



Integrated Device Technology

Smart Power Management
Superior Transient Response

Content Overview

Content

- Part 1: Comparison: ZSPM1000 versus Analog Controller
 - Test Setup
 - Results without using Sub-cycle Response™ and non-linear control features
 - Results using Sub-cycle Response™ and non-linear control features
 - Summary
- Part 2: Superior Transient Response Considerations
 - Test Setup
 - Results of test board performance
 - Results of test board using superior transient response to reduce output capacitance
 - Summary

Comparison: ZSPM1000 versus Analog Controller

Comparison: True-digital ZSPM1000 PWM Controller vs Traditional Analog Controller

ZSPM1000



True-digital control loop enables design flexibility and configurability

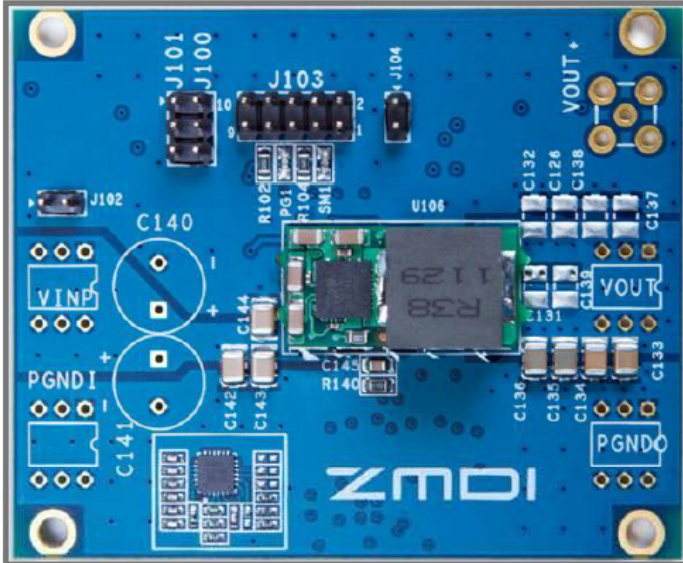
Best-in-class transient performance enabled by **IDT's Tru-Sample™ Technology**

Most compact controller solution enabled by application specific IC architecture

...and more.

Test Setup

Test Setup

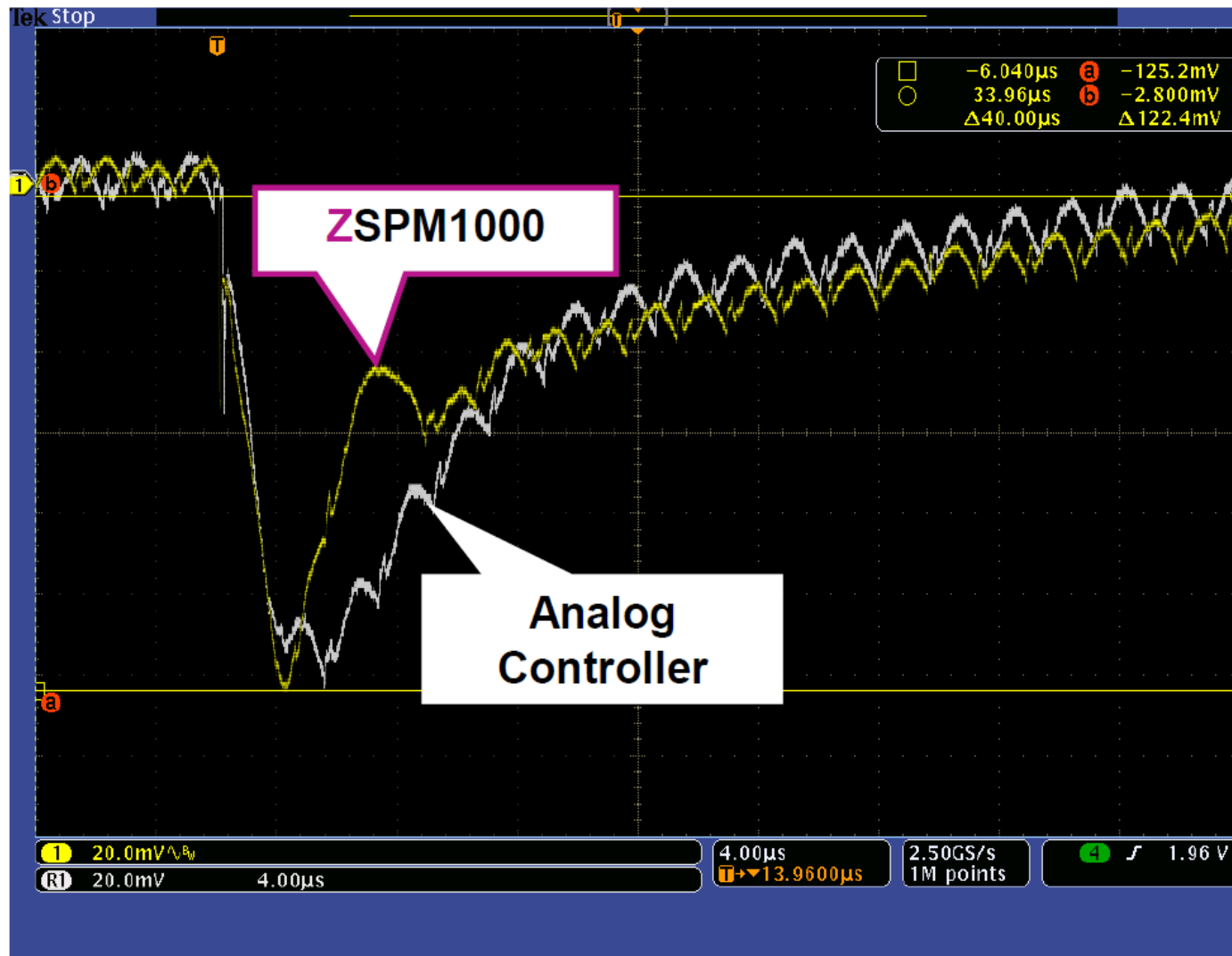


POL Solution with 35A Power Block

- 35A POL Solution
 - Version 1: with analog controller
 - Version 2: with ZSPM1000 PWM controller
 - Same power stage
 - Same characteristic (bandwidth, phase margin)
- System Parameters:
 - $V_{IN} = 12V$
 - $V_{OUT} = 1.2V$
 - $C_{OUT} = 300\mu F$
 - $FSW = 500kHz$
- Performed Test:
 - Transient Response
 - 10A load step at $500A/\mu s$

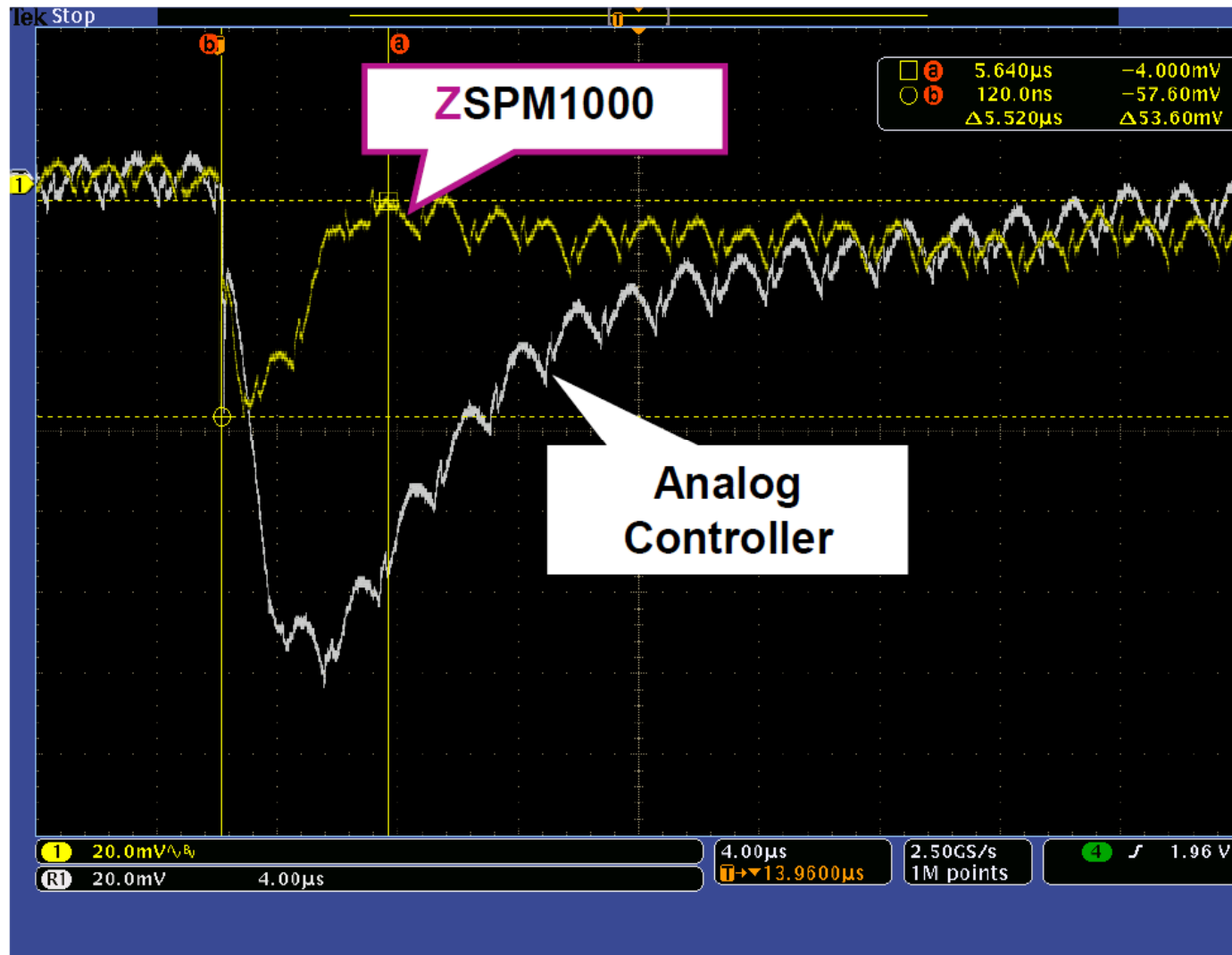
Results

Step-Performance Without Sub-Cycle Response™ and non-linear Control



Results

Step-Performance using Sub-Cycle Response™ and non-linear Control



Summary

Best in class transient performance

- The transient performance of a synchronous buck converter can be dramatically improved using the ZSPM1000 over a traditional, state-of-the-art controller.
- In ZMDI POL Solution Test Setup, the ZSPM1000 PWM Controller using Sub-Cycle Response™ and non-linear control features showing:
 - **50% reduced output voltage undershoot**
 - **75% improved settling time**
- Superior step-response performance can be used to reduce output capacitance of the power stage and results into a cost and PCB area saving

Superior Transient Response Considerations

Superior Transient Response Considerations

ZSPM1000



True-digital control loop enables design flexibility and configurability

Best-in-class transient performance enabled by IDT's **Tru-Sample™ Technology**

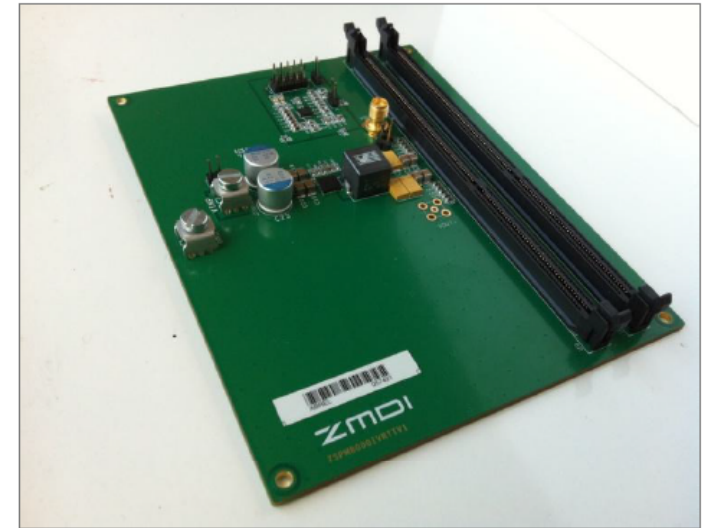
Most compact controller solution enabled by application specific IC architecture

...and more.

Test Setup

Test Setup

- Test Board
 - ZSPM1000 PWM Controller
 - Single-phase synchronous buck stage
 - DDR3 sockets to use INTEL's DDR Voltage Regulator Test Tool (VRTT)
- System Parameters:
 - $V_{IN} = 12V$
 - $V_{OUT} = 1.2V$
 - $FSW = 500kHz$
- Performed Test:
 - Transient Response (3A to 12A)
 - 9A load step at $10A/\mu s$ and $30A/\mu s$
- System Spec Requirements:
 - **V_{OUT} accuracy needs to be $\pm 3\%$ ($\pm 36mV$)**



ZMDI Test Board using INTEL's DDR Regulator Test Tool (VRTT)

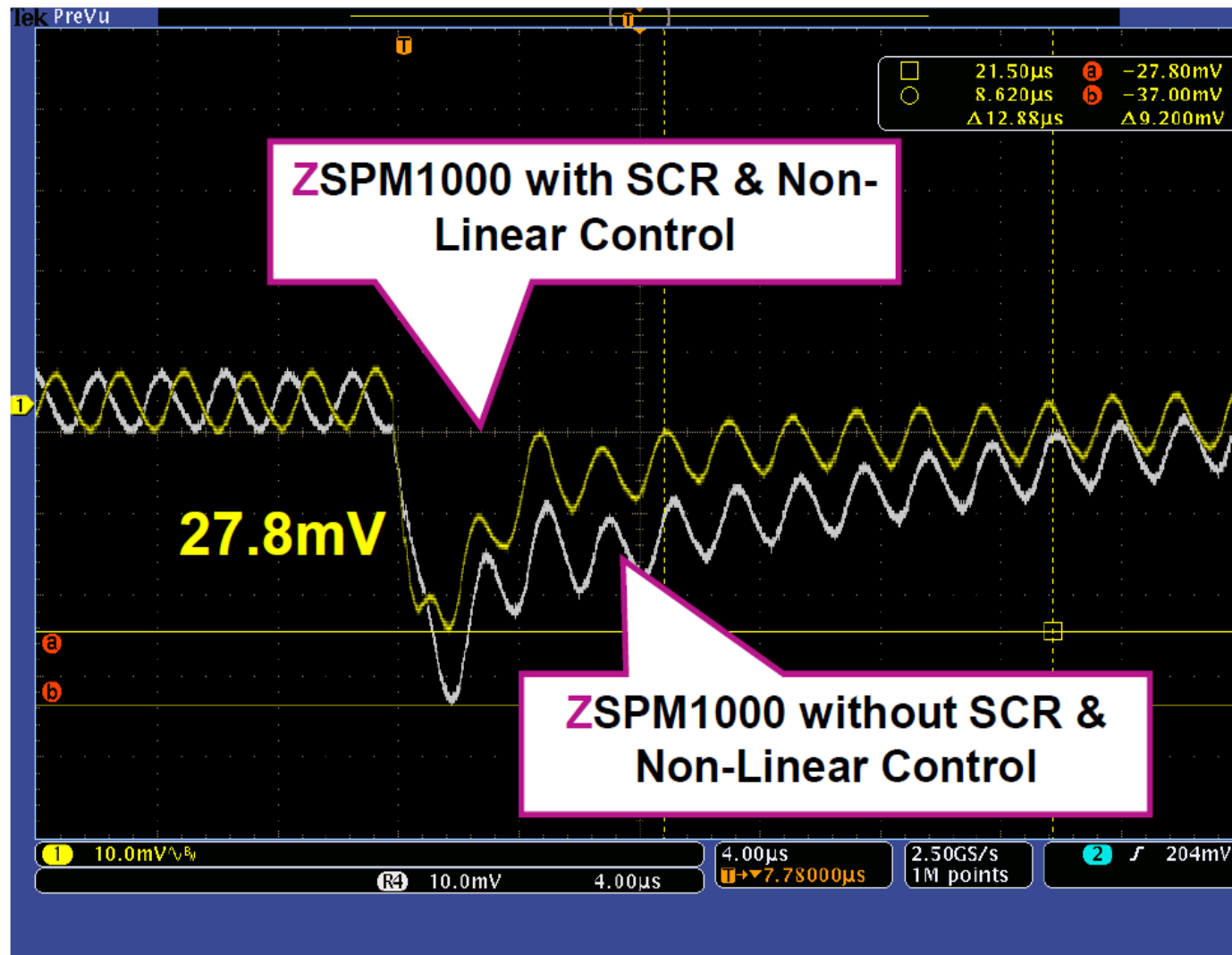
Test Setup

Output Components

Reference	Part Description	Quantity	Manufacturer	Manuf. P/N
C1,C2,C3,C4	470uF, 2V5, Case D	4	Kemet	T530D477M2R5ATE006
C5,C6,C7,C8	47u, X5R, 6V3	4	Kemet	C1210C476M9PACTU
L1	470nH	1	Wurth	7443320047

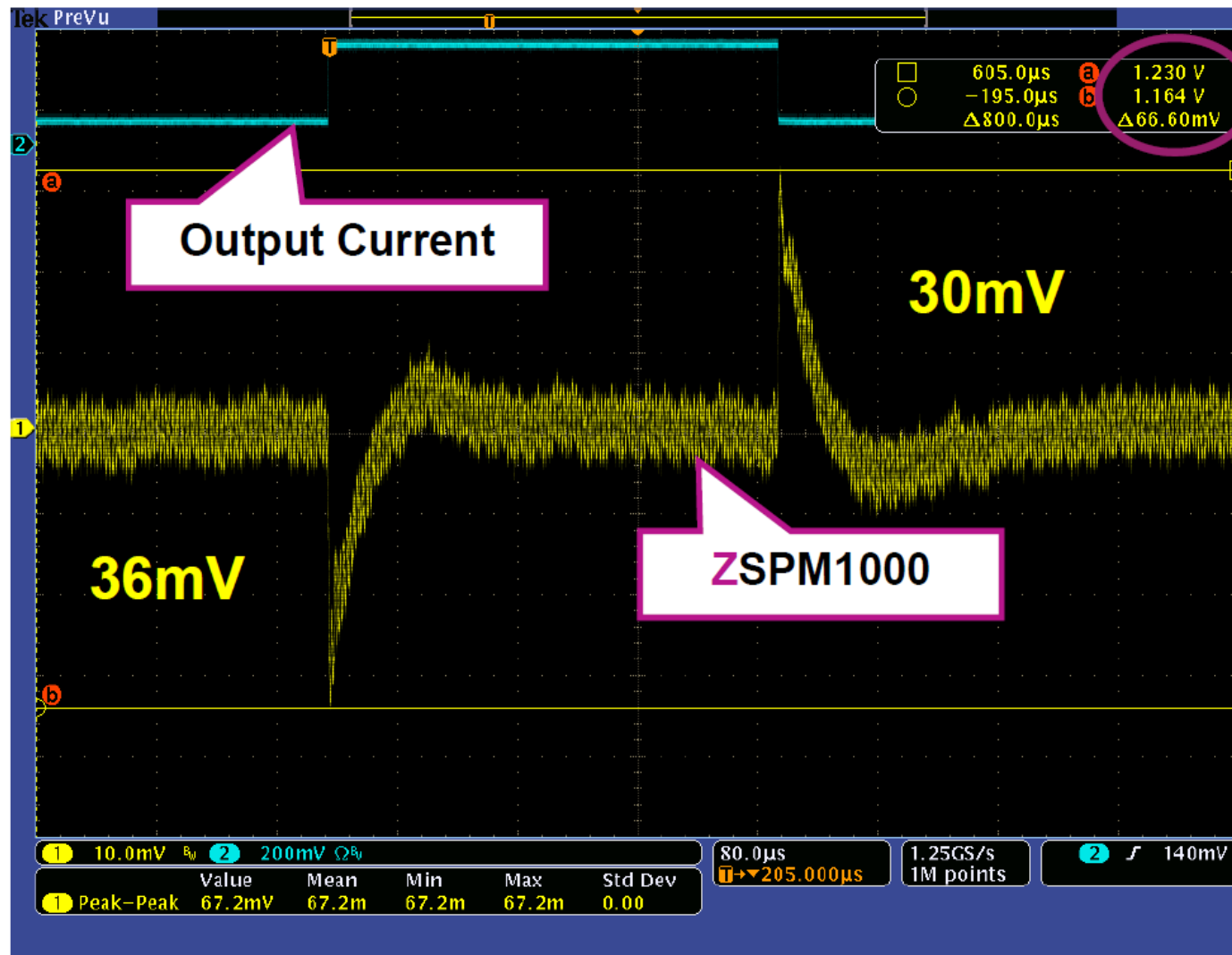
Results

Step-Performance meeting $\pm 3\%$ VOUT Accuracy



Results

Peak-Peak Transient Performance (4x 470 μ F)



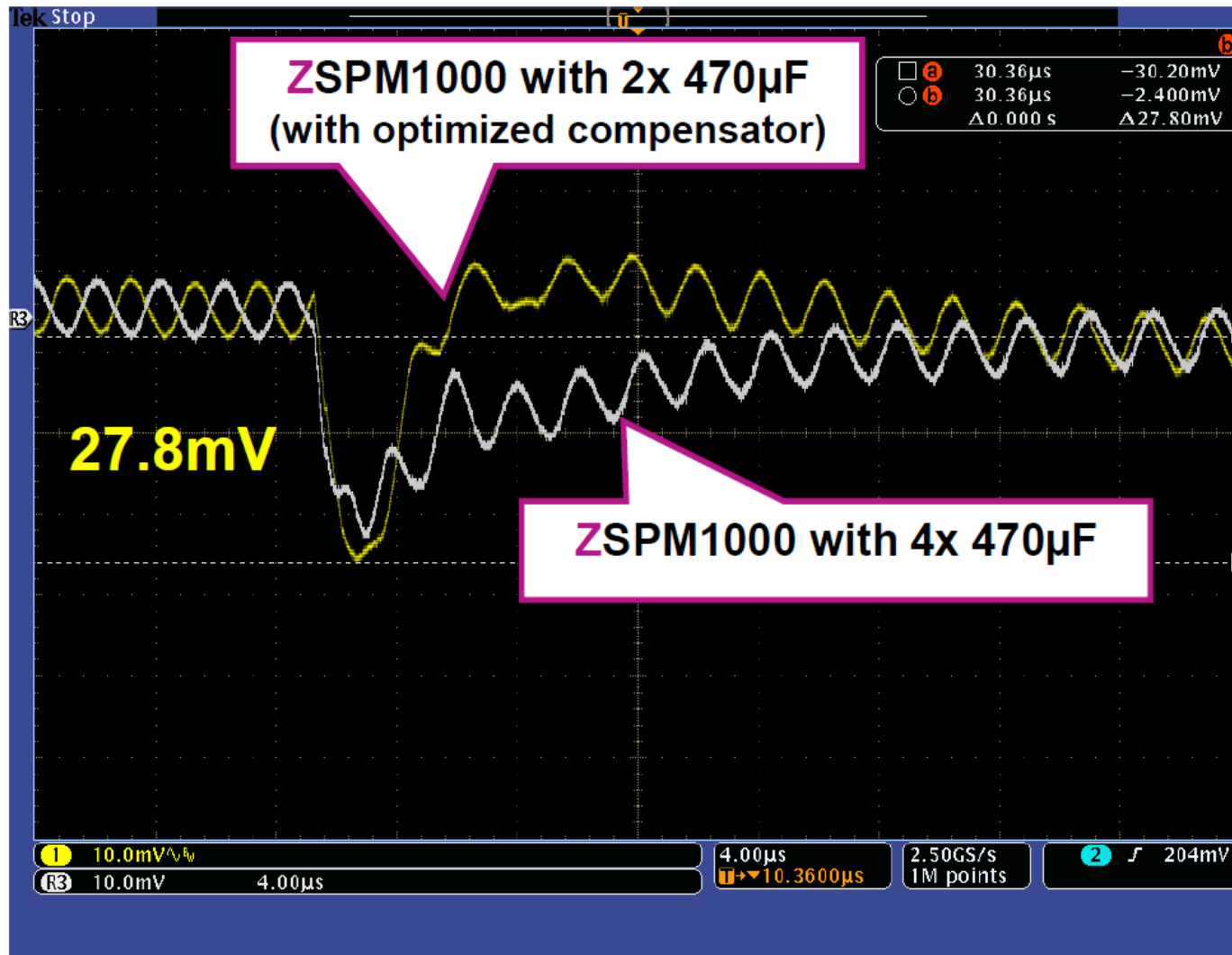
Test Setup

Changed Output Components

Reference	Part Description	Quantity	Manufacturer	Manuf. P/N
C1,C2,C3,C4	470uF, 2V5, Case D	2	Kemet	T530D477M2R5ATE006
C5,C6,C7,C8	47u, X5R, 6V3	4	Kemet	C1210C476M9PACTU
L1	470nH	1	Würth	7443320047

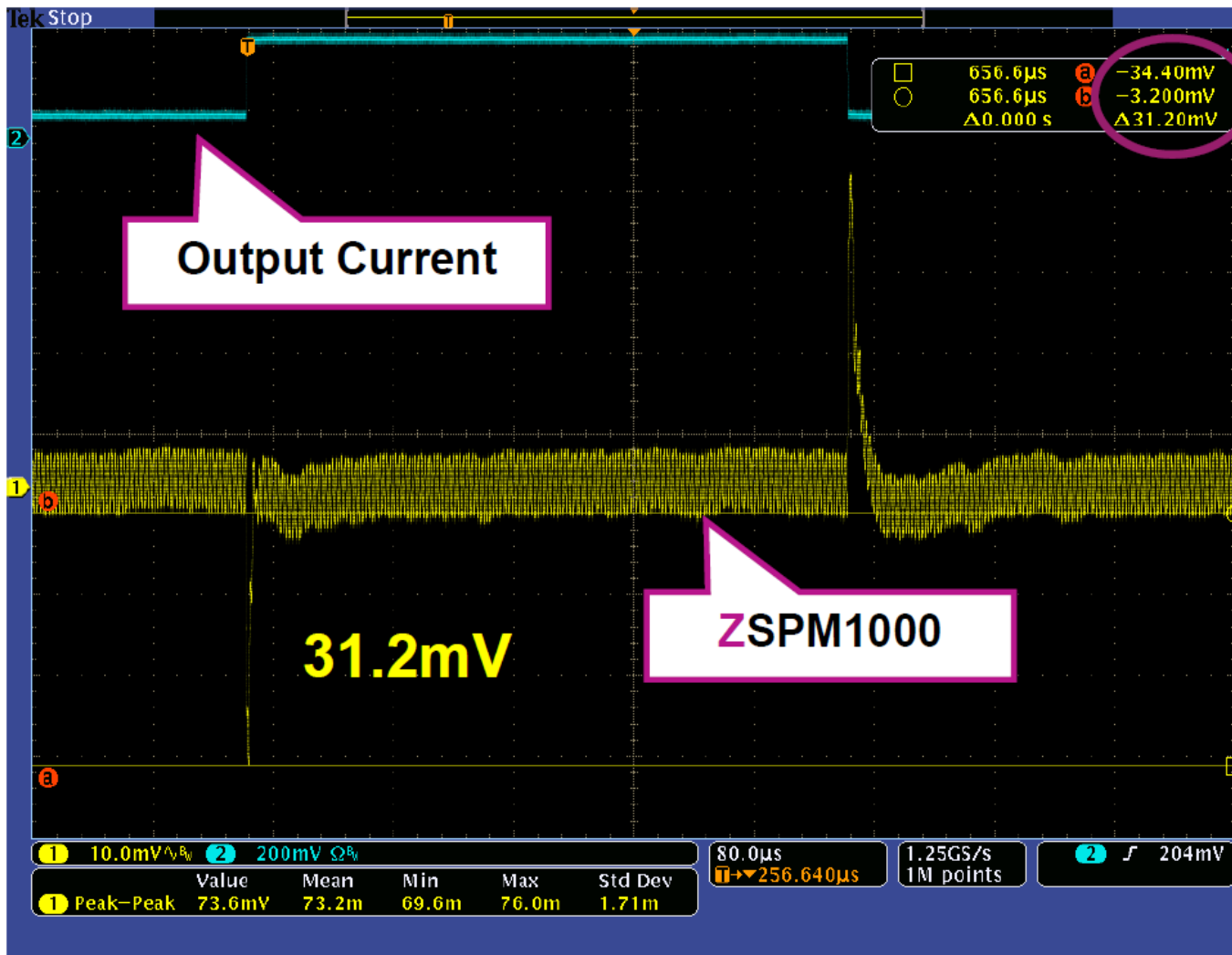
Results

Step-Performance still meeting $\pm 3\%$ VOUT Accuracy



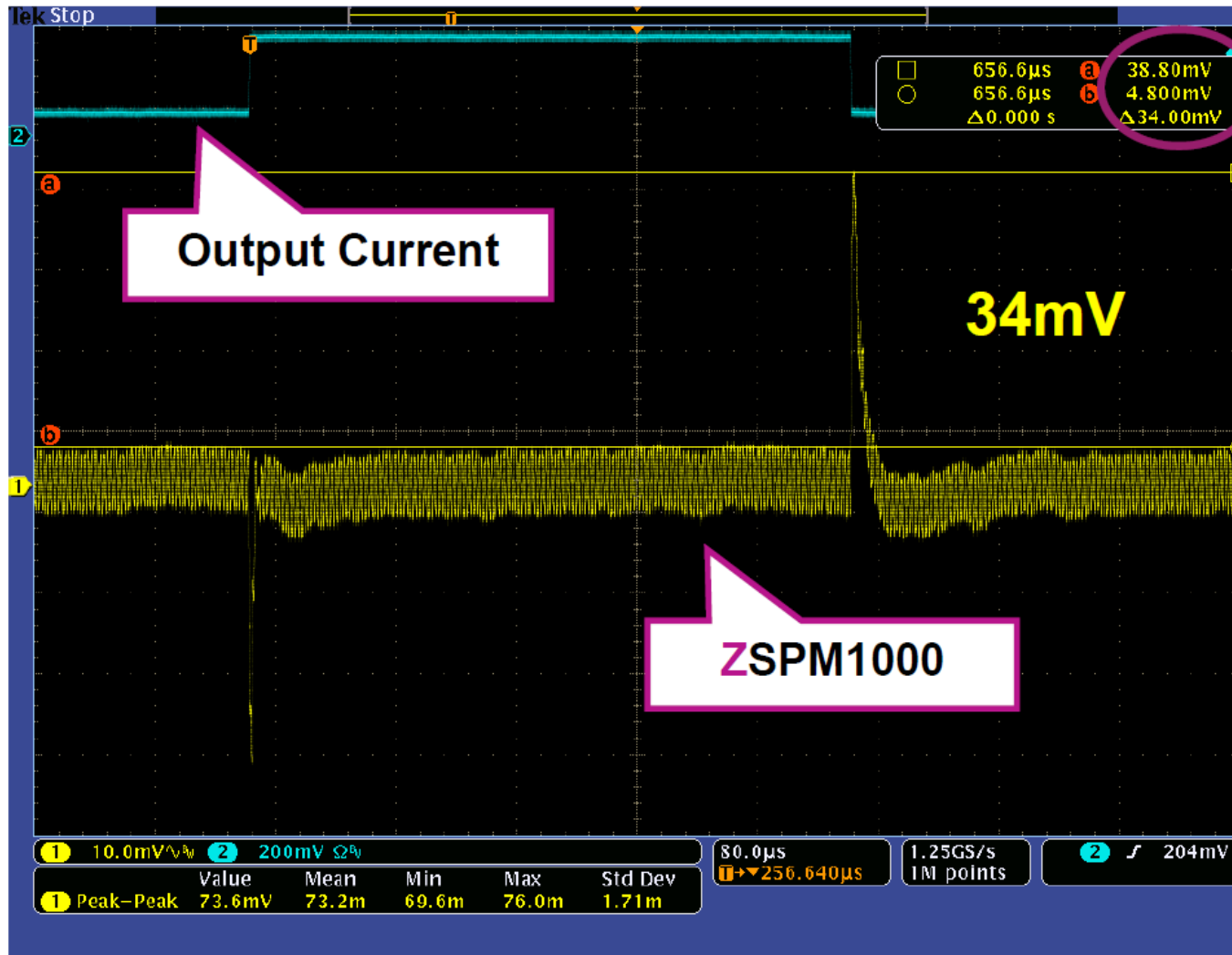
Results

Peak-Peak Transient Performance (2x 470 μ F): Undershoot



Results

Peak-Peak Transient Performance (2x 470 μ F): Overshoot



Summary

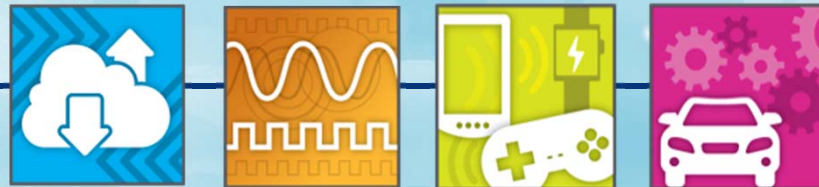
How does the superior step-response of the ZSPM1000 convert to cost savings?

- ZSPM1000 enables:
 - Improving transient performance specification without additional output capacitance OR
 - **Maintain the same performance but reducing the output capacitance up to 50%!**

$2 \times 470\mu\text{F} = 4\text{-}5^* \text{ USD SAVING!}$

***Might differ based on your own cost structure.**

Thank You



Analog Mixed Signal Product Leadership in Growth Markets