

Introduction

Modern devices are increasingly powered by Power over Ethernet (PoE), such as IP phones, wireless APs, and IP cameras. Customer premise equipment (CPE) and small base stations in the 5G era also require PoE power.

Figure 1 shows common applications powered by PoE.

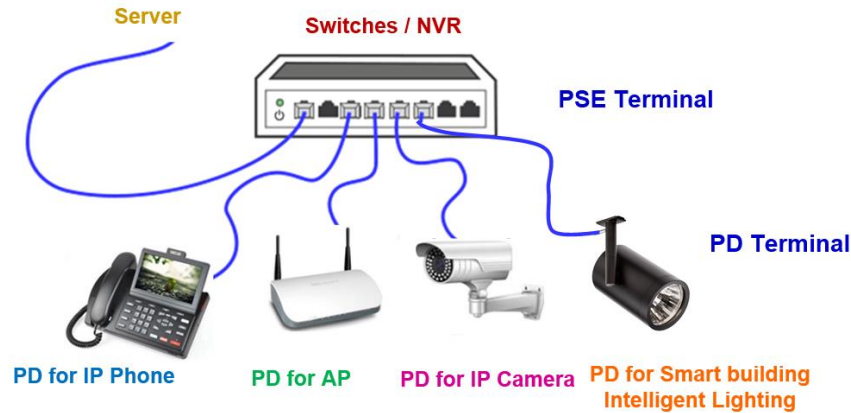


Figure 1: Common Applications Powered by PoE

This article discusses MPS’s comprehensive suite of [power management solutions](#) for a wide range of switches, including PSE, boost, high-voltage buck/flyback, high-current buck, and 2A to 3A buck.

PoE Switch Power Structure and Adapter Types

PoE offers clear advantages, as it does not require additional adapters and power cables, and can transmit both data and power through network cables.

The switch is a common device that can provide a PoE power supply. Figure 2 shows the PoE switch’s power structure, which is typically powered by an AC to DC adapter.

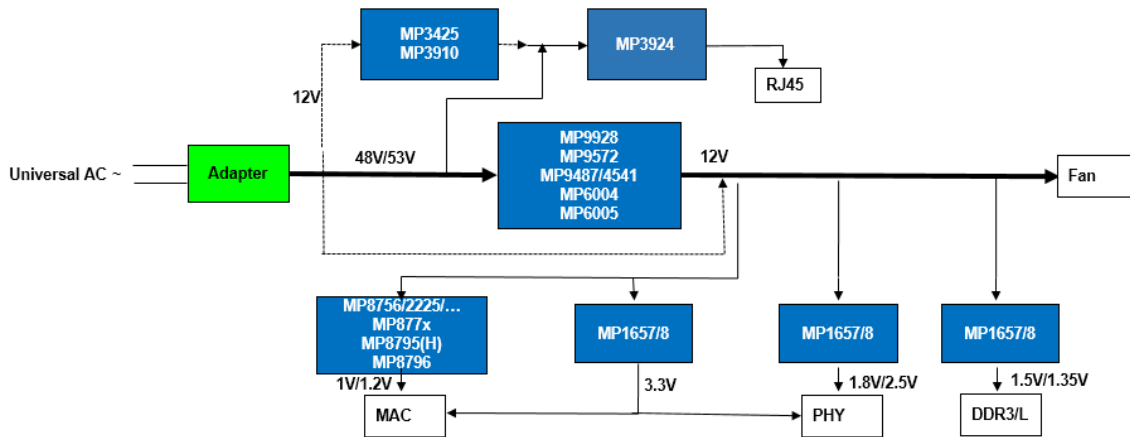


Figure 2: Power Structure of the PoE Switch

There are three types of adapters, described below:

1. 12V adapter power supply: With a 12V adapter, a voltage between 12V and 48V is required to supply the power-sourcing equipment (PSE) chip input.
2. 48V/53V adapter power supply: With a 48V/53V adapter, 48V/53V can be directly supplied to the PSE, but a 48V/53V step-down IC is required to step down to 12V, 5V, 3.3V, and so on. For high-power switches, the voltage is typically stepped down to 12V first, then later stages often utilize high-current buck converters and 2A/3A buck converters.
3. 48V/53V + 12V adapter power supply: For some high-power switches, the front-end adapter supplies two voltages. This means that the system can eliminate the 48V/53V boost or buck converter and directly use the 12V/5V buck converter to step down to Core, IO, or DDR.

MPS offers a wide range of power solutions for switches that can work with any front-end adapter. Table 1 shows the various MPS parts that can be selected depending on the application.

Table 1: MPS Power Solutions for Switches

Application	Part No.	Topology	Voltage Range	Current	Package
PSE	MP3924	4port at/at PSE Controller			QFN-32 (5mmx5mm)
Boost/Flyback	MP3425	Non Sync Boost	3.1- 22V	48V/350mA	QFN-14 (3mmx4mm)
	MP3910	Boost/Flyback Controller	5-35V	Up to 20A	MSOP10
High Voltage Buck	MP9928	Buck Controller	4-60V	Up to 10A	QFN-20 (3mmx4mm) /TSSOP-20 EP
	MP9572	Sync Buck	4.5-60V	2A	QFN-12 (2.5mmx3mm)
	MP9487	Non Sync Buck	4.5V-100V	1A continue current, 3.5A peak current	SOIC-8 EP
	MP4581	Sync buck/Flyback	10-80V	0.8A	SOIC8EP
Flyback	MP6004	PSR Flyback Converter	14-80V	13W	QFN-14 (3mm x 3mm)
	MP6005	ACF PSR/SSR Flyback or Forward Controller	8-80V	up to 200W	MSOP10
High Current Buck	MP8796	Sync Buck	3-16V	30A	TQFN-25 (4mmx5mm)
	MP8795/8795H	Sync Buck	2.7-16V	15/20A	QFN-21 (3mmx4mm)
	MP8770/1/2/4	Sync Buck	4.5-17V	8/10/12/12A	QFN-16 (3mmx3mm)
	MP8756/8759	Sync Buck	4.5-26V	6/8A	QFN-12 (2mmx3mm)
	MP2329/2386	Sync Buck	4.5-24	6.5/8A	QFN-11 (2mmx2mm)
	MP2225/MP2236	Sync Buck	4.5-18V/3-18V	5A/6A	TSOT23-8
	MP1655	Sync Buck	4.2-17V	5A	QFN-6 (2mm?2mm)
2A/3A Buck	MP1657/8	Sync Buck	4.5-16V	2/3A	SOT563

Power-Sourcing Equipment (PSE)

The [MP3924](#) is a quad-port PSE controller that is compatible with IEEE802.3af/at protocol. Its integrated VCC power supply addresses the challenges of the 48V to 3.3V power supply for the PSE chip. In addition, this device is available in a small QFN-32 (5mmx5mm) package that requires only one power MOSFET for single-port PSE applications, which reduces overall cost.

For configurability, the I²C interface can monitor the voltage and current of each port, as well as set the current limit of each port. A single port can support up to 40W of power. The MP3924's PMAx pin sets the total power for all four ports. If the total power exceeds its limit, the ports with lower priority close automatically.

Figure 4 shows the typical application circuit of the MP3924, as well as its key features.

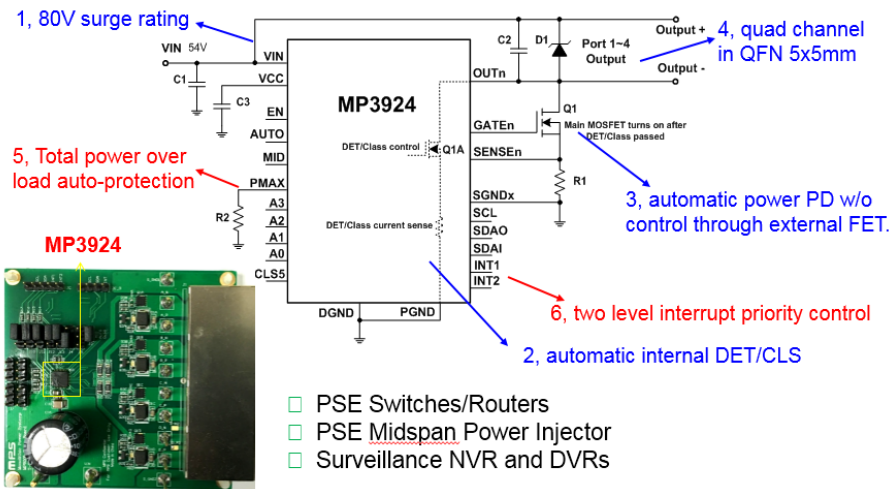


Figure 3: Typical Application Circuit and Key Features of the MP3924

Boost/Flyback

For 12V to 48V/53V applications, the [MP3425](#) or [MP3910](#) boost converter can be selected according to the power specifications. The MP3425 is a current mode step-up converter with a 3.5A, 90mΩ internal switch. Meanwhile, the MP3910 is a peak current mode pulse-width modulation (PWM) controller that can drive an external MOSFET capable of handling more than 10A of current.

In particular, the MP3910 supports isolation applications that can be boosted up to 48V/53V in a flyback topology.

High-Voltage Buck/Flyback

MPS also offers multiple solutions for non-isolated, 48V/53V step-down applications, according to the power requirements. These solutions include the [MP9928](#), [MP9572](#), [MP9487](#), and [MP4541](#) step-down converters.

For isolation applications, MPS also provides the [MP6004](#) and [MP6005](#) for different power levels.

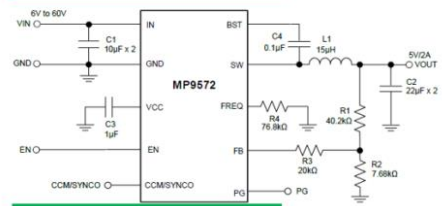
MP9572

The MP9572 is a fully integrated, 60V/2A synchronous buck converter. Figure 4 shows the MP9572's features, application circuit, and efficiency curve.

FEATURES

- Wide 4.5V to 60V Operating Input Range
- 2A Continuous Output Current
- High-Efficiency Synchronous Mode Control
- 250mΩ/45mΩ Internal Power MOSFETs
- Adjustable Frequency Up to 2.2MHz
- 180° Out-of-Phase SYNCO Clock
- 40μA Quiescent Current
- Selectable AAM or Forced CCM Operation at Light Load
- Over-Current Protection (OCP)
- Short-Circuit Protection with Hiccup Mode
- VIN Under-Voltage Lockout (UVLO)
- Thermal Shutdown
- Available in a QFN-12 (2.5mmx3mm)

Application Circuit



Efficiency

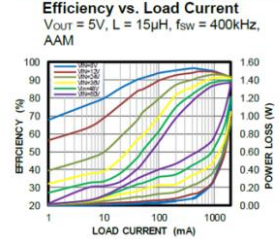


Figure 4: The MP9572 Details

The MP9572 is capable of a 12V/2A output with a high efficiency. Figure 5 shows the MP9572's efficiency curve.

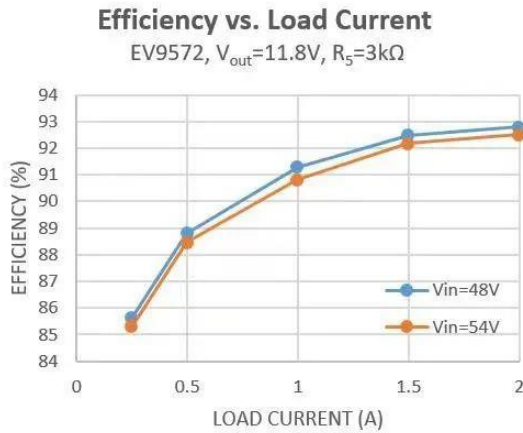


Figure 5: MP9572 Efficiency Curve

High-Current Buck Converters

For 5A to 30A applications, MPS provides a series of devices (e.g. isolators and buck converters) that can be selected according to Table 1.

2A to 3A Buck Converters

For 2A to 3A applications, the [MP1657](#) and [MP1658](#) are recommended due to their tiny SOT563 package, constant-on-time (COT) control, and excellent dynamic response.

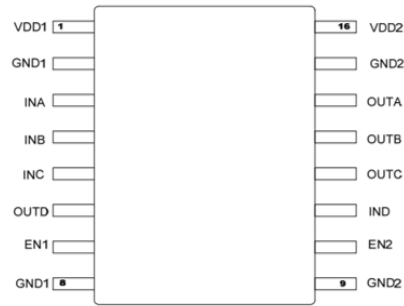
Digital Isolators

The [MP27631](#) is a quad-channel digital isolator that can support up to 150Mbps of data rate signal isolation.

For some isolation switches, the PSE registers (e.g. MP3924) must be configured via the I²C. Most of the switches isolate the I²C and reset the signals. Afterwards, the MP27631 can be used. Figure 6 shows the features of the MP27631.

FEATURES

- Support DC to 20Mbps Data Rate
- 2.5V to 5.5V Operation Range
- Ultra Low Power Supply Current
- Tri-state Outputs with EN Control
- Voltage High Fail-safe Output
- High Electromagnetic Immunity
- **>±100kV/μs Common-mode Transient Immunity (Good noise immunity ability)**
- 15ns Propagation Delay for 5V Operation
- **5kV_{RMS} Isolation (Good insulation ability)**
- **1.2kV peak V_{IORM} Working Insulation (Long life time)**
- Available in SOICW-16 Packages



3 IN 1 OUT
4-channel digital isolator
SOICW-16

Figure 6: Features of the MP27631

Conclusion

In this article, we reviewed the PoE switch power structure and three types of power supply adapters. We also covered MPS power solutions for switches and highlighted the [MP3924](#), [MP9572](#), and [MP27631](#). MPS leads the semiconductor industry with its robust portfolio of products across [PSE](#), [switching converters and controllers](#), and [isolation](#).