

Innovation in power conversion

PoE Interface

L1
10 μ H
1 A

C4
1000 pF R7
1500 V 10 k

Product Selector Guide

DC-DC Products

September 2008



Features & Benefits

The DPA-Switch Family combines a 220 V power MOSFET with a controller that provides current monitoring, undervoltage and over temperature protection, soft start and other control functions in a single device, saving up to 30 external components in the power supply design. Combining the key switching elements into a single package reduces design complexity and ensures rapid, low-risk development of highly cost-effective power supplies.

Superior Performance and Flexibility. The DPA-Switch family supports a range of power requirements in either forward or flyback topologies and offers a variety of package options to maximize design flexibility. A DIP-8 package is available for low-cost designs, and a thermally efficient TO-263-7C R package (2 °C/Watt) is available for higher power applications.

Product Highlights

- Supports flyback and forward topology
- Programmable internal current sense eliminates external sense components
- Built-in auto-restart for output overload/open loop protection
- Line undervoltage (UV) detection: meets ETSI standards
- Line overvoltage (OV) shutdown protection
- Fully integrated soft-start for minimum stress/overshoot
- Hysteretic thermal shutdown for over temperature protection and automatic recovery
- Source connected tab for low EMI

EcoSmart® Energy Efficiency

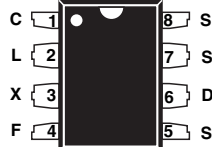
- Extremely low consumption at no-load (10 mA typ.) and in remote off (2 mA max.)
- Cycle skipping at light load for high standby efficiency



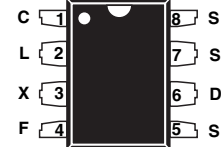
Package Information

- P and G packages have Pb-free finish (100% matte tin), are RoHS compliant and meet requirements of JEDEC standard J-STD-020C table 4.2. The R package is not available in Pb-free finish.

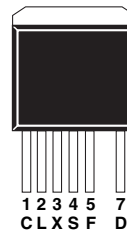
G-Package



P-Package



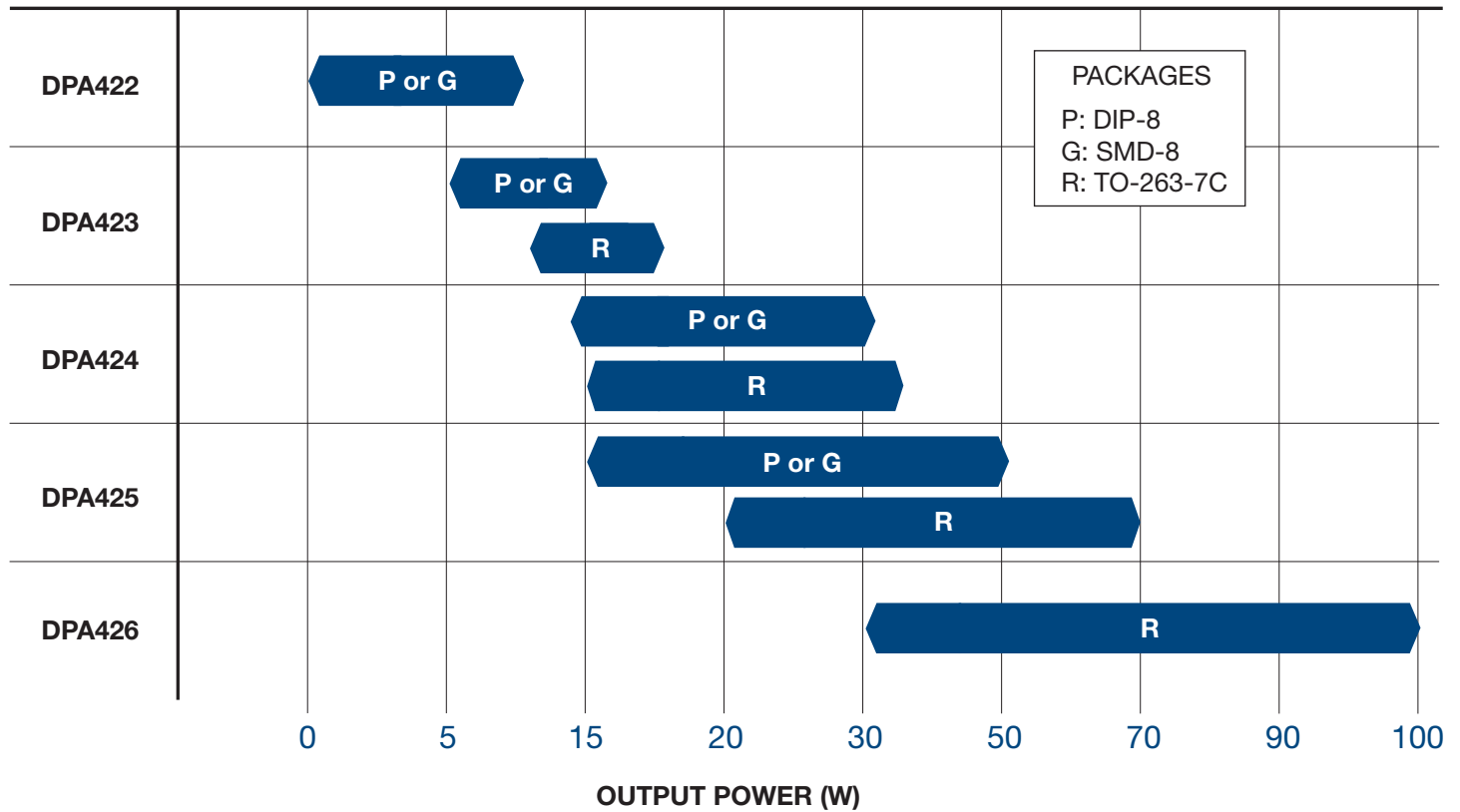
R-Package



Typical Applications

- PoE applications: VoIP phones, WLAN, security cameras
- Telco central office equipment: xDSL, ISDN, PABX
- Distributed power architectures (24 V/48 V bus)
- Industrial controls
- LED lighting

Product Selector Guide



24 V / 48 V DC-DC Power Conversion (Up to 100 W)

Output Power Table

Total Device Dissipation ³ PRODUCT ⁴	36-75 VDC Input Range (Forward) ²					
	0.5 W	1 W	2.5 W	4 W	6 W	Max Power Output ¹
DPA422 ⁷	7.5 W	10 W	-	-	-	10 W
DPA423	12 W	16 W	-	-	-	18 W
DPA424	16 W	23 W	35 W	-	-	35 W
DPA425	23 W	32 W	50 W	62 W	-	70 W
DPA426 ⁵	25 W	35 W	55 W	70 W	83 W	100 W

Total Device Dissipation ³ PRODUCT ⁴	36-75 VDC Input Range (Flyback) ²				
	0.5 W	0.75 W	1 W	1.5 W	Max Power Output ¹
DPA422 ⁷	6.5 W	9 W	-	-	9 W
DPA423	9 W	13 W	-	-	13 W
DPA424	10 W	14.5 W	18 W	24 W	26 W
DPA425	- ⁶	- ⁶	- ⁶	25.5 W	52 W

Notes:
1. Maximum output power is limited by device internal current limit. 2. See Applications Considerations section of the DPA-Switch data sheet for complete description of assumptions and for output powers with other input voltage ranges. 3. For device dissipation of 1.5 W or below, use P or G packages. Device dissipation above 1.5 W is possible with R packages. 4. Packages: P: DIP-8, G: SMD-8, R: TO-263-7C. For lead-free package options, see Part Ordering section of the DPA-Switch data sheet. 5. Available in R package only. 6. Due to higher switching losses, the DPA425 may not deliver additional power compared to a smaller device. 7. Available in P and G package only.

Integrated Features

HV-FET Rating	220 V	Soft Start	✓	Hysteretic Thermal Shutdown	✓	Remote ON/OFF	✓
Switching Frequency (kHz)	400/ 300	Fully Integrated Current Sensing	✓	Power Limiting	✓	EcoSmart® Low Standby/ No-load Power Consumption	✓
Max. Duty Cycle (DC _{MAX})	75%	Adjustable Current Limit	✓	Line UV Detection	✓	Synchronizable to Lower External Clock Frequency	✓
Control Method	PWM	Auto Restart	✓	Line OV Detection	✓	Remote ON/OFF	✓

DPA-Switch in PoE Applications

Power over Ethernet (PoE) is a method whereby power is transmitted to Ethernet-connected equipment (VoIP telephones, WLAN transmitters, security cameras) from the central switch. Power Integrations has developed circuits for highly cost-effective IEEE802.3af compliant power supplies. Tested by the University of New Hampshire's Interoperability Consortium (UNH-IOC), PI solutions have been shown to work with all available Power Sourcing Equipment (PSE). The results of the UNH-IOC testing are shown on the PI website.

Operation: PoE Powered Device (PD) fulfills three functions to work in conjunction with the sending end PSE: detection, classification and undervoltage lockout.

Detection Phase: The PSE checks the PD to determine if it is PoE-enabled. During the detection phase, the PSE applies a voltage ramp to the PD and looks for a characteristic impedance from the load (25 kΩ). If the signature impedance is detected, the PSE moves on to the classification phase. The signature identification voltage is a ramp voltage between 2.5 V and 10 V. A 24.9 kΩ resistor provides the correct signature impedance for detection.

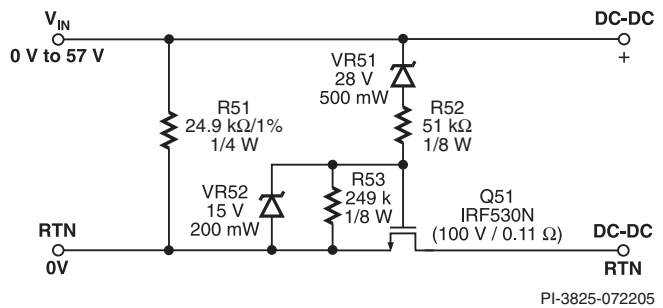
Classification Phase: The PSE continues to ramp the voltage to the PD. Between 14.5 V and 20.5 V, the PD must draw a specified current to identify the device class. The classification current describes the amount of power the PD will require during normal operation. A table of classification current and operating PD power requirements is shown below.

Classification Power Levels

Class	Power (Min)	Power (Max)	Class (Min)	I _{CLASS} (Max)
0	0.44 W	12.95 W	0 mA	4 mA
1	0.44 W	3.84 W	9 mA	12 mA
2	3.84 W	6.49 W	17 mA	20 mA
3	6.49 W	12.95 W	26 mA	30 mA
4	Reserved	Reserved	36 mA	44 mA

Table 1. Classification Power Levels.

PoE Class 0 Interface with MOSFET Pass-Switch



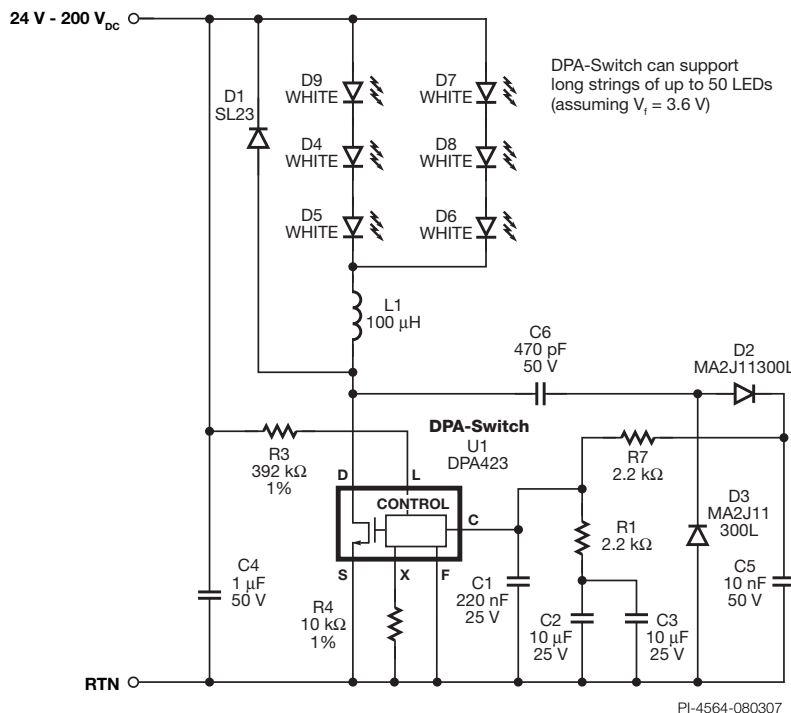
PI-3825-072205

Figure 1. PoE Class 0 Interface Circuit Using a MOSFET Pass-Switch.

Turn-on Phase: The PSE continues to ramp the input voltage up to 30 V. When the undervoltage lockout (UVLO) circuit is released the PD is allowed to power up. A typical undervoltage lockout circuit is shown in the Figure above.

For additional information see Design Ideas DI-70 (www.powerint.com/PDFFiles/di70.pdf) & DI-88 (www.powerint.com/PDFFiles/di88.pdf), also Reference Design Kits DAK-68A and DAK-86.

DPA-Switch – Constant Current LED Driver (10 W, 500 mA)



PI-4564-080307

DPA-Switch vs. Discrete Design

33-57 VDC Input, 12.95 W Class Programmable Power over Ethernet DC-DC Converter (see DAK-86)

Integrated Current Sense and Current Limit

- Tight tolerance and temperature compensated
- No current sense resistor (higher efficiency)
- No current sense transformer even for high-power designs
- Programmable using X pin resistor
- Saves up to 6 components

Integrated Start-up

- Higher efficiency (no "boot strap" losses)
- Saves up to 4 components

Programmable Undervoltage and Overvoltage Inhibit Feature

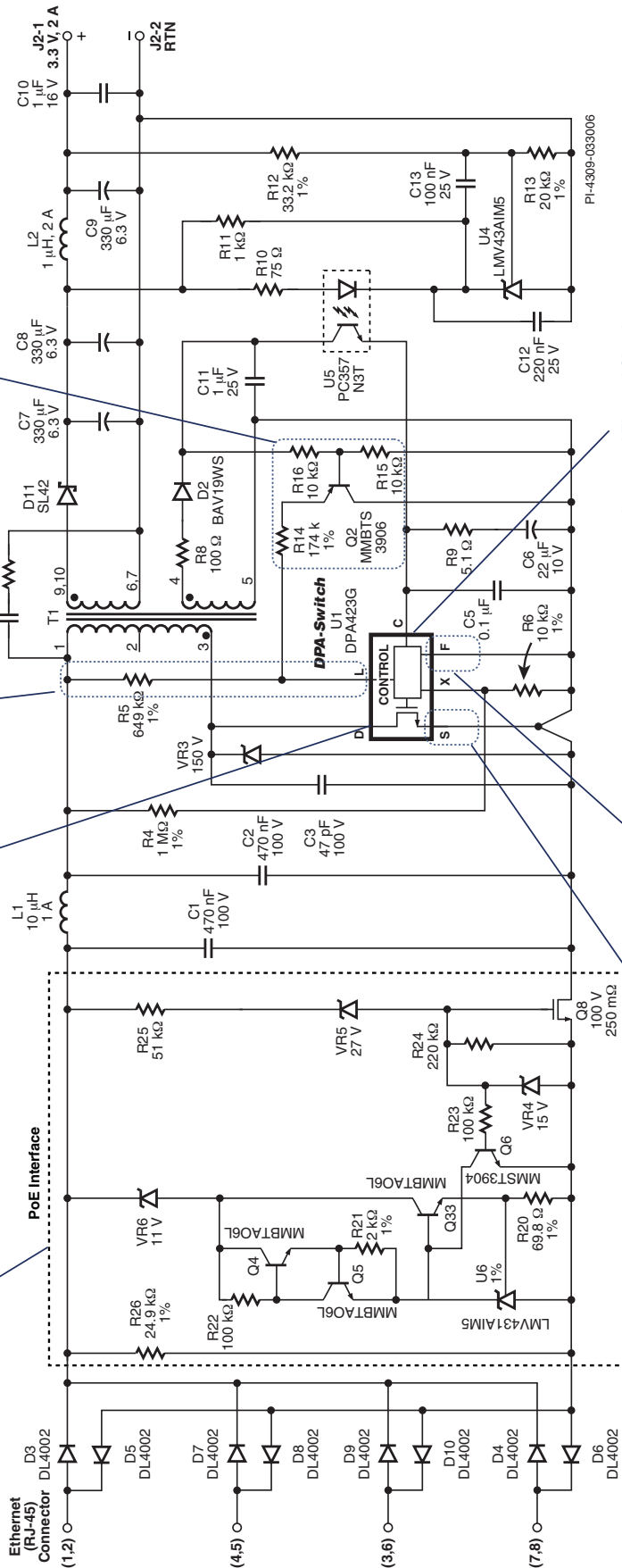
- Select startup point with IEEE802.3af compliant hysteresis characteristic. Also programmable to match legacy requirements
- Select overvoltage inhibit point

Integrated Line Sense

- Accurate temperature stability
- Provide UV/OV protection
- Saves up to 10 components

Simplified PoE Interface

- Includes signature resistor
- Multi class programmable classification circuit
- Undervoltage lockout function
- Classification circuit disabled during operation to improve efficiency
- Simple discrete design lower cost than integrated solutions



Integrated Thermal Shutdown

- Directly senses power MOSFET temperature
- Hysteretic auto-restarting
- Wide hysteresis prevents high average temperatures
- Saves up to 4 components

Integrated Voltage Mode Controller

- >50% duty cycle operation without requiring slope compensation
- Saves up to 10 components

Source Connected Tab

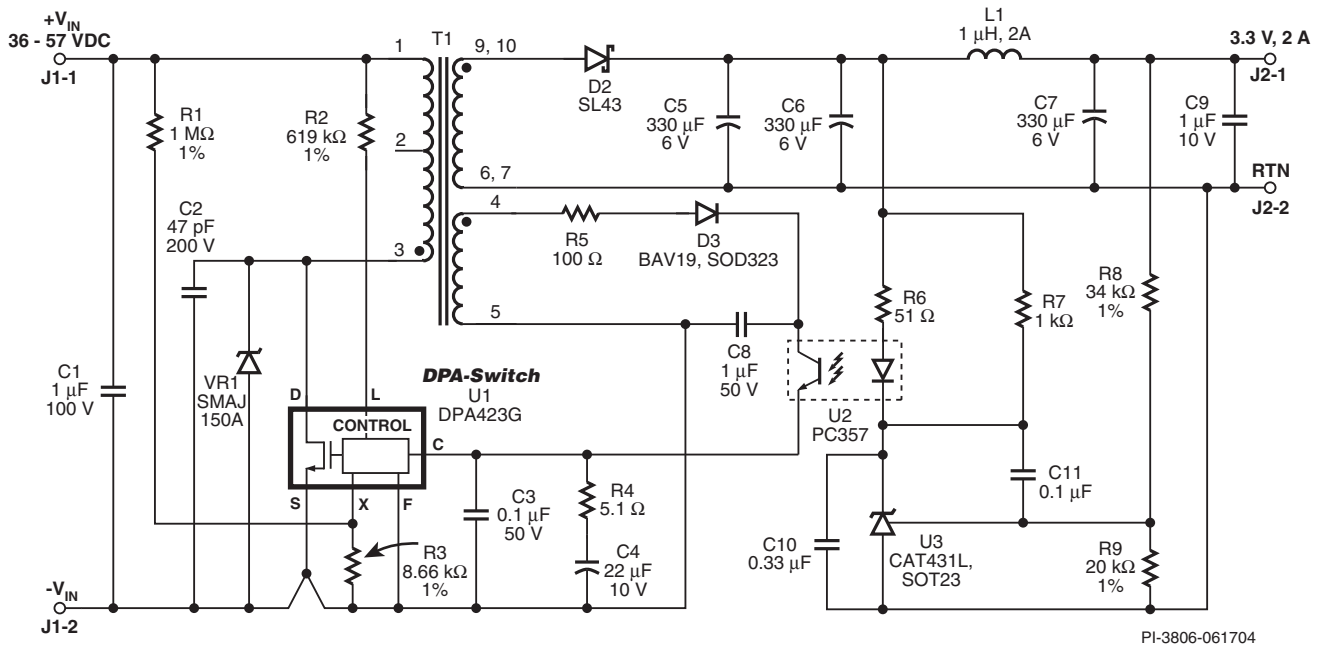
- Heat sink connected to source reduces EMI (electrically "quiet")
- Reduces EMI filter costs

Accurate Integrated Oscillator

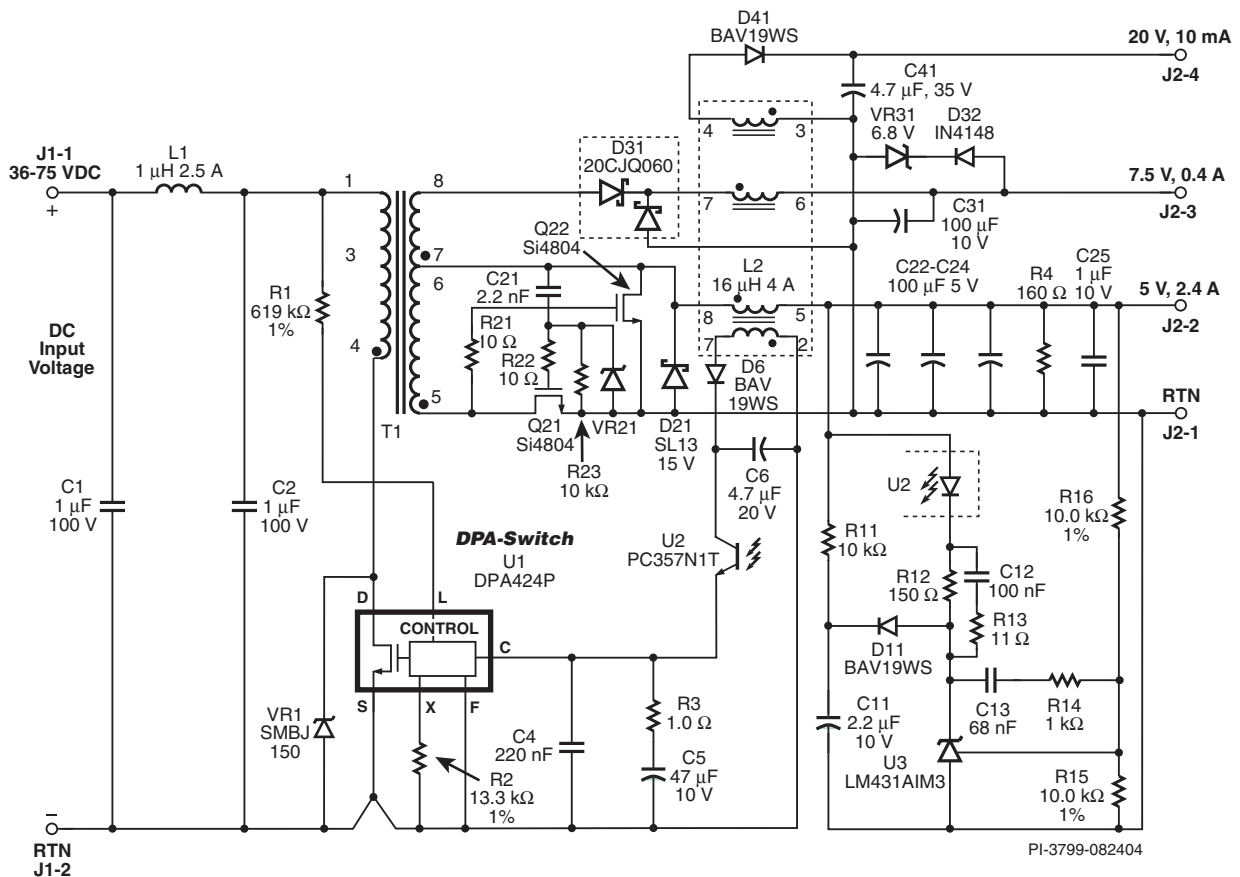
- No external components
- Tight tolerance and temperature stable
- Selectable 300/400 kHz operation

Design Examples

Cost-Effective 6.6 W, 3.3 V Flyback DC-DC Converter (EP-86)



15 W Multi-Output DC-DC Converter (DI-69)



Visit www.powerint.com/appcircuits.htm for additional design examples.

Design Tools

Reference Design Kits (RDks)

RDks include a working prototype power supply, sample devices, unpopulated pcb, data sheet, comprehensive engineering report and other related documentation.

DAK-21A	30 W, DC-DC Forward Converter
DAK-68A	6.6 W, Class 0 PoE Converter
DAK-71A	6 W, DC-DC Converter
DAK-86	6.6 W, Multi-Class Programmable PoE Powered Device



Power Supply Design Software*

With **PI Expert™** Suite, you're only "mouse clicks" away from determining the key components in your next switching power supply design, including the best Power Integrations power IC and detailed instructions for building the transformer! It's fast & easy... and best of all, **FREE!**

DPA-Switch Product and Design Collateral*

Data Sheet	DPA422-426	DPA-Switch Family Data Sheet
Application Note	AN-31	DPA-Switch DC-DC Forward Converter Design Guide
Design Ideas (2-page technical Circuit Document)	DI-24	Application: Telecom (36-75 VDC Input): 30 W, 5 V Forward Converter
	DI-25	Application: Telecom (36-75 VDC Input): 30 W, 5 V Forward Converter (Sync. Rectification)
	DI-29	Application: Telecom (36-75 VDC Input): 25 W, 7 V Flyback Converter
	DI-31	Application: Telecom (36-75 VDC Input): 70 W, 5 V Forward Converter
	DI-37	Application: Telecom (36-75 VDC Input): 16.5 W, 3.3 V Forward Converter (Sync. Rectification)
	DI-40	Application: Telecom (36-75 VDC Input): 20 W, 2.5 V Forward Converter (Sync. Rectification)
	DI-51	Application: Telecom (36-75 VDC Input): 5 W, 5 V Flyback Converter
	DI-52	Application: Telecom (36-75 VDC Input): 60 W, 12 V Forward Converter (Sync. Rectification)
	DI-53	Application: Telecom (36-75 VDC Input): 50 W, 5 V / 3.3 V Forward Converter (Sync. Rectification)
	DI-56	Application: Telecom (36-75 VDC Input): 19.2 W, ±12 V Flyback Converter
	DI-57	Application: Telecom (36-75 VDC Input): 60 W, 12 V Flyback Converter
	DI-69	Application: VoIP Phone, 15 W, 5 V / 7.5 V / 20 V Forward Converter (Sync. Rectification)
DI-70	Application: PoE VoIP Phone, 15 W, 5 V / 7.5 V / 20 V Forward Converter (Sync. Rectification)	
DI-88	Application: PoE PD Flyback Converter with Programmable Class	

* Downloadable from www.powerint.com

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