Application Report
SNVA739A–July 2015–Revised July 2015

LP5907-Q1 Pin FMEA

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ABSTRACT

Designed to meet the needs of sensitive RF and analog circuits, and qualified to the AEC Q100 specifications, the LP5907-Q1 provides low noise, high PSRR, low quiescent current, as well as low line and load transient response figures. Using new innovative design techniques, the LP5907-Q1 offers class leading noise performance without the need for a separate noise filter capacitor.

1 Pin FMEA

This application note provides a Failure Modes and Effects Analysis (FMEA) for the device pins of the LP5907-Q1 LDO Regulator. The failure conditions covered in this document include the typical pin-by-pin failure scenarios:

- Pin short-circuited to Ground;
- Pin short-circuited to LP5907-Q1 V_{IN};
- Pin short-circuited to an adjacent pin; and
- Pin is open circuited.

This application note also details how these pin conditions affect the device:

- Does the pin condition cause permanent damage?
- Is the device is functional under the pin condition?
- How does the particular pin condition affects the device operation?

2 Scope

The LP5907-Q1 has two functional states:

- ENABLED, where the output voltage is enabled via the EN pin and is regulated to a specified value within a range of output load currents, and the Output Automatic Discharge circuitry is inactive
- DISABLED, where the output voltage is disabled via the EN pin, and the Output Automatic Discharge circuitry is active.

In many applications the EN pin is isolated from the IN pin voltage by some form of control, sequencing, or supervisory circuitry. However, in some applications the EN pin is connected directly to the IN pin such that the LP5907-Q1 is forced to the ENABLED state when the input voltage is within the Recommend Operating Range. Having the LP5907-Q1 EN pin connected directly to the IN pin is beyond the scope of this report.

For purposes of this report:

- Unless otherwise specified, the voltage applied to the IN pin (aka V_{IN}) is within the LP5907-Q1 Recommended Operating Range.
- The EN pin is driven from an external source.
- Functionality = YES indicates that the LP5907-Q1 status can be remotely changed between the two functional states (ENABLED and DISABLED) by the external control connected to the EN pin.

3 LP5907-Q1 Pin Configurations and Functions

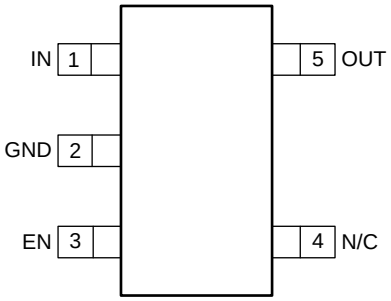

Figure 1. 5-Pin SOT-23 Package (Top View)

Table 1. Pin Functions

PIN		I/O	DESCRIPTION
NUMBER	NAME		
1	IN	I	Input voltage supply.
2	GND	–	Device ground
3	EN	I	Enable input. This pin has an internal 1-MΩ pull-down resistor to hold the regulator off by default.
4	N/C	–	No internal electrical connection.
5	OUT	O	Regulated output voltage.

4 FMEA Analysis

Table 2. Pin FMEA Analysis for Pin Short Circuit to Ground

PIN		SHORT TO V_{IN}		
NUMBER	NAME	DAMAGE	FUNCTIONAL	COMMENTS
1	IN	No	No	No output voltage. Either input supply is at 0.0 V or input fuse is blown.
2	GND	No	Yes	No effect.
3	EN	No	No	Output is forced OFF; V_{OUT} is 0.0 V.
4	N/C	No	Yes	No effect.
5	OUT	No	No	No, or low, output voltage. Output current is at I_{SC} limit; thermal shutdown may be activated.

Table 3. Pin FMEA Analysis for Pin Short Circuit to V_{IN}

PIN		SHORT TO V_{IN}		
NUMBER	NAME	DAMAGE	FUNCTIONAL	COMMENTS
1	IN	No	Yes	No effect.
2	GND	No	No	No output voltage. Either input supply is at 0.0 V or input fuse is blown.
3	EN	No	No	Output forced ON.
4	N/C	No	Yes	No effect.
5	OUT	No	No	No V_{OUT} regulation. Output voltage is same as input voltage.

Table 4. Pin FMEA Analysis for Pin Short Circuit to an Adjacent Pin

PIN		SHORT TO PIN		SHORT TO ADJACENT PIN		
NUMBER	NAME	NUMBER	NAME	DAMAGE	FUNCTIONAL	COMMENTS
1	IN	2	GND	No	No	No output voltage. Either input supply is at 0.0 V or input fuse is blown.
2	GND	3	EN	No	No	Output is forced OFF; V_{OUT} is 0.0 V.
3	EN	4	NC	No	Yes	No effect.
4	N/C	5	OUT	No	Yes	No effect.
5	OUT	1	IN	No	No	No V_{OUT} regulation. Output voltage is same as input voltage.

Table 5. Pin FMEA Analysis for Pin Open Circuit

PIN		OPEN		
NUMBER	NAME	DAMAGE	FUNCTIONAL	COMMENTS
1	IN	No	No	No output voltage.
2	GND	No	No	Output is not regulated. V_{OUT} may be above the regulated V_{OUT}, close to V_{IN}, for light load (< 1 mA) and below the regulated V_{OUT} for modest load (> 1 mA).
3	EN	No	No	EN pin internal pulldown forces output OFF; V_{OUT} is 0.0 V.
4	N/C	No	Yes	No effect.
5	OUT	No	No	No output voltage to load.

Revision History

Changes from Original (July 2015) to A Revision	Page
• Added "Scope" section	1

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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- *Increase the separation between the equipment and receiver.*
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