GAPTEC®
GREEN TECHNOLOGY

LEDD16_24 Series

Constant current power LED driver - Wide Input - Non-Isolated & Regulated



LED Driver

- 16 pin DIL package
- High efficiency up to 95%
- Short Circuit Protection (SCP)
- Ultra wide range voltage input (7-30V; 40V for 0.5sec.)
- Operation temperature range: -40°C ~ 85°C
- With large capacitive loads (1000µF)
- Open and short LED protection
- With MLCC capacitors only PWM dimming & analogue dimming
- Low ripple & noise

The LEDD16_24 is a high-efficiency series of step-down converters optimized to driving high current LEDs. The device operates from an input of 7VDC to 30VDC and provides an externally adjustable output current up to 1000mA and output power up to 24 watts. Compact size of DIL16 allows designers to integrate this driver together with LED module. UL94V-0 grade molded case with high grade filling material provides excellent fire proof characteristics.

Application: 12V and 24V lighting systems, household/commercial lighting, suitable for high illumination LED, power limited (battery) lighting system.

SHORT CIRCUIT PROTECTED

100% RoHS compliant

Specifications

Item	Test condition	Min	Typ	Max	Units
Input voltage		7	24	30	VDC
Input filter	Capacitor				
Output voltage range	Vin=48V	2		28	VDC
Operating frequency		50		330	KHz
Short circuit protection	Regulated at rated output current				
Temperature coefficient				±0.08	%/°C
Thermal impedance	Nature convection		+50		°C/W
Safety standard	designed to meet IEC/EN60950-1				
Ripple & Noise	20MHz bandwidth		250	300	mVp-p
Operating temperature range		-40		85	°C
Storage temperature		-40		125	°C
Maximum case temperature				100	°C
Soldering temperature	1.5mm away from the casing, 10 seconds			260	°C
Humidity				95	%
Operating frequency range		550	645	750	kHz
MTBF	MIL-HDBK-217F(+25°C)		>1.6		MHours
Case Material	Epoxy Resin (UL94-V0)				
Potting Material	Silicon (UL94-V0)				
Pin Material	ø0.5mm brass solder-coated				
Dimensions		0.92x0.55x0.4			inch
Weight			6.6		g

Model selection:
LEDC_xx-###
LED=Type; C=Case; yy=Vin; ###= Output Current

Example:
LEDD16_24-500
LED= Series D16= DIP16; yy= 24VDC nominal; 500= 0,5A

PWM dimming and ON/OFF control (leave open if not used)

Item	Test condition	Min	Typ	Max	Units
V_{ADJ} Pin input voltage range		0		1.25	V
V_{ADJ} Pin drive current	V_{ADJ}=1.25V			<1	mA
Adjust output current			0%-100%		
PWM frequency	Recommended maximum operation frequency			1	KHz
Remote ON/OFF	• ON • OFF (shutdown)		Open or 0.3V< V_{ADJ} <1.25V V_{ADJ} <0.15V or Short circuit pin 1, 2 amd pin 3		
Quiescent input current	Shutdown mode (Vin=30V)			25	µA

Analogue dimming (leave open if not used)

Item	Test condition	Min	Typ	Max	Units
V_{ADJ} Pin input voltage range		0		1.25	V
V_{ADJ} Pin drive current	V_{ADJ}=1.25V			<1	mA
Adjust output current	Vin-Vout <20V		25%-100%		
Control voltage range limits	• Full on • Full off		0.3V< V_{ADJ} <1.25V V_{ADJ} <0.15V		
Remote ON/OFF	• ON • OFF (shutdown)		Open or 0.3V< V_{ADJ} <1.25V V_{ADJ} <0.15V or Short circuit pin 1, 2 amd pin 3		
Quiescent input current	Shutdown mode (Vin=30V)			25	µA

EMC specifications

EMI	Conducted disturbance	EN55015/CISPR22		
EMI	Radiated Emission	EN55015/CISPR22		
EMS	Electrostatic Discharge	IEC/EN61000-4-2 Contact ±2KV		perf. Criteria A
EMS	Radiation Immunity	IEC/EN61000-4-3	10V/m	perf. Criteria A
EMS	EFT	IEC/EN61000-4-4	±1KV	perf. Criteria A
EMS	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A
EMS		IEC/EN61000-4-8		perf. Criteria A

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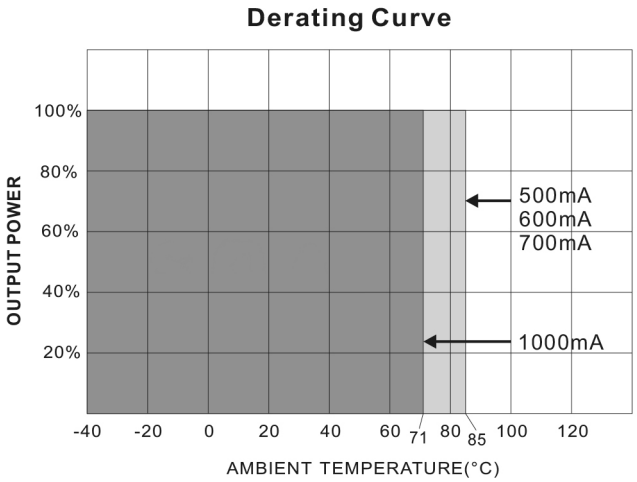
Specifications subject to change without notice.

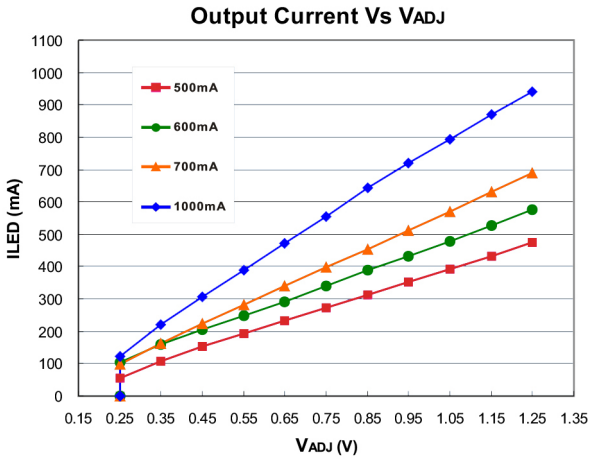
LEDD16_24 Series

Constant current power LED driver - Wide Input - Non-Isolated & Regulated

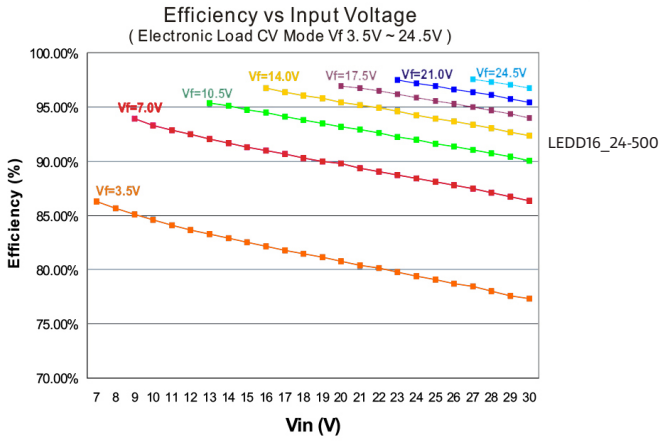
Part Number	Input Voltage [VDC] Nominal (Range)	Output Voltage [VDC]	Output Current [mA]	Output Current Accuracy [%, max]	Output Power [W, max]	Ripple&Noise [mVp-p, max]	Max. capacitive load [µF]	Efficiency [%, max]
LEDD16_24-500	24 (7-30)	2-28	500	±6	14	250	47	75-95
LEDD16_24-600	24 (7-30)	2-28	600	±7	17	250	47	75-95
LEDD16_24-700	24 (7-30)	2-28	700	±7	20	250	47	75-95
LEDD16_24-1000	24 (7-30)	2-28	1000	±7	24	300	47	75-95

Typical characteristics

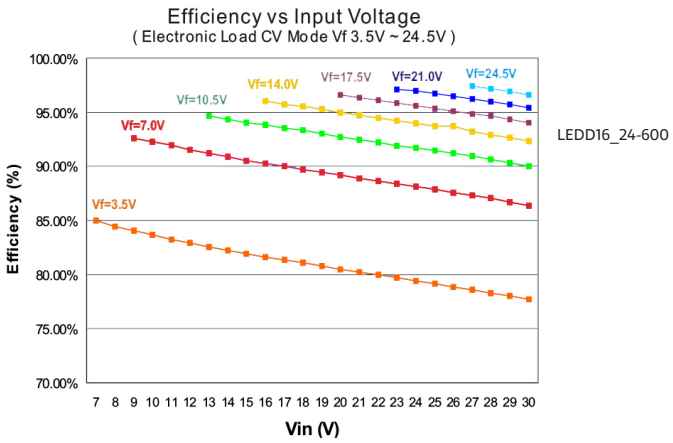




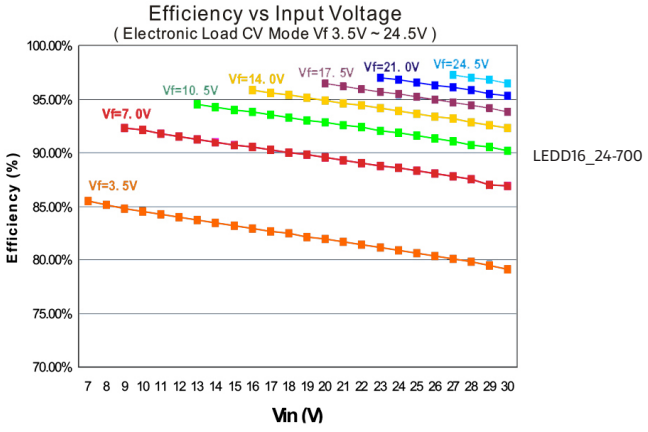
Efficiency



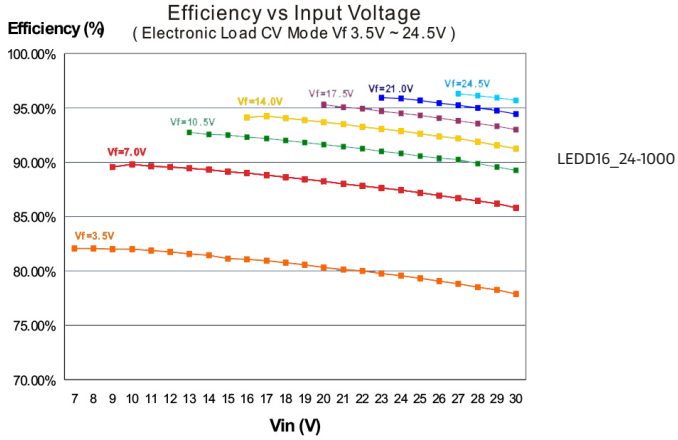
LEDD16_24-500



LEDD16_24-600



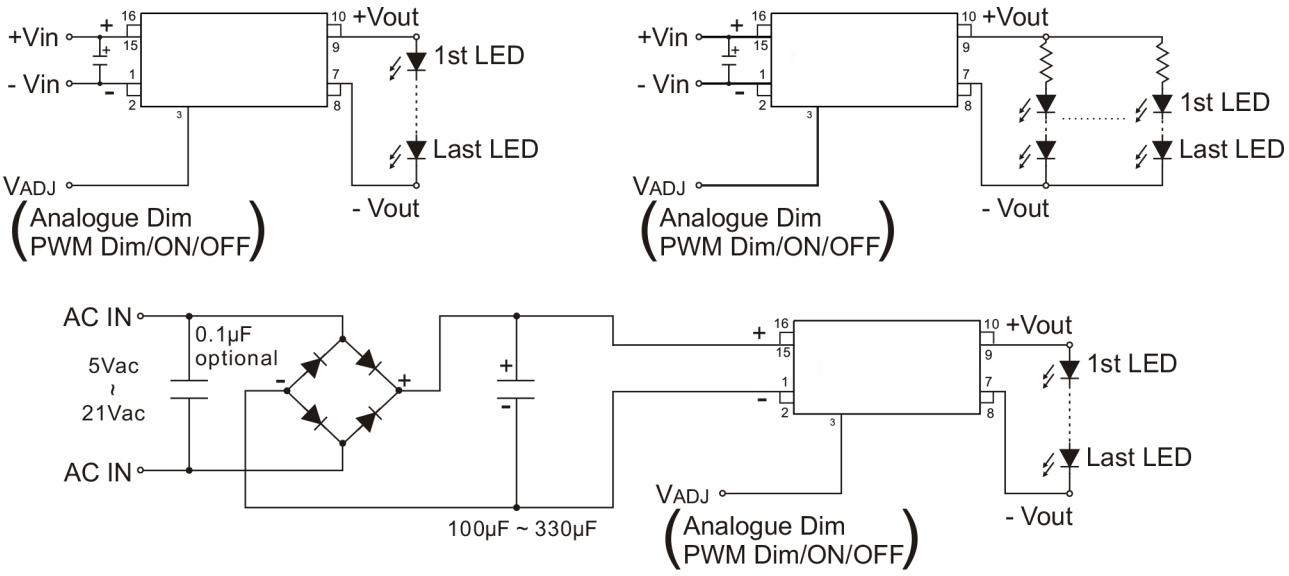
LEDD16_24-700



LEDD16_24-1000

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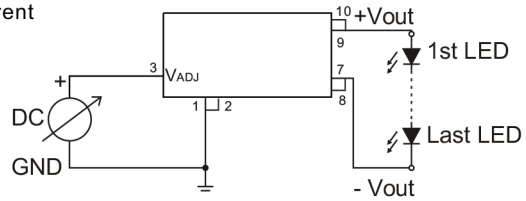
Typical application

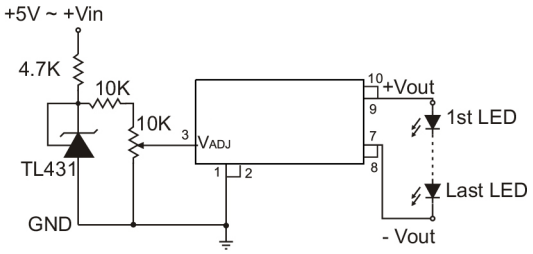


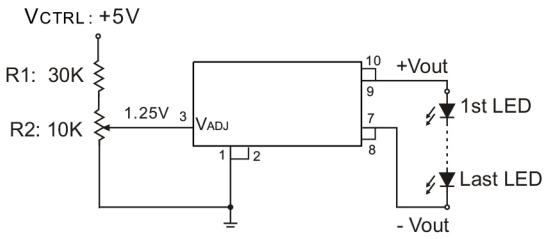
Output current adjustment by external DC control volta-

The nominal output current is then given by:

$$Ioutnom \approx Iout \times \frac{VADJ}{1.25}$$

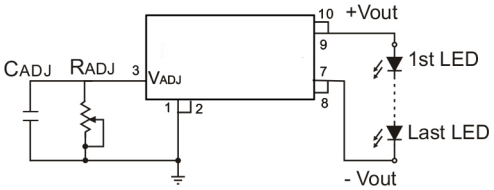






$$VADJ = \frac{R2}{R1 + R2} \times VCTRL$$

Resistor dimming



The current output $Ioutnom$ can be determined using the equation:

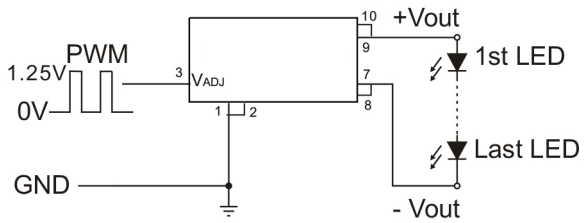
$$Ioutnom = \frac{Iout \times RADJ}{(RADJ + 200K)}$$

If the value of RADJ is 0 to 2M ohm, the maximum adjust range of output current is 25% to 90%. (For Vin-Vout<20Vdc)

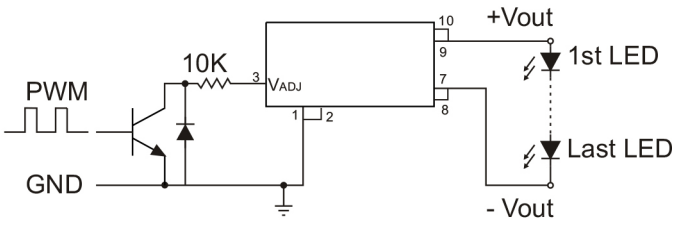
Output current adjustment by PWM control

Directly driving ADJ input
A Pulse Width Modulated (PWM) signal with duty cycle, D_{PWM}, can be applied to the ADJ pin, as shown below

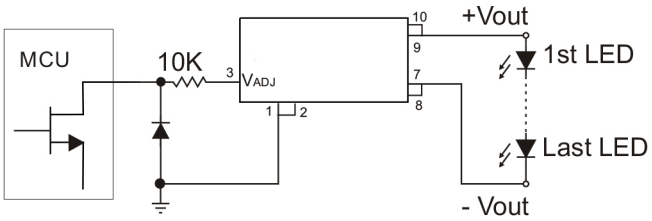
$Iout_{nom} \approx Iout \times D_{PWM}$ [If PWM frequency <200Hz, for $0.1<D_{PWM}<1$]



Driving the ADJ input via open collector transistor
The diode and resistor suppress possible high amplitude negative spikes on the ADJ input resulting from the drain-source capacitance of the transistor. Negative spikes at the input to the device should be avoided as they may cause errors in output current, or erratic device operation.



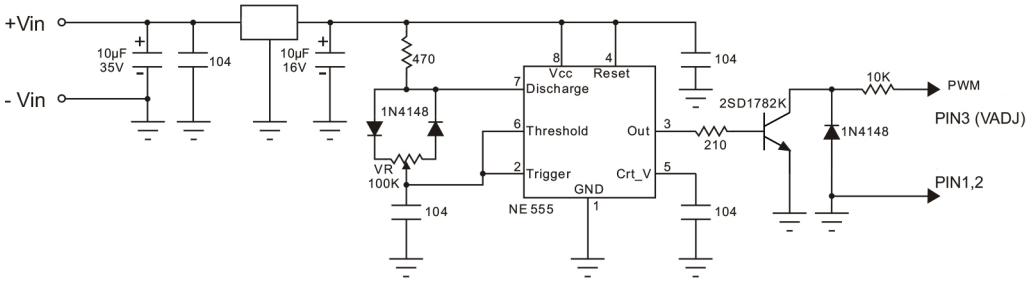
Driving the ADJ input from a microcontroller
Another possibility is to drive the device from the open drain output of a microcontroller. The diagram below shows one method of doing this:



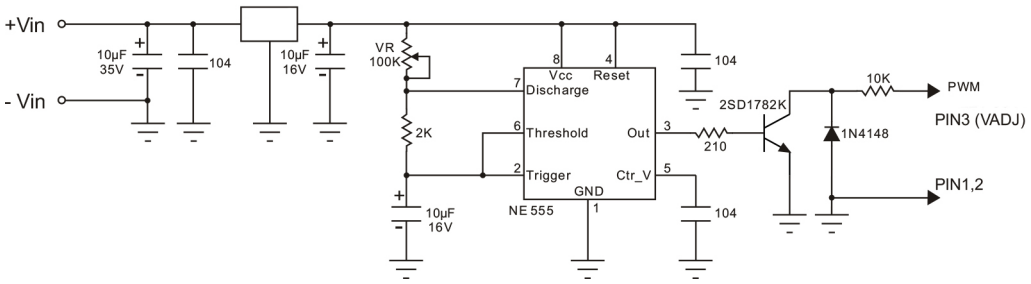
The diode and resistor suppress possible high amplitude negative spikes on the ADJ input resulting from the drain-source capacitance of the FET. Negative spikes at the input to the device should be avoided as they may cause errors in output current, or erratic device operation.

Output Current Adjustment By PWM Control (Dimming)

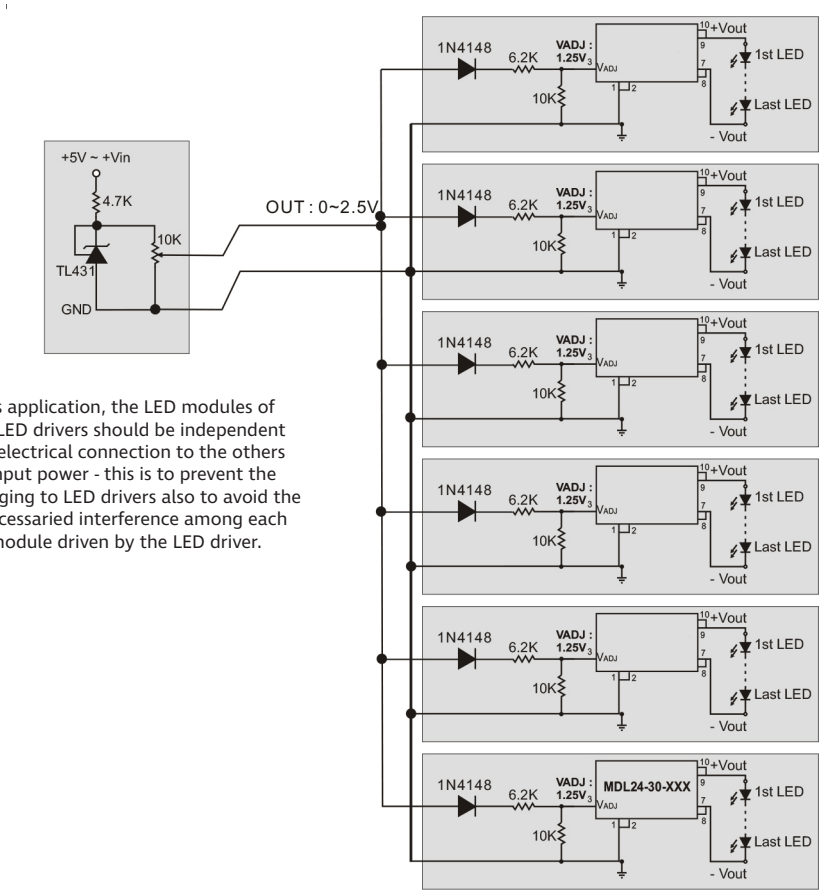
To avoid visible flicker the PWM signal must be greater than 100Hz.



Output Current Adjustment By PWM Control (Flash)

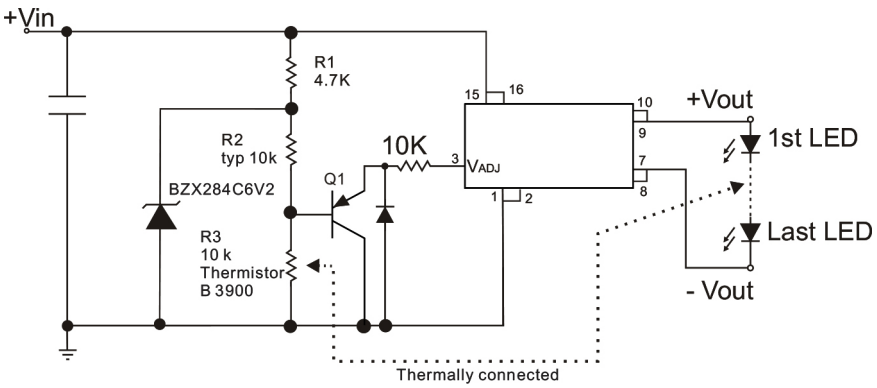


Output current adjustment by external DC control volta-



In this application, the LED modules of each LED drivers should be independent from electrical connection to the others and input power - this is to prevent the damaging to LED drivers also to avoid the un-necessaried interference among each LED module driven by the LED driver.

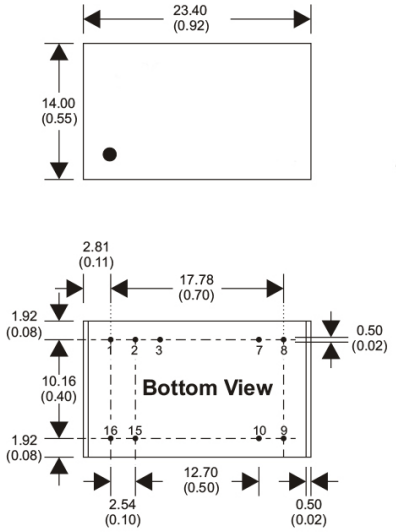
Thermal feedback circuit

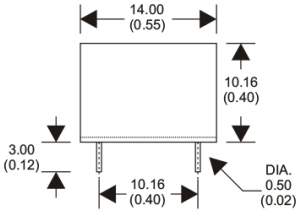


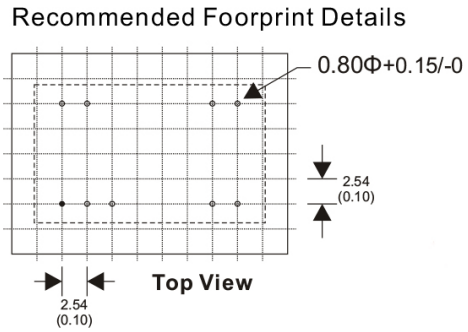
The selection of components for the thermal feedback circuit is not only dependent on the choice of R2 and R3, but also on the amount of heat sink area required to extract heat from the LEDs. To maximize the light output at high ambient or operating temperature conditions, the LEDs must have a sufficient thermal extraction path, otherwise the thermal control circuit will effect current drive reduction in non-optimal conditions. The thermal control threshold point is set by adjusting R2. For this design, three values (33k, 22k and 10k) were evaluated. These values were chosen to give break points at approximately 25°C, 40°C and 60°C.

Note that the light output will not continually dim to zero - the thermal control is applying DC control to the ADJ pin and therefore has a dimming ratio from maximum Current of approximately 5:1. Once the reduced DC level goes below the shutdown threshold of around 200mV, the LED drive current will fall to zero and the LEDs will be extinguished. The slope of the current reduction is determined by the beta value of the thermistor. The larger the beta value, the sharper will be the resultant current control response. The slope of the current reduction is also affected by Q1's base emitter voltage (VBE) variation with temperature.

Mechanical dimensions and footprint







Pin	Connections	
1, 2	-V Input	-DC supply
3	VADJ	PWM/ON/OFF or not used
7, 8	-V Output	LED Cathode Connection
9, 10	+V Output	LED Anode Connection
15, 16	+V Input	+DC Supply

No connection is allowed between input and output

Note:
All dimensions are typical in millimeters (inches).
1. Pin diameter: 0.5±0.05 (0.02±0.002)
2. Pin pitch and length tolerance: ±0.35 (±0.014)
3. Case Tolerance: ±0.5 (±0.02)

Note

1. Reversed power source damages the circuit, No connection is allowed between input ground and output.
2. DO NOT operate the driver over 24W output.
3. Leave pin VADJ open if not in use,ground pin to shut down the converter. Connecting Vadj to Vin damages the circuit.
4. Maximum output open voltage is equal to input voltage
5. Input filter components (C1, L, C2) are used to help meet conducted emissions requirement for the module.
6. For the compliance with IEC61000-4-5, a TVS is thus recommended to be installed in from of the input filter, the reference model: 3.0SMCJ24A or SMCJ24A (TVS Max Clamping Voltage @ Max Peak Pulse, Current VC (V) ≤ 40V)

