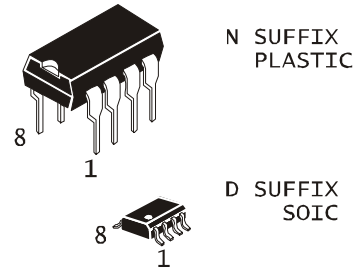


Automotive Wash Wiper Timer

IL33197A

The IL33197A 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 IL33197A 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 IL33197A is built using bipolar technology and parametrically specified over the automotive ambient temperature range and 8.0 to 16 V supply voltage. The IL33197A can operate in both front and rear wiper applications.

- Adjustable Time Interval of Less Than 500 ms to More Than 30 s
- Intermittent Control Pin Can Be Switched to Ground or Vbat
- Adjustable After Wipe Time
- 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



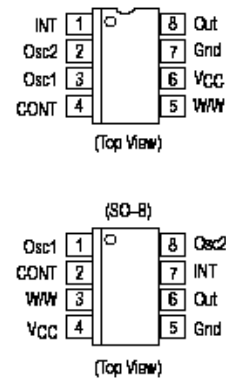
ORDERING INFORMATION

IL33197AN DIP
 IL33197AN-01 DIP
 IL33197AD SOIC
 IL33197AD-01 SOIC
 T_A = -45° to 105°C (SOIC)
 T_A = -45° to 125°C (DIP)

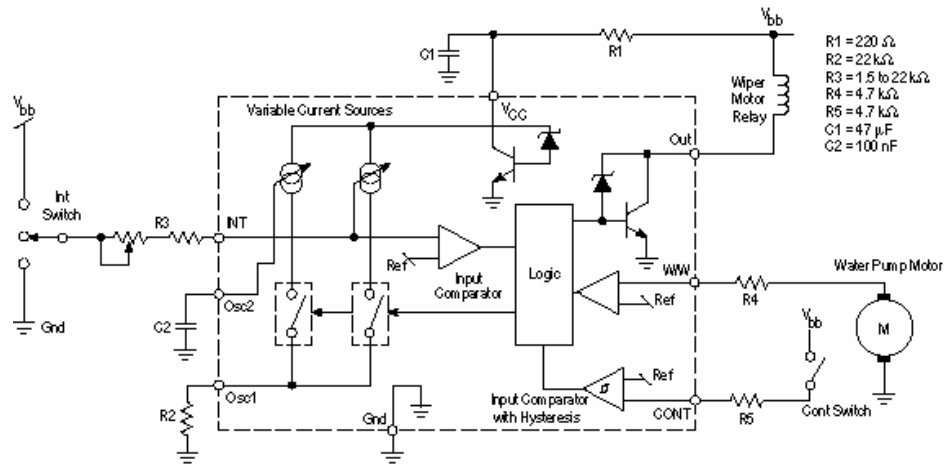
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Continuous Supply Voltage (V _{Pin 6})	V _{CC}	16	V
Storage Temperature	T _{stg}	-55 to +150	°C
Thermal Resistance (Junction-to-Ambient)	R _{θJA}	100 145	°C/W
Operating Ambient Temperature Range	T _A	-45 to +125 -45 to +105	°C
Operating Junction Temperature Range	T _J	-40 to +150	°C
Maximum Junction Temperature	T _{J(max)}	150	°C

PIN CONNECTIONS



Representative Block Diagram
This device contains 390 active transistors.



ELECTRICAL CHARACTERISTICS ($-45^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$, $8.0\text{ V} \leq V_{CC} \leq 16\text{ V}$, unless otherwise noted. Typical values reflect approximate mean at $T_A = 25^{\circ}\text{C}$ with $V_{CC} = 14\text{ V}$ at the time of initial device characterization.)

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 ($V_{CC} = 15\text{ V}$, $R2 = 68\text{ k}$)	CC	–	4.0	5.2	mA
Supply Current INT Active ($R3 = 2.5\text{ k}$)	CC	–	7.0	3.4	mA
Supply Current Relay "On" ($R2 = 68\text{ k}$)	CC	–	7.5	1.2	mA
Supply Current INT and Relay "Or" ($R2 = 68\text{ k}$, $R3 = 2.5\text{ k}$)	CC	–	10	14.5	mA
Oscillator Variations with Supply Voltage and Temperature (excluding external component tolerances, $C2 = 100\text{ nF}$ polyester capacitor) (Notes 1 & 2) $10\text{ V} \leq V_{Dbb} \leq 16\text{ V}$ $8.0\text{ V} \leq V_{bb} \leq 16\text{ V}$	K_{OSC}	–	10 15	–	%
Relay Resistance	R_L	60	–	–	Ω
Output Voltage ($I_{OUT} = 200\text{ mA}$)	V_{OUT}	–	0.9	1.5	V
Output Clamp Voltage ($I_{OUT} = 20\text{ mA}$) (for IL33197AN/D) (for ILA33197AN/D-01)	V_{CL}	19.5 27	–	22 32	V
Oscillator Period Coefficient ($T_A = 25^{\circ}\text{C}$) $V_{Dbb} = 15\text{ V}$ (Note 3) $V_{Dbb} = 15\text{ V}$ (INT Connected to Gnd) (Note 4) $V_{Dbb} = 15\text{ V}$ (INT Connected to V_{bat} , $R1 = 220\ \Omega$) (Note 4)	t_{b1} t_{b2g} t_{b2v}	0.98 15.1 11.5	1.0 15.5 12.1	1.03 15.9 12.7	–
CONT Threshold ($V_{CC} = 13\text{ V}$)	V_{IH}	6.0	–	3.5	V
CONT Threshold ($V_{CC} = 16\text{ V}$)	V_{IH}	–	$V_{CC}/2$	–	V

- NOTES:**
- The oscillator frequency is defined by the current flowing through the external resistor R2. The voltage at the INT pin is ($V_{CC}/2 - V_{be}$) 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 t_{b2} 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 t_{b2} timings (as in the case where two devices are sharing a common R1 resistor).
 - 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.
 - The t_{b1} duration is given by coefficient $4 \times R2 \times C2$ (t_{b1} duration = $t_{b1} \times 4 \times R2 \times C2$).
 - The t_{b2} duration is given by coefficient $\times R3 \times C2$ (t_{b2} duration = $t_{b2} \times R3 \times C2$).

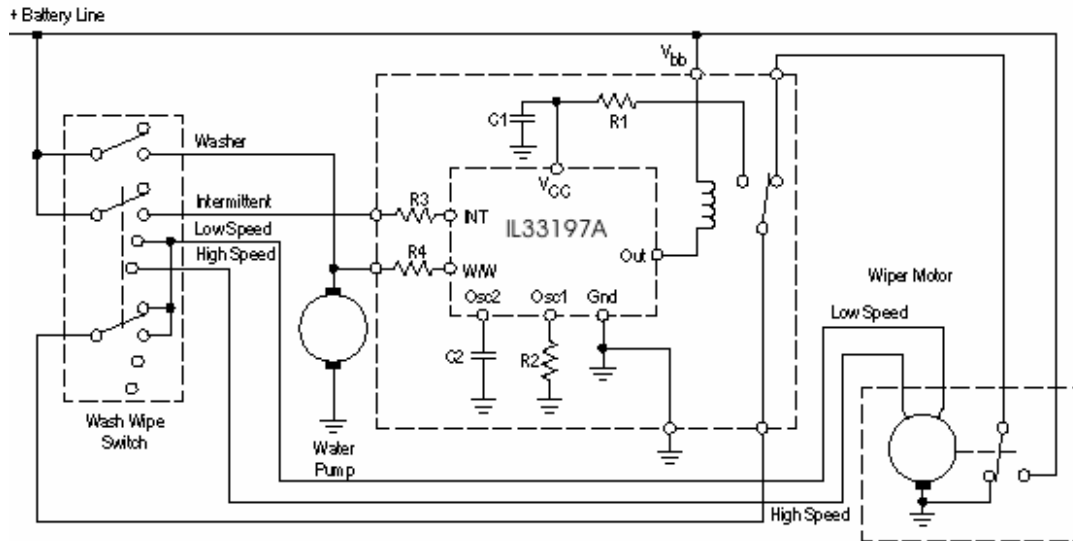


Figure 1. Intermittent Wash Wiper Typical Application

This application shows the IL33197A with the external wirings and two speed wiper motor. This application has the Intermittent and Wash Wiper functions.

INTRODUCTION

The IL33197A 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 IL33197A is designed to directly drive a wiper motor relay. The IL33197A is suitable for both front and rear wiper applications. The IL33197A connects directly to the vehicle's battery voltage (V_{bat}) through a 220Ω resistor used with a $47\ \mu\text{F}$ de-coupling filter capacitor. The device has an internal oscillator controlled by one of two external resistors (R_2 and R_3) in addition to one external capacitor (C_2), dependent on the application function required. The values of C_2 and R_2 determine the t_{b1} time base. t_{b1} is used to generate the relay wiper activation during the INT function (T_3) and the after wash timing (T_2) during the wash wipe mode. The values C_2 and R_3 determine the t_{b2} time base. The t_{b2} time base is used to generate the pause or intermittent time (T_4). The intermittent wiper function can generate intermittent timing (T_4) 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 V_{bat} . The intermittent timing is externally adjustable by changing the value of resistor R_3 . The wash wiper timer function detects the water pump motor's operation. When the pump motor activation is detected, the IL33197A 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 (T_2) to maintain the wiping action. The W/W pin is connected to the water pump motor through a protection resistor (R_4). The IL33197A 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 (R_5). The CONT input comparator has an input threshold of $V_{bb}/2$ 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.

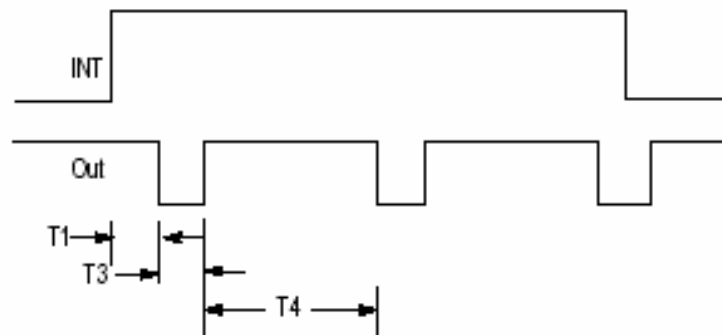
Intermittent Operation

Conditions:

- W/W not connected or connected to ground.
- CONT not connected or connected to ground.
- INT connected to V_{bb} or to ground.

In this configuration, the circuit will respond to the switching of INT to either V_{bb} or ground after a time T_1 (see T1 Debounce Timing). If INT is disconnected before the end of T_1 ; no action will be taken. After a time T_1 , the output will be switched on for a duration, $T_3 = 16 \times 4 \times t_{b1}$ and then switched off for a duration, $T_4 = 144 \times 4 \times t_{b2}$. This sequence will continue to repeat so long as INT is disconnected from V_{bb} or ground for a time duration greater than T_1 . If INT is disconnected during the time T_3 ; the output will remain on for the remainder of T_3 . This is illustrated in the diagram on Figure 2.

Figure 2. Switching Waveform INT Timing

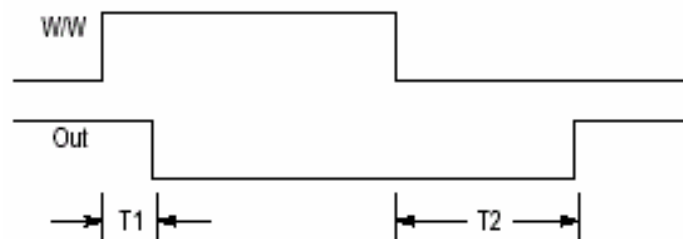
**Wash Wipe Operation**

Conditions:

- INT disconnected.
- CONT disconnected or connected to ground.

In this condition, the circuit will respond to the switching of W/W to V_{bb} 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 3. 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 t_{b1}.

Figure 3. Switching Waveform W/W Timing

**Continuous Operation**

In this condition, the circuit responds to the switching of CONT to V_{bb}. If CONT is connected to V_{bb}, 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 4.

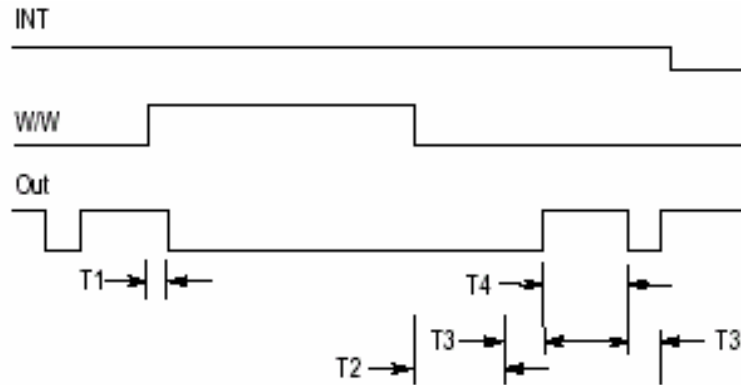


Figure 4. Switching Waveform W/W and INT Active

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 tb1 to 2 x 4 x tb2

Two IL33197A Devices Using One Decoupling Resistor and Capacitor

Two devices may be connected to the power source using a common R1 resistor for protection against overvoltages. If this is done it should be noted that the current flowing through R1 is increased and hence the voltage drop across R1 is increased.

Overvoltage Protection

In reference to the Block Diagram and Typical Application, all of the foregoing operational cases require:

R1 ≥ 100 Ω, C1 ≥ 47 μF

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 overvoltages 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 t_{b2v} parameter could be out of its 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:

$$10 \text{ k}\Omega \leq R2 \leq 68 \text{ k}\Omega$$

$$1.5 \text{ k}\Omega \leq R3 \leq 47 \text{ k}\Omega$$

$$R4 \gtrsim 4.7 \text{ k}\Omega$$

$$R5 \gtrsim 4.7 \text{ k}\Omega$$

$$C1 \gtrsim 47 \text{ }\mu\text{F}$$

$$47 \text{ nF} \leq C2 \leq 470 \text{ nF}$$

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:

$$t_{b1} \text{ duration} = t_{b1} \times 4 \times R2 \times C2 = 1 \times 4 \times 27e^3 \times 100e-9 = 10.8 \text{ ms}$$

$$t_{b2} \text{ duration}_g \text{ (INT to Gnd)} = t_{b2g} \times R3 \times C2 = 15.5 \times 2.2e^3 \times 100e-9 = 3.41 \text{ ms}$$

$$t_{b2} \text{ duration}_v \text{ (INT to Vbb)} = t_{b2v} \times R3 \times C2 = 12.1 \times 2.2e^3 \times 100e-9 = 2.66 \text{ ms}$$

Intermittent timing calculation:

$$T3 = 16 \times 4 \times t_{b1} \text{ duration} = 16 \times 4 \times 10.8 \text{ ms} = 691 \text{ ms}$$

$$T4 = 144 \times 4 \times t_{b2} \text{ duration}_g = 144 \times 4 \times 3.41 \text{ ms} = 1.96 \text{ s}$$

(INT connected to Gnd)

$$T4 = 144 \times 4 \times t_{b2} \text{ duration}_v = 144 \times 4 \times 2.66 \text{ ms} = 1.53 \text{ s}$$

(INT connected to Vbb)

Wash wipe timing calculation:

$$T2 = 96 \times 4 \times t_{b1} = 96 \times 4 \times 10.8 \text{ ms} = 4.15 \text{ s}$$

T1 Debounce Time Calculation (see T1 Debounce Timing)

When oscillator is oscillating at t_{b1} :

$$T1 \text{ minimum} = 4 \times t_{b1} = 4 \times 10.8 \text{ ms} = 43.2 \text{ ms}$$

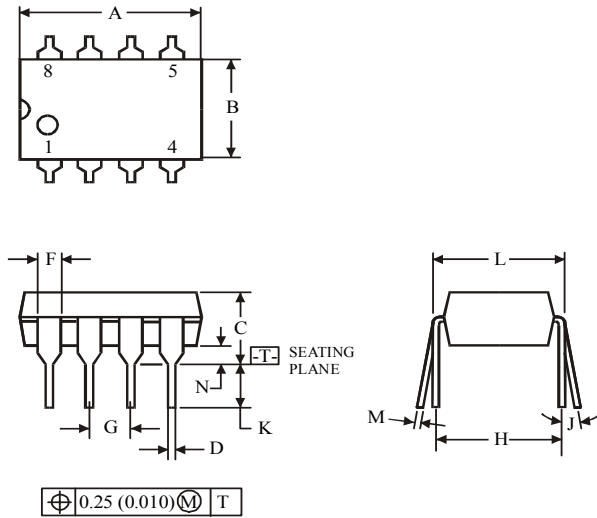
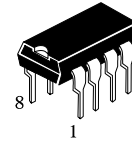
$$T1 \text{ maximum} = 2 \times 4 \times t_{b1} = 2 \times 4 \times 10.8 \text{ ms} = 86.4 \text{ ms}$$

When oscillator is oscillating at t_{b2} :

$$T1 \text{ minimum (INT connected to Gnd, } t_{b2g}) = 4 \times t_{b2} = 4 \times 3.41 \text{ ms} = 13.6 \text{ ms}$$

$$T1 \text{ maximum (INT connected to Gnd, } t_{b2g}) = 2 \times 4 \times t_{b2} = 2 \times 4 \times 3.41 \text{ ms} = 27.3 \text{ ms}$$

**N SUFFIX PLASTIC DIP
(MS - 001BA)**

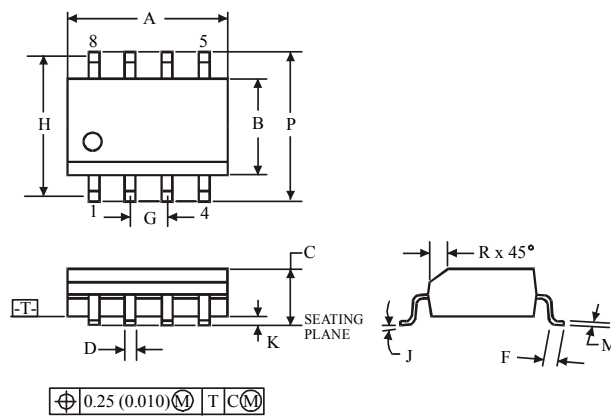
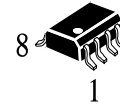


Symbol	Dimension, mm	
	MIN	MAX
A	8.51	10.16
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

NOTES:

- Dimensions "A", "B" do not include mold flash or protrusions.
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

**D SUFFIX SOIC
(MS - 012AA)**



Symbol	Dimension, mm	
	MIN	MAX
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

NOTES:

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.