

# **TDA1085C**

## **PHASE CONTROL INTEGRATED CIRCUIT**

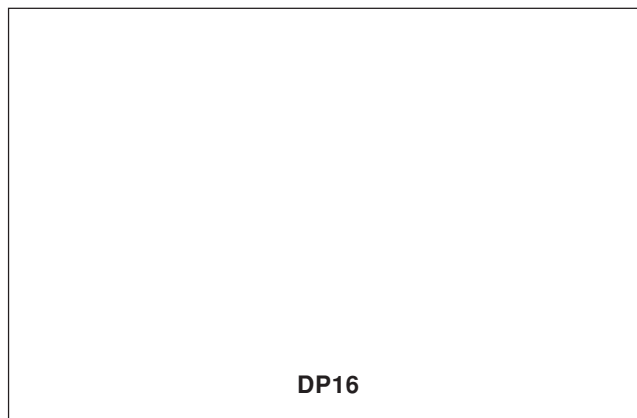
The TDA1085C is a silicon integrated circuit designed for use in phase control systems of AC mains with resistive and inductive loads. The circuit may form the basis of closed loop control systems utilizing tachometer frequency or analog voltage feedback.

The circuit was primarily designed for motor speed control in automatic washing machines and hence includes a programmable multiple ramp generator to control acceleration rates.

### **FEATURES**

- Powered direct from AC mains or DC line.
- Flexible ramp generator to provide controlled acceleration and distribution period.
- Actual speed derived from tachogenerator frequency or magnitude.
- Control amplifier allowing loop gain control.
- Symmetrical positive and negative wave firing of the triac.
- Motor current limiting.
- Fail safe in case of open circuit tachogenerator.
- Repeated triac pulses provided if triac unlatches.

### **BLOCK DIAGRAM**



*Fig.1 Pin Connections (top view)*

*Fig. 2 Block Diagram of TDA1085C*

## ELECTRICAL CHARACTERISTICS

## TEST CONDITIONS (unless otherwise stated)

 $T_{amb} = +25^{\circ}\text{C}$ 

All potentials measured with respect to common (Pin 8)

Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
<b>CURRENT CONSUMPTION</b> <b>Pin 9</b> IC operating current		7.4	8.9	mA	Total current required is dependent on external circuitry.
<b>VOLTAGE REGULATOR</b> <b>Pin 9</b> Shunt regulating voltage Monitor enable level Monitor disable level		15.5 15.1 14.5	16	V V V	$I_9 + I_{10} = 10\text{mA}$
<b>RAMP GENERATOR (See Fig.3)</b> <b>Pin 7</b> Fast ramp current Residual charging current  <b>Pin 5</b> Speed program voltage range Bias current  <b>Pin 6</b> Program distribute level Bias current  <b>Internal</b> Low distribute level $V_{RA}$  High distribute level $V_{RB}$		1.2 5		mA $\mu\text{A}$	During slow ramp period
	0.08		13.5 -20	V $\mu\text{A}$	
	0		4 -20	V $\mu\text{A}$	
		$V_6$	1.2	V	Distribute levels referred to ramp generator.
	$1.9V_6$	$2V_6$	$2.1V_6$	V	
<b>FREQUENCY-ANALOG CONVERTER</b> <b>Pin 12</b> Positive tacho input voltage Negative tacho input voltage Minimum tacho input voltage Internal bias current  <b>Pin 12 to Pin 11</b> Conversion factor (typical)  Conversion gain Linearity	200	25	6 -3	V V mV $\mu\text{A}$	Peak-Peak
		7.5 15 10		mV/Hz mV/Hz	C pin 6 = 390pF, R pin 4 = 150k $\Omega$ C pin 6 = 820pF, R pin 4 = 150k $\Omega$
	$\pm 4$		%		
<b>CONTROL AMPLIFIER</b> <b>Pin 4</b> Actual speed voltage limits Analog input bias current  <b>Pin 4, 5 &amp; 16</b> Differential offset voltage Transconductance  <b>Pin 16</b> Output current drive	0		13.5 -350	V nA	$V_5 - V_4$ to give $V_{16} = 0$
	-60	300	+20	mV $\mu\text{A/V}$	
		$\pm 100$		$\mu\text{A}$	

## ELECTRICAL CHARACTERISTICS (continued)

Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
<b>FIRING PULSE TIMING</b>					
<b>Pin 2</b> Voltage sync trip level		±50		µA	R pin 15 = 300kΩ C pin 14 = 47nF
<b>Pin 1</b> Current sync trip level		±50		µA	
<b>Pin 16</b> Phase control voltage swing		11.7		V	
<b>Pin 13</b> Firing pulse width Pulse repetition time		55 200		µs µs	
<b>Pin 14</b> Ramp recharge current ( $I_R$ )		150		µA	
<b>FIRING PULSE OUTPUT DRIVE</b>					
<b>Pin 13</b> High output level		$V_{CC} - 4$		V	At 150mA drive current
Leakage current			30	µA	Reset of ramp generator
<b>LOAD CURRENT LIMITER</b>					
<b>Pin 3 &amp; Pin 7</b> Current gain		170	-		
<b>Pin 7</b> Discharge current		35		mA	

## CIRCUIT DESCRIPTION

The TDA1085C incorporates a shunt type voltage regulator which enables it to be powered direct from the mains or from a DC supply. It can provide adequate current to drive external speed reference potential dividers that may be switched by contacts on mechanical timers. A supply monitor circuit resets timing functions and inhibits triac firing pulses when the circuit is being powered up at 'switch on'.

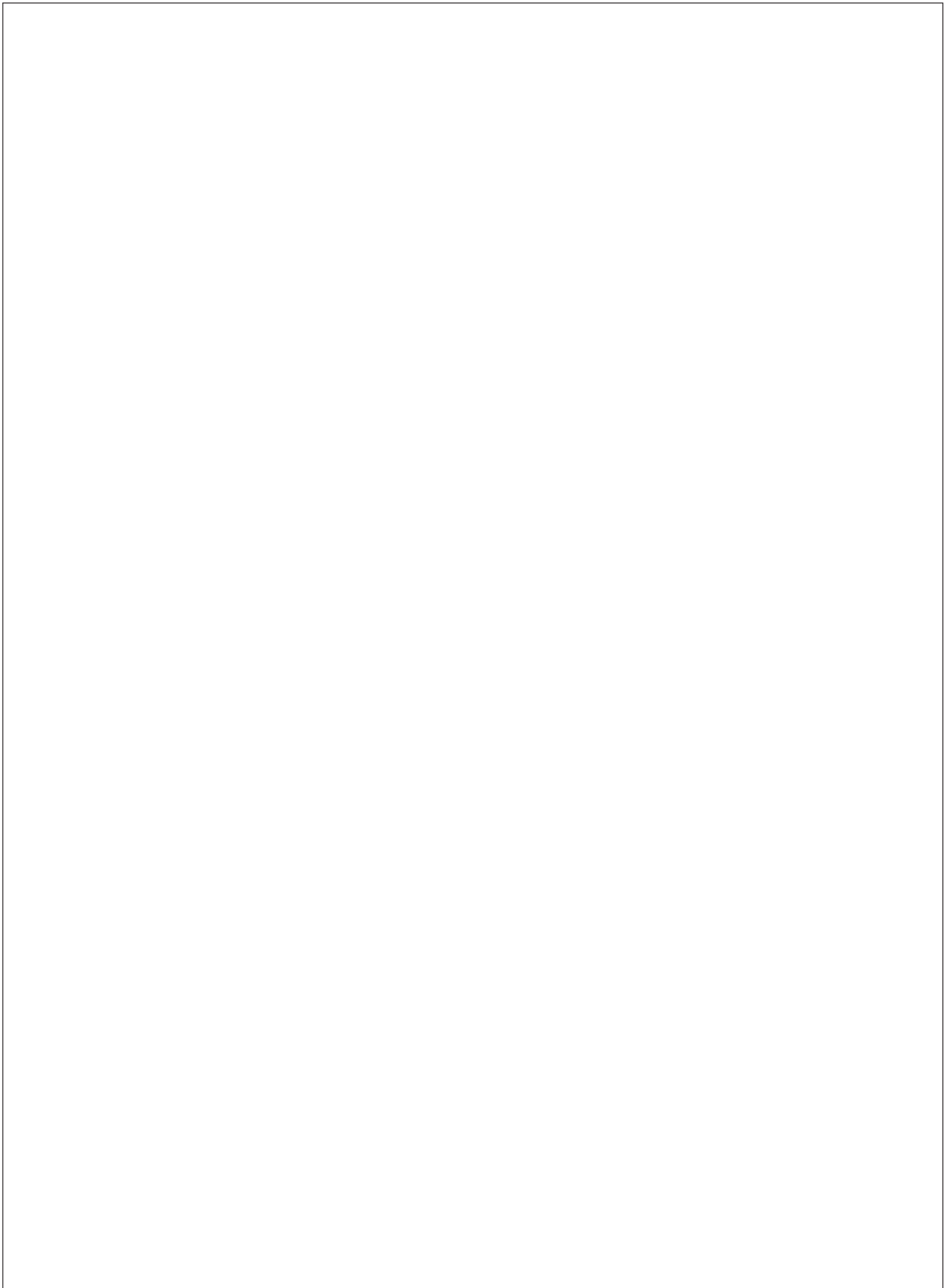
A ramp generator is provided to control the acceleration of the motor, to a speed as programmed on the speed program input, pin 5. If this pin becomes grounded a general reset and inhibit of triac pulses will take effect. A programmable period of slow acceleration may be used to give a 'distribution' period for automatic washing machines. Charging currents for the ramp generator are determined by an external resistor for the slow ramp period and internally during the fast ramp.

A frequency to analog (F-A) converter is provided on this device enabling advantage to be taken of tachogenerator frequency to be used for motor speed sensing. The conversion is carried out by transferring a pulse of charge (defined by the F-A converter capacitor) into an RC filter

when the tacho input goes positive. An internal bias current is provided to the input pin; this serves two purposes: it senses the continuity of the tacho, causing a general reset and inhibit of output pulses if it goes open circuit; secondly it enables the input to be easily biased such that tacho noise causes no additional triggering of the F-A converter.

The control amplifier has differential inputs that compare the ramp generator voltage (internal) against the actual speed voltage. The output of this amplifier is a bidirectional current of limited amplitude which is integrated to limit the maximum rate of change of triac firing pulse phase angle. The actual speed voltage may be derived directly from a tacho (for analog sensing) or via the F-A converter circuit (for digital sensing). Digital sensing has the advantage that no tacho calibration is required, plus stability against temperature variations and ageing effects.

Synchronisation of the triac pulse is achieved by delaying the pulse with reference to the zero voltage points of the mains cycles. These points are determined by the voltage synchronisation input to the device. Inductive motors give rise to phase lag of the load current. Under high speed or heavy load conditions it is essential that the triac is fired after the load current from the previous half cycle has ceased. The current synchronisation pin (1) performs this



*Fig. 4 TDA1085C Circuit Diagram*

task by ensuring that there is a voltage across the triac before a trigger pulse is supplied (when the triac is conducting current only a small voltage drop appears across it). The triac pulse width is dependent on the capacitor which also delays the pulse from the zero voltage point. If the triac fails to latch, repeated pulses will be supplied.

The current limitation pin (3) may be used to monitor the peak negative load current. This may be necessary to protect the triac and or motor under stall conditions. The trip point is determined by external resistors which when exceeded will cause the ramp generator to discharge to a safe working voltage.

**RAMP GENERATOR CHARACTERISTIC**

$V_{RA}$  and  $V_{RB}$  are determined by the voltage programmed on pin 6 ( $V_6$ ). Under all conditions  $V_{RB} = 2V_6$ , whereas  $V_{RA} = V_6$  for  $V_6 \leq 1.2V$  but is clamped at 1.2V for  $V_6 \geq 1.2V$ . The ramp generator output voltage only rises to the desired speed voltage as defined on pin 5.

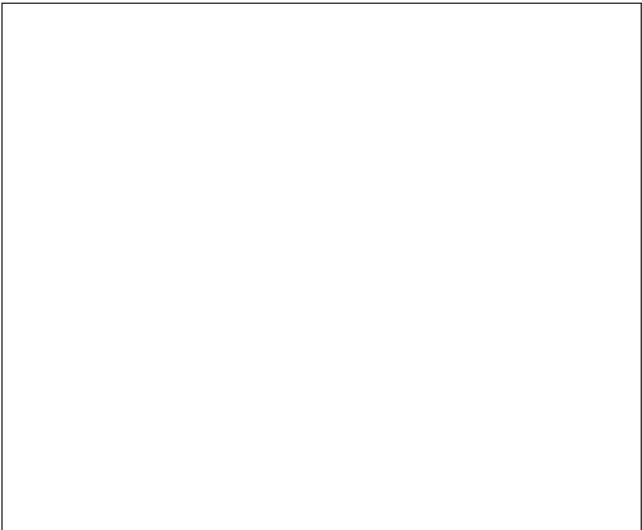


Fig. 3 Ramp Generator Characteristic

**ABSOLUTE MAXIMUM RATINGS**

**Electrical**

Peak input current (I sync), pin 1:	±2mA
Peak input current (V sync), pin 2:	±2mA
Current drain, pin 3:	5mA
Positive input voltage, pin 3:	6V
Analog voltage drive, pin 4:	$V_{CC}$
Speed reference voltage, pin 5:	$V_{CC}$
Distribute level, pin 6:	$V_{CC}$
IC Circuit current (pin 10 disconnected), pin 9:	10mA
Supply shunt regulating current, pin 10:	30mA
Tachogenerator(digital)drive input, pin 12: -3, +0.1 mA	
Triac gate current, pin 13:	200mA
Phase timing current, pin 15:	1 mA

**Thermal**

Operating ambient temperature:	0°C to +70°C
Storage temperature:	-55°C to +125°C

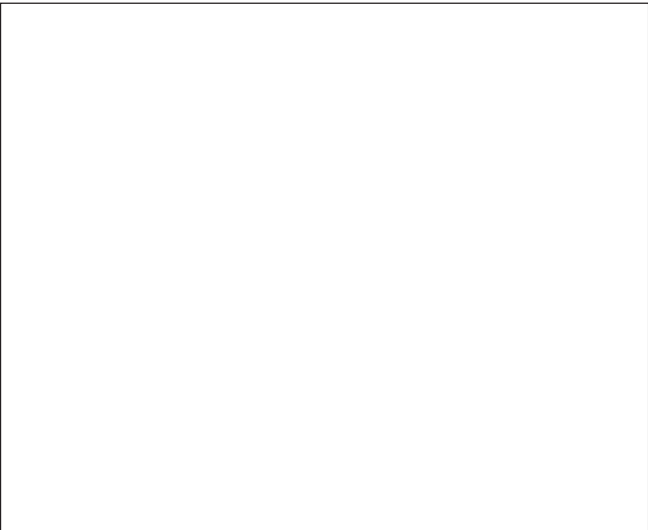


Fig. 5 Power Dissipation



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