HA11510NT

Channel Selector Interface

HA11510NT is a multifunctional IC developed for installation in the remote control channel selection systems of color televisions and video tape recorders. It includes tuner peripheral circuits and a remote control amplifier.

Functions

Tuner peripheral circuits

- 2-input, 4-output band switch
- On-chip +31V standard zener
- VT voltage pulse amplifier
- On-chip AFS switch

Power circuit

- On-chip +5V power supply for channel select microcomputer
- Channel select microcomputer and reset output
- Power supply relay control output

Channel select microcomputer peripheral circuits

- On-chip buffer amp for volume control
- On-chip waveform shaping circuit for AC timer

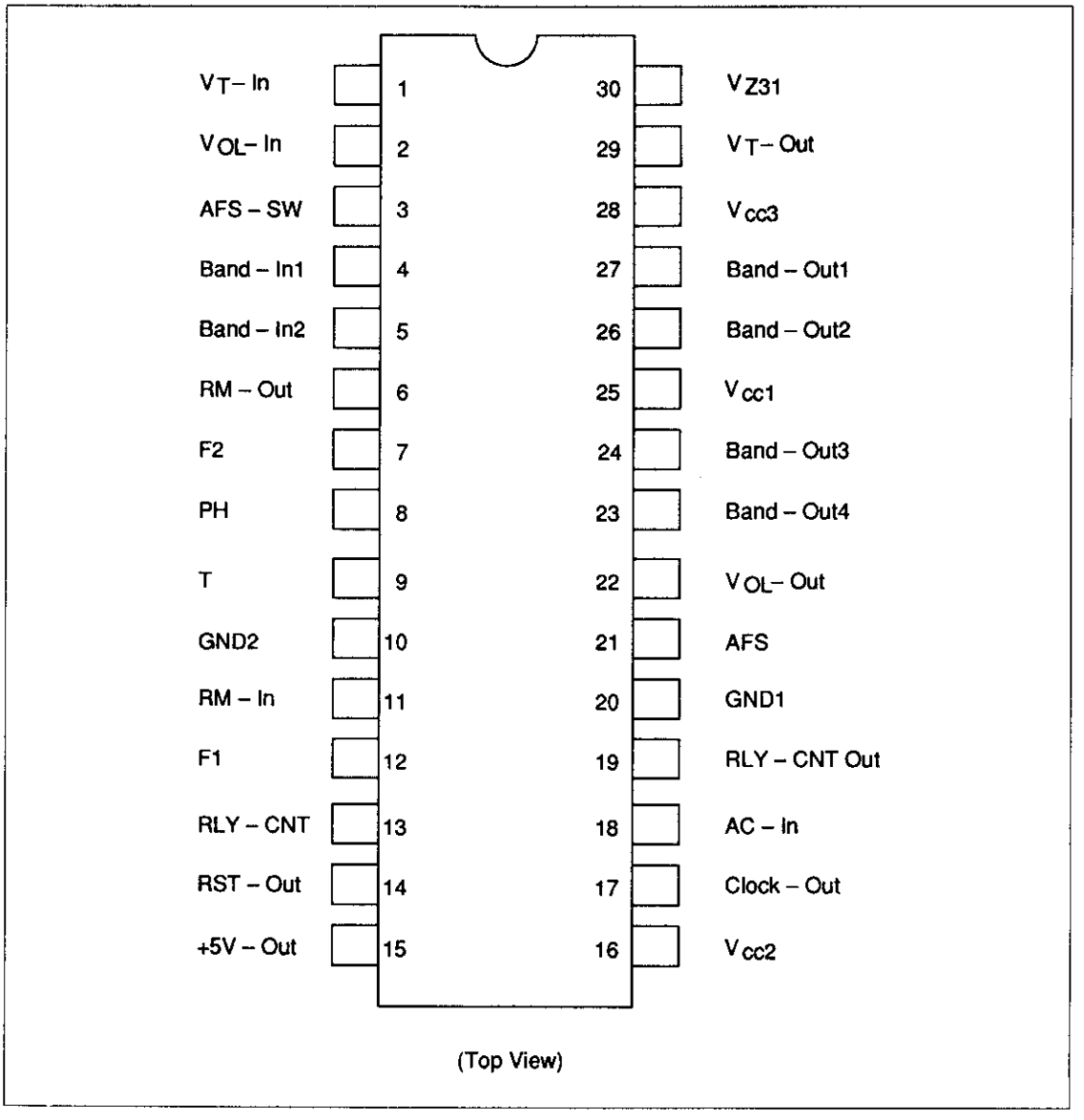
Remote control photo-receptor preamplifier section

- On-chip tuning amplifier
- On-chip peak detector waveform

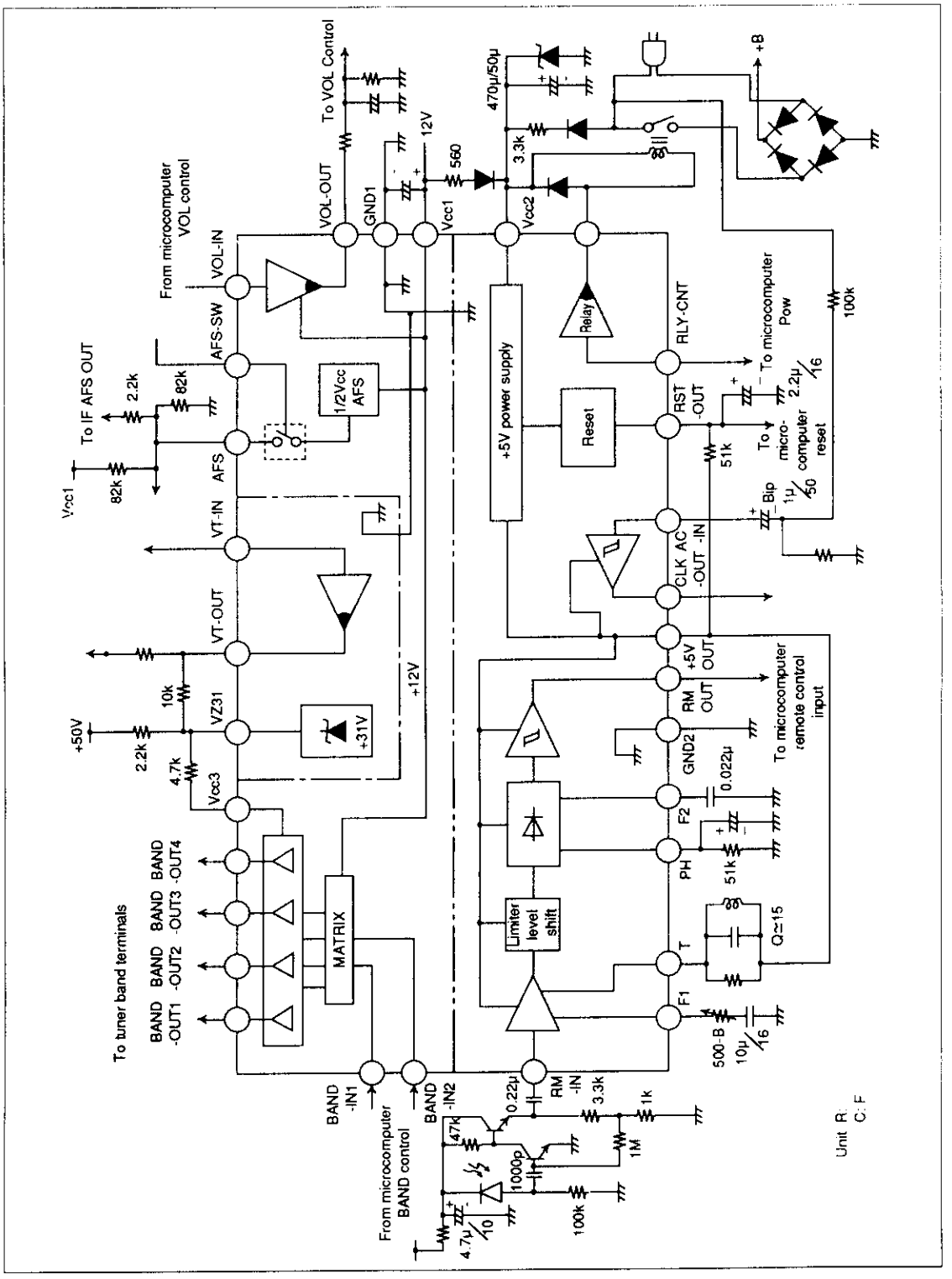
Features

- On on-chip preamplifier is included for the remote control photo-receptor. Using an external head amp for input eliminates the need for IC shielding.
- A volume control buffer employs push-pull output for easy setting of volume control characteristics.
- An on-chip AC powered waveform shaping hysteresis comparator is included for the timer.

Pin Arrangement



Block Diagram



Functional Description

Tuner / Channel Select Peripheral Circuits

Band Switch

HA11510NT features an on-chip 2-input, 4-output band switch. The following table shows the truth values for the band switch.

+31V Standard Zener

An on-chip standard zener generates tuning voltage for the tuner. The zener exhibits a temperature coefficient of ±3mV/°C at a current of I_Z = 4mA for high stability under temperature changes. Current should be limited by resistance so that this zener is used within the range of $I_Z \leq 8$mA.

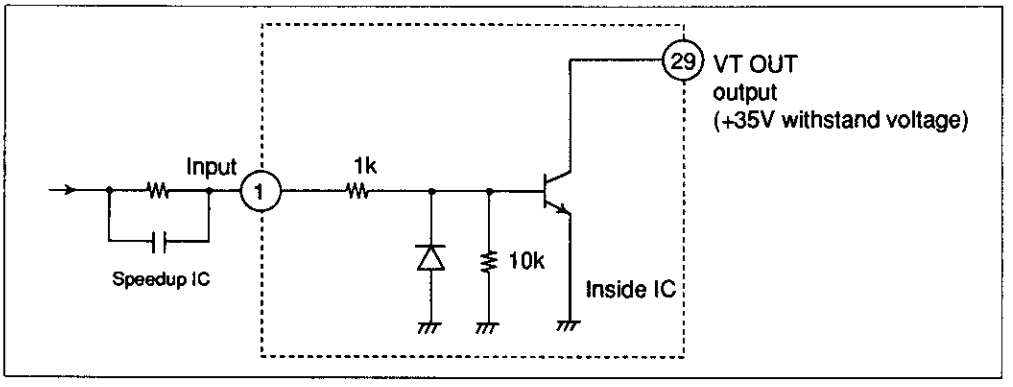
Pulse Amplifier for VT Voltage

This amplifier is an open collector inverter used to amplify the tuning pulse-duration modulation waveform from the channel select microcomputer. The following diagram illustrates the equivalent internal circuit.

• Truth Table

Input		Output			
1	2	1	2	3	4
Pin 4	Pin 5	Pin 27	Pin 26	Pin 24	Pin 23
L	L	H	Z	Z	Z
L	H	Z	H	Z	Z
H	L	Z	Z	H	Z
H	H	Z	Z	Z	H

(Z : high impedance)



Pulse Amplifier Equivalent Circuit

AFS Switch

This switch performs switching of the AFS signal line to a fixed 1/2 Vcc, in accordance with the control signal from the channel select microcomputer. Output impedance is low, and a ±2mA change in output current results in a change in output voltage of ±0.1V or less. This switch also provides stable operation under temperature changes. The following illustrates the block diagram of the AFS switch.

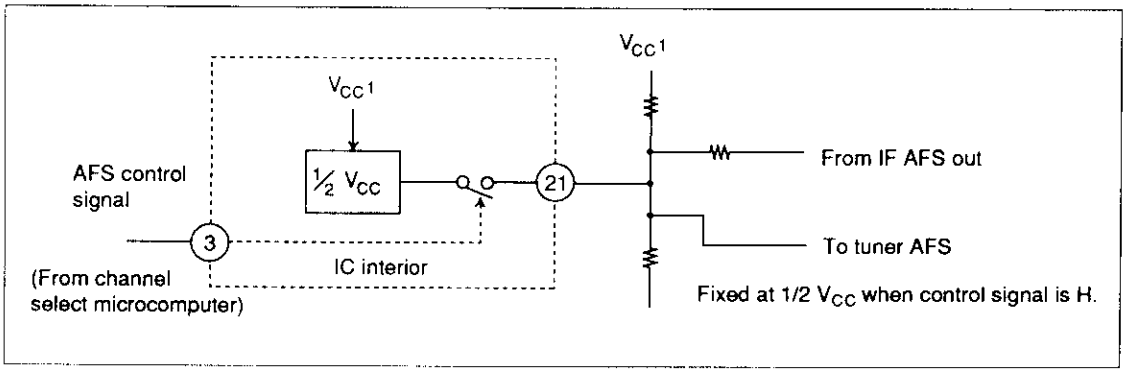
Power Circuit

+5V Power Supply (Pin 15)

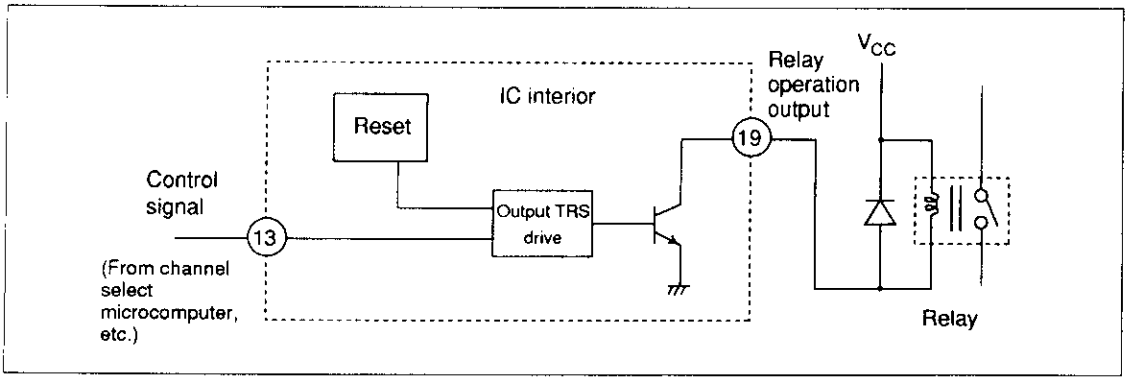
A stabilized on-chip +5V power supply provides power to the channel select microcomputer and its peripheral circuits. Current up to a Max. 25mA can be supplied, and this power is used for the on-chip AC timer waveform shaping circuit, relay control circuit, and remote control preamplifier.

Power Supply Relay Control Circuit

The power supply relay can be directly operated by the control signal from the channel select microcomputer. The open collector, NPN transistor at the output can operate up to a Typ 40mA (Max. 80mA) relay. The following is the block diagram of the power supply relay control circuit.



AFS Switch Block Diagram



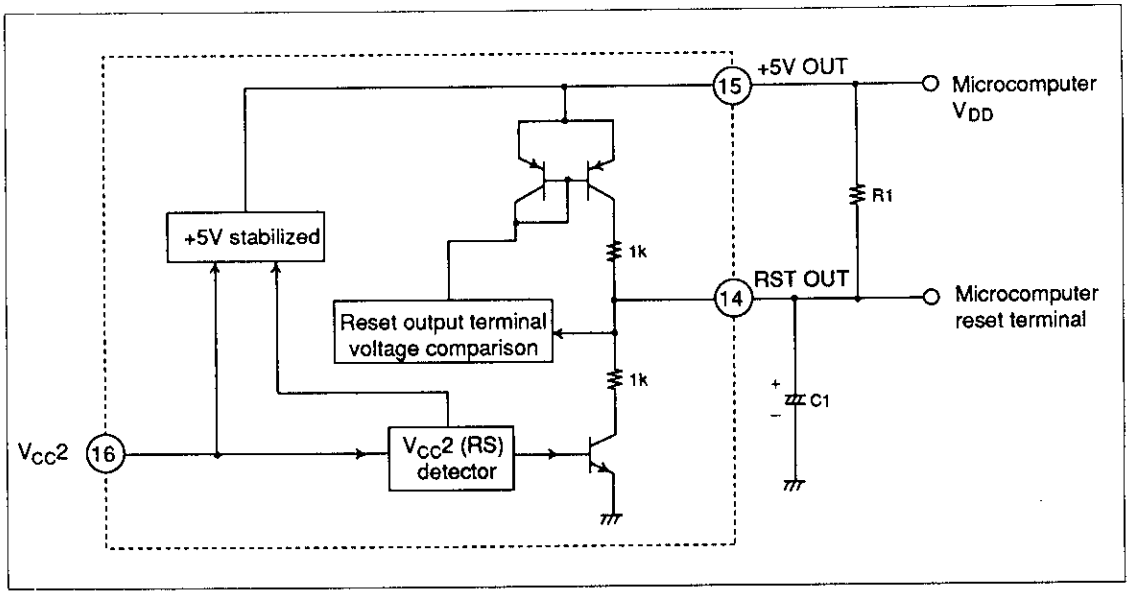
Power Supply Relay Control Circuit Block Diagram

Channel Select Microcomputer Reset Circuit

When power is switched ON (+5V stabilized supply V_{CC}), a channel select microcomputer reset output is generated. The reset output rise time can be controlled by the values of external capacitance C1 and resistance R1.

When power is switched ON, the reset output terminal (Pin 14) remains at the L level until $V_{CC}2$ rises to 6.5V (Typ). Once $V_{CC}2$ rises to 6.5V, the reset condition is released and charging starts to bring V_{DD} to a level of +5V in accordance with time constant τ of external capacitance C1 and resistance R1. Once the reset output terminal reaches the reset release threshold voltage of 3.15V (Typ), charging current is supplied from within the IC which makes the rise quicker, to stabilize within the range between 4.2V (Min) and V_{DD} (5V).

The following shows the block diagram for this circuit.

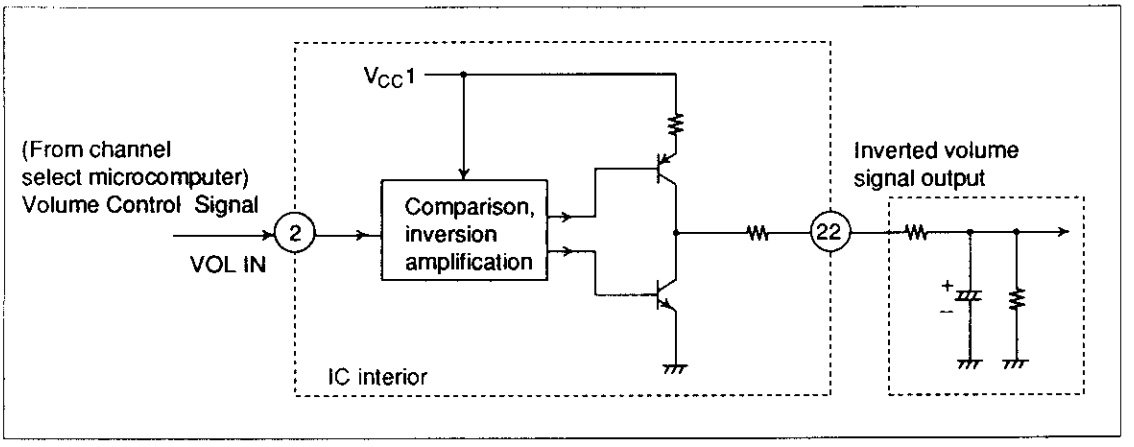


Reset Circuit Block Diagram

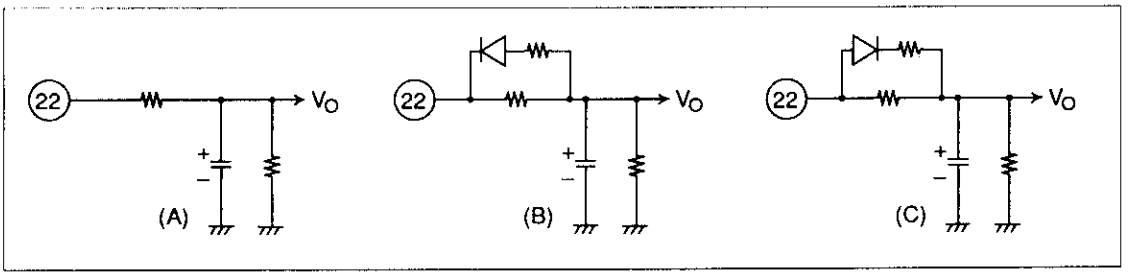
Channel Select Microcomputer Peripheral Circuits

Buffer Amplifier for Volume Control

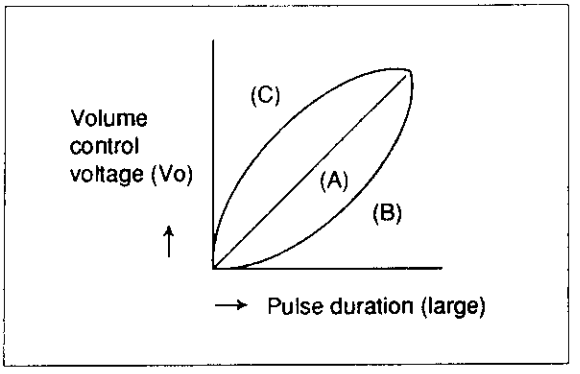
This inverting amplifier rectifies the volume control pulse-duration modulation signal from channel select microcomputer. A 5V input is converted to 12V (9V) and output. Push-pull output means that volume control characteristics can be set easily. The following shows the block diagram of this amplifier, along with a sample volume control voltage rectifier circuit.



Volume Control Buffer Amplifier Block Diagram



Sample Volume Control Voltage Rectifier Circuit



How the Rectifier Circuit Changes Volume Control Characteristics

Waveform Shaping Circuit for AC Timer

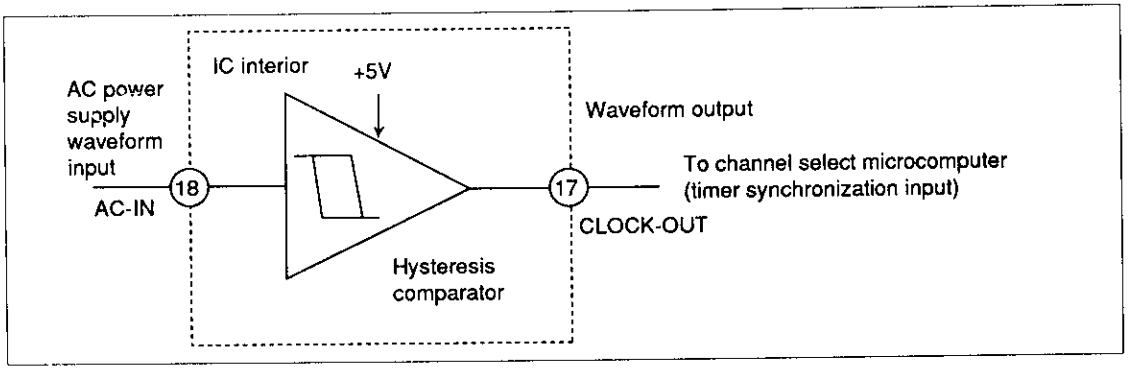
An on-chip hysteresis comparator reshapes the timer synchronizing wave from the AC power supply into a short waveform. This circuit has two threshold levels, H level and L level, and it performs the operation held by the hysteresis for a given input signal, so withstand voltage noise characteristics are outstanding.

Signals input to this circuits should be those whose amplitude and waveform do not vary depending on whether the power supply relay is ON or OFF. If a variable signal must be input, special attention must be paid to the input dynamic range (5V circuit), and the input signal must be set so that two threshold levels can be clearly cut even if a change occurs.

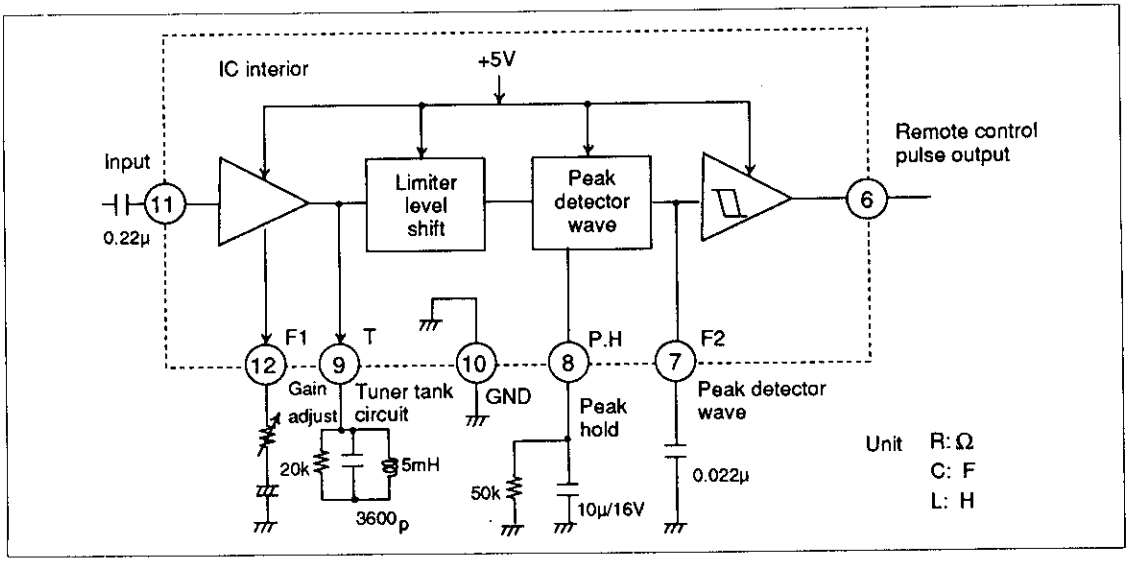
It should also be noted that since the circuit is operated by a +5V power supply, the output can be directly connected to the channel select microcomputer.

Remote Control Receive Preamplifier

A remove control receive preamplifier for remote control systems is include on chip. The circuit is configured of a primary tuning amplifier, a limiter, a peak detector, and a waveform shaping circuit. These elements are shown in the following block diagram.



AC Timer Waveform Shaping Circuit Block Diagram



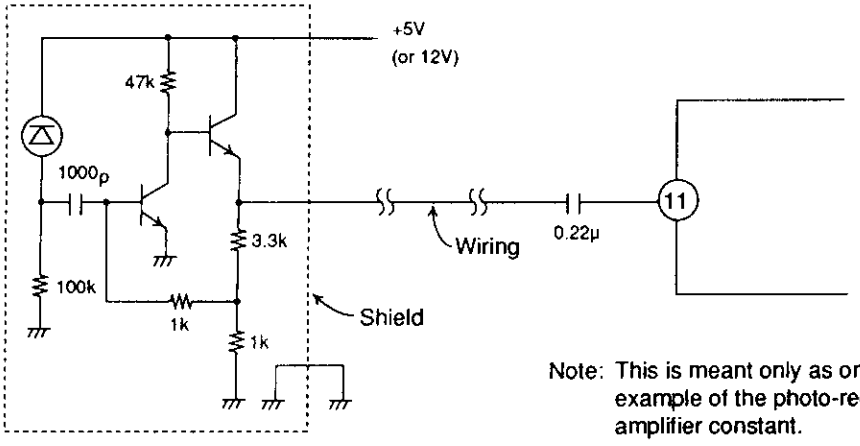
AC Timer Waveform Shaping Circuit Block Diagram

Adjustment of the preamplifier is performed at two points: adjustment of the primary tuning amplifier gain at Pin 12, and tuning of the synchronizing frequency using a coil connected externally at pin 9. The gain of the primary tuning amplifier (voltage gain of tank circuit Pin 9 output for input at Pin 11) can be amplified up to 66dB by a damping resistance of 20kΩ at Pin 9 and serial resistance of 10Ω at Pin 12. This value should be adjusted in accordance with the desired effective operational distance of the remote control unit.

HA11510NT's preamplifier has been designed assuming that a photo-receptor head amplifier will be used in the input stage, and so input impedance is relatively low at 22kΩ (Typ).

Note also that the preamplifier is designed to that the detector sensitivity varies with the input signal level (tank circuit output level). Detector sensitivity deteriorates as the input signal level becomes greater, while interference resistance characteristics improve while remote control code is being received. The detector sensitivity can be controlled at the Pin 8 peak hold terminal, and should normally be set at the recommended constant value.

Note as well that the remote control preamplifier circuit operates under the internal +5V power supply, so it can be connected directly to the channel change microcomputer remote control input.



Note: This is meant only as one possible example of the photo-receptor head amplifier constant.

Unit: R: Ω
C: F

Absolute Maximum Ratings (Ta = 25°C)

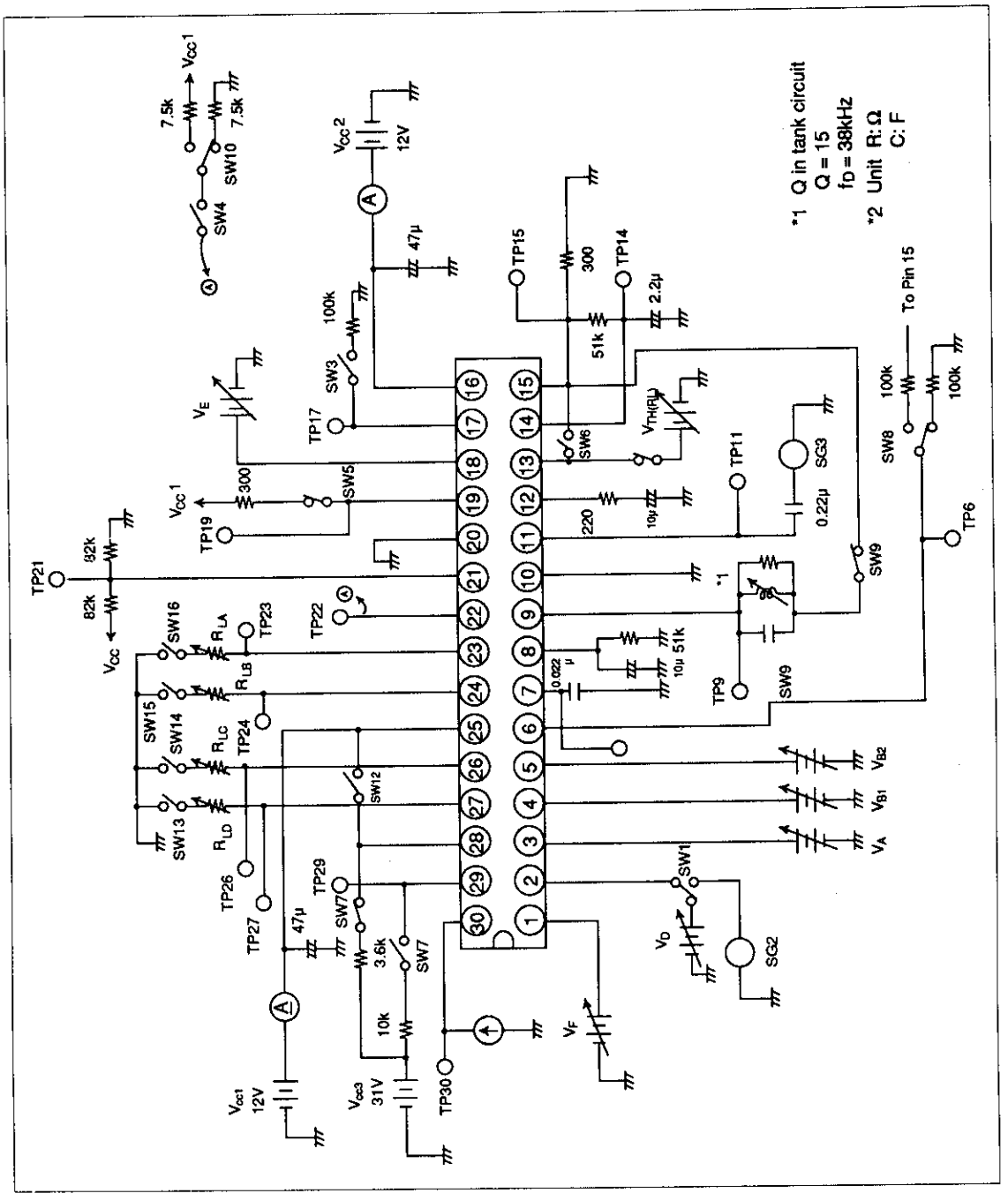
Item	Symbol	Rating	Unit
Supply voltage 1 *1	V_{CC}	15	V
Supply voltage 2 *2	V_{Z31}	35	V
Open collector applied voltage 1	V_{cop1}	−0.5 to 14.4	V
Open collector applied voltage 2	V_{cop2}	−0.5 to 35	V
31V Zener input current	Izmax	8	mA
BAND output current *3	I_O	60	mA
5V constant-voltage output current	I_O	−25	mA
Input terminal applied voltage *4	V_I	5.5	V
Open collector output current 1	I_{cop1}	80	mA
Open collector output current 2	I_{cop2}	20	mA
Power dissipation	P_T	850	mW
Operating temperature range	T_{opr}	−25 to +65	°C
Storage temperature	T_{stg}	−55 to +125	°C

Notes: *1: $V_{CC}1$, $V_{CC}2$, $V_{CC}3$
*2: Pin 30
*3: $I_{O1(B)}$, $I_{O2(B)}$, $I_{O3(B)}$, $I_{O4(B)}$
*4: $V_{I1(B)}$, $V_{I2(B)}$, $V_{I(A)}$, $V_{I(P)}$, $V_{I(RL)}$, $V_{I(RS)}$, $V_{I(T)}$

Electrical Characteristics (V_{CC} = 12V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Applicable Terminal
Operating supply voltage	V_{CC}	8	12	13	V	V_A=5V,V_D=5V	25
Operating supply current 1	I_{CC1}	7.0	11.0	15.0	mA		25
Operating supply current 2	I_{CC2}	23.5	29.0	34.5	mA		16
Band SW output voltage	$V_{OH(B)}$	11.4	11.8	–	V		23,24,26,27
Band SW input threshold voltage	$V_{TH(B)}$	0.8	2.4	3.0	V		4,5
AFS SW input threshold voltage	$V_{TH(A)}$	0.8	1.35	2.0	V		3
AFS SW output voltage	$V_{O(A)}$	5.7	6.0	6.3	V	V_A=5V	21
Volume control input threshold voltage	$V_{TH(V)}$	0.8	2.5	3.0	V		3
5V fixed voltage output	V_{O5}	4.5	5.0	5.5	V		15
Relay control input 1 threshold voltage	$V_{TR(RL)}$	0.8	1.3	3.0	V	SW5; ON	13
Reset release starting supply voltage	$V_{CC2(RS)}$	5.8	6.5	7.0	V	SW6; ON, SW2; OPEN	16
AC input terminal release voltage	V_{IN2}	2.1	2.5	2.9	V		18
Input signal high-threshold voltage	$\upsilon_{TH(H)}$	+0.25	+0.5	+0.75	V		18
Input signal low-threshold voltage	$\upsilon_{TH(L)}$	–0.65	–0.5	–0.35	V		18
31V zener voltage	V_Z	29	31	33	V	Iz=4mA	30
Pulse-amplifier input threshold voltage	$V_{TH(P)}$	0.3	0.82	1.5	V	SW7; ON	1
Remote control input terminal input impedance	γ_{in1}	15	22	30	kΩ	f_0=38kHz Q=15	11
Remote control preamplifier primary voltage gain	$A_{\upsilon L}$	–	36	–	dB	f_0=38kHz Q=15	9
Remote control detector sensitivity	υ_{in}	100	210	350	mV		9
Remote control output pulse duration	t_{RP}	560	620	700	µs		6

Test Circuit



Input/Output Interface