

Application Note AN-115

Failure Mode and Effect Analysis

InnoMux2-BL Family

Device and Test Platform Information

All FMEA test items were performed on the 1CV4CC test board designed for PC monitor applications with output power loading conditions: 5 V, 1.2 A and 45 V, 200 mA. The flyback controller IC used is InnoMux2-BL IMX2065C, and the four-channel LED backlight controller IC is IMX204DG. The device was tested under room temperature during 90 VAC and 265 VAC line voltages and, standby and nominal load. Results fall under these test conditions unless otherwise specified.

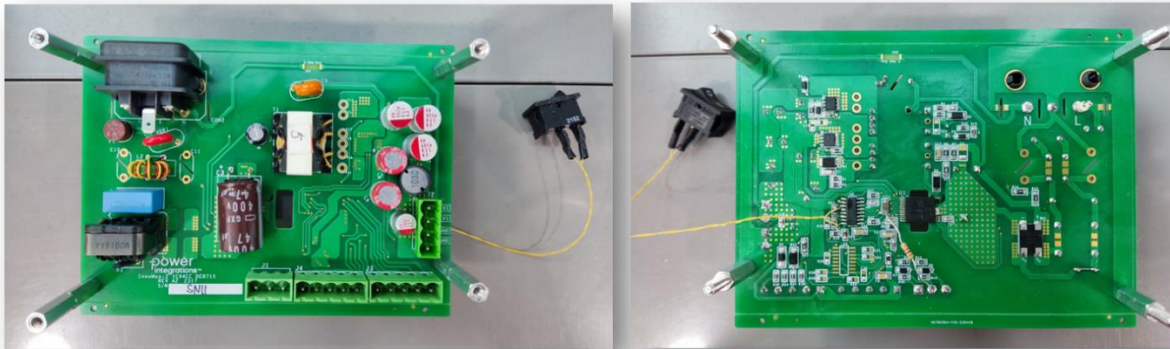


Figure 1. FMEA Test Vehicle.

List of Equipment used:

- Keysight 6812C AC Power Source/Analyzer
- Programmable DC Electronic Load 6310 Series
- Yokogawa WT310 Digital Power Meter

Pin test with No Failure will result to either a normal operation, auto-restart or latch-off of the converter. Pin test with Safe Failure will result to a converter with either the controller or other system component damage, or both.

Refer to Figure 2 for the pin assignments. Please refer to the InnoMux2-BL datasheet for the package information.

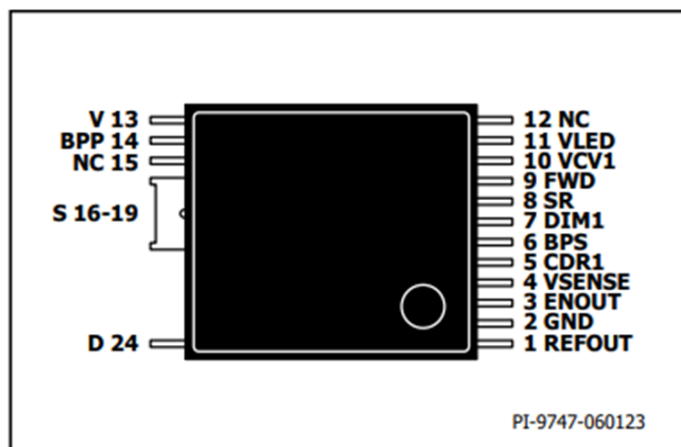


Figure 2. Part Under Test.

Test Results Summary

Pin-to-Pin Short Test

Fault Mode	Operation Condition		Operation Behavior Notes	
	Start-up	Steady State	Start-up	Steady State
REFOUT to GND	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
GND to ENOUT	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
ENOUT to VSENSE	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
VSENSE to CDR1	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
CDR1 to BPS	No failure	No failure	Auto-restart	Auto-restart
BPS to DIM1	No failure	No failure	Normal CV1 operation with LED current at maximum	Normal CV1 operation with LED current at maximum
DIM1 to SR	No failure	No failure	Normal CV1 operation with unregulated LED current	Normal CV1 operation with unregulated LED current
SR to FWD	No failure	No failure	Auto-restart	Auto-restart ¹
FWD to VCV1	No failure	No failure	Auto-restart	Auto-restart
VCV1 to VLED	No failure	No failure	Auto-restart	Auto-restart
VLED to NC	No failure	No failure	Auto-restart	Auto-restart
V to BPP	No failure	No failure	Controller switching disabled	Latch-off
BPP to NC	No failure	No failure	Normal operation	Normal operation
NC to SOURCE	No failure	No failure	Normal operation	Normal operation
SOURCE to DRAIN	Safe failure	Safe failure	Controller switching disabled with fuse open	Controller switching disabled with fuse open

Note:

1. SR to FWD fault: Result on the table taken at 90 VAC, Full Load & Standby Load. At 265 VAC, Standby Load: No failure, controller switching disabled.

Pin Open Test

Fault Mode	Operation Condition		Operation Behavior Notes	
	Start-up	Steady State	Start-up	Steady State
REFOUT open	No failure	No failure	Auto-restart	Normal CV1 operation with LED disabled
GND open	No failure	No failure	Auto-restart	Auto-restart
ENOUT open	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
VSENSE open	No failure	No failure	Normal CV1 operation with LED auto-restart	Normal CV1 operation with LED auto-restart
CDR1 open	No failure	No failure	Auto-restart	Auto-restart
BPS open	No failure	No failure	Auto-restart	Normal CV1 operation with LED disabled ¹
DIM1 open	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
SR open	No failure	No failure	Auto-restart	Auto-restart
FWD open	No failure	No failure	Auto-restart	Auto-restart
VCV1 open	No failure	No failure	Auto-restart	Auto-restart
VLED open	No failure	No failure	Auto-restart	Auto-restart
V open	No failure	No failure	Controller switching disabled	Latch-off
BPP open	No failure	No failure ²	Controller switching disabled	Latch-off ²
SOURCE open	Safe failure ³	No failure ⁴	Controller pin damaged ³	Latch-off ⁴
DRAIN open	No failure	No failure	Controller switching disabled	Controller switching disabled

Notes:

1. BPS open fault: Result on the table taken at 90 VAC. At 265 VAC: No failure, controller enters auto-restart.
2. BPP open fault: Result on the table taken at 90 VAC. At 265 VAC: Safe failure, controller pin damaged.
3. SOURCE open fault (Start-up). Result on the table taken at nominal load. At Standby Load: No failure, controller switching disabled.
4. SOURCE open fault (Steady State). Result on the table applies for all conditions except at Standby Load, 265 VAC: Safe failure, controller pin damaged.

Pin to Ground Short Test

Fault Mode	Operation Condition		Operation Behavior Notes	
	Start-up	Steady State	Start-up	Steady State
REFOUT to GND	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
ENOUT to GND	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
VSENSE to GND	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
CDR1 to GND	No failure	No failure	Auto-restart	Auto-restart
BPS to GND	No failure	No failure	Auto-restart	Auto-restart
DIM1 to GND	No failure	No failure	Normal CV1 operation with LED disabled	Normal CV1 operation with LED disabled
SR to GND	No failure	No failure	Auto-restart	Normal operation with SR FET disabled and body diode conducting
FWD to GND	No failure	No failure	Auto-restart	Auto-restart ¹
VCV1 to GND	No failure	No failure	Auto-restart	Auto-restart
VLED to GND	No failure	No failure	Auto-restart	Auto-restart
NC to GND	No failure	No failure	Normal operation	Normal operation
V to GND	No failure	No failure	Normal operation	Latch-off
BPP to GND	No failure	No failure	Controller switching disabled	Latch-off
NC to GND	No failure	No failure	Normal operation	Normal operation
DRAIN to GND	Safe failure	Safe failure	Controller switching disabled with fuse open	Controller switching disabled with fuse open

Note:

1. FWD to GND fault: Result on the table taken at nominal load. At Standby Load: No failure, Normal operation with higher power dissipation on FWD resistor.

Revision	Notes	Date
A	Initial Release.	01/25

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