

DI-30 Design Idea TOPSwitch®-GX

180 W PC Main SFX Supply

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
PC Main	TOP249YN	180 W	90 – 130 VAC / 180 – 265 VAC	3.3 V / 5 V / 12 V / -12 V	Forward

Design Highlights

- 180 W cont. (200 W peak) in PC SFX form factor
- Includes passive power factor correction (PFC)
- TOPSwitch-GX integrated features enable extremely low component count
- Meets 1 W standby spec (0.91 W input, 0.5 W output)
- High efficiency (71% minimum)
- Integrated line undervoltage and overvoltage detection
- Low EMI due to frequency jitter
- SOURCE referenced TO-220 tab lowers conducted EMI
- Maximum duty cycle reduction (DC_{MAX}) prevents transformer saturation for fault and transient loads
- Uses conventional magamp for 3.3 V output
- Meets CISPR22B/EN55022B conducted EMI

Operation

TOPSwitch-GX integrates many features designed for use with forward converters. Passive power factor correction (PFC) is implemented using inductors LPFC1 and LPFC2. Transistors Q4, Q6, R1, R2, R3, R5, and R6 form an active capacitor (C2, C3) balancing circuit, operating only as needed to minimize zero-load power consumption.

Resistors R3, R5 and R6 implement start-up undervoltage lockout, which prevents the supply from starting below

180 VDC. Components R4, R14, Q1 and R30 implement an independent undervoltage using the X pin, which allows the supply to continue delivering power all the way down to 140 VDC (increasing holdup time). Resistor R7 provides additional hysteresis.

The primary side components D1, VR3-5 and C4, along with secondary side C9 and R30, implement the Zener/capacitor reset/clamp circuit. This circuit provides reset voltage for the transformer and clamps the DRAIN pin voltage to a safe level (<-600 V) under all conditions.

The reset circuit works in conjunction with the DC_{MAX} reduction circuit (R8, R36, C22, VR19 and D18) to limit the maximum duty cycle and prevent transformer saturation under fault and transient conditions.

The components R12, C7, R38, Q7, C23, R37, U3, R106 and D105 implement the remote ON/OFF drive circuit. During the ON state, U3 and hence Q7 conduct, pulling the X pin to SOURCE via resistor R12 (which sets the current limit).

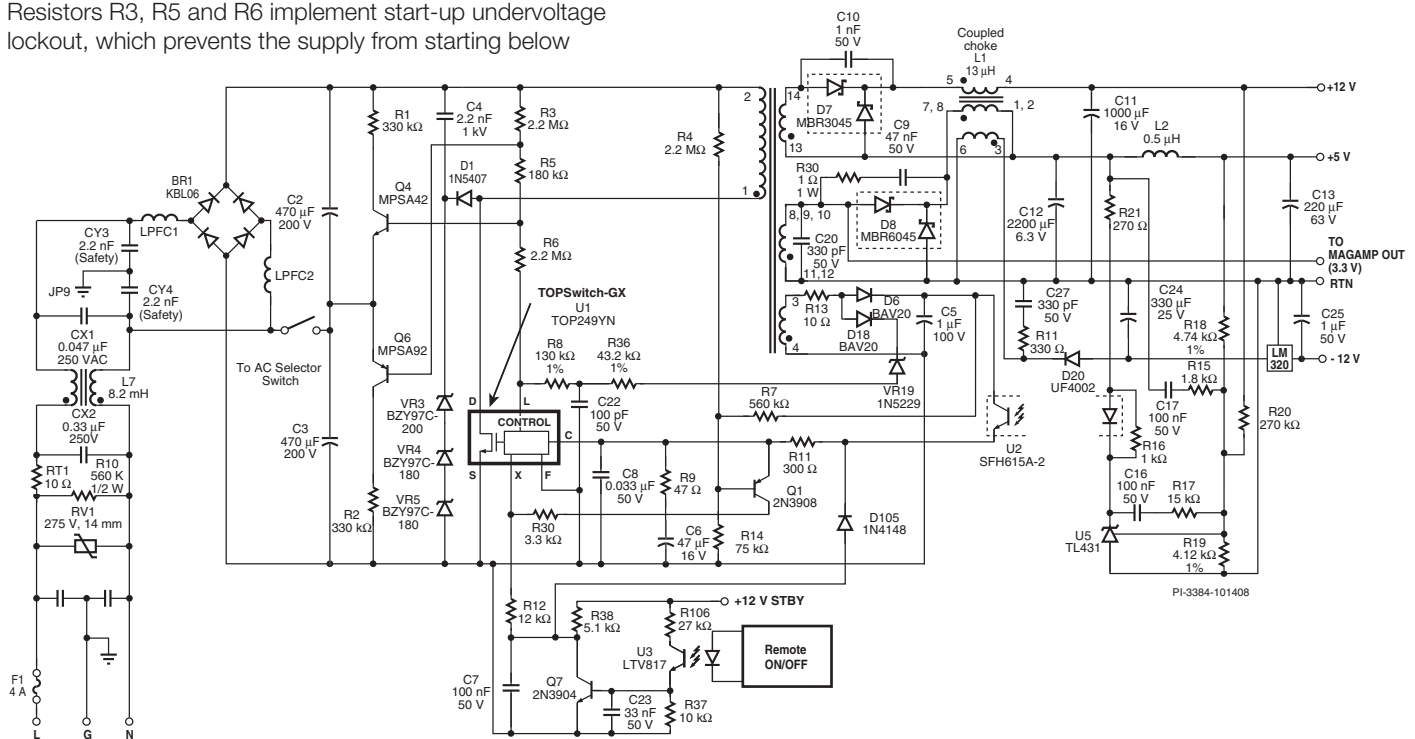


Figure 1. 180 W (200 W pk.) PC Main Power Supply Schematic (Note: Schematic does not include transformer Y-capacitor).

During the OFF state, U3 and Q7 are off, allowing the X pin to be pulled high by the +15 V standby supply via R38 and R12 and putting the TOPSwitch-GX into the OFF state. Components R38 and D105 reduce device consumption to around 2 mW by supplying external current to the CONTROL pin from the +15 V standby supply. Resistor R11 is required to allow external bias feed.

Key Design Points

- The passive PFC inductors (LPFC1 and LPFC2) are constrained by both thermal and efficiency requirements. Design of these inductors is not covered in this Design Idea.
- Transformer reset: Use recommended Zener/capacitor clamp/reset circuit to maintain drain voltage <600 V and DC_{MAX} reduction to prevent transformer saturation.
- Maintain maximum flux density on transformer (T1) <2500 gauss.

- Check for balanced currents on coupled inductor (L1) for all load combinations.
- Use PI Expert (PIXIs) Design Spreadsheet and refer to Application Note AN-30 for details on designing forward converters with TOPSwitch-GX.

This particular PC SFX 12 specification delivers a larger proportion of power on the 12 V winding; efficiency would be lower if that power were drawn from the 3.3 V output.

Due to the complexity of this design it is not possible to include all details in this Design Idea. An Engineering Prototype Report (EPR-31) with additional information is available. For updates and all other information please refer to Power Integrations' Web site.

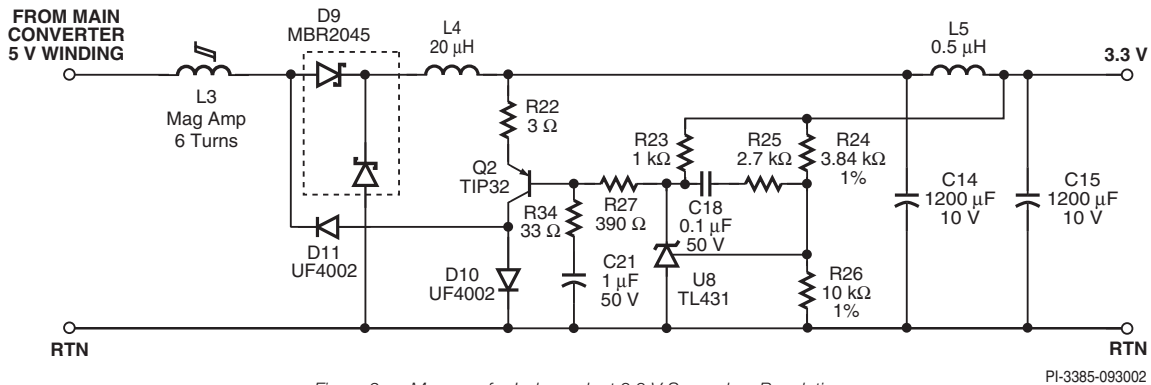


Figure 2. Magamp for Independent 3.3 V Secondary Regulation.

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