

# Current Mode PWM Controller

## Description

The SG1842/43 family of control IC's provides all the necessary features to implement off-line fixed frequency, current-mode switching power supplies with a minimum number of external components.

Current-mode architecture demonstrates improved line regulation, improved load regulation, pulse-by-pulse current limiting and inherent protection of the power supply output switch. The bandgap reference is trimmed to  $\pm 1\%$  over temperature.

Oscillator discharge current is trimmed to less than  $\pm 10\%$ . The SG1842/43 has under-voltage lockout, current limiting circuitry and start-up current of less than 1mA. The totem-pole output is optimized to drive the gate of a power MOSFET. The output is low in the off state to provide direct interface to an N-channel device. The SG1842/43 is specified for operation over the full military ambient temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SG2842/43 is specified for the industrial range of  $-25^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ , and the SG3842/43 is designed for the commercial range of  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## Product Highlight

## Features

- Optimized For Off-Line Control
- Low Start-Up Current ( $<1\text{mA}$ )
- Automatic Feed Forward Compensation
- Trimmed Oscillator Discharge Current
- Pulse-By-Pulse Current Limiting
- Enhanced Load Response Characteristics
- Under-Voltage Lockout with 6V Hysteresis (SG1842 only)
- Double-Pulse Suppression
- High-Current Totem-Pole Output (1A Peak)
- Internally Trimmed Bandgap Reference
- 500kHz Operation
- Undervoltage Lockout  
SG1842 - 16 volts  
SG1843 - 8.4 volts
- Low Shoot-Through Current  $<75\text{mA}$  Over Temperature

## Application

- Available To MIL-STD – 883,  $\text{J} 1.2.1$
- Available to DSCC  
- Standard Microcircuit Drawing (SMD)

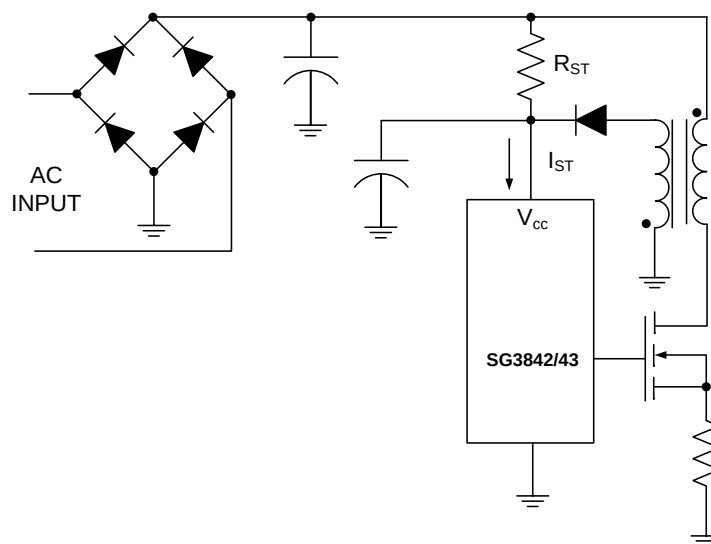
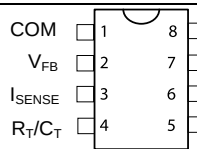
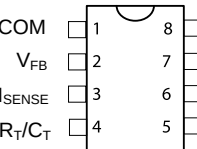
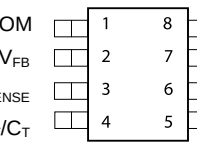
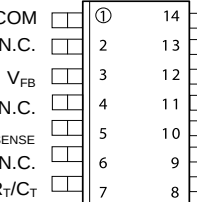
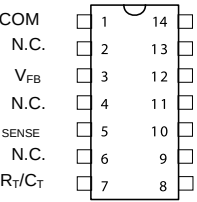
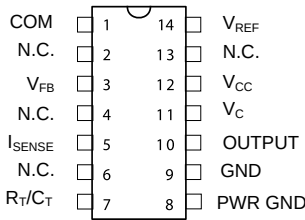
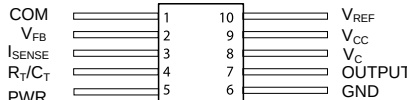
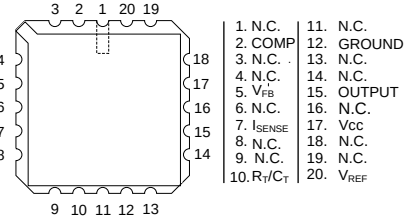


Figure 1 • Product Highlight

## Connection Diagrams and Ordering Information

| Ambient Temperature | Type | Package                                 | Part Number  | Packaging Type | Connection Diagram                                                                                                                                                                       |
|---------------------|------|-----------------------------------------|--------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0°C to 70°C         | M    | 8-PIN PLASTIC DUAL INLINE PACKAGE       | SG3842M      | Plastic DIP    |  <p><b>M PACKAGE</b><br/>(Top View)</p> <p>M Package: RoHS / Pb-free 100% Matte Tin Lead Finish</p>   |
| -25°C to 85°C       |      |                                         | SG3843M      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2842M      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2843M      |                |                                                                                                                                                                                          |
| 0°C to 70°C         | Y    | 8-PIN CERAMIC DUAL INLINE PACKAGE       | SG3842Y      | CERDIP         |  <p><b>Y PACKAGE</b><br/>(Top View)</p> <p>PbSn Tin Lead Finish</p>                                   |
| -25°C to 85°C       |      |                                         | SG3843Y      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2842Y      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2843Y      |                |                                                                                                                                                                                          |
| -55°C to 125°C      |      |                                         | SG1842Y      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG1843Y      |                |                                                                                                                                                                                          |
| MIL-STD/883         |      |                                         | SG1842Y-883B |                |                                                                                                                                                                                          |
|                     |      |                                         | SG1843Y-883B |                |                                                                                                                                                                                          |
| DESC                |      |                                         | SG1842Y-DESC |                |                                                                                                                                                                                          |
|                     |      |                                         | SG1843Y-DESC |                |                                                                                                                                                                                          |
| 0°C to 70°C         | DM   | 8-PIN SMALL OUTLINE INTEGRATED CIRCUIT  | SG3842DM     | SOIC           |  <p><b>DM PACKAGE</b><br/>(Top View)</p> <p>RoHS / Pb-free 100% Matte Tin Lead Finish</p>            |
| -25°C to 85°C       |      |                                         | SG3843DM     |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2842DM     |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2843DM     |                |                                                                                                                                                                                          |
| 0°C to 70°C         | D    | 14-PIN SMALL OUTLINE INTEGRATED CIRCUIT | SG3842D      | SOIC           |  <p><b>D PACKAGE</b><br/>(Top View)</p> <p>RoHS / Pb-free 100% Matte Tin Lead Finish</p>            |
| -25°C to 85°C       |      |                                         | SG3843D      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2842D      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2843D      |                |                                                                                                                                                                                          |
| 0°C to 70°C         | N    | 14-PIN DUAL INLINE PLASTIC PACKAGE      | SG3842N      | PLASTIC DIP    |  <p><b>N PACKAGE</b><br/>(Top View)</p> <p>N Package: RoHS / Pb-free 100% Matte Tin Lead Finish</p> |
| -25°C to 85°C       |      |                                         | SG3843N      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2842N      |                |                                                                                                                                                                                          |
|                     |      |                                         | SG2843N      |                |                                                                                                                                                                                          |

## Connection Diagrams and Ordering Information (continued)

| Ambient Temperature | Type | Package                            | Part Number  | Packaging Type                      | Connection Diagram                                                                                                                               |
|---------------------|------|------------------------------------|--------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| -55°C to 125°C      | J    | 14-PIN CERAMIC DUAL INLINE PACKAGE | SG1842J      | CERDIP                              |  <p><b>J PACKAGE</b><br/>(Top View)<br/>PbSn Lead Finish</p>  |
|                     |      |                                    | SG1843J      |                                     |                                                                                                                                                  |
| MIL-STD/883         |      |                                    | SG1842J-883B |                                     |                                                                                                                                                  |
|                     |      |                                    | SG1843J-883B |                                     |                                                                                                                                                  |
| DESC                |      |                                    | SG1842J-DESC |                                     |                                                                                                                                                  |
|                     |      |                                    | SG1843J-DESC |                                     |                                                                                                                                                  |
| -55°C to 125°C      | F    | 10-PIN CERAMIC FLAT PACK PACKAGE   | SG1842F      | FLAT PACK                           |  <p><b>F PACKAGE</b><br/>(Top View)<br/>PbSn Lead Finish</p>  |
|                     |      |                                    | SG1843F      |                                     |                                                                                                                                                  |
| MIL-STD/883         |      |                                    | SG1842F-883B |                                     |                                                                                                                                                  |
|                     |      |                                    | SG1843F-883B |                                     |                                                                                                                                                  |
| DESC                |      |                                    | SG1842F-DESC |                                     |                                                                                                                                                  |
|                     |      |                                    | SG1843F-DESC |                                     |                                                                                                                                                  |
| -55°C to 125°C      | L    | 20-PIN CERAMIC                     | SG1842L      | Ceramic Leadless Chip Carrier (LCC) |  <p><b>L PACKAGE</b><br/>(Top View)<br/>PbSn Lead Finish</p> |
|                     |      |                                    | SG1843L      |                                     |                                                                                                                                                  |
| MIL-STD/883         |      |                                    | SG1842L-883B |                                     |                                                                                                                                                  |
|                     |      |                                    | SG1843L-883B |                                     |                                                                                                                                                  |
| DESC                |      |                                    | SG1842L-DESC |                                     |                                                                                                                                                  |
|                     |      |                                    | SG1843L-DESC |                                     |                                                                                                                                                  |

**Notes:**

1. Contact factory for JAN and DESC part availability.
2. All parts are viewed from the top.
3. Available in Tape & Reel. Append the letters "TR" to the part number (SG3842N-TR).

## Absolute Maximum Ratings<sup>1 - 2</sup>

| Parameter                                                                                                                                                                          | Value         | Units            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|
| Supply Voltage ( $I_{CC} < 30\text{mA}$ )                                                                                                                                          | Self-limiting | V                |
| Supply Voltage (Low Impedance Source)                                                                                                                                              | 30            | V                |
| Output Current (Peak)                                                                                                                                                              | $\pm 1$       | A                |
| Output Current (Continuous)                                                                                                                                                        | 350           | mA               |
| Output Energy (Capacitive Load)                                                                                                                                                    | 5             | $\mu\text{J}$    |
| Analog Inputs ( $V_{FB}$ , $I_{SENSE}$ )                                                                                                                                           | -0.3 to +6.3  | V                |
| Error Amplifier Output Sink Current                                                                                                                                                | 10            | mA               |
| Power Dissipation at $T_A = 25^\circ\text{C}$ (DIL-8)                                                                                                                              | 1             | W                |
| <b>Operating Junction Temperature</b>                                                                                                                                              |               |                  |
| Hermetic (J, Y, F, L Packages)                                                                                                                                                     | 150           | $^\circ\text{C}$ |
| Plastic (N, M, D, DM Packages)                                                                                                                                                     | 150           | $^\circ\text{C}$ |
| Storage Temperature Range                                                                                                                                                          | -65 to +150   | $^\circ\text{C}$ |
| Lead Temperature (Soldering, 10 Seconds)                                                                                                                                           | 300           | $^\circ\text{C}$ |
| RoHS / Pb-free Peak Package Solder Reflow Temp. (40 second max. exposure)                                                                                                          | 260 (+0, -5)  | $^\circ\text{C}$ |
| <b>Notes:</b><br>1. Exceeding these ratings could cause damage to the device.<br>2. All voltages are with respect to Pin 5. All currents are positive into the specified terminal. |               |                  |

## Thermal Data

| Parameter                                                                                                                                                                                                                                            | Value | Units              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------|
| <b>M Package:</b>                                                                                                                                                                                                                                    |       |                    |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 95    | $^\circ\text{C/W}$ |
| <b>N Package:</b>                                                                                                                                                                                                                                    |       |                    |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 65    | $^\circ\text{C/W}$ |
| <b>DM Package:</b>                                                                                                                                                                                                                                   |       |                    |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 165   | $^\circ\text{C/W}$ |
| <b>D Package:</b>                                                                                                                                                                                                                                    |       |                    |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 120   | $^\circ\text{C/W}$ |
| <b>Y Package:</b>                                                                                                                                                                                                                                    |       |                    |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 130   | $^\circ\text{C/W}$ |
| <b>J Package</b>                                                                                                                                                                                                                                     |       |                    |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 80    | $^\circ\text{C/W}$ |
| <b>F Package</b>                                                                                                                                                                                                                                     |       |                    |
| Thermal Resistance-Junction to Case, $\theta_{JC}$                                                                                                                                                                                                   | 80    | $^\circ\text{C/W}$ |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 145   | $^\circ\text{C/W}$ |
| <b>L Package</b>                                                                                                                                                                                                                                     |       |                    |
| Thermal Resistance-Junction to Case, $\theta_{JC}$                                                                                                                                                                                                   | 35    | $^\circ\text{C/W}$ |
| Thermal Resistance-Junction to Ambient, $\theta_{JA}$                                                                                                                                                                                                | 120   | $^\circ\text{C/W}$ |
| <b>Notes:</b><br>1. Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$ .<br>2. The $\theta_{JA}$ numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow. |       |                    |

## Recommended Operating Conditions

| Symbol                                                  | Parameter                                             | Recommended Operating Conditions |     |     | Units |
|---------------------------------------------------------|-------------------------------------------------------|----------------------------------|-----|-----|-------|
|                                                         |                                                       | Min                              | Typ | Max |       |
| V <sub>S</sub>                                          | Supply Voltage Range                                  |                                  | 30  |     | V     |
| I <sub>PK</sub>                                         | Output Current (Peak)                                 |                                  | ±1  |     | A     |
| I <sub>OUT</sub>                                        | Output Current (Continuous)                           |                                  | 200 |     | mA    |
|                                                         | Analog Inputs (V <sub>FB</sub> , I <sub>SENSE</sub> ) | 0                                |     | 2.6 | V     |
| E <sub>A</sub> SINK                                     | Error Amp Output Sink Current                         |                                  | 5   |     | mA    |
| OSC <sub>FR</sub>                                       | Oscillator Frequency Range                            | 0.1                              |     | 500 | kHz   |
| R <sub>T</sub>                                          | Oscillator Timing Resistor                            | 0.52                             |     | 150 | kΩ    |
| C <sub>T</sub>                                          | Oscillator Timing Capacitor                           | 0.001                            |     | 1.0 | μF    |
| <b>Operating Ambient Temperature Range</b>              |                                                       |                                  |     |     |       |
|                                                         | SG1842/43                                             | -55                              |     | 125 | °C    |
|                                                         | SG2842/43                                             | -25                              |     | 85  | °C    |
|                                                         | SG3842/43                                             | 0                                |     | 70  | °C    |
| <i>Note:</i> Range over which the device is functional. |                                                       |                                  |     |     |       |

## Electrical Characteristics

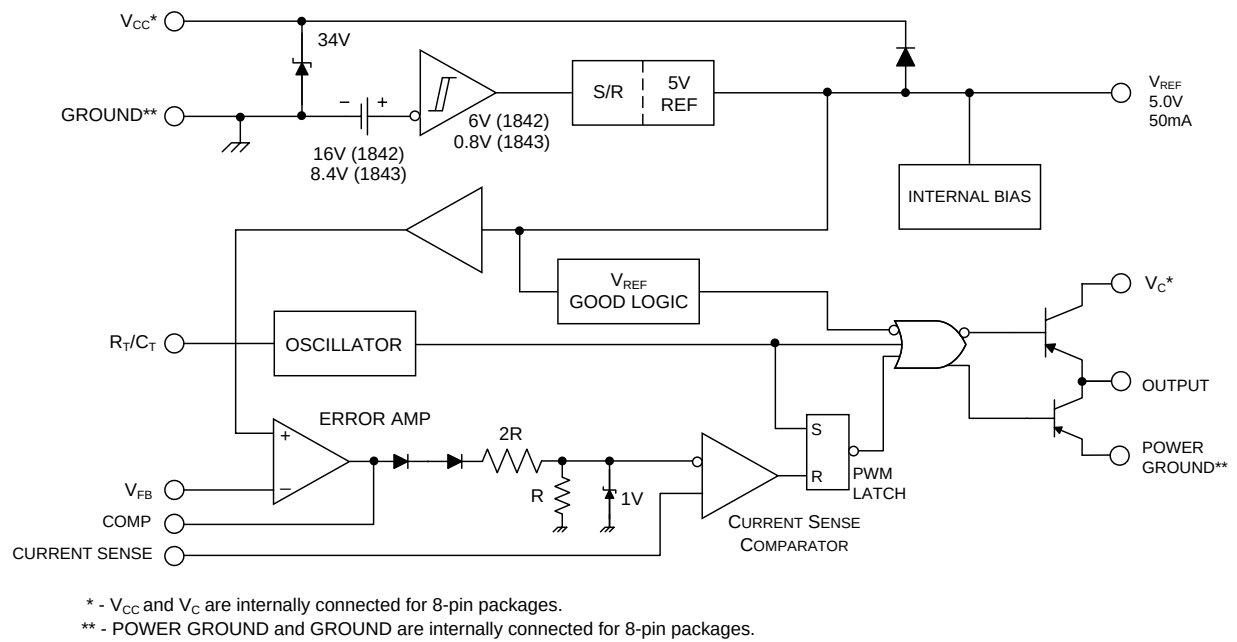
Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG1842/SG1843 with  $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ , SG2842/SG2843 with  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ , SG3842/SG3843 with  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ ,  $V_{CC} = 15\text{V}$ ,  $R_T = 10\text{k}\Omega$ , and  $C_T = 3.3\text{nF}$ . Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.

| Symbol                          | Parameter                           | Test Conditions                                                      | SG1842/43 |      |      | SG2842/43 |      |      | SG3842/43 |      |      | Units |
|---------------------------------|-------------------------------------|----------------------------------------------------------------------|-----------|------|------|-----------|------|------|-----------|------|------|-------|
|                                 |                                     |                                                                      | Min       | Typ  | Max  | Min       | Typ  | Max  | Min       | Typ  | Max  |       |
| Reference Section               |                                     |                                                                      |           |      |      |           |      |      |           |      |      |       |
| V <sub>REF</sub>                | Output Voltage                      | T <sub>J</sub> = 25°C, I <sub>O</sub> = 1mA                          | 4.95      | 5.00 | 5.05 | 4.95      | 5.00 | 5.05 | 4.90      | 5.00 | 5.10 | V     |
| V <sub>REG</sub>                | Line Regulation                     | 12V ≤ V <sub>IN</sub> ≤ 25V                                          |           | 6    | 20   |           | 6    | 20   |           | 6    | 20   | mV    |
| I <sub>REG</sub>                | Load Regulation                     | 1 ≤ I <sub>O</sub> ≤ 20mA                                            |           | 6    | 25   |           | 6    | 25   |           | 6    | 25   | mV    |
|                                 | Temperature Stability <sup>1</sup>  |                                                                      |           | 0.2  | 0.4  |           | 0.2  | 0.4  |           | 0.2  | 0.4  | mV/°C |
|                                 | Total Output Variation <sup>1</sup> | Line, Load, Temperature                                              | 4.90      |      | 5.10 | 4.90      |      | 5.10 | 4.82      |      | 5.18 | V     |
| V <sub>N</sub>                  | Output Noise Voltage <sup>1</sup>   | 10Hz ≤ f ≤ 10kHz, T <sub>J</sub> = 25°C                              |           | 50   |      |           | 50   |      |           | 50   |      | μV    |
|                                 | Long Term Stability <sup>1</sup>    | T <sub>A</sub> = 125°C, 1000hrs                                      |           | 5    | 25   |           | 5    | 25   |           | 5    | 25   | mV    |
| V <sub>REFOSC</sub>             | Output Short Circuit                |                                                                      | -30       | -100 | -180 | -30       | -100 | -180 | -30       | -100 | -180 | mA    |
| Oscillator Section <sup>3</sup> |                                     |                                                                      |           |      |      |           |      |      |           |      |      |       |
| f                               | Initial Accuracy <sup>5</sup>       | T <sub>J</sub> = 25°C                                                | 47        | 52   | 57   | 47        | 52   | 57   | 47        | 52   | 57   | kHz   |
| f <sub>REG</sub>                | Voltage Stability                   | 12V ≤ V <sub>CC</sub> ≤ 25V                                          |           | 0.2  | 1    |           | 0.2  | 1    |           | 0.2  | 1    | %     |
|                                 | Temperature Stability <sup>1</sup>  | T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>                 |           | 5    |      |           | 5    |      |           | 5    |      | %     |
| OSC <sub>PP</sub>               | Amplitude                           | V <sub>RT/CT</sub> (Peak to Peak)                                    |           | 1.7  |      |           | 1.7  |      |           | 1.7  |      | V     |
| I <sub>DSG</sub>                | Discharge Current                   | T <sub>J</sub> = 25°C                                                | 7.8       | 8.3  | 8.8  | 7.5       | 8.4  | 9.3  | 7.5       | 8.4  | 9.3  | mA    |
|                                 |                                     | T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>                 | 7.0       |      | 9.0  | 7.2       |      | 9.5  | 7.2       |      | 9.5  | mA    |
| Error Amp Section               |                                     |                                                                      |           |      |      |           |      |      |           |      |      |       |
| EA <sub>IN</sub>                | Input Voltage                       | V <sub>COMP</sub> = 2.5V                                             | 2.45      | 2.50 | 2.55 | 2.45      | 2.50 | 2.55 | 2.42      | 2.50 | 2.58 | V     |
| EA <sub>IB</sub>                | Input Bias Current                  |                                                                      |           | -0.3 | -1   |           | -0.3 | 1    |           | -0.3 | -2   | μA    |
| A <sub>VOL</sub>                | Open Loop Gain                      | 2V ≤ V <sub>O</sub> ≤ 4V                                             | 65        | 90   |      | 65        | 90   |      | 65        | 90   |      | dB    |
| EA <sub>BW</sub>                | Unity Gain Bandwidth <sup>1</sup>   | T <sub>J</sub> = 25°C                                                | 0.7       | 1    |      | 0.7       | 1    |      | 0.7       | 1    |      | MHz   |
| PSRR                            | Power Supply Rejection Ratio        | 12V ≤ V <sub>CC</sub> ≤ 25V                                          | 60        | 70   |      | 60        | 70   |      | 60        | 70   |      | dB    |
| EA <sub>SINK</sub>              | Output Sink Current                 | V <sub>VFB</sub> = 2.7V,<br>V <sub>COMP</sub> = 1.1V                 | 2         | 6    |      | 2         | 6    |      | 2         | 6    |      | mA    |
| EA <sub>SRC</sub>               | Output Source Current               | V <sub>VFB</sub> = 2.3V, V <sub>COMP</sub> = 5V                      | -0.5      | -0.8 |      | -0.5      | -0.8 |      | -0.5      | -0.8 |      | mA    |
| EA <sub>VOH</sub>               | V <sub>OUT</sub> High               | V <sub>VFB</sub> = 2.3V,<br>R <sub>L</sub> = 15k to GND              | 5         | 6    |      | 5         | 6    |      | 5         | 6    |      | V     |
| EA <sub>VOL</sub>               | V <sub>OUT</sub> Low                | V <sub>VFB</sub> = 2.7V,<br>R <sub>L</sub> = 15k to V <sub>REF</sub> |           | 0.7  | 1.1  |           | 0.7  | 1.1  |           | 0.7  | 1.1  | V     |

## Electrical Characteristics (continued)

| Symbol                                                                                        | Parameter                                 | Test Conditions                             | SG1842/43 |      |      | SG2842/43 |      |      | SG3842/43 |      |      | Units |
|-----------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------|-----------|------|------|-----------|------|------|-----------|------|------|-------|
|                                                                                               |                                           |                                             | Min       | Typ  | Max  | Min       | Typ  | Max  | Min       | Typ  | Max  |       |
| Current Sense Section                                                                         |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| CS <sub>AVOL</sub>                                                                            | Gain <sup>2, 3</sup>                      |                                             | 2.85      | 3    | 3.15 | 2.85      | 3    | 3.15 | 2.85      | 3    | 3.15 | V/V   |
|                                                                                               | Maximum Input Signal <sup>2</sup>         | V <sub>COMP</sub> = 5V                      | 0.9       | 1    | 1.1  | 0.9       | 1    | 1.1  | 0.9       | 1    | 1.1  | V     |
| PSRR                                                                                          | Power Supply Rejection Ratio <sup>2</sup> | 12V ≤ V <sub>CC</sub> ≤ 25V                 |           | 70   |      |           | 70   |      |           | 70   |      | dB    |
| CS <sub>IB</sub>                                                                              | Input Bias Current                        |                                             |           | -2   | -10  |           | -2   | -10  |           | -2   | -10  | μA    |
| CS <sub>DELAY</sub>                                                                           | Delay to Output <sup>1</sup>              |                                             |           | 150  | 300  |           | 150  | 300  |           | 150  | 300  | ns    |
| Output Section                                                                                |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| V <sub>OL</sub>                                                                               | Output Low Level                          | I <sub>SINK</sub> = 20mA                    |           | 0.1  | 0.4  |           | 0.1  | 0.4  |           | 0.1  | 0.4  | V     |
|                                                                                               |                                           | I <sub>SINK</sub> = 200mA                   |           | 1.5  | 2.2  |           | 1.5  | 2.2  |           | 1.5  | 2.2  | V     |
| V <sub>OH</sub>                                                                               | Output High Level                         | I <sub>SOURCE</sub> = 20mA                  | 13        | 13.5 |      | 13        | 13.5 |      | 13        | 13.5 |      | V     |
|                                                                                               |                                           | I <sub>SOURCE</sub> = 200mA                 | 12        | 13.5 |      | 12        | 13.5 |      | 12        | 13.5 |      | V     |
| R <sub>S</sub>                                                                                | Rise Time                                 | T <sub>J</sub> = 25°C, C <sub>L</sub> = 1nF |           | 50   | 150  |           | 50   | 150  |           | 50   | 150  | ns    |
| F <sub>T</sub>                                                                                | Fall Time                                 | T <sub>J</sub> = 25°C, C <sub>L</sub> = 1nF |           | 50   | 150  |           | 50   | 150  |           | 50   | 150  | ns    |
| Under-Voltage Lockout Section                                                                 |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| UVLO                                                                                          | Start Threshold                           | 1842/2842/3842                              | 15        | 16   | 17   | 15        | 16   | 17   | 14.5      | 16   | 17.5 | V     |
|                                                                                               |                                           | 1843/2843/3843                              | 7.8       | 8.4  | 9.0  | 7.8       | 8.4  | 9.0  | 7.8       | 8.4  | 9.0  | V     |
| V <sub>SMIN</sub>                                                                             | Min. Operation Voltage After Turn-On      | 1842/2842/3842                              | 9         | 10   | 11   | 9         | 10   | 11   | 8.5       | 10   | 11.5 | V     |
|                                                                                               |                                           | 1843/2843/3843                              | 7.0       | 7.6  | 8.3  | 7.0       | 7.6  | 8.2  | 7.0       | 7.6  | 8.2  | V     |
| PWM Section                                                                                   |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| DC <sub>MAX</sub>                                                                             | Maximum Duty Cycle                        |                                             | 93        | 95   | 100  | 90        | 95   | 100  | 90        | 95   | 100  | %     |
| DC <sub>MIN</sub>                                                                             | Minimum Duty Cycle                        |                                             |           |      | 0    |           |      | 0    |           |      | 0    | %     |
| Power Consumption Section                                                                     |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| I <sub>S</sub>                                                                                | Start-Up Current                          |                                             |           | 0.5  | 1    |           | 0.5  | 1    |           | 0.5  | 1    | mA    |
| I                                                                                             | Operating Supply Current                  | V <sub>FB</sub> = V <sub>ISENSE</sub> = 0V  |           | 11   | 17   |           | 11   | 17   |           | 11   | 17   | mA    |
| Z                                                                                             | V <sub>CC</sub> Zener Voltage             | I <sub>CC</sub> = 25mA                      |           | 34   |      |           | 34   |      |           | 34   |      | V     |
| Notes:                                                                                        |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| 1. These parameters, although guaranteed, are not 100% tested in production.                  |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| 2. Parameter measured at trip point of latch with V <sub>VFB</sub> = 0.                       |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| 3. Gain defined as: $A = \Delta V_{COMP} / \Delta V_{ISENSE}$ ; $0 \leq V_{ISENSE} \leq 0.8V$ |                                           |                                             |           |      |      |           |      |      |           |      |      |       |
| 4. Adjust V <sub>CC</sub> above the start threshold before setting at 15V.                    |                                           |                                             |           |      |      |           |      |      |           |      |      |       |

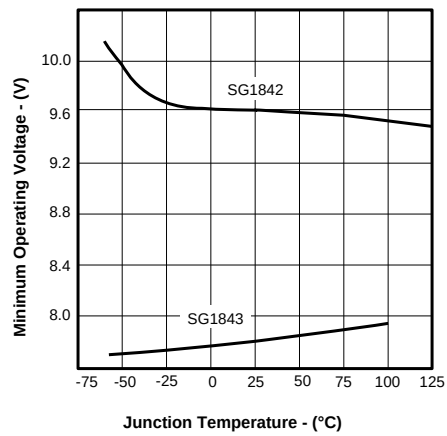
## Block Diagram



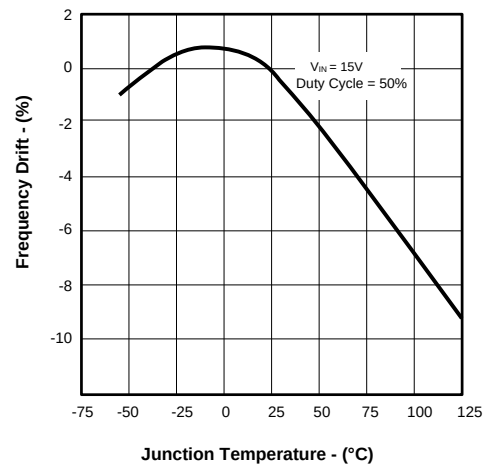
**Figure 2 • Block Diagram**



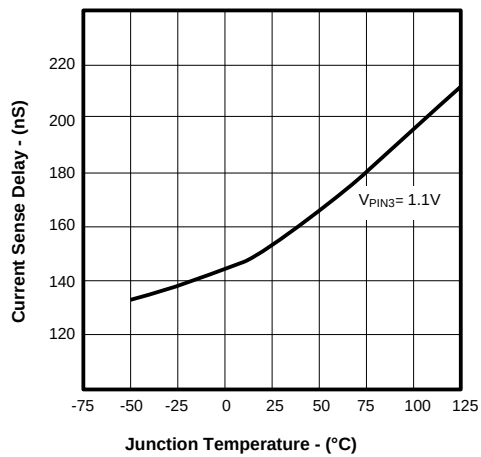
## Characteristic Curves



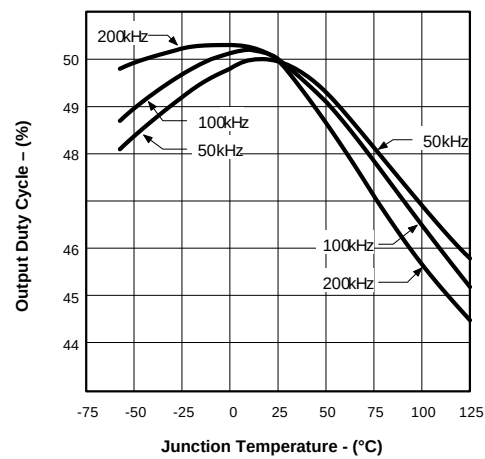
**Figure 3** • Dropout Voltage vs. Temperature



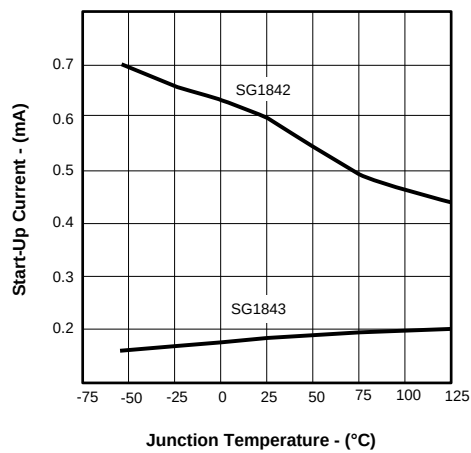
**Figure 4** • Oscillator Temperature Stability



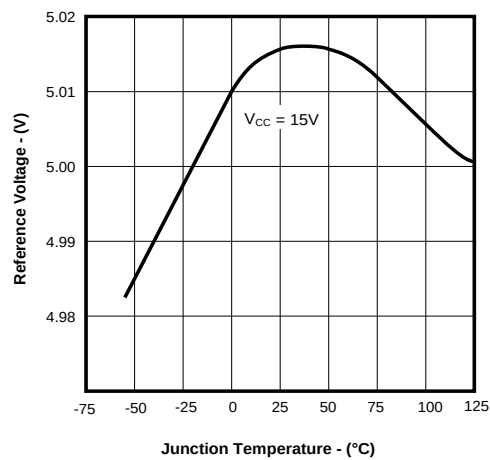
**Figure 5** • Current Sense to Output Delay vs. Temperature



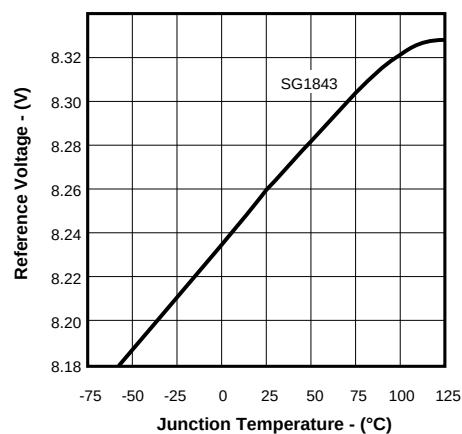
**Figure 6** • Output Duty Cycle vs. Temperature



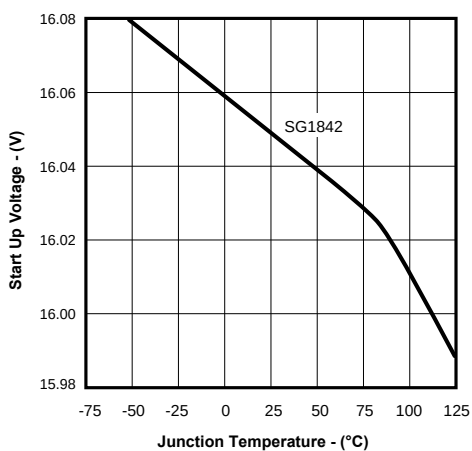
**Figure 7** • Start-Up Current vs. Temperature



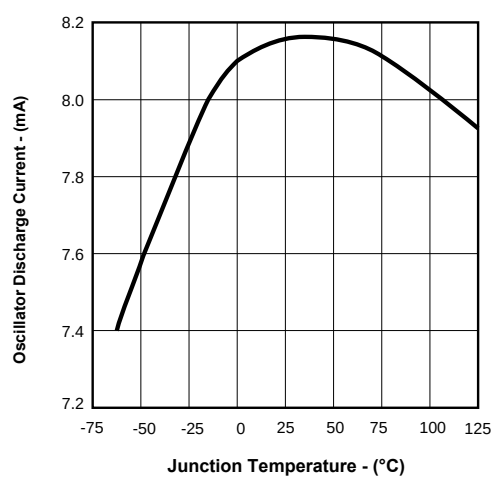
**Figure 8** • Reference Voltage vs. Temperature



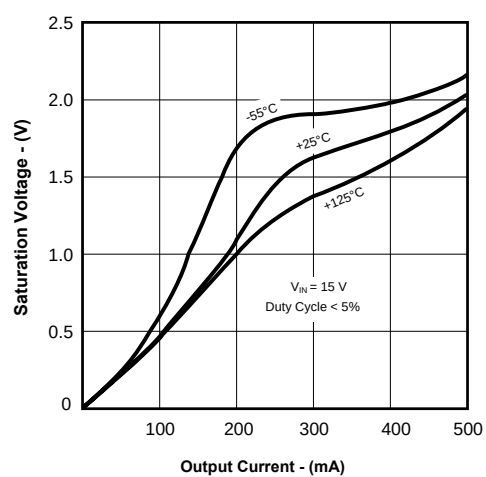
**Figure 9** • Start-Up Voltage Threshold vs. Temperature



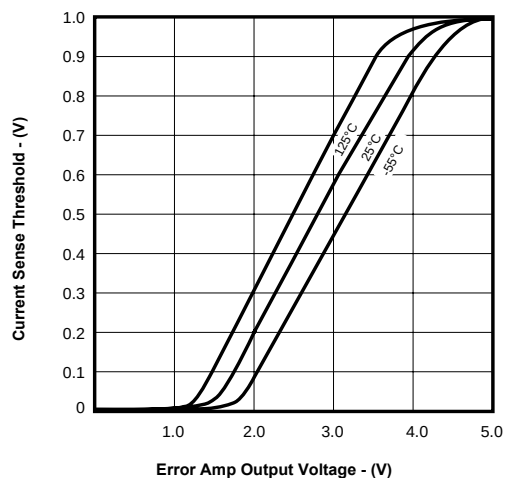
**Figure 10** • Start-Up Voltage Threshold vs. Temperature



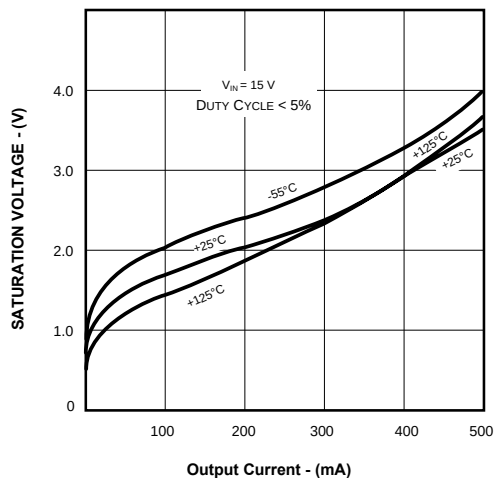
**Figure 11** • Oscillator Discharge Current vs. Temperature



**Figure 12** • Output Saturation Voltage vs. Output Current and Temperature (Sink Transistor)



**Figure 13** • Current Sense Threshold vs. Error Amplifier Output



**Figure 14** • Output Saturation Voltage vs. Output Current and Temperature

## Application Information

The oscillator of the 1842/43 family of PWM's is designed such that many values of  $R_T$  and  $C_T$  will give the same oscillator frequency, but only one combination will yield a specific duty cycle at a given frequency.

**Given:**

Frequency  $\equiv f$

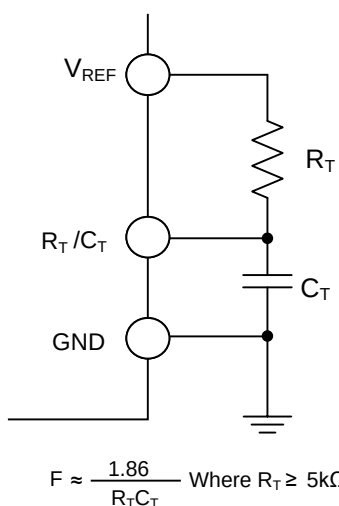
Maximum Duty Cycle  $\equiv D_m$

**Calculate:**  $R_T = 267 \left[ \frac{(1.76)^{1/D_m-1}}{(1.76)^{(1-D_m)/D_m-1}} \right] (\Omega)$

where  $0.3 < D_m < 0.95$

$$C_T = \frac{1.86 * D_m}{f * R_T} (\mu F)$$

For Duty-Cycles above 95% use:



**Figure 15** · Oscillator Timing Circuit

A set of formulas are given to determine the values of  $R_T$  and  $C_T$  for a given frequency and maximum duty cycle. (Note: These formulas are less accurate for smaller duty cycles or higher frequencies. This will require trimming of  $R_T$  or  $C_T$  to correct for this error.)

**Example:**

A Flyback power supply requires a maximum of 45% duty cycle at a switching frequency of 50 kHz. What are the values of  $R_T$  and  $C_T$ ?

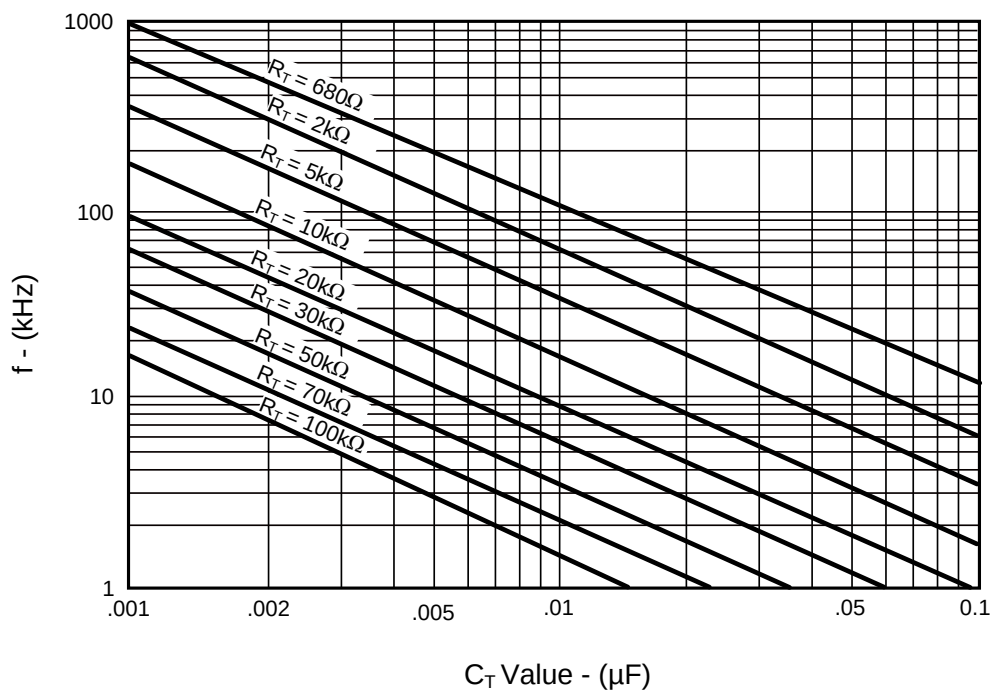
**Given:**

$$f = 50\text{kHz}$$

$$D_m = 0.45$$

$$\text{Calculate: } R_T = 267 \left[ \frac{(1.76)^{\frac{1}{.45}} - 1}{(1.76)^{\frac{.55}{.45}} - 1} \right] = 674 \Omega$$

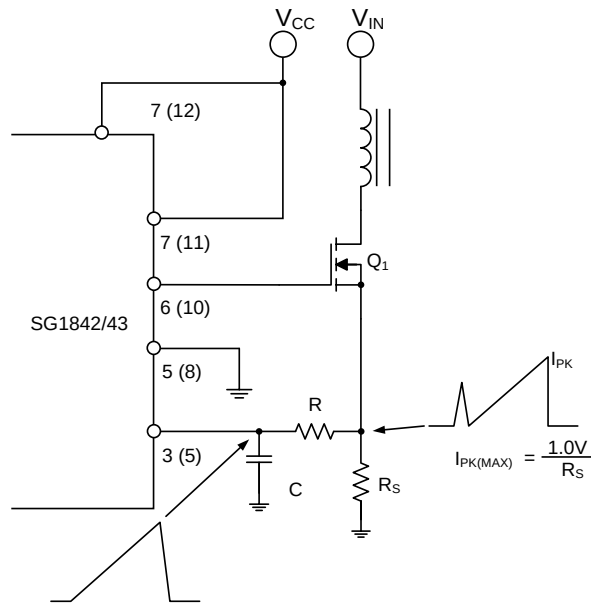
$$C_T = \frac{1.86 * 0.45}{50000 * 674} = .025 (\mu\text{F})$$



**Figure 16** · Oscillator Frequency Vs.  $R_T$  For Various  $C_T$

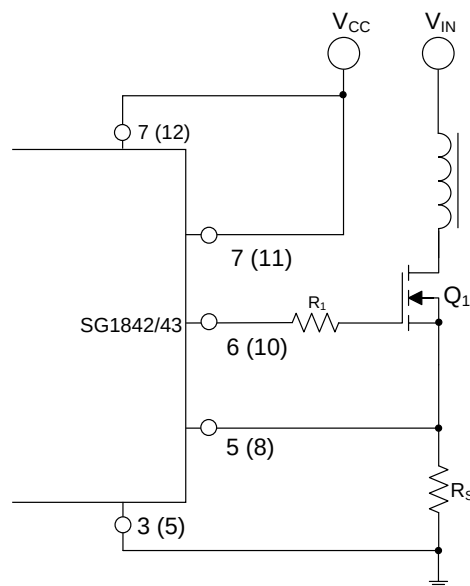
## Typical Application Circuits

Pin numbers referenced are for 8-pin package and pin numbers in parenthesis are for 14-pin package.



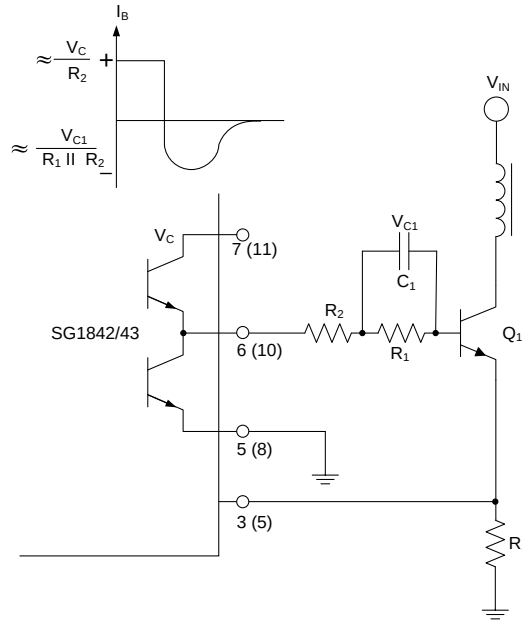
**Figure 17 • Current Sense Spike Suppression**

The RC low-pass filter eliminates the leading edge current spike caused by parasitic of Power MOSFET.



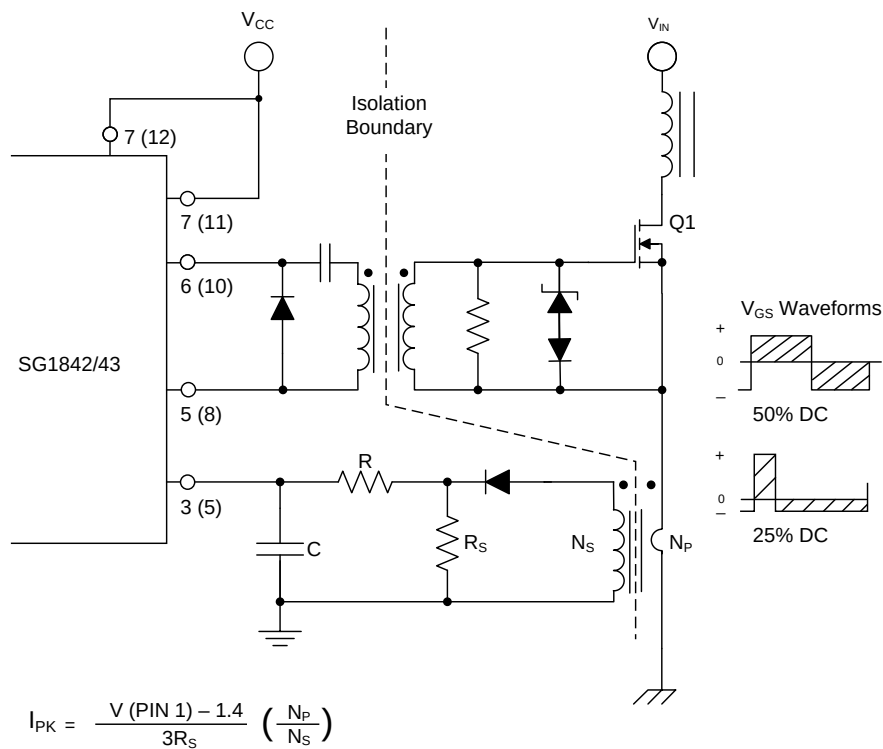
**Figure 18 • MOSFET Parasitic Oscillations**

A resistor (R1) in series with the MOSFET gate reduce overshoot and ringing caused by the MOSFET input capacitance and any inductance in series with the gate drive. (Note: It is very important to have a low inductance ground path to insure correct operation of the I.C. This can be done by making the ground paths as short and as wide as possible.)



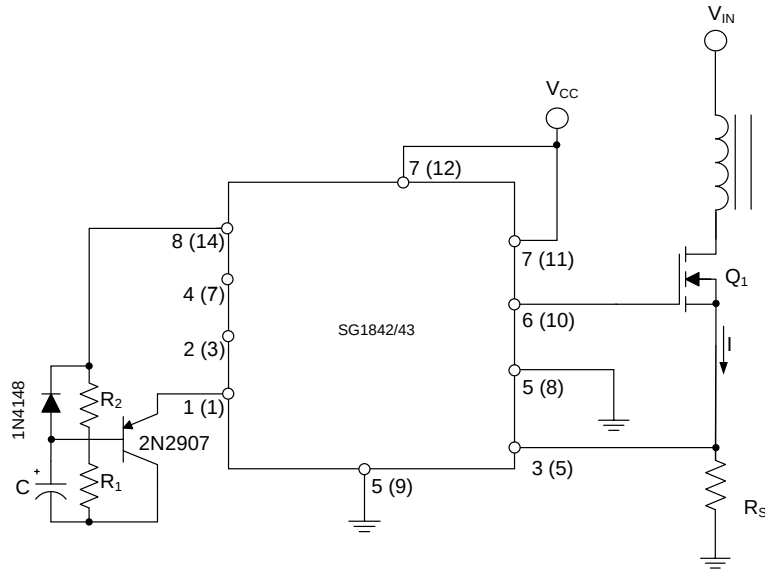
**Figure 19 • Bipolar Transistor Drive**

The 1842/43 output stage can provide negative base current to remove base charge of power transistor ( $Q_1$ ) for faster turn off. This is accomplished by adding a capacitor ( $C_1$ ) in parallel with a resistor ( $R_1$ ). The resistor ( $R_1$ ) is to limit the base current during turn on.



**Figure 20 • Isolated MOSFET Drive**

Current transformers can be used where isolation is required between PWM and Primary ground. A drive transformer is then necessary to interface the PWM output with the MOSFET.



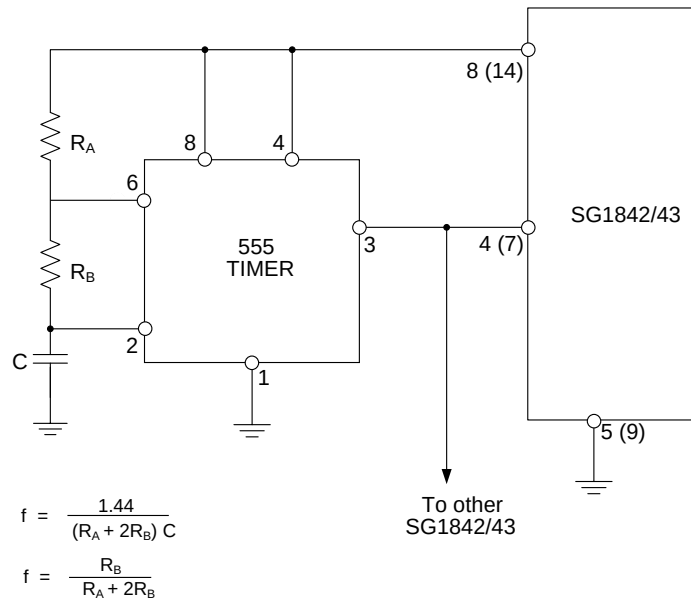
**Figure 21** • Adjustable Buffered Reduction of Clamp Level with Softstart

$$I_{PK} = \frac{V_{CS}}{R_S}$$

Where,  $V_{CS} = 1.67 \left( \frac{R_1}{R_1 + R_2} \right)$  and  $V_{C.S.MAX} = 1V$  (Typ.)

$$t_{SOFTSTART} = -\ln \left[ 1 - \frac{V_{EAO} - 1.3}{5 \left( \frac{R_1}{R_1 + R_2} \right)} \right] \left( \frac{R_1 R_2}{R_1 + R_2} \right) C$$

Where,  $V_{EAO}$  ≡ voltage at the Error Amp Output under minimum line and maximum load conditions  
Softstart and adjustable peak current can be done with the external circuitry shown above.

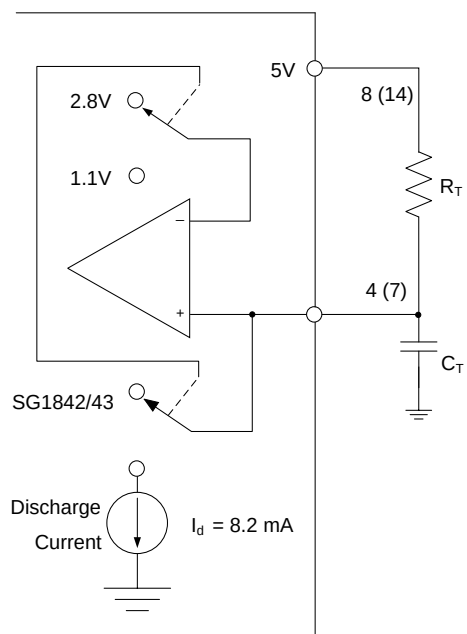


$$f = \frac{1.44}{(R_A + 2R_B) C}$$

$$f = \frac{R_B}{R_A + 2R_B}$$

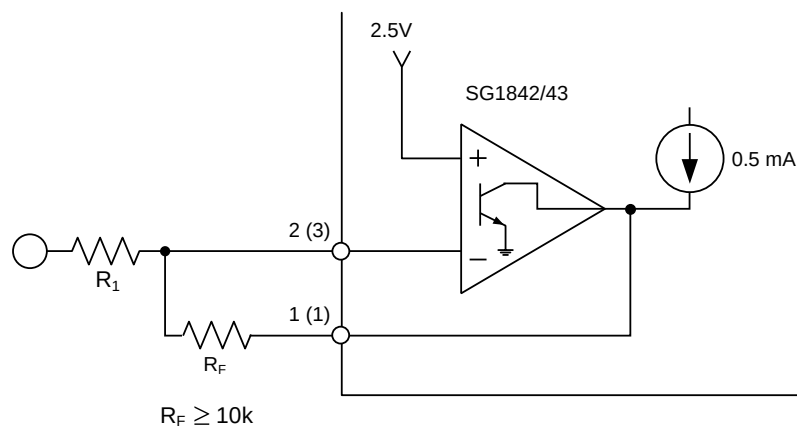
**Figure 22** • External Duty Cycle Clamp and Multi-Unit Synchronization

Precision duty cycle limiting as well as synchronizing several 1842/1843's is possible with the above circuitry.



**Figure 23** • Oscillator Connection

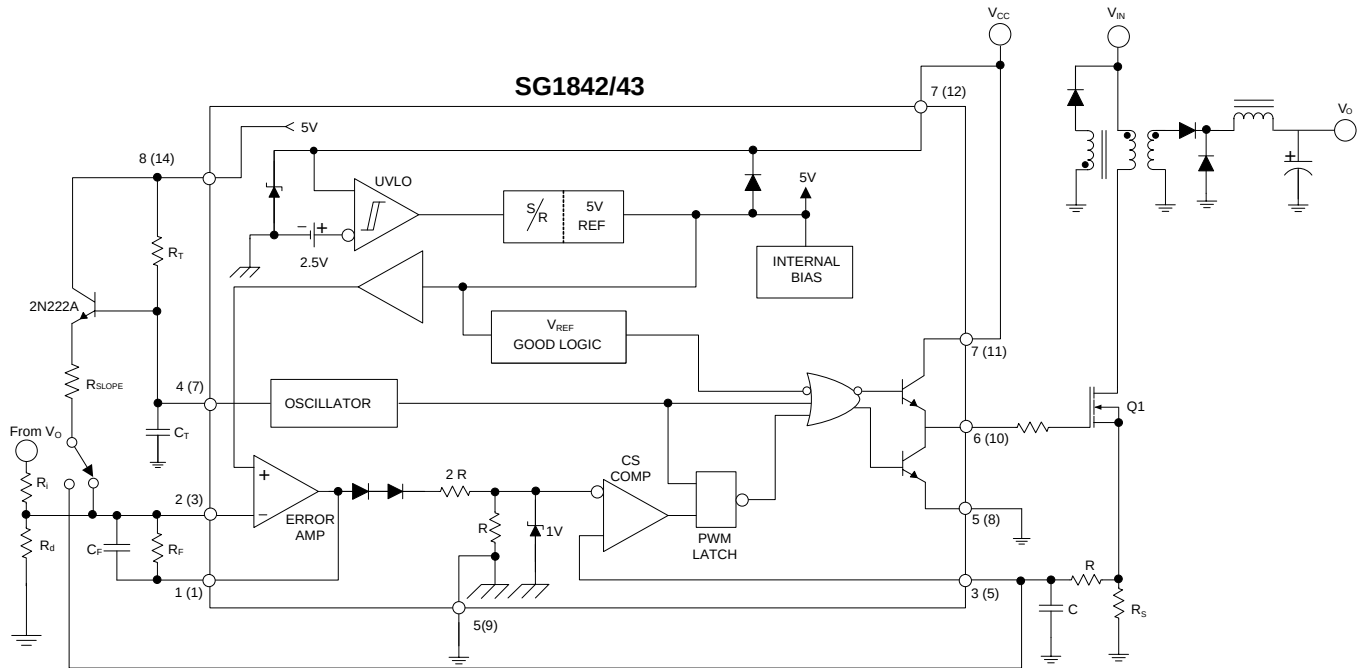
The oscillator is programmed by the values selected for the timing components  $R_T$  and  $C_T$ . Refer to application information for calculation of the component values.



**Figure 24** • Error Amplifier Connection

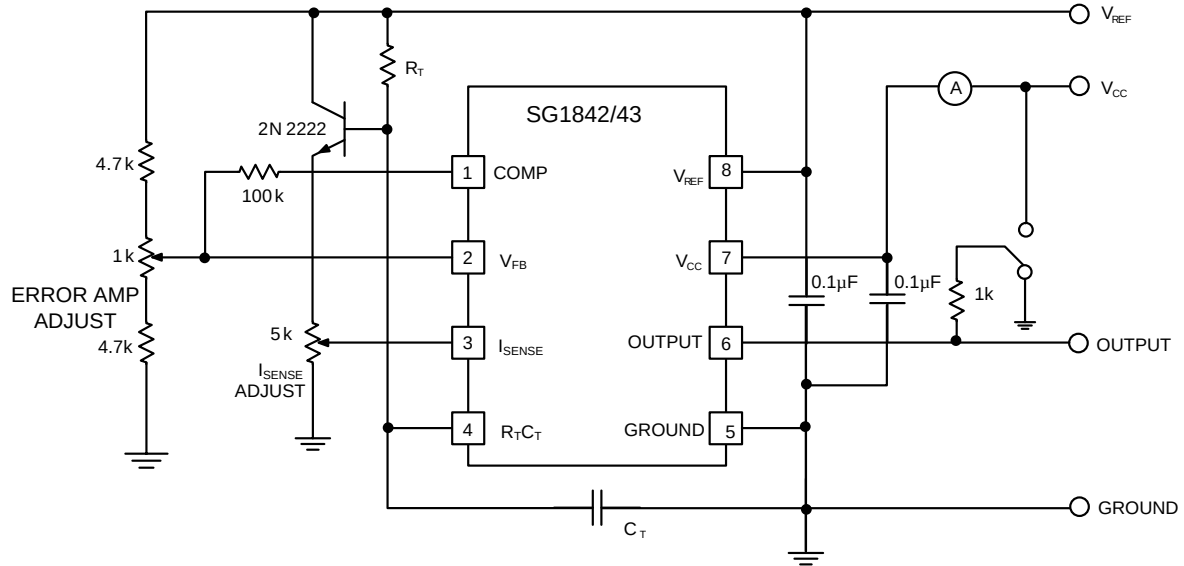
Error amplifier is capable of sourcing and sinking current up to 0.5mA.





### Figure 25 · Slope Compensation

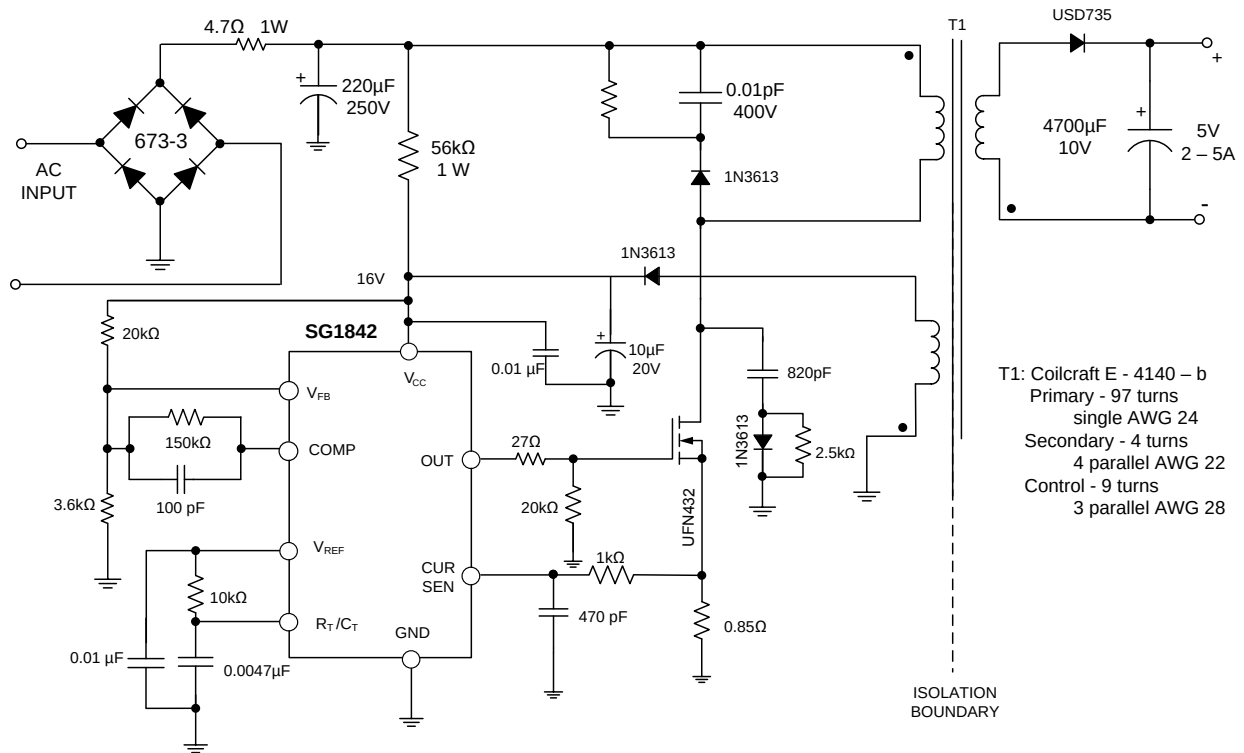
Due to inherent instability of current mode converters running above 50% duty cycle, slope compensation should be added to either current sense pin or the error amplifier. Figure 25 shows a typical slope compensation technique.



**Figure 26 • Open Loop Laboratory Fixture**

High-peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected 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 27 • Off-line Flyback Regulator**

#### SPECIFICATIONS

Input line voltage: 90VAC to 130VAC

Input frequency: 50 or 60Hz

Switching frequency: 40kHz  $\pm 10\%$

Output power: 25W maximum

Output voltage: 5V  $\pm 5\%$

Output current: 2 to 5A

Line regulation: 0.01%/V

Load regulation: 8%/A\*

Efficiency @ 25 Watt:

$V_{IN} = 90VAC$ : 70%

$V_{IN} = 130VAC$ : 65%

Output short-circuit current: 2.5 A average

\*This circuit uses a low-cost feedback scheme in which the DC voltage developed from the primary-side control winding is sensed by the SG1842 error amplifier. Load regulation is therefore dependent on the coupling between secondary and control windings, and on transformer leakage inductance.

## Package Outline Dimensions

Controlling dimensions are in inches, metric equivalents are shown for general information.

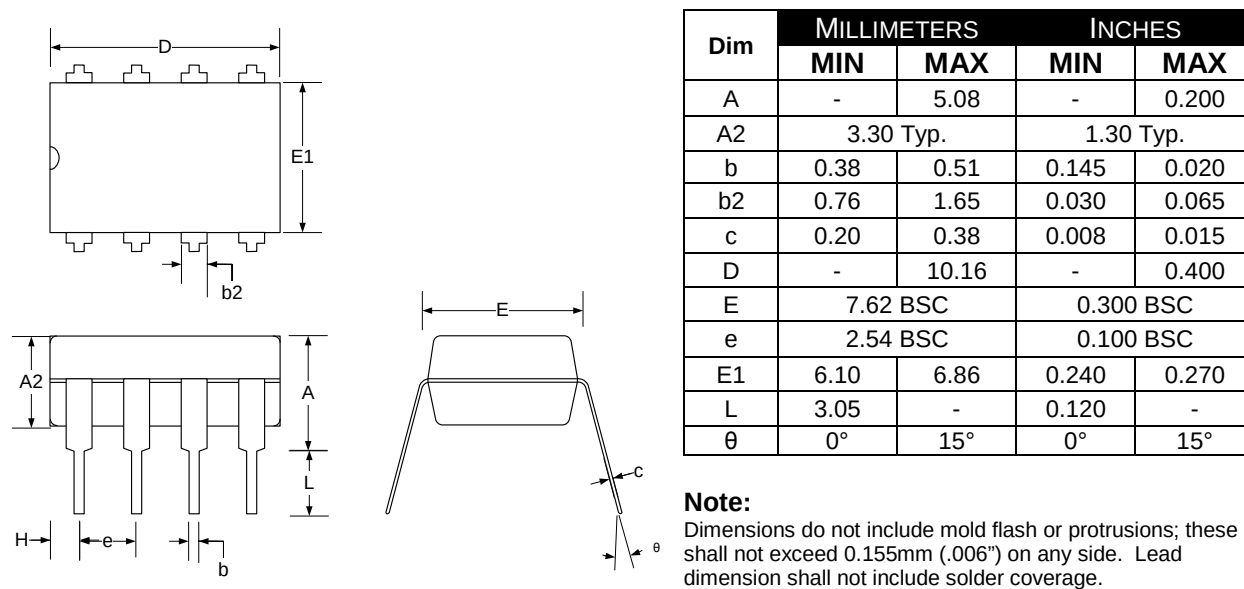


Figure 1 • M 8-Pin PDIP Package Dimensions

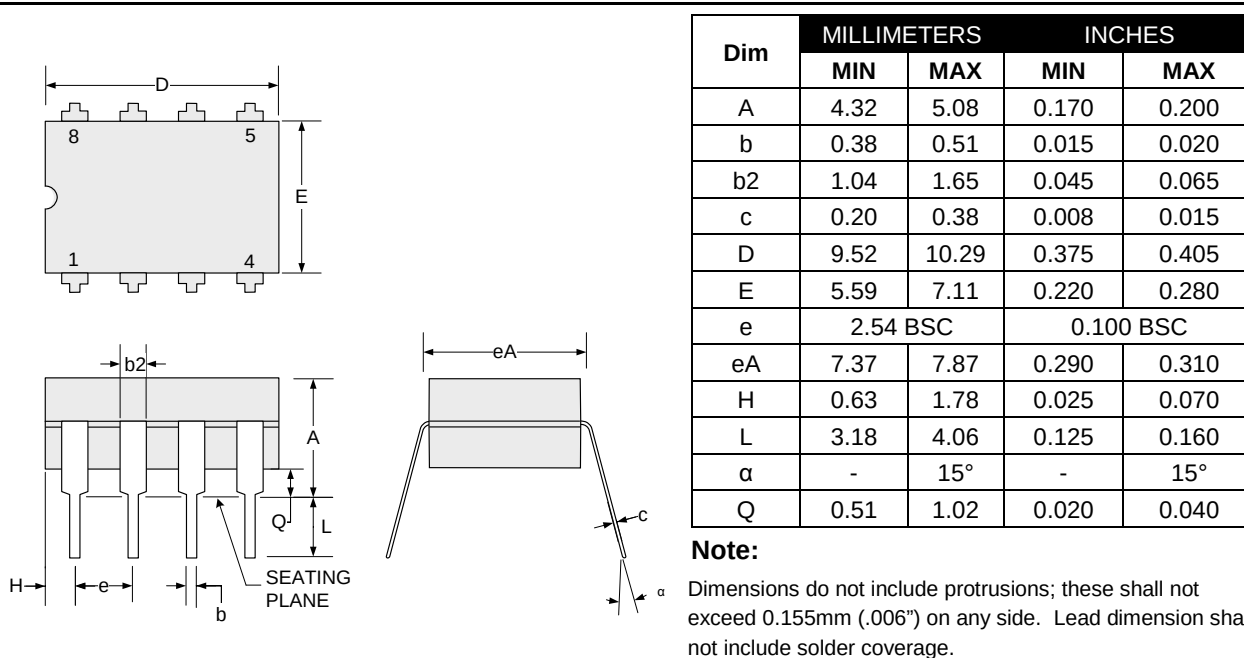
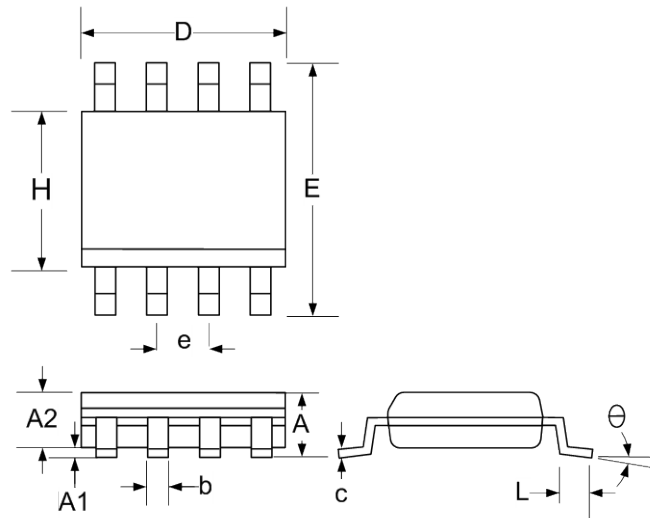


Figure 2 • Y 8-Pin Cerdip Package Dimensions

## Package Outline Dimensions



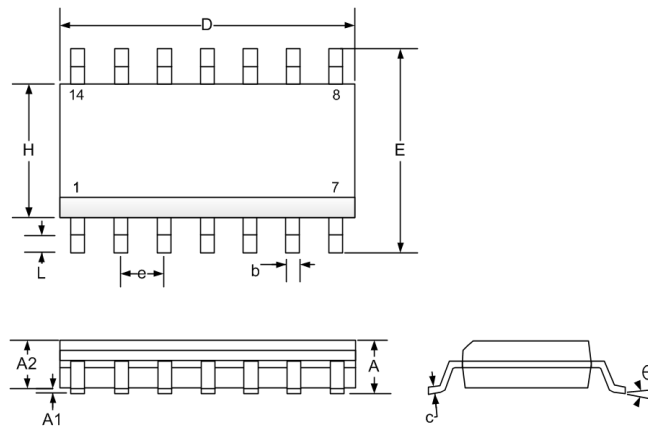
| Dim | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.053     | 0.069 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A2  | 1.25        | 1.52 | 0.049     | 0.060 |
| b   | 0.33        | 0.51 | 0.013     | 0.020 |
| c   | 0.19        | 0.25 | 0.007     | 0.010 |
| D   | 4.83        | 5.21 | 0.189     | 0.205 |
| E   | 5.79        | 6.20 | 0.228     | 0.244 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 3.81        | 4.01 | 0.150     | 0.158 |
| L   | 0.40        | 1.27 | 0.016     | 0.050 |
| θ   | 0°          | 8°   | 0°        | 8°    |
| *LC | -           | .010 | -         | 0.004 |

\*Lead Co-planarity

**Note:**

Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage

**Figure 3 • DM 8-Pin SOIC Package Dimensions**



| Dim | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.053     | 0.069 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A2  | 1.25        | 1.52 | 0.049     | 0.060 |
| b   | 0.33        | 0.51 | 0.013     | 0.020 |
| c   | 0.19        | 0.25 | 0.007     | 0.010 |
| D   | 8.54        | 8.74 | 0.336     | 0.344 |
| E   | 5.79        | 6.20 | 0.228     | 0.244 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 3.81        | 4.01 | 0.150     | 0.158 |
| L   | 0.40        | 1.27 | 0.016     | 0.050 |
| θ   | 0°          | 8°   | 0°        | 8°    |
| *LC | -           | .010 | -         | 0.004 |

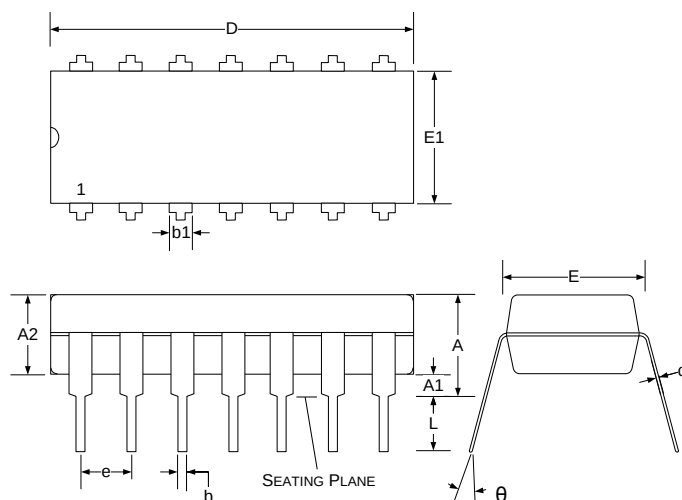
\*Lead Co-planarity

**Note:**

Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage

**Figure 4 • D 14-Pin SOIC Package Dimensions**

## Package Outline Dimensions

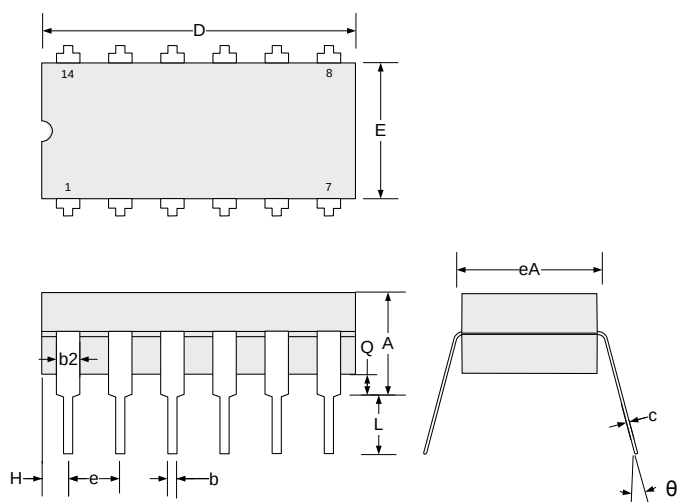


| Dim | MILLIMETERS |       | INCHES     |       |
|-----|-------------|-------|------------|-------|
|     | MIN         | MAX   | MIN        | MAX   |
| A   | -           | 5.33  | -          | 0.210 |
| A1  | 0.38        | -     | 0.015      | -     |
| A2  | 3.30 Typ.   |       | 0.130 Typ. |       |
| b   | 0.36        | 0.56  | 0.014      | 0.022 |
| b1  | 1.14        | 1.78  | 0.045      | 0.070 |
| c   | 0.20        | 0.36  | 0.008      | 0.014 |
| D   | 18.54       | 20.57 | 0.730      | 0.810 |
| e   | 2.54 BSC    |       | 0.100 BSC  |       |
| E   | 7.62        | 8.26  | 0.300      | 0.325 |
| E1  | 6.10        | 7.11  | 0.240      | 0.280 |
| L   | 2.92        | 3.81  | 0.115      | 0.150 |
| θ   | 0°          | 15°   | 0°         | 15°   |

### Note:

Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

Figure 5 • N 14-Pin PDIP Package Dimensions



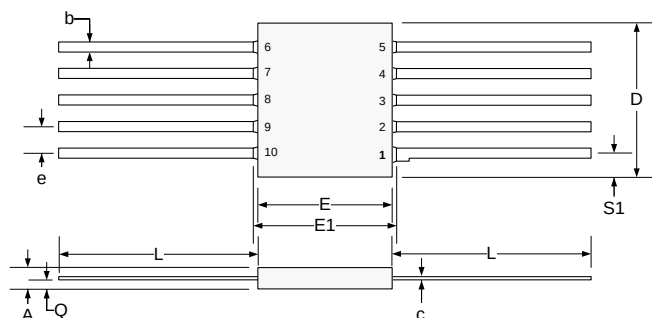
| Dim | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 4.32        | 5.08  | 0.170     | 0.200 |
| b   | 0.38        | 0.51  | 0.015     | 0.020 |
| b2  | 1.04        | 1.65  | 0.045     | 0.065 |
| c   | 0.20        | 0.38  | 0.008     | 0.015 |
| D   | 19.30       | 19.94 | 0.760     | 0.785 |
| E   | 5.59        | 7.11  | 0.220     | 0.280 |
| e   | 2.54 BSC    |       | 0.100 BSC |       |
| eA  | 7.37        | 7.87  | 0.290     | 0.310 |
| H   | 0.63        | 1.78  | 0.025     | 0.070 |
| L   | 3.18        | 4.06  | 0.125     | 0.160 |
| α   | -           | 15°   | -         | 15°   |
| Q   | 0.51        | 1.02  | 0.020     | 0.040 |

### Note:

Dimensions do not include protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

Figure 6 • J 14-Pin CERPDP Package Dimensions

## Package Outline Dimensions

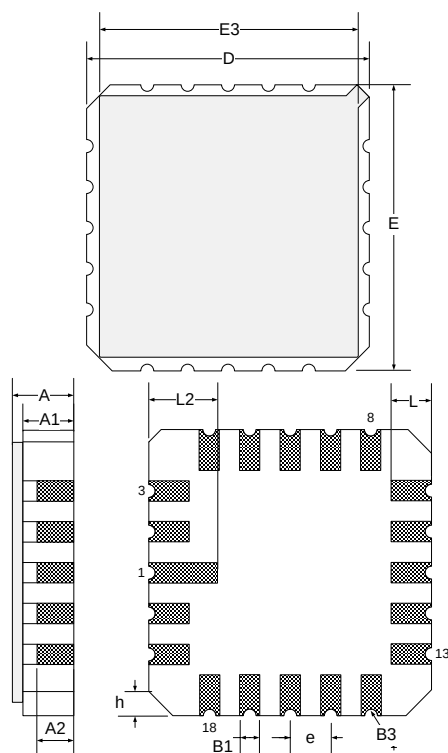


| Dim | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 1.45        | 1.70  | 0.057     | 0.067 |
| b   | 0.25        | 0.483 | 0.010     | 0.019 |
| c   | 0.102       | 0.152 | 0.004     | 0.006 |
| D   | -           | 7.37  | -         | 0.290 |
| E   | 6.04        | 6.40  | 0.238     | 0.252 |
| E1  | -           | 6.91  | -         | 0.272 |
| e   | 1.27 BSC    |       | 0.050 BSC |       |
| L   | 6.35        | 9.40  | 0.250     | 0.370 |
| Q   | 0.51        | 1.02  | 0.020     | 0.040 |
| S1  | 0.20        | 0.38  | 0.008     | 0.015 |

### Notes:

1. Lead No. 1 is identified by tab on lead or dot on cover.
2. Leads are within 0.13mm (.0005") radius of the true position (TP) at maximum material condition.
3. Dimension "e" determines a zone within which all body and lead irregularities lie.

**Figure 7 · F 10-Pin Ceramic Flatpack Package Dimensions**



| Dim | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| D/E | 8.64        | 9.14  | 0.340     | 0.360 |
| E3  | -           | 8.128 | -         | 0.320 |
| e   | 1.270 BSC   |       | 0.050 BSC |       |
| B1  | 0.635 TYP   |       | 0.025 TYP |       |
| L   | 1.02        | 1.52  | 0.040     | 0.060 |
| A   | 1.626       | 2.286 | 0.064     | 0.090 |
| h   | 1.016 TYP   |       | 0.040 TYP |       |
| A1  | 1.372       | 1.68  | 0.054     | 0.066 |
| A2  | -           | 1.168 | -         | 0.046 |
| L2  | 1.91        | 2.41  | 0.075     | 0.95  |
| B3  | 0.203R      |       | 0.008R    |       |

### Note:

All exposed metallized area shall be gold plated 60 micro-inch minimum thickness over nickel plated unless otherwise specified in purchase order.

**Figure 8 · L 20-Pin Leadless Chip Carrier Package Dimensions**



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