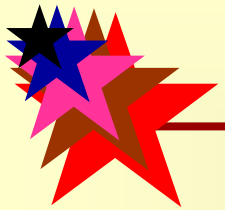

大功率半导体的基本应用

(((专为逆变焊机设计)))

2006.5

DAWIN ELECTRONICS. Co. Ltd.
应用工程师
Y.J KIM

DAWIN Electronics

内容

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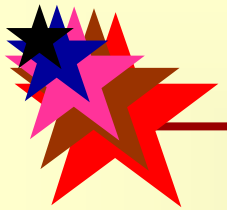


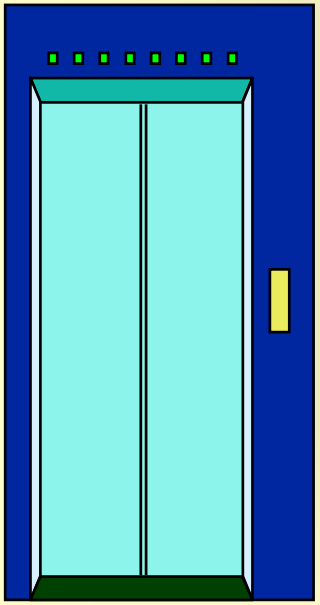
逆变系统的应用

大功率半导体的应用领域

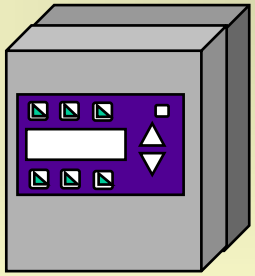
工业应用

模块 & 单管

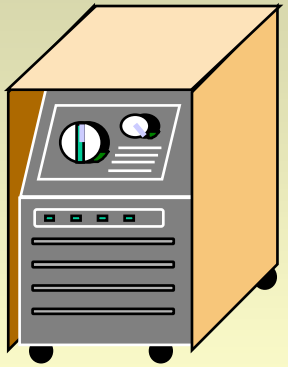
☞电梯



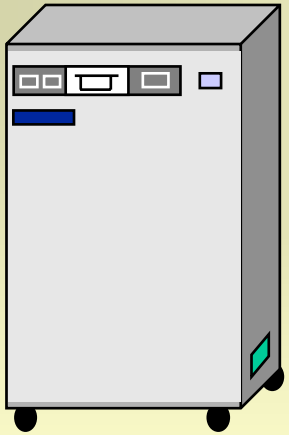
☞自动设备
- 转换器,
交流伺服,
机器人



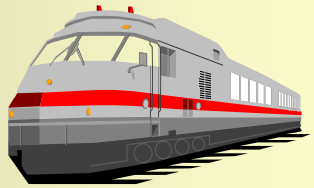
☞电焊机



☞电源- 不间断电源,
开关电源



☞运输
-点火控制,
充电机



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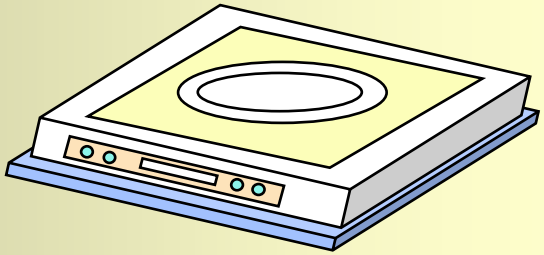
消费类领域

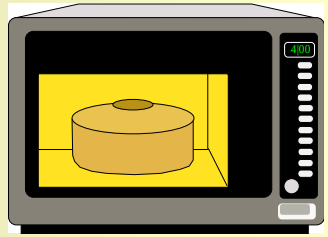
模块& 单管

- 电饭煲

- 电磁炉

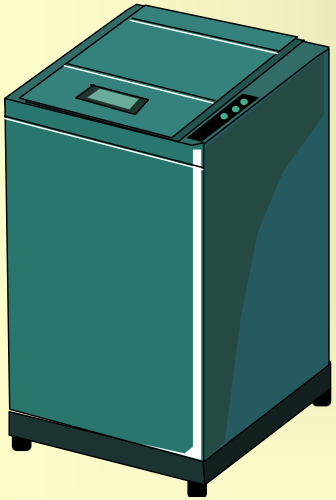


- 微波炉

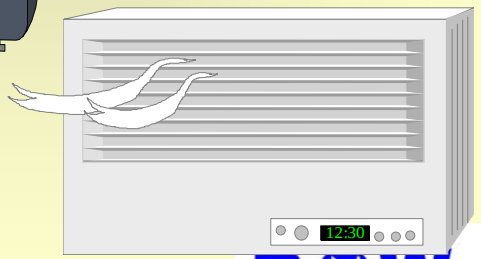


- 照相机

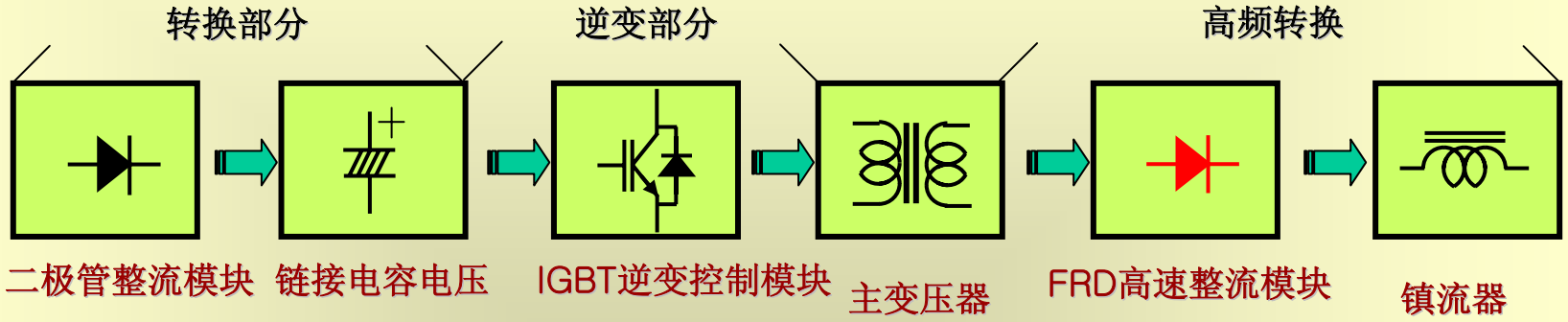
- 洗衣机



- 逆变空调



逆变焊机的基本组成部分

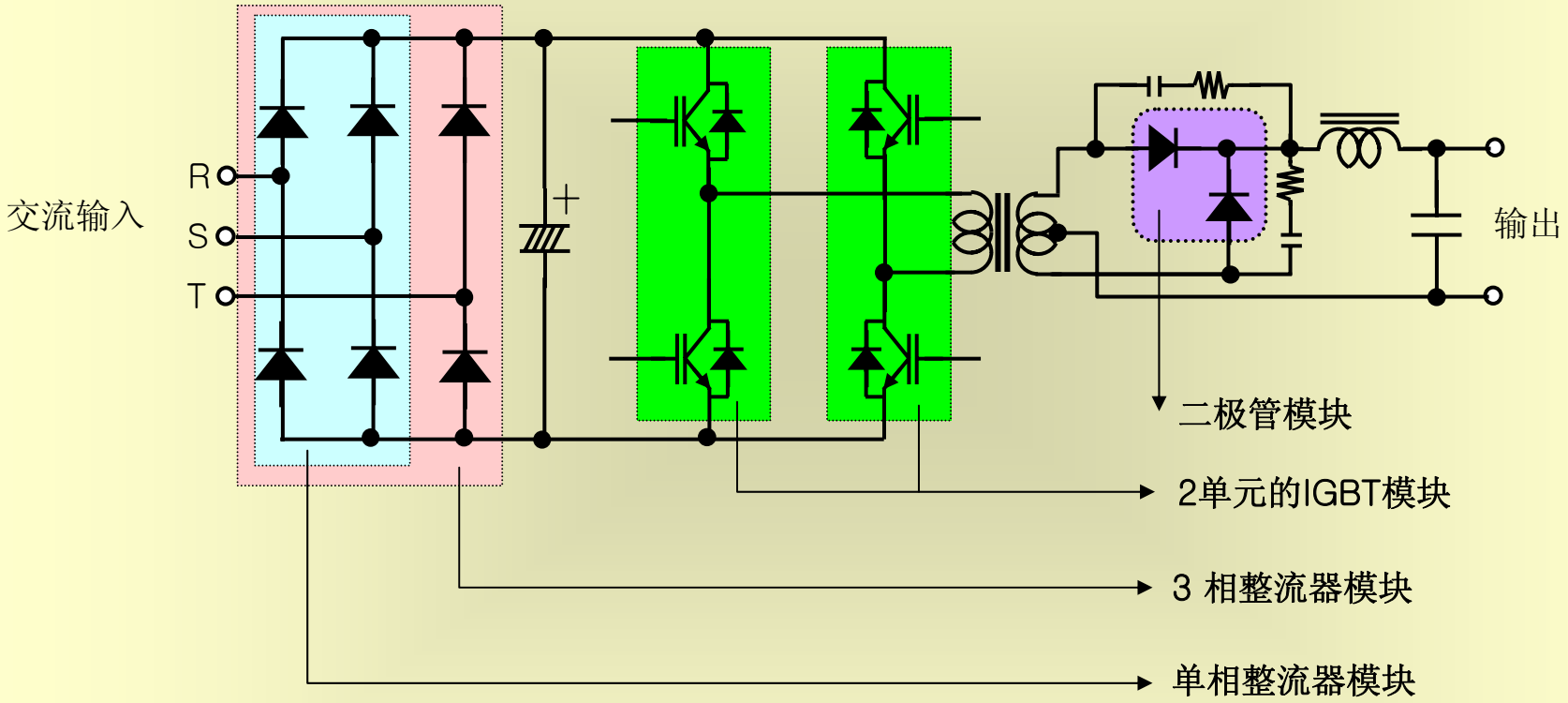


◈ 主要参数

整流	低正向压降, 高脉冲电流,较低的漏电流...
链接电容.	高质量, 使用寿命长...
绝缘栅型晶体管	低饱和电压, Rugged Type, High BVces, 低漏电流, 高速 & 软开关, 安全工作区宽 ... * 解决方案 => 全桥 & 半桥
主变压器	高度电压绝缘， 低噪音...
二极管	软开关, 恢复时间快, 正向压降低, 雪崩耐量高...

逆变焊机拓朴结构种类

用于直流氩弧焊机-全桥拓扑结构



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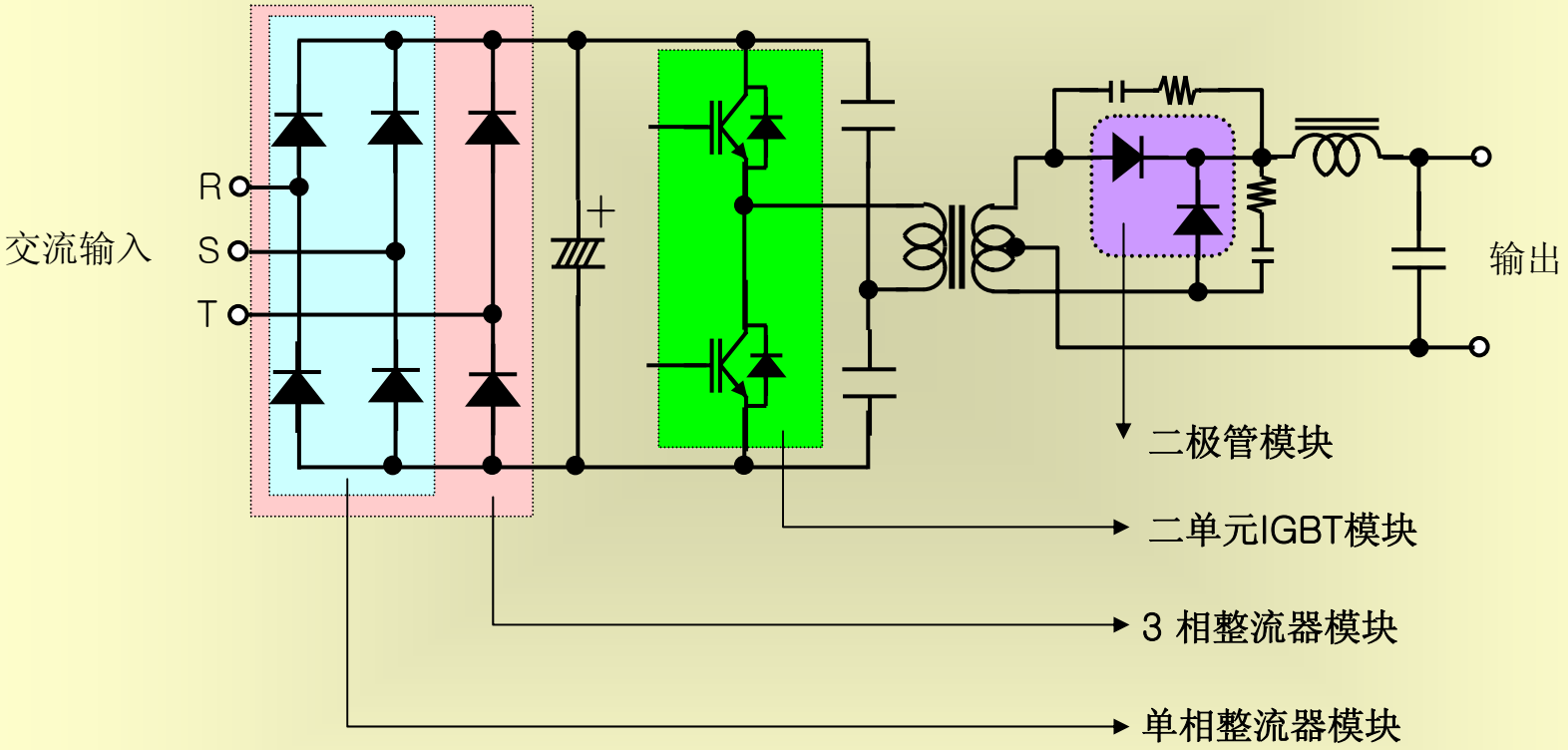
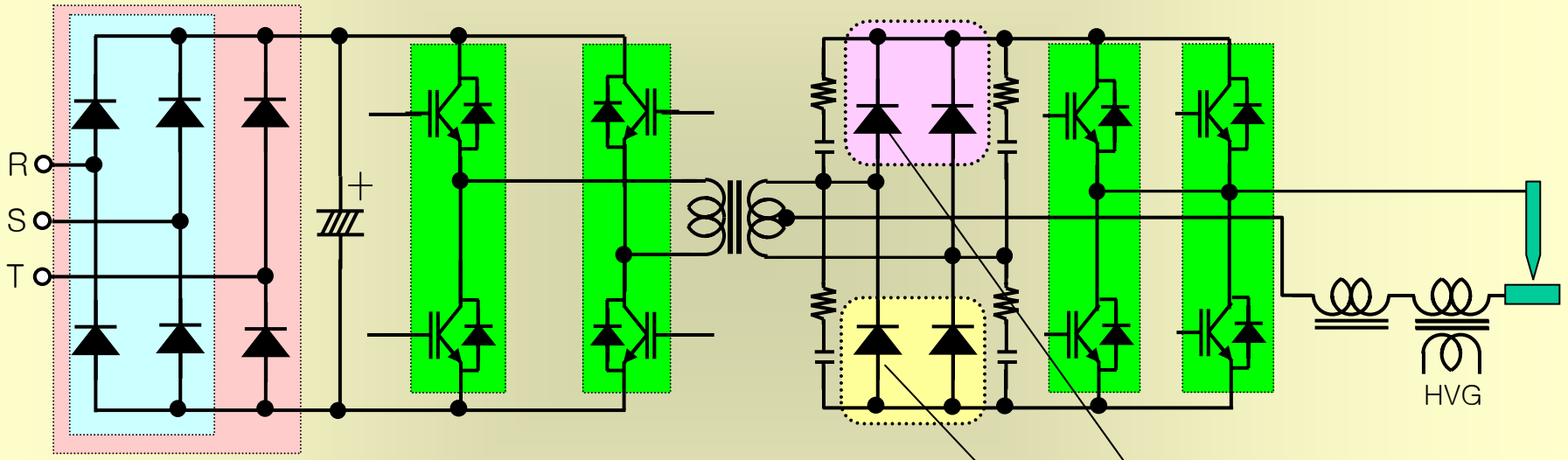
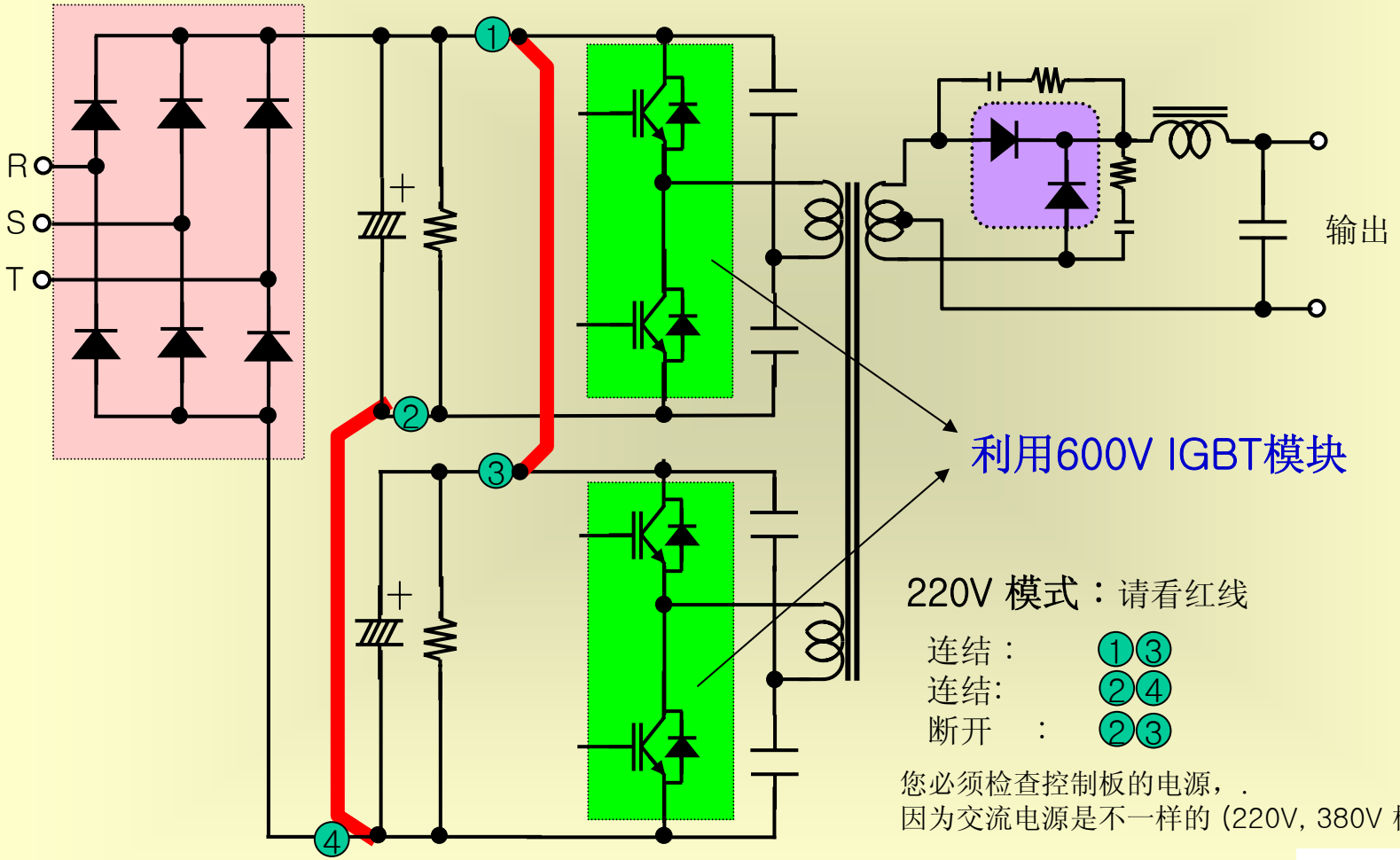
直流氩弧焊机-全桥拓扑结构



用于交流TIG焊机-全桥拓扑结构



焊机电路-220V交流输入



220V 模式：请看红线

连结： 1 3
连结: 2 4
断开 ： 2 3

您必须检查控制板的电源，.
因为交流电源是不一样的 (220V, 380V 模式)

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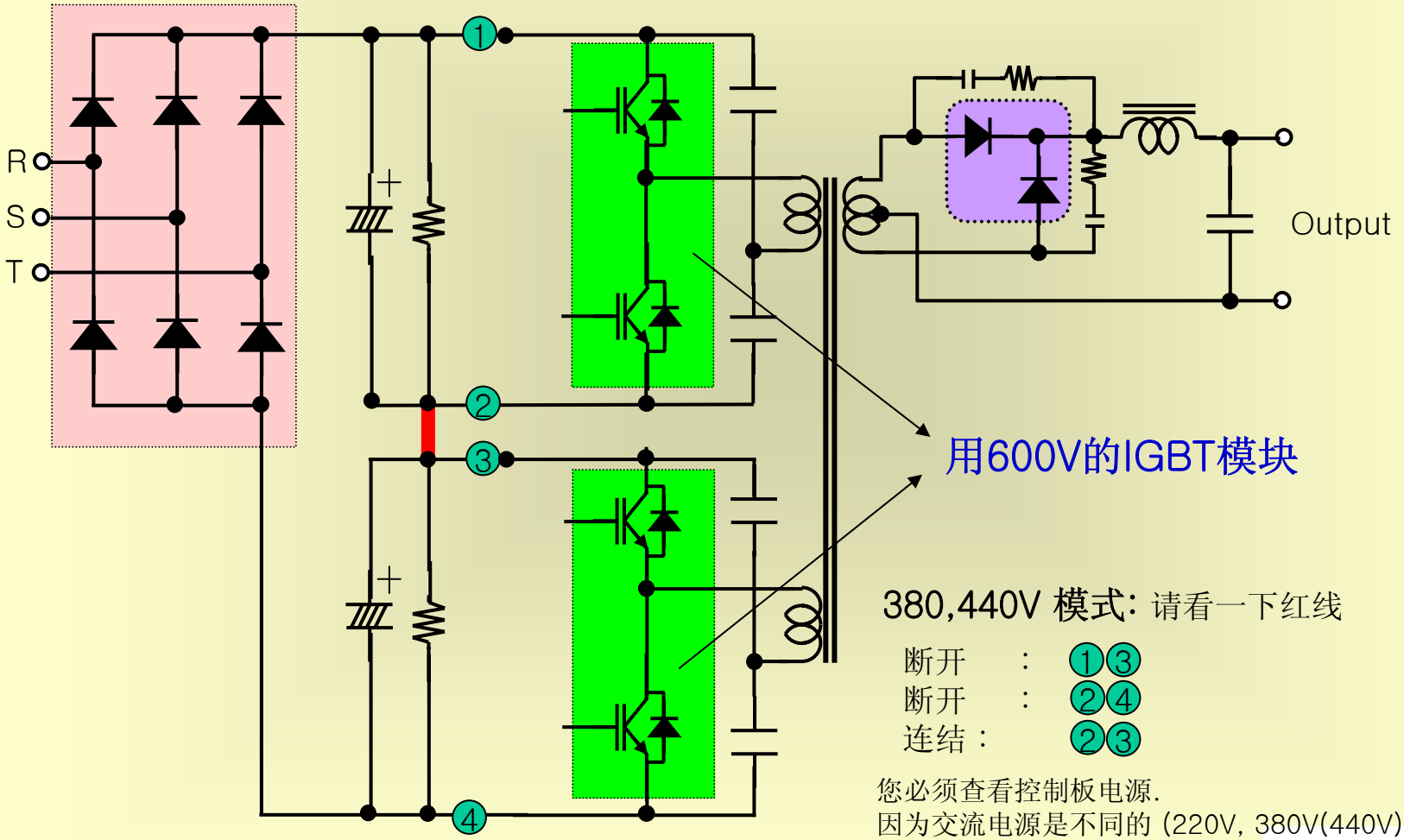
焊机电路- 380V 交流输入



380,440V 模式: 请看一下红线

断开 : 1 3
断开 : 2 4
连结 : 2 3

您必须查看控制板电源.
因为交流电源是不同的 (220V, 380V(440V) 模式))

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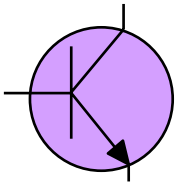
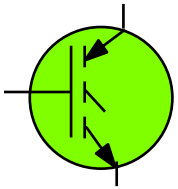
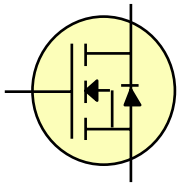
IGBT应用

什么是 IGBT？

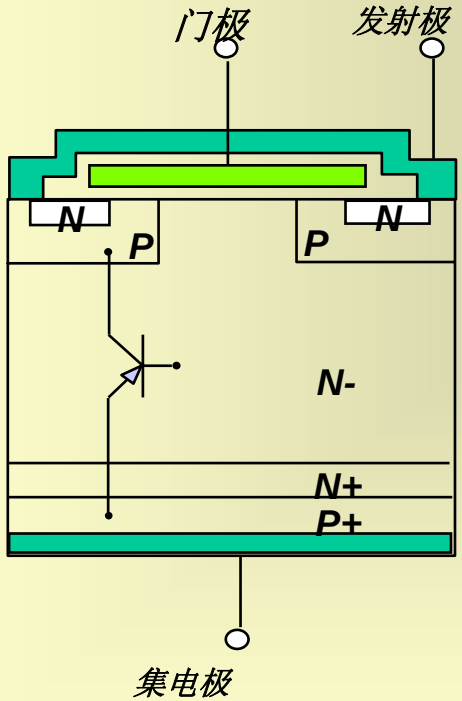
IGBT(绝缘栅型晶体管) 是电压控制的功率管, 其结构与运用和场效应管相似. 双极型晶体管具有良好的性能，是大功率产品上最经济的选择, 可广泛应用于多种频率。

对照表

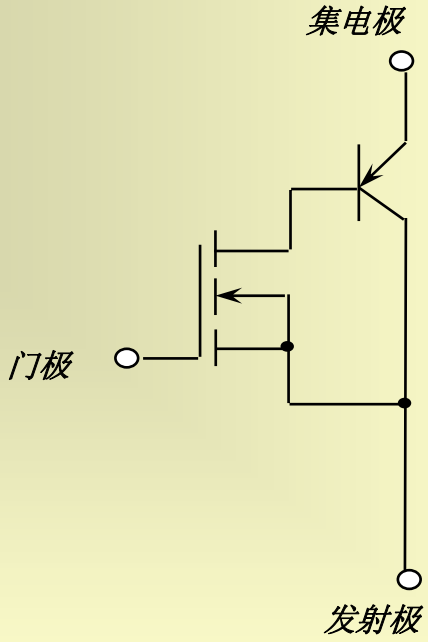
项目	T R	I G B T	MOSFET
SYMBOL			
控制参数	电流	电杖	电压
控制功率	高	低	低
控制电路	复杂	简单	简单
导通电阻	低	低	高
开关速度	慢	中	快
开关损耗	高	中	低

IGBT的结构和应用

IGBT的作用可以简单分割为一个N沟道的场效应管和一个PNP型的双极晶体管。IGBT的功能可以看作通过一个场效应管提供基电流的双极晶体管。



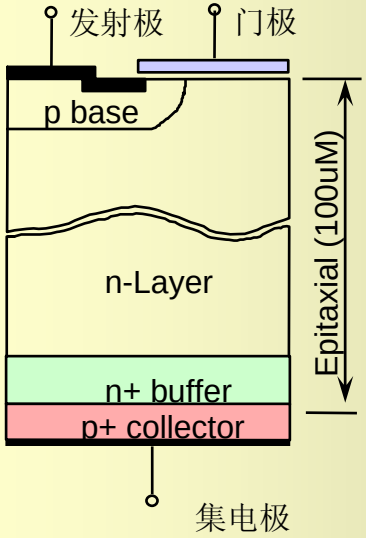
IGBT的结构



等效电路

IGBT的结构

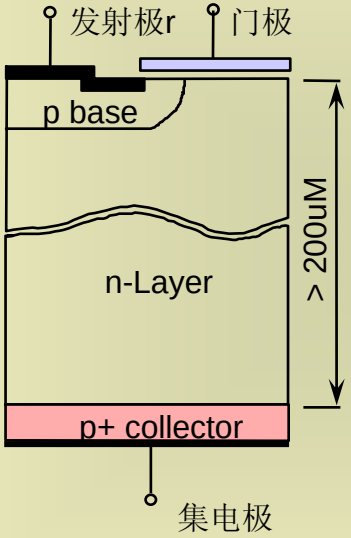
PT
(Punch Through)



. 生产率高
.成本高
.并联效果不好

.安全工作区好

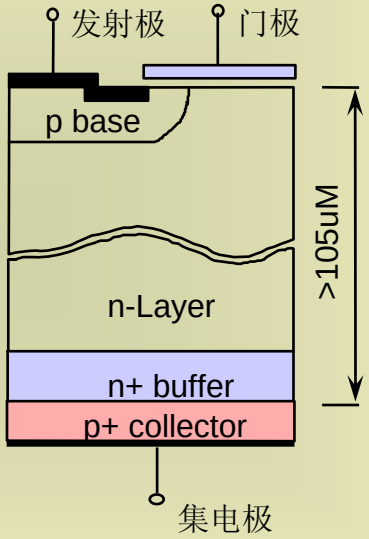
NPT
(Non Punch Through)



.生产率高
.低成本
.易于并联

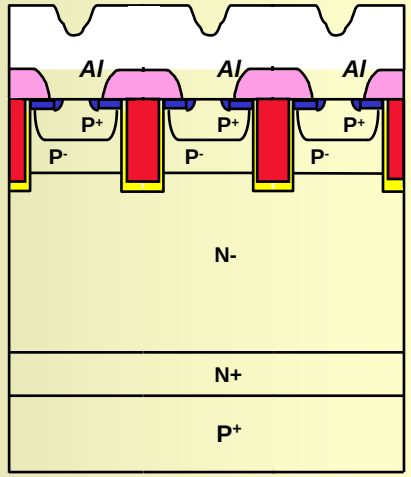
.安全工作区好
.拖尾电流长

SDB
(Silicon Direct Bonding)



.生产率低
.成本高
.No additional Increase
Eoff @ HT
.安全工作区好
. 拖尾电流短

Trench



.生产率一般
.低成本
.难于并联

.安全工作区一般
.拖尾电流长

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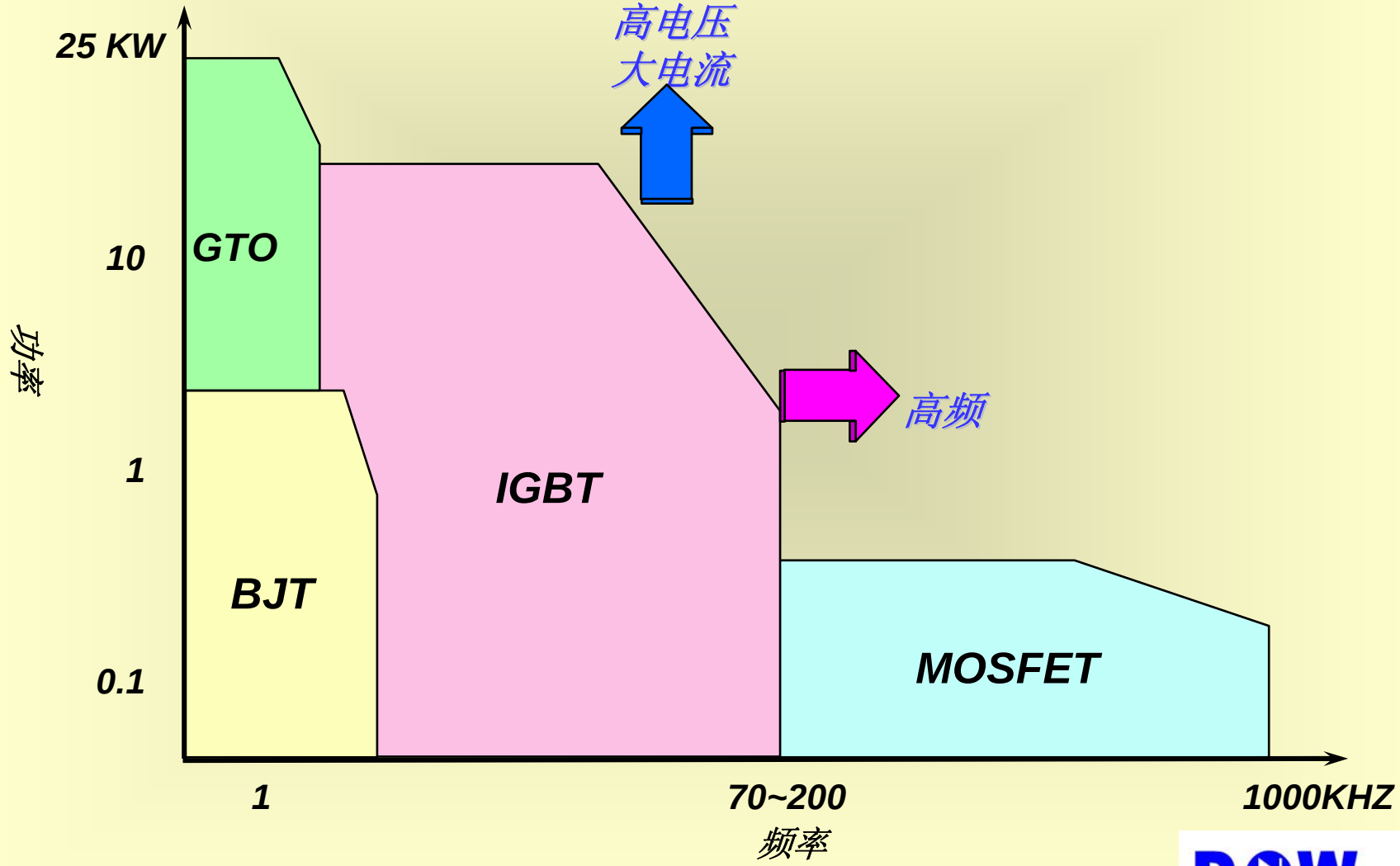
IGBT的应用区域



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IGBT模块的电特性

1) 考虑到绝对等级方面, 我们有必要设计一定的余量.

2) it is Wide RBSOA / SCSOA / FBSOA (Rugged Type)
because it generally uses Half or Full Bridge topology methods.

3) 低饱和压降Low Vce(sat)

4) 拖尾电流短

5) War-page(Flatness)

6) 较低的漏电流

7) 快而软的开关特性

8) 原则上, 600VIGBT用在交流220V的电压上, 1200V 的IGBT 用于交流280V以上.

9) 确认IGBT至少有10us的短路承受时间.

10) 对于IGBT和MOSFET, 为了门级平稳驱动， 一般选用相对小一些的输入电容 ，因为它在门极充电时运行。但是，如果输入电容太低，就会出现太大的噪音

11)在IGBT，发射极和集电极之间，二极管在相反的方向连接，在系统中，二极管是用做*平滑系统*的，必须确保有良好的快恢复特性。

问题：600V/1200V的电压等级是怎么划分的？

答案：

* IGBT的电压等级被分为两个部分，三相交流 220/240V 和 400/440V.
* 举例说明，200V的IGBT用于低电压的不间断电源,1700V 的适用于580V的交流输入电源。而 2200/3300V 主要适用于各种铁路系统.
* 工业上对于 400/600/1000/1200/1500V 的IGBT的需求越来越多。

For example :

IGBT 电压等级 (桥式拓普)

AC 220 => DC (220 *1.414=311V) => AC variation + 设计余量 (311*1.8 = 560V)

AC 380 => DC (400 *1.414=560V) => AC variation + 设计余量 (560*1.8 = 1008V)

IGBT 门级驱动

1) IGBT 在+15V输入信号打开，-15V输入信号关断时，会运行在最佳工作状态.
2）IGBT可以在较小的输入信号下产生大的功率, 所以门级驱动电路必须优化设计，因为存在门级噪音，避免IGBT的上下臂直通显现。并且，安装方法也很重要，它应该尽可能靠近IGBT门极.
3) 当主电源电压是不稳时，此时应关断门极信号.
4) 对于IGBT模块, 需将门极的金属线拉紧.
5) 对于IGBT模块, 在门级的终端用小的 PCB 较好。 并且在安装PCB时需要绝缘. 安装PCB时， IGBT模块中将有200V的的交流电通过, 昂贵的IGBT 模块可能会被烧坏。
建议, IGBT内部的门电压60V为合适， 而标称 为±20V.

6) 导通 & 关断
一般来说， 导通时间应该按照下面设计,而关断时间一般要比导通时间快3倍

Ex) 对于 600V IGBT 模块(20KHZ的开关频率），
电流高达 150A, 打开时间可被设计为700ns~1us.
如果输出超过了 150A, Rg 值应该被设成 1us ~ 1.5us.

7) IGBT门级驱动的PCB 厚度应高于 1.2mm.
8) 死区处理：对于现有的IGBT模块, 死区时间应大于3us.
9) 要注意门极的防静电措施.

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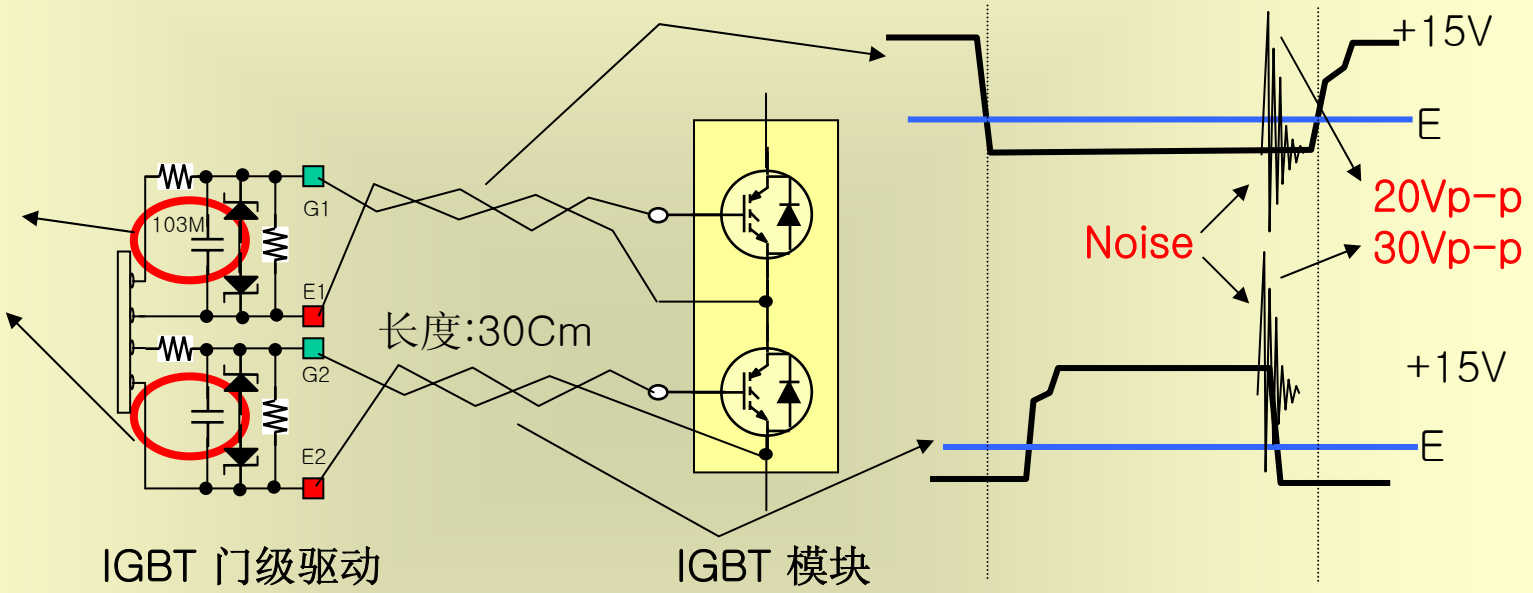
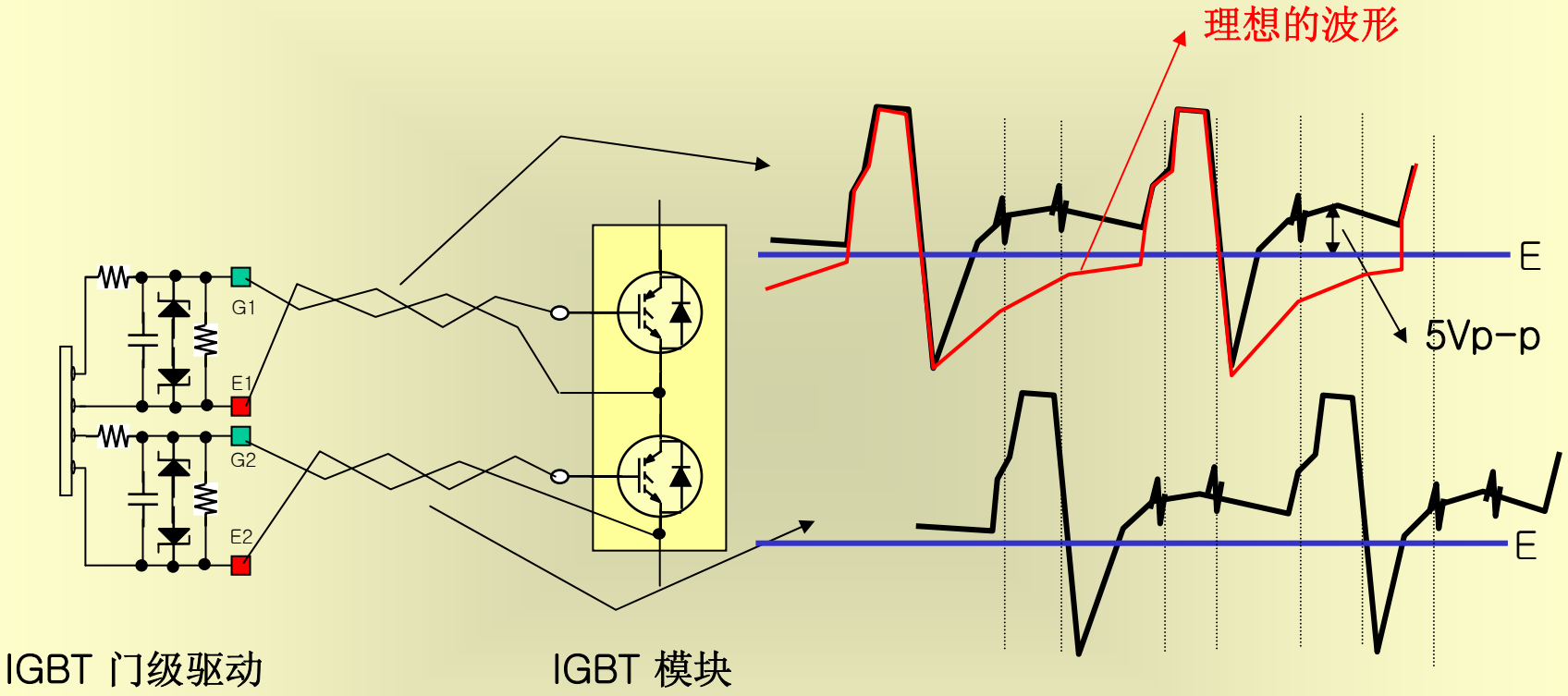
IGBT 门极电路1

推荐
Cap.103



-在上图中，作为IGBT门级驱动的金属线太长. 因为没有加电容, 所以产生了20V的干扰导致直通现象。
-推荐使用103M的电容. 或者缩短金属线来减少干扰.
-运行不要干扰到 Vth.

直通 noise in IGBT 门极电路 2



- 相对于IGBT的发射极，Vge波行会上升5倍Vp-p.
-当有噪音干扰时，IGBT上下臂就会发生直通。

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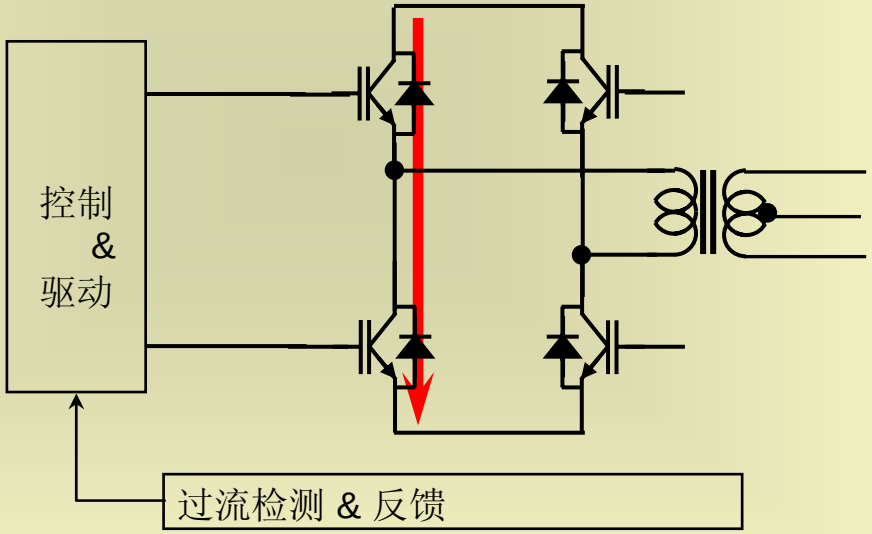
问题: 什么叫做短路承受时间?

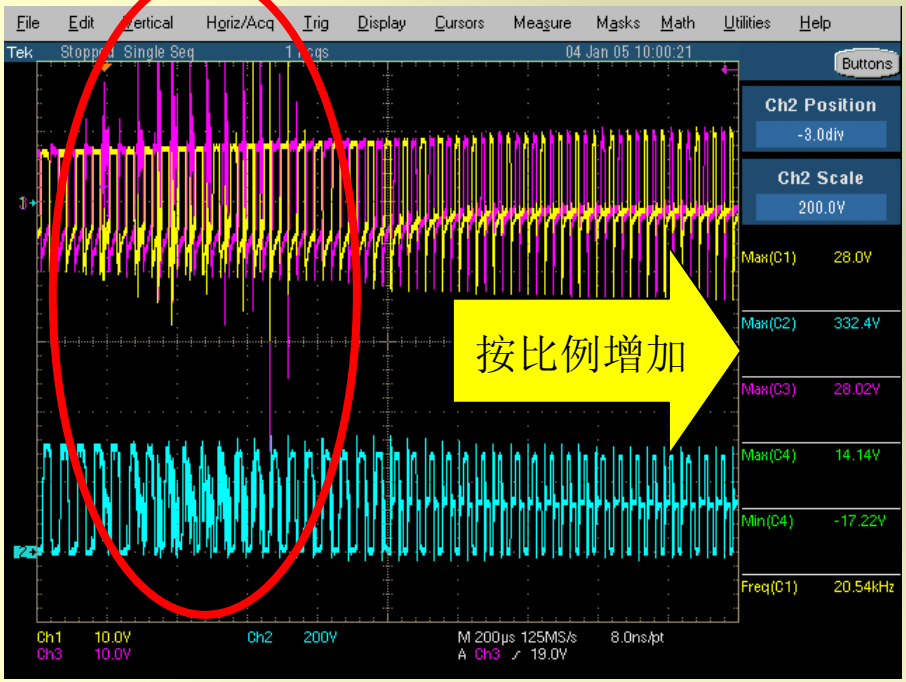
答案：

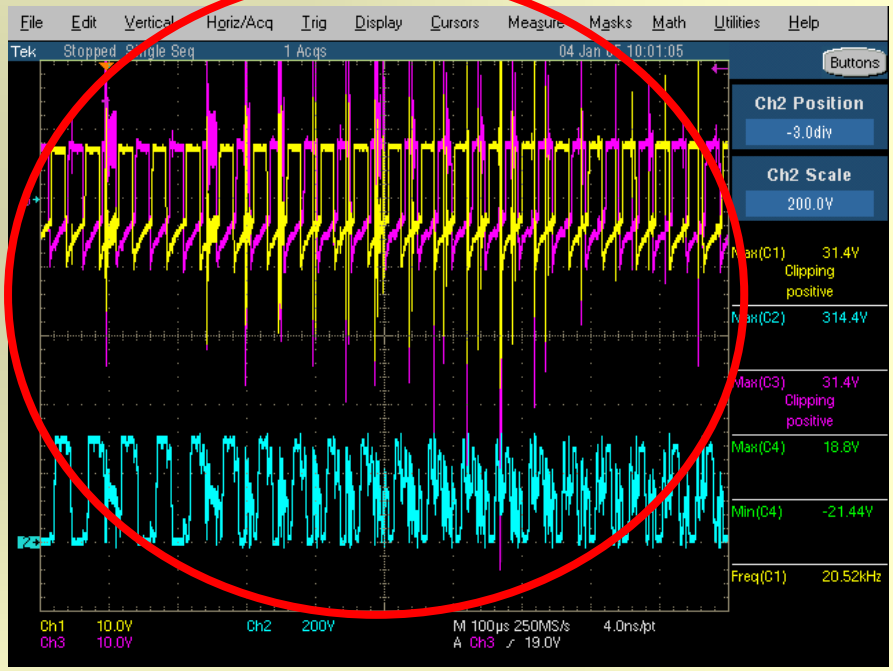
- 因为某些情况的启动或噪音破坏，IGBT必须有过电流保护电路.
  通常情况下，保护电路都有延迟时间(3~7uS),所以IGBT在短时间内能承受短路。
- 通常 IGBT 模块必须有10us的 短路承受时间.



SC --> 检测到反常情况 --> 反馈 --> 门级关断
(Over Vce(sat),DC line current) (软关断)

电焊机中的直通波形





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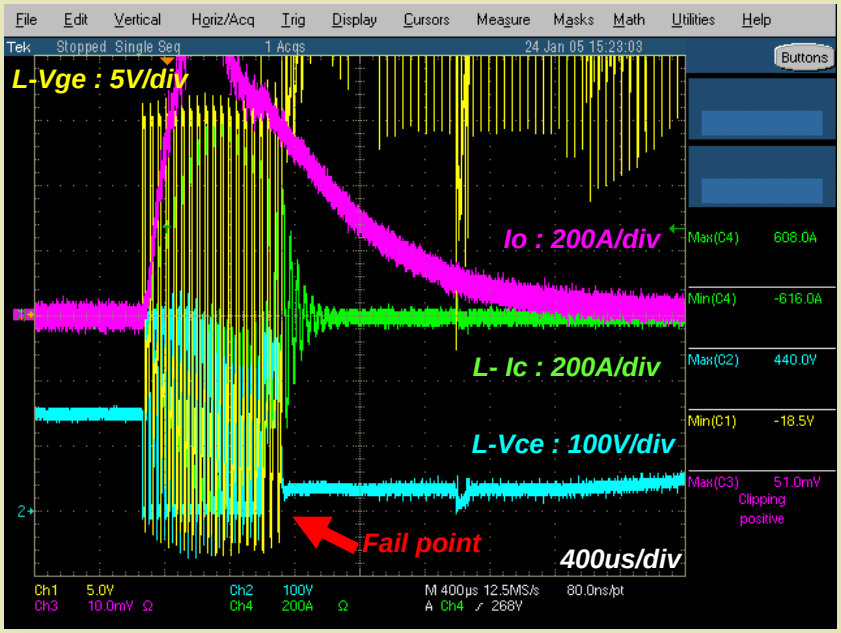
焊机系统中的产品损坏后波形图



最大值-有效负载状态

Ic = +608A / -616A, Io = over 1020Apk

L-Vce(pk) = 440V

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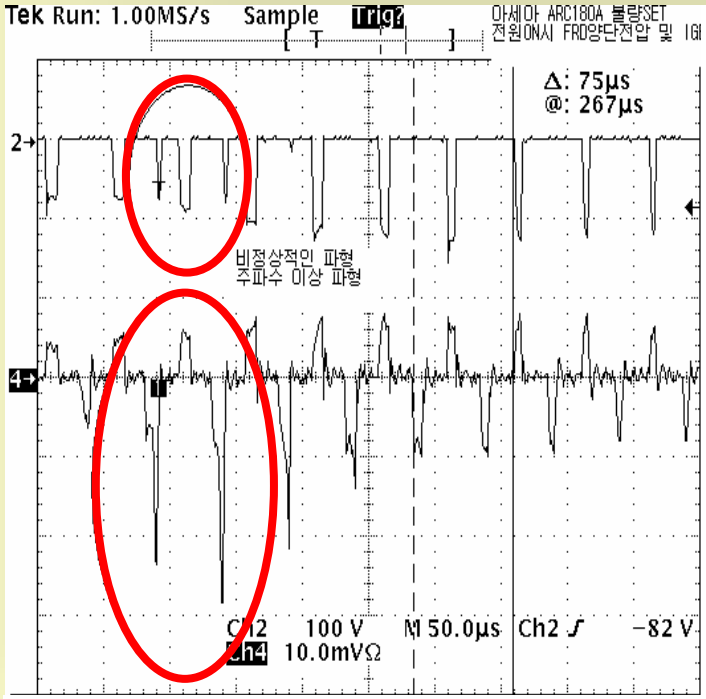
焊机系统中存在的脉宽调制误差

这是脉宽调制的反常波形.
如果以下现象频繁发生， 大功率管则会承受压力,持续不久就会损坏



FRD 波行

电流波形

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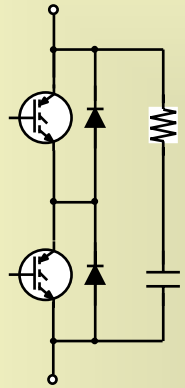
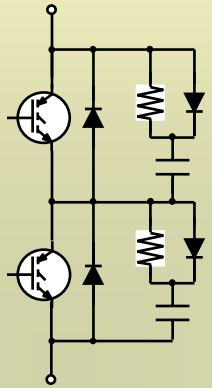
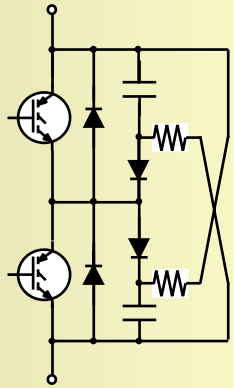
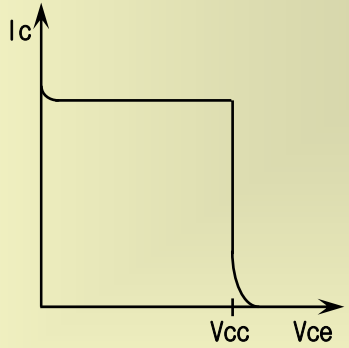
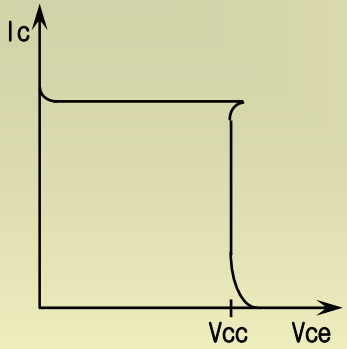
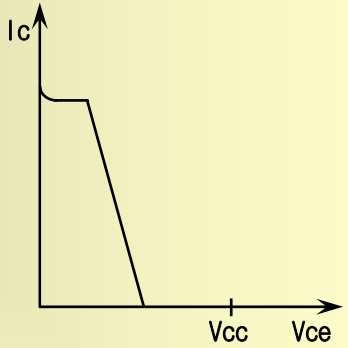
吸收回路及特性

	RC 吸收	RCD 充电型吸收	RCD 放电型吸收
电路			
关断时 V vs. I 关系			
比较	-低成本 -易于振荡 -不容易优化电容值	- 大功率 用 - General Circuit	-电路复杂 -成本高 -快速开关时 用

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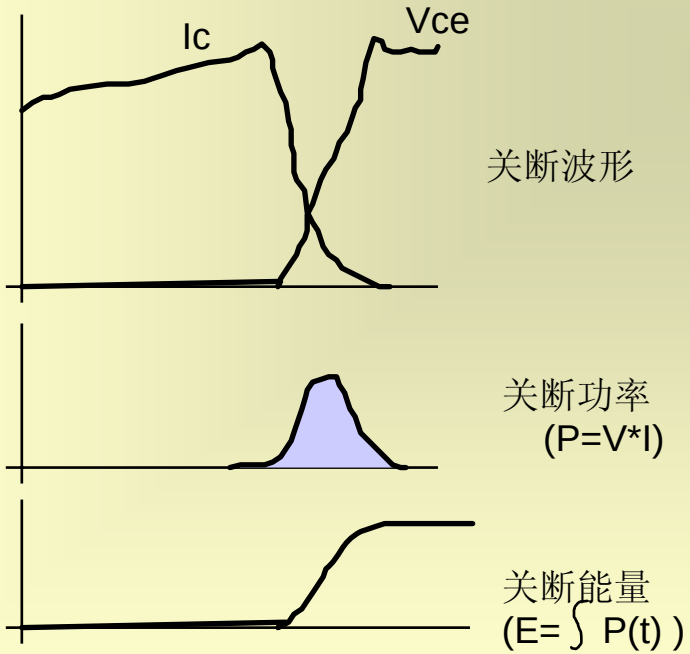
问题：什么是关断能量What's Turn off Energy (Eoff)？

Answer :

* 关断能量有助于设计者根据器件产生的开关损耗来处理散热。
* 关断损耗即关断能量乘以工作频率
* 对设计者来说，关断能量比关断时间更重要



S/W Loss=on loss+off loss
=(Eon+Eoff) * f

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Main Transformer and Reactor Application

Main Transformer and Reactor Application

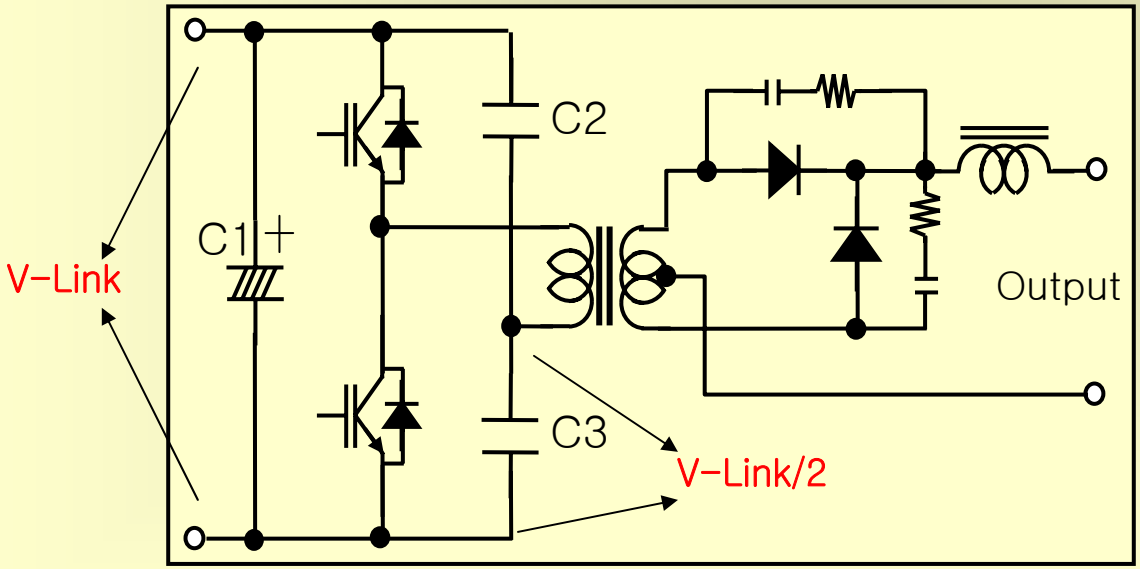
1) 变压器初端不要饱和，电流应该呈上升趋势The current of primary side of the Transformer should not be saturated and the slope of the current
should show increasing characteristics.
2) 高绝缘电压High Isolation Voltage
3) 漏电流越小越好The less leakage flux is, the better it is.
4) Line Regulation Characteristic(纹压低Low Ripple voltage)
Ripple voltage management for stable operation in your system
5) 热特性Thermal Characteristic
6) 分流电阻的连接Discharge resistor connection
7) 连接线Wire connection：越短越好as short as possible
8) 留出足够的设计余量Enough design margin
9) 根据电流选择粗细合适的线Choose the right thickness considering electricity on the coil.
10) 磁芯的选择要尽量减少噪音Select iron core carefully not to make noise in the coil.

Link Capacitor Application

Link Capacitor Application

1) 重要参数必须检查：You have to check about key parameters as follows
   - 高绝缘电压High Isolation Voltage
   - 低漏电流Low Leakage Current
   - 线路调节特性Line Regulation Characteristic(低纹压Low Ripple voltage)
   - 热特性Thermal Characteristic

2) 安装方法Assembly Technique
   - Ripple voltage management for stable operation in your system
   - Discharge resistor connection
   - 线路连接Wire connection：越短越好as short as possible
   - 充足的余量Enough design margin



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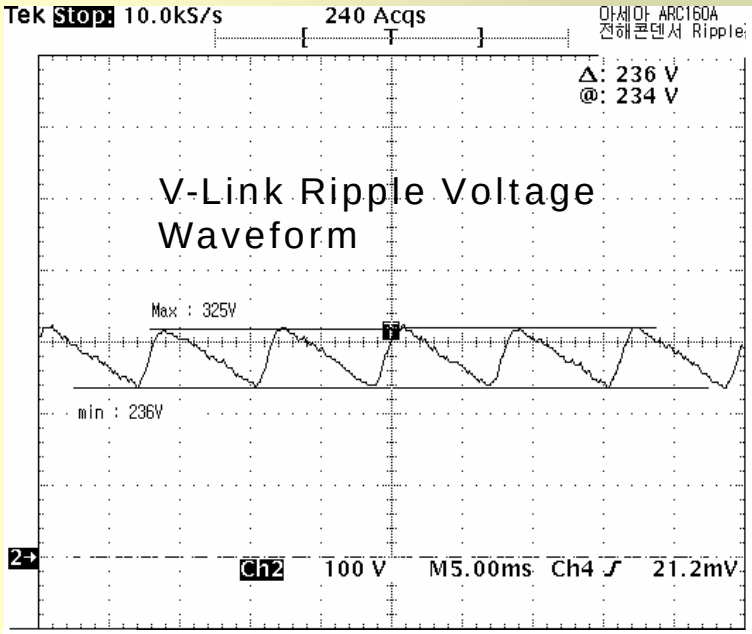
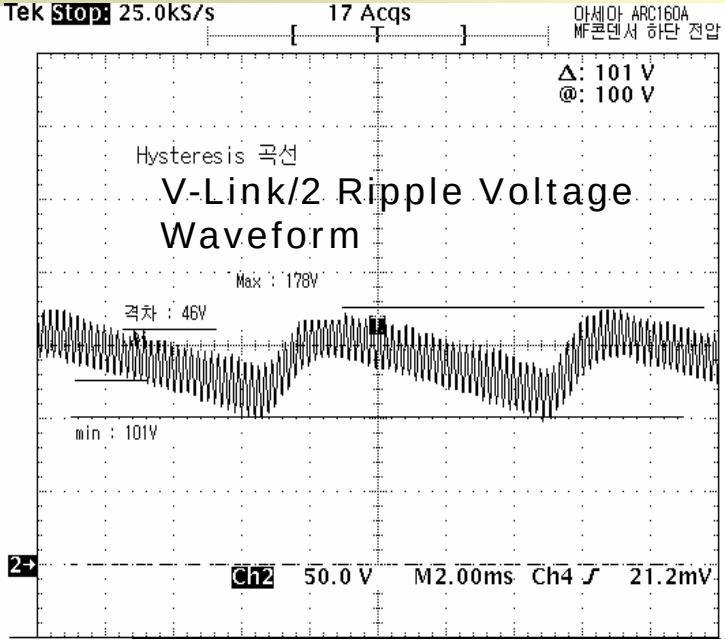
纹压测试Ripple Voltage Test

- 不要超过20%Don't over ± 20%
- 纹压最小化Minimized ripple voltage of hysteresis characteristic

V-Link



V-Link/2



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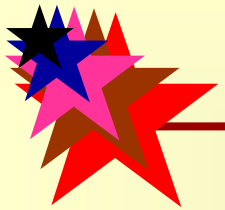


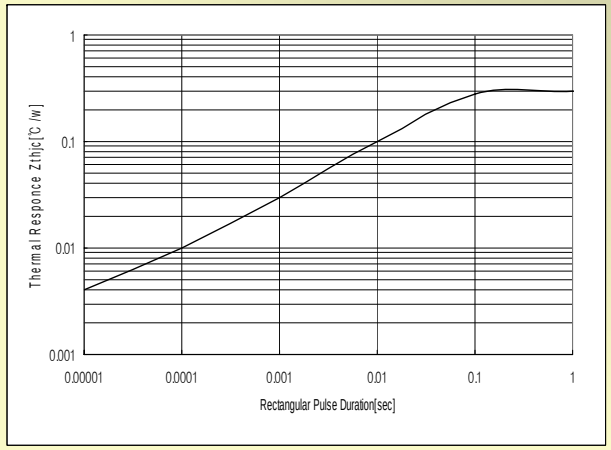
二极管模块的应用

Electrical Characteristics of FRD Module

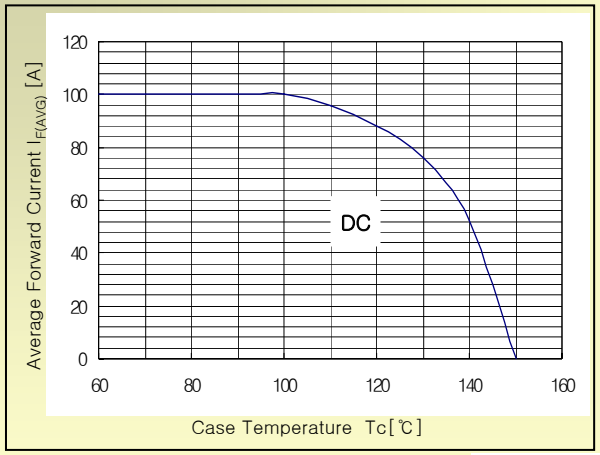
1) 电焊机是大功率产品，尤其是由人近距离操作的机器，所以安全性能最重要。因此，使用绝缘型的模块是最理想的选择。Welding Machine is a kind of High Power System. In particular it is a device to be used in the proximity of people and deals with high power. Therefore safety is the most important.
Thus, it is desirable to use Isolation Type FRD Module.
2) 焊机上使用的二极管模块，雪崩特性是一项很重要的参数，雪崩特性值应在300mJ以上。In case of FRD Module used in Welding Machine, one of the most important items is Single Pulse Avalanche Energy(EAS) characteristics. It is desirable to use a product with more than 300mJ.
3) 对于20Khz的焊机，应使用快速二极管，恢复时间应在300ns以内。当开关频率达到100Khz时，二极管的恢复时间应该在80ns以内。
4) 正向压降和漏电流也是重要的参数。If, Vf characteristics and Leakage item are important, too.
5) 考虑到二极管模块的反向电流特性，在设计时应该留有设计余量，因为其是焊机中的从动部分。
6) Wide V_R
7) 反向脉冲电流大
8) 正向压降低Low Forward Voltage
9) War-page(Flatness)
10) 漏电流小Low Leakage Current
11) 软而快的开关特性Soft and High Speed Switching

Absolute Maximum Ratings @ T_j=25℃ (Per Leg)

Symbol	Parameter	Conditions	Ratings	Unit
V_{RRM}	Repetitive Peak Reverse Voltage		600	V
$V_{R(DC)}$	Reverse DC Voltage		480	V
$I_{F(AV)}$	Average Forward Current @ Tc = 25℃ @ Tc = 100℃	Resistive Load	200 100	A A
I_{FSM}	Surge(non-repetitive) Forward Current	One Half Cycle at 60Hz, Peak Value	2000	A
I^2t	I^2t for Fusing	Value for One Cycle Current, t_w = 8.3ms, T_j = 25℃ Start	16.7* 10^3	A^2s
T_j	Junction Temperature		-40 ~ 150	℃
T_{stg}	Storage Temperature		-40 ~ 125	℃
V_{isol}	Isolation Voltage	@ AC 1 minutes	2500	V
P_d	Maximum Power Dissipation		400	W
-	Mounting Torque		4.0	N.m
-	Terminal Torque		2.0	N.m
-	Weight	Typical Including Screws	140	g



Transient Thermal Impedance(Z_{thjc}) Characteristics



Forward Current Derating Curve

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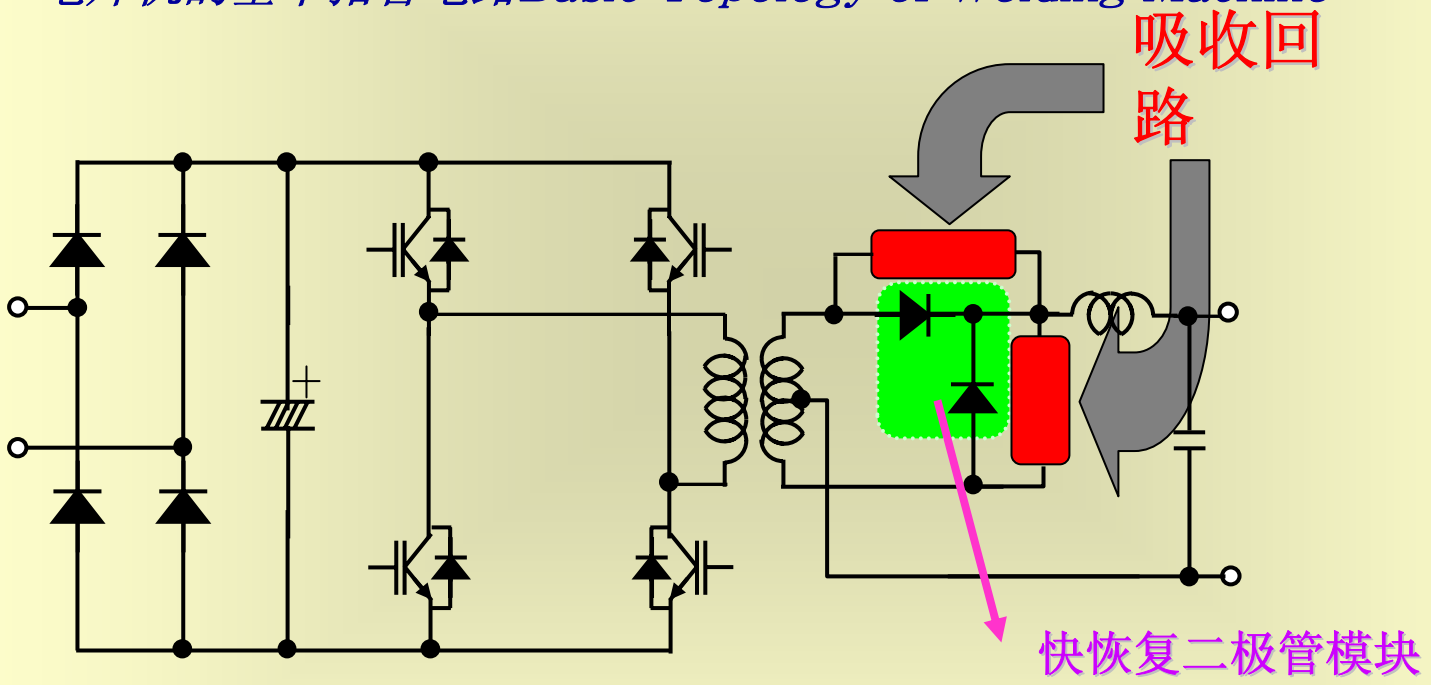
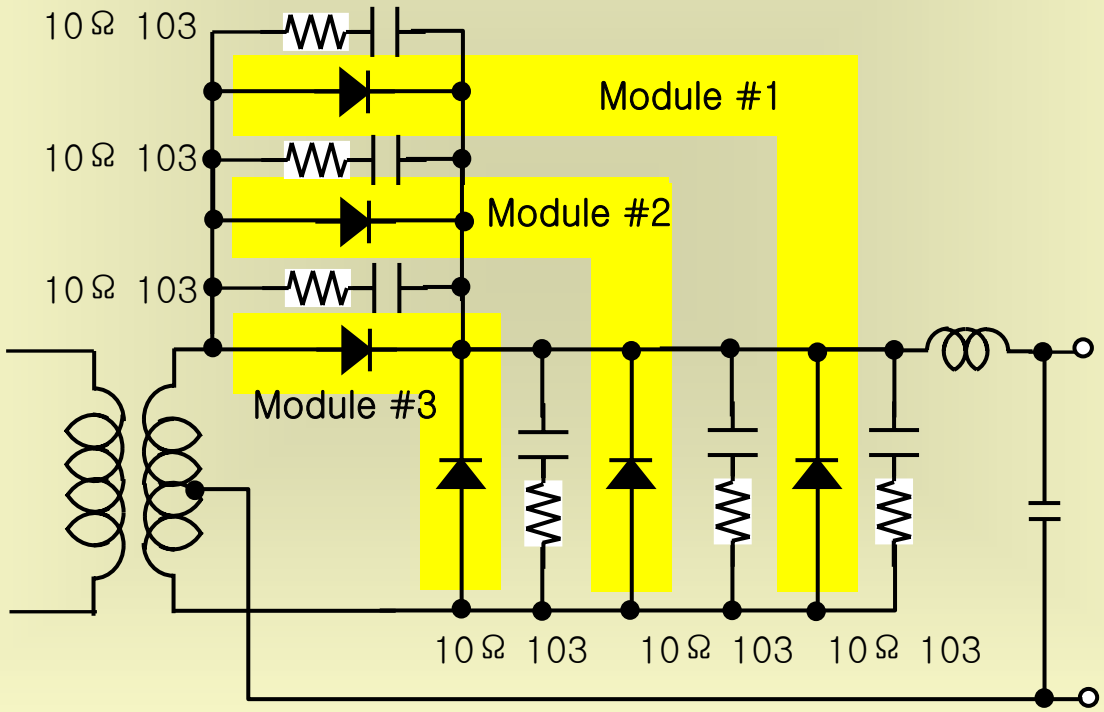
吸收的应用Snubber Application

电焊机的基本拓普电路Basic Topology of Welding Machine



RC吸收回路的最佳设计Best Design of RC Snubber Circuit

最好的方法是103 1KV电容和10 Ω电阻。



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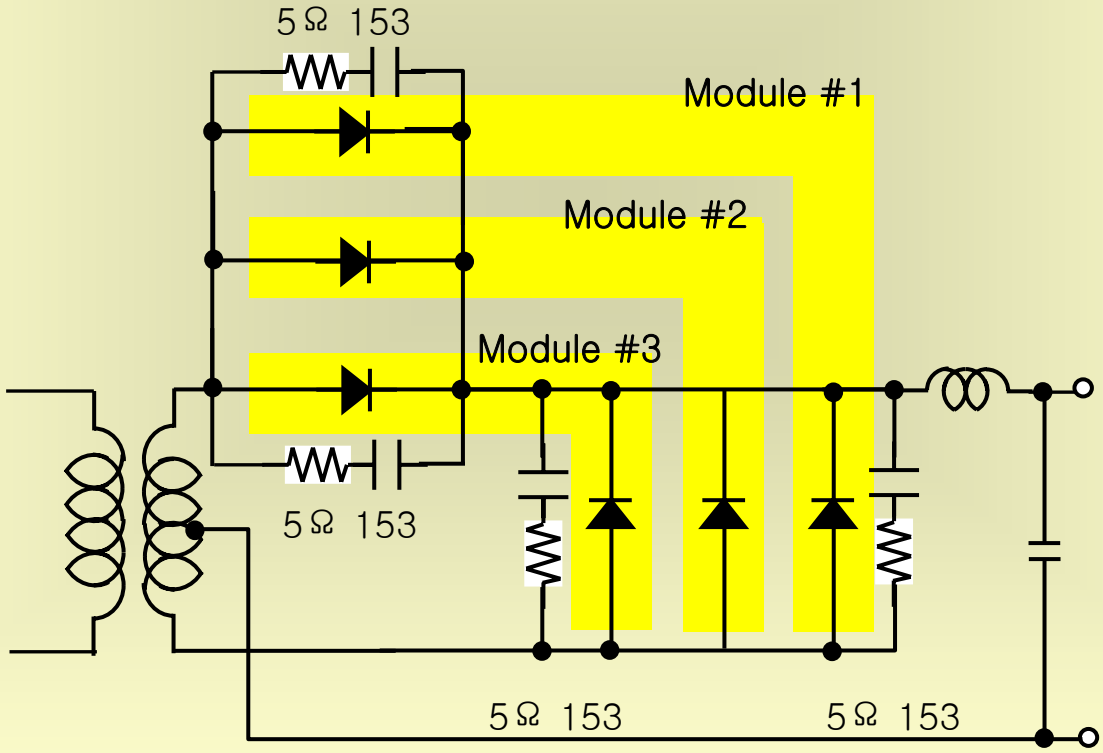
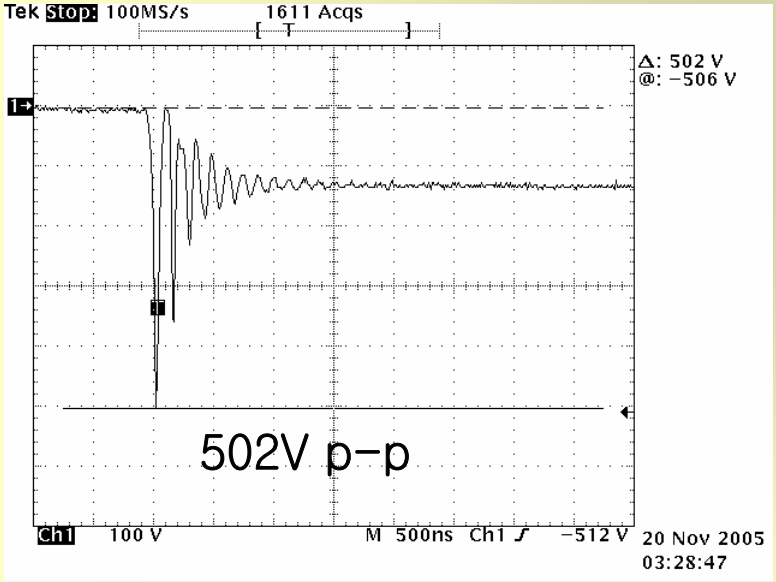
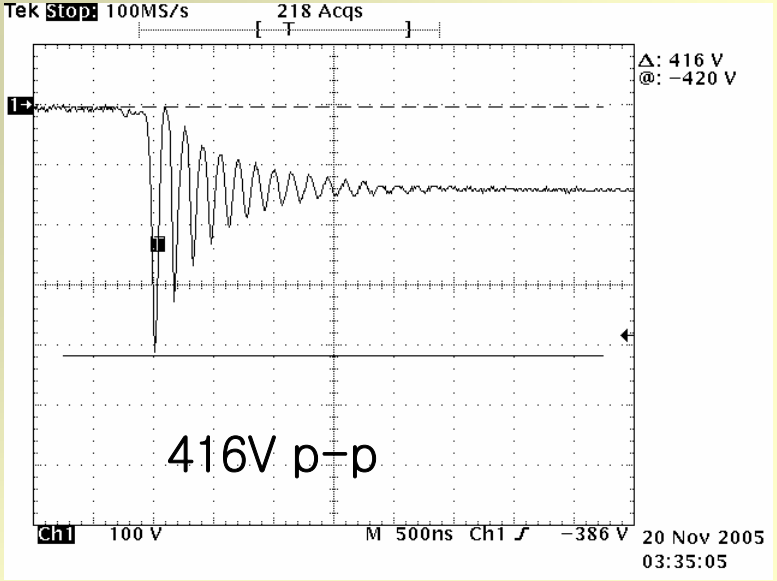
RC吸收回路的第二选择Next best RC snubber Circuit

如果前面的最佳方案并不容易连接，可以采用下面的方案：
在并联3个模块的情况下，至少要并联两阻RC吸收回路。In case of parallel connection of over 3 FRD modules, It is necessary to use minimum 2 RC snubber circuit.



下面波形的测试条件Test Condition for the all Waveforms

- 测试设备: 200A DC ARC
- RFD型号：DAH100N4S
- 开关频率：20KHz
- 负载: 阻性负载

Too bad：Over Vrrm Tc = 25℃, DAH100N4S 1EA, No Snubber 時 Voltage Waveform	Too bad：Over Vrrm Tc = 25℃, DAH100N4S 2EA Parallel Connection, No Snubber 時 Voltage Waveform
	

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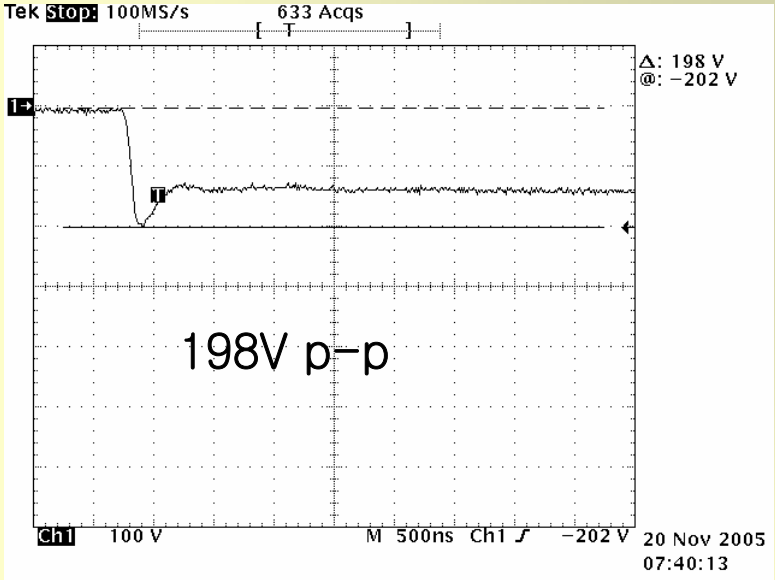
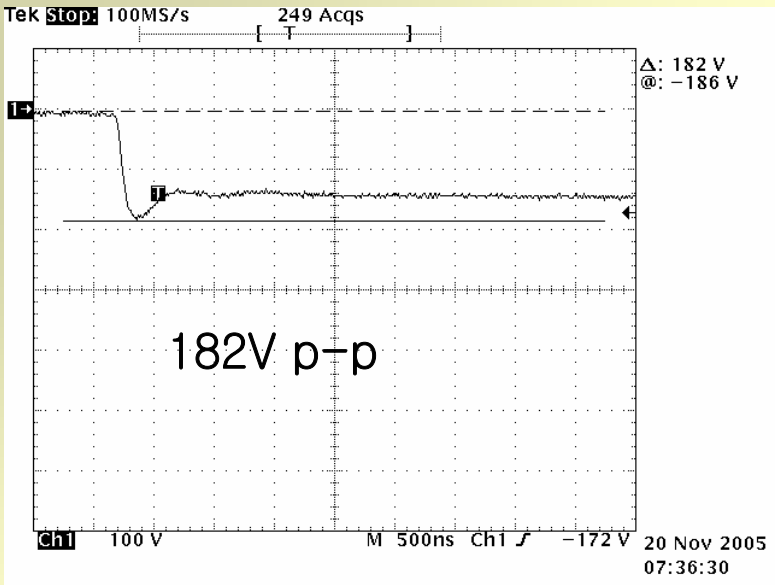
Very good

Tc = 25℃, DAH100N4S 1EA,
RC Snubber(103 pF * 10Ω) 時
Voltage Waveform



Very good

Tc = 25℃, DAH100N4S 2EA Parallel Connection,
RC Snubber (103 pF * 10Ω) 時
Voltage Waveform



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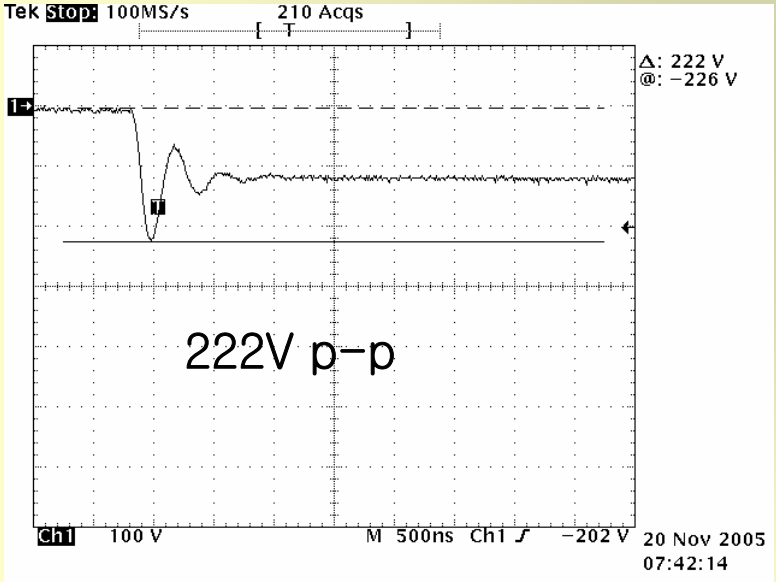
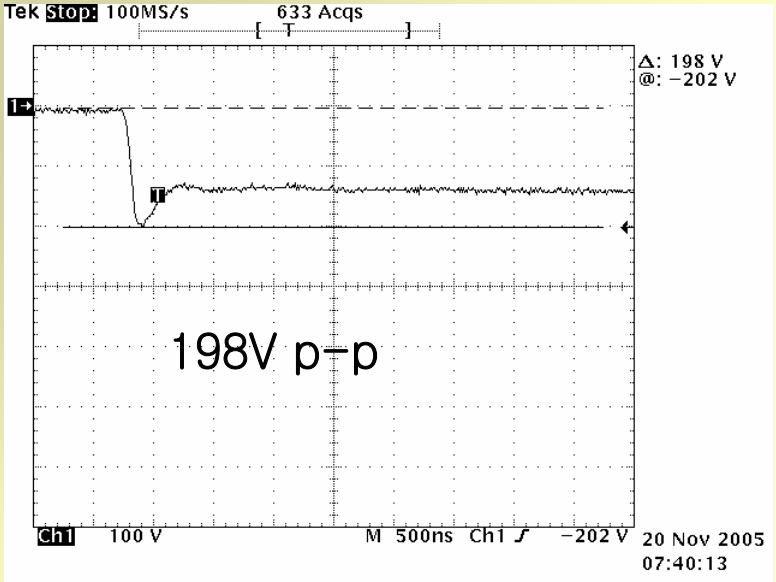
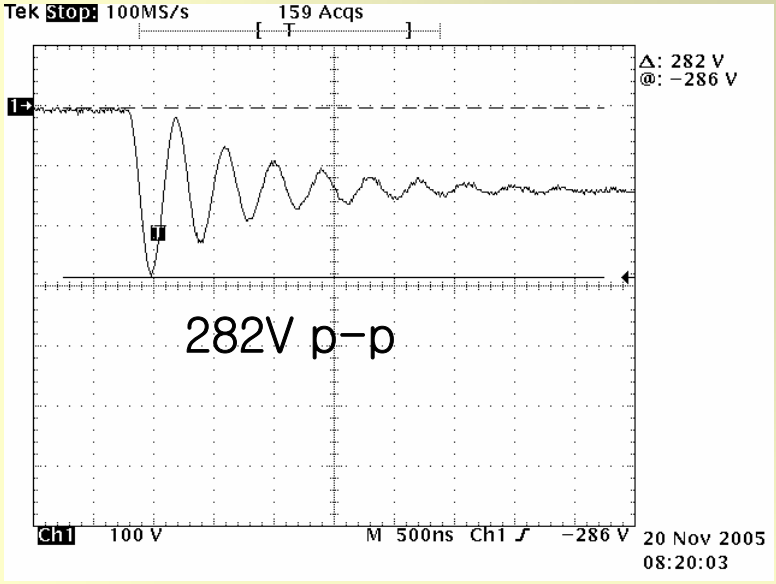
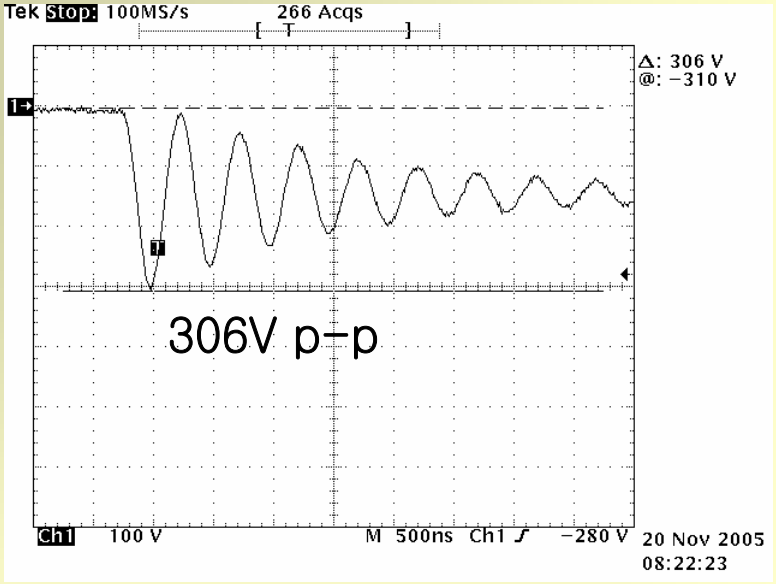
Good	Very good
Tc = 25℃, DAH100N4S 1EA, RC Snubber(472 pF * 4.7Ω) 時 Voltage Waveform	Tc = 25℃, DAH100N4S 1EA, RC Snubber (103 pF * 10Ω) 時 Voltage Waveform
	

DOW™ DAWIN Electronics

Bad

Bad

Tc = 25℃, DAH100N4S 1EA, C Snubber(472 pF) 時 Voltage Waveform	Tc = 25℃, DAH100N4S 1EA, C Snubber (103 pF) 時 Voltage Waveform
	

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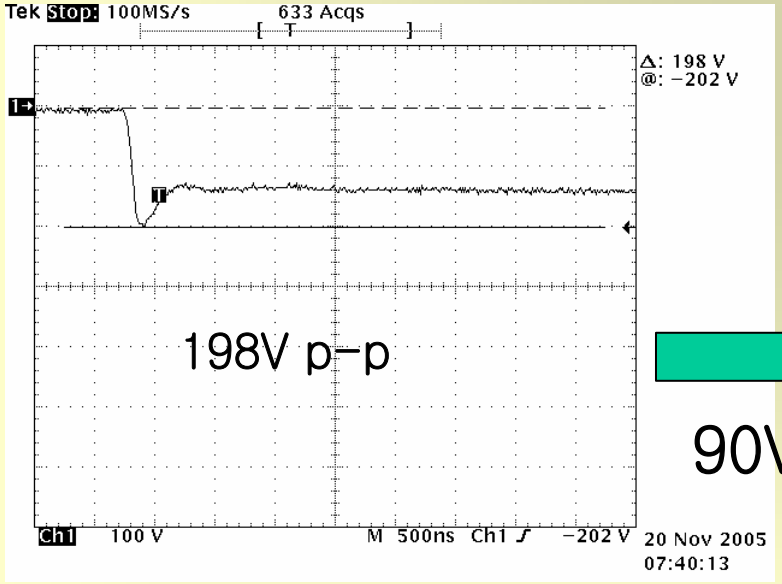
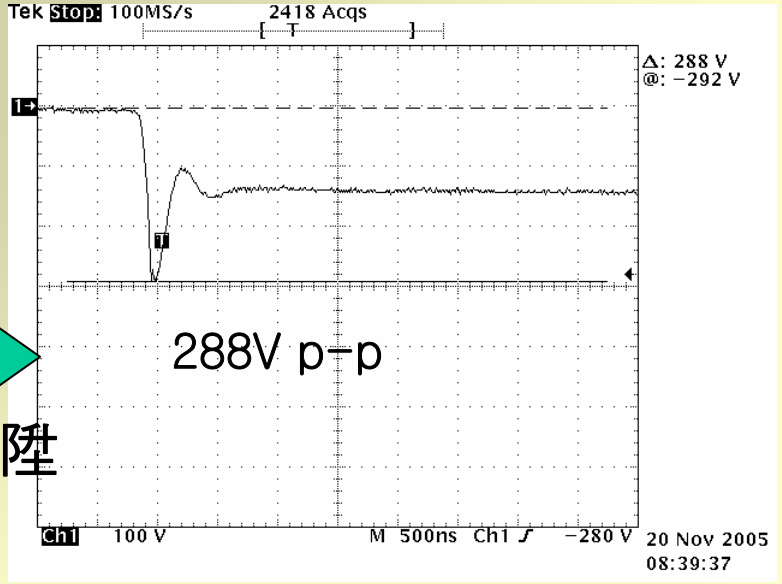
随着Tc 上升, Vp-p 也随之上升.
要改善这种状况，需要选用更大功率的电阻和电容。

Tc = 25℃, DAH100N4S 1EA, RC Snubber(103 pF * 10Ω) 時 Voltage Waveform	Tc = 100℃, DAH100N4S 1EA, RC Snubber (103 pF * 10Ω) 時 Voltage Waveform
	

90V 上陞

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大功率模块的安装Assembly Technique for High Power Modules

1) It is important to maintain evenness of Main Heat Sink. In case of general High Power Modules they have +150um specification. Considering this, Main Heat Sink needs such management.
2) 注意模块的安装扭矩Each product needs Mounting Torque management.
不要先把一边装紧，应该是同时把两边一点一点装紧。Do not tighten one side fully. Tighten ea
3) 吸收回路取决于Apply Snubber Circuit according to Switching Noise components.

4) 模块散热底板的硅胶厚度30~50um ° Apply Silicon Grease on the Sub- Heat Sink with the thickness .
5) 电容和IGBT模块的距离越短越好。Design the distance between Main Link Capacitor and
6) 要提高散热特性，应注意风扇和模块的分布。To enhance heat radiance characteristics, distribute fans and modules for good ventilation.

7) 温度传感器应该装在散热器的上部。Temperature detector should be installed on the upper part of Heat Sink.
8) 安装后要进行检查以确认安装合格。Make sure if they are well installed after assembly.
9) 并联安装时，尽量选用同一批号的模块。
10) 安装完毕，在给焊机通电之前先给控制板通电来看IGBT模块是否能正常输出信号。
Ex) In case of IGBT Module, open the wire between Rectifier Diode(+ output pin) and Link Capacitor(+ pin). When connecting Voltage Probe between the terminals of the Transformer, see if Gate Signal delivers signals through IGBT Input Capacitance and shows S curve at 2Vp-p.
11) 注意选择粗而短的线

半导体的损耗

一般方法General approach

- 分立器件的开断转换会更复杂When we review discrete components later, it will be seen that the transitions between the on and the off state are more complex
- 功率 = 能量 / 时间 = 能量 x 频率,
  可以通过能量乘以工作频率来计算开关损耗
- 开关损耗:
  Pon = 频率 x 开通能量
  Poff = 频率 x 关断能量
- 传导损耗Conduction losses:
  Pcond = Idrain^2 x Rdson x Duty Cycle for MOSFET
  Pcond = Ic x Vce x Duty Cycle for IGBT
  Pcond = Id x Vf x (1−Duty Cycle) for Diode

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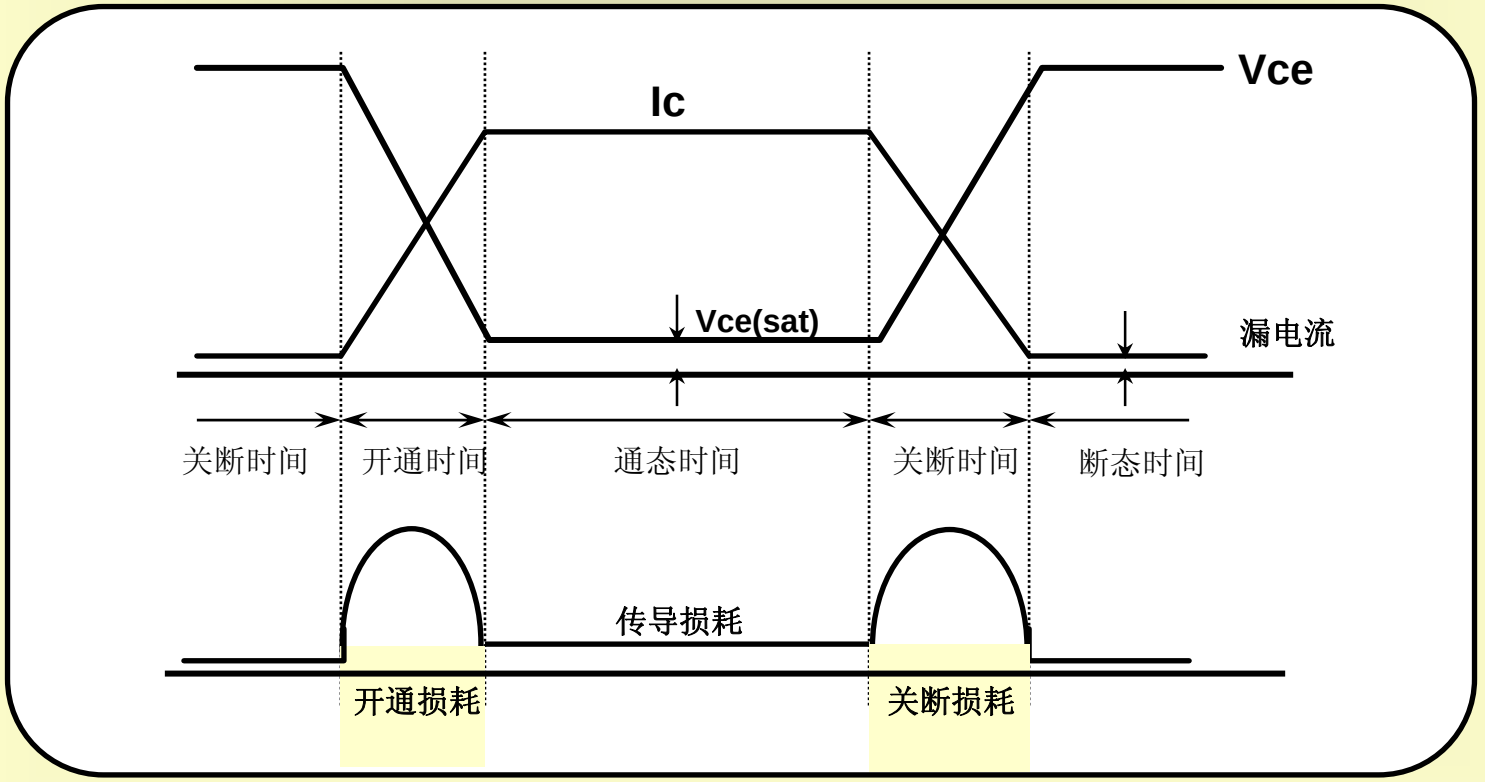
IGBT的功率损耗Power Loss of each IGBTs

= 开关损耗 +传导损耗 **Conduction Loss**

→ 开关损耗 = 开通损耗**Turn On Loss** + 关断损耗**Turn Off Loss**



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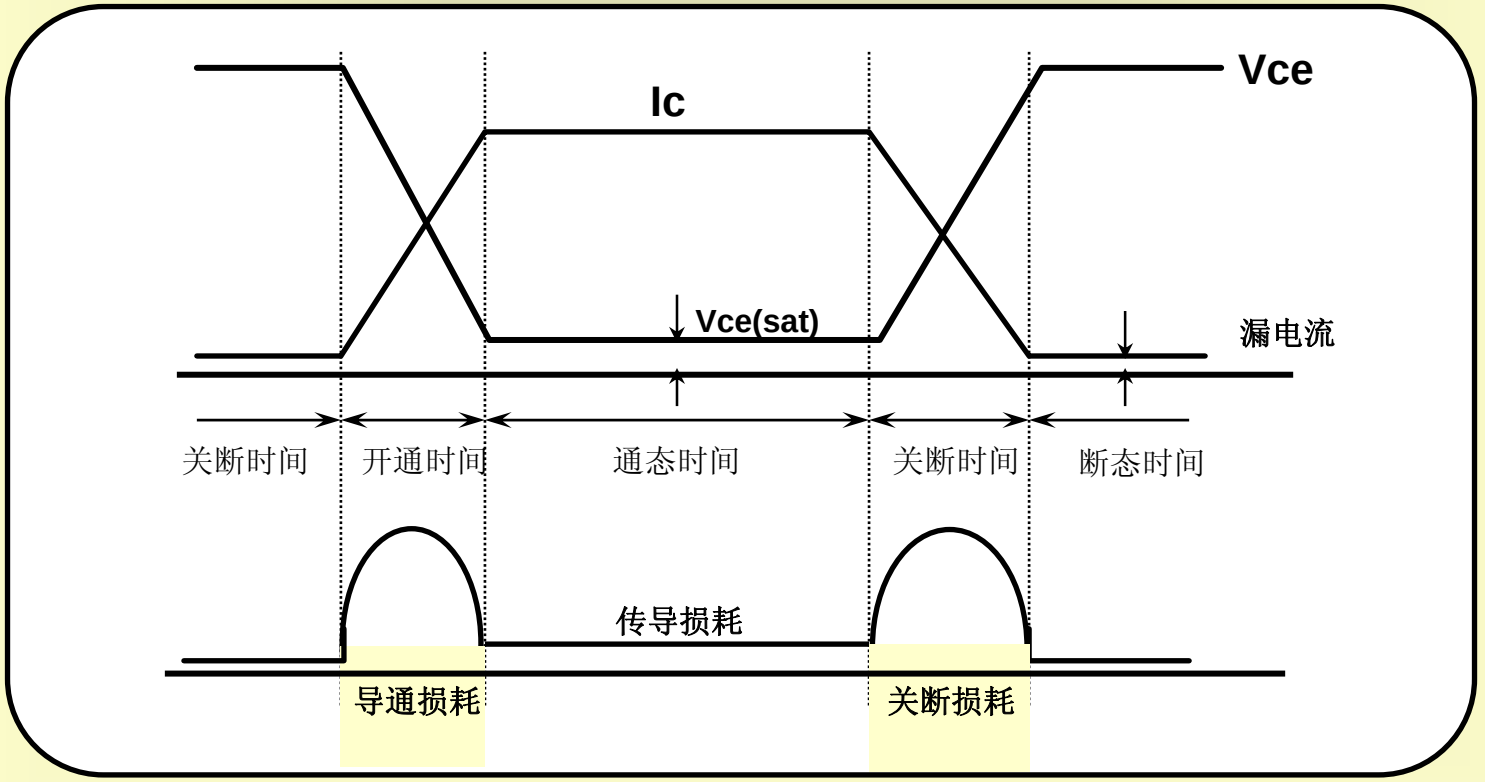
每一个IGBT的功率损耗

= 开关损耗 + 传导损耗

→ 开关损耗 = 导通损耗 + 关断损耗



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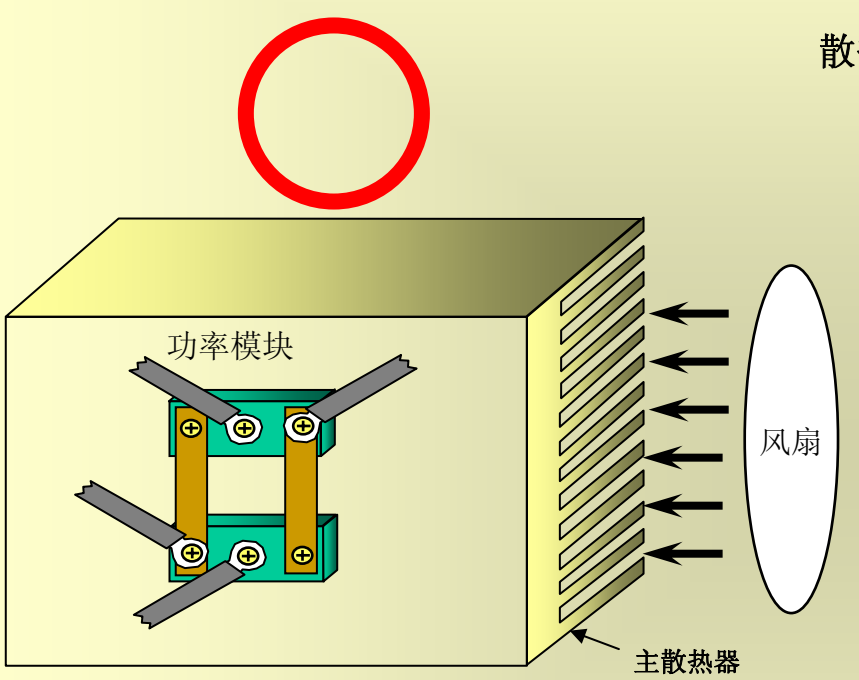
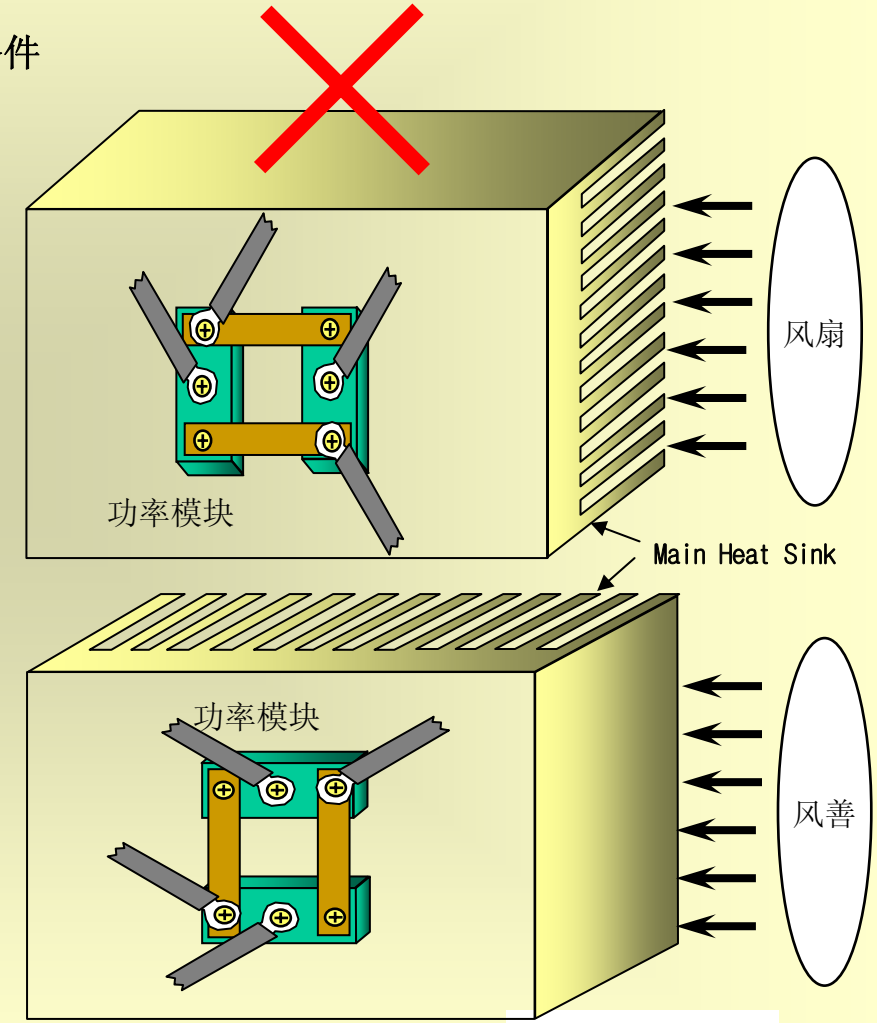
热耗散

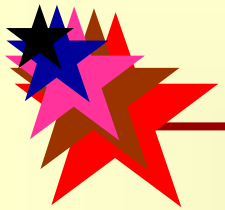
热耗散

散热条件





DOW™
DAWIN Electronics



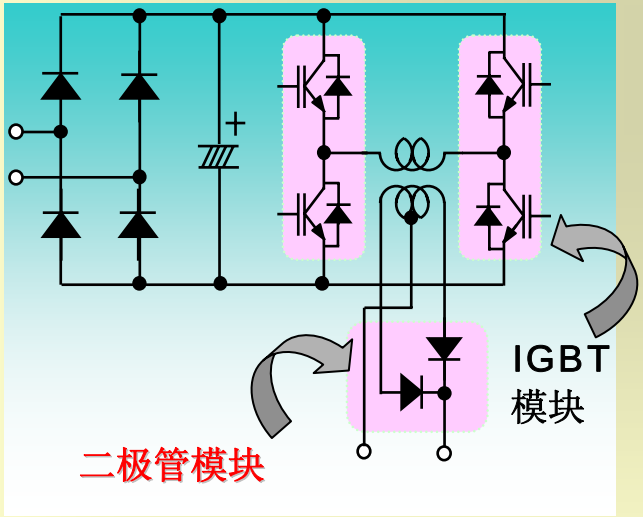
DAWIN'的大功率模块应用方案

DAWIN Electronics

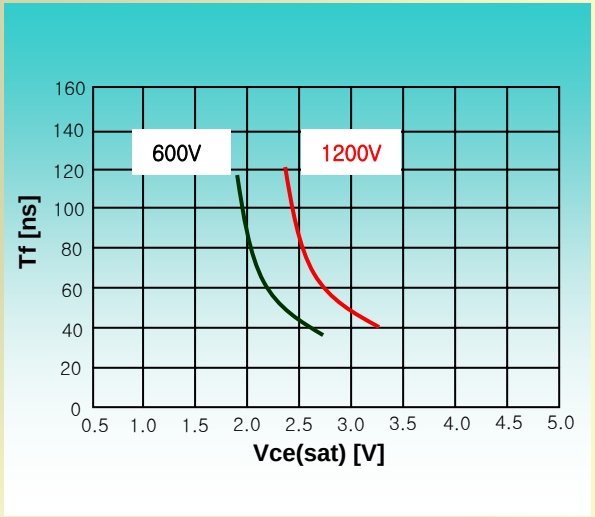
Dawin大功率模块的应用方案

DAWIN的二极管和**IGBT**模块会使您处于大功率行业的领军地位.
为您推荐的产品能满足您对安全工作区宽的需要，减少了整个系统的功率损耗，紧凑的安装方式也是高频系统要求的趋势。

逆变系统的基本拓扑结构



DW IGBT 模块Trade-off



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二极管模块的封装

SOT-227

60A~120A
300V~1200V
绝缘

5DM-1

400V~ 1200V
100A~150A
绝缘

3DM-NI

400V,
100A~150A
非绝缘

5DM-2

400V~600V,
150A~200A
绝缘

2DM

600V
250A~300A
Single Isolation

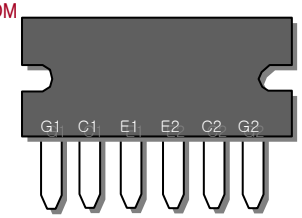
IGBT 模块的封装

7DM

600V
50A~100A

1200V
50A~75A
IGBT 模块

6DM



600V
50A~100A

1200V
50A~75A
IGBT 模块

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DW产品的命名方法

二极管命名方法

DAC2F100N4S

D	DW的公司名字(or DW)
A	封装形式(A：5DM-1, 3DM-NI, B：5DM-2, S：2DM, M：SOT-227)
C	输出端子(Blank：在边上, C：在中间 H：非绝缘)
2	内部二极管数量
F	二极管F：FRD)
100	电流等级
N	N：共阴 P：共阳
4	额定电压 (4：X 100 = 400V, 040：X 10 = 400V)
S	S：超快恢复 & 软恢复

IGBT 产品的命名方法

DM2G100SH6

D	DAWIN的公司缩写
M	封装形式(M：7DM Series (7DM, 7DM-1, 7DM-2), L：6DM)
2	内部二极管数量
G	IGBT and MOSFET
100	电流等级
S	短路电额定流
H	高性能
6	额定电压 (6：X 100 = 600V)

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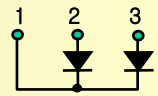
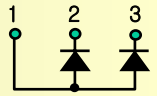
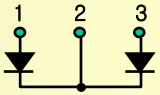
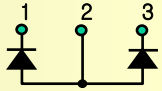
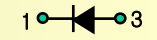
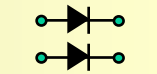
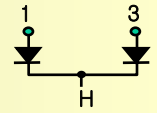
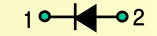
快恢复二极管模块系列

命名	特性					电路图	封装	注意事项
	V_{RRM}[V]	$I_{F(AV.)}$[A]	$V_{F(typ.)}$[V]	$t_{rr(typ.)}$[ns]	$I_{RRM(MAX)}$[mA] @Tc = 100℃			
DWM2F100N030	300	100*2	1.35	50	1.0	F	SOT-227	二个二极管
DWM2F120N030	300	120*2	1.30	55	1.0	F	SOT-227	二个二极管
DWM2F90N040	400	90*2	1.35	100	1.0	F	SOT-227	二个二极管
◆DWM2F100N040	400	100*2	1.05	90	1.0	F	SOT-227	二个二极管
◆DAC2F100N4S	400	100*2	1.05	90	1.0	C	5DM-1	N沟道中间抽头
◆DAC2F150N4S	400	150*2	1.05	100	1.0	C	5DM-1	N沟道中间抽头
DBC2F150N4S	400	150*2	1.40	150	6.0	C	5DM-2	N沟道中间抽头
DBC2F200N4S	400	200*2	1.50	150	10	C	5DM-2	N沟道中间抽头
★DBC2F150N4S	400	150*2	1.05	100	1.5	C	5DM-2	N沟道中间抽头
★DBC2F200N4S	400	200*2	1.05	150	2.0	C	5DM-2	N沟道中间抽头
DAH2F100N4S	400	100*2	1.05	90	1.0	G	3DM-NI	N沟道非绝缘系列
DAH2F150N4S	400	150*2	1.05	100	1.0	G	3DM-NI	N沟道非绝缘系列
◆DWM2F60N060	600	60*2	1.20	60	2.0	F	SOT-227	一个二极管
DWM2F90N060	600	90*2	1.40	100	3.0	F	SOT-227	一个二极管
DAC2F100N6S	600	100*2	1.50	120	3.0	C	5DM-1	N沟道中间抽头
DAC2F100P6S	600	100*2	1.50	120	3.0	D	5DM-1	P沟道中间抽头
DBC2F150N6S	600	150*2	1.50	160	6.0	C	5DM-2	N沟道中间抽头
DBC2F150P6S	600	150*2	1.50	160	6.0	D	5DM-2	P沟道中间抽头
DBC2F200N6S	600	200*2	1.50	180	8.5	C	5DM-2	N沟道中间抽头
DBC2F200P6S	600	200*2	1.50	180	8.5	D	5DM-2	P沟道中间抽头
DB1F250N6S	600	250	1.40	180	10	E	5DM-2	一个二极管
◆DS1F300N6S	600	300	1.50	180	10	H	2DM	一个二极管
DWM2F60N120	1200	60*2	2.50	90	1.0	F	SOT-227	二个二极管
DA2F75N12SA	1200	75*2	2.50	100	2.0	A	5DM-1	N沟道边上抽头
DA2F100N12SA	1200	100*2	2.50	100	3.0	A	5DM-1	N沟道边上抽头
★DWM2F60N120	1200	60*2	1.70	80	1.0	F	SOT-227	二个二极管
★DA2F75N12S	1200	75*2	1.70	100	2.0	A	5DM-1	N沟道边上抽头
★DA2F100N12S	1200	100*2	1.70	100	3.0	A	5DM-1	N沟道边上抽头

◆ : New Product ★ : Coming soon

Internal Circuit Diagram

A	
B	
C	
D	
E	
F	
G	
H	

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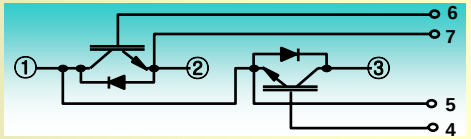
高频IGBT模块系列

命名	特性				封装	状态
	BV_{CES}[V]	Ic [A]	$V_{CESAT(typ.)}$[V]	$t_{f(typ.)}$[ns]		
二单元的IGBT模块						
DM2G50SH6	600	50*2	2.4	90	7DM	MP：3Q. 2006
DM2G75SH6	600	75*2	2.1	90	7DM	MP：3Q. 2006
DM2G100SH6	600	100*2	2.1	90	7DM	MP：3Q. 2006
DM2G150SH6	600	150*2	–	–	7DM-1	正在研发
DM2G200SH6	600	200*2	–	–	7DM-1	正在研发
DM2G300SH6	600	300*2	–	–	7DM-2	正在研发
DM2G400SH6	600	400*2	–	–	7DM-2	正在研发
DM2G600SH6	600	600*2	–	–	7DM-2	正在研发
DM2G50SH12	1200	50*2	2.7	80	7DM	MP：3Q. 2006
DM2G75SH12	1200	75*2	2.7	80	7DM	MP：3Q. 2006
DM2G100SH12	1200	100*2	–	–	7DM-1	正在研发
DM2G150SH12	1200	150*2	–	–	7DM-1	正在研发
DM2G200SH12	1200	200*2	–	–	7DM-2	正在研发
DM2G300SH12	1200	300*2	–	–	7DM-2	正在研发
Built-in Discrete IGBT * 2pcs						
DL2G50SH6	600	50*2	2.4	90	6DM	MP：4Q. 2006
DL2G75SH6	600	75*2	2.2	90	6DM	MP：4Q. 2006
DL2G100SH6	600	100*2	2.2	90	6DM	MP：4Q. 2006
DL2G60SH10	1000	60*2	2.4	80	6DM	MP：4Q. 2006
DL2G50SH12	1200	50*2	2.7	80	6DM	MP：4Q. 2006
DL2G75SH12	1200	75*2	2.7	80	6DM	MP：4Q. 2006

IGBT模块的封装

7DM



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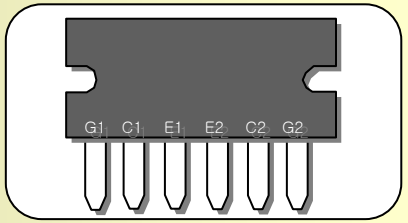

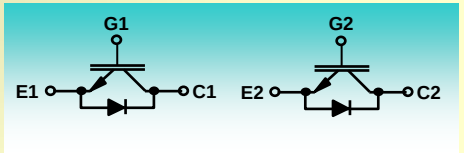

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新品

改进后的400V 二极管模块

DW公司最新改进400V系列的二极管模块

系列
-DWM2F100N040
-DAC2F100N4S
-DAC2F150N4S
-DBC2F150N4S
-DBC2F200N4S

优点
-低的正向压降 (将 DBC2F200N4S 由$V_{F\ (typ)}$ 1.5V→ 1.05V)
-较低的漏电流 (将 DBC2F200N4S由 I_{RRM} 20mA→ 2.0mA)
-提高了运行效率(低温度特性)
-扩大电流和封装的选择范围(100A~200A, SOT-227, 5DM-1, 5DM-2)

应用
-电焊机
-SMPS(开关电源)
-逆变设备

DOW™ DAWIN Electronics

新推出"IGBT模块"

系列

600V 系列的
- -DM2G50SH6
- -DM2G75SH6
- -DM2F100SH6

1200V 系列的
- -DM2G50SH12
- -DM2G75SH12

优点
- -开关速度快
- -BVCES = 600V,1200V
- -传导损耗极低
- -快& 软的 Anti-Parallel FWD
- -短路额定电流 和 Rugged Type
- -减少电磁干扰和 RFI
- -标准封装

应用场合
- -焊机
- -高频开关电源
- -不间断电源
- -马达驱动，机器人
- -大功率逆变设备
- -感应加热

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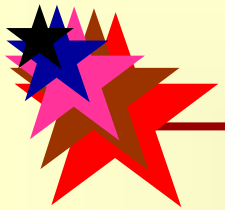

謝 謝 !

Thank you !!

감사합니다 !!!

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