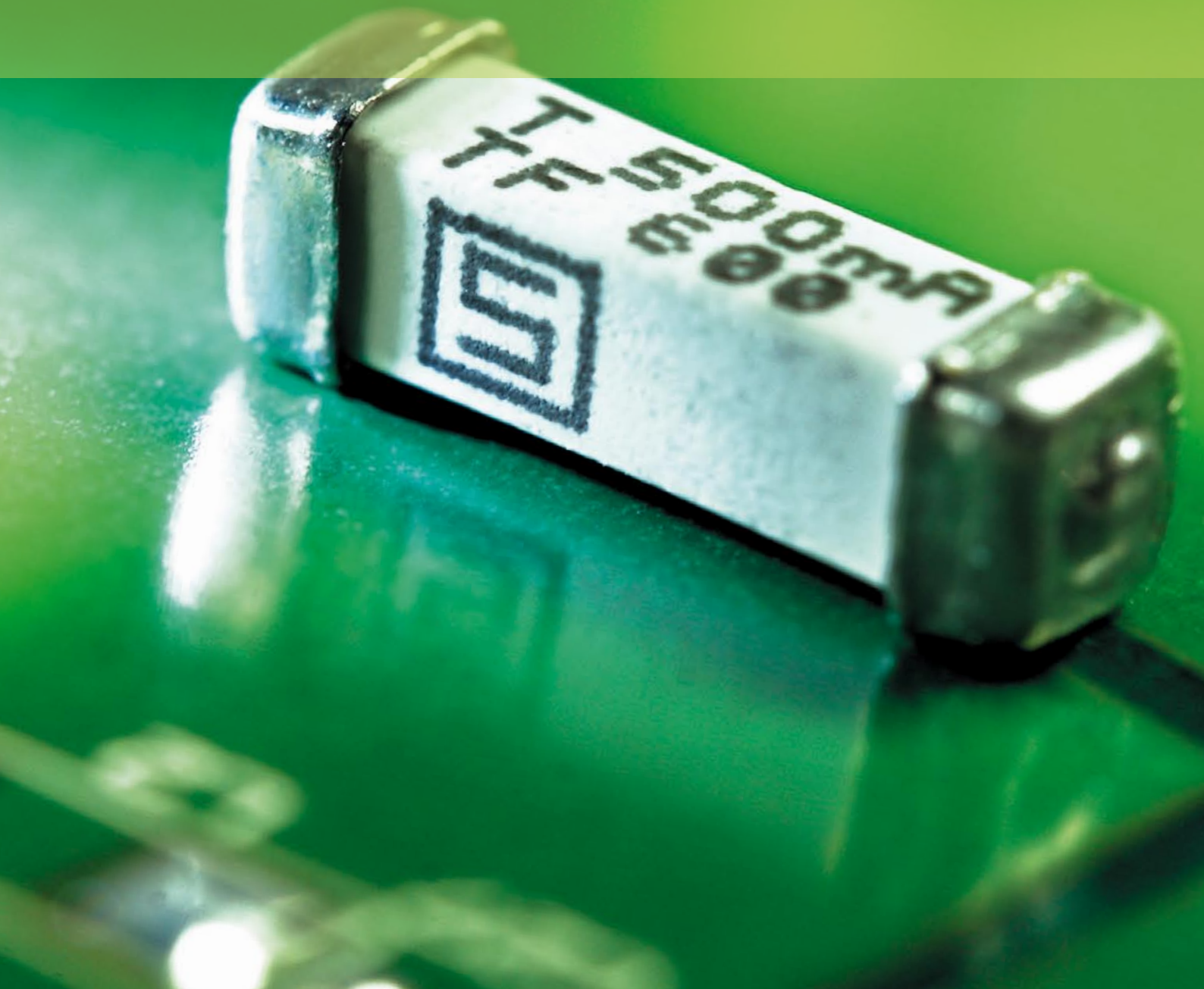
Product Group Catalog
Fuses

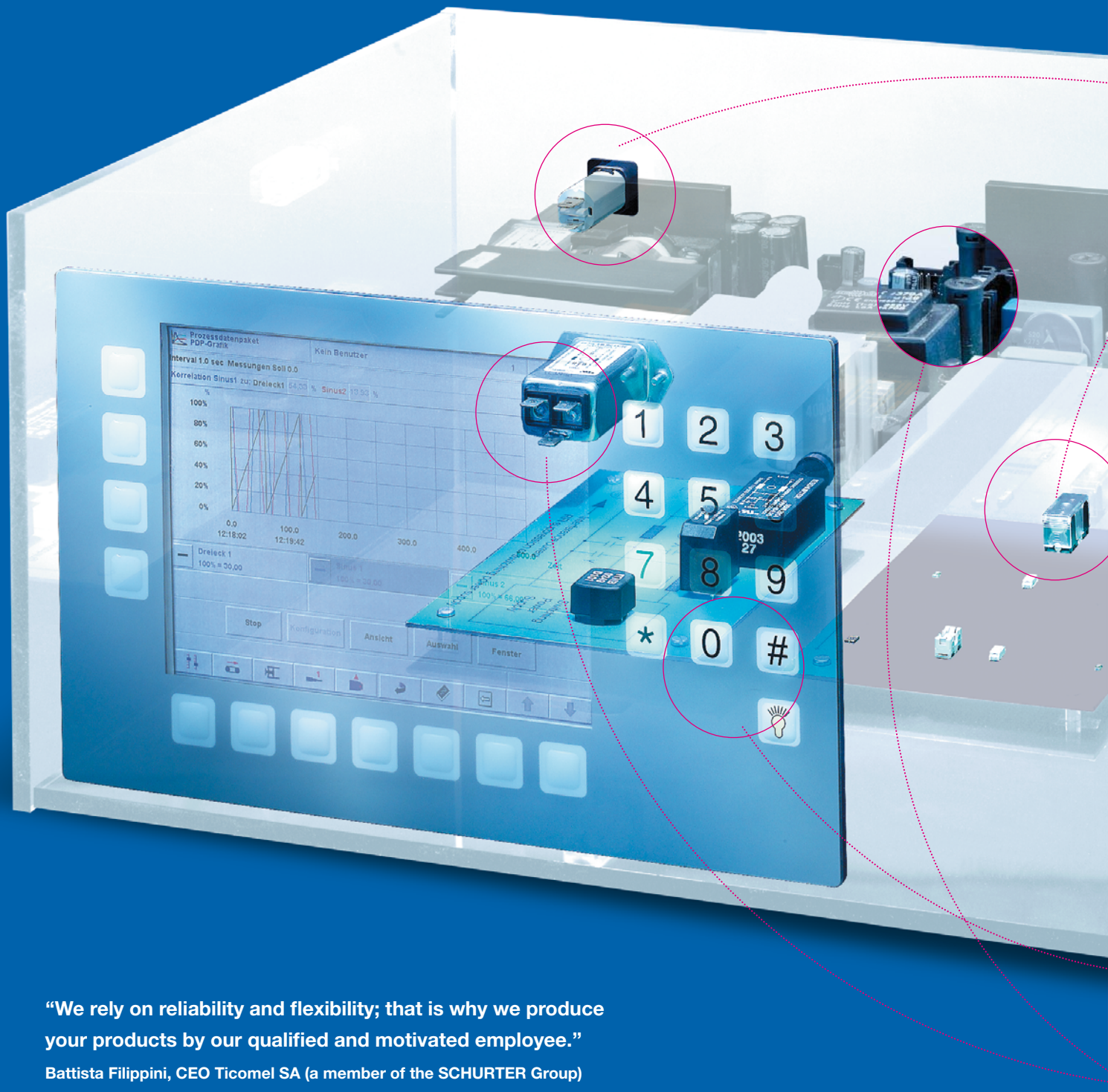
www.schurter.com/fuses

SCHURTER
ELECTRONIC COMPONENTS

Telecom Fuses



summary

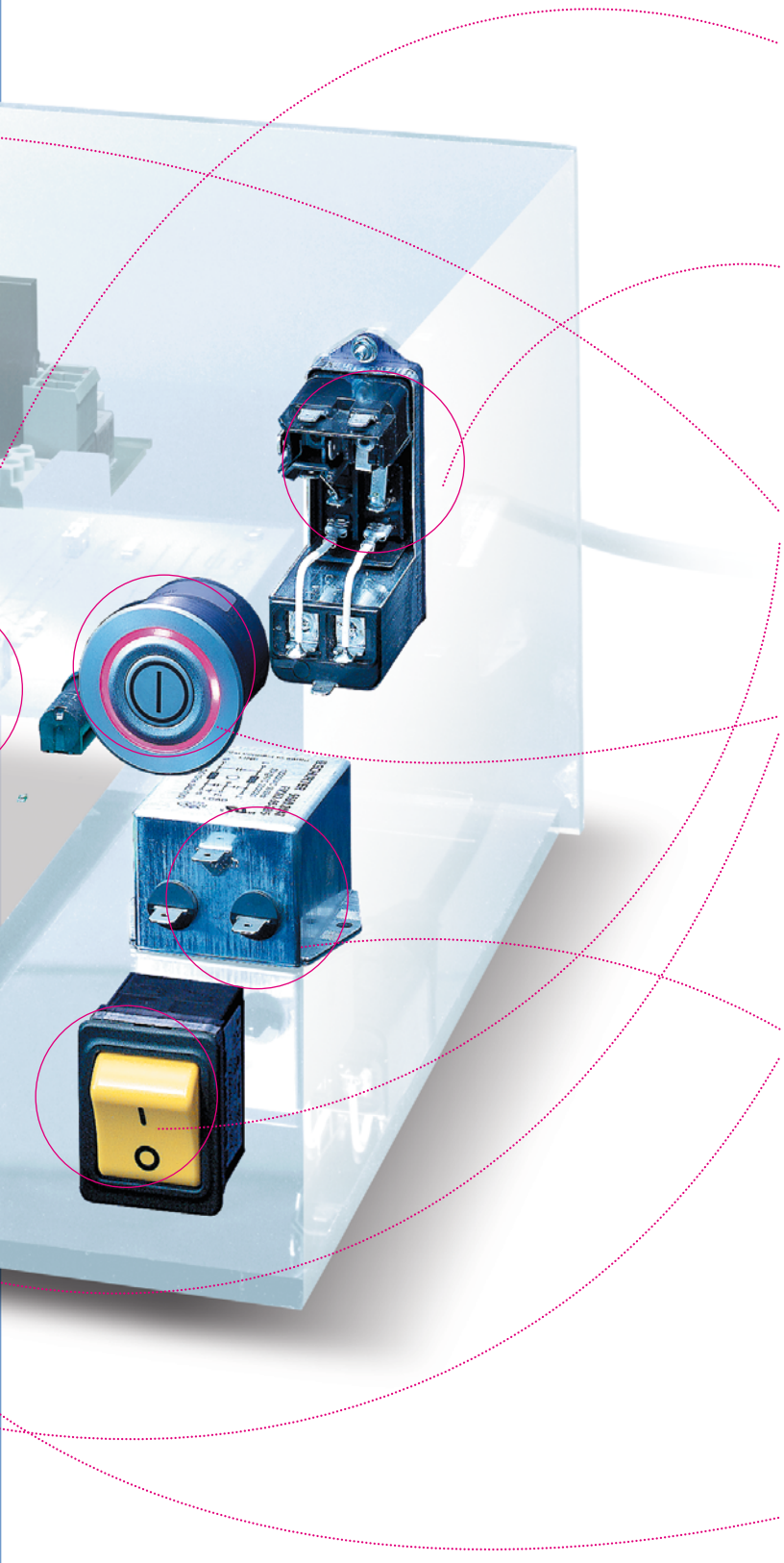


“We rely on reliability and flexibility; that is why we produce your products by our qualified and motivated employee.”

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 Approvals	Rated Current	Characteristic	Dimensions	Rated Voltage Breaking Capacity	Web Reference or Type
	SURFACE MOUNT FUSE					
	Surface Mount Fuse, 10.1 x 3.22 mm, Time-Lag T, Telecom cULus CCC	0.5 - 2A	Time-Lag T	10.1 x 3.22 mm	- 600 VAC / 125 VDC - 60 A	TF 600 8
	Surface Mount Fuse, 7.4 x 3.1 mm, Quick-Acting F, Telecom cULus CCC	0.25 - 3.15A	Quick-Acting F	7.4 x 3.1 mm	- 125 VAC / 125 VDC - 100 A	OSU 125 12
	Surface Mount Fuse, 11 x 4.6 mm, Quick-Acting F, Telecom cULus CCC	0.25 - 3.15A	Quick-Acting F	11 x 4.6 mm	- 250 VAC / 250 VDC - 100 A	OSU 250 14
	SUBMINIATURE FUSE					
	Subminiature Fuse, 6.4 mm, Quick-Acting F, Telecom cULus CCC	0.25 - 3.15A	Quick-Acting F	6.4 x 6.4 mm	- 125 VAC / 125 VDC - 300 A	MSU 125 17
	Subminiature Fuse, 8.5 mm, Time-Lag T, Telecom cULus	0.25 - 3.15A	Time-Lag T	8.5 x 8.5 mm	- 250 VAC - 35 A	MSU 250 20
	MINIATURE FUSE					
	Miniature Fuse, 5 x 20 mm, Time-Lag T, Telecom, L, 250 VAC cULus	0.25 - 3.15A	Time-Lag T	5 x 20 mm	- 250 VAC - 35 A	FSU 5x20 23
	Miniature Fuse, 5 x 20 mm, Time-Lag T, Telecom, H, 250 VAC cULus	0.25 - 3.15A	Time-Lag T	5 x 20 mm	- 250 VAC - 1500 A	SSU 5x20 25

For customer specific solutions, please contact us. www.schurter.com/contact
General Product Information see Fuses page 30

TF 600: Fuse for Telecommunication Applications (Tip&Ring)

The fuse meets all important telecommunications stanards like Telcordia GR-1089, ITU-T K.20 and K.21, UL/IEC 60950 and TIA-968-A and fits very well for applications like analog linecards, modems and office equipments.

Mission Statement

SCHURTER fulfills the most stringent requirements, thanks to its comprehensive quality, environment and personnel management systems according to ISO 9001, ISO 14001, OHSAS 18001, SIX SIGMA and EFQM.

Surface Mount Fuse, 10.1 x 3.22 mm, Time-Lag T, Telecom

Telcordia GR-1089 · 600 VAC · 125 VDC · Time-

Description
- Directly solderable on printed circuit boards

Standards
- IEC 60127-4
- UL 248-14
- CSA C22.2 no. 248.14
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- UL File Number: E41599

Applications
- Twisted pair telecom ports requiring Telcordia GR-1089 / TIA-968-A / ITU-T / UL 60950 / IEC 60950 compliance
- see following pages

References
General Product Information
Packaging Details

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

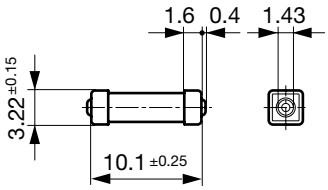
Technical Data

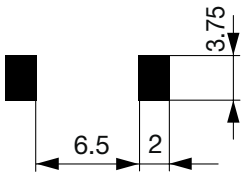
Rated Voltage	600 VAC, 125 VDC
Rated Current	0.5 - 2 A
Breaking Capacity	60 A
Characteristic	Time-Lag T
Mounting	PCB,SMT
Admissible Ambient Air Temp.	-55 °C to 125 °C
Climatic Category	55/125/21 acc. to IEC 60068-1
Material: Housing	Ceramic
Material: Terminals	Tin-Plated Copper Alloy
Unit Weight	0.23 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	SCHURTER, Type, Current Rating, Characteristic

Soldering Methods	Reflow
Solderability	245 °C / 3 sec acc. to IEC 60068-2-58, Test Td
Resistance to Soldering Heat	260 °C / 10 sec acc. to IEC 60068-2-58, Test Td
Flammability	min. UL 94V-1 (acc. to EIA/IS-722, Test 4.12)

Dimensions

Length 10.1 mm





Solder pads

Pre-Arcing Time

Rated Current In	1.0 x In	min.	2.5 x In	min.	2.5 x In	max
0.5 A - 2 A	4 h		1 s		120 s	

Variants

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

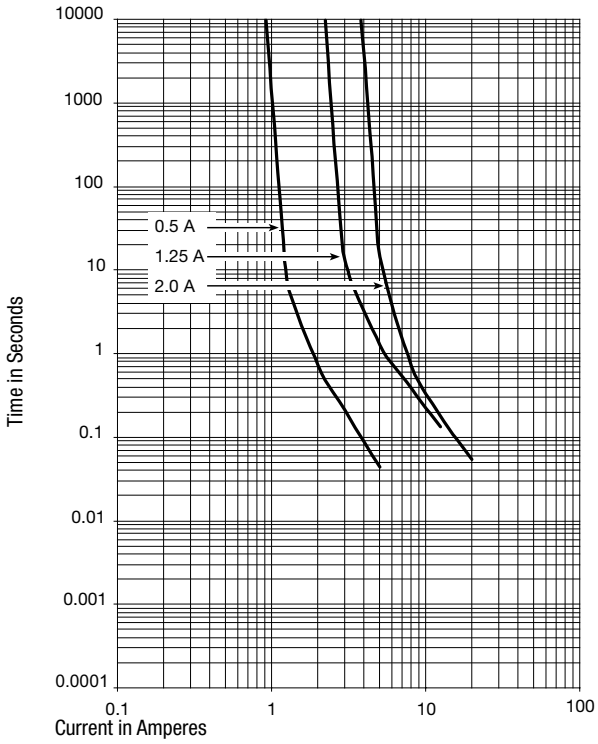
Rated Current [A]	Rated Voltage [VAC]	Voltage Drop 1.0 In typ. [mV]	Cold Resistance typ. [mΩ]	Melting I²t 10.0 Intyp. [A²s]	Order Number
0.5	600	107	210	1.14	2000.0010
1.25	600	94	73.2	21.4	2000.0011
2	600	55	27.8	22.3	2000.0012

1) 60 A @ 600 VAC / 60 A @ 125 VDC

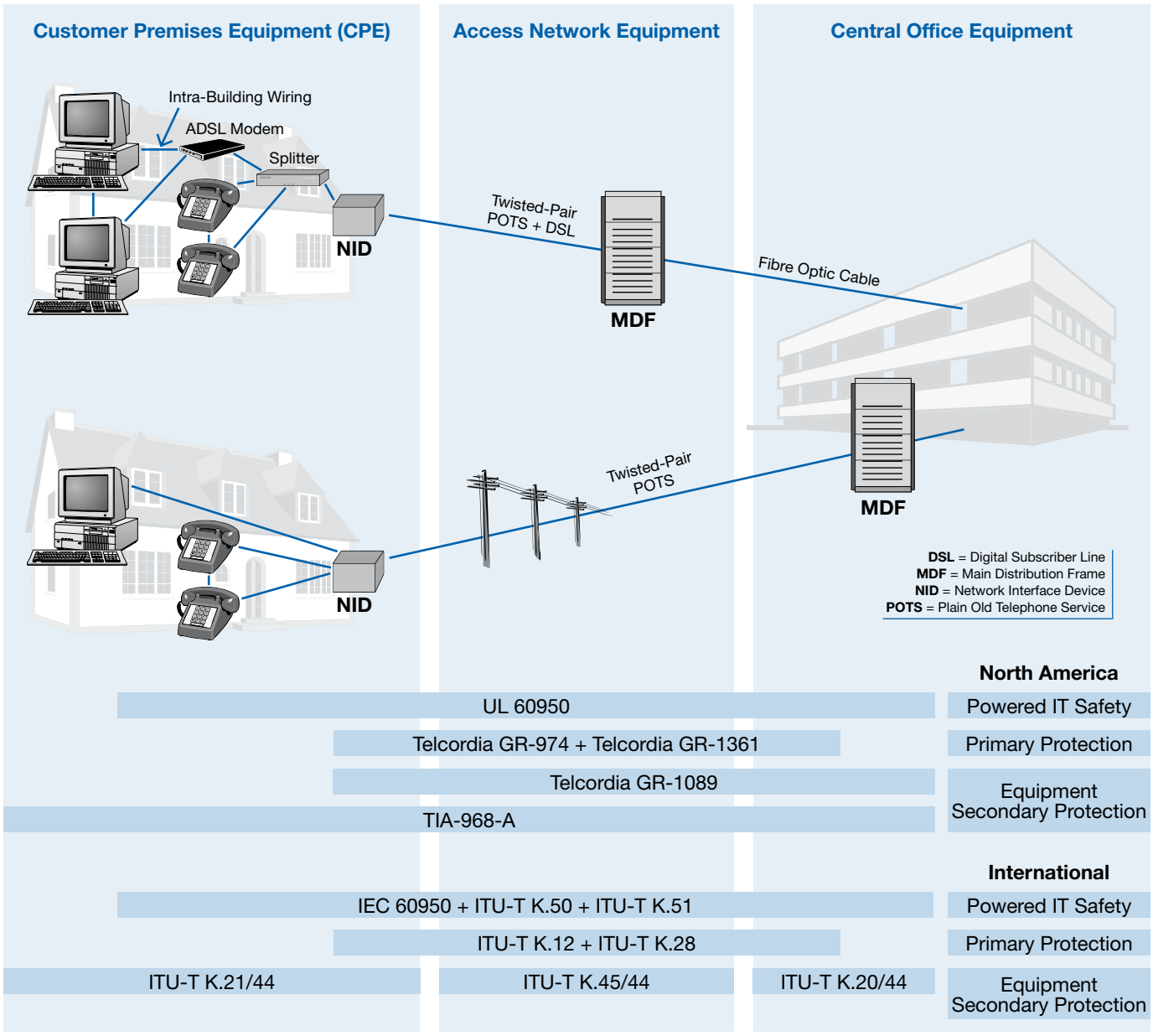
Packaging Unit

.xx = .11 Plastic Bag (100 pcs.)
.xx = .24 Blister Tape 33 cm Reel (2000 pcs.)

Time-Current Curves



GLOBAL TELECOM STANDARDS



HOW TO SELECT THE RIGHT FUSE-LINK FOR SECONDARY PROTECTION?

1. Select your equipment type

2. Use the Key Device Selection Criteria to determine best suitability for your application

Application	Specification	Key Device Selection Criteria	
		Faster Time-to-Open	**Cooler Surface Temperature**
Customer Premises Equipment (CPE) Modems (Analog, V.90, ISDN, xDSL), ADSL splitters, phone sets, fax machines, answering machines, caller ID, internet appliance, PBX systems, POS terminals	TIA-968-A UL 60950 / IEC 60950 ITU-T K.21/44	TF 600, 0.5 A (2000.0010.xx) TF 600, 1.25 A (2000.0011.xx)	TF 600, 2 A (2000.0012.xx)
Access Network Equipment Remote terminals, line repeaters, muliplexers, cross-connects	Telcordia GR-1089 TIA-968-A UL 60950 / IEC 60950 ITU-T K.45/44	TF 600, 1.25 A (2000.0011.xx)	TF 600, 2 A (2000.0012.xx)
Central Office Equipment Analog linecards (SLIC), ISDN linecards, xDSL modems, ADSL/VDSL splitters, T1/E1 linecards, muliplexers, servers	Telcordia GR-1089 TIA-968-A UL 60950 / IEC 60950 ITU-T K.20/44	TF 600, 1.25 A (2000.0011.xx)	TF 600, 2 A (2000.0012.xx)

3. Use Agency Specification based on the requirement

Lighting Surge Specifications

Surges are short-duration increases in system voltage due to external events, such as lightning

Telcordia GR-1089	First Level Test 1	First Level Test 2	First Level Test 3	First Level Test 4	First Level Test 5	Second Level Test 1
Surge Voltage [V]	600	1000	1000	2500	1000	6000
Surge Current [A]	100	100	100	500	25	500
Waveform [us]	10x1000	10x360	10x1000	2x10	10x360	2x10
Repetitions [each polarity]	25	25	25	10	5	1
2000.0010.xx, 0.5 A	*	*	*	*	✓	
2000.0011.xx, 1.25 A	✓	✓	✓	✓	✓	✓
2000.0012.xx, 2.0 A	✓	✓	✓	✓	✓	✓

■ Equipment under test can not be damaged & must continue to operate properly

* If sufficient series resistance is used, the 0.5 A fuse may pass Test 1-4

TIA-968-A (former FCC Part 68)	Type A Metallic	Type A Longitudinal	Type B Metallic	Type B Longitudinal
Surge Voltage [V]	800	1500	1000	1500
Surge Current [A]	100	200	25	37.5
Waveform [us]	10x560	10x160	5x320	5x320
Repetitions [each polarity]	1	1	1	1
2000.0010.xx, 0.5 A	Fuse open	Fuse open	✓	✓
2000.0011.xx, 1.25 A	✓	✓	✓	✓
2000.0012.xx, 2.0 A	✓	✓	✓	✓

■ Fuse can not open during type B events

ITU-T K.20	Test
Surge Voltage [V]	1000
Surge Current [A]	67
Waveform [us]	10x700
Repetitions [each polarity]	10
2000.0010.xx, 0.5 A	26 A*
2000.0011.xx, 1.25 A	✓
2000.0012.xx, 2.0 A	✓

■ Fuse does not open during test

* If sufficient series resistance is used, the 0.5 A fuse may pass

Power Cross Specifications

A power-cross is an instance where a high-voltage circuit is inadvertently connected to a low-voltage circuit; for example, a power line can fall onto a telephone line during a storm initiating a power-cross event.

Telcordia GR-1089	First Level Test 1	First Level Test 2	First Level Test 3	First Level Test 4	First Level Test 5	First Level Test 6	First Level Test 7	First Level Test 8	First Level Test 9
Voltage [Vrms]	50	100	200, 400, 600	1000	see GR-1089	600	440	600	1000
Overload Current [A]	0.33	0.17	1	1		0.5	2.2	3	5
Duration	15 min.	15 min.	60x1 s	60x1 s	60x5 s	30 s	5x2 s	1.1 s	0.5 s
2000.0010.xx, 0.5 A									
2000.0011.xx, 1.25 A	✓	✓	✓	✓	✓	✓	✓	✓	✓
2000.0012.xx, 2.0 A	✓	✓	✓	✓	✓	✓	✓	✓	✓

■ Fuse not allowed to open

Telcordia GR-1089	Second Level Test 1	Second Level Test 2	Second Level Test 3	Second Level Test 4	Second Level Test 5
Voltage [Vrms]	120, 277	600	600	100-600	see GR-1089
Overload Current [A]	25	60	7	2.2	
Duration	15 min.	5 s	5 s	15 min.	15 min.
2000.0010.xx, 0.5 A	✓	✓	✓	✓	✓
2000.0011.xx, 1.25 A	✓	✓	✓	✓*	✓
2000.0012.xx, 2.0 A	✓	✓	✓	✓*	✓

■ Fuse opens in a safe and controlled manner before wiring simulator fuse (MDL 2.0)

* Fuse does not open during test

ITU-T K.20	Power Induction	Power Contact
Voltage [Vrms]	300	250
Current [A]	0.5	60
Duration	200 ms	15 min.
Repetitions	5	1
2000.0010.xx, 0.5 A	✓	✓*
2000.0011.xx, 1.25 A	✓	✓*
2000.0012.xx, 2.0 A	✓	✓*

■ Fuse does not open during test

* Fuse opens during test

UL 60950 IEC 60950	Longitudinal Test 1	Longitudinal Test 2	Longitudinal Test 3	Longitudinal Test 4	Longitudinal Test 5	Metallic Test 1	Metallic Test 2	Metallic Test 3	Metallic Test 4
Voltage [V]	600	600	600	200	120	600	600	600	600
Current [A]	40	7	2.2	2.2	25	40	7	2.2	2.2
Time	1.5 s	5 s	30 min.	30 min.	30 min.	1.5 s	5 s	30 min.	30 min.
2000.0010.xx, 0.5 A	✓	✓	✓	✓	✓	✓	✓	✓	✓
2000.0011.xx, 1.25 A	✓	✓	✓*	✓*	✓	✓	✓	✓*	✓*
2000.0012.xx, 2.0 A	✓	✓	✓*	✓*	✓	✓	✓	✓*	✓*

■ Fuse opens in a safe and controlled manner before wiring simulator fuse (MDL 2.0)

* Fuse does not open during test

Surface Mount Fuse, 7.4 x 3.1 mm, Quick-Acting F, Telecom

UL 248-14 · 125 VAC · 125 VDC · Quick-Acting F

Description
- Directly solderable on printed circuit boards
- Fuseholder available

Standards
- UL 248-14
- CSA C22.2 no. 248.14
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- UL File Number: E41599

Applications
- xDSL and ADSL linecards and modems

References
General Product Information
Packaging Details

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

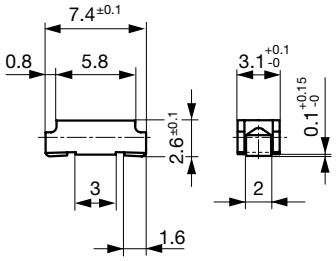
Technical Data

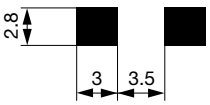
Rated Voltage	125 VAC, 125 VDC
Rated Current	0.25 - 3.15 A
Breaking Capacity	100 A
Characteristic	Quick-Acting F
Mounting	PCB,SMT
Admissible Ambient Air Temp.	-40 °C to 85 °C
Climatic Category	40/085/21 acc. to IEC 60068-1
Material: Housing	Thermoplastic, UL 94V-0
Material: Terminals	Tin-Plated Copper Alloy
Unit Weight	0.08 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	S, Type, Current Rating, Approvals

Soldering Methods	Reflow, Wave
Solderability	245 °C / 3 sec acc. to IEC 60068-2-58, Test Td
Resistance to Soldering Heat	260 °C / 10 sec acc. to IEC 60068-2-58, Test Td
Load Humidity Test	MIL-STD-202, Method 103B (1000h @ 0.1*In @ 0.85 r.H. @ 85°C)
Moisture Resistance Test	MIL-STD-202, Method 106E (50 cycles in a temp./mister chamber)
Terminal Strength	MIL-STD-202, Method 211A (Deflection of board 1 mm for 1 minute)
Case Resistance	acc. to EIA/IS-722, Test 4.7 >100 MΩ (between leeds and body)
Mechanical Shock	MIL-STD-202, Method 213B (Shock 50gn, half sine wave, 11 ms)
Vibration, High Frequency	MIL-STD-202, Method 204D (Shock 20 gn, 20 min, 10-2 kHz, 12 cyc.)
Resistance to Solvents	MIL-STD-202, Method 215A
Flammability	min. UL 94V-1 (acc. to EIA/IS-722, Test 4.12)

Dimensions

Length 7.4 mm





Solder pads

Pre-Arcing Time

Rated Current In	1.0 x In min.	2.0 x In max.	4.0 x In max.
0.25 A - 3.15 A	4 h	1 s	10 ms

Variants

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

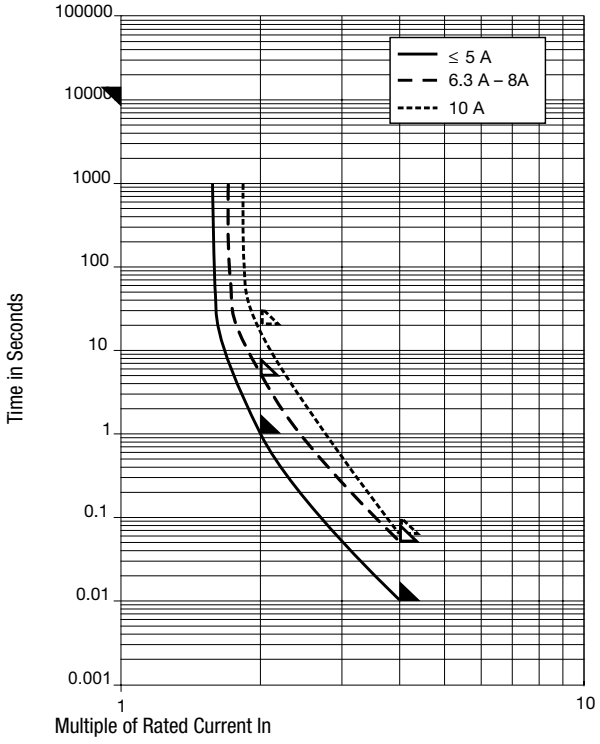
Rated Current [A]	Rated Voltage [VAC]	Rated Voltage [VDC]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.0 I_n typ. [mW]	Melting I^2t 4.0 In typ. [A^2s]	GR-1089-CORE [A]	UL60950	ITU - Lightning Surge [A]	ITU - Power Induc-	ITU - Power Contact [A]	Order Number
0.25	125	125	990	250	0.0058	< 1.5		2.5		50.0	2060.0006.xx
0.35	125	125	990	350	0.0076	< 1.5		4		25.0	2060.0043.xx
0.375	125	125	990	370	0.013	< 1.5		4.6	●	25.0	2060.0044.xx
0.4	125	125	960	380	0.016	< 1.5		5.8	●	25.0	2060.0007.xx
0.5	125	125	350	180	0.01	2.5		7.7	●	25.0	2060.0045.xx
0.63	125	125	290	180	0.02	4.6		10	●	25.0	2060.0008.xx
0.75	125	125	260	200	0.031	7.0		13	●	25.0	2060.0046.xx
1	125	125	220	220	0.078	9.3		16	●	25.0	2060.0009.xx
1.25	125	125	220	280	0.14	> 14.0		25	●	25.0	2060.0010.xx
1.6	125	125	200	320	0.27	> 14.0		33	●	12.5	2060.0011.xx
2	125	125	200	400	0.44	> 14.0		45	●	8.3	2060.0012.xx
2.5	125	125	190	480	0.97	> 14.0		67	●	8.3	2060.0013.xx
3	125	125	190	570	1.3	> 14.0		67	●	8.3	2060.0014.xx
3.15	125	125	190	600	1.2	> 14.0		67	●	8.3	2060.0048.xx

1) 100 A @ 125 VAC/DC

Packaging Unit

.xx = .11 Plastic Bag (100 pcs.)
.xx = .22 Blister Tape 18 cm Reel (750 pcs.)
.xx = .24 Blister Tape 33 cm Reel (3000 pcs.)

Time-Current Curves



Surface Mount Fuse, 11 x 4.6 mm, Quick-Acting F, Telecom

IEC 60127-4 · 250 VAC · 250 VDC · Quick-Acting F

Description
- Directly solderable on printed circuit boards

Standards
- IEC 60127-4/2
- UL 248-14
- CSA C22.2 no. 248.14
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- VDE License Number: 106328
- UL File Number: E41599

Applications
- xDSL and ADSL linecards and modems

References
General Product Information
Packaging Details

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

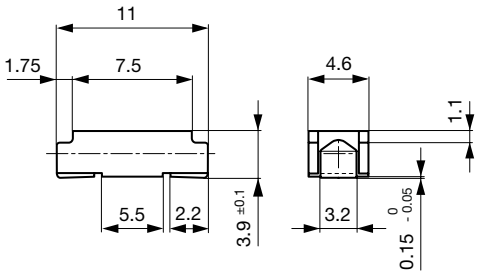
Technical Data

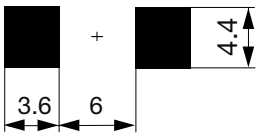
Rated Voltage	250 VAC, 250 VDC
Rated Current	0.25 - 3.15 A
Breaking Capacity	100 A
Characteristic	Quick-Acting F
Mounting	PCB,SMT
Admissible Ambient Air Temp.	-40 °C to 85 °C
Climatic Category	40/085/21 acc. to IEC 60068-1
Material: Housing	Thermoplastic, UL 94V-0
Material: Terminals	Tin-Plated Copper Alloy
Unit Weight	0.36 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	S, Type, Current Rating, Characteristic, Breaking Capacity, Approvals

Soldering Methods	Reflow, Wave
Solderability	245 °C / 3 sec acc. to IEC 60068-2-58, Test Td
Resistance to Soldering Heat	260 °C / 10 sec acc. to IEC 60068-2-58, Test Td
Current Carrying Capacity	acc. to EIA/IS-722, Test 4.3.3
Load Humidity Test	MIL-STD-202, Method 103B (1000h @ 0.1*In @ 0.85 r.H. @ 85°C)
Moisture Resistance Test	MIL-STD-202, Method 106E (50 cycles in a temp./mister chamber)
Terminal Strength	MIL-STD-202, Method 211A (Deflection of board 1 mm for 1 minute)
Thermal Shock	MIL-STD-202, Method 107D (200 air-to-air cycles from -55 to +125°C)
Case Resistance	acc. to EIA/IS-722, Test 4.7 >100 MΩ (between leeds and body)
Mechanical Shock	MIL-STD-202, Method 213B (Shock 50gn, half sine wave, 11 ms)
Vibration, High Frequency	MIL-STD-202, Method 204D (Shock 20 gn, 20 min, 10-2 kHz, 12 cyc.)
Resistance to Solvents	MIL-STD-202, Method 215A
Flammability	min. UL 94V-1 (acc. to EIA/IS-722, Test 4.12)

Dimensions

Length 11 mm





Solder pads

Pre-Arcing Time

Rated Current In	1.25 x In min.	2.0 x In max.	10.0 x In min.	10.0 x In max.
0.25 A - 3.15 A	60 min	120 s	1 ms	10 ms

Variants

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

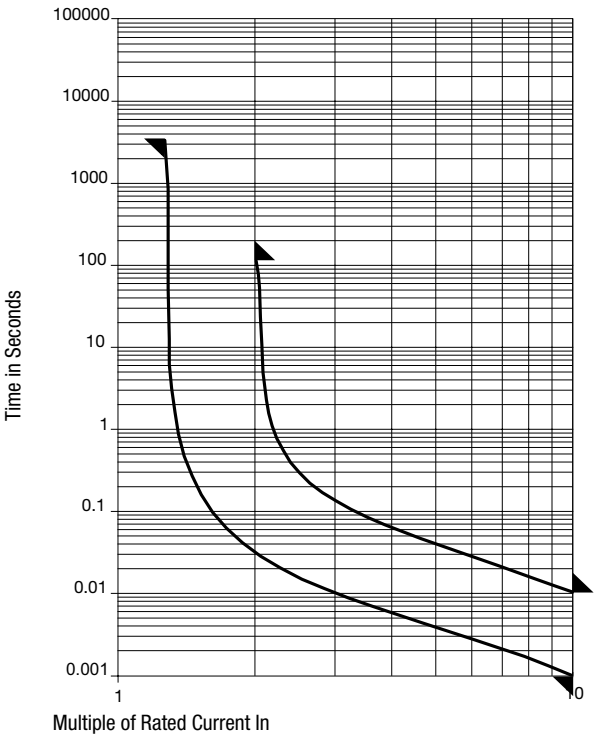
Rated Current [A]	Rated Voltage [VAC]	Rated Voltage [VDC]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.25 I_n typ. [mW]	Melting I^2t 10.0 Intyp. [A^2s]	GR-1089-CORE [A]	UL60950	ITU - Lightning Surge [A]	ITU - Power Induc-	ITU - Power Contact [A]	Order Number
0.25	250	250	1100	480	0.012	< 1.9	●	3.9		100.0	2070.0010.xx
0.315	250	250	1000	430	0.019	< 1.9	●	4.3	●	100.0	2070.0011.xx
0.4	250	250	230	190	0.02	3.1	●	5	●	100.0	2070.0012.xx
0.5	250	250	190	190	0.03	5.1	●	10	●	100.0	2070.0013.xx
0.63	250	250	170	230	0.07	9.2		16	●	100.0	2070.0014.xx
0.8	250	250	200	330	0.12	13.15		22	●	100.0	2070.0015.xx
1	250	250	170	390	0.23	13.15		27	●	100.0	2070.0016.xx
1.25	250	250	150	390	0.47	13.15		43	●	100.0	2070.0017.xx
1.6	250	250	150	490	0.84	13.15		67	●	100.0	2070.0018.xx
2	250	250	140	600	1.4	13.15		67	●	100.0	2070.0019.xx
2.5	250	250	130	670	2.6	13.15		67	●	100.0	2070.0020.xx
3.15	250	250	130	870	4.8	13.15		67	●	100.0	2070.0021.xx

1) 100 A @ 250 VAC/DC

Packaging Unit

.xx = .11 Plastic Bag (100 pcs.)
.xx = .24 Blister Tape 33 cm Reel (2000 pcs.)

Time-Current Curves



Subminiature Fuse, 6.4 mm, Quick-Acting F, Telecom

UL 248-14 · 125 VAC · 125 VDC · Quick-Acting F

Description
- Directly solderable on printed circuit boards

Standards
- UL 248-14
- CSA C22.2 no. 248.14
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- UL File Number: E41599

Applications
- xDSL and ADSL linecards and modems

References
General Product Information
Packaging Details

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

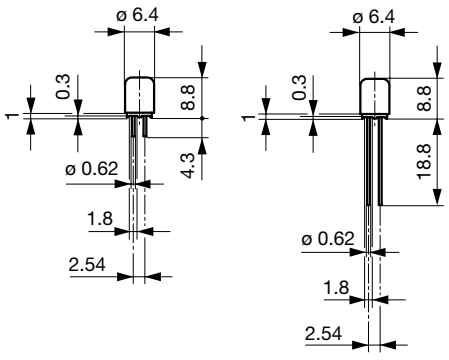
Technical Data

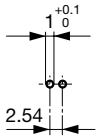
Rated Voltage	125 VAC, 125 VDC
Rated Current	0.25 - 3.15 A
Breaking Capacity	300 A
Characteristic	Quick-Acting F
Mounting	PCB, THT
Admissible Ambient Air Temp.	-25 °C to 85 °C
Climatic Category	25/085/21 acc. to IEC 60068-1
Material: Housing	Thermoplastic, UL 94V-0
Material: Terminals	Tin-Plated Copper
Unit Weight	0.34 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	SCHURTER, Type, Current Rating, Voltage Rating, Characteristic, Approvals

Soldering Methods	Wave, Iron
Solderability	235 °C / 2 sec acc. to IEC 60068-2-20, Test Ta, method 1
Resistance to Soldering Heat	260 °C / 5 sec acc. to IEC 60068-2-20, Test Tb, method 1A
Current Carrying Capacity	acc. to EIA/IS-722, Test 4.3.3
Life Test	MIL-STD-202, Method 108A (1000h @ 0.42*In @ 70°C)
Terminal Strength	MIL-STD-202, Method 211A (Deflection of board 1 mm for 1 minute)
Case Resistance	acc. to EIA/IS-722, Test 4.7 >100 MΩ (between leeds and body)
Mechanical Shock	MIL-STD-202, Method 213B (Shock 50gn, half sine wave, 11 ms)
Vibration, High Frequency	MIL-STD-202, Method 204D (Shock 20 gn, 20 min, 10-2 kHz, 12 cyc.)
Resistance to Solvents	MIL-STD-202, Method 215A

Dimensions

Length 6.4 mm





Drilling Diagram

Pre-Arcing Time

Rated Current In	1.5 x In max.	2.0 x In max.	2.75 x In max.	4.0 x In max.	10.0 x In max.
0.25 A - 3.15 A	10 min	5 s	300 ms	30 ms	4 ms

Variants

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

S = Short Terminals
L = Long Terminals
T = Taped and Reeled

.

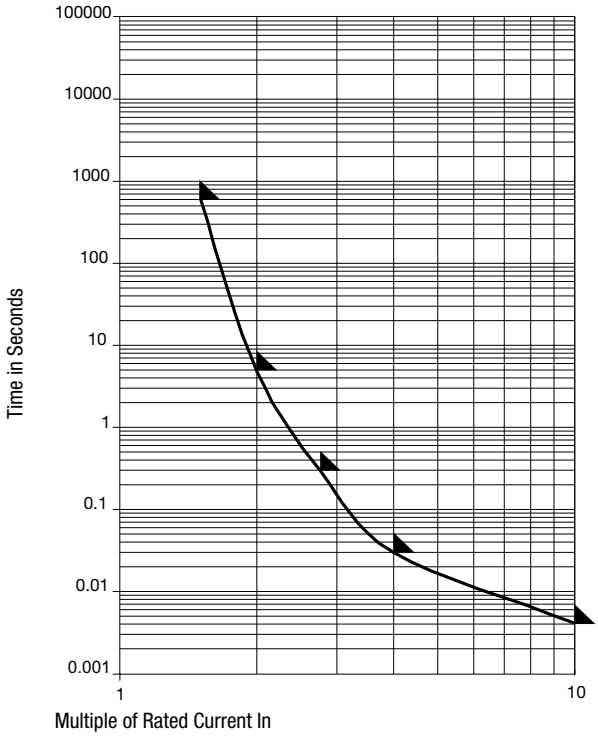
Rated Current [A]	Rated Voltage [VAC]	Rated Voltage [VDC]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.0 I_n typ. [mW]	Melting I^2t 10.0 Intyp. [A^2s]	GR-1089-CORE [A]	UL60950	ITU - Lightning Surge [A]	ITU - Power Induc-	ITU - Power Contact [A]	S	L	T	Order Number
0.25	125	125	620	100	0.0055	< 1.5	●	4.5	●	300.0	●			2030.0013
0.315	125	125	680	200	0.025	< 1.5	●	5.6	●	300.0	●			2030.0014
0.4	125	125	180	100	0.013	1.6	●	5.9	●	300.0	●			2030.0015
0.5	125	125	180	100	0.02	2.4	●	6.4	●	300.0	●			2030.0016
0.63	125	125	180	100	0.045	2.7	●	7.2	●	300.0	●			2030.0017
0.71	125	125	140	100	0.045	2.9	●	7.8	●	300.0	●			2030.0018
0.75	125	125	170	100	0.02	3.0	●	8.5	●	300.0	●			2030.0019
0.8	125	125	150	100	0.04	5.0	●	11	●	300.0	●			2030.0020
1	125	125	150	100	0.07	6.0	●	16	●	300.0	●			2030.0021
1.25	125	125	150	200	0.12	9.3	●	21	●	300.0	●			2030.0022
1.6	125	125	150	200	0.29	> 14.0	●	35	●	300.0	●			2030.0023
2	125	125	130	200	0.43	> 14.0	●	38	●	300.0	●			2030.0024
2.5	125	125	120	300	0.6	> 14.0	●	57	●	300.0	●			2030.0025
3.15	125	125	120	400	1.11	> 14.0	●	65	●	300.0	●			2030.0026
0.25	125	125	620	100	0.0055	< 1.5	●	4.5	●	300.0		●		2030.0243
0.315	125	125	680	200	0.025	< 1.5	●	5.6	●	300.0		●		2030.0244
0.4	125	125	180	100	0.013	1.6	●	5.9	●	300.0		●		2030.0245
0.5	125	125	180	100	0.02	2.4	●	6.4	●	300.0		●		2030.0246
0.63	125	125	180	100	0.045	2.7	●	7.2	●	300.0		●		2030.0247
0.71	125	125	140	100	0.045	2.9	●	7.8	●	300.0		●		2030.0248
0.75	125	125	170	100	0.02	3.0	●	8.5	●	300.0		●		2030.0249
0.8	125	125	150	100	0.04	5.0	●	11	●	300.0		●		2030.0250
1	125	125	150	100	0.07	6.0	●	16	●	300.0		●		2030.0251
1.25	125	125	150	200	0.12	9.3	●	21	●	300.0		●		2030.0252
1.6	125	125	150	200	0.29	> 14.0	●	35	●	300.0		●		2030.0253
2	125	125	130	200	0.43	> 14.0	●	38	●	300.0		●		2030.0254
2.5	125	125	120	300	0.6	> 14.0	●	57	●	300.0		●		2030.0255
3.15	125	125	120	400	1.11	> 14.0	●	65	●	300.0		●		2030.0256
0.25	125	125	620	100	0.0055	< 1.5	●	4.5	●	300.0			●	2030.0543
0.315	125	125	680	200	0.025	< 1.5	●	5.6	●	300.0			●	2030.0544
0.4	125	125	180	100	0.013	1.6	●	5.9	●	300.0			●	2030.0545
0.5	125	125	180	100	0.02	2.4	●	6.4	●	300.0			●	2030.0546
0.63	125	125	180	100	0.045	2.7	●	7.2	●	300.0			●	2030.0547
0.71	125	125	140	100	0.045	2.9	●	7.8	●	300.0			●	2030.0548
0.75	125	125	170	100	0.02	3.0	●	8.5	●	300.0			●	2030.0549
0.8	125	125	150	100	0.04	5.0	●	11	●	300.0			●	2030.0550
1	125	125	150	100	0.07	6.0	●	16	●	300.0			●	2030.0551
1.25	125	125	150	200	0.12	9.3	●	21	●	300.0			●	2030.0552
1.6	125	125	150	200	0.29	> 14.0	●	35	●	300.0			●	2030.0553
2	125	125	130	200	0.43	> 14.0	●	38	●	300.0			●	2030.0554
2.5	125	125	120	300	0.6	> 14.0	●	57	●	300.0			●	2030.0555
3.15	125	125	120	400	1.11	> 14.0	●	65	●	-			●	2030.0556

1) 50 A @ 125 VAC

Packaging Unit

S + L = Plastic Bag (100 pcs.)
T = Taped 36 cm Reel (1000 pcs.)

Time-Current Curves



Subminiature Fuse, 8.5 mm, Time-Lag T, Telecom

IEC 60127-3 · 250 VAC · Time-Lag T

Standards
- IEC 60127-3/4
- UL 248-14
- CSA C22.2 no. 248.14
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- VDE License Number: 40013529
- UL File Number: E41599

Applications
- xDSL and ADSL linecards and modems

References
General Product Information
Packaging Details

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

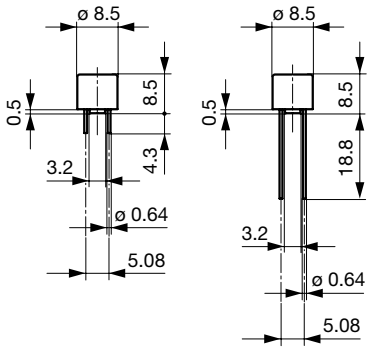
Technical Data

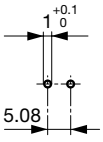
Rated Voltage	250 VAC
Rated Current	0.25 - 3.15 A
Breaking Capacity	35 A
Characteristic	Time-Lag T
Mounting	PCB,THT
Admissible Ambient Air Temp.	-40 °C to 85 °C
Climatic Category	40/085/21 acc. to IEC 60068-1
Material: Housing	Thermoplastic, UL 94V-0
Material: Terminals	Tin-Plated Copper
Unit Weight	0.5 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	ⓢ, Type, Current Rating, Voltage Rating, Characteristic, Approvals

Soldering Methods	Wave, Iron
Solderability	235 °C / 2 sec acc. to IEC 60068-2-20, Test Ta, method 1
Resistance to Soldering Heat	260 °C / 5 sec acc. to IEC 60068-2-20, Test Tb, method 1A
Current Carrying Capacity	acc. to EIA/IS-722, Test 4.3.3
Moisture Resistance Test	MIL-STD-202, Method 106E (50 cycles in a temp./mister chamber)
Terminal Strength	MIL-STD-202, Method 211A (Deflection of board 1 mm for 1 minute)
Case Resistance	acc. to EIA/IS-722, Test 4.7 >100 MΩ (between leeds and body)
Mechanical Shock	MIL-STD-202, Method 213B (Shock 50gn, half sine wave, 11 ms)
Vibration, High Frequency	MIL-STD-202, Method 204D (Shock 20 gn, 20 min, 10-2 kHz, 12 cyc.)
Resistance to Solvents	MIL-STD-202, Method 215A
Flammability	min. UL 94V-1 (acc. to EIA/IS-722, Test 4.12)

Dimensions

Length 8.5 mm





Drilling Diagram

Pre-Arcing Time

Rated Current In	1.5 x In min.	2.1 x In max.	2.75 x In min.	2.75 x In max.	4.0 x In min.	4.0 x In max.	10.0 x In min.	10.0 x In max.
0.25 A - 3.15 A	60 min	120 s	400 ms	10 s	150 ms	3 s	20 ms	150 ms

Variants

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

S = Short Terminals
L = Long Terminals
T = Taped and Reeled
.

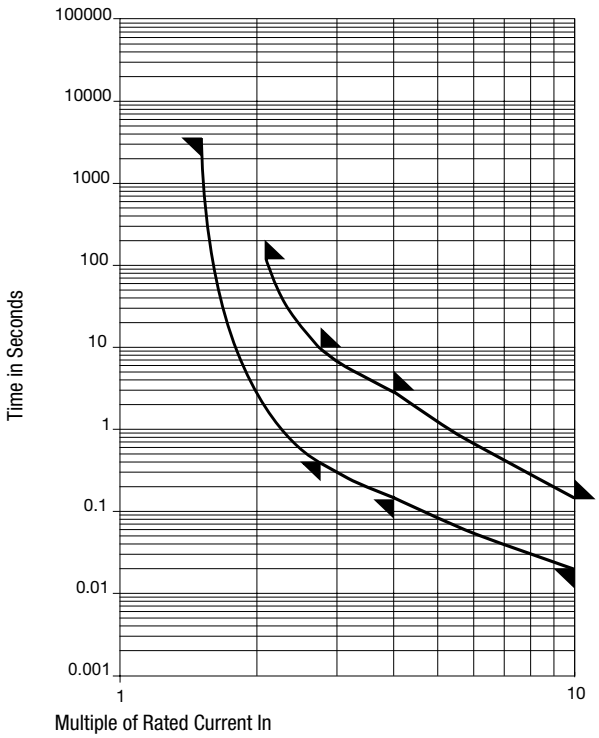
Rated Current [A]	Rated Voltage [VAC]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.5 I_n typ. [mW]	Melting I^2t 10.0 Intyp. [A^2s]	GR-1089-CORE [A]	UL60950	ITU - Lightning Surge [A]	ITU - Power Induc-	ITU - Power Contact [A]	S	L	T	Order Number
0.25	250	120	80	0.6	> 14.0		25.3	●	35.0	●			2040.0609
0.315	250	120	100	0.8	> 14.0		29.2	●	35.0	●			2040.0610
0.4	250	110	100	1.1	> 14.0		39.5	●	35.0	●			2040.0611
0.5	250	100	100	2.5	> 14.0		57	●	35.0	●			2040.0612
0.63	250	90	100	4	> 14.0		67	●	35.0	●			2040.0613
0.8	250	80	200	8	> 14.0	●	67	●	35.0	●			2040.0614
1	250	70	200	12	> 14.0	●	67	●	35.0	●			2040.0615
1.25	250	70	300	15	> 14.0	●	67	●	35.0	●			2040.0616
1.6	250	60	300	30	> 14.0	●	67	●	50.0	●			2040.0617
2	250	60	300	34	> 14.0	●	67	●	50.0	●			2040.0618
2.5	250	50	400	55	> 14.0	●	67	●	50.0	●			2040.0619
3.15	250	50	500	76	> 14.0	●	67	●	50.0	●			2040.0620
0.25	250	120	80	0.6	> 14.0		25.3	●	35.0		●		2040.0709
0.315	250	120	100	0.8	> 14.0		29.2	●	35.0		●		2040.0710
0.4	250	110	100	1.1	> 14.0		39.5	●	35.0		●		2040.0711
0.5	250	100	100	2.5	> 14.0		57	●	35.0		●		2040.0712
0.63	250	90	100	4	> 14.0		67	●	35.0		●		2040.0713
0.8	250	80	200	8	> 14.0	●	67	●	35.0		●		2040.0714
1	250	70	200	12	> 14.0	●	67	●	35.0		●		2040.0715
1.25	250	70	300	15	> 14.0	●	67	●	35.0		●		2040.0716
1.6	250	60	300	30	> 14.0	●	67	●	50.0		●		2040.0717
2	250	60	300	34	> 14.0	●	67	●	50.0		●		2040.0718
2.5	250	50	400	55	> 14.0	●	67	●	50.0		●		2040.0719
3.15	250	50	500	76	> 14.0	●	67	●	50.0		●		2040.0720
0.25	250	120	80	0.6	> 14.0		25.3	●	35.0			●	2040.0809
0.315	250	120	100	0.8	> 14.0		29.2	●	35.0			●	2040.0810
0.4	250	110	100	1.1	> 14.0		39.5	●	35.0			●	2040.0811
0.5	250	100	100	2.5	> 14.0		57	●	35.0			●	2040.0812
0.63	250	90	100	4	> 14.0		67	●	35.0			●	2040.0813
0.8	250	80	200	8	> 14.0	●	67	●	35.0			●	2040.0814
1	250	70	200	12	> 14.0	●	67	●	35.0			●	2040.0815
1.25	250	70	300	15	> 14.0	●	67	●	35.0			●	2040.0816
1.6	250	60	300	30	> 14.0	●	67	●	50.0			●	2040.0817
2	250	60	300	34	> 14.0	●	67	●	50.0			●	2040.0819
2.5	250	50	400	55	> 14.0	●	67	●	50.0			●	2040.0819
3.15	250	50	500	76	> 14.0	●	67	●	50.0			●	2040.0820

1) 35 A @ 250 VAC

Packaging Unit

S + L = Plastic Bag (100 pcs.)
T = Taped 36 cm Reel (750 pcs.)

Time-Current Curves



Miniature Fuse, 5 x 20 mm, Time-Lag T, Telecom, L, 250 VAC

IEC 60127-2 · 250 VAC · Time-Lag T

Standards
- IEC 60127-2/2
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- VDE License Number: 40016093
- UL File Number: E41599

References
General Product Information

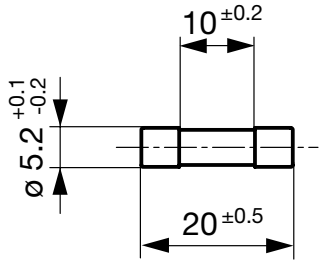
Weblinks
Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

Technical Data

Rated Voltage	250 VAC
Rated Current	0.25 - 3.15 A
Breaking Capacity	35 A
Characteristic	Time-Lag T
Mounting	Fuseholder / Clip
Admissible Ambient Air Temp.	-40 °C to 85 °C
Climatic Category	40/085/21 acc. to IEC 60068-1
Material: Tube	Glass
Material: Endcaps	Nickel-Plated Copper Alloy
Unit Weight	0.9 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	S, Current Rating, Voltage Rating, Characteristic, Breaking Capacity, Approvals

Dimensions

Length 20 mm



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

Variants

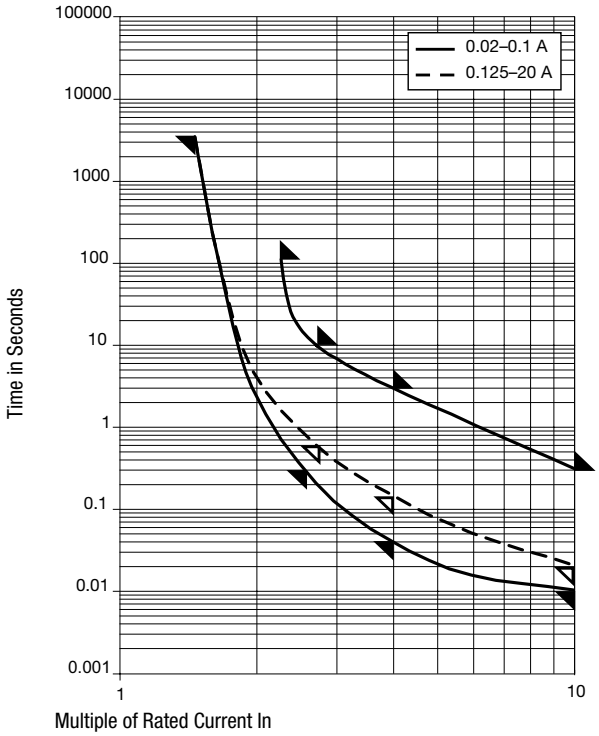
Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Rated Current [A]	Rated Voltage [VAC]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.5 I_n typ. [mW]	Melting I^2t 10.0 Intyp. [A^2s]	GR-1089-CORE [A]	UL60950	ITU - Lightning Surge [A]	ITU - Power Induc-	ITU - Power Contact [A]	Order Number
0.25	250	210	200	0.238	> 14.0	●	16	●	100.0	2010.0011
0.315	250	170	200	0.544	> 14.0	●	27	●	100.0	2010.0012
0.4	250	150	200	0.768	> 14.0	●	35	●	100.0	2010.0013
0.5	250	160	200	3	> 14.0	●	67	●	100.0	2010.0014
0.63	250	160	300	4.35	> 14.0	●	67	●	100.0	2010.0015
0.8	250	120	300	3.85	> 14.0	●	67	●	100.0	2010.0016
1	250	60	200	3.3	> 14.0	●	67	●	100.0	2010.0017
1.25	250	60	300	5.5	> 14.0	●	67	●	100.0	2010.0018
1.6	250	60	300	10.5	> 14.0	●	67	●	100.0	2010.0019
2	250	60	300	16	> 14.0	●	67	●	100.0	2010.0020
2.5	250	60	400	21.9	> 14.0	●	67	●	100.0	2010.0021
3.15	250	60	500	47	> 14.0	●	67	●	100.0	2010.0022
1.4	250	60	300	7.45	> 14.0	●	67	●	100.0	2010.0065

1) 35 A @ 250 VAC

Packaging Unit Plastic Bag (10 pcs.)

Time-Current Curves



Miniature Fuse, 5 x 20 mm, Time-Lag T, Telecom, H, 250 VAC

IEC 60127-2 · 250 VAC · Time-Lag T

Description
- Ceramic Tube

Standards
- IEC 60127-2/5
- UL 248-14
- CSA C22.2 no. 248.14
- Telcordia GR-1089
- UL 60950 / IEC 60950
- ITU-T K.20 and K.21
- TIA-968-A

Approvals
- VDE License Number: 40014395
- UL File Number: E41599

References
General Product Information

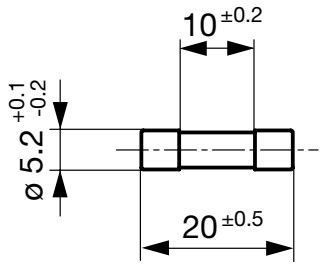
Weblinks
Approvals, RoHS, CHINA-RoHS, e-Store, SCHURTER-Stock-Check, Distributor-Stock-Check

Technical Data

Rated Voltage	250 VAC
Rated Current	0.25 - 3.15 A
Breaking Capacity	1500 A
Characteristic	Time-Lag T
Mounting	Fuseholder / Clip
Admissible Ambient Air Temp.	-40 °C to 85 °C
Climatic Category	40/085/21 acc. to IEC 60068-1
Material: Tube	Ceramic
Material: Endcaps	Nickel-Plated Copper Alloy
Unit Weight	1 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	S, Current Rating, Voltage Rating, Characteristic, Breaking Capacity, Approvals

Dimensions

Length 20 mm



Pre-Arcing Time

Rated Current In	1.5 x In min.	2.1 x In max.	2.75 x In min.	2.75 x In max.	4.0 x In min.	4.0 x In max.	10.0 x In min.	10.0 x In max.
0.5 A - 6.3 A	60 min	30 min	250 ms	80 s	50 ms	5 s	5 ms	150 ms

Variants

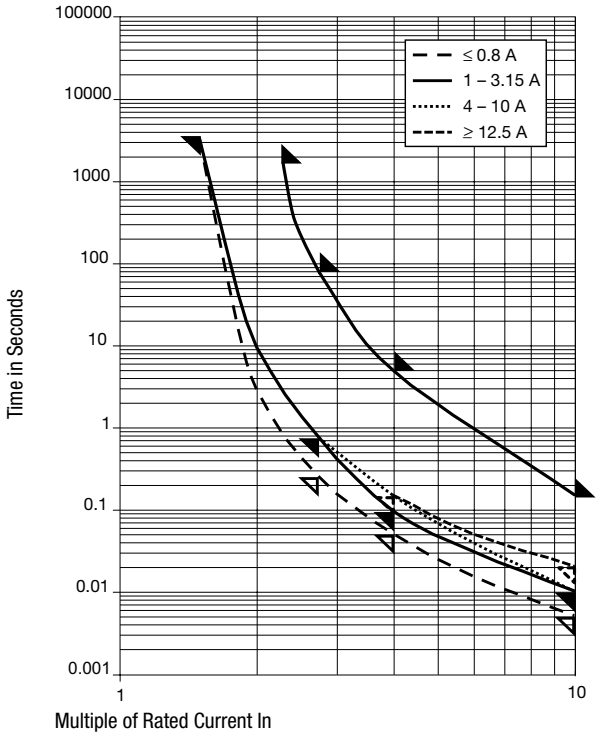
Distributor-Stock-Check | SCHURTER-Stock-Check | e-Store

Rated Current [A]	Rated Voltage [VAC]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.5 I_n typ. [mW]	Melting I^2t 10.0 Intyp. [A^2s]	GR-1089-CORE [A]	UL60950	ITU - Lightning Surge [A]	ITU - Power Induc-	ITU - Power Contact [A]	Order Number
0.5	250	360	500	0.5	> 14.0	●	27.7	●	1500.0	2020.0001
0.63	250	330	500	1.55	> 14.0	●	57	●	1500.0	2020.0002
0.8	250	260	500	2.3	> 14.0	●	67	●	1500.0	2020.0003
1	250	180	500	1.1	> 14.0	●	57	●	1500.0	2020.0004
1.25	250	150	500	1.86	> 14.0	●	67	●	1500.0	2020.0005
1.6	250	130	500	4.35	> 14.0	●	67	●	1500.0	2020.0006
2	250	120	600	9.2	> 14.0	●	67	●	1500.0	2020.0007
2.5	250	100	600	11.7	> 14.0	●	67	●	1500.0	2020.0008
3.15	250	100	800	33.7	> 14.0	●	67	●	1500.0	2020.0009

1) 1500 A @ 250 VAC

Packaging Unit Plastic Bag (10 pcs.)

Time-Current Curves



SCHURTER ELECTRONIC COMPONENTS

general product-information

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

(Mark)	European Norms Electrical Certification	
(Mark)	VDE	Verband Deutscher Elektrotechniker
(Certificate of conformity with factory surveillance)		
	UMF	Universal Modular Fuse meets the standard IEC 60127-4
(Recognition)	UL	Underwriters Laboratories (USA, Canada)
(Listing)	UL	Underwriters Laboratories (USA, Canada)
(Recognition)	UL	Underwriters Laboratories (USA)
(Listing)	UL	Underwriters Laboratories (USA, Canada)
	CSA	Canadian Standard Association, Component Acceptance Service
	CSA	Canadian Standard Association
	CCC	China Compulsory Certification
	PSE	Japan Electrical Safety & Environment technology Laboratories
	KTL	Korea Testing Laboratory
	TÜV	Technischer Überwachungs Verein
	NF	Norme française
	NNO	Numéro de nomenclature Otan (OTAN = NATO = North Atlantic Treaty Organisation)
	GAM T1	Liste interarmées AIR MER TERRE de composants électroniques

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.

Miniature fuse links

Explanations, application notes

The design engineer of electrical equipment is responsible for its safety and functioning to humans, animals and real values. Above all, it is his task to make sure that the state of the art as well as the valid national and international standards and regulations be observed.

The following information about fuse-links and their application are to be taken into consideration when selecting a fuse-link.

In view of the product liability of electrical equipment the selection of the most suitable fuse-link is of great importance.

1. Fuse

A fuse is a self-acting device that, by the fusing of one of its specially designed and proportioned components, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time.

Definition according to IEC 60127:
The fuse comprises all the parts that form the complete device, that means fuseholder and fuse-link.

Definition according to UL 248-1:
A North American fuse is an IEC fuse-link. An IEC fuse is a North American fuse with a fuse-holder.

2. Fuse-link (IEC 60127)

The part of a fuse including the fuse-element intended to be replaced after the fuse has operated. Fuse-links according to IEC 60127 relate to miniature fuses for the protection of electric appliances, electronic equipment and components thereof normally intended to be used indoors. These fuse-links are not permitted for equipment, which has to operate under special circumstances, e.g. in a corrosive or explosive environment.

3. Miniature fuse-link (IEC 60127)

An enclosed fuse-link of rated breaking capacity not exceeding 2 kA and which has at least one of its principal dimensions exceeding 10 mm.

4. Sub-miniature fuse-link (IEC 60127)

A miniature fuse-link of which the case (body) has no principal dimensions exceeding 10 mm.
Sub-miniature fuse-links are especially suitable for printed circuit boards. They are available for the through hole technique and surface mounting technique (SMT).

5. Standards for fuse-links

IEC 60127	Miniature fuses (general title)	
IEC 60127-1	Part 1:	Definitions for miniature fuses and general requirements for miniature fuse-links
IEC 60127-2	Part 2:	Cartridge fuse-links
IEC 60127-3	Part 3:	Sub-miniature fuse-links
IEC 60127-4	Part 4:	Universal modular fuse-links
IEC 60127-5	Part 5:	Guidelines for quality assessment for miniature fuse-links
NF C 93435		Cartridge Fuses with improved characteristics
UL 248-1		Low-Voltage Fuses: General requirements
UL 248-14		Low-Voltage Fuses: Supplemental Fuses
CSA/C22.2 No. 248.1		Low-Voltage Fuses: General requirements
CSA/C22.2 No. 248.14		Low Voltage Fuses: Supplemental Fuses

6. Rated voltage U_n

The rated voltage is the voltage up to which the fuse-link correctly interrupts an overcurrent.

The rated voltage of a fuse-link must be greater than or equal to the operating voltage of the equipment which is to be protected.

The use during operating voltages below the rated voltage of the fuse-link is permitted only, when the instructions regarding voltage drop (pos. 8) are taken into consideration.

The fuse-links are on principle suitable for use at alternating and direct voltage. The breaking capacity at direct-voltage is however considerably lower than the one at alternating voltage. The performance of the fuse-link at direct-voltage mainly depends on the size of the time-constant **T** = L/R of the load circuit.

7. Rated current I_n

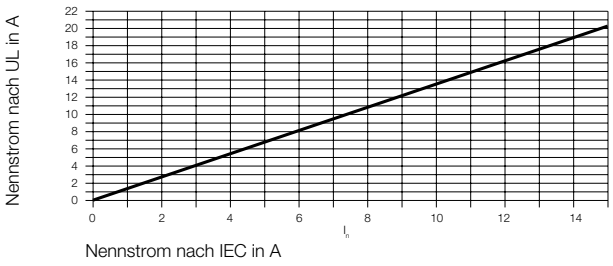
The rated current of the fuse-link corresponds to the operating current of the equipment to be protected. Basically there are two different rated current definitions:

a) On fuse-links according to IEC 60127 and EN 60127 the rated current corresponds to the current, which the fuse-link can be exposed to continually, according to the standardized regulations, without interrupting the fuse-link.

b) On fuse-links according to UL 248-14 however, the rated current corresponds to the current, which would interrupt the fuse-link already after a few hours. The current, which according to IEC, can flow constantly without interrupting the fuse-link, is approx. $0.7 \cdot I_n$.

Regarding influences of ambient air temperatures > 23 °C on the rated current see pos. 1

Correlation between the rated current of fuse-links according to IEC and UL:



8. Voltage drop

The voltage drop across a fuse-link is measured at an ambient air temperature of 23 °C, when the fuse-link has carried its rated current for a time sufficient to reach temperature stability. Attention is drawn to the fact that problems can arise when fuse-links are used at operating voltages considerably lower than their rated voltage. Due to the increase of the voltage drop when the element of a fuse-link approaches its melting point, care should be taken to ensure that there is sufficient circuit voltage available to cause the fuselink to interrupt the current when an electrical fault occurs. Furthermore, fuse-links of the same type and rating may, due to difference in design or element material, have different voltage drops and may therefore not be interchangeable in practice when used in applications with low circuit voltages, especially in combination with fuse-links of lower rated currents.

9. Non fusing current I_{nf}

A value of an over-current specified as that which the fuse-link is capable of carrying for a specified time (typical 1 hour) without melting.

10. Pre-arcing time/current characteristic (at T_a 23 °C)

The time-current-characteristic indicates the relation of the pre-arcing time (melting time) to the fault current.

The pre-arcing time is the interval of time between the beginning of a current large enough to cause a break in the fuse-element and the instant when an arc is initiated.

The arcing time is the interval of time between the instant of the initiation of the arc and the instant of final arc extinction. The arcing time is not considered in the time-current-characteristic.

The operating time (total clearing time) is the sum of the pre-arcing time and the arcing time.

The time-current-characteristics are shown as an envelope for all mentioned rated currents.

Usual time-current-characteristic and their symbols:

FF: denoting very quick acting
F: denoting quick acting
M: denoting medium time-lag
T: denoting time-lag
TT: denoting long time-lag

UL fuse-links are normally divided into:

- Non Time Delay fuse-links. These fuse-links are sometimes also referred to as Normal blow or Quick acting types.
- Time Delay fuse-links. These fuse-links are sometimes also refered to as Slow blow or Surge proof types.

Application notes for the various characteristics:

FF: Super-quick-acting fuse-links
Protection of semiconductors (thyristors, triacs, diodes). This fuse type tolerates small overcurrents only during a short period of time and limits the current at small short circuit currents. Current limiting even with low short circuit currents.

F: Quick-acting fuse-links
Protection of semiconductors and of an equipment with no current surge when operating or switching on and also for such devices where high overcurrent or high short-circuit current must be interrupted quickly.

M: Medium time lag fuse-links
Protection devices subjected to moderate in-rush currents and/or overcurrent peaks for a short time. Low voltage drop.

T: Time-lag fuse-links
Protection of devices subjected to high in rush currents and/or overcurrent peaks which decrease only slowly (e.g. transformers and motors).

TT: Super time-lag fuse-links
Protection of devices subjected to longer lasting in-rush currents and/or high overcurrent peaks.

11. Breaking capacity of a fuse-link (UL: interrupting rating IR)

A value (r.m.s. for alternating current) of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

The max. short-circuit current, which can occur in electric circuit of an equipment, due to fault conditions, may not exceed the breaking capacity of the fuse-link. Non-compliance of this rule can cause the danger of explosions and fire.

At direct current the breaking capacity of a fuse-link is lower than at alternating current. Values are given on request.

IEC 60127 miniature fuse-links are classified into two categories (for sub-miniature fuse-links other breaking capacities are defined).

Fuse-links with Low Breaking Capacity, symbol L.

Typically, the fuse-element of this type of fuse-link is visible. The insulation tube consists of transparent material, normally glass. There is no extinguishing medium, the arc is quenched in air.

The breaking capacity is:
250 VAC/35A or 10.In p.f.1 whichever is greater.

Fuse-links with High Breaking Capacity, symbol H.

Typically, the fuse-element of this type of fuse-link is not visible. The insulation tube normally is of ceramic material or glass. To quench the arc, there is often an extinguishing medium.

The breaking capacity is:
250 VAC 1500A p.f. 0.7 to 0.8

UL's and CSA's short circuit requirements (interrupting rating IR) are different as relates to IEC.

Interrupting ratings at 125 VAC = 10 000 A } p.f. 0.7-0.8
250 VAC = 35 to 1500 A
depending on rated current of the fuse-link.

12. Power dissipations

12.1 Max. sustained power dissipation

a) Fuse-links according to IEC 60127:

The test is carried out according to a standardised test procedure (open fuse-holder, room temperature).

The power dissipation produced by the non fusing current I_{nf} after one hour is determined.

Non fusing currents are different and depend on the fuse-link type.

In the SCHURTER catalogue you will usually find two values of sustained power dissipation, namely:

- the maximum sustained power dissipation i.e. according to IEC 60127.
- The typical sustained power dissipation of the SCHURTER fuse-links.

These values are mostly lower than the standardised ones.

b) Fuse-links according to UL 248-14:

UL does not, like IEC, determine the sustained power dissipation, but measures the maximum permissible temperature increase from 75 °C at 1 · I_n on the outer surface of the fuse-link according to the UL standard.

12.2 Rated power dissipation

The power dissipation caused by the rated current (over a long period). With respect to the power acceptance for the selection of a suitable fuseholder this rated power dissipation is considered.

13. I^2t-value (joule integral)

The integral of the square of the current over a given time interval. The I^2t-value is a measure of the energy required to disrupt the fuselink. That means for heating up the fuse-element to its melting temperature, for melting the fuse-element and for interruption of the current via an arcing period. Normally, distinction is made between.

- the pre-arcing I^2t (or fusing I^2t)
  is the I^2t integral extended over the pre-arcing time of the fuse-link. It represents the energy for heating up and melting the fuseelement. At high over-currents with melting times <10 ms the prearcing I^2t remains constant (adiabatic conditions). Sometimes the pre-arcing I^2t is determined by 10.times the rated current, based on the time-current-characteristic. The pre-arcing I^2t is a characteristic value of a fuse-link and informs about his resistance to pulses and in-rush-currents.

- the arcing I^2t
  is the I^2t integral extended over the arcing time of the fuse-links. It represents the arc-energy. The arcing I^2t depends on the electrical circuit parameters (e.g. operation voltage, power factor, closing angle etc.) of an electrical circuit.

- The operating I^2t (or: total I^2t)
  is the sum of pre-arcing and arcing I^2t. This value is an important parameter for the application of a fuse-link. It characterises the energy exposed to the object (let-through-energy) to be protected by the fuse-link in case of a fault current.

Application notes:

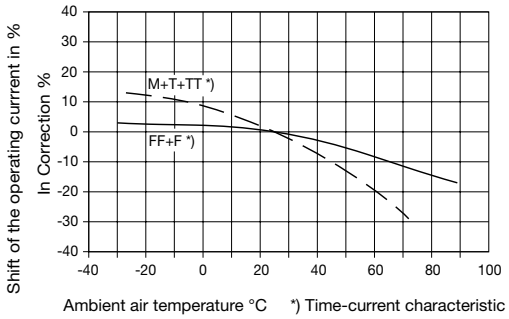
In order to choose the right fuse-link, the permitted I^2t-value of the component or component group to be protected, has to be known.

Selection criteria: The electric circuit to be protected contains:

- Components, which can cause in-rush currents, e.g. transformers. In this case, a fuse-link has to be chosen with a pre-arcing I^2t-value which is higher than the one of the in-rush-current.

- Components, which are sensitive to current impulses, e.g. semiconductors. In this case a fuse-link has to be chosen, with an operating I^2t-value which is lower than the one of the components to be protected.

Shift of the operating current as a function of ambient air temperature



14. Ambient air temperatures

The standardised current carrying capacity tests (IEC and UL) of fuse-links are performed at 23 °C and 25 °C respectively. In practical applications, the fuse-link s ambient temperature may be significantly higher, especially if the fuse-link is used in an unexposed fuseholder or mounted near other heat generating components. For such applications, the shift of the operating current according to the following diagram has to be considered.

15. Marking of the fuse-links

Marking according to IEC 127

Example: T[1] 200 mA[2] L[3] 250 V[4] [5]
Additional marking: approval marks

[1] symbol, denoting the relative pre-arcing time-current-characteristic
[2] rated current in mA or A
[3] symbol, denoting the rated breaking capacity
[4] rated voltage in V
[5] SCHURTER Logo
Additional marking: approval marks

16. Interchangeability of IEC- by UL fuse-links and Vice Versa

Fuse-links according to IEC und UL have different features and are on principle not interchangeable. However, after a thorough check of the technical data it may be possible to interchange, when the following, most important requirements are met.

- The rated currents must be adapted (see pos.7)
- The breaking capacity must be compatible.
- The time-current characteristic and voltage drop must be roughly the same.

17. Exchange of fuse-links under load

A fuseholder with an installed fuse-link shall not be used as a «switch» for turning power "on" and "off".

An opening and closing of electric-circuits may cause current- and voltage surges, depending on the dimension of the electric circuit. Such current or voltage peaks produce an arc between the contact points, which causes an increase of the contact resistance. In order to prevent the fuseholder from permanent damage, a fuselink shall only be exchanged when power in an electric circuit is switched off.

18. Quality assessment of fuse-links

SCHURTER fuse-links meet with the requirements according to IEC 60127-5 and EN 60127-5.
More detailled information is available on request.

19. Reliability of fuse-link (MIL-HDBK-217F)

The reliability modeling of fuses presents a unique problem. Unlike most other components, there is very little correlation between the number of fuse replacements and actual fuse failures. Generally when a fuse opens, or "blows" something else in the circuit has created an overload condition and the fuse is simply functioning as designed.

Fuse-link selection guide

1. The operating voltage U_B of the equipment to be protected defines the rated voltage U_N of the fuse-link (see pos. 6) $U_N \geq U_B$ For $U_B << U_N$ please refer to the remarks regarding voltage drop (see pos. 8).

2. The max. operating current of the equipment to be protected defines the rated current of the fuse-link. The different definitions for rated current according to IEC or UL as well as the influence of higher ambient temperatures are to be taken into consideration (pos. 6 and 14).

3. The possible fault current as well as its permitted operating times in the electric circuit of the equipment to be protected define the time-current-characteristic of the fuse-link (see pos. 10).

4. The necessary breaking capacity of the fuse-link depends on the max. short-circuit current, which can occur under fault conditions in the electric circuit of the equipment to be protected. It must be lower than the max. current which can be interrupted by the fuselink. (see pos. 11)

5. The rated power dissipation of the fuse-link is of importance for the selection of the suitable fuseholder (see pos. 12.2).

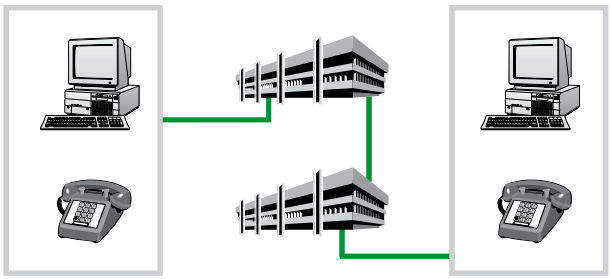
6. If current impulses occur in the electric circuit of the equipment to be protected, which may not interrupt the fuse-link under any circumstances or if the let-through-energy of the fuse-link may only reach a certain value (eg. protection of semi-conductors) the I^2t values have to be taken into consideration accordingly (see pos. 13).

7. The necessary approvals are mostly defined by national and international standards for equipment. SCHURTER fuse-links are according to international standards and were approved by the different agencies (refer to data sheets for the individual fuse-links).

8. It is essential that the selected fuse-links/fuse-holders that are fitted to the equipment to be protected, are being tested under normal and fault conditions, even if all relevant criteria for selection have been taken into consideration.

Telecom Fuses

Introduction
Telecommunication equipments serve for data exchange between a variety of subscribers. Communication takes place in various ways, e. g. per telephone, FAX etc.
This gives rise to the following classical network topology:

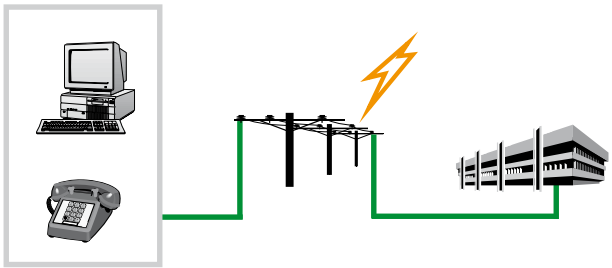


There can be extremely diverse distances between individual subscribers (man, machine). This means that network connections (overhead lines, signal cables) can be subject to various interference sources.

- Atmospheric interference, (lightning discharge, switching operations)
- Interference by power induction (equalizing currents, vicinity of power cables)
- Direct contact with energy network (short-circuits)

Interference sources

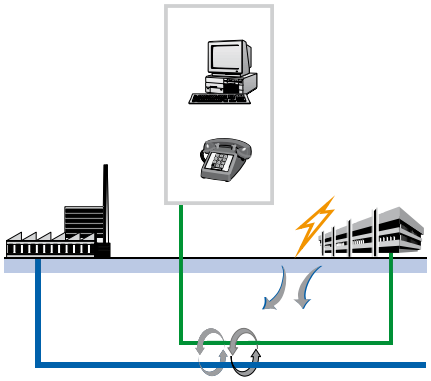
Atmospheric interference (Lightning Surge)



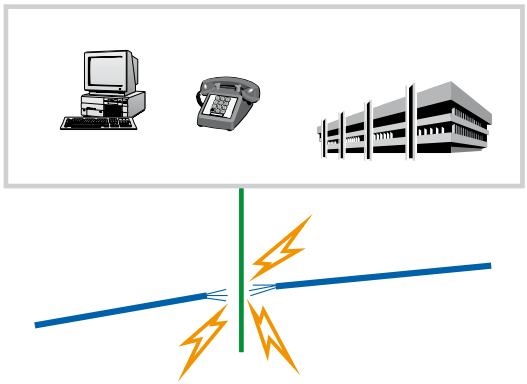
Interference through atmospheric discharge is very frequent. Occurring voltages are of the order of 100 kV with discharge currents up to 150 kA. Effects due to direct lightning stroke are principally to be expected on exposed signal lines (overhead lines).

Interference by induction (Power Induction)

Induction voltages occurring as interference on telecom lines are usually a result of circulating or equalizing currents in the earth or are produced by strong currents in adjacent power cables.



Direct contact with the power network (Power Contact)



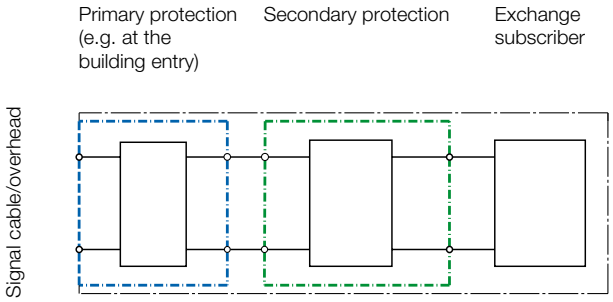
The highest intensity and usually long duration influence on a telephone line (a few seconds to several minutes) is by direct contact with the power network, e.g. short-circuit with an adjacent power cable.

Protection equipment

Regardless of which interference acts on the telecom equipment, it must be guaranteed at all times that no damage occurs, or only limited damage whose effects can be calculated.

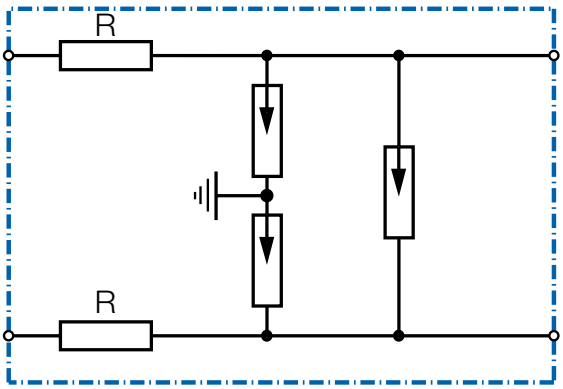
As shown below, this requirement can be satsified by the use of appropriate protection circuits.

Protection circuits in the telecom branch are usually designed on the two-stage principle. They comprise a primary and secondary protection.



Primary protection

Primary protection frequently comprises a combination of resistors and surge arrestors and is usually located at the «building entry» interface.
The task of the illustrated primary protection circuit is to sufficiently reduce the high-energy interference distortion so that they can be safely absorbed by the following secondary protection.



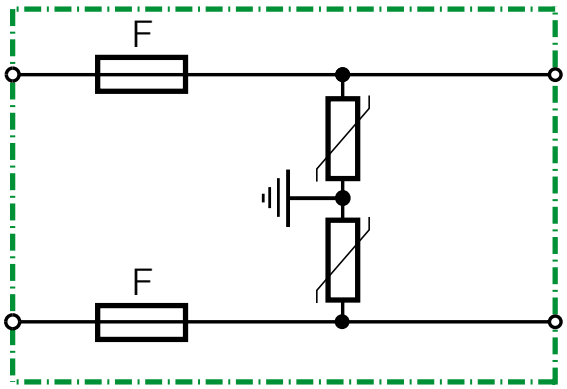
The secondary protection

The secondary protection is normally located directly at the appliance entry of the telecom equipment and has two objectives.

1. It operates as a voltage limiter which ensures that interference up to a defined amplitude, not yet capable of activating the primary protection, is absorbed or reduced to a level harmless for the telecom equipment.
2. It effectively suppresses high energy level interferences, which can no longer be adequately absorbed by the primary protection (e.g. in case of direct contact between the signal lines and the power network), by galvanic decoupling of the circuit. This prevents the occurrence of serious damage, even fire, in the telecom equipment.

The following schematic diagram shows a frequently used and extremely reliable protection circuit for this purpose. The circuit, which in its simplest form comprises two fuse-links and two varistors, is characterised by an extremely attractive cost-benefit ratio. The varistors limit the interference voltage peaks to a level compatible for the telephone exchange, respectively subscriber circuit. Under these normal conditions, the fuse-links remain intact.

Under worst-case conditions, e.g. direct contact with the power network, where both the telecom equipment components and the varistors in the protection circuit would be seriously damaged or destroyed, the fuse-links interrupt the circuit, thus effectively and reliably protecting the telecom equipment.



Introduction

Several standards have been established for the Telecom application field, all of which are aimed at combining the interference influences, Lightning Surge, Power Induction, Power Contact, previously described under the title "Application Note" together with the associated safety aspects, and to derive suitable testing methods for the components in question.

Various kinds of loads have been defined and standardised as testing criteria. They can be simulated with the aid of an appropriate test circuit. This provides circuit designers with the facility for optimally adapting the stages of a protection circuit to one another.

The presently relevant standards are:

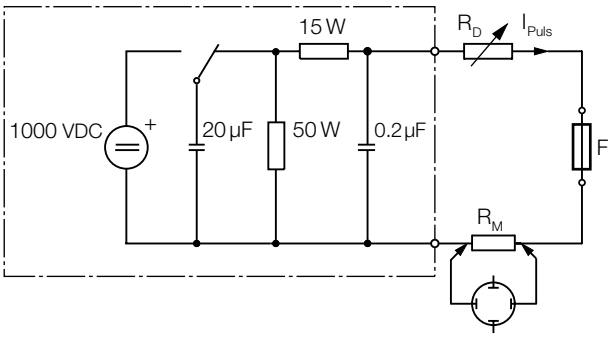
ITU-T K.20	International Telecommunication Union
UL 60950	UL Standard for Safety for Information Technology Equipment
IEC 60950	IEC Standard for Safety for Information Technology Equipment
Telcordia GR-1089	Telcordia Technologies
TIA-968-A	Telecommunications Industry Association

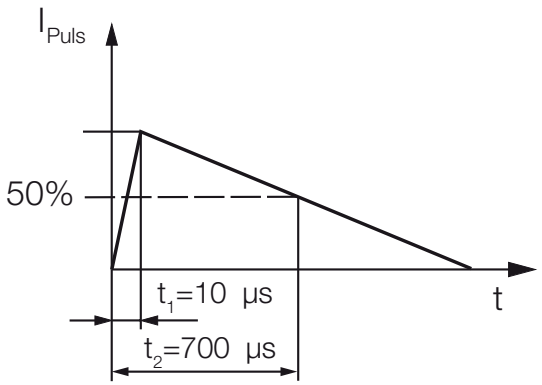
(The list is not exhaustive)

Tests:
SCHURTER fuselinks have been tested according to the following standards and testing criteria:

1. ITU-T K.20

Lightning Surge: Test circuit
Test:
1. The pulse amplitude (generator no-load) is set to 1000 V and the pulse shape to 10 µs / 700 µs.





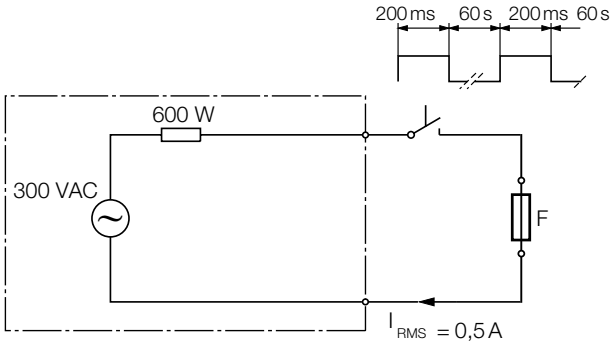
2. The pulse current I_{puls} is set to the value I_{puls} max. stated in the

3. Test mode : 10 single pulses, at an interval of 60 sec. alternating polarity.

Requirement: The fuse shall not interrupt the circuit.

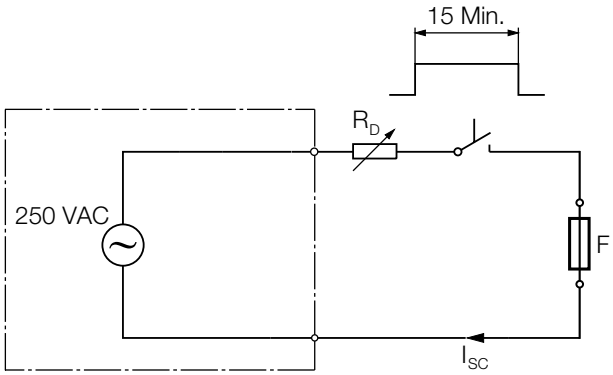
1) Note:
With a charge voltage of UC = 1000 V, the standardized pulse generator in Para. 1 supplies a maximum pulse current Ipuls = 67 A, providing the current limiting resistor is R_D = 0Ω. The shunt R_M for the current monitoring has a very low resistance and has therfore no notable influence to the current amplitude. This means that the data sheet current 67 A does not represent the maximum permissible pulse amplitude of the fuselink in question, but the maximum current amplitude which can be supplied by the pulse generator. If a max. current higher than 67 A is to be expected in a circuit, the I^2t-values of the fuse-link can be calculated using the formula $I^2t = 0.72 \times I^2_{peak} \times t^2$, as a good approximation in order that the selected fuse-link can accept the expected current pulse without interrupting the circuit.

Power induction: Test circuit



Test: The fuse-link in the test circuit AC 300 V / 50 Hz is loaded 5 times with I_{eff} = 0.5 A for 200 ms at intervals of 60 sec.
Requirement: The fuse-link shall not interrupt the circuit.

Power Contact: Test circuit

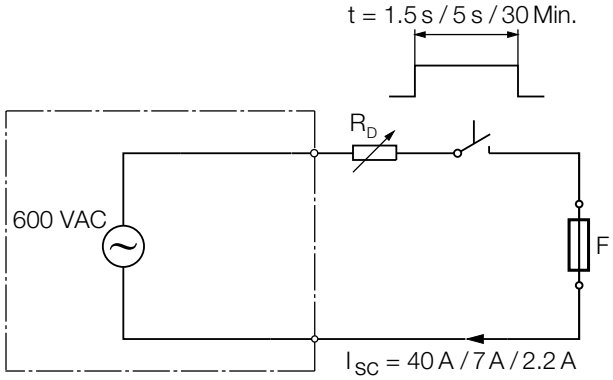


Test: The fuselink in the test circuit AC 250 V / 50 Hz is loaded with the current value I_{SC} stated in the data sheet. The supply voltage is maintained for 15 minutes.

Requirement: The fuse-link shall interrupt the circuit.

2. UL 60950/IEC 60950

Test circuit



Test 1
The fuse-link in the test current circuit is loaded with a test current of I_{SC} = 40 A .
The AC 600 V / 50 Hz source voltage is applied for a total of 1.5 sec.

Requirement: The fuse-link shall interrupt the circuit.

Test 2

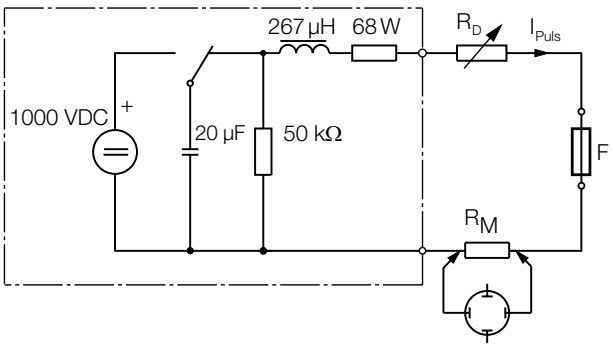
The fuse-link in the test current circuit is loaded with a test current of I_{SC} = 7 A .
The AC 600 V / 50 Hz source voltage is applied for a total of 5 sec.

Requirement: The fuse-link shall interrupt the circuit.

Test 3
The fuse-link in the test current circuit is loaded with a test current of ISC = 2.2 A .
The AC 600 V / 50Hz source voltage is applied for at least 30 minutes, or until stable thermal conditions are achieved in the telecom unit or until the fuse-link interrupts the circuit. This test is performed together with the equipment in which the fuse-link is installed.

3. Telcordia GR-1089

3.1 Lightning Surge
Test circuit



Test:
1. The pulse amplitude (generator no-load) is set to 1000 V and the pulse shape to 10 µs / 1000 µs.
2. The pulse current Ipuls is set to the value I_{puls} max. stated in the data sheet with limiting resistor RD.
3. Test mode: 50 single pulses, at an interval of 60 sec. alternating polarity.

Requirement: The fuse shall not interrupt the circuit.

5) Note: With a charge voltage of U_C = 1000 V, the standardized pulse generator in Para. 3.1 supplies a maximum pulse current I_{puls} = 14 A, providing the current limiting resistor is R_D = 0Ω . The shunt R_M for the current monitoring has a very low resistance and has no notable influence to the current amplitude. This
means that the data sheet current 14 A does not represent the maximum permissible pulse amplitude of the fuse-link in question, but the maximum current amplitude which can be supplied by the pulse generator. If a max. current higher than 14 A is to be expected in a circuit, the I^2t- values of the fuse-link can be calculated using the formula $I^2t = 0.72 \times I^2_{peak} \times t^2$, as a good approximation in order that the selected fuse-link can accept the expected current pulse without interrupting the circuit.

3.2 Power Cross

Test circuit see UL 60950/IEC 60950
Test 2, Second Level (only TF 600)

The fuse-link in the test current circuit is loaded with a test current of ISC = 60 A .
The AC 600 V / 50 Hz source voltage is applied for a total of 5 sec.

Requirement: The fuse-link shall interrupt the circuit.

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