

HIGH PERFORMANCE CURRENT MODE CONTROLLER

The KIA3842BP/BF is high performance fixed frequency current mode controller.

This is specifically designed for Off-Line and DC to DC converter applications offering the designer a cost effective solution with minimal external components. This integrated circuit 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 ideally suited for driving a power MOSFET.

Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, programmable output deadtime, and a latch for single pulse metering.

These devices are available in 8pin dual-in-line plastic packages as well as the 14pin plastic, surface mount (FLP-14).

The FLP-14 package has separate power and ground pins for the totempole output stage.

The KIA3842BP/BF has UVLO thresholds of 16V(on) and 10V(off), ideally suited for off-line converters.

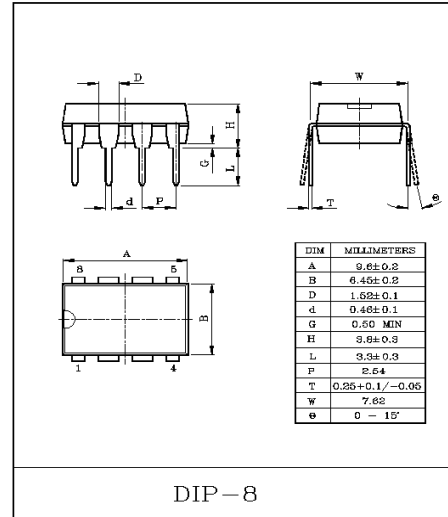
FEATURES

- Trimmed Oscillator Discharge Current for Precise Duty Cycle Control.
- Current Mode Operation to 500kHz.
- Automatic Feed Forward Compensation.
- Latching PWM for Cycle-By-Cycle Current Limiting.
- Internally Trimmed Reference with Undervoltage Lockout.
- High Current TotemPole Output.
- Undervoltage Lockout with Hysteresis.
- Low Start-up and Operating Current.

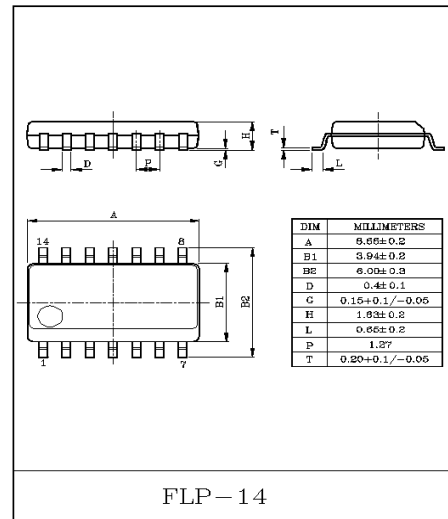
MAXIMUM RATING (Ta=25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|------------------------------------|---------------|------|
| Total Power Supply and Zener Current | (I _{CC} +I _Z) | 30 | mA |
| Output Current, Source or Sink (Note 1) | I _O | 1.0 | A |
| Output Energy (Capacitive Load Per Cycle) | W | 5.0 | μJ |
| Current Sense and Voltage Feedback inputs | V _{IN} | -0.3 to + 5.5 | V |
| Error Amp Output Sink Current | I _O | 10 | mA |
| Power Dissipation | KIA3842BP | 1.25 | W |
| | KIA3842BF | 862 | mW |
| Operating Temperature | T _a | 0 to + 70 | °C |
| Storage Temperature | T _{stg} | -65 to + 150 | °C |

NOTE : 1. Maximum package power dissipation limits must be observed.



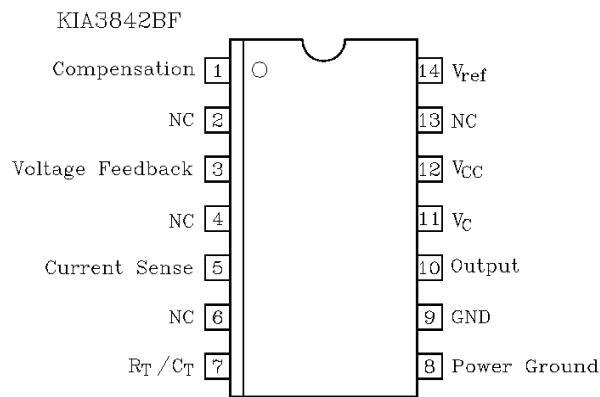
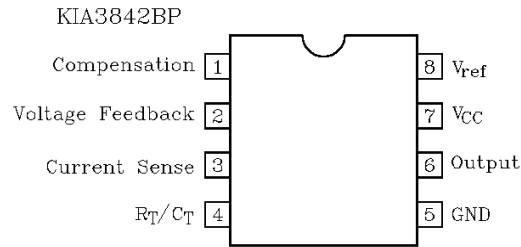
DIP-8



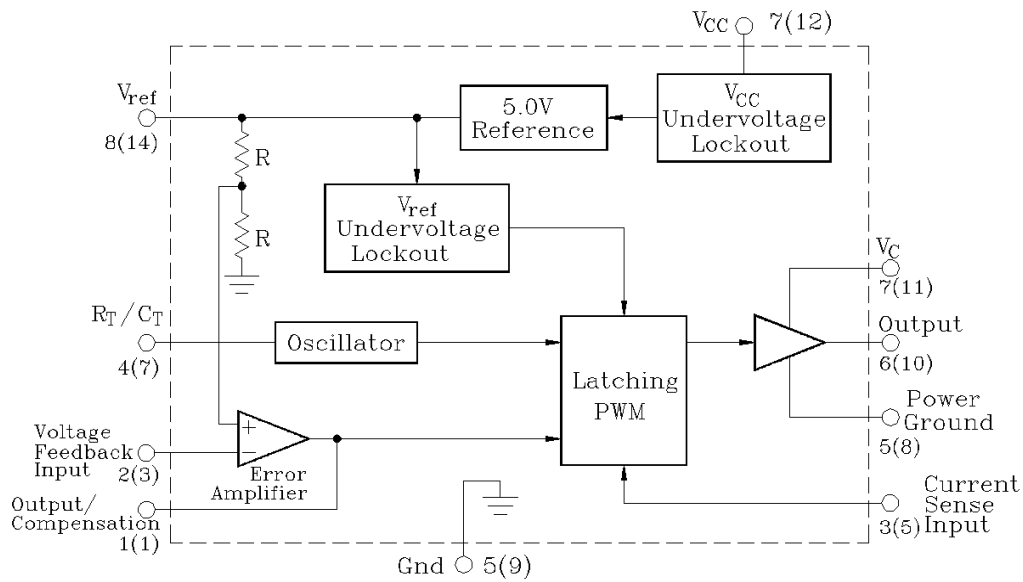
FLP-14

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PIN CONNECTIONS (TOP VIEW)



BLOCK DIAGRAM



Pin numbers adjacent to terminals are for the DIP-8 package.
 Pin numbers in parenthesis are for the FLP-14 package.

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ELECTRICAL CHARACTERISTICS ($V_{CC}=15V$ (Note 2), $R_T=10k\Omega$, $C_T=3.3nF$, $T_a=25^\circ C$)

REFERENCE SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|--------------|---------------------------------------|------|------|------|----------------|
| Reference Output Voltage | V_{ref} | $I_O=1.0mA$, $T_a=25^\circ C$ | 4.9 | 5.0 | 5.1 | V |
| Line Regulation | Reg_{line} | $V_{CC}=12V\sim 25V$ | - | 2.0 | 20 | mV |
| Load Regulation | Reg_{load} | $I_O=1mA\sim 20mA$ | - | 3.0 | 25 | mV |
| Temperature Stability | T_S | - | - | 0.2 | - | mV/ $^\circ C$ |
| Total Output Variation over Line, Load, and Temperature | V_{ref} | - | 4.82 | - | 5.18 | V |
| Output Noise Voltage | V_{no} | $f=10Hz\sim 10kHz$, $T_a=25^\circ C$ | - | 50 | - | μV |
| Long Term Stability | S | $T_a=125^\circ C$, 1000Hrs | - | 5.0 | - | mV |
| Output Short Circuit Current | I_{SC} | - | -30 | -100 | -180 | mA |

OSCILLATOR SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------|---------------------------|--------------------------------|------|------|------|------|
| Frequency | f_{osc} | $T_a=25^\circ C$ | 47 | 52 | 57 | kHz |
| Frequency Change With Voltage | $\Delta f_{osc}/\Delta V$ | $V_{CC}=12V\sim 25V$ | - | 0.2 | 1.0 | % |
| Frequency Change With Temperature | $\Delta f_{osc}/\Delta T$ | $T_a=0^\circ C\sim 70^\circ C$ | - | 5.0 | - | % |
| Oscillator Voltage Swing | V_{OSC} | 4 PIN Peak to Peak | - | 1.6 | - | V |

ERROR AMPLIFIER SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------------------------|--------------|---------------------------------|------|------|------|---------|
| Voltage Feedback Input | V_{FB} | $V_O=2.5V$ | 2.42 | 2.5 | 2.58 | V |
| Input Bias Current | I_{IB} | $V_{FB}=5.0V$ | - | -0.1 | -2.0 | μA |
| Open-Loop Voltage Gain | A_{VOL} | $V_O=2.0V\sim 4.0V$ | 65 | 90 | - | dB |
| Unity Gain Bandwidth | BW | $T_a=25^\circ C$ | 0.7 | 1.0 | - | MHz |
| Power Supply Rejection Ratio | PSRR | $V_{CC}=12V\sim 25V$ | 60 | 70 | - | dB |
| Output Sink Current | I_{sink} | $V_O=1.1V$, $V_{FB}=2.7V$ | 2.0 | 12 | - | mA |
| Output Source Current | I_{source} | $V_O=5.0V$, $V_{FB}=2.3V$ | -0.5 | -1.0 | - | |
| Vout High | V_{OH} | $R_L=15k$ to GND, $V_{FB}=2.3V$ | 5.0 | 6.2 | - | V |
| Vout Low | V_{OL} | $R_L=15k$ to Ref, $V_{FB}=2.7V$ | - | 0.8 | 1.1 | |

CURRENT SENSE SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---------------------------------------|-------------------|---|------|------|------|---------|
| Current Sense Input Voltage Gain | A_V | $V_{FB}=0$, $V_{IN}=0\sim 0.8V$ $A_V = \frac{\Delta V \text{ output Compensation}}{\Delta V \text{ Current Sense Input}}$ | 2.85 | 3.0 | 3.15 | V/V |
| Maximum Current Sense Input Threshold | V_{th} | $V_{FB}=0$ | 0.9 | 1.0 | 1.1 | V |
| Power Supply Rejection Ratio | PSRR | $V_{CC}=12V\sim 25V$, $V_{FB}=0$ | - | 70 | - | dB |
| Input Bias Current | I_{IB} | - | - | -2.0 | -10 | μA |
| Propagation Delay | $t_{PLH(IN/OUT)}$ | Current Sense Input to Output | - | 150 | 300 | nS |

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OUTPUT SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---------------------------|----------|-----------------------|------|------|------|------|
| Low State Output Voltage | V_{OL} | $I_{sink}=20mA$ | - | 0.1 | 0.4 | V |
| | | $I_{sink}=200mA$ | - | 1.6 | 2.2 | |
| High State Output Voltage | V_{OH} | $I_{source}=20mA$ | 13 | 13.5 | - | V |
| | | $I_{source}=200mA$ | 12 | 13.4 | - | |
| Rise Time | t_r | $C_L=1.0nF, V_{FB}=0$ | - | 50 | 150 | nS |
| Fall Time | t_f | $C_L=1.0nF, V_{FB}=0$ | - | 50 | 150 | nS |

UNDER VOLTAGE LOCKOUT SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|----------------------------|----------------|----------------|------|------|------|------|
| Start-up Threshold Voltage | V_{TH} | | 14.5 | 16 | 17.5 | V |
| Minimum Operating Voltage | $V_{CC(min.)}$ | After Turn ON | 8.5 | 10 | 11.5 | V |

PWM SECTION

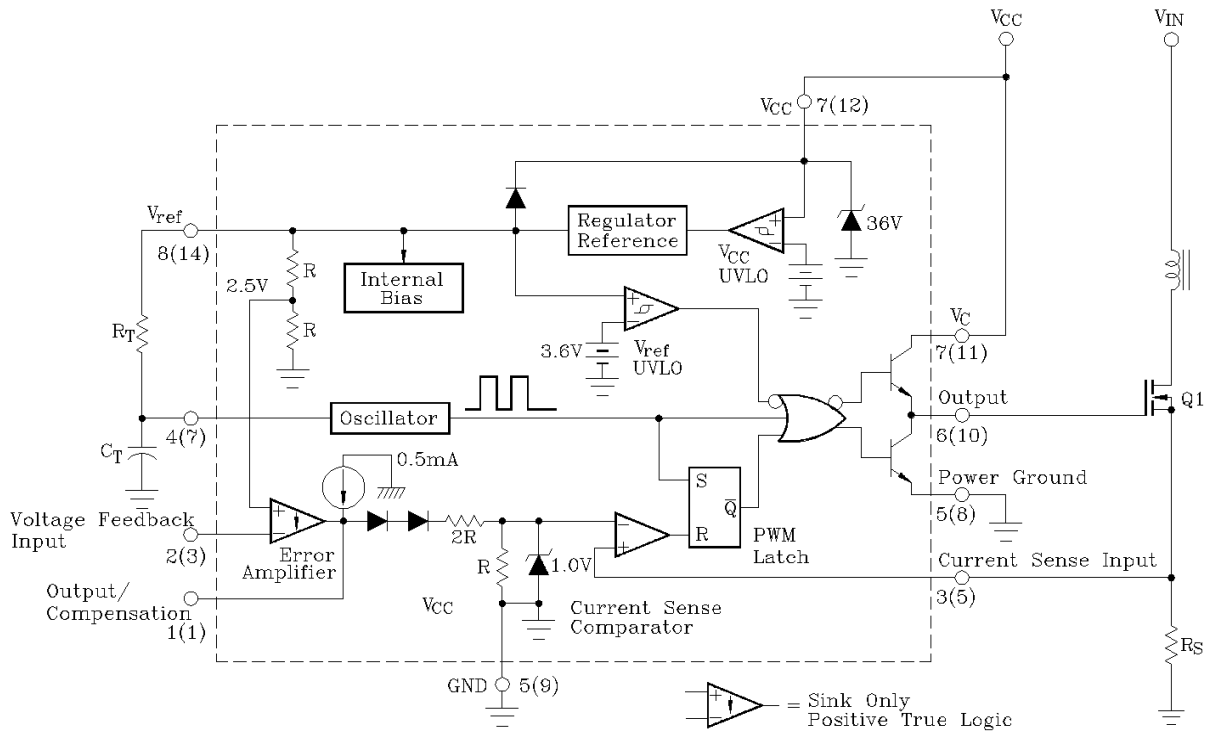
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------|-------------|----------------|------|------|------|------|
| Duty Cycle Max. | $DC_{max.}$ | | 94 | 96 | - | % |
| Duty Cycle Min. | $DC_{min.}$ | | - | - | 0 | % |

TOTAL DEVICE

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|----------------------------|----------|-------------------------------------|------|------|------|------|
| Power Supply Current | I_{CC} | $V_{CC}=14V$ | - | 0.5 | 1.0 | mA |
| | | $V_{CC}=15V, \text{ after turn ON}$ | - | 12 | 17 | |
| Power Supply Zener Voltage | V_Z | $I_{CC}=25mA$ | 30 | 36 | - | V |

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TEST CIRCUIT



Pin numbers adjacent to terminals are for the DIP-8 package.
Pin numbers in parenthesis are for the FLP-14 package.

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PIN FUNCTION DESCRIPTION

| PIN NO. | | FUNCTION | DESCRIPTION |
|---------|-------------|------------------|---|
| 8-PIN | 14-PIN | | |
| 1 | 1 | Compensation | This pin is the Error Amplifier output and is made available for loop compensation. |
| 2 | 3 | Voltage Feedback | This is the inverting input of the Error amplifier. It is normally connected to the switching power supply output through a resistor divider. |
| 3 | 5 | Current Sense | A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction. |
| 4 | 7 | R_T/C_T | The Oscillator frequency and maximum Output duty Cycle are programmed by connecting resistor R_T to V_{ref} and capacitor C_T to ground. Operation to 500kHz is possible. |
| 5 | - | GND | This pin is the combined control circuitry and power ground (8-pin package only). |
| 6 | 10 | Output | This output directly drives the gate of a power MOSFET. Peak currents up to 1.0A are sourced and sunk by this pin. |
| 7 | 12 | V_{CC} | This pin is the positive supply of the control IC. |
| 8 | 14 | V_{ref} | This is the reference output. It provides charging current for capacitor C_T through resistor R_T . |
| - | 8 | Power Ground | This pin is a separate power ground return (14pin package only) that is connected back to the power source. It is used to reduce the effects of switching transient noise on the control circuitry. |
| - | 11 | V_C | The output high state(V_{OH}) is set by the voltage applied to this pin (14pin package only). With a separate power source connection, It can reduce the effects of switching transient noise on the control circuitry. |
| - | 9 | GND | This pin is the control circuitry ground return (14pin package only) and is connected back to the power source ground. |
| - | 2, 4, 6, 13 | NC | No connection(14pin package only). These pins are not internally connected. |

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