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Design considerations for bespoke military power supplies.

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Who am I

- Matthew Bloxwich.
- Engineering Manager for PSU Designs.
- 22 Years Electronics industry experience.
- 16 Years designing power supplies.
- Knowledge of full design process.
  (Blank sheet of paper to Production ready design)
- Circuit design, PCB layout, Transformer Design, EMC testing, Designing to meet standards and Designing for Production.

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Topics

- PSU overview
- Your specification
- The need for and benefits of Bespoke design
- Full custom or modular design
- EMC
- Thermal requirements
- Approvals

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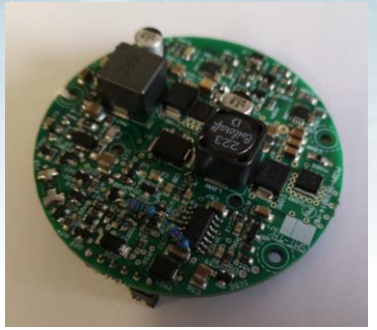
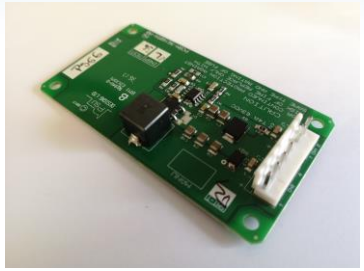
PSU Overview

Off the shelf

Modula design

Full Custom Design





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Your Specification

What are the basics

- Input
  AC, DC, Fixed, Variable, Frequency, Range
- Output
  Voltage, Current, Number of outputs, Connections
- Mechanics
  Size, Weight, Fixings, Cooling
- Environment
  Operating temperature, IP Rating, Altitude, Salt Spray etc

What might you not consider

- Input
  Legislation (PFC, Fusing, leakage current), Earthing
- Output
  Power limited requirement, connector ratings, protection circuits
- Mechanics
  Thermal interfacing, Air flow, Safety requirements
- Environment
  EMC, Safety requirements, Approvals.

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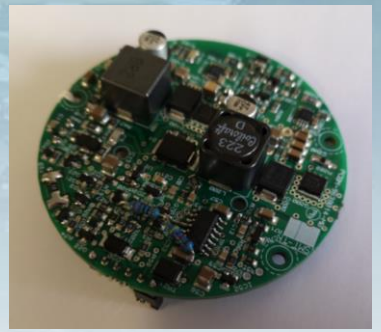
Your Specification

What does your industry need

- Do you need to meet specific standard?
- What are the EMC requirements?
- Are there any requirements for third party approvals?

The need for bespoke

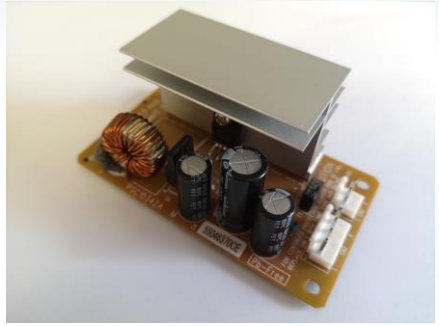
Size/Shape



Input requirements

Environment

Form/Fit/Function



Output requirements

Approvals

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The benefits of bespoke

- Designed to your specification --- No compromising on performance.
- Ability to have additional functionality --- Wish list of functions incorporated.
- Long life product --- The product is available as long as you need it.
- Product support --- Service and Technical data easily available.
- Easy upgrade path --- Accommodate future spec changes.
- Standards compliance --- Designed to meet the standards you require.
- Designing for long usable life and increased MTBF

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Full custom or Modular design

	Modular Design	Full Custom
Size	Very compact	Adaptable
Shape	Adaptable	Very Configurable
Efficiency	Very High	High
Cost	High Cost	Cost effective

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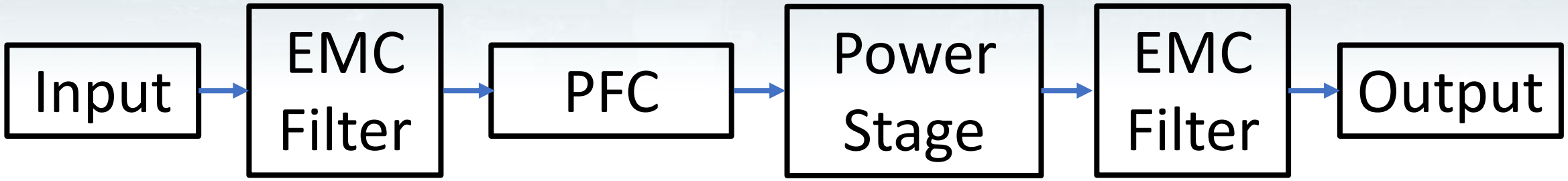
Modular or Full Custom Design



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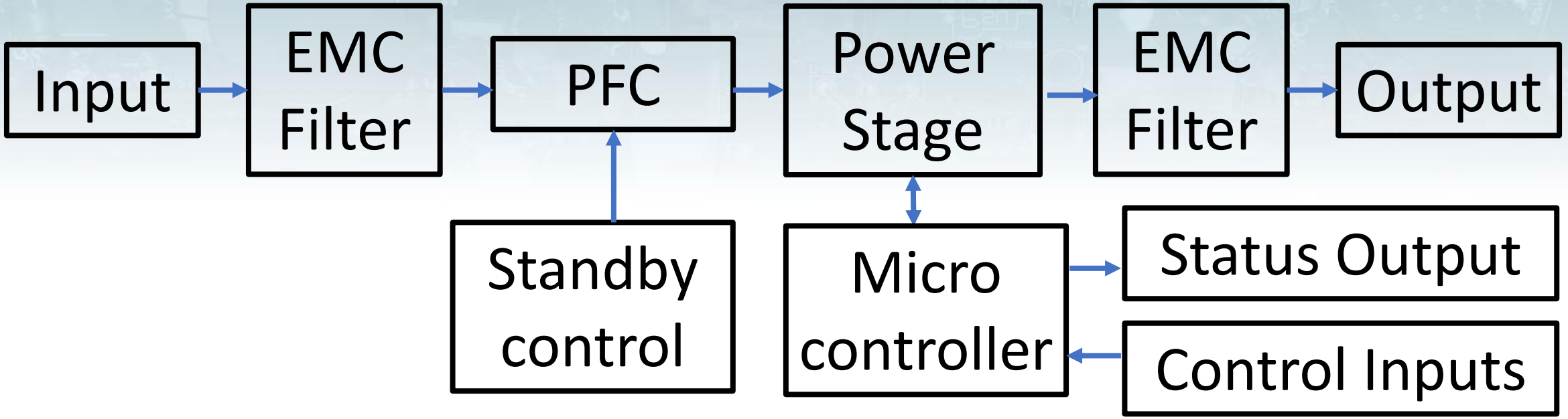
Modular or Full Custom Design



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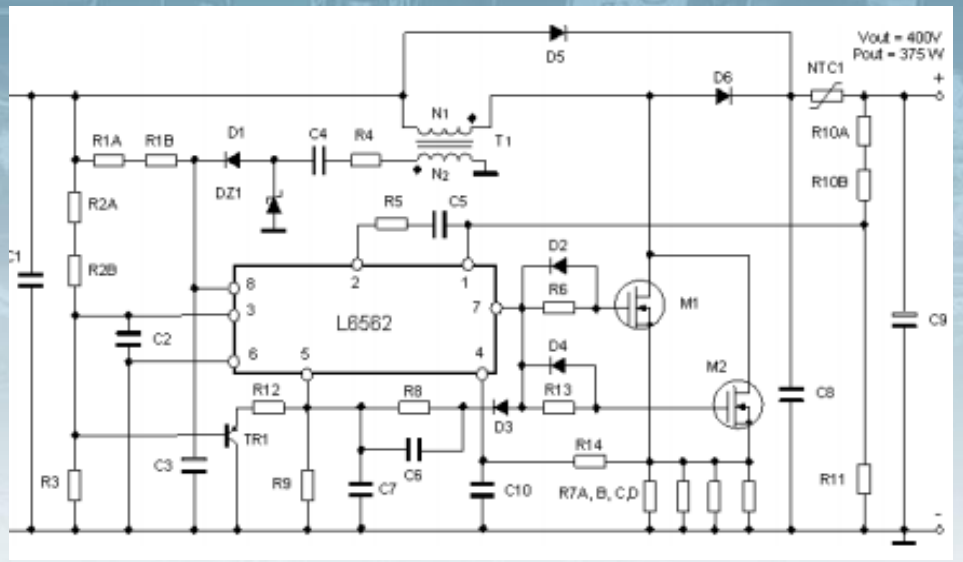
The Building Blocks

PFC Module

Off the shelf Module



Circuit based on well proven designs

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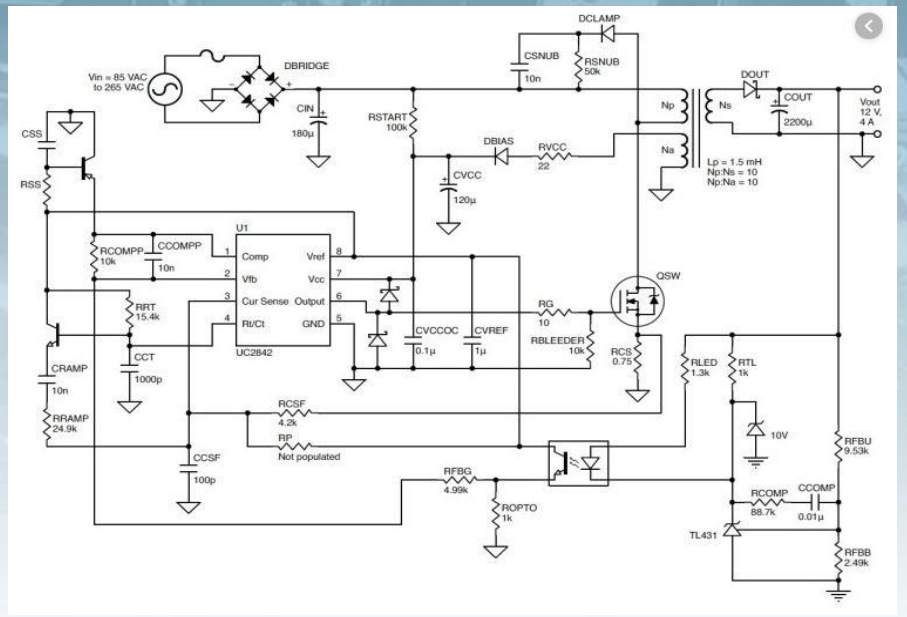
The Building Blocks

Power Module

Off the shelf Module



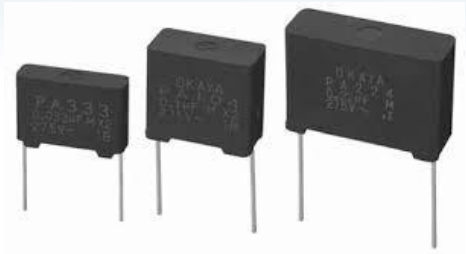
Circuit based on well proven designs

The Building Blocks

EMC Filter

Input filtering

Common Mode Chokes



X Class Capacitors

Y Class Capacitors

Output filtering

Drum inductors

Decoupling Capacitors

EMC

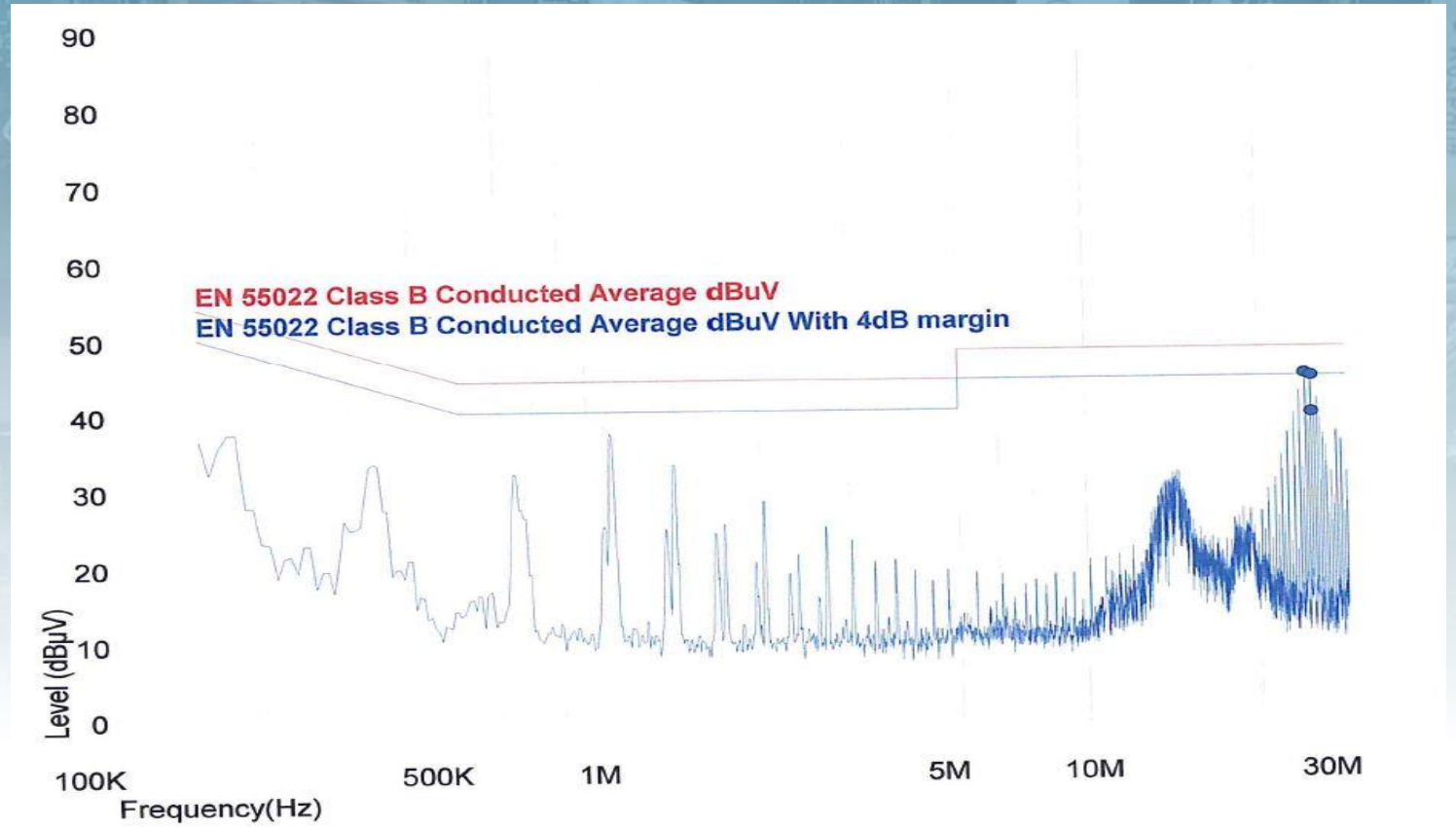
1. Emissions

Signals/noise given out by the PSU

Conducted and Radiated

2. Immunity

How the PSU perform when subjected to external signals/noise



Typical EMC plot

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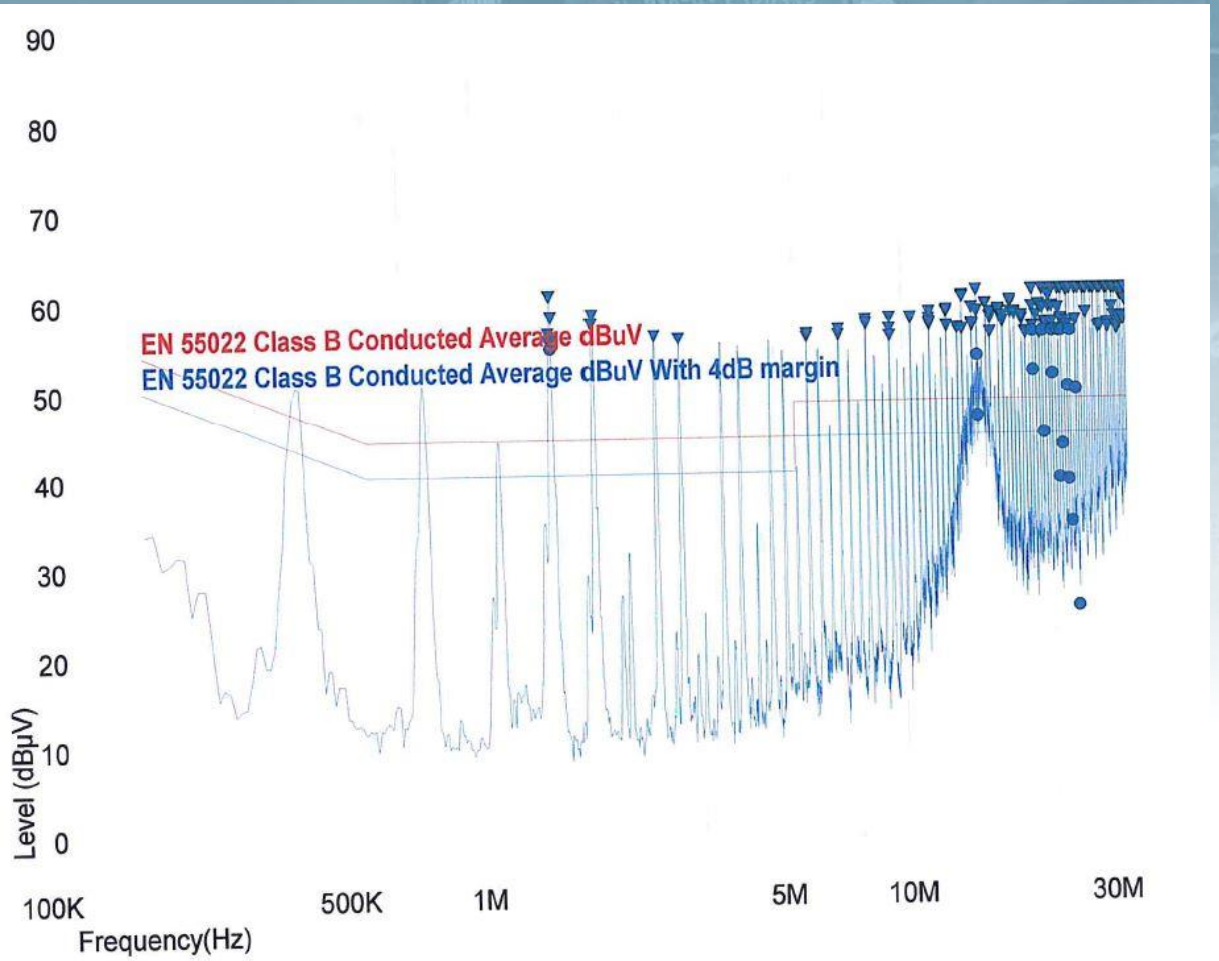
EMC



Example Plot from a modular design

EMC was not considered

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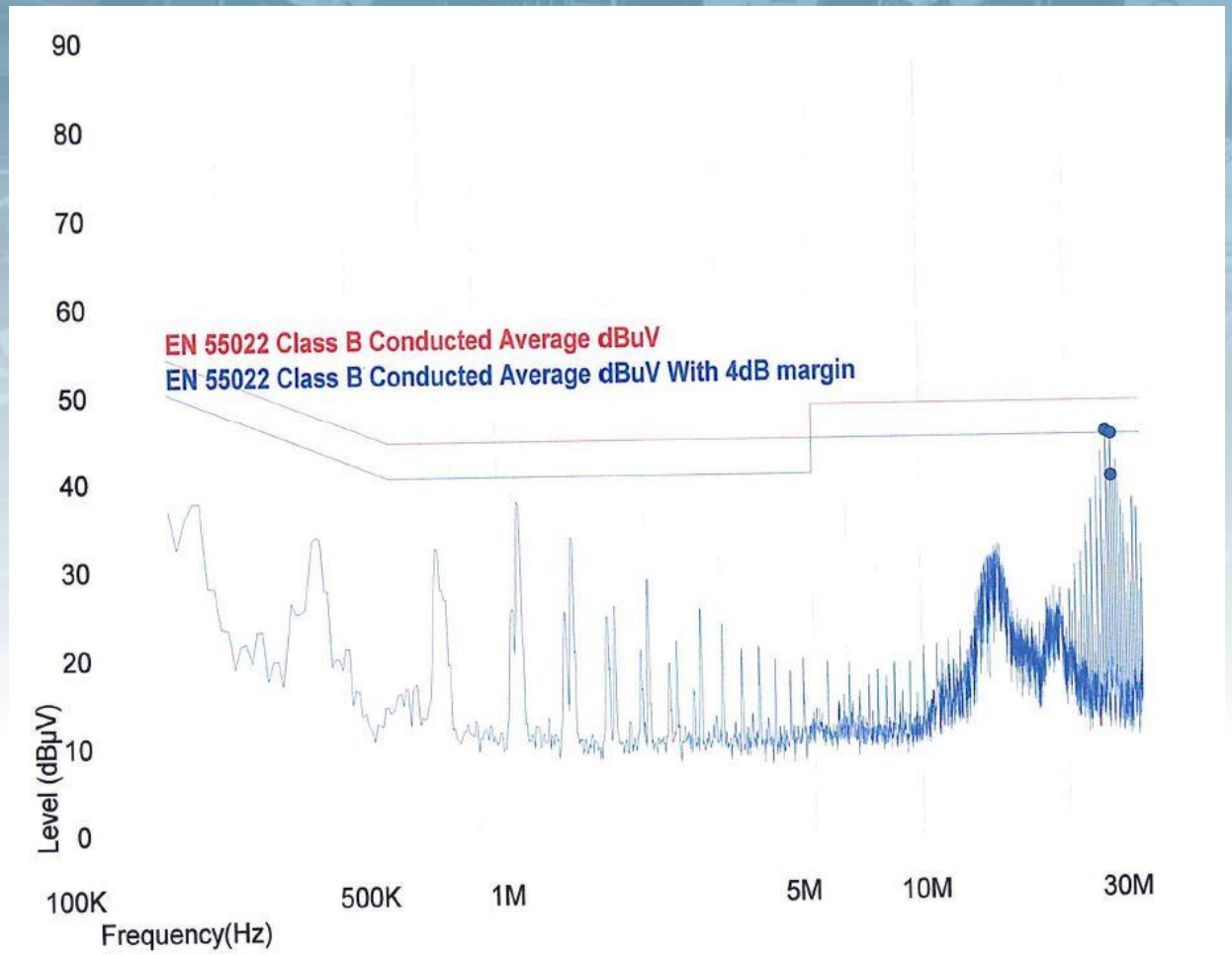
EMC

1. Filtering required
    a. Input filter
    b. Output filter
    c. Input to output capacitance
    d. Screening
    e. Prevent switching noise

2. Layout
    a. Track lengths
    b. Switching loops
    c. Earthing points (standoffs)



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Thermal requirements

How to get the heat out.

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Thermal requirements

How to get the heat out.

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Thermal requirements

Efficiency

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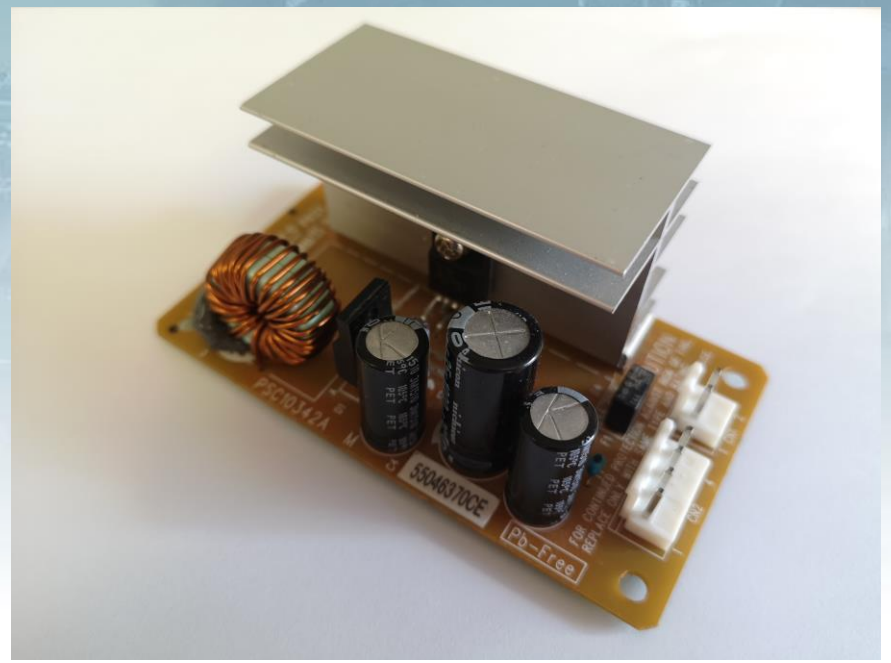
Thermal requirements



Specification:
DC – DC
24Vin to 12Vout (24W)
2A continuous
5A peaks

Around 80% efficient

30W in for 24W out
Total power loss 6W
Or 15W during peaks

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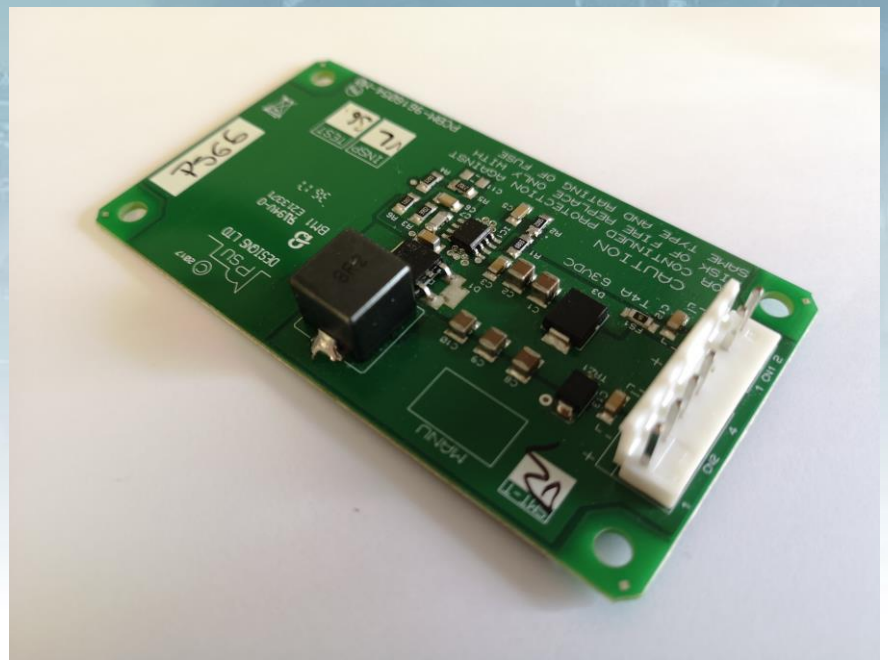
Thermal requirements

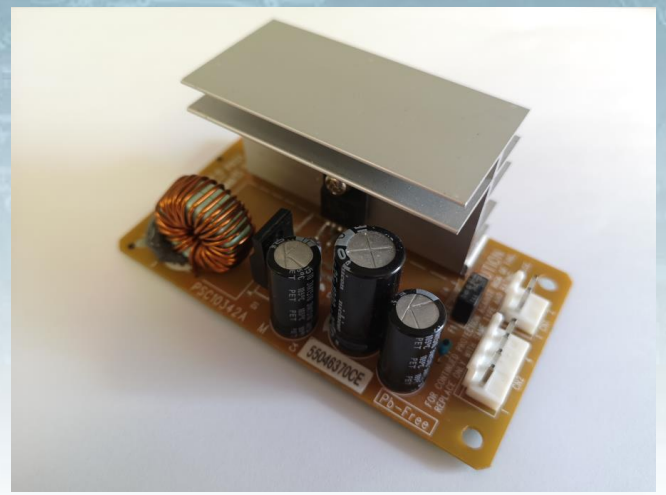


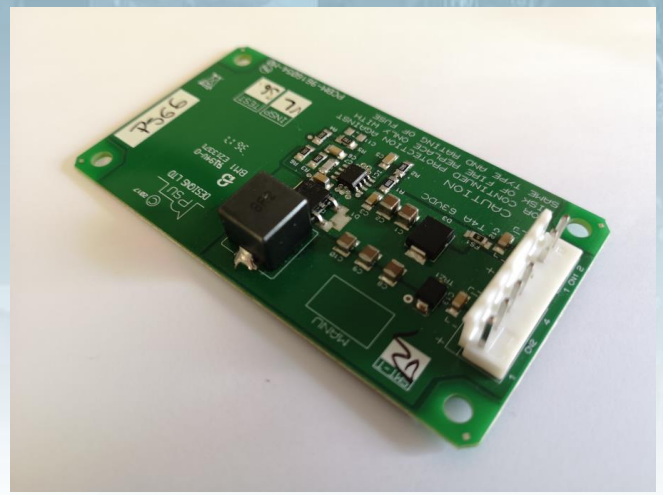
Specification:
DC – DC
24Vin to 12Vout (24W)
2A continuous
5A peaks

Around 93% efficient

26W in for 24W out
Total power loss 2W
Or 5W during peaks

Thermal requirements





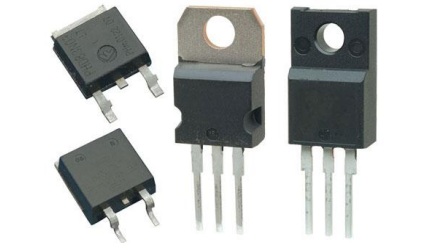
- BOM cost reduction
- Easier manufacturing
- Lower input power requirement
- Reduced weight
- Significantly better efficiency 80% to 92%

Thermal requirements

Where are the losses?

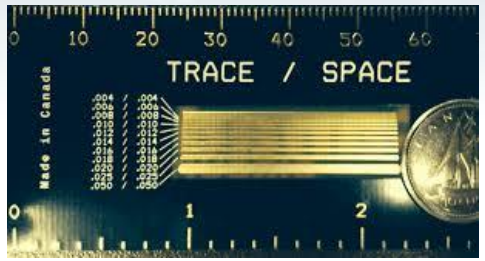
Transformers

MOSFETS

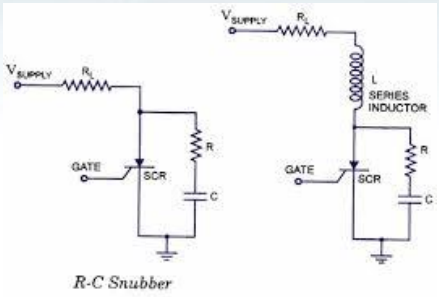


Diodes

PCB tracks



Snubbers



Control circuits

Approvals

Agencies

Standards

Safety Standards
e.g. EN62368

EMC Standards
e.g. EN55032

Industry Specific standards
e.g. EN54-4 (fire alarm PSUs)

Self Certification

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Thank You

Pod 15 in the Manufacturing Hub