

## DESCRIPTION

Demonstration circuit 561 is a high current step-down PolyPhase™ converter featuring the LTC®3731 three-phase synchronous buck controller. To minimize the supply footprint size and improve the thermal performance, the 5mm x 5mm QFN package LTC3731CUH controller is used. The switching frequency of the LTC3731 is in the 250kHz to 600kHz range. The input voltage is from 10V to 14V and output is 1.5V. An optional VID controller circuit is available on both DC561A-A and DC561A-B demo circuits for output voltage programming. DC561A-A can provide up to 180A output current with a 12-phase buck circuit, while DC561A-B is a 6-phase buck converter

with up to 90A output current. Optional 0.1% external voltage reference and external OP-AMP compensation circuits are also available on DC561A-A and DC561A-B for accurate voltage regulation and best transient response. Additional MOSFETs can be populated for higher output current.

**Design files for this circuit board are available. Call the LTC factory.**

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**Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )**

| PARAMETER                   | CONDITION                                                                                                                                                                 | VALUE                 |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Minimum Input Voltage       |                                                                                                                                                                           | 10V                   |
| Maximum Input Voltage       |                                                                                                                                                                           | 14V                   |
| $V_{OUT}$                   | DC561A-A: $I_{OUT} = 0\text{A to } 180\text{A}$<br>DC561A-B: $I_{OUT} = 0\text{A to } 90\text{A}$                                                                         | $1.5\text{V} \pm 1\%$ |
| Nominal Switching Frequency | Set by resistor divider on demo circuit                                                                                                                                   | 450kHz                |
| Typical Efficiency          | DC561A-A: $V_{IN} = 12\text{V}$ , $V_{OUT} = 1.5\text{V}$ , $I_{OUT} = 180\text{A}$<br>DC561A-B: $V_{IN} = 12\text{V}$ , $V_{OUT} = 1.5\text{V}$ , $I_{OUT} = 90\text{A}$ | 83%<br>84%            |

## QUICK START PROCEDURE

Demonstration circuit 561 is easy to set up to evaluate the performance of the LTC3731. Refer to Figure 2. For proper measurement equipment setup and follow the procedure below:

1. Preset the following jumpers on the demo circuit: JP1-Int Prog, JP2-Off, JP4-Off, JP9-Int. and JP10-On. With above jumper setup, the supply is running at about 450kHz phase frequency, and using the on board +5V bias supply.
2. Preset the voltage of the input power supply to be 12V. Preset the current limit of the input power supply to be greater than 30A for DC561A-A or 15A

for DC561A-B. With power off, connect the input power supply to  $V_{in}$  and GND.

3. Connect the electronic load to  $V_{out+}$  and  $V_{out-}$ . Preset the load current to be 0A.
4. Turn on the power at the input.
5. Check for the proper output voltages at no load and full load (180A for DC561A-A and 90A for DC561A-B).  $V_{out} = 1.485\text{V to } 1.515\text{V}$ . A cooling fan is needed if the load current is higher than 50% of the full rated load current.

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 561A

## 6-PHASE 90A / 12-PHASE 180A HIGH EFFICIENCY POWER SUPPLY

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6. Adjust the loads within the operating range and observe the output voltage regulation, efficiency and other parameters.
7. (Optional) To perform the load transient test, set jumpers JP4-On and JP2-On. Use coaxial cables to

connect LOAD STEP and Vout+ coaxial outputs to oscilloscope inputs. Adjust R81 and R75 for desired load current step and rising slope. Adjust R73 for desired load current falling slope.

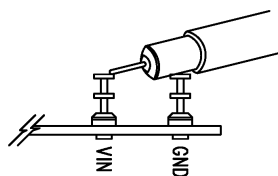
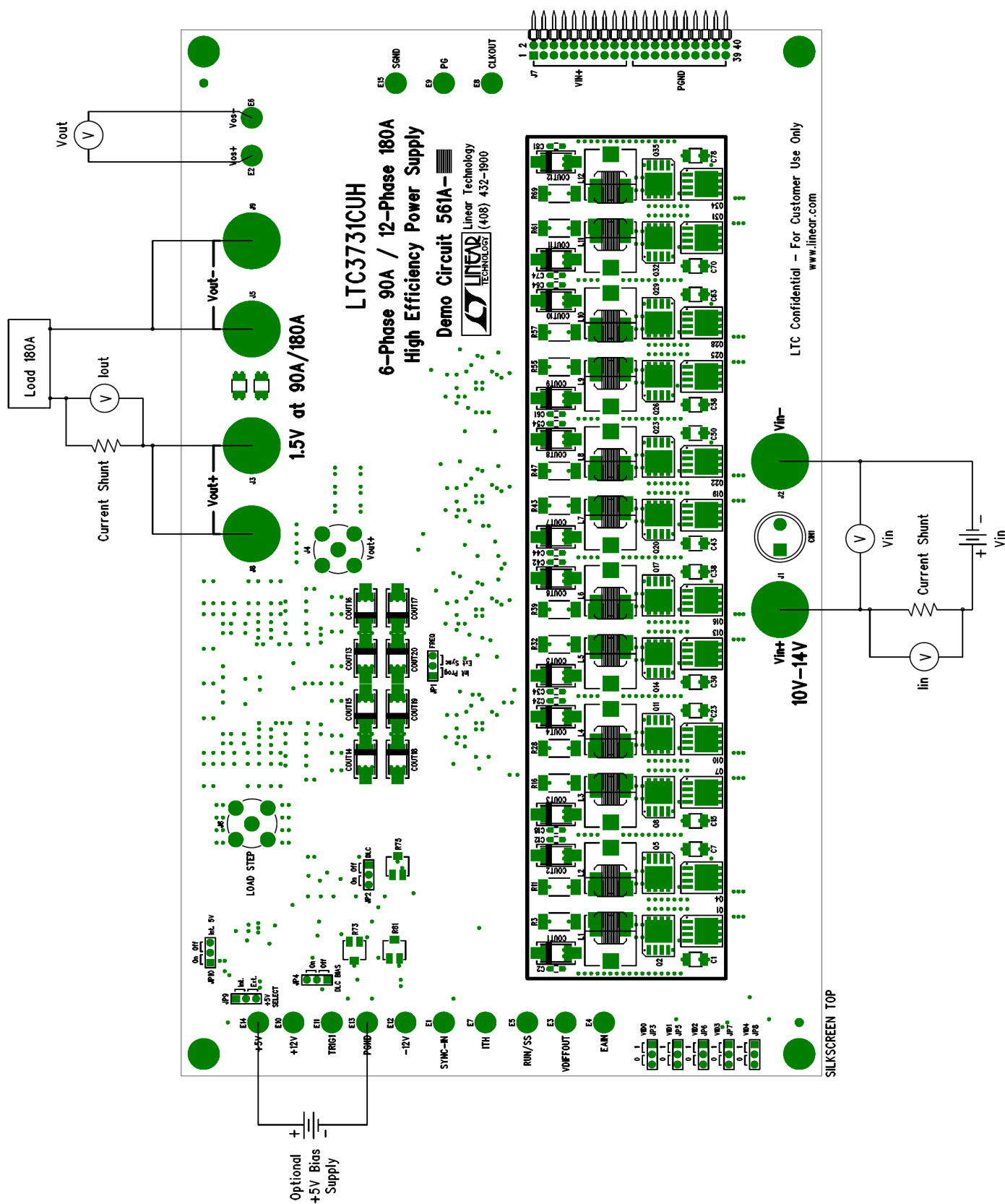


**Figure 1. Scope Probe Placement for Measuring Input or Output Ripple**

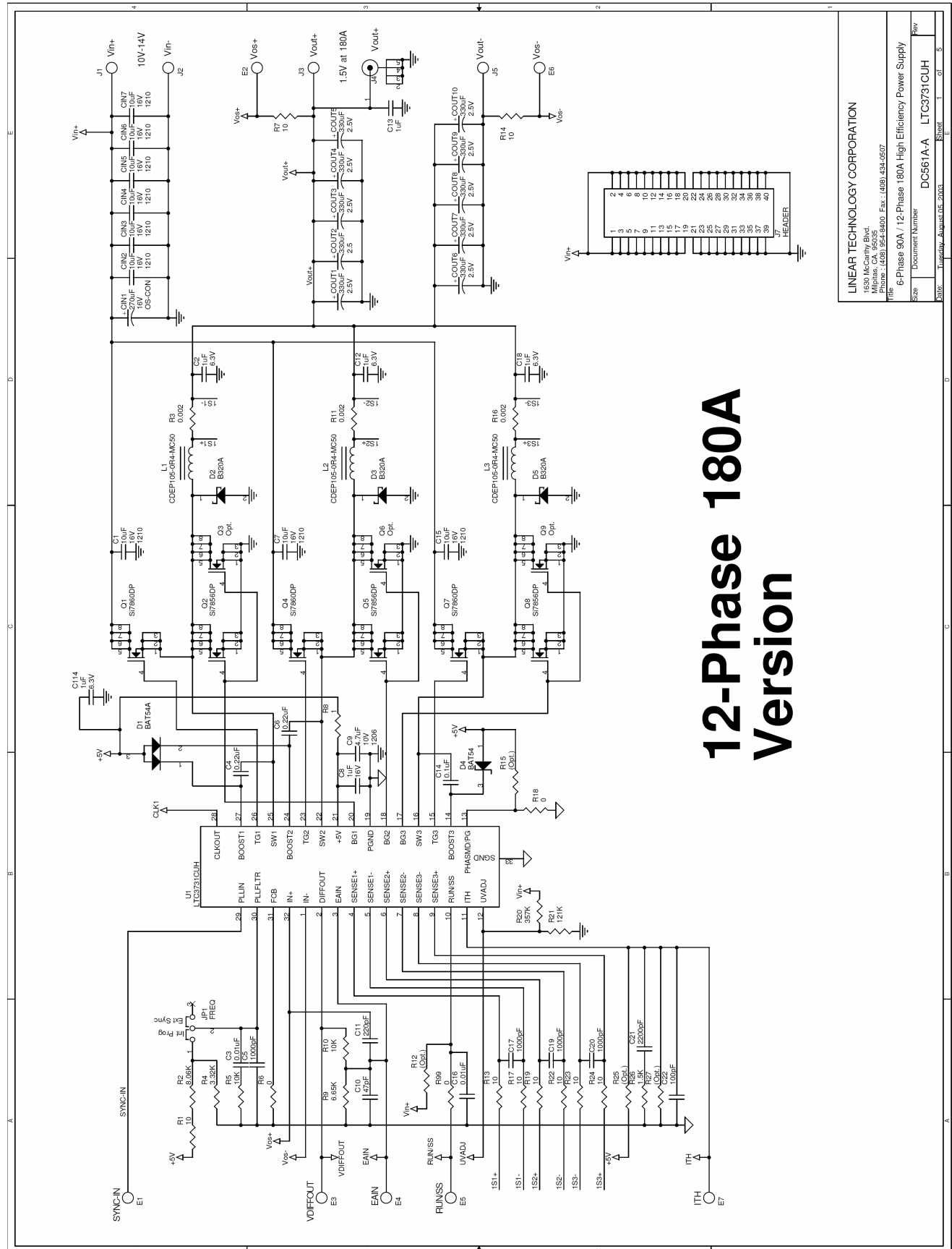
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## 6-PHASE 90A / 12-PHASE 180A HIGH EFFICIENCY POWER SUPPLY



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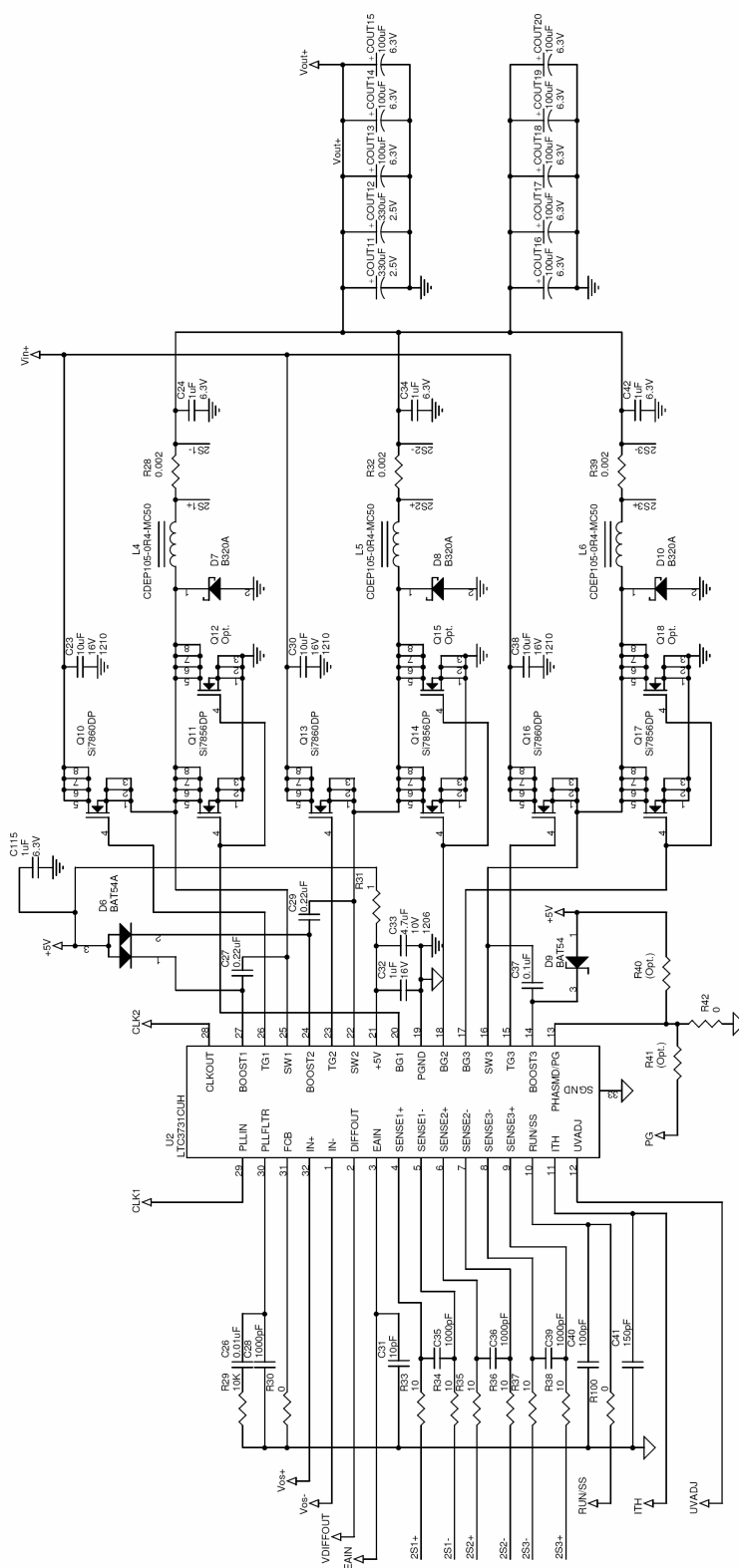
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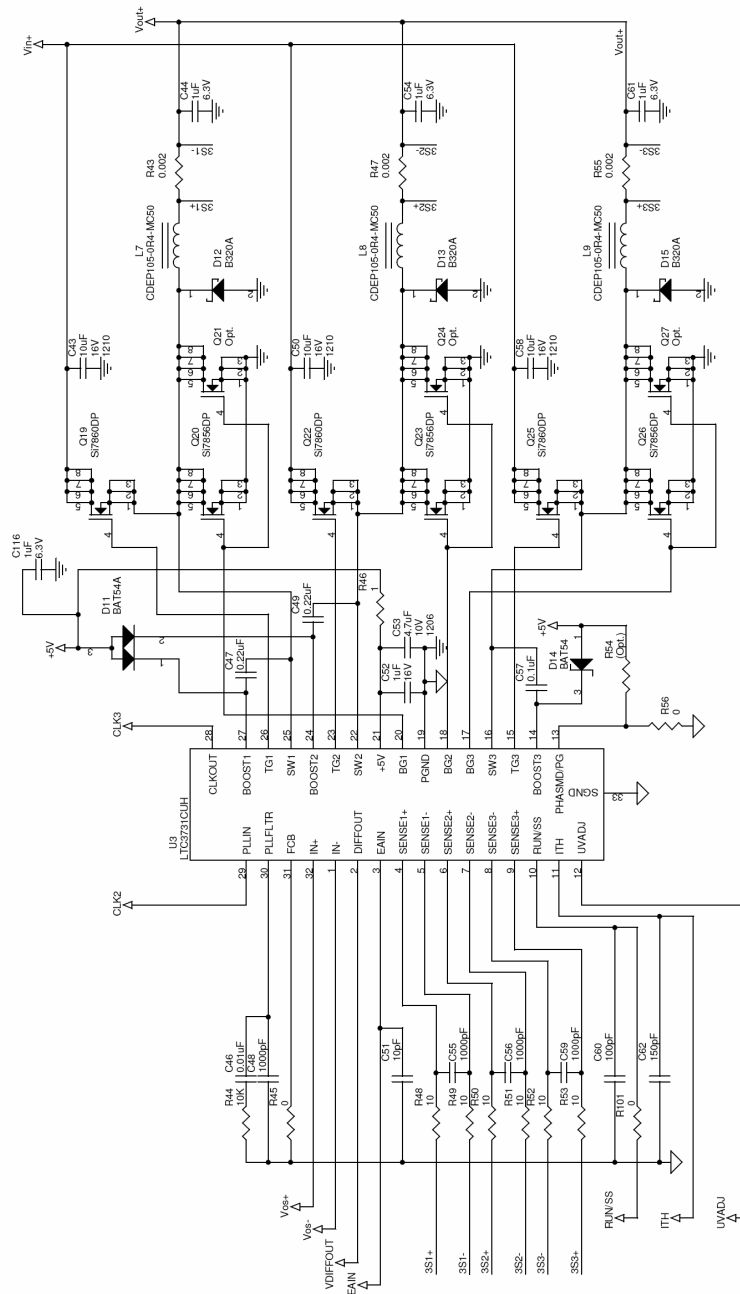
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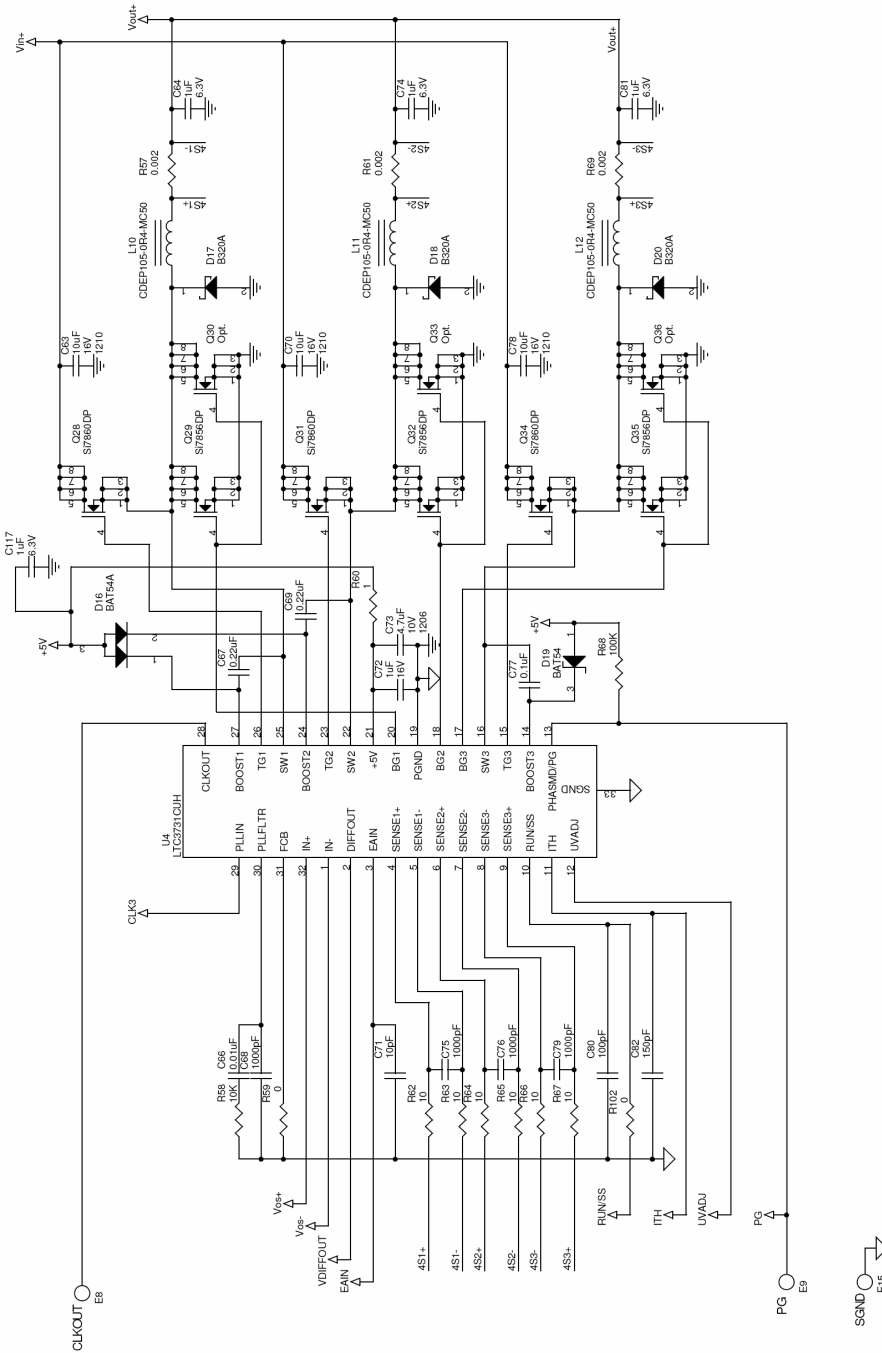
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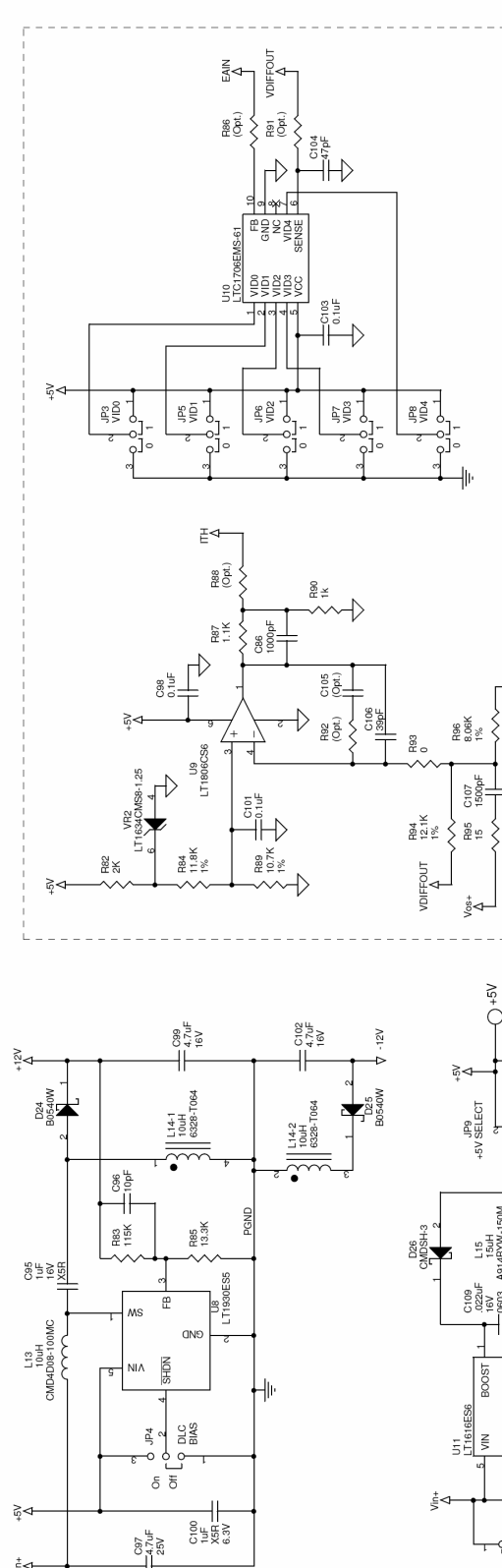
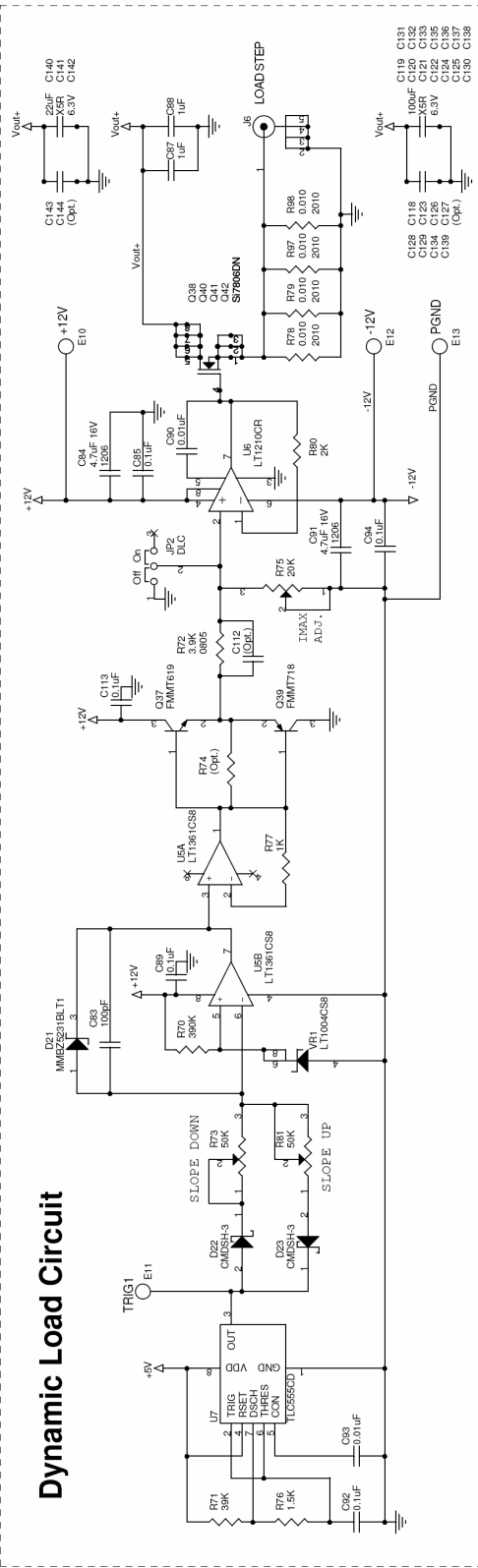
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## 6-PHASE 90A / 12-PHASE 180A HIGH EFFICIENCY POWER SUPPLY

### Dynamic Load Circuit



### Optional External Compensation and Voltage Programming Circuit

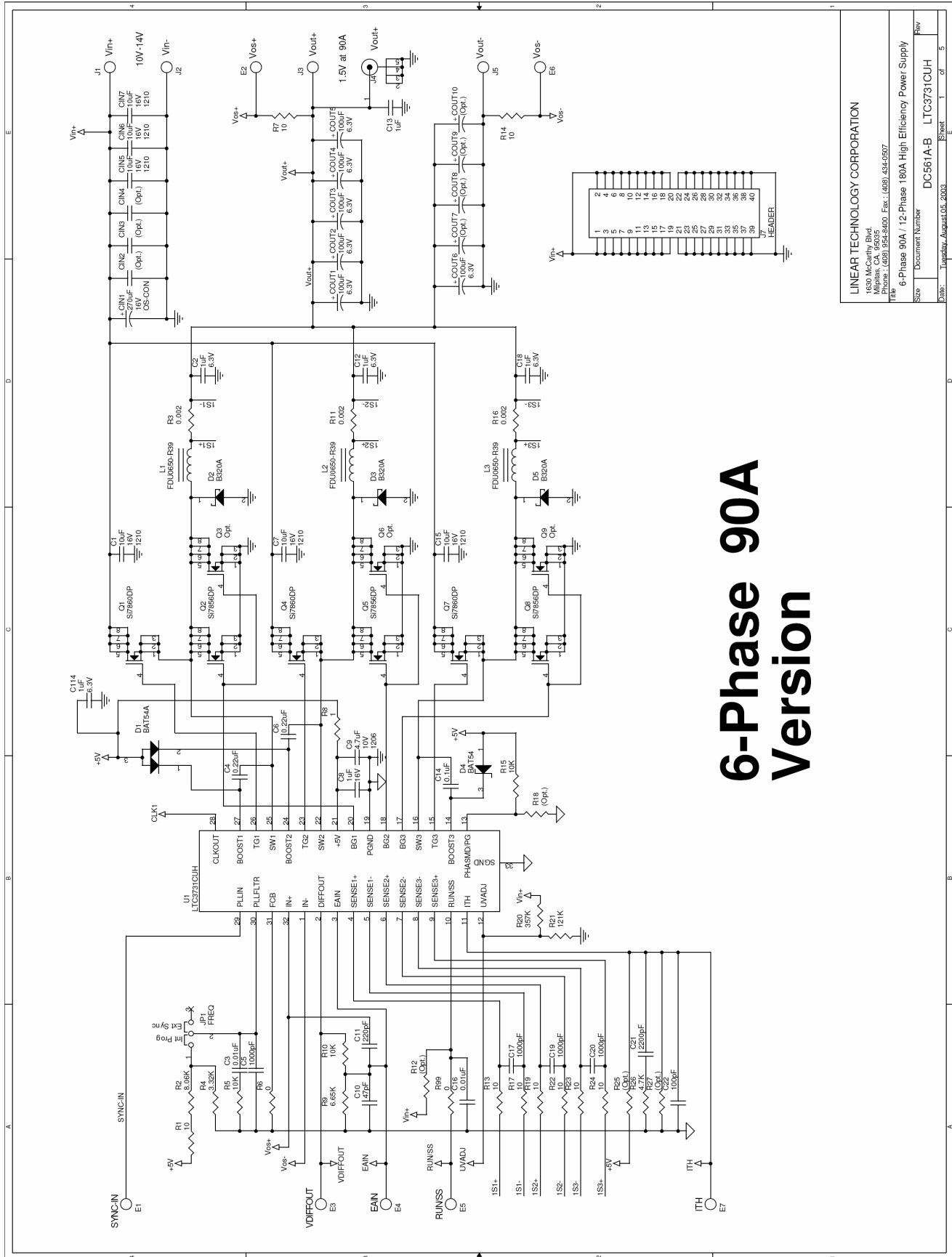
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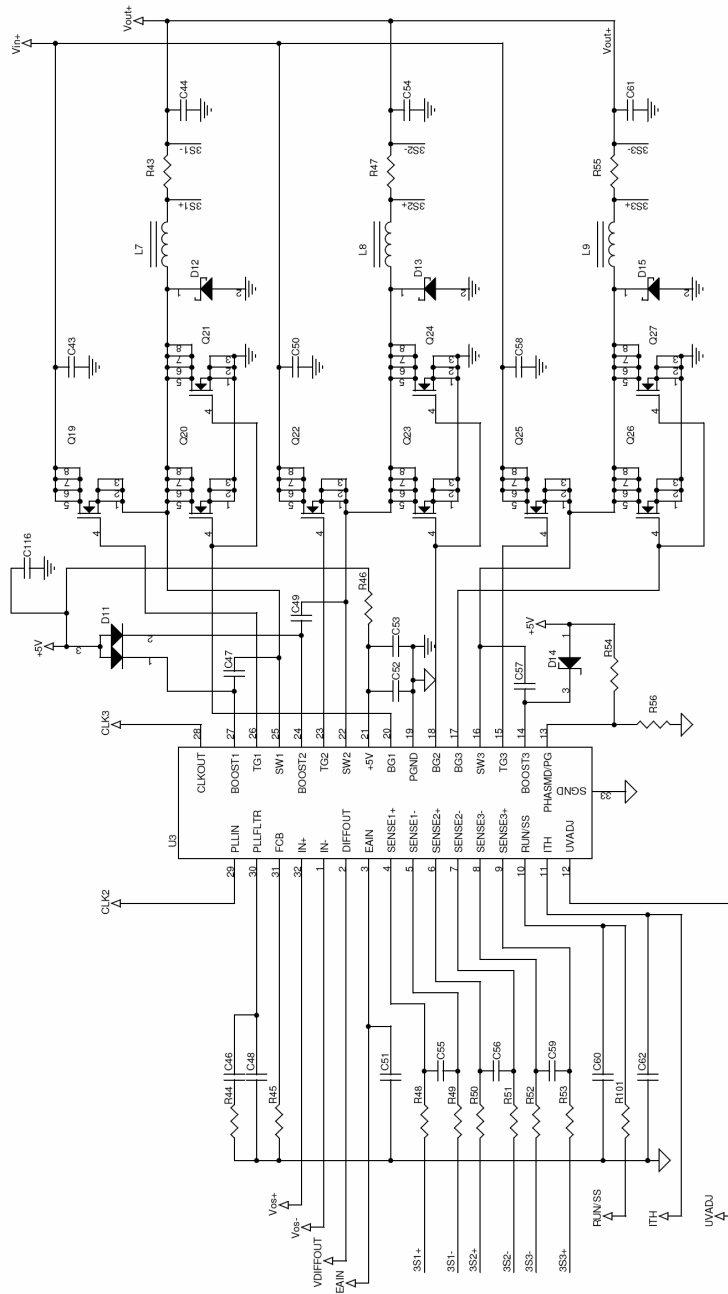
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## 6-PHASE 90A / 12-PHASE 180A HIGH EFFICIENCY POWER SUPPLY



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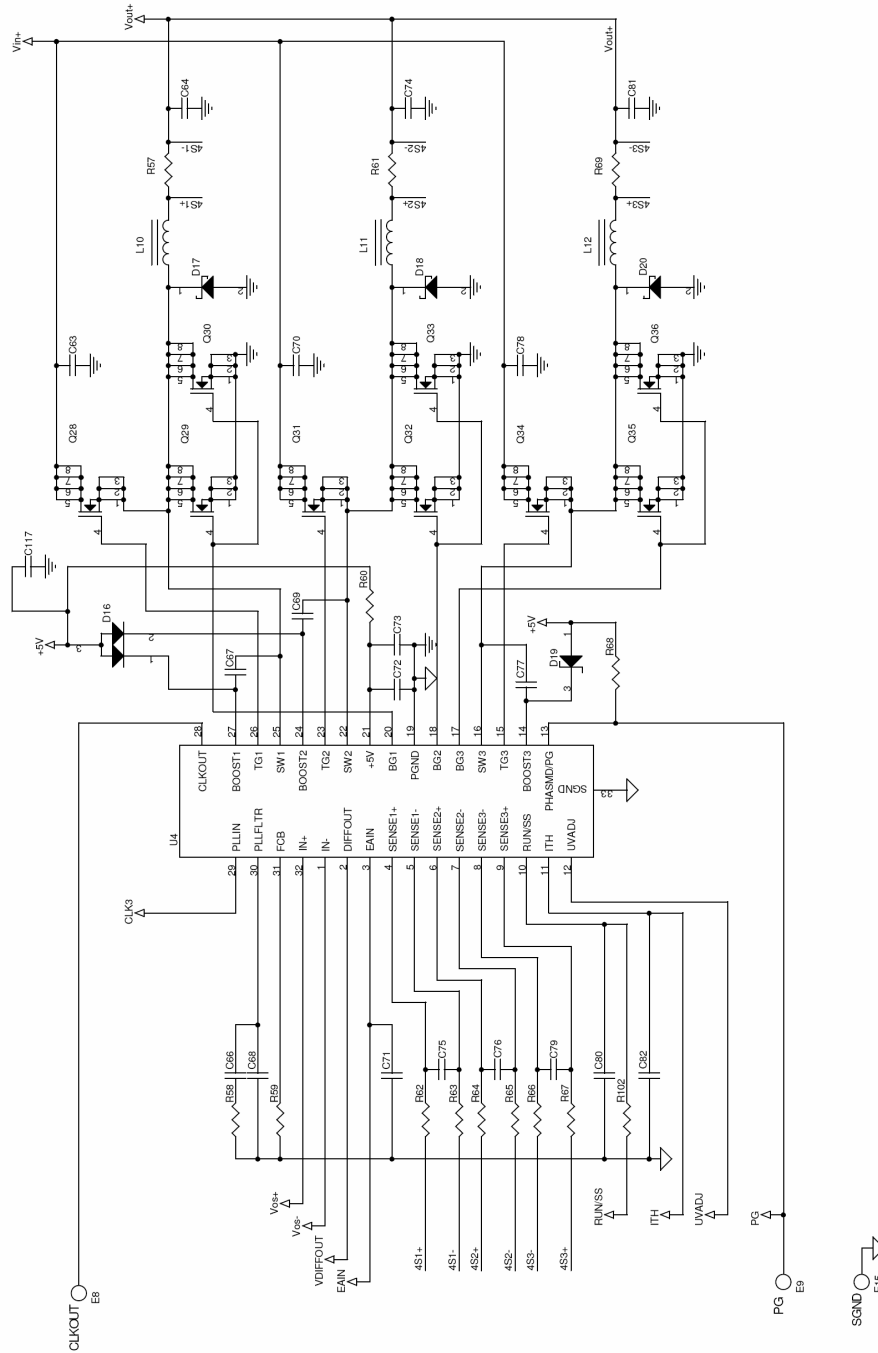
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## 6-PHASE 90A / 12-PHASE 180A HIGH EFFICIENCY POWER SUPPLY



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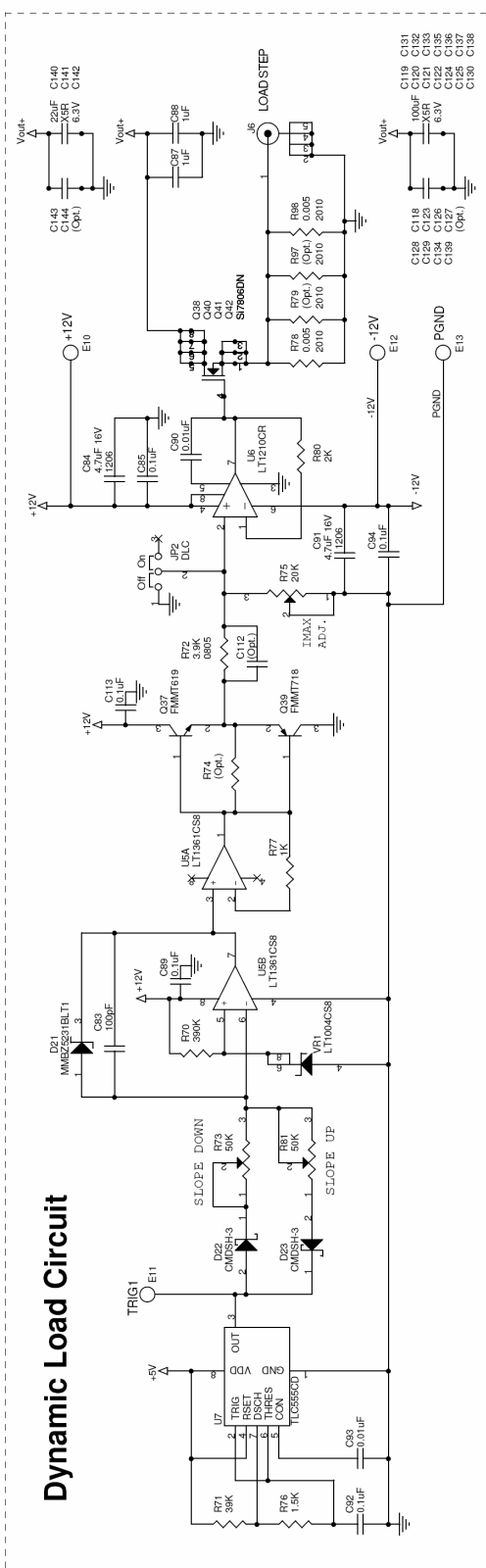
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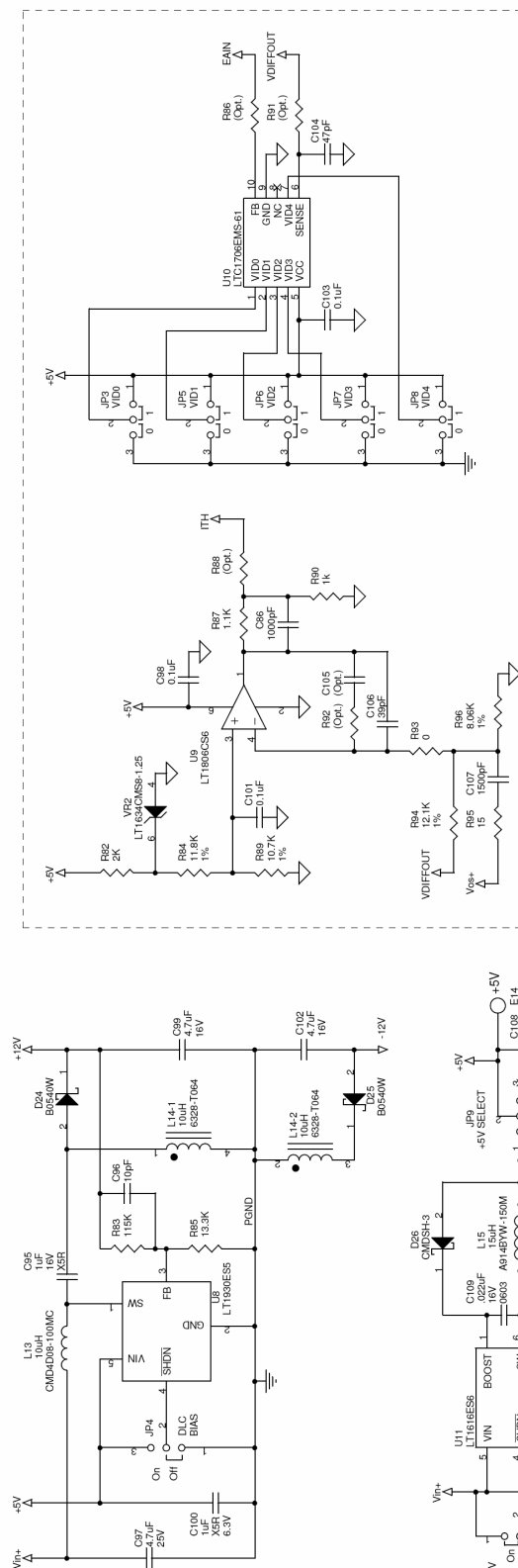
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## Dynamic Load Circuit



## Optional External Compensation and Voltage Programming Circuit

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$$\theta_1 = \frac{1}{1000} \ln \frac{1000}{1000 - 1000 \exp(-1000 \times 0.0001)} = 0.0001$$

6-Phase 90A / 12-Phase 180A High Efficiency Power Supply

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DC561A-B LIC3/31CUH

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