



EMI Filters

TRUSTED • INNOVATIVE • RELIABLE

Company Overview

At TDK-Lambda, a “Power Supply” is more than just an electronic device. It is the “heart” of our customers’ systems and the core element of safety and reliability.

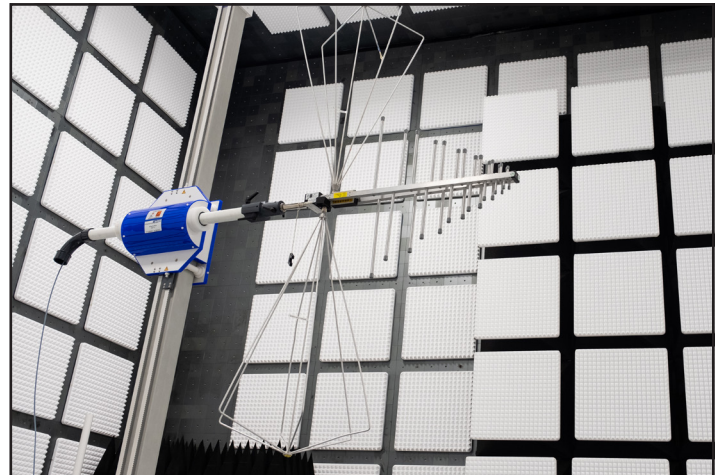
TDK-Lambda Corporation, a group company of TDK Corporation, is a leading global power supply company providing highly reliable power supplies worldwide. TDK-Lambda Corporation meets the various needs of customers with our entire range of activities, from research and development to manufacturing, sales, and service with bases in five key areas, covering Japan, EMEA, North America, China, and SE Asia.

Since 1948, as a leading global manufacturer, we have been developing and producing innovative and highly reliable power supplies for a wide spectrum of applications. TDK-Lambda is one of the oldest and most trusted manufacturers of high quality power supply solutions used in critical applications.

<https://www.us.lambda.tdk.com/>

Organization

- Founded in 1948; offering long term financial stability
- An independently recognized market leader
- Worldwide recognition for high reliability
- Outstanding customer support
- International organization with strong local presence
- Local design capability
- Experts in power supply solutions
- Local inventory / local buffer



Benefits of using TDK-Lambda

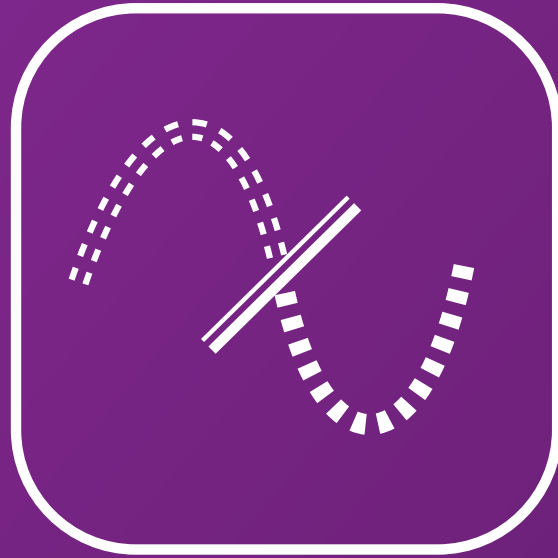
- World Class Design and Engineering Support
- Leaders in Development of Advanced Technologies
- Global Presence for Local Support
- Faster Time to Market
- Low Cost Manufacturing (Reduced System Cost)
- Increase Customer Productivity with High Level Assembly and Turnkey Solutions
- Lower Development Risk
- Extensive Catalog of Innovative Field Proven Designs
- Comprehensive In-House Qualification/Testing
- Highly Experienced Global Logistics Capability
- Vendor Reduction – Single Source for Custom and Standard Solutions
- Long Term Financial Stability

Key Market Segments Include:

- Medical and Life Science
- Industrial
- Factory/Building Automation
- Process Control
- Robotics
- Test and Measurement
- Transportation
- Renewable Energy
- LED Applications & Signage
- Avionics & Defense/COTS
- Semiconductor Fabrication Equipment
- Information & Communications Technology
- Broadcasting
- Food and Beverage



Filter Modules



EMI Filters

Applications

- ◆ Industrial
- ◆ Medical
- ◆ Communications
- ◆ Test and Measurement
- ◆ Avionics and Defense/COTS
- ◆ Transportation and Railway

Features

- ◆ Common mode and differential mode filters
- ◆ High saturation amorphous core
- ◆ Low AC leakage filters for medical applications
- ◆ Low profile
- ◆ Compact size and form factor
- ◆ Open frame, enclosed or Baseplate construction
- ◆ Remote ON/OFF
- ◆ Input spike and transient suppression (MIL-STD-1275, MIL-STD-704, RTCA/DO-160)
- ◆ MIL-STD-461



Filter Modules

Product Series	Input Phase	Rated Input Voltage	Rated Current (A)	SCCR Rating	Terminals	DIN Rail	Core Materials	2 Stage	Dimension / LxWxH (mm)	Low Leakage
IDQ	DC	DC 75V	10		On Board		Ferrite		50x15x10.8	
FQA	DC	DC 40V	20		On Board		Ferrite		60.6x55.9x12.7/ 60.6x39.5x12.7	
FQB	DC	DC 40V	20		On Board		Ferrite		60.6x55.9x12.7/ 60.6x39x12.7	
RDEN	DC	DC 48V	50		Stud		Ferrite		116x60x30	
RPA	1-Phase	AC/DC 250V	3, 6		Inlet		Amorphous		58.8x50x22.2	Yes
RPE	1-Phase	AC/DC 250V	3, 6, 10		Inlet		Ferrite		58.8x50x22.2	Yes
RPE-F	1-Phase	AC/DC 250V	3, 6		Inlet		Ferrite		58.7x44x35	Yes
RSAG	1-Phase	AC/DC 250V	0.5, 1, 2, 3, 4, 6		On Board		Amorphous		32x20x21	
RSAN	1-Phase	AC/DC 250V	3, 6, 10, 16, 20, 30, 40, 50, 60	Yes	Screw Terminal	Up to 30A	Amorphous		87x52x35/170x90x54	Yes
RSEG	1-Phase	AC/DC 250V	0.5, 1, 2, 3, 4, 6		On Board		Ferrite		32x20x21	
RSAL	1-Phase	AC/DC 250V	0.5, 1, 2, 3, 6		Push-on, Wire		Amorphous		45x50x20	Yes
RSEL	1-Phase	AC/DC 250V	0.5, 1, 2, 3, 6		Push-on, Wire		Ferrite		45x50x20	Yes
RSEN	1-Phase	AC/DC 250V	3, 6, 10, 16, 20, 30, 40, 50, 60, 80, 100, 150, 200, 250, 300	Up to 60A	Screw Terminal	Up to 30A	Ferrite		87x52x35/170x90x54/ 267x161x85/290x190x88/ 390x195x103	Yes
RSEV	1-Phase	AC/DC 250V	6, 10, 16, 20, 30	Yes	Screw Terminal		Ferrite		85x39x30	
RSHN	1-Phase	AC/DC 250V	3, 6, 10, 16, 20, 30, 40, 50, 60, 80, 100, 150, 200, 250, 300	Up to 60A	Screw Terminal	Up to 30A	Ferrite	Yes	98x52x35/127x52x35/ 272x100x60/430x161x85/ 473x190x88/593x195x103	Yes
RSKN	1-Phase	AC/DC 250V	6, 10, 20, 30		Screw Terminal		Nanocrystal	Yes	107x47x26/117x47x30/ 151x52x35/151x67x35	
RSMN	1-Phase	AC/DC 250V	3, 6, 10, 16, 20, 30, 40, 50, 60	Up to 60A	Screw Terminal	Up to 30A	Amorphous	Yes	98x52x35/127x52x35/ 272x100x60	Yes
RTAN	3-Phase	AC/DC 500V	6, 10, 20, 30, 40, 50, 60	Up to 60A	Screw Terminal	Up to 30A	Amorphous		120x63x42/140x70x42/ 170x90x54	
RTCN	3-Phase	AC/DC 500V	6, 10, 20, 30, 40, 50, 60, 80, 100, 150, 200, 250, 300	Up to 150A	Screw Terminal		Ferrite		120x63x42/140x70x42/ 170x90x54/267x161x85/ 290x190x88/390x195x103	
RTEN	3-Phase	AC/DC 500V	6, 10, 20, 30, 40, 50, 60, 80, 100, 150, 200, 250, 300		Screw Terminal	Up to 30A	Ferrite		120x63x42/140x70x42/ 170x90x54	
RTHB	3-Phase	AC/DC 500V 80, 100, 150	6, 10, 20, 30, 40, 50, 60,		Screw Terminal		Ferrite	Yes	210x64x100/240x64x115/ 300x80x140/472x100x205/ 534x100x234	
RTHN-5	3-Phase	AC/DC 500V	6, 10, 20, 30, 40, 50, 60, 80, 100, 150, 200, 250, 300	Up to 150A	Screw Terminal		Ferrite	Yes	210x95x50/240x105x55/ 300x128x68/430x161x85/ 473x190x88/593x195x103	
RTMN	3-Phase	AC/DC 500V	6, 10, 20, 30, 40, 50, 60	Yes	Screw Terminal		Amorphous	Yes	210x95x50/240x105x55/ 300x128x68	



Single Phase AC Filter Line Up

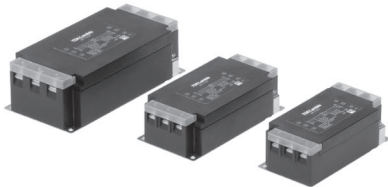


RSEN Series

[Full Datasheet](https://product.tdk.com/en/power/rsen)
<https://product.tdk.com/en/power/rsen>

Single phase 250Vac 3 to 300A EMI Filters with DIN rail option

- ◆ 3 to 300A Current Ratings
- ◆ Low Earth Leakage Current Option (Up to 30A)
- ◆ DIN Rail Mount Option (Up to 30A)
- ◆ Captive Hardware
- ◆ Safety Certified



RSHN Series

[Full Datasheet](https://product.tdk.com/en/power/rshn)
<https://product.tdk.com/en/power/rshn>

3 to 300A, 250Vac EMI Filters

- ◆ 3 to 300A Current Ratings
- ◆ Low Earth Leakage Current Option (Up to 30A)
- ◆ Two Stage Filter
- ◆ DIN Rail Mount Option (Up to 30A)
- ◆ Captive Hardware
- ◆ Safety Certified



RPA / RPE Series

[Full Datasheet](https://product.tdk.com/en/power/rpa)
<https://product.tdk.com/en/power/rpa>
<https://product.tdk.com/en/power/rpe>

Single phase 250Vac 3 to 10A Power Entry Module EMI Filters

- ◆ RPA 3 to 6A / RPE 3 to 10A Current Ratings
- ◆ Panel Mount with IEC320 Inlet
- ◆ Low Leakage and/or Discharge Resistor Options
- ◆ Amorphous Core Technology (RPA Only)
- ◆ Safety Certified

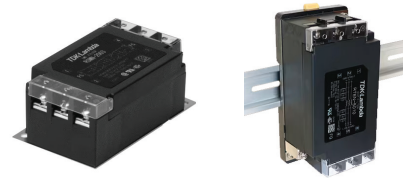


RSAN Series

[Full Datasheet](https://product.tdk.com/en/power/rsan)
<https://product.tdk.com/en/power/rsan>

Single phase 250Vac 3 to 60A EMI Filters with DIN rail option

- ◆ 3 to 60A Current Ratings
- ◆ Low Earth Leakage Current Option (Up to 30A)
- ◆ DIN Rail Mount Option (Up to 30A)
- ◆ Amorphous Core Technology
- ◆ Captive Hardware
- ◆ Safety Certified



RSMN Series

[Full Datasheet](https://product.tdk.com/en/power/rsmn)
<https://product.tdk.com/en/power/rsmn>

Single phase 250Vac 3 to 60A EMI Filters with DIN rail option

- ◆ 3 to 60A Current Ratings
- ◆ Low Earth Leakage Current Option (Up to 30A)
- ◆ Two Stage Filter
- ◆ DIN Rail Mount Option (Up to 30A)
- ◆ Amorphous Core Technology
- ◆ Captive Hardware
- ◆ Safety Certified



RPE-F Series

[Full Datasheet](https://product.tdk.com/en/power/rpe-f)
<https://product.tdk.com/en/power/rpe-f>

Single phase 250Vac 3 to 6A Power Entry Module EMI Filters

- ◆ 3 to 6A Current Ratings
- ◆ Panel Mount with IEC320 Inlet
- ◆ Low Leakage and/or Discharge Resistor Options
- ◆ Safety Certified



Single Phase AC Filter Line Up



RSAL Series

[Full Datasheet](#)

<https://product.tdk.com/en/power/rsal>

Single phase 250Vac 0.5 to 6A EMI Filters

- ◆ Compact Size
- ◆ Low Earth Leakage Current Option (Up to 30A)
- ◆ 0.5 to 6A Current Ratings
- ◆ Lightweight
- ◆ Amorphous Core Technology
- ◆ Safety Certified



RSEL Series

[Full Datasheet](#)

<https://product.tdk.com/en/power/rse>

Single phase 250Vac 0.5 to 6A EMI Filters

- ◆ Compact Size
- ◆ Low Earth Leakage Current Option (Up to 30A)
- ◆ 0.5 to 6A Current Ratings
- ◆ Lightweight
- ◆ Safety Certified



RSEV Series

[Full Datasheet](#)

<https://product.tdk.com/en/power/rsev>

Single phase 250Vac 6 to 30A EMI Filters with DIN rail option

- ◆ Compact Size
- ◆ 6 to 30A Current Ratings
- ◆ DIN Rail Bracket Option
- ◆ Recessed Captive Screws
- ◆ Safety Certified



RSKN Series

[Full Datasheet](#)

<https://product.tdk.com/en/power/rskn>

Single phase 250Vac 6 to 30A EMI Filters

- ◆ Wide Band, High Attenuation
- ◆ 6 to 30A Current Ratings
- ◆ Two Stage Filter
- ◆ Integrated Terminal Block
- ◆ Safety Certified

RSAG/RSEG Series

[Full Datasheet RSAG](#)

<https://product.tdk.com/en/power/rsag>

[Full Datasheet RSEG](#)

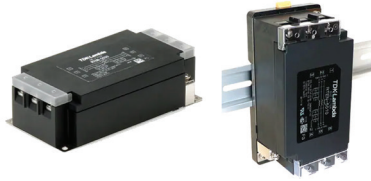
<https://product.tdk.com/en/power/rseg>

Single-Phase 250Vac 0.5 to 6A EMI Filters

- ◆ Compact Size
- ◆ 0.5 to 6A Current Ratings
- ◆ Lightweight
- ◆ Amorphous Core Technology (RSAG series)
- ◆ Safety Certified



Three Phase AC Filter Line Up


[Full Datasheet](https://product.tdk.com/en/power/rtan)

RTAN Series

Three phase 500Vac 6 to 60A EMI Filters with DIN rail mount option

- ◆ 6 to 60A Current Ratings
- ◆ Amorphous Core Technology
- ◆ DIN Rail Mount Option (Up to 30A)
- ◆ Captive Hardware
- ◆ Safety Certified

<https://product.tdk.com/en/power/rtan>

[Full Datasheet](https://product.tdk.com/en/power/rtcn)

RTCN Series

Three phase 500Vac 6 to 300A EMI Filters for Secondary Side Inverters

- ◆ 6 to 300A Current Ratings
- ◆ Low Profile Package
- ◆ Captive Hardware
- ◆ Safety Certified

<https://product.tdk.com/en/power/rtcn>

[Full Datasheet](https://product.tdk.com/en/power/rten)

RTEN Series

Three phase 500Vac 6 to 300A EMI Filters with DIN rail mount option

- ◆ 6 to 300A Current Ratings
- ◆ Low Profile
- ◆ DIN Rail Mount Option (Up to 30A)
- ◆ Captive Hardware
- ◆ Safety Certified

<https://product.tdk.com/en/power/rten>

[Full Datasheet](https://product.tdk.com/en/power/rthb)

RTHB Series

Three phase 500Vac 6 to 150A EMI Filters

- ◆ 6 to 150A Current Ratings
- ◆ Narrow Profile
- ◆ Two Stage Filter
- ◆ Captive Hardware
- ◆ Safety Certified

<https://product.tdk.com/en/power/rthb>

[Full Datasheet](https://product.tdk.com/en/power/rthn)

RTHN-5 Series

Three phase 500Vac 6 to 300A EMI Filters with high attenuation

- ◆ 6 to 300A Current Ratings
- ◆ Low Profile
- ◆ Two Stage Filter
- ◆ Captive Hardware
- ◆ Safety Certified

<https://product.tdk.com/en/power/rthn>

[Full Datasheet](https://product.tdk.com/en/power/rtmn)

RTMN Series

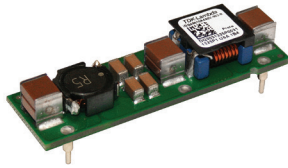
Three phase 500Vac 6 to 60A EMI Filters with high attenuation & surge protection

- ◆ 6 to 60A Current Ratings
- ◆ Low Profile
- ◆ High Noise and Pulse Attenuation
- ◆ Two Stage Filter
- ◆ Amorphous Core Technology
- ◆ Captive Hardware
- ◆ Safety Certified

<https://product.tdk.com/en/power/rtmn>



DC Input Filter Line Up



iDQ Series

[Full Datasheet](https://product.tdk.com/en/power/idq)

<https://product.tdk.com/en/power/idq>

75Vdc, 10A EMI Filters

- ◆ Differential and common mode noise filter module
- ◆ Low power loss (DCR ~11.5 mΩ Positive leg; ~6.5 mΩ Negative leg)
- ◆ High onboard capacitance reduces need for external components
- ◆ CE Mark
- ◆ Exceptional Differential Mode Performance
- ◆ Surface or Through Hole Mount Versions



FQB Series

[Full Datasheet](https://product.tdk.com/en/power/fqb)

<https://product.tdk.com/en/power/fqb>

MIL-COTS 20A, 40Vdc Active EMI Filters

- ◆ Filtering for Compliance to MIL-STD-461(F,G)
- ◆ Input Spike and Surge Suppression per MIL-STD-1275(D,E), MIL-STD-704(A-F) and RTCA/DO-160G (Sec 16-18)
- ◆ High Differential and Common Mode Noise Attenuation
- ◆ -55 to 115°C Temperature Range (M-Grade)
- ◆ Standard (S-Grade) or Enhanced Screening (M-Grade) Options
- ◆ Quarter Brick Size



FQA Series

[Full Datasheet](https://product.tdk.com/en/power/fqa)

<https://product.tdk.com/en/power/fqa>

MIL-COTS 20A, 40Vdc Passive EMI Filters

- ◆ Filtering for Compliance to MIL-STD-461G
- ◆ Input Spike suppression per MIL-STD-1275D and RTCA/DO-160G
- ◆ High Differential and Common Mode Noise Attenuation
- ◆ -55 to 115°C Temperature Range (M-Grade)
- ◆ Standard (S-Grade) or Enhanced Screening (M-Grade) Options
- ◆ Quarter Brick Size



RDEN Series

[Full Datasheet](https://product.tdk.com/en/power/rden)

<https://product.tdk.com/en/power/rden>

48Vdc 50A EMI Filter

- ◆ Wide Frequency Range
- ◆ High Noise Attenuation
- ◆ Large Termination Studs
- ◆ Low Profile



EMI Noise Filter Chart for Motors and Pumps

	208Vac 3-Phase					480Vac 3-Phase					115/120Vac 1-Phase				
Motor or Pump capacity(kW)	Noise Filter Rated Current(A)	General Purpose	High Saturation (Pulse Noise)	High Attenuation	High Saturation & Attenuation	Noise Filter Rated Current(A)	General Purpose	High Saturation (Pulse Noise)	High Attenuation	High Saturation & Attenuation	Noise Filter Rated Current(A)	General Purpose	High Saturation (Pulse Noise)	High Attenuation	High Saturation & Attenuation
Number of Filter stages	-	1	1	2	2	-	1	1	2	2	-	1	1	2	2
0.1	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	-	-	-	-	-	10	RSEN-2010	RSAN-2010	RSHN-2010	RSMN-2010
0.2	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	6	RTEN-5006	RTAN-5006	RTHN-5006	RTMN-5006	10	RSEN-2010	RSAN-2010	RSHN-2010	RSMN-2010
0.4	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	6	RTEN-5006	RTAN-5006	RTHN-5006	RTMN-5006	16	RSEN-2016	RSAN-2016	RSHN-2016	RSMN-2016
0.75	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	6	RTEN-5006	RTAN-5006	RTHN-5006	RTMN-5006	20	RSEN-2020	RSAN-2020	RSHN-2020	RSMN-2020
1.1	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	-	-	-	-	-	-	-	-	-	-
1.5	20	RTEN-5020	RTAN-5020	RTHN-5020	RTMN-5020	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	30	RSEN-2030	RSAN-2030	RSHN-2030	RSMN-2030
2.2	20	RTEN-5020	RTAN-5020	RTHN-5020	RTMN-5020	10	RTEN-5010	RTAN-5010	RTHN-5010	RTMN-5010	40	RSEN-2040	RSAN-2040	RSHN-2040	RSMN-2040
3	20	RTEN-5020	RTAN-5020	RTHN-5020	RTMN-5020	20	RTEN-5020	RTAN-5020	RTHN-5020	RTMN-5020	-	-	-	-	-
3.7	30	RTEN-5030	RTAN-5030	RTHN-5030	RTMN-5030	20	RTEN-5020	RTAN-5020	RTHN-5020	RTMN-5020	50	RSEN-2050	RSAN-2050	RSHN-2050	RSMN-2050
5.5	40	RTEN-5040	RTAN-5040	RTHN-5040	RTMN-5040	30	RTEN-5030	RTAN-5030	RTHN-5030	RTMN-5030					
7.5	60	RTEN-5060	RTAN-5060	RTHN-5060	RTMN-5060	40	RTEN-5040	RTAN-5040	RTHN-5040	RTMN-5040					
11	100	RTEN-5100		RTHN-5100		50	RTEN-5050	RTAN-5050	RTHN-5050	RTMN-5050					
15	100	RTEN-5100		RTHN-5100		60	RTEN-5060	RTAN-5060	RTHN-5060	RTMN-5060					
18.5	150	RTEN-5150		RTHN-5150		60	RTEN-5060	RTAN-5060	RTHN-5060	RTMN-5060					
22	150	RTEN-5150		RTHN-5150		100	RTEN-5100		RTHN-5100						
30	150	RTEN-5150		RTHN-5150		100	RTEN-5100		RTHN-5100						
37	200	RTEN-5200		RTHN-5200		100	RTEN-5100		RTHN-5100						
45	200	RTEN-5200		RTHN-5200		150	RTEN-5150		RTHN-5150						
55	300	RTEN-5300		RTHN-5300		150	RTEN-5150		RTHN-5150						
75						200	RTEN-5200		RTHN-5200						
90						250	RTEN-5250		RTHN-5250						
110						300	RTEN-5300		RTHN-5300						
132						Please inquire for 132kw or more on a case-by-case basis.									
160															
200															
220															
250															
315															
355															

Why are EMI/EMC filters needed?

From a legislative viewpoint, EMI (ElectroMagnetic Interference) is the measurement and restriction, to defined limits, of unwanted conducted or radiated electrical noise from a source. Both the power supply and the equipment it is powering may be considered the “source”.

EMC (ElectroMagnetic Compatibility) is the ability of equipment to withstand, again to defined limits, a variety of external electromagnetic signals. Regulation of both the “source’s” emissions and the ability of the load to function under those emissions (and other potential external influences), guarantees the end product a defined level of performance.

International standards for AC-DC and DC-DC power supplies

EN 55011, EN 55032 and EN 61000 are the most widely used standards, which cover emissions and immunity. For EMI, the less stringent Class A level is used for industrial applications and the more stringent Class B for medical and household applications. These in part refer to the standards of CISPR (International Special Committee on Radio Interference). Figure 1 shows levels for an AC-DC power supply over the 150kHz to 30MHz range required for EN 55011. In the US, FCC Part 15 is used to regulate “unlicensed” radio frequency (RF) transmissions. MIL-STD-461 is the US military standard for subsystems.

In the European Union (EU) manufacturers of electronic equipment have to state their compliance by labelling their product with the CE Mark to the EU Directive 2004/108/EC. For the UK, the UKCA mark is applied. These marks refer to multiple standards according to the end application.

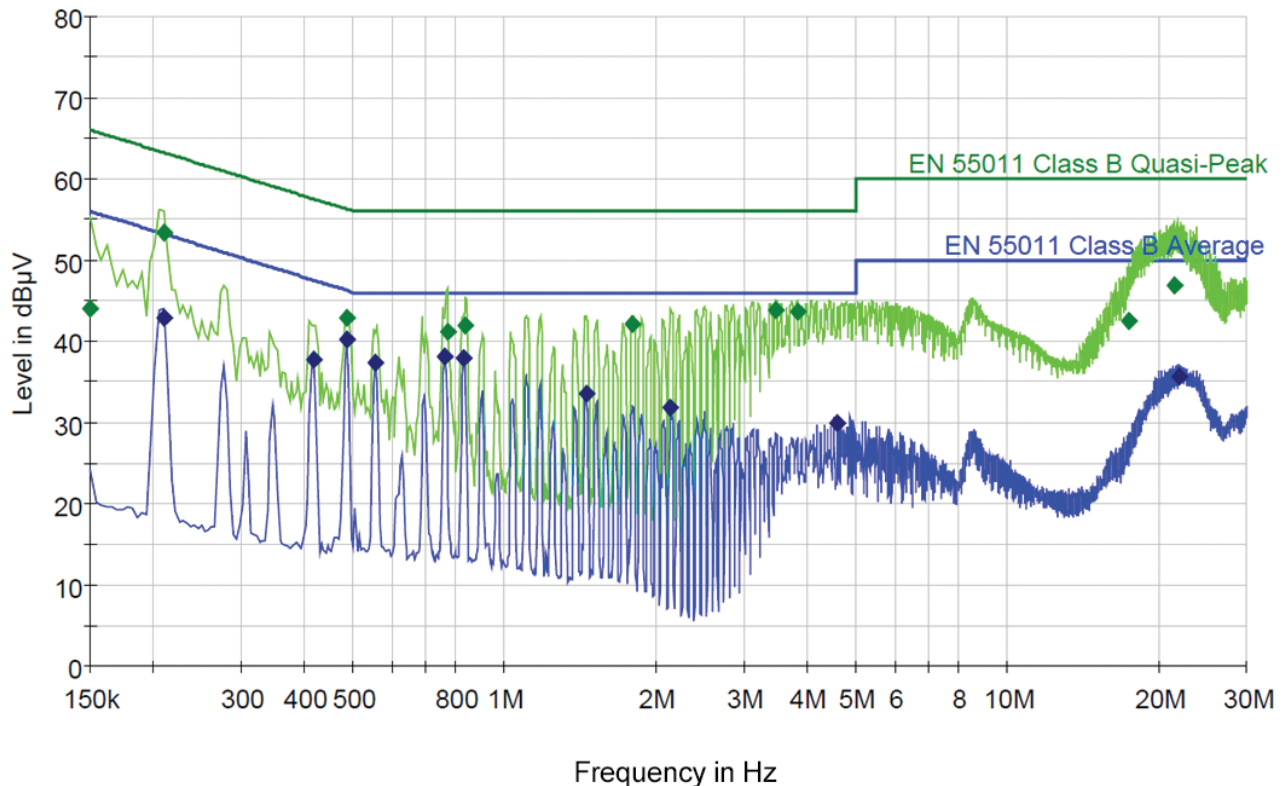


Figure 1: EN 55011-B conducted emissions plot and limits for an AC-DC power supply

Why are EMI/EMC filters needed?

Regulation of EMC immunity is usually defined by IEC 61000, which is a very broad set of standards. For the purpose of this article, only the two sections applicable to a typical EMI/EMC filter used with an AC-DC power supply will be discussed.

EN 61000-4-4: Electrical fast transient/burst immunity testing –bursts of electrical noise are injected on the input lines to simulate inductive switching, relays, etc.

EN 61000-4-5: Surge immunity testing –single pulses are injected on the input lines to simulate lightning strikes and high energy switching.

To address the impact of harm, both of the above include different immunity test voltages (ranging from 500V to 4,000V peak) and different performance criteria (A through D). With criteria A the product will continue to operate as normal during the test, B states an automatic recovery after the test, C requires user intervention to restart the product and D is a loss of function that is not recoverable. If a product was being used in a critical application, then criteria A would be used of course.



How does an input EMI filter work?

EMI is generated from the switching of electrical currents and from a variety of sources including electronic power supplies. Power supplies convert an input voltage into regulated and isolated (in most cases) DC voltages to run a host of electronic products. That conversion is performed at high frequencies ranging from several thousand times a second to more than a million and will generate electrical noise.

A simple external EMI filter for a power supply will consist of passive components, including capacitors and inductors, connected together to form L-C circuits. The inductor(s) allow DC or low frequency currents to pass through, while blocking the unwanted high frequency currents. The capacitors provide a low impedance path to divert the high frequency noise away from the input of the filter, either back into the power supply, or into the ground connection.

Figure 1 shows a simple single stage power supply filter.

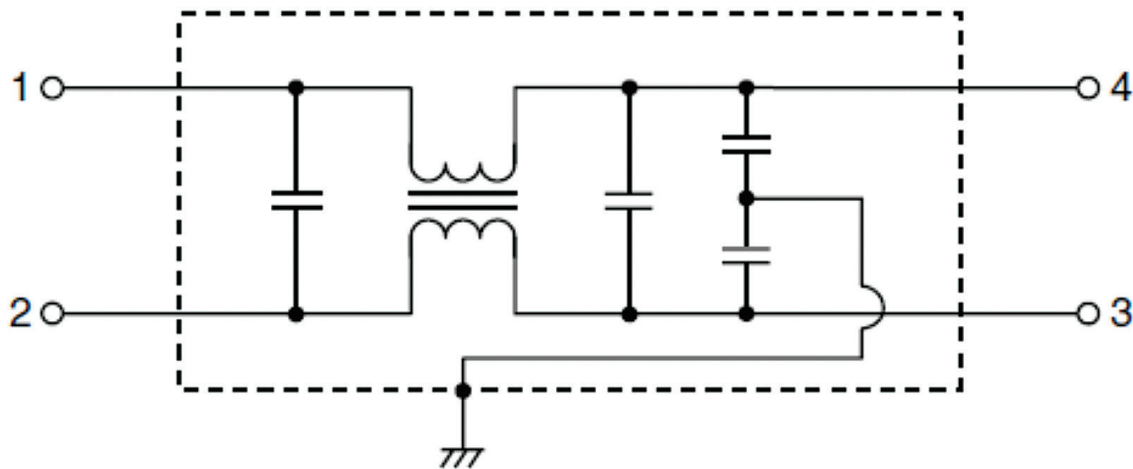


Figure 1: Single stage EMI filter

Why is an EMI filter needed?

One common question asked is “if the power supply meets the EMI/EMC standards, why do I need an external filter?” Power supplies are tested for the manufacturer by certification laboratories in optimum, repeatable conditions. Input and output cabling is defined, and resistors are often used to simulate a load for the product.

Unfortunately, when installed in a system, space constraints may add noise through closely coupled cables, particularly if the input and output wiring are not sufficiently separated. System microprocessors, motors, transmitters and other devices can also generate additional noise. In this case an additional system EMI filter may be needed for the system to pass EMC testing.

In some cases, manufacturers will rely on external shielding around their power supply, which may not be mentioned in the EMI test report.

Another blog will cover how to select a filter and how EMI/EMC testing is performed.

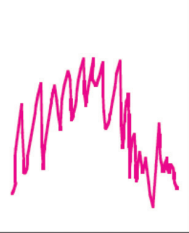
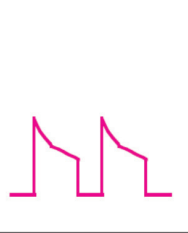
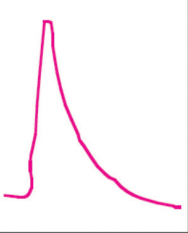
Selecting a line filter to reduce input transients

In addition to EMI (Electro Magnetic Interference) reduction, some EMC line filters are able to provide protection against input transients. These external influences can come from a number of sources and their energy level (measured in Joules) varies accordingly.

High frequency noise is usually generated by power supplies and motor drives. The voltage level is small and the energy level minimal - only several mJ. This can be easily handled by a standard EMI/EMC filter.

Impulsive noise is generated from relay switching or induction motors. Voltages can be in the thousands of Volts with an energy level of hundreds of mJs, significant enough to cause problems with a power supply. Although the IEC 61000-4-4 standard covers product immunity to electrical fast transient voltages on the input lines, the test limits for this are only +/-2kV. For more noisy environments, a filter containing additional protection is recommended.

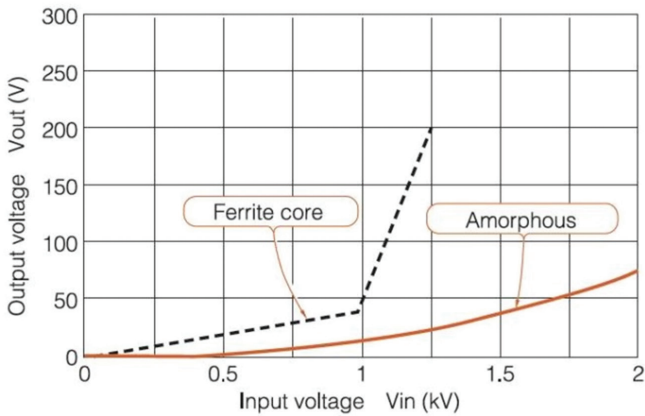
Surge noise is caused by lightning, and can have significant energy content. The voltage is very high, in the 10s of kVs. This level of energy is best clamped using special lightning arresters.

	High-frequency noise	Impulsive noise	Surge noise
Voltage level	- Several V	- Several kV	- Several 10 kV
Rise time	–	1 ns max.	0.5 μ s max.
Energy	Several mJ	Several 100 mJ	Several J – several kJ
Waveform			

TDK-Lambda uses amorphous cores to reduce impulsive noise spikes, rather than metal oxide varistors (MOVs) or voltage dependent resistors (VDRs). MOVs clamp spikes, but degrade over time following multiple line surges. Amorphous cores are made from very thin (μ m) ferromagnetic amorphous metal strips wound to form a doughnut shaped core, and do not degrade.

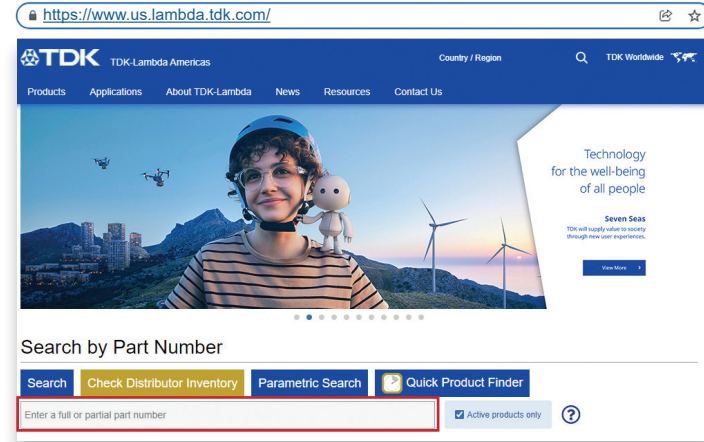
Although the ferrite cores used in most EMI/EMC filters do reduce the amplitude of voltage spikes, they can saturate and cause a significant decrease in attenuation.

Shown below is a comparison between a ferrite core and an amorphous core. It can be seen that the amorphous core out performs the ferrite core.

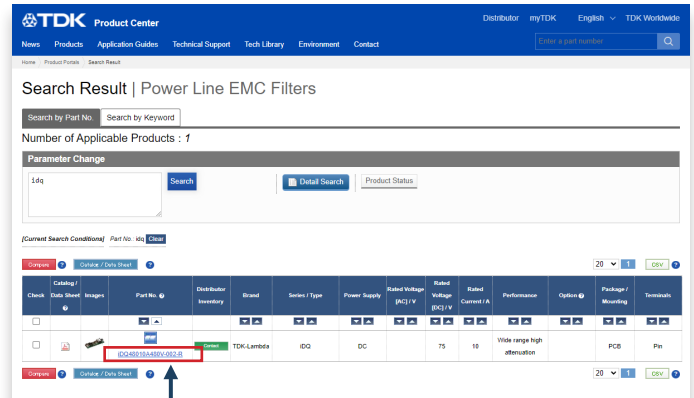


Design Tools and Product Collaterals

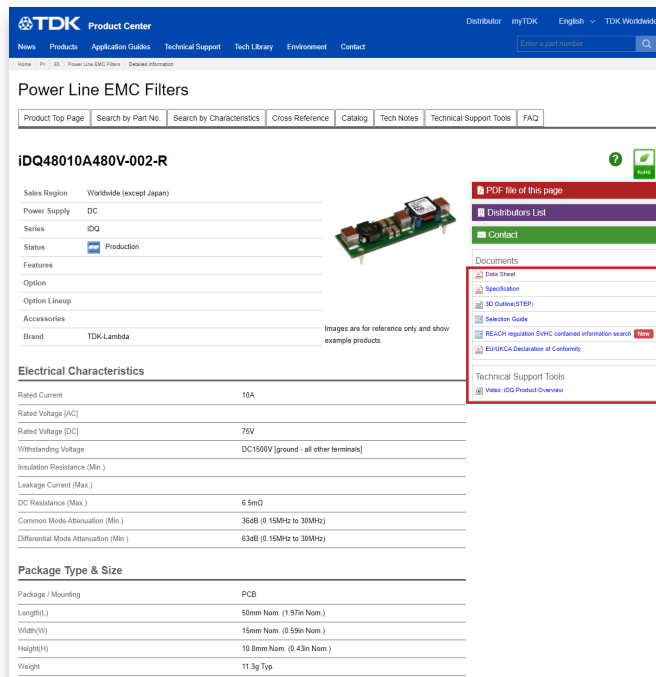
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