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*E. Kakihashi*

CHECKED BY:

*A. Miyake*

APPROVED BY:

*K. Ishii*

# SHARP

ELECTRONIC COMPONENTS GROUP  
SHARP CORPORATION

## SPECIFICATION

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REPRESENTATIVE DIVISION

- ELECTRONIC COMPONENTS DIV.
- II SEMICONDUCTOR APPLICATION DIV
- LIQUID CRYSTAL DISPLAY DIV.
- PHOTO VOLTAICS DIV.

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DEVICE SPECIFICATION FOR  
RF MODULATOR

MODEL NO. E2251T  
(PLL, PAL-G, TSG, 21ch~69ch)

CUSTOMER'S APPROVAL

DATE

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BY

\_\_\_\_\_

PRESENTED

BY

*M. Yamauchi*

**MIYOSHI YAMAUCHI**

GENERAL MANAGER  
ENGINEERING DEPARTMENT 1  
ELECTRONIC COMPONENTS DIVISION  
ELECTRONIC COMPONENTS (ELECTRONIC) GROUP

### 1. General Description

- 1) Transmission system: Europe standard system
- 2) Color system : PAL-G
- 3) Output channel : 21-69CH
- 4) Output impedance : 75 $\Omega$  unbalanced
- 5) Power source : +B(MOD) DC 5V +B(BT) DC 33V~28V
- 6) Video carrier frequency controls : 1<sup>2</sup>C bus

### 2. Test Condition

- 1) Power source +B(MOD): DC 5V $\pm$ 0.1V(Ripple 10mV p-p max.)  
  
+B(BT): DC 33V~28V $\pm$ 0.1V(Ripple 5mVp-p  ax.)
- 2) Unit setting conditions
  - a) Video  
Apply 75% modulated color bar signal 1Vp-p and set modulation factor and V/S ratio to specified values. For modulation factor setting, WHITE signal shall be 1Vp-p V/S=7/3, APL=50%
  - b) Audio  
Apply sine wave of 1kHz, -5dBs(approx 1.24Vp-p)
- 3) Ambient conditions  
Temperature: 25 $\pm$ 3 $^{\circ}$ C  
Humidity , 65 $\pm$ 5% RH  
However, if judgement is not in doubt, standard temperature may considered as 15~30 $^{\circ}$ C and humidity 45-85% RH.
- 4) Operating conditions  
ANT-TV through mode : +B(MOD) OFF  
ANT-TV off, MOD mode : +B(MOD) ON

### 3. Mechanical Performance

- 1) Appearance : There shall be no noticeable defects.
- 2) Shape and dimensions : As shown in the outline drawings.

4. Electrical performance(RF MOD portion)

(1) Video characteristics

<u>Item</u>	<u>Specified Value</u>	<u>Remarks</u>
1) Input impedance	1k $\Omega$ $\pm$ 30% unbalanced	Measure at 0~5MHz
2) Input signal level	1Vp-p synchronous - )	When load of 82 $\Omega$ is applied.
3) Modulation factor	80 $\pm$ 7%	When load of 82 $\Omega$ is applied.
4) VS/ratio	7 +0.25,-0  3+0,-0.25	Input:Staircase wave 1Vp-p synchronous(-) V/S = 7/3
5) Amplitude frequency characteristics	+2, - 3dB max.	Using 1MHz as a standard in the0.5 ~5MHz range, measure at RF output using multiburst or sweep generator. Spectrum analyzer band is 300kHz.
6) Differential gain	$\pm$ 10% max.	Superimposed 4.42MHz sine wave level shall be 20% of staircase wave level, measured in a modulation factor range of 65-78% and an APL range of 10-90%, However, differential gain of demodulator unit shall require correction.
7) Differential phase	$\pm$ 10 $^{\circ}$ max. (36CH) $\pm$ 15 $^{\circ}$ max. (other ch.)	Same as Para. 6) above
8) Change in modulation factor to APL	$\pm$ 5 %max.	Within an APL range of 10-90% With APL 50% as reference.
9) S/N ratio	45dB(p-p/rms)min.	Measure With standard demodulator output.

(2) Audio system characteristics

<u>Item</u>	<u>Specified Value</u>	<u>Remarks</u>
1) Input impedance	10k $\Omega$ min. unbalanced	Measure at 0.1~10kHz.
2) Input signal level	- 5dBs	Referred to as sine wave 1.24Vp-p.
3) Amplitude frequency characteristics	+2, - 3dB	Using 1kHz as a standard in the 100Hz~10kHz range, measure deviation from 50 $\mu$ S preemphasis characteristics theoretical value.
4) Modulation factor	G 100*24%	100% = $\pm$ 50kHz
5) Distortion rate	3.0% max.	
6) S/N ratio(incls. buzz)	40dB min.	

(3) output system characteristics

Item	Specified Value	Remarks
1) Video carrier frequency	$\pm 250\text{kHz max.}$	For test conditions, temperature shall be 25°C, and humidity 65% RH.
2) Audio frequency	G 5500kHz $\pm 8\text{kHz max.}$	Same as above.
3) Video output level	$72 \begin{smallmatrix} +4 \\ -4 \end{smallmatrix} \text{dB}\mu$ (36th)	P-P level(AT modulation): 75Ω load
	$72 \pm 5\text{dB}\mu$ (other ch)	
4) Audio output level difference (P/S ratio)	$16 \pm 4\text{dB max.}$	Difference between video output level and audio output level(Audio non modulation).
5) output terminal spurious(for fp output level)		
a) Specific frequency	$16 \pm 5\text{dB max.}$	fp - 5.5MHz
a) Specific frequency	40dB max.	fp + 11MHz, fp + 16.5MHz, 1/2fp, 1.5fp (fp: video carrier frequency)
b) Other frequencies	42dB max.	Measure as per FTZ Regulations: 0~1,000MHz, excluding the frequency in Para. a) above.
6) Spurious radiation within the band	50dB max.	Between fp and fs.
7) Chroma beat	50dB max.	Apply 4.43MHz 0.4Vp-p sine wave to video input and measure using spectrum analyzer.

(4) Temperature characteristic

Item	Specified Value	Remarks
1) Video modulation factor, temperature stability	$\pm 12\%$	Measure at 0~60°C: Check for variation from initial value. 25°C standard
2) Video carrier, temperature stability	$\pm 250\text{kHz}$	Same as above
3) Audio modulation factor, temperature stability	$\pm 10\%$	Same as above
4) Audio carrier, temperature stability	$\pm 15\text{kHz}$	Same as above

<u>Item</u>	<u>Specified Value</u>	<u>Remarks</u>
5) Video output level temperature stability	$\pm 5\text{dB}$	Measuru at $0\sim 60^{\circ}\text{C}$ : Check for variation from initial value. $25^{\circ}\text{C}$ standard.
6) Audio output level difference	* $5\text{dB}$	Same as above
7) Synchronous level, temperature stability	$V/S = 7 \pm 0.5 / 3 \pm 0.5$	Same as above
8) Differential gain, temperature stability	$\pm 15\%$ max.	Same as above

#### 9) Overall picture and total quality

Operation shall be problem-free. This paragraph is subject to sensory tests; therefore, any discrepancy arising between the parties concerned regarding final judgement shall be settled by mutual consent. (Limit standards shall be specified as needed.)

#### 9) Power source

- 1) Input voltage : +B(MOD)DC  $5 \pm 0.3\text{V}$ ; +B(BT)DC  $3.3 \sim 2.8\text{V} \pm 0.3$   
Allowable ripple voltage:  $10\text{mVp-p}$  max. + B(MOD)  
:  $5\text{mVp-p}$  max. + B(BT)
- 2) Current consumption : MOD:  $85\text{mA}$  Max. TYP.  $65\text{mA}$

#### 9) Software information

The synthesizer is controlled via a two-wire 12C bus receiver. For programming, the address byte (C8 in Hexa format) has to be sent first. Then one or two data bytes are used to set the 10 programmable bits of the dividing number N, the test bits (see table 1) and the output port state. Note that at the power-up of the IC, the two data bytes must be sent.

byte	MSB							LSB	
address C8	1	1	0	0	1	0	0	0	ack.
data byte 1	0	b11	b10	b9	b8	b7	b6	b5	ack.
data byte 2	1	T0	T1	T2	P0	b4	b3	b2	ack.

TABLE 1 : Data format.

ack. is the acknowledge bit.

b2, b3, . . . . b10, b11 are the 10 programmable bits of N.

b1 = 0 and b0 = 1 are set by internal hardware.

T0, T1 and T2 are 3 bits used for test purpose (see table 5).

P0 is a bit used for setting the state of the output port (see table 6).

bits	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
frequency in MHz	512	256	128	64	32	16	8	4	2	1	0.5	0.25

TABLE 2 : Structure of the dividing number N (\*)

The bits b2 to b11 are programmable and represent the integer part of the frequency in MHz. b1 and b0 are fixed internally to 0 and 1 to get the added 0.25 MHz, common to most TV channels (see table 2).

$$F_{0SC} = 512 \times b11 + 256 \times b10 + \dots + b2 \times 1 + 0.25 \text{ in MHz}$$

bits	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
value	0	1	1	1	0	1	0	1	1	1	0	1
frequency in MHz	0	256	128	64	0	16	0	4	2	1	0	0.25

TABLE 3 : dividing number N to program channel 21 = 471.25MHz (\*)

(\*) : Remark : shaded areas indicate bits which are not programmable,

byte	MSB							LSB	
address C8	1	1	0	0	1	0	0	0	ack.
data byte 1	0	0	1	1	1	0	1	0	ack.
data byte 2	1	0	0	0	0	1	1	1	ack.

TABLE 4 : Content of the **data** bytes to program channel 21 = **471.25MHz**.

It is possible to change only one data byte. The circuit will recognize which one is received with the value of MSB, 0 for data byte 1, 1 for data byte 2. It is possible to change the frequency by 1 MHz with data **byte 2**. It is easy to increment the channel frequency when its frequency width is 8 **MHz** by simply incrementing data byte 1.

Three bits, T0, T1 and T2 are **available** for test purposes.

T0	T1	T2	OPERATIONAL MODE
0	0	0	normal operation
0	0	1	Test Pattern Signal Generator on
0	1	0	RF oscillator off
0	1	1	<b>Balance</b> test
1	0	0	F <sub>REF</sub> out (if PO = 0)
1	0	1	High impedance test
1	1	0	F <sub>DI V</sub> out (If PO = 0)
1	1	1	phase detector disabled, baseband signals <b>on</b> RF outputs

X = 0 or 1

TABLE 5 : Test modes.

In "Test Pattern **Signal** Generator on" mode the video carrier is modulated **by the** test signal consisting **of** a sync. pulse and two vertical white bars on a black screen. This mode should be chosen to adjust the TV set receiving the modulated signal to the right frequency,

In "RF oscillator off" mode, the RF oscillator is switched-off and there is no RF carrier coming out of the device. This mode can be **selected** to avoid RF radiations to other parts when the modulator output is not used.

In Balance Test, the picture carrier is over-modulated. This allows to measure easily the residual carrier.

The "high impedance test" mode may be used to inject an external tuning **voltage** to the RF tank circuit, to test the oscillator. In this mode, the phase detector is disabled and the external transistor of the tuning amplifier is switched-off ; AMP output is low (<200mV).

In "**F<sub>REF</sub>**" and "**F<sub>DIV</sub>**" modes, ~~the~~ reference frequency **F<sub>REF</sub>** in the phase comparator or the divided RF oscillator frequency **F<sub>DIV</sub>** is available on the output port pin. This mode requires that the bit PO is 0.

In the "phase detector **disabled**" mode, it is possible to measure the leakage current at the input of the tuning amplifier, on the CP pin, In this mode the RF oscillator is off, and the "baseband TV channel signal is present on the RF outputs for testing the audio and the video parts.

There is a bit, called PO, which controls the output port (pin 14) following table 6.

PO	Output port state
0	off - high impedance
1	on - sinking current

TABLE 6 : Output port programming

The port is NPN open collector type.

For monitoring the FREF or FDIV frequency on the output port, the **PO** bit must be 0, to let the output port free.



## 5. RF Switch Portion

<u>Item</u>	<u>Specified Value</u>	<u>Remarks</u>
1) Insertion loss ANT IN→TV OUT	3dB Max.	Measure at 47~300MHz
Inserion loss ANT IN→TV OUT	5dB Max.	Measure at 470~870MHz
2) ANT IN terminal leakage voltage	44dB $\mu$ Max. (At 75 $\Omega$ terminal)	at 75 $\Omega$ terminal (other terminals)
3) <b>VSWR</b>		
a) ANT IN,	4 max.	At 75 $\Omega$ terminal(other terminals)
b) TV OUT	4 max.	At 75 $\Omega$ terminal(other terminals)
4) Cross modulation ANT IN→TV OUT		MOD power source: OFF
a) f1 = 480MHz, f2 = 590MHz, f(IM2) = 110MHz	55dB min. ,	f(IM2) = f2 - f1 RF input level= 100dB $\mu$ (At 75Q terminal)
b) f1 = 480MHz, f2 = 590MHz, f(IM3) = 700MHz	55dB min.	f(IM3) = 2f2 - f1 RF input level= 100dB $\mu$ (At 75Q terminal)
5)Switching operation		
ANT IN→TV OUT	Ground +B(MOD) terminal.	
MOD OUT→TV OUT	When +5V is applied across +B(MOD) terminal.	

## 6. Durability Test

## 1) Vibration test

Apply vibration of 2mm full amplitude, 1,500 times/minute from three directions for 10 minutes each: there shall be no looseness, etc. , and all performance requirements shall be satisfied.

## 2) Impact test

Apply a 70G impact using an impact tester; no damaged parts or looseness shall be observed, and performance shall not be remarkably affected.

## 3) Moisture resistance

Test samples shall be left in an environment with temperature at  $40 \pm 5^\circ\text{C}$  and relative humidity at  $90+0, -3\%$ , for 96 hours, then left at normal temperature and humidity for 90 minutes. The unit shall then operate normally without malfunction.

## 4) High temperature resistance

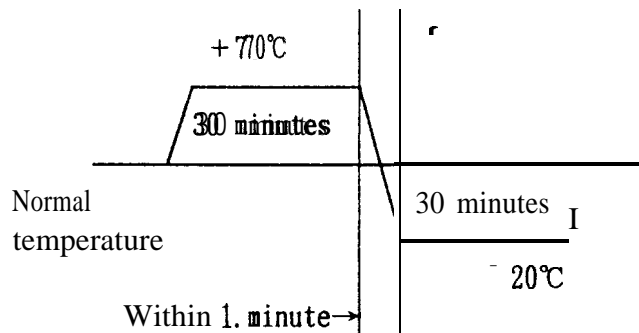
Test samples shall be left in a  $70 \pm 2^\circ\text{C}$  bath for 98 hours, then at normal temperature and humidity for 90 minutes. The unit shall then operate normally without malfunction.

## 5) Low temperature resistance

Test samples shall be left in a  $-20 \pm 2^\circ\text{C}$  bath for 96 hours, then at normal temperature and humidity for 90 minutes. The unit shall then operate normally without malfunction.

## 6) Thermal shock resistance

10 test cycles shall be conducted under the following conditions and samples shall then be placed in a normal temperature and humidity atmosphere, cleared of excess water, left for 90 minutes. Subsegment operation shall be trouble-free.



## 7. Operating Conditions

## 1) Operating guarantee Conditions

Operation shall be trouble-free under  $\pm 0 \sim 60^\circ\text{C}$  and 85% RH max.

## 2) Storage conditions

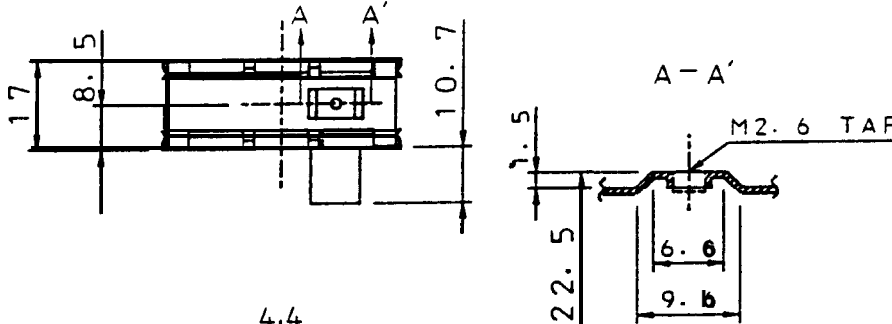
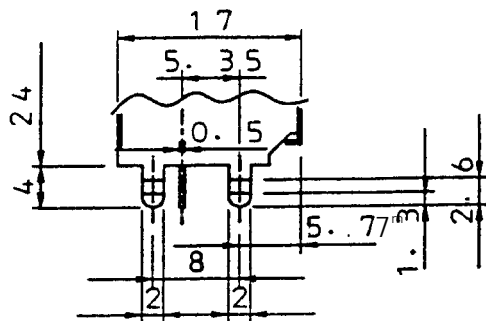
Temperature  $-10 \sim 70^\circ\text{C}$ , humidity 90% RH max.

## 8. Electrostatic Test

Electrostatic test ( $15\text{kV}(+)$  and  $(-)$  polarities, 10 times each) shall be conducted on ANT IN and TV OUT terminals, Subsegment operation shall be troublefree. ( $C=200\text{PF}$ ,  $R=500\Omega$ )

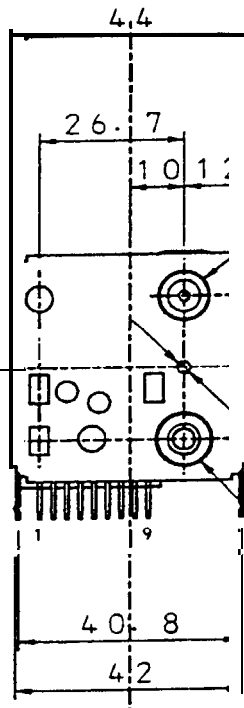
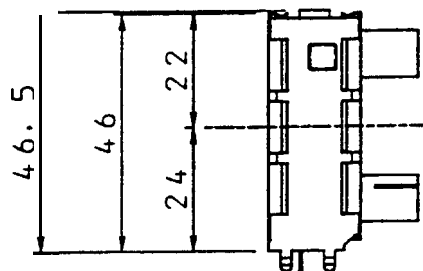
SHARP

(S=2/1)

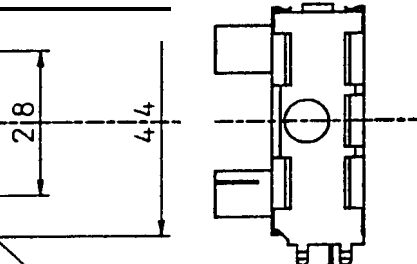


CONNECTOR LAYOUT

- 1. BT (33V~28V)
- 2. VIDEO IN
- 3. AUDIO IN
- 4. MD. +B (5V)
- 5. NC
- 6. NC
- 7. CLOCK
- 8. DATA
- 9. NC



TV-OUT (IEC-M)

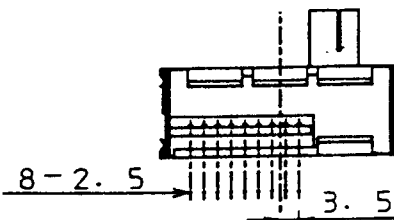
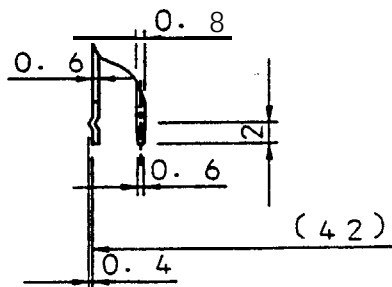


AN T-IN (IEC-F)

NOTE  
1. TOLERANCE SHALL BE WITHIN  $\pm 0.5$  UNLESS OTHERWISE SPECIFIED.

2. UNIT mm

(S=2/1)



適用機種 E2251T	尺貫 SCALE	単位 UNIT	△		
適用機種 E2252T	1 / 1	1 = /	△		
設計 MODEL	訂日 DATE	訂定書 REVISE	訂書 CHANGE		
板厚 THICKNESS	数量 PIECES	材質 MATERIAL	仕上 FINISH	名称 (PLL) NAME RF MODULATOR	
日付 DATE 1994 SEP.21				コード CODE	
設計 図面 確認 承認 DESIGN DRAW CHECK CHECK APPROVE	シャープ株式会社 電子部品事業本部			図番 DRAWING No.	
<i>e.Kafuku</i>		<i>Kobli</i>	製品課 第一技術部		
SHARP CORPORATION					

SHARP PROPRIETARY

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