

SEMICONDUCTOR®

KA2803B Earth Leakage Detector

Features

- Low Power Consumption $P_D = 5mW$, 100V/200V
- Built-in Voltage Regulator
- High Gain Differential Amplifier
- 0.4mA Output Current Pulse to Trigger SCR' S
- Low External Part Count
- DIP Package (8-DIP), High Packing Density
- High Noise Immunity, Large Surge Margin
- Super Temperature Characteristic of Input Sensitivity
- Wide Operating Temperature Range ($T_A = -25^{\circ}C \sim +80^{\circ}C$)
- Operation from 12 to 20V Input

Functions

- Differential Amplifier
- Level Comparator
- Latch Circuit

Block Diagram

Description

The KA2803B is designed for use in earth leakage circuit interrupters, for stable operation of 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 that is specified in KSC4613. The level comparator generates high level when earth leakage current is greater than the fixed level.





Absolute Maximum Ratings (T_A = 25°C)

| Parameter | Symbol | Value | Unit |
|------------------------------------|--------|-------------|------|
| Supply Voltage | Vcc | 20 | V |
| Supply Current | ICC | 8 | mA |
| Power Dissipation | PD | 300 | mW |
| Lead Temperature (Soldering 10sec) | TLEAD | 260 | °C |
| Operating Temperature | TOPR | - 25 ~ +80 | °C |
| Storage Temperature | TSTG | - 65 ~ +150 | °C |

Electrical Characteristics

 $(T_A = -25^{\circ}C \text{ to } 80^{\circ}C)$

| Parameter | Symbol | Conditions | | Circuit | Min. | Тур. | Max. | Unit |
|--|-----------------|--|---------|------------|------|------|-------------|------|
| Supply Current 1 | Icc | V _{CC} = 12V V _R = Open V _I = 2V | (-25°C) | - 1 300 | - | - | 580 | μA |
| | | | (25°C) | | 300 | 400 | 530 | |
| | | | (80°C) | | - | - | 480 | |
| Trip Voltage | VT | VCC = 16V VR = 2V ~ 2.02V VI = 2V | | 2 | 14 | 16 | 18 | mV |
| | | (Note1) | | 12.5 | 14.2 | 17 | mVrms | |
| Differential Amplifier Output Current 1 | IO(D) | V _{CC} = 16V (V _R -V _I =30mV , V _{OD} =1.2V) 3 | | -12 | 20 | -30 | μA | |
| Differential Amplifier Output Current 2 | IO(D) | V _{CC} =16V, V _{OD} =0.8V V _R , V _I =V _P (Note2) 4 | | 17 | 27 | 37 | (rms) μA | |
| Output Current | lo | V _{SC} = 1.4V (-25°C) | | | 200 | 400 | 800 | μΑ |
| | | Vos = 0.8V (25°C) | | 5 | 200 | 400 | 800 | |
| | | V _{CC} = 16V (25°C) | | | 100 | 300 | 600 | |
| Latch on Voltage | VSCON | VCC = 16V 6 | | 6 | 0.7 | 1.0 | 1.4 | V |
| Latch Input Current | ISCON | VCC = 16V 7 | | 7 | -13 | -7 | -1 | μΑ |
| Output Low Current | IOSL | VCC = 12V, VOSL = 0.2V 8 | | 8 | 200 | 800 | 1400 | μA |
| Diff. Input Clamp Voltage | VIDC | V _{CC} = 16V, I _{IDC} = 100mA 9 | | 9 | 0.4 | 1.2 | 2 | V |
| Maximum Current Voltage | VSM | ISM = 7mA 10 | | 10 | 20 | 24 | 28 | V |
| Supply Current 2 | I _{S2} | V _{CC} = 12V, V _{OSL} = 0.6V 11 | | 11 | 200 | 400 | 900 | μA |
| Latch Off Supply Voltage | VSOFF | Vos = 12V | | | 7.0 | 8.0 | 9.0 | V |
| | | VSC = 1.8V | | 12 | | | | |
| | | IIDC =100mA | | | | | | |
| Response Time(Note1) | TON | VCC = 16V VR-VI = 0.3V , 1V < VX < 5V 13 | | 13 | 2 | 3 | 4 | mS |

Note:

1. This Parameter, although guaranteed, is not tested in Production.

2. VP=Vpin1 -0.03V at Vpin2=2.0V , Vpin4=1.5V

Test Circuit



Typical Characteristics



Figure 1. Supply Current



Figure 3. Differential Amp. Output Current VR, VI=VP, VOD=0.8V



Figure 5. Output Low Current



Figure 2. Differential Amp. Output Current VR-VI=30mV, VOD=1.2V



Figure 4. Output Current



Figure 6. Vcc Voltage Vs. Supply Current 1

Typical Characteristics (Continued)



Figure 7. Differential Amp. Output Current 1



Figure 9. Latch Input Current



Figure 11. Output Current



Figure 8. Differential Amp. Output



Figure 10. Output Low Current



Figure 12. Vcc Voltage Vs. Supply Current 2



Typical Characteristics (Continued)



Figure 15. Latch On Input Voltage



Figure 17. Trip & Output





Typical Characteristics (Continued)



Figure 18. Output Response Time

Application Circuit





Figure 1. Full Wave Application Circuit

Figure 2. Half Wave Application Circuit

Application Note

(refer to full wave application circuit Fig. 1)

The Fig 1 shows the KA2803B connected in a typical leakage current detector system. The power is applied to the V_{CC} terminal (Pin 8) of the KA2803B directly from the power line. The resistor Rs and capacitor Cs are chosen so that pin 8 voltage is at least 12V. The value of Cs is recommended above 1µF at this time. 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 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 RL should be selected so that the breaker satisfies the required sensing current. The protection resistor Rp is not usually used put when the high current is injected at the breaker, this resistor should be used to protect the earth leakage detector IC the KA2803B. The range of Rp is from several hundred Ω to several k Ω . The capacitor C₁, is for the noise canceller and standard value of C₁ is 0.047μ F. Also the capacitor C₂ is noise canceller capacitance but it is not usually used. When high noise is only appeared at this system 0.047μ F capacitor may be connected between pin 6 and pin 7. The amplified signal is finally appeared to 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 breaker is decided by the capacitor C3 and the mechanism breaker. This capacitor should be selected under 1µF for the required the 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. If your application want the detail information, request it on our application circuit designer of KA2803B.

Dimensions in millimeters

Mechanical Dimensions

0~15°

Package

6.40 ±0.20 0.79 0.252 ±0.008 $\frac{1.524 \pm 0.10}{0.060 \pm 0.004}$ $\begin{array}{c} 0.46 \pm 0.10 \\ 0.018 \pm 0.004 \end{array}$ #1 #8 9.20 ±0.20 0.362 ±0.008 9.60 0.378 MAX #4 #5 П 2.54 0.100 3.30 ± 0.30 $\frac{5.08}{0.200}$ MAX 0.130 ± 0.012 7.62 0.300 3.40 ±0.20 $\frac{0.33}{0.013}\,\text{MIN}$ $\overline{0.134 \pm 0.008}$ 0.25 ^{+0.10} __0.05 0.010 ^{+0.004} __0.002

8-DIP

Mechanical Dimensions (Continued)

Package

Dimensions in millimeters



Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| KA2803B | 8-DIP | -20 - +80°C |
| KA2803BD | 8-SOP | -20 ~ +80 C |

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