

TOSHIBA Bi-CMOS

Constant Current Interface Driver



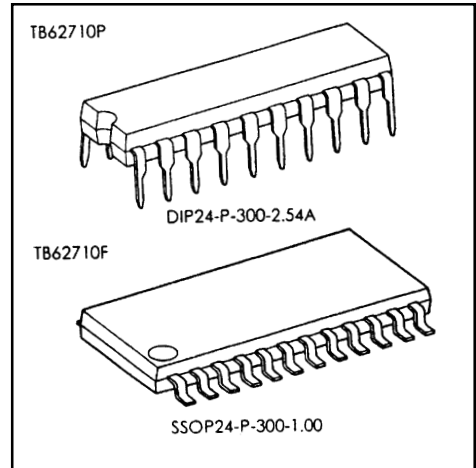
TB62710P/F

8 Bit Constant Current LED Source Driver with Shift Register and Latch Functions

Product Description:

The TB62710P/F are specifically designed for LED display applications. The Bi-CMOS device has 8 Bi-polar constant current output source channels and includes CMOS shift register and latch functions.

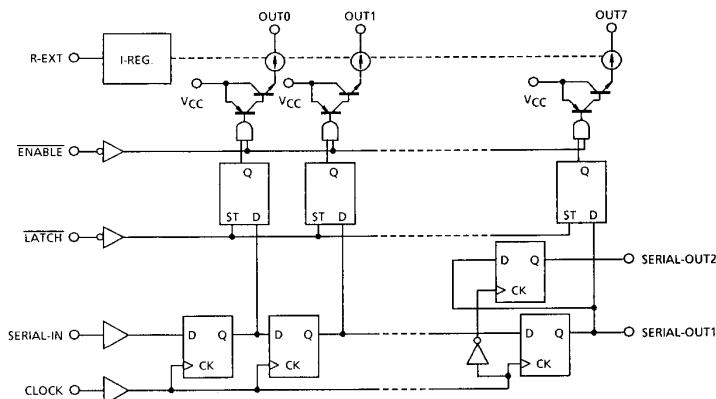
The LED drive current is programmed by the installation of a single resistor per device. Current is programmable from 5-90mA and is held constant across all 8 source outputs effectively compensating for the inherent circuit and component variables which affect the brightness of the LEDs.



Features:

- Current Source Device
- 8 Constant Current Output Channels
- Current Programmable from 5-90mA
- 5V CMOS Compatible Inputs
- Available in Thru Hole and Surface Mount Packages
- 15MHz max Clock Frequency (Cascade, Ta = 25°C)

Block Diagram:



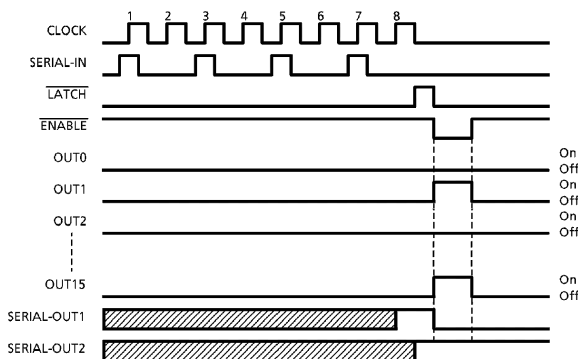


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Timing Diagram:

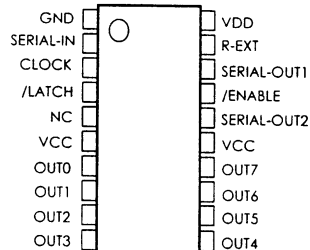


(Note) : Latches are level sensitive, not rising edge sensitive and not synchronous CLOCK.
Input of LATCH-terminal to "H" level, data passes latches, and input to "L" level, data hold latches.
Input of ENABLE-terminal to "H" level, all output (OUT0~7) do off.

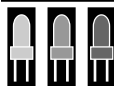
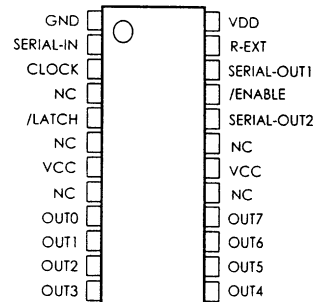
Terminal Description & Pin Out:

PIN No.		PIN NAME	FUNCTION
P type	F type		
1	1	GND	GND terminal for control logic
2	2	SERIAL-IN	Input terminal of a serial-data for shift-register
3	3	CLOCK	Input terminal of a clock for data shift to up-edge.
4	5	LATCH	Input terminal of a data strobe. Latches passes data with "H" level input of LATCH-terminal, and hold data with "L" level input.
7~14	9~16	OUT0~7	Output terminals.
17	21	ENABLE	Input terminal of output enable. All outputs (OUT0~7) do off with "H" level input of ENABLE-terminal, and do on with "L" level input.
18	22	SERIAL-OUT1	Output terminal of a serial-data for next SERIAL-IN terminal.
16	20	SERIAL-OUT2	
19	23	R-EXT	Input terminal of connects with a resistor for to set up all output current.
20	24	VDD	5V Supply voltage terminal
6,15	7,18	VCC	0~17V Supply voltage terminal for LED
5	4,6,8,17,19	NC	NO CONNECTION

"DIP20 / SSOP20[0.65mm]"



"SSOP24[1.00mm]"



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All specifications subject to change.

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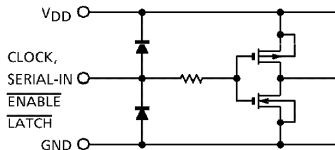
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Truth Table:

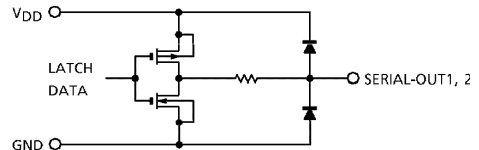
CLOCK	LATCH	ENABLE	SERIAL-IN	OUT0	OUT3	OUT7	SERIAL-OUT1	SERIAL-OUT2
UP	H	L	Dn	Dn	Dn-3	Dn-7	Dn-7	Dn-8
DOWN	H	L	Dn	Dn	Dn-3	Dn-7	No Change	Dn-7
UP	L	L	Dn+1	No Change (data hold)			Dn-6	No Change
DOWN	L	L	Dn+1	No Change (data hold)			No Change	Dn-6
No Edge	H	L	Dn+1	Dn +1	Dn-2	Dn-6	No Change	No Change
No Edge	X	H	Dn+1	Off			Dn-6	No Change

Equivalent Circuit of Inputs and Outputs:

1. ENABLE, LATCH, CLOCK & SERIAL-IN terminal



2. SERIAL-OUT terminal



Maximum Ratings:

CHARACTERISTICS	SYMBOL	RATING	UNIT
Supply Voltage	VDD	0 ~ +7.0	V
LED Supply Voltage	VCC	0 ~ +17.0	V
Output Current	IOUT	-90	mA
Output Voltage	VCE	-0.4 ~ +17.0	V
Input Voltage	VIN	-0.4 ~ VDD +0.4	V
Clock Frequency	FCK	15.0	MHz
Vcc Terminal Current	IVcc	720	mA
Power Dissipation	Pd1	P type: 1.47 (FREE AIR, Ta = 25°C)	W
	Pd2	F type: 0.60 (FREE AIR / 0.83 (On PCB, Ta = 25°C)	
Operating Temperature	Topr	-40 ~ +85	°C
Storage Temperature	Tstg	-55 ~+150	°C

NOTE:

P type: Ambient temperature delated above 25°C in the proportion of 12.5mW/°C (On PCB)

F type: Ambient temperature delated above 25°C in the proportion of 6.7mW/°C (On PCB)
(PCB: 50x50x1.6mm, 30% Copper Fill)



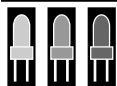
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Recommended Operating Condition:

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	VDD		4.5	5.0	5.5	V
Supply Voltage for LED	VLED		0	—	17	V
Output Voltage	VOUT		3	—	-17	V
Output Current	IOUT	DC 1 Circuit	-5	—	-78	mA
	IOH	SERIAL-OUT	—	—	1	mA
	IOL	SERIAL-OUT	—	—	-1	mA
Input Voltage	VIH		0.7VDD	—	VDD+0.3	V
	VIL		-0.3	—	0.3VDD	V
$\overline{\text{LATCH}}$ Pulse Width	tw LAT	VDD=4.5 ~ 5.5V	100	—	—	ns
CLOCK Pulse Width	tw CLK		50	—	—	ns
$\overline{\text{ENABLE}}$ Pulse Width	tw EN		1000	—	—	ns
Set-up Time	tsetup(D)		100	—	—	ns
Hold Time	thold(D)		100	—	—	ns
Clock Frequency	fCLK	Cascade Operation	—	—	10.0	MHz
Power Dissipation	Pd1	P-Type, Ta = 85°C on PCB	—	—	0.76	W
	Pd2	P-Type, Ta = 85°C on PCB	—	—	0.39	W



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Electrical Characteristics:

CHARACTERISTIC		SYMBOL	TEST CIR- CUIT	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage	"H" level	V _{IH}	—	—		0.7V _{DD}	—	V _{DD}	V
	"L" level	V _{IL}	—	—		GND	—	0.3V _{DD}	
Output Leakage Current		I _{LEAK}	—	V _{CC} =17.0V		—	—	-10	μA
Output Voltage	SERIAL-OUT	V _{OL}	—	I _{OL} =+1.0mA		—	—	0.4	V
		V _{OH}		I _{OH} =-1.0mA		4.6	—	—	V
Output Current 1	Current Skew	I _{OL1}	—	OVE=-15.0V	REXT=360Ω	-66.3	-78	-89.7	mA
		dI _{OL1}	—	I _{OL} =-78mA,	REXT=360Ω	—	1.5	6.0	%
Supply Voltage Regulation		% / V _{DD}	—	REXT=360Ω	Ta=40~+85°C	—	1.5	5.0	% /V
Supply Current	V _{DD}	I _{DD} (off)	—	REXT=OPEN	OUT0~7=off	—	0.6	1.2	mA
		I _{DD} (on)	—	REXT=360Ω	OUT0~7=on	5.7	7.0	8.3	
	V _{CC}	I _{CC} (off)	—	REXT=360Ω,	OUT0~7=off	—	0	2.0	
		I _{CC} (on)	—	REXT=360Ω,	OUT0~7=on	600	700	800	

(V_{CC} = 17V, V_{DD} = 5V, Ta = 25°C unless otherwise noted.)



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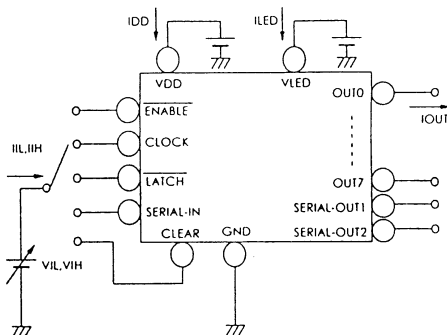
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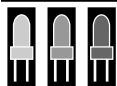
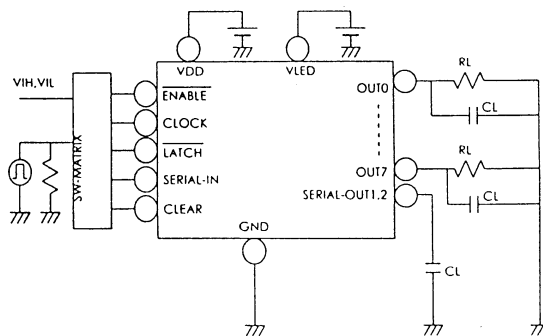
Switching Characteristics:

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time ("L" to "H")	CLK-OUTn	tpLH	—	tpLH & tpLH : 50% to 50% VOUT = -15V VLED = 17V VDD = 5.0V VIH = VDD VIL = GND REXT = 360Ω Ta = 25°C	—	450	—	ns
	LATCH-OUTn				—	450	—	ns
	ENABLE-OUTn				—	430	—	ns
	CLK-SOUT				—	30	—	ns
Propagation Delay Time ("H" to "L")	CLK-OUTn	tpHL	—		—	200	—	ns
	LATCH-OUTn				—	200	—	ns
	ENABLE-OUTn				—	200	—	ns
	CLK-SOUT				—	30	70	ns
Pulse Width	CLK	tw CLK,CLK	—		—	20	30	ns
	LATCH	tw LAT,LAT	—		—	10	25	ns
Set-up Time	L-H	tsetup	—		—	25	50	ns
Hold Time	H-L	thold	—		—	0	30	ns
Maximum CLOCK Rise Time		tr	—		—	—	10	μs
Maximum CLOCK Fall Time		tf	—		—	—	10	μs
Output Rise Time		tor	—		150	300	600	ns
Output Fall Time		tof	—		150	300	600	ns

DC Characteristic Test Circuit:



AC Characteristic Test Circuit:



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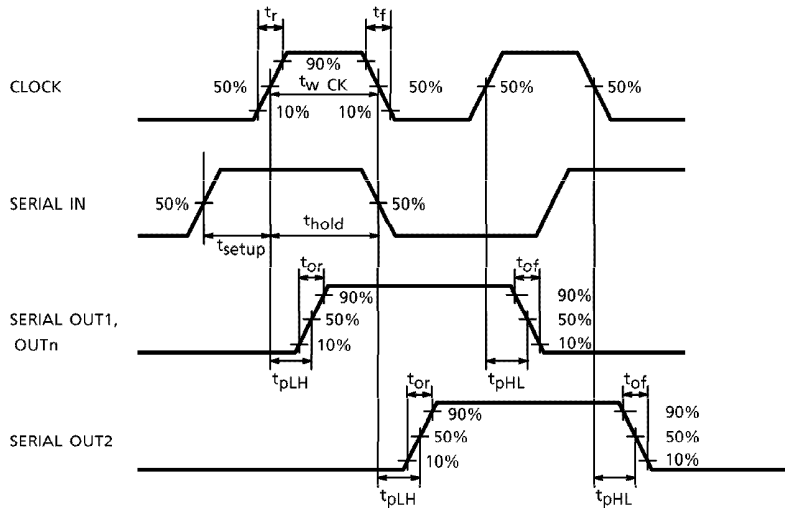
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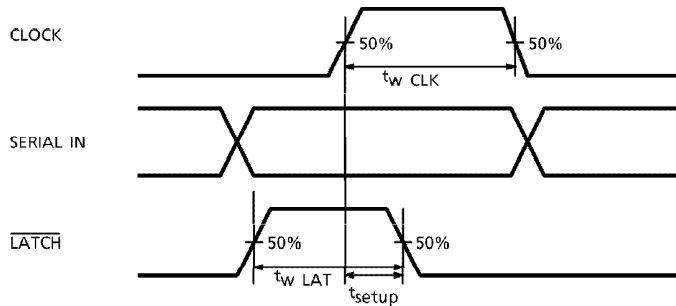
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Timing Wave Form:

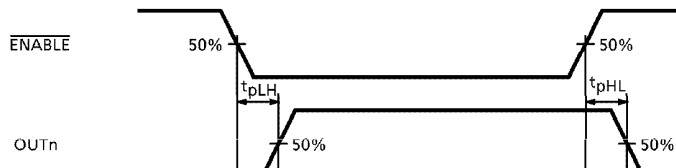
1. CLOCK-SERIAL OUT, OUTn



2. CLOCK-LATCH



3. ENABLE-OUTn



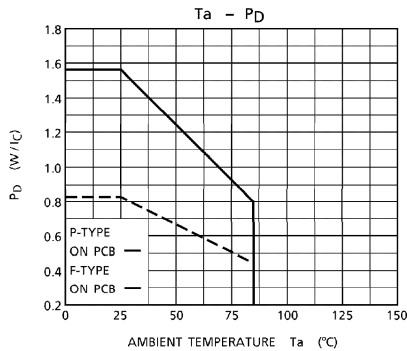
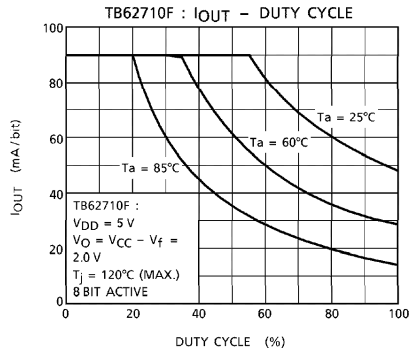
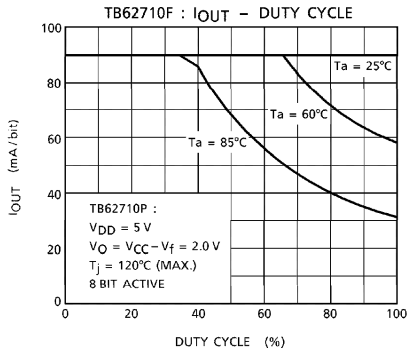


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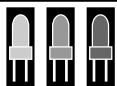
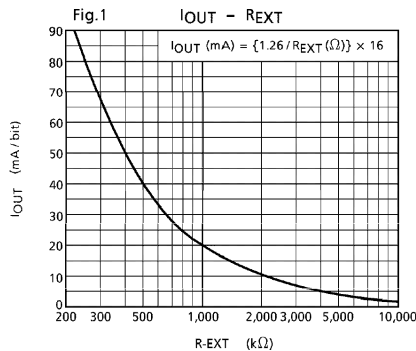
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Graphs:



LED DRIVER TB6270X SERIES APPLICATION NOTE



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Application Circuit:

[1] Output current (I_{OUT})

I_{OUT} is set by the external resistor (R-EXT)

[2] Total supply voltage (V_{LED})

This device can operate 2.0 V~2.3 V (V_O).

When a higher voltage is input to the device, the excess voltage is consumed inside the device, that leads to power dissipation.

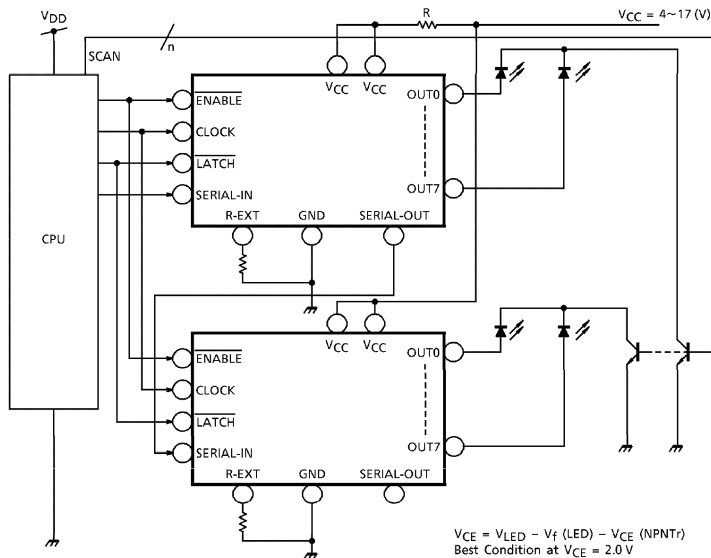
In order to minimize power dissipation and loss, we would like to recommended to set the total supply voltage as shown below.

V_{LED} (Total supply voltage)

$$= V_{CE} (I_{Tr} V_{sat}) + V_f \text{ (LED Forward voltage)} + V_O \text{ (IC supply voltage)}$$

When the total supply is too high considering the power dissipation of this device, an additional R can decrease the supply voltage (V_O).

APPLICATION (Example of dynamic lighting circuit)



[3] Pattern layout

This device has a single ground pin for both signal ground and power ground. If the ground pattern layout contains large inductances or other impedances the voltage between ground and the LATCH, CLOCK pins may exceed 2.5V. This may cause false triggering within the device and therefore, should be avoided.

PRECAUTIONS for USING

Utmost care is necessary in the design of the output line, V_{CC} (V_{DD}) and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper