Pericom Technology Inc.

Features

- 2-stage operational amplifier as filter
- Built-in noise rejection circuit
- On-chip regulator
- Override function by twice turn-off and -on of AC power
- 4s soft start and 1 minutes soft stop by three steps with 5 minutes hold time at $f_{OSCD} = 1Hz$
- 40 second warm-up
- Turn on 25% during night without motion
- Mode pin to set test mode, disable dimmer or auto mode
- Auto-reset if the ZC signal disappears over 3 seconds
- Quickly check mode for installation
- Synchronous with AC 220V/50Hz and 110V/60Hz
- Output pulse for triac drive and level for relay
- CDS to enable/disable output
- Adjustable output on time duration
- Operating voltage: 5V
- Average supply current: 80µA (Typ.)

Ordering Information

Part Number	Package
PT8A2612P	16 - Pin PDIP
PT8A2612W	16 - Pin SOP
PT8A2612DE	Die Form

General Description

The PT8A2612 is a CMOS LSI chip based on 260 base designed for use in automatic PIR lamp control. It can operate with a 2-wire configuration for triac applications with dimmer function or 3-wire configuration for RELAY application.

Its PIR sensor detects infrared power variations induced by the motion of a human body and transforms it to a voltage variation. If the PIR output voltage variation conforms to the criteria (refer to the functional description), the lamp can softly turn on as the below order, 25% lighteness, 50%, 75% 100% as well as turn off as reverse order with an adjustable duration.

The PT8A2612 offers three operating modes (TEST, AUTO, disable dimmer) which can be set through the MODE pin. While the chip is working in the AUTO mode the user can override it and switches to the quickly check mode, or manual ON mode, or return to the AUTO mode by switching the power switch.

Applications

- Energy saving auto-switch in Garden, kitchen, bathroom, corridor, storage, and yard
- Auto light in Meeting-room

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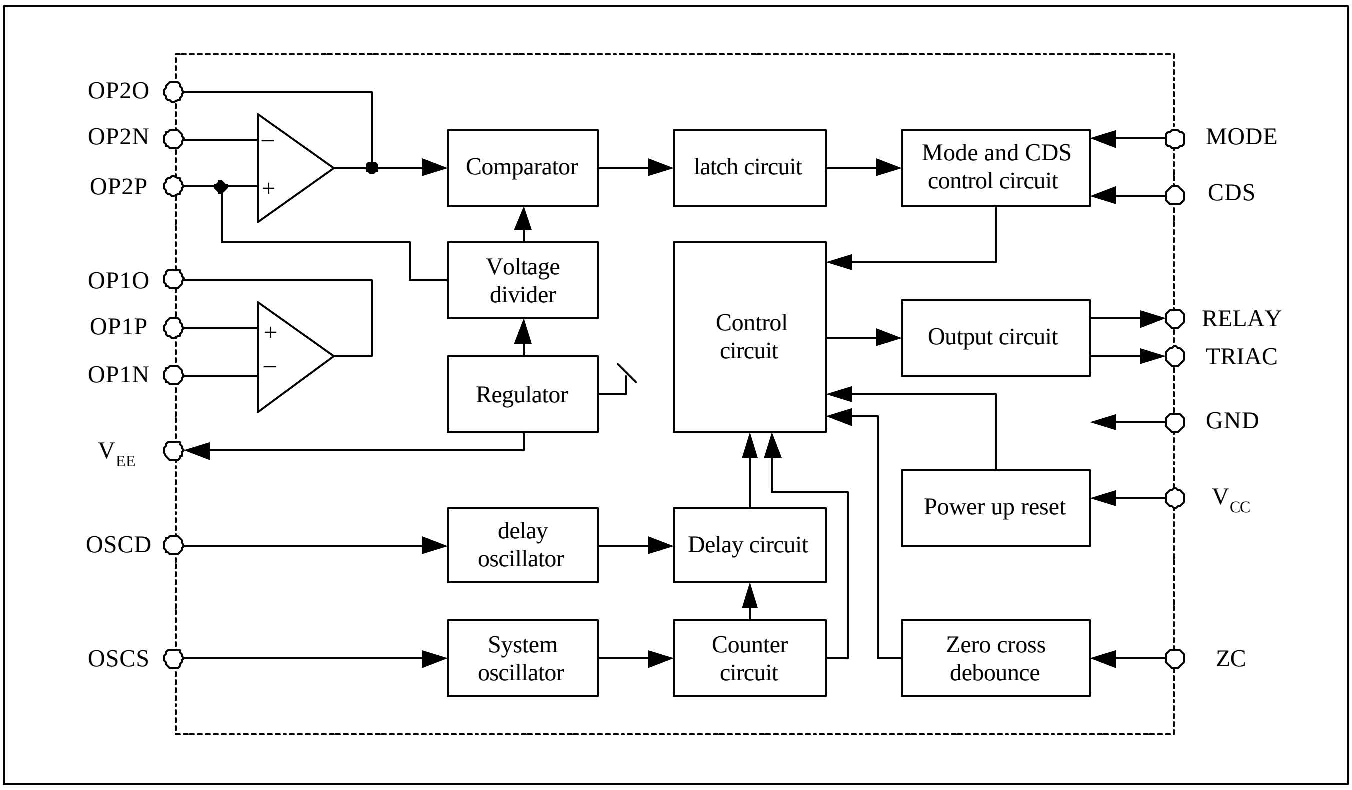
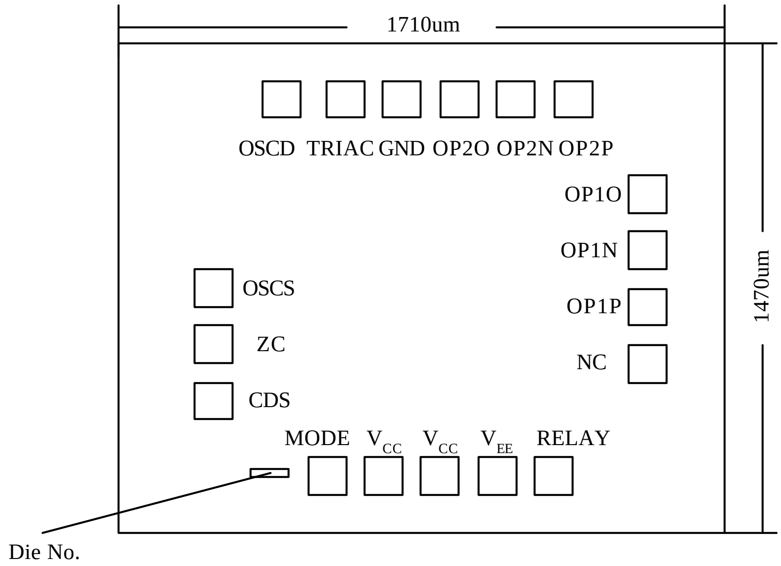
Block Diagram



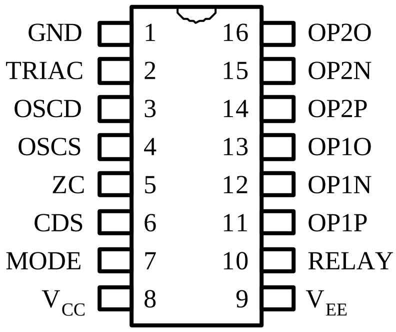
Pad Location



Pad Coordinate					
Pad Name	**X Coordinate**	**Y Coordinate**	**Pad Name**	**X Coordinate**	**Y Coordinate**
GND	-65.4	570	V_{EE}	268.6	-570
TRIAC	-232.4	570	RELAY	435.6	-570
OSCD	-399.4	570	NC	--	--
OSCS	-689.2	-44.8	OP1P	687.2	-30.1
ZC	-689.2	-211.8	OP1N	687.2	136.9
CDS	-689.2	-378.8	OP1O	687.2	303.9
MODE	-232.4	-570	OP2P	435.6	570
V_{CC}	-101.6	-570	OP2N	268.6	570
V_{CC}	65.4	-570	OP2O	101.6	570
Note: Substrate is connected to GND					

Pin Assignment

PT8A2612P/W



Top view

Pin Description

Pin No.	Pin/Pad Name	Type	Description
1	GND	Ground	Ground
2	TRIAC	O	**TRIAC drive output**: active negative pulse
3	OSCD	I/O	**Output timi**ng oscillator I/O: connected to an external RC to adjust output duration
4	OSCS	I/O	**System oscillator I/O**: connected to an external RC to set the system frequency. The system frequency = 16kHz for normal application
5	ZC	I	Schmitt input for AC zero crossing detection
6	CDS	I	Analog Schmitt, connected to a CDS voltage divider for daytime/night auto-detection. Low input to this pin can disable PIR input. CDS is a schmitt trigger input with 5-second input debounce time.
7	MODE	I/O	**Operating mode selection input:** V_{CC}: TEST mode for customer to quickly check function GND: disable dimmer function Open: Auto detection, MODE is square wave with 31.25Hz
8	V_{CC}	Power	Power supply
9	V_{EE}	O	**Internal voltage regulator output:** 3.6V with respect to ground. Connected to the drain of PIR sensor
10	RELAY	O	**RELAY driver output**, active high
11	OP1P	I	Non-inverted input of first operational amplifier, connected directly to source of PIR sensor
12	OP1N	I	Inverted input of first operational amplifier
13	OP1O	O	Output of first operational amplifier
14	OP2P	I	Non-inverted input of second operational amplifier, internal 1.8V default
15	OP2N	I	Inverted input of second operational amplifier
16	OP2O	O	Output of second operational amplifier

Functional Description

CDS

CDS	Status	CDS_EN
LOW	Day Time	inactive
HIGH	Night	active

Power On Initial

The PIR signal amplifier requires a warm up period after power-on. The input should be disabled during this period, meanwhile, TRIAC and RELAY output will hold on in order to indicator system has been power on.

In the AUTO mode within the first 10 seconds of power-on initialization, the chip allows override control to enter the quickly check mode. After 40 seconds of the initial time the chip allows override control between ON and AUTO. It will remain in the warm up period if the total initial time has not elapsed after returning to AUTO.

In case that the ZC signal disappears more than 3 seconds, the chip will restart the initialization operation.

MODE

The operation modes of PT8A2612 is shown in the following table.

Override function

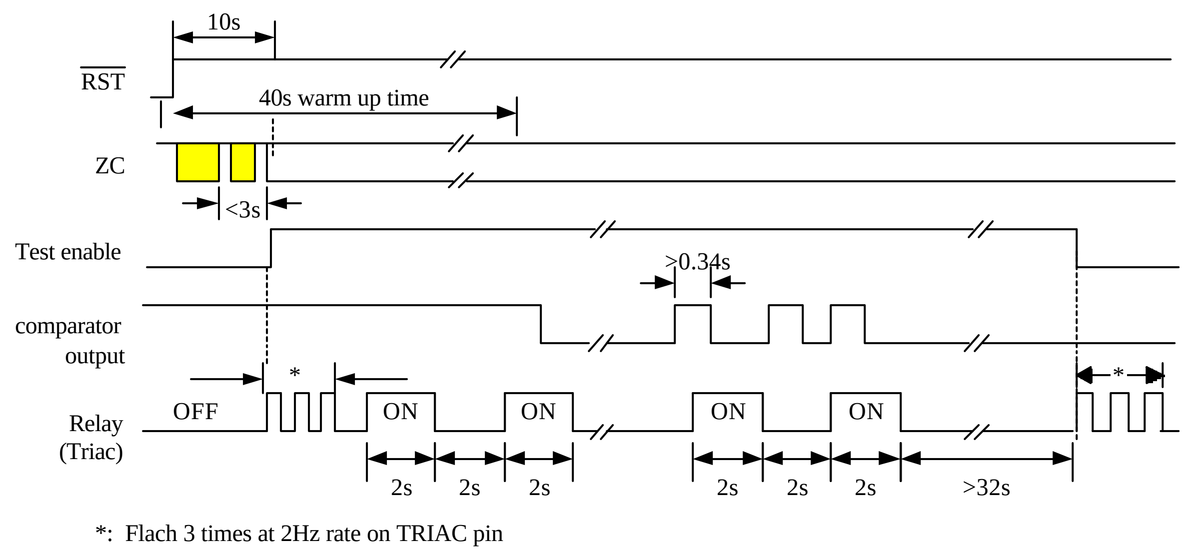
By effective ZC signal switching (switch OFF/ON twice within 3 seconds), the chip provides the following additional functions:

Quick check mode: Within 10 seconds after power-on, effective ZC switching will force the chip to enter the quickly check mode. During the mode, the outputs will be active for duration of 2 seconds each time a valid PIR trigger signal is received. If a time interval exceeds 32 seconds without a valid trigger input, the chip will return to the AUTO mode automatically.

MODE Operation

MODE status	Operating Mode	Functions
V_{CC}	TEST mode	TRIAC pulse train output will turn on 2 seconds once detecting an active motion
GND	DIMMER disable	Remove the dimmer function. In case that the chip allows override control by switching the ZC signal.
Open	AUTO	TRIAC output can soft start when activated by a valid PIR input trigger signal. TRIAC output can also soft stop when timing is elapsing. When working in the AUTO mode, the chip allows override control by switching the ZC signal too.

Figure 1. Quick Check Mode



Override control: When working in the AUTO mode (MODE = open), the output is activated by a valid PIR signal and the output active duration is relied on the OSCD oscillating period. Lamp can be switched always to "ON" from the AUTO mode by switching the ZC signal through an OFF/ON operation of the power switch (OFF/ON twice within 3 seconds). The term "override" refers to the change of operating mode by switching the power switch. The chip can be toggled from ON to AUTO by an override operation. Shows as figure 2.

The PT8A2612 will flash on TRIAC output pin when changing the operating mode. It will flash 3 times at a 1Hz rate each time the chip changes from the AUTO mode to another mode or flash 3 times at a 2Hz rate when returning to the AUTO mode. However, if the AUTO mode is changed by switching the MODE switch output will not flash.

25% Lighteness Function

In auto mode, when CDS is high (night), turn on 25% lighteness until receiving an active PIR signal.

Dimmer Function

Dimmer function includes soft start and soft stop function, soft start means lamp increases the lighteness in terms of four steps, 25%, 50%, 75%, 100%. Reversely, soft stop decreases the lighteness as reverse order (Figure 3).

Dimmer operation varies from the position of the retrigger point (Figure 4).

Supposing ZC is fixed, the dimmer function can be obtained by increasing/decreasing the phase difference between the positive edge of ZC and TRIAC (Figure 5).

The trigger points, in other words, the phase difference, are 7.2ms, 6.2ms, 4.7ms, 1.2ms in terms of 25%, 50%, 75%, 100%, respectively. But there may be about 20% error in the power accuracy of each step due to the system oscillator and 50/60Hz AC line.

Figure 2. Override control

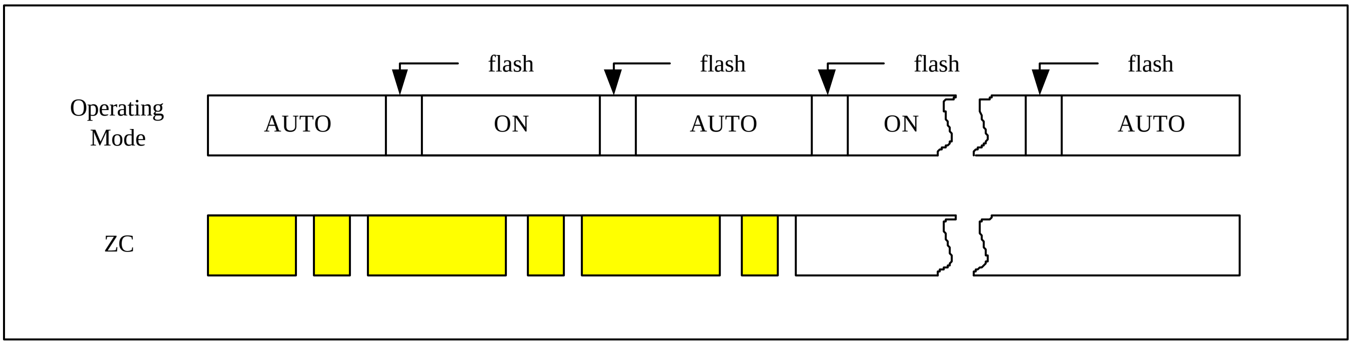


Figure 3. Dimmer Process

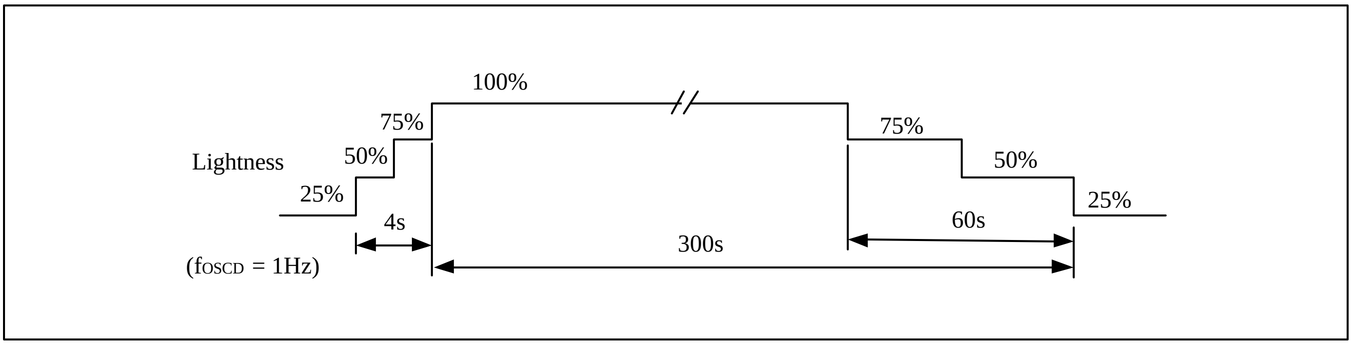


Figure 4. Dimmer operation in various retrigger point

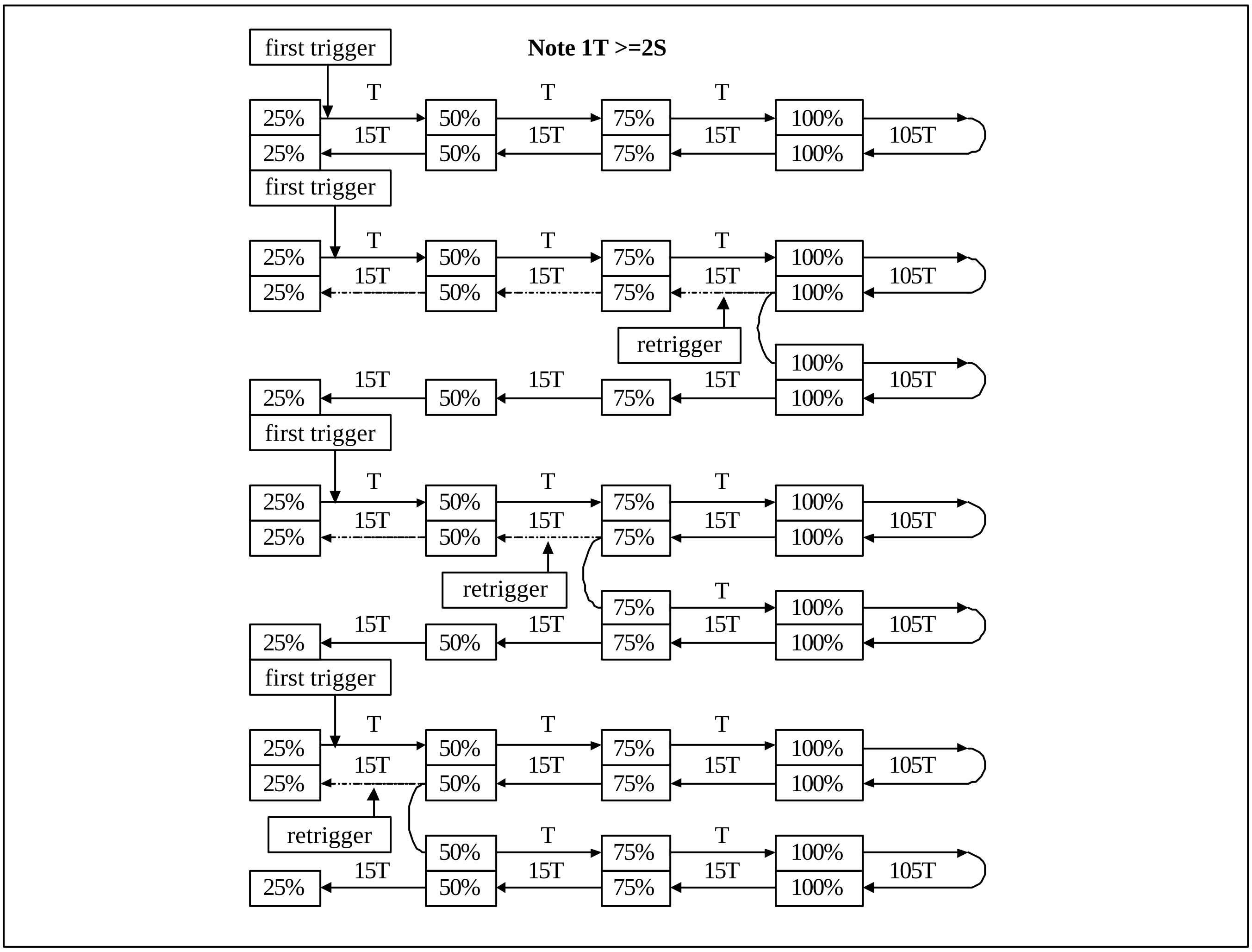


Figure 5. Principle illustration about soft start and soft stop

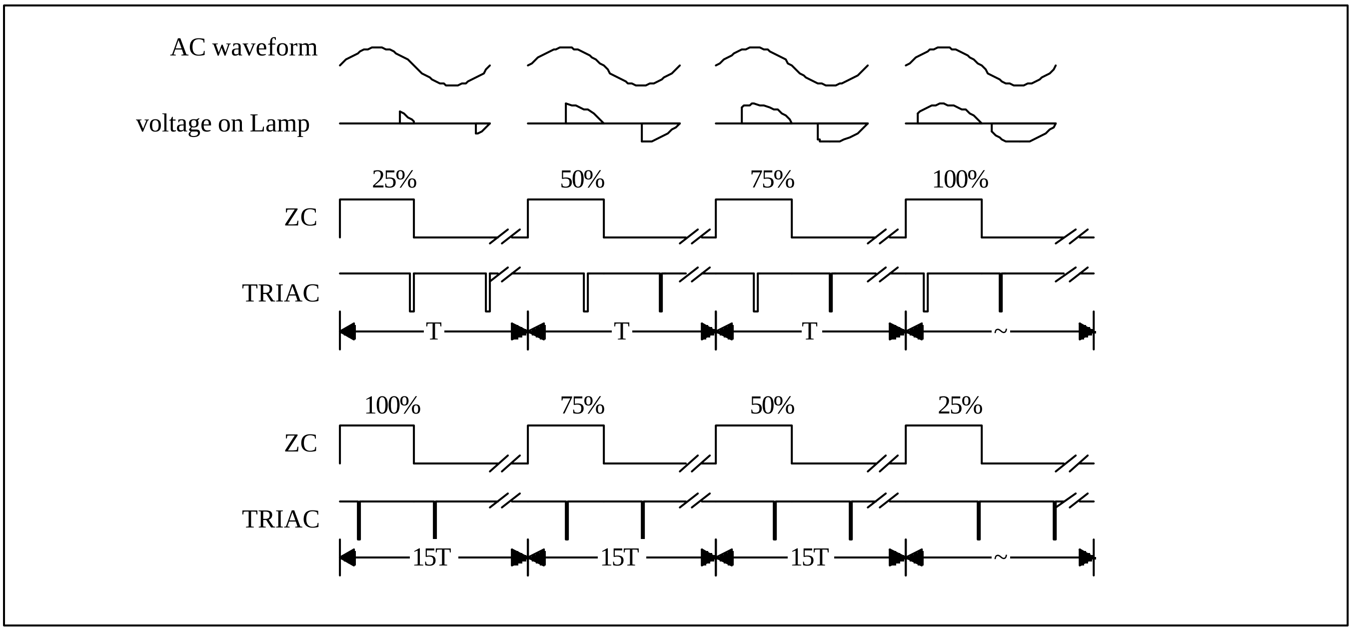
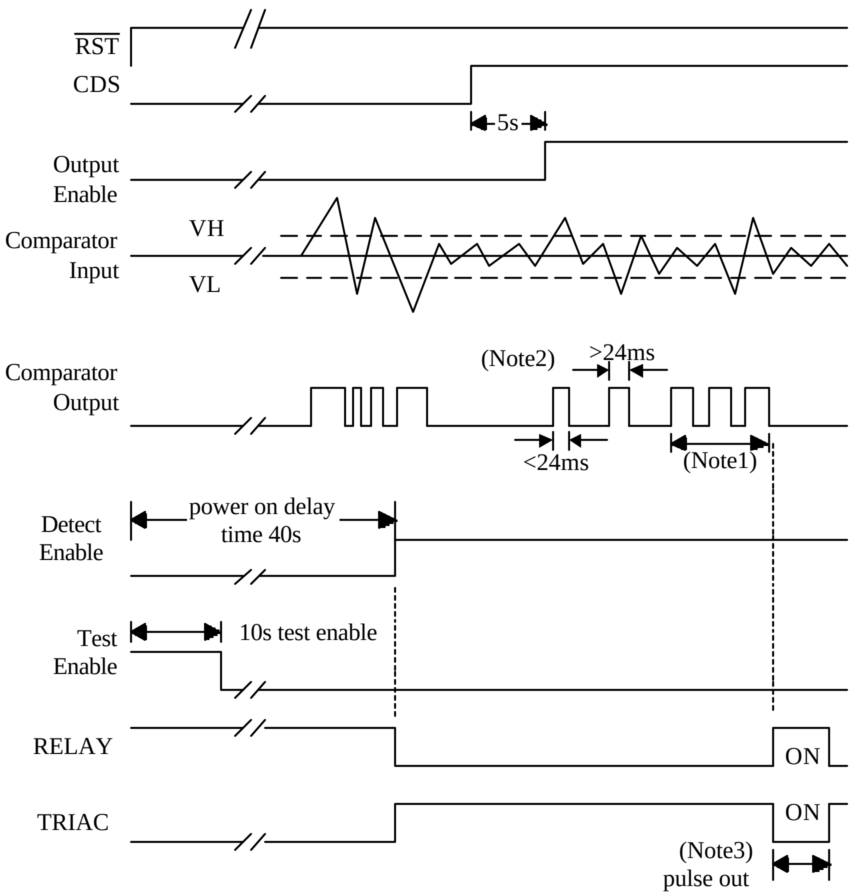


Figure 6. Trigger Timing



Notes: 1. The output is activated if the trigger signal conforms to the following criteria:
- More than 3 trigger pulses within 2 seconds.
- A trigger signal sustains duration 0.34 seconds.
- 2 trigger signals within 2 seconds with one of the trigger signal sustain 0.16 seconds.

2. The effective comparator output width can be selected to be 24ms or 32ms or 48ms by mask option. The default is 24ms (system frequency=16KHz).
3. The output duration is set by an external RC that is connected to the OSCD pin.

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested)

Storage Temperature	-40°C to +125°C
Supply Voltage to Ground Potential (Inputs & V_{CC} Only)	-0.3 to +6.0V
Supply Voltage to Ground Potential (Outputs & D/O Only)	-0.3 to +6.0V
DC Input Voltage	-0.3 to +6.0V
DC Output Current	20mA
Power Dissipation	500mW

Note:
Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operation Conditions

Sym	Description	Test Conditions	Min	Typ	Max	Units
V_{CC}	Supply Voltage	-	4.75	5.0	6.0	V
V_{IH}	Input HIGH Voltage	-	$0.8V_{CC}$	-	-	V
V_{IL}	Input LOW Voltage	-	-	-	$0.2V_{CC}$	V
f_{SYS}	System Oscillator Frequency	V_{CC} = 5V, R_S = 680k, C_S = 200p	12.8	16	21	kHz
T_A	Operation Temperature	-	-25	25	70	^oC

DC Electrical Characteristics

Sym	Description	Test Conditions	Min	Typ	Max	Units
I_{IH}	Input high leakage current (ZC, CDS)	V_{IH} = 4.5V	-1	-	1	µA
	Input high leakage current (OSCD, OSCS)		-	-	500	µA
I_{IL}	Input low leakage current (ZC, CDS, OSCD, OSCS)	V_{IL} = 0.5V	-1	-	1	µA
I_{OH}	OUTPUT Source Current (TRIAC, RELAY)	V_{OH} = 4.5V	-6	-	-	mA
I_{OL}	OUTPUT Sink Current (TRIAC, RELAY)	V_{OL} = 0.5V	15	-	-	mA
V_{TH1}	"H" Transfer Voltage (CDS)	-	3.0	3.2	3.6	V
V_{TL1}	"L" Transfer Voltage (CDS)	-	1.5	1.7	2.1	V
V_{TH2}	"H" Transfer Voltage (ZC)	-	2.6	2.9	3.2	V
V_{TL2}	"L" Transfer Voltage (ZC)	-	1.0	1.4	1.6	V
V_{TH3}	"H" Transfer Voltage (OSCS)	-	2.2	2.4	2.8	V
V_{TL3}	"L" Transfer Voltage (OSCS)	-	1.0	1.4	1.6	V
V_{TH4}	"H" Transfer Voltage (OSCD)	-	2.2	2.4	2.8	V
V_{TL4}	"L" Transfer Voltage (OSCD)	-	0.4	0.6	0.8	V
ΔVT1	Hysteresis voltage (CDS)	-	0.9	-	-	V
ΔVT2	Hysteresis voltage (ZC)	-	1.0	-	-	V

Note: These specifications apply for V_{CC} = 5.0V and $-25^oC \le T_A \le 70^oC$, unless otherwise specified.

AC Electrical Characteristics

Voltage Regulator

Sym	Description	Test Conditions	Min	Typ	Max	Units
V_{EE}	Regulator Output Voltage	No load	3.2	3.6	4.0	V
V_{OP2P}	Noninverting input of OP2	No load	1.6	1.8	2.0	V
ΔV_O	Line Regulation	$4.5V \le V_{CC} \le 5.5V$, I_L = 1mA	-	30	50	mV
ΔV_{LDR}	Load Regulation	V_{CC} = 5V, $0.5mA \le I_L \le 2mA$	-	60	100	mV
I_L	Regulator Output Current	V_{CC} = 5V	4	-	-	mA

Operational Amplifier and Window Comparator

Sym	Description	Test Conditions	Min	Typ	Max	Units
BW	3dB Bandwidth	-	10	-	-	kHz
V_{TH}	Windows Comparator Threshold	V_{CC} = 5V	1.9	2.05	2.2	V
V_{TL}		V_{CC} = 5V	1.4	1.55	1.7	V

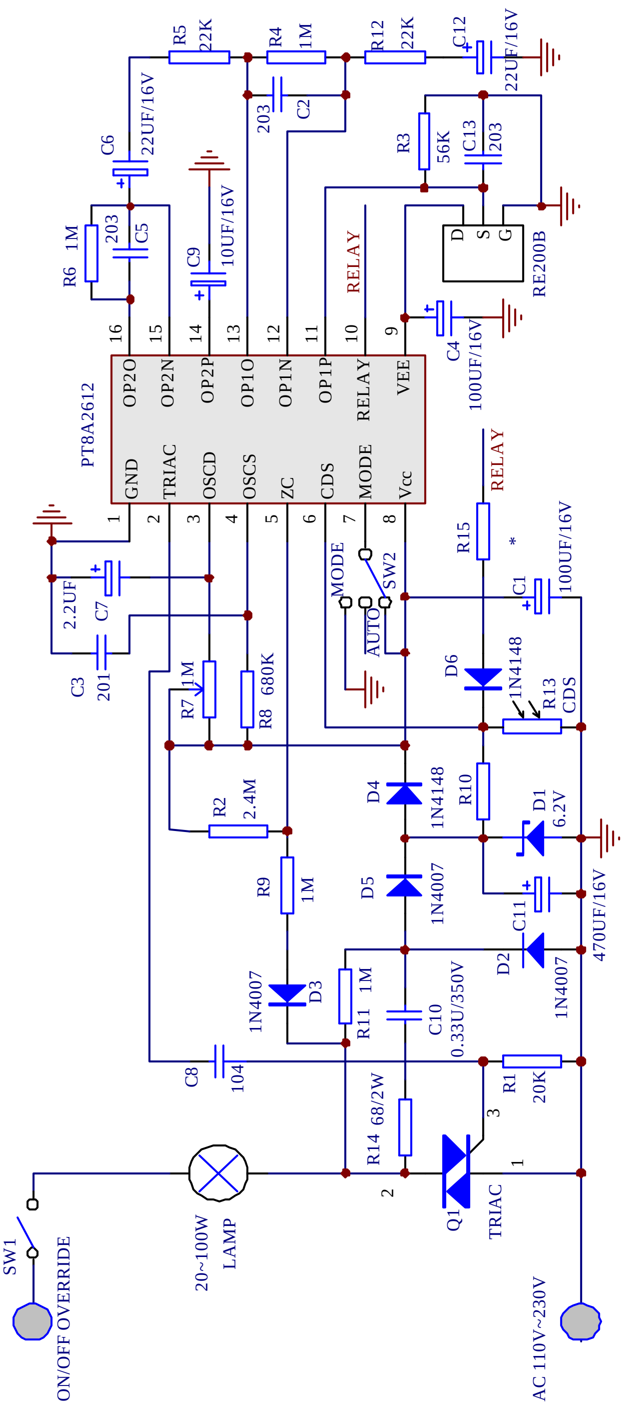
Oscillator and ZC Input Pulse and Trigger Output Pulse

Sym	Description	Test Conditions	Min	Typ	Max	Units
F_{OSCS}	Oscillator frequency	V_{CC} = 5V, R_S = 680k, C_S = 200p	12.8	16	19.2	kHz
T_{ZR}	ZC pulse rise time		-	30	100	ns
T_{ZF}	ZC pulse fall time		-	30	100	ns
T_{ZP}	ZC pulse period		15.1	20	22.2	ms
T_{ZW}	ZC pulse width		0.8	1	-	ms
T_{OR}	TRIAC pulse rise time		-	30	100	ns
T_{OF}	TRIAC pulse fall time		-	30	100	ns
T_{OP}	TRIAC pulse period		6.6	10	11	ms
T_{OW}	TRIAC pulse width		52	62.5	76	µs

Power Dissipation

Sym	Description	Test Conditions	Min	Typ	Max	Units
I_{CC}	Power Supply Current	V_{CC} = 5V, other input pins = GND, all outputs float	-	80	100	µA
I_{CCQ}	Quiescent power supply current	V_{CC} = 5V, All Input Pins = GND, all output float	-	60	80	µA

Application of PT8A2612



Note:

1. Adjust R10 and R15 to fit various CDS.
2. Change R7,C7 to obtain the desired adjusting range of output duration.
3. Change the value of C10 to 0.15uf/600V for AC 220V application.
4. Twice turn-off and -on forces system into override state.
5. * means the values need to be determined in real application.

Notes

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