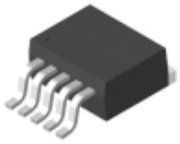
Light Emitting Diode (LED) Driver

IL7150, IL7150A

Features

- Supply voltage from 4.0 to 40 V
- Output driving current up to 0.8 A (IL7150A), 1.5 A (IL7150)
- Current consumption 4 mA
- ESD protection up to 2kV
- Temperature range from - 40 to +85 °C
- Only 5 external components required



TO-263-5L

IL7150D2T
IL7150AD2T

ORDERING INFORMATION

Device	Operating Temperature Range	Package	Packing
IL7150D2T	T_A = -40° to 125° C	TO-263	Tape & Reel
IL7150AD2T		TO-263	Tape & Reel

Applications

- Automotive
- DC/DC LED Driver
- Lighting Equipments
- Light Indicators

Description

IL7150, IL7150A (functional equivalent AMC7150 of ADDtek) - LED (Light Emitting Diode) driver with peak output current 0.8A (IL7150A) & 1.5A (IL7150).

Microcircuit designed for driving of power LEDs in the wide range of supply voltages and load currents with peak output currents 0.8 & 1.5A. Main application areas are automotive, DC/DC LED driver, lighting equipments and light indicators.

Table 1. Contact Pad Description

Contact pad Number	Pin Number	Symbol	Function
01	01	V_{CC}	Supply voltage input
02, 03, 04, 05	02	CS	Current sensor input
09, 15	03	GND	Ground
06, 07	04	OUT	Driver output
08	05	OSC	Oscillator output
Note: Contact pads 10 – 14 are purposed only for testing during IC manufacturing and are not used by customer			

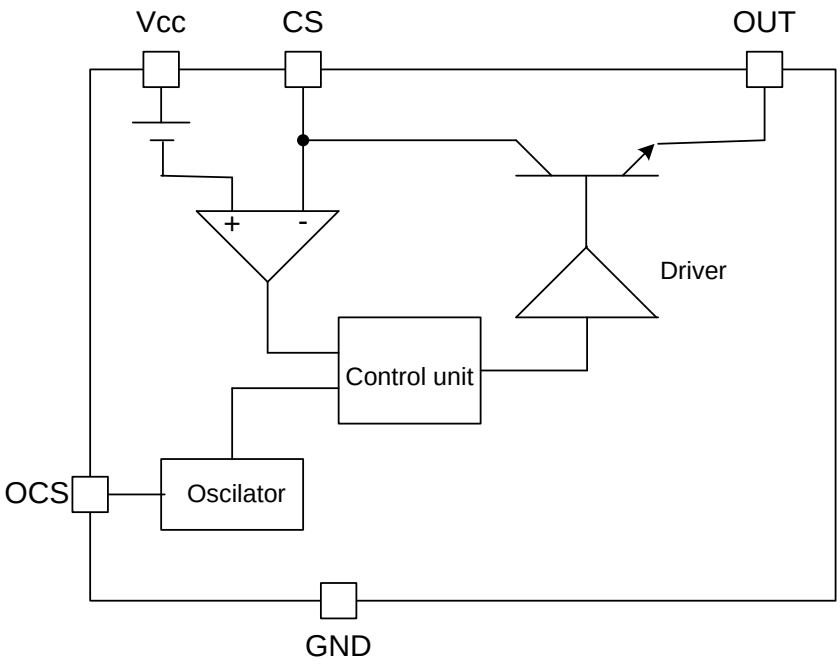


Fig. 1 – Block Diagram

Table 3. Recommended Operation Conditions

Parameter	Symbol	Target		Unit
		Min	Max	
Supply voltage	V_{CC}	4.0	40	V
Junction temperature	T_J	—	125	^oC

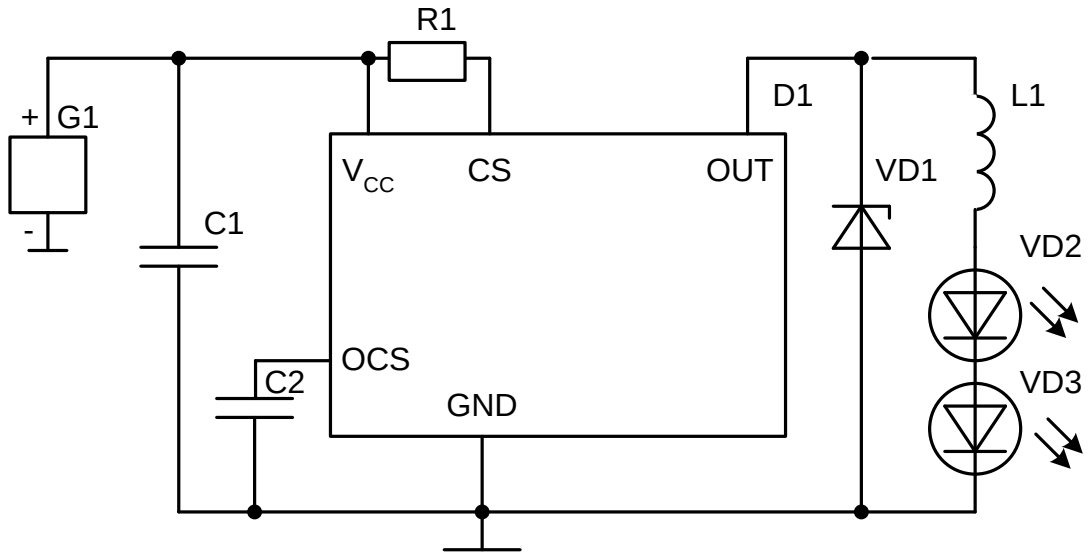
Table 4. Maximum Ratings

Parameter	Symbol	Target		Unit
		Min	Max	
Supply voltage	V_{CC}	-0.3	40	V
Output voltage	V_O	-0.3	40	V
Junction temperature	T_J	—	150	^oC
Storage temperature	T_{STG}	-60	150	^oC

* Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied.
Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Table 5. Electrical Characteristics

Symbol	Parameter	Testing mode	Value		Ambient temperature, °C	Unit
			Min	Max		
I_{CC}	Supply current	4.0 V ≤ V_{CC} ≤ 40 V	-	4.0 4.4	25 ± 10 -40; 85	mA
V_{DP}	Output saturation voltage IZ7150	V_{CC} = 5.0 V I_O = 1.0 A	-	1.3 1.4		V
		I_O = 1.5 A		3.0 3.0		
	IZ7150A	I_O= 0.5 A		1.3 1.4		
		I_O= 0.8 A		3.0 3.0		
I_{OL}	Output leakage current	V_{CC} = 40 V	-	300 330		μA
V_{CS}	Current sensor voltage	V_{CC} = 5.0 V	300 270	360 396		mV
DC_{MAX}	Max duty cycle	V_{CC} = 5.0 V	50	99	25 ± 10; -40; 85	%
I_{CH}	Capacitor charging current	V_{CC} = 5.0 V	20	50		μA



C1 – capacitor 47 μF ± 10%;
C2 – capacitor 680 pF ± 10%;
D1 – microcircuit ;
G1 – supply voltage source from 4.0 to 40 V;
L1 – inductance coil 220 μH ± 10%;
R1 – resistor 330 mΩ ± 1%;
VD1 – Zener diode with stabilization voltage 40 V (1N5819 or equivalent);
VD2, VD3 - LEDs

Fig. 2. Application Diagram

Functionality

Starting current is regulated in the range from few milliamps up to 1.5 A. The regulation is performed by means of PWM (pulse-width modulation).Load is repetitively connected to the supply voltage via output switch. Changing of pulses porosity, adjusts average output voltage that allows regulating of output current. Inductive energy storage is applied in the circuit because of output voltage is pulse

Input decoupling capacitor

Input decoupling capacitor C1 regulates the input voltage and rejects switching interference.

Limiting diode

Zener diode with fast recovering VD1 is recommended as limiting diode. High reverse recovery current will cause on R1 voltage drop more than 330 mV, therefore switch that has to be on will turned off.

LED driving current

Resistor R1 determine max output peak current to the LED.

Output peak current $I_{O,}$ flowing thought the LED, can be calculated by formula:

$$I_O = \frac{330mV}{R1} \quad .$$

Average LED current is determined by amplitude of oscillating (pulsating) current, that depends on inductivity of coil L1. For example , average current of LED is 550 mA (pulsating) current is 100 mA. Then:

$$R1 = \frac{330mV}{550mA + 0{,}5 \times 100mA} = 0{,}55\Omega \ .$$

In order to driving current not exceed recommended max rating 1.5 A for IL7150, (0.8A for IL7150A), R1 value has to be more than 200 mΩ.

Inductor

The Inductor L1 stores energy during switch turn-on period and discharge driving current to LEDs via flywheel diode while switch turn-off. In order to reduce the current ripple on LEDs, the L value should high enough to keep the system working at continuous-conduction mode that inductor current won't fall to zero.

Since in steady-state operation the waveform must repeat from one time period to the next, the integral of the inductor voltage V_L over one time period must be zero:

$$\int_0^{Ts} V_L dt = \int_0^{T_{ON}} V_L dt + \int_{Ton}^{Ts} V_L dt = 0 ,$$

Where, $T_S = T_{ON} + T_{OFF}$

Therefore

$$\frac{Ton}{Toff} = \frac{V_{LED} + V_F}{V_{CC} - V_R - V_{SAT} - V_{LED}} ,$$

Where, V_{LED} is the total forward voltage (at expecting current) of the LED string,
V_F is the forward voltage of the flywheel diode VD1,
V_R is the peak value of the voltage drop across R1 which is 300mV,
V_{SAT} is the saturation voltage of the switch which has a typical value of 1V.

Since the operation frequency *f* is determined by choosing appropriate value for timing capacitor C1, the switch turn-on time can also be known by $Ton = D \times Ts = \frac{D}{f}$,

Where duty cycle $D = \frac{Ton}{Ton + Toff}$

With knowledge of the peak switch current and switch on time, the value of inductance can be calculated:

$$L = \frac{V_{CC} - V_R - V_{SAT} - V_{LED}}{I_{PK}} \times T_{ON}$$

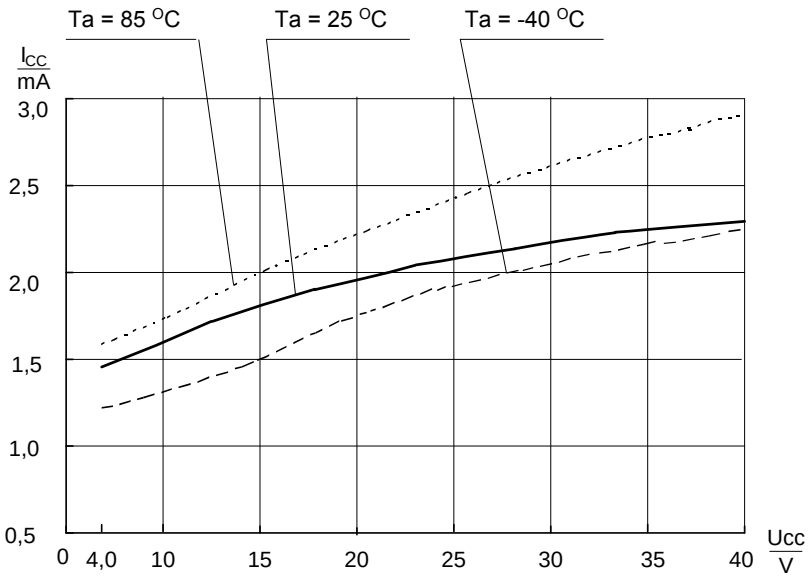


Fig. 3. Supply Current as a Function of Supply Voltage

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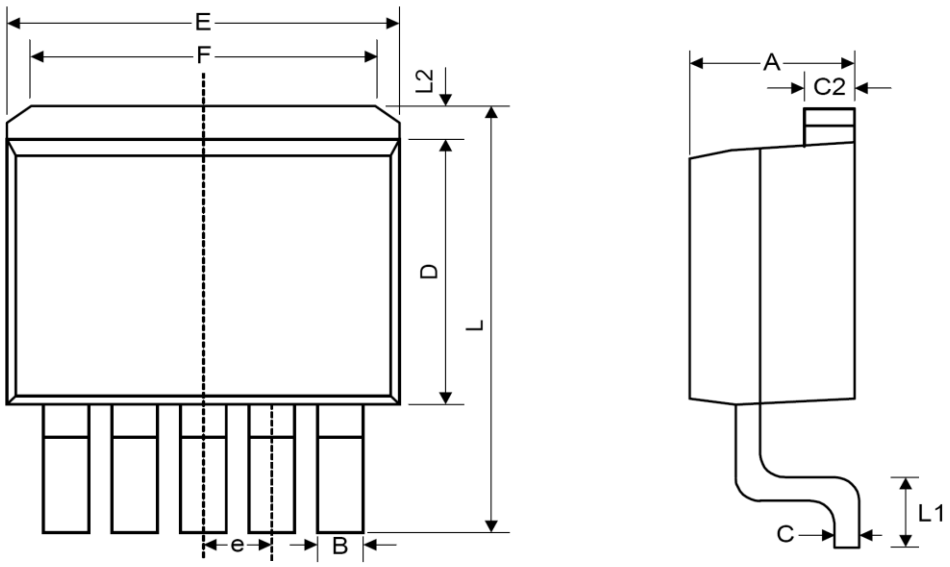

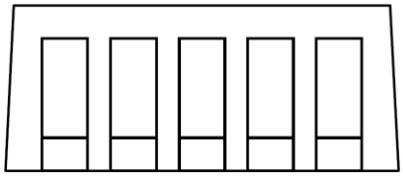

Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.07	4.46	4.85	0.160	0.176	0.191
B	0.66	0.84	1.02	0.026	0.033	0.040
C	0.36	0.50	0.64	0.014	0.020	0.025
C2	1.14	1.27	1.40	0.045	0.050	0.055
D	8.65	9.15	9.65	0.341	0.360	0.380
E	9.78	10.16	10.54	0.385	0.400	0.415
e	1.57	1.71	1.85	0.062	0.068	0.073
F	6.60	6.86	7.11	0.260	0.270	0.280
L	14.61	15.24	15.88	0.575	0.600	0.625
L1	2.29	2.54	2.79	0.090	0.100	0.110
L2	-	-	2.92	-	-	0.115