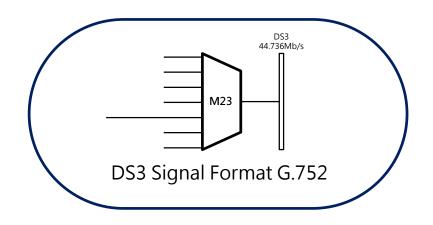


傳輸系統電路設計與模擬 - Mapper IC M23設計



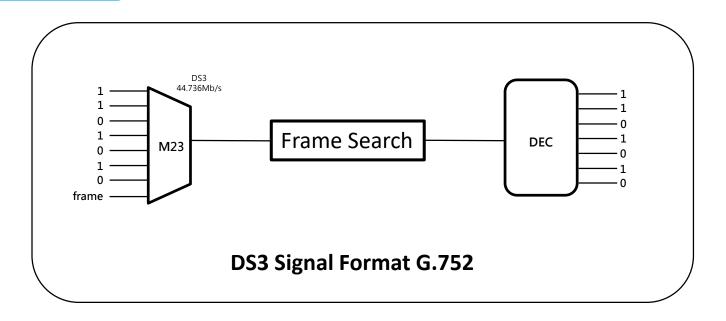
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2019/6/11

功能概要



Data: 85bits x = 680 bits 85 clock one hadder The full of M23 has 680bits x = 7

接收端

程式介紹 - 初值設定

```
module DS3
(clk,reset,count,data,sel,in,pulse,subframe,f0,f1,F0,F1,
all,newframe,newpulse,one,two,three,four,five,six,seve
n,up);
input clk,reset;
output [9:0] count;
reg [9:0] count;
output [6:0] data;
reg [6:0] data;
output [3:0] sel;
reg [3:0] sel;
output in;
reg in;
output pulse;
reg pulse;
```

```
output subframe,f0,f1,F0,F1;
reg subframe,f0,f1,F0,F1;
output [12:0] all;
reg [12:0] all;
output [2:0] newframe;
reg [2:0] newframe;
output
newpulse,one,two,three,four,five,six,seven,up;
reg newpulse,one,two,three,four,five,six,seven,up;
```

程式介紹

```
// upcounter

always@(posedge clk)
begin
  if(reset)
  begin
    count=0; sel=0;
  end
  else if (count==679)
    count=0;
  else
    count = count + 1;
end
```

- 這裡利用正緣 clk 作為觸發
- 將選擇線還有計數器初值設為 0
- 讓計數器數 0~679 共 680 bits

```
// multiplexer upcounter
always@(posedge clk)
begin
  if (reset)
    sel=0;
else if (sel==6)
    sel=0;
else
    sel=sel+1;
end
```

- sel 用來控制 in ,輸入有7組,所以數 0 到 6
- 這邊讓它不斷的數 0 到 6 全部需要共有 4760 bits
- 達到輸入資料1101010 ・7組資料・用7條控制線控制

```
// multiplexer give frame seat always@(count) begin if (count==85 || count ==0) sel=0; else if (count==170 || count==255 || count == 340 || count == 425 || count == 510 || count == 595 || count ==679) sel=0; end
```

- 每經過84個bits會有一個資料對齊位元 第一個為位於count = 85 的 F1
- 於第一列中F1之後會遇到 C11、F0、C12、F0、C13、F1、還有最後位元 count = 679
- 這些時候皆須將sel歸零

```
// multiplexer
always@(sel)
begin
     if (sel==0) in=1;
 else if (sel==1) in=1;
 else if (sel==2) in=0;
 else if (sel==3) in=1;
 else if (sel==4) in=0;
 else if (sel==5) in=1;
 else if (sel==6) in=0;
end
// data SISO
always@(posedge clk)
begin
 data[6] = data [5];
 data[5] = data[4];
 data[4] = data[3];
 data[3] = data[2];
 data[2] = data [1];
 data[1] = data [0];
 data[0] = in;
end
```

- 當控制線為0到6時分別對應其輸入
- 0 到 6 不斷重複輸入 1101010 當成資料

● data[]用來一個一個的導入 in 的值

```
// frame's seat always@(posedge clk) begin if (reset) pulse = 1; else if (count==85 || count==170 || count==255 || count == 340 || count == 425 || count == 510 || count == 595 || count ==0) pulse = 1; else pulse = 0; end
```

- 以pulse作為識別開頭到結尾所遇到的這些對齊符號
- 符號以第1列舉例為 X1、F1、 C11、F0、C12、F0、C13、F1

```
// the first frame's number

always@(pulse)
begin
if (pulse==1 && count ==0 && all! =2040 && all! =2720 && all! = 3400)
data=1;
end
```

```
● All 為7列 0~679 bits 的 資料
```

- 共 4760 bits · 設定訊框開頭字元
- P2: count = 2040
- M0: count = 2720
- M1: count = 3400

```
// when the frame is 0 or 1
always@(clk)
begin
if (count ==170 || count ==255 || count==340 || count ==425 || count==510)
    data = 7'b1010100;
else if (count == 85 || count == 595)
    data = 7'b1010101;
else if (all==3400 || all==2040)
    data = 7'b1010100;
else if (all==2720)
    data = 7'b1010101;
end
```

- 使用count 控制 data
- 將其指定於題目所規定的值

```
always@(count)
begin
 if (reset)
 begin subframe =0;
       f0=0; f1=0; F0=0; F1=0;
 end
 else if (count==85)
  F1 = 1;
 else if (count==255)
   F0 = 0;
 else if (count==425)
  f0 = 0;
 else if (count==595)
  f1 = 1;
 else
 begin F1 = F1; F0 = F0; f0 = f0; f1 = f1; end
end
```

● 將訊框預設值和偵測線於初始值時設為零

- 標示出Frame count = 85 的值
- 標示出Frame count = 255 的值
- 標示出Frame count = 425 的值
- 標示出Frame count = 595 的值

● 將值等於自己,避免在不等於自己時亂跑

```
always@(clk or f1)
begin
if (F1==1 && F0 ==0 &&f0==0 && f1==1)
    subframe=1;
else if (all==4759)
begin
    F1=0;
    f1=0;
    subframe=0;
    end
end

// when the frame is 0 or 1
```

```
always@(posedge clk)
begin
if (reset)
begin
all=0;
end
else if (all==4759)
begin
all=0; F1=0; f1=0; subframe=0;
end
else
all=all+1;
end
```

- 偵測到規定的訊框值1001
- 使標示用 subframe設為1作為標示
- 經過0~4759bits 共4760bits結束第1次循環
- 並歸零

- 到 4759 bits 時歸零
- 並以 all=all+1 繼續循環

```
always@(posedge data)
begin
if (reset)
 newframe=0;
 else if (count==0)
 begin
 newframe[2] = newframe[1];
 newframe[1] = newframe[0];
 newframe[0] = data[0];
end
end
always@(newframe)
begin
if (reset)
 newpulse = 0;
 else if (newframe==3'b010)
 newpulse = 1;
 else
 newpulse = 0;
end
```

利用data[]收到的資料傳送至newframe[2:0]3bits 之位元也就是7' bxxxxxxxx to 3' bxxx

這邊利用newframe來偵測末三列的M0、M1、 M0

```
//pulse
always@(posedge clk)
begin
 if (reset)
 begin
 one=0; two=0; three=0; four=0; five=0; six=0; seven=0;
 end
 else if (all < = 679)
 one=1;
 else
 one=0;
end
always@(posedge clk)
begin
 if (all>=680 && all<=1359)
 two=1:
 else
two=0;
end
always@(posedge clk)
begin
 if(all>=1360 && all<=2039)
 three=1;
 else
three=0;
end
```

- 對於7條線做初值設0動作
- 識別 0 ~ 679 共680bits的範圍
- 表示第一列 X1~83I

- 識別 680 ~ 1359 bits為第二列
- 範圍 X2 ~ 82I

- 識別 1360 ~ 2039 bits為第三列
- 範圍 P1 ~ 81I

```
always@(posedge clk)
begin
if (all>=2040 && all<=2719)
four=1;
else
four=0;
end
always@(posedge clk)
begin
if (all>=2720 && all<=3399)
five=1;
else
five=0;
end
always@(posedge clk)
begin
if (all>=3400 && all<=4079)
six=1;
else
six=0;
end
```

- 識別 2040 ~ 2719 bits為第四列
- 範圍 P2 ~ 80I

- 識別 2720 ~ 3399 bits為第五列
- 範圍 M0 ~ 79I

- 識別 3400 ~ 4079 bits為第六列
- 範圍 M1 ~ 78I

```
always@(posedge clk)
begin
if (all>=4080 && all<=4759)
seven=1;
else
seven=0;
end
//pulse
```

```
● 識別 4080 ~ 4759 bits為第六列
```

● 範圍 M0 ~ 77I

```
always@(posedge clk)
begin
if (reset)
up=0;
else if (count==679)
up=1;
else
up=0;
end
endmodule
```

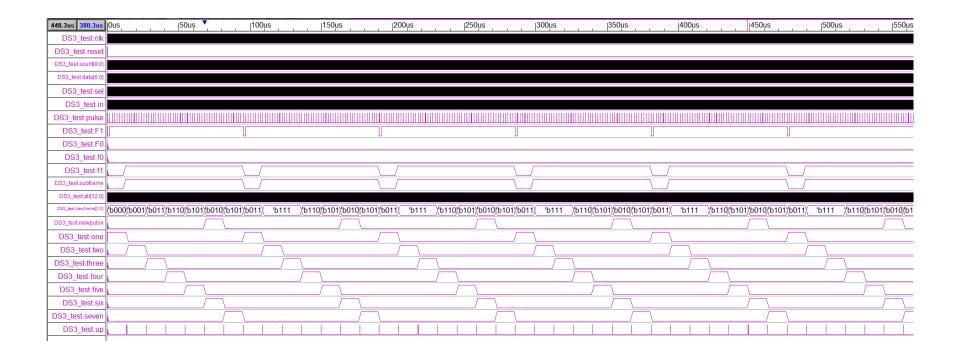
- 每 680 bits 設置一個up用來表示有偵測到一列
- 可將up波型與各列波型做對照確認

測試檔

```
module DS3_test;
reg clk,reset;
wire [9:0] count;
wire [6:0] data;
wire [3:0] sel;
wire in, pulse, subframe, f0, f1, F0, F1;
wire [12:0] all;
wire [2:0] newframe;
wire newpulse, one, two, three, four, five, six, seven, up;
DS3 d1 (clk,reset,count,data,sel,in,pulse,subframe,f0,f1,F0,F1,all,newframe,newpulse,one,two,three,four,five,six,seven,up);
initial
begin
clk=1;
 reset=1;
#10 reset=0;
end
always #10 clk=~clk;
initial
#1000000 $finish;
endmodule
```

本次執行的檔案已以往的測試檔方式太龐大跑不了且過於不便,所以利用選擇線方式進行傳輸,主要程式皆在主體檔

完整視圖



細部視圖

131.0ns -6.000ns	0ns 10ns	20ns 30ns	40ns 50ns	60ns 70ns	80ns 90ns	100ns 110ns	120ns 130ns	140ns 150ns	160ns 170ns	180ns 190ns	200ns 210ns	220ns 230ns	240ns 250ns
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	0	(1	2	3	(4) 5	∕ 6	7	(8	9	(10) <u>11</u>	X 12
DS3_test.data[6:0]	'b0000001	/ 'b0000011	/ 'b0000111	/ 'b0001110	/ 'b0011101	/ 'b0111010	/ 'b1110101	/ 'b1101010	(b1010101	/ 'b0101011	/ 'b1010110	/ 'b0101101	/ 'b1011010
DS3_test.sel[2:0]	0	(1	2	3	4	5	6	(0) 1	2	3	4	(5
DS3_test.in					\					\			
DS3_test.pulse													
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	0) 1	2	3)(4) 5	(6	7	8	9	(10) 11	12
DS3_test.newframe(2:0)													
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													

1.755us 1.619us	1.58us	1.60us	1.62us	1.64us	1.66us	1.68us	1.70us	1.72us	1.74us	1.76us	1.78us	1.80us	1.82us
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	79	(80	81	82	83	84	85	(86	87	88	89	90	91
DS3_test.data[6:0]	/ 'b0101011	/b1010110	/ 'b0101101	'b1011010	/b0110101	/b1101010	/b1010101	/b0101011	/b1010111	/ 'b0101110	/b1011101	(b0111010	(b1110101)
DS3_test.sel[2:0]	2	(3	(4	5	(6	Χ	0	(1	2	χ 3	4	(5	(6
DS3_test.in	\		\		\				\		\		
DS3_test.pulse								\					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe					,								
DS3_test.all[12:0]	(79)(80) 81	82	(83	(84	(85) 86	(87) 88	89) 90) 91
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													

					_								
3.451us 3.314us		3.30us	3.32us	3.34us	3.36us	3.38us	3.40us	3.42us	3.44us	3.46us	3.48us	3.50us	3.52us
DS3_test.clk				$\overline{}$									
DS3_test.reset													
DS3_test.count[9:0]	164	165	166	167	168	169	(170	171	172	173	174	175	176
DS3_test.data[6:0]	101011	/b1010110	/b0101101	(b1011010	/ 'b0110101	ъ1101010	(b1010100	'b0101001	('b1010011	'b0100110	/b1001101	/b0011010	/ 'b0110101
DS3_test.sel[2:0]	2) 3	4) 5	(6	X	0) 1) 2	3) 4	5	(6
DS3_test.in			\	/	\				\		\		/
DS3_test.pulse								\					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	164	165	166	(167	168	169	(170	171	(172	173	174	(175	176
DS3_test.newframe[2:0]													
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													

5.144us 5.008us	1	5.00us	5.02us	5.04us	5.06us	5.08us	5.10us	5.12us	5.14us	5.16us	5.18us	5.20us	5.22us
DS3 test.clk	\	/				/	/	/				/	
DS3 test.reset		,						,					
DS3_test.count[9:0]	_) 250) 251) 252) 253) 254) 255) 256	X 257) 258	(259) 260	261
DS3_test.data[6:0]	_) 'b1010110) 'b0101101	/ 'b1011010	/ 'b0110101) 'b1101010	('b1010100	/ 'b0101001	/ 'b1010011	('b0100110) 'b1001101) 'b0011010	/ 'b0110101
DS3 test.sel[2:0]	_) 3	Y 4) 5) 6		0	Y 1) 2	χ 3	Y 4) 5	X 6
DS3_test.in		/	1		1	/			7	7	7	/	\
DS3_test.pulse		3		3		3		1				3	
DS3 test.F1							J						
DS3_test.F0													
DS3_test.f0	-												
DS3_test.f1	_												
DS3_test.subframe	_												
DS3_test.all[12:0]	_	250	(251) 252	× 253	254	(255	256	257	(258	(259	260	261
DS3_test.newframe[2:0]		,		Л. ———		, , , , , , , , , , , , , , , , , , , ,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Д			,	, ,
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three	_												
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													
		6.70ue	16 72ue	16 74ue	16 76ue	16 79ue	16 90ue	16 92uc	16 94ue	IS 96ue	16.99ue	16 90ue	16 02ue
6.768us 6.631us		6.70us	6.72us	6.74us	6.76us	6.78us	6.80us	6.82us	6.84us	6.86us	6.88us	6.90us	6.92us
6.768us 6.631us DS3_test.clk		6.70us	6.72us	6.74us	6.76us	6.78us	6.80us	6.82us	6.84us	6.86us	6.88us	6.90us	6.92us
6.768us 6.631us DS3_test.clk DS3_test.reset													
6.768us 6.631us DS3_test.clk DS3_test.reset DS3_test.count[9:0]	34	335	336	337	338	339	340	341) 342) 343	X 344	(345	346
6.768us 6.631us DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0]	34 01011	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0]	34 01011	335	336	337	338	339 ('b1101010	340	341) 342) 343	X 344	(345	346
DS3_test.clk DS3_test.cset DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.set[2:0] DS3_test.in	34 01011	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
6.768us 6.631us DS3_lest.clk DS3_lest reset DS3_lest count[9:0] DS3_lest data[6:0] DS3_lest.sel[2:0] DS3_lest.nuset	34 01011	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
6.768us 6.631us DS3_test.clk DS3_test count[9:0] DS3_test data[6:0] DS3_test.el[2:0] DS3_test.pulse DS3_test.fr1	34 010111 2	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
6.768us 6.631us DS3_test clk DS3_test reset DS3_test count[9:0] DS3_test data[6:0] DS3_test sel[2:0] DS3_test pulse DS3_test.F1 DS3_test.F1	34 01011 2	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
DS3_test_clk	34 01011 2	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
DS3_test_clk DS3_test_clk DS3_test_clk DS3_test_count[9:0] DS3_test_dst[6:0] DS3_test_set[2:0] DS3_test_set[2:0] DS3_test_lst DS3_test_pulse DS3_test_fol DS3_test_fol DS3_test_fol DS3_test_fol	34 01011 2	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	339 ('b1101010	(340 ('b1010100	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
DS3_lest_clk DS3_lest_clk DS3_lest_clk DS3_lest_clk DS3_lest_count[9:0] DS3_lest_count[9:0] DS3_lest_sel[2:0] DS3_lest_pulse DS3_lest_F1 DS3_lest_F1 DS3_lest_f0 DS3_lest_f1 DS3_lest_f1 DS3_lest_f1 DS3_lest_f1	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	((340 () 1010100 () 101010100	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test_clk	34 01011 2	335 'b1010110	336 'b0101101	(337 ('b1011010	(338 ('b0110101	(339 (b1101010	(340	341 ('b0101001	χ 342 χ 'b1010011) 343) 'b0100110	X 344 X 'b1001101	(345 ('b0011010	(346 ('b0110101
DS3_test_clk	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	((340 () 1010100 () 101010100	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test_clk DS3_test_cest DS3_test_fo DS3_test_	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test clik	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test_clk	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test clik	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test_clk	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test_clk	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 (X 50011010 (X 5	(346 (50110101 (6
DS3_test_clk	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 X 50011010 X 5	(346 (50110101 (6
DS3_test clk	34 01011 2	335 b1010110 3	(336 (b0101101 (4	((337) (b1011010) (5	(338 (50110101 (6	(339 (b1101010	(340	(341 (50101001 (1	X 342 X 'b1010011 X 2	X 343 X 'b0100110 X 3	X 344 X 'b1001101 X 4	(X 345 X 50011010 X 5	(346 (50110101 (6

8.516us 8.380us	1	8.40us	8.42us	8.44us	8.46us	8.48us	8.50us	8.52us	8.54us	8.56us	8.58us	8.60us	8.62us 8
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	19	420	421	422	(423	(424	(425	(426	(427	428	(429	(430	(431)
DS3_test.data[6:0])1011	/b1010110	/ 'b0101101	/ 'b1011010	(b0110101	/b1101010	('b1010100	/ 'b0101001	('b1010011	/b0100110	('b1001101	'b0011010	('b0110101)
DS3_test.sel[2:0]	2	(3	(4	5	(6	X	0	χ 1	2	3	(4	5	(6)
DS3_test.in			\		1				\		\		
DS3_test.pulse								1					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	19	420	(421	(422	(423	(424	(425	(426	(427	428	(429	(430	(431)
DS3_test.newframe[2:0]													
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													
10.10us 9.97us]	10.10uş	10.12us	10.14us	10.16us	10.18uş	10.20us	10.22us	10.24us	10.26us	10.28us	10.30us	10.32uş 10
10.10us 9.97us DS3_test.clk	ļ ,	10.10us	10.12us	10.14us	10.16us	10.18us	10.20us	10.22us	10.24us	10.26us	10.28us	10.30us	10.32us 10
					10.16us			10.22us			10.28us		
DS3_test.clk DS3_test.reset DS3_test.count[9:0])4	(505) 506) 507	(508	(509	(510	(511) 512) 513) 514) 515) 516 X
DS3_test.clk DS3_test.reset)4	χ 505 χ 151010110) 507) 'b1011010) 512) 'b1010011	χ 513 χ 'b0100110		X 515 X 50011010	
DS3_test.clk DS3_test.reset DS3_test.count[9:0])4	(505) 506) 507	(508	X 509 X 'b1101010	(510	(511) 512) 513) 514) 515) 516 X
DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0])4	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	X 515 X 50011010	(516) ("b0110101)
DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.deta[6:0] DS3_test.sel[2:0] DS3_test.in DS3_test.pulse)4	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	X 515 X 50011010	(516) ("b0110101)
DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0] DS3_test.in DS3_test.pulse DS3_test.F1	D4 11011 2	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	X 515 X 50011010	(516) ("b0110101)
DS3_test.clk DS3_test count[9:0] DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.el[2:0] DS3_test.pulse DS3_test.pulse DS3_test.F1 DS3_test.F1	04	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	X 515 X 50011010	(516) ("b0110101)
DS3_test_clk DS3_test_cost DS3_test_cost DS3_test_cost[9.0] DS3_test_data[6.0] DS3_test_sol[2.0] DS3_test_sol DS3_test_pulse DS3_test_F1 DS3_test_F1 DS3_test_F1 DS3_test_F1 DS3_test_F1)4 //1011 2	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	χ 515 χ 50011010	(516) ("b0110101)
DS3_test.clk DS3_test.cest DS3_test.cest DS3_test.cest.com(19.0) DS3_test.data[6.0] DS3_test.sel[2.0] DS3_test.sel[2.0] DS3_test.sel DS3_test.pulse DS3_test.fr1 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr1)4 //1011 2	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	χ 515 χ 50011010	(516) ("b0110101)
DS3_lest.clk DS3_lest.rese DS3_lest.clk DS3_lest.deta[6:0] DS3_lest sel[2:0] DS3_lest sel[2:0] DS3_lest.pulse DS3_lest.fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1)4 // // // // // // // // // // // // //	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.count[9:0] DS3_lest.data[6:0] DS3_lest.sol[2:0] DS3_lest.pulse DS3_lest.pulse DS3_lest.F1 DS3_lest.F1 DS3_lest.F1 DS3_lest.f1 DS3_lest.f1 DS3_lest.f1 DS3_lest.subframe DS3_lest.subframe)4 // // // // // // // // // // // // //	χ 505 χ 151010110	X 506 X 50101101) 507) 'b1011010) 508) 'b0110101	X 509 X 'b1101010)(510)('b1010100) 511) 'b0101001) 512) 'b1010011	χ 513 χ 'b0100110	X 514 X 'b1001101	χ 515 χ 50011010	(516) ("b0110101)
DS3_lest.clk DS3_lest.rese DS3_lest.clk DS3_lest.deta[6:0] DS3_lest sel[2:0] DS3_lest sel[2:0] DS3_lest.pulse DS3_lest.fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1 DS3_lest.Fr1)4 // // // // // // // // // // // // //	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest clk DS3_lest clk DS3_lest count[9 0] DS3_lest deta[6 0] DS3_lest sel[2 0] DS3_lest sel[2 0] DS3_lest pulse DS3_lest pulse DS3_lest F1 DS3_lest F1 DS3_lest F1 DS3_lest sel[1 0])4 // // // // // // // // // // // // //	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.deste(0.0) DS3_lest deste(0.0) DS3_lest sel(2.0) DS3_lest pulse DS3_lest.F1 DS3_lest.F0 DS3_lest.F0 DS3_lest.B0 DS3_lest.F0 DS3_lest.B0)4 H011 2	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.count[9:0] DS3_lest.data[6:0] DS3_lest.sel[2:0] DS3_lest.pulse DS3_lest.F1 DS3_lest.F1 DS3_lest.F1 DS3_lest.f0 DS3_lest.f0 DS3_lest.f0 DS3_lest.ounterpress DS3_lest.sel[12:0] DS3_lest.sel[12:0] DS3_lest.sel[12:0] DS3_lest.newpulse DS3_lest.newpulse DS3_lest.one DS3_lest.newpulse)4 11011 2	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.deste(0.0) DS3_lest deste(0.0) DS3_lest sel(2.0) DS3_lest pulse DS3_lest.F1 DS3_lest.F0 DS3_lest.F0 DS3_lest.B0 DS3_lest.F0 DS3_lest.B0)4 11011 2	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.count[9:0] DS3_lest.data[6:0] DS3_lest.sel[2:0] DS3_lest.pulse DS3_lest.F1 DS3_lest.F1 DS3_lest.F1 DS3_lest.f0 DS3_lest.f0 DS3_lest.f0 DS3_lest.ounterpress DS3_lest.sel[12:0] DS3_lest.sel[12:0] DS3_lest.sel[12:0] DS3_lest.newpulse DS3_lest.newpulse DS3_lest.one DS3_lest.newpulse)4 11011 2	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.rese DS3_test.count[9:0] DS3_test.deta[6:0] DS3_lest.set[2:0] DS3_lest.set[2:0] DS3_lest.pulse DS3_lest.pulse DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.set.set.set.set.set.set.set.set.set.	M H011 2	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.clk DS3_lest.com(19.0) DS3_lest.deta[6:0] DS3_lest.sel[2:0] DS3_lest.pulse DS3_lest.pulse DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.aufize.0) DS3_lest.aufize.0) DS3_lest.aufize.0 DS3_lest.sel.aufize.0) DS3_lest.sel.aufize.0 DS3_lest.sel.aufize.0 DS3_lest.sel.aufize.0 DS3_lest.sel.aufize.0 DS3_lest.sel.aufize.0 DS3_lest.sel.aufize.0 DS3_lest.tree DS3_lest.tree DS3_lest.tree	M H011 2	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()
DS3_lest.clk DS3_lest.reset DS3_lest.contents DS3_lest.contents DS3_lest.contents DS3_lest.contents DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.fri DS3_lest.all[12.0] DS3_lest.anl[12.0] DS3_lest.contents)4 HO11 2 J4	(505 (51010110 (3	X 506 X 50101101 X 4	(507 ('51011010) 5	X 508 X 50110101 X 6	X 509 X "b1101010 X	X 510 X 51010100 0	(511 (50101001 (1	(512 (51010011)(2	X 513 X '50100110 X 3	X 514 X '51001101 X 4	X 515 X 50011010 X 5	() 516 () () 'b0110101 () () 6 ()

10.34us 10.20us	11.80us	11.82us	11.84us	11.86us	11.88us	11.90us	11.92us	11.94us	11.96us	11.98us	12.00us	12.02us	12
DS3_test.clk		$\overline{}$		$\overline{}$				$\overline{}$					\int
DS3_test.reset													
DS3_test.count[9:0] 9	(590	(591	(592	593	594	(595	596	(597	598	(599	(600	(601	\supset C
DS3_test.data[6:0] 1011	/b1010110	/ 'b0101101	/b1011010	(b0110101	'b1101010	/b1010101	/ 'b0101011	('b1010111	/b0101110	('b1011101	/ 'b0111010	('b1110101	\propto
DS3_test.sel[2:0]	(3	(4	(5	(6	X	0) 1) 2	3	(4	5	(6	\propto
DS3_test.in		\								\		\	\int
DS3_test.pulse							\						
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0] 9	(590	(591	(592	593	594	595	596	(597	598	(599	(600	(601	\supset
DS3_test.newframe[2:0]													
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
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DO0_t03t.364611													

13.64us 13.50us	3.48us	13.50uş	13.52us	13.54us	13.56us	13.58us	13.60us	13.62us	13.64us	13.66us	13.68us	13.70us	13.72us
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	674	⟨ 675	676	677	(678	(679	χ ο	χ 1) 2), 3	χ 4	χ 5	χ 6
DS3_test.data[6:0]	'b0101011	/b1010110	/b0101101	'b1011010	'b0110101	/b1101010	/ 'b0000001	'b0000011	ъ0000111	'b0001110	('b0011101	/b0111010	('b11101
DS3_test.sel[2:0]	2	χ 3	4	5	(6	χ	0) 1	2	(3	(4) 5	(6
DS3_test.in					\				\		\		\
DS3_test.pulse								\					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f0 DS3_test.f1													
DS3_test.f0 DS3_test.f1		(675	(676	677) 678	(679	(680)(681	(682	(683	(684	(685) 686
DS3_test.f0 DS3_test.f1 DS3_test.subframe		⟨ 675	(676	677) 678) 679)(680)(681) 682)(683	⟩ 684	() 685)686
DS3_test.f0 DS3_test.f1 DS3_test.subframe DS3_test.all[12:0]	674	<u>(</u> 675	(676	677	(678) 679)(680)() 681)(682)(683) 684)(685) 686
DS3_test.f0 DS3_test.f1 DS3_test.subframe DS3_test.all[12:0] DS3_test.newframe[2:0]	674	(675	(676	677)(678)(679)(680)() 681)(682)(683	(684)(685) 686
DS3_test.f0 DS3_test.f1 DS3_test.subframe DS3_test.all[12:0] DS3_test.newframe[2:0] DS3_test.newpulse	674) 675) 676	677	(678)(679)(680)() 681) 682)(683	(684)(685) 686
DS3_test.f0 DS3_test.f1 DS3_test.subframe DS3_test.all[12:0] DS3_test.newframe[2:0] DS3_test.newpulse DS3_test.one	674)(675	(676	(677)(678)(679)(680)() 681) 682)(683) 684) 685	∑ 686
DS3_test.f0 DS3_test.f1 DS3_test.subframe DS3_test.all[12:0] DS3_test.newframe(2:0) DS3_test.newpulse DS3_test.one DS3_test.two	674) 675	(676	(677	X 678	<u>)</u> 679) 680)) 681)(682)(683	χ 684	(685) 686
DS3_test.f0 DS3_test.f1 DS3_test.subframe DS3_test.all[12:0] DS3_test.newframe(2:0) DS3_test.newpulse DS3_test.one DS3_test.two DS3_test.two	674)(675	(676	677) 678	(679	X 680 X	χ 681	(682)(683	X 684)(685) 686
DS3_test.f0 DS3_test.f1 DS3_test subframe DS3_test.all[12:0] DS3_test.newframe[2] DS3_test.newpulse DS3_test.one DS3_test.two DS3_test.two DS3_test.two DS3_test.four	674) 675)(676	677	χ 678)(679	X 680 X	Х 681) 682)(683	χ 684	X 685)(686
DS3_test.f0 DS3_test.f1 DS3_test subframe DS3_test all[12:0] DS3_test.newprame[2:0] DS3_test.newpulse DS3_test.one DS3_test.three DS3_test.three DS3_test.four	674) 675) 676	(677	(678	χ 679	X 680 X	<u>)</u> 681)(682	χ 683	<u>)</u> 684	(685)(686

13.72us 13.59us	5.18us	15.20us	15.22us	15.24us	15.26us	15.28us	15.30us	15.32us	15.34us	15.36us	15.38us	15.40us	15.42us
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	79	X 80	X 81) 82) 83) 84	X 85	(86) 87	(88	89	90) 91
DS3_test.data[6:0]	'b0101011	('b1010110	/ 'b0101101	/b1011010	/ 'b0110101	/ 'b1101010	/ 'b1010101	('b0101011	('b1010111	/ 'b0101110	Ъ1011101	/ 'b0111010	('b111010
DS3_test.sel[2:0]	2	(3	χ 4	(5	χ 6	Х	0) 1	(2	(3	(4	5	(6
DS3_test.in			1		1				1		1		\
DS3_test.pulse								1					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	759	(760	761	762	763	764	765	766	(767	768	769	770	(771
DS3_test.newframe[2:0]													
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													
15.42us 15.29us).88us	16.90us	16.92us	16.94us	16.96us	16.98us	17.00us	17.02us	17.04us	17.06us	17.08us	17.10us	17.12us
DS3_test.clk).88us	16.90us	16.92us	16.94us	16.96us	16.98us	17.00us	17.02us	17.04us	17.06us	17.08us	17.10us	17.12us
DS3_test.clk DS3_test.reset													
DS3_test.clk DS3_test.reset DS3_test.count[9:0]	164	(165) 166) 167) 168) 169) 170) 171	172	173) 174	(175	176
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DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0]	164	(165) 166) 167) 168) 169) 'b1101010) 170) 171	172	173) 174	(175	176
DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0] DS3_test.in	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101	(175 ('b0011010	X 176 X 'b0110101
DS3_test.clk DS3_test.reset DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0] DS3_test.in DS3_test.pulse	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101	(175 ('b0011010	X 176 X 'b0110101
DS3_test.clk DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0] DS3_test.in DS3_test.plse	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101	(175 ('b0011010	X 176 X 'b0110101
DS3_test.clk	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101	(175 ('b0011010	X 176 X 'b0110101
DS3_test.clk DS3_test.cost DS3_test.cost DS3_test.cost DS3_test.cost[9:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.pulse DS3_test.pulse DS3_test.fr1 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101) 175) 'b0011010	X 176 X 'b0110101
DS3_test.clk DS3_test.rese DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.sel[2:0] DS3_test.f0 DS3_test.f1	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101) 175) 'b0011010	X 176 X 'b0110101
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DS3_test.clk DS3_test.count[9:0] DS3_test.count[9:0] DS3_test.sel[2:0] DS3_test.pulse DS3_test.pulse DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.subframe DS3_test.all[12:0]	164 'b0101011	χ 165 χ 'b1010110) 166) 'b0101101	χ 167 χ 51011010	χ 168 χ 'b0110101) 169) 'b1101010	χ 170 χ 'b1010100) 171) 'b0101001	\(172 \('b1010011) 173) 'b0100110)(174)('b1001101) 175) 'b0011010	X 176 X 'b0110101
DS3_test.clk DS3_test.costuff9.0) DS3_test.deat[6:0] DS3_test.deat[6:0] DS3_test.deat[6:0] DS3_test.pulse DS3_test.pulse DS3_test.pulse DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0 DS3_test.fr0	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6
DS3_test.clk DS3_test.cost DS3_test.cost DS3_test.cost(19.0) DS3_test.data[6:0] DS3_test.stel[2:0] DS3_test.in DS3_test.pulse DS3_test.pulse DS3_test.fr1 DS3_test.fr1 DS3_test.fr1 DS3_test.fr1 DS3_test.fr1 DS3_test.fr1 DS3_test.fr1 DS3_test.fr1 DS3_test.fr2 DS3_tes	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6
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DS3_test.clk DS3_test.count[9:0] DS3_test.data[6:0] DS3_test.sel[2:0] DS3_test.pulse DS3_test.pulse DS3_test.fri DS3_test.fri DS3_test.fri DS3_test.fri DS3_test.fri DS3_test.fri DS3_test.sel[12:0] DS3_test.sel[12:0] DS3_test.sel[12:0] DS3_test.sel[12:0] DS3_test.newpulse DS3_test.one DS3_test.two	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6
DS3_test.clk DS3_test.cond19:0 DS3_test.cond19:0 DS3_test.deta[6:0] DS3_test.pulse DS3_test.pulse DS3_test.pulse DS3_test.fr DS3_test.fr DS3_test.fr DS3_test.fr DS3_test.fr DS3_test.sulf D	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6
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DS3_test.clk DS3_test.clk DS3_test.com(19.0) DS3_test data[6:0] DS3_test data[6:0] DS3_test sel[2:0] DS3_test pulse DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.eompulse DS3_test.fol	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6
DS3_test.clk DS3_test.count[9:0] DS3_test.deta[6:0] DS3_test.deta[6:0] DS3_test.deta[6:0] DS3_test.pulse DS3_test.pulse DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.deta[12:0] DS3_test.subframe DS3_test.subframe DS3_test.subframe DS3_test.deta[12:0] DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6
DS3_test.clk DS3_test.clk DS3_test.com(19.0) DS3_test data[6:0] DS3_test data[6:0] DS3_test sel[2:0] DS3_test pulse DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.fol DS3_test.eompulse DS3_test.fol	164 'b0101011 2	X 165 X 161010110 X 3	X 186 X 'b0101101 X 4	\(\) 167 \(\) 161011010 \(\) 5	X 168 X 150110101 X 6	X 169 X 'b1101010 X	X 170 X 'b1010100 0	X 171 X 'b0101001 X 1	X 172 X 171010011 X 2	X 173 X 'b0100110 X 3	X 174 X '51001101 X 4	X 175 X 'b0011010 X 5) 176) '50110101) 6

18.76us 18.62us	.58us	18.60us	18.62uş	18.64us	18.66us	18.68us	18.70us	18.72us	18.74us	18.76us	18.78us	18.80us	18.82us
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	249	250	251	252	253	254	255	256	257	(258	259	260	261
DS3_test.data[6:0]	'b0101011	('b1010110	/ 'b0101101	'b1011010	ъ0110101	('b1101010	/ 'b1010100	/ 'b0101001	/ 'b1010011	('b0100110	/ 'b1001101	(b0011010	'b0110101
DS3_test.sel[2:0]	2)(3	(4	5	6	χ	0)(1	2)(3	(4	(5	6
DS3_test.in					\				\		\		
DS3_test.pulse								\					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	929) 930	931	932	933	934	935	936	937	938	939	940	941
DS3_test.newframe[2:0]													
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													

20.43us 20.30us	28us	20.30us	20.32us	20.34us	20.36us	20.38us	20.40us	20.42us	20.44us	20.46us	20.48us	20.50us	20.52us
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	334	335	336	337	338	339	340	341	342	343	344	345	346
DS3_test.data[6:0]	'b0101011	/b1010110	/ 'b0101101	'b1011010	'b0110101	/b1101010	'b1010100	/ 'b0101001	/b1010011	/b0100110	/b1001101	(b0011010	'b0110101
DS3_test.sel[2:0]	2	(3	4	5	6)()	0	/ 1	2	(3	(4	(5	6
DS3_test.in			\		\				\		\		\
DS3_test.pulse								\					
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	1014	(1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026
DS3_test.newframe[2:0]						'b(001						
DS3_test.newpulse													
DS3_test.one													
DS3_test.two													
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up													

DS3_best country 00 149
DS3_test close 00 D0101011 D0101101 D0101101 D0101101 D010101 D0101010 D0101000 D0101001 D0100101 D0100110 D0001101 D000110 D0001101 D00011
DS3_test set[20] 2 3 4 5 6 0 1 2 3 4 5 DS3_test public DS4_test public DS4_test public DS5_test public DS5_test public
DS3_test file DS3_te
DS3_test F1 DS3_test F2 DS3_test F2 DS3_test F3 DS3_test F4 DS3_test F5 DS3_test F6 DS3_test F7 DS3_test Market DS3_test marke
DS3_test F DS3_test Seven DS3_test f DS3_test Seven DS3_te
DS3_test Fo DS3_test F
DS3_test III
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DS3_test one 1099 1100 1101 1102 1103 1104 1105 1106 1107 1108 1109 1110 1109 1110 1100 1110 1100 1100 1110 1100 1110 1100 1110 1100 1110 11000 11000 11000 11000 11000 11000 11000 11000 11000 11000 110
DS3_test all[12:0] 1099 1100 1101 1102 1103 1104 1105 1108 1107 1108 1109 1110
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DS3_test new pulse DS3_test two DS3_test free DS3_test free DS3_test free DS3_test seven DS3_test up 23,76us
DS3_test two DS3_test two DS3_test for
DS3_test two DS3_test free DS3_test free DS3_test sween DS3_test sween DS3_test sween DS3_test sween DS3_test sween DS3_test tup 23.70up
DS3_test for DS3_test five DS3_test seven DS3_test five
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DS3_test up 23.76us 23.72us 38us 23.70us 23.72us 23.74us 23.76us 23.76us 23.80us 23.82us 23.82us 23.86us 23.88us 23.90us DS3_test close DS3_test count(9.0) 504 5.55 5.06 5.07 5.08 5.09 5.10 5.11 5.12 5.13 5.14 5.15 DS3_test detail(0.0) 50101011 50101010 50101101 50101101 50101101 50110100 50101001 50101001 5001100 5001100 DS3_test folio 2 3 4 5 6 0 1 2 3 4 5 DS3_test FI DS4_test FI DS5_test FI DS
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DS3_test cet DS3_test reset DS3_test count[9:0]
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DS3_test count 9 0 504 505 506 507 508 509 510 511 512 513 514 515 513 (514 515 505 506 507 508 509 510 511 512 513 514 515 513 514 515
DS3_test_data[6:0] b0101011 b1010110 b1010110 b1011010 b1011010 b1101010 b1010100 b1010101 b1010101 b0101011 b0100110 b1001010 b1001010 b1001011 b0100110 b0101011 b000110 b1001010
DS3_test set[2:0] 2
DS3_test.tin DS3_test.pulse DS3_test.F1 DS3_test.F0 DS3_test.f0
DS3_test.pulse DS3_test.F1 DS3_test.F0 DS3_test.10
DS3_test.F1 DS3_test.F0 DS3_test.f0
DS3_test.F0 DS3_test.F0
DS3_test.f0
DS3 test.f1
DS3_test.subframe
DS3_lest al(12.0) 1184 / 1185 / 1186 / 1187 / 1188 / 1189 / 1190 / 1191 / 1192 / 1193 / 1194 / 1195
DS3_bs1nexfsme(2:0)
DS3_lest newpulse
DS3_test one
DS3_test.two
DS3_test three DS3_test four

DS3_test.five DS3_test.six DS3_test.seven DS3_test.up

25.51us 25.38us	18us	25.40us	25.42us	25.44us	25.46us	25.48us	25.50us	25.52us	25.54us	25.56us	25.58us	25.60us	25.62us
DS3_test.clk													
DS3_test.reset													
DS3_test.count[9:0]	589	(590	591	592	593	594	595	596	597	598	(599	(600	(601
DS3_test.data[6:0]	b0101011	/ b1010110	/ 'b0101101	/b1011010	/b0110101	/ 'b1101010	/ 'b1010101	(b0101011	/b1010111	/ 'b0101110	/b1011101	(b0111010	(b1110101
DS3_test.sel[2:0]	2	(3	(4	5	6	Χ	0	(1	2	(3	(4	(5	(6
DS3_test.in													\
DS3_test.pulse													
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	3	(1270	1271	1272	1273	1274	(1275	1276	1277	1278	(1279	(1280	1281
DS3_test.newframe[2:0]													
DS3_test.newpulse	4												
DS3_test.one	-												
DS3_test.two													
DS3_test.three	_												
DS3_test.four	_												
DS3_test.five	-J												
DS3_test.six	-												
DS3_test.seven	_												
DS3_test.up													

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DS3_test.clk					$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$	$\overline{}$		$\overline{}$		
DS3_test.reset													
DS3_test.count[9:0]	673	674	(675	676	(677	(678	679	(0	(1	2	3	4	(5
DS3_test.data[6:0]	1010101	/ 'b0101011	/b1010110	/b0101101	/b1011010	('b0110101	(b1101010)	/b0000001	/ 'b0000011	("b0000111	/ 'b0001110	/ 'b0011101	/b0111010
DS3_test.sel[2:0]	1	2) 3	(4	(5	(6	χ	0	(1	(2	3	χ 4	(5
DS3_test.in		\		\		\				\		\	
DS3_test.pulse													
DS3_test.F1													
DS3_test.F0													
DS3_test.f0													
DS3_test.f1													
DS3_test.subframe													
DS3_test.all[12:0]	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	(1365
DS3_test.newframe[2:0]								XX					
DS3_test.newpulse													
DS3_test.one													
DS3_test.two								\					
DS3_test.three													
DS3_test.four													
DS3_test.five													
DS3_test.six													
DS3_test.seven													
DS3_test.up								7					

傳送端111111

程式介紹 - 初值設定

```
Module DS3 (clk,reset,count,in,sel,allcount,data,pulse,F,subframe,P ositionFrame,PositionPulse,trigger);
```

```
input reset,clk;
output [9:0] count;
output [15:0] allcount;
output [3:0] sel;
output in,pulse,subframe;
output [6:0] data;
output [3:0] F;
output [2:0] Positionframe;
output PositionPulse;
output trigger;
```

```
reg [9:0] count;
reg [15:0] allcount;
reg [3:0] sel,F;
reg in,pulse,subframe;
reg [6:0] data;
reg [2:0] Positionframe;
reg PositionPulse;
reg trigger;
```

程式介紹

```
//count
always@(posedge clk)
begin
 if (reset)
 count=0;
 else if (count==679)
 count=0;
 else
 count=count+1;
end
always@(posedge clk)
begin
 if (reset)
 allcount=0;
 else if (allcount = = 4759)
 allcount=0;
 else
 allcount=allcount+1;
end
```

- 這裡利用正緣 clk 作為觸發
- 將選擇線還有計數器初值設為 0
- 讓計數器數 0~679 共 680 bits
- 這邊讓它不斷的數 0 到 6 全部需要共有 4760 bits

```
// multiplexer upcounter
always@(posedge clk)
begin
  if (reset)
    sel=0;
  else if (sel==6)
    sel=0;
  else
    sel=sel+1;
end
```

```
● sel 用來控制 in , 輸入有7組, 所以數 0 到 6
```

● 達到輸入資料1111111 , 7組資料 , 用7條控制線控制

```
always@(posedge clk)
begin
if (reset)
in=1;
else if (sel==0) in=1;
else if (sel==1) in=1;
else if (sel==2) in=1;
else if (sel==3) in=1;
else if (sel==4) in=1;
else if (sel==5) in=1;
else if (sel==6) in=1;
end
```

● 因為傳送之資料皆為1,所以將所有資料的控制線設為1

```
always@(posedge clk)
begin
if (reset)
data=7'b00000000;
else
data[6]=data[5];
data[5]=data[4];
data[4]=data[3];
data[3]=data[2];
data[2]=data[1];
data[1]=data[0];
data[0]=in;
end
```

● data[]用來一個一個的導入 in 的值

```
//C=0 F0=0 always@(posedge clk) begin if (count==170 || count==255 || count==340 || count== 425 || count==510 || allcount==2720 || allcount==4080) data=7'b111110; end
```

● 將 0~4759 中需要以零表示之位置進行歸零動作。

```
always@(posedge clk)
begin
if (reset)
pulse = 1;
else if (count==85 || count==170 ||
count==255 || count == 340 || count
==425 || count == 510 || count == 595 ||
| count ==0)
pulse = 1;
else
pulse = 0;
end
```

```
● 透過偵測一列中之識別表示字元令pulse跳起之動作表示已經傳送完成1列中訊框部分資料
```

```
● 識別字元(依序)
EX. F1、C11、F0、C12、F0、C13、F1
```

```
//F0 and F1 1001
always@(clk)
begin
if(reset || allcount==0)
F=0;
else if (count==85)
F[3]=data[0];
else if (count==255)
F[2]=data[0];
else if (count==425)
F[1]=data[0];
else if (count==595)
F[0]=data[0];
end
```

● 在各個Frame將data[]資料引入F[3:0]中

```
//if F0 and F1 =1001 subframe HIGH
always@(posedge clk)
begin
  if (reset)
     subframe=0;
if (F==4'b1001)
     subframe=1;
if (allcount==0)
     subframe=0;
end
```

● 透過偵測data[0]送至F[3:0]之資料判定訊框1001時 令subframe跳起之動作表示已經傳送完成7列資料

```
// X1 X2 P1 P2 M0 M1 M0 SISO
always@(posedge clk)
begin
if(reset)
Positionframe=3'b001;
else if (count==0)
begin
Positionframe[2]=Positionframe[1];
Positionframe[1]=Positionframe[0];
Positionframe[0]=data[0];
end
end
```

將data[0]以序進序出方式傳送至Positionframe來準 備之後對齊符號之判定

```
// find 010
always@(posedge clk)
begin
if (reset)
PositionPulse=0;
else if (Positionframe==3'b010)
PositionPulse=1;
else
PositionPulse=0;
end
```

● 透過判定M0(2720)、M1(3400)、M0(4080)分別為0、1、0來進行資料對齊識別,並使用一個位置識別 波形表示。

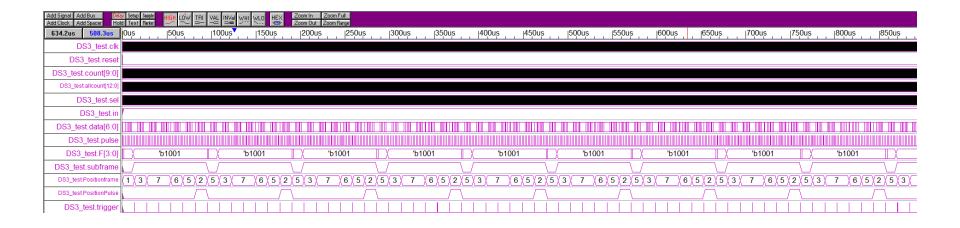
```
// trigger
always@(posedge clk)
begin
if(reset)
trigger=0;
else if (count==679)
trigger=1;
else
trigger=0;
end
endmodule
```

● 最後透過偵測一列中之識別表示字元令pulse跳起之動作表示已經傳送完成1列中整串資料。

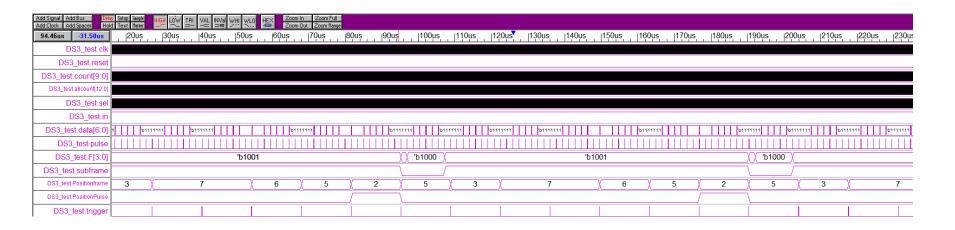
測試檔

```
module DS3 test;
reg clk,reset;
wire [9:0] count;
wire [15:0] allcount;
wire [3:0] sel;
wire in, pulse, subframe;
wire [6:0] data;
wire [3:0] F;
wire [2:0] Positionframe;
wire PositionPulse;
wire trigger;
DS3 d1 (clk,reset,count,in,sel,allcount,data,pulse,F,subframe,Positionframe,PositionPulse,trigger);
initial
begin
 clk=1;
 reset=1;
 #10 reset=0;
end
always #10 clk=~clk;
initial
#1000000 $finish;
endmodule
```

完整視圖



細部視圖



Add Signal Add Bus De Add Clock Add Spacer Ho	ay Setup Sampl Id Text Marks	HIGH LO	W IRI	VAL INV	ii Aii M	/LO HE:	.X Zoo	om In Zo om Out Zo	oom Full oom Range																				
110.0ns -125.8us	0ns			50ns				100ns			, [1:	50nş			200ns			250n	ış ,			300nş			350	ns		400ns	
DS3_test.clk				٦			\neg			\neg			٦ ,					\neg			١ ,			$\overline{\mathcal{L}}$	$\overline{}$				
DS3_test.reset																													
DS3_test.count[9:0]	0	(1	X	2	3		4	(5	X	6	7	X	8	9	(10	(11	X	12	(13	χ.	14	15	(16	6 (17	(18	(19	(20) (
DS3_test.allcount[12:0]	0	(1	X	2	3	Х	4	(5	χ	6	7	X	8	9	/ 10	(11	X	12	(13	χ.	14	15) 16	6 X	17	(18	(19	20))
DS3_test.sel	0	χ 1	χ	2	3	χ	4	χ 5	χ	6	χ ο	χ	1	2	χ 3	/ 4	χ	5	(6	χ	0	1	χ 2	2 X	3	χ 4	χ 5	χ 6	χ
DS3_test.in																													
DS3_test.data[6:0]	(b000000	1)(b00000)11)('b00	000111	'b0001	111)(b(001111	1)(b0111	1111)																				
DS3_test.pulse		7																											
DS3_test.F[3:0]																													
DS3_test.subframe																													
DS3_test.Positionframe																													
DS3_test.PositionPulse																													
DS3_test.trigger																													
Add Signal Add Bus De	ay Setup Sampl	HIGH LC	W IRI	VAL INV	i Aii A	/LO HE	Z00	om In Zo	oom Full																				
Add Signal Add Bus De Add Clock Add Spacer Ho 1.642us -124.3us	ay Setup Sampl Id Text Marke	нідн <u>го</u> 1.55		VAL INV	A ÀHI Á	/Lo HE	Zoo	om In Zo	oom Full oom Range	1.65us	.		1.	70us		. 1.7	5ųs			1.80us	i .		. 1.8	85ųs			1.90us		. [1
Add Clock Add Spacer Ho	ay Setup Sampl			VAL INV	Aii A		Zoo	om In Zo	oom Full oom Range	1.65us	5 		1.	70us		1.7	5us	\ /		1.80us	·			85ųs	-\ /		1.90us		
Add Clock				VAL INV			Zoo	om In Zo	oom Full oom Range	1.65us	5			70us		1.7	5us			1.80us	; 			85ųs			1.90us		, [1
Add Clock					₩ <u>₩</u> ₩₩	1.60 _/	Zoo	om In Zoom Out Zoo	oom Range	1.65 us	83	\ 84		70us	86	11.7	<u> </u>	\	89	1.80us		91	1.8		93 \	94	1.90us) 96	, [1]
Add Clock		1.55	ous	3 (1.60)us	om Out Zo	oom Range	<u> </u>		\ 84 \ 84	4 (86		<u> </u>	38 X	89			91			93 X	94		X 96 X 96	, [1] _/ \ \(97 \(97
Add Clock	76	77	ous \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	3 X	79	1.60 	Dus 80 (m Out Zo	oom Range	32 X	83		4 \(4 \)	85) 87) X			× 90	XX_		92	X X) 95		
Add Clock	76 76	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86)(87)(87) X	38	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97
Add Clock	76 76	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86) 87) 87) 3) X	38 X 4 X	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97
Add Clock	76 76 6	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86) 87) 87) 3	X	38 X 4 X	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97
Add Clock	76 76 6	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86) 87) 87) 3	X	38 X 4 X	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97
Add Clock	76 76 6	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86) 87) 87) 3	X	38 X 4 X	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97
Add Clock	76 76 6	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86) 87) 87) 3	X	38 X 4 X	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97
Add Clock	76 76 6	77	\ 78 \ 78	3 X	79 79	1.60 	80)(81 81	oom Range	B2 \(\)	83	⟨ 84	4 \(4 \)	85 85	86) 87) 87) 3	X	38 X 4 X	89) 90) 90	XX_	91) 92) 92	X X	93	94) 95) 95	96) 97

Add Signal Add Bus De Add Clock Add Spacer Ho	y Setup Samp Id Text Mark	HIGH LC	W IRI VAL	iM∧al ÀHi Á	LO HEX	Zoom In Zoo Zoom Out Zoo	om Full om Range															
3.344us -122.6us	Dus		3.25ι	IS		3.30us		3.35	us		3.40us		3.45u	s		3.50us		3.55us		,	3.60us	
DS3_test.clk		\neg		$\overline{}$	$\overline{}$		$\overline{}$		$\overline{\ \ }$						\neg							$\neg \Box$
DS3_test.reset																						
DS3_test.count[9:0]	160	161	162	163	164	165	166	167	168	169	(170	171	172	173	174	175	176	177	178	179 (180	181
DS3_test.allcount[12:0]	160	161	162	163	164	(165	166	(167	168	(169	(170	171)(172	173	174	175	176	177	178	179 (180	181
DS3_test.sel	6	0	1	2	3	4	5	∕ 6	(0	χ 1	(2	3)	4	5	6	0)	1 (2 \	3 \	4)(5	6
DS3_test.in																						
DS3_test.data[6:0]											(b1111110)	b1111101)(b 1111011	'b1110111	b1101 111	(b1011111)	b0111111)(
DS3_test.pulse																						
DS3_test.F[3:0]																						
DS3_test.subframe																						
DS3_test.Positionframe																						
DS3_test.PositionPulse																						
DS3_test.trigger																						
DS3_test.trigger																						
Add Signal Add Bus De	sy Setup Sam	HIGH LC	V IBI VAL	INVal WHI W	LO HEX	Zoom In Zo Zoom Out Zoo	om Full															
Add Signal Add Bus De	ay Setup Sam d Text Man	1 -	W TRI VAL	INVal WHI W	HEX 5.00us	Zoom Out Zoo	om Range	.05us		5.10us		__ 5.1	5us		5.20us		5.2	5us		5.30us		
Add Signal Add Bus Add Clock Add Spacer Ho	ay Setup Sam d Text Mark	1 -		INVal WHI		Zoom Out Zoo	om Range	.05us		5.10us		5.1	5us		5.20us		5.2	5us		5.30us		
Add Signal	Setup Sampled Text Man	1 -		INVal WHI W		Zoom Out Zoo	om Range	.05us		5.10us		5.1	5us		5.20us		5.2	5us	<u></u>	5.30us		<u> </u>
Add Signal Add Bus Add Clock Add Spacer Ho	Setup Samud Text Mari	1 -		WH W	5.00us	Zoom Out Zoo	om Range		25.			, 5.1 / \/ 257	5us	259	5.20us \(\) 260) 261	, [5.2) 262	5us / 263	264	5.30us \(\) \(\) \(\) 265	× 266	
Add Signal Add Bus Add Clock Add Spacer Ht		4.9	05us		5.00us	Zoom Out	om Range	2 (253		4 (255	(256			X 259 X 259		<u>)</u> 261) 264) 264		X 266 X 266	
Add Signal Add Bus De Add Clock Add Space Ht 5.054us -120.9us DS3_test.clk DS3_test.reset DS3_test.count[9:0]	246	(247)	05us	× 249	5.00us	Zoom Out	om Range 5	2 (253		4 \ 255 4 \ 255	(256	√ 257	258		260		262	263		265) 26) 26
Add Signal Add Bus Add Clock Add Space Ht 5.054us -120.9us DS3_test.clk DS3_test.count[9:0] DS3_test allcount[12:0]	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255	× 256 × 256	× 257 × 257) 258) 258	259) 260) 260	261) 262) 262) 263) 263	264) 265) 265	266	
Add Signal Add Bus Add Clock Add Space Ht 5.054us -120.9us DS3_test.clk DS3_test.count[9:0] DS3_test.sel	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255 \ 3	× 256 × 256	\(\ \ 257 \) \(\ \ 257 \) \(\ \ \ 5	(258 (258 (6	∑ 259 ∑ 0) 260) 260) 1	261	X 262 X 262 X 3) 263) 263	264) 265) 265	266	
Add Signal Add Bus Add Clook Add Signal Add Signa	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255 \ 3) 256) 256) 4	\(\ \ 257 \) \(\ \ 257 \) \(\ \ \ 5	(258 (258 (6	∑ 259 ∑ 0) 260) 260) 1	261	X 262 X 262 X 3) 263) 263	264) 265) 265	266	
Add Signal Add Bus Add Clock Add Signal Add Sig	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255 \ 3) 256) 256) 4	\(\ \ 257 \) \(\ \ 257 \) \(\ \ \ 5	(258 (258 (6	∑ 259 ∑ 0) 260) 260) 1	261	X 262 X 262 X 3) 263) 263	264) 265) 265	266	
Add Signal Add Bus Add Clock Add Spece Ht	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255 \ 3) 256) 256) 4	\(\ \ 257 \) \(\ \ 257 \) \(\ \ \ 5	(258 (258 (6	∑ 259 ∑ 0) 260) 260) 1	261	X 262 X 262 X 3) 263) 263	264) 265) 265	266	
Add Signal Add Bus Add Clock Add Signal Add Space Ht 5.054us	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255 \ 3) 256) 256) 4	\(\ \ 257 \) \(\ \ 257 \) \(\ \ \ 5	(258 (258 (6	∑ 259 ∑ 0) 260) 260) 1	261	X 262 X 262 X 3) 263) 263	264) 265) 265	266	
Add Signal	246	\(\text{247} \) \(\text{247} \)	248) 248	× 249	5.00us 5.00us \(\) 250	250m Out 250m	5	2 \(253 2 \(253	25	4 \ 255 4 \ 255 \ 3) 256) 256) 4	\(\ \ 257 \) \(\ \ 257 \) \(\ \ \ 5	(258 (258 (6	∑ 259 ∑ 0) 260) 260) 1	261	X 262 X 262 X 3) 263) 263	264) 265) 265	266	

DS3_test.trigger

	d Text Marker	0.05			G 70110		IG 75			IC 00110		ie or.	10		ic ooue		IC 01			17.0000	
.710us -119.2us		6.65	is		6.70us		6.75u	s		6.80us		6.85	is		6.90us		6.95	ous		7.00us	
DS3_test.clk					/ \/				<u>/ </u>	/ \	/ \			/ \	/ _	/ _			_/ _		
DS3_test.reset										\C	70			\C	\()(70	· · · · · ·	70	70	7(
DS3_test.count[9:0]	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
DS3_test.allcount[12:0]	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
DS3_test.sel	(<u>2</u>)	3	(4	5	(6	0	1)	2	(3	<u> </u>	<u>/</u> 5	(6	0	<u> 1</u>	2	3	χ 4	χ 5	Д 6	χ ο	<u> </u>
DS3_test.in										Vn 444440	W 444404		9.444044	VII. 4404444	VII. 404444	VI 04444	av .				
DS3_test.data[6:0]										/b1111110) <u>//b1111101</u>	(b1111011	(b1110111	<u>//b1101111</u>	(Б1011111	(b011111	1 <u>1</u>				
DS3_test.pulse										/	\										
DS3_test.F[3:0]									'D1	000											
S3_test.subframe																					
0S3_test.Positionframe										1											
S3_test.PositionPulse																					
DS3 test.trigger																					
DS3_test.trigger																					
gnal Add Bus Dela	Setup Sample	HIGH LOW	RI VAL INVa	WHI WLO	HEX Zoom1	n Zoom Full															
gnal Add Bus Dela ock Add Spacer Holo	Setup Sample Text Marker	HIGH LOW :		Àii Ári	Zoom (n Zoom Full Dut Zoom Rang	e	IS		18 50us		18 55	us.		18 60us		18.6	5us		18 70us	
gnal Add Bus Delay ock Add Spacer Hold 26us -117.5us	Setup Sample Text Marker	н <mark>ідн</mark>		ÀH ÁT	HEX Zoom I Zoom (8.40us	n Zoom Full Dut Zoom Rang	e 8.45u	IS .		8.50us	<u></u>	8.55	us		8.60us		8.6	5us		8.70us	
gnal Add Bus pock Add Spacer Holo 26us -117.5us DS3_test.clk	Setup Sample Text Marker			WHI WID	Zoom (n Zoom Full Dut Zoom Rang	e	IS .		8.50us		, 8.55	us		8.60us		8.6	5us		8.70us	
mal Add Bus Delay cock Add Spacer Holo 16us -117.5us DS3_test.clk DS3_test.reset		8.35	JS	/	8.40us	Out Zoom Rang	8.45u				¥ 426			V 429		√ 431			V 434		V 436
Add Bus Delay	416	8.35	, 418	× 419	Zoom (8.40us 420	Out Zoom Rang	8.45u	423	(424	X 425)(426)(426	(427	\ 428) 429) 429) 430	X 431 X 431	(432	433		(435	
Add Bus Delay	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	Out Zoom Rang	8.45u	423	\(\ \ 424 \) \(\ 424 \)	\(\text{ 425} \) \(\text{ 425} \)	426	\(\ \ 427 \) \(\ \ 427 \)		429) 430) 430	431) 432) 432	√ 433√ 433	434		436
Add Bus Delay	416	8.35	, 418	× 419	Zoom (8.40us 420	20m Rang 421 421	8.45u	423	(424	X 425		(427	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \) 430		(432	433		\(\ \ 435 \) \(\ \ 435 \)	
Add Bus	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	20m Rang 421 421	8.45u	423	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ 426 \) \(\ 6	\(\) 427 \(\) 427 \(\) 0	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(429	\(\) 430 \(\) 430 \(\) 3	X 431 X 4) 432) 432) 5	√ 433√ 433	434	\(\ \ 435 \) \(\ \ 435 \)	436
Add Bus Delay	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	20m Rang 421 421	8.45u	423	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	426	\(\) 427 \(\) 427 \(\) 0	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(429	\(\) 430 \(\) 430 \(\) 3	X 431 X 4) 432) 432) 5	√ 433√ 433	434	\(\ \ 435 \) \(\ \ 435 \)	436
Add Bus	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	20m Rang 421 421	8.45u	423	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ 426 \) \(\ 6	\(\) 427 \(\) 427 \(\) 0	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(429	\(\) 430 \(\) 430 \(\) 3	X 431 X 4) 432) 432) 5	√ 433√ 433	434	\(\ \ 435 \) \(\ \ 435 \)	436
Add Bus Delay	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	20m Rang 421 421	8.45u	423	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ 426 \) \(\ 6	\(\) 427 \(\) 427 \(\) 0	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(429	\(\) 430 \(\) 430 \(\) 3	X 431 X 4) 432) 432) 5	√ 433√ 433	434	\(\ \ 435 \) \(\ \ 435 \)	436
Add Sus Delay	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	20m Rang 421 421	8.45u	423	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ 426 \) \(\ 6	\(\) 427 \(\) 427 \(\) 0	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(429	\(\) 430 \(\) 430 \(\) 3	X 431 X 4) 432) 432) 5	√ 433√ 433	434	\(\ \ 435 \) \(\ \ 435 \)	436
Add Bus Delay	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.35 417 417	\(\square\) 418 \(\square\) 418	× 419 × 419	8.40us 420 420	20m Rang 421 421	8.45u	423	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\(\ \ 426 \) \(\ 6	\(\) 427 \(\) 427 \(\) 0	\(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(429	\(\) 430 \(\) 430 \(\) 3	X 431 X 4) 432) 432) 5	√ 433√ 433	434	\(\ \ 435 \) \(\ \ 435 \)	436

Add Clock Add Spacer Hold	d Text Marker	HIĞH TÖÇM	THI VAL	Val WHI WLO	HEX Zo	om In Zoom F om Out Zoom R	ange														
10.15us -115.8us		10	.05us	1 1	10.10u	5 ,	10	.15us		10.20us		10.	25us		10.30us		_, 10).35us		10.40us	1 1 1
DS3_test.clk																					
DS3_test.reset																					
DS3_test.count[9:0]	501	502	(503	504	505	(506	507	(508	509	(510	511	512	(513	514	515	516	517	518	519	520	(521)
DS3_test.allcount[12:0]	(501	502	(503	504	(505	506	507	(508	509	(510	(511	512	(513	(514	515	(516	517	(518	(519	520	(521)
DS3_test.sel	X 4	(5	(6	χ ο) 1	χ 2	(3	(4	(5	(6	χ ο	χ 1	(2	χ 3	/ 4	(5	χ 6	(0) 1	(2	(3)
DS3_test.in																					
DS3_test.data[6:0]										/b111111	0/b111110	n/b111101	1)(b111011	1/b110111	1)(b101111	1) b01111	11)				
DS3_test.pulse											1										
DS3_test.F[3:0]																					
DS3_test.subframe																					
DS3_test.Positionframe																					
DS3_test.PositionPulse																					
DS3_test.trigger																					
11.80us -114.2us	y Setup Sample d Text Marker 11.70us	HIGH LOW		Val WHI WLC	HEX Zo	om In Zoom F om Out Zoom R 11.80us	ull ange	11.8	5us		11.90us	<u></u>	111.95	us		12.00us		12.0	5us	<u>'</u>	12.10us
Add Clock		HIGH LOW			HEX Zo	om Out Zoom R	ull ange		5us		11.90us		11.95	us		12.00us		12.0	5us	<u></u>	12.10us
Add Clock	11.70us			75us	Zo Zo	om Out ¶Zoom R	ange					506					V 601				
Add Clock	11.70us	(586) 587	75us \ 588	(589	om Out Zoom R	591	592) 593	(594)	595	596	597	598	599	600	\(\) 601	(602	(603)	(604	X 605 X
Add Clock Add Spacer Hole 11.80us	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	Zo Zo	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ
Rdd Clock Add Speece	11.70us	(586) 587	75us \ 588	(589)	om Out Zoom R	591	592) 593	(594)	595		597	598	599	600	/	(602	(603)	(604	X 605 X
Rdd Clock Add Speece	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	(589)	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ
Rdd Clock Add Speece	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	(589)	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ
Rdd Clock Add Speece	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	(589)	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ
Rod Clock Add Speece Hote	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	(589)	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ
Rdd Clock Add Speece	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	(589)	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ
DS3_test.clic DS3_test.clic DS3_test.clic DS3_test.clic DS3_test.clic DS3_test.clic DS3_test.clic DS3_test.clic DS3_test.sel DS3_test.sel DS3_test.sel DS3_test.clic DS3_test.clic	11.70us 585 585) 586) 586	\(587 \) 587	/5us / 588 / 588	(589)	m Out Zoom R 11.80 us	591 591) 592) 592) 593) 593	∑ 594 ∑ 594	595 595	596	597	598 598	599 599	600	601	602	603) 604) 604	χ 605 χ χ 605 χ

dd Clock Add Spacer Hold	d Text Mark	er —	W IRI VAL	INVal WHI V	/LO HEX	Zoom Out Zoo	om Range																
13.52us -112.4us	13.40us	5 ,	, [13.45us	,	13.50	us	,	13.55as		13.60	IS	, 1	13.65us		13.70u	S		13.75	us		13.80լ	IS ,
DS3_test.clk	$\overline{}$																			$\overline{}$			
DS3_test.reset																							
DS3_test.count[9:0]	(670	(671	1 (67)	2 (67	3 (67	4 (67	5 (67	6 (67	7 (67	78 (67	9 (0	(1	(2	(3)	5	(6	X	7	8	9	(10	<u> </u>
DS3_test.allcount[12:0]	(670	671	1 (67:	2 (67	3 (67	4 (67	5 (67	6 (67	7 (67	78 (67	9 (68	68	1 (68	2 (68	3 (68	685	68	6	687	688	689	(69)
DS3_test.sel	(5	(6	(0	(1)(2	. (3	(4	(5	χ 6	3)(() (1	(2	(3	(4	χ ,	6	(0	X	1)	2	3	(4	X
DS3_test.in																							
DS3_test.data[6:0]														'b111	1111								
DS3_test.pulse												\neg											
DS3_test.F[3:0]																							
DS3_test.subframe																							
DS3_test.Positionframe											X												
DS3_test.PositionPulse																							
DS3_test.trigger											$\overline{}$												
dd Signal Add Bus Delay	y Setup Samp	e HIGH I C	W TRI VAL	INIVAL VIVUE V	I O HEY	Zoom In Zoo	om Full																
	Text Mark	HIGH LO	W TRI VAL 95.05			Zoom In Zoo Zoom Out Zoo 95.10 <mark>u</mark> s	om Full m Range	95.1	5us		95.20us		95.29	ius ,	1	95.30us		95	5.35jus		, 9	95.40us	
dd Clock Add Spacer Hold	Text Mark	HIGH LO					om Full m Range	__ 95.1:	5us		95.20us		95.2	jus		95.30us		, 95	5.35us	<u> </u>		95.40us	
dd Clock Add Spacer Hold 95.11us -30.84us	Text Mark	HIGH LO					om Full m Range	95.1: 	5us		95.20us		95.25 	jus ,		95.30us		95 	5.35us	<u> </u>	, <u> </u> 9	95.40us	
dd Clock	Text Mark	671 X					om Full m Range	95.1: 677	5us ,) 679	95.20µs / 0	1	95.29	ius 3	4	95.30us / / /	6	95 		8)	9 (95.40us	
95.11us -30.84us DS3_test.clk DS3_test.reset	Dous 670 X	at	95.05	ius		95.10 <mark>us</mark>						1 1			4		6 6			8 \(\)			$\overline{}$
Moderate	00us 670)	671	95.05	673	674	95.10 <mark>us</mark> 	676	677	√ 678	(679	χ ο		2	(3) 5))))(;		9 (10	1
Madd Space	00us 670)	671 X	95.05 95.05 672 4752	673 4753	674	95.10 <mark>us 675 4755</mark>	676	677 4757	√ 678 √ 4758) 679) 4759) 0)(0	1	2 2	3	4) 5)) 5)	6	7)))(;	8	9 (10	1
Hotologic Hotologic Hotologic Hotologic Hotologic St. Hotologic	00us 670)	671 X	95.05 95.05 672 4752	673 4753	674	95.10 <mark>us 675 4755</mark>	676	677 4757	√ 678 √ 4758) 679) 4759) 0)(0	1	2 2 2	3	4) 5)) 5)	6	7)))(;	8	9 (10	1
95.11us 30.84us DS3_test.clk DS3_test.reset DS3_test.count[19:0] DS3_test.sel DS3_test.sel DS3_test.sel	00us 670)	671 X	95.05 95.05 672 4752	673 4753	674	95.10 <mark>us 675 4755</mark>	676	677 4757	√ 678 √ 4758) 679) 4759) 0)(0	1	2 2 2	3 3	4) 5)) 5)	6	7)))(;	8	9 (10	1
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95.11us 3.0.84us DS3_test.clk DS3_test.clk DS3_test.count[9:0] 0 DS3_test.sel DS3_test.sel DS3_test.data[6:0] DS3_test.pulse DS3_test.filos	00us 670)	671 X	95.05 95.05 672 4752	673 4753	674	95.10 <mark>us 675 4755</mark>	676	677 4757	√ 678 √ 4758) 679) 4759) 0)(0	1	2 2 2	3 3	4) 5)) 5)	6	7)))(;	8	9 (10	1
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