



# Design considerations for bespoke military power supplies.

# 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.

## Topics

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



# PSU Overview

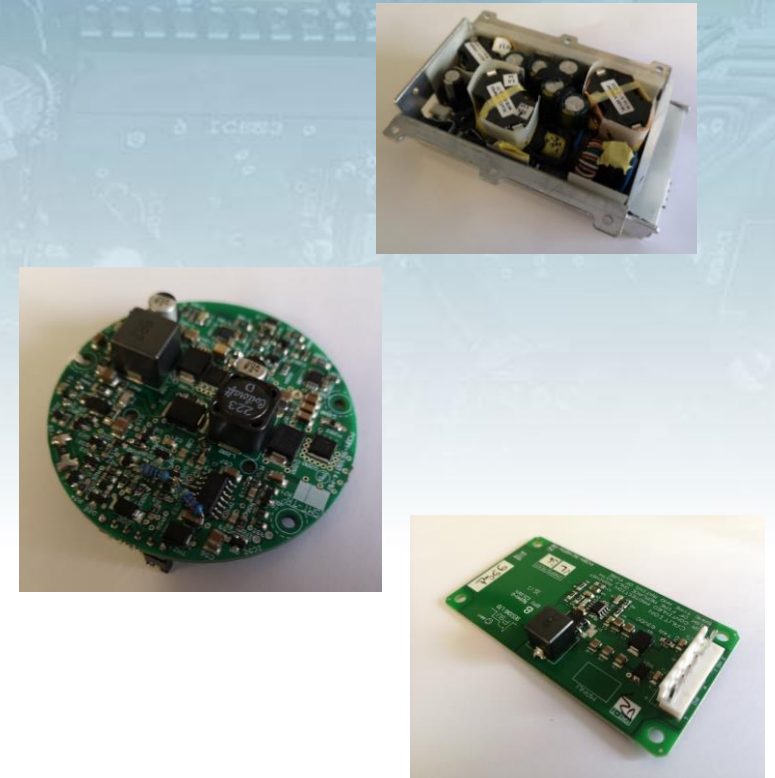
## Off the shelf



## Modula design



## Full Custom Design



# 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.

# Your Specification

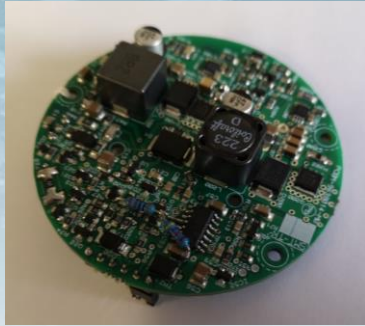
## What does your industry need

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

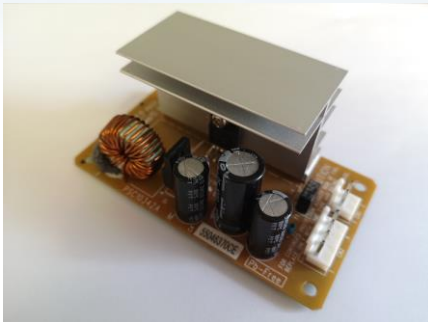


# The need for bespoke

Size/Shape



Form/Fit/Function



Input  
requirements



Output  
requirements



Environment



Approvals



# The benefits of bespoke

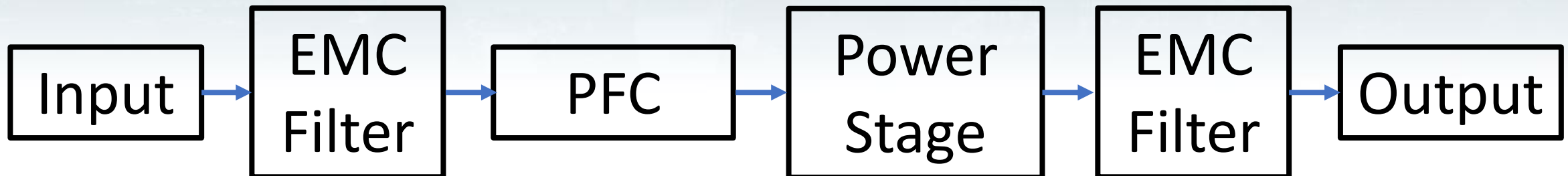
- Designed to your specification --- No compromising on performance.
- Ability to have additional functionality --- Wish list of functions incorporated.
- Long life product --- The product is available as long as you need it.
- Product support --- Service and Technical data easily available.
- Easy upgrade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



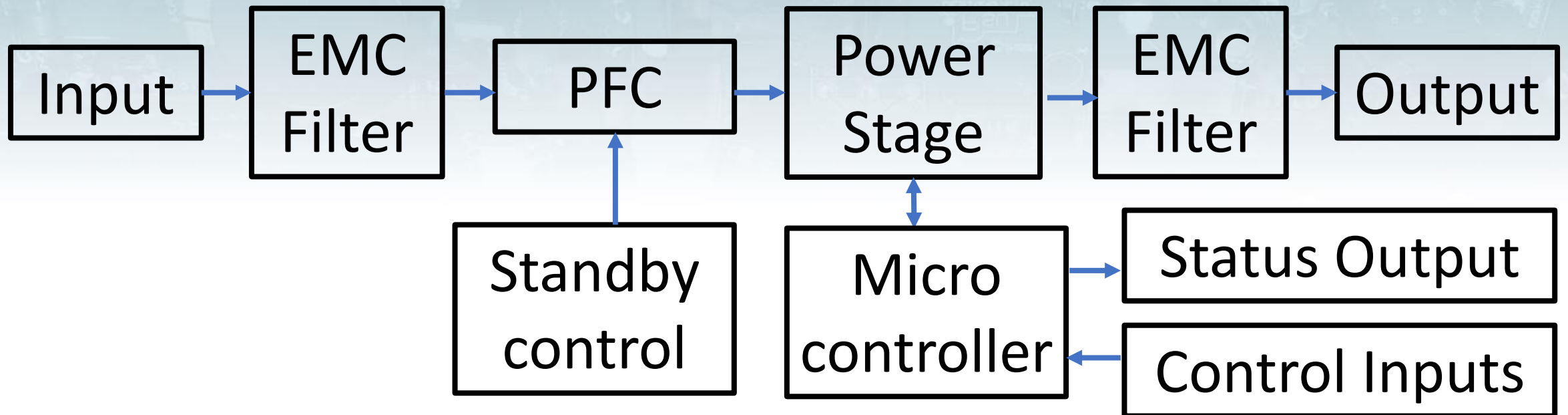
# Full custom or Modular design

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

# Modular or Full Custom Design



# Modular or Full Custom Design



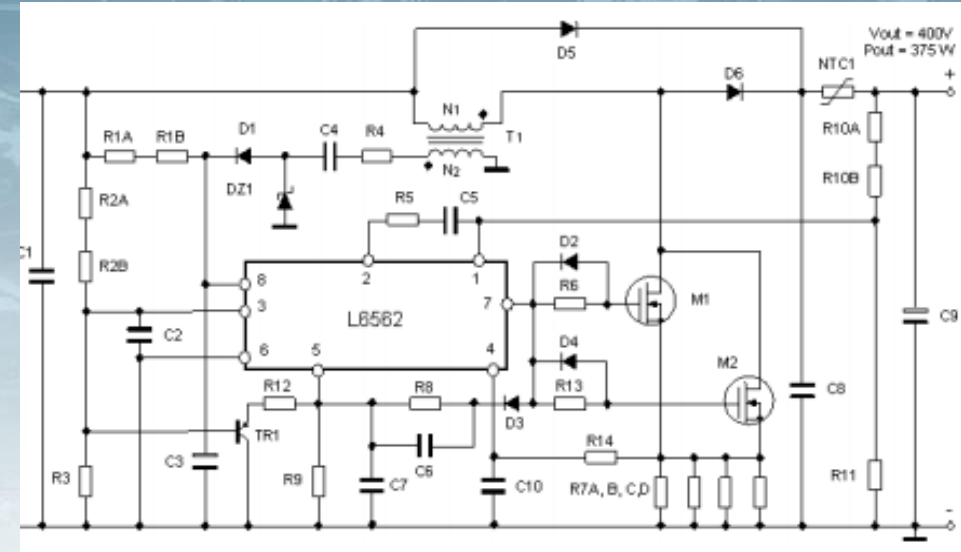


# The Building Blocks

## PFC Module



Off the shelf Module



Circuit based on well  
proven designs

Circuit based on well proven designs

# The Building Blocks

EMC  
Filter

Input filtering



Common Mode Chokes

Output filtering



Drum inductors



X Class Capacitors



Y Class Capacitors



Decoupling  
Capacitors



# EMC

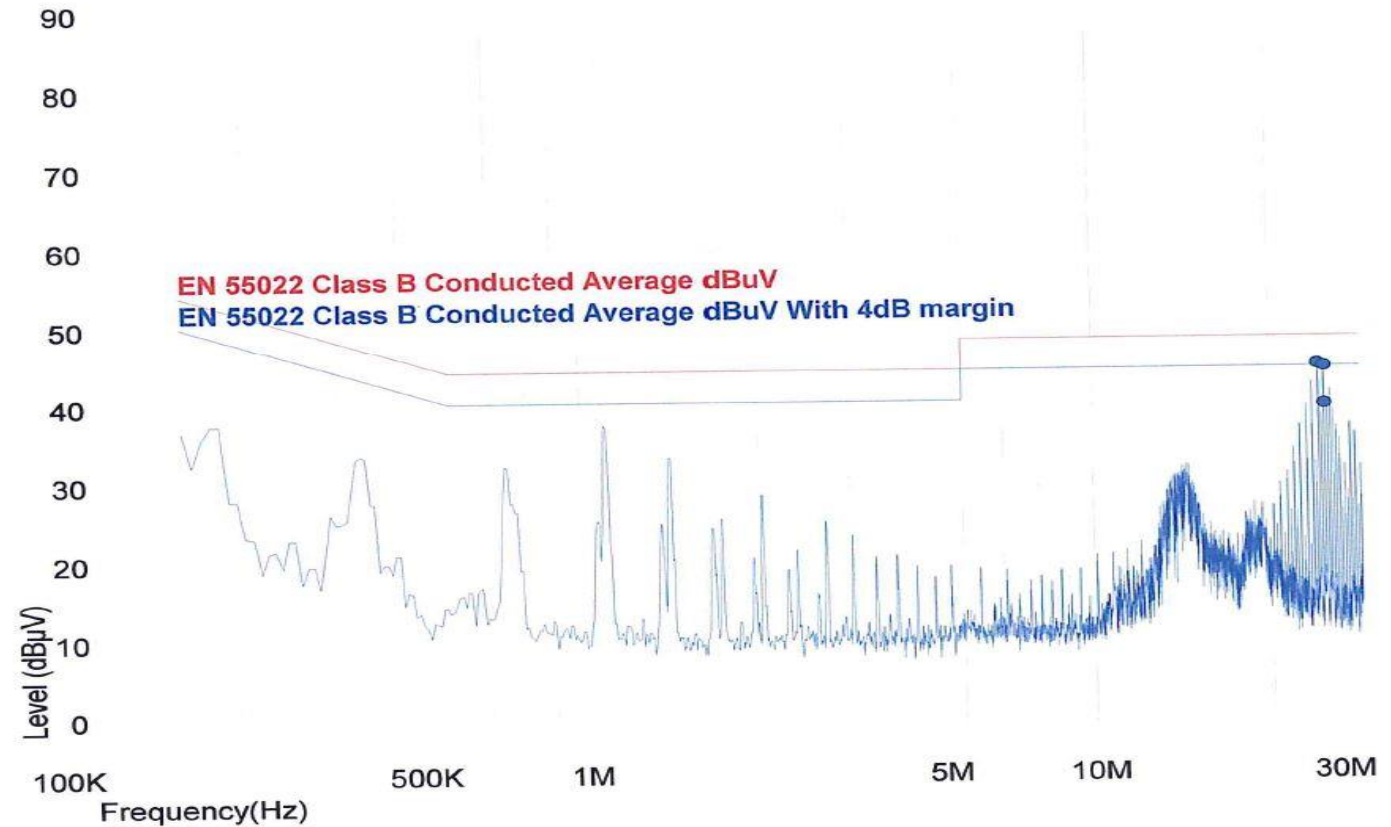
## 1. Emissions

Signals/noise given out by the PSU

Conducted and Radiated

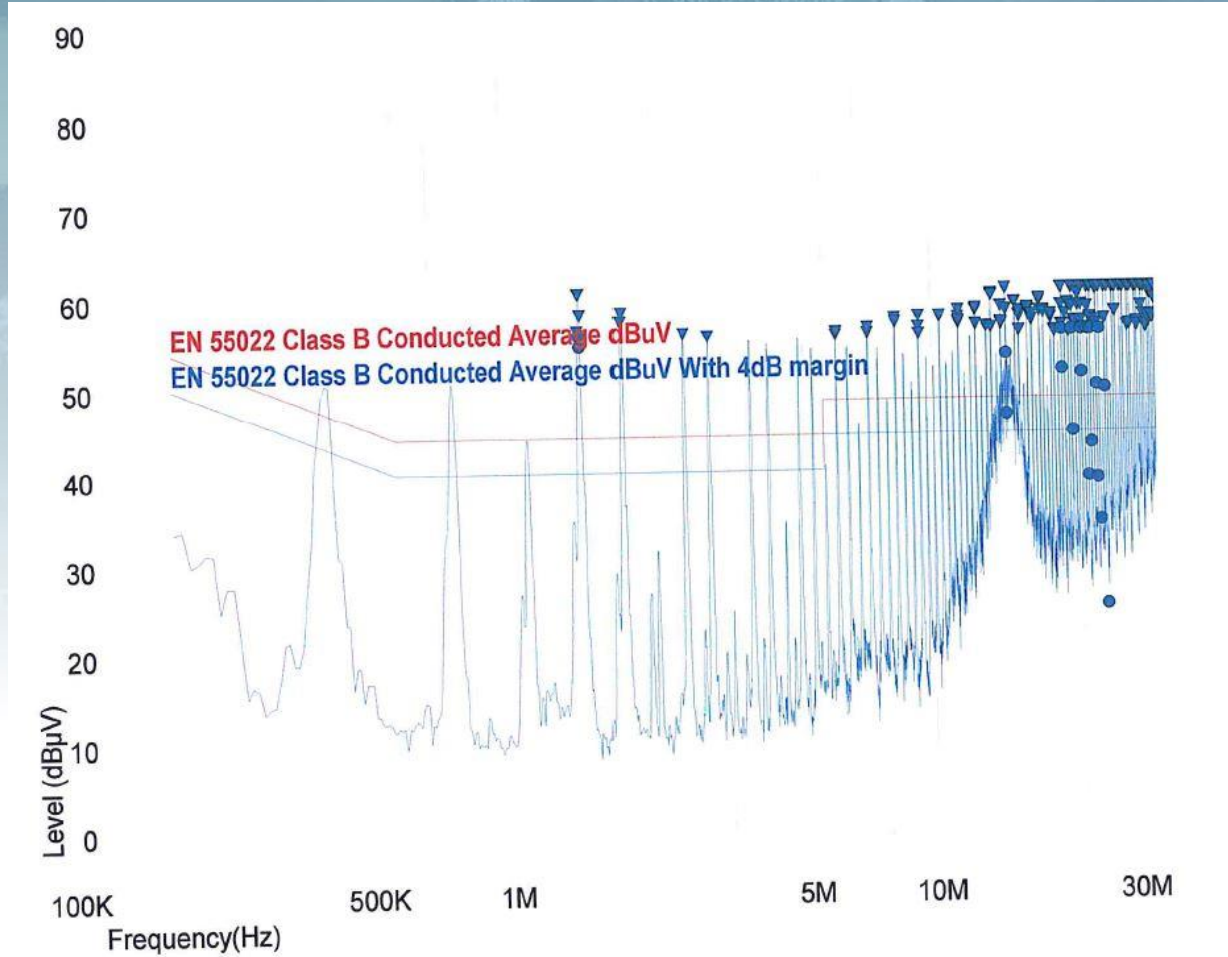
## 2. Immunity

How the PSU perform when subjected to external signals/noise



Typical EMC plot

# EMC



Example Plot from a modular design

EMC was not considered

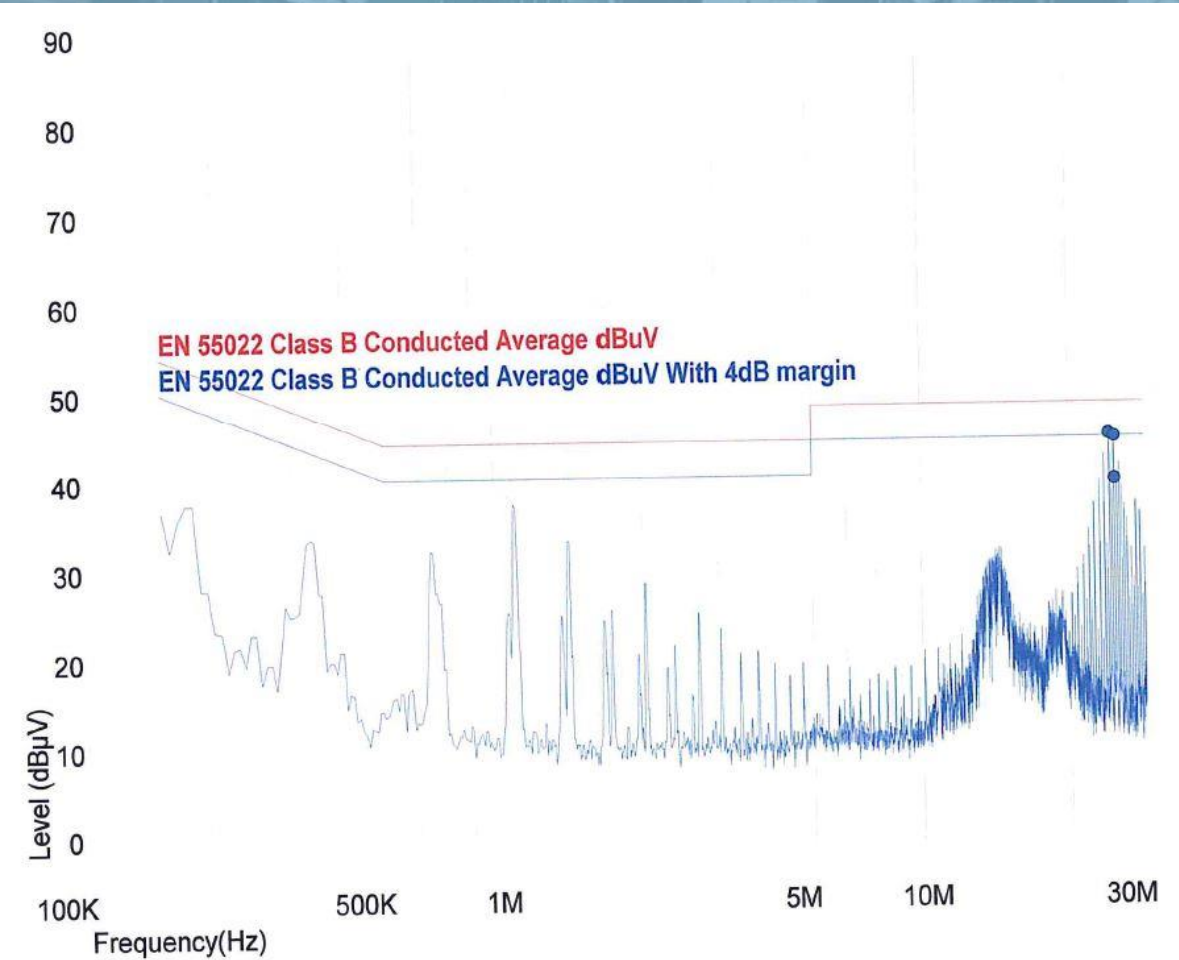
# EMC

## 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)





# Thermal requirements



How to get the heat out.

# Thermal requirements



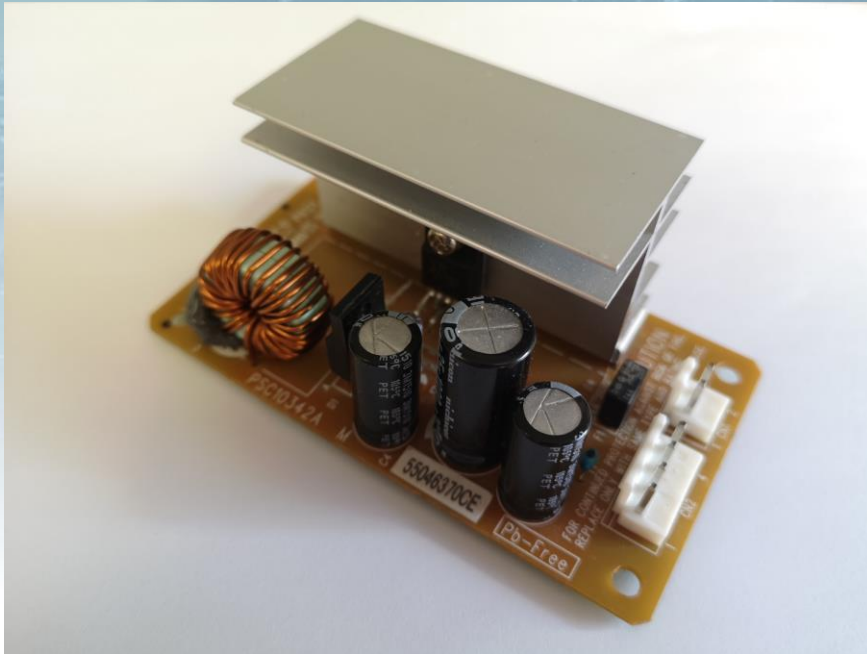
How to get the heat out.

# Thermal requirements

# Efficiency



# Thermal requirements



Specification:

DC – DC

24Vin to 12Vout (24W)

2A continuous

5A peaks

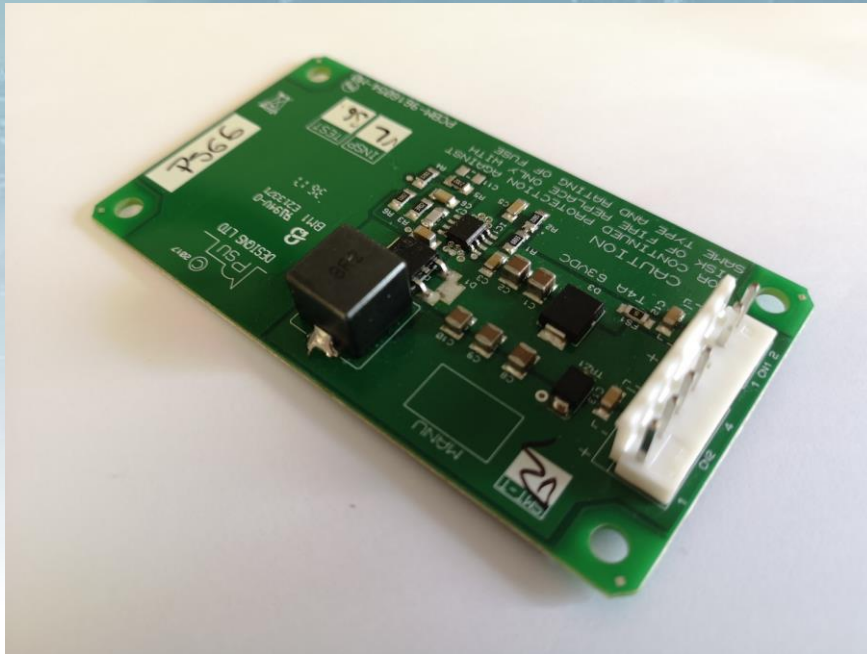
Around 80% efficient

30W in for 24W out

Total power loss 6W

Or 15W during peaks

# Thermal requirements



Specification:

DC – DC

24Vin to 12Vout (24W)

2A continuous

5A peaks

Around 93% efficient

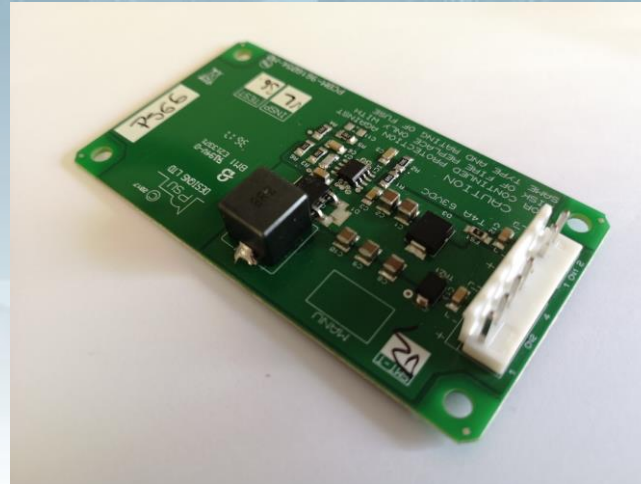
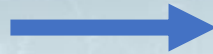
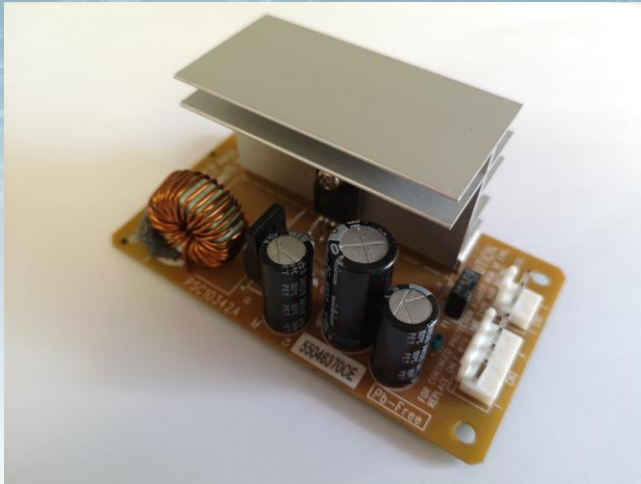
26W in for 24W out

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%





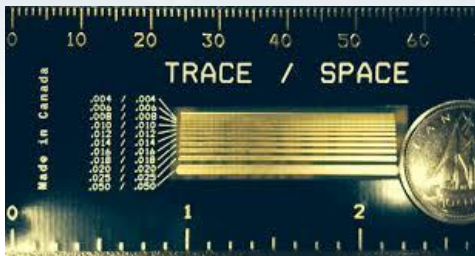
# Thermal requirements

Where are the losses?

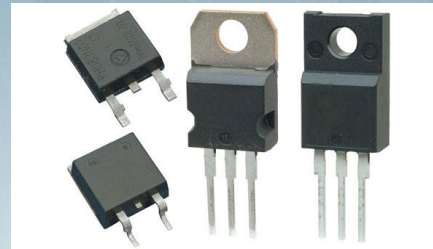
Transformers



PCB tracks



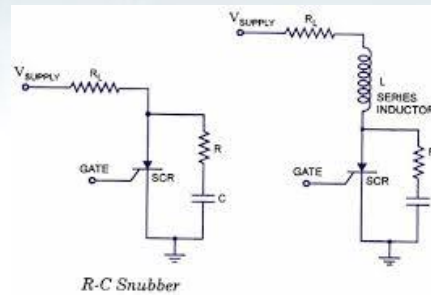
MOSFETS



Diodes



Snubbers



Control circuits



# Approvals

## Agencies



## Self Certification



## Standards

Safety Standards

e.g. EN62368

EMC Standards

e.g. EN55032

Industry Specific standards

e.g. EN54-4 (fire alarm PSUs)

Thank You

Pod 15 in the  
Manufacturing Hub