TIDA-00331- "Precision Power Limiting Solution”

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1. System Description:

This solution limits the power delivered to a maximum of 15W to ensure IEC60730 compliance in Human-Machine-Interaction (HMI) ports, making it very easy for the end equipment to meet safety regulations.

This design uses TI’s TPS25921AD to monitor the voltage and current flowing through the connected system and controls the power output within 2%. Along with the power limit function, TPS25921AD also protects against over voltage, under voltage, inrush current and short circuits.

2. System Operation

Figure 1 shows a very simple and cost effective way to limit the power delivered to the downstream load.This concept uses TI’s TPS25921 and supplies power to the connected output load in such a way that load power never exceeded 15W to meet IEC60730 compliance requiremements. The operation of the circuit is as follows.

For the given load condition, higher input will produce more power at the load and that may be more than 15W if the load current is not reduced.

The maximuim current limit of the drvice can be set up to 1.5A by R_{ILIM} resistor. A small circuit wired around Q1 with R3, R4 and R5 is utilized to reduce the current whenever output power exceeds more than 15W. The Q1 remains inactive until Vout is less than 10V and can delivers upto 15W load. The Q1 plays role to reduce the effective resistance at ILIM pin by diverting some current from ILIM pin thrugh R5 and Q1 as the Vout start increasing higher than 10V. The reduce inpdedance at Ilim alter current limit setting and now current limit will be lower than 1.5A for the increased input voltage.

The R3, R4 and R5 are selected in such a way that allows Q1 keep altering the TPS25921 current limit dynamicly as Vout increases.

For example if Vin or Vout is 12V, the Q1 will program 1.25A current limit and for 16V output, the current limit will be altered to 1.066A in order to maintain the output power not exceeding 15W.

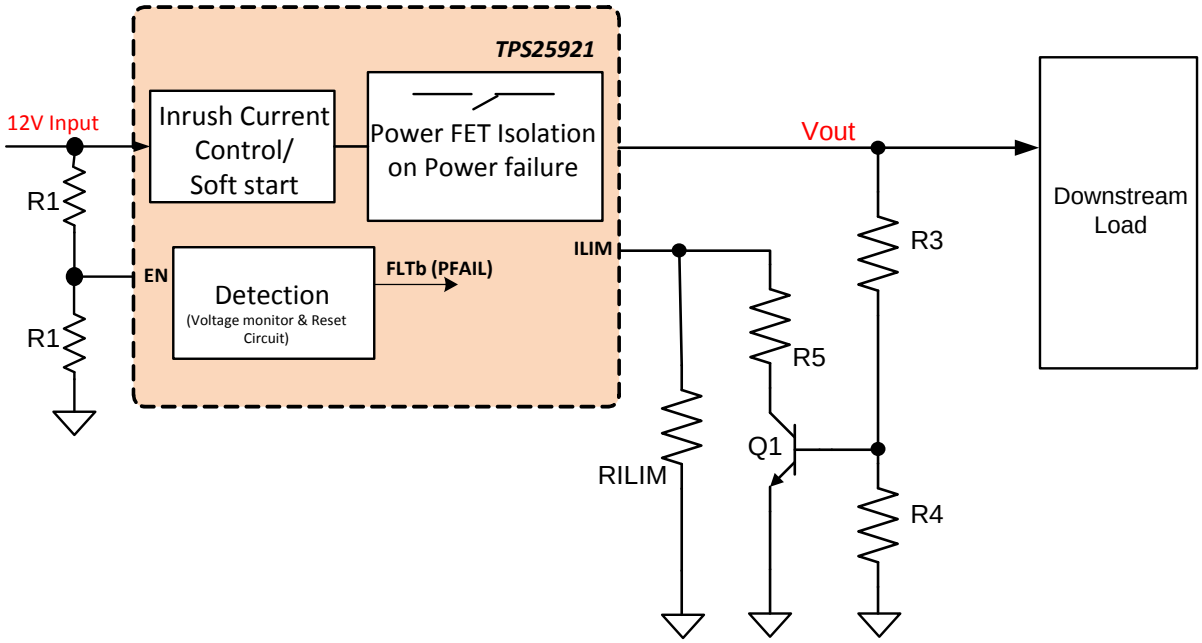

Figure 1: Block Diagram Precision Power Limiting Solution

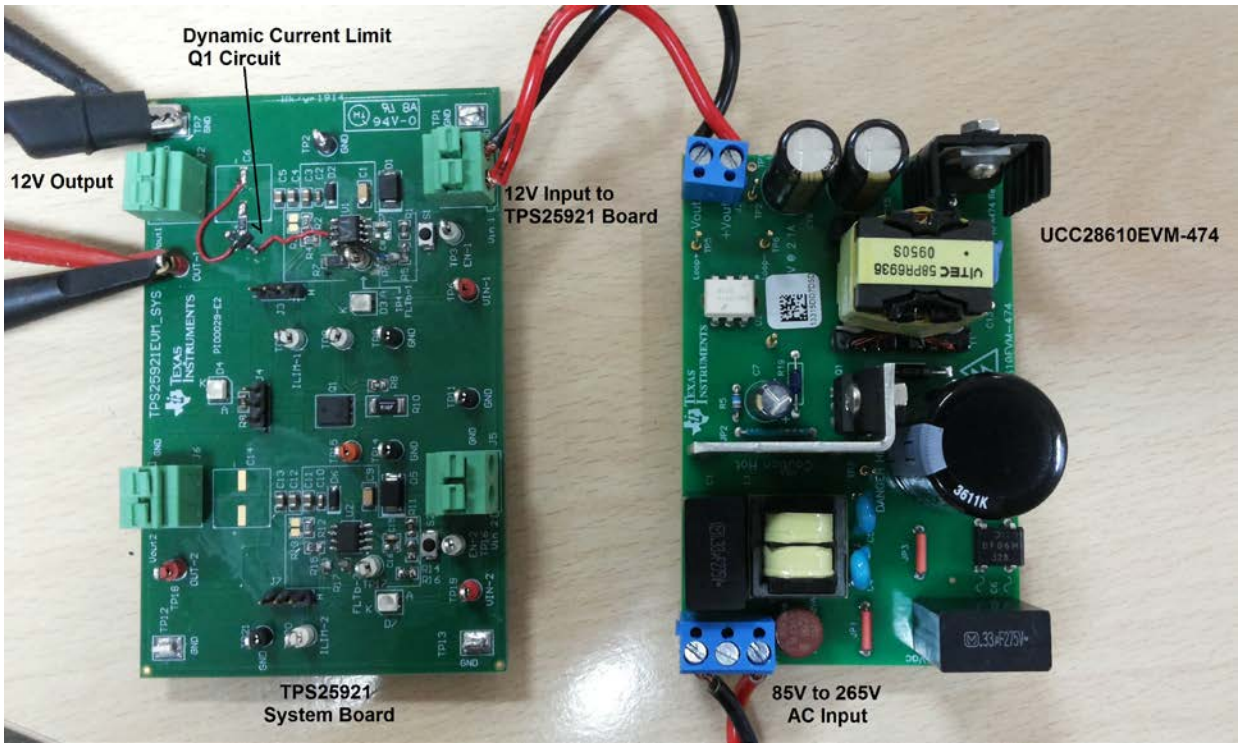

Figure 2 Test Set-up made by using TPS25921 System Board and UCC28610 EVM

3. Test Results

Test setup Precision Power Limiting Solution

- Vin from AC/DC converter (UCC28610EVM-474) = 12V@2.5A
- Output Voltage from TPS25921 system board = 12V
- TPS25921 EVM current limit set by RILIM= 1.5A
- Output Load Variation- 1A to 1.5A
- Additional power supply used for the test – 0-20V,10A

Scope label Information

- VIN- Input supply voltage to TPS25921 system board.
- IN= Iout = Load current
- Vout – Load voltage
- Pout – Power delivered to the load with varying load current or volatge

Test Result 1:

The input voltage is set to 12V and load current (Iout) is varied from 1A to 1.25A, the figure 3 show the dymanic adjustment of the current limit to limit output power when load current is incread beyoned 1.25A and load power is limited to 15W.The device enters retry-mode when it reachs the adjusted power limit.

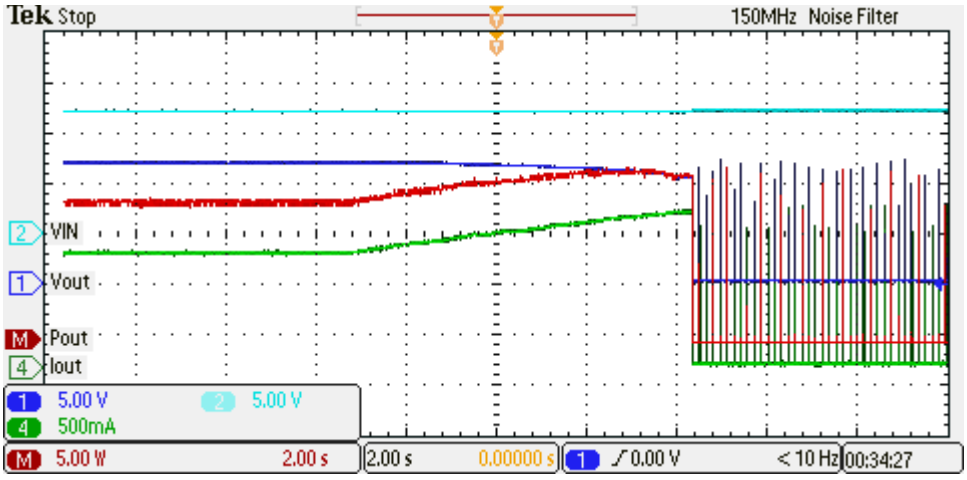

Figure 3: Load Power is limited to 15W for VIN= 12V, Iout varied from 1 to beyond 1.25A

Test Result 2:

In this case the input voltage is set to 10V and load current (Iout) is varied from 1.0A to 1.5A. Figure 4 shows this design adjusts the current limit and limits the output power at 15W, when load current is increased beyond 1.5A.

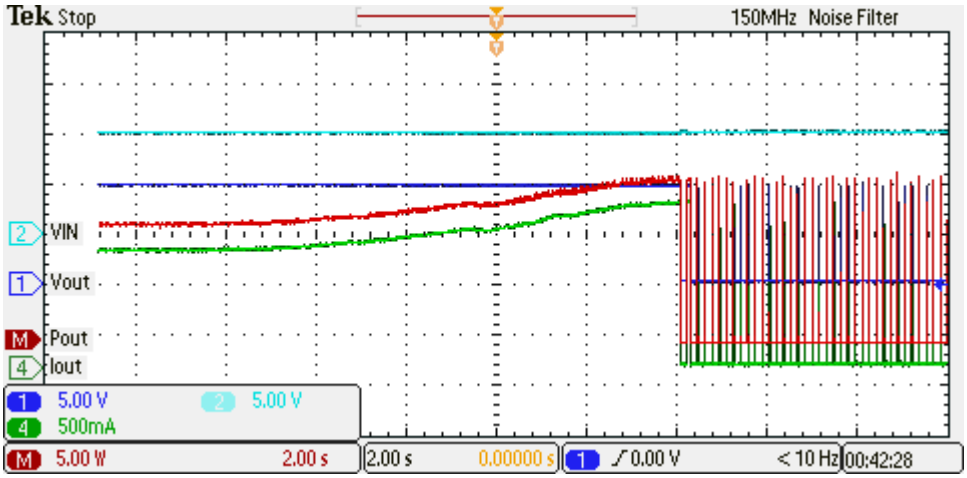

Figure 4: Load Power limited to 15W, for VIN= 10V and Iout is increased from 1A to beyoned 1.5A

Test Result 3:

In this case, the input voltage is set to 15V and load current (Iout) is varied from 0.5A to 1.0A and figure 5 show the dymanic power limiting feature of the solution limits the power at 15W, when load current is increased beyond 1A. This is shown in figure 5.

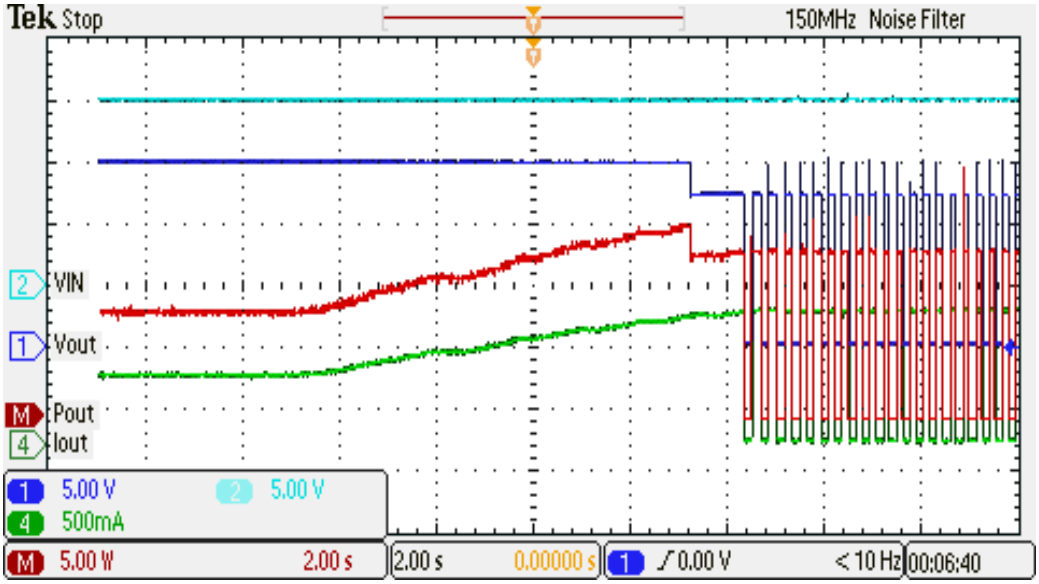

Figure 5: Load Power limits at 15W, for VIN= 15V, Iout is increased from 0.5A to beyond 1A

Test Result 4:

Figure 6, shows, Input voltage is varied from 8V to 15V at the constant load (Iout = 1.1A) and demonstrates that Vout start falling when load power goes beyond 15W. This also shows, the current limit is not adjusted until load power exceeding 15W. The device enters retry-mode when it reach the adjusted power limit.

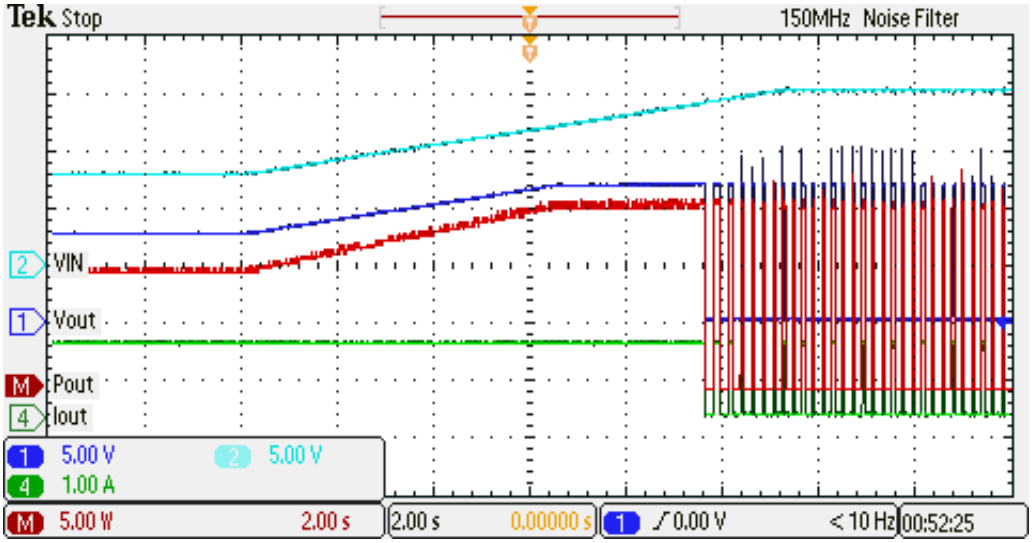

Figure 6 : Load Power limit at 15W, for VIN= 8V to 15V @ 1.1A load

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