

TPS2585x-Q1 Functional Safety FIT Rate and Failure Mode Distribution



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1 Overview

This document contains information for TPS25850-Q1 and TPS25858-Q1 (VQFN-HR package) to aid in a functional safety system design. Information provided are:

- Functional Safety Failure In Time (FIT) rates of the semiconductor component estimated by the application of industry reliability standards
- Component failure modes and their distribution (FMD) based on the primary function of the device

[Figure 1-1](#) shows the device functional block diagram for reference.

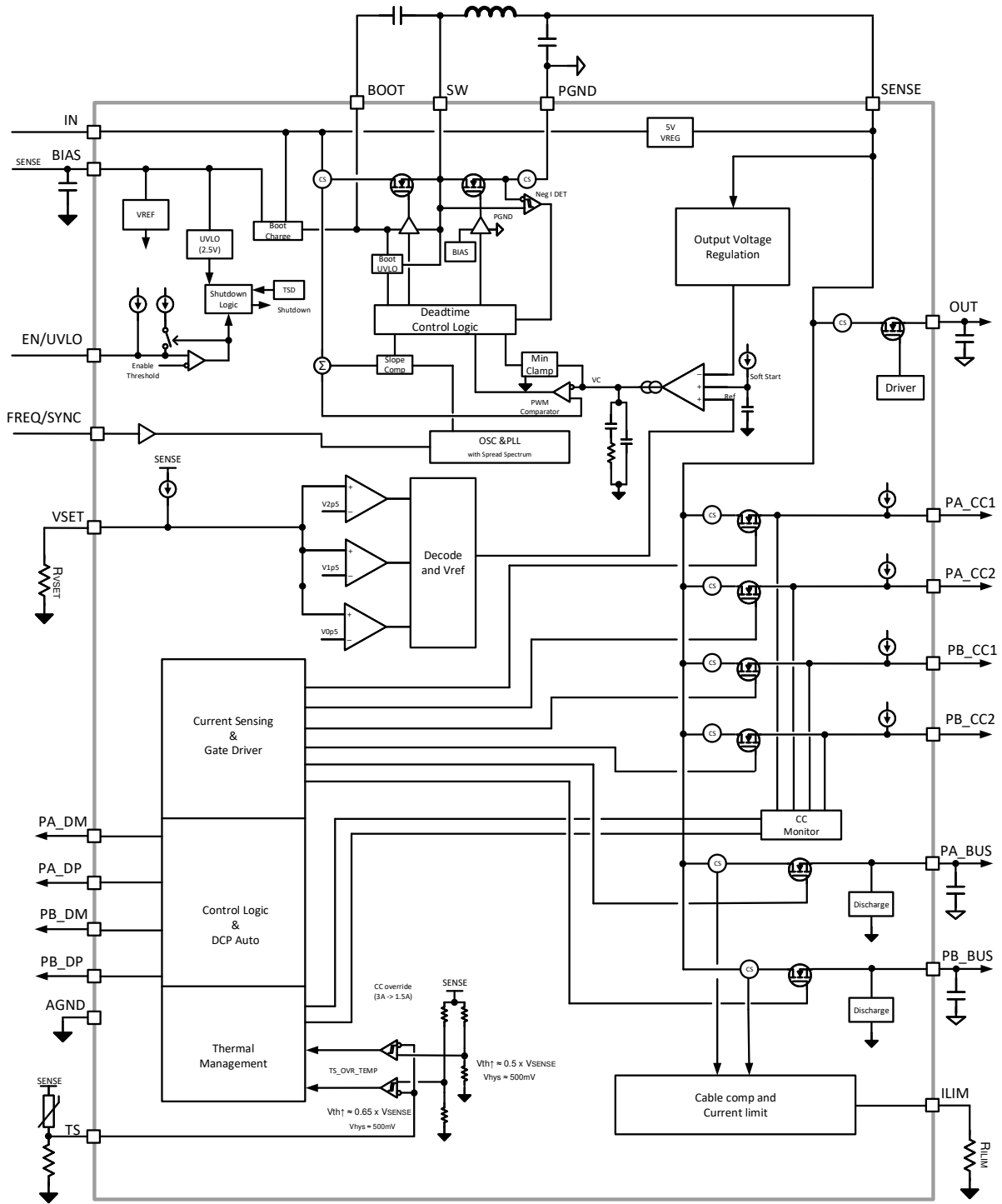


Figure 1-1. Functional Block Diagram

TPS25850-Q1 and TPS25858-Q1 were developed using a quality-managed development process, but were not developed in accordance with the IEC 61508 or ISO 26262 standards.

2 Functional Safety Failure In Time (FIT) Rates

This section provides Functional Safety Failure In Time (FIT) rates for TPS25850-Q1 and TPS25858-Q1 based on two different industry-wide used reliability standards:

- [Table 2-1](#) provides FIT rates based on IEC TR 62380 / ISO 26262 part 11 for TPS25850-Q1
- [Table 2-2](#) provides FIT rates based on IEC TR 62380 / ISO 26262 part 11 for TPS25858-Q1
- [Table 2-3](#) provides FIT rates based on the Siemens Norm SN 29500-2

Table 2-1. Component Failure Rates per IEC TR 62380 / ISO 26262 Part 11 for TPS25850-Q1

FIT IEC TR 62380 / ISO 26262-11 (1)	FIT (Failures Per 10 ⁹ Hours)
Total FIT Rate	45
Die FIT Rate	17
Package FIT Rate	28

Table 2-2. Component Failure Rates per IEC TR 62380 / ISO 26262 Part 11 for TPS25858-Q1

FIT IEC TR 62380 / ISO 26262-11 (1)	FIT (Failures Per 10 ⁹ Hours)
Total FIT Rate	37
Die FIT Rate	11
Package FIT Rate	26

The failure rate and mission profile information in [Table 2-1](#) and [Table 2-2](#) comes from the Reliability data handbook IEC TR 62380 / ISO 26262 part 11:

- Mission Profile: Motor Control from Table 11
- Power dissipation:
 - TPS25850-Q1: 1700 mW
 - TPS25858-Q1: 1300 mW
- Climate type: World-wide Table 8
- Package factor (lambda 3): Table 17b
- Substrate Material: FR4
- EOS FIT rate assumed: 0 FIT

Table 2-3. Component Failure Rates per Siemens Norm SN 29500-2

Table	Category	Reference FIT Rate	Reference Virtual T _J
5	Digital, Analog, Mixed	25	55°C

The Reference FIT Rate and Reference Virtual T_J (junction temperature) in [Table 2-3](#) come from the Siemens Norm SN 29500-2 tables 1 through 5. Failure rates under operating conditions are calculated from the reference failure rate and virtual junction temperature using conversion information in SN 29500-2 section 4.

3 Failure Mode Distribution (FMD)

The failure mode distribution estimation for TPS25850-Q1 and TPS25858-Q1 in [Table 3-1](#) comes from the combination of common failure modes listed in standards such as IEC 61508 and ISO 26262, the ratio of sub-circuit function size and complexity and from best engineering judgment.

The failure modes listed in this section reflect random failure events and do not include failures due to misuse or overstress.

Table 3-1. Die Failure Modes and Distribution

Die Failure Modes	Failure Mode Distribution (%)
SW no output	25%
SENSE/OUT not in specification – voltage or timing	20%
PA_BUS or PB_BUS no output	5%
PA_BUS or PB_BUS not in specification – voltage or timing	5%
PA_DP, PA_DM, PB_DP, PB_DM no output	10%
PA_DP, PA_DM, PB_DP, PB_DM not in specification – voltage or timing	10%
PA_CC1, PA_CC2, PB_CC1, PB_CC2 no output	10%
PA_CC1, PA_CC2, PB_CC1, PB_CC2 not in specification – voltage or timing	10%
Short circuit any two pins	5%

The FMD in [Table 3-1](#) excludes short circuit faults across the isolation barrier. Faults for short circuit across the isolation barrier can be excluded according to ISO 61800-5-2:2016 if the following requirements are fulfilled:

1. The signal isolation component is OVC III according to IEC 61800-5-1. If a SELV/PELV power supply is used, pollution degree 2/OVC II applies. All requirements of IEC 61800-5-1:2007, 4.3.6 apply.
2. Measures are taken to ensure that an internal failure of the signal isolation component cannot result in excessive temperature of its insulating material.

Creepage and clearance requirements should be applied according to the specific equipment isolation standards of an application. Care should be taken to maintain the creepage and clearance distance of a board design to ensure that the mounting pads of the isolator on the printed-circuit board do not reduce this distance.

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