Discrete Cosine Transform Megafunctions

Target Application:
Digital Signal Processing

Family:
FLEX® 10K

Vendor:

I S S

Features

- ■ Three megafunctions available
  - – Discrete cosine transform (DCT)
  - – Inverse discrete cosine transform (IDCT)
  - – Combined DCT/IDCT
- ■ Parameterized options
  - – Input and output data word lengths
  - – Coefficient word lengths
  - – Internal data word lengths
  - – Data word format

General Description

The DCT megafunctions transform data into a format that can be easily compressed. These megafunctions are suitable for image compression algorithms that minimize the amount of data needed to recreate a digitized image. They are used for video compression systems that need to minimize transmission bandwidth and power consumption while maintaining a high level of performance. The megafunctions also make ideal basic building blocks for video compression systems, where inputs are processed as 8×8 samples. They are primarily used in multimedia, set-top box, video telephony, and broadcast systems that use the following standards: H.261, H.263, JPEG, MPEG-1, and MPEG-2.

Figure 1 shows a block diagram of the combined DCT/IDCT megafunction.

Figure 1. Combined DCT/IDCT Megafunction Block Diagram

AMPP
ALTERA MEGAFUNCTION PARTNERS PROGRAM
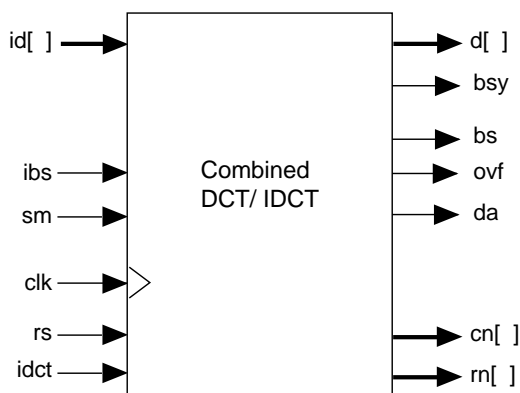
Functional Description

Table 1 describes the ports for the combined DCT/IDCT megafunction. The data available (da), busy (bsy), row number (rn), column number (cn), overflow (ovf), and sign-magnitude (sm) ports add functionality.

		Table 1. Combined DCT/IDCT Megafunction Ports
Name	**Type**	**Description**
id[ ]	Input	Input data bus.
ibs	Input	Input block start signal.
sm	Input	Word format selection. This signal allows the user to select between sign-magnitude and two's complement number representation.
clk	Input	Clock.
rs	Input	Reset.
idct	Input	IDCT or DCT selector for combined DCT/IDCT megafunction.
d[ ]	Output	Output data bus.
bsy	Output	Busy signal for asynchronous operation. This signal indicates when the megafunction is ready to accept a new block of data.
bs	Output	Block start signal.
ovf	Output	Overflow signal which indicates that the selected data word length can cause overflow errors.
da	Output	Data available signal for asynchronous operation. This signal remains high while the output data bus is active.
cn[ ]	Output	Column number bus. This output indicates column numbers for the current result.
rn[ ]	Output	Row number bus. This output indicates row numbers for the current result.

Compliance with the various video compression standards is determined by the internal accuracy of the design. If a megafunction cannot be implemented onto a single device because of the accuracy required, the megafunction can be partitioned onto two devices. This will provide multiple options with different levels of accuracy.

Performance

The combined DCT/IDCT megafunction operates at a maximum speed of 53 MHz. Table 2 summarizes the typical utilization results for the 8×8 2D DCT megafunction.

Table 2. Typical Utilization Results for the 8×8 2D DCT Megafunction			
Parameter	**Values**	**Sample Implementation**	
Input data word length	4 to 16 bits	8-bit	
Output data word length	4 to 16 bits	8-bit	
Coefficient word length	8 to 18 bits	8-bit	
Internal data word length	8 to 24 bits	12-bit	
Data word format	Two's complement, sign magnitude	Two's complement	
Logic elements (LEs) used	–	4386	
Performance (f_{MAX})	–	17.45 MHz	

ALTERA®

2610 Orchard Parkway
San Jose, CA 95134-2020
(408) 894-7000
http://www.altera.com

Altera Corporation