Design Idea DI-29
DPA-Switch®
25 W Flyback DC-DC Converter

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
DC-DC Converter	DPA425R	25 W	36 - 75 VDC	7 V	Flyback

Design Highlights

- Extremely low component count
- High efficiency – 85% using Schottky rectifiers
- No current sense resistor or transformer required
- Accurate input under/over voltage meets ETSI standards
- Operates to zero load with no pre-load required
- Output overload, open loop and thermally protected
- 400 kHz operation minimizes size of magnetics

Operation

DPA-Switch greatly simplifies the design compared to a discrete implementation. Resistor R1 programs the input under/over voltages to 33 V and 86 V, respectively. Including tolerances these thresholds guarantee the converter is operational between 36 V and 75 V, without the cost of additional line sense components.

Resistor R3 programs the internal current limit of the DPA425R to 50% of nominal. The larger *DPA-Switch* selection reduces conduction losses, raising efficiency without circuit changes or increased overload power.

Zener VR1 clamps leakage inductance spikes, keeping the DRAIN voltage below BV_{DSS}. The bias supply for U1 is provided from an auxiliary flyback transformer winding.

On the secondary, a snubber across D2 (C9, R5 and R13) limits the secondary leakage inductance spikes generated by diode reverse recovery. Inductor L2, C13 and C14 form a post-filter to reduce high frequency output switching ripple. A soft-finish network, C18, D3 and R7, eliminates output turn-on overshoot. The remaining components provide output voltage regulation and loop compensation.

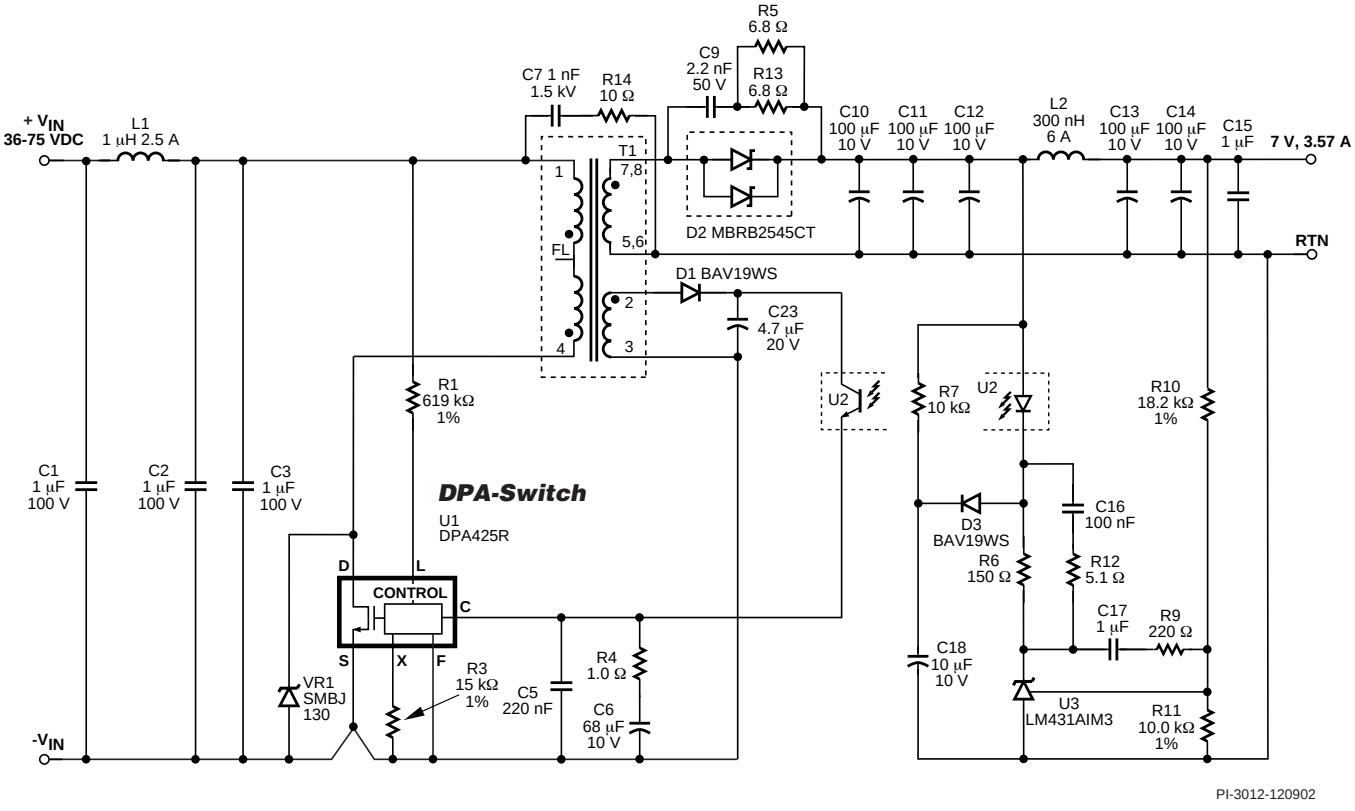

Figure 1. DPA-Switch Flyback DC-DC Converter Schematic.

Key Design Points

- For nominal under-voltage set point V_{UV}: R1 = (V_{UV}-2.35 V)/50µA. V_{OV} = (R1×135 µA)+2.5 V.
- Zener VR1 voltage is 130 V to safely limit the DRAIN voltage below V_{DSS} of 200 V.
- Opto U2 should have a CTR of between 100% and 200% for optimum loop stability.
- Set resonance of L2 and C13 + C14 to beyond loop crossover frequency (typically 5% to 10% of switching frequency).
- Good layout practices should be followed:
  - Locate C5, C6 and R4 close to U1, with grounds returned to the SOURCE pin.
  - Primary return should be connected to the *DPA-Switch* tab, not the SOURCE pin.
  - Minimize the primary and secondary loop areas to reduce parasitic leakage inductance.

Transformer Parameters	
Core Material	PR1408 Siemens N87 Gap for 340 nH/T^2
Bobbin	P1408 8 pin (B&B B-096 or equivalent)
Winding Details	Primary: 6T + 6T, 2 x 27 AWG Secondary: 3T, 4 x 25 AWG Bias: 6T, 32 AWG
Winding Order (pin numbers)	Primary (4-FL), tape, Bias (2-3), tape, Secondary (5,6-7,8), tape, Primary (FL-1), tape
Inductance	Primary: 49 µH ±10%, Leakage: 1 µH (max)
Primary Resonant Frequency	3.8 MHz (minimum)

Table 1. Transformer Construction Information.

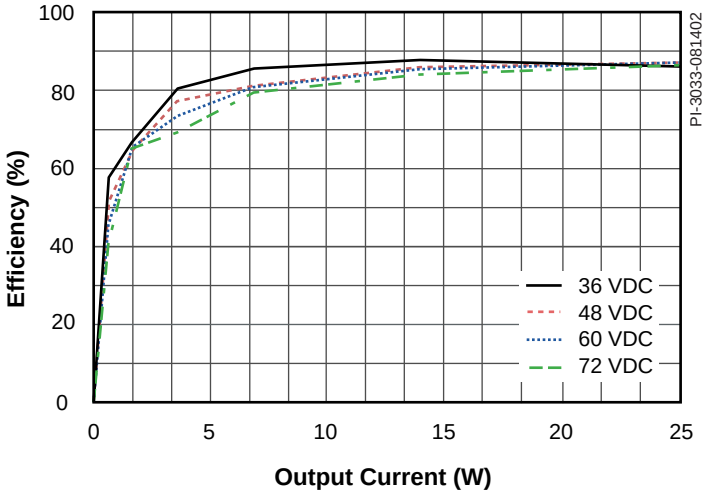

Figure 2. Efficiency vs. Output Power.

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