

PHOTO CONTROLLED OUTDOOR LIGHTING WITH PROGRAMMABLE TIMER

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FEATURES:

- Input interface to a LDR or a photo transistor
- Programmable Duration Selection
- Shunt regulator
- 50Hz / 60Hz time base selection
- Relay Driver output
- 6.0V \pm 0.75V operating voltage range ($V_{DD} - V_{SS}$)
- LS7217 (DIP), LS7217-S (SOIC) – See Figure 1

APPLICATIONS

Lighting control for outdoor area lighting, street lighting, parking lot lighting, billboards lighting

DESCRIPTION

The 7217 is a programmable Timer IC designed to turn on a relay at night and turn off the relay at dawn or after a selectable number of hours. Figure 2 shows a typical application schematic.

PIN DESCRIPTION:

The following describes the operation of the inputs and outputs of the IC.

V_{DD} (Pin 2)

V_{DD} is the supply voltage positive terminal. It is regulated internally in the IC. The internal voltage regulator produces 6.0V \pm 0.75V.

V_{SS} (Pin 6)

V_{SS} is the supply voltage negative terminal.

50Hz / 60Hz SELECT Input (Pin 8)

A **high** at this input selects the correct timing for 50Hz operation. **Floating** this input selects the correct timing for 60Hz operation. A **low** at this input places the LS7217 into **Test Mode** where the timeouts are accelerated by a factor of 60.

50Hz / 60Hz Input (Pin 7)

This input is the clock source for all timing functions. This input has a Schmitt trigger to ensure a clean internal clock waveform.

TIME SELECT Inputs TS1, TS2 (Pins 4, 5)

The two Select inputs determine the time duration that the Relay output stays on after the photo input goes low. Both inputs have internal pull-down transistors so that float is logic zero and connection to V_{DD} is logic 1.

PIN ASSIGNMENT

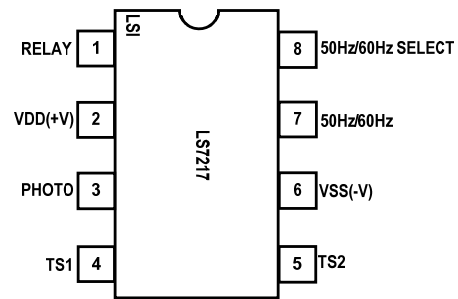


FIGURE 1

The Time Select Table is as follows:

<u>TS1</u>	<u>TS2</u>	<u>Time Duration</u>
0	0	4 Hours
0	1	6 Hours
1	0	8 Hours
1	1	Dusk-to-Dawn

Dusk-to-Dawn duration is determined solely by the photo-cell; i.e., the Relay output is on whenever the photocell recognizes an ambient dark condition.

PHOTO Input (Pin 3)

The photo input has hysteresis for a positive trip point. The input will work with a Light Dependent Resistor (LDR) or a photo-transistor connected between the input and V_{DD} . The photo device has low impedance in the presence of ambient light and high impedance in the presence of ambient darkness.

The IC is configured so that the detection of a **light condition** must remain for 6.0 seconds (\pm 0.5 seconds) continuously in order to be recognized as a **valid light condition**. A **dark condition** must remain for 1.0 second (\pm 0.25 seconds) continuously in order to be recognized as a **valid dark condition**.

RELAY Output (Pin 1)

This output is configured to drive the base of an external NPN transistor (see Figure 2). A valid dark condition at the PHOTO input causes the RELAY output to switch high and a valid light condition at the PHOTO input causes the output to switch low.

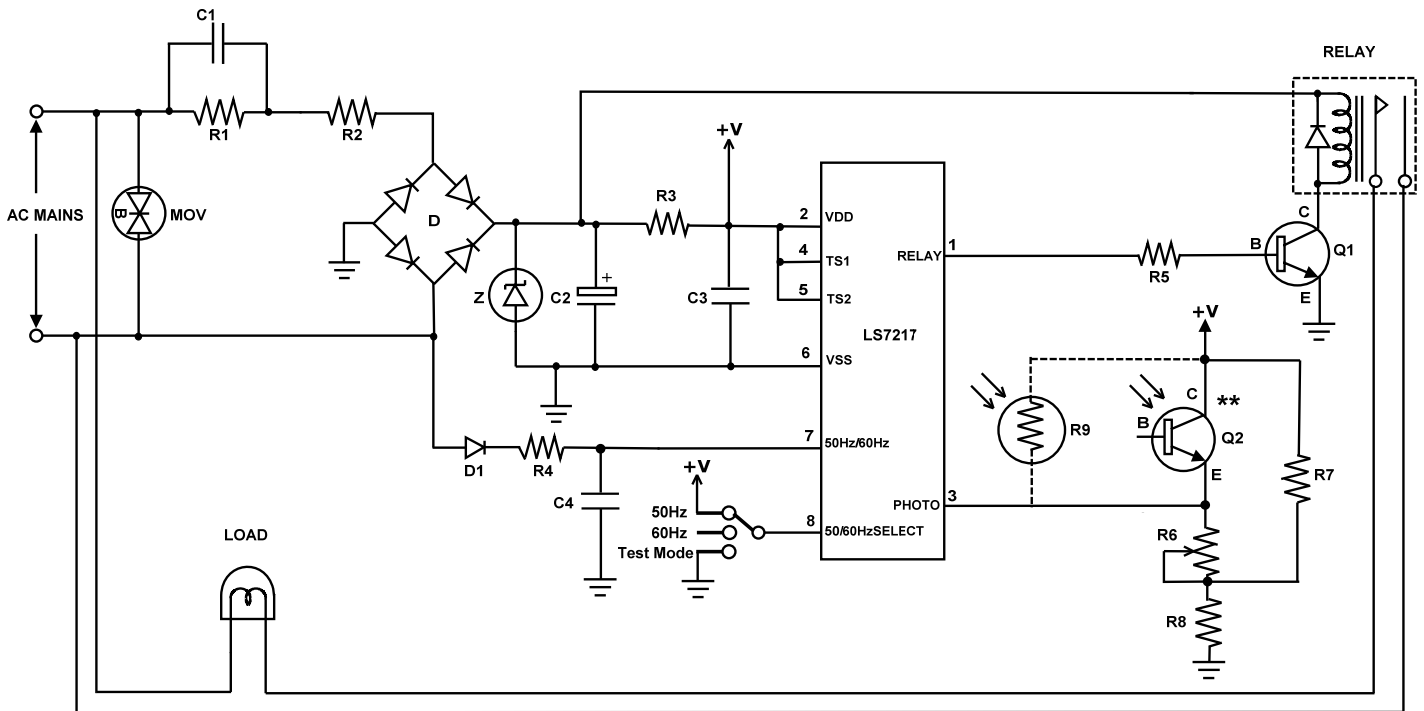


FIGURE 2. DUSK TO DAWN AUTO ON/OFF OUTDOOR LIGHTING APPLICATION

**COMPONENT SPECIFICATION
FOR 110V, 60 HZ AC SUPPLY**

R1=68k Ω , 1/2W, @120VAC
 R2=6.8k Ω , 2W, @120VAC
 R3=4.7k Ω , 2W, @120VAC
 R4=680k Ω , 2W, @120VAC
 R5=as needed for driving relay
 R6=100k Ω , 1/4W Potentiometer
 R7=18k Ω , 1/4W
 R8=4.3k Ω , 1/4W

C1=0.33uF, 200VAC, @120VAC
 C2=470uF, 25V
 C3=0.1uF
 C4=470pF

Z=12V Zener, 1W
 D=DF04
 D1=1N4148
 Q1=2N5845
 LOAD=Incandescent, LED, fluorescent or HID lamp

**COMPONENT SPECIFICATION
FOR 220V, 50 HZ AC SUPPLY**

R1=240k Ω , 1/2W, @240VAC
 R2=27k Ω , 2W, @240VAC
 R3=4.7k Ω , 2W, @240VAC
 R4=1M Ω , 2W, @240VAC
 R5=as needed for driving relay
 R6=100k Ω , 1/4W Potentiometer
 R7=18k Ω , 1/4W
 R8=4.3k Ω , 1/4W

C1=0.2uF, 400VAC, @240VAC
 C2=470uF, 25V
 C3=0.1uF
 C4=470pF

Z=12V Zener, 1W
 D=DF04
 D1=1N4148
 Q1=2N5845
 LOAD=Incandescent, LED, fluorescent or HID lamp

** For the photo-sensitive device use either LDR, R9=Silonex NSL-19M51 or use Photo-transistor, Q2=Vishay TEPT 4400.

NOTE1: This application circuit can be used for lighting control of public spaces such as Parking Lots, Billboards, street lamps etc.

NOTE2: Indicated connections of pins 4 and 5 keep the lamp on from dusk to dawn. See page 1 for configuring pins 4 and 5 connections to select 4, 6 or 8 hours on-time.

ABSOLUTE MAXIMUM RATINGS: (All voltages referenced to VSS)

	SYMBOL	VALUE	UNIT
DC Supply Voltage	VDD	+8	V
Voltage (Any Pin)	VIN	VSS - 0.3 to VDD + 0.3	V
Operating Temperature	TA	-20 to +85	°C
Storage Temperature	TSTG	-40 to +150	°C

DC ELECTRICAL CHARACTERISTICS:

(TA = 25°C, VDD = 6.0V unless otherwise specified.)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
TS1, TS2 Low	TLO	-	-	1.4	V
TS1, TS2 High	THI	3.0	-	-	V
50/60 Hz Low	VHZL	-	-	2.9	V
50/60 Hz High	VHZH	4.4	-	-	V
Photo					
Light Threshold	VIT	3.5	-	-	V
Dark Threshold	VET	-	-	2.9	V
Input Current (All inputs high)					
50Hz/60Hz Select] TS1, TS2]	I _{IH}	-	1.3	-	mA (12V source in series with 4.7K resistor connected to pin 2, VDD.)
RELAY Output Current					
Sourcing, Vo = 0.7V	I _{OH}	4.0	-	-	mA (The above 4.7K resistor in series with the 12V source should be lowered to 1K for the RELAY output to be able to source 4mA.)
Sinking, Vo = 0.4V	I _{OL}	-50	-	-	uA

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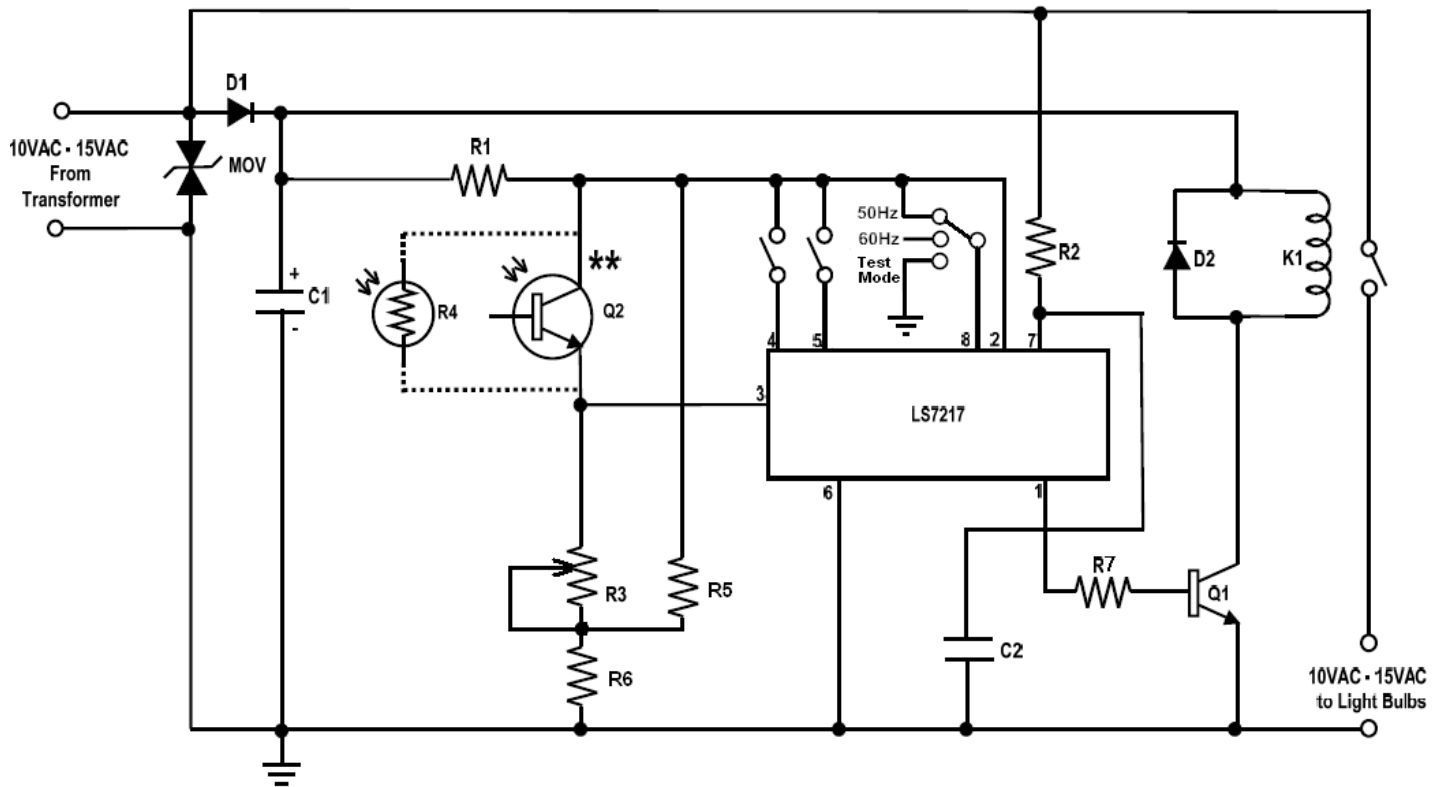


FIGURE 3. TYPICAL LANDSCAPE LIGHTING APPLICATION SCHEMATIC

R1=1k Ω , 1/4W

R2=220k Ω , 1/4W

R3=100k Ω , 1/4W Potentiometer

R5=18k Ω , 1/4W

R6=4.3k Ω , 1/4W

R7=As needed for sufficient base current to transistor to saturate the transistor and drive the external relay.

D1=1N4004

D2=1N4004

C1=220uF, 25V

C2=470pF, 10V

Q1=2N3904 (Typical)

** For the photo-sensitive device use either LDR, R4=Silonex NSL-19M51 or use Photo-transistor, Q2=Vishay TEPT 4400

NOTE: A 3 terminal positive voltage regulator such as LM78XX can be used after diode D1 to get a reliable fixed dc supply for the IC circuit and the relay; e.g. if a 12V rated relay is used, then LM7812 can be used to provide a fixed 12V dc voltage.

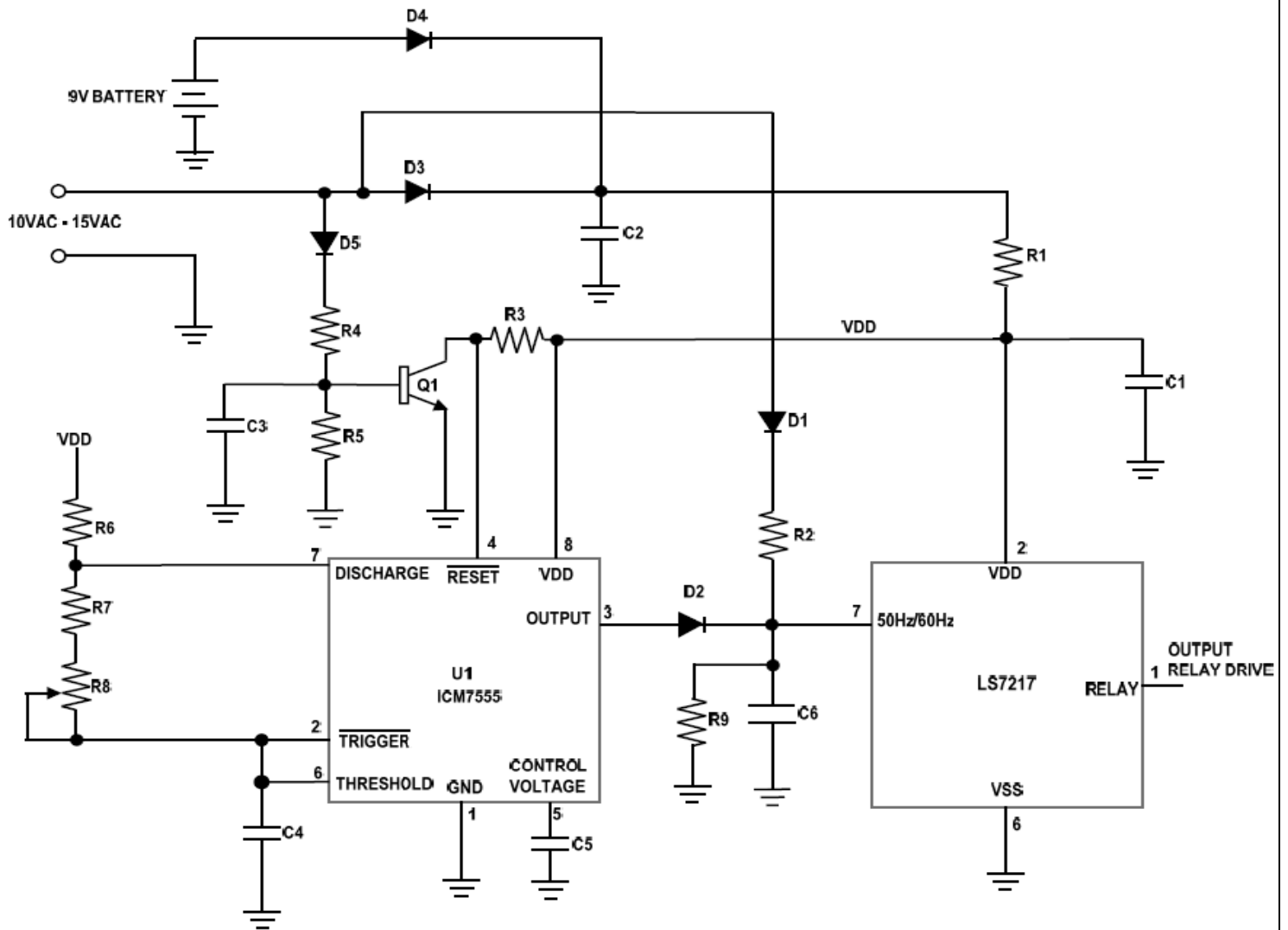


FIGURE 4. BATTERY BACK-UP FOR AC POWER FAILURE

R1=1k Ω	R6=10k Ω	C1=220uF	D1=1N4004	Q1=2N2222
R2=270k Ω	R7=10k Ω	C2=470uF	D2=1N4004	U1=ICM7555
R3=100k Ω	R8=50k Ω	C3=0.1uF	D3=1N4004	
R4=100k Ω	R9=1M Ω	C4=0.1uF	D4=1N4004	
R5=1M Ω		C5=0.1uF	D5=1N4004	
		C6=470pF		

Figure 4 shows how to connect a back-up battery circuit to the LS7217 timer in case of power failure. Upon ac power failure, U1 generates either a 50Hz or 60Hz clock (set by R8) so that the LS7217 timeout remains uninterrupted. When power returns timeout continues as if no ac interruption occurred.

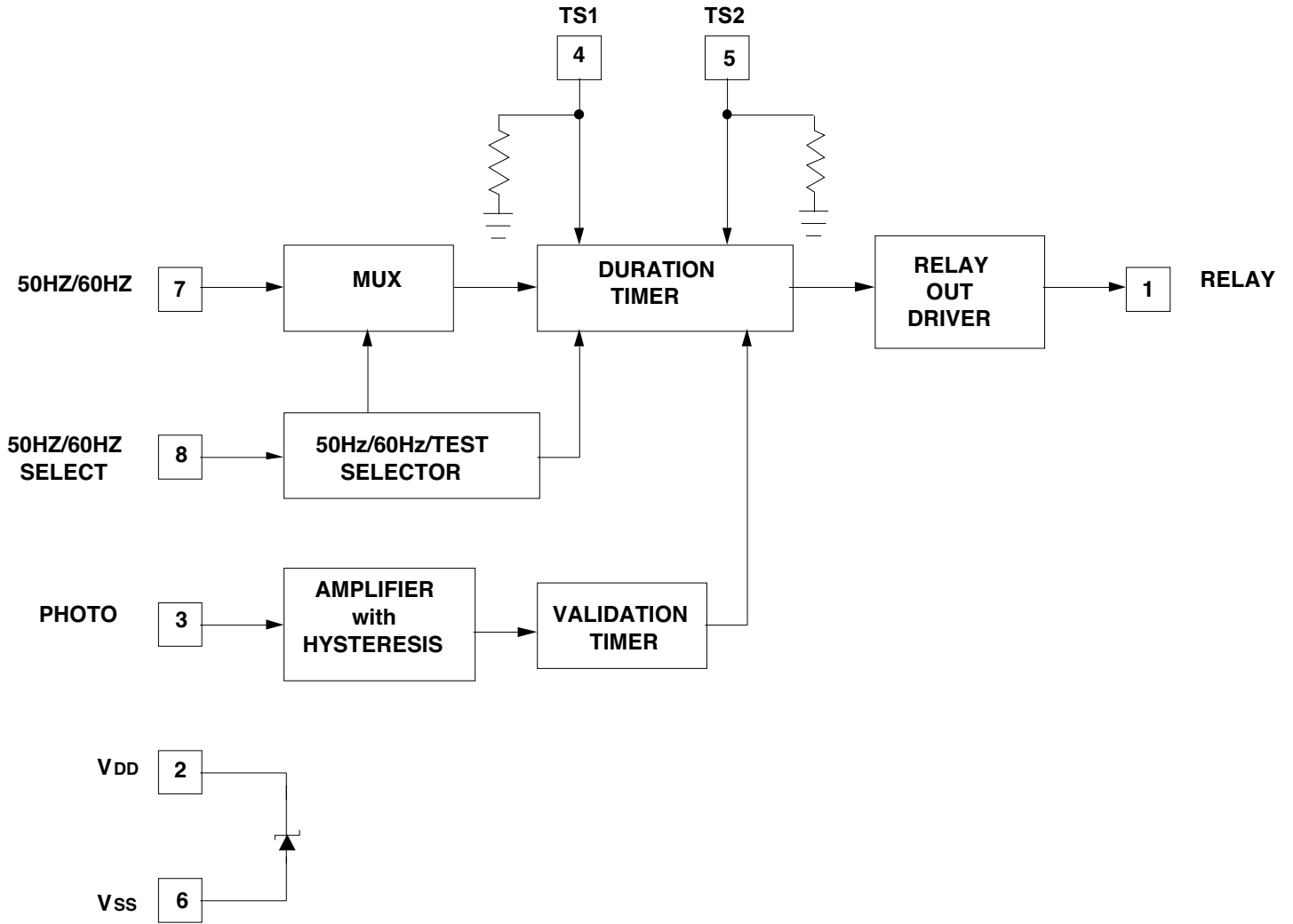


FIGURE 5. LS7217 BLOCK DIAGRAM