

# KA3842B/KA3843B/KA3844B/ KA3845B

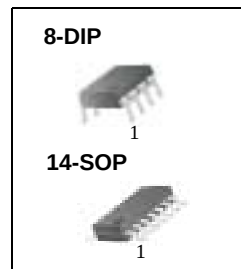
## SMPS Controller

### Features

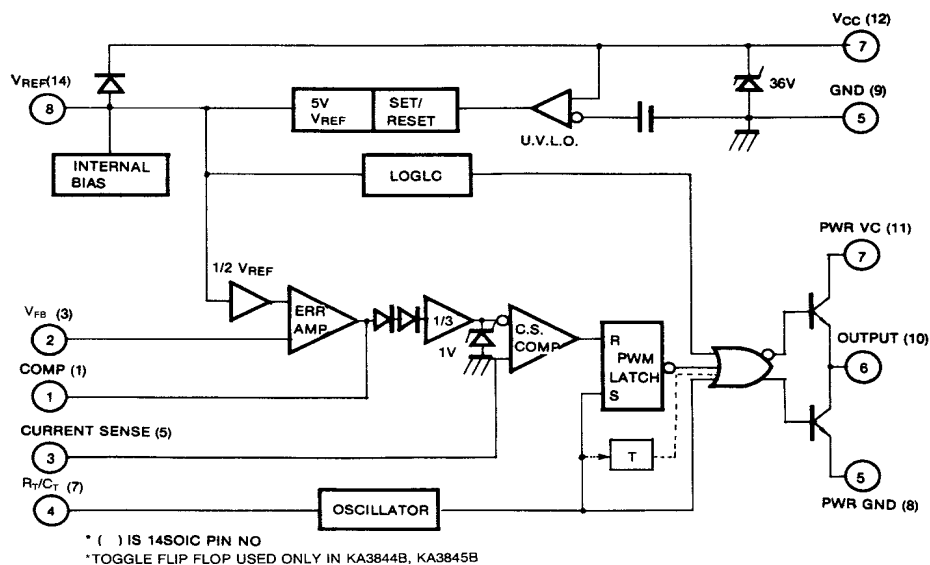
- Low Start up Current
- Maximum Duty Clamp
- UVLO With Hysteresis
- Operating Frequency up to 500KHz

### Description

The KA3842B/KA3843B/KA3844B/KA3845B are fixed frequency current-mode PWM controller. They are specially designed for Off - Line and DC-to-DC converter applications with minimum external components. These integrated circuits feature a trimmed oscillator for precise duty cycle control, a temperature compensated reference, high gain error amplifier, current sensing comparator and a high current totempole output for driving a power MOSFET. The KA3842B and KA3844B have UVLO thresholds of 16V (on) and 10V (off). The KA3843B and KA3845B are 8.5V (on) and 7.9V (off). The KA3842B and KA3843B can operate within 100% duty cycle. The KA3844B and KA3845B can operate with 50% duty cycle.



### Internal Block Diagram

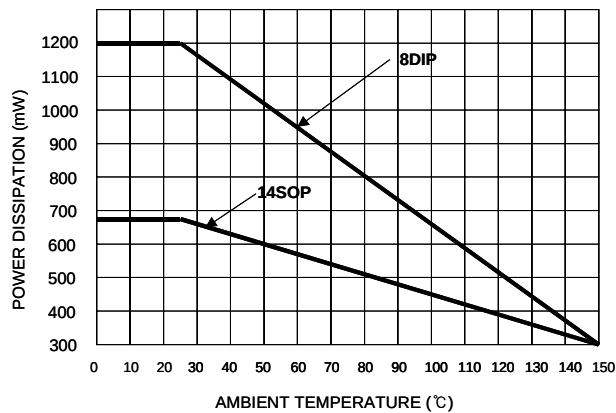


Absolute Maximum Ratings

| Parameter                            | Symbol      | Value       | Unit |
|--------------------------------------|-------------|-------------|------|
| Supply Voltage                       | VCC         | 30          | V    |
| Output Current                       | IO          | ±1          | A    |
| Analog Inputs (Pin 2.3)              | V(ANA)      | -0.3 to 6.3 | V    |
| Error Amp Output Sink Current        | ISINK (E.A) | 10          | mA   |
| Power Dissipation at TA≤25°C (8DIP)  | PD(Note1,2) | 1200        | mW   |
| Power Dissipation at TA≤25°C (14SOP) | PD(Note1,2) | 680         | mW   |
| Storage Temperature Range            | TSTG        | -65 ~ +150  | °C   |
| Lead Temperature (Soldering, 10sec)  | TLEAD       | +300        | °C   |

- Note:**
- 1. Board Thickness 1.6mm, Board Dimension 76.2mm ×114.3mm, (Reference EIA / JSED51-3, 51-7)
  - 2. Do not exceed PD and SOA (Safe Operation Area)

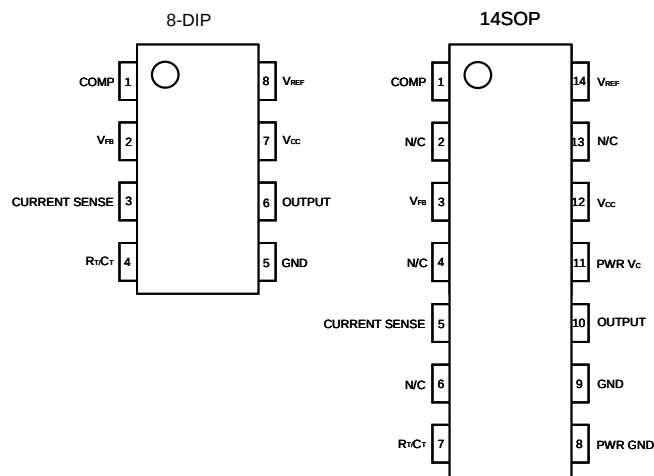
Power Dissipation Curve



Thermal Data

| Characteristic                      | Symbol        | 8-DIP | 14-SOP | Unit |
|-------------------------------------|---------------|-------|--------|------|
| Thermal Resistance Junction-ambient | Rthj-amb(MAX) | 100   | 180    | °C/W |

Pin Array



## Electrical Characteristics

(V<sub>CC</sub>=15V, R<sub>T</sub>=10K $\Omega$ , C<sub>T</sub>=3.3nF, T<sub>A</sub>= 0°C to +70°C, unless otherwise specified)

| Parameter                                 | Symbol                   | Conditions                                                       | Min. | Typ. | Max. | Unit             |
|-------------------------------------------|--------------------------|------------------------------------------------------------------|------|------|------|------------------|
| <b>REFERENCE SECTION</b>                  |                          |                                                                  |      |      |      |                  |
| Reference Output Voltage                  | V <sub>REF</sub>         | T <sub>J</sub> = 25°C, I <sub>REF</sub> = 1mA                    | 4.90 | 5.00 | 5.10 | V                |
| Line Regulation                           | $\Delta V_{REF}$         | 12V $\leq$ V <sub>CC</sub> $\leq$ 25V                            | -    | 6    | 20   | mV               |
| Load Regulation                           | $\Delta V_{REF}$         | 1mA $\leq$ I <sub>REF</sub> $\leq$ 20mA                          | -    | 6    | 25   | mV               |
| Short Circuit Output Current              | I <sub>SC</sub>          | T <sub>A</sub> = 25°C                                            | -    | -100 | -180 | mA               |
| <b>OSCILLATOR SECTION</b>                 |                          |                                                                  |      |      |      |                  |
| Oscillation Frequency                     | f                        | T <sub>J</sub> = 25°C                                            | 47   | 52   | 57   | KHz              |
| Frequency Change with Voltage             | $\Delta f/\Delta V_{CC}$ | 12V $\leq$ V <sub>CC</sub> $\leq$ 25V                            | -    | 0.05 | 1    | %                |
| Oscillator Amplitude                      | V <sub>Osc</sub>         | -                                                                | -    | 1.6  | -    | V <sub>P-P</sub> |
| <b>ERROR AMPLIFIER SECTION</b>            |                          |                                                                  |      |      |      |                  |
| Input Bias Current                        | I <sub>BIAS</sub>        | -                                                                | -    | -0.1 | -2   | $\mu$ A          |
| Input Voltage                             | V <sub>I(E&gt;A)</sub>   | V <sub>pin1</sub> = 2.5V                                         | 2.42 | 2.50 | 2.58 | V                |
| Open Loop Voltage Gain                    | G <sub>VO</sub>          | 2V $\leq$ V <sub>O</sub> $\leq$ 4V (Note3)                       | 65   | 90   | -    | dB               |
| Power Supply Rejection Ratio              | PSRR                     | 12V $\leq$ V <sub>CC</sub> $\leq$ 25V (Note3)                    | 60   | 70   | -    | dB               |
| Output Sink Current                       | I <sub>SINK</sub>        | V <sub>pin2</sub> = 2.7V, V <sub>pin1</sub> = 1.1V               | 2    | 7    | -    | mA               |
| Output Source Current                     | I <sub>SOURCE</sub>      | V <sub>pin2</sub> = 2.3V, V <sub>pin1</sub> = 5V                 | -0.6 | -1.0 | -    | mA               |
| High Output Voltage                       | V <sub>OH</sub>          | V <sub>pin2</sub> = 2.3V, R <sub>L</sub> = 15K $\Omega$ to GND   | 5    | 6    | -    | V                |
| Low Output Voltage                        | V <sub>OL</sub>          | V <sub>pin2</sub> = 2.7V, R <sub>L</sub> = 15K $\Omega$ to Pin 8 | -    | 0.8  | 1.1  | V                |
| <b>CURRENT SENSE SECTION</b>              |                          |                                                                  |      |      |      |                  |
| Gain                                      | G <sub>V</sub>           | (Note 1 & 2)                                                     | 2.85 | 3    | 3.15 | V/V              |
| Maximum Input Signal                      | V <sub>I(MAX)</sub>      | V <sub>pin1</sub> = 5V (Note 1)                                  | 0.9  | 1    | 1.1  | V                |
| Power Supply Rejection Ratio              | PSRR                     | 12V $\leq$ V <sub>CC</sub> $\leq$ 25V (Note1,3)                  | -    | 70   | -    | dB               |
| Input Bias Current                        | I <sub>BIAS</sub>        | -                                                                | -    | -3   | -10  | $\mu$ A          |
| <b>OUTPUT SECTION</b>                     |                          |                                                                  |      |      |      |                  |
| Low Output Voltage                        | V <sub>OL</sub>          | I <sub>SINK</sub> = 20mA                                         | -    | 0.08 | 0.4  | V                |
|                                           |                          | I <sub>SINK</sub> = 200mA                                        | -    | 1.4  | 2.2  | V                |
| High Output Voltage                       | V <sub>OH</sub>          | I <sub>SOURCE</sub> = 20mA                                       | 13   | 13.5 | -    | V                |
|                                           |                          | I <sub>SOURCE</sub> = 200mA                                      | 12   | 13.0 | -    | V                |
| Rise Time                                 | t <sub>R</sub>           | T <sub>J</sub> = 25°C, C <sub>L</sub> = 1nF (Note 3)             | -    | 45   | 150  | ns               |
| Fall Time                                 | t <sub>F</sub>           | T <sub>J</sub> = 25°C, C <sub>L</sub> = 1nF (Note 3)             | -    | 35   | 150  | ns               |
| <b>UNDER-VOLTAGE LOCKOUT SECTION</b>      |                          |                                                                  |      |      |      |                  |
| Start Threshold                           | V <sub>TH(ST)</sub>      | KA3842B/KA3844B                                                  | 14.5 | 16.0 | 17.5 | V                |
|                                           |                          | KA3843B/KA3845B                                                  | 7.8  | 8.4  | 9.0  | V                |
| Min. Operating Voltage<br>(After Turn On) | V <sub>OPR(MIN)</sub>    | KA3842B/KA3844B                                                  | 8.5  | 10.0 | 11.5 | V                |
|                                           |                          | KA3843B/KA3845B                                                  | 7.0  | 7.6  | 8.2  | V                |

Electrical Characteristics (Continued)

(VCC=15V, RT=10KΩ, CT=3.3nF, TA= 0°C to +70°C unless otherwise specified)

| Parameter                | Symbol   | Conditions      | Min. | Typ. | Max. | Unit |
|--------------------------|----------|-----------------|------|------|------|------|
| PWM SECTION              |          |                 |      |      |      |      |
| Max. Duty Cycle          | D(Max)   | KA3842B/KA3843B | 95   | 97   | 100  | %    |
|                          | D(MAX)   | KA3844B/KA3845B | 47   | 48   | 50   | %    |
| Min. Duty Cycle          | D(MIN)   | -               | -    | -    | 0    | %    |
| TOTAL STANDBY CURRENT    |          |                 |      |      |      |      |
| Start-Up Current         | IST      | -               | -    | 0.45 | 1    | mA   |
| Operating Supply Current | ICC(OPR) | Vpin3=Vpin2=ON  | -    | 14   | 17   | mA   |
| Zener Voltage            | VZ       | ICC = 25mA      | 30   | 38   | -    | V    |

Adjust VCC above the start threshold before setting at 15V

Note:

- 1. Parameter measured at trip point of latch
- 2. Gain defined as:

$$A = \frac{\Delta V_{pin1}}{\Delta V_{pin3}}, 0 \leq V_{pin3} \leq 0.8V$$

- 3. These parameters, although guaranteed, are not 100 tested in production.

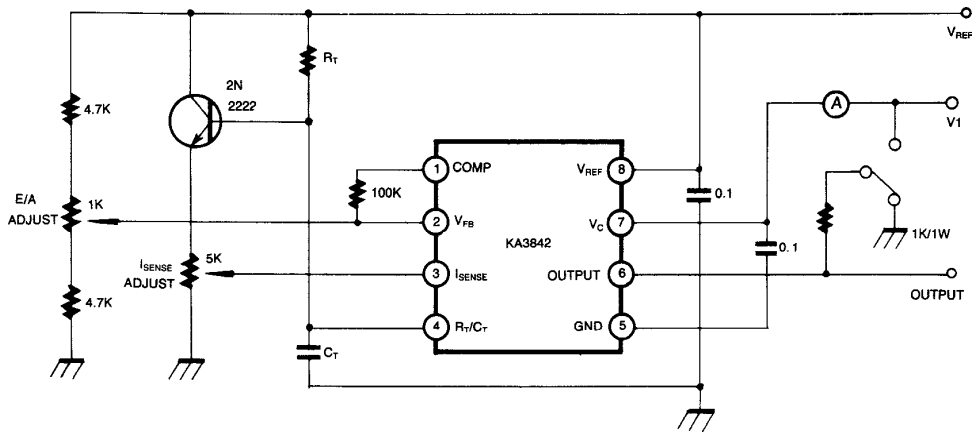


Figure 1. Open Loop Test Circuit

High peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to pin 5 in a single point ground. The transistor and 5KΩ potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin 3.

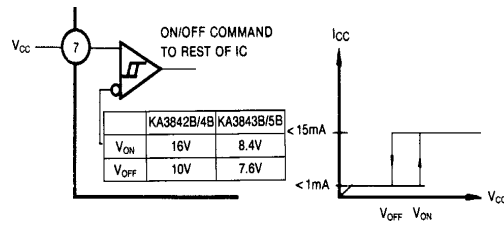


Figure 2. Under Voltage Lockout

During Under-Voltage Lock-Out, the output driver is biased to a high impedance state. Pin 6 should be shunted to ground with a bleeder resistor to prevent activating the power switch with output leakage current.

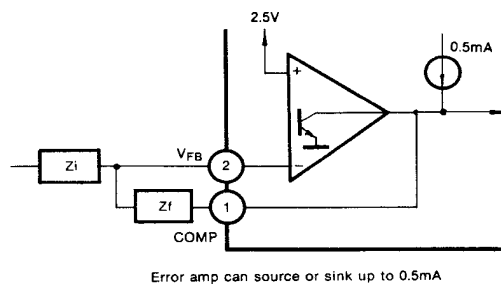


Figure 3. Error Amp Configuration

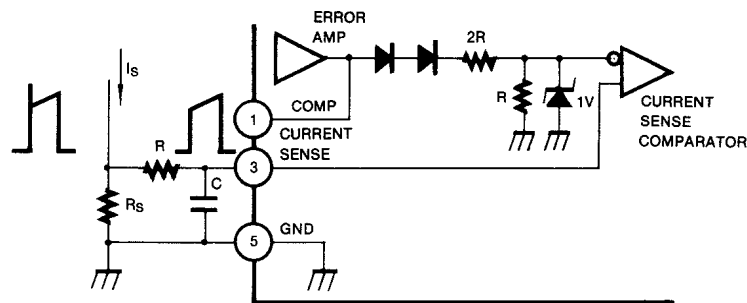


Figure 4. Current Sense Circuit

Peak current ( $I_S$ ) is determined by the formula:

$$I_S(\text{MAX}) = \frac{1.0V}{R_S}$$

A small RC filter may be required to suppress switch transients.

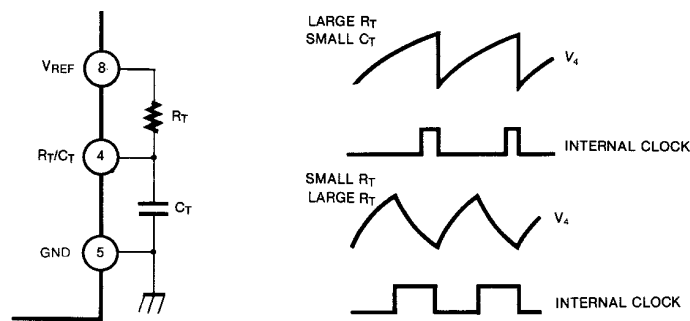


Figure 5. Oscillator Waveforms and Maximum Duty Cycle

Oscillator timing capacitor,  $C_T$ , is charged by  $V_{REF}$  through  $R_T$  and discharged by an internal current source. During the discharge time, the internal clock signal blanks the output to the low state. Selection of  $R_T$  and  $C_T$  therefore determines both oscillator frequency and maximum duty cycle. Charge and discharge times are determined by the formulas:

$$t_c = 0.55 R_T C_T$$

$$t_D = R_T C_T I_n \left( \frac{0.0063 R_T - 2.7}{0.0063 R_T - 4} \right)$$

Frequency, then, is:  $f = (t_c + t_d)^{-1}$

$$\text{For } R_T > 5K\Omega, f = \frac{1.8}{R_T C_T}$$

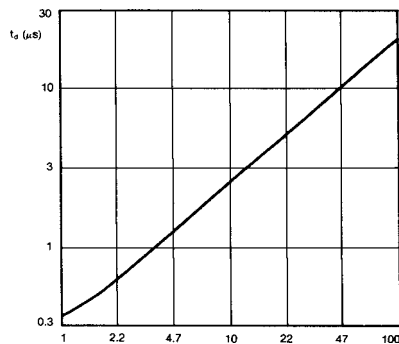


Figure 6. Oscillator Dead Time & Frequency  
(Deadtime vs  $C_T$   $R_T > 5k\Omega$ )

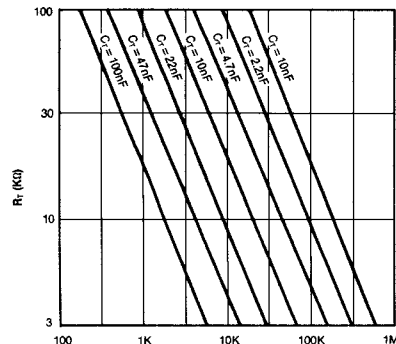


Figure 7. Timing Resistance vs Frequency

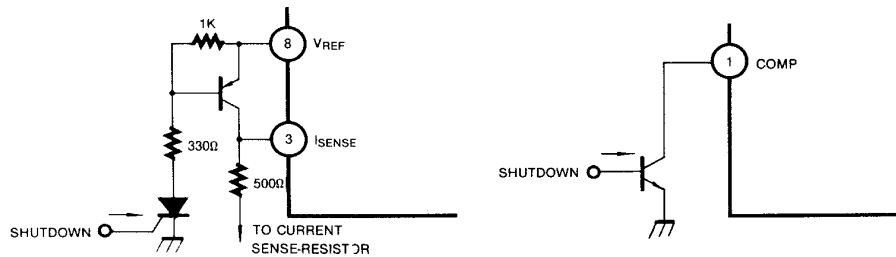


Figure 8. Shutdown Techniques

Shutdown of the KA3842B can be accomplished by two methods; either raise pin 3 above 1V or pull pin 1 below a voltage two diode drops above ground. Either method causes the output of the PWM comparator to be high (refer to block diagram). The PWM latch is reset dominant so that the output will remain low until the next clock cycle after the shutdown condition at pins 1 and/or 3 is removed. In one example, an externally latched shutdown may be accomplished by adding an SCR which will be reset by cycling VCC below the lower UVLO threshold. At this point the reference turns off, allowing the SCR to reset.

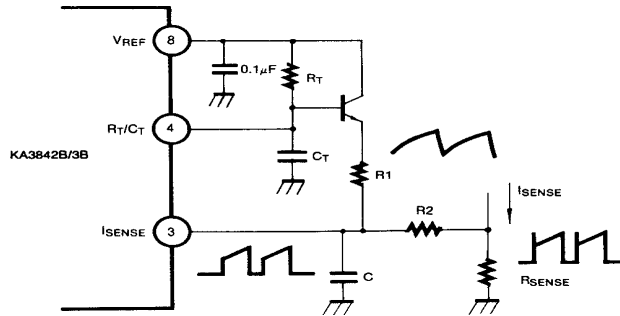


Figure 9. Slope Compensation

A fraction of the oscillator ramp can be resistively summed with the current sense signal to provide slope compensation for converters requiring duty cycles over 50%. Note that capacitor,  $C_T$ , forms a filter with  $R_2$  to suppress the leading edge switch spikes.

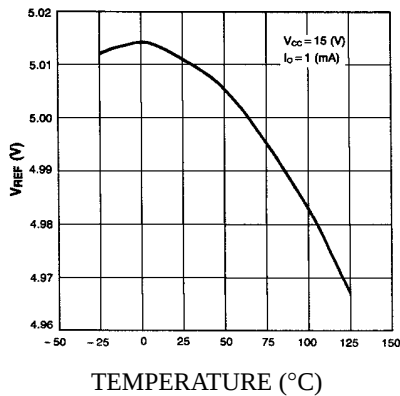


Figure 10. Temperature Drift (Vref)

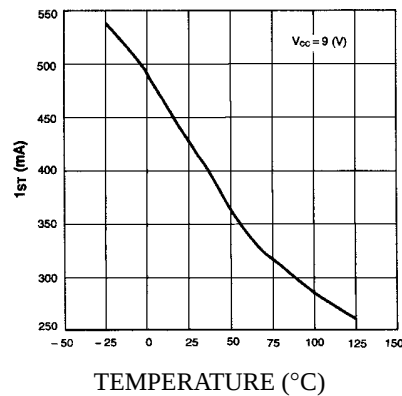


Figure 11. Temperature Drift (Ist)

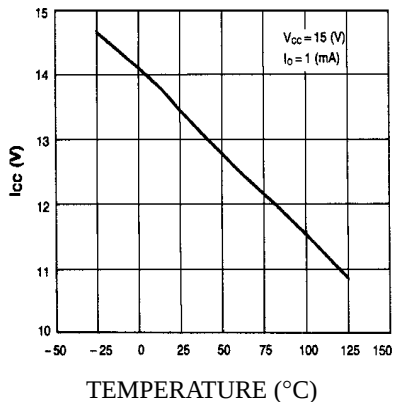


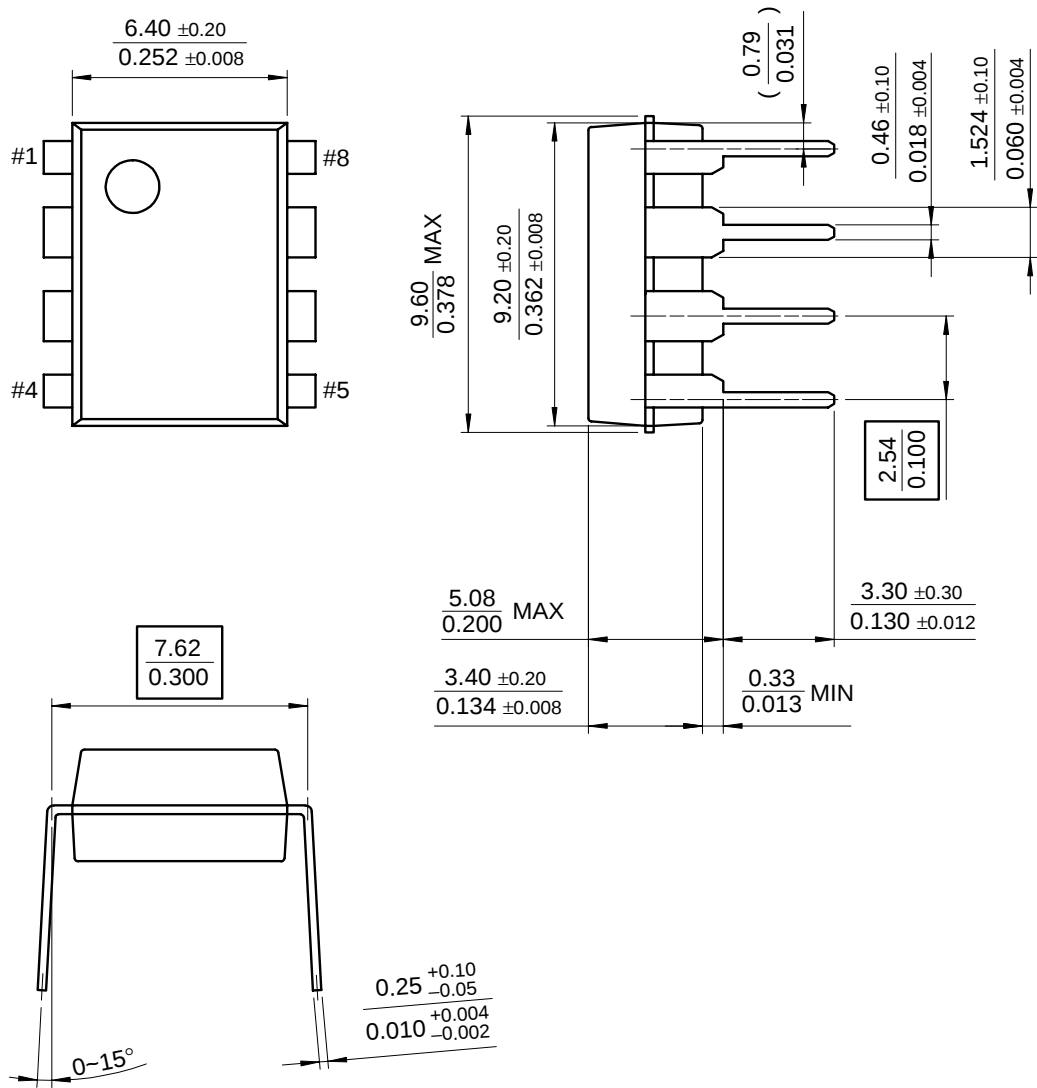
Figure 12. Temperature Drift (Icc)

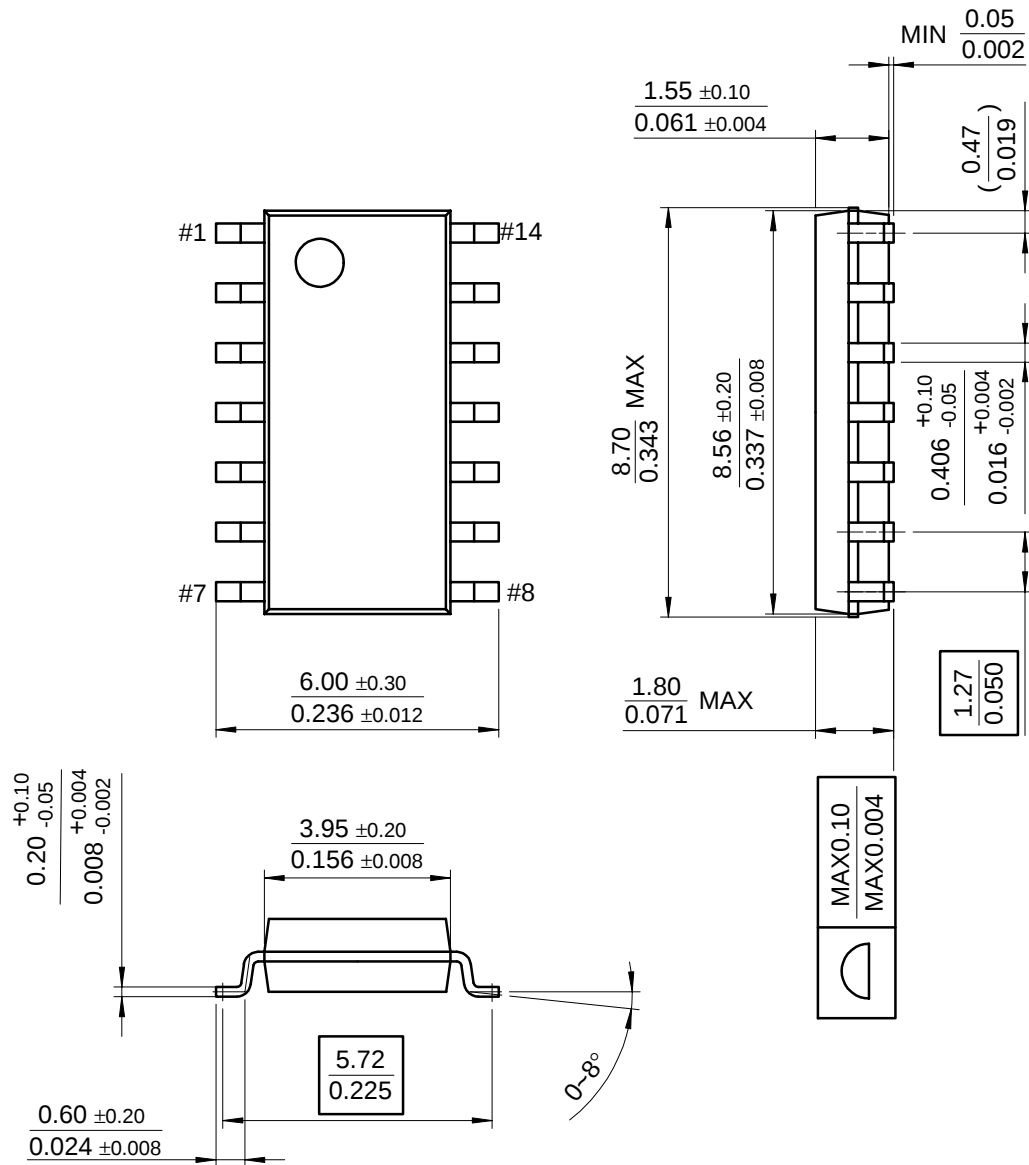
Mechanical Dimensions

Package

Dimensions in millimeters

8-DIP



**Mechanical Dimensions** (Continued)**Package****Dimensions in millimeters****14-SOP**

## Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| KA3842B        | 8-DIP   | 0 ~ + 70°C            |
| KA3843B        |         |                       |
| KA3844B        |         |                       |
| KA3845B        |         |                       |
| KA3842BD       | 14-SOP  |                       |
| KA3843BD       |         |                       |
| KA3844BD       |         |                       |
| KA3845BD       |         |                       |

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