東楠科技股份有限公司
Tungnan Technology Co., Ltd.

LED DRIVER

M13551

3-CHANNEL RGB LED LAMP DRIVER

GENERAL DESCRIPTION

The M13551 is a 3-channel PWM enabled current sink driver for RGB LED or display applications. Tri-state data format designed for single wire transmit data and clock. It is easy to be designed in applications that need mixing RGB light sources for multi-color output. The output current is determined by an external resistor and the brightness control code, both set by users.

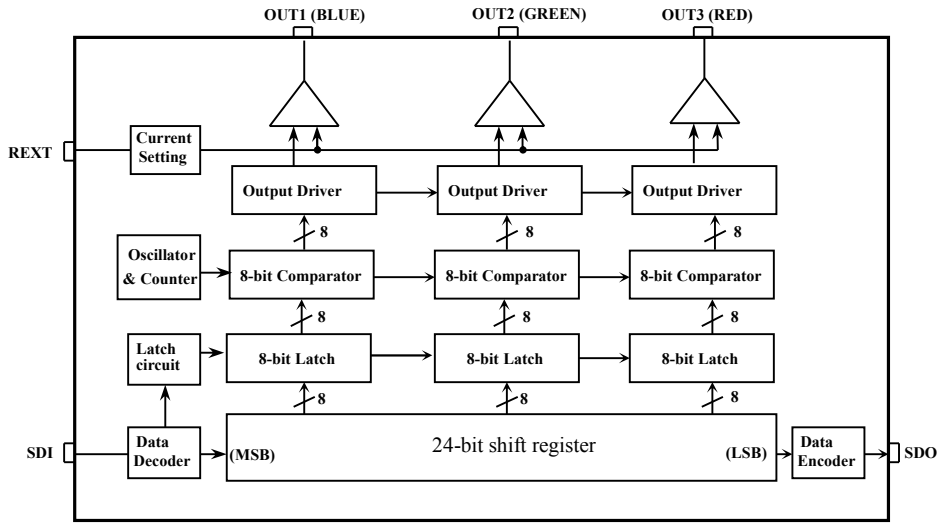
FEATURES

- CMOS technology.
- Single wire series transmit data
- 3 output channels for RGB LED lamps.
- Output current invariant to load voltage change.
- 8-bits luminance data with PWM current output.

APPLICATIONS

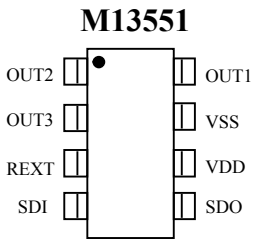
- LED Decorative Lighting.
- PWM Signal Generator.
- Keypad back lighting

BLOCK DIAGRAM



3-CHANNEL RGB LED LAMP DRIVER

PIN ASSIGNMENT



PIN DESCRIPTION

NO.	Pin Name	Type	Description
1	OUT2	OUTPUT	NMOS Output Driver(open-drain)
2	OUT3	OUTPUT	NMOS Output Driver(open-drain)
3	REXT	INPUT	External Resistor For Setting Up Output Current For All Output Channels
4	SDI	INPUT	Serial Data Input
5	SDO	OUTPUT	Serial Data Output
6	VDD	POWER	Positive power supply
7	VSS	GND	Negative power supply
8	OUT1	OUTPUT	NMOS Output Driver(open-drain)

3-CHANNEL RGB LED LAMP DRIVER

ABSOLUTE MAXIMUM RATINGS

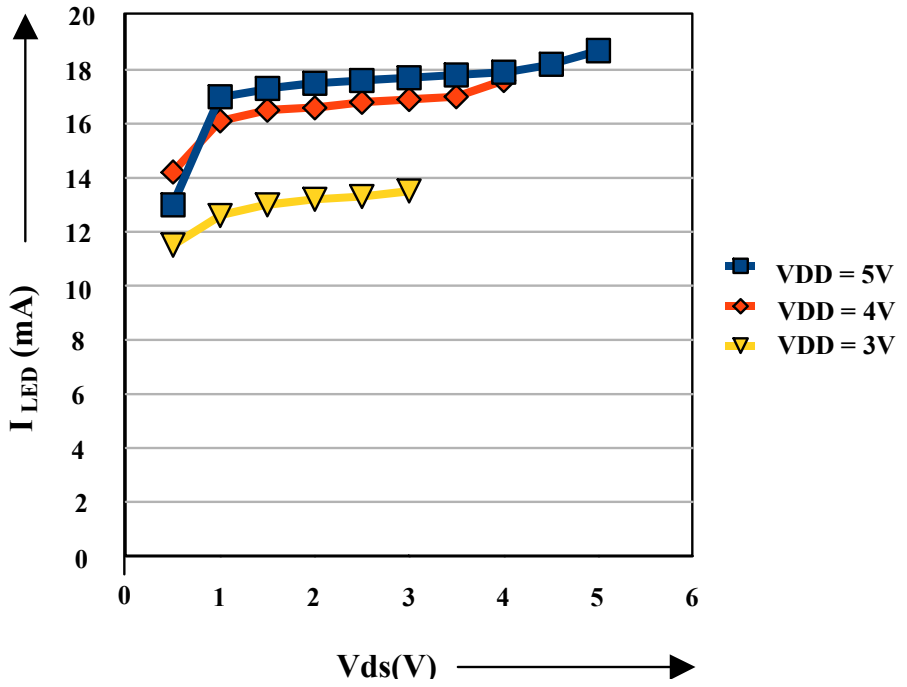
Characteristics	Symbol	Rating	Unit
Supply Voltage	V_{DD}	3.5 ~ 6	V
Logic Input Voltage	V_{IN}	-0.3 ~ +0.3	V
Clock Frequency	F_{CLK}	660	KHz
Output Sustaining Voltage	V_{DS}	6	V
Output Continuous Current, Each Channel	I_{OUT}	20	mA
Power Dissipation, Each Channel	P_{DISP}	100	mW
Operating Temperature	T_{OPR}	-20 ~ +85	℃
Storage Temperature	T_{STR}	-60 ~ +150	℃

ELECTRICAL CHARACTERISTICS

(VDD=5V, Ta=25℃, Unless Otherwise Specified)

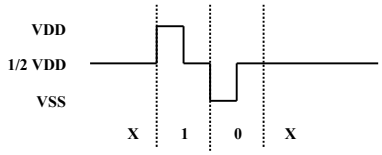
Characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage		V_{DD}	—	3.3	5.0	5.5	V
Output Voltage		V_{DS}	OUT1, OUT2, OUT3 terminals	—	—	5.5	V
Output Current		I_{OUT}	DC Test Circuit	—	18	—	mA
Input Voltage	"H" level	V_{IH}	Ta = -20~85ºC	0.7 V_{DD}	—	V_{DD}	V
	"L" level	V_{IL}	Ta = -20~85ºC	0	—	0.3 V_{DD}	V
Output Leakage Current		I_{OH}	V_{OH} = 5.0V	—	0	—	μA
OUT1		I_{OUT} 1	G_{BLUE} = (1,1,1,1,1,1,1,1)	—	18	—	mA
OUT2		I_{OUT} 2	G_{GREEN} = (1,1,1,1,1,1,1,1)	—	18	—	mA
OUT3		I_{OUT} 3	G_{RED} = (1,1,1,1,1,1,1,1)	—	18	—	mA
Current Skew		ΔI_{OUT}	I_{OUT} = 18mA V_{DS} = 1.0V	—	±10	—	%
Output Current Variation vs. Supply Voltage Variation		—	V_{DD} within 2.7V and 3.3V	—	±20	—	%
			V_{DD} within 4.5V and 5.5V	—	±10	—	
Supply Current	"OUT Off"	I_{DD} (Off) 1	OUT1~OUT3 = Off , V_{DD} = 3.3V	—	1	2	mA
	"OUT On"	I_{DD} (Off) 1	OUT1~OUT3 = On , V_{DD} = 3.3V	—	1	2	
	"OUT Off"	I_{DD} (Off) 1	OUT1~OUT3 = Off , V_{DD} = 5V	—	2	3	
	"OUT On"	I_{DD} (Off) 1	OUT1~OUT3 = On , V_{DD} = 5V	—	2	3	

LED Current VS Vds

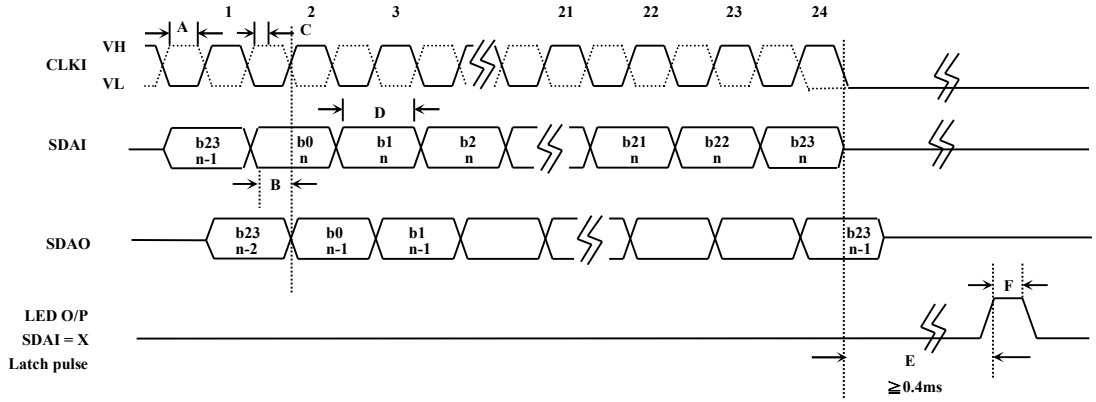


TIMING CHART & CONDITION

(1) DATA FORMAT



(2) TIMING DIAGRAM



(VDD=+5V, Ta=25℃, unless otherwise specified)

Item	Description	Min	Typ	Max	Unit
A	Clock Pulse Width	50	—	—	ns
B	Serial Data Setup Time	10	—	—	ns
C	Serial Data Hold Time	10	—	—	ns
D	Serial Data Pulse Width	50	—	—	ns
E	Time Between Clock Activation And Latch	0.4	—	—	ms
F	Latch Pulse Width	50	—	—	ns

TRUTH TABLE

Serial Data Input	Clock Input	Shift Register Contents	Serial Data Output	Latch Contents
		I_N I_{N-1}……..…….....I_2 I_1 I_0		**I_N I_{N-1}…….I_2 I_1 I_0**
H	↓↑	↓ H R_N R_{N-1}……..……..R_3 R_2 R_1	↑ R1	
L	↓↑	↓ L R_N R_{N-1}……...…….R_3 R_2 R_1	↑ R1	
⌐ X		R_N R_{N-1}……..…….R_2 R_1 R_0	R0	
		X X ……X X X	X	R_N R_{N-1}…….…R_2 R_1 R_0
		P_N P_{N-1}……..P_2 P_1 P_0	P0	P_N P_{N-1}…….P_2 P_1 P_0

Internal Oscillator Output	Counter Contents	Latch Contents	NMOS Output
	I_7…….…….I_2 I_1 I_0	**I_7 ……...I_2 I_1 I_0**	
X	L ……..…….L L L	P_7 …….…... P_2 P_1 P_0	If P >Q Then I_{DS} ON Else I_{DS} OFF
⌊	[Q_7：Q_0]+1 Count Up		
⌐	Q_7 ……..….Q_2 Q_1 Q_0		

L=Low Logic Level H=High Logic Level X=Irrelevant

R=Previous State P=Present State Q=Counter State

An Example

Vout = 1.0V for OUT1 / BLUE, OUT2 / GREEN, and OUT3 / RED

If the 24-bit Configuration Code is {11111111, 00000000, 10000000},

$I_{OUT1\ ,\ BLUE} = G_{BLUE} / 255 = 255/255 \times 18mA = 18mA$;

$I_{OUT2\ ,\ GREEN} = G_{GREEN} / 255 = 0/255 \times 18mA = 0mA$;

$I_{OUT3\ ,\ RED} = G_{RED} / 255 = 128/255 \times 18mA = 9mA$;

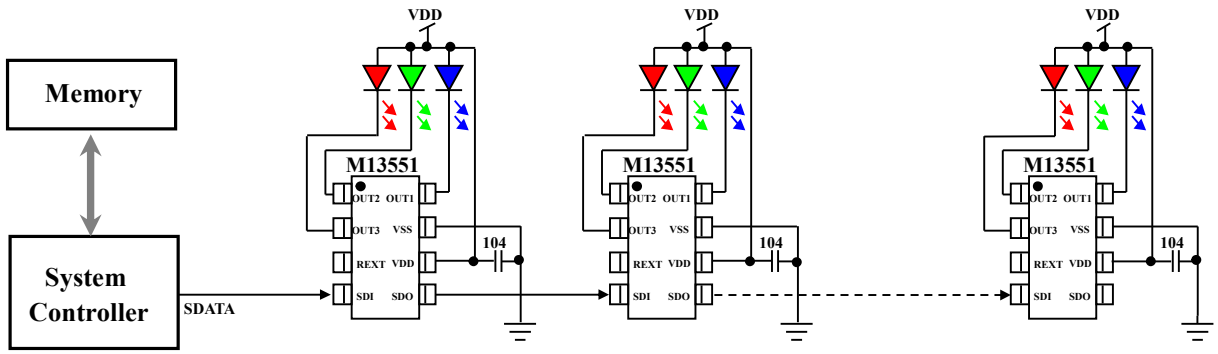
The mixing multi-color is determined by $I_{OUT\ ,\ GREEN} = 18mA$, $I_{OUT\ ,\ RED} = 0mA$, and $I_{OUT\ ,\ BLUE} = 9mA$.

Assuming Luminous Intensity (mcd) of R / G / B LEDs are the same and I= 18mA, we may ideally let

$G_{GREEN} + G_{RED} + G_{BLUE} = C$ (Constant value) to get a stable brightness.

For instance, while C = 10, that is $G_{GREEN} + G_{RED} + G_{BLUE} = 10$, M13551 can easily give system designers a wide range of color and brightness control in portable electronic devices.

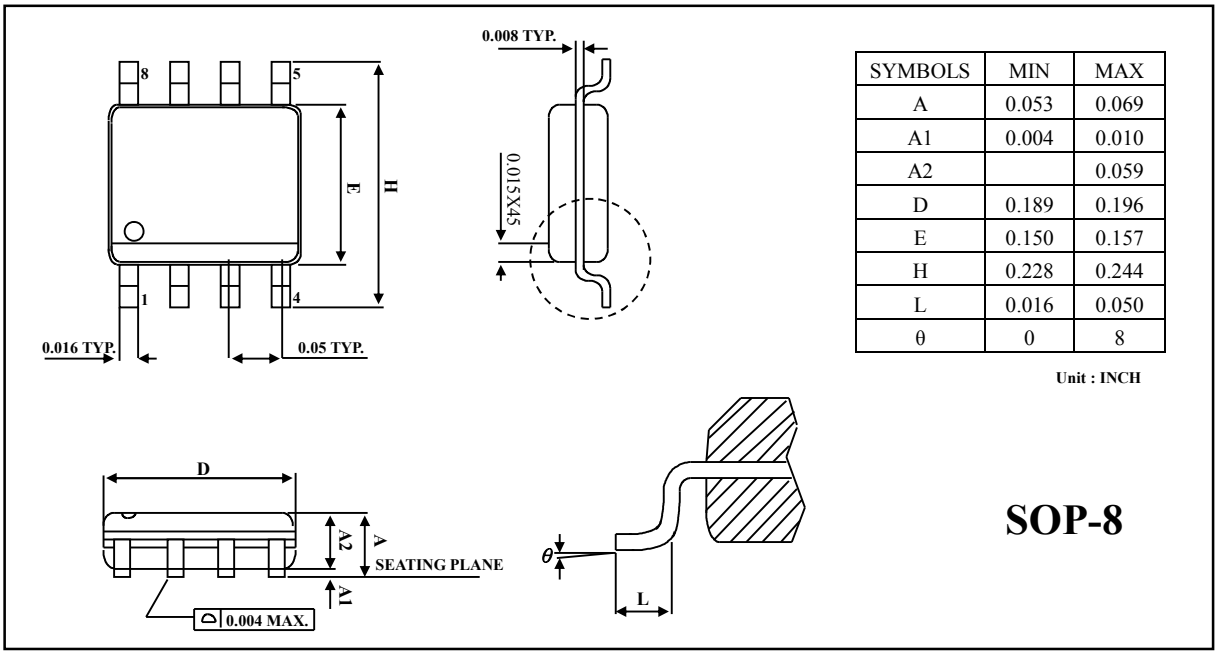
TYPICAL APPLICATION



* 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)

PACKAGE OUTLINE

8-Pin Plastic SOP



SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
A2		0.059
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ	0	8

Unit : INCH

SOP-8

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