DHA® QJ/DHA 01.43-2016 **LD33193**

Automotive LED Direction Indicator IC

Description

The LD33193 is a new generation industry standard "Flasher" ASIC. It has been developed for enhanced EMI sensitivity, system reliability, and improved wiring simplification. The LD33193 is without lamp short circuit detection and using a 23mΩ shunt resistor. The LD33193 has a standby mode of operation requiring very low standby supply current and can be directly connected to the vehicle's battery. It includes an RF filter on the fault detection pin (Pin 7) for EMI purposes. Fault detection thresholds are reduced relative to those of the Flasher IC, allowing a lower shunt resistance value (23mΩ) to be used. It can be used for LED lamp flasher. And the relay can be replaced with a transistor to achieve non-contact.

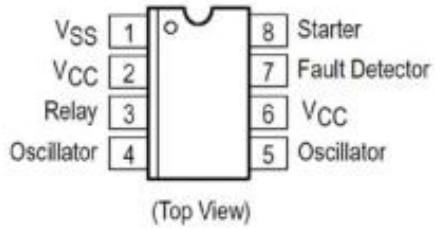
Features

- Defective Lamp Detection Threshold
- RF Filter for EMI Purposes
- Load Dump Protection
- Double Battery Capability for Jump Start Protection
- Internal Free Wheeling Diode Protection
- Low Standby Current Mode

Ordering Information

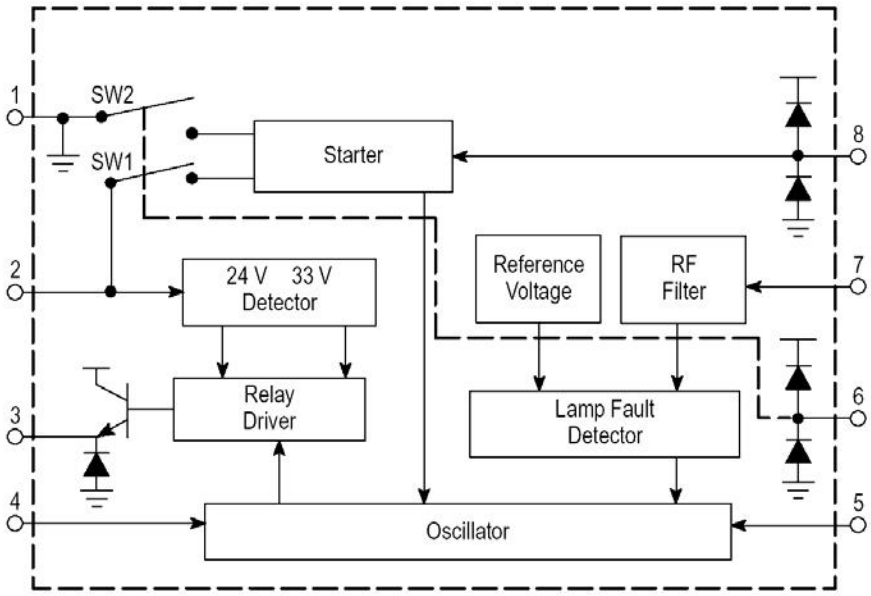
Package	Remarks
SOP8	Tubed, Reeled, Pb-free
DIP8	Tubed, Pb-free

Pin definition



PIN	Explain	PIN	Explain
1	GND	2、6	Supply
3	OUT	4、5	Oscillator
7	Detector	8	Start

Simplified Block Diagram



ELECTRICAL CHARACTERISTICS

(–40°C ≤ T_A ≤ +125°C, 8.0 V ≤ V_{CC} ≤ 18 V, unless otherwise noted. Typical values reflect approximate mean at T_A = 25°C, V_{CC} = 14 V at the time of initial device characterization.)

Characteristic	Symbol	Min	Typical	Max	Unit
Battery Voltage Range (Normal Operation)	V_b	8.0	–	32	V
Overvoltage Detector Threshold (VPin2 – VPin1)	V_{ih}	32	33	34	V
Clamping Voltage (R2 = 220 Ω)	V_{cl}	27	29.2	34	V
Output Voltage I = –250 mA (VPin2 – VPin3)	V_{sat}	–	–	1.5	V
Starter Resistance (Rst = R2 + RLamp)	R_{st}	–	3.3	3.6	kΩ
Oscillator Constant (Normal Operation, TA = 25°C)	K_n	2.1	2.3	2.55	
Temperature Coefficient of Kn	TC_{Kn}	–	0.001	–	1/°C
Duty Cycle (Normal Operation)	–	45		60	%
Duty Cycle (One 21 W Lamp Defect)	–	40		60	%
Oscillator Constant (TA = 25°C)	K1	0.167	0.180	0.193	
	K2	0.250	0.270	0.290	
Standby Current (Ignition “Off”)	I_{CC}	–	2.0	100	μA
Current Consumption (Relay “Off”, Enable Pin 6 High)	I_{CC}				mA
Vbat = 8.0 V, R3 = 220 Ω, T_A = 25°C		–	1.40	–	
Vbat = 13.5 V, R3 = 220 Ω		–	2.16	3.5	
Vbat = 18 V, R3 = 220 Ω, T_A = 25°C		–	2.64	–	
Current Consumption (Relay “On”)	I_{CC}				mA
Vbat = 8.0 V, R3 = 220 Ω, T_A = 25°C		–	1.62	–	
Vbat = 13.5 V, R3 = 220 Ω		–	2.06	6.0	
Vbat = 18 V, R3 = 220 Ω, T_A = 25°C		–	3.30	–	
Defect Lamp Detector Threshold (R3 = 220 Ω, (V_{Pin2} – V_{Pin7}) Vbat = 13.5 V	V_S	35	40	45	mV
LED Lamp load	P_L	4			W
Temperature Coefficient of V_S	TC_{Vs}		$0.3x10^{-3}$	–	1/°C

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Pin 1 Positive Current (Continuous/Pulse)	I1+	150 to 500	mA
Pin 1 Negative Current (Continuous/Pulse)	I1–	–35 to –500	mA
Pin 2 Current (Continuous/Pulse)	I2	±350 to ±1900	mA
Pin 3 Current (Continuous/Pulse)	I3	±300 to ±1400	mA
Pin 8 Current (Continuous/Pulse)	I8	±25 to ±50	mA
ESD (All Pins Except Pin 4 for Negative Pulse)	V_J	±2000	V
ESD (Pin 4 Negative Pulse)	V_{ESD4-}	–1000	V
Junction Temperature	T_J	150	°C
Operation Ambient Temperature Range	T_A	–40 to +125	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C

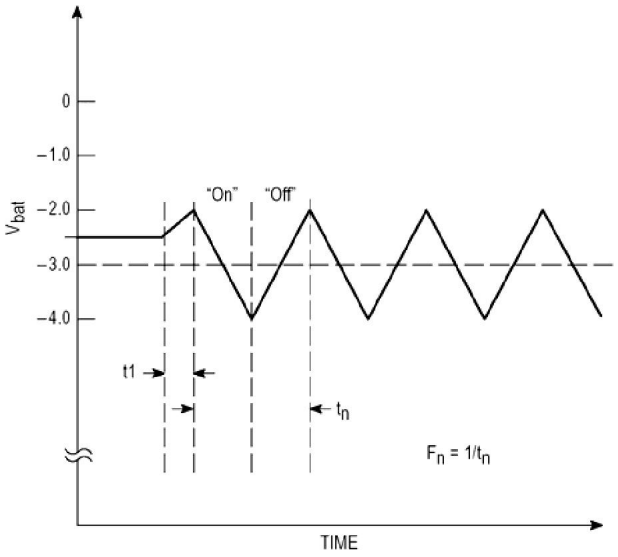


Figure 1. Normal Operation Oscillator Timing Diagram

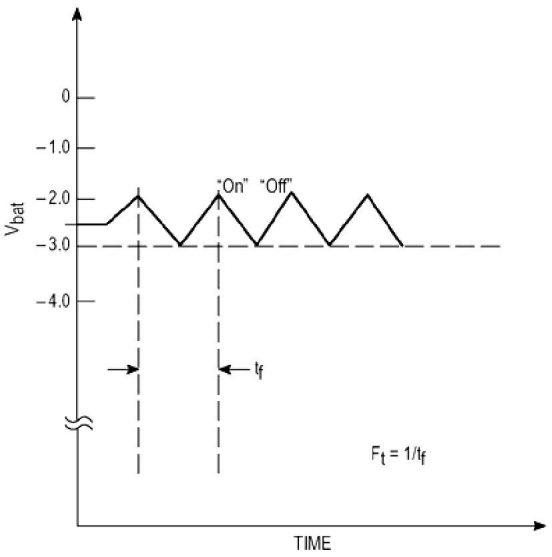


Figure 2. One Defective Lamp Oscillator Timing Diagram

INTRODUCTION

Supply and Protection Systems

Pin 1 is connected to ground via resistor R3 which limits the current in the event of any high voltage transients. Pin 2 (VCC) is the positive supply and may be connected directly to the vehicle's battery voltage.

Overvoltage and Double Battery Protection: When the applied VCC to VSS voltage is greater than 32V, the overvoltage detector circuit turns the relay driver off. Both the device and the lamps are protected if two 12 V batteries are connected in series and used to jump start the vehicle.

Load Dump Overvoltage Protection: A 39 V overvoltage detector protects the circuits against high voltage transients due to load dumps and other low energy spikes. The relay driver is automatically turned on whenever the VCC to VSS voltage is greater than 346V.

Overvoltage Protection, High Voltage Transients: The Enable and the Starter pins are protected against positive and negative transients by internal on–chip diodes.

On–Chip Relay Driver

The device directly drives the flasher relay. The output structure is an Emitter of an NPN transistor. It contains the free wheeling diode circuitry necessary to protect the device whenever the relay is switched off.

Oscillator

The device uses a sawtooth oscillator (Figure 1).

The frequency is determined by the external components C1 and R1. In the normal operating mode, the flashing frequency is: $F_n = 1/R1*C1*K_n$. With a defective (open) 21 W lamp (Figure 2), the flashing frequency changes to: $F_f = 2.2*F_n$.

The typical first flash delay (the time between the moment when the indicator switch is closed and the first lamp flash occurs) is: t1 = K1*R1*C1

The fault detection delay is from the time relay R1 is on and fault detection is enabled. Where a 21 W lamp opens, the delay is expressed as: t2 = K2*R1*C1

Starter

Pin 8 is connected through a 3.3 kΩ resistor to the flashing lamp. Pin 8 is the input to the starter function and senses the use of S1 by sensing ground through the lamp (Figures 9 and 10).

Lamp Fault Detector with Internal RF Filter

A Lamp defect is sensed by the lamp fault detector's monitoring of the voltage developed across the external shunt resistor R_S via the RF filter. The R_S voltage drop is compared to a V_{bat} dependent internal reference voltage (V_{ref}) to validate the comparison over the full battery voltage range. A detected fault causes the oscillator to change frequency (Figure 2).

Standby Mode

When the ignition key and warning switches are open. Enable is in a low state and the internal switches, SW1 and SW2 are open and no current passes through the circuit. In this condition, the device's current consumption is zero (I_{CC} = 0). When ignition key and warning switches are closed. Enable is in a high state with SW1 and SW2 being closed and the circuit is powered on.

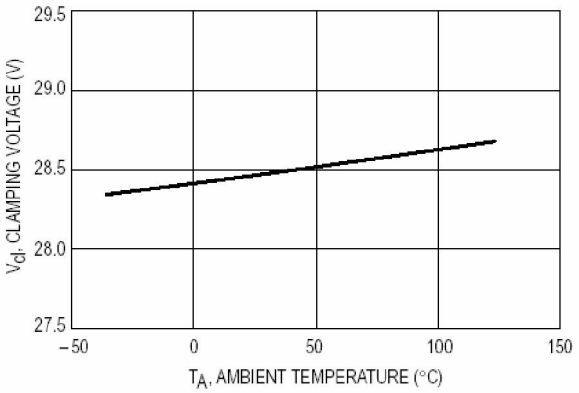


Figure 3. Clamping Voltage versus Temperature

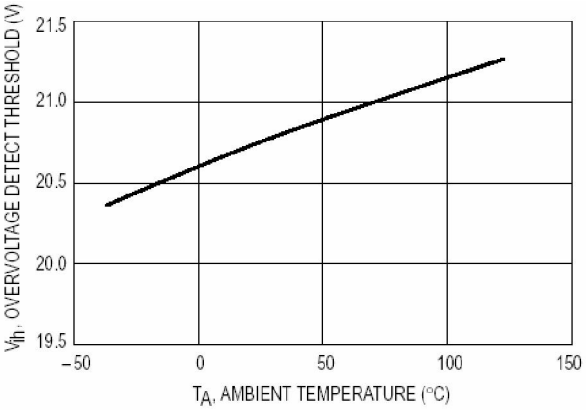


Figure 4. Overvoltage Detection versus Temperature

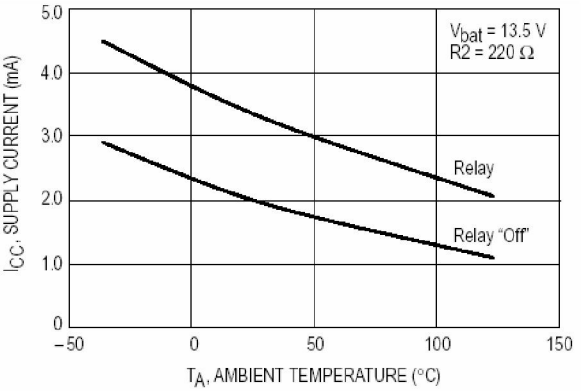


Figure 5. Supply Current versus Temperature

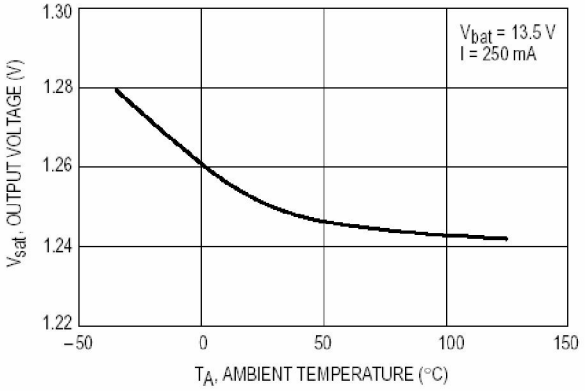


Figure 6. Output Voltage versus Temperature

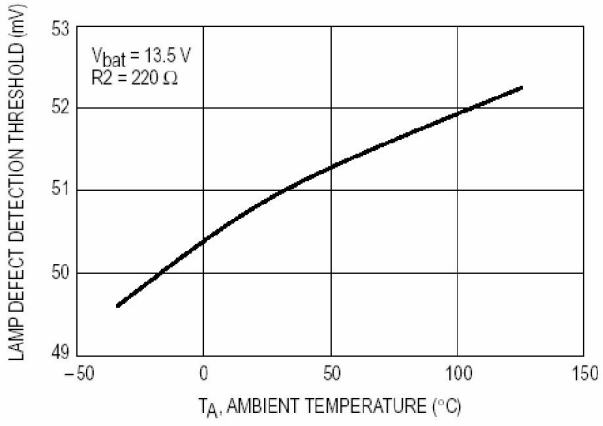


Figure 7. Defect Lamp Detection versus Temperature

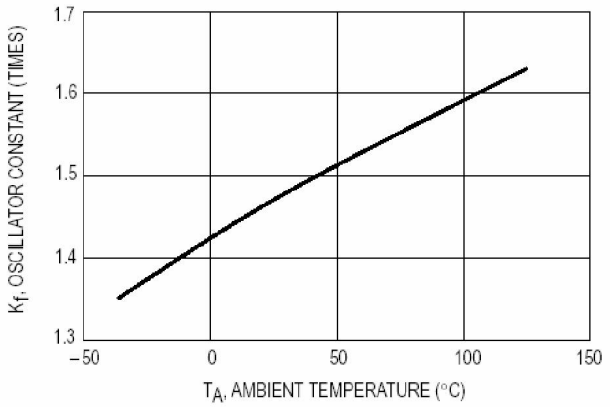
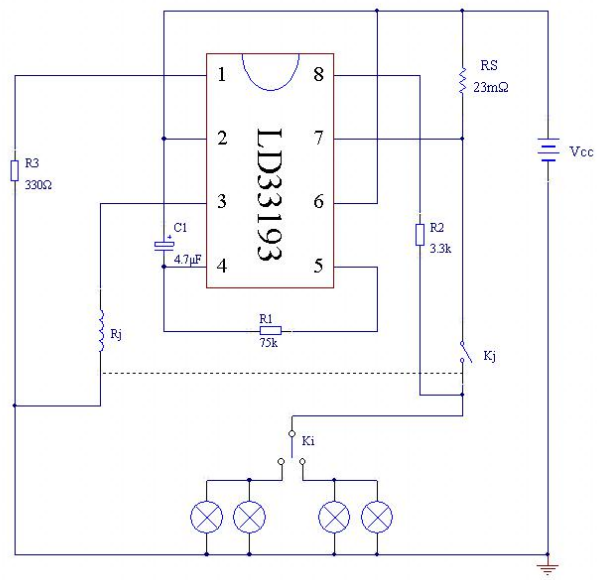
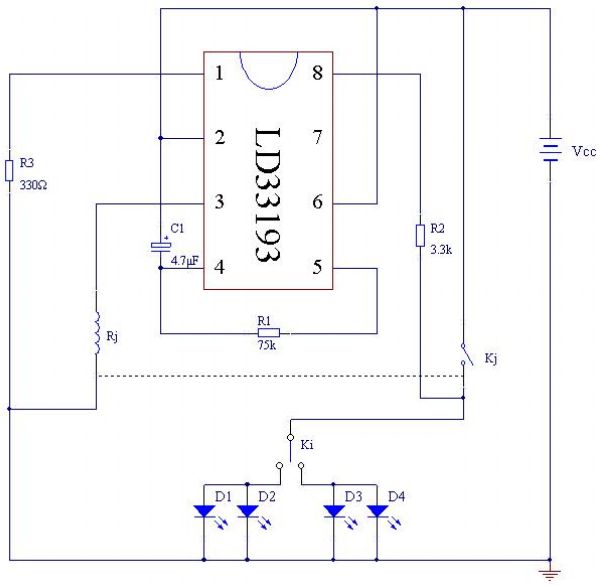


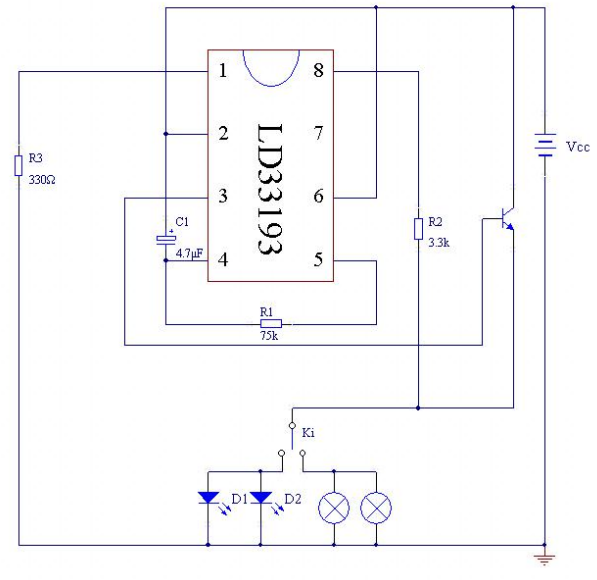
Figure 8. Oscillator Constant versus Temperature



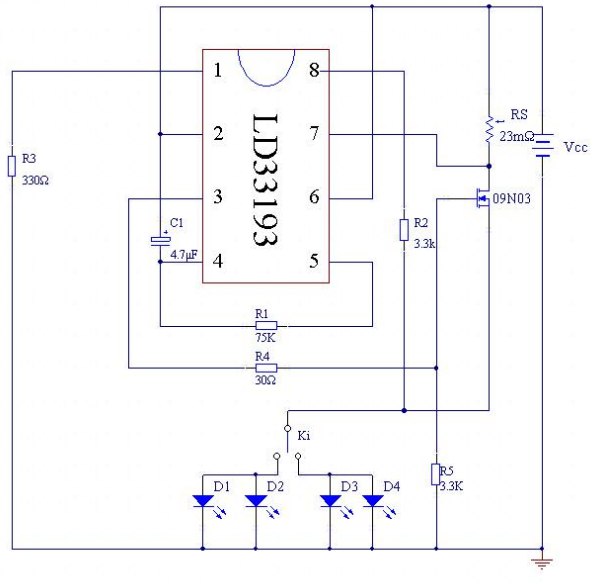
Light bulb application circuit



LED application circuit



Triode application circuit



Mos application circuit

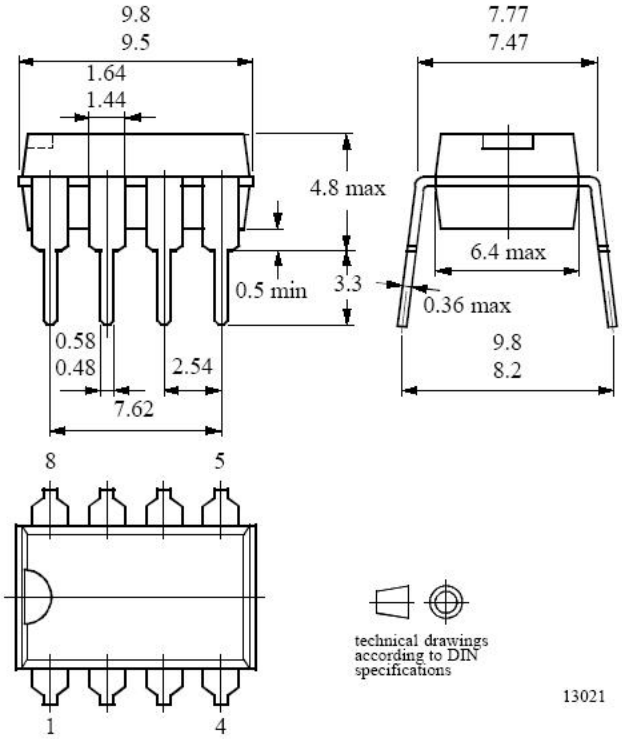
Figure 9. LD33193 Typical Application

Note：12V application circuit，Rs=23mΩ；24V application circuit，Rs=46mΩ

Package Information

DIP8

Dimensions in mm



SOP8

Dimensions in mm