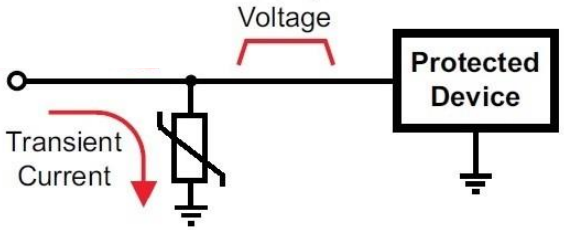
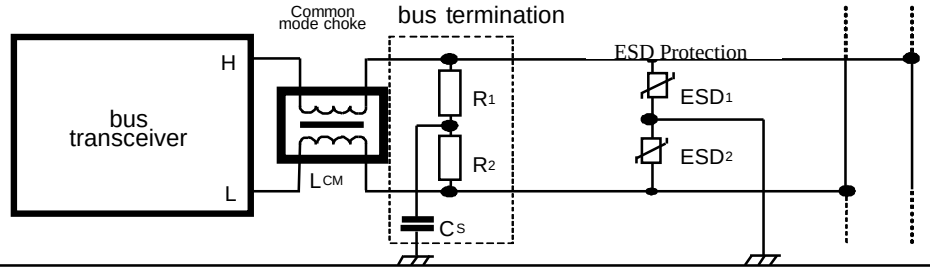
Single line and multiple line protection

Single line protection



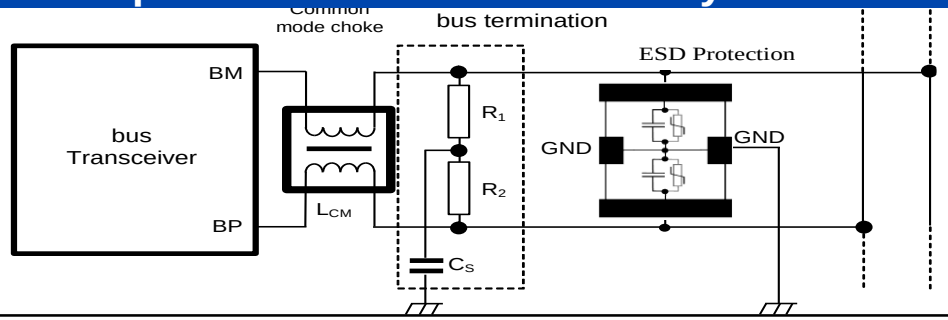
Connected in parallel with the electronic device to be guarded, the chip varistor form a low resistance shunt when voltage increases above a type-specific threshold value and thus prevent any further rise in the transient overvoltage.

Dual line protection with discrete solution



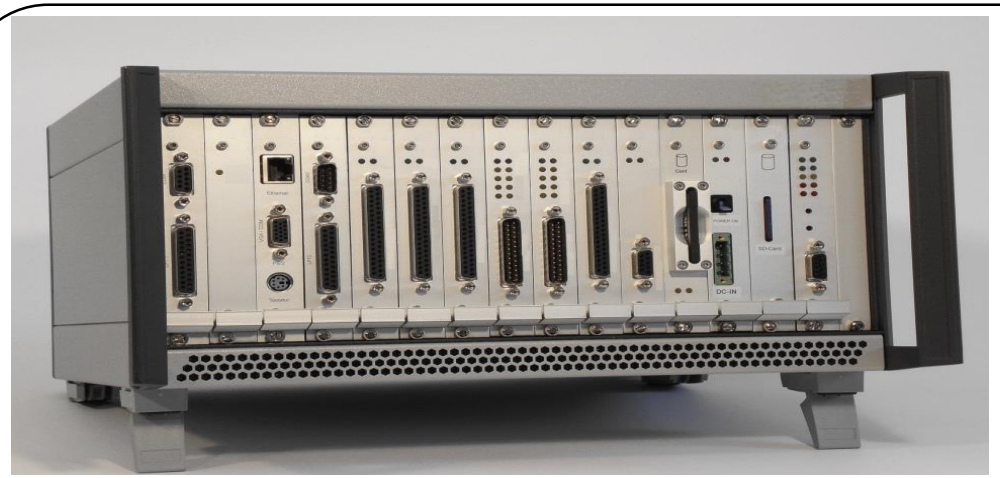

Usage of **two discrete** high speed varistors e.g. CT0603S14AHSG
Advantage: design flexibility

Dual line protection with varistor array



Usage of one varistor array e.g. CA05F2S10T100G (2 x10 pF)
Advantage: reduction of pick-and-place events, costs

Application example: Industrial interfaces



Control unit for industrial operations

Interfaces

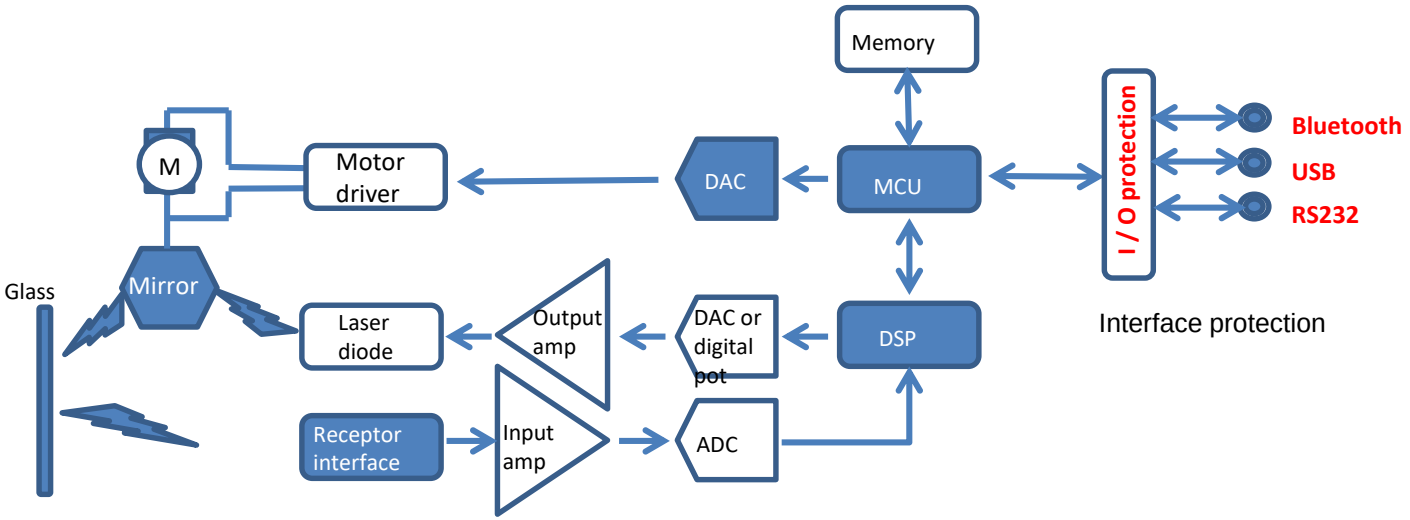
- **Serial interfaces**: COM, LPT, CCITT, RS-232
- **Serial buses**: SSI, LVDS, ECL, CML, TMDS
- **Communication interfaces**:
  USB2.0, Ethernet, FireWire, CAN, RS-422, RS-423, RS-485
- **Communication on PCB level**: I²C-Bus, SPI, 1-Wire-Bus
- **Communication inside device**: S-ATA, Serial Attached SCSI (SAS), PCI
- **Distance Communication**:
  FireWire (i.LINK or IEEE 1394), USB, PS/2, CBM-Bus, DVI, HDMI
- **Robust bus systems**:
  CAN, Profibus, DIN-bus, MPI, BITBUS, LON, AS-Interface

Solutions

Interface	Solution
RS-232 	0402: B72590D0050A060 (CDS2C05GTA) B72590D0150A060 (CDS2C15GTA) 0603: B72500D0050A060 (CDS3C5GTA) B72500D0200A060 (CDS3C20GTA)
PS/2 	
USB 3.0, USB 2.0 	0402: B72590D0050H260 (CDS2C05HDMI2)
Ethernet 	
CAN 	0402: B72590T8140S160 (CT0402S14AHSG) 0603: B72500T8140S160 (CT0603S14AHSG) 2fold array: B72812Q1120S160 (CA05M2S10T100HG)

Application example: Bar code scanner

ESD can occur when touching a bar code scanner. The unwanted pulse may damage the components inside and thus its function. Multilayer ESD protection devices are used to protect ESD sensitive components preventing damage to the board.



Features

- Ultra-low DC leakage current
- Low device capacitance
- Small package

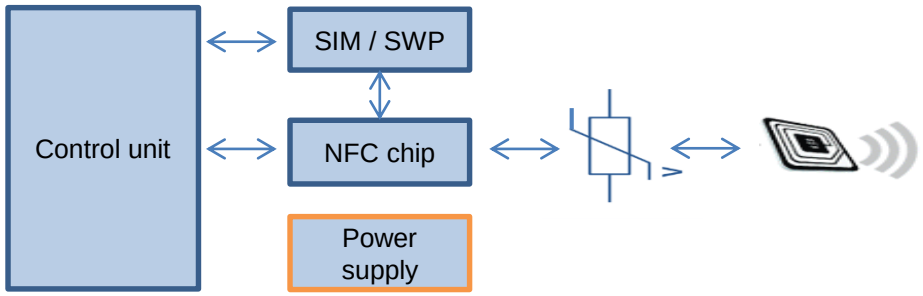
Recommended parts

EIA case size	Type	Working voltage [V]	Max. capacitance (@ 1 MHz, 1 V) [pF]
0402	CDS2C05HDMI2	5.6	0.9
	CDS2C15GTH	15.0	15.0
	CDS2C16GTH	16.0	3.0
0603	CDS3C05HDMI1	5.6	0.9
	CDS3C16GTH	16.0	5.0
	CDS3C30GTH	30.0	15.0

CeraDiodes® show comparable ESD performance than TVS diodes, but are smaller!

Application example: Near field communication (NFC)

NFC technology is an easy-to-use, intuitive, contactless application. These target a broad range of electronic devices such as smartphones, PDAs and other consumer electronic devices. Taking advantage of the three different operating modes (reader, peer to peer, card emulation), NFC technology is used to address a wide variety of use cases such as mobile payment, ticketing and transport, Bluetooth pairing and smart posters. **To protect the antenna of the NFC system and the NFC chip against EMI / ESD events, chip varistors are a common solution.**



Features

- No signal attenuation
- No significant IMD effect to RF signal quality

➢ **High RF signal integrity**

Recommended parts

Type	Case size		V_{DC} [V]	Max. capacitance [pF]
CT0201V150RFG	0201	-	30	1.0
CT0402V150RFG	0402	SOD-723	16	3.0

NEW

Contactless payment

- Credit cards
- Electronic ticket smart cards

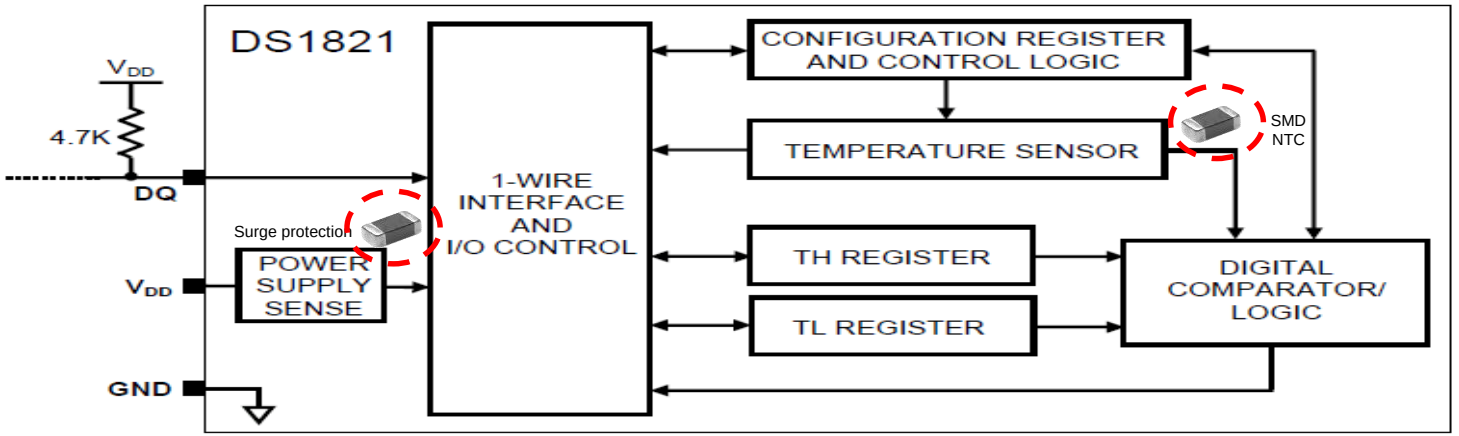
Tickets

- NFC payment systems for public transport
- Ticket stamping machine to be used to purchase mobile tickets

Parking meter label

- NFC enabled parking meter label to be used for payment and phone reminders of time remaining

Application example: Thermostat



Block diagram retrieved from:
https://www.maximintegrated.com/en/images/qv/2794.gif

Surge protection with chip varistors

chip varistor (MLV)	type	$I_{surge,max}$ [A]	W_{max} (2 ms) [mJ]
B72520T0350K062	CT1206K35G	100	400
B72520T0400K062	CT1206K40G	100	500
B72520T0600K062	CT1206K60G	100	700
B72530T0300K062	CT1210K30G	300	2,000

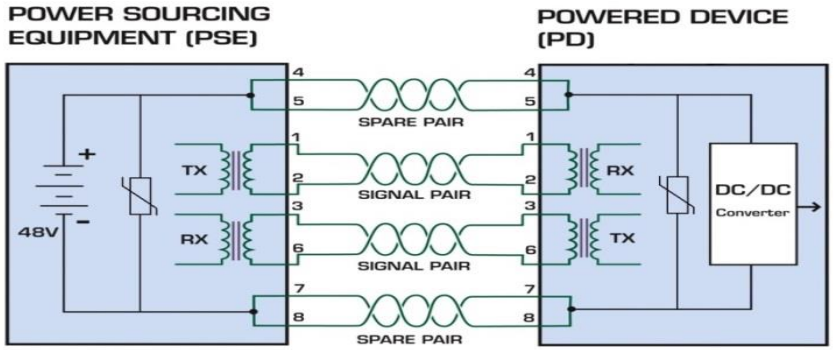
thermal measurement with chip NTC thermistor

chip NTC thermistor	EIA case size	R_{25} [Ω]	$\Delta R_R/R_R$ [%]	$B_{25/100}$ [K]	ΔB/B [%]
B57332V5103E360	0603	10 k	1	3450	1
B57332V2103D560	0603	10 k	0.5	3455	0.7

NEW: PROTOTYPE

Application example: Power over Ethernet (PoE)

Power over Ethernet (PoE) does use the same copper cable for supply 48 V_{DC} and the Ethernet data signal. This is an existing possibility how to transport data and supply voltage to Ethernet device by already existing net of cabling for computer networks (10 Mbit/s and 100 Mbit/s).
This standard is authorized as IEEE 802.3af.



2 types of IEEE 802.3

PoE	48 V; 350 mA; 15.4 W
PoE plus	48 V; 600 mA; 25.5 W

Recommended parts

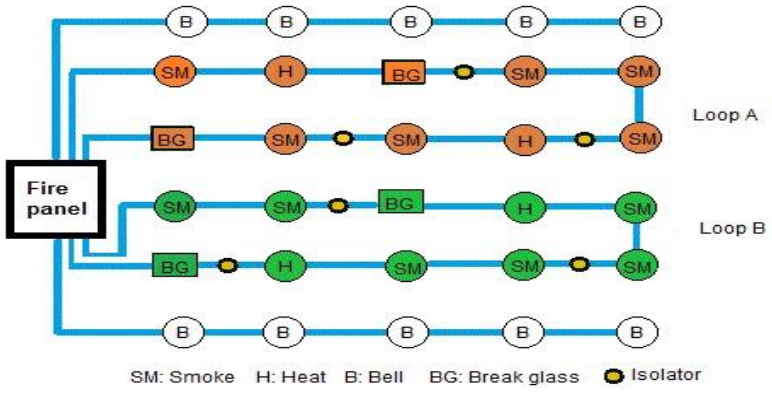
Type	EIA case size	V_{DC} [V]	V_V @ mA [V]	$V_{clamp,\ max}$ [V]	$I_{surge,max}$ [A]	$P_{diss,\ max}$ [mW]
B72542V6300K062 (CN2220K30E2GK2)	2220	38	47	77	1 x 6.000	20
B72542V6500S162 (CN2220S50E2GK2)	2220	63	77	130	1 x 4.500	20
B72540T6500S162 (CT2220S50E3G)	2220	65	78	115	1 x 4.500	20

High level of reliability: Increased 8/20 µs EoL for high fail-safe level. 100% passed ✓

Application example: Security systems

Smoke detectors are obligatory in many countries. Modern and intelligent fire security systems with a switching voltage of 30 V DC (from power connection 230 V AC) have up to 200 smoke detectors in a loop. Therefore components with a low leakage current are required.

Loop of smoke detectors



Recommended part

Type	EIA case size	$V_{RMS,max}$ [V]	V_{DC} [V]	V_V @ 1 mA [V]	$V_{clamp,max}$ [V]	$I_{surge,max}$ [A]	W_{max} (2 ms) [mJ]	I_{leak} @ 32 V [µA]
B72510T0350K062 (CT0805K35G)	0805	35	45	47	77	80	300	1

Detection system

- Motion / vibration detector
- Opening detector
- Breakage of glass detector
- Smoke detector
- Heat detector
- Water detector

Sender

- Emergency call sender
- Assault sender

Communication modules

- ISDN module
- GSM module
- IP module
- Info module

EPCOS has a save and reliable solution with very low leakage current