Protection Zener Series

A new application in LED field

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1. LED needs protection

Background

Electronic systems or components are sensitive to both external and internal sources of overvoltage transients. This can be in the form of external Electro-Static Discharge (ESD) or internally generated Electrical Fast Transients (EFT).

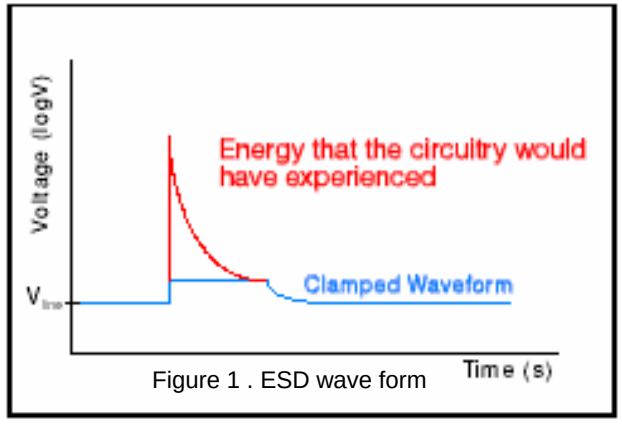


Figure 1 . ESD wave form

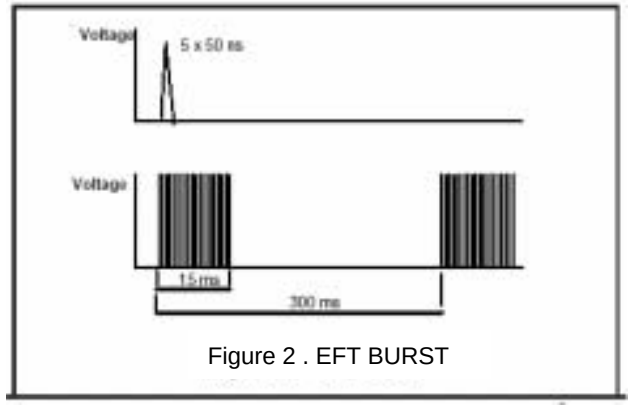
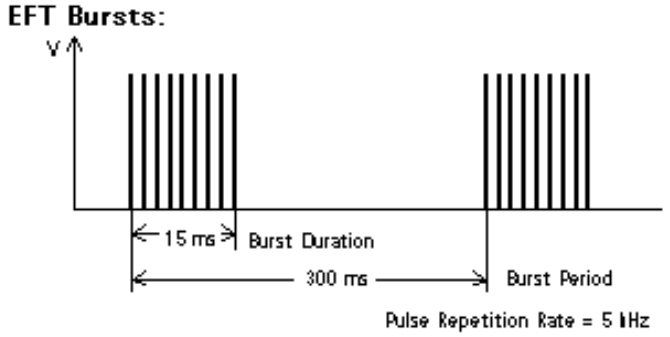
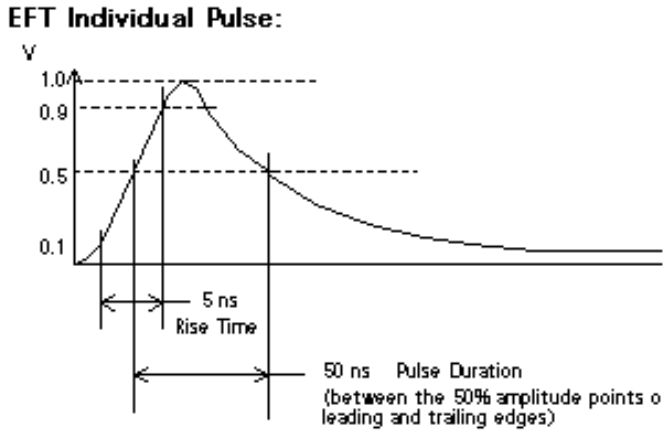


Figure 2 . EFT BURST

1. LED needs protection ---Cont'd

Of particular concern are EFT disturbances most often caused by transient currents (commonly called arcing) during a make or break of contact, and sudden changes in the magnitude and direction of currents in everyday office equipment, such as copiers, pencil sharpeners, and power switches.





1. LED needs protection ---Cont'd

High Brightness White/Blue/Green LED lamps with Sapphire substrate are basically fragile by ESD Surge. Wollemi Technical Incorporation's Zener Diodes are used for the safeguard of LEDs to prevent from ESD surge.

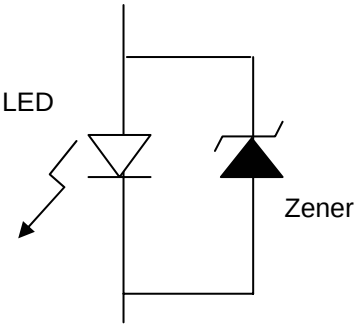


Fig. 3 General connection of Zener diode with LED chip

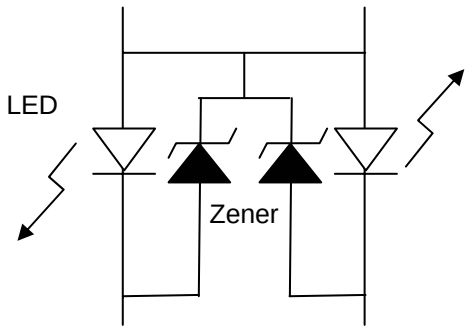


Fig. 4 Single Chip Dual Pad Parallel Connection

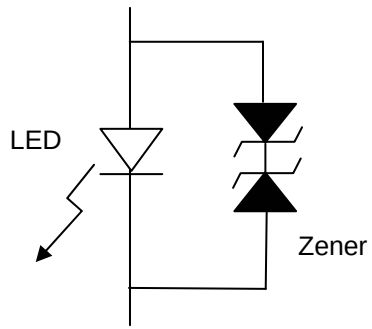


Fig. 5 Single Chip Dual Pad Series Connection (Cathode to cathode)

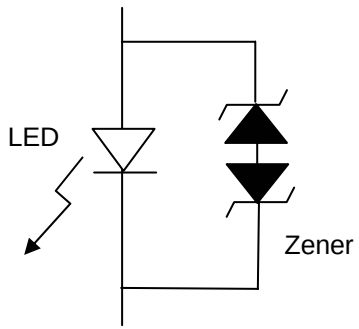
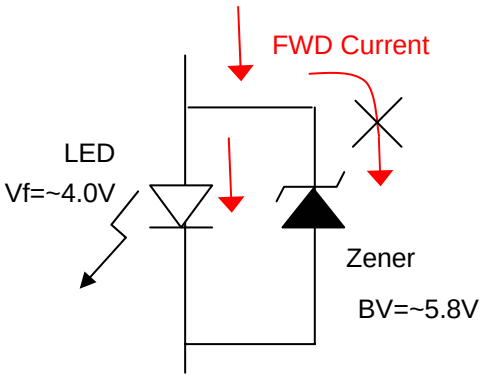
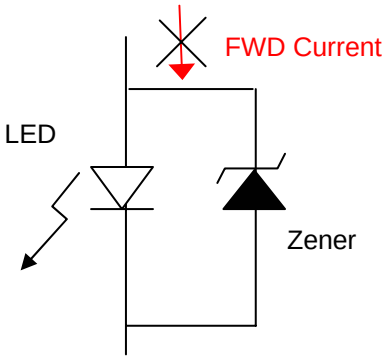


Fig. 6 Single Chip Dual Pad Series Connection (Anode to Anode)

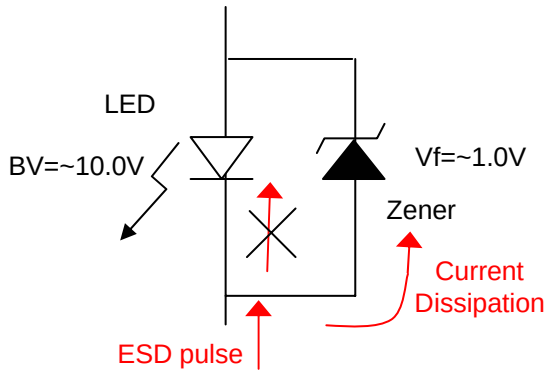
2. How zener diode works (ex. With blue LED)



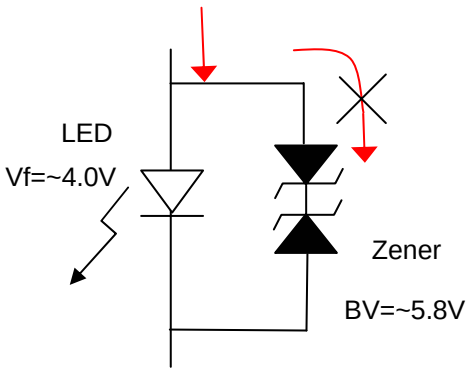
LED Lite state

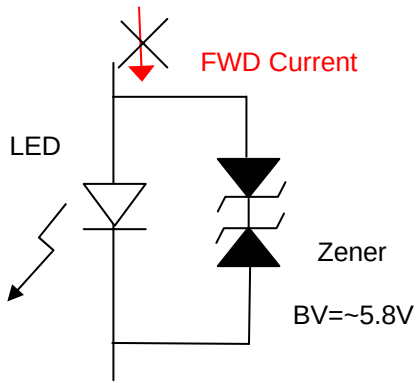


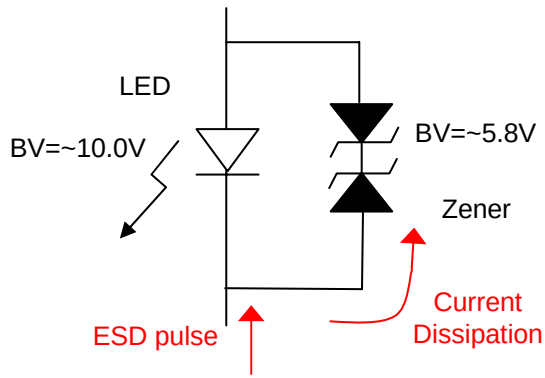
LED off state



Zener protection active



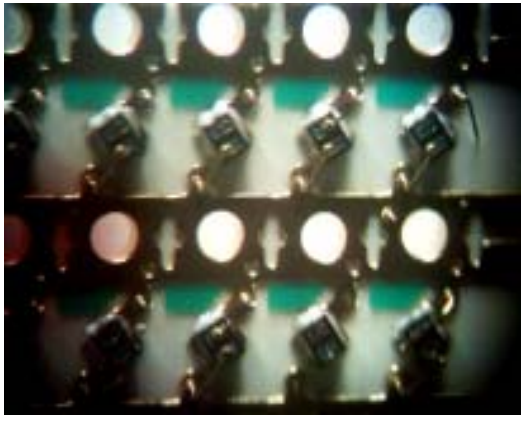




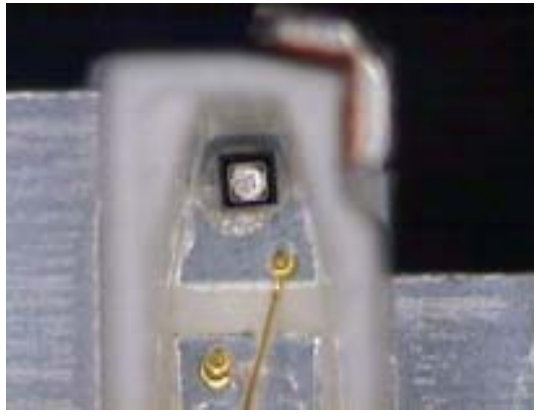
3. Connection of zener diode

Bi-directiom connect

Single directiom connect



Bi-directiom connect



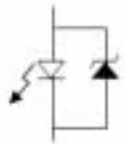
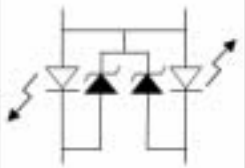
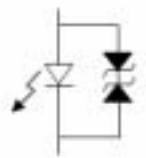
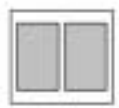
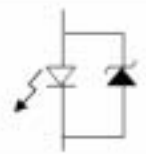
Single directiom connect

4. Zener diode selection

Zener Selection reference Table

Item	LED			Zener					Remark
	PKG	Type	Dim.	Pad	Pad layout	Bv	DIM. (mil)	Application	
1	SMD	RGB	-	Dual	P-top	5.8	10x10	Parallel Common Cathode	
			-	Dual	P-top	5.8	10x14	Parallel Common Cathode	
2	SMD	Blue	-	Dual	P-top	5.8	10x10	Parallel bi-direction	
			-	Single	P-top	5.8	8x8	Parallel Reverse	
3	SMD	Green	-	Dual	P-top	5.8	10x10	Parallel bi-direction	
			-	Single	P-top	5.8	8x8	Parallel Reverse	
4	Lead Frame	White	-	Single	P-top	3.6	14x14	Parallel Reverse	Cell phone flash
			-	Single	P-N same side	5.8	10x14	Parallel Reverse	Super Bright
5	Lead Frame	Blue	-	Single	P-top	5.8	8x8	Parallel Reverse	
			-	Dual	P-top	5.8	10x10	Parallel bi-direction	
6	Lead Frame	Green	-	Single	P-top	5.8	8x8	Parallel Reverse	
			-	Dual	P-top	5.8	10x10	Parallel bi-direction	

5. WTI current product line up

Item	Chip type	Chip size (mil)	Zener Voltage Vz (V)	Annotation	Pattern	LED Circuit
ZW02-5.8-SAL8	P/N	8*8*5	5.8	1. One Al wire bonding Pad 2. Parallel with one LED 3. Standard products		
ZW02-5.8-SAL8S		8*8*4	5.8			
ZW025-5.8-SAL10		10*10*5	5.8			
ZW05-5.8-SAL14		14*14*5	5.8			
ZW0125-5.8-DAL10		10*10*5	5.8	1. Two Al wire bonding Pad with common cathode 2. Parallel with two LED 3. Standard products		
ZW025-6.8-DAL1014		10*14*5	6.8			
ZW0125-5.8-DAL10I	P/N/P	10*10*5	5.8	1. Two Al wire bonding Pad 2. Parallel with one LED 3. Preliminary products		
ZW025-6.8-DAL1014I		10*14*5	6.8			
ZW02-6.0-SAL8.5R	N/P	8.5*8.5*5	6.0	1. One Al wire bonding Pad 2. Parallel with one LED 3. Standard products		

6. FAQ

1.) What is zener diode for in LED application?
Ans: ESD/EFT power dissipation.

2.) Why need to use this zener in LED?
Ans: Protect Blue/Green/White LED chips.

3.) Which LED need to use this zener in LED?
Ans: Blue/Green/White.

4.) How to use this zener in LED?
Ans: Reverse parallel connected with LED or use bi-direction connection.

5.) How can I measure reverse leakage of LED?
Ans: Use bi-direction zener instead.

6.) What is the min. thickness of zener diode?
Ans: 4 mil available by request.

7.) Pad metal Ag & Al , which's better?
Ans: It depends on customer's bonding parameter.

8.) Can provide fully tested chips?
Ans: Yes! But cost more.

9.) What is the ESD performance?
Ans: Per Jedec std. our zener can survive through 8000V/HBM with 8 mil chip

10) Why the top surface of your some series is not planar?
Ans: Because we use Al alloy diffusion technique it need a guard ring to keep all parameter in spec.

7. Appendix

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HBM(Human Body Mode): Per JESD22-A114-B

CLASS 0: Any part that fails after exposure to an ESD pulse of 250 volts or less.

CLASS 1A: Any part that passes after exposure to an ESD pulse of 250 volts but fails after exposure to an ESD pulse of 500 volts.

CLASS 1B: Any part that passes after exposure to an ESD pulse of 500 volts, but fails after exposure to an ESD pulse of 1000 volts.

CLASS 1C: Any part that passes after exposure to an ESD pulse of 1000 volts, but fails after exposure to an ESD pulse of 2000 volts.

CLASS 2: Any part that passes after exposure to an ESD pulse of 2000 volts, but fails after exposure to an ESD pulse of 4000 volts.

CLASS 3A: Any part that passes after exposure to an ESD pulse of 4000 volts, but fails after exposure to an ESD pulse of 8000 volts.

CLASS 3B: Any part that passes after exposure to an ESD pulse of 8000 volts.

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MM(Machine Mode): Per JESD22-A115-A

CLASS A: Any part that fails after exposure to an ESD pulse of 200 volts or less.

CLASS B: Any part that passes after exposure to an ESD pulse of 200 volts, but fails after exposure to an ESD pulse of 400 volts.

CLASS C: Any part that passes after exposure to an ESD pulse of 400 volts.

7. Appendix---Cont'd

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Per MIL-STD-883E

Class 1 0 volt to 1,999 volts

Class 2 2,000 volts to 3,999 volts

Class 3 4,000 volts and above

7. Appendix---Cont'd

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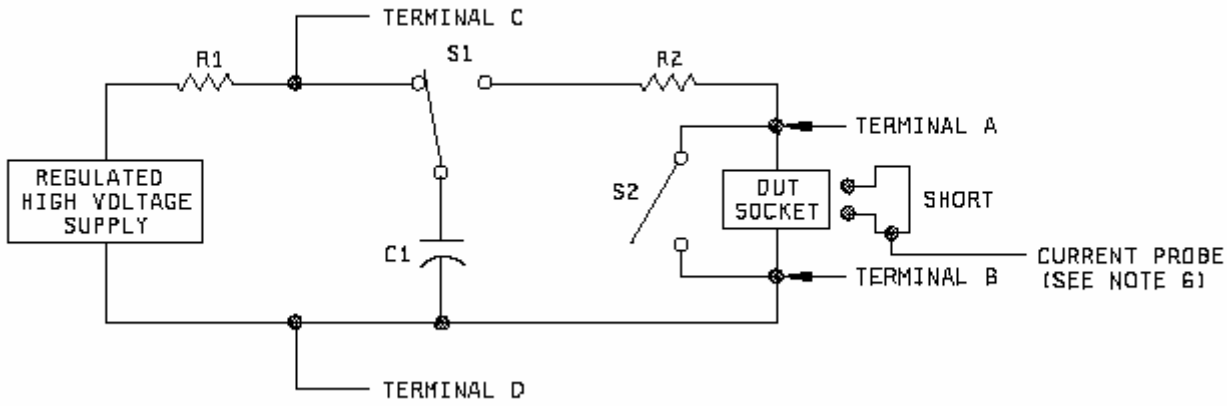

R1 = 106 ohms to 107 ohms

C1 = 100 picofarads ±10 percent (Insulation resistance 1012 ohms minimum)

R2 = 1,500 ohms ±1 percent

S1 = High voltage relay (Bounceless, mercury wetted, or equivalent)

S2 = Normally closed switch (Open during discharge pulse and capacitance measurement)

MIL-STD-883E ESD classification test circuit (human body model).

7. Appendix---Cont'd

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IEC 61000-4-4 : Electrical Fast Transient/Burst

1 - Well Protected
2 - Protected
3 - Typical Industrial
4 - Severe Industrial

	Peak Amplitude			
	Power Supply Port		I/O, Signal, Data & Control Lines	
Level	V_{oc} (kV)	I_{sc} (A)	V_{oc} (kV)	I_{sc} (A)
1	0.5	10	0.25	5
2	1	20	0.5	10
3	2	40	1	20
4	4	80	2	40