Another EMC resource
from EMC Standards

12 - Suppressing transients on AC, DC power, signals or data

Helping you solve your EMC problems

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Module 12: Suppressing transients on AC or DC power supplies, signals or data

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Change Record: v2.2 to 2.8, March 2019 (1)

- EMC Standards logo added
- Footnote added to all slides: 'Cherry Clough Consultants confidential training material'
- All URLs / hyperlinks now activated
- Contents list was 12.0.2, now renumbered as 12.0.3
- New slide added as 12.0.2 (Good EM Engineering; De-Risking projects)
- New slide 12.3.4 added
- Old slide 12.4.4 improved and renumbered as 12.6.7
- Slide 12.4.7 and 12.4.8 slightly improved (addition of 'PCB traces')
- Slide 12.4.11 improved with new photographs
- Old slide 12.4.12 replaced with new slides 12.4.12 and 12.4.12a
- Two new slides 12.4.12b and 12.4.18 added
- Slide 12.4.17 improved
- Slide 12.6.1 modified to cover safety as well

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Change Record: v2.2 to 2.8, March 2019 (2)

- Slide 12.6.5 improved
- New slides 12.6.8 – 12.6.12 added (*re:* compliance with safety standards)
- Slide 12.8.2's URL updated (Semtech capacitance graph)
- Slide 12.8.5's title improved a little
- Slide 12.9.2 improved; and new slide 12.9.2a added
- Slide 12.9.5 updated
- New slide 12.10.28a added, and slide 12.10.29 improved
- Slide 12.11.2 improved (added: 'chassis, hull, deck, fuselage of a vehicle')
- Slide 12.0.3 renumbered as 12.0.4 and moved right to the end
- Slides 12.14.2 - 4 updated and improved (Some useful references)

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Good EM (electromagnetic) Engineering, and De-Risking new projects

- **Good EM engineering is cost-effective SI, PI, EMC design: well-proven to save time & money in all lifecycle stages, helping increase profits & reduce financial risks…**
  - for all products, equipment, vehicles, systems, installations; etc., of any size, in all applications…
    see www.emcstandards.co.uk/testimonials *and Module 1*
    (especially 1.15, which is also in Webinar 1c; and 1.16 which is also in Webinar 1d)
- **Our courses (of which this is one) provide a complete set of good EM Engineering guidelines, that should *also* be used as an initial design checklist to De-Risk new projects:**
  any that can't or won't be followed identify a project risk!
  also see Module 1, section 1.16 (also in Webinar 1d)
  - to adapt any λ-based design guidelines to different applications and/or different EMC test standards: see Module 1, section 1.18 *(also in Webinar 1d)*

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Contents

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12. Suppressing transients

1

What transients are, and how they cause damage

(ESD transients are covered in Module 11)

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Transients (surges, spikes, etc.) are momentary over*voltages* or over*currents* on conductors

- and there are many different kinds, e.g...
  - uni- or bi-directional, ring or oscillatory wave, etc...
  - all with different risetimes, waveshapes, energies...
  - depending on the R, L, C characteristics of the circuit...
  - and on its exposure to lightning and sudden load changes

■ A big problem for power supply networks…

- especially if they are physically large, e.g. AC mains...
- or have abruptly switched loads (esp. electromechanical switching and inductive loads) e.g. AC mains and DC vehicle supplies

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Transients continued...

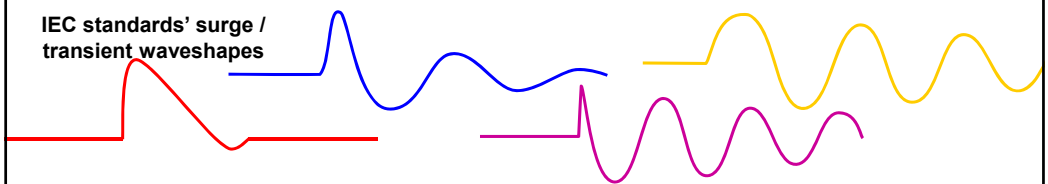
■ Signal, control, data cables also suffer transients...

- coupling to lightning electromagnetic pulses (LEMP)...
- and coupling to power supply cables carrying transients (e.g. due to lightning or load switching)

■ The chief problem caused by transients is damage to devices, by over-voltage or over-dissipation...

- but they can also cause signal and data errors

IEC standards' surge / transient waveshapes



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12. Suppressing transients

2

Galvanic isolation techniques for transient suppression

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Suitably-rated galvanic isolation gives best transient protection, using for e.g…

- High-voltage opto-isolators/couplers, fibre-optics
- Wireless, infra-red, free-space microwave or laser
- Motor-generator sets
- Isolating transformers, for both power and signals
  - 230Vac mains isolating transformers have to withstand 4.24kV peak, to meet typical safety standards (medical safety standards require higher voltages)
- ‘On-line double-conversion’ uninterruptible power supplies (UPS) (types that include an isolating transformer)