WINDOW LIFT CONTROLLER

ADVANCE DATA

- FOUR POWER OUTPUTS - UP TO 200 mA EACH ONE - FOR RELAIS DRIVING PROVIDED WITH INTERNAL RECIRCULATION
- TWO PROGRAMMING INPUTS FOR WINDOWS OPERATING MODE SELECTION
- ONLY TWO WIRES CONNECTING EACH KEYBOARD TO THE DEVICE
- WINDOW STATUS DETECTION BASED ON THE MOTOR CURRENT RIPPLE
- IGNITION KEY AND DOOR STATUS SENSING
- CLOCK FREQUENCY DEFINED BY AN EXTERNAL CAPACITOR
- ESD PROTECTION

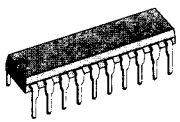
DESCRIPTION

The L9324 is a monolithic low side driver - realized with ST Multipower-BCD mixed technology - specially suited as window lift in automotive environment. The device drives four window motor control relais and it allows two possible window operating modes : the automatic (one touch) and the normal mode.

The window status (steady state, travel end) is checked by means of the ripple absence on the motor current.

The application circuit is able to withstand the load dump up to 80 V.

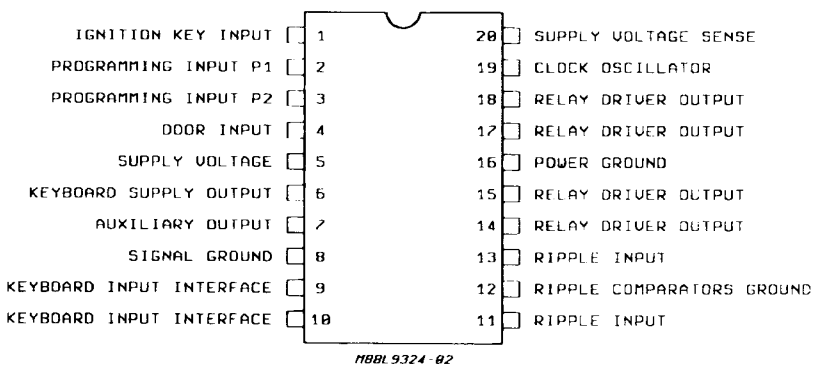
The device is assembled in 20 Lead Plastic DIP.



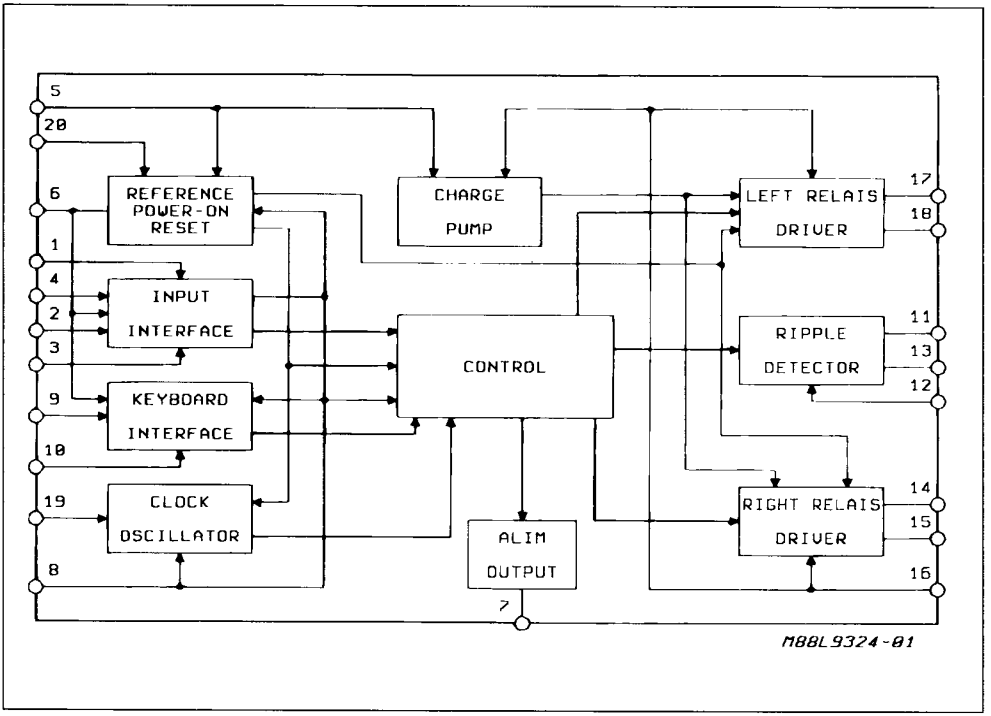
DIP20

ORDERING NUMBER : L9324

PIN CONNECTION (top view)



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_5	D.C. Supply Voltage D.C. Reverse Supply Voltage	25 – 0.7	V V
$I_{14,15,17,18}$	Max. Relais Driver Output Currents (in dump condition : V_{DUMP} = 80V 5ms ≤ t_{rise} ≤ 10ms) τ_f Fall Time Constant = 100ms R_{SOURCE} ≥ 0.5Ω	1	A
T_j, T_{stg}	Junction and Storage Temperature Range	– 55 to 150	°C

THERMAL DATA

$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	80	°C/W

ELECTRICAL CHARACTERISTICS (V_{BATT} = 14V, -20°C ≤ Tamb ≤ 85°C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_5	Operating supply Voltage		8		16	V
I_{q5}	Quiescent Current (OFF Condition)			1	2	mA
I_{q5ON}	Quiescent Current (OFF Condition			30		mA
V_{OVth}	(pin 20) Overvoltage Protection Threshold (power output stage		17	22	27	V
$V_{14, 15, 17, 18}$	Relais Driver Output Saturation Voltage	$I_{14, 15, 17, 18}$ = 200mA		0.7	1	V
V_{CZ}	Intrnal Voltage Clamp at the Outputs (pin 14, 15, 17, 18)			26		V
$V_{11, 13th}$	Ripple Detection Threshold		6	20	40	mV
I_{AUX7}	Auxiliary Output Source Current			20		mA
V_6	Keyboard Reference Voltage	0 < I_6 < 100mA	3.8	4.5	5.2	V
I_6	Keyboard Reference Output Current			100	120	mA
R_9, R_{10}	Comparator Input Resistance		30			KΩ
V_{2th}, V_{3th}	Programming Input Threshold Voltage			1.5		V
V_{1th}	Ignition Key Threshold Voltage			1.5		V
V_{4th}	Door Input Thereshold Voltage			50		mV
T	Clock Period	C_{EXT} = 2.2nF	0.5	1.5	2.5	ms
t_{fd1}	Keyboard Filter Delay Time		16T		32T	ms
t_{fd2}	Door and Key Filter Delay Time		32T		64T	ms
t_{dabs}	Delay Time Between the Ripple Absence and the Motor Stop		30T		36T	ms
t_{fd3}	Ripple Filter Delay Time at Motor Start-up		32T		48T	ms
t_{stup}	Start-up Delay Time		50T		182T	ms

FUNCTIONAL DESCRIPTION

PIN FUNCTIONS

1 - Ignition key input. This pin must be connected, through a resistor, to the ignition key ; in this way, at ignition key turn on (high level at pin 1), the full operating mode of the device is enabled. The a.m. resistor, together an internal zener, provides to protect this input in load dump condition ; recommended value for this resistor is 47 K.

2 and 3 - Programming inputs P_1 and P_2. These two pins allow to programme the device operation mode, according to the following truthtable :

P1	P2	Operating Mode
0	X	The device is programmed to work in a rear module. The automatic mode is disabled for both the windows. The high to low transition of a signal applied to pin 4 changes, in this operating mode, the status of the auxiliary output ; the device is enabled only at ignition key turn-on. The input P2 has no effect when P1 is low.
1	1	The device is programmed to work in a front module. The automatic mode is enabled for both the windows if the ign. key is on ; if the key is in off condition, the device works in traditional mode if one of the front doors is open, or it is disabled if both the front doors are closed.
1	0	In this case too the device is programmed to work in a front module. The operating mode is as for the last case but the automatic mode, when enabled, is possible only for the left window.

Note : a logic level 0 in the above table means the pin connected to ground ; a logic level 1 means the pin open ; X = don't care.

4 - Door input. This input senses the doors status (open or close) when the device is programmed to work in a front module. This pin must be connected, via an external resistor, to the door switch normally present on all the cars for the inside lamp. A low voltage level on this input means that the door is open (inside lamp on), an high voltage level means that the door is closed (inside lamp off). In the rear module this pin is connected to a push button which allows to enable and disable the module. The external resistor, together an internal zener, provides to protect the input against overvoltages ; recommended value for the external resistor is 100 ohms.

5 - Supply voltage. This pin must be connected to the battery through a voltage limiter not to damage the device in load dump conditions (see the application circuit).

6 - Keyboard supply output. The voltage on this pin is about 4 V and the output current capability is 100 mA. An internal divider connected to this same voltage source generates the 4 thresholds for the keyboards interface input. This pin is connected to the two keyboards through two resistors (recommended value 100 ohms).

7 - Auxiliary output. This output, by an external transistor, drives the relay necessary to enable the rear keyboard when the device works in a rear module. The output current capability of this output is 20 mA.

8 - Signal ground.

9 and 10 - Keyboards input interfaces. This two pins are respectively connected to the left and to the right keyboard ; pushing one of the 4 pushbuttons of each keyboard a voltage is established on this pins. The device "understands", by this voltage level, which pushbutton has been pressed and execute the command. This concept allows to have many functions with a limited number of wires between the module and the keyboards. The voltage levels of the keyboards are then function of the pressed pushbutton as follow :

- traditional up.....3/4 * V_{pin6}
- automatic up.....1/2 * V_{pin6}
- traditional down.....1/4 * V_{pin6}
- automatic down.....0

The recommended values of the keyboards resistor necessary to have the a.m. values are respectively 180, 68 and 33 ohms (see schematic diagram).

11 and 13 - Ripple inputs. These inputs sense respectively the ripple of the right and the left motor through 2 decoupling capacitors connected to the sense resistors.

12 - Ripple comparators ground. This pin must be connected directly to the sense resistor ground, so to avoid bad operations of the ripple comparators.

14, 15, 17 and 18 - Relay driver outputs. These outputs control the relais to drive the window motors in the correct way. The 4 power devices are also switched on during the relais current recirculation and in overvoltage condition to protect themselves. In this way the device can withstand overvoltages up to 80 V (t = 300 msec), because the current flowing in the output power devices is limited by the relais resistance.

16 - Power ground. This pin is internally connected to the common power ground of the relay driver outputs.

19 - Clock oscillator. A capacitor connected bet-

ween this pin and ground set the clock frequency necessary for the correct operation of the internal logic. Recommended value for this capacitor is 2.2 nF.

20 - Supply voltage sense. This pin, connected by an external resistor to the battery supply voltage, allows the device to sense overvoltages ; in this condition, as said above, all the relay drivers are switched on to protect themselves.

APPLICATION INFORMATION

The L9324 can perform two possible window operating modes : the normal and the automatic mode. In the normal operating mode the window goes up or down until the keyboard push-button is pushed and the window is not stopped by obstacles. In the automatic mode, even after releasing the keyboard push-button, the window continues its movement that is interrupted if another push-button is pushed or by an obstacle. The window status (steady state, travel end) is detected by the absence of the ripple on the motor current. The delay time between the ripple absence and the motor switch off is about 50 ms. During the starting phase the motor is driven up to 250 ms even if the ripple is not present.

The complete window lift system using L9324 is based on two modules, one for the front windows and the other for the rear ones.

The possible operating modes, set by the programming inputs P_1 and P_2, are shown in the following diagram.

Figure 1 : Operating Modes.

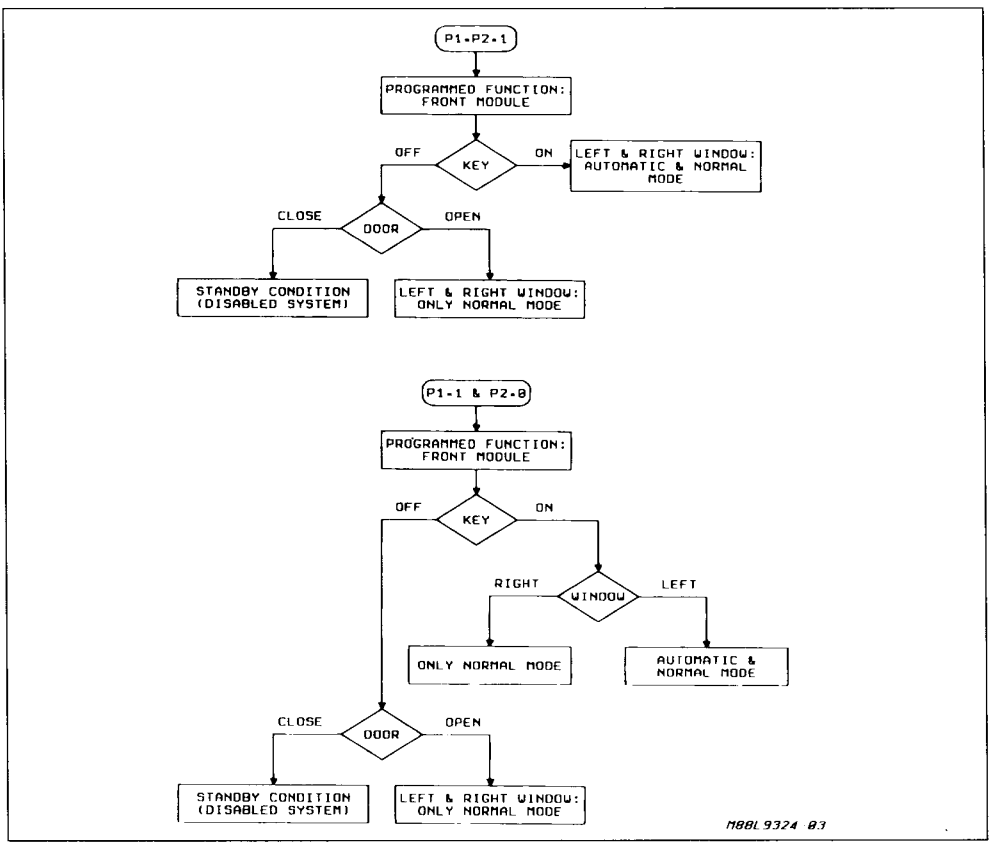


Figure 2 : Operating Modes.

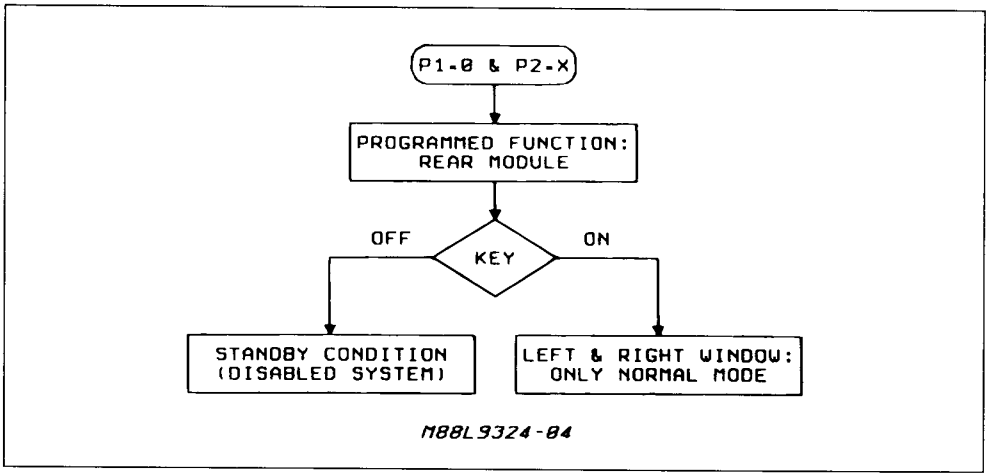


Figure 3 : Application Circuit.

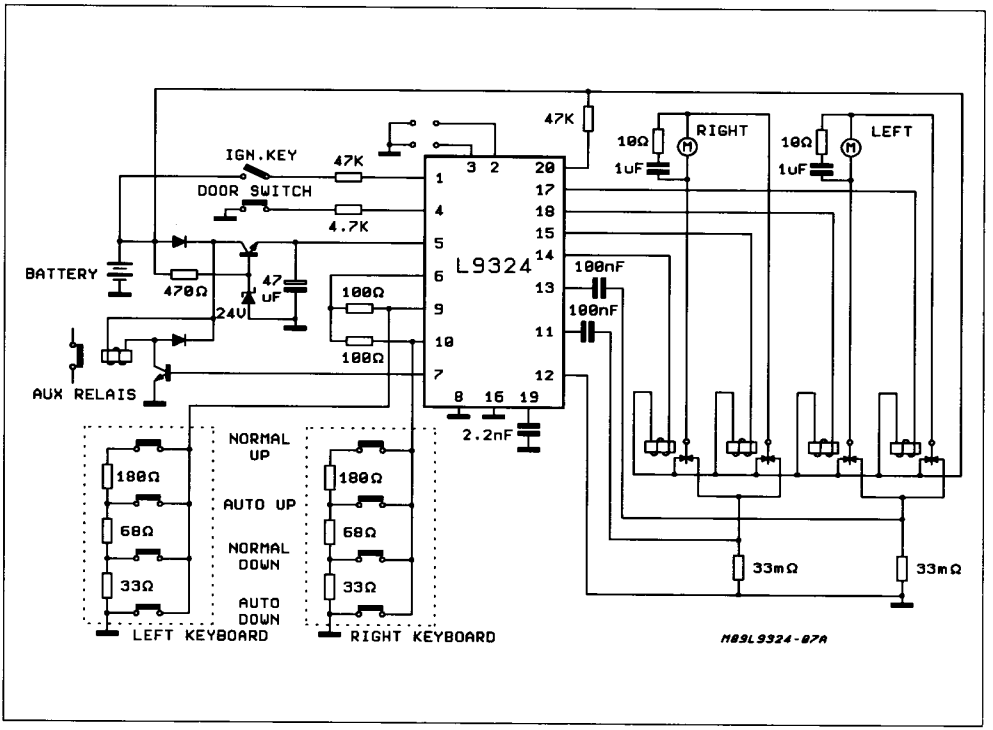


Figure 4 : Complete Window Lift System.