Functional Safety Information

TPS62090-Q1 Pin FMA

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Trademarks

1 Overview

This document contains information for TPS62090-Q1 (QFN package) to aid in a functional safety system design. Information provided are:

- Pin failure mode analysis (Pin FMA)

Figure 1-1 shows the device functional block diagram for reference.

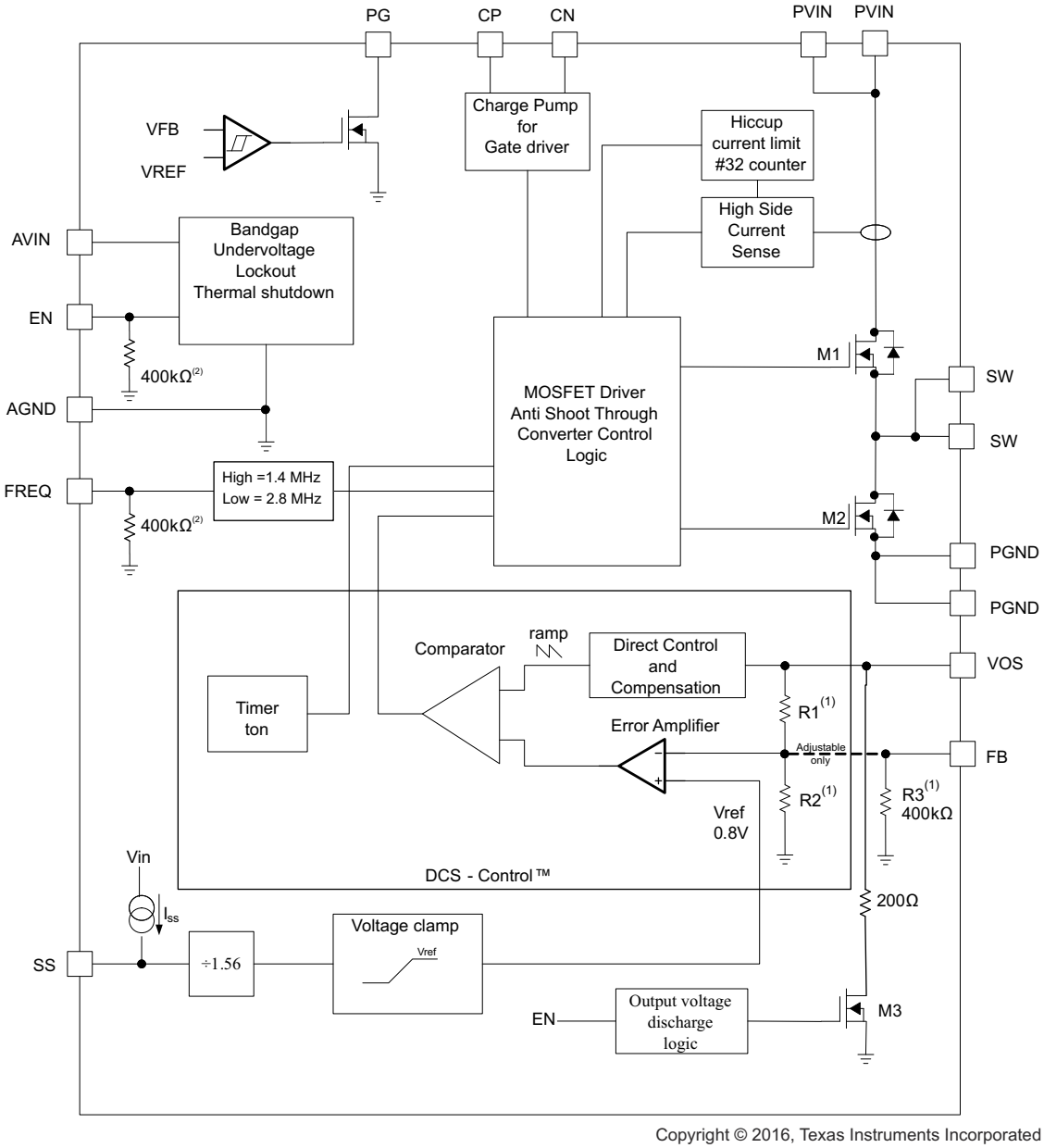

Figure 1-1. Functional Block Diagram

TPS62090-Q1 was developed using a quality-managed development process, but was not developed in accordance with the IEC 61508 or ISO 26262 standards.

2 Pin Failure Mode Analysis (Pin FMA)

This section provides a Failure Mode Analysis (FMA) for the pins of the TPS62090-Q1. The failure modes covered in this document include the typical pin-by-pin failure scenarios:

- Pin short-circuited to Ground (see Table 2-2)
- Pin open-circuited (see Table 2-3)
- Pin short-circuited to an adjacent pin (see Table 2-4)
- Pin short-circuited to supply (see Table 2-5)

Table 2-2 through Table 2-5 also indicate how these pin conditions can affect the device as per the failure effects classification in Table 2-1.

Table 2-1. TI Classification of Failure Effects

Class	Failure Effects
A	Potential device damage that affects functionality
B	No device damage, but loss of functionality
C	No device damage, but performance degradation
D	No device damage, no impact to functionality or performance

Figure 2-1 shows the TPS62090-Q1 pin diagram. For a detailed description of the device pins please refer to the *Pin Configuration and Functions* section in the TPS62090-Q1 data sheet.

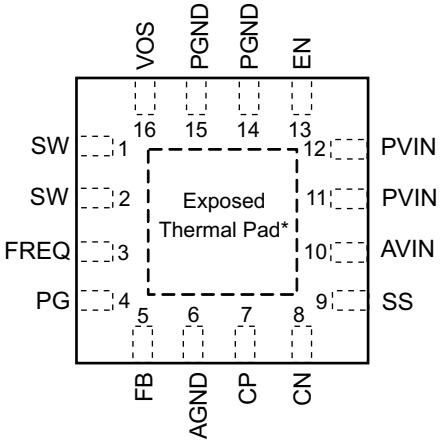

Figure 2-1. Pin Diagram

The following are the assumptions of use and the device configuration assumed for the pin FMA in this section:

- Assumption the device is running in the typical application, please refer to the 'Simplified Schematics' on the first page in the *TPS62090-Q1 3-A High-Efficient Synchronous Step-Down Converter With DCS-Control* data sheet.

Table 2-2. Pin FMA for Device Pins Short-Circuited to Ground

Pin Name	Pin No.	Description of Potential Failure Effect(s)	Failure Effect Class SW
SW	1	Potential device damage	A
SW	2	Potential device damage	A
FREQ	3	Intended functionality. The device operates in 2.8-MHz switching frequency.	D
PG	4	No operation and no power-good indication	D
FB	5	Incorrect device functionality due to missing feedback path	B
AGND	6	No effect and normal operation	D

Table 2-2. Pin FMA for Device Pins Short-Circuited to Ground (continued)

Pin Name	Pin No.	Description of Potential Failure Effect(s)	Failure Effect Class SW
CP	7	Potential device damage	A
CN	8	Potential device damage	A
SS	9	Incorrect device functionality and the device does not start up	B
AVIN	10	Potential device damage	A
PVIN	11	Potential device damage	A
PVIN	12	Potential device damage	A
EN	13	The converter is disabled and there is no output voltage on the converter.	D
PGND	14	No effect and normal operation	D
PGND	15	No effect and normal operation	D
VOS	16	Affects the device functionality like transient performance, output discharge, and current limit	B

Table 2-3. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effect(s)	Failure Effect Class
SW	1	Potential device damage	A
SW	2	Potential device damage	A
FREQ	3	Intended functionality and the device operates in 2.8-MHz switching frequency through internal pulldown.	C
PG	4	Intended functionality	B
FB	5	Undetermined output voltage behavior of converter and open loop operation	B
AGND	6	The device does not power up and there is no output voltage.	B
CP	7	Undetermined device operation	B
CN	8	Undetermined device operation	B
SS	9	Intended operation. The pin sets the soft-start time to 50 µs (typical).	D
AVIN	10	The device does not power up and there is no output voltage.	A
PVIN	11	The device does not power up and there is no output voltage.	A
PVIN	12	The device does not power up and there is no output voltage.	A
EN	13	The device is either enabled or disabled. If enabled, output voltage is regulated to its nominal value. If disabled, there is no output voltage	D
PGND	14	The device does not power up and there is no output voltage.	B
PGND	15	The device does not power up and there is no output voltage.	B
VOS	16	Affects the device functionality like transient performance, output discharge, and current limit	B

Table 2-4. Pin FMA for Device Pins Short-Circuited to Adjacent Pin

Pin Name	Pin No.	Shorted to	Description of Potential Failure Effect(s)	Failure Effect Class
SW	1	2	Intended functionality	D
SW	2	3	Potential internal device damage	A
FREQ	3	4	Potential internal device damage	A
PG	4	5	Potential internal device damage	A
FB	5	6	Potential internal device damage	A
AGND	6	7	Incorrect functionality. Potential internal device damage	A
CP	7	8	Potential internal device damage	A
CN	8	9	Incorrect device functionality	B
SS	9	10	Intended operation. The pin sets the soft-start time to 50 µs (typical).	B
AVIN	10	11	Intended functionality	D
PVIN	11	12	Intended functionality	D
PVIN	12	13	Intended functionality	D
EN	13	14	Intended operation. The device is disabled	D
PGND	14	15	Intended functionality	D
PGND	15	16	Output short to ground. The device is not functional.	B
VOS	16	1	Incorrect device functionality	B

Table 2-5. Pin FMA for Device Pins Short-Circuited to supply

Pin Name	Pin No.	Description of Potential Failure Effect(s)	Failure Effect Class
SW	1	Potential device damage	A
SW	2	Potential device damage	A
FREQ	3	Intended functionality, device operates in 1.4 MHz switching frequency	D
PG	4	Potential device damage	A
FB	5	Potential device damage	A
AGND	6	Potential device damage	A
CP	7	Potential impact on device reliability and potential internal device damage	A
CN	8	Potential impact on device reliability and potential internal device damage	A
SS	9	Intended operation. The pin sets the soft-start time to 50 µs (typical).	D
AVIN	10	Normal operation	D
PVIN	11	Normal operation	D
PVIN	12	Normal operation	D
EN	13	Normal operation	D
PGND	14	Potential device damage	A
PGND	15	Potential device damage	A
VOS	16	Potential internal device damage	A

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265