



CIRCUIT
PROTECTION
SOLUTIONS



Littelfuse Technologies: Power Thyristors • Protection Arrays • Fuses • PTCs • Varistors • TVS Diodes • GDTs • ESD Suppressors • SIDACTor Devices

Introduction to SDP / SEP SIDACTor Overvoltage Protection Devices



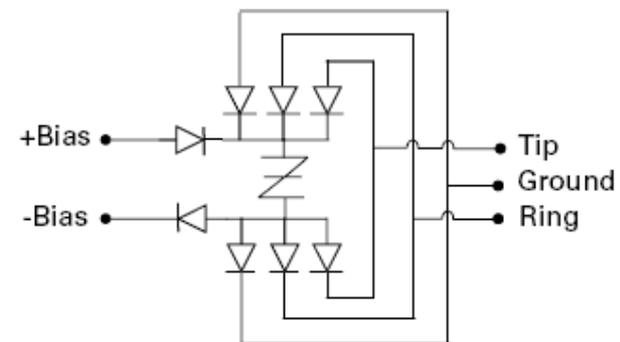
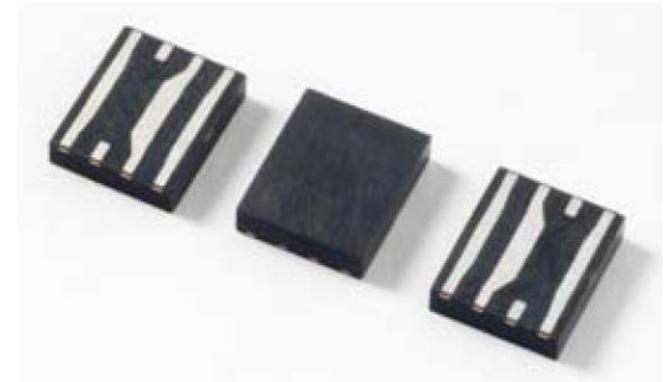
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■ SDP / SEP Protectors

- High Surge Capability
- Breakthrough Package Size
- Low Capacitance
- Capacitance Independent of Line Voltage
- Perfect Balance Bridge
 - Transformer Coupled Apps
- SDP vs GDT
- Notes on Biasing
- Notes on the QFN Package
- Demo PCBs Available



High Surge Capability

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| Surge Regulatory Requirement (without external resistance) | Voice, ISDN, T1/E1, T3, ADSL, VDSL | Ethernet Power Over Ethernet |
|--|--|--|
| GR-1089 Interbuilding ITU K.20/K.21 Enhanced (500A 2x10) | SDPxxx0Q38CB (8V-350V) | SEPxxx0Q38CB (8V -90V) |
| ITU K.20/K.21 Basic (100A 10x560) | SDPxxx0Q38B (64V-350V) | All SDP / SEP Devices are RoHS Compliant and UL recognized. (File# E133083) |

SDP: **S**emiconductor **D**SL **P**rotector

SEP: **S**emiconductor **E**thernet **P**rotector

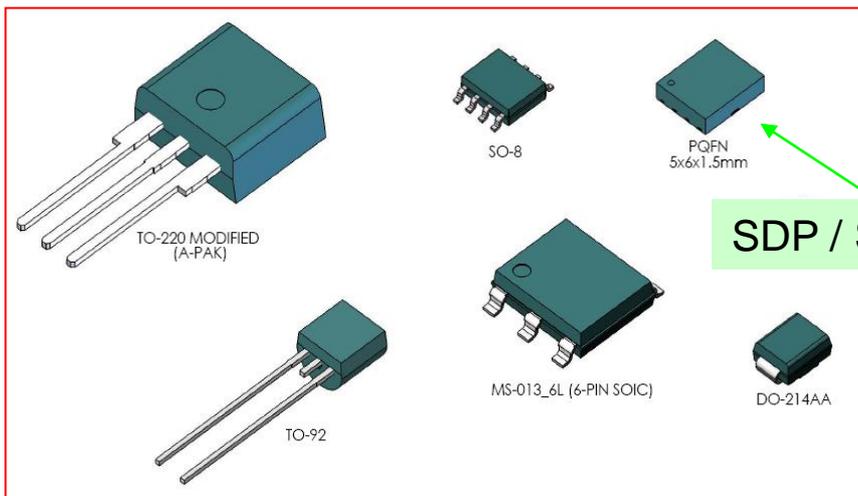




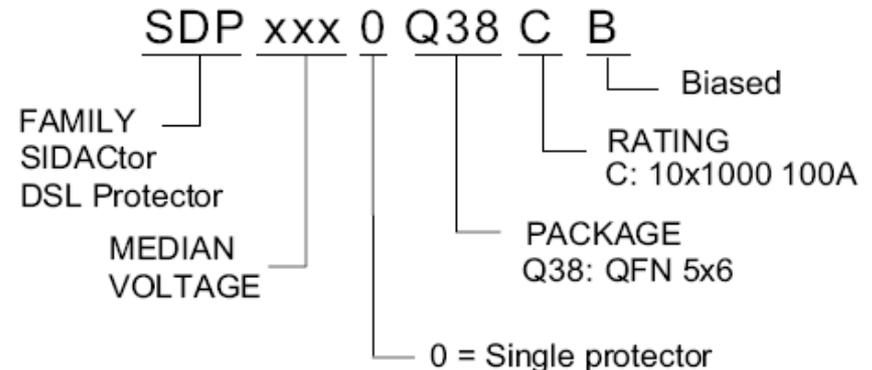
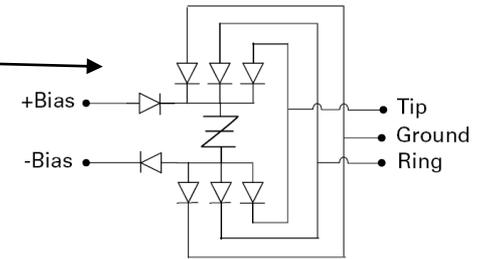
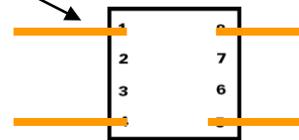
Breakthrough Package Size

- Tip & Ring Protection in one package
- 5 x 6 x 1.5mm Surface Mount Package
- Standard SO-8 Footprint
- Feed-thru PCB Layout

Package Size Comparison



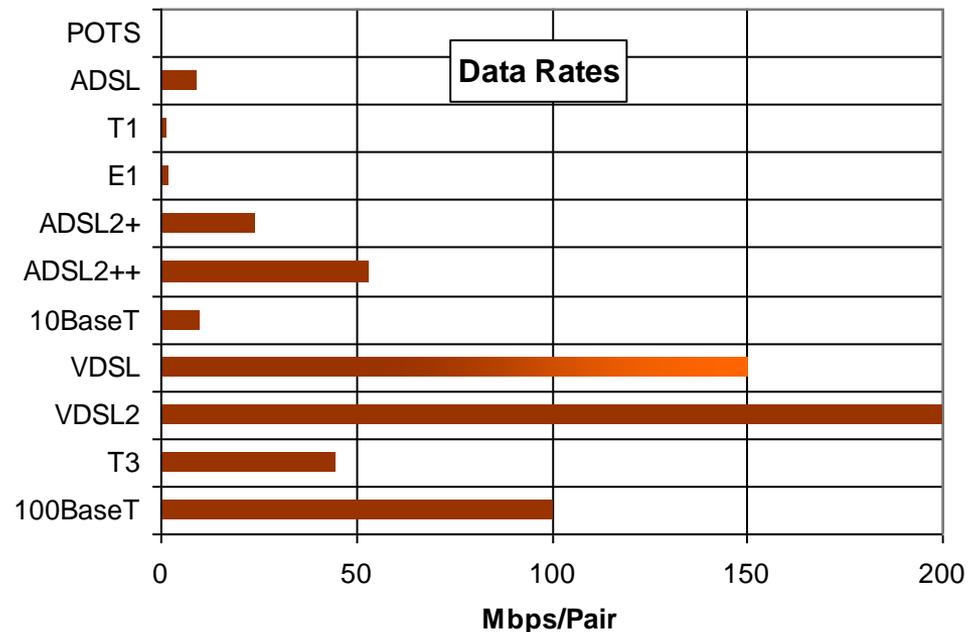
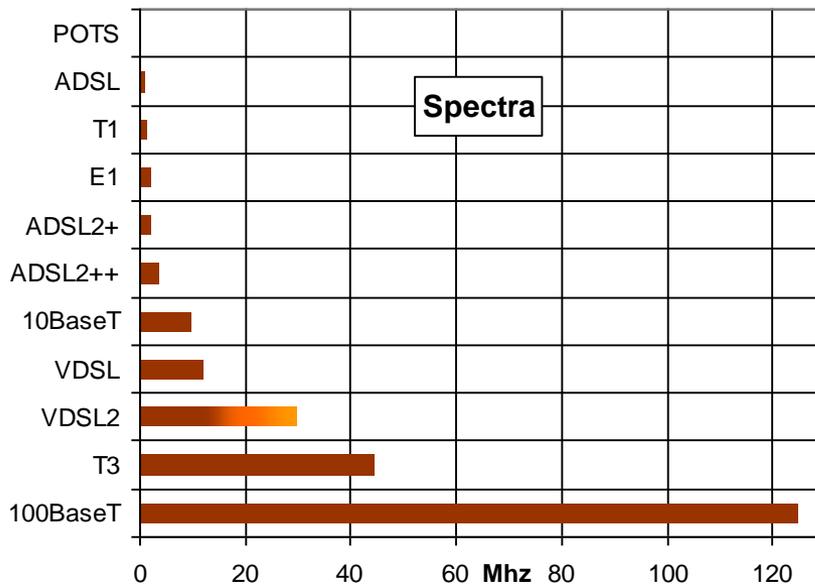
SDP / SEP





Broadband Overview

- Broadband encompasses many technologies and protocols.
- For this module we will be focusing on the xDSL technologies.
- xDSL uses complex coding schemes to pack more data into less bandwidth.





Low Capacitance

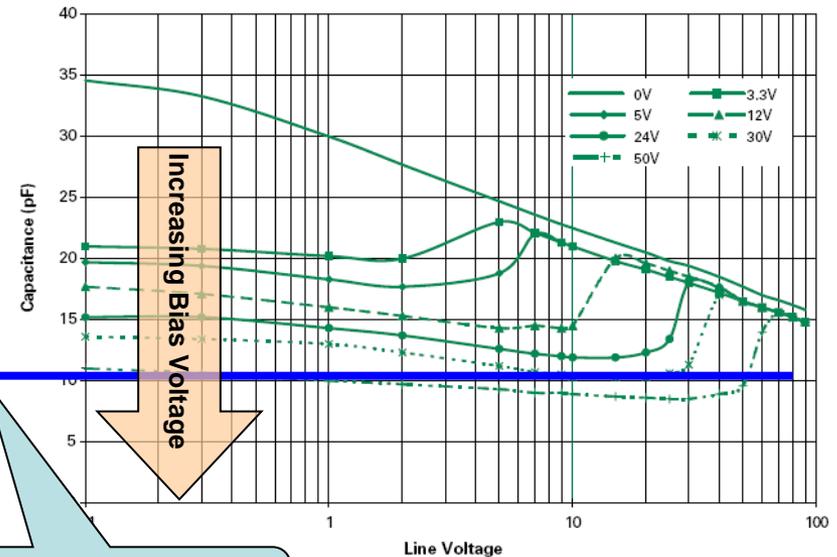
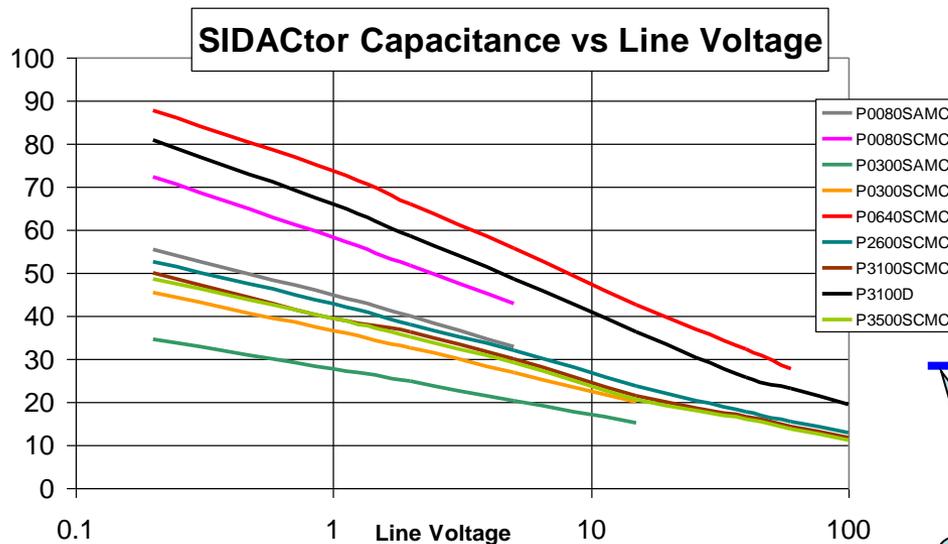
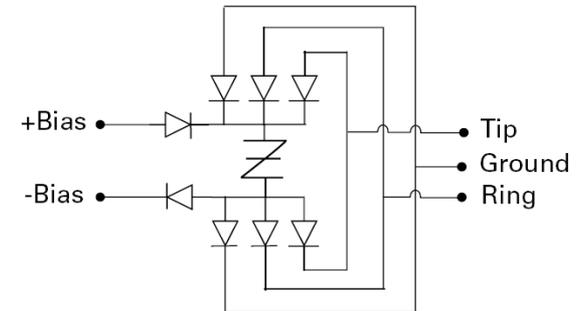
- High Capacitance will rob power from the signal.
- Capacitance gains in importance as the data rate of the signal increases.
 - Non-Issue for Voice, T1/E1
 - Minor Issue for T3, ADSL
 - Major Issue for VDSL, Ethernet
- **SDP & SEP devices have capacitance values that are low enough to preserve signal power.**

| Typical Capacitance Values (Zero Line Voltage) | |
|---|-------|
| SDPxxx0Q38CB $V_{BIAS} = 50V$ | 11 pF |
| SDPxxx0Q38B | 23 pF |
| SEPxxx0Q38CB $V_{BIAS} = 5V$ | 20 pF |
| SP03-3.3 | 9 pF |
| P0080SCMC | 73 pF |
| P0640SCMC | 93 pF |
| P1800SCMC | 57 pF |
| P3100SCMC | 50 pF |
| GDT | <1 pF |

Constant Capacitance / Changing Voltage



- Error-Free Broadband Requires Unchanging Capacitance As Line Voltage Varies
- Changing Capacitance Causes Data Errors
- Constant Capacitance Becomes More Critical as Data Rates Increase
- **Only the Patented Circuit of the SDP / SEP Can Offer Constant Capacitance in a Semiconductor Protector. (US Patent #7515391)**

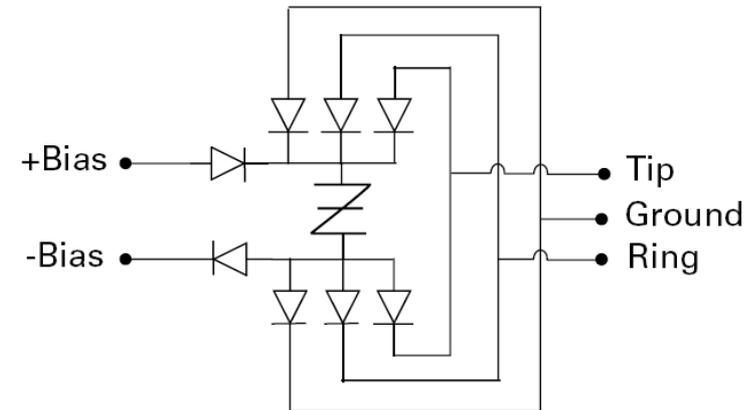


Ideal Constant Capacitance

A Perfectly Balanced Bridge



- One Robust SIDACtor Device
 - One V_S (T-R, T-G, R-G)
- Optimal Capacitance Balance to Ground
- Minimal Longitudinal Conversion Loss
- No Conversion of Common-Mode Events to Differential Mode

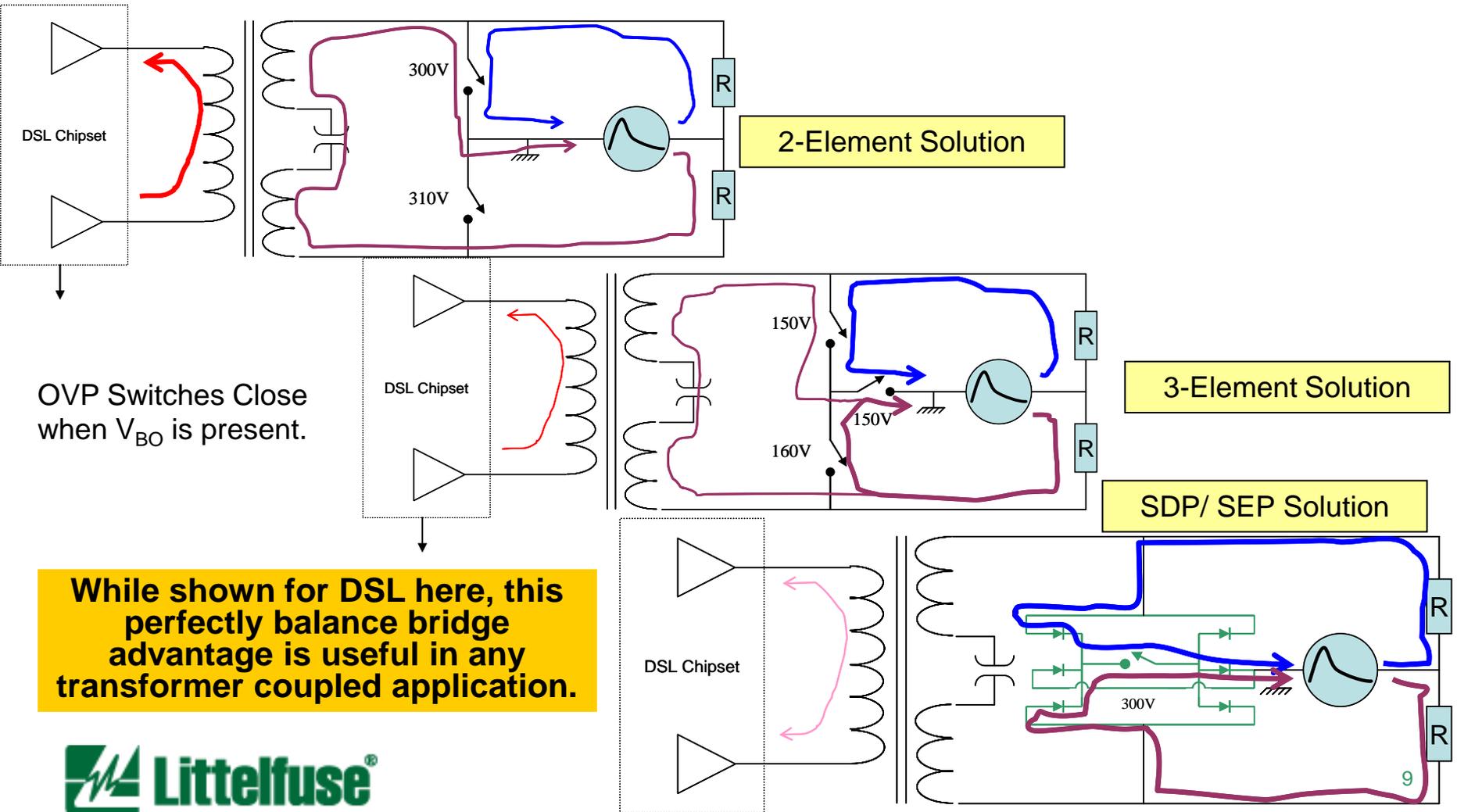


Transformer Coupled Applications

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No Conversion of Common-Mode Events to Differential Mode



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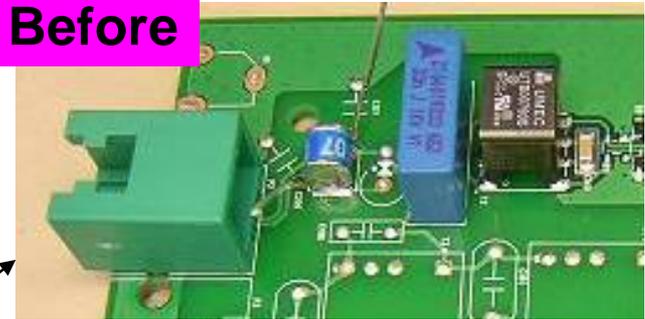
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SDP vs GDT

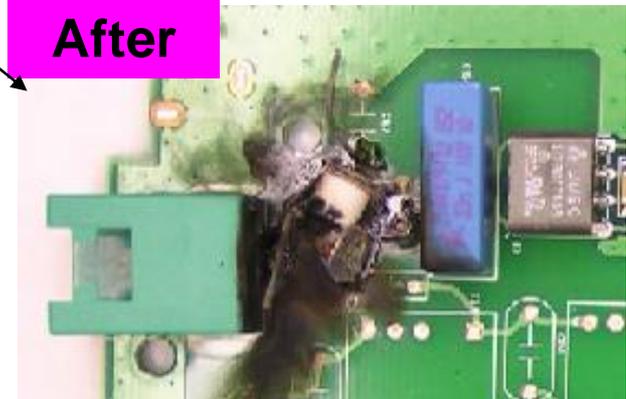


| Comparison | SDP / SEP | GDT |
|--|-----------|-------------|
| Acceptable Capacitance | Yes | Yes |
| Constant Capacitance | Yes | Yes |
| AC Power Cross Dissipation | Very Low | Very High |
| Low (< 75V) Breakover Voltages Available | Yes | No |
| Voltage Overshoot | Very Low | Very High |
| Board Space Req'd | Minimal | Substantial |
| Backside PCB Mount | Yes | Not Likely |

Before



After

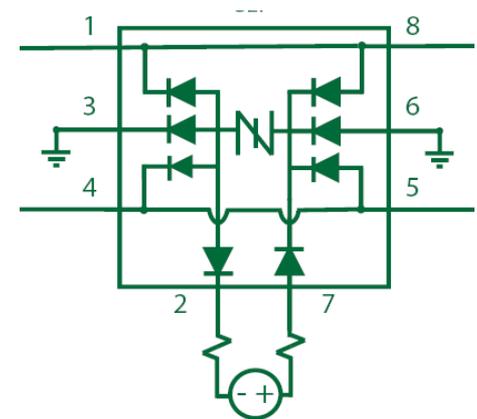




Seven SDP / SEP Biasing Rules

1. The bias voltage **MUST** be less than the SDP / SEP stand-off voltage. ($V_{\text{bias}} < V_{\text{drm}}$)
2. The bias supply may be ground referenced.
3. The bias supply may “float” with respect to ground.
4. The higher the bias supply voltage, the better the performance of the SDP / SEP. Just watch out for Rule #1...
5. We recommend 1 M Ω resistors for most applications.
6. The bias supply isolation resistors must be voltage rated to V_S to avoid flash-over during a surge event. (Usually 1206 for SDP or 0805 for SEP)
7. Several devices can share bias resistors.

Bias supply current will be $< 5\mu\text{A}$ if these rules are followed.



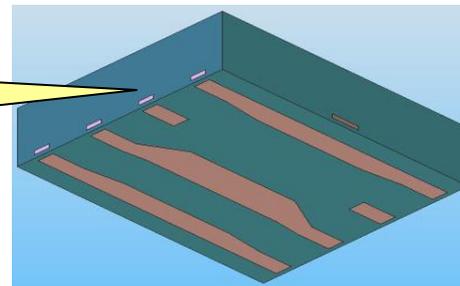
FAQ: Will My CM Have Trouble Mounting Your QFN Package??



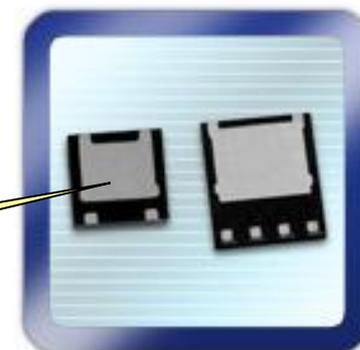
Not Likely!

While some CM's have had issues with other QFN packages, those concerns are usually associated with a central ground pad in the center of the package. Our QFN package does not utilize such a pad.

Littelfuse
QFN



Non-Littelfuse QFN
w/ pad

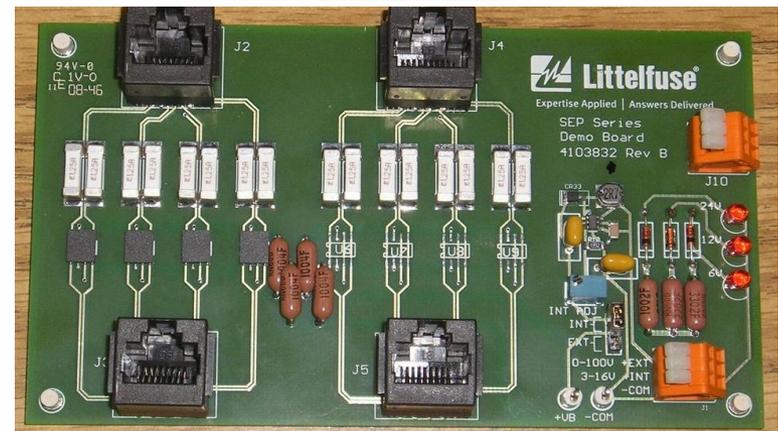
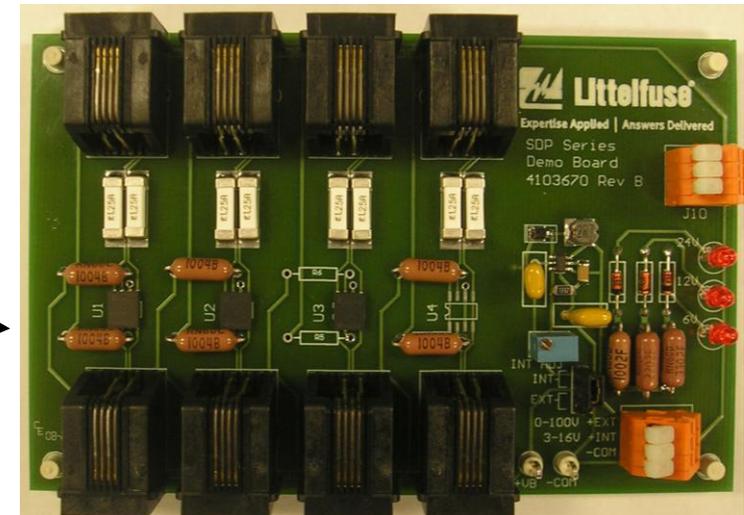


SDP / SEP Demo PCB

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- SDP Demo PCB
 - Four RJ11 Channels
 - Variety of SDP's Can be Specified
 - One Reference Channel
 - On-board 3 – 35V Bias Supply
 - External Bias Option
 - Enhanced TeleLink Fuses
- SEP Demo PCB
 - One 4-Pair Ethernet Channel
 - Variety of SEP's Can be Specified
 - One Reference Channel
 - On-board 3-35V Bias Supply
 - External Bias Option
 - Enhanced TeleLink Fuses



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SDP / SEP SIDACtor Overvoltage Protection Devices

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Thank You!



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