

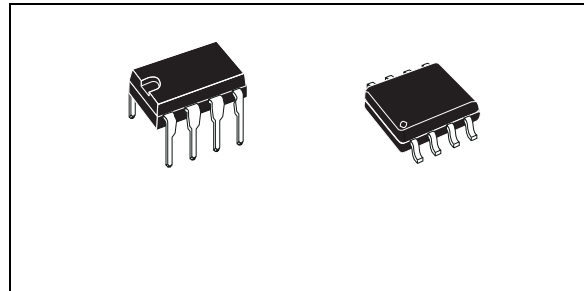


**UC2842B/3B/4B/5B**

**UC3842B/3B/4B/5B**

## HIGH PERFORMANCE CURRENT MODE PWM CONTROLLER

- TRIMMED OSCILLATOR FOR PRECISE FREQUENCY CONTROL
- OSCILLATOR FREQUENCY GUARANTEED AT 250kHz
- CURRENT MODE OPERATION TO 500kHz
- AUTOMATIC FEED FORWARD COMPENSATION **Minidip SO8**
- LATCHING PWM FOR CYCLE-BY-CYCLE CURRENT LIMITING
- INTERNALLY TRIMMED REFERENCE WITH UNDERVOLTAGE LOCKOUT

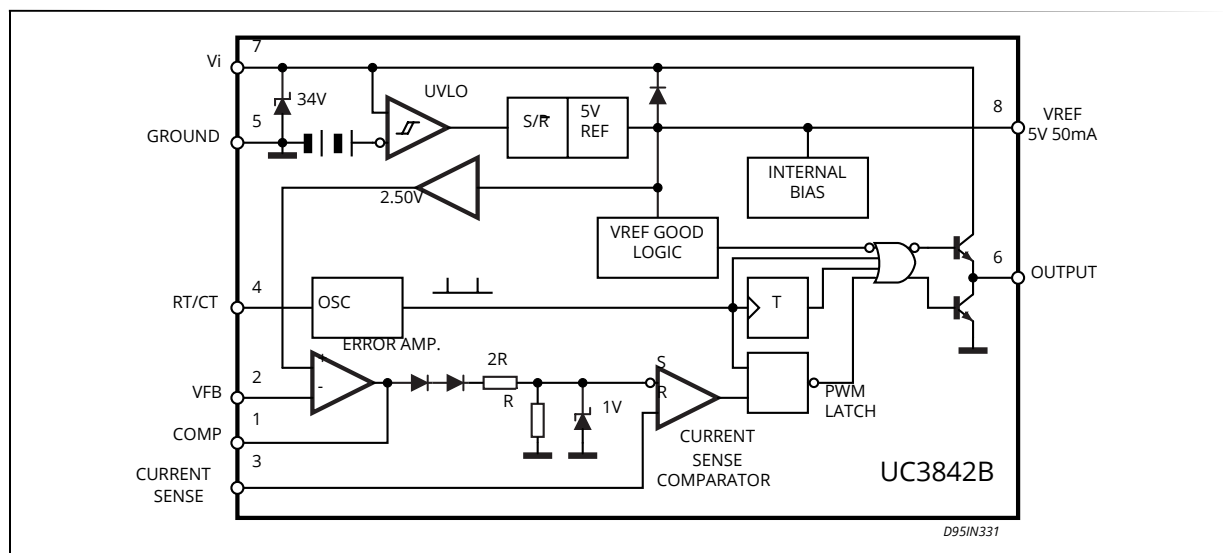


- HIGH CURRENT TOTEM POLE OUTPUT comparator which also provides current limit control, UNDERVOLTAGE LOCKOUT WITH HYSTER- and a totem pole output stage designed to source ESIS or sink high peak current. The output stage, suitable for driving N-Channel MOSFETs, is low in the off-state.

### DESCRIPTION

The UC384xB family of control ICs provides the necessary features to implement off-line or DC to DC conversion schemes with a minimal external parts count. Internally implemented circuits include a trimmed oscillator for precise frequency control, a current mode control scheme with automatic feed forward compensation, a minimal external parts count. Internally implemented circuits include a trimmed oscillator for precise frequency control, a current mode control scheme with automatic feed forward compensation, a minimal external parts count. Internally implemented circuits include a trimmed oscillator for precise frequency control, a current mode control scheme with automatic feed forward compensation, a minimal external parts count.

### BLOCK DIAGRAM (toggle flip flop used only in UC3844B and UC3845B)



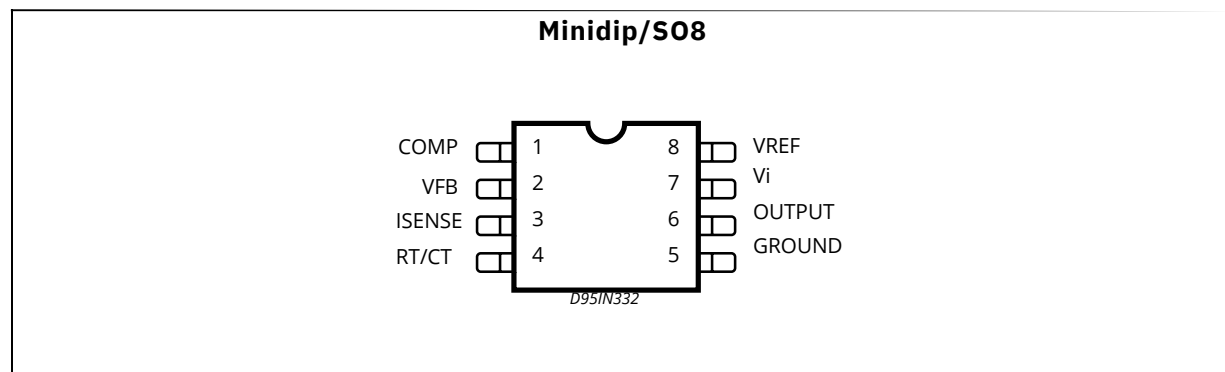
## UC2842B/3B/4B/5B - UC3842B/3B/4B/5B

### ABSOLUTE MAXIMUM RATINGS

| Symbol   | Parameter                                                      | Value         | Unit             |
|----------|----------------------------------------------------------------|---------------|------------------|
| $V_i$    | Supply Voltage (low impedance source)                          | 30            | V                |
| $V_i$    | Supply Voltage ( $I_i < 30\text{mA}$ )                         | Self Limiting |                  |
| $I_O$    | Output Current                                                 | $\pm 1$       | A                |
| $E_O$    | Output Energy (capacitive load)                                | 5             | $\mu\text{J}$    |
|          | Analog Inputs (pins 2, 3)                                      | - 0.3 to 5.5  | V                |
|          | Error Amplifier Output Sink Current                            | 10            | mA               |
| $P_{to}$ | Power Dissipation at $T_{amb} \leq 25^\circ\text{C}$ (Minidip) | 1.25          | W                |
| $P_t$    | Power Dissipation at $T_{amb} \leq 25^\circ\text{C}$ (SO8)     | 800           | mW               |
| $T_{to}$ | Storage Temperature Range                                      | - 65 to 150   | $^\circ\text{C}$ |
| $T_t$    | Junction Operating Temperature                                 | - 40 to 150   | $^\circ\text{C}$ |
| $T_{st}$ | Lead Temperature (soldering 10s)                               | 300           | $^\circ\text{C}$ |

\*All voltages are with respect to pin 5, all currents are positive into the specified terminal.

### PIN CONNECTION (top view)



### PIN FUNCTIONS

| No | Function | Description                                                                                                                                                          |
|----|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | COMP     | This pin is the Error Amplifier output and is made available for loop compensation.                                                                                  |
| 2  | VFB      | This is the inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider.                        |
| 3  | ISENSE   | A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.                      |
| 4  | RT/CT    | The oscillator frequency and maximum Output duty cycle are programmed by connecting resistor RT to Vref and capacitor CT to ground. Operation to 500kHz is possible. |
| 5  | GROUND   | This pin is the combined control circuitry and power ground.                                                                                                         |
| 6  | OUTPUT   | This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sunk by this pin.                                                     |
| 7  | VCC      | This pin is the positive supply of the control IC.                                                                                                                   |
| 8  | Vref     | This is the reference output. It provides charging current for capacitor CT through resistor RT.                                                                     |

### ORDERING NUMBERS

| SO8                                                                                          | Minidip                                                                              |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| UC2842BD1; UC3842BD1<br>UC2843BD1; UC3843BD1<br>UC2844BD1; UC3844BD1<br>UC2845BD1; UC3845BD1 | UC2842BN; UC3842BN<br>UC2843BN; UC3843BN<br>UC2844BN; UC3844BN<br>UC2845BN; UC3845BN |

# UC2842B/3B/4B/5B - UC3842B/3B/4B/5B

## THERMAL DATA

| Symbol    | Description                                  | Minidip | S08 | Unit |
|-----------|----------------------------------------------|---------|-----|------|
| Rth j-amb | Thermal Resistance Junction-ambient. max.100 |         | 150 | °C/W |

**ELECTRICAL CHARACTERISTICS** ( [note 1] Unless otherwise stated, these specifications apply for -25 ≤ Tamb < 85°C for UC284XB; 0 < Tamb < 70°C for UC384XB; Vi = 15V (note 5); RT = 10K; CT = 3.3nF)

| Symbol                       | Parameter                              | Test Conditions                 | UC284XB | UC384XB | Unit  |
|------------------------------|----------------------------------------|---------------------------------|---------|---------|-------|
|                              |                                        | Min. Typ. Max.                  | Min.    | Typ.    | Max.  |
| <b>REFERENCE SECTION</b>     |                                        |                                 |         |         |       |
| VREF                         | Output Voltage                         | Tj = 25°C Io = 1mA              | 4.955   | 0.005   | 5.054 |
| ΔVREF                        | Line Regulation                        | 12V ≤ Vi ≤ 25V                  | 22      | 20      | 22    |
| ΔVREF                        | Load Regulation                        | 1 ≤ Io ≤ 20mA                   | 32      | 53      | 25    |
| ΔVREF/ΔT                     | Temperature Stability                  | (Note 2)                        | 0.20    | 0.2     | mV/°C |
|                              | Total Output Variation                 | Line, Load, Temperature         | 4.95    | 14.82   | 5.18  |
| eN                           | Output Noise Voltage                   | 10Hz ≤ f ≤ 10KHz Tj = 25°C      | 50      | 50      | μV    |
|                              | Long Term Stability                    | Tamb = 125°C, 1000Hrs           | 52      | 55      | 25    |
| IS                           | Output Short Circuit                   | (note 2)                        | -30     | -100    | -180  |
| <b>OSCILLATOR SECTION</b>    |                                        |                                 |         |         |       |
| fOSC                         | Frequency                              |                                 |         |         |       |
| Tj = 25°C                    |                                        |                                 | 49      | 52      | 55    |
| TA = Tlow to Thigh           |                                        |                                 | 48      | -       | 56    |
|                              |                                        | Tj = 25°C (RT = 6.2k, CT = 1nF) | 22      | 250     | 27    |
| ΔfOSC/ΔV                     | Frequency Change with Volt.            | VCC = 12V to 25V                | 5       | 0.2     | 5     |
| ΔfOSC/ΔT                     | Frequency Change with Temp.            | TA = Tlow to Thigh              | -       | 1       | -     |
| VOSC                         | Oscillator Voltage Swing(peak to peak) |                                 | -       | 1.6     | -     |
| Idischg                      | Discharge Current (VOSC = 2V)          | Tj = 25°C                       | -       | 8.3     | -     |
|                              |                                        | TA = Tlow to Thigh              | 7.8     | -       | 8.8   |
| <b>ERROR AMP SECTION</b>     |                                        |                                 |         |         |       |
| V2                           | Input Voltage                          | VPIN1 = 2.5V                    | 2.45    | 2.5     | 2.55  |
| Ib                           | Input Bias Current                     | VFB = 5V                        |         | 0       | -1    |
| AVOL                         | 2V ≤ Vo ≤ 4V                           |                                 | 65      | -0.1    | 65    |
| BW                           | Unity Gain Bandwidth                   | Tj = 25°C                       | 0.7     | 90      | 0.7   |
| PSRR                         | Power Supply Rejec. Ratio              | 12V ≤ Vi ≤ 25V                  | 60      | 1       | 60    |
| Io                           | Output Sink Current                    | VPIN2 = 2.7V VPIN1 = 1.1V       | 2       | 70      | 2     |
|                              | Output Source Current                  | VPIN2 = 2.3V VPIN1 = 5V         | -0.5    | 12      | -0.   |
| VOUT High                    | VPIN2 = 2.3V;                          |                                 | 5       | -1      | 5     |
| RL = 15KΩ                    | to Ground                              |                                 |         | 6.2     |       |
| VOUT Low                     | VPIN2 = 2.7V;                          |                                 |         |         | 6.2   |
| RL = 15KΩ                    | to Pin 8                               |                                 |         | 1.1     |       |
| <b>CURRENT SENSE SECTION</b> |                                        |                                 |         |         |       |
| GV                           | Gain(note 3 & 4)                       |                                 |         |         |       |
| V3                           | Maximum Input Signal                   | VPIN1 = 5V (note 3)             | 2.8     | 3       | 3.1   |
| SVR                          | Supply Voltage Rejection               | 12 ≤ Vi ≤ 25V (note 3)          | 5       | 1       | 5     |
| Ib                           | Input Bias Current                     |                                 | 0.9     | 70      | 1.1   |
|                              | Delay to Output                        |                                 |         | -2      | -10   |
|                              |                                        |                                 |         | 15      | 30    |
|                              |                                        |                                 | 0       | 0       | 0     |



## UC2842B/3B/4B/5B - UC3842B/3B/4B/5B

### ELECTRICAL CHARACTERISTICS (continued)

| Symbol Parameter              |                       | Test Conditions           | UC284XB   |              |      | UC384XB |      |      | Unit |   |
|-------------------------------|-----------------------|---------------------------|-----------|--------------|------|---------|------|------|------|---|
|                               |                       |                           | Min.      | Typ.         | Max. | Min.    | Typ. | Max. |      |   |
| OUTPUT SECTION                |                       |                           |           |              |      |         |      |      |      |   |
| VO                            | Output Low Level      | ISINK = 200mA             |           |              |      | 0.1     | 0.4  | 0.1  | 0.4  | V |
|                               | ISINK = 200mA         |                           |           |              |      | 1.6     | 2.2  | 1.6  | 2.2  | V |
| VOH                           | Output High Level     | ISOURCE = 20mA            | 13        | 13.5         | 13   | 13.5    |      |      |      | V |
|                               | ISOURCE = 200mA       |                           | 12        | 13.5         | 12   | 13.5    |      |      |      | V |
| VOLS                          | VLO Saturation        | VCC = 6V; ISINK = 1mA     |           |              |      | 0.1     | 1.1  | 0.1  | 1.1  | V |
|                               |                       | trRise Time               | Tj = 25°C | CL = 1nF (2) |      | 50      | 150  | 50   | 150  | n |
|                               |                       | tfFall Time               | Tj = 25°C | CL = 1nF (2) |      | 50      | 150  | 50   | 150  | s |
| UNDER-VOLTAGE LOCKOUT SECTION |                       |                           |           |              |      |         |      |      |      |   |
| Start Thresh                  | hold                  | X842B/4B                  |           | 15           | 16   | 17      | 14.  | 16   | 17.  | V |
|                               |                       | X843B/5B                  |           | 7.           | 8.   | 9.      | 5    | 8.   | 5    | V |
| X842B/4B                      | Min Operating Voltage |                           |           | 8            | 4    | 0       | 7.8  | 4    | 9.0  | V |
| X843B/5B                      | Re-on                 |                           |           | 9            | 10   | 11      | 8.5  | 10   | 11.  | V |
| PWM SECTION                   |                       |                           | 7.        | 7.           | 8.   | 7.0     | 7.   | 5    |      |   |
|                               | Maximum Duty Cycle    | X842B/3B                  | 9         | 9            | 100  | 9       | 9    | 100  |      | % |
|                               |                       | X844B/5B                  | 4         | 6            | 50   | 4       | 6    | 50   |      | % |
|                               | Minimum Duty Cycle    |                           | 4         | 4            | 0    | 4       | 4    | 0    |      | % |
| TOTAL STANDBY CURRENT         |                       |                           | 7         | 8            |      | 7       | 8    |      |      |   |
| Ist                           | Start-up Current      | Vi = 6.5V for UCX843B/45B |           | 0.           | 0.   |         | 0.   | 0.   |      | m |
|                               |                       | Vi = 14V for UCX842B/44B  |           | 3            | 5    |         | 3    | 5    |      | A |
| Ii                            | Operating Supply      | VPIN2 = VPIN3 = 0V        |           | 0.           | 0.   |         | 0.   | 0.   |      | m |
| Vi                            | Current Zener Voltage | Ii = 25mA                 | 30        | 3            | 5    | 30      | 3    | 5    |      | A |
| Z                             |                       |                           |           | 12           | 17   |         | 12   | 17   |      | m |

- Notes :**
- 1.Max package power dissipation limits must be respected; low duty cycle pulse techniques are used during test mainly Tj as close to Tamb as possible.
  - 2.These parameters, although guaranteed, are not 100% tested in production.
  - 3.Parameter measured at trip point of latch with VPIN2 = 0.
  - 4.Gain defined as :  

$$\Delta VPIN1$$

$$A = 0 \leq VPIN3 \leq 0.8 V$$

$$\Delta VPIN3$$
  - 5.Adjust Vi above the start threshold before setting at 15 V.



**Figure 4:** Oscillator Discharge Current vs. Temperature.

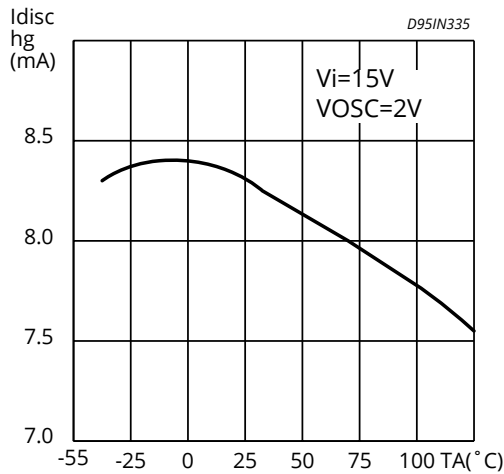


**Figure 5:** Maximum Output Duty Cycle vs. Timing Resistor.

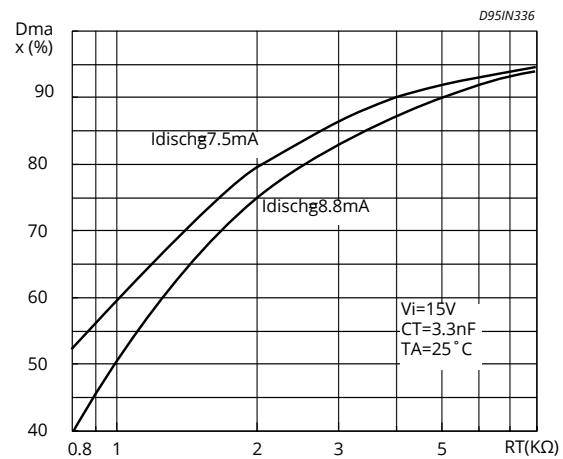


**Figure 6:** Error Amp Open-Loop Gain and Phase vs. Frequency.

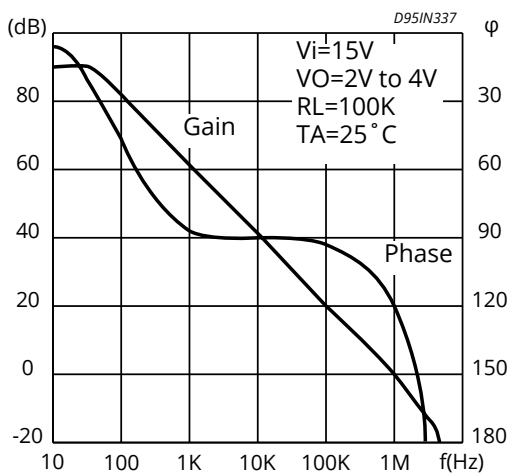


**Figure 7:** Current Sense Input Threshold vs. Error Amp Output Voltage.

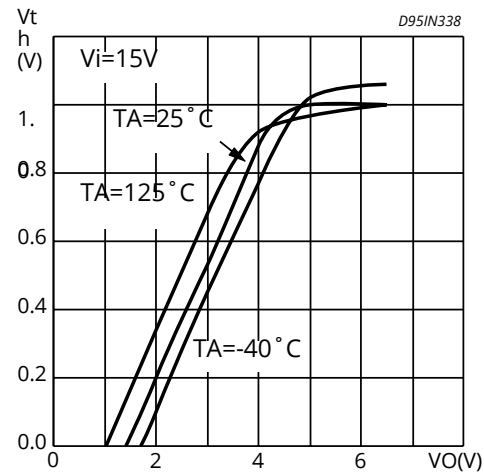


**Figure 8:** Reference Voltage Change vs. Source Current.

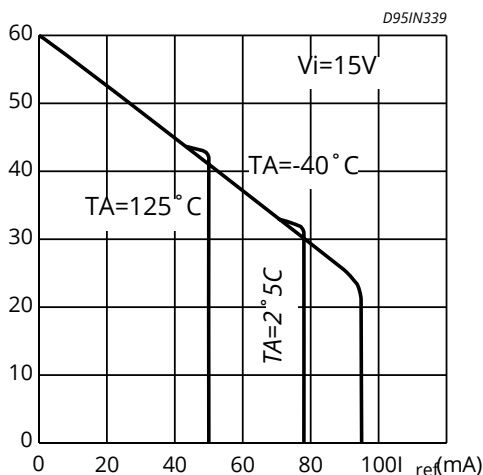


**Figure 9:** Reference Short Circuit Current vs. Temperature.

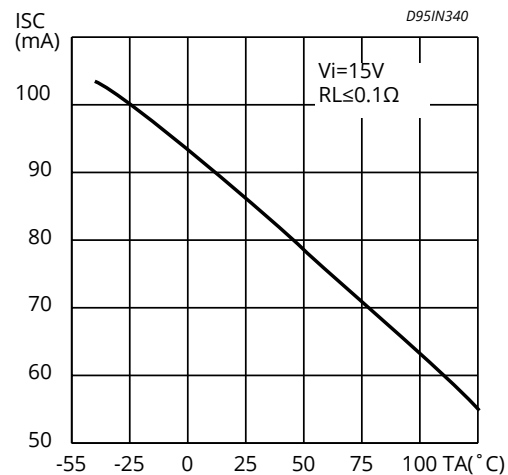


**Figure 10:** Output Saturation Voltage vs. Load Current.

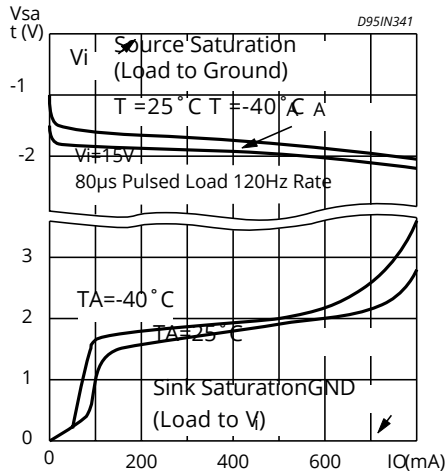


**Figure 12:** Output Waveform.

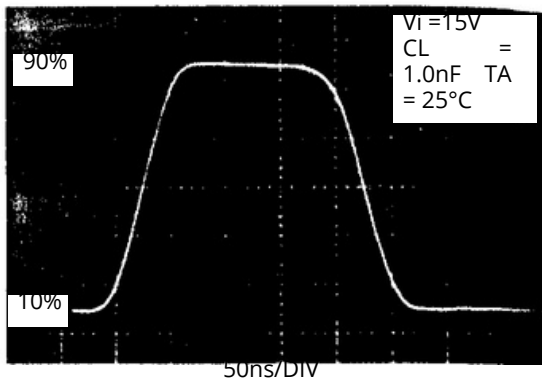
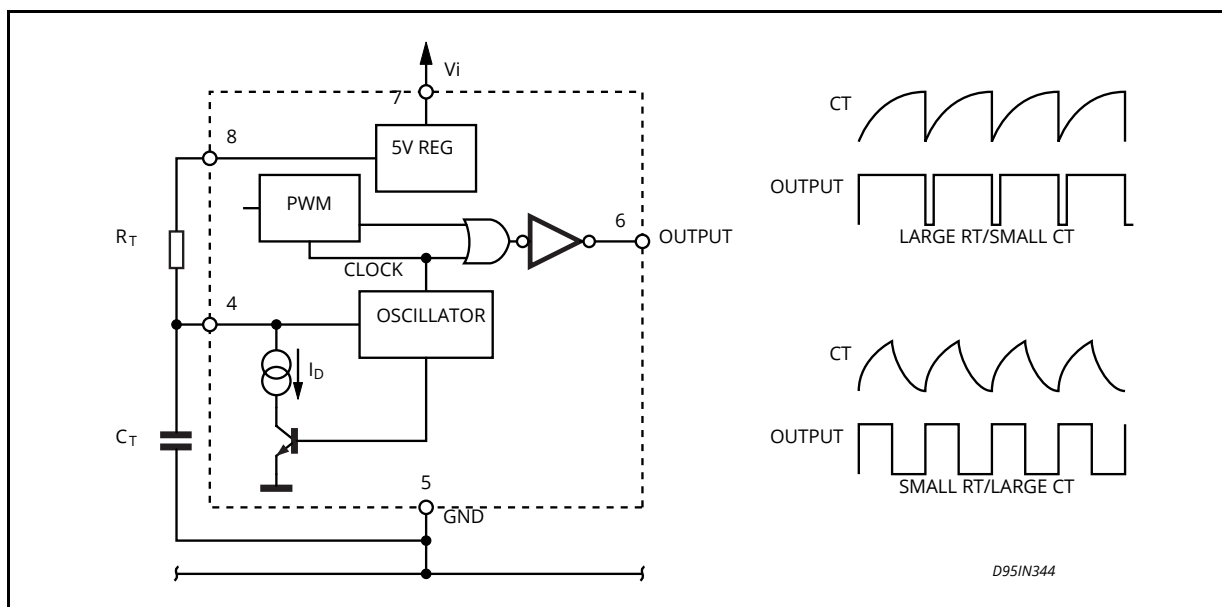


**Figure 14:** Oscillator and Output Waveforms.



## UC2842B/3B/4B/5B - UC3842B/3B/4B/5B

**Figure 15 :** Error Amp Configuration.

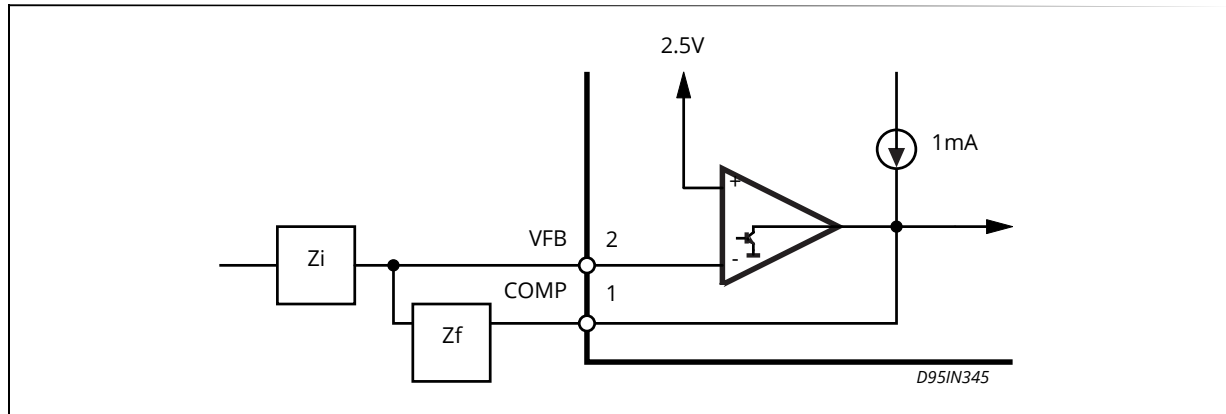


**Figure 16 :** Under Voltage Lockout.

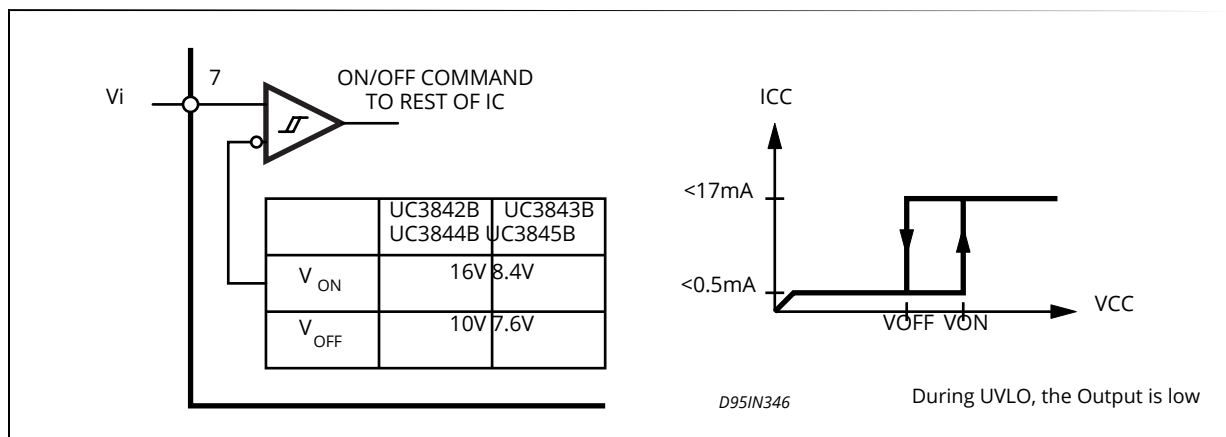
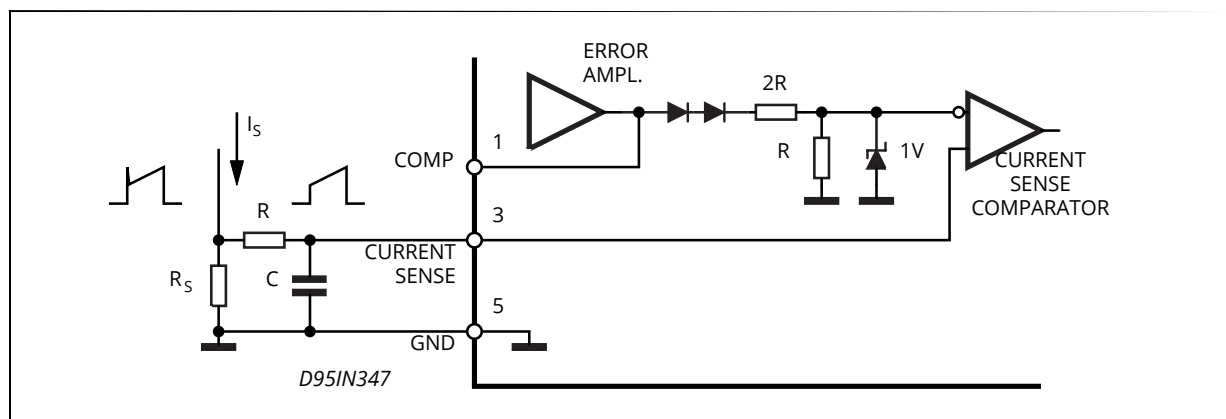


**Figure 17 :** Current Sense Circuit .



Peak current ( $i_s$ ) is determined by the formula

$$I_{S \text{ max}} \approx \frac{1.0V}{R_S}$$

$R_S$

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

**Figure 18 :** Slope Compensation Techniques.

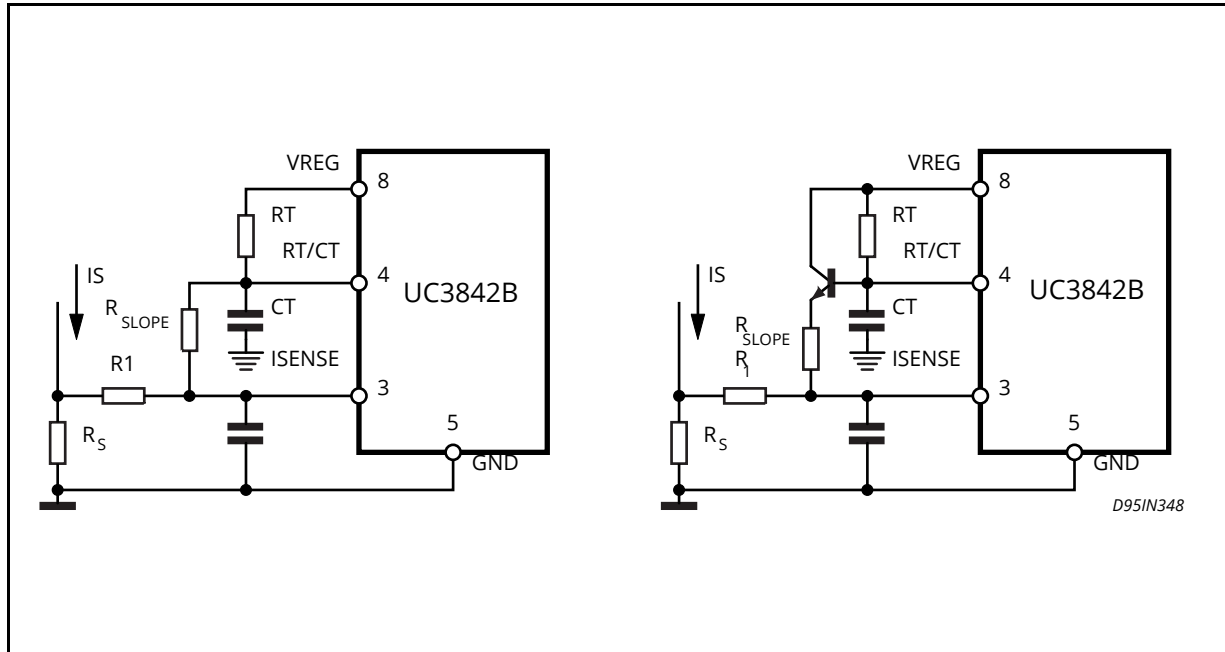


**Figure 19 :** Isolated MOSFET Drive and Current Transformer Sensing.

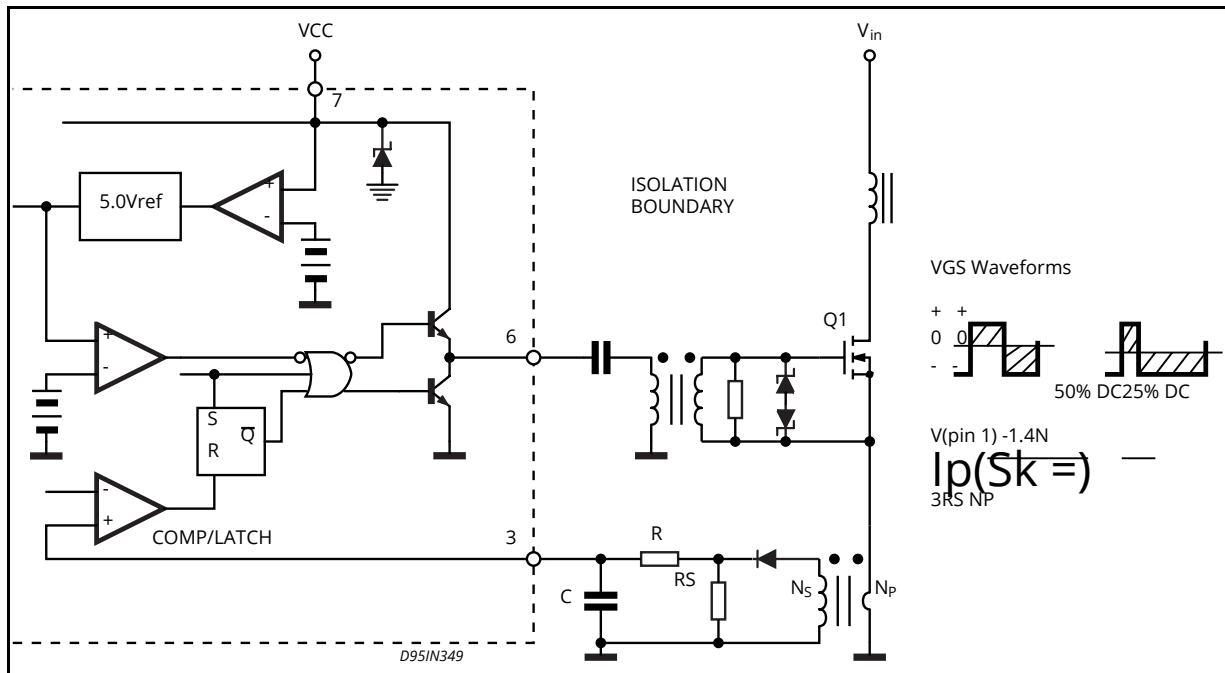


**Figure 20 :** Latched Shutdown.

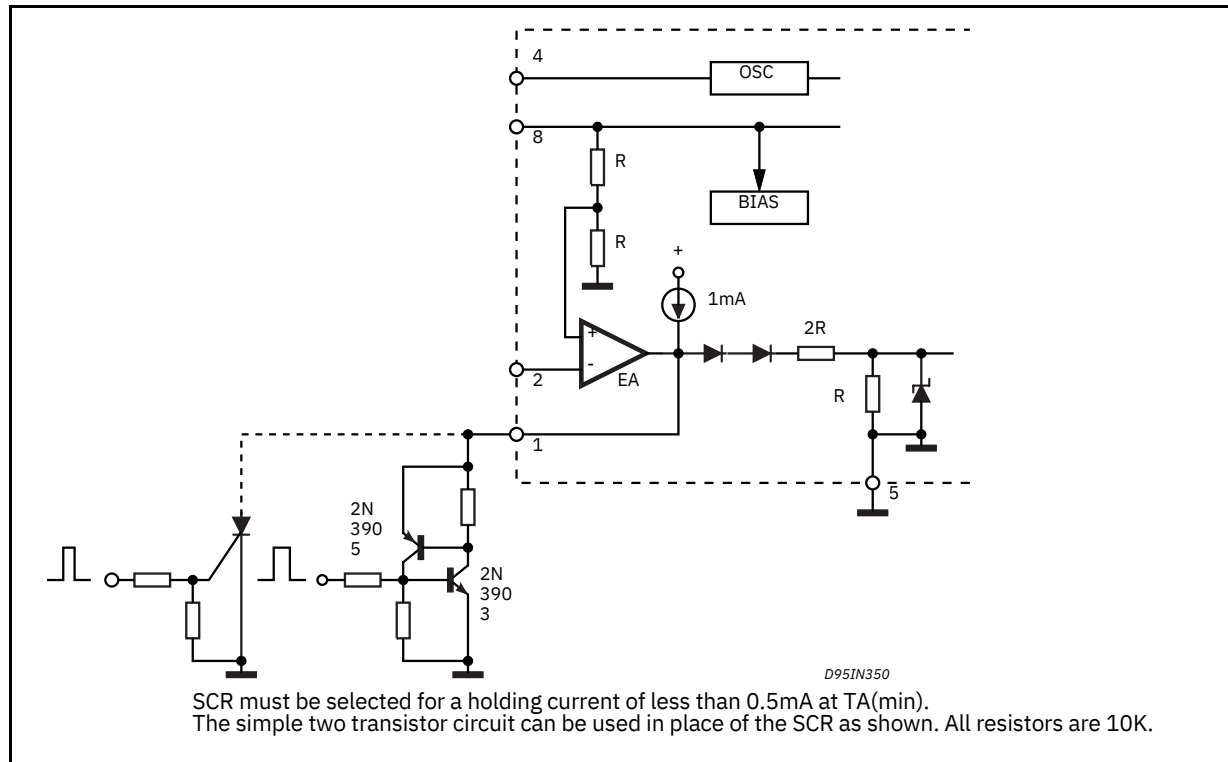


**Figure 21:** Error Amplifier Compensation

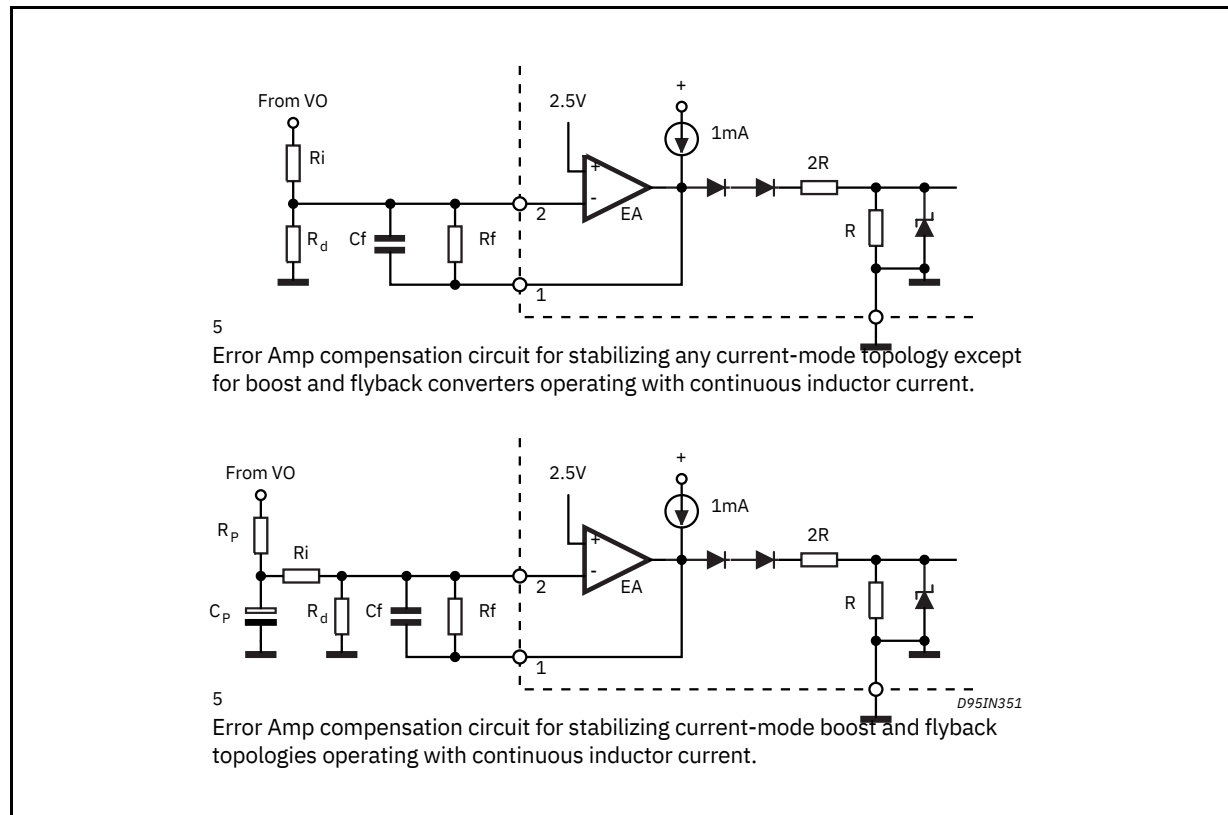


**Figure 22:** External Clock Synchronization.

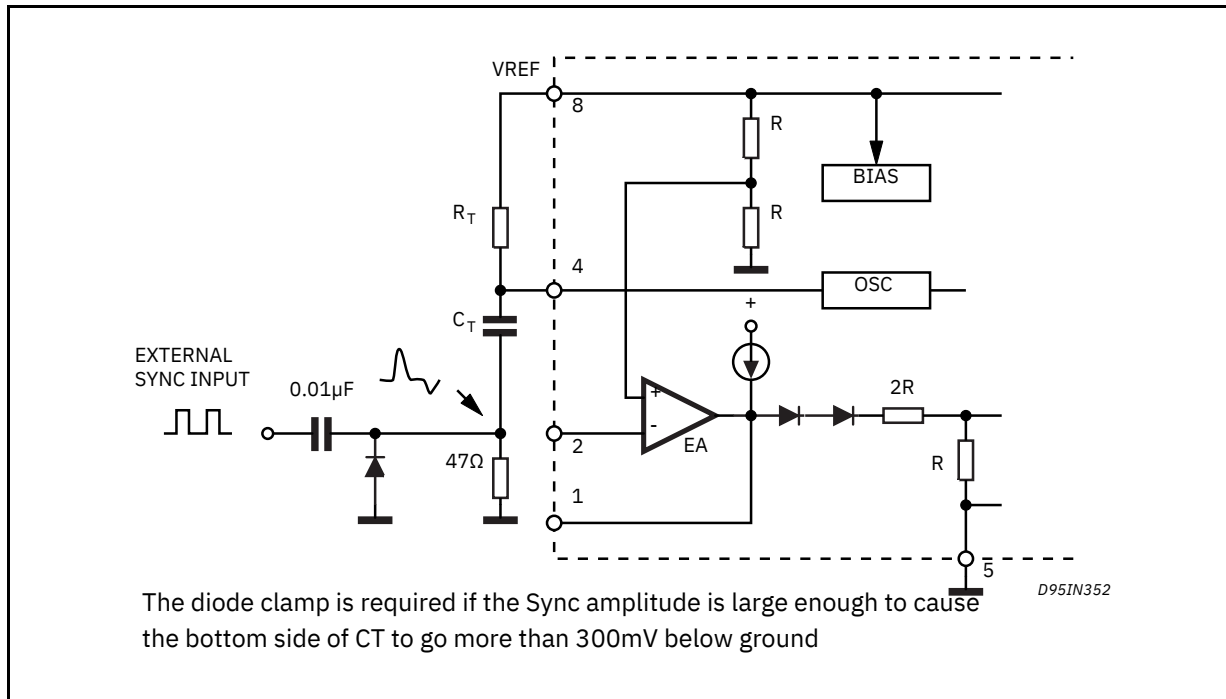


**Figure 23:** External Duty Cycle Clamp and Multi Unit Synchronization.

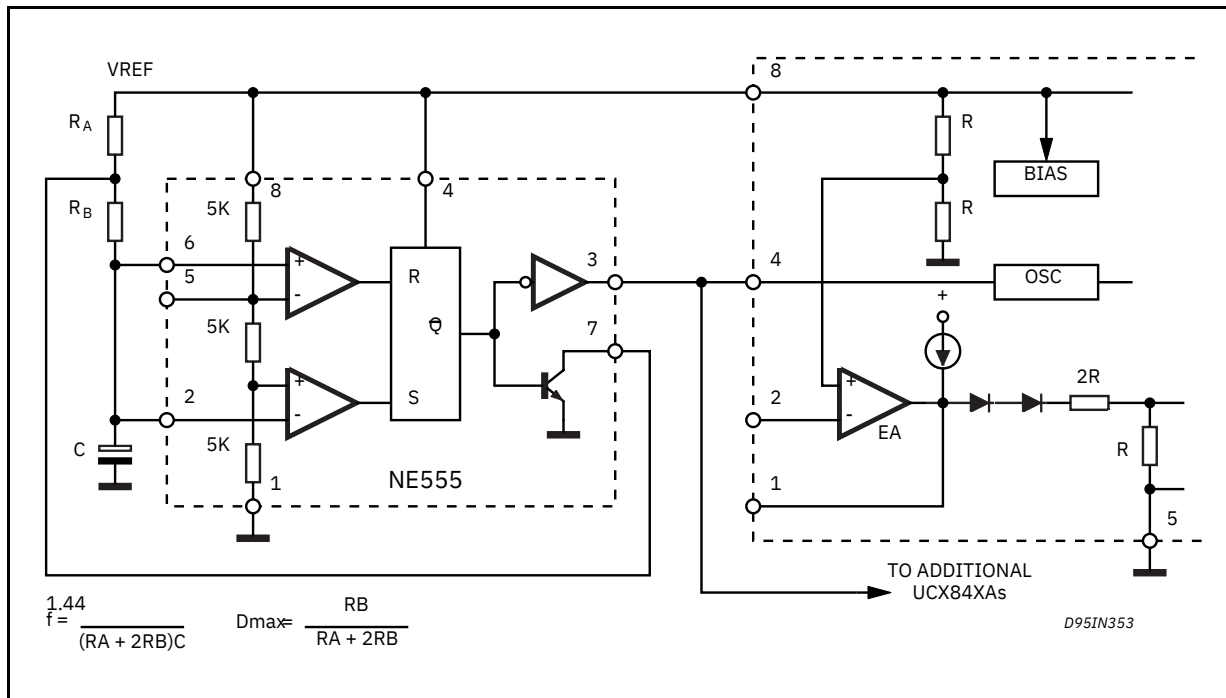


**Figure 24:** Soft-Start Circuit

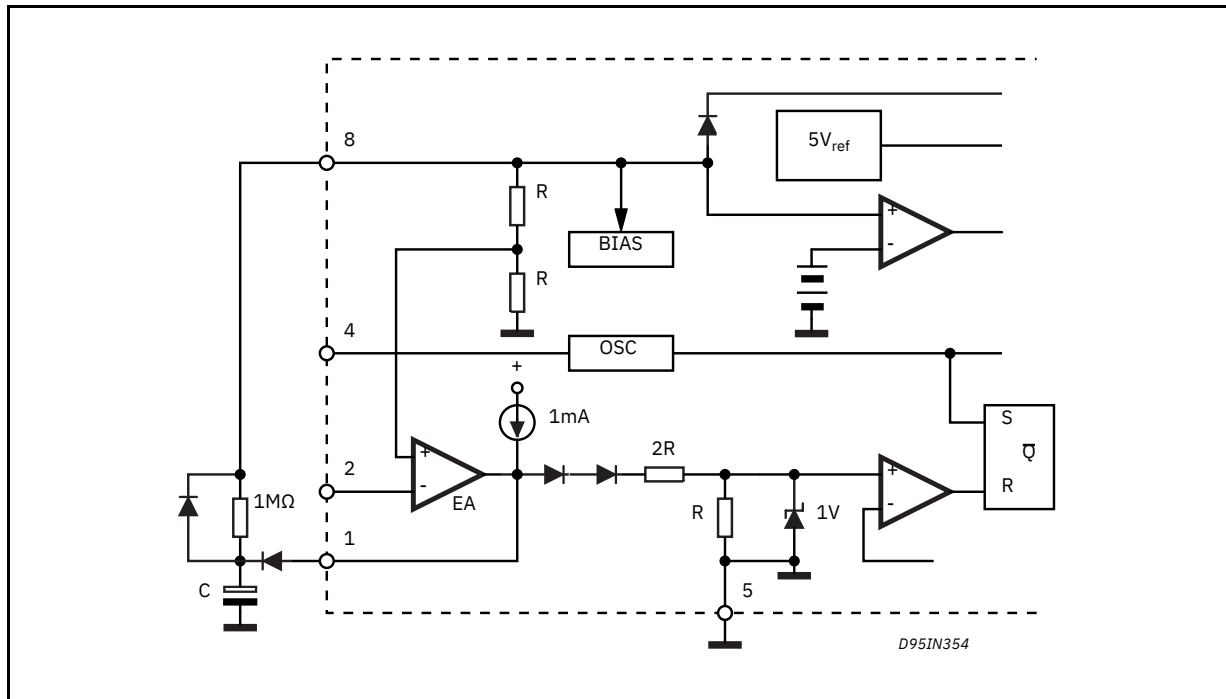
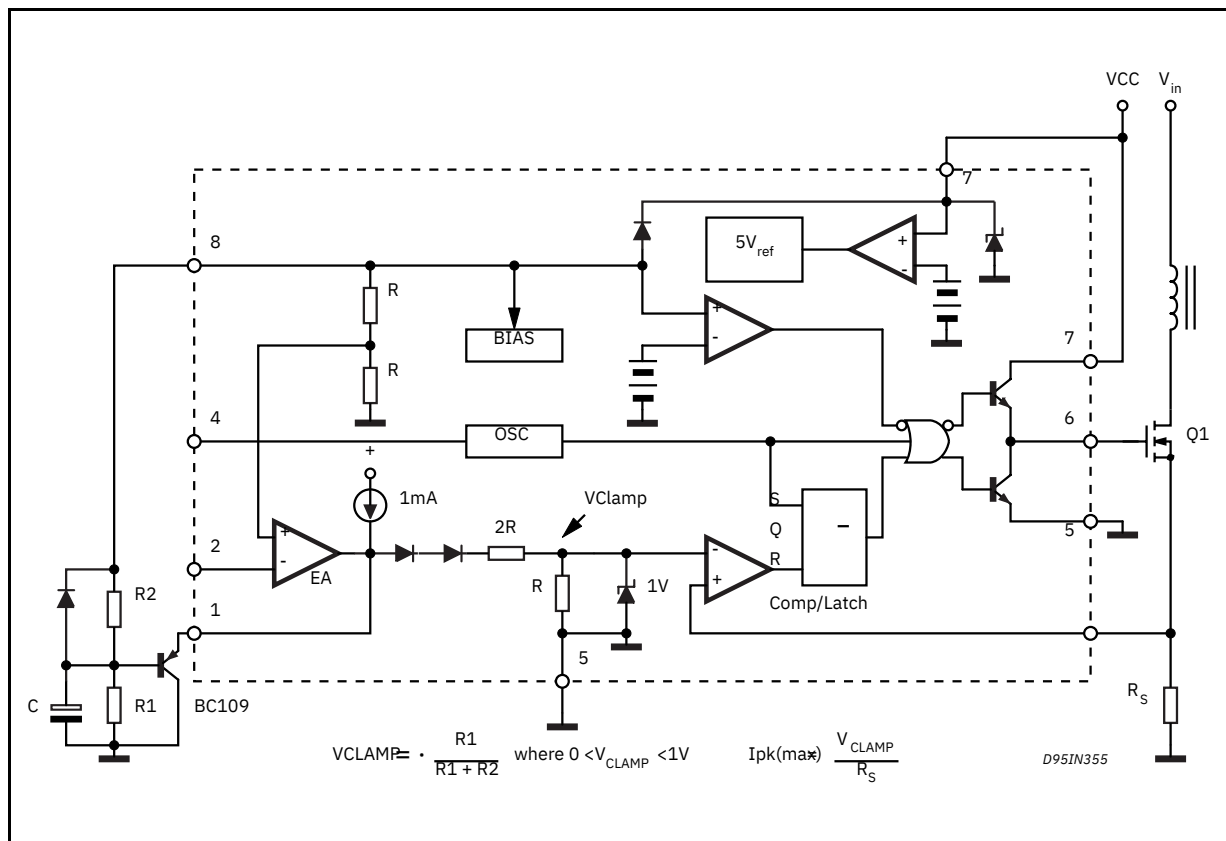


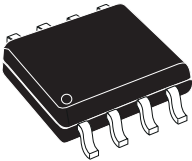
**Figure 25:** Soft-Start and Error Amplifier Output Duty Cycle Clamp.



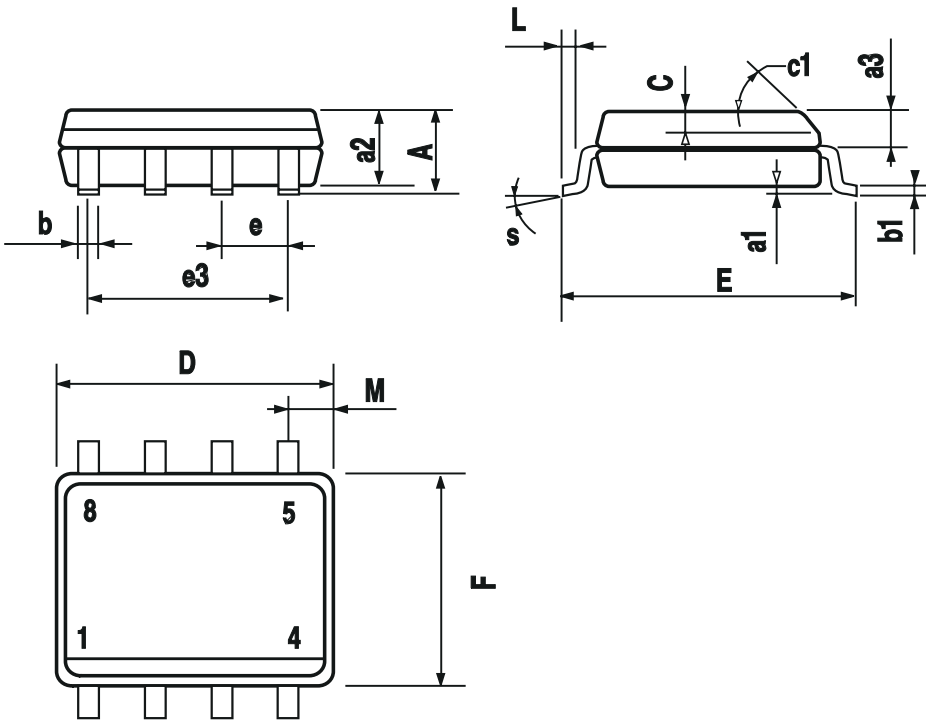
| DIM.  | mm   |            |           | inch  |      |       |
|-------|------|------------|-----------|-------|------|-------|
|       | MIN. | TYP.       | MAX.      | MIN.  | TYP. | MAX.  |
| A     |      |            | 1.75      |       |      | 0.069 |
| a1    | 0.1  |            | 0.25      | 0.004 |      | 0.010 |
| a2    |      |            | 1.65      |       |      | 0.065 |
| a3    | 0.6  |            | 0.85      | 0.026 |      | 0.033 |
| b     | 5    |            | 0.48      | 0.014 |      | 0.019 |
| b1    | 0.3  |            | 0.25      | 0.007 |      | 0.010 |
| C     | 5    |            | 0.5       | 0.010 |      | 0.020 |
| c1    | 0.1  | 45° (typ.) |           |       |      |       |
| D (1) | 9.1  |            | 5.0       | 0.189 | 6.2  | 0.19  |
| E     | Ø2   |            |           | 0.228 |      | 7     |
| e     | 5.1  | 1.2        |           |       | 0.05 | 0.24  |
| e3    | 8    | 7          |           |       | 0    | 4     |
| F (1) | 3.1  | 3.8        | 4.0       | 0.15  | 1.27 | 0.15  |
| L     | 8    | 1          | 0.016     | 0.6   | 0    | 7     |
| M     | 0.1  |            | 8° (max.) |       |      | 0.05  |
| S     | 4    |            |           |       |      | 0     |

(1) D and F do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch).

OUTLINE AND MECHANICAL DATA



S08

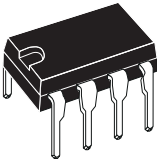


UC2842B/3B/4B/5B - UC3842B/3B/4B/5B

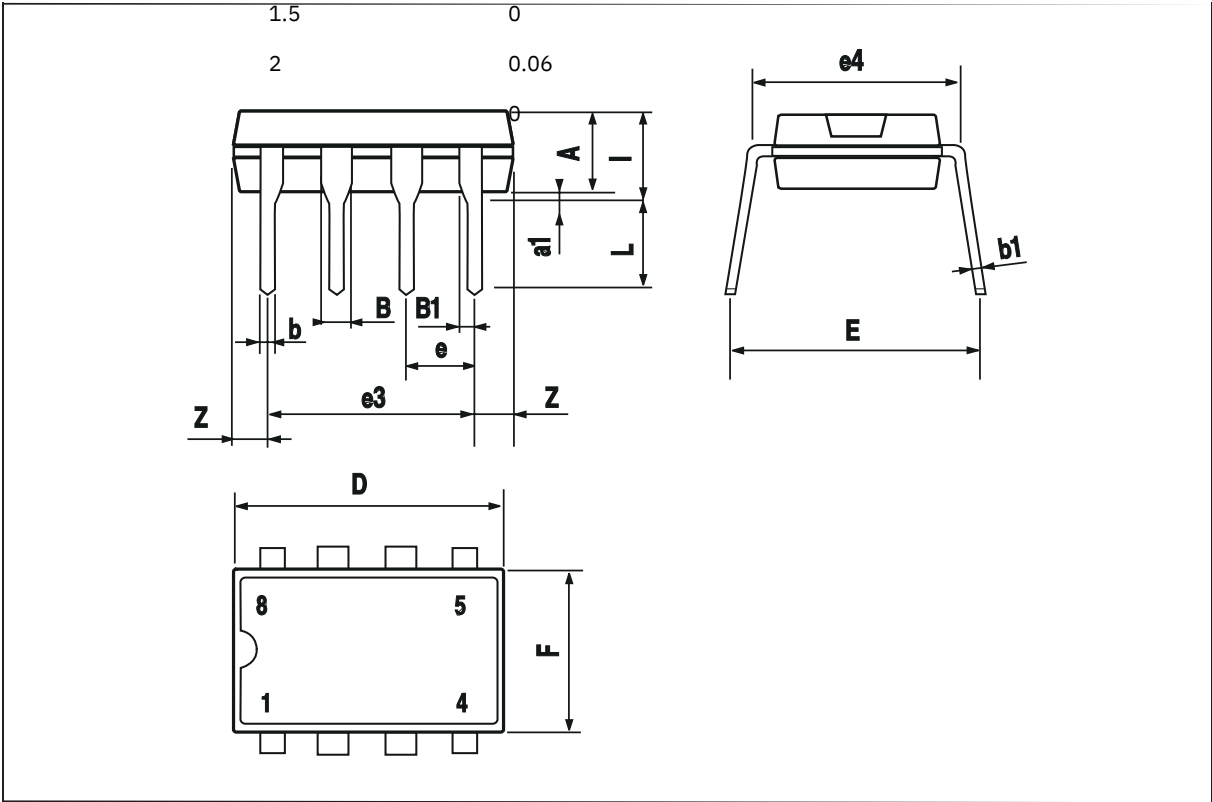
| DIM. | mm   |      |      | inch  |       |      |
|------|------|------|------|-------|-------|------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX. |
| A    |      | 3.32 |      |       | 0.131 |      |
| a1   | 0.51 |      |      | 0.02  |       |      |
| B    | 1.15 |      | 1.65 | 0     |       | 0.06 |
| b    | 0.35 |      | 0.55 | 0.04  |       | 5    |
| b    | 6    |      | 0.30 | 5     |       | 0.02 |
| 1    | 0.20 |      | 4    | 0.01  |       | 2    |
| D    | 4.95 |      | 10.9 | 0.313 |       | 0.01 |
| E    |      | 2.5  | 2    | 0.00  | 0.10  | 2    |
| e    |      | 4    | 9.75 | 8     | 0     | 0.43 |
| e3   |      | 7.6  |      |       | 0.30  | 0    |
| e4   |      | 2    | 6.6  |       | 0     | 0.28 |
| F    |      | 7.6  | 5.0  |       | 0.30  | 0    |
| I    | 3.18 | 2    | 8    | 0.125 | 0     | 0.20 |
| L    |      |      | 3.8  |       |       | 0    |

Z 1 0.15

OUTLINE AND  
MECHANICAL DATA



Minidip



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