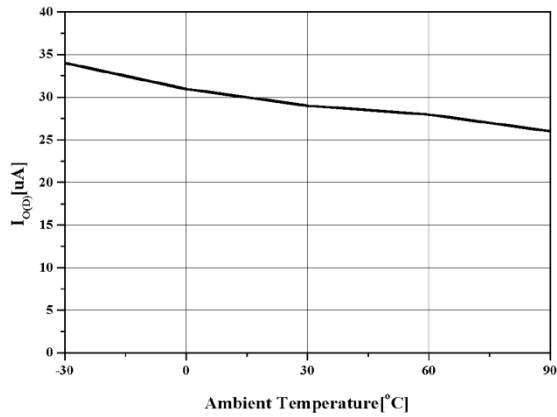


Figure 20. Differential Amplifier Output Current  
( $V_R, V_I = V_P$ ,  $V_{OD} = 0.8 \text{ V}$ )

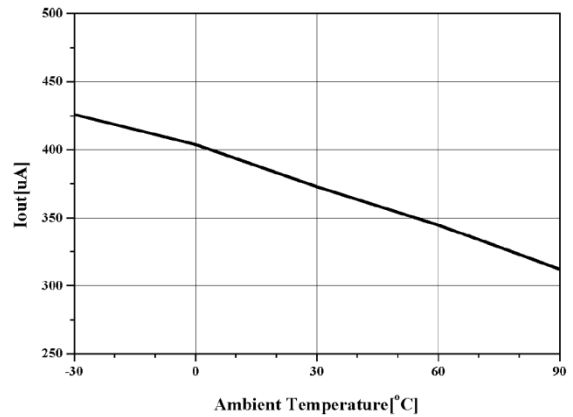


Figure 21. Output Current

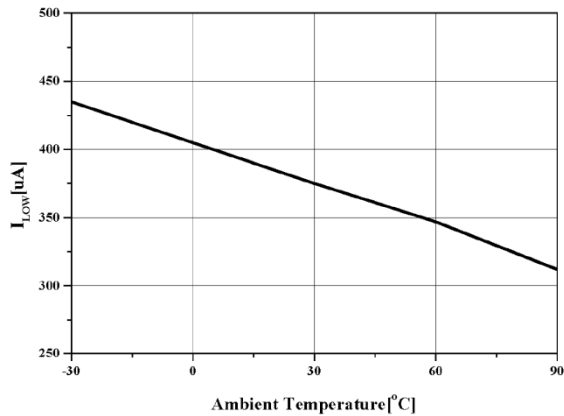


Figure 22. Output Low Current

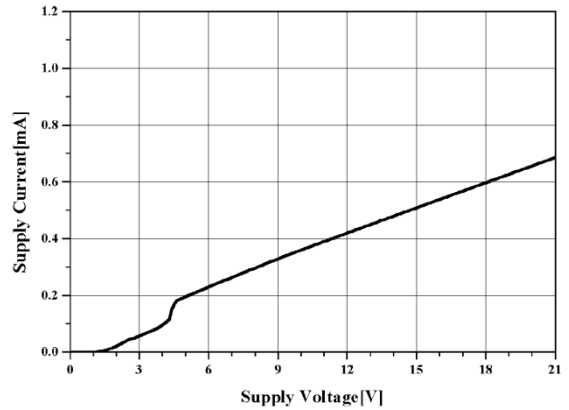


Figure 23. V<sub>CC</sub> Voltage vs. Supply Current 1

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

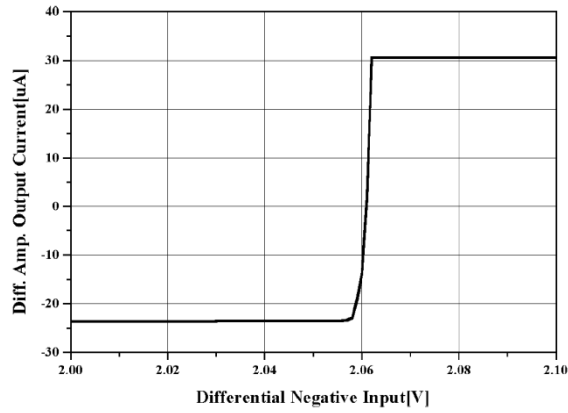


Figure 24. Differential Amplifier Output Current 1

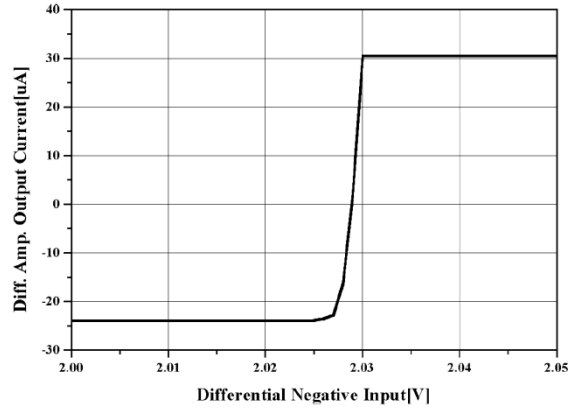


Figure 25. Differential Amplifier Output

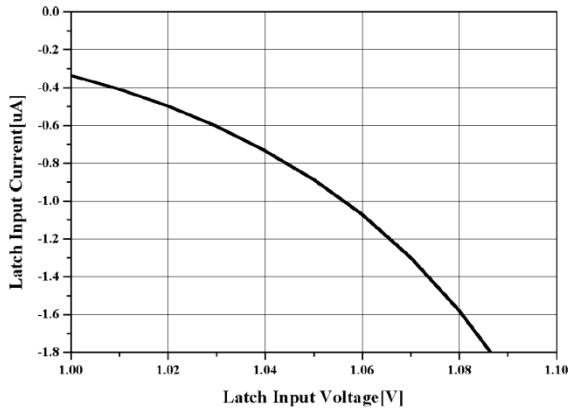


Figure 26. Latch Input Current

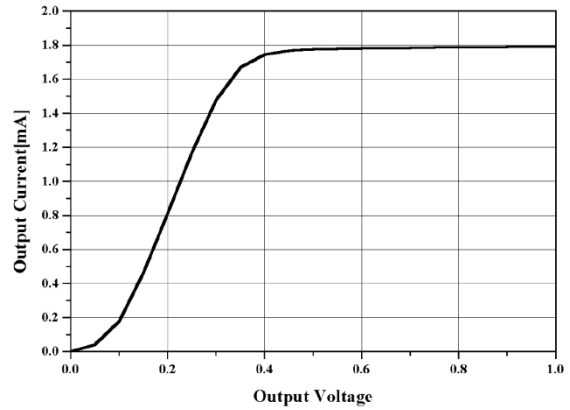


Figure 27. Output Low Current

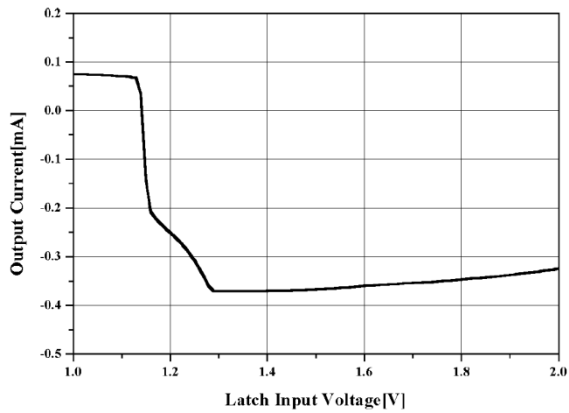


Figure 28. Output Current

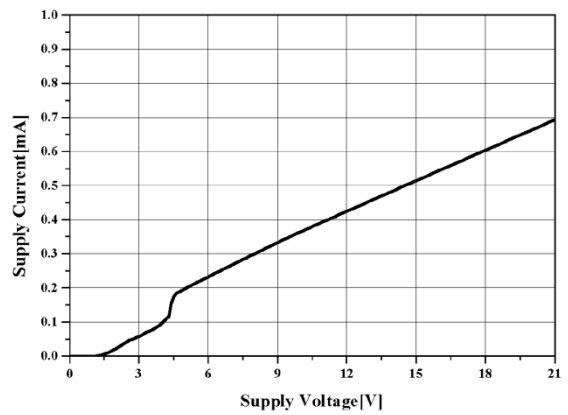


Figure 29. V<sub>CC</sub> Voltage vs. Supply Current 2

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

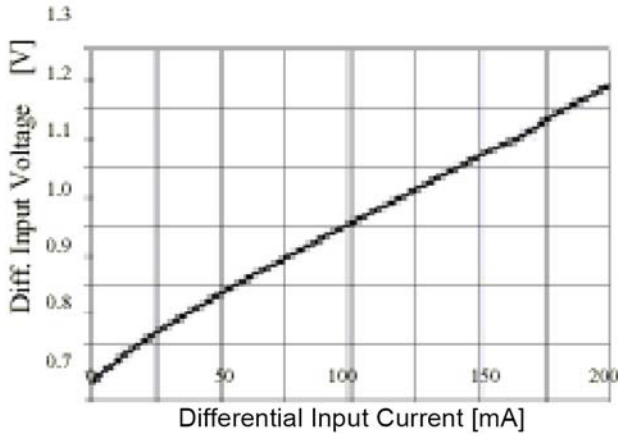


Figure 30. Differential Input Clamp Voltage

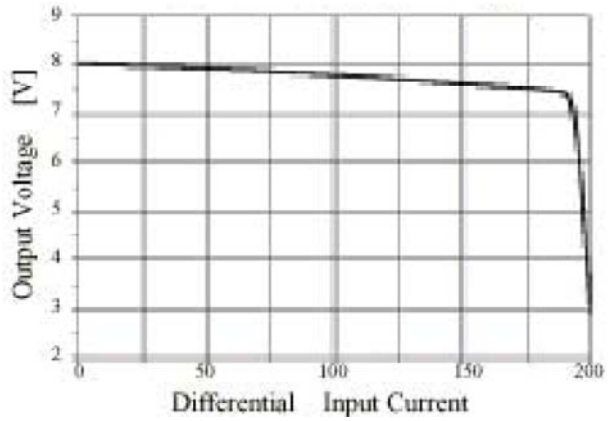


Figure 31. Latch-Off Supply Voltage

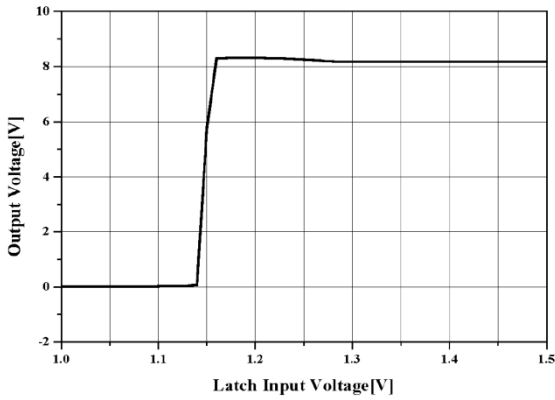


Figure 32. Latch-On Input Voltage

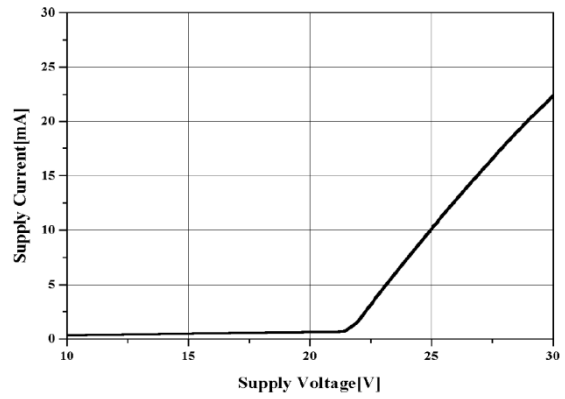


Figure 33. Maximum Supply

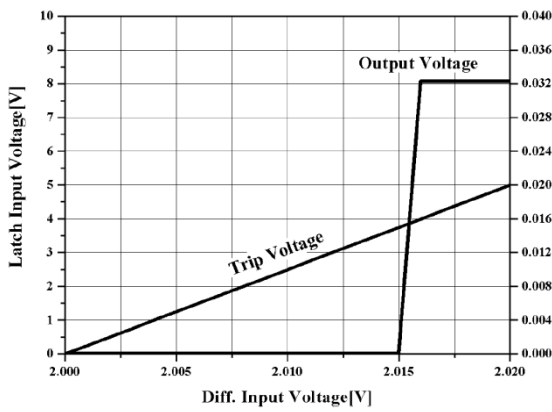


Figure 34. Trip and Output

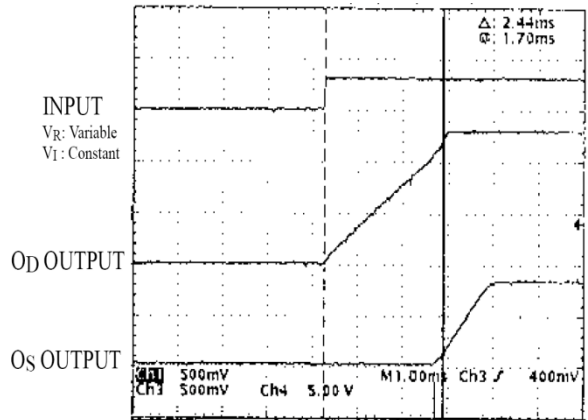


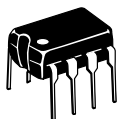
Figure 35. Output Response Time



# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

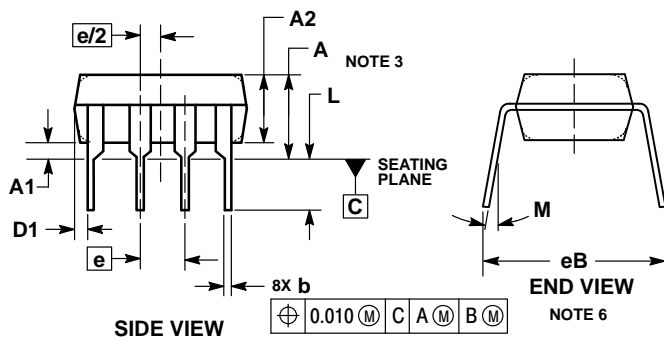
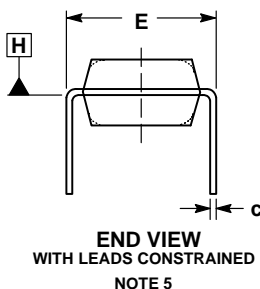
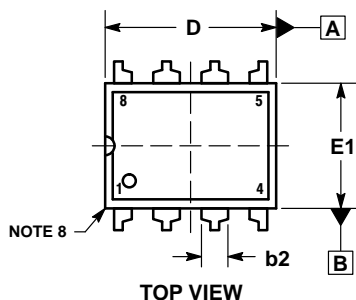
ON Semiconductor®



SCALE 1:1

PDIP-8  
CASE 626-05  
ISSUE P

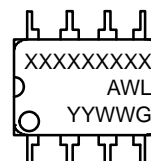
DATE 22 APR 2015



- NOTES:
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  - CONTROLLING DIMENSION: INCHES.
  - DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3.
  - DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
  - DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
  - DIMENSION eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
  - DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
  - PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	---	0.210	---	5.33
A1	0.015	---	0.38	---
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.35	0.56
b2	0.060 TYP		1.52 TYP	
C	0.008	0.014	0.20	0.36
D	0.355	0.400	9.02	10.16
D1	0.005	---	0.13	---
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100 BSC 2.54 BSC			
eB	---	0.430	---	10.92
L	0.115	0.150	2.92	3.81
M	---	10°	---	10°

### GENERIC MARKING DIAGRAM\*



- XXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = Pb-Free Package

\*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.

- STYLE 1:  
PIN 1. AC IN  
2. DC + IN  
3. DC - IN  
4. AC IN  
5. GROUND  
6. OUTPUT  
7. AUXILIARY  
8. V<sub>CC</sub>

DOCUMENT NUMBER:	98ASB42420B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
STATUS:	ON SEMICONDUCTOR STANDARD	
NEW STANDARD:		
DESCRIPTION:	PDIP-8	PAGE 1 OF 2



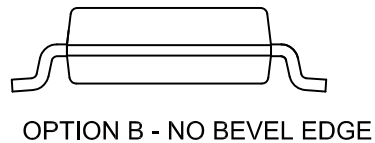
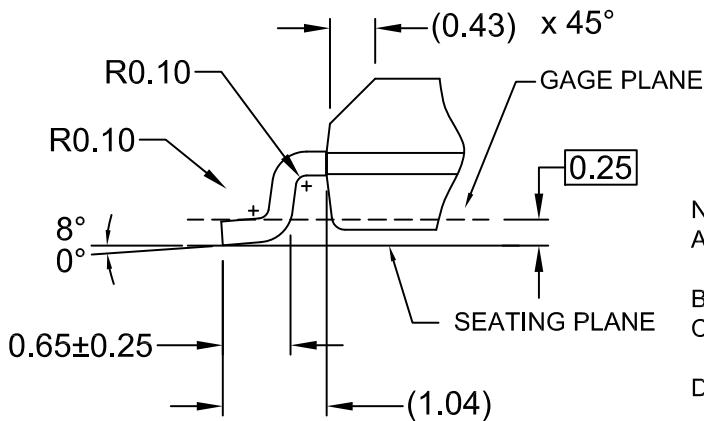
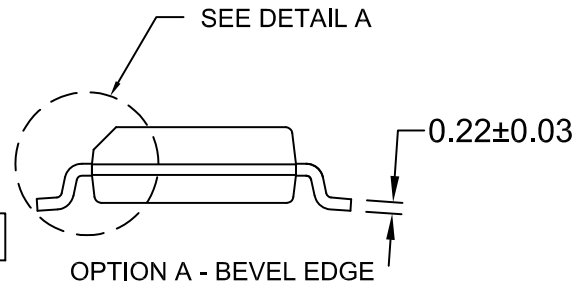
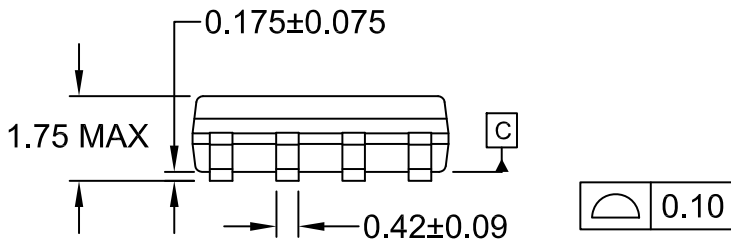
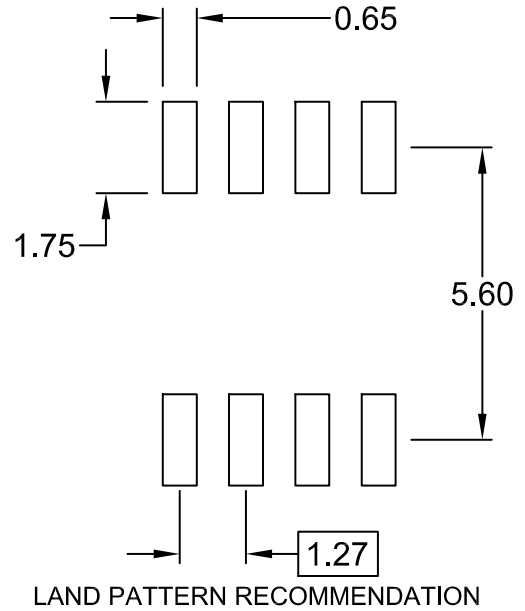
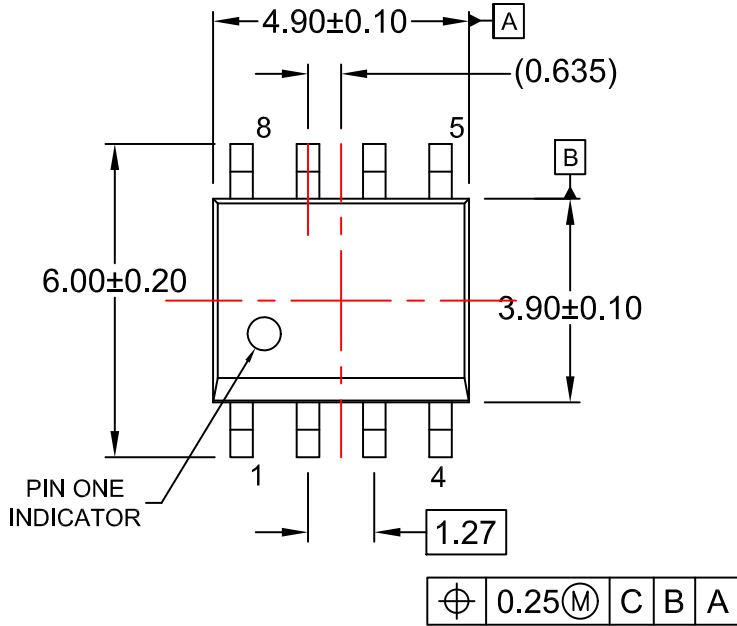
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



**SOIC8**  
CASE 751EB  
ISSUE A

DATE 24 AUG 2017



- NOTES:  
A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.  
B) ALL DIMENSIONS ARE IN MILLIMETERS.  
C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.  
D) LANDPATTERN STANDARD: SOIC127P600X175-8M

**DETAIL A**  
SCALE: 2:1

<b>DOCUMENT NUMBER:</b>	<b>98AON13735G</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>STATUS:</b>	<b>ON SEMICONDUCTOR STANDARD</b>	
<b>NEW STANDARD:</b>		
<b>DESCRIPTION:</b>	<b>SOIC8</b>	<b>PAGE 1 OF 2</b>



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 owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor 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:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910

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

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative