## Summarize

TM1803 is a 3 bits LED (light-emitting diode display) drive control circuit, internal integrated with MCU digital interface, latch, LED high voltage driver and so on .Through the external MCU control, the chip can achieve separate luminance, And through cascade control can achieve outdoor large-screen color dot-matrix light-emitting control. TM1803 have excellent performance and high reliability.

Feature

- Use high-voltage power CMOS process
- Output voltage is up to 24V
- Brightness adjustment circuit(256)
- Serial-shift and cascade Interface
- Oscillation mode：Built-in RC oscillator, signal clock synchronization. While accepting the completed data of this module, data can be auto-shaped and transmitted to next chip via data output pin.
- Built-in power-on reset circuit
- PWM control side can achieve 256 adjustment, scan frequency not less than 400hz / s
- The completion of data reception and decoding by a signal line
- When the refresh rate of 30 frames/ s, the number of cascade is not less than 512 on low-speed mode.
- SOP8 package
- Data transmission speed can be 400Kbps.

PIN Configuration (Top View)

TM1803

OUTR	1	8	VDD
OUTG	2	7	NC
OUTB	3	6	DIN
GND	4	5	DO
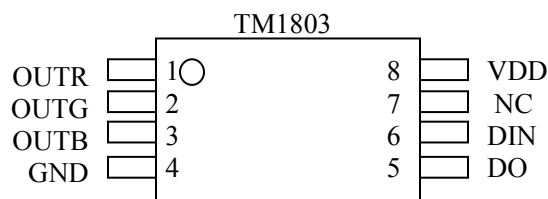
PIN identifications ：

PIN NO.	PIN name	Description
1	OUTR	Red PWM Control Output
2	OUTG	Green PWM Control Output
3	OUTB	Blue PWM Control Output
4	VSS	Logical gnd ; system gnd
5	DOUT	Data Output
6	DIN	Data Input
7	NC	
8	VDD	Logic Power ,5V±10%

Electrical parameters

Limit parameter（Ta = 25℃, Vss = 0 V）

Parameter	Symbol	Range	Unit
Logic Supply Voltage	VDD	-0.5 ～+7.0	V
Output voltage	VOUT	24	V
Logic input voltage	VI1	-0.5 ～ VDD + 0.5	V
LED Driver Output Current	IO1	80	mA
Power loss	PD	400	mW
Operating Temperature	Topt	-40 ～ +80	℃
Storage Temperature	Tstg	-65 ～+150	℃

The normal scope of work（Ta = -20 ～ +70 ℃，Vss = 0 V）

Parameter	Symbol	Min	Typical	Max	unit	Test Conditions
Logic Supply Voltage	VDD		5		V	-
Hign-level input voltage	VIH	0.7 VDD	-	VDD	V	-
Low-level input voltage	VIL	0	-	0.3 VDD	V	-

Electrical characteristics（Ta = -20 ～ +70 ℃，VDD = 4.5 ～ 5.5 V， Vss = 0 V）

Parameter	Symbol	Min	Typical	Max	unit	Test Condition
Low-level output current	IOL1	35	40	-	mA	OUTR/OUTG/OUTB Vo=0.3V
Low-level output current	Idout	10	-	-	mA	VO = 0.4V，DOUT
Input Current	II	-	-	±1	μA	VI = VDD / VSS
High-level input voltage	VIH	0.7 VDD	-		V	DIN
Low-level input voltage	VIL	-	-	0.3 VDD	V	DIN
Hysteresis voltage	VH	-	0.35	-	V	DIN
Dynamic current consumption	IDDdyn	-	-	1	mA	No load, display off
Power Dissipation	PD			250	mW	(Ta=25°C)
Thermal Resistance	Rth(j-a)	79.2		190	°C/W	

Switching characteristics（Ta = -20 ～ +70 ℃，VDD = 4.5 ～ 5.5 V）

| Parameter	Symbol	Min	Typical	Max	Unit	Test Conditions
Oscillation frequency	fosc	-	500	-	KHz	/
Propagation delay time	tPLZ	-	-	300	ns	DIN → DOUT
	tPZL	-	-	100	ns	CL = 15pF, RL = 10K Ω
Fall Time	TTHZ	-	-	120	μs	CL = 300pF，OUTR/OUTG/OUTB
Data rate	Fmax	400	-	-	Kbps	50% duty cycle
Input capacitance	CI	-	-	15	pF	-

Function Description

TM1803 adopts single wire to communicate and RZ (return to zero code) method to sent signal. On power-on resert status, when chip receive complete 24bits data from DIN, it begin transmitting data to next chip via DO. Before transmission, DO will be keep low-level.OUTR, OUTG, OUTB these 3 PWM will output different duty signal according to different data per 24bits, the cycle of signal is 4ms.If input signal is RESET, the chip will be ready to receive new data after displaying all the received data.The same when receive new 24bit data completely, it will transmit them to next chip via DO.

TM1803 has the ability of auto-shape and signal transmission.The number of cascade is not limited by signal transmission, just limited by screen refresh speed.For example, we design 1024 cascade with TM1803, the refresh time can be canculated is 1024*0.4*2=0.8192ms(delay time is 0.4us), no any twinkle will be detected.

Timing Waveform

Input Pattern

0 code
T0L
T0H

1 code
T1L
T1H
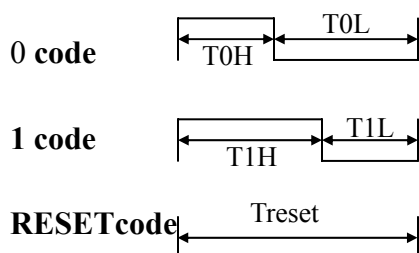
RESETcode
Treset

Time Table

Name	Description	TYP	Tolerance
T0H	0 code, high time	0.78us	±150ns
T1H	1 code, high time	1.55us	±150ns
T0L	0 code, low time	1.55us	±150ns
T1L	1 code, low time	0.78us	±150ns
Treset	Resetcode，low time	24us	≥24uS

Connection Method

```
D1          ┌──────────┐  D2   ┌──────────┐  D3   ┌──────────┐  D4
───────────▶│ DIN  DO  │──────▶│ DIN  DO  │──────▶│ DIN  DO  │──────▶
            │          │       │          │       │          │
            │  chip1   │       │  chip2   │       │  chip3   │
            └──────────┘       └──────────┘       └──────────┘
```

Data Transfer Method

D1	The first 24bit	The second 24bit	The third 24bit	RESET CODE
D2		The second 24bit	The third 24bit	
D3			The third 24bit	
D4				
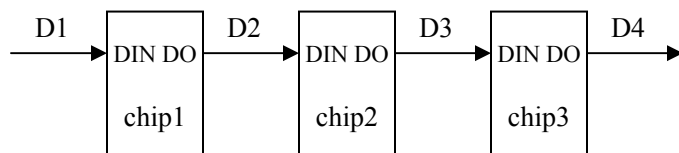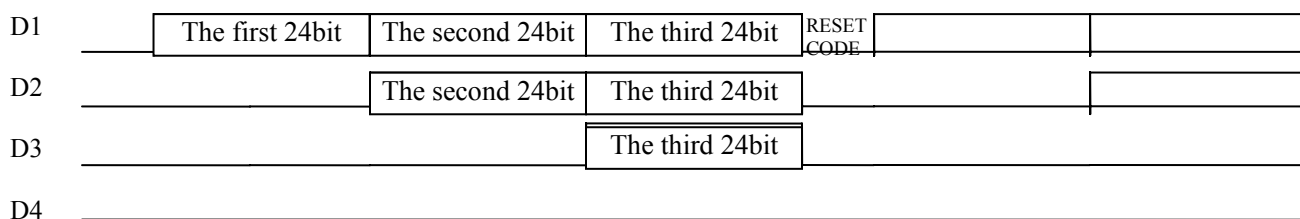
24bit data structure

R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0

Upper bit first, sent data in accordance with R, G, B order.

IC Package diagram

Sop8
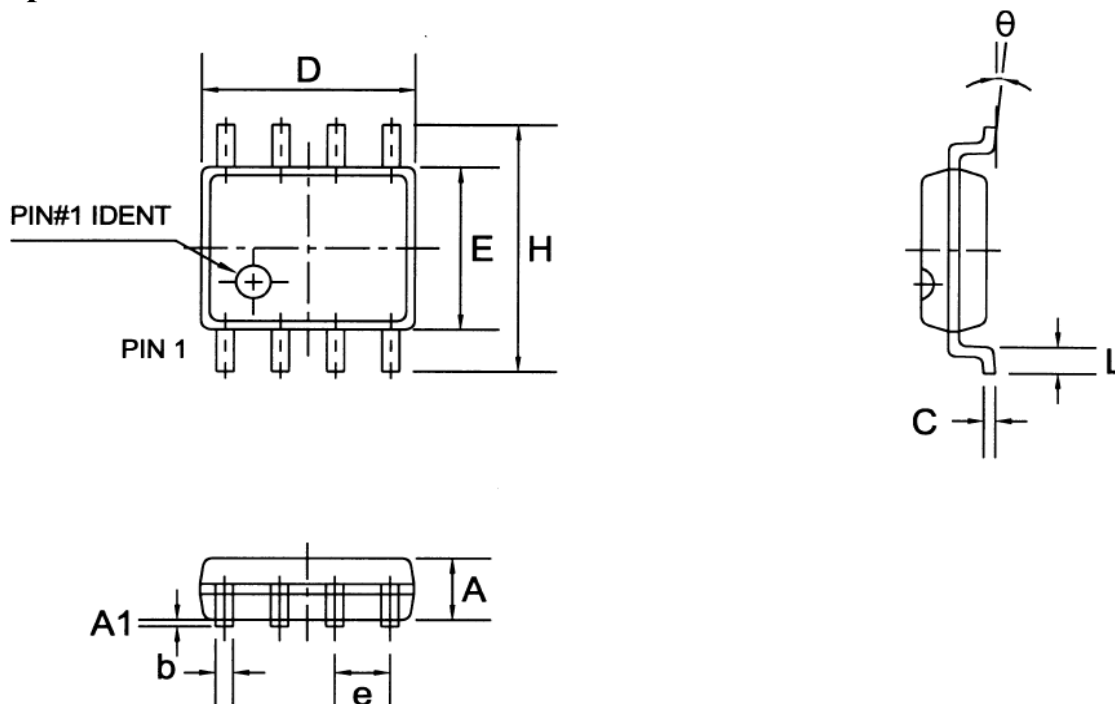
Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	1.30	1.50	1.70	0.051	0.059	0.067
A1	0.06	0.16	0.26	0.002	0.006	0.010
b	0.30	0.40	0.55	0.012	0.016	0.022
C	0.15	0.25	0.35	0.006	0.010	0.014
D	4.72	4.92	5.12	0.186	0.194	0.202
E	3.75	3.95	4.15	0.148	0.156	0.163
e	—	1.27	—	—	0.050	—
H	5.70	6.00	6.30	0.224	0.236	0.248
L	0.45	0.65	0.85	0.018	0.026	0.033
θ	0°	—	8°	0°	—	8°