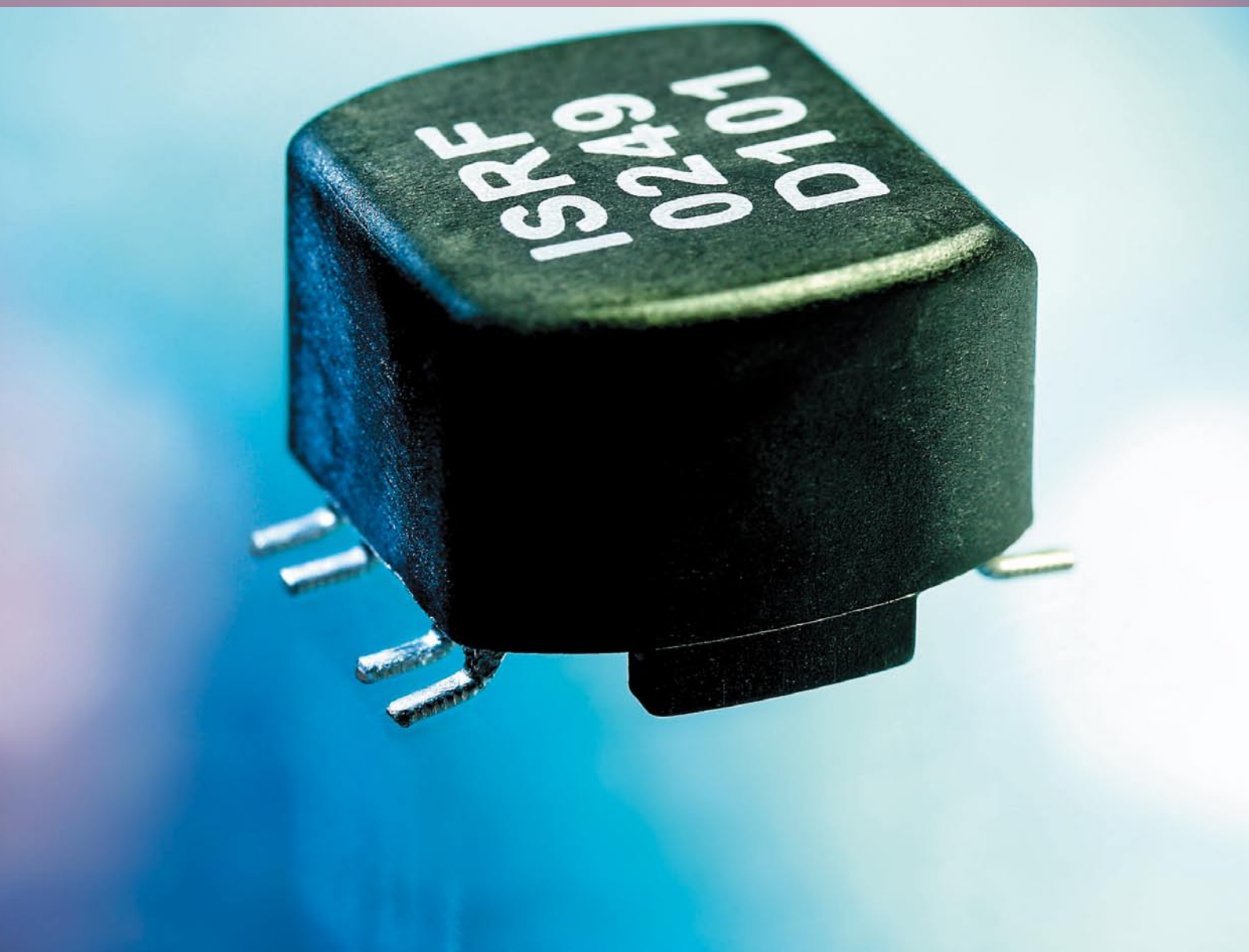
Product Group Catalog
EMC Products

www.schurter.com/emc

SCHURTER
ELECTRONIC COMPONENTS

Pulse Transformers



summary

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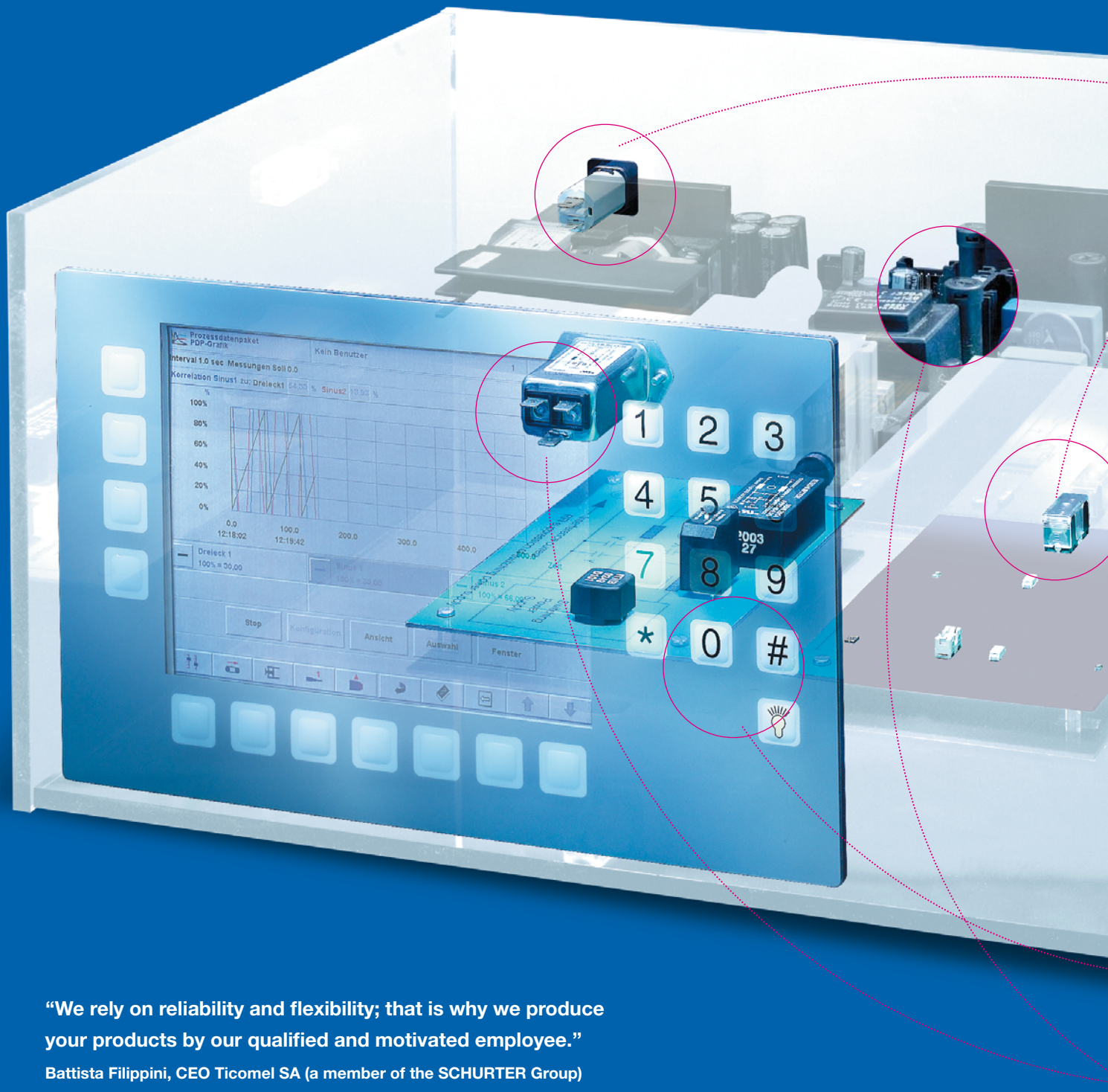
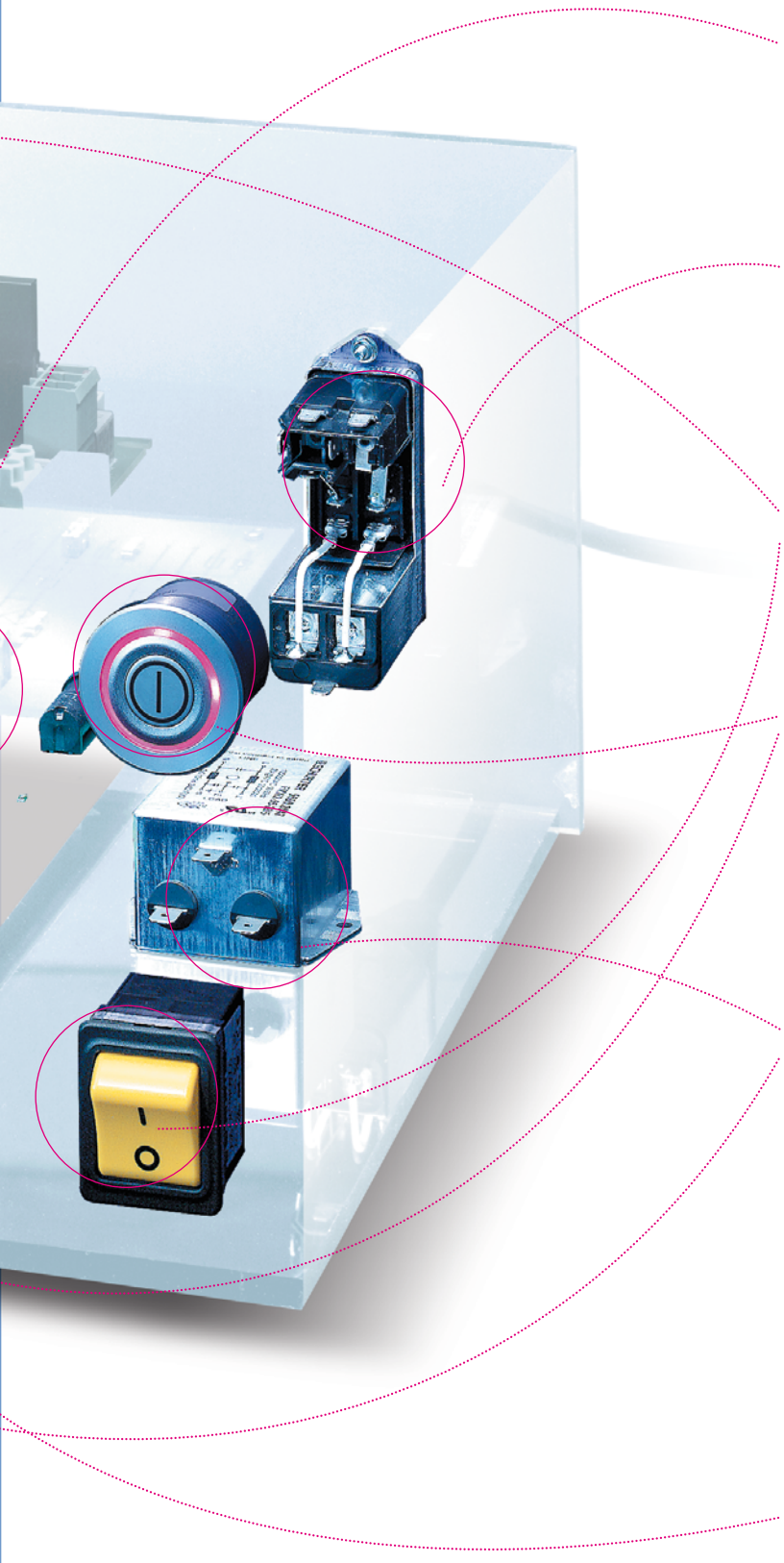


“We rely on reliability and flexibility; that is why we produce your products by our qualified and motivated employee.”

Battista Filippini, CEO Ticomel SA (a member of the SCHURTER Group)

> the Schurter Range at the Glance

SCHURTER is a progressive innovator and manufacturer of fuses, connectors, circuit breakers, input systems, EMC products and manufacturing services for the electronics industry. We focus on components that ensure safe supply of power and make the interface between human and machine easier.



fuses
non resettable fuses
telecom fuses
resettable fuses
fuseholders
fuseholders blocks & clips

connectors
power entry modules without line filter
power entry modules with line filter
appliance couplers
cord connectors (rewireable)
distribution units
cord sets

circuit breakers
thermal (t- and ta-line)
thermal-magnetic (tm- and as-line)
undervoltage protection
power entry modules with CBE

input systems
printmount switches
frontpanel switches
public transport switch
metal line switches
sensor switches
membrane keypads
sensor keypad
metal line keypads
touch panel / touch screen
housing systems and front panels

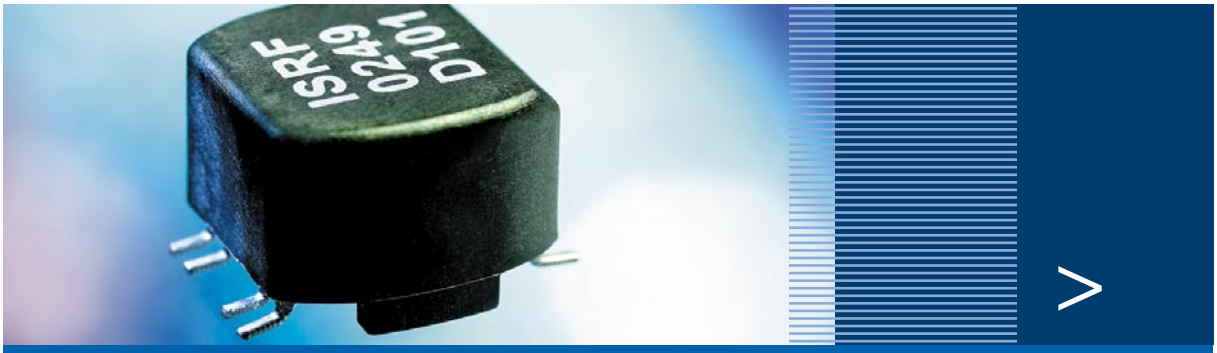
EMC products
power entry modules with line filter
1-phase line filters
3-phase line filters
chokes
pulse transformers
power stage driver modules

other products
voltage selector
test jacks & probes
indicators
data & signal, audio, dc/ din connectors

EMS
Electronic Manufacturing Services

	Description	Turn Ratio	Rated Voltage	Voltage-Time Integral	Pulse Rise Time	Mounting	Web Reference or Type
	Pulse transformers for THT mounting	1:1 , 2:1 , 1:1:1	up to 600 VAC	150 - 400 Vµs	0.05 - 1.5 µs	THT	IT 8
	Pulse transformers for SMD mounting	1:1 , 2:1 , 1:1:1	up to 600 VAC	150 - 400 Vµs	0.05 - 1.5 µs	SMD	IS 10
	Cost optimized pulse transformers for THT mounting	1:1 , 1:1:1 , 3:1:1	up to 500 VAC	200 - 500 Vµs	0.5 - 1.5 µs	THT	IL 13
	Cost optimized pulse transformers for THT mounting, short rise time	1:1 , 2:1 , 3:1 , 1:1:1	up to 500 VAC	150 - 300 Vµs	0.1 - 0.3 µs	THT	ILR 15
	Cost optimized pulse transformer for THT mounting, up to 2W	1:1:1 , 3:1:1	up to 500 VAC	500 Vµs	0.7 - 0.8 µs	THT	IX 16

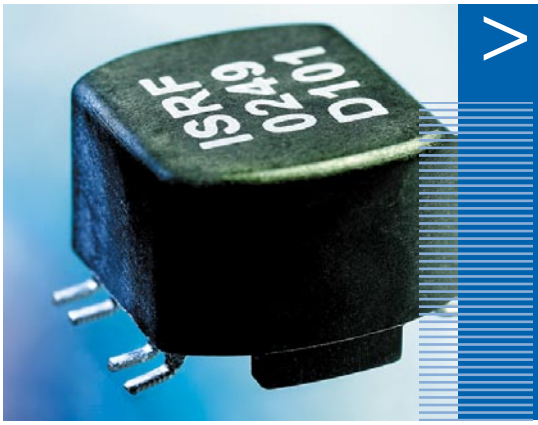
General Product Information see Pulse transformers page 30



SMD Pulse Transformers of the IS Serie

Schurter's IS-Pulse transformers are base on toroid technology which reduces the leakage inductance, stray capacitance and the losses. This is why this series suits for application having high switching cycles.

Converters require a galvanic decoupling between the signal and the power section. The efficiency of the IS series help you to switch our semiconductors safe and reliable.



Pulse Transformers

The application range of pulse transofrmers is very broad. In most cases, a signal or a control pulse must be transmitted between electrically isolated circuits.

Pulse transformers for THT mounting

Description

- High insulation rating (>3.2 kVAC) between the primary and the secondary windings
- High insulation rating up to 500V between the secondary windings
- Small coupling capacitances between primary and secondary windings limit transient feedback from the power supply side to the control electronics
- The defined partial discharge voltage guarantees an effecively unlimited serviceable live

Standards

- VDE 110b

Applications

- Galvanic separation of drive- and power-circuit
- Mainly used in ignition circuits with Thyristors, Triacs, power transistors and IGBT's
- DC/DC converters
- Line coupling transformers in high speed data transmission

References

General Product Information

Weblinks

Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

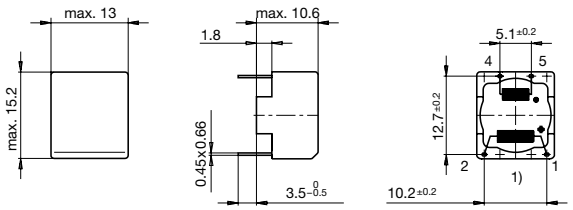
Technical Data

Rated Voltage	up to 600 VAC
Voltage-time Integral Us x Tw	150 - 400 Vµs
Pulse Rise Time	0.05 - 1.5 µs
Turn Ratio	1:1, 2:1, 1:1:1
Terminal technic	THT
Weight	6 - 11 g
Material: Housing	Plastics
Sealing Compound	UL 94V-0

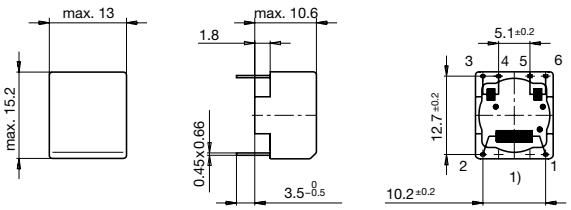
Climatic Category	25/100/21 acc. to IEC 60068-1
Allowable Operation Temp.	-25 °C to 100 °C

Dimensions

Case 35-3

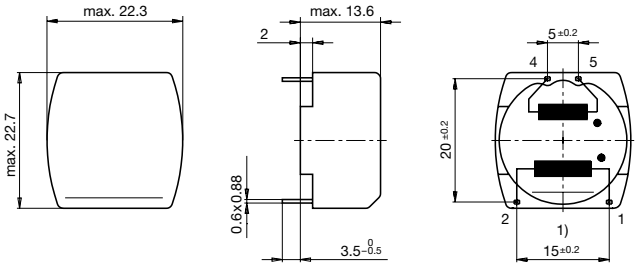


Case 35-4

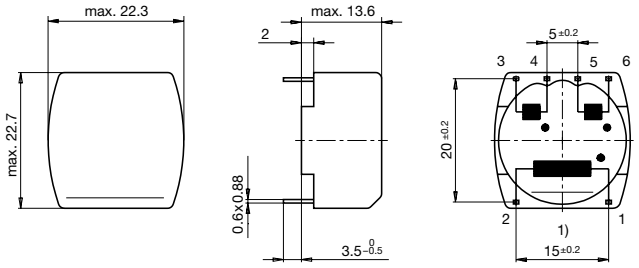


1) Prim.

Case 39-3

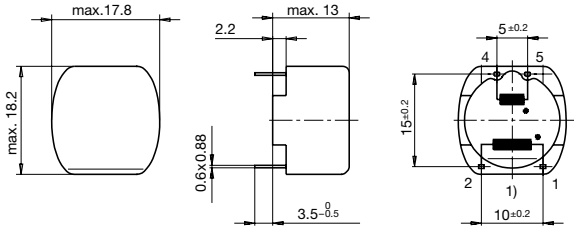


Case 39-4

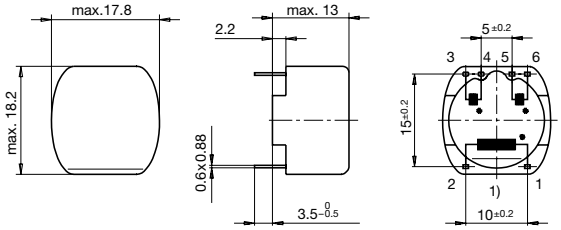


1) Prim.

Case 49-3



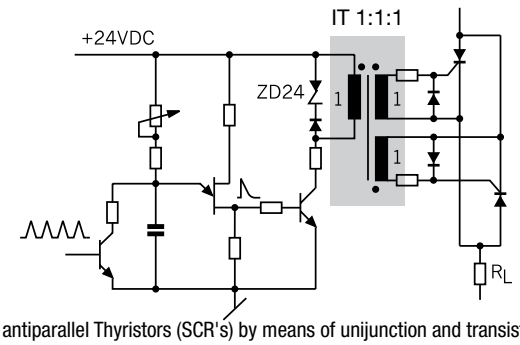
Case 49-4



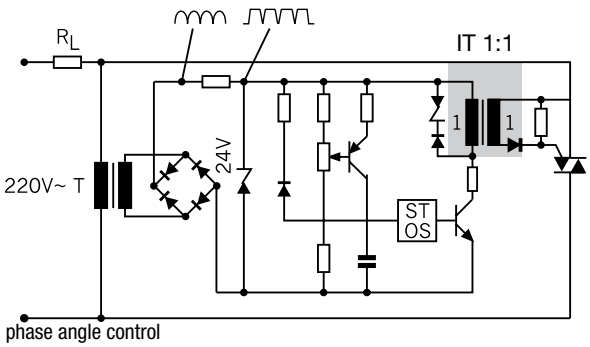
1) Prim.

1) Prim.

Diagrams



Firing of antiparallel Thyristors (SCR's) by means of unijunction and transistor amplifiers



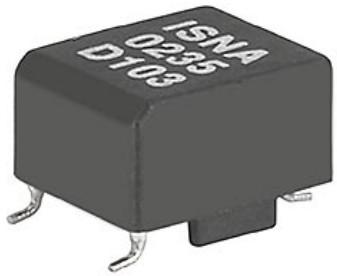
Triac phase angle control

Variants

Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Turn Ratio	T_r [µs]	I_{ign} [A]	U_{isol} [kV]	$U_s \times T_w$ [Vµs]	L_s [mH]	R_P [Ω]	R_S [Ω]	C_C [pF]	Weight [g]	Packing unit [pcs.]	Case	Order Number
1:1	0.9	0.1	3.5	200	2.8	1	1	20	8	480	35-3	ITNA-0235-D103
1:1	1	0.17	3.5	400	2.2	0.4	0.4	20	11	28	39-3	ITNA-0239-D202
1:1	1	0.1	3.5	300	3.5	0.7	0.7	20	9	45	49-3	ITNA-0249-D104

Pulse transformers for SMD mounting



Description

- High insulation rating (>3.2 kVAC) between the primary and the secondary windings
- High insulation rating up to 500V between the secondary windings
- Small coupling capacitances between primary and secondary windings limit transient feedback from the power supply side to the control electronics
- The defined partial discharge voltage guarantees an effecively unlimited serviceable live

Standards

- VDE 110b

Applications

- Galvanic separation of drive- and power-circuit
- Mainly used in ignition circuits with Thyristors, Triacs, power transistors and IGBT's
- DC/DC converters
- Line coupling transformers in high speed data transmission

References

General Product Information

Weblinks

Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

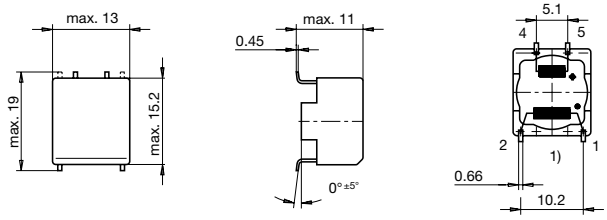
Technical Data

Rated Voltage	up to 600 VAC
Voltage-time Integral Us x Tw	150 - 400 Vµs
Pulse Rise Time	0.05 - 1.5 µs
Turn Ratio	1:1, 2:1, 1:1:1
Terminal technic	SMD
Weight	3 - 10 g
Material: Housing	UL 94V-0
Sealing Compound	UL 94V-0

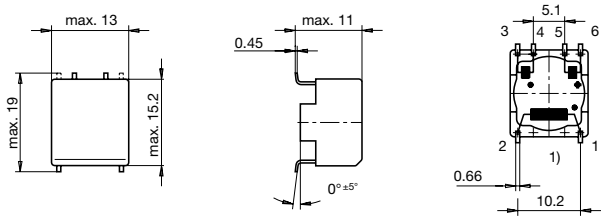
Climatic Category	25/100/21 acc. to IEC 60068-1
Allowable Operation Temp.	-25 °C to 100 °C

Dimensions

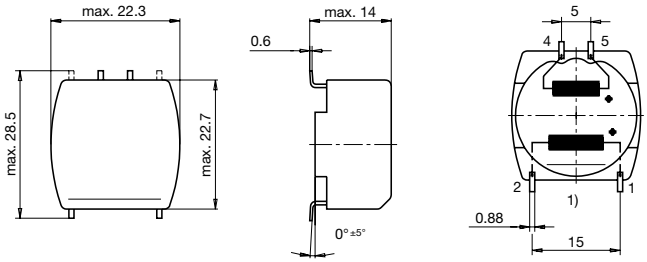
Case 35-3S



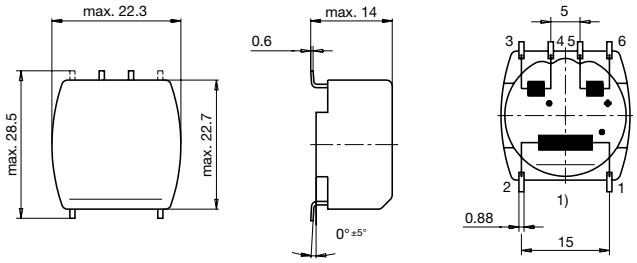
Case 35-4S



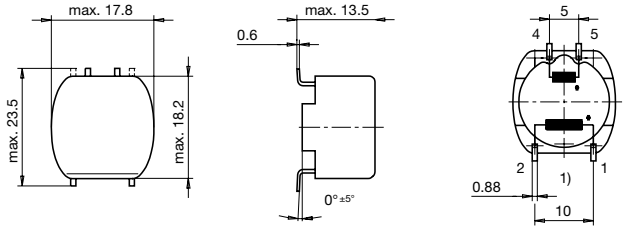
Case 39-3S



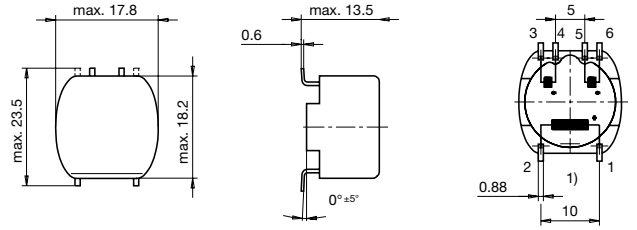
Case 39-4S



Case 49-3S

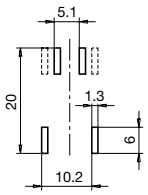


Case 49-4S



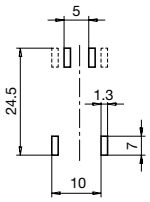
1) Prim.

Possible solder land pattern for SMD mounting
Case 35S

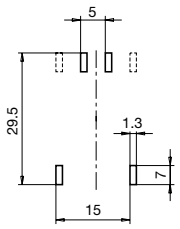


1) Prim.

Possible solder land pattern for SMD mounting
Case 49S



Possible solder land pattern for SMD mounting
Case 39S



Variants

Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Turn Ratio	T_r [µs]	I_{ign} [A]	U_{isol} [kV]	U_s x T_w [Vµs]	L_s [mH]	R_P [Ω]	R_S [Ω]	C_C [pF]	Weight [g]	Packing unit [pcs.]	Case	Order Number
1:1	0.9	0.1	3.5	200	2.8	1	1	20	3	480	35-3S	ISNA-0235-D103
1:1	1	0.17	3.5	400	2.2	0.4	0.4	20	10	28	39-3S	ISNA-0239-D202
1:1	1	0.1	3.5	300	3.5	0.7	0.7	20	6	45	49-3S	ISNA-0249-D104

SCHURTER ELECTRONIC COMPONENTS
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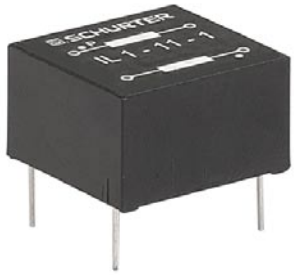
Cost optimized pulse transformers for THT mounting



Description

- High insulation rating (>2.2 kVAC) between the primary and the secondary windings
- Small coupling capacitances between primary and secondary windings limit transient feedback from the power supply side to the control electronics
- Cost optimized design
- The defined partial discharge voltage guarantees an effecively unlimited serviceable live

Standards

- VDE 110b

Applications

- Galvanic separation of drive- and power-circuit
- Mainly used in ignition circuits with Thyristors, Triacs, power transistors and IGBT's
- DC/DC converters
- Line coupling transformers in high speed data transmission

References

General Product Information

Weblinks

Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

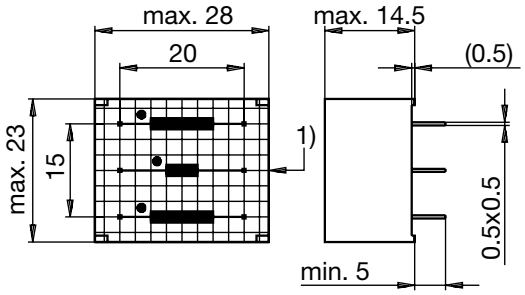
Technical Data

Rated Voltage	up to 500 VAC
Voltage-time Integral Us x Tw	200 - 500 Vµs
Pulse Rise Time	0.5 - 1.5 µs
Turn Ratio	1:1, 1:1:1, 3:1:1
Terminal technic	THT
Weight	7 - 15 g
Material: Housing	Plastics
Sealing Compound	UL 94V-0

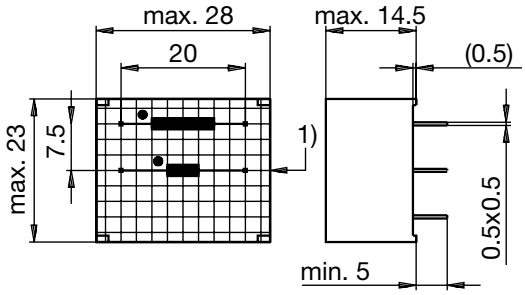
Climatic Category	25/100/21 acc. to IEC 60068-1
Allowable Operation Temp.	-25 °C to 100 °C

Dimensions

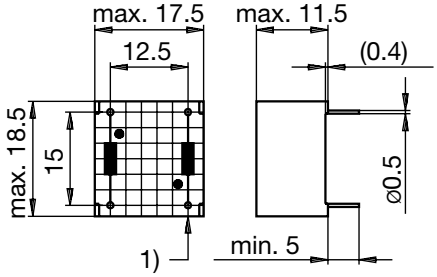
Case 14-8



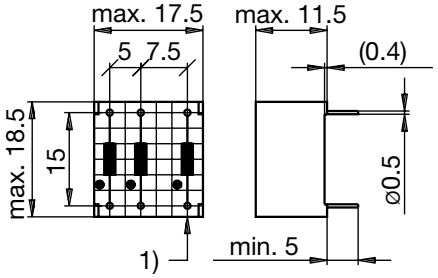
Case 14-9



Case 05-7



Case 05-8



1) Prim.

Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Variants

Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Turn Ratio	T_r [µs]	I_{ign} [A]	U_{VAC} [V]	U_{isol} [kV]	U_s x T_w [Vµs]	L_s [mH]	R_P [Ω]	R_S [Ω]	C_C [pF]	P_m [W]	Weight [g]	Packing unit [pcs.]	Case	Order Number
1:1	1	0.1	500	3.5	500	8.0	1.2	1.2	10	0.5	7	50	05-7	IL-11-0001
1:1	1	0.25	500	3.5	250	2.5	0.6	0.6	8	0.5	7	50	05-7	IL-11-0002
1:1	1	0.25	380	4.0	300	3.0	0.6	0.6	8	1.1	15	50	14-9	IL-21-0001

SCHURTER ELECTRONIC COMPONENTS

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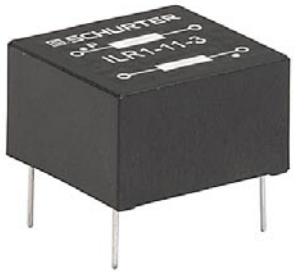
Cost optimized pulse transformers for THT mounting, short rise time



Description

- High insulation rating (>2.2 kVAC) between the primary and the secondary windings
- Small coupling capacitances between primary and secondary windings limit transient feedback from the power supply side to the control electronics
- Cost optimized design
- The defined partial discharge voltage guarantees an effecively unlimited serviceable live

Standards

- VDE 110b

Applications

- Galvanic separation of drive- and power-circuit
- Mainly used in ignition circuits with Thyristors, Triacs, power transistors and IGBT's
- DC/DC converters
- Line coupling transformers in high speed data transmission

References

General Product Information

Weblinks

Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

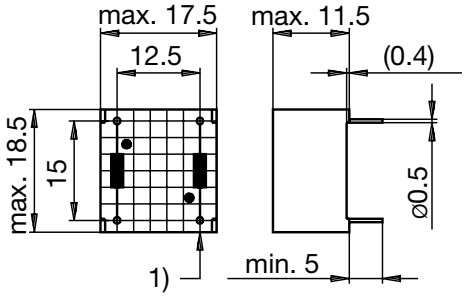
Technical Data

Rated Voltage	up to 500 VAC
Voltage-time Integral Us x Tw	150 - 300 Vµs
Pulse Rise Time	0.1 - 0.3 µs
Turn Ratio	1:1, 2:1, 3:1, 1:1:1
Terminal technic	THT
Weight	7 g
Material: Housing	Plastics
Sealing Compound	UL 94V-0

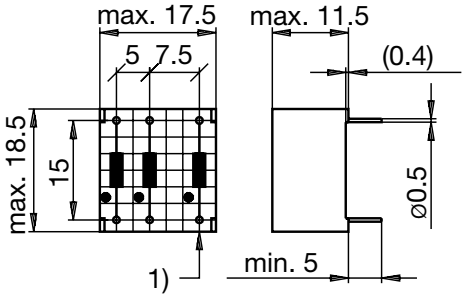
Climatic Category	25/100/21 acc. to IEC 60068-1
Allowable Operation Temp.	-25 °C to 100 °C

Dimensions

Case 05-7



Case 05-8



1) Prim.

Variants

Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Turn Ratio	T_r [µs]	I_{ign} [A]	U_{VAC} [V]	U_{isol} [kV]	U_s x T_w [Vµs]	L_s [mH]	R_P [Ω]	R_S [Ω]	C_C [pF]	P_m [W]	Weight [g]	Packing unit [pcs.]	Case	Order Number
1:1	0.2	1.0	500	3.2	300	2.5	0.7	0.7	60	0.5	7	50	05-7	ILR-11-0001

Cost optimized pulse transformer for THT mounting, up to 2W

Description
- High insulation rating (>2.2 kVAC) between the primary and the secondary windings
- Small coupling capacitances between primary and secondary windings limit transient feedback from the power supply side to the control electronics
- Cost optimized design
- The defined partial discharge voltage guarantees an effecively unlimited serviceable live

Standards
- VDE 110b

Applications
- Galvanic separation of drive- and power-circuit
- Mainly used in ignition circuits with Thyristors, Triacs, power transistors and IGBT's
- DC/DC converters
- Line coupling transformers in high speed data transmission

References
General Product Information

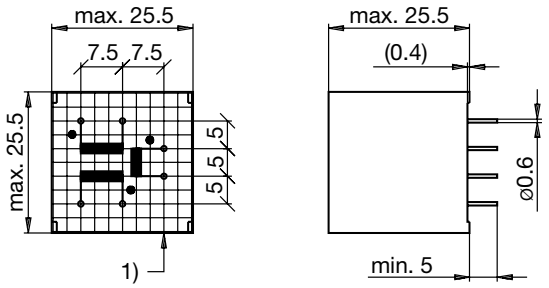
Weblinks
Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

Technical Data

Rated Voltage	up to 500 VAC
Voltage-time Integral Us x Tw	500 Vµs
Pulse Rise Time	0.7 - 0.8 µs
Turn Ratio	1:1:1, 3:1:1
Terminal technic	THT
Weight	34 g
Material: Housing	Plastics
Sealing Compound	UL 94V-0

Climatic Category	25/100/21 acc. to IEC 60068-1
Allowable Operation Temp.	-25 °C to 100 °C

Dimensions
Case 13-8



1) Prim.

Variants
Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Turn Ratio	T_r [µs]	I_{ign} [A]	U_{VAC} [V]	U_{isol} [kV]	U_s x T_w [Vµs]	L_s [mH]	R_P [Ω]	R_S [Ω]	C_C [pF]	P_m [W]	Weight [g]	Packing unit [pcs.]	Case	Order Number
1:1:1	0.8	1.0	380	2.5	500	3.0	0.3	0.3	40	2.0	34	60	13-8	IX-30-0001

SCHURTER ELECTRONIC COMPONENTS
The specifications, descriptions and illustrations indicated in this document are based on current information. All content is subject to modifications and amendments.

general product-information

Product Standard / Definitions / CE-Marking / Conformity 18

National approvals 18

Electrical Protection 19

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Pulse Transformers 30

general product-information

Product standard equipment standard

The product standard only contains minimum requirements. Attention is drawn to the fact that appliance specifications might contain requirements additional to or deviating from those specified in the relevant product standards.

Comments on definitions used

Please be aware that the specifications nominal value used in the German part of the Schurter catalogue and the data sheets, is synonymous with rated value.
The difference between these two values is a pure matter of definition. In order to avoid any unnecessary complications we will continue to use the specifications nominal value.

CE marking CE acc. to EU-directives

CE marking is the only marking which indicates that a product conforms to the relevant EU-directive.
This means that the CE-mark is no quality or standard conformity mark but only an administration mark.
SCHURTER products are covered by the low voltage directives 72/23/EEC and 93/68/EEC. Those are valid for equipment and appliances with rated voltage values between AC 50 V to AC 1000 V as well as DC 75 V to DC 1500 V.
The CE marking of SCHURTER parts will be found on the label of the smallest packing unit. On request we will submitt a CE conformity statement for each component. CE conformity statements and approvals can also be retrieved from the internet under www.schurter.com.

Conformity to component standards, national approvals

National testing institutions are testing according to national and international standards or other generally recognized rules of technology. Their certification/approval-marks confirm the observance of the safety requirements which electric appliances must fulfil.

National approvals

(Recognition)	UL	Underwriters Laboratories (USA)
(Listing)	UL	Underwriters Laboratories (USA, Canada)
(Recognition)	UL	Underwriters Laboratories (USA, Canada)
(Listing)	UL	Underwriters Laboratories (USA, Canada)
	CSA	Canadian Standard Association, Component Acceptance Service
	CSA	Canadian Standard Association
	SEV	Schweizerischer Elektrotechnischer Verein
(Mark)	VDE	Verband Deutscher Elektrotechniker
(Certificate of conformity with factory surveillance)		
	BSI	British Standard Institute
	SEMKO	Svenska Elektriska Materielkontrollanstalten
	NEMKO	Norges Elektriske Materiellkontroll
	DEMKO	Danmarks Elektriske Materielkontrol
	FIMKO	Finnish Electrical Inspectorate
	ÖVE	Österreichischer Verband für Elektrotechnik
	KEMA	Keuring van Elektrotechnische Materialien
	IMQ	Instituto italiano del marchio di qualità
(Mark)	European Norms Electrical Certification	
	CCC	China Compulsory Certification

In addition to the combined UL/CSA approvals, most of the SCHURTER components are also approved by one of the European Certification Bodies like VDE (Germany), Electrosuisse (Switzerland) or SEMKO (Sweden). The safety testing of all these European Certification Bodies are based on the commen European Safety Standards. With the harmonisation effort in Europe, the different National European Certification Bodies have lost their importance and SCHURTER has decided to maintain only one European approval (e.g. VDE, SEV or SEMKO) in future. The others will not be renewed once they have expired.

Because UL and CSA are not members of the CENELEC, the standards of UL and CSA are not harmonised yet with the European Standards. However, UL and CSA are trying to harmonize their standards with each other. Where possible, SCHURTER will apply for the combined cULus or cURus approval.

Further to development in Asia, SCHURTER has obtained national approvals from China, Japan and Korea.

IP degrees of protection provided by enclosures (IP code)

Standards IEC 60529; EN 60529

Scope
These standards apply to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72.5 kV.

Object
The object of these standards is to give:

a) Definitions for degrees of protection provided by enclosures of electrical equipment as regards:
1. Protection of persons against access to hazardous parts inside the enclosure
2. Protection of the equipment inside the enclosure against ingress of solid foreign objects
3. Protection of the equipment inside the enclosure against harmful effects due to the ingress of water.

b) Designations for these degrees of protection.
c) Requirements for each designation.
d) Tests to be performed to verify that the enclosure meets the requirements of these standards.

Designations

The degree of protection provided by an enclosure is indicated by the IP Code.

Elements of the IP Code and their meanings

A brief description of the IP Code elements is given in the following table.

IP xy	Meaning for the protection of equipment	Meaning for the protection of persons
	Against ingress of solid foreign objectif	**Against access to hazardous parts with**
x = 0	(non-protected)	(non-protected)
x = 1	50 mm diameter	back of hand
x = 2	12.5 mm diameter	finger
x = 3	2.5 mm diameter	tool
x = 4	1.0 mm diameter	wire
x = 5	dust-protected	wire
x = 6	dust-tight	wire
	Against ingress of water with harmful effects	
y = 0	(non protected)	
y = 1	vertically dripping	
y = 2	dripping (15° tilted)	
y = 3	spraying	
y = 4	splashing	
y = 5	jetting	
y = 6	powerful jetting	
y = 7	temporary immersion	
y = 8	continuous immersion	

Protection against electric shock

1. Protection against direct and indirect contact General terms

The protection against electric shock on electric equipment as well as their components are divided into the following parts:

- Protection against direct contact with live parts concerns all measures for the protection of human beings and animals against hazards which result from direct contact with live parts of electric equipment and their components.
- Protection against indirect contact is the protection of human beings and animals against hazards which result from contact of live parts 1 of electric equipment as well as components thereof, which have become live due to an insulation failure.

[1)] Accessible, conductive part, which is not conductive normally but which may be conductive due to a failure.

2. Protection against direct contact with live parts e.g. of a fuseholder

The data sheets of the relevant components inform about the taken measures.

3. Protection against indirect contact

Measures for the protection against indirect contact on electrical equipment are defined according to IEC 61140 by the 4 protection classes 0, I, II, III. Each protection class includes two protection measures. Even if one of these measures should fail, no electric shocks will occur.

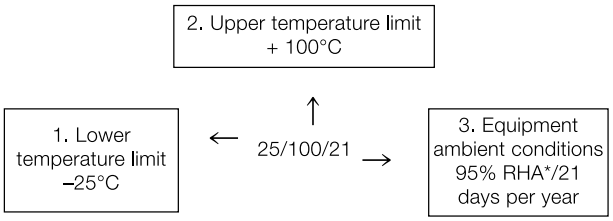
Protection class	Main protective measures
0	1. Basic insulation between live parts and accessible conductive parts. 2. Earth-free location, non-conducting environment.
I 	1. Basic insulation between live parts and accessible conductive parts. 2. Means are provided for the connection of accessible conductive parts of the equipment to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.
II 	1. Basic insulation between live parts and accessible conductive parts. 2. Additional insulation. Basic and supplementary insulation are summarised under the term "double insulation". Under certain circumstances also a "reinforced insulation» (single insulation system) may guarantee an equivalent protection against electric shock as a "double-insulation" does. No terminal for a protective conductor is allowable. A possibly existing protective conductor must not be connected and has to be insulated like any live part.
III 	1. Functional insulation. 2. Supply at safety extra-low voltage SELV (the circuit is isolated from the mains supply by such means as a safety isolating transformer). The protection against electric shock is in this case completely based on the supplying by SELV-circuits (U ≤ 42 V). Higher voltages are not generated in the equipment. No terminal for a protective conductor is allowable.

general product-information

Application Classes (IEC 60068-1)

The aim of this standard is to create a basis for classification of telecommunication engineering electrical components according to application classes which correspond to their climatic and mechanical suitability.

Example:



* relative humidity

MTBF

The high reliability of the filters can be excelled from MTBF (Meantime between failures). These values are according MIL-HB-217-F class G_B at an amient temperatur 40§C at rated voltage and current.

Industrial mains filters

Frequency range 0.01 MHz ... 1000 MHz

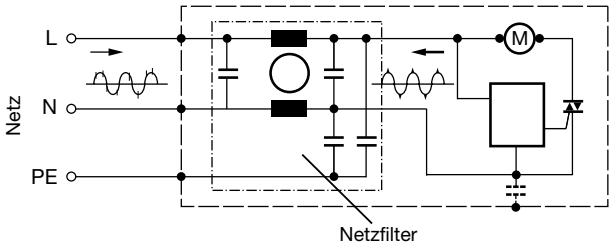
General Information

Electromagnetic Compatibility (EMC) is the capability of electrical equipment (installations, devices, assemblies) to operate effectively in its electromagnetic environment (Immunity), without in turn irresponsibly affecting this environment (Emission).

Mains filters of various types are used for the protection of electronic circuits, components and equipment against transients or similar interference, on the mains power supply. A suitable filter can be selected from the existing product range for each equipment type in accordance with electromagnetic conditions of its environment.

Mains interference can be classified into four categories:
A) Fluctuations in the industrial mains supply
(magnetic voltage stabilizer)
B) Harmonic wave interference in the frequency range 100 Hz ... 2 kHz
(filter type selective harmonic)
C) Transient interference signals in the frequency range up to
300 MHz (filter type low-pass)
D) Sinusoidal interference signals in the frequency range up to
1 GHz (filter type broad band, low-pass)

In practice, however, interference is mainly found in the last three categories B, C and D. Superimposed on the high-voltage mains supply, such interference can affect the performance of electronic circuits, or even cause them damage. An optimally-designed mains filter can perform a double function:



Function 1

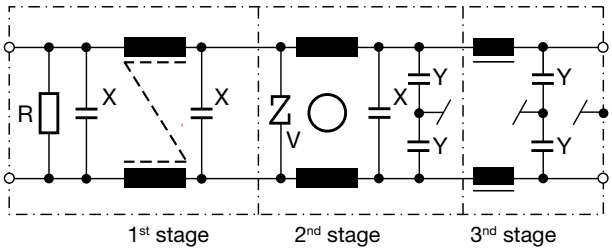
The filter protects an electronic control circuit from voltage spikes in the mains supply, which may be generated, for example, by electromechanical switches and relays.

Function 2

The same filter also acts simultaneously in the opposite direction. The HF interference generated in the unit by thyristor control is attenuated such that the boundary values Class B, (EN 55011/55022) are maintained.

Filters are usually made up of capacitors and inductance coils. Components such as leakage resistors, surge dissipators and VHF chokes can also be integrated into the filter. Broad band filters
which meet the highest requirements are often composed of 2 or 3 single stages put together to make one filter unit:

3-stage filter



1st stage

A differential mode acting filter with high energy absorption. Discharging resistors are normally used for Cx capacitors > 100 nF. The capacitors are tested and approved as so-called Class X noise suppression capacitors. The 1st stage serves as dI/dt limitation.

2nd stage

A common mode acting filter with a high, broad band attenuation ratio. A ZNR varistor surge serves as the overvoltage suppression component. The earthed capacitors are tested and approved as so-called Class Y noise suppression capacitors.

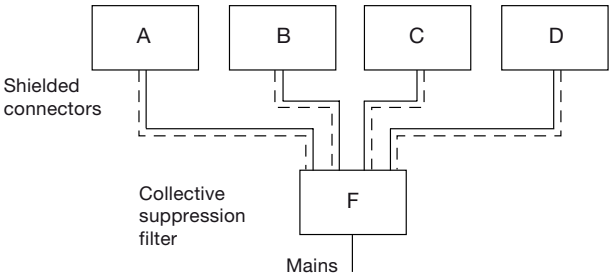
3rd stage

Common mode as well as differential mode acting filter in the HF range up to 300 MHz. Feedthrough capacitors make high attenuation values possible up to the gigahertz range. These capacitors are also Class Y type. SCHURTER uses only approved noise suppression capacitors according to EN 132400.

Filter Assemblies

Three types of mains noise suppression filter assemblies are used in practice:

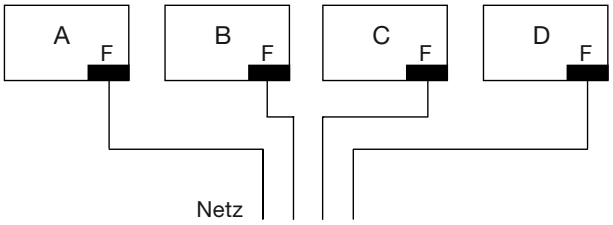
Collective Suppressor



The collective suppressor principle results in one filter per plant. This has to cope with the entire power input. In addition, all of the connecting cables have to be shielded. Furthermore interference generated by «A» device can reach other devices for instance «B» or «C» through the connecting cables. The following example promises to be a more economical solution. In many cases, the single suppressor principle is

the most economical solution.

Single Suppressors



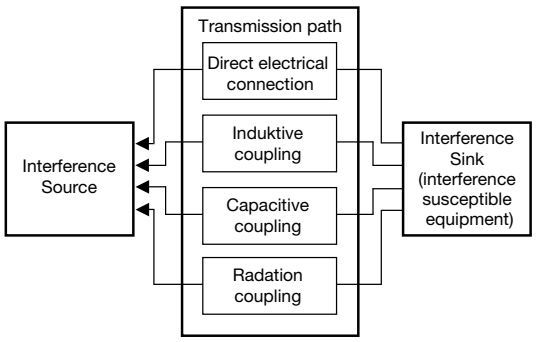
Combined Single and Collective Suppressor

From the technical point of view, only the combined application of both suppression techniques can result in a significant improvement.

Interference Propagation

In the field of interference and RF suppression, the most significant means of transmission is the direct electrical connection, i.e. the connecting wiring. The radiation coupling is also important from the electromagnetic compatibility (EMC) point of view; it cannot, however, be dealt with here.

Interference Propagation



Propagation and Coupling Paths

The capacitive and inductive coupling effects occur inside the case. These could be:
- Capacitive coupling through the coupling capacity of a mains transformer.
- Inductive coupling through control system wiring in parallel.

The introduction briefly mentioned the possibility of the mains filter operating with a double function. Depending on the main area of application, these filters are designated as either RF SUPPRESSION FILTERS or INTERFERENCE SUPPRESSION FILTERS.

The one filter may, therefore, appear under two references in the documentation. A filter is also classified by its mechanical design as well as its electrical data.

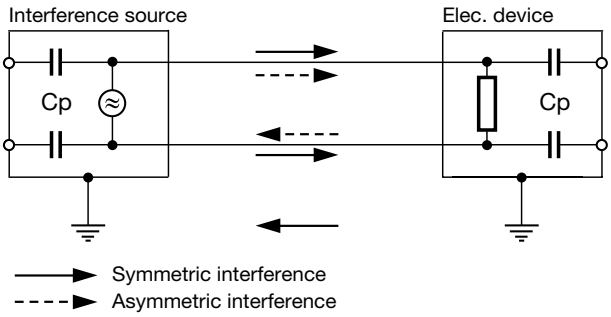
RF SUPPRESSION FILTERS impede the propagation of RF interference, generated by an electronic or electrical device into the mains. They also ensure an interference-free radio reception in the immediate vicinity.

INTERFERENCE SUPPRESSION FILTERS prevent mains interference from affecting electronic equipment. They enable an interference- free operation even in the case of a power supply badly affected by mains interference.

It is common to operate the mains filter in both directions in the one piece of equipment, allowing it to fulfil its double function as both interference and RF suppression filters as specified.

Common- and differential Mode Interference

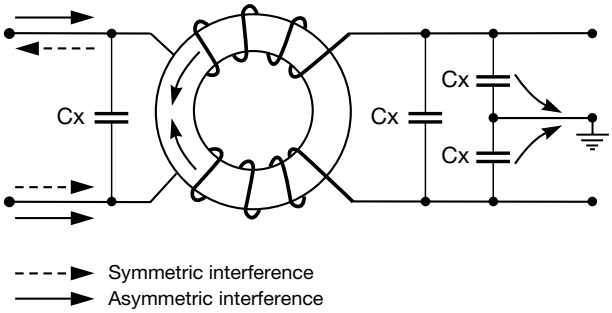
Filter engineering differentiates between common and differential mode interference originating from supply lines.



In the case of a non-earthed interference source, interference at first only propagates along the connecting lines. Like the mains AC current, the parasitic current flows to the user on one lead, and returns to the interference source on the other. Both these currents are in differential mode. This type of interference is therefore referred to as differential mode interference.

Due to the mechanical configuration and its parasitic capacitance, parasitic currents are also generated in the earthing circuit. This parasitic current flows on both connecting leads to the user and over an earthed lead back to the interference source. Both currents on the connecting lead are in common mode. This type of interference is therefore referred to as common mode interference.

Current Compensated Chokes in Interference Suppression Filters



The main type of choke used in suppression filter engineering is the current compensated choke. This mainly damps the common mode interference. The differential mode parasitic current, or rather the magnetic flux they produce in the core, is compensated by means of a special type of winding. The relatively small attenuation of the dif-

ferential mode parasitic currents can be balanced through the large, symmetrically connected capacitance C_x between the lines. Only the leakage inductance L_s of the choke is then of any importance.

$$L_{leakage} \approx \frac{L_{nominal}}{50} \text{ to } \frac{L_{nominal}}{100}$$

The high nominal inductance LN active for common mode parasitic currents allows the insertion of small, earthed capacitances CY in a filter circuit. These capacitances are regulated by international standards for leakage currents.

RF Suppression Capacitors:

General Information

All SCHURTER filters are fitted with Class X or Y RF suppression capacitors in accordance with international standards (IEC, EN). These are mainly self-healing metallized paper or polyester types, tested against the standards of major countries around the world and approved as noise suppression capacitors. Class X capacitors are capacitors with unlimited capacity for those applications in which a failure caused by a short circuit cannot result in a dangerous electrical shock. Class Y capacitors are capacitors intended for an operating voltage V_{eff} = 250 V with increased electrical and mechanical safety and limited capacitance.

General notes

a) Leakage current according to IEC 60335-1

The leakage current of a device is mainly determined by the capacity value of the Y-capacitor. According to international standards (IEC 60335-1) the following regulations with respect to leakage current can be assumed:

Type of appliance	Protection class	I_L max. (mA)	U(V)	f(Hz)
Portable appliances	I	0.75	250	50
Stationary motor appliances *	I	3.5	250	50
Stationary heating appliances	I	0.75/kW (max. 5.0)	250	50
Appliances	II	0.25	250	50
Appliances	I, OI, III	0.5	250	50

* Stationary appliances fixed or weighing in excess of 18 kg (without carrying handle).

For other applications:

Ref.	Laboratory	Medical	IT	Test equipment
UL	0.5 mA (UL 1262)	0.1 mA (UL 544)	3.5 mA (UL 1950)	5.0 mA (UL 1244)
IEC		0.1 mA (IEC 60601-1)	3.5 mA (IEC 60950)	3.5 mA (IEC 61010-1)

Filter classification

For easy reading of the catalogue data, SCHURTER uses the following simplified filter classification:

Differential Mode and Common Mode Attenuation

Attenuation value			
Standard	Medium	High	Excellent
20-50 dB	40-70 dB	60-80 dB	70-95 dB

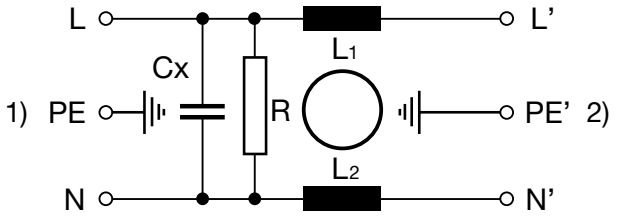
Leakage Current Classification

Operating leakage current			
Medical	Standard	Industrial	Other
<0.1 mA	<0.5 mA	<5 mA	>5 mA

Medical filter

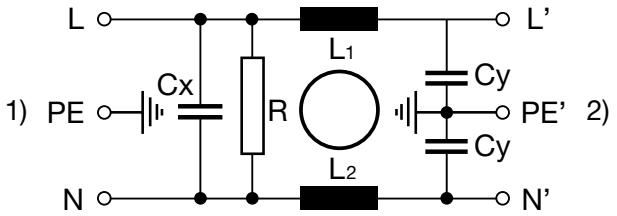
SCHURTER medical filters comply with UL544 and IEC 60601-1 standard specifications and are available in two versions, which differ in terms of their leakage current values.

Medical filter (M5)



1) Line
2) Load

Medical filter (M80)



1) Line
2) Load

Standard medical filters for direct person contact supplied by SCHURTER have a leakage current value of <5 µA (M5). This can only be achieved without C_y. Here, a common mode fault current against earth is not attenuated and the filter acts only on differential mode fault currents. In addition, an inlet in protection class II can be used here, as no earth connection exists. However, if an earth connection is desired, Type (M80) can be used for indirect person contact; this has a leakage current of <80 µA which is below the required limit value of 0.1 mA. Type (M80) is manufactured to special order.

general product-information

Bleed resistor

Medical filters and filters with a X-capacitor >100 nF have a bleed resistor so that no inadmissible rest voltage occurs at the touchable pins of the inlet.

EMC requirements in Europe

Household, Luminaries and Telecommunication Residential, commercial and light industrial	**Class Industrial** (ISM) Industrial, Scientific and Medical
Emission IEC 61000-6-3 (EN 50081-1) EN 55022 ITE Information technology equipment EN 55014 Household Applications and Tools Harmonic (IEC 61000-3-2) Voltage fluctuations (IEC 61000-3-3)	**Emission** IEC 61000-6-4(EN 50081-2) EN 55011 Harmonics (IEC 61000-3-2) Voltage fluctuation (IEC 61000-3-3)
Immunity IEC 61000-6-1 (EN 50082-1) IEC 61000-4-2 ESD IEC 61000-4-3 HF-Field IEC 61000-4-4 Burst IEC 61000-4-5 Surge	**Immunity** IEC 61000-6-2 (EN 50082-2) IEC 61000-4-2 ESD IEC 61000-4-3 Inducted HF-Field (enclosure) IEC 61000-4-6 Inducted HF-Field (lines) IEC 61000-4-4 Burst IEC 61000-4-5 Surge IEC 61000-4-8 NF Magnetic Field (only for magnetic devices)

Electrical Safety Regulations

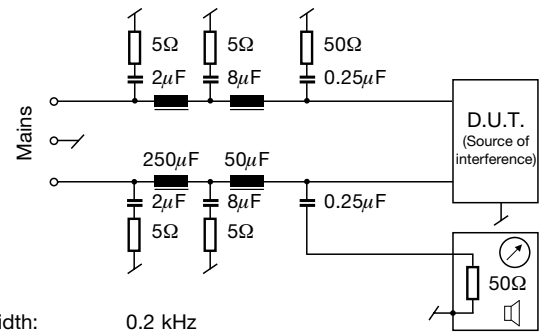
The most important safety standards for equipment/installations are listed in the following:

IEC 60950	Safety of Information Technology Equipment including Electrical Business Equipment
IEC 60335	Safety of Household and similar Electrical Appliances
IEC 61010-1	Safety requirements for Electronic Measuring Apparatus
IEC 60601	Safety requirements for Electro-medical Equipment
UL 1950	Safety requirements for Information Technology Equipment
UL 544	Electric Medical and Dental Equipment

Interference Emissions

There are basically 2 types of emitted disturbances: conducted and radiated. Line interferences are high frequency noise signals which are superimposed on the useful signals on input and output lines. Interference signals can be of common- or differential mode type. The significance of line interference is reduced dramatically above a frequency of 30 MHz. From here radiated interference increases greatly. On the following pages we will nevertheless deal with conducted interference only.

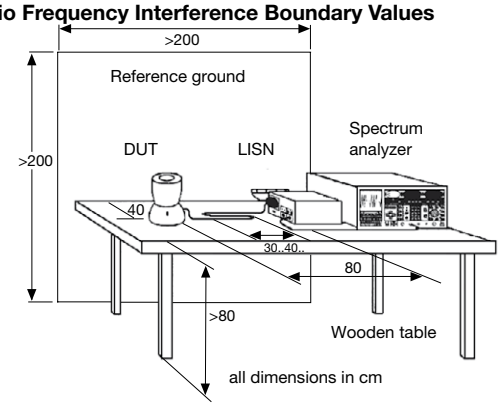
Measuring Technique CISPR 3



Bandwidth: 0.2 kHz
Impedance: 50 Ohm/1 MHz
Frequency range: 10 kHz–30 MHz

Test Receiver

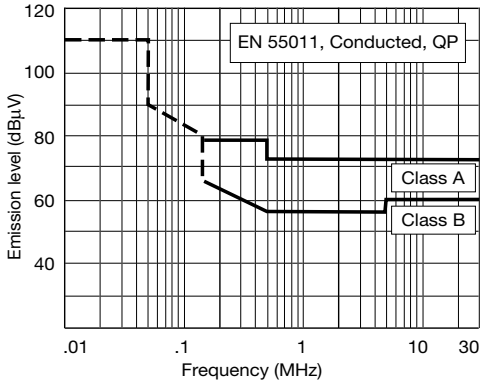
Radio Frequency Interference Boundary Values



RFI testing station

EN 55011: Boundary values and measuring systems for RF suppression for industrial, scientific and medical high frequency equipment (ISM), 1991 (see also CISPR 11 or VDE 0871)

Boundary values complying with EN 55011



Quasipeak (QP) and Average (AV) are two limits, neither of which must be exceeded and which are measured by two different test receivers. The test arrangement remains the same. These boundary values replace the boundary values given by the old standards for broadband

and narrowband noise generators.

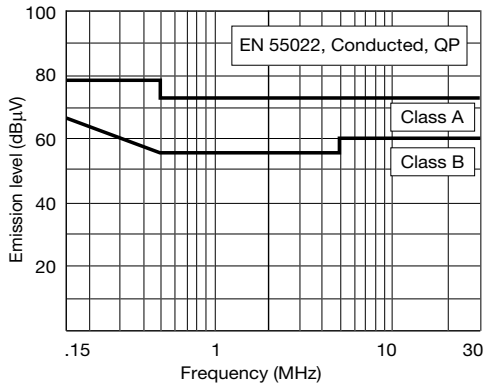
Boundary values are divided into Class A and B.

Into Class A fall those devices which should not be operated in residential buildings and should not be connected to power supplies which also supply these areas. Class A boundary values shall not be exceeded.

Into Class B fall devices for which above restrictions do not apply. Class B boundary values shall not be exceeded.

EN 55022: Boundary values and measuring systems for RF suppression for information technology installations (Telecommunications) 1987 (see also CISPR 22 or VDE 0878).

Boundary values complying with EN 55022



Into Class A fall all units which should be used in a commercial environment and should be used with a safety distance of 30 m to other units.
Into Class B fall all units which have no restrictions on their use.

EN 55013: Boundary value and measuring techniques for RF suppression characteristics of radio receivers and connected applications.

EN 55014: Boundary values and measuring systems for RF suppression for electrical household appliances, handheld electrical tools and similar electrical products, 1993 (see also CISPR 14).

EN 55015: Boundary values and measuring systems for RF suppression for fluorescent lamps and lighting, 1993 (see also CISPR 13).

Harmonics

(EN 61000-3-2, IEC 61000-3-2)
Current harmonics represent a distortion of the normal sine wave provided by the utility. When a product such as an SCR switched load or a switching power supply distorts the current, harmonics at multiples of the power line frequency are generated. Two significant consequences arise as a result of harmonic generation. First, because of finite impedances of power lines, voltage variations are generated that other equipment on the line must tolerate. Second, when generated in a three-phase system, harmonics may cause overheating of neutral lines.

Power line harmonics are generated when a load draws a non linear current from a sinusoidal voltage. The harmonic component is an element of a Fourier series which can be used to define any periodic waveshape. The harmonic order or number is the integral number defined by the ratio of the frequency of the harmonic to the fundamental frequency (e.g., 150 Hz is the third harmonic of 50 Hz; n = 150/50).

After multiple postponement finishes at 1.1. 2001 the transition-period for the EN 61000-3-2, frequently called "PFC-Norm". It applies to all electrical and electronic devices with input current up to max. 16 A per phase, which are designed to connect to the general lowvoltage mains. Limits are set only for 220/380 V, 230/400 V and 240/415 V at 50 Hz.

This standard distinguishes four classes of equipment.

Class	Equipment
A	Simmetric three phase equipment and all other equipment not in other classes
B	Portable tools
C	Lighting equipment
D	Equipment having special Waveshape (see EN 61000-3-2, paragraph 4 picture 1)

A harmonics test to conform to the standards must include an analysis of the incoming current up to the 40th harmonic (for f_N = 50 Hz, f_H = 2 kHz).
The IEC 61642 "Industrial a.c. networks affected by harmonics- Application of filters and shunt capacitors" give guidance for the use of passive a.c. harmonic filters and shunt capacitors for the limitation of harmonics and power factor correction intended to be used in industrial applications, at low and high voltages.

Voltage Fluctuations (Flicker)

(EN61000-3-3, IEC 61000-3-3, IEC 61000-3-5)
The appearance of flicker effects and voltage fluctuations on the mains supply is caused by varying loads connected to the mains. The most critical are the effects of voltage fluctuations on equipment such as lights and illumination. Here the light output and thereby the intensity is an exponential function of the supplied voltage. This fluctuation in light intensity is called flicker. Many people experience dizziness and headaches as a result.

There are various limit values depending on the type of voltage fluctuation (square, sinusoidal and mixed or erratic voltage fluctuation).

Flickers are measured by so-called flicker meters (arranged in compliance with EN 60808).

Immunity

ESD (Electrostatic Discharge)

(EN 61000-4-2, IEC 61000-4-2)
One of the main interference sources, along with switching through radio interference, is electrostatic discharge from people and equipment.

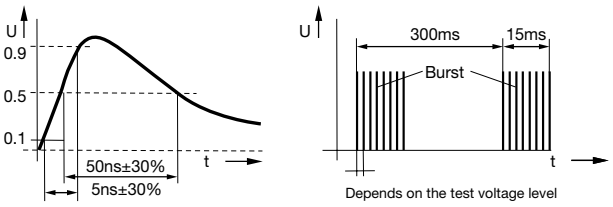
Burst

(EN 61000-4-4, IEC 61000-4-4)
One of the most common and most dangerous sources of interference are transient disturbances such as those originating from switching transients (interruption of inductive loads, relay contact bounce, etc.). The burst test measures the resistance of the device to repetitive fast transients.

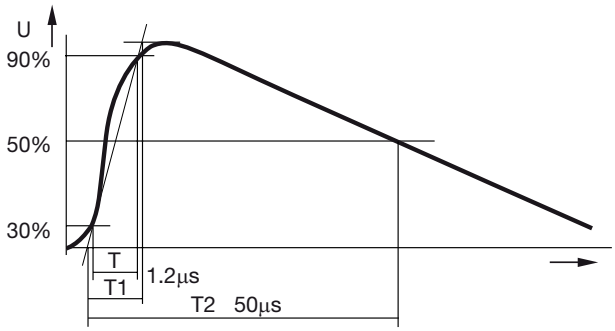
Surge

(EN 61000-4-5, IEC 61000-4-5)
This test procedure measures the behaviour of a device when subjected to high-energy pulses. Sources of such pulses are switching events due to lightning strikes, short-circuits, or switching cycles which vary in time and place. Surge test on SCHURTER filters are according to EN 133200.

Specification of the Burst test impulse



Surge voltage form in open circuit



Guideline for the selection of ESD test levels

Class	Relative ambient humidity as low as [%]	Antistatic material (floor)	Synthetic material (floor)	Level air discharge (kV)	Level contact discharge (kV)
Class 1	35	x		2.00	2.00
Class 2	10	x		4.00	4.00
Class 3	50		x	8.00	6.00
Class 4	10		x	15.00	8.00

Recommended test levels for Fast Transient/Burst (acc. IEC 61000-4-4)

Test levels	The installation is characterized by following attributes	Voltage peak: [kV]		Repetition rate [kHz]
		Power supply	Signal ports	
Level 1 Well-protected environment	Suppression of all EFT/B* in the switched power supply circuits Separation between power supply lines and control and measurement circuits Shielded power supply cables with the screens earthed at both ends	0.50	0.25	5.0
Level 2 Protected environment	Partial suppression of EFT/B* in the power supply and control circuits Separation of all the circuits from other circuits associated with environments of higher severity levels Physical separation of unshielded power supply and control cable from signal and communication cables	1.00	0.50	5.0
Level 3 Typical industrial environment	No suppression of EFT/B* in the power supply and control circuits Poor separation of the industrial circuits from other circuits Dedicated cables for power supply, control, signal and communication lines Poor separation between power supply, control, signal and communication cables	2.00	1.00	5.0
Level 4 Severe industrial environment	No Suppression of EFT/B* in the power supply and control and power circuits No separation between power supply, control, signal and communication cables Use of multicore cables in common for control and signal lines	4.00	2.00	2.5

*EFT/B: Electrical Fast Transient/Burst

Installation classification for Surge Immunity test (acc. IEC 61000-4-5)

Class	Environment definition	Voltage peak [kV]	
		L → N [2kV]	L/N → PE [12kHz]
Class 0 well-protected environment	- All cables with overvoltage protection - Well-designed earthing system - Surge voltage may not exceed 25 V	-	-
Class 1 Partly protected environment	- All cables with overvoltage protection, well interconnected earth line network - Power supply completely separated from the other equipment - Surge voltage may not exceed 500 V	-	0.50
Class 2	- Separate earth line to earthing system - The power supply is separated from other circuits - Non-protected circuits are in the installation, but well separated and in restricted numbers - Surge voltage may not exceed 1000 V	0.50	1.00
Class 3	- The installation is earthed to the common earthing system - Protected electronic equipment and less sensitive electric equipment on the same power supply network - Unsuppressed inductive loads are in the installation	1.00	2.00

Installation classification for Surge Immunity test (acc. IEC 61000-4-5)

Class 4	- The installation is connected to the earthing system for the power installation - Current in the kA range due to earth faults - The power supply network can be the same for both the electronic and the electrical equipment - Surge voltages may not exceed 2000 V	2.00	4.00
Class 5	- Electrical environment for electronic equipment connected to telecommunication cables - The interference voltages can be extremely high - All cables and lines are provided with overvoltage protection	dep. on the local power supply network	dep. on the local power supply network dep. on the local power supply network

General Technical Data - Filter parameters

Rated voltage UR (U_{max})

The rated voltage UR is the maximum RMS alternating line to line voltage (U_{max}) which may be applied continuosly to the terminals of the filter. The rated voltage is the nominal voltage including 10% tolerances.

Example:

Filter with U_R = 440 VAC is made for a power system with nominal voltage 400 VAC +10%.
For standard three phase filters the voltage between phase and earth is intended $U_R/\sqrt{3}$ (example 440/250 VAC).

Filters made for IT power systems withstand a voltage between phase and earth equal to U_R.

SCHURTER filters for IT systems have code endingwith "I": ex. FMAC-0932-2512I.

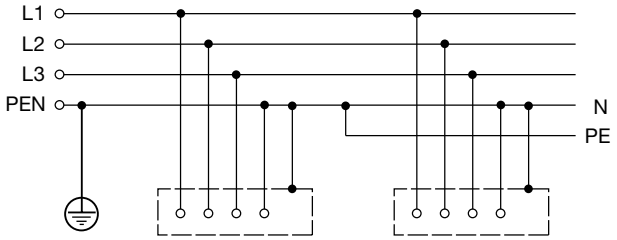
The line frequency f_N (50/60 Hz) may be exceeded under certain conditions. We recommend the users to consult in any case our technical department. DC power operation is possible in most cases.

Power distribution system

There are three main types of power distribution systems according to IEC 60950 (1.2.12): TN, TT, IT.

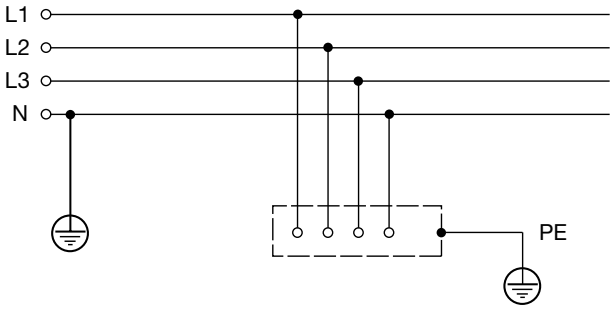
The TN POWER SYSTEM is a power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to that point by protective earth conductors. Three types of TN POWER SISTEMS are recognized according to the arrangement of neutral and protective earth conductors: TN-S, TN-C-S, TN-C.

Example of a TN-C-S system



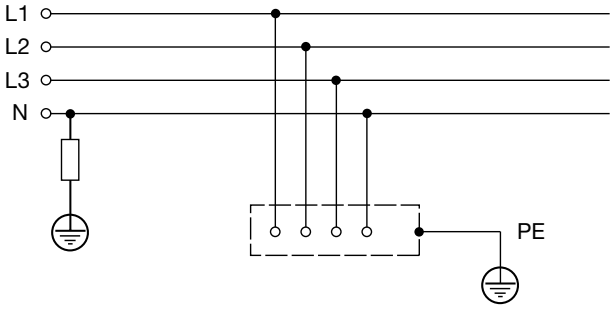
TN-C-S is in a system which neutral and protective functions are combined in a single conductors in a part of the system.

Example of a TT system



A TT POWER SYSTEM is a power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to earth electrodes electrically indipendent of the earth electrodes of the power system.

Example of a IT system



The IT POWER SYSTEM is a power distribution system having no direct connection to earth, the exposed conductive parts of the electrical installation being earthed. In this case the voltage between phase and earth can reach the line to line voltage.

Nominal Current I_N

The technical data gives the max continuous supply current in function of the ambient temperature I_N/va. The SCHURTER range generally differentiates between two types of filters:

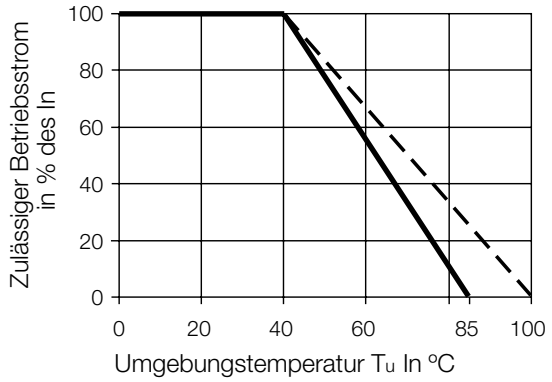
- High-current filter: va at I_N = 40°C
  va_{max} = 100°C
- All other filters: va at I_N = 40°C
  va_{max} = 85°C

The permissible working current at higher ambient temperatures can be read from the following graph.

general product-information

Permissible Working Current as a Function of Ambient Temperature
Up to the approved nominal ambient temperature a the filter can be operated continuously at its nominal current. Above this temperature the square of the nominal current drops off linearly and reaches its zero point at Tmax (85 or 100 °C).

Derating curve (approx.)



Formula:

$$I = I_n \sqrt{\frac{T_{max} - T_a}{T_{max} - T_n}}$$

I = admissible operating current at elevated ambient air temperature
I_n = rated current
T_{max} = max. allowable ambient air temperature Ta (85 °C)
T_a = ambient air temperature
T_n = allowable ambient air temperature at rated current (40 °C)

RF Suppression Capacitor Complying with IEC 60384-14

All SCHURTER filters are equipped with components which have been tested and approved as R_F suppression capacitors.
The most important test data for R_F suppression capacitors are:
Capacitance C_x, C_y ± 20% for fM = 1 kHz

Insulation resistance Ris between the capacitor terminals:
for C > 0.33 µF: R_{is} x C > 2000 s (time constant)
for C 0.33 µF: R_{is} > 6000 MOhm

Major voltage test and standards for C_X and C_Y capacitors

Country	Standard	C	Rigidity	Pulse Test 1.2/50 µs
Europe	EN 132400	X1	4.3 UR VAC	4.0 kV
	IEC 60384-14.2	X2	4.3 UR VAC	2.5 kV
		Y1	4.0 kVAC	8.0 kV
		Y2	2.5 kVAC	5.0 kV
	IEC 60950	X1	2700 V_{DC}, 60s	4.0 kV
	(Equipment Standard)	X2	2121 V_{DC}, 60s	2.5 kV
USA	UL 1414		2121 V_{DC}, 60s	50 Pulse, 10 kV, 1000 W
	UL 1283		2121 VDC, 60s 2545 VDC, 1s	-
Switzerland	SEV 1055	x	4.3 UR VAC	3.0 kV
		y	2(100 + 2 UR) min. 2250 VAC	5.0 kV

RF Suppression Chokes Conforming to IEC60938

All SCHURTER filters are fitted with chokes which satisfy the guidelines set down by international and national standards organizations.

The most important test data for RF suppression chokes are:

Maximum variation of inductance:	30% / +50% for compensated 15% / +15% for linear and storage
Test frequency	1MHz ± 20% at L 10 µH 100kHz ± 20% at 10 µH < L 1 mH 10kHz ± 20% at 1 mH < L 50 mH 50 to 120 Hz ± 20% at L > 50 mH
Test current:	0.1 mA
Test temperature:	25°C ± 3°C
Insulation resistance R_{is}:	6000 MOhm

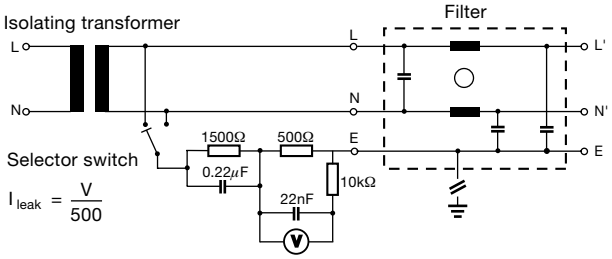
Test voltages

Chokes for	Between connections	Inner and outer insulation
AC	4.3 U_R VDC	2 U_R + 1500 VAC, but at least 2000 VAC
DC	3 U_R VDC	2 U_R + 1500 VDC

Leakage Current

(see also Chapter 1.6 RF Suppression Capacitors: General information)
1-Phase measuring Techniques
Measurement of the leakage current (simplified).
The leakage current is measured from every pole of the network:
- to all accessible metal parts
- to metal parts of protection class II equipment which is separated only by the base material from parts under voltage.

The test is made with AC at 250 V / 50 Hz.
Measurements are made in both switch positions (see diagram).



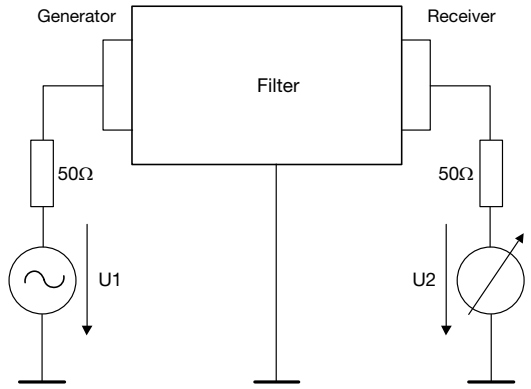
TT or TN Power System according to IEC 60950 - 5.2.3 - Annex D

Protection Class I:

Devices are fitted with a special grounding conductor to provide protection against electrical shocks (L,N,PE wire cable). SCHURTER filters correspond to Protection Class I.

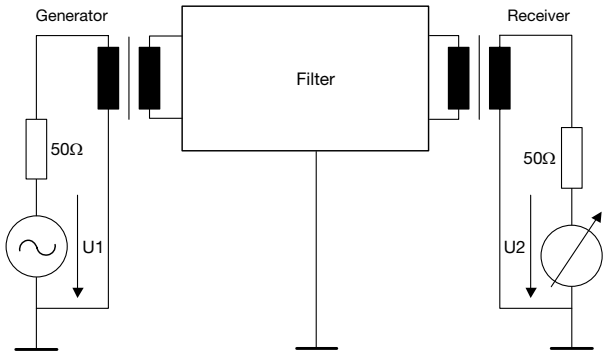
Insertion loss acc. CISPR 17 (common- and differential mode)

Asymmetrical measurement



In common mode measurements, the line and neutral conductors are measured with respect to earth.
Line (L) and neutral (N) are measured to earth (E).

Symmetrical measurement



In differential mode measurements, the insertion transmission loss is measured between line and neutral through a balancing transformer; the earth wire is not used.
4-pole network with integrated balancing transformer for the measurement of insertion transmission loss in the symmetric case.

Measurement Method

The insertion loss D is defined as that loss which results when a four-pole network is inserted into an existing layout, having a surge impedance Z, assuming that the LHS and the RHS terminal impedances of the four-pole network are equal in magnitude and real, the insertion transmission loss and the overall loss are the same.
The insertion transmission loss, in decibels, can be obtained as follows:

$$D_{dB} = \frac{20 \log (U_G)}{2\, U_2}$$

IEC 60939-2

Nominal voltage connections	Between	Inner and outer insulation	
		C*≤ 1 µF	C*> 1 µF
150 ≤ U_R ≤ 250 VAC	4.3 U_R VDC	1500 VAC or 2250 VDC	4.3 U_R VDC
250 ≤ U_R ≤ 500 VAC	4.3 U_R VDC	2 kVAC or 3 kVDC	4.3 U_R VDC
500 ≤ U_R ≤ 760 VAC	4.3 U_R VDC	3 kVAC or 4 kVDC	4.3 U_R VDC

*) C is the capacity measured between the connection block to which the high voltage is connected for test.

UL 1283 (Appliance filters)

Nominal voltage	Between connection	Between connection and case
UR ≤ 250 VAC	1250 VAC or 1768 VDC	1500 VAC or 2121 VDC

In compliance to the known standards of the IEC, EN, VDE and UL, the filters are tested as follows. In principle, these tests correspond to those of the RF suppression capacitors.

Test duration

- 2 sec for production test
- 60 sec for types test

The SCHURTER final production test has a duration of 2 sec. This test may not be repeated more than one time (i.e. incoming inspection at the customer). Any filter that has been under test for 60 sec can not be commercially used (reduced life cycle).

general product-information

Pulse transformers

Introduction

The application range of pulse transformers is very broad. In most cases, a signal or a control pulse must be transmitted between electrically isolated circuits. This problem exists in the activation of thyristors and triacs, or in the operation of FETs or IGBTs in highpower switching circuits. Another application involves electrical isolation in telephone switchboards and data transfer systems.

High Insulation Rating

When used in power electronics, the secondary side of pulse transformers is normally at a high voltage potential. This requires a high insulation strength for pulse transformers.

Complying with VDE 110 b, Part 1, the following test voltages between the primary and the secondary circuits are required for transformers of Protection Class I and choke coils, as a function of the working voltage:

Working Voltage [V]	Test Voltage U_{isol} [V]
250	1500
500	2500
1000	3000

Test Voltage U_{isol}

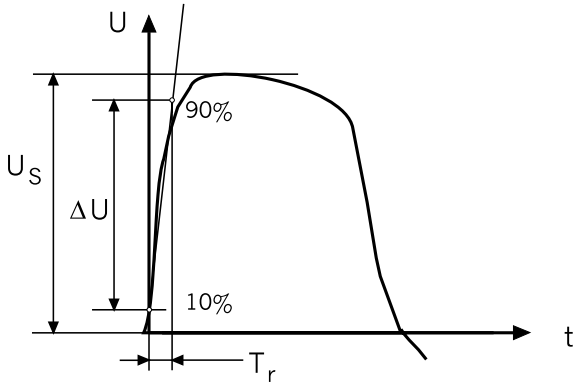
The test voltage for SCHURTER pulse transformers depend on the type of winding and coating on the coil wire. Exact information concerning each type is available in the technical specifications. The test voltage is in each case considerably higher than that prescribed by VDE 110 b.

Partial Discharge Voltage U_e

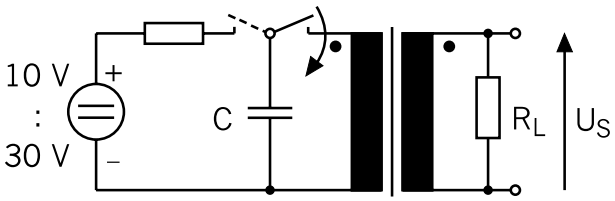
Partial discharges during normal operation have little effect on the operation of the circuit, but can accelerate the ageing of the pulse transformer. The glow discharge and the intermittent voltages are at least 50% higher than the approved working voltages for all SCHURTER pulse transformers. This provides the best assurance against long-term damage.

Definition of the Rise Time T_r

Over the almost straight-line in the lower 2/3 of the rise curve, i.e. in the area where the semiconductor is triggered with certainty, we draw a line and measure the time from 10% to 90% of the overall pulse height.



The measurement is made with the following circuit. The load resistance R_L is given for each type.



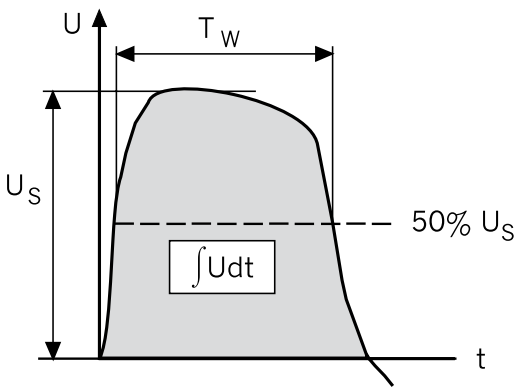
For a turn ratio of 1:1, the test voltage is 10V;
For a turn ratio of 2:1, the test voltage is 20V, and so on.

Trigger Current I_{ign}

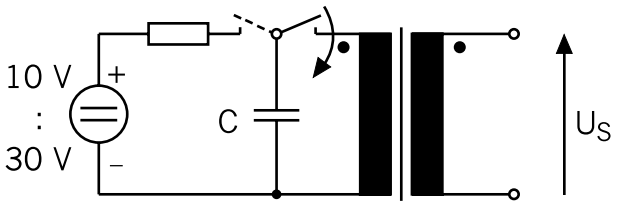
The maximum trigger current is a guide value. For a given current, the drop in voltage over the secondary winding resistance is smaller than one volt.

The Voltage-Time integral $U_s \cdot t_w$

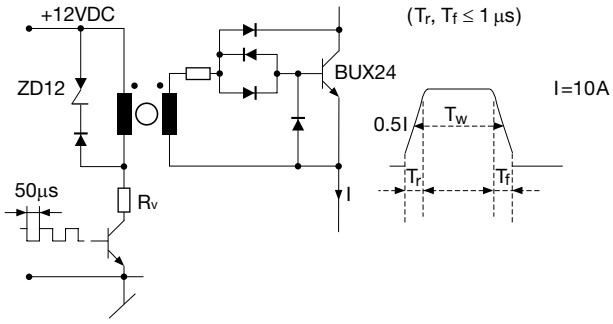
The voltage-time integral is the product of the pulse height and width, measured at half pulse height. The voltage-time area is measured on the secondary side during operation under no load.



The voltage-time integral $U_s \cdot T_w$ is measured according to the principle of the following circuit. The same voltages as used for measuring the rise time are used.



Example of application



Power transistor in pulse operation

Primary and Secondary Inductances L_p, L_s

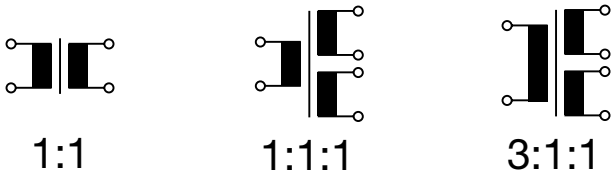
Primary and secondary inductances are measured with a low-power signal of 0.1 mA/10 kHz at 25°C. The tolerance is -30% / +50%. The measured value can also vary up to ± 25% under temperature variation in the range 0°C to 70°C.

Coupling Capacity C_c

The coupling capacity is measured between the primary and one secondary winding. This value varies depending on the type of winding. Bifilar windings, designed for models with faster rise times, have higher coupling capacitances than the layer or selection windings.
In general, this value is not important with regards transmission properties. To guarantee effective interference protection from the control electronics, however, the smallest possible coupling capacity is desired.

Turn Ratio N

In the given turn ratios, the first figure always refers to the primary winding. Hence a «1:1» pulse transformer has the same number of winding on both the primary and the secondary windings. The turn ratio «3:1:1» stands for one primary and two secondary windings with a transformation ratio of three to one between the primary and the secondary windings.



UL-Approbation

The plastic cases and the potting resin of all SCHURTER pulse transformers are fire resistant in compliance with UL 94 V-0.

Abbreviations used in the technical data

$\int$Udt	Voltage-time integral ($U_s \cdot T_w$)
T_r	Pulse rise time
P_m	Power dissipation at ambient 50°C
P	Power dissipation at elevated temperature
ϑa	Ambient temperature
I_{ign}	Trigger current
C_c	Coupling capacity
R_L	Test load resistance (secondary)
R_p	Primary resistance
R_s	Secondary resistance
L_p	Primary inductance = L_s x N^2
L_s	Secondary inductance
U_{eff}	Working voltage primary-secondary in $_{VRMS}$
U_{isol}	Test voltage
N	Turns ratio

Code

I[1] T[2] N[3] F[4] - 0[5] 2[6] 35[7] - D1[8] 03[9]

1) Pulse transf.
2) T.. conventional
   S.. SMD
3) N.. normal
   R.. small rise time
4) A.. 1:1 / B.. 2:1/C.. 3:1
   F.. 1:1:1 / H.. 3:1:1
5) Brandlabel SCHURTER
6) C_K:1..≤10pF / 2..>10..≤100pF
7) Case code
8) Trigger current
9) Inductance

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IX	■EMC products	16

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