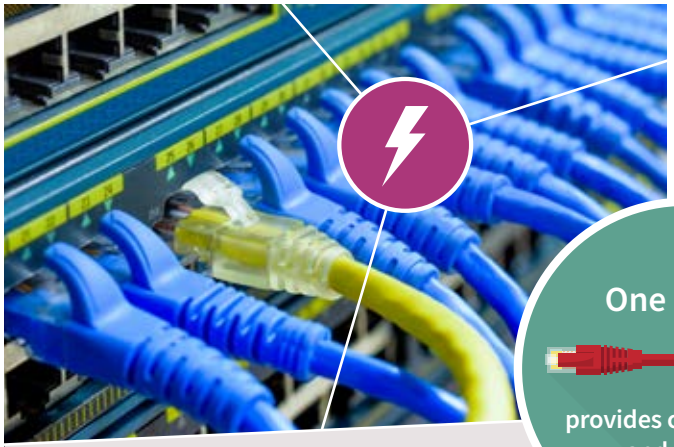
Application brief

Power over Ethernet

Bring your Power over Ethernet (PoE) power supply designs to the next level for the new IEEE 802.3bt standard

What is Power over Ethernet?

Power over Ethernet (PoE) describes **any means of delivering electric power along with data** on twisted pair Ethernet cabling. In general, you can distinguish between PoE Power Sourcing Equipment (PSE) and PoE Powered Devices (PD):



One cable:

provides connectivity and power

Power Sourcing Equipment (PSE)

- Provides connectivity and sources power on the Ethernet cable
- Manages the power demand of connected Powered Devices

Powered Devices (PD)

- Any device which is powered by PoE with optional (external) auxiliary power supply

Overview of existing PoE standards

		802.3af (802.3at Type 1) “PoE”	802.3at Type 2 “PoE+”	802.3bt Type 3 “4PPoE”	802.3bt Type 4
Power Sourcing Equipment	Power available	15.40 W	30.00 W	60.00 W	100.00 W
	Voltage range	44.00 – 57.00 V	50.00 – 57.00 V	50.00 – 57.00 V	52.00 – 57.00 V
	Max. current	350 mA	600 mA	600 mA per pair	960 mA per pair
Powered Devices	Power available	12.95 W	25.50 W	51.00 W	71.00 W
	Voltage range	37.00 – 57.00 V	42.50 – 57.00 V	42.50 – 57.00 V	41.10 – 57.00 V
	Max. current	350 mA	600 mA	600 mA per pair	960 mA per pair

New IEEE 802.3bt standard

In September 2018, a new standard for Power over Ethernet, IEEE 802.3bt, was introduced. The standard changed the requirements for the power supply design of PoE devices.

Main features & changes with IEEE 802.3bt

1. Increased maximum power per port with fine power classification
Available power increased to 100 W with 8 power classes per port via signature or 0.1 W steps negotiated by LLDP

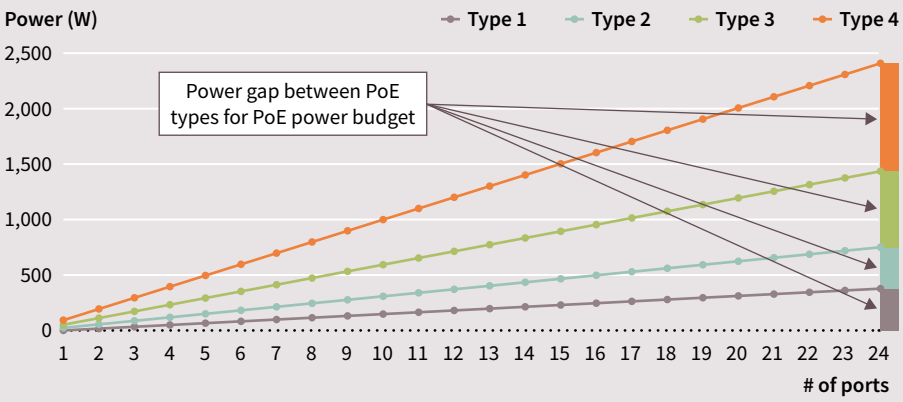
2. Power delivery via all four pairs
Power now delivered via four instead of two pairs to increase overall system efficiency

3. Lower standby power support
Changes in Maintain Power Signature (MPS) to maintain power supply of PD by PSE at lower standby power

4. Autoclass
Allows PSE to measure PD maximum power during power-on for better allocation of available power budget

The increased available power in IEEE 802.3bt creates new design challenges – e.g. for the Power Sourcing Equipment main power supply

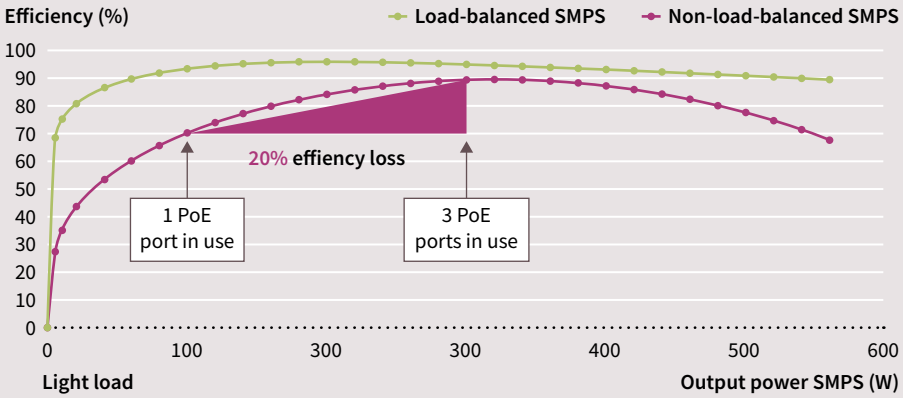
Relative power increase per port and PoE type



- Increased available power
- In IEEE 802.3bt, up to 100 W per port are available
- To fully support all ports with 100 W, PSE's power budget needs to be increased

Need for higher power density and efficiency gains

SMPS power sourcing equipment efficiency importance for 802.3bt type 4



- Wide load conditions
- Connected devices can be plugged and unplugged from PSE on the fly
- Dependent on number of connected devices, load of PSE can vary greatly

Even in wide load conditions, highest efficiency required

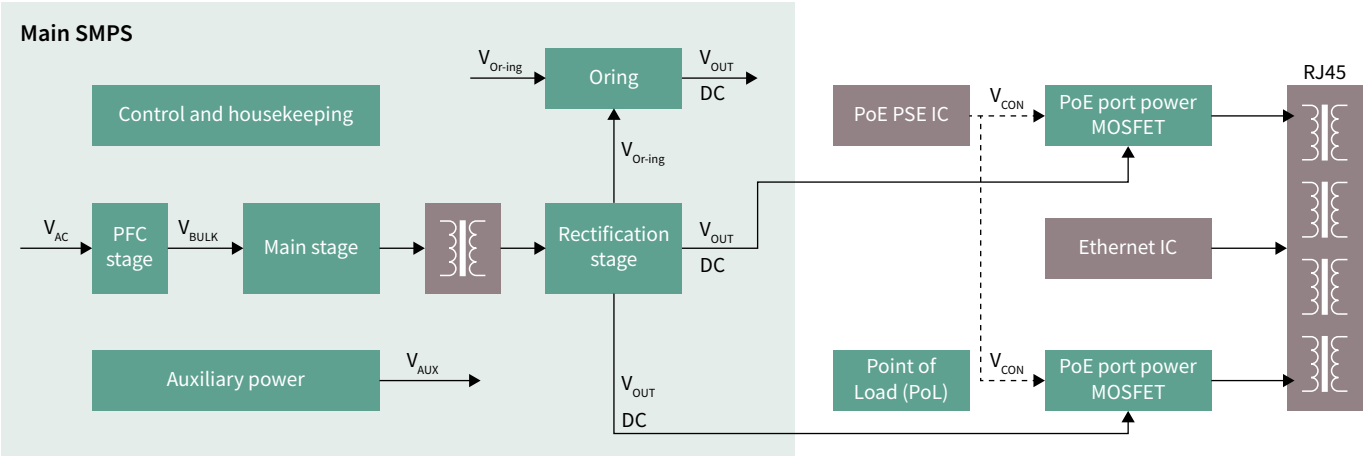
Infineon has long-standing expertise in power supplies and offers a highly reliable and efficient MOSFET and control IC portfolio for the power supply in your PoE designs.

Visit us at: www.infineon.com/poe

Infineon's portfolio for Power over Ethernet

Power Sourcing Equipment

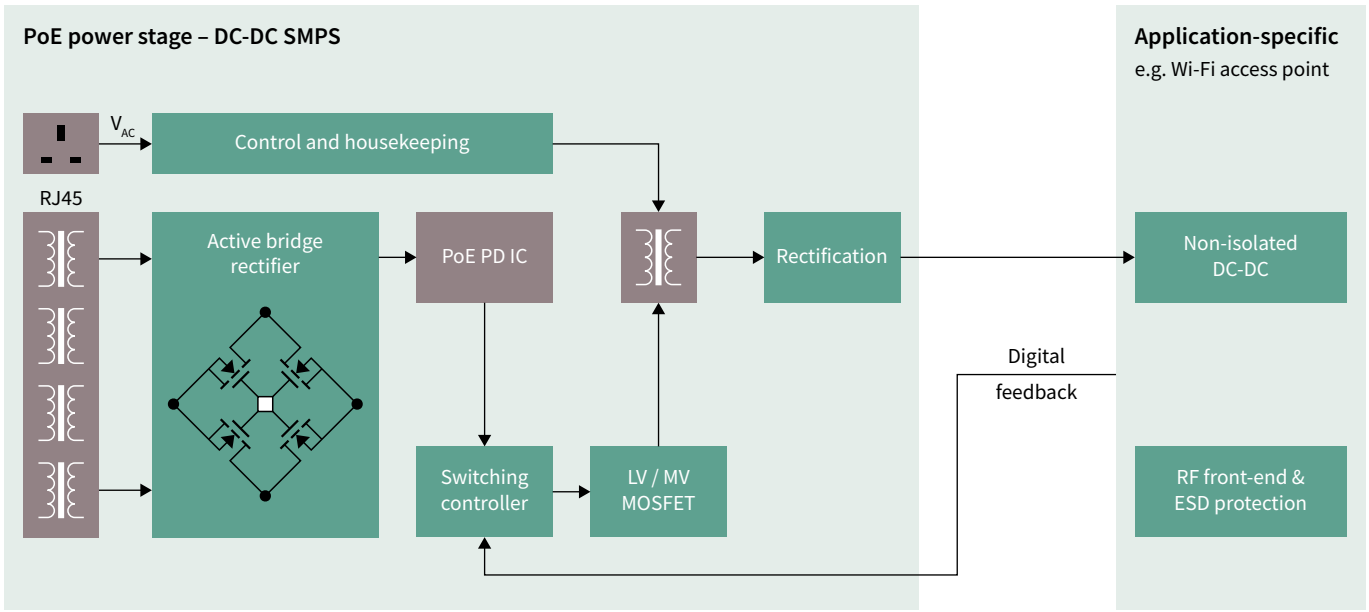
	Control and housekeeping Control ICs and MCUs for the SMPS stages, e.g. PFC, main stage, rectification	**Main stage** Highly efficient DC-DC switching main stage for voltage conversion	**Oring** Combination of several power stages in Oring configurations
Infineon offering	› Control ICs: CCM PFC IC, HB LLC IC, sync. rectification ICs, digital PFC-LLC combo controllers › XMC1000 & XMC4000 32-bit XMC™ Arm® Cortex®-M series	› 600 V to 950 V CoolMOS™ P7 › 600 V CoolMOS™ CFD7 & C7	› OptiMOS™ 60 V - 200 V



	Power Factor Correction (PFC) stage Correction of power factor closer to 1 to maximize real power drawn	**Rectification stage** Synchronous rectification of main stage output to provide smoothed and stabilized DC voltage output	**PoE port MOSFETs** Limit of port current during start-up and in case of faulty events
Infineon offering	› 600 V / 650 V CoolMOS™ C7 › 600 V CoolMOS™ P7 › CoolSiC™ Schottky diode 650 V G6	› 150 V OptiMOS™ 5 › OptiMOS™ 40 V - 200 V	› IR MOSFET™ 100 V

Powered Devices

	Low-voltage & medium-voltage MOSFET Switching element of the DC-DC SMPS	AC-DC backup SMPS Backup power supply via AC-DC stage if power via PoE is not available or sufficient	Active bridge rectifier Rectifier required by IEEE standard for polarity protection – efficiency boost by active bridge rectification	Switching controller Switching controllers for actively managing the DC-DC conversion	Rectification Rectifying output of DC-DC switching stage to provide smoothed and stabilized DC voltage output
Infineon offering	› OptiMOS™ 100 V - 150 V	› AC-DC integrated power stage – CoolSET™	› IR MOSFET™ 100 V › OptiMOS™ 100 V - 150 V	› XDP™ digital power controller XDPP1100	› OptiMOS™ 40 V / 60 V / 80 V / 100 V



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