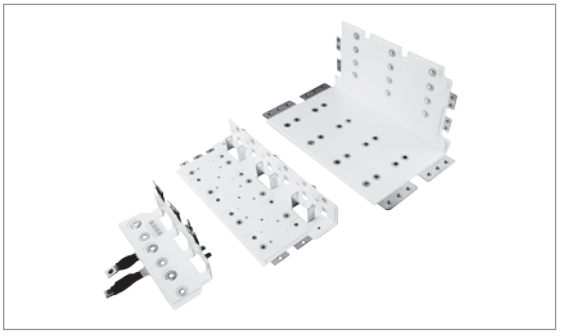
叠层母线
Laminated Busbar

层叠母线产品UL号:E353414
Laminated Busbar Product UL Number: E353414

产品简述 (Product Profile)

叠层母线用于实现电力电子产品中功率器件的连接，通过正负极层叠平行分布的结构形式降低线路分布电感，从而降低功率元件关断时的浪涌电压，降低功率元器件的耐压要求，提高功率器件运行的可靠性和稳定性，同时提高电路的集成度，便于维修维护。



Laminated Busbar is applied to implementing the connection of power devices in electric and electronic products. Through the parallel and laminated structure of the positive and negative electrodes, the inductance distributed among the circuit is reduced, which helps reduce the peak reverse voltage of both ends of the power elements and lower the requirements of voltage protection and circuit absorbing. This structure is aimed at improving the reliability and stability of power devices and the circuit integration for easier repair and maintenance.

用户可以自行设计产品，通过向我们提供图纸进行订做，用户也可以向我们提供实际应用环境的资料由我们帮助客户设计产品。
Laminated Busbar could be customized or specified according to your design or drawings. It also could be designed and developed by EAGTOP according to your application and requirements.

产品特点 (Product Features)

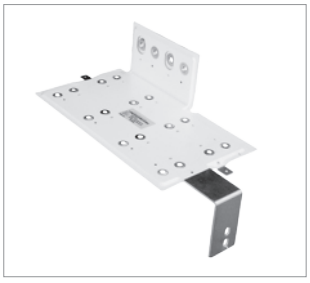
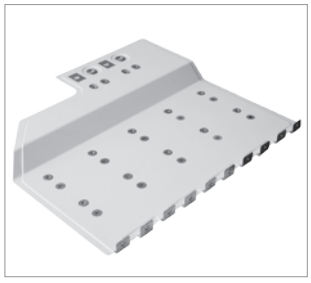
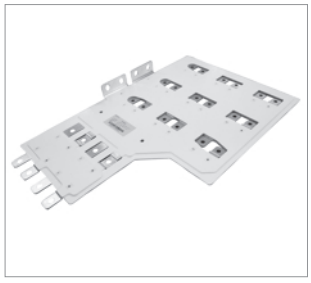
1. 低电感系数	Low inductance
2. 结构紧凑，有效利用空间且能控制系统温度	Compact structure,space-saving and able to control system temperature
3. 最小的阻抗、压降	Minimal impedance and voltage drop
4. 过载能力强	High overload capacity
5. 减少电压尖峰对元器件的损害，延长（提高）电子元件的使用寿命	Able to reduce the harm caused by peak voltage to components and extend the service life of electronic components
6. 降低系统噪音和电磁干扰/射频干扰	Able to reduce noise and EMI/RFI radiation
7. 方便安装和现场维护	Easy for installation and on-site maintenance
8. 减少部件数量，增加了系统的可靠性	Fewer components for better system reliability
9. 均匀分布的电容	Proportionally distributed capacitance
10. 简洁、美观	Simplicity and beauty in appearance

产品参数 (Product parameters)

项目 Item	说明 Description
工作电压 Operating voltage range	0~20kV
额定电流 Rated current range	0~3600A
产品结构 Product structure	热压封边、热压不封边、热压灌封 Hot pressing edge sealed,hot pressing edge open,hot pressing edge with potting
最大加工尺寸 Max size	1600×800mm
阻燃等级 Flame rating	UL94 V-0
导体材料 Conductor material	T2 Cu、1060 AL
导体表面处理 Conductor surface treatment	钝化、镀锡、镀镍、镀银 Passivation, tin plating,nickel plating or silver plating
与器件连接方式 Connection with the device	压凸、铜柱铆接、铜柱焊接 Embossing, riveted bronze columns ， welded copper columns
绝缘电阻 Insulation resistance	20MΩ～∞
局部放电 Partial discharge	<10PC
温升 Temperature rise	0～40K

检测和验证能力 (Testing and Validation Capabilities)

项目 Item	测试能力 Testing capabilities	测试设备 Test equipment	参考标准 Reference standards	测试类型 Test type		
				出厂测试 Routine test	型式试验 Type test	可靠性测试 Reliability test
外观 Appearance	有 Equipped	无 No	/	*		
产品尺寸 Product size	有 Equipped	2.5D光学测量仪 2.5D Optical Measuring Instrument	/	*	*	
绝缘电阻 Insulation resistance	有 Equipped	绝缘耐压测试仪 Insulation Tester	GB/T 24343-2009 6	*	*	
绝缘耐压 Dielectric strength	有 Equipped	绝缘耐压测试仪 Insulation Tester	GB/T 24344-2009 5.4	*	*	
局部放电 Partial discharge	有 Equipped	局放测试仪 Partial Discharge Tester	GB/T 16935.1-2008	*	*	
温升试验 Temperature rise test	有 Equipped	可编程变频器 Programmable Inverter	/		*	
分布电感测试 Stray inductance	有 Equipped	电感测试系统 Inductance Test System	/		*	
分布电容测试 Distributed capacitance test	有 Equipped	数字电桥 Digital Bridge	/		*	
推出力测试 Release force test	有 Equipped	电子万能试验机 Electronic Universal Testing Machine	/		*	
扭力测试 Torque test	有 Equipped	扭力扳手 Torque Wrench	/		*	
燃烧试验 Burning test	委外 Outsourcing	/	UL 94		*	*
低温试验 Low temperature test	有 Equipped	恒温恒湿试验箱 Temperature and Humidity Chamber	GB2423.01 2001			*
高温试验 High temperature test	有 Equipped	恒温恒湿试验箱 Temperature and Humidity Chamber	GB2423.02 2001			*
湿热试验 Humidity heat test	有 Equipped	恒温恒湿试验箱 Temperature and Humidity Chamber	GB2423.3 2006			*
高低温循环试验 Temperature cycling test	有 Equipped	恒温恒湿试验箱 Temperature and Humidity Chamber	GB2423			*
盐雾试验 Salt spray test	有 Equipped	盐雾试验箱 Salt Spray Test Chamber	GB2423.18-2000			*
剥离强度测试 Peel strength test	委外 Outsourcing	/	GB/T 2790-1995			*


绝缘材料的选择 (Selection of Insulation Materials)

叠层母线的电感非常低，而这一点须由良好的绝缘材料来保证，要满足一系列电绝缘和环境要求，用户可以根据实际应用环境进行最优选择。

Low stray inductance of Busbar could be achieved by excellent insulation materials. In order to meet all the insulating or environmental requirements, customers could make optimal choices from the materials below according to the actual application environments.

性能 Property / 材料 Material	密度 Density (g/cm)	热膨胀系数 Thermal expansion coefficient	热导率 Thermal conductivity W/(kg.K)	介电常数 Permittivity (f=60Hz)	介电强度 Dielectric strength (kV/mm)	阻燃等级 Flammability Rating	绝缘耐热等级 Continuous use temperature	吸水性 Water absorption (%)/24h
NOMEX	0.8~1.1		0.143	1.6	9	94 V-0	220	
聚酰亚胺 PI	1.42	20	0.094	3.5	9	94 V-0	220	0.24
聚氟乙烯 PVF	1.38	53	0.126	10.4	19.7	94 V-0	105	0
聚脂薄膜 PET	1.38~1.41	60	0.128	3.3	25.6	94 V-0	120	0.1~0.2

绝缘材料的特点 (Insulation Material Characteristics)

NOMEX

优良的耐火、耐热性，良好的耐化学腐蚀性，机械性能好，耐辐射阻燃

Flame resistance;
Thermal resistance;
Strong corrosion protection
Good mechanical properties
Radiation resistance

聚氟乙烯PVF

优良的电气性能，化学性质稳定，极低的吸湿性，阻燃

Excellent electrical and chemical performance.
Low water absorption;
Flame resistance.

聚脂薄膜PET

良好的电性能，耐化学腐蚀，低吸湿性，价格低廉

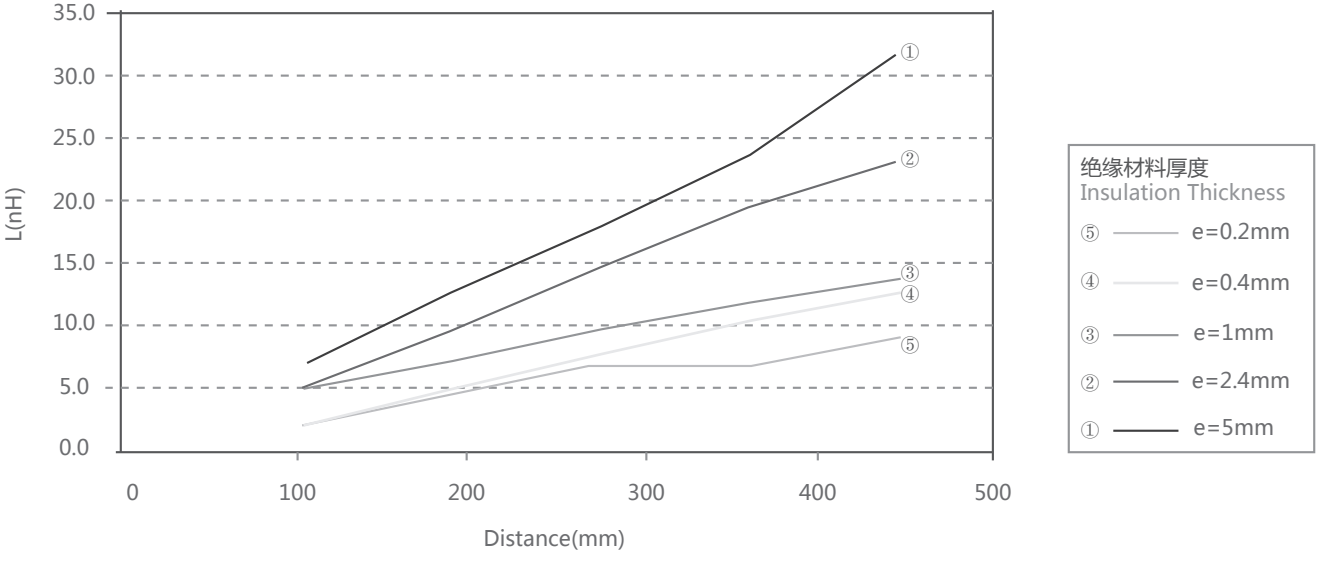
Good electrical performance;
Corrosion protecion;
Low water absorption;
Low price

聚酰亚胺PI

优良的耐热性，良好的电性能，耐辐射，阻燃

High temperature proof; excellent electrical performance; Radiation resistance; Flame resistance

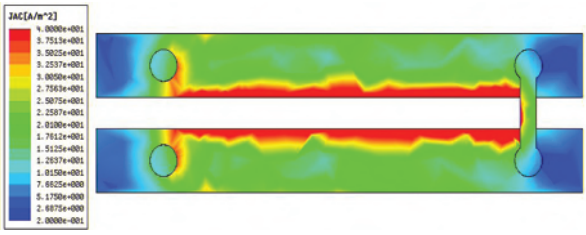
母线的电感与母线层间绝缘材料厚度的关系
(Relationship Between Busbar Stray Inductance and Insulation Thickness)



市场与应用 (Markets&Applications)

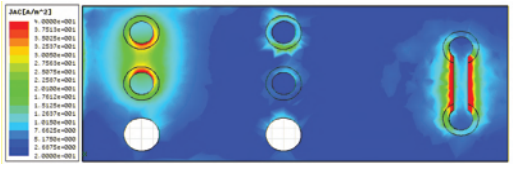
电力电子 Power electronics	工业变频器、逆变（变流）器、风力发电、 UPS系统、高密度配电箱、电焊机、测试设备 大型服务器、医疗器械	Motor drives,inverters, wind power generation, UPS systems, high density power distribution cabinets, electric welding machines, test Equipment
交通运输 Transportation	电力机车、轨道交通、电动汽车、电驱动船舶	Electric locomotives, railway transportation, electric vehicles, electric drive vessels
航空航天 Aerospace	客机、卫星系统、航天飞机、导弹系统	Airliners, satellite systems, space shuttle, missile systems
军事 Military	潜艇、通讯系统、装甲车辆、雷达系统	Submarines, communication systems, armored vehicles, radar systems
通信 Communication	IT服务器、超级计算机	IT server, super computer

叠层母线仿真图 (Laminated Busbar Simulation)



平行铜排的
表面电流分布
Ls=73.4nH

Traditional copper bar
current distribution
Ls=73.4nH



层叠铜排的
表面电流分布
Ls=10.6nH

Bus Bar
current distribution
Ls=10.6nH

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母线与电器元件连接方式 (Busbar and Electrical Components Connection Mode)

连接方式 Connection		优点 Advantage	缺点 Disadvantage	成本对比 Cost
压凸 Embossing		性能好，可靠性高 Good performance, high reliability	有工艺局限性 Technological limitations	低 Low
黄铜柱铆接 Riveted bronze columns		工艺范围宽,可满足各种设计要求 Easy to make and able to meet all kinds of design requirements	机械性能一般，不适用于恶劣工况 Moderate mechanical performance,not suitable for harsh working conditions	适中 Moderate
紫铜柱锡钎焊 Tin-brazed copper columns		机械性能优于铜柱铆接，适用范围广 Good mechanical performance, wide application range	/	高 High
紫铜柱银钎焊 Silver-brazed copper columns		相比于锡焊,电阻更低，耐温更高 Compared with tin-brazing, lower resistance and higher temperature resistance	成本高 High cost	最高 Higher

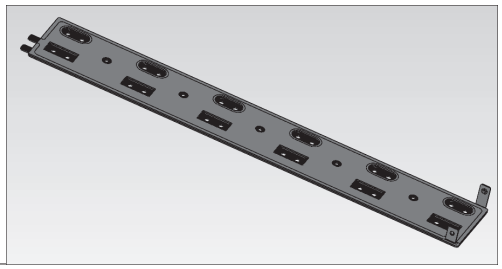
母线端子连接应力的处理方案 (Treatment Scheme of Busbar Terminal Connection Stress)

方案 Solution	特点 Advantage	缺点 Disadvantage	成本对比 Cost
结构槽适放应力 The slot	方便加工，缓冲效果一般 Easy to make,moderate cushioning effect	电气性能降低 Lower electric performance	低 Low
端子局部热处理软化 Local terminal heat treatment	方便加工，缓冲效果良好 Easy to make, good cushioning performance	接触面积较大时，接触电阻增大，电气性能降低 If contact area is large, contact resistance increases and electrical performance decreases	适中 Moderate
编织带连接 Copper woven belt connection	缓冲效果良好，补偿装配偏差 Good cushioning performance,the assembly deviation compensated	端子较长，杂散电感增大 The terminal is longer and the stray inductance increases	高 High
铜泊软连接 Soft joining with copper foil	缓冲效果良好，单个方向补偿装配偏差 Good cushioning performance,the assembly unidirectional deviation compensated	端子较长，杂散电感增大；成本高 The terminal is longer and the stray inductance increases	最高 Higher

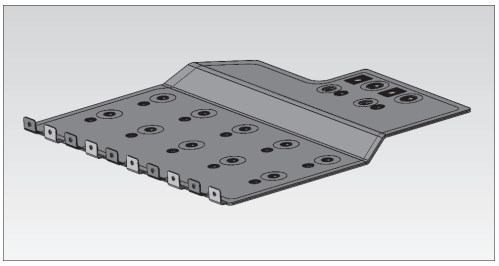



应用方案介绍 (Markets&Applications)

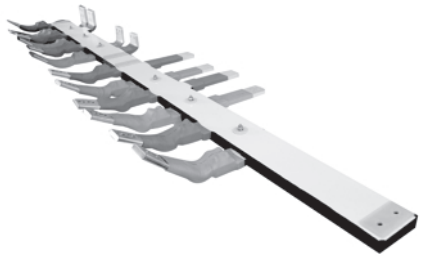
尺　寸; Dimension	1107x176(mm)
导体层数; The conductor layers	2
电　压; Rated voltage	1300VDC
电　流; Rated current	670A
最小密度; The minimum current density	2.1A/mm~2
应用领域; Application fields	风力发电 Wind Power
封装形式; Packaging forms	热压封边 Hot pressing edge-sealed
产品特点; Product features	端子局部大电流；拉伸凸台有效降低成本 Local high current of terminals and low cost due to embossing



尺　寸; Dimension	450x418(mm)
导体层数; The conductor layers	2
电　压; Rated voltage	1000VDC
电　流; Rated current	600A
最小密度; The minimum current density	2.6A/mm~2
应用领域; Application fields	光伏发电 Photovoltaic power generation
封装形式; Packaging forms	热压封边 Hot pressing edge-sealed
产品特点; Product features	器件不同的安装面，空间利用率高，Z形结构一次压合 Different installation surfaces for components; high space utilization rate; one-time lamination of Z-shape



尺　寸; Dimension	2400x240(mm)
导体层数; The conductor layers	2
电　压; Rated voltage	1200VDC
电　流; Rated current	2500A
最小密度; The minimum current density	1.67A/mm~2
应用领域; Application fields	船舶 Ship
封装形式; Packaging forms	热压环氧灌封 Hot pressing edge-sealed
产品特点; Product features	产品超长超厚；软连接设计消除振动应力；热压、灌封、螺丝三重机械加固 Super long&thick;the soft connection design to eliminate vibration stress;triple mechanical reinforcement through hot pressing,edge with potting and screws



尺　寸; Dimension	620x510(mm)
导体层数; The conductor layers	2
电　压; Rated voltage	1000VDC
电　流; Rated current	600A
最小密度; The minimum current density	1.6A/mm~2
应用领域; Application fields	光伏发电 Photovoltaic power generation
封装形式; Packaging forms	热压封边；电容组件 Hot pressing edge-sealed
产品特点; Product features	母排与电容装配成组件，更高的组件综合性能；更低的综合成本. Busbar and capacitors constitute the components with higher comprehensive performance and lower overall cost.