HWB Series HWB030S-05
Ultra-low Noise Power Supply (30 W, Single-Output)

General Description

The HWB series employs proprietary LLC type resonant-mode circuits. These low price, ultra-low noise (ripple voltage, conducted emissions, and noise electric field strength) power supplies have a built-in propriety resonant-mode hybrid IC and transformer.

Features and Benefits

- Ripple noise: less than 5 mV_{P-P}
- Conduction noise: lower than Class-B of CISPR by 20 DdB
- Radiation noise: Complies with Class-B of CISPR
- Leakage current: 50 µA or less for medical use
- Safety mark for medical use: EN60601-1 3rd edition
- Safety standards: UL1950, CSA950, EN60950, and CE marking
- World-wide input range
- Parallel operation

Sample Test Conditions

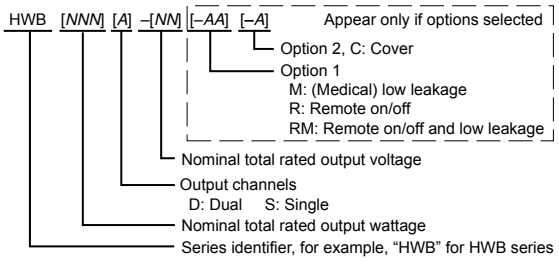
Input Voltage, V_{IN}

Min. (V)	Nom. (V)		Max. (V)
85	100	240	264

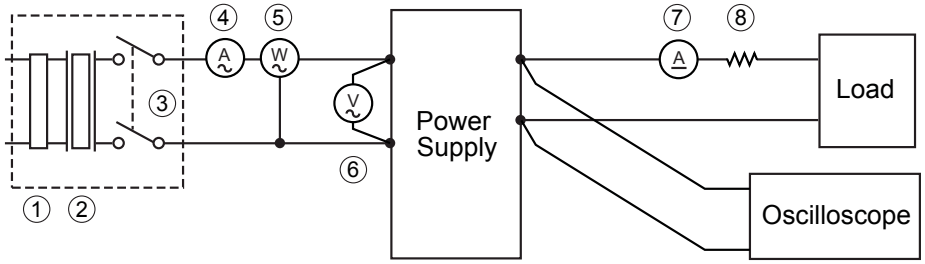
Load Current, I_{LOAD}

Output Voltage (V)	Min. (A)	Nom. (A)	Max. (A)
5	0	6	6

Model Number Key Table



Sample Test Circuit Diagram



Key	Description	Remarks
–	Measuring instrument	Output voltage is measured with a digital multimeter
1	Variable autotransformer	–
2	Isolation transformer	–
3	Circuit breaker	–
4, 7	Ammeter	–
5	Watt meter	–
6	Volt meter	–
8	Shunt resistor	–

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Table 1. Input Characteristics
(At T_A = 25°C)

Test Item	Conditions		Test Results			Specifi-cation	Remarks
	V_{IN}	I_{LOAD}	V_{IN} = 100 V	V_{IN} = 240 V			
Input Current	Nom	Nom	0.56 A	0.29 A	–	0.7 A	Figure 1
Input Power	Nom	Nom	40.45 W	38.91 W	–	–	–
Power Factor	Nom	Nom	0.72	0.57	–	–	Figure 2
Efficiency	Nom	Nom	74.25%	77.19%	–	75%	Figure 3
Inrush Current	Nom	Nom	12.20 A	28.60 A	–	30 A/ 60 A	Figure 4
Leakage Current (Standard Model)	Nom	Nom	0.049 mA at 60 Hz	0.120 mA at 60 Hz	R = 1.5 kΩ, C = 0.15 µF	0.25 mA	Figure 6
Leakage Current (Medical Equipment Model)	Nom	Nom	0.019 mA at 60 Hz	0.046 mA at 60 Hz	R = 1.5 kΩ, C = 0.15 µF	50 µA	–
Minimum Input Voltage for Voltage Output	–	Min	–	–	On = 43.65 V Off = 22.3 V	–	–
	–	Nom	–	–	On = 47.65 V Off = 41.44 V	–	–
Hold-Up Time	–	Nom	–	–	31 ms at T_A = 25°C	20 ms	Figure 7

Figure 1. Input Current
(By Load Current)

Input Voltage	Output	Temperature	Remarks
85 to 264 VAC	5 V, 40% to 100%	T_A = 25°C	–

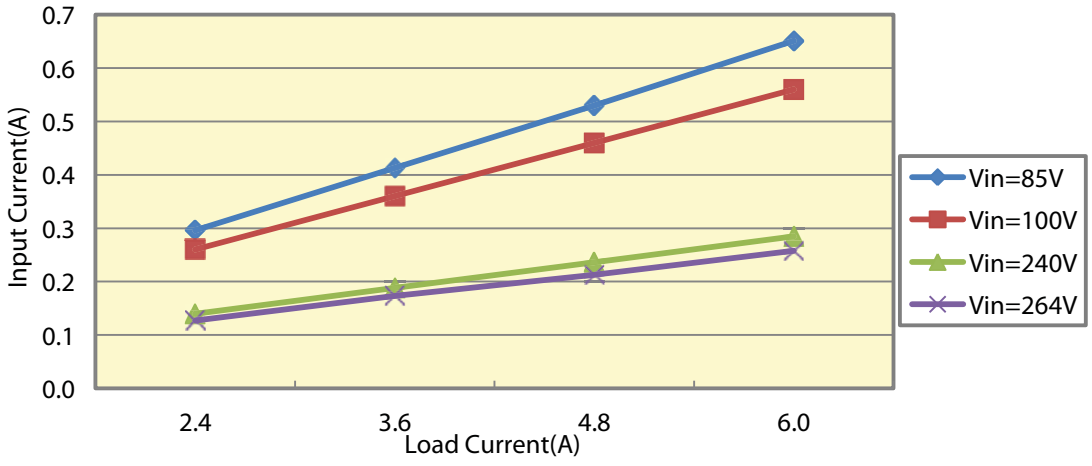


Figure 2. Power Factor (By Load Current)

Input Voltage	Output	Temperature	Remarks
85 to 264 VAC	5 V, 40% to 100%	T_A = 25°C	–

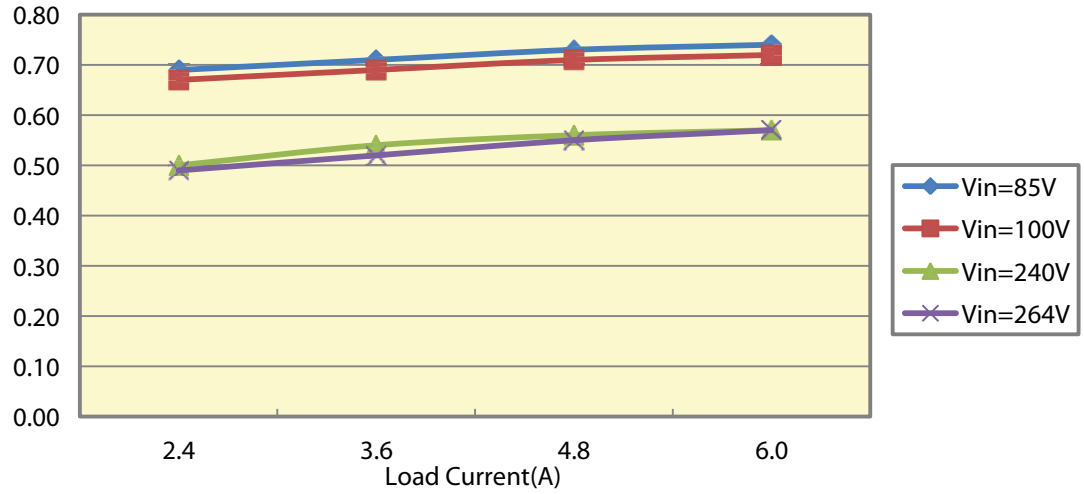


Figure 3. Efficiency (By Load Current)

Input Voltage	Output	Temperature	Remarks
85 to 264 VAC	5 V, 20% to 100%	T_A = 25°C	–

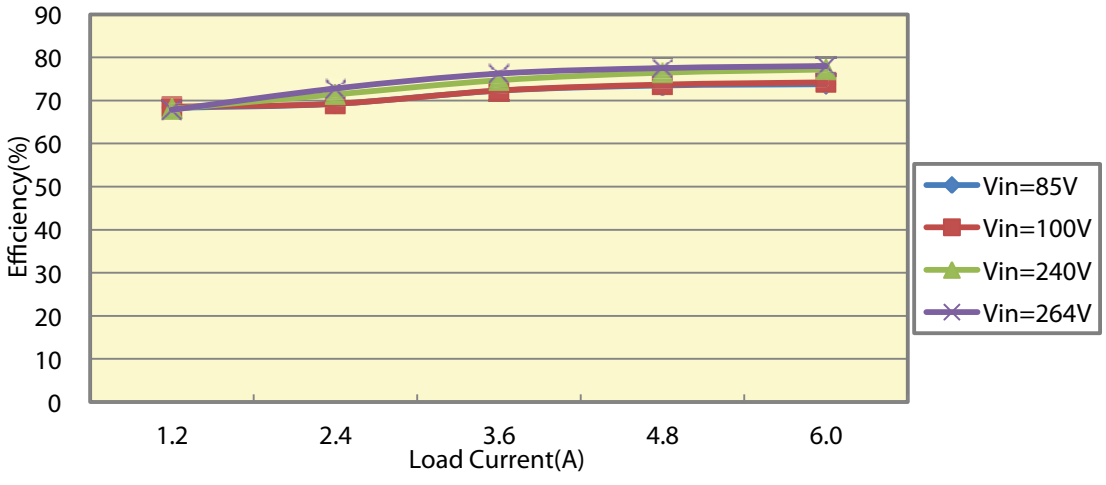


Figure 4. Inrush Current (By Input Voltage)

Input Voltage	Output	Temperature	Remarks
100 to 240 VAC	5 V, 6 A	T_A = 25°C	Cold start

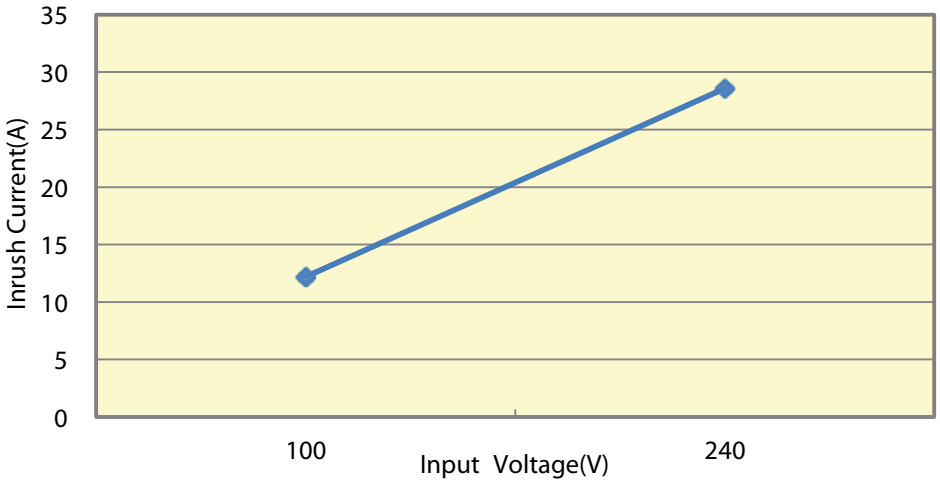


Figure 5. Inrush Current Operation

Input Voltage	Output	Temperature	Remarks
V_{IN} =240 V	I_{OUT} = 6 A	T_A = 25°C	Inrush Current: 5 A /div., time = 2 ms /div.

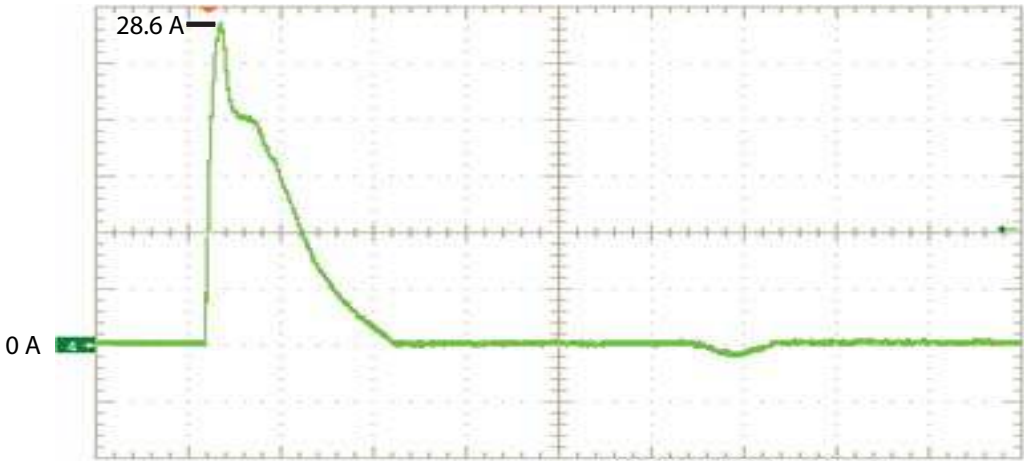


Figure 6. Leakage Current (By Load Current)

Input Voltage	Output	Temperature	Remarks
100 to 240 VAC	5 V, 6 A	T_A = 25°C	R = 1.5 kΩ, C = 0.15 µF

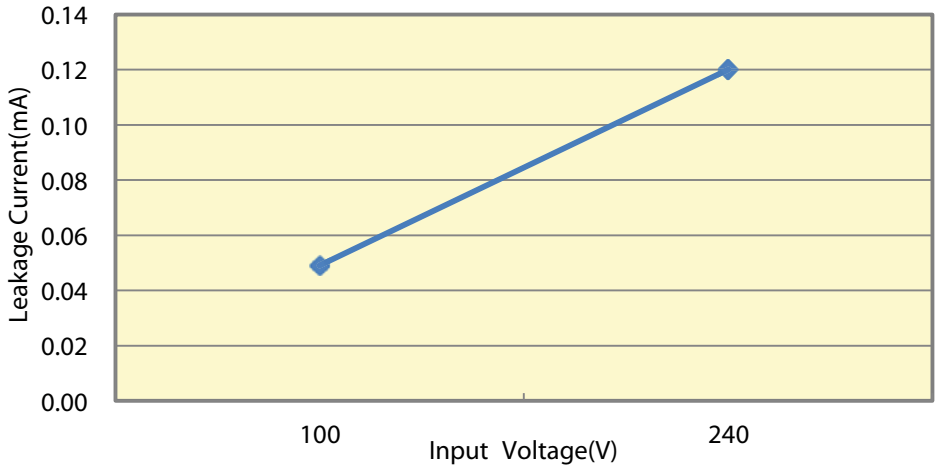


Figure 7. Hold-Up Time (By Load Current)

Input Voltage	Output	Temperature	Remarks
100 to 240 VAC	5 V, 20% to 100%	T_A = –10°C to 60°C	–

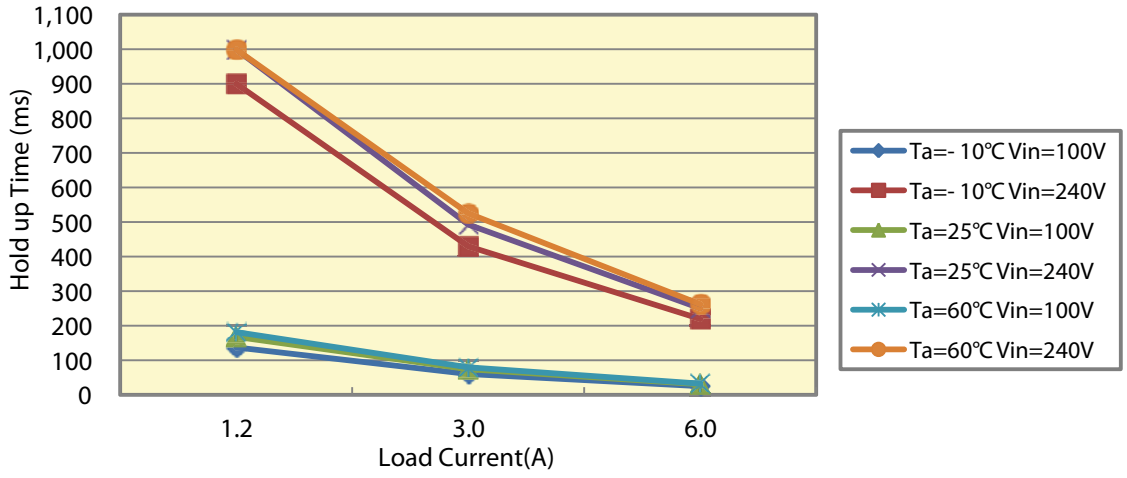


Table 2. Output Characteristics
(At T_A = 25°C)

Test Item	Conditions		Test Results			Specification	Remarks
	V_{IN}	I_{LOAD}	5 V				
Output Setting Voltage	Nom	Nom	+6 mV			–	–
Input/Output Voltage Change Fluctuation	Min	Min	4.999 V			–	Note 1, Figure 8
	Max	Max	5.006 V			–	
Temperature Drift	Nom	Nom	–7 mV to +2 mV			–	Note 1, Figure 8
Warm-Up Drift	Nom	Nom	–5 mV			–	Note 1, Figure 11
Total Regulation	–	–	4.987 V			4.850 V	Note 1
	–	–	5.008 V			5.150 V	
Ripple Voltage	Nom	Nom	1.8 mV at T_A = 25°C			5 mV	Note 2, Figure 12
Ripple Noise Voltage	Nom	Nom	3.9 mV at T_A = 25°C			10 mV	Note 3, Figure 13
Output Voltage Variable Range	Min	Min	4.170 V			–	–
	Max	Max	6.190 V			–	–

1. Total Regulation (output regulation) is the sum of: Input/Output Voltage Change Fluctuation, Temperature Drift, and Warm-Up Drift.
2. Used probe = Ripple Voltage 1:1.
3. Used probe = Ripple Noise Voltage 1:1.

Figure 8. Output Voltage Accuracy
(By Load Current)

Input Voltage	Output	Temperature	Remarks
100 to 240 VAC	5 V, 0% to 100%	T_A = –10°C to 60°C	–

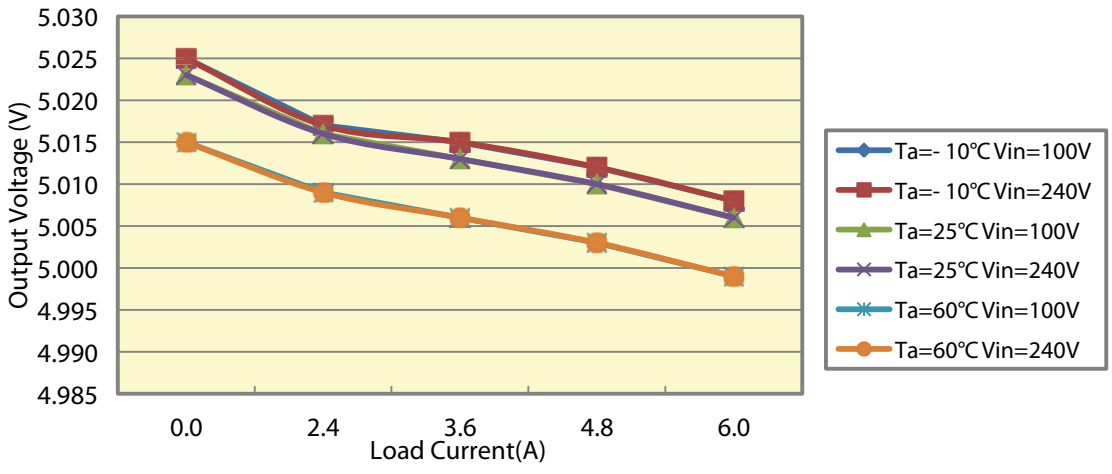


Figure 9. Output Voltage Rising

Input Voltage	Output	Temperature	Remarks
V_{IN} =100 V	I_{OUT} = 6 A	T_A = 25°C	Input Voltage: 100 V /div., Output Voltage: 2 V /div., time = 100 ms /div.

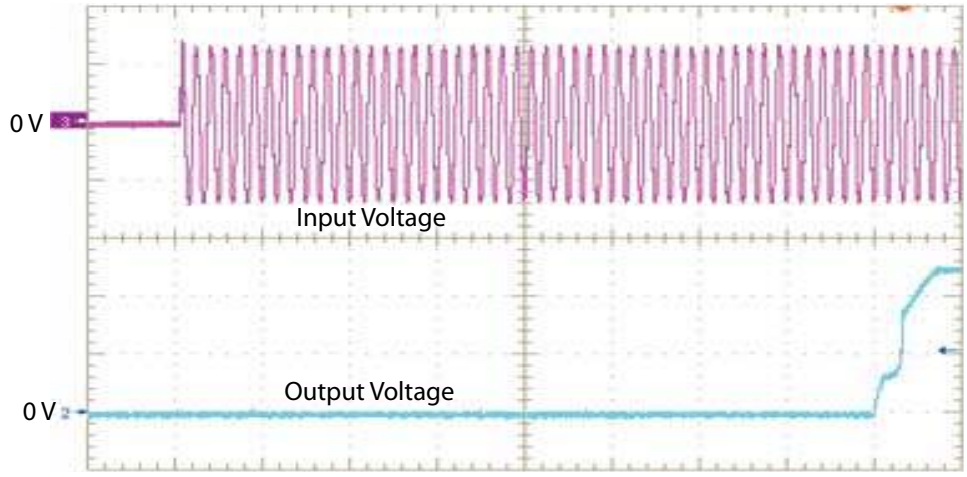


Figure 10. Output Voltage Falling

Input Voltage	Output	Temperature	Remarks
V_{IN} =100 V	I_{OUT} = 6 A	T_A = 25°C	Input Voltage: 100 V /div., Output Voltage: 2 V /div., time = 20 ms /div.

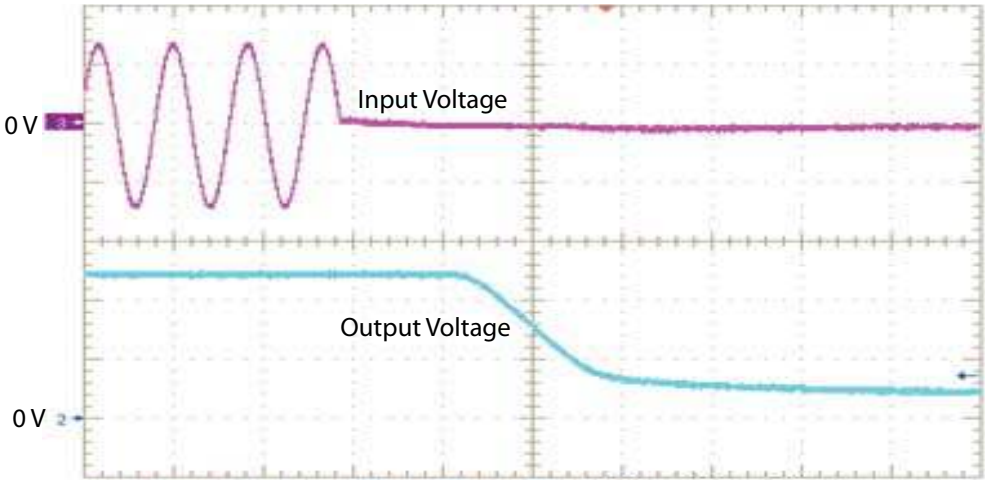


Figure 11. Warm-Up Drift

Input Voltage	Output	Temperature	Remarks
100 VAC	5 V, 6 A	T_A = 25°C	–

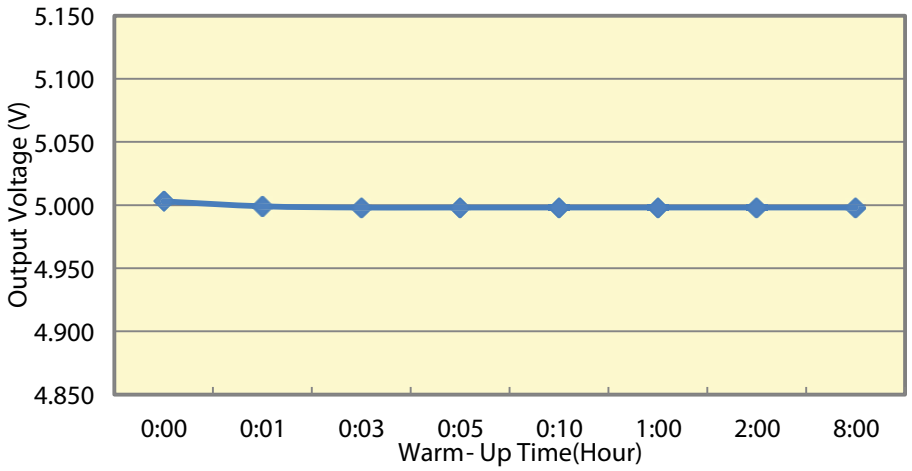


Figure 12. Ripple Voltage (By Load Current)

Input Voltage	Output	Temperature	Remarks
100 VAC	5 V, 40% to 100%	T_A = –10°C to 60°C	–

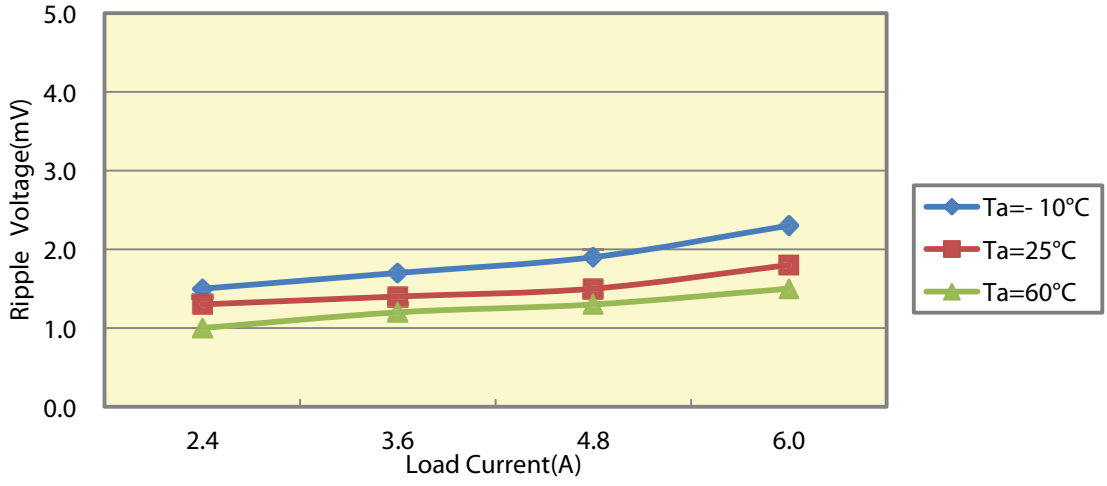


Figure 13. Ripple Noise Voltage
(By Load Current)

Input Voltage	Output	Temperature	Remarks
100 VAC	5 V, 40% to 100%	T_A = –10°C to 60°C	–

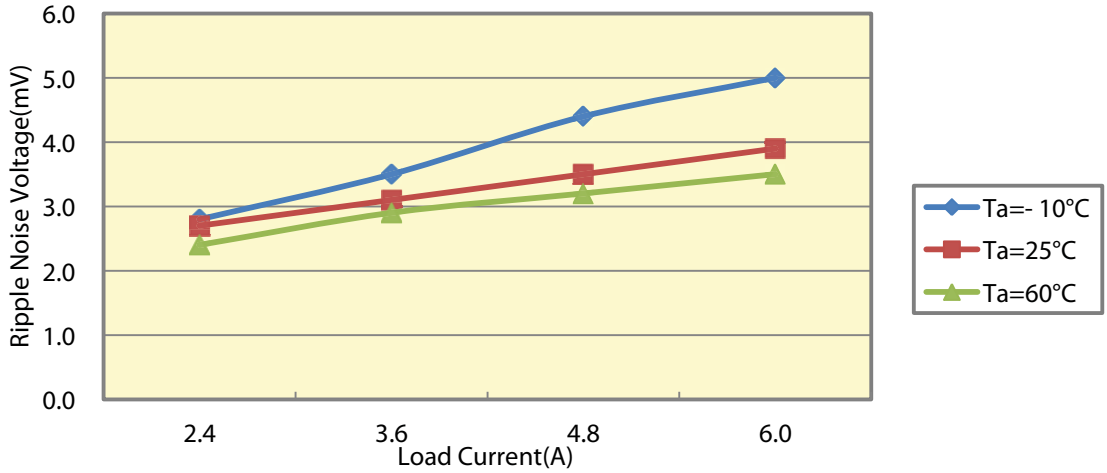


Table 3. Protection Characteristics

Test Item	Conditions		Test Results			Specification	Remarks
	V_{IN}	I_{LOAD}	T_A = –10°C	T_A = 25°C	T_A = 60°C		
Overcurrent Protection	Min	Max	7.55 A	7.40 A	7.12 A	≥ 6.3 A	Figure 14
Overvoltage Protection	Nom	Min	6.71 V	6.72 V	6.74 V	≥ 5.75 V	Figure 15
Reset Time	Max	Min	10.5 s at T_A = 25°C			–	–

Figure 14. Overcurrent Protection (By Load Current)

Input Voltage	Output	Temperature	Remarks
100 VAC	5 V	T_A = –10°C to 60°C	–

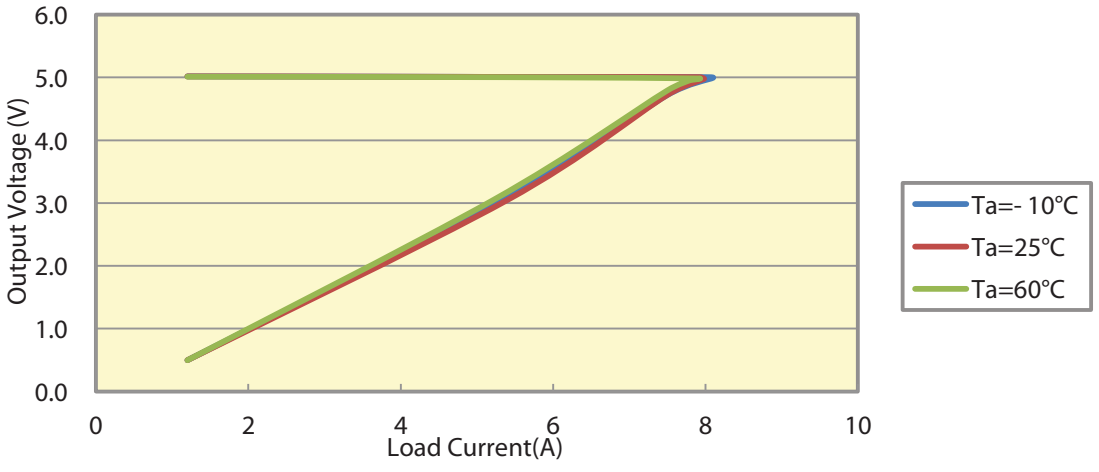


Figure 15. Overvoltage Protection (By Temperature)

Input Voltage	Output	Temperature	Remarks
100 VAC	5 V, 0 A	T_A = –10°C to 60°C	–

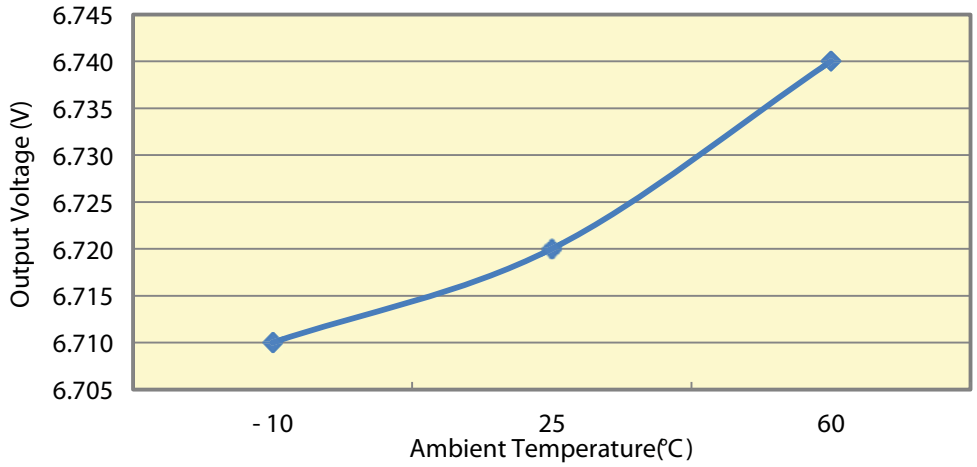


Figure 16. Overvoltage Protection Operation

Input Voltage	Output	Temperature	Remarks
V_{IN} =100 V	I_{OUT} = 0 A	T_A = 25°C	Output Voltage: 2 V /div., time = 20 ms /div.

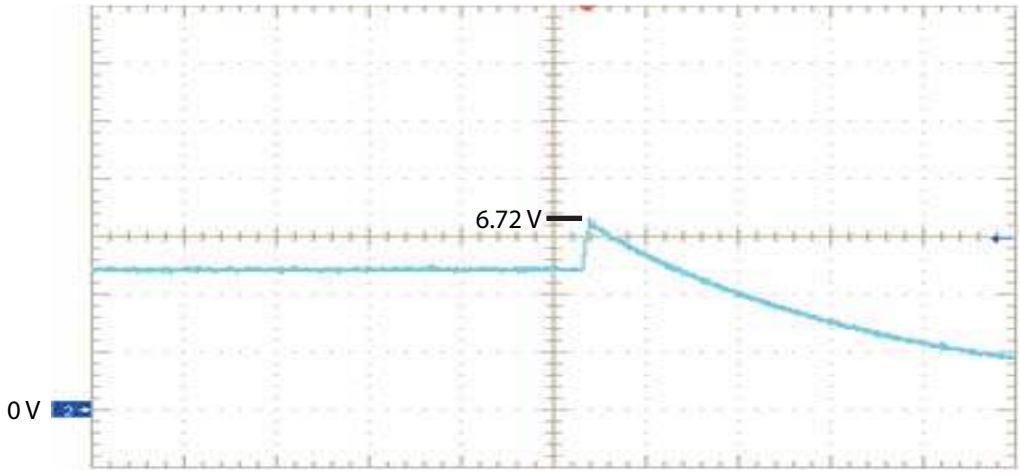


Figure 17. Start-Up Time (By Input Voltage)

Input Voltage	Output	Temperature	Remarks
85 to 264 VAC	5 V, 6 A	T_A = –10°C to 60°C	–

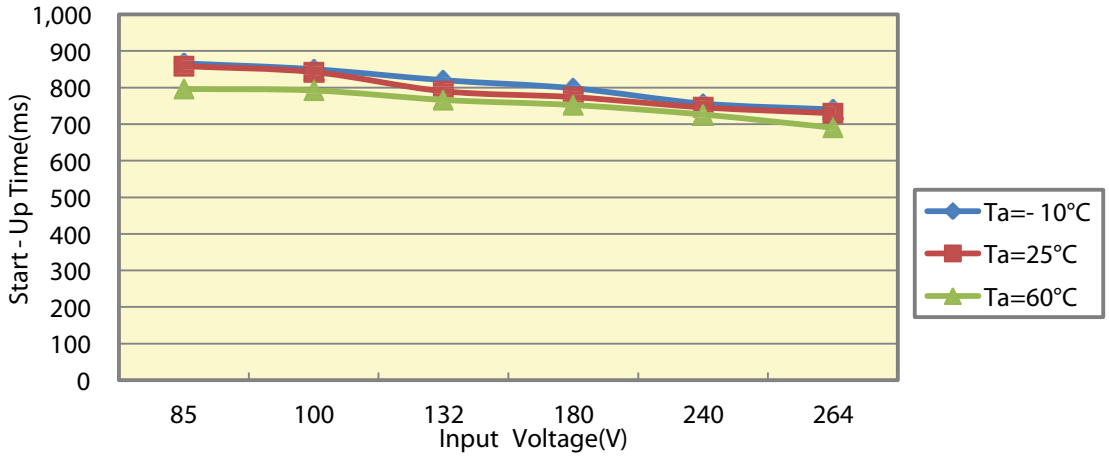


Table 4. Environment Tests
(At T_A = 25° C)

Test Item	Conditions		Test Results	Specifi-cation	Remarks
	V_{IN}	I_{LOAD}			
Vibration (Non-Operating)	–	–	Frequency = 10 to 55 Hz, Sweep Cycle = 3 minutes, Acceleration = 19.6 m/s^2, Direction = x,y, and z axes at 60 minutes per axis	Normal operation	–
Power-On at High Temperature	Nom	Max	Power-off for 1 hour at 65°C, then power-on	Normal operation	–
Power-On at Low Temperature	Nom	Max	Power-off for 1 hour at –15°C, then power-on	Normal operation	–
Shock	–	–	Product is dropped from a height of 50 mm (98 m/s^2) onto a flat surface of wood (10 mm or thicker); the test is performed three times on each edge of the bottom side of the product	Normal operation	–

Table 5. Noise Tolerance Characteristics
(At T_A = 25° C)

Test Item	Conditions		Test Results	Specifi-cation	Remarks
	V_{IN}	I_{LOAD}			
AC Line Noise (50 to 1000 ns)	Min to Max	Min to Max	Line to Line ±1.44 kV OK	L–L 1.2 kV	–
	Min to Max	Min to Max	Line to Frame Ground ±1.44 kV OK	L–FG 1.2 kV	–
Lightning Surge (1.2 × 50 µs)	Nom	Min to Max	Line to Line ±2.88 kV OK	L–L 2.4 kV	–
	Nom	Min to Max	Line to Frame Ground ±2.88 kV OK	L–FG 2.4 kV	
Electrostatic Discharge	Min to Max	Min to Max	±21 kV OK at R = 100 Ω, C = 500 pF	15 kV	–

Figure 18. Conduction Noise 100 V

Input Voltage	Output	Temperature	Remarks
V_{IN} =100 V	I_{OUT} = 6 A	T_A = 25°C	–

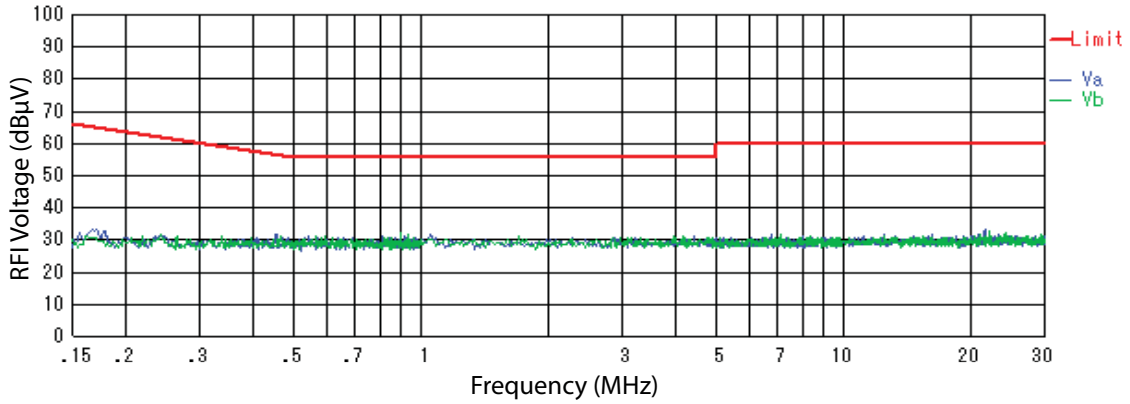


Figure 19. Conduction Noise 240 V

Input Voltage	Output	Temperature	Remarks
V_{IN} =240 V	I_{OUT} = 6 A	T_A = 25°C	–

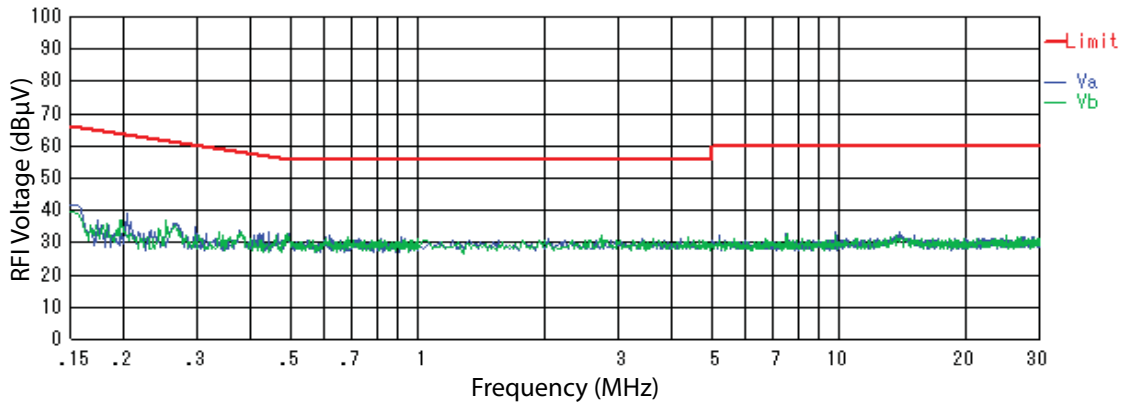


Table 6. Other Characteristics
(At T_A = 25° C)

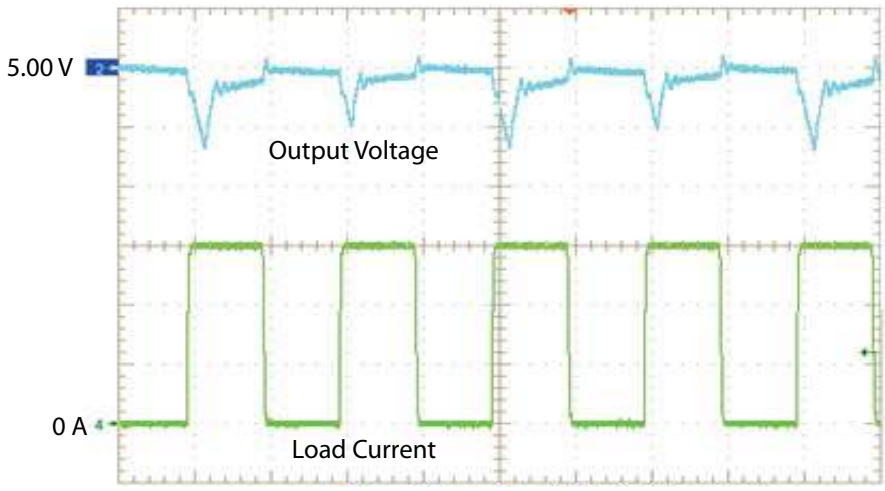
Test Item	Conditions		Test Results			Specification	Remarks
	V_{IN}	I_{LOAD}	P–S	P–E	S–E		
Withstand Voltage (Standard Model)	–	–	3.0 kV / 3.6 kV	1.5 kV / 1.8 kV	0.5 kV / 0.6 kV	P–S: 3 kV for 1 minute 3.6 kV for 1 second P–E: 1.5 kV for 1 minute 1.8 kV for 1 second S–E: 500 V for 1 minute 600 V for 1 second	–
Leakage Current at Withstand Voltage (Standard Model)	–	–	1.52 mA /1.67 mA	1.18 mA /1.34 mA	1.19 mA /1.29 mA	≤15 mA	–
Withstand Voltage (Medical Equipment Model)	–	–	4 kV	1.5 kV / 1.8 kV	0.5 kV / 0.6 kV	P–S: 4.0 kV for 1 minute P–E: 1.5 kV for 1 minute 1.8 kV for 1 second S–E: 500 V for 1 minute 600 V for 1 second	–
Leakage Current at Withstand Voltage (Medical Equipment Model)	–	–	1.03 mA	0.45 mA /0.54 mA	1.21 mA /1.32 mA	≤15 mA	–
Insulation Resistance	–	–	≥1000 MΩ	≥1000 MΩ	≥1000 MΩ	≥100 MΩ at 500 VDC Megger	–

Table 7. Output under Dynamic Load

Test Item	Conditions		Test Results			Specification	Remarks
	V_{IN}	I_{LOAD}	5 V				
Output Voltage at T_A = –10°C	Min	0 A to 6 A for 10 ms	3.66 V / 5.25 V			–	Figure 20
Output Voltage at T_A = 60°C	Min	0 A to 6 A for 10 ms	3.56 V / 5.15 V			–	Figure 20

Figure 20. Dynamic Load

Input Voltage	Output	Temperature	Remarks
V_{IN} =100 V	I_{OUT} = 0 to 6 A	T_A = 25°C	Output Voltage: 1 V /div., Load Current: 2 A /div., time = 10 ms /div.



Important Information

- The products described in this document are built-in type DC stabilized power supplies with special structures and are designed for installation in equipment. Be sure to use the products only for installation in equipment.
- The products should be handled only by persons who have competent electrical knowledge.
- Be sure to read through all safety precaution and operation manuals before installation, operation, or maintenance and to use the products only for the intended use and in accordance with all applicable safety standards and regulations in the location of use.

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