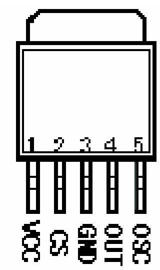
1.5A Power LED Driver

PJ7150 is a PWM power LED driver IC. The driving current from few milliamps up to 1.5A. It allows high bright- ness power LED operating at high efficiency from 4Vdc to 40Vdc. Up to 200KHz external controlled operation frequency. External resistor controlled the maximum output current to single LED or a LED string.

FEATURES

- Only 5 external components required
- Output driving current up to 1.5A
- 4V~40V wide operation voltage range
- High efficiency
- ESD protection HBM 2KV
- TO-252-5L pin power package

PACKAGE PIN OUTLINE



TO-252 TOP VIEW

APPLICATIONS

◆ DC/DC LED driver ◆ Automotive ◆ Lighting

POWER DISSIPATION TABLE

Package	θ_{JA} (℃/W)	Derating factor (mW/℃)TA≧25℃	TA≦25℃ Power rating (mW)	TA=70 ℃ Power rating (mW)	TA= 85℃ Power rating (mW)
TO-252-5L	80	12.5	1560	1000	812

ABSOLUTE MAXIMUM RATINGS

Input Voltage, VCC	-0.3V to 40V
Output Voltage, OUT	-0.3V to 40V
Maximum Junction Temperature , T_J	150℃
Storage Temperature Range	-40℃ to 150℃
Lead Temperature (soldering, 10 seconds)	260℃

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	VCC	4		40	V
Output current	I_{OUT}			1.5	A
Operating free-air temperature range	Ta	-40		85	℃

ELECTRICAL CHARACTERISTICS(VCC=5V, Ta=25°C. Unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Apply Pin
Supply Current	I_{CC}	VCC=4~40V			4	mA	VCC
Output Drop-out Voltage	V_{DP}	I_{OUT}=1A, V_{CS}-V_{OUT}		1	1.3	V	OUT
Output Leakage Current	I_{LK}	V_{CS}-V_{OUT}= 40V		0.01	10	μA	
Current Sense Voltage	V_{CS}	VCC- V_{CS}	270	300	330	mV	CS
Maximum duty cycle	T_{DC}	V_{CS}=VCC		85		%	OSC
OSC Charge Current	I_{CH}			35		uA	

PIN DESCRIPTION

Pin Number	Pin Name	Pin Function
1	VCC	Input Voltage 4V ~ 40V
2	CS	Peak current senses pin.
3	GND	Ground
4	OUT	Driver output pin.
5	OSC	Oscillator timing capacitor.

APPLICATION INFORMATION

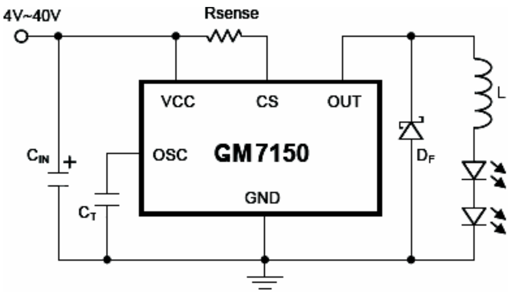


Figure1 Typical application

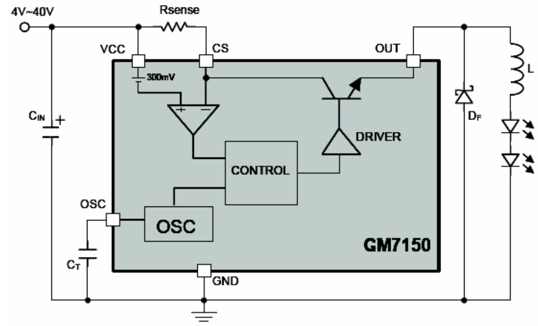


Figure2 Block diagram

Low Voltage DC/DC Application

The PJ7150 was designed for power LED driving application. Only 5 external components were required for low voltage application. Fig.1 shows the typical application circuit for input voltage range from 4V to 40V. Buck power conversion topology was used and total forward voltage (at expecting current) of the LED string should lower than supply voltage by 1.6V at least.

Input Bypass Capacitor

The input by-pass capacitor CIN holds the input voltage and filters out the switching noise of PJ7150.

Flywheel Diode

The fast recovery diode was recommended for flywheel diode DF. This is because the high reverse recovery current will cause the voltage drop across Rsense being higher than 300mV, and consequently the switch will be turned off which has just been turned on.

LED Driving Current

The peak current IPK flow though LEDs was decided by:

$$I_{PK} = \frac{300mV}{Rsense}$$

The average current on LEDs was determined by the peak-to-peak ripple current that was decided by inductor L. Assume the target average current 550mA on LEDs and ripple current 100mA then the Rsense should be:

$$Rsense = \frac{300mV}{550mA + 0.5 \cdot 100mA} = 0.5\Omega$$

The Rsense value should higher than 200mΩ so that driving current won't over the recommended maximum driving current 1.5A.

Inductor

The Inductor L 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 *vL* over one time period must be zero:

$$\int_0^{T_s} v_L dt = \int_0^{t_{ON}} v_L dt + \int_{t_{ON}}^{T_s} v_L dt = 0 \quad \text{Where } T_s = t_{ON} + t_{OFF}$$

Therefore

$$\frac{t_{ON}}{t_{OFF}} = \frac{V_{LED} + V_F}{V_{CC} - V_{Rsense} - V_{SAT} - V_{LED}}$$

Where, *VLED* is the total forward voltage (at expecting current) of the LED string, *VF* is the forward voltage of the flywheel diode DF, *VRsense* is the peak value of the voltage drop across Rsense which is 300mV, and *VSAT* 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 CT, the switch turn-on time can also be known by

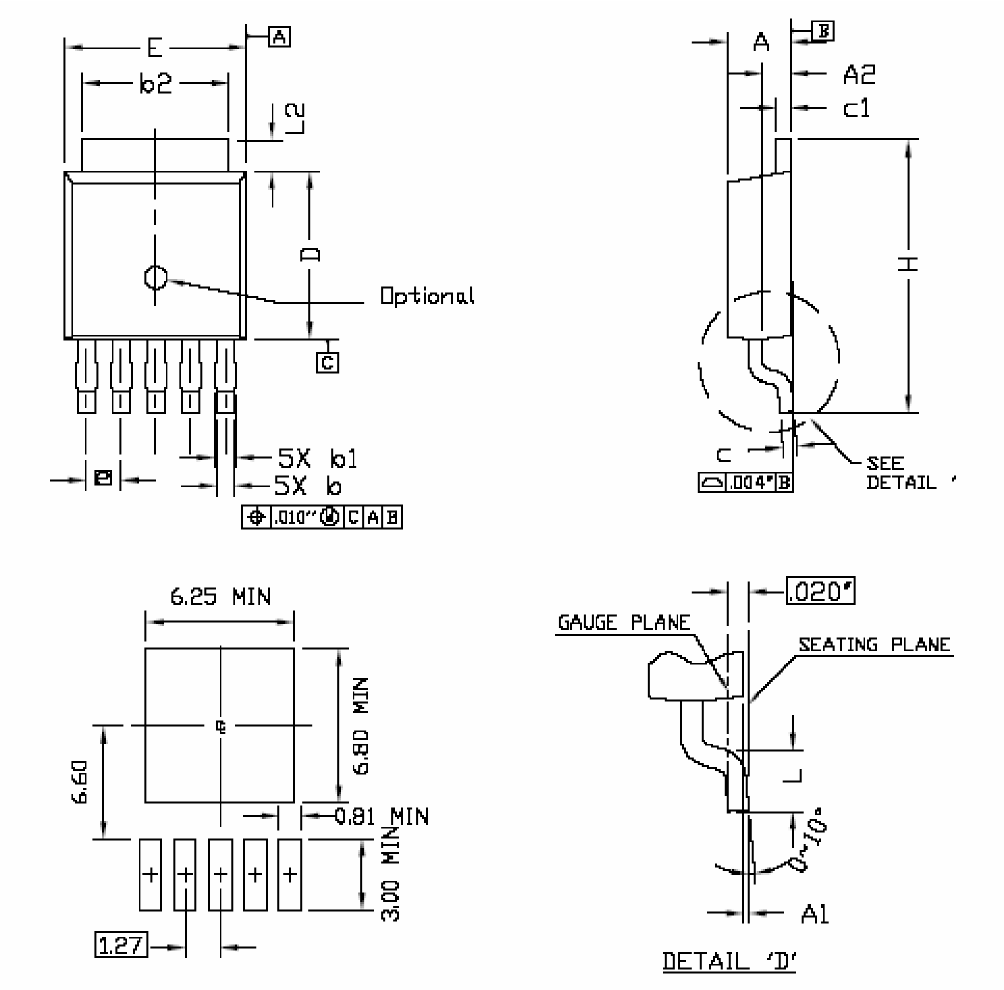
$$t_{ON} = D \cdot T_s = \frac{D}{f} \quad \text{Where } D(Dutycycle) = \frac{t_{ON}}{t_{ON} + t_{OFF}}$$

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

$$L = \frac{V_{CC} - V_{Rsense} - V_{SAT} - V_{LED}}{I_{PK}} \cdot t_{ON}$$

TO252-5L PACKAGE OUTLINE

Dimensions in Millmeters (UNIT:mm)



SYMBOL	DIMENSION IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	2.184	2.286	2.388	0.086	0.090	0.094
A1	0.000	—	0.127	0.000	—	0.005
A2	0.889	—	1.143	0.035	—	0.045
b	0.508	—	0.711	0.020	—	0.028
b1	0.584	—	0.787	0.023	—	0.031
b2	4.953	—	5.461	0.195	—	0.215
c	0.457	0.508	0.610	0.018	0.020	0.024
c1	0.457	—	0.610	0.018	—	0.024
D	5.969	6.096	6.223	0.235	0.240	0.245
E	6.350	6.604	6.731	0.250	0.260	0.265
e	1.270 BSC.			0.050 BSC.		
H	9.398	—	10.414	0.370	—	0.410
L	1.270	—	2.032	0.050	—	0.080
L2	0.889	—	1.270	0.035	—	0.050