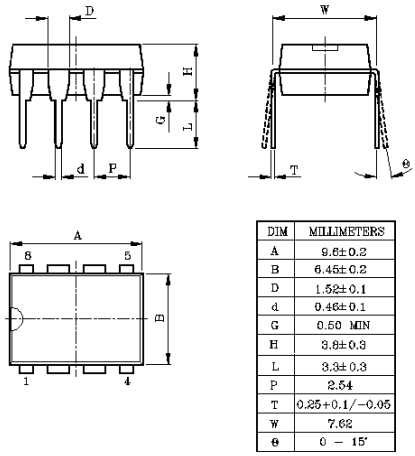
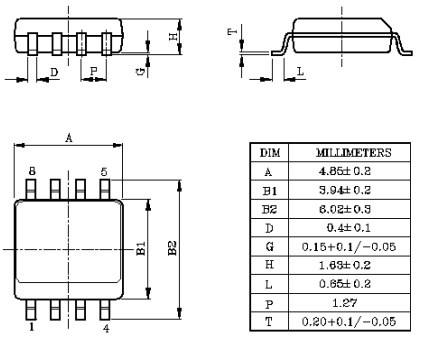
HIGH PERFORMANCE CURRENT MODE CONTROLLER

The KIA3842/3/4/5AP/AF are 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. Differences between members of this family are the under-voltage lockout thresholds and maximum duty cycle ranges. The KIA3842A and KIA3844A have UVLO thresholds of 16V(on) and 10V(off), ideally suited off-line applications The corresponding thresholds for the KIA3843A and KIA3845A are 8.5V and 7.9V. The KIA3842A and KIA3843A can operate to duty cycles approaching 100%. A range of the zero to <50% is obtainedby the KIA3844A and KIA3845A by the addition of an internal toggle flip flop which balanks the output off every other clock cycle.



| DIM | MILLIMETERS |
|---|---|
| A | 9.6±0.2 |
| B | 6.45±0.2 |
| D | 1.52±0.1 |
| d | 0.46±0.1 |
| G | 0.50 MIN |
| H | 3.8±0.3 |
| L | 3.3±0.3 |
| P | 2.54 |
| T | 0.25+0.1/−0.05 |
| W | 7.62 |
| θ | 0 ~ 15° |

DIP-8



| DIM | MILLIMETERS |
|---|---|
| A | 4.85±0.2 |
| B1 | 3.94±0.2 |
| B2 | 6.02±0.3 |
| D | 0.4±0.1 |
| G | 0.15+0.1/−0.05 |
| H | 1.65±0.2 |
| L | 0.65±0.2 |
| P | 1.27 |
| T | 0.20+0.1/−0.05 |

FLP-8

FEATURES

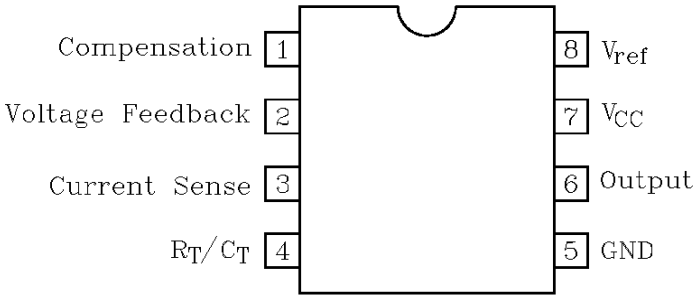
- Trimmed Oscillator Discharge Current for Precise Duty Cycle Control.
- Current Mode Operation to 500kHz.
- Automatic Feed Forward Compensation.
- Latching PWM for Cycle-By-Cycle Current Limiting.
- Internally Trimmed Reference with Undervoltage Lockout.
- High Current TotemPole Output.
- Undervoltage Lockout with Hysteresis.
- Low Start-up and Operating Current 0.2mA(Typ.)

MAXIMUM RATING (Ta=25℃)

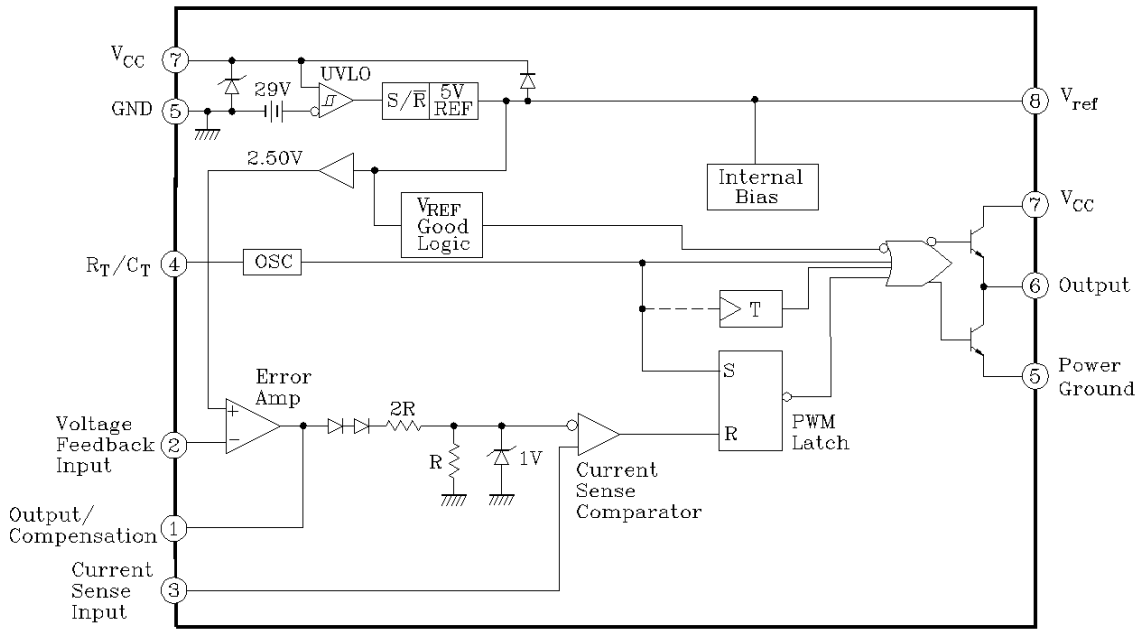
| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Supply Voltage | | $V_{CC}$ | 30 | V |
| Output Current, Source of Sink (Note 1) | | $I_O$ | 1.0 | A |
| Output Energy (Capacitive Load Per Cycle) | | W | 5.0 | μJ |
| Analog Inputs (Pin ②, ③) | | $V_{IN}$ | -0.3 to + 6.3 | V |
| Error Amp Output Sink Current | | $I_O$ | 10 | mA |
| Power Dissipation | KIA384XAP | $P_D$ | 1.25 | W |
| | KIA384XAF | | 800 | mW |
| Operating Temperature | | Ta | 0 to + 70 | ℃ |
| Storage Temperature | | $T_{stg}$ | -65 to + 150 | ℃ |

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

PIN CONNECTIONS (TOP VIEW)




BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (Vcc=15V (Note 2), $R_T$=10kΩ, $C_T$=3.3nF, Ta=25℃)

REFERENCE SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Reference Output Voltage | $V_{ref}$ | $I_O$=1.0mA, Ta=25℃ | 4.9 | 5.0 | 5.1 | V |
| Line Regulation | $Reg_{line}$ | 12V≤$V_{IN}$≤25V | - | 2.0 | 20 | mV |
| Load Regulation | $Reg_{load}$ | 1mA≤$I_O$≤20mA | - | 3.0 | 25 | mV |
| Temperature Stability | $T_S$ | - | - | 0.2 | - | mV/℃ |
| Total Output Variation over Line, Load, and Temperature | $V_{ref}$ | - | 4.82 | - | 5.18 | V |
| Output Noise Voltage | $V_{no}$ | 10Hz≤f≤10kHz, Ta=25℃ | - | 50 | - | μV |
| Long Term Stability | S | Ta=125℃, 1000Hrs | - | 5.0 | - | mV |
| Output Short Circuit Current | $I_{SC}$ | - | -30 | -85 | -180 | mA |

OSCILLATOR SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Frequency | $f_{osc}$ | Ta=25℃ | 47 | 52 | 57 | kHz |
| Frequency Change With Voltage | $\Delta f_{osc}/\Delta V$ | 12V≤$V_{CC}$≤25V | - | 0.2 | 1.0 | % |
| Frequency Change With Temperature | $\Delta f_{osc}/\Delta T$ | 0≤Ta≤70℃ | - | 5.0 | - | % |
| Oscillator Voltage Swing | $V_{OSC}$ | 4 PIN Peak to Peak | - | 1.7 | - | V |
| Discharge Current | $I_{dischg}$ | $V_{PIN4}$=2V | 7.8 | 8.3 | 8.8 | mA |

ERROR AMPLIFIER SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Voltage Feedback Input | $V_{FB}$ | $V_{PIN1}$=2.5V | 2.42 | 2.5 | 2.58 | V |
| Input Bias Current | $I_{IB}$ | - | - | -0.3 | -2.0 | μA |
| Open-Loop Voltage Gain | $A_{VOL}$ | 2V≤$V_O$≤4V | 65 | 90 | - | μA |
| Unity Gain Bandwidth | BW | Ta=25℃ | 0.7 | 1.0 | - | MHz |
| Power Supply Rejection Ratio | PSRR | 12V≤$V_{CC}$≤25V | 60 | 70 | - | dB |
| Output Sink Current | $I_{sink}$ | $V_{PIN2}$=2.7V, $V_{PIN1}$=1.1V | 2.0 | 12 | - | mA |
| Output Source Current | $I_{source}$ | $V_{PIN2}$=2.3V, $V_{PIN1}$=5V | -0.5 | -0.8 | - | |
| Vout High | $V_{OH}$ | $R_L$=15k to GND, $V_{PIN2}$=2.3V | 5.0 | 6.0 | - | V |
| Vout Low | $V_{OL}$ | $R_L$=15k to Ref, $V_{PIN2}$=2.7V | - | 0.7 | 1.1 | |

CURRENT SENSE SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Current Sense Input Voltage Gain | $A_V$ | $V_{FB}$=0, $V_{IN}$=0~0.8V<br>$A_V=\frac{\Delta V \text{ output Compensation}}{\Delta V \text{ Current Sense Input}}$ | 2.85 | 3.0 | 3.15 | V/V |
| Maximum Current Sense Input Threshold | $V_{th}$ | $V_{PIN1}$=5V, $V_{PIN2}$=0V | 0.9 | 1.0 | 1.1 | V |
| Power Supply Rejection Ratio | PSRR | 12V≤$V_{CC}$≤25V, $V_{PIN2}$=0V | - | 70 | - | dB |
| Input Bias Current | $I_{IB}$ | - | - | -2.0 | -10 | μA |
| Propagation Delay | $t_{PLH(IN/OUT)}$ | Current Sense Input to Output, $V_{PIN3}$=0 to 2V | - | 100 | 200 | nS |

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 | - | 1.5 | 2.2 | |
| High State Output Voltage | $V_{OH}$ | $I_{source}$=20mA | 13 | 13.5 | - | V |
| | | $I_{source}$=200mA | 12 | 13.5 | - | |
| Rise Time | $t_r$ | $C_L$=1.0nF, $V_{FB}$=0 | - | 40 | 100 | nS |
| Fall Time | $t_f$ | $C_L$=1.0nF, $V_{FB}$=0 | - | 40 | 100 | nS |
| UVLO Saturation | $V_{OLS}$ | $V_{CC}$=6V, $I_{SINK}$=1mA | - | 0.7 | 1.2 | V |
| Output Voltage Swing Limit | $V_{OLIM}$ | $V_{CC}$=27V, $C_1$=1nF | - | 22 | - | V |

UNDER VOLTAGE LOCKOUT SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Start-up Threshold Voltage | $V_{TH}$ | | KIA3842/4A | 14.5 | 16 | 17.5 | V |
| | | | KIA3843/5A | 7.8 | 8.4 | 9.0 | |
| Minimum Operating Voltage | $V_{CC(min.)}$ | After Turn ON | KIA3842/4A | 8.5 | 10 | 11.5 | V |
| | | | KIA3843/5A | 7.0 | 7.6 | 8.2 | |

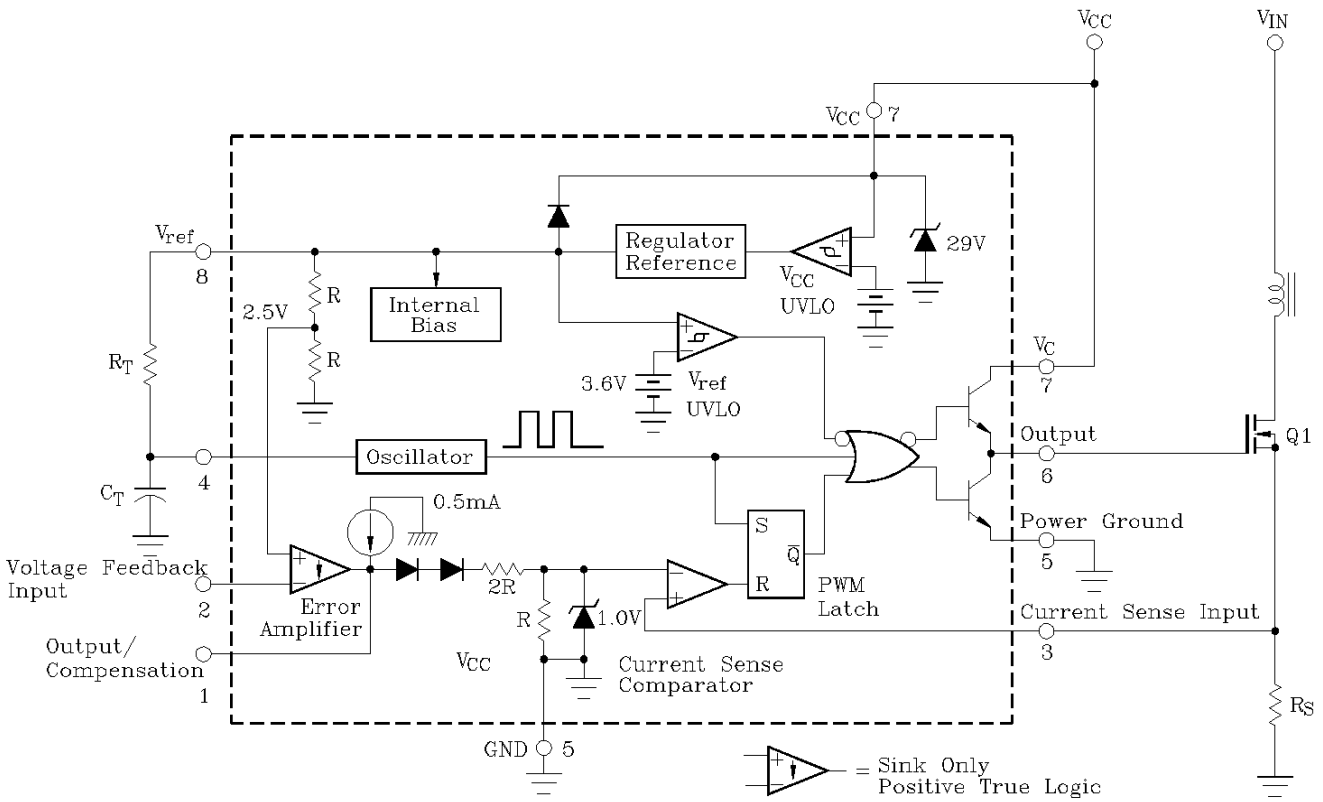
PWM SECTION

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Duty Cycle Max. | $DC_{max.}$ | | KIA3842/3A | 94 | 96 | 100 | % |
| | | | KIA3844/5A | 47 | 48 | 50 | |
| Duty Cycle Min. | $DC_{min.}$ | | | - | - | 0 | % |

TOTAL DEVICE

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Power Supply Current | $I_{CC}$ | $V_{CC}$=14V | - | 0.2 | 0.5 | mA |
| | | $V_{CC}$=15V, after turn ON | - | 11 | 17 | |
| Power Supply Zener Voltage | $V_Z$ | $I_{CC}$=25mA | - | 29 | - | V |

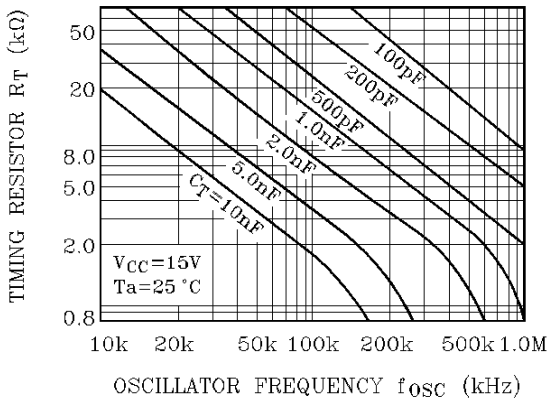
TEST CIRCUIT



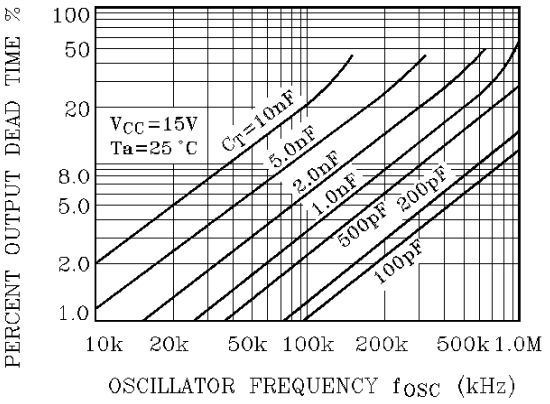
PIN FUNCTION DESCRIPTION

| PIN NO. | FUNCTION | DESCRIPTION |
|---|---|---|
| 1 | Compensation | This pin is the Error Amplifier output and is made available for loop compensation. |
| 2 | 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 | 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 | $R_T/C_T$ | 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 | 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 | $V_{CC}$ | This pin is the positive supply of the control IC. |
| 8 | $V_{ref}$ | This is the reference output. It provides charging current for capacitor $C_T$ through resistor $R_T$. |

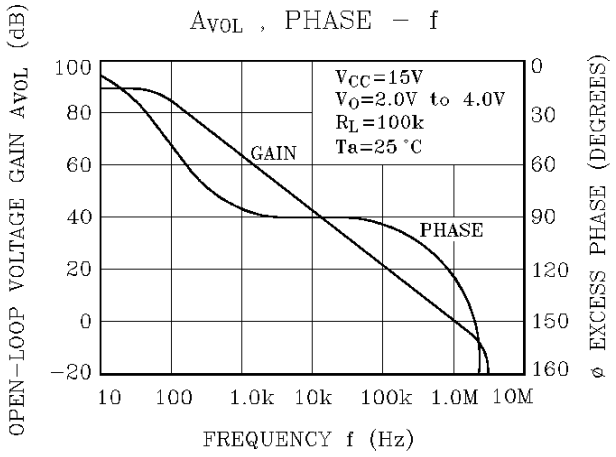
$R_T$ – $f_{OSC}$




$O_T$ – $f_{OSC}$




$A_{VOL}$ , PHASE – f




$I_{CC}$ – $V_{CC}$