# TOSHIBA Bi-CMOS
# Constant Current Interface Driver

# TB62706BN/BF

**16 Bit Constant Current LED Driver with Shift Register and Latch Functions**

## Product Description:

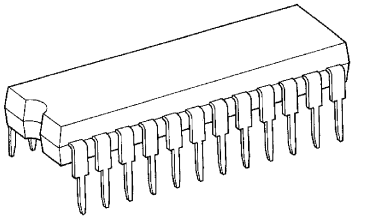
The TB62706BN/BF is specifically designed for LED display applications. The Bi-CMOS device has 16 Bi-polar constant current output channels and includes CMOS shift register and latch functions.

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 16 outputs effectively compensating for the inherent circuit and component variables which affect the brightness of the LEDs.

## Features:

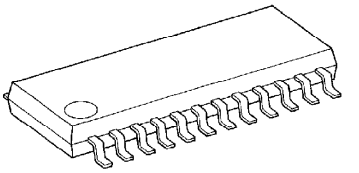
- 16 Constant Current Output Channels
- Current Programmable from 5-90mA
- 5V CMOS Compatible Inputs
- 15MHz Max Clock Frequency (Cascade)

**TB62706BN**



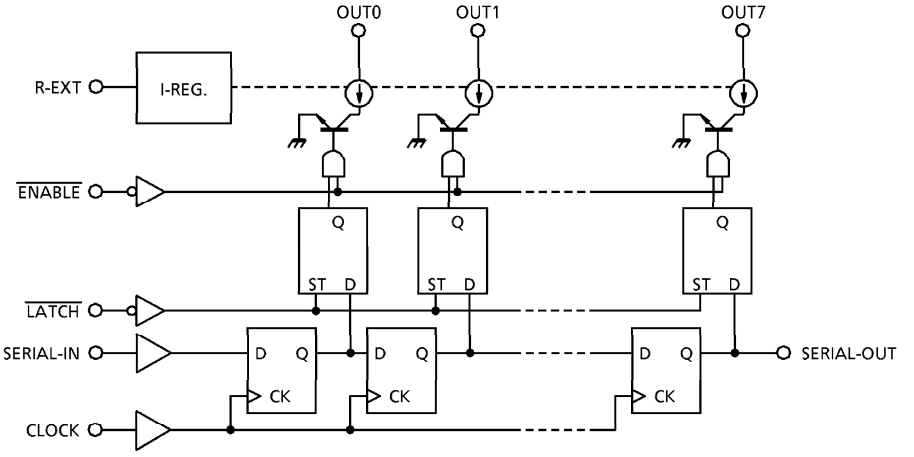
SDIP24-P-300 Weight: 1.22g(typ)

**TB62706BF**



SSOP24-P-300B Weight: 0.32g(typ)

**Block Diagram:**

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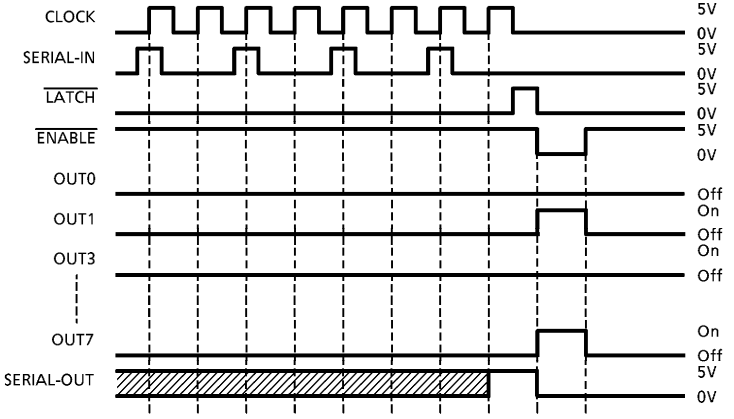
### Timing Diagram:



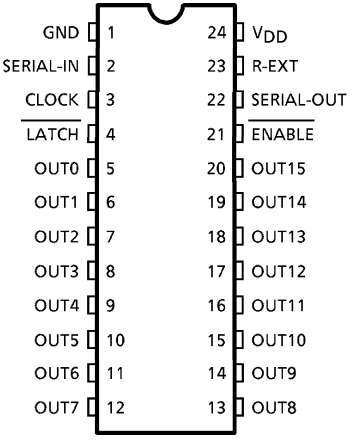

**Latches are:**

1. Level Sesitive
2. Not edge sensitive
3. Not clock synchronous
4. Passing Data when $\overline{\text{LATCH}}$ is H
5. Hold Data when $\overline{\text{LATCH}}$ is L

All Outputs are OFF when $\overline{\text{ENABLE}}$ is H and ON when $\overline{\text{ENABLE}}$ is L.

### Terminal Description & Pin Out:

| 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 | Iinput 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 LATCH-terminal, and hold data with "L" level input. |
| 5~20 | $\overline{\text{OUT0~15}}$ | Output terminals |
| 21 | $\overline{\text{ENABLE}}$ | Input terminal of output enable. All outputs (OUT~15) do off with "H" level input of ENABLE-terminal, and do on with "L" level input. |
| 22 | SERIAL-OUT | Output terminal of a serial-data for next SERIAL-IN terminal. |
| 23 | R-EXT | Input terminal of connects with a resister for to set up all output current. |
| 24 | VDD | 5V Supply voltage terminal |



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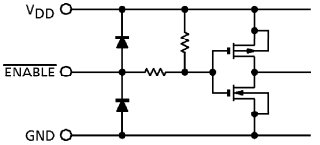
### Truth Table:

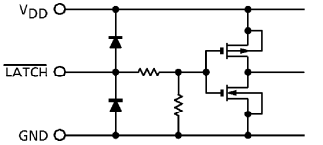
| CLOCK | LATCH | ENABLE | SERIAL-IN | OUT0 | OUT5 | OUT7 | SERIAL-OUT |
|---|---|---|---|---|---|---|---|
| UP | H | L | Dn | Dn | Dn-7 | Dn-15 | Dn-15 |
| UP | L | L | Dn+1 | No Change | | | Dn-14 |
| UP | H | L | Dn+2 | Dn+2 | Dn-5 | Dn-13 | Dn-13 |
| DOWN | X | L | Dn+3 | Dn+2 | Dn-5 | Dn-13 | Dn-13 |
| DOWN | X | H | DN+3 | Off | | | Dn-13 |

### Equivalent Circuit of Inputs and Outputs:

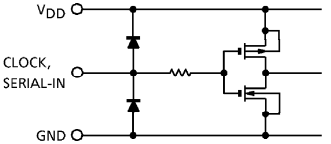
1. $\overline{\text{ENABLE}}$ terminal



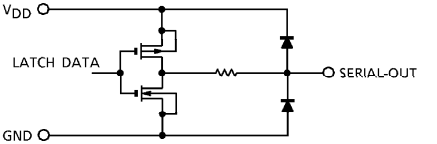

2. $\overline{\text{LATCH}}$ terminal




3. CLOCK, SERIAL-IN termina




4. SERIAL-OUT terminal




### Maximum Ratings:

| CHARACTER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage | VDD | 0~7.0 | V |
| Input Voltage | VIN | -0.4~VDD + 0.4 | V |
| Output Current | IOUT | +90 | mA |
| Output Voltage | VOUT | -0.5~+17.0 | V |
| Clock Frequency | FCLK | 15 | MHz |
| GND Terminal Current | IGND | 1440 | mA |
| Power Dissipation | PD | 1.78 (BN type: ON PCB,Ta=25°C) | W |
| | | 1.00 (BF type: ON PCB,Ta=25°C) | |
| Thermal Resistance | Rth(j-a) | 70 (BN type: On PCB) | °C/W |
| | | 120 (BF type: On PCB) | |
| Operating Temperature | Topr | -40~+85 | °C |
| Storage Temperature | Tstg | -55~+150 | °C |

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**Recommended Operating Condition:**

| CHARACTERISTIC | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | VDD | — | 4.5 | 5.0 | 5.5 | V |
| Outout Voltage | VOUT | — | — | — | 15.0 | V |
| Output Current | IOUT | DC 1 Circuit | 5 | — | 88 | mA |
| | IOH | SERIAL-OUT | — | — | 1.0 | mA |
| | IOL | SERIAL-OUT | — | — | -1.0 | mA |
| Input Voltage | VIH | — | 0.7VDD | — | VDD+0.3 | V |
| | VIL | — | -0.3 | — | 0.3VDD | |
| LATCH Pulse Width | tw LAT | VDD=4.5 ~ 5.5V | 100 | — | — | ns |
| CLOCK Pulse Width | tw CLK | | 50 | — | — | ns |
| ENABLE Pulse Width | tw EN | | 4500 | — | — | ns |
| Set-up Time for DATA | tsetup(D) | | 60 | — | — | ns |
| Hold Time for Data | thold(D) | | 20 | — | — | ns |
| Set-up Time for LATCH | tsetup(L) | | 100 | — | — | ns |
| Hold Time for ENABLE | thold(L) | | 60 | — | — | ns |
| Clock Frequency | FCLK | Cascade Operation | — | — | 10.0 | MHz |
| Power Dissipation | PD | Ta=85°C (BN type) | — | — | 0.92 | W |
| | | Ta=85°C (BF type) | — | — | 0.50 | |

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## Electrical Characteristics:

| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Input Voltage | "H" level | VIH | — | Ta = -40~85℃ | | 0.7VDD | — | VDD | V |
| | "L" level | VIL | — | Ta = -40~85℃ | | GND | — | 0.3VDD | |
| Output Leakage Current | | IOH | — | VOH=15.0V | | — | — | 10 | μA |
| Output Voltage | SERIAL--OUT | VOL | — | IOL=+1.0mA | | — | — | 0.4 | V |
| | | VOH | | IOH=-1.0mA | | 4.6 | — | — | V |
| Output Current 1 | | IOL1 | — | VCE=0.7V | REXT=470Ω (include Current Matching) | 34.1 | 40.0 | 45.9 | mA |
| | | IOL2 | — | VCE=0.4V | | 33.7 | 39.5 | 45.3 | |
| | Current Skew | dIOL1 | — | IO=40mA, VCE=0.4V | REXT=470Ω | — | ±1.5 | ±6.0 | % |
| Output Current 2 | | IOL3 | — | VCE=0.7V | REXT=250Ω (Include Current Matching) | 64.2 | 75.5 | 86.8 | mA |
| | | IOL4 | — | VCE=0.4V | | 63.8 | 75.0 | 86.2 | |
| | Current Skew | dIOL2 | — | IO=75mA, VCE=0.7V | REXT=250Ω | | 1.5 | 6.0 | % |
| Supply Voltage Regulation | | % / VDD | — | REXT=470Ω | Ta = -40~+85°C | — | ±1.5 | ±5.0 | % /V |
| Pull Up Resistor | | RIN(up) | — | — | | 150 | 300 | 600 | KΩ |
| Pull-down Resistor | | RIN(down) | — | — | | 100 | 200 | 400 | KΩ |
| Supply Current | "OFF" | IDD (off) 1 | — | REXT=OPEN | OUT~8=off | — | 0.6 | 1.2 | mA |
| | | IDD (off) 2 | — | REXT=470Ω | OUT~8=off | 3.5 | 5.8 | 8 | |
| | | IDD (off) 3 | — | REXT=250Ω | OUT~8=off | 6.5 | 10.2 | 15 | |
| | "ON" | IDD (on)1 | — | REXT=470Ω | OUT~8=on | 10 | 16 | 22 | |
| | | IDD (on)2 | — | REXT=250Ω | OUT~8=on | 18 | 28.3 | 38.5 | |

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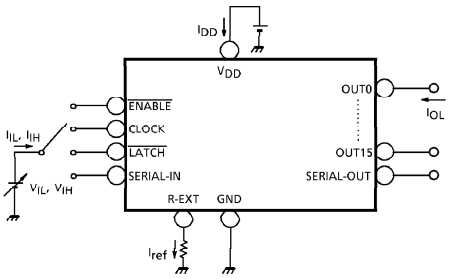
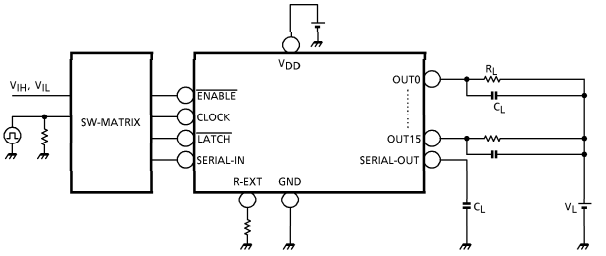
### Switching Characteristics:

| CHARACTERISTIC | | SYMBOL | TEST CIRCUIT | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| Propagation Delay Time ("L" to "H") | CLK-OUTn | tpLH | — | VDD = 5.0V<br>VCE = 0.4V<br>VIH = VDD<br>VIL = GND<br>REXT = 470Ω<br>VL = 3.0V<br>RL = 65Ω<br>CL = 10.5pF | — | 1200 | 1500 | ns |
| | $\overline{\text{LATCH}}$-$\overline{\text{OUTn}}$ | | | | — | 1200 | 1500 | ns |
| | $\overline{\text{ENABLE}}$-$\overline{\text{OUTn}}$ | | | | — | 1200 | 1500 | ns |
| | CLK-SOUT | | | | — | 30 | 70 | ns |
| Propagation Delay Time ("H" to "L") | CLK-OUTn | tpHL | — | | — | 700 | 1000 | ns |
| | $\overline{\text{LATCH}}$-$\overline{\text{OUTn}}$ | | | | — | 700 | 1000 | ns |
| | ENABLE-OUTn | | | | — | 700 | 1000 | ns |
| | CLK-SOUT | | | | — | 30 | 70 | ns |
| Pulse Width | CLK | tw CLK,CLK | — | | — | 20 | 30 | ns |
| | $\overline{\text{LATCH}}$ | tw LAT,LAT | — | | — | 10 | 25 | ns |
| Set-up Time for Latch | L-H | tsetup LAT | — | | — | 25 | 50 | ns |
| | H-L | | — | | — | 25 | 50 | ns |
| Hold Time for LATCH | L-H | thold LAT | — | | — | 0 | 15 | ns |
| | H-L | | — | | — | 0 | 15 | 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:



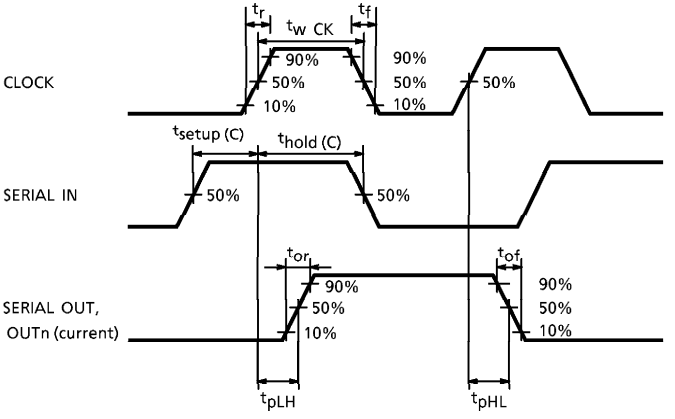

### AC Characteristic Test Circuit:



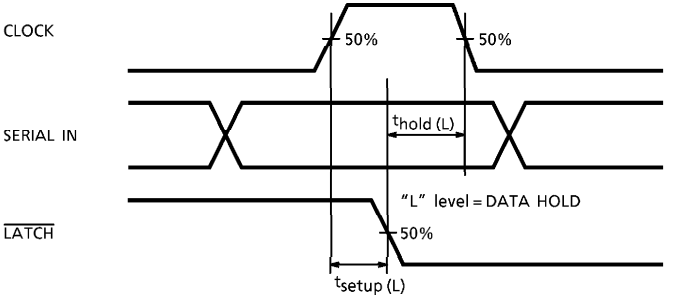
# TB62706BN/BF

**Timing Wave Form:**

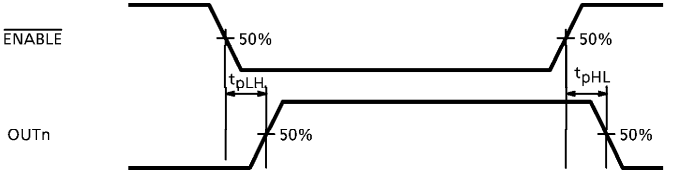
1. CLOCK-SERIAL OUT, OUTn




2. CLOCK-$\overline{\text{LATCH}}$




3. $\overline{\text{ENABLE}}$-OUTn



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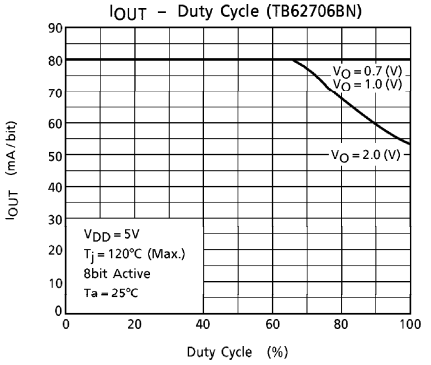
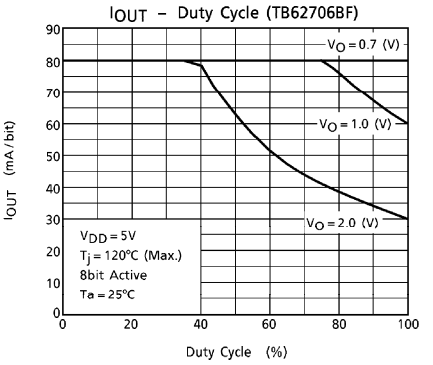
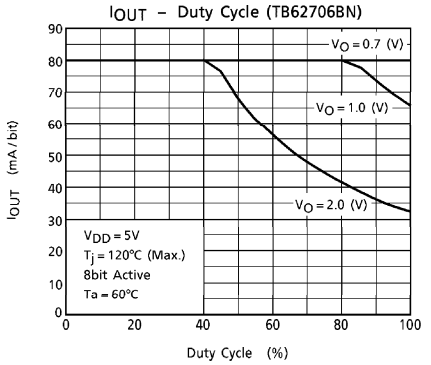
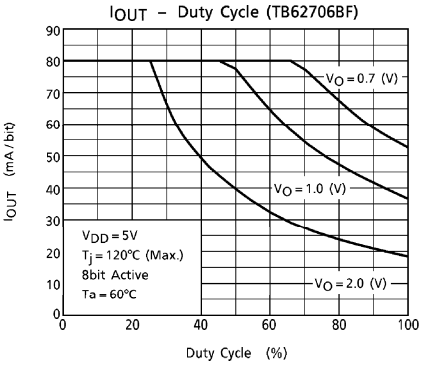
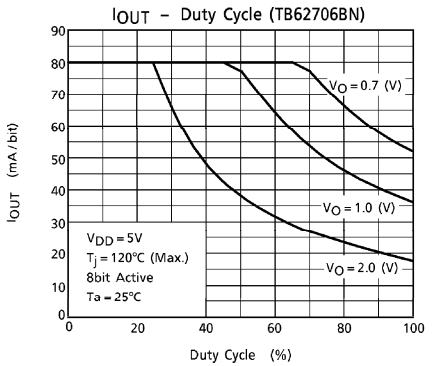
**Graphs:**

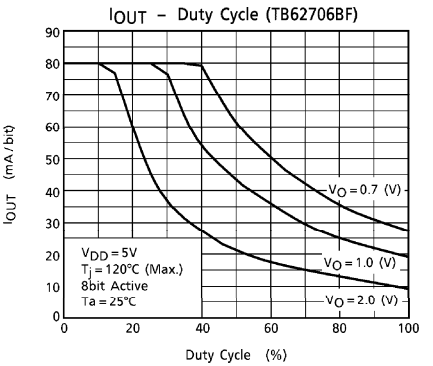


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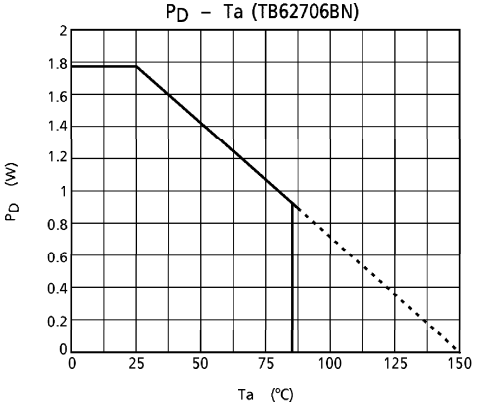
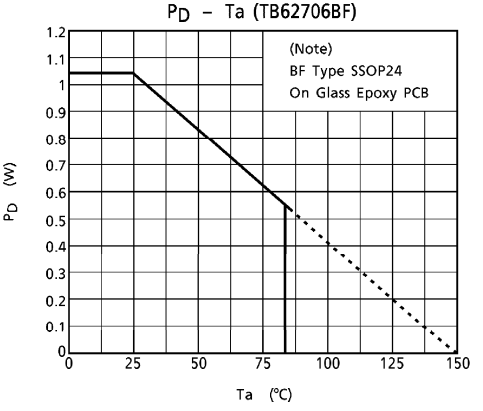
**Graphs:**




**Current Programming Resistor Selection:**

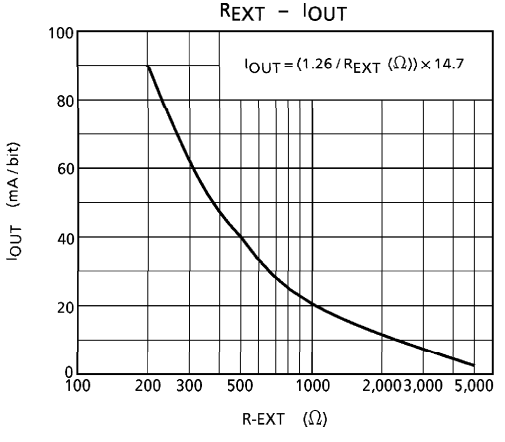
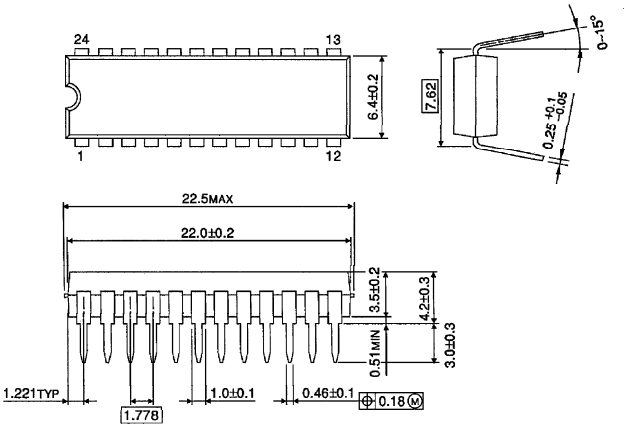



Fig. 1

# TB62706BN/BF

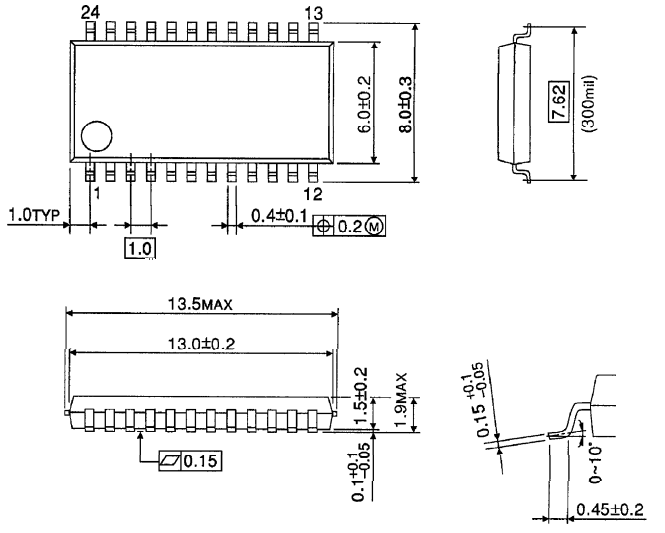
**Outline Drawings:**

SDIP24-P-300-1.78 Unit : mm




Weight : 1.22g (Typ.)

SSOP24-P-300-1.00B Unit : mm




Weight : 0.32g (Typ.)