


## Features

- Lead free versions available (RoHS compliant*)
- Overvoltage/lightning protection to Bellcore GR-1089 & ITU-T K.20
- Standard "off the shelf" designs
- Typical application is secondary protection on telecom line cards
- Custom versions available, including SMD solutions and fuse technology (contact factory)

# 4B04B-50X-RC - Surge Line Protection Modules

### 4B04B-501 (Pair of Matched Resistors)

#### Product Characteristics

Resistance Values.....20 ohms - 100 ohms
Resistance Tolerance .....±1 %
TCR.....100 ppm/°C
Ratio Tolerance.....>34 ohms.....±0.5 %
<34 ohms.....±1 %
Power Dissipation (per resistor) @ 25 ºC .....2 W
Temperature Range .....-55 ºC to +125 ºC

#### Environmental Characteristics

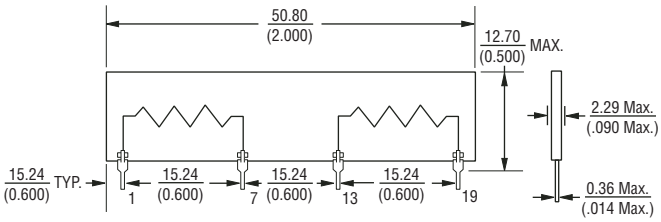
TESTS PER MIL-STD-202 .....ΔR MAX.
Resistance to Solvents .....No Marking Deterioration
Resistance to Solder Heat .....±0.5 % or 0.5 ohms, whichever is greater
Solderability .....>95 % Coverage
Insulation Resistance .....10 megohms min. (isolated pins)
Bias Humidity Test .....50 V/85 % RH/85 °C

#### Functional Characteristics

Lightning Surge Test
Bellcore Spec GR-1089 — 10 x 1000 µsec .....1 kV
2 x 10 µsec .....2.5 kV
ITU-T K.20 — 10 x 700 µsec .....2 kV
Power Cross Test .....Per Bellcore spec.
(Vrms applied vary with resistance values)

#### Physical Characteristics

Body Style .....Open Frame SIP
Body Material.....96 % Alumina
Lead Frame Material.....Copper, solder coated
Standard Parts Available Off the Shelf.....50 ohms, 100 ohms




#### How To Order

4B 04 B - 50X - XXX LF

- Model (4B = Open Frame)
- Number of Pins
- Physical Configuration
- Electrical Configuration
  - 501 = Pair of Matched Resistors
- Resistance Code
  - First 2 digits are significant
  - Third digit represents the number of zeros to follow
- Lead Free Option
  - Blank = Standard Product
  - LF = Lead Free / RoHS Compliant Product

### 4B04B-502 (Resistor with Thermal Fuse)

#### Product Characteristics

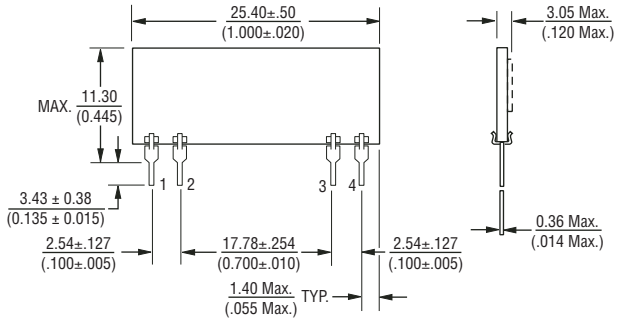
Resistance Values.....5.6 ohms - 100 ohms
Resistance Tolerance.....1 % (optional), 5 % (standard)
TCR .....800 ±200 ppm/°C
Power Dissipation @ 25 ºC.....2 W
Temperature Range.....-55 ºC to +125 ºC

#### Functional Characteristics

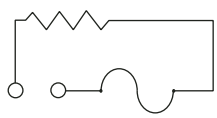
Lightning Surge Test
Bellcore Spec GR-1089 — 10 x 1000 µsec .....1 kV
2 x 10 µsec .....2.5 kV
Power Cross Test .....Per Bellcore spec.
(Vrms applied vary with resistance values)

#### Physical Characteristics

Body Style .....Open Frame SIP
Body Material .....96 % Alumina
Lead Frame Material .....Copper, solder coated
Standard Parts Available Off the Shelf
.....5.6 ohms, 10 ohms, 34 ohms




Functional Schematic



Governing dimensions are in mm. Dimensions in parenthesis are inches and are approximate.

User must short pins 3 & 4 on the circuit board

#### How To Order

4B 04 B - 50X - XXX J LF

- Model (4B = Open Frame)
- Number of Pins
- Physical Configuration
- Electrical Configuration
  - 502 = Resistor with Thermal Fuse
- Resistance Code
  - First 2 digits are significant
  - Third digit represents the number of zeros to follow
- 5% Tolerance
- Lead Free Option
  - Blank = Standard Product
  - LF = Lead Free / RoHS Compliant Product

**WARNING**
**Cancer and Reproductive Harm**
www.P65Warnings.ca.gov

*RoHS Directive 2015/863, Mar 31, 2015 and Annex.

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## General Description

Surge is defined as a high-energy, short-duration pulse caused by lightning or the switching of power loads. In short, a surge can be a transient wave of voltage, current or power. Most of the surge pulse waveforms are unidirectional impulses. Surge waveforms occur in many situations, including computer memory drivers and telecommunication equipment. Standards for various natural surge pulse waveforms in the telecommunication industry are IEC 801-5, ANSI/IEEE C62.41 and Bellcore GR-NWT-001089. Two consequences of inefficient surge protection in a system are (1) permanent damage to internal components, which will require component replacement and (2) temporary instability to a system, resulting in volatile memory loss in a computer or other disruptions.

A typical telecommunication application is shown in Figure 1. There are various protection devices which guard against surge overstresses. Typically, a crowbar is used for primary protection, while current limiters and clamps are used as secondary protection.

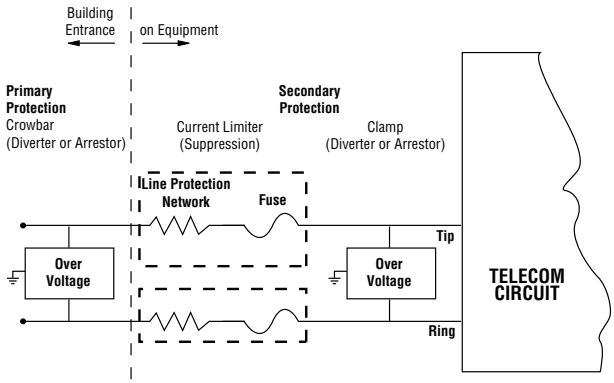



*Figure 1. Typical Telecom Application*

There are several standard telecommunication waveforms - 10 x 1000 microsecond, 0.5 x 700 micro-second, 10 x 700 microsecond, etc. The definition of a 10 x 1000 microsecond is shown in Figure 2. The first number refers to the voltage rise time while the second numbers indicate the duration. All of these surge pulse waveforms consist of energy levels from 10 to 100 Joules.

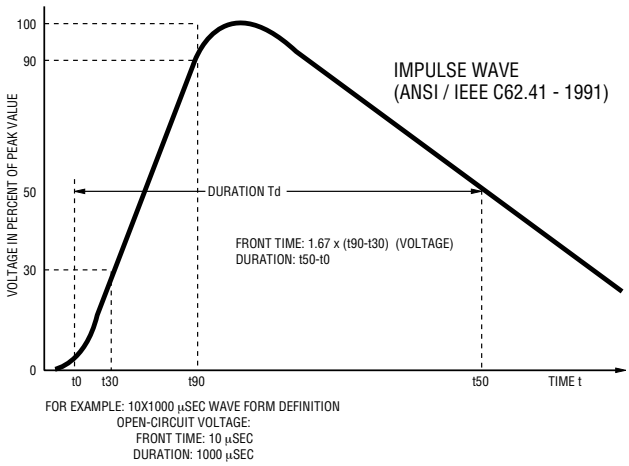
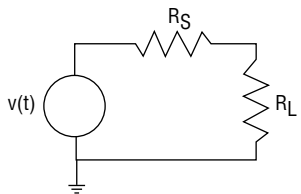



*Figure 2. Surge Waveform*

## Line Protection Networks

Line protection networks are used to dissipate high energy for a short period of time. Figure 3 shows how the amount of energy is dependent on the pulse duration and value of the load resistance. An equation used to determine the amount of energy transferred to the load by the overstress test waveform can be given as follows[1]:

$$\text{Energy, } W = \frac{1}{(R_S + R_L)} \bullet \frac{R_L}{(R_S + R_L)} \int_0^\infty v^2(t)dt$$




where RS = source resistance (W)
RL = load resistance (W)
W = energy (Joules)

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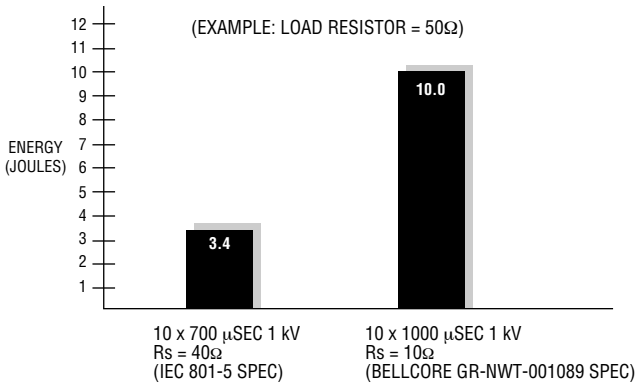



*Figure 3. Energy Comparison*

Surge protection is necessary in situations where smaller device geometries and higher densities make circuits susceptible to electrical over stress. Applications include instances where faster processing speeds having less inherent filtering make circuits more susceptible to noise. Also, when vulnerable ICs are used in less-controlled environments, circuits can be exposed to extreme electrical conditions.

## Common Surge Modes

There are two common surge modes: (1) metallic, i.e., normal, transverse or differential (Figure 4) and (2) longitudinal, i.e., common (Figure 5). In the metallic surge mode, earth or ground is not involved. Both conductors are metal. Surge current flows from tip to ring or ring to tip. The longitudinal surge mode involves a connection in which the wave is applied between one or more lines and ground. The longitudinal surge current flows from tip to ground and ring to ground.

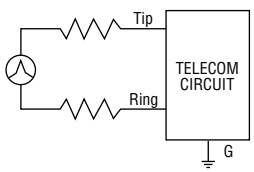



*Figure 4. Typical Metallic Application Mode*

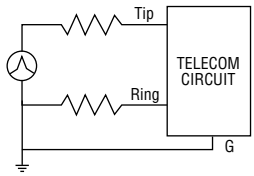



*Figure 5. Typical Longitudinal Application Mode*

## Bourns Line Protection Networks

The Bourns Line Protection Network provides current limiting for telecommunication protection circuits and consists of two high-power surge resistors, which are utilized in the secondary protection block of central office switch systems (Figure 6). This device protects sensitive circuitry from lightning strikes and power cross-conditions by limiting irregular currents through the system.

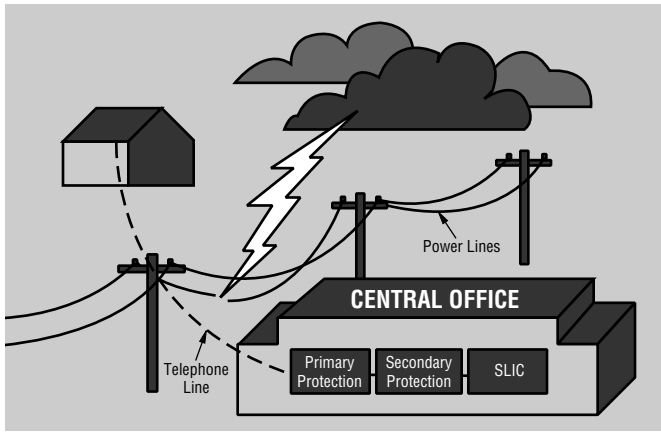



*Figure 6. Surge Causes*

The line protection network features a resistance range between 50 and 100 ohms, resistors that are able to withstand lightning and power conditions per Bellcore specification GR-NWT-001089, noise reduction through close-ratio matching (± percent) between tip and ring resistor pairs and superior material systems created especially for high-power, high-reliability products and applications.

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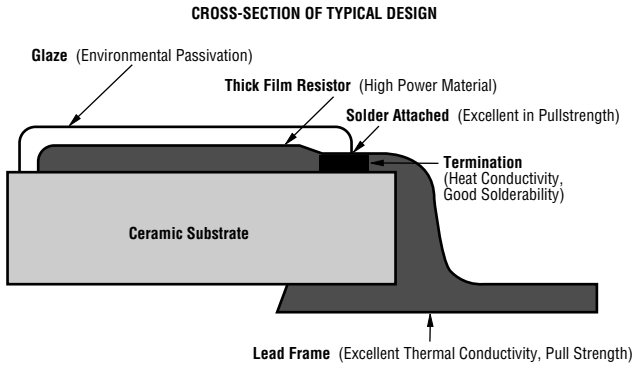
# 4B04B-50X-RC - Surge Line Protection Modules

BOURNS®

## Thick Film Line Protection Network Technology Comparison

| ELEMENTS | OLDER TECHNOLOGY | STATE-OF-THE-ART TECHNOLOGY |
|---|---|---|
| Ceramic thickness | Greater than 0.040 in. | Less than or equal to 0.040 in. |
| Seated height | Greater than 0.5 in. | Less than or equal to 0.5 in. |
| Material and process | Standard thick film material and process | • New high power material<br>• Improved processing |
| Temperature coefficient of resistance (TCR) | Greater than 100ppm/°C | Less than 100ppm/°C |
| Tip and ring resistors ratio | 1% | 0.5% or lower |
| Surge test waveforms<br>• 100 cycles<br>• 100 cycles<br>• 10 cycles | <br>10 x 700 μsec 1 kV<br>10 x 1000 μsec 1 kV | <br>10 x 700 μsec 1 kV<br>10 x 1000 μsec 1 kV<br>2 x 10 μsec 2.5 kV |
| Bias humidity temperature 1000 hr. ΔR | 2% or greater | 0.25% or lower |

## Thick Film Line Protection Network Construction And Benefits




## Customer Advantages

The Bourns Thick Film Line Protection Network provides customers with tip and ring resistors on the same component for single placement processing. Customer lead times are reduced because parts are readily available. Bourns is an experienced supplier of state-of-the-art thick film overcurrent protection devices. Bourns also has global design and manufacturing centers for localized service.

Specialty devices are available like surge resistor and standard resistors on the same package, fusible links which are “fail safe” integrated with surge resistors and custom electrical configurations and tolerances. The thick film line protection network also has quick-turn sample times.

[1]REFERENCE: STANDLER, RONALD B., “PROTECTION OF ELECTRONIC CIRCUITS FROM OVERVOLTAGES.” PP 89 - 102, 1989.

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