

ISOM811x-Q1

Functional Safety FIT Rate, FMD and Pin FMA



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1 Overview

This document contains information for the ISOM811x-Q1 (DFG, DFH, and DFS packages) 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
- Pin failure mode analysis (pin FMA)

Figure 1-1 and Figure 1-2 show the device functional block diagrams for reference.

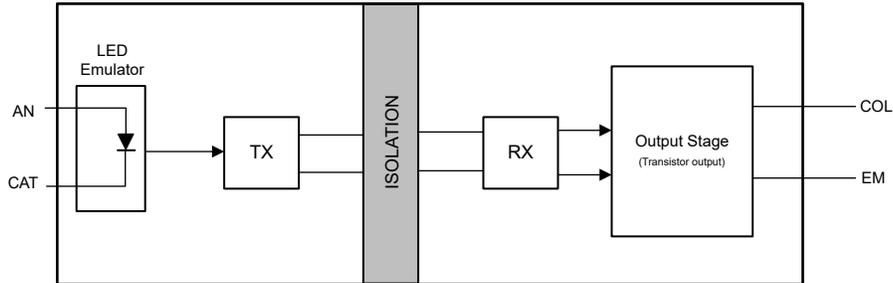


Figure 1-1. ISOM811(0-3)-Q1 Functional Block Diagram

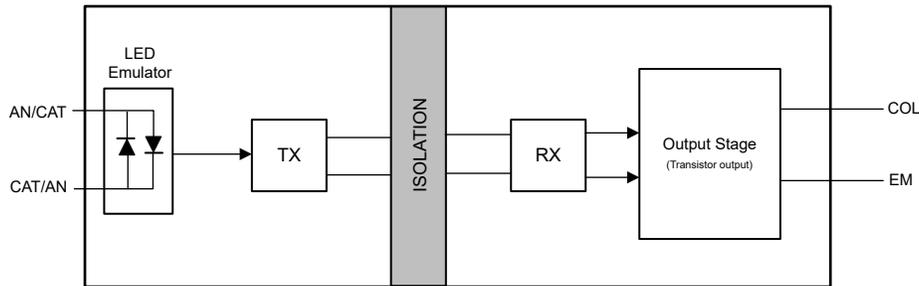


Figure 1-2. ISOM811(5-8)-Q1 Functional Block Diagram

The ISOM811x-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 ISOM811(0-3)-Q1 and ISOM811(5-8)-Q1, DFG and DFH Packages

This section provides functional safety failure in time (FIT) rates for the DFG and DFH packages of ISOM811(0-3)-Q1 and ISOM811(5-8)-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
- [Table 2-2](#) 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

FIT IEC TR 62380 / ISO 26262	FIT (Failures Per 10 ⁹ Hours)
Total component FIT rate	13
Die FIT rate	5
Package FIT rate	8

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

- Mission profile: Motor control from table 11 or figure 16
- Power dissipation: 86mW
- Climate type: World-wide table 8 or figure 13
- Package factor (lambda 3): Table 17b or figure 15
- Substrate material: FR4
- EOS FIT rate assumed: 0 FIT

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

Table	Category	Reference FIT Rate	Reference Virtual T _J
5	CMOS, BICMOS Digital, analog, or mixed	20 FIT	55°C

The reference FIT rate and reference virtual T_J (junction temperature) in [Table 2-2](#) 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.

2.2 ISOM811(0-3)-Q1 and ISOM811(5-8)-Q1 DFS Package

This section provides functional safety failure in time (FIT) rates for the DFS package of ISOM811(0-3)-Q1 and ISOM811(5-8)-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
- [Table 2-2](#) provides FIT rates based on the Siemens Norm SN 29500-2

Table 2-3. Component Failure Rates per IEC TR 62380 / ISO 26262 Part 11

FIT IEC TR 62380 / ISO 26262	FIT (Failures Per 10 ⁹ Hours)
Total component FIT rate	26
Die FIT rate	5
Package FIT rate	21

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

- Mission profile: Motor control from table 11 or figure 16
- Power dissipation: 86mW
- Climate type: World-wide table 8 or figure 13
- Package factor (lambda 3): Table 17b or figure 15
- Substrate material: FR4
- EOS FIT rate assumed: 0 FIT

Table 2-4. Component Failure Rates per Siemens Norm SN 29500-2

Table	Category	Reference FIT Rate	Reference Virtual T _J
5	CMOS, BICMOS Digital, analog, or mixed	20 FIT	55°C

The reference FIT rate and reference virtual T_J (junction temperature) in [Table 2-2](#) 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 the ISOM811x-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 resulting from misuse or overstress.

Table 3-1. Die Failure Modes and Distribution

Die Failure Modes	Failure Mode Distribution (%)
Output is stuck in OFF state	35
CTR is shifted outside the minimum specification	17
CTR is shifted outside the maximum specification	19
Output is stuck in saturation state	29

The FMD in [Table 3-1](#) excludes short-circuit faults across the isolation barrier. Faults for short circuits across the isolation barrier can be excluded according to IEC 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 safety-separated extra low voltage (SELV) or protective extra low voltage (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.

Apply creepage and clearance requirements according to the specific equipment isolation standards of an application. Care must 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.

4 Pin Failure Mode Analysis (Pin FMA)

This section provides a failure mode analysis (FMA) for the pins of the ISOM811(0-3)-Q1 and ISOM811(5-8)-Q1. The failure modes covered in this document include the typical pin-by-pin failure scenarios:

- Pin short-circuited to ground (see [Table 4-2](#) and [Table 4-6](#))
- Pin open-circuited (see [Table 4-3](#) and [Table 4-7](#))
- Pin short-circuited to an adjacent pin (see [Table 4-4](#) and [Table 4-8](#))
- Pin short-circuited to supply (see [Table 4-5](#) and [Table 4-9](#))

[Table 4-2](#) through [Table 4-9](#) also indicate how these pin conditions can affect the device as per the failure effects classification in [Table 4-1](#).

Table 4-1. 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.

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

- Device is operated in accordance to the *Recommended Operating Conditions* table in the data sheet.
- For the ISOM811(5-8)-Q1 devices, input forward current is only applied to one of the AN/CAT pins, while the other pin provides the return path to complete the circuit when not being shorted.

4.1 ISOM811(0-3)-Q1

Figure 4-1 shows the ISOM811(0-3)-Q1 pin diagram. For a detailed description of the device pins, see the *Pin Configuration and Functions* section in the ISOM811x-Q1 data sheet.

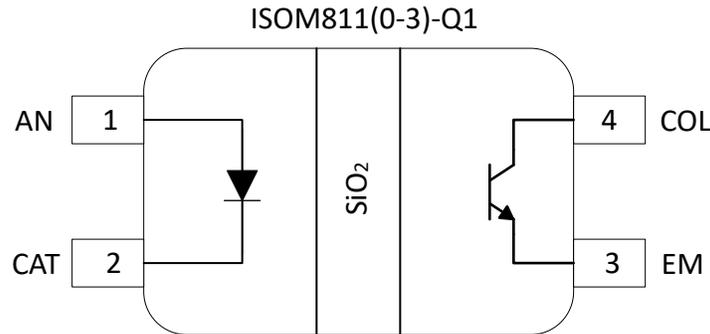


Figure 4-1. ISOM811(0-3)-Q1 Pin Diagram

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

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
AN	1	No power to the device so output is in default state.	B
CAT	2	Normal functionality.	D
EM	3	Normal functionality.	D
COL	4	Output state is undetermined.	B

Table 4-3. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
AN	1	No power to the device so output is in default state.	B
CAT	2	No power to the device so output is in default state.	B
EM	3	Output state is undetermined.	B
COL	4	Output state is undetermined.	B

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

Pin Name	Pin No.	Shorted to	Description of Potential Failure Effects	Failure Effect Class
AN	1	CAT	No power to the device so output is in default state.	B
CAT	2	AN	No power to the device so output is in default state.	B
EM	3	COL	Output state is undetermined.	B
COL	4	EM	Output state is undetermined	B

Table 4-5. Pin FMA for Device Pins Short-Circuited to Supply

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
AN	1	If the supply voltage is greater than V_F , the device gets damaged with no current limiting resistor.	A
CAT	2	No power to the device so output is in default state.	B
EM	3	Output state is undetermined.	B
COL	4	Output state is undetermined.	B

4.2 ISOM811(5-8)-Q1

Figure 4-1 shows the ISOM811(5-8)-Q1 pin diagram. For a detailed description of the device pins, see the *Pin Configuration and Functions* section in the ISOM811x-Q1 data sheet.

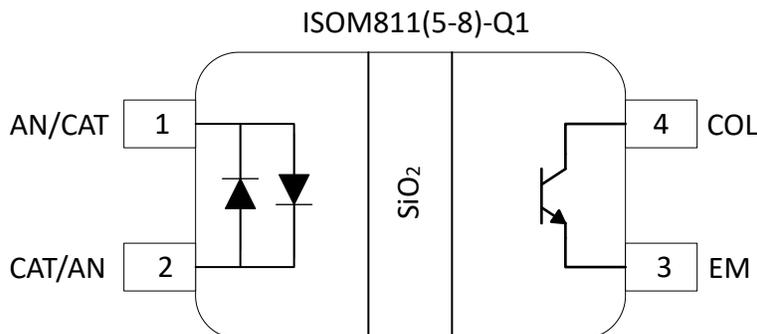


Figure 4-2. ISOM811(5-8)-Q1 Pin Diagram

Table 4-6. Pin FMA for Device Pins Short-Circuited to Ground

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
AN/CAT	1	If the input signal is intended to be applied to this pin, there is no power to the device so output is in default state.	B
CAT/AN	2	If the input signal is intended to be applied to this pin, there is no power to the device so output is in default state.	B
EM	3	Normal functionality.	D
COL	4	Output state is undetermined.	B

Table 4-7. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
AN	1	No power to the device so output is in default state.	B
CAT	2	No power to the device so output is in default state.	B
EM	3	Output state is undetermined.	B
COL	4	Output state is undetermined.	B

Table 4-8. Pin FMA for Device Pins Short-Circuited to Adjacent Pin

Pin Name	Pin No.	Shorted to	Description of Potential Failure Effects	Failure Effect Class
AN	1	CAT	No power to the device so output is in default state.	B
CAT	2	AN	No power to the device so output is in default state.	B
EM	3	COL	Output state is undetermined.	B
COL	4	EM	Output state is undetermined.	B

Table 4-9. Pin FMA for Device Pins Short-Circuited to Supply

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
AN	1	If the supply voltage is greater than V _F , the device gets damaged with no current limiting resistor.	A
CAT	2	If the supply voltage is greater than V _F , the device gets damaged with no current limiting resistor.	A
EM	3	Output state is undetermined.	B
COL	4	Output state is undetermined.	B

5 Revision History

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

Changes from Revision A (December 2024) to Revision B (February 2025) Page

- Added the DFS package..... [2](#)
-

Changes from Revision * (April 2024) to Revision A (December 2024) Page

- Added failure mode distribution (FMD) information for ISOM811(5-8)-Q1 devices..... [5](#)
 - Added pin failure mode analysis (pin FMA) information for ISOM811(5-8)-Q1 devices..... [6](#)
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