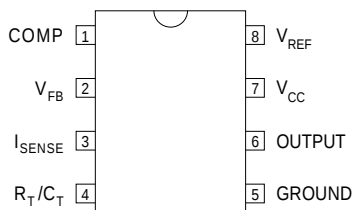


TOP VIEW

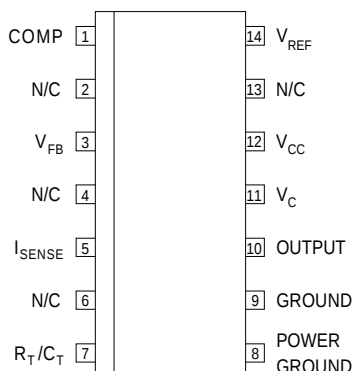


J Package – 8 Pin Ceramic DIP

N Package – 8 Pin Plastic DIP

D-8 Package – 8 Pin Plastic (150) SOIC

TOP VIEW



D-14 Package – 14 Pin Plastic (150) SOIC

## CURRENT MODE REGULATING PULSE WIDTH MODULATORS

### FEATURES

- Guaranteed  $\pm 1\%$  reference voltage tolerance
- Accurate oscillator discharge current
- Guaranteed  $\pm 10\%$  frequency tolerance
- Low start-up current ( $< 500 \mu A$ )
- Under voltage lockout with hysteresis
- Output state completely defined for all supply and input conditions
- Interchangeable with IP and UC1842/3 series for improved operation
- 500kHz Oscillator operation

### Order Information

| Part Number | J-Pack<br>8 Pin | N-Pack<br>8 Pin | D-8<br>8 Pin | D-14<br>14 Pin | Temp.<br>Range | Note:                                                                                       |
|-------------|-----------------|-----------------|--------------|----------------|----------------|---------------------------------------------------------------------------------------------|
| IP1842A     | ✓               |                 |              |                | -55 to +125°C  | To order, add the package identifier to the part number.<br><br>eg. IP1842AD-14<br>IP3843AJ |
| IP2842A     | ✓               | ✓               | ✓            | ✓              | -25 to +85°C   |                                                                                             |
| IP3842A     | ✓               | ✓               | ✓            | ✓              | 0 to +70°C     |                                                                                             |
| IP1843A     | ✓               |                 |              |                | -55 to +125°C  |                                                                                             |
| IP2843A     | ✓               | ✓               | ✓            | ✓              | -25 to +85°C   |                                                                                             |
| IP3843A     | ✓               | ✓               | ✓            | ✓              | 0 to +70°C     |                                                                                             |

### ABSOLUTE MAXIMUM RATINGS ( $T_{case} = 25^\circ C$ unless otherwise stated)

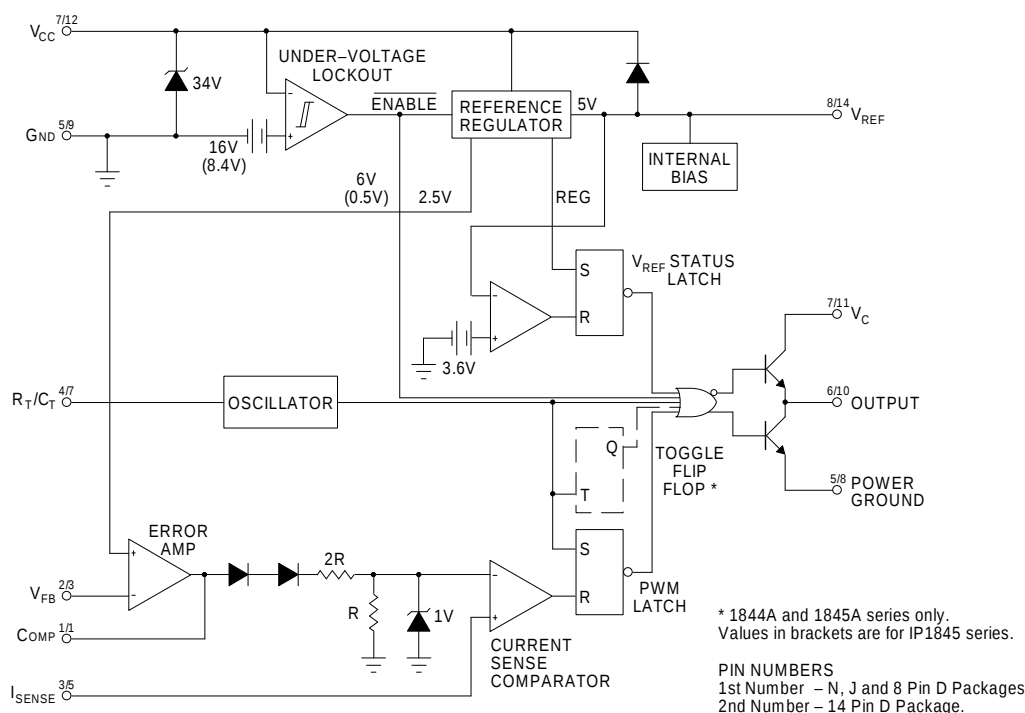
|           |                                  |                                               |                       |
|-----------|----------------------------------|-----------------------------------------------|-----------------------|
| $V_{CC}$  | Supply Voltage                   | (low impedance source)<br>( $I_{CC} < 30mA$ ) | +30V<br>Self limiting |
| $I_O$     | Output Current                   |                                               | $\pm 1A$              |
|           | Output Energy                    | (capacitive load)                             | 5 $\mu J$             |
|           | Analog Inputs                    | (pins 2 and 3)                                | -0.3V to $+V_{CC}$    |
|           | Error Amp Output Sink Current    |                                               | 10mA                  |
| $P_D$     | Power Dissipation                | $T_{amb} = 25^\circ C$ J, N Packages          | 1W                    |
|           | Derate @ $T_{amb} > 50^\circ C$  |                                               | 10mW/ $^\circ C$      |
| $P_D$     | Power Dissipation                | $T_{case} = 25^\circ C$ D Package             | 725mW                 |
|           | Derate @ $T_{amb} > 50^\circ C$  |                                               | 7.25mW/ $^\circ C$    |
| $P_D$     | Power Dissipation                | $T_{case} = 25^\circ C$ J, N Packages         | 2W                    |
|           | Derate @ $T_{case} > 25^\circ C$ |                                               | 16mW/ $^\circ C$      |
| $T_{STG}$ | Storage Temperature Range        |                                               | -65 to 150°C          |
| $T_L$     | Lead Temperature                 | (soldering, 10 seconds)                       | +300°C                |

## DESCRIPTION

The IP1842A/IP1843A series of switching regulator control circuits contain all the functions necessary to implement off-line, current mode switching regulators, using a minimum number of external parts. Functions included are voltage reference, error amplifier, current sense comparator, oscillator, totem-pole output driver and under-voltage lockout circuitry.

Although pin compatible with the standard IP1842/3 parts these devices offer improved performance in several areas. They also offer tighter specification and improved performance over the IP and UC1842/3 series, whilst retaining complete compatibility.

## BLOCK DIAGRAM



## RECOMMENDED OPERATING CONDITIONS

|          |                                     |                                                                         |
|----------|-------------------------------------|-------------------------------------------------------------------------|
| $V_{CC}$ | Supply Voltage <sup>1</sup>         | $\leq 30V$                                                              |
| $I_O$    | Output Current                      | 0 to $\pm 200mA$                                                        |
|          | Analog Inputs (pins 2 and 3)        | $-0.3V$ to $3V$                                                         |
|          | Error Amp Output Sink Current       | 0 to $2mA$                                                              |
|          | Operating Ambient Temperature Range | IP1842A, IP1843A<br>IP2842A, IP2843A<br>IP3842A, IP3843A                |
|          |                                     | $-55$ to $125^{\circ}C$<br>$-25$ to $85^{\circ}C$<br>0 to $70^{\circ}C$ |

### Notes:

1. Lower limit set by under voltage lockout specification.

**ELECTRICAL CHARACTERISTICS** (Over Full Operating Temperature Range unless otherwise stated)

| Parameter                       | Test Conditions <sup>1</sup>                                     | IP1842A , IP1843A<br>IP2842A , IP2843A |      |      | IP3842A<br>IP3843A |      |      | Units     |
|---------------------------------|------------------------------------------------------------------|----------------------------------------|------|------|--------------------|------|------|-----------|
|                                 |                                                                  | Min.                                   | Typ. | Max. | Min.               | Typ. | Max. |           |
| REFERENCE SECTION               |                                                                  |                                        |      |      |                    |      |      |           |
| Output Voltage                  | I <sub>O</sub> = 1mA                    T <sub>J</sub> = 25°C    | 4.95                                   | 5.00 | 5.05 | 4.90               | 5.00 | 5.10 | V         |
| Input Regulation                | V <sub>CC</sub> = 12V to 25V                                     |                                        | 6    | 20   |                    | 6    | 20   | mV        |
| Output Regulation               | I <sub>O</sub> = 1mA to 20mA                                     |                                        | 6    | 25   |                    | 6    | 25   |           |
| Temperature Stability           |                                                                  |                                        | 0.2  | 0.4  |                    | 0.2  | 0.4  | mV<br>/°C |
| Total Output Variation          | Line, Load, Temp                                                 | 4.90                                   |      | 5.10 | 4.82               |      | 5.18 | V         |
| Output Noise Voltage            | f = 10Hz to 10kHz        T <sub>J</sub> = 25°C                   |                                        | 50   |      |                    | 50   |      | μV        |
| Long Term Stability             | T <sub>J</sub> = 125°C @ 1000Hrs                                 |                                        | 5    | 25   |                    | 5    | 25   | mV        |
| Output Short Circuit<br>Current | V <sub>REF</sub> = 0                                             | 30                                     | 80   | 160  | 30                 | 80   | 160  | mA        |
| OSCILLATOR SECTION              |                                                                  |                                        |      |      |                    |      |      |           |
| Frequency                       | T <sub>J</sub> = 25°C                                            | 47                                     | 52   | 57   | 47                 | 52   | 57   | kHz       |
| Voltage Stability               | V <sub>CC</sub> = 12V to 25V                                     |                                        | 0.2  | 1    |                    | 0.2  | 1    | %         |
| Temperature Stability           | ΔT <sub>A</sub> = Min to Max                                     |                                        | 5    |      |                    | 5    |      | %         |
| Amplitude                       | V <sub>PIN4</sub> Peak to Peak                                   |                                        | 1.7  |      |                    | 1.7  |      | V         |
| Discharge Current               | T <sub>J</sub> = 25°C                                            | 7.8                                    | 8.3  | 8.8  | 7.8                | 8.3  | 8.8  | mA        |
|                                 | ΔT <sub>A</sub> = Min to Max                                     | 7                                      |      | 9    | 7                  |      | 9    |           |
| ERROR AMP SECTION               |                                                                  |                                        |      |      |                    |      |      |           |
| Input Voltage                   | V <sub>PIN1</sub> = 2.5V                                         | 2.45                                   | 2.50 | 2.55 | 2.42               | 2.50 | 2.58 | V         |
| Input Bias Current              |                                                                  |                                        | −0.3 | −1   |                    | −0.3 | −2   | μA        |
| Open Loop Voltage<br>Gain       | V <sub>O</sub> = 2V to 4V                                        | 65                                     | 90   |      | 65                 | 90   |      | dB        |
| Unity Gain Bandwidth            |                                                                  | 0.7                                    | 1    |      | 0.7                | 1    |      | MHz       |
| Supply Voltage<br>Rejection     | V <sub>CC</sub> = 12V to 25V                                     | 60                                     | 70   |      | 60                 | 70   |      | dB        |
| Output Sink Current             | V <sub>PIN2</sub> = 2.7V                V <sub>PIN1</sub> = 1.1V | 2                                      | 6    |      | 2                  | 6    |      | mA        |
| Output Source Current           | V <sub>PIN2</sub> = 2.3V                V <sub>PIN1</sub> = 5V   | −0.5                                   | −0.8 |      | −0.5               | −0.8 |      |           |
| V <sub>OUT</sub> High           | V <sub>PIN2</sub> = 2.3V                R <sub>L</sub> = 15kΩ    | 4.6                                    | 6    |      | 4.6                | 6    |      | V         |
| V <sub>OUT</sub> Low            | V <sub>PIN2</sub> = 2.7V                R <sub>L</sub> = 15kΩ    |                                        | 0.7  | 1.1  |                    | 0.7  | 1.1  |           |

**NOTES**

1. Test Conditions unless otherwise stated:

$V_{CC} = 15\text{V}^*$  ,  $R_T = 10\text{k}\Omega$  ,  $C_T = 3.3\text{nF}$  ,  $f = 52\text{kHz}$ .

\*Adjust  $V_{CC}$  above start threshold before setting at required level.

All specifications apply over the full operating temperature range unless otherwise stated.  
(See Ordering Information for further details).

## ELECTRICAL CHARACTERISTICS (Over Full Operating Temperature Range unless otherwise stated)

| Parameter                             | Test Conditions <sup>1</sup>              |                | IP1842A , IP1843A<br>IP2842A , IP2843A |      |      | IP3842A<br>IP3843A |      |      | Units |
|---------------------------------------|-------------------------------------------|----------------|----------------------------------------|------|------|--------------------|------|------|-------|
|                                       |                                           |                | Min.                                   | Typ. | Max. | Min.               | Typ. | Max. |       |
| CURRENT SENSE SECTION                 |                                           |                |                                        |      |      |                    |      |      |       |
| Gain                                  | See Notes 2,3                             |                | 2.85                                   | 3    | 3.15 | 2.85               | 3    | 3.15 | V/V   |
| Maximum Input Signal                  | V <sub>PIN1</sub> = 5V (Note 2)           |                | 0.9                                    | 1    | 1.1  | 0.9                | 1    | 1.1  | V     |
| Supply Voltage Rejection              | V <sub>C</sub> = 12V to 25V               |                | 60                                     | 70   |      | 60                 | 70   |      | dB    |
| Input Bias Current                    |                                           |                |                                        | −2   | −10  |                    | −2   | −10  | μA    |
| Delay to Output                       |                                           |                |                                        | 150  | 300  |                    | 150  | 300  | ns    |
| OUTPUT SECTION                        |                                           |                |                                        |      |      |                    |      |      |       |
| Output Low Level                      | I <sub>SINK</sub> = 20mA                  |                |                                        | 0.1  | 0.4  |                    | 0.1  | 0.4  | V     |
|                                       | I <sub>SINK</sub> = 200mA                 |                |                                        | 1.5  | 2.2  |                    | 1.5  | 2.2  |       |
| Output High Level                     | I <sub>SOURCE</sub> = 20mA                |                | 13                                     | 13.5 |      | 13                 | 13.5 |      | V     |
|                                       | I <sub>SOURCE</sub> = 200mA               |                | 12                                     | 13.5 |      | 12                 | 13.5 |      |       |
| Rise Time                             | C <sub>L</sub> = 1nF                      |                |                                        | 50   | 150  |                    | 50   | 150  | ns    |
| Fall Time                             | C <sub>L</sub> = 1nF                      |                |                                        | 50   | 150  |                    | 50   | 150  |       |
| UVLO Saturation                       | V <sub>CC</sub> = 6V I <sub>L</sub> = 1mA |                |                                        | 0.7  | 1.1  |                    | 0.7  | 1.1  | V     |
| UNDER-VOLTAGE LOCKOUT SECTION         |                                           |                |                                        |      |      |                    |      |      |       |
| Upper Threshold<br>(V <sub>CC</sub> ) | IP1842A Series                            |                | 15                                     | 16   | 17   | 14.5               | 16   | 17.5 | V     |
|                                       | IP1843A Series                            |                | 7.8                                    | 8.4  | 9    | 7.8                | 8.4  | 9    |       |
| Lower Threshold<br>(V <sub>CC</sub> ) | IP1842A Series                            |                | 9                                      | 10   | 11   | 8.5                | 10   | 11.5 | V     |
|                                       | IP1843A Series                            |                | 7                                      | 7.6  | 8.2  | 7                  | 7.6  | 8.2  |       |
| TOTAL STANDBY CURRENT                 |                                           |                |                                        |      |      |                    |      |      |       |
| Start-up Current                      |                                           |                |                                        | 0.3  | 0.5  |                    | 0.3  | 0.5  | mA    |
| Operating Supply<br>Current           | V <sub>PIN2</sub> = 0V                    | IP1842A Series |                                        | 11   | 15   |                    | 11   | 15   | mA    |
|                                       | V <sub>PIN3</sub> = 0V                    | IP1843A Series |                                        | 14   | 17   |                    | 14   | 17   |       |
| V <sub>CC</sub> Zener Voltage         | I <sub>CC</sub> = 25mA                    |                | 30                                     | 34   | 40   | 30                 | 34   | 40   | V     |
| PWM SECTION                           |                                           |                |                                        |      |      |                    |      |      |       |
| Maximum Duty Cycle                    |                                           |                | 95                                     | 97   | 100  | 95                 | 97   | 100  | %     |
| Minimum Duty Cycle                    |                                           |                |                                        |      | 0    |                    |      | 0    |       |

### NOTES

1. Test Conditions unless otherwise stated:

V<sub>CC</sub> = 15V\*, R<sub>T</sub> = 10kΩ, C<sub>T</sub> = 3.3nF, f = 52kHz.

\*Adjust V<sub>CC</sub> above start threshold before setting at required level.

2. Parameter measured at trip point of latch with

V<sub>PIN2</sub> = 0V

3. Gain defined as:

$$A = \frac{\Delta V_{PIN1}}{\Delta V_{PIN3}}$$

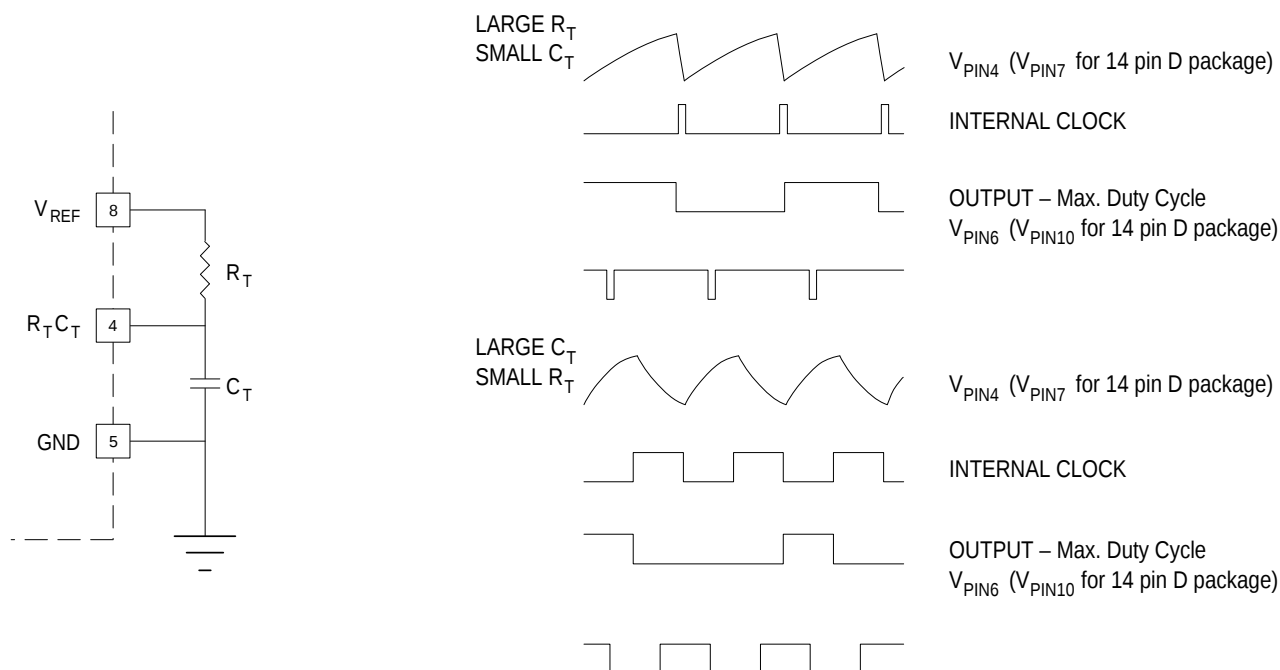
$$0 \leq V_{PIN3} \leq 0.8$$

All specifications apply over the full operating temperature range unless otherwise stated.

(See Ordering Information for further details).

## APPLICATIONS INFORMATION

### 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 formulae:

$$t_c \approx 0.55 R_T C_T$$

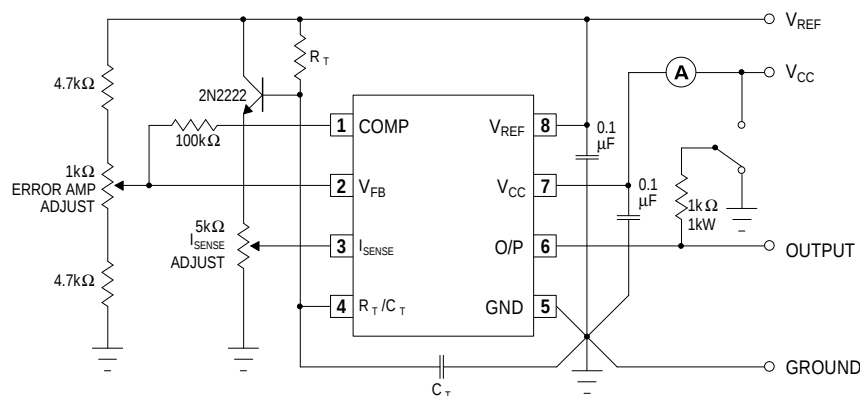
$$t_d \approx R_T C_T \ln \left( \frac{.0063 R_T - 2.3}{.0063 - 4} \right)$$

$$\text{Resultant frequency } f = \frac{1}{(t_c + t_d)}$$

For  $R_T > 5k\Omega$ ,

$$\text{Resultant frequency } f \approx \frac{1.8}{(R_T C_T)}$$

### Open-Loop Laboratory Test Fixture



High peak current 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 5K potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin 3.

## TYPICAL PERFORMANCE CHARACTERISTICS

