一詮半導體股份有限公司
MOSDESIGN SEMICONDUCTOR CORP.

LED DRIVER
M1355

3-CHANNEL RGB LED LAMP DRIVER

GENERAL DESCRIPTION

The M1355 is a 3-channel PWM enabled current sink driver for RGB LED or display applications. M1355 includes a serial buffer and data latches which convert serial input data into parallel output format, and built-in oscillator for PWM functioning. Data and clock buffer outputs are designed for cascading another chip. 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.

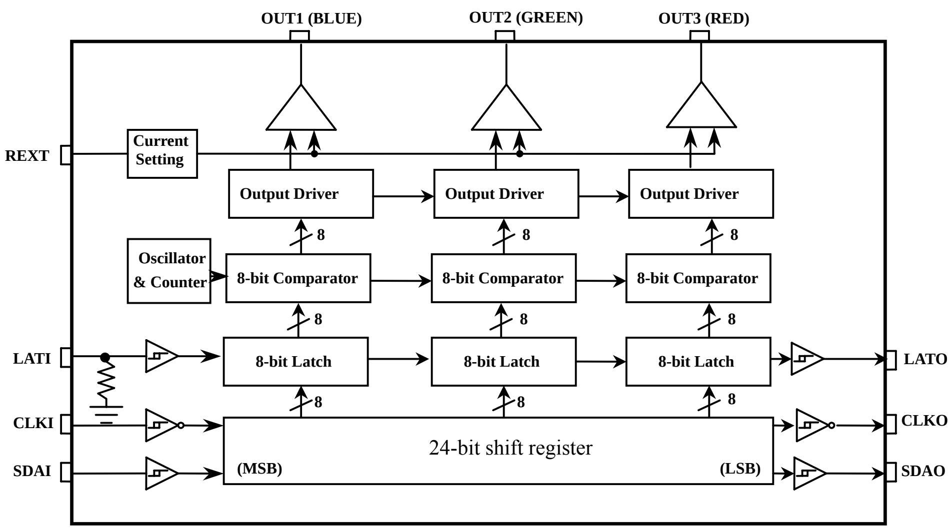
FEATURES

- CMOS technology.
- 3 output channels for RGB LED lamps.
- Output current invariant to load voltage change.
- 8-bits luminance data with PWM current output.
- Built-in buffers for cascading clock, CK, SDA,STB to other devices.

APPLICATIONS

- LED Decorative Lighting.
- PWM Signal Generator.
- Keypad backlighting

BLOCK DIAGRAM



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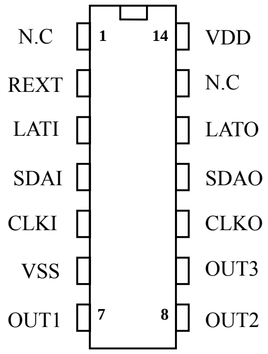
PIN ASSIGNMENT

M1355



PIN DESCRIPTION

NO.	Pin Name	Type	Description
1 , 13	NC		No Connection
2	REXT	INPUT	External Resistor For Setting Up Output Current For All Output Channels
3	LATI	INPUT	Latch Signal Input For 8-Bit Latches
4	SDAI	INPUT	Serial Data Input
5	CLKI	INPUT	System Clock Input
6	VSS	GND	Negative power supply
7~9	OUT1~3	OUTPUT	NMOS Output Driver(open-drain)
10	CLKO	OUTPUT	System Clock Output
11	SDAO	OUTPUT	Serial Data Output
12	LATO	OUTPUT	Latch Signal Output For 8-Bit Latches
14	VDD	POWER	Positive power supply

ABSOLUTE MAXIMUM RATINGS

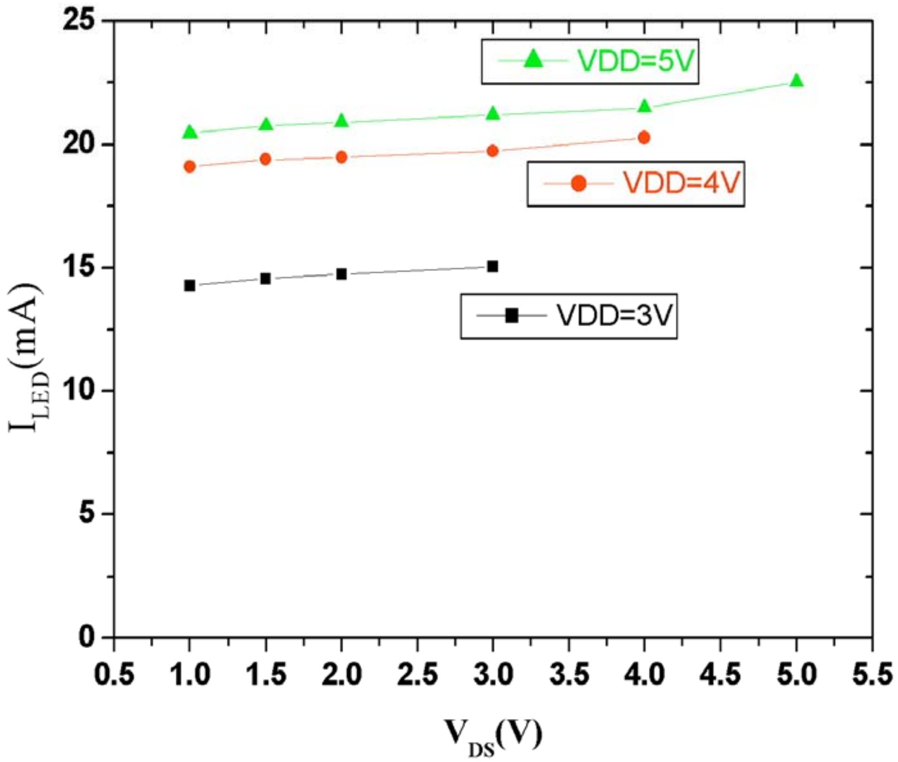
Characteristics	Symbol	Rating	Unit
Supply Voltage	V_{DD}	3.5 ~ 6	V
Logic Input Voltage	V_{IN}	-0.3 ~ +0.3	V
Clock Frequency	F_{CLK}	660	KHz
Output Sustaining Voltage	V_{DS}	6	V
Output Continuous Current, Each Channel	I_{OUT}	20	mA
Power Dissipation, Each Channel	P_{DISP}	100	mW
Operating Temperature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

ELECTRICAL CHARACTERISTICS

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

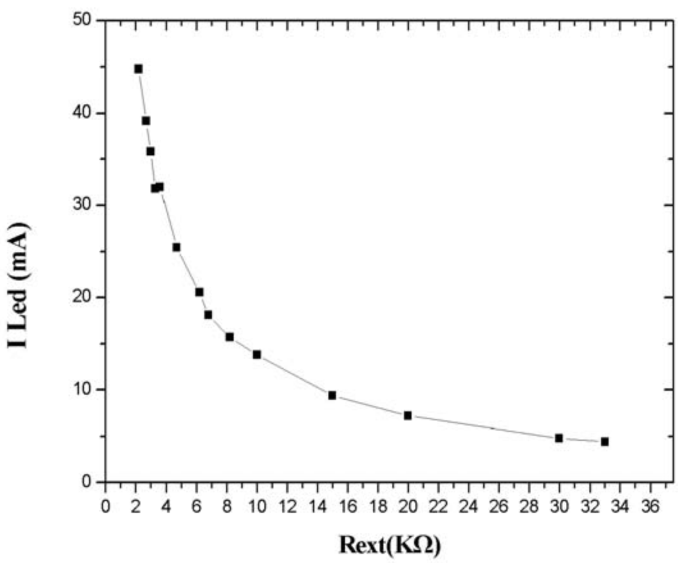
Characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage		V_{DD}	—	3.3	5.0	5.5	V
Output Voltage		V_{DS}	OUT1, OUT2, OUT3 terminals	—	—	5.5	V
Output Current		I_{OUT}	DC Test Circuit	5	—	40	mA
Input Voltage	"H" level	V_{IH}	Ta = -20~85°C	0.7 V_{DD}	—	V_{DD}	V
	"L" level	V_{IL}	Ta = -20~85°C	0	—	0.3 V_{DD}	V
Output Leakage Current		I_{OH}	V_{OH} = 5.0V	—	0	—	µA
OUT1		I_{OUT} 1	V_{DS} = 1.0V, Rex t = 6.2KΩ GBLUE = (1,1,1,1,1,1,1,1)	—	20	—	mA
OUT2		I_{OUT} 2	V_{DS} = 1.0V, Rext = 6.2KΩ GGREEN = (1,1,1,1,1,1,1,1)	—	20	—	mA
OUT3		I_{OUT} 3	V_{DS} =1.0V, Rext = 6.2KΩ GRED = (1,1,1,1,1,1,1,1)	—	20	—	mA
Current Skew		ΔI_{OUT}	I_{OUT} = 20mA V_{DS} = 1.0V Rext = 6.2KΩ	—	±10	—	%
Output Current Variation vs. Supply Voltage Variation		—	V_{DD} within 2.7V and 3.3V, Rext = 6.2KΩ	—	±20	—	%
			V_{DD} within 4.5V and 5.5V, Rext = 6.2KΩ	—	±10	—	
Pull-down Resistor		RIN	LATI	—	250	—	KΩ
Supply Current	"OUT Off"	I_{DD} (Off) 1	Rext =6.2KΩ, OUT1~OUT3 = Off, V_{DD} = 3.3V	—	1	2	mA
	"OUT On"	I_{DD} (Off) 1	Rext =6.2KΩ, OUT1~OUT3 = On, V_{DD} = 3.3V	—	1	2	
	"OUT Off"	I_{DD} (Off) 1	Rext =6.2KΩ, OUT1~OUT3 = Off, V_{DD} = 5V	—	2	3	
	"OUT On"	I_{DD} (Off) 1	Rext =6.2KΩ, OUT1~OUT3 = On, V_{DD} = 5V	—	2	3	

LED Current VS Vds (@Rext = 6.2KΩ)

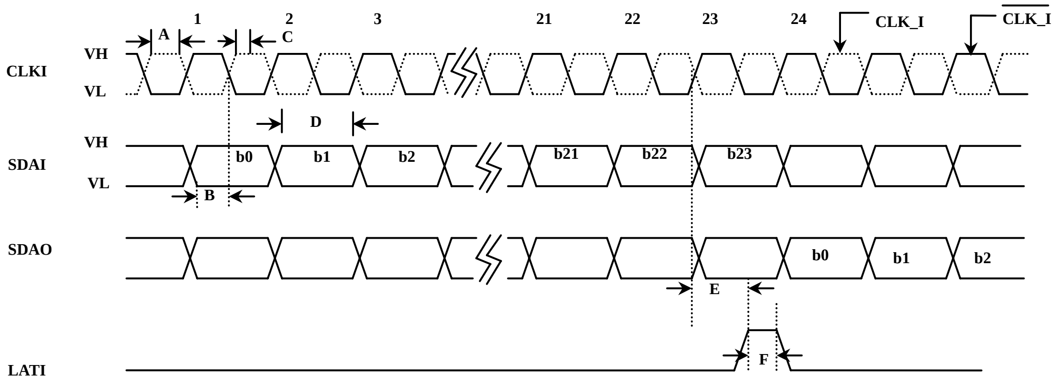


LED Current VS Resistance (@VDD=5V)

Rext (Ω)	**I_{LED} (A)**
2.2K	44.8m
2.7K	39.2m
3K	35.8m
3.3K	31.8m
3.6K	32m
4.7K	25.5m
6.2K	20.5m
6.8K	18.1m
8.2K	15.7m
10K	13.8m
15K	8.4m
20K	7.2m
30K	4.8m
33K	4.4m



TIMING CHART & CONDITION



(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	50	—	—	ns
F	Latch Pulse Width	50	—	—	ns

TRUTH TABLE

Serial Data Input	Clock Input	Shift Register Contents	Serial Data Output	Latch Input	Latch Contents
		IN IN-1…………………....I2 I1 I0			IN IN-1…………….I2 I1 I0
H	↓↑	↓ H R_N R_{N-1}……..……..R3 R2 R1	↑ R1		
L	↓↑	↓ L R_N R_{N-1}……...…….R3 R2 R1	↑ R1		
_|¯ X		R_N R_{N-1}………….…….R2 R1 R0	R0		
¯|_		X X ………………………X X X	X		RN RN-1……..….R2 R1 R0
_|¯		PN PN-1………………..P2 P1 P0	P0		PN PN-1 …………P2 P1 P0

Internal Oscillator Output	Counter Contents	Latch Contents	NMOS Output
	I9 I8 I7………….…….I2 I1 I0	I9 I8 I7 ………………...I2 I1 I0	
X	L L L ……………..…….L L L	P9 P8 P7 ………….…...P2 P1 P0	If P >Q Then I_{DS} ON Else I_{DS} OFF
¯|_	[Q9:Q0]+1 Count Up		
_|¯	Q9 Q8 Q7 ……..….Q2 Q1 Q0		

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

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

An Example

Setting Rext = 6.2KΩ, Vout = 1.0V for OUT1 / BLUE, OUT2 / GREEN, and OUT3 / RED, then I (Rext) = 20mA

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

IOUT1, BLUE = GBLUE /255 x I (Rext) = 255/255 x 20mA = 20mA；

IOUT2, GREEN = GGREEN /255 x I (Rext) = 0/255 x 20mA = 0mA；

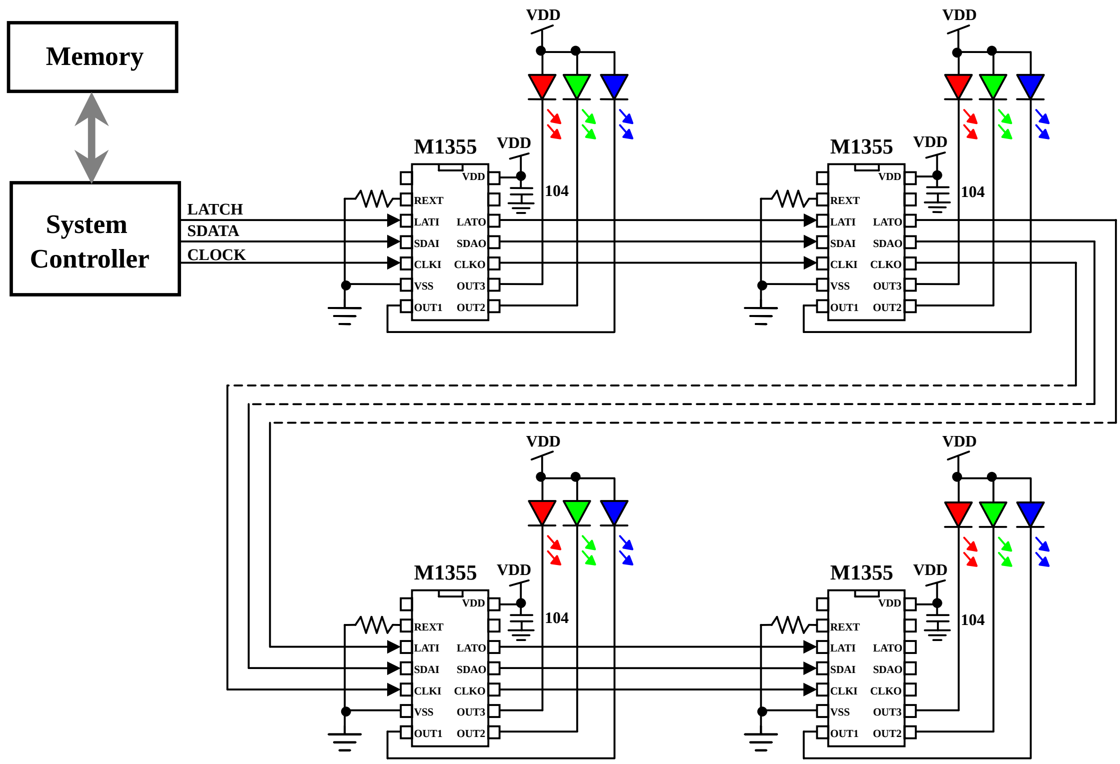
IOUT3, RED = GRED /255 x I (Rext) = 128/255 x 20mA = 10mA；

The mixing multi-color is determined by IOUT, GREEN = 20mA, IOUT, RED = 0mA, and IOUT, BLUE = 10mA.

Assuming Luminous Intensity (mcd) of R/G/B LEDs are the same and I (Rext) = 20mA, we may ideally let GGREEN + GRED + GBLUE = C (Constant value) to get a stable brightness.

For instance, while C = 10, that is GGREEN +GRED + GBLUE = 10, M1355 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)