

TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# TB62707F

## 8BIT LATCHES & CONSTANT CURRENT DRIVERS

The TB62707F is specifically designed for LED and LED DISPLAY constant current drivers.

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

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

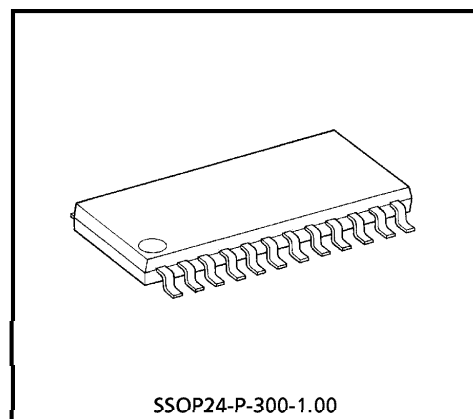
The devices consist of 8bit latches, AND-GATE and Constant Current Drivers.

### 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
$\geq 0.4$ [V]	$\pm 6.0$ [%]	5~40mA
$\geq 0.7$ [V]	$\pm 6.0$ [%]	40~90mA

- 5V CMOS Compatible Input
- Package : SSOP24-P-300

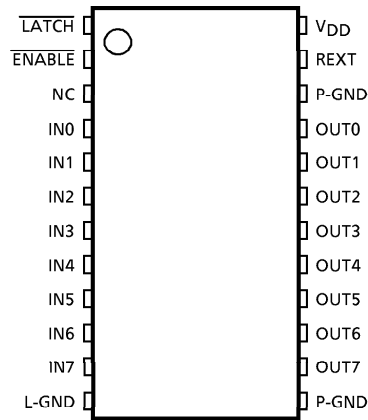


Weight : 0.32g (Typ.)

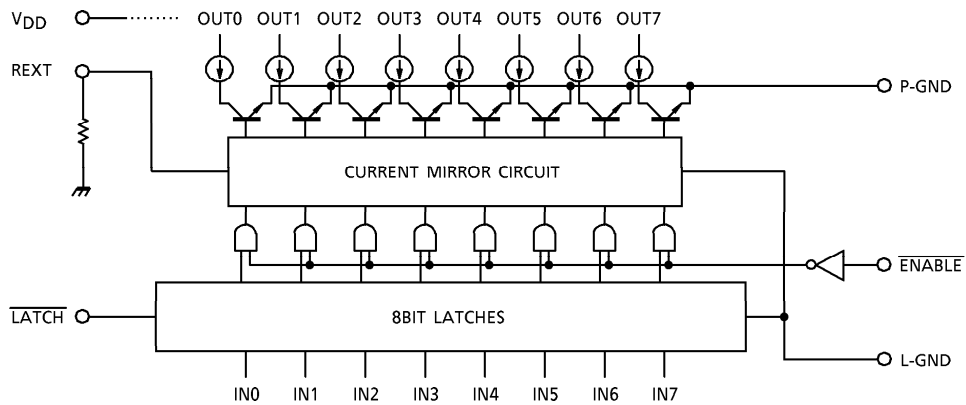
961001EBA1

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

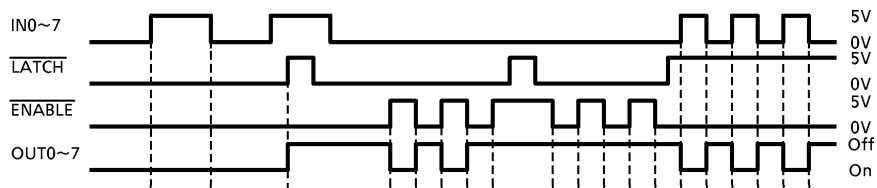
**PIN CONNECTION (Top view)**



**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 (OUT0~7) do off.

**TERMINAL DESCRIPTION**

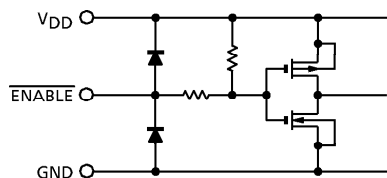
PIN No.	PIN NAME	FUNCTION
1	$\overline{\text{LATCH}}$	Input terminal of a data strobe. Latches passes data with "H" level input of LATCH-terminal, and hold data with "L" level input.
2	$\overline{\text{ENABLE}}$	Input terminal of output enable. All outputs (OUT0~7) do off with "H" level input of $\overline{\text{ENABLE}}$ -terminal, and do on with "L" level input.
4~11	IN0~7	Input terminal of a parallel-data for latches.
3	NC	No connection.
12	L-GND	GND terminal for controll logic.
13	P-GND	GND terminal for output constant current drivers.
14~21	OUT0~7	Output terminals.
22	P-GND	GND terminal for output constant current drivers.
23	REXT	Input terminal of connects with a resister for to set up all output current.
24	VDD	5V Supply voltage terminal

**TRUTH TABLE**

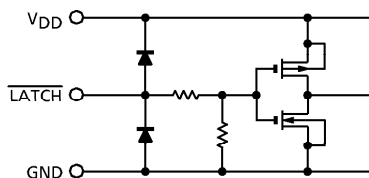
IN0~7	$\overline{\text{LATCH}}$	ENABLE	OUT0~7
L	L	L	OFF
H	L	L	OFF
L	H	L	OFF
H	H	L	ON
L		L	OFF
H		L	ON
H		H	OFF

EQUIVALENT CIRCUIT OF INPUTS

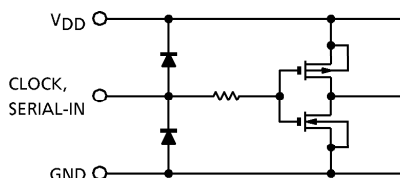
1.  $\overline{\text{ENABLE}}$  terminal



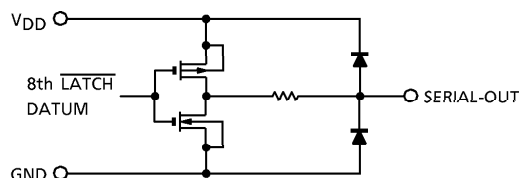
2.  $\overline{\text{LATCH}}$  terminal



3. CLOCK、SERIAL-IN terminal



4. SERIAL-OUT terminal



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	7.0	V
Input Voltage	V <sub>IN</sub>	-0.3~V <sub>DD</sub> +0.3	V
Output Current	I <sub>O</sub>	90.0	mA
Output Voltage	V <sub>O</sub>	-0.3~17.0	V
GND Terminal Current	I <sub>GND</sub>	720	mA
Power Dissipation	P <sub>D</sub>	780 (*)	mW
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Storage Temperature	T <sub>stg</sub>	-55~150	°C

(\*) On PCB (50×50×1.6mm Cu 30% Glass Epoxy PCB)  
 Ambient temperature delated above 25°C in the proportion of 6.66mW/°C

**RECOMMENDED OPERATING CONDITION** (Ta = -40~85°C unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Supply Voltage	V <sub>DD</sub>	—	4.5	5.0	5.5	V	
Output Voltage	V <sub>O</sub>	—	—	—	15.0	V	
Output Current	I <sub>OUT</sub>	DC1 circuit	5.0	—	88	mA	
	I <sub>OH</sub>	SERIAL-OUT	—	—	-1.0	mA	
	I <sub>OL</sub>	SERIAL-OUT	—	—	1.0	mA	
Input Voltage	V <sub>IH</sub>	—	0.7 V <sub>DD</sub>	—	V <sub>DD</sub> + 0.3	V	
	V <sub>IL</sub>	—	-0.3	—	0.3 V <sub>DD</sub>		
LATCH Pulse Width	t <sub>w</sub> LATCH	V <sub>DD</sub> = 4.5V~5.5V	100	—	—	ns	
	t <sub>w</sub> LATCH		100	—	—		
INPUT Pulse Width	t <sub>w</sub> IN		4500	—	—	ns	
	t <sub>w</sub> IN		4500	—	—		
ENABLE Pulse Width	t <sub>w</sub> EN		4500	—	—	ns	
	t <sub>w</sub> IN		4500	—	—		
Set-Up Time for LATCH	t <sub>setup</sub> (L)		100	—	—	ns	
Hold Time for ENABLE	t <sub>hold</sub> (L)		100	—	—	ns	
Power Dissipation	P <sub>D</sub>		ON PCB, Ta = 85°C	—	—	0.60	W

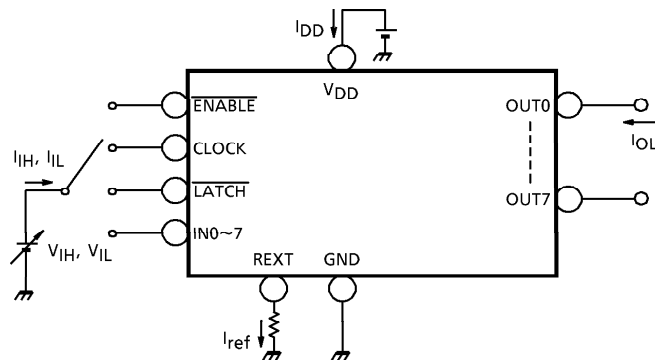
**ELECTRICAL CHARACTERISTICS** (V<sub>DD</sub> = 5.0V, Ta = 25°C unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Input Voltage	"H" Level	V <sub>IH</sub>	—	0.7 V <sub>DD</sub>	—	V <sub>DD</sub>	V	
	"L" Level	V <sub>IL</sub>	—	GND	—	0.3 V <sub>DD</sub>		
Output Leakage Current	I <sub>OH</sub>	—	V <sub>OH</sub> = 15.0V	—	—	10	μA	
Output Voltage	SERIAL-OUT	V <sub>OL</sub>	I <sub>OL</sub> = 1.0mA	—	—	0.4	V	
		V <sub>OH</sub>	I <sub>OL</sub> = -1.0mA	4.6	—	—	V	
Output Current 1		I <sub>OL1</sub>	V <sub>CE</sub> = 0.7V	R <sub>EXT</sub> = 620Ω (Include skew)	35.7	42.0	48.3	
		I <sub>OL2</sub>	V <sub>CE</sub> = 0.4V					68.0
Current Skew	ΔI <sub>OL1</sub>	—	I <sub>O</sub> = 40mA, V <sub>CE</sub> = 0.4V	R <sub>EXT</sub> = 620Ω	—	±1.5	±6.0	%
Output Current 2		I <sub>OL3</sub>	V <sub>CE</sub> = 0.7V	R <sub>EXT</sub> = 330Ω (Include skew)	64.2	75.5	86.8	
		I <sub>OL4</sub>	V <sub>CE</sub> = 0.7V					63.8
Current Skew	ΔI <sub>OL2</sub>	—	I <sub>O</sub> = 75mA, V <sub>CE</sub> = 0.7V	R <sub>EXT</sub> = 330Ω	—	±1.5	±6.0	%
Supply Voltage Regulation	% / V <sub>DD</sub>	—	R <sub>EXT</sub> = 470Ω, Ta = -40~85°C	—	+5.0	—	% / V	
Reference Voltage	V <sub>ref</sub>	—	—	—	1.26	—	V	
Supply Current "OFF"	I <sub>DD</sub> (off) 1	—	R <sub>EXT</sub> = OPEN, OUT1~8 = off, V <sub>DD</sub> = 4.5V, ENABLE = "H"	—	0.6	1.2	mA	
	I <sub>DD</sub> (off) 2	—	R <sub>EXT</sub> = 500Ω, OUT1~8 = off, V <sub>DD</sub> = 4.5V, ENABLE = "H"	6.0	8.0	10.0		
	I <sub>DD</sub> (off) 3	—	R <sub>EXT</sub> = 280Ω, OUT1~8 = off, V <sub>DD</sub> = 4.5V, ENABLE = "H"	12.0	15.0	18.0		
Supply Current "ON"	I <sub>DD</sub> (on) 1	—	R <sub>EXT</sub> = 500Ω, OUT1~8 = on, V <sub>DD</sub> = 4.5V, ENABLE = "L"	8.0	13.0	20.0	mA	
	I <sub>DD</sub> (on) 2	—	R <sub>EXT</sub> = 280Ω, OUT1~8 = on, V <sub>DD</sub> = 4.5V, ENABLE = "L"	18.0	25.0	35.0		

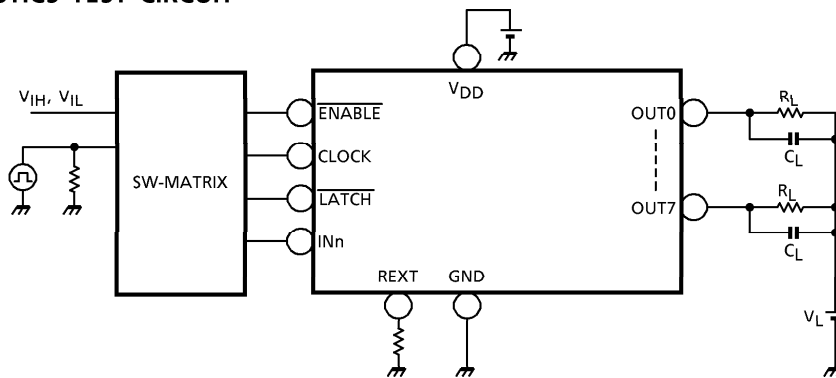
## SWITCHING CHARACTERISTICS (Ta = 25°C, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time ("L" to "H")	IN-OUTn	$t_{pLH}$	—	$V_{DD} = 5.0V$ $V_{CE} = 0.4V$ $V_{IH} = V_{DD}$ $V_{IL} = 0V$ $R_{EXT} = 500\Omega$ $I_{OUT} = 40mA$ $V_L = 3.0V$ $R_L = 65\Omega$ $C_L = 10.5pF$	—	600	1200	ns
	LATCH-OUTn		—		—	600	1200	
	ENABLE-OUTn		—		—	600	1200	
Propagation Delay Time ("H" to "L")	IN-OUTn	$t_{pHL}$	—		—	300	1200	ns
	LATCH-OUTn		—		—	300	1200	
	ENABLE-OUTn		—		—	300	1200	
Pulse Width	IN	$t_w IN, \overline{IN}$	—		—	2000	3500	ns
	LATCH	$t_w LAT, \overline{LAT}$	—		—	25	50	
	ENABLE	$t_w ENA, \overline{ENA}$	—		—	2000	3500	
Set-Up Time for LATCH & CLOCK	L-H	$t_{setup} \overline{LAT}$	—		—	25	50	ns
	H-L		—	—	25	50		
Hold Time for LATCH & CLOCK	L-H	$t_{hold} \overline{LAT}$	—	—	0	15	ns	
	H-L		—	—	0	15		
Maximum CLOCK Rise Time		$t_r$	—	—	—	10	$\mu s$	
Maximum CLOCK Fall Time		$t_f$	—	—	—	10	$\mu s$	
Output Rise Time		$t_{or}$	—	—	200	1000	1200	ns
Output Fall Time		$t_{of}$	—	—	200	1000	1200	ns

**DC CHARACTERISTICS TEST CIRCUIT**



**AC CHARACTERISTICS TEST CIRCUIT**

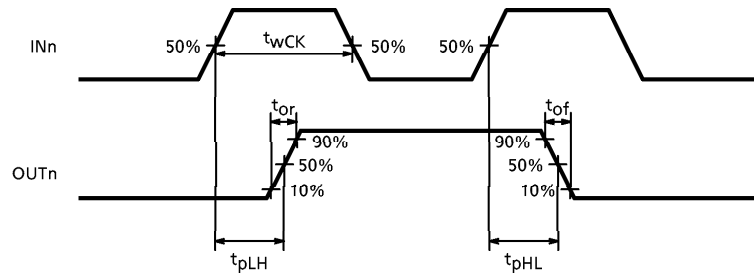


**PRECAUTIONS for USING**

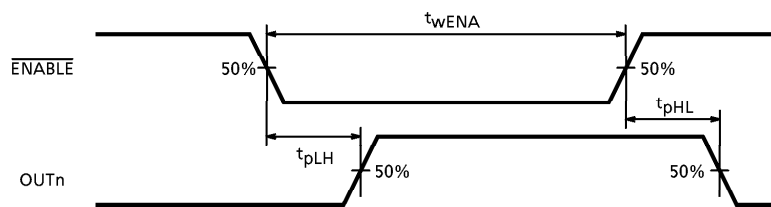
Utmost care is necessary in the design of the output line,  $V_{CC}$  ( $V_{DD}$ ) and GND (L-GND, P-GND) line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

**TIMING WAVEFORM**

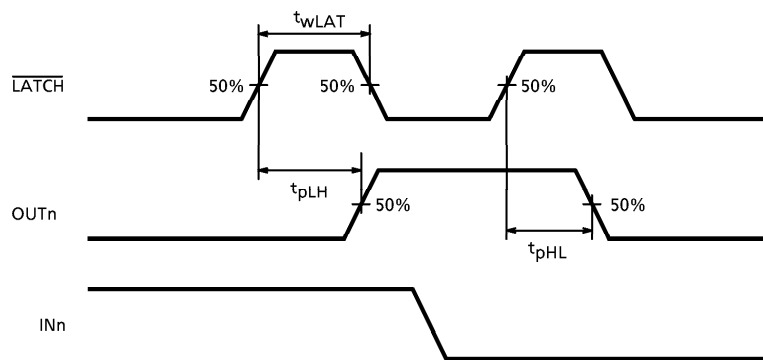
1.  $INn$ - $OUTn$



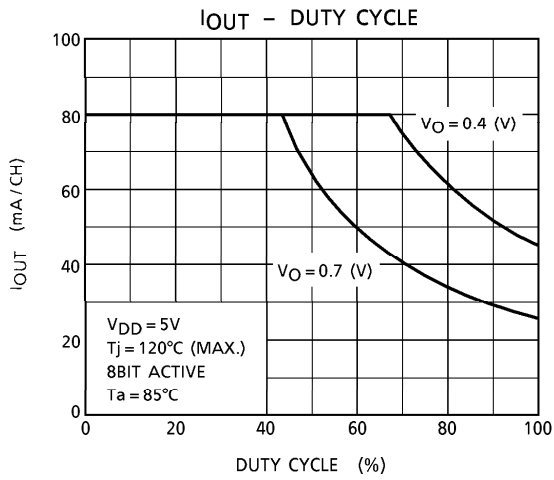
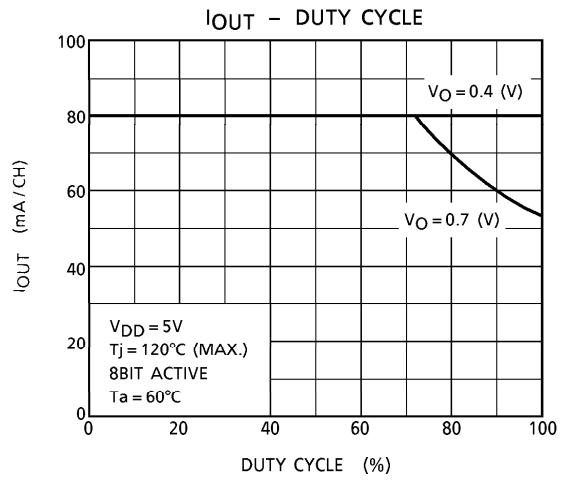
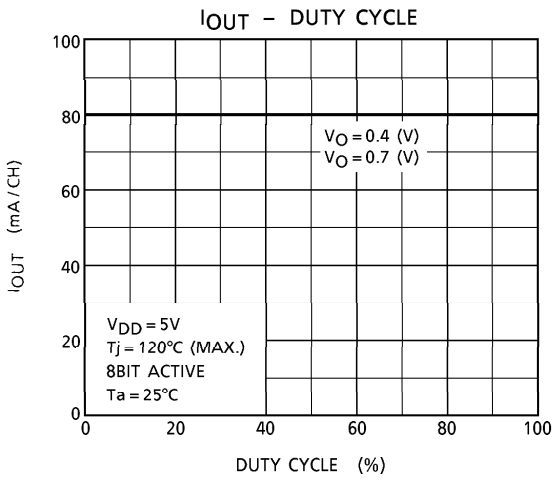
2.  $\overline{ENABLE}$ - $OUTn$



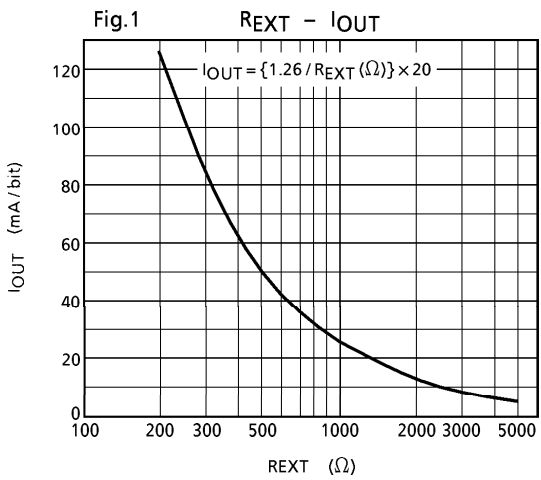
3.  $\overline{LATCH}$ - $OUTn$







**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 0.4~0.7V ( $V_O$ ).

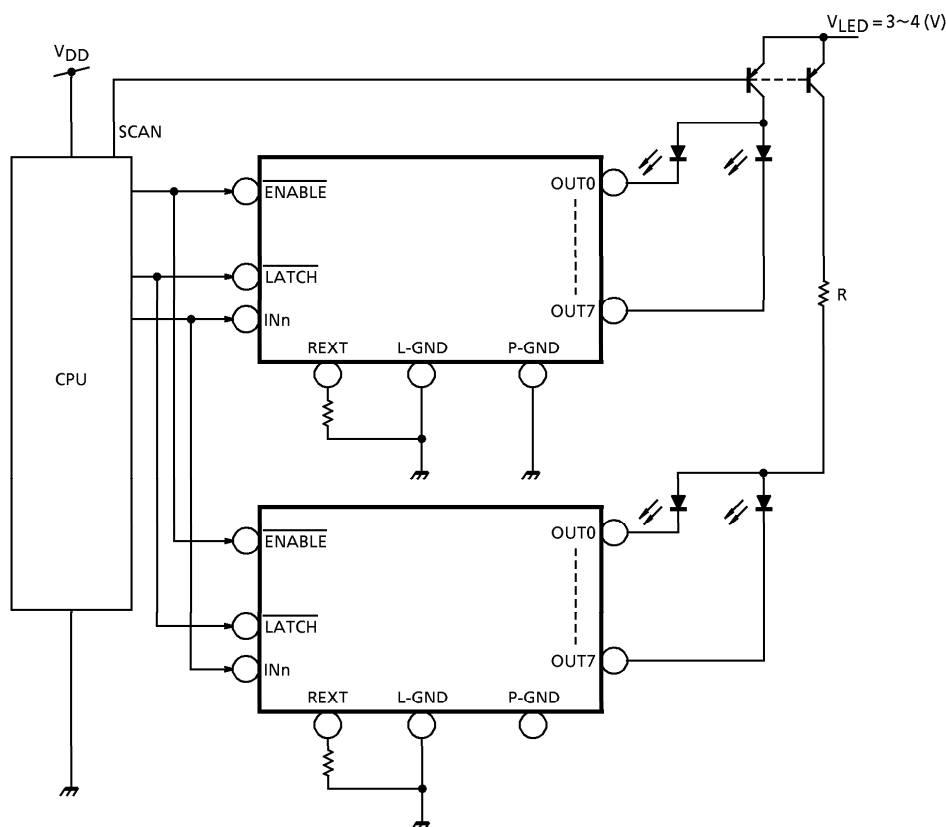
When a higher voltage is input to the device, the excess voltage is consumed inside the device, that leads to power dissipation.

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



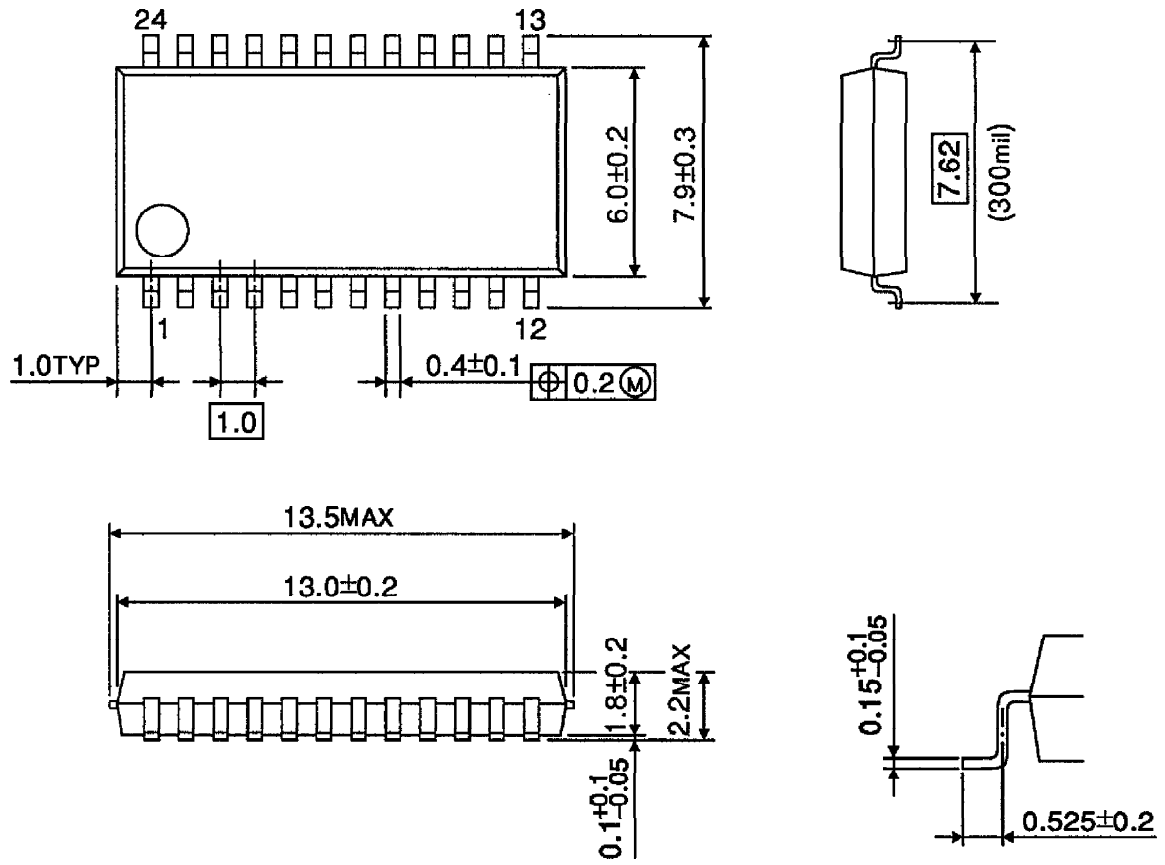
## [3] Pattern layout

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**  
SSOP24-P-300-1.00

Unit : mm



Weight : 0.32g (Typ.)