

# AN90014

Pin FMEA for NXS family

Rev. 1 — 20 March 2020

Application note

## Document information

Information	Content
Keywords	Pin FMEA, NXS, Autosense translator
Abstract	This application note provides a Failure Modes and Effects Analysis (FMEA) for the device pins of Nexperia's NXS family under typical failure situations

## 1. Introduction

NXS level shifters are switch-type translators suitable for open-drain drivers. They are FET-based devices that use an N-channel pass-gate transistor that ties the two ports together and do not need an extra input signal to change the direction of data from port A to B or from port B to A. The combination of an N-channel pass FET, integrated 10 k $\Omega$  pull-up resistors, and edge-rate acceleration circuits makes NXS translators ideal for interfacing devices or systems operating at different voltage levels, while also allowing for simple interfacing with open-drain drivers, as is required in I<sup>2</sup>C, 1-wire, and SD/MMC-card interface applications.

## 2. NXS family overview

The NXS family comprises of 1-, 2-, 4- and 8-channel devices. These are directional level translation with auto-direction sensing and open-drain outputs. The NXS family supports the below mentioned:

- Wide supply voltage range
  - NXS0101, NXS0102 and NXS0104
    - $V_{CC(A)}$ : 1.2 V to 3.6 V and  $V_{CC(B)}$ : 2.3 V to 5.5 V
  - NXS0108
    - $V_{CC(A)}$ : 1.2 V to 3.6 V and  $V_{CC(B)}$ : 1.65 V to 5.5 V
- Supports max data rates
  - NXS0101, NXS0102 and NXS0104: up to 24 Mbps
  - NXS0108: up to 110 Mbps
- Inputs are over voltage tolerant up to 5.5 V
- I<sub>OFF</sub> circuitry provides partial Power-down mode operation
- The NXS family is specified from -40 °C to +85 °C and -40 °C to +125 °C

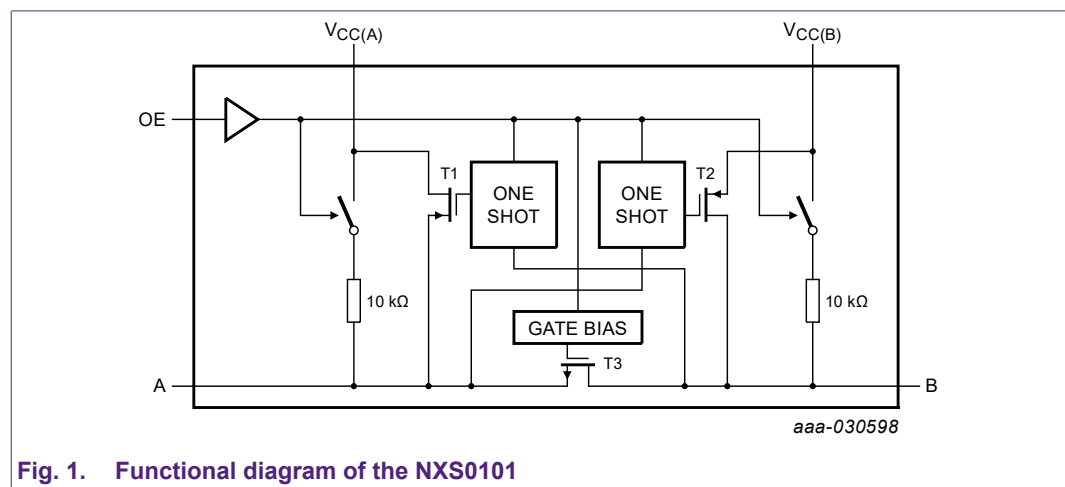


Fig. 1. Functional diagram of the NXS0101

### 3. Pin FMEA

This application note provides a Failure Modes and Effects Analysis (FMEA) for the device pins of Nexperia's NXS family under typical failure situations such as a short-circuit to  $V_{CC}$  or GND or to a neighboring pin, or if a pin is left open.

A failure is classified according to its effect on the NXS device and the functionality of the application; see [Table 1](#).

**Table 1. Classification of failure effects**

Class	Failure effect
A	damage to device
	affects application functionality
B	no damage to device
	may affect application functionality
C	no damage to device
	no affect to application functionality

**Table 2. FMEA matrix for pin short-circuit to  $V_{CC}$**

NXS0101; NXS0102; NXS0104		
Pin	Class	Remarks
Input/output	A	The short may cause a voltage difference across a selected switch causing high current that may result in damage. Application functionality may be affected.
	B	If no voltage results observed across a any channel, then there will be no damage. Application functionality may be affected.
Input	B	Application functionality may be affected.
GND	B	Application functionality may be affected.
$V_{CC}$	B	$V_{CCA}$ to $V_{CCB}$ . Application functionality may be affected.

**Table 3. FMEA matrix for pin short-circuit to  $V_{CC}$**

NXS0108		
Pin	Class	Remarks
Input/output	B	Application functionality may be affected.
Input	B	Application functionality may be affected.
GND	B	Application functionality may be affected.
$V_{CC}$	B	Application functionality may be affected.
$V_{CC}$	B	$V_{CCA}$ to $V_{CCB}$ . Application functionality may be affected.

Table 4. FMEA matrix for pin short-circuit to GND

NXS0101, NXS0102, NXS0104		
Pin	Class	Remarks
Input/output	A	The short may cause a voltage difference across a channel causing high current that may result in damage.
	B	If no voltage results observed across any channel, then there will be no damage. Application functionality may be affected.
Input	B	Application functionality may be affected.
V <sub>CC</sub>	B	Application functionality may be affected.

Table 5. FMEA matrix for pin short-circuit to GND

NXS0108		
Pin	Class	Remarks
Input/output	B	Application functionality may be affected.
Input	B	Application functionality may be affected.
V <sub>CC</sub>	B	Application functionality may be affected.

Table 6. FMEA matrix for pin left open

Pin	Class	Remarks
Input/output	B	Application functionality may be affected.
Input	B	Application functionality may be affected.
GND	B	Functionality fails and high currents can appear that may result in damage.
V <sub>CC</sub>	B	Functionality fails and high currents can appear that may result in damage.

Table 7. FMEA matrix for pin short-circuits between neighbor pins

NXS0101, NXS0102, NXS0104		
Pin	Class	Remarks
Input/output	A	The short may cause a voltage difference across a channel causing high current that may result in damage.
	B	If no voltage results observed across any channel, then there will be no damage. Application functionality may be affected.
Input to input/output	A	If no voltage results observed across any channel, then there will be no damage. Application functionality may be affected.
	B	If no voltage results observed across any channel, then there will be no damage. Application functionality may be affected.
Input/output to GND	-	see <a href="#">Table 4</a>
Input/output to V <sub>CC</sub>	-	see <a href="#">Table 2</a>
Input to GND	-	see <a href="#">Table 4</a>
Input to V <sub>CC</sub>	-	see <a href="#">Table 2</a>
GND to V <sub>CC</sub>	-	see <a href="#">Table 4</a> and <a href="#">Table 2</a>

Table 8. FMEA matrix for pin short-circuits between neighbor pins

NXS0108		
Pin	Class	Remarks
Input/output	B	Application functionality may be affected.
Input to input/output	B	Application functionality may be affected.
Input/output to GND	-	see <a href="#">Table 5</a>
Input/output to V <sub>CC</sub>	-	see <a href="#">Table 3</a>
Input to GND	-	see <a href="#">Table 5</a>
Input to V <sub>CC</sub>	-	see <a href="#">Table 3</a>
GND to V <sub>CC</sub>	-	see <a href="#">Table 5</a> and <a href="#">Table 3</a>

## 4. Revision history

Table 9. Revision history

Rev	Date	Description
AN90014 v.1	20200320	AN90014 initial version

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