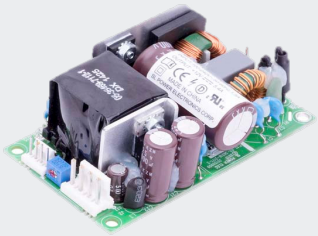
SL POWER
MB65 SERIES

65 Watts Single Output
Medical Grade

Medical



Advanced Energy's SL Power MB65 medically-approved AC-DC power supplies are available with a nominal main output of 12 V, 15 V, 18V, 24 V, 28 V, 32 V or 48 V. MB65 power supplies provide up to 65 Watts of output power with convection cooling. All models have output overvoltage, short circuit and overload protection and a 2 x 3.5 x 1.3 inch form factor.

AT A GLANCE

Total Power

65 Watts

Input Voltage

90 to 264 VAC

# of Outputs

Single

SPECIAL FEATURES

- 65 Watts Convection
- 2"W x 3.5"L x 1.3"H Size
- Universal Input 90 to 264 VAC
- 10-year Life Design with Premium E-caps
- Internal Temperature Monitor, DC-OK Signal, LED
- Meets IEC60601-1-2 4th Edition
- 2 X MOPP Isolation
- BF Isolation Type Rated
- Class I and Class II Input Versions Available
- ROHS Compliant
- 3 Years Warranty

SAFETY

- UL ES60601
- CSA CSAS60601-1
- Demko EN60601-1
- CB IEC60601-1
- China Safety Doc. No. GB4943.1-2011 at 5Km, tropical Standard at 40°C, 93% RH at 120 hours

ELECTRICAL SPECIFICATIONS

Input	
Input Range	90 to 264 VAC
Input Current	1.5A max at 110VAC, 1A max at 240VAC
Inrush Current	40A max., cold start @ 264VAC input
Turn-On Input Voltage	>75VAC ± 8VAC. Full spec performance at 85VAC
Turn-Off Input Voltage	<63VAC ± 8VAC
Input fuses	3.15A, 250VAC fuse provided in both line & neutral
Earth Leakage Current	<350uA@264VAC, 60Hz, NC
Efficiency	88% to 90% typical at 115/230VAC
No Load Input Power	<0.5W
Isolation Voltage	Input/Ground: 1900VAC (1 MOPP) Input/Output: 4500VAC (2 MOPP) Output/Ground: 1900VAC (1 MOPP)
Output	
Output Voltage	See "Ordering information" section
Rise Time	<30mS, 48V model: < 40mS
Ripple and Noise	0.5% of Vout, pk-pk
Total Regulation	1% for all models
Minimum Load	Not required
Turn On Delay	<2 Seconds at 120Vac
Overshoot	2% overshoot at turn-on, 1% overshoot at turnoff, under all conditions
Hold Up Time	20mS minimum from loss of ac input at 110Vac, full load
Patient Leakage Current	<4mA@264Vac, 60Hz input, NC for BF rating
Touch Current	<90uA@264Vac, 60 Hz input, NC, also suitable for BF rating <450uA@264Vac, 60Hz input, SFC, also suitable for BF rating
Transient Response	500us response time for return to within 0.5% of final value for any 50% load, $\Delta i/\Delta t<0.2A/\mu s$. Max. voltage deviation is ±3.5% of final value.
Reliability	
MTBF	564,500 hours @ 110VAC, 25°C ambient, SR332 Issue 6
Warranty	3 years
Protection	
Overvoltage Protection	See models chart for trip ranges. Latch mode
Short circuit Protection	Hiccup Mode. Auto-recovery
Overtemperature Protection	Will shutdown at temperature of 70°C at full load. Hiccup mode. Auto-recovery
Overload Protection	125% to 200% of rated output current value. Hiccup mode. Auto-revovery

EMI/EMC COMPLIANCE

Conducted emissions	EN55011/22: Class B, FCC Part 15. Class B: 6db margin typ, Class 1 PSU configuration EN55011/22: Class B, FCC Part 15. Class B: 2db margin typ, Class 2 PSU configuration
Radiated emissions	EN55011/22: Class B, FCC Part 15. Class B: 3db margin typ, Class 1 PSU configuration EN55011/22: Class B, FCC Part 15. Class B: 3db margin typ, Class 2 PSU configuration
Harmonic current emissions	EN61000-3-2, Class A
Voltage fluctuations & flicker	IEC61000-3-3
Electro static discharge immunity	IEC61000-4-2: Level 4, 8kV Contact Discharge, 15kV air discharge, Criteria A Also meets proposed IEC60601-1-2, 4th edition, Table 4
Radiated RF EM fields susceptibility	IEC61000-4-3: Level 3, 10V/m, Criteria A. 80MHz-1000 MHz and 3V/m 1.4Ghz to 2.7 GHz. 80% AM at 1kHz Also meets proposed IEC60601-1-2, 4th edition, Table 4
Proximity Fields from RF wireless communications Equipment	IEC60601-1-2: 4th edition, Table 4
Rated Power Frequency magnetic fields	IEC61000-4-8: Level 5, 30A/m, 50/60 Hz
Electrical fast transients / bursts	IEC61000-4-4: Level 3, 2KV, 100Khz rep rate, 40A (PS Output), Criteria A IEC61000-4-4: Level 3, 1kV, 20A, (Other Outputs), Criteria B Also meets proposed IEC60601-1-2, 4th edition standard, Table 5 & 6
Surges line to line (DM) and line to ground (CM)	IEC61000-4-5: Level 3, +/-1kV DM, +/-2kV CM, Criteria A Also meets proposed IEC60601-1-2, 4th edition standard, Table 5.
Conducted disturbances induced by RF fields	IEC61000-4-6: 3V/m & 10 V/m – 0.15 to 80Mhz and 10V/m in ISM and amateur radio bands between 0.15 MHz and 80 MHz, 80% AM at 1 KHz Also meets proposed IEC60601-1-2, 4th edition standard, Table 5 & 6 & 8
Voltage dips	IEC61000-4-11 100% dip for 10mS, at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°, Criteria A; 60% dip for 100mS, Criteria B; 30% dip for 500mS (25/30 cycles) 1ø, and 0° for 500mS, Criteria A. Also meets proposed IEC60601-1-2, 4th edition standard, Table 5

ENVIRONMENTAL SPECIFICATIONS

Vibration	Operating: Sinusoidal Frequency: 10-500 Hz, Impact Acceleration: 1g, Sweep rate: 1 octave/min Cycles: 10 times per axis in X, Y, Z direction Random Vibration: Operating: 0.003 g^2/Hz, 1.224 grams overall, 3 axes, 10 min/axis, 1 to 500 Hz Non-operating: 0.02 g^2/Hz, 3.1 grms overall, 3 axes, 1 hour per axis, 20-500 Hz
Shock	Operating: Half-sine shock waveform. Impact Acceleration: 20g, Pulse duration: 11mS. Cycles: 3 times per axis in X,Y, Z direction Non-Operating: Half-sine shock waveform. Impact Acceleration: 100g, Pulse duration: 6mS. Cycles: 3 times per direction on 3 axes (X,Y. Z)
Cooling	Convection
Temperature derating	65W continuous convection cooled, -20°C to 50°C ambient. See chart for derating above 50°C
Storage temperature	-40°C to +85°C
Altitude	Operating: -500 to 3,000 m. Non-operating: -500 to 12,192 m
Relative humidity	5% to 95%, non-condensing
Weight	140g

ORDERING INFORMATION

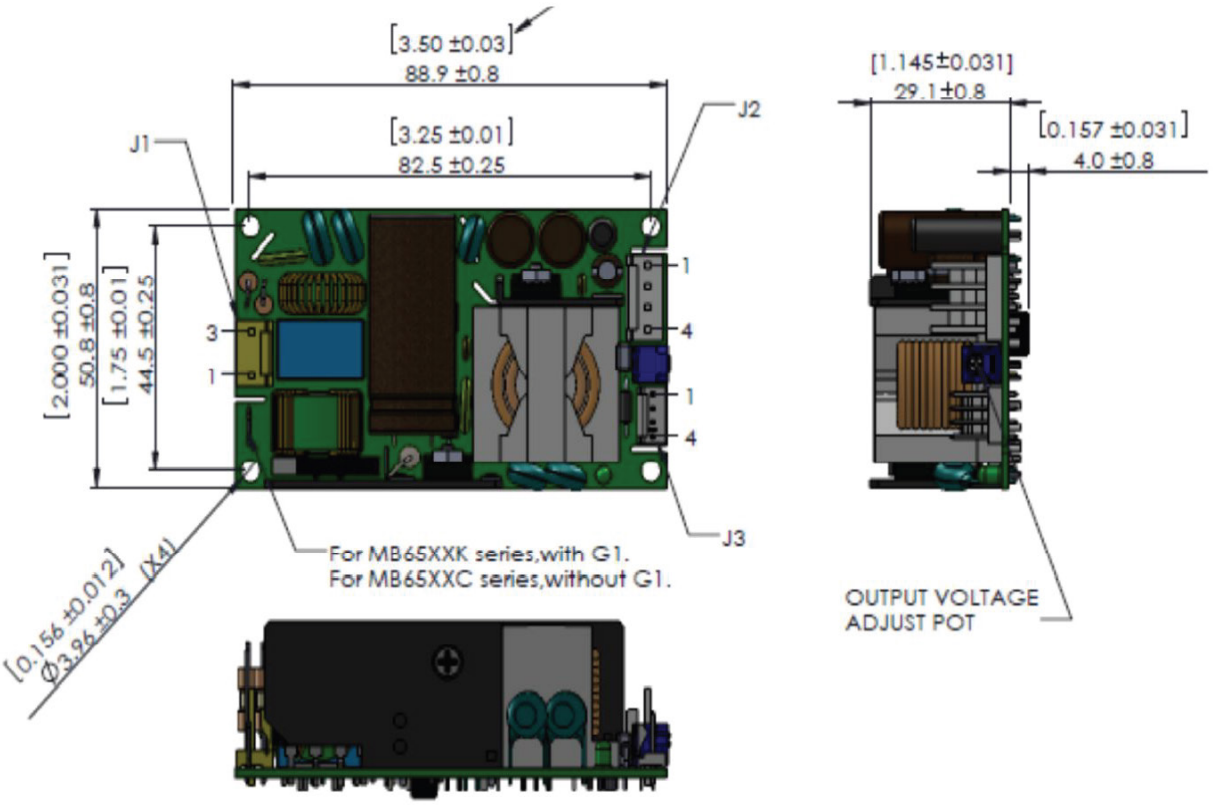
Model Number	Class	Output Voltage	Output Current (Convection)	Efficiency[1]	Ripple & Noise[2]	Total Regulation	OVP Threshold
MB65S12K	Class I	12 V	5.4 A	88%	0.5%	±1%	17.3±2.4 Vdc
MB65S12C	Class II	12 V	5.4 A	88%	0.5%	±1%	17.3±2.4 Vdc
MB65S15K	Class I	15 V	4.3 A	88%	0.5%	±1%	20.1±2.4 Vdc
MB65S15C	Class II	15 V	4.3 A	88%	0.5%	±1%	20.1±2.4 Vdc
MB65S24K	Class I	24 V	2.7 A	89%	0.5%	±1%	29.3±3.5 Vdc
MB65S24C	Class II	24 V	2.7 A	89%	0.5%	±1%	29.3±3.5 Vdc
MB65S48K	Class I	48 V	1.35 A	90%	0.5%	±1%	55.5±4.5 Vdc
MB65S48C	Class II	48 V	1.35 A	90%	0.5%	±1%	55.5±4.5 Vdc
MB65S18K	Class I	18 V	3.6 A	89%	0.5%	±1%	21.7±2.5 Vdc
MB65S18C	Class II	18 V	3.6 A	89%	0.5%	±1%	21.7±2.5 Vdc
MB65S28K	Class I	28 V	2.3 A	89%	0.5%	±1%	35.2±3.5 Vdc
MB65S28C	Class II	28 V	2.3 A	89%	0.5%	±1%	35.2±3.5 Vdc
MB65S32K	Class I	32 V	2.0 A	89%	0.5%	±1%	41.5±4.5 Vdc
MB65S32C	Class II	32 V	2.0 A	89%	0.5%	±1%	41.5±4.5 Vdc

Notes:
1. Efficiency, Typical at 115/230Vac, 25°C. See Charts below for load conditions.
2. Measured at 25°C using 6 inch twisted pair wires with noise probe directly across output terminals, and load terminated with 0.1uF ceramic and 10uF low ESR capacitors.
3. Replace "K" in model number with "C" for class II input versions.
4. Consult factory for following models, available may vary.

SAFETY

UL	ANSI/AAMI ES60101:2005 3rd Edition
CSA	CAN/CSA-C22.2 No. 60601-1 (2008)
Demko	EN 60601-1:2006
CB Report	IEC60601-1-1 3rd Edition

MECHANICAL DRAWING

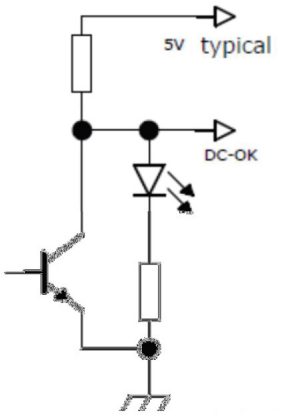


PIN ASSIGNMENTS

Connector	Pin Assignment		Mating Connector
J1 (Input connector)	PIN 1	AC Line	Tyco/AMP 640250-3, Pins: 640252-2
	PIN 2	Empty	
	PIN 3	AC Neutral	
J200 (DC output connector)	PIN 1	+Vout	AMP 640250-4, Pins: 640252-2
	PIN 2	-Vout	
	PIN 3	+Vout	
	PIN 4	-Vout	
J3 (Signal Connector)	PIN 1	RTN	Tyco/AMP 1375820-4, Pins: 1375819
	PIN 2	DCOK	
	PIN 3	Temp Sensor (+)	
	PIN 4	Temp Sensor (+)	
FG (Ground)	0.187" Quickconnect tab		Molex 01-90020005

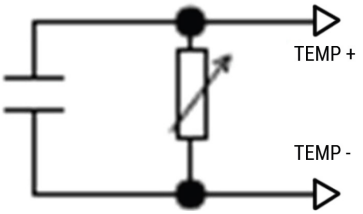
PIN ASSIGNMENTS

DCOK Signal



During normal operation, this signal is logic HIGH for output more than 85% (typical) of normal.
Signal will go LOW for output less than 80% (typical) of normal.
Green LED will light on PCB top side during normal operation

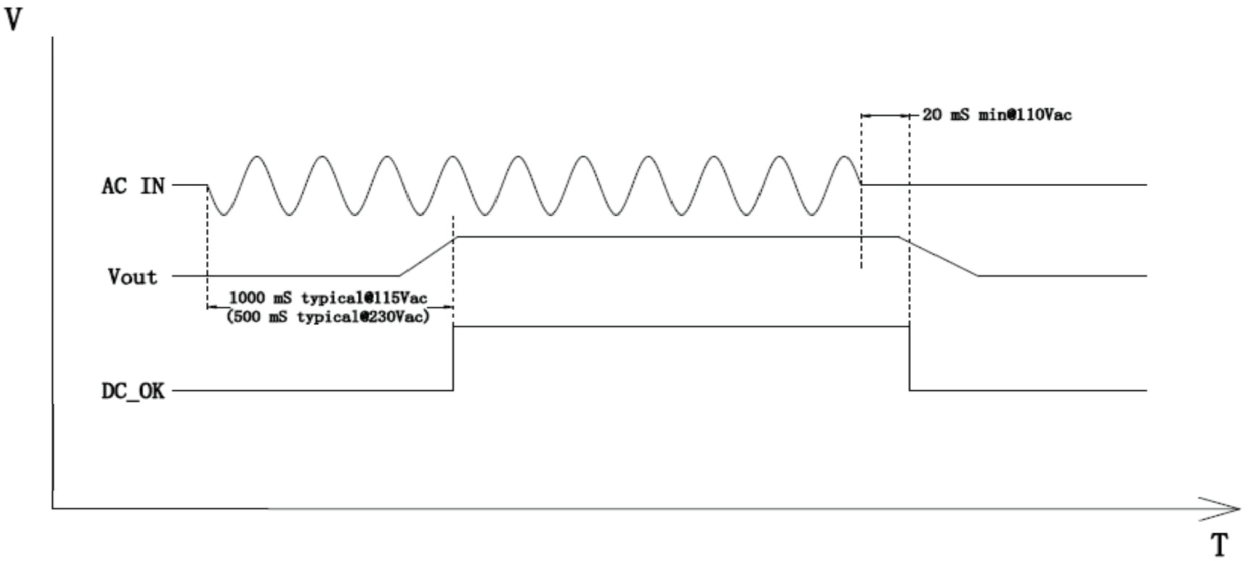
Temperature Sensor Signal



Internal temperature sensor conversion table

Resistance Value across connector J3, pins 3-4	Internal Temperature
6,040K ohms	-20°C
3,227K ohms	-10°C
1,788K ohms	0°C
1,025K ohms	10°C
605.1K ohms	20°C
367.6K ohms	30°C
229.2K ohms	40°C
146.4K ohms	50°C
95.62K ohms	60°C
63.80K ohms	70°C
43.40K ohms	80°C
30.07K ohms	90°C

Timing Sequence



PERFORMANCE CURVES

Output vs. Temperature

1. 65W convection cooled at -20°C to 50°C operating ambient temperature. Derated output power to 45.5W at 70°C.

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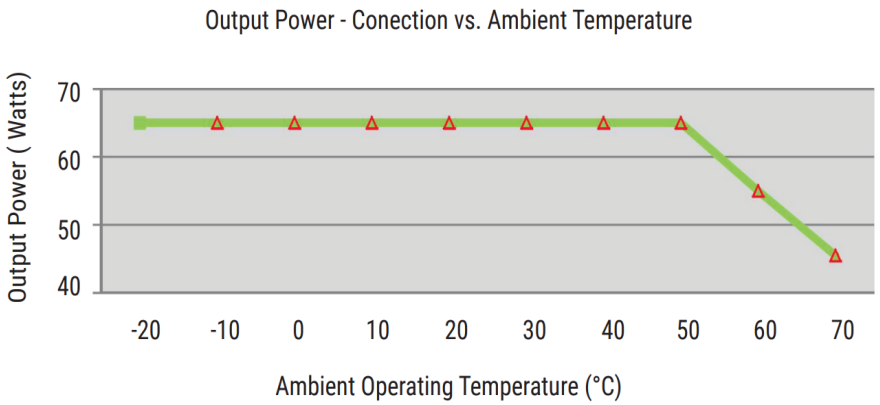
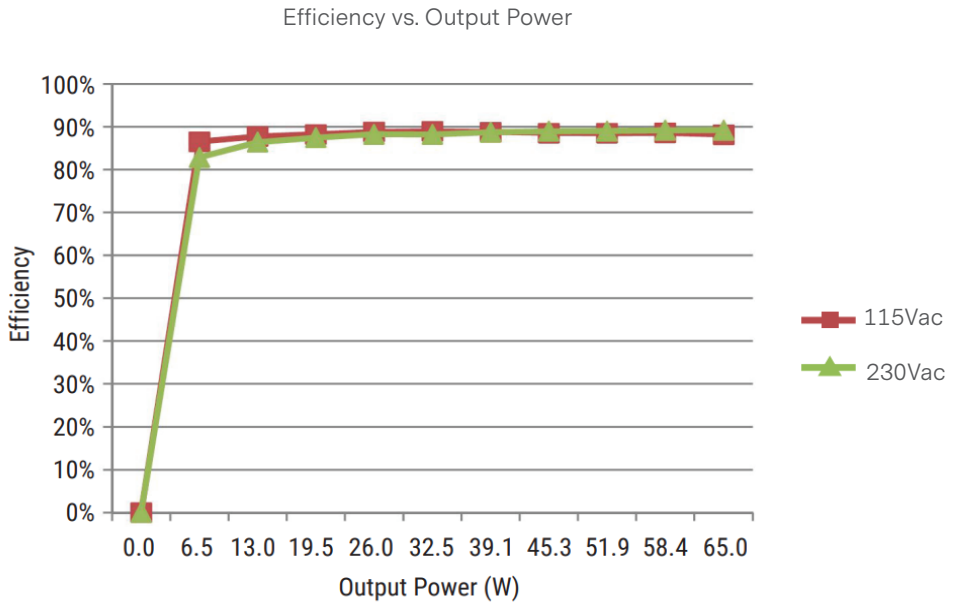


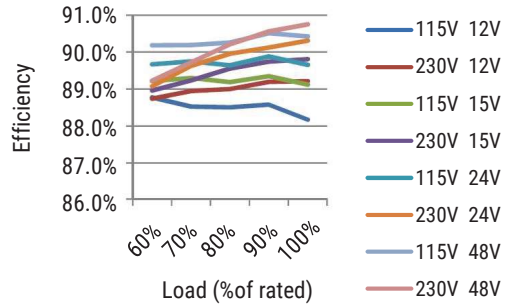
Efficiency vs. Loading



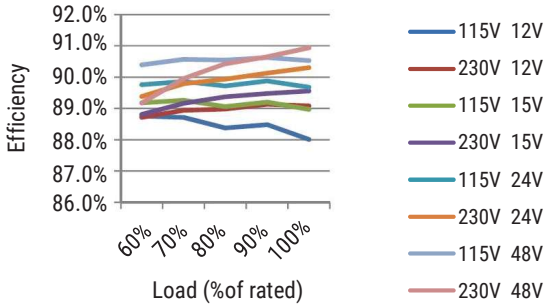
PERFORMANCE CURVES

Efficiency vs. Loading at 25°C, 50°C and 70°C under de-rated power

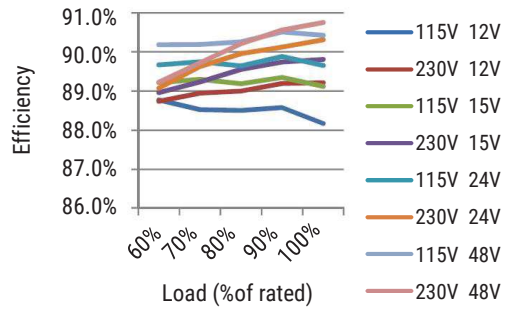
25°C ambient



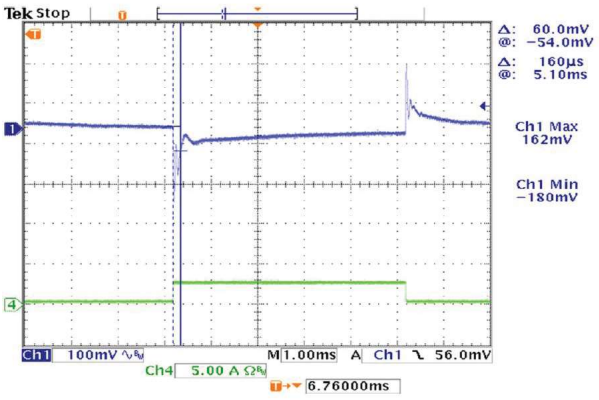
50°C ambient



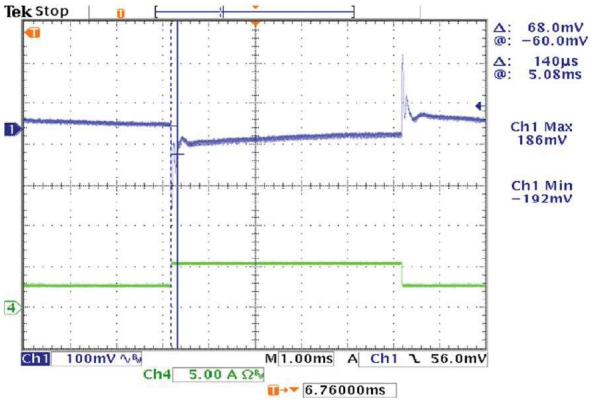
70°C ambient



Output transient response



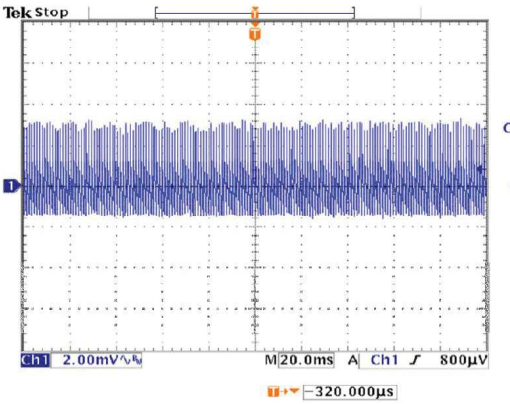
5%~50% Load Transient (AC) at 25°C@115V



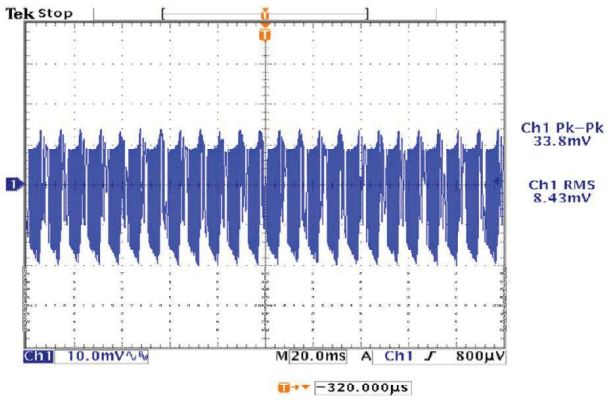
5%~50% Load Transient (AC) at 25°C@115V

PERFORMANCE CURVES

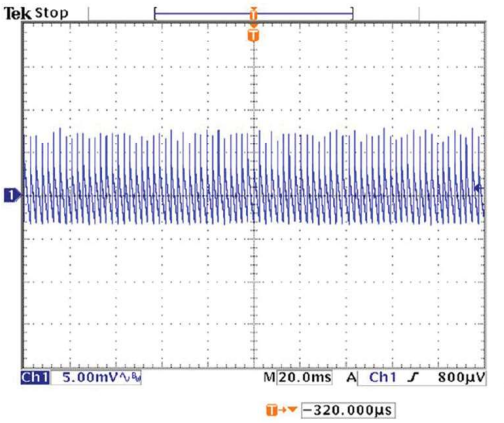
Ripple and noise



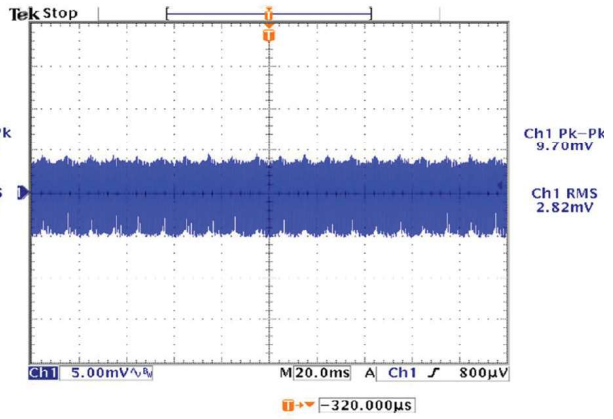
12V Out, No Load, 85VAC, 60HZ



12V Out, No Load, 85VAC, 60HZ



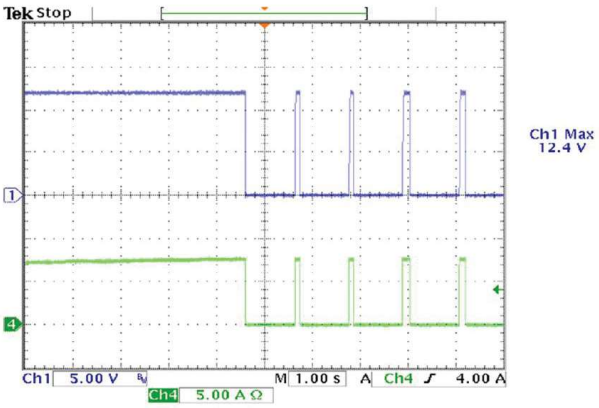
12V Out, No Load, 264VAC, 50HZ



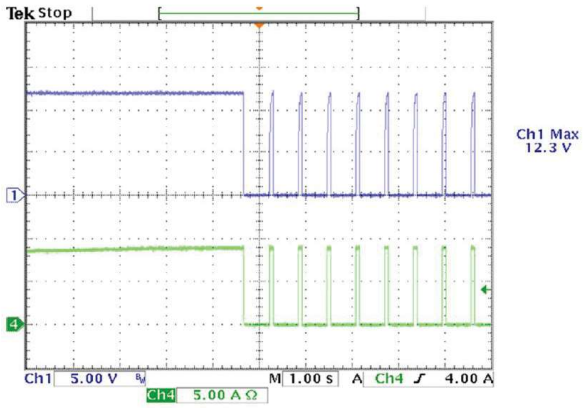
12V Out, No Load, 264VAC, 50HZ

PERFORMANCE CURVES

Output over load characteristic

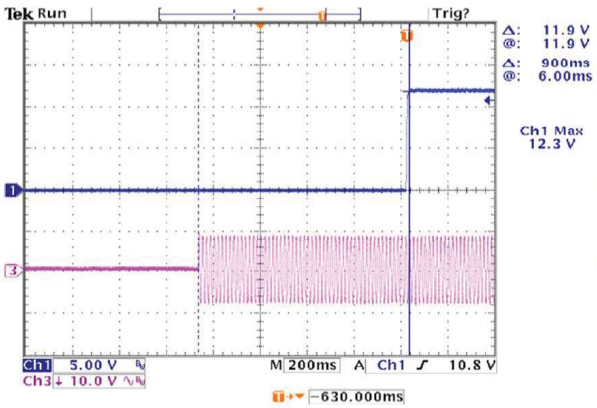


12V Out, 100VAC

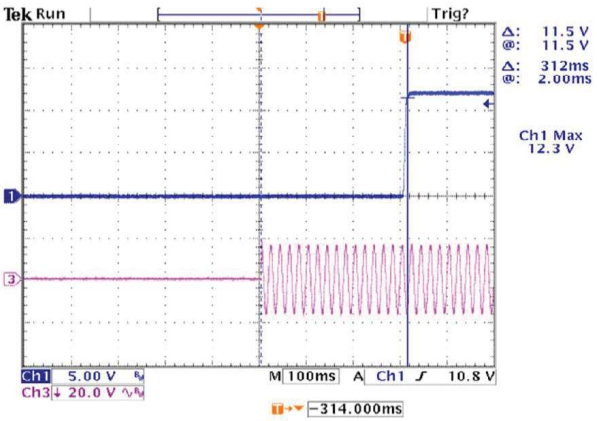


12V Out, 240VAC

Turn on time



12V Out, Full load, 115VAC



12V Out, Full load, 230VAC

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

PRECISION | POWER | PERFORMANCE | TRUST

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