New Generation of Suppressor

PolyDiode™

- JumboTek, as a leading components manufacturer of over-voltage protection, has newly developed an innovatory product which is made of polycrystalline mixed oxide ceramics.
- This is the world 1st successfully researched and developed a semiconductor in ceramic protective device-PolyDiodeTM which combines the advantages of TVS diode and MLVand still offers you excellent electrical performance.

The Excellent Performance of PolyDiode

The specification comparison for PolyDiode, Silicon TVS diode and MLV(Multilayer Varistor) :

	Characteristics and features				
Device Type	Clamping factors (ratio of clamping voltage to breakdown voltage)	Peak current capability (8*20μs)	ESD durability (repetitive strike)(*1)	Response Time (*2)	Leakage current (*3)
PolyDiode	1.25~1.6(Excellent)	Excellent	>60000	<0.5nSec.	<5μA
TVS diode	1.3~1.6(Excellent)	N/S(*4)	Unidirectional<100 Bidirectional<1000	Between 0.8nSec. and 3nSec.	<100μA
MLV	1.8~3.5(Moderate)(*5)	Good	Between1000 and 10000	<1.0nSec.	<10μA

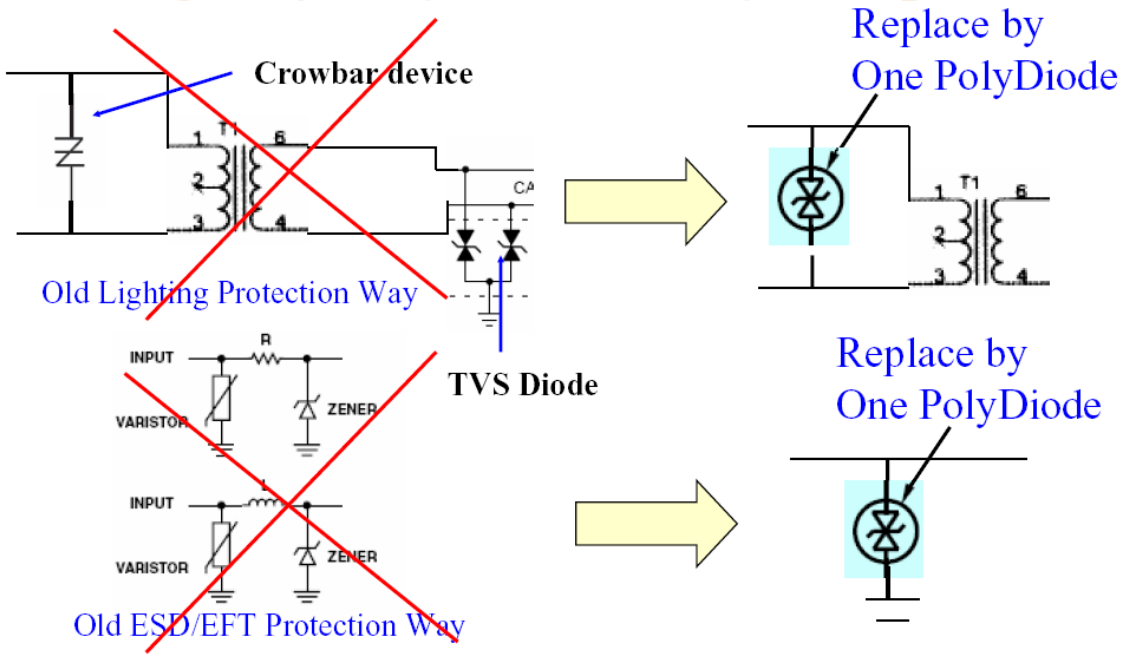
REMARKS:

(*1) Withstand ESD durability test severity of IEC 61000-4-2 level 4.
(*2) Fast time operation response to protect the USB components against the fast rise time of the ESD pulses.
(*3) Low leakage current to minimize the power consumption under normal operation conditions.
(*4) The TVS diodes are not sufficient for a peak surge current. PolyDiode keeps symmetrical I-V characteristics even after suppres fast voltage transients, including electrostatic
absorption and pulse noise absorption.
(*5) The main disadvantage of a MLV' s clamping voltage is typically higher than a comparable PolyDiode or TVS diode. MLVs a for ESD on less sensitive lines where their higher
clamping voltages can be tolerated.

Advantages of PolyDiode - Performance

- As we know, MLV's clamping rate is much higher than Zener diode. But PolyDiode even have better clamping rate (1.25-1.6. VS. Zener 1.3-1.6). Like MLV, PolyDiode also can stands over 10,000 times' surge.
- On the other hand, the response time and leakage current are also better than Zener diode.
- Replace the crowbar device and TVS diode by using one single PolyDiode even can get better performance.
- Replace MLV device and TVS diode in ESD and EFT protection by using one single PolyDiode even can get better performance.

Advantages of PolyDiode – Layout Space



Advantages of PolyDiode- Cost

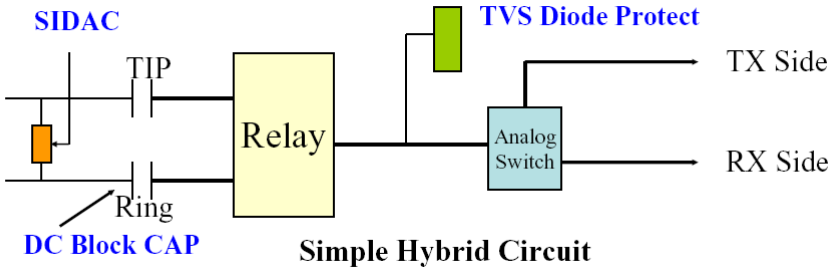
- As usual the price of MLV product is 30% to 40% lower than one single Zener diode. Compared to TVS diode, PolyDiode even can be lower than 60%.
- PolyDiode with processing improvement has the lower cost than TVS Diode.
- A lot of current TVS manufactures have moved to high profit products,like solar cell, and the production quantity of TVS diode has dropped. The price of TVS diode in some areas even rose 40%.
- For cost and lead time issue, it is good time to revise the design to PolyDiode.

Case Study

- In the following section we will demonstrate some difficult cases happened in current industry and how PolyDiode solve those problems.
- First case is one telecom company's POTS tester.
- Second case is another case of C.O side's xDSL test system.
- Third case is DC plug-in protection of handheld device.
- Fourth case is on commercial USB product of ESD protection.
- After those real cases, we will also present other applications on AC power.

Case 1- POTS Tester

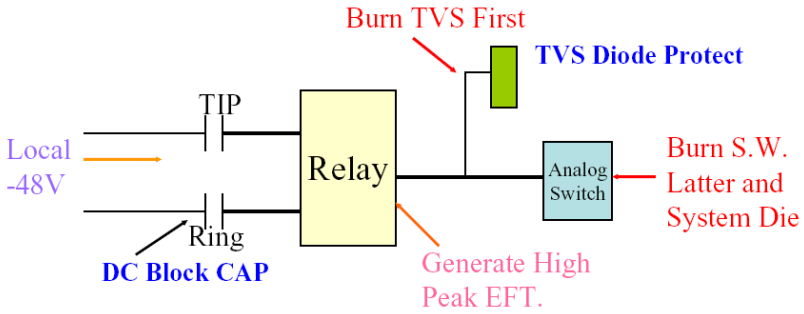
Background: One company developed a POTS tester. This tester needs to measure the frequency ranged from 20Hz to 200KHz. Using the transformer to isolate external and internal components is a traditional design way. But it is impossible to find the small transformer fitting in small handheld device with so broad range. So designer sacrificed the transformer and just used simple analog switch on hybrid circuit.



Simple Hybrid Circuit

Problem: Although this circuit provides the standard lighting surge protection and DC block CAP, relay click still makes high peak's EFT.

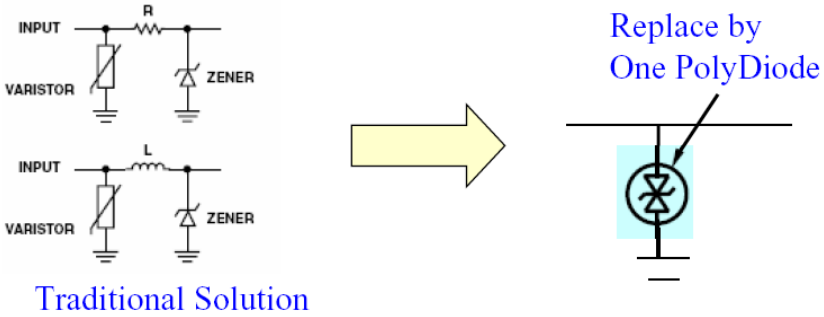
Especially when system ran in DID or GND start mode, unit needs to provide local –48V. In this situation several times' relay clicking will burn TVS diode. After TVS burned, analog switch will be burned without any protection.



Case 1- Solutions

Traditionally we can use small varistor and resistor or inductor to fix this problem. But it definitely will increase the in-serial resistor and attenuate the signal. After in-site trial, we need to put up to 1K resistor to make it work. That is so big loss.

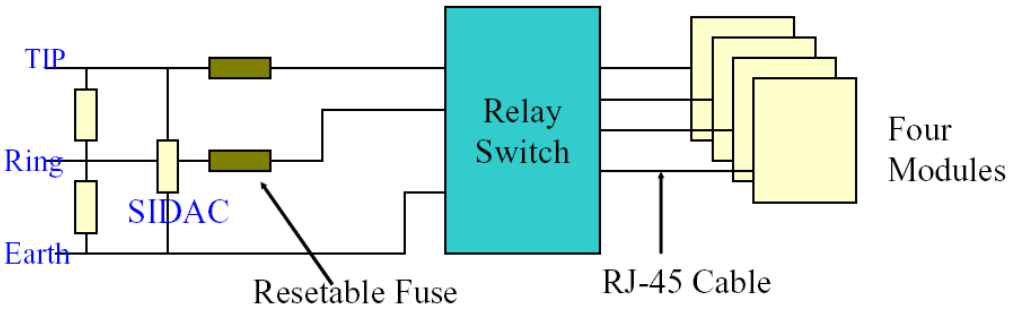
By using PolyDiode, it is not necessary to sacrifice the measurement performance. It also can save cost and reduce lay-out space.



Traditional Solution

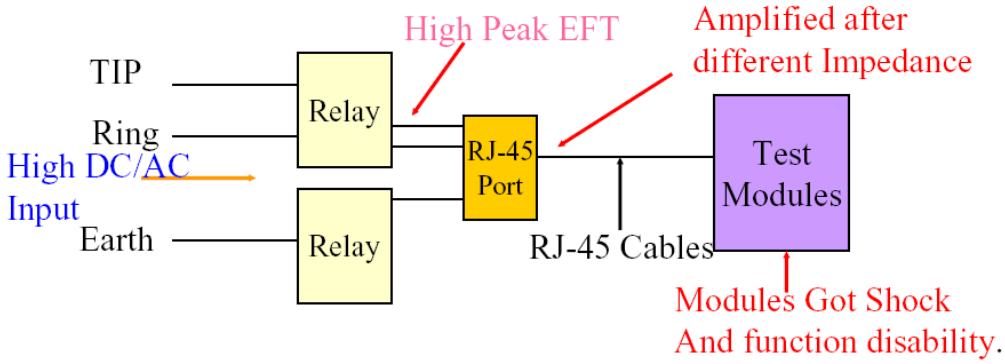
Case 2- xDSL Test System

Background: This case happened in same telecom company. This system is to test the property of xDSL copper loop and do the modem simulation. There is one single port input and used relay to switch to four different modules. From the block diagram we can see this system provided very good lighting protection circuit.



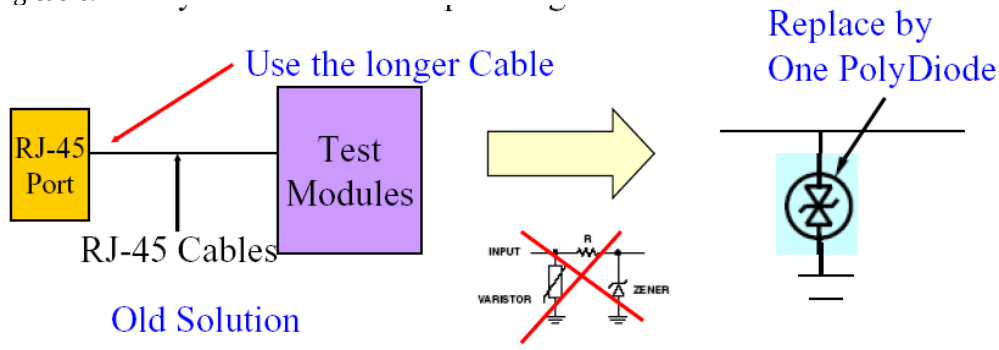
Case 2- xDSL Test System Cont.

Problem: This system's problem happened in RJ-45 port. When high DC/AC input, relay produces the some EFT. As usual those modules still can stand this EFT. But when signal went from low impedance's PCB trace to higher impedance RJ cable (about 26 AWG), the EFT had been amplified and disable the system function.



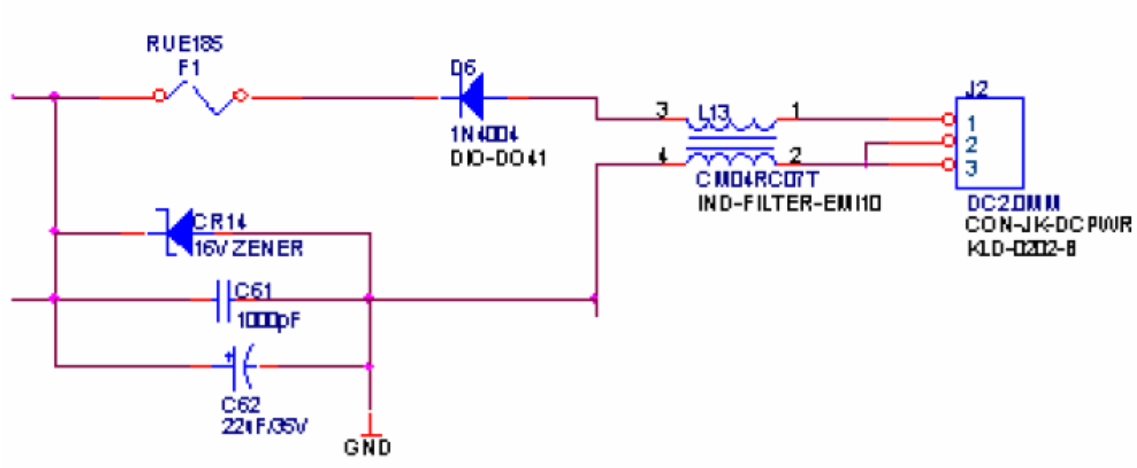
Case 2- Solution

This system is for Copper Loop Test. It needs to measure loop length. So they really can't use varistor, zener and resistor like case 1, because it won't get accurate loop length. So they used the first principle of surge protection- To attenuate transients, thus preventing their propagation into the sensitive circuit. Put longer cable between RJ-45 port and test modules. By using PolyDiode, it is not necessary to put longer cable. Sometime the chassis may be too crowd to put long cable.



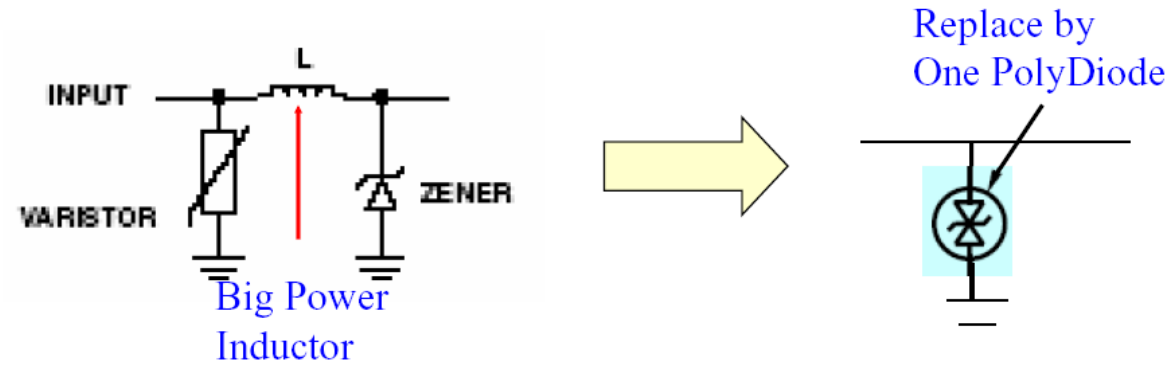
Case 3- DC Charger Plug-In

Background: Most of handheld devices need to use plug-in DC charger to get power. The picture shows the traditional protect circuit we mentioned in previous section. But once ESD or EFT is so high to burn Zener diode. There is no surge protection any more. Another surge may damage this device.



Case 3- Problem and Solution

Problem: By using a varistor, inductor, and Zener diode we can fix this problem. But another problem is we have to use very big power inductor providing high current capability and low in-line resistor. It may not have enough space for small handheld devices. Solution: It is the simplest way to use PolyDiode.



Case 4- Small USB Devices

Background: When our sales demonstrated PolyDiode in Mongolian, we found out ESD problem is very serious there. At that time we just plugged in non-protected ESD devices and killed this USB device right away. Traditionally industry still used the TVS diode to protect USB port.(see picture below).

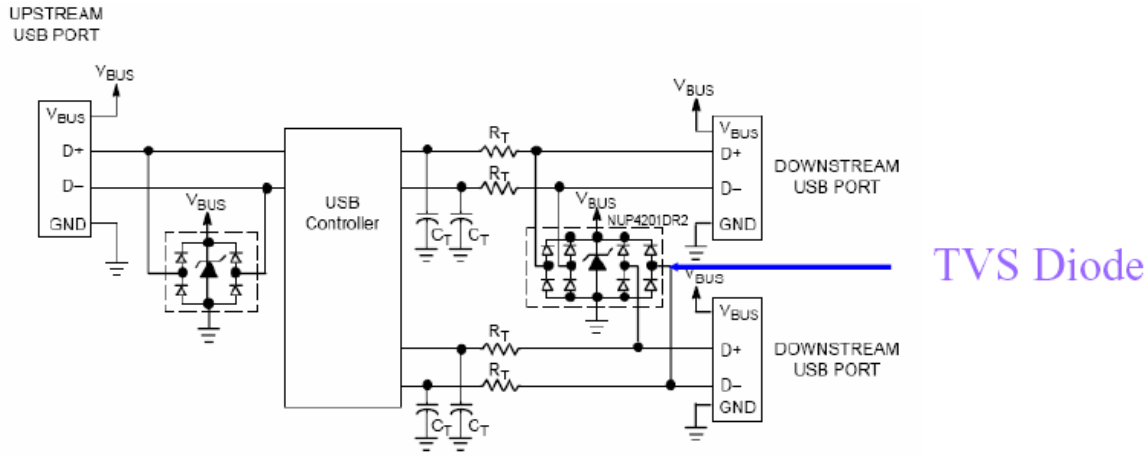
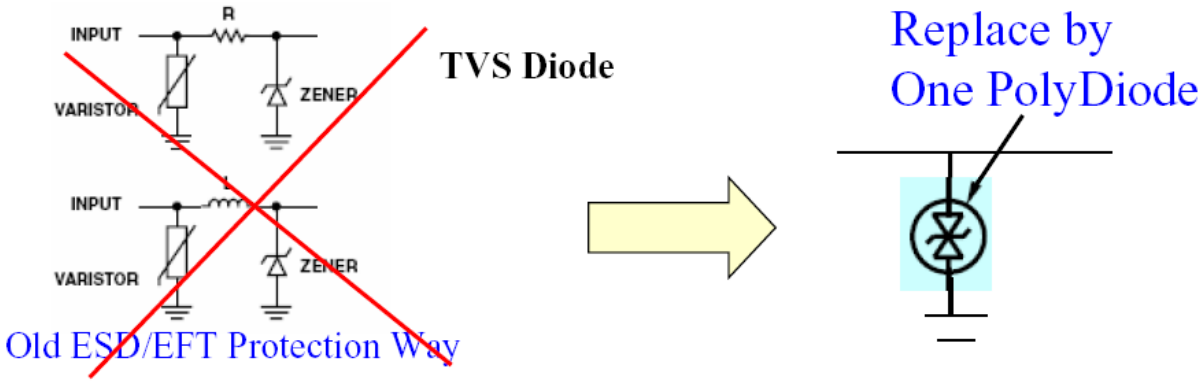


Figure 16. ESD Protection for USB Port

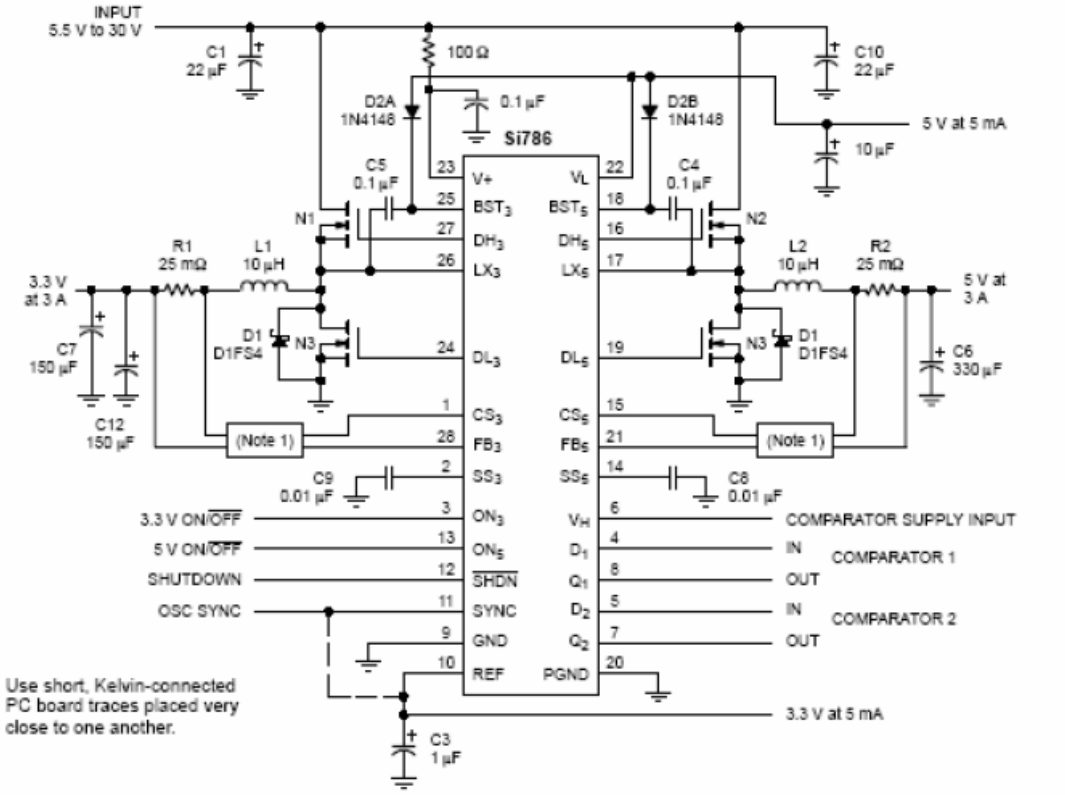
Case 4- Problem and Solution

Problem: Same problem like before, TVS diode will be burned after several times' surge. By using a varistor, resistor, and Zener diode we can fix this problem. But the problem is some USB devices like jump drive is very small. How can we fit more circuits? On the other hand adding extra resistor also have some impact on transmission rate.
Solution: It is the simplest way to use PolyDiode.



Case 5 – Switching Power Supply Burned

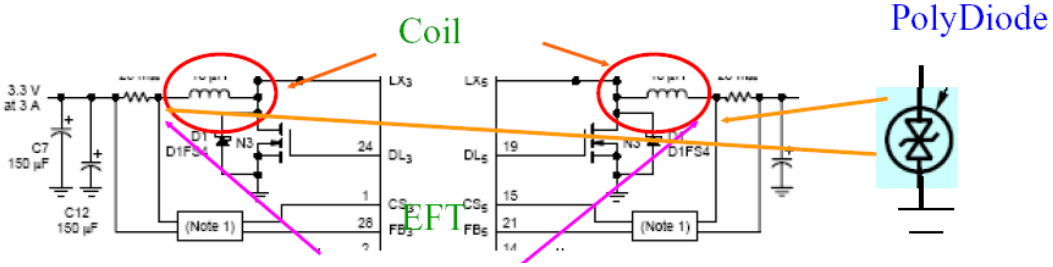
Background: That is a typical switching power supply circuit in electronic device.
From this reference design we can't see any EFT protection circuit.



From Vishay SI-786 Ref Design

Case 5 – Problem and Solution

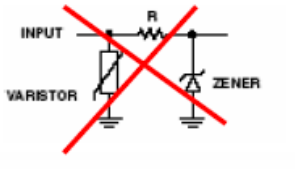
Problem: In the production line manufacture found the burned rate of this IC is very high. After analysis, CS(current sense) and FB(feedback) pins are easy to be burned. That is a typical EFT problem. The coil will generate EFT when power switches via coil.
Solution: Adding protection circuit to take out surge. Same thing like previous cases, it is hard to get good result by using the combination of varistor and Zener because the in-line resistor will drop voltage and FB can't get accurate feedback value. PolyDiode can provide very good solution.



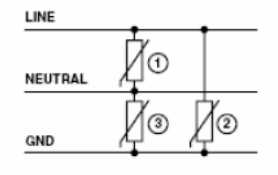
Another Cases' Study

Background: The following pictures show the traditional varistor protect circuit on three wires(Tip, Ring Earth or AC Power Line).

Problem: As we know, MLVs can't provide the good clamping characteristics. So we have to add Zener and resistor(or inductor). It definitely increased a lot of components and design effort.



Solution: It is the simplest way to use PolyDiode.



Single Phase

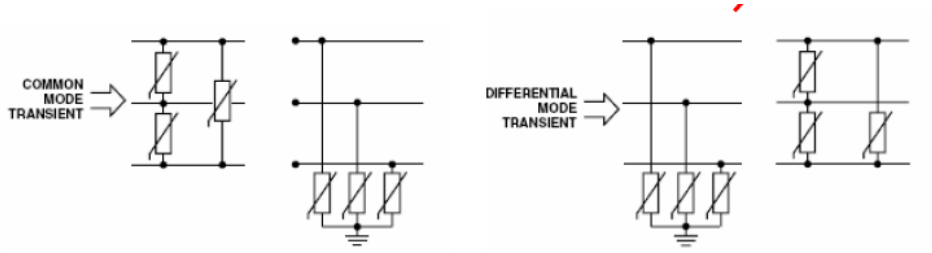


FIGURE 25A. INCORRECT FIGURE 25B. CORRECT FIGURE 26A. INCORRECT FIGURE 26B. CORRECT

Three Phase

Summary of Case Study

Although traditional protection components can provide some solutions to fix the problems happened in previous cases, they are not perfect.
We need the revolution and better solution on surge protection.

The answer is PolyDiode.

For more information please ask to :

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or have a look to :

www.asiatronix.com