PLESSEY
Semiconductors

T-65-09

TDA2090A

ZERO VOLTAGE SWITCH

The TDA2090 is a symmetrical burst control zero voltage switch designed for temperature control in smoothing irons, water heaters, refrigerators, room heaters etc.

The circuit is designed to eliminate half wave firing and has a programmable switching rate to eliminate lamp flicker (EN50.006, BS5406, 1976).

FEATURES

- 3 LED Drive Circuit Indicates High, Low or In-band for Controlled Temperature
- Symmetrical Negative Triac Firing Pulses about the Mains Zero Voltage Points to Minimise RFI
- Programmable Switching Rate, Proportional Band and LED Indicator Window
- -5V Supply for Sensing, Thermistor Bridge and Ancillary Control Circuits
- Open Circuit Sensor Thermistor Detector demands Zero Power and Lights Over-temperature LED
- Powered Direct from Mains via Current Limiting Components or from DC Line

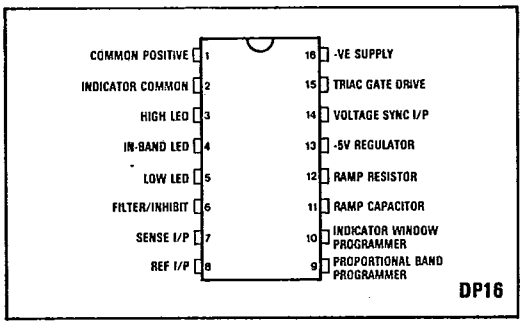

Fig.1 Pin connections - top view

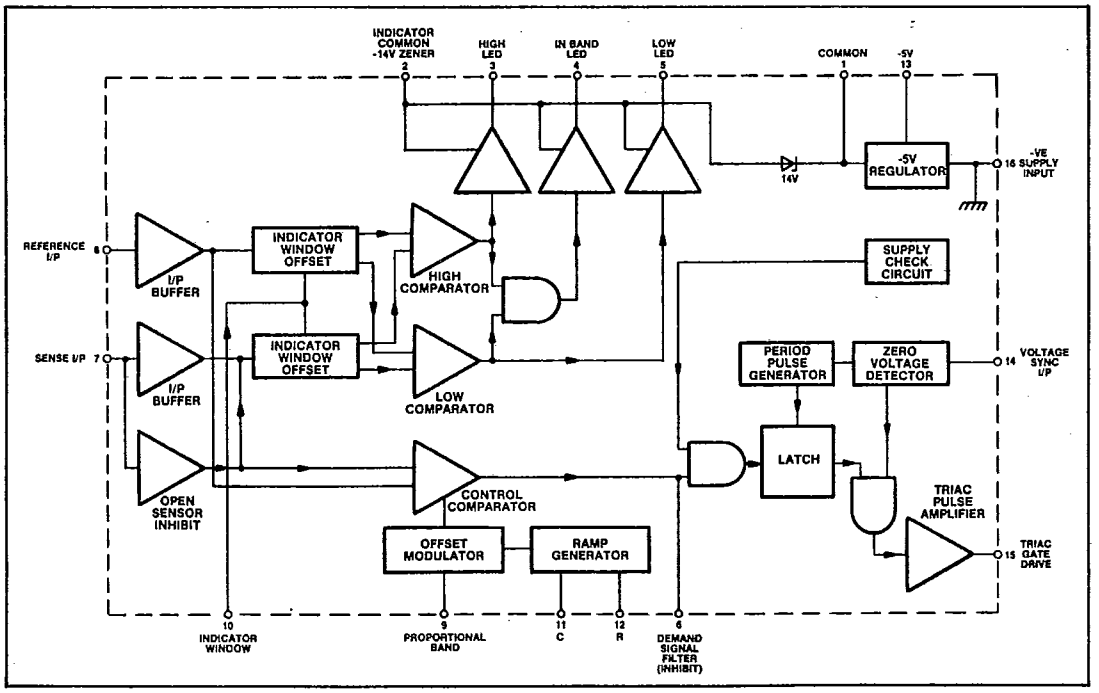

Fig.2 Block diagram

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ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):
T_{amb} = 25°C

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Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
CURRENT CONSUMPTION					
Pin 16					
IC operating current		3.5	5.5	mA	Not including triac gate or bridge supply current
VOLTAGE MONITOR					
Pin 16					
Voltage monitor enable level	-11		-9	V	
SHUNT VOLTAGE REGULATOR (V_{EE})					
Pin 2					
Regulating voltage	-13.5	-13.5	-15.5	V	
SERIES REGULATOR					
Pin 13					
Regulating voltage (V_{reg})	-5.35	-5	-4.65	V	1mA external load
External current			5	mA	
Regulation	120		120	mV	For 0-5mA load change
CONTROL COMPARATOR					
Pins 6,7,8					
Proportional control band	±20	±50	±80	mV	Pin 9 = -0.5
Proportional control band	±140	±200	±260	mV	Pin 9 = -2V
Pins 7,8					
Input bias current			2	μA	
Hysteresis		10		mV	
Pin 7					
OPEN SENSOR inhibit level	20		40	mV	With respect to V_{reg}
INDICATOR WINDOW COMPARATORS					
Pins 7,8					
Indicator window	±50	±100	±150	mV	Pin 10 = -0.5V
Indicator window	±300	±400	±500	mV	Pin 10 = -2V
Indicator window hysteresis	10		30	mV	
FILTER/INHIBIT INPUT					
Pin 6					
Output drive current	±10		±50	μA	
Inhibit trip level	-3.5		-2.6	V	
LED DRIVE CIRCUIT					
Pins 3,4,5					
LED drive current			40	mA	
High output voltage		6.4		V	Output current = 20mA Pin 2 connected to common
Output leakage current			10	μA	Output voltage = V_{EE}
TRIAC PULSE AMPLIFIER					
Pin 15					
Drive current	50	75	95	mA	Pin 15 = -3V
Leakage current			10	μA	Pin 15 = 0V
WINDOW PROGRAMMER					
Pin 10					
Input bias current			2	μA	Pin 10 = 0V
PROPORTIONAL BAND PROGRAMMER					
Pin 9					
Input bias current			2	μA	Pin 9 = 0V

ELECTRICAL CHARACTERISTICS (Continued)

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Test conditions (unless otherwise stated):
T_{amb} = 25°C

Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
RAMP GENERATOR					
Pin 11					
Ramp Capacitor charge current	-12		-6	μA	With 470k resistor from
Ramp capacitor discharge current	6		12	μA	Pin 12 to 0V
Upper ramp trip voltage	-1.0		-2.5	V	
Lower ramp trip voltage	-6.5		-5.5	V	
Pin 12					
Ramp programming current	5		50	μA	
VOLTAGE SYNCHRONISATION					
Pin 14					
Voltage synchronisation trip level (I_{sync})	±20	±25	±30	μA	
Period pulse trip level	35	50	75	μA	

ABSOLUTE MAXIMUM RATINGS

	Value	Units
ELECTRICAL		
-14V shunt regulator repetitive peak input current pin 2	100	mA
Non repetitive peak input current pin 2 ($t_p < 250\mu s$)	250	mA
Repetitive peak input current pins 3,4,5	100	mA
Non repetitive peak input current pins 3,4,5 ($t_p < 250\mu s$)	250	mA
Peak input current pin 14	±5	mA
-5V regulator current pin 13	10	mA
Supply voltage pin 16	-18	V
Voltage on pins 6,7,8,9,10	V_{reg}	V
Triac gate voltage pin 15	4	V
Ramp current pin 12	0.5	mA
THERMAL		
Operating ambient temperature	0 to 60	°C
Storage temperature	-55 to +125	°C

CIRCUIT DESCRIPTION

Power is supplied direct from the mains via current limiting components to a nominal 14V zener. An external capacitor maintains a smooth DC supply between mains cycles. The -14V supply is monitored by the supply check circuit which prevents unsuitable firing pulses being applied to the triac if the supply is less than that required to guarantee correct circuit operation.

A separate -5V series stabiliser provides internal biasing and a smooth external supply for the thermistor bridge and any ancillary control circuitry.

A differential input comparator compares the measured temperature with the set temperature to determine whether a power demand condition exists. A programmable triangular wave oscillator and modulator can vary the comparator offset such that a proportional control band and controlled switching rate are provided. Filtered and latched hysteresis feedback prevents switching jitter due to interference.

The power demand signal from the comparator is clocked into the latch by the period pulse which occurs once in each mains cycle, thus preventing halfwave firing of the triac.

The zero voltage detector generates a symmetrical pulse about the zero voltage points of the mains cycle. When gated by the latch output and amplified by the triac pulse amplifier the pulse provides the negative triac gate drive. By sensing the current in the voltage sync. pin (14) symmetrically about the zero voltage point, a firing pulse is produced which will maintain the triac in conduction throughout the entire mains cycle, thus minimising RF1. The width of the firing pulse is set by the external resistor in series with pin 14.

The device is capable of driving 3 LEDs to indicate a high, low or in-band temperature condition. The LEDs are connected in series with the device to reduce current consumption when power is provided direct from the mains via current limiting components, or in parallel when a DC supply is used.

The indicator window which determines the range of temperature over which the in-band LED is on, is programmed by the voltage applied to the indicator window programming pin (10). A similar input sets the width of proportional band for the control comparator. To minimise external component count, the indicator window and proportional band programming inputs (pins 10 and 9) may be connected to the same external voltage. Under these conditions the indicator window is twice the proportional control band.