勇 做 科 技 先 锋 铸 造 电 源 未 来

AC/DC DC/DC 系列模块电源

承力电源

CHENGLI POWERSUPPLY

Corporate Profile

www.chengli.com.cn

企业简介

北京承力电源有限公司位于中关村科技园昌平园，占地 12000 平方米，员工约２７０人，是经北京市科委认证的中关村高新技术企业。承力公司凭借出众的技术优势和可靠的质量管理体系，“ＣＬ”品牌的模块电源产品已覆盖全国市场，广泛应用于通信、自控、仪器仪表、航空航天、医疗、车载设备、铁路、船舶和电力等领域。

承力公司早在９７年即开始批量生产军品模块电源，现产品已广泛应用于中国人民解放军海、陆、空及防化、装甲、通讯等各军、兵种的列装装备中。

承力公司始终以质量第一，信誉第一，用户至上为企业理念。以求新、求实、求精的企业精神，经过完善的科学管理和技术进步，成为国内具有一定规模，一定实力，一定水准的开关电源制造企业。

我公司以顾客需求为关注焦点，为顾客提供高标准、高质量、高可靠的电源产品作为我们的目标。以严格的生产流程，科学的质量控制，周到的客户服务为企业发展的宗旨。

公司拥有一支理论基础扎实和实践经验丰富高素质的研发队伍。并具有数条装备精良的生产线（其中一条军品生产线）及经过培训操作熟练的技术工人。力争在复杂的市场环境对客户的需求作出最满意的答复。

承力电源公司早于 1995 年就通过邮电部工业产品质量监督检验中心的 YD/T733 标准的检验，并制定了高于此标准的企业标准。

◆2000 年承力公司率先通过 2000 版的 GB/T9001-2000 质量体系认证。

◇2001 年 11 月通过信息产业部电信设备进网许可证。

◆2004 年 3 月获得 GJB9001A-2001 军工产品质量体系认证证书

Corporate Profile

Located in the Changping Park of the Zhonguancun Science Park, Beijing Chengli Power Supply Co., Ltd. occupies a land area of 12,000m2 and employs some 270 workers. It is a high and new technology enterprise certified by the Beijing Municipal Commission on Science and Technology. Building upon its outstanding technological advantages and reliable quality management system, Chengli Company has promoted its CL Brand modular power supply products to the market in the whole state. Its products have now been widely used in the fields of communications, automatic control, instruments and meters, aviation and aerospace, healthcare, in-board equipment, railway, ships and electric power.

As early as in 1997, Chengli Company started the batch production of military power supply modules. Currently, its products are widely used in the equipment of the army, air force, navy, antichemical warfare corps, armored forces and communications forces of the People’ s Liberation Army.

Chengli Company has long carried forward the corporate philosophy of Quality and Reputation First and Users Foremost. In line with the spirit of innovation, practicality and refinement and through sound scientific management and technological progress, the company has now become a switch power supply manufacturer of a certain size, strength and level in China.

The company takes customer demand as its focus of attention, providing customers with high standard, high quality and high reliability power supply products as its goal, and vigorous production workflows, scientific quality control and comprehensive customer services as its corporate tenet.

The company has a high quality R&D force with solid theoretical knowledge and rich practical experiences, several well-equipped production lines (one of them is a military product line) and skillful workers. The company strives to make the most satisfactory response to customer needs in a complicated market environment.

In 1995, Chengli Company passed the YD/T733 test undertaken by the Industrial Product Quality Supervision and Test center of the Ministry of Post and Telecommunications. It has also formulated an enterprise standard much higher than the YD/T733 Standard.

2000: Chengli Company was the first to pass GB/T9001-2000 certification.
November 2001: Chengli Company obtained Network Access License for Telecom Equipment from the Ministry of Information Industry.
March 2004: Chengli Company obtained the GJB9001A-2001 Certificate of Conformity of Quality System Certification of Military Product Supplier.

公司认证证书

Our certifications

生产及试验设备

Production, test & measurement equipment

三条装备精良生产线（一条军工产品生产线）

Three well-equipped production lines (one military production line)

承力电源

最具专业实力的军工电源生产商

承力电源公司（EMC）电磁兼容试验室

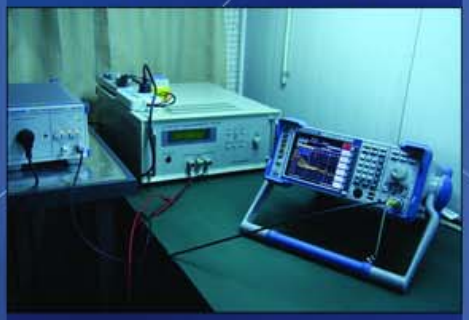
雷击浪涌测试现场

周波跌落测试现场

快速脉冲群测试现场

电磁传导测试现场

电磁辐射测试现场

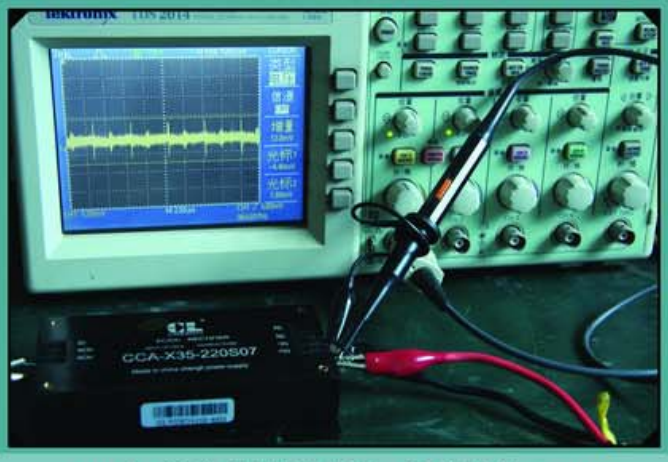


德国 R&S 公司（EMC）接收设备

用开关电源替代线性电源

解决方案“X系列电源”

可在承力便装式电源系列中选定X系列电源



100Mhz带宽测试条件峰-峰值纹波<30Mv

CHENGLI

元件式模块电源

Component Model

工业标准模块－引出脚功能兼容

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DC-DC CS.MZE 系列

【重量】MZE/CS:0.01Kg

输入电压：12V、24V、48V
输出路数：单路，双路
功率：3-5W
外型尺寸：31.8*20.3*11.4（CS）25.4*25.4*10.2(MZE)
特性：体积小巧，引出脚功能兼容

P.1-2

DC-DC MZD 系列

【重量】MZD:0.02Kg

输入电压：12V、24V、48V
输出路数：单路
功率：5-10W
外型尺寸：50.8*25.4*10.2
特性：体积小巧，引出脚功能兼容，
高可靠性设计

P.3-4

DC-DC CD 系列

输入电压：5V、12V、18V、24V、48V、110V【重量】CD:0.05Kg
输出路数：单路，双路
功率：5-12W
外型尺寸：52.8*27.4*11.5
特性：引出脚功能兼容，输入可9-36V(四倍电压输入)，
输入66-160V可做单路输出

P.3-4

DC-DC CR.CRF 系列

【重量】CR:0.05Kg CRF:0.05Kg

输入电压：12V、18V、24V、48V
输出路数：单路，双路
功率：5-12W
外型尺寸：52.8*27.4*11.5
特性：体积小巧，可9-36V(四倍电压输入)

P.5-6

DC-DC CJ 系列

【重量】CJ:0.05Kg

输入电压：12V、18V、24V、48V、110V
输出路数：单路，双路
功率：15-20W
外型尺寸：50.8*40.6*12.5
特性：体积小巧，可9-36V(四倍电压输入)，引出脚功能兼容

P.7-8

DC-DC CB(H) 系列

【重量】CB/CBH:0.08Kg

输入电压：12V、24V、48V
输出路数：单路
功率：15-30W
外型尺寸：58.2*46*15(CB)
60*62*17(CBH)
特性：引出脚功能兼容，输出低纹波

P.9-10

DC-DC CRZ 系列

【重量】CRZ:0.09Kg

输入电压：12V、24V、48V
110V、300V
输出路数：单路
功率：30-50W
外型尺寸：71*37*15
特性：体积小巧，宽电压输入范围

P.11-12

DC-DC CA(H) 系列

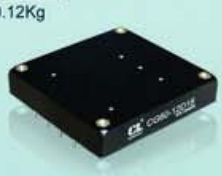
【重量】CA:0.13Kg CAH:0.1Kg

输入电压：5V、12V、18V、24V、48V
输出路数：单路，双路，三路
功率：25-40W
外型尺寸：71*49.5*13.5(CA) 72*62*15.5(CAH)
特性：引出脚功能兼容，输入可9-36V(四倍电压输入)，安装方便（带马蹄孔与不带马蹄孔方式可选择）

P.13-14

DC-DC CG 系列

【重量】CG:0.12Kg



输入电压：12V、24V、48V
输出路数：双路
功率：30-60W
外型尺寸：72*69*13.5
特性：体积小巧，双路独立稳压

P.15-16

DC-DC CE(H) 系列

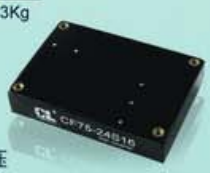
【重量】CE:0.15Kg CEH:0.14Kg

输入电压：12V、18V、24V、48V、110V
输出路数：单路，双路，三路
功率：50-75W
外型尺寸：84.3*49.5*16.1(CE) 86*62*18.1(CEH)
特性：引出脚功能兼容，输入可9-36V(四倍电压输入)，安装方便（带马蹄孔与不带马蹄孔方式可选择）

P.17-18

DC-DC CF 系列

【重量】CF:0.13Kg



输入电压：12V、24V、48V、110V
输出路数：单路，双路
功率：50-125W
外型尺寸：87.6*61*16.1
特性：引出脚功能兼容，宽电压输入范围，双路独立稳压

P.19-20

DC-DC CKN 系列

【重量】CKN:0.2Kg

输入电压：12V、18V、24V、48V、72V、110V
输出路数：单路
功率：75-200W
外型尺寸：120*68*16.6
特性：引出脚功能兼容，
宽电压输入范围可2倍、4倍、10倍

P.21-22

DC-DC CW 系列

【重量】CW:0.34Kg

输入电压：24V、48V
输出路数：单路，双路
功率：100 -150W
外型尺寸：127*88.9*17.3
特性：小体积，大功率输出

P.23-24

DC-DC CK(K) 系列

【重量】CK:0.3Kg CKK:0.36Kg

输入电压：12V、24V、48V
300V、600V
输出路数：单路，双路
功率：100-500W
外型尺寸：139*88*23.5(CK)139*88*25.5(CKK)
特性：双路独立稳压，大电流、大功率输出

P.25-26

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DC-DC CNZ 系列

【重量】CNZ:0.55Kg

输入电压：12V、24V、48V
输出路数：单路
功率：300-750W
外型尺寸：159*98*25.6
特性：高可靠性设计，大电流、大功率输出

P.27-28

DC-DC CMZ 系列 1/4 砖

【重量】CMZ:0.07Kg

输入电压：24V、48V
输出路数：单路
功率：50-100W
外型尺寸：57.9*36.8*12.7
特性：工业标准 1/4，高可靠性，高效率

P.29-30

DC-DC CLZ 系列 半砖

【重量】CLZ:0.11Kg

输入电压：24V、48V、110V
输出路数：单路
功率：75-200W
外型尺寸：61*57.9*12.7
特性：工业标准 1/2 砖，高可靠性，高效率

P.31-32

DC-DC CHZ 系列 整砖

【重量】CHZ:0.2Kg

输入电压：24V、48V
输出路数：单路
功率：150-400W
外型尺寸：116.8*61*12.7
特性：工业标准整砖，高可靠性，高效率

P.33-34

DC-DC MZB 系列

【重量】MZB:0.1Kg

输入电压：24V、48V、110V
输出路数：单路
功率：50-75W
外型尺寸：86*41*12.7
特性：引出脚功能兼容，高可靠性，高效率

P.35-36

DC-DC MZA 系列

【重量】MZA:0.25Kg

输入电压：24V、48V、110V、300V
输出路数：单路
功率：75-150W
外型尺寸：86*72*12.7
特性：引出脚功能兼容，高可靠性，高效率

P.37-38

AC-DC CAA 系列

【重量】CAA:0.14Kg

输入电压：220VAC
输出路数：单路
功率：5-10W
外型尺寸：55*45*21.5
特性：可宽电压输入，范围（85-265VAC），
引出脚功能兼容

P.39-40

AC-DC CBA 系列

【重量】CBA:0.19Kg

输入电压：220VAC
输出路数：单路
功率：15-25W
外型尺寸：70*48*23.5
特性：引出脚功能兼容，外型设计美观

P.41-42

AC-DC CEW 系列

【重量】CEW:0.33Kg

输入电压：220VAC
输出路数：双路
功率：50-75W
外型尺寸：127*88.9*25
特性：，外型设计美观，双路独立稳压

P.43-44

AC-DC CRAA 系列

【重量】CRAA:0.14Kg

输入电压：220VAC
输出路数：单路，双路，三路
功率：5-10W
外型尺寸：62*45*25
特性：宽电压输入范围，金属外壳，
高隔离电压

P.45-46

AC-DC CRAB 系列

【重量】CRAB:0.22Kg

输入电压：220VAC
输出路数：单路
功率：10-20W
外型尺寸：75*53*25
特性：宽电压输入范围，金属外壳，高隔离电压

P.47-48

AC-DC CRAC 系列

【重量】CRAC:0.2Kg

输入电压：220VAC
输出路数：双路
功率：20-30W
外型尺寸：80*56*25
特性：宽电压输入范围，金属外壳，
高隔离电压，双路独立稳压

P.49-50

AC-DC CCW 系列

【重量】CCW:0.25Kg

输入电压：220VAC
输出路数：单路，双路，三路
功率：30-75W
外型尺寸：116.4*65*21.5
特性：符合 GB9254，安装方便（端子与引针出线方式可选择）

P.51-53

AC-DC COW 系列

【重量】COW:0.21Kg

输入电压：220VAC
输出路数：单路
功率：50-150W
外型尺寸：130*70*26
特性：通过 GB9254. EN50121
（端子与引针出线方式可选择）

P.54-56

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铁路专用超薄：13mm DC-DC CFZ 系列

【重量】CFZ:0.23Kg

输入电压：12V、24V、48V、110V
输出路数：单路，双路，三路
特性：输入防浪涌限制，符合铁标 T/B3034

功率：30-75W

外型尺寸：116.4*65*21.5
116.4*65*13

AC-DC CCA.CCW 系列 超低输出噪音 <30mvp-p

【重量】CCA:0.25Kg
CCW:0.25Kg

输入电压：220VAC
输出路数：单路，双路，三路
特性：符合 GB9254，
安装方便（端子与引针出线方式可选择）

P.51-53

小尺寸、大功率 DC-DC COF 系列

【重量】COF:0.38Kg

输入电压：12V、24V、48V
输出路数：单路，双路
特性：输入防浪涌限制，符合 GB9254

功率：50-150W

外型尺寸：130*70*26

AC-DC COA.COW 系列 内置浪涌抑制及滤波电路

【重量】COA:0.38Kg
COW:0.21Kg

输入电压：220VAC
输出路数：单路
特性：符合 GB9254.EN50121
（端子与引针出线方式可选择）

P.54-56

内置浪涌抑制及滤波电路 DC-DC CEF 系列

【重量】CEF:0.46Kg

输入电压：12V、24V、48V
输出路数：单路，双路
特性：外型设计美观，双路独立稳压，双端出线

功率：50-120W

外型尺寸：139*88*26

AC-DC CEA 系列 内置浪涌抑制及滤波电路

【重量】CEA:0.4Kg

输入电压：220VAC
输出路数：单路，双路，三路
特性：安装方便（自然散热与传导散热可选择）
双路独立稳压

P.57-59

单端出线－内置滤波电路 DC-DC CDF 系列

【重量】CDF:0.47Kg

输入电压：24V、48V、110V
输出路数：双路
特性：双路独立稳压，单端出线

功率：100-150W

外型尺寸：139.2*108*27

AC-DC CDA 系列 单端出线－自然散热

【重量】CDA:0.4Kg

输入电压：220VAC
输出路数：单路
特性：高可靠性设计

P.60-62

双路大功率、传导散热 DC-DC CLF 系列

【重量】CLF:0.8Kg

输入电压：24V、48V、110V、300V
输入路数：双路
特性：双路独立稳压

功率：100-200W

外型尺寸：150*115*27

AC-DC CLD 系列 双端出线－传导散热

【重量】CLD:0.8Kg

输入电压：220VAC
输出路数：双路
特性：双路独立稳压，外型设计美观

P.63-65

大功率三路独立输出 DC-DC CNF 系列

【重量】CNF:0.69Kg

输入电压：24V、48V、110V、300V
输入路数：单路，双路，三路
特性：单端出线，散热方式可选

功率：150-300W

外型尺寸：159*98/118*33/27

AC-DC CNA 系列 提供多种散热及装配方式

【重量】CNA:0.6Kg

输入电压：220VAC
输出路数：单路，双路，三路
特性：内置浪涌抑制及滤波电路

P.66-68

内置浪涌抑制及滤波电路 DC-DC CIF 系列

【重量】CIF:0.64Kg

输入电压：12V、18V、24V、48V、110V
输入路数：单路，双路
特性：双路独立稳压，符合 GB9254.EN50121

功率：50-150W

外型尺寸：170*88*26mm

AC-DC CIA 系列 内置功率因数校正电路

【重量】CIA:0.64Kg

输入电压：220VAC
输出路数：单路，双路
特性：符合 GB9254

P.69-71

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提供多种散热及出线方式 DC-DC CAZ.CBZ.CCZ.CDZ.CEZ 系列

【重量】CAZ: 0.12Kg CBZ: 0.12Kg
CCZ: 0.16Kg
CDZ,CEZ: 0.12Kg

输入电压：12V、18V、24V、48V
输出路数：单路
功率：75-120W
外型尺寸：98*52.5*16, 100*65*18/17
特性：可四倍电压输入

P.72-73

小尺寸、双路独立稳压 DC-DC MZM 系列

【重量】MZM:0.15Kg

输入电压：12V、24V、48V
输出路数：双路
功率：20-50W
外型尺寸：92*58*16.1
特性：双路独立稳压

P.74-75

小尺寸、双路独立稳压 DC-DC CDD 系列

【重量】CDD:0.3Kg

输入电压：12V、24V、48V
输出路数：双路
功率：40-100W
外型尺寸：100*80*19
特性：双路独立稳压，快速动态响应

P.76-77

单路大功率传导散热 DC-DC MZK 系列

【重量】MZK:0.39Kg

输入电压：12V、24V、48V
输出路数：单路
功率：150-300W
外型尺寸：129*79*25.5
特性：可靠性高，电磁兼容性好

P.78-79

薄型、大功率、双路独立稳压 DC-DC COZ.CPZ 系列

【重量】COZ:0.4Kg CPZ:0.47Kg

输入电压：12V、24V、48V
输出路数：单路，双路
功率：150-300W
外型尺寸：160*88*23
特性：底面散热与顶面散热可选择

P.80-81

AC-DC MAC.MAD 系列 超低输出噪声 <30mvp-p

【重量】MAC:0.3Kg
MAD:0.28Kg

输入电压：220VAC
输出路数：单路，双路
功率：10-30W
外型尺寸：120/110*85/65*27
特性：双路独立稳压，安装方便
（带马蹄孔与不带马蹄孔方式可选择）

P.82-83

AC-DC CQA 系列 内置功率因数校正电路

【重量】CQA:0.72Kg

输入电压：220VAC
输出路数：单路
功率：100-300W
外型尺寸：210*118*27
特性：带 PFC，可靠性高

P.84-85

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铁路机车专用电源 DC-DC CSZ 系列

【重量】CSZ:0.65Kg

输入电压：12V、18V、24V、48V、110V、300V
输出路数：单路，双路
特性：通过铁标 T/B3034
输入防浪涌限制

功率：75-150W

AC-DC CSA 系列

【重量】CSA:0.6Kg

超低输出噪声 <30mvp-p
输入电压：220VAC
输出路数：单路，双路
特性：通过电磁兼容辐射实验（B 级），GB9254, EN50121

尺寸：160*100*31mm

P.86-88

铁路机车专用电源 DC-DC MZF 系列

【重量】MZF:0.9Kg

输入电压：24V、48V、110V
输出路数：单路，双路
特性：输出低纹波，双路独立稳压
通过铁标 T/B3034
输入防浪涌限制

功率：75-150W

AC-DC MAG 系列

【重量】MAG:1.1Kg

三路独立稳压输出
输入电压：220VAC
输出路数：双路，三路
特性：输出低纹波，双路独立稳压

尺寸：140/160*120*50mm

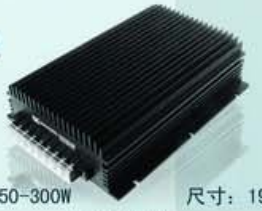
P.89-91

铁路机车专用电源 DC-DC MZC 系列

【重量】MZC:1.8Kg

输入电压：24V、48V、110V、300V、600V
输出路数：单路，双路，三路
特性：通过铁标 T/B3034
输入防浪涌限制

功率：150-300W



AC-DC MAA 系列

【重量】MAA:1.8Kg

内置功率因数校正电路
输入电压：220VAC、380VAC
输出路数：单路，双路，三路，四路
特性：宽电压输入范围，
输出低纹波，定制性强

尺寸：196*148*52mm

P.92-94

最高输入 1400VDC DC-DC CUZ 系列

【重量】CUZ:2.7Kg

输入电压：24V、48V、110V
300V、600V、1000V
输出路数：单路，双路
特性：输出低纹波，双路独立稳压

功率：300-750W

AC-DC CFA 系列

【重量】CFA:2.8Kg

内置功率因数校正电路
输入电压：220VAC
输出路数：单路，双路
特性： 全面通过电磁兼容测试，符合 EN55022 (GB9254), IEC61000-4 (GB17626)

尺寸：240*174*67mm

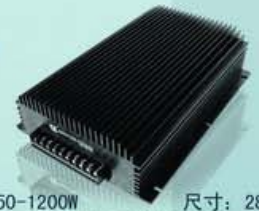
P.95-97

最高输入 1400VDC DC-DC MZH 系列

【重量】MZH:4.2Kg

输入电压：24V、48V、110V、300V、600V、1000V
输出路数：单路，双路，三路
特性：通过 IEC60571，IEC61000
输出低纹波，定制性强

功率：750-1200W



AC-DC MAH 系列

【重量】MAH:4.6Kg

多路输出电源（定制）
输入电压：220VAC、380VAC
输出路数：单路，双路，三路
特性：宽电压输入范围，
输入浪涌抑制电路

尺寸：280*200*69mm

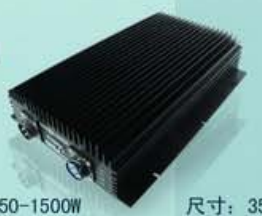
P.98-100

军用电源 DC-DC CKZ 系列

【重量】CKZ:6.1Kg

输入电压：24V、48V、60V、300V、600V、1000V
输出路数：单路，双路
特性：航空插头与端子出线方式可选择
通过 IEC61000

功率：750-1500W



AC-DC CKA 系列

【重量】CKA:6.1Kg

军用电源
输入电压：220VAC
输出路数：单路，双路
特性：航空插头与端子出线方式可选择
输出低纹波，定制性强

尺寸：350*241*72mm

P.101-103

大功率电源 DC-DC CTZ 系列

【重量】CTZ:15.4Kg

输入电压：24V、48V、60V、300V、600V
输出路数：单路
特性：宽电压输入范围，航空插头出线方式
通过 IEC61000

功率：800-2000W

AC-DC CTA 系列

【重量】CTA:15.4Kg

大功率电源
输入电压：220VAC、380VAC
输出路数：单路
特性：宽电压输入范围，航空插头出线方式

尺寸：400*310*94mm

P.104-106

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全功率 4 路独立输出电源 **DC-DC MBZ 系列**

【重量】MBZ:1.1Kg

输入电压：12V、24V、48V
输出路数：四路
特性：输出低纹波，四路独立稳压

功率：75-150W 尺寸：135*100*70mm

P.107-109

AC-DC MBA 系列 交、直流同时输入，零秒切换

【重量】MBA:1.1Kg

输入电压： 220VAC
输出路数：双路、四路
特性：输出低纹波，四路独立稳压，
可交流与直流零秒切换，
AC、DC 相互完全隔离

全功率 4 路独立输出电源 **DC-DC MCZ 系列**

【重量】MCZ:2.5Kg

输入电压：12V、24V、48V
输出路数：四路
特性：输出低纹波，四路独立稳压

功率：150-300W 尺寸：220*160*107mm

P.110-112

AC-DC MCA 系列 交、直流同时输入，零秒切换

【重量】MCA:2.5Kg

输入电压：220VAC
输出路数：双路、四路
特性：输出低纹波，四路独立稳压

全功率 4 路独立输出电源 **DC-DC MDZ 系列**

【重量】MDZ:8.0Kg

输入电压：12V、24V、48V
输出路数：四路
特性：输出低纹波，四路独立稳压

功率：800-1500W 尺寸：360*240*146mm

P.113-115

AC-DC MDA 系列 内置功率因数校正电路

【重量】MDA:8.0Kg

输入电压：220VAC
输出路数：双路、四路
特性：输出低纹波，四路独立稳压

超轻！（传导散热） **DC-DC MZCB 系列**

【重量】MZCB:1.2Kg

输入电压：12V、24V、48V、110V、
300V、600V
输出路数：单路、双路、三路、四路
特性：输出低纹波，四路独立稳压

功率：150-300W 尺寸：196*148*40mm

P.116-118

AC-DC MAAB 系列 超轻！（传导散热）

【重量】MAAB:1.2Kg

输入电压：220VAC
输出路数：单路、双路、三路、四路
特性：输出低纹波，四路独立稳压

超轻！（传导散热） **DC-DC CUZB 系列**

【重量】CUZB:1.5Kg

输入电压：12V、24V、48V、110V、300V
600V、800V、1000V
输出路数：单路、双路
特性：输出低纹波，双路独立稳压

功率：300-750W 尺寸：240*174*53mm

P.119-121

AC-DC CFAB 系列 超轻！（传导散热）

【重量】CFAB:1.5Kg

输入电压：220VAC
输出路数：单路、双路
特性：输出低纹波，双路独立稳压

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1U- 通用式机箱电源

300-2000W

特性

- 具备全面输入、输出保护功能
- 优化散热设计，功率可达 2000W
- 电源具有：输出电压、电流显示（按键切换）
- 符合 UL1950、IEC950 安全规程
- 1U（19 英寸标准机箱）
- 出线方式：接线柱、接线端子

输入电压范围

220VAC（额定值）	176-264VAC
220VDC（额定值）	180-380VDC
110VDC（额定值）	80-180VDC
48VDC（额定值）	36-72VDC
24VDC（额定值）	18-36VDC

2U- 通用式机箱电源

1500-4000W

特性

- 具备全面输入、输出保护功能
- 优化散热设计，功率可达 4000W
- 电源具有：输出电压、电流显示（按键切换）
- 符合 UL1950、IEC950 安全规程
- 2U（19 英寸标准机箱）
- 出线方式：接线柱、接线端子

输入电压范围

220VAC（额定值）	176-264VAC
220VDC（额定值）	180-380VDC
110VDC（额定值）	80-180VDC
48VDC（额定值）	36-72VDC
24VDC（额定值）	18-36VDC

3U- 通用式机箱电源

750-2000W

特性

- 模块失效监控功能具有声、光报警；支持远端控制
- 宽电压输入范围，具备全面输入、输出保护功能
- 具备无主均流功能，能实现 N+1 热备份，支持热插拔
- 具备输出电压微调功能
- 符合 UL1950、IEC950 安全规程
- 3U（19 英寸标准机箱）
- 出线方式：接线端子

输入电压范围

220VAC（额定值）	176-264VAC
220VDC（额定值）	180-380VDC
110VDC（额定值）	80-180VDC
48VDC（额定值）	36-72VDC
24VDC（额定值）	18-36VDC

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选型说明 Selection Guide

1. 模块电源

CLZ 150 - 48 S 05 - J
1 2 3 4 5 6

1- 系列号

2- 输出功率： 单路输出功率或多路输出功率总和；

3- 输入电压

4- 输出路数： S －单路； D- 双路； T- 三路； Q- 四路； F- 五路； F1- 六路；

5- 输出电压

a) 当输出为双路（D）时，如果为正负输出，此项代表正负输出电压值；如果两路输出不同，第一个电压值为第一路输出（Vo1），第二个电压值为第二路输出（Vo2）；不共地用“&”联接两个电压值；

b) 当输出为三路（T）时，如果为正负，加一正输出，第一项为正负电压值；第二项为正输出值；如果三路输出不同，此处三项一次为三个电压值；

四路及以上输出的情况与三路输出相同或只标明路数再做详细解释

6- 辅助说明

J- 军品； K- 宽范围； S- 安装散热器

附加说明：

(1) 若把 AC/DC 产品型号转换为相对应的 DC/DC 型号，可将“系列号”最后一个字母 A 改成 F。

如原交流输入电源模块 CDA120-220S24 转换直流输入的型号应该是：CDF120-220S24

(2) 若低纹波输出的模块电源，命名方法只需在“系列号”后加“-X”。 如：CCA-X35-220S07

2. 箱体式电源：

CL 19 A 2 A 400 -220S12
1 2 3 4 5 6 7

1- 系列号前缀

2- 机箱宽度：定制尺寸“19”为标准 U 箱电源

3- 机箱深度 A—350 ～ 400； B—400 ～ 450； C—450 ～ 500； D-500； X—客户定制尺寸

4- 机箱高度： 客户定制高度，对于 U 箱 1—1U； 2—2U； 3—3U（1U=44.45mm）

5- 输入交流或直流方式： A—交流 Z—直流

6- 输出功率：电源单路输出功率或多路输出功率的总和；

7- 与模块电源命名方法第 3 ～ 6 部分相同

选型说明 Selection Guide

1.Module Power Supply Naming

CLZ 150 - 48 S 05 - J

1 2 3 4 5 6

1Series Number

2Output Power: Single output loop power or the power sum of output circuits;

3Input Voltage

4Output Circuits: S-Single; D-Double; T-Triple; Q-Quad; F-Five; F1-Six

5Output Voltage

For double output, if it is positive or negative, this part refers to positive or negative voltage value, if both output are different, the first voltage refers to the first output(Vo1), and the second voltage refers to the second output(Vo2).Using symbol "&" link up two voltage values when the output circuits are isolation each other.

For triple output, if it is positive or negative output plus a positive output, then first part refers to positive or negative voltage value, the second part refers to positive; if all three are different, then three parts refers to three kind of voltage value in turn.

Quad and more outputs are same with triple output.

6Auxiliary Notes: J-Military; K- Extension Input-Voltage; S-Heat Sink Installed

Attachment:

(1) Properly transition the model of AC/DC into DC/DC, using the letter "F" replacing "A". For example AC/DC model is "CDA120-220S24", correspond with the DC/DC model is: CDF120-220S24

(2) For the output at ultra-low ripple, insert "-X" between the series number and output power value.

2.Chassis Power Supply Naming:

CL 19 A 2 A 400 -220S12

1 2 3 4 5 6 7

1Series prefix

2 Width: Customize size; "19" is 19 inch standard chassis

3Depth: A—350~400; B—400~450; C—450~500; D- 500; X—Customize size

4Height: Customize size, for 19 inch chassis is under 1—1U; 2—2U; 3—3U (1U=44.45mm)

5Input Volt at Alternation or Direct: A—Alternative current Z—Direct current

6Output power: Single loop output power or the power sum of output circuits.

7Same as Module Power Supply Series part 3-6

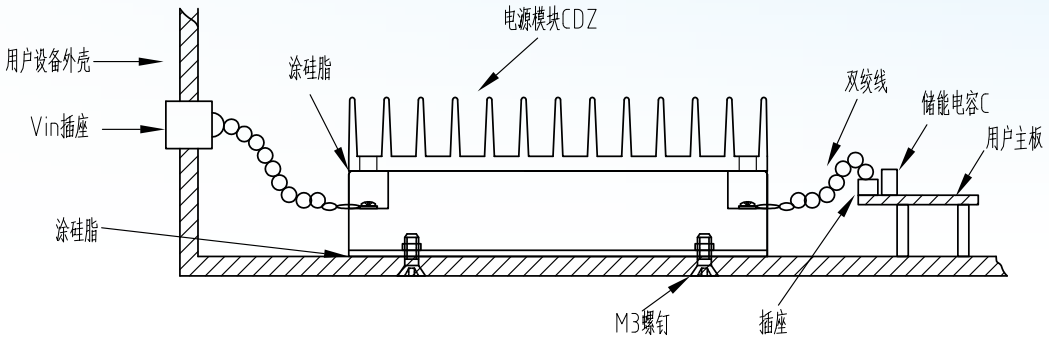
附录

便装式电源的选型与安装

便装式电源是为方便用户安装而设计的，可直接安装，无需印制电路板。全部采用接线端子出线方式。此产品有多种系列可满足不同用户的需求，选择便装式电源不但可减小电源系统设计上的许多麻烦，还可降低设计成本和有效节省使用空间。以下推荐几种装配方式供用户参考。

1．自然冷却安装方式

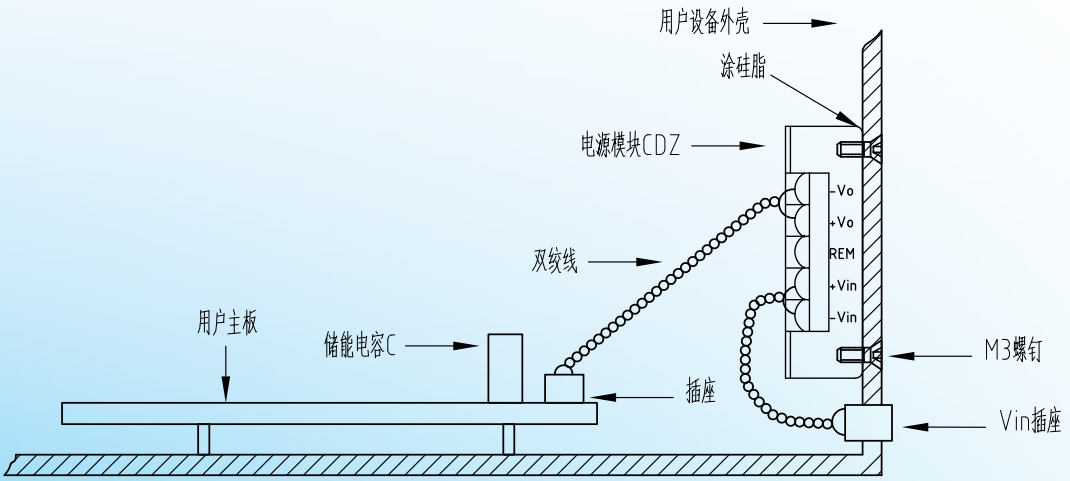
用户设计系统时，可采用自然冷却散热方式，见图一。要求一定空间以求空气能顺向自然对流，若电源使用功率较大，还可加装散热器或采用强迫风冷，关于散热的设计见第 107 页。



此方案适用型号为：CAZ、CBZ、CEZ、COZ、CDA、CEA、CSA、CUZ 等。

2．直接利用系统外壳散热的装配方式

若用户系统中空间较小，可直接利用外壳散热，如图二所示。因模块直接利用系统外壳散热，所以一定要保证无间隙装配。



此方案适用型号为：CCZ、CDZ、CPZ、CCA、COA 等。

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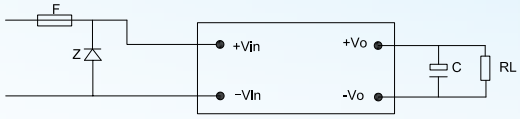
一、一般应用

我公司电源全系列产品，在无特殊要求时，都可以直接应用，而不必附加任何其它元器件．
接线如图一所示

图一

但为了防止接线错误和降低走线噪声，建议您采用如图二所示的方案：

图二



注：电容 C 应靠近负载连接

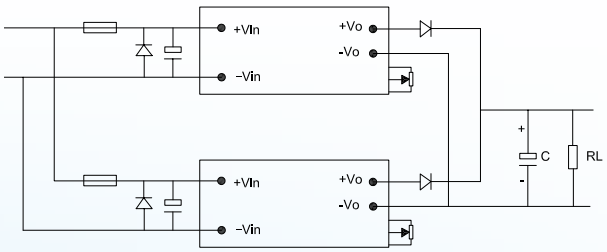
二、并联应用

如果单个模块的功率满足不了系统需求，或系统需要进行 N+1 备份时，就需要多个模块并联工作，这种并联应用要求各模块之间要均流，有均流端子的模块只需将该端子接均流母线，不具备该端子的并联方式有三种。

1. 冗余热备份的应用

热备份应用可以大大提高电源系统的可靠性，方便更换电源模块，能实现不停机的维护，将模块连接到母线上，出现故障的模块及时更换（故障模块自动退出），电源系统将有非常高的可靠性。这种方法并联的模块没有数量的限制。但是串联的二极管要消耗一部分能量，二极管一般选择肖特基二极管。接线图如图三所示。

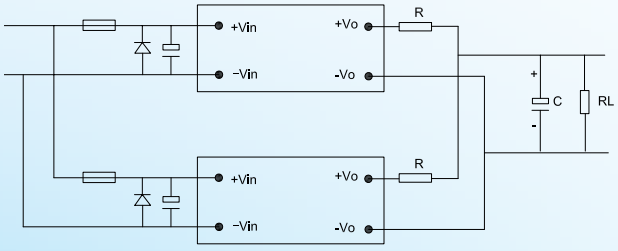
图三



2. 采用均流电阻

为提高电源系统的容量，将电源模块并联在一起使用。接线图如图四所示，均流电阻 R 一般为十几至几十毫欧。

图四



3. 直接并联的应用

这种并联方法是将两个（或多个）电源模块直接并联使用，利用调整端实现均流的目的，如图五所示。调整方法有两种：

（1）将输出电压的误差调整在 ±50mV 以内。这样各模块电源可基本实现均流。

（2）模块电源工作时，用电位器调节输出电压，使并联的各模块输入电流相等，达到各模块基本均流。

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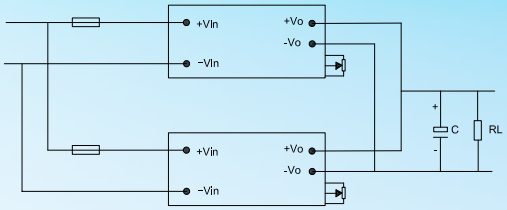
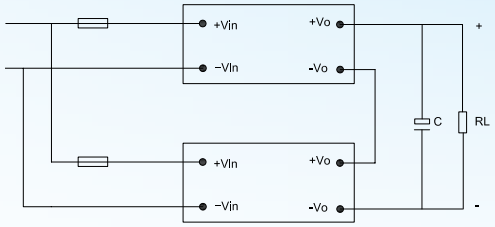
图五



三、串联应用

我公司的电源产品可直接串联应用，输出电压、功率成倍增加，如图六所示。电容 C 为去耦电容，应加在靠近负载端。

图六



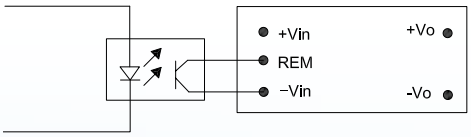
四、辅助端子的应用

根据电源系统工程应用的需要，承力电源在系列产品上设计了辅助端子，方要包括遥控端（REM），远端传感（SENSE），调整端（TRIM），辅助电容端（AUX）及接地端（Gr.）。具体功能和应用如下：

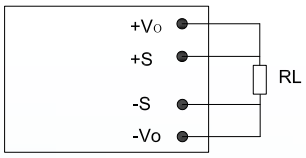
1. 遥控端的应用

遥控端可以控制模块电源的工作与否。一般 REM 与 -VIN（参考地）相连，模块关断，REM 与 -VIN 短路电流为 2-3mA；REM 悬空或与 +VIN 相连，模块正常工作。如果控制需要与输入端隔离可以使用光耦作为传递控制信号，如图七所示。

图七



图八



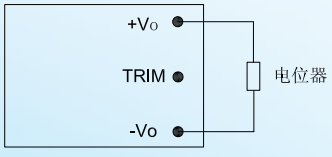
2. 远端采样的应用

若输出电流较大，负载距电源输出端较远，线路上存在较大的降压，使用远端采样（SENSE）可以保证负载电压为额定输出电压、负载效应为额定指标。接线图如图八所示。注意：引线压降应小于输出电压的 10%。

3. 调整端的应用

本公司电源产品是具有调整端（TRIM）的产品，可以通过电阻或电位器对输出电压进行一定范围内输出电压的调整。将电位器的中心与 TRIM 相连，其它两端分别接 +S, -S, 没有 +S, -S 管脚时将两端分别接到相应的主路的输出正负极上，如图九所示，调节器即可微调输出电压。电位器的阻值的选择请参考表一。

图九



VO	5V	12V	15V	24V	48V
Resistance	10K	20K	33K	47K	100K

表一

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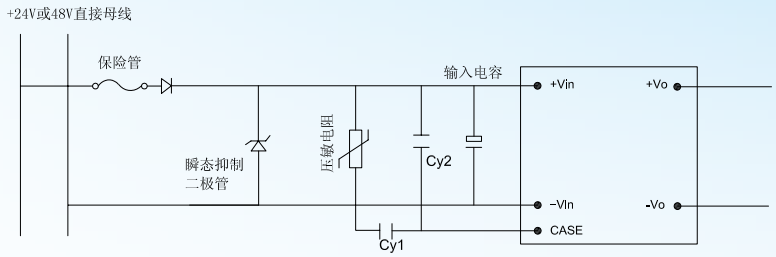
4. 接地端 Gr 的应用

AC-DC 模块电源中均设有 Gr. 接地端子，（等同接地符号 ⏚）此端子在内部与模块外壳相接，用户只需将此端子接到系统安全地上。

五、输入保护

根据模块电源实际的工作环境及用户对可靠性的要求，可以选择输入保护电路，以提高电源系统的可靠性，输入保护电路由保险丝、反极性保护二极管、输入电容、瞬态抑制二极管等组成，常用的输入保护电路如图十所示：

图十



1、保险丝

在模块输入端的保险丝提供安全保护，一般保险丝规格可选取 1.5-2 倍的额定输入电流，如果模块工作在一个当宽电压范围，保险丝应该选择 2 倍的最大输入电流。是否选择一个快速熔断的保险丝取决于具体的应用。一般来说一个普通的保险丝能提供足够的保护，但在热备份的应用中，我们推荐使用快速保险丝，以防失效的模块将输入母线短路。

2、输入电容

在模块的输入端应加装一只电解电容，这个电容有两个作用：
①吸收模块输入端的电压尖峰
②在输入母线上出现瞬间电压跌落，给模块提供一定时间的维持电压。

3、反极性保护

为了防止模块在输入极性接错，在输入端安装一只二极管，这只二极管可串在输入回路（如图十接法），对低压输入电源，可并联在输入回路（如图二接法）。如果使用瞬态抑制二极管作为瞬态过压保护，则省略串联二极管，同样可起到反极性保护的作用。

六、输入极性的选择

我公司的电源产品都是输入、输出隔离变换，请用户注意：输入 +VIN 端要接高电位，-VIN 端接低电位，输入端的极性不能接错，否则，将损坏电源模块。若用户采用正极性输入，请按照一般应用接入即可。若用户采用负极性输入，请注意 0V 接在 +VIN, 如图十一所示。

图十一

七、加载的要求

本公司部分双路、三路输出的电源产品，如 CD ,CRF,CJ,CA,CE 等系列，因采用单振 PWM 控制电路，因此要求电源主路负载电流不小于 30%，以保证电源辅路的输出能力。

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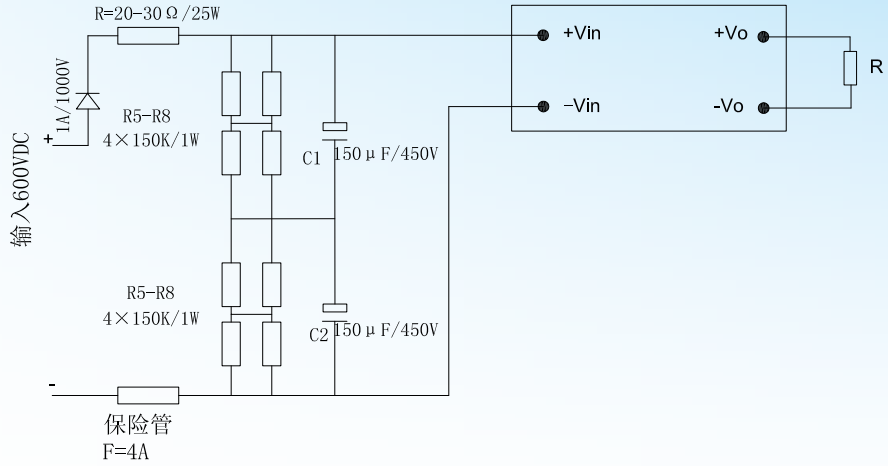
附录

所以本公司针对以上系列产品给出交叉调节率参数，既主路负载在 30%-100% 之间变化时，辅路负载调整率在 ±3%。如用户需求高精度的双路、多路电源，可选用本公司 CG、CK 系列产品或采用多支单路输出电源模块组成多路输出系统。

八、高压输入电源的应用

高压 600V 输入的电源模块，希望用户采用如下措施：

1. 滤波电容的接入方法见图十二：

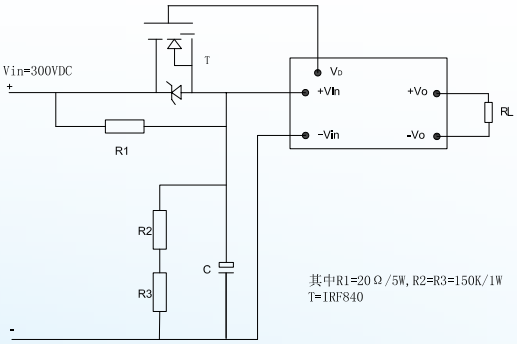


图十二

说明：如图所示，输入端外接的 C1,C2(150uF/450V) 电解电容必须使用高品质的长寿命电解电容，以避免由于 C1、C2 的损坏而导致电源模块的损坏。

2. 高压输入 V_D 端子的应用

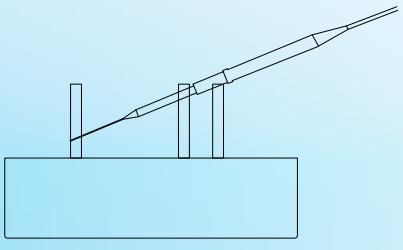
高压输入 CKK 系列电源，设有 V_D 端子，用户可利用 V_D 端子，接成输入浪涌电流抑制电路，可以防止浪涌电流（见图十三），既提高系统的可靠性，又使损耗降至最低。



图十三

九、输出噪声纹波的测试

输出纹波和噪声是指叠加在输出直流上交流成份，其中纹波是叠加在输出直流上开关频率的谐波分量，而噪声电压是与开关频率无关的非周期的分量。测试纹波和噪声应在规定的带宽内测试，一般用 20MHZ 带宽，超 20MHZ 带宽的示波器可选用 20MHZ 带宽限制，一般用 mVp-p 表示，测量时应采用靠测法（见图十四）即去掉探头上的地线夹和测试钩，直接用示波器探头靠在电源模块的输出引针上，这样可以避免空间辐射造成影响，还可以避免将共模信号叠加在真正要测试的差模信号上。



图十四

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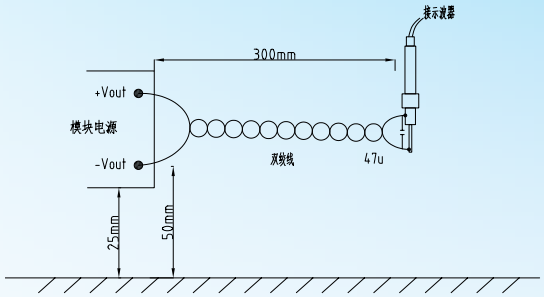
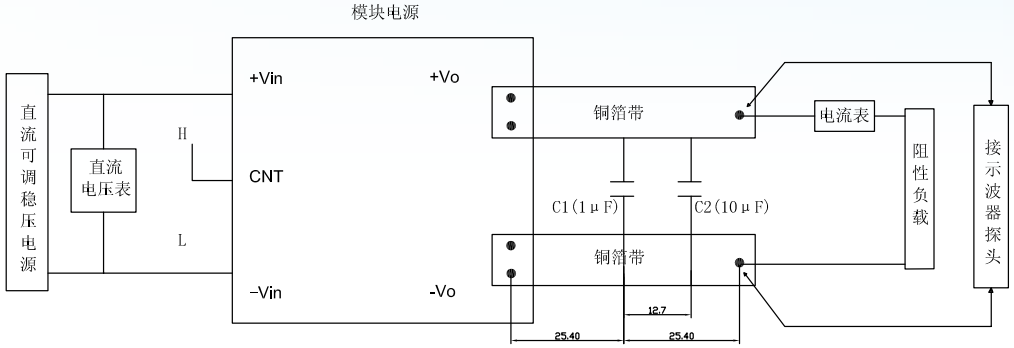
另一种方法是用双绞线测量。适用于便装式电源的测量，如图十五所示。将电源放置在一个离接地板 25mm 之上的地方，接地板由铝或铜板构成。电源的输出公共端和 AC 输入地端直接与接地板连结，而且不长于 50mm（线径应＞ 1mm^2）用 16AWG 铜线做成 300mm 长的双绞线，一端接电源输出，另一端并联一只 47μF 的钽电容，再接到示波器上。电容的引线应尽可能短，注意极性不要接反。示波器探头的地线应尽可能接到地线环。

图十五



输出纹波和噪声是指叠加在输出直流上交流成份，其中纹波是叠加在输出直流上开关频率的谐波分量，而噪声电压是与开关频率无关的非周期的分量。测试纹波和噪声应在规定的带宽内测试，一般用 20MHZ 带宽，超 20MHZ 带宽的示波器可选用 20MHZ 带宽限制，一般用 mVp-p 表示，测量时应采用模拟示波器选择适当的量程，扫描速度应低于 0.5 秒，测量峰－峰值杂音电压，接线如图十六。

图十六



十、关于散热设计

模块电源在工作时存在一定的自身功率损耗，也就是说存在着一个转换效率问题。转换效率的高低与输入电压、输入电压范围、工作温度、输出电压、输出功率有关，转换效率直接影响散热系统的设计。

1、转换效率和自身损耗的计算：

我公司产品的转换效率在技术手册上可以查到。特殊定制的产品，可来电与销售部技术支持咨询，用户也可通实验求出转换效率。

计算如下：　　η=Pout/Pin

η----- 转换效率

Pout----- 输出功率

Pin ------ 输入功率

知道模块的效率就可求出电源模块的自身损耗。

即 Pd=Pin-Pout=Pout/η-Pout

Pd----- 自身损耗

2、温升的计算

在我公司手册里每一种产品均提供了该型号电源模块的热阻 θca，其单位为℃/W。知道热阻 θca 和自损 Pd 就

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就可以准确的求出电源模块的温升 ΔT。

计算方法：ΔT=Pd • θca

举例说明：已知我公司产品 xx 型号模块，其输出参数：

Vin 输入电压 =48VDC

Vo 输出电压 =12VDC

Io 输出电流 =4A

Po 功 率 =48W

η 变换效率 =89%（查手册）

先求出自身损耗 Pd

Pd=Pout/g-Pout=48/0.89-48 ≈ 6W

查我公司产品手册，假设该型号的 θca=5℃ /W，

代入 ΔT = Pd • θca= 6W • 5℃ /W=30℃

由此我们可以得出该模块正常工作时其温升 ΔT=30℃。

温升 ΔT 是一个很重要的参数，我们知道了温升 ΔT 和环境温度 Ta 就可以很方便算出工作壳温 T c 。

公式为：T c=Ta+ΔT

T c----- 壳温

Ta------ 环境温度

ΔT-- 温升

如环境温度 Ta=20℃，那么壳温就是

Tc=20℃ +30℃ =50℃

此时再查找我公司产品手册中规定的该模块允许的最高壳温 Tcmax，常规工艺模块 Tcmax 最高为 85℃，铝基板工艺模块 Tcmax 最高为 100℃，我们计算的壳温 Tc=50℃，远低于最高允许值，满足 Tc<<Tc max，可以正常使用。在这里用户还应注意一个重要的问题：根据可靠性的计算方法，工作时温度越低可靠性越高，有数据表明电源模块的温度上升 10℃，MTBF 就会下降 20% 客户根据这个原则，工作时模块的温度应尽可能的低。

手册中查到的最高壳温 Tcmax 是极限值，厂家保证在最高温度 Tc max 下可以正常工作，但 MTBF 要降低，这点用户一定要注意！把温度降下来有多种途径，采用不同的方法会直接影响热阻 θca 的大小。

安装方式上一般安装和加装散热器安装，加装散热器应考虑不同的物理面积。

散热器的大小影响 θca 的大小，有关散热器的参数可参照散热器的生产厂家的数据，我公司的电源产品一般均配有散热器，个别产品备有大小不同规格的散热器供用户选择，凡我公司所配的散热器均标明热阻 θca 。空气流速为米每秒 M/S，也有用英制单位线性英尺每分钟 LFM。

换算关系近似为：

200LFM=1M/S.

凡是我公司配套的散热器均有数据，用户可根据带有散热器的 θca 热阻代入公式即可算出模块工作时的 Tc

如果用户采用强迫风冷，可根据不同风速 M/S 下的 θca 值代入公式，即可得到该风速下的温升 ΔT。采用强迫风冷，增加空气的流速会带来明显的效果，可以大大缩小散热器的物理尺寸，甚至可以不要散热器。但风扇带来体积的增加和明显的风噪，风扇本身可靠性的 MTBF 还会直接影响整个电源系统的 MTBF，用户要均衡考虑。

安装散热器应注意空气对流的方向问题。

见图十七：

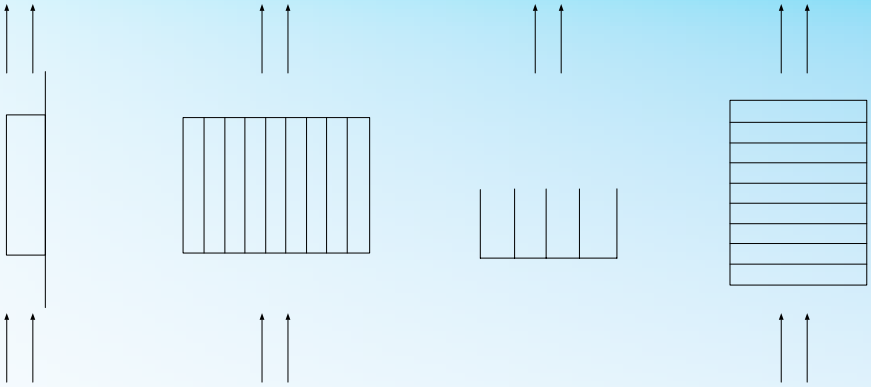

图 1　　图 2　　图 3　　图 4

图十七

不管采用什么不同的散热方法，必须注意气流的方向，不加散热器时，模块应立式安装（见图 1），加装散热器对流空气应平行于散热器齿筋。前两种情况有利于空气的对流，后两种情况均不利于对流，以第四种情况散热效果最差，第三种情况稍好一些，如采用强迫风冷，只需注意使风扇的气流平行于散热器的散热齿筋流动即可。

长方形的散热器其齿筋应平行于短边，其效果优于平行于长边。

电源模块加装散热器时，由于模块与散热器之间的表面粗糙，不平整，存在一定的空间，在这个空间里留有一定的不流动空气，而不流动空气的热阻是很大的，应在电源模块和散热器之间涂一层导热硅脂，以减小电源模块与散热器之间的热阻。

下面列出几种不同材料的热阻。

材料	热阻℃ /W
不流动空气：	1200
硅脂：	204
灌封硅橡胶：	81
钢：	0.84
铝：	0.19
铜：	0.1

由此可见“不流动空气”对散热的影响之大，除了上面说的是由于散热片与模块之间的表面粗糙之外，还应注意避免将电源模块安装在一个密闭的狭小空间，此时周围也是不流动空气，呈现很大的热阻，这一点在使用时一定要注意，否则会造成模块过热保护。

十一、关于电磁兼容

设备或系统在其电磁环境中能正常工作，且不对该环境中的任何事物构成不能承受的电磁骚扰的能力。

也就是说我们使用的电源在电磁干扰的环境中能正常工作并还不能影响其它设备或系统正常工作。

由于电源模块是一个很强的干扰源，电源内部电路大功率开关管导通截止开关频率高达几百 KHZ，并且具有非常丰富的谐波成份，因此要有一定的措施才能抑制它的电磁干扰。我公司部分产品按照电磁兼容要求生产，并通过电磁兼容相关标准的检测。用户如有电磁兼容的要求可首选此类产品。

电源模块由于体积的限制，其输入级只有比较简单的滤波电路，满足客户一般使用。如用户有 EMC 电磁兼容要求，并要通过电磁兼容相关标准的测试，那么用户需采取一些加强电磁兼容的措施。

开关电源模块的 EMC 有二个方面：传导和辐射。

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附录

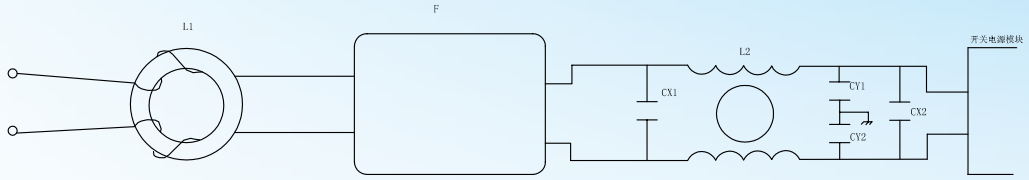
1．传导

对于开关电源来讲是从电源输入端子的电磁传导骚扰。

CISPR22 标准规定传导骚扰的频段为 150K-30MHz，分 A 级、B 级两种限值。欧盟标准为 EN55022，我国的国家标准等同采用国际标准称为 GB9254。国军标有关电磁兼容的标准为 GJB151A，该标准有很多分类，涉及电源端子项目一般为 CE102，其频段为 10K-10MHz。

用户可采用如图十八措施：

图十八



L1： EMI 磁环。用导线穿以数匝，该磁环可将高频成份转变为热的形式。

F： 滤波器。 采用双节、插入损耗高的产品。

Cx1-2：X 电容。抑制差模干扰。

Cy1-2：Y 电容。抑制共模干扰。

L2：共模电感。抑制共模干扰。

以上 L、C 元件只要搭配布局合理，并良好接地，可有效地抑制传导骚扰。

2．辐射

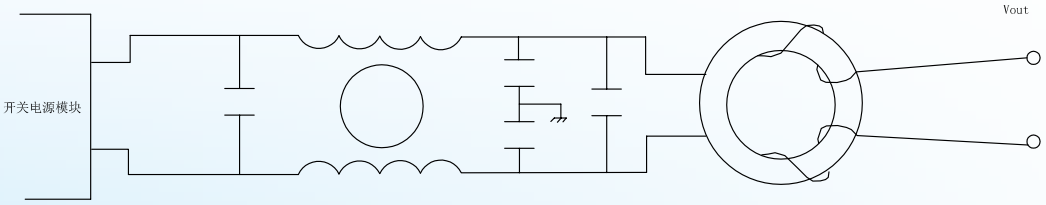
开关电源本身或借助与其相关联的导线，向空间辐射的电磁骚扰。

CISPR22、EN55022 中规定辐射的频段为 30M-1000MHz 我国的国家标准 GB9254 等同采用。GJB151A 国军标对辐射有很多分类，其中有的项目上限最高达 40GHz。

由于开关电源是一个谐波成分非常丰富辐射骚扰源，须要较完善的屏蔽措施。但传导和辐射会相互作用，会因传导而引起辐射。与开关电源相连的输出线、控制线等会起辐射天线的作用，因此完善的屏蔽措施加上对各端子的连线进行滤波可有效地抑制辐射骚扰。

用户如要通过各类电磁兼容标准对辐射的要求，建议用户采取屏蔽和滤波措施，由于电源模块是一个金属六面体外壳良好接地即可，但输出端要进行处理，加 LC 滤波网络。见图十九：

图十九



与图十八输入端的电路有共同之处，只是作用的频段不同，为减少传导引起辐射，所用的元件尽量靠近模块电源的输出口，Cy 电容的引脚要尽量短，模块电源的外壳（屏蔽层）要良好接地。

3．关于抗扰度

装置、设备或系统面临电磁骚扰不降低运行能力的能力。

这里的电磁骚扰有四个分类：电、磁、静电、电磁。

关于抗扰度的国家标准 GB17626.1-12 是等同采用 IEC61000-4 标准，抗扰度的标准是一个系列标准，内容较多，用户可以根据自己的使用需求进行选择。

我们公司的部分产品通过 IEC61000-4（idt GB17626）的检测，有抗扰度要求的用户在订货时可选择这一部分产品。

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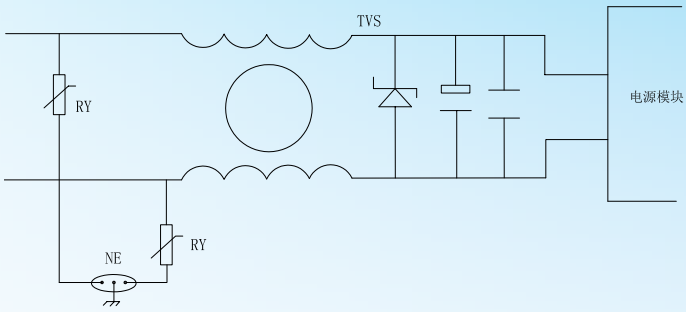
我公司一般常规产品在电路结构和工艺上已采取了一些措施，即使用户不加任何措施也可以通过大部分抗扰度项目的测试，但因体积所限，个别项目还是需要用户加强措施，如浪涌、电脉冲群、传导骚扰。

建议客户采用如图二十的措施：

图二十



Ry：压敏电阻

TVS：瞬态抑制二极管

NE：气体放电管

根据客户使用的不同电压，采用压敏电阻、气体放电和 TVS，TVS 动作速度非常快，达 pS 级（10^{-12}），但其通流量不大，应将其放在后级。压敏电阻和气体放电的通流量可以做得很大。但速度较慢只有微 μ S 级（10^{-6}）。为了让高能量的浪涌电压尽量作用在压敏电阻、气体放电管上，建议在压敏电阻和气体放电与 TVS 之间放一级电感，用电感阻挡一些时间，高能量的浪涌电压尽量从压敏电阻、气体放电管泄放。气体放电管是一种负阻元件，一旦导通只有几十伏的压降，故应与压敏电阻配合使用。二级间的阻滞电感可与 EMC 输入级的电感共用。

所有压敏器件、元件的动作电压按下面公式计算：

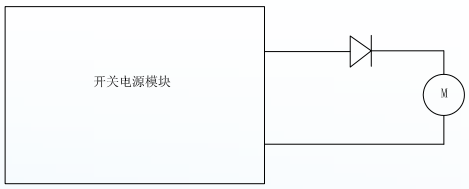
Vz ≥ Vin（1+20%）1.4

例：Vin=220Vac 输入回路，Vz ≥ 370V。在交流电压波动较大的地区还可取得大一些。

十二、关于感性负载和启动电流

如用户采用电源模块驱动感性负载如电动机、电磁阀等，那么应当注意感性负载会产生感生电动势，造成电源模块的误动作。可在输出级加一支二极管，将感生电动势隔离。见图二十一：

图二十一



如果用电源模块驱动电动机，除应注意感生电动势外，还需注意电动机的启动电流，一般来讲电动机的起动电流是正常工作标称值的 6-8 倍，我公司电源模块的保护电路可靠而灵敏，会因过流保护而启动不了，须适当加大电源容量并在订货时予以说明。

十三、关于可靠性

可靠性的指标用平均无故障间隔时间 MTBF 来表示，我公司的产品 MTBF=$20x10^4$h，铝基板工艺的产品 MTBF=$100x10^4$h

平均无故障间隔时间有二种计算方法，一是用长时间大量的统计数字来计算，二是用 MIL-HDBK-217F2，国军标为 GJB299 标准规定的方法来计算，即 MTBF=1 / λ，计算方法非常浩繁。最关键是求得 λ 的值，λ 的值与以下几项内容有关：

1、环境温度

2、使用环境

3、元件的数量

4、元器件的等级

5、降额的冗余度

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Appendix

其中 1、2 项与客户使用有关。第 3-5 项由生产厂家掌握，我公司的产品在计算 MTBF 时环境温度取 25℃，使用环境为“一般地面环境”。如客户在使用环境温度过高，工作环境过于严酷会直接影响 λ 的值，从而降低 MTBF 的值。为保证 MBTF 达到要求，我公司在产品设计上依据 GJB / Z35 采用冗余、降额方法，元器件采购方面采用高等级产品，并按照 GJB128A、GJB548A 进行老化、筛选，电路结构上尽量简捷，在保证功能的前提下，尽量减少元器件的数目，以提高平均无故障间隔时间 MTBF。

综上所述，平均无故障间隔时间 MTBF 会因客户在使用方法、使用环境温度的不同而有一定的变化，我公司目前采取的是根据 MIL-HDBK-217F2、GJB299 规定的方法计算所得，也是国内、外各生产厂家通用的计算方法。

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Appendix

Model Selection and Installation of Compact Power Supply

Compact power supply is designed to facilitate installation by users. It can be installed directly, with no printed circuit board required. Outlet terminal method is adopted for this model. Multiple series can meet users' different needs.By selecting compact power supply, users can avoid many troubles in power supply system design, lower design cost and save space of application. The following assembly methods are recommended for reference use by users.

1. Natural cooling installation method

When user designs a system, natural cooling may be adopted. A certain space is needed to let air have a natural convection along the direction. If power supply has higher power, you may need to add another heat sink or adopt forced air cooling. For heat diffusion design, please refer to Page 130.

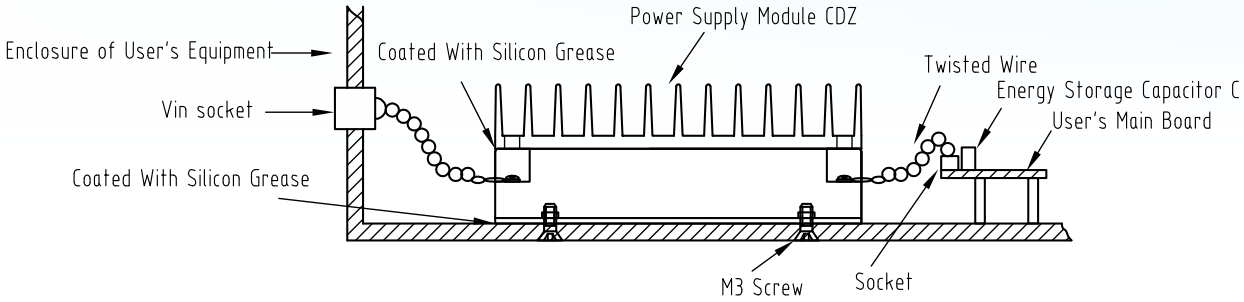

Fig.1

The following models are suitable for this solution: CAZ, CBZ, CEZ, COZ, CDA and CEA.

2. Method of assembly directly using the system's enclosure for heat diffusion

If the space inside user system is fairly small, enclosure may be directly used to diffuse heat, as shown in Fig.2. Because the module directly uses the enclosure of the system to diffuse heat, gapless assembly must be ensured.

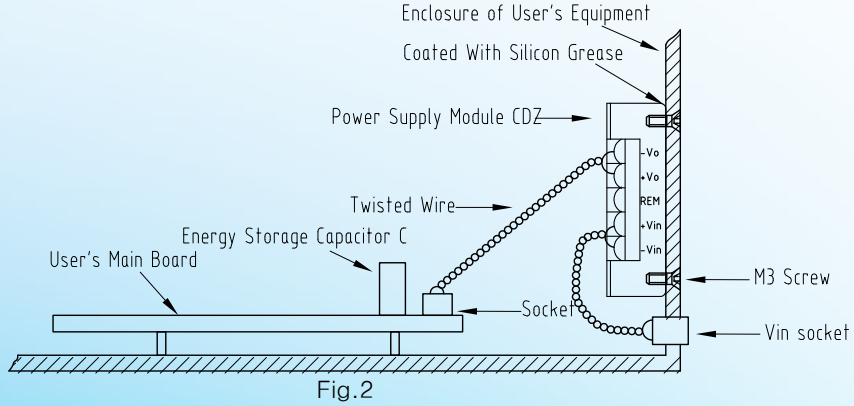

Fig.2

The following models are suitable for this solution: CCZ, CDZ, CPZ and CCA.

Applications of Power Supply

I. General applications

When there are no special requirements, all the power supply product series of our company can be directly used, without attaching any other devices. The wiring method is as shown in Fig.1:

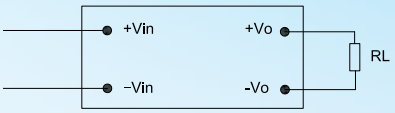

Fig.1

But, to prevent wiring errors and lower wire noise, the wiring method as shown in Fig.2 is recommended:

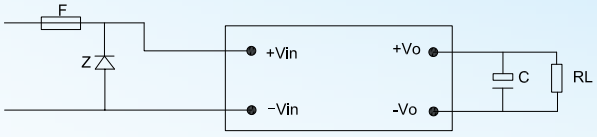

Fig.2

Note: Capacitor C should be close to the load.

II. Parallel connection applications

If the power of individual modules cannot meet the system demand, or the system requires N+1 backup, several modules will be required to work in parallel connection. Such a parallel connection application requires current sharing between individual modules. For those modules with current-sharing terminal, the user only needs to connect the terminal with the current sharing bus. When such a terminal does not exist,there are three ways of parallel connection.

1. Application of redundant hot backup

Hot backup application can greatly improve the reliability of power supply systems and facilitate the replacement of power supply modules. It can achieve nonstop maintenance. Modules are connected with the bus and those defective modules can be promptly replaced (defective modules will exit automatically). The power supply system in this way will have very high reliability. This parallel connection method has no limit on the number of modules. But, the diodes connected in series will consume some energy. Normally, Schottky diode is recommended. The wiring diagram is as shown in Fig.3.

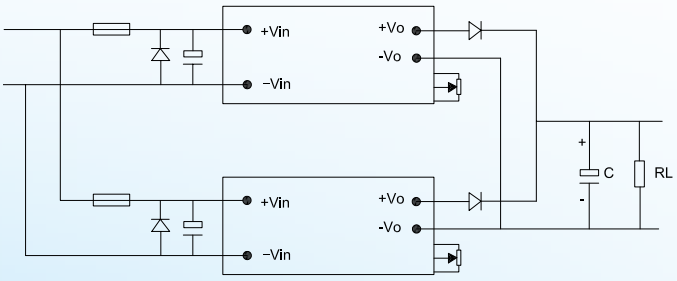

Fig.3

2. Method of using current sharing resistor

To improve the capacity of the power supply system, the power supply modules are connected in parallel for joint use. The wiring diagram is as shown in Fig.4. Normally, the value range of current sharing resistor R is from several tens of milliohm to dozens of milliohm.

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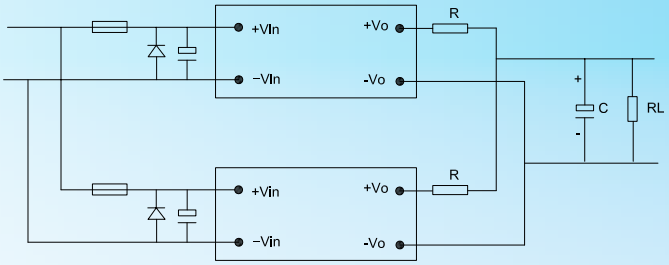

Fig.4

3. Application of direct parallel connection

This parallel connection method directly connects and uses 2 (or several) power supply modules in parallel and uses the adjustment pin to achieve current sharing, as shown in Fig.5. There are two adjustment methods:

(1) Adjust the output voltage error to within 50mV. The current sharing can be basically achieved between the power supply modules.

(2) When the power supply module is operating, use potentiometer to regulate output voltage to make the parallel-connected modules have the same input current, thus basically achieving current sharing between individual modules.

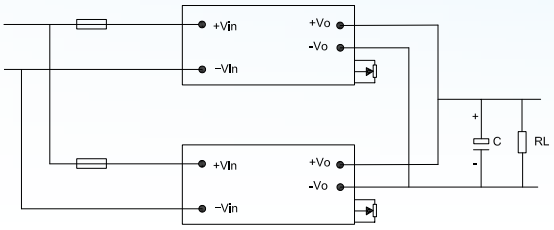

Fig.5

III. Series connection applications

The power supply products of our company can be directly used in series, which increases output voltage and power severalfold, as shown in Fig.6. Capacitor C is decoupling capacitor and should be installed close to the load end.

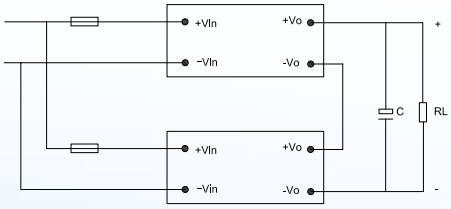

Fig.6

IV. Application of auxiliary terminals

Depending on the needs of power supply system project applications, Chengli has designed auxiliary terminals to its power supply product series. These mainly include the remote control (REM), the remote sense (SENSE), the adjustment (TRIM), the auxiliary capacitor (AUX) and the grounding (Gr.). The functions and applications are as follows:

1. Application of remote control

REM can control whether the modular power supply works. When REM is connected to-VIN(reference ground), the module is shut down, the short circuit current between REM and -VIN is 2-3mA; when REM is hanged up or connected with +VIN (input power supply voltage is no higher than 72V), the module works normally. If the REM control needs to be separated from the input, optical coupler may be used to transfer control signal, as shown in Fig.7.

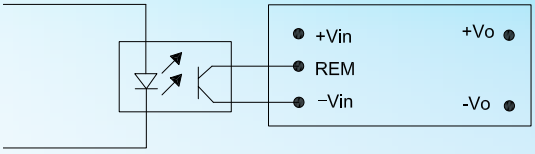

Fig.7

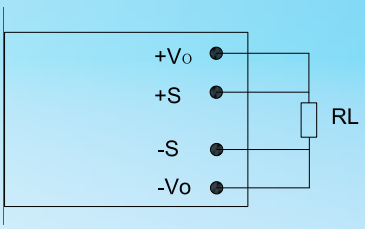

Fig.8

2. Application of SENSE

If the output current is rather big, the load is rather far away from the output of the power supply and there is a big voltage drop on the line, SENSE can be used to ensure that the load voltage is the rated output voltage and the load effect is the rated value. The wiring diagram is as shown in Fig.8. Attention: The voltage drop of the wire should be less than 10% of the output voltage.

3. Application of TRIM

The power supply products of our company have TRIM terminal. With resistor or potentiometer, it is possible to adjust the output voltage within a certain range. Connect the center of potentiometer with TRIM and another two ends with +S and −S, respectively. When there is no +S or −S pin, connect the two ends with the positive pole and the negative pole of the corresponding main circuit output respectively, as shown in Fig.9. Then, it is possible to use TRIM to adjust output voltage. For the selection of potentiometer's resistance value, please refer to Table 1.

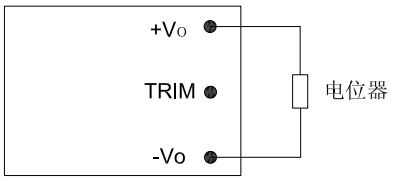

Fig.9

VO	5V	12V	15V	24V	48V
Resistance	10K	20K	33K	47K	100K

Table 1

4. Application of Gr

All AC-DC module power supplies have Gr. Grounding terminal (equivalent to grounding symbol). Inside, the terminal is connected to the enclosure of the module. Users only need to connect this terminal to the safety ground of the system.

V. Input protection

Based on the actual working environment of the power supply module and users' reliability requirement, input protection circuit may be selected to improve the reliability of the power supply system. The input protection circuit consists of fuse, reverse polarity protection diode, input capacitor and transient voltage suppressor. Commoly used input protection circuit is shown in Fig.10:

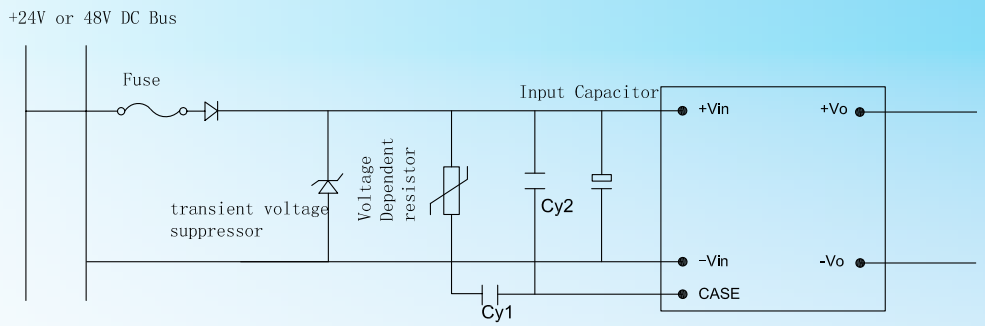

Fig.10

1. Fuse

The fuse at the input end of the module provides safety protection. Normally, the fuse specification may be chosen as 1.5–2 times the rated input current. If the module works within a considerably wide voltage range, the fuse should be selected as 2 times the maximum input current. Whether to select a fast acting fuse will depend on specific applications. Generally speaking, an ordinary fuse can provide sufficient protection.But, in hot backup applications, we recommend the use of fast fuse to prevent defective modules from resulting in short circuit to the input bus.

2. Input capacitor

At the input end of the module, one electrolytic capacitor should be added. This capacitor plays 2 roles:

① Absorb the voltage peak at the input end of the module

② When transient voltage drop occurs on the input bus, it provides the module with a maintenance voltage for a certain period of time.

3. Reverse polarity protection

To prevent wrong input polarity connections at the module, one diode is installed at the input end. This diode can be serially connected with the input loop (the connection method as shown in Fig.10). For low voltage input power supply, it can be parallel connected with the input loop (as the connection method in Fig.2). If transient voltage suppressor is used as transient over voltage protection, the serial connected diode can be saved. It can play the same role of reverse polarity protection.

VI. Selection of input polarity

The input and output of all the power supply products of our company are isolated each other. Users should pay attention that the input +VIN needs to be connected with the high potential, while the –VIN needs to be connected with the low potential. There should be no wrong polarity connection at the input. Otherwise, the power supply module may be damaged. If the user adopts positive pole input, please follow the normal application connection. If the user adopts negative pole input, please make sure to connect OV with +VIN, as shown in Fig.11

Fig.11

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VII. Loading requirements

Some double and triple outlets power supply modules, such as CD, CRF, CJ, CA and CE series adopt single oscillate PW control circuit. It is required that the load current of the main circuit of the power supply is no less than 30%, to ensur the output capacity of the auxiliary circuits of the power supply. The company has thus given the cross adjustment ratio parameters for the products of the above series. In other words, when the load of the main circuit changes between 30% and 100% the load adjustment ratio of the auxiliary circuit will be 3%. If users need high accuracy double and multiple outputs powe supplies, they may select the CG and CK product series of the company or adopt several single way output power supply modules to form a multiple-way output system.

VIII. Application of high voltage input power supply

For power supply module with high voltage 600V input, users are expected to adopt the following measures:

1. The connection method for filtering capacitor is shown in Fig.12:

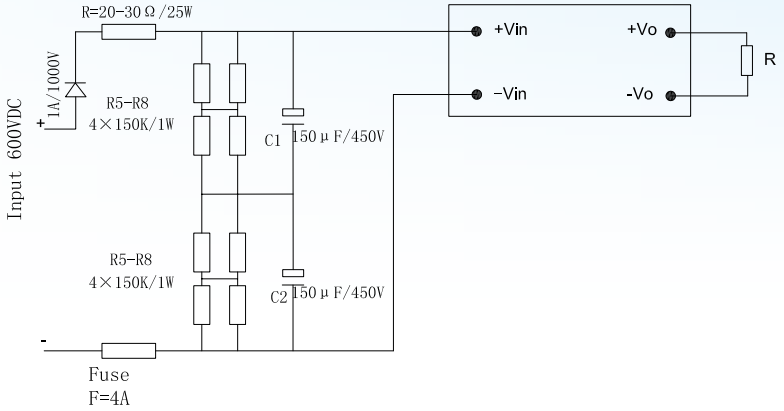

Fig.12

Note: 1. As shown in the figure, the C1 and C2(150uF/450V) electrolytic capacitors externally connected with the input mu be high quality, long lifespan electrolytic capacitor to avoid damage to the power supply module as a result of C1 or C2 destruction.

2. Application of high voltage input VD terminal

VD terminal is set up for the CKK high voltage input power supply series. Users can use the VD terminal to connect into a input surge current control circuit. It can prevent surge current (as shown in Fig.13), improve system reliability and minimiz wastage.

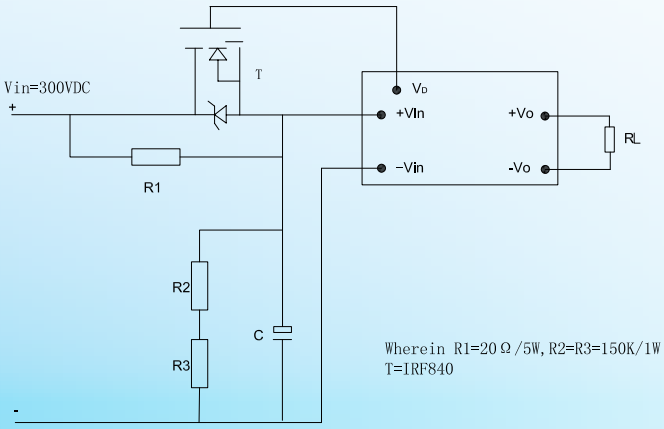

Fig.13

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IX. Output noise ripple test

Output ripple and noise refer to the AC component superimposed on the output DC. Of this, the ripple is the harmonic wave component superimposed on the switch frequency of the output DC, while the noise voltage is the non-periodic component unrelated to the switch frequency. Ripple and noise test should be undertaken within the stipulated bandwidth. Normally, 20MHZ bandwidth is used. 20MHZ bandwidth restriction may be selected for oscillographs over 20MHZ. Noise and ripple test is nor-mally expressed using mVp-p. Docking measurement should be used here (see Fig. 14), first remove grounding clip and test hook, then connect probe tip directly to the output pin of power supply module. This method can prevent from interfering of ambient radiations, and from overlaying common mode signals with differential signals which is truly to be measured.The connection diagram is as shown in Fig.14.

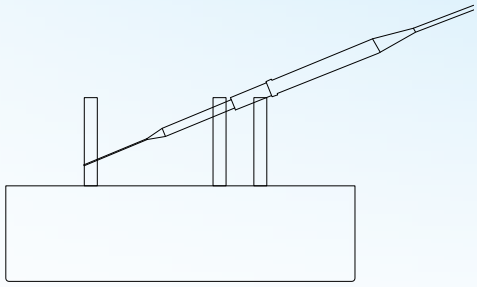

Fig.14

The alternative measurement is Twist-Pair method, which is for measurement of compact module power supply, as shown in Fig.15. Put the power supply at a place which is 25mm above grounding plane made by aluminum or copper. The common output and AC input of power supply are connected directly to the grounding plane, and the length of connection is less than 50mm (diameter of wire should be greater than 1mm2 . 16AWG copper wire is used to make a 300mm twist pair, one end of wire is connected to power supply output, the other end is parallel connected with a 47uF Tantalum electrolytic capacitor before oscilloscope. The lead of capacitor should be short as possible, and make sure there is no reverse polarity. The "grounding wire" of oscilloscope probe should be connected with grounding ring as possible.

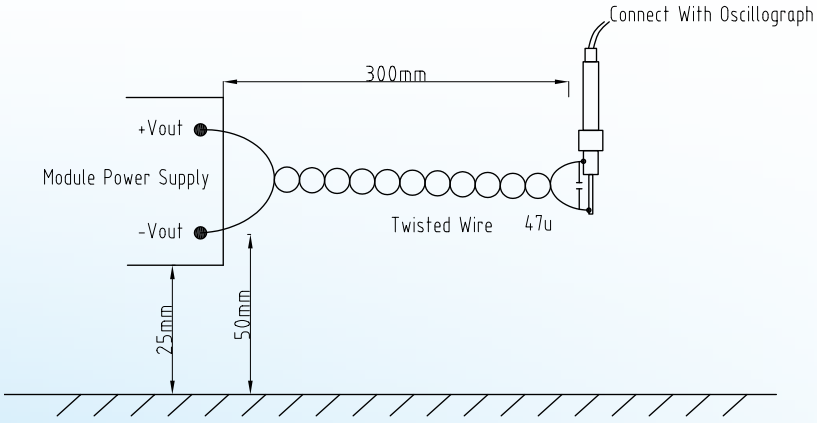

Fig.15

Output ripple and noise refer to the AC component superimposed on the output DC. Of this, the ripple is the harmonic wave component superimposed on the switch frequency of the output DC, while the noise voltage is the non-periodic component unrelated to the switch frequency. Ripple and noise test should be undertaken within the stipulated bandwidth. Normally, 20MHZ bandwidth is used. 20MHZ bandwidth restriction may be selected for oscilloscopes over 20MHZ. Noise and ripple test is nor-mally expressed using mVp-p. When measurement is made, analogue oscillograph should be adopted to select a suitable range. The scanning speed should be no lower than 0.5s. Peak-peak value noise voltage is measured.

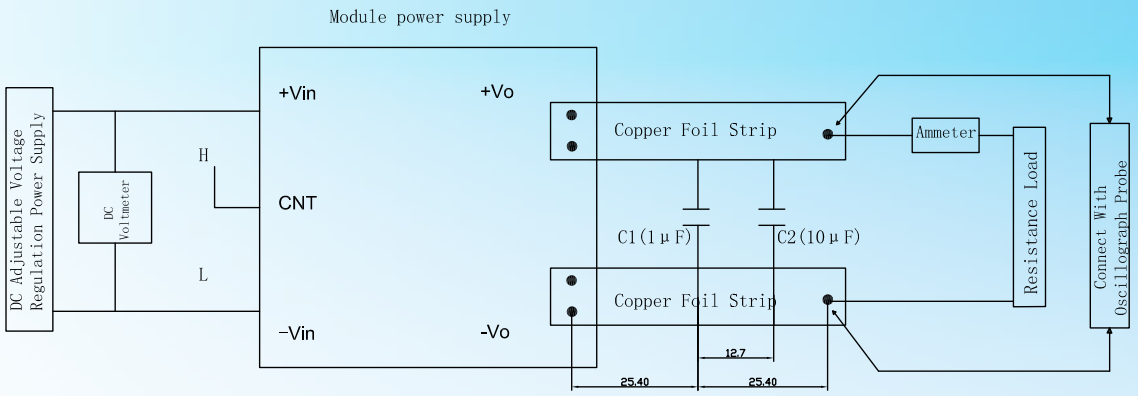

Fig.16

X. About heat diffusion design:

When module power supply works, there is a certain power loss. In other words, there is a matter of conversion efficiency. onversion efficiency is related to input voltage, input voltage range, operating temperature, output voltage and output power.onversion efficiency directly affects the design of heat diffusion systems.

1. Calculation of conversion efficiency and module loss

The conversion efficiency of the products of our company can be found in the technical manual. For specially customized roducts, users may make calls and get technical support and advice from the Sales Department. Users may also conduct xperiment to calculate conversion efficiency. The calculation is as follows:

$\eta = Pout/Pin$

η -----conversion efficiency

Pout----- output power

Pin----- input power

When the module efficiency is known, it is possible to calculate the own loss of the power supply module.

Namely, Pd=Pin-Pout=Pout/ -Pout

Pd -----own loss

2.Calculation of temperature rise

In the manual of our company, the thermal resistor ca of each power supply module model is given. Its unit is ℃ /W. When he thermal resistor θ ca and the own loss Pd are known, it is possible to accurately calculate the temperature rise ΔT of the ower supply module.

Calculation method: $\Delta T = Pd \cdot \theta ca$

Example: It is known that the XX module model of our company has the following parameters:

Vin input voltage =48VDC

Vo output voltage =12VDC

Io output current =4A

Po power =48W

η conversion efficiency=89% (find in the manual)

Firstly, calculate the own loss Pd

$Pd=Pout/\eta - Pout=48/0.89-48 \approx 6W$

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Look up in our company's product manual, and assume that the θ ca of the model is 5 ℃ /W,

Put it into: ΔT = Pd • θ ca= 6W • 5℃ /W=30℃

Then, we can get that when the module works normally, its temperature rise Δ T is =30℃ .

The temperature rise ΔT is a very important parameter. When we know the temperature rise ΔT and the environmental temperature Ta, we can conveniently calculate the working case temperature T c.

The formula is: T c=Ta+ΔT

T c----- case temperature

Ta -----environmental temperature

ΔT-----temperature rise

If the environmental temperature Ta is =20 , then the case temperature will be:

Tc=20℃ +30℃ =50℃

Then, find in the permissible maximum casing temperature Tcmax of the module as stipulated in the product manual of our company. For modules with conventional techniques, the Tcmax is 85℃ . For aluminum base modules, the Tcmax is 100℃ . Our calculated casing temperature Tc is =50℃ , which is far lower than the maximum permissible value. Tc<<Tc max is satisfied. The module can be used normally. Here, users must pay attention to an important problem: According to the reliability calculation method, the lower the temperature is while at work, the higher the reliability will be. There are data showing that when the temperature of the power supply module rises by 10℃ , its MTBF will drop by 20%. According to this principle, customers should lower the temperature of their working modules as much as possible.

The maximum case temperature Tcmax found in the manual is an extreme value. The manufacturer ensures that its product can work normally under the maximum temperature Tc max, but with falling MTBF. Users must bear this in mind! There are many ways to lower temperature. Different methods will directly affect the magnitude of the thermal resistance θ ca.

Installation is divided into general installation and installation with extra heat sink. In the latter, different physical areas should be taken into account.

Heat sink dimension affects θ ca magnitude. For related heat sink parameters, users may refer to the heat sink manufacturer's data. Our power supply products are normally equipped with heat sink. Some products are equipped with heat sinks of different specifications for users to choose from. All the heat sinks provided by our company are with specified thermal resistance θ ca. The air flow speed is M/S. The English unit of linear feet per minute (LFM) may also be used.

The approximate conversion relationship is:

200LFM=1M/S.

All the heat sinks provided by our company are accompanied by data. Users can put the heat sink's θ ca thermal resistance into the formula and calculate the Tc when the module is at work.

If forced air cooling is adopted, the user may put the ca value under different wind speeds M/S into the formula and get the temperature rise ΔT under that wind speed. When forced air cooling is adopted, increasing air speed will bring about notable effects, greatly reduce the physical dimension of the heat sink or even do not use heat sink at all. But, the increased size and notable wind noise caused by the fan and the MTBF of the fan itself will directly affect the MTBF of the whole power supply system. Users need to make balanced considerations.

When installing heat sink, users should pay attention to the direction of air convection.

See Fig.17:

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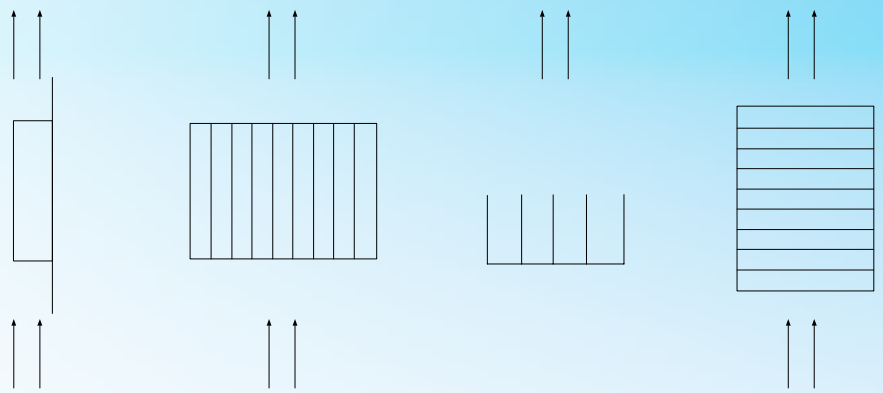

Fig.1 Fig.2 Fig.3 Fig.4

Fig.17

Whatever heat diffusion method is adopted, attention must be paid to air flow direction. When no heat sink is added, the module should be installed in a standing manner (see Fig.1). When heat sink is added, the convective air should be parallel to the heat sink's fear veins. The first 2 situations help air convection, while the last 2 situations are not favorable for convection. The 4th situation has the poorest heat diffusion effect, while the 3rd situation is slightly better. If forced air cooling is adopted, attention only needs to be paid to make the fan's air flow parallel to the direction of the heat sink's heat diffusion gear veins.

The gear veins of rectangular heat sink should be parallel to its short edges. This will produce better effect than when the veins are parallel to the long edges.

When the power supply module is added with heat sink, there will be a certain space between the module and the heat sink due to rough and uneven surface. In this space, there is certain still air. But, still air has a very great thermal resistance. A heat-conducting silicon grease layer should be coated between the power supply module and the heat sink to reduce the thermal resistance between them.

The thermal resistors of several different materials are listed below.

Material	Thermal Resistance ℃ /W
Still air	1200
Silicon grease	204
Embedded silicon rubber	81
Steel	0.84
Aluminum	0.19
Copper	0.1

It can be seen that "still air" has a very great influence on heat diffusion. In addition to the surface roughness between the heat diffusion sheet and the module mentioned above, attention should also be paid to avoid installing the power supply module into a narrow space. At such a time, there is still air in the surrounding space, thus showing a very great thermal resistance. Attention must be paid to this point when the module is used. Otherwise, module overheating protection will be caused.

XI. EMC

The equipment or system can work normally in its electromagnetic environment, and does not cause any electromagnetic disturbance unbearable to any objects in the said environment. In other words, the power supply which we use can work normally in an environment of electromagnetic interference and does not affect the normal working of other equipment or systems.

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Because the power supply module is a very strong source of interference and the high power switch transistor of the internal circuit of the power supply has a conduction and cutoff switch frequency as high as hundreds of KHZ and contain very rich harmonic wave components, certain measures must be adopted to suppress its electromagnetic interference. Some of our company's products are made in accordance with the EMC requirements and have also passed the relevant EMC tests. If users have EMC requirements, they should give priority to such products.

Due to dimensional restrictions, the input stage of the power supply module only has fairly simple filtering circuits to meet customers' general use. If users have EMC requirements and need to pass the relevant EMC tests, they then need to adopt some reinforced EMC measures.

The EMC of switching Power Supply modules includes 2 aspects: conduction and radiation.

1. Conduction

For the switching Power Supply, it is the electromagnetic conduction disturbance from the input end of the power supply.

The spectrum of conduction disturbances as stipulated in the CISPR22 Standard is 150K-30MHz, divided into A and B class limiting values. The EU standard is EN55022. China's national standard is equivalent to and adopts the international standard, known as GB9254. GJB151A is the EMC standard among the national military standards. The standard has many classifications. The one involving sub-items at the power supply end is normally CE102. Its frequency band is 10K-10MHz.

Users may adopt the measures as shown in Fig.18:

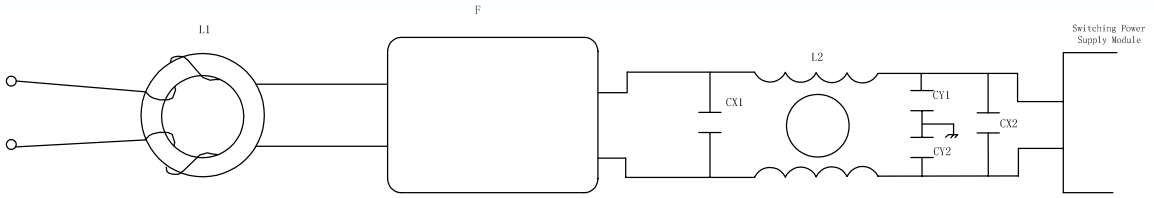

Fig.18

L1: EMI magnetic ring. Winding conducting wire round the ring several loops, this magnetic ring can convert high frequency components into the form of heat.

F: Filter. Adopt 2-segment, high insertion loss products.

Cx1-2: X capacitor. Control differential mode interference.

Cy1-2: Y capacitor. Control common mode interference.

L2: Common mode inductance. Control common mode interference.

Once well-arranged and properly grounded, the L and C devices above can effectively control conduction disturbances.

2. Radiation

Electromagnetic disturbance radiated into the air by the switching Power Supply itself or through conducting wires connected with it.

The radiation frequency band stipulated in CISPR22 and EN55022 is 30M-1000MHz. This is equivalently adopted in China's national standard GB925. The national military standard GJB151A has many radiation classifications. The maximum upper limit for some items is 40GHz.

Because the switching Power Supply is a radiation disturbance source with very rich harmonic waves, sound shielding measures must be adopted. But, conduction and radiation will interact and conduction will produce radiation. The output line and control line connected with the switching Power Supply will play the role of radiation antenna.

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Therefore, sound shielding measures plus the connecting wires of all the terminals can perform filtering and effectively control radiation disturbances.

To pass the radiation requirements of the various EMC standards, users are recommended to adopt shielding and filtering measures. Because the power supply module is a metal hexahedron, proper grounding of its Enclosure can well serve the purpose. But, the output end needs to be treated, plus the LC filtering network, as shown in Fig.19.

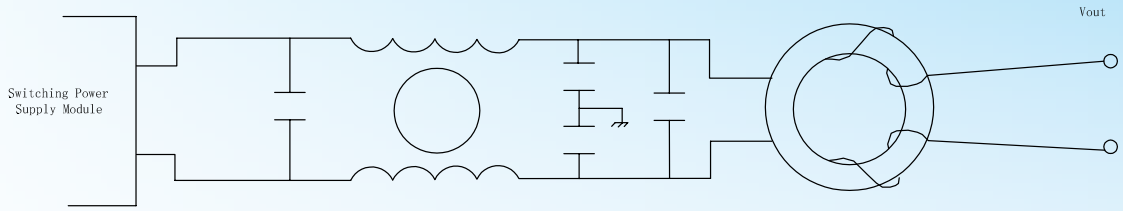

Fig.19

It has common aspects with the circuit at the input end in Fig.17. But, they act on different spectrum. To reduce the radiation caused by conduction, the device adopted should be close to the output port of the module power supply as much as possible. Cy capacitor's pins should be as short as possible. The Enclosure (shielding layer) of the module power supply needs to be properly grounded.

3. On noise immunity

Devices, equipment or systems need to have the ability not to lower their operating paucity in the face of electromagnetic disturbances.

Here, electromagnetic disturbances are divided into 4 parts: electric, magnetic, static and electromagnetic

The national standard on noise immunity is GB17626.1-12. It adopts the equivalent IEC61000-4 Standard. The noise immunity standard is a standard series and contains many contents. Users can choose based on their use needs.

Some of our company's products have passed IEC61000-4 (idt GB17626) tests. Users with noise immunity requirements may choose such products when placing their orders.

Our company has adopted some circuit structural and technical measures for its general conventional products. Even without any additional measures, users can still pass most noise immunity item tests. But, due to size constraint, users need to adopt reinforced measures for certain items, such as surge, electric impulse clusters and conduction disturbance. It is recommended that customers adopt the measures as shown in Fig.20:

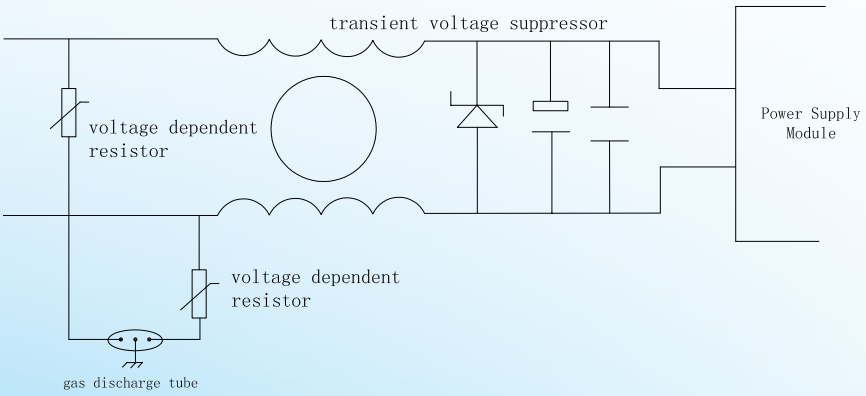

Fig.20

Based on the different voltages, voltage dependent resistors, gas discharge tubes and TVSes used by the customer, TVS action is very fast, reaching the pS level (10^{-12}). But, its discharge current capacity is small. It should be put at the back stage. The through flow of voltage dependent resistor and gas discharge tube can be made very big. But, the speed is very low, only at the uS level (10^{-6}). To let the surge voltage of high energy

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act on voltage dependent resistor and gas discharge tube as much as possible, it is suggested that inductors be put between the voltage dependent resistor and the gas discharge tube and TVS to use inductance to block for some time. The surge voltage of high energy should be discharged from the voltage depen-dent resistor and gas discharge tube as much as possible. Gas discharge tube is a kind of negative resistor device. Once connected, it only has a voltage drop of scores of V. It therefore should be used along with the voltage dependent resistor. The retardant inductance between Level 2 can also be used as the inductance at the EMC input stage.

The action voltage of all voltage dependent devices and components is calculated using the following formula:

$Vz \geqslant Vin\ (1+20\%)1.4$

Example: Vin=220Vac input loop, Vz ⩾ 370V. Higher values may be taken for regions where AC voltage fluctuations are rather strong.

XII. On inductive load and pickup current

If the user adopts the power supply module to drive inductive load such as electric motor and electromagnetic valve, attention should be paid to the induced electromotive force generated by the inductive load. Inductive load can produce induced electro-motive force and causes misoperations with the power supply module. One diode can be added at the output stage to separate induced electromotive force, as shown in Fig.21:

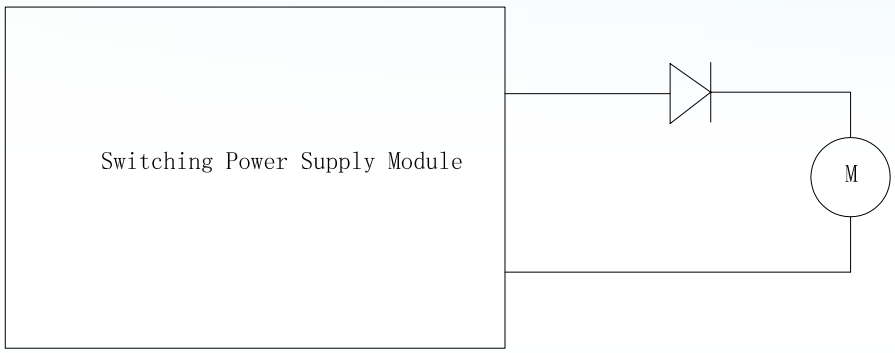

Fig.21

If the power supply module is used to drive electric motor, users should pay attention to the motor's pickup current in addition to the induced electromotive force. Generally speaking, electric motor's pickup current is 6-8 times the rated normal working current. The power supply modules of our company have reliable and sensitive protection circuit and may not start due to over current protection. Power supply capacity should be properly increased and specifications be made at the time of placing orders.

XIII. On reliability

The reliability indicator is expressed as MTBF. Our products have an MTBF of 20x104h. Aluminum base products have an MTBF of 100x104h.

There are 2 methods to calculate MTBF. One is to calculate using large amounts of statistical data over long periods of time. The second is to follow the method as stipulated in MIL-HDBK-217F2 and the national military standard GJB299, namely MTBF=1/λ. The calculation method is very tedious. The most critical step is to find the value of λ. The λ value is related to the following items:

1. Environmental temperature
2. Operating environment
3. Number of devices
4. Grade of devices
5. Redundancy of derating

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Among them, Items 1 and 2 are related to the use by customers, while Items 3-5 are controlled by the manufacturer. When calculating the MTBF of our company's products, the environmental temperature is taken as 25℃ , while the use environment is "General ground environment". If the customer uses the product in a too high environmental temperature and a too harsh working environment, the λ value will be directly affected, thus lowering the value of MTBF. To ensure to meet the MBTF requirements, our company has followed GJB / Z35 in its product design and adopted the redundancy and derating methods. High-class devices are procured. In accordance with GJB128A and GJB548A, aging and screening are made. Circuit structure is made as concise as possible. Under the precondition of ensuring functions, the number of devices and components is reduced as much as possible to improve MTBF.

To sum up, MTBF will vary as customers adopt different use methods and different environmental temperatures. Currently, our company adopts the method as stipulated in MIL-HDBK-217F2 and GJB299. This is also the general-purpose calculation method adopted by manufacturers both at home and abroad.

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- 军工产品在设计上依据 GJB/Z35 采用冗余、降额设计方法
- 对全部所需元器件按照 GJB548A、GJB128A 和 GJB360A 进行高温功率老化筛选
- 提供 -70℃～150℃ 试验环境，可完成高低温测试、存储、恒温恒湿、恒温变湿和冲击振动等试验

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诚征代理

本公司承诺严格按照（GJB9001A-2001）国军标质量管理体系的要求，为军队及普通客户专门设计、生产特殊要求与规格的电源产品。

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