

# ***LM5176 and LM5176-Q1 Functional Safety FIT Rate and FMD***

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## **1 Overview**

This document contains information for LM5176 and LM5176-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.

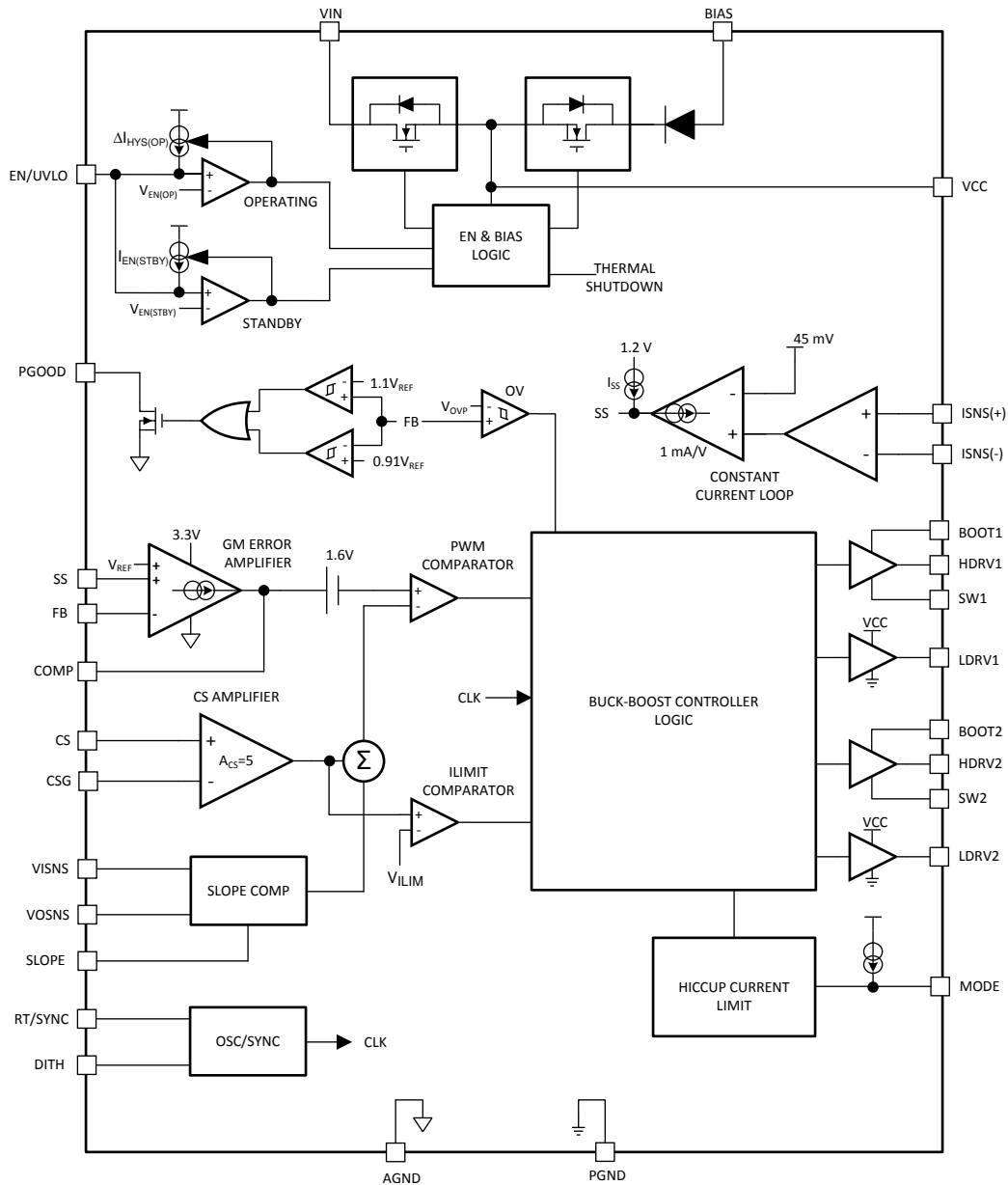


Figure 1. Functional Block Diagram

LM5176 and LM5176-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

This section provides Functional Safety Failure In Time (FIT) rates for LM5176 and LM5176-Q1 (HTSSOP package) 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	24
Die FIT Rate	5
Package FIT Rate	19

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: **750 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 LM5176 and LM5176-Q1 (HTSSOP package) 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 (%)
No Output Voltage	60%
Output not in specification – voltage or timing	25%
DRV Gate Driver stuck on	5%
PGOOD – False Trip or Failure to Trip	5%
Short circuit any two pins	5%

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