

## AC POWER CONTROLLERS

January 2003

### FEATURES:

- 10 I/Os to Select/Indicate up to ten Power Levels
- Inputs activated by Touch or Pushbutton Switch
- Output switches pure and precise AC Power to Load
- Operates with 50Hz/60Hz line frequency
- Rugged, latchup-free process technology
- +10V to +14V operation ( $V_{SS} - V_{DD}$ )
- LS7314, LS7315 (DIP);  
LS7314-S, LS7315-S (SOIC) - See Figure 1

### APPLICATIONS:

- Universal and shaded-pole motor speed control for modern appliance designs. Eliminates awkward mechanical switch assemblies and multi-tapped motor windings. (See Fig. 4C)
- Multi-level light switches. (See Fig. 4D)

### DESCRIPTION:

The LS7314 - LS7315 are MOS integrated circuits specifically designed for appliance motor speed control, lighting control, etc. I/Os (PLs) are provided for selecting/indicating from one to ten power levels. The LS7315 is designed for pushbutton control. The LS7314 is designed for touch control. (See Figures 4A and 4B)

### INPUT/OUTPUT DESCRIPTION:

#### PL1 - PL10 (Pins 1 - 8, 15, 16)

Ten inputs/outputs for selecting ten output phase angles (power levels). When no power level is selected (such as after system power-up) PL1 - PL10 all act as inputs. When a power level is selected by applying a logic zero at one of these inputs for  $T_H$  time (See Dynamic Characteristics), the output (TRIG) is turned on at the phase angle selected and the PL input switches status to become an output in order to drive a display, such as an LED. It switches back to the input state when another PL input is activated or when OFF is selected. (See Note 1)

#### OFF (Pin 10)

If TRIG is on, a logic 0 applied to the OFF input for  $T_H$  time turns TRIG output off and switches the selected PL back to the input state. If TRIG is off, activating OFF leaves the circuit unaffected. Following an OFF activation, TRIG can be turned on by applying any PL input. (See Note 1)

#### SYNC (Pin 12)

Input for PLL reference frequency (50Hz/60Hz). All internal clock frequencies are synchronized with the SYNC input.

#### CAP (Pin 11)

Input for component connection for the PLL filter capacitor.

CONNECTION DIAGRAM - TOP VIEW

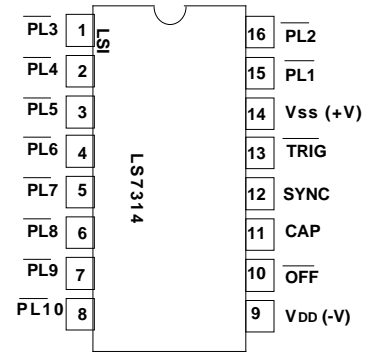


FIGURE 1

#### TRIG (Pin 13)

This output is designed to drive a triac in series with the load and control its firing angle with respect to the AC line. A 1ms output pulse width is provided to enable the triac to fire even with inductive loads which cause significant phase delays between voltage and current.

#### VSS (Pin 14)

Supply voltage positive terminal.

#### VDD (Pin 9)

Supply voltage negative terminal (ground).

**NOTE 1:** LS7315 has an internal pullup resistor on this input and LS7314 does not. (See DC Electrical Characteristics.)

FIGURE 2. TRIG PHASE ANGLE  $\theta$

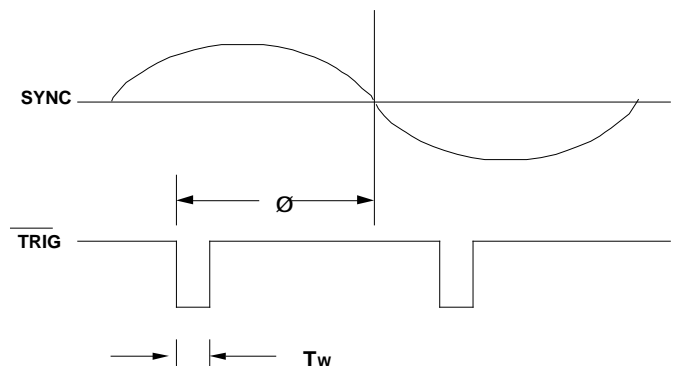


FIGURE 3. LS7314-LS7315 BLOCK DIAGRAM

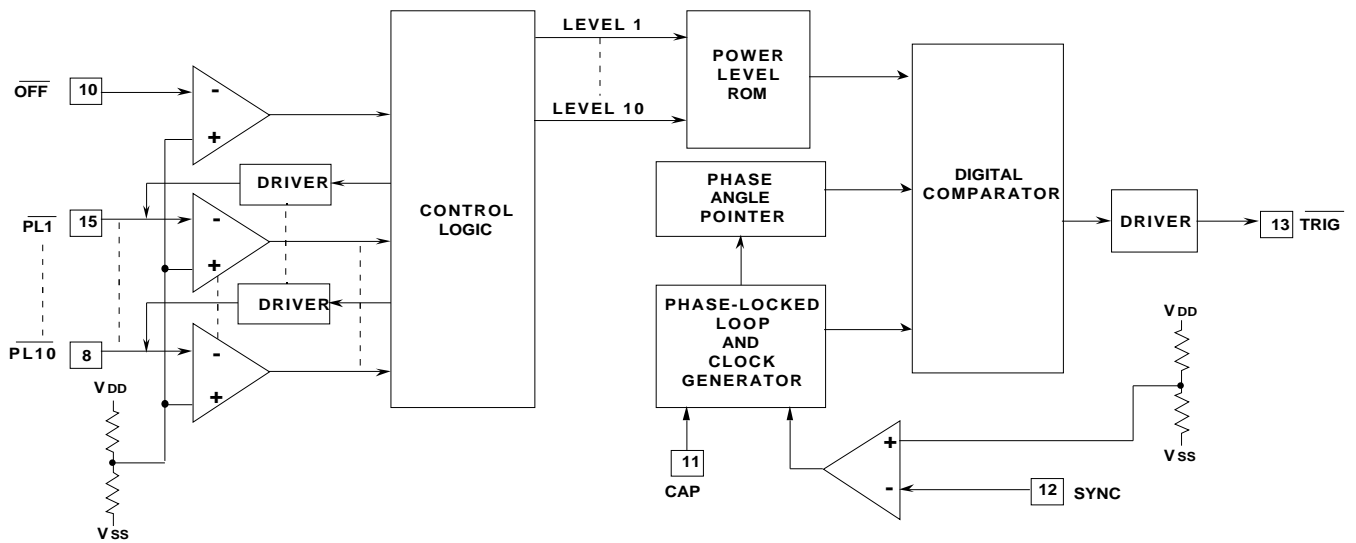


TABLE 1.  $\overline{\text{TRIG}}$  PHASE ANGLES,  $\emptyset$  (1)

PL	$\emptyset^*$	% PWR (2)	$\emptyset^{**}$	%PWR (2)
1	43°	8	81°	40
2	55°	16	105°	67
3	68°	26	116°	77
4	81°	40	120°	80
5	95°	55	123°	83
6	108°	69	129°	87
7	122°	82	134°	90
8	134°	90	160°	99
9	147°	96	167°	99
10	160°	99	175°	99

\*LS7314 & LS7315

\*\*LS7315-51

- (1) The  $\overline{\text{TRIG}}$  Phase Angles shown in TABLE 1 are referenced to the SYNC input.  $\emptyset$  values are mask programmable.  
 (2) The percentage of Full Power delivered to a resistive load by the Triac Switch.

FIGURE 4C and 4D NOTES

- NOTE 1: Value for 5mA LEDs.  
 NOTE 2: Use zener which produces 6.2V  $\pm$ 5% at 500 $\mu$ A or less, i.e. P/N MZ4627.  
 NOTE 3: R6-C6 Snubber Network may be required for large inductive loads.  
 NOTE 4: Tie all unused touch inputs together and return to Vss through 100k Ohm, 1/4W resistor.  
 NOTE 5: The AC Mains Polarity shown is required for Touch Control applications.

FIGURE 4C VALUE TABLE

CONDITION	C2( $\mu$ F)
(1), (3)	0.47
(1), (4)	0.33
(2), (3)	0.68
(2), (4)	0.47

- (1) No LEDs (2) 5mA LEDs  
 (3) 115VAC, C2 = 200V (4) 220VAC, C2 = 400V

FIGURE 4A. PUSHBUTTON INTERFACE FOR LS7315

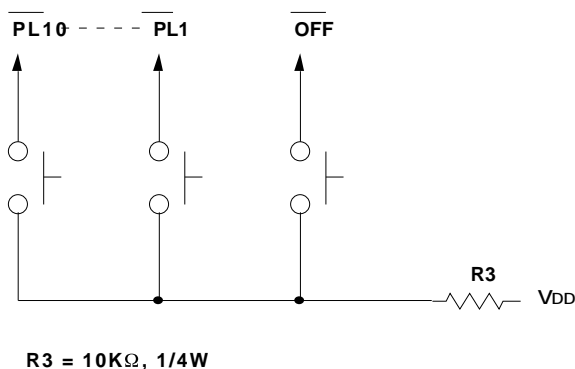
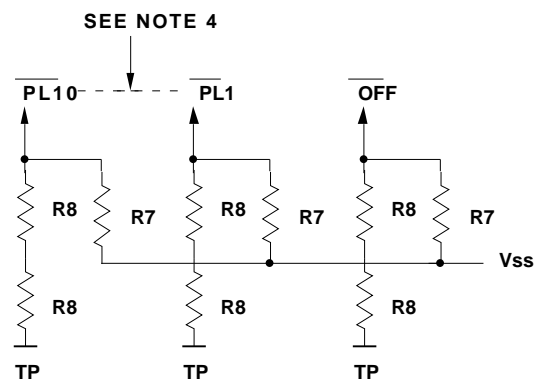
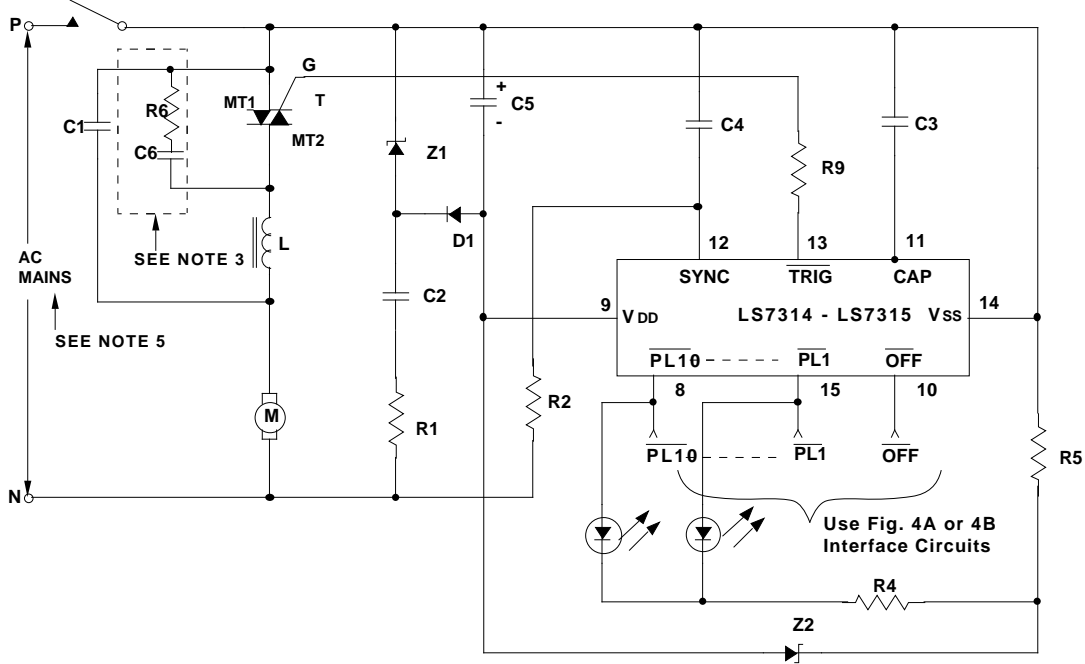


FIGURE 4B. TOUCH INTERFACE FOR LS7314



- R7 = 1M $\Omega$  to 5M $\Omega$ , 1/4W (Select for Sensitivity)  
 R8 = 2.7M $\Omega$ , 1/4W for 115VAC Mains  
 R8 = 4.7M $\Omega$ , 1/4W for 220VAC Mains

**FIGURE 4C. MOTOR SPEED CONTROL APPLICATION**

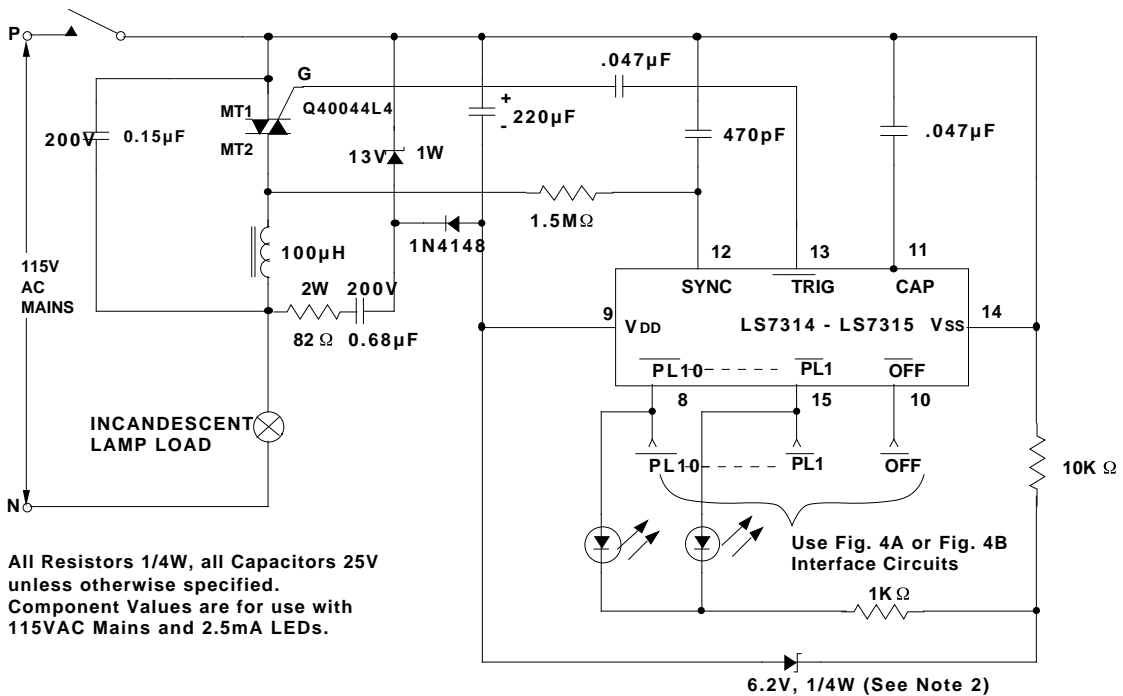


- C1 = 0.15 $\mu$ F, 200V (400V) \*
- C2 = See Figure 4 Value Table
- C3 = 0.047 $\mu$ F
- C4 = 470pF
- C5 = 220 $\mu$ F
- C6 = 0.47 $\mu$ F, 200V (400V) \*
- L = 100 $\mu$ H (200 $\mu$ H) \*
- D1 = 1N4148
- T = Q4004L4 (Q5004L4)\* Typical

- R1 = 82
- R2 = 1.5M
- R4 = 560 (See Note 1)
- R5 = 10k
- R6 = 1.8k , 1W (2W) \*
- R9 = 100
- Z1 = 13V  $\pm$  5%, 1W
- Z2 = 6.2V, 1/4W (See Note 2)

All resistors 1/4W, all capacitors 25V unless otherwise specified.  
 \* Indicates component change for 220VAC Mains.

**FIGURE 4D. MULTI-LEVEL WALL SWITCH DIMMER APPLICATION**



All Resistors 1/4W, all Capacitors 25V unless otherwise specified.  
 Component Values are for use with 115VAC Mains and 2.5mA LEDs.

6.2V, 1/4W (See Note 2)

**MAXIMUM RATINGS:**

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage	$V_{SS} - V_{DD}$	+20	V
Any Input Voltage	$V_{IN}$	$V_{SS} - 20$ to $V_{SS} + 0.5$	V
Storage Temperature	TSTG	-65 to +150	°C
Operating Temperature	$T_A$	0 to +80	°C

**DC ELECTRICAL CHARACTERISTICS:**

(TA = 25°C, all voltages referenced to VDD)

	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Supply Voltage	$V_{SS}$	+10	+12	+14	V	-
Supply Current	$I_{DD}$	-	1.2	2	mA	$V_{SS} = 12V$ , outputs off
<b>Input Voltage:</b>						
<b>SYNC, LO</b>	$V_{ISL}$	0	-	$1/3V_{SS}$	V	-
<b>SYNC, HI</b>	$V_{ISH}$	$2/3V_{SS}$	-	$V_{SS}$	V	-
<b>All other inputs, LO</b>	$V_{IL}$	0	-	$1/4V_{SS}$	V	-
<b>All other inputs, HI</b>	$V_{IH}$	$1/2V_{SS}$	-	$V_{SS}$	V	-
<b>Input Current:</b>						
<b>SYNC Input</b>	$I_H$	-	-	110	μA	With Series 1.5M Resistor to 115VAC
<b>Input Pull-up Resistance:</b>						
For LS7315						
<b>PL, OFF</b>	$R_{IN}$	50	100	200	k	-
<b>Output Voltage:</b>						
<b>TRIG, HI</b>	$V_{OH}$	$V_{SS}$	-	-	V	-
<b>TRIG, LO</b>	$V_{OL}$	-	$V_{SS} - 8$	-	V	-
<b>Output Current:</b>						
<b>TRIG, Sink</b>	$I_{OS}$	25	-	-	mA	$V_{SS} = +12V$ $V_{OL} = V_{SS} - 4V$
<b>PL Source</b>	$I_{OPL}$	5	-	-	mA	$V_{OPL} = V_{SS} - 1V$

**DYNAMIC CHARACTERISTICS:**

	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
<b>SYNC frequency</b>	$f_s$	40	-	70	Hz	-
<b>PL, OFF hold time</b>	$T_H$	50	-	infinite	ms	60Hz SYNC
	$T_H$	60	-	infinite	ms	50Hz SYNC
<b>TRIG Pulse Width</b>	$T_w$	-	1.0	-	ms	60Hz SYNC
	$T_w$	-	1.2	-	ms	50Hz SYNC

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