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	SPECIFICATION	☒ ELECTRONIC COMPONENTS DIV.
		☐ SEMICONDUCTOR APPLICATON DIV
		☐ LEQUID CRYSTAL DISPLAY DIV.
		☐ PHOTO VOLTAICS DIV.

DEVICE SPECIFICATION FOR

RF MODULATOR

MODEL NO. E 2 2 5 8 T

(PLL, PAL-G/I, TSG, 21ch~69ch)

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

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ELECTRONIC COMPONENTS (ELECOM) GROUP

1. General Description

1) Transmission system: Europe standard system
2) Color system : PAL-G/I
3) Output channel : 21-69CH
4) Output impedance : 75Ω unbalanced
5) Power source : +B(MOD) DC 5V +B(BT) DC 33V~28V
6) Video carrier freguency controls : I²C bus

2. Test Condition

1) Power source +B(MOD): DC 5V±0.1V(Ripple 10mV p-p max.)

+B(BT) : DC 33V~28V±0.1V(Ripple 5mVp-p max.)

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±3℃
   Humidity : 65±5% RH
   However, if judgement is not in doubt, standard temperature may considered as 15~30℃ 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. Electorical perfoormance(RF MOD portion)

(1) Video characteristics

Item	Specified Value	Remarks
1) Input impedance	1kΩ±30% unbalanced	Measuru at 0～5MHz
2) Input signal level	1Vp-p synchronous(−)	When load of 82Ω is applied.
3) Modulation factor	80±7%	When load of 82Ω is applied.
4) VS/ratio	7 +0.25, −0	Input:Staircase wave 1Vp-p synchronous(−)
	3+0, −0.25	V/S=7/3
5) Amplitude freguency characteristics	+2, −3dB max.	Using 1MHz as a standard in the 0.5～5MHz range, measure at RF output using multiburst or sweep generator. Spectrum analyzer band is 300kHz.
6) Differential gain	±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 reguire correction.
7) Differential phase	±10° max.(36CH) ±15° max.(other ch)	Same as Para.6) above
8) Change in modulation factor to APL	±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

Item	Specified Value	Remarks
1) Input impedance	10kΩ min. unbalanced	Measure at 0.1～10kHz.
2) Input signal level	−5dBs	Referred to as sine wave 1.24Vp-p.
3) Amplitude freguency characteristics	+2, −3dB	Using 1kHz as a standard in the 100Hz～10kHz range, measure deviation from 50μS preemphasis characteristics theoretical value.
4) Modulation factor	G 100±24% I 100±28%	100%=±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 freguency	±250kHz max.	For test conditions, temperature shall be 25℃, and humidity 65% RH.
2) Audio freguency	G 5500kHz ±8kHz max. I 6000kHz ±8kHz max.	Same as above.
3) Video output level	72^{+4}_{-4}dBμ (36ch) 72±5dBμ (other ch)	p-p level(AT modulation):75Ω load
4) Audio output level difference (P/S ratio)	16±4dB 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±5dB max.	fp−5.5MHz, fp−6MHz
a) Specific frequency	40dB max.	G:fp+11MHz, fp+16.5MHz, 1/2fp, 1.5fp I:fp+12MHz, fp+18MHz, 1/2fp, 1.5fp (fp:video carrier freguency)
b) Other frequencies	42dB max.	Measure as per FTZ Regulations:0～1,000MHz, excluding the freguency 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	±12%	Measure at 0～60℃:Check for variation from initial value. 25℃ standard
2) Vidio carrier, temperature stability	±250kHz	Same as above
3) Audio modulation factorte, temperature stability	±10%	Same as above
4) Audio carrier, temperature stability	±15kHz	Same as above

Item	Specified Value	Remarks
5) Video output level temperature stability	±5dB	Measuru at 0~60℃:Check for variation from initial value. 25℃ standard.
6) Audio output level difference	±5dB	Same as above
7) Synchronous level, temperature stability	V/S=7±0.5/3±0.5	Same as above
8) Differential gain, temperature stability	±15% max.	Same as above

(5) Overall picture and total guality

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.)

(6) Power source

1) Input voltage : +B(MOD)DC 5±0.3V: +B(BT)DC33V~28V±0.3V
Alowable ripple voltage:10mVp-p max. +B(MOD)
: 5mVp-p max. +B(BT)

2) Current consumption : MOD: 85mA Max. TYP. 65mA

(7) Software information

The synthesizer is controlled via a two-wire I2C 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_{osc} = 512 x b11 + 256 x b10 + ... + b2 x 1 + 0.25 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	Balance test
1	0	0	F_{REF} out (if P0 = 0)
1	0	1	High impedance test
1	1	0	F_{DIV} out (if P0 = 0)
1	1	1	phase detector disabled, baseband signals on 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_{REF}" and "F_{DIV}" modes, the reference frequency F_{REF} in the phase comparator or the divided RF oscillator frequency F_{DIV} is available on the output port pin. This mode requires that the bit P0 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 P0, which controls the output port (pin 14) following table 6.

P0	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 P0 bit must be 0, to let the output port free.

5. RF Switch Portion

Item	Specified Value	Remarks
1) Insertion loss ANT IN→TV OUT	3dB Max.	Measure at 47~300MHz
Insersion loss ANT IN→TV OUT	5dB Max.	Measure at 470~870MHz
2) ANT IN terminal leakage voltage	44dBμ Max. (At 75Ω terminal)	at 75Ω terminal (other terminals)
3) VSWR		
a) ANT IN	4 max.	At 75Ω terminal(other terminals)
b) TV OUT	4 max.	At 75Ω terminal(other terminals)
4) Cross modulation ANT IN→TV OUT		MOD power source:OFF
a) f1=480MNz, f2=590MHz, f(IM2)=110MHz	55dB min.	f(IM2)=f2−f1 RF input level=100dBμ (At 75Ω terminal)
b) f1=480MHz, f2=590MHz, f(IM3)=700MHz	55dB min.	f(IM3)=2f2−f1 RF input level=100dBμ (At 75Ω 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. Durabitity 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 reguirements 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±5℃ and relative humidity at 90+0,−3%, for 96 hours,then left at nomal temperature and humidity for 90 minutes.The unit shall then operate normally without malfunction.

4) High temperature resistance

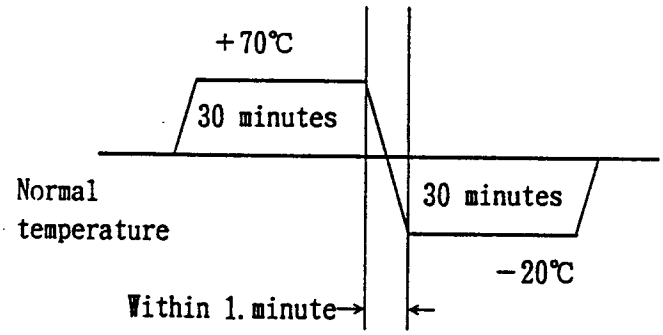
Test samples shall be left in a 70±2℃ bath for 98 hours, then at normal temperature and humidity for 90 minutes. The unit shall then operate normally without malfunction.

5) Low temperature resistance

Test samples shall be left in a −20±2℃ bath for 96hours, then at normal temperature and humidity for 90 minutes. The unit shall then operate nomally 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. Subseguent operation shall be trouble-free.



7. Operating Conditions

1) Operating guarantee Conditions
Operation shall be trouble-free nuder ±0~60℃ and 85% RH max.

2) Storage conditions
Temperature −10~70℃, humidity 90% RH max.

8. Electrostatic Test

Electrostatic test (15kV(+) and(−) polarities, 10 times each)shall be conducted on ANT IN and TV OUT terminals. Subseguent operation shall be troublefree. (C=200PF, R=500Ω)

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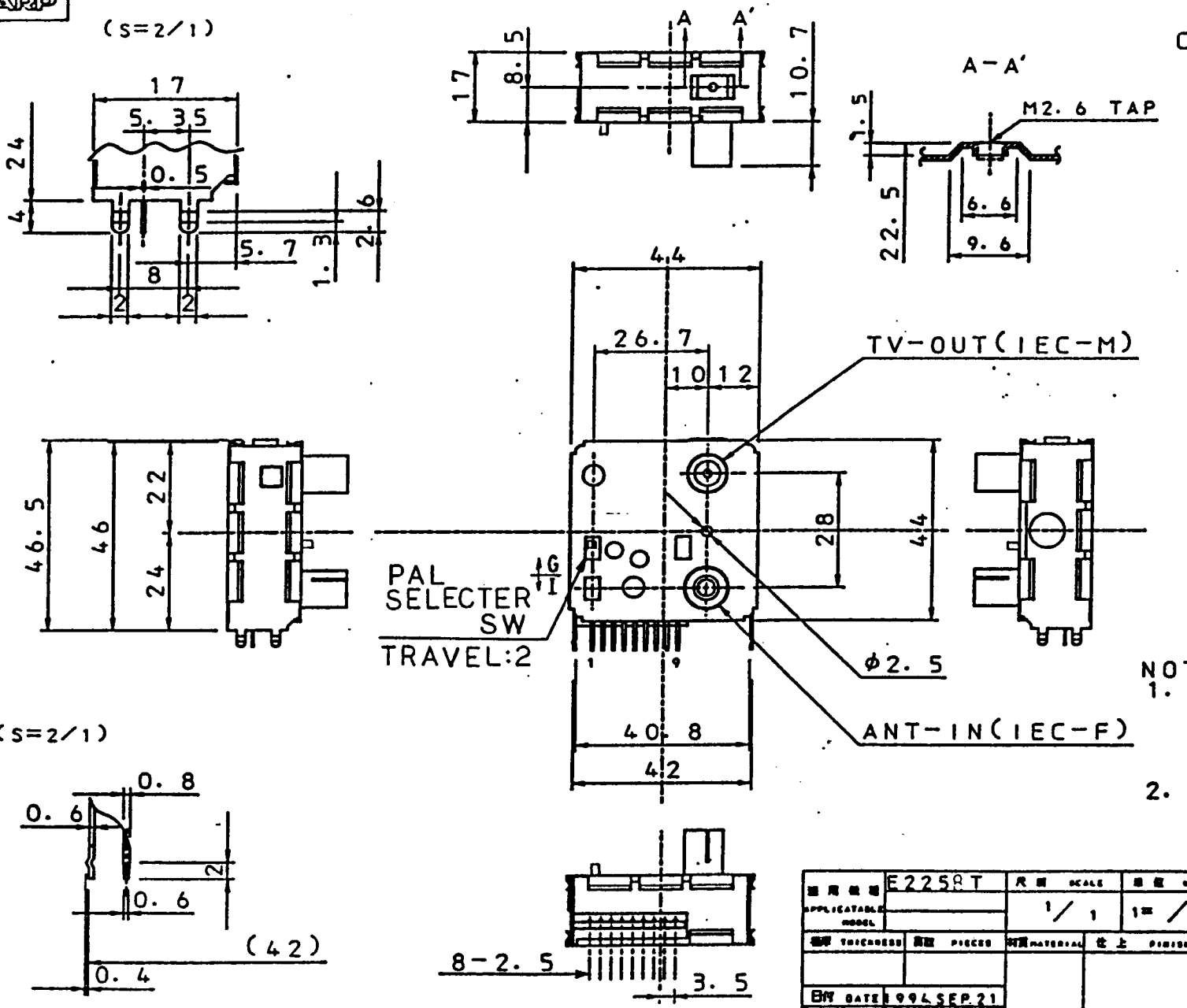

NOTE
1. TOLERANCE SHALL BE WITHIN ±0.5 UNLESS OTHERWISE SPECIFIED.
2. UNIT mm

APPLICABLE MODEL	E225RT	SCALE 1/1	UNIT 1= /
DATE 1994 SEP 21			NAME (PLL) RF MODULATOR
SHARP CORPORATION			CODE / DRAWING No.