Interval and Wipe/ Wash Wiper Control IC

Description

The LD33197 (analog MC33197) is a standard wiper timer control device designed for harsh automotive applications. The device can perform the intermittent, after wash, and continuous wiper timer functions. It is designed to directly drive a wiper motor relay. The LD33197 requires very few external components for full system implementation. The intermittent control pin can be switched to ground or Vbat to meet a large variety of possible applications. The intermittent timing can be fixed or adjustable via an external resistor. The LD33197 is built using bipolar technology and parametrically specified over the automotive ambient temperature range and 8.0 to 16 V supply voltage. The LD33197 can operate in both front and rear wiper applications.

Features

- Adjustable Time Interval of Less Than 500 ms to More Than 30s
- Adjustable After Wipe Time
- Intermittent Control Pin Can Be Switched to Ground or Vbat
- Priority to Continuous Wipe
- Minimum Number of Timing Components
- Integrated Relay Driver With Free Wheeling Protection Diode
- Operating Voltage Range From 8.0 to 16 V
- For Front Wiper and Rear Wiper Window Applications

Ordering Information

Package	Remarks
SOP8	Tubed, Reeled, Pb-free
DIP8	Tubed, Pb-free

Block Diagram

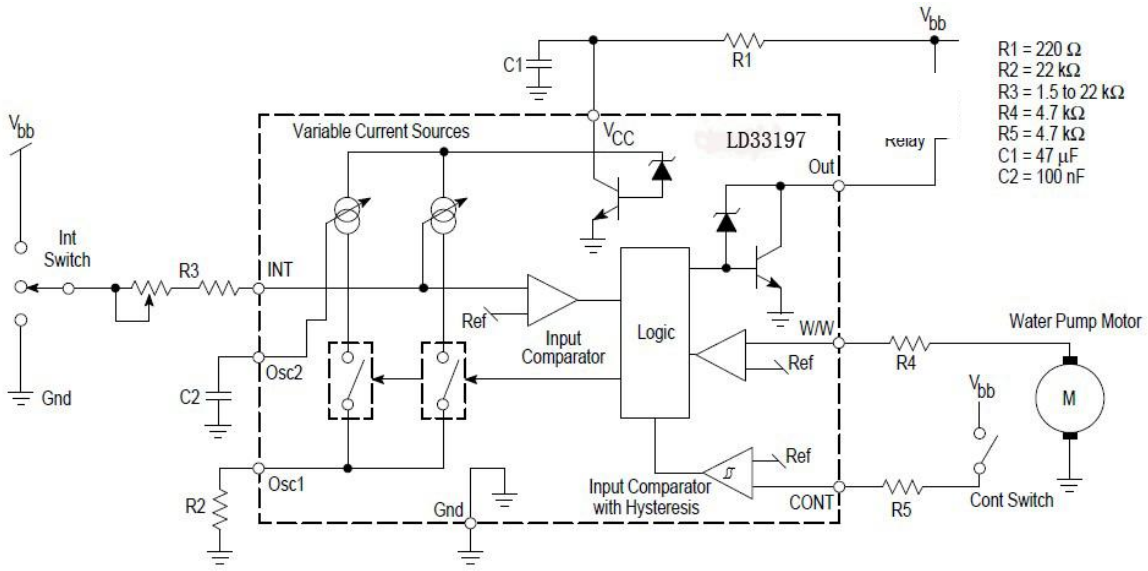
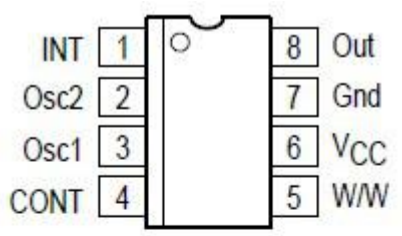


Figure 1. Block diagram

Pin Description

Pin	Symbol	Function
1	INT	Interval Switch
2	Osc2	Timing Capacitor C
3	Osc1	Timing Resistance R
4	CONT	Cont Switch
5	W/W	Wipe/Wash Switch
6	Vcc	Supply Voltage
7	GND	Ground
8	OUT	Relay Control Output

DIP8



SOP8

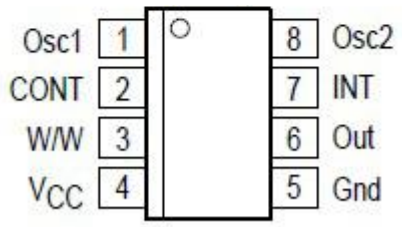


Figure 2. Pinning

Thermal Resistance

Rating	Symbol	Symbol	Unit
Continuous Supply Voltage (VPin 6)	Vcc	16	V
Storage Temperature	Tstg	–55 to +150	℃
Thermal Resistance (Junction–to–Ambient) DIP–8 Package SO–8 Package	$R_{\theta JA}$	 100 145	℃/W
Operating Ambient Temperature Range DIP–8 Package SO–8 Package	T_A	 –40 to +125 –40 to +105	℃
Operating Junction Temperature Range	T_J	–40 to +150	℃
Operating Junction Temperature Range	$T_{J(max)}$	150	℃

Electrical Characteristics

V_{Batt} = 12 V, Tamb = 25℃, reference point is Pin 8 (see figure 3) unless otherwise specified.

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Supply Voltage Range	V_{CCF}	8.0	–	18	V
Operating Supply Voltage Range	V_{CCOP}	8.0	–	16	V
Standby Supply Current (VCC = 16 V, R2 = 68 k)	ICC	–	4.0	5.2	mA
Supply Current INT Active (R3 = 2.5 k)	ICC	–	7.0	8.4	mA
Supply Current Relay “On” (R2 = 68 k)	ICC	–	7.5	11.2	mA
Supply Current INT and Relay "On" (R2 = 68 k, R3 = 2.5 k)	ICC	–	10	14.5	mA
Oscillator Variations with Supply Voltage and Temperature (excluding external component tolerances, C2 = 100 nF polyester capacitor) (Notes 1 & 2) 10≤Vbb≤16 V 8.0≤Vbb≤16 V	Kosc	 –	 10	 –	%
Relay Resistance	RL	60	_	–	Ω
Output Voltage (Iout = 200 mA)	Vout	–	0.9	1.5	V
Output Clamp Voltage (Iout = 20 mA)	Vcl	19.5	–	22	V
Output Clamp Voltage (Iout = 20 mA) Vbb = 13 V (Note 3) Vbb = 13 V (INT Connected to Gnd) (Note 4) Vbb = 13 V (INT Connected to Vbat, R1 = 220 W) (Note 4)	 tb1 tb2g tb2v	 0.98 15.1 11.5	 1.0 15.5 12.1	 1.03 15.9 12.7	–
CONT Threshold (VCC = 13 V)	Vih	6.0	–	8.5	V
CONT Threshold (VCC = 16 V)	Vih	–	VCC/2	–	V

NOTES:

1. The oscillator frequency is defined by the current flowing through the external resistor R2. The voltage at the INT pin is (VCC/2 – Vbe) and hence the current flowing through R3 is different if R3 is connected to Vbb or to Gnd because of the voltage drop across resistor R1. This voltage drop causes the oscillator coefficient for tb2 to be different for the two cases of INT terminated to Gnd or to Vbb. Because of this, the oscillator coefficient is specified with a specific value of R1 whenever INT is connected to Vbb. If R1 is changed, the coefficient will change. Also, any extra current through the resistor R1 other than the current used by the device will cause timing deviations in tb2 timings (as in the case where two devices are sharing a common R1 resistor).
2. The oscillator stability with temperature is dependent on the temperature coefficients of the external components. If the capacitance value of the external capacitor varies more than 5% over the parametric temperature range, the figures quoted for oscillator variation are not valid.
3. The tb1 duration is given by coefficient 4 x R2 x C2 (tb1 duration = tb1 x 4 x R2 x C2).
4. The tb2 duration is given by coefficient x R3 x C2 (tb2 duration = tb2 x R3 x C2).

Application Circuit

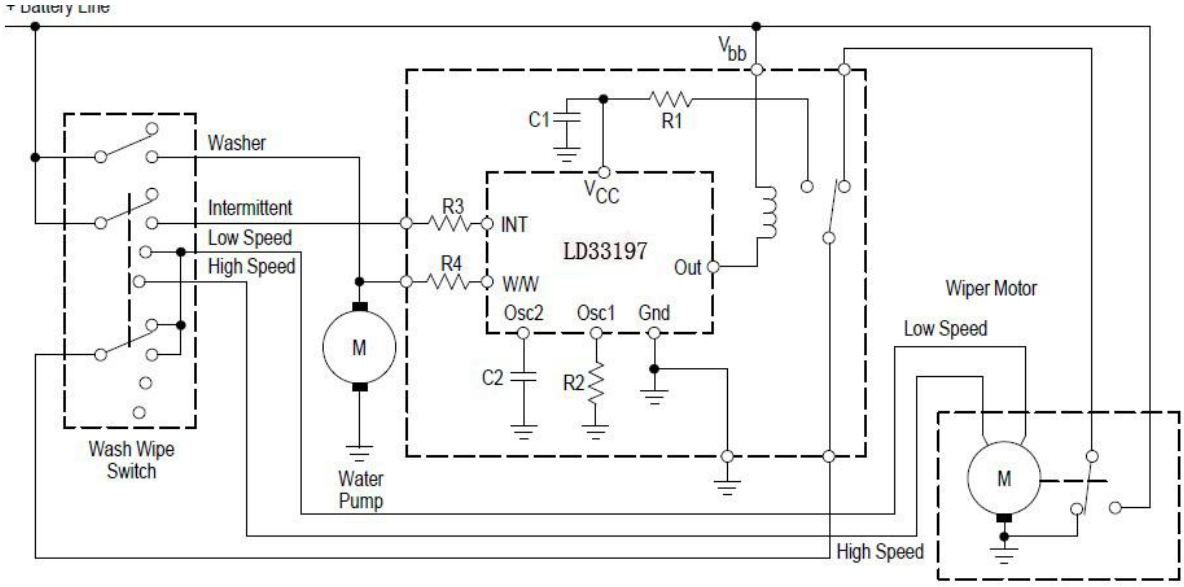


Figure 3. Intermittent Wash Wiper Typical Application

Circuit Description

The LD33197 is a wiper timer control device designed for use in harsh automotive applications. The device can perform the intermittent, after wash, and continuous wiper timer functions.

The LD33197 is designed to directly drive a wiper motor relay. The LD33197 is suitable for both front and rear wiper applications. The LD33197 connects directly to the vehicle's battery voltage (Vbat) through a 220Ω resistor used with a 47uF de–coupling filter capacitor. The devi Bce has an internal oscillator controlled by one of two external resistors (R2 and R3) in addition to one external capacitor (C2), dependent on the application function required. The values of C2 and R2 determine the tb1 time base. Tb1 is used to generate the relay wiper activation during the INT function (T3) and the after wash timing (T2) during the wash wipe mode. The values C2 and R3 determine the tb2 time base. The tb2 time base is used to generate the pause or intermittent time (T4).

The intermittent wiper function can generate intermittent timing (T4) from less than 500 ms to more than 30 seconds. The intermittent function of the device can be activated by the INT input connected to either ground or Vbat. The intermittent timing is externally adjustable by changing the value of resistor R3.

The wash wiper timer function detects the water pump motor's operation. When the pump motor activation is detected, the LD33197 turns the wiper on for the entire duration of the pump motor's activation. When the motor is turned off, it generates an after wash timing (T2) to maintain the wiping action. The W/W pin is connected to the water pump motor through a protection resistor (R4).

The LD33197 also has a continuous function, which activates the wiper relay whenever the CONT input is activated. The CONT input is connected to a switch through a protection resistor (R5). The CONT input comparator has an input threshold of Vbb/2 with hysteresis.

The device has internal debounce circuitry, based on the oscillator period. This provides filtering of the intermittent (INT) and wash wipe (W/W) input signals (see T1 Debounce Timing paragraph that follows). The device directly drives the wiper motor relay. It internally incorporates a 20 V free wheeling zener diode to protect the device against overvoltage spikes produced when relay is switched off.

Intermittent Operation

Conditions:

• W/W not connected or connected to ground.

• CONT not connected or connected to ground.

• INT connected to Vbb or to ground.

In this configuration, the circuit will respond to the switching of INT to either Vbb or ground after a time T1 (see T1 Debounce Timing). If INT is disconnected before the end of T1; no action will be taken. After a time T1, the output will be switched on for a duration, T3 = 16 x 4 x tb1 and then switched off for a duration, T4 = 144 x 4 x tb2. This sequence will continue to repeat so long as INT is disconnected from Vbb or ground for a time duration greater than T1. If INT is disconnected during the time T3; the output will remain on for the remainder of T3. This is illustrated in the diagram on Figure 4.

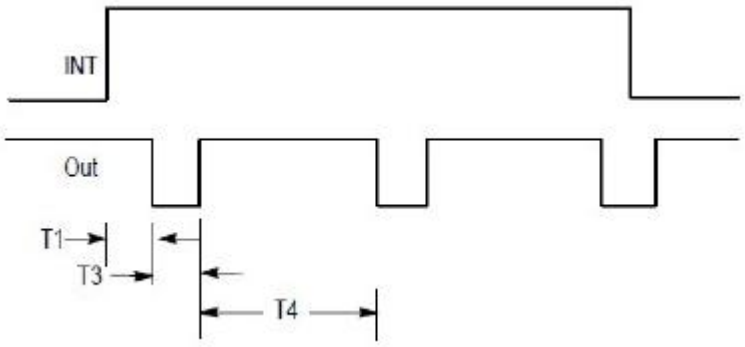


Figure 4. Switching Waveform INT Timing

Wash Wipe Operation

Conditions:

• INT disconnected.

• CONT disconnected or connected to ground.

In this condition, the circuit will respond to the switching of W/W to Vbb after a time T1 (see T1 Debounce Timing). If W/W is disconnected or connected to ground before the end of T1; no action will be taken. After a time T1; the circuit will perform as shown on Figure 5. The output will turn on and remain on for the duration of W/W. When W/W becomes inactive, the output will remain on for T2 = 96 x 4 x tb1.

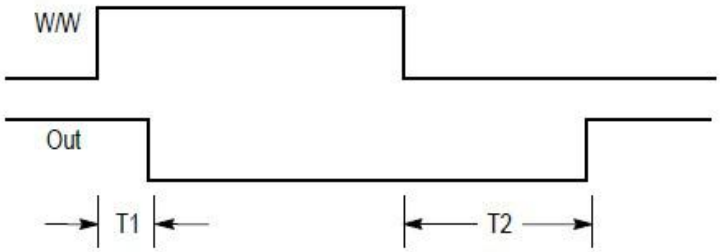


Figure 5. Switching Waveform W/W Timing

Continuous Operation

In this condition, the circuit responds to the switching of CONT to Vbb. If CONT is connected to Vbb, the output will turn on regardless of the state of any other input and remain on so long as CONT is active. This command operates directly on the relay output and does not interfere with any other timing. Therefore, the circuit will not be reset to a defined state.

Wash Wiper and Intermittent Operation

If W/W is activated during the time INT is also activated, the circuit will respond to W/W after a time T1 (see T1 Debounce Timing). The output will turn on after T1, and stay on for a time T2 + T3 after W/W is deactivated. Following this, normal operation of INT will occur. This is shown on Figure 6.

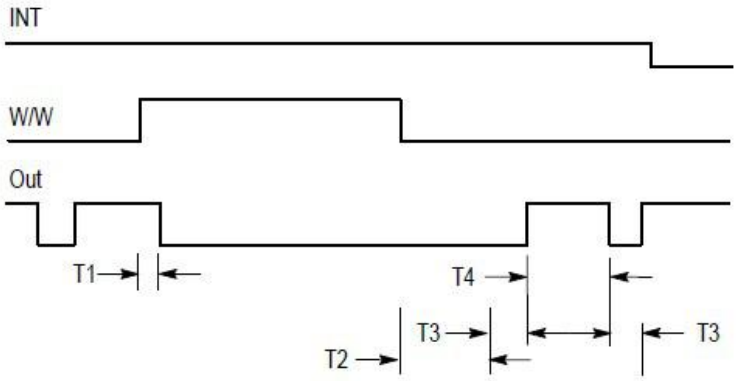


Figure 6. Switching Waveform W/W and INT Active

T1 Debounce Timing

The criteria for an input signal to be detected is that it should be active at two successive negative internal clock edges. The inputs are sampled on the negative edge of the internal clock. If two consecutive samples are the same, the input is detected as being in that state. Hence the time T1 from a signal becoming active to the time that the circuit responds can be anytime from 4 x tb1 to 2 x 4 x tb1 (due to synchronizing the input to the oscillator period) when the oscillator is oscillating with a time base of tb1 and 4 x tb2 to 2 x 4 x tb2, when the oscillator is oscillating with a time base of tb2.

The following table summarizes all T1 debounce timings:

Condition	Debounce Time
INT Active	4 x tb1 to 2 x 4 x tb1
INT Inactive	4 x tb1 to 2 x 4 x tb1
W/W Active When INT Inactive	4 x tb1 to 2 x 4 x tb1
W/W Active When INT Active During T3	4 x tb1 to 2 x 4 x tb1
W/W Active When INT Active During T4	4 x tb2 to 2 x 4 x tb2

Overvoltage Protection

In reference to the Block Diagram and Typical Application, all of the foregoing operational cases require:
R1≥100 Ω, C1≥47 uF
R3≥1.0 kΩ, R4≥4.7 kΩ, R5≥4.7 kΩ
The circuit will not operate during the transient conditions. By using the above component values, the circuit will be able to sustain the following overvoltage on Vbb without permanent damage:
1. +28 V for 5 minutes
2. –15 V for 5 minutes
3. –16 V cycled off for 1.0 minute
4. +80 V pulse decaying exponentially to 8.0 V in 400 ms repeated 3 times at 1.0 minute intervals.
5. ± 300 V pulse decaying exponentially to 30 V in 300 ms with a maximum energy of 1.0 Joule.
6. ±100 V pulse decaying exponentially to 10 V in 2 ms.

Recommended External Component Values

Below are the recommended component values to ensure the device will operate properly, and that all specified parameters will stay within their tolerances.
R1 should be greater than 100Ω; recommended value of 220Ω. R1 can be up to 500Ω, but in this case the tb2v parameter could be out of it's specified value (see Electrical Characteristics and Note 1). Also, the minimum operating voltage range should be greater than 8.0 V. The following values should be adhered to:
10 kΩ ≤R2≤68 kΩ
1.5 kΩ≤R3 ≤47 kΩ
R4 ≥4.7 kΩ
R5 ≥4.7 kΩ
C1 ≥47 uF
47 nF ≤C2 ≤470 nF

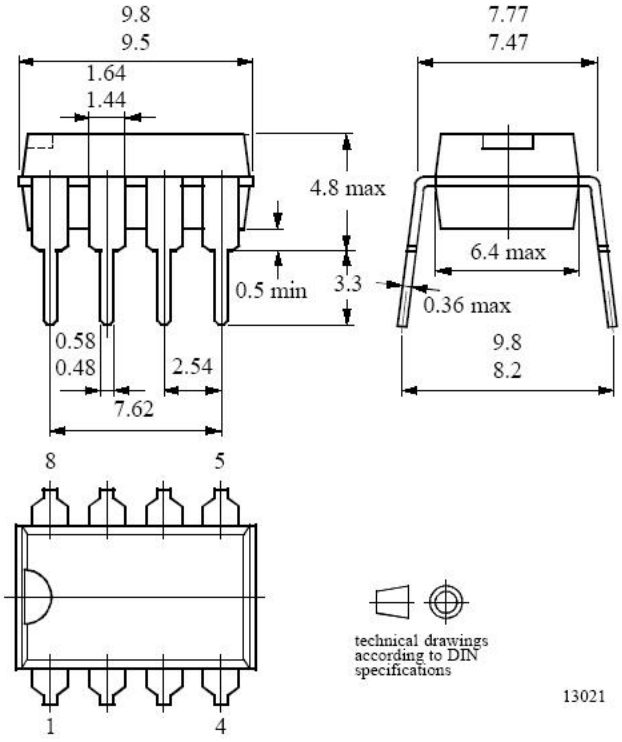
Application Information

The following is an example of timing calculations using the following external components values:
R2 = 22 kΩ, R3 = 2.2 kΩ, C2 = 100 nF (Referring to Block Diagram and Typical Application).
Oscillator Time Base Calculation:
tb1 duration = tb1 x 4 x R2 x C2 = 1 x 4 x 27e3 x 100e–9 = 10.8 ms
tb2 duration_g (INT to Gnd) = tb2g x R3 x C2 = 15.5 x 2.2e3 x 100e–9 = 3.41 ms
tb2 duration_v (INT to Vbb) = tb2v x R3 x C2 = 12.1 x 2.2e3 x 100e–9 = 2.66 ms
Intermittent timing calculation:
T3 = 16 x 4 x tb1 duration = 16 x 4 x 10.8 ms = 691 ms
T4 = 144 x 8 x tb2 duration_g = 144 x 8 x 3.41 ms = 3.92 s
(INT connected to Gnd)
T4 = 144 x 8 x tb2 duration_v = 144 x 8 x 2.66 ms = 3.06 s
(INT connected to Vbb)
LD33197 and MC33197 are different at T4 time.
In practical applications, T4 time can be adjusted by resistor R3.
Wash wipe timing calculation:
T2 = 96 x 4 x tb1 = 96 x 4 x 10.8 ms = 4.15 s
T1 Debounce Time Calculation (see T1 Debounce Timing)
When oscillator is oscillating at tb1:
T1 minimum = 4 x tb1 = 4 x 10.8 ms = 43.2 ms
T1 maximum = 2 x 4 x tb1 = 2 x 4 x 10.8 ms = 86.4 ms
When oscillator is oscillating at tb2:
T1 minimum (INT connected to Gnd, tb2g) = 4 x tb2 = 4 x 3.41 ms = 13.6 ms
T1 maximum (INT connected to Gnd, tb2g) = 2 x 4 x tb2 = 2 x 4 x 3.41 ms = 27.3 ms

Package Information

DIP8

Dimensions in mm



SOP8

Dimensions in mm