



Customer : ALPS ELECTRIC EUROPA GmbH

No. E004519 (1/20)

Date. Jul. 28 ' 00

Attention : _____

Your ref. No. : _____

Your Part No. : _____

SPECIFICATIONS

ALPS :

MODEL : BSRU6-701A

Spec. No. : _____

Sample No. : _____

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ALPS ELECTRIC CO., LTD.

HEAD OFFICE

1-7, YUKIGAYA OTSUKA-CHO, OHTA-KU, TOKYO,

145-8501 JAPAN

PHONE: (3) 3726-1211

FAX : (3) 3728-1741

RF DEVICES DIVISION

1-2-1, OKINOCHI, SOMA-SHI, FUKUSHIMA-KEN,

976-8501 JAPAN

PHONE: (244) 36-5111

FAX : (244) 36-1902

DSG' D *Y. Furuyama*

APP' D *M. Kojima*

ENG. DEPT. RF DEVICES DIVISION
COMPONENTS BUSINESS UNIT

Sales _____

SPECIFICATION

This specification describes a tuner with QPSK demodulator
and FEC for digital satellite direct TV receiving.

CONTENTS

1. General specification
2. Standard test condition
3. Current consumption
4. Absolute maximum voltage
5. Electrical specification
6. Terminal description
7. PLL IC data format
8. QPSK demodulator data format
9. Register setting
10. Register description
11. Reliability specification
12. Mechanical specification

					—	ALPS ELECTRIC EUROPA GmbH	—		BSRU6-701A
					END CUST	CUST.	CUST. MODEL NO.	ALPS MODEL NO.	
					DSGD.				
					CHKD.			TITLE	PRODUCT
								BSRU6	SPECIFICATION
					APPD.			DOCUMENT NO.	
								(1 / 17)	
					<i>ALPS ELECTRIC CO., LTD.</i>				
SYMB.	DATE OR NO.	APPD.	CHKD.	DSGD.					

SECTION	DESCRIPTION	SPECIFICATION
1.	General specification	
1-1.	Input frequency range	950 MHz to 2150 MHz
1-2.	Input level per channel	-65 dBm to -25 dBm @27.5Mbaud minimum input: -70 dBm
1-3.	Symbol rate	1 Mbaud to 45 Mbaud
1-4.	RF input impedance	75 Ω
1-5.	Loop through output impedance	75 Ω
1-6.	LO frequency	950 MHz to 2150 MHz
1-7.	I2C address	TSA5059 or equivalent : C2 STV0299 or STV0299B : D0
1-8.	Crystal reference frequency	TSA5059 or equivalent : 4 MHz STV0299 or STV0299B : 4 MHz
1-9.	LO step size	1 MHz
1-10.	Modulation method	QPSK
1-11.	Output format	MPEG2 transport stream
1-12.	FEC method: Viterbi	Puncture rate 1/2, 2/3, 3/4, 5/6, 7/8 : mode A(DVB) 1/2, 2/3, 6/7 : mode B
	Reed-Solomon	(204, 188) : mode A(DVB) (146, 130) : mode B FEC operation mode is switchable by "FECM" register on STV0299 / STV0299B.
1-13.	RF input connector	F female
1-14.	Loop through output connector	F female
1-15.	Operating voltage	
	+ 5 V (1st RF-Amp)	5 \pm 0.25 V DC
	+ 5 V (Synth)	5 \pm 0.25 V DC
	+ 5 V (Other)	5 \pm 0.25 V DC
	+2.5 V	2.5 \pm 0.10 V DC
	+3.3 V	3.3 \pm 0.16 V DC
	Tuning	30 \pm 1 V DC
1-16.	Operating temperature	0 to 60 $^{\circ}$ C
1-17.	Operating humidity	Less than 80 % RH (at 40 $^{\circ}$ C)
1-18.	Storage temperature	-20 to 70 $^{\circ}$ C
1-19.	Storage humidity	Less than 95 % RH (at 40 $^{\circ}$ C)

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SECTION	DESCRIPTION	SPECIFICATION																																												
2.	Standard test condition	Test for electrical specification shall be performed at following condition unless otherwise specified.																																												
2-1.	Ambient condition	Temperature 25 °C±2 °C Humidity 65 %±5 %RH If no doubt on test results temperature 5 °C~30 °C and humidity 45 %~85 % RH could be applied.																																												
2-2.	Measurement to start	30 minutes after DC power supplied.																																												
2-3.	Power supply	<table border="1"> <thead> <tr> <th>Terminal</th> <th colspan="4">Supply voltage</th> </tr> </thead> <tbody> <tr> <td>LNB power</td> <td colspan="4"></td> </tr> <tr> <td>+5 V (RF-Amp)</td> <td colspan="4">+ 5 V±0.1 V</td> </tr> <tr> <td>+5 V (Synth)</td> <td colspan="4">+ 5 V±0.1 V</td> </tr> <tr> <td>+5 V (Other)</td> <td colspan="4">+5 V±0.1 V</td> </tr> <tr> <td>+2.5 V</td> <td colspan="4">+2.5 V±0.1 V</td> </tr> <tr> <td>+3.3 V</td> <td colspan="4">+3.3 V±0.1 V</td> </tr> <tr> <td>+30 V</td> <td colspan="4">+30 V±0.1 V</td> </tr> </tbody> </table>					Terminal	Supply voltage				LNB power					+5 V (RF-Amp)	+ 5 V±0.1 V				+5 V (Synth)	+ 5 V±0.1 V				+5 V (Other)	+5 V±0.1 V				+2.5 V	+2.5 V±0.1 V				+3.3 V	+3.3 V±0.1 V				+30 V	+30 V±0.1 V			
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SECTION	DESCRIPTION	SPECIFICATION				CONDITION
		MIN.	TYP.	MAX.	UNIT	
5.	Electrical specification					
5-1.	General specification					
5-1-1.	Input return loss	8			dB	75 Ω
5-1-2.	Required Eb/No					
	Condition: BER 2×10^{-4} after Viterbi decoder, mode A					
	Noise BW = Bit rate \times Puncture rate \times (188/204)					
	Puncture rate 1/2			4.5	dB	
	Puncture rate 2/3			5.0		
	Puncture rate 3/4			5.5		
	Puncture rate 5/6			6.0		
	Puncture rate 7/8			6.4		4 Mbaud \leq Symbol rate, Symbol rate \leq 30 Mbaud.
	Puncture rate 7/8			6.6		Symbol rate < 4 Mbaud, 30 Mbaud < Symbol rate.
5-1-3.	3rd order intermodulation E.N.D.* ³			0.1	dB	Frequencies: F _D , F _D \pm 59 MHz, and F _D \pm 118 MHz
	*3: Equivalent Noise Degradation.					
	Condition: Puncture rate: 5/6, Eb/No: 6.0 dB measured on the same input level of a desired frequency and undesired frequencies.					
5-1-4.	LO lock up time			50	ms	
5-1-5.	Spurious at RF input			-63	dBm	950 MHz ~ 2150 MHz
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SECTION				
6. Terminal description				
1.	LNB POWER (RF INPUT)	Power supply input for LNB (RF INPUT)		
2.	LNB POWER (LOOP OUT)	Power supply input for LNB (LOOP OUT)		
3.	GND			
4.	+5 V (1st RF-Amp)	Power supply input for 1st RF Amp.		
5.	NC	No connection		
6.	+5 V (Synth)	Power supply input for IQ demodulator and PLL IC		
7.	DNC	Do not connect		
8.	DNC	Do not connect		
9.	NC	No connection		
10.	GND			
11.	+30 V	Tuning voltage input		
12.	GND			
13.	+5 V (Other)	Power supply input		
14.	RESET	Set QPSK demod. into default mode (Active at low level)		
15.	NC	No connection		
16.	OP0	Programmable output port 0		
17.	OP1	Programmable output port 1		
18.	F22/DiSEqC	DiSEqC modulation / 22 kHz tone / programmable output port		
19.	LOCK/OP2	Carrier found / data found / output port 2		
20.	SCL	I2C clock for QPSK demod.		
21.	SDA	I2C data for QPSK demod.		
22.	+3.3 V	+3.3 V supply input for QPSK demod.		
23.	+2.5 V	+2.5 V supply input for QPSK demod.		
24.	STR_OUT	Sync byte output (first byte = high)		
25.	ERROR	Error signal output		
26.	D/P	Data/Parity signal output		
27- 34.	DATA[7:0]	Parallel data output (bit 7:0)		
35.	CLK_OUT	Clock signal output		
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7. PLL IC data format (Philips:TSA5059)

										Hex	
ADDRESS	1	1	0	0	0	MA1	MA0	0	A	Byte 1	C2
	1	1	0	0	0	0	1	0			
PROGRAMMABLE DIVIDER EX)	0	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	A	Byte 2	06
	0	0	0	0	0	1	1	0			
PROGRAMMABLE DIVIDER EX)	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	A	Byte 3	0E
	0	0	0	0	1	1	1	0			
CONTROL DATA	1	2 ¹⁶	2 ¹⁵	PE	R3	R2	R1	R0	A	Byte 4	81
	1	0	0	0	0	0	0	1			
CONTROL DATA	C1	C0	XCE	XCS	P3	P2/T2	P1/T1	P0T	A	Byte 5	C0
	1	1	0	0	0	0	0	0			

PROGRAMMABLE DATA = (RF freq./prescaler)/(comparison freq.)
 = (1550 MHz)/(1 MHz)
 = 1550(dec)
 = 00 000 0110 0000 1110 (17 bits)
 = 60E(Hex)

Prescaler division ratio

PE	Ratio	Comment
0	1/1	ALPS recommended.
1	1/2	

Note:

When PE = 1, step frequency is 2 times of comparison frequency.

Charge pump current

C1	C0	Current(μA)			Comment
		MIN.	TYP.	MAX.	
0	0	±100	±120	±150	
0	1	±195	±260	±325	
1	0	±416	±555	±694	
1	1	±900	±1200	±1500	ALPS recommended.

Reference division ratio

R3	R2	R1	R0	Ratio	Comparison frequency with 4MHz reference	R3	R2	R1	R0	Ratio	Comparison frequency with 4 MHz reference
0	0	0	0	2	2 MHz	0	0	0	0	Not allowed	
0	0	0	1	4	1 MHz	0	0	0	1	5	800 kHz
0	0	1	0	8	500 kHz	0	0	1	0	10	400 kHz
0	0	1	1	16	250 kHz	0	0	1	1	20	200 kHz
0	1	0	0	32	125 kHz	0	1	0	0	40	100 kHz
0	1	0	1	64	62.5 kHz	0	1	0	1	80	50 kHz
0	1	1	0	128	31.25 kHz	0	1	1	0	160	25 kHz
0	1	1	1	256	15.625 kHz	0	1	1	1	320	12.5 KHz

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9. Register setting (STV0299 or STV0299B)

Condition : VCO=352 MHz, f_{M_CLK} =88 MHz

Name	Address (Hex)	Setting	R/W	Comment
ID	00	A1	R	Identification
RCR	01	15	W	f_{XTAL} =4 MHz, VCO=352 MHz
MCR	02	30	W	f_{M_CLK} =88 MHz
ACR	03	00	W	ALPS recommended
F22FR	04	7D	W	Output frequency : 22kHz
I2CRPT	05	05/85	W	Bit 7 is set when the repeater is used.
DACR1(MSB)	06	00	W	ALPS recommended
DiSEqC	08		W	See following description.
DiSEqC FIFO	09		W	See following description.
DiSEqC Status	0A		R	See following description.
IOCFG	0C	F0/F1	W	Set I/Q or I/-Q. See following description.
AGC1C	0D	82	W	ALPS recommended
AGC1R	0F	12	W	ALPS recommended
AGC2O	10	34	W	ALPS recommended
TLSR	11	84	W	ALPS recommended
CFD	12	B9/39	W	B9 : During search. 39 : After lock.
ACLC	13	B6	W	See following description.
BCLC	14	93	W	See following description.
CLDT	15	C9	W	ALPS recommended
AGC1I	16		R	AGC1 value (signed number)
TLIR	17		R	Timing lock indicator(positive value)
AGC2I1(MSB)	18		R	AGC2 value
AGC2I2(LSB)	19		R	AGC2 value
RTF	1A		R/W	Timing frequency register(signed number)
VSTATUS	1B		R	See following description.
CLDI	1C		R	Carrier lock detector value(signed number)
ERRCNT_HIGH	1D		R	MSB byte
ERRCNT_LOW	1E		R	LSB byte
SFRH	1F		W	Symbol rate* 2^{20} /88MHz(MSB, [7:0])
SFRM	20		W	Symbol rate* 2^{20} /88MHz(MID, [7:0])
SFRL	21		W	Symbol rate* 2^{20} /88MHz(MLB, [7:4], [3:0]=0)
CFRM	22		R/W	Derotator frequency(MSB, signed value)
CFRL	23		R/W	Derotator frequency(LSB, signed value)
NIRH	24		R	Noise indicator(MSB)
NIRL	25		R	Noise indicator(LSB)
VEERROR	26		R	Error rate
FECM	28	00	W	See following description.
RS	33	FC	W	See following description.
ERRCNT	34	13	W	

Notes: 1. Need the carrier search when signal receiving, because LO step is 1 MHz.

2. No need to access to other registers. Reset value is used for the other registers.

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10. Register description (STV0299 or STV0299B)

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
DiSEqC	08	Lock output		Lock config	0	0	DiSEqC/Burst	DiSEqC mode[1:0]	
DiSEqC FIFO	09	FIFO[7:0]							
DiSEqC Status	0A	X	X	0	0	0	0	FIFO empty	FIFO full
Lock output : Signal at Lock/OP2 Pin19									
									=00 : Output 0 =01 : Output 1 =10 : Carrier found =11 : Sync word found
Lock config									=0 : Push-pull output for LOCK/OP2(Pin19) =1 : Open drain for LOCK/OP2(Pin19)
DiSEqC mode : Output F22/DiSEqC(Pin18)									=00 : Output 0 at F22/DiSEqC at =01 : Output 1 at F22/DiSEqC =10 : DiSEqC or Tone burst =11 : Continuous 22kHz
DiSEqC/Burst									=0 : '0' tone burst(Satellite position A) when FIFO=00h '1' tone burst(Satellite position B) when FIFO=FFh =1 : DiSEqC mode
FIFO									DiSEqC message register A typical byte transfer loop is below. while(there is data to transfer) 1 Read the control data 2 If FIFO_full=1, go to 1 3 Write byte to transfer in the FIFO
									Note: 1. At the beginning, the FIFO is empty (FIFO empty=1, FIFO full=0). This is an idle state. 2. As soon as a byte is written in the FIFO, the transfer will begin. After the last transmitted byte, the interface will go into the idle state.
NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
IOCFG	0C	OP1 control	OP1 value	OP0 control	OP0 value	0	Nyquist Filter[1:0]	IQINV	
OP1 control									=1 : Open drain =0 : Push-pull
OP1 value									Output value at OP1(Pin17)
OP0 control									=1 : Open drain =0 : Push-pull
OP0 value									Output value at OP0(Pin 16)
Nyquist filter									=00 : Raised cosine at 35% =01 : Raised cosine at 20% =10 : Reserved =11 : Reserved
IQINV									=0 : I/-Q =1 : I/Q
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10. Register description (STV0299 or STV0299B, continue)

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
RTF		[7:0]							
RTF[7:0]	Timing frequency register (Signed value). It shows an offset frequency of symbol rate. Actual symbol rate = ($f_{M_CLK} * \text{Reg_SFR}[23:4] + 2 * \text{Symbol rate} * \text{RTF}[7:0] $) / 2^{20}								
NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
VSTATUS	1B	Carrier found	0	0	Puncture rate found	Locked	Current puncture rate[2:0]		
Carrier found	=1 : QPSK carrier is found.								
Puncture rate found	=0 : During search =1 : Puncture rate is found.								
Locked	=0 : During a sync word search =1 : The sync word is found.								
Current puncture rate	=100 : 1/2(mode A(DVB) and mode B or reserved mode) =000 : 2/3 =001 : 3/4 =010 : 5/6 =011 : 7/8(mode A(DVB) and mode B) or 6/7(reserved mode)								
NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
CLDI	1C	[7:0]							
CLDI[7:0]	Carrier lock detector value(Signed value) If CLDI[7:0]>C9h, QPSK carrier is found.								
NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
ERRCNT_HIGH	1D	[7:0]							
ERRCNT_LOW	1E	[7:0]							
VERROR	26	[7:0]							
ERRCNT	34	Error mode	0	Error source	0	0	1	1	
Error mode	=0 : Error rate measure. BER = $\text{ERRCNT}(\text{ADD}:1\text{D}, 1\text{E}) / 2^{18}\text{byte}$ =1 : Error counter. The error counter is reset when the MSB byte is read.								
Error source	=00 : QPSK bit errors =01 : Viterbi bit errors =10 : Viterbi byte errors =11 : Packet errors								
VERROR	Error rate during 256 bit periods								
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10. Register description (STV0299 or STV0299B, continue)

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
SFRH	1F	[7:0]							
SFRM	20	[7:0]							
SFRL	21	[7:4]				0	0	0	0

$SFR[23:4] = \text{Symbol frequency} * 2^{20} / f_{M_CLK}$

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
CFRM	22	[7:0]							
CFRL	23	[7:0]							

CFRM MSB of derotator frequency
CFRL LSB of derotator frequency

The derotator frequency can be either measured(read operation) or forced (write operation). The derotator frequency is a 16 bit signed value.
The write operation is used for SCPC receiving as an offset frequency cancellor.

$\text{Offset freq} = \text{Derotator frequency} * f_{M_CLK}[\text{kHz}] / 2^{16}$

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
NIRH	24	[7:0]							
NIRL	25	[7:0]							

NIRH MSB of noise indicator
NIRL LSB of noise indicator

C/N ratio is imaged by a following calculation.

$C/N[\text{dB}] = -0.0017 * \text{NIR} + 19.02$

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
FECM	28	FEC mode				0	0	0	0

FEC mode =0000 : mode A(DVB)(QPSK)
 =0100 : Mode B
 Others are reserved.

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10. Register description (STV0299 or STV0299B, Continue)

NAME	ADD	B7	B6	B5	B4	B3	B2	B1	B0
RS	33	RS7	1	RS5	RS4	RS3	RS2	RS1	RS0
RS7		=1 : Deinterleaver enable =0 : Deinterleaver disable							
RS5		=1 : Reed-Solomon enable =0 : Reed-Solomon disable							
RS4		=1 : Descrambler enable =0 : Descrambler disable							
RS3		=1 : Error indicator bit enable in mode A(DVB) =0 : Error indicator bit disable in mode A(DVB)							
RS2		=1 : The first byte of each packet is forced to 47h in mode A(DVB) mode. =0 : The first byte is the one that is received.							
RS1		=1 : The data and control signals change during the HIGH TO LOW transition of CLK_OUT. =0 : The data and control signals change during the LOW TO HIGH transition of CLK_OUT.							
RS0		=1 : CLK_OUT is continuous and the parity bytes are transmitted. If the packet contains more than 8 errors, ERROR remains HIGH during the entire packet. =0 : D[7:0] and ERROR are null during the parity bytes. If the packet contains more than 8 errors, ERROR only remains HIGH during the data transmission. The CLK_OUT remains LOW during the parity bytes.							

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SECTION	DESCRIPTION	SPECIFICATION	CONDITION
11.	Reliability specification	Following value shall be maintained after each reliability test except for 11-6. Compared with initial value.	With PLL locked.
11-1.	Heat loading test	E.N.D. 1 dB Min. compare with initial value at BER 2×10^{-4} after viterbi decoder.	
11-2.	Humidity test	(1)Leave samples in $60 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ for 96 ± 5 hours with standard power supply, then in standard ambient for 30 minutes. (2)Take measurement within 1 hour.	
11-3.	Cold test	(1)Leave samples in $40 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ for 24 ± 2 hours, with standard power supply, then in standard ambient for 30 minutes. (2)Initial values are measured at standard condition. (3)Leave samples in $40 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ 90~95 %RH for 96 ± 5 hours then in standard condition for 2 hours. (4)Take measurement within 1 hour.	
11-4.	Life test	(1)Leave samples in $-20 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ for 96 ± 5 hours, then in standard ambient for 60 minutes with standard power supply. (2)Take measurement within 1 hour.	
11-5.	Vibration test	(1)Leave samples for 1000 hours in normal ambient with standard power supply.	
11-6.	Lightning test	Vibration test fixture is used to vibrate the sample with Total amplitude : 1 mmp-p Freq. range : 10 to 55 Hz Freq. consecutiveness : once per minute Time duration for each three directions : 40 minutes No defect in operation	$\pm 15 \text{ kV}$ through 1000 pF and $0 \text{ } \Omega$ to center conductor (Performed 3 times)

								-701A
					TITLE			PRODUCT
					BSRU6			SPECIFICATION
					DOCUMENT NO.			(16 /)

(29/E)

RECORD OF REVISIONS

BSRU6-701A

DATE	PRESENT CONTENTS	NEW CONTENTS / REASON	DSGN BY
Jul.28 '00 (E004519)	NEW		Y.Furuyama
		JAPAN	
		ALPS ELECTRIC CO.,LTD.	
		MANUFACTURER	