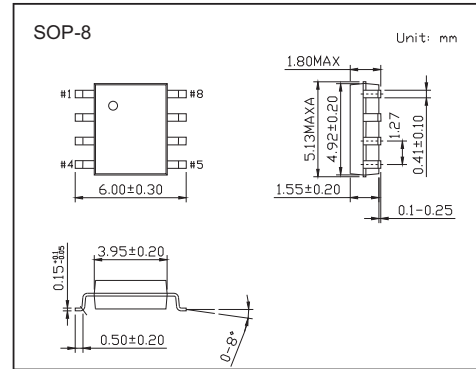


Power Factor Controllers

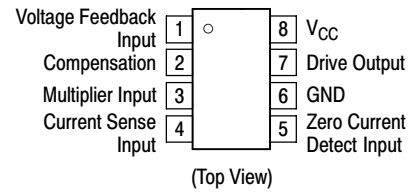
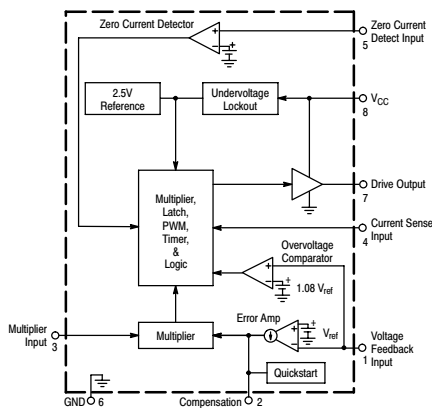
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Features

- Overvoltage Comparator Eliminates Runaway Output Voltage
- Internal Startup Timer
- One Quadrant Multiplier
- Zero Current Detector
- Trimmed 2% Internal Bandgap Reference
- Totem Pole Output with High State Clamp
- Undervoltage Lockout with 6.0 V of Hysteresis
- Low Startup and Operating Current



Functional Block Diagram



Absolute Maximum Ratings $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Rating | Unit |
|--|------------------|-------------|---------------------------|
| Total Power Supply and Zener Current | $(I_{cc} + I_z)$ | 30 | mA |
| Output Current, Source or Sink (Note 1) | I_o | 500 | mA |
| Current Sense, Multiplier, and Voltage Feedback Inputs | V_{in} | -1.0 to +10 | V |
| Zero Current Detect Input High State Forward Current Low State Reverse Current | I_{in} | 50 -10 | mA |
| Power Dissipation @ $T_A = 70^\circ\text{C}$ | P_D | 450 | mW |
| Thermal Resistance, Junction to Air | $R_{\theta JA}$ | 178 | $^\circ\text{C}/\text{W}$ |
| Operating Junction Temperature | T_J | 150 | $^\circ\text{C}$ |
| Operating Ambient Temperature Range | T_A | 0 to +85 | $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | -65 to +150 | $^\circ\text{C}$ |

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

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Electrical Characteristics ($V_{CC} = 12\text{ V}$ (Note 2), for typical values $T_A = 25^\circ\text{C}$, for min/max values T_A is the operating ambient temperature range that applies (Note 3), unless otherwise noted.)

| Parameter | Symbol | Test conditons | Min | Typ | Max | Unit |
|--|------------------------------|--|---------------------------------------|---------------------------------------|----------------|-----------------|
| Voltage Feedback Input Threshold $T_A = 25^\circ\text{C}$ $T_A = T_{\text{low}} \text{ to } T_{\text{high}}$ | V_{FB} | | 2.465 | 2.5 | 2.535 | V |
| | | $V_{CC} = 12\text{ V to } 28\text{ V}$ | 2.44 | | 2.54 | |
| Line Regulation | Reg_{line} | $V_{CC} = 12\text{ V to } 28\text{ V}$ | | 1.0 | 10 | mV |
| Input Bias Current | I_{IB} | $V_{FB} = 0\text{ V}$ | | -0.1 | -0.5 | μA |
| Transconductance | g_m | | 80 | 100 | 130 | μmho |
| Output Current ---Source ---Sink | I_O | $V_{FB} = 2.3\text{ V}$ $V_{FB} = 2.7\text{ V}$ | | 10 10 | | μA |
| Output Voltage Swing High State Low State | $V_{OH(ea)}$ $V_{OL(ea)}$ | $V_{FB} = 2.3\text{ V}$ $V_{FB} = 2.7\text{ V}$ | 5.8 | 6.4 1.7 | 2.4 | V |
| Voltage Feedback Input Threshold | $V_{FB(OV)}$ | | $1.065 V_{FB}$ | $1.08 V_{FB}$ | $1.095 V_{FB}$ | V |
| Input Threshold | $V_{th(M)}$ | | $1.05 V_{OL(EA)}$ | $1.05 V_{OL(EA)}$ | | V |
| Dynamic Input Voltage Range | | | | | | |
| Multiplier Input (Pin 3) | $V_{Pin 3}$ | | 0 to 2.5 | 0 to 3.5 | | V |
| Compensation (Pin 2) | $V_{Pin 2}$ | | $V_{th(M)}$ to $(V_{th(M)} + 1.0)$ | $V_{th(M)}$ to $(V_{th(M)} + 1.5)$ | | |
| Multiplier Gain (Note 4) | K | $V_{Pin 3} = 0.5\text{ V}, V_{Pin 2} = V_{th(M)} + 1.0\text{ V}$ | 0.43 | 0.65 | 0.87 | 1/V |
| ZERO CURRENT DETECTOR | | | | | | |
| Input Threshold Voltage (V_{in} Increasing) | V_{th} | | 1.3 | 1.6 | 1.87 | V |
| Hysteresis (V_{in} Decreasing) | V_H | | 100 | 200 | 300 | mV |
| Input Clamp Voltage High State Low State | V_{IH} V_{IL} | $I_{DET} = + 3.0\text{ mA}$ $I_{DET} = ? 3.0\text{ mA}$ | 6.1 0.3 | 6.7 0.7 | | V |
| CURRENT SENSE COMPARATOR | | | | | | |
| Input Bias Current | I_{IB} | $V_{Pin 4} = 0\text{ V}$ | | -0.15 | -1.0 | μA |
| Input Offset Voltage | | $V_{Pin 2} = 1.1\text{ V}, V_{Pin 3} = 0\text{ V}$ | | 9.0 | 25 | mV |
| Maximum Current Sense Input Threshold | $V_{th(max)}$ | $V_{FB} = 0\text{ V}, \text{ and } V_{Pin 3} = 3.0\text{ V}$ | 1.3 | 1.5 | 1.8 | |
| Delay to Output | $t_{PHL(in/out)}$ | | | 200 | 400 | ns |
| DRIVE OUTPUT | | | | | | |
| Output Voltage Low State High State | V_{OL} V_{OH} | $I_{Sink} = 20\text{ mA}$ $I_{Sink} = 200\text{ mA}$ $I_{Source} = 20\text{ mA}$ $I_{Source} = 200\text{ mA}$ | | 0.3 2.4 9.8 7.8 | 0.8 3.3 | V |
| Output Voltage --High State | $V_{O(max)}$ | $V_{CC} = 30\text{ V}, I_{Source} = 20\text{ mA},$ $C_L = 15\text{ pF}$ | 14 | 16 | 18 | V |
| Output Voltage Rise Time | t_r | $C_L = 1.0\text{ nF}$ | | 50 | 120 | ns |
| Output Voltage Fall Time | t_f | $C_L = 1.0\text{ nF}$ | | 50 | 120 | ns |
| Output Voltage with UVLO Activated | $V_{O(UVLO)}$ | $V_{CC} = 7.0\text{ V}, I_{Sink} = 1.0\text{ mA}$ | | 0.1 | 0.5 | V |

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Electrical Characteristics (V_{CC} = 12 V (Note 2), for typical values T_A = 25°C, for min/max values T_A is the operating ambient temperature range that applies (Note 3), unless otherwise noted.)

| RESTART TIMER | | | | | | | |
|--|-----------------------|-------------------------|---------------------------------|-------------------------|------|----|-----|
| Restart Time Delay | tdLY | | 200 | 600 | | μs | |
| UNDERVOLTAGE LOCKOUT | | | | | | | |
| Startup Threshold (V _{CC} Increasing) | V _{th(on)} | | 11.5 | 13 | 14.5 | V | |
| Minimum Operating Voltage After Turn?On (V _{CC} Decreasing) | V _{Shutdown} | | 7.0 | 8.0 | 9.0 | V | |
| V _{Shutdown} | V _H | | 3.8 | 5.0 | 6.2 | V | |
| TOTAL DEVICE | | | | | | | |
| Power Supply Current | I _{CC} | V _{CC} = 7.0 V | 50 kHz, C _L = 1.0 nF | I _{CC} = 25 mA | | mA | |
| Startup | | | | | 0.25 | | 0.4 |
| Operating | | | | | 6.5 | | 12 |
| Dynamic Operating | | | 9 | 20 | | | |
| Power Supply Zener Voltage | V _Z | | 30 | 36 | | V | |

NOTES: 2.Adjust V_{CC} above the startup threshold before setting to 12 V.

3.T_{low} = 0°C, T_{high} = +85°C.

4. $K = \text{Pin 4 Threshold} / (V_{\text{Pin 3}} - V_{\text{th(M)}})$

Typical Characteristics

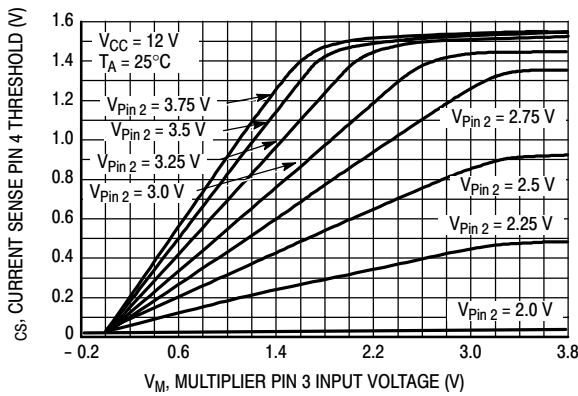


Figure 3. Current Sense Input Threshold versus Multiplier Input

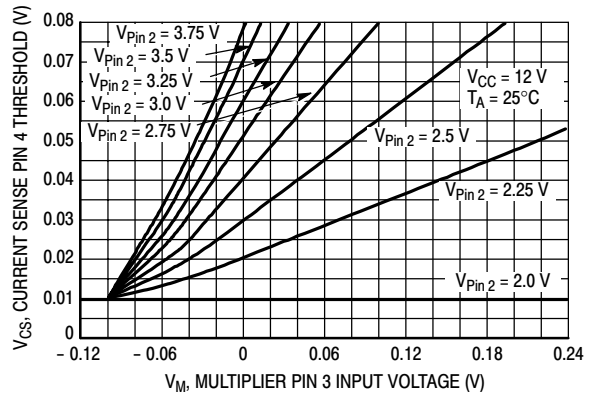


Figure 4. Current Sense Input Threshold versus Multiplier Input, Expanded View

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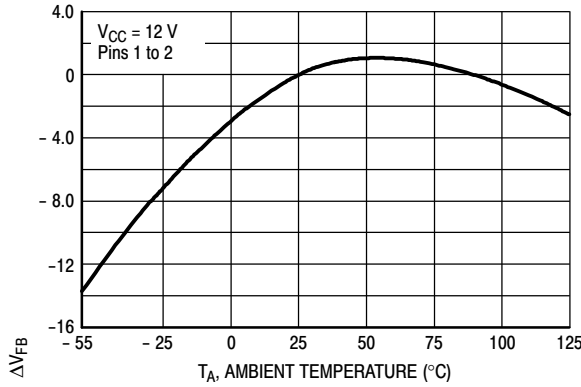


Figure 3. Voltage Feedback Input Threshold Change versus Temperature

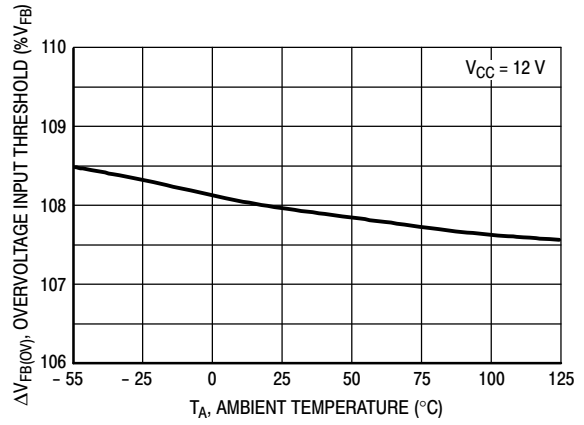


Figure 4. Overvoltage Comparator Input Threshold versus Temperature

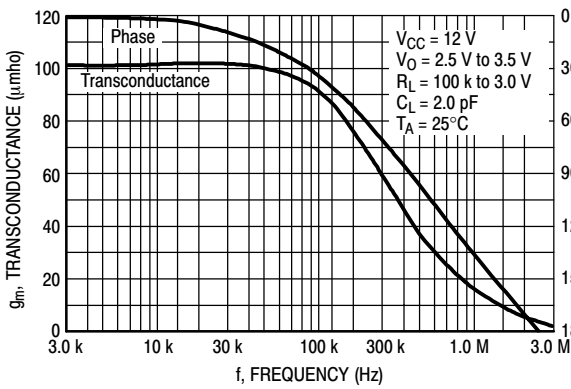


Figure 5. Error Amp Transconductance and Phase versus Frequency

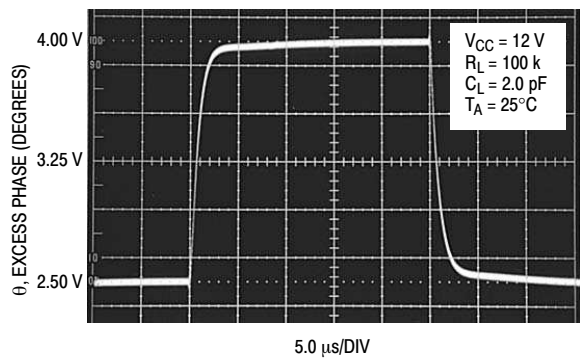


Figure 6. Error Amp Transient Response

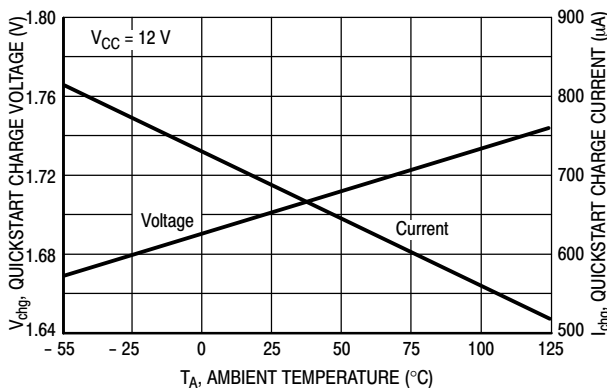


Figure 7. Quickstart Charge Current versus Temperature

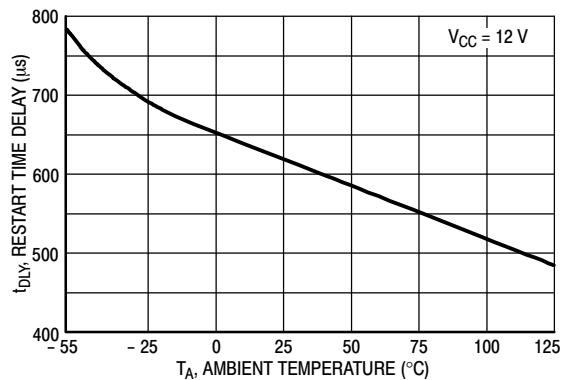


Figure 8. Restart Timer Delay versus Temperature

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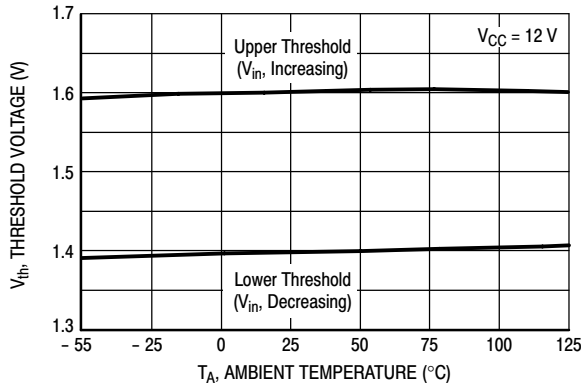


Figure 9. Zero Current Detector Input Threshold Voltage versus Temperature

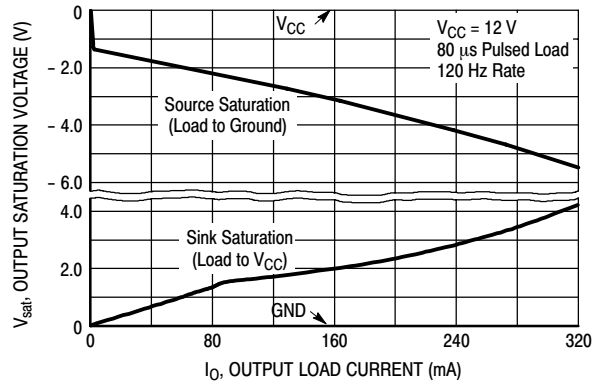


Figure 10. Output Saturation Voltage versus Load Current

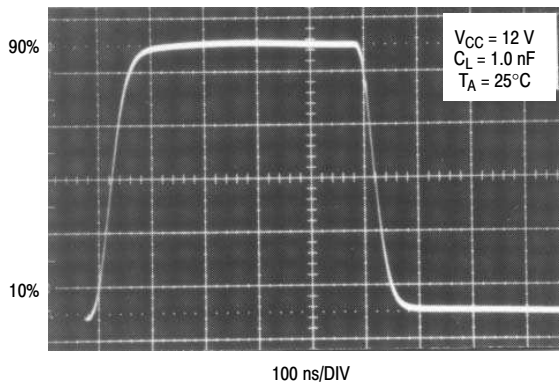


Figure 11. Drive Output Waveform

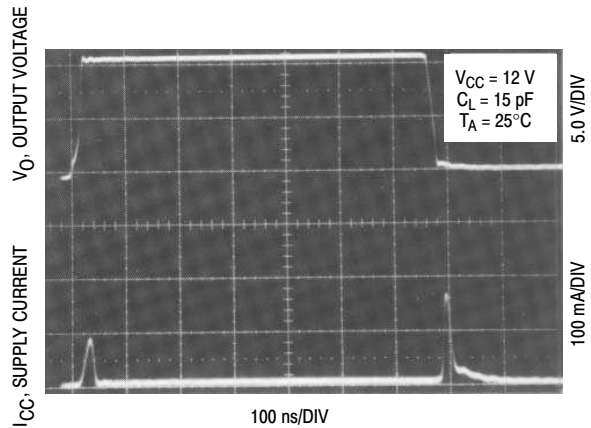


Figure 12. Drive Output Cross Conduction

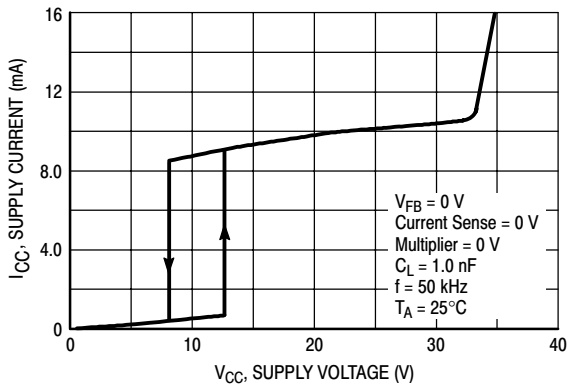


Figure 13. Supply Current versus Supply Voltage

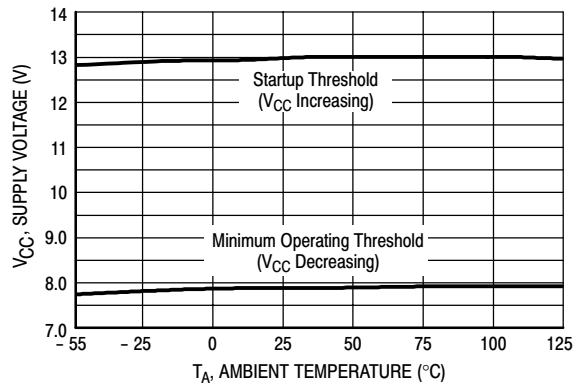


Figure 14. Undervoltage Lockout Thresholds versus Temperature

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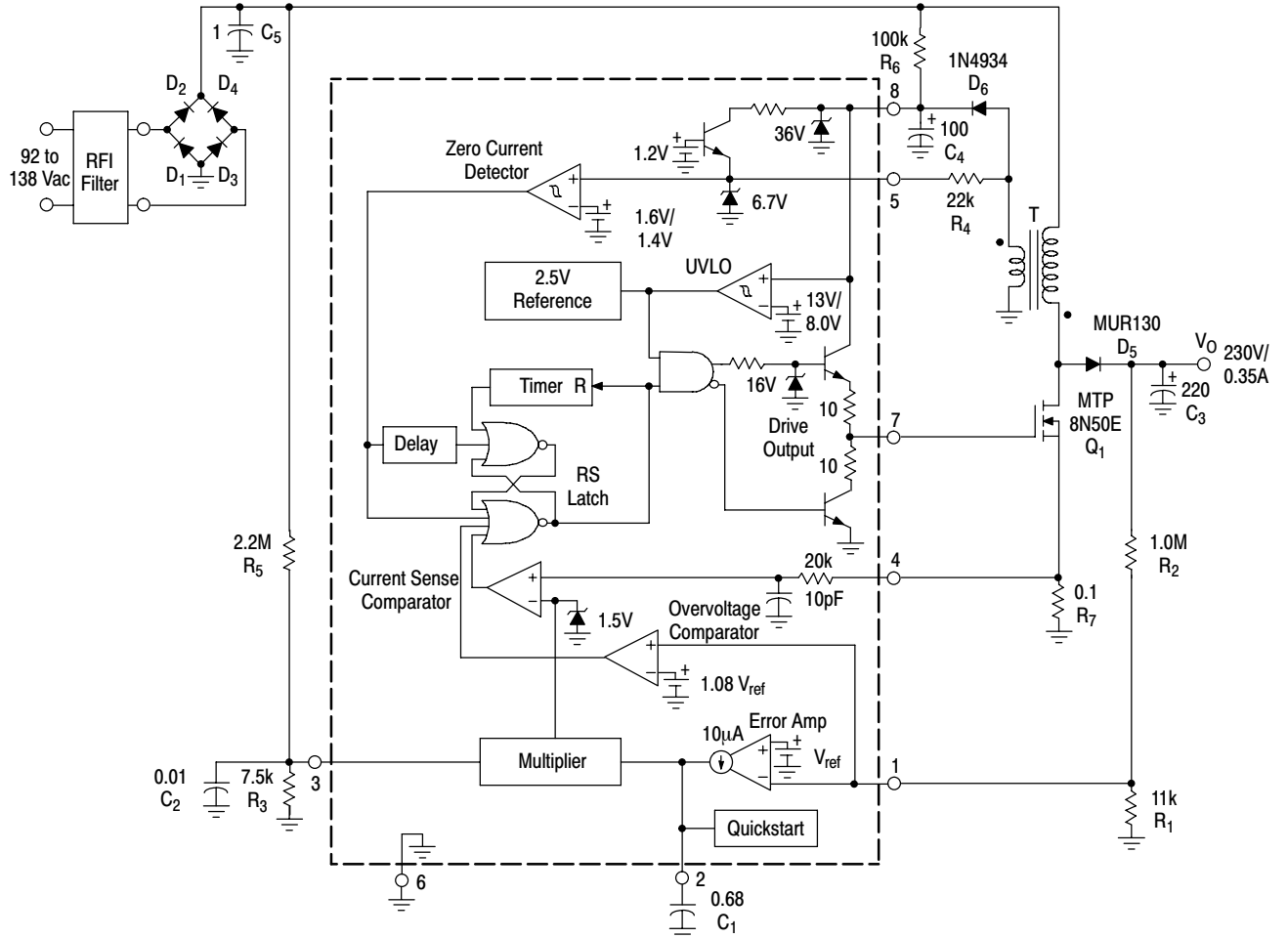


Figure 15. 80 W Power Factor Controller

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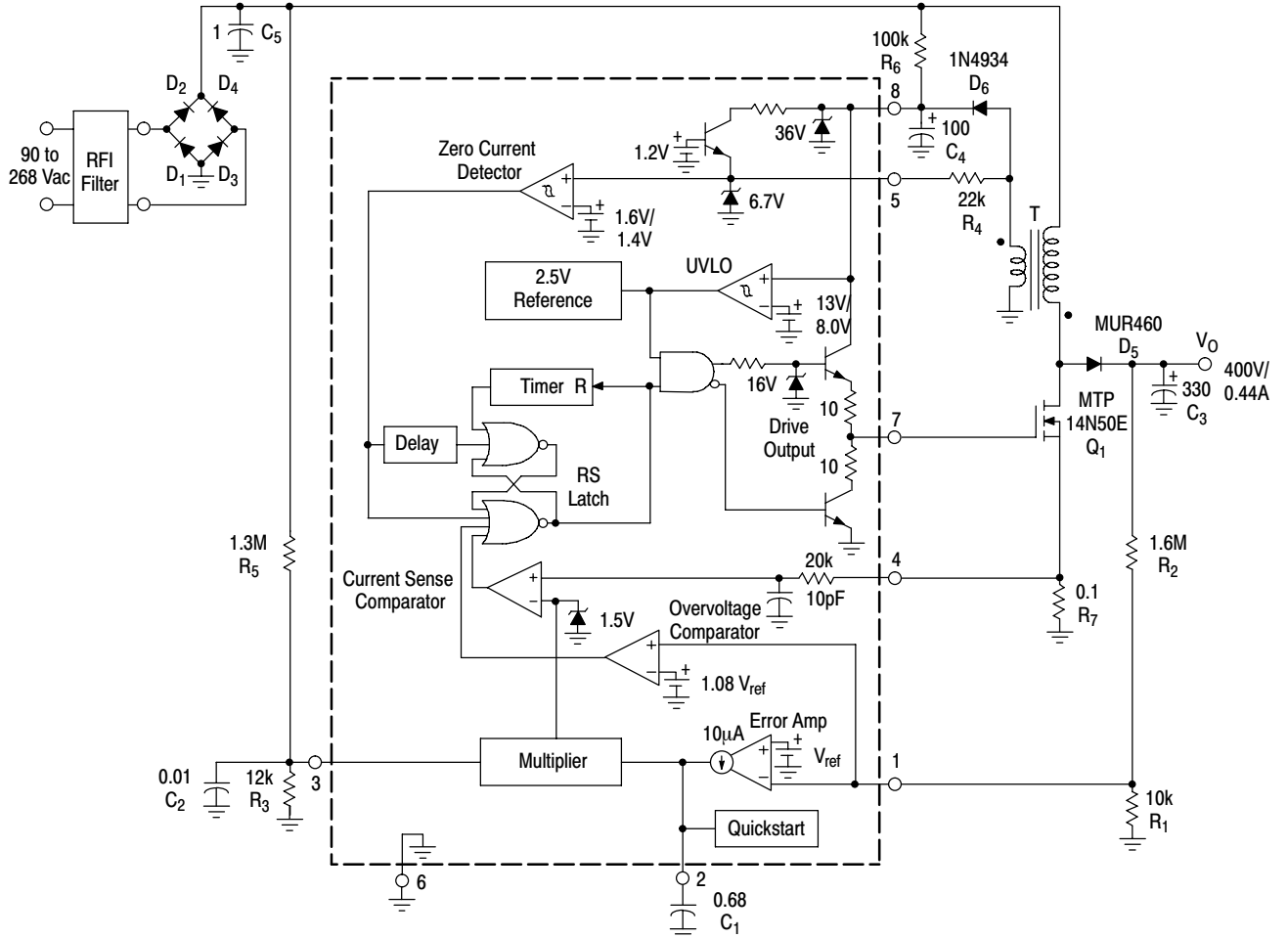


Figure 16. 175 W Universal Input Power Factor Controller

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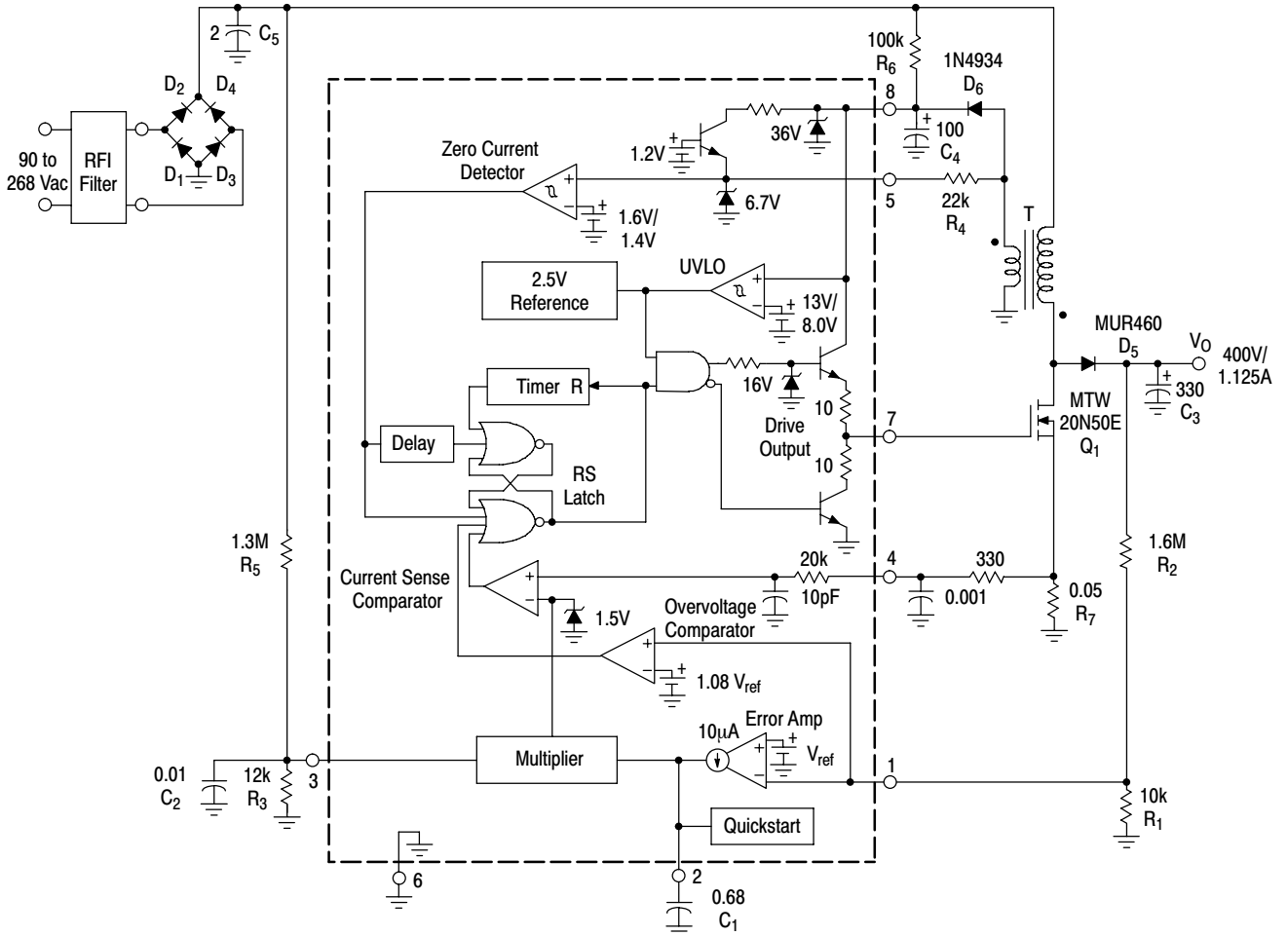


Figure 17. 450 W Universal Input Power Factor Controller