Viareggio
26 February 2016

Introduction

The Low Voltage A251X Board family implements a digital regulation system of the channels control loop. The digital regulation provides a control loop compensation easier than the "traditional" analog regulation. The implemented control algorithm is called PID (proportional, integrative, derivative). Such algorithm uses three parameters:

- Proportional, Kp;

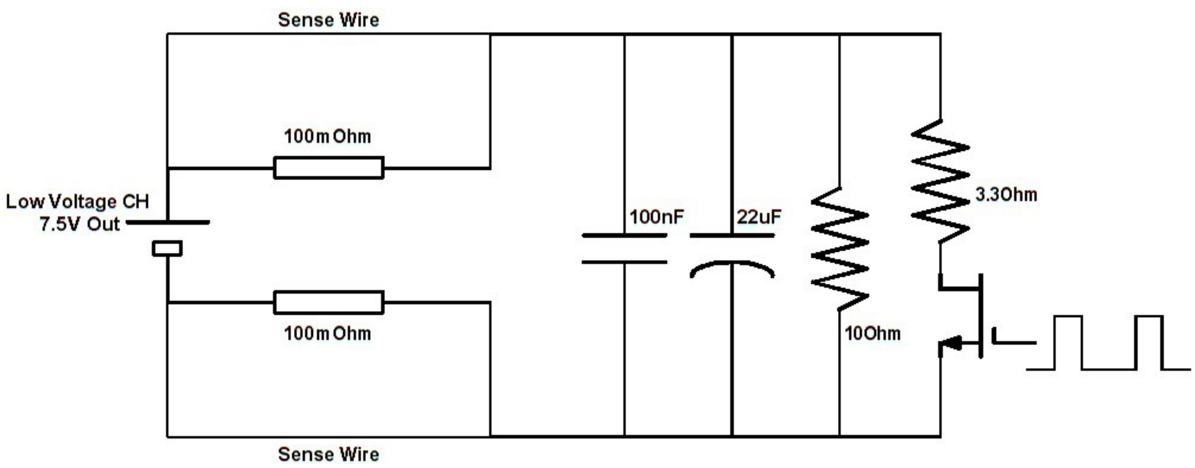
- Integrative, Ki;

- Derivative, Kd.

By tuning the three constants in the PID controller algorithm, the control action is provided; the general PID formula is the following:

$$u(t) = K_p e(t) + K_i \int_0^t e(\tau) d\tau + K_d \frac{\mathrm{d}}{\mathrm{d}t} e(t)$$

The A251X boards are provided with a default parameter setting, which is User programmable, in order to achieve the best control, depending on the load type. This Application Note explains how to set Kp, Ki, Kd parameters, when using one A2519 channel on a load like the figure below:



The load is connected to the LV channel, through a couple of cables, whose impedance is estimated 100 mOhm each. The voltage on the load is set to 7.5V, thanks to the sense wires.

The results are reported as Output Voltage vs. Time, as the channel is subject to load variation.

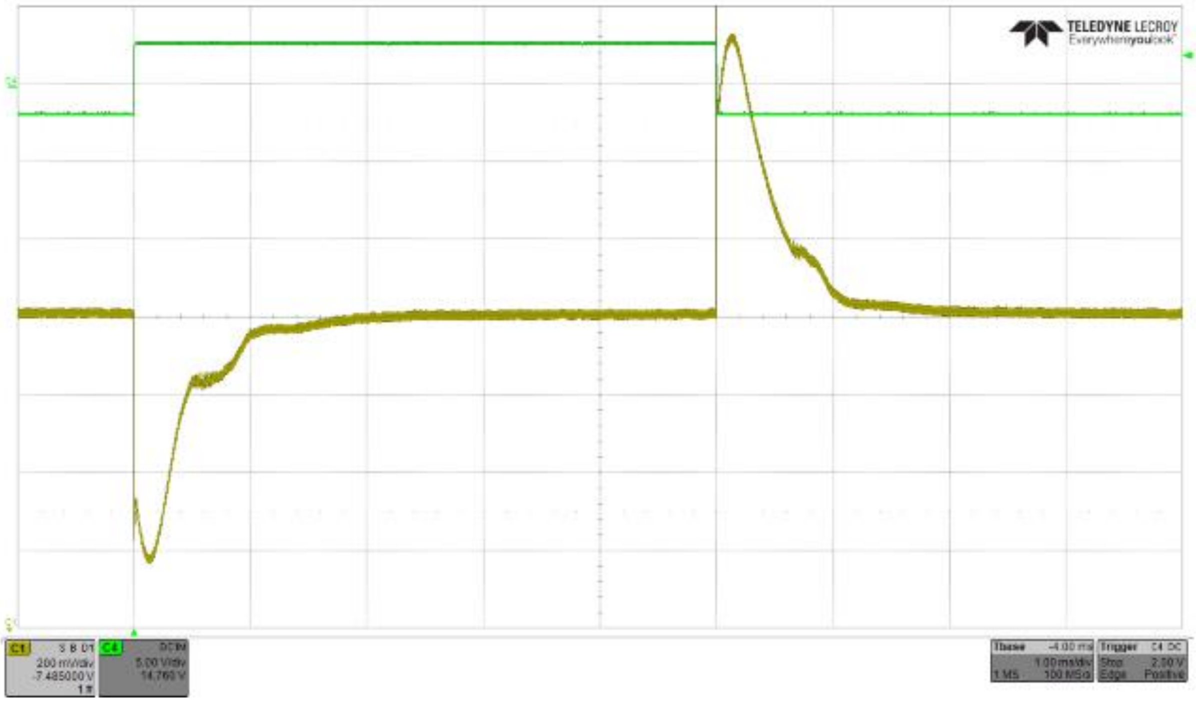
The channel frequency response is also reported.

Default Configuration

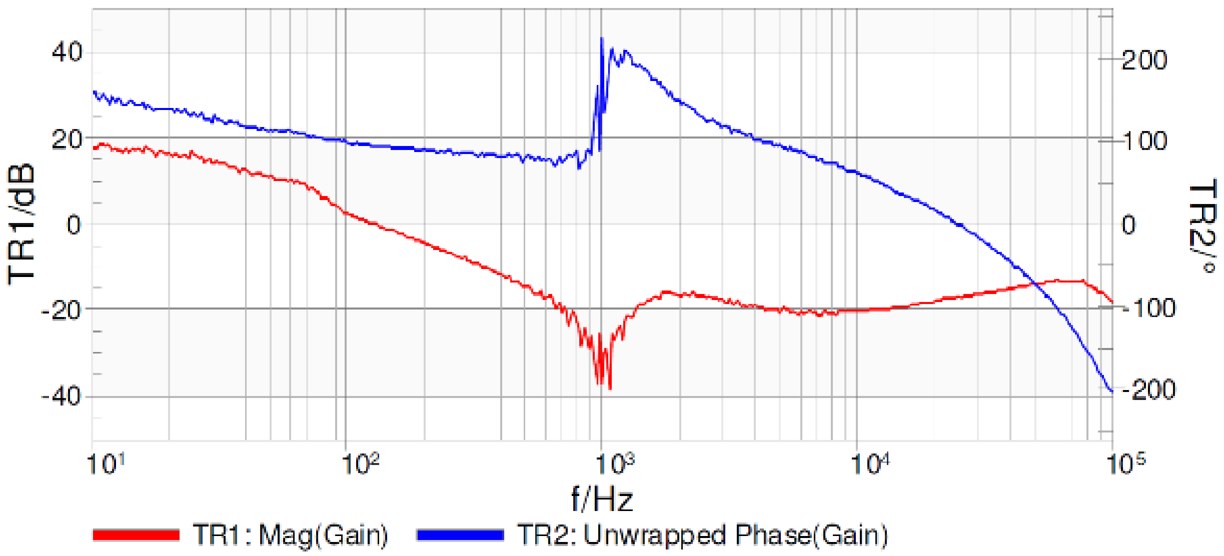
A2519 PID Default Configuration is as follows:

Kp = 6; Ki = 10; Kd = 20000;

The channel response after a load change is reported in the figure below; C1 and C4 traces represent respectively channel output and load change.



The following figure represent the power supply closed loop transfer function, in the same conditions:

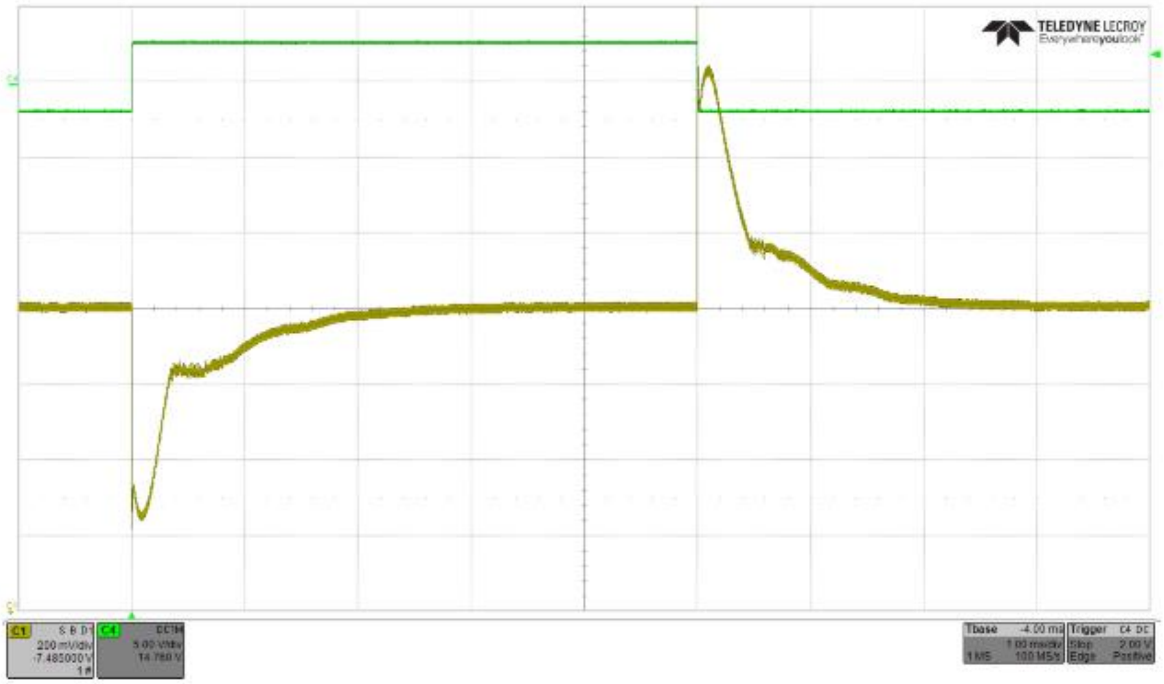


Configuration 1

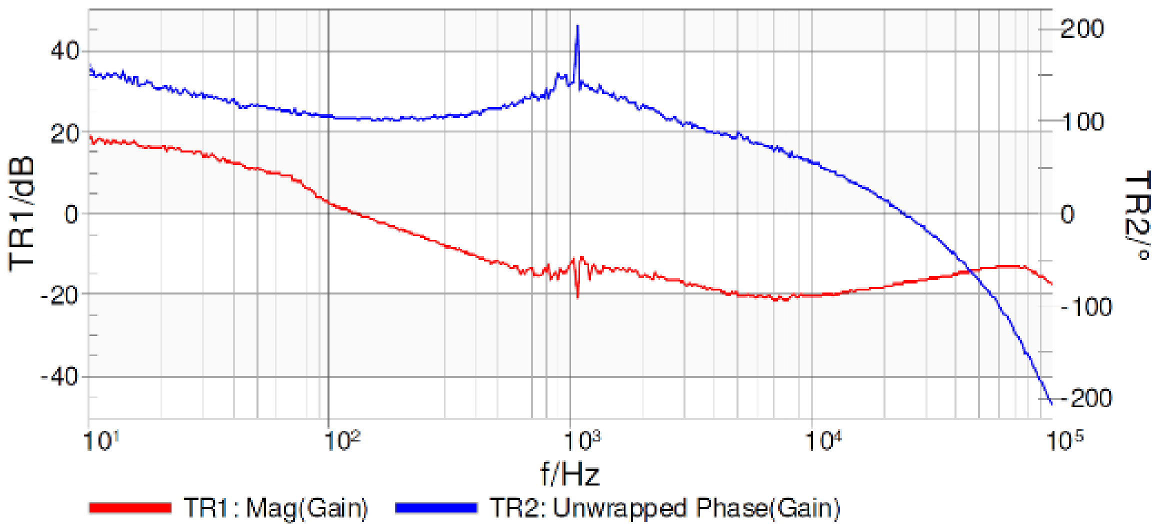
If we change the parameters (increasing Kp):

Kp = 500; Ki = 10; Kd = 20000;

The channel response after a load change is reported in the figure below; C1 and C4 traces represent respectively channel output and load change.



The following figure represent the power supply closed loop transfer function, in the same conditions:



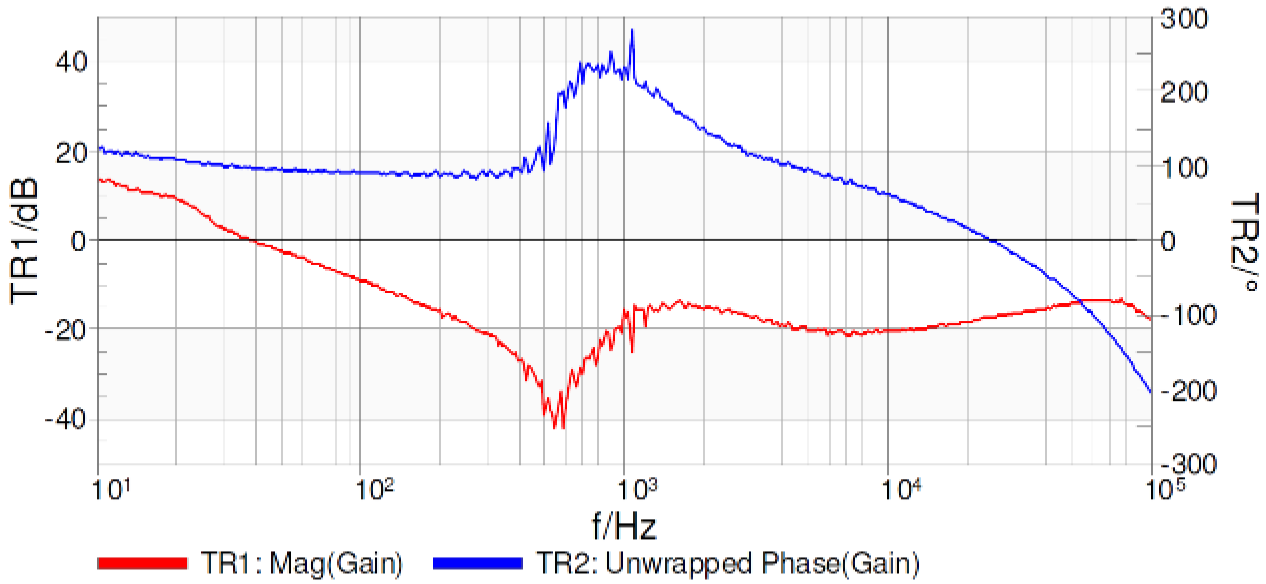
Configuration 2

If we change the parameters (decreasing Ki):

Kp = 6; Ki = 3; Kd = 20000;

The channel response after a load change is reported in the figure below; C1 and C4 traces represent respectively channel output and load change.

The following figure represent the power supply closed loop transfer function, in the same conditions:

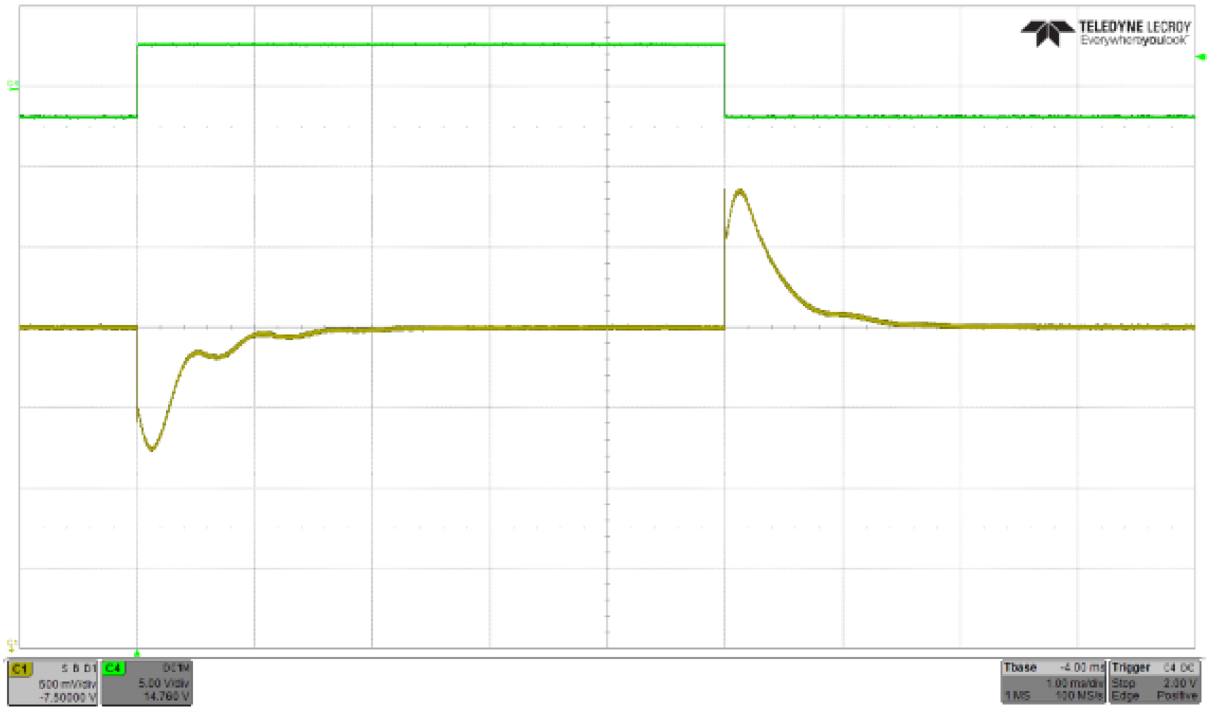


Configuration 3

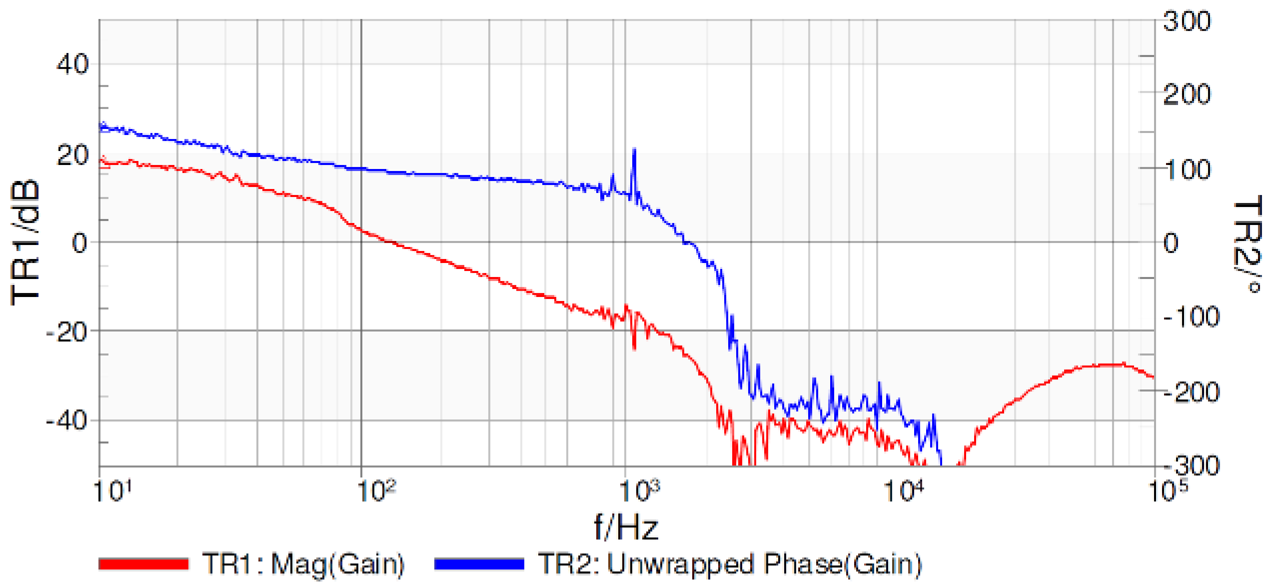
If we change the parameters (decreasing Kd):

Kp = 6; Ki = 10; Kd = 2000;

The channel response after a load change is reported in the figure below; C1 and C4 traces represent respectively channel output and load change.



The following figure represent the power supply closed loop transfer function, in the same conditions:

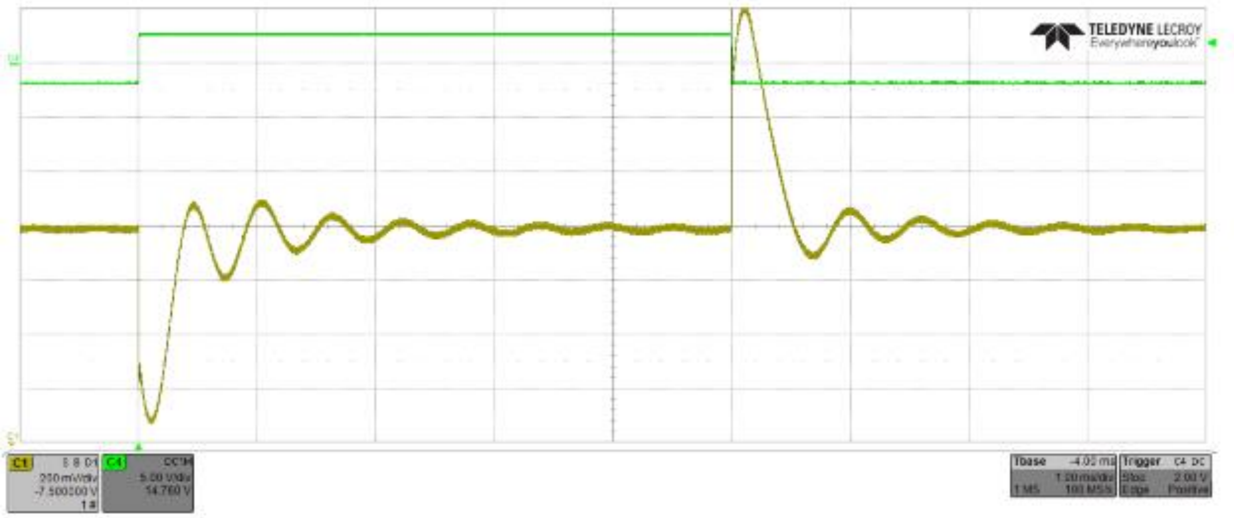


Configuration 4

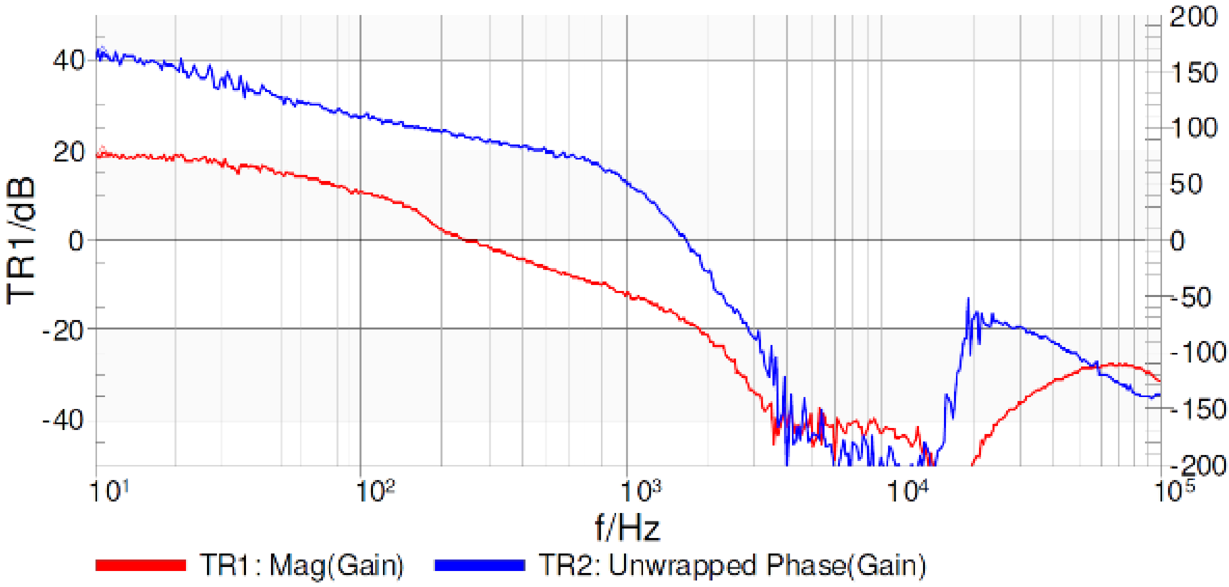
If we change the parameters (ingreasing Ki and decreasing Kd):

Kp = 6; Ki = 20; Kd = 2000;

The channel response after a load change is reported in the figure below; C1 and C4 traces represent respectively channel output and load change.



The following figure represent the power supply closed loop transfer function, in the same conditions:



Conclusions

The default configuration is expected to satisfy most load conditions. Whenever this doesn't occur, the User can change the loop parameters (Kp, Ki and Kd), through the power supply system “transparent mode” access. Such operation must be performed carefully, since it might also lead to a worse channel response to a load change.

Copyright © CAEN SpA. All rights reserved. Information in this publication supersedes all earlier versions. Specifications subject to change without notice.

CAEN SpA
Via Vetraia 11
55049 – Viareggio Italy
Tel +39.0584.388.398
Fax +39.0584.388.959
info@caen.it www.caen.it