



4-CHANNEL CONSTANT CURRENT LED DRIVER

GENERAL DESCRIPTION

The M1924 is a linear constant current driver designed to drive multiple LEDs in series from a high input voltage rail. The driver acts as a high current matched, four-channel current source ensuring constant LED current for a range of input voltages. The M1924 allows implementing the lowest cost LED driver for a variety of applications. Internal circuitry maintains the preset constant current output for a wide voltage range at the LED outputs (LED1,2,3,4). LED current can be adjusted from 20 mA up to 240 mA through an external resistor.

The dimming can be achieved by feeding a PWM signal to the $\overline{\text{OE}}$ pin. Fast $\overline{\text{OE}}$ turn-on and turnoff time allows for very fast PWM dimming frequencies, completely eliminating flicker. The built-in thermal protection automatically adjusts LED current to prevent overheating.

FEATURES

- Four Channel LED Driver provides matched LED current
- Constant Current adjusted via an external resistor range : 20 to 240 mA (Max.)
- High Output Current Accuracy
 - Between channels : $\pm 3\%$ (Max.)
 - Between Ics : $\pm 6\%$ (Max.)
- PWM dimming possible
- Maximum output terminal voltage : 17 V
- Outputs can be connected in parallel to increase drive
- Thermal shutdown protects the driver
- 8-Lead SOP with thermal pad.

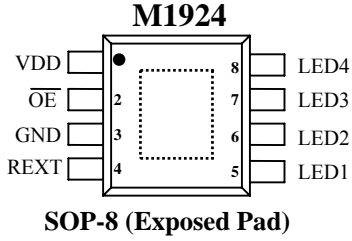
APPLICATIONS

- LED Displays
- LCD Backlight
- Keyboard Backlight



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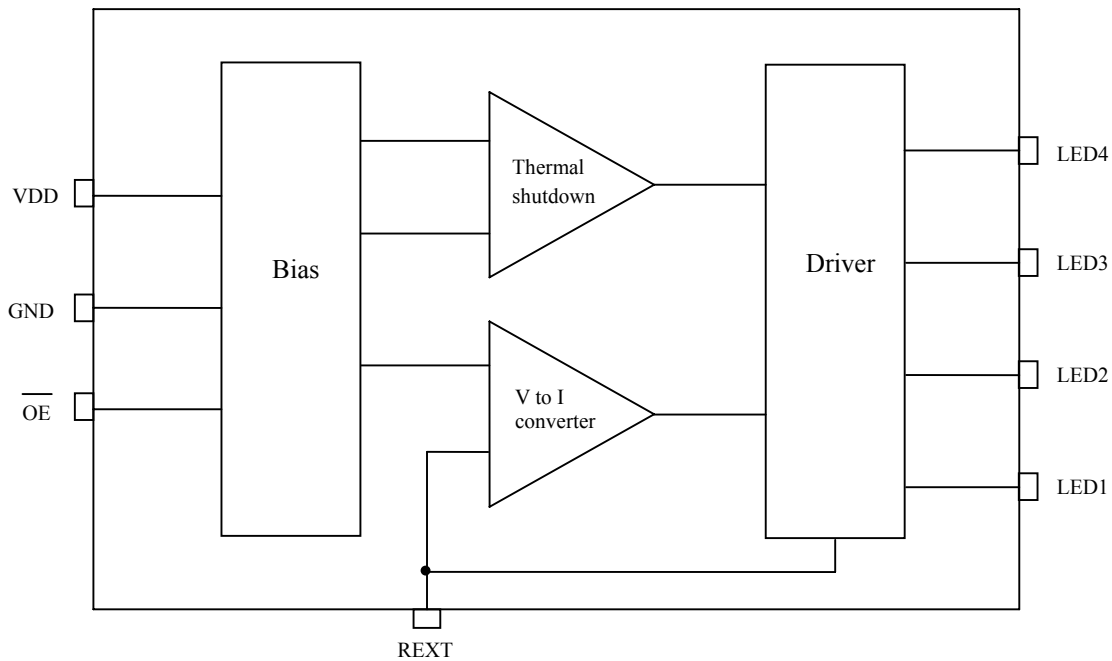
PIN ASSIGNMENT



PIN DESCRIPTION

| Pin No | I/O | Pin Name | Description |
|--------|-----|------------------|--|
| 1 | | VDD | Positive power supply. |
| 2 | I | OE | Input terminal for output enable. All outputs are turned off, when the OE terminal is driven High. And are turned on, when the terminal is driven Low. |
| 3 | | GND | Negative power supply. |
| 4 | I | R _{EXT} | Input terminal used to connect an external resistor. This regulated the output current. |
| 5~8 | O | LED1~LED4 | Constant-current output terminals |

BLOCK DIAGRAM





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ABSOLUTE MAXIMUM RATING

(TA=25°C)

| Parameter | Sym. | Rating | Unit |
|--|-----------------------------------|--------------------------------|------|
| Power Supply V _{DD} With Respect to V _{SS} | V _{DD} - V _{SS} | 6.0 | V |
| Voltage On Any Pin | | -0.3 to (V _{DD} +0.3) | V |
| Operating Temperature | Top | -20 to +125 | °C |
| Storage Temperature | | -65 to 150 | °C |

ELECTRICAL CHARACTERISTICS

| Characteristics | Sym. | Min. | Typ. | Max. | Units | Conditions | |
|---|---------------------|------------------------|------|-----------------------|-------|--|--|
| Supply Voltage | V _{DD} | 4.5 | 5.0 | 5.5 | V | | |
| Input voltage | “H” level | 0.7 x V _{DD} | | V _{DD} | V | Ta=-40~85°C | |
| | “L” level | V _{SS} | | 0.3 x V _{DD} | V | Ta=-40~85°C | |
| Sustaining Voltage at LED pin | V _{DS} | — | — | 17 | V | LED1~LED4 | |
| Output Current | I _{OUT} | 20 | — | 240 | mA | DC test circuit | |
| Output Leakage Current | I _{OH} | — | — | 0.5uA | uA | V _{OH} = 17V | |
| Output Current 1 | I _{OUT1} | — | 120 | — | mA | V _{DS} =0.8V, R _{EXT} =390Ω | |
| Current Skew1 | dI _{OUT1} | — | ±1 | ±3 | % | I _{OL} =120mA V _{DS} =0.8V R _{EXT} = 390Ω | |
| Output Current 2 | I _{OUT2} | — | 240 | — | mA | V _{DS} =1.0V, R _{EXT} = 200Ω | |
| Current Skew | dI _{OUT2} | — | ±1 | ±3 | % | I _{OL} =240mA V _{DS} =1.0V R _{EXT} = 200Ω | |
| Regulation of output current vs. Sustaining voltage | %/dV _{DS} | — | ±0.1 | — | %/V | V _{DS} within 1.0 and 3.0V | |
| Regulation of output current vs. Supply voltage | %/dV _{DD} | — | ±0.1 | — | %/V | V _{DD} within 4.5V and 5.5V | |
| Pull-up Resistor | R _{IN(up)} | 250 | 500 | 800 | KΩ | OE | |
| Junction Temperature Threshold | T _X | — | 165 | — | °C | When T _i approaches T _x and LED is shut off | |
| Supply Current | “OFF” | I _{DD} (off)1 | — | 5 | 9 | mA | R _{EXT} =Open, LED1~LED4=Off |
| | | I _{DD} (off)2 | — | 6 | 10 | | R _{EXT} = 390Ω, LED1~LED4=Off |
| | | I _{DD} (off)3 | — | 8 | 12 | | R _{EXT} = 200Ω, LED1~LED4=Off |
| | “ON” | I _{DD} (on)1 | — | 6 | 10 | | R _{EXT} = 390Ω, LED1~LED4=Off |
| | | I _{DD} (on)1 | — | 7 | 10 | | R _{EXT} = 200Ω, LED1~LED4=Off |



4-CHANNEL CONSTANT CURRENT LED DRIVER

Introduction

The M1924 is a four channel constant current source LED driver with programmable output current level. The design consists of a regulator bandgap , voltage to current converter, and output mirror drivers. The band-gap ensures good performance over voltage and temperature. The four outputs are tightly coupled allowing for excellent channel matching.

Thermal Shutdown

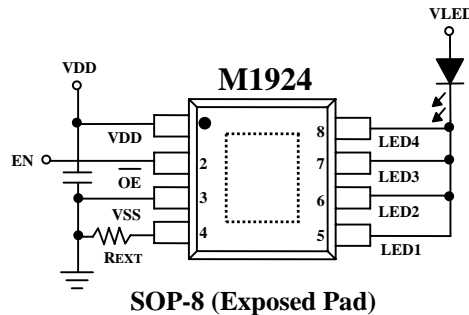
The M1924 uses a thermal comparator to monitor the system temperature shutting the device down if the internal temperature reaches 165°C.

OE

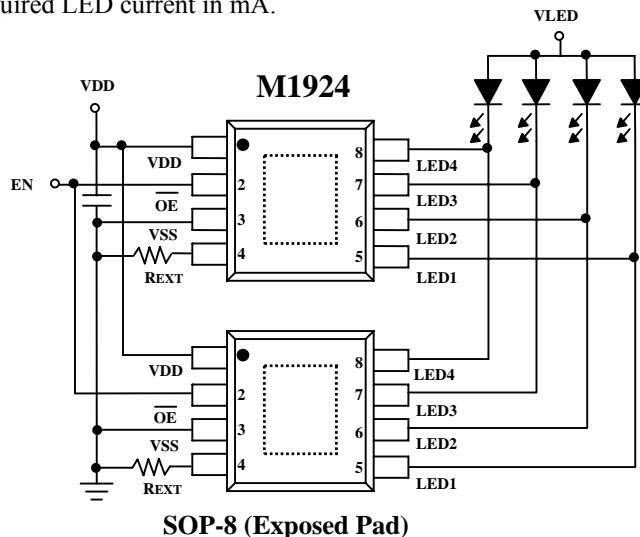
The enable pin can also be used to control the LED brightness with a pulse width modulated control signal. Duty Cycle or PWM control of the LED current maintains constant LED color while brightness is changing. The M1924 responds in less than 10us to PWM signals applied to this pin.

R_{EXT} Pin

The R_{EXT} pin is the servo point of an amplifier configured as a voltage to current converter. The voltage at this pin trips servos to the internal bandgap potential. A set resistor can be connected from the R_{EXT} pin to ground to generate a reference current for the following current gain stages. A current could alternately be applied to this pin in the form of a current source or current output DAC. This pin can also have a PWM signal applied to control the LED brightness.



The R_{EXT} value may be determined as $R_{SET} = 1.26 * 40 / I_{OUT}$, KΩ where 1.26 is a typical R_{EXT} pin voltage, 40 is a typical current multiplication ratio, and I_{OUT} is a required LED current in mA.

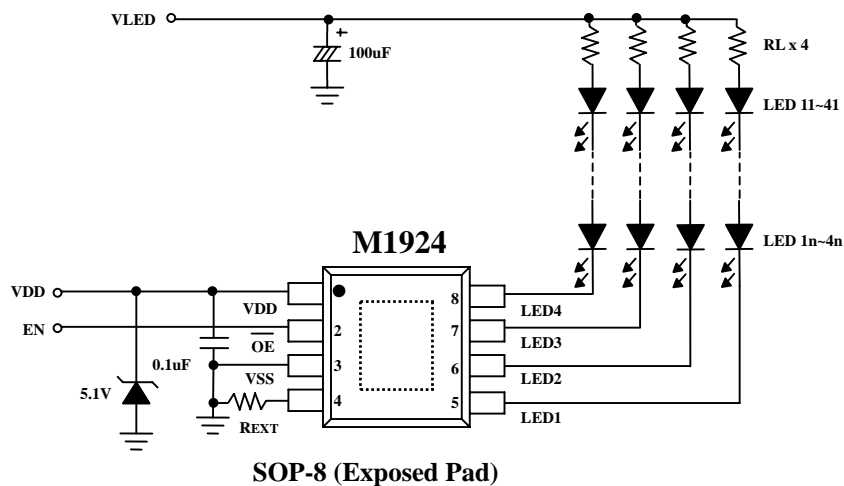
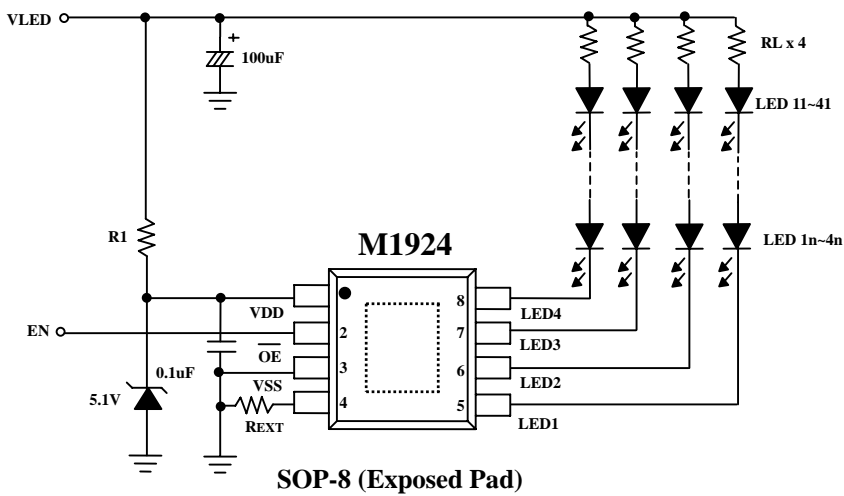




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The voltage applied to the cathode of each LED determines the overall efficiency of the M1924 circuit. The M1924 is designed to be able to sink 240mA at each of its four outputs; LED1~4. The M1924 is also designed to be able to handle up to 17V on these pins. This voltage handling capability assumes the total power can be dissipated by the M1924. The power dissipation inside the M1924 will be directly related to the voltage and current applied to these pins. For example, the typical operating cathode voltage is 500mV. At maximum current the power dissipated by one LED driver output is 125mA * 500mV = 62.5mW.

APPLICATIONS CIRCUIT

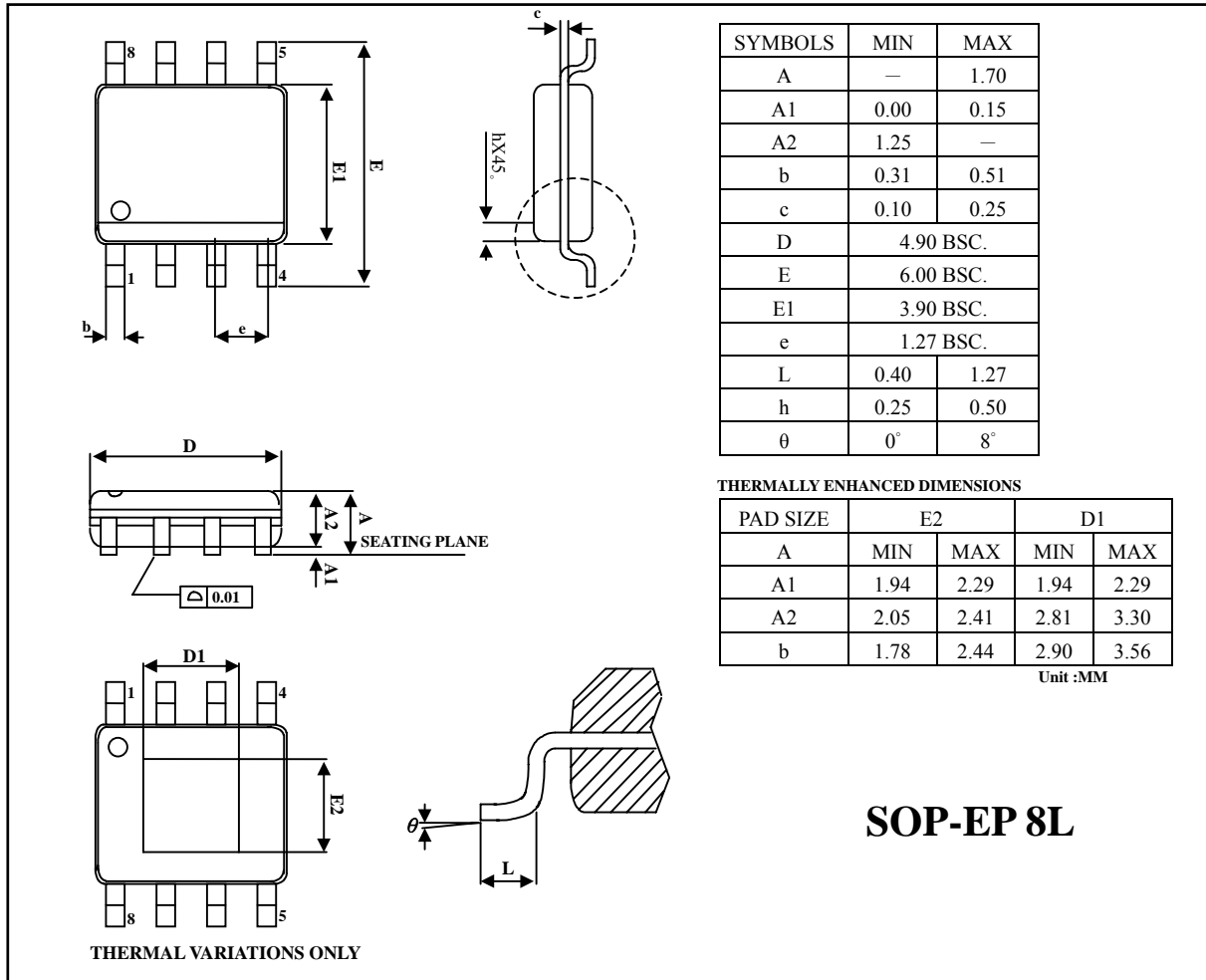


* All specs and applications shown above subject to change without prior notice.
(以上電路及規格僅供參考,本公司得逕行修正)



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PACKAGE OUTLINE



SOP-EP 8L