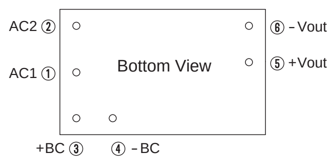
Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
TUHS3F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS5F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS10F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS15F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS25F	Flyback converter	80-250 *3	*1	Thermistor	glass fabric base,epoxy resin		Yes	Yes	*2

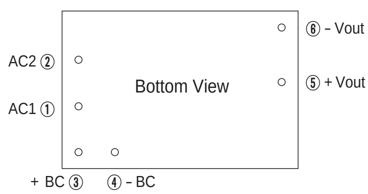
*1 Refer to Specification.
*2 Refer to instruction manual.
*3 The value changes depending on input and load.

1 Pin Connection

●TUHS3/TUHS5



●TUHS10/TUHS15



●TUHS25

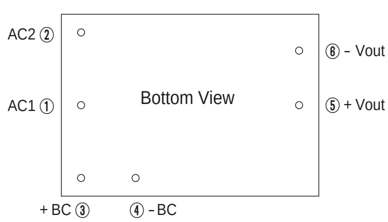


Fig.1.1 Pin connection (bottom view)

Table 1.1 Pin connection and function

No.	Pin Connection	Function
①	AC1	AC input
②	AC2	
③	+BC	+BC output
④	-BC	-BC output
⑤	+VOUT	+DC output
⑥	-VOUT	-DC output

2 Connection for Standard Use

■To use TUHS series, connection shown in Fig.2.1 (a) or (b) and external components are required.

●AC input or DC input

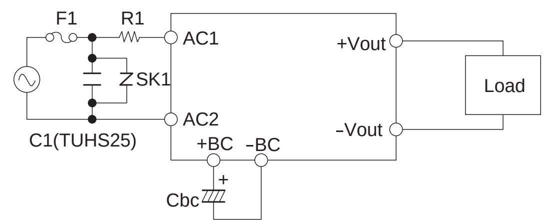


Fig.2.1(a) Connection for standard use (AC input or DC input)

Table 2.1 External components

No.	Symbol	Components	Reference
1	F1	Input fuse	3.1 “Wiring input pin (1)”
2	C1	Input Capacitor	3.1 “Wiring input pin (2)”
3	R1	Inrush current protection resistor	3.1 “Wiring input pin (3)”
4	Cbc	Smoothing Capacitor	3.1 “Wiring input pin (4)”
5	SK1	Surge Protective Device	3.1 “Wiring input pin (5)”

●DC input

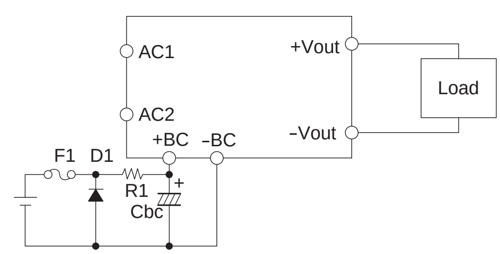


Fig.2.1(b) Connection for standard use (DC input)

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) F1:External fuse

■Fuse is not built-in on input side. In order to protect the unit, install the slow-blow type fuse on input side (as shown in Table 3.1).
In the case of using DC input, please use a DC fuse.

Table 3.1(a) Recommended fuse (AC input)

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Rated current	2A	2A	2A	2A	3.15A

Table 3.1(b) Recommended fuse (DC input)

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Rated current	2A	2A	2A	2A	2A

(2) C1:Input Capacitor(TUHS25)

To comply with conducted noise CISPR22-B, EN55022-B, connect capacitor C1 which is 0.1μF or more at AC input terminal.

(3) Cbc:Smoothing capacitor

■In order to smooth voltage, connect Cbc between +BC and -BC. Recommended capacitance of Cbc is shown in Table3.2.Hold-up time and load factor is shown in figure 3.1-figure 3.10.
■Keep the capacitance within the allowable external capacitance.
■Select a capacitor of which the ripple voltage does not exceed 25Vp-p.
■When the power supply is operated under -20degC, it may cause the smoothing voltage unstable due to the characteristic of equivalent series resistor. Please choose the capacitor which has more than recommended capacitance.

Table 3.2 Input Capacitor C1

No.	Model	Rated Input Voltge	Cbc	Allowable capacitance range
1	TUHS3	DC400V or more (AC200Vin) DC200V or more (AC100Vin)	18μF	4.7μF to 68μF
2	TUHS5		22μF	10μF to 68μF
3	TUHS10		47μF	22μF to 150μF
4	TUHS15		68μF	33μF to 220μF
5	TUHS25		120μF	47μF to 390μF

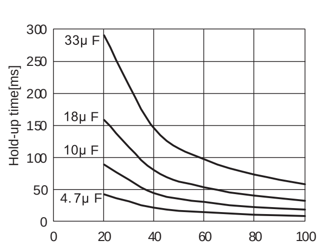


Fig.3.1 TUHS3 hold-up time(AC100V)

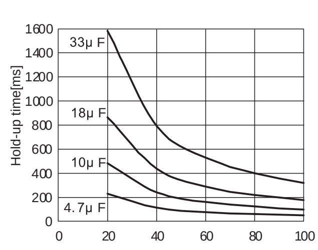


Fig.3.2 TUHS3 hold-up time(AC200V)

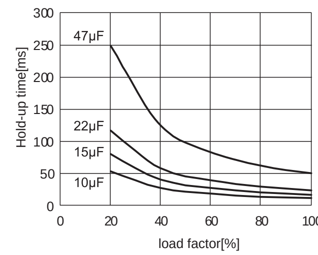


Fig.3.3 TUHS5 hold-up time(AC100V)

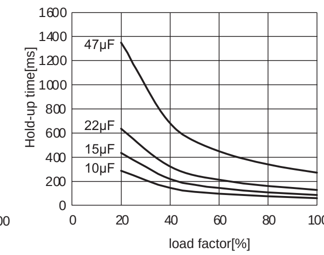


Fig.3.4 TUHS5 hold-up time(AC200V)

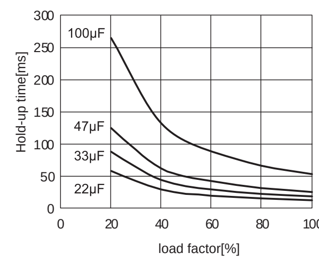


Fig.3.5 TUHS10 hold-up time(AC100V)

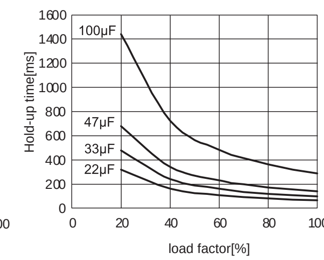


Fig.3.6 TUHS10 hold-up time(AC200V)

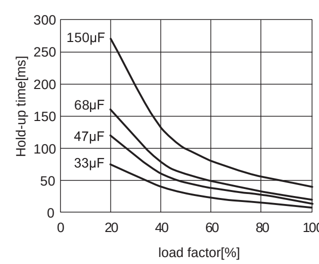


Fig.3.7 TUHS15 hold-up time(AC100V)

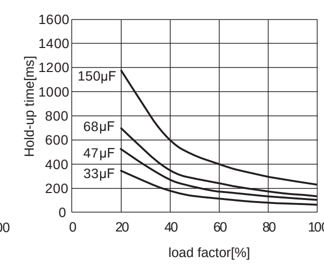


Fig.3.8 TUHS15 hold-up time(AC200V)

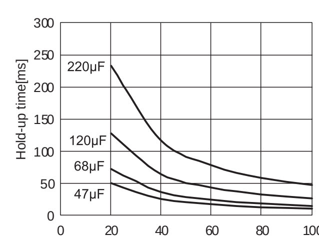


Fig.3.9 TUHS25 hold-up time(AC100V)

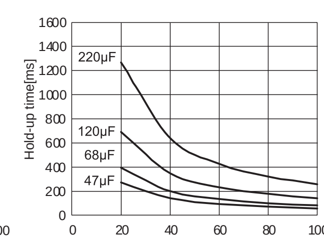


Fig.3.10 TUHS25 hold-up time(AC200V)

(4) R1: Inrush current limiting resistor

■Connect resistor R1 between AC input and power supply to limit inrush current to 50A(TUHS3/5/10/15) and 60A(TUHS25).
Select a resistor which has enough permissible current capability.
■The power thermistors are heat-generating components. Pay attention to the rated operating temperature when using the power thermistors.
■When the power turns ON/OFF repeatedly within a short term, please keep enough interval to cool down the power supply before turning it on again.
■In this case, recommend using thermistor with thermal resistor in parallel or inrush current limiting circuit by triac.

(5) SK1: Surge Protective Device

■Connect a surge protective device to improve Surge immunity.

(6) D1: Reverse Input Voltage Protection(DC input)

■Avoid the reverse polarity input voltage. It cause the power supply failure. It is possible to protect the unit from the reverse input voltage by installing an external diode.

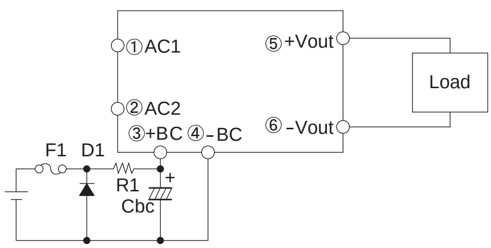


Fig.3.11 Reverse input voltage protection

3.2 Wiring output pin

(1) Co:Output capacitor

■In the TUHS series, the output capacitor is basically unnecessary. Reduce the ripple voltage by connecting the output capacitor.

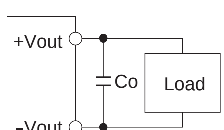


Fig.3.12 Connecting Example of an External Capacitor to the Output Side

■Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply.
Recommended capacitance of Co is shown in Table 3.3.
■If output current decreases rapidly, output voltage rises transiently and the overvoltage protection circuit may operate.
In this case, please install a capacitor Co.

Table 3.3 Recomemended capacitance Co

No.	output voltage	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
1	5V	0 - 100μF	0 - 100μF	0 - 330μF	–	0 - 1000μF
2	12V	0 - 47μF	0 - 47μF	0 - 150μF	0 - 150μF	0 - 470μF
3	24V	0 - 22μF	0 - 22μF	0 - 68μF	0 - 68μF	0 - 220μF

■The specified ripple and ripple noise are measured by the method introduced in Fig.3.13.

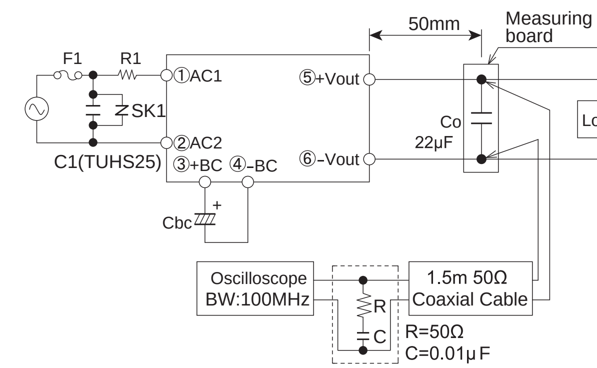


Fig.3.13 Method of Measuring Output Ripple and Ripple noise

■When connect the output to FG of an equipment, a noise may become big. The noise can be reduced by connecting external filter and grounding capacitor on the input side.

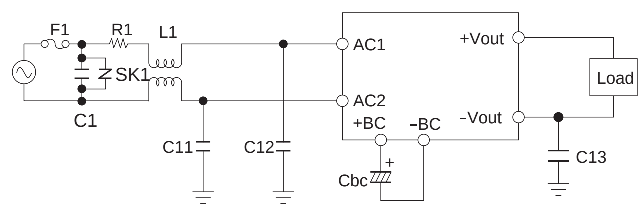
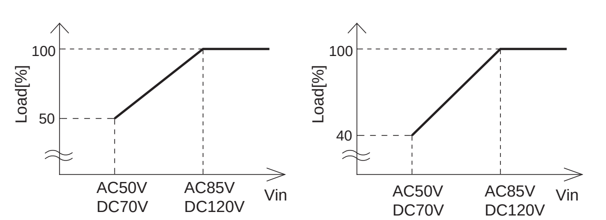


Fig.3.14 Recomemended circuit of connect output to FG

4 Function

4.1 Input voltage range

■The range is from AC85V to AC264V or DC120V to DC370V (please see SPECIFICATIONS for details).
■In case of less than AC85V or DC120V, it is possible to operate continuously by input voltage derating as shown Fig.4.1.
■In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz) and DC120-DC370V.



(a)TUHS3 (b)TUHS5,TUHS10,TUHS15,TUHS25

Fig.4.1 Input voltage derating

4.2 Overcurrent protection

■Overcurrent protection is built-in and comes into effect at over 105% of the rated current.
Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

■When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.3 Overvoltage protection

■The overvoltage protection circuit is built-in and comes into effect at 110% to 160% of the rated output voltage. When the load factor is less than 30%, output voltage may be increased more than maximum voltage depending on the failure mode.

■Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.4 Isolation

■For a receiving inspection, such as Hi-Pot test, increase (decrease) the voltage gradually for a start (shut down). Avoid using Hi-Pot tester with timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

4.5 Reducing standby power

■A circuit reducing standby power is built in TUHS.
(standby power : 0.5W max)
The load factor: Io=0-30%, the internal switch element is intermittent operated, and the switching loss is decreased. The specification of the Ripple/Ripple Noise changes by this intermittent operation. The value of the ripple/ripple Noise when intermittent operates changes in the input voltage and the output current. Please contact us for details.

5 Series and Parallel Operation

5.1 Series operation

■Series operation is available by connecting the outputs of two or more power supplies as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

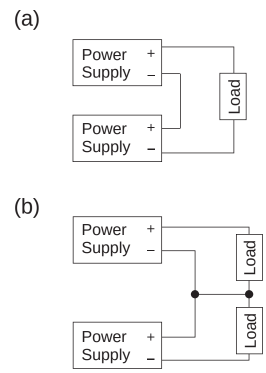


Fig.5.1 Examples of series operation

5.2 Parallel operation

■Parallel operation is not possible.

■Redundancy operation is available by wiring as shown below.

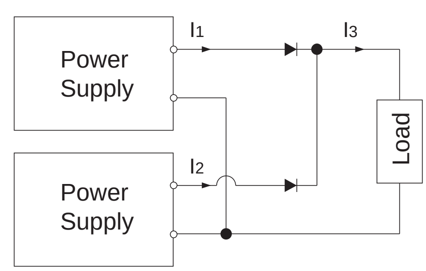


Fig.5.2 Example of Redundancy Operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2.
Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$I_3 \leqq$ the rated current value

TUHS

5.3 Various connection methods

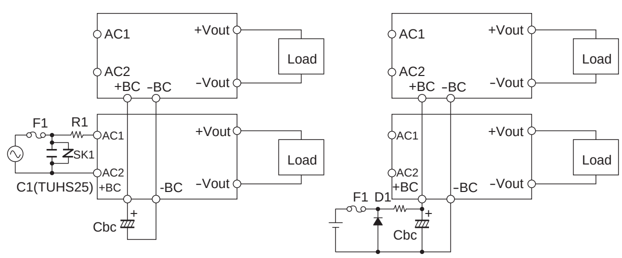
■Using one smoothing capacitor, up to two TUHS can be operated. Shown an example in Fig.5.3.

■Total output wattage must be less than the maximum wattage of TUHS which AC is supplied.

■When connect different wattage of TUHS, please input AC into the power supply which the wattage is higher.

■When smoothing capacitor is commonly used, noise may become big because of the length of the power line. The noise can be attenuate by connecting Line Filter between TUHS and R1.

■Avoid connecting AC input and DC input at the same time because it may damage the TUHS or an equipment(Fig.5.4).



(a) AC input , Cbc common (b) DC input , Cbc common

Fig.5.3 TUHS connect method

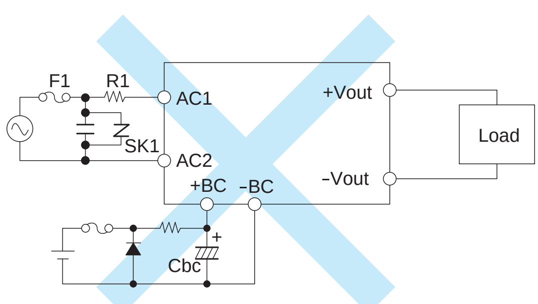


Fig.5.4 TUHS Connection prohibition

5.4 Long hold-up time connection

■It is possible that setting the hold-up time of the power supply for a long time by connecting like Fig.5.5. Please set the charge current of the CL to become less than 1A. Please use the diode which reverse voltage is 600V or more.Please contact us for detail.

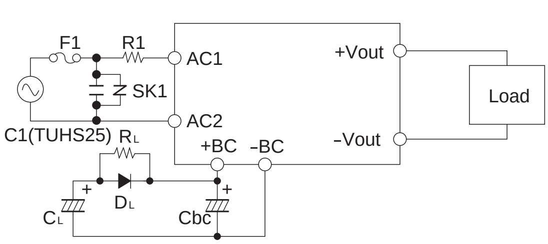


Fig.5.5 Long hold-up time connection

6 Implementation・Mounting Method

6.1 Mounting method

■The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.

■Avoid placing the AC input line pattern layout underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.

■Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.

6.2 Stress to the pins

■Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.

■Input/output pin are soldered to the PCB internally. Do not pull or bend a lead powerfully.

■If it is expected that stress is applied to the input/output pin due to vibration or impact, reduce the stress to the pin by taking such measures as fixing the unit to the PCB by silicone rubber, etc.

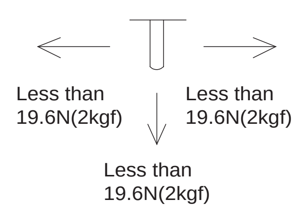


Fig. 6.1 Stress to the pins

6.3 Cleaning

■If you need to clean the unit, please clean it under the following conditions. Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning Cleaning agent: IPA (Solvent type)

Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning

■Please dry the unit sufficiently after cleaning.

■If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/ℓ or below.

6.4 Soldering

■Flow soldering: 260℃ for up to 15 seconds.

■Soldering iron (26W): 450℃ for up to 5 seconds.

7 Derating

■It is necessary to note thermal fatigue life by power cycle. Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

■Please have sufficient ventilation to keep the temperature of point A in Fig.7.1 at Table7.1 or below. Please also make sure that the ambient temperature does not exceed 85℃.

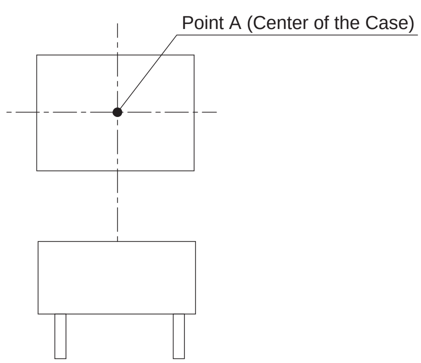


Fig.7.1 Temperature Measuring Point on the case (Top View)

Table 7.1 Point A Temperature

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Point A	105℃	105℃	105℃	100℃	100℃

7.1 Derating curve(TUHS3)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

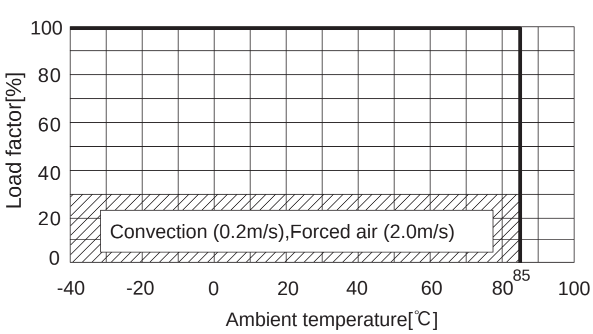


Fig.7.2 Ambient temperature Derating curve(TUHS3)

7.2 Derating curve(TUHS5)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

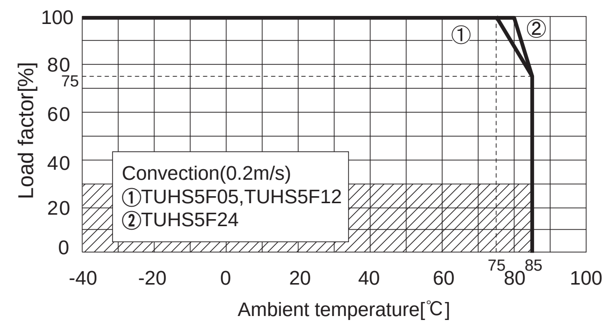


Fig.7.3 Ambient temperature Derating curve(convection cooling)

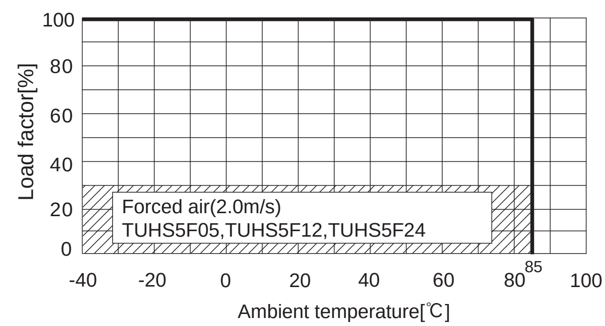


Fig.7.4 Ambient temperature Derating curve(Forced air)

7.3 Derating curve(TUHS10)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

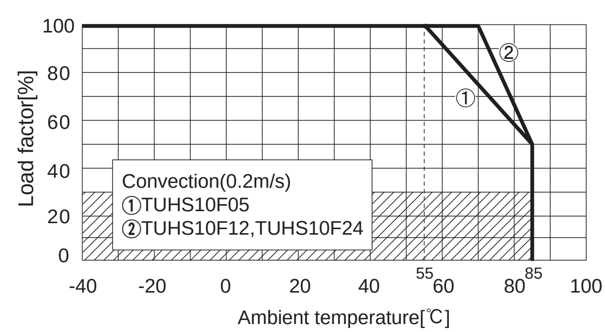


Fig.7.5 Ambient temperature Derating curve(convection cooling)

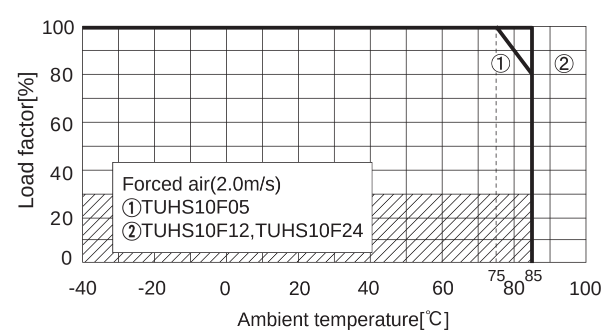


Fig.7.6 Ambient temperature Derating curve(Forced air)

7.4 Derating curve(TUHS15)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

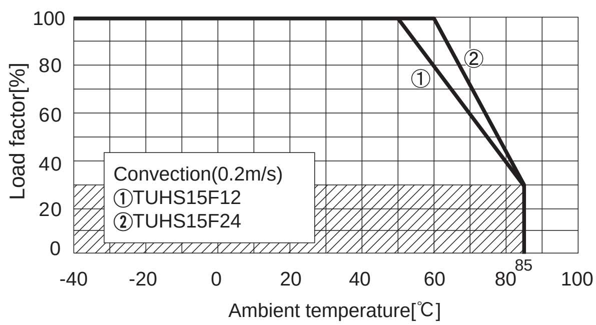


Fig.7.7 Ambient temperature Derating curve(convection cooling)

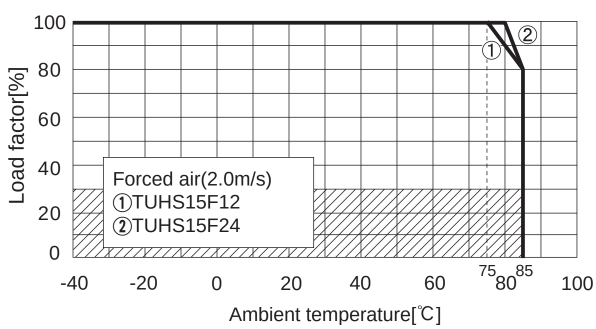


Fig.7.8 Ambient temperature Derating curve(Forced air)

7.5 Derating curve(TUHS25)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

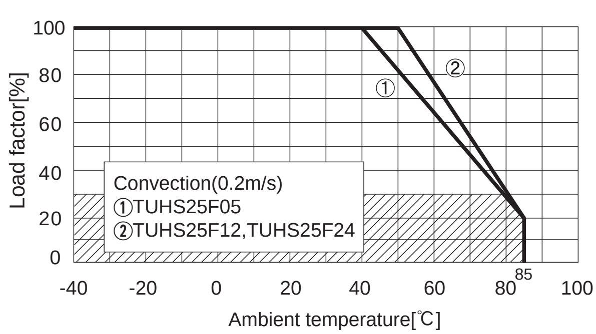


Fig.7.9 Ambient temperature Derating curve(convection cooling)

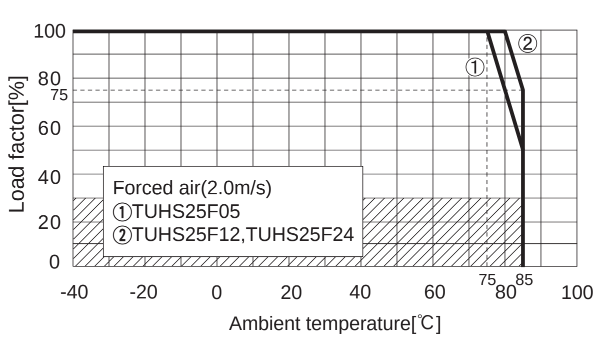


Fig.7.10 Ambient temperature Derating curve(Forced air)

Application manuals available at our website.
Recommended external components are also introduced for your reference.