

Serial-in / Parallel-out Driver Series

# Serial-Parallel 3-input Driver



BA823F

No.09051EAT01

●Description

BA823F are an 8-bit serial-to-parallel-output driver, applicable for thermal printer heads or LED character display drivers.

●Features

- 1) Capable of driving a maximum of 200mA.
- 2) Non-driving current consumption can be reduced by controlling the strobe timing pulse.
- 3) Output data terminal can be used for a cascade configuration.
- 4) Digital ground and power ground are separated.
- 5) TTL and CMOS allow driving.

●Applications

- Driver for thermal print head
- Driver for LED character display

●Absolute maximum ratings (Ta=25°C)

| Parameter             | Symbol    | Limits            | Unit |
|-----------------------|-----------|-------------------|------|
| Power supply voltage  | Vcc       | 7.0* <sup>1</sup> | V    |
| Power dissipation     | BA823F Pd | 500* <sup>3</sup> | mW   |
| Input voltage         | VIN MAX   | +0.3 to +6.0      | V    |
| Operating temperature | Topr      | -20 to +75        | °C   |
| Storage temperature   | Tstg      | -55 to +125       | °C   |

\*1 Voltage of  $\overline{O}_0\sim\overline{O}_7$  terminals is 34V (Max.)

\*2 Reduced by 5.5 mW/°C over 25°C.

\*3 Reduced by 5.0 mW/°C over 25°C.

●Thermal derating curve

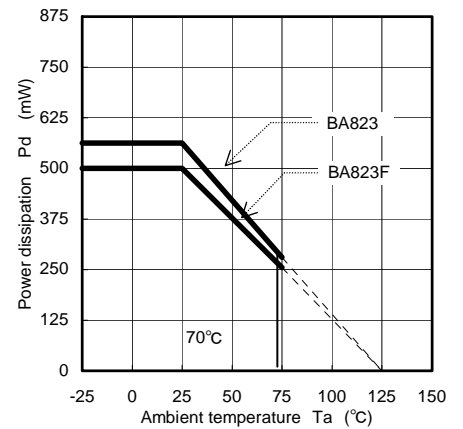


Fig.1

● **Electrical characteristics** (Unless otherwise specified,  $T_a=25^{\circ}\text{C}$ ,  $V_{cc}=+5.0\text{V}$ )

| Parameter                     | Symbol       | Min. | Typ. | Max. | Unit          | Conditions                                       | Test Circuit |
|-------------------------------|--------------|------|------|------|---------------|--------------------------------------------------|--------------|
| Power supply                  | $V_{CC}$     | 4.5  | 5.0  | 5.5  | V             | $V_{CC}$ terminal                                | Fig.2        |
| Current dissipation(no load)1 | $I_{O1}$     | -    | 4    | 6    | mA            | @All outputs = "0"                               | Fig.2        |
| Current dissipation(no load)2 | $I_{O2}$     | -    | 8    | 11   | mA            | @All outputs = "0"                               | Fig.2        |
| Input low level voltage       | $V_{IL}$     | -    | -    | 0.8  | V             | -                                                | Fig.2        |
| Input high level voltage      | $V_{IH}$     | 2    | -    | -    | V             | -                                                | Fig.2        |
| Input low level current       | $I_{IL}$     | -    | -    | 0.4  | mA            | $V_{IN}=4.5\text{V}$                             | Fig.2        |
| Input high level current      | $I_{IH}$     | -    | -    | 100  | $\mu\text{A}$ | $V_{IN}=2.0\text{V}$                             | Fig.3        |
| Maximum output voltage        | $V_{O\ OFF}$ | -    | -    | 21.8 | V             | $\bar{O} 0$ to $\bar{O} 7$ , $I_o=10\mu\text{A}$ | Fig.3        |
| Output saturation voltage     | $V_{O\ ON}$  | -    | 0.8  | 1.3  | V             | @ $I_o=100\text{mA}$ sink                        | Fig.3        |
| Output current                | $I_{OL}$     | -    | -    | 207  | mA            | External voltage = 11.8V                         | Fig.3        |
| "H" output voltage            | $V_{DOH}$    | 2.4  | -    | -    | V             | $R_L=10\text{k}\Omega$                           | Fig.3        |
| "L" output voltage            | $V_{DOL}$    | -    | -    | 0.8  | V             | -                                                | Fig.3        |
| Minimum set up time           | $t_1$        | -    | -    | 300  | ns            | $V_{IH}=2.0\text{V}$ , $V_{IL}=0.8\text{V}$      | -            |
| Minimum shift clock width     | $T_2$        | -    | -    | 1    | $\mu\text{s}$ | $V_{IH}=2.0\text{V}$ , $V_{IL}=0.8\text{V}$      | -            |
| Minimum timing pulse width    | $T_3$        | -    | -    | 1    | $\mu\text{s}$ | $V_{IH}=2.0\text{V}$ , $V_{IL}=0.8\text{V}$      | -            |
| Maximum transfer time         | $f_{Max}$    | 500  | -    | -    | kHz           | $V_{IH}=2.0\text{V}$ , $V_{IL}=0.8\text{V}$      | -            |

● **Usage conditions range**

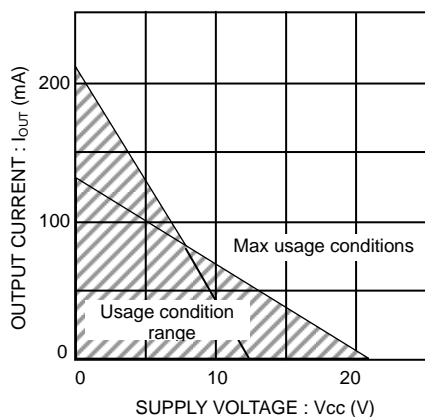
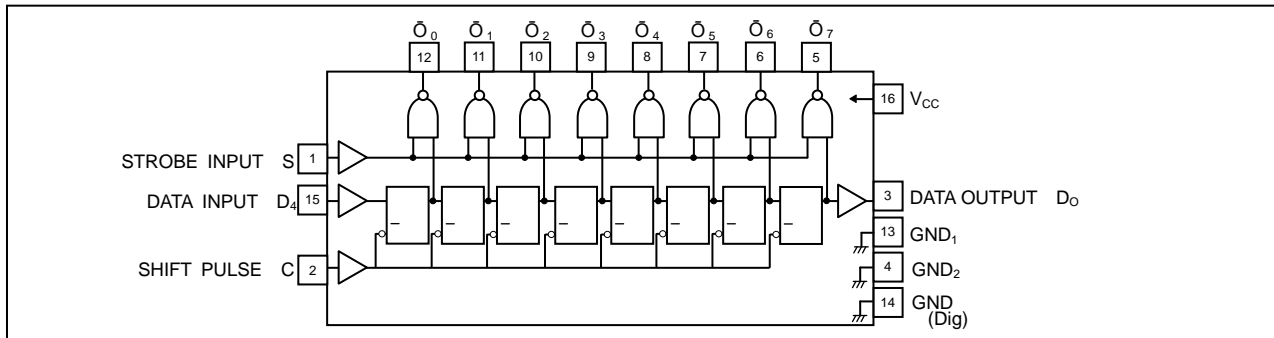


Fig.2: Conditions to use supply voltage and output current (per circuit)  
 Maximum conditions of use in the diagram to the left, show the absolute maximum supply voltage and IC output current.  
 This product should not exceed the usage conditions range.

Fig.2 Power supply voltage and current usage conditions

### ●Block diagram



### ●Pin descriptions

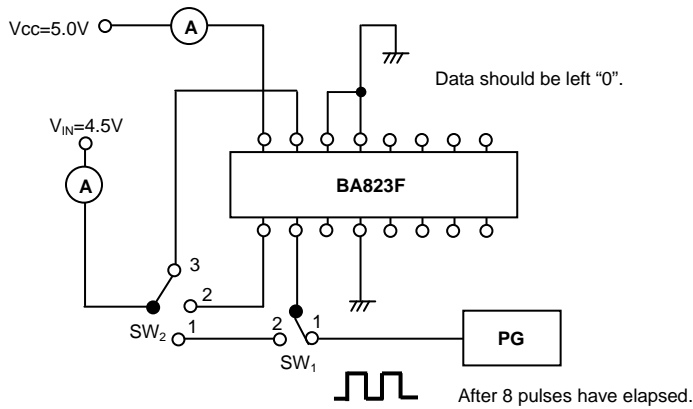
| Pin No. | Pin Name    | Symbol      | Function                                                                                         |
|---------|-------------|-------------|--------------------------------------------------------------------------------------------------|
| 2       | SHIFT PULSE | C           | Shift pulse of shift register                                                                    |
| 15      | DATA INPUT  | D1          | Data input of shift register is stored during the shift pulse rise time.                         |
| 1       | STROBE      | S           | When "1" is effective, the content of shift register is outputted.                               |
| 12      | OUTPUT      | $\bar{O}_0$ | "0" is effective when the content of register is "1" on the 1st bit is outputted.                |
| 11      | OUTPUT      | $\bar{O}_1$ | "0" is effective when the content of register is "1" on the 2nd bit is outputted.                |
| 10      | OUTPUT      | $\bar{O}_2$ | "0" is effective when the content of register is "1" on the 3rd bit is outputted.                |
| 9       | OUTPUT      | $\bar{O}_3$ | "0" is effective when the content of register is "1" on the 4th bit is outputted.                |
| 8       | OUTPUT      | $\bar{O}_4$ | "0" is effective when the content of register is "1" on the 5th bit is outputted.                |
| 7       | OUTPUT      | $\bar{O}_5$ | "0" is effective when the content of register is "1" on the 6th bit is outputted.                |
| 6       | OUTPUT      | $\bar{O}_6$ | "0" is effective when the content of register is "1" on the 7th bit is outputted.                |
| 5       | OUTPUT      | $\bar{O}_7$ | "0" is effective when the content of register is "1" on the 8th bit is outputted.                |
| 3       | DATA OUTPUT | D0          | Data having passed through the output circuit of $\bar{O}_7$ becomes the input of the next stage |
| 16      | Vcc         | Vcc         | 5.0V .is used normally ( $\pm 10\%$ )                                                            |
| 13      | GND         | GND1        | Especially, GND of the output circuit of $\bar{O}_0 \sim \bar{O}_3$                              |
| 4       | GND         | GND2        | Especially, GND of the output circuit of $\bar{O}_4 \sim \bar{O}_7$                              |
| 14      | GND         | GND(Dig)    | Especially, GND of the logic circuit                                                             |

### ●Description of operation

BA823 is configured internally as shown in the block diagram. Terminals of clock C, data D1, and strobe S are used as input. Data input is synchronized with the clock, read serially during the rise time and latched at the rise time edge of the shifted shift register. The content of the set shift register appears on the output terminal of  $\bar{O}_0 \sim \bar{O}_7$  when the strobe is input, as shown in the time chart of Fig.5. Pulse width is the same as that of the strobe input pulse.

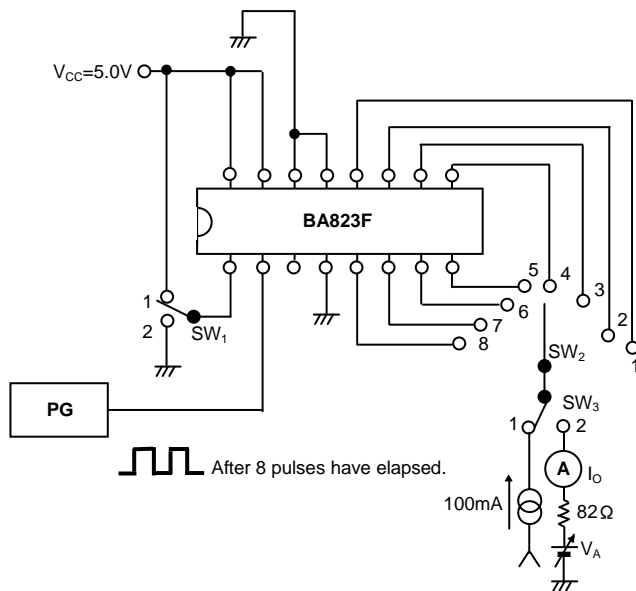
Data output terminal D0, is a terminal used for cascade connection of the IC, where the output of the final stage of the shift register has appeared, and is connected to the next data input terminal D1. In this case, when the clock and the strobe are used in conjunction, output terminal can be increased by 8 bits at a time.

● Measurement circuits



| Item            | SW <sub>1</sub> | SW <sub>2</sub> |
|-----------------|-----------------|-----------------|
| I <sub>CC</sub> | 1               | 1               |
| I <sub>IH</sub> | 2               | 1~3             |

Fig.3 Icc 1st measurement circuit



| Item   | SW <sub>1</sub> | SW <sub>2</sub> | SW <sub>3</sub> |
|--------|-----------------|-----------------|-----------------|
| VO ON  | 1               | 1~8             | 1               |
| IOL    | 1               | 1~8             | 1               |
| VO OFF | 2               | 1~8             | 2               |

I<sub>O</sub> = 10μA when VO OFF is measured  
 V<sub>A</sub> = 30V when I<sub>O</sub> ON is measured

Fig.4 Vo ON, Vo OFF, IOL measurement circuit

● Input conditions

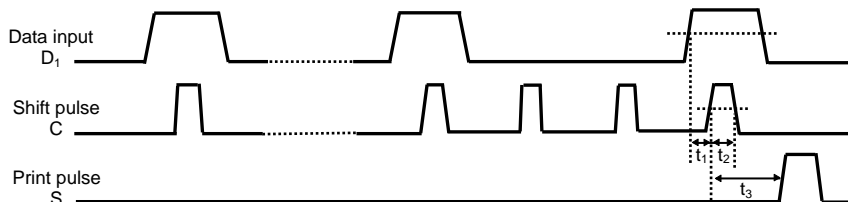


Fig.5

●Timing chart

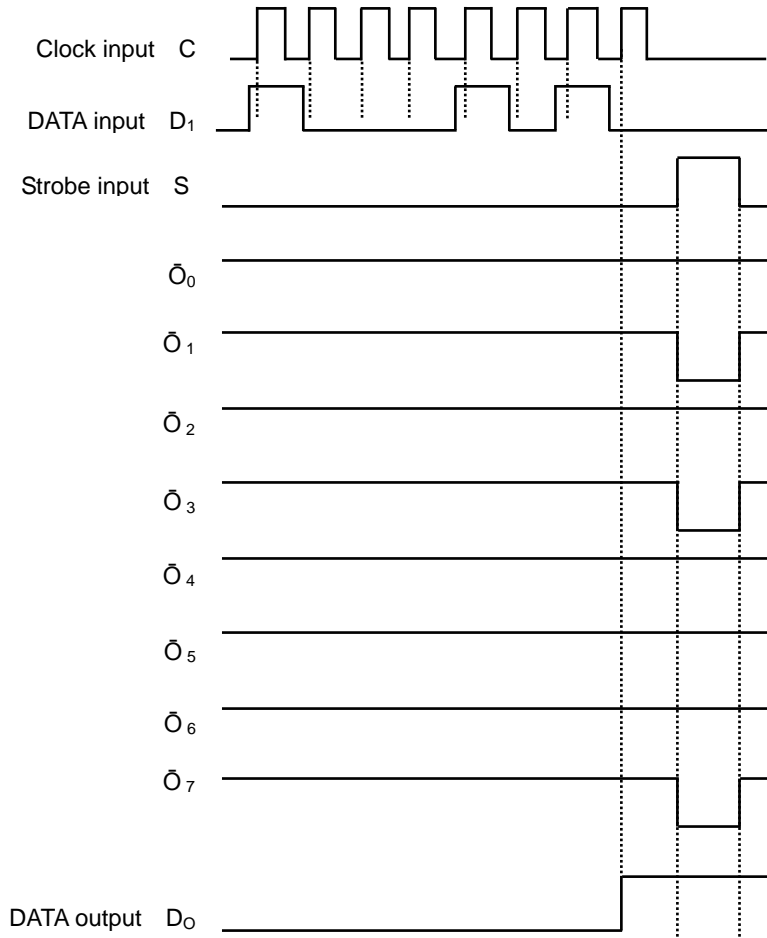


Fig.6

●Application example

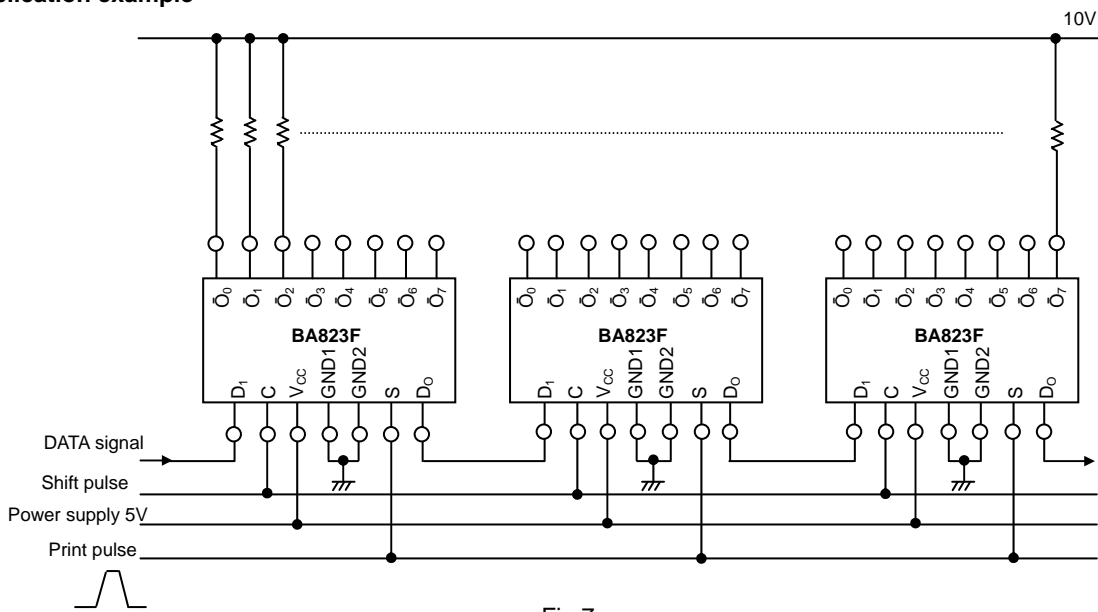


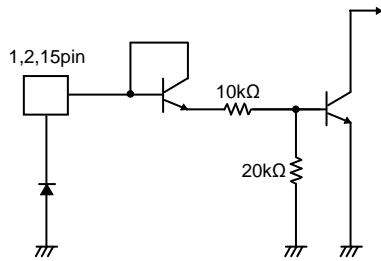
Fig.7

Example: Print head using the strobe function  
 Disabling the high current while the heating element is switched off is advantageous.

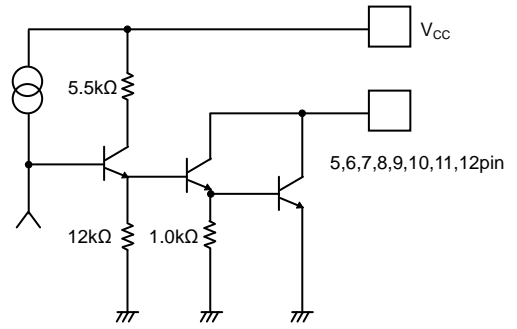
Use for thermal printer (when the timing is 1 phase) example

● Interfaces

(a) Input



(b) Output



(c) Serial data output

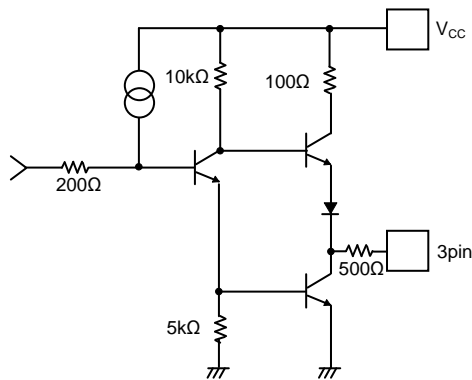
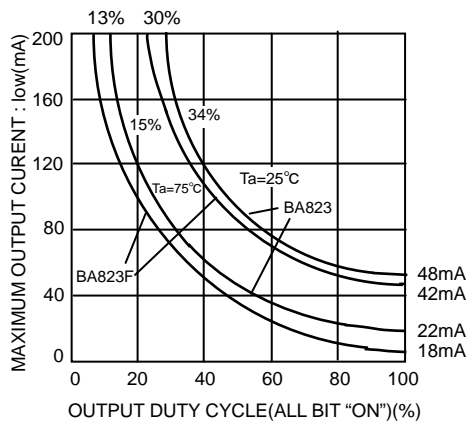


Fig.8

● Thermal derating curve



At repetition frequency 1Hz or higher

Fig.9 Output conditions

### ●Notes for use

#### 1. Absolute maximum ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

#### 2. Connecting the power supply connector backward

Connecting of the power supply in reverse polarity can damage IC. Take precautions when connecting the power supply lines. An external direction diode can be added.

#### 3. Power supply lines

Design PCB layout pattern to provide low impedance GND and supply lines. To obtain a low noise ground and supply line, separate the ground section and supply lines of the digital and analog blocks. Furthermore, for all power supply terminals to ICs, connect a capacitor between the power supply and the GND terminal. When applying electrolytic capacitors in the circuit, not that capacitance characteristic values are reduced at low temperatures.

#### 4. GND voltage

The potential of GND pin must be minimum potential in all operating conditions.

#### 5. Inter-pin shorts and mounting errors

Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if pins are shorted together.

#### 6. Actions in strong electromagnetic field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

#### 7. Testing on application boards

When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting or storing the IC.

#### 8. Regarding input pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of these P layers with the N layers of other elements, creating a parasitic diode or transistor. For example, the relation between each potential is as follows:

When  $GND > Pin A$  and  $GND > Pin B$ , the P-N junction operates as a parasitic diode.

When  $GND > Pin B$ , the P-N junction operates as a parasitic transistor.

Parasitic diodes can occur inevitable in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Accordingly, methods by which parasitic diodes operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin, should not be used.

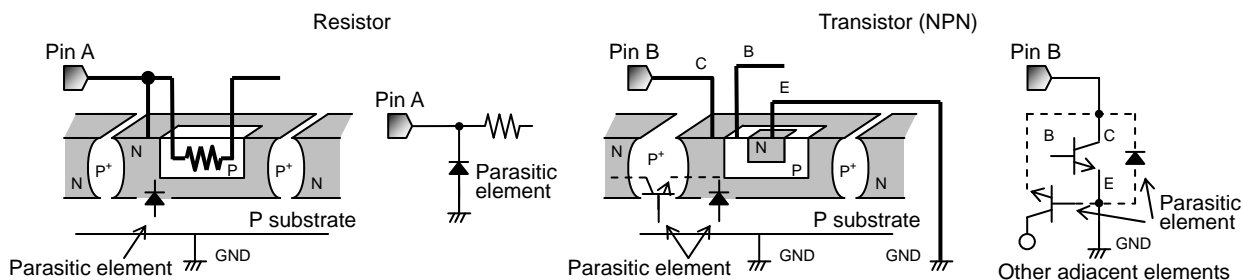


Fig.10 Example of IC structure

#### 9. Ground Wiring Pattern

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

●Ordering part number

|   |   |
|---|---|
| B | D |
|---|---|

Part No.

|   |   |   |
|---|---|---|
| 8 | 2 | 3 |
|---|---|---|

Part No.

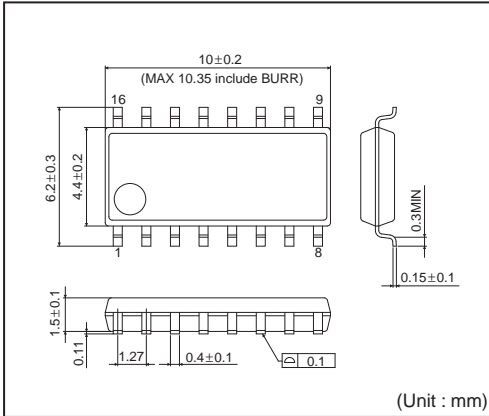
|   |
|---|
| F |
|---|

Package  
F: SOP16

|   |   |
|---|---|
| E | 2 |
|---|---|

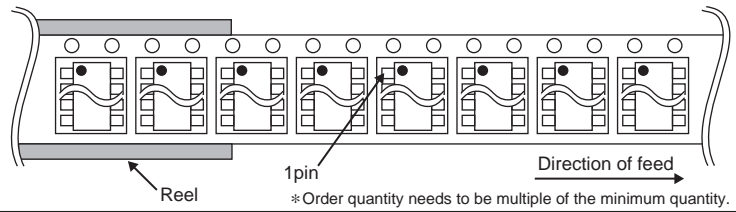
Packaging and forming specification  
E2: Embossed tape and reel

SOP16



<Tape and Reel information>

|                   |                                                                                                                                                      |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tape              | Embossed carrier tape                                                                                                                                |
| Quantity          | 2500pcs                                                                                                                                              |
| Direction of feed | E2<br>( The direction is the 1 pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand ) |





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