CTVS –
Ceramic transient voltage suppressors

SMD multilayer varistors (MLVs),
surge protection series

Series/Type:

Date: April 2016

EPCOS AG is a TDK Group Company.

EPCOS type designation system for surge protection series

CT	1206	K	30	E2	G	K2

Construction:
CT ≙ Single chip with nickel barrier termination (AgNiSn)
CN ≙ Single chip with silver-platin temination (AgPt)

Case sizes:
0805
1206
1210
1812
2220

Tolerance of the varistor voltage:
K ≙ ±10%, standard
S ≙ Special tolerance

Maximum RMS operating voltage (V_{RMS}):
30 ≙ 30 V

Features:
E2 ≙ Increased energy handling capability
TELE ≙ Specified for 10/700 µs pulses, acc. to telecom standards
A ≙ Special tolerance

Taping mode:
G ≙ 180-mm reel, 7"
G2 ≙ 330-mm reel, 13"

Termination:
K2 ≙ Code for AgPt termination (CN types only)

Description

The surge protection series comprises a range of multilayer varistors for protection against severe transient overvoltage and high surge currents, such as 8/20 µs pulses with peak currents up to 6000 A and 10/700 µs pulses up to 45 A.

Features

- High energy absorption capability
- High surge load capability acc. to IEC 61000-4-5
- Reliable ESD protection up to 30 kV acc. to IEC 61000-4-2, level 4
- High surge voltage capability up to 2 kV for 10/700 µs acc. to IEC 61000-4-5 (types with $V_{RMS,max} \leq 60$ V)
- Bidirectional protection
- Low leakage current
- Long-term ESD stability
- RoHS-compatible, lead-free
- PSpice simulation modesl available

Applications

- Industrial applications
- Building safety and security applications
- Power supplies
- Control and measurement equipment
- Hard disk drives

Design

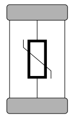
- Multilayer technology
- Flammability rating better than UL 94 V-0
- Termination (see “Soldering directions”):
  - CT types with nickel barrier terminations (AgNiSn), recommended for lead-free soldering, and compatible with tin/lead solder
  - CN types with silver-platin termination (AgPt) for reflow and wave soldering with solder on tin/lead basis or lead-free with a silver containing solder

V/I characteristics and derating curves

V/I and derating curves are attached to the data sheet. The curves are sorted by V_{RMS} and then by case size, which is included in the type designation.

Single chip

Internal circuit



MLV0006-H

Available case sizes:

EIA	Metric
0805	2012
1206	3216
1210	3225
1812	4532
2220	5750

Multilayer varistors (MLVs)

Surge protection series

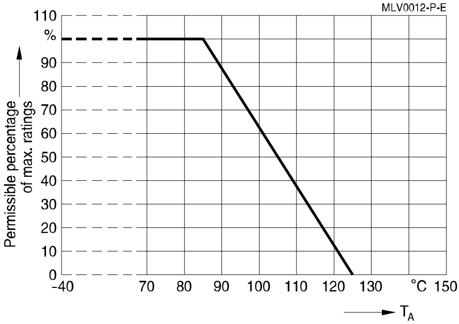
SMD

General technical data

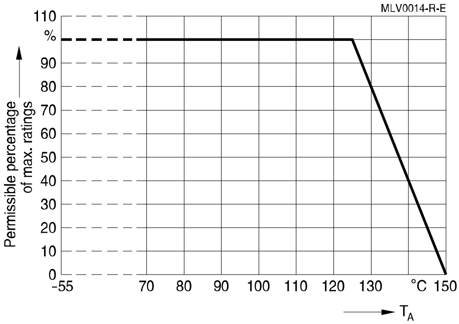
Maximum RMS operating voltage		$V_{RMS,max}$	30 ... 115	V
Maximum DC operating voltage		$V_{DC,max}$	38 ... 150	V
Maximum surge current	(8/20 µs)	$I_{surge,max}$	40 ... 6000	A
Maximum surge current	(10/700 µs)	$I_{surge,max}$	45	A
Maximum clamping voltage		$V_{clamp,max}$	77 ... 360	V
Operating temperature	(8/20 µs surge ratings)	T_{op}	−55/+125	°C
Operating temperature	(10/700 µs surge ratings)	T_{op}	−40/+85	°C
Storage temperature	(8/20 µs surge ratings)	LCT/UCT	−55/+150	°C
Storage temperature	(10/700 µs surge ratings)	LCT/UCT	−40/+125	°C
Response time		t_{resp}	< 0.5	ns

Temperature derating

Climatic category:
−40/+85 °C for chip size 1812 (dedicated telecom types: CT1812S60AG2, CT1812K75TELEG2, CT1812S95 AG2, CT1812K115TELEG2)



Climatic category:
−55/+125 °C for chip sizes 0805, 1206, 1210, 1812, and 2220



Electrical specifications and ordering codes

Maximum ratings ($T_{op,max}$)

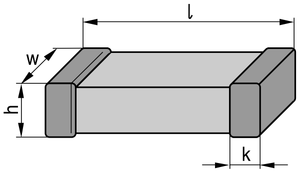
Type	Ordering code	$V_{RMS,max}$ V	$V_{DC,max}$ V	$I_{surge,max}$ (8/20 µs) A	$I_{surge,max}$ (10/700 µs) A	W_{max} (2 ms) mJ	$P_{diss,max}$ (2 ms) mW
High surge protection types, 8/20 µs surge rating, $T_{op,max}$ = +125 °C							
CT2220K30E2G	B72540T6300K062	30	38	5000	-	15000	20
CN2220K30E2GK2	B72542V6300K062	30	38	6000	-	15000	20
CN2220K50E2GK2	B72542V6500K062	50	65	4500	-	15000	20
CT2220K50E2G	B72540T6500K062	50	65	4500	-	15000	20
CT2220S50E3G	B72540T6500S162	50	63	4500	-	15000	20
Surge protection types, 8/20 µs surge rating, $T_{op,max}$ = +125 °C							
CT0805K30G	B72510T0300K062	30	38	80	-	300	5
CT1206K30G	B72520T0300K062	30	38	200	-	1100	8
CT1210K30G	B72530T0300K062	30	38	300	-	2000	10
CT1812K30G	B72580T0300K062	30	38	800	-	4200	15
CT2220K30G	B72540T0300K062	30	38	1200	-	12000	20
CT0805K35G	B72510T0350K062	35	45	80	-	300	5
CT1206K35G	B72520T0350K062	35	45	100	-	400	8
CT1210K35G	B72530T0350K062	35	45	250	-	2000	10
CT1812K35G	B72580T0350K062	35	45	500	-	4000	15
CT1206K40G	B72520T0400K062	40	56	100	-	500	8
CT1210K40G	B72530T0400K062	40	56	250	-	2300	10
CT1812K40G	B72580T0400K062	40	56	500	-	4800	15
CT2220K40G	B72540T0400K062	40	56	1000	-	9000	20
CT1206K50G	B72520T0500K062	50	65	100	-	600	8
CT1210K50G	B72530T0500K062	50	65	200	-	1600	10
CT1812K50G	B72580T0500K062	50	65	400	-	4500	15
CT2220K50G	B72540T0500K062	50	65	800	-	5600	20
CT1206K60G	B72520T0600K062	60	85	100	-	700	8
CT1210K60G	B72530T0600K062	60	85	200	-	2000	10
CT1812K60G	B72580T0600K062	60	85	400	-	5800	15
CT2220K60G	B72540T0600K062	60	85	800	-	6800	20
CT1812K130G2	B72580T0131K072	130	170	250	-	3500	15
Telecom types, 10/700 µs surge rating, $T_{op,max}$ = +85 °C							
CT1812S60AG2	B72580T0600S172	60	85	400	45	2200	15
CT1812K75TELEG2	B72580T6750K072	75	100	400	45	2500	15
CT1812S95AG2	B72580T0950S172	95	125	250	45	2800	15
CT1812K115TELEG2	B72580T6111K072	115	150	250	45	3200	15

Characteristics (T_A = 25 °C)

Type	V_V (1 mA) V	ΔV_V %	$V_{clamp,max}$ V	I_{clamp} (8/20 µs) A	C_{typ} 1) (1 MHz, 1 V) pF
High surge protection types, 8/20 µs surge rating, $T_{op,max}$ = +125 °C					
CT2220K30E2G	47	±10	77	10	10000
CN2220K30E2GK2	47	±10	77	10	10000
CN2220K50E2GK2	82	±10	135	10	3000
CT2220K50E2G	82	±10	135	10	3000
CT2220S50E3G	77.5	±8.4	115	10	8800
Surge protection types, 8/20 µs surge rating, $T_{op,max}$ = +125 °C					
CT0805K30G	47	±10	77	1	200
CT1206K30G	47	±10	77	1	500
CT1210K30G	47	±10	77	2.5	1000
CT1812K30G	47	±10	77	5	2000
CT2220K30G	47	±10	77	10	4000
CT0805K35G	56	±10	95	1	150
CT1206K35G	56	±10	90	1	200
CT1210K35G	56	±10	90	2.5	600
CT1812K35G	56	±10	90	5	1200
CT1206K40G	68	±10	110	1	250
CT1210K40G	68	±10	110	2.5	500
CT1812K40G	68	±10	110	5	1000
CT2220K40G	68	±10	110	10	2000
CT1206K50G	82	±10	135	1	120
CT1210K50G	82	±10	135	2.5	250
CT1812K50G	82	±10	135	5	500
CT2220K50G	82	±10	135	10	1000
CT1206K60G	100	±10	165	1	100
CT1210K60G	100	±10	165	2.5	200
CT1812K60G	100	±10	165	5	400
CT2220K60G	100	±10	165	10	800
CT1812K130G2	205	±10	340	5	200
Telecom types, 10/700 µs surge rating, $T_{op,max}$ = +85 °C					
CT1812S60AG2	100	+19/−1	200	45	400
CT1812K75TELEG2	120	±10	250	45	320
CT1812S95AG2	165	±10	270	45	250
CT1812K115TELEG2	180	±10	360	45	200

1) Measurement frequency: f = 1 MHz for C < 100 pF, f = 1 kHz for C ≥ 100 pF

Dimensional drawing



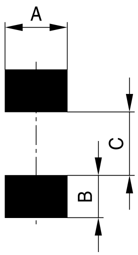
MLV0031-M

Dimensions in mm

Case size EIA / mm	l	w	h	k
0201 / 0603	0.6 ±0.03	0.30 ±0.03	0.33 max.	0.15 ±0.05
0402 / 1005	1.0 ±0.15	0.50 ±0.10	0.6 max.	0.10 ... 0.30
0603 / 1608	1.6 ±0.15	0.80 ±0.10	0.9 max.	0.10 ... 0.40
0805 / 2012	2.0 ±0.20	1.25 ±0.15	1.4 max.	0.13 ... 0.75
1206 / 3216	3.2 ±0.30	1.60 ±0.20	1.7 max.	0.25 ... 0.75
1210 / 3225	3.2 ±0.30	2.50 ±0.25	1.7 max.	0.25 ... 0.75
1812 / 4532	4.5 ±0.40	3.20 ±0.30	2.5 max.	0.25 ... 1.00
2220 / 5750	5.7 ±0.40	5.00 ±0.40	2.5 max.[1) 2)]	0.25 ... 1.00

1) h_{max} = 3.0 mm for type CN2220K30E2GK2, CN2220K50E2GK2, CT2220K30E2G and CT2220K50E2G
2) h_{max} = 3.3 mm for type CT2220S50E3G

Recommended solder pad layout



MLV0034-P

Dimensions in mm

Case size EIA / mm	A	B	C
0201 / 0603	0.30	0.25	0.30
0402 / 1005	0.60	0.60	0.50
0603 / 1608	1.00	1.00	1.00
0805 / 2012	1.40	1.20	1.00
1206 / 3216	1.80	1.20	2.10
1210 / 3225	2.80	1.20	2.10
1812 / 4532	3.60	1.50	3.00
2220 / 5750	5.50	1.50	4.20

Multilayer varistors (MLVs)

Surge protection series

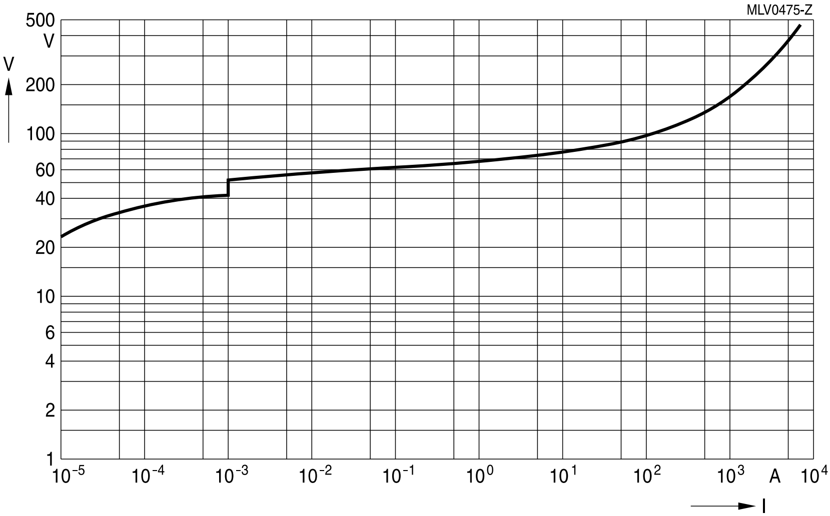
SMD

Delivery mode

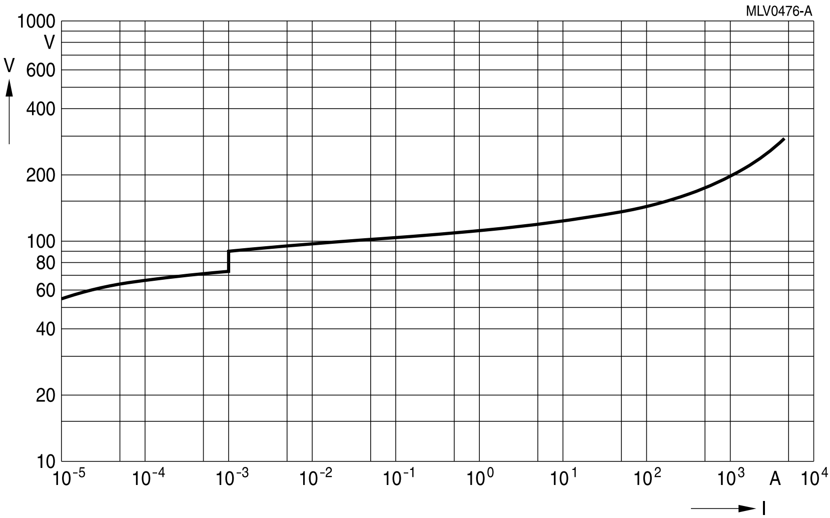
EIA case size	Taping	Reel size mm	Packing unit pcs.	Type	Ordering code
Single chip					
0805	Blister	180	3000	CT0805K30G	B72510T0300K062
0805	Blister	180	3000	CT0805K35G	B72510T0350K062
1206	Blister	180	2000	CT1206K30G	B72520T0300K062
1206	Blister	180	2000	CT1206K35G	B72520T0350K062
1206	Blister	180	2000	CT1206K40G	B72520T0400K062
1206	Blister	180	2000	CT1206K50G	B72520T0500K062
1206	Blister	180	2000	CT1206K60G	B72520T0600K062
1210	Blister	180	2000	CT1210K30G	B72530T0300K062
1210	Blister	180	2000	CT1210K35G	B72530T0350K062
1210	Blister	180	2000	CT1210K40G	B72530T0400K062
1210	Blister	180	2000	CT1210K50G	B72530T0500K062
1210	Blister	180	2000	CT1210K60G	B72530T0600K062
1812	Blister	180	1000	CT1812K30G	B72580T0300K062
1812	Blister	180	1000	CT1812K35G	B72580T0350K062
1812	Blister	180	1000	CT1812K40G	B72580T0400K062
1812	Blister	180	1000	CT1812K50G	B72580T0500K062
1812	Blister	180	1000	CT1812K60G	B72580T0600K062
1812	Blister	180	3000	CT1812K130G2	B72580T0131K072
1812	Blister	330	3000	CT1812K115TELEG2	B72580T6111K072
1812	Blister	330	3000	CT1812S95AG2	B72580T0950S172
1812	Blister	330	4000	CT1812K75TELEG2	B72580T6750K072
1812	Blister	330	4000	CT1812S60AG2	B72580T0600S172
2220	Blister	180	500	CT2220S50E3G	B72540T6500S162
2220	Blister	180	600	CN2220K30E2GK2	B72542V6300K062
2220	Blister	180	600	CN2220K50E2GK2	B72542V6500K062
2220	Blister	180	600	CT2220K30E2G	B72540T6300K062
2220	Blister	180	600	CT2220K50E2G	B72540T6500K062
2220	Blister	180	1000	CT2220K30G	B72540T0300K062
2220	Blister	180	1000	CT2220K40G	B72540T0400K062
2220	Blister	180	1000	CT2220K50G	B72540T0500K062
2220	Blister	180	1000	CT2220K60G	B72540T0600K062

SMD

V/I characteristics for high surge protection types



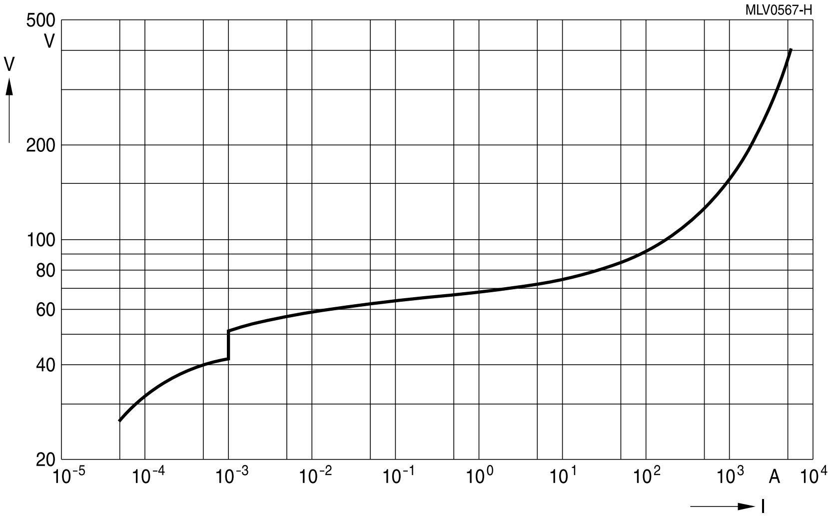
CN2220K30E2GK2



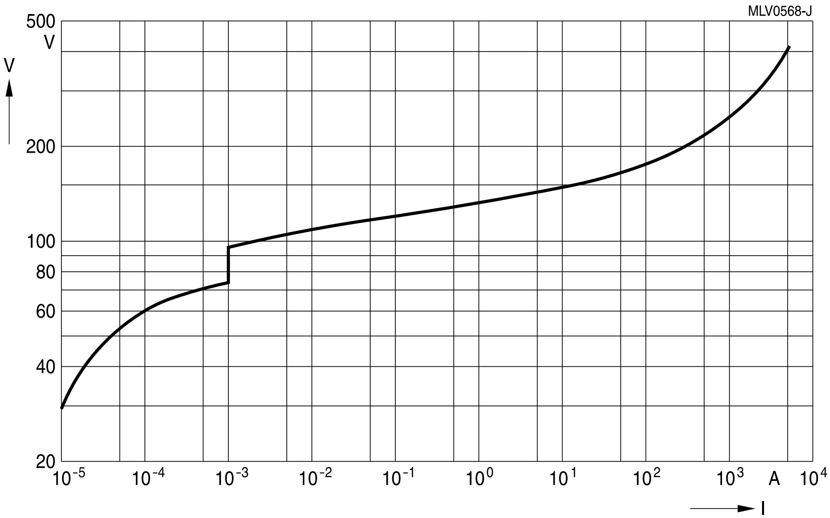
CN2220K50E2GK2

SMD

V/I characteristics for high surge protection types

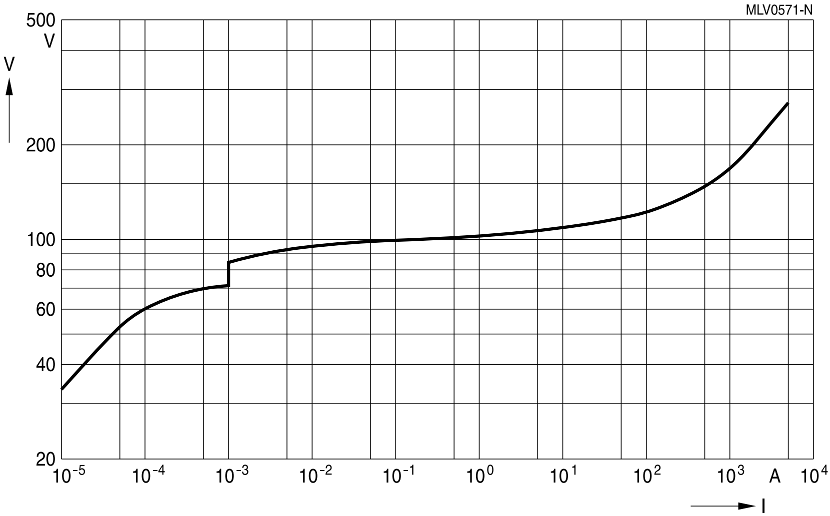


CT2220K30E2G



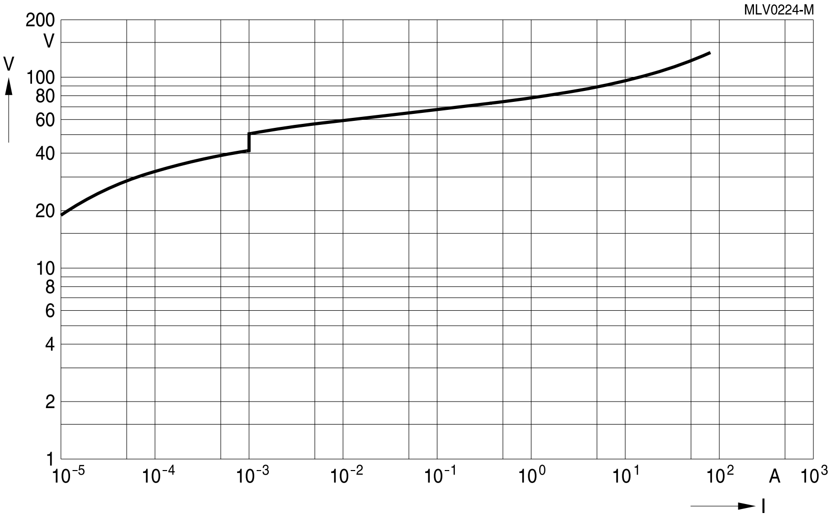
CT2220K50E2G

V/I characteristics for high surge protection types

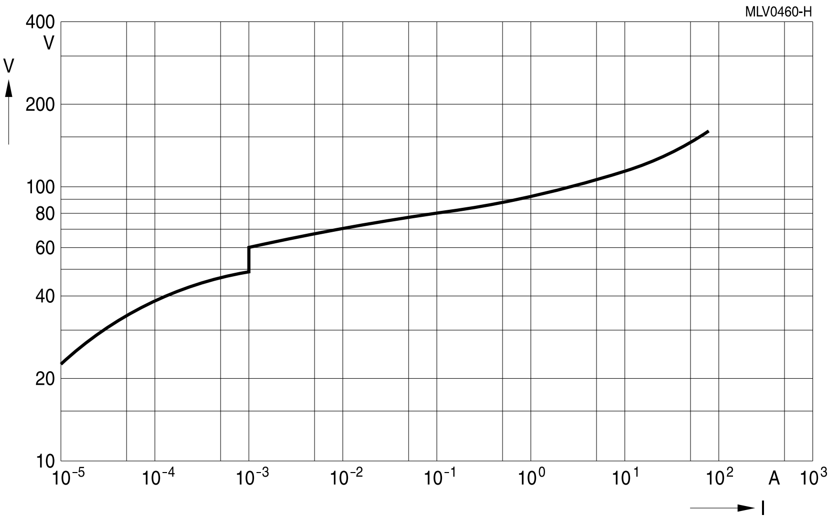


CT2220S50E3G

V/I characteristics for surge protection types



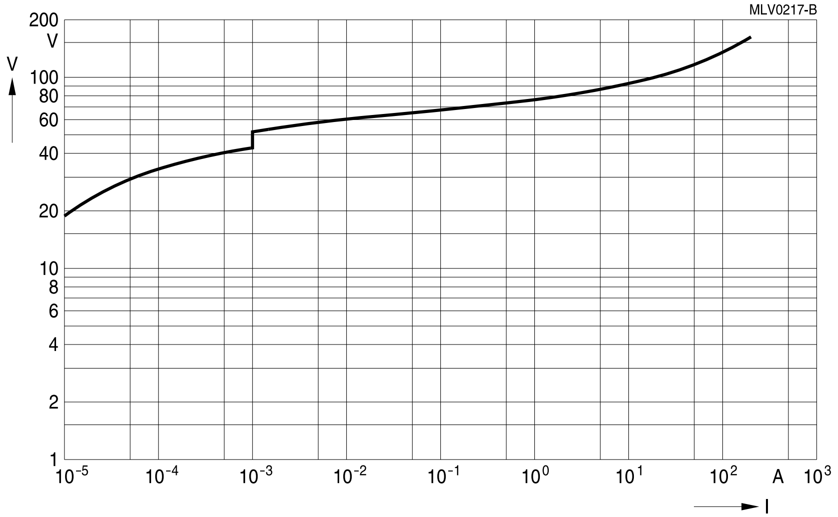
CT0805K30G



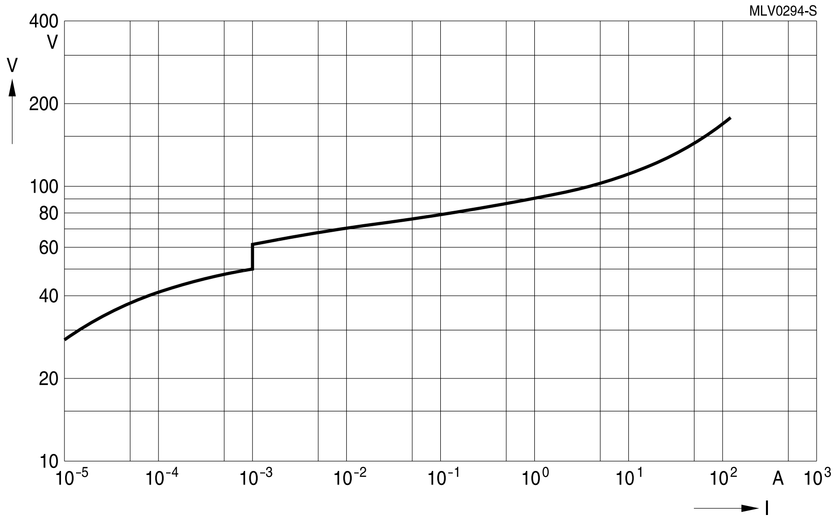
CT0805K35G

SMD

V/I characteristics for surge protection types



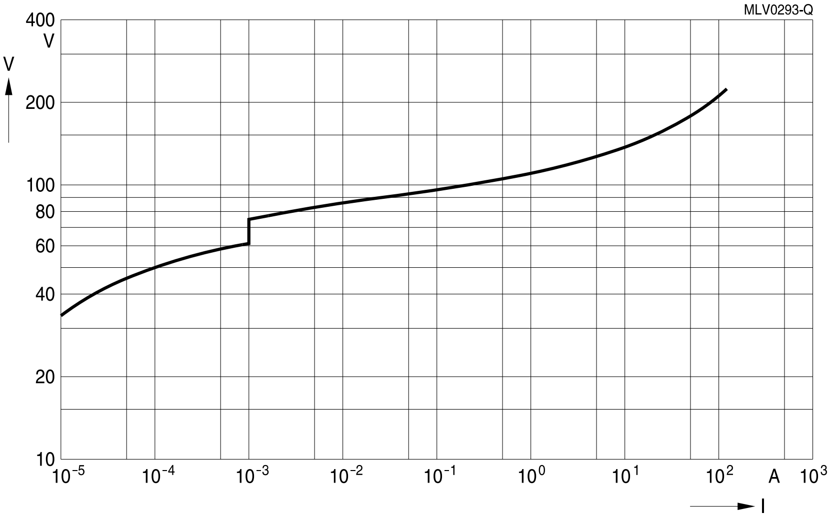
CT1206K30G



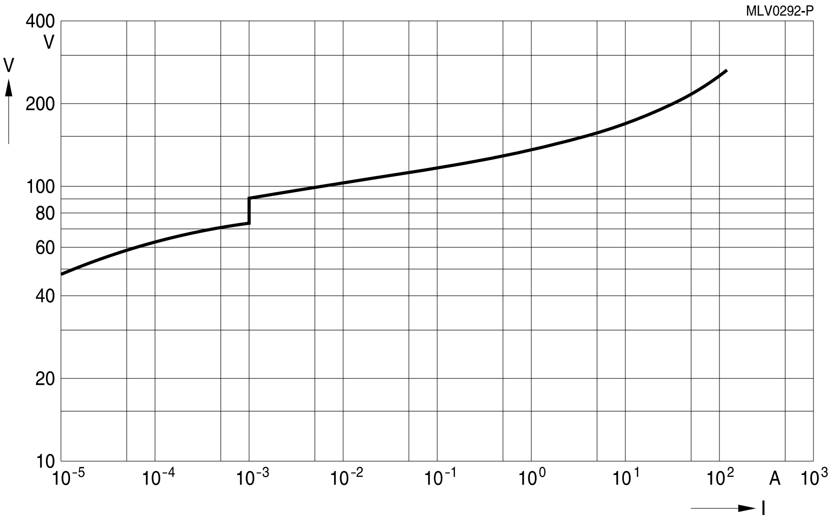
CT1206K35G

SMD

V/I characteristics for surge protection types

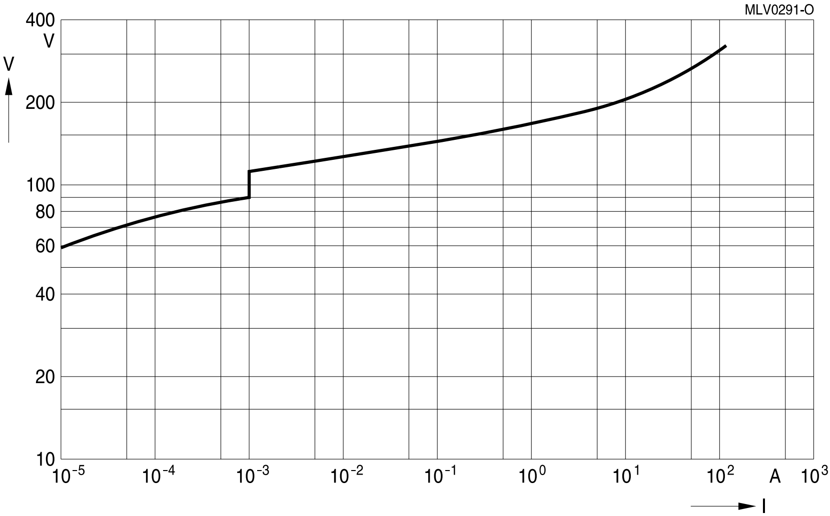


CT1206K40G

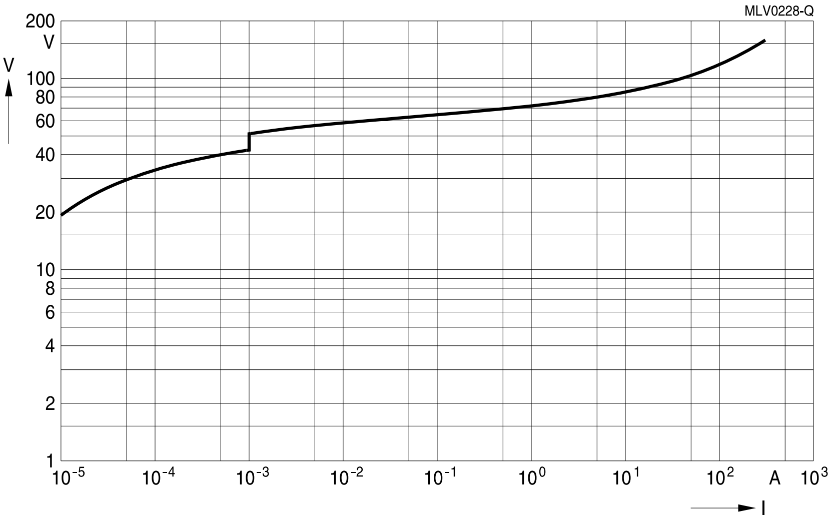


CT1206K50G

V/I characteristics for surge protection types

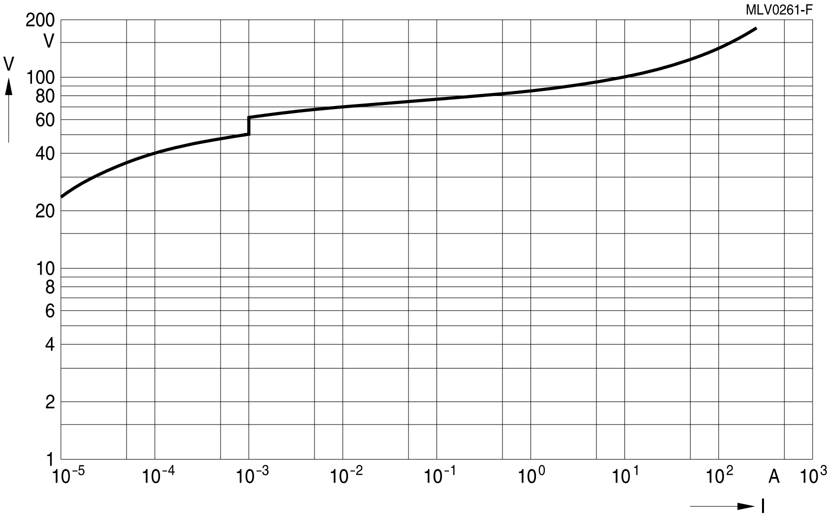


CT1206K60G

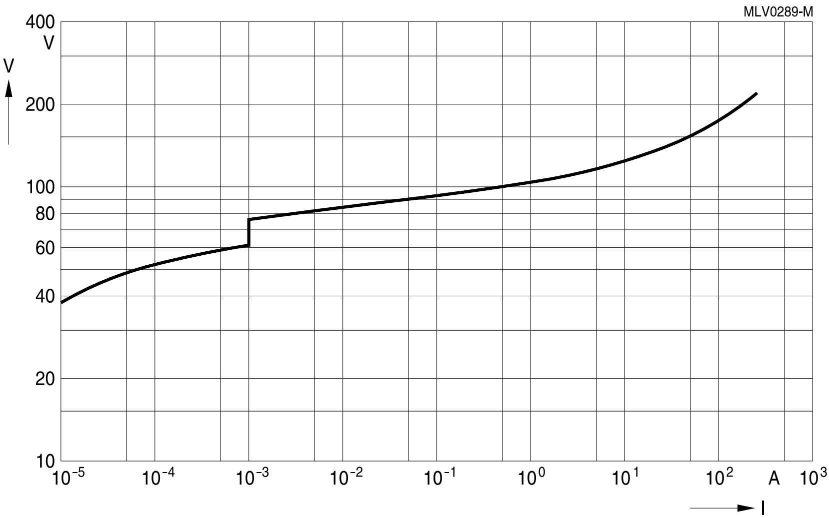


CT1210K30G

V/I characteristics for surge protection types

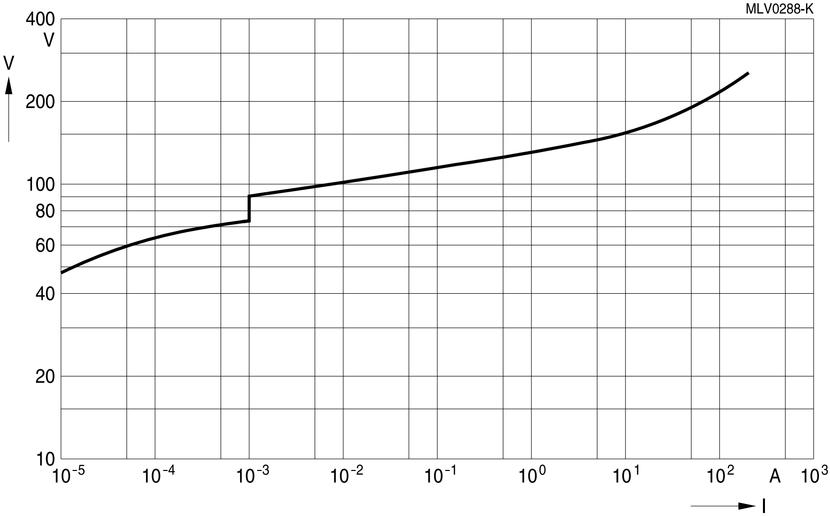


CT1210K35G

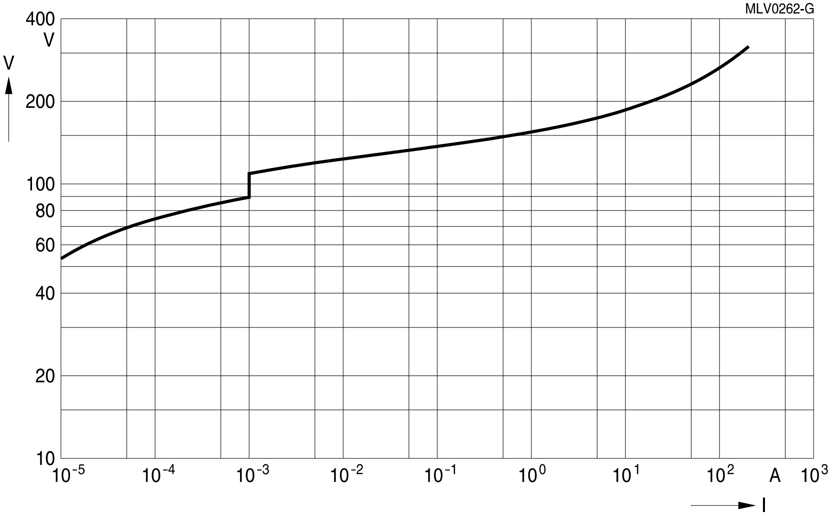


CT1210K40G

V/I characteristics for surge protection types

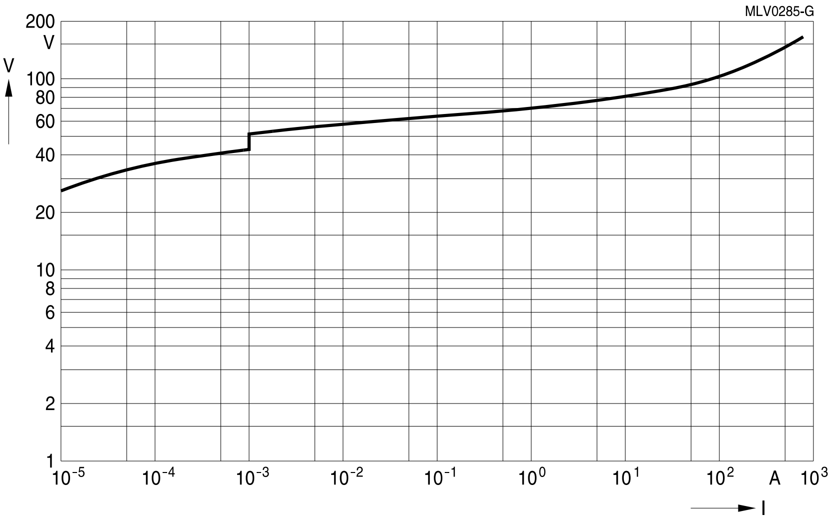


CT1210K50G

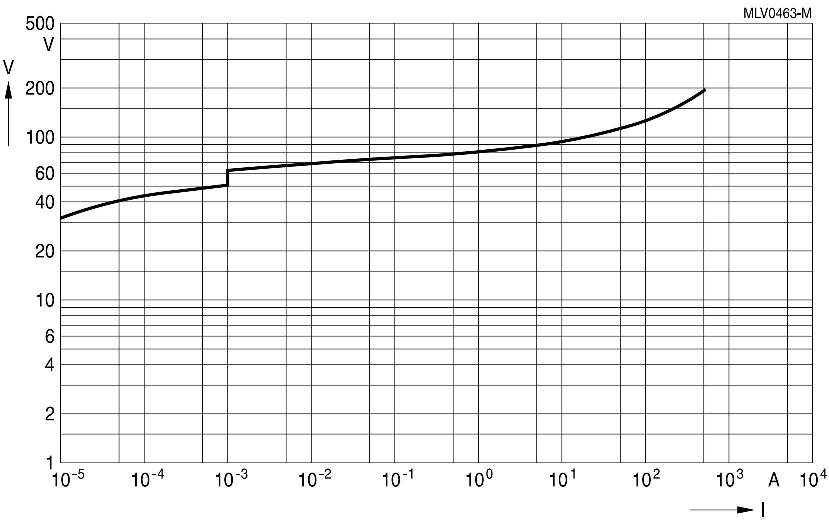


CT1210K60G

V/I characteristics for surge protection types



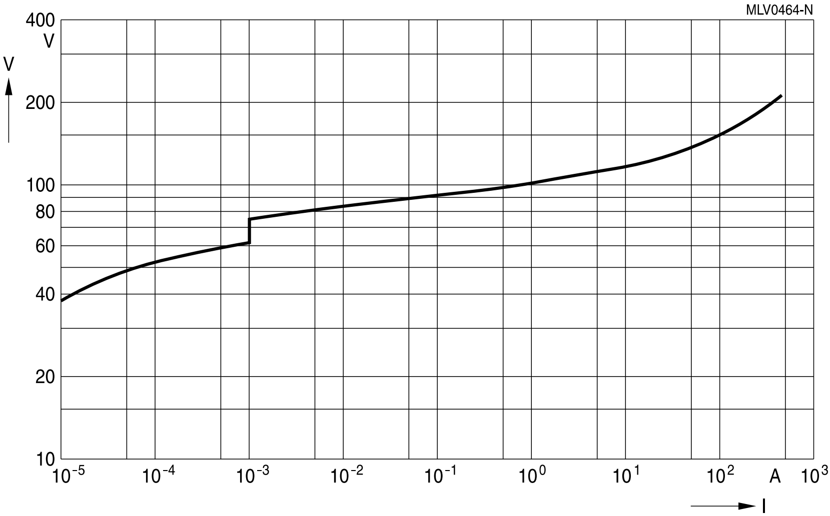
CT1812K30G



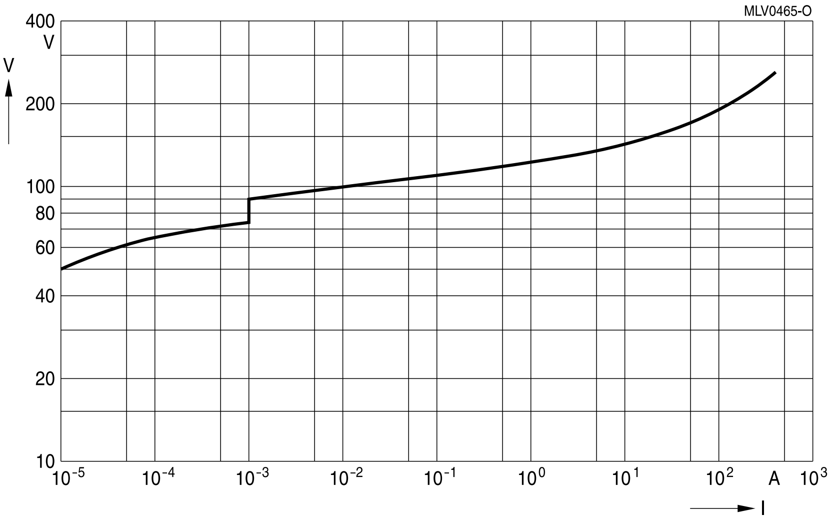
CT1812K35G

SMD

V/I characteristics for surge protection types

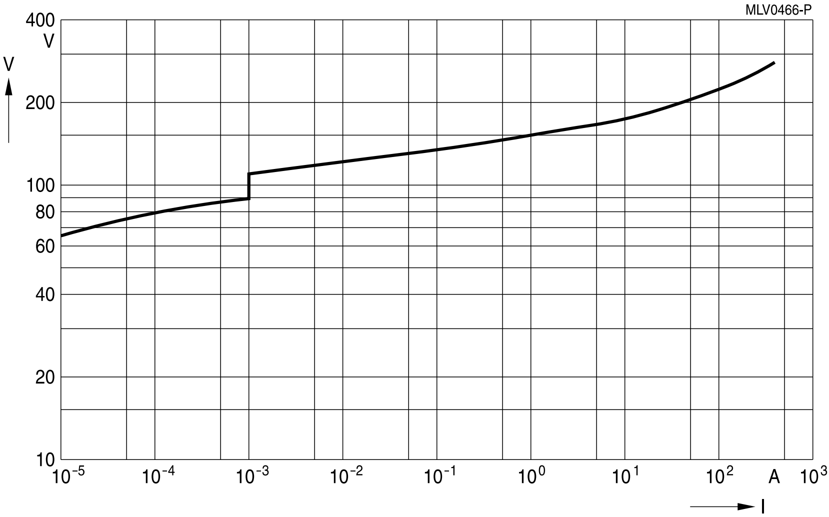


CT1812K40G

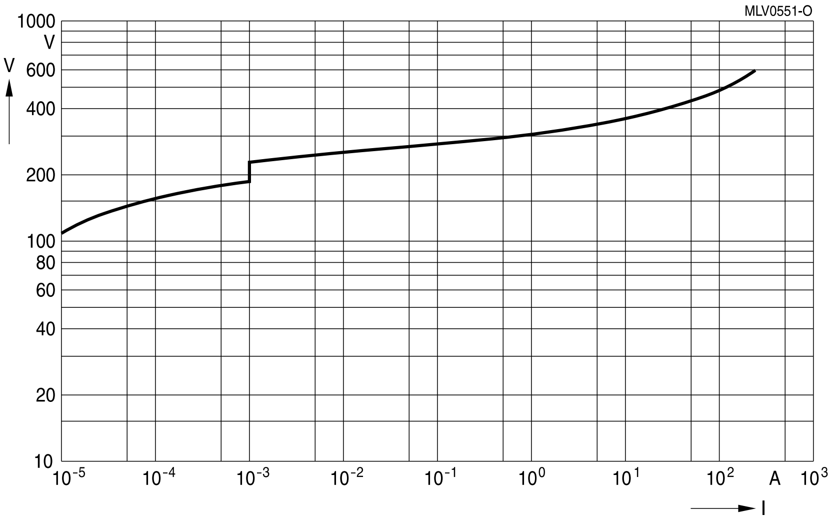


CT1812K50G

V/I characteristics for surge protection types

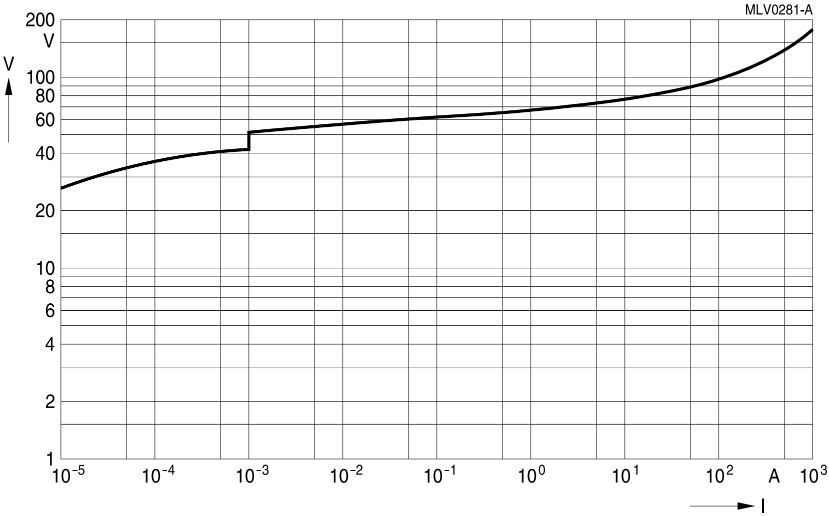


CT1812K60G

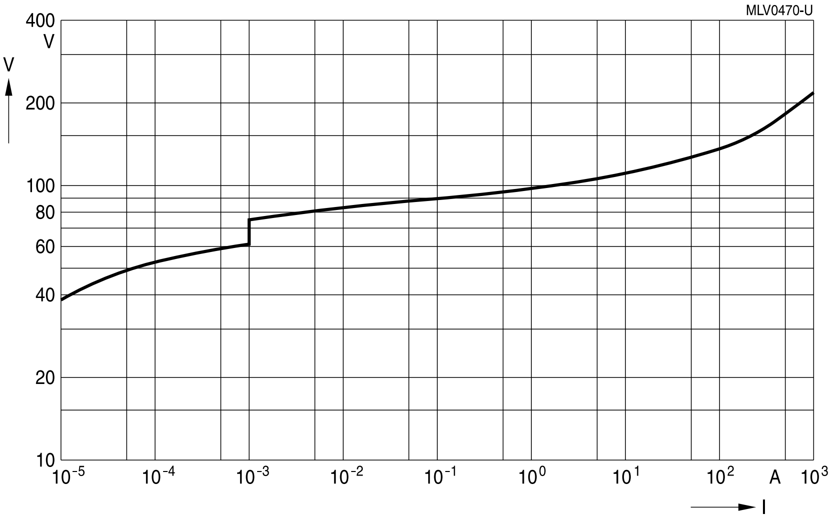


CT1812K130G2

V/I characteristics for surge protection types



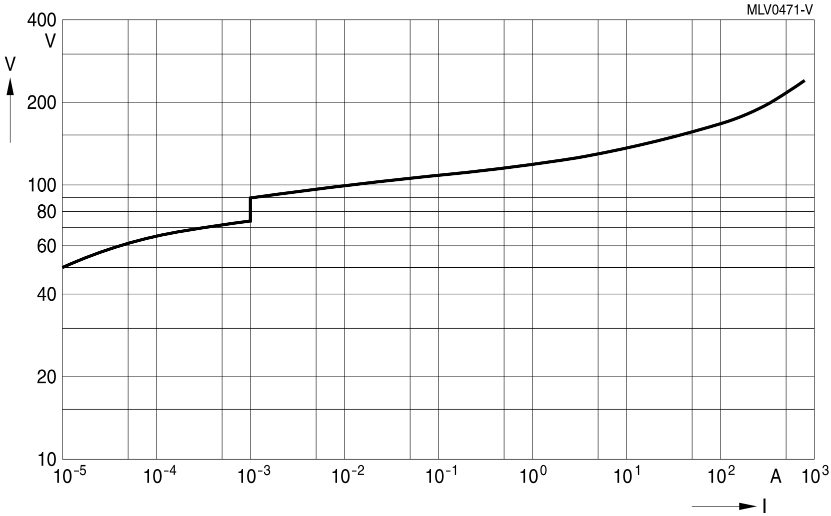
CT2220K30G



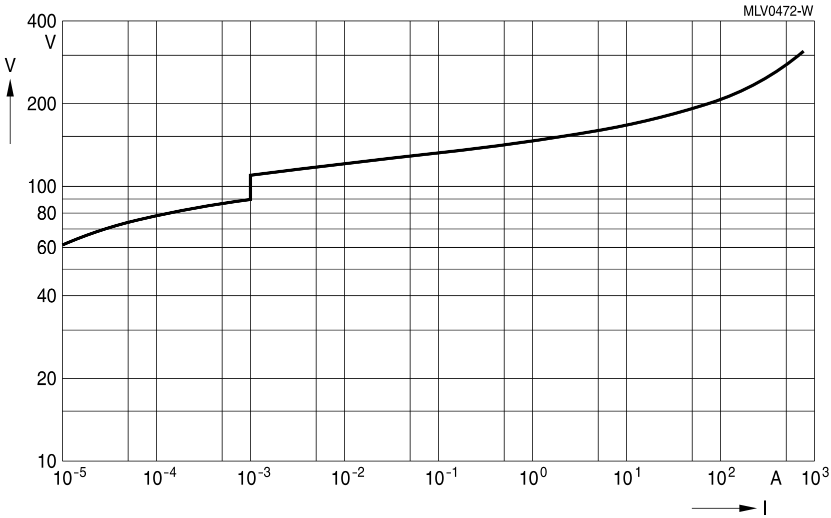
CT2220K40G

SMD

V/I characteristics for surge protection types

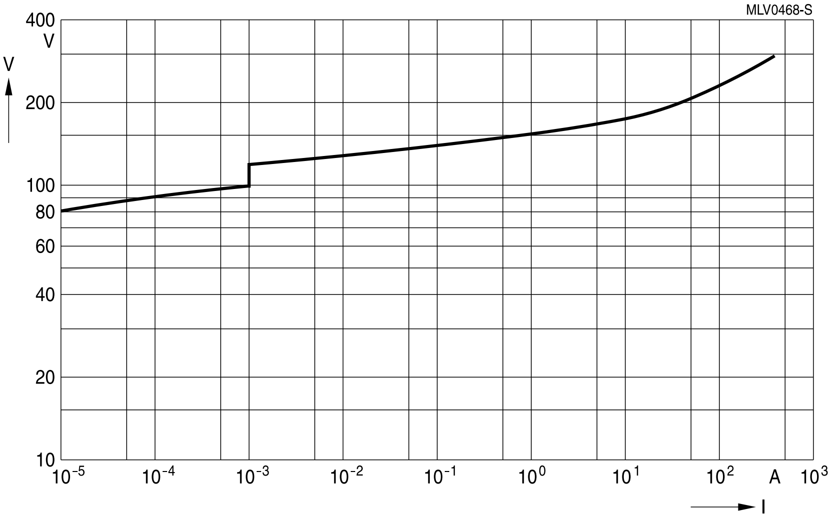


CT2220K50G

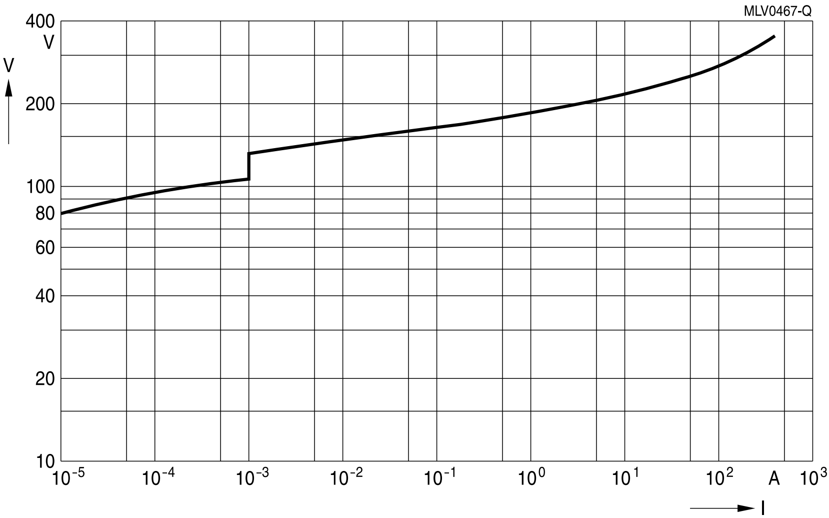


CT2220K60G

V/I characteristics for telecom types

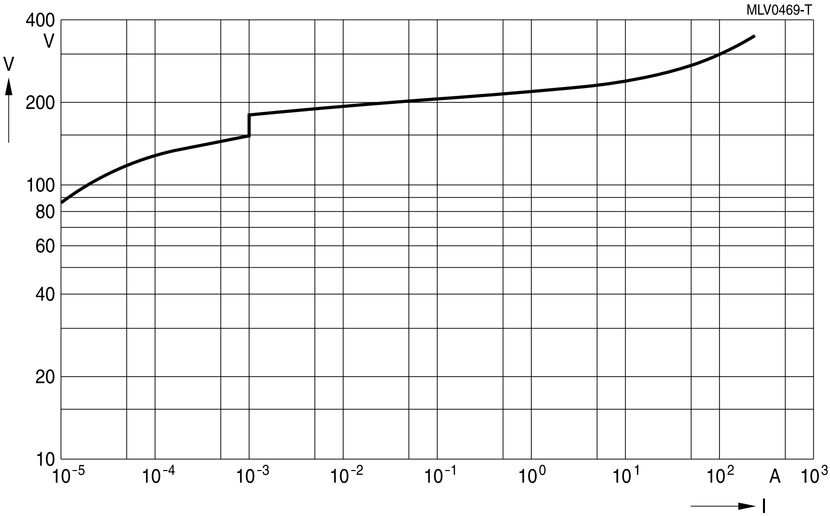


CT1812S60AG2



CT1812K75TELEG2

V/I characteristics for telecom types



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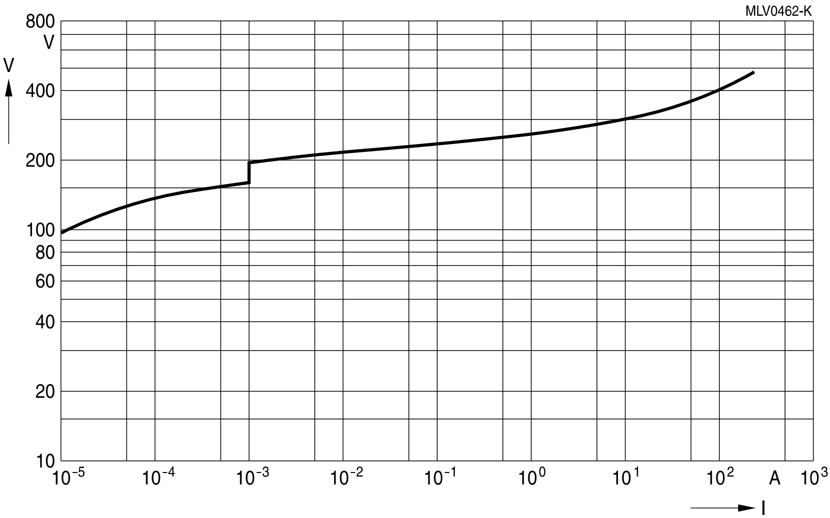
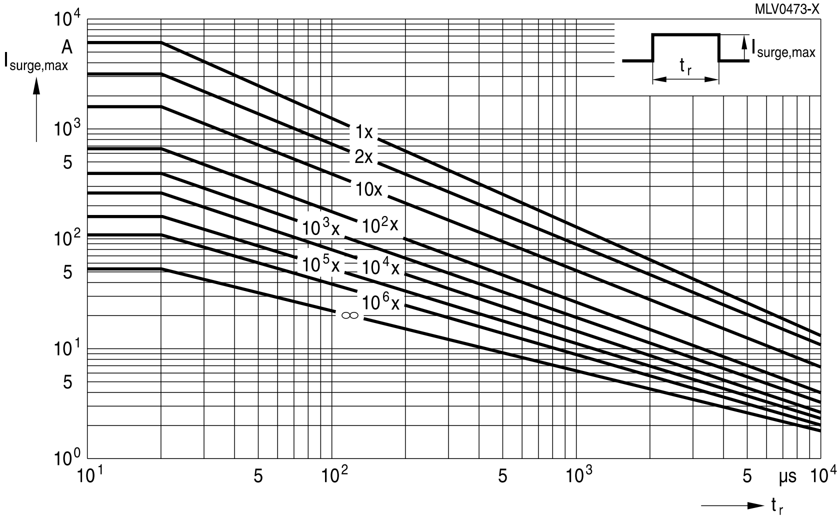


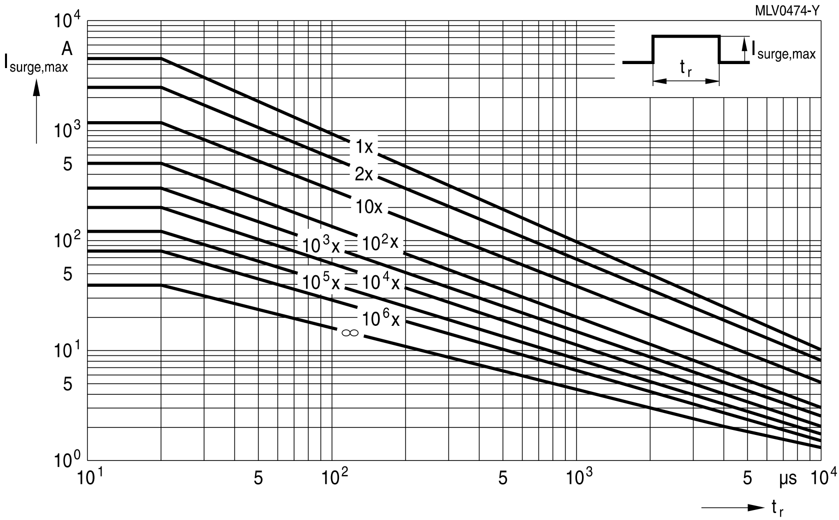
CT1812K115TELEG2

Derating curves for high surge protection types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.1



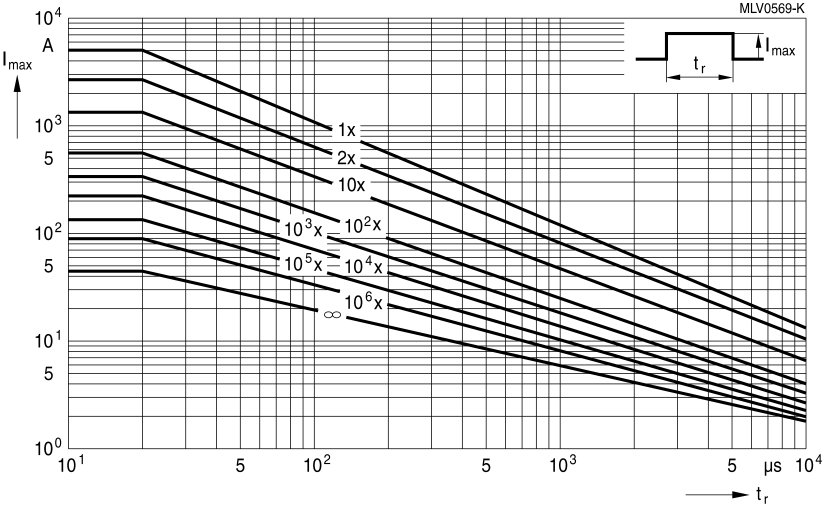
CN2220K30E2GK2



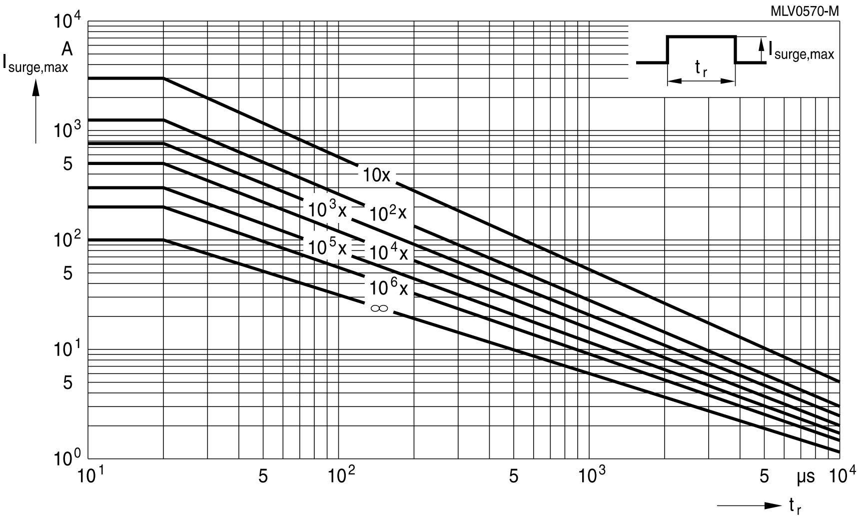
CN2220K50E2GK2, CT2220K50E2G

Derating curves for high surge protection types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.1



CT2220K30E2G

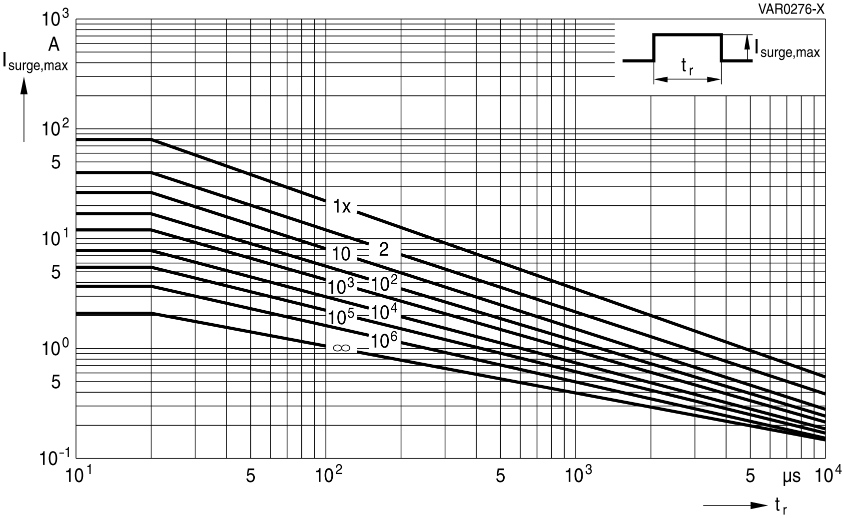


CT2220S50E3G

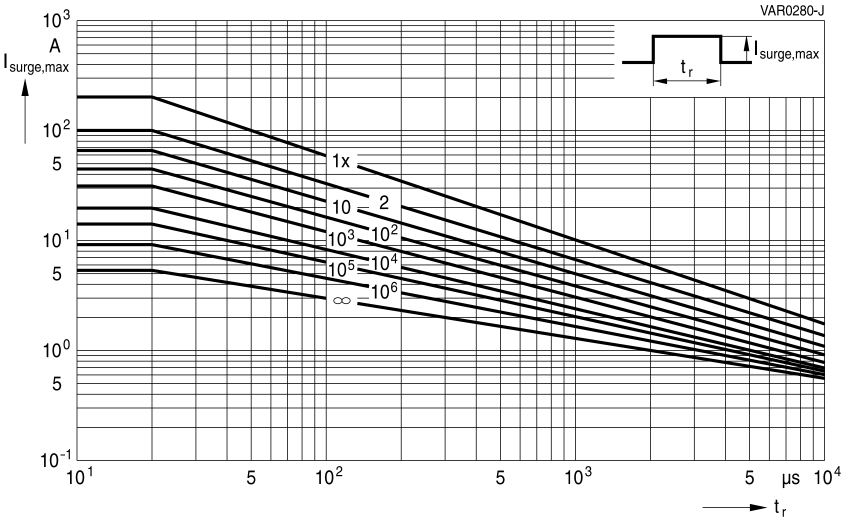
Derating curves for surge protection types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)

For explanation of the derating curves refer to "General technical information", chapter 2.7.1



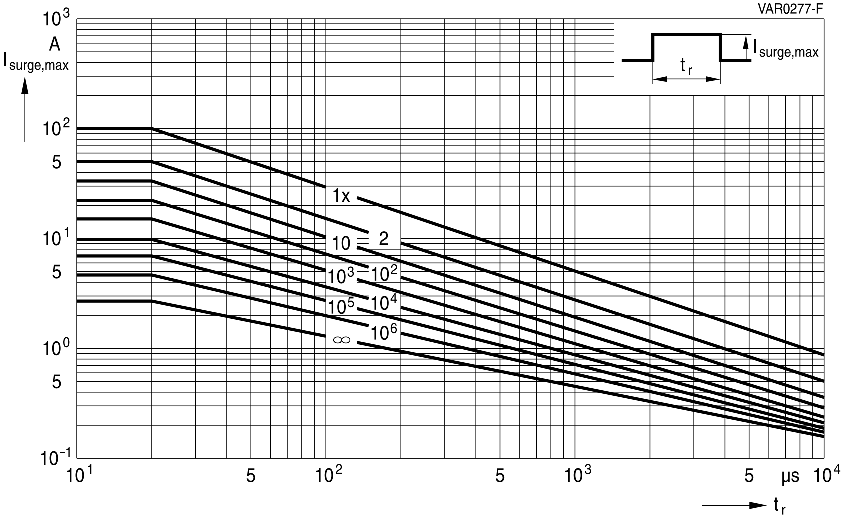
CT0805K30G CT0805K35G



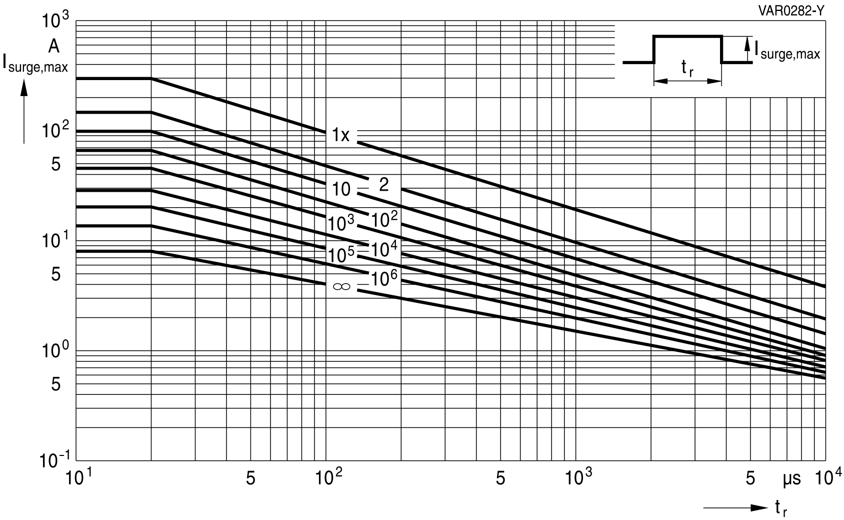
CT1206K30G CT1210K35G ... K60G

Derating curves for surge protection types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.1



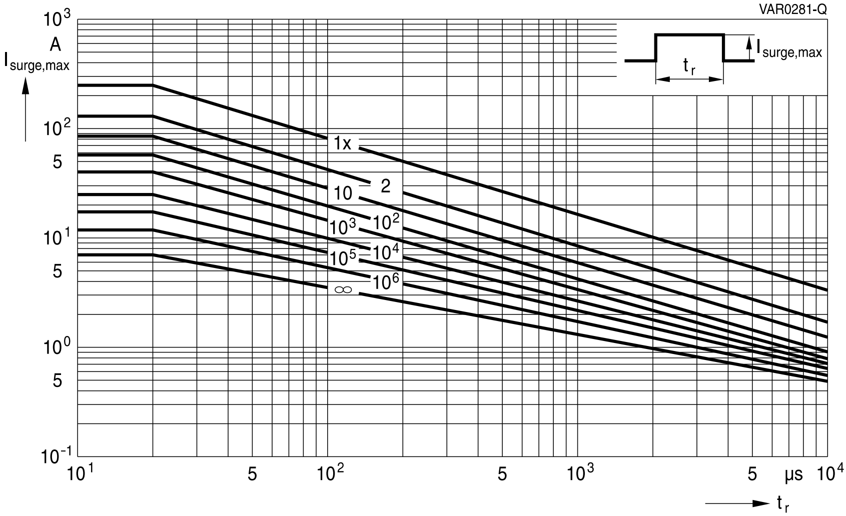
CT1206K35G ... K60G



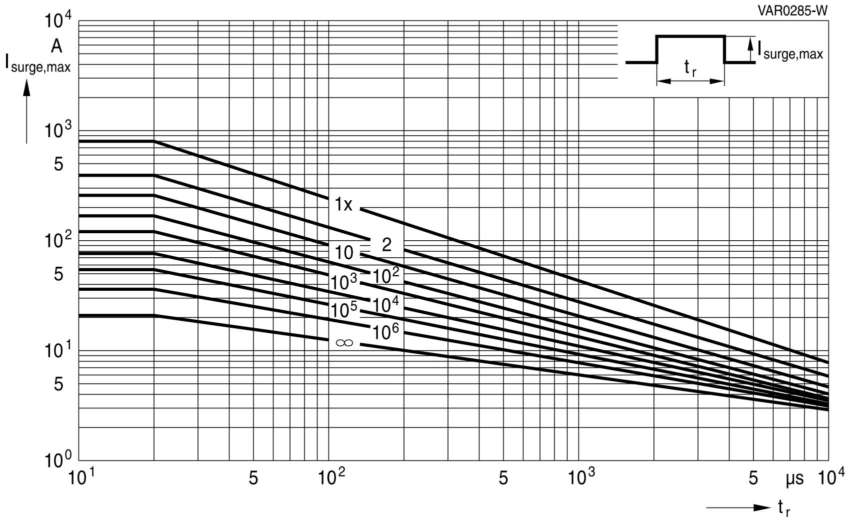
CT1210K30G

Derating curves for surge protection types

Maximum surge current $I_{surge,max} = f(t_r$, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.1



CT1210K40G CT2220K30G

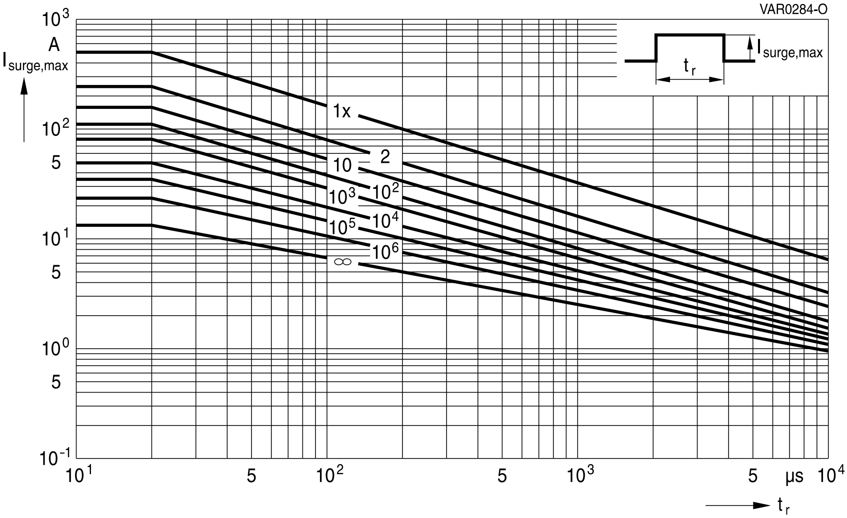


CT1812K30G

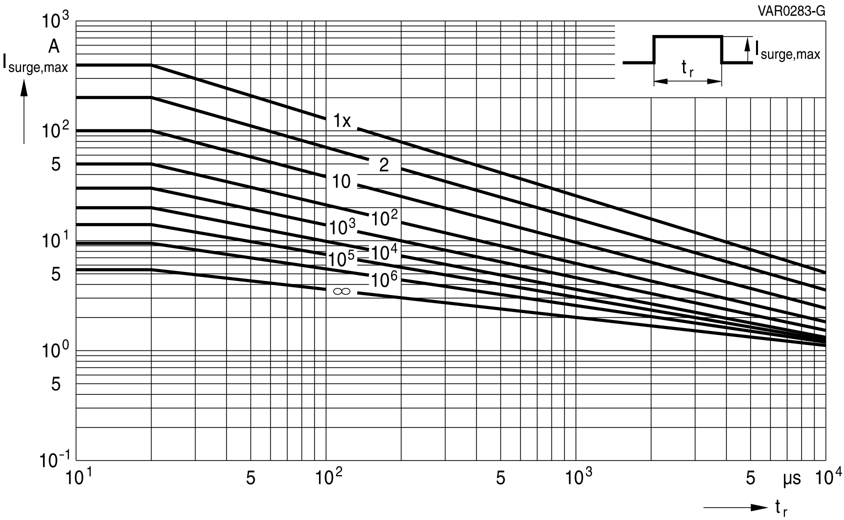
Derating curves for surge protection types

Maximum surge current $I_{surge,max} = f$ (t_r, pulse train)

For explanation of the derating curves refer to "General technical information", chapter 2.7.1



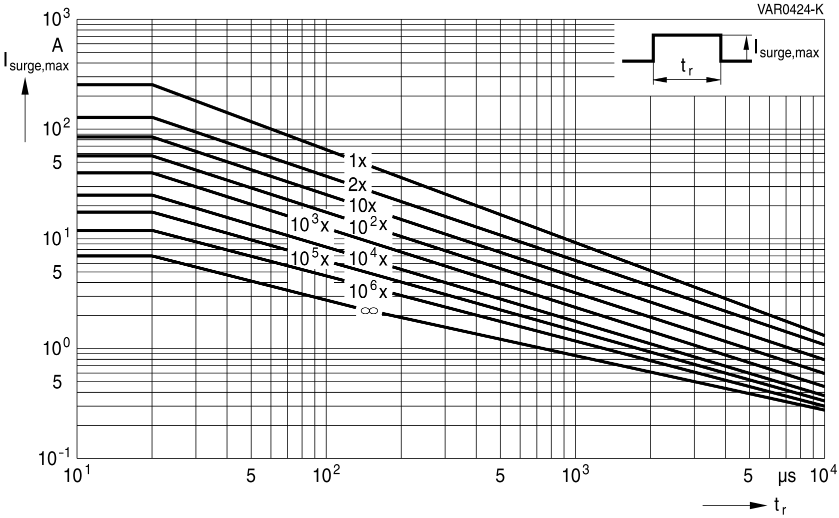
CT1812K35G ... K40G



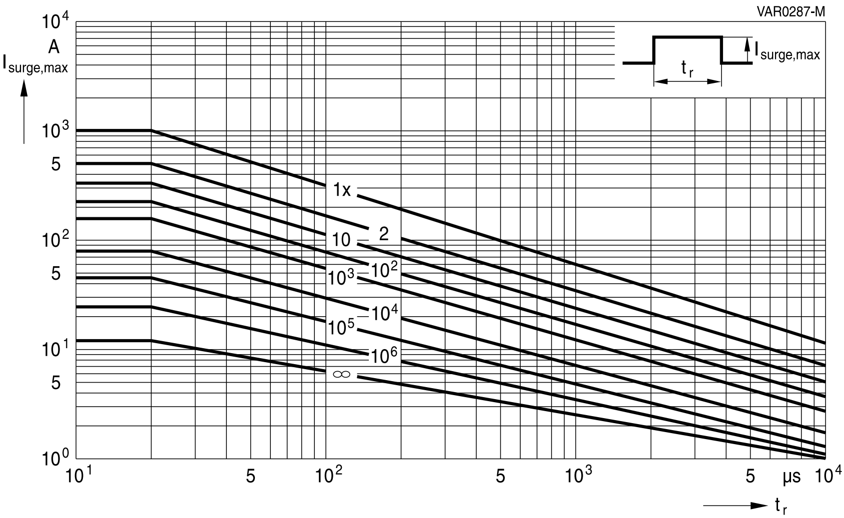
CT1812K50G ... K60G

Derating curves for surge protection types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.1



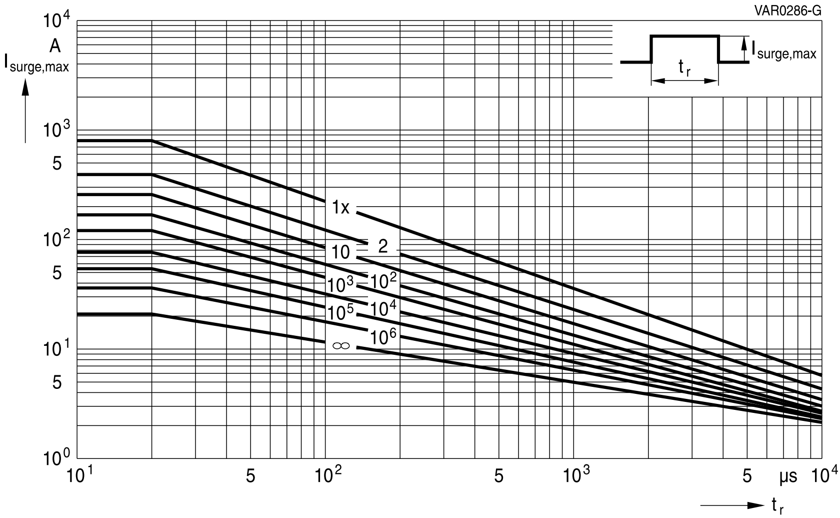
CT1812K130G2



CT2220K40G

Derating curves for surge protection types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.1

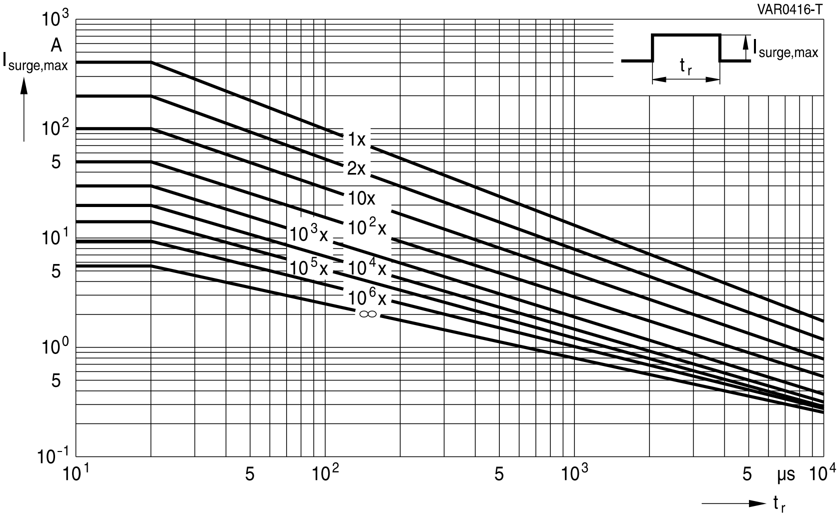


CT2220K50G ... K60G

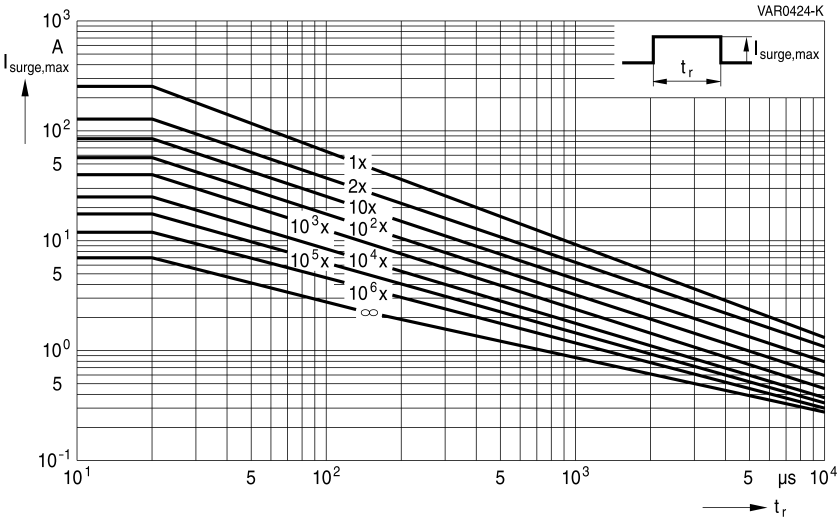
Derating curves for telecom types

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)

For explanation of the derating curves refer to "General technical information", chapter 2.7.1



CT1812S60AG2 CT1812K75TELEG2



CT1812S95AG2 CT1812K115TELEG2

Symbols and terms

For ceramic transient voltage suppressors (CTVS)

Symbol	Term
$C_{line,max}$	Maximum capacitance per line
$C_{line,min}$	Minimum capacitance per line
$C_{line,typ}$	Typical capacitance per line
C_{max}	Maximum capacitance
C_{min}	Minimum capacitance
C_{nom}	Nominal capacitance
ΔC_{nom}	Tolerance of nominal capacitance
C_{typ}	Typical capacitance
$f_{cut\text{-}off,max}$	Maximum cut-off frequency
$f_{cut\text{-}off,min}$	Minimum cut-off frequency
$f_{cut\text{-}off,typ}$	Typical cut-off frequency
$f_{res,typ}$	Typical resonance frequency
I	Current
I_{clamp}	Clamping current
I_{leak}	Leakage current
$I_{leak,max}$	Maximum leakage current
$I_{leak,typ}$	Typical leakage current
I_{PP}	Peak pulse current
$I_{surge,max}$	Maximum surge current (also termed peak current)
LCT	Lower category temperature
L_{typ}	Typical inductance
$P_{diss,max}$	Maximum power dissipation
P_{PP}	Peak pulse power
R_{ins}	Insulation resistance
R_{min}	Minimum resistance
R_S	Resistance per line
$R_{S,typ}$	Typical resistance per line
T_A	Ambient temperature
T_{op}	Operating temperature
$T_{op,max}$	Maximum operating temperature
T_{stg}	Storage temperature

Symbol	Term
t_r	Duration of equivalent rectangular wave
t_{resp}	Response time
$t_{resp,max}$	Maximum response time
UCT	Upper category temperature
V	Voltage
$V_{BR,min}$	Minimum breakdown voltage
$V_{clamp,max}$	Maximum clamping voltage
$V_{DC,max}$	Maximum DC operating voltage (also termed working voltage)
$V_{ESD,air}$	Air discharge ESD capability
$V_{ESD,contact}$	Contact discharge ESD capability
V_{jump}	Maximum jump-start voltage
$V_{RMS,max}$	Maximum AC operating voltage, root-mean-square value
V_V	Varistor voltage (also termed breakdown voltage)
V_{LD}	Maximum load dump voltage
V_{leak}	Measurement voltage for leakage current
$V_{V,min}$	Minimum varistor voltage
$V_{V,max}$	Maximum varistor voltage
ΔV_V	Tolerance of varistor voltage
W_{LD}	Maximum load dump energy
W_{max}	Maximum energy absorption (also termed transient energy)
α_{typ}	Typical insertion loss
$\tan \delta$	Dissipation factor
$\boxed{e}$	Lead spacing
≪*≫	Maximum possible application conditions

All dimensions are given in mm.
The commas used in numerical values denote decimal points.

For CeraDiodes

CeraDiode	Semiconductor diode	
C_{max}		Maximum capacitance
C_{typ}		Typical capacitance
I_{BR}	I_R, I_T	(Reverse) current @ breakdown voltage
I_{leak}	I_{RM}	(Reverse) leakage current
I_{PP}	I_P, I_{PP}	Current @ clamping voltage; peak pulse current
P_{PP}	P_{PP}	Peak pulse power
T_{op}		Operating temperature
T_{stg}		Storage temperature
V_{BR}	V_{BR}	(Reverse) breakdown voltage
$V_{BR,min}$		Minimum breakdown voltage
V_{clamp}	V_{cl}, V_C	Clamping voltage
$V_{clamp,max}$		Maximum clamping voltage
V_{DC}	V_{RM}, V_{RWM}, V_{WM}, V_{DC}	(Reverse) stand-off voltage, working voltage, operating voltage
$V_{DC,max}$		Maximum DC operating voltage
$V_{ESD,air}$		Air discharge ESD capability
$V_{ESD,contact}$		Contact discharge ESD capability
V_{leak}	V_{RM}, V_{RWM}, V_{WM}, V_{DC}	(Reverse) voltage @ leakage current
- *)	I_F	Current @ forward voltage
- *)	I_{RM}, $I_{RM,max}$@V_{RM}	(Reverse) current @ maximum reverse stand-off voltage, working voltage, operating voltage
- *)	V_F	Forward voltage

*) Not applicable due to bidirectional characteristics of CeraDiodes.

Cautions and warnings

General

Some parts of this publication contain statements about the suitability of our ceramic transient voltage suppressor (CTVS) components (multilayer varistors (MLVs)), CeraDiodes, ESD/EMI filters, leaded transient voltage/ RFI suppressors (SHCV types)) for certain areas of application, including recommendations about incorporation/design-in of these products into customer applications. The statements are based on our knowledge of typical requirements often made of our CTVS devices in the particular areas. We nevertheless expressly point out that such statements cannot be regarded as binding statements about the suitability of our CTVS components for a particular customer application. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always incumbent on the customer to check and decide whether the CTVS devices with the properties described in the product specification are suitable for use in a particular customer application.

- Do not use EPCOS CTVS components for purposes not identified in our specifications, application notes and data books.
- Ensure the suitability of a CTVS in particular by testing it for reliability during design-in. Always evaluate a CTVS component under worst-case conditions.
- Pay special attention to the reliability of CTVS devices intended for use in safety-critical applications (e.g. medical equipment, automotive, spacecraft, nuclear power plant).

Design notes

- Always connect a CTVS in parallel with the electronic circuit to be protected.
- Consider maximum rated power dissipation if a CTVS has insufficient time to cool down between a number of pulses occurring within a specified isolated time period. Ensure that electrical characteristics do not degrade.
- Consider derating at higher operating temperatures. Choose the highest voltage class compatible with derating at higher temperatures.
- Surge currents beyond specified values will puncture a CTVS. In extreme cases a CTVS will burst.
- If steep surge current edges are to be expected, make sure your design is as low-inductance as possible.
- In some cases the malfunctioning of passive electronic components or failure before the end of their service life cannot be completely ruled out in the current state of the art, even if they are operated as specified. In applications requiring a very high level of operational safety and especially when the malfunction or failure of a passive electronic component could endanger human life or health (e.g. in accident prevention, life-saving systems, or automotive battery line applications such as clamp 30), ensure by suitable design of the application or other measures (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of such a malfunction or failure. Only use CTVS components from the automotive series in safety-relevant applications.

- Specified values only apply to CTVS components that have not been subject to prior electrical, mechanical or thermal damage. The use of CTVS devices in line-to-ground applications is therefore not advisable, and it is only allowed together with safety countermeasures like thermal fuses.

Storage

- Only store CTVS in their original packaging. Do not open the package prior to processing.
- Storage conditions in original packaging: temperature −25 to +45°C, relative humidity ≤75% annual average, maximum 95%, dew precipitation is inadmissible.
- Do not store CTVS devices where they are exposed to heat or direct sunlight. Otherwise the packaging material may be deformed or CTVS may stick together, causing problems during mounting.
- Avoid contamination of the CTVS surface during storage, handling and processing.
- Avoid storing CTVS devices in harmful environments where they are exposed to corrosive gases for example (SO_x, Cl).
- Use CTVS as soon as possible after opening factory seals such as polyvinyl-sealed packages.
- Solder CTVS components after shipment from EPCOS within the time specified:
  - CTVS with Ni barrier termination, 12 months
  - CTVS with AgPt termination, 6 months
  - SHCV, 24 months

Handling

- Do not drop CTVS components and allow them to be chipped.
- Do not touch CTVS with your bare hands - gloves are recommended.
- Avoid contamination of the CTVS surface during handling.
- Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g. ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.

Mounting

- When CTVS devices are encapsulated with sealing material or overmolded with plastic material, electrical characteristics might be degraded and the life time reduced.
- Make sure an electrode is not scratched before, during or after the mounting process.
- Make sure contacts and housings used for assembly with CTVS components are clean before mounting.
- The surface temperature of an operating CTVS can be higher. Ensure that adjacent components are placed at a sufficient distance from a CTVS to allow proper cooling.
- Avoid contamination of the CTVS surface during processing.

Soldering

- Complete removal of flux is recommended to avoid surface contamination that can result in an instable and/or high leakage current.
- Use resin-type or non-activated flux.
- Bear in mind that insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended, otherwise a component may crack.

Operation

- Use CTVS only within the specified operating temperature range.
- Use CTVS only within specified voltage and current ranges.
- Environmental conditions must not harm a CTVS. Only use them in normal atmospheric conditions. Reducing the atmosphere (e.g. hydrogen or nitrogen atmosphere) is prohibited.
- Prevent a CTVS from contacting liquids and solvents. Make sure that no water enters a CTVS (e.g. through plug terminals).
- Avoid dewing and condensation.
- EPCOS CTVS components are mainly designed for encased applications. Under all circumstances avoid exposure to:
  - direct sunlight
  - rain or condensation
  - steam, saline spray
  - corrosive gases
  - atmosphere with reduced oxygen content
- EPCOS CTVS devices are not suitable for switching applications or voltage stabilization where static power dissipation is required.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.

Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data sheets, data books, other publications, on the EPCOS website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.epcos.com/orderingcodes

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.

Important notes

7. The trade names EPCOS, Alu-X, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.

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- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

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- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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