
EIGHTEENTH ANNUAL
BiTS
TM
Burn-in & Test Strategies Workshop
March 5 - 8, 2017
Hilton Phoenix / Mesa Hotel
Mesa, Arizona
Archive – Session 4
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Session 4

Rahima Mohammed

Session Chair

BiTS Workshop 2017 Schedule

Frontier Day

Tuesday March 7 - 8:00 am

Launch Pad

"Load Board PCB Socket Contact Pad Solution"

Willy Ganoy, Jess Coleta – ON Semiconductor Philippines

"Addressing high frequency challenges for burn-in requiring LVDS"

Rolando Reyes - Analog Devices Inc.

"New Applications for Embedded Thin Film Heaters"

Bruce Mahler - Ohmega Technologies, Inc.

"Adressing the EOS on legacy burn-in boards with over voltage protection through a modular design"

Gil Conanan - Analog Devices, Inc.

Addressing the EOS on Legacy Burn-in Boards with Over Voltage Protection through a Modular Design

Gil S. Conanan
Analog Devices Inc.

BiTS Workshop
March 5 - 8, 2017

Outline

- Overview
- Introduction
- Methodology
- Results and Discussion
- Conclusion
- Recommendation
- Acknowledgements

Overview

- The Over Voltage Protection (OVP) circuit is a circuit designed with safety features such as fuse, Transient Voltage Suppressor(TVS) diode and indicators primarily to protect Device Under Test (DUT) on a board from Excessive current, Sudden voltage surge or potential Electrical Overstress (EOS) occurrence.
- The OVP module is uniquely structured with provision for a Crowbar and TVS protection circuits.
- This modular board design can be utilized in most of legacy burn-in board design with insufficient power supply protection.
- Going modular, re-work of burn-in boards is eliminated and overall manufacturing cycle time is improved.
- The OVP circuit is populated on a miniature sized adapter board ideally suited for most circuit applications like in any burn-in board design where tight spacing is a concern.

Introduction

- Most of legacy burn-in boards have no Over Voltage Protection circuit.
- Here are some of the events of worst case ever!!!

Occurrence	Date of Incident	Affected BIB	Oven Column/Slot	Picture
1	December 14, 2013	BLL31006 BLL31008 – due to contamination	Column 3/ Slot 10 & 11	
2	February 8, 2014	BLL31007	Column 3/ Slot 14	
3	July 14, 2014	BLL31009 BLL31010 – due to smog	Column 2/ Slot 11 & 12	
4	September 7, 2014	BLL31008	Column 1/ Slot 15	

Introduction

The following events are sent these boards to scrap and most likely affect EOS on the part.

Introduction

Legacy Burn-In Board design actual Burn-In Board K0104 rev. O

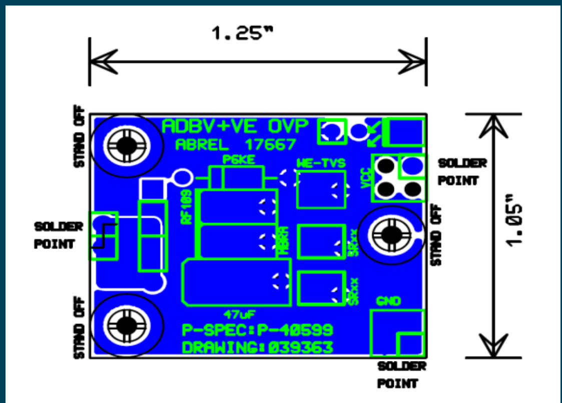
NO Over-Voltage Protection Circuit (OVP) !!!

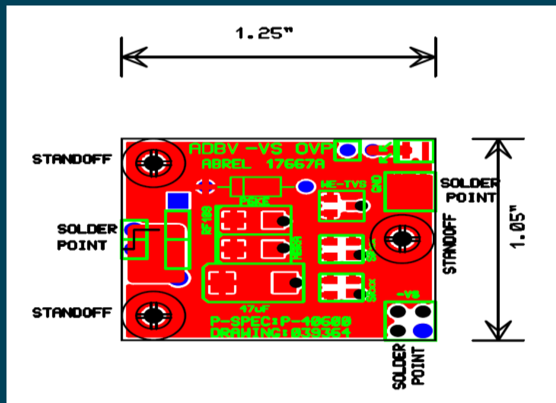
K-SPEC: K0104 rev. O

Methodology

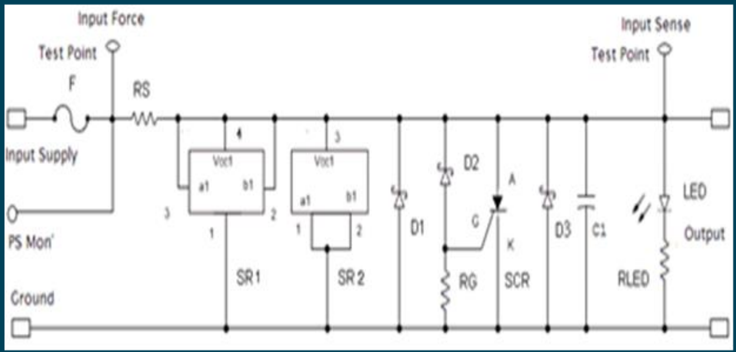
The OVP modular board design was built by Abrel in a four layer polyimide material, basically similar board characteristics of most Manufacturing/reliability burn-boards.

- The physical dimension of the board was achieved by engineering
- The maximum area of the burn-in boards where the standard DUT power-supply protection circuit is laid-out on the board.
- The OVP module can be configured to provide positive or negative output signal.

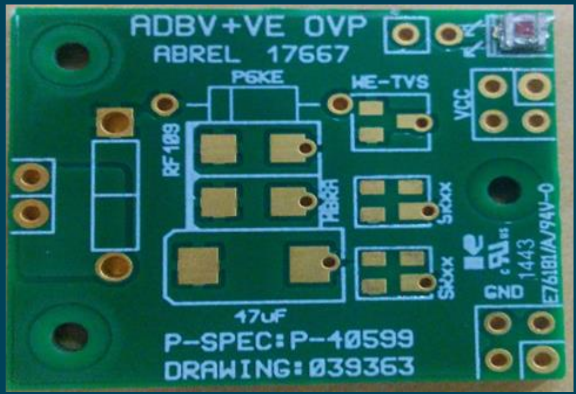




Methodology



OVP Schematic Diagram
(Positive Output)



Actual OVP Module Design
(Positive Output)

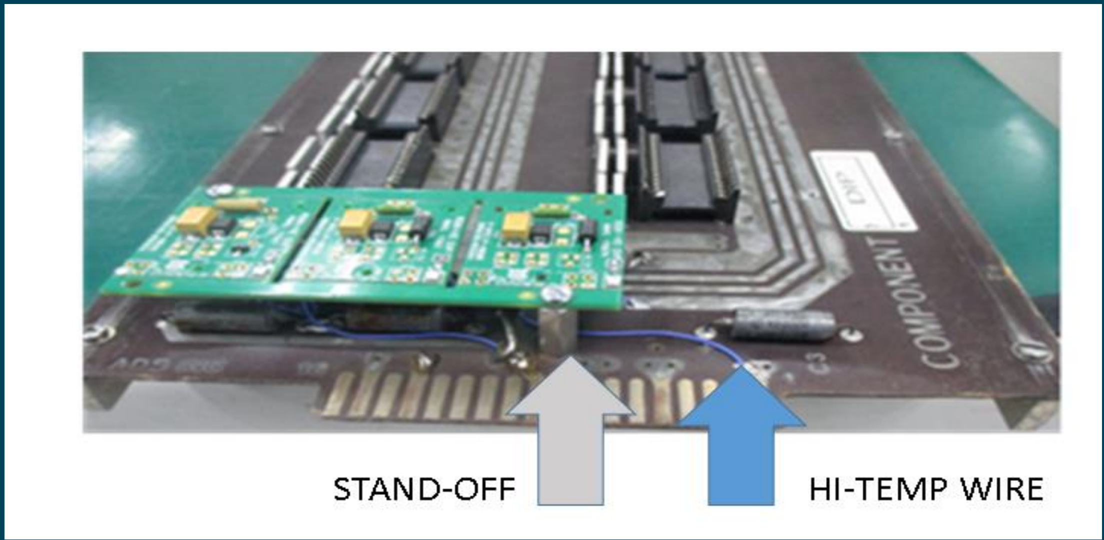
Benefits:

- Since it was miniature this are flexible and can be placed any where on the board.
- The design meet the standards qualification for Burn-in applications.
- Save cycle-time and cost for rework.
- Adaptable to existing and new reliability, manufacturing or customer application boards.

Project Implementation

The OVP modules are installed for each individual DUT main supply pins close to the edge finger connection of burn-in board. The following components is needed In order to connect the OVP module to the board.

- High-temp wire and stand-off are used.

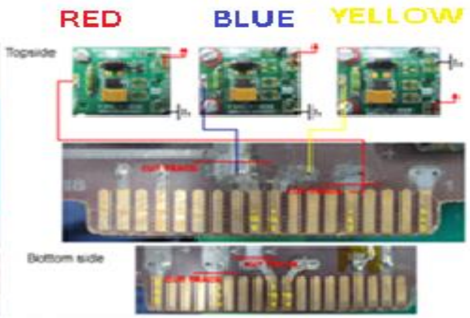


Project Implementation

RED= +5V

BLUE = +15V

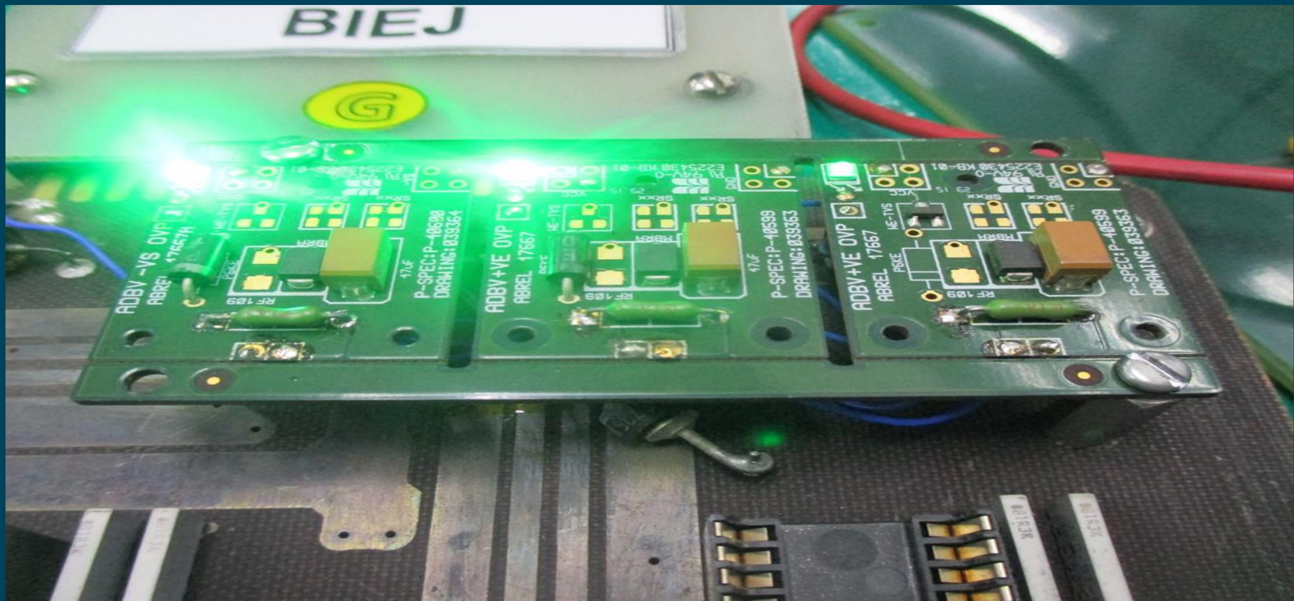
YELLOW = -15V



The top 1st picture is NO OVP, 2nd picture is with the adapter board with OVP installed, 3rd picture is OVP interconnection

Project Implementation

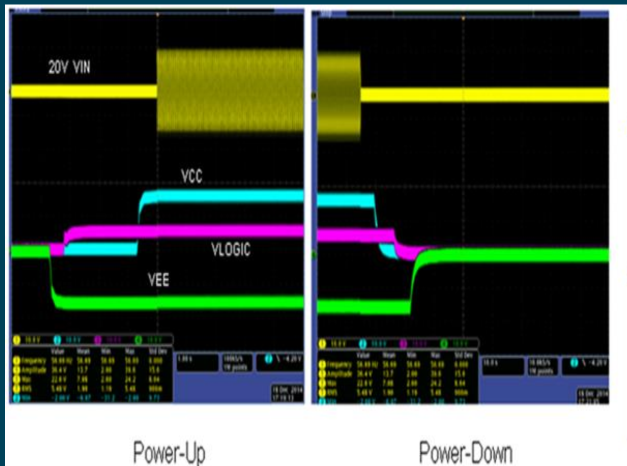
The sample devices will run in the following conditions: normal power-up/down sequence using no-OVP and with OVP burn-in board design. A power cycling test was also included for monitoring any glitches on the power supply lines.



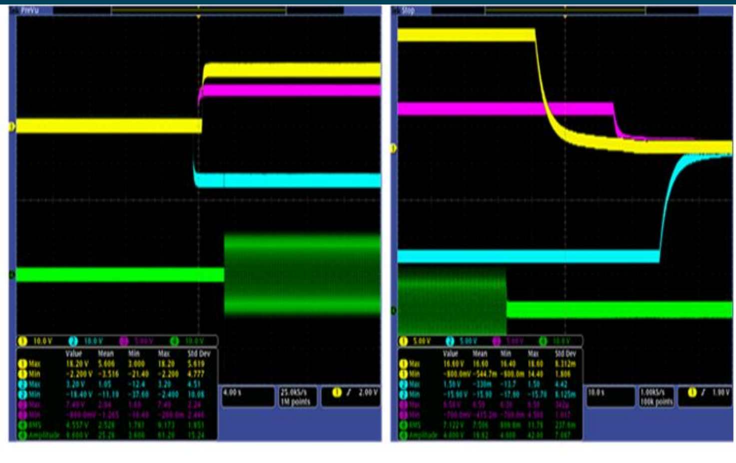
Evaluation of Result

The Evaluation achieved the following:

- Can captured power-up and power down.
- There is no big difference between the existing and improved design in terms of its functionality, burn-in operation and handling process .
- During evaluation, pre and post BI test results have no impact on the performance of the device.
- Full implementation of OVP circuitry is mandated on all legacy boards and future burn-in board design.



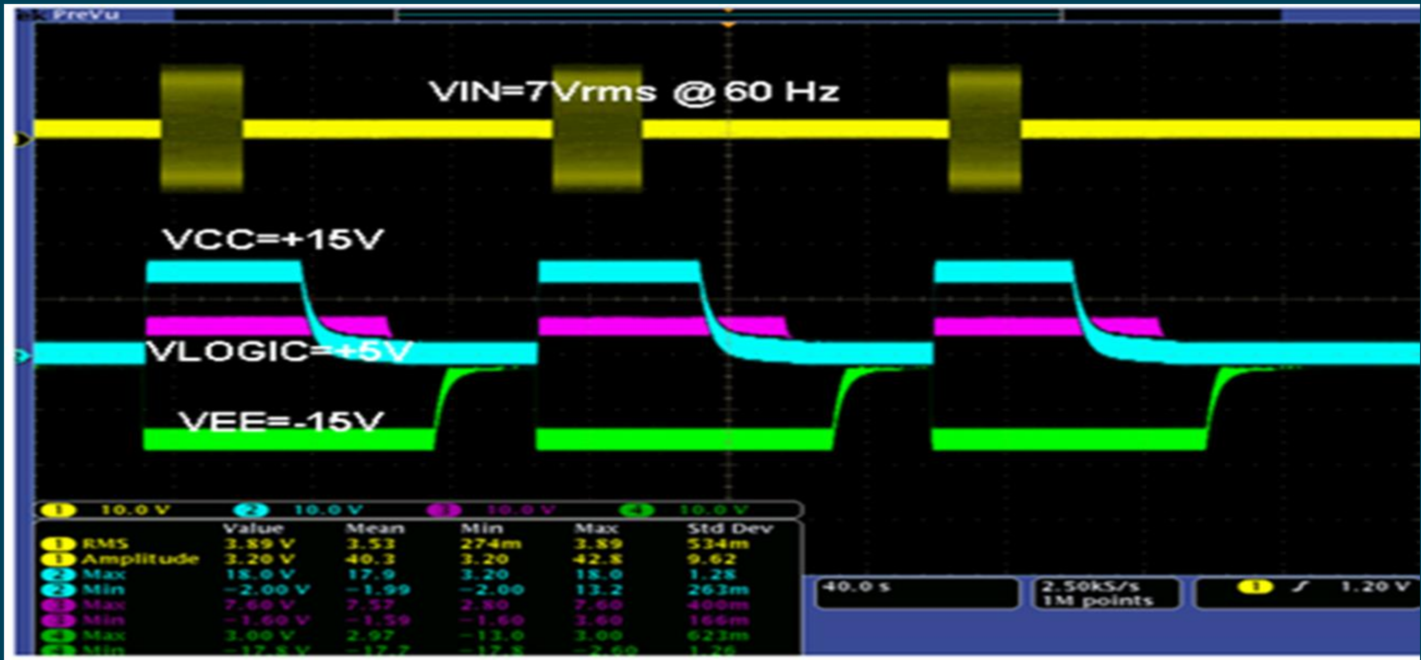
Without OVP, No glitch or distortion found



With OVP, No glitch or distortion found

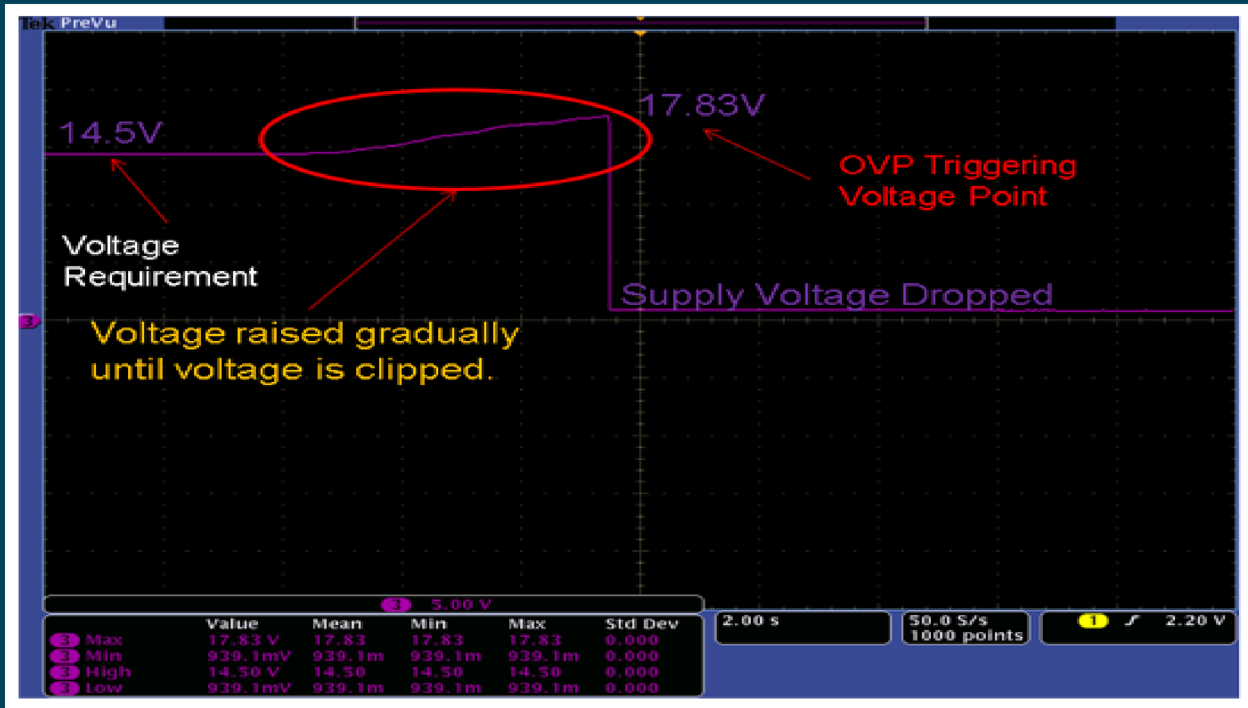
Evaluation of Result

Power cycling test was performed to see any glitches during power-up/down of the improved burn-in board loaded in the oven.



No glitch or spike are found during power cycling test

Evaluation of Result: Over Voltage Experiment



The OVP is responding and blown the fuse in the event of over voltage

Evaluation of Result

The picture below shown is based from the datasheet from little fuse.

Littelfuse Expertise Applied | Answers Delivered

Transient Voltage Suppression Diodes

Axial Leaded – 600W > P6KE series

Electrical Characteristics (T_A=25°C unless otherwise noted)

Part Number (Uni)	Part Number (Bi)	Reverse Stand off Voltage V_R (Volts)	Breakdown Voltage V_{BR} (Volts) @ I_T		Test Current I_T (mA)	Maximum Clamping Voltage V_C @ I_{pp} (V)	Maximum Peak Pulse Current I_{pp} (A)	Maximum Reverse Leakage I_R@ V_R (µA)	Agency Approval
			MIN	MAX					
P6KE6.8A	P6KE6.8CA	5.80	6.45	7.14	10	10.5	58.1	1000	X
P6KE7.5A	P6KE7.5CA	6.40	7.13	7.88	10	11.3	54.0	500	X
P6KE8.2A	P6KE8.2CA	7.02	7.79	8.61	10	12.1	50.4	200	X
P6KE9.1A	P6KE9.1CA	7.78	8.65	9.55	1	13.4	45.5	50	X
P6KE10A	P6KE10CA	8.55	9.50	10.50	1	14.5	42.1	10	X
P6KE11A	P6KE11CA	9.40	10.50	11.60	1	15.6	39.1	5	X
P6KE12A	P6KE12CA	10.20	11.40	12.60	1	16.7	36.5	5	X
P6KE13A	P6KE13CA	11.10	12.40	13.70	1	18.2	33.5	1	X
P6KE15A	P6KE15CA	12.80	14.30	15.80	1	21.2	28.8	1	X
P6KE16A	P6KE16CA	13.60	15.20	16.80	1	22.5	27.1	1	X
P6KE18A	P6KE18CA	15.30	17.10	18.90	1	25.2	24.2	1	X
P6KE20A	P6KE20CA	17.10	19.00	21.00	1	27.7	22.0	1	X
P6KE22A	P6KE22CA	18.80	20.90	23.10	1	30.6	19.9	1	X

Evaluation of Result

Project Measurement

Secondary Measurement	Target Evaluation of Result	Results
• Cost Avoidance	50% Cost of k104-4 Burn-in boards fabrication	Zero Cost on Re-fabrication of Burn-in boards

K104-4 Burn-in Boards Inventory =150
Cost Burn-in Boards Fabrication = $2000
Total cost Avoidance = $300,000
Cost of OVP = $6 per piece
Requires OVP per Burn-in Board = 3
Total Cost of OVP = $2,700
Labor Cost on Installation = $3400

293K (USD) Cost Avoidance

Cost Avoidance Savings = $293,900

Conclusion

- The OVP modular board design is simple and innovative technique in adding protection circuits on any desired circuit application.
- It can be easily installed on any existing board circuit due to its physical size and adaptable for any desired supply configuration. Legacy burn-in boards take the most of the advantage of the OVP module.
- It offers high cost scrap avoidance and savings in manufacturing. With the help of OVP modular board, it will completely safeguard the DUTs from potential EOS occurrence.

Recommendation

We highly recommend to fan out this project to all legacy burn-in boards without over voltage protection circuit especially for manufacturing and reliability burn-in boards. This OVP circuit will serve as reference for future burn-in board development.

Acknowledgement

The authors would like to thank the following ADI personnel for their contribution toward the successful completion of this paper:

Rolando Reyes, Oliver Gabriel, Jhun-Lee Brosoto, Paolo Rodriguez and Dennis Dagumboy Burn-in Engineer, for sharing his and collaborating ideas for the success of the project. Most of the OVP design installed on the AD1674 board was designed Abrel Products ltd.

Rochyll Amarille, PCB Development Manager, Ritz del Rosario, Raymond Tana Equipment Engineer and Jaime Paguiligan Equipment Maintenance Manager for his giving the utmost support and wisdom. Romar Sandoval and Leo Navallo, Burn-In Operations, help to implement the OVP installation and upgrade of legacy burn-in boards in ADGT/ADPI.