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| PREPARED BY: <i>D. Ise</i> DATE: 11 June 1996 | <h1>SHARP</h1> <p>ELECTRONIC COMPONENTS GROUP SHARP CORPORATION</p> <h2>SPECIFICATION</h2> | SPEC NO. TENTATIVE |
| CHECKED BY: <i>T. Yamaguchi</i> DATE: 11 June 1996 | | FILE NO. |
| APPROVED BY: <i>M. Noboru</i> DATE: | | ISSUE: 11. June 1996 PAGE: 8 |
| | | REPRESENTATIVE DIVISION <input type="checkbox"/> ELECTRONIC COMPONENTS DIV. <input type="checkbox"/> OPTICAL DEVICE DIV. <input type="checkbox"/> PHOTO VOLTAICS DIV. |

DEVICE SPECIFICATION FOR
Single conversion tuner for cable modem

MODEL NO. CASD19E03

•i CUSTOMER'S APPROVAL

DATE _____

BY _____

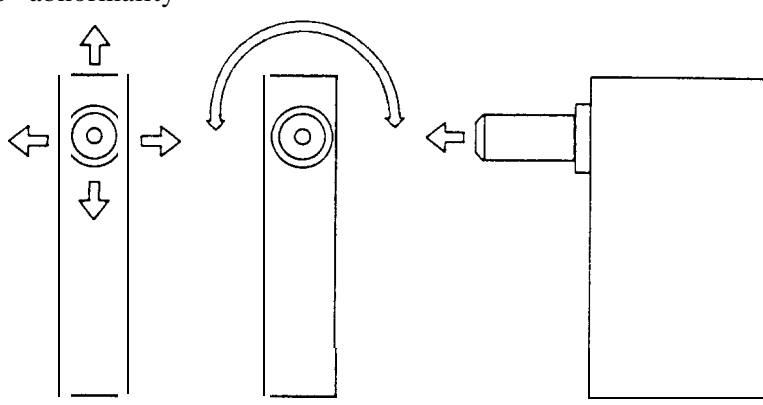
PRESENTED
BY

Toyomi Yonemaru

TOYOMI YONEMARU

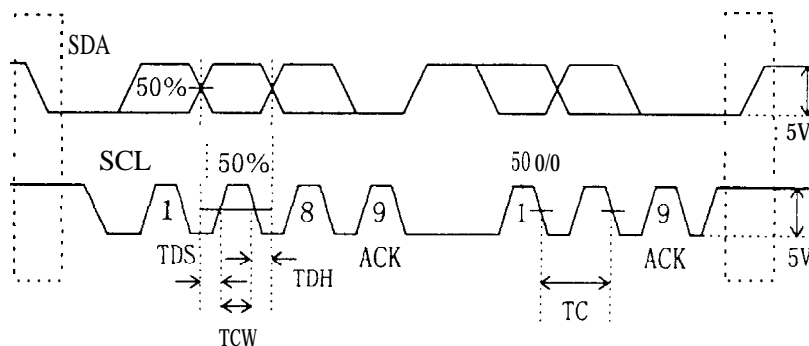
ASSISTANT DEPARTMENT GENERAL MANAGER
ENGINEERING COMPONENTS DIVISION
ELECTRONIC COMPONENTS DIVISION
ELECTRONIC COMPONENTS (ELECTRONIC) GROUP

| 1 | General | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|----------------------------|---|----------------|--|-------------|-------------|-------------|----------------------------------|-----------|-------------|--------------------------------|-----------|-----------|---------------|----------------|--|-----|---------------|----------------|--|-------------|--------------|-----|----------------|-------------|--------|-------|---------|--------|---------|--|
| 1-1 | Application | This tuner is intended to use in cable modem. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-2 | Receiving frequency range | 47MHz to 862MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-3 | Input level | -15dBmV to 15dBmV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-4 | Nominal input impedance | 75 Ω Unbalance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-5 | Nominal output impedance | 75 Ω Unbalance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-6 | Nominal data in impedance | 75 Ω Unbalance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-7 | Intermediate frequency | 36.15MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-8 | 3dB Band width | 7MHz (typ.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-9 | Channel selection system | Frequency synthesizer (I2C-bus) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-10 | PLL step size | 50kHz (PLL internal reference : 50kHz) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-11 | X'tal reference frequency | 3.2MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-12 | Operating voltage | <table border="1"> <thead> <tr> <th>Terminal</th> <th>Description</th> <th>Voltage (V)</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>B1</td> <td>Main supply</td> <td>9.0\pm0.45</td> <td></td> </tr> <tr> <td>B2</td> <td>Main supply</td> <td>5.0\pm0.25</td> <td></td> </tr> <tr> <td>BT</td> <td>Tuning supply</td> <td>30.0\pm1.5</td> <td></td> </tr> <tr> <td>AGC</td> <td>Gain control</td> <td>0-5</td> <td>5V to max gain</td> </tr> <tr> <td rowspan="2">PLL control</td> <td>VH(=1)</td> <td>3~5.5</td> <td>SCL,SDA</td> </tr> <tr> <td>VL(=1)</td> <td>1.5 max</td> <td></td> </tr> </tbody> </table> | | | Terminal | Description | Voltage (V) | Condition | B1 | Main supply | 9.0 \pm 0.45 | | B2 | Main supply | 5.0 \pm 0.25 | | BT | Tuning supply | 30.0 \pm 1.5 | | AGC | Gain control | 0-5 | 5V to max gain | PLL control | VH(=1) | 3~5.5 | SCL,SDA | VL(=1) | 1.5 max | |
| Terminal | Description | Voltage (V) | Condition | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B1 | Main supply | 9.0 \pm 0.45 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B2 | Main supply | 5.0 \pm 0.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BT | Tuning supply | 30.0 \pm 1.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AGC | Gain control | 0-5 | 5V to max gain | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PLL control | VH(=1) | 3~5.5 | SCL,SDA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | VL(=1) | 1.5 max | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-14 | Breakdown voltage | <table border="1"> <tbody> <tr> <td>B1</td> <td>Main supply</td> <td>11.0</td> <td></td> </tr> <tr> <td>B2</td> <td>Main supply</td> <td>6.0</td> <td></td> </tr> <tr> <td>BT</td> <td>Tuning supply</td> <td>32.0</td> <td></td> </tr> <tr> <td>AGC</td> <td>Gain control</td> <td>6.0</td> <td></td> </tr> <tr> <td>PLL control</td> <td></td> <td>5.5</td> <td>SCL, SDA</td> </tr> </tbody> </table> | | | B1 | Main supply | 11.0 | | B2 | Main supply | 6.0 | | BT | Tuning supply | 32.0 | | AGC | Gain control | 6.0 | | PLL control | | 5.5 | SCL, SDA | | | | | | | |
| B1 | Main supply | 11.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B2 | Main supply | 6.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BT | Tuning supply | 32.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AGC | Gain control | 6.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PLL control | | 5.5 | SCL, SDA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-15 | Temperature and humidity | <table border="1"> <thead> <tr> <th>Temperature</th> <th>Humidity</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>-15$^{\circ}$C~70$^{\circ}$C</td> <td>90%RH max</td> <td>Storage</td> </tr> <tr> <td>0$^{\circ}$C~60$^{\circ}$C</td> <td>85%RH max</td> <td>Operating</td> </tr> </tbody> </table> | | | Temperature | Humidity | Condition | -15 $^{\circ}$ C~70 $^{\circ}$ C | 90%RH max | Storage | 0 $^{\circ}$ C~60 $^{\circ}$ C | 85%RH max | Operating | | | | | | | | | | | | | | | | | | |
| Temperature | Humidity | Condition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -15 $^{\circ}$ C~70 $^{\circ}$ C | 90%RH max | Storage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 $^{\circ}$ C~60 $^{\circ}$ C | 85%RH max | Operating | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-16 | Circuit block diagram | Figure 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Mechanical characteristics | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-1 | Appearance | No appreciable defects in appearance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-2 | Shape and dimensions | As per attached outline drawing. (Figure 2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-3 | Mounting on PC board | Must insert easily into PC board tuner holes as shown in the attached drawing. (Figure 2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| <p>2-4</p> | <p>Terminal strength 1) Data input, IF output and Power supply terminal. 2) ANT terminal</p> | <p>1. Tensile strength Terminal No. 2~10 : 29.4N min. (3kgf)</p> <p>When a force of 98.cm(10kgf·cm) is applied to F connector base in the direction shown by the arrow, there shall be no abnormality</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|-------------------|--------------------------------|------------|-----------------------|-----------|-------------------------|----|----|----|--|--|----|----|----|--|--|---|---|------|--|--|--|-----|----|--|----|--|----|----|--|----|--|--|----|----------|---|--|--|----|--------------------------------|--|--|---|----|------------------|--|--|-----|----|-----------------|--|--|-----|-----|--------------|
| <p>3 3-1</p> | <p>Test condition Supply voltage</p> | <p>B1 : 9.0V±0.1V B2 : 5.0V±0.1V BT : 30.0V±0.1V AGC : 5.0V±0.1V</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>3-2</p> | <p>Ambient temperature</p> | <p>25°C±2°C</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>3-3</p> | <p>Ambient humidity</p> | <p>55%RH±10%RH</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>3-4</p> | <p>Receiving channel and input level (CM, IM, CTB)</p> | <table border="1"> <tr> <td>Receiving channel</td> <td>Input level</td> <td>Modulation</td> </tr> <tr> <td>STD134 (47MHz~862MHz)</td> <td>0dBmV</td> <td>CW or 15.75kHz, 100VOAM</td> </tr> </table> <p>Set AGC voltage to keep IF output at 30dBmV</p> | Receiving channel | Input level | Modulation | STD134 (47MHz~862MHz) | 0dBmV | CW or 15.75kHz, 100VOAM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Receiving channel | Input level | Modulation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STD134 (47MHz~862MHz) | 0dBmV | CW or 15.75kHz, 100VOAM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>4 4-1 4-2 4-3 4-4 4-5 4-6 4-7 4-8</p> | <p>Electrical characteristics</p> <p>Current consumption B1 (9.0V) B2 (5.0V) BT (30.0V) AGC (5V)</p> <p>Conversion gain</p> <p>Noise figure</p> <p>AGC range</p> <p>Return loss Input terminal</p> <p>IF output bandpass response</p> <p>Group delay flatness</p> <p>Cross modulation</p> | <p>Electrical characteristics involve the spread of values guaranteed within the specified test condition. (Refer to 3-1-3-3)</p> <table border="1"> <thead> <tr> <th>Min.</th> <th>Typ.</th> <th>Max.</th> <th>Unit</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td></td> <td>40</td> <td>50</td> <td>mA</td> <td></td> </tr> <tr> <td></td> <td>45</td> <td>55</td> <td>mA</td> <td></td> </tr> <tr> <td></td> <td>1</td> <td>5</td> <td>2 mA</td> <td></td> </tr> <tr> <td></td> <td></td> <td>100</td> <td>μA</td> <td></td> </tr> <tr> <td>28</td> <td></td> <td>42</td> <td>dB</td> <td></td> </tr> <tr> <td>25</td> <td></td> <td></td> <td>dB</td> <td>AGC=0.5V</td> </tr> <tr> <td>6</td> <td></td> <td></td> <td>dB</td> <td>on channel selected best point</td> </tr> <tr> <td></td> <td></td> <td>4</td> <td>dB</td> <td>36.15MHz±2.75MHz</td> </tr> <tr> <td></td> <td></td> <td>100</td> <td>ns</td> <td>36.15MHz±2.5MHz</td> </tr> <tr> <td></td> <td></td> <td>-50</td> <td>dBc</td> <td>Refer to 3-4</td> </tr> </tbody> </table> | Min. | Typ. | Max. | Unit | Condition | | 40 | 50 | mA | | | 45 | 55 | mA | | | 1 | 5 | 2 mA | | | | 100 | μA | | 28 | | 42 | dB | | 25 | | | dB | AGC=0.5V | 6 | | | dB | on channel selected best point | | | 4 | dB | 36.15MHz±2.75MHz | | | 100 | ns | 36.15MHz±2.5MHz | | | -50 | dBc | Refer to 3-4 |
| Min. | Typ. | Max. | Unit | Condition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 40 | 50 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 45 | 55 | mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 5 | 2 mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100 | μA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | 42 | dB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | dB | AGC=0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | dB | on channel selected best point | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4 | dB | 36.15MHz±2.75MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100 | ns | 36.15MHz±2.5MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | -50 | dBc | Refer to 3-4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | |
|---|---|--|----------|--------|--------|---------------------------------|-----|-------|--------|
| 4-9 | Intermodulation 1) 2'nd/3rd order beat 2) Composite triple beat | Min. | I T YD . | Max. | Unit | Condition | | | |
| | | | | -50 | dBc | Refer to 3-4 | | | |
| | | | | -50 | dBc | Refer to 3-4 | | | |
| 4-10 | Spurious signals at input terminal | | | TBD | dBmV | 54 to (and including) 300 | | | |
| | Local leakage | | | TBD | dBmV | 300 to (and including) 450 | | | |
| 4-11 | Image rejection | | | -40 | dB | | | | |
| 4-12 | IF rejection | | | -60 | dB | | | | |
| 4-13 | Local phase noise | | -82 | -75 | dBc/Hz | 10kHz offset | | | |
| | | | -105 | -95 | dBc/Hz | 100kHz offset | | | |
| 4-14 | LO frequency accuracy | | | ±50 | kHz | Over temperature of 0°C to 60°C | | | |
| 4-15 | PLL setting time | | | 100 | msec | * | | | |
| 4-16 | Data in insertion loss | | | 2.5 | dB | | | | |
| <p>* Setting time is measured after reference & local frequency set up data is transmitted. (f0±1kHz)</p> | | | | | | | | | |
| 5 | Environmental tests | After the test (5-1~5-3) no mechanical looseness shall be present, the conversion gain and noise figure shall stay within ±3dB of the original. | | | | | | | |
| 5-1 | On-load test | 1) In a high temperature, high humidity environment. (40°C, 90%RH for 500hours) | | | | | | | |
| 5-2 | Vibration test | 2) In a high temperature environment. (60°C for 500hours) In 3 different directions, scanning time with 1min, for 2hours with peak to peak amplitude of 1.5min at a rate of 10I[Z-55IIZ. | | | | | | | |
| 5-3 | Impact test | In 686m/S2 (70G) on 6 planes, 3 times each. | | | | | | | |
| 6 | Others | | | | | | | | |
| 6-1 | Terminal affinity to so | Sample terminals to be soldered shall be dipped in methanol (as per JIS-K-1501) into which rosin (as per JIS-K-5902) is dissolved to a concentration of 7~10% for about 5s, then dipped in a solder bath containing molten solder (JIS-Z-3282H, 63A) maintained at 230°C±5°C for 3±0.5s. After removal from the solder bath, each sample terminal tested shall show solder adhering over 90% of the submerged portions along the entire circumference. | | | | | | | |
| 6-2 | PLL data format | Bus inputs | SCL, SDA | Symbol | Min | Typ | Max | Units | Con. |
| | | HIGH input voltage | | VH | 3 | | 5.5 | v | |
| | | LOW input voltage | | VL | | | 1.5 | v | |
| | | HIGH input current | | IH | | | 10 | μA | VH=5 v |
| | | LOW input current | | IL | -20 | | | μA | VL=0 V |

| | Symbol | Min | Typ | Max | Units | Conditions |
|-------------------|--------|-----|-----|-----|-------|------------|
| DATA set up time | TDS | 0.1 | | | μs | |
| DATA hold time | TDH | 0 | | | μs | |
| CLOCK pulse width | TCW | 0.6 | | | μs | |
| CLOCK frequency | TC | 2.5 | | | μs | |



| | MSB | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | LSB | Ack |
|--------------------|-----|------|------|------|------|------|------|-----|-----|
| Address Byte | 1 | 1 | 0 | 0 | 0 | MA1 | MA0 | 0 | Ack |
| Reg. Divider Byte1 | 0 | n14 | n13 | n12 | n11 | n10 | n9 | n8 | Ack |
| Reg. Divider Byte2 | n7 | n6 | n5 | n4 | n3 | n2 | n1 | n0 | Ack |
| Control Byte1 | 1 | 5I | 0 | 0 | 1 | 1 | 1 | 1 | Ack |
| Control Byte2 | U/V | x | x | x | x | P2 | P1 | Po | Ack |

Ports PO, P1, P2 :

High Open-collector output is active
 Low Open-collector output is inactive

Bandswitch switch V/U :

High switch to OSC/MIX UHF
 Low Switch to OSC/MIX VHF

Pump current 51:

High switch to high current

Table 1 : Band Selection

| | u/v | P2 | PI | PO |
|----------|-----|----|----|----|
| UHF | 1 | 0 | 0 | 1 |
| VHF high | 0 | 0 | 1 | 0 |
| VHF low | 0 | 1 | 0 | 0 |

Table2:Address Selection

| Voltage at CAS | MA1 | MA0 |
|---------------------|-----|-----|
| (0. . . 0. 1)*B2 | 0 | 0 |
| open circuit | 1 | 0 |
| (0. 4. . . 0. 6)*B2 | 0 | 1 |
| (0. 9. . . 1)*B2 | 1 | 1 |

Divider ratio:

$$fvco=N \times 50kHz$$

$$N = 16384 \times n14 + 8192 \times n13 + 4096 \times n12 + 2048 \times n11 \\ + 1024 \times n10 + 512 \times n9 + 256 \times n8 + 128 \times n7 + 64 \times n6 \\ + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0$$

fvco : Local frequency

fosc : 3.2MHz (X' tal reference frequency)

R : 64 (Reference divider)

6-3 Channe condition

VHF low 87. 15MHz~207. 15MHz (fvco)

VHF high 214. 15MHz~502. 15MHz

UHF 510. 15MHz~894.15MHz

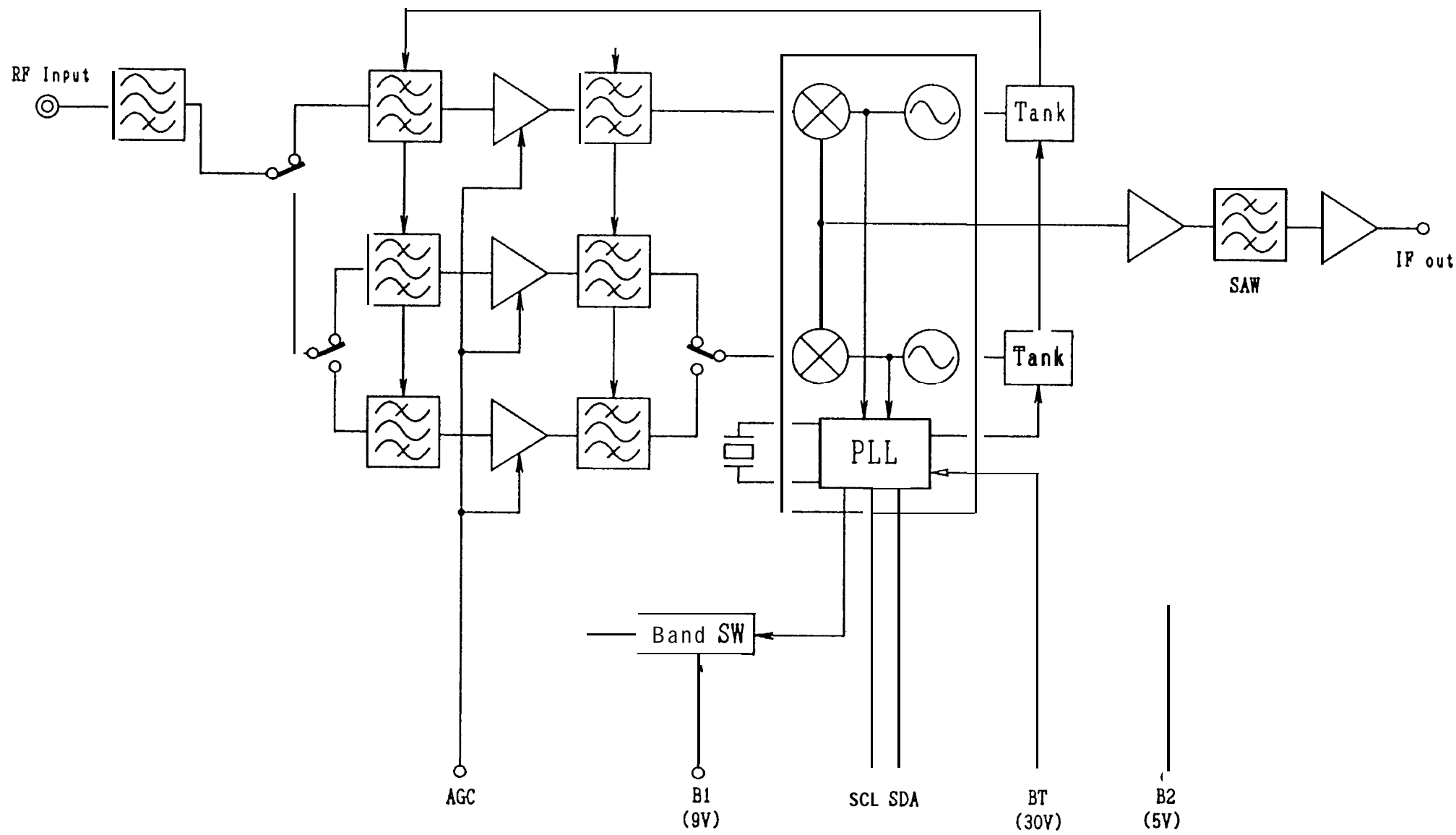
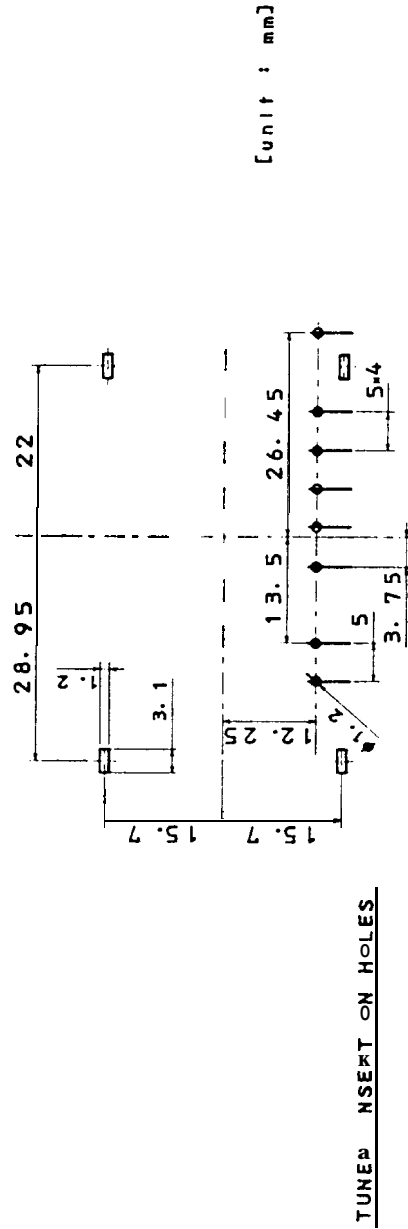
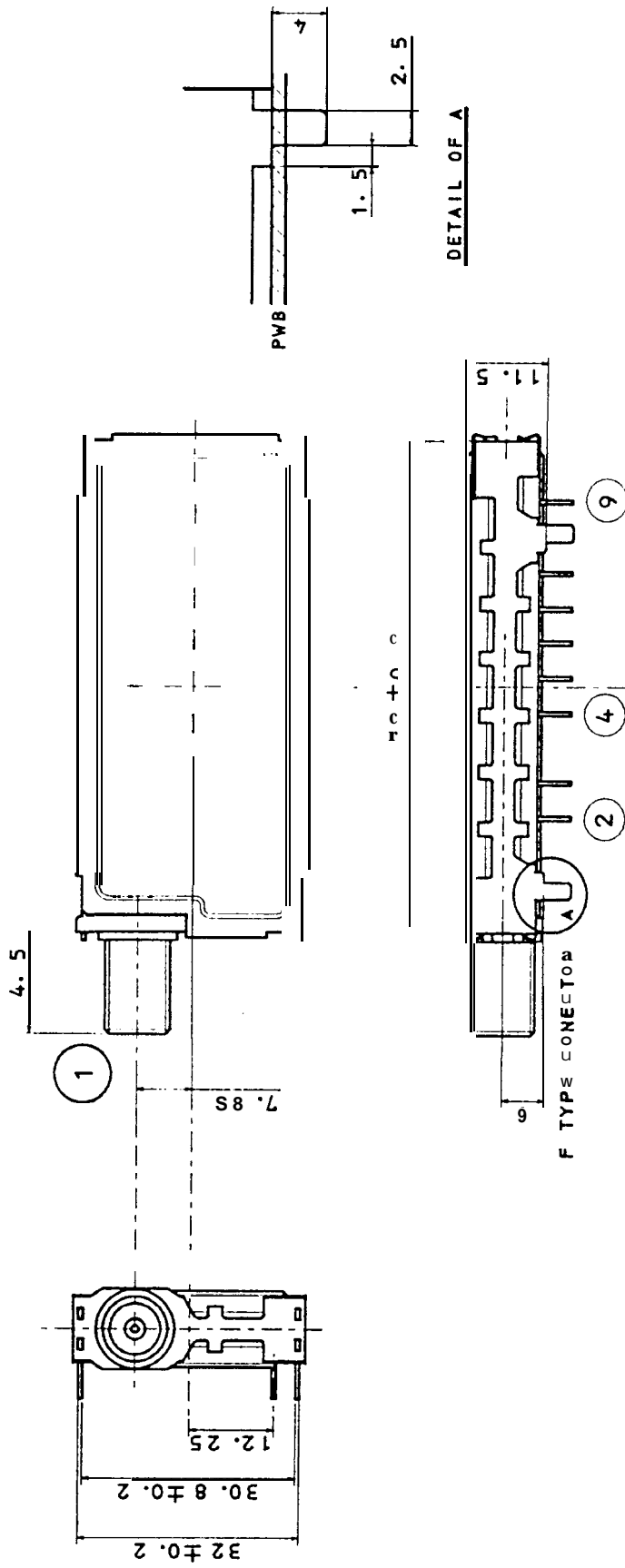


Figure 1 Block Diagram

SHARP CONFIDENTIAL AND PROPRIETARY



| | | | | | | | | | |
|------|--------|----------|---------|---------|-----|-----|-----|----------|--------|
| No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| NAME | ANT IN | AGC (5V) | B1 (9V) | B2 (5V) | SDA | SCL | CAS | BT (30V) | IF OUT |

Figure 2. Outline drawing