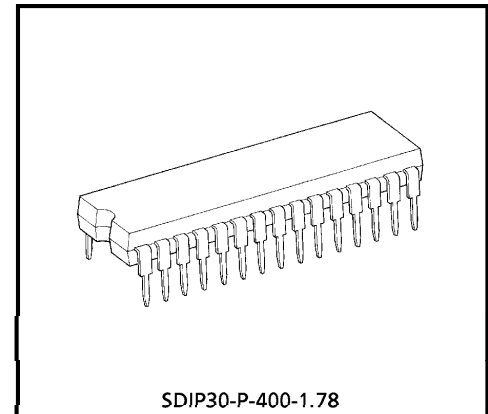


TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# 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.



Weight : 1.99g (Typ.)

### FEATURES

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

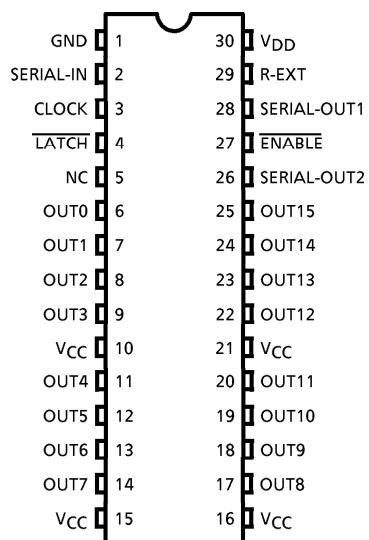
OUTPUT-GND VOLTAGE	CURRENT MATCHING	OUTPUT CURRENT
$\geq 2.0$ [V]	$\pm 6.0$ [%]	- 90 [mA]

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

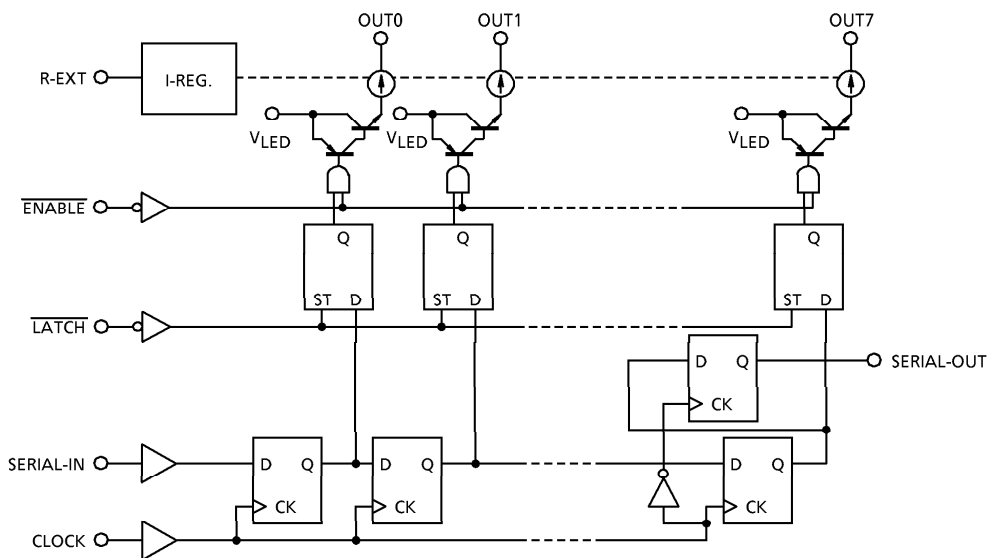
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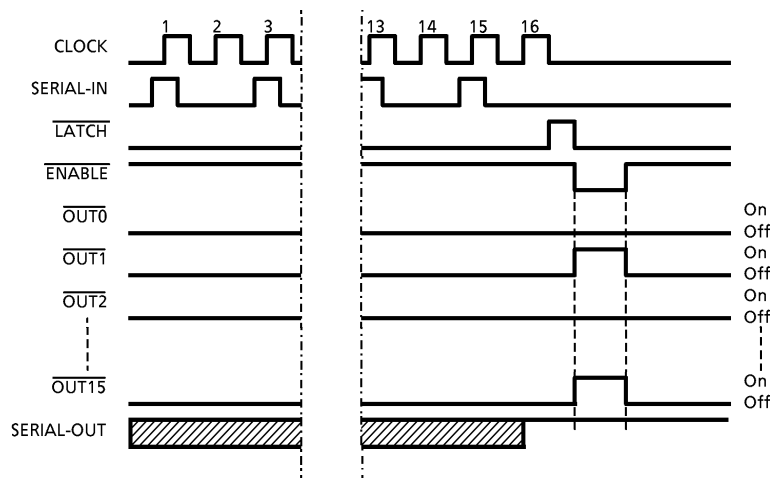
**PIN CONNECTION (Top view)**



**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 <sub>DD</sub>	5V Supply voltage terminal
10, 15, 16, 20	V <sub>CC</sub>	0~17V Supply voltage terminal for LED

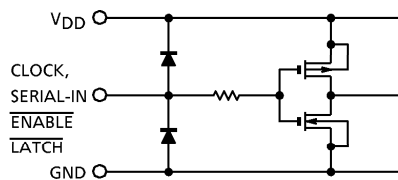
**TRUTH TABLE**

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

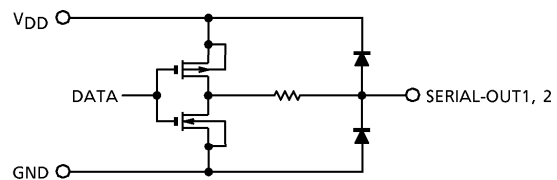
(Note) OUT0~15=on in case of  $D_n = "H"$  level and OUT0~15=off in case of  $D_n = "L"$  level.  
 A resistor is connected with R-EXT and GND accompanied with outside, and it is necessary that a correct power supply voltage is supplied.

**EQUIVALENT CIRCUIT OF INPUTS AND OUTPUTS**

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



2. SERIAL-OUT terminal



**MAXIMUM RATINGS (Ta = 25°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, Ta = 25°C)	W
		1.56 (FREE AIR, Ta = 25°C)	
Operating Temperature	$T_{opr}$	-40~85	°C
Storage Temperature	$T_{stg}$	-55~150	°C

(Note) Ambient temperature delated above 25°C in the proportion of 16.64mW/°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

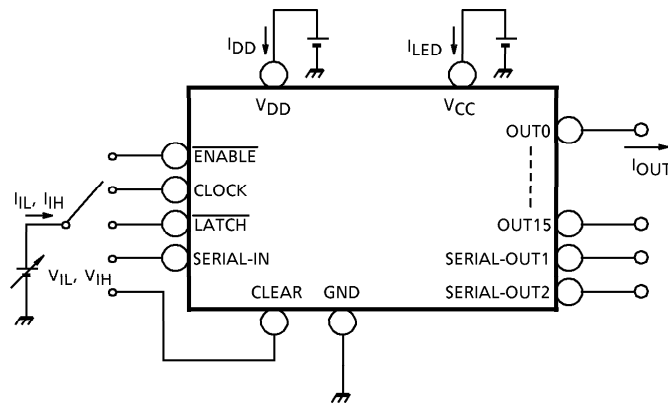
ELECTRICAL CHARACTERISTICS ( $V_{CC} = 17V$ ,  $V_{DD} = 5V$ ,  $T_a = 25^\circ C$  unless otherwise noted)

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	$\mu A$	
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	$\Delta I_{OL1}$	—	$V_{OUT} = V_{CC} - 2.0V$ $R_{EXT} = 360\Omega$	—	$\pm 1.5$	$\pm 6.0$	%
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

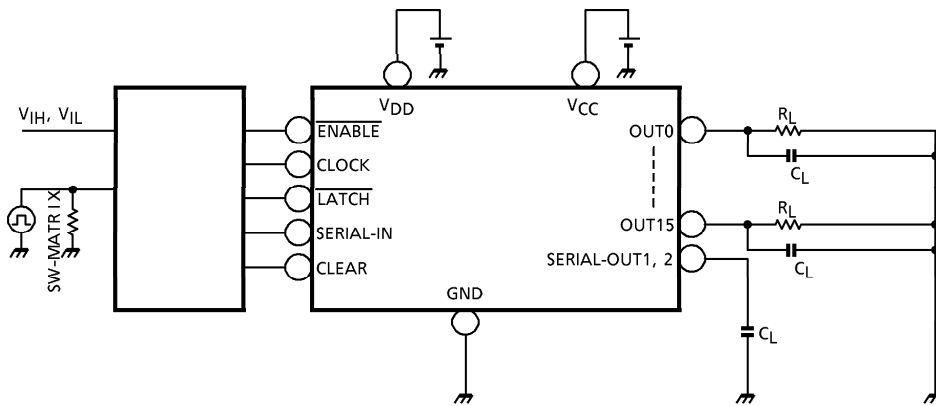
**SWITCHING CHARACTERISTICS** (Ta = 25°C, unless otherwise noted)

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

**DC CHARACTERISTICS TEST CIRCUIT**



**AC CHARACTERISTICS TEST CIRCUIT**

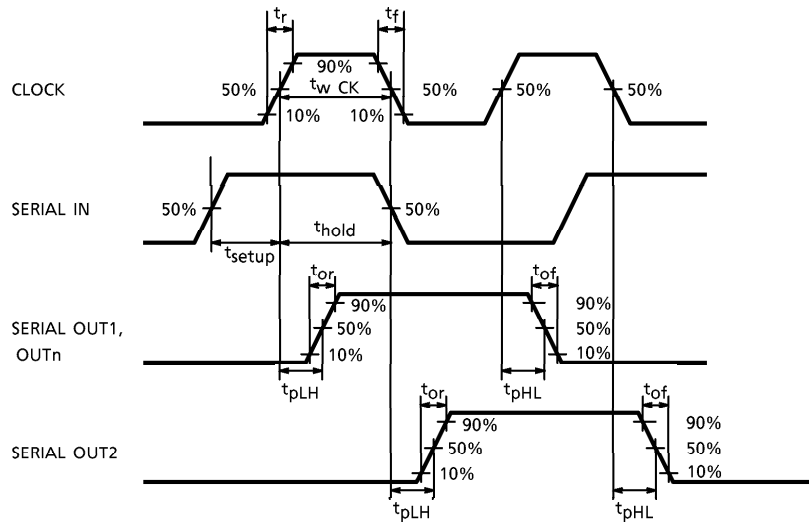


**PRECAUTIONS for USING**

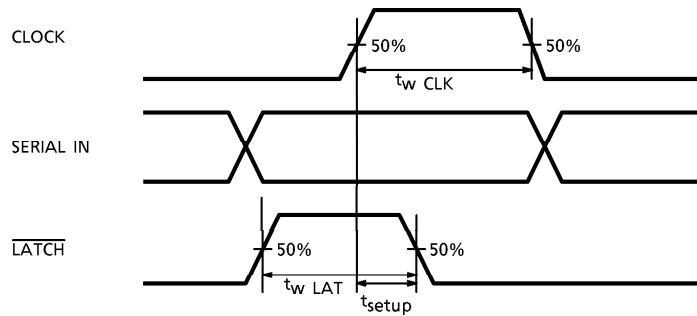
Utmost care is necessary in the design of the output line,  $V_{CC}$  ( $V_{DD}$ ) and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

**TIMING WAVEFORM**

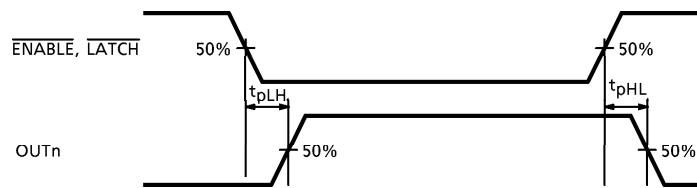
**1. CLOCK-SERIAL OUT, OUTn**



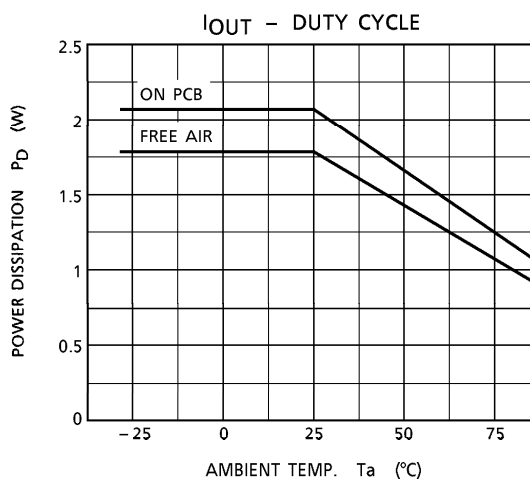
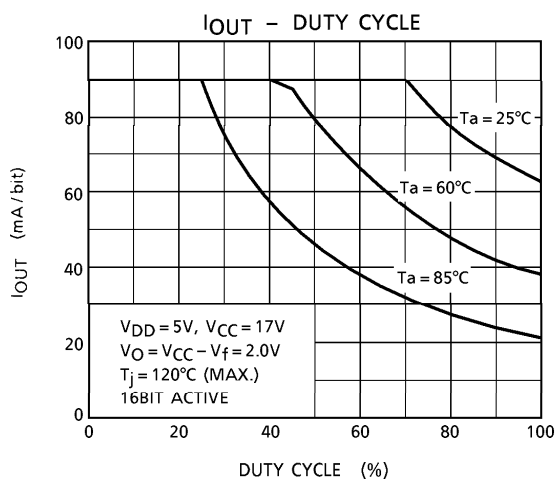
**2. CLOCK-LATCH**



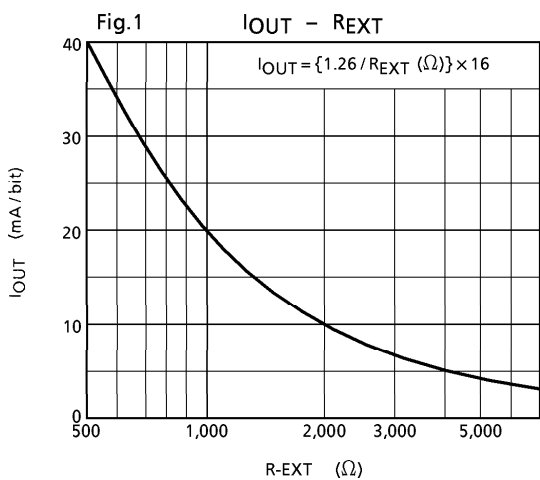
**3. ENABLE, LATCH-OUTn**







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 ( $V_O$ ).

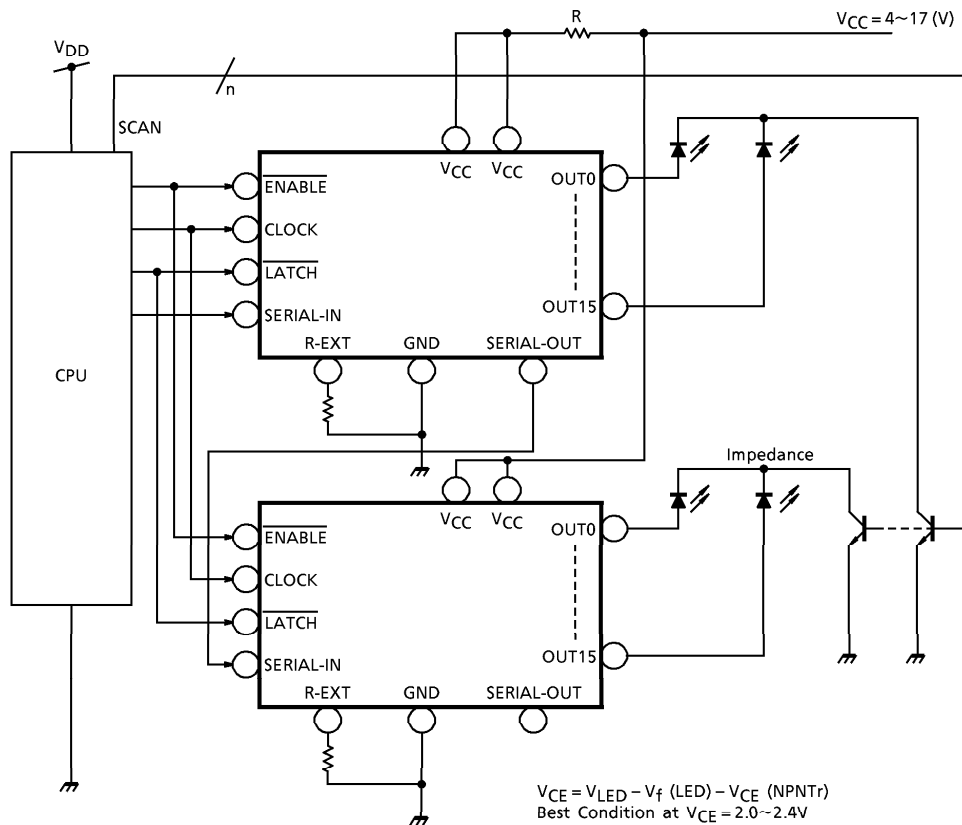
When a higher voltage is input to the device, the excess voltage is consumed inside the device, that leads to power dissipation.

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



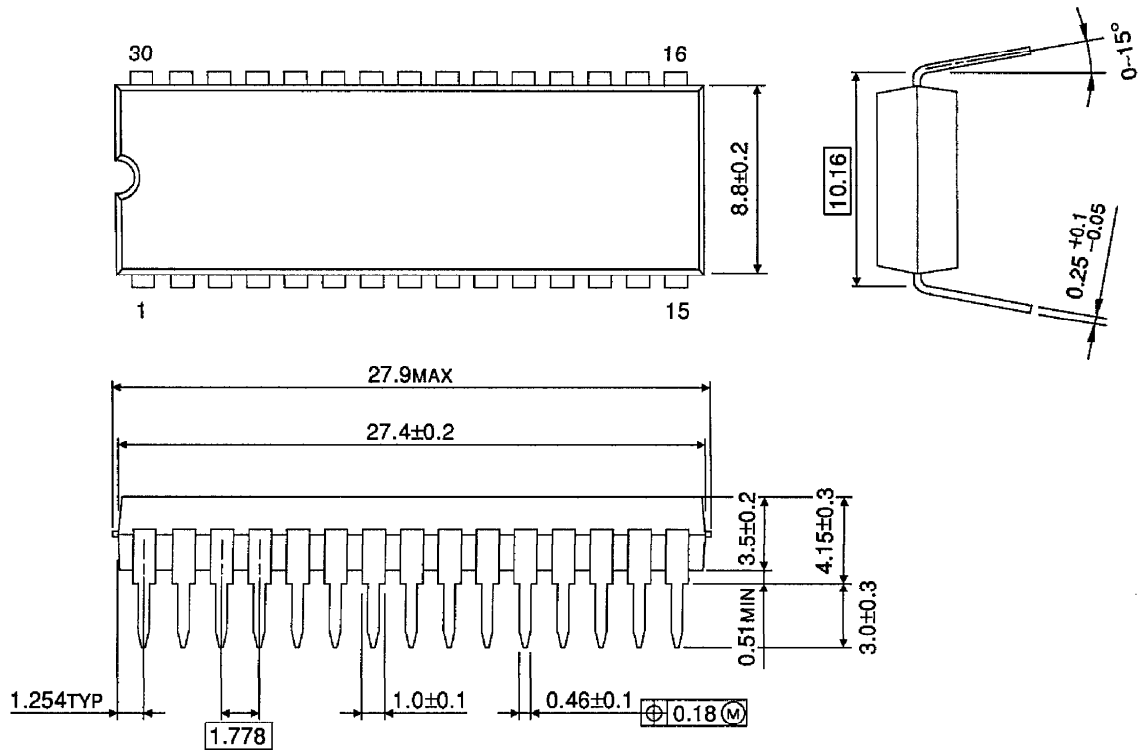
[3] Pattern layout

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  $\overline{LATCH}$ ,  $\overline{CLOCK}$  terminals exceeds 2.5V by switching noise in operation, this device may misoperate. So we would life you to pay attention to pattern layout to minimize inductance.

**OUTLINE DRAWING**  
SDIP30-P-400-1.78

Unit : mm



Weight : 1.99g (Typ.)