

Customer :
ALPS ELECTRIC EUROPA GmbH

No. E004521 (1/19)
Date. Jul. 28 '00

Attention : _____

Your ref. No. : _____

Your Part No. : _____

SPECIFICATIONS

ALPS :
MODEL : BSRU6-502A
Spec. No. : _____
Sample No. : _____

| |
|-----------------|
| RECEIPT STATUS |
| RECEIVED |
| By. Date _____ |
| Signature _____ |
| Name _____ |
| Title _____ |

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, OKINOUCHI, 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 | — | BSRU6-502A |
| END CUST. | CUST. | CUST. MODEL NO. | ALPS MODEL NO. |

| | | | | | | |
|--------------------------------|-------------|-------|-------|-------|-------|--|
| | | | | | DSGD. | |
| | | | | | CHKD. | TITLE BSRU6 PRODUCT SPECIFICATION |
| | | | | | APPD. | DOCUMENT NO. (1 / 16) |
| ALPS ELECTRIC CO., LTD. | | | | | | |
| 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. | LO frequency | 950 MHz to 2150 MHz |
| 1-6. | I2C address | TSA5059 or equivalent : C2 STV0299 or STV0299B : D0 |
| 1-7. | Crystal reference frequency | TSA5059 or equivalent : 4 MHz STV0299 or STV0299B : 4 MHz |
| 1-8. | LO step size | 1 MHz |
| 1-9. | Modulation method | QPSK |
| 1-10. | Output format | MPEG2 transport stream |
| 1-11. | FEC method: Viterbi Reed-Solomon | Puncture rate 1/2, 2/3, 3/4, 5/6, 7/8 : mode A(DVB) 1/2, 2/3, 6/7 : mode B (204, 188) : mode A(DVB) (146, 130) : mode B FEC operation mode is switchable by "FECM" register on STV0299 / STV0299B. |
| 1-12. | RF input connector | F female |
| 1-13. | Operating voltage + 5 V (1st RF-Amp) + 5 V (Synth) + 5 V (Other) +2.5 V +3.3 V Tuning | 5 \pm 0.25 V DC 5 \pm 0.25 V DC 5 \pm 0.25 V DC 2.5 \pm 0.10 V DC 3.3 \pm 0.16 V DC 30 \pm 1 V DC |
| 1-14. | Operating temperature | 0 to 60 $^{\circ}$ C |
| 1-15. | Operating humidity | Less than 80 % RH (at 40 $^{\circ}$ C) |
| 1-16. | Storage temperature | -20 to 70 $^{\circ}$ C |
| 1-17. | Storage humidity | Less than 95 % RH (at 40 $^{\circ}$ C) |

| | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--------------|--|--|--|---------|--|--|--|---------------|
| | | | | | | | | | | | | | | | | | | -502A |
| | | | | | | | | | | TITLE | | | | PRODUCT | | | | SPECIFICATION |
| | | | | | | | | | | DOCUMENT NO. | | | | | | | | (2 /) |

| 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>Supply voltage</th> </tr> </thead> <tbody> <tr> <td>LNB power</td> <td></td> </tr> <tr> <td>+5 V (RF-Amp)</td> <td>+ 5 V±0.1 V</td> </tr> <tr> <td>+5 V (Synth)</td> <td>+ 5 V±0.1 V</td> </tr> <tr> <td>+5 V (Other)</td> <td>+5 V±0.1 V</td> </tr> <tr> <td>+2.5 V</td> <td>+2.5 V±0.1 V</td> </tr> <tr> <td>+3.3 V</td> <td>+3.3 V±0.1 V</td> </tr> <tr> <td>+30 V</td> <td>+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 | | | | | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | Current consumption | <table border="1"> <thead> <tr> <th>Terminal</th> <th>MIN.</th> <th>TYP.</th> <th>MAX.</th> <th></th> </tr> </thead> <tbody> <tr> <td>+5 V (RF-Amp)</td> <td>21</td> <td>26</td> <td>31</td> <td>mA</td> </tr> <tr> <td>+5 V (Synth)</td> <td>87</td> <td>125</td> <td>168</td> <td>mA</td> </tr> <tr> <td>+5 V (Other)</td> <td>11</td> <td>20</td> <td>28</td> <td>mA</td> </tr> <tr> <td>+2.5 V</td> <td>-</td> <td>240*1</td> <td>330*2</td> <td>mA</td> </tr> <tr> <td>+3.3 V</td> <td>-</td> <td>-</td> <td>10</td> <td>mA</td> </tr> <tr> <td>+30 V</td> <td>-</td> <td>-</td> <td>1.5</td> <td>mA</td> </tr> </tbody> </table> <p>*1 Condition : f_{M_CLK}: 88 MHz Symbol rate: 20 Mbaud Puncture rate: 7/8</p> <p>*2 Condition : f_{M_CLK}: 88 MHz Symbol rate: 45 Mbaud Puncture rate: 7/8</p> | | | | Terminal | MIN. | TYP. | MAX. | | +5 V (RF-Amp) | 21 | 26 | 31 | mA | +5 V (Synth) | 87 | 125 | 168 | mA | +5 V (Other) | 11 | 20 | 28 | mA | +2.5 V | - | 240*1 | 330*2 | mA | +3.3 V | - | - | 10 | mA | +30 V | - | - | 1.5 | mA |
| Terminal | MIN. | TYP. | MAX. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +5 V (RF-Amp) | 21 | 26 | 31 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +5 V (Synth) | 87 | 125 | 168 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +5 V (Other) | 11 | 20 | 28 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +2.5 V | - | 240*1 | 330*2 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +3.3 V | - | - | 10 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +30 V | - | - | 1.5 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | -502A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | TITLE | PRODUCT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | BSRU6 | SPECIFICATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | DOCUMENT NO. | (3 /) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | ALPS ELECTRIC CO., LTD. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| SECTION | DESCRIPTION | SPECIFICATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|--------------------------|--|-------|-------|--------------------------------|---------------|----------|-----------------|-----------|-------|---------------|---------|--------------|---------|--------------|---------|--------|---------|--------|---------|-------|-------|--------------|-----|----------|--------------------------|-----------|-------|
| 4. | Absolute maximum voltage | <table border="1" data-bbox="839 254 1477 653"> <thead> <tr> <th data-bbox="839 254 1078 299">Terminal</th> <th data-bbox="1078 254 1477 299">Maximum voltage</th> </tr> </thead> <tbody> <tr> <td data-bbox="839 299 1078 344">LNB power</td> <td data-bbox="1078 299 1477 344">+25 V</td> </tr> <tr> <td data-bbox="839 344 1078 390">+5 V (RF-Amp)</td> <td data-bbox="1078 344 1477 390">+5.25 V</td> </tr> <tr> <td data-bbox="839 390 1078 435">+5 V (Synth)</td> <td data-bbox="1078 390 1477 435">+5.25 V</td> </tr> <tr> <td data-bbox="839 435 1078 480">+5 V (Other)</td> <td data-bbox="1078 435 1477 480">+5.25 V</td> </tr> <tr> <td data-bbox="839 480 1078 526">+2.5 V</td> <td data-bbox="1078 480 1477 526">+2.60 V</td> </tr> <tr> <td data-bbox="839 526 1078 571">+3.3 V</td> <td data-bbox="1078 526 1477 571">+3.46 V</td> </tr> <tr> <td data-bbox="839 571 1078 616">+30 V</td> <td data-bbox="1078 571 1477 616">+32 V</td> </tr> <tr> <td data-bbox="839 616 1078 653">Logic inputs</td> <td data-bbox="1078 616 1477 653">TTL</td> </tr> </tbody> </table> <table border="1" data-bbox="839 694 1477 789"> <thead> <tr> <th data-bbox="839 694 1078 739">Terminal</th> <th data-bbox="1078 694 1477 739">Maximum take off current</th> </tr> </thead> <tbody> <tr> <td data-bbox="839 739 1078 789">LNB power</td> <td data-bbox="1078 739 1477 789">0.8 A</td> </tr> </tbody> </table> | | | | | Terminal | Maximum voltage | LNB power | +25 V | +5 V (RF-Amp) | +5.25 V | +5 V (Synth) | +5.25 V | +5 V (Other) | +5.25 V | +2.5 V | +2.60 V | +3.3 V | +3.46 V | +30 V | +32 V | Logic inputs | TTL | Terminal | Maximum take off current | LNB power | 0.8 A |
| Terminal | Maximum voltage | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LNB power | +25 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +5 V (RF-Amp) | +5.25 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +5 V (Synth) | +5.25 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +5 V (Other) | +5.25 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +2.5 V | +2.60 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +3.3 V | +3.46 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| +30 V | +32 V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Logic inputs | TTL | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Terminal | Maximum take off current | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LNB power | 0.8 A | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | -502A | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | TITLE | PRODUCT | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | BSRU6 | SPECIFICATION | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | DOCUMENT NO. | (4 /) | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | <i>ALPS ELECTRIC CO., LTD.</i> | | | | | | | | | | | | | | | | | | | | | | | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | | | | | | | | | | | | | | | | | | | | | | | | |

| 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 ± 59 MHz, and F _D ± 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 |
| | | | | | | -502A |
| | | | | | TITLE | PRODUCT |
| | | | | | BSRU6 | SPECIFICATION |
| | | | | | DOCUMENT NO. | (5 /) |
| | | | | | ALPS ELECTRIC CO., LTD. | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | | |

SECTION

6.

Terminal description

| | | |
|------------|-------------------------|---|
| 1. | LNB POWER (RF INPUT) | Power supply input for LNB (RF INPUT) |
| 2. | NC | No connection |
| 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 |

-502A

TITLE

BSRU6

PRODUCT

SPECIFICATION

DOCUMENT NO.

(6 /)

SYMB. DATE OR NO. APPD. CHKD. DSGD.

ALPS ELECTRIC CO., LTD.

7. PLL IC data format (Philips:TSA5059)

| | | | | | | | | | | Hex | |
|--------------------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|---|------|----|
| ADDRESS | 1 | 1 | 0 | 0 | 0 | MA1 | MA0 | 0 | A | Byte | C2 |
| | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | | 1 | |
| PROGRAMMABLE DIVIDER EX) | 0 | 2 ¹⁴ | 2 ¹³ | 2 ¹² | 2 ¹¹ | 2 ¹⁰ | 2 ⁹ | 2 ⁸ | A | Byte | 06 |
| | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | | 2 | |
| PROGRAMMABLE DIVIDER EX) | 2 ⁷ | 2 ⁶ | 2 ⁵ | 2 ⁴ | 2 ³ | 2 ² | 2 ¹ | 2 ⁰ | A | Byte | 0E |
| | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | | 3 | |
| CONTROL DATA | 1 | 2 ¹⁶ | 2 ¹⁵ | PE | R3 | R2 | R1 | R0 | A | Byte | 81 |
| | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | 4 | |
| CONTROL DATA | C1 | C0 | XCE | XCS | P3 | P2/T2 | P1/T1 | P0/T | A | Byte | C0 |
| | | | | | | | | 0 | | 5 | |
| | 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(μ A) | | | 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 |

-502A

TITLE

BSRU6

PRODUCT

SPECIFICATION

DOCUMENT NO.

(7 /)

ALPS ELECTRIC CO., LTD.

8. QPSK demodulator data format

Write :

| | | | | | | | |
|---|-------------------|---|---------------------|---|---------|---|---|
| S | 0xD0 | A | 0x00 | A | WR_DATA | A | P |
| | Device address | | Register address | | | | |

Read :

| | | | | | |
|---|-------------------|---|---------------------|---|---|
| S | 0xD0 | A | 0x02 | A | P |
| | Device address | | Register address | | |

| | | | | | |
|---|------|---|---------|-----------|---|
| S | 0xD1 | A | RD_DATA | \bar{A} | P |
|---|------|---|---------|-----------|---|

S : Start bit

P : Stop bit

A : Acknowledge

index : Resister address

Notes : Need $\overline{\text{RESET}}$ input for initialize STV0299 / STV0299B before I2C access.

| | | | | | | | | | | |
|-------|-------------|-------|-------|-------|--------------------------------|--|--|--------------|---------------|---------|
| | | | | | | | | | | -502A |
| | | | | | | | | TITLE | PRODUCT | |
| | | | | | | | | BSRU6 | SPECIFICATION | |
| | | | | | | | | DOCUMENT NO. | | (8 /) |
| | | | | | ALPS ELECTRIC CO., LTD. | | | | | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | | | | | | |

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.

-502A

TITLE

BSRU6

PRODUCT

SPECIFICATION

DOCUMENT NO.

(9 /)

ALPS ELECTRIC CO., LTD.

SYMB. DATE OR NO. APPD. CHKD. DSGD.

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 : =00 : Output 0
Signal at Lock/OP2 Pin19 =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 : =00 : Output 0 at F22/DiSEqC
Output at =01 : Output 1 at F22/DiSEqC
F22/DiSEqC(Pin18) =10 :DiSEqC or Tone burst
=11 : Continous 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:

- At the beginning, the FIFO is empty (FIFO empty=1, FIFO full=0). This is an idle state.
- 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

-502A

TITLE PRODUCT
BSRU6 SPECIFICATION

DOCUMENT NO. (10 /)

ALPS ELECTRIC CO., LTD.

| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. |
|-------|-------------|-------|-------|-------|
| | | | | |

10. Register description (STV0299 or STV0299B, Continue)

| NAME | ADD | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
|------|-----|--------------------------|----|----|---------------|----------------|----|----|----|
| ACL | 13 | Derotator | 0 | 1 | 1 | Alpha_car[3:0] | | | |
| BCLC | 14 | Phase_detector_algo[1:0] | | | Beta_car[5:0] | | | | |

Derotator =0 : Off
 =1 : On

Phase_detector_algo =01 : For normal channel noise condition
 =10 : For low channel noise condition. Should be set after lock.

Alpha_car, Beat_car Dependent symbol rate

| Symbol rate[Mbaud] | Alpha_car | Beta_car |
|--------------------|-----------|----------|
| 1 - 1.5> | 7 | 7 |
| 1.5 - 3> | 7 | B |
| 3 - 7> | 7 | F |
| 7 - 14> | 7 | 13 |
| 14 - 30> | 6 | 13 |
| 30 - 45 | 4 | 11 |

| NAME | ADD | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 | |
|-------|-----|-------|----|----|----|----|----|----|----|--|
| AGC1I | 15 | [7:0] | | | | | | | | |

AGC1I[7:0] Signed number(-128 to 127)
 When tuner gain is the maximum, the value would be -128.

| NAME | ADD | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 | |
|------|-----|-------|----|----|----|----|----|----|----|--|
| TLIR | 17 | [7:0] | | | | | | | | |

TLIR[7:0] Timing clock indicator value.
 48< : Timing is locked.
 42< : Locked with low C/N ratio or unlocked with higher C/N ratio. In the after case, a timing frequency(symbol rate) should be changed within 1%.
 Note : The indicator needs 30k symbols for stabilization.

| NAME | ADD | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 | |
|-------------|-----|-------|----|----|----|----|----|----|----|--|
| AGC2I1(MSB) | 18 | [7:0] | | | | | | | | |
| AGC2I2(LSB) | 19 | [7:0] | | | | | | | | |

AGC2I[15:0] Internal AGC value of STV0299 / STV0299B. It is an image of the signal power in the useful band.

| | | | | | | | | | |
|-------|-------------|-------|-------|-------|--------------------------------|--------------|-----------------------|--|-------|
| | | | | | | | | | -502A |
| | | | | | | TITLE | PRODUCT SPECIFICATION | | |
| | | | | | | BSRU6 | | | |
| | | | | | | DOCUMENT NO. | (11 /) | | |
| | | | | | ALPS ELECTRIC CO., LTD. | | | | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | | | | | |

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} * Reg_SFR[23:4] + 2 * Symbol rate * RTF[7:0]) / 2²⁰

| 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] | | | | | | | |
| VEERROR | 26 | [7:0] | | | | | | | |
| ERRCNT | 34 | Error mode | 0 | Error source | 0 | 0 | 1 | 1 | |

Error mode =0 : Error rate measure. BER = ERRCNT(ADD:1D, 1E) / 2¹⁸byte
 =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
 VEERROR Error rate during 256 bit periods

| | | | | | | | | | |
|-------|-------------|-------|-------|-------|--------------------------------|--------------|---------------|--|-------|
| | | | | | | | | | -502A |
| | | | | | | TITLE | PRODUCT | | |
| | | | | | | BSRU6 | SPECIFICATION | | |
| | | | | | | DOCUMENT NO. | (12 /) | | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | ALPS ELECTRIC CO., LTD. | | | | |

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 |

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

| 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.

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

| 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.

| | | | | | | | | | |
|--|--|--|--|--|--|--------------|---------------|--|-------|
| | | | | | | | | | -502A |
| | | | | | | TITLE | PRODUCT | | |
| | | | | | | BSRU6 | SPECIFICATION | | |
| | | | | | | DOCUMENT NO. | (13 /) | | |

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. | | | | | | | | |

| | | | | | | | | | | |
|-------|-------------|-------|-------|-------|--|--|--|---------------------------------------|-----------------------|-------|
| | | | | | | | | | | -502A |
| | | | | | | | | TITLE | PRODUCT SPECIFICATION | |
| | | | | | | | | BSRU6 | | |
| | | | | | | | | DOCUMENT NO. | (14 /) | |
| | | | | | | | | <i>ALPS ELECTRIC CO., LTD.</i> | | |
| SYMB. | DATE OR NO. | APPD. | CHKD. | DSGD. | | | | | | |

| 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 | (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. | |
| 11-2. | Humidity 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. | |
| 11-3. | Cold 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. | |
| 11-4. | Life test | (1)Leave samples for 1000 hours in normal ambient with standard power supply. | |
| 11-5. | Vibration 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 | |
| 11-6. | Lightning test | No defect in operation | $\pm 15 \text{ kV}$ through 1000 pF and $0 \text{ } \Omega$ to center conductor (Performed 3 times) |

-502A

TITLE

BSRU6

PRODUCT
SPECIFICATION

DOCUMENT NO.

(15 /)

