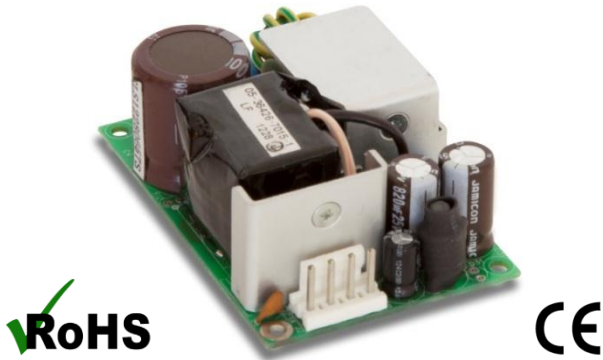


Features

- Ultra Small size of 2" x 3" x 1"
- For 1U Applications
- 60W convection cooled
- Universal Input 90-264Vac
- Approved to IEC60601-1, 3rd Edition with 2 MOPP
- Level V Efficiency Compliant Models
- Less than 0.5W no-load Power Consumption
- 3 Year Warranty
- Optional LED indicator for power-on
- RoHS Compliant



Description

The MB60S Series models provide a reliable power source in high power density in 2" x 3" x 1" package. Fully compliant to the applicable safety and EMC standards, these models will allow easy integration into many Medical applications. All 6 models are CE marked to low voltage directive and approved to Medical standards of IEC60601-1 3rd edition with 2 MOPP.

Model Selection

| Model Number | Volts | Output Current Convection Cooled | Output Power Convection Cooled | Ripple & Noise* | Total Regulation | OVP Threshold |
|--------------|-------|-------------------------------------|-----------------------------------|-----------------|------------------|---------------|
| MB60S12K | 12V | 4.58A | 55W | 120mV pk-pk | ±2% | 14.4-18Vdc |
| MB60S15K | 15V | 4.00A | 60W | 150mV pk-pk | ±2% | 18-22.5Vdc |
| MB60S18K | 18V | 3.33A | 60W | 180mV pk-pk | □2% | 21-25.5Vdc |
| MB60S24K | 24V | 2.50A | 60W | 240mV pk-pk | ±2% | 28.8-36Vdc |
| MB60S36K** | 36V | 1.67A | 60W | 360mV pk-pk | ±2% | 42-47Vdc |
| MB60S48K | 48V | 1.25A | 60W | 480mV pk-pk | ±2% | 57.6-72Vdc |

Notes:

* At -20C, the noise and ripple is 2% of the output.

** For product availability, please contact the factory

Input Specifications

| PARAMETER | SPECIFICATION | NOTES |
|--------------------------------|-----------------------------|--------------|
| AC Input Voltage: | 90-264Vac, single phase | |
| AC Input Frequency: | 47-63Hz | |
| AC Input Current: | 120Vac: 1.4A, 240Vac: 0.75A | |
| Turn-on Input Voltage: | 75V | Ramping Up |
| Turn-off Input Voltage: | 65V | Ramping Down |
| Inrush Current: | 40A maximum @ 0C | |

| | | |
|--|---|---|
| Leakage Current (Input–Earth): | <275 μ A @264Vac, 60 Hz input, NC | IEC 60601-1 3 rd Ed – 8.7.3.c |
| Leakage Current (Output–Earth): | N/A | |
| Leakage Current (Input-Output): | <90 μ A @264Vac, 60 Hz input, NC | |
| Input Fuses: | F1, F2: 4A, 250VAC | Fuses provided on all models |
| Efficiency | Typical | Measured at 120Vac and full load |
| MB60S12K | 83% | |
| MB60S15K | 85% | |
| MB60S18K | 85% | |
| MB60S24K | 88% | 24V, 36V, and 48V Models meet Level V requirement |
| MB60S36K | 88% | |
| MB60S48K | 88% | |
| No Load Input Power: | <0.5W | Meet Level V, standby Power Consumption |
| Turn-on Time: | <2 Seconds at 120Vac. | |
| Hold-up Time: | 16mS minimum from loss of ac input at 120 Vac, full load. | 55 Watts for 12V output |

DC Output Specifications

| PARAMETER | SPECIFICATION | NOTES |
|------------------------------------|---|---|
| Output Power: | 60W continuous for operation from -10°C to 50°C 55 Watts for 12V output. | |
| Cooling: | Convection | |
| Total Regulation: | $\pm 2\%$ for all models | Total regulation is the maximum deviation from nominal voltage for all loading conditions |
| Overload Protection: | 120% - 180% of rated output current value, Hiccup Mode | |
| Short Circuit Protection: | Short across the output terminals will not cause damage to the unit. Hiccup Mode | |
| Overvoltage Protection: | OVP firing reduces output voltage to <50% of nominal in <50mS. See chart for trip range | |
| Overtemperature Protection: | Automatic Power Shutdown at Tc = 155°C, | |
| Minimum Load: | No minimum load is required | |
| Ripple and Noise: | 0.5% RMS, 1% pk-pk for all models. | 20 MHz Bandwidth, differential mode. Measured with noise probe directly across output terminals, and load terminated with 0.1 μ F ceramic and 10 μ F low ESR capacitors |
| Transient Response: | 500 μ s typ. response time for return to within 0.5% of final value for a 50% load change, $\Delta i/\Delta t < 0.2A/\mu s$. Max. voltage deviation is 3.5%. | |
| Overshoot: | 5% overshoot at turn-on, 5% overshoot at turn-off, under all conditions. | |

Safety Standard Compliance

| Agency | CONDITIONS |
|-----------------|---|
| UL | ANSI/AAMI ES60101:2005, 3 rd Edition |
| CSA | CAN/CSA-C22.2 No. 60601-1 (2008) |
| Demko | EN 60601-1:2006 |
| CB Report | IEC 60601-1 (3 rd Edition) |
| Isolation Type: | B rated |

Isolation Specifications

| PARAMETER | CONDITIONS | Rating | NOTES |
|---------------------------------|------------------|---------|-------|
| Insulation Safety Rating: | Input to Ground | 2 MOPP | |
| | Input to Output | 1 MOPP | |
| | Output to Ground | 1 MOPP | |
| Electric Strength Test Voltage: | Input to Ground | 1800Vac | |
| | Input to Output | 4000Vac | |
| | Output to Ground | 500Vac | |

Environmental Specifications

| PARAMETER | SPECIFICATION | NOTES |
|------------------------|---|--|
| Operating Temperature: | -10°C to +80°C | -40°C Startup guaranteed |
| Temperature Derating: | For 24V output and over, derate output power to 50W @ 60C, 40 Watt @ 70C, and 20 Watts for 80C | <24V will derate to 40W at 60C, 30W at 70C, and 20W at 80C |
| Cooling: | Convection | |
| Storage Temperature: | -40°C to +85°C | |
| Altitude: | Operating: -500 to 3,000 meter Non-operating: -500 to 40,000 ft. | |
| Relative Humidity: | 5% to 95%, non-condensing | |
| Shock: | Non-Operating: Half-sine, 40 gpk, 10mS, 3 axes, 6 shocks total | |
| Vibration: | Random vibration per MIL-STD-810E, Method 514.4, Cat. 1, Figure 514.4-1, 1 hr in each of three axes | |

Reliability Specifications

| PARAMETER | SPECIFICATION | NOTES |
|------------|--|---|
| MTBF: | 700,000 hours, 25°C ambient, full load | Calculation is done based on Telcordia. Reports for each model is available |
| Warranty: | 3 Years | Limited |
| HALT Data: | Per SL Power Halt procedure | Report is available |

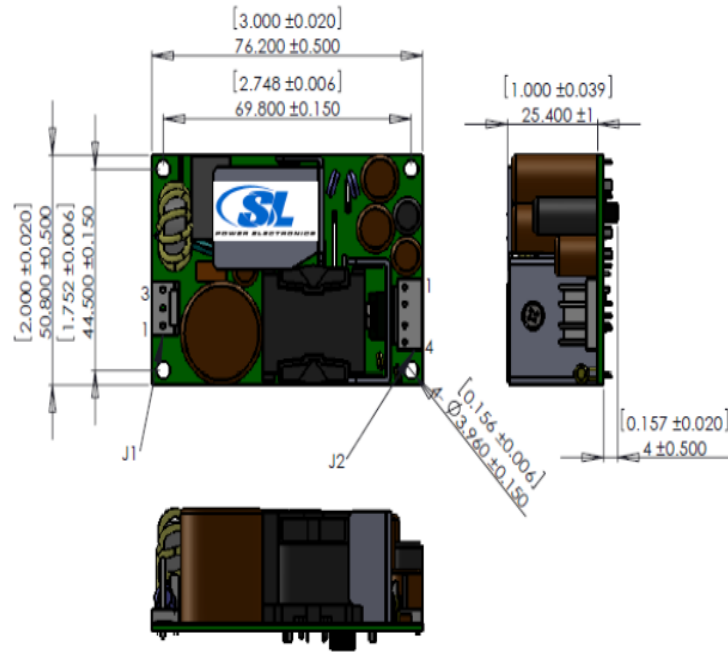
EMI/EMC Compliance

| PARAMETER | SPECIFICATION | NOTES |
|-------------------------------------|--|---|
| Conducted Emissions: | EN55011/22 Class B; FCC Part 15 | |
| Radiated Emissions: | EN55011/22 Class A; FCC Part 15 | |
| Harmonic Current Emissions | EN61000-3-2, Class A | |
| Voltage Fluctuations & Flicker | EN61000-3-3 | |
| Static Discharge Immunity: | EN61000-4-2 6kV contact, 8kV air, Criteria A | Performance criteria are defined as following: A – Normal performance during and after the test B – Temporary degradation, self-recoverable C – Temporary degradation, operator intervention required to recover the operation |
| RF Field Susceptability | EN61000-4-3 (3V/m), Criteria A | |
| Fast Transients/Bursts | EN61000-4-4 (PS: 2kV-40A, other lines 1kV-20A), Criteria B | |
| Surge Susceptability | EN61000-4-5, Installation Class 3 (1kV diff. mode, 2kV common mode), Criteria A | |
| Conducted RF Susceptability | EN61000-4-6 (3Vrms), Criteria A | |
| Power Frequency Magnetic Field Test | EN61000-4-8 (3A/m), Criteria A | |
| Voltage Sags & Surges | EN61000-4-11, 95% dip/0.5 cycle (Criteria A), 60%/5cycles (Criteria B), 30%/25 cycles (Criteria A). | |

Notes:

1. Specifications subject to change without notice.
2. Specifications are for convection rating at factory settings with 115Vac input and 25°C ambient unless otherwise stated.

Mechanical Drawing



Connector Information

| Input Connector J100 | DC Output Connector J2 | Ground (FG) |
|---|--|--|
| PIN 1) AC LINE PIN 2) EMPTY PIN 3) AC NEUTRAL | PIN 1) +Vout PIN 3) -Vout PIN 2) +Vout PIN 4) -Vout | 19-30258-0187 (Keystone 1285) (Zierick 895)(.187*0.020) |
| Mating Connector: Tyco/AMP 640250-3 Pins = 770461-1 | Mating Connector: AMP 640250-4 Pins = 770461-1 | Mating Connector Molex 19002-0005 |

1. Mounting holes should be connected together for EMI purpose
2. FG is safety ground connection
3. This power supply requires mounting on metal standoffs 0.20" (5mm) in height

Characteristic Curves

Output vs. Temperature

-40C start up. At -20C, the supply meet its full spec except ripple & noise might be increased from 1% to 2% of the output voltage

55W convection cooled, derating output power to 30W at 70°C for outputs 12V and 15V

60W convection cooled, derating output power to 50W at 60°C and 40W at 70°C for Output Voltages ≥ 24V

20W convection cooled at 80C

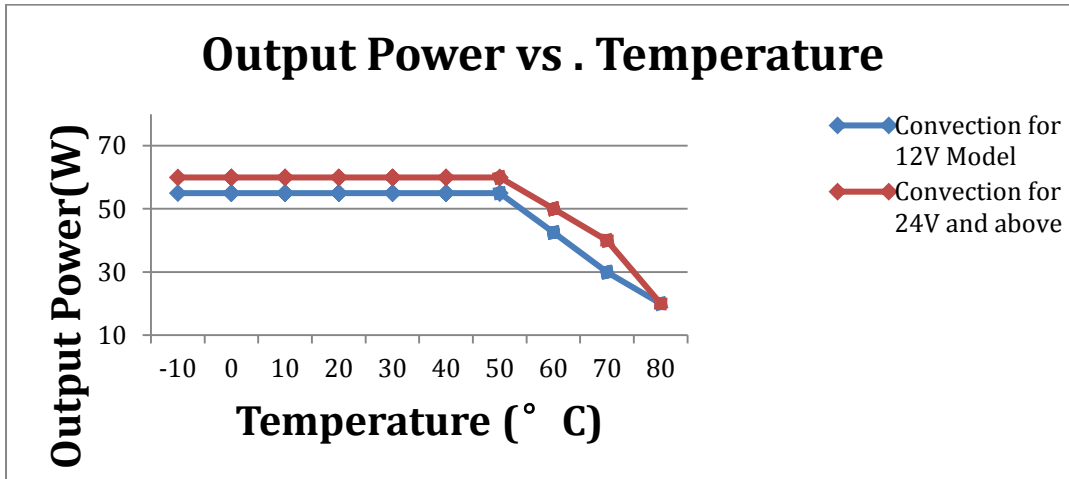


Fig.1

Efficiency vs. Loading

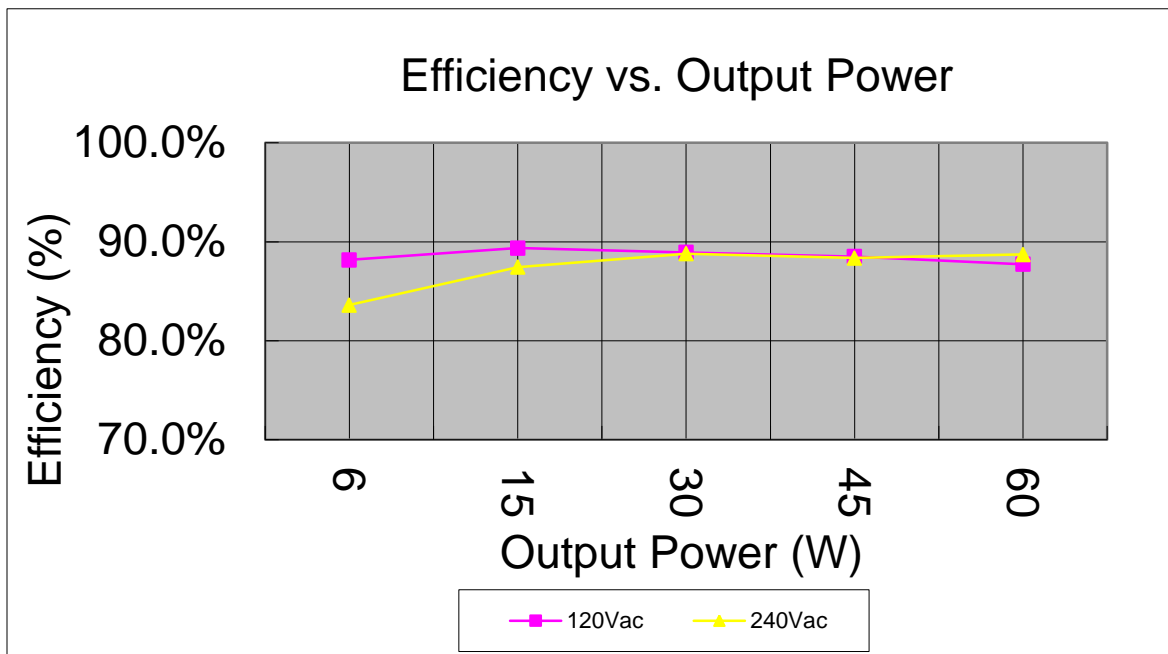
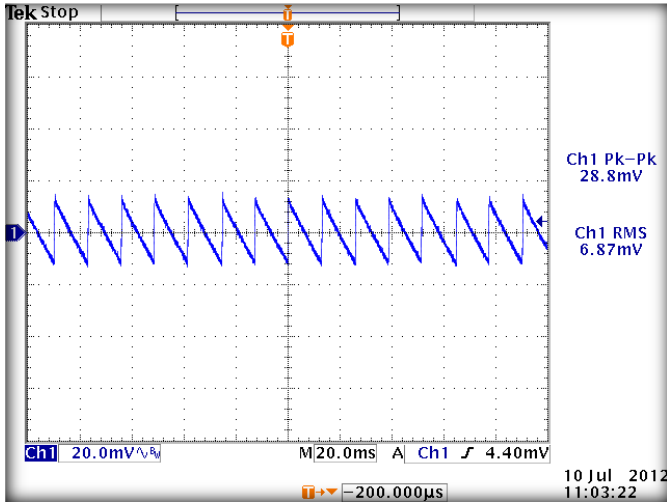
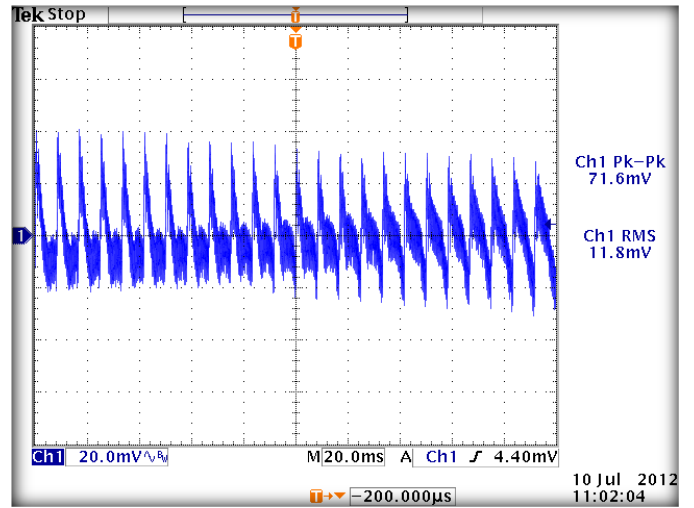


Fig.2

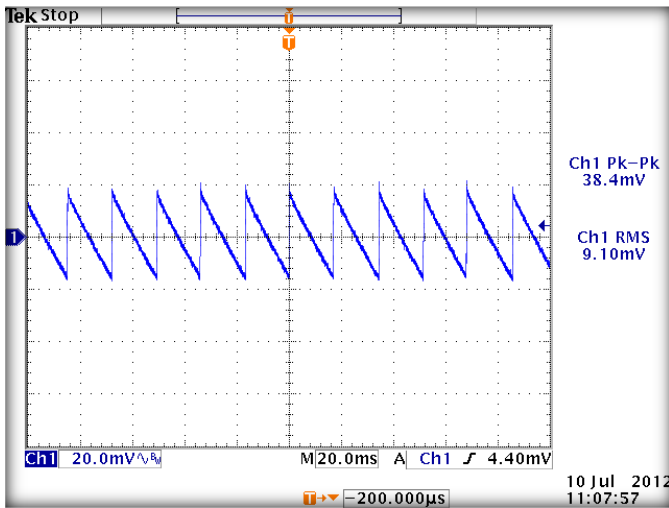
To verify that the output ripple and noise does not exceed the level specified in the product specification, measured using a scope probe socket with 0.1uF ceramic and a 10uF electrolytic capacitor connected in parallel across it, 20MHz BW.



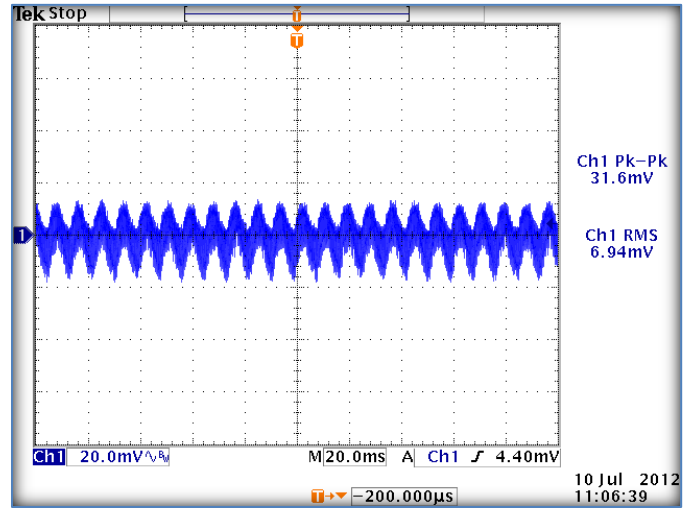
[24V OUT, FULL LOAD, 90VAC, 60Hz](#)



[24V OUT, NO LOAD, 90VAC, 60Hz](#)



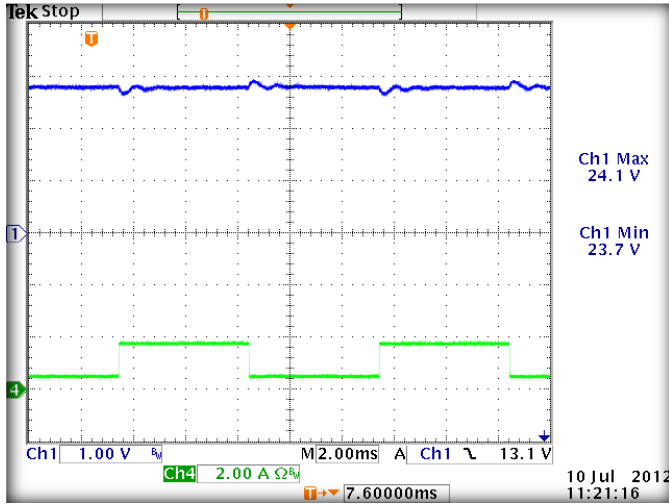
[24V OUT, NO LOAD, 264VAC, 50Hz](#)



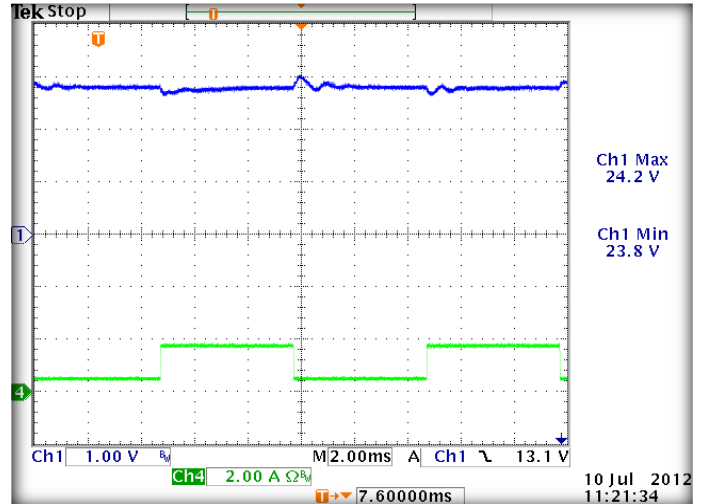
[24V OUT, FULL LOAD, 264VAC, 50Hz](#)

Output Transient Response

50% load step within the regulation limits of minimum and maximum load, $di/dt < 0.2A/\mu\text{Sec}$. Recovery time not specified as there is no laps in regulation with a 50% Load Step. Maximum voltage deviation is 3.5%

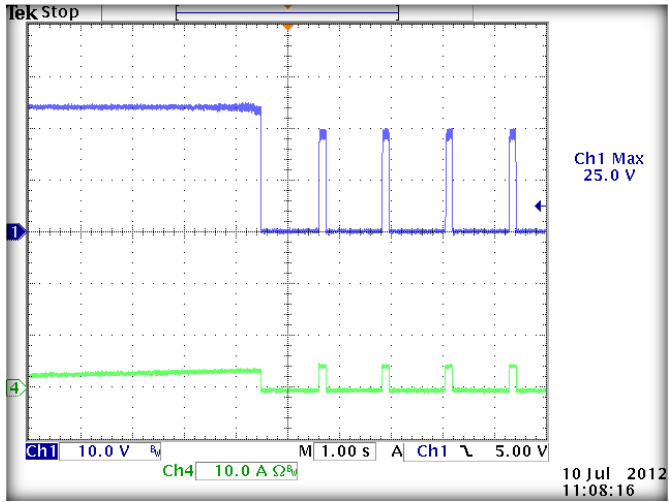


[24V OUT, 120VAC, 25% TO 75% LOAD STEP](#)

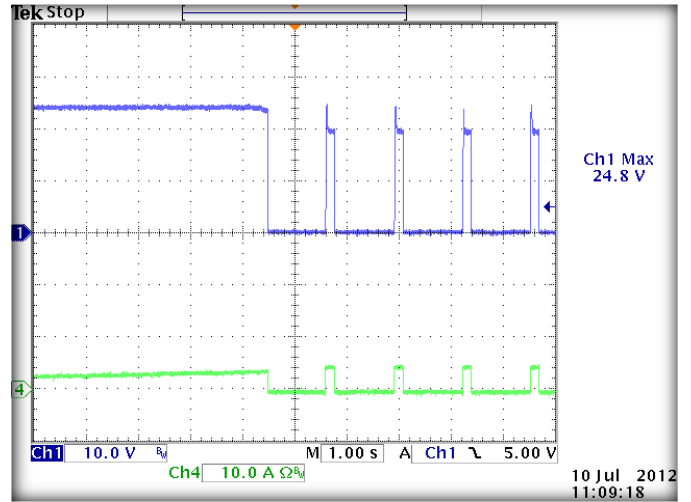


[24V OUT, 240VAC, 25% TO 75% LOAD STEP](#)

Output Overload Characteristic



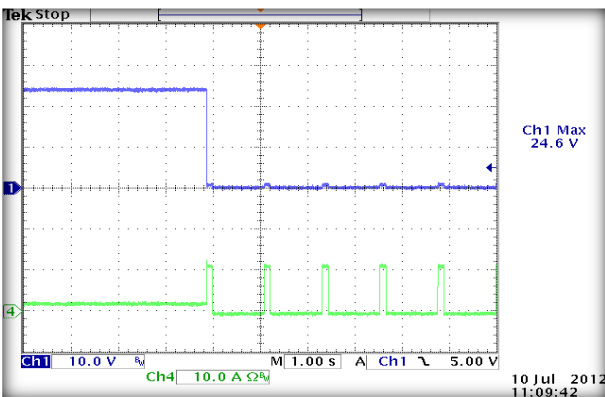
[24V OUT, 90VAC](#)



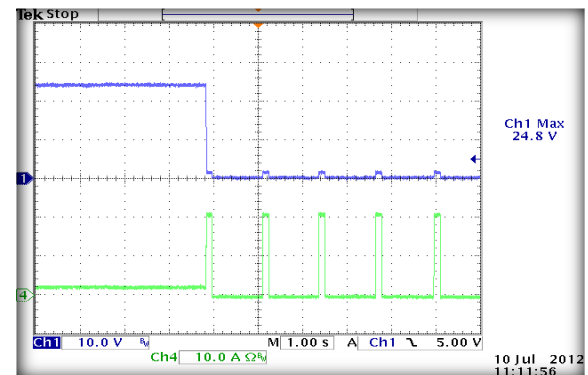
[24V OUT, 264VAC](#)

Short Circuit Protection

Supply shall protect itself against Short Circuit conditions. No damage will occur if the output is shorted.



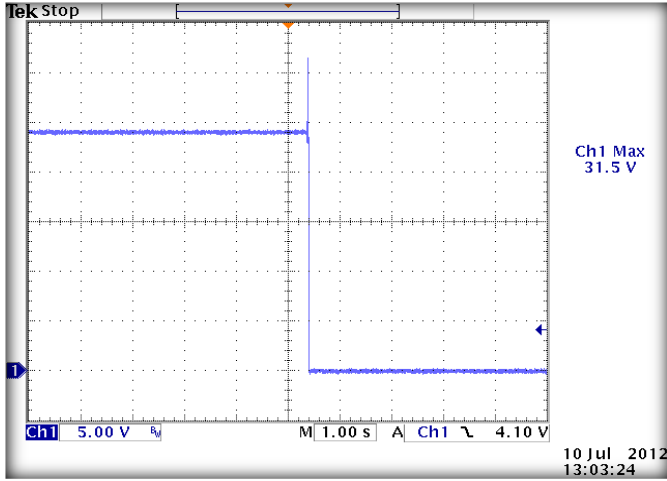
[24V OUT, 264VAC](#)



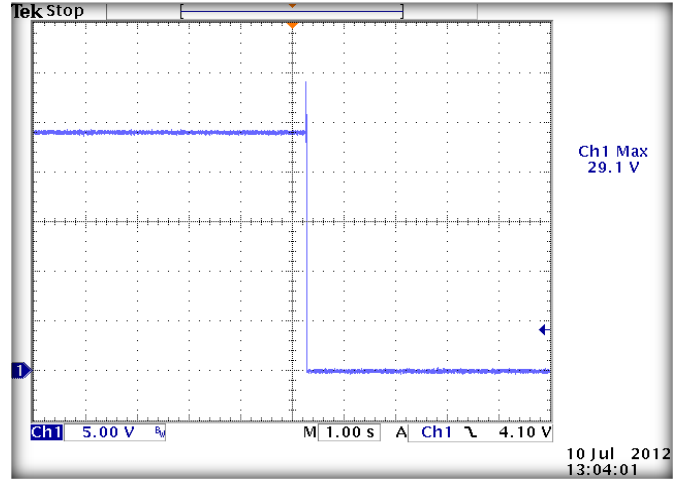
[24V OUT, 90VAC](#)

Overvoltage Protection

OVP firing reduces output voltage to <50% of nominal in <50ms. See models chart for trip ranges.

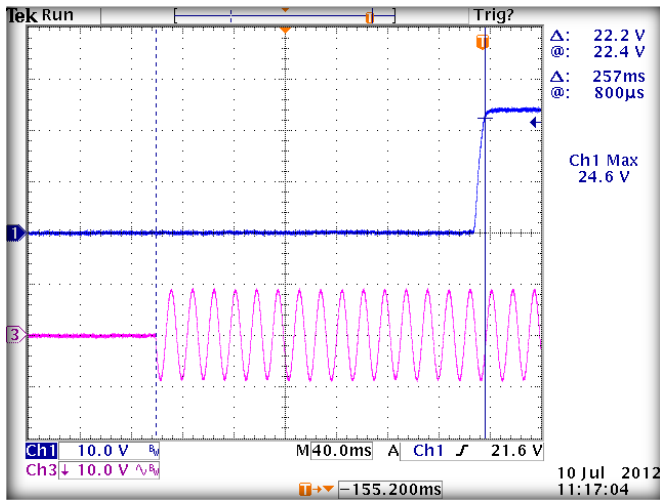


[24V OUT, FULL LOAD, 90VAC, 60HZ](#)

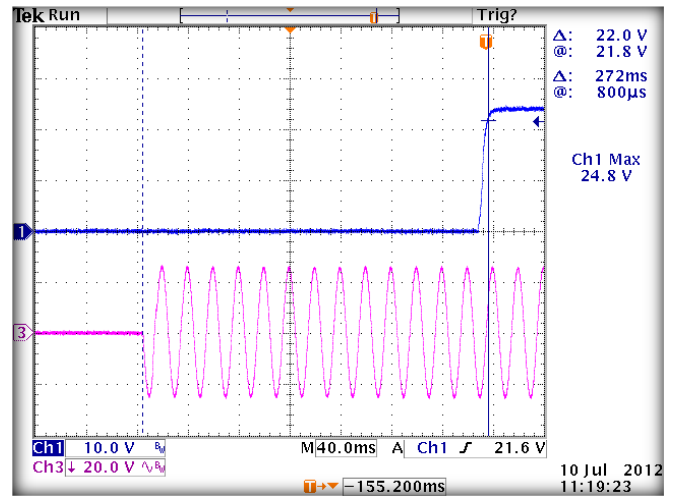


[24V OUT, FULL LOAD, 264VAC, 50HZ](#)

Turn On Time

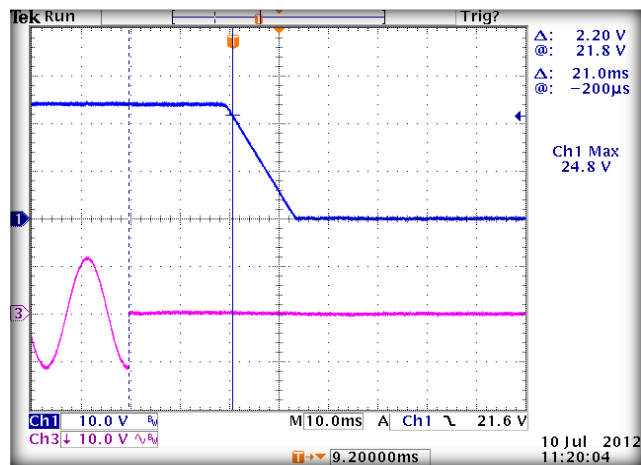


[24V OUT, FULL LOAD, 90VAC, 60HZ](#)



[24V OUT, FULL LOAD, 264VAC, 50HZ](#)

Hold Up Time



[24V OUT, FULL LOAD, 120VAC, 60HZ](#)

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