

TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

T B 6 2 7 0 8 N**16BIT SHIFT REGISTER, LATCHES & CONSTANT CURRENT SOURCE DRIVERS**

The TB62708N is specifically designed for LED and LED DISPLAY (Cathode Common) constant current drivers.

This constant current output circuits is able to set up external resistor ($I_{OUT} = 5 \sim 90\text{mA}$).

This IC is monolithic integrated circuit designed to be used together with Bi-CMOS process.

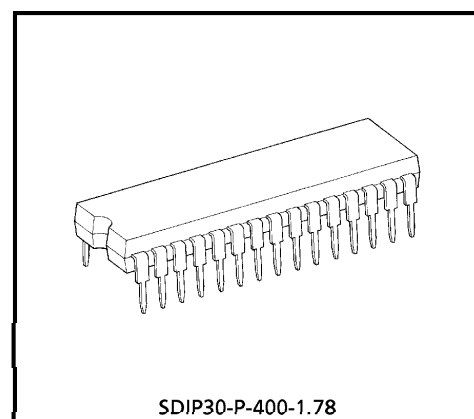
The devices consist of 16bit shift register, latch, AND-GATE and Constant Current Drivers.

FEATURES

- Constant Current Output :
Can set up all output current with one resistor for 5 to 90mA.
- Constant Output Current Matching :

OUTPUT-GND VOLTAGE	CURRENT MATCHING	OUTPUT CURRENT
$\geq 2.0 \text{ [V]}$	$\pm 6.0 \text{ [%]}$	$- 90 \text{ [mA]}$

- Maximum Clock Frequency : $f_{CLK} = 15 \text{ [MHz]}$ (Cascade Connected Operate, $T_{opr} = 25^\circ\text{C}$)
- 5V CMOS Compatible Input
- Package : SDIP30-P-400-1.78 (TB62708N)



SDIP30-P-400-1.78
Weight : 1.99g (Typ.)

961001EBA1

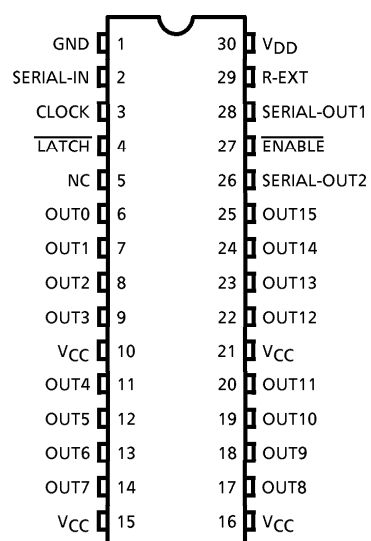
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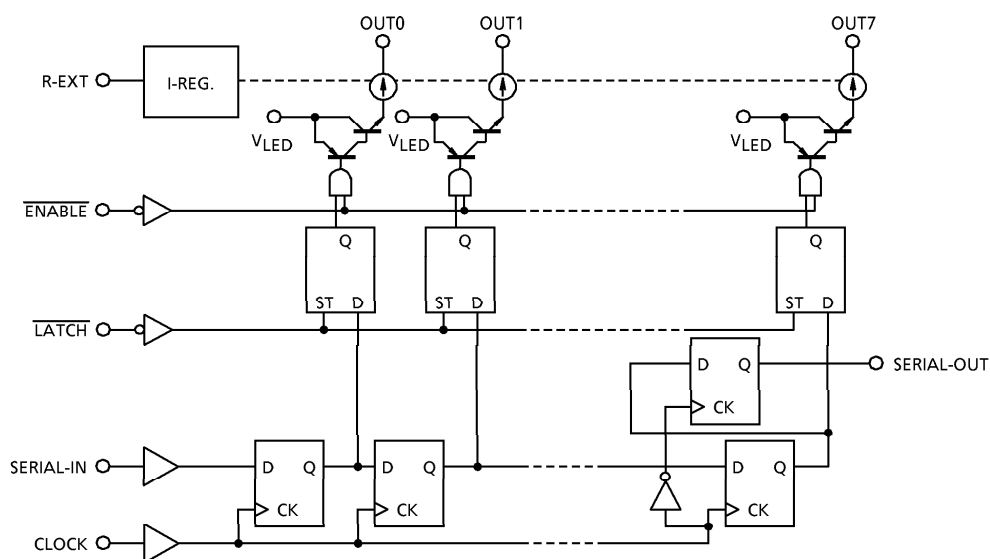
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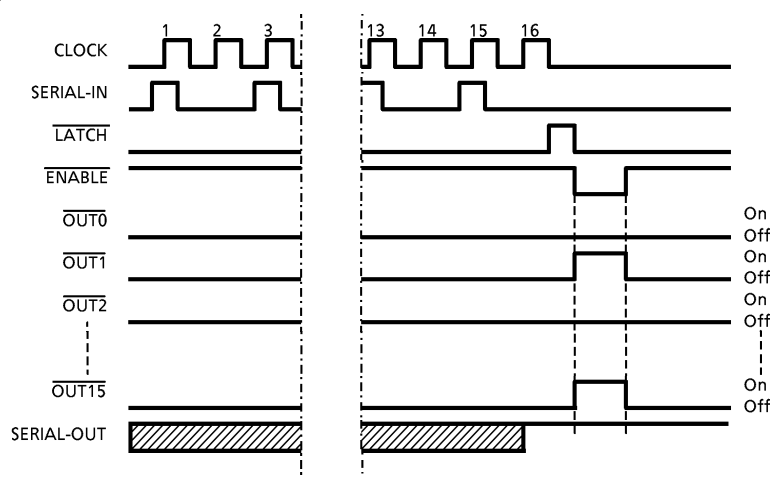
PIN CONNECTION (Top view)



BLOCK DIAGRAM



TIMING DIAGRAM



(Note) Latches are level sensitive, not rising edge sensitive and not synchronous CLOCK.
 Input of $\overline{\text{LATCH}}$ -terminal to "H" level, data passes latches, and input to "L" level, data hold latches.
 Input of $\overline{\text{ENABLE}}$ -terminal to "H" level, all output (OUT0~15) do off.

TERMINAL DESCRIPTION

PIN No.	PIN NAME	FUNCTION
1	GND	GND terminal for control logic.
2	SERIAL-IN	Input terminal of a serial-data for shift-register
3	CLOCK	Input terminal of a clock for data shift to up-edge.
4	$\overline{\text{LATCH}}$	Input terminal of a data strobe. Latches passes data with "H" level input of $\overline{\text{LATCH}}$ -terminal, and hold data with "L" level input.
6~9, 11~14, 17~20, 22~25	OUT0~15	Output terminals.
27	$\overline{\text{ENABLE}}$	Input terminal of output enable. All outputs (OUT0~7) do off with "H" level input of $\overline{\text{ENABLE}}$ -terminal, and do on with "L" level input.
26	SERIAL-OUT2	Output terminal of a serial-data for next SERIAL-IN terminal.
28	SERIAL-OUT1	Output terminal of a serial-data for next SERIAL-IN terminal.
29	R-EXT	Input terminal of connects with a resister for to set up all output current.
30	V _{DD}	5V Supply voltage terminal
10, 15, 16, 20	V _{CC}	0~17V Supply voltage terminal for LED

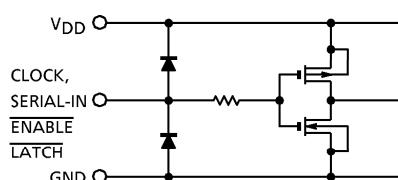
TRUTH TABLE

CLOCK	$\overline{\text{LATCH}}$	$\overline{\text{ENABLE}}$	SERIAL-IN	OUT0 ... OUT7 ... OUT15	SERIAL-OUT1	SERIAL-OUT2
UP	H	L	D_n	$D_n \dots D_{n-7} \dots D_{n-15}$	D_{n-15}	D_{n-16}
DOWN	H	L	D_n	$D_n \dots D_{n-7} \dots D_{n-15}$	No change	D_{n-15}
UP	L	L	D_{n+1}	No change (data hold)	D_{n-14}	No change
DOWN	L	L	D_{n+1}	No change (data hold)	No change	D_{n-14}
No Edge	H	L	D_{n+1}	$D_{n+1} \dots D_{n-6} \dots D_{n-14}$	No change	No change
No Edge	X	H	D_{n+1}	Off	D_{n-14}	No change

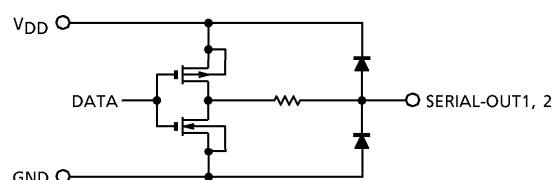
(Note) OUT0~15=on in case of D_n ="H" level and OUT0~15=off in case of D_n ="L" level.

A resistor is connected with R-EXT and GND accompanied with outside, and it is necessary that a correct power supply voltage is supplied.

EQUIVALENT CIRCUIT OF INPUTS AND OUTPUTS

1. $\overline{\text{ENABLE}}$, $\overline{\text{LATCH}}$, CLOCK & SERIAL-IN terminal

2. SERIAL-OUT terminal

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	0~7.0	V
Supply Voltage for LED	V_{CC}	0~17	V
Input Voltage	V_{IN}	-0.4~ $V_{DD} + 0.4$	V
Output Current	I_{OUT}	-90	mA
Output Voltage	V_{CE}	-0.4~17.0	V
Clock Frequency	f_{CK}	15	MHz
GND Terminal Current	I_{VCC}	1440	mA
Power Dissipation	P_D	2.08 (ON PCB, $T_a = 25^\circ\text{C}$)	W
		1.56 (FREE AIR, $T_a = 25^\circ\text{C}$)	
Operating Temperature	T_{opr}	-40~85	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55~150	$^\circ\text{C}$

(Note) Ambient temperature delated above 25°C in the proportion of $16.64\text{mW}/^\circ\text{C}$ on PCB.
On PCB (100 × 150 × 1.6mm.Universal PCB).

RECOMMENDED OPERATING CONDITION ($V_{DD} = 5V$, $T_a = -40 \sim 85^\circ C$ unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{DD}	—	4.5	5.0	5.5	V
Supply Voltage for LED	V_{CC}	GND Standard	0	—	17	V
Output Voltage	V_{OUT}	V_{CC} Standard	0	—	-17	V
Output Current	I_{OUT}	OUTn, DC 1 circuit	-5	—	-78	mA
	I_{OH}	SERIAL-OUT1, 2	—	—	1.0	
	I_{OL}	SERIAL-OUT1, 2	—	—	-1.0	
Input Voltage	V_{IH}	$V_{DD} = 4.5 \sim 5.5V$	0.7 V_{DD}	—	$V_{DD} + 0.3$	V
	V_{IL}		-0.3	—	$0.3 V_{DD}$	
LATCH Pulse Width	t_w LAT		100	—	—	ns
CLOCK Pulse Width	t_w CLK		50	—	—	ns
ENABLE Pulse Width	t_w EN		1000	—	—	ns
Set-Up Time	t_{setup}		50	—	—	ns
Hold Time	t_{hold}		30	—	—	ns
Clock Frequency	f_{CLK}	Cascade operation	—	—	10.0	MHz
Power Dissipation	P_D	ON PCB, $T_a = 85^\circ C$	—	—	1.08	W

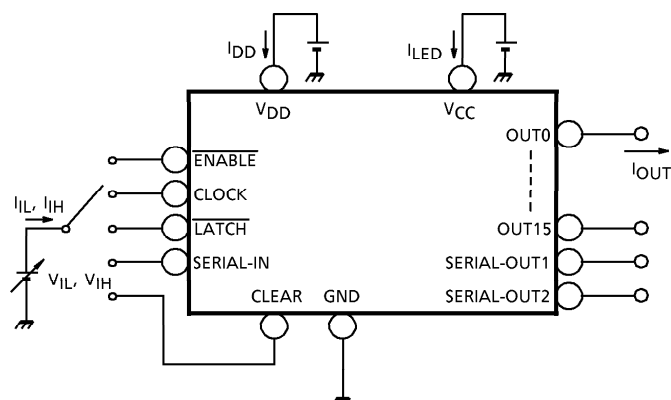
ELECTRICAL CHARACTERISTICS ($V_{CC} = 17V$, $V_{DD} = 5V$, $T_a = 25^\circ C$ unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage	"H" Level	V_{IH}	—	0.7 V_{DD}	—	V_{DD}	V
	"L" Level	V_{IL}	—	GND	—	$0.3 V_{DD}$	
Output Leakage Current	I_{LEAK}	—	$V_{CC} = 17.0V$	—	—	-10	μA
Output Voltage	S-OUT	V_{OL}	$I_{OL} = 1.0mA$	—	—	0.4	V
		V_{OH}	$I_{OH} = -1.0mA$	4.6	—	—	
Output Current 1	I_{OL1}	—	$V_{OUT} = V_{CC} - 2.0V$ $R_{EXT} = 360\Omega$ (Include skew)	-66.3	-78	-89.7	mA
Current Skew	ΔI_{OL1}	—	$V_{OUT} = V_{CC} - 2.0V$ $R_{EXT} = 360\Omega$	—	± 1.5	± 6.0	%
Supply Voltage Regulation	% / V_{DD}	—	$R_{EXT} = 360\Omega$, $T_a = -40 \sim 85^\circ C$	—	1.5	5.0	% / V
Supply Current 1	"OFF"	$I_{DD} (off)$	$R_{EXT} = OPEN$, OUT0~15 = off	—	0.6	1.2	mA
	"ON"	$I_{DD} (on)$	$R_{EXT} = 360\Omega$, DATA = "H" OUT0~15 = on	—	10.0	15.0	
Supply Current 2	"OFF"	$I_{CC} (off)$	$R_{EXT} = 360\Omega$, ALL DATA = "L" OUT0~15 = off	—	1.0	2.0	mA
	"ON"	$I_{CC} (on)$	$R_{EXT} = 360\Omega$, ALL DATA = "H" OUT0~15 = on	—	1260	—	mA

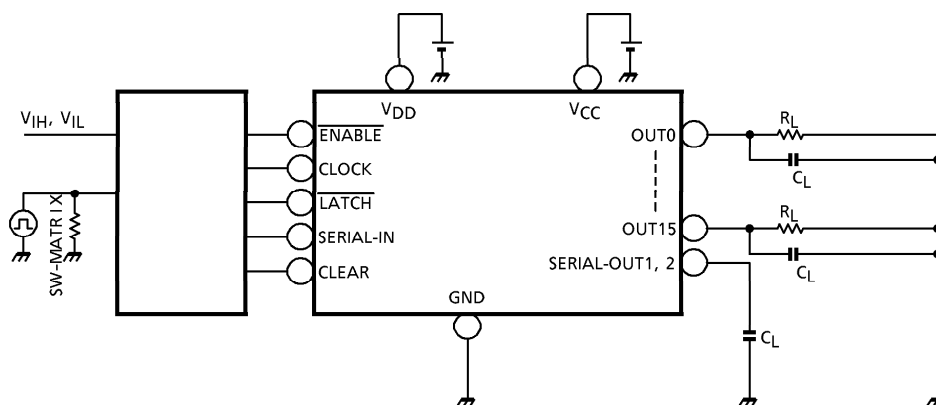
SWITCHING CHARACTERISTICS (Ta = 25°C, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Propagation Delay Time ("L" to "H")	CLK-OUTn	t _{pLH}	—	{CLK, LATCH & ENABLE to t _{pLH} & t _{pHL} : 50% to 50%} V _{DD} = 5.0V, V _{CC} = 17.0V V _{OUT} = V _{CC} – 2.0V V _{IH} = V _{DD} V _{IL} = GND R _{EXT} = 360Ω R _L = 300Ω	—	200	500	ns	
	LATCH-OUTn				—	200	500		
	ENABLE-OUTn				—	200	500		
	CLK-SOUT				—	30	70		
Propagation Delay Time ("H" to "L")	CLK-OUTn	t _{pHL}	—		—	200	500	ns	
	LATCH-OUTn				—	200	500		
	ENABLE-OUTn				—	200	500		
	CLK-SOUT				—	30	70		
Pulse Width		CLK	t _w CLK, CLK		—	—	20	30	ns
		LATCH	t _w LAT, LAT		—	—	10	25	
Set-Up Time for LATCH & CLOCK		t _{setup} LAT	—			—	25	50	ns
Hold Time for LATCH & CLOCK		t _{hold} LAT	—			—	0	15	ns
Maximum CLOCK Rise Time		t _r	—			—	—	10	μs
Maximum CLOCK Fall Time		t _f	—			—	—	10	μs
Output Rise Time		t _{or}	—			150	300	600	ns
Output Fall Time		t _{of}	—			150	300	600	ns

DC CHARACTERISTICS TEST CIRCUIT



AC CHARACTERISTICS TEST CIRCUIT

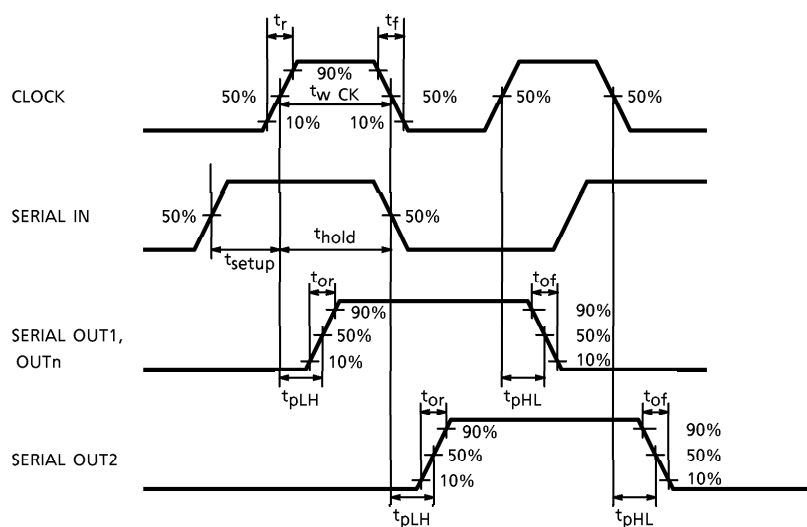


PRECAUTIONS for USING

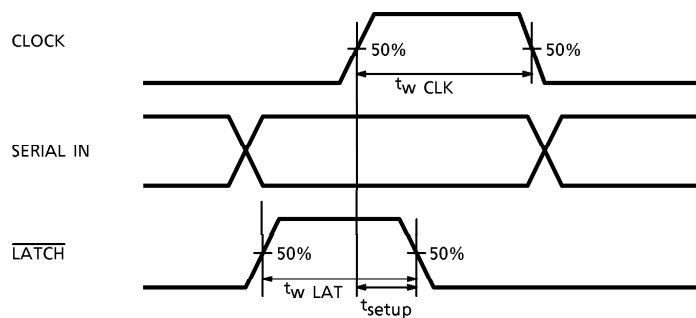
Utmost care is necessary in the design of the output line, V_{CC} (V_{DD}) and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

TIMING WAVEFORM

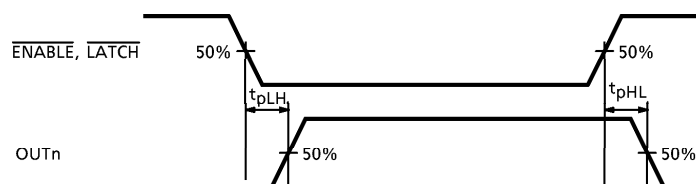
1. CLOCK-SERIAL OUT, OUTn

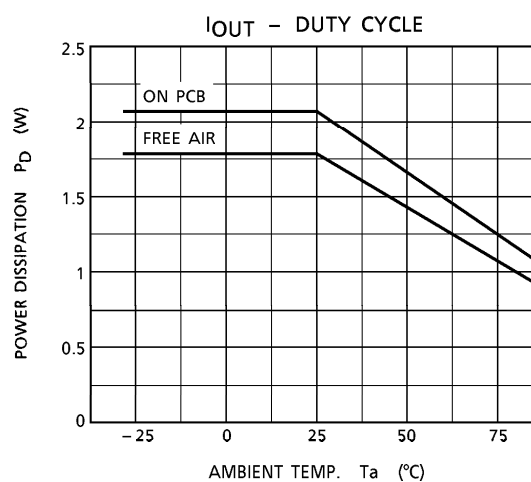
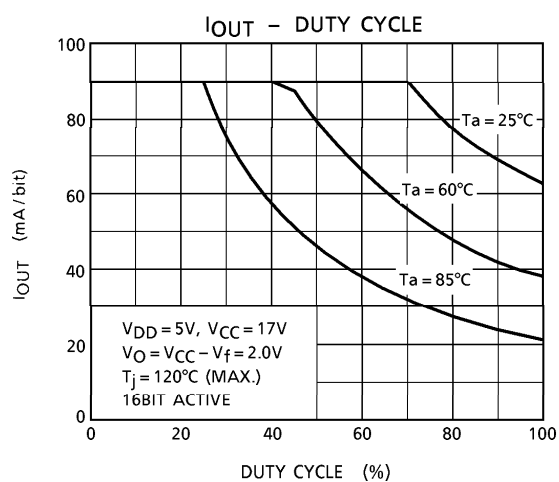


2. CLOCK-LATCH

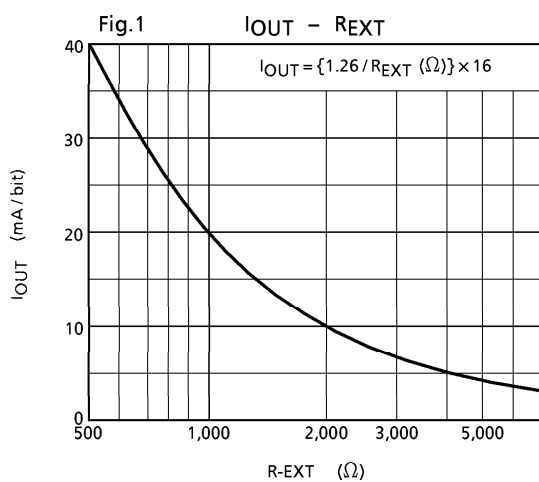


3. ENABLE, LATCH-OUTn





LED DRIVER TB6270X SERIES APPLICATION NOTE



[1] Output current (I_{OUT})

I_{OUT} is set by the external resistor (R-EXT) as shown in Fig.1.

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

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

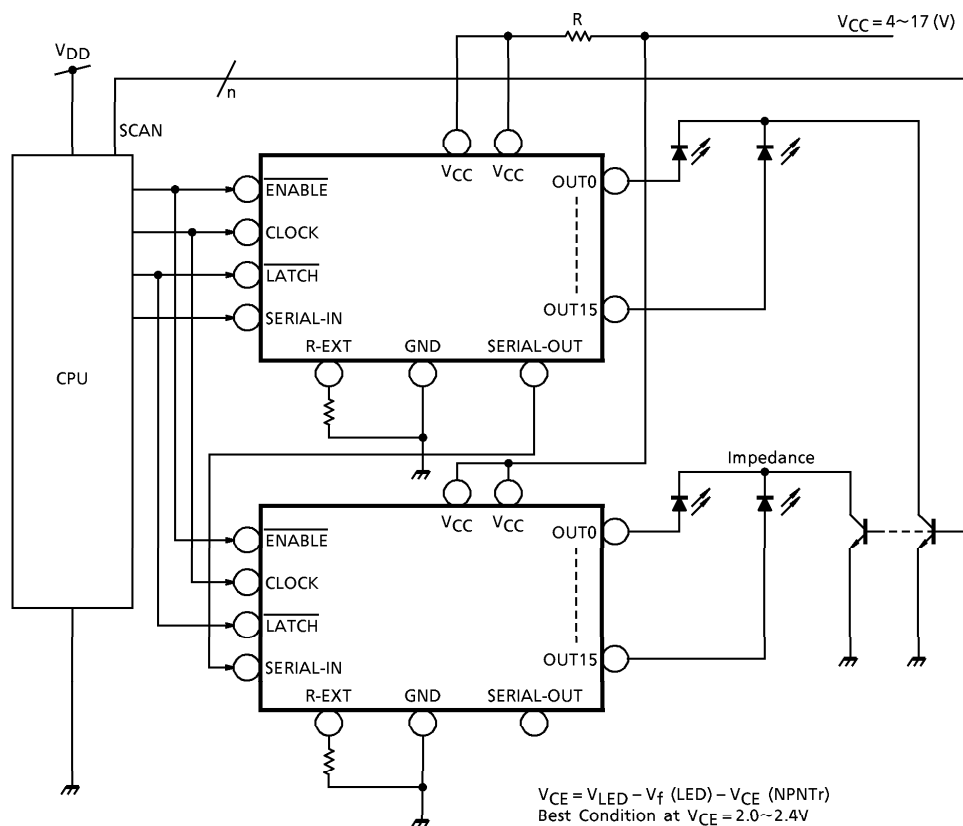
When a higher voltage is input to the device, the excess voltage is consumed inside the device, that leads to power dissipation.

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

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

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



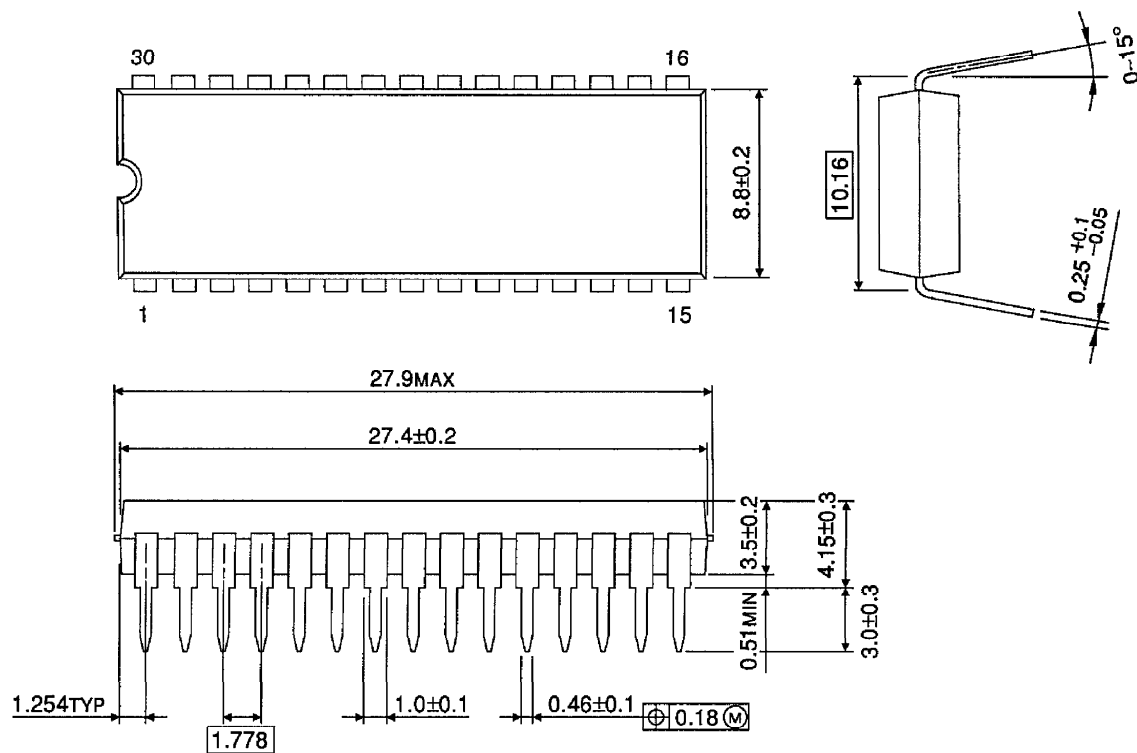
[3] Pattern layout

This device owns only one ground pin that means signal ground pin and power ground pin are common.

If ground pattern layout contains large inductance and impedance and the voltage between ground and LATCH, CLOCK terminals exceeds 2.5V by switching noise in operation, this device may misoperate. So we would like you to pay attention to pattern layout to minimize inductance.

OUTLINE DRAWING
SDIP30-P-400-1.78

Unit : mm



Weight : 1.99g (Typ.)