

ASD™ and discrete products for Telecom wireline



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Introduction

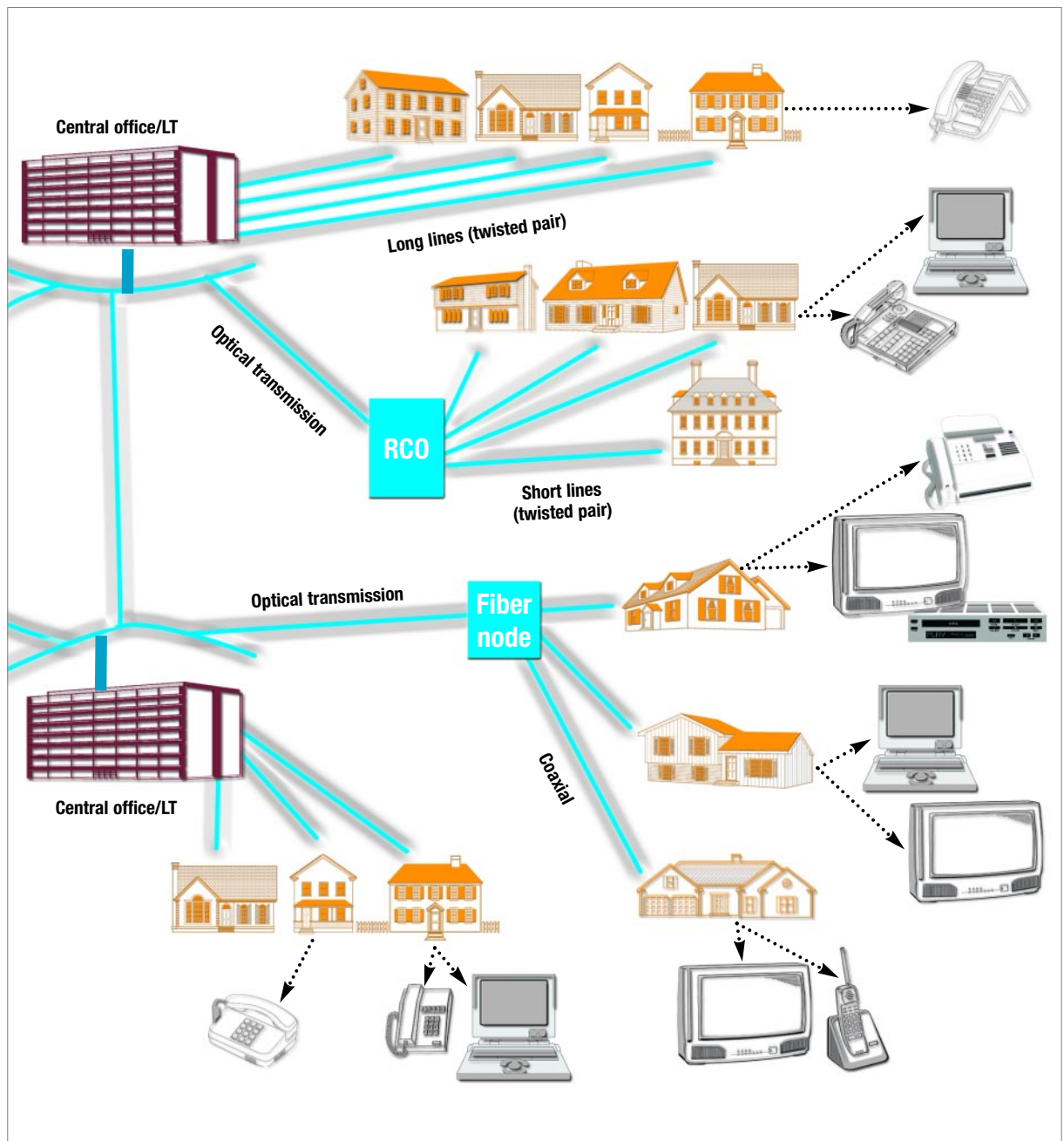
You no longer need to take hours to download a file from the Internet. By using xDSL technology, it's now possible to get 8Mb/s on a single twisted pair – a solution which can take advantage of the existing infrastructure in most countries.

Another solution meeting the need for very high data rates is the cable modem. Sales of these devices are growing rapidly, and it is a trend which will continue for some time. In the near future, many people will have access to these new technologies –

and those who don't can make use of some 800 million twisted pairs to transport voice and data at lower speeds.

But such systems have a high integration level, and are very sensitive to overload. That's why they are protected by worldwide standards such as GR-1089 Core, ITU, etc.

In this document, we will provide an overview of the ST solutions – discrete products and standard IC devices – for these applications.



The importance of protection

Telecommunications equipment connected to twisted pair cabling has always been vulnerable. Today, with the increasing use of complex ICs, protection against overload is especially important.

Three kinds of overload can be applied to a system:

- **Electrostatic discharge (ESD):** familiar to most of us when we touch our car in dry weather, these are low power surges.
- **Lightning surges:** these high power surges result from the massive voltages induced in power lines during storms.
- **Power faults:** as telecommunication lines and power lines can be physically close, AC voltages can be induced on phone lines.

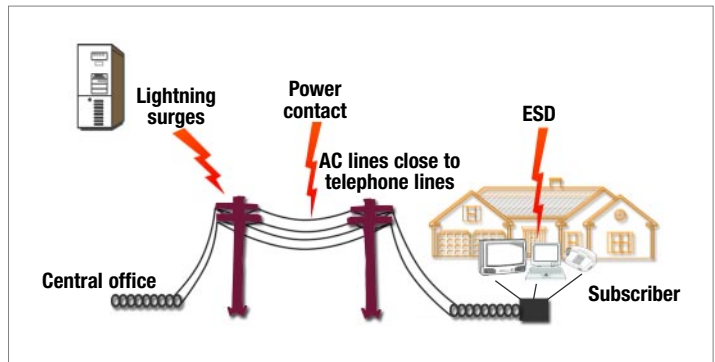
These kinds of overloads can be defined by specific waveforms:

- ESD surges are short duration waveforms (a few ns)
- Lightning models are medium duration waveforms (a few tens of μs)
- Power faults are either 50 or 60Hz waveforms (up to 15mins)

Surge levels depend not only on country, but equipment location. Both the central office and subscriber side must be protected, as well as equipment inside buildings.

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Each country has its own standards. The main ones are GR-1089 Core and FCC part 68 for North America and ITU-T K20/21 for the rest of the world.



ITU-T K21 applies to subscriber equipment.

ITU-T K20 applies to central office equipment.

GR-1089 Core applies to central office equipment in North America.

FCC part 68 applies to subscriber equipment in North America.

IEC61000-2 is dedicated to electrostatic discharge.

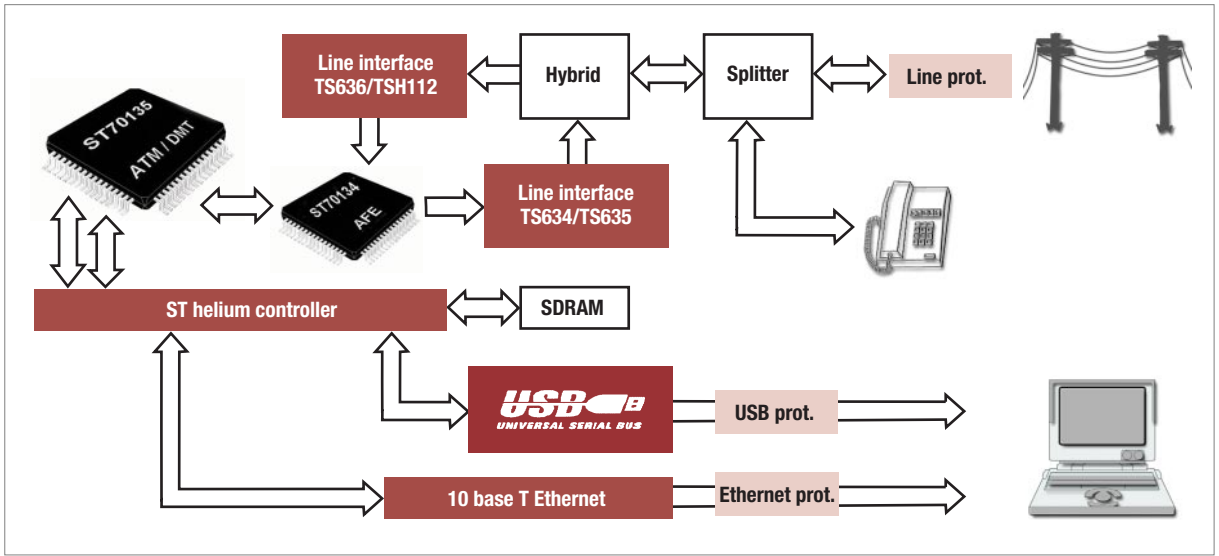
In some cases, national standard committees have redefined their own standards based on the main ones. For example, Chinese YDT standards are based on ITU. The table below shows the principal standard waveforms and levels.

Main standards by region

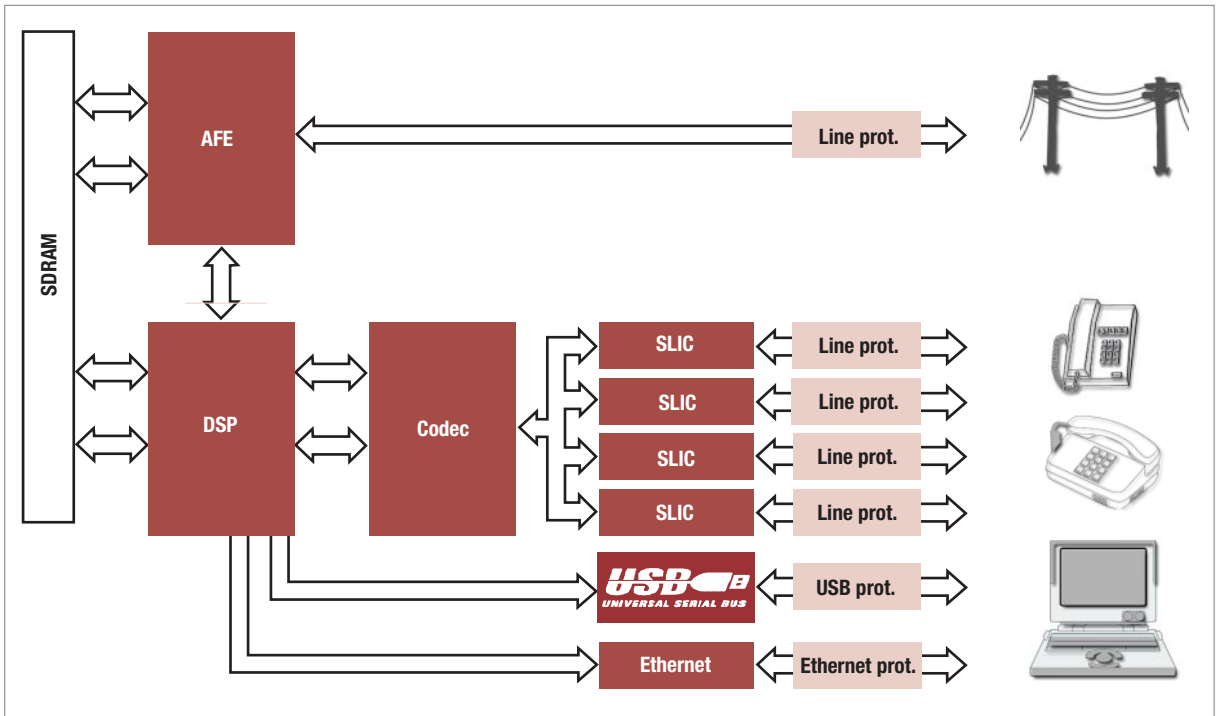
Region	Standard	Peak surge voltage (V)	Voltage waveform	Required peak current (A)	Current waveform
America	GR-1089 core first level	2500	2/10 μs	500	2/10 μs
	GR-1089 core second level	1000	10/1000 μs	100	10/1000 μs
	GR-1089 core intrabuilding	5000	2/10 μs	500	2/10 μs
Europe/Asia	ITU-T-K20/K21	1500	2/10 μs	100	2/10 μs
	ITU-T-K20 (IEC61000-4-2)	6000 15000	10/700 μs	150 37.5	5/310 μs
Germany	VDE0433	4000 2000	10/700 μs	100 50	5/310 μs
	VDE0878	4000 2000	1.2/50 μs	100 50	1/20 μs
Worldwide	IEC61000-4-5	4000	10/700 μs	100	5/310 μs
		4000	1.2/50 μs	100	8/20 μs
America	FCC part 68, lightning surge type A	1500	10/160 μs	200	10/160 μs
	FCC part 68, lightning surge type B	800	10/560 μs	100	10/560 μs
		1000	9/720 μs	25	5/320 μs

ADSL modem (subscriber side)

ADSL modem



ADSL splitterless modem



ADSL modem (subscriber side)

Line protection

Part number	Voltage	Junction capacitance	Surge capability	Surge capability	Package
Trisil					
SMP100LC-200	200V	60pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-270	262V	60pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-200	200V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-270	270V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP80MC-270	270V	30pF @ 2V	120A (5/310µs)	100A (10/560µs)	SMB
SMP30-200	200V	25pF @ 2V	40A (5/310µs)	35A (10/560µs)	SMA
SMP30-270	270V	25pF @ 2V	40A (5/310µs)	35A (10/560µs)	SMA
Transil					
SMAJ15CA	15V	975pF @ 0V	16.4A (10/1000µs)	71A (8/20µs)	SMA

Under development

Ethernet protection

Part number	Junction capacitance	Surge capability	Surge capability	Package
Primary protection (2 lines protection)				
TPN3021	16pF	50A (5/310µs)	200A (2/10µs)	SO-8
Secondary protection (4 lines protection)				
DALC208SC6	7pF	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT23-6L

USB protection

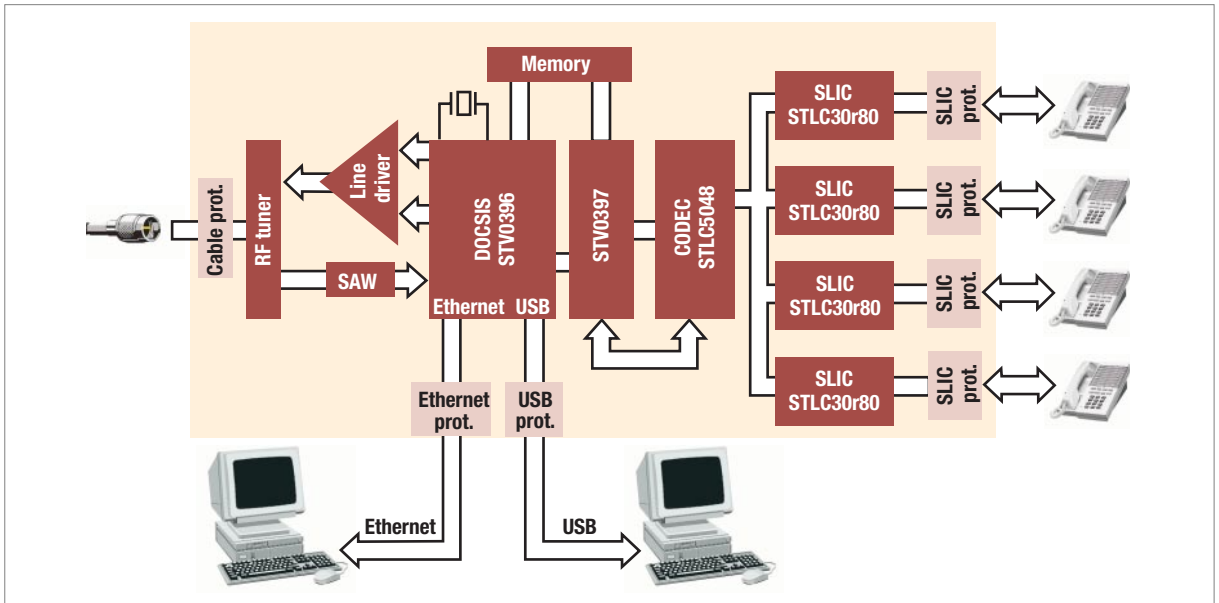
Part number	Application area	Applicable standards		Package
ESDALC6V1W5	Clamping protection	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT323-5L
DALC208SC6	Rail to rail protection	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT23-6L
USBUF01W6	USB1.1 compliant	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT323-6L

Line interface

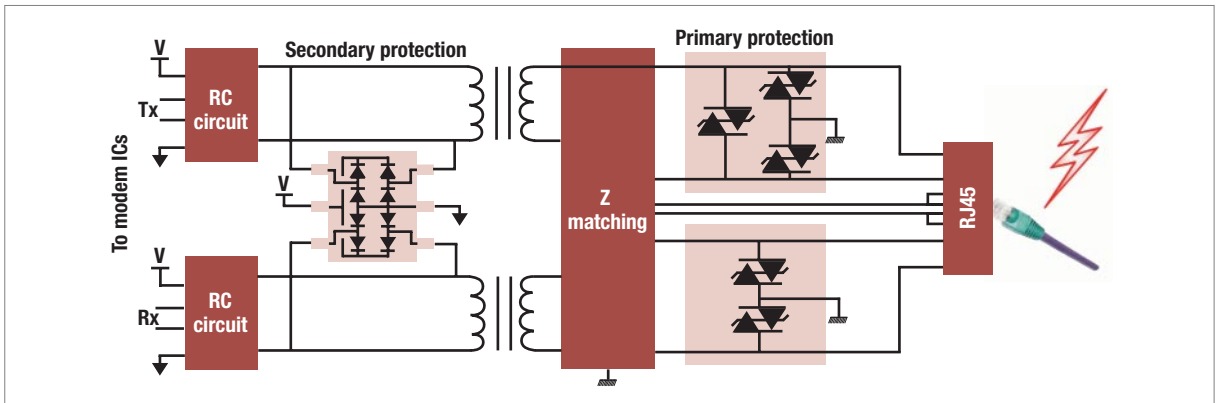
Part number	Noise nV/VHz	GBP (MHz)	IM3	SR (V/µs)	I _{out} (mA)	I _{cc} (mA)	Power down	Package
Driver								
TS634	3.2	130	-77 dB (diff.out=16Vpp 70k/80KHz)	40	160	14	Yes	SO-20 batwing
TS635	3.2	130	-77 dB (diff.out=16Vpp 70k/80KHz)	40	160	11	No	SO-8 exposed-pad
Receiver								
TS636 (variable gain amplifier)	4.7	100 (-3dB Bw.)	-80 dB (diff.out=16Vpp 70k/80KHz)	90	28	28	Yes	SO-14
TSH112 (dual opamp)	3	100 (-3dB Bw.)	-81 dB (diff.out=12Vpp 180k/280KHz)	450	20	3.5	No	SO-8 TSSOP8

Cable modem

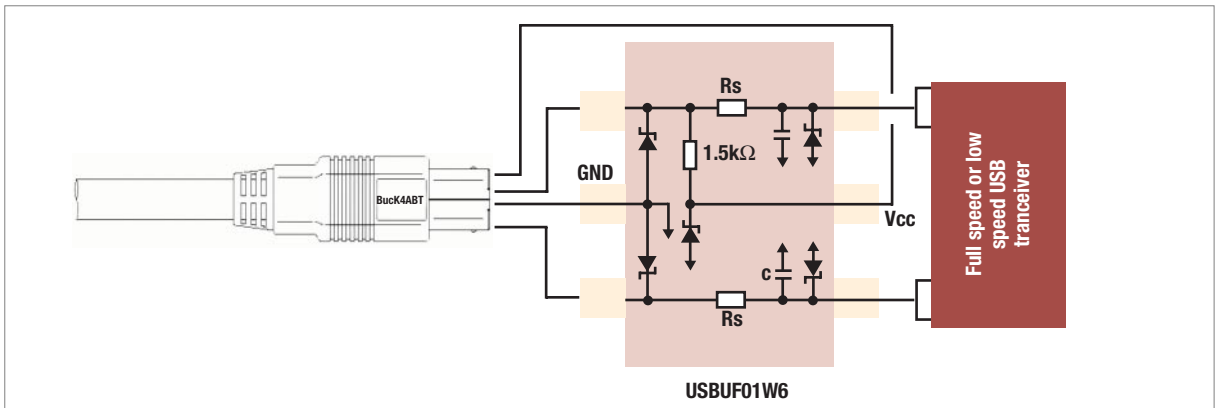
Topology



Ethernet topology



USB connection



SLIC protection

Part number	Maximum operating line voltage	Surge capability of ITU-T K21/K20	Surge capability of GR-1089	Package
Protection for single voltage SLICs				
LCP152DEERL	-150V	40A (5/310µs)	170A (2/10µs)	QFN 3x3
LCP1521S	-150V	40A (5/310µs)	170A (2/10µs)	S0-8
Dual protection for single voltage SLICs				
LCDP1521	-150V	25A (5/310µs)	70 A (2/10µs)	S0-8
Protection for dual voltages SLICs				
LCP02-150M	-110V to +95V	130A (5/310µs)	500A (2/10µs)	PowerSO-10
LCP02-150B1	-110V to +95V	45A (5/310µs)	65A (2/10µs)	S0-8wide

Under development

Cable protection

Part number	Voltage	Surge capability	Surge capability	Package
Transil array				
ESDA14V2L	14.2V	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT23

Ethernet protection

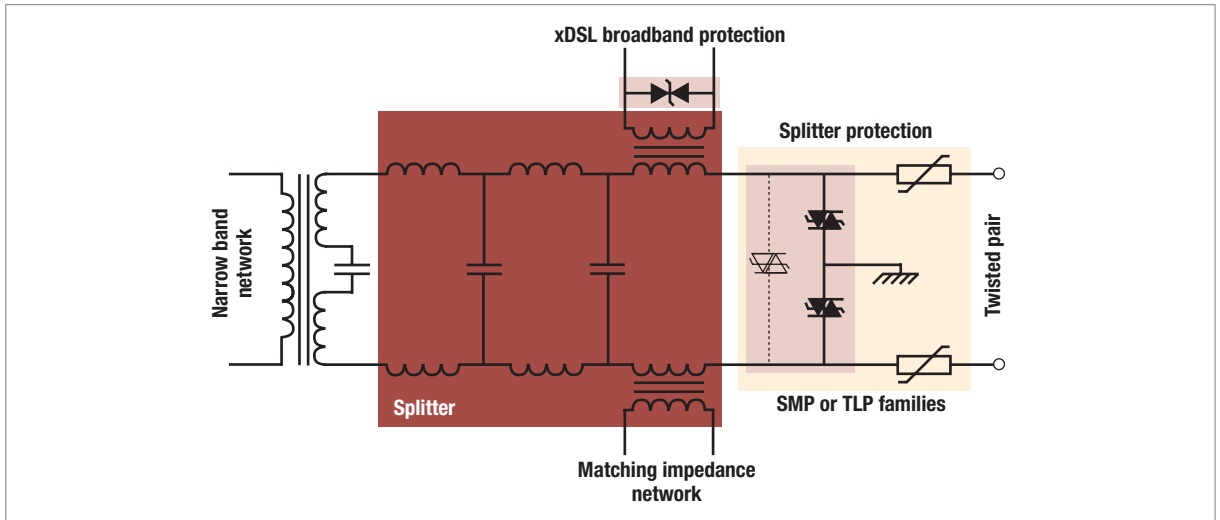
Part number	Junction capacitance	Surge capability	Surge capability	Package
Primary protection (2 lines protection)				
TPN3021	16pF	50A (5/310µs)	200A (2/10µs)	S0-8
Secondary protection (4 lines protection)				
DALC208SC6	7pF	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT23-6L

USB protection

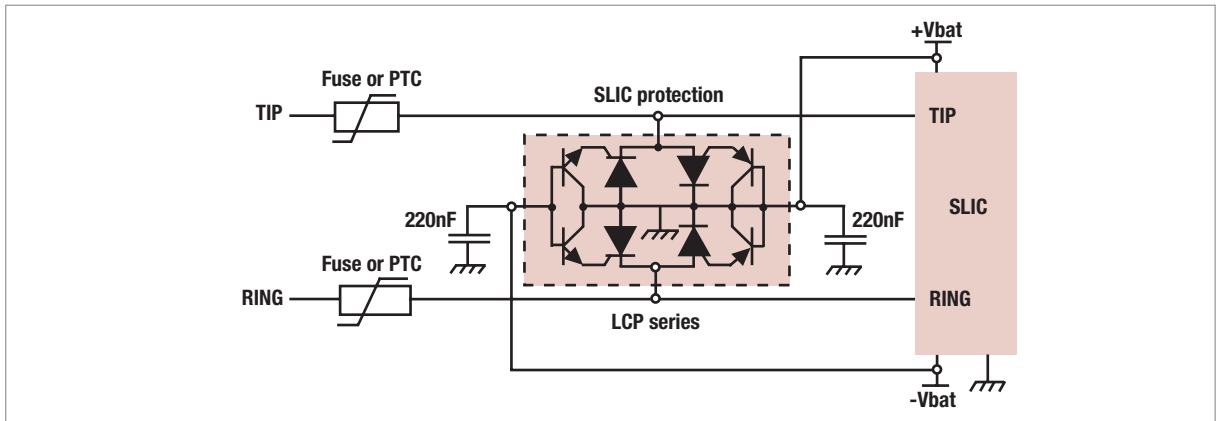
Part number	Application area	Application standards		Package
ESDALC6V1W5	Clamping protection	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT323-5L
DALC208SC6	Rail-to-rail protection	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT23-6L
USBUF01W6	USB1.1 compliant	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT323-6L

xDSL (central office side) and PABX

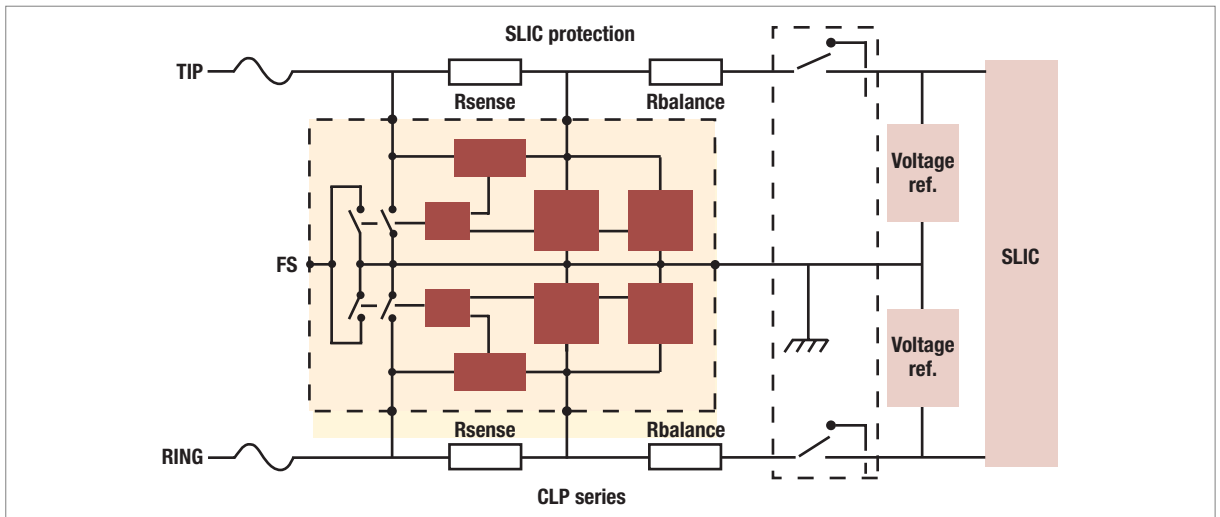
Splitter protection



SLIC protection



SLIC protection (fully GR-1089 and ITU-T K20/21 compliant)



xDSL (central office side) and PABX

Splitter protection

Part number	Voltage	Junction capacitance	Surge capability of ITU-T K21/K20	Surge capability of GR-1089	Package
Primary protection					
SMP100LC-200	200V	60pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-270	262V	60pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-360	360V	50pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-400	400V	50pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-200	200V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-270	270V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
TLP270G	270V	70pF @ 2V	100A (5/310µs)	500A (2/10µs)	D ² PAK
TLP270G-1	270V	70pF @ 2V	100A (5/310µs)	500A (2/10µs)	I ² PAK

Under development

SLIC protection for voice band

Part number	Maximum operating line voltage	Surge capability of ITU-T K21/K20	Surge capability of GR-1089	Package
Protection for single voltage SLICs				
LCP152DEERL	-150V	40A (5/310µs)	170A (2/10µs)	QFN 3x3
LCP1521S	-150V	40A (5/310µs)	170A (2/10µs)	SO-8
Dual protection for single voltage SLICs				
LCDP1521	-150V	25A (5/310µs)	70A (2/10µs)	SO-8
Overvoltage and overcurrent protection for SLICs				
TPP25011RL	250V	40A (5/310µs)	70A (2/10µs)	SO-8
LCP3121	-100V	150A (5/310µs)	250A (2/10µs)	SO-8
Protection for dual voltages SLICs				
LCP02-150M	-110V to +95V	130A (5/310µs)	500A (2/10µs)	PowerSO-10
LCP02-150B1	-110V to +95V	45A (5/310µs)	65A (2/10µs)	SO-8wide
Complete protection for SLICs and ring relays				
CLP270M-TR	270V	150A (5/310µs)	500A (2/10µs)	PowerSO-10
Protection for solid state relays and SLICs				
SSRP105B1	105 and 180V	2 x 25A (5/310µs)	2 x 70A (2/10µs)	SO-8
SSRP130B1	130 and 185V	2 x 25A (5/310µs)	2 x 70A (2/10µs)	SO-8

Under development

xDSL broadband protection

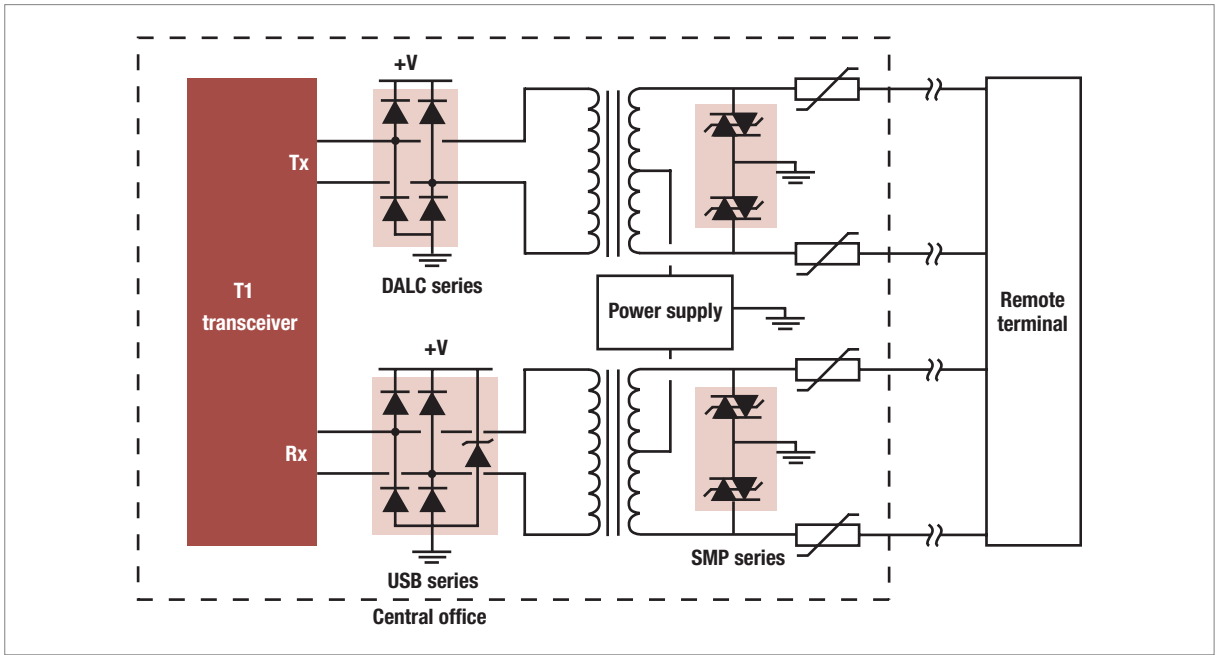
Part number	Voltage and peak pulse power	Surge capability 10/1000µs	Surge capability 8/20µs	Package
Transil				
SMAJ12CA	12V - 400W	20.1A	91A	SMA
SMAJ15CA	15V - 400W	16.4A	71A	SMA
SMAJ18CA	18V - 400W	13.7A	59A	SMA

Ethernet protection on central office

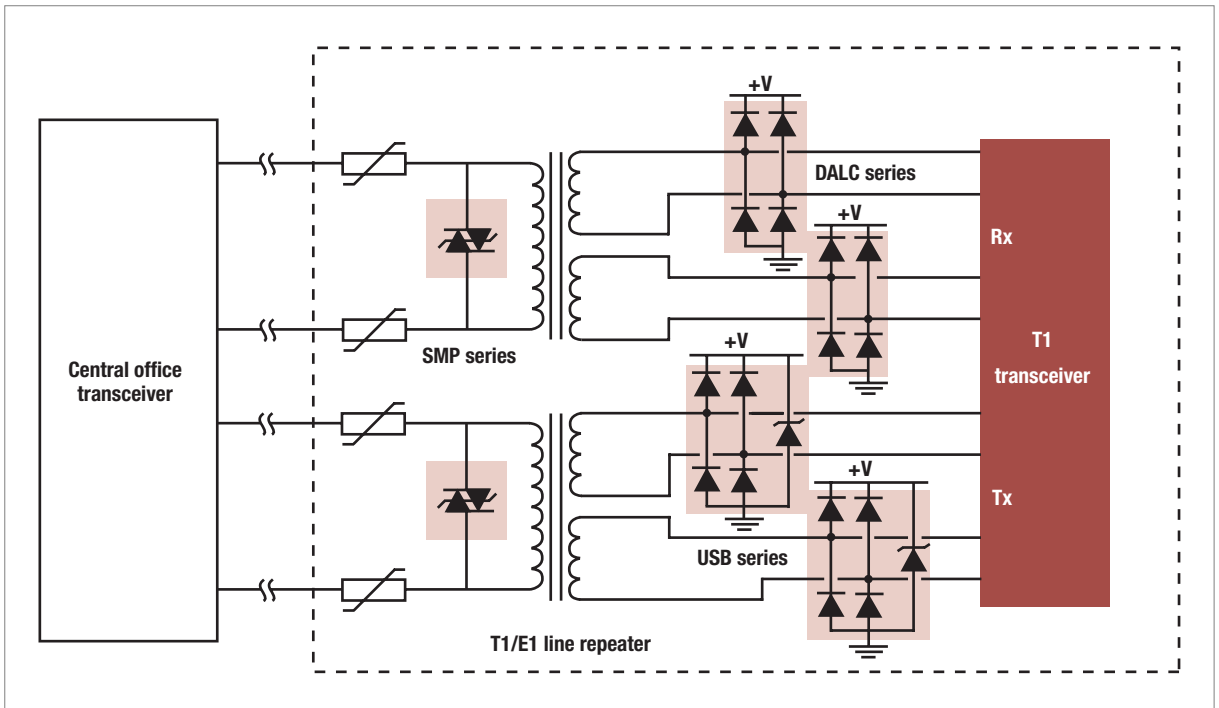
Part number	Junction capacitance	Surge capability	Surge capability	Package
Primary protection (2 lines protection)				
TPN3021	16pF typical	50A (5/310µs)	200A (2/10µs)	SO-8
Secondary protection (4 lines protection)				
DALC208SC6	7pF typical	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7L	SOT23-6L

T1/E1 application

Central office transceiver



Repeater transceiver



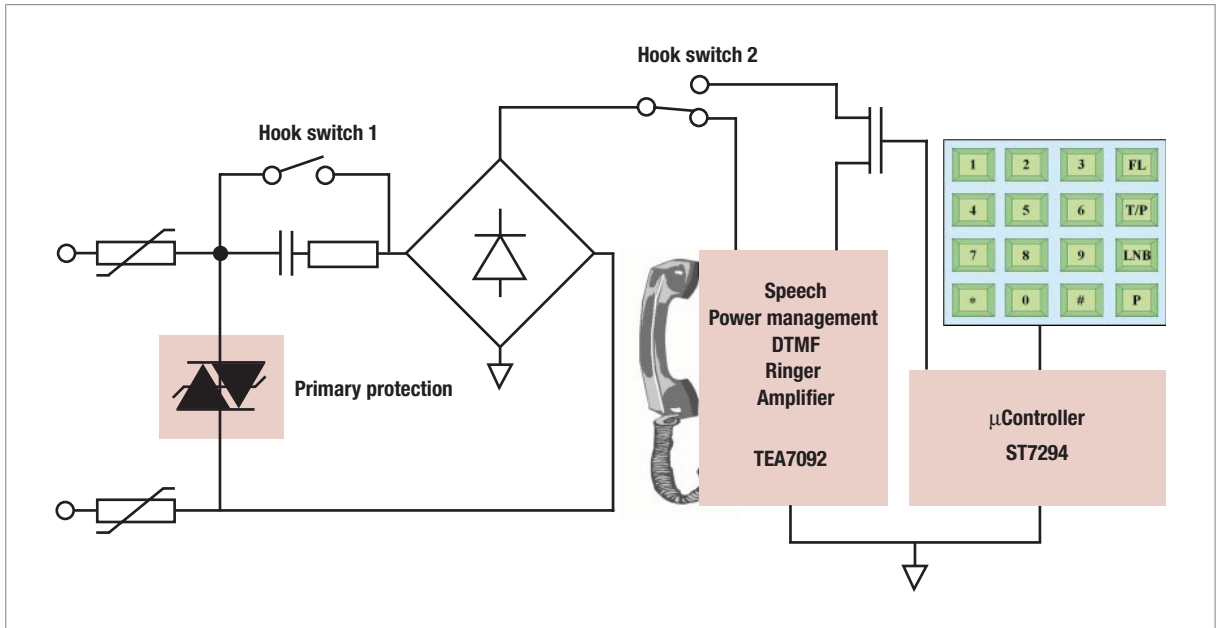
T1/E1 application

Part number	Voltage	Junction capacitance	Surge capability of ITU-T K21/K20	Surge capability of GR-1089	Package
Central office transceiver protection					
SMP100LC-140	140V	65pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-200	200V	60pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-140	140V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-200	200V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
Repeater transceiver protection primary					
SMP100LC-8	8V	75pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-25	25V	65pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-35	35V	55pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-65	65V	90pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100LC-200	200V	60pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB
SMP100MC-200	200V	40pF @ 2V	150A (5/310µs)	500A (2/10µs)	SMB

Under development

Part number	Junction capacitance	Surge capability		Package
Central office and repeater transceiver protection secondary (2 lines and power supply protection)				
USB6B1	25pF typical	IEC61000-4-2 Level 4 MIL STD 883E, Method 3015-7	25A (8/20µs)	S0-8
Secondary (4 lines protection)				
DALC208SC6	7pF typical	IEC61000-4-2 Level 4	MIL STD 883E, Method 3015-7	SOT23-6L

Terminals: fax – modem – phone



Part number	Surge capability of ITU-T K20/K21	Surge capability of FCC part 68 part A	Surge capability of FCC part 68 part B	Package
Primary protection				
SMP100LC-270	150A (5/310µs)	200A (10/160µs) 120A (10/560µs)	150A (5/320µs)	SMB
SMPTPA270	65A (5/310µs)	75A (10/160µs)* 55A (10/560µs)*	65A (5/320µs)	SMB
SMP50-270	65A (5/310µs)	75A (10/160µs)* 55A (10/560µs)*	65A (5/320µs)	SMA
TPA270	65A (5/310µs)	75A (10/160µs)* 55A (10/560µs)*	40A (5/320µs)	DO-15
TP30	40A (5/310µs)	45A (10/160µs)* 35A (10/560µs)*	40A (5/320µs)	DO-15
SMP30-270	40A (5/310µs)	45A (10/160µs)* 35A (10/560µs)*	40A (5/320µs)	DO-15
TSI200B1	40A (5/310µs)	75A (10/160µs)* 55A (10/560µs)*	40A (5/320µs)	S0-8

*PTC or serial resistance is required



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