



KA2803B Earth Leakage Detector

Features

- Low Power Consumption: 5mW, 100V/200V
- Built-In Voltage Regulator
- High-Gain Differential Amplifier
- 0.4mA 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°C to +80°C
- Operation from 12V to 20V Input

Functions

- Differential Amplifier
- Level Comparator
- Latch Circuit

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.



8-DIP



8-SOP

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

Block Diagram

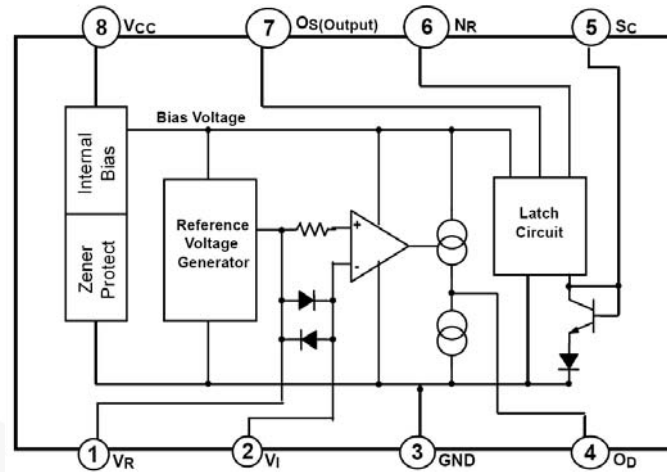


Figure 1. Block Diagram

Application Circuit

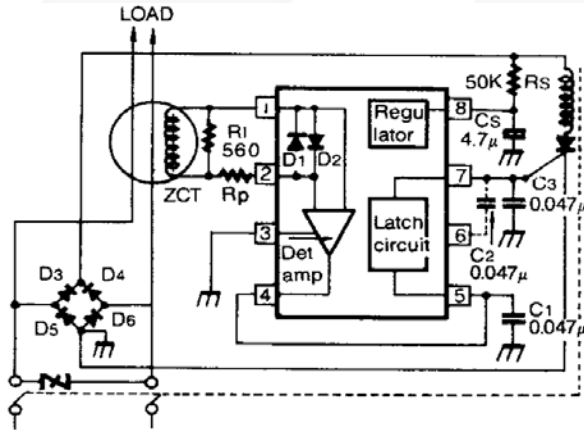


Figure 2. Full-Wave Application Circuit

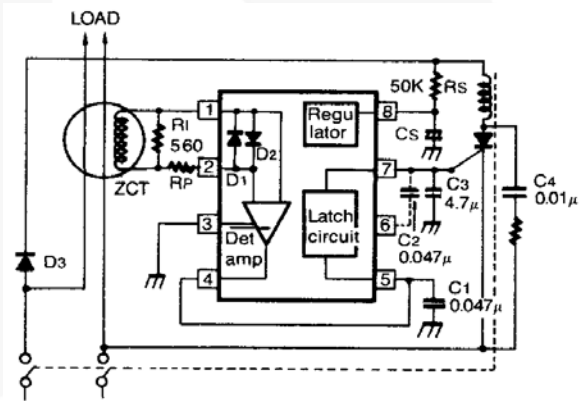


Figure 3. Half-Wave Application Circuit

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_{CC} terminal (Pin 8) directly from the power line. The resistor R_S and capacitor C_S are chosen so that Pin 8 voltage is at least 12V. The value of C_S is recommended above $1\mu\text{F}$.

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_L should be selected so that the breaker satisfies the required sensing current. The protection resistor R_P 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_P is from several hundred Ω to several $\text{k}\Omega$.

Capacitor C_1 is for the noise canceller and a standard value of C_1 is $0.047\mu\text{F}$. Capacitor C_2 is also a noise canceller capacitance, but it is not usually used.

When high noise is present, a $0.047\mu\text{F}$ 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_3 and the mechanism breaker. This capacitor should be selected under $1\mu\text{F}$ 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.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply Voltage		20	V
I_{CC}	Supply Current		8	mA
P_D	Power Dissipation		300	mW
T_L	Lead Temperature, Soldering 10 Seconds		260	°C
T_A	Operation Temperature Range	-25	+80	°C
T_{STG}	Storage Temperature Range	-65	+150	°C

Electrical Characteristics

$T_A = -25^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Test Circuit	Min.	Typ.	Max.	Units	
I_{CC}	Supply Current 1	$V_{CC}=12\text{V}$ $V_R=\text{OPEN}$ $V_I=2\text{V}$	Figure 4			580	μA	
				$T_A = -25^{\circ}\text{C}$				
				$T_A = +25^{\circ}\text{C}$	300	400		530
						480		
V_T	Trip Voltage	$V_{CC}=16\text{V}$, $V_R=2\text{V}\sim 2.02\text{V}$, $V_I=2$	Figure 5	14	16	18	mV (ms)	
				Note 1	12.5	14.2		17.0
$I_{O(D)}$	Differential Amplifier Current Current 1	$V_{CC}=16\text{V}$, $V_R\sim V_I=30\text{mV}$, $V_{OD}=1.2\text{V}$	Figure 7	-12	20	-30	μA	
	Differential Amplifier Current Current 2	$V_{CC}=16\text{V}$, $V_{OD}=0.8\text{V}$, V_R , V_I Short= V_P	Figure 8	17	27	37		
I_O	Output Current	$V_{SC}=1.4\text{V}$, $V_{OS}=0.8\text{V}$, $V_{CC}=16.0\text{V}$	Figure 9	$T_A = -25^{\circ}\text{C}$	200	400	800	μA
				$T_A = +25^{\circ}\text{C}$	200	400	800	
				$T_A = +80^{\circ}\text{C}$	100	300	600	
V_{SCON}	Latch-On Voltage	$V_{CC}=16\text{V}$	Figure 10	0.7	1.0	1.4	V	
I_{SCON}	Latch Input Current	$V_{CC}=16\text{V}$	Figure 11	-13	-7	-1	μA	
I_{OSL}	Output Low Current	$V_{CC}=12\text{V}$, $V_{OSL}=0.2\text{V}$	Figure 12	200	800	1400	μA	
V_{IDC}	Differential Input Clamp Voltage	$V_{CC}=16\text{V}$, $I_{IDC}=100\text{mA}$	Figure 13	0.4	1.2	2.0	V	
V_{SM}	Maximum Current Voltage	$I_{SM}=7\text{mA}$	Figure 14	20	24	28	V	
I_{S2}	Supply Current 2	$V_{CC}=12.0\text{V}$, $V_{OSL}=0.6\text{V}$	Figure 15	200	400	900	μA	
V_{SOFF}	Latch-Off Supply Voltage	$V_{OS}=12.0\text{V}$ $V_{SC}=1.8\text{V}$ $I_{IDC}=100.0\text{mA}$	Figure 16	7	8	9	V	
t_{ON}	Response Time	$V_{CC}=16\text{V}$, $V_R\sim V_I=0.3\text{V}$, $1\text{V}<V_X<5\text{V}$	Figure 17	2	3	4	ms	

Note:

- Guaranteed by design, not tested in production.

Test Circuits

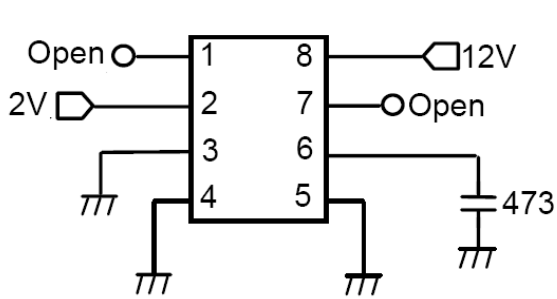


Figure 4. Supply Current 1

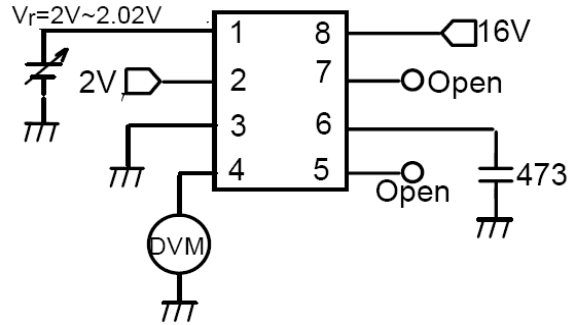
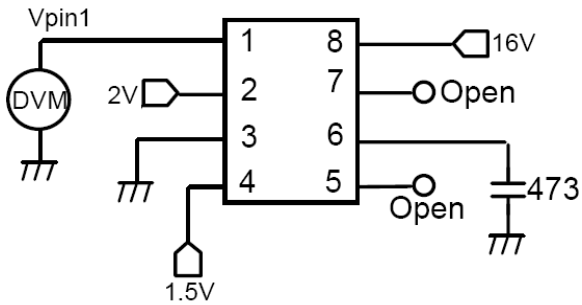


Figure 5. Trip Voltage



* $V_p = V_{pin1} - 0.03V$

Figure 6. V_{PN1} for V_p Measurement

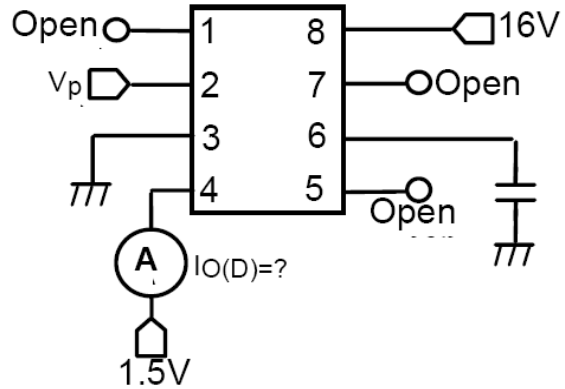


Figure 7. Differential Amplifier Output Current 1

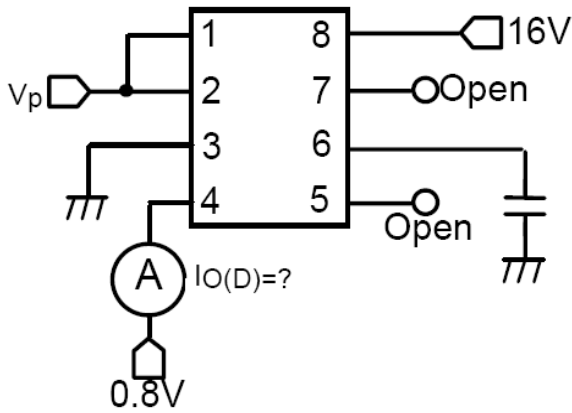


Figure 8. Differential Amplifier Output Current 2

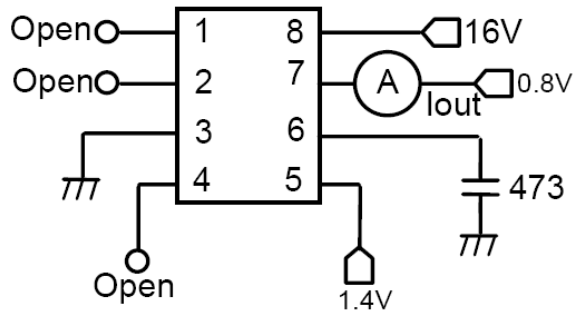


Figure 9. Output Current

Test Circuits (Continued)

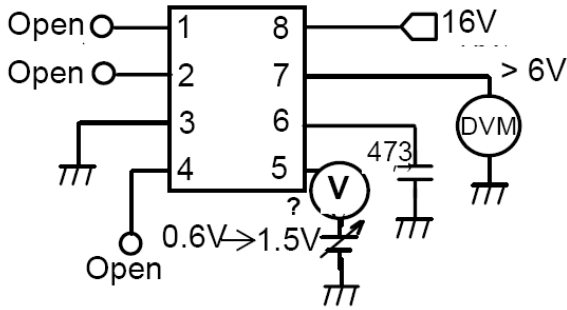


Figure 10. Latch-On Voltage

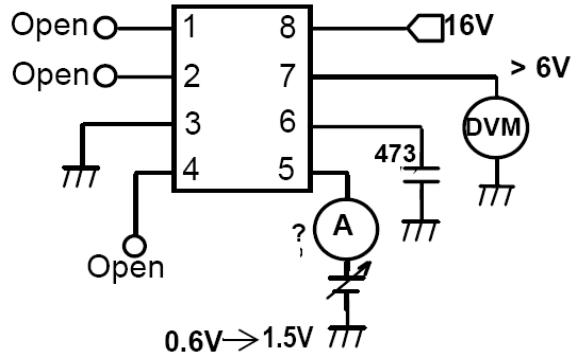


Figure 11. Latch Input Current

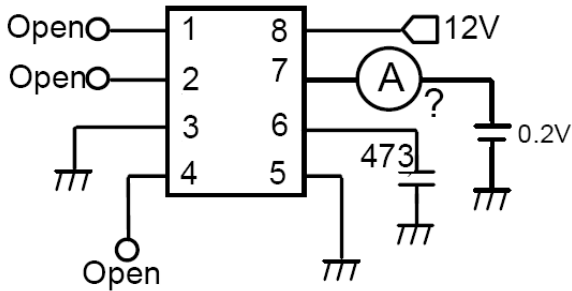


Figure 12. Output Low Current

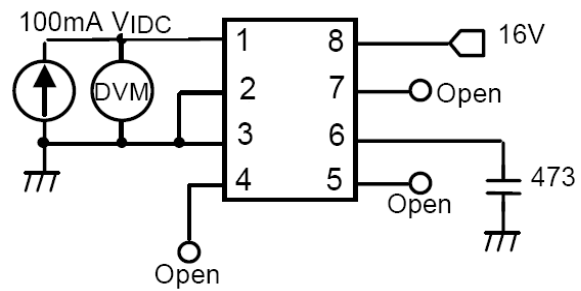


Figure 13. Differential Input Clamp Voltage

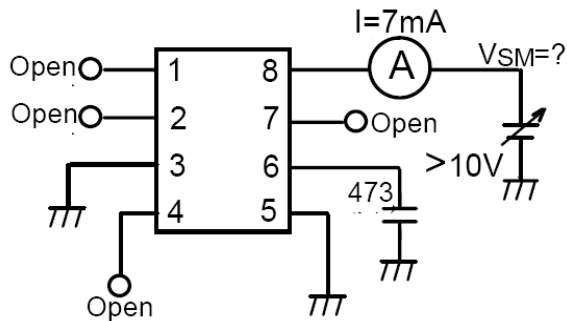


Figure 14. Maximum Current Voltage

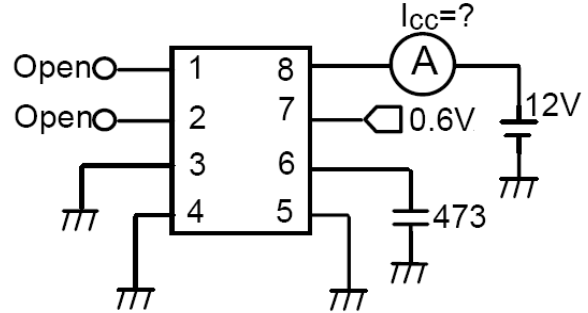


Figure 15. Supply Current 2

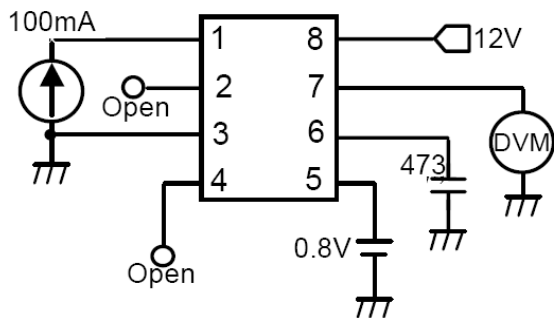


Figure 16. Latch-Off Supply Voltage

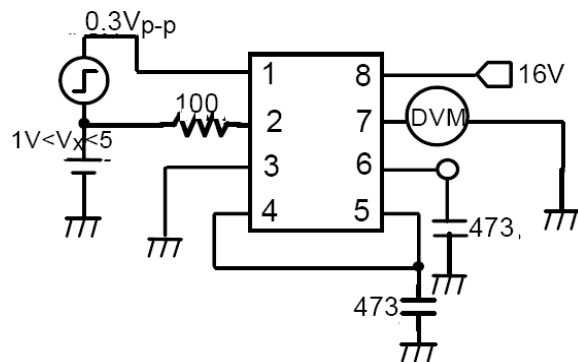


Figure 17. Response Time

Typical Performance Characteristics

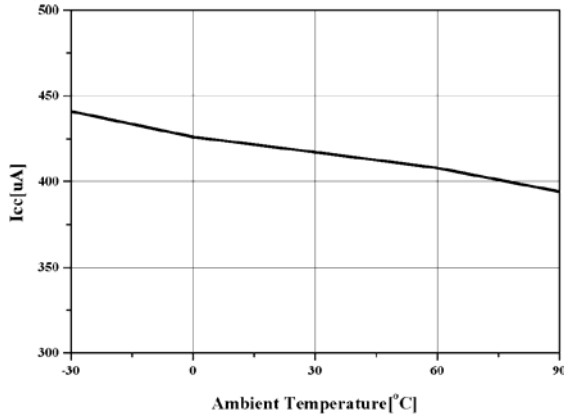


Figure 18. Supply Current

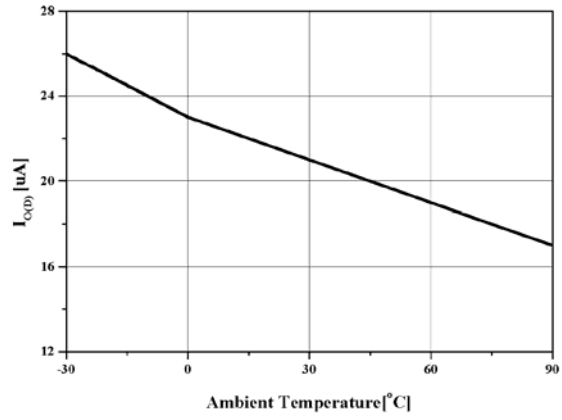


Figure 19. Differential Amplifier Output Current
($V_R - V_I = 30\text{mV}$, $V_{OD} = 1.2\text{V}$)

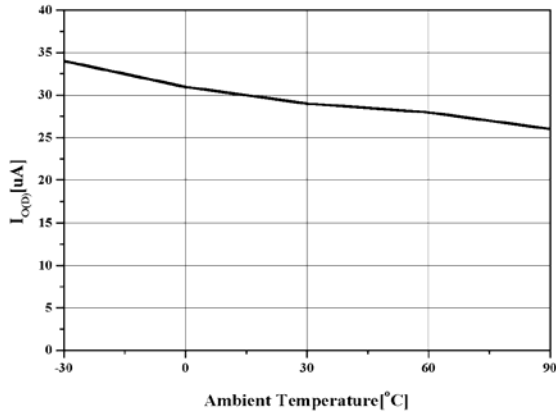


Figure 20. Differential Amplifier Output Current
(V_R , $V_I = V_P$, $V_{OD} = 0.8\text{V}$)

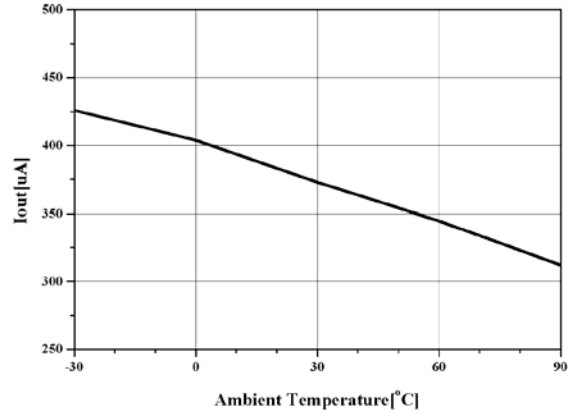


Figure 21. Output Current

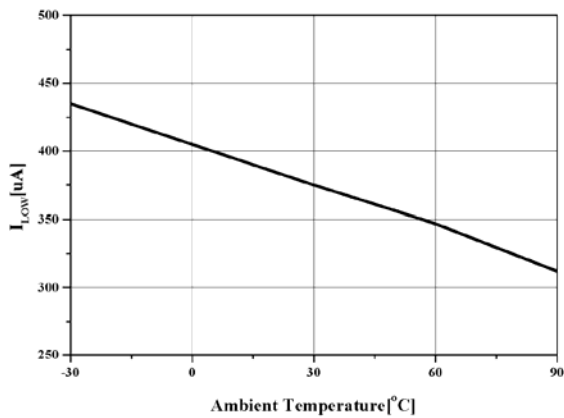


Figure 22. Output Low Current

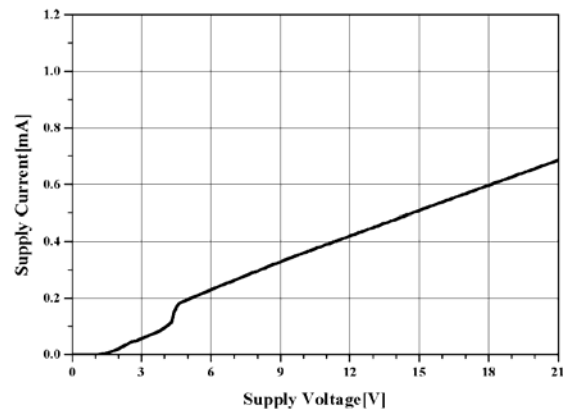


Figure 23. V_{CC} Voltage vs. Supply Current 1

Typical Performance Characteristics (Continued)

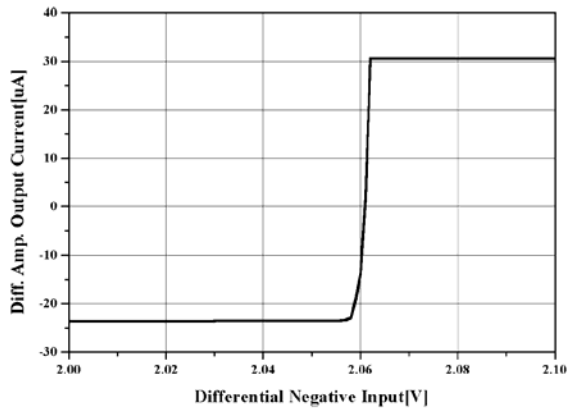


Figure 24. Differential Amplifier Output Current 1

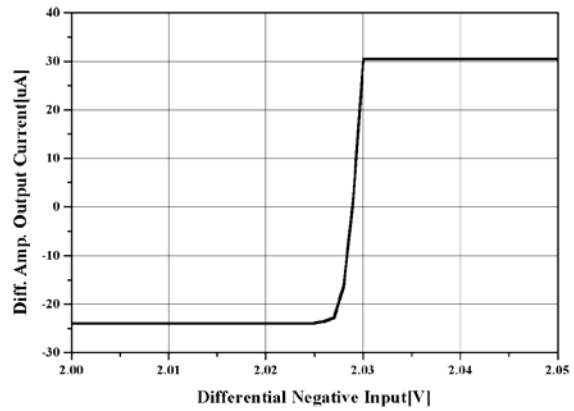


Figure 25. Differential Amplifier Output

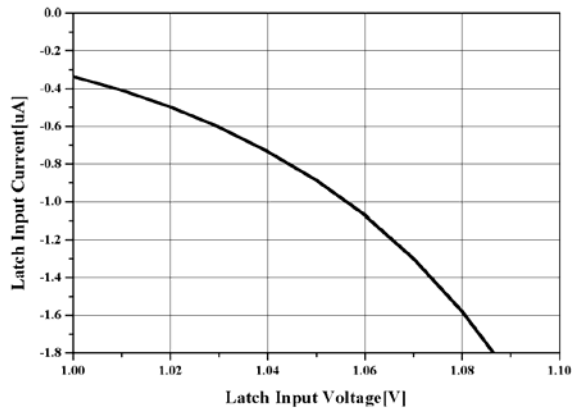


Figure 26. Latch Input Current

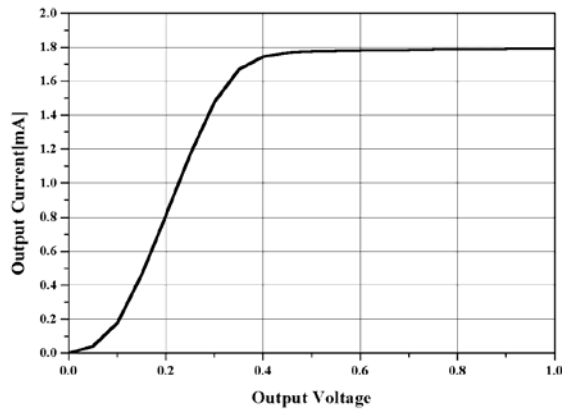


Figure 27. Output Low Current

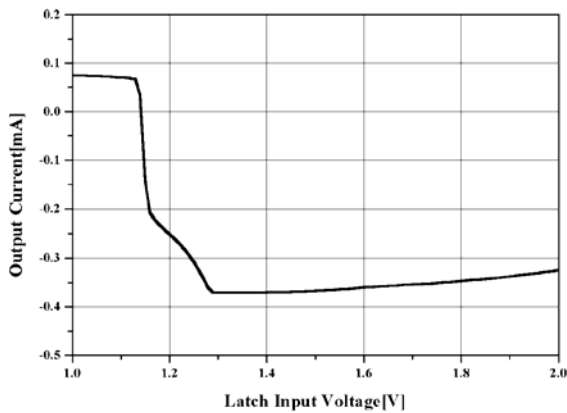


Figure 28. Output Current

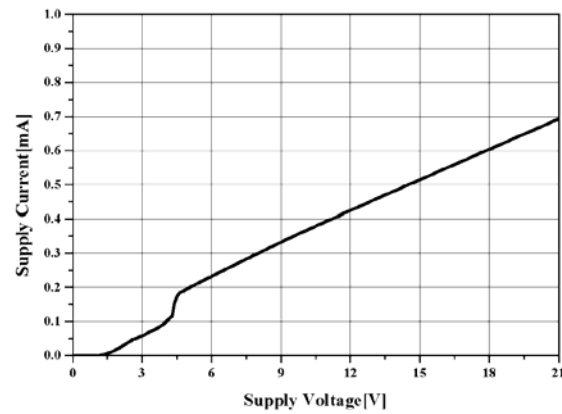


Figure 29. V_{CC} Voltage vs. Supply Current 2

Typical Performance Characteristics (Continued)

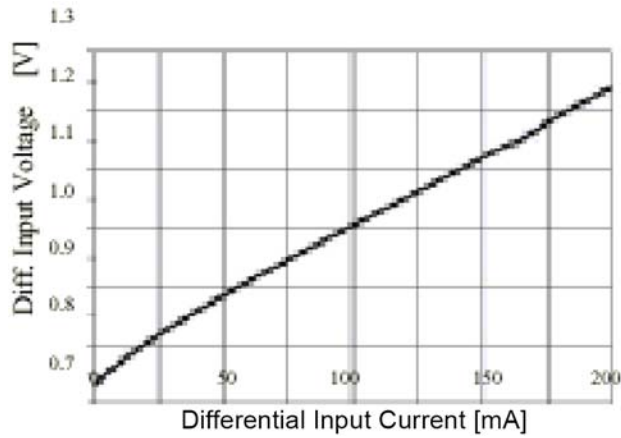


Figure 30. Differential Input Clamp Voltage

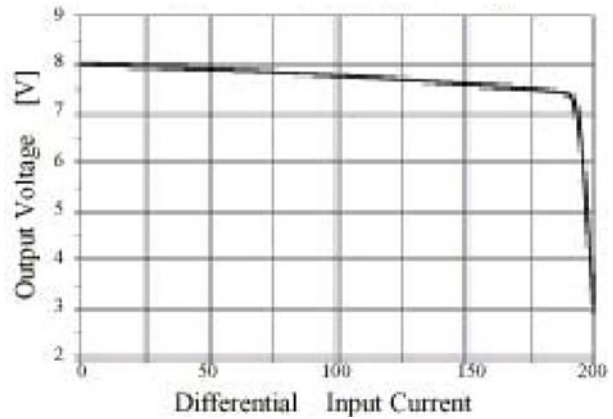


Figure 31. Latch-Off Supply Voltage

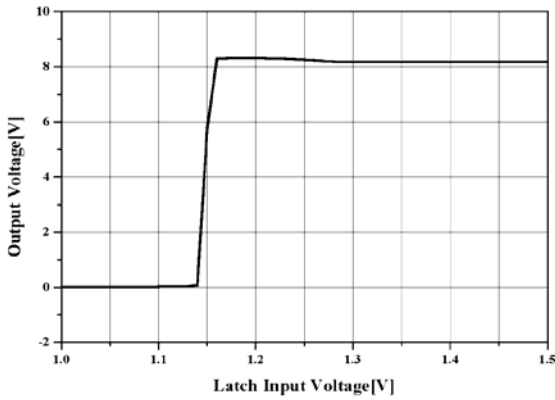


Figure 32. Latch-On Input Voltage

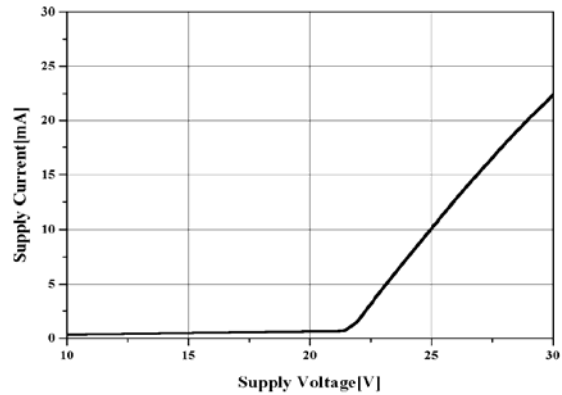


Figure 33. Maximum Supply

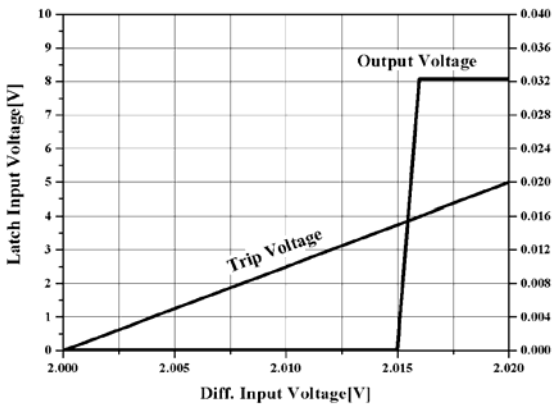


Figure 34. Trip and Output

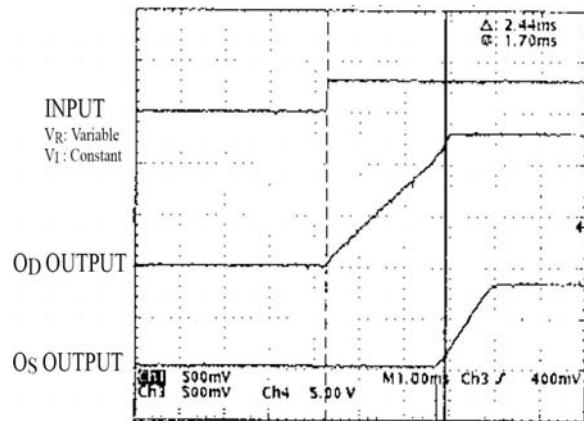
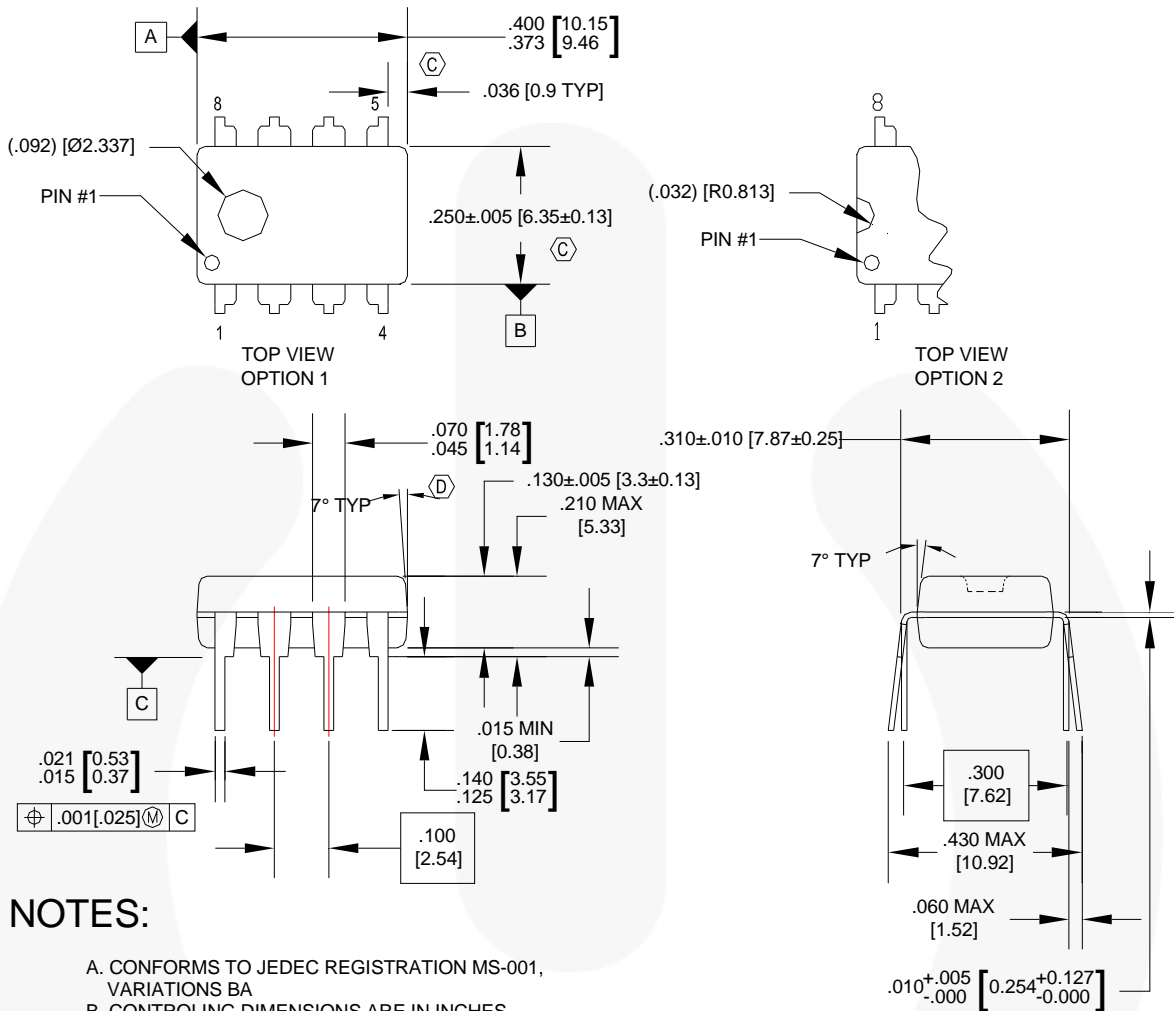


Figure 35. Output Response Time

Physical Dimensions



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MS-001, VARIATIONS BA
- B. CONTROLLING DIMENSIONS ARE IN INCHES
REFERENCE DIMENSIONS ARE IN MILLIMETERS
- (C) DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED
.010 INCHES OR 0.25MM.
- (D) DOES NOT INCLUDE DAMBAR PROTRUSIONS.
DAMBAR PROTRUSIONS SHALL NOT EXCEED
.010 INCHES OR 0.25MM.
- E. DIMENSIONING AND TOLERANCING
PER ASME Y14.5M-1994.

N08EREVG

Figure 36. 8-Lead, Dual Inline Package (DIP)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>.

Physical Dimensions

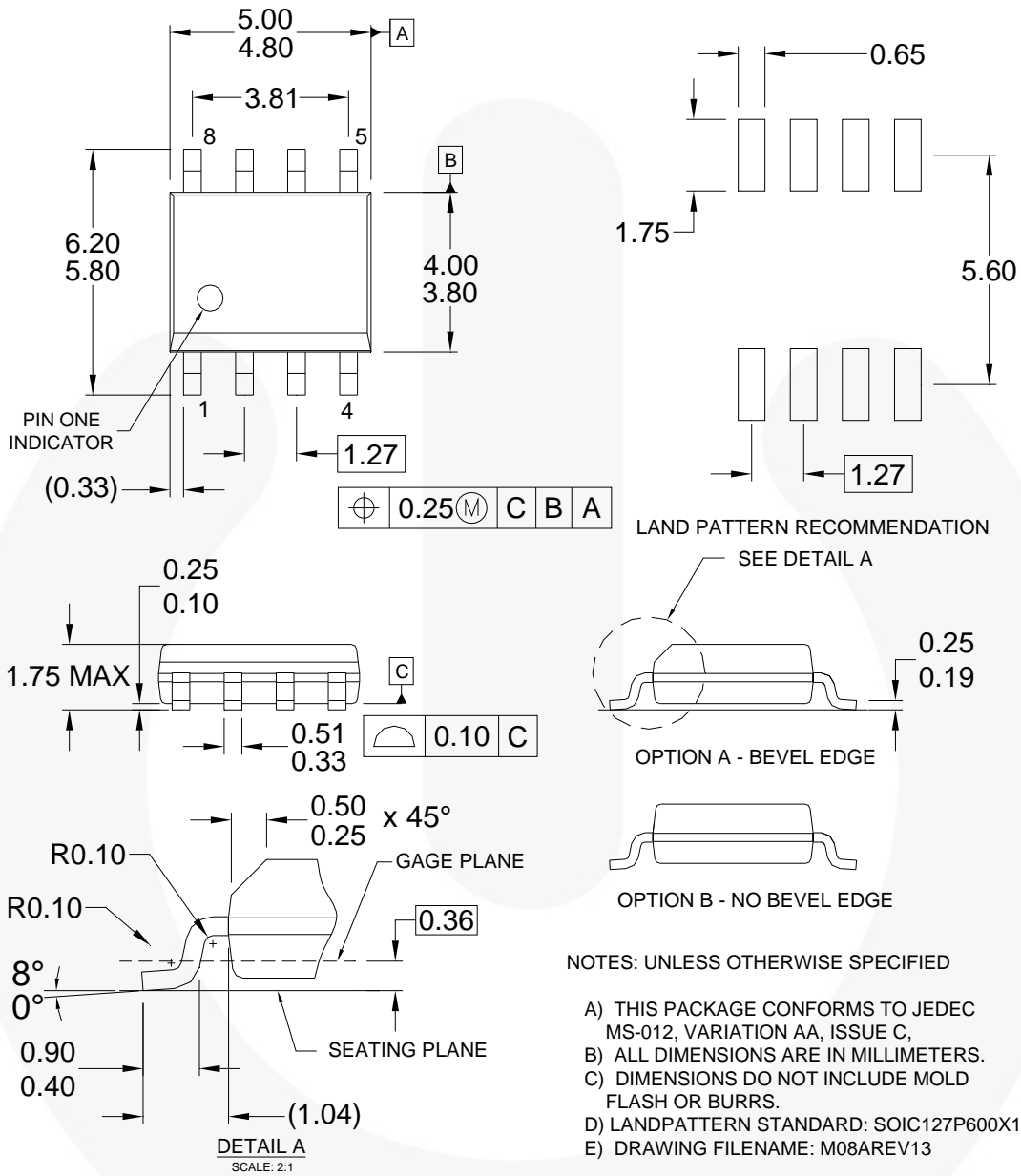


Figure 37. 8-Lead, Small Outline Package (SOP)




Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>.



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|---|--|---|---|
| 2Cool™ | FPS™ |  | The Power Franchise® |
| AccuPower™ | F-PFS™ | | the power franchise |
| Auto-SPM™ | FRFET® | PowerTrench® | TinyBoost™ |
| AX-CAP™* | Global Power Resource™ | PowerXS™ | TinyBuck™ |
| BitSiC™ | GreenBridge™ | Programmable Active Droop™ | TinyCalc™ |
| Build it Now™ | Green FPS™ | QFET® | TinyLogic® |
| CorePLUS™ | Green FPS™ e-Series™ | QS™ | TINYOPTO™ |
| CorePOWER™ | Gmax™ | Quiet Series™ | TinyPower™ |
| CROSSVOLT™ | GTO™ | RapidConfigure™ | TinyPWM™ |
| CTL™ | IntelliMAX™ |  | TinyWire™ |
| Current Transfer Logic™ | ISOPLANAR™ | Saving our world, 1mW/kW at a time™ | TranSiC™ |
| DEUXPEED® | Making Small Speakers Sound Louder and Better™ | SignalWise™ | TriFault Detect™ |
| Dual Cool™ | MegaBuck™ | SmartMax™ | TRUECURRENT®* |
| EcoSPARK® | MICROCOUPLER™ | SMART START™ | µSerDes™ |
| EfficientMax™ | MicroFET™ | Solutions for Your Success™ |  |
| ESBC™ | MicroPak™ | SPM® | UHC® |
|  | MicroPak2™ | STEALTH™ | Ultra FRFET™ |
| Fairchild® | MillerDrive™ | SuperFET® | UniFET™ |
| Fairchild Semiconductor® | MotionMax™ | SuperSOT™-3 | VCX™ |
| FACT Quiet Series™ | Motion-SPM™ | SuperSOT™-6 | VisualMax™ |
| FACT® | mWSaver™ | SuperSOT™-8 | VoltagePlus™ |
| FAST® | OptoHiT™ | SupreMOS® | XS™ |
| FastvCore™ | OPTOLOGIC® | SyncFET™ | |
| FETBench™ | OPTOPLANAR® | Sync-Lock™ | |
| FlashWriter®* | |  | |

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. 160

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[ON Semiconductor:](#)

[KA2803BD](#) [KA2803B_NL](#)