



**WHITE/BLUE LED DRIVER FOR LI-ION BATTERY**

**GENERAL DESCRIPTION**

The M1913/M1914 is a CMOS constant current driver that provides four regulated current sources. It is designed to drive LEDs with matched currents to produce balanced light sources for backlights.

M1913/M1914 is simple and easy to use. It accepts an input voltage range from 2.7V to 6V and maintains a constant current determined by an external resistor. This configuration eliminates the need of external Schottky diode, capacitors and inductances. M1913/M1914 delivers up to 30mA of load current. In addition, customers can get very high efficiency (up to 92%) by well matching VLED input supply voltage and LED forward voltages, Vf. M1913/M1914 features low cost, high efficiency, easy to use, and space-saving SOT-26 or MSOP-8 package for applications that need uniform LEDs illumination.

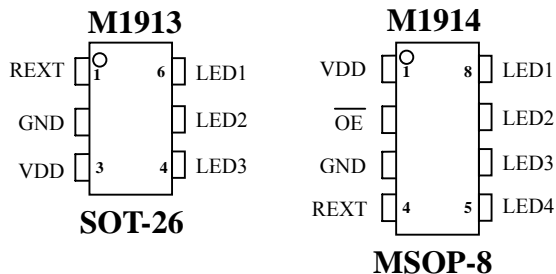
**FEATURES**

- Four Channel LED Driver provides matched LED current
- Constant Current adjusted via an external resistor range : 5 to 30 mA (Max.)
- High Output Current Accuracy :  
Between channels : ±3% (Max.)  
Between Ics : ±6% (Max.)
- PWM dimming possible
- Supply voltage range 2.7 V ~ 6.0 V
- 0.1uA standby current
- Thermal shutdown protects the driver

**APPLICATIONS**

- LED Displays
- LCD Backlight
- Keyboard Backlight

**PIN ASSIGNMENT**



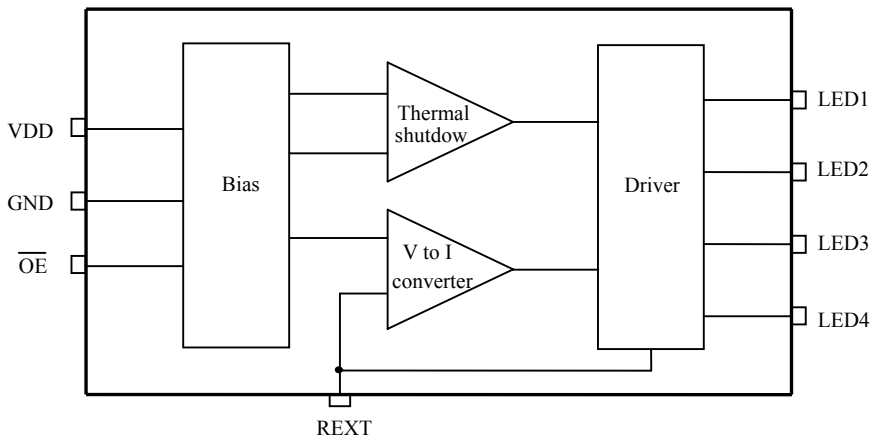


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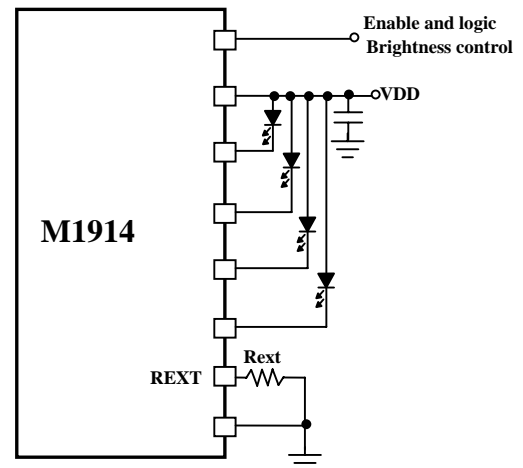
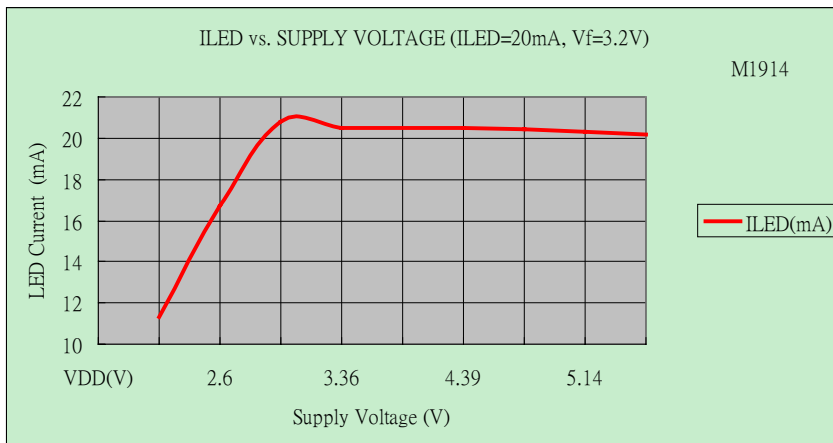
**PIN DESCRIPTION (MSOP-8)**

Pin No	I/O	Pin Name	Description
1		VDD	Positive power supply.
2	I	$\overline{\text{OE}}$	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	REXT	Input terminal used to connect an external resistor. This regulated the output current.
5~8	O	LED1~LED4	Constant-current output terminals

**BLOCK DIAGRAM**

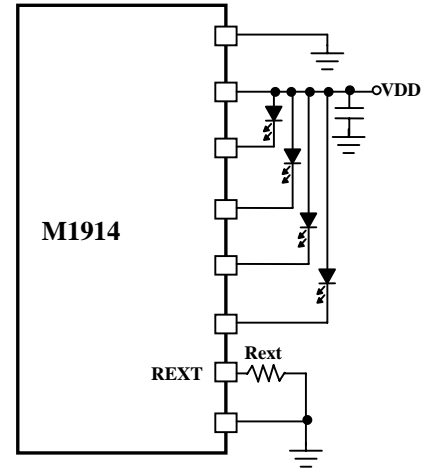
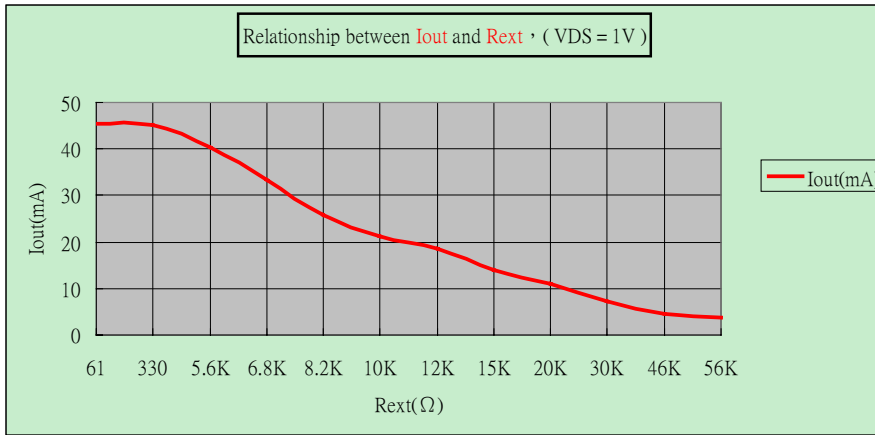


**TYPICAL OPERATING CHARACTERISTICS**

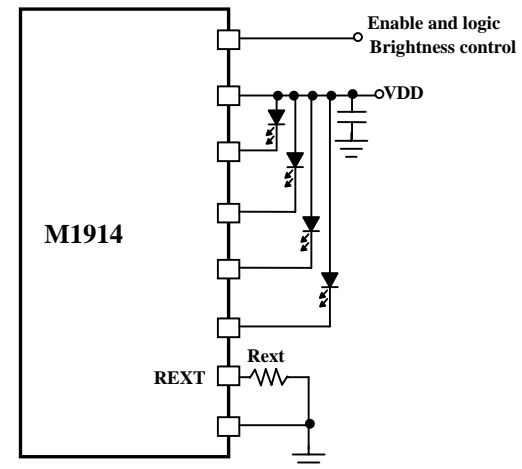
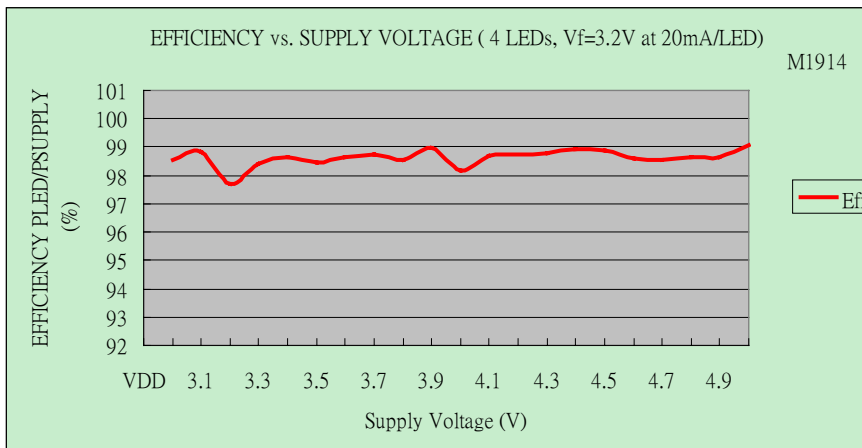




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$$\text{Efficiency} = (V_{f1} \times I_{LED1} + V_{f2} \times I_{LED2} + V_{f3} \times I_{LED3} + V_{f4} \times I_{LED4}) / (V_{DD} \times I_{DD})$$





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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	V
Voltage On Any Pin		-0.3 to ( $V_{DD}+0.3$ )	V
Operating Temperature	Top	-20 to +85	°C
Storage Temperature		-65 to 150	°C

ELECTRICAL CHARACTERISTICS

$V_{DD}=3.7V$ ,  $T_A=25^\circ C$ , No Load, Input:  $V_{IH}=3.3V$ ,  $V_{IL}=GND$ . (Unless otherwise noted)

Characteristics	Sym.	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	$V_{DD}$	2.7	3.7	6	V	
Input voltage	“H” level	$0.7 \times V_{DD}$		$V_{DD}$	V	$T_A=-40\sim 85^\circ C$
	“L” level	$V_{SS}$		$0.3 \times V_{SS}$	V	$T_A=-40\sim 85^\circ C$
Sustaining Voltage at LED pin	$V_{DS}$	—	—	6	V	LED1~LED4
Output Current	$I_{OUT}$	5	—	30	mA	DC test circuit
Output Leakage Current	$I_{OH}$	—	—	0.5uA	uA	$V_{OH}=6V$
Output Current	$I_{OUT}$	—	20	—	mA	$V_{DS}=0.6V$ , $R_{EXT}=10.6K\Omega$
Current Skew	$dI_{OUT}$	—	$\pm 1$	$\pm 3$	%	$I_{OL}=20mA$ $V_{DS}=0.6V$ $R_{EXT}=10.6K\Omega$
Regulation of output current vs. Sustaining voltage	$\%/dV_{DS}$	—	$\pm 0.1$	—	%/V	$V_{DS}$ within 1.0V and 3.0V
Regulation of output current vs. Supply voltage	$\%/dV_{DD}$	—	$\pm 0.1$	—	%/V	$V_{DD}$ within 4.5V and 6V
Pull-up Resistor	$R_{OE(up)}$	—	400	—	K $\Omega$	$\overline{OE}$ @ $V_{DD}=5V$
Junction Temperature Threshold	$T_x$	—	150	—	°C	When $T_j$ approaches $T_x$ and LED is shut off
Supply Current	“OFF”	$I_{DD} (off)1$	—	0.5	1	uA $R_{EXT}=10.6K\Omega$ , LED1~LED4=Off
	“ON”	$I_{DD} (on)1$	—	400	600	



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**INTRODUCTION**

The M1913/M1914 is a three/four channel constant current source LED driver with programmable output current level. The design consists of a regulator band-gap, 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 M1913/M1914 uses a thermal comparator to monitor the system temperature shutting the device down if the internal temperature reaches 150°C.

**$\overline{\text{OE}}$**

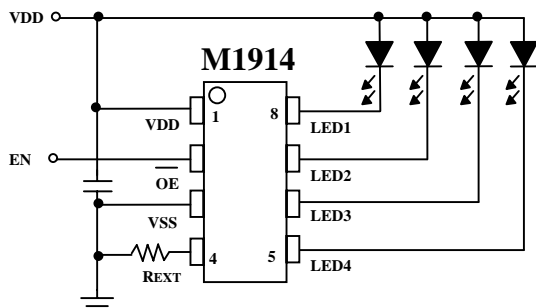
The enable pin can also be used to control the LED brightness with a pulse width modulated control signal. Duty cycle or PWM control of the LED current maintains constant LED color while brightness is changing. The M1913/M1914 responds in less than 10us to PWM signals applied to this pin.

**R<sub>EXT</sub> PIN**

The R<sub>EXT</sub> pin is the servo point of an amplifier configured as a voltage to current converter. R<sub>ext</sub> is used to regulate the LED current. For the best accuracy, a resistor with ±1% precision should be used.

The R<sub>EXT</sub> value may be determined as  $R_{EXT} = 1.26 * 200 / I_{OUT}$ , KΩ where 1.26 is a typical R<sub>EXT</sub> pin voltage, 200 is a typical current multiplication ratio, and I<sub>OUT</sub> is a required LED current in mA.

**APPLICATION 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

SYMBOLS	MIN	NOM.	MAX
A	—	—	1.45
A1	—	—	0.15
A2	0.90	1.15	1.3
b	0.30	—	0.50
c	0.08	—	0.22
D	2.90 BSC.		
E	2.80 BSC.		
E1	1.60 BSC.		
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.30	0.45	0.60
L1	0.60 REF.		
L2	0.25 BSC.		
R	0.10	—	—
R1	0.10	—	0.25
$\theta$	0°	4°	8°
$\theta 1$	5°	10°	15°

Unit : MM

**SOT-23(26)-6L**

SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.10
A1	0.00	—	0.15
A2	0.75	0.85	0.95
D	3.00 BSC		
E	4.90 BSC		
E1	3.00 BSC		
L	0.40	0.60	0.80
L1	0.95 REF		
$\theta^+$	0	—	8

UNIT : MM

**THERMALLY ENHANCED DIMENSIONS**

PAD SIZE	E2		D1	
	MIN.	MAX.	MIN.	MAX.
68 X 70E	1.38	1.73	1.42	1.78

( SHOWN IN MM )

**8-Pin Plastic MSOP**