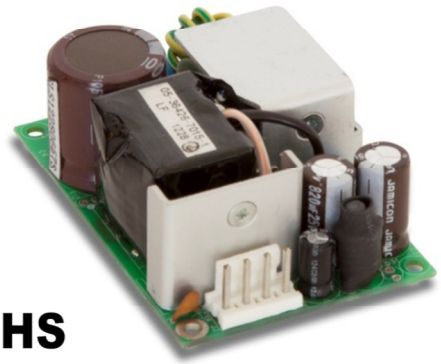
MB60S

60W Single Output

Medical Series



Features

- Ultra Small size of 2” x 3” x 1.0”
- 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 1.0” 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:	70V	Ramping Up
Turn-off Input Voltage:	65V	Ramping Down
Inrush Current:	40A maximum @ 0C	

Leakage Current (Input–Earth):	<275µA@264Vac, 60 Hz input, NC	IEC 60601-1 3rd Ed – 8.7.3.c
Leakage Current (Output–Earth):	N/A	
Leakage Current (Input-Output):	<90µA@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 -10ºC to 50ºC55 Watts for 12V output.	
Cooling:	Convection	
Total Regulation:	±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 = 155ºC,	
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 0.1µF ceramic and 10µF low ESR capacitors
Transient Response:	500µs typ. response time for return to within 0.5% of final value for a 50% load change, $\Delta i/\Delta t$< 0.2A/µs. 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, 3rd Edition
CSA	CAN/CSA-C22.2 No. 60601-1 (2008)
Demko	EN 60601-1:2006
CB Report	IEC 60601-1 (3rd 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℃ to +80℃	-40℃ 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℃ to +85℃	
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

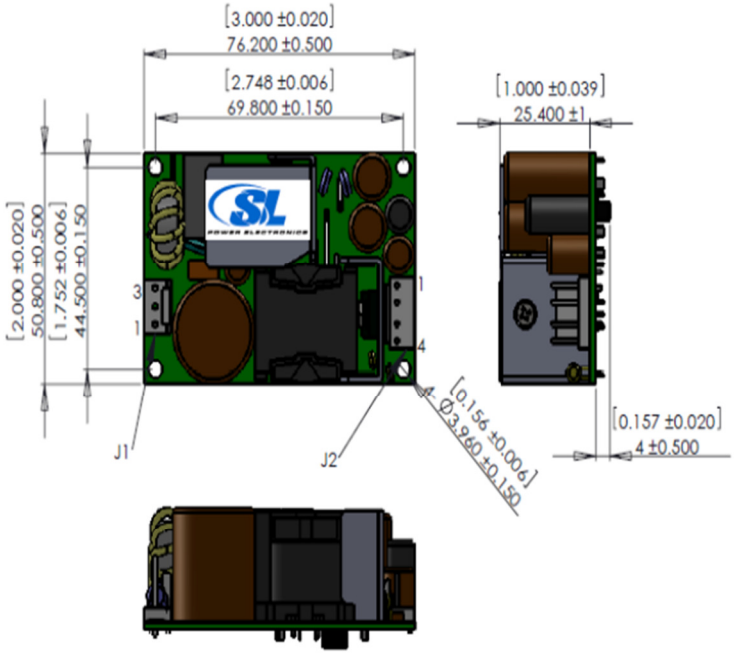
PARAMETER	SPECIFICATION	NOTES
MTBF:	700,000 hours, 25℃ ambient, full load	Calculation is done based on Telcordia. Reports for each model is available
Warranty:	3 Years	Limited
HALT Data:	Per SL Power Halt procedure	Report is available

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, Level 4: 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, Level 3 (3V/m), Criteria A	
Fast Transients/Bursts	EN61000-4-4, Level 3 (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, Level 3 (3Vrms), Criteria A	
Power Frequency Magnetic Field Test	EN61000-4-8, Level 3 (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℃ 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

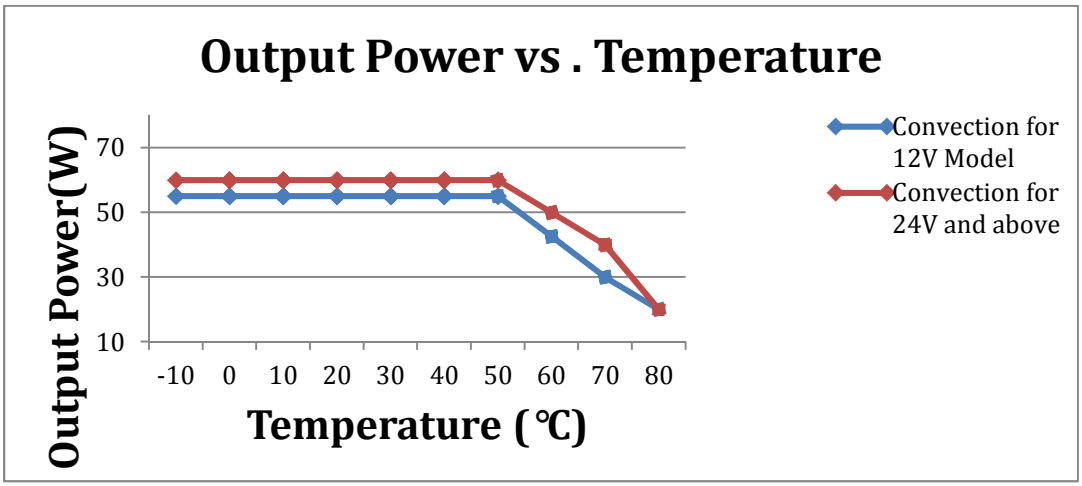


Fig.1

Efficiency vs. Loading

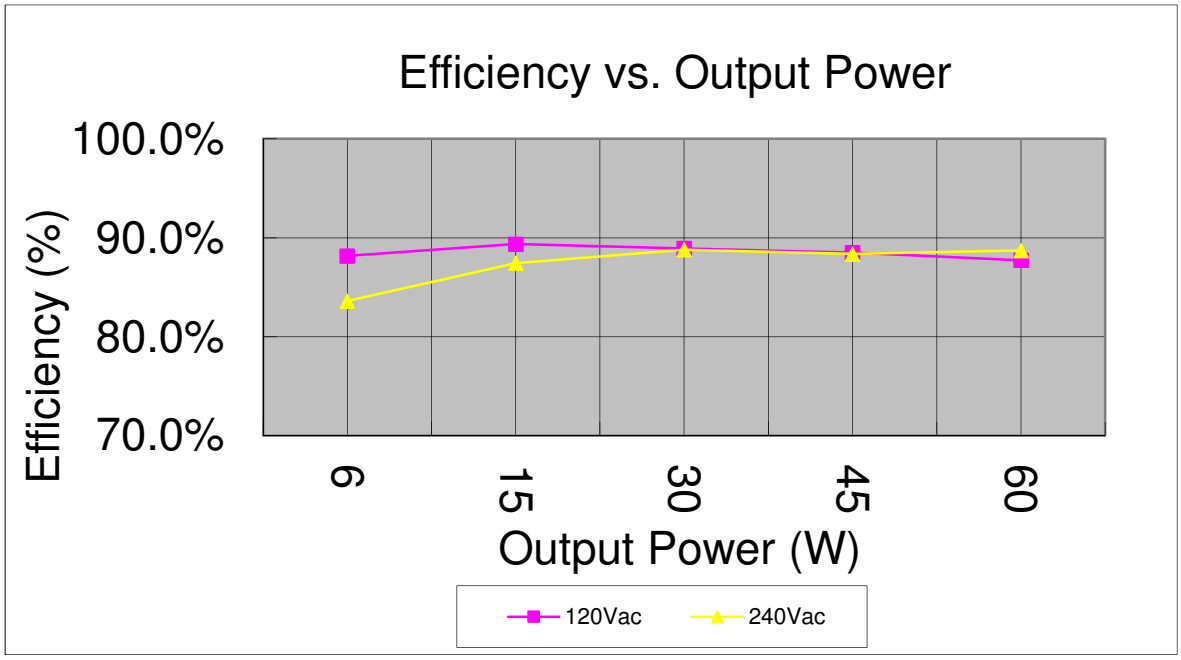
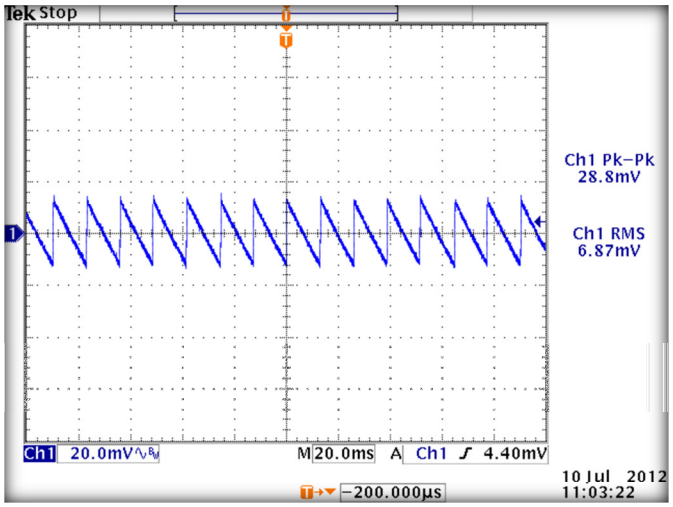


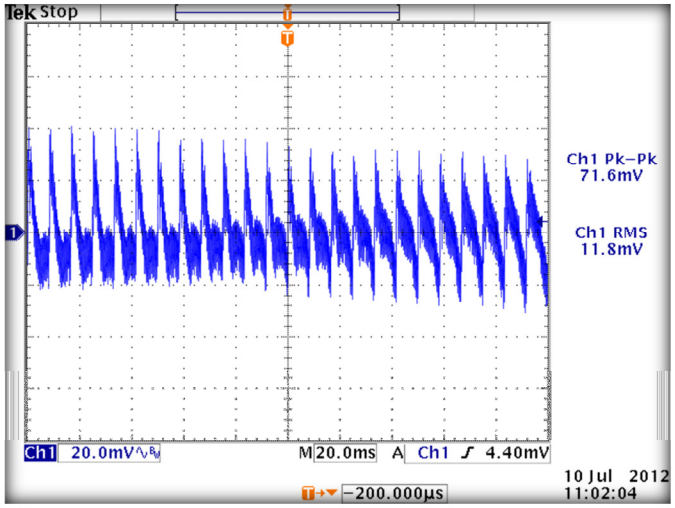
Fig.2

Ripple & Noise

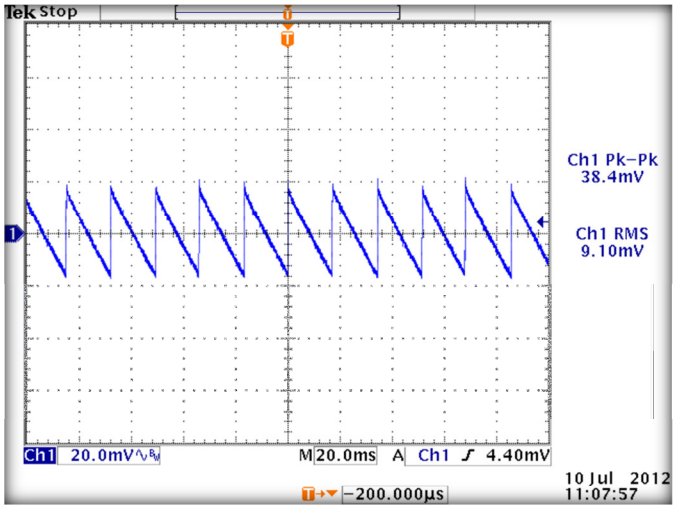
To verify that the output ripple and noise does not exceed the level specified in the product specification, measured using a scope probe socket with 0.1uF ceramic and a 10uF electrolytic capacitor connected in parallel across it, 20MHz BW.



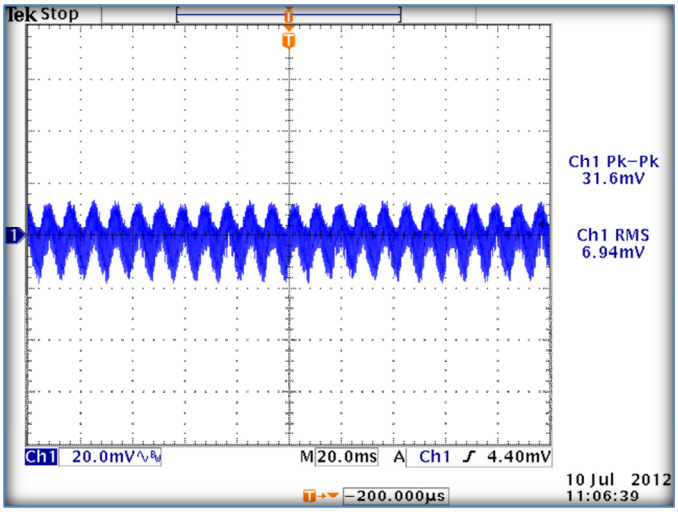
24V OUT, FULL LOAD, 90VAC, 60HZ



24V OUT, NO LOAD, 90VAC, 60HZ



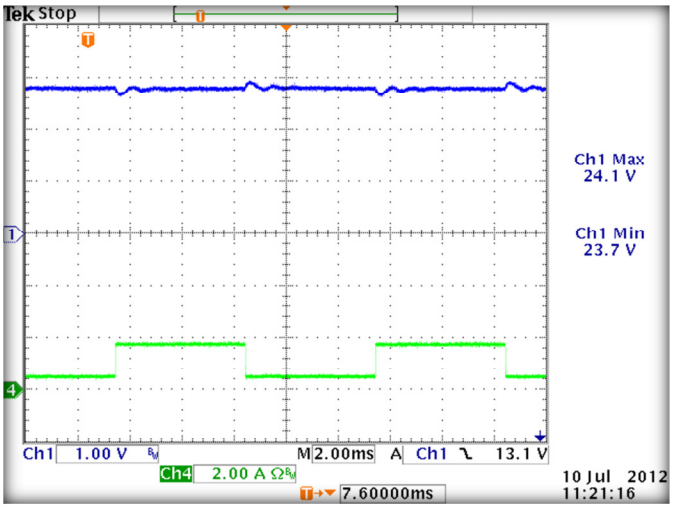
24V OUT, NO LOAD, 264VAC, 50HZ



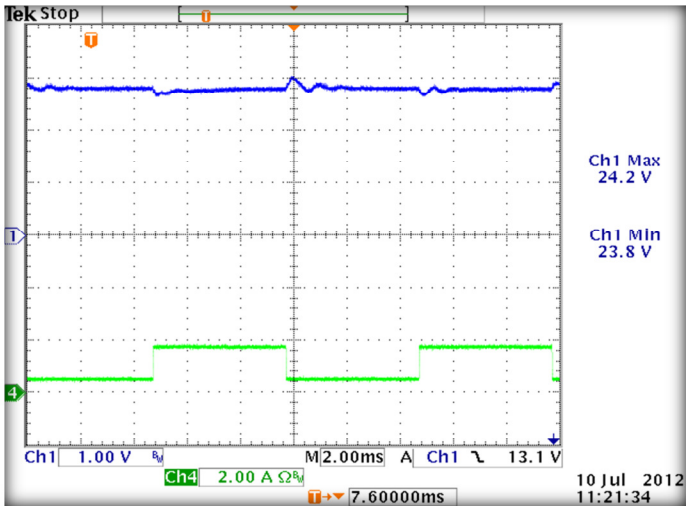
24V OUT, FULL LOAD, 264VAC, 50HZ

Output Transient Response

50% load step within the regulation limits of minimum and maximum load, dI/dt< 0.2A/µSec. Recovery time not specified as there is no laps in regulation with a 50% Load Step. Maximum voltage deviation is 3.5%

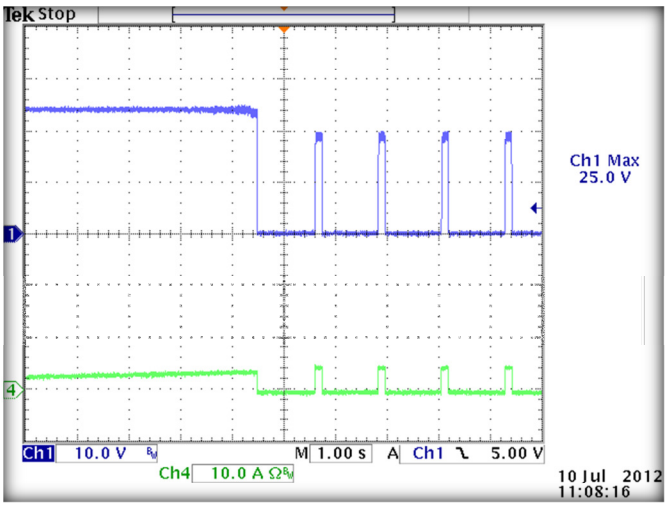


24V OUT, 120VAC, 25% TO 75% LOAD STEP

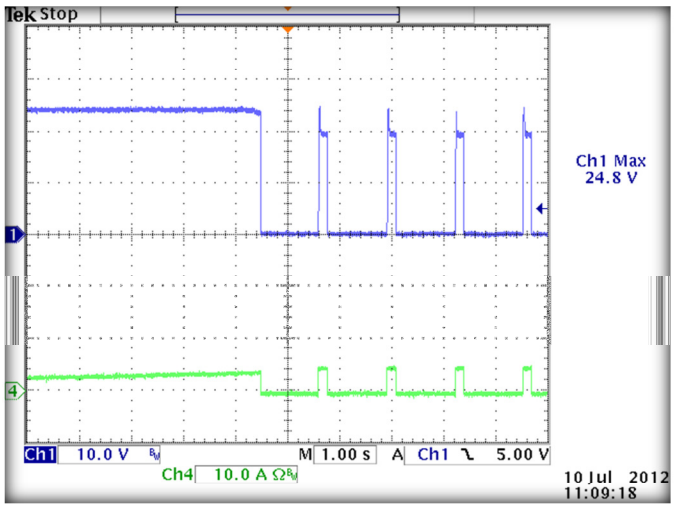


24V OUT, 240VAC, 25% TO 75% LOAD STEP

Output Overload Characteristic



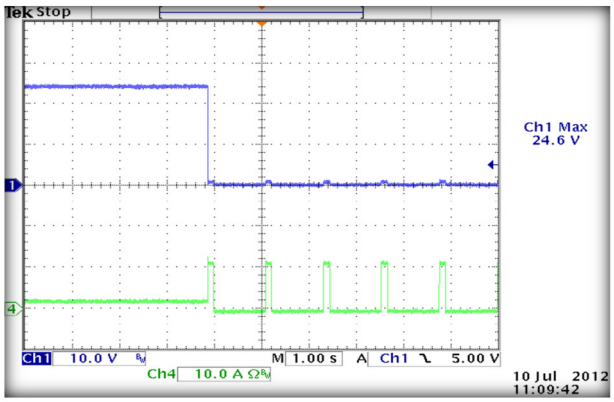
24V OUT, 90VAC



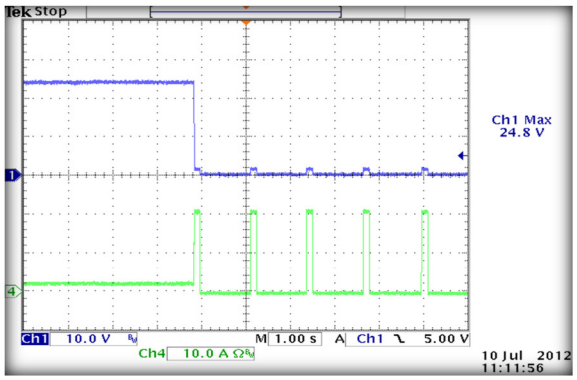
24V OUT, 264VAC

Short Circuit Protection

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



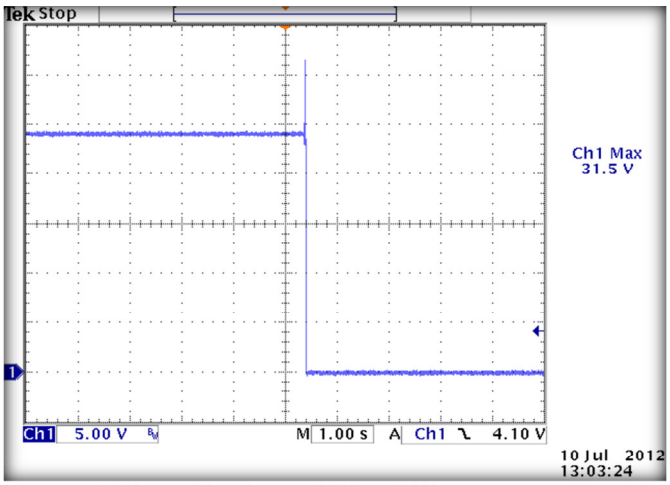
24V OUT, 264VAC



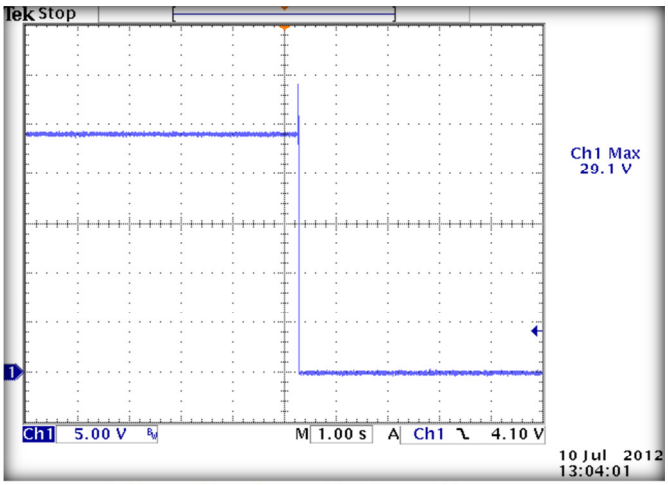
24V OUT, 90VAC

Overvoltage Protection

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

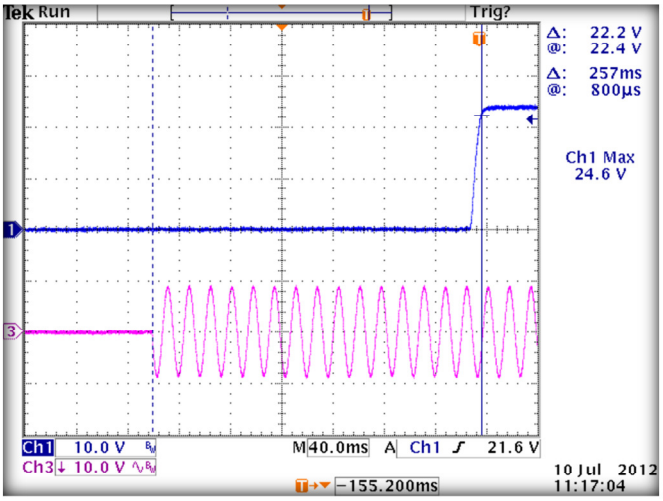


24V OUT, FULL LOAD, 90VAC, 60HZ

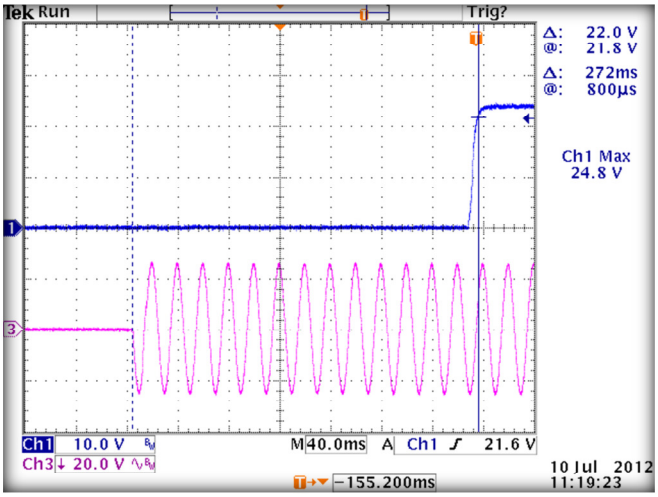


24V OUT, FULL LOAD, 264VAC, 50HZ

Turn On Time

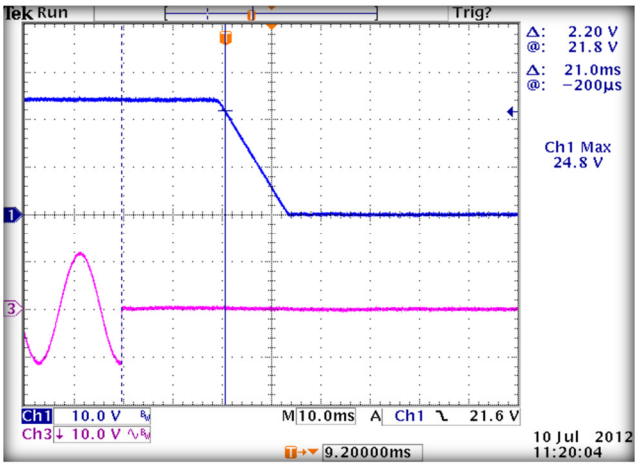


24V OUT, FULL LOAD, 90VAC, 60HZ



24V OUT, FULL LOAD, 264VAC, 50HZ

Hold Up Time



24V OUT, FULL LOAD, 120VAC, 60HZ

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