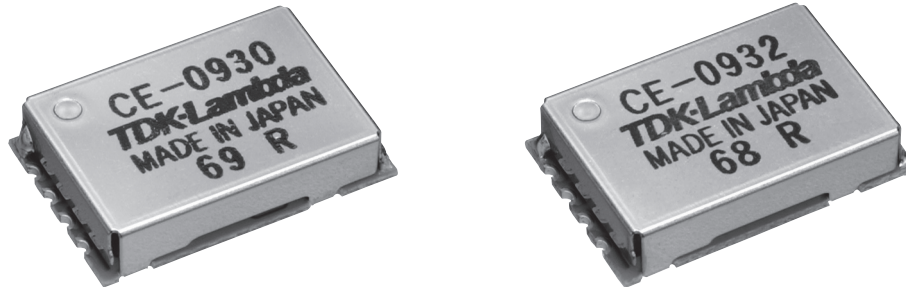# CE-09 XX   Non-insulation type DC-DC converter
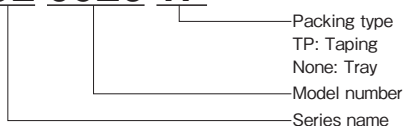

■ Features

- ●SMD type
- ●Short in height: 4.0mm or 4.3mm
- ●Equipped with variable output voltage (single output type only)
- ●Wide range of operating temperature conditions: -40℃ to +85℃ (CE-0994: -10℃ to +70℃)
- ●5-side metal-shielded low noise design
- ●Delivery in tray or by taping available

■ Model naming method

CE-0926-TP

- Packing type
  TP: Taping
  None: Tray
- Model number
- Series name

■ Applications

COMP   COM   F A   SEMI   Others

■ 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.

■ Product Line up

Model name	CE-0926	CE-0927	CE-0928 Discontinued	CE-0929 Discontinued	CE-0930	CE-0931	CE-0932	CE-0925A	CE-0928LC	CE-0952
Input voltage (V)	3.0-5.5	3.0-3.6	4.5-5.5	3.0-5.5	3.0-3.6	3.0-5.5	3.0-5.5	3.0-5.5	3.0-5.5	3.0-5.5
Output voltage (V)	±12.0	1.0-2.0	2.0-3.3	-1.8 - -2.5	4.0-5.8	±15.0	-4.0- -5.5	50-100	1.5-3.3	40-80
Output current (mA)	50/ch	600	600	300	300	40/ch	200	2	1200	2
Output power (W)	1.2	1.2	1.98	0.6	1.5	1.2	1.0	0.15	3.96	0.12

Model name	CE-0970 Discontinued	CE-0994 Discontinued		CE-0972 Discontinued	CE-0993 Discontinued		CE-0995 Discontinued
Input voltage (V)	4.5-5.5	4.5-5.5	4.5-5.5	4.5-5.5	4.5-5.5	4.5-5.5	4.5-5.5
Output voltage (V)	3.3	12	15	-5	-12	-15	-24
Output current (mA)	360	100	80	160	66	53	33
Output power (W)	1.2	1.2	1.2	0.8	0.8	0.8	0.8

CE-09xx Specifications

ITEMS/UNIT			MODEL	CE-0926	CE-0927	CE-0928 Discontinued	CE-0929 Discontinued	CE-0930	CE-0931	CE-0932	CE-0925A	CE-0928LC	CE-0952
Input	Nominal Voltage		V	DC3.3/5.0	DC3.3	DC5	DC3.3/5.0	DC3.3	DC3.3/5.0				
	Voltage Range		V	DC3.0-5.5	DC3.0-3.6	DC4.5-5.5	DC3.0-5.5	DC3.0-3.6	DC3.0-5.5				
	Efficiency (typ) (*1)		%	80		88	67	83		72	50	92	50
Output	Nominal Voltage		VDC	± 12.0	2.0	3.3	-2.0	5.0	± 15.0	-5.0	75	3.3	60
	Maximum Current (*2)		mA	50/ch	600		300		40/ch	200	2	1200	2
	Maximum Power (*3)		W	1.2		1.98	0.6	1.5	1.2	1.0	0.15	3.96	0.12
	Max Power Total Regulation (max)(*4)		%	± 5	± 4						± 5	± 4	± 5
	Maximum Ripple & Noise (typ) (*5)		mVp-p	50							20		
	Maximum Ripple & Noise (max)(*5)		mVp-p	100							150	100	150
	Voltage Adjustable Range		VDC	Fixed	1.0-2.0	2.0-3.3	-1.8--2.5	4.0--5.8	Fixed	-4.0--5.5	50-100	1.5-3.3	40-80
Function	Over Current Protection				Not available						Available		
	Over Voltage Protection				Not available								
	Remote ON/OFF Control				Not available								
Environment	Operating Temperature		℃	-40 to +85									
	Storage Temperature		℃	-40 to +85									
	Operating Humidity		% RH	10-95 (the conditions of maximum 38℃ in wet bulb temperature and non-condensation should be ensured.)									
	Storage Humidity		% RH	10-95 (the conditions of maximum 38℃ in wet bulb temperature and non-condensation should be ensured.)									
	Vibration			10-2000Hz, 4 minutes sweep and 98m/s² (10G) acceleration, 3 directions, 0.5h for each, in non-operation									
	Shock			980m/s² (100G), 6ms, 3 directions, 3 times for each, in non-operation									
Mechanical	Weight		g	1.5									
	Size (W x H x D)		mm	18 x 4 x 11.8									

(*1) In CE-0926: Vin=5V, and Io1=Io2=50mA.
In CE-0927: Vin=3.3V, nominal output voltage, Io=300mA.
In CE-0928: Vin=5.0V, nominal output voltage, Io=300mA.
In CE-0929/0930/0932: Vin=3.3V, nominal output voltage, Io=150mA.
In CE-0931: Vin=3.3V, Io1=Io2=40mA.
(*2) For the output side (Io2) of dual-output models (CE-0926/0931), refer to the items of output voltage setting in the instructions.
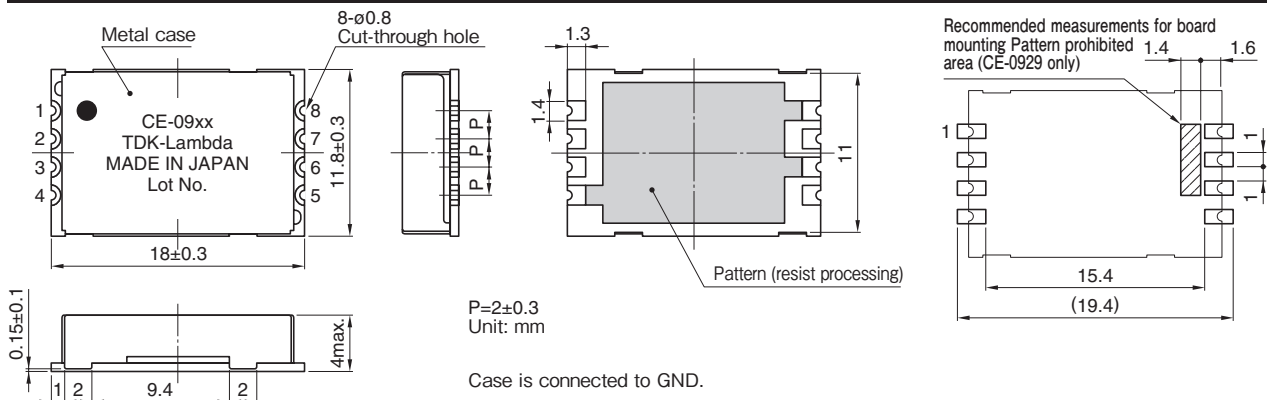(*3) The maximum output power value is that of nominal output voltage x maximum output current.
(*4) Max power total regulation (%) is the regulation of the set output voltage including load change, input change, and temperature change.
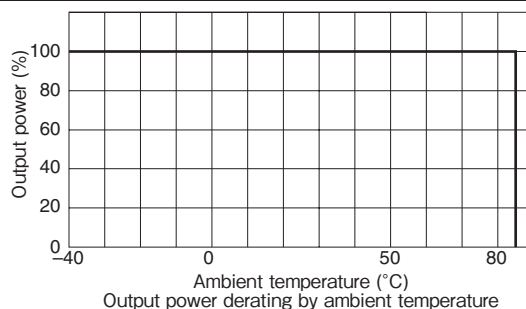Condition of Io2 for dual-output models (CE-0926/0931): 0.5 x Io1 < Io2 < 1.5 x Io2
(*5) In 20MHz, Ta=25℃.

With nominal input/output voltage, maximum output current, and Ta=25℃, if not specified separately.
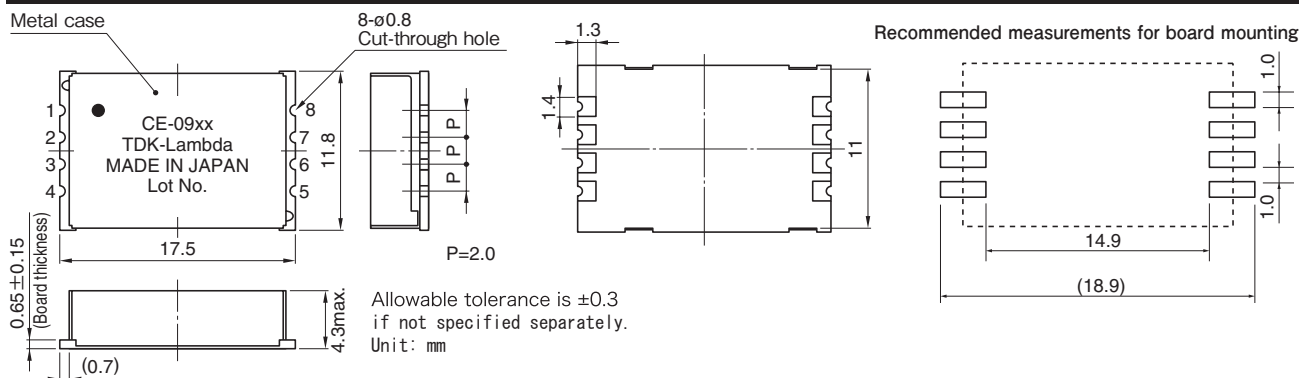
Outline Drawing

Metal case
8-ø0.8 Cut-through hole
CE-09xx
TDK-Lambda
MADE IN JAPAN
Lot No.
18±0.3
11.8±0.3
P=2±0.3
Unit: mm
0.15±0.1
9.4
4max.
1.3
1.4
11
Pattern (resist processing)
Recommended measurements for board mounting Pattern prohibited area (CE-0929 only)
1.4   1.6
15.4
(19.4)
Case is connected to GND.

Derating Curve

Output power derating by ambient temperature

· All specifications are subject to change without notice.

CE-09xx Specifications

ITEMS/UNIT	MODEL		CE-0970 Discontinued	CE-0994 Discontinued		CE-0972 Discontinued	CE-0993 Discontinued		CE-0995 Discontinued
Input	Voltage Range Nominal:5VDC	V	DC4.5-5.5						
	Efficiency (typ) (*1)	%	82	85			72		75
Output	Nominal Voltage (*2)	V	3.3	12	15	-5	-12	-15	-24
	Maximum Current	mA	360	100	80	160	66	53	33
	Maximum Power (*3)	W	1.2			0.8			
	Maximum Line Regulation Within input voltage range (typ)		0.05%	0.5%		0.02%	0.05%		
	Maximum Load Regulation (0-100%)(typ)		0.1%	1%		0.1%			
	Temperature Coefficient (-10 to 50°C)(typ) (*4)	%	0.3	3		0.3			
	Max Power Total Regulation (max)	%	± 5						
	Maximum Ripple & Noise (typ) (*5)	mVp-p	120	140	170	100			
	Maximum Ripple & Noise (max)(*5)	mVp-p	250	350		250	300		
	Acceptable Output Capacitorco (*6)	μF	68	22					6.8
Function	Over Current Protection		Available	Not available					
	Over Voltage Protection		Not available						
	Remote ON/OFF Control		Not available						
Environment	Operating Temperature	°C	-10 to +70						
	Storage Temperature	°C	-40 to +85						
	Operating Humidity	% RH	10-95 (the conditions of maximum 38°C in wet bulb temperature and non-condensation should be ensured.)						
	Storage Humidity	% RH	10-95 (the conditions of maximum 38°C in wet bulb temperature and non-condensation should be ensured.)						
	Vibration		10-500Hz, 15 minutes sweep and 98m/s² (10G) acceleration, 3 directions, 2h for each, in non-operation						
	Shock		980m/s² (100G), 6ms, 3 directions, 3 times for each, in non-operation						
Mechanical	Weight	g	1.2						
	Size (W x H x D)	mm	17.5 x 4.3 x 11.8						

(*1) In nominal input voltage, maximum output current, and Ta=25°C.
(*2) 15V in CE 0994 is the value when Vset and +Vset are short-circuited. -15V in CE 0993 is the value when Vset and +Vset are short-circuited.
(*3) The maximum output power value is between -10°C and +50°C. For use outside this temperature rage, derating is needed.
(*4) Temperature coefficient in -10°C - +50°C.
(*5) Frequency range in measurement (50MHz). Ripple & noise value is that in the condition where a specified external output capacitor Co is attached to the output terminal.
(*6) Use an external output capacitor with 3Ωmax. impedance and 0.06 max. loss angle. Recommended capacitor: TE series (MATSUSHITA)
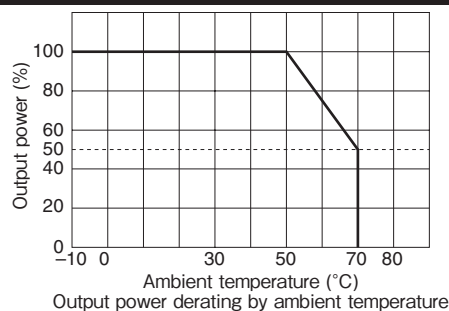
With nominal input/output voltage, maximum output current, and Ta=25°C, if not specified separately.

Outline Drawing

Metal case
8-ø0.8 Cut-through hole
CE-09xx TDK-Lambda MADE IN JAPAN Lot No.
17.5
11.8
P=2.0
0.65±0.15 (Board thickness)
(0.7)
4.3max.
Allowable tolerance is ±0.3 if not specified separately.
Unit: mm
1.3
1.4
11
Recommended measurements for board mounting
14.9
(18.9)
1.0
1.0
· Case is connected to GND.

Derating Curve

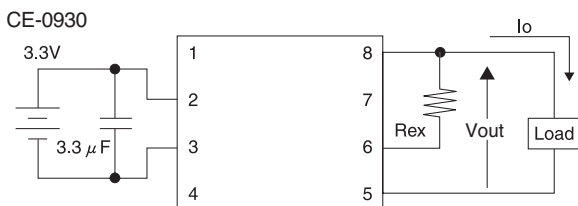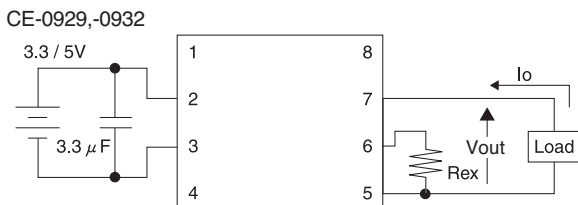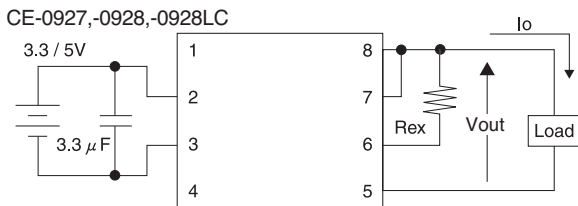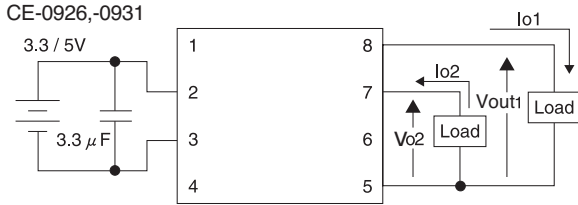Output power derating by ambient temperature

· All specifications are subject to change without notice.

CE-09xx Instruction Manual

1. CE-0926,-0927,-0928,-0929,-0930,-0931,-0932,-0925A,-0928LC,-0952

1-1. Connection diagram

CE-0926,-0931

CE-0927,-0928,-0928LC

CE-0929,-0932

CE-0930

CE-0925A,-0952
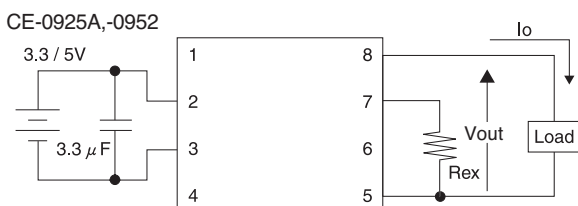
· The No. 1/3/5 terminals are the internally common GND terminals. However, if possible, use the No. 3 terminal for the input-side GND, and the No. 5 terminal for the output-side GND. (Or, use them as solid GND.)

· It is not necessary to connect the No. 1 terminal to GND.

1-2. Output voltage setting

Terminal assignments

	CE-0926 CE-0931	CE-0927 CE-0928 CE-0928LC	CE-0929 CE-0932	CE-0930	CE-0925A CE-0952
No.1	GND	GND	GND	GND	GND
No.2	Vin	Vin	Vin	Vin	Vin
No.3	GND	GND	GND	GND	GND
No.4	NC	NC	NC	NC	NC
No.5	GND	GND	GND	GND	GND
No.6	NC	Vset	Vset	Vset	NC
No.7	−Vo	+Vo	−Vo	NC	Vset
No.8	+Vo	+Vo	NC	+Vo	+Vo

1-3. Output voltage setting

To change the output voltage, calculate Rex by assigning the absolute value of the output voltage to Vout in the expression below, and attach it between the terminals to be connected.

| Model name	Terminal numbers to be connected	Expression
CE-0927	6-7	$Rex = \dfrac{5.90 \times Vout - 5.95}{2 - Vout}$
CE-0928	6-7	$Rex = \dfrac{13 \times Vout - 25.56}{3.3 - Vout}$
CE-0929	5-6	$Rex = \dfrac{34 \times Vout - 61}{2.5 - Vout}$
CE-0930	6-8	$Rex = \dfrac{46 \times Vout - 183}{5.83 - Vout}$
CE-0932	5-6	$Rex = \dfrac{98 \times Vout - 389}{5.5 - Vout}$
CE-0925A	5-7	$Rex = \dfrac{256 \times Vout - 12849}{100 - Vout}$
CE-0928LC	6-7	$Rex = \dfrac{10.2 \times Vout - 14.91}{3.3 - Vout}$
CE-0952	5-7	$Rex = \dfrac{197 \times Vout - 7859.4}{79.82 - Vout}$

Unit: V, kΩ

Total regulation (%) is the regulation of the set output voltage including load change, input change, and temperature change.
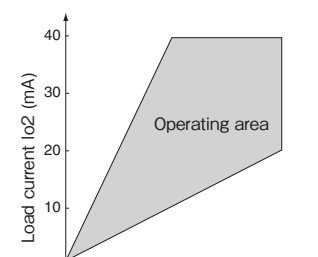
1-4. Output current range (dual-output type)

Observe the operating area shown in the figure below for the -output side (Io2) of the output model.
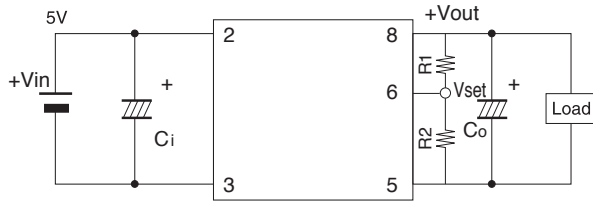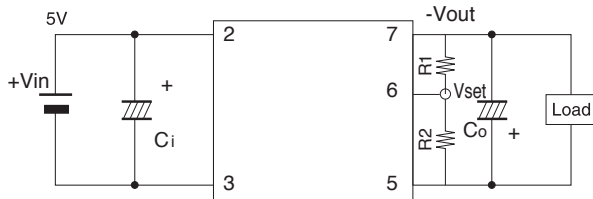
CE-0926
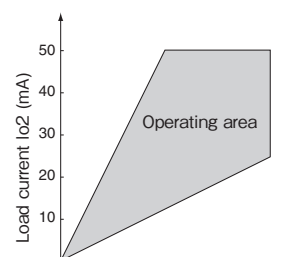
CE-0931

2. CE-0970,-0994,-0972,-0993,-0995

2-1. Connection diagram

CE-0970/CE-0994

CE-0972/CE-0993/CE-0995

Ci: External input capacitor (10V, 22µF)
Co: External output capacitor (Refer to specifications.)
L: Load (electronic load module)

2-2. Terminal assignments

Terminal assignments

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

2-3. Output voltage setting

To raise the output voltage, calculate R1 or R2 by assigning the absolute value of the output voltage to Vout in the expression below, and attach it between the terminals to be connected.

Model name	Terminal numbers to be connected	Expression
CE-0970	5-6	$R2 = \dfrac{9.3 - Vout}{Vout - 3.3}$
CE-0994	6-8	$R1 = \dfrac{1652 - 110 \times Vout}{Vout - 12}$
CE-0972	6-7	$R1 = \dfrac{30 - Vout}{Vout - 5}$
CE-0993	6-7	$R1 = \dfrac{1125 - 75 \times Vout}{Vout - 12}$
CE-0995	6-7	$R1 = \dfrac{1678.3 - 56 \times Vout}{Vout - 24.16}$

Unit: V, kΩ

To reduce the output voltage, calculate R1 or R2 by assigning the absolute value of the output voltage to Vout in the expression below, and attach it between the terminals to be connected.

Model name	Terminal numbers to be connected	Expression
CE-0970	6-8	$R1 = \dfrac{3.4 \times Vout - 9.3}{3.3 - Vout}$
CE-0994	5-6	$R2 = \dfrac{1652 - 178 \times Vout}{Vout - 12}$
CE-0972	5-6	$R2 = \dfrac{30 - 11 \times Vout}{Vout - 5}$
CE-0993	5-6	$R2 = \dfrac{1126 - 166 \times Vout}{Vout - 12}$
CE-0995	5-6	$R2 = \dfrac{1678.3 - 186 \times Vout}{Vout - 24.16}$

Unit: V, kΩ

· All specifications are subject to change without notice.

CE-09xx

3. Notes on mounting and handling

● The connection diagrams in these handling instructions represent the standard connection methods for this product. Consult us for use with other connection methods.

● When a choke coil is to be connected between the input power supply and the No.2 terminal, it should be of 4.7μH or lower Otherwise, maximum ripple voltage may increase.

● If the ripple voltage of the input power supply is high, or the ripple returned to input from the converter should be reduced, connect a capacitor with the appropriate capacity.

● For proper start-up of the converter, the start-up time of the input voltage should be 40ms or less. The time after the input voltage becomes 0.5V until it reaches the specified input voltage range, should be 40ms or less.

● Parallel operation of outputs for enhancing the output current of the converter is not applicable.

● Series connection is not applicable for this product.

● Input fuse is not installed in this product.

● Do not use this product in an overload condition. Doing so can cause failure.

● Cleaning is not applicable for this product.

● Use low-residue or non-cleaning flux.

● Notes on storage

Keep this product indoors with little temperature/humidity change and away from direct sunlight. Note that if this product is kept in a hot and humid condition or in a condition with drastic temperature changes, it can cause condensation, performance deterioration, or solderability deterioration.

Recommended reflow soldering conditions
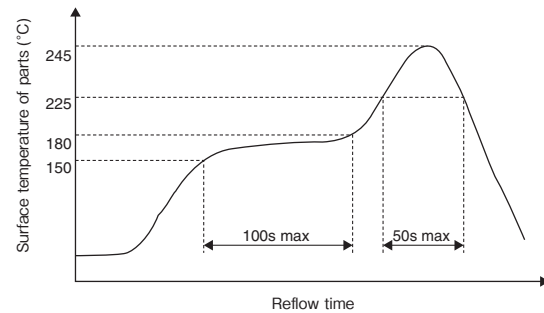
· Reflow frequency: 2 times max. (mounting on rear panel not allowed)
· Using soldering copper: Within 360°C and 3s (for product terminals)
· Flow soldering not allowed

Preheating temperature: 150°C-180°C, within 100s
Soldering temperature: 245°C or lower
Solder melting temperature: 225°C or upper, within 50s

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