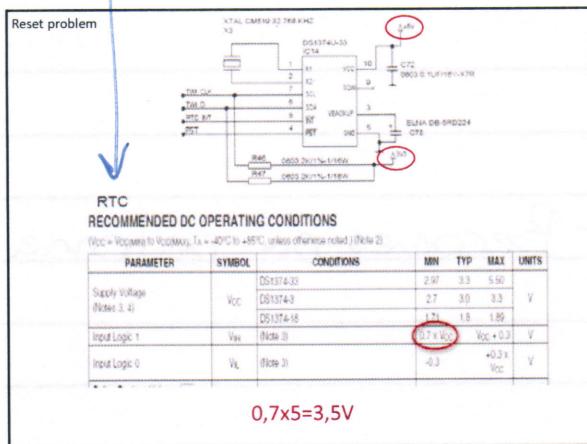
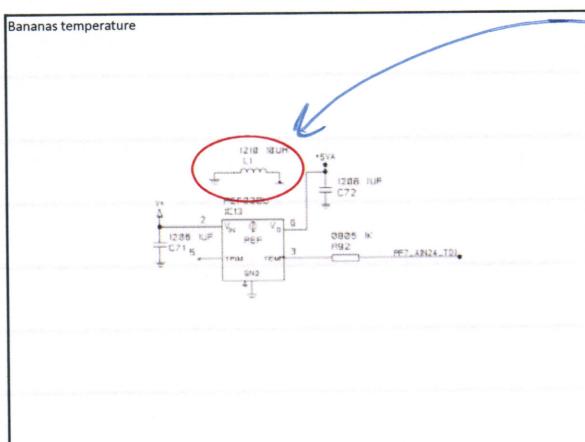
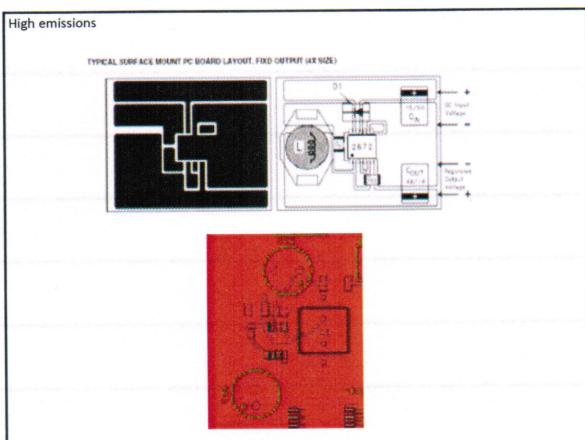
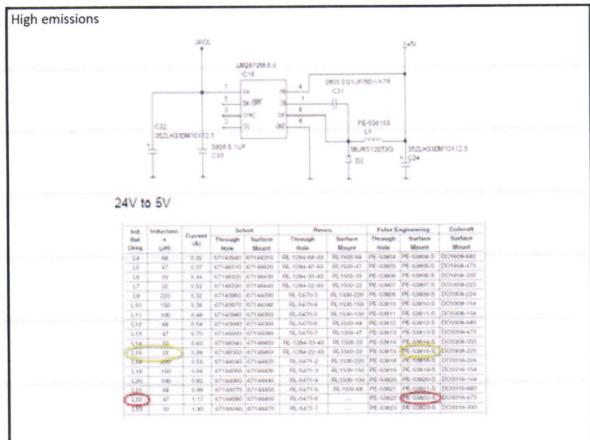


# Real Time Clock

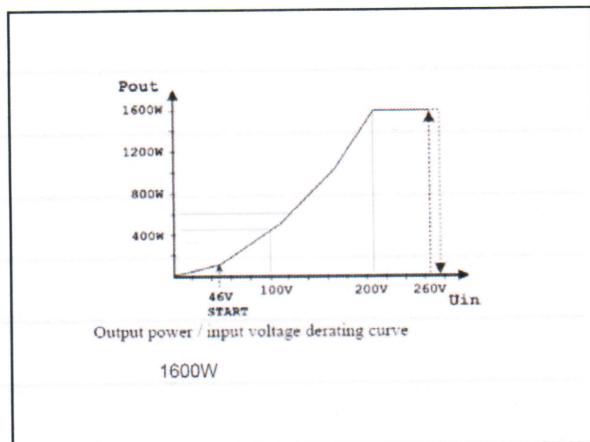


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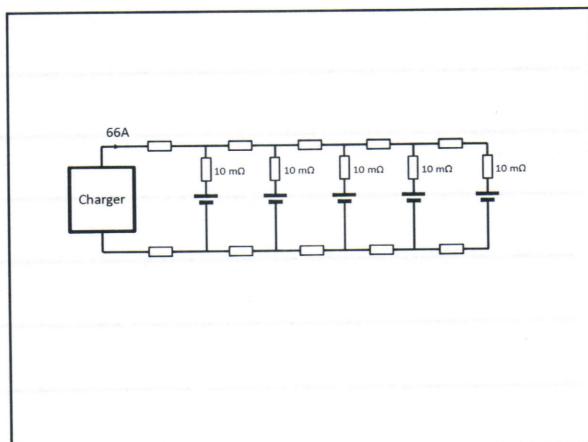


- Will cause potential of ground planes to differ because of resistance (reactance). Was done to separate digital and analog ground → Bads

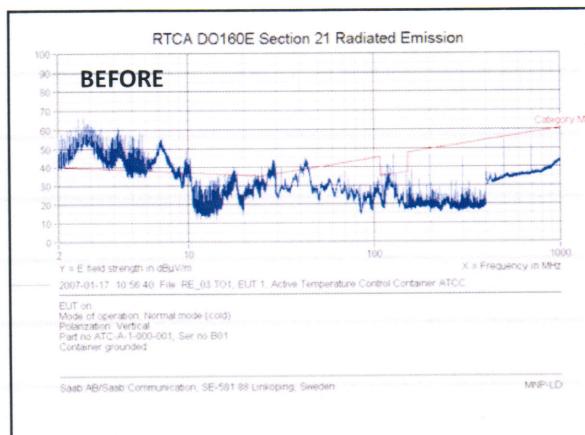
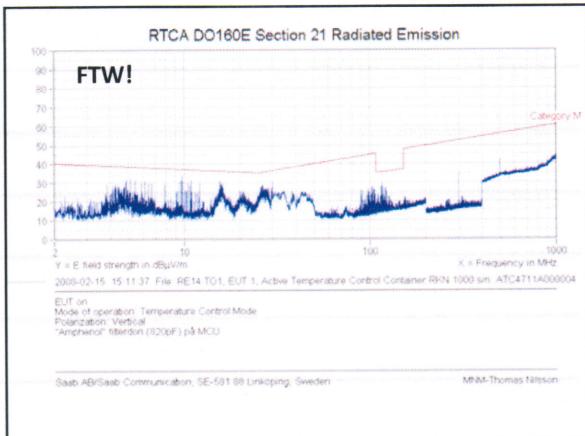


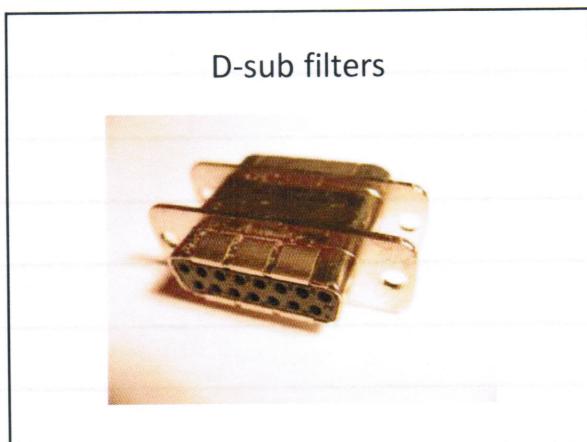
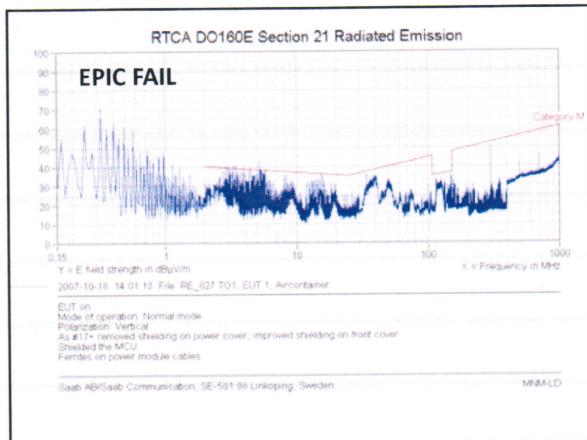
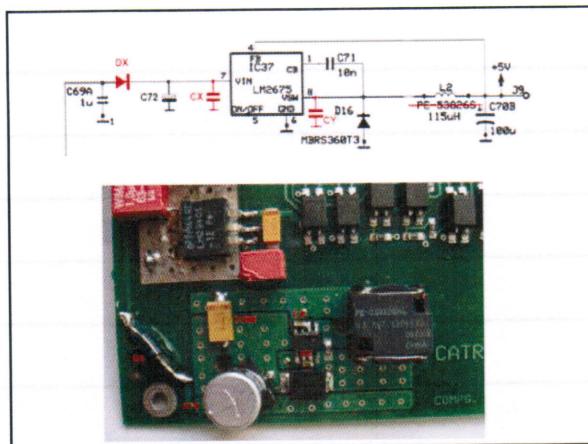
Output power / input voltage derating curve

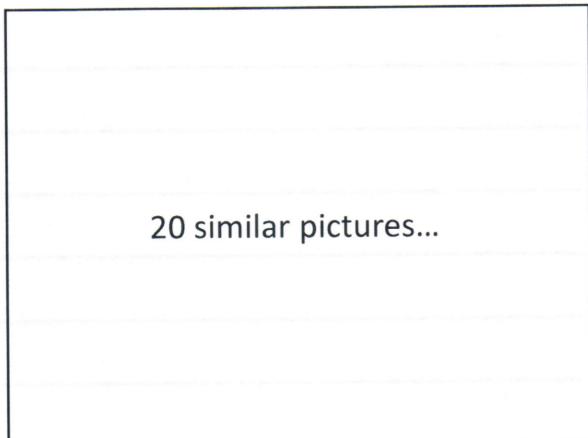
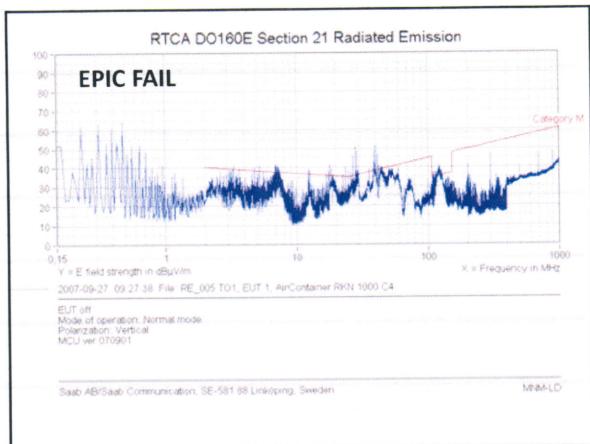
1600W



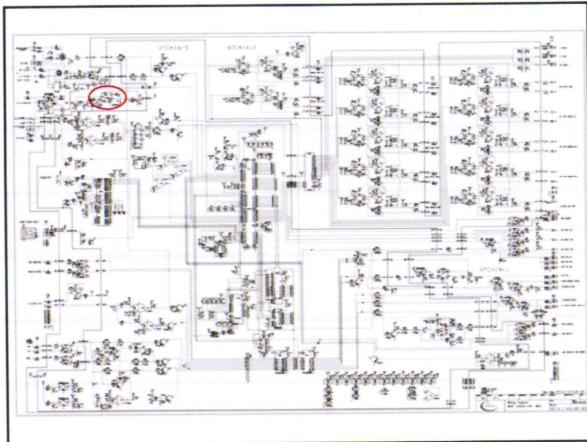
EMC time - fingers crossed...







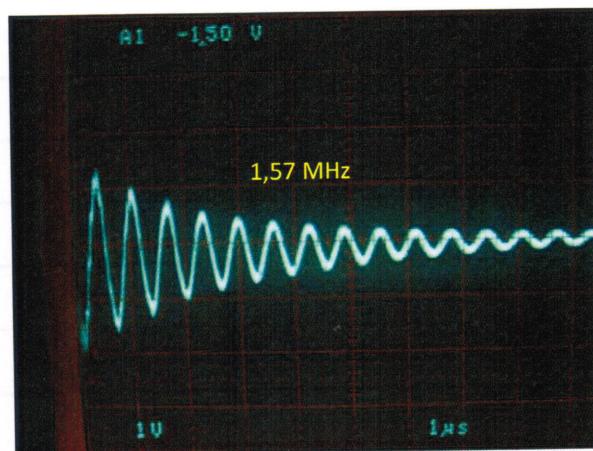
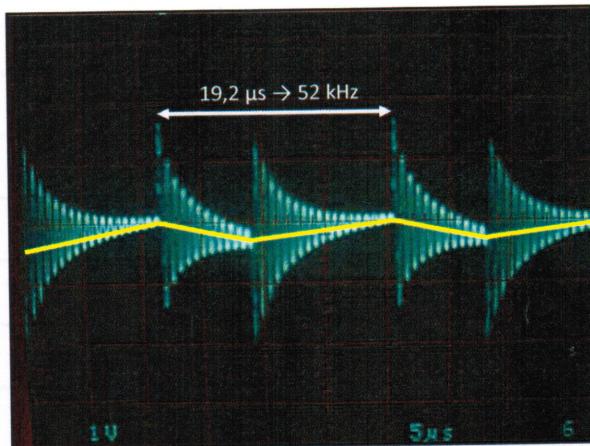
20 similar pictures...



Electrical Specifications @ 25°C—Operating Temperature -40° to +						
Pulse <sup>6</sup> THT Part Number	Pulse <sup>6</sup> SMT Part Number	National Part Number	In Circuit Operating Parameters <sup>1</sup>			Nominal DCR (Ω)
			Nominal Inductance (μH)	Rated Current (Amp)	Max <sup>2</sup> E <sub>T</sub> <sub>OP</sub> (Volts)	
PE-53826	PE-53826S	LM259X-L26	377	0.68	75.9	1.0
PE-53827	PE-53827S	LM259X-L27	248	0.83	72.6	0.6
PE-53828	PE-53828S	LM259X-L28	168	1.02	56.1	0.4
PE-53829	PE-53829S	LM259X-L29	112	1.25	42.9	0.3
PE-53830	PE-53830S	LM259X-L30	77	1.54	39	0.2
PE-53831	PE-53831S	LM259X-L31	53	1.87	26.4	0.13
PE-53932	PE-53932S	LM259X-L32	37	2.24	19.8	0.10
PE-53933	PE-53933S	LM259X-L33	24	2.74	16.5	0.07
PE-53934	PE-53934S	LM259X-L34	17	3.0	13.2	0.05

42.9 < 115

@ 150 kHz



## Guesswork

- Common ground plane
- Conductive treatment of aluminium surfaces
- Better grounding
- Shielding
- Shielding of cables
- Investigation of the condenser fan

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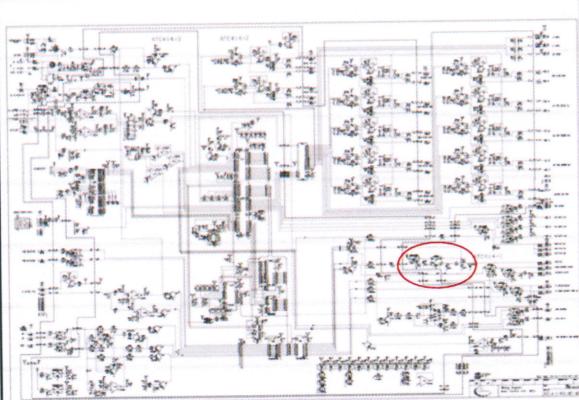
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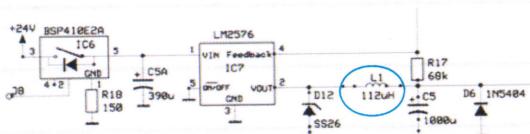


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## Condenser fan driver



Recommendation:  
Check L1. Use the formulas in the LM2576 datasheet to calculate the value.

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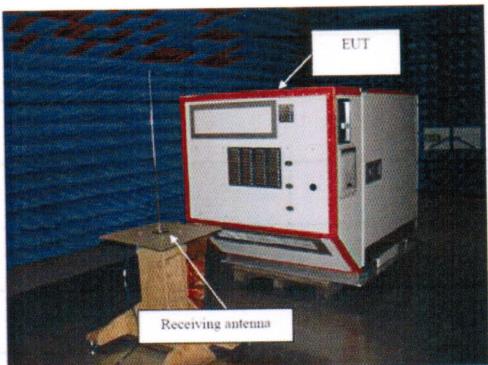
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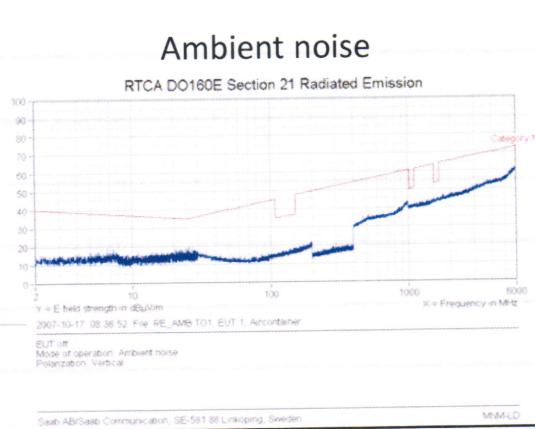
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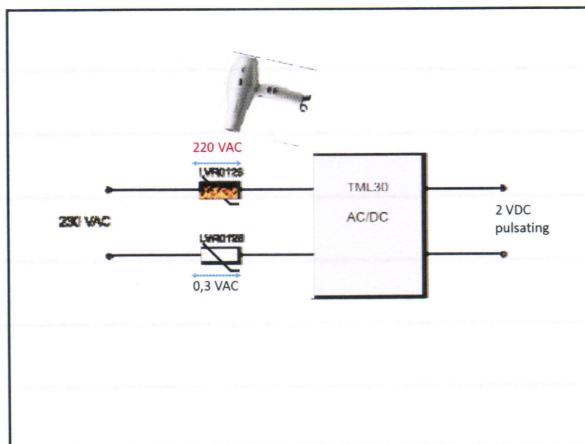
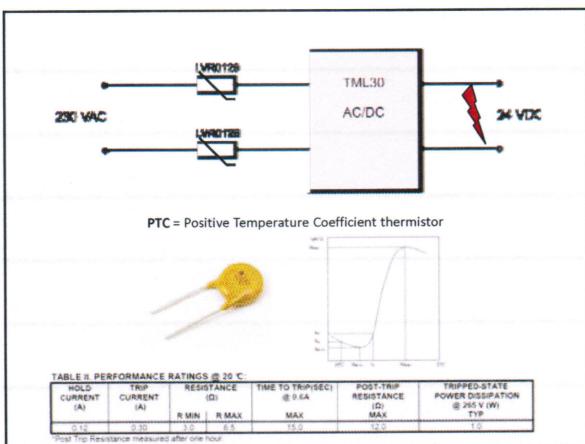
Picture 1: Basic test setup in the SAC



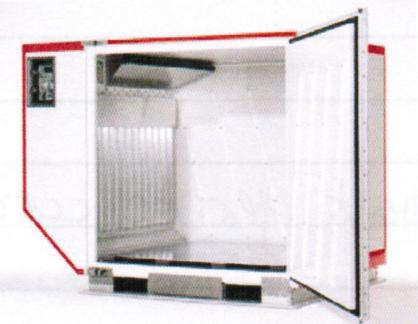
Picture 2: Radiated Emission, antenna position.

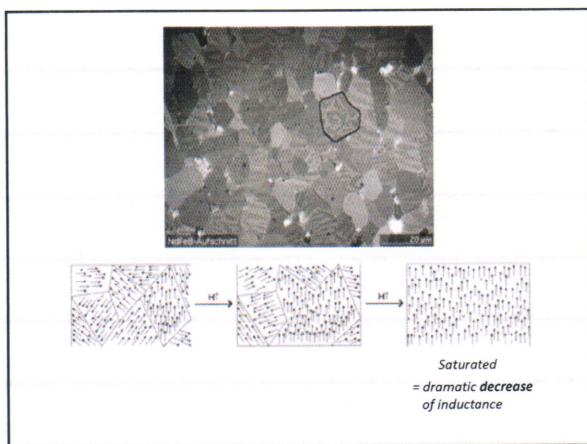


"Robust design"



Cargo: volume 2.6 m<sup>3</sup>, net weight 1200 kg






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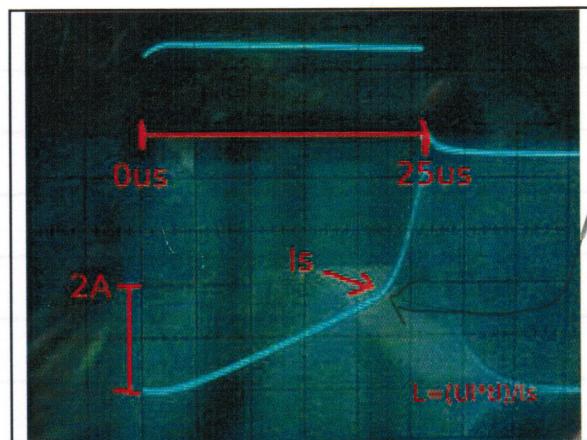
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Saturation point

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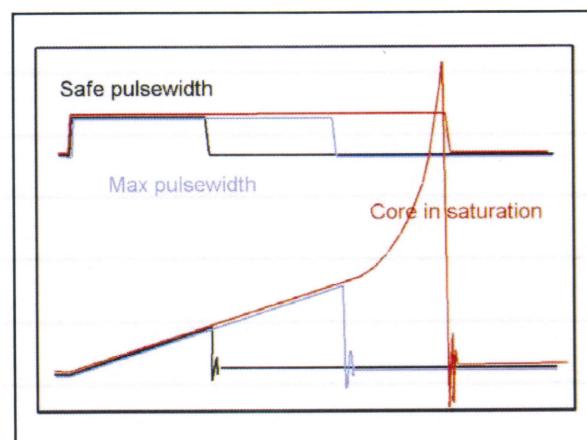
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PW too long,  
saturation reached

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Small induktor →  
fast reaching of  
saturation point

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Search for faults

## Holes in the bucket - plug it!



Countermeasure strategy

- Look for the most dominant coupling mechanism  
- Fix it
- Look for the second most dominant mechanism  
- Fix it

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Things to consider

- Zoning - for structured design
- Ground structure - provides shielding
- Ground only if necessary
- A optimal PCB design is an effective EMC solution
- ESD - protect and prevent charge build up
- Shield and filter belong together
- Consider EMC in all phases of the project

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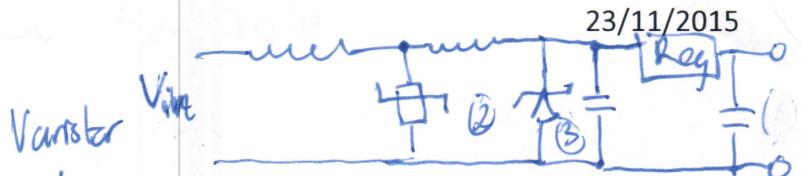
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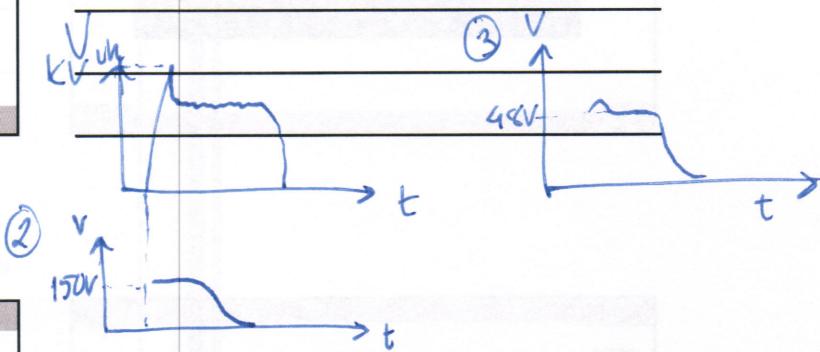


### Protection for transients

- Varistor  
Withstands kA for 8μs  
Response time ~30 ns
- Zener diode
- Capacitor
- Does not protect for high voltage during "long" time



High resistance between pins when not transient.



### Protection for ESD

Tests, classes

- Final product
- While working with components

### ESD directly to a PCB



- Direct discharge to circuit is usually destructive, at least aging
- ESD protection may be enhanced, thus increasing the immunity
  - use internally protected IC's
  - ground planes
  - guard traces at edges connected to ground plane
  - filter and decoupling capacitors close to IC's
  - low impedance circuits and signal transmissions
  - extra long 0V-pin