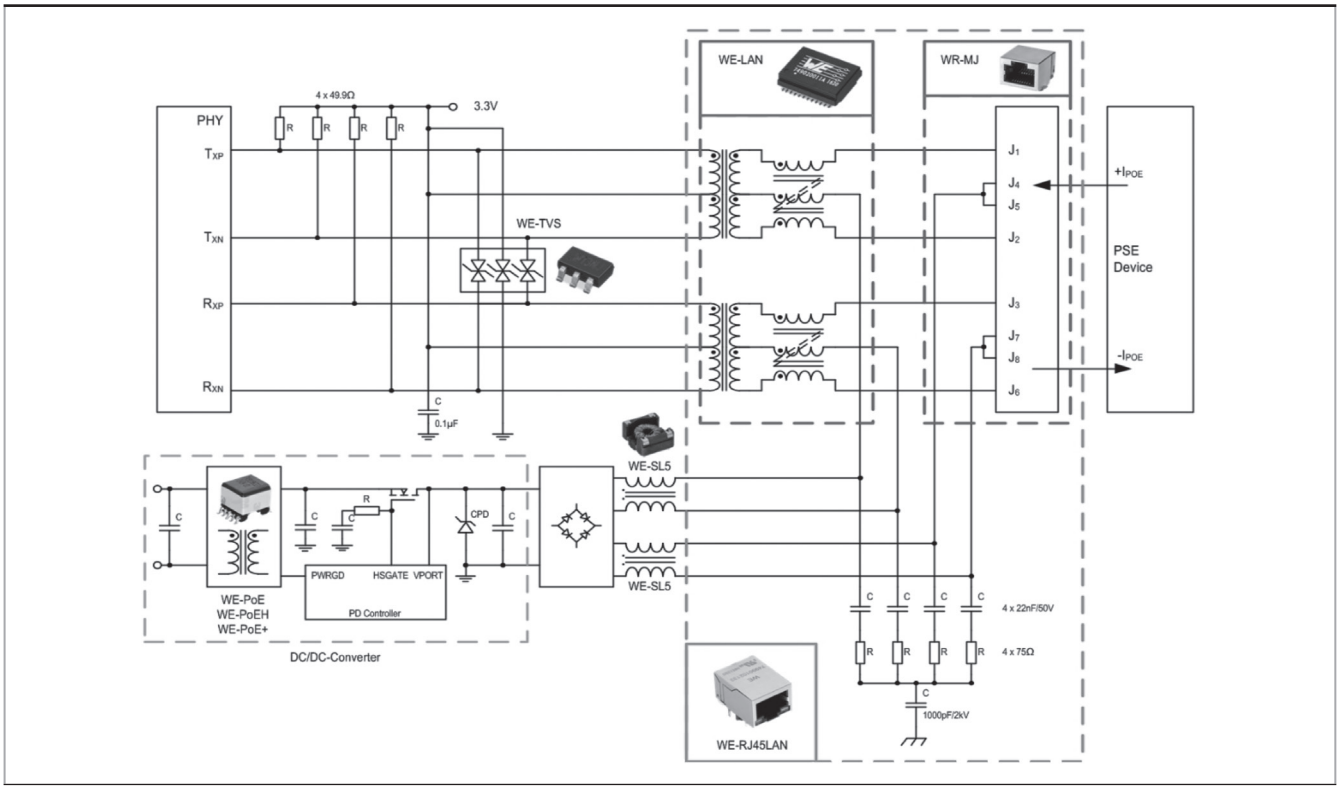
WE-LAN / WE-LAN RJ45

The LAN-PoE Connection



A connection between LAN and Power over Ethernet (PoE) follows the structure as shown in the picture. The Ethernet signals are routed through the cable to the PHY chip whereas the PoE current is transmitted over the same cable and will flow towards the DC/DC converter.

The differential LAN signals typically range between ±1 Volt at currents of 10 – 40 mA. With PoE according to IEEE 802.3af, currents of up to 350 mA per conductor pair are transmitted, whereas with PoE+ according to IEEE 802.3at, currents up to 600mA are possible. The voltage in both cases ranges between 48 and 57 Volts. In the case of PoE connection, currents will be transmitted either isolated from the data signals on separate conductor pairs (this is only possible with 10/100 Base-T systems, as only two pairs are used for signals), or they will be superimposed as PoE signals on top of the differential Ethernet signals.

Should this be the case, Ethernet signals and PoE currents will be separated at the transformer as described in the picture above. The Ethernet signals will be transmitted to the PHY chip, whereas the PoE currents will continue towards the DC/DC converter.

Only certain LAN transformers are suitable for PoE applications. As well as larger wire cross-sections being required, the magnetic (ring) cores are less susceptible to saturation due to the high PoE currents. Furthermore, the common mode chokes are usually trifillar or quadfillar wounded to also avoid also the saturation.

Most LAN transformers do not provide protection against ESD or surge impulses. Since these voltages are associated with rapid current increases, they can couple onto the transformer from the cable side to the PHY chip and damage it. It is therefore recommended to connect each signal line between the transformer and PHY chip to a TVS diode with a low capacitance of around 2pF (e.g. WE-TVS 824 015). Protection against surge pulses, such as long lines near electrical machines, is provided by gas discharge tubes (GDTs) connected between the LAN transformers and PHY chip from each signal line to GND.

Common mode interferences can also flow in the direction of the DC/DC converter, which is the reason for the use of a common mode choke (CMC) is also advisable here. This filter should be designed to suppress as much broadband signals as possible from the switching frequency of the DC/DC converter, without attenuating the PoE signal (e.g. WE-SL5 744272392 for PoE and WE-SL5 744272332 for PoE+. Other available matchcodes for PoE application could be WE-CNSW, WE-SL2, WE-SL3 and WE-SL5HC).

After the CMC a diode bridge follows, which protects the powered device from polarity mismatches coming from the power source. An extra TVS diode (labelled in the picture above as CPD) is needed as protection of the DC/DC converter against surge pulses.

The DC/DC converter itself is used to control the incoming voltage. Step-down converters can thus be used to operate devices which have a voltage supply of for example 5 Volts.

Typically, a flyback transformer is used to provide power to the powered devices, such as an IP Camera. The PoE transformer inside the DC/DC converter is isolated like the LAN transformer, with typically 1.5kV primary to secondary side isolation, separating SELF and TNV-1 circuits, as per IEEE 802.3.

Depending on the power required by the powered device, customers may choose between the power transformers WE-PoE, WE-PoEH or WE-PoE+. They all use forward/flyback topology and are compatible with IEEE PoE standards.