L4620



LIQUID LEVEL ALARM

- DRIVES DIRECTLY 300 mA ALARM LOAD
- PROGRAMMABLE INPUT POLARITY TO
- ACTIVATE THE OUTPUT STAGE PROGRAMMABLE DELAY TIME
- PROGRAMMABLE OUTPUT DUTY CYCLE OUTPUT SHORT CIRCUIT PROTECTION
- OVERVOLTAGE AND THERMAL
- PROTECTION

DESCRIPTION

The L4620 is an integrated circuit, designed for the liquid level control in automotive applications. The liquid level is indicated by an attenuation between transmitted and received signal across a sensor tip in the louid. If the attenuation exceedes an internal threshold - sensor tip outside the liquid or liquid temperature higher than a determined value - a squarewave alarm output indicates an unsufficient liquid condition. If the liquid level is restored before the end of a delay time the alarm is not activated.

Through two pins it is possible to program : the delay



time to activate the alarm, the duty cycle of the output squarewave, the polarity of the input threshold of the sensor for alarm activation.

The above features make the L4620 particularly versatile for many applications and give the possibility to use various sensor types.

Internal circuits prevent spurious indications from the liquid sensor and a latch keeps the alarm activated until the supply voltage is switched off. The device includes thermal shutdown protections.



BLOCK DIAGRAM

L4620

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
ls	Supply Current ($V_S > V_Z$)	200	mA
V ₃	Sensor Input Voltage (V ₂ High)	7	V
lout	Output Current	500	mA
Ptot	Power Dissipation at T _{amb} = 70°C	0.8	W
T _j , T _{stg}	Junction and Storage Temperature Range	– 55 to 150	°C

PIN CONNECTION (top view)



THERMAL DATA

Sym	nbol	Parameter	Value	Unit
R _{th} j	j-amb	Thermal Resistance Junction-ambient Max	100	°C/W



PIN FUNCTION (Block Diagram)

N°	Name	Function
1	Oscillator	A capacitor C_{osc} connected to ground and a resistor R_{osc} connected to pin 5 (supply voltage) set the frequency of the internal oscillator. The period is given by: $T_{osc} = 0.693$ ($R_{osc} + 5000$) C_{osc}
2	Sensor Output	A squarewave is available at this pin to drive the external sensor. The output frequency is 1/32 of the internal oscillator fosc, i.e. 50Hz using the values of $R_{osc} = 180k\Omega$ and $C_{osc} = 4.7nF$ for the external components.
3	Sensor Input	Connection for liquid level sensing. During the zero level of the squarewave signal at pin 2, the internal sensing circuit is disabled. During the high level of the wave shape the input is compared with a threshold which depends on the output sensor volta $V_{SENSH} = 0.4V_2$ (typ). If the input voltage becomes higher than the above V_{SENSH} , the V_{sens} value is reduced to $V_{SENSL} = 0.22V_2$ (typ), providing an hysteresis available with both the programmable polarities.
4	GND	This pin must be connected to ground.
5	Supply Voltage	Supply voltage input. A 4.5V (typical) zener is present at the input. The external resistor limits the current through the zener for high supply voltages. Moreover when the voltage at this pin is down 2.5V (typical) the internal reset circuit is activated
6	Alarm Driver Output	An internal open collector stage is available at this pin to drive the external alarm indicator by a rectangular waveshape. The output period depends on the external component R_{osc} and C_{osc} . Using the recommended values of block diagram th
7	Alarm Delay Select	This program pin selects the alarm delay to activate the output stage after a low liquid level indication of the sensor. The delay depends on the internal oscillator frequency. Refer to application circuit, if this pin is kept low the typical delay is 10.
8	Sensor Polarity Select Output Duty-cycle Select	Through this pin it is possible to program both the sensor polarity with respect to the internal threshold and the duty-cycle of the output waveform which drives the alarm. When this pin is kept low the output rectangular wave duty cycle is 1:64 (T = 320ms, t = 5ms in fig. 2) and the output is activated, after the delay time, if the voltage at pin 3 is higher than V_{SENS} . When the voltage at this pin is high the output duty cycle is 50% (t = 160ms) and the output goes on, after the delay



ELECTRICAL CHARACTERISTICS ($T_{amb} = 25$ °C, unless otherwise specified. Refer to block diagram for external component values)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Vz	Internal Zener Voltage (pin 5) I _S = 24 mA		4	4.5	5	V
ls	Supply Current (pin 5)	upply Current (pin 5) $V_S = 3.8 V$		6.5	11	mA
f _{osc}	Oscillator Frequency (pin 1)	(pin 1) $R_{osc} = 180 \text{ k}\Omega, C_{osc} = 4.7 \text{ nF}$ 1.45 1.6		1.6	1.75	kHz
V ₇ , V ₈	Programming Pins Input	Low State			0.3	V
	Voltage (pin 7, 8)	High state	2			V
I7, I8	Programming Pins Input Current	$V_7 = V_8 = 0 V$	- 1		5 11 1.75	μA
	(pin 7, 8)	$V_7 = V_8 = V_Z$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	150	μA	
V ₂	Sensor Drive Output Voltage, (*)	$V_2 = Low,$ $I_2 = 1 mA$			0.4	V
		$V_2 = High,$ $I_2 = 1 mA$	V _Z –1		V _Z -0.4	V
I_2	Sensor Driver Output Current		- 1		1	mA
V_{SENSH}/V_2	Sensor Input High Threshold Voltage Versus V ₂ (pin 3)	V ₂ = High V _{pin 3} < V _{SENSL}	0.33	0.4	0.47	
V _{sens}	Sensor Input Low Threshold Voltage Versus V ₂ (pin 3)	V ₂ = High V _{pin 3} > V _{SENSH}	0.15	0.22	0.29	
V _{clamp3L}	Sensor Input Clamping Voltage (pin 3)	– 100 μA < I _{sens} < 100 μA V2 = Low	- 0.1		0.1	V
V _{clamp3H}		V ₂ = High I ₃ = − 100 μA	- 0.8	- 0.6	- 0.4	V
		I ₃ = + 100 μA	Vz		V _Z +0.8	V
I _{sens}	Sensor Input Bias Current (pin 3)	V _{sens} = High			1.2	μΑ
T _d	Delay Time	$f_{osc} = 1.6 \text{ kHz}$ V ₇ = Low		10.24		sec
		V ₇ = High		20.48		sec
V _{out(sat)}	Output Stage Saturation Voltage (pin 6) (**)	I _{out} = 200 mA			1.3	V
Vout (clamp)	Output Stage Overvoltage Protection (pin 6)	I _{out} = 70 mA	19	21	23	V

*) This is a squarewave signal. The frequency is given by : $f = \frac{1}{32}$ force.

**) The output squarewave signal frequency is given by f = -

The duty cycle depends on the state of the pin 8 and can be or 1 : 2 or 1 : 64, i.e. refer to figure 2, T = 320 ms, t = 160 or 5 ms when the oscillator frequency f_{osc} = 1.6 KHz.



CIRCUIT OPERATION

The L4620 liquid level alarm is designed to operate with a variety of sensor types which change impedance depending on whether the sensor is above or below the level of a liquid. If the impedance variation of ther liquid itself is sensed, a very simple sensor (two electrodes) can be used. The output stage drives directly the alarm indicator with a 300mA rectangular wave signal, the duty cycle of which is programmable.

SENSOR INTERFACE.

As shown in the application circuit, the sensor is connected so that it varies the attenuation of a squarewave signal between pin 2 and pin 3 where its positive half cycle is compared with the reference threshold (with hysteresis).

This frequency, generated internally by a 50% duty cycle oscillator, is 50Hz in the typical application ($R_{osc} = 180 K\Omega C_{osc} = 4.7 nF$).

The threshold of the sensor input is a function of the output voltage at pin 2. The hysteresis is provided by a Schmitt trigger comparator. As shown in figure 1, this gives hysteresis with either threshold polarity selected.

The AC driving of the level sensor allows the use of a capacitive filter (C_A , C_B , C_C in block diagram) which acts as a bandpass filter at the frequency used. The resistor R_C in the application circuit biases the sensor input stage. In this way the interference problems typical of automotive applications are reduced considerably. If, however, it is not necessary to decouple and filter the sensor a simple resistive network may be used, eliminating the capacitors.

SPURIOUS INDICATION PROTECTION.

To prevent spurious alarm signals when the liquid is

agitated or in the presence of interference, the device includes two protection mechanism :

Firstly, the sensor interface which samples the positive half cycle of the sensor signal activates its output only if there are four consecutive alarm condition indications. Secondly, the alarm output stage is only activated after an externally programmable delay. During this delay if the alarm condition ceases the alarm output will not be activated.

Using the values $C_{osc} = 4.7 nF$ and $R_{osc} = 180 K\Omega$, which give a typical oscillator frequency of 1.6KHz, delays of about 10 s (programming pin 7 low) or 20s.

INTERNAL MEMORY.

When the alarm output has been activated an internal latch holds it in the active state until the power supply is removed. This feature ensures that the alarm will not be interrupted if the sensor connection breaks.

OUTPUT STAGE.

Through pin 8 it is possible to program the duty cycle of the alarm signal waveform (see figure 2). When pin 8 is high the output signal has a duty cycle of 50% ; if pin 8 is low the duty cycle is 1 : 64. The period of the output signal is always 320ms using the component values indicated in block diagram.

The output stage can deliver up to 300mA and is protected internally against overvoltages (by a zener).

A thermal shutdown circuit provides additional protection.



SENSOR INPUT WAVEFORM

Figure 1a : Pin 8 Low; Alarm with Input Voltage > Threshold.



Figure 1b : Pin 8 High ; Alarm with Input Voltage < Threshold.





Figure 2a : Output Alarm Waveform with Pin 8 High : $t = \frac{1}{2}$ T.



Figure 2b : Output Alarm Waveform with Pin 8 Low : $t = \frac{1}{64}$ T.





L4620

MINIDIP MECHANICAL DATA

DIM.	mm			inch			
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
А		3.32			0.131		
a1	0.51			0.020			
В	1.15		1.65	0.045		0.065	
b	0.356		0.55	0.014		0.022	
b1	0.204		0.304	0.008		0.012	
D			10.92			0.430	
E	7.95		9.75	0.313		0.384	
е		2.54			0.100		
e3		7.62			0.300		
e4		7.62			0.300		
F			6.6			0.260	
I			5.08			0.200	
L	3.18		3.81	0.125		0.150	
Z			1.52			0.060	



Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1995 SGS-THOMSON Microelectronics - All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco - The Netherlands - Singapore-Spain - Sweden - Switzerland - Taiwan - Thaliand - United Kingdom - U.S.A.

