

(19) (KR)
(12) (A)

(51) Int. Cl.⁷
G06F 13/00

(11)
(43)

10-2004-0073344
2004 08 19

(21) 10-2004-0008889
(22) 2004 02 11

(30) 03090038.5 2003 02 12 EP(EP)

(71) 92648 46

(72) -30827가 .7

-30159 .20

-30419 .20

(74)

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(54)

가 / ,
PCM , 가 PCM

- 1
- 2 IEC 958
- 3 AC'97
- 4 ADAT
- 5 I2S
- 6 1
- 7
- 8 FIFO ()
- 9
- 10 GPI/
- 11
- 12 /

< >

- 11
- 12
- 13
- 14 FIFO
- 16
- 17
- 18

(IO) / IEC958 ADAT, AD/DA AC-Link I2S ,
 가 A/V ,
 가

words) (clean data bit) (polling) FIFO (known building blocks) (serial data bit stream) (serial-to-parallel converter) (sample) DMA(direct memory access) (data transfer) DMA DMA 가

DMA / (IEC958) (MSB first) (LSB first) (interface specialised for a single protocol) (synchronisation) (audio-related clock) 가

24 PCM (IEC958, I2S type 2, ; ADAT type 8; AC-Link types 2 to 6: PCM) (side information), SPDF: VUC; ADAT: User Bits; AC-Link: Tag, Cmd, Status가 PCM LSB(least significant bit)가 MSB(most significant bit)가

1 2 가 / 3 4

K (number)() K

IC (parameterised universal audio IC cell) IC , PCB 가

(cell) DSP(digital signal processor) 가 SIO() DSP / (clocked)

1 SADI SADO (RISC, DSP μP;

) SB 가
 () () (domain), 가
 N GPI(SADI) , N
 (11) - (, IEC958, I2S, AC-Link, ADAT) , PCM, N
) N PCM
) (13) N N (PCT
) FIFO(14) . FIFO(14) (15)
 SB
 2) SB (15), FIFO(14), (13), M (1
 M N GPO(SADO) M SADO ,
 (12) PCM , IEC
 958, AC'97, I2S ADAT .
 PCM (13) / (19) , FIFO(14) 16 8
 , FIFO(14) , 8 (18) 8
 (17) (16) (enable signal)
 (counter), 가 (loadable timer)
 , I2S AC97 } 가 (sync){ (16)
 1 PCM 1 LRCK, MCK SADI SADO BCK
 / /
 censing) , (pre-processing) (common-format central pro
 ;
 (channel decoding) - 가 PCM
 - ;
 , FIFO PCM PCM
 -
 , , /
 , ,
 , PCM
 , 가 FIFO PCM
 - ; - PCM

(13) (, 1, 2) FIFO(14)() 가 PCM)
 (configuration register)가
 DMA () DMA (channel aggregation)', (3x2) 3
 IEC958 } (in phase) , ,
 가 ()
 FIFO(-RAM) / / / 가 ,
 FIFO(14) { (11) (12) () ,
 (data rate) } ,
 FIFO-RAM FIFO(appropriately - sized isolated stream FIFO) FIFOs
 , () / I/O
 가 , SIO () , SIO ,
 (/) 가 SIO (system_) { (13) 가 ,
 가 , FIFO (bie wise) / /
 } 가 , I/O
 () 가 , I/O 가 , I/O
 , I/O 가 ,
 12 , (11) (12) , 12
 (13) ,
 , sys_clk / (clocking) , 11
 , TFF1, TFF2 RFF0 가
 , (chip) , (gate edge)
 가 1 6
 (16) , SIO , 가 ,
 (machine) 가 ,
 (channel permutation) 1
 6 , ,
 가 ,
 1 6 , / (11, 12) (13) sfra
 me_enable () , (13) (sync_clk) pcm_ena
 ble subcode_enable PCM -
 syc_clk
 PCM :
 P (P=1, 2, 3, ...) (s
 ample sequential) , (6) P
 (, 32) 가 ,
 24 가 ,
 , / RISC D
 SP, 2 (double word) 2x16 , 16 DSP , 32 가

가 , 24 DSP , 24 가 가 ,
 가 (moving), (scaling), 가

8a 8b FIFO(14) , 32 24 ,
 (8c) 가 / , (,
) PCM 가 , F L ,
 . PCM 가 , GPI/GPO /

가 , 32 . ,
 :
 DAT(C1..C4), AC97() 가 가 1 . SPDIF . SPDIF(VUCP), A
 5 3 . 8a , . SPDIF 24 ,
 bit) 가 , 32 (original subcode
 , (V) . (13)

- a) V (forwarded), 가
- b) P , 가 (FIFO/). ,
- c) (mute) . ,
- d) CD (interpolation) .

IEC958 4 VUCP ,
 (4 가) P 1 ADAT ,
 I2S DSP , amp; 가 I2S
 , -PCM (non-PCM location) ,
 / { (correlating)} ALink .

:
 P 가 . , (, DMA , IO , FIFO) 가)가
 , (entity) (, 가 (, ,)
 ,) 가

DMA / (in-time
 service) 가 , FIFO 가
 가 , () , 6
 , FIFO DMA (13) /
 sframe_enable ,
 가 , 가
 , (measure) ()
 '1' , 'L' , 1 '1'
 , '0' , /
 ,
 ener) (list
 Hz DMA) 1 / , L (, L 0.1
 'F-bit' () , 1152/1024 @48 K
 DMA (DMA 1 1 F='1') ,
 , () F-bit (set) 가 /
 , () DMA 가 () , DMA
 () / .
) , F , FLEN (sequence
 1 가 F='1' (start-up) , FIFO(14) 1
 FLEN*P (set-up) , DMA() (DMA)
 1 가 F- 가 (DMA)
 (DMA) 1 가 , ()
 DMA)
 (DMA) FLEN*P , F
 (13) (13) , FIFO(14)(, 1 F-
 FIFO 가) , F-bit 가 FLEN*P-1 가 . FLEN*(P+P)
 , F-
 F- 가 , P FLEN
 , F- FLEN (zero) , 가
 (13) } (91) FLEN 9 (92) FCNT { (DMA)
 F- 가) (, F- , FCNT (P
) (, FCNT '0' , FLEN-1
 , FCNT '0' , FLEN-1
 가 F-
 F- SYNC {

(check sum) } , ()
 가 , (가
 가 , SYNC 가
 가 ,) FI
 FO(14) DMA (chaining) DMA(
)
 DMA () DMA
 가, DMA FCNT/FLEN DMA
 / - FIFO가 , FIFO
 , DMA 가
 DMA DMA 가
 FL- (Bitfield), (don't care)

L	F	
0	0	
0	1	
1	0	
1	1	

1
 DMA , F-
 FL 2- (1 8a) , LF = 01_b DMA (F=1)
 1 (L=0) , LF = 10_b 가 LF = 00
 b LF = 11_b ,
 가 , (13) LF = 01_b LF = 10_b L
 F , LF = 00_b LF = 11_b 가 (32) DMA
 , PCM , (8a) . (13) LF = 00_b LF = 11_b PCM 24 DMA
 , DMA
 가 LF = 10_b , F- ()
 , LF , DMA 가 ,
 , SPTS:
 (13) , (92) FCNT, (91)
) FLEN, F- DMA () (95) P
 TS , DMA
 ERROR(99) 가 (93) FCNT = F
 LEN - 1 sframe_enable
 9 (94) CTS() , 0xFFFF FFFF가 '0'
 가 (wrapping around to '0'), (32) CTS
 sframe_enable , CTS (95) PTS() (FCNT = FLEN - 1)

(101) sys_clk (102) bck (103) RFF3} (RFF0.Q) sys_clk
 가 (bck, RFF.Q) , sys_clk가 bck , bck , sys_clk
 (bck () , Din RFF0 , sys_clk () Din
 (, bck) , bck Din

11 (time diagram) 10

10 , bck 가 가

10 sys_clk (sys_clk) 가 TFF0 , bck (sys_clk)/(bck bck_ en (103) 가 , bck_en 가 bck , bck bck_ en () , TFF0 , bck , bck TFF1 I/O , bck_en , TFF2 Q , 11 : 10

bck 가 가 TFF0 TFF2 , TFF0 , TFF0 sys_clk (10 sDout) 가 , sys_clk bck_en

TFF2 , I/O bck ,

(104) 가 , BCK , BCK , bck

/ /

- bck ' ' (,) TFF1 RFF0,

- ' ' 2 TFF2,

- bck(CFF0, CFF1) Din(RFF1, RFF2) ' ' , sys_clk bck_en sys_clk (RFF3 TFF0) 가 (TFF0 10).

a) Din bck sys_clk RFF0

b) bck ' ' (,) Dout (propagation delay) , sys_clk 가 , T FF2() TFF1()

c) (sys_clk)/(bck)가 3...4 , Din가 Dout bck '(11 . T_d)

sDout sDin () TFF0 bck 가 . (TFF0)
 ,
 ,
 / CFF1 CFF2 가 . , 가 sys_clk ,
 , (sys_clk)/(bck) 가 . 10 가
 '2' ,
 '2' .
 , 가
 n) , (m-) (: LRCK= ; AC97 : SY D
 NC; DSP {I2S (strobe)}
 in Dout (10, 103) 가 (10, 101) 가
 , (BCK 가
 ,)
 , () 11 Din Dout
 T_d .

- (F) 가 ; F : (dont'care) ; (PTS)
 ;
 - , 가 /
 .
 - 가 .

가 가 , , IC ,
 가 가 . , FPGA ,
 N 가 sysclk/bitclk > N ,

(57)

1.

-Link, ADAT) (common-format central processing) (SADI) (sys_clk) (IEC958, I2S, AC (pre-processing))

input signal) (SADI) (GPI); (system clock synchronised i

(IEC958, I2S, AC-Link, ADAT) PCM
 (11) - ;
 PCM
 PCM (SB) - (14), FIFO (13) -
 2. (sys_clk) (IEC958, I2S, AC- Link, ADAT) (SADO)
 , /
 (SB) (14), PCM FIFO 가 , (13) - PCM (IEC958, I2S, AC-Link, ADAT)
 - ;
 가 , PCM (IEC958, I2S, AC-Link, ADAT) (12) -
 ,
 (SADO) (GPO)
 3. (sys_clk) (IEC958, I2S, AC-Link, ADAT) (SADI)
 , /
 (SADI) (GPI);
 (11) - (IEC958. I2S, AC-Link, ADAT) 가 PCM
 - ;
 PCM (14), FIFO (13) - PCM ,
 PCM (SB) -
 4. (sys_clk) (IEC958, I2S, AC-Link, ADAT) (SADO)
 , /

(SB) (14), PCM FIFO 가 , (13) - PCM (IEC958, I2S, AC-Link, ADAT) - ;

가 , PCM (IEC958, I2S, AC-Link, ADAT) (12) - ;

(SADO) (GPO)

1 5. 4 , IEC958, I2S, AC-Link ADAT

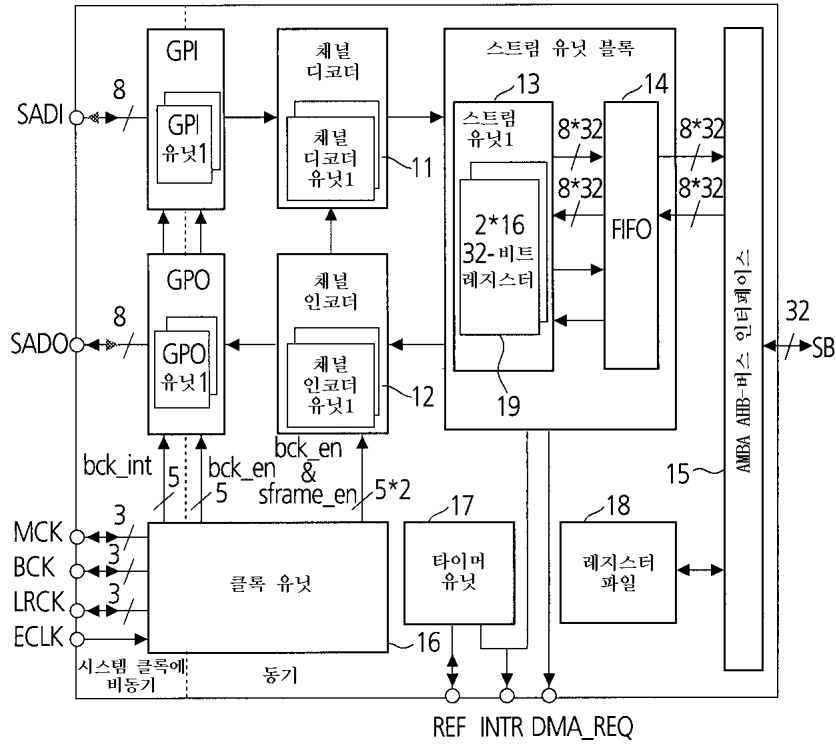
1 6. 5 , (channel permutation) (13), , ,

1 7. 6 , (14) , LF DMA 가 DMA , DMA (evaluate)

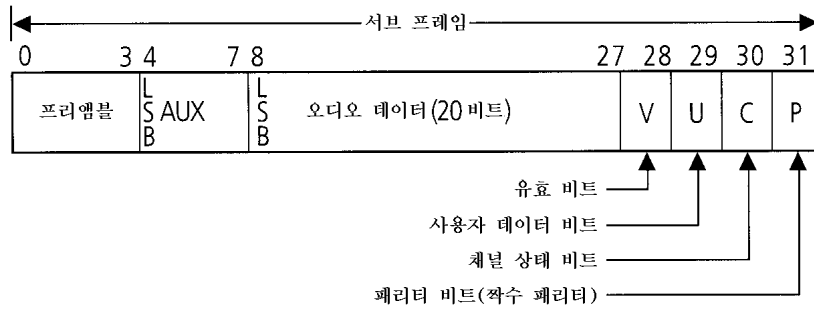
1 8. 7 , (13) (precisely timed start-up) , (time stamp) p)가

1 9. 8 , (bck) (clocked) D ,

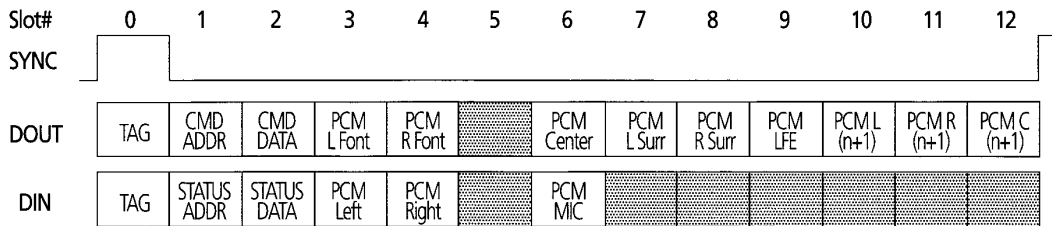
1



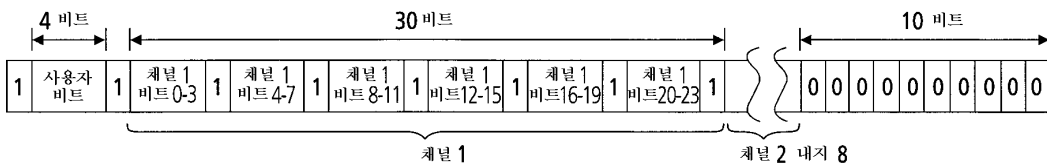
2



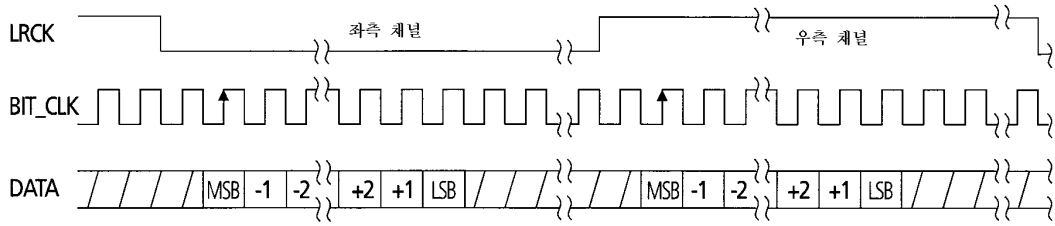
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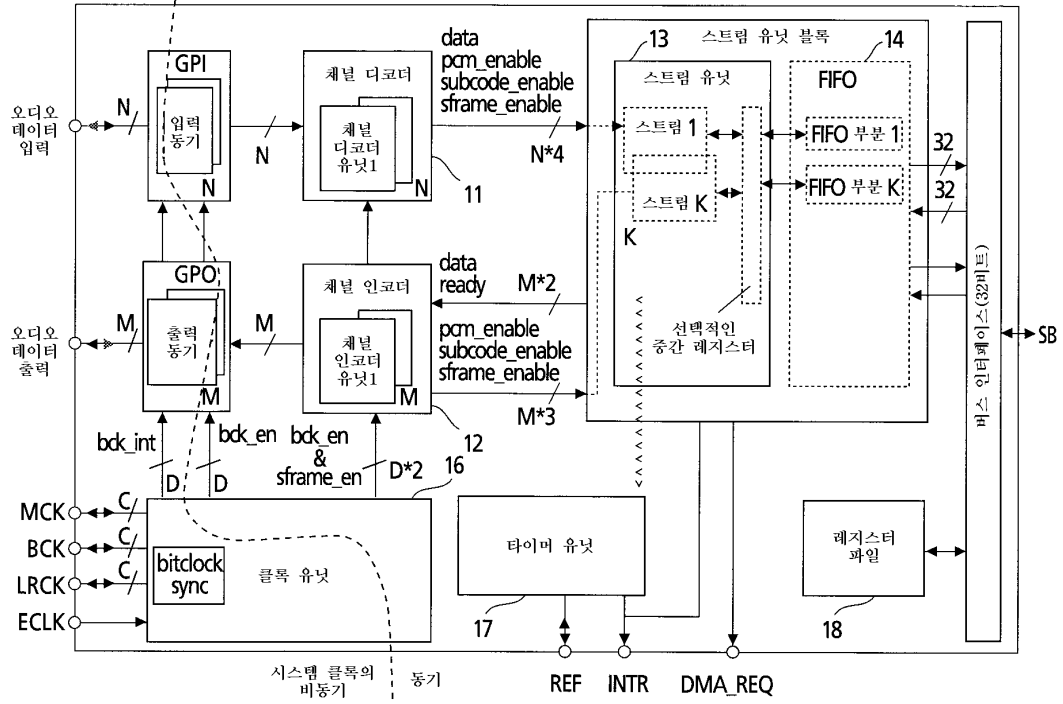
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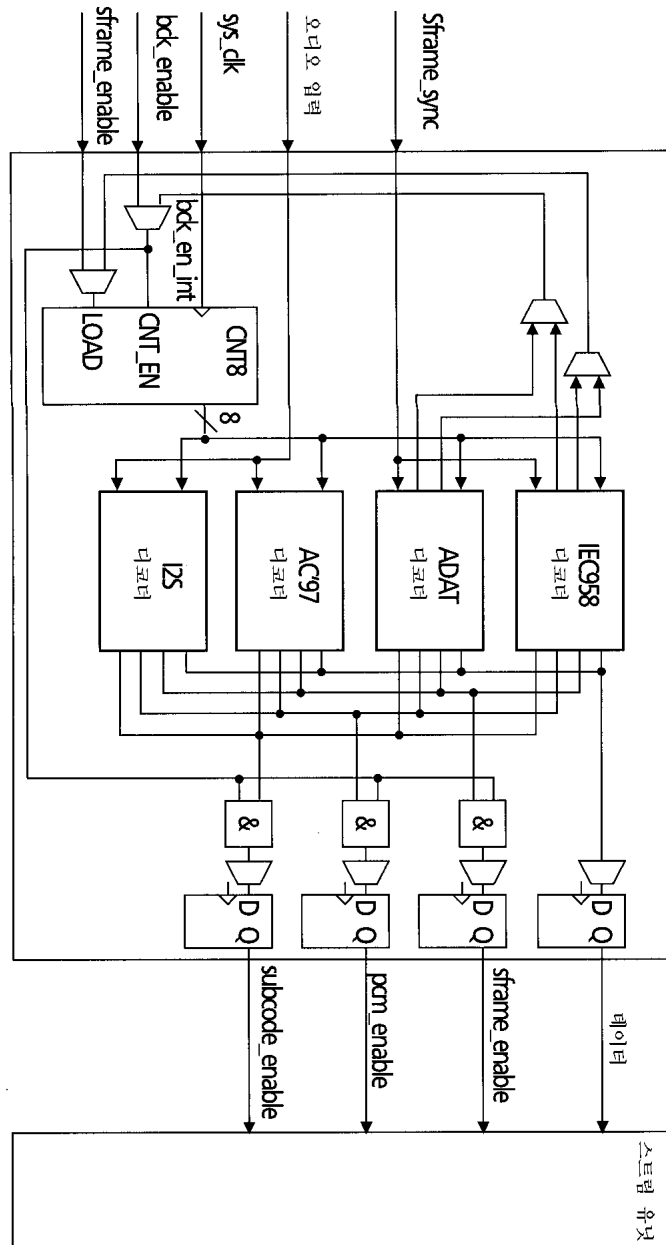
5



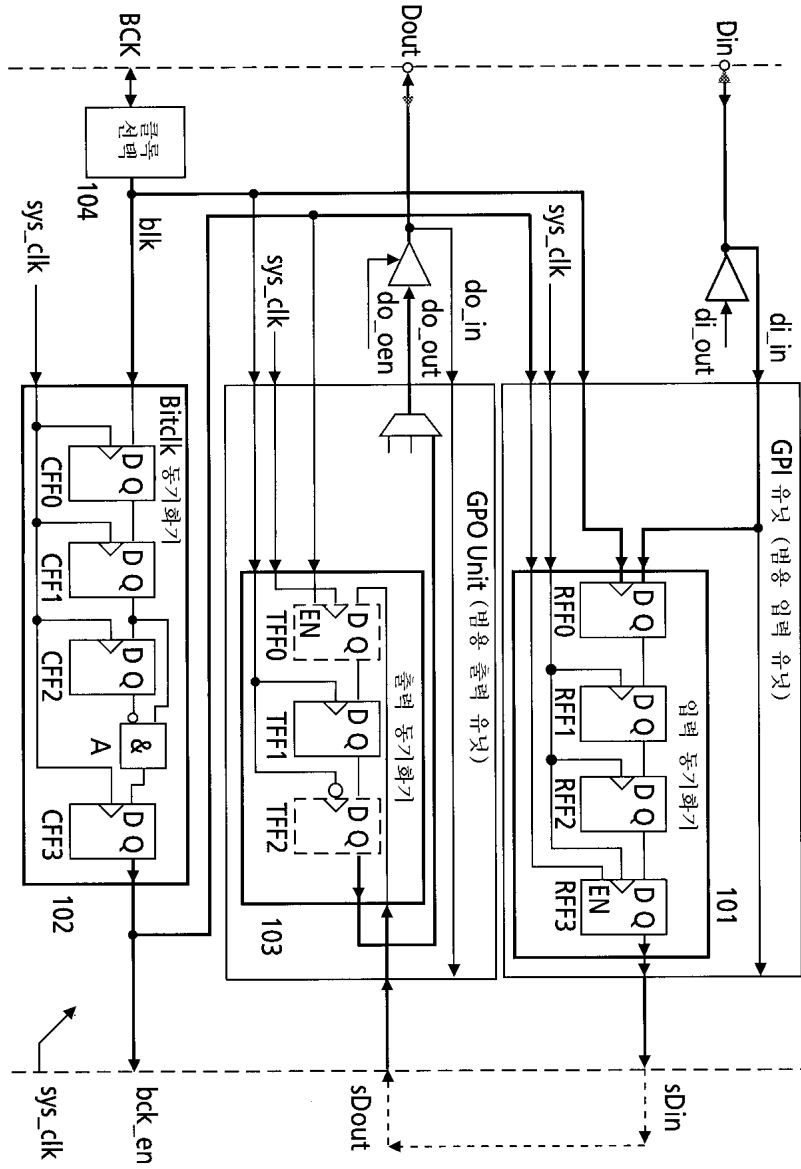
6



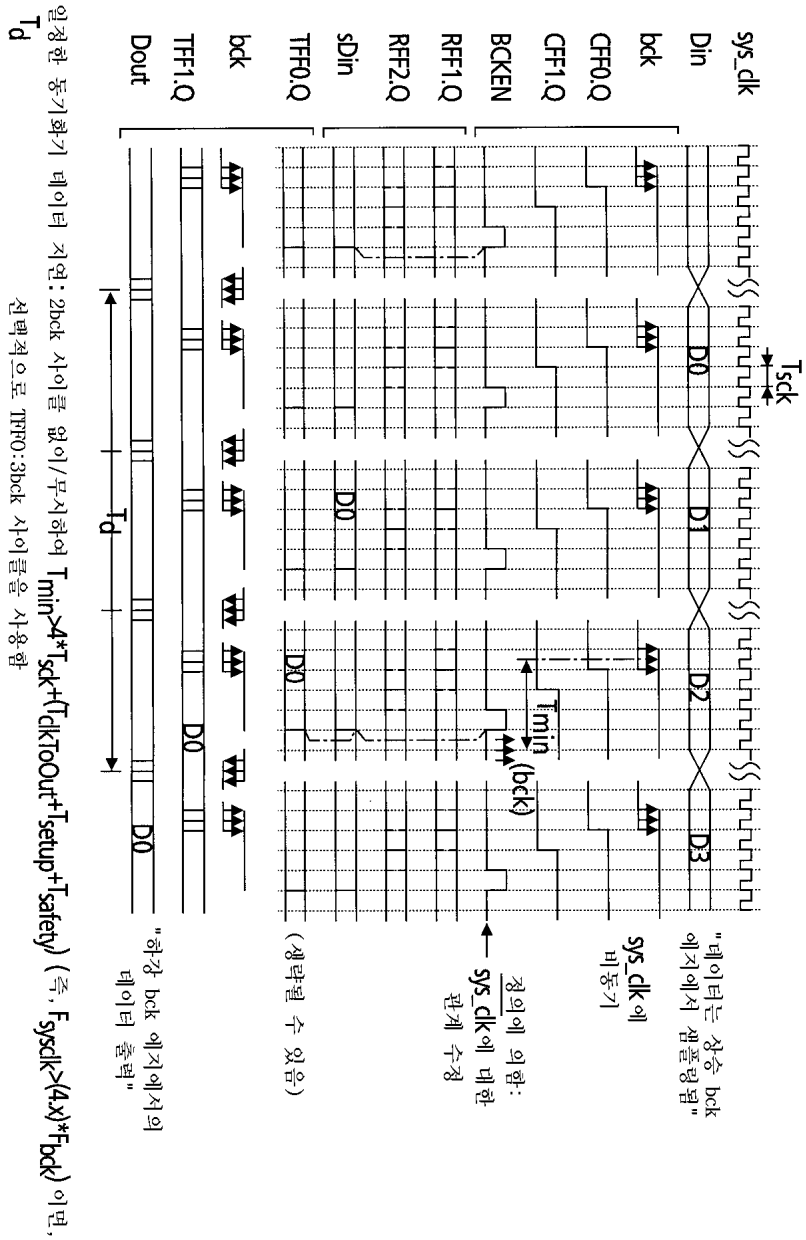
7



10



11



12

