

# DC to DC Converters

## Non-insulation, 8-pin SMD Type, 0.8 to 1.2W Output

Conformity to RoHS Directive

### CE-09 Series

#### SPECIFICATIONS AND STANDARDS

Part No.		CE-0970	CE-0994	CE-0994*1	CE-0972
Maximum output power	W	1.2	1.2	1.2	0.8
Input conditions					
Input voltage E <sub>dc</sub>	V	+4.5 to +5.5(+5typ.)	+4.5 to +5.5(+5typ.)	+4.5 to +5.5(+5typ.)	+4.5 to +5.5(+5typ.)
Efficiency(typ.) <sup>*2</sup>	%	82	85	85	72
Output characteristics					
Output voltage E <sub>dc</sub>	V	+3.3	+12	+15	-5
Maximum output current	mA	360	100	80	160
Output voltage total variation(max.)	%	±5	±5	±5	±5
Voltage stability	Input variation	%	0.05	0.5	0.05
	Load variation	%	0.1	1	0.1
	Temperature variation <sup>*3</sup>	%	0.3	3	0.3
Ripple noise Ep-p	(typ.) <sup>*4</sup>	mV	120	140	170
	(max.) <sup>*4</sup>	mV	250	350	250
Output capacitor Co <sup>*5</sup>	μF	68	22	22	22

Part No.		CE-0993	CE-0993*1	CE-0995
Maximum output power	W	0.8	0.8	0.8
Input conditions				
Input voltage E <sub>dc</sub>	V	+4.5 to +5.5(+5typ.)	+4.5 to +5.5(+5typ.)	+4.5 to +5.5(+5typ.)
Efficiency(typ.) <sup>*2</sup>	%	72	72	75
Output characteristics				
Output voltage E <sub>dc</sub>	V	-12	-15	-24
Maximum output current	mA	66	53	33
Output voltage total variation(max.)	%	±5	±5	±5
Voltage stability	Input variation	%	0.05	0.05
	Load variation	%	0.1	0.1
	Temperature variation <sup>*3</sup>	%	0.3	0.3
Ripple noise Ep-p	(typ.) <sup>*4</sup>	mV	100	100
	(max.) <sup>*4</sup>	mV	300	300
Output capacitor Co <sup>*5</sup>	μF	22	22	6.8

\*1 V<sub>set</sub> and +V<sub>out</sub>(or -V<sub>out</sub>) are shorted.

\*2 Typical input voltage, maximum output current.

\*3 The value when the temperature is changed from -10 to +50°C for the rated input and output.

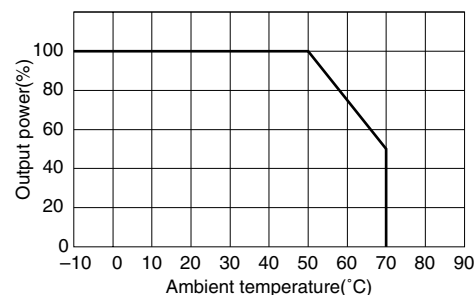
\*4 Measuring bandwidth: 50MHz

Output ripple noise is measured after connection of the indicated external capacitor Co to the output terminals.

\*5 Impedance: 3Ω max., loss angle: 0.06 max.

Recommended capacitor: TE Series(MATSUSHITA)

#### OUTPUT POWER - AMBIENT TEMPERATURE(DERATING)



#### COMMON SPECIFICATIONS

Operating temperature range(°C)	-10 to +70 [Derating is necessary when operating environment temperature exceed 50°C]
Storage temperature range(°C)	-40 to +85
Humidity range(%)RH	95 max. [Maximum wet-bulb temperature: 38°C, without dewing]

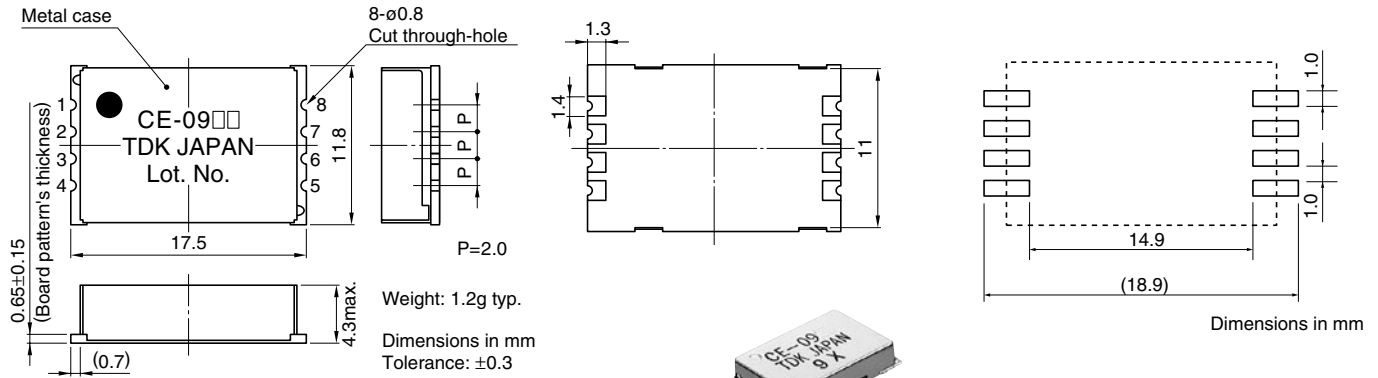
#### PRECAUTIONS

- These units are not equipped with overvoltage or overcurrent protection circuit for input or output (CE-0970 includes an overcurrent protection circuit).
- Install external input/output capacitors as close to the unit's terminal as possible. Excessive noise voltage may result if they are placed too far apart.
- These units are not equipped with input fuses. Please install an input fuse for safety if the input power capacity is 1A or greater or you require load protection in the unlikely event that the input and output are shorted due to a failure in the unit (0.5 to 1A withstand rush current fuse).
- Parallel operation to increase output current is not possible.
- These units cannot be washed.

• Conformity to RoHS Directive: This means that, in conformity with EU Directive 2002/95/EC, lead, cadmium, mercury, hexavalent chromium, and specific bromine-based flame retardants, PBB and PBDE, have not been used, except for exempted applications.

• All specifications are subject to change without notice.

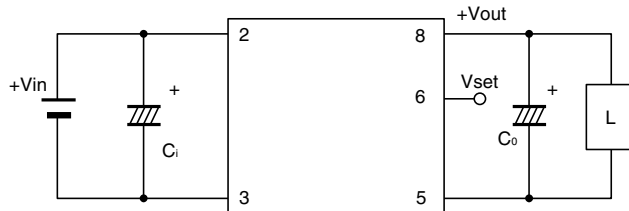
## SHAPES AND DIMENSIONS/RECOMMENDED PC BOARD PATTERN



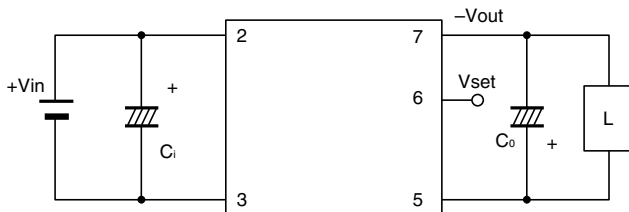
- Case is connected to GND.

## CIRCUIT DIAGRAMS

### CE-0970, CE-0994



### CE-0972, CE-0993, CE-0995

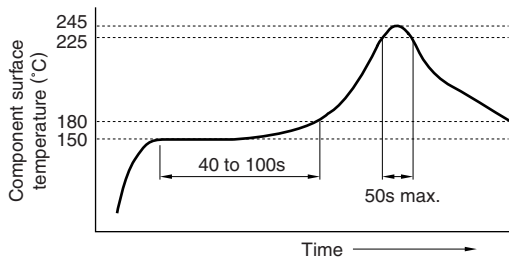


C<sub>i</sub> : External input capacitor (10V, 22μF)

C<sub>o</sub> : External output capacitor (please refer to Electrical Characteristics.)

L : Load (electronic load)

## RECOMMENDED REFLOW SOLDERING CONDITION



- This product should be used under the above reflow conditions as standards. When using this product under other reflow conditions, please consult TDK before use.

## TERMINAL CONNECTIONS

Type	Step-down type	Step-up type	Invert type
Part No.	CE-0970	CE-0994	CE-0972 CE-0993 CE-0995
No.1	NC	NC	NC
No.2	+Vin	+Vin	+Vin
No.3	-Vin(GND)	-Vin(GND)	-Vin(GND)
No.4	NC	NC	NC
No.5	GND	GND	GND
No.6	Vset	Vset	Vset
No.7	NC	NC	-Vout
No.8	+Vout	+Vout	NC

## MEASUREMENT SYSTEM

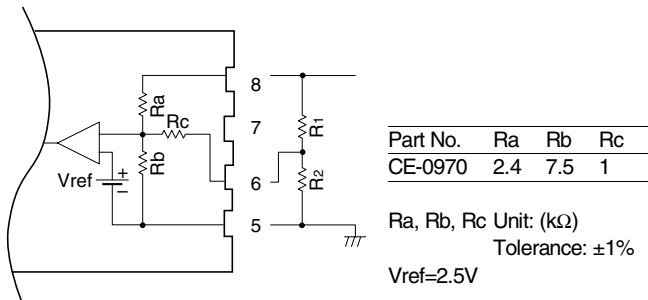
- Thermocouple  
K-thermocouple(ø0.23mm max.)
- Measurement equipment  
NR-250(Keyence Corporation)
- Reflow  
Infrared ray reflow  
FIP-150B  
(Nihon Den-Netsu Keiki Co., Ltd.)
- Higher temperature in the terminal section or in the upper portion

## ADJUSTABLE OUTPUT VOLTAGE (Vset)

Output voltage can be adjusted by externally connecting the R1 and R2.

### THE INTERNAL CIRCUIT OF THE PLUSE OUTPUT TYPE

#### CE-0970



#### CE-0970

For use in a high output voltage

$$V_o = \frac{3.3 \times R_2 + 9.3}{R_2 + 1} \quad \text{Unit: V, k}\Omega$$

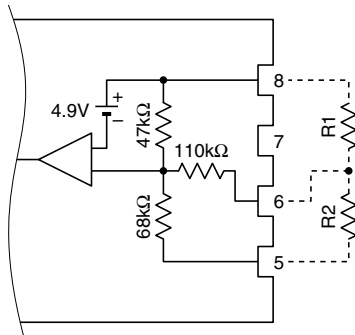
$$R_2 = \frac{9.3 - V_o}{V_o - 3.3} \quad 7.5 \leq R_2$$

For use in a low output voltage

$$V_o = \frac{3.3 \times R_1 + 9.3}{R_1 + 3.4} \quad \text{Unit: V, k}\Omega$$

$$R_1 = \frac{3.4 \times V_o - 9.3}{3.3 - V_o} \quad 3 \leq R_1$$

### AN INTERNAL CIRCUIT FOR THE CE-0994



#### CE-0994

For use in a high output voltage

$$V_o = \frac{12 \times R_1 + 1652}{R_1 + 110} \quad \text{Unit: V, k}\Omega$$

$$R_1 = \frac{1652 - 110 \times V_o}{V_o - 12}$$

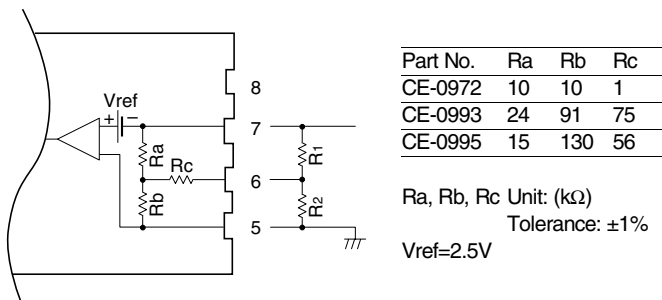
For use in a low output voltage

$$V_o = \frac{12 \times R_2 + 1652}{R_2 + 178} \quad \text{Unit: V, k}\Omega$$

$$R_2 = \frac{1652 - 178 \times V_o}{V_o - 12}$$

### THE INTERNAL CIRCUIT OF THE MINUS OUTPUT TYPE

#### CE-09 SERIES



#### CE-0972

For use in a high output voltage

$$V_o = -\frac{30 + 5 \times R_1}{R_1 + 1} \quad \text{Unit: V, k}\Omega$$

$$R_1 = \frac{30 - V_o}{V_o - 5} \quad 5.1 \leq R_1$$

For use in a low output voltage

$$V_o = -\frac{5 \times R_2 + 30}{R_2 + 11} \quad \text{Unit: V, k}\Omega$$

$$R_2 = \frac{30 - 11 \times V_o}{V_o - 5} \quad 1.5 \leq R_2$$

#### CE-0993

For use in a high output voltage

$$V_o = -\frac{12 \times R_1 + 1125}{R_1 + 75} \quad \text{Unit: V, k}\Omega$$

$$R_1 = \frac{1125 - 75 \times V_o}{V_o - 12}$$

For use in a low output voltage

$$V_o = -\frac{12 \times R_2 + 1126}{R_2 + 166} \quad \text{Unit: V, k}\Omega$$

$$R_2 = \frac{1126 - 166 \times V_o}{V_o - 12} \quad 120 \leq R_2$$

#### CE-0995

For use in a high output voltage

$$V_o = -\frac{24.16 \times R_1 + 1678.3}{R_1 + 56} \quad \text{Unit: V, k}\Omega$$

$$R_1 = \frac{1678.3 - 56 \times V_o}{V_o - 24.16}$$

For use in a low output voltage

$$V_o = -\frac{24.16 \times R_2 + 1678.3}{R_2 + 186} \quad \text{Unit: V, k}\Omega$$

$$R_2 = \frac{1678.3 - 186 \times V_o}{V_o - 24.16} \quad 270 \leq R_2$$

### PACKAGING STYLE AND QUANTITY

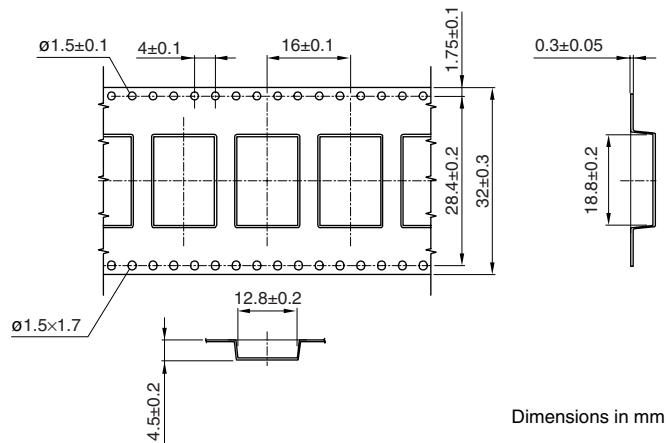
- Tray(1 layer: 50 pieces, 1 carton: 450 pieces max.)
  - Taping(500 pieces, 1 carton: 3 reels max.)
- When ordering taping product, please apply “-TP” on the end of Part No.  
Example: CE-0970-TP

The following items are indicated on the packing box:

1. Part No.
2. Quantity
3. Lot No. or manufacturing date
4. Name of manufacturing company

### TAPING SPECIFICATIONS

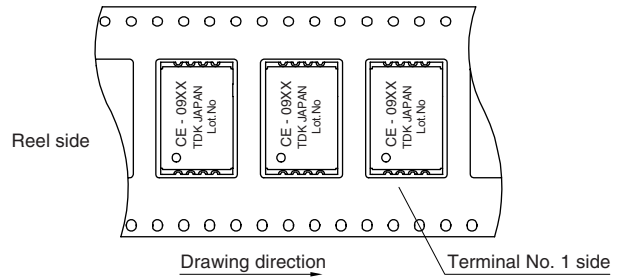
Carrier tape dimensions



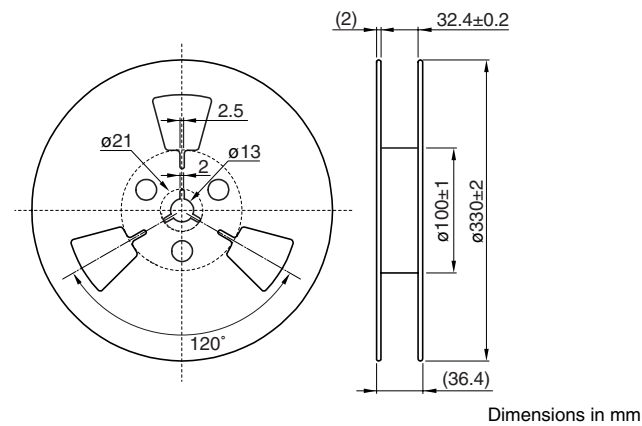
Dimensions in mm

### TAPING DIRECTION

View from cover tape



### Reel dimensions



Dimensions in mm

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