A. General Description —

The HT–1315 is a presettable electronic timer to control the power ON/OFF of electrical devices such as Christmas lights, electric fans, mosquito repellers, relays etc. Seven presettable time intervals are available and three different kinds of trigger source can be selected by the user. The HT–1315 has two outputs, a TRIAC driving output and an output for driving a relay or an LED. It is fabricated on a single LSI chip using Holtek's LOVAG process technology.

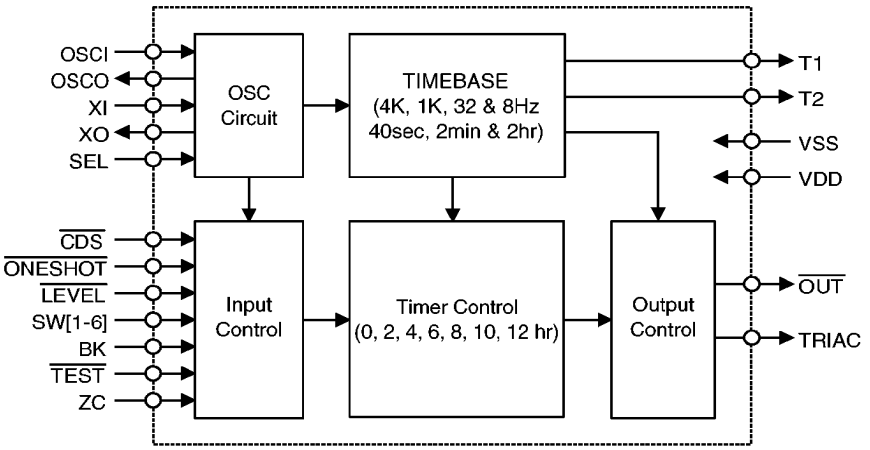
Initially, the HT–1315 stays idle, both outputs $\overline{OUT}$ and TRIAC being inactive, and waits a trigger from an external source. Once a trigger is received, the HT–1315 will reset the timer and activate the output $\overline{OUT}$ and TRIAC, driving the relay and TRIAC respectively. The HT–1315 will go back to it's idle state after a presettable timer intervals has been reached. The interval is determined by pins SW1~6.

The HT–1315 also has a Mask between-trigger-time to define the duration of off time between two effective trigger source. The duration is configured by pin BK.

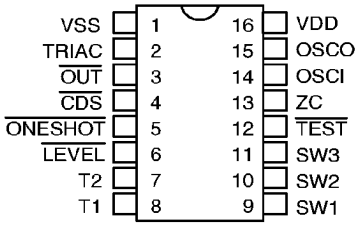
B. Features —

- Operating voltage: 3V~5V
- Uses RC oscillator or Crystal oscillator
- Oscillator frequency: 32KHz (R=560K)
- Seven time intervals: 0, 2, 4, 6, 8, 10, 12hr
- 3 kinds of trigger:
  - * Level hold: connect $\overline{LEVEL}$ pin to VSS
  - * Single shot: inputs a negative pulse at $\overline{ONESHOT}$ pin, the width of pulse is 60ms
  - * CDS: photo-resistor $\overline{CDS}$ unlighted for 20 second
- Uses external RC to implement power on trigger on $\overline{ONESHOT}$ pin
- 2 values of Mask between-trigger-time: 6 and 12 hours-sets
- Any trigger activated will reset timer
- Two outputs: TRIAC, $\overline{OUT}$

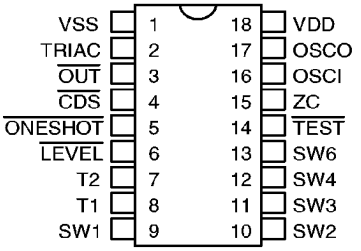
C. System Block Diagram —



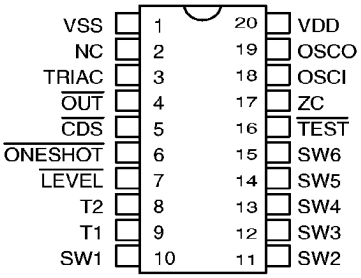
D. Pin Assignment —



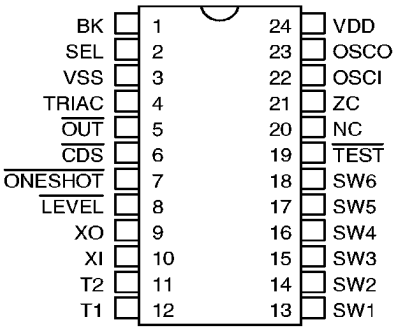
16 DIP



18 DIP

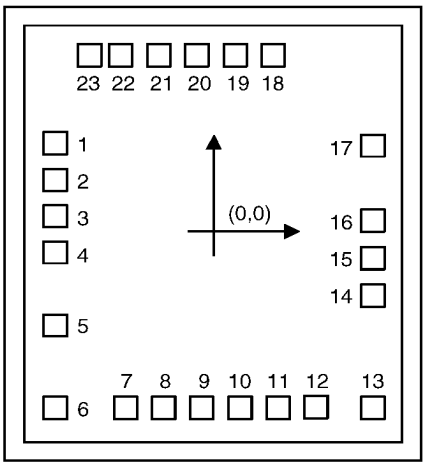


20 DIP/SOP



24 DIP/SOP/SKINNY

E. Pad Assignment & Position —



Chip size: 94 × 107 (mil)^2

Unit: mil

Pad No.	Symbol	X	Y	Pad No.	Symbol	X	Y
1	SW4	–41.0	23.8	13	$\overline{OUT}$	41.0	–47.6
2	SW5	–41.0	13.9	14	$\overline{CDS}$	41.0	–17.3
3	SW6	–41.0	4.1	15	$\overline{ONESHOT}$	41.0	–7.2
4	$\overline{TEST}$	–41.0	–5.7	16	$\overline{LEVEL}$	41.0	2.9
5	ZC	–41.0	–25.4	17	XO	41.0	23.1
6	OSCI	–41.0	–47.6	18	XI	15.3	47.6
7	OSCO	–22.8	–47.6	19	T2	5.5	47.6
8	VDD	–13.0	–47.6	20	T1	–4.4	47.6
9	BK	–3.2	–47.6	21	SW1	–14.2	47.6
10	SEL	6.7	–47.6	22	SW2	–24.1	47.6
11	VSS	16.5	–47.6	23	SW3	–32.1	47.6
12	TRIAC	26.4	–47.6				

F. Absolute Maximum Ratings —

Parameter	Symbol	Minimum	Maximum	Unit
Supply Voltage	V_{DD}	–0.3	5.5	V
Input Voltage	V_I	VSS–0.3	VDD+0.3	V
Storage Temperature	T_{STG}	–50	125	°C
Operating Temperature	T_{OP}	–20	70	°C

G. D.C. Characteristics —

Ta=25°C

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_{DD}	Operating voltage	VDD	Condition	3	—	5	V
I_{DD}	Operating current	3V	No Load, Crystal f_{SYS}=32KHz	—	8	10	μA
		3V	No Load, R=560KΩ f_{SYS}=32KHz	—	25	—	μA
		5V		—	50	—	μA
I_{STDBY}	Stand_by current	3V	—	—	—	1	μA
		5V		—	—	2	μA
I_{OH1}	$\overline{OUT}$ output drive current	3V	V_{OL}=2.7V	–0.3	–0.6	—	mA
		5V	V_{OL}=4.5V	–0.7	–1.2	—	mA
I_{OL1}	$\overline{OUT}$ output sink current	3V	V_{OL}=0.3V	0.9	2.1	—	mA
		5V	V_{OL}=0.5V	2.3	5.1	—	mA
I_{OH2}	TRIAC output drive current	3V	V_{OL}=2.7V	–0.6	–1.0	—	mA
		5V	V_{OL}=4.5V	–1.1	–2.0	—	mA
I_{OL2}	TRIAC output sink current	3V	V_{OL}=0.3V	1.5	3.1	—	mA
		5V	V_{OL}=0.5V	3.5	7.0	—	mA
R_{PH1}	Pull–high resistance	—	BK, SEL	32	43	100	kΩ
		—	$\overline{ONESHOT}$, $\overline{LEVEL}$, SW[1-6]	100	370	1000	kΩ
V_{CDS}	$\overline{CDS}$ threshold voltage	—	—	—	1/2V_{DD}	—	V

H. A.C. Characteristics —

Ta=25°C

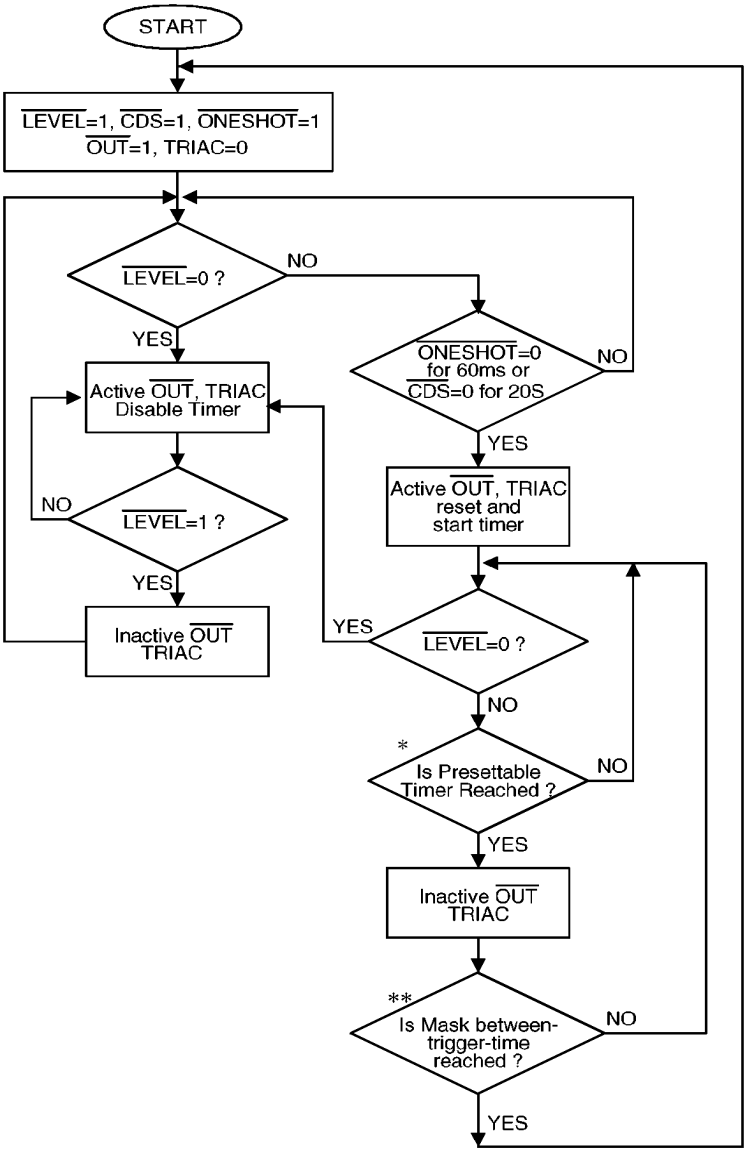
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
f_{SYS}	System clock	RC R=560KΩ	—	32	—	KHz
		Crystal Oscillator	—	32	—	KHz
t_{DEB}	Debounce time of $\overline{ONESHOT}$	f_{SYS}=32KHz	—	60	—	ms
t_{CDS}	Unlighted time for $\overline{CDS}$	f_{SYS}=32KHz	—	20	—	S

I. Pad Description —

Pad No.	Symbol	I/O	Function
21~23 1~3	SW1~3 SW4~6	I	These inputs pin are used to configure the presettable time intervals of the HT–1315. Seven time intervals are available (0, 2, 4, 6, 8, 10, 12hr) and can be reconfigured at any time except Mask between-trigger-time. Internal pull-high.
4	$\overline{TEST}$	I	For test mode selection pin. Internal pull-high.
5	ZC	I	This pin is an AC input pin to synchronize the output trigger pulses from the TRIAC pin with an AC source. There are internal clamping diode to protect the input pin.
7 6	OSCO OSCI	O I	For RC oscillator input and output. If crystal oscillator is configured, OSCI is connected to VDD.
8	VDD	I	For positive power supply.
9	BK	I	This pin is used to configure the Mask between-trigger-time of HT–1315. Two durations are available (Hi for 6hr, Low for 12hr) and can be reconfigured at any time. Internal pull-low.

Pad No.	Symbol	I/O	Function
10	SEL	I	This pin is used to decide whether the RC or crystal oscillator is in operation. (Hi for crystal, Low for RC). Internal pull-low.
11	VSS	I	For negative power supply.
12	TRIAC	O	This is an AC output pin which used to produce a positive trigger pulse, synchronized with an AC source to drive the TRIAC. In the idle state this pin is low.
13	$\overline{\text{OUT}}$	O	This is an DC output pin to drive the relay or LED. The pin is active low.
14	$\overline{\text{CDS}}$	I	For CDS sensor trigger input the unlighted time should be beyond 20s. If the CDS trigger input is not used the pin should be connected to VDD.
15	$\overline{\text{ONESHOT}}$	I	For single shot trigger input the debounce time should be beyond 60ms. Internal pull-high.
16	$\overline{\text{LEVEL}}$	I	For level hold trigger input. Internal pull-high.
17 18	XO XI	O I	For crystal oscillator input and output. Both SEL and OSCI are connected to VDD.
19,20	T2,T1	O	For test mode output pins.

J. Flowchart —



* Presettable time is defined by SW1~6.
** Mask between-trigger-time is configured by BK. (Hi for 6hr, Low for 12hr)

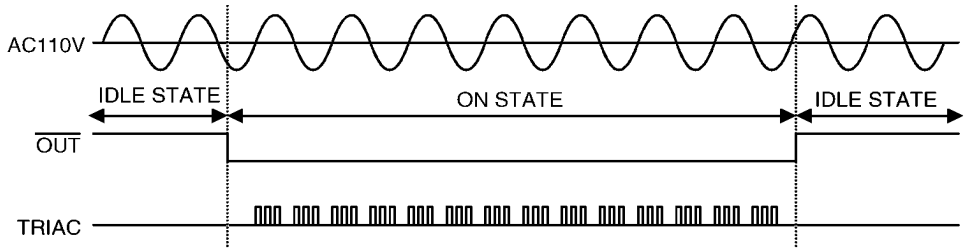
K. Functional Description —

The HT–1315 is an interval timer which counts a fixed period, whose time is determined by the condition of the external lines SW1~6. The HT–1315 has seven time intervals from 0~12 hours programmable (0, 2, 4, 6, 8, 10, 12hrs) by the inputs SW1~6. The user can configure the SW1~6 at any time except the Mask between-trigger-time. During the Mask between-trigger-time, any configuration [except OFF configuration] of SW1~6 has no effect on HT–1315. The following table shows the inputs and the corresponding hour setting.

SW1	SW2	SW3	SW4	SW5	SW6	Hours Setting
X	X	X	X	X	X	0 hour (OFF)
0	X	X	X	X	X	2 hours
X	0	X	X	X	X	4 hours
X	X	0	X	X	X	6 hours
X	X	X	0	X	X	8 hours
X	X	X	X	0	X	10 hours
X	X	X	X	X	0	12 hours

Note: The X represents open and all SW pins are internally pulled high.

There are 2 outputs both simultaneously active during this fixed period. One line named TRIAC can deliver three positive trigger pulses, synchronised to the 110V 60Hz supply, directly to an external TRIAC. The other line $\overline{OUT}$ is a logic out line to drive a relay or other circuitry. In the inactive state $\overline{OUT}$ will be high and TRIAC will be low. The outputs will be inactive at power on reset or OFF configuration of SW1~6. The following graph shows the timing signals.



The trigger source to the HT-1315 can be any one of three inputs, a single-shot input $\overline{\text{ONESHOT}}$, a photoresistor $\overline{\text{CDS}}$ or the logic line $\overline{\text{LEVEL}}$. For the first two inputs described, once the trigger signal has been detected, the timer resets to zero and begins counting and simultaneously the two outputs become active. After the programmed time duration has been reached the device returns to the inactive state. The device can only become active again once the Mask between-trigger-time has been exceeded and another trigger signal has been received. Trigger signals received during this mask programmed time, fixed by the condition of the line BK, will have no effect. Note that the minimum debounce time of the $\overline{\text{ONESHOT}}$ input is 60ms and the unlighted period of $\overline{\text{CDS}}$ should be beyond 20 seconds for a suitable trigger signal. For the $\overline{\text{LEVEL}}$ line, if activated by pulling low, it will ignore the timer restriction and makes both outputs active. Allow it to return high again and the outputs return to their inactive state. The $\overline{\text{LEVEL}}$ line has priority over the other trigger lines. $\overline{\text{CDS}}$ or $\overline{\text{ONESHOT}}$ can trigger the HT–1315 by the following...

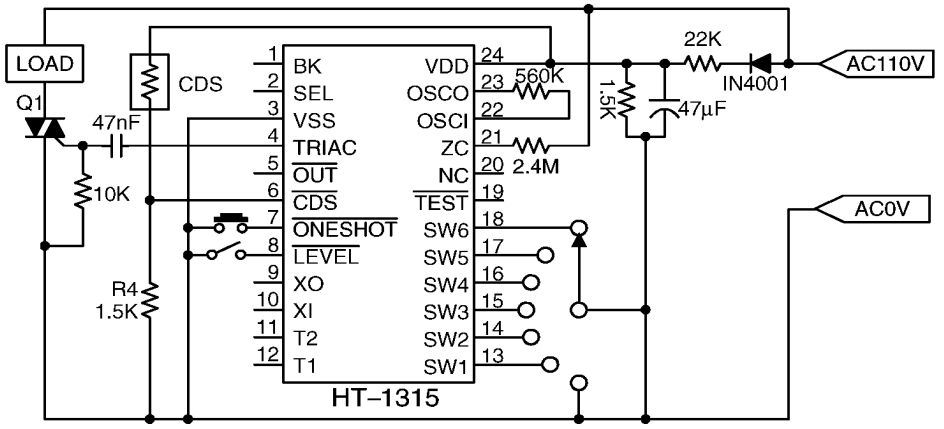
- Power on reset.
- After set SW[1~6] to OFF configuration.
- After a $\overline{\text{LEVEL}}$ trigger.
- After reaching the Mask between-trigger-time intervals.

The line BK is used to configure the Mask between-trigger-time which determines the duration of the between-trigger off time. During this duration, the HT–1315 takes no action on trigger signals from $\overline{\text{CDS}}$ or $\overline{\text{ONESHOT}}$. If BK is high this time is set to 6 hours, otherwise it will be fixed at 12 hours. The user can configure the BK pin at any time.

In the application diagram, pin ZC is connected to the AC line source by a resistor. It is used to synchronize the output TRIAC with the 60Hz AC source.

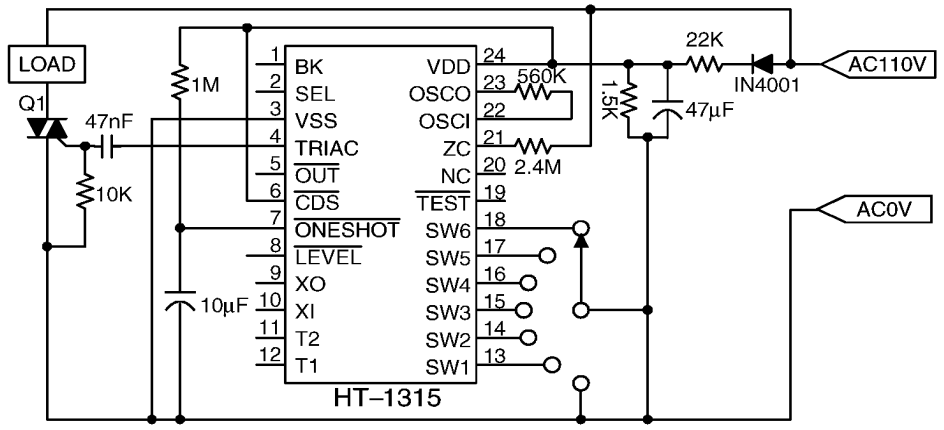
L. Application Diagram —

(1) Application for $\overline{\text{LEVEL}}$, $\overline{\text{ONESHOT}}$, and $\overline{\text{CDS}}$ trigger input with RC oscillator



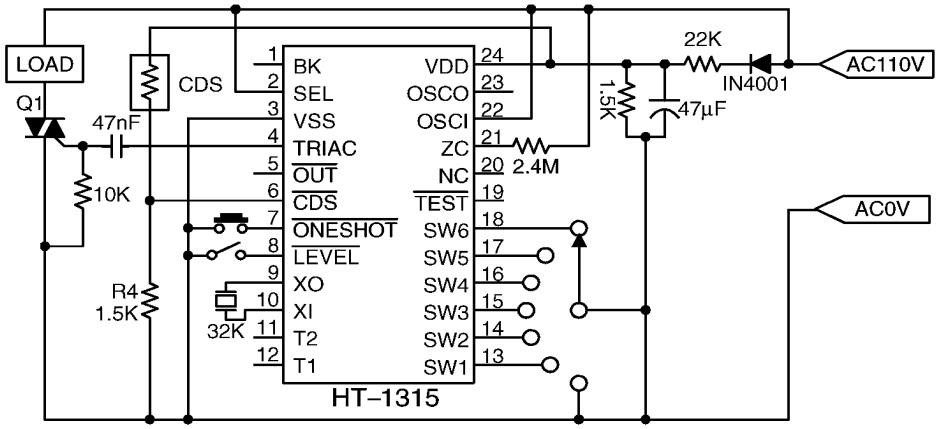
1. All resistors are 1/4W.
2. $\overline{\text{CDS}}$ sensitivity is adjusted by R4.

(2) Application for power on trigger with RC oscillator



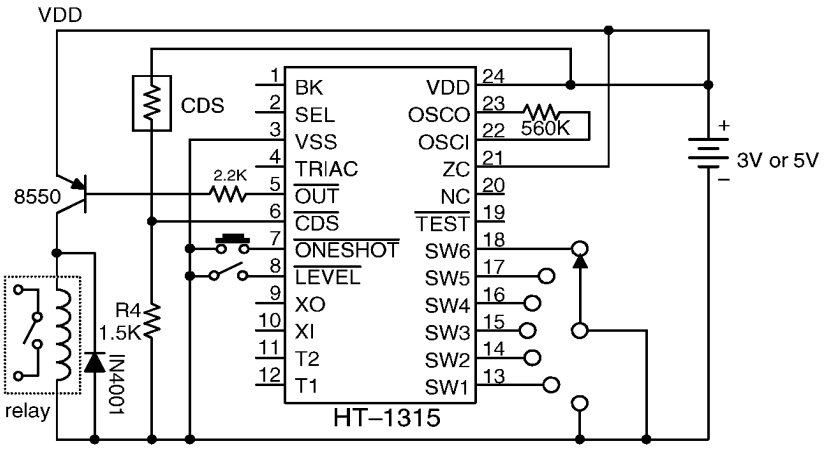
1. All resistors are 1/4W.

(3) Application for $\overline{\text{LEVEL}}$, $\overline{\text{ONESHOT}}$, and $\overline{\text{CDS}}$ trigger input with crystal oscillator



1. All resistors are 1/4W.
2. $\overline{\text{CDS}}$ sensitivity is adjusted by R4.

(4) Application for $\overline{\text{LEVEL}}$, $\overline{\text{ONESHOT}}$, and $\overline{\text{CDS}}$ trigger input to drive a relay with RC oscillator



1. All resistors are 1/4W.
2. $\overline{\text{CDS}}$ sensitivity is adjusted by R4.