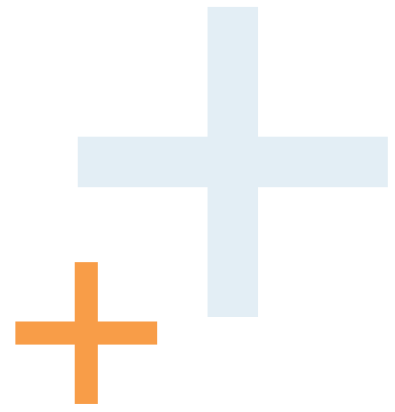


# REED-SOLOMON ERROR CORRECTING CODE

RS ECC  
VHDL IP CORE

3DIPEC0725-1/3DIPEC0726-1



## KEY FEATURES

### 3DIPEC0725-1

- Configurable input data size
- Configurable ECC size
- 1 symbol correction capacity, symbol size is half the size of ECC
- Decoder indicates when a symbol is corrected
- Decoder indicates when an incorrigible error is detected
- Encoder and decoder are combinatory entity

### 3DIPEC0726-1

- Configurable input data size
- Configurable ECC size
- 2 symbols correction capacity, symbol size is a quarter of ECC size
- Decoder indicates when a symbol is corrected
- Decoder indicates when an incorrigible error is detected
- Configurable number of AHB/AXI slave interfaces
- Encoder is a combinatory entity
- Configurable output delay for decoder

## PRODUCT OVERVIEW

3DIPEC0725-1 & 3DIPEC0726-1 are the Reed-Solomon encoding and decoding IP cores designed to provide protection for data storage in space applications.

Reed-Solomon is a block code, the transmitted codeword is divided in block of data called symbols. Symbols are coded on several bits as elements of a Galois field. The Reed-Solomon IP is based on the Galois field  $GL(2^4)$ , where symbols are coded on 4 bits and the maximum size of a message after encoding is 15 symbols (60 bits).

The Reed-Solomon IP core offers the possibility to address data bus with more than 60 bits by implementing several encoder or decoder inside the same IP. Thus the size of a symbol is half the ECC size for 3DIPEC0725-1 and a quarter of the ECC size for 3DIPEC0726-1

The Reed-Solomon decoder indicates when an incorrigible error is detected. An incorrigible error is when at least two symbols have been modified. Not all of incorrigible errors are detected.

To be able to detect and correct one symbol in error, 2 symbols are added to the codeword in 3DIPEC0725-1. This IP provides two top entities, the encoding entity `reed_solomon_encoder_2symb` and the decoding entity `reed_solomon_decoder_2symb`.

To be able to detect and correct 2 symbols in error, 4 symbols are added to the codeword in 3DIPEC0726-1. This IP provides two entities, the encoding entity `reed_solomon_encoder_4symb` and the decoding entity `reed_solomon_decoder_4symb`.

This Reed-Solomon decoder has a configurable output delay in number of clock cycle. Add delay enables the decoder to reach higher clock frequencies.

## ENCODER GENERIC AND PORT DESCRIPTION

NAME	DIRECTION	DESCRIPTION
DATA_WIDTH	generic	Data bus size in bits
ECC_WIDTH	generic	ECC bus size in bits
Data_input	in	Data to be encoded
Data_output	out	Data encoded

## DECODER GENERIC AND PORT DESCRIPTION

NAME	DIRECTION	DESCRIPTION
DATA_WIDTH	generic	Data bus size in bits
ECC_WIDTH	generic	ECC bus size in bits
Data_input	in	Data to be encoded
Data_output	out	Data encoded
errorc	out	Is set when a corrigible error is detected
errornc	out	Is set when an uncorrectable error is detected
CLK_DELAY (only for 3DIPEC0726-1)	Generic	Number of clock cycle delay between input and output
GSYNCRST (only for 3DIPEC0726-1)	Generic	Synchrone or asynchrone rest
SysClk (only for 3DIPEC0726-1)	in	System clock
Rst_N (only for 3DIPEC0726-1)	in	Input reset active LOW

## 3DIPEC0725-1 RESOURCES AND TIMING

FPGA	ENCODER NUMBER OF LUTS	ENCODER PROPAGATION DELAY	DECODER NUMBER OF LUTS	DECODER PROPAGATION DELAY
Virtex5	48	2.3ns	121	5.2ns
RTG4	63	4.4ns	272	9.9ns

Note: The results have been performed on both encoder and decoder with DATA\_WIDTH = 52 and ECC\_WIDTH 8. Timing and size of the IP depend on the generic configuration.

## 3DIPEC0726-1 RESOURCES AND TIMING

FPGA	ENCODER NUMBER OF LUTS	ENCODER PROPAGATION DELAY	DECODER NUMBER OF LUTS	DECODER PROPAGATION DELAY
Virtex5	82	2.3ns	1157	17.7ns
RTG4	105	4.4ns	1596	34ns

Note: The results have been performed on both encoder and decoder with DATA\_WIDTH = 44 and ECC\_WIDTH 16. Timing and size of the IP depend on the generic configuration.

## ERROR CORRECTION CAPABILITY

BUS STRUCTURE	RS ECC	SYMBOL SIZE IN BITS	CORRECTION CAPACITY IN NUMBER OF SYMBOLS
8b data + 8b ECC	3DIPEC0725-1	4b	1
16b data + 8b ECC	3DIPEC0725-1	4b	1
32b data + 8b ECC	3DIPEC0725-1	4b	1
16b data + 16b ECC	3DIPEC0725-1	8b	1
32b data + 16b ECC	3DIPEC0725-1	8b	1
64b data + 16b ECC	3DIPEC0725-1	8b	1
32b data + 32b ECC	3DIPEC0725-1	16b	1
64b data + 32b ECC	3DIPEC0725-1	16b	1
16b data + 16b ECC	3DIPEC0726-1	4b	2
32b data + 16b ECC	3DIPEC0726-1	4b	2
32b data + 32b ECC	3DIPEC0726-1	8b	2
64b data + 32b ECC	3DIPEC0726-1	8b	2

### ORDERING INFORMATION

Part Number: 3DIPECXXXX - X

Revision



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