POWER PLAY SOLUTIONS™

Surge Protection for AC Power in Baseband Units

Solution Products

IsoMOV™ / GMOV™ Hybrid Protection Components

Common Mode Inductors

Power TVS Diodes

Bourns® SinglFuse™ SMD Fuses

Situation

A Baseband Unit (BBU) in a telecom system is used to process uplink and downlink data traffic and transmit the traffic via optical fiber to the Remote Radio Unit (RRU), which is normally placed in a tower. Since the BBU must be near the radio tower, it is usually located in an exposed area such as an outdoor cabinet as opposed to inside a secure, climate-controlled building. Given its outdoor location, BBU power cables are more likely to be subjected to dangerous lightning and power induced surges. A direct or induced surge caused by lightning will generate high energy transient voltage to the power line of a wireless base station. Direct and indirect lightning strikes, as well as excessive power-induced surges to the base station power lines may, in some cases, lead to reduced reliability and negatively affect the uptime of the network, or in extreme events, may cause an extended shutdown or permanent damage. Therefore, it is paramount that any power lines entering or leaving the BBU cabinet be properly protected.

BBUs are predominantly powered by AC power rather than DC power. Aside from lightning strikes, AC power lines can experience large voltage swells from power stations, which can cause potentially damaging voltage levels to the BBU power system. To guard against both of these harmful events that can seriously affect the reliable operation of the entire application design, the use of effective protection is necessary.

In addition, BBUs placed in an open area can be exposed to common mode noise through the atmosphere or other types of RF signals. The BBU may also transfer its own high frequency noise to the power line of the BBU and disrupt power to the AC line. Consequently, it is also recommended to add common mode noise filtration to the AC power line.

Compliance

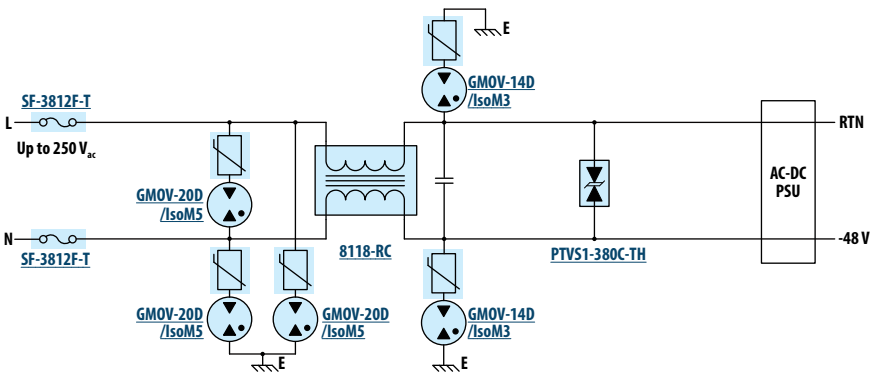
IEC 61000-4-5 8/20 µs 2-5 kA
(Differential mode, common mode)

IEEE 1159
(Power quality, TOV or AC swell)

CISPR25
(Common mode noise)

Bourns® PowerPlay Solution™

The circuit shown below is an optimized AC power protection solution for small cell or BBU applications.



Qty.	Component Description	Part Number & Data Sheet Link	Distributor Inventory
2	SinglFuse™ SMD Fuse	SF-3812F-T	Select and buy
3	GMOV™ Hybrid Protector or IsoMOV™ Hybrid Protector	GMOV-20D or IsoM5	Select and buy Select and buy
1	Common Mode Inductor	8118-RC	Buy now
3	GMOV™ Hybrid Protector or IsoMOV™ Hybrid Protector	GMOV-14D or IsoM3	Select and buy Select and buy
1	Power TVS Diode	PTVS1-380C-TH	Buy now

The schematic shown here illustrates the application protection and does not constitute the complete circuit design. Customers should verify actual device performance in their specific applications.

POWER PLAY SOLUTIONS™

Surge Protection for AC Power in Baseband Units

Solution Products

IsoMOV™ / GMOV™ Hybrid Protection Components

Common Mode Inductors

Power TVS Diodes

Bourns® SinglFuse™ SMD Fuses

Coordinated Solution

The protection circuitry shown in the schematic can help ensure that the protected device is able to withstand a surge level of 8/20 µs 5 kA in both the metallic and the longitudinal modes of the surge, which is a common surge level in small cell or BBU designs. This protection design is commonly powered by an AC input voltage of 220 VAC, which may increase up to 280 V_{rms} due to the AC swell from the power station. The AC-DC Power Supply Unit (PSU) represents the circuitry of an AC-DC conversion or a power module typically adopted in a design. The AC-DC PSU is responsible for converting the 220 VAC to the conventionally-used 48 V telecom DC power. Because the AC-DC PSU cannot typically defend against a high energy surge (the highest performing PSU input of which we are aware is rated to withstand an input voltage limit of approximately 800 V), any differential surges higher than this level may damage the PSU.

For primary side overvoltage protection, the Bourns® GMOV™ Model GMOV-20D or IsoMOV™ Model IsoM5 Hybrid Protection Components are installed across the L-N, L-E and N-E providing both common and differential modes of protection. The Bourns® Model GMOV-20D or IsoM5 Series were selected for their ability to handle up to 10 kA max., and 12 kA max., respectively. The GMOV™ and IsoMOV™ Hybrid Protectors offer low leakage that helps minimize wattage loss.

For secondary side overvoltage protection, the Bourns® Model GMOV-14D or IsoM3 Series protectors are used to further suppress the incoming residual surge to a lower clamping voltage. The secondary side does not need to have the same surge rating as the primary, so a lower rating will generally be adequate. The Bourns® Model 8118-RC common mode choke is responsible for filtration of the common mode noise from the environment. For the coordination to work, the secondary protection breakdown or clamping voltage must be lower than the primary protection. When the secondary protection is activated, a voltage will develop across the inductor (choke) until it is sufficiently high enough to activate the primary protector.

For secondary side protection, a precise and low let-through overvoltage protector is required across the sensitive input port of the AC-DC PSU in the differential mode. The Bourns® Model PTVS1-380C-TH high voltage Power TVS (PTVS) diode can be utilized. This PTVS diode is an ideal solution to avoid TURN-ON at abnormally fluctuating high AC voltages of 268 VAC, while at the same time clamping the voltage with superior performance below 520 V when the 1 kA peak surge current is applied. A PTVS diode is specified here as it exhibits a much lower clamping voltage than a conventional varistor protection solution in this situation. If a designer uses conventional varistor protection in this special situation, the clamping voltage will be higher and potentially may be harmful to the AC-DC PSU.

Additional Resources

The following related resources are also available from Bourns:

- Technical Library: Bourns® SinglFuse™ SMD Fuses
- New Product Brief: Bourns® GMOV™ Hybrid Protectors
- New Product Brief: Bourns® IsoMOV Hybrid Protectors
- Application Note: Designing Effective Surge Protection for AC and DC Powered Systems
- Application Note: Surface Mount Power TVS Diodes Deliver Optimal Protection for Power Supplies
- White Paper: Meeting Sustained Overvoltage Protection Requirements with GMOV™ Hybrid Protectors
- White Paper: IsoMOV™ Hybrid Protector Solves Circuit Protection Design Issues

www.bourns.com

BOURNS®

Americas: *Tel* +1-951 781-5500
Email americus@bourns.com

EMEA: *Tel* +36 88 885 877
Email eurocus@bourns.com

Asia-Pacific: *Tel* +886-2 256 241 17
Email asiacus@bourns.com