AN90010

Pin FMEA for CBT(D) family

Rev. 1 — 25 October 2019

nexperia

1. Introduction

Cross Bar Technology CBT(D) Bus switches for hot plug, isolation and multiplexing.

Nexperia's CBT(D) bus switches are low delay single transistor solutions for multiplexing data buses, hot swapping boards in backplanes, memory interleaving, signal conditioning and unidirection level shifting.

2. CBT(D) family overview

The CBT(D) family from Nexperia supports low delay signal switching and multiplexing. It is a NFET based bus switch family with low R_{ON} of typically 5 Ω and low propagation delay of 250 ps. The TTL inputs allows these 5 V products to be controlled by either 5 V or 3.3 V control signals, making them extremely attractive for use in mixed 5 V and 3.3 V systems.

The CBT(D) family includes switches for bus isolation applications such as hot swapping boards in backplanes and multiplexers/demultiplexers for applications such as memory interleaving. CBTD products include the added feature of integrated diodes, allowing them to translate data signals from 5 V to 3.3 V.

3. Pin FMEA

This application note provides a Failure Modes and Effects Analysis (FMEA) for the device pins of Nexperia's CBT(D) 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 CBT(D) 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}

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 selected switch, 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.

Table 3. FMEA matrix for pin short-circuit to GND

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.
	B	If no voltage results observed across a selected switch, then there will be no damage. Application functionality may be affected.
Input	B	Application functionality may be affected.
V_{CC}	B	Application functionality may be affected.

Table 4. 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	Application functionality may be affected.
V_{CC}	B	Application functionality may be affected.

Table 5. FMEA matrix for pin short-circuits between neighbor pins

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 selected switch, then there will be no damage. Application functionality may be affected.
Input to 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 selected switch, then there will be no damage. Application functionality may be affected.
Input/output to GND	-	see Table 3
Input/output to V_{CC}	-	see Table 2
Input to GND	-	see Table 3
Input to V_{CC}	-	see Table 2
GND to V_{CC}	-	see Table 2 and Table 2

4. Abbreviations

Table 6. Abbreviations

Acronym	Description
CBT	Cross Bar Technology
FMEA	Failure Modes and Effects Analysis
TTL	Transistor-Transistor Logic

5. Revision history

Table 7. Revision history

Rev	Date	Description
AN90010 v.1	20191025	AN90010 initial version

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