

Switching power supplies

## ■ Ordering Information

**BF E 3.3 SX-U 1**

Series name

60950-1 safety standard certified  
Safety standard certified (U: UL, C-UL, EN Listed)  
Input voltage type (X: Wide input AC85-264V)  
No. of output (S: Single output)  
DC output voltage  
Output power (D: 100W class, E: 150W class)

## ■ Features

- Ultra-small size (40mm smaller depth compared to equivalent product in the industry)
- Synchronous rectification system adopted (output 6V or less)
- Harmonic current complies to IEC61000-3-2
- Low cost
- High power factor BFE : 0.98/0.93 (AC100V/230V) (except for 3.3V)
- High efficiency
- Line Conducted Noise : Designed to meet FCC Class A, EN55022 Class B, or VCCI Class B
- Safety standard : UL60950-1, CSA60950-1, and EN60950-1 certified, CE (LV directive) compliant



## ■ General Description

2. Allowable Input Voltage Range	AC85 to 264V
2. Output Voltage Range	±10%
3. Input Regulation	Rated output voltage × 0.3% (maximum)
4. Drift	Rated output voltage [V] × 0.4%, for 8 hour period after 1 hour warm-up
5. Recovery Time	5mS (typical)
6. Power Factor Correction	Built-in active filter
7. Withstanding Voltage	Input-Output : AC3000V, Input-Frame Ground : AC2500V, Output-Frame Ground : AC500V
8. Vibration	Capable of with standing vibration along X, Y, and Z axes (5-10Hz : 10 [mm] double amplitude, 10-55Hz : acceleration 19.6 [m/s <sup>2</sup> ])
9. Shock	Impact force 294 [m/S <sup>2</sup> ]

## BF Series (Input Voltage AC85-264V)

## 100W/150W Class

## Single output

## ■ Product Lineup

[Single output]

Wattage	Type	Models	Input voltage(DC)	Output current	◎Efficiency	Price
100W	BFD-SX	BFD 3.3SX-U1	3.3V	20A	77/79%	¥7,800
		BFD 05SX-U1	5V	20A	80/84%	
		BFD 06SX-U1	6V	17A	81/85%	
		BFD 09SX-U1	9V	11.4A	81/85%	
		BFD 12SX-U1	12V	8.6A	82/86%	
		BFD 15SX-U1	15V	7.0A	83/87%	
		BFD 24SX-U1	24V	4.5A	84/87%	
		BFD 36SX-U1	36V	3.0A	84/88%	
		BFD 48SX-U1	48V	2.3A	86/89%	
150W	BFE-SX	BFE 3.3SX-U1	3.3V	30A	76/79%	¥8,900
		BFE 05SX-U1	5V	30A	80/82%	
		BFE 06SX-U1	6V	25A	80/83%	
		BFE 09SX-U1	9V	17A	82/85%	
		BFE 12SX-U1	12V	13A	83/86%	
		BFE 15SX-U1	15V	10.5A	83/86%	
		BFE 24SX-U1	24V	6.7A	84/87%	
		BFE 36SX-U1	36V	4.5A	85/88%	
		BFE 48SX-U1	48V	3.4A	85/88%	

◎Option : Complete wire harness (40 cm length) ¥250

◎Efficiency (at AC100V/AC230V input)

## ■ Notes for use of AC/DC-type synchronous rectification system

Forward type

- No parallel connection is allowed. However, connecting two units using a diode OR connection for the purpose of redundant operation is possible.
- No series connection is allowed. However, series operation will be available if entry of current into the power supply is prevented by way of inserting a diode in series-parallel to an output terminal of the power supply.
- Capacity of external connection is not limited unless otherwise specified in overcurrent protection function (OCP) specifications. Please contact us for details in individual case.

BF  
seriesAC  
DC

General Description/Product Lineup

## ■ BFD \*\* SX Series (100W), Single Output

Model	BFD3.3SX-U1	BFD05SX-U1	BFD06SX-U1	BFD09SX-U1	BFD12SX-U1	BFD15SX-U1	BFD24SX-U1	BFD36SX-U1	BFD48SX-U1
Specifications									
Input Characteristics									
Rated Input Voltage	AC100 to 240 [V]								
Rated Input Current	1.7 to 0.8 [A]								
Allowable Input Voltage Range	AC85 to 264 [V] (DC120 to 340 [V] )								
Rated Input Frequency	50/60 [Hz]								
Allowable Input Frequency Range	47 to 63 [Hz]								
Phase	1 [Φ]								
Inrush Current (Startup Current) *1	18 [A] Typ. AC100 [V] /41 [A] Typ. AC230 [V] (At cold start/25°C)								
Efficiency [%] (typical)(at AC100V/230V input)	77/79	80/84	81/85	81/85	82/86	83/87	84/87	84/88	86/89
Power Factor	0.97/0.92	0.98 Typ. AC100 [V] / 0.92Typ. AC230 [V]							
Output Characteristics									
Output Voltage [V]	3.3	5	6	9	12	15	24	36	48
Output Current [A]	20	20	17	11.4	8.6	7.0	4.5	3.0	2.3
Voltage Adjust Range [V]	±10% of rated output voltage								
Ripple And Noise[mVp-p] (maximum) *2	120/160	150/180(ambient temperature : 0 to 50°C/-10 to 0°C)							
Regulation									
a. Static Line Regulation[mV] (maximum)	9.9	15	18	27	36	45	72	108	144
b. Static Load Regulation[mV] (maximum) *3	40	40	40	40	40	100	150	150	150
c. Temperature Coefficient *4	0.03 [%/°C] (at -10 to +50°C)								
d. Drift [mV] (typical) *5	13.2	20	24	36	48	60	96	144	192
e. Dynamic Load Regulation [V] (typical) *6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
f. Recover Time of Dynamic Load *6	0.5 [mS] Typ.								
Rise Time	500 [mS] (maximum), at 25 [°C] and rated input/output								
Hold Up Time	20 [mS] (typical), at 25 [°C] and rated input/output								
Optional Functions									
Overcurrent Protection	Fold-back current limiting, automatic recovery								
Overvoltage Protection	Output shutdown, operable at 140% of output voltage or below								
Remote Sense	Not available								
Remote Control	Not available								
Power Fail Detection	Not available								
Series Operation	Available								
Parallel Operation	Not available								
Environmental Specification									
Operating Temperature	-10 to 60 [°C] (see output derating table)								
Operating Humidity	20 to 85 [%RH] (non-condensing)								
Storage Temperature	-20 to +85 [°C] without thermal shock								
Storage Humidity	10 to 85 [%RH] (non-condensing)								
Withstanding Voltage Primary - Secondary	AC3000V for 1 minute without defect, faradic current=20 [mA]								
Primary - Frame Ground	AC2500V for 1 minute without defect, faradic current=20 [mA]								
Secondary - Frame Ground	AC500V for 1 minute without defect, faradic current=20 [mA]								
Isolation Resistance Primary - Secondary - Frame Ground	At least 50 [MΩ] each (when DC500[V] is applied)								
Vibration	5-10Hz : 10 [mm] double amplitude, 10-55Hz : acceleration 19.6 [m/s²], 20 minute cycle for 60 minutes each along X, Y, and Z axes without defect (non-operating)								
Shock	Impact force : 294 [m/S²]								
Cooling	Convection cooling								
□Leakage Current	1 [mA] (maximum) at 25 [°C], rated input/output and rated input frequency								
□Line Conducted Noise	Built to meet FCC Part15-B Class B Built to meet VCCI Class B Built to meet CISPR Class B Built to meet EN55022 Class B								
□Line Harmonic Distortion	Built to meet IEC61000-3-2								
□Safety	UL 60950-1, CSA60950-1, EN60950-1 certified CE (LV directive) compliant								
□Appearance/Weight	Board type / 320[g]								
□Ref. MTBF	366,000	363,000	404,000				421,000		
□Ref. Frequency[kHz] Typ.	100 Fix								

Conditions :

\*1 : Since inrush current is suppressed by a thermistor, the above values will not be met when input is reentered during operation.

\*2 : Measured by a bayonet probe with 100MHz bandwidth synchroscope at the end of a pair of 5[cm] long load wires from power supply terminated with a 100[μF] electrolytic capacitor and a 0.1[μF] film capacitor.

\*3 : When output current changed from 0 to rated current

\*4 : At between -10 and +50[°C]

\*5 : For 8 hour period after 1 hour warm-up at 25[°C] and rated input/output

\*6 : When output current changed within allowable input voltage range, between 25% and 75% of rated output current rapidly

## ■ BFE \*\* SX Series (150W), Single Output

Model	BFE3.3SX-U1	BFE05SX-U1	BFE06SX-U1	BFE09SX-U1	BFE12SX-U1	BFE15SX-U1	BFE24SX-U1	BFE36SX-U1	BFE48SX-U1
Specifications									
Input Characteristics									
Rated Input Voltage	AC100 to 240 [V]								
Rated Input Current	2.3 to 1.0 [A]								
Allowable Input Voltage Range	AC85 to 264 [V] (DC120 to 340 [V])								
Rated Input Frequency	50/60 [Hz]								
Allowable Input Frequency Range	47 to 63 [Hz]								
Phase	1 [Φ]								
Inrush Current (Startup Current) *1	18 [A] Typ. AC100 [V] / 41 [A] Typ. AC230 [V](at cold start/25°C)								
Efficiency [%] (typical)(at AC100V/230V input)	76/79	80/82	80/83	82/85	83/86	83/86	84/87	85/88	85/88
Power Factor	0.97/0.91	0.98 Typ. AC100 [V] / 0.93 Typ. AC230 [V]							
Output Characteristics									
Output Voltage [V]	3.3	5	6	9	12	15	24	36	48
Output Current [A]	30	30	25	17	13	10.5	6.7	4.5	3.4
Voltage Adjust Range [V]	±10% of rated output voltage								
Ripple And Noise[mVp-p] (maximum) *2	120/160		150/180(ambient temperature : 0 to 40°C/-10 to 0°C)						
Regulation									
a. Static Line Regulation[mV] (maximum)	9.9	15	18	27	36	45	72	108	144
b. Static Load Regulation[mV] (maximum) *3	40	40	50	40	40	40	100	150	150
c. Temperature Coefficient *4	0.03 [ %/°C] (at -10 to +40°C)								
d. Drift[mV] (typical) *5	13.2	20	24	36	48	60	96	144	192
e. Dynamic Load Regulation[V] (typical) *6	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.5
f. Recover Time of Dynamic Load *6	5 [mS]Typ.								
Rise Time	500 [mS] (maximum), at 25 [°C]and rated input/output								
Hold Up Time	20 [mS] (typical), at 25 [°C] and rated input/output								
Optional Functions									
Overcurrent Protection	Fold-back current limiting, automatic recovery								
Overvoltage Protection	Output shutdown, operable at 140% of output voltage or below (5.5V or less in case of 3.3V product)								
Remote Sense	Not available								
Remote Control	Not available								
Power Fail Detection	Not available								
Series Operation	Available								
Parallel Operation	Not available								
Operating Temperature									
Operating Temperature	-10 to 50 [°C] (see output derating table)								
Operating Humidity	20 to 85 [%RH] (non-condensing)								
Storage Temperature	-20 to +85 [°C] without thermal shock								
Storage Humidity	10 to 85 [%RH] (non-condensing)								
Isolation Resistance Primary - Secondary - Frame Ground	AC3000V for 1 minute without defect, faradic current=20 [mA]								
Primary - Frame Ground	AC2500V for 1 minute without defect, faradic current=20 [mA]								
Secondary - Frame Ground	AC500V for 1 minute without defect, faradic current=20 [mA]								
Isolation Resistance Primary - Secondary - Frame Ground	At least 50 [MΩ] each (when DC500 [V] is applied)								
Vibration	5-10Hz : 10[mm] double amplitude, 10-55Hz : acceleration 19.6[m/s2], 20 minute cycle for 60 minutes each along X, Y, and Z axes, without defect (non-operating)								
Shock	Impact force : 294 [m/S²]								
Cooling	Convection cooling								
□Leakage Current	1[mA] (maximum) at 25 [°C], rated input/output and rated input frequency								
□Line Conducted Noise	Built to meet FCC Part15-B Class A Built to meet VCCI Class B Built to meet CISPR Class B Built to meet EN55022 Class B								
□Line Harmonic Distortion	Built to meet IEC61000-3-2								
□Safety	UL 60950-1, CSA60950-1, EN60950-1 certified CE (LV directive) compliant								
□Appearance/Weight	Board type / 420 [g]								
□Ref. MTBF [H]	363,000			404,000			421,000		
□Ref. Frequency [kHz] Typ.	100 Fix								

Conditions :

\*1 : Since inrush current is suppressed by a thermistor, the above values will not be met when input is reentered during operation.

\*2 : Measured by a bayonet probe with 100MHz bandwidth synchroscope at the end of a pair of 5[cm] long load wires from power supply terminated with a 100[μF] electrolytic capacitor and a 0.1[μF] film capacitor

\*3 : When output current changed from 0 to rated current

\*4 : At between -10 and +40[°C] \*5 : For 8 hour period after 1 hour warm-up at 25[°C] and rated input/output

\*6 : When output current changed within allowable input voltage range, between 25% and 75% of rated output current rapidly

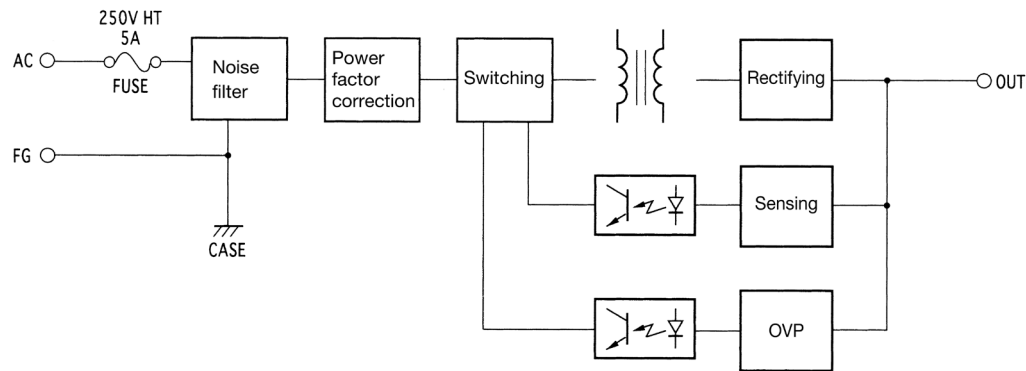
**BF**  
series

AC  
DC

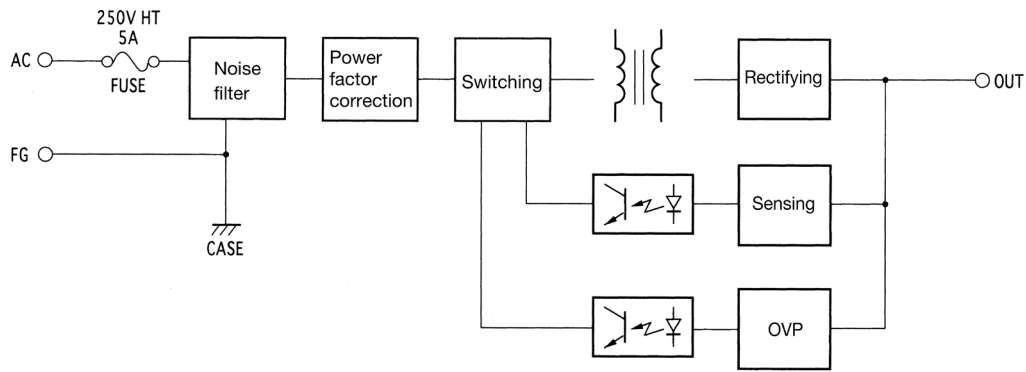


Specification list

■ **BFD-SX Series**, Single Output  
(100W)

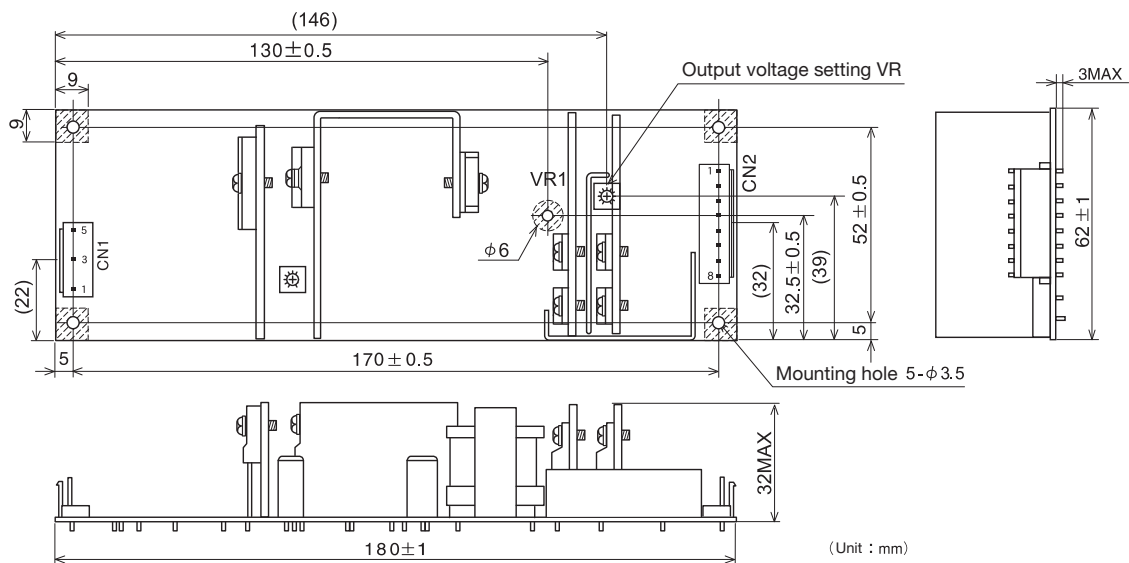


■ **BFE-SX Series**, Single Output  
(150W)



## ■ BFD-SX Series (100W), Single Output

Dimension Diagram



The shaded areas are mountable range of metal brackets (maximum).

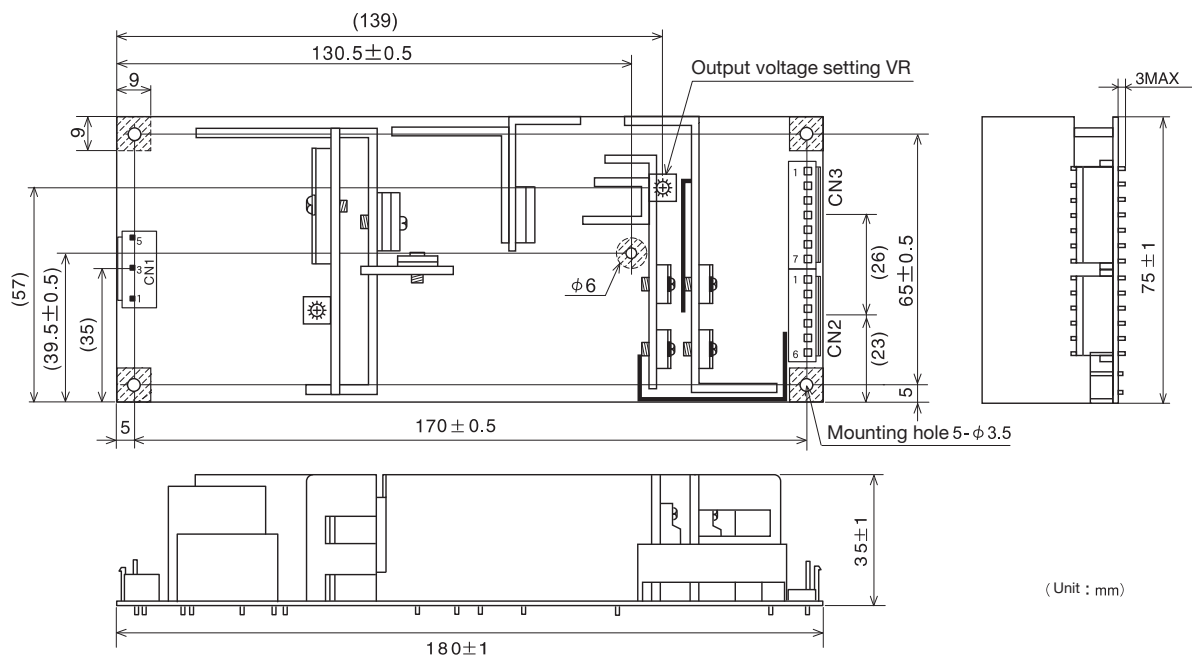
Pin No.	Function
1	AC IN(L)
3	AC IN(N)
5	FG

Pin No.	Function
1	0V OUT
2	0V OUT
3	0V OUT
4	0V OUT
5	+V OUT
6	+V OUT
7	+V OUT
8	+V OUT

	Acceptable Housing	Contact
CN1	VHR5N	SVH-21T-P1.1
CN2	VHR8N	SVH-21T-P1.1

Manufacturer: JST Mfg. Co., Ltd.

## ■ BFE-SX Series (150W), Single Output



The shaded areas are mountable range of metal brackets (maximum).

Pin No.	Function
1	AC IN(L)
3	AC IN(N)
5	FG

Pin No.	Function
1	+V OUT
2	+V OUT
3	+V OUT
4	+V OUT
5	+V OUT
6	+V OUT

Pin No.	Function
1	0V OUT
2	0V OUT
3	0V OUT
4	0V OUT
5	0V OUT
6	0V OUT
7	0V OUT

	Acceptable Housing	Contact
CN1	VHR5N	SVH-21T-P1.1
CN2	VHR6N	SVH-21T-P1.1
CN3	VHR7N	SVH-21T-P1.1

Manufacturer: JST Mfg. Co., Ltd.

BF series

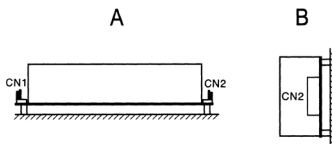
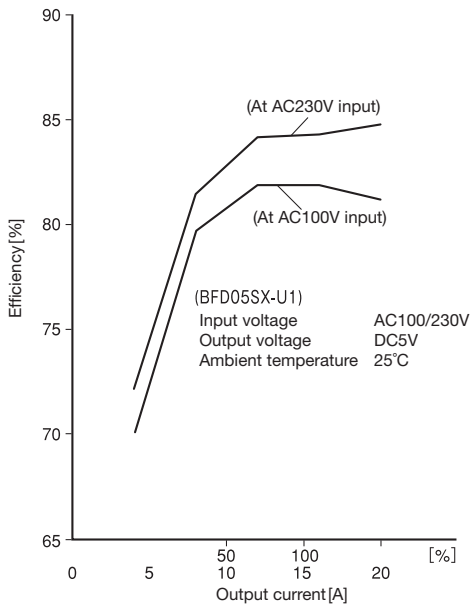
AC/DC



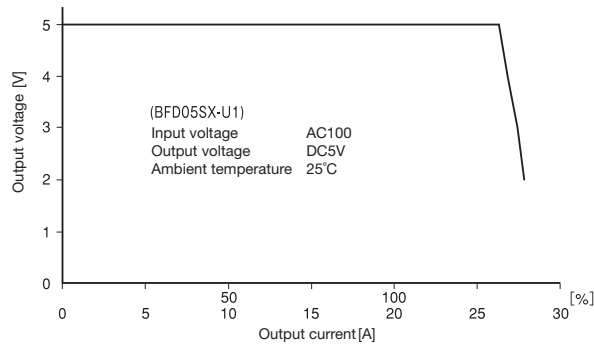
Block Diagram/Dimension Diagram

## ■ BFD-SX Series (100W), Single Output

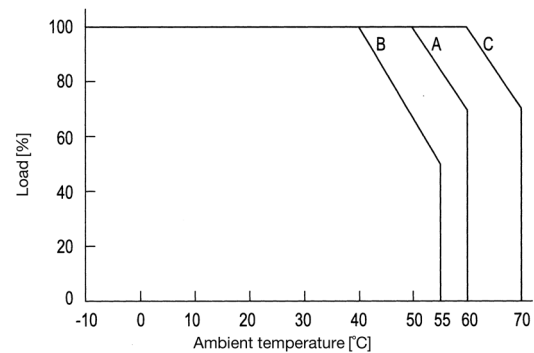
### ■ Output current and efficiency curve



### ■ Overcurrent protection (COP) curve



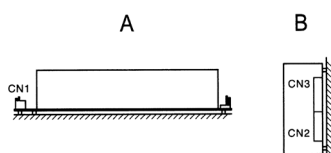
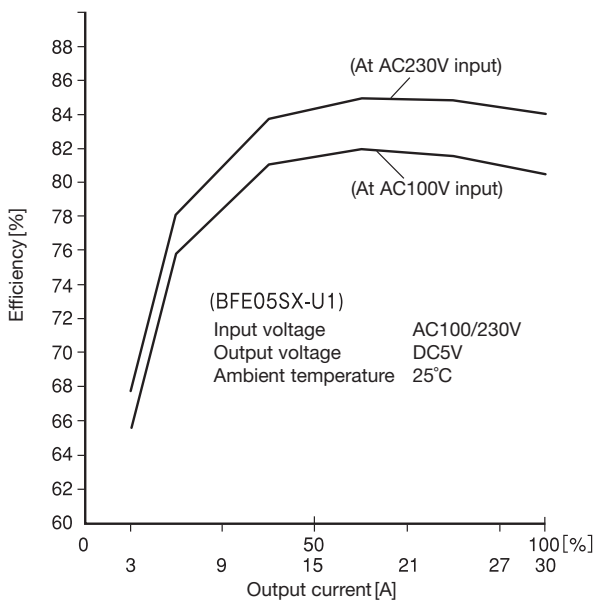
### ■ Derating curve



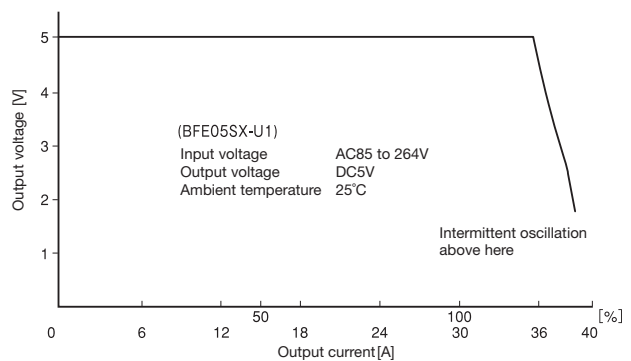
※For detailed conditions for certified safety standards, please contact us.

## ■ BFE-SX Series (150W), Single Output

### ■ Output current and efficiency curve



### ■ Overcurrent protection (COP) curve



### ■ Derating curve

