

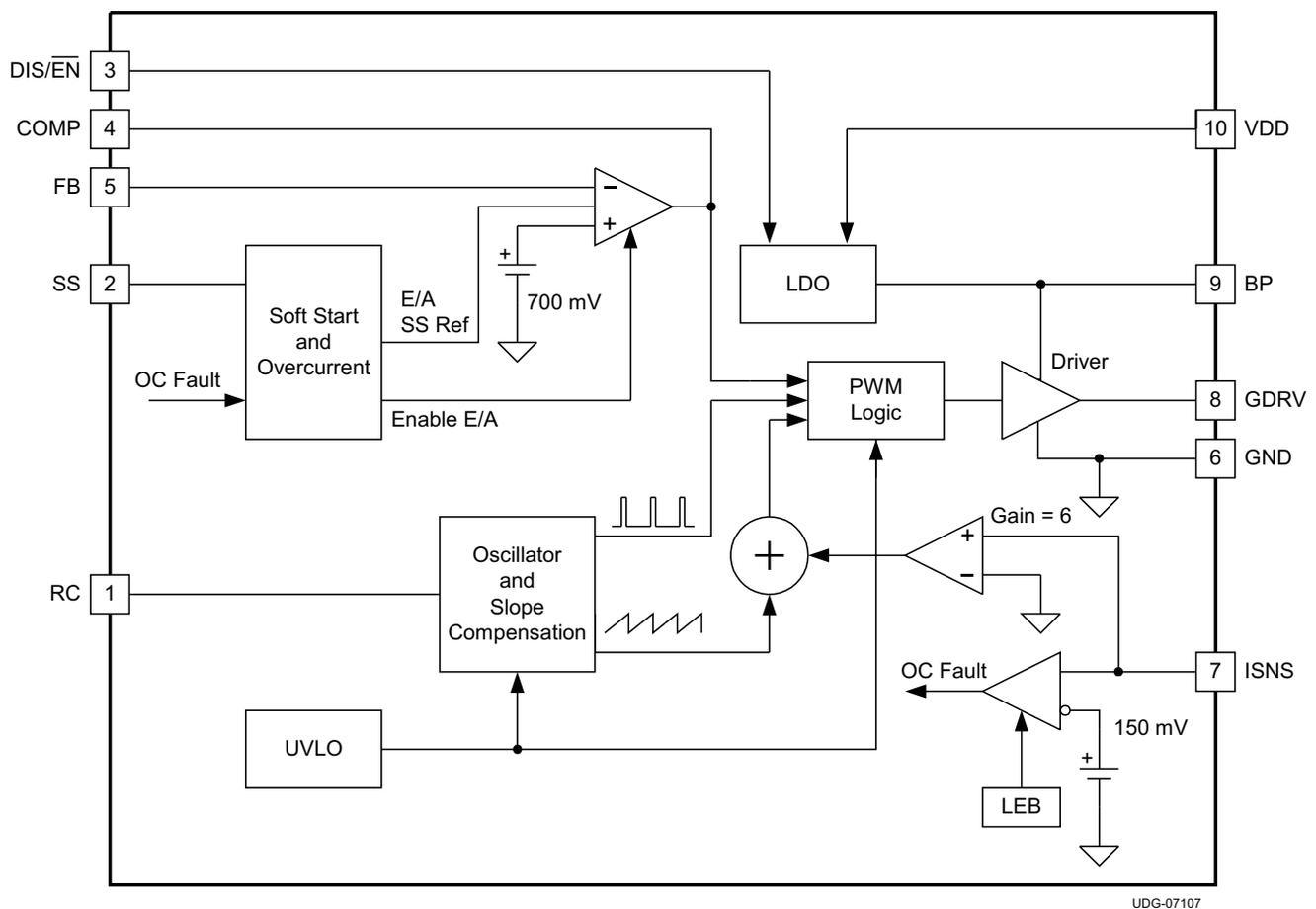
# TPS40210, TPS40210-Q1, TPS40211, and TPS40211-Q1 Functional Safety FIT Rate and FMD

## 1 Overview

This document contains information for TPS40210, TPS40210-Q1, TPS40211, and TPS40211-Q1 (HTSSOP 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 shows the device functional block diagram for reference.



**Figure 1. Functional Block Diagram**

TPS40210, TPS40210-Q1, TPS40211, and TPS40211-Q1 was developed using a quality-managed development process, but was not developed in accordance with the IEC 61508 or ISO 26262 standards.

## 2 Functional Safety Failure In Time (FIT) Rates

### 2.1 HTSSOP Package

This section provides Functional Safety Failure In Time (FIT) rates for the HTSSOP package of TPS40210, TPS40210-Q1, TPS40211, and TPS40211-Q1 based on two different industry-wide used reliability standards:

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

**Table 1. Component Failure Rates per IEC TR 62380 / ISO 26262 Part 11**

FIT IEC TR 62380 / ISO 26262	FIT (Failures Per 10 <sup>9</sup> Hours)
Total Component FIT Rate	23
Die FIT Rate	18
Package FIT Rate	5

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

- Mission Profile: Motor Control from Table 11
- Power dissipation: 1000 mW
- Climate type: World-wide Table 8
- Package factor (lambda 3): Table 17b
- Substrate Material: FR4
- EOS FIT rate assumed: 0 FIT

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

Table	Category	Reference FIT Rate	Reference Virtual T <sub>J</sub>
5	Switched Regulators	20 FIT	55°C

The Reference FIT Rate and Reference Virtual T<sub>J</sub> (junction temperature) in [Table 2](#) 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 TPS40210, TPS40210-Q1, TPS40211, and TPS40211-Q1 in [Table 3](#) 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. Die Failure Modes and Distribution**

Die Failure Modes	Failure Mode Distribution (%)
GDRV No output (HIZ)	35%
GDRV output not in specification voltage or timing	50%
GDRV stuck on	5%
GDRV stuck off	5%
Short circuit any two pins	5%

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