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NTE914
Integrated Circuit
Zero–Voltage Switch

Description:

The NTE914 zero–voltage switch is a monolithic silicon integrated circuit in a 14–Lead DIP type package designed to control a thyristor in a variety of AC power switching applications for AC input voltages of 24V, 120V, 208/230V, and 277V at 50/60Hz and 400Hz. The NTE914 incorporates 4 functional blocks as follows:

Limiter–Power Supply: Permits operation directly from an AC line.

Differential ON/OFF Sensing Amplifier: Tests the condition of external sensors or command signals. Hysteresis or proportional–control capability may easily be implemented in this section.

Zero–Crossing Detector: Synchronizes the output pulses of the circuit at the time when the AC cycle is at zero voltage point; thereby eliminating radio–frequency interference (RFI) when used with resistive loads.

TRIAC Gating Circuit: Provides high current pulses to the gate of the power controlling thyristor.

The NTE914 also provides the following important auxiliary functions:

A built–in protection circuit that may be actuated to remove drive from the TRIAC if the sensor opens or shorts.

Thyristor firing may be inhibited through the acting of an internal diode gate connected to Pin1.

High–power DC comparator operation is provided by overriding the action of the zero–crossing detector. This is accomplished by connecting Pin12 to Pin7. Gate current to the thyristor is continuous when Pin13 is positive with respect to Pin9.

Features:

- 24V, 120V, 208/230V, 277V at 50Hz, 60Hz, or 400Hz Operation
- Differential Input
- Low Balance Input Current: 1μA Max
- Built–In Protection Circuit or Opened or Shorted Sensor
- Sensor Range: R_X = 2 to 100kΩ
- DC Mode
- External Trigger
- External Inhibit
- DC Supply Voltage: 14V Max

Applications:

- Relay Control
- Valve Control
- Synchronous Switching of Flashing Lights
- ON/OFF Motor Switching
- Differential Comparator with Self–Contained Power Supply for Industrial Applications
- Photosensitive Control
- Power One–Shot Control
- heater Control
- Lamp Control

Absolute Maximum Ratings: (T_A = +25°C unless otherwise specified)

DC Supply Voltage (Between Pin2 and Pin7) 14V
DC Supply Voltage (Between Pin2 and Pin8) 10V
Peak Supply Current (Between Pin5 and Pin7) . . . . . ±50mA
Output Pulse Current (Pin4) 150mA
Power Dissipation ($T_A \le +55°C$), P_D 700mW
Derate Linearly Above 55°C . . . . . 6.67mW/°C
Operating Ambient Temperature Range, T_{opr} . . . . . –55° to +125°C
Storage Temperature Range, T_{stg} . . . . . –65° to + 150°C
Lead Temperature (During Soldering 1/16" from case, 10sec max), T_L . . . . . +265°C

Electrical Characteristics: (T_A = +25°C, All voltages are measured with respect to Pin7 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
For Operation at 120V_{rms}, 50–60Hz (AC Line Voltage) (Note 1)						
DC Supply Voltage (Inhibit Mode) At 50/60Hz	V_S	R_S = 8kΩ, I_L = 0	6.1	6.5	7.0	V
		R_S = 5kΩ, I_L = 2mA	–	6.4	–	V
At 400Hz		R_S = 10kΩ, I_L = 0	–	6.8	–	V
DC Supply Voltage (Pulse Mode) At 50/60Hz	V_S	R_S = 8kΩ, I_L = 0	6.0	6.4	7.0	V
		R_S = 5kΩ, I_L = 2mA	–	6.3	–	V
At 400Hz		R_S = 10kΩ, I_L = 0	–	6.7	–	V
Gate Trigger Current	I_{GT}(4)	V_{GT} = 1V, Pin3 and Pin4 Connected	–	105	–	mA
Peak Output Current (Pulsed) With Internal Power Supply	I_{OM}(4)	V_{GT} = 0, Pin3 Open	50	84	–	mA
		V_{GT} = 0, Pin3 and Pin2 Connected	90	124	–	mA
With External Power Supply		V+ = 12V, V_{GT} = 0, Pin3 Open	–	170	–	mA
		V+ = 12V, V_{GT} = 0, Pin3 and Pin2 Connected	–	240	–	mA
Inhibit Input Ratio	V_9/V_2	Voltage Ratio of Pin9 to Pin2	0.465	0.485	0.520	
Total Gate Pulse Duration (Positive dv/dt) 50–60Hz	t_P	C_{EXT} = 0	70	100	140	µs
400Hz		C_{EXT} = 0, R_{EXT} = ∞	–	12	–	µs
Total Gate Pulse Duration (Negative dv/dt) 50–60Hz	t_N	C_{EXT} = 0	70	100	140	µs
400Hz		C_{EXT} = 0, R_{EXT} = ∞	–	10	–	µs

Note 1. The values given in the "Electrical Characteristics" chart at 120V also apply for operation at input voltages of 24V, 208/230V, and 277V, except for Pulse Duration. However, the series resistor (R_S) must have the indicated value shown in Table 1 for the specified value.

Electrical Characteristics (Cont'd): (T_A = +25°C, All voltages are measured with respect to Pin7 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
For Operation at 120V_{rms}, 50–60Hz (AC Line Voltage) (Note 1)						
Pulse Duration After Zero Crossing (50–60Hz) For Positive dv/dt	t_{P1}	C_{EXT} = 0, R_{EXT} = ∞	–	50	–	µs
For Negative dv/dt	t_{N1}		–	60	–	µs
Output Leakage Current (Inhibit Mode)	I_4		–	0.001	10	µs
Input Bias Current	I_I		–	220	1000	nA
Common–Mode Input Voltage Range	V_{CMR}	Pin9 and Pin13 Connected	1.5 to 5.0			V
Sensitivity (Pulse Mode)	ΔV_{13}	Pin12 Open, Note 2	–	6	–	mV

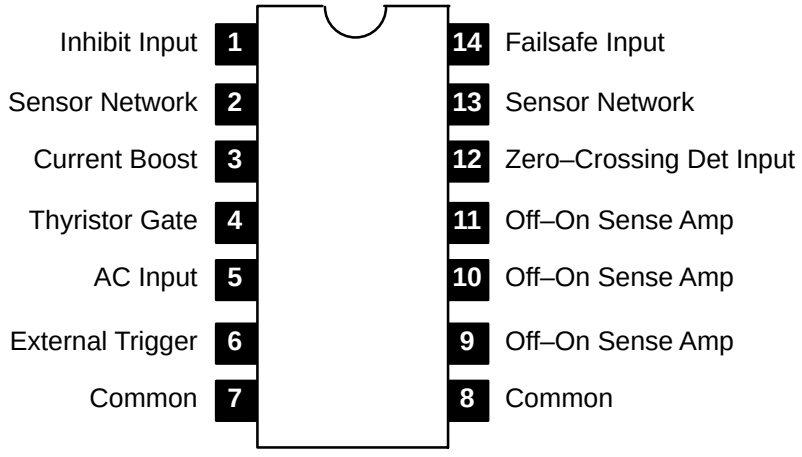
Note 1. The values given in the "Electrical Characteristics" chart at 120V also apply for operation at input voltages of 24V, 208/230V, and 277V, except for Pulse Duration. However, the series resistor (R_S) must have the indicated value shown in Table 1 for the specified value.

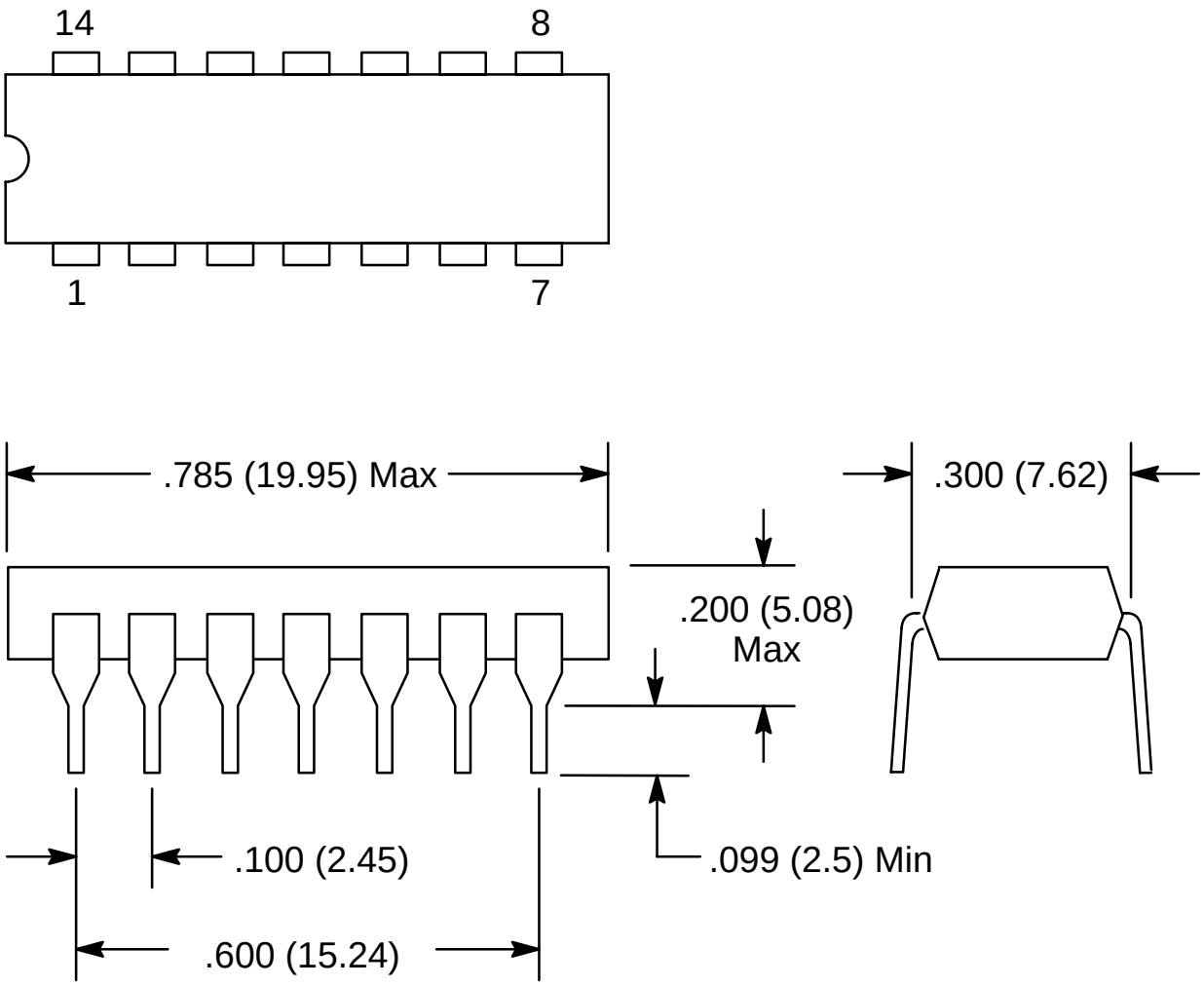
Note 2. Required voltge change at Pin13 to either turn OFF the TRIAC or turn ON the TRIAC when OFF.

Table 1:

AC Input Voltage (50/60 or 400Hz)	Input Series Resistor, R_S	Dissipation Rating for R_S
V AC	**kΩ**	**W**
24	2	0.5
120	10	2.0
208/230	20	4.0
277	25	5.0

Pin Connection Diagram




14
8
1
7
.785 (19.95) Max
.300 (7.62)
.200 (5.08)
Max
.100 (2.45)
.099 (2.5) Min
.600 (15.24)