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Technical Note TN011:
Fast Response versus Cost Optimised Drive PCB designs: performance comparison

1 INTRODUCTION

TTP Ventus offers two Disc Pump Drive PCB products: a Fast Response design, and the more-recently developed Cost Optimised design. This application note compares the performance of the two designs to aid the selection process. As can be seen from the data in Section 5, the Fast Response design offers faster response bandwidth and pressure rise time, whilst the Cost Optimised design is more efficient.

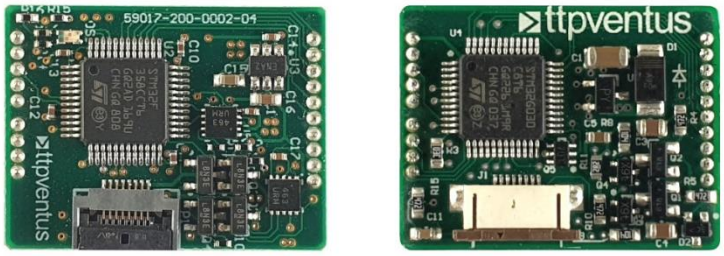

Figure 1: The Fast Response Drive PCB (left) and the Cost Optimised Drive PCB (right)

2 DISCLAIMER

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3 HEALTH AND SAFETY

WARNING
The Disc Pump Driver PCB is capable of producing DC voltages up to 60V, and output AC voltages up to 120V peak- to- peak, at frequencies between 19 and 23 kHz. It is the user's responsibility to ensure that the Disc Pump Driver PCB is used and/or integrated within any product in a safe manner. Read the user manual prior to first operation and take note of all safety notices.

WARNING
Take care during use of the Disc Pump Drive PCB not to create short circuits between exposed conductive parts of the board. Short circuits may lead to malfunctioning and heating.

4 PERFORMANCE COMPARISON

4.1 Summary

- The peak efficiency of the Cost Optimised design is 20 – 24% higher than the Fast Response design.
- The standard design has 2.5x – 6x response bandwidth of Cost Optimised design.

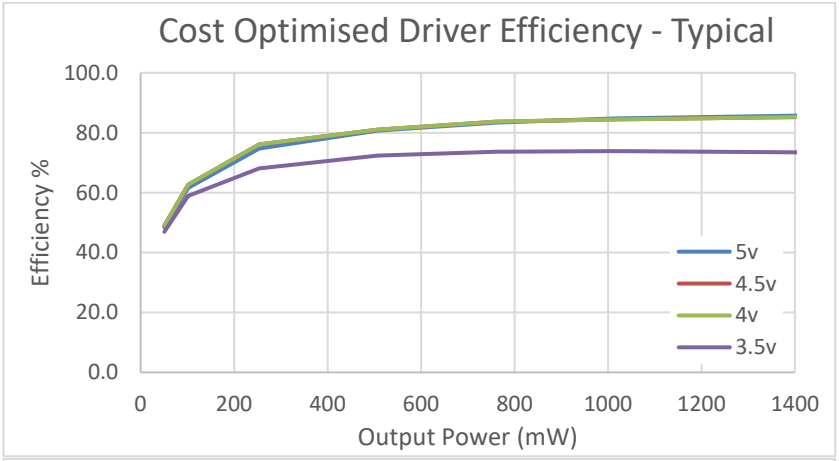
4.2 Efficiency analysis

Test details:

- Load: Dummy resistance, ~2.1 kOhm
- Drive: 1 W power into load.
- Measurement: voltage and current into load, divided by voltage and current supplied to drive PCB – both calibrated.

Result:

- Peak efficiency of Cost Optimised design is ~20 – 24% higher than Fast Response design, dependent on drive power and supply voltage.
- Peak efficiency at highest drive level (1400 mw) of Cost Optimised design (~85%) is 20% higher than Fast Response design (~65%)
- Efficiency at lowest drive level (50 mW) of Cost Optimised design (47%) is 24% higher than standard design (~23%)



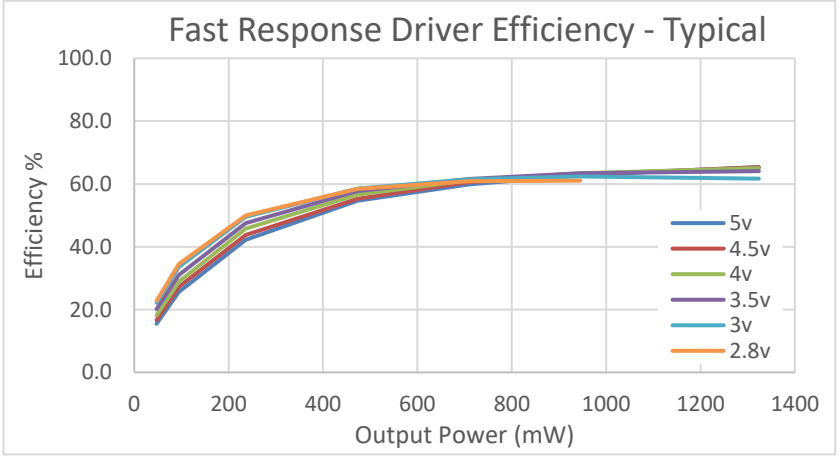


Figure 2: Drive PCB efficiency versus output power and supply voltage

4.3 Response bandwidth analysis

Test details:

- Load: ~700 Ohm DP-S2-007 pump
- Power setpoint determined by sine wave input, mapped from 0 to 1000 mW peak.
- Frequency of sine wave increased from 2 to 120 Hz
- PCB response measured as a percentage of 0 to 1000 mW target swing.

Result:

- Fast Response design has 2.5x to 6x bandwidth of Cost Optimised design.
- Full-scale response bandwidth of Fast Response design (~20 Hz) is 2.5x greater than Cost Optimised design (~8 Hz).
- 50% response bandwidth of Fast Response design (~150 Hz) is 6x greater than Cost Optimised design (~25 Hz).

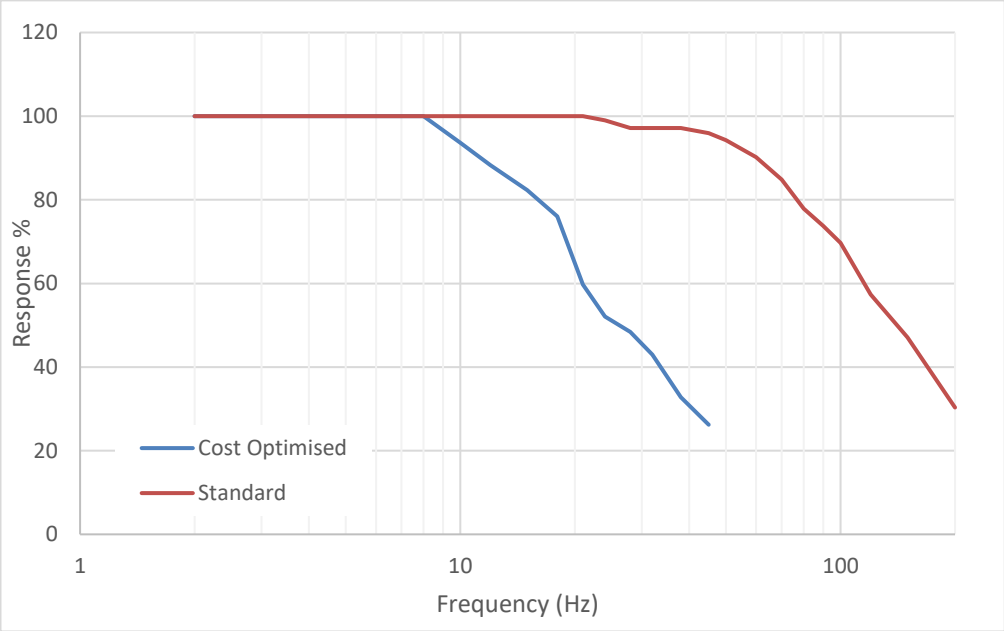
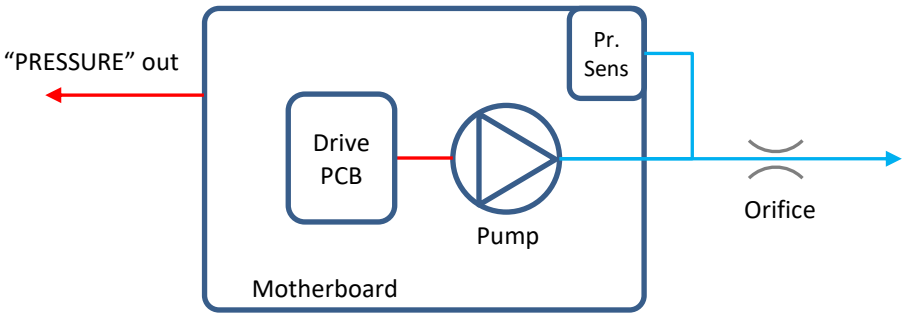


Figure 3: Drive PCB response bandwidth

4.4 Pressure rise time analysis

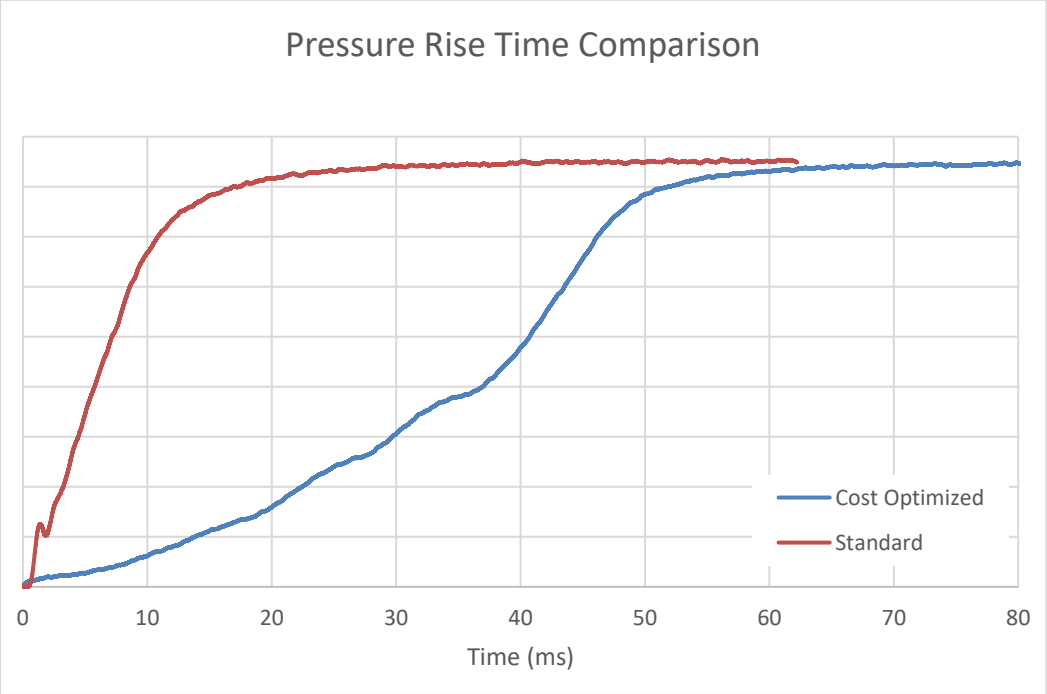
Test details:

- Load: ~700 Ohm DP-S2-007 pump, exhaust driven through 8k Lohm orifice, with < 1 ml internal system volume.
- Power setpoint: 1000 mW.
- Pressure rise time monitored by “PRESSURE” output on Disc Pump Evaluation Kit Motherboard



Result:

- Rise time of Fast Response board (~30 ms) ~2x faster than Cost Optimised board (~70 ms).



5 SUPPORT

Resources to support the next stage of product development and integration can be found at:

- www.ttpventus.com/support

For specific questions, please contact support@ttpventus.com.

6 REVISION HISTORY

Date	Version	Change
03 August 2021	r210803	Update to TN and new document format; updated Figure 1.
29 January 2021	r210129	Updated board references.
15 December 2020	r201215	Initial release.