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PRODUCT SPECIFICATIONS

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CUSTOMER'S PRODUCT NAME :

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TDK PRODUCT NAME : DC-DC CONVERTER UNIT  
CC6-xxxxxF-E Series

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***TDK-Lambda***

**TDK Corporation**  
**Power Systems Business Group**

DWG.No.	TRSA-0286-3
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Revised 2006/12/01

The specifications may be changed without prior notice.  
 When placing orders,  
 please confirm the product specifications through TDK sales or the distributor.

1. Part Name

The part name is the CC6-xxxxxF-E Series.

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TDK CORPORATION

# SAFETY INSTRUCTIONS

Please be sure to read these instructions for safe design when using the product.  
Improper use may pose the danger of smoke or fire.

## CAUTION Notes

### Storage

- Store the converter unit in the manner specified in the purchase specifications or catalog.
- Do not store the converter unit in a corrosive gas or corrosive dust environment.
- Do not store the converter unit in a strong electrical or magnetic field. It will cause damage.

### Environment & Conditions of Use

- Do not operate the converter unit in a corrosive gas or corrosive dust environment.
- Operate the converter unit in the environment and under the conditions specified in the purchase specifications or catalog.
- Operate the input and output voltage, output current, etc. within the rated electrical specifications.
- This converter has no built-in over voltage protection.
- A continuous over current condition may damage the converter.
- This DC to DC converter has a built-in input fuse, over current of any kind will cause the input to open.
- Be sure to insulate the metal case bottom from surrounding components and trace pattern.
- Do not operate the converter unit in a strong electrical or magnetic field.
- If there is the possibility of surge voltages occurring, take surge voltage prevention countermeasures.
- The metal case of this DC to DC converter is insulated from internal components. However, if high voltage parts contact the metal case, it may damage the internal components.
- Do not change or modify the product , TDK will not be responsible for any damage due to modification.
- Do not remove or disassemble the case.
- The converter unit is not designed to be resistant to radiation. Do not use it in nuclear power controls, medical equipment, etc.
- Give due design consideration for safeguarding against personal injury, fire and other accidents.
- The converter unit must be wired according to the measurement circuits given in the purchase specifications or catalog. Consult TDK concerning any other connection schemes in order to avoid possible damage. These converter units cannot be connected in parallel (Fig.1).
- These converters may be connected in series, to ensure reliable operation, TDK recommends the connection shown in Figure 2. The output current must not exceed the rated current of the smaller converter unit.
- Consult us when using this product in vehicles or in an environment where vibration is regularly applied.

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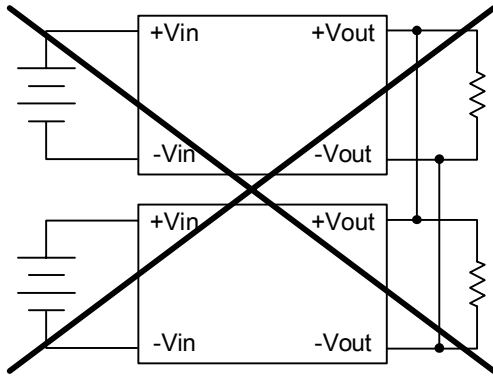


Fig.1 Parallel Connection

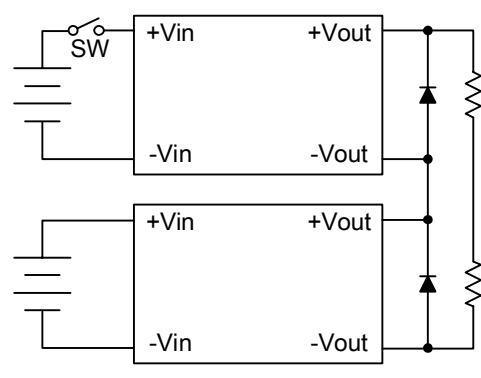
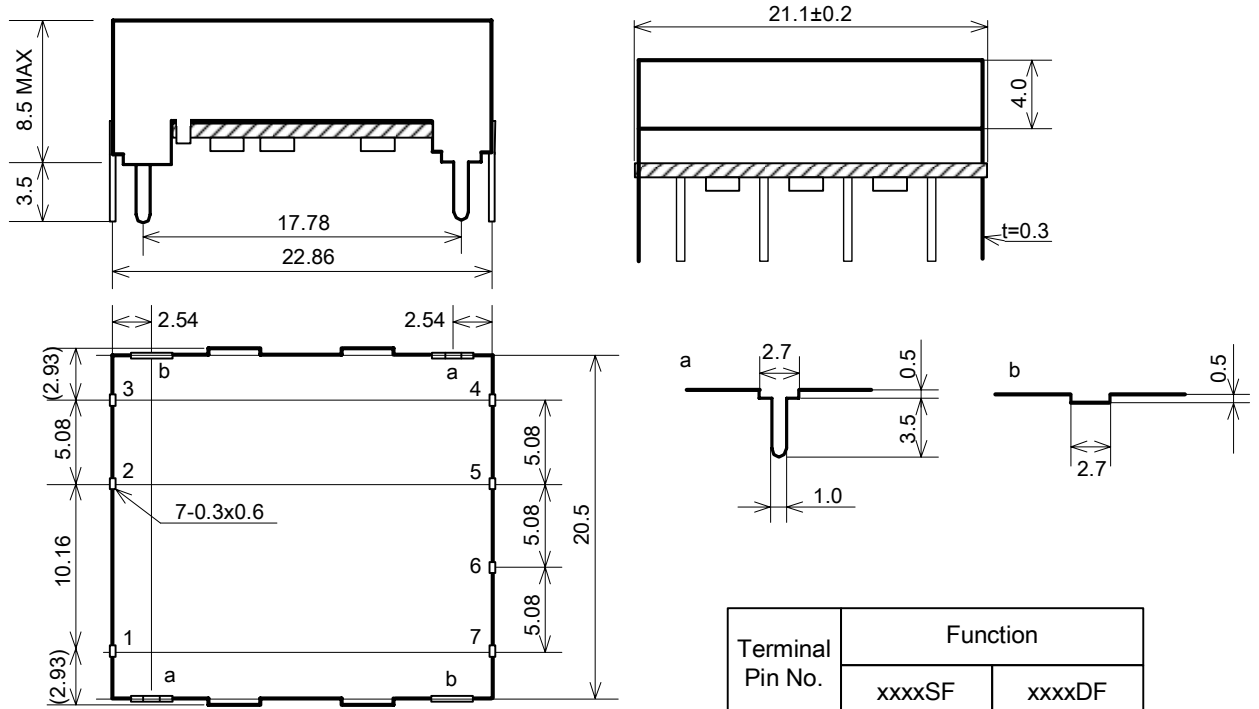


Fig.2 Connection to Ensure Reliable Series Operation

Other	
<ul style="list-style-type: none"> <li>• The converters in this document have limited 5 years warranty for defect in workmanship and components. The warranty is voided if the unit malfunction or damaged due to negligence and any of following reason but not limited to               <ul style="list-style-type: none"> <li>o Unauthorized modification or improper application</li> <li>o Mishandling such as improper transportation after product has been delivered to customer</li> <li>o Damage caused by natural disasters such as earthquake, fire, flood, wind</li> </ul> </li> <li>• It is not recommended for the converters to be stored for extended period (over one year) in high temperature, humidity or sudden temperature fluctuation environment as solder connections may be deteriorated.</li> <li>• It is not recommended to apply strong shock to the converter unit as it may be damaged.</li> </ul>	

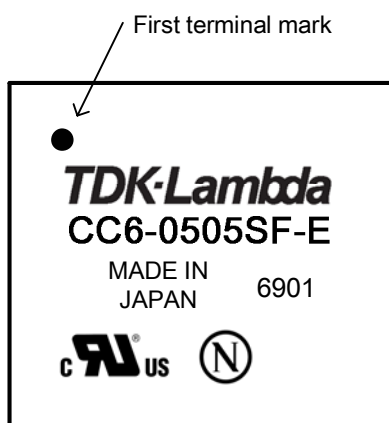
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[1] Mechanical Spec.



Tolerance : ±0.5  
 Dimensions in mm  
 Weight : 5.8g (Typ)

Terminal Pin No.	Function	
	xxxxSF	xxxxDF
1	+Vin	+Vin
2	RC	RC
3	-Vin	-Vin
4	NC	-Vout
5	-Vout	COM
6	TRM	TRM
7	+Vout	+Vout



Marking: Followings are marked on the converter case  
 Company Trademark, Model number, safety agencies (UL and Nemko mark),  
 First terminal mark, country of origin and production lot number

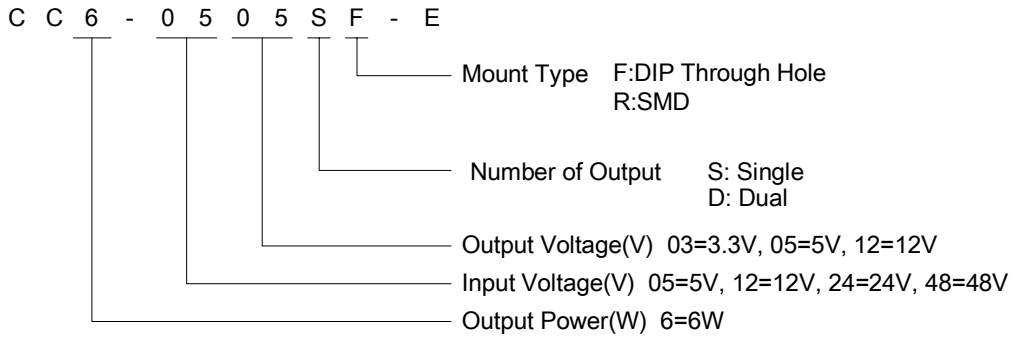
Lot Number details : September 1, 2006 = 6901

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Day  
 Month: month  
 (Jan: 1~ Sep: 9, Oct: X, Nov: Y, Dec: Z)  
 Year : final digit of year

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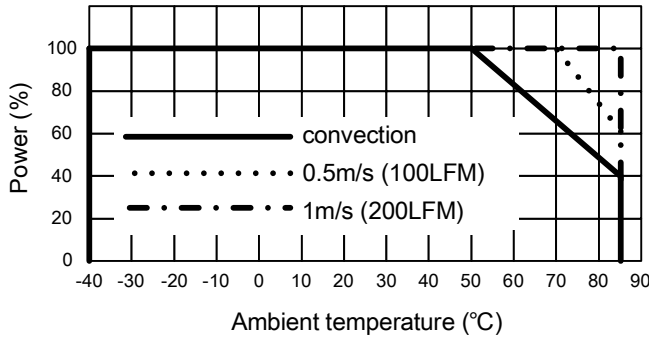
[2] Composition of product name



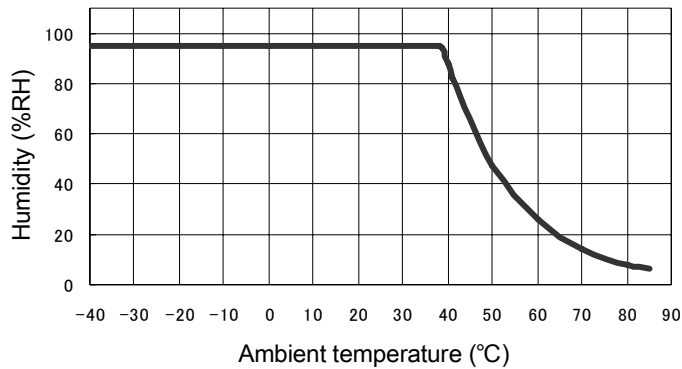
[3] Absolute Maximum Ratings

Item	Symbol	Specification	Notes
Input Voltage	Vin	See Table 1	
Output Current	Iout	See Table 1	
Operating Temperature	Topr	-40°C~85°C	At 50°C or above, refer to the Power derating curve.
Storage Temperature	Tstg	-40°C~85°C	
Storage Humidity	Hstg	95%R.H.	Maximum Wet Bulb Temperature: 38°C refer to the Humidity derating curve.

Power Derating Curve



Humidity Derating Curve



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Table 1

Item	Output Voltage(V)	Absolute Maximum Ratings		
		Input Voltage(V)	Output Current(A)	Output Power(W)
CC6-0503SF-E	3.3	9	1.2	3.96
CC6-0505SF-E	5	9	1.0	5.0
CC6-0512SF-E	12	9	0.5	6.0
	15	9	0.4	6.0
CC6-0512DF-E	±12	9	0.25	6.0
	±15	9	0.2	6.0
CC6-1203SF-E	3.3	18	1.2	3.96
CC6-1205SF-E	5	18	1.2	6.0
CC6-1212SF-E	12	18	0.5	6.0
	15	18	0.4	6.0
CC6-1212DF-E	±12	18	0.25	6.0
	±15	18	0.2	6.0
CC6-2403SF-E	3.3	36	1.2	3.96
CC6-2405SF-E	5	36	1.2	6.0
CC6-2412SF-E	12	36	0.5	6.0
	15	36	0.4	6.0
CC6-2412DF-E	±12	36	0.25	6.0
	±15	36	0.2	6.0
CC6-4803SF-E	3.3	76	1.2	3.96
CC6-4805SF-E	5	76	1.2	6.0
CC6-4812SF-E	12	76	0.5	6.0
	15	76	0.4	6.0
CC6-4812DF-E	±12	76	0.25	6.0
	±15	76	0.2	6.0

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[4] Electrical Characteristics

Item	Input Voltage (V)	Output Voltage (V) <sup>*1</sup>		Output Current (A)	Output Voltage Stability <sup>*2</sup>			Output Noise Voltage (mVp-p) max. <sup>*3</sup>	Eff (%) typ. <sup>*4</sup>	Input to Output Isolation
					LINE (mV) max.	LOAD (mV) max.	Temp (mV) max.			
CC6-0503SF-E	4.5~9	3.3	±3%	1.2	20	40	80	120	73	Input to Output Voltage 500VAC 1min. DC Resistance 500VDC 50MΩ min.
CC6-0505SF-E	4.5~9	5.0	±3%	1.0	20	40	80	120	77	
CC6-0512SF-E	4.5~9	12	±3%	0.5	40	100	200	120	82	
	4.5~9	15 <sup>*6</sup>	±3%	0.4	40	100	200	120	82	
CC6-0512DF-E <sup>*5</sup>	4.5~9	±12	±5%	0.25	80	600	300	120	81	
	4.5~9	±15 <sup>*6</sup>	±5%	0.2	80	600	300	120	81	
CC6-1203SF-E	9~18	3.3	±3%	1.2	20	40	80	120	74	
CC6-1205SF-E	9~18	5.0	±3%	1.2	20	40	80	120	79	
CC6-1212SF-E	9~18	12	±3%	0.5	40	100	200	120	82	
	9~18	15 <sup>*6</sup>	±3%	0.4	40	100	200	120	82	
CC6-1212DF-E <sup>*5</sup>	9~18	±12	±5%	0.25	80	600	300	120	81	
	9~18	±15 <sup>*6</sup>	±5%	0.2	80	600	300	120	81	
CC6-2403SF-E	18~36	3.3	±3%	1.2	20	40	80	120	73	
CC6-2405S-E	18~36	5.0	±3%	1.2	20	40	80	120	78	
CC6-2412SF-E	18~36	12	±3%	0.5	40	100	200	120	82	
	18~36	15 <sup>*6</sup>	±3%	0.4	40	100	200	120	82	
CC6-2412DF-E <sup>*5</sup>	18~36	±12	±5%	0.25	80	600	300	120	81	
	18~36	±15 <sup>*6</sup>	±5%	0.2	80	600	300	120	81	
CC6-4803SF-E	36~76	3.3	±3%	1.2	20	40	80	120	73	
CC6-4805SF-E	36~76	5.0	±3%	1.2	20	40	80	120	79	
CC6-4812SF-E	36~76	12	±3%	0.5	40	100	200	120	81	
	36~76	15 <sup>*6</sup>	±3%	0.4	40	100	200	120	81	
CC6-4812DF-E <sup>*5</sup>	36~76	±12	±5%	0.25	80	600	300	120	80	
	36~76	±15 <sup>*6</sup>	±5%	0.2	80	600	300	120	80	

<sup>\*1</sup> Total output voltage range

<sup>\*2</sup> Input Voltage : Vin = min.~ max., Iout = max., Topr = 25°C

Output Current : Vin = typ., Iout = 0 ~ max., Topr = 25°C

Products with Two Outputs: at Balanced Load (the +output and -output load currents are in equal condition)

Temperature : Vin = typ., Iout = max., Topr = -40 ~ +50°C

<sup>\*3</sup> Measured with a 50MHz Bandwidth oscilloscope

<sup>\*4</sup> Vin = typ. Iout = max.

<sup>\*5</sup> Dual outputs units can be used as a single output units with output voltage range of 24 ~ 30V when output return (COM) is not used.

<sup>\*6</sup> When using the 15V output, short the Vout and TRM terminals.

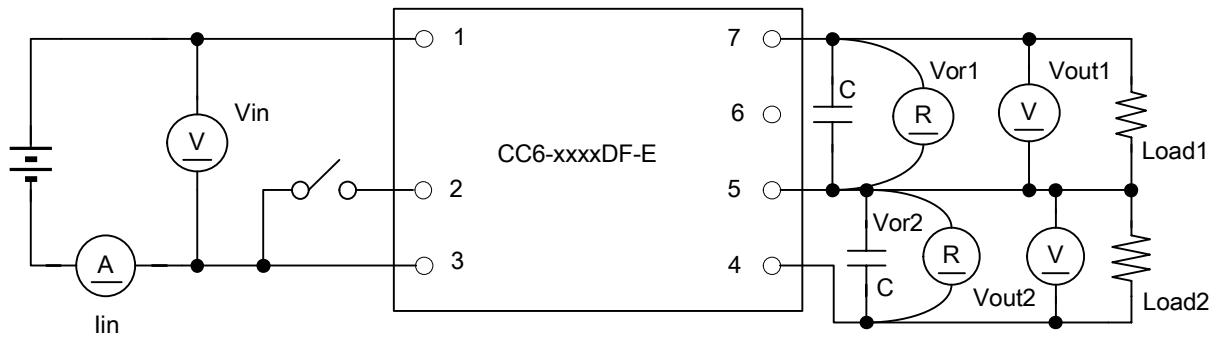
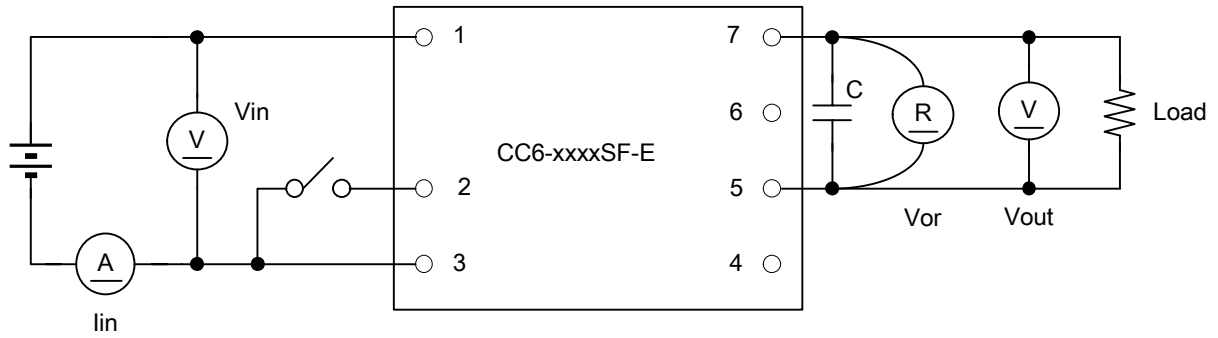
<sup>\*7</sup> The output voltage can be varied as follows:

3.3V: 3.15~3.6V 5V: 4.75~6V 12V: 11.4~15V ±12V: ±11.4~±15V (22.8~30V)

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[5] Test Circuit



Test Instruments

- Ⓧ : 0.5 Class DC current ammeter 2012 (YEW) or equivalent.
- ⓐ : Digital voltmeter HP3455A (HP) or equivalent.
- Ⓡ : Ripple voltmeter RM-100 (Keisoku Giken, BW 50MHz) or equivalent.
- C : Multi-layer ceramic capacitor 0.1mF

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[6] Reliability

Item	Test Conditions	Criteria
High Temperature	Temperature : 50 <sup>+5</sup> <sub>-0</sub> °C Time : 1000 hours Operation : Vin : Typical Load = Maximum	No abnormality in electrical characteristics or external appearance, either before or after, the test.
Heat Shock	Low Temperature : -40 <sup>+0</sup> <sub>-3</sub> °C High Temperature : +85 <sup>+3</sup> <sub>-0</sub> °C 100cycles	
Humidity	Temperature : 60 <sup>+5</sup> <sub>-0</sub> °C Humidity : 90~95%R.H Time : 1000 hours Operation : Vin = Rated Input, Load = Minimum	
Vibration	Frequency : 10~55Hz Sweep Time : 15 minutes Amplitude : 1.52mmp-p Vibration Time : 2 hours each in X,Y and Z directions	
Shock	Peak Acceleration : 100G Duration of the pulse : 6msec Number of test : 3times in each axis for total of 18 times	
High Temperature Storage	Temperature : 85°C Time : 1000 hours	
Solderability	Temperature : 245±5°C Time : 5±1s	
Lead Strength	Tensile Strength : 5N 10±1s Torsion Strength : 2.5N	There must be no breakage or loosening.
Low Temperature Start	Temperature : -40±3°C Time : 72 hours	Normal start.

[7] Soldering Condition

Dip Soldering : 260°C 10sec. max.  
Hand Soldering : 380°C 3sec. max.  
(soldering iron)

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[8] Functions

8-1. On/Off function(RC)

The converter can be turned on or off by using RC terminal(2 pin).

On function / Start operation: RC terminal is Low ( 0 ~ 0.4 with respect to -Vin)

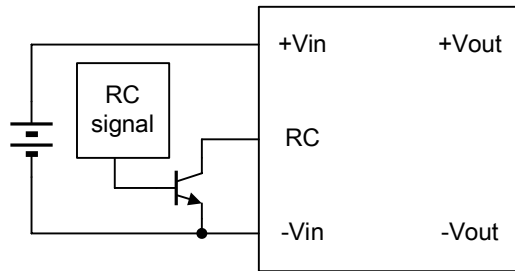
Off function / Stop operation: RC terminal is Open or High

Note:

RC Current : external circuitry requires to sink maximum of 1mA during on function.

RC Voltage: Maximum voltage is +Vin

Output voltage can be adjusted up or down by connecting a resistor between Output TRM pin and the output (+Vin or -Vin) as shown below.



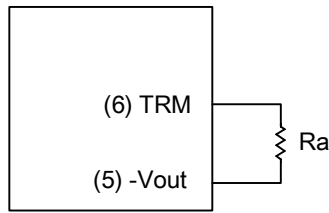
8-2. Output Voltage Adjustment

It is possible to adjust the output voltage as shown below by connecting the TRM terminal to the -Vout terminal. When you don't want to adjust the output voltage, open the TRM terminal.

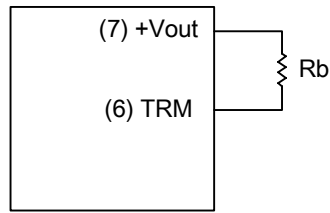
Product	Open	Short to -Vout terminal
CC6-xx03SF-E	3.3V	3.6V
CC6-xx05SF-E	5.0V	6.0V
CC6-xx12SF-E	12.0V	15.0V
CC6-xx12DF-E	±12.0V	±15.0V

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It is possible to adjust the output voltage by connecting a resistor between the TRM terminal and either the -Vout terminal or the +Vout terminal as shown below.



Increase output voltage



Decrease output voltage

Connect resistor(Rb) between TRM( 6)and +Vout(7) as below formula.

CC1R5-xx03SF-E	$V_{out} = 3.3 - 15.53 / (39.6 + R_b)$	$R_b \geq 62$ The range of the change is up to 3.15V.
	$R_b = 15.53 / (3.3 - V_{out}) - 39.6$	
CC1R5-xx05SF-E	$V_{out} = 5.01 - 52.55 / (31.8 + R_b)$	$R_b \geq 160$ The range of the change is up to 4.75V.
	$R_b = 52.55 / (5.01 - V_{out}) - 31.8$	
CC1R5-xx12SF-E	$V_{out} = 12.01 - 431.1 / (57 + R_b)$	$R_b \geq 620$ The range of the change is up to 11.4V.
	$R_b = 431.1 / (12.01 - V_{out}) - 57$	
CC1R5-xx12DF-E	$V_{out} = 12.02 - 968.5 / (103 + R_b)$	$R_b \geq 1500$ The range of the change is up to 11.4V.
	$R_b = 968.5 / (12.02 - V_{out}) - 103$	

Connect resistor(Ra) between -Vout(5) and TRM(6) as below formula.

CC1R5-xx03SF-E	$V_{out} = 3.3 + 9.59 / (32 + R_a)$
	$R_a = 9.59 / (V_{out} - 3.3) - 32$
CC1R5-xx05SF-E	$V_{out} = 5.01 + 17.64 / (17.8 + R_a)$
	$R_a = 17.64 / (V_{out} - 5.01) - 17.8$
CC1R5-xx12SF-E	$V_{out} = 12.01 + 50.53 / (16.9 + R_a)$
	$R_a = 50.53 / (V_{out} - 12.01) - 16.9$
CC1R5-xx12DF-E	$V_{out} = 12.02 + 53.55 / (18 + R_a)$
	$R_a = 53.55 / (V_{out} - 12.02) - 18$

**Caution :** Do not use the converter over its rated output power; care must be taken when output voltage is adjusted up as it could significantly affect output power.

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8-3. Output Over Current Protection (OCP) :

OCP is activated when output Over Current (OC) is detected (105 to 250% of nominal output current) .  
 Converter is auto recovery, if OC is removed.  
 However, manual recovery is necessary if OC condition continues for more than 30 sec.  
 If auto recovery is not activated for some reason, please shut off the converter and restart the converter.  
 If you require the converter to be latched up during over current condition, please consult your TDK representative for recommendation of adding an external circuitry to RC terminal.

8-4. Output Over Voltage Protection :

This converter does not have an output over voltage protection function.  
 Consult your TDK representative for recommendation of adding external circuitry to RC terminal.

8-5. Output Under Voltage Protection :

This converter does not have an output over voltage protection function.  
 Consult your TDK representative for recommendation of adding external circuitry to RC terminal.

8-6. Under Voltage Lock out :

This product is equipped with a low input voltage protection circuit in order to prevent miss-operation when the input voltage is low. The converter stops operating when it falls below the voltage setting. The setting range is shown in the table below.

Product	Low Input Voltage Protection Setting Range
CC6-05xxxF-E	3.3~4.5V
CC6-12xxxF-E	6.0~9.0V
CC6-24xxxF-E	13.0~18.0V
CC6-48xxxF-E	27.0~36.0V

8-7. Input Circuit Protection :

The converters are equipped with input fuse. Fuses rating and capacity are shown in below table

Product	Rated Current	Fusing Current
CC6-05xxxF-E	5A	10A or more
CC6-12xxxF-E	2.5A	5A or more
CC6-24xxxF-E	1.25A	2.5A or more
CC6-48xxxF-E	0.75A	1.5A or more

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[9] Packaging and Marking

Components are packaged to prevent damage from moisture and handling. The following items shall be marked:

1. Manufacturer's part number CC6-xxxxF-E (Ex: CC6-0505SF-E)
2. Name of manufacturer TDK

[10] Environment

This product complies with Restriction of Hazardous Substances (RoHS) directive that refers to the regulation of harmful substances by the European Union (EU) effective July 1, 2006. The directive bans the use of six specific harmful substances in electric and electronic devices and products handled within the EU. The six substances are lead, mercury, cadmium, hexavalent chromium, PBB (polybrominated biphenyls), and PBDE (polybrominated diphenylethers).

[11] Test Condition

Unless specified otherwise, the following specification applies:

Ambient Temperature: 20±15°C  
 Relative Humidity: 65±20%

[12] Other precaution

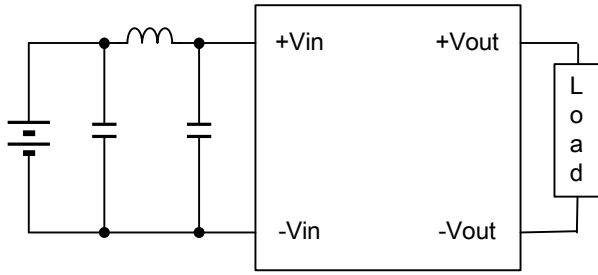
- Under normal conditions, this product will operate even without connecting an external capacitor. However, if there is a desire to further decrease noise or if the pattern layout is too long, connect a capacitor within the range shown in the table below.

Product	Output Capacitor range
CC6-xx03SF-E	220uF max.
CC6-xx05SF-E	220uF max.
CC6-xx12SF-E	100uF max.
CC6-xx12DF-E	100uF max.

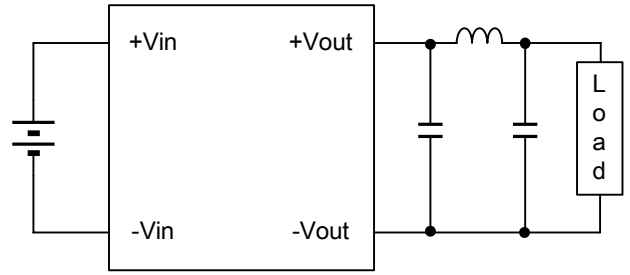
- We recommend that the substrate not be washed after soldering. However, depending on the conditions, it is possible in some situations, therefore consult us concerning this.
- This product is certified to the following safety standards: UL60950-1, CUL(CSA 60950-1), EN60950-1 (NEMKO)

No.	MATERIAL NAME	QU	MATERIAL	REMARKS
PRODUCT NAME or MODEL, TITLE				
DC-DC CONVERTER UNIT CC6-xxxxF-E Series				
TDK CORPORATION	NAME OF DRAWING		DRAWING No.	PAGE
	PRODUCT SPECIFICATIONS		TRSA-0286-3	13 / 17

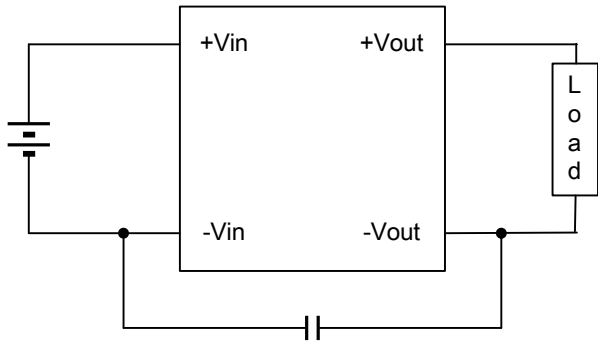
Connection Examples



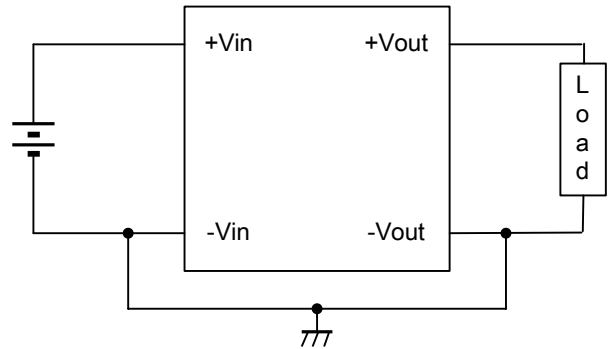
Connection to reduce input ripple voltage



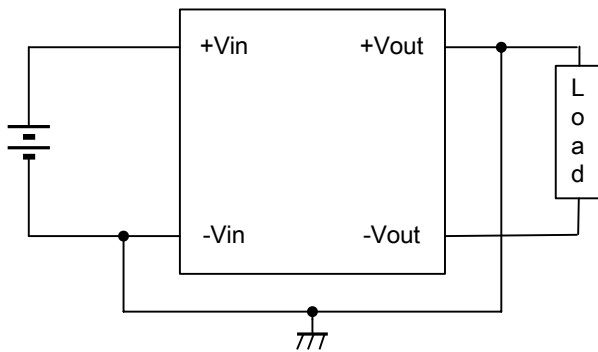
Connection to reduce output ripple voltage



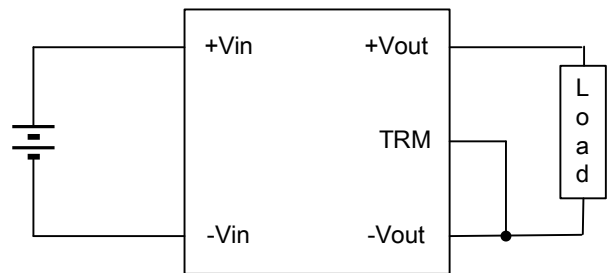
Connection to reduce common mode noise



Connection to use non-isolation



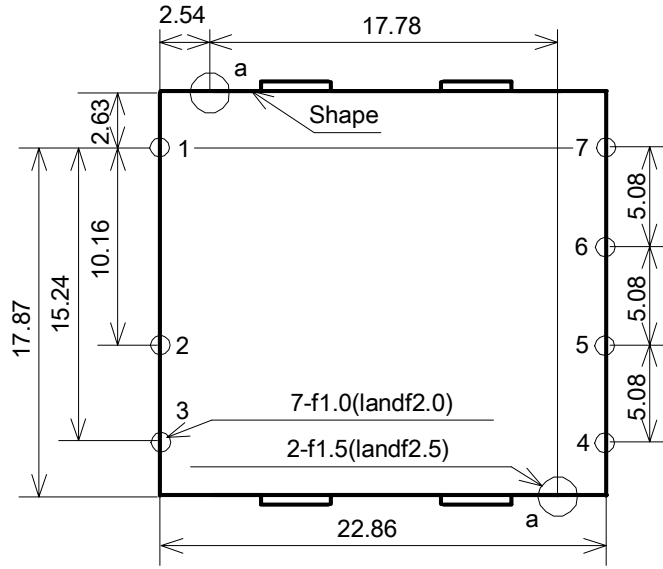
Connection to use turn around output voltage



Connection to use maximum output voltage

No.	MATERIAL NAME	QU	MATERIAL	REMARKS
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DC-DC CONVERTER UNIT CC6-xxxxxF-E Series				
NAME OF DRAWING			DRAWING No.	PAGE
PRODUCT SPECIFICATIONS			TRSA-0286-3	14 / 17

Recommended PWB Hole Size and Location



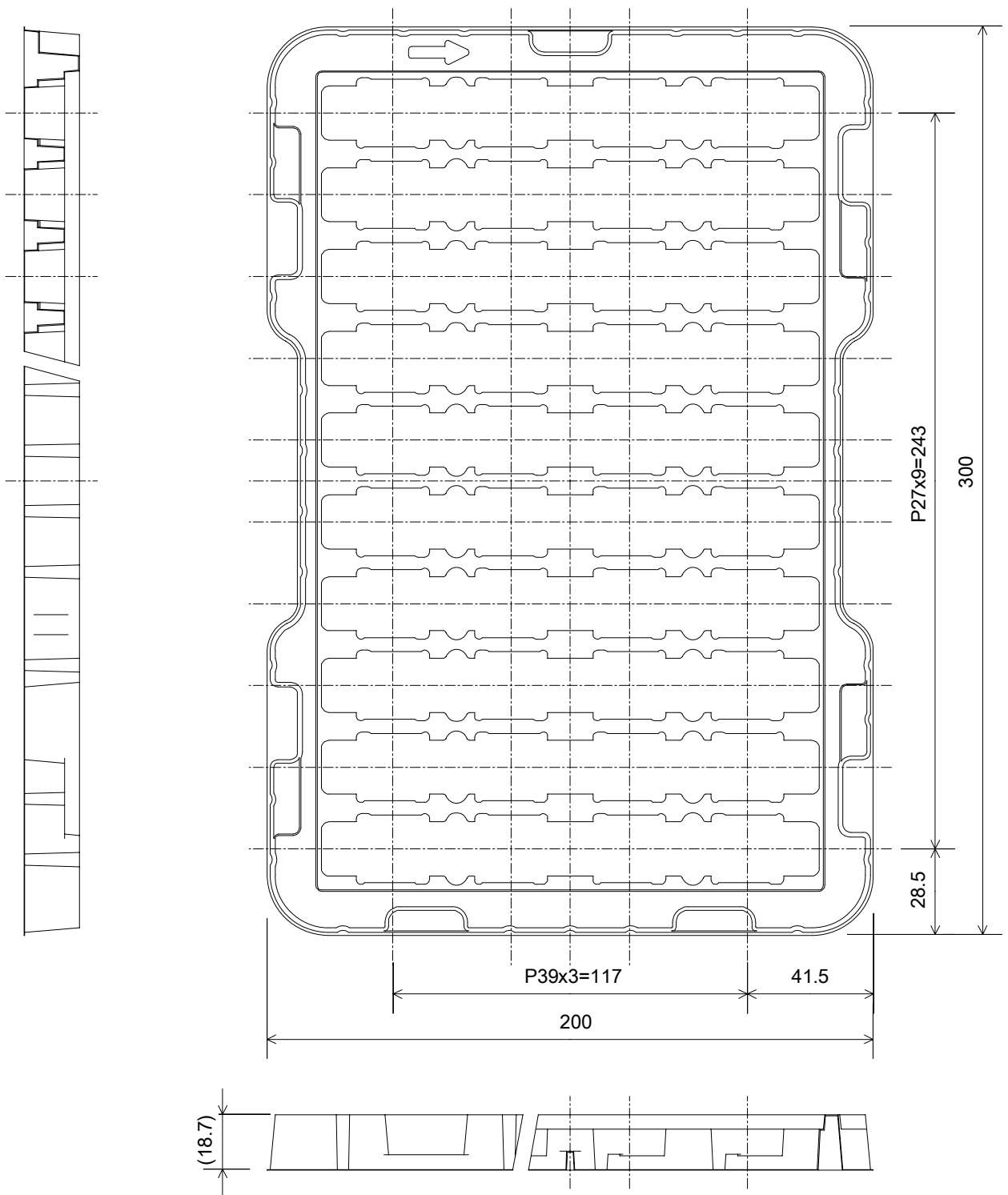
TOP VIEW

No.	MATERIAL NAME	QU	MATERIAL	REMARKS
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DC-DC CONVERTER UNIT CC6-xxxxxF-E Series				
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[13] Packing Specification



Dimensions in mm

Material : Electrification Prevention Polystyrene  
 Quantity : 40 pieces MAX

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NAME OF DRAWING			DRAWING No.	PAGE
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Cardboard

Dummy tray

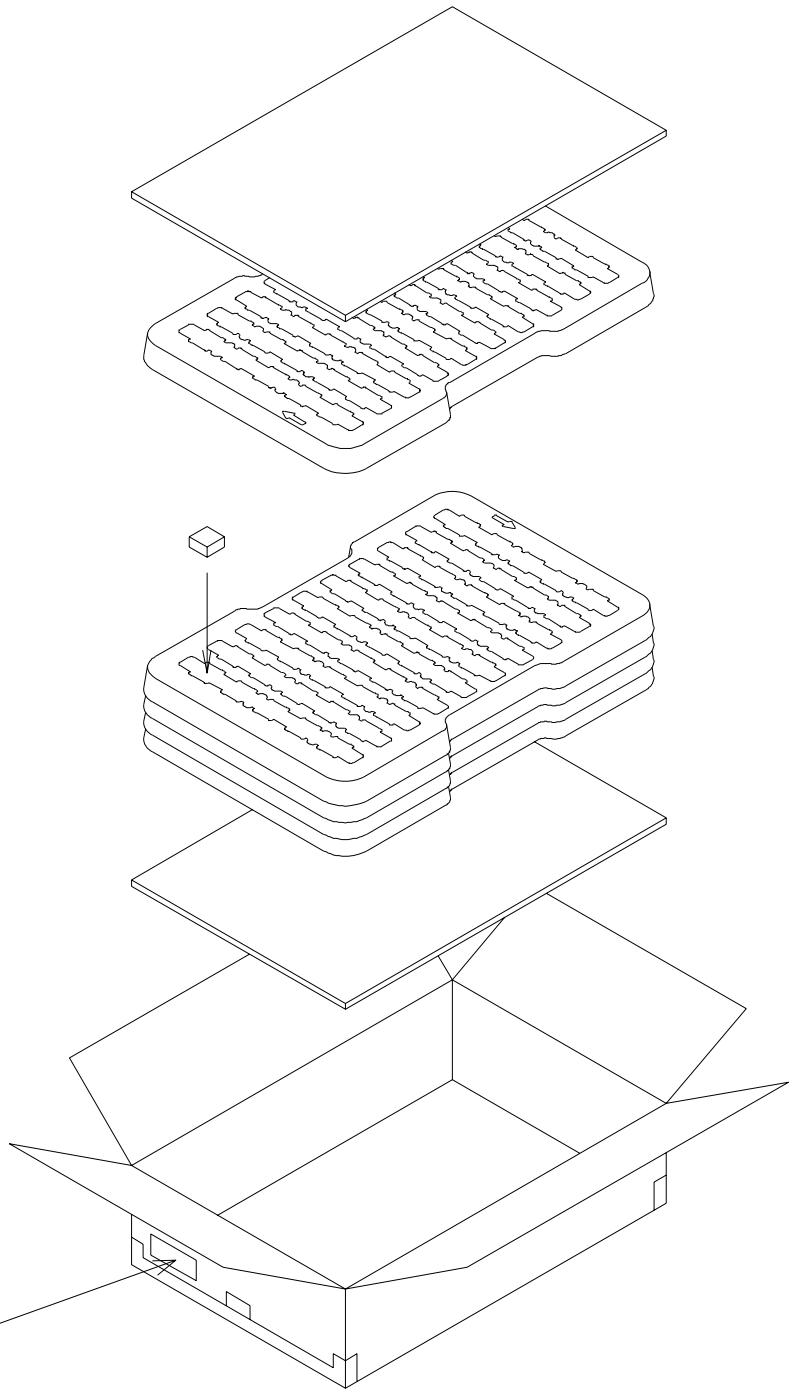
Tray (electric charge prevention type)

(40pcs)x4= 160pcs/ box  
The tray direction is alternated.

Cardboard

Outer Carton  
(321mm:L)x(221mm:W)x(104mm:H)

LABEL  
TDK Part No.  
Manufacturer  
Customer Part No.  
QTY.  
Inspection No.  
Country of Origin



No.	MATERIAL NAME	QU	MATERIAL	REMARKS
PRODUCT NAME or MODEL, TITLE				
DC-DC CONVERTER UNIT CC6-xxxxxF-E Series				
TDK CORPORATION	NAME OF DRAWING		DRAWING No.	PAGE
	PRODUCT SPECIFICATIONS		TRSA-0286-3	17 / 17