

LCB50 Series

Up to 50 Watts

Low Power

Total Power: Up to 50 Watts
Input Voltage: 88 to 264 Vac
125 to 373 Vdc

of Outputs: Single

Special Features

- No-load power consumption 0.5 W
- Low cost
- 3.9" x 3.2" x 1.4"
- -25 °C to 70 °C with derating
- High efficiency: 90% @ 230 Vac
- Power ON with LED indicator
- Withstand 5G vibration test
- 2 Years warranty

Safety

UL /cUL 60950-1
TUV EN60950-1
CE



Product Descriptions

The LCB50 series features a universal 88-264Vac input – enabling it to be used anywhere in the world – and is also capable of operating from a 125-373Vdc Input. The LCB50 series offers a power rating up to 50W with convection cooling, and it provide precisely regulated output voltages of 3.3V, 5V, 12V, 15V, 24V and 48Vdc.

The LCB50 series power supply is comprehensively protected against over voltage, over load and short-circuit conditions.

Model Numbers

Model	Output Voltage (Vdc)	Minimum Load (A)	Maximum Load (A)	Efficiency ¹ (%)
LCB50D	3.3	0	10	78
LCB50E	5	0	10	83
LCB50L	12	0	4.2	88
LCB50N	15	0	3.4	89
LCB50Q	24	0	2.2	90
LCB50W	48	0	1.1	90

Note 1 - Typical value at nominal input voltage(230Vac) and maximum load.

Options

None

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the “Absolute Maximum Ratings” may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply’s reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage	AC continuous operation	$V_{IN,AC}$	88	-	264	Vac
	DC continuous operation	$V_{IN,DC}$	125	-	373	Vdc
Maximum Output Power Convection continuous operation	LCB50D	$P_{O,max}$	-	-	33	W
	LCB50E		-	-	50	W
	LCB50L		-	-	50.4	W
	LCB50N		-	-	51	W
	LCB50Q		-	-	52.8	W
	LCB50W		-	-	52.8	W
Isolation Voltage	Input to Output	All models	-	-	3000	Vac
	Input to Safety Ground	All models	-	-	1500	Vac
	Output to Earth Ground	All models	-	-	500	Vdc
Ambient Operating Temperature	All models	T_A	-25	-	+70 ¹	°C
Storage Temperature	All models	T_{STG}	-40	-	+85	°C
Humidity (non-condensing)	Operating	All models	20	-	90	%
	Non-operating	All models	10	-	95	%

Note 1 - Derate each output at 2.5% per degree C from 50 °C to 70 °C.

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	
Operating Input Voltage, AC ¹	All	$V_{IN,AC}$	88	115/230	264	Vac	
Operating Input Voltage, DC	All	$V_{IN,DC}$	125	-	373	Vdc	
Input AC Frequency	All	f_{IN}	47	50/60	63	Hz	
Input Current	$V_{IN,AC} = 115Vac$ $V_{IN,AC} = 230Vac$	$I_{IN,max}$	-	1.3 0.5	-	A_{PK}	
No Load Input Power ($V_O = ON, I_O = 0A$)	$V_{IN,AC} = 115/230Vac$	$P_{IN,no-load}$	-	-	0.5	W	
Harmonic Line Currents	All	THD	EN61000-3-2/EN61000-3-3				
Startup Surge Current (Inrush) @ 25°C	$V_{IN,AC} = 230Vac$	$I_{IN,surge}$	-	40	-	A_{PK}	
Efficiency ($T_A = 25°C$, free air convection cooling)	LCB50D	$V_{IN,AC} = 230Vac$ $I_O = I_{O,max}$	η	-	78	-	%
	LCB50E			-	83	-	
	LCB50L			-	88	-	
	LCB50N			-	89	-	
	LCB50Q			-	90	-	
	LCB50W			-	90	-	
Hold Up Time	$V_{IN,AC} = 115Vac$ $P_O = P_{O,max}$	$t_{Hold-Up}$	10	-	-	mSec	
	$V_{IN,AC} = 230Vac$ $P_O = P_{O,max}$	$t_{Hold-Up}$	32	-	-	mSec	
Turn On Delay	$V_{IN,AC} = 115Vac$ $P_O = P_{O,max}$	$t_{Turn-On}$	-	1000	-	mSec	
	$V_{IN,AC} = 230Vac$ $P_O = P_{O,max}$	$t_{Turn-On}$	-	800	-	mSec	
Leakage Current to safety ground	$V_{IN} = 240Vac$ $f_{IN} = 50/60Hz$	$I_{IN,leakage}$	-	-	2000	μA	

Note 1 - Withstand 300Vac surge for 5sec, without damage.

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Factory Set Point Accuracy	LCB50D	Inclusive of setpoint, line, load change	V_O	-3	-	+3	%
	LCB50E			-2	-	+2	
	LCB50L			-1	-	+1	
	LCB50N			-1	-	+1	
	LCB50Q			-1	-	+1	
	LCB50W			-1	-	+1	
Output Adjust Range	LCB50D	All	V_O	2.97	3.3	3.63	V
	LCB50E			4.5	5	5.5	
	LCB50L			10.8	12	13.2	
	LCB50N			13.5	15	16.5	
	LCB50Q			21.6	24	26.4	
	LCB50W			43.2	48	52.8	
Output Ripple, pk-pk	LCB50D	Measure with a 0.1 μ F ceramic capacitor in parallel with a 47 μ F aluminum electrolytic capacitor	V_O	-	-	100	mV _{PK-PK}
	LCB50E			-	-	100	
	LCB50L			-	-	120	
	LCB50N			-	-	120	
	LCB50Q			-	-	120	
	LCB50W			-	-	200	
Convection Output Current, continuous	LCB50D	Convection cooling	$I_{O,max}$	0	-	10	A
	LCB50E			0	-	10	
	LCB50L			0	-	4.2	
	LCB50N			0	-	3.4	
	LCB50Q			0	-	2.2	
	LCB50W			0	-	1.1	
Line Regulation	All Modules	$V_{IN,DC} = V_{IN,min}$ to $V_{IN,max}$ $I_O = I_{O,max}$	V_O	-0.5	-	+0.5	%
Load Regulation	LCB50D	All	V_O	-2.0	-	+2.0	%
	LCB50E			-1.0	-	+1.0	
	LCB50L			-0.5	-	+0.5	
	LCB50N			-0.5	-	+0.5	
	LCB50Q			-0.5	-	+0.5	
	LCB50W			-0.5	-	+0.5	
Temperature Coefficient(0~50°C)		All		-0.03	-	+0.03	%/°C
Load Capacitance	LCB50D	Startup		-	-	2200	uF
	LCB50E			-	-	2200	
	LCB50L			-	-	1500	
	LCB50N			-	-	1000	
	LCB50Q			-	-	470	
	LCB50W			-	-	220	
V_O Over Voltage Protection		Latch off (AC recycle to reset)	V_O	115	-	150	%
V_O Over Current Protection ¹		All	I_O	110	-	-	% $I_{O,max}$

Note 1 - Hiccup Mode and Auto recovery after full load is remove.

LCB50D Performance Curves

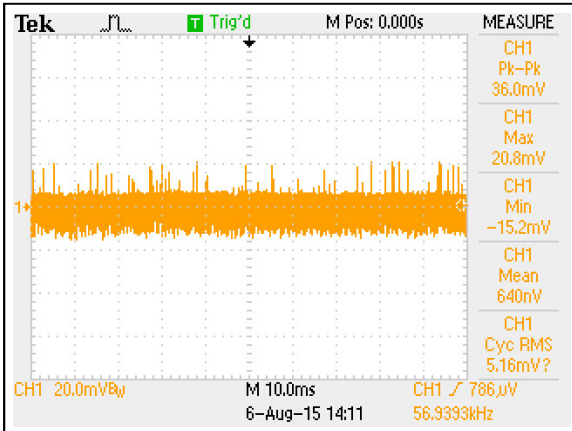


Figure 1: LCB50D Output Ripple Voltage
 Vin = 230Vac Load: Io = 10A Ta = 25 °C
 Ch1 = Vo

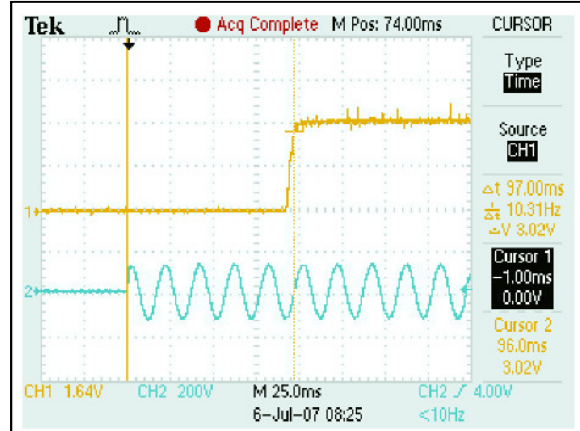


Figure 2: LCB50D Turn On delay
 Vin = 90Vac Load: Io = 10A Ta = 25 °C
 Ch1: Vo Ch2: Vin

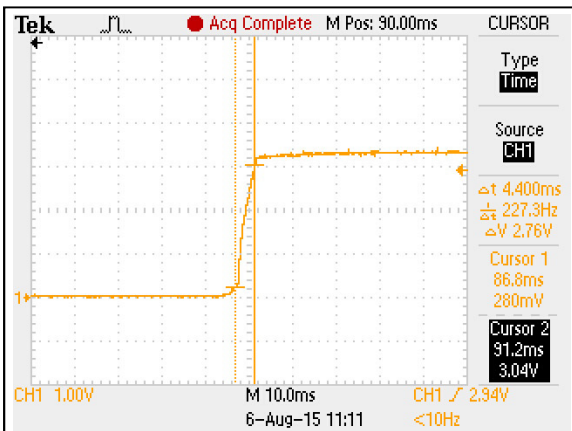


Figure 3: LCB50D Rise Time
 Vin = 230Vac Load: Io = 10A Ta = 25 °C
 Ch 1: Vo

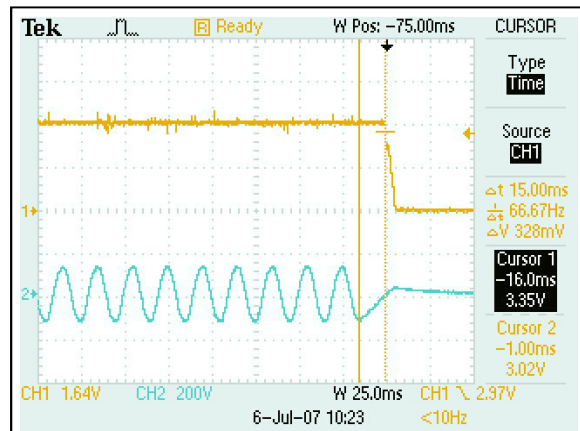


Figure 4: LCB50D Hold Up Time
 Vin = 90Vac Load: Io = 10A Ta = 25 °C
 Ch 1: Vo Ch 2: AC Mains

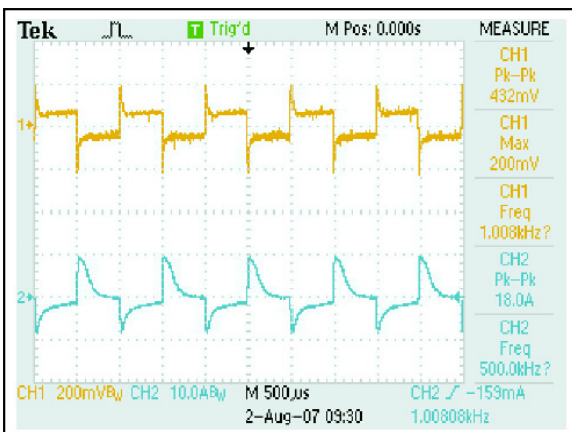


Figure 5: LCB50D Transient Response
 Vin = 230Vac Load: Io = 10%-90% LOAD, 90%DUTY/1KHZ
 Ch 1: Vo Ch 2: Io

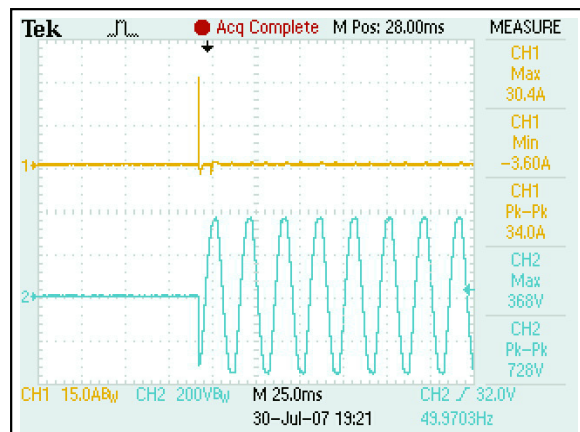


Figure 6: LCB50D Inrush Current
 Vin = 264Vac Load: Io = 10A Ta = 25 °C
 Ch 1: Iin Ch 2: AC Mains

LCB50E Performance Curves

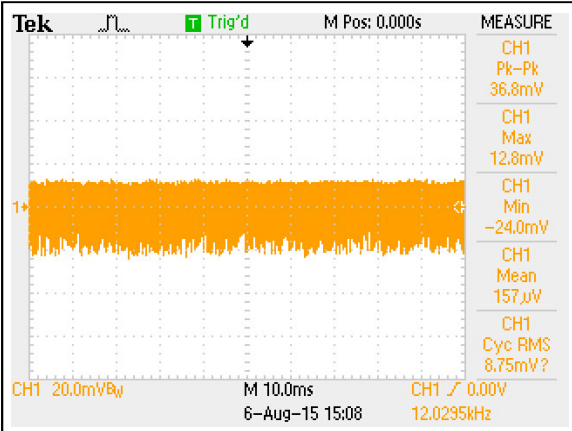


Figure 1: LCB50E Output Ripple Voltage
 Vin = 230Vac Load: Io = 10A Ta = 25 °C
 Ch1 = Vo

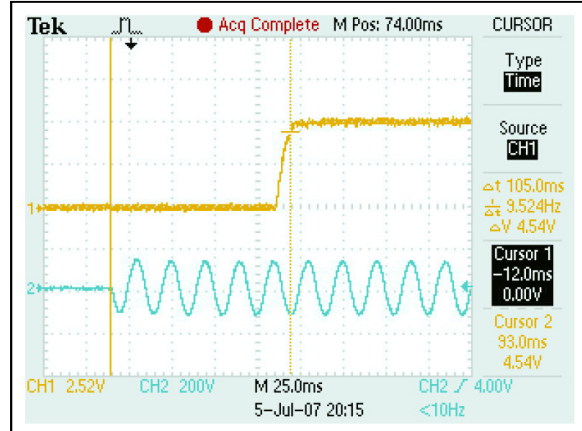


Figure 2: LCB50E Turn On delay
 Vin = 90Vac Load: Io = 10A Ta = 25 °C
 Ch1: Vo Ch2: Vin

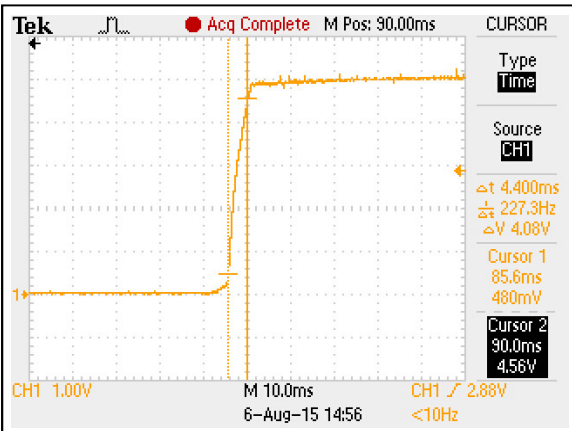


Figure 3: LCB50E Rise Time
 Vin = 230Vac Load: Io = 10A Ta = 25 °C
 Ch 1: Vo

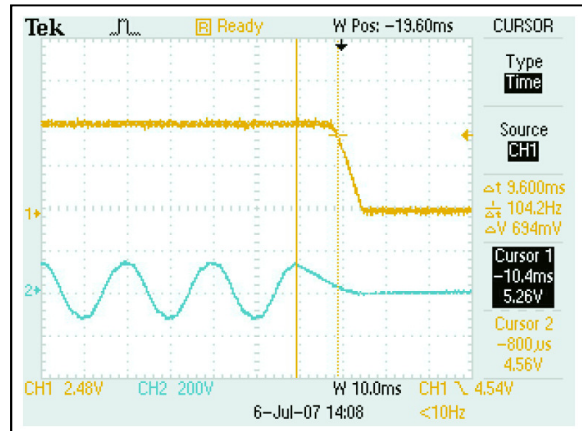


Figure 4: LCB50E Hold Up Time
 Vin = 90Vac Load: Io = 10A Ta = 25 °C
 Ch 1: Vo Ch 2: AC Mains

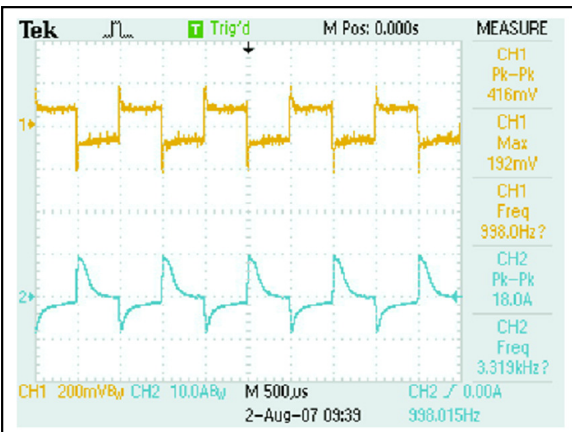


Figure 5: LCB50E Transient Response
 Vin = 230Vac Load: Io = 10%-90% LOAD, 90%DUTY/1KHZ
 Ch 1: Vo Ch 2: Io

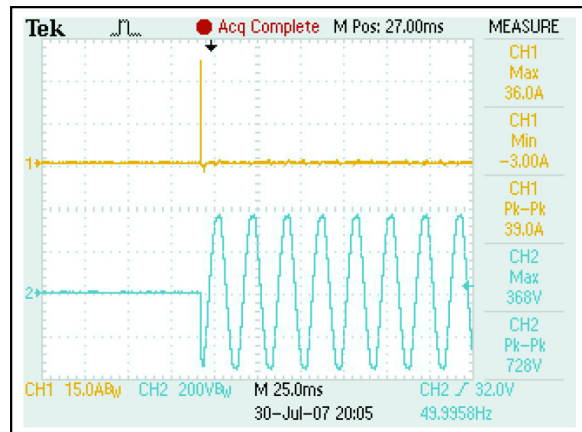


Figure 6: LCB50E Inrush Current
 Vin = 264Vac Load: Io = 10A Ta = 25 °C
 Ch 1: Iin Ch 2: AC Mains

LCB50L Performance Curves

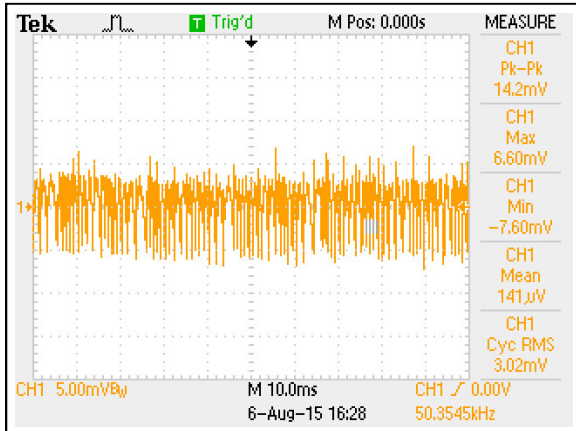


Figure 1: LCB50L Output Ripple Voltage
 Vin = 230Vac Load: Io = 4.2A Ta = 25 °C
 Ch1 = Vo

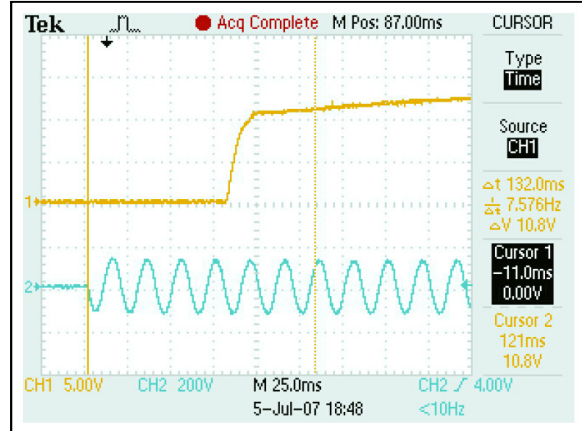


Figure 2: LCB50L Turn On delay
 Vin = 90Vac Load: Io = 4.2A Ta = 25 °C
 Ch1: Vo Ch2: Vin

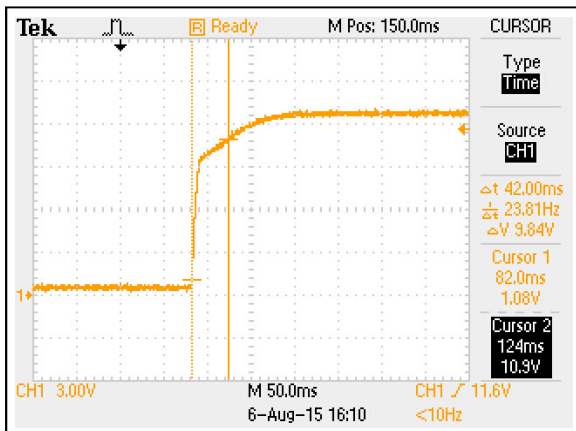


Figure 3: LCB50L Rise Time
 Vin = 230Vac Load: Io = 4.2A Ta = 25 °C
 Ch 1: Vo

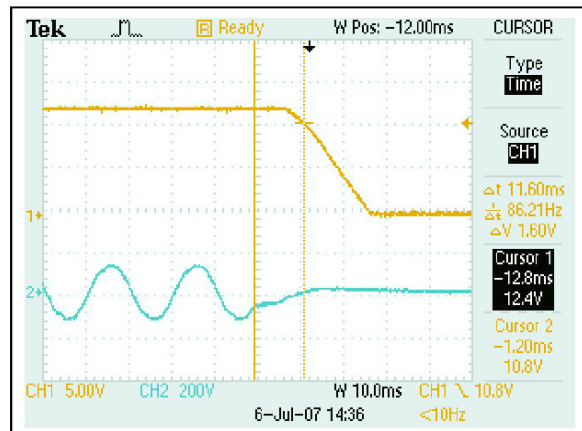


Figure 4: LCB50L Hold Up Time
 Vin = 90Vac Load: Io = 4.2A Ta = 25 °C
 Ch 1: Vo Ch 2: AC Mains

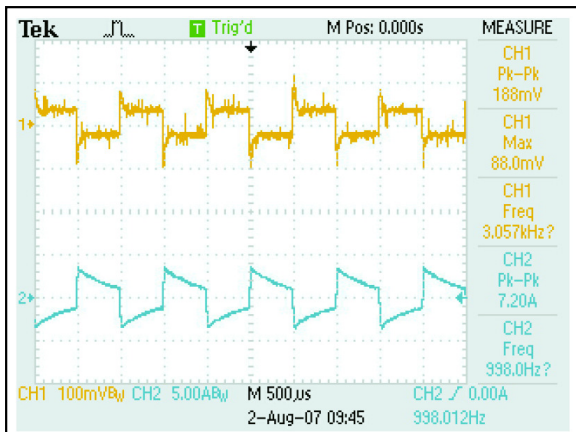


Figure 5: LCB50L Transient Response
 Vin = 230Vac Load: Io = 10%-90% LOAD, 90%DUTY/1KHZ
 Ch 1: Vo Ch 2: Io

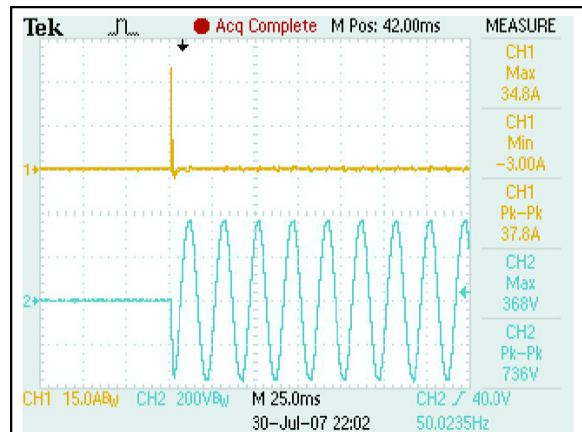


Figure 6: LCB50L Inrush Current
 Vin = 264Vac Load: Io = 4.2A Ta = 25 °C
 Ch 1: lin Ch 2: AC Mains

LCB50N Performance Curves

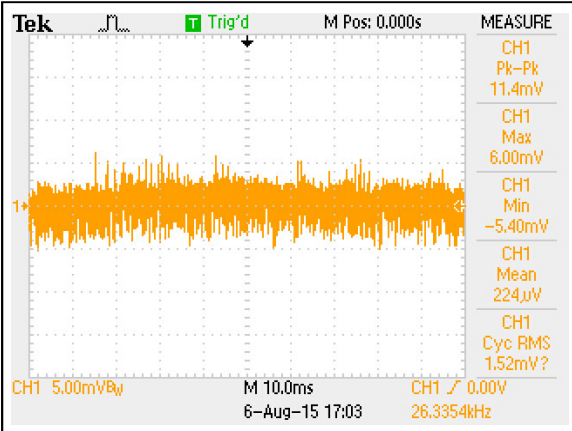


Figure 1: LCB50N Output Ripple Voltage
 Vin = 230Vac Load: Io = 3.4A Ta = 25 °C
 Ch1 = Vo

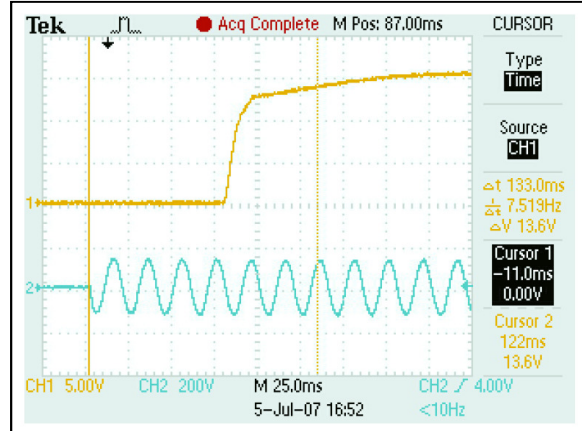


Figure 2: LCB50N Turn On delay
 Vin = 90Vac Load: Io = 3.4A Ta = 25 °C
 Ch1: Vo Ch2: Vin

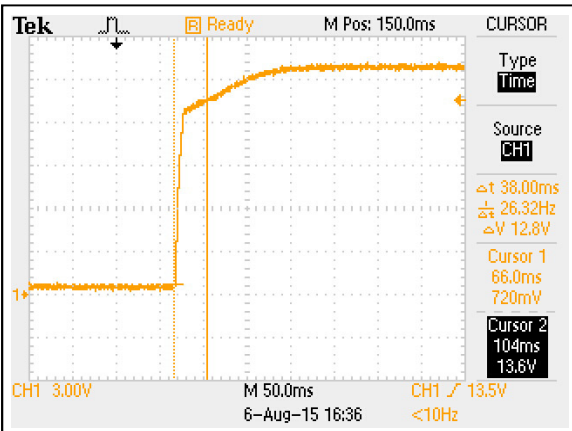


Figure 3: LCB50N Rise Time
 Vin = 230Vac Load: Io = 3.4A Ta = 25 °C
 Ch 1: Vo

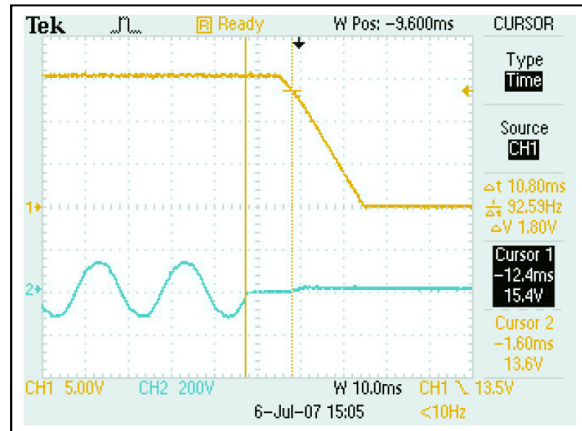


Figure 4: LCB50N Hold Up Time
 Vin = 90Vac Load: Io = 3.4A Ta = 25 °C
 Ch 1: Vo Ch 2: AC Mains

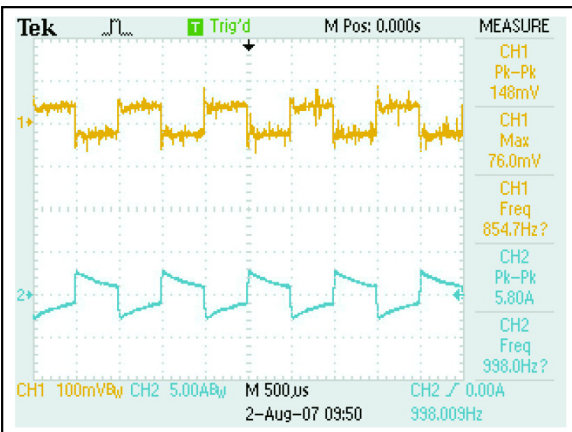


Figure 5: LCB50N Transient Response
 Vin = 230Vac Load: Io = 10%-90% LOAD, 90%DUTY/1KHZ
 Ch 1: Vo Ch 2: Io

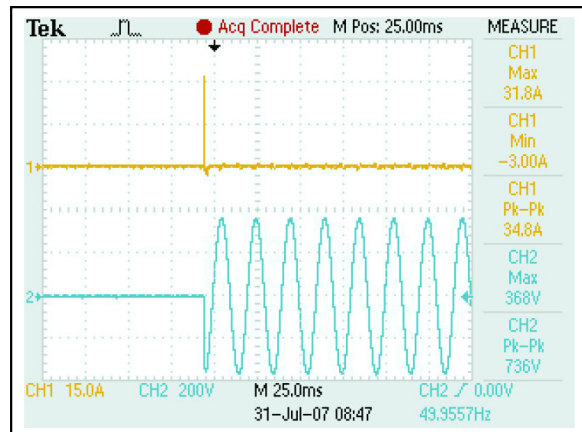


Figure 6: LCB50N Inrush Current
 Vin = 264Vac Load: Io = 3.4A Ta = 25 °C
 Ch 1: Iin Ch 2: AC Mains

LCB50Q Performance Curves

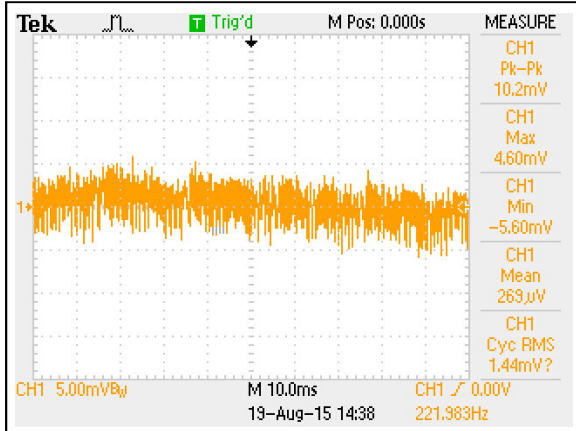


Figure 1: LCB50Q Output Ripple Voltage
Vin = 230Vac Load: Io = 2.2A Ta = 25 °C
Ch1 = Vo

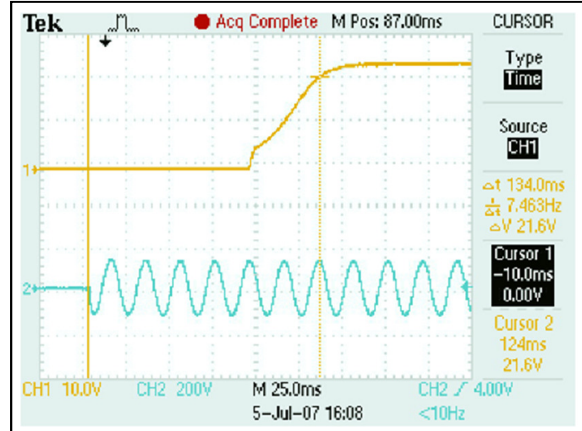


Figure 2: LCB50Q Turn On Delay
Vin = 90Vac Load: Io = 2.2A Ta = 25 °C
Ch1: Vo Ch2: Vin

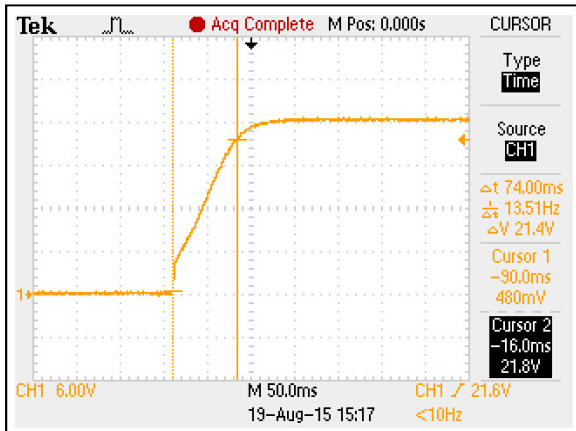


Figure 3: LCB50Q Rise Time
Vin = 230Vac Load: Io = 2.2A Ta = 25 °C
Ch 1: Vo

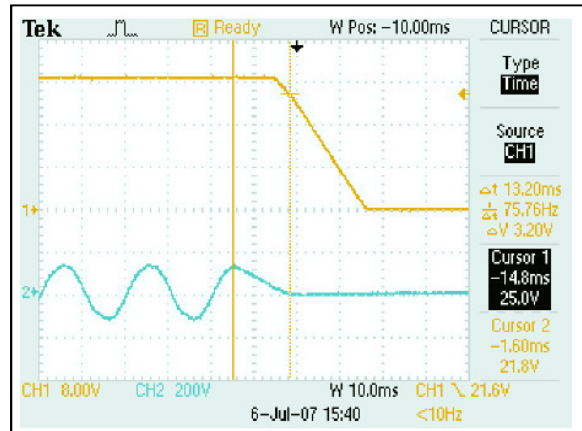


Figure 4: LCB50Q Hold Up Time
Vin = 90Vac Load: Io = 2.2A Ta = 25 °C
Ch 1: Vo Ch 2: AC Mains

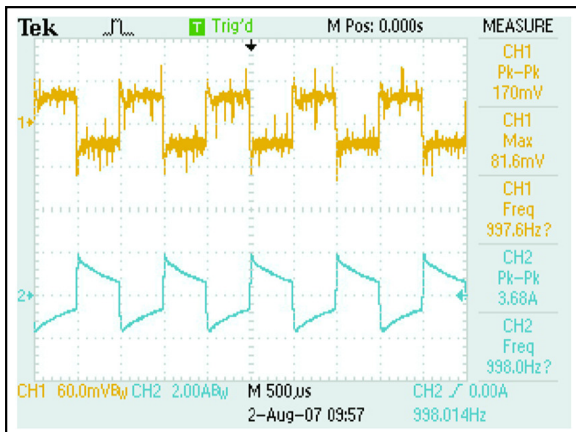


Figure 5: LCB50Q Transient Response
Vin = 230Vac Load: Io = 10%-90% LOAD, 90%DUTY/1KHZ Ta = 25 °C
Ch 1: Vo Ch 2: Io

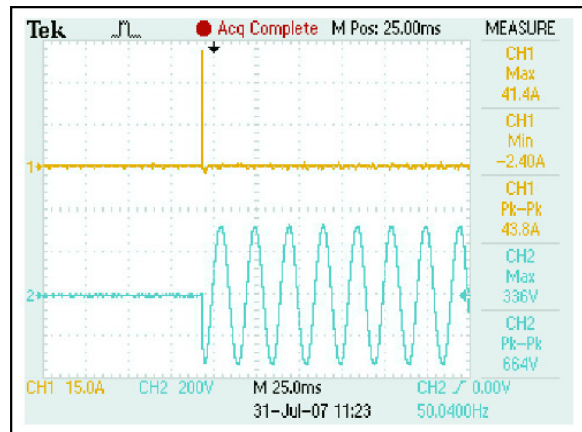


Figure 6: LCB50Q Inrush Current
Vin = 264Vac Load: Io = 2.2A Ta = 25 °C
Ch 1: lin Ch 2: AC Mains

LCB50W Performance Curves

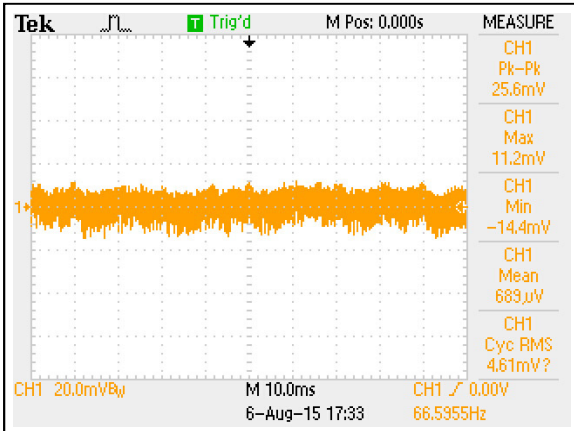


Figure 1: LCB50W Output Ripple Voltage
Vin = 230Vac Load: Io = 1.1A Ta = 25 °C
Ch1 = Vo

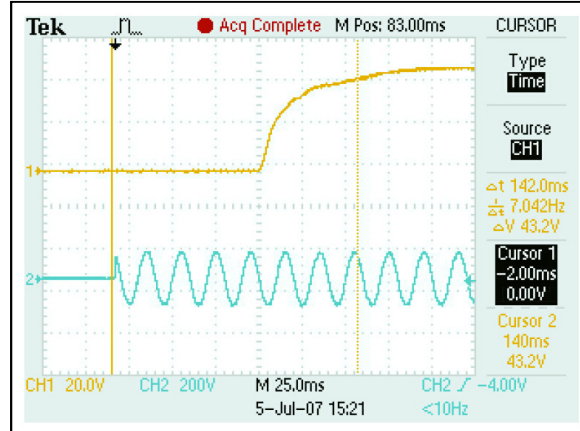


Figure 2: LCB50W Turn On delay
Vin = 90Vac Load: Io = 1.1A Ta = 25 °C
Ch1: Vo Ch2: Vin

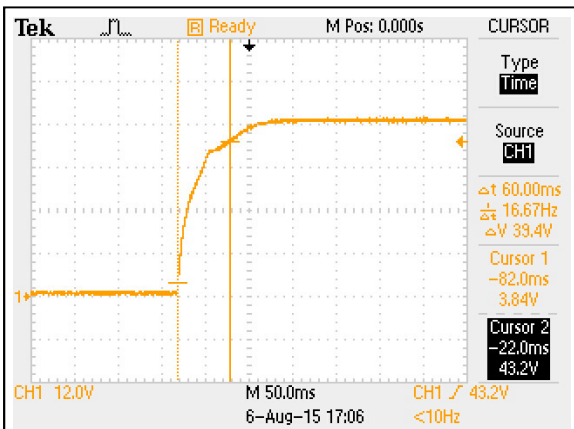


Figure 3: LCB50W Rise Time
Vin = 230Vac Load: Io = 1.1A Ta = 25 °C
Ch 1: Vo

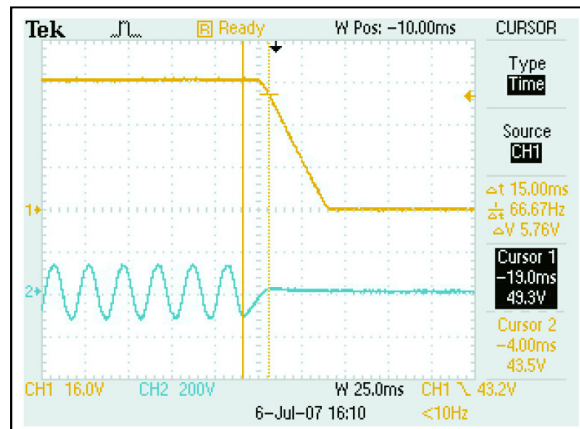


Figure 4: LCB50W Hold Up Time
Vin = 90Vac Load: Io = 1.1A Ta = 25 °C
Ch 1: Vo Ch 2: AC Mains

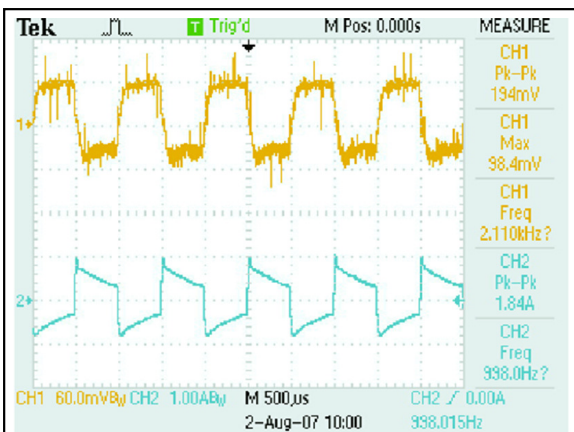


Figure 5: LCB50W Transient Response
Vin = 230Vac Load: Io = 10%-90% LOAD, 90%DUTY/1KHZ
Ch 1: Vo Ch 2: Io

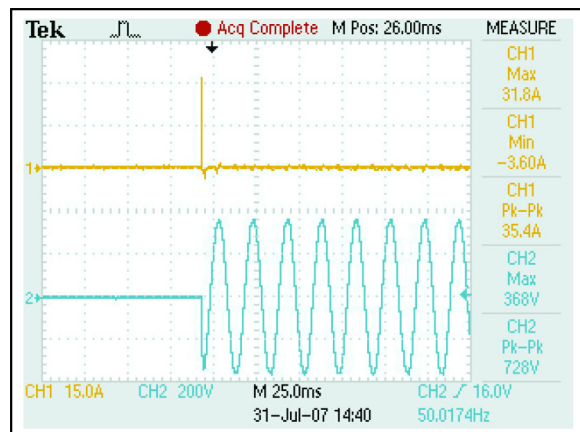


Figure 6: LCB50W Inrush Current
Vin = 264Vac Load: Io = 1.1A Ta = 25 °C
Ch 1: Iin Ch 2: AC Mains

Protective Function Specifications

Over Voltage Protection (OVP)

The power supply output voltage latches off during output overvoltage with the AC line recycled to reset the latch.

LCB50D

Parameter	Min	Nom	Max	Unit
3.3Vo Output Overvoltage	3.79	/	4.95	V

LCB50E

Parameter	Min	Nom	Max	Unit
5Vo Output Overvoltage	5.75	/	7.5	V

LCB50L

Parameter	Min	Nom	Max	Unit
12Vo Output Overvoltage	13.8	/	18	V

LCB50N

Parameter	Min	Nom	Max	Unit
15Vo Output Overvoltage	17.25	/	22.5	V

LCB50Q

Parameter	Min	Nom	Max	Unit
24Vo Output Overvoltage	27.6	/	36	V

LCB50W

Parameter	Min	Nom	Max	Unit
48Vo Output Overvoltage	55.2	/	72	V

Over Current Protection (OCP)

LCB50 series power supply includes internal current limit circuitry to prevent damage in the event of overload or short circuit. In the event of overloads, the output voltage may deviate from the regulation band but recovery is automatic when the load is reduced to within specified limits.

LCB50D

Parameter	Min	Nom	Max	Unit
3.3Vo Output Overcurrent	11	/	/	A

LCB50E

Parameter	Min	Nom	Max	Unit
5Vo Output Overcurrent	11	/	/	A

LCB50L

Parameter	Min	Nom	Max	Unit
12Vo Output Overcurrent	4.62	/	/	A

LCB50N

Parameter	Min	Nom	Max	Unit
15Vo Output Overcurrent	3.74	/	/	A

LCB50Q

Parameter	Min	Nom	Max	Unit
24Vo Output Overcurrent	2.42	/	/	A

LCB50W

Parameter	Min	Nom	Max	Unit
48Vo Output Overcurrent	1.21	/	/	A

Weight

The LCB50 Series packing weight is 0.62lb/0.28kg typical.

Environmental Specifications

EMC Immunity

LCB50 series power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

Document	Description
EN 55022	Conducted Level B and Radiated Level B (stand alone)
EN61000-3-2	Harmonic Distortion
EN 61000-3-3	Harmonic Distortion
EN 61204-3	EMS immunity
EN 55024	EMS immunity

Safety Certifications

The LCB50 series power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for LCB50 series power supply system:

Document	Description
UL 60950-1	US and Canada Requirements
TUV EN 60950-1	Germany and European Requirements (All CENELEC Countries)

EMI Emissions

The LCB50 series has been designed to comply with the Class B limits of EMI requirements of EN55022 (FCC Part 15) and CISPR 22 (EN55022) for emissions and relevant sections of EN61000 (IEC 61000) for immunity.

The unit is enclosed inside a metal box, tested at full load using resistive load.

Conducted Emissions

The applicable standard for conducted emissions is EN55022 (FCC Part 15). Conducted noise can appear as both differential mode and common mode noise currents. Differential mode noise is measured between the two input lines, with the major components occurring at the supply fundamental switching frequency and its harmonics. Common mode noise, a contributor to both radiated emissions and input conducted emissions, is measured between the input lines and system ground and can be broadband in nature.

The LCB50 series power supply have internal EMI filters to ensure the convertor's conducted EMI levels comply with EN55022 (FCC Part 15) Class B and EN55022 (CISPR 22) Class B limits. The EMI measurements are performed with resistive loads under forced air convection at maximum rated loading.

Sample of EN55022 Conducted EMI Measurement at 230Vac input.

Note: Top Line refers to Artesyn Quasi Peak margin, which is 6dB below the CISPR international limit. Bottom Line refers to the Artesyn Average which is 6dB below the CISPR international limit.

Quietek

File#: 626 Page: 430
 Engineer: Site: ShieldingRoom2 Time: 2007/07/11 - 16:21
 Limit: CISPR_B_00M_QP Margin: 0
 EUT: GRS0-B5 Probe: QTK-LISN-SR2-Line1
 Power: AC 230V/50Hz Note: 5W10A

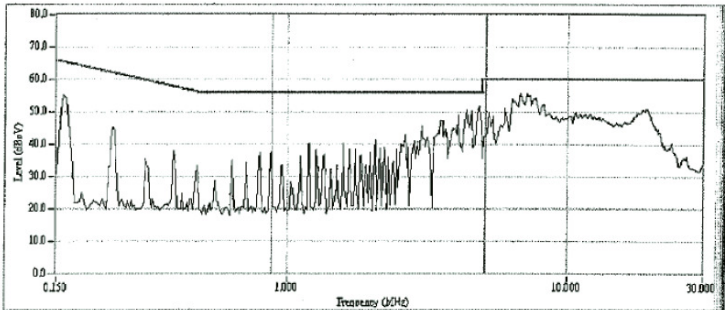


Table 6. Conducted EMI emission specifications of the LCB50 series

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	-	-	6	dB
CISPR 22 (EN55022) class B	All	Margin	-	-	6	dB

Radiated Emissions

Unlike conducted EMI, radiated EMI performance in a system environment may differ drastically from that in a stand-alone power supply. It is thus recommended that radiated EMI be evaluated in a system environment. The applicable standard is EN55022 Class B (FCC Part 15). Testing ac-dc convertors as a stand-alone component to the exact requirements of EN55022 can be difficult, because the standard calls for 1m leads to be attached to the input and outputs and aligned such as to maximize the disturbance. In such a set-up, it is possible to form a perfect dipole antenna that very few ac-dc convertors could pass. However, the standard also states that 'an attempt should be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample'.

MTBF and Reliability

The MTBF of LCB50 series of AC/DC converters has been calculated using MIL-HDBK 217F.
Operating Temperature @25 °C, Ground Benign.

Model	MTBF	Unit
LCB50D	420.4	K Hrs
LCB50E		
LCB50L		
LCB50N		
LCB50Q		
LCB50W		

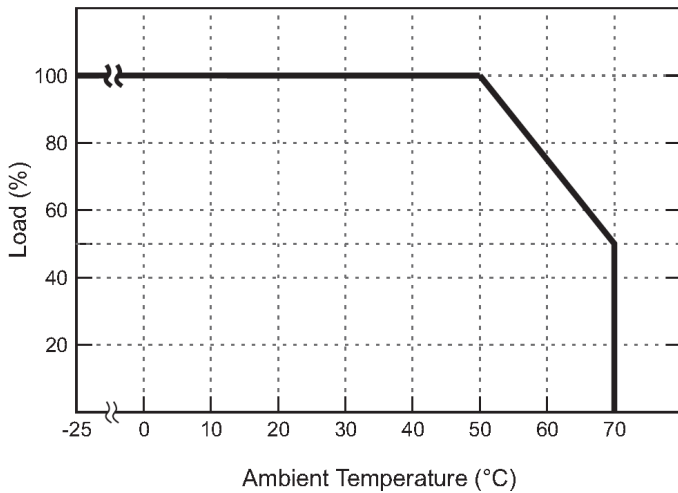
Operating Temperature

The LCB50 series start and operate within stated specifications at an ambient temperature from -25°C to 70°C under all load conditions (see below derating curves for other amount of convection and orientation. Derate output current and power by 2.5% per degree above 50°C . Maximum operating ambient temperature is 70°C (which implies a 50% derating at max 70°C ambient).

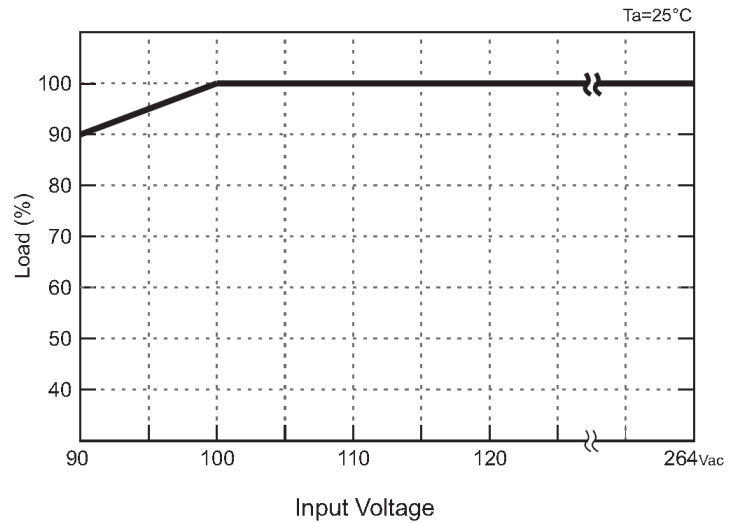
Under convection cooling condition, the maximum output power derates linearly from full load. When input voltage is 90Vac, the maximum output power will derate to 90% full load.

Derating Curve

Load V.S Temp.



Load V.S I/P Voltage



Storage and Shipping Temperature / Humidity

The LCB50 series can be stored or shipped at temperatures between -40 °C to +85 °C and relative humidity from 10% to 95%, non-condensing.

Humidity

The LCB50 series will operate within specifications when subjected to a relative humidity from 20% to 90% non-condensing. The LCB50 series can be stored in a relative humidity from 10% to 95% non-condensing.

Vibration

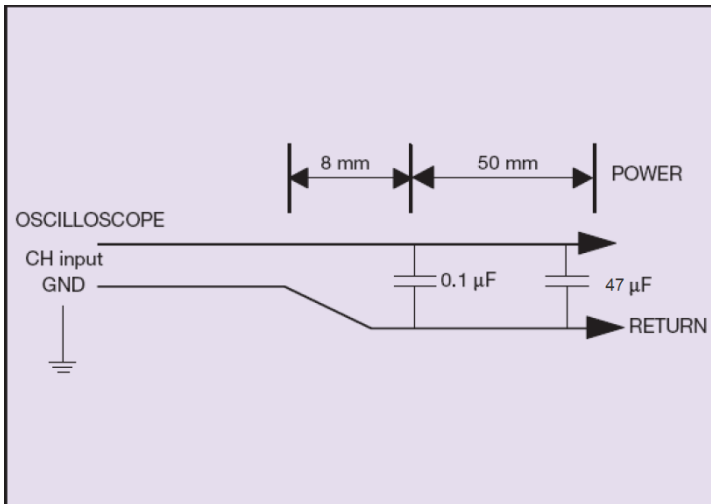
The LCB50 series will pass the following vibration specifications:

Acceleration	5	gRMS
Frequency Range	10-500	Hz
Duration	60 min per Axis, 180 min total	mins
Direction	3 mutually perpendicular axis	
PSD Profile	FREQ 10-500 Hz	SLOPE dB/oct ---
		PSD g²/Hz ---

Application Notes

Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the LCB50 series. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 47uF aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20MHz bandwidth for this measurement.



Record of Revision and Changes

Issue	Date	Description	Originators
1.0	08.04.2015	First Issue	A.Li
1.1	09.21.2015	Update LCB50 performance curves	A.Li
1.2	07.21.2017	Update the vibration	A.Zhang

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